TM 5-9513

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

CRANE-SHOVEL

POWER UNIT, REVOLVING TRUCK MOUNTED, PNEUMATIC TIRED, 6 x 6, TWO ENGINE DRIVE, GASOLINE DRIVEN 10 TON, ½ CU YD BAY CITY MODEL 150M (LESS ENGINES)

HEADQUARTERS, DEPARTMENT OF THE ARMY
MARCH 1958

SAFETY PRECAUTIONS

When operating the crane-shovel, be guided by the simple and fundamental rules of safety. Always take all necessary precautions to insure the safety of others as well as yourself. Avoid careless operating habits which cause accidents to personnel and damage to machinery and equipment.

Always correct or report any mechanical failure or deficiency that may result in further damage to the unit if operation is continued.

Before operating the crank-shovel be sure that the carrier service brakes are securely set.

Never attempt to operate the crane-shovel with defective cables. Inspect cables for kinks, breaks, frayed sections, or excessively worn condition. See that cable wedges and clamps are in place and properly secured.

Before engaging master clutch be sure that all control levers are in neutral position.

Check mounting points of all revolving frame operating brakes and clutches for insecure mounting.

Make certain that the crane-shovel is resting on firm, level ground.

Determine the safe maximum radius when working with a loaded hook block or buckets.

When lifting heavy loads, keep lift height as short as possible. Keep crane-shovel stationary, using outriggers when necessary.

When swinging heavy loads, start and stop the revolving frame slowly.

Make certain that the swing lock is released before attempting to swing the revolving frame.

Before attempting to engage the swing lock, be sure the revolving frame is stopped.

Apply brakes or engage clutches carefully. Sudden engagement of clutches or application of brakes causes undue strain on the crane-shovel.

Before leaving the crane-shovel, always lower bucket or load to the ground. Check to see that brakes, pawls, or other devices that are used to keep the boom from falling are in place and securely fastened.

Do not operate or leave the machine near a bank that is likely to collapse.

When dumping into trucks, spot the trucks so that the swing will be over the tailgate of the truck. Never swing the dipper or load over the truck cab.

Keep brake and clutch linings free of oil and grease.

Keep revolving frame floors free of oil, grease, and mud to prevent slipping and falling.

Block the wheels when parked on a grade or when performing maintenance or service beneath the crane-shovel.

Stop the revolving frame engine before performing any adjustments or maintenance on revolving frame machinery.

Never get on or off a crane-shovel when it is in motion.

Always keep boom at least 6 feet away from all overhead wires.

If the boom should hit high tension wires, stay on the crane-shovel until the boom is cleared and the current is shut off. Keep personnel on the ground away from the crane-shovel. If you must leave the machine, jump off; do not step off.

Before disconnecting electrical accessories, leads, and cables, disconnect and tape the battery ground cable.

See that all slings, ties, and hooks are properly placed and secured before raising or lowering loads.

Make sure that containers used for handling fuel and oil are clean and dry.

When filling a fuel tank, always provide a metal contact between the container and the tank.

If an engine overheats because of lack of coolant, permit the radiator to cool before removing the cap and fill slowly. Allow the engine to idle while filling the radiator.

After starting the engine, allow it to warm up at faster than idling speed to a temperature of 160° F. (Fahrenheit) before applying load.

Before attempting to move the crane-shovel, be sure the boom is forward and lowered over the carrier engine; the revolving frame swing lock is engaged; the outriggers are stowed and secured with locking bolts; and the carrier air pressure gage registers 80 psi (pounds per square inch) or more.

Never coast the crane-shovel with the carrier clutch disengaged or the transmission in neutral.

Do not pump the brake pedal unnecessarily since this wastes air pressure and gives poor braking performance.

Check the route to be traveled for overhead clearance and bridge capacities.

Use the proper gear ratio on all grades up or down. Do not exceed the maximum allowable top speed of the crane carrier in each ratio.

Always have the front axle drive engaged when operating off the road, on steep grades, or under hard pulling.

When ascending steep grades, always shift into lower transmission speeds before the carrier begins to labor. This can be

accomplished most successfully when the carrier still has sufficient momentum to permit changing gears without bringing the carrier to a stop. When shifting to a lower gear at any rate of carrier speed, make sure the engine speed is synchronized with the carrier speed before the clutch is engaged. If the clutch is engaged when the engine is operating at lower than relative carrier speed, the drive line may be damaged.

Do not use a lower gear ratio to descend a hill than would be required to ascend the same hill.

Disengage the front axle before using the transmission as a brake when going down a steep hill, especially before shifting to a lower gear.

TECHNICAL MANUAL
No. 5–9513

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., *21 March, 1958*

CRANE-SHOVEL, POWER UNIT, REVOLVING, TRUCK MOUNTED, PNEUMATIC TIRED, 6 x 6, TWO ENGINE DRIVE, GASOLINE DRIVEN, 10 TON, ½ CU YD, BAY CITY MODEL 150M (LESS ENGINES)

CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

a. This manual is published for the use of the personnel to whom the crane-shovel is issued. It contains information on the operation, organizational maintenance, and field and depot maintenance of the crane-shovel as well as a description of the major units and their functions in relation to other components of the materiel. This manual applies only to the Crane-Shovel, Power Unit, Revolving, Truck Mounted, Pneumatic Tired, 6 x 6, Two Engine Drive, Gasoline Driven, 10 Ton, ½ cu yd, Bay City Model 150M (Less Engines).

b. Supply manuals, technical manuals, and other publications applicable to the equipment covered in this manual are listed in appendix I. Appendix II tabulates the replaceable parts available for the equipment. Appendix III lists the tools and publications which are available to the operator of the crane-shovel.

c. Any errors, or suggestions for improvement of this manual, should be brought to the attention of The Commanding General, The U. S. Army Engineer Maintenance Center, Corps of Engineers, P. O. Box 119, Columbus 16, Ohio. Direct communication is authorized.

2. Record and Report Forms

The following forms pertain to this equipment:

a. DA Form 5–13, (Spot Check Inspection Report of Organizational Maintenance of Engineer Equipment).

b. DA Form 5–14 (Annual Technical Inspection Report of Engineer Equipment).

c. DA Form 5–22 (Unserviceable Part Identification Tag).

d. DA Form 9–71 (Locator and Inventory Control Card).

e. DA Form 9–75 (Daily Dispatching Record of Motor Vehicles).

f. DA Form 9–79 (Parts Requisition).

g. DA Form 285 (Accident Report of Individual Accident).

h. DA Form 446 (Issue Slip).

i. DA Form 447 (Turn-in Slip).

j. DA Form 460 (Preventive Maintenance Roster).

k. DA Form 464 (Work Sheet for Preventive Maintenance and Technical Inspection Engineer Equipment).

l. DA Form 468 (Unsatisfactory Equipment Report).

m. DA Form 478 (Organizational Equipment File).

n. DA Form 811 (Work Request and Job Order).

o. DA Form 867 (Status of Modification Work Order).

p. DA Form 1546 (Request for Issue or Turn-In).

q. DD Form 6 (Report of Damaged or Improper Shipment).

r. DD Form 110 (Vehicle and Equipment Operational Record).

s. DD Form 313 (U. S. Government Operator's Permit).

t. DD Form 518 (Accident-Identification Card).

u. Standard Form 91 (Operator's Report of Motor-Vehicle Accident).

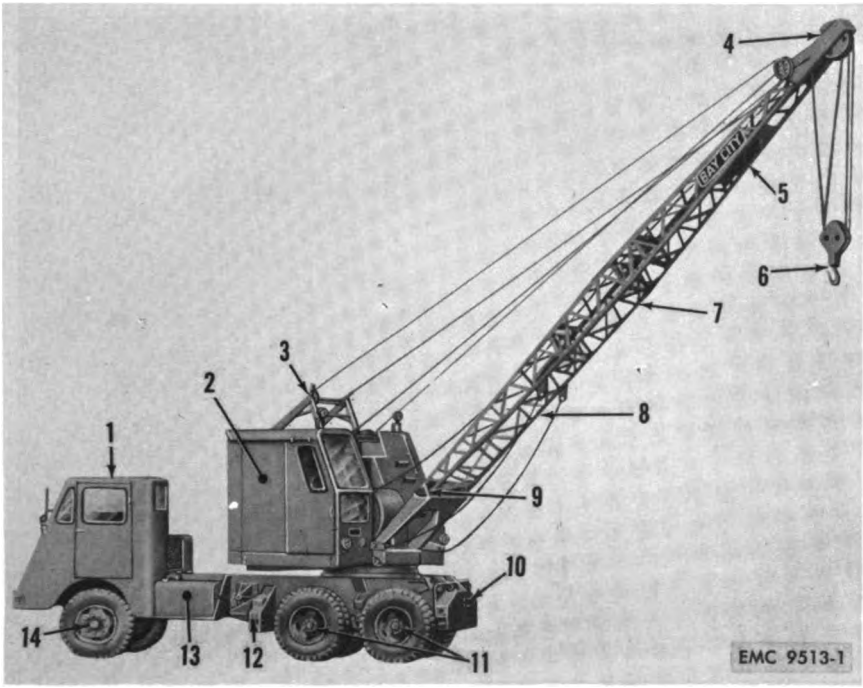
Section II. DESCRIPTION AND DATA

3. Description

a. General Information.

(1) The Bay City Model 150M crane-shovel can be converted to crane (figs. 1 and 2), clamshell (fig. 3), dragline (fig. 4), shovel (fig. 5), or back hoe (fig. 6) operation. It is possible to change over for the various types of operation by changing booms and cable reeving and adding various components. The full revolving frame contains the operating machinery (figs. 7 and 8) mounted in a cast steel frame. The frame is mounted on the rear of a motorized chassis (fig. 9) equipped with a driving front axle and tandem rear axle with pneumatic-tired dual wheels. The revolving frame machinery is powered by a Hercules Model JXLDER internal combustion gasoline engine (figs. 10 and 11). The carrier is powered by a Hercules Model TDXC internal combustion engine (TM 5–5252). Floodlights (4 and 12, fig. 2) are provided on the revolving frame cab for operation of the equipment at night.

(2) In this manual, the terms "left" and "right" or "front" and "rear" are used with respect to the operator when he is seated in operating position in the revolving frame cab or the driver in the carrier cab. "Front" is also the end of the revolving frame to which the boom is at-



1	Carrier cab	8	Boom lower section
2	Revolving frame cab	9	Boom angle indicator
3	Gantry	10	Pintle
4	Boom point assembly	11	Tandem rear axle
5	Boom upper section	12	Center-of-gravity marking
6	Hook block	13	Carrier fuel tank
7	Boom center section	14	Front axle assembly

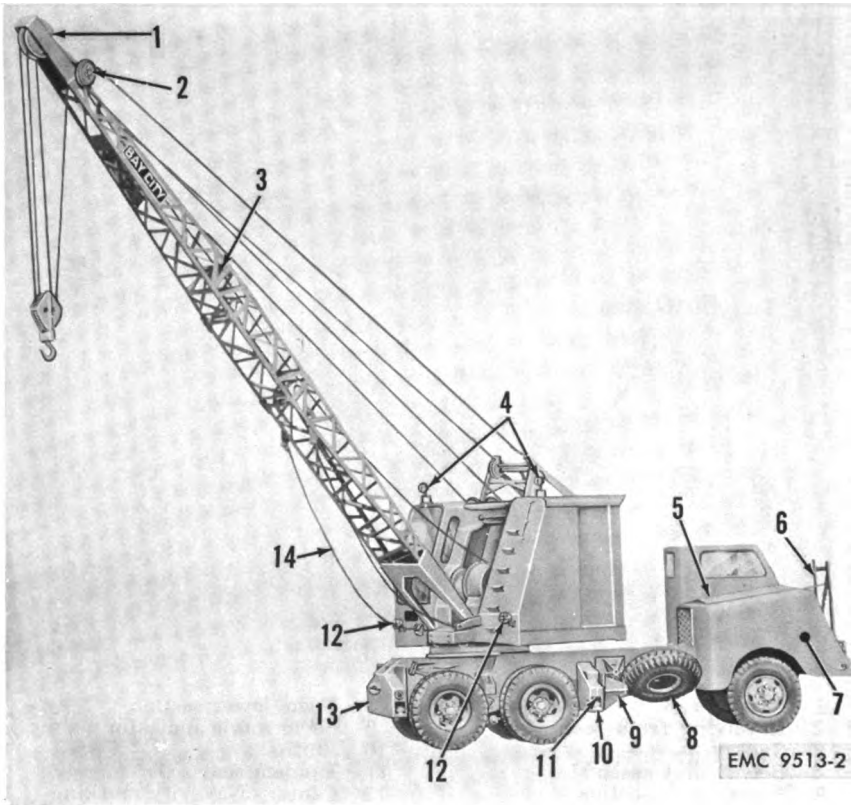
Figure 1. Crane-shovel, with crane installed, right side view.

tached. "Rear" is also the end of the revolving frame at which the revolving frame engine is mounted.

b. Crane-Carrier (fig. 9).

(1) *Frame assembly.* The frame is the structural center of the carrier, carrying the revolving frame with front end attachment and supporting the outriggers (8) and (12), cab assembly, engine (18), transmission (16), transfer case (6), and their connecting units. The frame is carried on the front axle assembly (3) and the tandem rear axles (9 and 11). The frame maintains these units in their correct relationship to each other in order that they may operate without stress or strain. The rear outrigger support (12) is removable for lengthy shovel and back hoe operation.

(2) *Front axle assembly.* The front axle assembly (3) is a driving unit of double reduction type. The housing



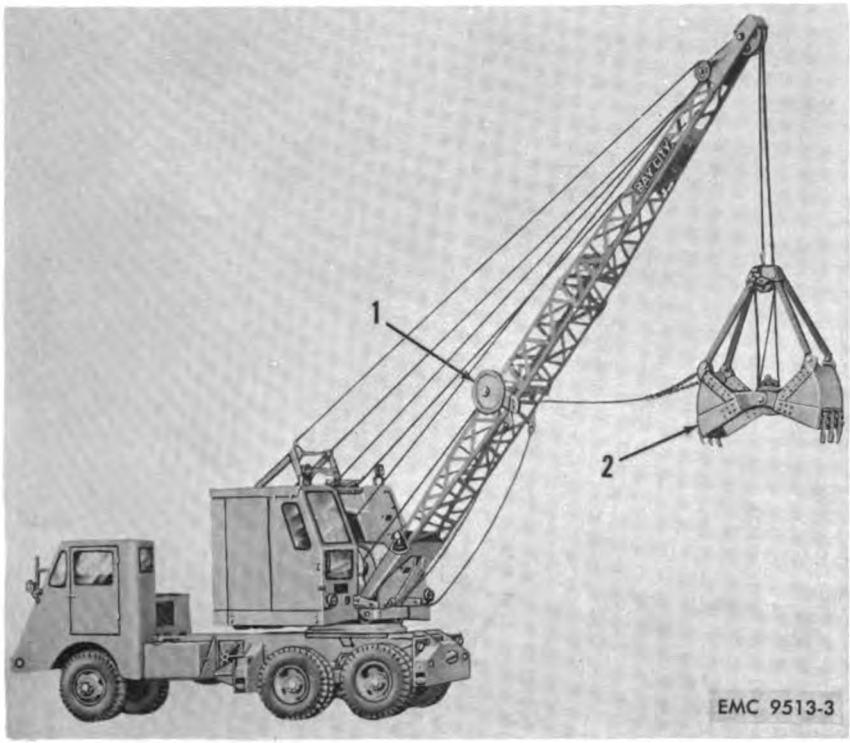
1	Hoist pulley	8	Spare tire and wheel
2	Boom hoist pulley	9	Outrigger screw jack base
3	Cable roller	10	Front outrigger support
4	Upper floodlight	11	Center-of-gravity marking
5	Engine compartment	12	Lower floodlight
6	Boom support	13	Rear outrigger support
7	Tool and battery box	14	Boom stop cable

Figure 2. Crane-shovel, with crane installed, left side view.

is a bowl type, and provides mounting for constant velocity type steering drive universal joints and a conventional type differential. A control lever in the cab enables the driver to engage or disengage the front axle drive at will.

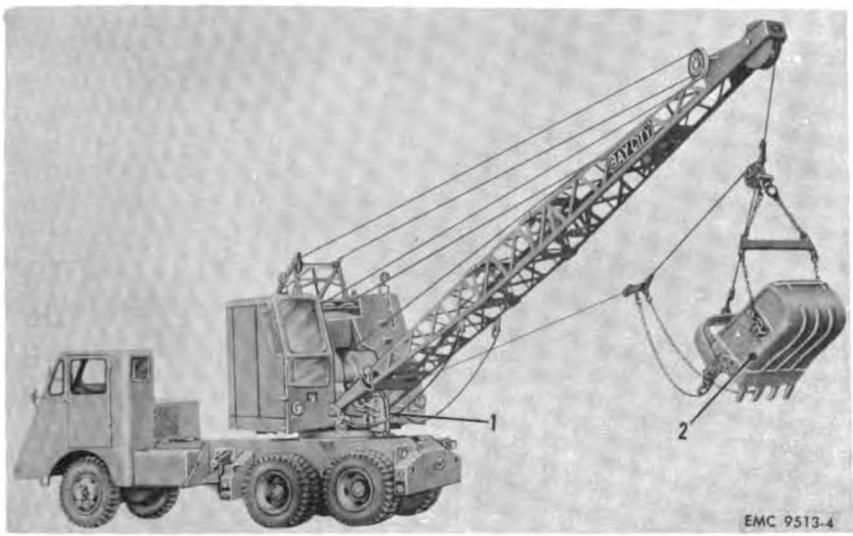
(3) *Tandem rear axle.* Two rear driving axles (9) and (11) are incorporated into a unit by a system of torque rods (13), equalizers, and a cross shaft tube (10) that maintain alinement and equalize the load, respectively. The axles are of the full-floating type, using double reduction driving units and conventional top-mounted differentials.

(4) *Transmission.* The transmission (16) is of the selective-gear type, having five speeds forward and one



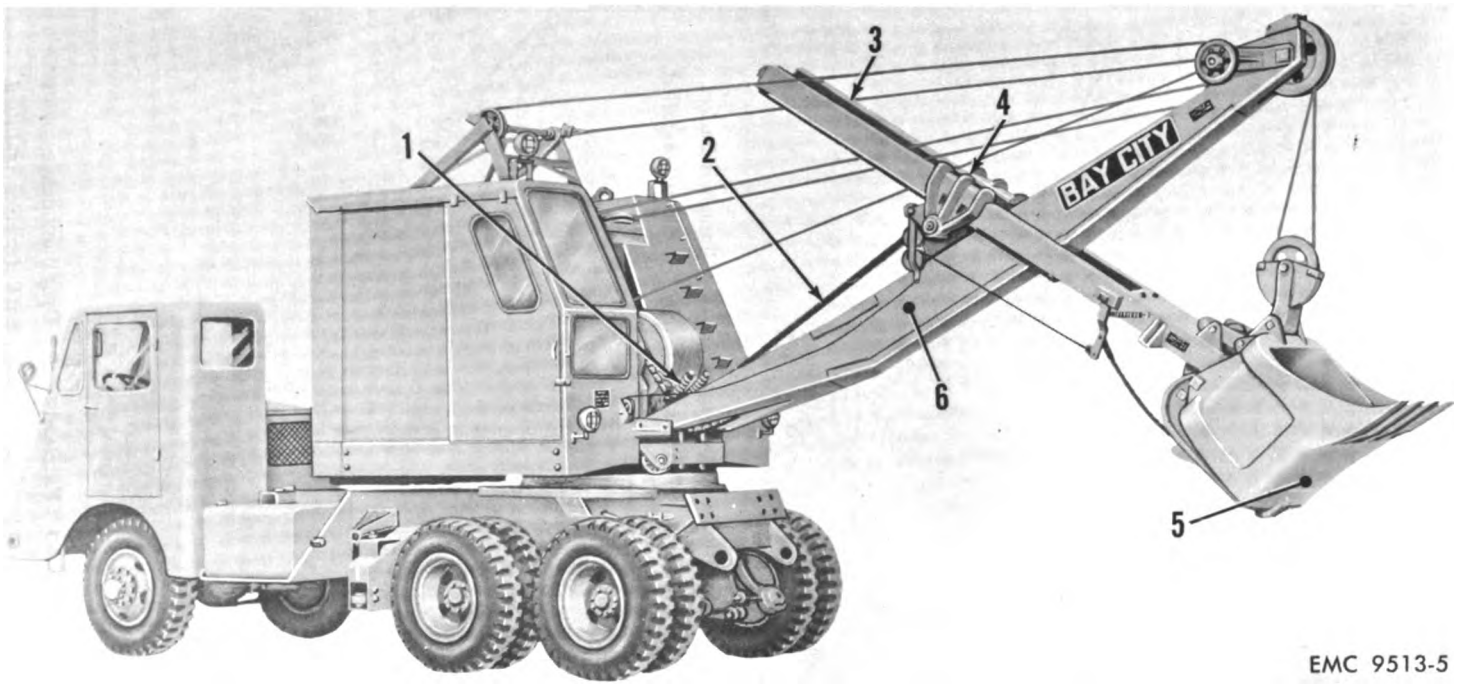
1 Rud-o-matic tagline 2 Clamshell bucket

Figure 3. Crane-shovel, with clamshell installed.



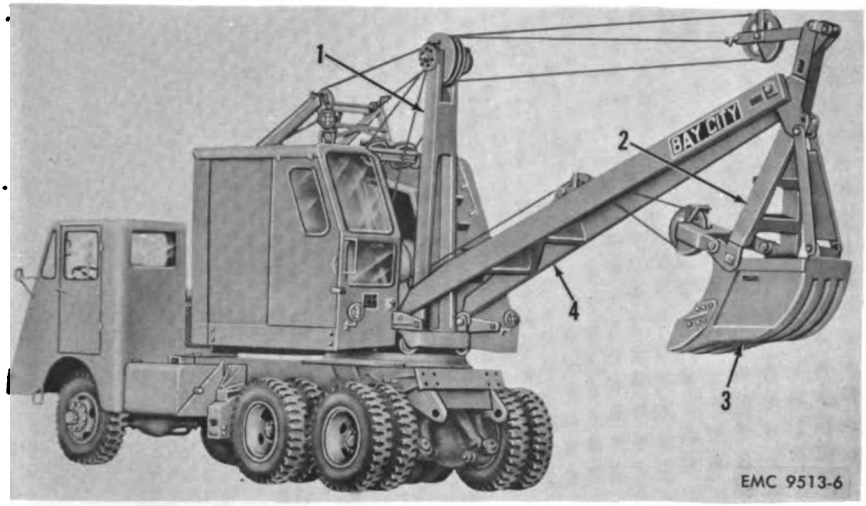
1 Fairlead 2 Dragline bucket

Figure 4. Crane-shovel, with dragline installed.



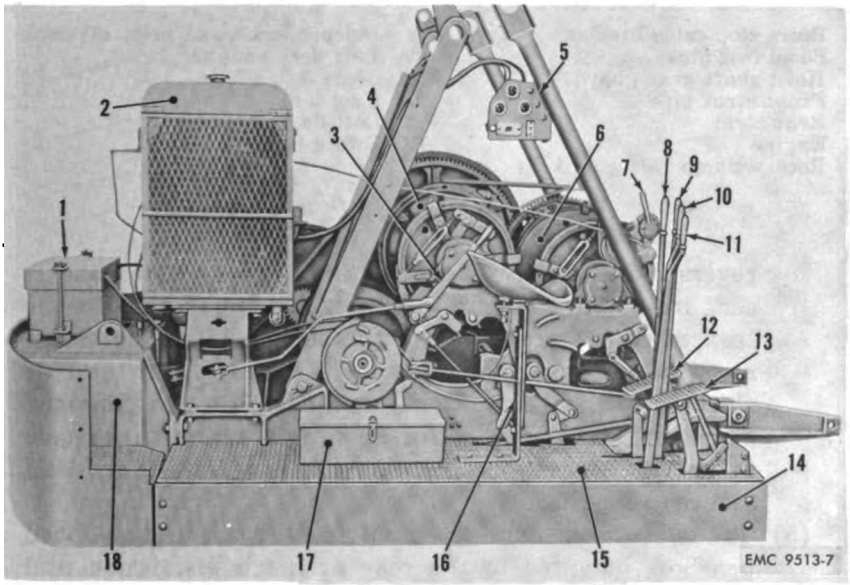
1 Crowd chain takeup
2 Crowd chain
3 Dipper handle
4 Shipper shaft
5 Dipper
6 Shovel boom

Figure 5. Crane-shovel, with shovel installed.



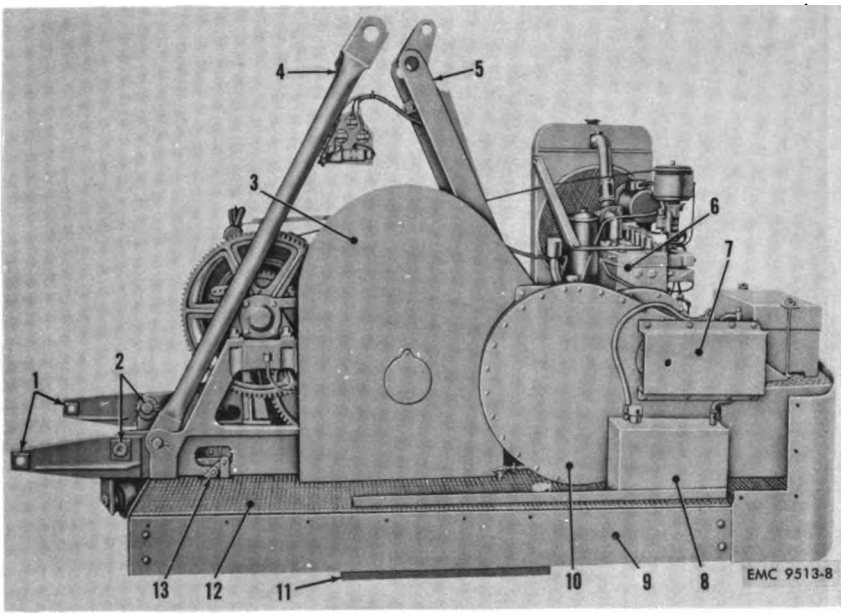
1 Mast **2 Handle** **3 Bucket** **4 Boom**

Figure 6. Crane-shovel, with back hoe installed.



1 Battery box
2 Radiator assembly
3 Engine clutch hand lever
4 Hoist shaft assembly
5 Engine control panel
6 Front drum shaft assembly
7 Throttle hand lever
8 Intermediate shaft clutch hand lever
9 Crowd and front drum clutch hand lever
10 Hoist shaft clutch hand lever
11 Independent boom hoist clutch hand lever
12 Front drum brake foot pedal
13 Hoist drum brake foot pedal
14 Right deck channel
15 Right floorplate
16 Operator's seat
17 Toolbox
18 Counterweight

Figure 7. Revolving frame, right side view.



1 **Boom stop cable brackets**
2 **Boom foot pins**
3 **Hoist shaft gear guard**
4 **Front strut pipe**
5 **Rear strut**
6 **Engine**
7 **Rotary pump belt guard**
8 **Independent boom hoist oil tank**
9 **Left deck channel**
10 **Gearcase**
11 **Fuel tank**
12 **Left floorplate**
13 **Swing lock**

Figure 8. Revolving frame, left side view.

reverse, direct drive being in fifth speed. The case is cast iron with a separate clutch housing bolted to the transmission and directly to the bellhousing. The transmission has the standard shift arrangement and is shifted in the conventional manner. By shifting the gears, different gear ratios and combinations are made to provide power or speed, as made necessary by load and road conditions.

(5) *Transfer case.* The transfer case (6) is a two-speed gearbox, mounted to the rear of the transmission and

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1 **Steering gear assembly**
2 **Drag link assembly**
3 **Front axle assembly**
4 **Front axle drive shaft**
5 **Fuel tank**
6 **Transfer case and bracket**
7 **Outrigger screw jack base**
8 **Front outrigger support**
9 **Front rear axle assembly**
10 **Cross shaft tube**
11 **Rear axle assembly**
12 **Rear outrigger support**
13 **Torque rod**
14 **Emergency brake assembly**
15 **Spare tire and wheel**
16 **Transmission**
17 **Tie rod**
18 **Engine**
19 **Front spring**
20 **Engine muffler assembly**

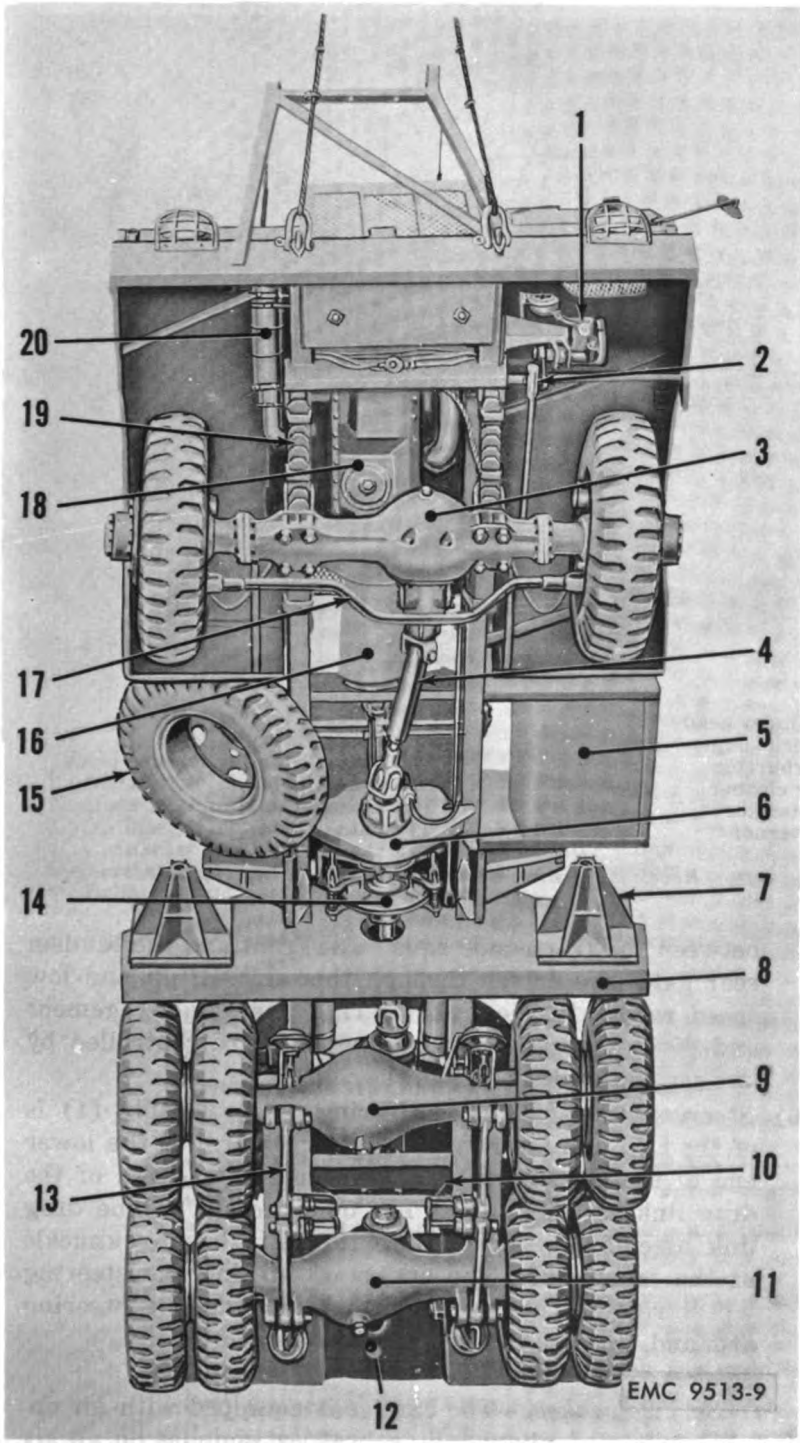
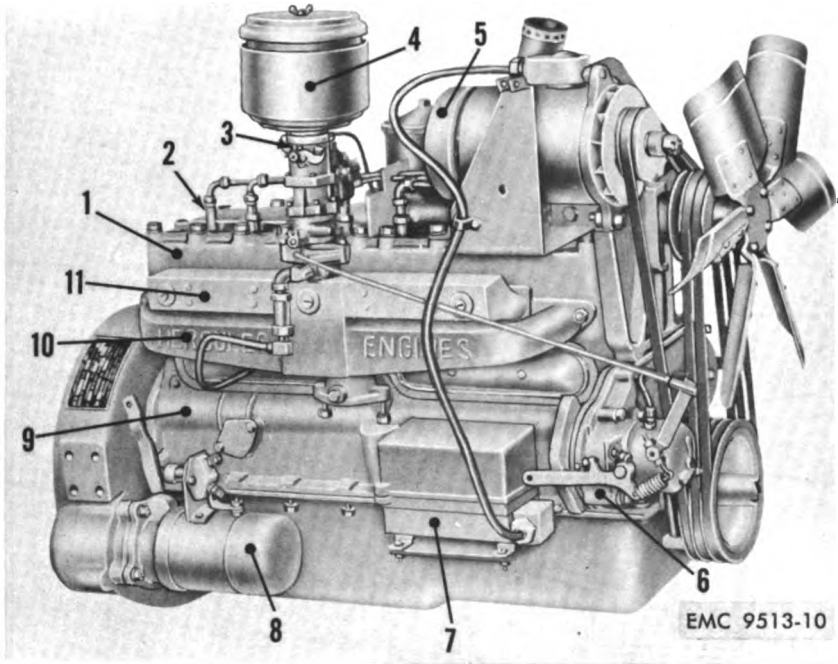


Figure 9. Crane-carrier, bottom view.



1 Cylinder head
2 Spark plug
3 Carburetor
4 Air cleaner
5 Generator
6 Governor
7 Voltage regulator
8 Starting motor
9 Cylinder and crankcase block assembly
10 Exhaust manifold
11 Intake manifold

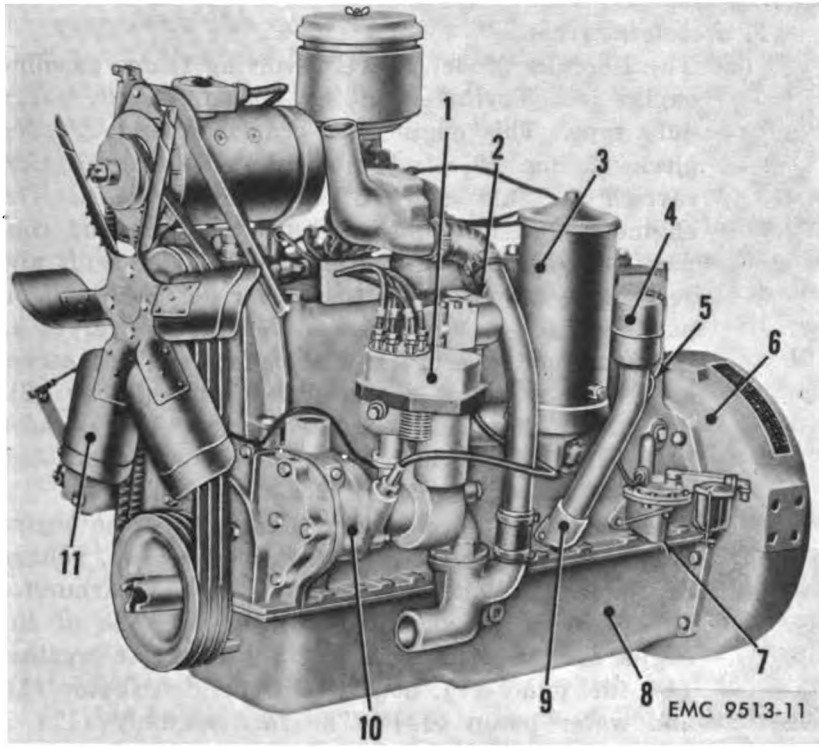
Figure 10. Revolving frame engine, right front three-quarter view.

between the frame side rails. The front and the tandem rear axles are driven through this unit. High and low speed ranges in the transfer case and the engagement and disengagement of the front axle are controlled by two separate shift levers in the cab.

(6) *Steering assembly.* The steering gear assembly (1) is of the cam and lever type. A steering arm at the lower end of the steering tube is connected to one end of the drag link assembly (2). The opposite end of the drag link assembly is attached to the left steering knuckle of the front axle. The action of turning the steering wheel rotates the steering tube, turning the steering arm and, through the tie rod, the front wheels.

(7) *Brakes.*

(*a*) *Service brakes.* The carrier is equipped with air-operated internal expanding brake assemblies on all six wheels. Trailer connections are provided at both front



1	Distributor	7	Fuel pump
2	Hour-meter	8	Oil pan
3	Oil filter	9	Fill pipe
4	Crankcase breather	10	Water pump
5	Level gage	11	Fan assembly
6	Bellhousing		

Figure 11. Revolving frame engine, left front three-quarter view.

and rear of the carrier for towing purposes. The service brake system is divided into two general groups: the mechanical portion which includes shoes, drums, cams, anchors, camshafts, and slack adjusters; and the air control portion which includes the air compressor, governor, application valve, safety devices, chambers, compression tanks, and connecting liners.

(*b*) *Emergency brake.* The emergency brake assembly (14) is located to the rear of the transfer case and consists of a flat circular brake disk fastened between two universal joint flanges. The brake lever in the cab is connected to two pair of brake shoes which grip both sides of the brake disk.

c. Engines.

(1) *Revolving frame.*

(*a*) The Hercules Model TDXC revolving frame gasoline engine is a 6-cylinder, in-line, L-head, 4-cycle, heavy duty type. This engine has crankcase and cylinder block (9, fig. 10) cast integral, with water jacket carried the full length of the cylinder walls. The engine is pressure-lubricated to the main and connecting rod bearings, and also to the idler shaft and gear. The crankcase bottom cover serves as an oil pan (8, fig. 11). The gear cover casting serves as the front engine support. The bellhousing (6) serves as a rear cover for the crankcase and oil pan (8), and also as the rear engine support. The cylinder head (1, fig. 10), which is completely water-jacketed, is attached to the cylinder block by cap screws.

(*b*) Accessories mounted on the right side of the engine are the generator (5, fig. 10), governor (6), voltage regulator (7), starting motor (8), and carburetor (3). Accessories mounted on the left side of the engine are the oil filter (3, fig. 11), crankcase breather (4), fuel pump (7), hour-meter (2), distributor (1), and water pump (10). The fan assembly (11) is mounted by a bracket which is bolted to the top of the timing gear cover. Electrical accessories are 24-volt and waterproof.

(*c*) Engine references to "right" or "left" refer to a view of the engine from the rear or flywheel end. The right side is also the camshaft and manifold side. The left side is the distributor and water pump side.

(2) *Carrier.* See TM 5–5252 for description, operation, and maintenance of the Hercules Model TDXC carrier engine.

d. Revolving Frame Machinery. The revolving frame base and machinery supports are cast integral and support the hoist shaft assembly (4, fig. 7), front drum shaft assembly (6), engine (6, fig. 8), gearcase (10), independent boom hoist assembly (1, fig. 12), reverse crowd idler gear (5), vertical swing shaft gear (7), and horizontal intermediate shaft assembly (9). The deck channels (14, fig. 7) and (9, fig. 8) are attached to the base. The counterweight (18, fig. 7) and the boom stop cable brackets (1, fig. 8) are welded to the base. The front strut pipes (4, fig. 8) and rear struts (5) support the A-frame and are pin connected to brackets in the base. The gearcase (1, fig. 13) contains the engine clutch shaft pinion (2), idler shaft pinion

(3), independent boom hoist drive pinion (4), and jackshaft spur gear (5). The control levers and pedals (7–13, fig. 7) attach to clutches and brakes through a system of reach rods, arms, and shafts that pass through, around, and under the machinery.

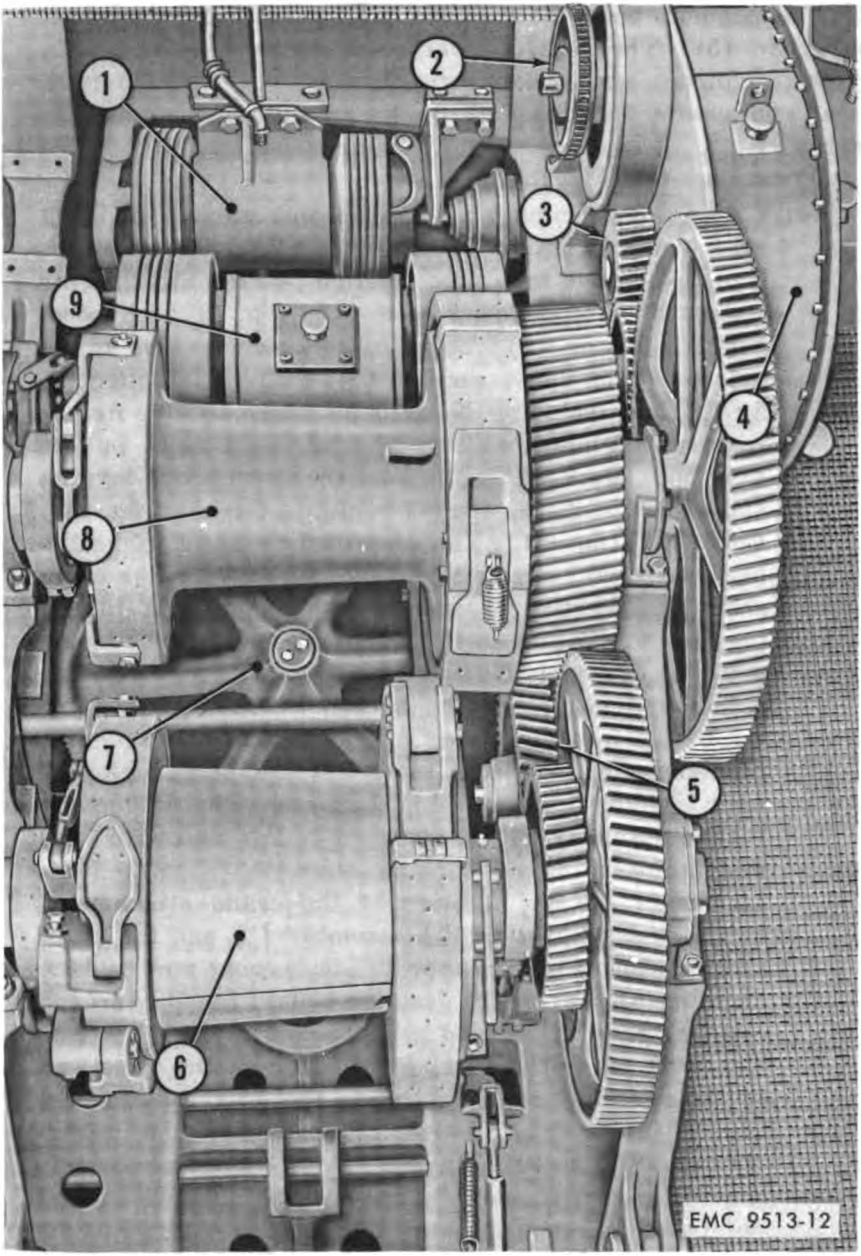
e. Front End Attachments.

(1) *Crane.* The primary purpose of the crane is to lift a load, swing or travel it to a new location, and lower the load to place it in a new position. Crane attachments consist of a boom lower section (8, fig. 1) with boom angle indicator (9); boom center section (7), if required; boom upper section (5) with cable roller (3, fig. 2) and including boom point assembly (4, fig. 1) with hoist pulleys (1, fig. 2) and boom hoist pulleys (2); hook block (6, fig. 1); and the appropriate lagging and cables including the boom stop cables (14, fig. 2).

(2) *Clamshell* (fig. 3). The clamshell is used to handle loose material such as coal, sand, or gravel. The clamshell bucket (2) consists of two half-scoops hinged together at the top so they will close when picking up material. The only digging force available is the closing action and weight of the bucket which tend to force the bucket into the material. Teeth of the bucket must be removed when loose materials are being unloaded from railway cars or ship bottoms. The Rudomatic tagline assembly (1) is attached to the bucket to keep it from twisting or turning sidewise. Clamshell attachments are, in addition to the crane attachments less hook block, the tagline assembly (1) and the clamshell bucket (2) with appropriate lagging and cables.

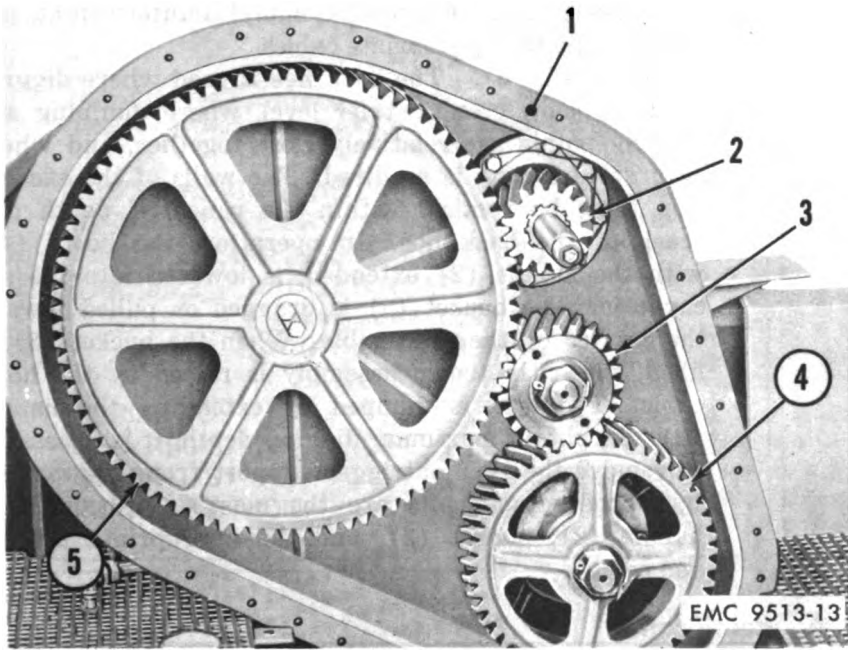
(3) *Dragline* (fig. 4). The dragline is used for digging and cleaning out ditches, and general excavation below carrier level. A fairlead (1) is installed on the front end of the revolving frame to guide the drag cable as the bucket (2) is dragged through the material to be excavated. The bucket acts as a scoop as it moves through the material and may be raised and dumped at any point within range of the boom. Dragline attachments are, in addition to the crane attachments less hook block, the fairlead (1) and the bucket (2) with appropriate lagging and cable.

(4) *Shovel* (fig. 5). The shovel is used to excavate in very hard material and is designed for very accurate dumping. It is limited to operations where dumping is at levels not too far above machine height, and where



1 Independent boom hoist assembly
2 Engine clutch assembly
3 Jackshaft pinion
4 Gearcase
5 Reverse crowd idler gear
6 Front drum shaft assembly
7 Vertical swing shaft gear
8 Hoist shaft assembly
9 Horizontal intermediate shaft assembly

Figure 12. Revolving frame machinery power train.



1 Gearcase
2 Engine clutch shaft pinion
3 Idler shaft pinion
4 Independent boom hoist drive pinion
5 Jackshaft spur gear

Figure 13. Gearcase, with cover removed.

the entire equipment may be operated in the excavation. The dipper (5) is attached to the end of the dipper handle (3), which slides in the shipper shaft (4) yoke mounted on the shovel boom (6). In the digging motion, the dipper (5) is crowded, thrust outward, by the crowd chain (2) mechanism, into the bank in order to fill it. As the bite is taken, the dipper is hoisted simultaneously. After the dipper is loaded, the boom is swung to dumping position, where the dipper door is unlatched by means of the electric dipper trip. The dipper trip is controlled by a pushbutton on the intermediate shaft clutch control hand lever. For lengthy shovel operation it is desirable to remove the rear outrigger support (12, fig. 9) from the carrier. Shovel attachments are: the boom (6, fig. 5) dipper handle (3) and dipper (5); crowd mechanism consisting of the crowd chain (2), crowd chain takeup (1), reverse crowd clutch assembly, front drum split sprocket, front drum and the reverse crowd clutches control; electric

dipper trip mechanism consisting of the pushbutton, trip wheel and cable drum assembly, counterweight, and pulleys; and the appropriate cables.

(5) *Back hoe* (fig. 6). The back hoe is used where digging is at or below crane carrier level, where dumping and digging points are relatively close together, and where accurate dumping is required. The walls of the excavation must be vertical within the range of depth and reach of the back hoe. In operation, the boom (4), with the handle (2) extended, is lowered into the excavation. The bucket (3) is dragged or pulled toward the carrier by the drag cable. When the bucket (3) is filled, the entire boom assembly is raised by the hoist cable. The load is dumped by extending the handle (2). To obtain maximum digging depth, it is necessary to remove the rear outrigger support from the carrier. Back hoe attachments are the mast (1), boom (4), handle (2), bucket (3), and the appropriate lagging and cables.

4. Identification

(fig. 14)

a. Corps of Engineers Identification Plate. The Corps of Engineer identification plate (A) is mounted on the lower right front corner of the revolving frame cab. This plate indicates the official nomenclature, model number, serial number, USA registration number, stock list number, gross weight, and tire size and inflation data for the crane-shovel.

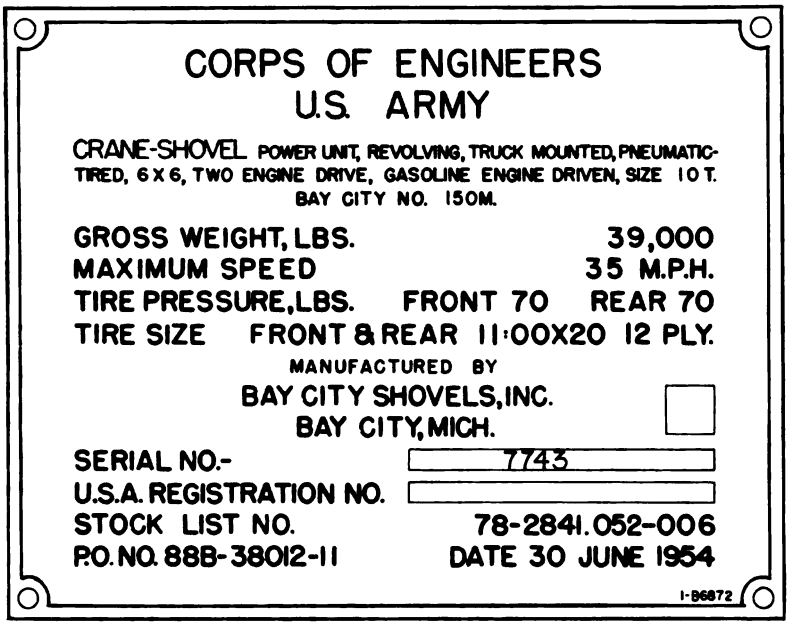
b. Transportation Data Plate. The transportation data plate (B) is mounted on the lower left corner on the left side of the revolving frame cab. This plate gives the overall dimensions of the crane-shovel, shipping cubage, shipping weight, and the shipping tonnage.

c. Lifting Capacity Plate. The lifting capacity plate (C) is mounted inside the revolving-frame cab on the right rear door. This plate shows the safe load capacity of the crane, with and without outriggers, at various radii.

d. Carrier Serial Number Plate. The carrier serial number plate (D) is mounted inside the carrier cab to the right of the driver.

e. Revolving Frame Serial Number Plate. The revolving frame serial number plate (E) is mounted inside the revolving frame cab on the right rear door. This plate shows the model, serial number, and standard capacity of the crane-shovel.

f. Crane Boom Plate. The plate (F) is attached to the lower,



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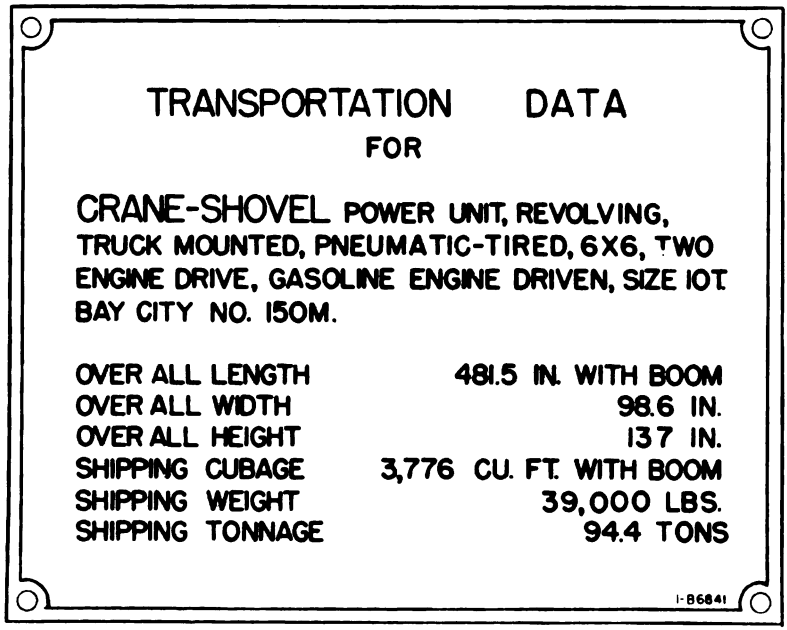


B

EMC 9513-14/1

Figure 14. Identification plates.

CRANE WORKING LOADS—MODEL 150 M

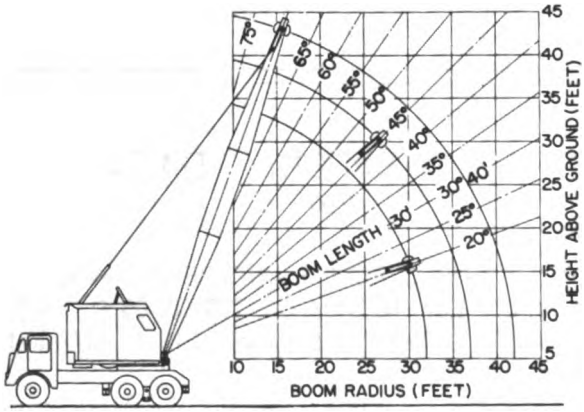
With Outriggers (Over Side & Rear)

RADIUS	30 Ft. Boom		35 Ft. Boom		40 Ft. Boom	
	ANGLE	WEIGHT	ANGLE	WEIGHT	ANGLE	WEIGHT
10'	74°-30'	20,000 lbs.				
12'	70°-30'	15,800	73°-30'	15,600 lbs.		
15'	64°-30'	12,800	68°-0'	12,000	71°-0'	11,800 lbs.
20'	53°-0'	8,900	59°-0'	8,700	63°-30'	8,500
25'	40°-0'	7,150	49°-0'	6,950	55°-0'	6,750
30'	21°-0'	6,000	37°-0'	5,800	45°-30'	5,600
35'			19°-30'	4,600	34°-30'	4,400
40'					18°-0'	3,700

Without Outriggers (Over Side & Rear)

RADIUS	30 Ft. Boom		35 Ft. Boom		40 Ft. Boom	
	ANGLE	WEIGHT	ANGLE	WEIGHT	ANGLE	WEIGHT
10'	74°-30'	13,500 lbs.				
12'	70°-30'	10,250	73°-30'	10,050 lbs.		
15'	64°-30'	7,500	68°-0'	7,300	71°-0'	7,100 lbs.
20'	53°-0'	5,050	59°-0'	4,850	63°-30'	4,650
25'	40°-0'	3,750	49°-0'	3,550	55°-0'	3,350
30'	21°-0'	3,000	37°-0'	2,800	45°-30'	2,600
35'			19°-30'	2,100	34°-30'	1,900
40'					18°-0'	1,500

NOTES: 1. Crane lifting capacities are gross loads in pounds applied at a radius measured from the center of rotation of the crane.
2. These capacities are 85% of tipping load based on unit standing on firm level ground.
3. Lifting slings, hook blocks, buckets, and other external auxiliary lifting equipment are to be considered part of load.



BAY CITY SHOVELS, INC., BAY CITY MICHIGAN, U. S. A.

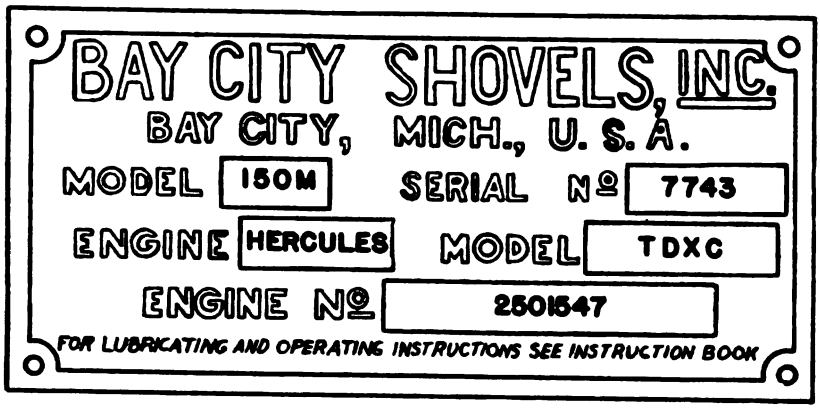
C

EMC 9513-14/2

Figure 14—Continued.

center, and upper sections of the crane boom identifying the model, serial number, and capacity of the crane-shovel to which they are assigned.

g. Fairlead Plate. The plate (G) is attached to the fairlead assigned to the crane-shovel, noted in the serial number location, for dragline operation.



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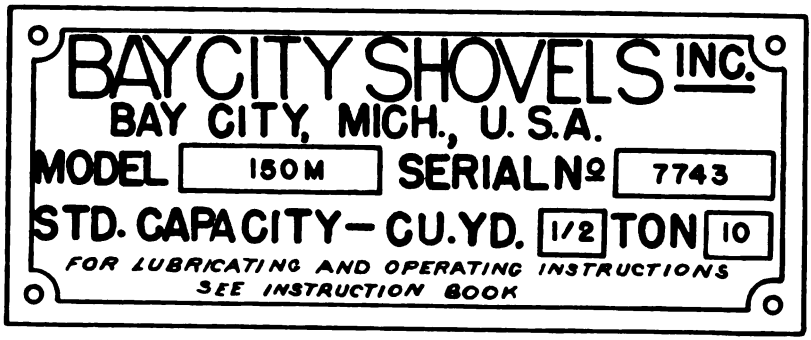

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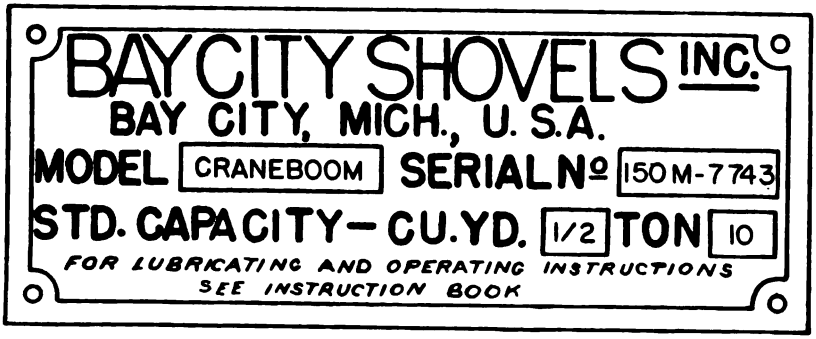
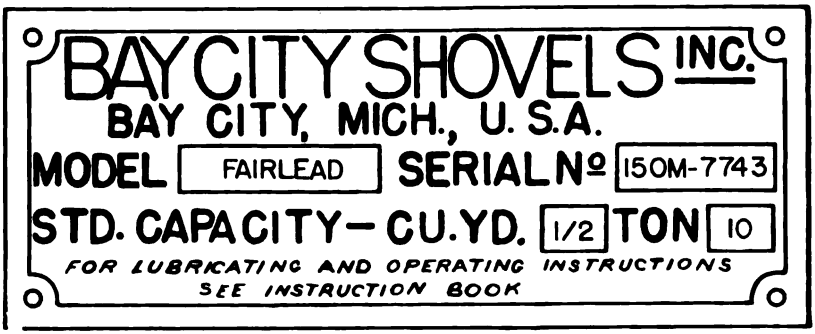


F

EMC 9513-14/3

Figure 14—Continued.



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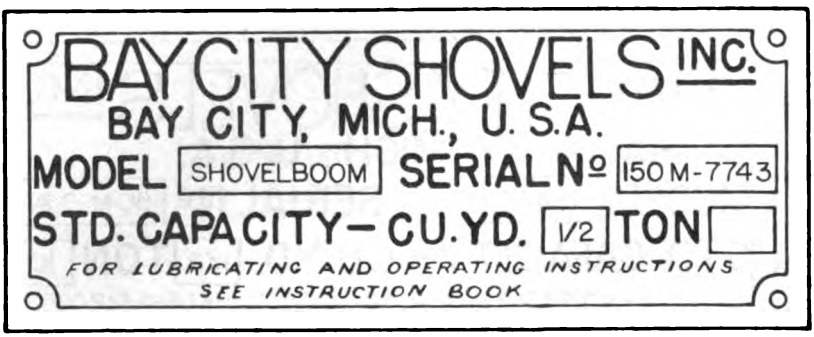
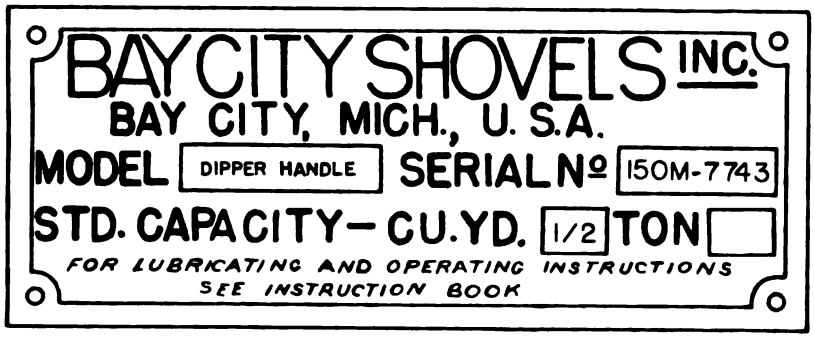
H



I

EMC 9513-14/4

Figure 14—**Continued.**



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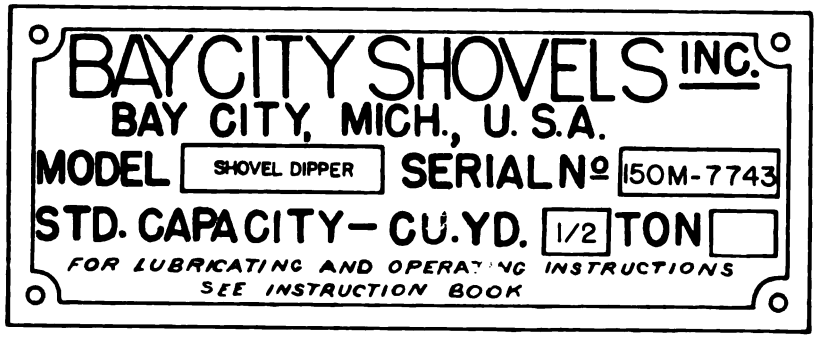

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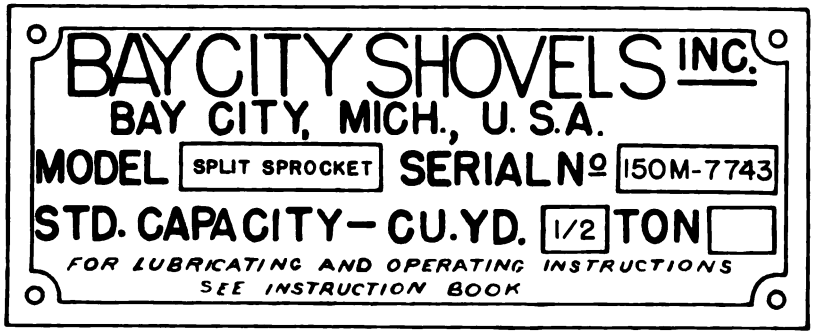
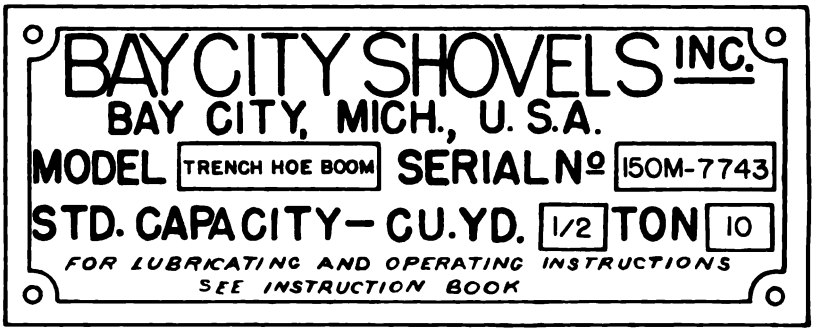


L

Figure 14—Continued.

EMC 9513-14/5



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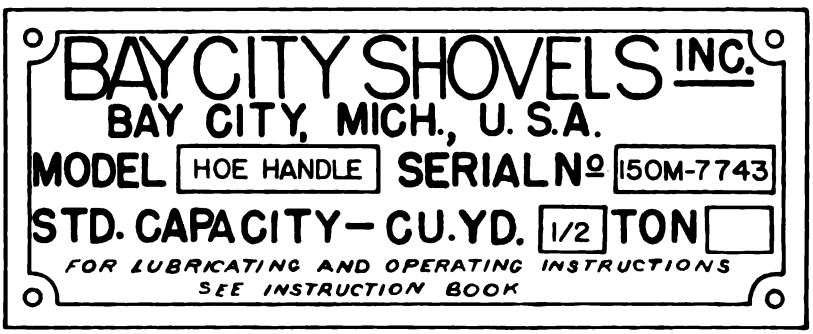

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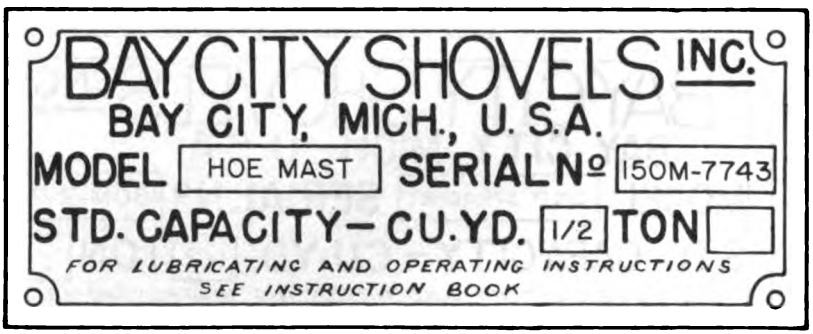

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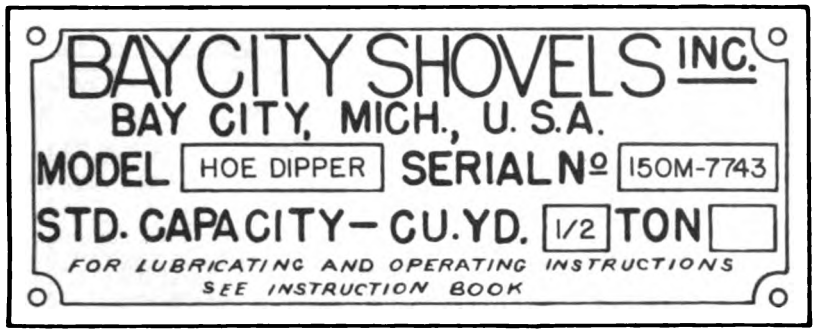
Figure 14—**Continued.**



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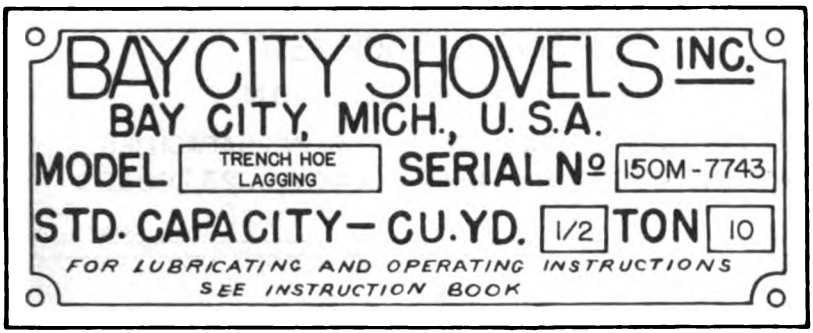

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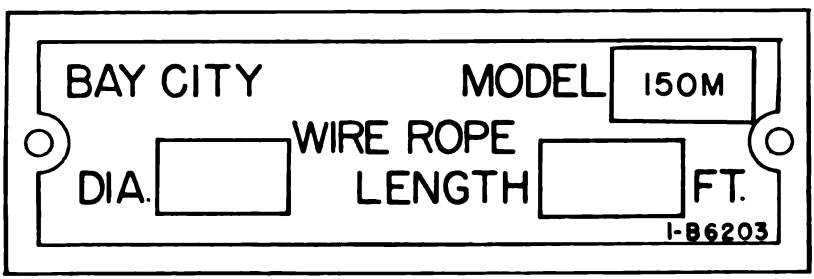


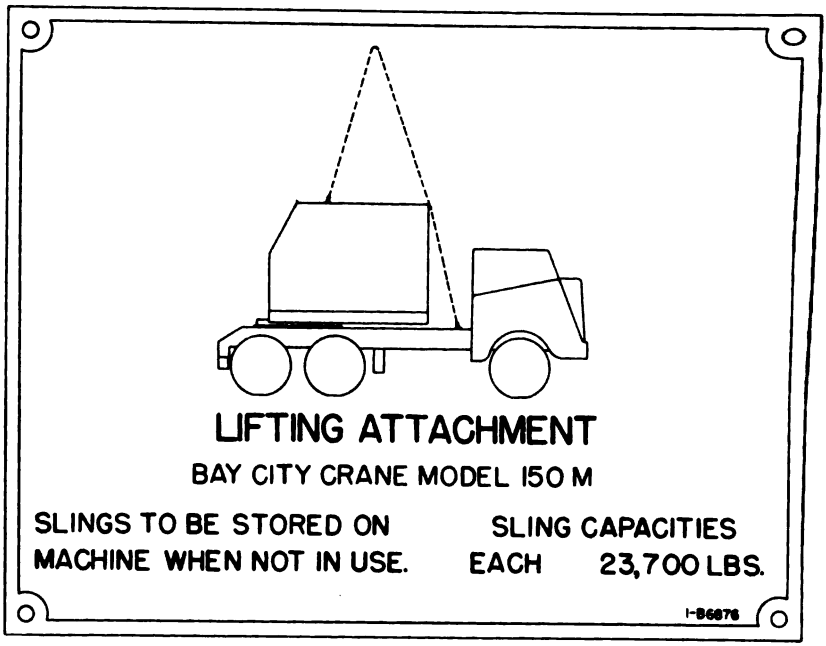
R

EMC 9513-14/7

Figure 14—**Continued.**

h. Dragline Lagging Plate. **The plate (H) is attached to the lagging assigned to the crane-shovel, noted in the serial number location, for dragline operation.**

i. Shovel Boom Plate. **The plate (I) is attached to the shovel boom assigned to the crane-shovel, noted in the serial number location, for shovel operation.**



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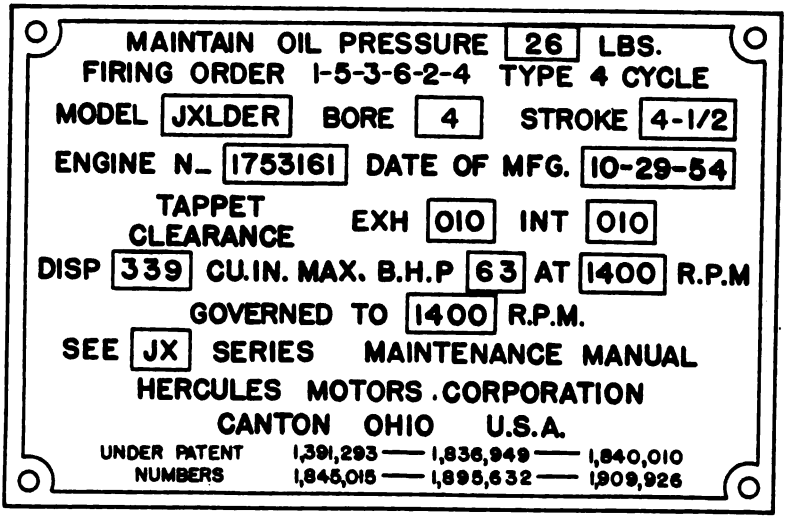


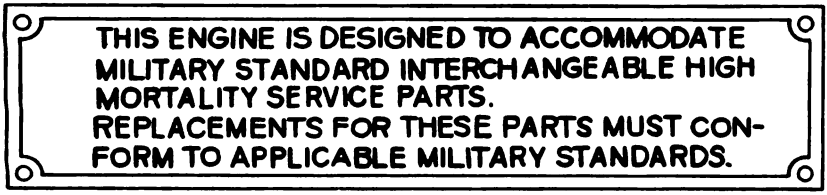
T

EMC 9513-14/8

Figure 14—**Continued.**

j. Dipper Handle Plate. The plate (J) is attached to the dipper handle assigned to the crane-shovel, noted in the serial number location, for shovel operation.

k. Shovel Dipper Plate. The plate (K) is attached to the dipper assigned to the crane-shovel, noted in the serial number location, for shovel operation.



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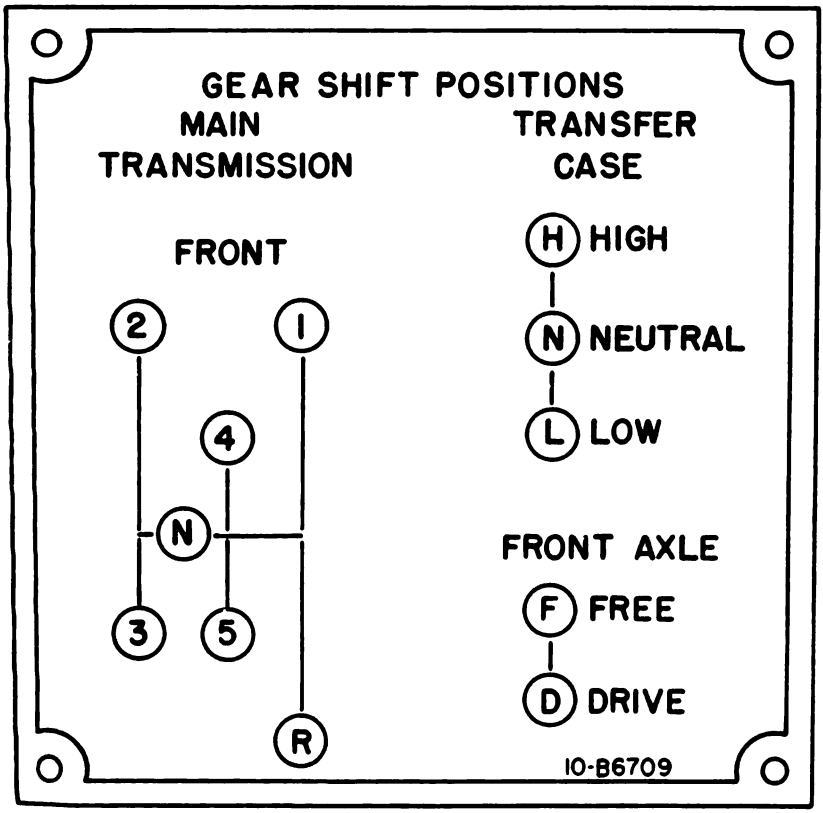
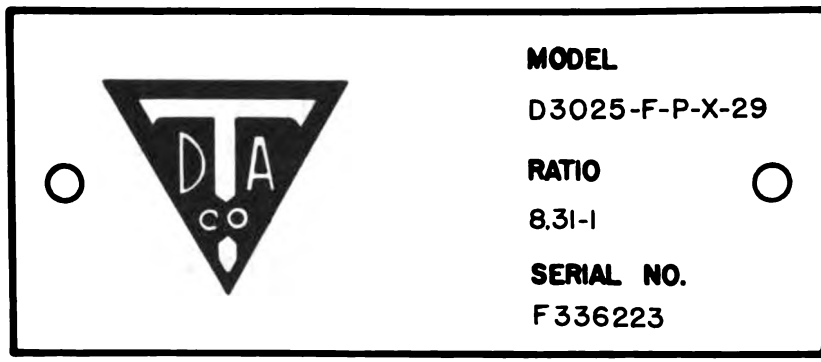


V

EMC 9513-14/9

Figure 14—Continued.

W



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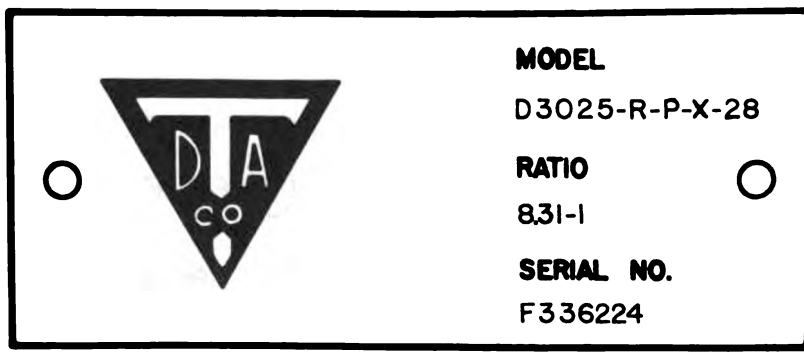


Y

EMC 9513-14/10

Figure 14—**Continued.**

l. Split Sprocket Plate. The plate (L) is attached to the front drum split sprocket assigned to the crane-shovel, noted in the serial number location, for shovel operation.

m. Trench Hoe Boom Plate. The plate (M) is attached to the hoe boom assigned to the crane-shovel, noted in the serial number location for back hoe operation.

n. Hoe Handle Plate. The plate (N) is attached to the hoe handle assigned to the crane-shovel, noted in the serial number location, for back hoe operation.

o. Hoe Mast Plate. The plate (O) is attached to the hoe mast assigned to the crane-shovel, noted in the serial number location, for back hoe operation.

p. Hoe Dipper Plate. The plate (P) is attached to the bucket assigned to the crane-shovel, noted in the serial number location for back hoe operation.

q. Trench Hoe Lagging Plate. The plate (Q) is attached to the front drum lagging assigned to the crane-shovel, noted in the serial number location, for crane, clamshell, and back hoe operation.

r. Wire Rope Plate. The plate (R) is attached to a coil of cable assigned to the crane-shovel model shown and gives the diameter and length of the cable in the coil.

s. Lifting Attachment Plate. The plate (S) is mounted on the lower left corner on the left side of the revolving frame cab. This plate shows the method of attaching the lifting slings to the crane-shovel and gives the safe capacity of each sling.

t. Revolving Frame Engine Serial Number Plate. The plate (T) is mounted on the bellhousing of the revolving frame engine. This plate shows the model, serial number, and pertinent data of the revolving frame engine.

u. Military Standard Replacement Parts Plate. The plate (U) is mounted on the bellhousing of the revolving frame engine and indicates that replacement parts must conform to applicable military standards.

v. Carrier Gearshift Positions Plate. The plate (V) is mounted inside the carrier cab to the right of the driver and shows the gearshift positions for the transmission, the transfer case, and the front axle declutch levers.

w. Transmission Serial Number Plate. The plate (W) is mounted on the side of the transmission case and indicates its model and serial number.

x. Front Rear Axle Serial Number Plate. The plate (X) is

mounted at rear of the front rear axle housing and above the axle centerline. This plate gives the model, ratio, and serial number of the front rear axle assembly.

y. Rear Axle Serial Number Plate. The plate (Y) is mounted at rear of the rear axle housing and above the axle centerline. This plate gives the model, ratio, and serial number of the rear axle assembly.

z. Transfer Case and Front Axle Assembly. Identification for the transfer case and the front axle assembly is stamped on the case and housing.

5. Differences in Models

There are no differences within the model of the crane-shovel covered in this manual.

6. Tabulated Data

a. General.

Revolving frame:	
Make	Bay City
Model	150M
Rated lifting capacity	½ cu yd, 10 ton
Revolving frame engine:	
Make	Hercules
Model	JXLDER
Type	L-head, vertical, 6 cylinder, in-line, gasoline, liquid-cooled
Clutch make and model	Twin Disc X7876–C110
Rated horsepower at 1400 rpm	60
Carrier:	
Make	Bay City
Model	150M
Carrier engine:	
Make	Hercules
Model	TDXC
Type	L-head, vertical, 6-cylinder, in-line, gasoline, liquid-cooled
Clutch make and model	Lipe-Rollway 140–1–509
Rated horsepower at 2450 rpm	150
Steering gear:	
Make	Ross
Model	TA72084
Ratio	27:23:27
Front axle assembly:	
Make	Timken-Detroit
Model	F–3200–WX27
Ratio	8.27–1
Front rear axle assembly:	
Make	Timken-Detroit
Model	D3025–F–P–X–29
Ratio	8.31–1

Rear axle assembly:
- Make — Timken-Detroit
- Model — D3025–R–P–X–28
- Ratio — 8.31–1

Transmission:
- Make — Fuller
- Model — 5–A–62

Transfer case:
- Make — Timken-Detroit
- Model — T76–37, 1.72–1

Emergency brake:
- Make — American Chain
- Model — TRU–STOP 65D–16550

Rudomatic tagline:
- Make — McCaffrey-Ruddock
- Model — 636

b. Capacities.

Revolving frame:
- Fuel tank — 27 gallon
- Gearcase — 10 quart
- Independent boom hoist oil tank — 5 gallon
- Vertical intermediate shaft bearing housing. — 3 pound
- Independent boom hoist bevel case. — 2½ quart
- Independent boom hoist worm case. — 2 quart
- Engine crankcase — 2.2 gallon
- Engine cooling system — 6 gallon
- Engine air cleaner — ¾ quart
- Engine oil filter — 2 quart

Carrier:
- Fuel tank — 74 gallon
- Transmission — 12 quart
- Transfer case — 2 quart
- Front axle — 22 pint
- Rear axle (each) — 31 pint
- Engine crankcase — 2.5 gallon
- Engine cooling system — 10¾ gallon
- Engine air cleaner — 3½ pint
- Engine oil filter (each) — 2 quart
- Tires, 11:00 x 20, 12 ply (each) — 70 pounds per square inch
- Rud-o-matic tagline — 8 quart

c. Engine Accessories.

(1) *Revolving frame engine.*

	Manufacturer	*Model*
Crankcase breather	Hercules	38939A
Oil filter unit	Fram	7846
Air cleaner	Air-Maze	F140–71F
Carburetor	Zenith	11754
Batteries	Auto-Lite	6TNR–US
Fuel pump	AC	5594198

	Manufacturer	Model
Governor	Pierce	GC–604
Distributor	Delco-Remy	1111608
Generator	Delco-Remy	1117496
Hour-meter	Durant	HM–7486
Ignition coil	Delco-Remy	1915992
Magnetic switch	Ideal Clamp	78–1
Starting motor	Delco-Remy	1108575
Voltage regulator	Delco-Remy	118625
Spark plugs	Champion	XEJ–8–64

(2) *Carrier engine.*

	Manufacturer	Model
Crankcase breather	Donaldson	C–279
Oil filters	Michiana	SA–50
Air cleaner	Air-Maze	F350–71H
Carburetor	Zenith	10769
Fuel filter	AC	854107
Fuel pump	AC	5594198
Governor	Pierce	MA–1841
Batteries	Auto-Lite	8TR–US
Magnetic switch	Delco-Remy	1119751
Distributor	Delco-Remy	1111608
Generator	Delco-Remy	1117496
Hour-meter	Durant	HM–7486
Ignition coil	Delco-Remy	1915992
Starting motor	Delco-Remy	1109727
Voltage regulator	Delco-Remy	1118625
Air compressor	Bendix-Westinghouse	222317
Spark plugs	Champion	XE–J–8

d. Carrier and Revolving Frame Dimensions (fig. 15).

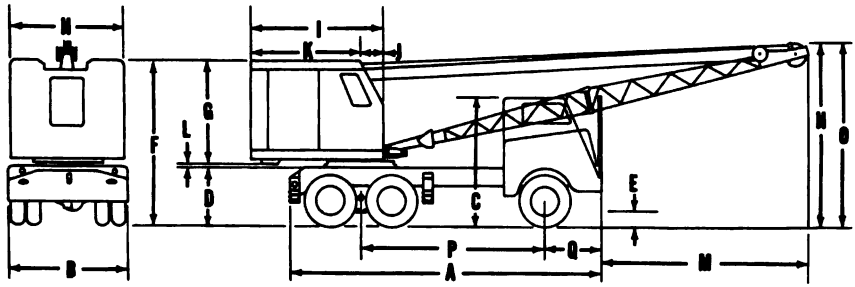
e. Shipping and Working Weights.

Crane:	
Working	41,000 lb
Shipping (without bucket or hook block)	40,800 lb
Shovel:	
Working	42,540 lb
Shipping	42,540 lb
Back hoe:	
Working	42,800 lb
Shipping	42,800 lb

f. Front End Attachments, Specifications.

Crane attachments:

	Height ft.	Height in.	Length ft.	Length in.	Width ft.	Width in.	Wt. lbs.	Capacity
Boom lower section.	1	11	15	4	2	10¾	970	....
Boom upper section.	1	11	16	0	1	10	880	....
Boom center sections:								
5 foot extension.	2	0	5	4	1	10	240	....
10 foot extension.	2	0	10	4	1	10	450	....



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		Feet	Inches
A	Carrier length	23	½
B	Carrier width:	----	----
	outriggers stowed	8	----
	outriggers extended	10	5½
C	Carrier height (top of cab to ground)	8	8⅝
D	Carrier height (from ground to deck)	4	1/16
E	Carrier ground clearance	1	3¾
F	Carrier and revolving frame:		
	overall height	----	----
	gantry lowered	11	4¾
	gantry elevated	13	3½
G	Revolving frame height (cab)	5	11¾
H	Revolving frame width	7	8¼
I	Revolving frame length	9	3½
J	Revolving frame, center of rotation to front of cab	1	7⅝
K	Revolving frame, center of rotation to back of counterweight	7	7⅞
L	Revolving frame clearance (between counterweight and carrier deck).	----	1¾
M	Length of crane boom extending beyond front of carrier	15	----
N	Height of boom point from ground, 30 ft boom in travel position.	12	2
O	Height of boom point from ground, 35 ft boom in travel position.	12	10
P	Carrier wheel base	13	1
Q	Front axle to carried front	4	----

Figure 15. Crane-shovel and carrier dimensions.

	Height ft.	Height in.	Length ft.	Length in.	Width ft.	Width in.	Wt. lbs.	Capacity
Hook block								10 ton
Clamshell bucket.								½ cu yd
Rudomatic tagline.	3	1½	4	4¼	0	6⅝	150	----
Dragline bucket.								½ cu yd
Fairlead	2	3	3	9	1	6½	580	----

Shovel attachments:

Boom length	17 ft 6 in.
Boom weight	2,130 lb
Dipper handle length	13 ft 1½ in.
Dipper handle weight	1,320 lb
Dipper capacity	½ cu yd
Dipper weight	1,755 lb

Back hoe attachments:	
Bucket capacity	½ cu yd
Bucket weight	1,200 lb
Bucket width over side cutters	36 in.
Length of boom hinge pin to point shaft	17 ft
Boom weight	1,640 lb
Length of handle	7 ft 5 in.
Weight of handle	1,100 lb
Height of mast	9 ft 7 in.
Weight of mast	800 lb
Carrier weight	21,850 lb

g. Cable Specifications.

Crane:	*Diameter*	*Length*
Boom hoist[1]	⅝ in.	118 ft
Boom stop[2] (2 rqr)	½ in.	15 ft 2 in.
Hoist[3]:		
Single line:		
30 ft boom	½ in.	80 ft
35 ft boom	½ in.	90 ft
40 ft boom	½ in.	100 ft
Three-part line:		
30 ft boom	½ in.	150 ft
35 ft boom	½ in.	170 ft
40 ft boom	½ in.	190 ft
Four-part line:		
30 ft boom	½ in.	185 ft
35 ft boom	½ in.	210 ft
40 ft boom	½ in.	235 ft
Clamshell:		
Holding[1]:		
30 ft boom	½ in.	65 ft
35 ft boom	½ in.	75 ft
40 ft boom	½ in.	85 ft
Closing[1]:		
30 ft boom	½ in.	90 ft
35 ft boom	½ in.	100 ft
40 ft boom	½ in.	110 ft
Tagline[2]	⅜ in.	60 ft
Dragline:		
Hoist[1]:		
30 ft boom	½ in.	85 ft
35 ft boom	½ in.	95 ft
40 ft boom	½ in.	105 ft
Drag[1]:		
30 ft boom	⅝ in.	40 ft
35 ft boom	⅝ in.	45 ft
40 ft boom	⅝ in.	50 ft
Dump[1]	⅜ in.	20 ft

[1] 6 x 19 Filler Wire, Type W, I.W.R.C., improved plow steel, right regular lay, nonpreformed wire rope.

[2] 6 x 19 Warrington, I.W.R.C., improved plow steel, uncoated, right regular lay, preformed wire rope.

[3] 18 x 7 Nonrotating, hemp center, improved plow steel, preformed wire rope.

Shovel:

	Diameter	Length
Boom hoist[2]	5/8 in.	118 ft
Dipper hoist[2]	5/8 in.	75 ft
Trip cable on handle[4]	5/16 in.	131/2 ft
Trip cable—drum to handle[4]	5/16 in.	20 ft
Trip cable—drum to counterweight[4]	1/4 in.	141/2 ft
Back hoe:		
Mast hoist[2]	1/2 in.	70 ft
Boom hoist[1]	5/8 in.	95 ft
Drag[1]	5/8 in.	55 ft

h. Crane and Clamshell Working Ranges. The crane and clamshell working range diagram, figure 16, indicates the boom radius and boom angle for the 30-, 35-, and 40-foot booms as used in the following tabulations. Crane and clamshell capacities are gross loads, in pounds, applied at a radius measured from the center of rotation of the crane shovel. These capacities are 85 percent of tipping load based on the crane-shovel standing on firm, level ground. Lifting slings, hook blocks, buckets, and other external auxiliary lifting equipment are to be considered part of the load.

(1) 30-foot boom with outriggers (over side and rear).

Boom radius (feet)	Boom angle (degrees)	(minutes)	Lifting capacity (pounds)
10	74	30	20,000
12	70	30	15,800
15	64	30	12,200
20	53	0	8,900
25	40	0	7,150
30	21	0	6,000

(2) 30-foot boom without outriggers (over side and rear).

Boom radius (feet)	Boom angle (degrees)	(minutes)	Lifting capacity (pounds)
10	74	30	13,500
12	70	30	10,250
15	64	30	7,500
20	53	0	5,050
25	40	0	3,750
30	21	0	3,000

(3) 35-foot boom with outriggers (over side and rear).

Boom radius (feet)	Boom angle (degrees)	(minutes)	Lifting capacity (pounds)
12	73	30	15,600
15	68	0	12,000
20	59	0	8,700
25	49	0	6,950
30	37	0	5,800
35	19	30	4,600

[1] 6 x 19 Filler Wire, Type W, I.W.R.C., improved plow steel, right regular lay, nonpreformed wire rope.

[2] 6 x 19 Warrington, I.W.R.C., improved plow steel, uncoated, right regular lay, preformed wire rope.

[4] 6 x 19 Warrington, hemp center, plow steel, right regular lay.

(4) 35-foot boom without outriggers (over side and rear).

Boom radius (feet)	Boom angle (degrees minutes)		Lifting capacity (pounds)
12	73	30	10,050
15	68	0	7,300
20	59	0	4,850
25	49	0	3,550
30	37	0	2,800
35	19	30	2,100

(5) 40-foot boom with outriggers (over side and rear).

Boom radius (feet)	Boom angle (degrees minutes)		Lifting capacity (pounds)
15	71	0	11,800
20	63	30	8,500
25	55	0	6,750
30	45	30	5,600
35	34	30	4,400
40	18	0	3,700

(6) 40-foot boom without outriggers (over side and rear).

Boom radius (feet)	Boom angle (degrees minutes)		Lifting capacity (pounds)
15	71	0	7,100
20	63	30	4,650
25	55	0	3,350
30	45	30	2,600
35	34	30	1,900
40	18	0	1,500

i. Dragline Working Ranges. Standard dragline booms are extended to secure the needed digging and dumping ranges by the

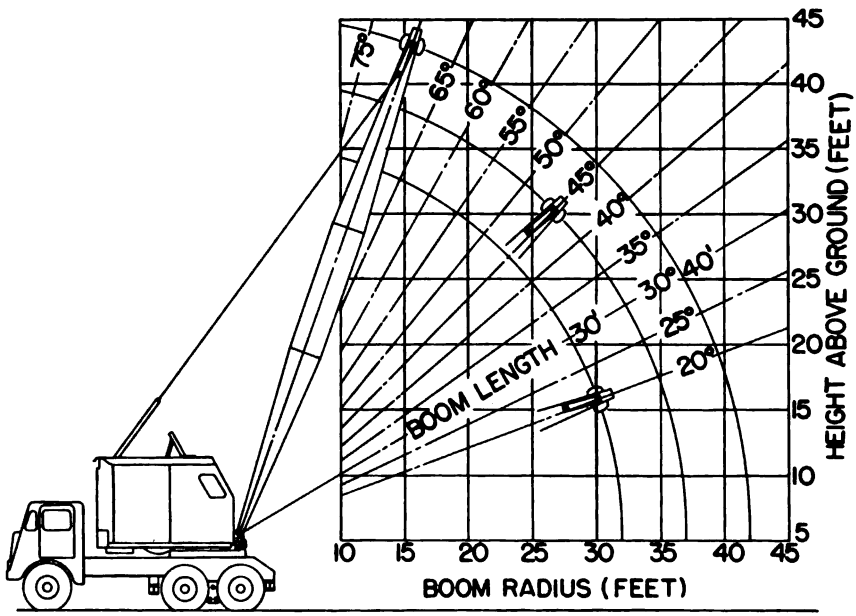

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Figure 16. Diagram of crane and clamshell working ranges.

insertion of a 5- or a 10-foot center section. This may call for reducing the bucket size to come within the stability rating of the crane-shovel. There is also a variation in bucket capacity due to application of buckets of various weights for handling different types of materials. Rating for each boom length is given in *h* above and covers weight of bucket plus weight of material. Water content and suction of material in the bank must be considered as well as the actual weight of the material. Nominal dragline working range is increased by the throw of the bucket which will be from ⅓ to ½ the dumping height depending on the skill of the operator. This extends both the digging and dumping range for overcasting, but does not affect the dumping range when loading to hauling equipment. Boom angles less than 35° from horizontal are seldom advisable for dragline work.

j. Shovel Working Range. Shovel reach range with the crane-shovel resting on firm, level ground and the shovel boom positioned at a 45° angle are not less than those noted below.

	Feet	*Inches*
Dump height with door open	15	3
Dump radius	21	0
Cut height	21	6
Cut radius	24	0
Dipping depth	3	0
Cleanup radius	15	0

k. Back Hoe Working Range. Hoe working range with a bucket width of 36 inches is as follows:

	Feet	*Inches*
Clearance at start of dump	11	0
Dipping depth over the rear	14	6

l. Carrier Performance.

Minimum turning radius ..... 25 ft—½ in.
Maximum speed, highest forward gear ..... 36 mph
Maximum grade ascending ability ..... 50.6 percent
Operating speeds, MPH (miles per hour):

	Transfer case—high		*Transfer case—low*	
Gear	*Gear ratio*	*MPH*	*Gear ratio*	*MPH*
5th	8.31	36.0	14.3	20.9
4th	11.5	26.0	19.75	15.1
3d	21.8	13.75	37.4	8.0
2d	38.8	7.7	66.7	4.48
1st	67.0	4.46	115.5	2.59
Reverse	67.5	4.43	116.2	2.58

m. Front End Attachments Performance.

(1) *Crane and clamshell.* Crane and clamshell production is dependent on the material being worked, the hauling equipment, and the skill of the operator.

(2) *Dragline.* Typical 30-foot boom dragline production for various types of material on a theoretical 60-minute hour, loading for hauling equipment, based upon optimum

depth of cut, 90° swing, and grade level loading are as follows:

Class of material	*Depth of cut (feet)*	*Cubic yards per hour*
Light moist clay or loam	5.5	95
Sand or gravel	5.5	90
Good common earth	6.7	75
Clay, hard, tough	8.0	55
Clay, wet, sticky	8.0	30

(3) *Shovel.* Approximate shovel production figures, in cubic yards per hour, in various materials, based upon optimum depth of cut, 90° swing, and grade level loading are as follows:

Class of material	*Cubic yards per hour*
Moist loam or light sandy clay	115
Sand and gravel	110
Good common earth	95
Clay, hard, tough	75
Rock, well blasted	60
Common, with rocks and roots	50
Clay, wet and sticky	40
Rock, poorly blasted	25

(4) *Back hoe.* Back hoe production is dependent on the material being worked, digging depth, clearances, and the skill of the operator.

n. Weight of Material. Special consideration must be given to weights of material, particularly for dragline or clamshell operation. The following gives approximate weights of average materials, per cubic yard of excavated material:

Material	*Pounds per cubic yard*
Earth, moist	2500
Sand, dry	2700
Sand, wet	3300
Gravel	2900
Loose stone	2700
Clay, wet	3000
Coal	1350
Cinders	1100
Ashes	900

CHAPTER 2

OPERATING INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF EQUIPMENT

7. New Equipment
(fig. 17)

a. General. The crane-shovel will be shipped, usually on a flatcar, without the front end attachments mounted on the revolving frame. The revolving frame machinery is assembled for crane, clamshell, or dragline operation only, less lagging and cables. The crane-carrier is shipped suitable for mounting any of the front end attachments. The particular front end attachment or, if requisitioned, all front end attachments are placed and tied down on the flatcar around the crane-shovel and, if necessary, on a second flatcar. Small items are boxed or crated.

b. Removal of Blocking and Tie-Down Devices.

(1) Remove any steel strapping and blocking used to tie down front end attachments and boxes on the flatcar.

(2) Remove all cable clamps (11), cables (12), cable thimbles (10), and black annealed wire (23) and (38).

(3) At the front end of the crane-carrier, remove the wood stakes (20), triangular-shaped wood blocks (22), fill lumber (19), wood blocks (18), waterproof paper (21), wood cleats (16), and triangular-shaped wood blocks (17).

(4) At the rear of the crane-carrier, remove the wood stakes (20), wood cleats (16), fill lumber (19), wood blocks (29), waterproof paper (21), wood cleats (28), bolts (26), wood blocks (25), and wedge-shaped wood blocks (27) and (30).

c. Removal of Preservative Compounds, Lubricants, and Devices.

(1) Remove the cover (7) from the carrier cab windshield, windows, and door glass.

(2) Remove the shields or covers from the revolving frame side window (35) and the front upper windows (36) and lower windows (45).

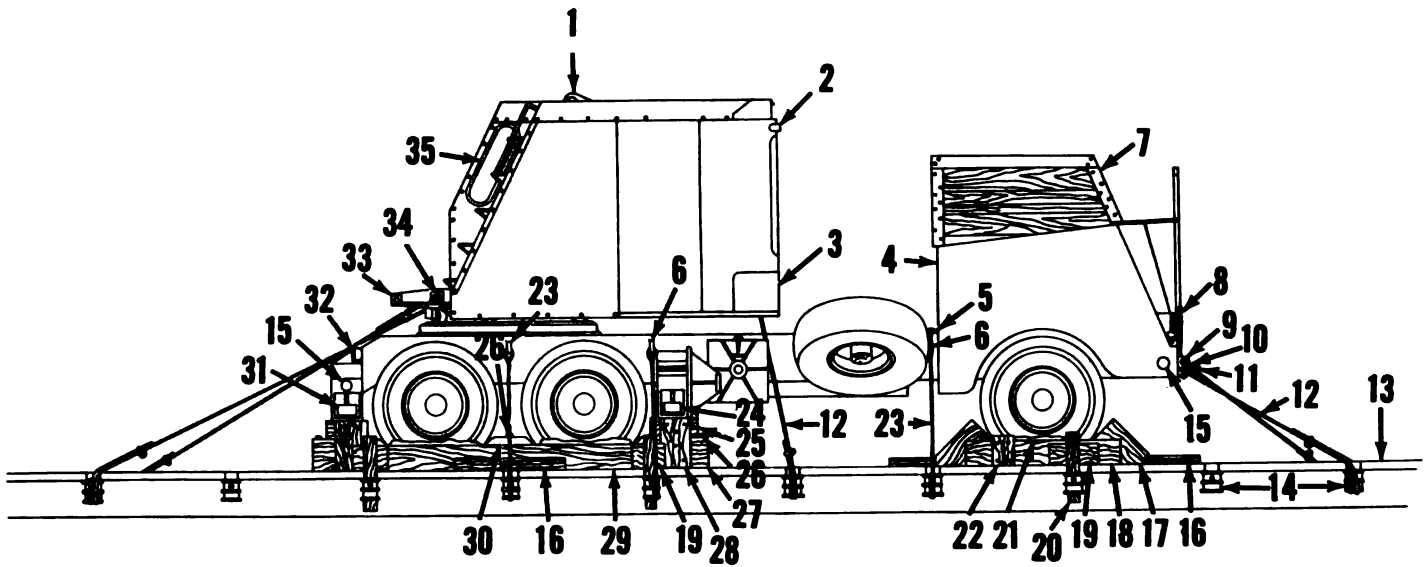
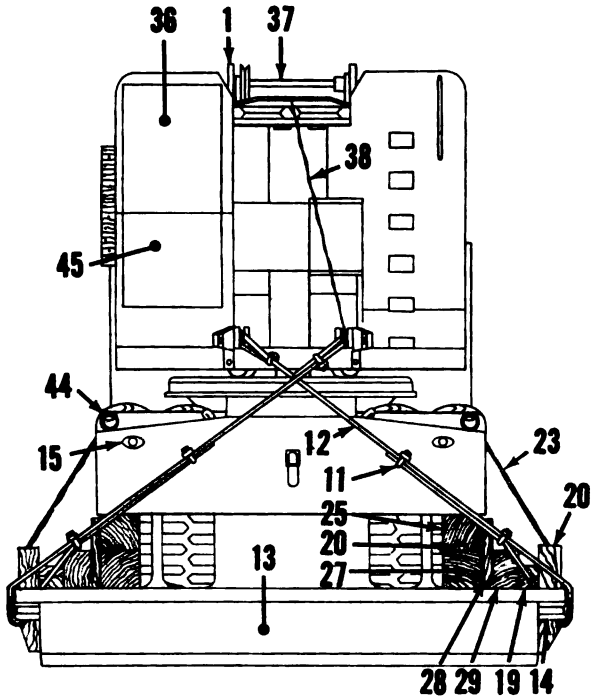


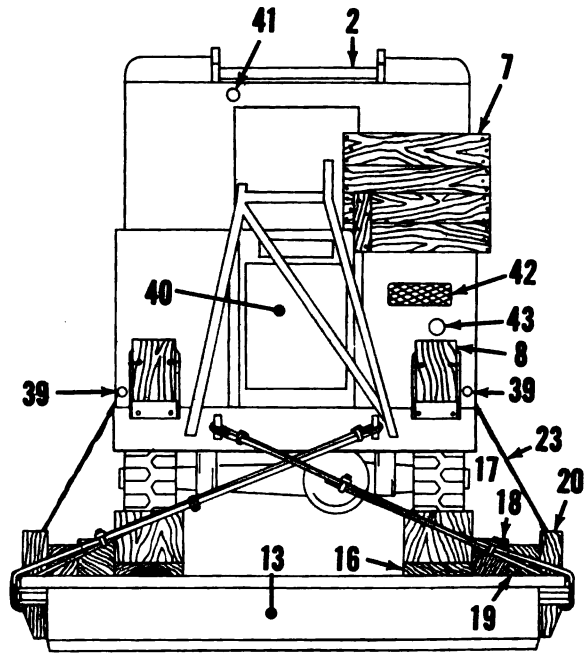
Figure 17. Crane-shovel loaded for shipment.

1 Upper lifting sling eye
2 Lifting sling spacer bar
3 Counterweight
4 Carrier engine compartment
5 Lower lifting sling eye
6 Tie-down eye
7 Carrier cab cover
8 Headlight cover (2 rqr)
9 Tow hook eye
10 Cable thimble (24 rqr)
11 Cable clamp (18 rqr)
12 Cable (6 rqr)
13 Flatcar
14 Stake pocket
15 Reflector
16 Wood cleat (6 rqr)
17 Triangular-shaped wood block (4 rqr)
18 Wood block (2 rqr)
19 Fill lumber (as rqr)
20 Wood stake (6 rqr)
21 Waterproof paper (as rqr)
22 Triangular-shaped wood block (2 rqr)
23 Black annealed wire (6 rqr)
24 Front outrigger support
25 Wood block (4 rqr)
26 Bolt (6 rqr)
27 Wedge-shaped wood block (4 rqr)
28 Wood cleat (4 rqr)
29 Wood block (2 rqr)
30 Wedge-shaped wood block (2 rqr)
31 Rear outrigger support
32 Tail and stoplight
33 Boom stop cable bracket
34 Boom foot pin
35 Side window
36 Front upper window
37 Bridle
38 Black annealed wire (2 rqr)
39 Marker light
40 Carrier radiator
41 Engine exhaust pipe
42 Carrier cab ventilator
43 Blackout light
44 Tail, stop, and blackout light
45 Front lower window

(3) Remove the covers (8) from the headlight guards.
(4) Remove the masking tape and waterproof paper from the openings at the carrier radiator (40), carrier engine compartment (4), the revolving frame engine exhaust pipe (41), the carrier cab ventilator (42), and any other openings covered.
(5) Remove the masking tape from the faces of the reflectors (15); tail and stoplight (32); tail, stop, and blackout light (44); blackout light (43), and marker lights (39).
(6) Remove the locks or wires from all doors and covers in the revolving frame cab and carrier cab.
(7) Drain the preservative oil from the revolving frame and carrier engines. Remove the sealing material from all openings in the generators, starters, distributors, and engines.
(8) Remove the paper between the pulleys on the generator, cooling fan, air compressor, and crankshaft and the belts on both engines.
(9) Remove the paper and masking tape from the battery cables. Clean the cable terminals.
(10) Remove the sealing material from the instruments in the revolving frame cab and the carrier cab. Remove the paper wrapper from the revolving frame and the carrier seat cushions.
(11) Remove the pipe plugs, caps, or tape from the carrier brakedrums and airbrake exhaust ports.



CARRIER REAR VIEW



CARRIER FRONT VIEW

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Figure 17—Continued.

(12) Remove the preservative from the carrier drive shafts, using an approved cleaning solvent.

(13) Remove the preservative or paper from all clutches and brakes on the revolving frame machinery. Remove preservative with an approved cleaning solvent.

(14) Remove the preservative from exposed and installed gears and chains using an approved cleaning solvent.

d. Inspection.

(1) *General.* Make a systematic visual inspection of the crane-shovel, observing and noting any damage. Check all front end attachments shipped with the crane-shovel for damage. Report any damaged or missing items to proper authority.

(2) *Carrier.*

(*a*) Check cab door, windows, and windshield for breakage and panels for dents or damage. Inspect all painted surfaces and refinish where paint has been scratched or worn away.

(*b*) Inspect all engine electrical accessories and wiring for corrosion, loose connections, or other damage.

(*c*) Check fuel tanks and lines for loose connections or other damage.

(*d*) Check brake system lines for loose connections or other damage.

(*e*) Inspect lights, controls, and instruments for damage or loose fit; tighten where necessary.

(*f*) Check battery cases and all metal castings for cracks or other damage.

(*g*) Check all tires for damage and correct inflation pressure. Correct tire inflation pressure is 70 psi each.

(*h*) Notify proper authority if damage is found.

(3) *Revolving frame.*

(*a*) Check all metal castings for cracks or other damage.

(*b*) Inspect lights, controls, and instruments for damage or loose fit; tighten where necessary.

(*c*) Inspect all engine electrical accessories and wiring for corrosion, loose connections, or other damage. Check battery cases for cracks or other damage.

(*d*) Check fuel tanks and lines for loose connections or other damage.

(*e*) Check cab windows for breakage. Check cab panels for dents or damage. Inspect all painted surfaces and refinish where paint has been scratched or worn away.

(*f*) Notify proper authority if damage is found.

(4) *Front end attachments.*

(*a*) Inspect all front end attachments for breaks, dents, or other damage. Inspect all painted surfaces and refinish where paint has been scratched or worn away.

(*b*) Inspect cables for kinks, rust spots, or other damage.

(*c*) Notify proper authority if damage is found.

(5) *Boxes and crates.* Care should be taken in removing covers of boxes and crates; pull nails to remove boards. Gouging with a bar might damage the contents of the box or crate. Check contents of boxes and crates for damage or loss. Report damaged or missing items to proper authority.

e. Unloading Front End Attachment. Major components of front end attachments are shipped unboxed or uncrated and tied down to the flatcar with steel strapping and wood blocks. Use an auxiliary lifting device to remove these components from the flatcar. If front end attachments are placed on the ground, they should be mounted on cribbing (figs. 19, 26, and 28) to prevent damage from dampness and to prevent their freezing to the ground.

f. Uncrating Front End Attachments. Small items such as cables, pulleys, and chains are shipped boxed or crated. Boxes and crates are tied down to the flatcar with steel strapping and wood blocks. An auxiliary lifting device may be needed to remove these items from the flatcar.

g. Servicing Carrier.

(1) Add electrolyte, from the containers shipped with the crane-shovel, to the batteries as early as possible before using the starter. Fill the batteries until the plates are covered approximately one-half inch or to the fill line under the cell caps. Position the batteries in the equipment and connect in series with negative to ground. Tighten all connections.

(2) Inspect the fuel tank to make sure that it is clean, and fill with fuel.

(3) Lubricate the carrier at points indicated in LO 5–9513–3, without regard to interval.

(4) Perform the before-operation services (par. 96).

8. Unloading Crane-Shovel

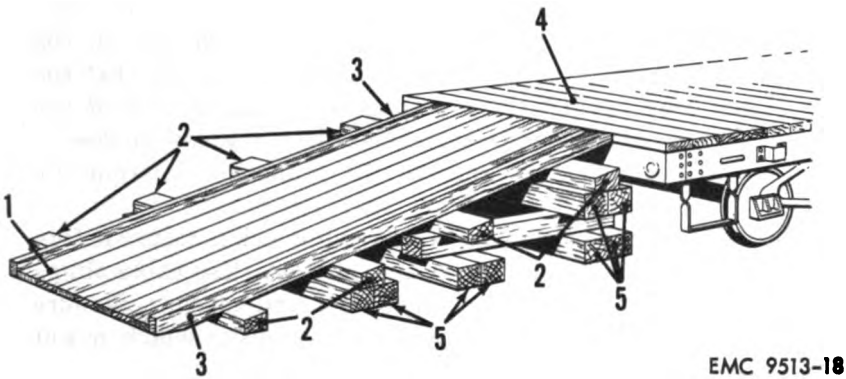
a. General. The crane-shovel may be lifted from the flatcar by using a lifting crane and lifting slings of sufficient capacity and attached to the equipment as shown on the lifting data plate (S, fig. 14). The crane-shovel may be driven off the flatcar and down a permanent ramp, if available. If neither a lifting crane

nor a permanent ramp is available, construct a temporary unloading ramp and drive the carrier off the flatcar and down the temporary ramp.

b. Constructing Unloading Ramp (fig. 18).

(1) Level the roadbed at the unloading end of the flatcar to the top of the rails, using dirt, cinders, and planks.

(2) Locate lower railroad ties (5) across the rails. Crisscross other ties over these lower ties to provide a gradual descending grade from the flatcar to the roadbed. Bevel the edges of the top railroad ties (2).



1 Runner board
2 Top railroad tie
3 Guide board
4 Flatcar
5 Lower railroad tie

Figure 18. Construction of improvised ramp.

(3) Secure the railroad ties to each other and the roadbed, using nails and stakes.

(4) Position the runner boards (1) and nail to the top railroad ties (2). Bevel both ends of the runner boards.

(5) Nail guide boards (3) to the length of each outside runner board (1).

(6) Drive wood wedges or blocks against the front and rear of each flatcar wheel to prevent movement when driving off the crane-shovel.

(7) Build up a cribbing of blocks or railroad ties under the end of the flatcar next to the ramp to support the weight of the equipment at that point.

c. Unloading By Carrier Power.

(1) The driver of the crane-carrier must familiarize himself with the controls and instruments (pars. 21–60) and the operating details (par. 77) of the carrier.

(2) Start the carrier engine (par. 63).

(3) Slowly and carefully run the crane-shovel down the ramp.

Caution: Before attempting to run the carrier off the flatcar, test the emergency and service brakes. Also, be sure that the revolving frame swing lock is engaged to avoid the revolving frame from swinging while unloading.

d. Unloading With Lifting Crane. The crane-shovel may be removed from the flatcar, using a crane having a lifting capacity of 30 tons. Attach the lifting slings (S, fig. 14) to the upper lifting sling eyes (1, fig. 17) on the revolving frame gantry and the lower lifting sling eyes (5) on the crane-carrier. The hook of the lifting crane must be at a point above the revolving frame cab and over the center-of-gravity marking (12, fig. 1) on the front outrigger support of the crane-carrier. Make sure that the lifting slings bear against the crossbar at the upper rear of the revolving frame cab. Lift the crane-shovel only a few inches to check for balance and then remove the crane-shovel from the flatcar.

Caution: Be sure the revolving frame swing lock is secure before attempting to lift the crane-shovel and carrier. Use cable slings of sufficient strength to lift the crane-shovel and carrier. Be sure all cables are secure and free of any sharp objects which might cut the cables when pulled taut.

e. Service Prior To Use. Service the crane-shovel according to instructions given in paragraph 7*g*.

9. Used Equipment

a. General. Use equipment is shipped and unloaded in the same manner as new equipment (pars. 7*a*, *b*, *c*, *e*, and *f*).

b. Inspection. Inspect the equipment as instructed in paragraph 7*d*.

c. Service.

(1) *Revolving frame.*

(*a*) Service the revolving frame as instructed in paragraph 7*g*.

(*b*) Start the revolving frame engine (par. 62).

(*c*) Stop the revolving frame engine (par. 64).

(*d*) Perform the inspection and weekly services for the revolving frame (par. 96).

(2) *Carrier.*

(*a*) Service the carrier as instructed in 7*g*.

(*b*) Start the carrier engine (par. 63).

(*c*) Stop the carrier engine (par. 65).

(*d*) Perform the inspection and weekly services for the carrier (par. 96).

Section II. FRONT END ATTACHMENTS, INSTALLATION AND REMOVAL

10. Crane Boom Installation and Removal as a Unit

a. Description.

(1) The crane boom is of the pin connected type, welded sections, and of lattice construction, supported by the boom hoist cable, and so arranged that the boom can be lengthened by the addition of a center section without changing the boom hoist cable. The lower and upper boom sections are each 15 feet long. Boom center sections can be either 5 or 10 feet long. Two boom stop cables provide additional safety when the boom reaches maximum operating angle.

(2) Unload the crane boom sections as instructed in paragraph 7*e*.

(3) Assemble the boom sections as instructed in paragraph 228*c*.

b. Installation.

(1) Operate and travel the carrier (par. 77) at right angle near the boom feet. When close, stop the carrier.

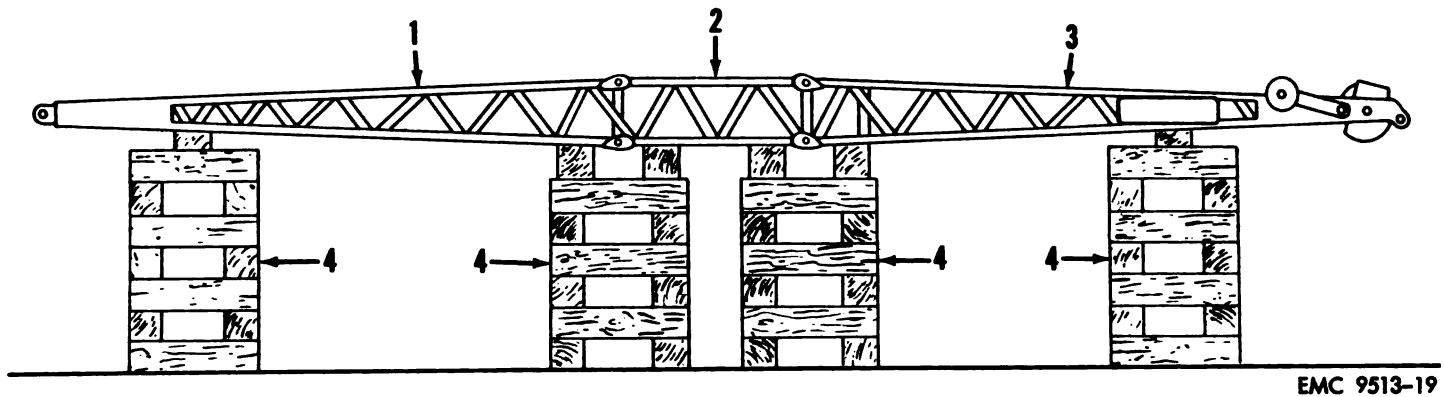
(2) If the boom cribbing (4, fig. 19) has settled, lift or jack up the boom feet to the same height as the boom foot pins on the revolving frame.

(3) Remove the boom foot pins (5, fig. 20) from their brackets. Start the revolving frame engine (par. 62). Operate the revolving frame machinery to swing the front of the frame toward the boom feet.

Caution: To determine the safety of operating the revolving frame without a boom or front end attachment installed, test the unit with the carrier standing still. Extend all four outriggers and lower the jacks to within 3 inches from the ground. Swing the revolving frame so that the counterweight is extended over one side of the carrier, then the opposite side. If, during this operation, the jacks do not touch the ground, the installation or removal of all front end attachments may be made without the use of the outriggers. If, at any time, the counterweight is changed, repeat the above test.

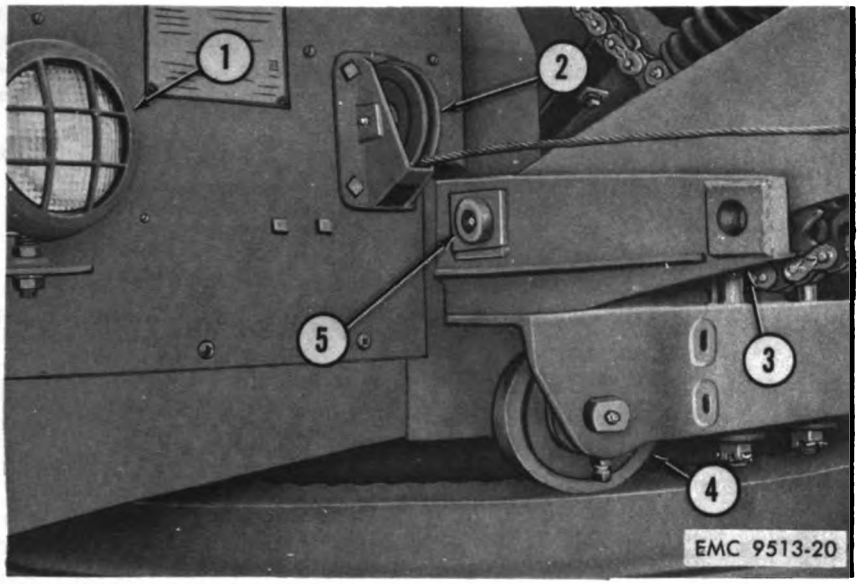
(4) Simultaneously travel the carrier and swing the revolving frame to have the brackets travel into and between the boom feet.

Note. Maneuver the carrier and swing the revolving frame to have the rear of the revolving frame over the side of the carrier.



1 Boom lower section 2 Boom center section 3 Boom upper section 4 Cribbing

Figure 19. Crane, clamshell, and dragline booms on cribbing.



1 Lower floodlight
2 Dipper trip pulley
3 Boom foot pin and stop cable bracket
4 Front revolving frame roller
5 Boom foot pin

Figure 20. Boom foot pin installed.

This procedure will provide more clearance for installing the boom hoist cable on the independent boom hoist drum under the rear of the revolving frame.

(5) Install the boom foot pins and secure with cotter pins.
(6) Reeve the crane boom (par. 11).
(7) Travel the crane to the new location (par. 77).
(8) Stop the revolving frame engine (par. 64) and carrier engine (par. 65).

c. Lubrication. Lubricate the boom hoist cable, boom foot pins, boom angle indicator, cable roller, boom hoist pulleys, equalizer pulleys, and boom point pulleys (LO 5–9513–1).

d. Removal.

(1) Operate and travel the crane-shovel (par. 77) to the storage area.
(2) On dry, level ground, build cribbing (4, fig. 19) of timbers upon which the boom (1), (2), and (3) can be placed. Cribbing should be high enough to place the boom foot at the same height as the boom foot pins on the revolving frame.
(3) Travel the crane-shovel to the cribbing. Operate the revolving frame machinery (par. 62) to lower the boom on the cribbing.

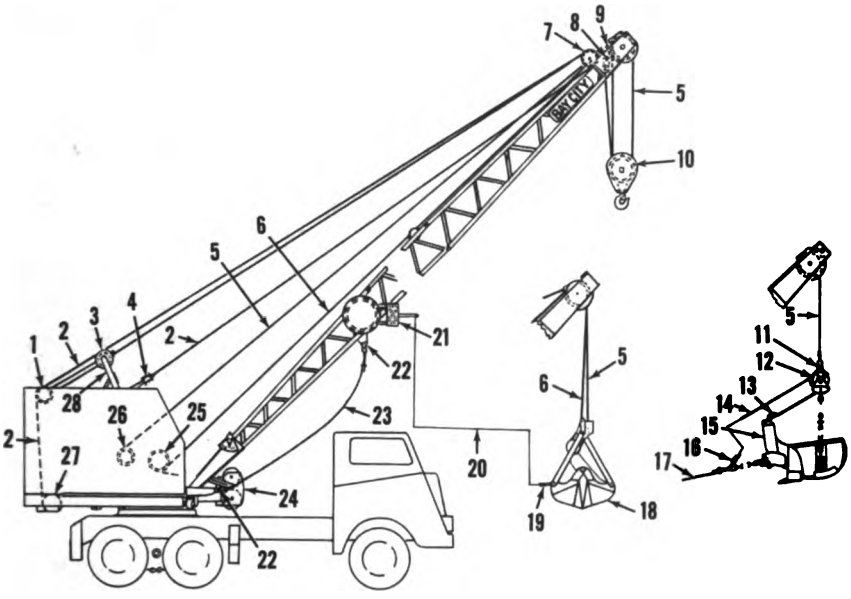
Note. Maneuver the carrier and swing the revolving frame to have the rear of the revolving frame over the side of the carrier. This procedure will provide more clearance for removing the boom hoist cable from the independent boom hoist drum under the rear of the revolving frame.

(4) Stop the revolving frame engine (par. 64) and carrier engine (par. 65).
(5) Unreeve the crane boom (par. 11).
(6) Remove the boom foot pins (5, fig. 20).
(7) Operate and drive the carrier away from the boom.
(8) Install the boom foot pins in their brackets and secure with cotter pins.
(9) Travel the carrier to the new location (par. 77).

11. Crane Reeving and Unreeving

a. Boom Hoist Reeving (fig. 21).

(1) Raise the gantry (28) as instructed in paragraph 66*h*.
(2) Unroll the boom hoist cable (2) on the ground along the right side of the revolving frame and boom. Keep cable as clean as possible. For size and length of the boom hoist cable, see paragraph 6*g*.
(3) Take the cable end at rear of the revolving frame and pass it through the cable guide and gantry pulley (3). Continue the cable end over the rear gantry pulley (1) and down to the independent boom hoist drum (27). Deadend the cable in the drum with a cable wedge. Make sure that the end of the cable does not protrude from the drum.
(4) Place the cable, from the ground at the boom point, up on the right boom hoist pulley (7). Take the loose end of the cable and pass it in back of the right pulley on the equalizer (4) and then across and in back of the left equalizer pulley.
(5) Continue the cable to and over the left boom hoist pulley (7) and deadend with a wedge at the wedge socket opposite the cable guide and gantry pulley (3). The end of the cable is always inserted through the tapered opening from the bottom of the socket up, wrapped around the socket wedge, doubled back through the socket, and pulled tight.
(6) Avoid kinks and twists in the cable. Remove mud, grit, and sand from the cable while reeving. Lubricate the cable (LO 5–9513–1).
(7) Operate the revolving frame machinery and pull on the independent boom hoist clutch hand lever (par. 47) to wind the cable on the independent boom hoist



1	Gantry pulley	14	Dragline dump cable
2	Boom hoist cable	15	Dragline bucket
3	Cable guide and gantry pulley	16	Wedge socket
4	Equalizer and pulley	17	Dragline cable to fairlead
5	Hoist cable and clamshell closing cable	18	Clamshell bucket
6	Clamshell holding and opening cable	19	Clamshell bucket chain
7	Boom hoist pulley	20	Clamshell tagline
8	Wedge socket	21	Tagline fairlead pulleys
9	Boom point pulley	22	Chain shackle
10	Hook block	23	Boom stop cable
11	Wedge socket	24	Fairlead
12	Dump sheave	25	Front drum
13	Wedge socket	26	Hoist drum
		27	Independent boom hoist drum
		28	Gantry

Figure 21. Crane, clamshell, and dragline reeving.

drum (27). See that the cable winds true on the drum. Make sure that the cable is in the grooves of the pulleys.

(8) Position the boom stop cables (23) and attach to the brackets and boom with the chain shackles (22) secured by pins and cotter pins.

b. Hoist Line Reeving.

(1) *General* (fig. 21). The hoist cable (5) is reeved in the same manner from the hoist drum (26) to the boom point pulleys (9) for either a two-part or four-part hook block line. The hoist cable size and length listed in paragraph 6*g* is for a four-part line. Operate the revolving frame machinery and push on the independent

boom hoist clutch hand lever (par. 47) to lower the boom for access to the boom point pulleys (9).

(2) *Hook block two-part line.*

(*a*) Unroll the hoist cable at the boom point and pass one end over the right boom point pulley (9, fig. 21). Pull the cable over the pulley to the hoist drum (26). Dead end the cable in the drum, using a wedge similar to the wedge (5, fig. 22). Make sure that the end of the cable does not protrude from the drum. Remove mud, grit, and sand from the cable while unrolling and reeving. Lubricate the cable (LO 5–9513–1).

(*b*) Operate the revolving frame machinery and pull on the hoist shaft clutch hand lever (par. 46) to wind the cable on the hoist drum. Keep the cable taut while winding it in slowly. See that the cable winds true on the drum. Leave sufficient cable at the boom point to reeve the hook block (10, fig. 21).

(*c*) Pass the end of the hoist cable around a hook block pulley and continue up to the boom point, dead-ending at the wedge socket (8). The end of the cable is always inserted through the tapered opening from the bottom of the socket up, wrapped around the socket wedge, doubled back through the socket, and pulled tight.

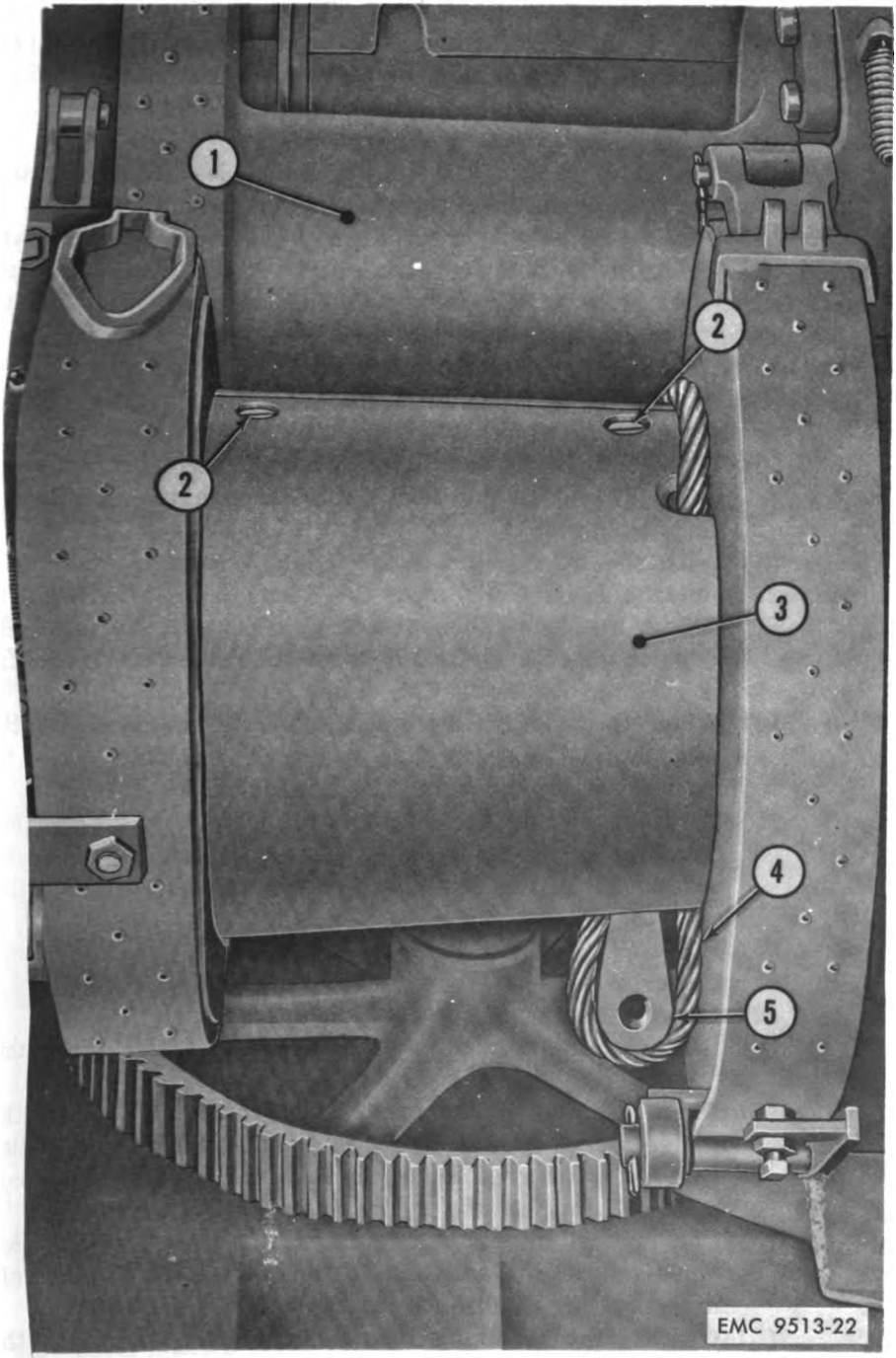
(*d*) Avoid kinks and twists in the cable. Remove mud, grit, and sand from the cable while reeving.

(3) *Hook block four-part line.*

(*a*) Unroll the hoist cable at the boom point and pass one end over the right boom point pulley (9, fig. 21). Pull the cable over the pulley to the hoist drum (26). Dead end the cable in the drum, using a wedge similar to the wedge (5, fig. 22). Make sure that the end of the cable does not protrude from the drum. Remove mud, grit, and sand from the cable while unrolling and reeving. Lubricate the cable (LO 5–9513–1).

(*b*) Operate the revolving frame machinery and pull on the hoist shaft clutch hand lever (par. 46) to wind the cable on the hoist drum. Keep the cable taut while winding it in slowly. See that the cable winds true on the drum. Leave sufficient cable at the boom point to reeve the hook block (10, fig. 21).

(*c*) Pass the end of the hoist cable around a hook block pulley and continue up and over the left boom point pulley (9), then down around the second hook block pulley, and up to the boom point, dead-ending



1 **Hoist drum**
2 **Lagging screw**
3 **Front drum lagging**
4 **Cable**
5 **Wedge**

Figure 22. Front drum lagging and cable wedge.

at the wedge socket (8). The end of the cable is always inserted through the tapered opening from the bottom of the socket up, wrapped around the socket wedge, doubled back through the socket, and pulled tight.

(*d*) Avoid kinks and twists in the cable. Remove mud, grit, and sand from the cable while reeving.

c. Hoist Line Unreeving. Procedure for unreeving the crane and hook block is identical for either a two-part or a four-part line. Operate the revolving frame machinery and push on the independent boom hoist clutch hand lever (par. 47) to lower the boom for access to the boom point pulleys (9, fig. 21).

(1) Release the hoist drum brake foot pedal (par. 52) to lower the hook block (10) on planks.

(2) Drive the wedge and hoist cable (5) from the wedge socket (8). Pull the hoist cable through the pulleys of the hook block.

(3) With the hoist drum brake pedal released (par. 52), pull the hoist cable over the boom point pulley (9). Coil or reel the cable, avoiding kinks and twists. Remove mud, grit, and sand from the cable while coiling or reeling. Lubricate the cable (LO 5–9513–1).

(4) When the end of the hoist cable is reached at the hoist drum (26), pry the wedge (5, fig. 22) loose by inserting a driftpin from the outside of the drum.

(5) Continue pulling and coiling or reeling the hoist cable from the boom point pulley. After coiling, wrap wire around the strands, in three or four places, to hold the cable together.

d. Boom Hoist Cable Unreeving (fig. 21).

(1) Lower the crane boom on cribbing (par. 10*d*).

(2) Unreeve the hoist line (par. 11*c* above).

(3) Remove the pins and chain shackles (22) from the boom stop cables (23). Coil the cables.

(4) Drive the wedge and boom hoist cable (2) from the wedge socket opposite the cable guide and gantry pulley (3). Take the loose end of the cable forward of the boom point. Keep the cable on the boom hoist pulleys (7).

(5) Coil or reel the cable, avoiding kinks and twists. Remove mud, grit, and sand from the cable while coiling or reeling. Lubricate the cable (LO 5–9513–1).

(6) Operate the revolving frame machinery and push the independent boom hoist clutch hand lever forward. Pull the cable over the left boom hoist pulley (7) and from the equalizer (4), right boom hoist pulley (7), cable

guide and gantry pulley (3), gantry pulley (1), and the independent boom hoist drum (27). Continue coiling or reeling the cable.

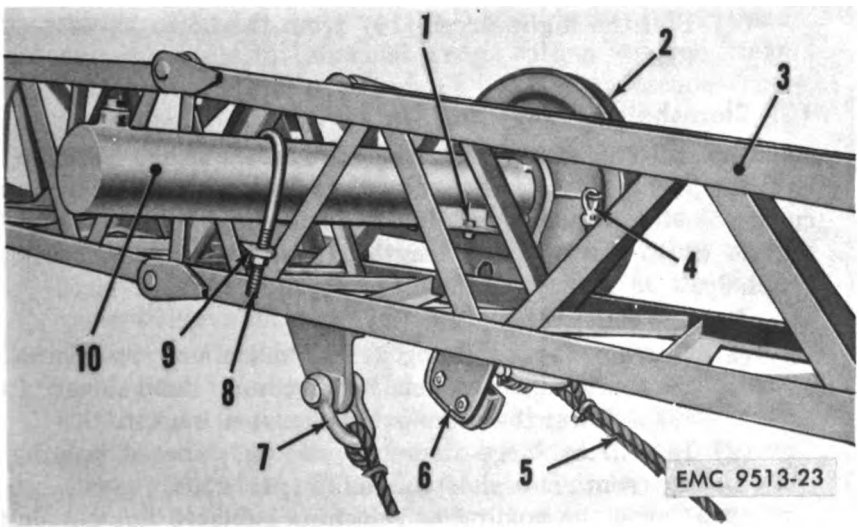
(7) When the end of the cable is reached at the independent boom hoist drum (27), pull the independent boom hoist clutch hand lever to neutral position. Stop the revolving frame machinery (par. 64). Pry the wedge and cable from the drum by using a driftpin.

(8) Continue pulling and coiling or reeling the boom hoist cable from the gantry pulley (1), cable guide and gantry pulley (3), right boom hoist pulley (7), equalizer (4), and off the left boom hoist pulley (7). After coiling, wrap wire around the strands, in three or four places, to hold the cable together.

(9) Lower the gantry (28) as instructed in paragraph 66*i*.

12. Tagline Reel Installation and Removal

a. General. The rud-o-matic tagline reel (10, fig. 23) is a spring-loaded device designed to maintain a constant tension on the clamshell bucket (18, fig. 21) through a tagline (20) to prevent rotation and oscillation during operation. The tagline reel need not be removed to permit use of the boom for other operations.



1 Mounting bolt
2 Tagline wheel
3 Boom lower section
4 Tagline cable clamp
5 Boom stop cable
6 Tagline fairlead
7 Chain shackle
8 U-bolt
9 Plate
10 Rud-o-matic tagline barrel

Figure 23. Tagline reel, installed.

b. Installation (fig. 23).

(1) Operate the revolving frame machinery and push on the independent boom hoist clutch hand lever (par. 47) to lower the boom.

(2) Check lubrication of the tagline reel (LO 5–9513–1).

(3) Position the tagline barrel (10) through the boom lower section (3) and on the brackets welded to the boom section. The tagline wheel (2) should be on the right side of the boom lower section.

(4) Install the mounting bolts (1) through the tagline barrel mounting pads and the angle bracket on the boom. Secure the bolts with lockwashers and nuts.

(5) Position the U-bolt (8) over the tagline reel barrel and the boom angle bracket. Position the plate (9) on the U-bolt and up against the bracket and secure with lockwashers and nuts.

c. Removal (fig. 23).

(1) Operate the revolving frame machinery and push on the independent boom hoist clutch hand lever (par. 47) to lower the boom.

(2) Unreeve the tagline (par. 13*e*).

(3) Remove the nuts, lockwashers, and mounting bolts (1). Remove the nuts, lockwashers, plate (9) and U-bolt (8).

(4) Pull the tagline reel (10) from the boom lower section (3).

13. Clamshell Reeving and Unreeving

a. General (fig. 21). Installation of the clamshell bucket (18) is accomplished by reeving and unreeving the clamshell closing cable (5), the clamshell holding and opening cable (6), and the tagline (20). For size and length of clamshell cables, see paragraph 6*g*.

b. Holding Cable Reeving.

(1) Operate the revolving frame machinery and push on the independent boom hoist clutch hand lever (par. 47) to lower the boom to the clamshell bucket.

(2) Install the large-diameter, smooth, tapered lagging on the front drum shaft assembly (par. 229*c*).

(3) Unroll the holding and opening cable (6 fig. 21) on the ground at the boom point. Keep the cable as clean as possible.

(4) Pass one end of the cable over the left boom point pulley (9) and pull to the front drum (25). Dead end the cable (4, fig. 23) in the front drum with a wedge

(5). Make sure that the end of the cable does not protrude from the drum.

(5) Operate the revolving frame machinery and push the front drum clutch hand lever (par. 45) to wind the holding and opening cable (6, fig. 21) on the front drum. Keep the cable taut while winding slowly on the drum. See that the cable winds true on the drum.

(6) Dead end the other end of the holding and opening cable (6) in the wedge socket on the top of the clamshell bucket. The end of the cable is always inserted through the tapered opening from the bottom of the socket up, wrapped around the socket wedge, doubled back through the socket, and pulled tight.

(7) Avoid kinks and twists in the cable. Remove mud, grit, and sand from the cable while reeving. Lubricate the cable (LO 5–9513–1).

c. *Closing Cable Reeving.*

(1) Operate the revolving frame machinery and push on the independent boom hoist clutch hand lever (par. 47) to lower the boom to the clamshell bucket.

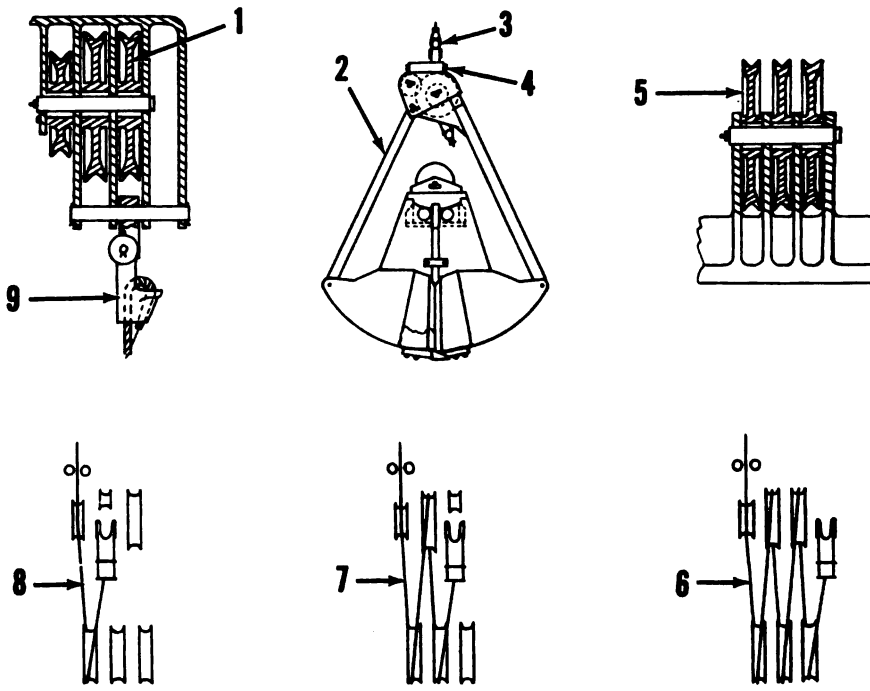
(2) Unroll the closing cable (5, fig. 21) on the ground at the boom point. Keep the cable as clean as possible.

(3) Pass one end of the cable over the right boom point pulley (9) and pull to the hoist drum (26). Dead end the cable in the hoist drum with a wedge. Make sure that the end of the cable does not protrude from the drum.

(4) Operate the revolving frame machinery and pull on the hoist shaft clutch hand lever (par. 46) to wind the closing cable on the hoist drum. Keep the cable taut while winding slowly on the drum. See that the cable winds true on the drum. Leave sufficient cable at the boom point to reeve the clamshell bucket (18).

(5) Insert the end of the closing cable between the guide rollers at the top of the clamshell bucket. Pull the cable down and around a lower pulley, up and over an upper pulley as many times as required for the desired parts of line (fig. 24). The end of the closing cable is always dead-ended at the wedge socket near the upper pulleys. The end of the cable is always inserted through the tapered opening from the bottom of the socket up, wrapped around the socket wedge, doubled back through the socket, and pulled tight.

(6) Avoid kinks and twists in the cable. Remove mud,



1 Upper pulley
2 Clamshell bucket
3 Holding cable wedge socket
4 Upper arm pin and guide pulley
5 Lower pulley
6 Six-part line
7 Four-part line
8 Two-part line
9 Closing cable wedge socket

Figure 24. Reeving the clamshell bucket.

grit, and sand from the cable while reeving. Lubricate the cable (LO 5–9513–1).

d. Tagline Reeving.

(1) Release the front drum and hoist drum brake foot pedals and lower the clamshell bucket to the ground.

(2) Operate the revolving frame machinery and push on the independent boom hoist clutch hand lever (par. 47) to lower the boom to the ground.

(3) Unroll the tagline (20, fig. 21) on the ground along the boom. Keep the tagline as clean as possible.

(4) Place one end of the tagline, through the tagline fairlead, in the groove of the tagline wheel (2) (fig. 23) and through the opening in the inside flange of the wheel. Attach a cable clamp (4) to a loop made in the end of the tagline.

(5) Turn the tagline wheel, in a counterclockwise direction,

five to seven turns from neutral. Hold the tagline wheel.

(6) Wrap the tagline, by hand, over the tagline wheel. Leave sufficient tagline to reach the clamshell bucket.

(7) Using cable clamps, attach the free end of the tagline to the center of the clamshell bucket chain (19, fig. 21).

(8) Wrap any slack in the tagline on the tagline wheel.

(9) Release the tagline wheel.

(10) Avoid kinks and twists in the tagline. Remove mud, grit, and sand from the tagline while reeving. Lubricate the tagline (LO 5–9513–1).

e. Tagline Unreeving.

(1) Raise the clamshell bucket to the boom.

(2) Operate the revolving frame machinery and push on the independent boom hoist clutch hand lever (par. 47) to lower the boom to the ground.

(3) Holding the tagline securely, remove the cable clamps from the tagline at the clamshell bucket chain (19, fig. 21).

Caution: Because the tagline reel is spring-loaded, the tagline will tend to snap back to the tagline wheel unless it is held securely.

(4) Unwrap the tagline from the tagline wheel (2, fig. 23). Remove the cable clamp (4) from in back of the tagline wheel. Remove the tagline.

(5) Coil the tagline, avoiding kinks and twists. Remove mud, grit, and sand from the tagline while coiling. Lubricate the tagline (LO 5–9513–1). After coiling, wrap wire around the strands, in three or four places, to hold the tagline together.

f. Closing Cable Unreeving (fig. 24).

(1) Raise the clamshell bucket to the boom.

(2) Operate the revolving frame machinery and push on the independent boom hoist clutch hand lever (par. 47) and lower the boom to the ground.

(3) Drive the wedge and closing cable from the wedge socket (9).

(4) Pull the closing cable from the bucket pulleys (1) and (5). Release the hoist drum brake foot pedal. Pull the closing cable from the boom point pulley.

(5) Coil or reel the closing cable, avoiding kinks and twists. Remove mud, grit, and sand from the closing cable while coiling or reeling. Lubricate the closing cable (LO 5–9513–1).

(6) When the end of the closing cable is reached at the

hoist drum, pry the wedge loose by inserting a driftpin from outside the drum.

(7) Continue pulling and coiling or reeling the closing cable. After coiling, wrap wire around the strands, in three or four places, to hold the closing cable together.

g. Holding Cable Unreeving.

(1) Raise the clamshell bucket to the boom.

(2) Operate the revolving frame machinery and push on the independent boom hoist clutch hand lever (par. 47) and lower the boom to the ground.

(3) Drive the wedge and the holding and opening cable from the wedge socket on the top of the clamshell bucket.

(4) Release the front drum brake foot pedal. Pull the holding and opening cable from the boom point pulley.

(5) Coil or reel the holding and opening cable, avoiding kinks and twists. Remove mud, grit, and sand from the holding and opening cable while coiling or reeling. Lubricate the holding and opening cable (LO 5–9513–1).

(6) When the end of the holding and opening cable is reached at the front drum, pry the wedge loose by inserting a driftpin from outside the drum.

(7) Continue pulling and coiling or reeling the holding and closing cable. After coiling, wrap wire around the strands, in three or four places, to hold the holding and closing cable together.

(8) Remove the large-diameter, smooth, tapered lagging from the front drum shaft assembly (par. 229*a*).

14. Dragline Fairlead Installation and Removal (fig. 25)

a. General. The freely rotating fairlead receives the dragline cable from any operating angle of the dragline bucket and feeds it evenly to the front drum.

b. Installation.

(1) Reeve the dragline bucket hoist cable (par. 15*b*).

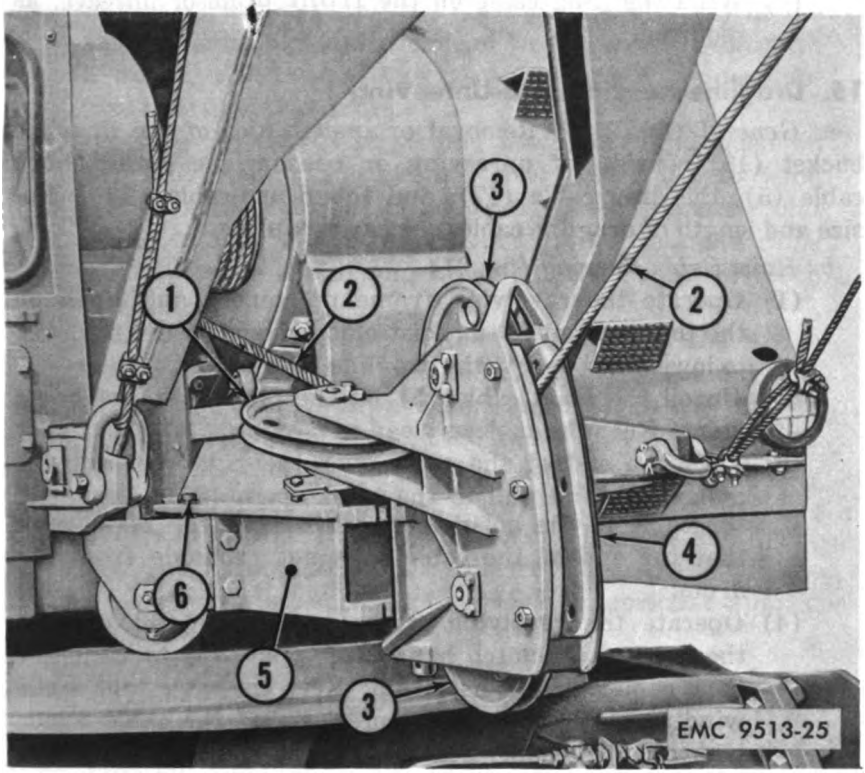
(2) Reeve the drag cable on the front drum (par. 15*c*).

(3) Using cable clamps, attach the dragline bucket hoist cable to the front fairlead bracket (4). If the dragline bucket has been reeved, wire the front fairlead bracket to the bucket.

(4) Using cable clamps, attach the drag cable to the rear fairlead bracket (5).

(5) Operate the dragline (par. 71) to raise and pull the fairlead to position on the front of the revolving frame.

(6) Secure the fairlead to the revolving frame with mounting screws (6), lockwashers, and nuts.



1	Horizontal pulley	4	Front fairlead bracket
2	Drag cable	5	Rear fairlead bracket
3	Vertical pulley	6	Mounting screws

Figure 25. Fairlead installed on crane-shovel.

(7) Remove the cables or wire from the fairlead.

c. *Removal.*

(1) Operate the dragline (par. 71) to bring the wedge socket on the end of the drag chain yoke up to the front fairlead bracket (4).

(2) Fasten the fairlead to the yoke with wire.

(3) Remove the mounting screws (6) from the rear fairlead bracket (5).

(4) Slowly release the front drum brake foot pedal to allow the bucket and fairlead to swing out. Operate the dragline to place the fairlead as desired.

(5) When the fairlead has been placed, remove the wire from the fairlead and the yoke.

(6) Drive out the drag cable and wedge from the wedge socket. Pull the drag cable from the fairlead. Reinstall the wedge in the wedge socket.

(7) Wind the drag cable on the front drum or unreeve, as required.

15. Dragline Reeving and Unreeving

a. General (fig. 21). Removal or installation of the dragline bucket (15) consists of unreeving or reeving the bucket hoist cable (5), the drag cable (17), and the dump cable (14). For size and length of dragline cables see paragraph 6*g*.

b. Hoist Cable Reeving (fig. 21).

(1) Operate the revolving frame machinery and push on the independent boom hoist clutch hand lever (par. 47) to lower the boom to the dragline bucket.

(2) Unroll the hoist cable (5) on the ground at the boom point. Keep the cable as clean as possible.

(3) Pass one end of the cable over the right boom point pulley (9) and pull to the hoist drum (26). Dead end the cable in the hoist drum with a wedge. Make sure that the end of the cable does not protrude from the drum.

(4) Operate the revolving frame machinery and pull on the hoist shaft clutch hand lever (par. 46) to wind the hoist cable on the hoist drum. Keep the cable taut while winding slowly on the drum. See that the cable winds true on the drum. Leave sufficient cable at the boom point to reach the dragline bucket.

(5) Dead end the free end of the hoist cable in the wedge socket (11) above the dump sheave (12) on the dragline bucket. The end of the cable is always inserted through the tapered opening from the bottom of the socket up, wrapped around the socket wedge, doubled back through the socket, and pulled tight.

(6) Avoid kinks and twists in the cable. Remove mud, grit, and sand from the cable while reeving. Lubricate the hoist cable (LO 5–9513–1).

c. Drag Cable Reeving.

(1) Operate the revolving frame machinery and push on the independent boom hoist clutch hand lever (par. 47) to lower the boom to the dragline bucket.

(2) Install the small-diameter, straight, grooved lagging on the front drum shaft assembly (par. 229*c*).

(3) Adjust the front drum clutch control for dragline operation (par. 192*e*).

(4) Unroll the drag cable (17, fig. 21) on the ground alongside the boom. Keep the cable as clean as possible.

(5) Pass one end of the drag cable between the vertical

pulleys (3, fig. 25) and the horizontal pulleys (1) of the fairlead assembly and deadend in the front drum with a wedge. Make sure that the end of the cable does not protrude from the drum.

(6) Operate the revolving frame machinery and push on the front drum clutch hand lever (par. 45) to wind the drag cable on the front drum. Keep the cable taut while winding slowly on the drum. See that the cable winds true on the drum. Leave sufficient cable to reach the dragline bucket.

(7) Dead end the free end of the drag cable in the wedge socket (16, fig. 21) at the end of the drag chains. The end of the cable is always inserted through the tapered opening from the bottom of the socket up, wrapped around the socket wedge, doubled back through the socket, and pulled tight.

(8) Avoid kinks and twists in the cable. Remove mud, grit, and sand from the cable while reeving. Using an approved cleaning solvent, remove any lubricant applied for storage purposes.

d. Bucket Dump Cable Reeving (fig. 21).

(1) Position the dump cable (14) around the dump sheave (12) and deadend in the wedge socket (13) on the dragline bucket.

(2) Dead end the free end of the dump cable in the wedge socket (16) at the end of the drag chains.

(3) The end of the cable is always inserted through the tapered opening from the bottom of the socket up. wrapped around the socket wedge, doubled back through the socket, and pulled tight.

(4) Avoid kinks and twists in the cable. Using an approved cleaning solvent, remove any lubricant applied for storage purposes.

e. Bucket Dump Cable Unreeving (fig. 21).

(1) Release the hoist drum brake foot pedal and lower the dragline bucket to the ground.

(2) Drive the wedge and dump cable (14) from the wedge sockets (13 and 16). Pull the dump cable from the dump sheave (12).

(3) Coil the dump cable, avoiding kinks and twists. Remove mud, grit, and sand from the dump cable while coiling. Lubricate the dump cable for storage purposes.

f. Drag Cable Unreeving (fig. 21).

(1) Release the hoist drum brake foot pedal and lower the dragline bucket to the ground.

(2) Drive the wedge and drag cable (17) from the wedge socket (16) at the end of the drag chains.
(3) Release the front drum brake foot pedal.
(4) Pull the drag cable from the front drum through the fairlead. Coil or reel the drag cable, avoiding kinks and twists. Remove mud, grit, and sand from the drag cable while coiling or reeling. Lubricate the drag cable for storage purposes.
(5) When the end of the drag cable is reached at the front drum, pry the wedge loose by inserting a driftpin from outside the drum.
(6) Continue pulling and coiling or reeling the drag cable. After coiling, wrap wire around the strands, in three or four places, to hold the drag cable together.
(7) Remove the small-diameter, straight, grooved lagging from the front drum shaft assembly (par. 229*a*).

g. Hoist Cable Unreeving (fig. 21).
(1) Operate the revolving frame machinery and push on the independent boom hoist clutch hand lever (par. 47) to lower the boom. Release the hoist drum brake foot pedal to lower the dragline bucket to the ground.
(2) Drive the wedge and hoist cable from the wedge socket (11) above the dump sheave (12) on the dragline bucket.
(3) Release the hoist drum brake foot pedal.
(4) Pull the hoist cable from the boom point pulley and hoist drum. Coil or reel the hoist cable, avoiding kinks and twists. Remove mud, grit, and sand from the hoist cable while coiling or reeling. Lubricate the hoist cable (LO 5–9513–1).
(5) When the end of the hoist cable is reached at the hoist drum, pry the wedge loose by inserting a driftpin from outside the drum.
(6) Continue pulling and coiling or reeling the hoist cable. After coiling, wrap wire around the strands, in three or four places, to hold the hoist cable together.

16. Shovel Installation and Removal

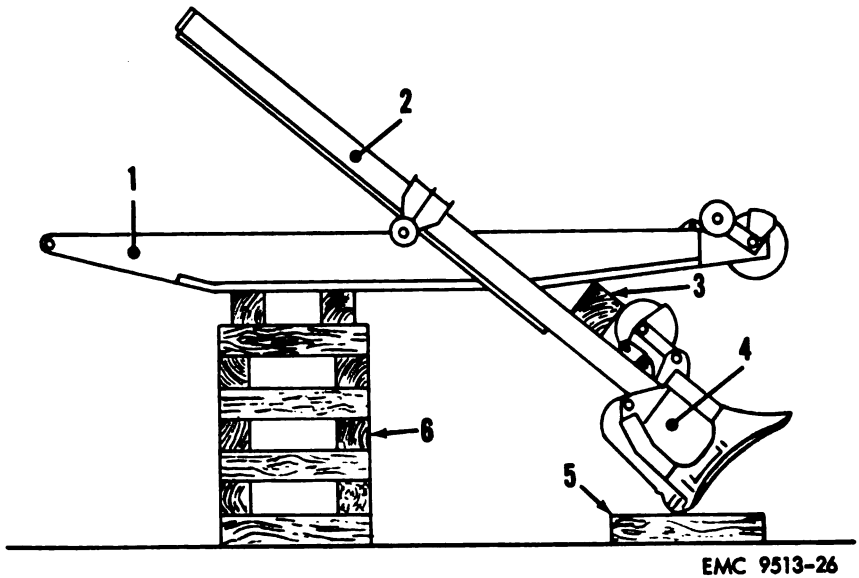
a. General. The shovel is designed especially for excavating purposes and is equipped with an attachment consisting of a boom, dipper handle, and dipper which are of all-welded structure and usually assembled as a unit. The crowd mechanism consists of a chain sprocket installed on the front drum shaft, chain takeup, chain, and reverse crowd clutch. The electric dipper trip mechanism consists of a drum and magnet assembly, pulleys, cable, counterweight, and pushbutton. The boom is raised and

lowered by the independent boom hoist. The dipper is controlled by the cable on the hoist drum. The boom foot pins are the same for all front end attachments.

b. Installation.

(1) Operate and travel the carrier (par. 77) at right angle near the boom feet. When close, stop the carrier.

(2) If the boom cribbing (6, fig. 26) has settled, lift or jack up the boom feet to the same height as the boom foot pins on the revolving frame.



1 Shovel boom
2 Dipper handle
3 Wood block
4 Dipper
5 Wood block
6 Cribbing

Figure 26. Shovel attachment on cribbing.

(3) Remove the boom foot pins (5, fig. 20) from their brackets. Start the revolving frame engine (par. 62*b*). Operate the revolving frame machinery to swing the front of the frame toward the boom feet.

(4) Simultaneously travel the carrier and swing the revolving frame to have the brackets travel into and between the boom feet.

Note. Maneuver the carrier and swing the revolving frame to have the rear of the revolving frame over the side of the carrier. This procedure will provide more clearance for installing the boom hoist cable on the independent boom hoist drum under the rear of the revolving frame.

(5) Install the boom foot pins and secure with cotter pins.

(6) Stop the revolving frame (par. 64) and carrier (par. 65) engines.
(7) Install the crowd chain sprocket (par. 234*f*).
(8) Install the crowd chain takeup and chain (par. 234*f*).
(9) Install the reverse crowd clutch (par. 193*d*).
(10) Install the dipper trip drum and magnet assembly (par. 238*d*).
(11) Install the dipper trip pulleys, cable guide pipes, and counterweight (par. 238*d*).
(12) Install the dipper trip pushbutton (par. 238*d*).
(13) Reeve the shovel (par. 17).
(14) Lubricate the shovel front end attachment (LO 5–9513–1).
(15) Travel the crane-shovel to the new location (par. 77).

c. Removal.

(1) Operate and travel the crane-shovel (par. 77) to the storage area.
(2) On dry, level ground, build a crib (6, fig. 26) of timbers upon which the boom (1) can be placed. Cribbing should be high enough to place the boom foot at the same height as the boom foot pins on the revolving frame.
(3) Travel the crane-shovel to the cribbing. Operate the revolving frame machinery (par. 73) to lower the dipper (4) on wood blocks placed on the ground, and the boom (1) on the cribbing (6). Position a wood block (3) between the dipper handle (2) and the bottom of the boom.

Note. Maneuver the carrier and swing the revolving frame to have the rear of the revolving frame over the side of the carrier. This procedure will provide more clearance for removing the boom hoist cable from the independent boom hoist drum under the rear of the revolving frame.

(4) Stop the revolving frame (par. 64) and carrier (par. 65) engines.
(5) Unreeve the shovel (par. 17).
(6) Remove the dipper trip pushbutton (par. 238*b*(14)).
(7) Remove the dipper pulleys, cable guide pipes, counterweight, and counterweight tube (par. 238*b*(8)).
(8) Remove the dipper trip drum and magnet assembly (par. 238*b*(21)).
(9) Remove the reverse crowd clutch (par. 193*b*).
(10) Remove the crowd chain and chain takeup (par. 234*b*).
(11) Remove the crowd chain sprocket (par. 234*b*).
(12) Remove the boom foot pins (5, fig. 20).

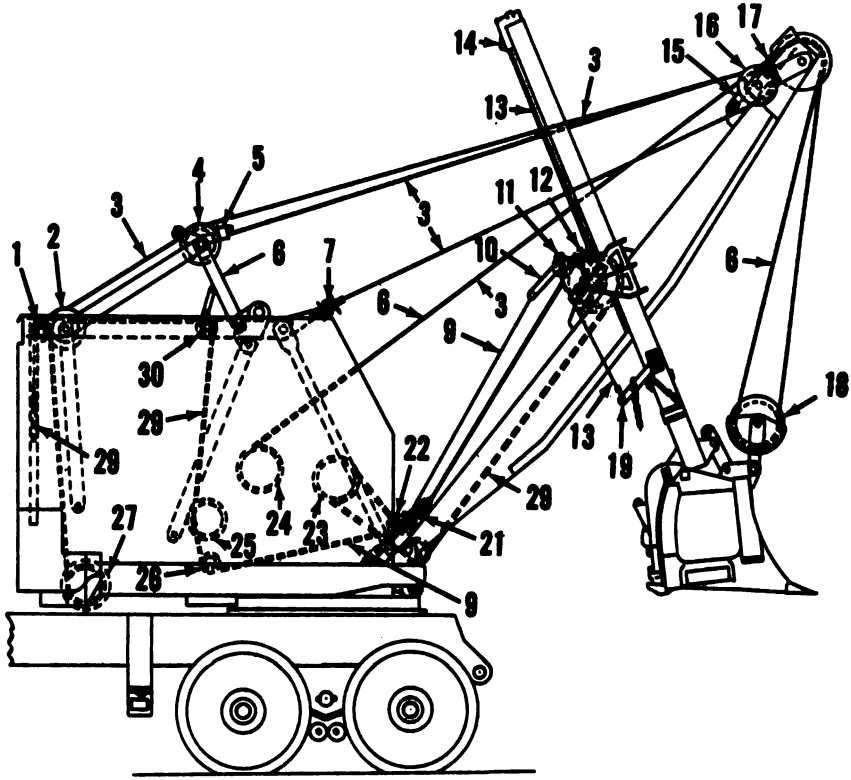
(13) Operate and drive the carrier away from the boom.
(14) Install the boom foot pins in their brackets and secure with cotter pins.
(15) Travel the carrier to the new location (par. 77).

Note. The dipper trip pushbutton, trip pulleys, cable guide pipes, counterweight, trip drum and magnet assembly, and reverse crowd clutch (if disconnected) can be left installed on the revolving frame without interfering with the operation of any other front end attachment.

17. Shovel Reeving and Unreeving
(fig. 27)

a. Boom Hoist Reeving.

(1) Raise the gantry as instructed in paragraph 66*h*.
(2) Unroll the boom hoist cable (3) on the ground along the right side of the revolving frame and boom. Keep cable as clean as possible. For size and length of the boom hoist cable, see paragraph 6*g*.
(3) Take the cable end at rear of the revolving frame and pass it through the cable guide and gantry pulley (4). Continue the cable end over the rear gantry pulley (2) and down to the independent boom hoist drum (27). Dead end the cable in the drum with a wedge. Make sure that the end of the cable does not protrude from the drum.
(4) Place the cable, from the ground at the boom point, up on the right boom hoist pulley (16). Take the loose end of the cable and pass it in back of the right pulley on the equalizer (7) and then across and in back of the left equalizer pulley.
(5) Continue the cable to and over the left boom hoist pulley (16) and dead end with a wedge at the wedge socket (5). The end of the cable is always inserted through the tapered opening from the bottom of the socket up, wrapped around the socket wedge, doubled back through the socket, and pulled tight.
(6) Avoid kinks and twists in the cable. Remove mud, grit, and sand from the cable while reeving. Lubricate the cable (LO 5–9513–1).
(7) Operate the revolving frame machinery and pull on the independent boom hoist clutch hand lever (par. 47) to wind the cable on the independent boom hoist drum (27). See that the cable winds true on the drum. Make sure that the cable is in the grooves of the pulleys.



1	Trip pulley	16	Boom hoist pulley
2	Gantry pulley	17	Boom point pulley
3	Boom hoist cable	18	Padlock pulley
4	Cable guide and gantry pulley	19	Trip lever
5	Wedge socket	20	Crowd chain
6	Gantry	21	Crowd chain takeup
7	Equalizer and pulley	22	Trip pulley
8	Dipper hoist cable	23	Front drum sprocket
9	Dipper trip cable	24	Hoist drum
10	Trip lever	25	Dipper trip drum
11	Trip pulley	26	Trip pulley
12	Trip pulley	27	Independent boom hoist drum
13	Dipper trip cable	28	Counterweight
14	Trip cable wedge socket	29	Dipper trip cable
15	Wedge socket	30	Trip pulley

Figure 27. Shovel reeving.

b. Dipper Hoist Cable Reeving.

(1) For size and length of dipper hoist cable, see paragraph 6*g*).

(2) Unroll the dipper hoist cable (8) at the boom point and pass one end over the right boom point pulley (17). Pull the cable over the pulley to the hoist drum (24). Dead end the cable in the drum using a wedge.

Make sure that the end of the cable does not protrude from the drum. Remove mud, grit, and sand from the cable while unrolling and reeving. Lubricate the cable (LO 5–9513–1).

(3) Operate the revolving frame machinery and pull on the hoist shaft clutch hand lever (par. 46) to wind the cable on the drum. Keep the cable taut while winding it in slowly. See that the cable winds true on the drum. Leave sufficient cable at the boom point to reach the padlock pulley (18).

(4) Pass the end of the dipper hoist cable around the padlock pulley (18) and continue up and over the left boom point pulley (17) and dead end in the wedge socket (15). The end of the cable is always inserted through the tapered opening from the bottom of the socket up, wrapped around the socket wedge, doubled back through the socket, and pulled tight.

Dipper Trip Cable Reeving.

(1) For size and length of dipper trip cables, see paragraph 6*g*.

(2) Unroll the dipper trip cable (13). Keep the cable as clean as possible.

(3) Wrap one end of the dipper trip cable (13) around a cable wedge and install in the trip cable wedge socket (14).

(4) Pass the free end of the dipper trip cable (13) over and around the trip pulley (12), around and under the trip pulley (11), and attach to the trip lever (19), using a cable thimble and cable clamps.

(5) Unroll the dipper trip cable (9). Keep the cable as clean as possible.

(6) Using a cable thimble and cable clamps, attach the dipper trip cable (9) to the trip lever (10).

(7) Pass the dipper trip cable (9) under the trip pulley (22), through a guide pipe, and under the trip pulley (26) to the dipper trip drum (25). Insert the end of the cable through the bottom of the outer drum flange and attach to the cable drum with a wedge.

(8) Unroll the dipper trip cable (29). Keep the cable as clean as possible.

(9) Insert one end of the dipper trip cable (29) through the top of the outer drum flange of the dipper trip drum (25) and attach to the cable drum with a wedge.

(10) Take the free end of the dipper trip cable (29) up and over the trip pulley (30), over and around the trip pul-

ley (1) to the counterweight (28). Using a cable clamp, attach the dipper trip cable to the counterweight. Insert the counterweight in the counterweight tube.

(11) Avoid kinks and twists in the dipper trip cables. Remove mud, grit, and sand from the dipper trip cables while reeving. Using an approved cleaning solvent, remove any lubricant applied to dipper trip cable (13). Lubricate dipper trip cables (9 and 29) as specified in LO 5–9513–1.

d. Dipper Trip Cable Unreeving.

(1) Lift the counterweight (28) from the counterweight tube. Remove the cable clamp and dipper trip cable (29) from the counterweight.

(2) Remove the wedge and dipper trip cable (29) from the dipper trip drum (25). Pull the cable from the trip pulleys (1 and 30). Coil the cable.

(3) Remove the wedge and dipper trip cable (9) from the dipper trip drum (25). Remove the cable clamps, cable, and cable thimble from the trip lever (10).

(4) Pull the dipper trip cable (9) from the trip pulley (26), cable guide pipe, and trip pulley (22). Coil the cable.

(5) Remove the cable clamps, dipper trip cable (13), and cable thimble from the trip lever (19).

(6) Remove the wedge and dipper trip cable (13) from the trip cable wedge socket (14). Pull the cable from the trip pulleys (11 and 12). Coil the cable.

(7) Coil the dipper trip cables (9, 13, and 29), avoiding kinks and twists. Remove mud, grit, and sand from the cables while coiling. Lubricate the cables for storage purposes.

e. Dipper Hoist Cable Unreeving.

(1) Operate the revolving frame machinery and lower the shovel boom (par. 73) for access to the boom point.

(2) Drive the wedge and dipper hoist cable (8) from the wedge socket (15). Pull the hoist cable from the padlock pulley (18).

(3) With the hoist drum brake foot pedal released (par. 52), pull the hoist cable over the boom point pulley (17). Coil or reel the cable, avoiding kinks and twists. Remove mud, grit, and sand from the cable while coiling or reeling. Lubricate the cable (LO 5–9513–1).

(4) When the end of the hoist cable is reached at the hoist

drum (24), pry the wedge loose by inserting a driftpin from the outside of the drum.

(5) Continue pulling and coiling or reeling the hoist cable from the boom point pulley. After coiling, wrap wire around the strands, in three or four places, to hold the cable together.

f. Boom Hoist Unreeving.

(1) Operate and travel the crane-shovel (par. 77) to the storage area for removal (par. 16*c*).

(2) Drive the wedge and boom hoist cable (3) from the wedge socket (5). Take the loose end of the cable forward of the boom point. Keep the cable on the boom hoist pulleys (16).

(3) Coil or reel the cable, avoiding kinks and twists. Remove mud, grit, and sand from the cable while coiling or reeling. Lubricate the cable (LO 5–9513–1).

(4) Operate the revolving frame machinery and push the independent boom hoist clutch hand lever forward. Pull the cable over the left boom hoist pulley (16) and from the equalizer (7), right boom hoist pulley (16), cable guide and gantry pulley (4), gantry pulley (2), and the independent boom hoist drum (27). Continue coiling or reeling the cable.

(5) When the end of the boom hoist cable (3) is reached at the independent boom hoist drum (27), pull the independent boom hoist clutch hand lever to neutral position. Stop the revolving frame machinery (par. 64). Pry the wedge and cable from the drum by inserting a driftpin from outside the drum.

(6) Continue pulling and coiling or reeling the boom hoist cable from the gantry pulley (2), cable guide and gantry pulley (4), right boom hoist pulley (16), equalizer (7), and off the left boom hoist pulley (16). After coiling, wrap wire around the strands, in three or four places, to hold the cable together.

(7) Lower the gantry (6) as instructed in paragraph 66*i*.

Note. The dipper trip cable (29) can be left installed on the revolving frame without interfering with the operation of any other front end attachment.

18. Back Hoe Installation and Removal

a. General. The back hoe combines some of the features of a dragline and a shovel. The back hoe digs as the bucket is pulled toward the crane-shovel like a dragline bucket and can be controlled with the same speed and accuracy as a shovel dipper. A pin-connected hoe mast at the front of the revolving frame sup-

ports the pulleys employed in the boom and bucket raising and lowering operations. The hoe bucket is pulled by the drag cable from the front drum to the bail pulley. The hoe boom, mast, handle, and bucket are of all-welded structure. The boom foot pins are the same for all front end attachments.

b. Installation.

(1) Operate and travel the carrier (par. 77) at right angle near the boom feet. When close, stop the carrier.

(2) If the boom cribbing (7, fig. 28) has settled, lift or jack up the boom feet to the same height as the boom foot pins on the revolving frame.

(3) Remove the boom foot pins from their brackets on the revolving frame. Start the revolving frame engine (par. 62*b*). Operate the revolving frame machinery to swing the front of the frame toward the boom feet.

(4) Simultaneously travel the carrier and swing the revolving frame to have the brackets travel into and between the boom feet.

Note. Maneuver the carrier and swing the revolving frame to have the rear of the revolving frame over the side of the carrier. This procedure will provide more clearance for installing the mast hoist cable on the independent boom hoist drum under the rear of the revolving frame.

(5) Install the boom foot pins (2, fig. 29) and secure with cotter pins (5).

(6) Stop the revolving frame (par. 64) and carrier (par. 65) engines.

(7) Position the mast foot brackets (7) on top of the revolving frame and secure with mounting bolts (8), nuts, and jamnuts.

(8) Raise the hoe mast (3, fig. 28) from the hoe boom (1) and install the mast foot (3, fig. 29) in the mast foot brackets (7). Install the mast foot pins (4) and secure with cotter pins (6).

(9) Install the larger-diameter, smooth, tapered lagging on the front drum (par. 229*c*).

(10) Adjust the front drum clutch control for back hoe operation (par. 192*e*).

(11) Reeve the back hoe (par. 19).

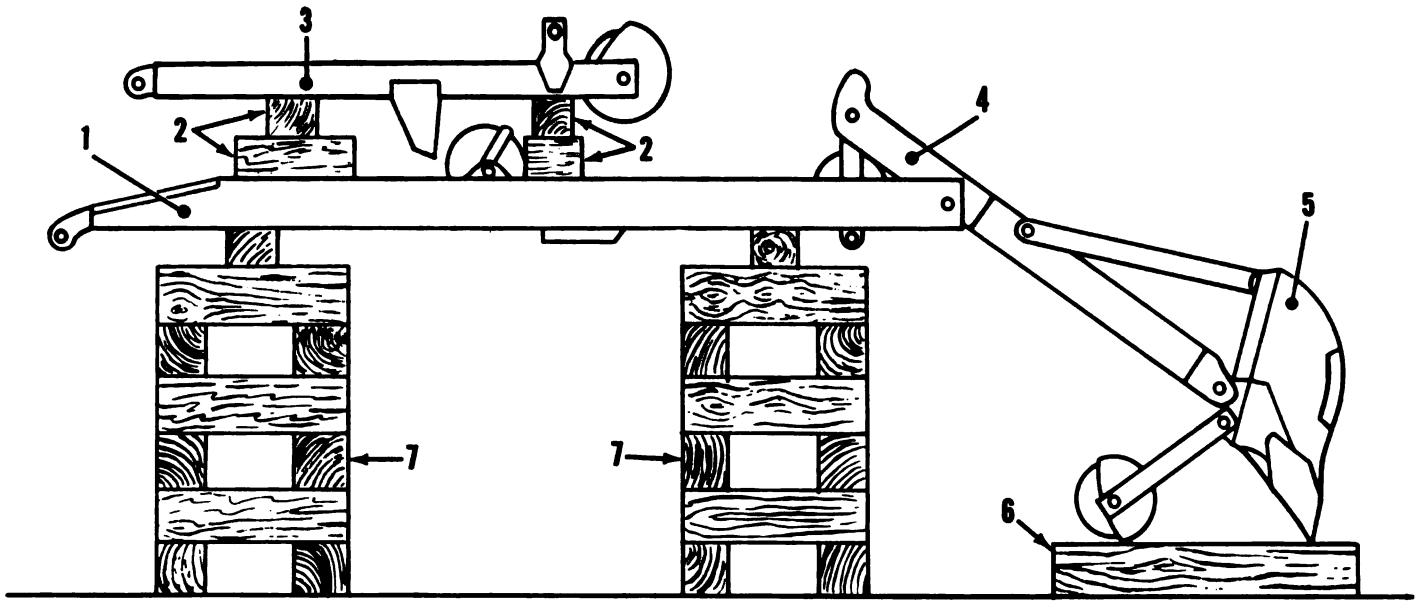
(12) Lubricate the back hoe front end attachment (LO 5–9513–1).

(13) Travel the crane-shovel to the new location (par. 77).

c. Removal.

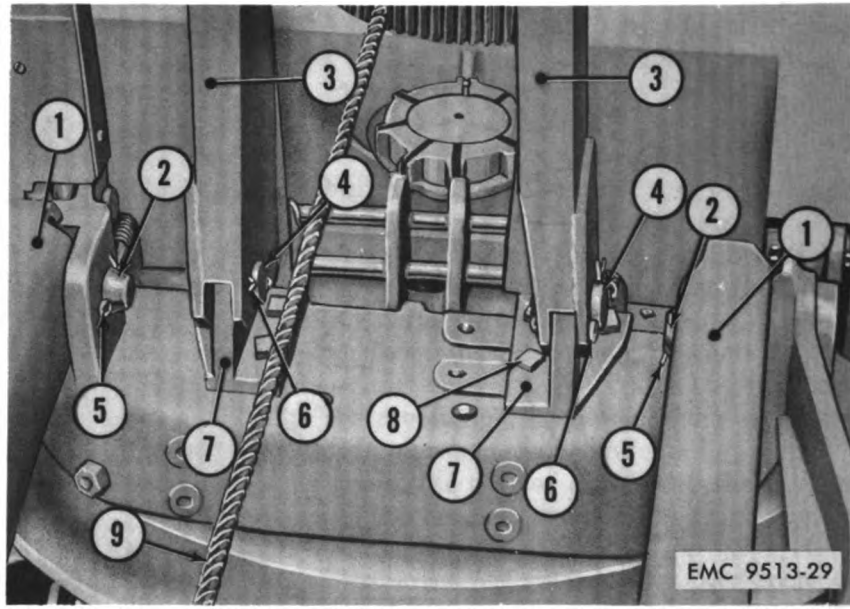
(1) Operate and travel the crane-shovel (par. 77) to the storage area.

(2) On dry, level ground, build cribbing (7, fig. 28) of timber



1 Back hoe boom
2 Block
3 Hoe mast
4 Bucket handle
5 Bucket
6 Platform
7 Cribbing

Figure 28. Back hoe attachment on cribbing.



1 Hoe boom foot
2 Boom foot pin
3 Hoe mast foot
4 Mast foot pin
5 Cotter pin
6 Cotter pin
7 Mast foot bracket
8 Mounting bolt
9 Cable

Figure 29. Hoe boom and mast foot pins, installed.

upon which the hoe boom (1) can be placed. Cribbing should be high enough to place the boom foot at the same height as the boom foot pins on the revolving frame.

(3) Travel the crane-shovel to the cribbing. Operate the revolving frame machinery (par. 75) to extend and lower the bucket (5) on a platform (6) and the hoe boom (1) on the cribbing (7).

Note. Maneuver the carrier and swing the revolving frame to have the rear of the revolving frame over the side of the carrier. This procedure will provide more clearance for removing the mast hoist cable from the independent boom hoist drum under the rear of the revolving frame.

(4) Stop the revolving frame (par. 64) and carrier (par. 65) engines.

(5) Unreeve the back hoe (par. 19).

(6) During unreeving, allow the hoe mast (3, fig. 28) to rest on blocks (2) placed on the hoe boom (1).

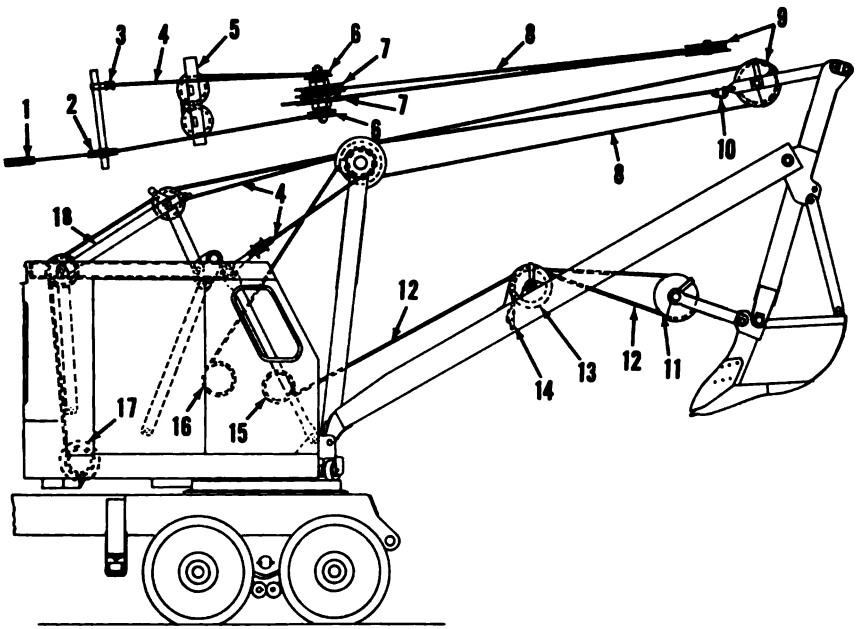
(7) Remove the cotter pins (6, fig. 29) and mast foot pins (4) and lower the mast on the blocks.

(8) Remove the jamnuts, nuts, mounting bolts (8), and mast foot brackets (7) from the revolving frame.
(9) Remove the cotter pins (5) and boom foot pins (2) from the boom feet (1).
(10) Remove the large-diameter, smooth, tapered lagging from the front drum (par. 229*a*).
(11) Operate and drive the carrier away from the boom.
(12) Install the boom foot pins in their brackets and secure with cotter pins.
(13) Travel the carrier to the new location (par. 77).

19. Back Hoe Reeving and Unreeving
(fig. 30)

a. Mast Hoist Cable Reeving.

(1) For size and length of the mast hoist cable (4), see paragraph 6*g*.



EMC 9513-30

1	Gantry pulley	10	Wedge socket
2	Cable guide and gantry pulley	11	Bail pulley
3	Wedge socket	12	Drag cable
4	Mast hoist cable	13	Boom pulley
5	Equalizer and pulley	14	Wedge socket
6	Mast hoist pulley	15	Front drum
7	Mast pulley	16	Hoist drum
8	Boom hoist cable	17	Independent boom hoist drum
9	Bridle pulley	18	Gantry

Figure 30. Back hoe reeving.

(2) Raise the gantry (18) as instructed in paragraph 66*h*.
(3) Unroll the mast hoist cable on the ground along the right side of the revolving frame and boom. Keep the cable as clean as possible.
(4) Take the cable end at rear of the revolving frame and pass it through the cable guide and gantry pulley (2). Continue the cable end over the rear gantry pulley (1) and down to the independent boom hoist drum (17). Dead end the cable in the drum with a wedge. Make sure that the end of the cable does not protrude from the drum.
(5) Avoid kinks and twists in the cable. Remove mud, grit, and sand from the cable while reeving. Lubricate the cable (LO 5–9513–1).
(6) Operate the revolving frame machinery and pull on the independent boom hoist clutch hand lever (par. 47) to wind approximately one-half the cable length on the independent boom hoist drum. Keep the cable taut while winding it in slowly. See that the cable winds true on the drum. Make sure that the cable is in the grooves of the pulleys.
(7) Place the mast hoist cable on the right mast hoist pulley (6). Take the loose end of the cable and pass it in back of the right pulley on the equalizer (5) and then across and in back of the left equalizer pulley.
(8) Continue the cable to, under, and around the left mast hoist (6) and dead end with a wedge at the wedge socket (3). The end of the cable is always inserted through the tapered opening from the bottom of the socket up, wrapped around the socket wedge, doubled back through the socket, and pulled tight.

b. Boom Hoist Cable Reeving.

(1) For size and length of boom hoist cable (8), see paragraph 6*g*.
(2) Unroll the boom hoist cable (8) on the ground at the boom point. Keep the cable as clean as possible.
(3) Pass one end of the boom hoist cable under and around the bridle pulley (9). Continue the cable over the right mast pulley (7) and down to the hoist drum (16). Dead end the cable in the drum with a wedge. Make sure that the end of the cable does not protrude from the drum.
(4) Avoid kinks and twists in the cable. Remove mud, grit, and sand from the cable while reeving. Lubricate the cable (LO 5–9513–1).

(5) Operate the revolving frame machinery and pull on the hoist shaft clutch hand lever (par. 46) to wind the cable on the drum. Keep the cable taut while winding it in slowly. See that the cable winds true on the drum. Leave sufficient cable to complete reeving.

(6) Take the loose end of the boom hoist cable (8) and pass it under and around the left mast pulley (7) and dead end in the wedge socket (10). The end of the cable is always inserted through the tapered opening from the bottom of the socket up, wrapped around the socket wedge, doubled back through the socket, and pulled tight.

c. Drag Cable Reeving.

(1) For size and length of the drag cable (12), see paragraph 6*g*.

(2) Unroll the drag cable on the ground at the boom point. Keep the cable as clean as possible.

(3) Pass one end of the drag cable over the right boom pulley (13) and continue the cable to the front drum (15). Dead end the cable in the drum with a wedge. Make sure that the end of the cable does not protrude from the drum.

(4) Avoid kinks and twists in the cable. Remove mud, grit, and sand from the cable while reeving. Lubricate the cable (LO 5–9513–1).

(5) Operate the revolving frame machinery and pull on the front drum clutch hand lever (par. 45) to wind the cable on the drum. Keep the cable taut while winding it in slowly. See that the cable winds true on the drum. Leave sufficient cable to complete reeving.

(6) Take the loose end of the drag cable and pass it over and around the bail pulley (11). Continue the cable over the left boom pulley (13) and dead end in the wedge socket (14). The end of the cable is always inserted through the tapered opening from the bottom of the socket up, wrapped around the socket wedge, doubled back through the socket, and pulled tight.

d. Drag Cable Unreeving.

(1) Operate and travel the crane-shovel (par. 77) to the storage area for removal (par. 18*c*).

(2) Drive the wedge and drag cable (12) from the wedge socket (14). Pull the cable from the bail pulley (11).

(3) With the front drum brake foot pedal released (par. 51), pull the drag cable over the right boom pulley (13). Coil or reel the cable, avoiding kinks or twists. Remove

mud, grit, and sand from the cable while coiling or reeling. Lubricate the cable (LO 5–9513–1).

(4) When the end of the drag cable is reached at the front drum (15), pry the wedge loose by inserting a driftpin from the outside of the drum.

(5) Continue pulling and coiling or reeling the drag cable from the boom pulley. After coiling, wrap wire around the strands, in three or four places, to hold the cable together.

e. Boom Hoist Cable Unreeving.

(1) Operate and travel the crane-shovel (par. 77) to the storage area for removal (par. 18c).

(2) Drive the wedge and boom hoist cable (8) from the wedge socket (10). Pull the cable from the left mast pulley (7) and the bridle pulley (9).

(3) With the hoist drum brake foot pedal released (par. 52), pull the boom hoist cable over the right mast pulley (7). Coil or reel the cable, avoiding kinks or twists. Remove mud, grit, and sand from the cable while coiling or reeling. Lubricate the cable (LO 5–9513–1).

(4) When the end of the boom hoist cable is reached at the hoist drum (16), pry the wedge loose by inserting a driftpin from outside of the drum.

(5) Continue pulling and coiling or reeling the boom hoist cable. After coiling, wrap wire around the strands, in three or four places, to hold the cable together.

f. Mast Hoist Cable Unreeving.

(1) Operate and travel the crane-shovel (par. 77) to the storage area for removal (par. 18c).

(2) Drive the wedge and mast hoist cable (4) from the wedge socket (3). Pull the cable from the mast hoist pulleys (6) and equalizer pulleys (5).

(3) Coil or reel the cable, avoiding kinks and twists. Remove mud, grit, and sand from the cable while coiling or reeling. Lubricate the cable (LO 5–9513–1).

(4) Operate the revolving frame machinery and push the independent boom hoist clutch hand lever forward. Pull the mast hoist cable from the cable guide and gantry pulley (2). Continue coiling or reeling the cable.

(5) When the end of the mast hoist cable is reached at the independent boom hoist drum (17), pull the independent boom hoist clutch hand lever to neutral position. Stop the revolving frame machinery (par. 64). Pry the wedge and cable from the drum by inserting a driftpin from outside the drum.

(6) Continue pulling and coiling or reeling the mast hoist cable from the cable guide and gantry pulley (2). After coiling, wrap wire around the strands, in three or four places, to hold the cable together.

(7) Lower the gantry (18) as instructed in paragraph 66*i*.

20. Care and Application of Cables

a. General. The size and length of the cables used on the crane-shovel are given in paragraph 6*g*. When cables which are removed are to be stored temporarily, lubricate as instructed in the current lubrication order. Inspect and lubricate new cable as it is reeved on the crane-shovel. The term "wire rope" is used to designate cable, before it is cut to length. Wire rope is made of steel or iron wires laid together to form strands. Strands are laid together to form a rope, either wound about each other or wound together about a central core. The number of strands, number of wires per strand, type of material, and nature of the core will depend on the purpose for which the rope is intended.

b. Construction. Wire rope is classified by the number of strands, number of wires per strand, strand construction, lay, core, and fabrication.

(1) *Wire.* The basic unit of wire rope construction is the individual wire, which is made of steel or iron in various sizes.

(2) *Strand.* Wires are laid together to form strands. The number of wires in a strand varies according to the purpose for which the rope is intended.

(3) *Rope.* A number of strands are laid together to form the wire rope itself. Wire rope is designated by the number of strands per rope and the number of wires per strand. In this manner, a 6 x 19 wire rope will have six strands with 19 wires per strand. In winding the wires together to form the strand, and in winding the strands together to form the rope, the individual wires are usually wound or laid together in a direction opposite to the lay of the strands to form the rope. Wire rope made up of a large number of small wires is flexible but the small wires are easily broken, so the rope is not resistant to external abrasion. Rope made up of a smaller number of larger wires is more resistant to external abrasion but is less flexible.

(4) *Core.* The strands of the rope are laid up around a central core, which may be only a single wire, or a single strand. A hemp core is used in many wire ropes to contribute flexibility and form a cushion for the

strands as the rope contracts under a strain. A hemp core will hold a portion of the lubricant placed on the wires for continuous lubrication. A hemp or wire center may be used as the core for the individual strand. A wire core for the rope is stronger than hemp and can be used in installations where conditions would damage the hemp, such as in high temperatures.

(5) *Lay.* Lay refers to the direction of winding of the wires in the strands or the strands in the rope. There are two lays in a rope: the strand lay, or the winding of the wires in the strands; and the rope lay, or the winding of the strands in the rope. Both may be wound in the same direction, or they may be wound in opposite directions, depending upon the intended use of the rope. In some ropes, the wires and strands are formed to their final shape before being laid together in the rope. Preforming relieves internal stresses in the rope.

(6) *Fabrication.* Wire rope may be fabricated by either of two methods. If the strands or wires are preformed, or shaped to conform to the curvature of the finished rope, prior to their laying up, the rope is termed "preformed." If they are not shaped before fabrication, the rope is termed "nonpreformed." Nonpreformed rope has a tendency to untwist when the rope is cut. Preformed rope does not tend to untwist and is more flexible.

c. *Coiling and Uncoiling* (fig. 31).

(1) *Coiling.* Loose wire rope should be coiled in a manner that prevents small loops from forming. These small loops, or twists, will form if the rope is being wound into the coil in a direction opposite to the direction in which the wire is attempting to turn. Left lay wire rope should be coiled in a counterclockwise direction and right lay wire rope should be coiled in a clockwise direction. Straighten out all loops before coiling past them. These small loops cannot be straightened by pulling the rope taut. Twist the rope to remove them.

(2) *Uncoiling.* Attempts to uncoil or unreel wire rope from a stationary reel or coil must be avoided because of kinking (C) and (D). In all cases the reel or coil is rotated to uncoil the rope smoothly. The most satisfactory method of unreeling wire rope (1) is to mount the reel on a pipe or rod supported by two uprights (A). As the wire rope is pulled away from the reel, the reel will turn, keeping the wire rope straight. If it is necessary to pull a considerable length of wire rope off the reel,

snake it off with some mechanical device, such as a truck or tractor. In this case, improvise a brake to prevent the momentum of the reel from unwinding an excessive amount of rope at any time, causing snarls and kinking. If a wire rope is in a small coil, stand the coil on end and roll it along the ground. It is unwise to attempt to unroll a very large coil of wire rope along the ground because it is too difficult to handle.

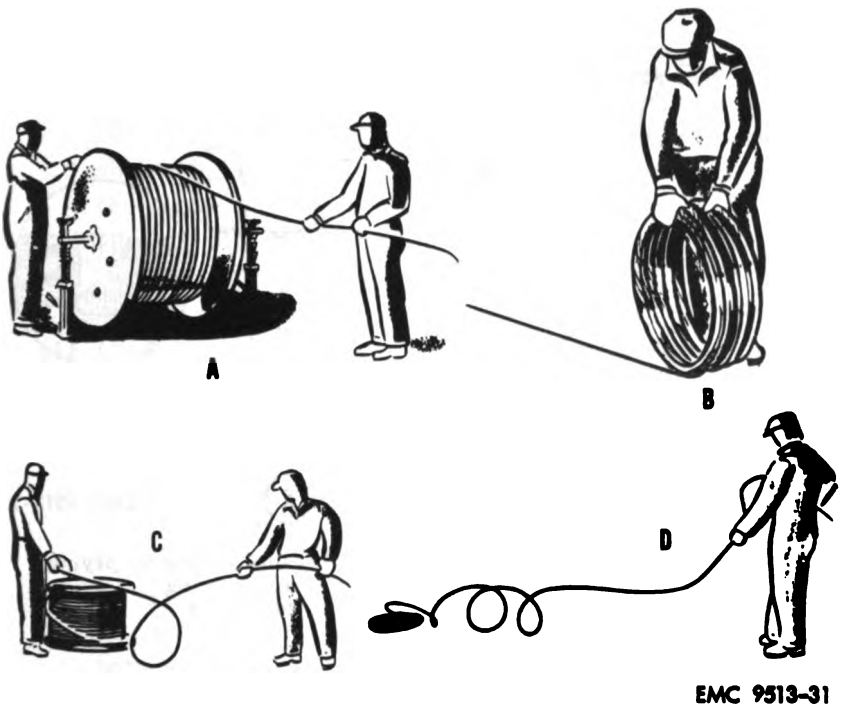


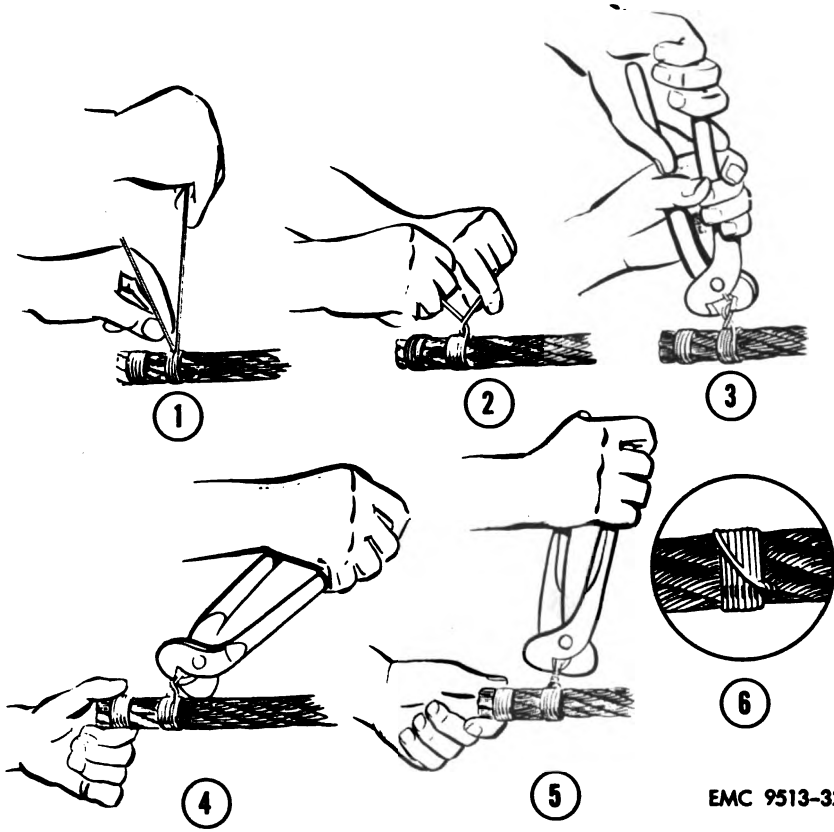
Figure 31. Cable handling.

d. Cutting and Binding. In cutting wire rope, bind the loose ends to prevent untwisting of the strands. Wherever possible, seize or weld the new ends before cutting.

(1) *Seizing* (fig. 32).

(*a*) Wind annealed iron wire around the rope by hand, keeping the turns tight (1) and considerable tension on the wire.

(*b*) After several turns have been taken about the wire rope, twist the ends of the binding wire together counterclockwise (2) so that the twisted portion of the wire is near the middle of the seizing.



1 Winding wire by hand
2 Twisting wire by hand
3 Twisting wire with plier
4 Tightening seizing by prying
5 Tightening seizing
6 Finished seizing

Figure 32. Seizing wire rope.

(*c*) Tighten the twist with pliers (3) to take up the slack. Do not attempt to tighten the seizing itself by twisting the ends; tighten the seizing by prying the twist (4) in the wire away from the wire rope. Then again tighten the twist with pliers (5). Repeat this as necessary to make the seizing tight.

(*d*) Cut off the ends of the wires and bend the twisted portion down against the rope (6).

(*e*) There are three convenient rules for determining the number of seizings, lengths, and space between seizings. In each case, when the calculation results in a fraction, the next larger whole number is used. The number of seizings to be applied equals approximately three times the diameter of the rope. Each seizing

should be 1 to 1½ times as long as the diameter of the rope. The seizings should be spaced a distance apart equal to twice the diameter of the rope.

(2) *Welding.* Wire rope ends may be bound together by fusing or welding the wires. Before welding the rope, a short piece of the core should be cut out of the end so that a clean weld will result and the core will not be burned deep into the rope. The area heated should be kept to a minimum, and no more heat should be applied than essential to fuse the metal.

(3) *Cutting.* Wire rope may be cut with a wire rope cutter, a cold chisel, a hacksaw, bolt clippers, or an oxyacetylene cutting torch. Before cutting the wire rope, the strands should be bound tightly together to prevent unlaying of the rope. Seizing (using three separate seizings on each side of the cut) or welding will secure satisfactorily the ends that are to be cut.

e. Cleaning and Lubrication.

(1) *Cleaning.* Used wire rope should be carefully cleaned of any accumulation of dirt, grit, or other foreign material. Rust should be removed at regular intervals by wire brushing. Scraping or steaming will remove most of the dirt or grit which may accumulate on the wire. The rope should always be carefully cleaned just prior to lubrication. The object of cleaning at that time is to remove all foreign material and old lubricant from the valleys between the strands and from the spaces between the outer wires to permit the newly applied lubricant free entrance into the rope.

(2) *Lubrication.* At the time of fabrication, a lubricant is applied to wire rope. This lubricant generally is not sufficient to last throughout the life of the rope, making it necessary that the lubricant be renewed periodically. Lubricant can be brushed on the rope, or the lubricant can be applied by passing the rope through a trough or box containing the lubricant. The application of the lubricant should be made as uniform as possible throughout the length of the rope. In every case where the rope is being stored for any length of time, it should be cleaned and lubricated prior to storage.

f. Kinking. When loose wire rope is handled, small loops frequently form in the slack portion of the rope. If

tension is applied to the rope while these loops are in position, they will not straighten out but will form sharp kinks, resulting in unlaying of the rope. All of these loops should be straightened out of the rope prior to applying a load. After a kink has formed in wire rope, it is impossible to remove it and the strength of the rope is seriously damaged at the point where the kink occurs. Such a kinked portion should be out of the rope before it is used again for hoisting.

g. Attachments.

(1) *Cable clamps* (fig. 33). Clamps may be used in making up eyes in wire rope, either for a simple eye or for an eye reinforced with a thimble. A thimble should be used for every eye, unless special circumstances prevent it, because it protects the rope from sharp bends around pins.

(*a*) Place the back of the thimble against the wire rope, leaving sufficient free rope to allow for the proper number and spacing of clamps.

(*b*) Bend the wire rope around the thimble and install a clamp close to the pointed end of the thimble where the two parts of the wire rope come together.

(*c*) Slip the U-bolts over the running end (short end) of the rope.

(*d*) The bases of the clamps are placed in position over the end of the U-bolt, so that they bear against the long end of the rope (1).

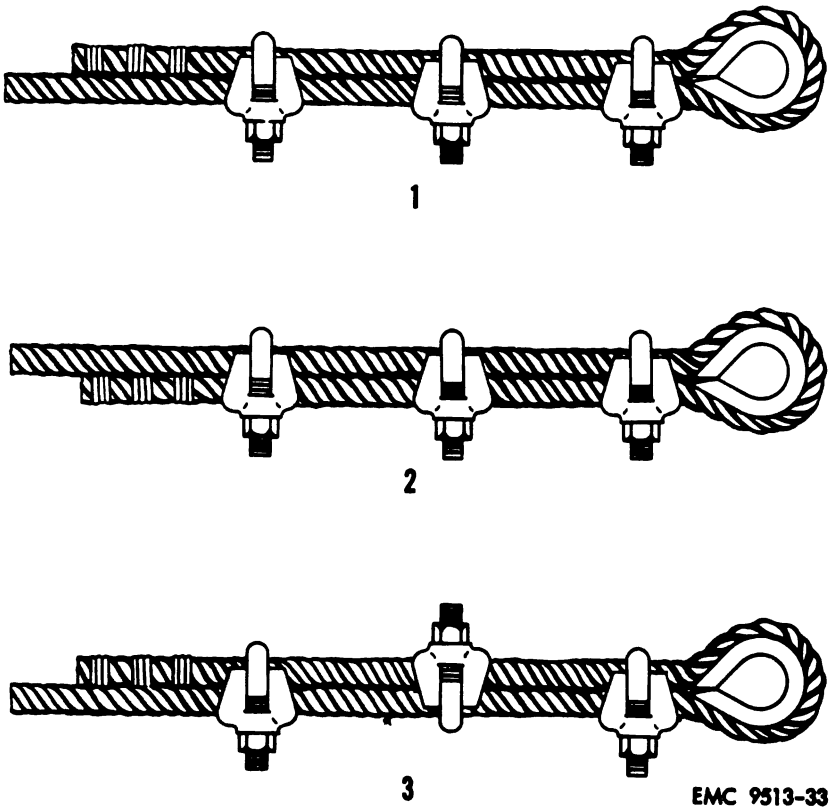
(*e*) Install and tighten the nuts on the U-bolt ends finger-tight, until all clamps have been installed.

(*f*) Space the clamps about six rope diameters apart. The number of clamps to be installed is equal to three times the diameter of the rope plus one. When this calculation results in a fraction, use the next larger whole number.

(*g*) After all clamps are installed, tighten the clamp farthest from the thimble with a wrench. Place the rope under tension and tighten the nuts on the clamp next to the first clamp. Then tighten the remaining clamps in order, moving toward the thimble.

(2) *Wedge socket.* A wedge socket end fitting (fig. 34) is used when it may be necessary to change the fitting at frequent intervals. It is made in two parts. The socket itself has a tapered opening for the wire rope and a small wedge to go into this tapered socket.

(*a*) Remove the wedge and insert a loop of the wire rope



1 Correct 2 Incorrect 3 Incorrect

Figure 33. Correct and incorrect methods of attaching cable clamps.

through the tapered opening from the bottom of the socket up.

(*b*) Place the wedge through the loop and pull the ends of the wire rope back through the tapered opening until the wedge forces the wire rope against the sides of the wedge socket.

(*c*) The loop of wire rope must be inserted in the wedge socket so that the standing part of the wire rope will form a nearly direct line to the clevis pin of the fitting. A properly made up wedge socket connection will tighten when a strain is placed on the wire rope.

h. Measuring Cable and Pulley Throat.

(1) *Measuring cable.* The size of wire rope is designated by its diameter in inches. The diameter of a cable is the diameter of a circle inclosing it entirely. When measuring diameter, always take the largest diameter. Also,

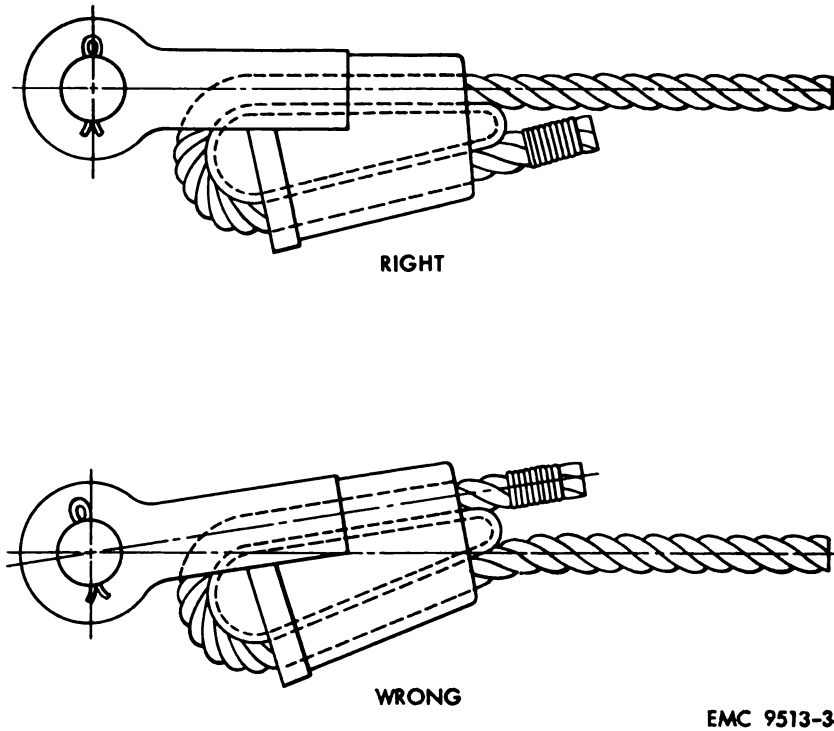


Figure 34. Wedge socket end fitting.

the actual diameter of a wire rope when new is usually a little larger than nominal size. Any variation in diameter is always over; it is never under. This variation will normally be from one-sixty-fourth to one-sixteenth of an inch.

(2) *Measuring pulley throat.*

(*a*) Pulleys with grooves too large give insufficient support to the wire rope. To be suitable for most installations, about 135° of the rope circumference should be supported by the groove.

(*b*) Tight or pinching grooves cause considerable rope abuse with consequent reduction in rope life and service. Table I gives the proper groove clearance.

i. Storage. Wire rope should be coiled on a spool for storage and should be properly tagged as to size and length. It should be stored in a dry place to reduce corrosion, and kept away from chemicals and fumes which might attack the metal. Prior to storage, wire rope should always be cleaned and lubricated.

Table I. Clearance by which groove diameter should exceed nominal rope diameter for proper operation

Nominal rope diameter (inches)	Recommended clearance (inches)
¼— 5/16	1/64
3/8— ¾	1/32
13/16—1⅛	3/64
1¾6—1½	1/16
1 9/16—2¼	3/32
2 5/16 and larger	⅛

Section III. CONTROLS AND INSTRUMENTS

21. General

This section describes, locates, illustrates, and furnishes the operator and the driver sufficient information about the various controls and instruments for the proper operation of the crane-shovel.

22. Ignition Switches

a. Revolving Frame Engine (fig. 35).

(1) *Location.* The ignition switch (13) is located on the lower left corner of the control panel (2).

(2) *Purpose.* The ignition switch opens and closes the ignition circuit of the revolving frame engine.

b. Carrier Engine (fig. 36).

(1) *Location.* The ignition switch and key (19) is located at the lower center of the instrument panel (9).

(2) *Purpose.* The ignition switch and key opens and closes the ignition circuit of the carrier engine.

23. Choke Controls

a. Revolving Frame Engine (fig. 37).

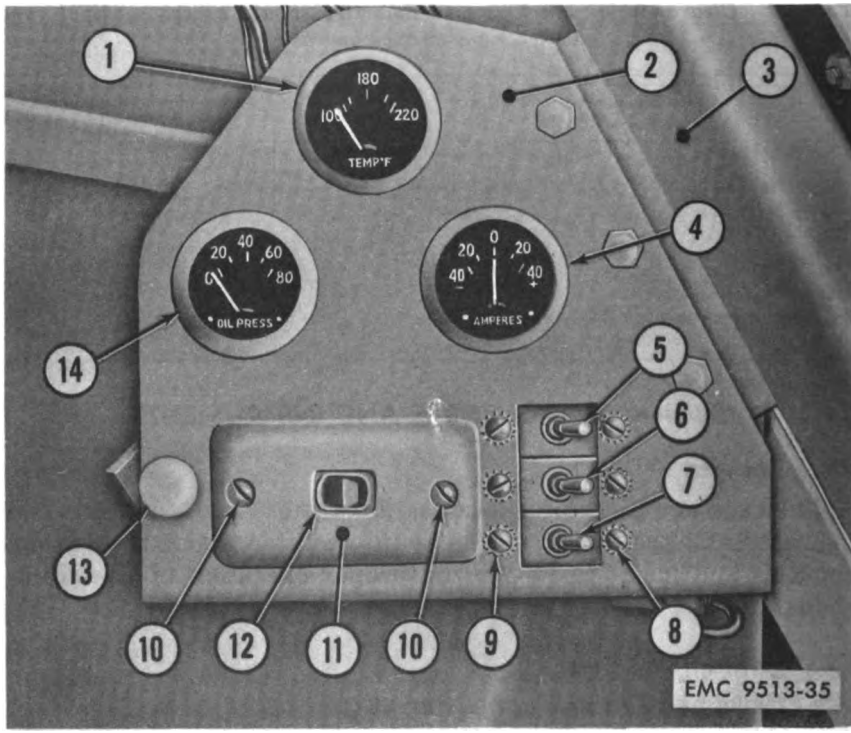
(1) *Location.* The choke control (12) is mounted on a bracket attached to the rotating base at the operator's left hand.

(2) *Purpose.* The choke control regulates the amount of air which enters the revolving frame engine carburetor throat, so that the richness of the fuel-and-air mixture may be controlled for cold weather operation.

b. Carrier Engine (fig. 36).

(1) *Location.* The choke control (11) is located on the lower right corner of the instrument panel (9).

(2) *Purpose.* The choke control regulates the amount of



1	Water temperature gage	8	Mounting screw
2	Control panel	9	External teeth lockwasher
3	Front strut pipe	10	Cover screw
4	Ammeter	11	Receptacle box cover
5	Upper floodlight switch	12	Receptacle
6	Lower floodlight switch	13	Ignition switch
7	Cab light switch	14	Oil pressure gage

Figure 35. Revolving frame engine instrument and control panel.

air which enters the carrier engine carburetor throat, so that the richness of the fuel-and-air mixture may be controlled for cold weather operation.

24. Starter Controls

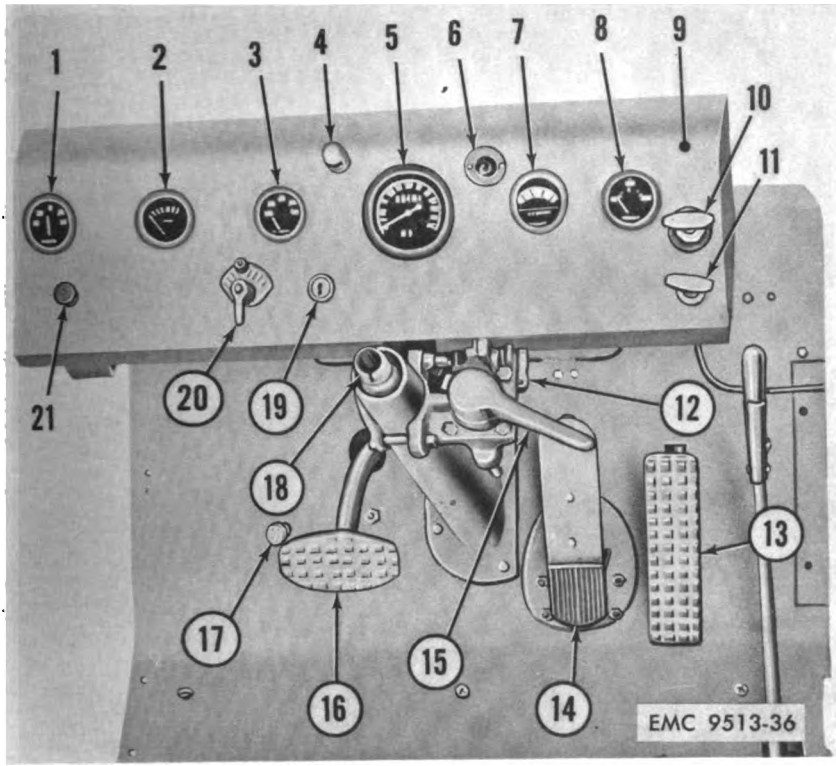
a. Revolving Frame Engine (fig. 37).

(1) *Location.* The starter control (11) is mounted on a bracket attached to the rotating base at the operator's left hand.

(2) *Purpose.* The starter control actuates the starter switch mounted on the revolving frame engine starting motor.

b. Carrier Engine (fig. 38).

(1) *Location.* The starter hand lever (5) is located near the deck plate at the driver's right hand.



1	Ammeter	11	Choke control
2	Fuel gage	12	Air compressor governor
3	Oil pressure gage	13	Accelerator pedal
4	Instrument panel light and switch	14	Service brake treadle
5	Speedometer	15	Handbrake valve handle
6	Low air pressure warning lamp	16	Clutch pedal
7	Air pressure gage	17	Headlight dimmer switch
8	Water temperature gage	18	Steering wheel tube
9	Instrument panel	19	Ignition switch and key
10	Throttle control	20	Selector switch
		21	Windshield wiper switch

Figure 36. Carrier engine controls and instruments.

(2) *Purpose.* The starter hand lever actuates the starter switch mounted on the carrier engine starting motor.

25. Throttle Controls

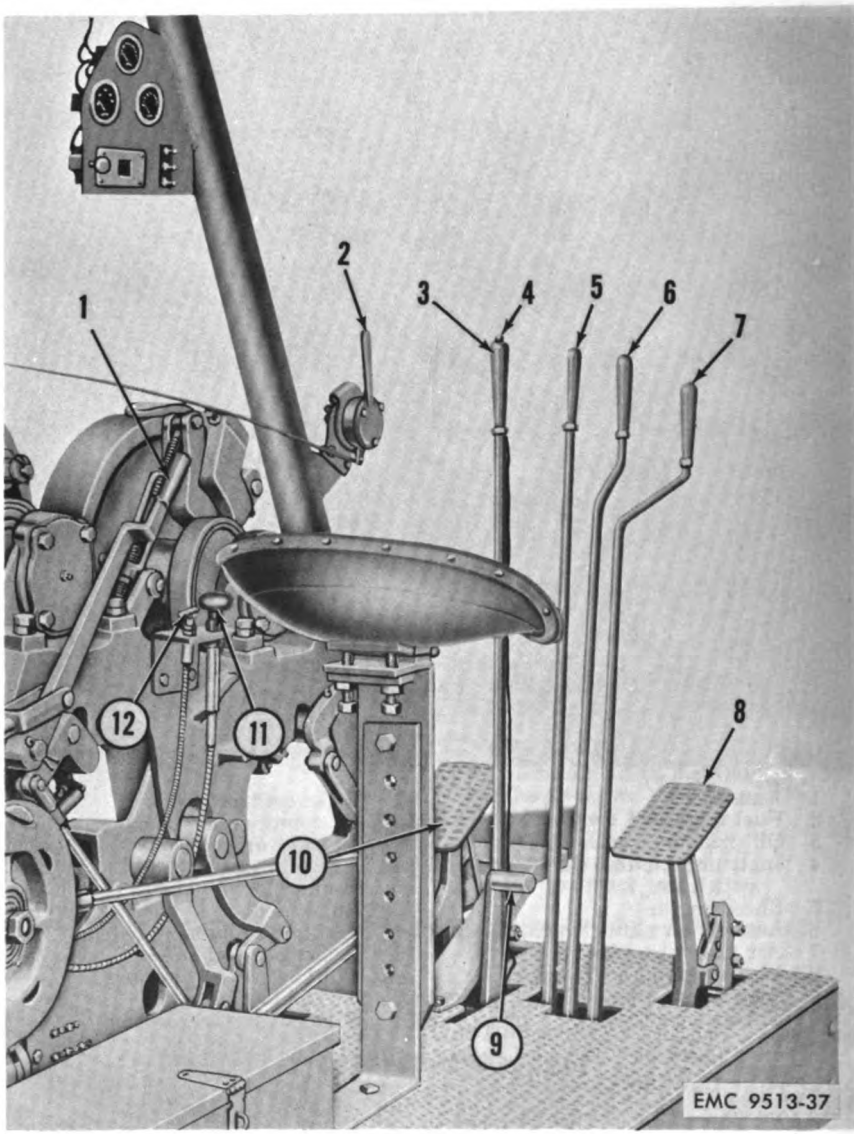
a. Revolving Frame Engine (fig. 37).

(1) *Location.* The throttle hand lever (2) is mounted on the front strut pipe to the left of the operator.

(2) *Purpose.* The throttle hand lever controls the speed of the revolving frame engine at the carburetor.

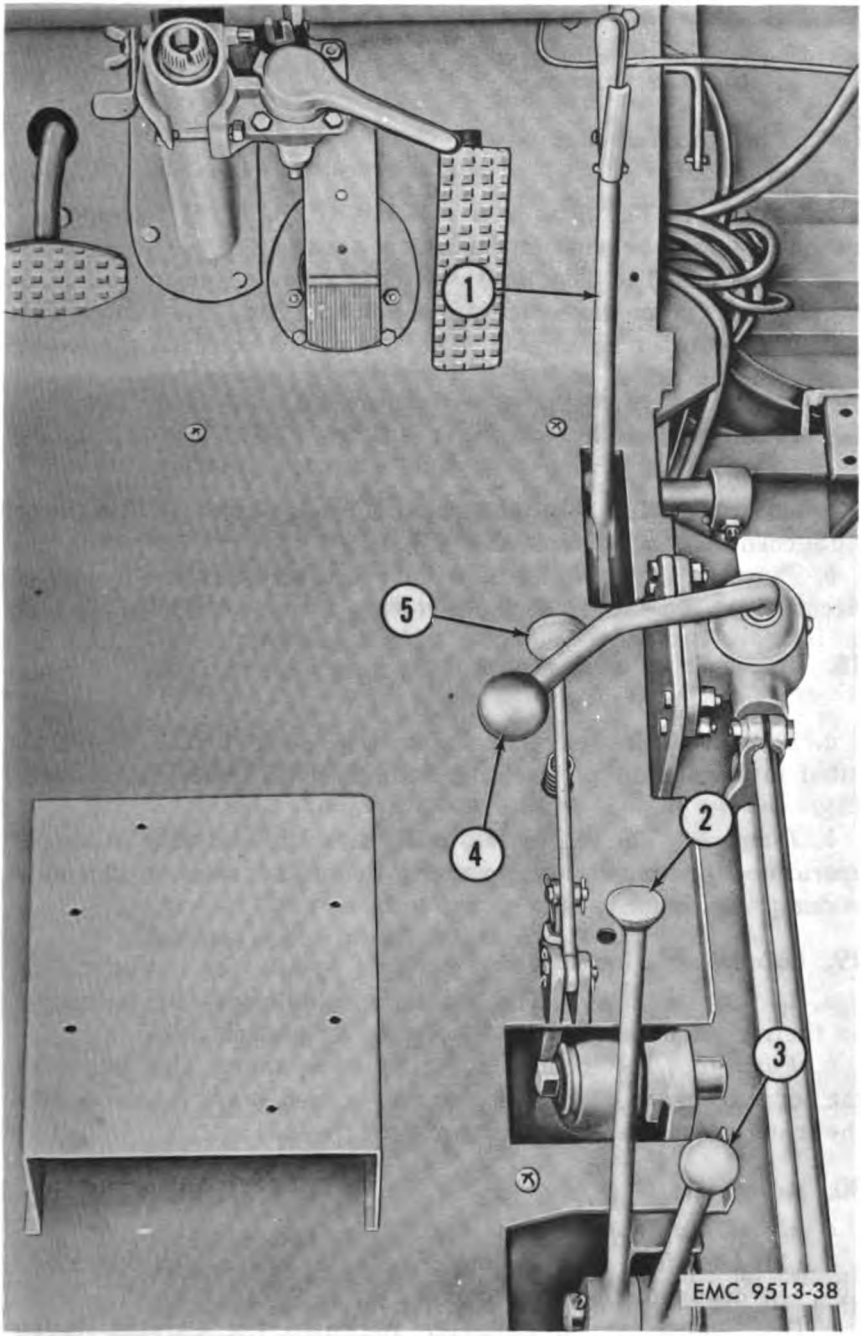
b. Carrier Engine (fig. 36).

(1) *Location.* The throttle control (10) is located on the lower right corner of the instrument panel (9).



1 Engine clutch hand lever
2 Throttle hand lever
3 Intermediate shaft clutch hand lever
4 Dipper trip pushbutton
5 Crowd and front drum clutch hand lever
6 Hoist shaft clutch hand lever
7 Independent boom hoist clutch hand lever
8 Hoist drum brake foot pedal
9 Swing lock foot lever
10 Front drum brake foot pedal
11 Starter control
12 Choke control

Figure 37. Revolving frame control levers and pedals.



1 **Emergency brake lever**
2 **Transfer case gearshift lever**
3 **Front axle declutch lever**
4 **Transmission gearshift lever**
5 **Starter hand lever**

Figure 38. Carrier controls.

(2) *Purpose.* The throttle control sets the speed of the carrier engine at the carburetor through the accelerator pedal linkage.

26. Floodlight Switches
(fig. 35)

a. Location. The floodlight switches (5) and (6) are located on the lower right corner of the control panel (2).

b. Purpose. The floodlight switches open or close the electrical circuit from the battery to the floodlights. The switch (5) controls the upper floodlights. The switch (6) controls the lower floodlights.

27. Cab Light Switch
(fig. 35)

a. Location. The cab light switch (7) is located on the lower right corner of the control panel (2).

b. Purpose. The cab light switch opens or closes the electrical circuit from the battery to the revolving frame cab lights.

28. Dipper Trip Pushbutton
(fig. 37)

a. Location. The electric dipper trip pushbutton (4) is located in the handle of the intermediate shaft clutch hand lever (3).

b. Purpose. The dipper trip pushbutton is used only in shovel operation to actuate the dipper trip drum and magnet assembly to dump the dipper.

29. Boom Angle Indicator

a. Location (fig. 1). The boom angle indicator (9) is located on the right side of the crane boom lower section (8).

b. Purpose. The boom angle indicator shows the angle of the boom from the boom foot pins and is used in conjunction with the crane and clamshell working ranges (fig. 16).

30. Ammeters

a. Revolving Frame Engine (fig. 35).

(1) *Location.* The ammeter (4) is located on the right center of the control panel (2).

(2) *Purpose.* The ammeter indicates the current being supplied to the battery by the revolving frame engine generator. The gage pointer should show on the plus side at all times when the revolving frame engine is operating.

415	17	.....	290	2808C653	290	2808-C-653	GASKET	2
415	18	.....	290	3866F552	290	3866-F-552	COVER, bearing cage	2
415	19	.....	290	4X1201	290	4-X-1201	STUD	12
415	21	.....	290	32122130	290	32122130	CAP (NSS)	4
415	22	.....	290	1820A53	290	1820-A-53	LOCK	4
415	23	.....	.....	5306-298-8637	290	S286D1	SCREW, cap	4
415	24	FABRI FROM	GE	22-8011-500-380	290	LW-1612	LOCKWIRE (1 ROLL FOR 480 EA)	4
415	26	.....	290	15X583	290	15-X-583	STUD	8
415	27	.....	290	S269-1	290	S-269-1	SCREW, cap	12
415	28	.....	290	A3866H554	290	A-3866-H-554	COVER	2
415	29	.....	290	2808B652	290	2808-B-652	GASKET	2
416	1	.....	.....	5310-353-2656	290	2814-B-2	RING, adjusting	4
416	2	.....	.....	3110-100-0329	892	572	CUP, bearing	4
416	3	.....	.....	3110-100-0645	892	581	CONE, bearing	4
416	4	.....	78500	2520-353-2368	290	A-3835-M-39	CASE, differential	2
416	5	.....	.....	2520-447-7592	290	1229-X-882	WASHER, thrust	4
416	6	.....	290	2234J244	290	2234-J-244	GEAR, side	4
416	7	.....	.....	2520-353-2713	290	3878-C-3	SPIDER	2
416	10	.....	290	A2233G137	290	A-2233-G-137	GEAR, spider	8
416	11	.....	290	1225W361	290	1225W361	BUSHING	8
416	12	.....	.....	2520-353-2494	290	1829-S-45	WASHER, thrust	8
416	13	.....	.....	3020-517-0640	290	3892-H-606	GEAR, helical	2
416	14	.....	.....	5306-353-2457	290	15-X-130	BOLT, case	16
416	1	.....	290	2814E57	290	2814-E-57	RING, adjusting	2
416	2	.....	.....	3110-100-0329	290	572	CUP, bearing	2
416	3	.....	.....	3110-100-0645	290	581	CONE, bearing	2
416	4	.....	.....	2520-353-2368	290	A-3835-M-39	CASE, differential	1
416	5	.....	.....	2520-447-7592	290	1229-X-882	WASHER, thrust	2
416	6	.....	.....	2520-353-2661	290	2834-N-66	GEAR, side	2
416	7	.....	.....	2520-353-2713	290	3878-C-3	SPIDER	1
416	10	.....	.....	2520-447-7519	290	2833-B-2	GEAR, spider	4
416	12	.....	.....	2520-353-2494	290	1829-S-45	WASHER, thrust	4

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
416	13	.....	.....	2520-353-2758	290	3892-Y-623	GEAR, helical	1
416	14	.....	.....	5306-353-2457	290	15-X-130	BOLT, case	8
417	2	.....	.....	5310-753-5081	290	14-X-57	NUT	4
417	3	.....	.....	5310-447-7591	290	1829-Y-363	WASHER	4
417	4	.....	290	1227F448	290	1227-F-448	JAM NUT, adjusting nut	2
417	5	.....	290	1229A209	290	1229-A-209	LOCK, jam nut	2
417	6	.....	.....	5310-753-5270	290	1229-V-48	NUT, adjusting	2
417	7	.....	.....	3110-100-0263	892	497	CONE, bearing	2
417	8	.....	.....	3110-100-0321	892	493	CUP, bearing	2
417	9	.....	290	.....	290	3826-Q-225	CAGE, bearing	2
417	10	.....	290	.....	290	3889-L-272	GEAR, hypoid (NSS)	2
417	11	.....	290	U1218TAM	290	U-1218-TAM	BEARING	2
417	12	.....	290	1821M13	290	1821-M-13	SLEEVE	2
417	13	.....	.....	5315-276-5385	290	16-X-79	KEY	2
417	14	.....	.....	.....	.....	.....	SHIM	AR
417	15	.....	290	A3826N222	290	A-3826-N-222	CAGE, bearing	2
417	16	.....	.....	3110-100-0608	892	66462	CUP, bearing	4
417	17	.....	.....	3110-100-3647	892	66225	CONE, bearing	4
417	18	.....	.....	5310-350-5407	290	1829-S-149	WASHER	2
417	19	.....	.....	5306-272-3738	290	S-278-D1	SCREW, cap	6
417	20	FABRI FROM	GE	22-8011-500-380	290	LW-166	LOCKWIRE (1 ROLL FOR 960 EA)	2
417	21	.....	.....	3040-569-0976	290	3891-H-450	SHAFT, pinion	2
417	22	.....	290	1244Y597	290	1244-Y-597	SPACER	2
417	23	.....	290	.....	290	3280-U-2075	SHAFT, thru, assembly	2
417	24	.....	.....	3110-198-1850	526	R-1212-TS	BEARING	2
417	25	.....	290	1244K557	290	1244-K-557	SPACER	2

417	27	.....	.....	.....	290	3890-P-354	PINION, hypoid (NSS).....	2
417	28	.....	.....	3110-159-9390	290	42350	CONE, bearing.....	2
417	29	.....	.....	3110-100-0583	290	42584	CUP, bearing.....	2
417	....	.....	.....	.....	290	A-1-3889-L-272-831.	GEAR SET.....	2
421	1	.....	290	3816D82	290	3816-D-82	TUBE, housing, short.....	1
421	2	.....	78500	2530-734-9598	290	A-3801-Y-77	HOUSING.....	1
421	3	.....	.....	5330-263-9668	290	1829-P-172	WASHER.....	4
421	4	.....	.....	5306-207-2238	290	15-X-209	BOLT, thru.....	4
421	6	.....	290	3816E83	290	3816-E-83	TUBE, housing, long.....	1
421	7	.....	.....	4730-050-4208	806	1610B	FITTING, lubrication.....	2
421	8	.....	.....	5315-276-5642	290	1246-L-272	PIN, lock.....	2
421	9	.....	.....	5306-353-2410	290	10-X-216	BOLT, yoke.....	2
421	10	.....	290	S1822-1	290	S-1822-1	SCREW, cap.....	4
421	11	.....	290	3944B28	290	3944-B-28	YOKE, tie rod end.....	1
421	12	.....	.....	5310-275-1758	290	1827-J-88	NUT.....	2
421	15	.....	.....	5310-282-5662	290	1827-K-89	LOCKNUT.....	1
421	16	.....	78500	2530-353-2764	290	3902-R-18	ROD, tie.....	1
421	17	.....	.....	2530-278-2246	290	3944-H-8	YOKE, tie rod.....	1
421	18	.....	GE	4730-010-3874	290	P-28	PLUG.....	1
421	19	.....	.....	5310-595-6582	290	1829-L-298	WASHER.....	4
421	20	.....	290	K2412	290	K-2412	PIN, cotter.....	2
421	26	.....	.....	5330-353-2630	290	2808-K-167	GASKET.....	1
422	1	.....	78500	2530-495-7716	290	A-3897-V-100	KNUCKLE, steering.....	2
422	2	.....	.....	3120-353-2472	290	1825-E-31	BUSHING, steering knuckle.....	2
422	3	.....	.....	3120-353-2473	290	1825-G-59	BUSHING, brake shaft.....	4
422	4	.....	.....	5307-281-6836	290	4-X-73	STUD, threaded.....	24
422	5	.....	.....	5307-272-4739	290	4-X-526	STUD, threaded.....	4
422	7	.....	290	13X14	290	13-X-14	NUT.....	4
422	8	.....	.....	3110-100-0599	892	53387	CUP, bearing.....	4
422	9	.....	.....	3110-142-4351	892	53176	CONE AND ROLLER, bearing.....	4
422	10	.....	.....	5330-353-2462	290	1805-M-39	RETAINER, grease.....	2

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
422	11			2530-734-9766	290	A-3897-R-96	KNUCKLE ASSEMBLY	2
422	12			5306-206-4238	290	3-X-168	SCREW, cap	16
422	14			5310-220-6732	290	N-49	NUT	30
422	15			5330-292-1596	290	A-1805-X-128	SEAL, oil	2
422	16		78500	5330-353-2771	290	5-X-322	PACKING	2
422	17		78500	3810-353-2466	290	1818-B-2	RING, retaining	2
422	18			4730-222-0990	806	1611	FITTING, lubrication	2
422	19			5310-353-2605	290	2803-W-309	SHIM	24
422	20		78500	2530-495-7948	290	3933-E-31	ARM, steering	1
422	21			4730-050-4208	806	1610B	FITTING, lubrication	2
422	22		290	2910X24	290	2910-X-24	BALL, steering knuckle	1
422	24		290	K2412	290	K-2412	PIN	1
422	25		78500	2530-734-9610	290	A2-3897-D-264	FLANGE, knuckle, rh	1
422	25		78500	2530-463-4382	290	A3-3897-D-264	FLANGE, knuckle, lh	1
422	27			5310-208-2815	290	13-X-47	NUT	2
422	30			3120-353-2478	290	1825-S-71	BUSHING	2
422	31			2530-024-1942	290	3866-G-137	CAP	3
422	32			5305-292-8945	290	S-21012-1	SCREW, cap	12
422	33		GE	4730-278-3397	290	P-32	PLUG	4
425	1			5305-174-0626	290	1898-W-75	SCREW	12
425	2		78500	2530-353-2510	290	1898-K-193	RETAINER, axle shaft	2
425	3			5340-353-2511	290	1898-L-194	RING, spacer	2
425	4		78500	2530-353-2361	290	A-3802-A-495	SHAFT, axle, short	1
425	....		78500	2530-353-2362	290	A-3802-B-496	SHAFT, axle, long	1
425	5		78500	2530-353-2508	290	1898-B-80	SEAT, pilot pin	2
425	6		78500	5315-353-2517	290	1898-Y-77	PIN, pilot	2

425	7	.....	78500	2530-377-8810	290	1898-X-440	PLUNGER, pin	4
425	8	.....	78500	5340-353-2515	290	1898-W-439	SPRING, pilot plunger	2
425	10	.....	78500	2530-495-7657	290	A-1898-J-114	RACE, inner	2
425	11	.....	.....	2520-377-6189	290	1898-S-71	CAGE, ball	2
425	12	.....	78500	2530-353-2516	290	1898-X-76	PILOT, cage	2
425	13	.....	78500	2530-353-2282	290	A1-3897-Z-234	RACE, outer	2
425	14	.....	.....	3110-227-4675	290	1898-T-72	BALL	12
429	3	.....	.....	2520-615-9608	290	3866-G-189	CAP, bearing	1
429	4	.....	.....	2520-353-2641	290	2808-T-774	GASKET	1
429	5	.....	.....	5310-353-2571	290	2803-C-55	SHIM	AR
.....	.....	.....	.....	2520-447-7594	290	2803-D-56	SHIM	AR
.....	.....	.....	.....	5310-353-2610	290	2803Y-571	SHIM	AR
429	6	.....	.....	5307-281-6836	290	4-X-73	STUD	6
429	7	.....	290	A3866Z182	290	A-3866-Z-182	COVER, side	1
429	8	.....	.....	2520-447-7604	290	2808-A-183	GASKET	1
429	9	FABRI FROM	GE	22-8011-500-380	290	IW-164	LOCKWIRE (1 ROLL FOR 1440 EA)	1
429	11	.....	.....	5310-737-4139	290	1829-G-7	WASHER	1
429	12	.....	.....	3110-100-0331	892	612	CUP, bearing	1
429	13	.....	.....	3110-100-0655	892	623	CONE, bearing	1
429	14	.....	290	3889W179	290	3889-W-179	GEAR, bevel	1
429	15	.....	290	3891C471	290	3891-C-471	PINION, helical	1
429	16	.....	.....	2520-353-2634	290	2808-N-300	GASKET	1
429	17	.....	78500	2520-353-2507	290	1850-A-1	CAP, inspection hole	1
429	18	.....	290	A28-3800U359	290	A28-3800-U-359	CARRIER, differential	1
429	19	.....	290	3812Q69	290	3812-Q-69	CAP (NSS)	2
429	23	.....	.....	5306-298-8637	290	S-286-D1	SCREW, cap	2
429	24	FABRI FROM	GE	22-8011-500-380	290	IW-1612	LOCKWIRE (1 ROLL FOR 1440 EA)	2
429	25	.....	.....	2530-353-2470	290	1820-N-40	LOCK	2
429	26	.....	.....	5307-206-2523	290	4-X-397	STUD	18
429	27	.....	.....	5310-353-2581	290	2803-H-346	SHIM	AR
429	....	.....	.....	2530-447-7600	290	2803-K-349	SHIM	AR
429	....	.....	.....	2530-353-2585	290	2803-J-348	SHIM	AR

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
429	28	.....	.....	2530-447-7605	290	2808-L-194	GASKET	1
429	29	.....	.....	2520-353-2371	290	A-3838-S-45	CAGE, bearing	1
429	32	.....	.....	3110-100-0607	892	65500	CUP, bearing	1
429	33	.....	.....	3110-100-3641	892	65225	CONE, bearing	1
429	34	.....	290	4X173	290	4-X-173	STUD	6
430	1	.....	.....	5310-426-8816	290	16278	NUT	1
430	3	.....	.....	5310-447-7591	290	1829-Y-363	WASHER	1
430	4	.....	290	A1-3897C315	290	A1-3897-C-315	YOKE, companion	1
430	5	.....	290	2847V308	290	2847-V-308	DEFLECTOR, dirt	1
430	6	.....	290	A1805Y155	290	A-1805-Y-155	SEAL, oil	1
430	7	.....	.....	3110-100-3636	892	59200	CONE, bearing	1
430	8	.....	.....	3110-100-0603	892	59412	CUP, bearing	1
430	9	.....	.....	4730-142-1630	290	1850-V-48	PLUG	1
430	10	.....	290	A3826U151	290	A-3826-U-151	CAGE, bearing	1
430	11	.....	.....	2520-353-2609	290	2803-Y-519	SHIM	AR
430	....	.....	.....	5310-353-2611	290	2803-Z-520	SHIM	AR
430	....	.....	.....	2520-353-2569	290	2803-A-521	SHIM	AR
430	12	.....	78500	2530-374-2155	290	1844-W-153	SPACER	1
430	13	.....	.....	3110-100-0655	892	623	CUP, bearing	1
430	14	.....	.....	3110-100-0331	892	612	CONE, bearing	1
430	15	.....	290	38908253	290	3890-S-253	PINION, bevel	1
430	16	.....	.....	2530-353-2631	290	2808-K-323	GASKET	1
430	17	.....	.....	2520-353-2580	290	2803-H-242	SHIM	AR
430	....	.....	.....	2520-447-7597	290	2803-G-241	SHIM	AR
430	....	.....	.....	5310-353-2575	290	2803-F-240	SHIM	AR
430	....	.....	78500	2530-353-2574	290	2803-E-239	SHIM	AR

432	1	.....	008	8-B6516	008	8-B6516	SHAFT.....	1
432	2	.....	008	8-B6627	008	8-B6627	COLLAR.....	2
432	5	.....	.....	5330-246-4838	008	3-1-2X4-1-4X3-8	WASHER, felt, 3½ ID x 4¼ OD x ⅜...	4
432	6	.....	.....	3120-425-2645	008	24-B3660	BUSHING.....	2
432	7	.....	008	B6787	008	B6787	EQUALIZER.....	2
432	8	.....	290	3280Z1846	008	3280-Z-1846	SPRING GUIDE AND SUPPORT BRACKET.	2
432	9	.....	290	1199K1311	290	1199-K-1311	BOLT.....	16
432	10	.....	290	1229S1397	290	1229-S-1397	WASHER.....	16
432	13	.....	290	3280Y1845	290	3280-Y-1845	SPRING GUIDE AND SUPPORT BRACKET.	2
433	1	.....	008	H2127A-B3884	008	H2127A-B3884	GEAR, ring.....	1
433	2	.....	008	3-B2948	008	3-B2948	PIN, center.....	1
433	3	.....	008	T757-B598	008	T757-B598	WASHER.....	1
433	4	.....	.....	5310-352-1725	008	H2564-B4172	NUT.....	1
433	5	.....	.....	5315-261-3602	008	1-B1107	KEY, center pin.....	1
433	8	.....	008	58-B3800	008	58-B3800	BUSHING.....	2
433	9	.....	008	1-B7060	008	1-B7060	COVER.....	1
433	11	.....	008	B6027	008	B6027	BRACKET.....	1
433	15	.....	008	B6894	008	B6894	SUPPORT, boom.....	1
433	16	.....	008	5-B4913	008	5-B4913	GUARD, headlight.....	2
433	19	.....	008	37888	008	37888	NUT.....	3
433	21	.....	008	14-B3410	008	14-B3410	PLATE, mounting.....	1
433	24	.....	008	D3300	008	D3300	FRAME.....	1

APPENDIX III

TOOL AND PUBLICATION SET

The tools listed herein are those required to perform the operator maintenance services on the crane-shovel.

Quantity	Engineer stock No.	Nomenclature
1	3810-319-5228	TOOL AND PUBLICATIONS SET.
1	5120-251-1102	BAR, socket wrench: cross; ¾ in. dia, 20 in. approx length; MIL-W-15838; Type III; class 6.
1	5110-242-8807	CUTTER, cable: hammer-type; 1 in. cap.; JAN-R-800.
1	.....	DEPARTMENT OF THE ARMY LUBRICATION ORDER 5-5252 (For Hercules Model TDXC Engine).
1	.....	DEPARTMENT OF THE ARMY SUPPLY MANUAL ENG 7, 8 & 9-9513.
1	.....	DEPARTMENT OF THE ARMY SUPPLY MANUAL ENG 9-5219 (For Hercules Model JXL Engine, also applicable to Model JXLDER Engine).
1	.....	DEPARTMENT OF THE ARMY TECHNICAL BULLETIN 5-5252-1 (For Hercules Model TDXC Engine).
2	.....	DEPARTMENT OF THE ARMY TECHNICAL MANUAL 5-5219 (For Hercules Model JXL Engine, also applicable to Model JXLDER Engine).
1	4930-360-2801	GREASE GUN, HAND: lever operated; spring primed; 16 oz cap.; 7000 psi max pressure; rigid, bent, angle tube type extension, 7 in. lg.; hydraulic-type coupler; w/loader fitting; MIL-G-3859.
1	5120-243-2963	HAMMER, machinist's: FS GGG-H-86; ball peen; class 1; Type L; handled; 1½ lb.
1	7610-355-7130	MODIFICATION KIT: MWO ENG 1999-1; for lubrication guides, check cards and manuals; MIL-P-11743.
1	4930-273-3641	OILER, HAND: steel; rd; pump-type; 16 oz cap.; FS RR-O-376; Type II; class A; 9 in. flexible spout, w/straight tip.
1	5120-223-7397	PLIERS, combination: slip joint; regular; w/cutter; FS GGG-P-471; Type F; class 1; style 1; 8 in.
1	5120-278-1282	SCREWDRIVER, common: plastic handle; normal-duty; 4 in. blade; ¼ in. tip; FS GGG-S-121; Type I; class 5; style 1; design A.

Quantity	Engineer stock No.	Nomenclature
1	5120–230–7858	SLEDGE, blacksmith's: FS GGG–H–86; Type SA; double face; class II; handled; 8 lb.
1	5120–264–3796	WRENCH, adjustable: crescent-type; single head; open end; heavy-duty; FS GGG–W–631; Type I; 1 5/16 in. opening x 12 in. lg.
1	5120–277–2343	WRENCH, engineer's: FS GGG–W–636; 15 deg; double head; Type IV; open end; spear head; style 2; single; 3/8 x 7/16 in. nominal opening; 5 in. approx length.
1	5120–184–8556	WRENCH, engineer's: FS GGG–W–636; 15 deg; double head; Type IV; open end; spear head; style 2; single; 5/8 x 3/4 in. nominal opening; 7 7/8 in. approx length.
1	5120–277–2326	WRENCH, engineer's: FS GGG–W–636; 15 deg; double head; Type IV; open end; spear head; style 2; single; 1 7/16 x 1 5/8 in. nominal opening; 15 1/2 in. approx length.
1	5120–449–8162	WRENCH, engineer's: FS GGG–W–636; 15–deg; single head; open end; heavy-duty; single; Type V; class A; 7/8 in. nominal opening; 8 in. approx length.
1	5120–357–8599	WRENCH, packing nut: water pump; single; 1 1/16 in. nominal opening; 7 in. lg; Bonney Forge No. 1234 or equal.
1	5120–449–8258	WRENCH, rim: truck; Budd No. 18806; 1 1/2 in. hex opening; 13/16 in. sq opening; 14 7/8 in. lg.
1	5120–473–6532	WRENCH, spark plug: pressed steel type; w/bar handle; double end; 1 1/32 x 1 5/32 in. opening.

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b. Carrier Engine (fig. 36).

(1) *Location.* The ammeter (1) is located on the left side of the instrument panel (9).

(2) *Purpose.* The ammeter indicates the current being supplied to the battery by the carrier engine generator. The gage pointer should show on the plus side at all times when the carrier engine is operating.

31. Water Temperature Gages

a. Revolving Frame Engine (fig. 35).

(1) *Location.* The water temperature gage (1) is located at the top of the control panel (2).

(2) *Purpose.* The water temperature gage indicates the temperature of the revolving frame engine coolant. Normal operating temperature is 160° to 180° F.

b. Carrier Engine (fig. 36).

(1) *Location.* The water temperature gage (8) is located on the right side of the instrument panel (9).

(2) *Purpose.* The water temperature gage indicates the temperature of the carrier engine coolant. Normal operating temperature is 160° to 180° F.

32. Oil Pressure Gages

a. Revolving Frame Engine (fig. 35).

(1) *Location.* The oil pressure gage (14) is located on the left center of the control panel (2).

(2) *Purpose.* The oil pressure gage indicates the oil pressure in the revolving frame engine lubrication system. Normal operating oil pressure is 26 psi.

b. Carrier Engine (fig. 36).

(1) *Location.* The oil pressure gage (3) is located to the left of center on the instrument panel (9).

(2) *Purpose.* The oil pressure gage indicates the oil pressure in the carrier engine lubrication system. Normal operating oil pressure is 40 psi.

33. Hour-Meters

a. Revolving Frame Engine (fig. 11).

(1) *Location.* The hour-meter (2) is located above and to the rear of the distributor (1) on the left side of the revolving frame engine.

(2) *Purpose.* The hour-meter indicates the total number of hours that the revolving frame engine has been operating.

[AG 413.8 (12 Dec 57)]

By Order of *Wilber M. Brucker*, Secretary of the Army:

MAXWELL D. TAYLOR,
General, United States Army,
Chief of Staff.

Official:

HERBERT M. JONES,
Major General, United States Army,
The Adjutant General.

Distribution:

Active Army:

DCSLOG	Div Engrs
ASA	Engr Dist
CNGB	Engr Cen
Technical Stf, DA	AMS
Engr Bd	Engr Maint Cen
USCONARC	Chicago Proc Ofc
USA Arty Bd	Engr Proc Cen
USA Armor Bd	Japan Engr Sup Cen
USA Inf Bd	Fld Maint Shops
USA Air Def Bd	Sandia Base, AFSWP
USA Abn & Elct Bd	JBUSMC
USA Avn Bd	USAREUR, Sup Con Agcy
OS Maj Comd	MAAG
US ARADCOM	Mil Dist
Log Comd	Units organized under
MDW	following TOE's:
Armies	5–48
Corps	5–157
Ft & Camps	5–262
USMA	5–267
USACGSC	5–278
USASES	5–279
Gen Depots	6–545
Engr Sec, Gen Depots	9–45
Engr Depots	9–47
Ports of Emb (OS)	9–77
Trans Terminal Comds	9–228
Army Terminals	9–375
OS Sup Agcy	9–500 (Tms DA)

NG: State AG; units—same as Active Army.
USAR: None.
For explanation of abbreviations used, see AR 320–50.

* U. S. GOVERNMENT PRINTING OFFICE : 1958 O—461264

b. Carrier Engine.

(1) *Location.* The hour-meter is located in front of the carburetor on the right side of the carrier engine.

(2) *Purpose.* The hour-meter indicates the total number of hours that the carrier engine has been operating.

34. Speedometer
(fig. 36)

a. Location. The speedometer (5) is located in the center of the instrument panel (9).

b. Purpose. The speedometer pointer indicates the speed of the carrier in miles per hour. The trip mileage is indicated in the center of the face.

35. Fuel Gage
(fig. 36)

a. Location. The fuel gage (2) is located to the right of the ammeter (1) in the instrument panel (9).

b. Purpose. The fuel gage indicates the amount of fuel in the tank.

36. Air Pressure Gage
(fig. 36)

a. Location. The air pressure gage (7) is located between the speedometer (5) and water temperature gage (8) on the instrument panel (9).

b. Purpose. The air pressure gage indicates the air pressure in the carrier airbrake reservoirs. The gage pointer should indicate 80 to 105 psi at all times when the carrier engine is operating.

37. Low Air Pressure Warning Lamp
(fig. 36)

a. Location. The low air pressure warning lamp (6) is located above and to the left of the air pressure gage (7) on the instrument panel (9).

b. Purpose. The red low air pressure warning lamp is actuated and lighted by the low air pressure switch when the air pressure in the carrier airbrake reservoirs drops to approximately 60 psi. When the air pressure in the reservoirs is increased to approximately 66 psi, the warning lamp goes out.

38. Selector Switch
(fig. 36)

a. Location. The selector switch (20) is located to the left of the ignition switch and key (19).

b. Purpose. The handle of the selector switch can be turned to provide blackout driving lights, blackout marker lights, stoplights, or headlights on the carrier.

39. Headlight Dimmer Switch
(fig. 36)

a. Location. The headlight dimmer switch (17) is located to the left of the clutch pedal (16) on the toe-plate.

b. Purpose. The dimmer switch raises or lowers the beam of the headlights when the headlights are on.

40. Instrument Panel Light and Switch
(fig. 36)

a. Location. The instrument panel light and switch (4) is located on the top center of the instrument panel (9).

b. Purpose. The switch turns the lamp in the combined socket and switch on and off.

41. Windshield Wiper Switch
(fig. 36)

a. Location. The windshield wiper switch (21) is located on the lower left of the instrument panel (9).

b. Purpose. The windshield wiper switch starts and stops the windshield wiper electric motor.

42. Steering Wheel
(fig. 36)

a. Location. The steering wheel is mounted on the steering wheel tube (18) in the carrier cab.

b. Purpose. The steering wheel turns the front wheels of the carrier in the same direction in which the steering wheel is operated.

43. Horn Button

a. Location. The horn button is located in the center of the steering wheel.

b. Purpose. When depressed, the horn button operates the electric horn.

44. Intermediate Shaft Clutch Hand Lever
(fig. 37)

a. Location. The intermediate shaft clutch hand lever (3) is the extreme lefthand lever in front of the operator.

b. Purpose. The intermediate shaft clutch hand lever operates the clutches on the horizontal intermediate shaft assembly for swing operation of the revolving frame.

45. Crowd and Front Drum Clutch Hand Lever
(fig. 37)

a. Location. The crowd and front drum clutch hand lever (5) is the second hand lever from the left in front of the operator.

b. Purpose. The crowd and front drum clutch hand lever operates the clutches on the front drum shaft assembly. In shovel operation, the movement of the lever causes the dipper handle to move on the boom to crowd the dipper. In dragline and back hoe operation, movement of the lever drags or pulls the bucket. In clamshell operation, movement of the lever controls the holding and opening cable on the clamshell bucket.

46. Hoist Shaft Clutch Hand Lever
(fig. 37)

a. Location. The hoist shaft clutch hand lever (6) is the third lever from the left in front of the operator.

b. Purpose. The hoist shaft clutch hand lever operates the clutches on the hoist shaft assembly for hook block and bucket operation.

47. Independent Boom Hoist Clutch Hand Lever
(fig. 37)

a. Location. The independent boom hoist clutch hand lever (7) is the extreme right-hand lever in front of the operator.

b. Purpose. The independent boom hoist clutch hand lever operates the clutches on the independent boom hoist assembly to raise or lower the crane, dragline, and clamshell booms, and the back hoe mast.

48. Engine Clutch Hand Lever
(fig. 37)

a. Location. The engine clutch hand lever (1) is located on the rotating base to the left of the operator.

b. Purpose. The engine clutch hand lever engages and disengages the clutch on the revolving frame engine.

49. Engine Starting Cranks

a. Revolving Frame Engine.

(1) *Location.* The starting crank for the revolving frame engine is located in the toolbox mounted on the platform of the rotating base.

(2) *Purpose.* The starting crank is used to turn over the revolving frame engine by hand.

b. Carrier Engine.

(1) *Location.* The starting crank for the carrier engine is located in the tool and battery box (7, fig. 2).

(2) *Purpose.* The starting crank is used to turn over the carrier engine by hand.

50. Swing Lock Foot Lever
(fig. 37)

a. Location. The swing lock foot lever (9) is located on the deck near the base of the intermediate shaft clutch hand lever (3).

b. Purpose. The swing lock foot lever releases and engages the revolving frame swing lock.

51. Front Drum Brake Foot Pedal
(fig. 37)

a. Location. The front drum brake foot pedal (10) is located on the deck at the operator's left foot.

b. Purpose. The front drum brake foot pedal operates the brake on the drum of the front drum shaft assembly. Tipping the foot pedal forward with the foot operates the brake pawl to lock the brake.

52. Hoist Drum Brake Foot Pedal
(fig. 37)

a. Location. The hoist drum brake foot pedal (8) is located on the deck at the operator's right foot.

b. Purpose. The hoist drum brake foot pedal operates the brake on the drum of the hoist drum shaft assembly. Tipping the foot pedal forward with the foot operates the brake pawl to lock the brake.

53. Service Brake Treadle
(fig. 36)

a. Location. The service brake treadle (14) is located to the left of the accelerator pedal (13).

b. Purpose. The service brake treadle, when depressed, applies the brakes on each wheel to slow down or bring the crane-shovel to rest.

54. Clutch Pedal
(fig. 36)

a. Location. The clutch pedal (16) is located on the left side of the toeplate.

b. Purpose. The clutch pedal engages and disengages the carrier engine clutch.

55. Accelerator Pedal
(fig. 36)

a. Location. The accelerator pedal (13) is located on the right side of the toeplate.

b. Purpose. The accelerator pedal controls the amount of fuel delivered through the carburetor to the carrier engine and controls the road speed.

56. Handbrake Valve Handle
(fig. 36)

a. Location. The handbrake valve handle (15) is located to the right of the steering wheel tube (18).

b. Purpose. The handbrake valve handle controls the brakes on the towed vehicle.

57. Emergency Brake Lever
(fig. 38)

a. Location. The emergency brake lever (1) is located to the front of the deck plate to the right of the operator.

b. Purpose. The emergency brake lever sets the brake assembly on the drive shaft for parking. When completely pulled back, the emergency brake lever also, through linkage, pulls down the service brake treadle.

58. Transmission Gearshift Lever
(fig. 38)

a. Location. The transmission gearshift lever (4) is located at the driver's right hand.

b. Purpose. The transmission gearshift lever permits the selection of various gear ratios for various load and road conditions.

59. Transfer Case Gearshift Lever
(fig. 38)

a. Location. The transfer case gearshift lever (2) is located to the right rear of the driver.

b. Purpose. The transfer case gearshift lever permits the selection of the high or the low speed range of the transfer case depending on road conditions.

60. Front Axle Declutch Lever
(fig. 38)

a. Location. The front axle declutch lever (3) is located to the right of the transfer case gearshift lever (2).

b. Purpose. The front axle declutch lever engages or disen-

gages the front axle drive when selected for various road conditions.

Section IV. OPERATION UNDER USUAL CONDITIONS

61. General

a. The instructions in this section are published for the use of the personnel responsible for the operation of this crane-shovel.

b. It is essential that the operator know how to perform every operation of which the crane-shovel is capable. This section gives instructions on starting and stopping the crane-shovel, instructions on the basic motions of the crane-shovel, and instructions on how to coordinate the basic motions to perform the specific tasks for which the crane-shovel is designed. Since nearly every job presents a different problem, the operator may have to vary the given procedure to fit the individual job.

62. Starting Revolving Frame

a. Positioning Controls Prior To Starting Revolving Frame Engine (fig. 37).

(1) Perform the before-operation services (par. 96).

(2) Check to see that the engine clutch hand lever (1) is in the forward position; that the independent boom hoist clutch hand lever (7), hoist shaft clutch hand lever (6), crowd and front drum clutch hand lever (5), and the intermediate shaft clutch hand lever (3) are in a vertical position; that the hoist drum brake foot pedal (8) and the front drum brake foot pedal (10) are down and latched; and that the swing lock foot lever (9) is down and engaged.

b. Starting Revolving Frame Engine.

(1) Push the throttle hand lever (2, fig. 37) slightly forward of the vertical, idle position. If the engine is cold, pull up the choke control (12).

(2) Pull out the ignition switch (13, fig. 35). Pull up the starter control (11, fig. 37). The engine should start after three or four revolutions. Push down the starter control as soon as the engine starts. If the engine does not start, reset the choke control and after waiting a few moments, pull up on the starter control.

Note. Engage the starting motor for periods of no longer than 15 seconds until engine starts.

(3) After the engine has run a few minutes, push the choke control down and pull the throttle hand lever to the vertical, idle position.

(4) Check all gage readings. Normal oil pressure is 26 psi on the oil pressure gage (14, fig. 35). Oil pressure will be above normal while the engine is cold. It may drop below normal at idling speed after the engine has warmed up. If the oil pressure indicator shows an unusual drop, or no pressure, stop the engine immediately and report the condition to proper authority. The water temperature gage (1) should show a gradual rise during the warmup period until it reaches 160°—180° F. The ammeter (4) should show in the plus or charge range. The hour-meter on the engine will show an increase of one revolution for every hour of engine operation.

c. *Positioning Controls Prior To Operation* (fig. 37).

(1) Push the throttle hand lever (2) forward about halfway. Pull the engine clutch hand lever (1) back and engage the clutch. Push the throttle hand lever forward all the way.

(2) Release the hoist drum brake foot pedal (8) and the front drum brake foot pedal (10).

(3) Pull up the swing lock foot lever (9).

(4) Perform the during-operation services (par. 96).

63. Starting the Carrier

a. *Positioning Controls Prior To Starting Carrier Engine.*

(1) Perform the before-operation services (par. 96).

(2) Check to see that the transmission gearshift lever (4, fig. 38) and the transfer case gearshift lever (2) are in the neutral (N) position (V fig. 14). The front axle declutch lever (3, fig. 38) must be in the free position (V, fig. 14). The emergency brake lever (1, fig. 38) must be pulled all the way back to set the brakes.

b. *Starting Carrier Engine.*

(1) Pull out the throttle control (10, fig. 36) about one-half inch. Pull out the choke control (11) about half way if the engine is cold.

(2) Turn the ignition switch key (19) to the right. Depress the clutch pedal (16). Pull up on the starter hand lever (5, fig. 38) and release it immediately when the engine starts.

Note. Engage the starting motor for periods of no longer than 15 seconds until engine starts.

(3) After the engine has run a few minutes, push in the choke control and the throttle control. Release the clutch pedal.

(4) Check all gage readings. Normal oil pressure is 40 psi on the oil pressure gage (3, fig. 36). Oil pressure will be above normal while the engine is cold. It may drop below normal at idling speed after the engine has warmed up. If the oil pressure indicator shows an unusual drop, or no pressure, stop the engine immediately and report the condition to proper authority. The water temperature gage (8) should show a gradual rise during the warmup period until it reaches 160°—180° F. The ammeter (1) should show in the plus or charge range. The air pressure gage (7) should show pressure being built up in the reservoirs to a maximum of 105 psi. The hour-meter on the engine will show an increase of one revolution for every hour of engine operation.

c. Positioning Controls Prior To Operation.

(1) Push the clutch pedal (16, fig. 36) down to disengage the engine from the transmission. Move the transmission gearshift lever (4, fig. 38) as far to the right as possible. Move the transfer case gearshift lever (2) as far forward as it will go for light loads over level ground or as far back as possible for heavy loads on uphill starts. Release the emergency brake lever (1) and move it as far forward as possible. Push the handbrake valve handle (15, fig. 36) forward (counterclockwise direction) to release the brakes on the trailer, if attached.

(2) Perform the during-operation services (par. 96).

64. Stopping Revolving Frame

a. Positioning Controls Prior To Stopping Engine (fig. 37).

(1) When operation is completed, push down and latch the hoist drum brake foot pedal (8) and the front drum brake foot pedal (10). Put the independent boom hoist clutch hand lever (7), hoist shaft clutch hand lever (6), crowd and front drum clutch hand lever (5), and the intermediate shaft clutch hand lever (3) in the vertical position. Push down and engage the swing lock foot lever (9).

(2) Push the engine clutch hand lever (1) all the way forward. Pull the throttle hand lever (2) to the vertical, idle, position.

b. Stopping Revolving Frame Engine (fig. 35).

(1) After the engine has idled a few minutes, push in the ignition switch (13).

(2) Perform the at-halt or the after-operation services (par. 96).

65. Stopping Carrier

a. Positioning Controls Prior To Stopping Engine.

(1) Release the accelerator pedal (13, fig. 36) and depress the service brake treadle (14). If a trailer is attached, move the handbrake valve handle (15) clockwise to slow down the trailer.

(2) Depress the clutch pedal (16) when the carrier speed has been reduced to engine idling speed.

(3) Move the transmission gearshift lever (4, fig. 38) to neutral (N) position (V, fig. 14). Release the clutch pedal. Move the transfer case gearshift lever (2) to the neutral (N) position.

(4) When the carrier has come to a complete stop, pull back on the emergency brake lever (1, fig. 38).

(5) Put the front axle declutch lever (3) in the free position (V, fig. 14).

(6) If in operation, turn the selector switch (20, fig. 36) and the windshield wiper switch (21) to the off position.

b. Stopping Carrier Engine (fig. 36).

(1) After the carrier engine has idled a few minutes, turn the ignition switch key (19) to the left.

(2) If in operation, turn the instrument panel light switch (4) to the off position.

(3) Perform the at-halt or the after-operation services (par. 96).

66. General Operating Instructions

a. Power Flow.

(1) *Revolving frame.* When the engine clutch hand lever is engaged, the engine clutch assembly (2, fig. 12) revolves and turns the engine clutch shaft pinion (2, fig. 13) in the gearcase (1). The engine clutch shaft pinion drives the jackshaft spur gear (5) in the gearcase and the jackshaft pinion (3, fig. 12) outside the gearcase (4) and on the same jackshaft. The jackshaft pinion drives the gear on the end of the horizontal intermediate shaft assembly (9) which in turn drives the large diameter gear on the end of the hoist shaft assembly (8). The wide gear on the hoist shaft assembly drives the large diameter gear on the end of the front drum shaft assembly (6) and also the reverse crowd idler gear (5). The reverse crowd idler gear drives the small diameter reverse crowd gear on the front drum shaft assembly (6). The jackshaft spur gear (5, fig. 13) drives

the idler shaft pinion (3) which, in turn, drives the independent boom hoist drive pinion (4). The independent boom hoist drive pinion motivates the independent boom hoist assembly (1, fig. 12). All of the above gears revolve when the engine clutch assembly is engaged. When activated by the intermediate shaft clutch hand lever (3, fig. 37), the vertical intermediate shaft assembly in the horizontal intermediate shaft assembly (9, fig. 12) revolves the vertical swing shaft gear (7). The vertical swing shaft gear, through the swing shaft, drives the vertical swing shaft pinion located under the rotating base. The vertical swing shaft pinion revolves in the ring gear on the carrier to provide the swing or rotating action for the revolving frame.

(2) *Carrier.* The carrier power train consists of the engine (18, fig. 9), a selective-gear type transmission (16) having five speeds forward and one speed reverse, a two-speed transfer case (6), and front (3) and rear (9) and (11) driving axle assemblies. When the engine clutch assembly is engaged, power is transmitted from the engine to the transmission. When the appropriate gear selection is made in the transmission (V, fig. 14) and the transfer case gearshift lever is in the high position (V, fig. 14), power is transmitted through drive shafts to the front and rear axle assemblies. The front axle declutch lever must be in the free position (V, fig. 14) when the transfer case gearshift lever is in the high position. To have the front axle assembly driving, the transfer case gearshift lever must be in the low position and the front axle declutch lever must be in the drive position to transmit power from the transfer case through a drive shaft to the front axle assembly.

b. Picking Working Site. Pick a working site that provides solid footing for crane-shovel operation. If necessary, improve the footing where such conditions as deep mud, slick grades, or loose rocks are present, by the use of mats and timbers. Do not leave the crane-shovel near a bank that is liable to cave. Never pick a working site within 6 feet of an overhead wire. If other vehicles are used to supply or carry away materials, the performance and capacity of these vehicles should be considered when picking a working site.

c. Determining Safe Maximum Working Radius.

(1) Make certain that the carrier is resting on firm, level ground.

(2) With the boom extended directly over the side of the unit, raise the load or bucket about 3 feet above the ground.

(3) Hold the load or bucket in the suspended position and, at the same time, slowly lower the boom until the crane-shovel just starts to tip. Then raise the boom slightly.

(4) Swing the revolving frame at the same swing-speed used when operating. Hold your foot on the hoist drum brake foot pedal, ready to drop the load or bucket in case the machine starts to tip. As the load swings away from the crane-shovel due to centrifugal force, it may cause the machine to tip, although there was no indication that it would tip when not swinging.

(5) If possible, swing the load or bucket clear around to complete the circle. Then swing in the opposite direction.

(6) After the swing test is completed, raise the boom about 2 feet for added stability.

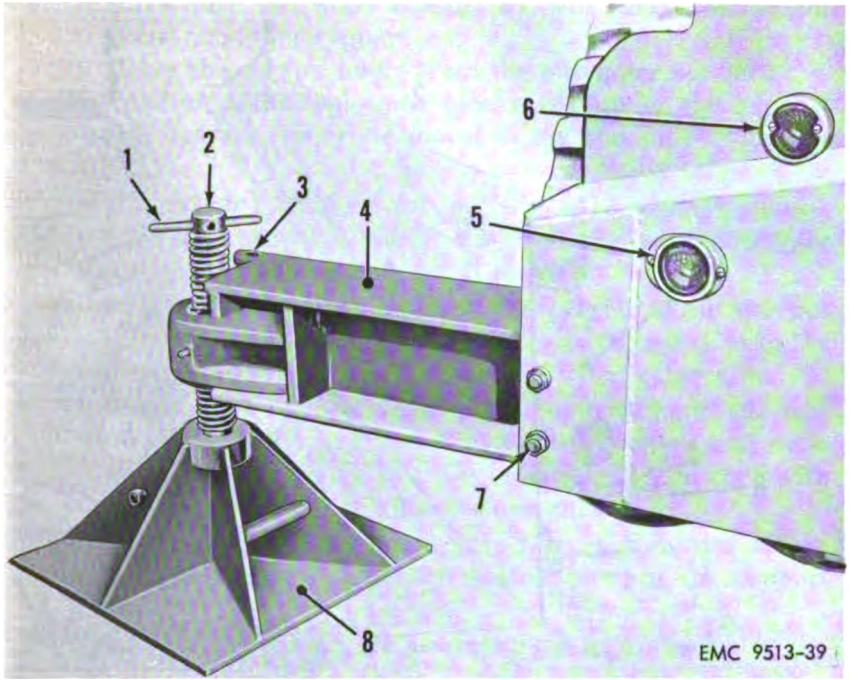
d. Setting Up Outriggers (fig. 39). Outriggers are located at the rear and in the center of the carrier frame. Before operating the crane-shovel, set the brakes and extend the outriggers to give the carrier the greatest possible stability. Outriggers must be positioned and properly blocked up if high lifting capacities are required.

(1) Remove the keeper bolt, lockwasher, and nut from the extension on the outrigger box and the extension (3) on the outrigger beam (4). Pull the outrigger beam from the box until the drilled hole in the beam lines up with the keeper bolt extension on the box. Insert a keeper bolt and secure with a lockwasher and nut. Keeper bolts (7) prevent the beam from being pulled out of the box.

(2) Remove the screw jack base (8) from the carrier frame and position it under the screw jack (2). Insert the handle (1) in the jack. Turn the screw jack into the base.

(3) Swing the revolving frame so that the rear of the rotating base is on the side away from the outrigger being set. This procedure will remove weight from the outrigger and permit the screw jack to be turned easily.

(4) Turn the screw jack down until the carrier is level and the weight is partially removed from the tires. Use blocks or planks under the screw jack base if necessary. This will remove the spring effect of the tires and tend to stabilize the carrier.



1	Screw jack handle	5	Red reflector
2	Screw jack	6	Taillight
3	Keeper bolt extension	7	Keeper bolt
4	Outrigger beam	8	Screw jack base

Figure 39. Outrigger.

e. Retracting Outriggers (fig. 39).

(1) Turn the screw jack (2) out of the screw jack base (8).

(2) Remove the keeper bolt, lockwasher, and nut from the box extension.

(3) Slide the outrigger beam (4) into the box. Insert and secure the keeper bolt through the extension (3) on the box and the beam.

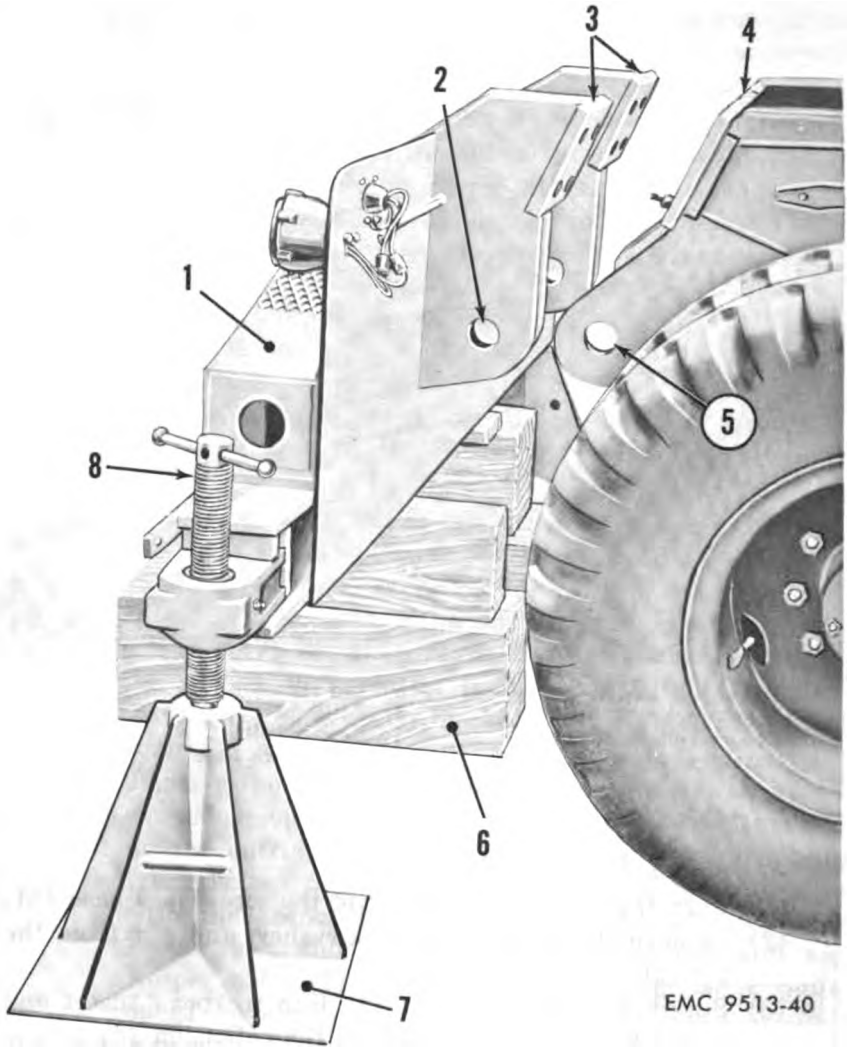
(4) Position the screw jack base (8) on the carrier frame.

f. Removing Rear Outrigger Support (fig. 40). To obtain maximum digging depth for back hoe and shovel operation, it is necessary to remove the rear outrigger support (1).

(1) Without attempting to put any weight of the carrier on the outrigger, set the rear outrigger as instructed in *d* above.

(2) Disconnect the wiring connectors located between the support pads (3).

(3) Position wood blocks (6) under the support to keep it from tipping.



1	Rear outrigger support	5	Pin hole
2	Pin hole	6	Wood block
3	Support pad	7	Screw jack base
4	Carrier pad	8	Screw jack

Figure 40. Carrier rear outrigger support, removed.

(4) Remove four bolts, lockwashers, and nuts from each support pad (3) and the carrier pad (4).

(5) Remove a cotter pin from the outrigger pins on each side of the support. Drive the outrigger pins from the pin holes (2) and (5). It may be necessary to turn the screw jack (8) to facilitate removal of the pins.

Make sure the wood blocks (6) will carry the weight of the outrigger support.

(6) Drive the carrier away from the outrigger support.

(7) Position additional wood blocks (6) under the support and operate the crane-shovel to lay the support on the blocks.

g. Installing Rear Outrigger Support (fig. 40).

(1) Operate the crane-shovel and set the rear outrigger support (1) on wood blocks (6).

(2) Operate and carefully back the carrier until the pin holes (2) and (5) aline. Install the outrigger pins in the pin holes (2) and (5) and secure with cotter pins.

(3) Install four bolts in each of the support pads (3) and carrier pad (4) and secure with lockwashers and nuts. It may be necessary to raise or lower the support with the screw jack (8) to aline the bolt holes.

(4) Connect the wiring connectors from the carrier to the support wiring connectors located between the support pads (3).

(5) Retract the outriggers as instructed in *a* above.

h. Raising Gantry. For shipping and traveling the crane-shovel, the gantry is recessed to provide overhead clearance. When the crane-shovel is reeved and the gantry recessed (fig. 41), raising the boom to an angle of approximately 40° will raise the bridle (2) so that the bridle strut (7) can be positioned. The bridle (3, fig. 42) rests on the bridle strut (9) when the crane-shovel is operating at a boom angle of approximately 40° or lower. When the crane-shovel is not reeved, personnel must lift the bridle to position the bridle strut.

(1) Remove the link bolts (10, fig. 41), nuts, and lockwashers from the link brackets (4). Loosen the bolts on the strut links (8).

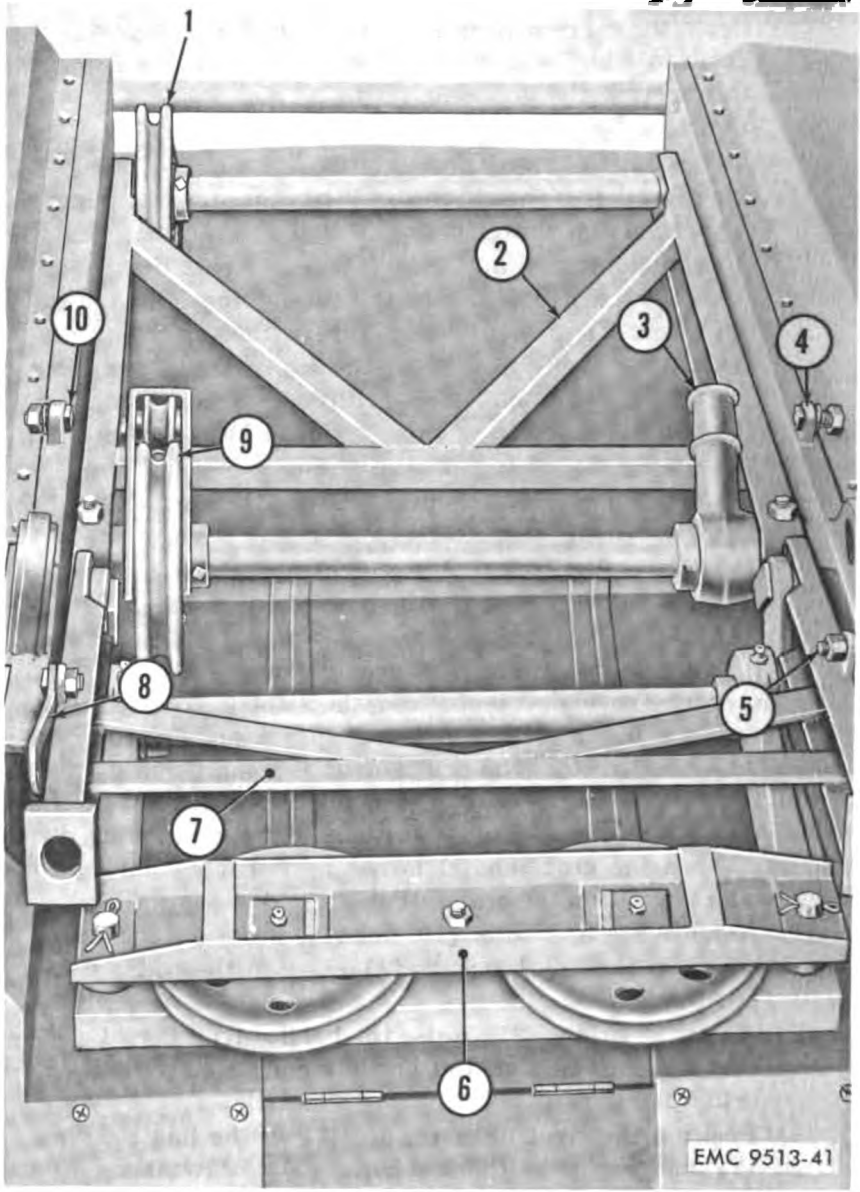
(2) Raise the bridle (2). Raise the bridle strut (7). Lower the bridle to rest on the bridle strut. Steady both the bridle and the strut.

(3) Position the strut links (6, fig. 42) in the link brackets (7) and secure with link bolts (5), lockwashers, and nuts. Tighten the link bolts (5) at the bridle strut (9).

i. Recessing Gantry.

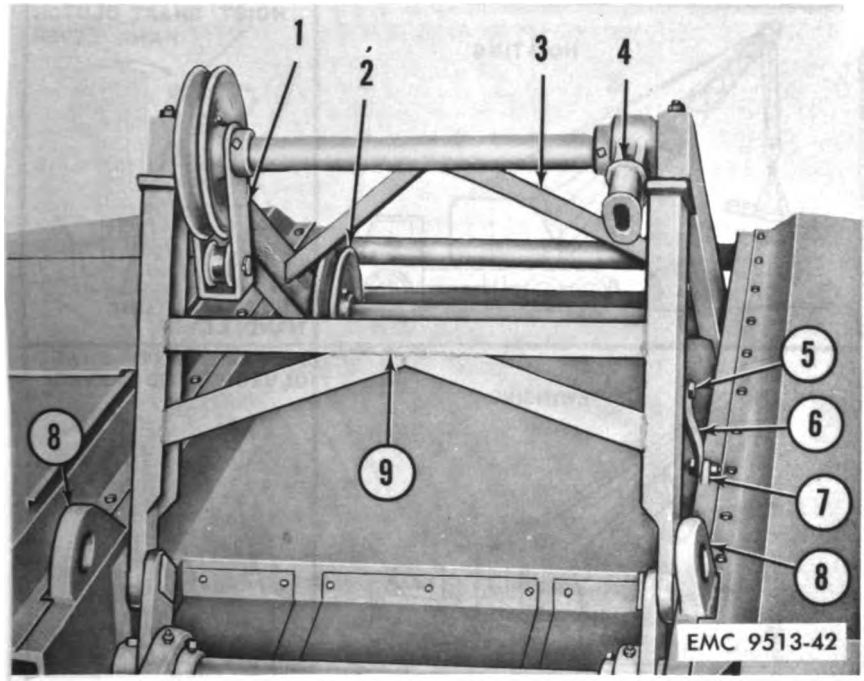
(1) Steady the bridle (3, fig. 42) and the bridle strut (9). Remove the nuts, lockwashers, and link bolts (5) from the link brackets (7). Loosen the link bolts (5) at the bridle strut.

(2) Hold the bridle strut (9). Raise and hold the bridle



1	Gantry pulley	6	Equalizer
2	Bridle	7	Bridle strut
3	Wedge socket	8	Strut link
4	Link bracket	9	Cable guide and gantry pulley
5	Link bolt	10	Link bolt

Figure 41. Gantry recessed.



1 Cable guide and gantry pulley
2 Gantry pulley
3 Bridle
4 Wedge socket
5 Link bolt
6 Strut link
7 Link bracket
8 Lifting eye
9 Bridle strut

Figure 42. Gantry raised.

(3). Lower the bridle strut (7, fig. 41) forward to rest on the equalizer (6). Lower the bridle (2) to rest.

(3) Reinstall the link bolts (10), lockwashers, and nuts in the link brackets (4). Tighten the link bolts at the bridle strut.

67. Crane Operation

a. General.

(1) In crane operation (fig. 43) the load is attached to a hook block suspended by cable from the boom point assembly. The swing motion is used to spot the load horizontally.

(2) The crane is used to load and unload heavy machinery, flat plates, girders, guns, boxes, and crates from the railroad cars, trucks, and ships, and for placing and erecting structural steel and trusses.

(3) Crane lifting capacities and working ranges are listed in paragraph 6*h*

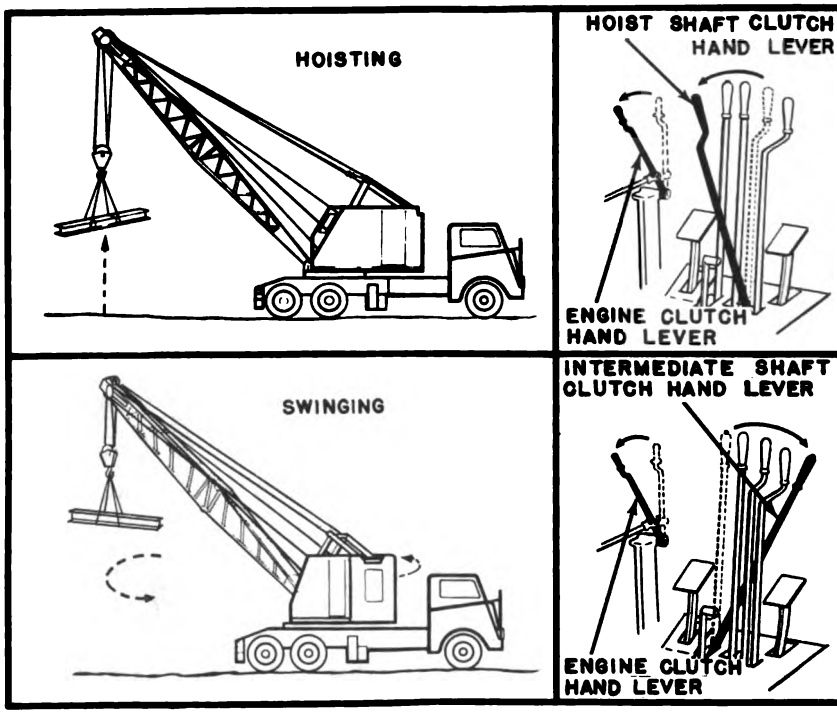


Figure 43. Crane in operation.

b. Prior To Operation Instructions.

(1) Position the revolving frame controls (par. 62*a*).

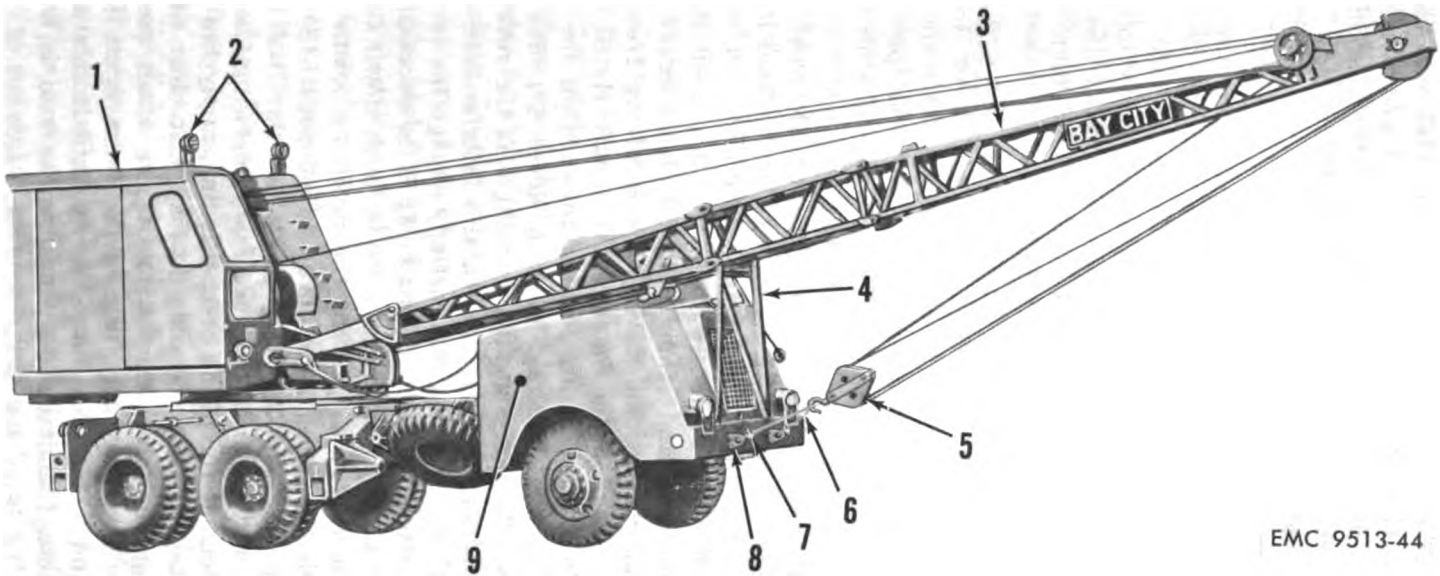
(2) Start the revolving frame engine (par. 62*b*).

(3) Push the throttle hand lever (2, fig. 37) forward about halfway. Pull the engine clutch hand lever (1) back and engage the clutch. Push the throttle hand lever forward all the way.

(4) Release the hoist drum brake foot pedal (8) and remove the hook block (5, fig. 44) from the cable (6). Apply and latch the hoist drum brake foot pedal. Remove the cable clamps (7) and cable (6) from the tow eyes (8) and store in the tool and battery box (9).

(5) Pull back on the independent boom hoist clutch hand lever (7, fig. 37) and raise the boom (3, fig. 44) to clear the boom support (4). Return the independent boom hoist hand lever to the neutral position.

(6) Release the hoist drum brake foot pedal (8) (fig. 37). Pull back on the hoist shaft clutch hand lever (6) to raise the hook block clear of the ground and surrounding



1 Recessed gantry	4 Boom support	7 Cable clamp
2 Floodlight.	5 Hook block	8 Tow eye
3 Boom	6 Cable	9 Tool and battery box

Figure 44. Crane-shovel, with crane installed, in travel position.

objects. Apply and latch the hoist drum brake foot pedal.

(7) Pull up the swing lock foot lever (9). Pull back on the intermediate shaft clutch hand lever (3) and swing the revolving frame to the right and over the rear of the carrier. Push down on the swing lock foot lever.

(8) Raise the gantry (par. 66*h*).

(9) If necessary, set the outriggers (par. 66*d*).

c. Specific Crane Operation (fig. 37). Raise or lower the boom in accordance with the particular operation and the working range (par. 6*h*). Pull back on the independent boom hoist clutch hand lever (7) to raise the boom, push the lever forward to lower the boom. Release the hoist drum brake foot pedal (8) and lower the hook block within reach of the ground man. Pull up the swing lock foot lever (9). Pull back on the intermediate shaft clutch hand lever (3) to swing the revolving frame to the right, push forward on the hand lever (3) to swing left, to spot the hook block over the load. After the load is safely attached and the ground man is in the clear, pull back gently on the hoist shaft clutch hand lever (6) to take up slack. Then lift the load slowly, watching it carefully as you lift to be sure the hitch is correct. Pull back on the throttle hand lever (2) to slow down engine speed if desired. When the load is at a sufficient height to provide clearance for swing or travel, return the hoist shaft clutch hand lever (6) to the vertical position. At the same time, depress and latch the hoist drum brake foot pedal (8) to support the load. Swing the revolving frame as required, pulling back on the intermediate shaft clutch hand lever (3) to swing to the right, pushing forward on the hand lever to swing to the left. Engage the hand lever (3) slowly so the swing motion will start and stop smoothly. If the revolving frame shows a tendency to drift when the intermediate shaft clutch hand lever (3) is in neutral, partially engage the lever to provide the opposite direction of swing. If it is necessary to maintain one position for extended periods, push down on the swing lock foot lever (9) to prevent the revolving frame from drifting. Unlatch the hoist drum brake foot pedal (8) and gradually release pressure on the pedal to let the load lower slowly to its resting place. If it is necessary to swing the load in to correct alinement for piling or positioning, apply the hoist drum brake foot pedal (8) to hold the load just clear of the ground so the ground crew can swing it into exact position without danger. Then partially release the hoist drum brake foot pedal (8) and let the load down slowly until it sets firmly on the ground or a foundation. When sure the load is solidly

at rest, fully release the hoist drum brake foot pedal (8) so the ground man can unfasten the hitch. Pull back on the hoist shaft clutch hand lever (6) to pick up the hook block in order to clear any obstructions. Return the hoist shaft clutch hand lever (6) to the vertical position and hold the hook block in position by depressing and latching the hoist drum brake foot pedal (8). Push the intermediate shaft clutch hand lever (3) forward to swing to the left, or pull back to swing right, until the hook block is spotted for the next load. Repeat the above cycle as often as necessary.

d. Adjustments. Adjust the independent boom hoist clutches (par. 205*d*), independent boom hoist brake (par. 198*e*), intermediate shaft clutches (par. 194*g*), hoist shaft clutch (par. 192*e*), and hoist drum brake (par. 196*e*) as required.

68. General Instructions on Crane Operation

a. Be sure footing is solid. A little extra time spent preparing for good footing will be more than repaid by increased speed, steadiness, and safety of operation. Keep the crane-shovel as level as possible. When swinging the crane-shovel with the first load, the loaded side will settle. The opposite side should settle and level up the crane-shovel when working. If the crane-shovel is not level after making the first swing, back the crane-shovel up and use any substantial material to fill in the low track. Pull forward and resume work.

b. Do not exceed maximum allowable lifting loads in paragraph 6*h*. Do not lift heavy loads with the boom raised at more than a 72° angle.

c. When operating in close places, be sure there is adequate clearance for swinging both the boom and tailswing.

Caution: Do not swing a load over workmen's heads. Be sure workmen are clear before attempting to lift the load. Always watch the hook block and boom when swinging. Do not work too close to electric power lines.

d. Accurate control means safety and speed. Keep brakes and clutches in proper adjustment. Slow down engine speed with the hand throttle to increase accuracy of control.

Caution: Disengage the engine clutch when working on the machinery.

e. Do not drive the crane-shovel while the boom is at a high angle or when a load is suspended high above the ground.

f. If necessary to move with a load on soft ground, the crane-shovel will travel better if the load is behind.

g. When traveling with a suspended load, snub it to the crane-shovel to prevent it from swaying out beyond the boom point.

h. See that the loads are secure before lifting. Always be sure the hook block is in the center of the load before lifting it.

i. Use the proper cable length. A cable which is too long requires excessive overwinding which increases wear. Cable life can be increased by reversing the cable end for end.

j. Replace the cables as soon as they show signs of excessive wear.

69. Clamshell Operation

a. General.

(1) The clamshell is similar to the lifting crane except that it is used for excavating or material handling with a clamshell bucket and is equipped with a tagline cable to prevent the bucket from rotating or twisting the cables (fig. 45). A clamshell bucket may be equipped with teeth for new excavation work in pits, trenches, foundations, and under water. Buckets are also used without teeth for rehandling material or loading from stock piles. A clamshell bucket is operated by two cables. The holding cable holds and opens the loaded bucket. The closing cable controls the closing, opening, and lifting of the bucket.

(2) Clamshells are used for excavation work in subways, buildings, sand and gravel pits, drainage and irrigation ditches, and for stock piling and material handling.

(3) Clamshell lifting capacities and working ranges are listed in paragraph 6*h*.

b. Prior To Operation Instructions.

(1) Position the revolving frame controls (par. 62*a*).

(2) Start the revolving frame engine (par. 62*b*).

(3) Push the throttle hand lever (2, fig. 37) forward about halfway. Pull the engine clutch hand lever (1) back and engage the clutch. Push the throttle hand lever forward all the way.

(4) Release the hoist drum brake foot pedal (8) and the front drum brake foot pedal (10) and lower the clamshell bucket (5, fig. 46) to the ground. At the same time, pull back on the independent boom hoist clutch hand lever (7, fig. 37) to raise the boom (4, fig. 46) out of the boom support (6).

(5) When the boom and bucket are high enough to clear all obstructions, put the independent boom hoist clutch hand lever in the vertical, neutral, position. Depress and latch the hoist drum brake foot pedal (8, fig. 37) and the front drum brake foot pedal (10).

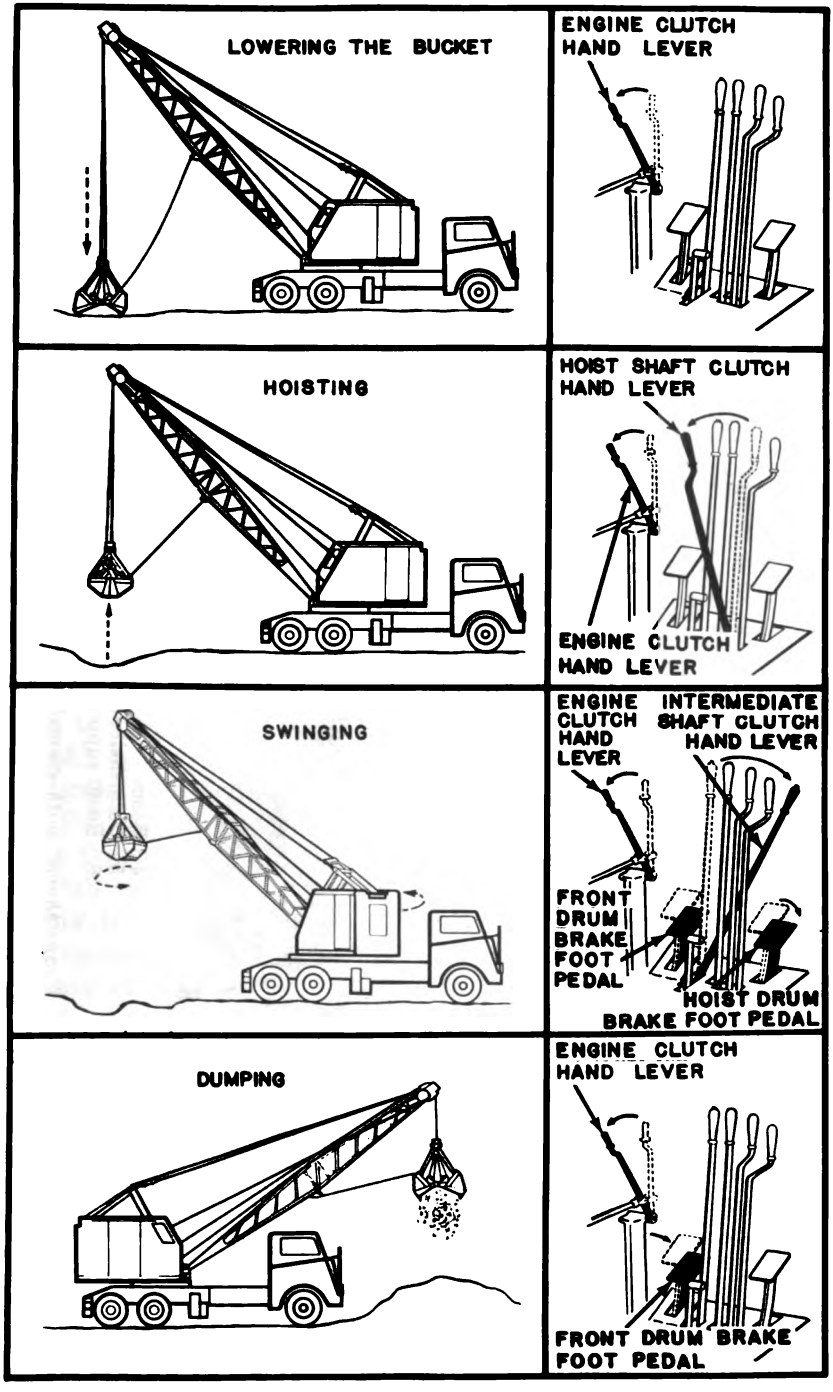


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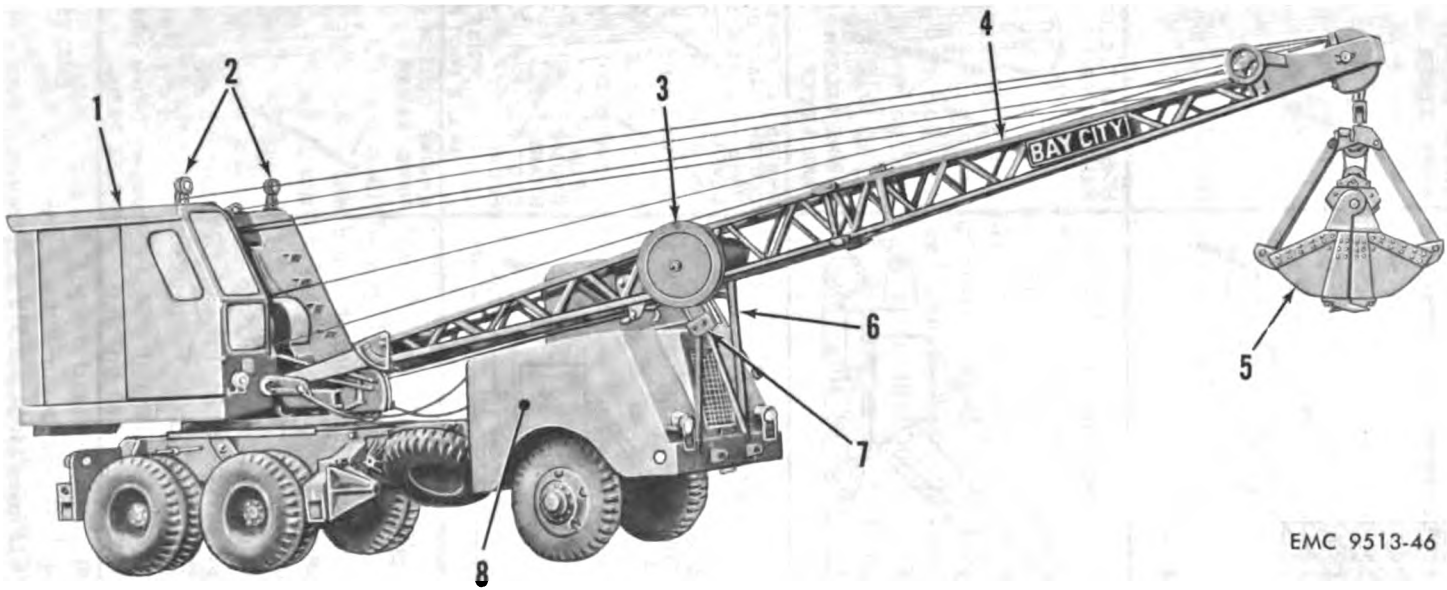
Figure 45. Clamshell in operation.



1 Recessed gantry
2 Floodlight
3 Rud-o-matic tagline
4 Boom
5 Clamshell bucket
6 Boom support
7 Tagline fairlead
8 Tool and battery box

Figure 46. Crane-shovel, with clamshell installed, in travel position.

(6) Pull up the swing lock foot lever (9). Pull back on the intermediate shaft clutch hand lever (3) and swing the revolving frame to the right and over the rear of the carrier. Push down on the swing lock foot lever.

(7) Release the hoist drum brake foot pedal (8) and the front drum brake foot pedal (10) and lower the clamshell bucket to the ground. Depress and latch both brake foot pedals.

(8) Raise the gantry (par. 66*h*).

(9) If necessary, set the outriggers (par. 66*d*).

c. Specific Clamshell Operation (fig. 37). Raise or lower the boom in accordance with the particular operation and the working range (par. 6*h*). Pull back on the independent boom hoist clutch hand lever (7) to raise the boom; push the lever forward to lower the boom. With the hoist drum brake foot pedal (8) and the front drum brake foot pedal (10) released, pull back on the hoist shaft clutch hand lever (6) to start the bucket to dig and close. When closed, the bucket will lift. If necessary, adjust the front drum clutch band (par. 192*e*) so it will act as a slip friction and will turn the front drum just enough to keep the holding line taut at all times with the front drum clutch hand lever (5) in the vertical position. When the bucket is high enough to clear all obstructions, push the hoist shaft clutch hand lever (6) to the vertical position. Depress and latch the hoist drum brake foot pedal (8) and the front drum brake foot pedal (10). Pull up on the swing lock foot lever (9). Swing the revolving frame until the bucket is in the desired dumping position. Pull back on the intermediate shaft clutch hand lever (3) to swing to the right; push the lever forward to swing to the left. Engage the hand lever (3) slowly so the swing motion will start and stop smoothly. If the revolving frame shows a tendency to drift when the intermediate shaft clutch hand lever (3) is in neutral, partially engage the lever to provide the opposite direction of swing. If it is necessary to maintain one position for extended periods, push down on the swing lock foot lever (9) to prevent the revolving frame from drifting. Keep the front drum brake foot pedal (10) depressed and latched. Release the hoist drum brake foot pedal (8), causing the bucket to open and the material to fall out. When the bucket is fully open, depress and latch the hoist drum brake foot pedal (8) to prevent the cable from running off the drum. When the material is clear of the bucket, swing the revolving frame and bucket back over the loading point. Release both brake foot pedals and lower the bucket to the loading point. If digging in hard material, use a long

fast drop to force the bucket teeth into the material. Repeat the above cycle as often as necessary.

d. Teeth Removal and Installation. For removal and installation of clamshell bucket teeth, see paragraph 191.

e. Adjustments.

(1) Adjust the independent boom hoist clutches (par. 205*d*), independent boom hoist brake (par. 198*e*), intermediate shaft clutches (par. 194*g*), hoist shaft clutch (par. 192*e*), front drum shaft clutch (par. 192*e*), hoist drum brake (par. 196*e*), and the front drum brake (par. 197*e*), as required.

(2) When working in loose materials, reeve the clamshell bucket (par. 13*c*) with a two-part line to permit faster closing action of the bucket. When working in hard materials, reeve the clamshell bucket (par. 13*c*) with a four- or six-part line to slow down the closing action of the bucket, enabling it to dig in more effectively.

(3) To increase tension in the tagline, block the tagline wheel to keep it from turning, and remove the cable clamps from the tagline at the clamshell bucket chain. Remove the blocking and turn the tagline wheel, in a counterclockwise direction, one or more turns. Reblock the tagline wheel and reinstall the tagline and cable clamps on the clamshell bucket chain. Remove the blocking from the tagline wheel. In case there is too much slack in the tagline, block the tagline wheel, remove the tagline from the bucket chain, wrap the slack around the tagline wheel, reinstall the tagline on the bucket chain, and remove the blocking from the tagline wheel.

70. General Instructions on Clamshell Operation

a. Be sure footing is solid. A little extra time spent preparing for good footing will be more than repaid by increased speed, steadiness, and safety of operation. Keep the crane-shovel as level as possible. When swinging the crane-shovel with the first load, the loaded side will settle. The opposite side should settle and level up the crane-shovel when working. If the crane-shovel is not level after making the first swing, back the crane-shovel up and use any substantial material to fill in the low track. Pull forward and resume work.

b. Do not exceed maximum allowable lifting loads in paragraph 6*h*. Do not lift heavy loads with the boom raised at more than a 72° angle.

c. When operating in close places, be sure there is adequate clearance for swinging both the boom and tailswing.

Caution: Do not swing the bucket over workmen or over the cab of vehicles. Always watch the bucket when swinging. Do not work too close to electric power lines.

d. Accurate control means safety and speed. Keep brakes and clutches in proper adjustment. Slow down engine speed with the hand throttle to increase accuracy of control.

Caution: Disengage the engine clutch when working on the machinery.

e. Do not drive the crane-shovel while the boom is at a high angle or when the bucket is suspended high above the ground.

f. If necessary to move with a load on soft ground, the crane-shovel will travel better if the load is behind.

g. Use the proper cable length. A cable which is too long requires overwinding which increases wear. Cable life can be increased by reversing the cable end for end.

h. Replace the cables as soon as they show signs of wear.

i. When lowering the bucket, do not let the cable unwind off the cable drum too fast and become tangled.

j. When unloading loose material from railway cars or ships, remove the bucket teeth. This is necessary in order to completely clean up floors or bottoms.

71. Dragline Operation

a. General.

(1) The dragline (fig. 47) is similar to the lifting crane except that it is equipped with a fairlead used as a drag cable guide to the front drum, and a dragline bucket for excavating. The dragline bucket is operated by two cables. The hoist line lifts and holds the loaded bucket suspended and controls the digging depth. The teeth of the bucket penetrate for digging as the drag cable drags the bucket toward the crane-shovel over the material being excavated. The hoist line also balanced the loaded bucket while being hoisted.

(2) Draglines are used for digging and cleaning ditches, building dikes and levees, stripping mines and gravel pits, placer mining, or excavating.

(3) Dragline working ranges are listed in paragraph 6*i*.

b. Prior To Operation Instructions.

(1) Position the revolving frame controls (par. 62*a*).

(2) Start the revolving frame engine (par. 62*b*).

(3) Push the throttle hand lever (2, fig. 37) forward about halfway. Pull the engine clutch hand lever (1) back and engage the clutch. Push the throttle hand lever forward all the way.

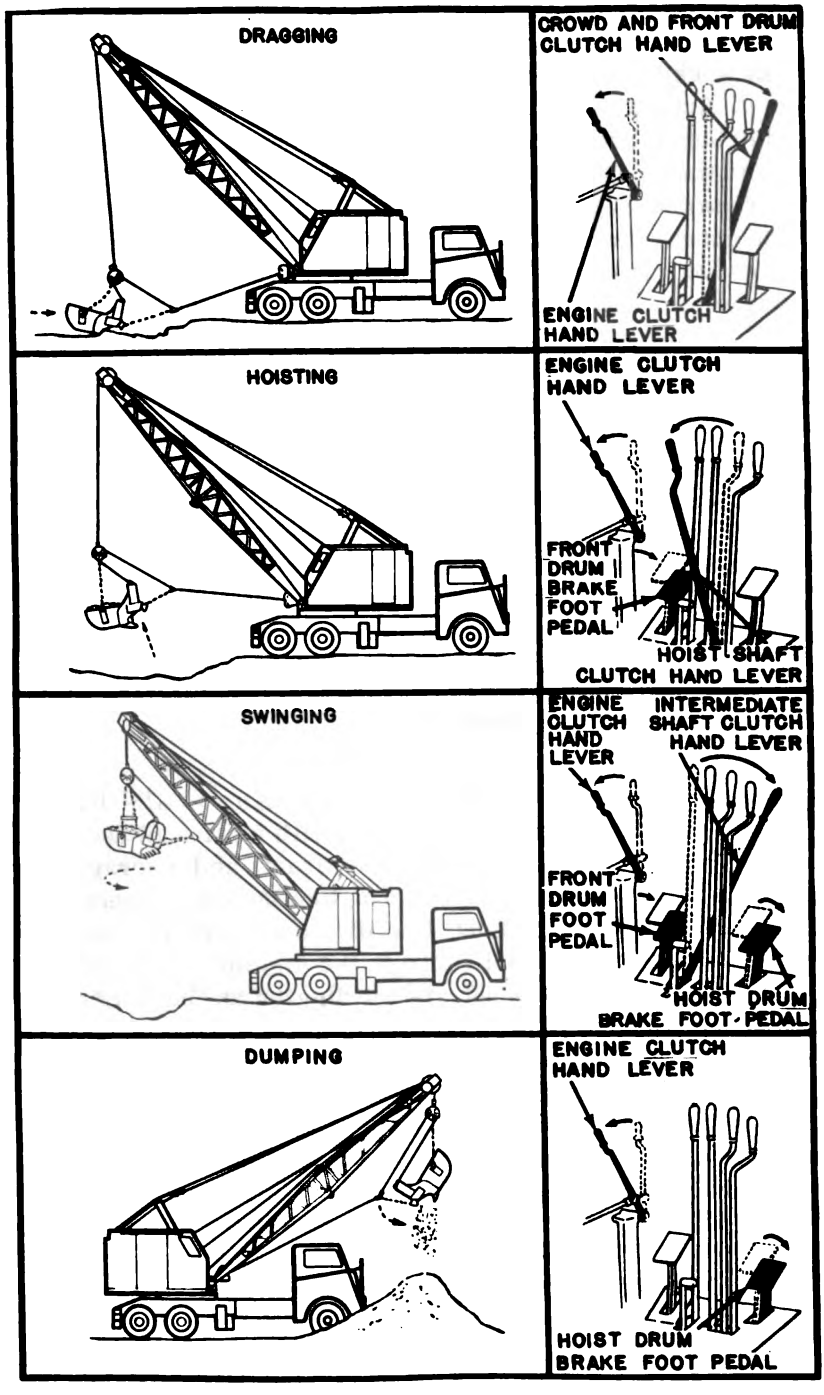


Figure 47. Dragline in operation.

(4) Release the hoist drum brake foot pedal (8) and the front drum brake foot pedal (10) and lower the dragline bucket (4, fig. 48) to the ground. At the same time, pull back on the independent boom hoist clutch hand lever (7, fig. 37) to raise the boom (3, fig. 48) out of the boom support (6).

(5) When the boom and bucket are high enough to clear all obstructions, put the independent boom hoist clutch hand lever in the vertical, neutral position. Depress and latch the hoist drum brake foot pedal (8, fig. 37) and the front drum brake foot pedal (10).

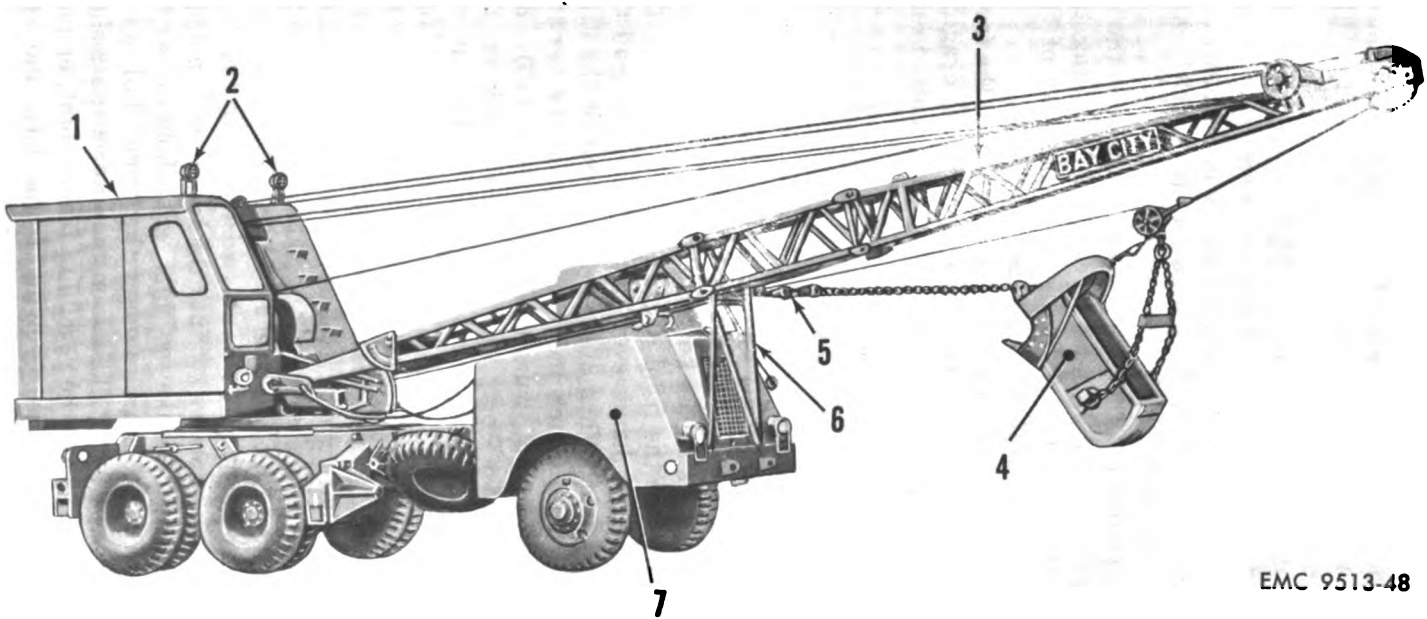
(6) Pull up the swing lock foot lever (9). Pull back on the intermediate shaft clutch hand lever (3) and swing the revolving frame to the right and over the rear of the carrier. Push down on the swing lock foot lever.

(7) Release the hoist drum brake foot pedal (8) and the front drum brake foot pedal (10) and lower the dragline bucket to the ground. Depress and latch both brake foot pedals.

(8) Raise the gantry (par. 66*h*).

(9) If necessary, set the outriggers (par. 66*d*).

c. Specific Dragline Operation (fig. 37). Raise or lower the boom in accordance with the particular operation and the working range (par. 6*i*). Pull back on the independent boom hoist clutch hand lever (7) to raise the boom, push the lever forward to lower the boom. Release the front drum brake foot pedal (10). Push the front drum clutch hand lever (5) forward and pull the slack out of the drag cable. When all the slack is out of the drag cable, pull the front drum clutch hand lever (5) to the vertical position and depress the front drum brake foot pedal (10). Release the hoist drum brake foot pedal (8). Pull back on the hoist shaft clutch hand lever (6), raising the bucket off the ground clear of any obstacles. Release the front drum brake foot pedal (10) slowly and evenly to provide slack in the drag cable as the bucket is raised. When the bucket reaches the desired height, push the hoist shaft clutch hand lever (6) to the vertical position. At the same time, depress and latch the hoist drum brake foot pedal (8) and the front drum brake foot pedal (10) to hold the bucket in position. Do not raise the bucket high enough to pull the dump cable socket into the boom point pulleys. Do not hold the front drum brake too tight when hoisting as the bucket will pull into the boom and damage the boom. Pull up on the swing lock foot lever (9). Pull back on the intermediate shaft clutch hand lever (3) to swing the revolving frame right, or push the lever forward to swing the revolving frame left, and spot



1 Recessed gantry
2 Floodlight
3 Boom
4 Dragline bucket
5 Wedge socket
6 Boom support
7 Tool and battery box

Figure 48. Crane-shovel, with dragline installed, in travel position.

the bucket in line with the point in the pit in which the cut is to be made. Release the hoist drum brake foot pedal (8) and lower the bucket to the cut to be made, leaving just enough slack in the hoist line so the bucket is free to dig in. Keep the bucket level while lowering. Release the front drum brake foot pedal (10). Push the front drum clutch hand lever (5) forward and drag in the bucket. Because of the angle of the teeth, it will fill as it comes in through the dirt. The digging depth is controlled by the hoist drum brake. Slacking off the hoist cable allows the bucket to dig in; holding tension on the hoist cable causes the bucket to lift up or pull out of the ground when the front drum clutch hand lever (5) is engaged. Pull the hoist shaft clutch hand lever (6) back as needed to keep the hoist cable from fouling or developing too much slack. As soon as there is a heaping load in the bucket and the bucket has been dragged in close enough to be lifted without dumping, pull the front drum clutch hand lever (5) to the vertical position. Pull back on the hoist shaft clutch hand lever (6) and lift the bucket enough to clear the bank and any other obstructions between the point of digging and the point of dumping. Keep the bucket from dumping by holding the drag cable with the front drum brake foot pedal (10). As soon as the bucket has reached clearance height, push the hoist shaft clutch hand lever (6) to the vertical position and depress and latch the hoist drum brake foot pedal (8) to hold the position of the bucket. Simultaneously, while hoisting, pull up on the swing lock foot lever (9) and swing the revolving frame and bucket to the desired position for dumping. Push the intermediate shaft clutch hand lever (3) forward to swing to the left; pull the lever back to swing right. Keep both brake foot pedals depressed to keep the bucket in the desired position. If the bucket is lifted a considerable distance from the crane-shovel and the dirt is to be dropped as far away as possible, simultaneously release the front drum brake foot pedal (10) and push the front drum clutch hand lever (5) forward to pull the bucket close to the boom. The bucket can then be thrown to the dump by pulling the front drum clutch hand lever (5) to the vertical position and allowing the bucket to swing outward before it goes into dumping position. The drag cable from the front drum must be kept in tension at all times to prevent dumping the load. When the drag cable is released the bucket tips down and dumps its load. The load can be swung out beyond the boom point before dropping by pulling the load in under the boom and then releasing the drag cable enough to start the bucket swing. Retain a slight tension on the front drum brake so the bucket does not go into dumping position until after it swings past the boom point. When

the dump is completed, swing the revolving frame and bucket to return the bucket to position for the next cut. Push the intermediate shaft clutch hand lever (3) forward to swing to the left, pull the lever back to swing right. Hold the bucket in position by keeping both brake pedals depressed and latched. Return the intermediate shaft clutch hand lever (3) to the vertical, neutral, position as soon as the bucket is in line with the next cut. Release the hoist drum brake foot pedal (8) and lower the bucket into the next cut to be made. Repeat the digging cycle as often as necessary.

d. Teeth Removal and Installation. For removal and installation of dragline bucket teeth, see paragraph 191.

e. Adjustments. Adjust the dragline bucket digging angle and the dump cable as instructed in paragraph 15. Adjust the independent boom hoist clutches (par. 205*d*), intermediate shaft clutches (par. 194*g*), hoist shaft clutch (par. 192*e*), front drum shaft clutch (par. 192*e*), hoist drum brake (par. 196*e*), and the front drum brake (par. 197*e*) as required.

72. General Instructions for Dragline Operation

a. Be sure footing is solid. A little extra time spent preparing for good footing will be more than repaid by increased speed, steadiness, and safety of operation. Keep the crane-shovel as level as possible. When swinging the crane-shovel with the first load, the loaded side will settle. The opposite side should settle and level up the crane-shovel when working. If the crane-shovel is not level after making the first swing, back the crane-shovel up and use any substantial material to fill in the low track. Pull forward and resume work.

Caution: Always watch the dragline bucket when working. Do not swing the bucket over workmen.

b. Accurate control means safety and speed. Keep brakes and clutches in proper adjustment. Slow down engine speed with the hand throttle to increase accuracy of control.

Caution: Disengage the engine clutch when working on the machinery.

c. Keep the boom at the highest angle, giving enough reach for the particular job, which is approximately 45° in most instances.

d. Do not use a bucket of larger capacity than is recommended for normal operation. The gain of more per pass usually is offset by less passes per hour. Also, overloading results in extra maintenance and delay.

e. Keep the bucket teeth sharp and built up to proper shape. This protects the lip from unnecessary wear and increased digging speed.

f. Hoist the bucket from digging as soon as it is filled. Piling up dirt under the boom foot wastes time and power, and also builds a "wearing trap" for the drag cable.

g. It is important to use the proper length of dump cable so the bucket can be picked up a considerable distance ahead of the crane-shovel without spilling the dirt. If the dump cable is too long, it is necessary to pull the loaded bucket close to the fairlead to keep it level. Too long a dump cable also causes the bucket to dump before it gets out under the maximum reach of the boom point.

h. Fill the bucket with an even cut and be sure back corners are filled. Avoid "gouging." Heap the bucket.

i. Keep the bucket correctly adjusted for fast filling, carrying, and dumping.

j. Do not pull the wedge socket into the fairlead.

k. Keep the fairlead pulleys well lubricated and see that the worn bushings are promptly replaced. Make it a regular practice to clean out any dirt brought into the crane-shovel by the drag cable.

l. Use the proper cable length. A cable which is too long requires overwinding which increases wear. Cable life can be increased by reversing the cable end for end.

m. Replace the cables as soon as they show signs of wear.

73. Shovel Operation

a. General.

(1) The shovel (fig. 49) is designed especially for excavating purposes and is equipped with an attachment consisting of the boom, dipper handle, and dipper. The machinery crowd mechanism replaces the lagging on the front drum. The dipper is controlled by the cable on the hoist drum. The boom is raised and lowered by the independent boom hoist assembly. Although the particular function of a shovel is to dig from ground level up to the maximum digging height of the dipper, it may be used for digging shallow trenches below ground. For lengthy shovel operation it is desirable to remove the rear outrigger support (par. 66*f*).

(2) Shovels are used for digging and loading rock, earth, and ore on highway, general construction, and mining work. Because of the accuracy and speed with which the dipper can be controlled, the shovel is ideal for loading the material it digs into trucks or other conveyances.

(3) Shovel working ranges are listed in paragraph 6*j*.

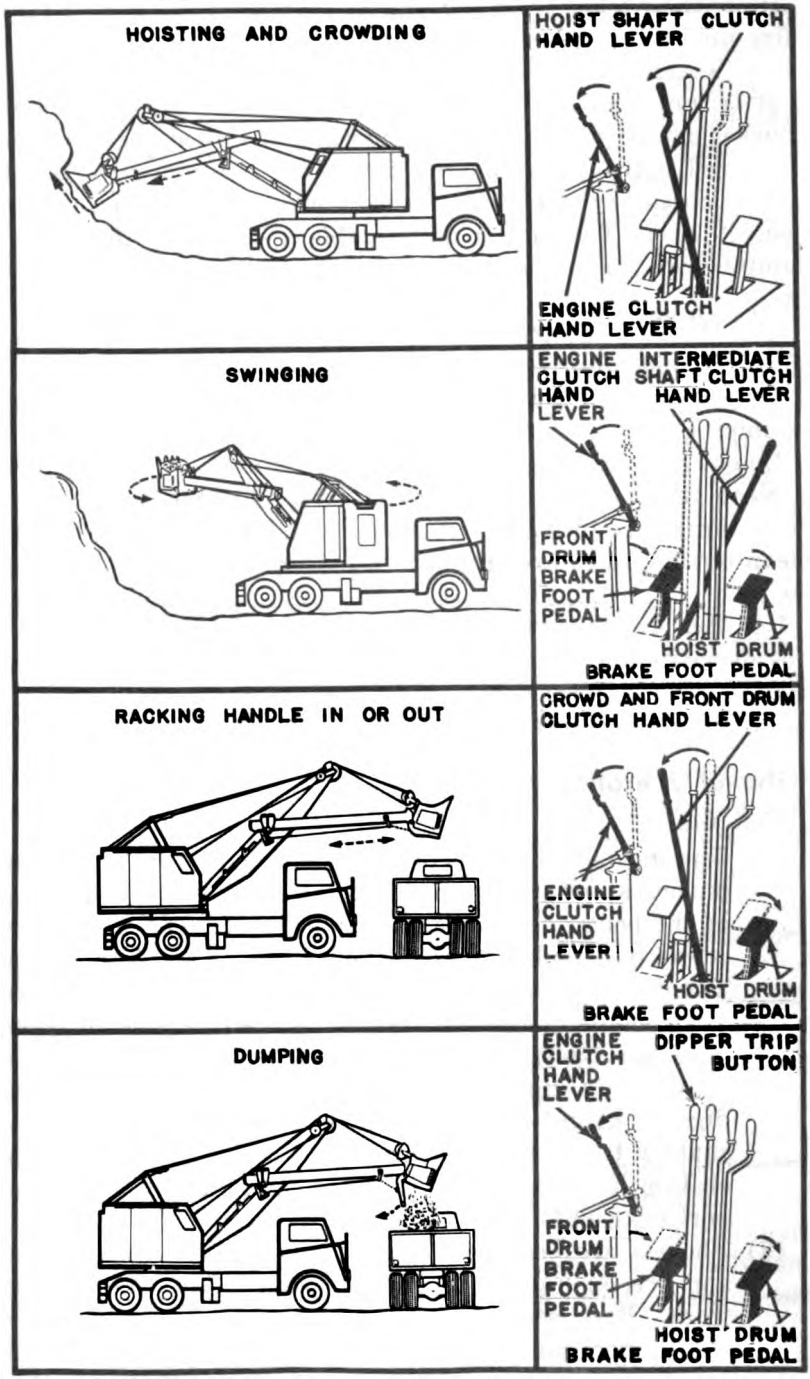


Figure 49. Shovel in operation.

b. Prior To Operation Instructions.

(1) Position the revolving frame controls (par. 62*a*).

(2) Start the revolving frame engine (par. 62*b*).

(3) Push the throttle hand lever (2, fig. 37) forward about halfway. Pull the engine clutch hand lever (1) back and engage the clutch. Push the throttle hand lever forward all the way.

(4) Pull back on the independent boom hoist clutch hand lever (7, fig. 37) to raise the boom (3, fig. 50) and the dipper handle (4) from the boom support (7). At the same time, release the hoist drum brake foot pedal (8, fig. 37) and pull back the hoist shaft clutch hand lever (6) to maintain the dipper (5, fig. 50) position.

(5) When the boom and dipper are high enough to clear all obstructions, put the independent boom hoist clutch hand lever (7, fig. 37) in the vertical, neutral, position. Depress and latch the hoist drum brake foot pedal (8).

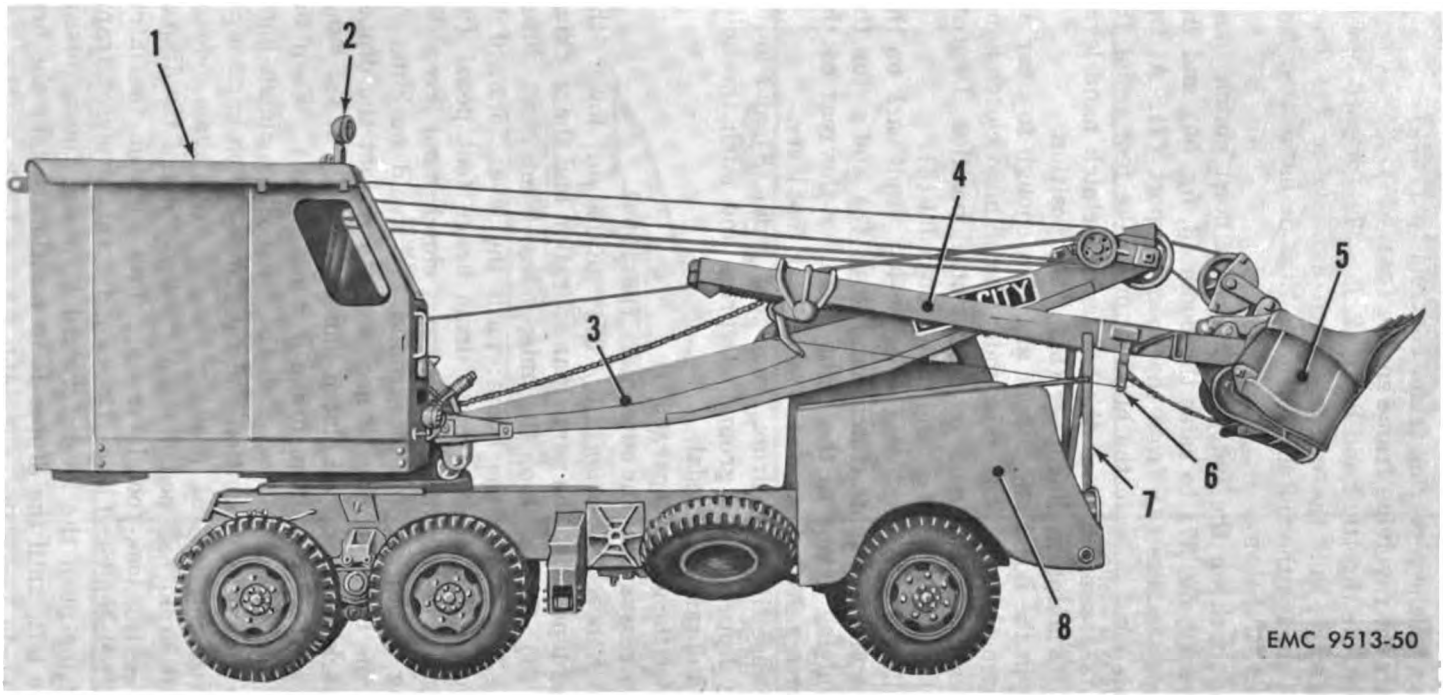
(6) Pull up the swing lock foot lever (9). Pull back on the intermediate shaft clutch hand lever (3) and swing the revolving frame to the right and over the rear of the carrier. Push down on the swing lock foot lever.

(7) Release the hoist drum brake foot pedal (8) and lower the dipper to the ground. Depress and latch the hoist drum brake foot pedal.

(8) Raise the gantry (par. 66*h*).

(9) If necessary, set the outriggers (par. 66*d*).

c. Specific Shovel Operation (fig. 37). Raise or lower the boom in accordance with the particular operation and the working range (par. 6*j*). Pull back on the independent boom hoist clutch hand lever (7) to raise the boom; push the lever forward to lower the boom. Release the hoist drum brake foot pedal (8) and, at the same time, pull the hoist shaft clutch hand lever (6) back, raising the dipper off the ground. To avoid pushing the dipper into the bank, it may be necessary to retract the dipper by pulling back on the crowd clutch hand lever (5), at the same time releasing the front drum brake foot pedal (10). When the dipper will clear all obstacles, push the hoist shaft clutch hand lever (6) to the vertical position and the crowd clutch hand lever (5) to the vertical, neutral, position. At the same time, depress and latch both brake foot pedals to hold the position of the dipper. Pull up the swing lock foot lever (9). Pull back on the intermediate shaft clutch hand lever (3) to swing the revolving frame to the right, or push the lever forward to swing the revolving frame to the left, until the dipper is in position to take the first cut. This should be to the outer side of the bank, so the load



1 Recessed gantry
2 Floodlight
3 Shovel boom
4 Dipper handle
5 Dipper
6 Dipper trip lever
7 Boom support
8 Tool and battery box

Figure 50. Crane-shovel, with shovel installed, in travel position.

can be swung out without retracting the dipper. Release the hoist drum brake foot pedal (8) and lower the dipper slowly to within 3 or 4 feet of the ground. Release the front drum brake foot pedal (10) and pull back on the crowd clutch hand lever (5), swinging the dipper back into digging position. Depress both brake foot pedals to hold the dipper in position and to prevent the cable from unwinding from the drum. Be careful not to drop the dipper too fast or to pull the dipper back too far; to do so will result in hitting the base of the boom or the carrier. Release the hoist drum brake foot pedal (8) and, at the same time, pull back on the hoist shaft clutch hand lever (6) to pull the dipper forward and upward. Simultaneously, release the front drum brake foot pedal (10) to let the dipper handle run out by gravity. Pull back on the crowd clutch hand lever (5) if the dipper teeth start to dig before reaching the bank. When the teeth are crowded into dirt at the foot of the bank and the hoist cable has started the dipper on its upward motion, work the crowd clutch hand lever (5) forward and back, as needed, to maintain an adequate cutting depth and to prevent the revolving frame engine stalling as the dipper is pulled up through the face of the bank. Do not "ram" the dipper into rock. Pull through the blasted or shattered rock with steady power to get the most material into the dipper with the least shock on the machinery and least slowing down of the hoist cycle. The dipper fills easier under steady, controlled power than by the "slam-bang" method, which often brings the dipper out of the bank with little or no load. As soon as the dipper is full, push the hoist shaft clutch hand lever (6) to the vertical position and retract the dipper by pulling the crowd clutch hand lever (5) back. Usually the dipper is above horizontal and will come back by gravity. Bring the dipper back only enough to clear the bank. As soon as the desired position is obtained, depress both drum brake foot pedals. Pull back on the intermediate shaft clutch hand lever (3) to swing the revolving frame to the right, or push the lever forward to swing the revolving frame to the left, as needed, to swing the dipper load over the hauling equipment or spoil pile. While swinging, release the front drum brake foot pedal (10); and with the crowd clutch hand lever (5), crowd or retract the dipper to bring the circumference of the swing in line with the point at which the dipper is to be dumped. Put the crowd clutch hand lever (5) in the vertical, neutral, position and depress the front drum brake foot pedal (10) when this position is reached. At the same time, release the hoist drum brake foot pedal (8) and pull back on the hoist shaft clutch hand lever (6) to raise the dipper to the height desired for dumping. In loading trucks or wagons, be sure to swing in over

the body with plenty of room for safe clearance; but before dumping, lower the dipper with the hoist drum brake foot pedal (8) as close as possible without danger of the dipper door striking and damaging the vehicle. This minimizes the shock load of dumped material. When the dipper is in the desired position, depress the dipper trip pushbutton (4) on top of the intermediate shaft clutch hand lever (3). As the dipper door opens, pull the hoist shaft clutch hand lever (6) back to raise the dipper from flowing material and permit the dipper door to swing open freely. Hoist only enough, however, to give adequate clearance to dump the material and to swing back to the bank. As soon as the material cleans the dipper, pull back on the intermediate shaft clutch hand lever (3) to swing the revolving frame to the right, or push the lever forward to swing the revolving frame to the left, as needed, to swing back to the bank. As soon as the swing has picked up normal speed, return the intermediate shaft clutch hand lever (3) to the vertical, neutral, position and coast until the dipper is almost in line with the next cut to be made. Then reverse the intermediate shaft clutch hand lever (3) to engage the opposite clutch and stop the swing motion. Return the intermediate shaft clutch hand lever (3) to the vertical, neutral, position as soon as the swing has stopped. While swinging, release the hoist drum brake foot pedal (8) to release the dipper so it falls rapidly by gravity, catches up to the open swinging dipper door, and engages the latch. If the latch does not catch, crowd the dipper forward by pushing on the crowd clutch hand lever (5). Then pull back on the crowd clutch hand lever (5) sharply to bang the dipper door against the dipper body and dislodge any material which may be blocking the latch. After the dipper is swung into position, repeat the digging cycle as often as necessary.

d. Teeth Removal and Installation. For removal and installation of dipper teeth, see paragraph 191.

e. Adjustments. Adjust the dipper pitch (par. 232*f*) as necessary. Adjust the crowd chain takeup (par. 234*g*), crowd clutch (par. 193*e*), independent boom hoist clutches (par. 205*d*), independent boom hoist brake (par. 198*e*), intermediate shaft clutches (par. 194*g*), hoist shaft clutch (par. 192*e*), front drum shaft clutch (par. 192*e*), hoist drum brake (par. 196*e*), and the front drum brake (par. 197*e*), as required.

74. General Instructions on Shovel Operation

a. Keep dipper teeth sharp.

b. Heap the dipper to get a full load every pass.

c. Take a relatively thin slice so the dipper hoists through the

bank quickly and easily. Overcrowding slows down the hoist and does not increase speed of filling.

d. It is not necessary to pull the dipper through the full length of the bank in order to fill it. Pull out with just enough to fill the dipper. The best practice is to regulate depth of cut with the crowd so the dipper will be full just as it reaches the top of the bank. On high banks, take top passes first; then move back to take out material at the bottom of the bank.

e. See that the pitch braces are adjusted to give the dipper its most efficient angle. In ordinary digging the teeth should penetrate as nearly as possible at the average angle of the overall cut. For deep digging, adjust to the maximum forward pitch farthest from the dipper.

f. Spot trucks to line up with the arc of the swing and try to have them always spotted the same distance from the center of rotation.

g. Start digging next to spotted trucks and work in toward the center of the cut. Take the cut out in layers across the entire face.

h. Whenever possible, move up while waiting for trucks.

i. Clean up the pit while waiting for hauling equipment. In cleaning up, use the dipper in forward motion only—never sidewise. If the bank digs hard, loosen the material while waiting by cutting with an open dipper. Move up while there are still several feet of dipper handle left.

j. Do not let the tires bog down in soft soil. Use mats of corduroy of logs or poles to keep up out of the muck.

k. Replace cables as soon as they show signs of wear.

l. Use the proper cable length. A cable which is too long requires overwinding which increases wear. Cable life can be increased by reversing the cable end for end.

m. Accurate control means safety and speed. Keep brakes and clutches in proper adjustment.

Warning: Disengage the engine clutch when working on the machinery.

n. Do not use the swing lock when the revolving frame is in motion. Be sure to disengage the swing lock before swinging.

Caution: Do not swing the dipper over workmen or truck cab. Be sure the dipper is raised high enough to clear the truck body.

75. Back Hoe Operation

a. General.

(1) The back hoe (fig. 51) combines some of the features of a dragline and a shovel. The back hoe digs as the bucket is pulled toward the crane-shovel like a dragline

bucket and can be controlled with the same speed and accuracy as a shovel dipper. A pin-connected hoe mast at the front of the revolving frame supports the cable pulleys employed in the boom and bucket raising and lowering operations. The boom and hoe handle are rigid members. For lengthy back hoe operation it is desirable to remove the rear outrigger support (par. 66*f*).

(2) Back hoes are used for trench digging for sewer lines and conduit, basements, and foundations.

(3) Back hoe working ranges are listed in paragraph 6*k*.

b. Prior To Operation Instructions.

(1) Position the revolving frame controls (par. 62*a*).

(2) Start the revolving frame engine (par. 62*b*).

(3) Push the throttle hand lever (2, fig. 37) forward about halfway. Pull the engine clutch hand lever (1) back and engage the clutch. Push the throttle hand lever forward all the way.

(4) Pull back on the independent boom hoist clutch hand lever (7, fig. 37) and raise the hoe mast (3, fig. 52). As the hoe mast is being raised, keep the bucket (5) extended and raise the boom (4) by depressing and unlatching both drum brake foot pedals (8 and 10, fig. 37) pulling on the hoist shaft clutch hand lever (6) and releasing the hoist drum brake foot pedal (8) to raise the boom, and gradually releasing the front drum brake foot pedal (10) to keep the bucket extended.

(5) When the hoe mast (3, fig. 52) is in a vertical position and the boom (4) and bucket (5) are high enough so that the drag cable (6) will clear the boom support and surrounding obstructions, push the independent boom hoist clutch hand lever (7, fig. 37) to the vertical, neutral, position, push the hoist shaft clutch hand lever (6) to the vertical position, and depress and latch both brake foot pedals (8 and 10).

(6) Pull up on the swing lock foot lever (9). Pull back on the intermediate shaft clutch hand lever (3) and swing the revolving frame to the right and over the rear of the carrier. Push down on the swing lock foot lever.

(7) Simultaneously, push the front drum clutch hand lever (5) forward and release both brake foot pedals (8 and 10) to pull and lower the bucket to the ground toward the crane-shovel. Pull the front drum clutch hand lever (5) to the vertical position and depress and latch both brake foot pedals.

(8) Raise the gantry (par. 66*h*).

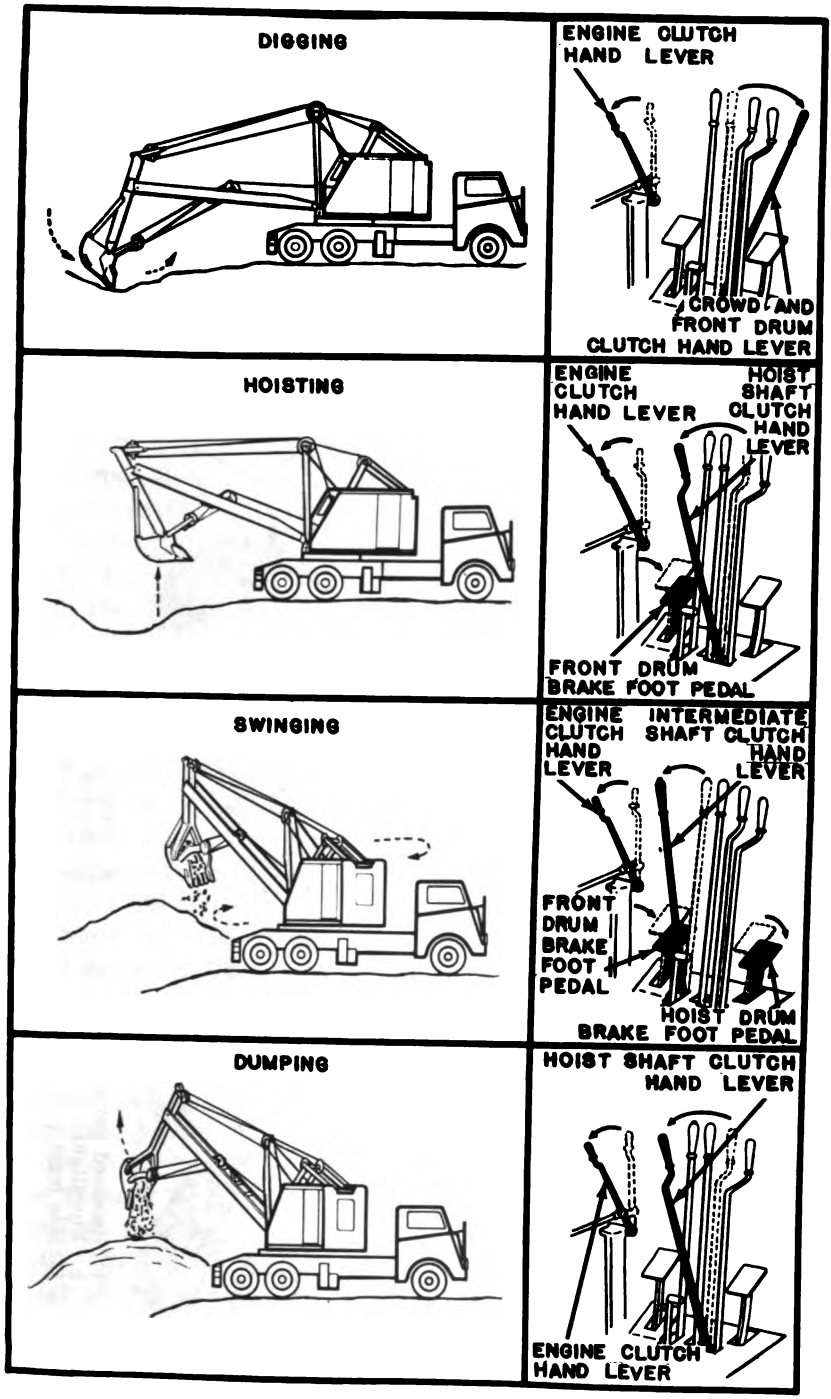
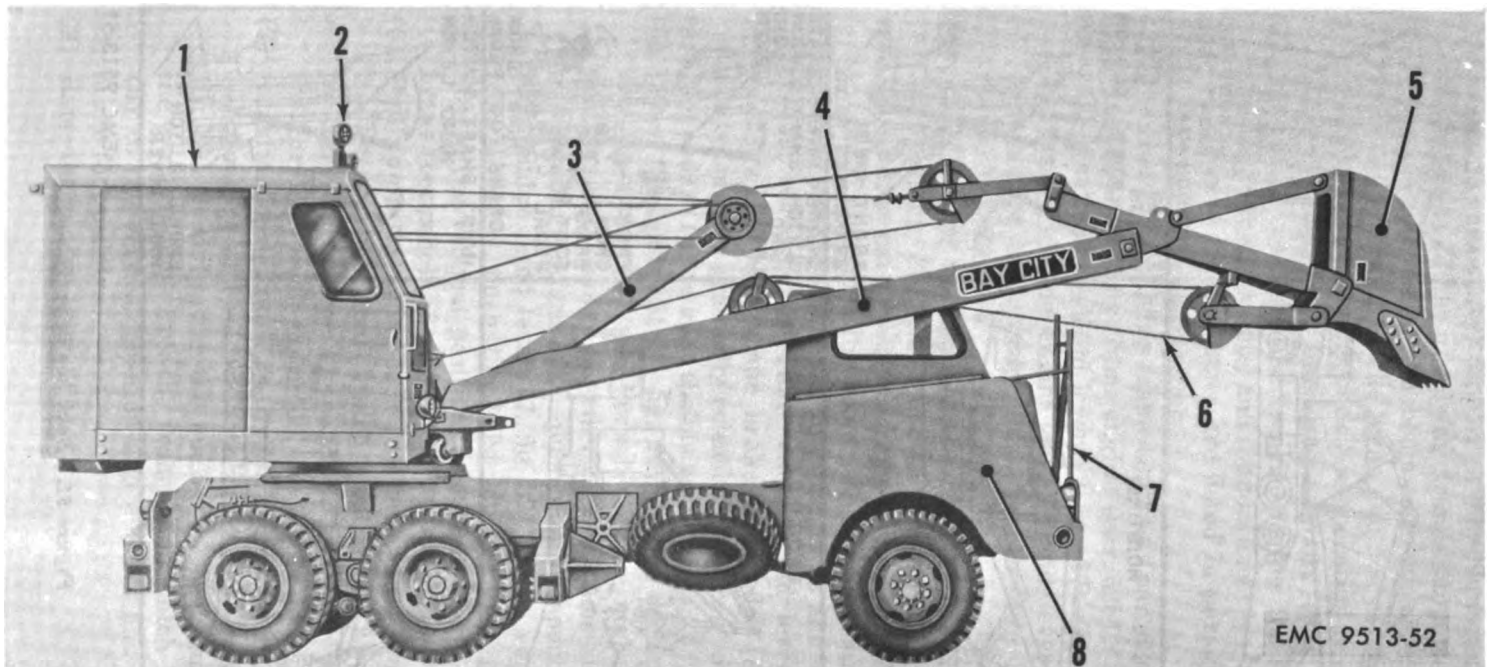


Figure 51. Back hoe in operation.



1 Recessed gantry	4 Boom	7 Boom support
2 Floodlight	5 Bucket	8 Tool and battery box
3 Hoe mast	6 Drag cable	

Figure 52. Crane-shovel, with back hoe installed, in travel position.

(9) If necessary, set the outriggers (par. 66*d*).

c. Specific Back Hoe Operation (fig. 37). The handle and bucket are free to pivot over the boom point. They are positioned by the hoist cable that pulls the upper end of the handle and by the drag cable that pulls the bucket at the lower end of the handle. The hoist and drag motions must be synchronized to keep both cables under tension at all times, as the handle will straighten out suddenly if the drag cable is allowed to get slack. Also, if the hoist cable is released it will cause the boom to drop. Pull up the swing lock foot lever (9). Release the hoist drum brake foot pedal (8) and pull the hoist shaft clutch hand lever (6) back, raising the boom and handle. As the bucket clears the ground, release the front drum brake foot pedal (10) slowly to let the bucket and handle swing out to the maximum reach position of the boom point. Push the hoist shaft clutch hand lever (6) to the vertical position; use the hoist drum brake foot pedal (8) to maintain the boom position, and the front drum brake foot pedal (10) to prevent excess cable from unwinding from the drum. Pull back on the intermediate shaft clutch hand lever (3) to swing the revolving frame to the right, or push the lever forward to swing the revolving frame to the left, and spot the bucket over the trench or point where the digging is to be done. Release the hoist cable by relieving pressure on the hoist drum brake foot pedal (8). At the same time, release the front drum brake foot pedal (10) and pull in on the drag cable by pushing the front drum clutch hand lever (5) forward, dragging the dipper through the material until it is filled. Regulate the depth of the cut taken by the dipper by paying out or taking in the hoist cable with the hoist shaft clutch hand lever (6) and the hoist drum brake foot pedal (8). As soon as the bucket is filled, pull the hoist shaft clutch hand lever (6) back and release the hoist drum brake foot pedal (8) to lift the bucket out of the material. Then push the hoist shaft clutch hand lever (6) to the vertical position and depress the hoist drum brake foot pedal (8). Continue pulling in with the drag cable by pushing on the front drum clutch hand lever (5) until the load is pulled up close under the boom. Pull the front drum clutch hand lever (5) to the vertical position and depress the front drum brake foot pedal (10). Release the hoist drum brake foot pedal (8) and pull the hoist shaft clutch hand lever (6) back to raise the boom high enough to clear all obstacles. Then push the hoist shaft clutch hand lever (6) to the vertical position and hold the boom by depressing the hoist drum brake foot pedal (8). Swing the bucket into line with the point at which it is to be dumped by pulling back on the intermediate shaft clutch hand lever (3) to

swing to the right, or push on the lever to swing to the left. Pull back on the hoist shaft clutch hand lever (6). At the same time, release the hoist drum brake foot pedal (8) and partially release the front drum brake foot pedal (10). This causes the bucket to swing outward and up, dumping the material. As the dipper empties, its position is approximately straight ahead of the boom which is held high by the hoist cable. Push the hoist shaft clutch hand lever (6) to the vertical position and hold the boom by depressing and latching the hoist drum brake foot pedal (8). Also depress and latch the front drum brake foot pedal (10) to prevent overrunning of the cable. Return the bucket to the digging point by pulling back on the intermediate shaft clutch hand lever (3) to swing to the right, or push on the lever to swing to the left. Simultaneously, push the front drum clutch hand lever (5) forward and release both brake foot pedals (8) and (10) to pull and lower the bucket to the ground. Repeat the above cycle as often as necessary.

d. Teeth Removal and Installation. For removal and installation of hoe bucket teeth, see paragraph 191.

e. Adjustments. For adjustment of the bucket pitch angle, see paragraph 241*f*. Adjust the independent boom hoist clutches (par. 205*d*), independent boom hoist brake (par. 198*e*), hoist shaft clutch (par. 192*e*), intermediate shaft clutches (par. 194*g*), front drum shaft clutch (par. 192*e*), hoist drum brake (par. 196*e*), and the front drum brake (par. 197*e*), as required.

76. General Instructions on Back Hoe Operation

a. The operator should not attempt to dump into trucks with a back hoe until he has had considerable experience in overcasting material. In loading trucks, the elevation of the boom must be high enough and the takeup on the hoist cable rapid enough to provide clearance between the swinging bucket and the truck as the bucket swings into position for its dump.

b. The bucket can be used as a pick to break and loosen hard materials. Its substantial welded construction and inserted teeth are designed to meet this kind of service with minimum maintenance. Strike blows cleanly, with the teeth hitting straight into the material. Do not try to break solid rocks or boulders in this manner. Solid ledge rock should be drilled and blasted.

c. Boulders should be dug around and rolled out or blasted if they are too large to be dug easily. Good sized boulders should be taken out on a chain sling attached to the bucket.

d. Like all front ends, the back hoe is not built to take side loads beyond those normally encountered in free swinging. Be

sure to bring the bucket clear of the trench before starting to swing.

Warning: Do not swing the bucket over workmen or truck cab. Be sure the bucket is raised high enough to clear the truck body.

e. Accurate control means safety and speed. Keep brake and clutches in proper adjustment.

Warning: Disengage the engine clutch when working on the machinery.

f. Use the proper cable length. A cable which is too long requires overwinding which increases wear. Cable life can be increased by reversing the cable end for end.

g. Replace cables as soon as they show signs of wear.

77. Operating Carrier

a. General.

(1) Use care in operating the carrier, as it has a high center of gravity and can be capsized.

(2) In making turns, always allow enough room for the front end attachment, which projects in front of the carrier, to clear all obstructions.

(3) Become familiar with the space needed to maneuver the carrier safely, and always allow this much space when operating.

(4) Before backing the carrier, look behind and under the carrier to make sure there are no obstructions; when backing, one man should always act as a guide and stand where his signals can be seen by the driver.

(5) Do not shift gears on railroad crossings or intersections. The carrier should be placed in proper gear before entering a crossing or intersection, and should proceed through in that gear.

(6) In general, it is advisable to go down hill in the next lower gear than that used to ascend the same hill. Remember that the engine governor is not effective in controlling the engine speed when the engine is used as a brake in descending hills.

(7) Carrier performance data are listed in paragraph 6*l*.

b. Putting Carrier Into Motion.

(1) *Moving forward.*

(*a*) Start the carrier (par. 63).

(*b*) Depress the clutch pedal (16, fig. 36) to disengage the clutch. Shift the transfer case gearshift lever (2, fig. 38) into proper speed range (V, fig. 14)—high for ordinary loads on solid, level ground; low for heavy

loads on rough ground or uphill starts. Shift the transmission gearshift lever (4, fig. 38) into first speed position (extreme right and forward) (V, fig. 14). Ease up on the clutch pedal (16, fig. 36) and, at the same time, depress the accelerator pedal (13) the amount necessary for the engine to carry the load and set the carrier in motion.

(*c*) As the carrier gains speed, release the accelerator pedal and depress the clutch pedal at the same time. Move the transmission gearshift lever (4, fig. 38) into neutral (N, V, fig. 14) and release the clutch pedal. When the engine speed and the carrier speed are synchronized for the next higher gear, depress the clutch pedal and shift the transmission gearshift lever into the next higher gear. The entire operation must be quickly performed before the carrier loses speed. Ease up on the clutch pedal and press down on the accelerator pedal so the carrier continues to move forward smoothly. Increase the speed of the carrier until it has attained a speed sufficient to allow shifting into the next higher gear. Repeat the above operations until the transmission is in the highest gear the carrier can use for the load and working conditions.

(2) *Shifting to lower gear.* Always shift to a lower speed before the engine begins to labor or the carrier loses appreciable road speed. Depress the clutch pedal (16, fig. 36) and release the accelerator pedal (13). Move the transmission gearshift lever (4, fig. 38) into neutral (N, V, fig. 14) position. Release the clutch pedal and accelerate the engine to synchronize the carrier and engine speeds. Depress the clutch pedal and move the transmission gearshift lever to the next lower speed. Release the clutch pedal slowly, depressing the accelerator pedal at the same time so the gears will mesh smoothly and the carrier continues its forward motion.

(3) *Moving backwards.* Bring the carrier to a complete stop before attempting to shift into reverse. Depress the clutch pedal (16, fig. 36). Move the transmission gearshift lever (4, fig. 38) as far to the right as possible and then to the rear as far as it will go. Release the service brake treadle (14, fig. 36). Release the clutch pedal and, at the same time, depress the accelerator pedal (13) to start the carrier backing smoothly. Always back up slowly.

(4) *Transfer case operation.*

(*a*) Selection of the low- or high-speed range (V, fig. 14) of the transfer case is controlled by the transfer case gearshift lever (2, fig. 38). This lever operates independently of the transmission gearshift lever (4). When the transfer case gearshift lever is forward, the transfer case is in high; when the lever is pulled back, the transfer case is in low. The low range is used only under heavy load or severe operating conditions.

(*b*) To shift the transfer case from high to low, bring the carrier to a stop, or operate at a low speed. Depress the clutch pedal (16, fig. 36) and move the transfer case gearshift lever (2, fig. 38) to neutral (N, V, fig. 14). Release the clutch pedal and accelerate the engine so it is approximately double the relative speed of the carrier. Depress the clutch pedal again and pull the transfer case gearshift lever back into low speed range position. This operation should be done quickly and smoothly, without excessive pressure. Release the clutch pedal and accelerate the engine at the same time. Shifting from high to low range when the carrier is in motion must be done in this manner to synchronize the speeds of the engaging gears and prevent damage to them.

(*c*) To shift the transfer case from low to high when the carrier is moving, depress the clutch pedal and move the transfer case gearshift lever forward through neutral into the high position. Make the shift slowly.

Note. The front axle must not be engaged when the transfer case is in high. The safety bar welded on the transfer case gearshift lever will disengage the front axle drive when the transfer case gearshift lever is pushed forward into high. The driver should make it a practice to disengage the front axle before placing the transfer case in high.

(5) *Front axle drive.* The front axle drive should be used for off-the-road operation only, and the transfer case must be in low.

(*a*) To engage the front axle drive, shift the transfer case into low ((4) (*b*) above). Pull the front axle declutch lever (3, fig. 38) back to DRIVE position (V, fig. 14). It is not necessary to disengage the clutch. The front axle is easier to engage with the clutch engaged and the carrier in motion.

(*b*) To disengage the front axle drive, push the front axle declutch lever (3, fig. 38) forward to FREE

position (V, fig. 14). The transfer case can either be left in low, or shifted into high ((4) (*c*) above).

c. Stopping Carrier. For carrier stopping procedures, refer to paragraph 65.

78. Moving With Crane Boom Attachments Installed

a. General. If the crane-shovel is to be moved only a short distance, the crane boom and attachments need not be removed. If a long move is anticipated, it is necessary to remove the crane boom and attachments and transport them separately.

Note. Before moving the crane-shovel, check with proper authority for possible overall weight or length restrictions along the route.

b. Stowing Outriggers. Retract and stow the outriggers as instructed in paragraph 66*e*.

c. Recessing Gantry (fig. 41). Recess the gantry (1) as instructed in paragraph 66*i*.

d. Removing Floodlights (fig. 44). To provide more clearance, remove the upper floodlights (2) as instructed in paragraph 152*b*.

e. Moving Instructions.

(1) *Hook block.*

(*a*) Release the hoist drum brake foot pedal (8, fig. 37). Pull back on the hoist shaft clutch hand lever (6) to raise the hook block clear of the ground and surrounding objects. Apply and latch the hoist drum brake foot pedal.

(*b*) Pull up the swing lock foot lever (9). Push the intermediate shaft clutch hand lever (3) forward and swing the revolving frame and boom to the left and over the boom support (4, fig. 44). If necessary to raise the boom to clear the boom support, pull back on the independent boom hoist clutch hand lever (7, fig. 37). Push down on the swing lock foot lever when the boom is spotted.

(*c*) Push the independent boom hoist clutch hand lever (7) forward and lower the boom (3, fig. 44) between the uprights of the boom support (4). Pull the independent boom hoist clutch hand lever to the vertical, neutral, position when the boom is about 3 inches above the boom support. Do not allow the boom to rest on the boom support.

(*d*) Loop a cable (6) through the two eyes (8) and secure with cable clamps (7). Pull the hook block (5) to the cable (6). Attach the hook block to the cable with the hook point down. To provide slack in the hoist cable for pulling the hook block, release the hoist drum brake foot pedal (8, fig. 37).

(*e*) Pull back on the hoist shaft clutch hand lever (6) and pull the hook block (5, fig. 44) tight on the cable (6). Keeping tension on the hook block, cable, and boom, apply and latch the hoist drum brake foot pedal. Check to make sure that the boom (3, fig. 44) is not resting on the boom support (4) or on the rear of the tool and battery box (9).

(*f*) Stop the revolving frame (par. 64). For added safety while traveling, pull back the engine clutch hand lever (1, fig. 37) and the hoist shaft clutch hand lever (6).

(*g*) Carefully operate and travel the carrier (par. 77) to the new location.

(*h*) If a long move is anticipated and it is necessary to remove the front end attachment, unreeve the hoist line and remove the hook block (par. 11*c*), and remove the crane boom (par. 10*d*).

(2) *Clamshell.*

(*a*) Release the hoist drum brake foot pedal (8) (fig. 37) and the front drum brake foot pedal (10). Pull back on the hoist shaft clutch hand lever (6) and close and lift the clamshell bucket. When the bucket is high enough to clear all obstructions, push the hoist shaft clutch hand lever to the vertical position. Depress and latch both brake foot pedals.

(*b*) Pull up the swing lock foot lever (9). Push the intermediate shaft clutch hand lever (3) forward and swing the revolving frame and boom to the left and over the boom support (6, fig. 46). If necessary to raise the boom to clear the boom support, pull back on the independent boom hoist clutch hand lever (7, fig. 37). Push down on the swing lock foot lever when the boom is spotted.

(*c*) Push the independent boom hoist clutch hand lever (7) forward and lower the boom (4, fig. 46) between the uprights of the boom support (6). Pull the independent boom hoist clutch hand lever to the vertical, neutral, position when the boom is about 3 inches above the boom support. Do not allow the boom to rest on the boom support.

(*d*) Release the hoist drum brake foot pedal (8, fig. 37) and the front drum brake foot pedal (10). Pull back on the hoist shaft clutch hand lever (6) and raise the closed clamshell bucket (5, fig. 46) close to the boom point. Push the hoist shaft clutch hand lever

to the vertical position and depress and latch both brake foot pedals.

(*e*) Make sure there is clearance between the tool and battery box (8) and the boom (4) and tagline fairlead (7). Make sure the boom is not resting on the boom support (6).

(*f*) Stop the revolving frame (par. 64). For added safety while traveling, pull back the engine clutch hand lever (1, fig. 37), the hoist shaft clutch hand lever (6), and the front drum clutch hand lever (5).

(*g*) Carefully operate and travel the carrier (par. 77) to the new location.

(*h*) If a long move is anticipated and it is necessary to remove the front end attachment, unreeve the closing cable (par. 13*f*) and holding cable (par. 13*g*), and remove the crane boom (par. 10*d*).

(3) *Dragline.*

(*a*) Release the front drum brake foot pedal (10, fig. 37) and push the front drum clutch hand lever (5) forward to pull the slack out of the drag cable. When all the slack is out of the drag cable, pull the front drum clutch hand lever to the vertical position and depress the front drum brake foot pedal.

(*b*) Release the hoist drum brake foot pedal (8) and pull back on the hoist shaft clutch hand lever (6), raising the dragline bucket off the ground clear of any obstacles. Release the front drum brake foot pedal (10) slowly and evenly to provide slack in the drag cable as the bucket is raised. When the bucket reaches the desired height, push the hoist shaft clutch hand lever (6) to the vertical position. At the same time, depress and latch both brake foot pedals.

(*c*) Pull up the swing lock foot lever (9). Push the intermediate shaft clutch hand lever (3) forward and swing the revolving frame and boom over the boom support (6, fig. 48). If necessary to raise the boom to clear the boom support, pull back on the independent boom hoist clutch hand lever (7, fig. 37). Push down on the swing lock foot lever when the boom is spotted.

(*d*) Push the independent boom hoist clutch hand lever (7) forward and lower the boom (3, fig. 48) between the uprights of the boom support (6). Release the hoist drum brake foot pedal (8, fig. 37) as necessary to keep the dragline bucket dump cable socket away from the boom point pulleys. Pull the independent

boom hoist clutch hand lever to the vertical, neutral, position when the boom is about 3 inches above the boom support. Do not allow the boom to rest on the boom support.

(*e*) Release the front drum brake foot pedal (10) and push the front drum clutch hand lever (5) forward to pull the wedge socket (5, fig. 48) up to the boom support (6). When the wedge socket is at the boom support, depress and latch the front drum brake foot pedal and pull the front drum clutch hand lever to vertical position.

(*f*) Release the hoist drum brake foot pedal (8, fig. 37) and pull back on the hoist shaft clutch hand lever (6) and raise the dragline bucket as far as possible but not so far that the dump cable socket pulls in to the boom point pulleys. Depress and latch the hoist drum brake foot pedal and push the hoist shaft clutch hand lever to the vertical position.

(*g*) Make sure that the boom (3, fig. 48) is not resting on the boom support (6) and that there is clearance between the boom and the tool and battery box (7).

(*h*) Stop the revolving frame (par. 64). For added safety while traveling, push the front drum clutch hand lever forward and pull back on the hoist shaft clutch hand lever and the engine clutch hand lever.

(*i*) Carefully operate and travel the carrier (par. 77) to the new location.

(*j*) If a long move is anticipated and it is necessary to remove the front end attachment, unreeve the drag cable (par. 15*f*) and hoist cable (par. 15*g*) and remove the crane boom (par. 10*d*).

79. Moving With Shovel Boom Installed

a. General. If the crane-shovel is to be moved only a short distance, the shovel boom need not be removed. If a long move is anticipated, it is necessary to remove the shovel boom and transport it separately.

Note. Before moving the crane-shovel, check with proper authority for possible overall weight or length restrictions along the route.

b. Stowing Outriggers. Retract and stow the outriggers as instructed in paragraph 66*e*.

c. Installing Rear Outrigger Support. If the rear outrigger support has been removed, install it (par. 66*g*) and carry it to the new location.

d. Recessing Gantry. Recess the gantry (1, fig. 50) as instructed in paragraph 66*i*.

e. Removing Floodlights. To provide more clearance, remove the upper floodlights (2, fig. 50) as instructed in paragraph 152*b*.

f. Moving With Shovel Boom Installed.

(1) Release the hoist drum brake foot pedal (8, fig. 37) and, at the same time, pull back on the hoist shaft clutch hand lever (6) to pull the dipper forward and upward. Simultaneously, release the front drum brake foot pedal (10) to let the dipper handle run out by gravity. As soon as the dipper is up as high as it will go and the dipper handle is fully extended, depress and latch both brake pedals and push the hoist shaft clutch hand lever to the vertical position.

(2) Pull up the swing lock foot lever (9). Push the intermediate shaft clutch hand lever (3) forward and swing the dipper (5, fig. 50) and boom (3) over the boom support (7). If necessary to raise the boom in order to have the dipper handle (4) clear the boom support, pull back on the independent boom hoist clutch hand lever (7, fig. 37). Push down on the swing lock foot lever when the boom and dipper handle are spotted.

(3) Push the independent boom hoist clutch hand lever (7) forward and lower the boom (3, fig. 50) to within about 3 inches of the tool and battery box (8). The dipper handle (4) will be centered in the boom support (7). Make sure that the dipper trip lever (6) and cables are on the outside of the boom support as the boom is being lowered. Pull the independent boom hoist clutch hand lever to the vertical, neutral, position. Make sure that the dipper handle is not resting on the boom support.

(4) Stop the revolving frame (par. 64). For added safety while traveling, pull back the engine clutch hand lever (1, fig. 37), the hoist shaft clutch hand lever, and the front drum clutch hand lever.

(5) Carefully operate and travel the carrier (par. 77) to the new location.

(6) If a long move is anticipated, it will be necessary to remove the shovel front end attachment (par. 16*c*).

80. Moving With Back Hoe Boom Installed

a. General. If the crane-shovel is to be moved only a short distance, the back hoe boom need not be removed. If a long move is anticipated, it is necessary to remove the back hoe boom and transport it separately.

Note. Before moving the crane-shovel, check with proper authority for possible overall weight or length restrictions along the route.

b. Stowing Outriggers. Retract and stow the outriggers as instructed in paragraph 66*e*.

c. Installing Rear Outrigger Support. If the rear outrigger support has been removed, install it (par. 66*g*) and carry it to the new location.

d. Recessing Gantry. Recess the gantry (1, fig. 52) as instructed in paragraph 66*i*.

e. Removing Floodlights. To provide more clearance, remove the upper floodlights (2, fig. 52) as instructed in paragraph 152*b*.

f. Moving With Back Hoe Boom Installed.

(1) Release the hoist drum brake foot pedal (8, fig. 37) and pull the hoist shaft clutch hand lever (6) back, raising the boom and handle. As the bucket clears the ground, release the front drum brake foot pedal (10) slowly to let the bucket and handle swing out to the maximum reach position of the boom point. Push the hoist shaft clutch hand lever (6) to the vertical position; use the hoist drum brake foot pedal (8) to maintain the boom position, and the front drum brake foot pedal (10) to prevent excess cable from unwinding from the drum.

(2) Pull up the swing lock foot lever (9). Push the intermediate shaft clutch hand lever (3) to swing the boom (4, fig. 52) to the left and spot the boom over the boom support (7). Push down the swing lock foot lever.

(3) Perform the following operations slowly and cautiously. Push the independent boom hoist clutch hand lever (7, fig. 37) forward to let the hoe mast (3, fig. 52) fall forward while, at the same time, pulling back on the hoist shaft clutch hand lever (6, fig. 37) and releasing the hoist drum brake foot lever (8) to lower and maintain the boom position over the boom support (7). Allow the boom to lower until the drag cable (6, fig. 52) is within, but not touching, the boom support. Depress and latch the hoist drum brake foot pedal and return the independent boom hoist clutch hand lever and the hoist shaft clutch hand lever to vertical position.

(4) Stop the revolving frame (par. 64). For added safety while traveling, pull back the engine clutch hand lever and the hoist shaft clutch hand lever. Push the hoist shaft clutch hand lever forward.

(5) Carefully operate and travel the carrier (par. 77) to the new location.

(6) If a long move is anticipated, it will be necessary to remove the back hoe front end attachment (par. 18*c*).

Section V. OPERATION OF MATERIAL USED IN CONJUNCTION WITH CRANE-SHOVEL

81. General

A fire extinguisher is located in the cab of the revolving frame and the carrier. The fire extinguisher is a vaporizing liquid type, pump operated, and uses carbon tetrachloride. The capacity of the fire extinguisher is 1 quart. This fire extinguisher is recommended and suitable for extinguishing fires on engines and electrical accessories.

82. Fire Extinguishers

a. Operation.

(1) In case of fire, turn the pump handle to the left, or counterclockwise, to release it from its locked position.

(2) Hold a finger over the outlet nozzle and work the pump handle two or three times, first with the outlet nozzle pointed up, and then with the nozzle pointed down. This operation builds up pressure in the air chamber and forces the fluid to flow in a strong, steady stream when it is released.

(3) Continue to work pump handle up and down and direct the stream of the fluid on the fire at the base of the flame.

Warning: Do not attempt to extinguish a fire in electrical equipment with water or other fluids that will conduct electricity.

b. Refilling and Maintenance. Refer to TM 5–687 and to TM 9–1799 for refilling and maintenance instructions on fire extinguishers.

Section VI. OPERATION UNDER UNUSUAL CONDITIONS

83. Operation in Extreme Cold (Below 0° F.)

Operation in extremely cold temperatures requires careful inspection and checking of the lubrication, cooling, and electrical systems, as well as adjustment of the equipment in general. For safe operation of the crane-shovel, the following instructions should be carefully observed:

a. Care and General Handling.

Warning: Personnel should use care to keep from spilling fuel, coolant, or other liquids upon themselves. Also, exposed parts

of the body should not come in contact with metal during extremely cold temperatures, as serious and painful injury may result.

(1) The engines should be allowed to idle for a reasonable length of time after starting, to warm up slowly. Particular attention should be paid to the readings of all gages, immediately after starting. After the warmup period, the oil pressure gage should indicate a normal pressure of 26 psi for the revolving frame engine and 40 psi for the carrier engine. Engine coolant temperature should increase gradually during the warmup period. Extremely low reading on the temperature gage after a reasonable warmup period may indicate trouble and should be investigated.

(2) Personnel should be especially careful when operating equipment during extremely cold weather to prevent sudden shock loads and jerky handling, which might strain the machine and cause cracks in the metal. All operations must be started carefully at slow speed.

b. Lubrication. If it is impossible to keep the crane-shovel in a heated inclosure, drain the oil from the engine crankcases as soon as the engines have stopped. Store the oil in a warm place, if possible. If a heated place is not available, preheat the oil before putting it in the crankcases. A warning tag should be placed in a conspicuous place in the operator's and the driver's cab to warn personnel that the crankcases are empty. Should no facilities be available for heating the oil, dilute the oil in the engine crankcases with gasoline, if the crane-shovel is to be parked unprotected for a period of more than 3 hours. Dilute each quart of lubricating oil with one-half pint of gasoline. Turn the engines over several times to thoroughly mix the oil and diluent.

Caution: If oil dilution is used, the oil consumption will be increased and a frequent check of the oil level is necessary.

c. Fuel System. Fuel tanks should be kept as full as possible at all times to minimize the volume of air from which moisture can condense. If the presence of water is suspected in the fuel supply, strain all the fuel through a chamois skin or other suitable strainer that will prevent passage of water. Remove and clean the fuel sediment bowl daily.

Warning: A metallic contact should be maintained between the container and the fuel tank while transferring fuel.

d. Cooling System. Before pouring antifreeze solution into the radiators, observe these precautions.

(1) Drain and flush the cooling systems as described in paragraph 178*a*(1) (*a*) and *b*(1) (*a*).

(2) Inspect the engine system for leaks and damaged condition. Replace excessively worn, rotted, or damaged hose connections. Make sure that all clamps are tight and that draincocks are properly closed.

(3) Lubricate the water pump (LO 5–9513–2).

(4) Keep the radiator sufficiently covered to maintain coolant temperatures between 150° and 175° F. At temperatures below —20° F., drain the contents of the cooling system into clean containers, after stopping the engine, and warm the coolant and refill before starting again.

(5) Check the antifreeze solution in the cooling system with a hydrometer. Add antifreeze if necessary. When filling the radiator with antifreeze solution, refer to table II, showing the percentage of antifreeze required for protection at the temperature indicated.

Table II. Freezing Points, Composition, and Specific Gravities of Military Antifreeze Materials

Lowest expected ambient temp°F.	Pints of inhibited glycol per gal of coolant[1]	Compound, Antifreeze, Artic[2]	Ethylene glycol coolant solution specific gravity at 68°F. [3]
+20	1½.....	Issued full-strength and	1.022
+10	2.....	ready mixed for 0° to	1.036
0	2¾.....	—65°F. temperatures for	1.047
—10	3¼.....	both initial installation	1.055
—20	3½.....	and replenishment of	1.062
—30	4.....	losses.	1.067
—40	4¼.....		1.073
—50	Artic Antifreeze	DO NOT DILUTE WITH	
—60	preferred.	WATER OR ANY	
—75		OTHER SUBSTANCE.	

[1] Maximum protection is obtained at 60 percent by volume, that is 4.8 pints of ethylene glycol per gallon of solution.

[2] Military Specification MIL–C–11755 Arctic type, nonvolatile antifreeze compound is intended for use in the cooling system of liquid-cooled internal combustion engines for protection against freezing primarily in Arctic regions where the ambient temperature remains for extended periods of time close to —40°F or drops below, to as low at —90°F.

[3] Use an accurate hydrometer. To test hydrometer, use 1 part ethylene glycol type antifreeze to 2 parts water. This should produce a hydrometer reading of 0°F.

Note: Fasten a tag near the radiator filler cap indicating the type of antifreeze.

e. Special Battery Care. Special battery care is needed to prevent the loss of energy in subzero temperatures.

(1) Keep the battery fully charged (1.275 to 1.300 specific gravity) at all times.

Caution: Unless the engine is running, or the battery is immediately charged, do not add water in subzero temperatures.

(2) In extremely cold temperatures, remove the battery and place in a heater shelter when not in use.

f. Electrical System. Keep all wiring connections and battery terminals tight and free of snow and ice.

(1) Check the ignition coil for proper spark. Replace coil and condenser if spark is weak. Properly clean and adjust the distributor points. See that the spark plugs are clean and properly adjusted. Check the timing and adjust if necessary (par. 147*a*(3)).

(2) Check the light connections for tightness and make sure that there is no moisture around the sockets. Tighten any loose connections and wipe off moisture with a clean, dry cloth.

g. Starting.

(1) Turn the engine over a few times with the handcrank before starting in order to ease the strain on the starter and battery.

(2) Keep the entire crane-shovel as free as possible of ice and snow.

84. Operation in Extreme Heat

a. General. The engines will require a general check at short intervals to make sure that all adjustments are correct and all parts of the crane-shovel are in proper order.

b. Lubrication. Check the oil level of the engine crankcases frequently. Lubricate according to LO 5–9513–3.

c. Cooling System. If the engine coolant tends to overheat, proceed as follows:

(1) Clean the cooling system (par. 178*a*(3)).

(2) Inspect all radiator hoses and replace if not in good condition.

(3) Replace the engine thermostat with one of a lower heat range to increase the flow of coolant.

(4) Allow the engine to slow down and idle a few minutes before turning off the ignition switch.

d. Batteries. Make frequent checks of the fluid level of the batteries.

85. Operation in Dusty or Sandy Areas

a. General. Operation of the crane-shovel when there is an unusual amount of dust or grit creates difficulties which only the most careful inspection, precaution, and maintenance can counter-

act. Dust or sand penetrates most parts of the crane-shovel normally protected under ordinary conditions. Special attention must be given to all systems and all moving parts containing bushings and bearings. The crane-shovel should be positioned, while working, so that its most protected side faces the wind. All doors, covers, and windows, with the exception of the doors at and opposite the revolving frame engine radiator, should be closed as tightly as possible, to protect against infiltrations of sand and dust. Keep the crane-shovel in an inclosure when not being operated, if possible. Cover with tarpaulins, if an inclosure is not available. Compressed air should be used to clean parts inaccessible by hand, when its use would cause no damage to the parts.

b. Lubrication.

(1) Engine crankcase oil should be checked twice daily for the presence of dirt and other foreign matter.

(2) Drain and refill the engine crankcase if the oil is dirty (LO 5–9513–3).

(3) Clean the crankcase breather cap at least every 4 hours.

(4) Make a frequent visual inspection of all open gears for sand or other foreign matter which would cause unnecessary wear.

(5) Wash gears thoroughly, if necessary, with an approved cleaning solvent and apply new lubricant (LO 5–9513–3).

Caution: Lubricate frequently but avoid applying excessive amounts of lubricant under sandy or dusty conditions. Excessive grease will attract grit and dirt and will cause unnecessary wear of gears and bushings. All oil or grease, when spilled, should be wiped up immediately. A new oil filter element must be installed in the oil filter each time the engine crankcase oil is changed.

c. Fuel System.

(1) Remove the sediment bowl of the fuel pump, and clean the screen after at least every 4 hours of operation.

(2) The carburetor air cleaner should be cleaned at least every 4 hours. Make sure that the air cleaner cover is tightly secured to prevent entrance of dust and sand to the carburetor.

(3) Keep the ventholes in the fuel tank filler cap open to insure proper operation of the fuel system. If there is any reason to believe that the fuel supply contains dirt or sand, strain the fuel through a chamois skin and flush out the tank.

Caution: Use a good metallic conductor between the container and the fuel tank to ground the static electricity.

d. Cooling System.

(1) Inspect the radiator core frequently to determine whether it is free of dirt. Compressed air or water, applied from the rear, can be used to drive foreign matter from the fins and between the tubes. Inspect all radiator hose connections for tightness and all hoses for deterioration. Replace the hoses if necessary.

(2) Inspect the coolant daily for proper level and for presence of dirt or sand, which might prevent proper circulation of the coolant and cause the engine to overheat. Flush the cooling system, if necessary, and refill the radiator.

e. Electrical System. Blow dust or sand from wiring and batteries to prevent short circuits. Be sure that battery filler caps are tight. Exercise extreme care when filling the battery to prevent foreign matter from entering the cells.

86. Operation in Salt Water Areas

a. General. If the crane-shovel is operating in or near salt water, all exposed surfaces should be covered with paint (par. 94). Exposed metal parts that cannot be painted should be kept well coated with oil or grease. Any part in actual contact with salt water should be flushed with fresh water at the end of the operation period, dried, and lubricated.

b. Lubrication. Dry and lubricate parts that have been flushed with fresh water in accordance with current lubrication order.

c. Fuel System. Keep the fuel tanks free from corrosion and repaint as necessary.

d. Cooling System. Keep the radiators free from corrosion and repaint as necessary. Check hose clamps for corrosion. Replace corroded clamps.

e. Electrical System.

(1) If corrosion is evident on the spark plugs or terminals, clean and polish them with sandpaper to provide proper contact.

(2) Remove the cables from the batteries, clean them, and cover their contact surfaces with a thin film of chassis lubricant.

(3) Clean distributor contact points frequently, removing all corrosion.

87. Operation in High Humidity

a. General. Keep all doors, windows, and covers closed when the crane-shovel is not in use. If possible, place tarpaulins over unprotected parts. Place a suitable cover over the carrier radiator opening. When the crane-shovel is in operation, keep all doors and windows open for ventilation. Clean rust from parts where paint is chipped or worn and repaint.

b. Lubrication. Shorten the intervals specified on lubrication order to compensate for conditions of high humidity.

c. Fuel System. Keep the fuel tanks full to avoid condensation. Make sure that fuel tank and engine crankcase fill caps are tightly closed. Clean the fuel sediment bowls at more frequent intervals.

d. Cooling System. The entire cooling system should be clean to allow free circulation of the coolant.

e. Electrical System. Wires, terminals, and engine electrical accessories must be kept dry and free of moisture and corrosion.

88. Operation at High Altitudes

The crane-shovel will, in general, operate satisfactorily at high altitudes without special attention. It may be necessary to adjust the engine carburetor to give a leaner fuel mixture.

CHAPTER 3

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. ORGANIZATIONAL TOOLS AND EQUIPMENT

89. General

The tools and equipment listed in this section are those required to perform organizational maintenance on the crane-shovel. Standard mechanic's handtools and on-equipment tools are not enumerated in this section.

90. Tool and Publication Set

The tool and publication set listed in appendix III lists the tools required by the operator for the organizational maintenance of the crane-shovel.

91. Special Organizational Maintenance Tools and Equipment

The tools and equipment in table III bearing identification numbers are listed in Department of the Army supply manuals, as shown in appendix I. Table III lists only special tools and equipment necessary to perform the operations described in this chapter. The table is included for information only and is not to be used for requisitioning tools or equipment.

Section II. LUBRICATION AND PAINTING

92. General Lubrication Information

a. The lubrication order prescribes first and second echelon lubrication maintenance for the Crane-Shovel, Bay City Model 150M.

b. A lubrication order is published for each item of equipment. The lubrication order shown in figure 53 is a reproduction of an approved lubrication order for this crane-shovel. For the current lubrication order, refer to DA Pam 310–4.

c. Lubrication orders prescribe approved first and second echelon lubrication procedures. The instructions contained therein are mandatory.

Table III. Special Organizational Maintenance Tools and Equipment

Item	Stock No.	References		Use
		Fig.	Par.	
EXTRACTOR, screw, standard length, single, MIL-E-1254, size No. 3, screw dia 5/16"—7/16", drill dia 5/32".	5120-240-5221	103	189	Removing threaded studs from pulley hub and bushing.
WRENCH, tap, T-handle, 1/16"—1/4", Greenfield No. 328 or equal.	5120-448-2416	103	189	Handle for EXTRACTOR, screw.
PULLER, part of, TOOL SET, Tractor Maintenance, Owatonna No. CT-643, consisting of 38 items.	5180-596-1201	105	190	Pulling bearings.

93. Detailed Lubrication Information

a. Care of Lubricants. Store lubricants in containers that properly protect them from dirt, water, or any other foreign matter. Keep the equipment used to handle lubricants clean and free of dust and grit. When covers, caps, or plugs are removed from any containers or lubrication points on the equipment, protect the openings so that no foreign matter can enter.

b. Points of Application. Follow the detailed lubrication instructions given beneath each lubrication point illustration indicating procedures to be followed at each point. Aplpy lubricant indicated on the lubrication chart.

c. Cleaning. Use an approved cleaning solvent to clean all parts. Allow the cleaned parts to dry and wipe them off with a clean absorbent cloth. Reassemble the cleaned and dried parts as soon as possible. Do not keep the parts dry for long periods of time. Clean the lubrication fittings at the point of application before lubricating and immediately after, to avoid the accumulation of dust and dirt. During scheduled lubrication, normally, the only parts to be disassembled and reassembled are the air cleaners, oil filters, and sediment bowls.

d. Operation Immediately After Lubrication. Immediately after lubrication, start the revolving frame and carrier engines and check the oil pressure gages for proper operation. Inspect the oil filters, oil lines, and connections for possible leaks. Operate the revolving frame machinery a few minutes and then stop the machinery and the revolving frame engine. Check the oil level in the revolving frame engine crankcase, engine gearcase, bevel gearcase, worm case, bearing housing, and the independent boom hoist oil reservoir. Add oil if necessary. Travel the carrier a short distance and then stop the carrier and the carrier engine. Check the coil level in the carrier engine crankcase, transmission, transfer case, and the front and rear axle differentials. Add oil if necessary.

e. Air Cleaners. Check the oil level in the air cleaner base and refill if necessary. Every week, disassemble the air cleaner, clean it, wipe it off with a soft absorbent cloth, and refill with fresh oil. Refer to paragraph 161 for proper disassembly and reassembly procedures.

f. Crankcase Breathers. Weekly, remove entire unit, disassemble, wash in an approved cleaning solvent, wipe dry with a clean absorbent cloth, reassemble, and install. Reoil before completing installation. Refer to paragraph 184 for proper disassembly and reassembly procedures.

g. Oil Filters. Remove the plug at the bottom of the filter

LUBRICATION ORDER **LO5-9513-1**

22 October 1954

CRANE-SHOVEL, POWER UNIT, REVOLVING, TRUCK MOUNTED, PNEUMATIC TIRED, 6x6, TWO ENGINE DRIVE, GASOLINE DRIVEN, 10 TON, ½ CU YD, BAY CITY MODEL 150M

References: TB 5-9513-1, LO 5-9513-2, LO 5-9513-3, TM 5-9513

Intervals given are maximums for normal 10-hour day or 60-hour week operation. For abnormal conditions or activities, intervals shall be shortened to compensate.

Clean fittings before lubricating.

Relubricate after washing.

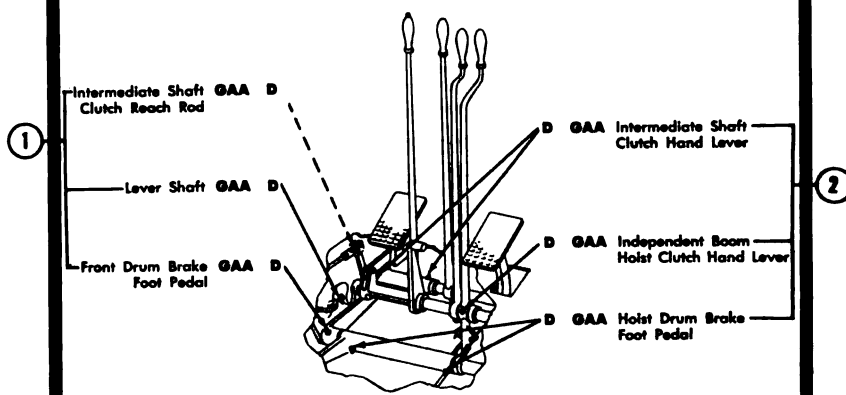
Clean parts with SOLVENT, Dry-Cleaning, or OIL, fuel, Diesel. Dry before lubricating.

Lubricate points indicated by dotted arrow shafts on both sides of equipment.

Drain tagline housing only when warm after operation; replenish and check level when cool.

—KEY—

LUBRICANT	CAPACITY	EXPECTED TEMPERATURE			
		Above +32°F	+32°F to −10°F	Below −10°F	
OE—OIL, Engine Heavy Duty		OE 30 or 9250	OE 10 or 9110	OES	½D—Twice Daily D—Daily W—Weekly
Tagline Housing	8 qts				
Other Points					
CW—LUBRICANT, Chain, Exposed Gear and Wire Rope, Type II		CWIIC	CWIIB	CWIIA	
GAA—GREASE, Automotive and Artillery					



REVOLVING FRAME CONTROLS

EMC 9513-53/1

Figure 53. Lubrication orders.

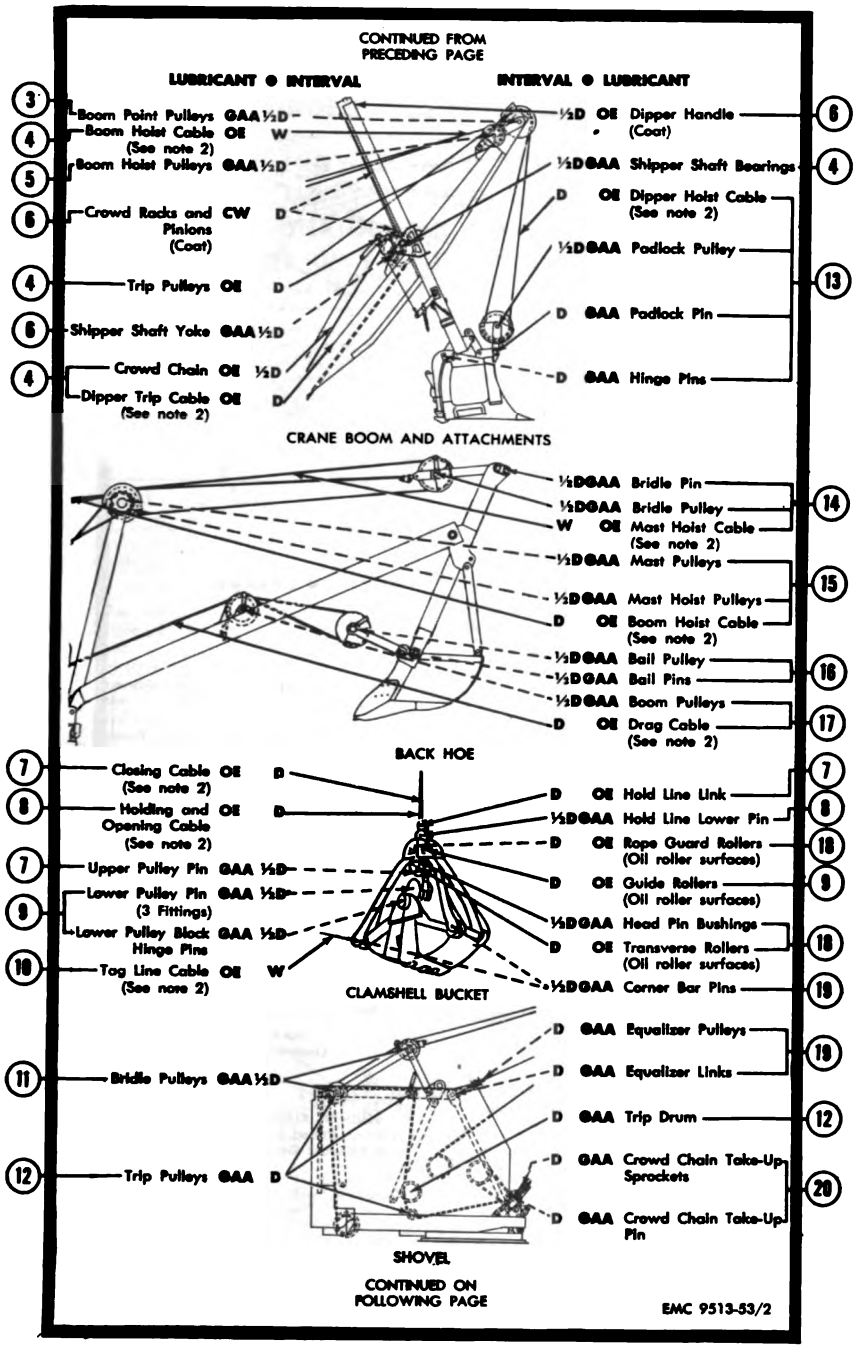


Figure 53—Continued.

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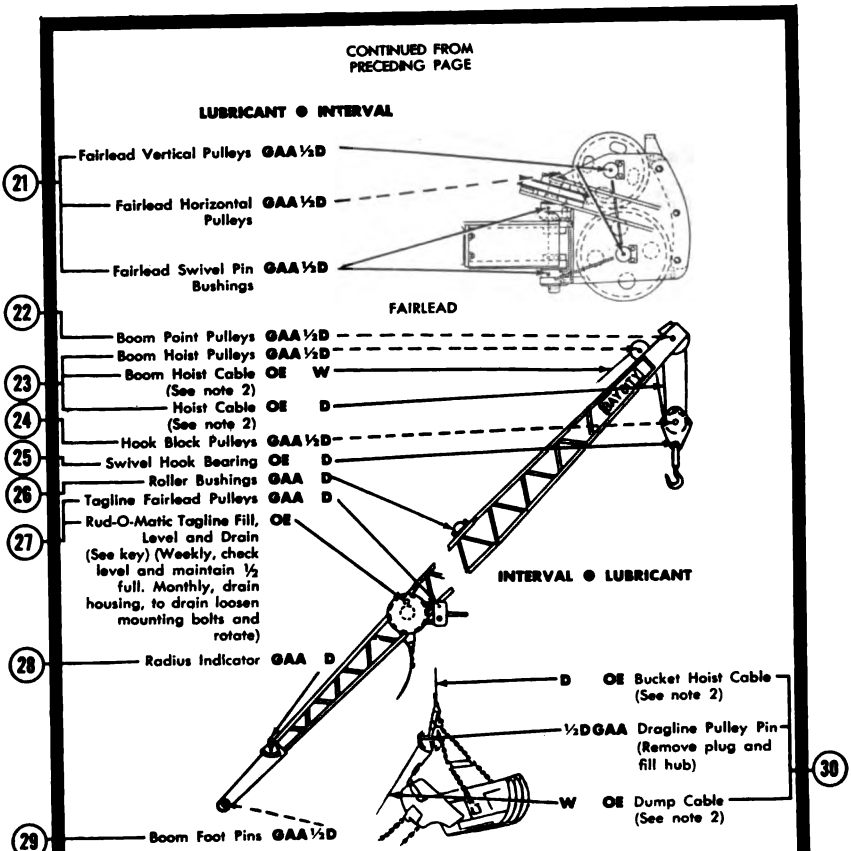


NOTES:

1. FOR OPERATION OF EQUIPMENT IN PROTRACTED COLD TEMPERATURES BELOW —10°F. Clean parts with SOLVENT, Dry-Cleaning, and drain the tagline housing. Relubricate with lubricants indicated in the key for below —10°F temperatures.

2. CABLES — Do not lubricate the drag line cable or any cables coming in contact with excavated material.

3. OILCAN POINTS—Every week lubricate pins, exposed springs, and adjusting screw threads with OE.

Copy of this Lubrication Order will remain with the equipment at all times; instructions contained herein are mandatory and supersede all conflicting lubrication instructions dated prior to the date of this Lubrication Order.

BY ORDER OF WILBER M. BRUCKER, SECRETARY OF THE ARMY:

MAXWELL D. TAYLOR,
General, United States Army,
Chief of Staff

OFFICIAL:

JOHN A. KLEIN,
Major General, United States Army,
The Adjutant General

EMC 9513-53/3

Figure 53—Continued.

LUBRICATION ORDER **LO5-9513-2**

22 October 1956

CRANE-SHOVEL, POWER UNIT, REVOLVING, TRUCK MOUNTED, PNEUMATIC TIRED, 6x6, TWO ENGINE DRIVE, GASOLINE DRIVEN, 10 TON, ½ CU YD, BAY CITY MODEL 150M

References: TB 5-9513-1, LO 5-9513-1, LO 5-9513-3, TM 5-5219, TM 5-9513

Intervals given are maximums for normal 10-hour day or 60-hour week operation. For abnormal conditions or activities, intervals shall be shortened to compensate.

Clean fittings before lubricating.

Relubricate after washing.

Clean parts with SOLVENT, Dry-Cleaning, or OIL, fuel, Diesel. Dry before lubricating.

Lubricate points indicated by dotted arrow shafts on both sides of equipment.

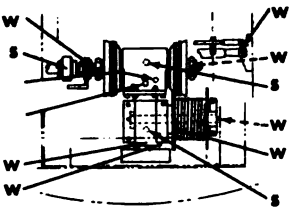
Drain crankcase and gear housings only when hot after operation; replenish and check level when cool.

—KEY—

LUBRICANT	CAPACITY	EXPECTED TEMPERATURE			INTERVALS
		Above +32°F	+32°F to −10°F	Below −10°F	
OE—OIL, Engine Heavy Duty		OE 30 or 9250	OE 10 or 9110	See Note 1	½D—Twice Daily
Crankcase	9 qts				D—Daily
Air Cleaner	¼ qt	OE 30 or 9250	OE 10 or 9110	OES	W—Weekly
Other Points					2W—Two Weeks
GO—LUBRICANT, Gear, Universal		GO 90	GO 75	GOS	Q—Quarterly
Engine Gear Case	10 qts				S—Semi-annually
Bevel Gear Case	2½ qts				
Worm Case	2 qts				
Bearing Housing	1½ qts				
Independent Boom Hoist Oil Reservoir	20 qts				
CW—LUBRICANT, Chain, Exposed Gear and Wire Rope, Type II		CWIIC	CWIIB	CWIIA	
WP—GREASE, Lubricating, Automotive and Industrial					
GAA—GREASE, Automotive and Artillery					

LUBRICANT ● INTERVAL

Clutch Shaft Bearing GAA W
Flexible Coupling GAA S (31)
Bevel Gear Case Fill GO
(See key)
Warm Case Fill GO
(See key)
Brake Wheel Bearing GAA W (32)
Warm Case Level W (33)
(Check level)



INTERVAL ● LUBRICANT

W GAA Control Reach Rod Bellcrank (34)
W GAA Clutch Shifter Collars (33)
S Bevel Gear Case Drain (Drain and refill)
W GAA Drum Shaft Bushings (34)
W Bevel Gear Case Level (Check level) (33)
S Worm Case Drain (Drain and refill) (34)

INDEPENDENT BOOM HOIST

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EMC 9513-53/4

Figure 53—Continued.

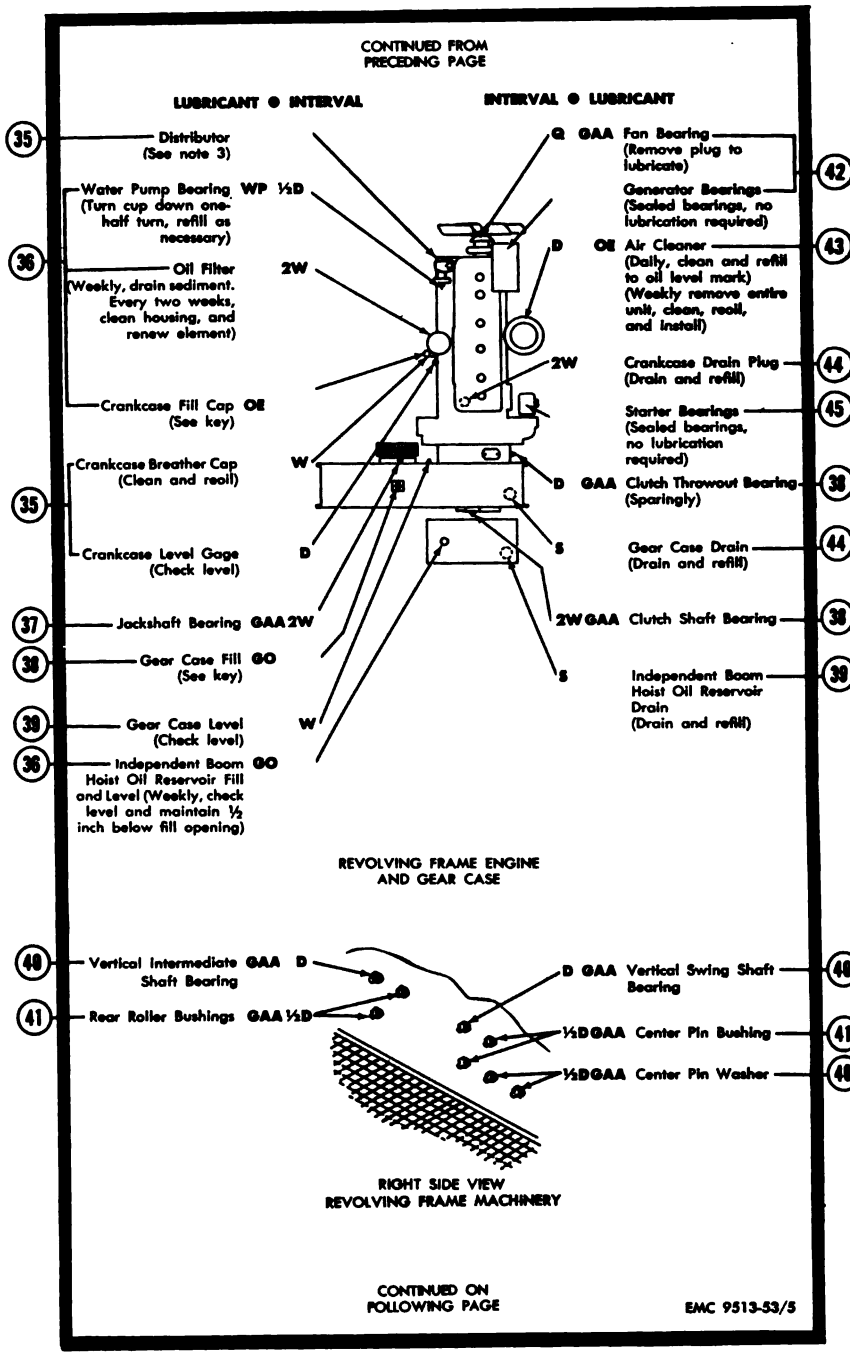

Figure 53—Continued.

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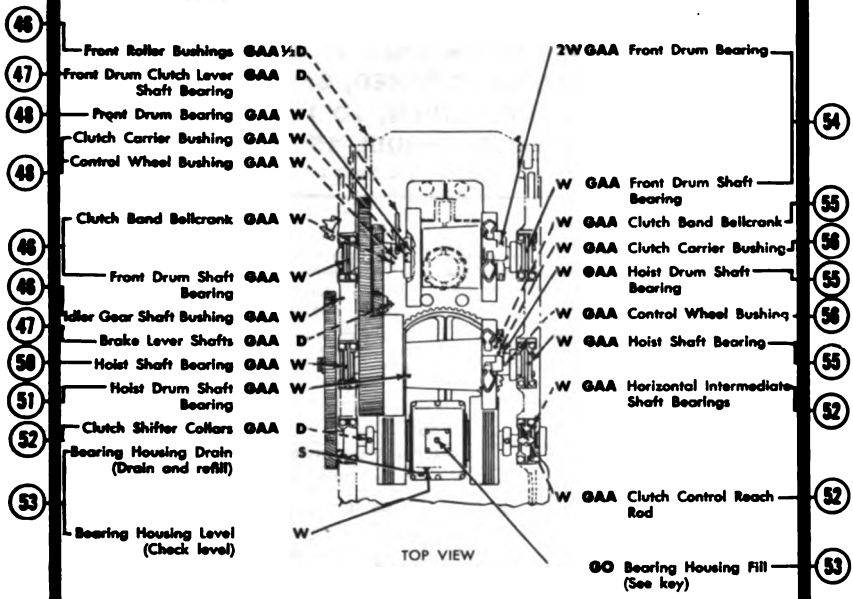

NOTES:

1. COLD WEATHER (When winterization kit is not available). Every 3 days, drain crankcase and refill to "FULL" mark with OE 10. Add 2 qts. of gasoline and run engine 5 minutes to mix. Mark the new level on the gage for future reference. CAUTION: Every ½ day check level and fill to "FULL" mark with OE 10. If the engine is to be shut down for ½ day or more, add 2 qts. of gasoline to reach new level mark and run engine 5 minutes to mix. WARNING: Diluent used is inflammable; do not service equipment near heater or open flame.

2. FOR OPERATION OF EQUIPMENT IN PROTRACTED COLD TEMPERATURES BELOW —10°F. Clean parts with SOLVENT, Dry-Cleaning, and drain the gear cases. Relubricate with lubricants indicated in the key for below —10°F temperatures.

3. DISTRIBUTOR — Quarterly, remove the plug in the distributor housing and refill the shaft oil reservoir with OE. Lubricate the wick located under rotor sparingly with OE.

4. DO NOT LUBRICATE — The governor.

5. OILCAN POINTS — Every week, lubricate control lever shaft bearings, clutch roller bearings, pins, linkage and clevises, clutch and brake linkage exposed springs, threads, adjusting screws, and swing lock with OE.

6. GEARS AND PINIONS — Daily, coat open gears and pinions with CW.

Copy of this Lubrication Order will remain with the equipment at all times; instructions contained herein are mandatory and supersede all conflicting lubrication instructions dated prior to the date of this Lubrication Order.

BY ORDER OF WILBER M. BRUCKER, SECRETARY OF THE ARMY:

MAXWELL D. TAYLOR,
General, United States Army,
Chief of Staff

OFFICIAL:

JOHN A. KLEIN,
Major General, United States Army,
The Adjutant General

EMC 9513-53/6

Figure 53—Continued.

LUBRICATION ORDER **LO5-9513-3**

22 October 1954

CRANE-SHOVEL, POWER UNIT, REVOLVING, TRUCK MOUNTED, PNEUMATIC TIRED, 6x6, TWO ENGINE DRIVE, GASOLINE DRIVEN, 10 TON, ½ CU YD, BAY CITY MODEL 150M

References: TB 5-9513-1, TB 5-5252-1, LO 5-9513-1, LO 5-9513-2, TM 5-9513

Intervals given are maximums for normal 10-hour day or 60-hour week operation. For abnormal conditions or activities, intervals shall be shortened to compensate.

Clean fittings before lubricating.

Relubricate after washing or fording.

Clean parts with SOLVENT, Dry-Cleaning, or Oil, fuel, Diesel. Dry before lubricating.

Lubricate points indicated by dotted arrow shafts on both sides of equipment.

Drain crankcase and gear housings only when hot after operation; replenish and check level when cool.

—KEY—

LUBRICANT	CAPACITY	EXPECTED TEMPERATURE			INTERVALS
		Above +32°F	+32°F to −10°F	Below −10°F	
OE—Oil, Engine Heavy Duty		OE 30 or 9250	OE 10 or 9110	See Note 1	D—Daily
Crankcase	10 qts				W—Weekly
Air Cleaner	1¾ qts	OE 30 or 9250	OE 10 or 9110	OES 10	2W—Two Weeks
Other Points					M—Monthly
GO—LUBRICANT, Gear, Universal		GO 90	GO 75	GOS	Q—Quarterly
Front Differential	11 qts				S—Semi-annually
Rear Differential	15½ qts (each)				
Transfer Case	2 qts				
Transmission	12 qts				
WB—GREASE, General Purpose No. 2		WB	WB	GAA	
GAA—GREASE, Automotive and Artillery					

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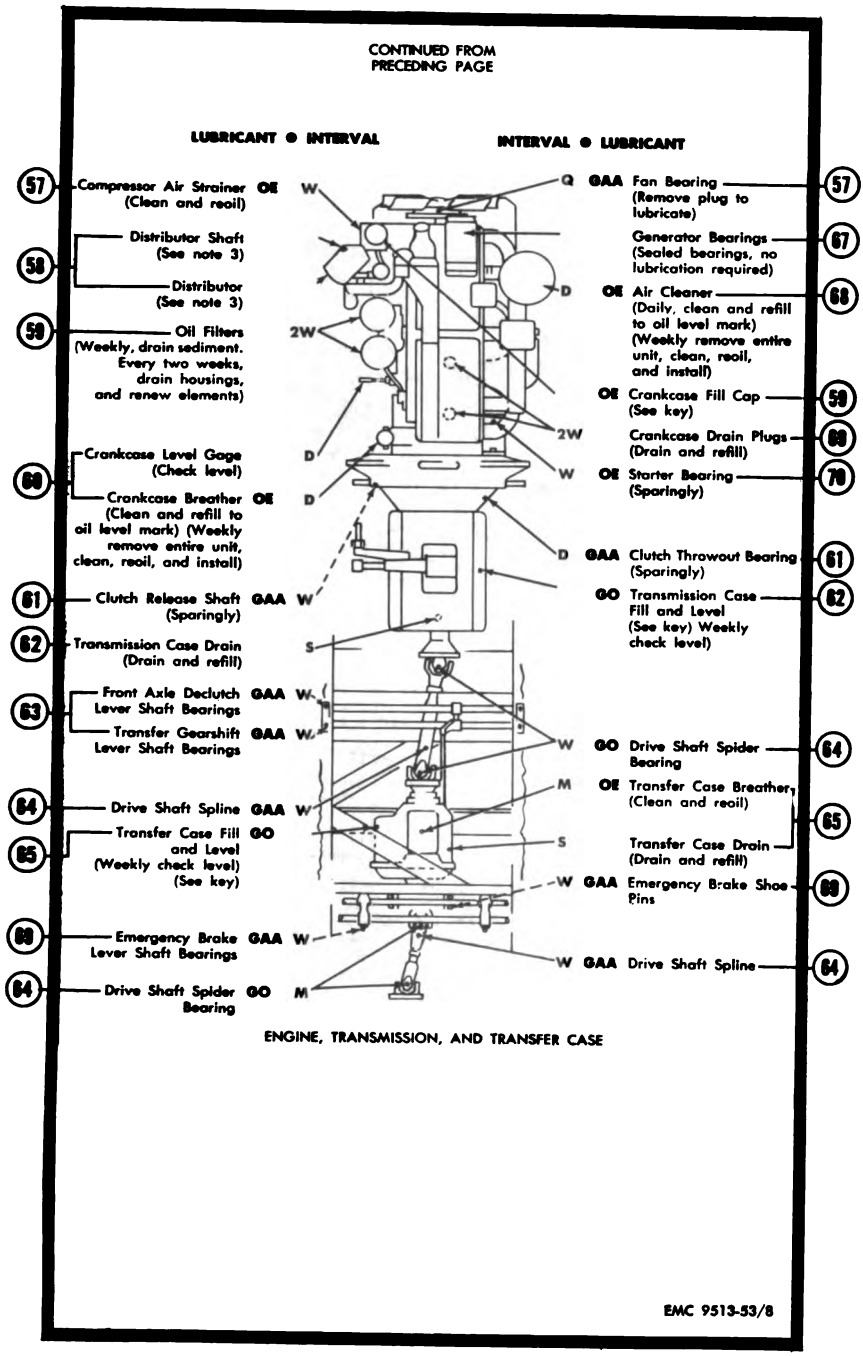
EMC 9513-53/7

Figure 53—Continued.



ENGINE, TRANSMISSION, AND TRANSFER CASE

Figure 53—Continued.

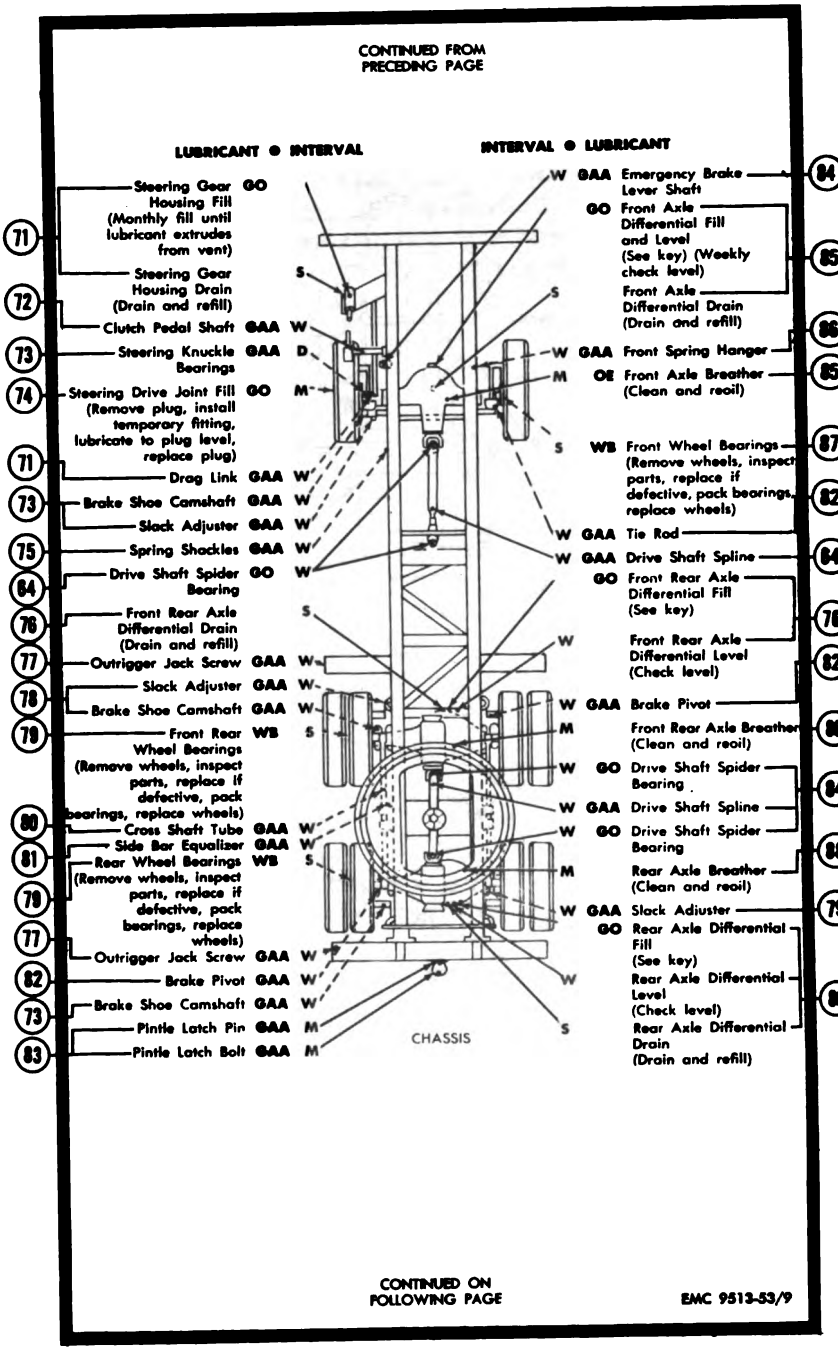


Figure 53—Continued.

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NOTES:

1. COLD WEATHER (When winterization kit is not available). Every 3 days, drain crankcase and refill to "FULL" mark with OE 10. Add 2 qts. of gasoline and run engine 5 minutes to mix. Mark the new level on the gage for future reference.

CAUTION: Every ½ day check level and fill to "FULL" mark with OE 10. If the engine is to be shut down for ½ day or more, add 2 qts. of gasoline to reach new level mark and run engine 5 minutes to mix.

WARNING: Diluent used is inflammable; do not service equipment near heater or open flame.

2. FOR OPERATION OF EQUIPMENT IN PROTRACTED COLD TEMPERATURES BELOW —10 F. Clean parts with SOLVENT Dry-Cleaning, and drain the gear cases. Relubricate with lubricants indicated in the key for below —10 F temperatures.

3. DISTRIBUTOR — Quarterly, remove the plug in the distributor housing and refill the shaft oil reservoir with OE. Lubricate the wick located under rotor sparingly with OE.

4. DO NOT LUBRICATE — Brake system air compressor and engine governor.

5. OILCAN POINTS—Every week, lubricate transmission rod joint shifter assemblies, interconnecting declutch gear shift, brake rods, pins, clevises, threads, exposed springs, ball joints, throttle and choke linkage, and adjusting screws with OE.

Copy of this Lubrication Order will remain with the equipment at all times; instructions contained herein are mandatory and supersede all conflicting lubrication instructions dated prior to the date of this Lubrication Order.

BY ORDER OF WILBER M. BRUCKER, SECRETARY OF THE ARMY:

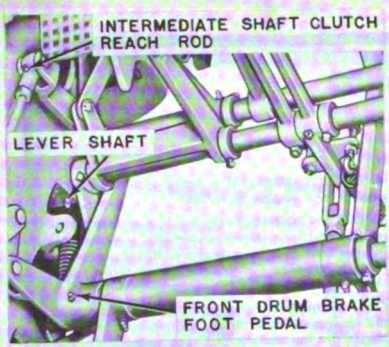
MAXWELL D. TAYLOR,
General, United States Army,
Chief of Staff

OFFICIAL:

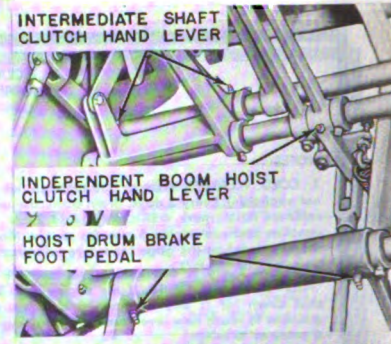
JOHN A. KLEIN,
Major General, United States Army,
The Adjutant General

EMC 9513-53/10

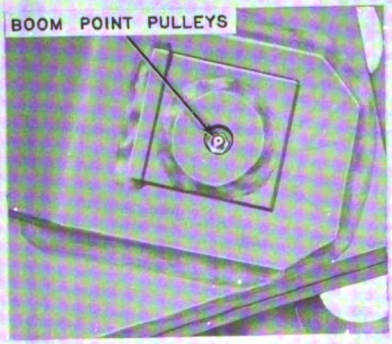
Figure 53—Continued.



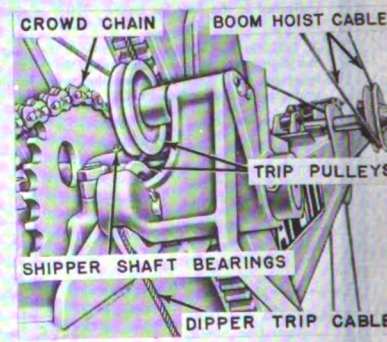
REFERENCE 1: Clean fittings (4) and apply lubricant through fittings.



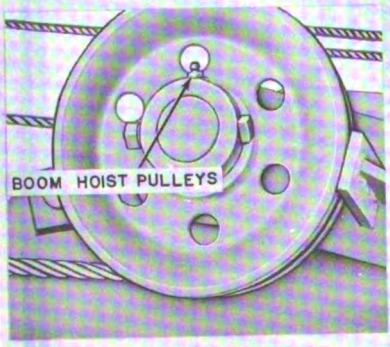
REFERENCE 2: Clean fittings (5) and apply lubricant through fittings.



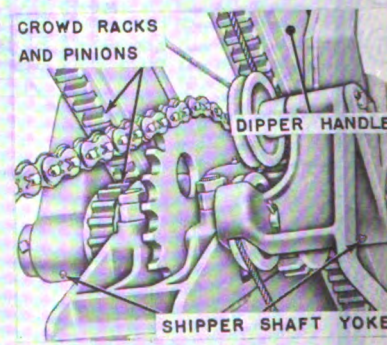
REFERENCE 3: Clean fittings (2) and apply lubricant through fittings.



REFERENCE 4: Clean fittings (2) and apply lubricant through fittings. Clean cables and chain and apply lubricant.



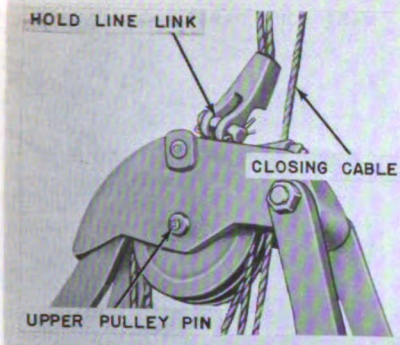
REFERENCE 5: Clean fittings (2) and apply lubricant through fittings.



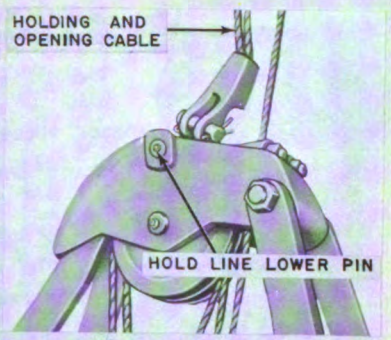
REFERENCE 6: Clean fittings (2) and apply lubricant through fittings. Apply lubricant to racks, pinions, and sides of handle.

EMC 9513-53/11

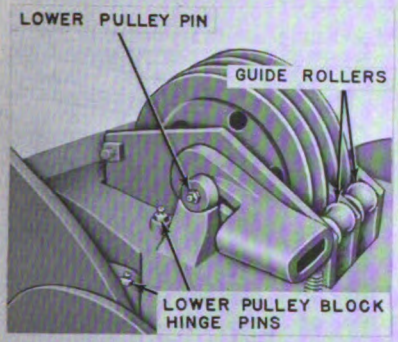
***Figure 53*—Continued.**



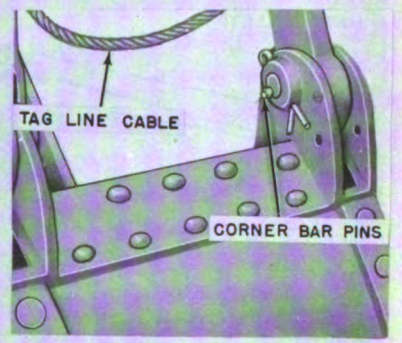
REFERENCE 7: Clean fittings (2) and apply lubricant through fittings. Clean cable and link and apply lubricant.



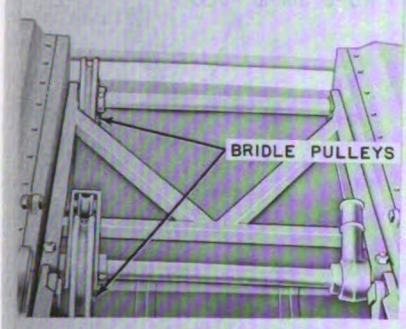
REFERENCE 8: Clean fitting and apply lubricant through fitting. Clean cable and apply lubricant.



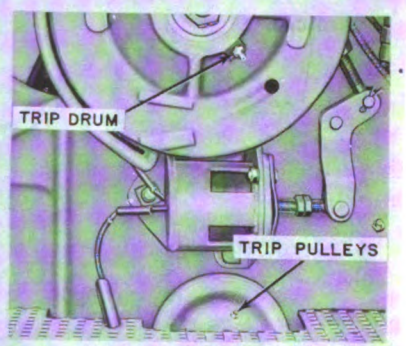
REFERENCE 9: Clean fittings (5) and apply lubricant through fittings. Apply lubricant to roller surfaces.



REFERENCE 10: Clean fittings (4) and apply lubricant through fittings. Clean cable and apply lubricant.



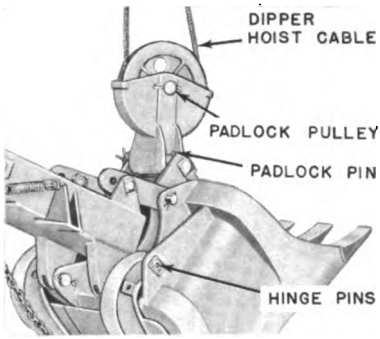
REFERENCE 11: Clean fittings (2) and apply lubricant through fittings.



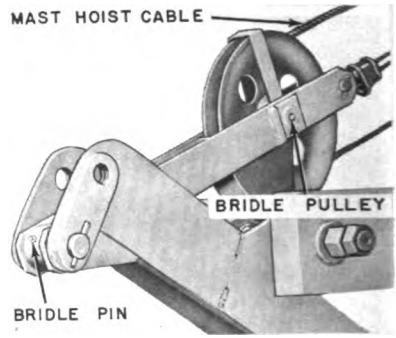
REFERENCE 12: Clean fittings (4) and apply lubricant through fittings.

EMC 9513-53/12

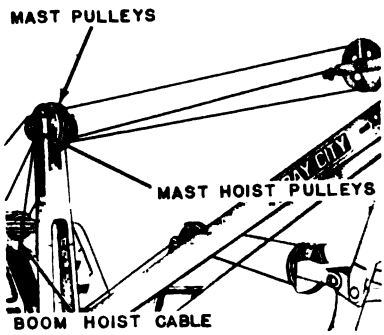
***Figure 53*—Continued.**



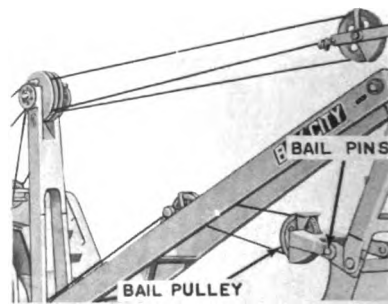
REFERENCE 13: Clean fittings (4) and apply lubricant through fittings. Clean cable and apply lubricant.



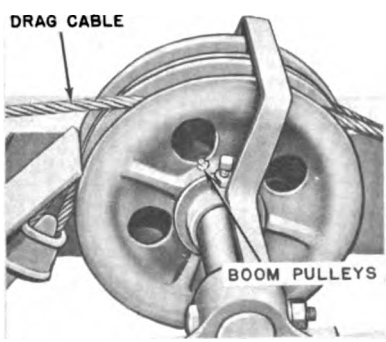
REFERENCE 14: Clean fittings (2) and apply lubricant through fittings. Clean cable and apply lubricant.



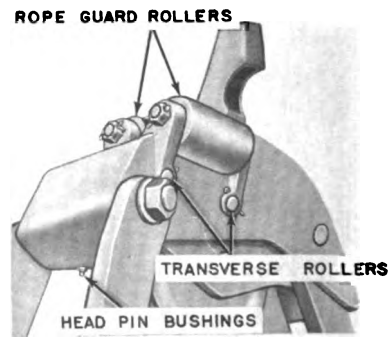
REFERENCE 15: Clean fittings (4) and apply lubricant through fittings. Clean cable and apply lubricant.



REFERENCE 16: Clean fittings (4) and apply lubricant through fittings.



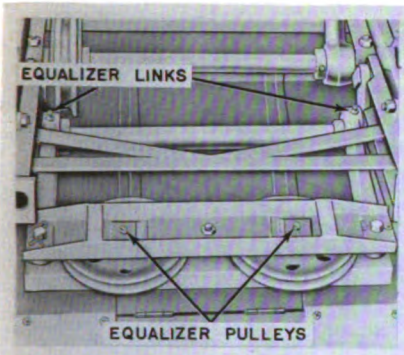
REFERENCE 17: Clean fittings (2) and apply lubricant through fittings. Clean cable and apply lubricant.



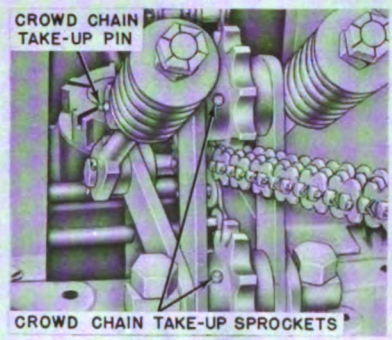
REFERENCE 18: Clean fitting and apply lubricant through fitting. Apply lubricant to roller surfaces.

EMC 9513-53/13

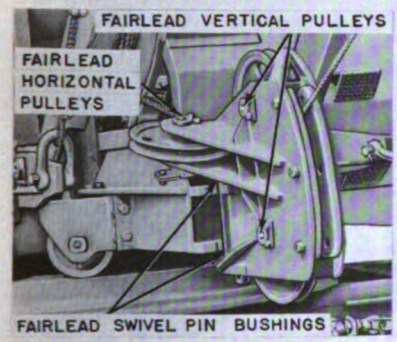
Figure 53—**Continued.**



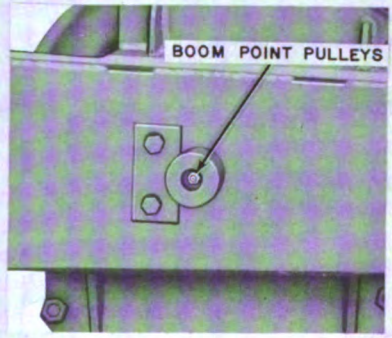
REFERENCE 19: Clean fittings (4) and apply lubricant through fittings.



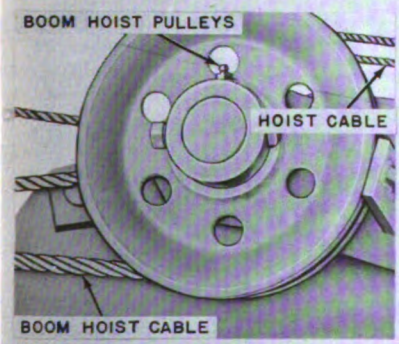
REFERENCE 20: Clean fittings (4) and apply lubricant through fittings.



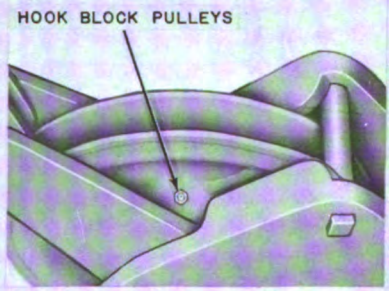
REFERENCE 21: Clean fittings (6) and apply lubricant through fittings.



REFERENCE 22: Clean fittings (2) and apply lubricant through fittings.



REFERENCE 23: Clean fittings (2) and apply lubricant through fittings. Clean cables and apply lubricant.



REFERENCE 24: Clean fittings (2) and apply lubricant through fittings.

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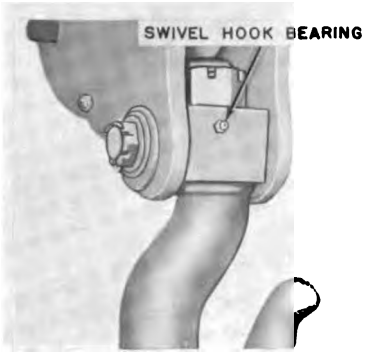
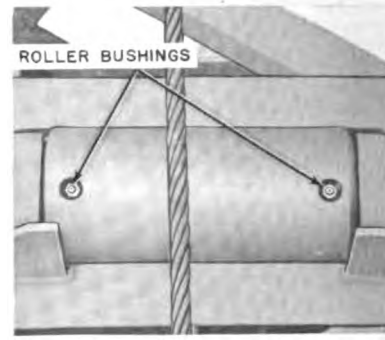
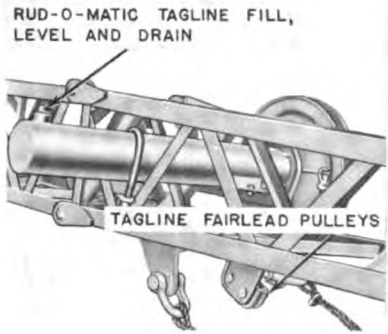
***Figure 53*—Continued.**



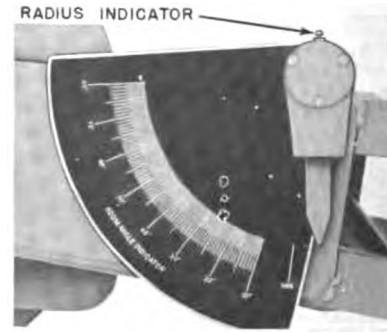
REFERENCE 25: Clean fitting and apply lubricant through fitting.



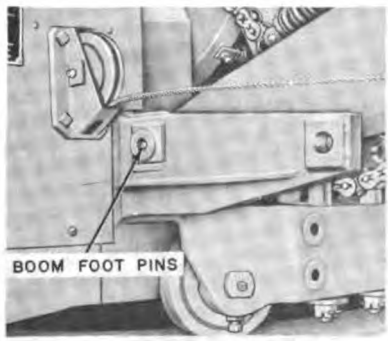
REFERENCE 26: Clean fittings (2) and apply lubricant through fittings.



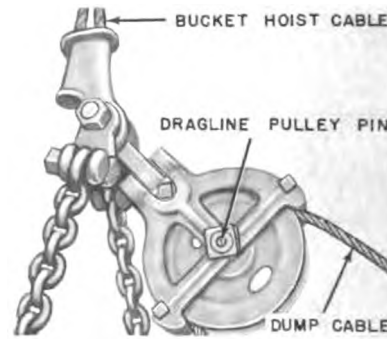
REFERENCE 27: Clean fittings (2) and apply lubricant through fittings. Loosen mounting bolts, rotate tagline, clean and remove plug to drain.



REFERENCE 28: Clean fitting and apply lubricant through fitting.



REFERENCE 29: Clean fittings (2) and apply lubricant through fittings.



REFERENCE 30: Clean fitting and apply lubricant through fitting. Clean cables and apply lubricant.

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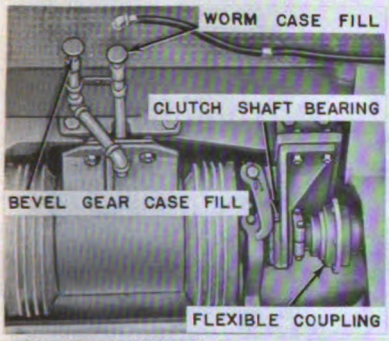
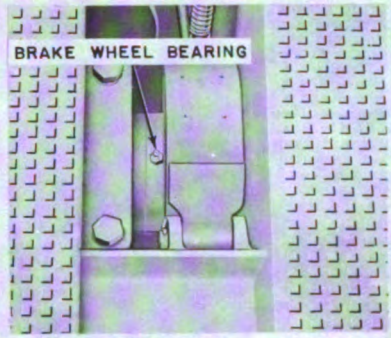
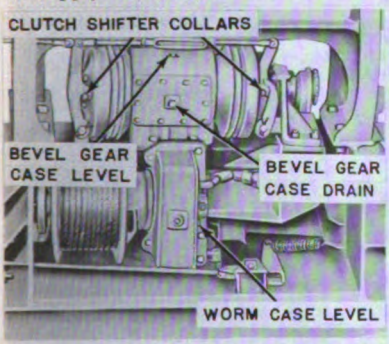
***Figure 53*—Continued.**



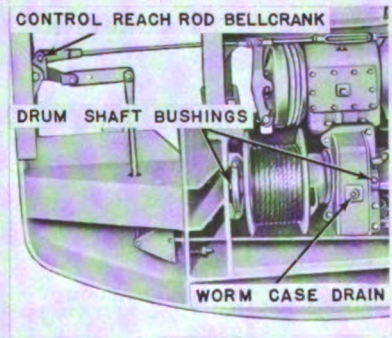
REFERENCE 31: Clean and remove caps and apply lubricant through holes. Clean fitting and apply lubricant through fitting. Remove coupling cover and apply lubricant.



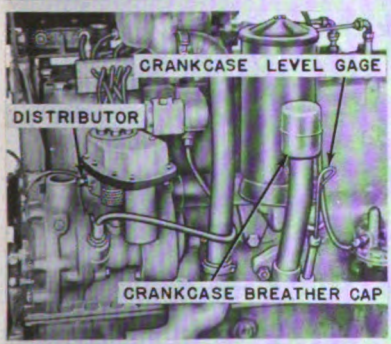
REFERENCE 32: Clean fitting and apply lubricant through fitting.



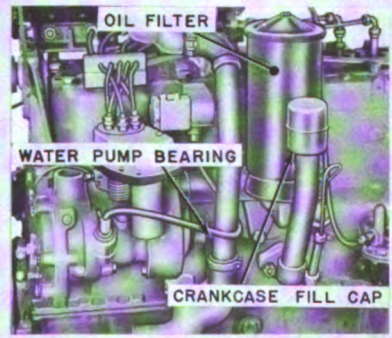
REFERENCE 33: Clean and remove side plugs to check levels. Remove bottom plug to drain. Clean fittings (2) and apply lubricant through fittings.



REFERENCE 34: Clean fittings (3) and apply lubricant through fittings. Clean and remove bottom plug to drain.



REFERENCE 35: Remove gage to check level. Remove cap, clean, apply lubricant, reinstall. Remove plug, fill distributor shaft reservoir. Remove cover, oil breaker cam wick sparingly.



REFERENCE 36: Drain and clean filter housing, replace element. Remove cap to fill. Turn cup down to lubricate, refill as necessary.

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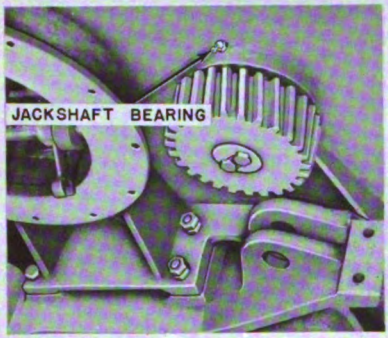
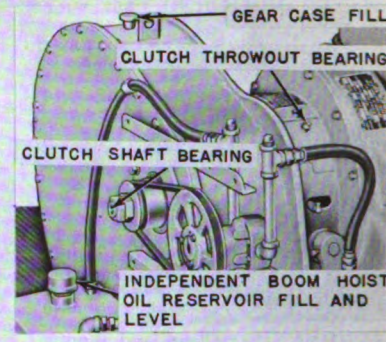
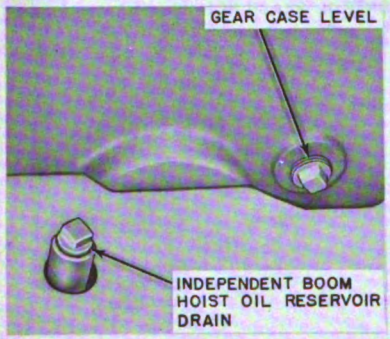
***Figure 53*—Continued.**



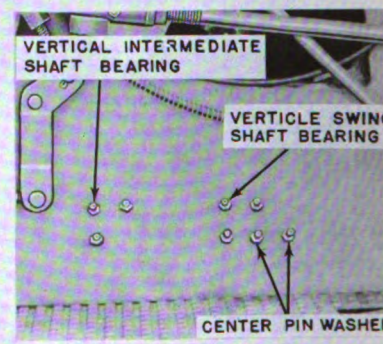
REFERENCE 37: Clean fitting and apply lubricant through fitting.



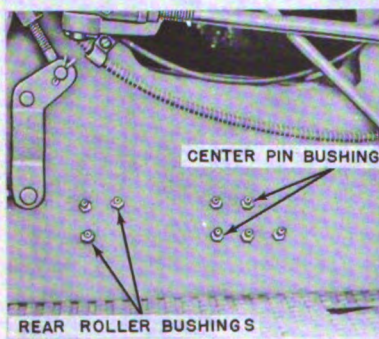
REFERENCE 38: Clean fittings (2) and apply lubricant through fittings. Clean and remove caps and apply lubricant through holes.



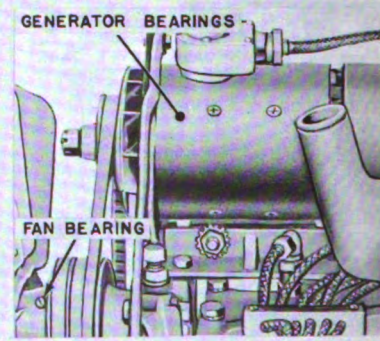
REFERENCE 39: Clean and remove side plug to check level. Remove bottom plug to drain.



REFERENCE 40: Clean fittings (4) and apply lubricant through fittings.



REFERENCE 41: Clean fittings (4) and apply lubricant through fittings.



REFERENCE 42: Clean and remove fan hub plug and apply lubricant. No lubrication required on generator bearings.

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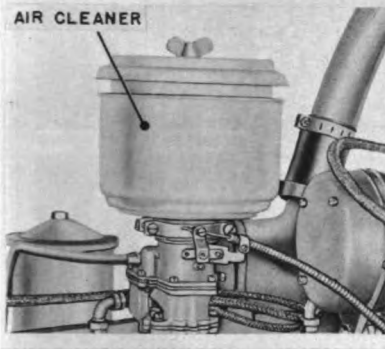
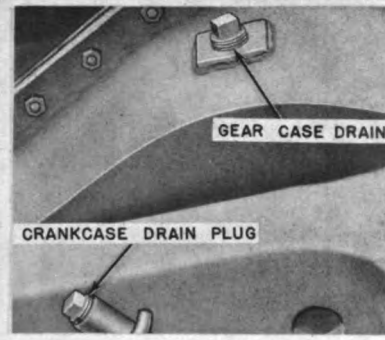
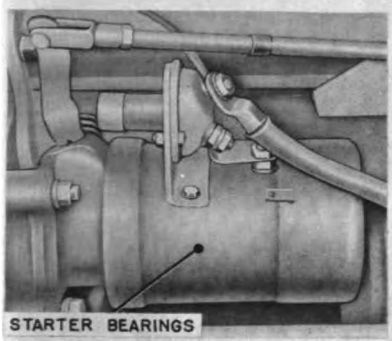
***Figure 53*—Continued.**



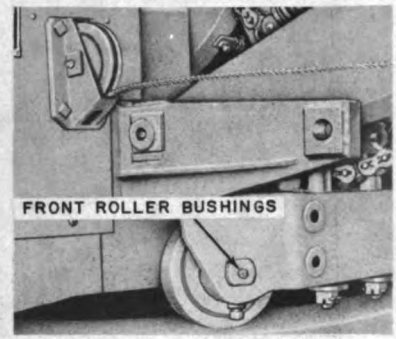
REFERENCE 43: Clean and refill to level mark.



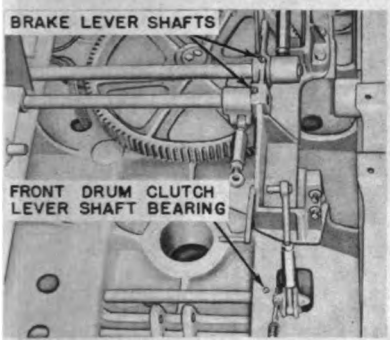
REFERENCE 44: Remove plugs (2) to drain.



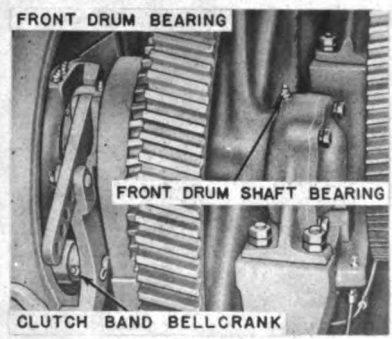
REFERENCE 45: No lubrication required on starter bearings.



REFERENCE 46: Clean fittings (2) and apply lubricant through fittings.



REFERENCE 47: Clean fittings (6) and apply lubricant through fittings.



REFERENCE 48: Clean fittings (4) and apply lubricant through fittings.

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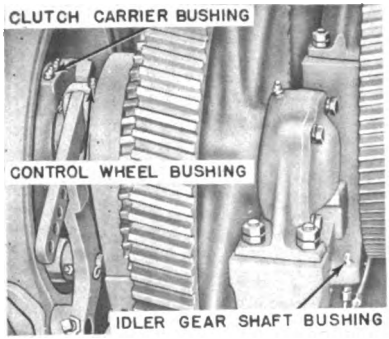
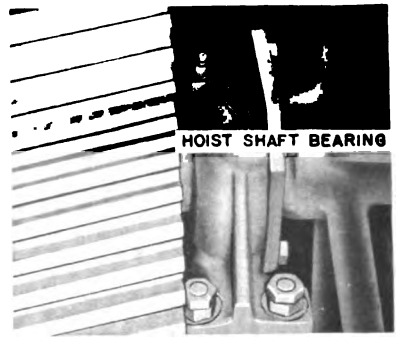
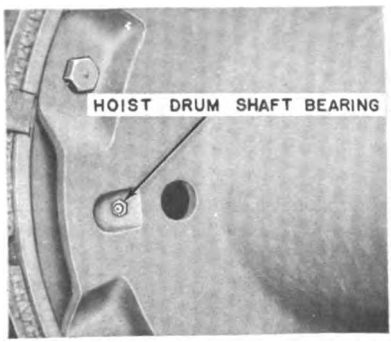
***Figure 53*—Continued.**



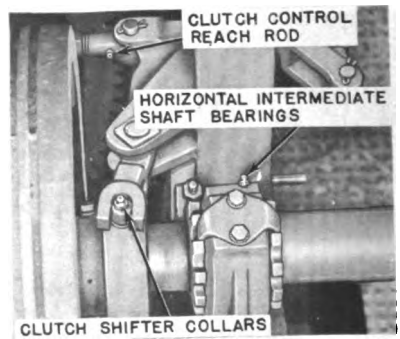
REFERENCE 49: Clean fittings (5) and apply lubricant through fittings.



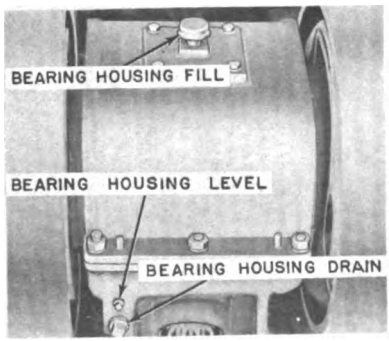
REFERENCE 50: Clean fitting and apply lubricant through fitting.



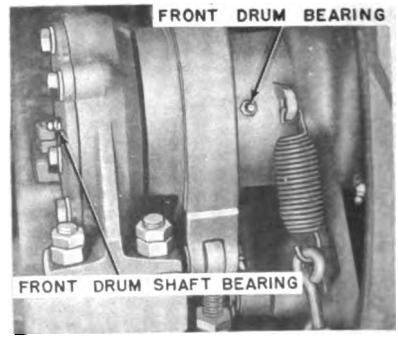
REFERENCE 51: Turn drum until fitting is accessible. Clean fitting and apply lubricant through fitting.



REFERENCE 52: Clean fittings (6) and apply lubricant through fittings.



REFERENCE 53: Clean and remove cap and apply lubricant through hole. Clean and remove plug to check level and to drain.



REFERENCE 54: Clean fittings (2) and apply lubricant through fittings.

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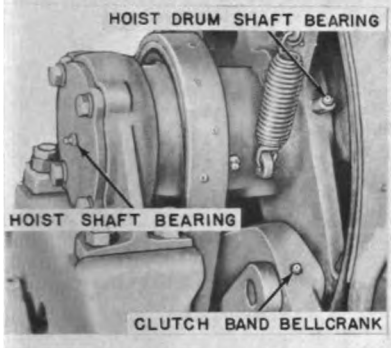
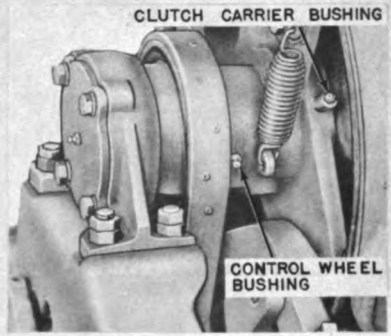
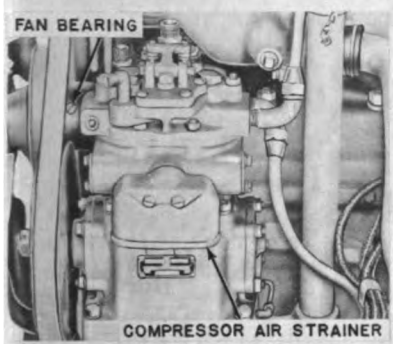
***Figure 53*—Continued.**



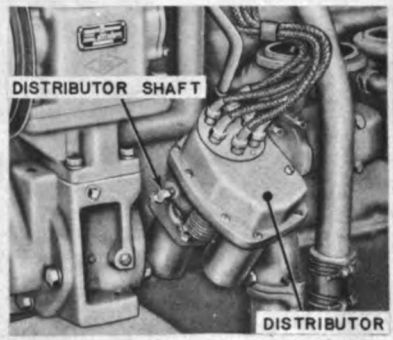
REFERENCE 55: Clean fittings (4) and apply lubricant through fittings.



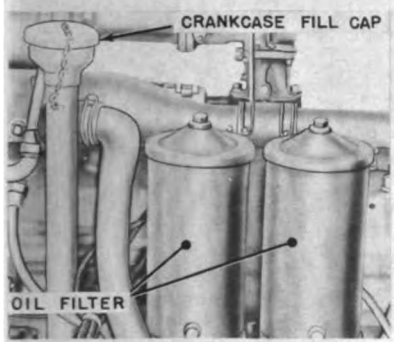
REFERENCE 56: Clean fittings (4) and apply lubricant through fittings.



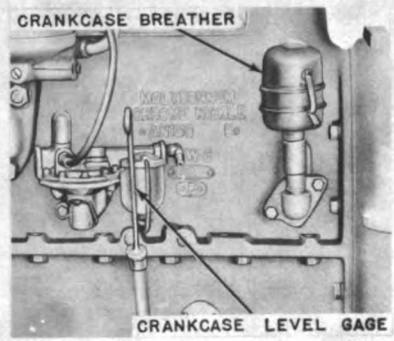
REFERENCE 57: Clean and reoil strainer. Remove fan hub plug to lubricate.



REFERENCE 58: Fill shaft reservoir. Remove cover, oil breaker cam wick sparingly.



REFERENCE 59: Drain and clean housings, replace elements. Remove cap to fill.



REFERENCE 60: Remove gage to check level. Clean and reoil breather.

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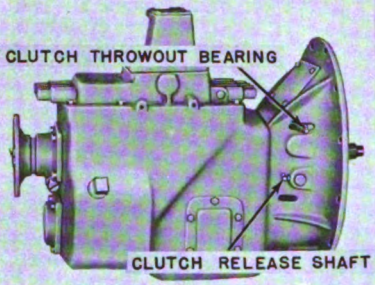
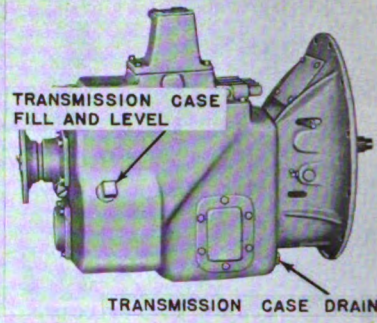
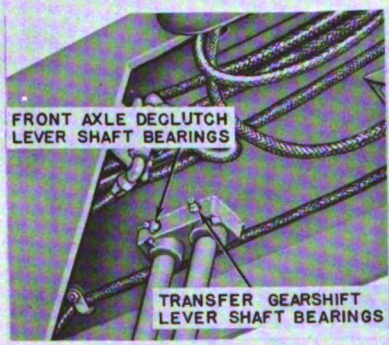
***Figure 53*—Continued.**



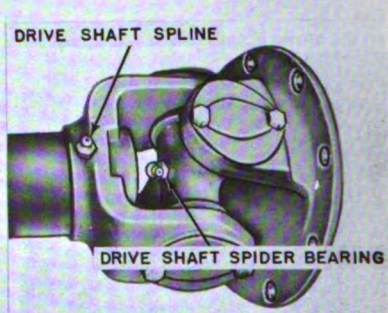
REFERENCE 61: Clean fittings (3) and apply lubricant through fittings.



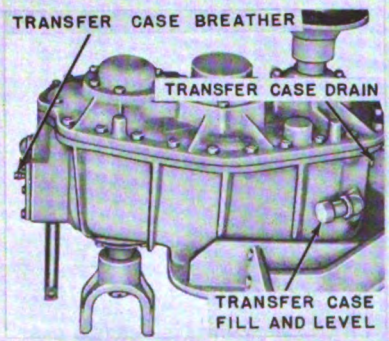
REFERENCE 62: Clean and remove plugs to check level, fill, and drain.



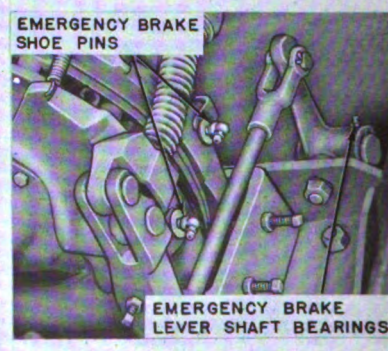
REFERENCE 63: Clean fittings (4) and apply lubricant through fittings.



REFERENCE 64: Clean fittings (2) and apply lubricant through fittings.



REFERENCE 65: Remove breather, clean and reoil. Clean and remove cap to check level and fill. Remove plug to drain.



REFERENCE 66: Clean fittings (6) and apply lubricant through fittings.

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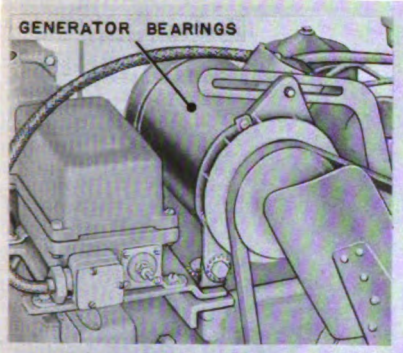
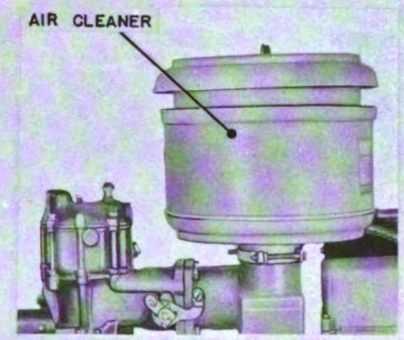
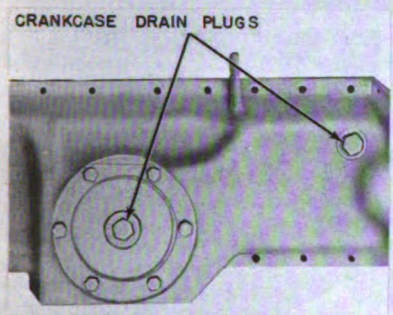
***Figure 53*—Continued.**



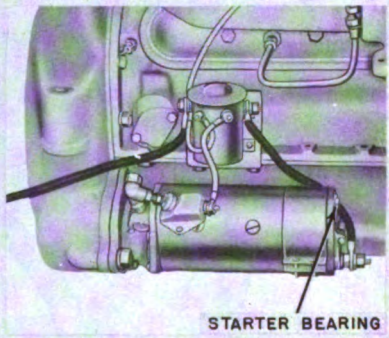
REFERENCE 67: No lubrication required.



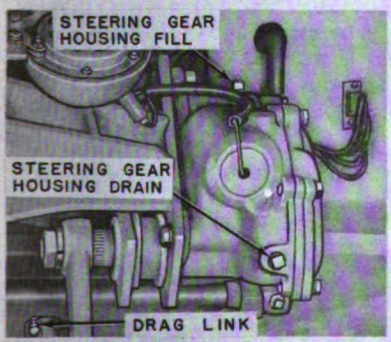
REFERENCE 68: Clean and refill to oil level mark.



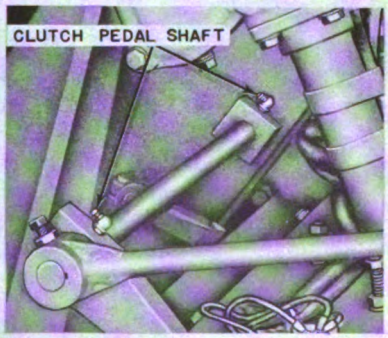
REFERENCE 69: Remove plugs, drain, install plugs, and refill.



REFERENCE 70: Lubricate sparingly.



REFERENCE 71: Clean fittings (2) and apply lubricant through fittings. Clean and remove plugs to fill and drain.



REFERENCE 72: Clean fittings (2) and apply lubricant through fittings.

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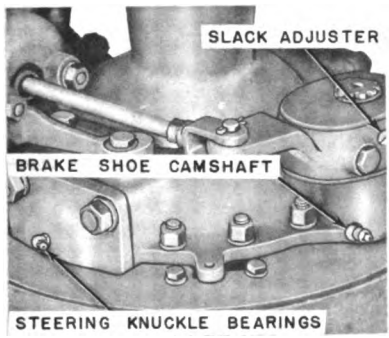
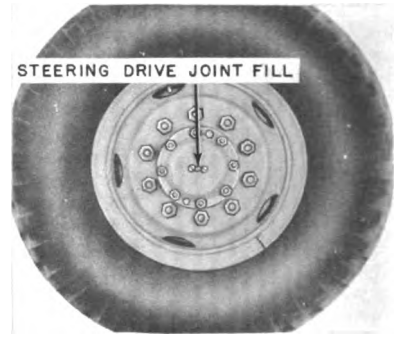
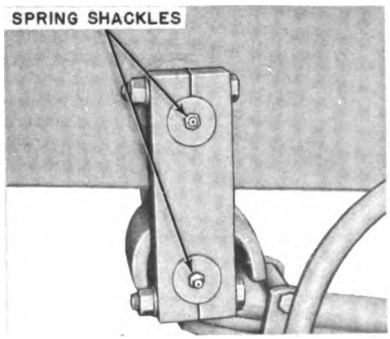
Figure 53—**Continued.**



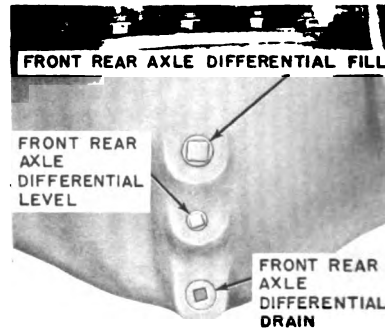
REFERENCE 73: Clean fittings (6) and apply lubricant through fittings.



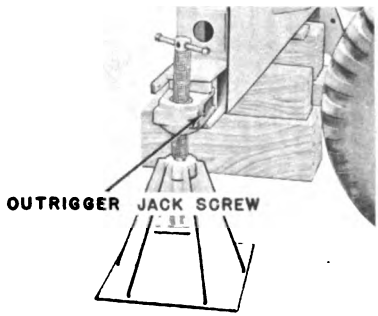
REFERENCE 74: Clean and remove plug, install temporary fitting, lubricate to plug level, replace plug.



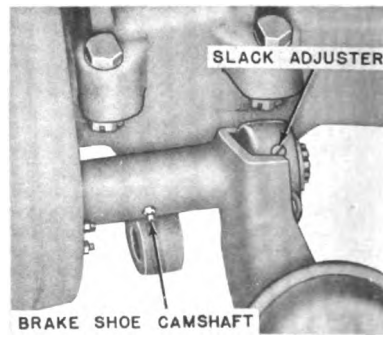
REFERENCE 75: Clean fittings (4) and apply lubricant through fittings.



REFERENCE 76: Clean and remove plugs to check level, fill, and drain.



REFERENCE 77: Clean fittings (4) and apply lubricant through fittings.



REFERENCE 78: Clean fittings (4) and apply lubricant through fittings.

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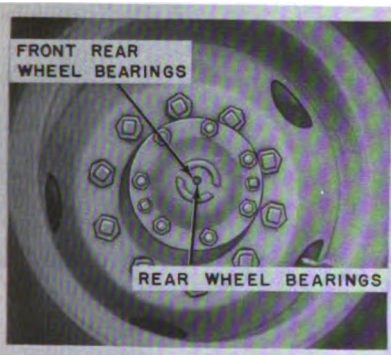
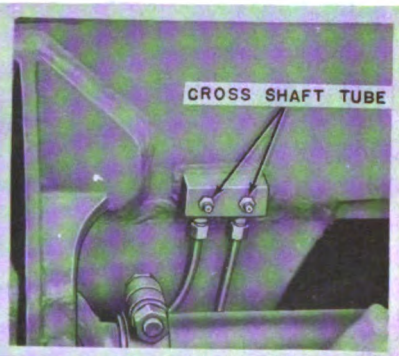
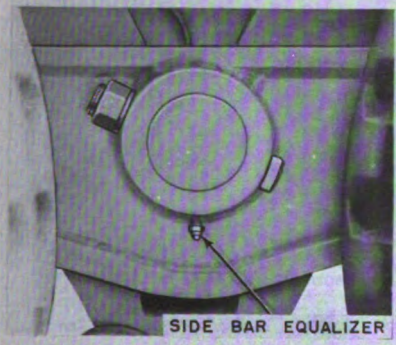
***Figure 53*—Continued.**



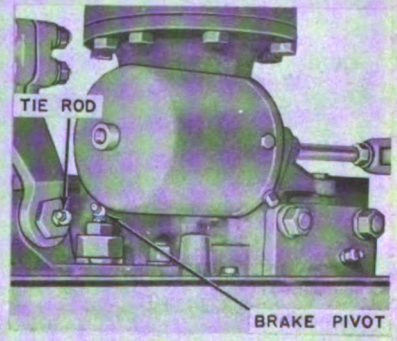
REFERENCE 79: Remove wheels, inspect parts, replace if defective, pack bearings, replace wheels.



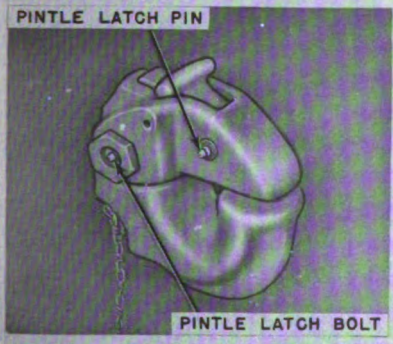
REFERENCE 80: Clean fittings (4) and apply lubricant through fittings.



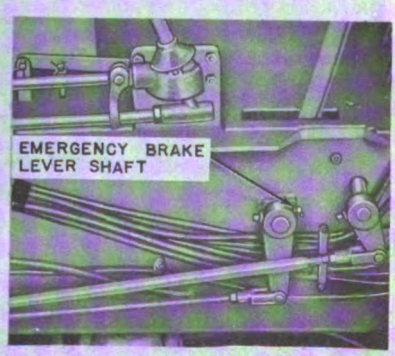
REFERENCE 81: Clean fittings (2) and apply lubricant through fittings.



REFERENCE 82: Clean fittings (4) and apply lubricant through fittings.



REFERENCE 83: Clean fittings (2) and apply lubricant through fittings.



REFERENCE 84: Clean fitting and apply lubricant through fitting.

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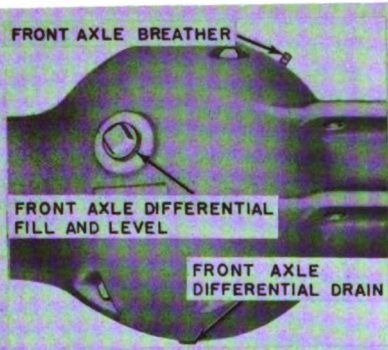
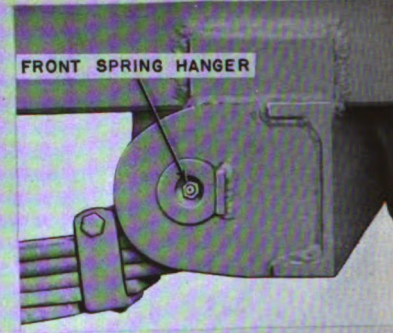
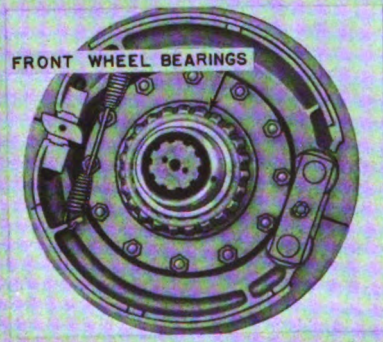
***Figure 53*—Continued.**



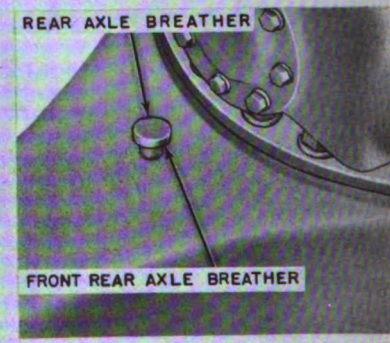
REFERENCE 85: Clean and remove plugs to check level, fill, and drain. Remove breather, clean and reoil.



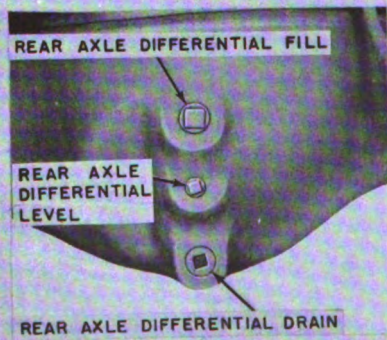
REFERENCE 86: Clean fittings (2) and apply lubricant through fittings.



REFERENCE 87: Remove wheels, inspect parts, replace if defective, pack bearings, replace wheels.



REFERENCE 88: Remove breather, clean and reoil.



REFERENCE 89: Clean and remove plugs to check level, fill, and drain.

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***Figure 53*—Continued.**

and drain out the sediment. Remove the filter cover and filter element. Clean the filter shell with an approved cleaning solvent and wipe it dry with a clean absorbent cloth. Install the new filter element and gasket. Install the filter cover and see that the cover top fitting and the drain plug at the bottom of the filter are tight. Refer to paragraph 183 for proper disassembly and reassembly procedures.

94. Painting

In addition to keeping the crane-shovel clean, it is necessary to inspect the crane-shovel monthly for signs of chipped paint or corrosion. Cabs and other exposed parts of the crane-shovel are more likely to require touchup or repainting. Extreme weather conditions will accelerate deterioration of the paint. Surface treatment and paint are to be applied in accordance with TM 9–2851.

a. Parts to Be Painted.

(1) When required, paint the cabs, frames, decks, radiators, engines, and accessories.

Caution: Use heat-resisting paint when painting the engines, exhaust manifolds, pipes, muffler, and other parts exposed to heat.

(2) Coat the information, data, and identification plates with a clear lacquer.

b. Parts Not To Be Painted. Do not paint threaded surfaces or sliding parts of control rods and linkages. Do not paint electrical contacts, terminal blocks, or instruments.

Note. If accessory equipment has been removed from the crane-shovel, make sure good ground contacts are established when reinstalling the equipment. In some cases it may be necessary to scrape off a small amount of paint.

Section III. PREVENTIVE MAINTENANCE SERVICES

95. General

To insure that the crane-shovel is ready for operation at all times, it must be inspected systematically before operation, during operation, at halt, and after operation so that defects may be discovered and corrected before they result in serious damage or failure. Preventive maintenance services will be performed at these designated intervals. Defects discovered during operation of the unit will be noted for future correction, to be made as soon as operation has ceased. The operator must stop operation immediately if a deficiency is noticed that would damage the equipment if operation were continued. After-operation services will be performed by the operator immediately after any operating period of 10 hours or less. Defects or unsatisfactory operat-

ing characteristics beyond the scope of the operator to correct must be reported at the earliest opportunity to the proper authority. Responsibility for performance of preventive maintenance services rests not only with the operator, but with the entire chain of command from section chief to commanding officer (AR 750–5).

96. Operator's Daily Services

Intervals				Procedure
Before-operation	During-operation	At-halt	After-operation	
X	....	X	X	*Fuel.* Check the fuel supply. See that the fuel tanks are full.
X	....	X	X	*Reserves.* Check the reserve supplies of fuel, oil, and lubricants if they are carried with the unit. Replenish if necessary.
X	....	....	....	*Coolant.* Close any open draincocks in the cooling systems. Add coolant to the proper operating level. Add antifreeze if necessary. When filling a cold cooling system containing anti-freeze, allow room for expansion. Operate the engine to mix the coolant properly after filling.
X	....	X	X	Check the coolant level in the cooling systems. Add coolant if necessary.
X	....	X	X	*Oil.* Check the oil level in the crankcases. Add oil if necessary.
X	....	....	....	*Tires.* Check all tires for proper inflation. The correct pressure for front and rear tires is 70 pounds per square inch (psi).
X	....	X	X	Inspect the tires for cuts, bruises, fabric breaks, and uneven or worn tread. Correct all deficiencies noticed or report them to proper authority.
X	....	....	X	*Clean equipment.* Clean windshields and other glass. Remove all dirt and excess grease from machinery and floor of cabs. See that the roller path is clean. Clean mud and dirt from any part of the crane-shovel, especially where it would interfere with the movement of any linkage.
X	....	....	....	*Lights.* Check all lights for proper operation. Wipe dirt from all lamps and reflectors.
X	....	....	....	*Horn.* Blow the horn to be sure that it is in proper working condition.
X	....	....	....	*Windshield wiper.* Operate the windshield wiper. Replace the blade if it is excessively bent or worn.
X	....	X	X	*Cables.* Inspect cables for frayed or broken strands.
X	....	X	X	*Visual inspection.* Make a general visual inspection of the entire unit for bent, cracked, or broken parts or any obvious deficiencies such as oil or water leaks and loose or missing bolts or nuts. Look under the crane-shovel for signs of leakage. See that batteries are securely mounted and that

Intervals				Procedure
Before-operation	During-operation	At-halt	After-operation	
				connections and caps are clean and tight. Inspect steering mechanism for damaged or loose connections. Correct any deficiencies noticed.
X	....	....	....	*Starting precautions.* See that the engine clutches are disengaged, that the gearshift lever on the carrier is in neutral position, and that the carrier hand brake is securely latched in the hold position.
X	....	....	....	*Instruments.* Check all instruments and gages for broken glass and insecure mounting.
....	X	....	....	When at normal operating speed, the oil air pressure gages and the water temperature gages should give satisfactory readings as follows: Oil pressure: Revolving frame engine.....26 psi Carrier engine.....40 psi Air pressure.....80 to 105 psi Water temperature.....160° to 180° F. Ammeter.....in *charge* range See that all gages and instruments function properly.
X	....	....	....	*Airbrakes.* When the air pressure gage passes 80 psi, test the airbrakes for proper operation.
....	X	....	....	*Unusual noises or operation.* Check for unusual noises or operation such as too much vibration or overheating, brakes not holding, clutches slipping or chattering, improper steering action, or excessive smoke. Report any deficiencies or irregularities to the proper authority. Check cables frequently for alinement on the drums. If cables crosswind, stop and correct alinement.
....	....	....	X	*Shutdown precautions.* Move crane-carrier to an area where there is the least danger of its being damaged. Park it on firm, level footing, especially if freezing temperature is expected. Use planking or other suitable material under the wheels if necessary. Lower boom to correct traveling position. Engage swing lock and place operating levers in neutral position. Block wheels or set parking brake as necessary to prevent movement. Idle the engine a few minutes to allow even cooling.
....	....	....	X	*Tools and equipment.* See that all tools and equipment assigned to the crane-shovel are in serviceable condition, clean, and properly stowed or mounted.
....	....	....	X	*Lubrication.* Lubricate the crane-shovel as required by the current lubrication order.
....	....	....	X	*Fire extinguisher.* Check the fire extinguishers for signs of corrosion and inspect for a full charge. See that they are securely mounted. Do not discharge any of the contents.
....	....	....	X	*Protection.* Protect the crane-shovel from damage by parking it in a secure place. Always move the crane-shovel back

Intervals				Procedure
Before-operation	During-operation	At-halt	After-operation	
				from loose or hanging debris. If freezing weather is anticipated and antifreeze is available, open all drains in the cooling systems and leave the draincocks open. Drain the air reservoir tanks and lines, leaving the draincocks and valves open. Place tags on the ignition switches stating that the equipment has been drained. See that all doors, hoods, panels, windows, and lids are closed.

97. Maintenance Precautions

a. Always report or correct any deficiencies that may result in damage to the crane-shovel if operation is continued.

b. Do not completely depress the brake pedal unless an emergency stop must be made.

c. Do not use the handbrake to stop the crane-shovel unless required in an emergency.

d. Stop all operation when cleaning, adjusting, or lubricating the crane-shovel.

e. Use handlines for guiding loads.

f. Keep hands free of cables feeding in on pulleys or drums.

g. Replace all guards immediately after completing lubrication or adjustment.

h. Remove and store all tools before resuming operation.

98. Organizational Maintenance

a. Organizational preventive maintenance is performed by organizational maintenance personnel with the aid of the operator at weekly and monthly intervals. The weekly interval will be equivalent to a maximum of 60 hours of use. The monthly interval will be equivalent to 4 weeks or a maximum of 240 hours of use, whichever occurs first.

b. The preventive maintenance services to be performed at these regular intervals are listed and described below. The numbers appearing in the columns opposite each service refer to a corresponding number appearing on DA Form 464, and indicate that a report of the services should be made at that particular number on Form 464. These numbers appear either in the second, the third, or both columns as an indication of the interval at which the service is to be performed.

c. The first column headed "Inspection," is provided for the

information of the person performing the inspection. A number in this column indicates that an inspection should be made of the listed item in accordance with the instructions given in the text opposite. The indicated items and instructions constitute the minimum inspection requirements for the equipment.

Service			General
Inspection	Monthly	Weekly	
1	1	1	*Before-operation services.* Check and perform the services listed in daily before-operation services.
2	2	2	*Lubrication.* Inspect the entire machine for missing or damaged lubrication fittings and lines, and for insufficient lubrication. Check for lubricant leaks from all lines and gearcases and for evidence of defective oil and grease seals.
	2	2	Lubricate as specified in LO 5–9513–1, LO 5–9513–2, and LO 5–9513–3. Replace missing or damaged fittings and lines. Correct or report all leaks to the proper authority.
3	3	3	*Tools and equipment.* Inspect the condition of all tools and equipment assigned to the crane-shovel. Check the condition and mounting of toolboxes and compartments.
	3	3	See that all tools and equipment assigned to the crane-shovel are clean, serviceable, and properly stowed or mounted. See that the toolbox is in good condition and that it closes and fastens properly.
4	4	.....	*Fire extinguisher.* Check the carbon tetrachloride type for insufficient charge, judging by sound and weight. Do not discharge any of the contents. Check for corrosion and insecure mounting. Inspect the carbon dioxide (CO_2) type for insecure mounting, kinked or damaged hose, and missing or broken seal. If the seal is missing or broken, the extinguisher should be weighed to determine the amount of charge. The empty and full weights are stamped on the valve body. Check the date of the last hydrostatic test stamped on the cylinder just below the neck. It should not exceed 5 years. See that all extinguisher deficiencies are corrected or reported to the proper authority.
5	5	5	*Publications.* See that a copy of this technical manual, TM 5–5219, TM 5–5252, TB 5–9513–1, TB 5–5252–1, LO 5–9513–1, LO 5–9513–2, LO 5–9513–3, and Standard Form 91 are on the unit and in serviceable condition.
6	6	6	*Appearance.* Inspect the general appearance of the crane-shovel, paying special attention to cleanness, legibility of identification markings, and condition of paint.
	6	6	See that any deficiencies noticed are corrected or reported to proper authority.
7	7	7	*Modifications.* See that all available modification work orders applying to this crane-shovel have been completed and are recorded on DA Form 478.

Service			General
Inspection	Monthly	Weekly	
			REVOLVING FRAME ENGINE ACCESSORIES
14	14	14	*Crankcase, breaker.* Inspect the crankcase for leaks. Check to see if the crankcase breather needs cleaning.
	14	14	Correct or report all oil leaks noticed. Change the oil in the crankcase and clean the breather if necessary. Refer to current lubrication orders for specific instructions.
15	15	15	*Oil filter.* Inspect the oil filter assembly and oil and water connections for leaks while the engine is running. Check for loose mounting.
	15	15	Service the oil filter as specified in LO 5–9513–3. After servicing, check carefully for oil or water leaks while the engine is running. Correct any deficiencies noticed.
16	16	16	*Radiator.* Inspect the radiator for leaks, clogged air passages, and loose mounting. Inspect the radiator hoses for leaks, deterioration, and loose connections. Check operating temperature and condition of coolant. If coolant temperature remains below 160° F. or rises above 180° F. during operation, thermostat may be defective. If antifreeze is used, check the freezing point of the coolant.
	16	16	Drain, flush, and refill the cooling system if coolant is contaminated with rust or dirt. See that the core air passages are clean. Renew any damaged or defective cooling system hose, lines, and gaskets. See that all mounting bolts and connections are tight. Protect the coolant from freezing, and record its freezing point on DA Form 464. Correct any other deficiencies noticed or report them to the proper authority.
17	17	17	*Water pump, fan, shroud.* Inspect the water pump for leaks and for loose mounting and assembly bolts. Check the condition and mounting of fan blades and shroud.
	17	17	Tighten or replace, as required, loose or missing bolts and screws. Report other irregularities to the proper authority.
18	18	18	*Belts and pulleys.* Inspect for worn or frayed fan or generator belts. Check the belt tension and the pulley alinement. The belts are properly adjusted when they can be deflected approximately ½- inch with moderate pressure at a point midway between the pulleys.
	18	18	Adjust the tension of the belts if necessary (par. 143). If the generator belt is frayed or worn, replace the belt. If a fan belt is frayed or worn replace both fan belts. Clean the pulleys and report any misalinement to the proper authority.
19	19	19	*Oil pump, pressure relief valve.* Check for leaks in oil lines. Check oil pressure, using oil pressure gage on engine. Correct revolving frame engine oil pressure is 26 psi. Oil pres-

Service			General
Inspection	Monthly	Weekly	
			sure will be above normal when engine is cold, and may drop below normal when engine idles after warming up.
	19	19	Correct or report deficiencies to the proper authority.
20	20	20	*Governor and linkage.* Check linkage connections to see if there is any indication of wear or improper adjustment. Check governor operation under varying load conditions for signs of surging or other improper operation. If the engine surges when running at top speed without a load, the governor may be out of adjustment (par. 169*a*(3)).
	20	20	Report all deficiencies to the proper authority.
			FUEL SYSTEMS
38	38	38	*Fuel pumps and housings.* Inspect the fuel pump and lines for leaks. Check for loose mounting and assembly screws. Check sediment bowl for water and dirt.
	38	38	Tighten any loose screws and connections. Clean sediment bowl if it contains water or dirt. See that screen is clean. Make sure gasket is in good condition before replacing bowl. Replace a defective fuel pump (par. 167).
39	39	39	*Carburetor and linkage.* See if all carburetor mounting and assembly bolts are in place and secure, and if there is any leakage. Check the flexibility and operation of the linkage. See if all connections are tight.
	39	39	Tighten any loose bolts and connections. Replace damaged or defective linkage. Report all other deficiencies to the proper authority.
41	41	41	*Air cleaner.* Remove air cleaner. Inspect the body clamp. Observe the condition of the cleaning element and body. Notice the oil in the reservoir, paying particular attention to the amount of dirt present in the oil.
	41	41	Clean and service the air cleaner in accordance with the instructions in LO 5–9513–3. Reassemble and install, being sure that the mounting is secure and the body is properly clamped.
43	43	43	*Fuel tank, cap, and gasket.* Inspect fuel tank for loose mounting bolts. Check tank, gasket, and connections for leaks.
	43	43	See that the tank is securely mounted, air vent open, and filler cap clean and tight fitting. Replace leaky or damaged gaskets, and tighten connection. Replace defective fuel tank (par. 171).
44	44	44	*Fuel lines.* Check the fuel lines for leaks, loose connections, and damage.
	44	44	Replace fuel lines. Tighten loose connections. Report all uncorrected deficiencies to the proper authority.
			ELECTRIC SYSTEM
46	46	46	*Spark plugs.* Examine the installed spark plugs to see that

Service			General
Inspection	Monthly	Weekly	
			there are no signs of leakage around the gasket. See if the leads are secure. When operating conditions require, the spark plugs may be removed for servicing.
	46	46	Correct any deficiencies noticed.
46	46	.....	Remove the spark plugs and examine for poor condition, paying particular attention to broken insulators, carbon deposits, and electrodes which are burned thin. Replace unserviceable plugs. Report carbon deposits or damaged insulators, as these conditions may indicate incorrect heat range. Clean spark plugs by removing deposits from the electrodes and insulators. Check again for cracks. Adjust spark gaps to from 0.028 to 0.032 inch by bending the grounded electrodes. Reinstall the plugs using new gaskets. Be careful not to overtighten the plugs, as this may cause distortion and damage to gaskets.
47	47	47	*Battery.* Inspect the battery for cracked and leaky case, for loose holddown clamps, and for dirt and corrosion on top of battery. Check for loose, corroded, or damaged terminals and cables. Check level of electrolyte. Proper level is approximately $\frac{3}{8}$ inch above the plates. Check the specific gravity and record the reading on DA Form 464. Readings from 1.275 to 1.300 indicate a fully charged battery. Readings of 1.225 or below normally indicate that the battery should be recharged or replaced.
47	47	.....	Make a high rate discharged test of the battery to see if the cells are in a satisfactory condition, taking care to make the test according to the instructions for a condition test which accompanies the test instrument. Normally, a true test cannot be conducted if the specific gravity reading of the battery is below 1.225. If the difference in the readings obtained from the cells is more than 30 percent when using a voltmeter for testing, replace the battery (par. 141).
	47	47	Clean all dirt and corrosion off the top of the battery, battery posts, cables, and terminals. Replace damaged cables. Apply a thin film of chassis grease over the terminals after they are clamped tight. Add distilled water if needed to bring the solution up to proper level. If freezing temperatures prevail or are expected, the battery must be charged for a period long enough to mix the solution thoroughly after adding water. When possible, water should be added just before beginning operation. See that the battery is securely mounted, that filler caps are tight, and that the ventholes are open. Clean and repaint battery box if it is corroded. Tighten the holddowns carefully.
48	48	48	*Generator, starter.* Inspect the generator and starter for loose mounting bolts and wiring connections.

Service			General
Inspection	Monthly	Weekly	
	48	48	Tighten any loose mounting bolts and wiring connections.
49	49	49	*Distributor.* Check to see if the distributor and leads are in good condition and securely mounted.
	49	49	Wipe off the distributor and tighten the leads and mounting screws.
49	49	.....	Unscrew the leads and remove the distributor cover. See if the rotor and breaker plate assembly are in good condition, and correctly mounted. Check the cap in the cover and the rotor for cracks, pitting, corrosion, and etching. Check the rotor metal strip for burning or pyramiding. See that the breaker points are in good condition, well alined, and properly adjusted. The gap should be 0.022 inch.
	49	.....	If the breaker plate assembly is dirty or oily, clean it with an approved cleaning solvent and wipe it dry with a soft absorbent cloth. Clean the cap and rotor, removing all carbon. Replace a cracked or damaged cap (par. 147). If the breaker points are slightly pitted, burned, or discolored, clean them with a clean fine-cut contact file. If the points are unserviceable, they should be replaced. Be sure to aline the points correctly. Lubricate the distributor as instructed in LO 5-9513-3. Install the distributor rotor. Install the cover, gasket, and leads, making sure they are securely mounted.
50	50	50	*Coils, wiring, switches.* Check switches for loose mounting, cracked insulation, and other defects. Inspect wiring for oil-soaked, cracked, or frayed insulation, broken wires, and loose or corroded connections.
	50	50	Replace or report to the proper authority defective coil, switches, and wires. See that connections are clean and tight. See that all switches and wiring conduits are securely mounted.
51	51	51	*Voltage regulator.* Check the voltage regulator for improper operation and insecure mounting. See if wire connections are loose. The regulator should allow an appreciable charge to go into the battery after the starter is used. After the battery is fully charged, the ammeter should read only a slight charge.
	51	51	Tighten any loose connections and replace any missing mounting screws. Replace the regulator if it is defective (par. 142).
52	52	52	*Lights.* Check the operation of all lights and inspect them for loose mounting bolts or screws, defective bulbs, and cracked or broken lenses and reflectors. See if the foot switch correctly lowers or raises the headlight beams and check to see if the beams are correctly alined and aimed.
	52	52	Tighten or replace loose or missing bolts or screws. Replace defective bulbs and cracked or broken lenses or reflectors (pars. 152–157). Report all deficiencies not corrected to the proper authority.

Service			General
Inspection	Monthly	Weekly	
			CONTROL SYSTEM
56	56	56	*Steering gear assembly.* Check for wear, hard steering, and play in the steering gear. See if any mounting bolts or nuts are loose or missing.
	56	56	See that all mounting bolts and nuts are tight. Report other deficiencies in the steering gear assembly to the proper authority.
57	57	57	*Gages.* Inspect temperature, fuel, oil, and air pressure gages on the control panels for cracked or broken glass, insecure mounting, and defective operation.
	57	57	See that gages are securely mounted. Replace damaged or defective gages (par. 151).
58	58	58	*Meters.* Inspect ammeters, speedometer, and hour-meter for cracked or broken glass, loose mounting screws, and defective operation.
	58	58	Tighten or replace loose or missing mounting screws. Replace (par. 151), or report to proper authority, damage or defective meters.
59	59	59	*Safety valve.* Check the safety valve for leakage and for loose connections. With the air reservoir charged, pull the exposed end of the safety valve stem, permitting the valve to release. When the stem is released, the valve should close.
	59	59	If air leaks are detected at the safety valve, replace the valve (par. 294) or report the condition to the proper authority. If air does not blow off when the stem is pulled or the valve does not close when the stem is released, replace the safety valve (par. 294) or report the condition to the proper authority.
60	60	60	*Pump (air compressor).* Check condition and mounting of the air compressor. With compressor operating, check for any unusual noise and for air, water, and oil leaks. Operate carrier engine and observe air pressure gage reading (minimum 80 psi; maximum 105 psi). With air gage reading at maximum pressure, depress brake pedal several times or until gage reads 80 psi. Compressor control valve should open and pressure gradually rise until control valve cuts out at 105 psi. Inspect air cleaner for loose connection.
	60	60	Tighten any loose bolts or nuts and leaky line connections. Replace damaged lines or fittings. Clean accumulations of dirt and grease from unloading valves, springs, and unloading lever. Adjust the unloading valve clearance if incorrect (par. 286). Proper clearance for the unloading valve is 0.010 inch minimum to 0.015 inch maximum. Report all irregularities or deficiencies not corrected to the proper authority.
61	61	61	*Air valves and cylinders.* Check all air valves for loose mounting bolts and air line connections. Check for leaks and operating deficiencies with the air in the system at normal

Service			General
Inspection	Monthly	Weekly	
			pressure. Check the operation of the brake system foot treadle valve. With the treadle valve fully depressed, the valve should deliver full reservoir pressure to the brake chambers.
	61	61	Tighten or replace loose mounting bolts, connections, and hoses. Replace leaky valves or air cylinder or report the deficiency to the proper authority. If the foot treadle valve does not deliver full reservoir pressure to the brake chambers when the treadle is fully depressed, replace the valve (par. 296). Report all deficiencies not corrected to the proper authority.
62	62	62	*Levers, pedals, linkage.* Check revolving frame levers and pedals for proper operation and adjustment. Inspect condition of all control rods and linkage and see if all connecting pins, cotter pins, locknuts, and bolts are in place and secure. Check condition of clutch shifter shoes and brake locks. Check the gearshift lever for smoothness of operation with the carrier in motion. Check for difficult gear selection. Accelerate and decelerate with the carrier in each gear and if the gearshift lever slips back into neutral position, report the condition to proper authority. See if the handbrake lever will remain latched in the applied position. Check the brake treadle while in released position for tendency to exert pressure on the brake valve, causing delayed and incomplete releasing of the brakes. Check the accelerator pedal and linkage for binding and wear sufficient to prevent smooth operation of the engine. Check the clutch pedal to see if it has 1½ inches of free travel. With the engine operating, check for proper clutch release with pedal depressed.
	62	62	Adjust revolving frame levers and pedal linkages if necessary (pars. 201–210). Tighten or replace, as required, any loose or missing connecting pins, cotter pins, locknuts, and bolts. Replace worn or damaged clutch shifter shoes and brake ratchets, pawls, and locks. Straighten or replace bent or damaged rods. If lost motion in the gearshift lever is sufficient to make accurate gear selection difficult, replace the gearshift lever assembly. If binding is noticed, or if the gears will not stay meshed, report the condition to the proper authority. If the emergency handbrake lever will not remain in the applied position when pulled back, the pawl or sector may be worn; replace with a new part or report the condition to proper authority. If the clutch pedal binds or wobbles sideways, report the condition to the proper authority. If free play at the top end of the clutch pedal travel is more or less than 1½ inches, adjust the clearance between the clutch release bearing and the clutch release sleeve to ⅛-inch, by turning the adjusting screw on the clutch adjusting dog. Do not attempt to adjust the clutch by turning the screws

Service			General
Inspection	Monthly	Weekly	
			on the clutch release yoke. If free play is still more or less than 1½ inches or if the clutch does not release properly, report the deficiency to the proper authority. If the brake treadle valve does not return far enough to release the brakes completely, adjust the screw located under the heel of the treadle until no pressure is exerted on the cap of the valve. Replace worn accelerator pedal hinge or linkage. If binding is noticed, realine the linkage, if necessary, and lubricate. Report all deficiencies not corrected to the proper authority.
63	63	63	*Universal joints, ball joints.* Check the control system universal joints and ball joints for wear.
	63	63	If any control system parts are worn to the point where looseness affects the proper functioning of the control, adjust, repair, or replace the necessary parts, or report the deficiency to the proper authority.
67	67	67	*Power control unit.* Check operation of dipper trip mechanism. Look for loose wiring connections and broken or exposed wires.
	67	67	Tighten loose wiring connections. Repair broken or exposed wires or report to the proper authority. Report any other deficiencies to the proper authority.
69	69	69	*Tie rod, linkage, boots, and seals.* Inspect the tie rod for bends and other damage. Check for loose tie rod stud nuts, missing cotter pins, and worn or damaged grease retainers and dust shields. Move the steering wheel back and forth and look for lost motion between the studs and bushings in the tie rod ends and for movement of the steering arm in the spindles. If no deficiencies are noticed during the above inspection, and the kingpins, bushings, and wheel bearings have no visible play with the front axle jacked up, lower the jack and check the toe-in of the front wheels. Place the carrier on a smooth, level surface and mark the center of each front tire at hub height. Measure the distance between the marks. Roll the carrier backward until the marks are at hub height at the back of the tires. The measurement at the front should be 1/16-inch less than at the rear.
	69	69	Correct all deficiencies noticed or report them to the proper authority.
71	71	71	*Brake air chambers.* Check for loose mounting studs, air leaks, and damage to the air chambers or mounting brackets. Check for binding in the movement of the arm.
	71	71	Tighten loose mounting studs and nuts. If air leaks are noticed when air pressure is applied, report the deficiency to the proper authority. Replace damaged or worn yokes and pins (par. 288).
72	72	72	*Air tubing and hoses.* Inspect all air tubing and hoses for leaks, loose connections, and loose or missing mounting clamps. Check hoses for deterioration and cracks.

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Inspection	Monthly	Weekly	
	72	72	Tighten all loose hose connections, mounting brackets, and clamps. Replace all defective hoses, tubing, or clamps.
			FRAMES AND MOUNTINGS
76	76	76	*Tires.* Inspect the tires for improper inflation, missing valve caps, cuts, embedded foreign material, blisters, bruises, uneven wear, flat spots, and cupping, and for injuries extending to or into the cord body.
	76	76	Any mechanical deficiencies causing uneven wear, flat spots, or cupping should be determined and corrected, or reported to the proper authority. The wheel position of tires that are irregularly worn should be changed to even the wear. Front tires worn irregularly should be moved to rear wheel positions. Record tire condition and pressure in the space provided on DA Form 464. Remove the foreign matter from the tires. See that all tires are properly inflated and that all valve caps are in place. Correct inflation for all tires, front and rear, is 70 psi.
78	78	78	*Rear wheels.* Check wheels for cracks and other damage. Check for loose or missing nuts, cap screws, and lockwashers on the driving flange and cover. Check the wheel bearing adjustment. Revolve the wheels by hand and listen for indications of dry or damaged wheel bearings.
	78	78	Tighten all drive flange nuts securely. Report unusual noises, or cracked or otherwise damaged wheels to the proper authority. Replace bent or distorted lock rings. If the lock rings are not installed properly, deflate the tire completely before attempting to pry or drive them into place on the rim.
	78	.....	Remove the wheel, clean the bearings, and check for wear and damage to the bearings and axle (par. 306). Replace the grease, oil seals, and bearings if damaged or worn. Install new cups if new bearing cones are used. If the bearing cups are loose in the hub, report it to the proper authority. Pack the wheel bearings; refer to LO 5–9513–3. Be sure that all old oil, grease, and foreign matter are cleaned from the hub and that all water and cleaning solvents are removed from the bearings, axle, and hub before lubricating. Before installing the wheel, wrap the axle threads with masking or similar tape to protect the seals. Take care not to damage the threads when sliding the wheel onto the axle.
79	79	79	*Front wheels.* Inspect for cracks or other damage and loose or missing bolts, nuts, and lockwashers. See if the lock rings are bent, distorted, or improperly installed. Look for misalinement.
	79	.....	Lock the rear wheels, jack and block the front axle, and check the wheels for binding and unusual noises which might indi-

Service			General
Inspection	Monthly	Weekly	
			cate loose, dry, or damaged bearings. If a wheel wobbles when rotated, check for improperly mounted tire and rim or bent wheel.
	79	79	Tighten all drive flange nuts securely. Report unusual noises, cracked or otherwise damaged wheels, binding, sideplay, or grease leaks to the proper authority. Replace or report bent or distorted wheels or lock rings. If the lock rings are not installed properly, deflate the tire completely before attempting to pry or drive them into place in the rim gutter. Report all deficiencies not corrected to the proper authority.
79	.....	.....	Jack up and block the axle and remove the wheels. Clean the bearings, spindle, and hub. Oil the bearings cones before rotating them. Check the cones, cups, and grease seals for wear and damage. Inspect the spindle for cracks, misalinement, and nicked or worn machined surfaces which will result in a loose fit or misalinement of the bearing cones. See that the cups are tight in the hub. Replace worn or damaged cones, cups, and grease seals (par. 304). Install new cups if new cones are used. Report deficiencies, such as bends, cracks, or damaged machined surfaces on the spindles to the proper authority. Be sure all old grease and foreign matter are removed from the hub and that all water and cleaning solvent are removed from the bearings, spindle, and hub before lubricating. Lubricate spindle and wheel bearings according to LO 5–9513–3. Rotate the wheel while installing the adjusting nut. Tighten the nut until snug enough to seat the cones and then back the nut off approximately one-quarter turn to the nearest hole in the adjusting nut washer. Install the key washer and locking nut. Bend the washer over the nut. Check the rotation of the wheel for end play and binding. Do not mistake the drag caused by a new grease seal for wheel bearing bind.
80	80	80	*Frames* (*crane and carrier*). Inspect the carrier frame, brackets, siderails, and crossmembers for misalinement, cracks, and breaks. Check the condition and operation of the outriggers and pintle. Inspect the machinery frame and revolving frame base, and gantry for cracks, breaks, and loose bolts and nuts. Check gantry mounting pins for wear.
	80	80	Tighten or replace missing or loose pins, bolts, nuts, and lockwashers. If cracks, breaks, or misalinement are noticed, which will cause failure or result in further damage, report the condition to the proper authority immediately. Repair all broken welds. See that outriggers and pintle are in good condition and can be properly operated.
81	81	81	*Front axle assembly*. Check for cracks, bent parts, and apparent misalinement. Check for damaged or plugged breather and oil leaks.

Service			General
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	81	81	Clean out or replace the breather. Report other deficiencies to the proper authority.
82	82	82	*Rear axle assembly.* Check for cracks, bent parts, and loose or missing bolts and nuts. Check for clogged or damaged breather.
	82	82	Tighten or replace missing or loose bolts and nuts. Clean out or replace a clogged or damaged breather. Report all unusual noises and other deficiencies not corrected to the proper authority.
83	83	83	*Springs, equalizers, stabilizers.* Check for loose or missing spring clips, bolts, spring leaves that have shifted out of their correct position. If spring leaves have shifted, check for sheared center bolt. Notice whether the deflection of both springs is normal and approximately the same. Test the hangers and bolts for wear by means of a prybar. Check tension and mounting of the torque rods and shock absorbers. Check the equalizer, torque rods, and shock absorbers for movement and misalinement.
	83	83	Tighten all spring bolts securely and uniformly. Replace defective springs (par. 284). See that worn bushings and worn or bent torque rods or pins are replaced. Correct or report to the proper authority any other deficiencies.
			DRIVE SYSTEM
93	93	93	*Transmission and transfer case.* Inspect gearcases for leaks and for loose mounting and assembly bolts and screws. Check for any unusual gear noise during operation. Check condition and mounting of breathers.
	93	93	See that all mounting and assembly bolts and screws are in place and tight. Clean breathers if necessary. Correct or report to the proper authority any other deficiencies noticed.
95	95	95	*Master clutch (engine clutches).* Check operation of the clutch. Clutch should not grab or chatter while being engaged and should not slip when fully engaged.
	95	95	Report all irregularities to the proper authority.
98	98	98	*Operating clutches (hoist, crowd, swing, boom).* Inspect clutches for worn or oil-soaked lining. Check adjustment. The linings should clear the drums by at least 0.020-inch when operating levers are in neutral position. Clutches should not grab, chatter, or squeal on engagement, nor slip under load when clutch lever is in fully engaged position. See if all connecting pins, bolts, springs, and locks are in place and secure.
	98	98	Remove oil and grease from lining and drums and adjust clutches, if necessary. Replace bands before lining has worn to the

Service			General
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			extent that rivets may contact drums. See that all connecting pins, spring, bolts, and locks are in place and secure.
99	99	99	*Service brakes.* See that the air pressure gage registers from 80 to 105 psi. Operate the carrier to test brakes. Notice whether brakes grab, chatter, or cause carrier to pull to one side. Check brake system for leaks. Air pressure drop on gage, when engine is stopped, should not exceed 3 psi per minute when brakes are released, and not over 4 psi per minute when the brakes are applied. Make a thorough check of the entire brake system if excess leakage is apparent. Check condition and mounting of brake chambers, hose, valves, and slack adjusters.
	99	99	Adjust brakes if necessary (pars. 300*e* and 301*e*). If properly adjusted and brakes grab, causing the carrier to pull to one side, or fail to hold, remove the drums and check for worn, dirty, or greasy lining. See that lining is renewed if worn to the extent that mounting rivets may contact drums. See that air lines, brake chambers, valves, and slack adjusters are in good condition and securely mounted.
100	100	100	*Emergency brake.* See if brake holds securely when set. It should hold when lever is pulled back half the distance on the ratchet.
	100	100	Adjust the brake if necessary (par. 231*e*). See that all pins, bolts, locks, and springs in operating linkage are in place and secure. Report deficiencies or worn lining to the proper authority.
102	102	102	*Operating brakes (hoist, swing, boom).* Check brakes for worn or oil-soaked lining. Check adjustment. Brakes must hold securely under load and not drag when released. Check operating linkage and shifter yokes for wear or damage.
	102	102	Remove any oil and grease from lining and drums and adjust brakes if necessary. Replace bands if lining is worn so rivets may contact drums. See that all springs, bolts, pins, and locks in operating mechanism are in place and secure.
104	104	104	*Gears and pinions.* Inspect all open gears and pinions for wear and damage. Check gearcases for loose mounting bolts and oil leaks. Check for unusual gear noise during operation.
	104	104	Replace or tighten any missing or loose mounting bolts. Correct or report leaky gearcases. Report defective or damaged gears to the proper authority.
105	105	105	*Bearings and shafts.* Inspect bearing pillow blocks and retainers for loose bolts and screws. Check for defective bearings, misalined shafts, and defective oil or grease seals.
	105	105	See that all bearing pillow blocks and retainer bolts and nuts are tight. Correct or report to the proper authority any other deficiencies noticed.
108	108	108	*Drive shafts and universal joints.* Inspect drive shafts for

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			damage and misalinement. Check universal joints for wear and see if any companion flange or bearing cap bolts are loose or missing.
	108	108	See that companion flange or bearing cap bolts are in place and tight. Replace defective universal joints (par. 303). Correct or report to the proper authority any other deficiencies noticed.
			SHOVELS, CRANES, AND ATTACHMENTS
115	115	115	*Hoist assembly (boom).* Check for proper operation. Look for loose or missing bolts or nuts, and for breaks or cracks in the case.
	115	115	Tighten loose bolts or nuts. Replace any missing bolts or nuts. Report to the proper authority any other deficiencies noticed.
117	117	117	*Boom or mast assembly.* Inspect the boom for cracks, breaks, loose or missing bolts and nuts, and bent members. Check foot pins for wear; they should have not more than 1/8-inch of play.
	117	117	Tighten or replace loose or missing bolts and nuts. See that bent members, cracks, and breaks are repaired before further damage results. See that foot pins are in good condition and secure.
119	119	119	*Center pin.* Check center pin adjustment. Center pin should be adjusted if rear conical rollers raise from roller path more than 1/8-inch when crane load is suspended.
	119	119	Adjust center pin if necessary. When the center pin is properly adjusted, the rear rollers should raise about 1/16-inch above the roller path.
120	120	120	*Crowd assembly.* Check crowd chain and sprockets for wear and damage. Check crowd chain adjustment. Chain is properly adjusted when it has approximately 3 inches sag on top, measured halfway between shipper shaft sprocket and boom foot, when bottom is tight.
	120	120	Adjust crowd chain if necessary. Be sure to turn both adjusting screws the same distance to maintain takeup sprocket alinement. Replace crowd chain or crowd chain links if necessary.
121	121	121	*Dipper, dragline, clamshell, back hoe buckets.* Inspect for cracks, breaks, loose bolts and rivets, missing locking pins, and for a defective dipper door latch, hinge pins, hinge pin bushings and bearings, clamshell and dragline bucket chains. Check condition and operation of dipper trip and tagline assembly.
	121	121	Tighten or replace, as required, loose or missing bolts and rivets. See that all worn parts are replaced and that all

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			cracks and breaks are repaired before further damage may result. Adjust dipper trip chain if necessary (par. 232*f*).
122	122	122	*Teeth (dipper or bucket).* Check for worn, broken, or loose teeth.
	122	122	Reverse or replace teeth as necessary (par. 232*g*). Dipper or bucket teeth should be reversed often enough to equalize wear on both sides. See that teeth are securely attached.
123	123	123	*Drums, sheaves, cables.* See if sheaves are securely mounted. Check sheaves, bearings, and shafts for wear and damage. Inspect cables for wear, kinks, and broken strands. Check drum lagging for loose mounting bolts.
	123	123	Replace cables or sheaves if they are worn or damaged. Do not install new cables on worn or damaged sheaves. Tighten any loose mounting bolts on sheaves or drum lagging.
125	125	125	*Shipper shaft and saddle block assembly.* Check shipper shaft and saddle block bushings for wear. See if saddle block or yoke retaining collars are up against the thrust washers and if clamp bolts are tight. Check rack pinions and saddle block slide plates for wear. Clearance between the top of the dipper handles and slide plates should not exceed 1/4-inch when handle is fully extended.
	125	125	Adjust or replace saddle block or yoke slide plates (par. 235) if necessary. See that slide plate bolts and saddle block retaining collar bolts are tight. Report any deficiencies not corrected to the proper authority.
126	126	126	*Handles and racking.* Inspect for loose bolts, cracks, and breaks. Check dipper handles for worn, damaged, or loose racking.
	126	126	See that any cracks or breaks are repaired. If any sections of dipper handle racking show considerable wear, interchange them with sections which are not worn. See that all rack and stop-casting bolts are tight.
127	127	127	*Swing assembly.* Check rollers for flat spots, worn bushings, and loose roller-shaft retaining screws. Inspect roller path, circle gear, and swing pinion for wear and damage. The roller path should be free of grease and dirt.
	127	127	See that roller path is clean and that rollers turn freely. Replace worn rollers. Report a worn or damaged circle gear and swing pinion.
128	128	128	*Swing lock.* Check condition, operation, and mounting of swing lock assembly.
	128	128	Correct or report any deficiencies noticed to the proper authority.
			MISCELLANEOUS ITEMS
133	133	133	*Fairlead.* Check for loose mounting bolts and worn sheaves, rollers, pins, bushings, and wear plates.
	133	133	Tighten any loose mounting bolts. Replace defective parts.

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134	134	134	*Cabs.* Inspect cabs for loose or missing mounting and assembly bolts, cracked glass, and bent or damaged sheet metal and frame members. Check the operation of the door and door latch. Check the rearview mirror for cracks and seats for torn condition. Check for cleanness and signs of corrosion. Examine the legibility of any instruction plates or stenciled information.
	134	134	Tighten or replace, as required, loose or missing bolts. See that broken glass is replaced and that doors and windows close and fasten properly. Clean away any dirt or corrosion. Replace or repair the rearview mirror and seat if defective. Report other deficiencies, including illegible or missing instruction plates, to the proper authority.

Section IV. TROUBLESHOOTING

99. Use of Troubleshooting Section

This section provides information useful in diagnosing and correcting unsatisfactory operation or failure of the crane-shovel or any of its components. Each trouble symptom is followed by a list of probable causes of the trouble. The possible remedy recommended is described opposite the probable cause.

Note. All references in this section to paragraphs in chapter 4 (pars. 310–432) pertain to operations that are the responsibility of the field and depot maintenance personnel. Organizational maintenance personnel should not proceed without proper authority.

100. Engines Fail To Start

Probable cause	*Possible remedy*
Fuel turned off at tank	Turn fuel on at tank.
No fuel in tank	Fill tank and prime the carburetor.
Clogged fuel line	Remove and clean the fuel line (par. 170).
Carburetor out of adjustment	Adjust carburetor (par. 168).
Battery discharged	Test for dead cells, recharge, or replace (par. 141).
Loose connection or defective cables on starter motor.	Tighten connections. Replace defective cables (par. 151).
Coil open or shorted	Replace (par. 148).
Condenser burned out	Install a new condenser (par. 147).
Points out of adjustment or burned	Adjust or replace with new points (par. 147).

101. Carrier Engine Clutch Slips

Probable cause	*Possible remedy*
Improper adjustment	Adjust clutch (par. 195*b*(2)).
Weak spring	Replace clutch (par. 357). See *note* in paragraph 99.
Worn lining	Replace clutch disk (par. 357). See *note* in paragraph 99.
Lining oil-soaked	Replace clutch disk (par. 357). See *note* in paragraph 99.
Lined plate sticking	Replace clutch disk (par. 357). See *note* in paragraph 99.

102. Carrier Engine Clutch Does Not Release

Probable cause	*Possible remedy*
Loose linkage	Adjust linkage (par. 210*b*).
Incorrect pressure plate adjustment	Adjust clutch (par. 195*b*(2)).
Warped or cracked driven plate	Replace clutch (par. 357). See *note* in paragraph 99.
Dirt in clutch assembly	Remove and clean (par. 357). See *note* in paragraph 99.
Broken throwout yoke	Replace throwout yoke (par. 357). See *note* in paragraph 99.

103. Dipper Handle Unsteady

Probable cause	*Possible remedy*
Swing clutches grab	Remove swing clutch shoes, clean, reinstall, adjust properly, and lubricate in accordance with current lubrication order.
Worn saddle block wear plates	Adjust wear plates or replace with new plates (par. 235).
Shipper shaft bushings worn	Adjust or replace bushings (par. 235).
Machine not sitting on level ground	Level the machine.

104. Revolving Frame Rocks When Swinging

Probable cause	*Possible remedy*
Accumulated dirt on roller circle	Clean roller circle.
Roller bushings or roller shaft worn	Replace bushings or roller shaft (par. 248).
Rollers worn uneven	Replace with new rollers (par. 248).

105. Clutch Drums Overheat

Probable cause	*Possible remedy*
Clutch shoe dragging	Adjust clutch (pars. 192–194).
Bearings not properly lubricated	Lubricate in accordance with current lubrication order.
Clutch slipping	Adjust clutch (pars. 192–194).
Hoist shaft out of alinement or bent	Aline, straighten, or replace shaft (par. 372). See *note* in paragraph 99.
Grease on clutch lining	Remove clutch shoes and clean with cleaning solvent (pars. 192–194).
Improper clutch adjustment	Adjust clutch linkage (pars. 203–208).

Brake band dragging	Adjust brake properly (paras. 196–198).
Operator slipping brake or riding brake.	Do not slip brake more than necessary. Release footbrake completely when hoisting.

106. Boom Will Not Raise

Probable cause	*Possible remedy*
Boom hoist clutch slipping	Adjust clutch (par. 192*e*).
Clutch lining worn out	Reline clutch (par. 320). See *note* in paragraph 99.
Boom too long to receive proper leverage.	Assist lifting of the boom with an auxiliary crane until boom is raised above leverage point.
Cable loose on hoist drum	Resocket cable in drum with proper size wedge (par. 11).
Boom hoist brake too tight	Adjust brake properly (par. 196*e*).

107. Shovel Dipper Door Does Not Open

Probable cause	*Possible remedy*
Door latch needs adjusting	Adjust latch (par. 232*f*).
Damaged or broken latch mechanism	Repair or replace latch mechanism (par. 232).
Dipper trip clutch out of adjustment	Adjust dipper trip clutch (par. 238*e*).
Dipper trip clutch lining worn out	Reline clutch (par. 320). See *note* in paragraph 99.
Grease on clutch lining	Remove clutch plate, clean, reinstall, and adjust (par. 238).

108. Cables Wear Out Quickly

Probable cause	*Possible remedy*
Pulley out of alinement or wobbles	Correct pulley alinement by straightening pulley shaft (par. 188), rebushing (par. 189), or installing new pulley (par. 188).
Pulley throat or flange worn	Build up pulley with weld and machine to correct fit or replace with new pulley (par. 188).
Cable pulling over sharp objects or rubbing a solid surface.	Correct reeving, remove sharp or solid object.

109. Revolving Frame Swing Lock Will Not Engage

Probable cause	*Possible remedy*
Linkage out of adjustment	Adjust linkage (par. 204).
Broken lock	Weld on a new lock and grind to correct fit or replace with a new lock (par. 204).
Dirt and grease packed into swing circle teeth.	Clean circle teeth.

110. Revolving Frame Gears Noisy

Probable cause	*Possible remedy*
Worn or defective gear teeth	Replace with new gears (par. 381). See *note* in paragraph 99.

Improper lubrication	Lubricate in accordance with current lubrication order.
Defective gear shaft bearings	Replace with new bearings (par. 381). See *note* in paragraph 99.

111. Boom Rocks When Swinging

Probable cause	*Possible remedy*
Boom foot bushings worn out	Replace with new bushings (par. 228).
Boom foot pin worn out	Replace with new pins (par. 228).
Load swings when being lifted	Keep load centered under boom point. Stop and start swinging gradually.
Accumulated dirt and grease on revolving frame roller circle.	Clean roller circle thoroughly.
Revolving frame rollers worn uneven	Replace with new rollers (par. 248).

112. Main Shafts Noisy

Probable cause	*Possible remedy*
Improper or insufficient lubricant	Lubricate in accordance with current lubrication order.
Bearings worn out	Replace bearings (par. 372). See *note* in paragraph 99.
Main shaft bent	Straighten or replace (par. 372). See *note* in paragraph 99.

113. Transmission Gears Difficult To Shift

Probable cause	*Possible remedy*
Clutch not releasing	Adjust clutch (par. 195*b*(2)).
Improper or insufficient lubricant	Check or change lubricant. Refer to current lubrication order.
Worn or bent shifting yokes	Replace shifting yokes (par. 214). See *note* in paragraph 99.
Transmission linkage out of adjustment.	Adjust linkage (par. 214).

114. Transmission Noisy

Probable cause	*Possible remedy*
Lack of lubricant	Check gaskets and vent plugs. Fill to proper level. See current lubrication order.
Lubricant of improper viscosity	Drain and refill with correct lubricant. See current lubrication order.
Defective gears, bearings, or worn shaft splines.	Repair the transmission (par. 404). See *note* in paragraph 99.

115. Transfer Case Difficult To Shift

Probable cause	*Possible remedy*
Improper linkage adjustment	Adjust linkage (par. 216*c*).
Improper lubricant	Drain and refill with correct lubricant. See current lubrication order.
Worn or bent shifting yoke	Replace shifting yoke (par. 407). See *note* in paragraph 99.

116. Transfer Case Noisy

Probable cause	*Possible remedy*
Improper or insufficient lubrication	Check gaskets and vent plugs. Lubricate in accordance with current lubrication order.
Transfer case out of alinement	Replace mounting, if necessary (par. 407).
Defective gears, bearings, or worn shaft splines.	Repair transfer case (par. 407). See *note* in paragraph 99.

117. Drive Shaft Noisy

Probable cause	*Possible remedy*
Worn or broken spider bearings	Replace bearings (par. 303).
Worn yoke or spline assemblies	Replace yoke or spline assemblies (par. 303).

118. Drive Shaft Vibrates

Probable cause	*Possible remedy*
Bent drive shaft	Replace shaft (par. 303).
Worn spider bearings	Replace bearings (par. 303).
Transfer case or transmission out of alinement.	Refer to paragraph 407 or 404. See *note* in paragraph 99.

119. Differential Noisy

Probable cause	*Possible remedy*
Lack of lubricant	Lubricate. See current lubrication order.
Wheel bearing out of adjustment (continuous hum).	Adjust bearing (par. 414).
Ring gear and pinion out of adjustment.	Adjust clearance (par. 414). See *note* in paragraph 99.
Broken tooth in ring gear or pinion (snapping noise).	Repair differential (par. 414). See *note* in paragraph 99.
Loose nuts on axle driving flange (clicking noise).	Tighten axle flange nuts.

120. Excessive Backlash in Differential

Probable cause	*Possible remedy*
Poor ring gear and pinion adjustment	Adjust clearance (par. 414). See *note* in paragraph 99.
Worn bearings	Replace bearings (par. 414). See *note* in paragraph 99.
Worn splines on either end of axle shaft.	Replace the axle (par. 411). See *note* in paragraph 99.

121. Excessive or Uneven Tire Wear

Probable cause	*Possible remedy*
Tires underinflated	Inflate to proper pressure.
Improper toe-in	Adjust toe-in (par. 420*c*). See note in paragraph 99.
Tires mounted out of balance	Deflate and mount properly (par. 303).

122. Wheels Shimmy

Probable cause	*Possible remedy*
Bent front wheel	Install new wheel (par. 307).
Loose front wheel bearings	Adjust bearings (par. 304).
Front wheel and/or hub out of balance	Balance or replace wheel and/or hub (par. 307).
Improper caster or camber	Adjust (par. 420). See *note* in paragraph 99.
Steering connection worn	Replace (par. 401). See *note* in paragraph 99.

123. Emergency Brake Does Not Hold

Probable cause	*Possible remedy*
Normal wear of brake lining	Adjust brake (par. 199*g*).
Brakeshoes improperly adjusted	Adjust brake (par. 199*g*).
Brakeshoe lining burned and glazed	Replace lining (par. 320). See *note* in paragraph 99.
Brake disk burned and warped	Replace disk (par. 199). See *note* in paragraph 99.
Brake lever rod improperly adjusted	Adjust rod (par. 199*g*).
Pull rod improperly adjusted	Adjust pull rod (par. 199*g*).

124. Brake Pedal Goes to Floorboard

Probable cause	*Possible remedy*
Normal wear of brake lining	Adjust brakes (pars. 300 and 301).
Low air pressure in air reservoirs	Check air system.
Air pressure leak	Check air system.
Water trapped in air system	Drain air reservoirs.
Brakeshoes improperly adjusted	Adjust brakes (pars. 300 and 301).

125. Brakes Drag

Probable cause	*Possible remedy*
Floor brake valve improperly adjusted	Replace air valve (par. 296).
Water trapped in air system	Drain air reservoirs.
Brakeshoe spring weak or broken	Replace spring (pars. 300 and 301).
Brakeshoe improperly adjusted	Adjust brakes (pars. 300 and 301).
Wheel bearings improperly adjusted	Adjust bearings (par. 306*d*).
Restriction in air tubing or hose	Clean or replace tubing or hose.
Grease-soaked brakeshoe lining	Replace lining (par. 320). See *note* in paragraph 99.

126. Slow Braking Action

Probable cause	*Possible remedy*
Restriction in air tubing or hose	Clean or replace air tubing or hose.
Brakes improperly adjusted	Adjust brakes (pars. 300 and 301).
Air cylinder diaphragm leaking	Replace air cylinder (par. 288).
Brake lining worn	Replace lining (par. 320). See *note* in paragraph 99.

127. Slow Brake Release

Probable cause	*Possible remedy*
Brake camshaft binding	Lubricate in accordance with current lubrication order.

Restriction in air tubing or hose	Clean or replace air tubing or hose.
Brakes improperly adjusted	Adjust brakes (para. 300 and 301).

128. Slow Buildup of Air Pressure

Probable cause	*Possible remedy*
Leaking floor foot air valve	Replace valve (par. 296).
Leaking air compressor discharge valve.	Replace head assembly (par. 286).
Leaking air pipes or connections	Tighten connections or replace pipe.
Air compressor unloader valve not adjusted properly.	Adjust unloader valve (par. 286).
Clogged air compressor strainer	Clean strainer.
Worn air compressor pistons and piston rings.	Replace air compressor (par. 286).

129. Rapid Loss of Air Pressure When Engine Is Stopped

Probable cause	*Possible remedy*
Worn or leaking air compressor discharge valves.	Replace head assembly (par. 286).
Leaking air pipes or connections	Tighten connections or replace pipe.
Leaking floor foot air valve	Replace valve (par. 296).
Leaking safety valve	Replace safety valve (par. 294).
Leaking governor	Replace governor (par. 295).

130. Air Pressure Too High

Probable cause	*Possible remedy*
Broken air compressor unloader	Replace cylinder head assembly (par. 286).
Governor not operating	Replace governor (par. 295).

131. Road Shock Felt at Steering Wheel

Probable cause	*Possible remedy*
Drag link too tight	Adjust drag link (par. 403). See *note* in paragraph 99.
Stud in cam groove adjustment too tight.	Adjust backlash (par. 403). See *note* in paragraph 99.

132. Hard Steering

Probable cause	*Possible remedy*
Lack of lubrication	Lubricate in accordance with current lubrication order.
Worn steering gear parts	Replace parts (par. 401). See *note* in paragraph 99.

Section V. RADIO INTERFERENCE SUPPRESSION

133. Definitions

a. Interference. The term "interference", as used herein, applies to electrical disturbances in the radio frequency range which are generated by the crane-shovel and which may interfere with the proper operation of radio receivers or other electronic equipment.

b. Interference Suppression. The term "interference suppression" as used herein applies to the methods used to eliminate or effectively reduce radio interference generated by the crane-shovel.

134. Purpose of Interference Suppression

The tactical importance of effective interference suppression cannot be stressed too greatly. Since the electrical disturbances generated by the crane-shovel are composed partly of electrical waves in the radio frequency range they must be suppressed for two important reasons. First, they will interfere with the proper operation of the friendly radio net, and second, they will enable the enemy to locate the equipment and its associated units.

135. General Sources of Interference

Generally, radio interference is generated anywhere a spark occurs or where a high-frequency current is present. A spark is a small amount of current jumping an air gap in response to the force of a relatively high voltage. The gasoline engine ignition system is a common source. Generator commutators, relay contacts, and static charges collecting on the frame are other common sources which in some way must be suppressed.

136. General Methods Used To Attain Proper Suppression

Essentially, suppression is attained by providing a low resistance path to ground for the stray currents. The methods used to attain suppression include shielding the ignition and high-frequency wires, grounding the frame with bonding straps, and using capacitor, filter, and resistance circuits where necessary.

137. Testing for Proper Suppression

a. Equipment. A portable AM (amplitude modulation) receiving set with a wide frequency band, a nondirectional antenna, and no automatic volume control (or a set in which it may be cut out), is the most desirable type of radio to use in performing the following tests. For a rough check, however, any AM receiver will do. A probe type antenna, which can easily be made, will prove useful in determining the exact location of the source of interference. The probe may consist either of a short length of wire coiled into a ring about 2 inches in diameter or of a small coil. Either type probe is connected to the receiver through a shielded cable.

b. Checking for Proper Suppression. Set up the radio about

10 or 20 feet away from the piece of equipment. Tune the set with the volume turned high and on a frequency where no intelligible signal is received. Listen for the sounds that are listed in table IV. Listen for these sounds at several different frequencies as widely separated as possible over the range of the receiver.

c. Isolation of Source. If interference is found, table IV will help to isolate the source to a particular system of the equipment. If a probe type antenna is not available, then, once the source is partially isolated by use of table IV, check each component of the suppression system one by one and correct any deficiencies until all interference is eliminated. Paragraph 138 lists all suppression components. If a probe type antenna is available, use it to probe various locations in the machine and listen for the interference on the receiver to reach its loudest point. By this method the source can be isolated to its exact point. Correct any deficiencies found until all interference is eliminated. Refer to paragraph 139 for replacement or repair of components.

138. Interference Suppression Components

a. Distributors and Ignition Coils. The distributor is built into a shielded housing which also provides the mounting for the ignition coil. Built-in radio suppression is employed in the distributors by a feed-through condenser as part of the primary terminal and a condenser inclosed in the housing and connected between the ignition coil terminal and ground.

b. Generators. A capacitor on the output cable in the shielding elbow of the terminal connector reduces radio interference on the generators.

c. Voltage Regulators. A terminal shield incloses the voltage regulator terminals and provides fittings for radio interference shielding.

d. Spark Plugs and Ignition Cables. Spark plugs and ignition cables have built-in shielding.

e. Lockwashers. Tooth-type washers are used under all bolt or screw heads and nuts used in mounting the voltage regulators, generators, distributors, fan adjusting arms, and fan brackets.

139. Replacement and Repair of Suppression Components

a. Replacement and repair of suppression components is accomplished in maintenance procedures outlined in the paragraph in this manual on the individual component.

b. Use new tooth-type washers under both the mounting screw

Table IV. Interference Checklist

Type of noise	Probable source	Probable cause
Clicks: Regular clicks that speed up when the engine speeds up and stop the second the switch is turned off.	Ignition system: clicks are spark plugs firing or points opening.	Poor adjustment or poor condition of breaker points or spark plugs, loose connections, loose bond straps, broken resistor-suppressors, loose shielding, or defective filter or capacitor.
Clicks: Irregular clicks that speed up when the engine speeds up and continue a moment after the switch is turned off.	Generator regulator: clicks are contacts opening and closing.	Loose connections, loose mounting bolts or screws, loose shielding, or defective filter or capacitor.
Whine: Moaning sound that rises in pitch as the engine is speeded up and continues a moment after the switch is turned off.	Generator or exciter: whine is coming from the make and break contacts of brushes on the armature.	Loose connections, worn brushes or commutator, loose bond straps or shielding, or defective filter or capacitor.

or bolt heads and nuts when installing the distributors, voltage regulators, generators, fan adjusting arms, and fan brackets.

c. Replace damaged spark plugs and ignition cables.

Section VI. ELECTRICAL SYSTEMS

140. Description

a. Revolving Frame (fig. 54).

(1) *Starting circuit.* The starting circuit of the revolving frame engine includes the batteries (27), an ignition switch (19), and starting motor (24) with starter switch (25). The starting circuit is designed to carry high current with a minimum of loss. When the starter switch is actuated, the electric current from the battery flows to the starting motor. The starting motor converts this electric current into a mechanical force for cranking the engine. The starting circuit is a 24-volt system.

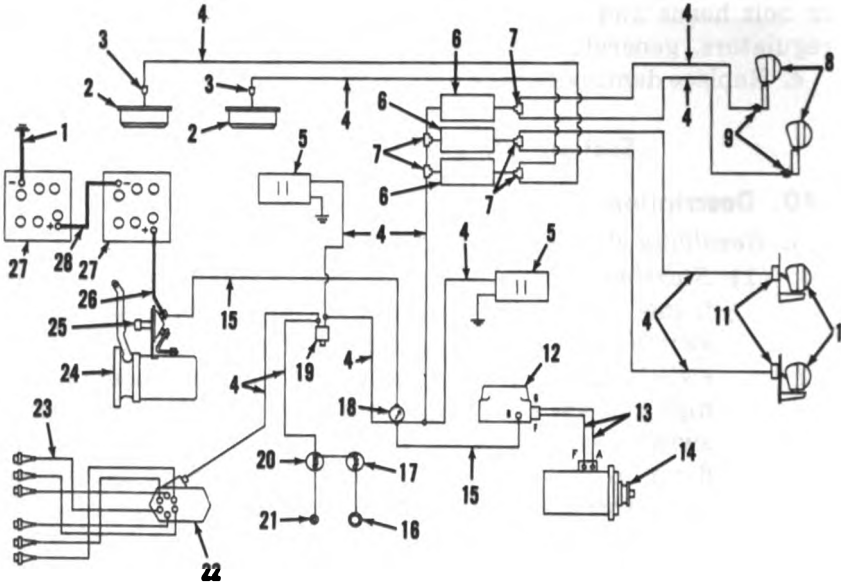
(2) *Charging circuit.* The charging circuit includes the generator (14), voltage regulator (12), batteries (27), and an ammeter (18). The generator is wound to produce a certain specified current. The voltage regulator is set to allow enough current from the generator to replace that which is taken from the battery. When the battery is fully charged, the voltage regulator bypasses the battery and keeps the battery from being overcharged. The battery does not store electrical current, but the chemical reaction of the electrolyte and the paste in the battery plates causes the electrical reaction. The charging circuit is a 24-volt system.

(3) *Ignition circuit.* The ignition circuit includes the distributor and ignition coil (22) and the spark plugs and shielded high-tension spark plug wires (23). The ignition coil produces high-tension current, and the distributor directs it at properly timed intervals to the spark plugs. The ignition circuit is a 24-volt system.

(4) *Lighting circuit.* The lighting circuit includes the switches (6), the cab lights (2), the upper floodlights (8), and the lower floodlights (10). Current from the battery is controlled by the switches to the cab lights and floodlights. The lighting circuit is a 24-volt system.

b. Carrier (fig. 55).

(1) *Starting circuit.* The starting circuit of the carrier engine includes the batteries (40), an ignition switch (27), and starting motor (37) with starter switch (38).



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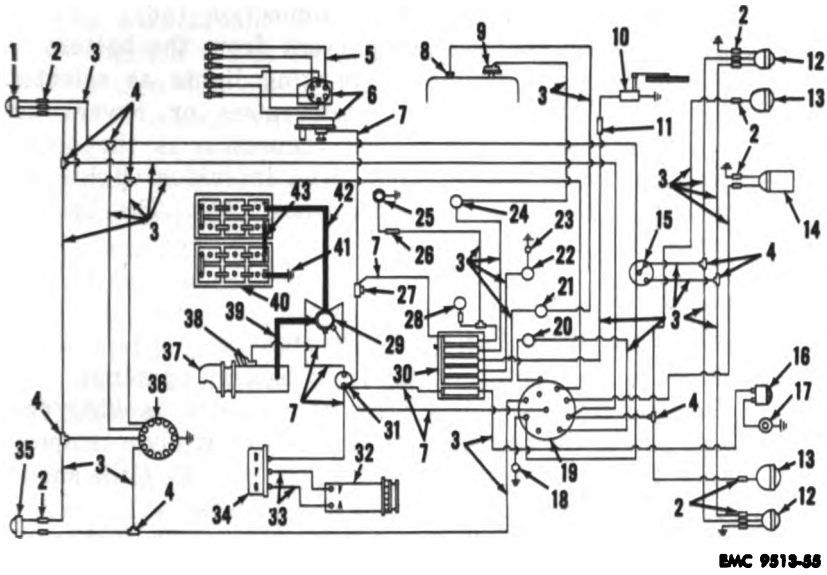
1	Battery cable	16	Oil pressure gage sending unit
2	Cab light	17	Oil pressure gage
3	Two-wire connector	18	Ammeter
4	Cable, No. 14 AWG	19	Ignition switch
5	Receptacle	20	Water temperature gage
6	Switch	21	Water temperature gage sending unit
7	Three-wire connector	22	Distributor and ignition coil
8	Upper floodlight	23	Shielded high tension spark plug wire
9	Entrance fitting	24	Starting motor
10	Lower floodlight	25	Starter switch
11	Junction box	26	Battery cable
12	Voltage regulator	27	Battery, 12-volt
13	Shielded cable assembly	28	Battery cable
14	Generator		
15	Cable, No. 8 AWG		

Figure 54. Practical wiring diagram, revolving frame.

The starting circuit is designed to carry high current with a minimum of loss. When the starter switch is actuated, the electric current from the battery flows to the starting motor. The starting motor converts this electric current into a mechanical force for cranking the engine. The starting circuit is a 24-volt system.

(2) *Charging circuit.* The charging circuit includes the generator (32), voltage regulator (34), batteries (40), and an ammeter (31). For description of the charging circuit, refer to *a*(2) above.

(3) *Ignition circuit.* The ignition circuit includes the distributor and ignition coil (6) and the spark plugs and shielded high-tension spark plug wires (5). The ig-



1	Combination blackout tail and service tail and stoplight	21	Water temperature gage
2	Two-wire connector	22	Fuel gage
3	Cable, No. 14 AWG	23	Fuel gage sending unit
4	Three-wire connector	24	Oil pressure gage
5	Shielded high-tension spark plug wire	25	Low air pressure warning lamp
6	Distributor and ignition coil	26	Low air pressure switch
7	Cable, No. 8 AWG	27	Ignition switch
8	Water temperature gage sending unit	28	Moisture ejector
9	Oil pressure gage sending unit	29	Magnetic switch
10	Windshield wiper	30	Fuse box
11	Windshield wiper switch	31	Ammeter
12	Headlight	32	Generator
13	Blackout marker light	33	Shielded cable assembly
14	Blackout headlight	34	Voltage regulator
15	Headlight dimmer switch	35	Combination blackout tail and stoplight
16	Horn	36	Trailer connection
17	Horn button	37	Starting motor
18	Instrument panel light and switch	38	Starter switch
19	Selector switch	39	Starter cable
20	Stoplight switch	40	Battery, 12-volt
		41	Battery cable
		42	Battery cable
		43	Battery cable

Figure 55. Practical wiring diagram, carrier.

nition coil produces high-tension current, and the distributor directs it at properly timed intervals to the spark plugs. The ignition circuit is a 24-volt system.

(4) *Lighting circuit.* The lighting circuit includes the combination blackout tail and service tail and stoplight (1), the combination blackout tail and stoplight (35), the headlights (12), the blackout marker lights (13), the blackout headlight (14), instrument panel light and switch (18), headlight dimmer switch (15), selector

switch (19), and the trailer connection (86). The selector switch controls the current from the battery to the individual running or parking lights as selected. The headlight dimmer switch raises or lowers the headlight beam. The trailer connection is the socket for the trailer lights cable. The individual lights are protected by fuses in the fuse box (80). The lighting circuit is a 24-volt system.

141. Batteries

a. Prepare Dry-Charge Battery for Service.

(1) Remove the sealing device from battery openings.

(2) Remove the electrolyte from the wooden packing case and add to the battery. Battery and electrolyte temperature should be above 60° and under 100° F. Cells should be filled to about one-half inch above plates.

(3) Allow the battery to stand for 2 hours. Check level of electrolyte. Raise it to one-half inch above the plates, if necessary.

(4) The battery is now ready for service. It will deliver about 75 percent of its rated capacity. Initial charge can be raised to full capacity by charging the battery before using.

b. Testing Battery. The battery should be tested weekly with a hydrometer which indicates the specific gravity of the electrolyte in the cells. The specific gravity readings should always be taken with the battery at the temperature of the surrounding air. A hydrometer reading of 1.275 to 1.300 at 80° F. indicates a fully charged battery. If any cells of the battery show a low reading on two successive testing dates, the battery should be removed, tested, and fully charged. A battery that cannot hold a charge should be replaced.

c. Filling.

(1) The level of electrolyte should be kept three-eighths to one-half inch above the plates. Add distilled water as needed before each day's run. If distilled water is not available, use clean, fresh rainwater. If any cell requires the addition of an abnormal amount of water, it should be checked for possible leaks. If all cells require an abnormal amount, the charging equipment should be checked.

(2) The top of the battery should be kept clean. After adding water, wipe the top and terminals with a piece of cloth. Clean terminals with a weak solution of ordinary baking soda or ammonia. Corrosion can be scraped off with

a wire brush. Rinse with fresh water and wipe dry. Tighten cables on terminals and coat with vaseline or a thin film of chassis grease to prevent corrosion.

Warning: Discard the cloth used to wipe the battery as it is contaminated with acid.

d. Removal of Revolving Frame Batteries (fig. 56).

(1) Remove the wingnuts (3). Lift off the battery box cover (2).

(2) Unscrew the clamp bolts of the battery ground cable (1), battery-to-starter switch cable (9), and the battery jumper cable (10). Remove the cables from the battery terminals. Lift out the batteries (4).

(3) Remove the nuts (6) and lockwashers (7). Remove the battery box bolts (5). Lift the battery box (8) off the revolving frame tailswing.

e. Removal of Carrier Batteries (fig. 57).

(1) Remove the wingnuts from the battery compartment studs (2) and lift off the battery compartment cover.

(2) Unscrew the clamp bolts of the battery-to-magnetic switch cable (1), the battery jumper cable (5), and the battery ground cable (6). Remove the cables from the battery terminals.

(3) Unscrew the wingnuts (8) from the battery holddown bolts (7). Lift out the battery holddown strap (4). Lift the batteries (3) from the battery compartment.

f. Installation of Revolving Frame Batteries (fig. 56).

(1) Position the battery box (8) on the angles welded to the revolving frame tailswing.

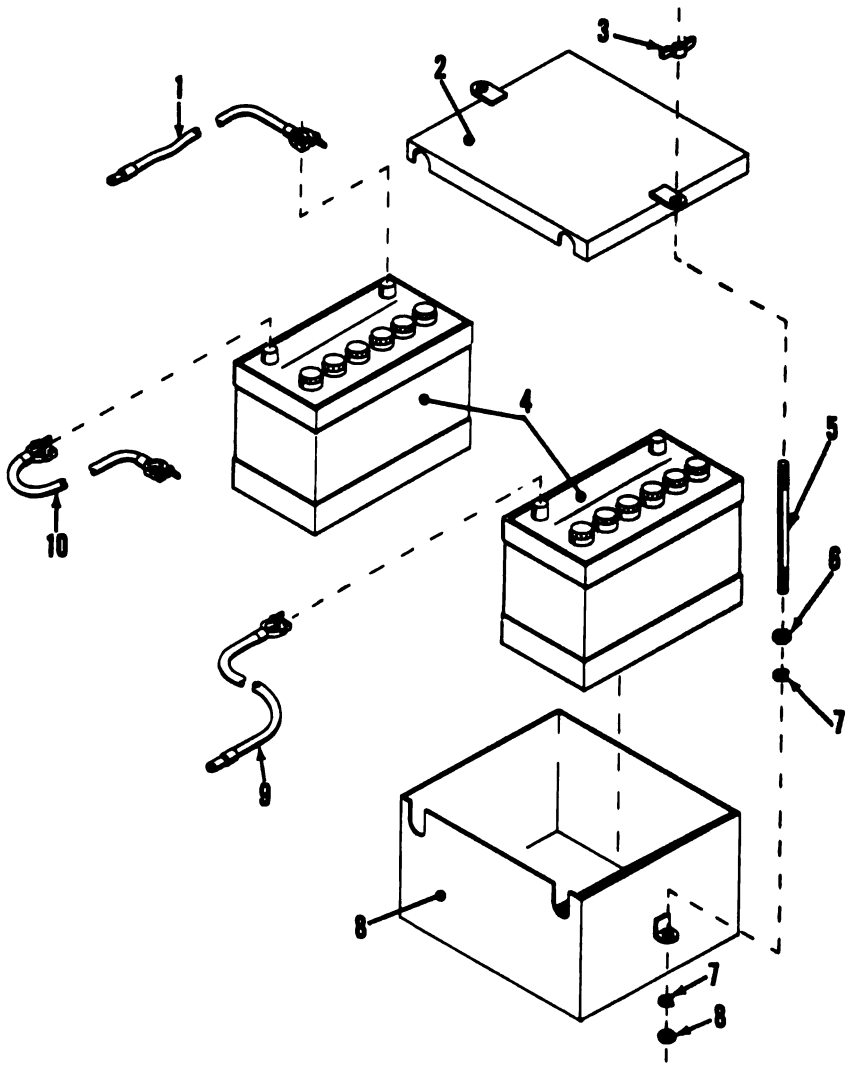
(2) Install the battery box bolts (5) with nuts (6) and lockwashers (7) through the angles on the box and secure with lockwashers (7) and nuts (6).

(3) Lower the batteries (4) into the battery box (8). Install the battery jumper cable (10), battery-to-starter switch cable (9), and the battery ground cable (1) on the battery terminals and tighten the cable clamp bolts. The battery-to-starter switch cable (9) is installed on the battery positive terminal. The battery ground cable (1) is installed on the battery negative terminal. Coat the cable clamps and terminals with vaseline or a thin film of chassis grease.

(4) Position the battery box cover (2) on the battery box (8) and battery box bolts (5). Secure the cover with wingnuts (3) on the bolts.

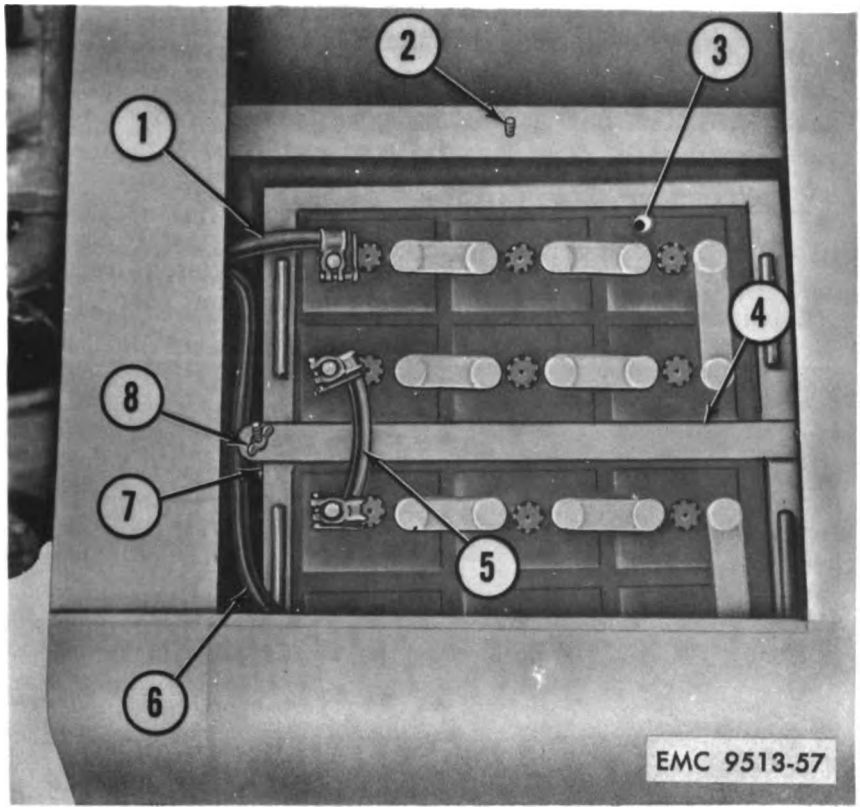
g. Installation of Carrier Batteries (fig. 57).

(1) Lower the batteries (3) into the battery compartment.



1 Battery ground cable
2 Battery box cover
3 Wingnut, std, ⅜–11 NC (2 rqr)
4 Battery, 12-volt (2 rqr)
5 Battery box bolt (2 rqr)
6 Nut, regular, hex, ⅜–11 NC (4 rqr)
7 Lockwasher, spring, std, ⅜ (4 rqr)
8 Battery box
9 Battery-to-starter switch cable
10 Battery jumper cable

Figure 56. Revolving frame battery box and batteries, exploded view.



1 Battery-to-magnetic switch cable
2 Battery compartment cover stud
3 Battery, 12-volt (2 rqr)
4 Battery holddown strap
5 Battery cable
6 Battery ground cable
7 Battery holddown bolt (2 rqr)
8 Wingnut, std, ⅝–16 NC (2 rqr)

Figure 57. Carrier batteries, installed

Position the battery holddown strap (4) across the batteries on the battery holddown bolts (7) and secure with the wingnuts (8).

Warning: When removing or installing batteries, be sure that tools or metal items do not make contact between the battery terminals or intercell connectors, as an explosion of gases created in the cells, or shorted cells, could cause serious burns to personnel and permanent damage to the batteries.

(2) Install the battery jumper cable (5), the battery-to-magnetic switch cable (1), and the battery ground cable (6) on the battery terminals and tighten the cable clamp bolts. The battery-to-magnetic switch cable (1) is installed on the battery positive cable. The battery ground cable (6) is installed on the battery

negative cable. Coat the cable clamps and terminals with vaseline or a thin film of chassis grease.

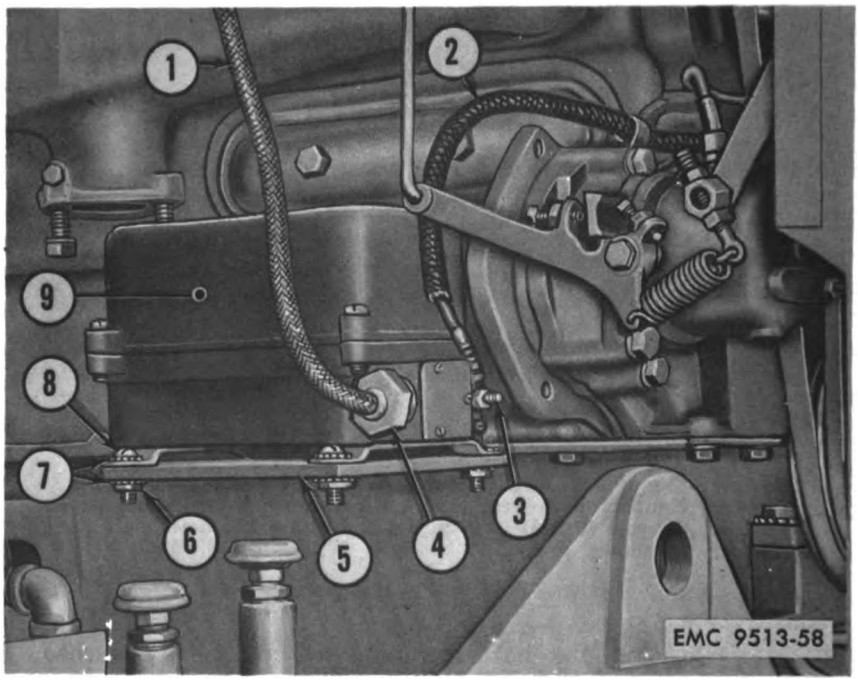
(3) Position the battery compartment cover over the batteries and studs (2) and secure with wingnuts.

142. Voltage Regulators

a. Revolving Frame (fig. 58).

(1) *Removal.*

(*a*) Remove the nut, lockwasher, and voltage regulator-to-ammeter cable (2) from the terminal (3).



1 Generator-to-voltage regulator shielded cable
2 Voltage regulator-to-ammeter cable
3 Terminal
4 Cable nut
5 Mounting bracket
6 Nut
7 External tooth lockwasher
8 Mounting screw
9 Voltage regulator

Figure 58. Revolving frame voltage regulator, installed.

(*b*) Unscrew the nut (4) of the generator-to-voltage regulator shielded cable (1). Pull the cable from the connector.

(*c*) Remove the nuts (6), external tooth lockwashers (7), and mounting screws (8). Remove the voltage regulator (9) from its mounting bracket (5).

(2) *Installation.*

(*a*) Position the voltage regulator (9) on the mounting bracket (5) and secure with mounting screws (8), external tooth lockwashers (7), and nuts (6). Make sure there is a new external tooth lockwasher under both the screw head and nut as an aid to radio interference suppression.

(*b*) Install the generator-to-voltage regulator cable (1) in the connector and screw on the cable nut (4).

(*c*) Install the voltage regulator-to-ammeter cable (2), lockwasher, and nut on the terminal (3).

b. Carrier. Refer to TM 5–5252 for removal and installation procedures on the carrier voltage regulator.

143. Generator Belt

a. Revolving Frame.

(1) *Adjustment.*

(*a*) Loosen the mounting screw nuts (4, fig. 59) on the mounting screws (10) at each end of the generator (2).

(*b*) Loosen the adjusting screws (3, fig. 60) and (13) of the generator adjusting strap (2). Pull the generator away from the engine to tighten the belt. Tighten the adjusting screws (3 and 13) and the mounting screw nuts (4, fig. 59) on the mounting screws (10).

(*c*) The generator belt is properly adjusted when the deflection (8, fig. 61) is approximately one-half inch using moderate pressure at a point midway between the generator pulley (1) and the crankshaft pulley (5).

(2) *Removal.*

(*a*) Loosen the mounting screw nuts (4, fig. 59) on the mounting screws (10) at each end of the generator (2).

(*b*) Loosen the adjusting screws (3, fig. 60) and (13). Push the generator toward the engine to loosen the belt.

(*c*) Lift the belt off the generator pulley (1, fig. 61), over the fan blades, and remove from the crankshaft pulley (5).

(3) *Installation.*

(*a*) Slip the generator belt over the fan blades. Position bottom of belt in the inner groove of the crankshaft

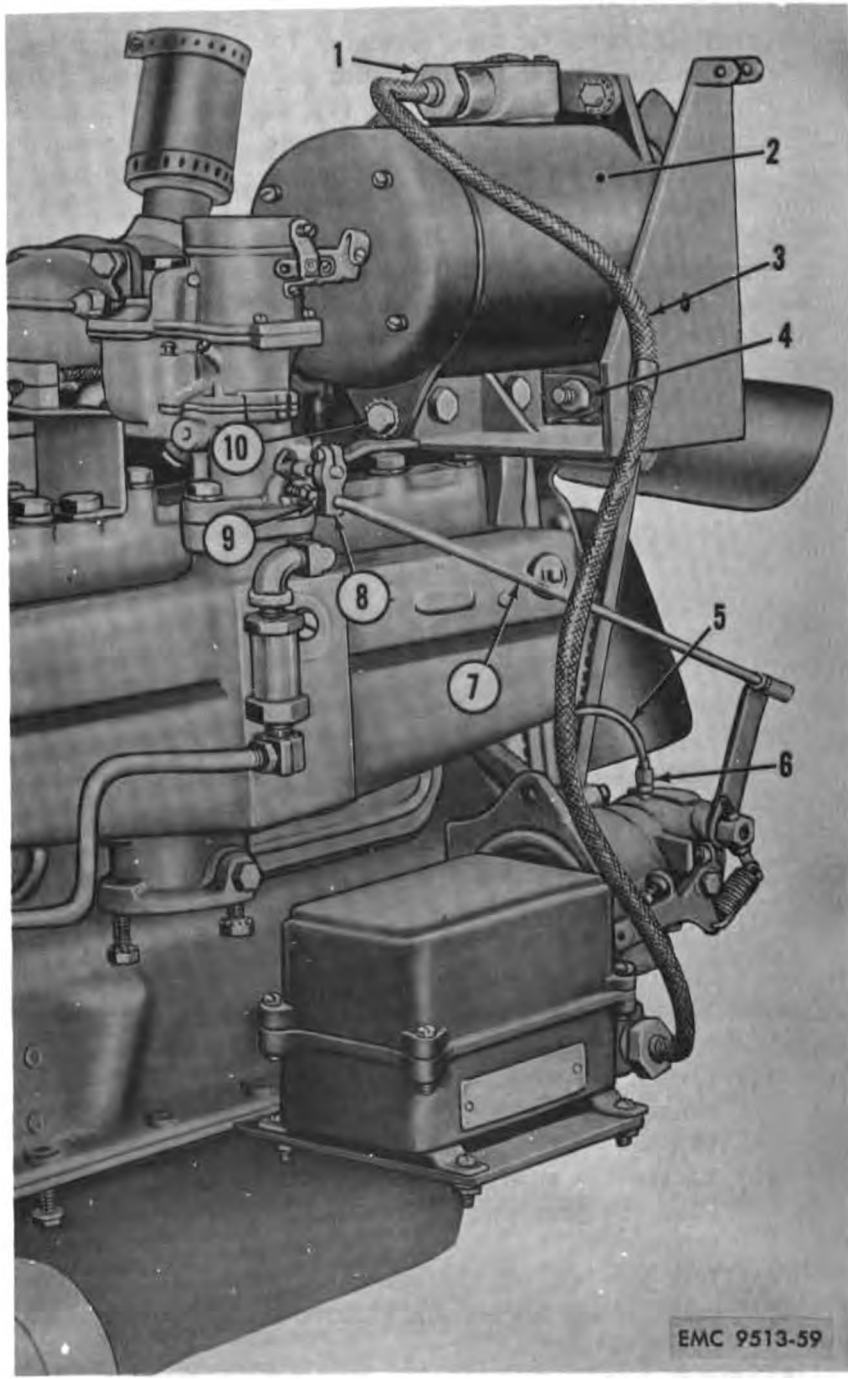


Figure 59. Generator, installed.

1 Nut
2 Generator
3 Generator-to-voltage regulator shielded cable
4 Mounting screw nut
5 Governor oil line
6 Tubing nut
7 Governor rod
8 Throttle clamp lever
9 Cotter pin
10 Mounting screw

pulley (5, fig. 61). Position fan belt in the generator pulley (1).

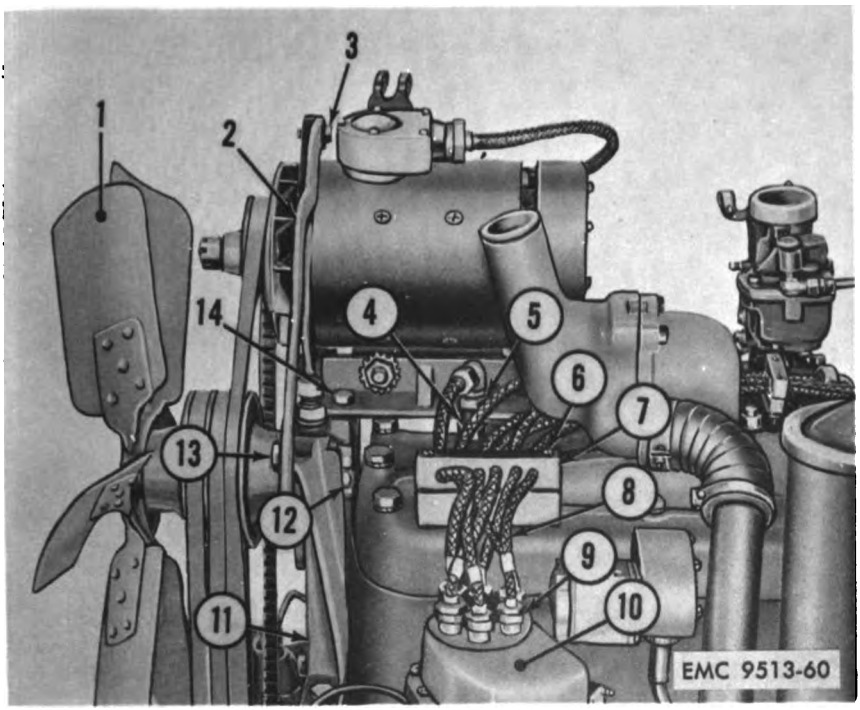
(*b*) Adjust the generator belt, as instructed in (1) above.

b. Carrier. Refer to TM 5–5252 for adjustment, removal, and installation of the carrier generator belt.

144. Generators

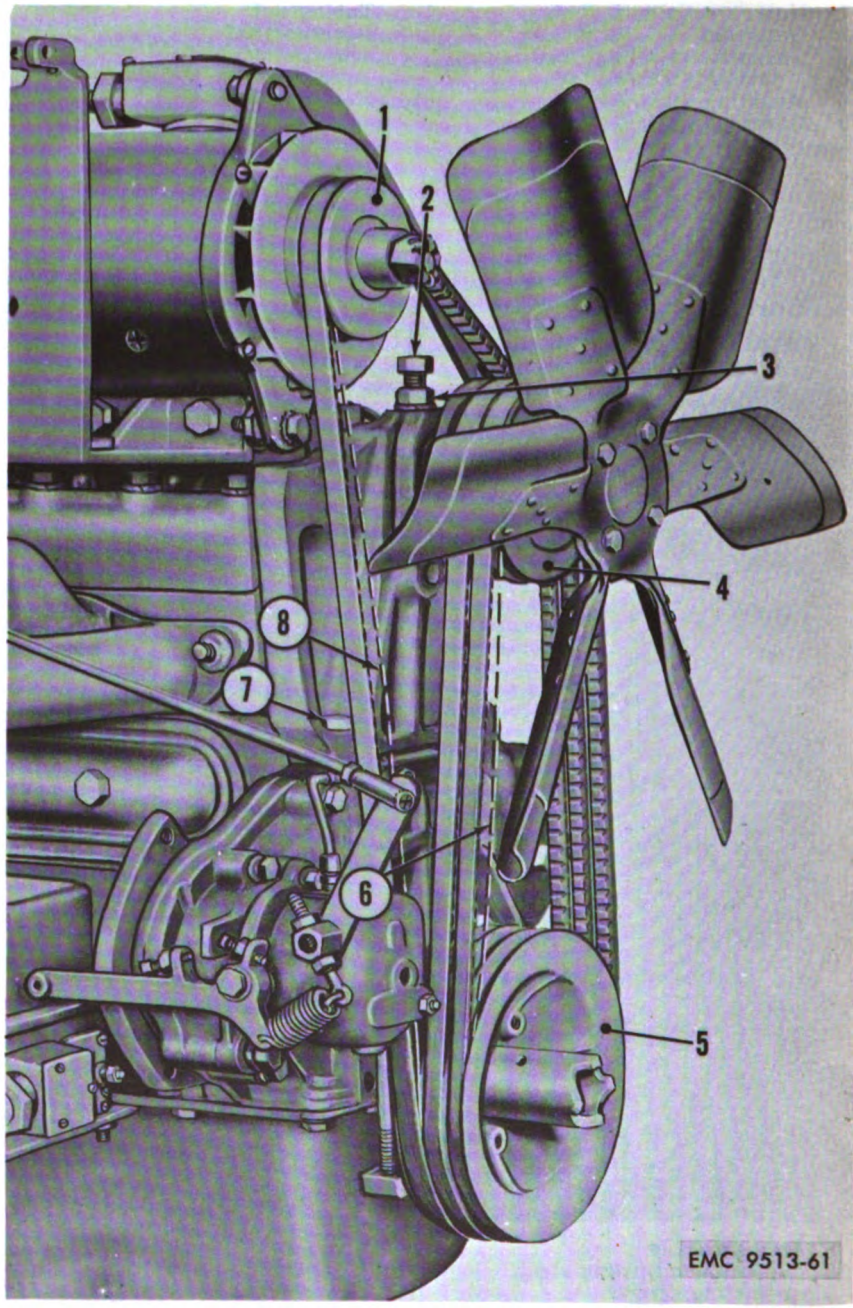
a. Revolving Frame.

(1) *Removal.*



1 Fan assembly
2 Generator adjusting strap
3 Adjusting screw
4 Spark plug
5 Elbow nut
6 Mounting screw
7 Bracket
8 Shielded high tension spark plug wire
9 Nut
10 Distributor and ignition coil
11 Fan bracket
12 Spindle nut
13 Adjust screw
14 Generator bracket mounting screw

Figure 60. Generator adjusting strap and spark plug, installed.



1 Generator pulley
2 Fan adjusting screw
3 Nut
4 Fan pulley
5 Crankshaft pulley
6 Fan belt deflection
7 Fan bracket mounting screw
8 Generator belt deflection

Figure 61. Generator and fan belt deflection.

(*a*) Unscrew the nut (1, fig. 59) from the generator (2) and pull the generator-to-voltage regulator shielded cable (3) from the connector.

(*b*) Remove the generator belt (par. 143*a*(2)).

(*c*) Remove the adjusting screw (3, fig. 60) and external tooth lockwasher from the generator adjusting strap (2).

(*d*) Remove the mounting screw nuts (4, fig. 59), external tooth lockwashers, and mounting screws (10). Lift the generator from the engine.

(2) *Installation.*

(*a*) Position the generator on the engine and install the mounting screws (10, fig. 59), external tooth lockwashers, and mounting screw nuts (4). Install the generator adjusting strap (2, fig. 60), external tooth lockwasher, and adjusting screw (3).

Note. **Use new external-tooth type lockwashers under both the screw heads and nuts as an aid to radio interference suppression.**

(*b*) Install and adjust the generator belt (par. 143*a*(1)).

(*c*) Install the generator-to-voltage regulator shielded cable (3, fig. 59) in the generator connector (2) and secure with the nut (1).

b. Carrier. Refer to TM 5–5252 for removal and installation procedures of the carrier generator.

145. Starting Motors

a. Revolving Frame (fig. 62).

(1) *Removal.*

(*a*) Remove the nut (3) and the lockwasher. Remove the battery cable (4) and ammeter cable (2) from the starter switch (7). Tape the terminal end of the battery cable (4).

(*b*) Remove a cotter pin and the pin (13) from the adjustable yoke end (1) and upper shift lever (12).

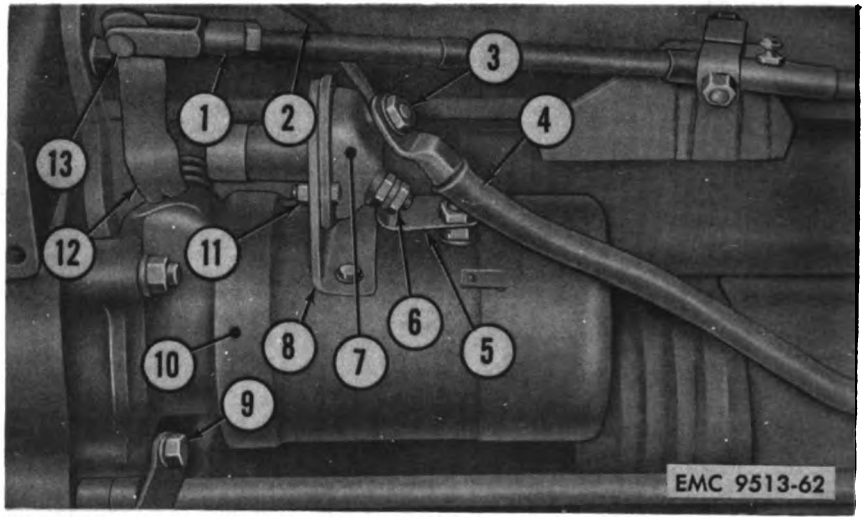
(*c*) Remove the mounting stud nuts (9) and lockwashers. Pull the starting motor (10) from the bellhousing.

(2) *Installation.*

(*a*) Position the starting motor (10) on the mounting studs and into the bellhousing to mesh with the flywheel. Secure the starting motor with lockwashers and mounting stud nuts (9).

(*b*) Position the ammeter cable (2) and battery cable (4), with tape removed, on the starter switch (7) terminal and secure with a lockwasher and nut (3).

(*c*) Position the adjustable yoke end (1) on the upper



1 Adjustable yoke end
2 Ammeter cable
3 Nut
4 Battery cable
5 Connector
6 Nut
7 Starter switch
8 Mounting bracket
9 Mounting stud nut
10 Starting motor
11 Mounting screw nut
12 Upper shift lever
13 Pin

Figure 62. Starting motor and starter switch, installed.

shift lever (12), insert the pin (13), and secure with a cotter pin.

b. Carrier. Refer to TM 5–5252 for removal and installation procedures of the carrier starting motor.

146. Starter and Magnetic Switches

a. Revolving Frame (fig. 62).

(2) *Removal.*

(*a*) Remove the nut (3) and lockwasher. Remove the battery cable (4) and ammeter cable (2) from the starter switch (7). Tape the terminal end of the battery cable (4).

(*b*) Remove the nut (6) and lockwasher from the starter switch terminal at the connector (5).

(*c*) Remove the mounting screw nuts (11), lockwashers, and mounting screws. Remove the starter switch (7) from the mounting bracket (8).

(2) *Installation.*

(*a*) Position the starter switch (7) in the mounting bracket (8) and secure with mounting screws, lockwashers, and mounting screw nuts (11). Install the connector

(5) on the starter switch terminal and secure with a lockwasher and nut (6).

(*b*) Position the ammeter cable (2) and battery cable (4), with tape removed, on the starter switch terminal and secure with a lockwasher and nut (3).

b. Carrier. Refer to TM 5–5252 for removal and installation procedures of the carrier magnetic switch.

147. Distributors

a. Revolving Frame.

(1) *Removal* (fig. 63).

(*a*) Remove the spark plug cable nuts (2) from the distributor cover (9). Remove the cables.

(*b*) Remove the mounting screws (8), lockwashers, and holddown clamps. Lift the distributor from the water pump body.

(2) *Installation* (fig. 63).

(*a*) Insert the distributor in the water pump body and position on the distributor flange of the body. Secure the distributor with the holddown clamps, external-tooth type lockwashers, and the mounting screws (8).

(*b*) Install the spark plug cables in the distributor cover (9) and secure with the cable nuts (2).

(3) *Timing.*

(*a*) Remove the number 1 cylinder spark plug. Crank the engine and bring number 1 piston on compression stroke until the flywheel dead center mark (2, fig. 64) lines up with the bellhousing dead center mark (1) at the timing hole in the bellhousing. The number 1 piston is now on top dead center.

(*b*) Remove the cover attaching screws (1, fig. 63), lockwashers, and distributor cover (9).

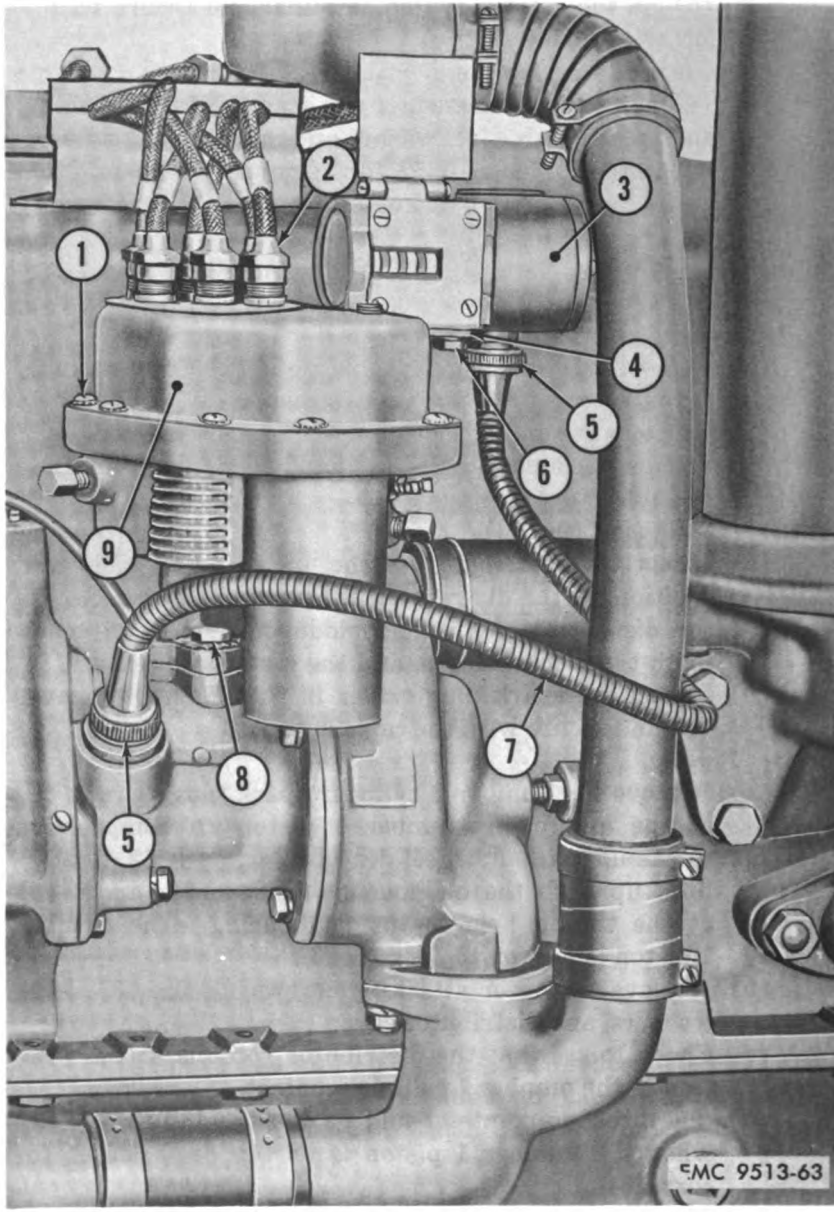
(*c*) Check to see that the distributor rotor is at the position of the number 1 cylinder contact.

(*d*) The breaker points should be just beginning to open when the number 1 piston is on top dead center for correct timing.

(*e*) If timing is not correct, loosen the mounting screws (8) and turn the distributor body until the breaker points just begin to open, then tighten the mounting screws.

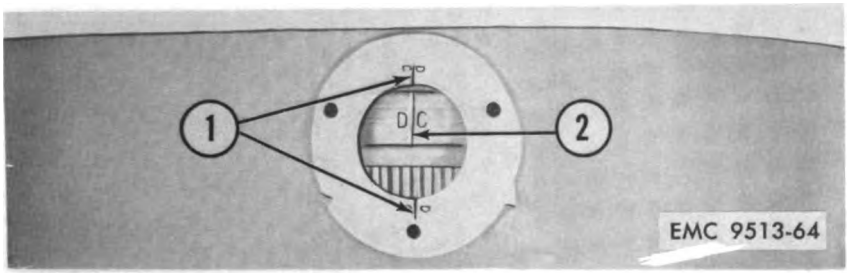
(*f*) Position the distributor cover (9) and gasket and secure with lockwashers and cover attaching screws (1).

(*g*) Install the spark plug.



1 **Cover attaching screw**
2 **Spark plug cable nut**
3 **Hour-meter**
4 **Mounting bracket**
5 **Drive shaft nut**
6 **Mounting screw**
7 **Flexible drive shaft**
8 **Mounting screw**
9 **Distributor cover**

Figure 63. Distributor and hour-meter, installed.



1 **Bellhousing dead center marks** 2 **Flywheel dead center mark**

Figure 64. Engine timing marks.

(4) *Breaker points.*

(*a*) *Adjustment* (fig. 65).

1. With the distributor cover removed, turn the breaker cam in the direction of rotation until the flat on the cam is next to the breaker lever. The cam lobe at the trailing end of the flat on the cam should just open the contact points.

2. Using a thickness gage, check the opening between the points. Minimum opening is 0.018-inch, maximum opening is 0.020-inch.

3. To adjust the opening, loosen the contact and support attaching screw and turn the adjusting screw in the contact and support until the opening is between 0.018- and 0.020-inch.

4. Tighten the contact and support attaching screw. Recheck the opening for a minimum of 0.018-inch and a maximum of 0.020-inch.

5. Install the distributor cover.

(*b*) *Removal.*

1. Remove the rotor (19, fig. 66).

2. Remove the distributor capacitor lead, adjusting screw, and contact and support attaching screw (fig. 65).

3. Remove the breaker lever (18, fig. 66) and the contact and support (3).

(*c*) *Installation.*

1. Position the contact and support (3, fig. 66) and secure with the contact and support attaching screw and the adjusting screw (fig. 65).

2. Install the distributor capacitor lead on the contact and support.

3. Install the rotor (19, fig. 66).

4. Adjust the breaker points ((*a*) above).

5. Check the engine timing ((3) above).

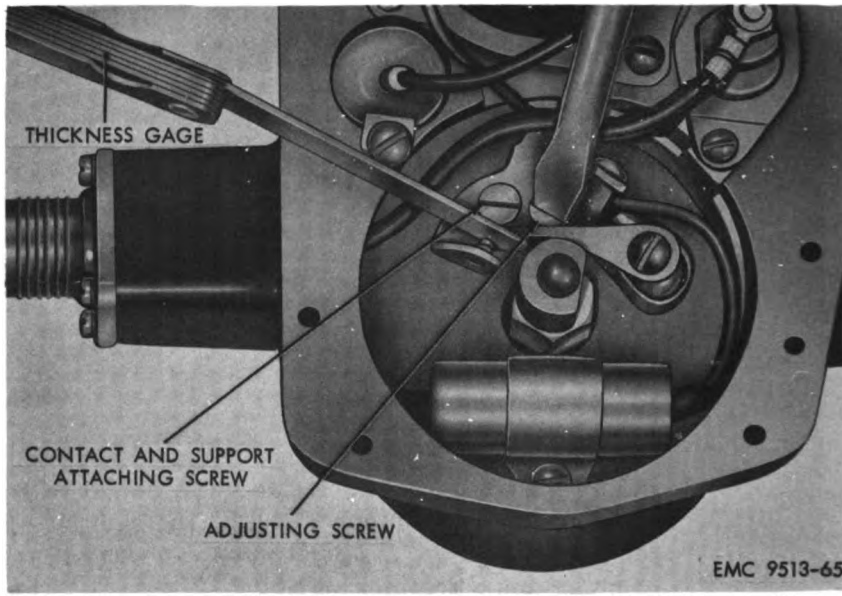


Figure 65. Adjusting distributor contact point opening.

(5) *Distributor capacitor* (fig. 66).

(*a*) *Removal.*

1. Remove the rotor (19).
2. Remove the mounting screw (1) and lockwasher and lift out the distributor capacitor (2).
3. Disconnect the capacitor lead at the contact and support (3).

(*b*) *Installation.*

1. Connect the capacitor lead to the contact and support (3).
2. Position the distributor capacitor (2) in the distributor housing (20) and secure with lockwasher and mounting screw (1).
3. Install the rotor (19).

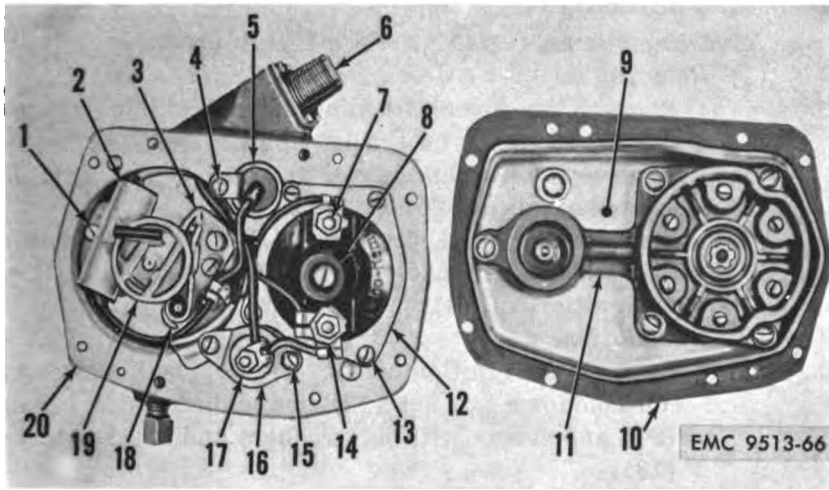
(6) *Ignition coil capacitor* (fig. 66).

(*a*) *Removal.*

1. Disconnect the lead of the ignition coil capacitor (5).
2. Remove the clamp screw (4), lockwasher, and clamp. Lift the capacitor from the distributor housing (20).

(*b*) *Installation.*

1. Position the ignition coil capacitor (5) in the distributor housing (20).
2. Connect the capacitor lead to the ignition coil connection (14).



1	Mounting screw	11	Distributor cap
2	Distributor capacitor	12	Coil holddown bracket
3	Contact and support	13	Bracket screw
4	Clamp screw	14	Ignition coil capacitor connection
5	Ignition coil capacitor	15	Bracket screw
6	Primary terminal capacitor and coupling	16	Resistor holddown bracket
7	Coil terminal	17	Radio suppression resistor
8	Ignition coil	18	Breaker lever
9	Distributor cover	19	Rotor
10	Cover gasket	20	Distributor housing

Figure 66. Distributor and cover.

3. Secure the capacitor with the clamp, lockwasher, and clamp screw (4).

(7) *Radio suppression resistor* (fig. 66).

(*a*) *Removal.*

1. Disconnect the lead at the terminal of the radio suppression resistor (17).

2. Remove the bracket screws (15), lockwashers, and resistor holddown bracket (16).

3. Remove the resistor and fiber glass sheet which is wrapped around the resistor.

(*b*) *Installation.*

1. Wrap the radio suppression resistor (17) with fiber glass sheet and position in the distributor housing (20).

2. Position the resistor holddown bracket (16) and secure with lockwashers and bracket screws (15).

3. Connect the resistor lead.

b. Carrier. Refer to TM 5–5252 for organizational maintenance on the carrier distributor.

148. Ignition Coils

a. Revolving Frame.

(1) *Removal.*

(*a*) Remove the cover attaching screws (1, fig. 63) and lockwashers. Lift off the distributor cover (9).

(*b*) Remove the lead at the coil terminal (7, fig. 66). Remove the coil capacitor connection (14).

(*c*) Remove the bracket screws (13) and lockwashers, coil holddown bracket (12), and coil gasket. Lift out the ignition coil (8).

(2) *Installation.*

(*a*) Position the ignition coil (8, fig. 66), coil gasket, and coil holddown bracket (12) in the distributor housing (20) and secure with lockwashers and bracket screws (13).

(*b*) Install the lead on the coil terminal (7). Install the capacitor connection (14).

(*c*) Position the distributor cover (9, fig. 63) and gasket and secure with lockwashers and cover attaching screws (1).

b. Carrier. Refer to TM 5–5252 for removal and installation procedures for the carrier ignition coil.

149. Spark Plugs

a. Revolving Frame.

(1) *Removal* (fig. 60).

(*a*) Remove the elbow nut (5) and spark plug wire (8) from the spark plug (4).

(*b*) Blow or brush away any loose dirt and dust in the spark plug well.

(*c*) Using a spark plug wrench, remove the spark plug from the cylinder head.

(2) *Cleaning and inspection.*

(*a*) Scrape away deposits of burnt carbon from the two electrodes, from the insulator, and around the inside of the shell. If deposits are not heavy, a soft wire brush will clean the plugs satisfactorily. Otherwise, use a knife blade.

(*b*) If the plug electrodes are burned so that an arc shows on the underside of the ground electrode, replace the plug.

(*c*) If the center insulator is cracked, chipped, or shows bits of shiny glass particles on its surface, replace the plug.

(3) *Adjusting gap* (fig. 67).

(*a*) Bend the side or ground electrode over the center electrode until the feeler gage will offer a slight resistance as it is drawn between the points.

(*b*) Adjust the point gap 0.028- to 0.030-inch.

(4) *Installation* (fig. 60).

(*a*) Position a new gasket and the spark plug in the cylinder head and tighten with a spark plug wrench, just a little more than handtight.

(*b*) Insert the spark plug wire (8) and elbow on the spark plug (4). Tighten the elbow nut (5) on the spark plug.

b. Carrier. Refer to TM 5–5252 for removal, installation, and adjustment of the carrier engine spark plugs.

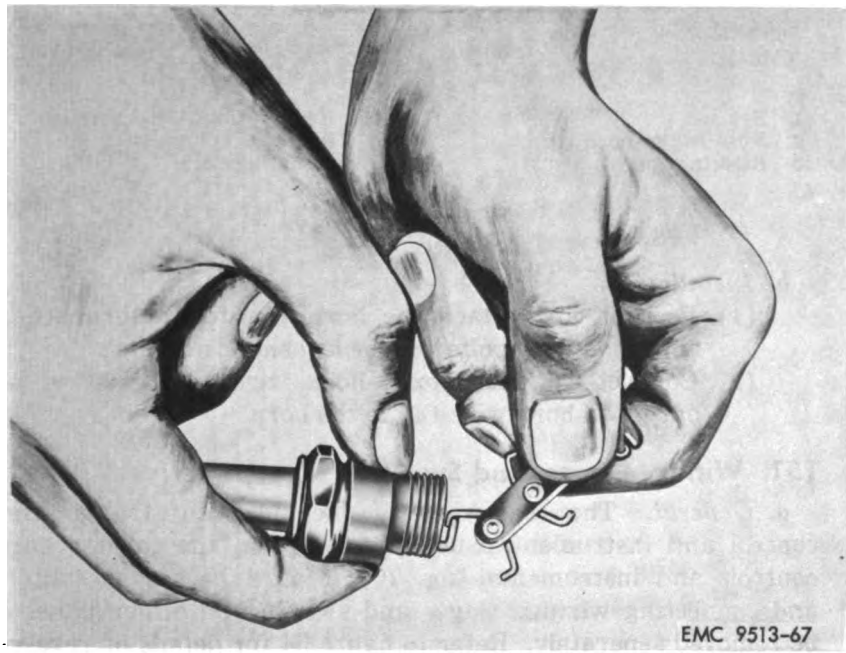


Figure 67. Checking spark plug gap with a wire feeler gage.

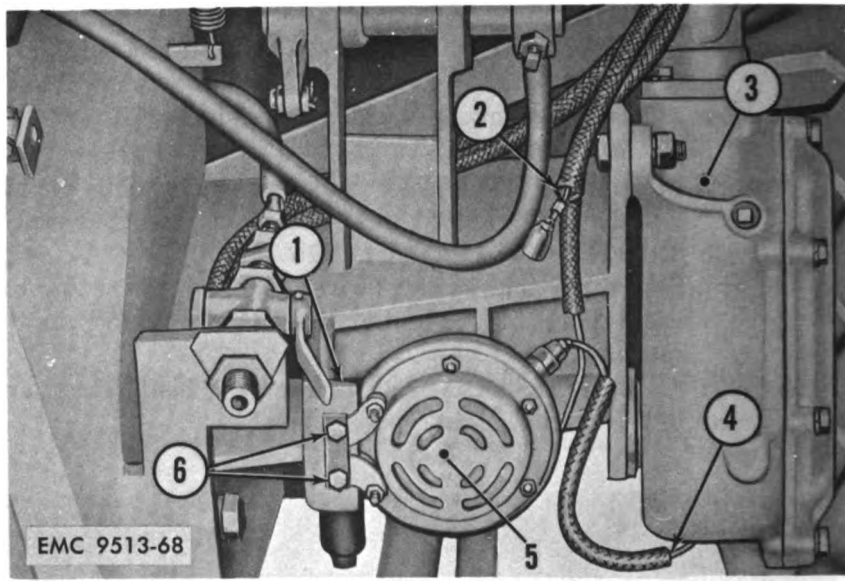
150. Horn

(fig. 68)

a. Removal.

(1) Disconnect the fuse box-to-horn wire (2) and the horn button-to-horn wire (4) from the horn (5).

(2) Remove the nuts, lockwashers, and mounting bolts (6) from the horn and bracket (1). Remove the horn.



1 Bracket
2 Fuse box-to-horn wire
3 Steering gear assembly
4 Horn button-to-horn wire
5 Horn
6 Mounting bolts

Figure 68. Horn, installed.

b. Installation.

(1) Position and attach the horn (5) to the bracket (1) with mounting bolts (6), lockwashers, and nuts.

(2) Connect the fuse box-to-horn wire (2) and the horn button-to-horn wire (4) to the horn.

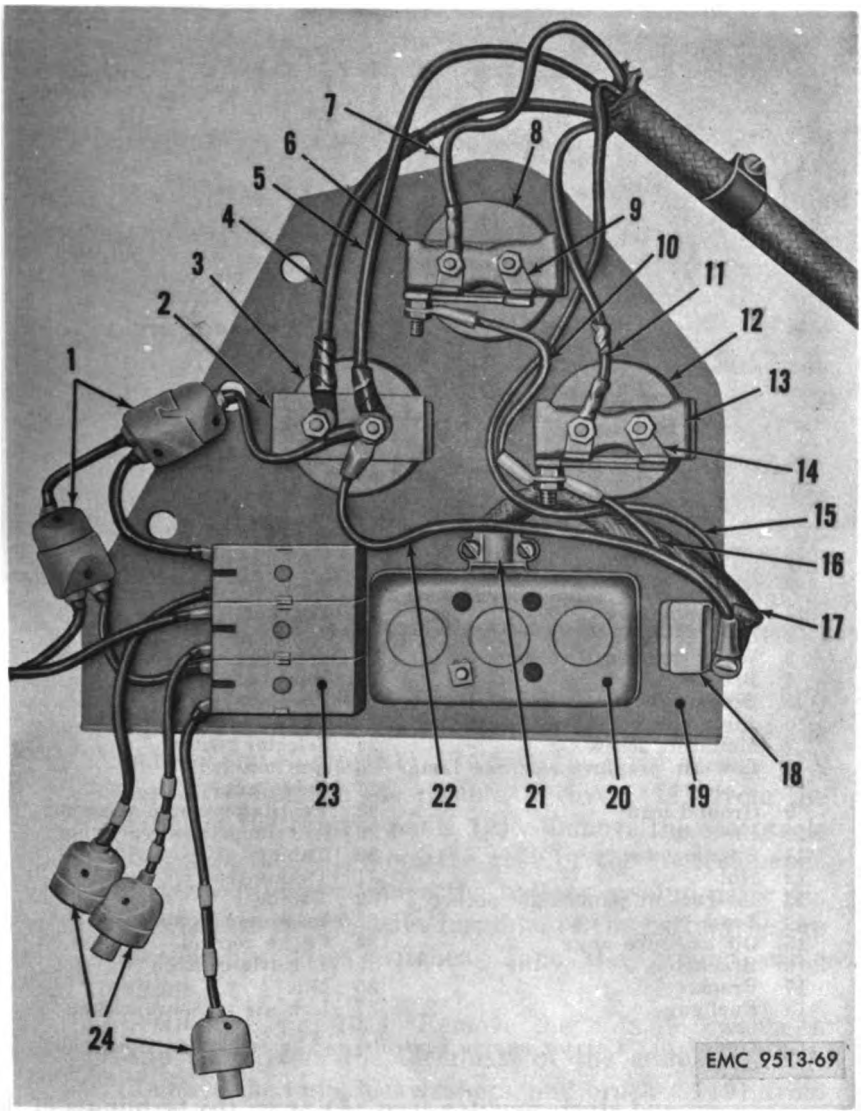
151. Wiring, Gages, and Switches

a. General. The rear view of the revolving frame engine control and instrument panel (fig. 69) and the carrier engine controls and instruments (fig. 70) locates the gages, switches, and connecting wiring. Gages and switches on either panel can be removed separately. Refer to figure 54 for details of revolving frame wiring and to figure 55 for details of carrier wiring. Make sure that all leads are tagged before removal from the gage or switch.

b. Removal.

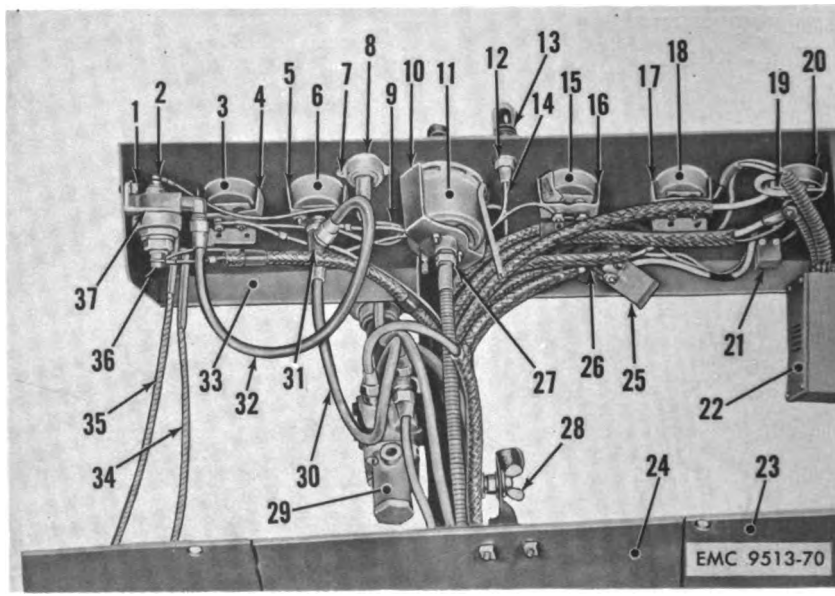
(1) *Revolving frame.* Always remove the battery ground cable (1, fig. 56) from the negative terminal of the battery before removing gages or switches. Tape the ground cable terminal.

(*a*) *Ammeter* (fig. 69). Remove the nuts, lockwashers, voltage regulator lead (4), ignition switch lead (22),



1	Three-wire connector	12	Oil pressure gage
2	Bracket	13	Bracket
3	Ammeter	14	Jumper
4	Voltage regulator lead	15	Distributor lead
5	Starter switch lead	16	Ignition switch lead
6	Bracket	17	Loom
7	Water temperature gage sending unit lead	18	Ignition switch
8	Water temperature gage	19	Control panel
9	Jumper	20	Receptacle box
10	Water temperature gage-to-oil pressure gage lead	21	Clamp
11	Oil pressure gage sending unit lead	22	Ignition switch lead
		23	Light switch
		24	Two-wire connector

Figure 69. Revolving frame engine control and instrument panel, rear view.



1	Mounting screw	19	Bracket
2	Nut	20	Ammeter
3	Water temperature gage	21	Windshield wiper switch
4	Bracket	22	Fuse box
5	Bracket	23	Toeplate
6	Air pressure gage	24	Ventilator
7	Mounting screw	25	Selector switch
8	Low air pressure warning lamp socket	26	Ignition switch
		27	Cable nut
9	Ground lead	28	Ventilator clamp wingnut
10	Bracket	29	Air compressor governor
11	Speedometer	30	Tubing
12	Nut	31	Tubing tee
13	Instrument panel light socket	32	Tubing
14	Lead	33	Instrument panel
15	Oil pressure gage	34	Choke control
16	Bracket	35	Throttle control
17	Bracket	36	Nut
18	Fuel gage	37	Low air pressure switch

Figure 70. Carrier engine controls and instruments, rear view.

and starter switch lead (5) from the terminals of the ammeter (3). Remove the nuts, lockwashers, and bracket (2) from the terminals of the ammeter. Remove the ammeter from the front of the control panel (19).

(*b*) *Water temperature gage* (fig. 69). Remove the nuts, lockwashers, jumper (9), and water temperature gage sending unit lead (7) from the terminals of the water temperature gage (8). Remove the nuts, lockwashers, and bracket (6) from the terminals of the water temperature gage. Remove the gage from the front of the control panel (19).

(*c*) *Oil pressure gage* (fig. 69). Remove the nuts, lockwashers, jumper (14), and oil pressure gage sending unit lead (11) from the terminals of the oil pressure gage (12). Remove the nuts, lockwashers, and bracket (13) from the terminals of the oil pressure gage. Remove the gage from the front of the control panel (19).

(*d*) *Ignition switch* (fig. 69). Remove the ignition switch leads (22 and 16), distributor lead (15), and leads in the loom (17) from the terminals of the ignition switch (18). Loosen the setscrew in the body of the ignition switch button on the front of the control panel (19). Remove the button and the nut behind the button. Remove the ignition switch from the rear of the control panel.

(*e*) *Light switches.* Disconnect the two-wire connector (24, fig. 69) or three-wire connector (1) from the light switch (23) to be removed. Remove two mounting screws (8, fig. 35) and two external teeth lockwashers (9) from the switch to be removed. Remove the light switch from the rear of the control panel (2).

(*f*) *Receptacle.* Disconnect the leads in the loom (17, fig. 69) from the ignition switch (18). Remove the screws and clamp (21). Remove the cover screws (10, fig. 35). Remove the receptacle cover (11) from the front of the control panel (2). Remove the receptacle box (20, fig. 69) from the rear of the control panel.

(2) *Carrier.* Always remove the battery ground cable (6, fig. 57) from the negative terminal of the battery before removing gages or switches. Tape the ground cable terminal.

(*a*) *Ammeter* (fig. 70). Remove the nuts, lockwashers, and leads from the terminals of the ammeter (20). Remove the nuts, lockwashers, and bracket (19) from the terminals of the ammeter. Remove the ammeter from the front of the instrument panel (33).

(*b*) *Water temperature gage* (fig. 70). Remove the nuts, lockwashers, and leads from the terminals of the water temperature gage (3). Remove the nuts, lockwashers, and bracket (4) from the terminals of the water temperature gage. Remove the gage from the front of the instrument panel (33).

(*c*) *Oil pressure gage* (fig. 70). Remove the nuts, lockwashers, and leads from the terminals of the oil pressure gage (15). Remove the nuts, lockwashers, and

bracket (16) from the terminals of the oil pressure gage. Remove the gage from the front of the instrument panel (33).

(*d*) *Air pressure gage* (fig. 70). Drain the air reservoirs. Disconnect the tubing (30 and 32) from the tubing tee (31). Remove the tubing tee from the air pressure gage (6). Remove the nuts, lockwashers, and bracket (5) from the terminals of the air pressure gage. Remove the gage from the front of the instrument panel (33).

(*e*) *Fuel gage* (fig. 70). Remove the nuts, lockwashers, and leads from the terminals of the fuel gage (18). Remove the nuts, lockwashers, and bracket (17) from the terminals of the fuel gage. Remove the gage from the front of the instrument panel (33).

(*f*) *Speedometer* (fig. 70). Remove the cable nut (27) from the speedometer (11). Remove the nuts, lockwashers, and bracket (10) from the terminals of the speedometer. Remove the speedometer from the front of the instrument panel (33).

(*g*) *Ignition switch* (fig. 70). Remove the leads from the terminals of the ignition switch (26). Remove the locking ring from the ignition switch on the front of the instrument panel (33). Remove the switch from the rear of the instrument panel.

(*h*) *Selector switch* (fig. 70). Remove the leads from the terminals of the selector switch (25). Remove the screw in the selector switch handle on the front of the instrument panel (33). Remove the handle. Remove the selector switch from the rear of the instrument panel.

(*i*) *Windshield wiper switch* (fig. 70). Remove the leads from the terminals of the windshield wiper switch (21). Loosen the setscrew in the body of the windshield wiper switch button on the front of the instrument panel (33). Remove the button and the nut behind the button. Remove the windshield wiper switch from the rear of the instrument panel.

(*j*) *Low air pressure switch* (fig. 70). Drain the air reservoirs. Disconnect the tubing (32) from the low air pressure switch (37). Remove the nuts (2 and 36) and leads from the terminals of the low air pressure switch. Remove two nuts, two lockwashers, and two mounting screws (1). Remove the low air pressure switch from the instrument panel.

(*k*) *Low air pressure warning light socket* (fig. 70). Remove the nut (2) and lead from the terminal of the low air pressure switch (37). Disconnect the ground lead (9) from ground. Remove two nuts, two lockwashers, and two mounting screws (7) from the warning light ring on the front of the instrument panel and the socket (8) on the rear of the panel. Remove the socket.

(*l*) *Instrument panel light socket* (fig. 70). Disconnect the lead (14) from the terminal on the selector switch (25). Remove the nut (12). Remove the instrument panel light socket (13) from the front of the instrument panel (33).

c. *Installation.*

(1) *Revolving frame.* Be sure to remove the tape from the battery ground cable terminal (1, fig. 56), and install the cable terminal on the negative terminal of the battery after gages or switches are installed.

(*a*) *Ammeter* (fig. 69). Install the ammeter (3) in the front of the control panel (19). Install the bracket (2) on the terminals of the ammeter and secure with lockwashers and nuts. Install the starter switch lead (5), ignition switch lead (22), and voltage regulator lead (4) on the terminals of the ammeter and secure with lockwashers and nuts.

(*b*) *Water temperature gage* (fig. 69). Install the water temperature gage (8) in the front of the control panel (19). Install the bracket (6) on the terminals of the water temperature gage and secure with lockwashers and nuts. Install the water temperature gage sending unit lead (7) and the jumper (9) on the terminals of the water temperature gage and secure with lockwashers and nuts.

(*c*) *Oil pressure gage* (fig. 69). Install the oil pressure gage (12) in the front of the control panel (19). Install the bracket (13) on the terminals of the oil pressure gage and secure with lockwashers and nuts. Install the oil pressure gage sending unit lead (11) and jumper (14) on the terminals of the oil pressure gage and secure with lockwashers and nuts.

(*d*) *Ignition switch* (fig. 69). Install the ignition switch in the rear of the control panel (19) and secure with a large nut on front of the panel. Install the ignition switch button and secure with a setscrew. Install the ignition switch leads (16 and 22), distributor lead

(15), and leads in the loom (17) on the terminals of the ignition switch and secure with lockwashers and nuts.

(*e*) *Light switches.* Install the light switch (23, fig. 69) in the rear of the control panel (19) and secure with external teeth lockwashers (9, fig. 35) and mounting screws (8). Connect the two-wire connector (24, fig. 69) or three-wire connector (1) to the proper light circuit.

(*f*) *Receptacle.* Position the receptacle box (20, fig. 69) on rear of control panel (19). Position the receptacle cover (11, fig. 35) on the front of the panel and secure to the box with cover screws (10). Clamp the loom (17, fig. 69) to the control panel with clamp (21) and screws. Attach the leads to the terminals of the ignition switch (18).

(2) *Carrier.* Be sure to remove the tape from the battery ground cable terminal (6, fig. 57) and install the cable terminal on the negative terminal of the battery after gages or switches are installed.

(*a*) *Ammeter* (fig. 70). Install the ammeter (20) in the front of the instrument panel (33). Install the bracket (19) on the terminals of the ammeter and secure with lockwashers and nuts. Install the leads on the terminals of the ammeter and secure with lockwashers and nuts.

(*b*) *Water temperature gage* (fig. 70). Install the water temperature gage (3) in the front of the instrument panel (33). Install the bracket (4) on the terminals of the water temperature gage and secure with lockwashers and nuts. Install the leads on the terminals of the water temperature gage and secure with lockwashers and nuts.

(*c*) *Oil pressure gage* (fig. 70). Install the oil pressure gage (15) in the front of the instrument panel (33). Install the bracket (16) on the terminals of the oil pressure gage and secure with lockwashers and nuts. Install the leads on the terminals of the oil pressure gage and secure with lockwashers and nuts.

(*d*) *Air pressure gage* (fig. 70). Install the air pressure gage (6) in the front of the instrument panel (33). Install the bracket (5) on the terminals of the air pressure gage and secure with lockwashers and nuts. Install the tubing tee (31) on the air pressure gage.

Connect the tubing (30 and 32) to the tubing tee. Close the air reservoir draincocks.

(*e*) *Fuel gage* (fig. 70). Install the fuel gage (18) in the front of the instrument panel (33). Install the bracket (17) on the terminals of the fuel gage and secure with lockwashers and nuts. Install the leads on the terminals of the fuel gage and secure with lockwashers and nuts.

(*f*) *Speedometer* (fig. 70). Install the speedometer (11) in the front of the instrument panel (33). Install the bracket (10) on the terminals of the speedometer and secure with lockwashers and nuts. Position the speedometer cable in the speedometer and secure with the cable nut (27).

(*g*) *Ignition switch* (fig. 70). Install the ignition switch (26) in the rear of the instrument panel (33) and secure with a locking ring on the front of the panel. Install the leads on the terminals of the ignition switch and secure with lockwashers and nuts.

(*h*) *Selector switch* (fig. 70). Install the selector switch (25) in the rear of the instrument panel (33). Install the switch handle on the front of the panel and secure with a screw. Install the leads on the terminals of the selector switch and secure with lockwashers and nuts.

(*i*) *Windshield wiper switch* (fig. 70). Install the windshield wiper switch (21) in the rear of the instrument panel (33). Install the switch nut on the front of the panel. Install the switch button and secure by tightening the setscrew in the body of the button.

(*j*) *Low air pressure switch* (fig. 70). Position the low air pressure switch (37) on the instrument panel (33) and secure with mounting screws (1), lockwashers, and nuts. Connect the tubing (32) to the low air pressure switch. Install the leads on the switch and secure with nuts (2 and 36). Close the air reservoir draincocks.

(*k*) *Low air pressure warning light socket* (fig. 70). Position the low air pressure warning light socket (8) on the rear of the instrument panel (33). Position the warning light ring on the front of the panel and secure to the light socket with mounting screws (7), lockwashers, and nuts. Install the lead on the terminal of the low air pressure switch (25) and secure with the nut (2). Connect the ground lead (9) to ground.

(*l*) *Instrument panel light socket* (fig. 70). Install the instrument panel light socket (13) in the front of the instrument panel (33). Install the nut (12) on the socket. Connect the lead (14) to the terminal on the selector switch (25).

152. Floodlights
(fig. 71)

a. Replacing Sealed Units.

(1) Remove the screws (7) and lockwashers (5). Pull the door (1) from the body (15).

(2) Remove the screws (6) and lockwashers (5). Remove the retaining plate (4) and the sealed unit (3). Remove the sealed unit from connector (20).

(3) Position new sealed unit in the door. Position the retaining plate (4) on the sealed unit (3) and secure to the door with lockwashers (5) and screws (6).

(4) Position sealed unit and door in the wiring and connector assembly (20) and body (15). Secure body and door with lockwashers (5) and screws (7).

b. Removal.

(1) Disconnect the wires outside the body from the wiring and connector assembly (20).

(2) Remove the bottom jamnut (17) and lockwasher (19) from the body stud. Remove the headlight assembly from the mounting bracket. Remove the mounting washer (18) from the mounting bracket.

c. Installation.

(1) Position the mounting washer (18) on the mounting bracket. Insert the body stud through the mounting washer and bracket and secure with a lockwasher (19) and jamnut (17).

(2) Connect the wiring to the wiring and connector assembly (20) outside the body (15).

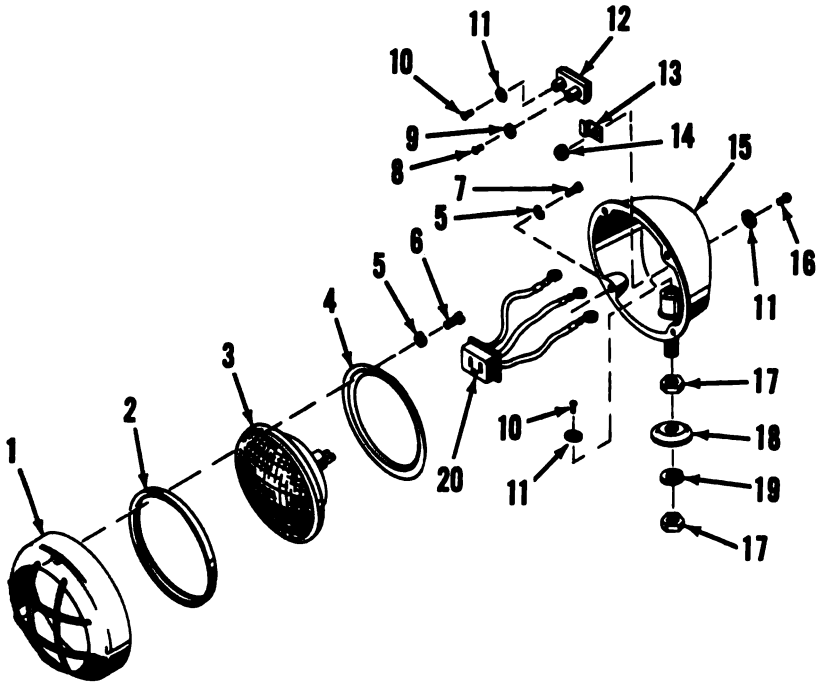
d. Adjustment.

(1) *Horizontal.* Loosen the bottom jamnut (17) and turn the body (15) as desired. Tighten the jamnut.

(2) *Vertical.* Vertical adjustment of the floodlight is confined to the position of the jamnuts (17) on the body stud and bracket.

153. Headlights
(fig. 72)

a. General. Headlights are sealed beam units combining lens, reflector, and lamp in a sealed unit (5). Each headlight has a double filament to provide two distinct beams: an upper beam



EMC 9513-71

1 Door (4 rqr)
2 Door gasket (4 rqr)
3 Sealed unit assembly (4 rqr)
4 Retaining plate (4 rqr)
5 Lockwasher, spring std, No. 10 (28 rqr)
6 Screw (12 rqr)
7 Screw (16 rqr)
8 Screw, machine, rd hd, No. 10–32 x ¼ (4 rqr)
9 Lockwasher, internal tooth, No. 10 (4 rqr)
10 Screw, machine, rd hd, No. 8–32 x ¼ (8 rqr)
11 Lockwasher, internal tooth, No. 8 (16 rqr)
12 Terminal plate assembly (4 rqr)
13 Terminal plate clip (8 rqr)
14 Nut, regular, hex, No. 8–32 (8 rqr)
15 Body assembly (4 rqr)
16 Screw, machine, rd hd, No. 8–32 x 7/16 (8 rqr)
17 Jamnut, regular, hex, ⅝–18 NF (8 rqr)
18 Mounting washer (4 rqr)
19 Lockwasher, spring, std, ⅝ (4 rqr)
20 Wiring and connector assembly (4 rqr)

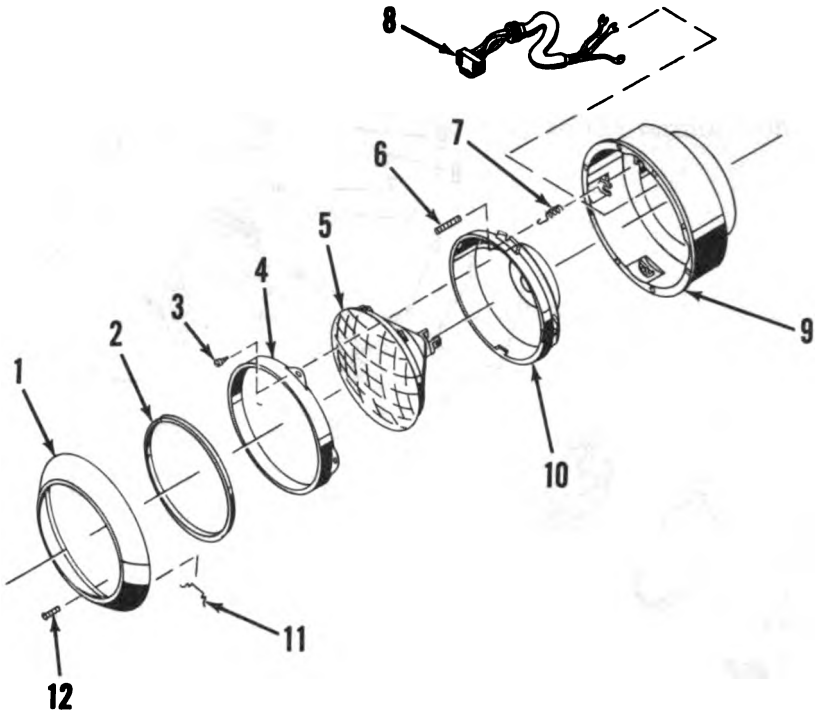
Figure 71. Floodlights, exploded view.

for night driving on clear roads, and a lower beam for use in traffic. Selection of the beams is controlled by the headlight dimmer switch.

b. Removal of Sealed Unit.

(1) Remove door screw (12) from bottom of door (1).

(2) Lift off the door and waterproofing door gasket (2) which is held secure inside door rim by door springs (11).



EMC 9513-72

1 Door (2 rqr)
2 Door gasket (2 rqr)
3 Screw (6 rqr)
4 Retaining ring (2 rqr)
5 Sealed unit (2 rqr)
6 Adjusting screw (4 rqr)
7 Adjusting screw spring (4 rqr)
8 Connector and wiring assembly (2 rqr)
9 Body assembly (2 rqr)
10 Mounting ring (2 rqr)
11 Door spring (6 rqr)
12 Door screw (2 rqr)

Figure 72. Headlights, exploded view.

(3) Remove the screws (3) and lift off the retaining ring (4).

(4) Pull sealed unit (5) partially out of the mounting ring (10) and disconnect from the connector and wiring assembly (8).

c. *Installation of Sealed Unit.*

(1) Plug the sealed unit into the connector and wiring assembly (8). Make sure the word "Top", stamped on the lens, is at the top.

(2) Push the sealed unit into and hold in the mounting ring (10)by placing the retaining ring (4) over the sealed unit. Secure the retaining ring with screws (3).

(3) Position the door (1), making sure the door gasket

(2) is correctly placed in the door rim. Install and tighten the door screw (12).

d. Removal of Headlight Assembly.

(1) Remove door screws (12) and door (1). Remove adjusting screws (6) and adjusting screw springs (7) and remove the retaining ring, sealed beam, and mounting ring assembly intact.

(2) Disconnect the wiring from the connector and wiring assembly (8) outside the body (9).

(3) Remove the mounting screws from the body.

e. Installation of Headlight Assembly.

(1) Position the body (9) in the headlight well of the carrier and secure with mounting screws.

(2) Connect the wiring to the connector and wiring assembly (8) outside the body.

(3) Install the retaining ring, sealed beam, and mounting ring assembly intact. Install the adjusting screw springs (7) and adjusting screws (6). Install the door (1) and door screws (12).

f. Adjustment.

(1) Park carrier on level ground with the carrier centerline at right angles to a smooth vertical wall. Headlights should aim directly at the wall and be 25 feet away from the wall.

(2) Draw a line on the wall parallel to the floor at the same height as the center of the headlights from the floor. Mark the carrier centerline on the wall and measure right and left of this centerline to indicate the centers of the headlights.

(3) Turn on the headlights. Cover one headlight and check the adjustment of the other headlight. A correctly adjusted headlight should have the brightest part of its beam hit the wall at a spot 3 inches below the headlight center point previously marked on the wall.

(4) To adjust direction of headlight beams, remove the door screw (12) and door (1). Turn the adjusting screws (6) in opposite directions as needed to direct headlight beam to conform with instructions in (3) above. Reinstall the door (1) and door screw (12). Repeat this operation to adjust the other headlight.

Note. Use care in aiming headlights, as an error of a few degrees from correct focus can be the difference between safe and unsafe lighting.

154. Combination Blackout Tail and Service Tail and Stoplight (fig. 73)

a. Replacing Bulbs.

(1) Remove the screws (1) and remove the door assembly (2) and door gasket (4) from the body (7).

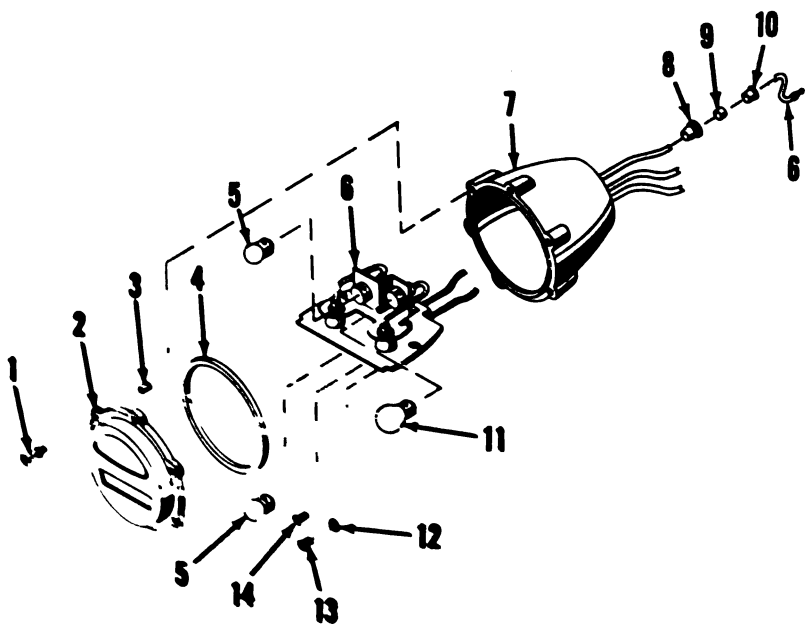
(2) Turn the bulbs (5 and 11) counterclockwise and remove from the socket and wiring assembly (6).

(3) Install new bulbs (5 and 11) in the socket and wiring assembly and turn clockwise to lock.

(4) Position the door assembly (2) with gasket (4) on the body (7) and secure with the screws (11).

b. Removal.

(1) Remove the screws (1) and remove the door assembly (2) and door gasket (4) from the body (7).



EMC 9513-73

1 Screw (6 rqr)
2 Door assembly
3 Screw, retaining ring (6 rqr)
4 Door gasket
5 Bulb, [illegible] volt
6 Socket and wiring assembly
7 Body
8 Shell (3 rqr)
9 Bushing (3 rqr)
10 Grommet (3 rqr)
11 Bulb, 32 cp, 24–28 volt
12 Lockwasher, spring std, No. 8 (3 rqr)
13 Screw, machine, rd hd, No. 8–32 x ⅜ (3 rqr)
14 Screw, machine, rd hd, No. 8–32 x 5/16 (3 rqr)

Figure 73. Combination blackout tail and service tail and stoplight, exploded view.

(2) Disconnect the opposite end of the wiring from the socket and wiring assembly (6), outside the body.
(3) Remove the screws (13) and lockwashers (12) from the socket and wiring assembly (6).
(4) Remove the socket and wiring assembly from the body. Remove the mounting screws (14) and body (7) from the carrier.

c. Installation.

(1) Position the body (7) on the carrier and secure with mounting screws (14).
(2) Position the socket and wiring assembly (6) in the body and secure with lockwashers (12) and screws (13).
(3) Connect the wiring to the socket and wiring assembly outside the body.
(4) Position the door assembly (2) with gasket (4) on the body and secure with the screws (1).

155. Combination Blackout Tail and Stoplight
(fig. 74)

a. Replacing Bulb.

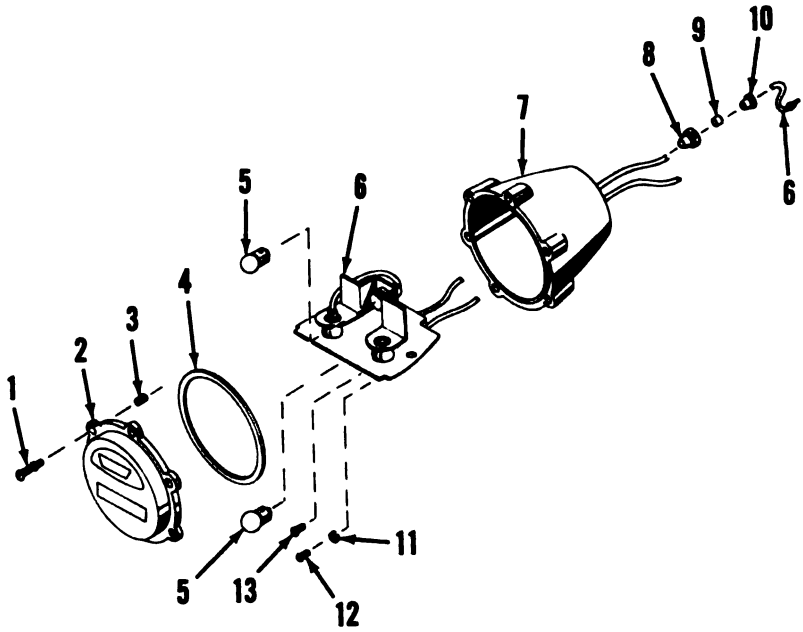
(1) Remove the screws (1) and remove the door assembly (2) and door gasket (4) from the body (7).
(2) Turn the bulb (5) counterclockwise and remove from the socket and wiring asembly (6).
(3) Install new bulb (5) in the socket and wiring assembly and turn clockwise to lock.
(4) Position the door assembly (2) with door gasket (4) on the body (7) and secure with the screws (1).

b. Removal.

(1) Remove the screws (1) and remove the door assembly (2) and door gasket (4) from the body (7).
(2) Disconnect the wiring from the socket and wiring assembly (6) outside the body.
(3) Remove the screws (12) and lockwashers (11) from the socket and wiring assembly.
(4) Pull the socket and wiring assembly out of the body. Remove mounting screws (13) and body (7) from the carrier.

c. Installation.

(1) Position the body (7) on the carrier and secure with mounting screws (13).
(2) Position the socket and wiring assembly (6) in the body and secure with lockwashers (11) and screws (12).



EMC 9513-74

1 Screw (6 rqr)
2 Door assembly
3 Screw retaining ring (6 rqr)
4 Door gasket
5 Bulb, 3 cp, 24–28 volt (2 rqr)
6 Socket and wiring assembly
7 Body
8 Shell (2 rqr)
9 Bushing (2 rqr)
10 Grommet (2 rqr)
11 Lockwasher, spring, std, No. 8 (3 rqr)
12 Screw, machine, rd hd, No. 8–32 x ⅜ (3 rqr)
13 Screw, machine, rd hd, No. 8–32 x 5/16 (2 rqr)

Figure 74. Combination blackout tail and stoplight, exploded view.

(3) Connect the wiring to the socket and wiring assembly outside the body.

(4) Position the door assembly (2) with gasket (4) on the body and secure with the screws (1).

156. Blackout Headlight
(fig. 75)

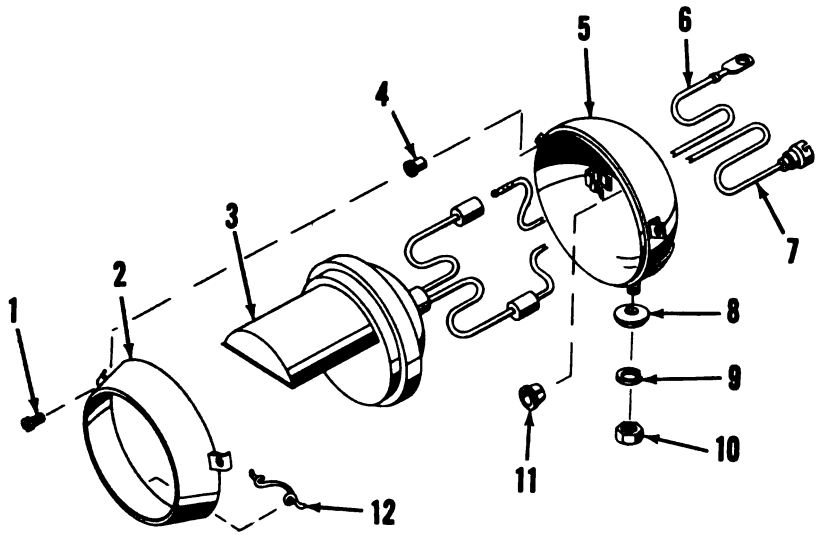
a. Replacing Sealed Unit.

(1) Remove the screws (1) and remove the door (2) from the body (5).

(2) Pull out and disconnect the sealed unit and wiring assembly (3) from the body (5).

(3) Connect wires of new sealed unit and wiring assembly in body (5). Position the unit in the body.

(4) Position the door (2) over the sealed unit and on the body and secure with screws (1).



EMC 9513-75

1	Screw (3 rqr)	7	Wire assembly
2	Door	8	Bearing washer
3	Sealed unit and wiring assembly	9	Lockwasher, spring, std, ⅜
4	Retaining ring (3 rqr)	10	Nut, regular, hex, ⅜–16 NC
5	Body assembly	11	Grommet
6	Ground wire assembly	12	Spring (3 rqr)

Figure 75. Blackout headlight, exploded view.

b. Removal.

(1) Disconnect the wire assemblies (6 and 7) outside of the body (5).

(2) Remove the nut (10) and lockwasher (9) from the body stud.

(3) Remove the headlight assembly and bearing washer (8) from the mounting bracket.

c. Installation.

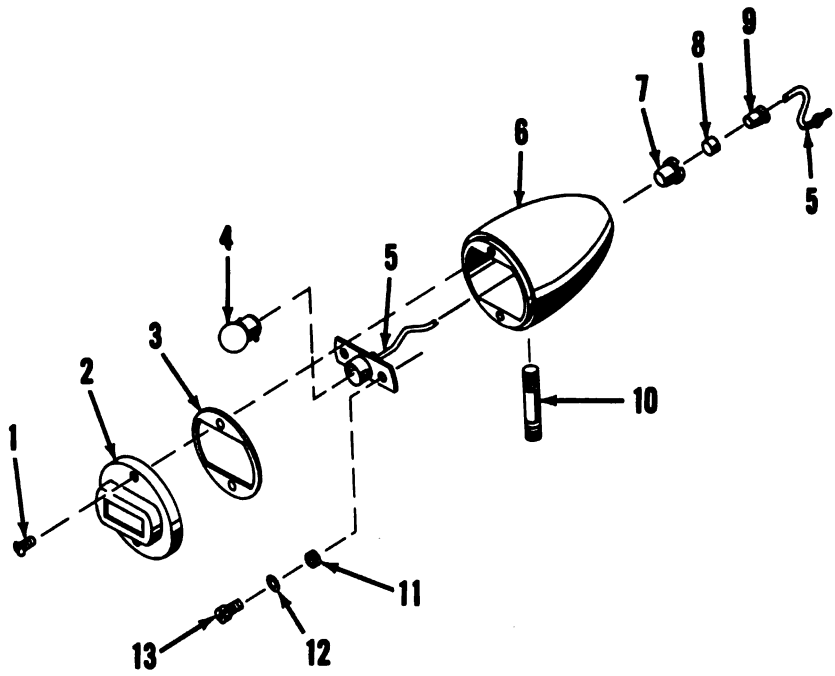
(1) Position the bearing washer (8) on the mounting bracket. Insert the body stud through the washer and bracket and secure with the lockwasher (9) and nut (10).

(2) Connect the wire assemblies (6) and (7).

157. Blackout Marker Lights
(fig. 76)

a. Replacing Bulb.

(1) Remove the door screws (1), door (2), and door gasket (3).



EMC 9513-76

1	Door screw (4 rqr)	7	Shell (2 rqr)
2	Door assembly (2 rqr)	8	Bushing (2 rqr)
3	Door gasket (2 rqr)	9	Grommet (2 rqr)
4	Bulb, 3 cp, 24–28 volt (2 rqr)	10	Stud (2 rqr)
5	Socket and wiring assembly (2 rqr)	11	Grommet (4 rqr)
6	Body (2 rqr)	12	Washer (2 rqr)
		13	Socket mounting screw (4 rqr)

Figure 76. Blackout marker lights, exploded view.

(2) Turn bulb (4) counterclockwise and remove from the socket and wiring assembly (5).

(3) Install new bulb (4) in the socket and wiring assembly (5) and turn clockwise to lock.

(4) Position door gasket (3) and door (2) on the body (6) and secure with the door screws (1).

b. Removal.

(1) Disconnect the wiring from the socket and wiring assembly (5) outside the body (6).

(2) Remove the mounting nuts and lockwashers attaching the stud (10) to the mounting bracket. Remove the marker light.

c. Installation.

(1) Install the marker light on the mounting bracket and secure with nut and lockwasher.

(2) Connect the wiring to the socket and wiring assembly (5) outside the body (6).

Section VII. HOUR-METERS

158. Description

The hour-meter records the total running time, in hours, of the engine. The hour-meter is driven through a flexible drive shaft from the hour-meter drive on the revolving frame engine water pump, and from the governor drive on the carrier engine.

159. Hour-Meter
(fig. 63)

a. Revolving Frame.

(1) *Removal.*

(*a*) Turn the drive shaft nuts (5) counterclockwise and remove the flexible drive shaft (7).

(*b*) Remove the mounting screws (6) and lockwashers. Lift the hour-meter (3) from the mounting bracket (4).

(2) *Installation.*

(*a*) Position the hour-meter (3) on the mounting bracket (4) and secure with lockwashers and mounting screws (6).

(*b*) Install the flexible drive shaft (7) in the hour-meter and drive and tighten the drive shaft nuts (5).

b. Carrier. Refer to TM 5–5252 for removal and installation of the carrier engine hour-meter.

Section VIII. FUEL SYSTEMS

160. Description

a. Revolving Frame (fig. 77). The revolving frame fuel system consists of the fuel tank (12), fuel lines (4 and 8) and fittings, fuel pump (5) with filter, carburetor (1), and the engine governor. The fuel stored in the fuel tank, mounted under the left platform, is drawn through the fuel lines and the fuel filter by the fuel pump and forced into the carburetor, where it is mixed with clean air coming through the air cleaner in the proper quantities before being delivered to the engine intake manifold.

b. Carrier (fig. 78). The carrier fuel system consists of the fuel tank (20), fuel lines (4 and 9) and fittings, a fuel filter (27), fuel pump (6) with filter, carburetor (1), and the engine governor. The fuel stored in the fuel tank, mounted on the left

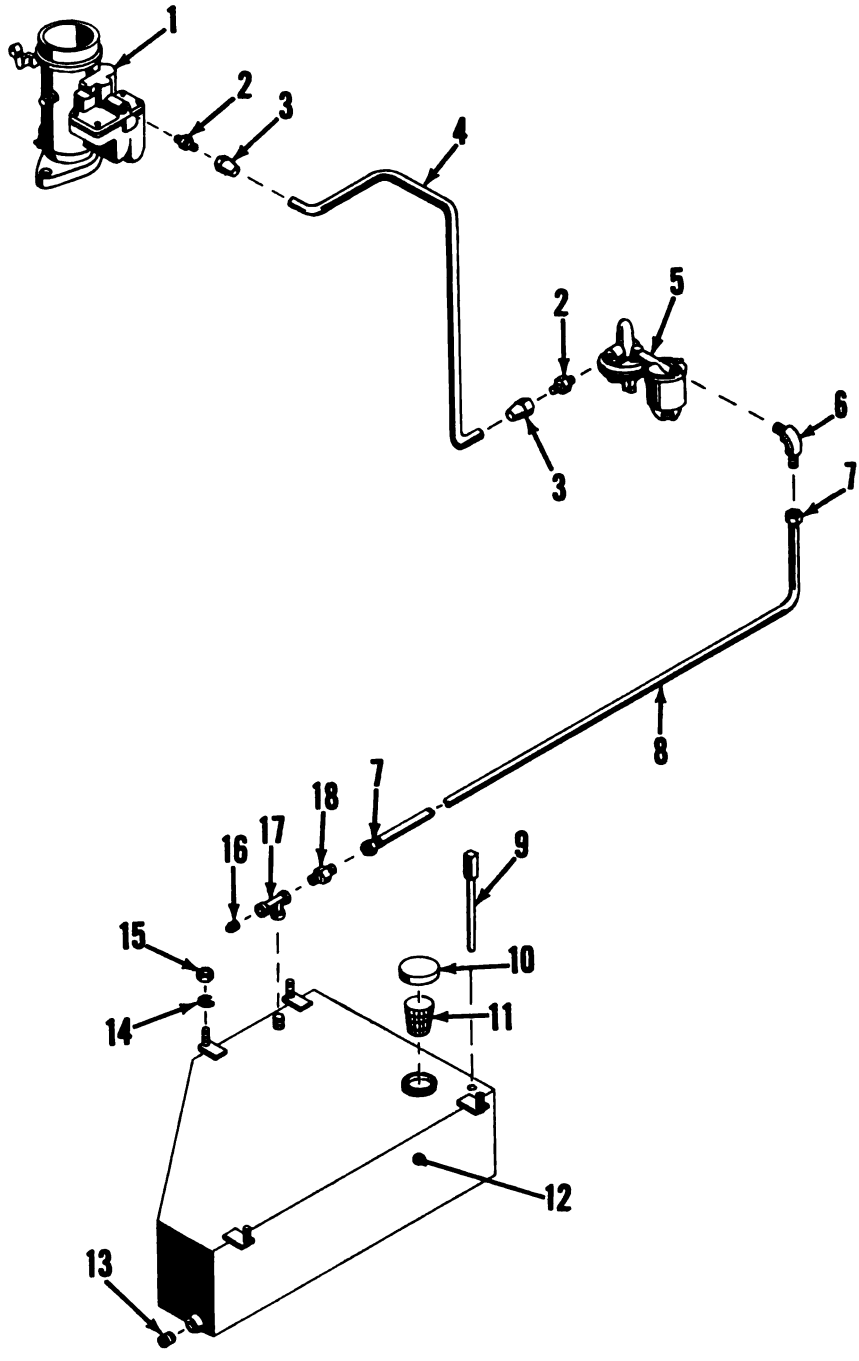


Figure 77. Revolving frame fuel system, exploded view.

1 Carburetor
2 Connector, tubing, brass, 5/16 x 1/8
3 Nut, tubing, brass, 5/16 (2 rqr)
4 Tubing, copper, 5/16 O.D. (as rqr)
5 Fuel pump
6 Elbow, tubing, brass, 1/4
7 Swivel fitting (2 rqr)
8 Hose
9 Fuel level gage
10 Tank cap assembly
11 Strainer
12 Fuel tank
13 Plug, pipe, countersunk, 1
14 Lockwasher, spring, std, 1/2 (4 rqr)
15 Nut, regular, hex, 1/2-13 NC (4 rqr)
16 Plug, pipe, sq hd, 3/8
17 Tee, pipe, regular, 3/8
18 Connector, tubing, brass, 1/4 x 3/8

←

side of the carrier, is drawn through the fuel lines, fuel filter, and the fuel pump filter, and delivered to carburetor by the fuel pump, where it is mixed with clean air coming through the air cleaner in the proper quantities, before being delivered to the engine intake manifold.

161. Air Cleaners

a. Revolving Frame (fig. 79).

(1) *Removal.*

(*a*) Unscrew wingnut (1) assembly from the base (7). Remove the wingnut assembly with top assembly (2), cork gasket (3), and screened element (4) from the bowl (5).

(*b*) Remove the clamp screw nuts (8), base clamp (9), lockwashers (10), and base clamp screws (11).

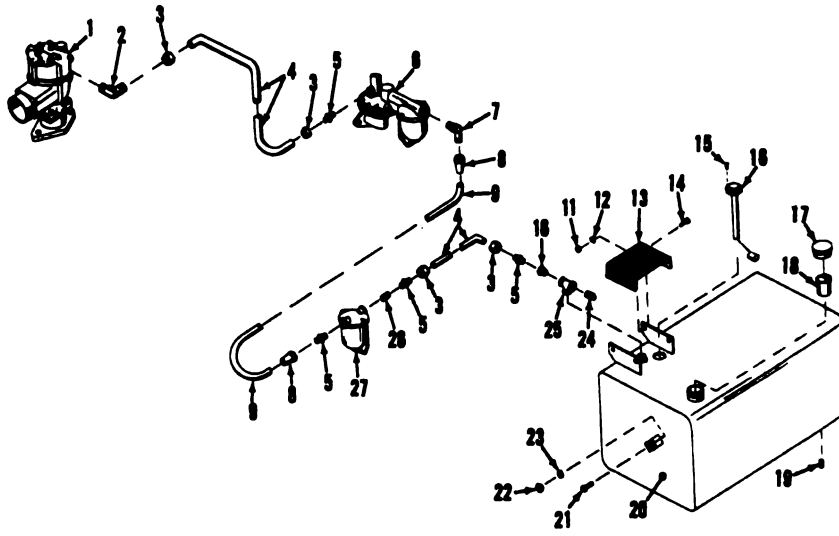
(*c*) Lift the bowl (5), base gasket (6), and base (7) from the carburetor.

(2) *Disassembly.* Pull the screened element (4) and cork gasket (3) from the top assembly (2).

(3) *Cleaning.* Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean absorbent cloth. Use a blunt screwdriver and remove all sludge, dirt, and sediment from the edges and recesses of the top assembly (2), bowl (5), and base (7). If embedded dirt cannot be soaked from the filter element (4), replace the element.

(4) *Inspection and repair.* Inspect all parts for breaks, cracks, and damage. Check the top assembly (2) and bowl (5) for leaks. Small holes may be repaired by soldering. Replace a cracked, badly bent, or warped top assembly or bowl. Replace a base clamp (9) that is damaged or corroded.

(5) *Reassembly.* Position a new cork gasket (3) and the screened element (4) in the top assembly (2).



1 Carburetor
2 Elbow, tubing, brass, 5/16 x 1/4
3 Nut, tubing, brass, 5/16 (4 rqr)
4 Tubing, copper, 5/16 O.D. (as rqr)
5 Connector, tubing, brass, 5/16 x 1/4 (4 rqr)
6 Fuel pump
7 Elbow, tubing, brass, 1/4
8 Swivel fitting (2 rqr)
9 Hose
10 Bushing, reducing, pipe, 3/8 x 1/4
11 Nut, square, regular, 3/8-16 NC (4 rqr)
12 Lockwasher, spring, std, 3/8 (4 rqr)
13 Cover
14 Bolt, sq hd, regular, 3/8-16 NC x 1 1/2 (4 rqr)
15 Bolt, stove, rd hd, 5/16 x 1/2 (5 rqr)
16 Fuel gage sending unit
17 Tank cap
18 Strainer
19 Plug, pipe, sq hd, 1
20 Fuel tank
21 Screw, cap, hex hd, 1/2-13 NC x 1 1/4 (2 rqr)
22 Nut, regular, hex, 1/2-13 NC (2 rqr)
23 Lockwasher, spring, std, 1/2 (2 rqr)
24 Plug, pipe, sq hd, 3/8
25 Tee, pipe, regular, 3/8
26 Nipple, pipe, close, brass, 1/4
27 Fuel filter

Figure 78. Carrier fuel system, exploded view.

(6) *Installation.*

(*a*) Position the base (7) on the carburetor. Secure the base with the base clamp (9), base clamp screws (11), lockwashers (10), and clamp screw nuts (8).

(*b*) Position a new base gasket (6) and the bowl (5) on the base (7).

1 Wingnut
2 Top assembly
3 Cork gasket
4 Filter element
5 Bowl
6 Base gasket
7 Base
8 Clamp screw nut, 1/4-20 NC (2 rqr)
9 Base clamp
10 Lockwasher, spring, std, 1/4 (2 rqr)
11 Base clamp screw, fil hd, 1/4-20 NC x 1 1/2 (2 rqr)

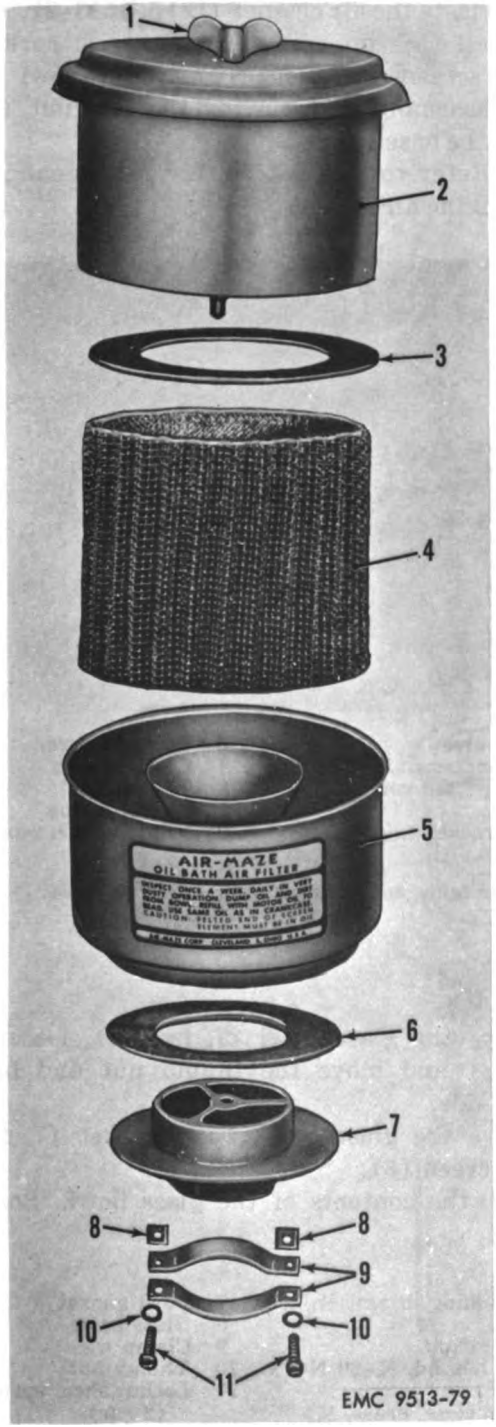
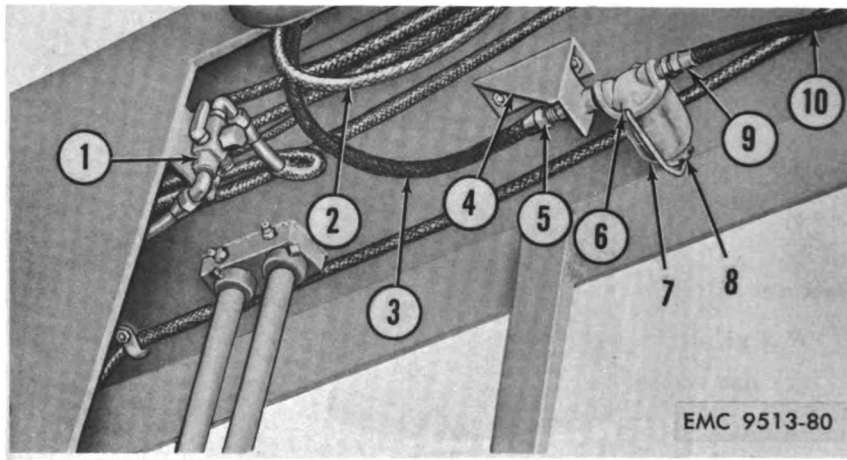


Figure 79. Revolving frame engine air cleaner, exploded view.

(*c*) Lubricate the air cleaner (LO 5–9513–2).

(*d*) Install the top assembly (2) with cork gasket (3) and screened element (4) in the bowl (5). Secure the assembly by screwing the wingnut (1) assembly into the base (7).

b. Carrier. Refer to TM 5–5252 for maintenance procedures on the carrier engine air cleaner.



1 Air supply valve
2 Fuel gage sending unit cable
3 Fuel tank-to-filter covered tubing
4 Mounting bracket
5 Tubing nut
6 Strainer cover
7 Glass bowl
8 Thumb nut
9 Swivel fitting
10 Filter-to-fuel pump hose

Figure 80. Carrier fuel filter, installed.

162. Fuel Filter

a. Servicing.

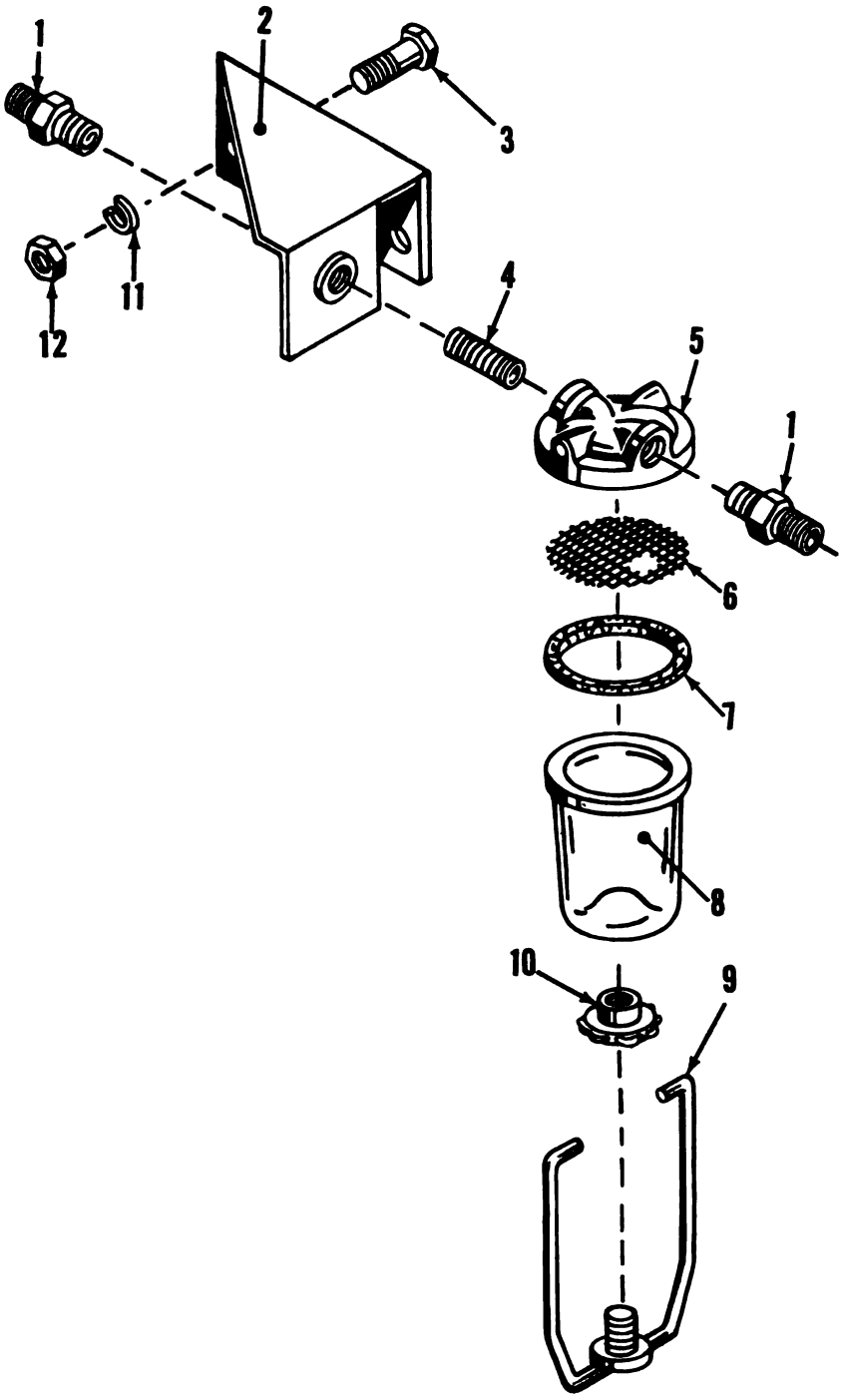
(1) Holding the glass bowl (7, fig. 80), loosen the thumb nut (8) and move the thumb nut and bail assembly to one side.

(2) Remove the glass bowl, bowl gasket (7, fig. 81), and filter screen (6).

(3) Empty the contents of the glass bowl. Soak and wash

➠

1 Connector, tubing, brass, 5/16 x ¼ (2 rqr)
2 Mounting bracket
3 Screw, cap, hex hd, ¼–20 NC x 1¼ (2 rqr)
4 Nipple, pipe, close, brass, ¼
5 Strainer cover
6 Filter screen
7 Bowl gasket
8 Glass bowl
9 Clamp wire
10 Thumb nut
11 Lockwasher, spring, std, ¼ (2 rqr)
12 Nut, regular, hex, ¼–20 NC (2 rqr)



EMC 9513-81

Figure 81. Fuel filter, exploded view.

the glass bowl and filter screen in an approved cleaning solvent. Wipe the glass bowl dry with a clean lintless cloth. Blow the filter screen clean and dry with compressed air. Replace the bowl gasket.

(4) Position the filter screen, bowl gasket, and glass bowl in the strainer cover (6, fig. 80). Make sure all parts are seated properly.

(5) Move the thumb nut (8) and bail assembly to position on the bottom of the glass bowl and tighten the thumb nut.

(6) Start the engine and check the fuel filter for leaks.

b. Removal.

(1) Holding the glass bowl (7, fig. 80), loosen the thumb nut (8) and move the thumb nut and bail assembly to one side.

(2) Remove the glass bowl, bowl gasket (7, fig. 81), and filter screen (6).

(3) Turn the swivel fitting (9, fig. 80) counterclockwise and off the tubing connector (1, fig. 81) in the strainer cover (6, fig. 80).

(4) Turn the strainer cover with thumb nut and bail assembly counterclockwise and off the mounting bracket (4).

c. Installation.

(1) If removed, install a tubing connector (1, fig. 81) in the strainer cover (5) and a brass close pipe nipple (4) in the strainer cover or mounting bracket (2).

(2) Turn the strainer cover (6, fig. 80) with thumb nut and bail assembly clockwise into the mounting bracket (4). Tighten the cover so the glass bowl (7) will be in a vertical position when installed.

(3) Position the filter screen (6, fig. 81), bowl gasket (7), and glass bowl (8) in the strainer cover (6, fig. 80). Make sure all parts are seated properly.

(4) Move the thumb nut (8) and bail assembly to position on the bottom of the glass bowl and tighten the thumb nut.

(5) Position the swivel fitting (9) on the tubing connector and tighten the fitting.

(6) Start the engine and check the fuel filter and fittings for leaks.

163. Choke Controls

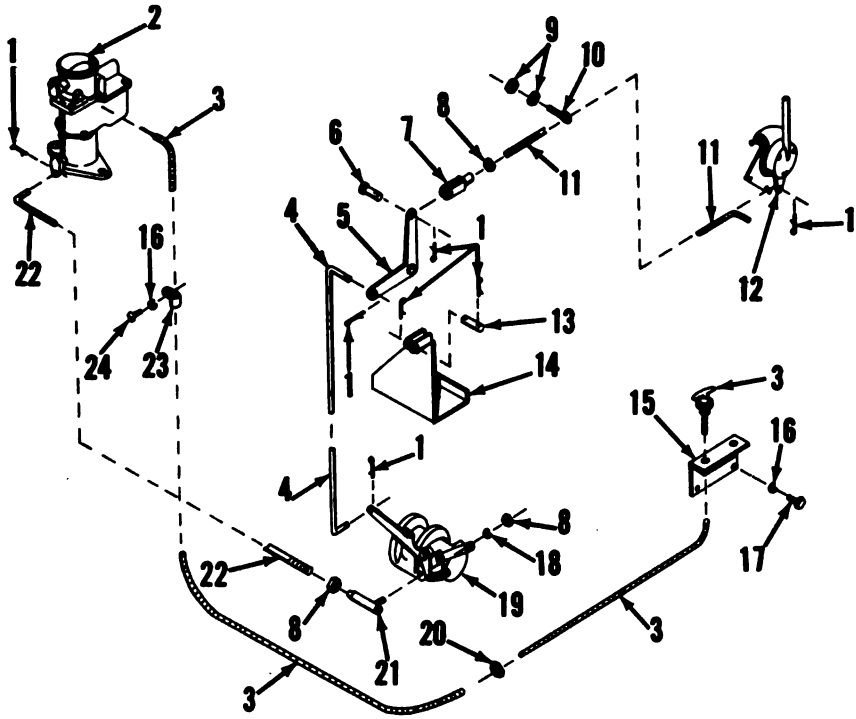
a. Revolving Frame (fig. 82).

(1) *Removal.*

(*a*) Loosen the swivel screw on the choke shaft and lever of the carburetor (2). Loosen the tube clamp screw and nut on the choke bracket of the carburetor. Remove the choke flexible cable (3) from the carburetor.

(*b*) Remove the cap screws (24) and lockwashers (16) from the cable clamps (23). Remove the cable clamps from the choke flexible cable (3).

(*c*) Remove the flexible cable nut (20) from the end of



1	Pin, cotter, split, 1/16 x 1/2 (7 rqr)	13	Pin
2	Carburetor	14	Generator bracket
3	Choke flexible control	15	Cable bracket
4	Control rod	16	Lockwasher, spring, std, 3/8 (2 rqr)
5	Bellcrank	17	Screw, cap, hex hd, 3/8–16 NC x 1 1/4 (2 rqr)
6	Pin	18	Lockwasher, spring, std, 1/4
7	Adjustable yoke end	19	Governor
8	Nut, regular, hex, 1/4–28 NF (3 rqr)	20	Flexible control nut
9	Nut, regular, hex, 3/8–16 NC (2 rqr)	21	Ball joint
10	Eyebolt	22	Governor rod
11	Control rod	23	Clamp, cable, 1/4 (6 rqr)
12	Throttle hand lever	24	Screw, cap, hex hd, 3/8–16 NC x 1 (6 rqr)

Figure 82. Revolving frame engine choke throttle, and governor controls, exploded view.

the cable near the handle of the control. Pull the length of the cable control through the nut and cable bracket (15).

(2) *Installation.*

(*a*) Insert the end of the flexible cable control (3) through the cable bracket (15) until the sleeve of the cable is seated in the bracket. Slide the nut (20) over the cable and onto the sleeve and tighten the nut on the sleeve against the bracket.

(*b*) Position the flexible control cable along the revolving frame and install the cable clamps with lockwashers (16) and cap screws (24).

(*c*) Install the control cable on the choke bracket of the carburetor and secure with the cable clamp, screw, and nut.

(*d*) Insert the end of the control wire in the swivel of the choke shaft and lever on the carburetor and tighten the swivel screw.

(3) *Adjustment.* See paragraph 333 for adjustment of the choke control.

b. Carrier (fig. 83).

(1) *Removal.*

(*a*) Loosen the swivel screw of the choke lever on the carburetor (2). Loosen the cable clamp screw of the choke bracket on the carburetor. Remove the choke control cable (3) from the carburetor.

(*b*) Remove the choke control cable sleeve nut (4) from the sleeve of the choke control cable on the underside of the instrument panel in the cab.

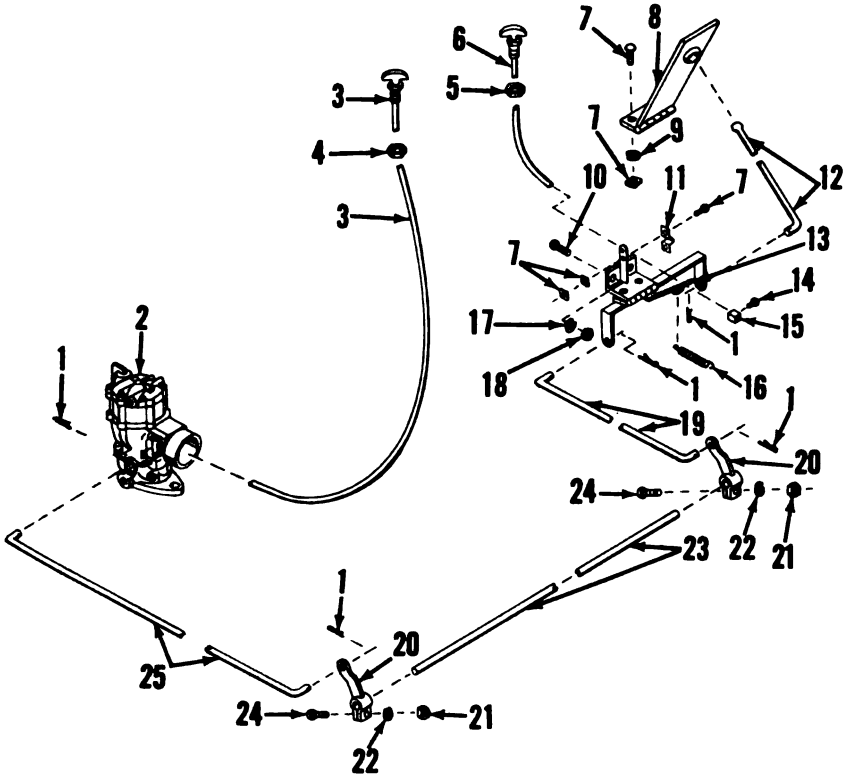
(*c*) Pull the length of the choke control cable through the instrument panel.

(2) *Installation.*

(*a*) Start the tube end of the choke control cable (3) through the instrument panel. Pull the control cable through the panel until the control cable sleeve is installed in the panel. Tighten the nut (4) on the sleeve and against the instrument panel.

(*b*) Position the choke control cable over the engine to the carburetor. Install the control cable on the choke bracket and secure with the cable clamp screw. Insert the end of the control cable wire in the swivel of the choke lever on the carburetor and tighten the lever swivel screw.

(3) *Adjustment.* Refer to TM 5–5252 for adjustment of the choke lever.



1	Pin, cotter, split, ⅛ x ½ (5 rqr)	15	Throttle control block
2	Carburetor	16	Tension spring
3	Choke control cable	17	Lockwasher, spring, std, ⅜ (2 rqr)
4	Choke control cable sleeve nut	18	Nut, regular, hex, ⅜–16 NC (2 rqr)
5	Throttle control nut	19	Reach rod
6	Throttle control	20	Lever (2 rqr)
7	Bolt, stove; steel; flat hd; w/sq nut; 5/16 x ¾ (4 rqr)	21	Nut, regular, hex, ¼–20 NC (2 rqr)
8	Accelerator pedal	22	Lockwasher, spring, std, ¼ (2 rqr)
9	Lockwasher, spring, std, 5/16 (2 rqr)	23	Throttle shaft
10	Bolt, carriage, ⅜–16 NC x ¾ (2 rqr)	24	Screw, cap, hex hd, ¼–20 NC x 1¼ (2 rqr)
11	Clamp, wire, ¼	25	Reach rod
12	Reach rod		
13	Throttle lever		
14	Screw, machine, rd hd, 5/16 x ⅜		

Figure 83. Carrier engine choke, throttle, and accelerator controls, exploded view.

164. Throttle Controls

a. Revolving Frame (fig. 82).

(1) *Removal.*

(*a*) Remove a cotter pin (1) and remove the pin (6) from the adjustable yoke end (7) and bellcrank (5).

(*b*) Remove nut (9) from inner side of strut and pull out the eyebolt (10).

(*c*) Remove a cotter pin (1) and remove the control rod (11) from the throttle hand lever (12).

(*d*) Remove cotter pins (1) from the control rod (4). Remove the control rod from the bellcrank (5) and governor (19).

(*e*) Remove the nut (8) and lockwasher (18) from the ball joint (21). Remove a cotter pin (1) from the governor rod (22) at the carburetor (2). Remove the governor rod.

(*f*) Remove the cotter pins (1) and remove the pin (13) from the generator bracket (14) and the bellcrank (5). Remove the bellcrank.

(2) *Installation.*

(*a*) Position the bellcrank (5) on the generator bracket (14). Install the pin (13) and secure with cotter pins (1).

(*b*) Install the governor rod (22) in the throttle lever at the carburetor and secure with a cotter pin (1). Install the ball joint (21) on the governor arm and secure with a lockwasher (18) and nut (8).

(*c*) Install the control rod (4) in the bellcrank (5) and governor arm and secure with cotter pins (1).

(*d*) Position the adjustable yoke end (7) of the control rod (11) on the bellcrank (5) and attach with pin (6) and cotter pin (1). Insert the other end of the control rod in the throttle hand lever (12) and secure with a cotter pin (1). Slide the eyebolt (10) on the control rod to position on the strut, insert into strut, and secure with a nut (9).

(3) *Adjustment.* See paragraph 333 for adjustment of the throttle control.

b. Carrier (fig. 83).

(1) *Removal.*

(*a*) Loosen the machine screw (14) and remove the throttle control block (15). Loosen the stove bolts (7) and nuts at the wire clamp (11).

(*b*) Remove the throttle coontrol cable sleeve nut (5) from the control sleeve and away from the underside of the instrument panel. Pull the throttle control cable (6) from the wire clamp (11), toeboard, control nut (5), and the instrument panel.

(2) *Installation.*

(*a*) Insert the wire end of the throttle control cable (6)

through the instrument panel until the sleeve is seated in the panel. Install the sleeve nut (5). Pass the control cable through the toeboard and under the wire clamp (11).

(*b*) Install the throttle control block (15) on the wire end and tighten the machine screw (14). Tighten the wire clamp stove bolts (7) and nuts.

(3) *Adjustment.* See paragraph 335 for adjustment of the throttle control.

165. Throttle Hand Lever Control

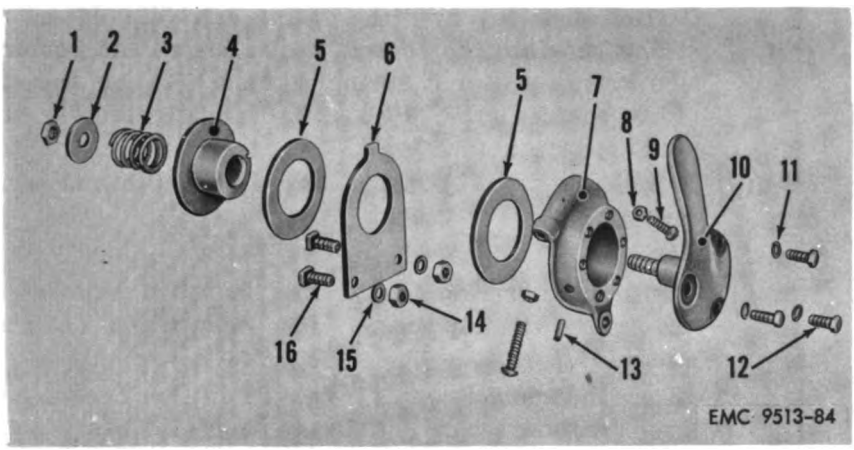
a. Removal.

(1) Remove the cotter pin (1, fig. 82) from the control rod (11). Remove the control rod from the throttle hand lever (12).

(2) Remove the nuts (14, fig. 84), lockwashers (15), and cap screws (16) from the bracket (6) and the bracket welded to the front strut pipe.

b. Disassembly (fig. 84).

(1) Remove the pin (13) from the control body (7).



1 Jamnut, regular, hex, ½–13 NC (2 rqr)
2 Spring retainer
3 Compression spring
4 Spring cap
5 Friction disk (2 rqr)
6 Bracket
7 Control body
8 Nut, regular, hex, ¼–20 NC (2 rqr)
9 Bolt, stove, steel, rd hd, ¼ x 1½ (2 rqr)
10 Control lever
11 Lockwasher, spring, std, 5/16 (3 rqr)
12 Screw, cap, hex hd, 5/16–18 NC x 1 (3 rqr)
13 Pin
14 Nut, regular, hex, ⅜–16 NC (2 rqr)
15 Lockwasher, spring, std, ⅜ (2 rqr)
16 Screw, cap, hex hd, ⅜–16 NC x 1 (2 rqr)

Figure 84. Throttle hand lever, exploded view.

(2) Remove the jamnuts (1). Remove the spring retainer (2), compression spring (3), spring cap (4), a friction disk (5), the bracket (6), and a friction disk (5).

(3) Remove the cap screws (12) and lockwashers (11). Separate the control lever (10) and control body (7).

c. Inspection and Repair. Soak and wash all metal parts in an approved cleaning solvent and dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth.

(1) Inspect the friction disks for wear. Replace a friction disk that is excessively worn.

(2) Inspect all parts for cracks, breaks, and distortion. Replace a part that is defective.

(3) Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace parts that are defective.

(4) Inspect all parts for good condition. Replace parts not in good condition.

d. Reassembly (fig. 84).

(1) Attach the control lever (10) to the control body (7) with the lockwashers (11) and cap screws (12).

(2) Position a friction disk (5), the bracket (6), and a friction disk (5) over the spring cap (4). Insert the spring cap into the control body. Install the compression spring (3) and spring retainer (2) on the stud of the control lever (10). Install and tighten the jamnuts (1) on the stud.

(3) Install the pin (13) in the control body (7) and spring cap (4).

e. Installation.

(1) Position the bracket (6) on the front strut pipe bracket and secure with cap screws (16), lockwashers (15), and nuts (14).

(2) Insert the control rod (11, fig. 82) in the throttle hand lever (12) and secure with a cotter pin (1).

f. Adjustment (fig. 84).

(1) If the control lever (10) operates stiffly, loosen the jamnuts (1).

(2) Adjust the nuts (8) and stove bolts (9) to act as stops to correspond to the fully open and fully closed positions of the carburetor throttle lever.

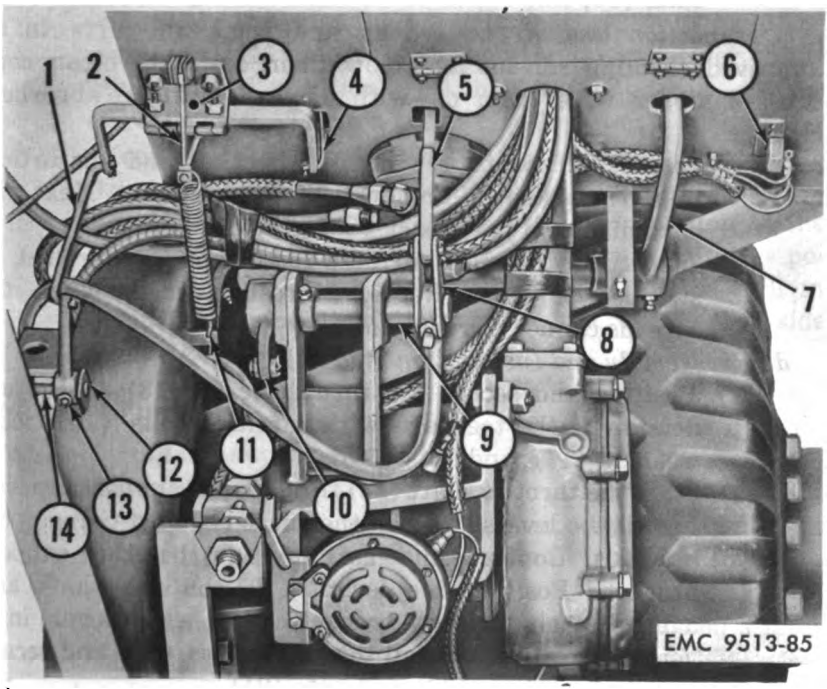
(3) The position of the control lever (10) can be changed by installing the cap screws (12) in the various holes in the control body (7). If this is done, readjust the stove bolts (9).

166. Accelerator Control

a. Description (fig. 85). The throttle lever (3) transmits the action of the accelerator pedal and reach rod (4) to the engine carburetor throttle valve. The reach rod (1) connects the throttle lever to lever (13) on the throttle shaft (14). A second lever (13) on the other end of the throttle shaft connects to a reach rod from the carburetor throttle valve lever. The throttle control (2) connects to the throttle lever. The tension spring (11) returns the throttle lever and accelerator pedal to the idle position of the carburetor. The throttle shaft (14) is supported by support brackets (12) welded to the carrier frame.

b. Removal and Disassembly (fig. 83).

(1) Loosen the machine screw (14) and pull the throttle control block (15) from the end of the throttle control (6). Remove the stove bolts (7) and square nuts attaching the wire clamp (11) to the throttle lever (13).



1	Reach rod	8	Lever
2	Throttle control	9	Lever shaft
3	Throttle lever	10	Lever
4	Reach rod	11	Tension spring
5	Connecting link	12	Support bracket
6	Dimmer switch	13	Lever
7	Clutch foot lever	14	Throttle shaft

Figure 85. Throttle, accelerator, and emergency brake controls, installed.

(2) Unhook the tension spring (16) from the throttle lever and the carrier frame.

(3) Remove the square nuts, lockwashers (9), and stove bolts (7) from the toeboard and accelerator pedal (8). Remove the pedal.

(4) Pull a cotter pin (1) and remove the reach rod (12) from the throttle lever.

(5) Remove cotter pins (1) from the reach rod (19). Remove the reach rod from the throttle lever (13) and lever (20).

(6) Remove cotter pins (1) from the reach rod (25). Remove the reach rod from the lever (20) and the carburetor throttle lever.

(7) Remove the nuts (21), lockwashers (22), and cap screws (24) from the levers (20). Pull the throttle shaft (23) from the support brackets and the levers (20).

(8) Remove the nuts (18), lockwashers (17), and carriage bolts (10) and lift off the throttle lever (13).

c. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, absorbent cloth.

(1) Inspect all parts for cracks, breaks, and distortion. Repair cracked or broken parts by welding. Heat and bend distorted parts back to original shape.

(2) Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace threaded parts when the threads cannot be renewed.

d. Reassembly and Installation (fig. 83).

(1) Position and secure the throttle lever (13) to the underside of the toeboard with carriage bolts (10), lockwashers (17), and nuts (18).

(2) Start the throttle shaft (23) through one support bracket. Install the levers (20) on the shaft between the support brackets. Continue the shaft through the other support bracket. Position the levers (20) on the shaft and against each support bracket. Hold each lever in a vertical position. Install the cap screws (24) and secure with lockwashers (22) and nuts (21).

(3) Install the reach rod (25) in the carburetor (2) throttle lever and lever (20). Secure the rod with cotter pins (1).

(4) Install the reach rod (19) in the lever (20) and throttle lever (13). Secure the rod with cotter pins (1).

(5) Insert the reach rod (12) through the toeboard. Install

bent end of the rod in the throttle lever (13) and secure with a cotter pin (1).

(6) Position the accelerator pedal (8) on the toeboard and secure with stove bolts (7), lockwasher (9), and square nuts. Position the reach rod (12) on underside of the pedal.

(7) Hook the tension spring (16) in the throttle lever (13) and the carrier frame.

(8) Position the throttle control (6) and wire clamp (11) on the throttle lever and secure with stove bolts (7) and square nuts. Insert wire end of throttle control in the throttle lever. Install the throttle control block (15) on the wire end and against the throttle lever. Tighten the machine screw (14) in the block and against the wire.

e. Adjustment (fig. 83).

(1) Loosen the nuts (21) at the levers (20). Rotate the right-side lever on the throttle shaft (23) to have the reach rod (25) push the carburetor throttle lever to the fully closed position. Do not put a strain on the throttle lever. Tighten the nut on the lever.

(2) Keep the throttle shaft (23) from moving and rotate the left-side lever (20) to have the reach rod (19) return the throttle lever (13) to retracted position at the toeboard. The tension spring (16) will maintain this position. Make sure that the reach rod (25) is still in adjustment and then tighten the nut on the left-side lever (20).

167. Fuel Pumps

a. Revolving Frame (fig. 86).

(1) *Servicing.*

(*a*) Holding the glass bowl (6), loosen the thumb nut (5) and move the thumb nut and bail assembly to one side.

(*b*) Remove the glass bowl (6), a bowl gasket, and a filter screen.

(*c*) Empty the contents of the glass bowl. Soak and wash the glass bowl and filter screen in an approved cleaning solvent. Wipe the glass bowl dry with a clean, lintless, cloth. Blow the filter screen clean and dry with compressed air. Replace the bowl gasket.

(*d*) Place the filter screen and bowl gasket on the rim of the glass bowl and position the bowl in the fuel pump.

Make sure that the filter screen and bowl gasket are located correctly in the fuel pump.

(*e*) Move the thumb nut (5) and bail assembly to position on the bottom of the bowl. Tighten the thumb nut against the glass bowl.

(*f*) Check the bowl gasket for leaks after starting the engine. If leaking, tighten the thumb nut or replace the gasket.

(2) *Removal.*

(*a*) Disconnect the fuel outlet line (8) from the fuel pump (3). Disconnect the fuel inlet line from the tubing elbow (4).

(*b*) Remove two mounting screws (7) and lockwashers from the fuel pump and cylinder block.

(*c*) Remove the fuel pump from the cylinder block, remembering that the rocker arm will catch on the block unless it is carefully pulled out of the small opening. Remove the fuel pump attaching gasket.

Note. If the fuel pump is forced away from the cylinder block by the spring tension on the rocker arm, this will indicate that the high point of the eccentric on the camshaft is toward the pump. To facilitate installation of the pump, crank the engine over one full turn to place this high spot away from the fuel pump.

(3) *Installation.*

(*a*) Place a new attaching gasket on the fuel pump.

(*b*) Insert the pump rocker arm in the opening in the cylinder block, being careful to keep the flange of the fuel pump in correct position while the two mounting screws (7) and lockwashers are started. When inserting, be sure that the pump rocker arm is correctly positioned on the fuel pump drive pin in the cylinder block.

(*c*) A slight pressure will be exerted by the rocker arm springs while the mounting screws are being pulled up tight. If the pressure is excessive, remove the fuel pump and turn the engine over one full turn and reinstall the fuel pump.

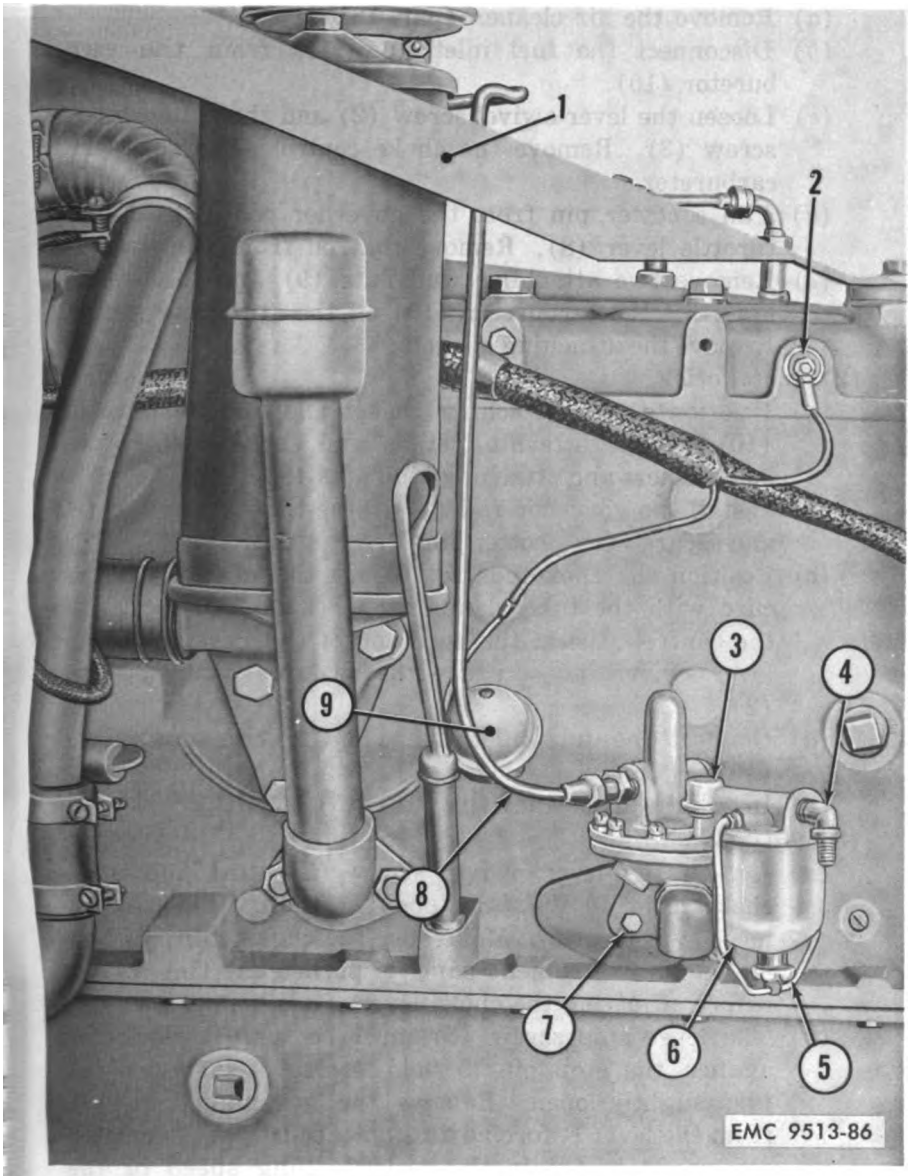
(*d*) Connect the fuel inlet line to the tubing elbow (4). Connect the fuel outlet line (8) to the fuel pump.

b. Carrier. Refer to TM 5–5252 for servicing, removal, and installation instructions on the carrier fuel pump.

168. Carburetors

a. Revolving Frame (fig. 87).

(1) *Removal.*



1 Radiator brace
2 Water temperature gage sending unit
3 Fuel pump
4 Tubing elbow
5 Thumb nut
6 Glass bowl
7 Mounting screw
8 Fuel outlet line
9 Oil pressure gage sending unt

Figure 86. Revolving frame engine fuel pump, installed.

(*a*) Remove the air cleaner (par. 161*a*(1)).

(*b*) Disconnect the fuel inlet line (11) from the carburetor (10).

(*c*) Loosen the lever swivel screw (2) and the tube clamp screw (3). Remove the choke control (4) from the carburetor.

(*d*) Pull a cotter pin from the governor rod (7) at the throttle lever (8). Remove the rod from the lever.

(*e*) Remove two attaching stud nuts (9) and lockwashers. Lift the carburetor (10) off the attaching studs. Remove the attaching gasket.

(2) *Installation.*

(*a*) Position a new attaching gasket and the carburetor (10) on the attaching studs and secure with two lockwashers and attaching stud nuts (9).

(*b*) Install the governor rod (7) in the throttle lever (8) and secure with a cotter pin.

(*c*) Position the choke control (4) in the clamp and secure with the tube clamp screw (3). Do not crush the control. Insert the wire end of the control in the lever swivel and secure with the lever swivel screw (2).

(*d*) Connect the fuel inlet line (11) to the carburetor (10).

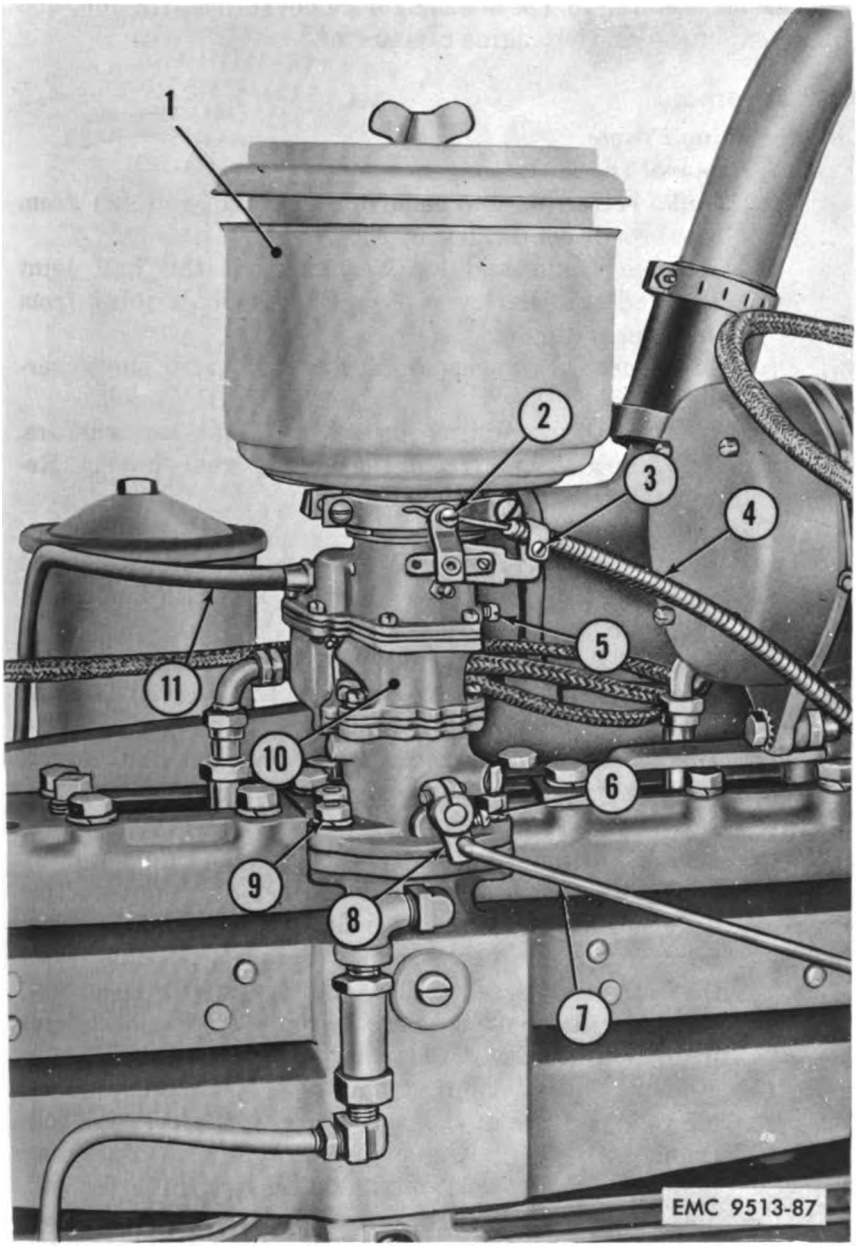
(*e*) Install the air cleaner (par. 161*a*(6)).

(3) *Adjustment.*

(*a*) Loosen the lever swivel screw (2) and move the choke lever to the fully open position. Tighten the lever swivel screw. Make sure the choke control handle on the instrument panel is pushed all the way in before adjusting the choke lever.

(*b*) The lever stop screw (6) must be turned clockwise against the stop pin to hold the throttle lever (8) just slightly open. Remove the governor rod (7) from the lever before adjusting. Adjust the lever stop screw (6) to obtain the desired idling speed of the engine. Reinstall the governor rod. Check the governor adjustment.

(*c*) The idle adjusting screw (5) should be from one to one and one-half turns off its seat. Adjust the screw to obtain smooth idling when the engine has become thoroughly warmed up. Turning the screw clockwise cuts off air, making the idling mixture richer; while turning the screw counterclockwise admits more air, making the mixture leaner.



1	Air cleaner	7	Governor rod
2	Lever swivel screw	8	Throttle lever
3	Tube clamp screw	9	Attaching stud nut
4	Choke control	10	Carburetor
5	Idle adjusting screw	11	Fuel inlet line
6	Lever stop screw		

Figure 87. Revolving frame engine carburetor installation and adjustment points.

b. Carrier. Refer to TM 5–5252 for removal, installation, and adjustment of the carrier engine carburetor.

169. Governors

a. Revolving Frame.

(1) *Removal* (fig. 88).

(*a*) Pull a cotter pin and remove the control rod (2) from the throttle control lever (8).

(*b*) Remove a nut and lockwasher from the ball joint (5) and throttle lever (6). Pull the ball joint from the lever.

(*c*) Disconnect the governor oil line (4) from the governor (7).

(*d*) Remove the mounting screws (3) and lockwashers. Pull the governor from the timing gear cover. Remove the mounting gasket.

(2) *Installation* (fig. 88).

(*a*) Position the governor (7) and a new mounting gasket on the timing gear cover and secure with lockwashers and mounting screws (3).

(*b*) Connect the governor oil line (4) to the governor.

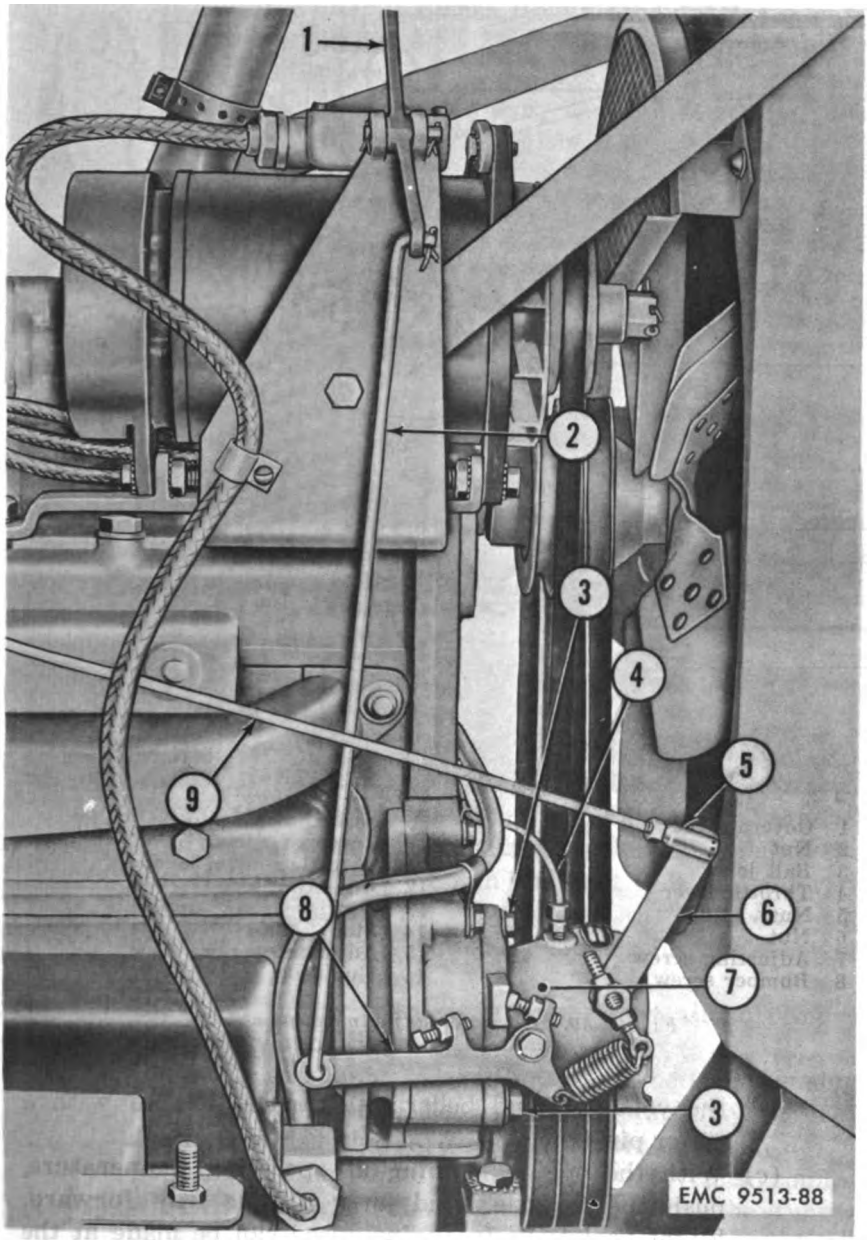
(*c*) Install the ball joint (5) in the throttle lever (6) and secure with a lockwasher and nut.

(*d*) Install the control rod (2) in the throttle control lever (8) and secure with a cotter pin.

(3) *Adjustment.*

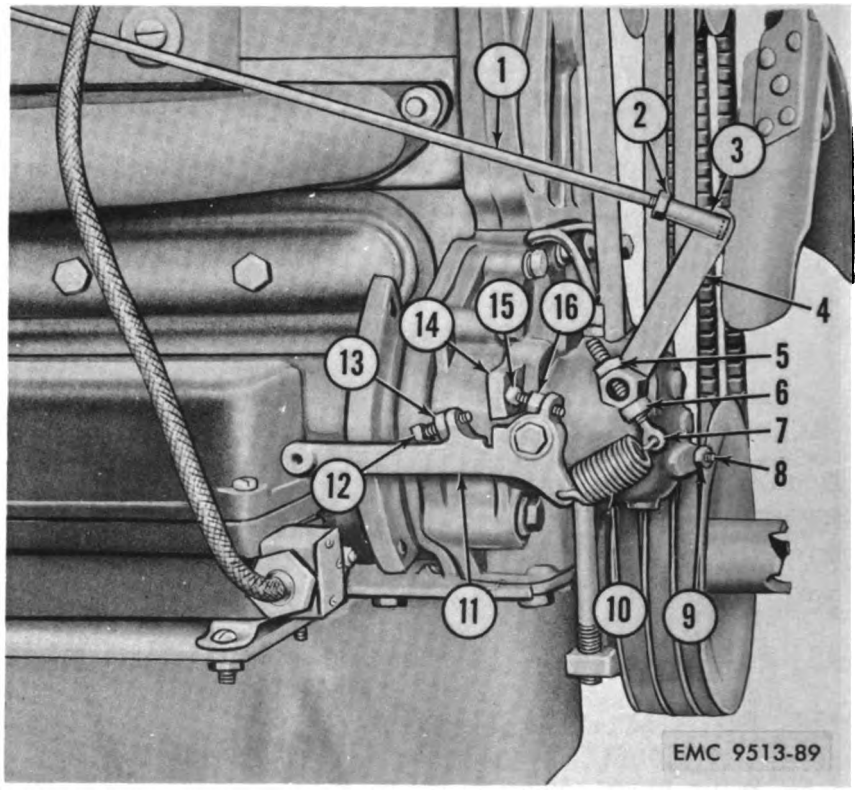
(*a*) Loosen the nut (2, fig. 89). Remove the ball joint (3) from the throttle lever (4). Adjust the length of the governor rod (1) at the ball joint so that the carburetor throttle valve is in wide open position when the ball joint is reinstalled and the enigne is at rest. When adjustment is correct, reinstall the ball joint in the throttle lever (4) and tighten the nut (2).

(*b*) Remove the cotter pin (1, fig. 82), pin (6), and adjustable yoke end (7) of the control rod (11) from the bellcrank (5). With the engine running at operating temperature, loosen and hold the nut (16, fig. 89) and turn the adjusting screw (15) clockwise to decrease the idling speed or counterclockwise to increase the idling speed. When adjustment is correct, tighten the nut (16). Put the throttle hand lever (12, fig. 82) in the idle, vertical, position. Loosen the nut (8) and adjust the length of the control rod (11), at the adjustable yoke end (7), to meet the bellcrank (5). Tighten the nut (8) and install the pin (6) through



1 **Bellcrank**
2 **Control rod**
3 **Mounting screws**
4 **Governor oil line**
5 **Ball joint**
6 **Throttle lever**
7 **Governor assembly**
8 **Throttle control lever**
9 **Governor rod**

Figure 88. Governor installation points.



1	Governor rod	9	Nut
2	Nut	10	Governor spring
3	Ball joint	11	Throttle control lever
4	Throttle lever	12	Adjusting screw
5	Nut	13	Nut
6	Nut	14	Stop
7	Adjusting screw	15	Adjusting screw
8	Bumper screw	16	Nut

Figure 89. Governor adjustment points.

the yoke end and bellcrank. Secure the pin with a cotter pin (1).

(*c*) With the engine running at operating temperature, push the throttle hand lever all the way forward. Slight variations in engine speed can be made at the adjusting screw (12, fig. 89). Loosen and hold the nut (13) while turning the screw clockwise to decrease engine speed or counterclockwise to increase engine speed. When adjustment is correct, tighten the nut (13).

(*d*) Should the engine surge at full-load speed, loosen the nut (9) and turn the bumper screw (8) counterclock-

wise three or four turns. Holding the nut (9), slowly turn the bumper screw clockwise until the surging stops. After making sure that the engine is stable, hold the bumper screw steady and tighten the nut.

(*e*) If the governor is too sluggish in response to the requirement for full-load speed, loosen the nut (6) and tighten the nut (5) to make the governor more sensitive. When adjustment is satisfactory, tighten the nut (6).

(*f*) If the governor is too quick in response to the requirement for full-load speed, turn the nut (5) counterclockwise to slow up the governor. When adjustment is satisfactory, tighten the nut (6).

b. Carrier. See TM 5–5252 for removal, installation, and adjustment of the carrier engine governor.

170. Lines and Fittings

a. Removal. Disconnect the tubing nuts from the tubing fittings. Remove any clamps along the length of the tubing and remove the tubing.

b. Cleaning and Inspection. All tubing must be clean and free of dents or kinks. All tubing fittings must be cleaned, using an approved cleaning solvent, and must not be damaged in any way.

c. Installation.

(1) When replacing tubing lines, cut tubing to required length with a hacksaw or tubing cutter. Make sure the end of the tubing is smooth and that it is cut squarely with the outside wall. Make sure the ends are not crimped or partially closed. Ream or file the ends of the tubing if necessary.

(2) Blow out tubing with clean compressed air to remove all cuttings and filings.

(3) Place nut on tubing. Flare the end of the tubing, using a flaring tool. Nuts, fittings, and tubing may be used again provided they are in serviceable condition.

(4) Position the length of the tubing, using cable clamps where necessary. Tighten tubing nut on the tubing fitting. It is not necessary to tighten the nut until it bottoms. Tighten the nut only enough to stop leaks.

171. Fuel Tanks

a. Revolving Frame (fig. 77).

(1) *Removal.*

(*a*) Remove the pipe plug (13) and tank cap assembly (10) and drain the fuel from the fuel tank (12).

(*b*) Disconnect the swivel fitting (7) from the tubing connector (18). Remove the pipe tee (17) from the fuel tank.

(*c*) Block up or support the fuel tank while removing the nuts (15) and lockwashers (14). Lower the fuel tank from the revolving frame deck plate.

(2) *Cleaning and inspection.*

(*a*) Remove the strainer (11) and soak in an approved cleaning solvent. Remove the fuel level gage (9). Remove the tubing connector (18). Install a pipe cap in the pipe tee (17) opening. Using a clean rag, plug the fuel level gage opening in the fuel tank. Insert the end of an air hose in the tank cap (10) and strainer (11) opening. Place a clean cloth around the air hose to close the opening completely. Blow the sediment out of the fuel tank with clean compressed air. Flush the fuel tank with clean fuel until the fuel leaving the pipe plug (13) opening is free of sediment. Wash the strainer (11) and blow clean and dry with compressed air.

(*b*) Inspect the strainer and tank cap for punctures and other damage. Inspect the fuel tank for leaks. Inspect all threaded surfaces for damaged, corroded, or stripped threads.

(3) *Repair.*

(*a*) Replace a strainer or tank cap that is punctured or otherwise damaged.

(*b*) Renew threaded surfaces if possible, otherwise replace the fuel tank.

(*c*) Before attempting to repair leaks, flush the fuel tank out thoroughly with hot water and steam to remove all fuel vapor. With the puncture uppermost and all outlets closed or plugged, fill the tank with water, allowing room for expansion. Repair puncture by welding and test the tank for leakage. Drain all water thoroughly and allow the tank to stand upside down with all outlets open until thoroughly dry.

Warning: Fill the fuel tank with water to eliminate air space where gas fumes might linger and cause an explosion while welding.

(4) *Installation.*

(*a*) Raise and support or block the fuel tank (12) in position underneath the revolving frame deck plate. Install and tighten the lockwashers (14) and nuts

(15) on the tank studs sticking up through the deck plate.

(*b*) Install the pipe plug (13), strainer (11), and fuel level gage (9).

(*c*) Install the pipe tee (17) with pipe plug (16) in the fuel tank. Install the tubing connector (18) in the pipe tee. Connect the swivel fitting (7) of the hose (8) on the tubing connector.

(*d*) Fill the fuel tank with clean fuel. If fuel from an open container is used, strain the fuel through a chamois cloth. Install the tank cap assembly (10).

b. Carrier.

(1) *Removal* (fig. 90).

(*a*) Remove the pipe plug from the bottom of the fuel tank (5) and drain the fuel.

(*b*) Remove four bolts (1), lockwashers, and nuts and lift off the cover (2).

(*c*) Disconnect the fuel tank-to-fuel filter tubing from the pipe tee (3).

(*d*) Disconnect the wire from the fuel gage sending unit (4).

(*e*) Remove a nut (7), lockwasher, and screw (8) from each end of the fuel tank. Remove the fuel tank from the fuel tank support (6).

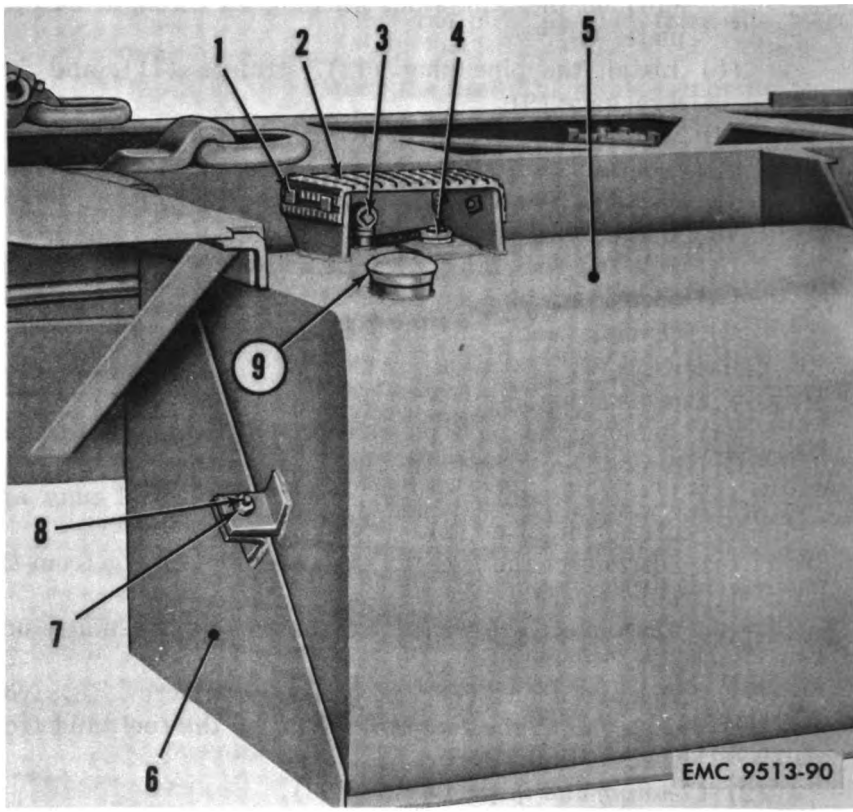
(2) *Cleaning and inspection* (fig. 78).

(*a*) Remove the strainer (18) and soak in an approved cleaning solvent. Remove the stove bolts (15) and lift out the fuel gage sending unit (16). Remove the pipe tee (25). Install a pipe cap in the pipe tee opening. Install the tank cap (17). Insert the end of an air hose in the fuel gage sending unit (16) opening. Place a clean cloth around the air hose to close the opening completely. Blow the sediment out of the fuel tank with clean compressed air. Flush the fuel tank with clean fuel until the fuel leaving the pipe plug (19) opening is free of sediment. Wash the strainer (18) and blow clean and dry with compressed air.

(*b*) Inspect the strainer and tank cap for punctures and other damage. Inspect the fuel tank for leaks. Inspect all threaded surfaces for damaged, corroded, or stripped threads.

(3) *Repair.*

(*a*) Replace a strainer or tank cap that is punctured or otherwise damaged.



1 Bolt
2 Cover
3 Pipe tee
4 Fuel gage sending unit
5 Fuel tank
6 Fuel tank support
7 Nut
8 Screw
9 Tank cap

Figure 90. Carrier fuel tank installed.

(*b*) Renew threaded surfaces if possible, otherwise replace the fuel tank.

(*c*) Before attempting to repair leaks, flush the fuel tank out thoroughly with hot water and steam to remove all fuel vapor. With the puncture uppermost and all outlets closed or plugged, fill the tank with water, allowing room for expansion. Repair puncture by welding and test the tank for leakage. Drain all water thoroughly and allow the tank to stand upside down with all outlets open until thoroughly dry.

Warning: Fill the fuel tank with water to eliminate air space where gas fumes might linger and cause an explosion while welding.

(4) *Installation.*

(*a*) Install the fuel gage sending unit (16, fig. 78) and secure with stove bolts (15).

(*b*) Install the strainer (18) and tank cap (17).

(*c*) Install the pipe tee (25) in the fuel tank. Install the pipe reducing bushing (10) in the pipe tee. Install the pipe plug (24) in the pipe tee.

(*d*) Install the pipe plug (19) in the bottom of the fuel tank.

(*e*) Position the fuel tank (5, fig. 90) on the fuel tank support (6). Install the screws (8) through the ears of the support and tank and secure with lockwashers and nuts (7).

(*f*) Connect the fuel tank-to-fuel filter tubing to the pipe tee (3).

(*g*) Connect the wire to the fuel gage sending unit (4).

(*h*) Position the cover (2) on the fuel tank and secure with nuts, lockwashers, and bolts (1).

(*i*) Fill the fuel tank with clean fuel. If fuel from an open container is used, strain the fuel through a chamois cloth. Install the tank cap (9).

Section IX. COOLING SYSTEMS

172. Description

A centrifugal-pump cooling system is employed in both the revolving frame and carrier engines. Each system consists of a radiator, gear-driven pump, thermostat, bypass tube, inlet hose, manifolds, outlet hose, and the water jackets in the cylinder block. Coolant is pumped from the water jackets in the cylinder block through the outlet hose and into a radiator. As warm coolant is pumped out of the block, fresh coolant is drawn from the radiator down through the inlet hose, and on through the pump into the engine. When the engine is cold, the thermostat in the outlet manifold shuts off the flow of coolant, and the coolant is forced through the bypass tube and back into the water jackets. As the engine warms up, coolant is allowed to pass the opened thermostat and return to the radiator. A belt-driven fan assembly pulls air through the radiator to help cool the coolant.

173. Water Temperature Gage Sending Units

a. General. The water temperature gage sending unit (2, fig. 86) is a resistance chamber which is installed in the water chamber of the cylinder head. The resistance in the chamber varies

with the water temperature, thereby controlling the current flowing in the variable field circuit of the water temperature gage (8, fig. 36) to move the gage pointer. Water temperature gages and sending units are identical for the revolving frame and carrier engines.

b. Testing.

(1) If the water temperature gage reads zero at all times, check for a broken lead between the gage and sending unit. Replace a broken lead. If condition is not corrected, replace the sending unit. If the gage still does not register, replace the gage.

(2) If the water temperature gage reads maximum at all times, check for a grounded lead between gage and sending unit. Replace a grounded lead. If condition is not corrected, replace the sending unit.

c. Removal.

(1) Drain the cooling system.

(2) Remove the lead from the sending unit (2, fig. 86). Turn the sending unit counterclockwise from the cylinder head.

d. Installation.

(1) Turn the sending unit clockwise into the cylinder head. Attach lead.

(2) Fill the cooling system.

174. Thermostats

a. Revolving Frame (fig. 91).

(1) *Removal.*

(*a*) Drain the cooling system.

(*b*) Remove the screws (7) and lockwashers (6). Pull the thermostat housing (1) away from the water outlet pipe (8).

(*c*) Remove the screws (5) and lockwashers (4). Remove the thermostat (3) from the thermostat housing (1).

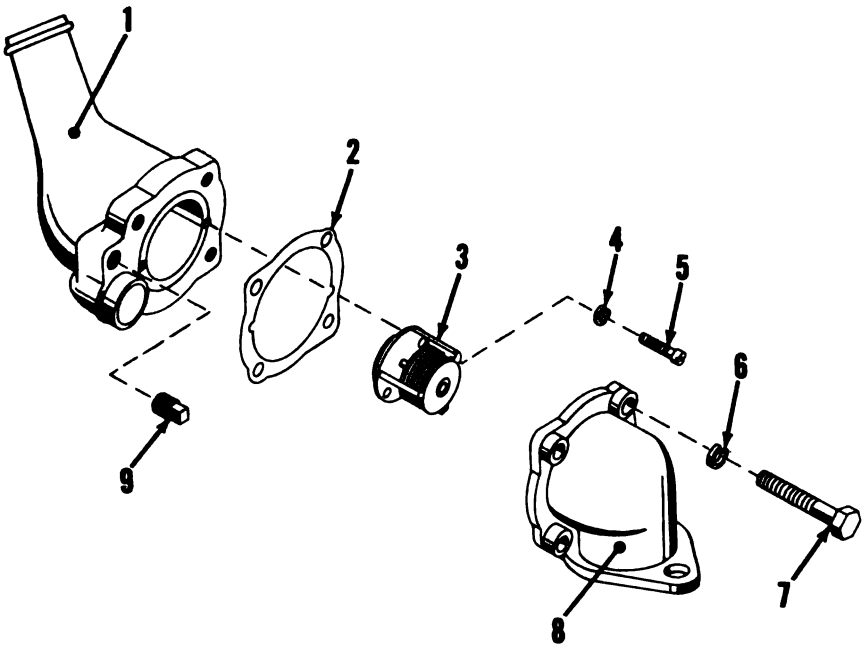
(2) *Testing.*

(*a*) Place the thermostat in a pail containing sufficient water to cover the bellows completely.

(*b*) Place a thermometer in the water.

(*c*) Heat the water slowly, and observe at what temperature the thermostat starts to open.

(*d*) The thermostat should start to open at 150° F. and be fully open at 160° F. Five degrees over or under are permissible. If the thermostat does not perform satisfactorily in this test, replace the unit.



EMC 9513-91

1 Thermostat housing
2 Housing attaching gasket
3 Thermostat
4 Lockwasher, spring, brass, No. 10 (2 rqr)
5 Screw, machine, rd hd, No. 10–24 x ⅜ (2 rqr)
6 Lockwasher, spring, std, ⅜ (4 rqr)
7 Screw, cap, hex hd, ⅜–16 NC x 1⅛ (4 rqr)
8 Water outlet pipe
9 Plug, pipe, sq hd, ⅜

Figure 91. Thermostat and water outlet pipe, exploded view.

(3) *Installation.*

(*a*) Replace the housing attaching gasket (2). Position the thermostat (3) in the thermostat housing (1) and secure with lockwashers (4) and screws (5).

(*b*) Position the thermostat housing on the water outlet pipe (8) and secure with lockwashers (6) and screws (7).

(*c*) Fill the cooling system. Check for coolant leaks immediately after engine is started.

b. Carrier. Refer to TM 5–5252 for removal, testing, and installation of the carrier engine thermostat.

175. Fan Belts

a. Revolving Frame.

(1) *Adjustment.* The fan belts are properly adjusted when the deflection (6, fig. 61) is approximately one-half inch,

using moderate pressure at a point midway between the fan pulley (4) and crankshaft pulley (5).

(*a*) Loosen the spindle nut (12, fig. 60). Loosen the nut (3, fig. 61).

(*b*) Turn the fan adjusting screw (2) clockwise to tighten the belts. Turn the screw until the belt deflection is approximately one-half inch.

(*c*) When adjustment is correct, tighten the nut (3) and the spindle nut (12, fig. 60).

(2) *Removal.*

(*a*) Loosen the spindle nut (12). Loosen the nut (3, fig. 61).

(*b*) Turn the fan adjusting screw (2) counterclockwise until the fan spindle bottoms in the fan bracket (11, fig. 60).

(*c*) Remove the fan belts from the crankshaft pulley (5, fig. 61) and fan pulley (4).

(3) *Installation.*

(*a*) Position the fan belts over the fan assembly and on the fan pulley (4). Install the belts in the grooves of the fan pulley and the crankshaft pulley (5).

(*b*) Turn the fan adjusting screw (2) clockwise to tighten the belts. Turn the screw until the belt deflection (6) is approximately one-half inch.

(*c*) When adjustment is correct, tighten the nut (3) and the spindle nut (12, fig. 60).

b. Carrier. Refer to TM 5–5252 for adjustment, removal, and installation of the carrier engine fan belts.

176. Fans

a. Revolving Frame (fig. 92).

(1) *Removal.*

(*a*) Remove the fan belts (par. 175*a*(2)).

(*b*) Remove the cotter pin (1), nut (2), and clamp washer (3).

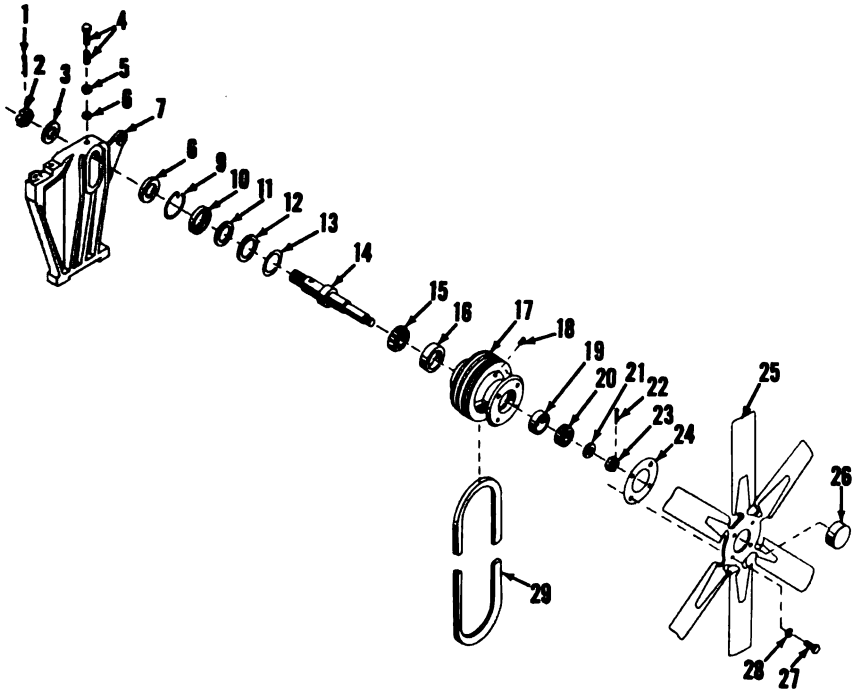
(*c*) Remove the adjusting screw (4), locknut (5), and lockwasher (6).

(*d*) Pull the fan assembly from the bracket (7). Remove the clamp washer (8) from the spindle (14).

(2) *Disassembly.*

(*a*) Remove the cap screws (27) and lockwashers (28). Remove the blade assembly (25), spindle pilot (26), and gasket (24) from the hub (17).

(*b*) Remove the cotter pin (22), nut (23), and cone clamp washer (21) from the spindle (14).



1	Cotter pin	16	Bearing cup
2	Nut	17	Hub
3	Clamp washer	18	Pipe plug
4	Adjusting screw	19	Bearing cup
5	Locknut	20	Bearing cone
6	Lockwasher	21	Cone clamp washer
7	Bracket	22	Cotter pin
8	Clamp washer	23	Nut
9	Snap ring	24	Gasket
10	Seal retainer	25	Blade assembly
11	Seal washer	26	Spider pilot
12	Seal washer retainer	27	Cap screw (4 rqr)
13	Gasket	28	Lockwasher (4 rqr)
14	Spindle	29	Belt (2 rqr)
15	Bearing cone		

Figure 92. Fan, belts, and pulley, exploded view.

(*c*) Remove the snap ring (9).

(*d*) Using an arbor press, press the spindle (14) from the hub (17).

(*e*) Remove the bearing cones (15 and 20) and the gasket (13), seal washer (11), seal retainer (10), and seal washer retainer (12) from the spindle (14) and hub (17).

(*f*) Using an arbor press, press the bearing cups (16 and 19) from the hub.

(3) *Inspection and repair.* Soak and wash all metal parts

in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth.

(*a*) Inspect the bearings thoroughly, checking particularly for out-of-round condition caused by corrosion or wear. Check for overheating, which is evidenced by discoloration of the rollers. Examine the outer race for scoring or galling. Replace a bearing that is worn, scored, or galled, or has been overheated.

(*b*) Inspect the spindle, hub, and fan assembly for cracks, breaks, and distortion. Replace the spindle, hub, or fan assembly if cracked, broken, or distorted.

(*c*) Replace the gasket (13), seal washer (11), seal retainer (10), seal washer retainer (12), and the gasket (24).

(4) *Reassembly.*

(*a*) Using an arbor press, position and press the bearing cups (16 and 19) into the hub (17).

(*b*) Position bearing cone (15) over end of the spindle (14) against the shoulder. Insert the spindle in the hub (17).

(*c*) Assemble the gasket (13), seal washer retainer (12), seal washer (11), and seal retainer (10) into the hub (17) on the bracket end of the spindle, and secure them in the hub with the snap ring (9).

(*d*) Install the bearing cone (20) over the spindle and into the hub.

(*e*) Position the cone clamp washer (21) on the spindle. Install and tighten the nut (23). The absence of noticeable play with the spindle turning freely is an indication of the correct adjustment of the bearings. After adjustment has been made, install the cotter pin (22).

(*f*) Position the gasket (24), spindle pilot (26), and fan assembly (25) on the hub (17) and secure with the cap screws (27) and lockwashers (28).

(*g*) Lubricate the fan assembly (LO 5–9513).

(5) *Installation.*

(*a*) Position the clamp washer (8) on the spindle (14). Install the spindle in the bracket (7).

(*b*) Install the lockwasher (6), locknut (5), and adjusting screw (4) in the bracket and spindle.

(*c*) Install the clamp washer (3) and nut (2) on the spindle.

(*d*) Install the fan belts (par. 175*a*(3)). When adjust-

ment is complete, install cotter pin (1) in the spindle and nut.

b. Carrier. Refer to TM 5–5252 for maintenance procedures on the carrier engine fan.

177. Water Pumps

a. Revolving Frame. Refer to TM 5–5219 for maintenance procedures on the revolving frame engine water pump.

b. Carrier. Refer to TM 5–5252 for maintenance procedures on the carrier engine water pump.

178. Radiators and Hoses

a. Revolving Frame.

(1) *Removal.*

(*a*) Open the draincock (4, fig. 93). Open the draincock in the bottom of the water pump inlet pipe. Open any other draincocks found in either side of the cylinder block, usually at the rear of the block. Allow the cooling system to drain.

(*b*) Remove the radiator mounting stud nuts (3) and lockwashers.

(*c*) Loosen the hose clamps (4, fig. 94) and hoses (5) from the radiator (2) connections.

(*d*) Remove the screws (13), lockwashers (12), and the fan guard (14) from the radiator.

(*e*) Remove the screws (7) and lockwashers (8) from the radiator braces (10 and 23) and the radiator.

(*f*) Lift the radiator from the support (17) and pull from the hoses (5).

(2) *Disassembly* (fig. 94).

(*a*) Remove the radiator cap (3).

(*b*) Remove the screws (13), lockwashers (12), and the radiator guard (1).

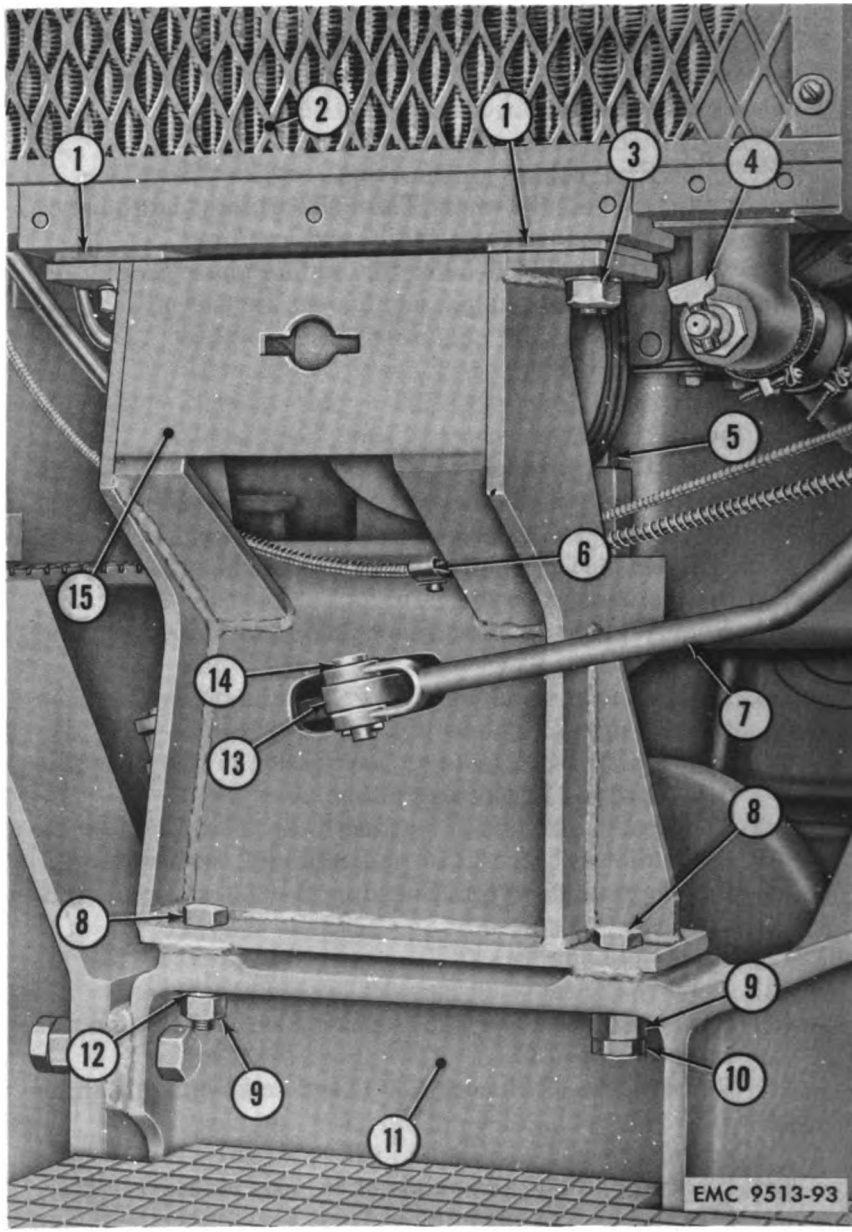
(*c*) Remove the draincock (25) and reducing bushing (24).

(3) *Cleaning.*

(*a*) Soak and wash all metal parts, except the radiator, in an approved cleaning solvent and blow them dry with clean compressed aid or wipe them off with a clean, lintless, and absorbent cloth.

(*b*) Reverse-flush the radiator by feeding water through the lower hose connection and gradually applying air pressure. Repeat this operation until the water comes out clear.

(*c*) Use a soft brush to remove insects and other foreign



1	Fabreeka pad	9	Nut
2	Radiator	10	Jamnut
3	Radiator mounting stud nut	11	Rotating base
4	Draincock	12	Lockwasher
5	Engine support mounting bolt	13	Bellcrank
6	Cable clamp	14	Bellcrank pin
7	Reach rod	15	Support
8	Support mounting screw		

Figure 93. Revolving frame engine radiator, installed.

matter from the core of the radiator. Apply light air pressure or a stream of water through the radiator from the rear to dislodge foreign matter from the inner tubes and fins.

(4) *Inspection and repair.*

(*a*) Examine the radiator for leakage by closing all openings and applying air pressure while submerging the radiator in a tub of water. Do not use higher than 5 psi of air, otherwise the radiator core might be damaged. Watch for air bubbles and mark the point of origin. Small leaks can be repaired by soldering. Clean the area around the leak with acid flux, and solder the hole tight. A good solder job will make the core as good as new. When the job is completed, wash off all traces of acid flux. If the hole is too large for soldering, block off the leaking tube (as an emergency repair), then replace the radiator as soon as possible.

(*b*) Using long-nose pliers, straighten bent fins.

(*c*) Inspect the hoses for swollen or peeling rubber. Check the inside of the hose for dirt and sediment. Replace swollen, damaged, or cut hose.

(*d*) Inspect the radiator cap and hose clamps for cracks or breaks. Replace a radiator cap or hose clamp that is cracked or broken.

(*e*) Inspect hose connector tubes and castings for cracks and breaks. Small holes and cracks may be closed by brazing. Replace badly cracked or broken tubes and castings.

(*f*) Inspect all parts for good condition. Replace parts not in good condition.

(5) *Reassembly* (fig. 94).

(*a*) Position the radiator guard (1) on the radiator and secure with lockwashers (12) and screws (13).

(*b*) Install the reducing bushing (24) and draincock (25). Install the radiator cap (3).

(6) *Installation.*

(*a*) If removed, install the upper radiator tube (6, fig. 94), hoses (5), and hose clamps (4) on the engine thermostat housing.

(*b*) If removed, install the lower radiator tube (15), hoses (5), and hose clamps (4) on the engine water pump inlet pipe.

(*c*) Position the fabreeka pads (1, fig. 93) on the support (15). Install the radiator mounting studs through the

pads and support and, at the same time, position the tube hoses on the radiator. Secure the radiator with lockwashers and nuts (3). Make sure the hoses are properly located and secure with hose clamps.

(*d*) Position the fan guard (14, fig. 94) on the radiator and secure with the lockwashers (12) and screws (13).

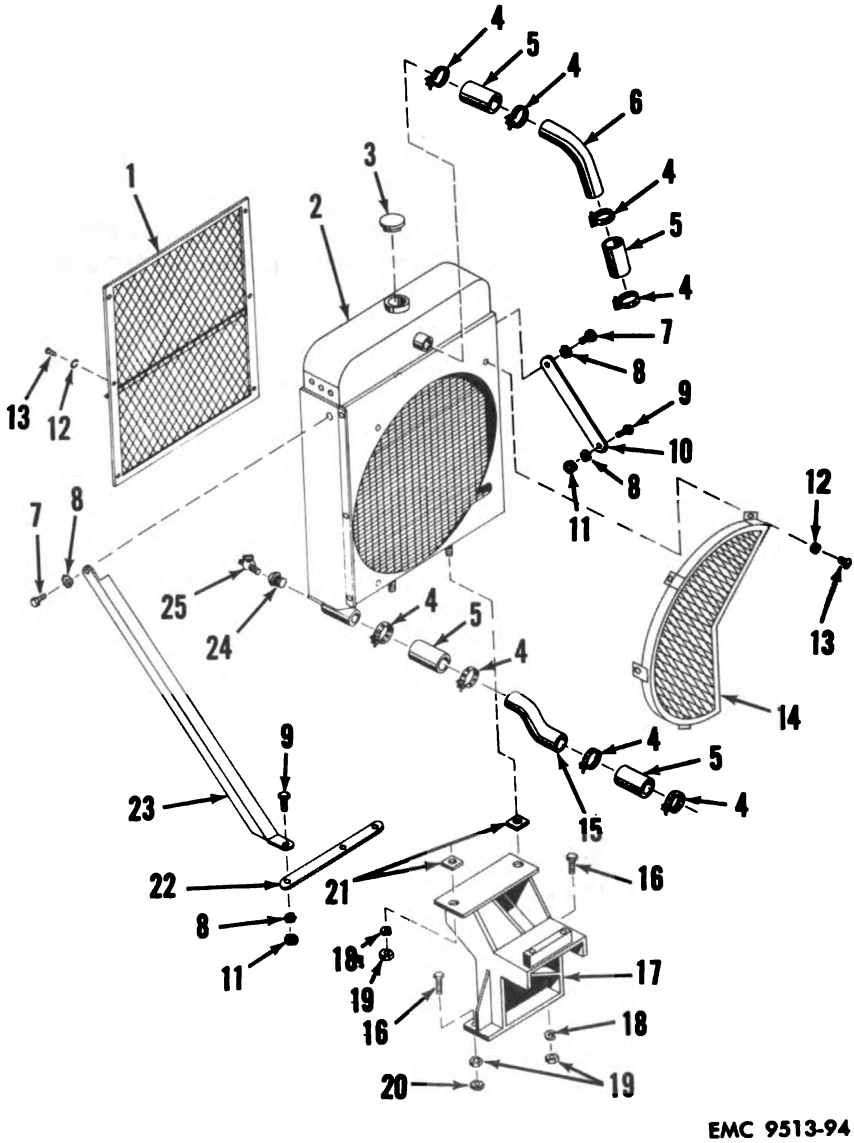


Figure 94. Revolving frame engine radiator, exploded view.

(*e*) Attach the radiator braces (10 and 23) to the side of the radiator with lockwashers (8) and screws (7).

(*f*) Close all draincocks. Fill the cooling system. Check the cooling system for leaks immediately after starting the engine.

(7) *Installing coolant.*

(*a*) *Preparation of cooling system.*

1. Approximately twice a year, or oftener, depending upon the kind of cooling water used, the cooling system should be drained, flushed, and cleaned with an approved cleaning compound. Flush the system thoroughly with clean hot water after using the cleaning compound. Hot water must be used to avoid damage to the hot engine.

2. See that all hoses are in good condition. Eliminate all leaks in the cooling system. Check the fan belts, thermostat, and water pump for good condition.

(*b*) *Installing antifreeze.* After cleaning the cooling system, close all draincocks. Install the antifreeze as indicated in table II. When installing antifreeze, always idle the engine for 10 minutes to thoroughly mix the antifreeze throughout the cooling liquid.

Caution: Be sure to refill the cooling system before starting the engine. If the engine is hot, use warm water to avoid cracking the cylinder block or cylinder head.

(8) *Installing rust inhibitor.*

(*a*) For rust prevention during cold weather, antifreeze containing a rust inhibitor should be used. Most commercial permanent antifreeze preparations have rust preventatives in them. Check the manufacturer's in-

←

1 Radiator guard
2 Radiator
3 Radiator cap
4 Clamp, hose, universal (8 rqr)
5 Hose, 2 ID x 3 (4 rqr)
6 Upper radiator tube
7 Screw, cap, hex hd, ½–13 NC x ¾ (2 rqr)
8 Lockwasher, external tooth, ½ (4 rqr)
9 Screw, cap, hex hd, ½–13 NC x 1 (2 rqr)
10 Radiator brace
11 Nut, regular, hex, ½–13 NC (2 rqr)
12 Lockwasher, spring, std, ¼ (9 rqr)
13 Screw, machine, rd hd, ¼–20 NC x ¾ (9 rqr)
14 Fan guard
15 Lower radiator tube
16 Screw, cap, hex hd, ⅝–18 NF x 2½ (2 rqr)
17 Support
18 Lockwasher, spring, std, ⅝ (3 rqr)
19 Nut, regular, hex, ⅝–18 NF (4 rqr)
20 Jamnut, regular, hex, ⅝–18 NF
21 Fabreeka pad (2 rqr)
22 Radiator brace bar
23 Radiator brace
24 Bushing, pipe, reducing, ¾ x ⅜
25 Draincock, ⅜

structions before adding additional rust inhibitor to the antifreeze.

(*b*) An approved rust inhibitor should be added to the cooling system to protect against corrosion during operation in warm weather, or when antifreeze is not in use.

b. Carrier.

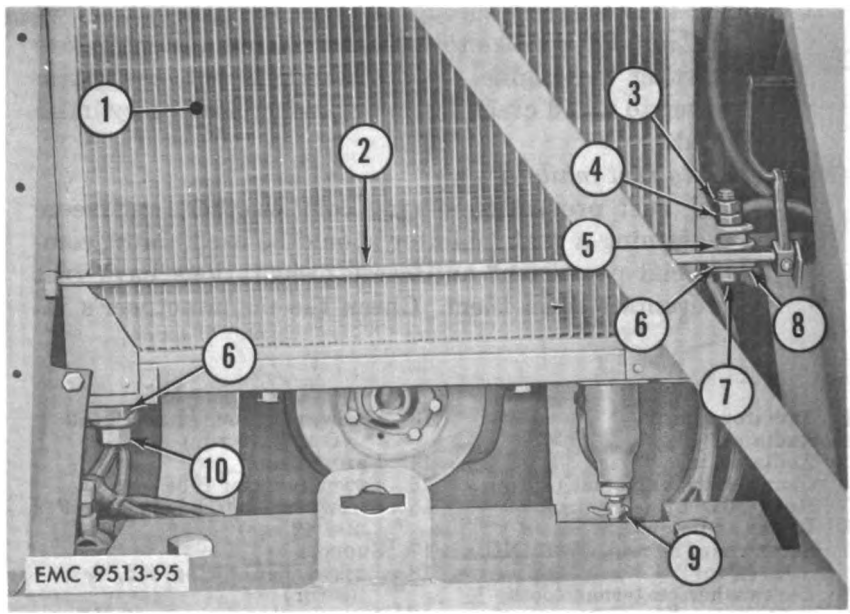
(1) *Removal.*

(*a*) Open the draincock (9, fig. 95). Open the draincock in the bottom of the water pump inlet pipe. Open any other draincocks found in either side of the cylinder block, usually at the rear of the block. Allow the cooling system to drain.

(*b*) Remove the radiator grille from the carrier.

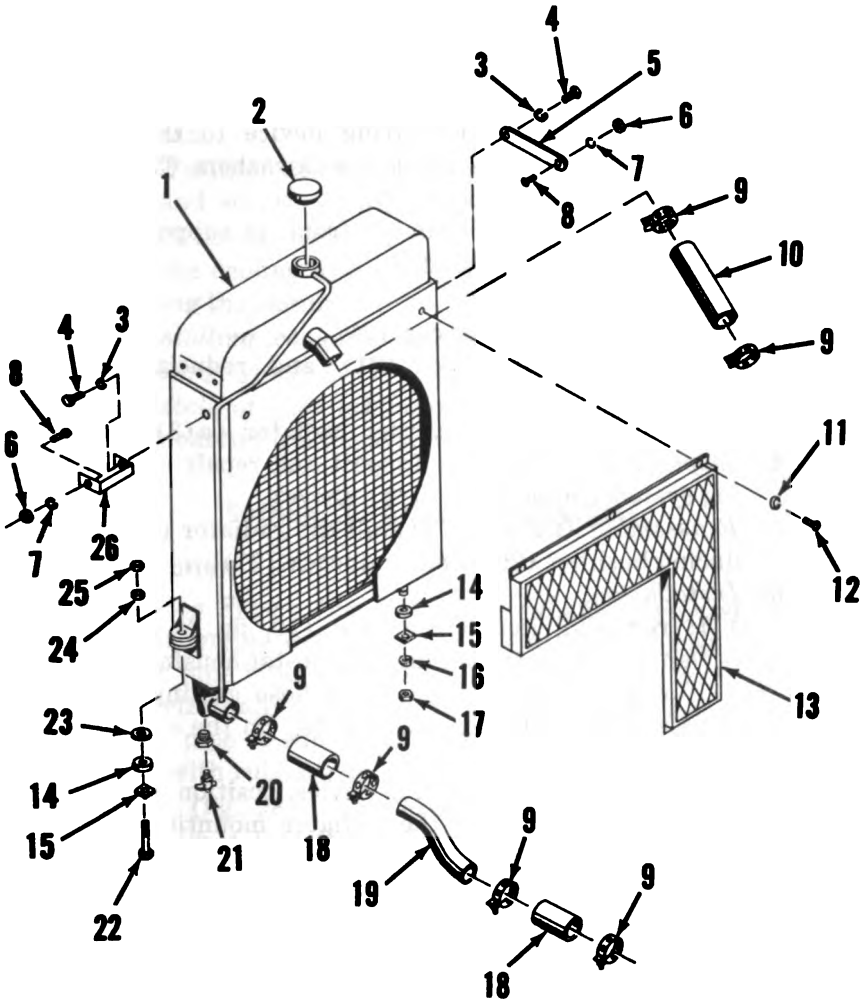
(*c*) Remove the mounting stud nut (10), lockwasher, square washer (8), and rubber pad (6). Remove the jamnut (3) and nut (4) and pull out the mounting bolt (7), square washer (8), and rubber pad (6).

(*d*) Remove the screws (12, fig. 96), lockwashers (11), and fan guard (13).



1 Radiator
2 Throttle shaft
3 Jamnut
4 Nut
5 Fabreeka pads
6 Rubber pads
7 Mounting bolt
8 Square washers
9 Draincock
10 Mounting stud nut

Figure 95. Carrier engine radiator, installed.



1	Radiator
2	Radiator cap
3	Lockwasher, spring, std, ½ (2 rqr)
4	Screw, cap, hex hd, ½–13 NC x ¾ (2 rqr)
5	Radiator brace
6	Nut, regular, hex, ⅜–16 NC (3 rqr)
7	Lockwasher, spring, std, ⅜ (3 rqr)
8	Screw, cap, hex hd, ⅜–16 NC x 1 (3 rqr)
9	Clamp, hose, universal (6 rqr)
10	Hose, 2¼ ID x 10½
11	Lockwasher, spring, std, ¼ (8 rqr)
12	Screw, machine, rd hd, ¼–20 NC x ¾ (8 rqr)
13	Fan guard
14	Rubber pad (2 rqr)
15	Square washer (2 rqr)
16	Lockwasher, spring, std, ¾
17	Nut, regular, hex, ¾–16 NF
18	Hose, 2¼ ID x 3 (2 rqr)
19	Lower hose casting
20	Bushing, pipe, reducing, ¾ x ⅜
21	Draincock, ⅜
22	Mounting bolt
23	Fabreeka pad (2 rqr)
24	Nut, regular, hex, ⅞–14 NF
25	Jamnut, regular, hex, ⅞–14 NF
26	Radiator brace

Figure 96. Carrier engine radiator, exploded view.

(*e*) Remove the blade assembly from the engine cooling fan to avoid damage to it.

(*f*) Loosen the hose clamps (9) and hoses (10 and 18) from the radiator (1) connections.

(*g*) Attach an auxiliary lifting device to the radiator. Remove the screws (4) and lockwashers (3) from the radiator braces (5 and 26).

(*h*) Carefully lift the radiator from its support and pull from the hoses (10 and 18).

(2) *Disassembly* (fig. 96).

(*a*) Remove the radiator cap (2).

(*b*) Remove the draincock (21) and reducing bushing (20).

(3) *Cleaning.* Clean the carrier radiator (*a*(3) above).

(4) *Inspection and repair.* Inspect and repair carrier cooling system components (*a*(4) above).

(5) *Reassembly* (fig. 96). Install the radiator cap (2), reducing bushing (20), and draincock (21).

(6) *Installation.*

(*a*) If removed, install the hose (10, fig. 96) and hose clamps (9) on the engine thermostat housing.

(*b*) If removed, install the lower hose casting (19) and hoses (18) with hose clamps (9) on the engine water pump inlet pipe.

(*c*) Using an auxiliary lifting device, position the radiator on its support with the radiator mounting stud just entering the angle.

(*d*) Position two fabreeka pads (5, fig. 95) between the radiator supporting arm and the support angle. Place a square washer (8) and a rubber pad (6) over the mounting bolt (7). Insert the bolt through the support and arm. Start the nut (4) on the bolt.

(*e*) Lower the radiator to rest and, at the same time, position the hoses on the radiator. Position a rubber pad (6) and square washer (8) on the mounting stud and start the nut (10).

(*f*) Position the radiator brace (5, fig. 96) on the radiator and battery and equipment box and secure with lockwasher (3), screw (4), screw (8), lockwasher (7), and nut (6).

(*g*) Position the radiator brace (26) on the radiator and carrier cab and secure with lockwasher (3), screw (4), screws (8), lockwashers (7), and nuts (6).

(*h*) Position and tighten all hose clamps (9).

(*i*) Tighten the mounting stud nut (10, fig. 95). Tighten

the nut (4) on the mounting bolt (7). Install and tighten the jamnut (3). Remove the auxiliary lifting device.

(*j*) Reinstall the blade assembly on the engine cooling fan.

(*k*) Position the fan guard (13, fig. 96) on the radiator and secure with lockwashers (11) and screws (12).

(*l*) Close all draincocks. Fill the cooling system. Check the cooling system for leaks immediately after starting the engine.

(7) *Installing coolant.* Install the coolant in the carrier cooling system (*a*(7) above).

(8) *Installing rust inhibitor.* Install the rust inhibitor in the carrier cooling system (*a*(8) above).

Section X. EXHAUST SYSTEMS

179. Description

a. Revolving Frame (fig. 97). The exhaust pipe casting (12) connects the engine exhaust manifold to the exhaust pipe (1). The exhaust pipe rises vertically to the revolving frame cab roof and then horizontally under the roof and out the rear of the cab. The exhaust pipe is supported from the cab roof by an exhaust bracket (6) with rubber pad (8).

b. Carrier (fig. 98). The exhaust pipe (2) connects the engine exhaust manifold through the carrier frame to the muffler (5). The muffler is supported by muffler brackets (8) and straps (10) attached to the outside of the right frame channel. The exhaust tail pipe (9) deflects the exhaust away from the carrier.

180. Exhaust Pipe, Revolving Frame Engine (fig. 97)

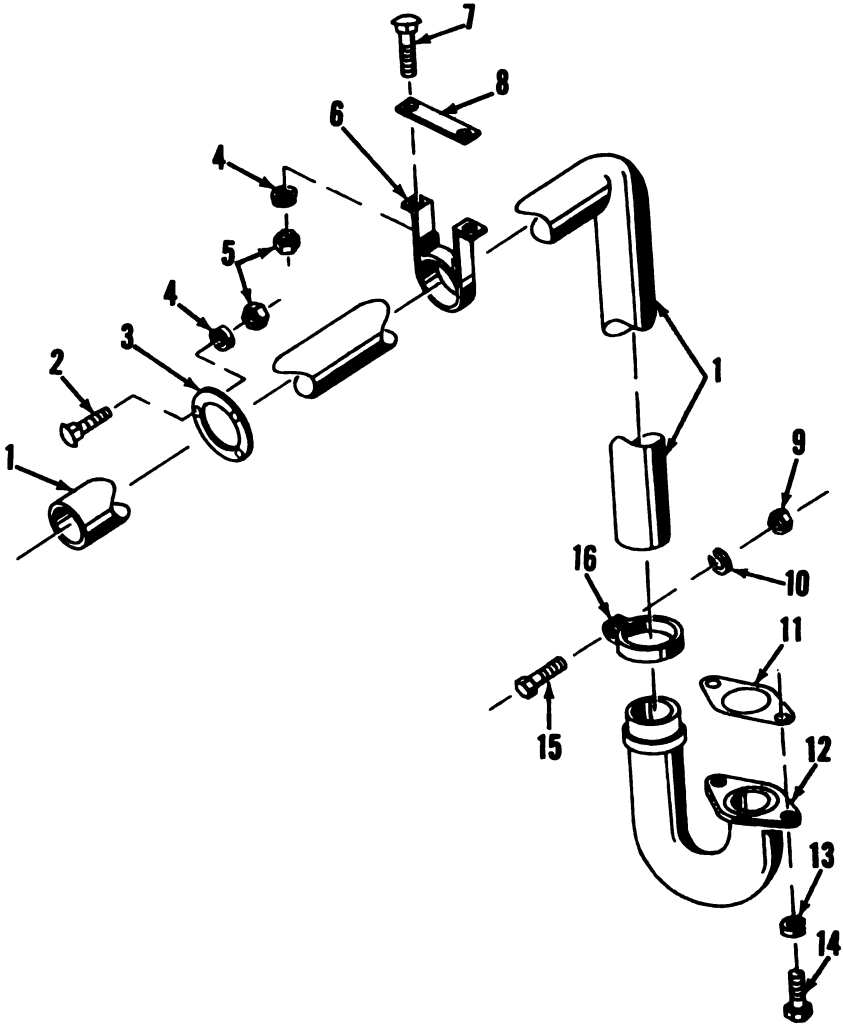
a. Removal and Disassembly.

(1) Loosen the nut (9), screw (15), and exhaust pipe clamp (16).

(2) Remove the screws (14) and lockwashers (13). Remove the exhaust pipe casting (12) from the engine exhaust manifold and the exhaust pipe (1). Remove the gasket (11).

(3) Remove the nuts (5), lockwashers (4), bolts (7), bracket (6), and the rubber pad (8).

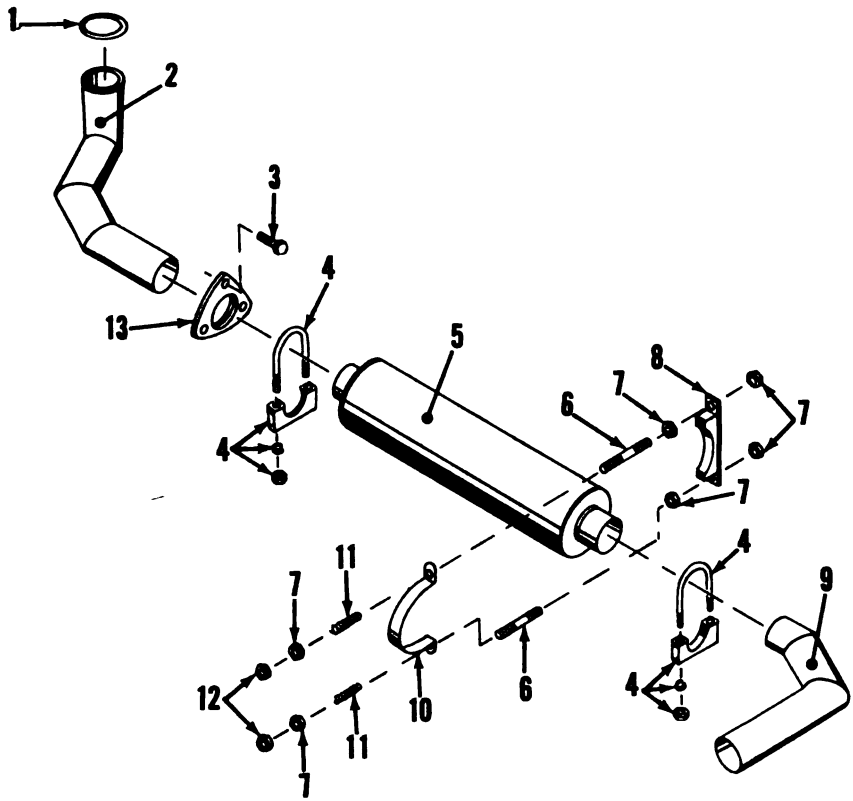
(4) Pull the exhaust pipe (1) from the cab rear and the rear exhaust flange (3). Remove the exhaust bracket (6) from the exhaust pipe.



EMC 9513-97

1 Exhaust pipe
2 Bolt, carriage, regular, ⅜–16 NC x ¾ (3 rqr)
3 Rear exhaust flange
4 Lockwasher, spring, std, ⅜ (5 rqr)
5 Nut, regular, hex, ⅜–16 NC (5 rqr)
6 Exhaust bracket
7 Bolt, carriage, regular, ⅜–16 NC x 1¼ (2 rqr)
8 Rubber pad
9 Nut, regular, hex, ¼–20 NC
10 Lockwasher, spring, std, ¼
11 Gasket
12 Exhaust pipe casting
13 Lockwasher, spring, std, 7/16 (2 rqr)
14 Screw, cap, hex hd, 7/16–14 NC x 1¼ (2 rqr)
15 Screw, cap, hex hd, ¼–20 NC x 1¼
16 Exhaust pipe clamp

Figure 97. Revolving frame exhaust pipe and braces, exploded view.



1	Flange gasket	8	Muffler bracket (2 rqr)
2	Exhaust pipe	9	Exhaust tail pipe
3	Screw, cap, hex hd, ½–13 NC x 1⅝ (3 rqr)	10	Muffler strap (2 rqr)
4	Muffler clamp 3¼ (2 rqr)	11	Spring (4 rqr)
5	Muffler	12	Jamnut, regular, hex, ⅜–16 NC (4 rqr)
6	Rod (4 rqr)	13	Companion flange
7	Nut, regular, hex, ⅜–16 NC (12 rqr)		

Figure 98. Carrier exhaust pipe, muffler and brackets, exploded view.

(5) Remove the nuts (5), lockwashers (4), bolts (2), and the exhaust flange (3) from the cab rear.

b. Inspection. Using a wire brush, clean the corrosion off the exhaust pipe and exhaust pipe casting.

(1) Inspect the exhaust pipe and exhaust pipe casting for cracks or breaks. Replace a cracked or broken pipe or casting.

(2) Inspect the exhaust bracket and the exhaust pipe clamp for cracks or breaks. Replace a bracket or clamp that is cracked or broken.

(3) Inspect the rubber pad, rear exhaust flange, screws, bolts, lockwashers, and nuts for good condition. Replace parts not in good condition. Replace the gasket.

c. Reassembly and Installation.

(1) Position the exhaust bracket (6) and exhaust pipe clamp (16) on the exhaust pipe (1).

(2) Insert end of the exhaust pipe through the rear of the cab. Position the bracket and rubber pad (8). Install the bolts (7) from top of cab and through the rubber pad and bracket. Start the lockwashers (4) and nuts (5) on the bolts (7).

(3) Start the exhaust pipe casting (12) in the exhaust pipe (1). Position a gasket (11) on the casting. Install the casting and gasket on the engine exhaust manifold and secure with lockwashers (13) and screws (14). Correctly position the exhaust pipe (1) in the casting and secure with the exhaust pipe clamp (16), screw (15), lockwasher (10), and nut (9).

(4) Tighten the nuts (5) at the exhaust bracket (6).

(5) Position the rear exhaust flange (3) on the exhaust pipe and cab rear. Secure the flange with bolts (2), lockwashers (4), and nuts (5).

181. Exhaust Pipe and Muffler, Carrier Engine (fig. 98)

a. Removal and disassembly.

(1) Remove the muffler clamp (4) from the muffler (5) and exhaust pipe (2).

(2) Remove the jamnuts (12), nuts (7), springs (11), and muffler straps (10) from the rods (6) and muffler (5). Remove the muffler from the muffler brackets (8) and the exhaust pipe (2).

(3) Remove the muffler clamp (4) from the muffler (5) and exhaust tail pipe (9). Remove the exhaust tail pipe.

(4) Remove the screws (3) from the companion flange (13) and the engine exhaust manifold. Remove the exhaust pipe (2), flange, and flange gasket (1).

(5) Remove the nuts (7), muffler brackets (8), and rods (6) from the carrier frame.

b. Inspection. Using a wire brush, clean the corrosion off the muffler and exhaust pipes.

(1) Inspect the muffler and exhaust pipes for pinholes, cracks, and breaks. Replace a muffler or exhaust pipe that is cracked, broken, or is perforated with pinholes.

(2) Inspect the brackets, clamps, and straps for cracks and

breaks. Replace a bracket, clamp, or strap that is cracked or broken.

(3) Inspect all parts for good condition. Replace parts not in good condition.

c. Reassembly and Installation.

(1) Install a nut (7) on each rod (6). Position the muffler brackets (8) on the carrier frame. Insert the rods through the brackets and frame and secure with nuts (7).

(2) Install the companion flange (13) on the exhaust pipe (2). Install the exhaust pipe in the carrier frame. Position the flange gasket (1) on the companion flange. Position the flange on the engine exhaust manifold and secure with screws (3).

(3) Position the muffler (5) on the exhaust pipe (2) and against the muffler brackets (8). Install the muffler straps (10) and springs (11) on the rods (6) and secure with nuts (7) and jamnuts (12). Install a muffler clamp (4) over the muffler and exhaust pipe (2).

(4) Position the exhaust tail pipe (9) on the muffler at an angle of approximately 45° to deflect the exhaust to the ground away from the carrier. Install a muffler clamp (4) over the muffler and exhaust pipe (9).

Section XI. LUBRICATION SYSTEMS

182. Description

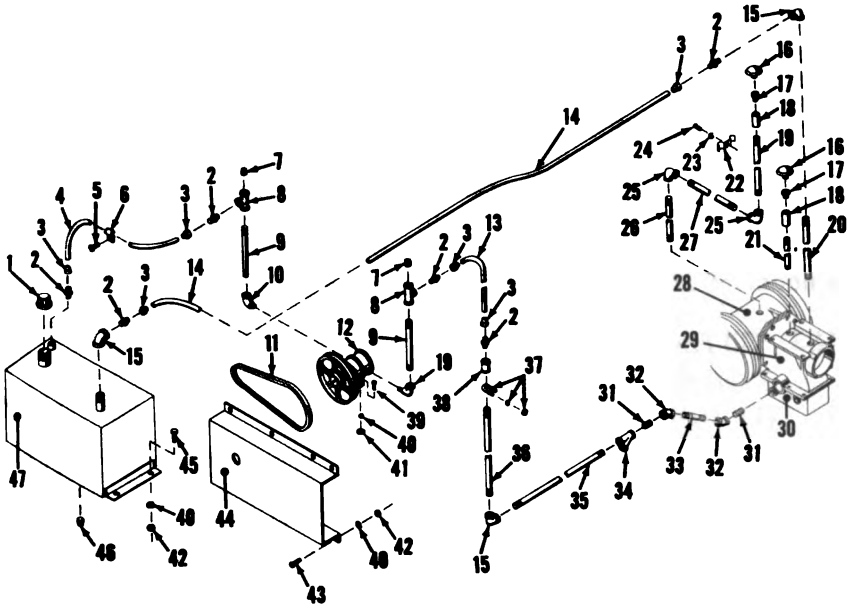
a. Revolving Frame.

(1) The lubrication system on the revolving frame engine is the forced-feed type to all main and connecting rod bearings by means of a gear-type pressure pump. The oil pump is driven through a suitable gear arrangement at the center of the camshaft. The pump picks up the oil from the center sump of the oil pan and delivers it to the oil filter and to a drilled passage in the cylinder block. From there it flows through an oil manifold and through various leads to the main bearings. From the main bearings the oil flows through suitable drilled holes in the crankshaft to the connecting rod bearings. The bypass-type pressure regulator, consisting of a spring loaded piston, is incorporated in the oil pump body. The idler shaft and accessory shaft are pressure-lubricated. The cam bearings, valve tappets, valve stems, and cylinders are lubricated by the mist of oil thrown off by the main and connecting rod bearings. The crank-

case ventilation system consists of a breather cap on the oil filler pipe and a metering valve connected between the intake manifold and the rear valve tappet cover plate. The valve meters the amount of air which will flow through the crankcase while the engine is running at either full load or part load. In order that the carburetion is not upset at idling speeds, the increased vacuum offsets the gravity pull of the weighted metering pin, moving it to its uppermost position and thus cutting down the amount of air which it will bypass into the intake manifold.

(2) The independent boom hoist rotary pump (12, fig. 99) circulates lubricating oil from the oil reservoir (47) to the top of the worm shaft housing (29), over the worm shaft and worm wheel, to the bottom of the drum shaft case (30), and back to the oil reservoir. The primary purpose of the circulating oil system is to cool the lubricating oil. The rotary pump is belt-driven from the engine clutch shaft assembly.

b. Carrier. The combination pressure and scavenging pump of the carrier engine maintains oil pressure at all angles of operation. The pump picks up the oil through pipes from either end of the oil pan, and returns it to the center sump of the oil pan. In this manner the oil pressure pump is supplied with ample quantities of oil for safe operation providing the oil level in the crankcase is maintained at or near the 4/4 mark on the level gage. The oil pump is located in the crankcase and is driven by a spiral gear at the center of the camshaft. The oil pump is below the level of the oil in the crankcase and needs no priming. Oil is delivered from the oil pump through a short flexible tube to a drilled passage in the crankcase, which delivers the oil to the oil filters, and then through a drilled passage, which extends from front to rear of the cylinder block on the side opposite the camshaft. Radial holes are drilled from each crankshaft main bearing to meet this horizontal oil passage and this permits oil to be delivered under pressure to the main bearings and through drilled holes in the crankshaft to the connecting rod bearings. Suitable drilled passages provide force-feed lubrication to the idler gear bearing, accessory shaft sleeve bearing, governor, and air compressor. The camshaft bearings, valve tappets, valve stems, and cylinders are lubricated by the mist of oil thrown off by the main and connecting rod bearings. The bypass-type pressure regulator, consisting of a spring-loaded piston, is incorporated in the oil filter base. The crankcase ventilation system consists



1 Cap, pipe, 1¼
2 Connector (6 rqr)
3 Hose fitting (6 rqr)
4 Hose, 26½ long
5 Gearcase cover screw
6 Clamp tubing, 1
7 Plug, pipe, sq hd, ⅜ (2 rqr)
8 Tee, pipe, std, ⅜ (2 rqr)
9 Nipple, pipe, std, ⅜ x 6 (2 rqr)
10 Elbow, pipe, street, ⅜ x 90° (2 rqr)
11 Belt
12 Rotary pump
13 Hose, 12½ long
14 Hose, 42 long
15 Elbow, pipe, ⅜ x 90° (3 rqr)
16 Breather (2 rqr)
17 Bushing, pipe, reducing, ⅜ x ½ (2 rqr)
18 Coupling, pipe, std, ½ (2 rqr)
19 Nipple, pipe, ½ x 5
20 Nipple, pipe, ⅜ x 11¼
21 Nipple, pipe, ½ x 10
22 Pipe clip
23 Lockwasher, spring, std, ¼
24 Bolt, stove, rd hd, ¼ x 2
25 Elbow, pipe, ½ x 90° (2 rqr)
26 Nipple, pipe, ½ x 2
27 Nipple, pipe, ½ x 4
28 Bevel gearcase
29 Worm shaft housing
30 Drum shaft case
31 Nipple, close, pipe, ⅜ (2 rqr)
32 Elbow, pipe, ⅜ x 45° (2 rqr)
33 Nipple, pipe, ⅜ x 2½
34 Separator, sediment, ⅜ Y
35 Nipple, pipe, ⅜ x 15¼
36 Nipple, pipe, ⅜ x 25
37 Pipe clamp assembly
38 Coupling, pipe, std, ⅜
39 Screw, cap, hex hd, ⅜–24 NF x 1¼ (4 rqr)
40 Lockwasher, spring, std, ⅜ (16 rqr)
41 Nut, regular, hex, ⅜–24 NF (4 rqr)
42 Nut, regular, hex, ⅜–16 NC (12 rqr)
43 Screw, cap, hex hd, ⅜–16 NC x ¾ (8 rqr)
44 Pulley guard
45 Screw, cap, hex hd, ⅜–16 NC x 1¼ (4 rqr)
46 Plug, pipe, sq hd, ½
47 Oil reservoir

Figure 99. Independent boom hoist circulating oil system diagram, exploded view.

of an oil bath-type crankcase breather mounted on the left side of the engine, and a metering valve connected between the intake manifold and the rear valve tappet cover plate. The valve meters the amount of the air which will flow through the crankcase while the engine is running at either full load or part load. In order that the carburetion is not upset at idling speeds, the increased vacuum offsets the gravity pull of the weighted metering pin, moving it to its uppermost position and thus cutting down the amount of air which it will bypass into the intake manifold.

183. Oil Filters

a. Revolving Frame (fig. 100).

(1) *Removal and disassembly.*

(a) Remove the pipe plug (6) and drain the oil from the oil filter body (5).

(*b*) Unscrew the cover center screw (1) and remove the center screw, center screw gasket (2), oil filter cover (3), and cover spring (16). Remove the cover gasket (15) from the cover.

(*c*) Pull out the oil filter cartridge (14).

(*d*) Remove the center tube (13) and center tube adapter (12) from the oil filter body (5) and base (8).

(*e*) Remove the body, body washer (4), and body gasket (7) from the base.

(*f*) Remove the screws (9) and lockwashers (10). Remove the base and attaching gasket (11) from the engine.

(2) *Inspection and repair.* Soak and wash all metal parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(*a*) Replace the oil filter cartridge and all gaskets.

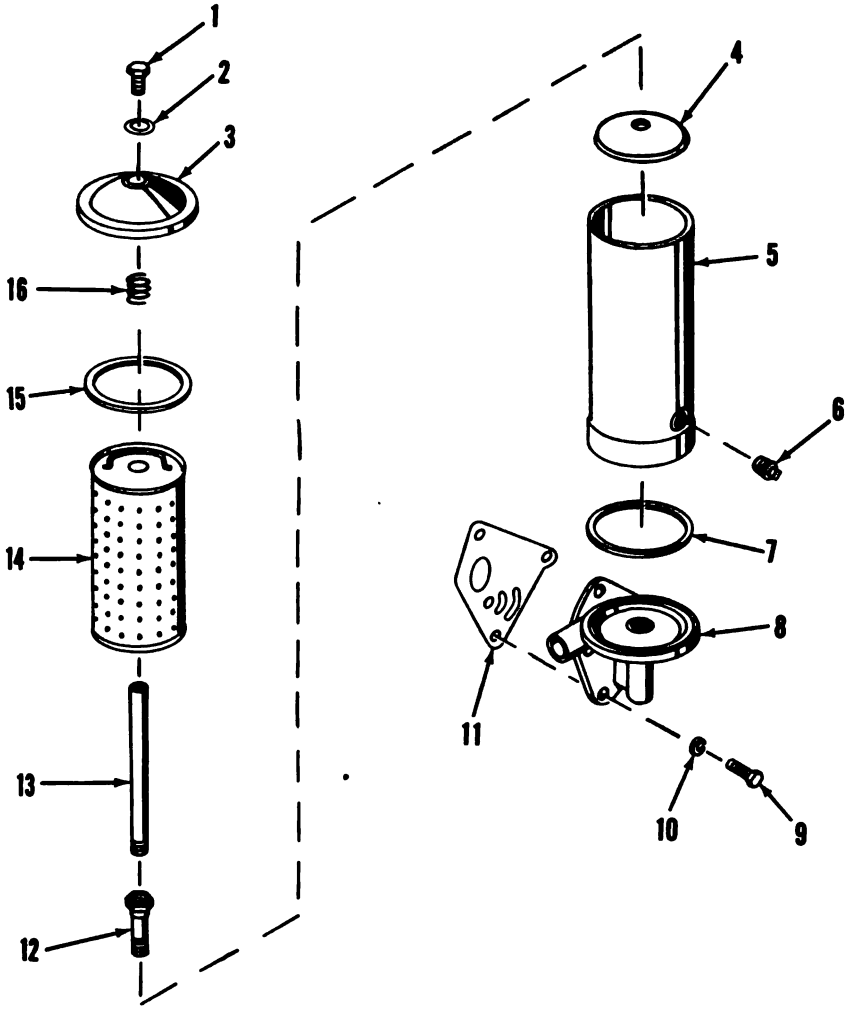
(*b*) Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace parts having damaged, corroded, or stripped threads.

(*c*) Inspect the oil filter cover, body, body washer, and base for cracks, breaks, and distortion. Replace a cover, body, body washer, or base if cracked, broken, or distorted.

(*d*) Inspect all parts for good condition. Replace parts not in good condition.

(3) *Reassembly and installation.*

(*a*) Position the attaching gasket (11) and oil filter base (8) on the engine and secure with lockwashers (10) and screws (9).



EMC 9513-100

1 Cover center screw
2 Center screw gasket
3 Oil filter cover
4 Body washer
5 Oil filter body
6 Plug, pipe, sq hd, ⅜
7 Body gasket
8 Oil filter base
9 Screw, cap, hex hd, ½–13 NC x 1¼ (2 rqr)
10 Lockwasher, spring, std, ½ (2 rqr)
11 Attaching gasket
12 Center tube adapter
13 Center tube
14 Oil filter cartridge
15 Cover gasket
16 Cover spring

Figure 100. Revolving frame engine oil filter, exploded view.

(*b*) Install the body gasket (7) in the base.

(*c*) Position the oil filter body (5) and body washer (4) on the base. Insert and tighten the center tube adapter (12) and center tube (13) into the body washer and base.

(*d*) Install the oil filter cartridge (14) in the body over the center tube.

(*e*) Install the cover gasket (15), center screw gasket (2), center screw (1), and cover spring (16) in the oil filter cover (3).

(*f*) Position the oil filter cover assembly on the oil filter body. Tighten the cover by turning the cover center screw on the center tube (13).

(*g*) Lubricate the engine (LO 5–9513–3). Check for oil leaks immediately after starting the engine.

b. Carrier. Refer to TM 5–5252 for maintenance procedures on the carrier engine oil filters.

184. Crankcase Breathers

a. Revolving Frame (fig. 101).

(1) *Removal and disassembly.*

(*a*) Pull the breather cap (1) off the oil filter pipe (2).

(*b*) Remove the nuts (6) and lockwashers (5) from the attaching studs (4). Remove the oil filler pipe (2) and gasket (3) from the engine and studs.

(2) *Inspection and repair.* Soak and was the breather cap and oil filler pipe in an approved cleaning solvent and blow them dry with clean compressed air.

(*a*) Replace the attaching gasket.

(*b*) Inspect the breather cap and oil filler pipe for cracks and breaks. Replace a cracked or broken breather cap and oil filler pipe. Small cracks in the oil filler pipe can be brazed shut.

(3) *Reassembly and installation.*

(*a*) Position the attaching gasket (3) and oil filler pipe (2) on the attaching studs (4) and engine. Secure the oil filler pipe with lockwashers (5) and nuts (6).

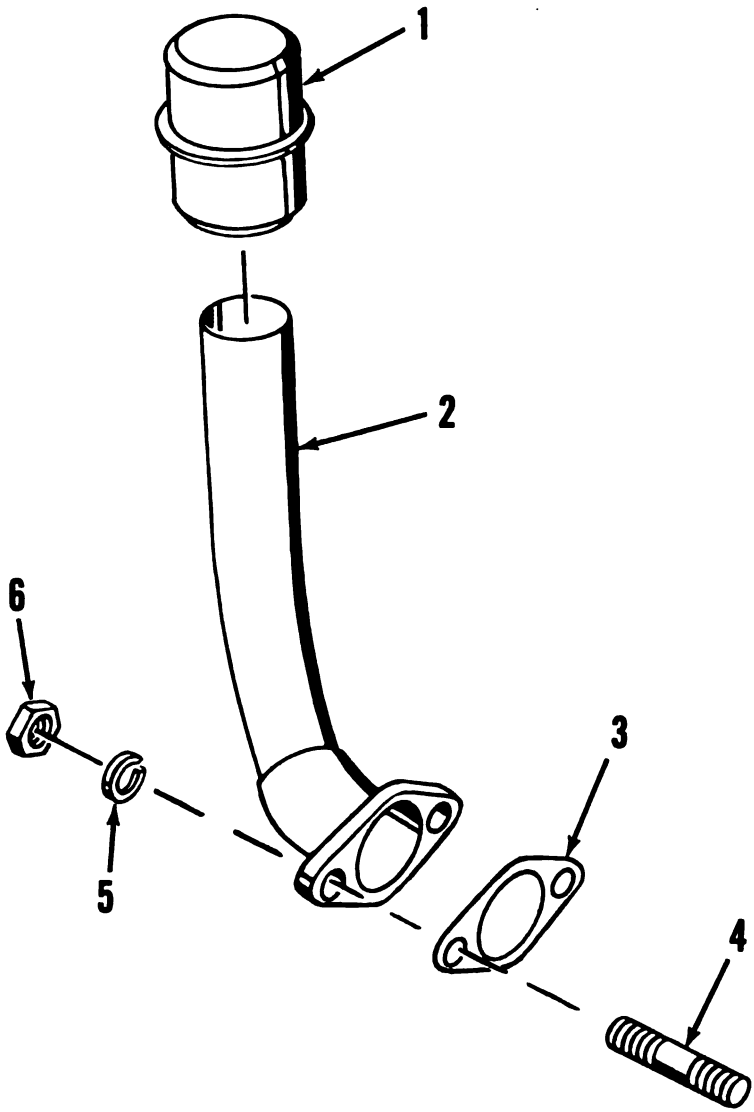
(*b*) Install the breather cap (1) on the oil filler pipe.

(*c*) Check for oil leaks immediately after starting the engine.

b. Carrier. Refer to TM 5–5252 for maintenance procedures on the carrier engine oil-bath type crankcase breather.

185. Oil Pressure Gage Sending Units

a. General. The oil pressure gage sending unit (9, fig. 86) has a resistance with a sliding contact, which is actuated by the



1 Breather cap
2 Oil filler pipe
3 Attaching gasket
4 Attaching stud (2 rqr)
5 Lockwasher, spring, std, ½ (2 rqr)
6 Nut, regular, hex, ½–20 NF (2 rqr)

Figure 101. Revolving frame engine breather cap and oil filler pipe, exploded view.

oil pressure, thereby controlling the current flowing in the variable field circuit of the oil pressure gage (3, fig. 36) to move the gage pointer. Oil pressure gages and sending units are identical for the revolving frame and carrier engines.

b. Testing. Make sure the crankcase oil level is correct, that the oil pump is operating, and that there are no broken oil lines before replacing either the oil pressure gage or sending unit.

(1) If the oil pressure gage reads zero at all times, check for a broken lead between the gage and sending unit. Replace a broken lead. If condition is not corrected, replace the sending unit. If the gage still does not register, replace the gage.

(2) If the oil pressure gage reads maximum at all times, check for a grounded lead between the gage and sending unit. Replace a grounded lead. If condition is not corrected, replace the sending unit.

c. Removal.

(1) Remove the lead from the sending unit.

(2) Turn the sending unit counterclockwise from the cylinder block.

d. Installation.

(1) Turn the sending unit clockwise into the oil gallery in the cylinder block.

(2) Install the lead on the sending unit.

186. Independent Boom Hoist Rotary Pump

a. Removal.

(1) Remove the nuts (42, fig. 99), lockwashers (40), and screws (43). Remove the pulley guard (44) from the pulley guard supports (1, fig. 102) welded on the gear case (7).

(2) Disconnect the rotary pump intake hose (4) and discharge hose (11) from the pipe tees above the pump (3).

(3) Remove the nuts (8), lockwashers, and mounting screws (6) from the pump and gearcase.

(4) Remove the belt (2). Remove the rotary pump.

(5) Remove circulating oil system components (fig. 99) as necessary. Drain the system (LO 5–9513–2) before removing components below the level of the oil reservoir (9, fig. 102).

b. Installation.

(1) Install any circulating oil system components (fig. 99) that may have been removed.

(2) Position the rotary pump (3, fig. 102) on the platform welded to the gearcase (7). Install the screws (6),

lockwashers, and nuts (8). Install the belt (2) on the pump pulley and engine clutch shaft assembly (12).

(3) Pull the pump away from the clutch shaft assembly until the belt is tight, then tighten the nuts (8).

(4) Connect the rotary pump intake hose (4) and discharge hose (11) to the pipe tees above the pump.

(5) Position the pulley guard (44, fig. 99) on the pulley guard supports (1, fig. 102) and secure with screws (43, fig. 99), lockwashers (40), and nuts (42).

(6) Lubricate the independent boom hoist circulating system (LO 5–9513–2). Check for oil leaks after lubricating and again immediately after starting the engine.

Section XII. PULLEYS, PULLEY BUSHINGS AND BEARINGS AND DIPPER AND BUCKET TEETH

187. Description

This section gives general information on the repair of pulleys, replacement of pulley bushings and bearings, and the rebuilding and shaping of dipper and bucket teeth.

188. Pulleys

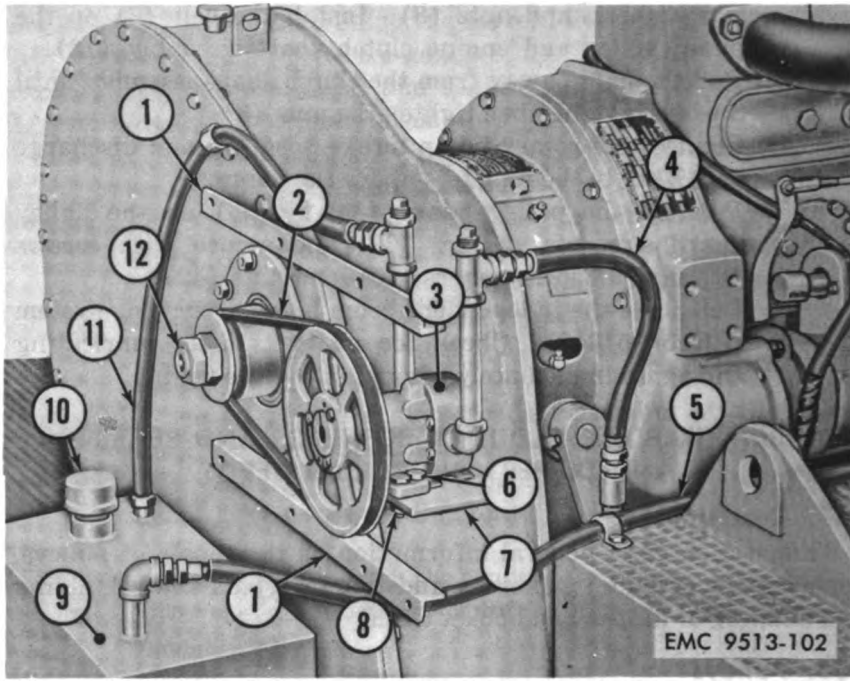
a. Cleaning. Remove the lubrication fittings from the pulley. Soak and wash the pulley in an approved cleaning solvent. Clean out the lubrication passages. Blow pulley dry with clean compressed air.

b. Inspection.

(1) Inspect the pulley bushings (par. 189*a*) and pulley bearings (par. 190*a*).

(2) Inspect the pulley groove for wear. If a piece of cold-roll steel, of the same diameter as the cable running over the pulley, bottoms in the pulley groove and the clearance between the steel and the pulley groove exceeds one-sixteenth inch, replace the pulley. If the side of the pulley groove is corrugated or worn deep enough to chafe sides of the cable passing over it, chuck the pulley in a lathe and take a light cut off the groove to smooth it up. If it is necessary to remove so much material in repairing the groove that the pulley will be weakened, replace the pulley.

(3) Inspect the lubrication fitting and passage on the shaft or pin on which the pulley is to be installed to be sure lubricant can reach the bushing or bearings. When the pulley is ready for installation, coat the inside of the bushing or pack the bearings with lubricant. Refer to current lubrication order.



1	Pulley guard support	7	Gearcase
2	Belt	8	Nut
3	Rotary pump	9	Oil reservoir
4	Rotary pump intake hose	10	Pipe cap
5	Hose to worm shaft housing	11	Rotary pump discharge hose
6	Mounting screw	12	Engine clutch shaft assembly

Figure 102. Rotary pump, pulley guard removed, installed.

(4) Inspect the pulley for cracks and breaks. Replace a pulley if cracked or broken.

189. Pulley Bushings

a. Inspection. Clean the pulley (par. 188*a*).

(1) Inspect the bushing for wear. If a bushing is worn, it should be replaced.

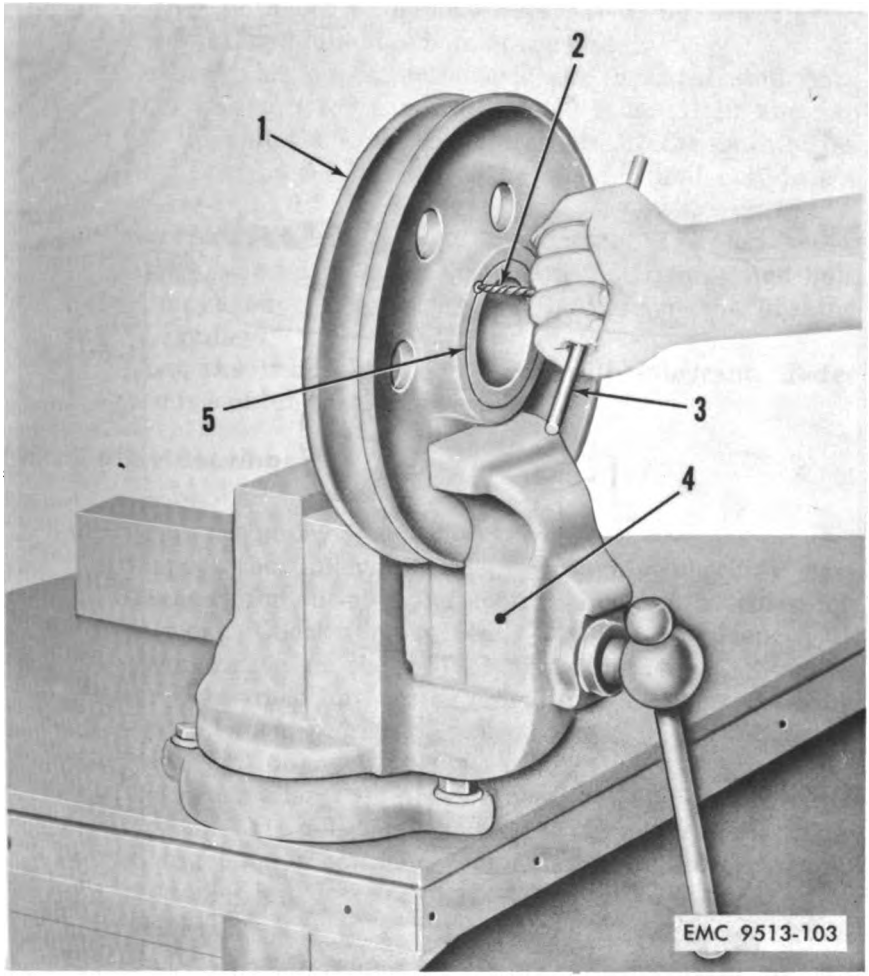
(2) Position, function, and availability of a replacement bushing should be taken into consideration in determining when a bushing must be replaced.

(3) Inspection of the bushing should include examination of lubrication fittings and passages. Be sure lubricant reaches the bushing. If bushings run dry, check the lubrication fittings and ducts immediately for clogging by dirt or hard dried grease.

b. Removal.

(1) Locate the pulley (1, fig. 103) in a bench vise (4).

(2) Drill the threaded stud in the pulley (1) and bushing



1 Pulley
2 Screw extractor
3 Tap wrench
4 Bench vise
5 Pulley bushing

Figure 103. Removing threaded stud from pulley and bushing.

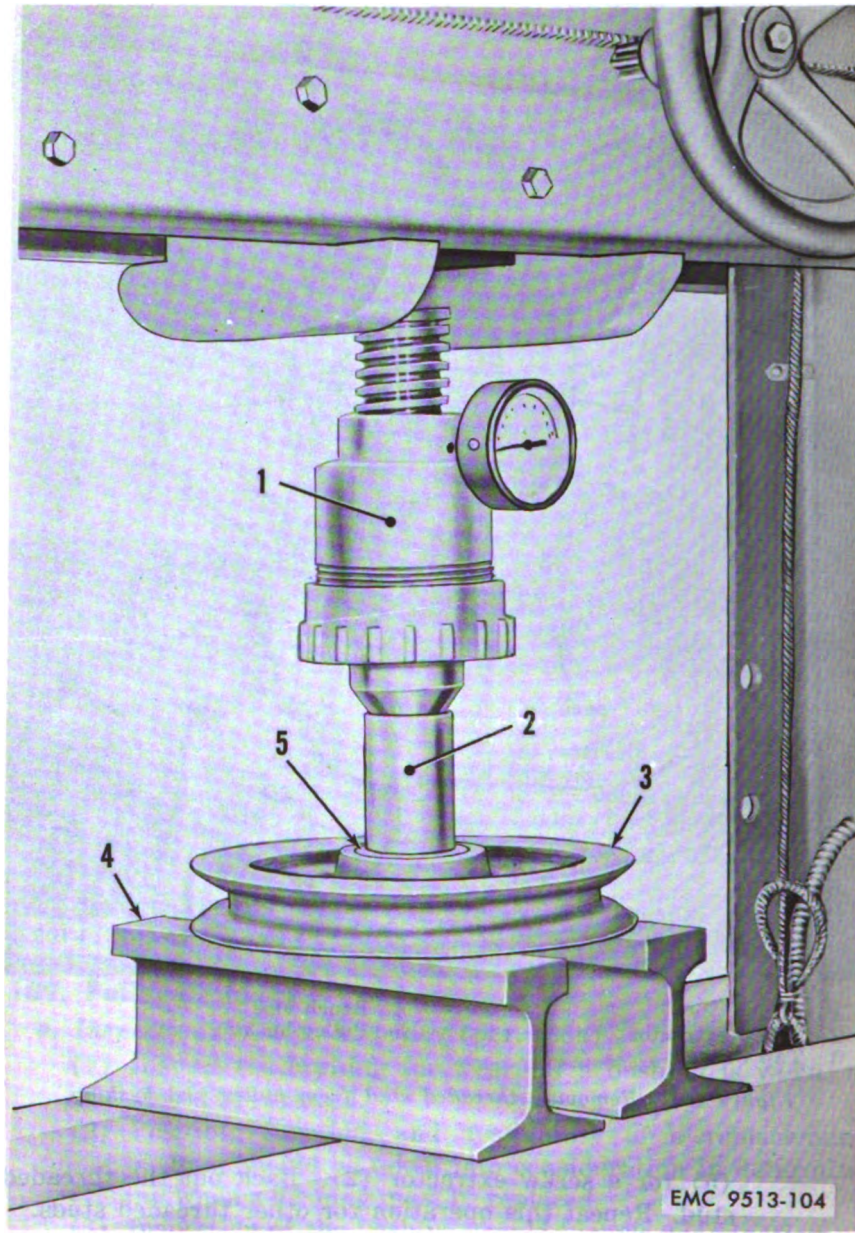
(5) for a screw extractor (2). Back out the threaded stud. Repeat this operation for other threaded studs.

(3) Position the pulley (3, fig. 104) on supports (4) on the table of an arbor or hydraulic press (1).

(4) Position a pilot (2), slightly smaller in diameter than the outside diameter of the bushing, and press the pulley bushing (5) out of the pulley.

c. *Installation.*

(1) Remove any sharp edges and burs from the surface and bore of the pulley.



1 Press
2 Pilot
3 Pulley
4 Support
5 Pulley bushing

Figure 104. Pressing out pulley bushing.

(2) Using an arbor or hydraulic press (1, fig. 104), press a new bushing into the bore of the pulley.
(3) On the side opposite the original threaded stud hole, drill and tap for a new threaded stud. Drill and tap the hole at the outer circumference of the bushing so that half of the hole is in the bushing and half in the pulley hub. If a cap screw is used as a threaded stud, cut off the cap screw head and remaining portion of the screw, when tightened, flush with the bushing and hub. Remove any sharp edges and burs from the bushing and pulley.
(4) Coat the inside of the bushing with lubricant. Refer to current lubrication order.

190. Pulley Bearings

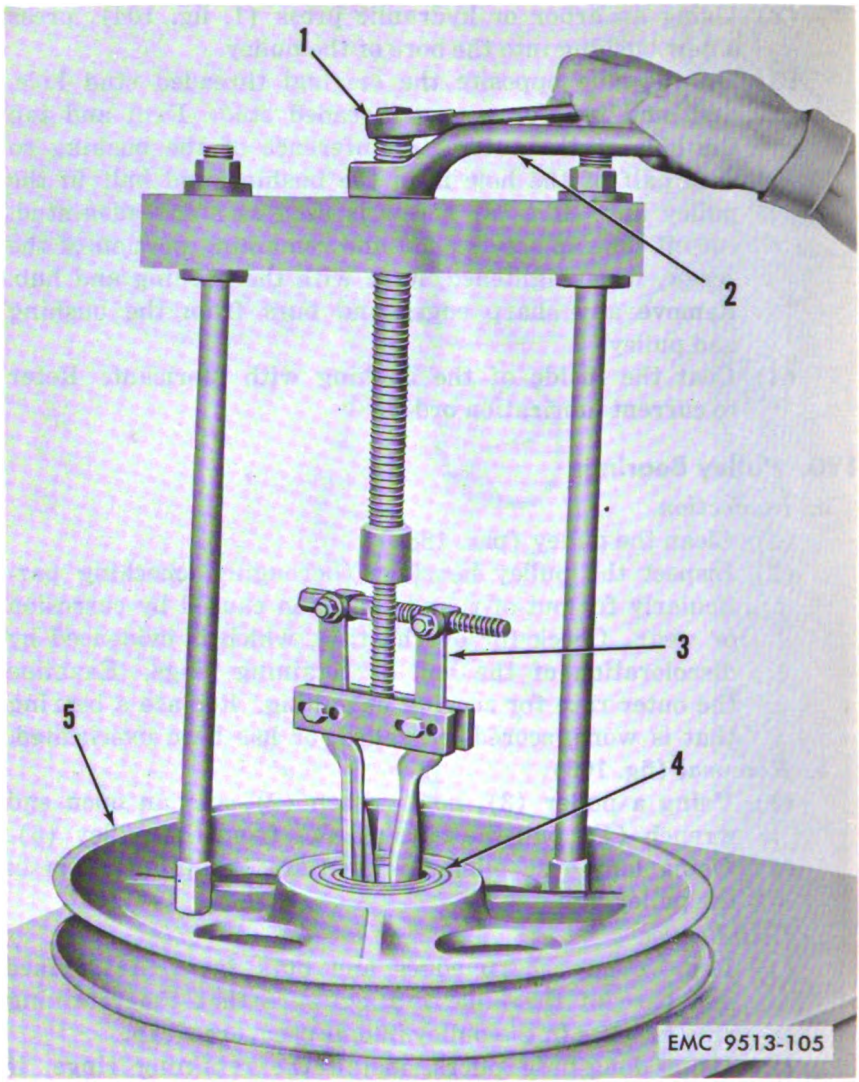
a. Inspection.
(1) Clean the pulley (par. 188*a*).
(2) Inspect the pulley bearings thoroughly, checking particularly for out-of-round condition caused by corrosion or wear. Check for overheating, which is evidenced by discoloration of the ball or retaining rings. Examine the outer race for scoring or galling. Replace a bearing that is worn, scored, or galled, or has been overheated.

b. Removal (fig. 105).
(1) Using a puller (3), box wrench (2), and an open end wrench (1), pull the bearing (4) from the pulley (5).
(2) Using long-nose pliers, remove any retaining rings in the pulley hub.

c. Installation.
(1) Remove any sharp edges and burs from the surface and bore of the pulley. Make sure that the retaining ring grooves in the pulley hub, if used, are clean.
(2) Using long-nose pliers, install the retaining rings, if used, in the pulley hub.
(3) Using a soft hammer, tap the bearing into the pulley hub.
(4) Lubricate the pulley. Refer to current lubrication order.

191. Dipper and Bucket Teeth

a. Turning Teeth Over. Shovel, dragline, and back hoe dipper teeth can be turned over to achieve self-sharpening, equalize tooth wear, and provide a better bite. The teeth should be turned before they become excessively worn. To turn the dipper teeth, remove the pins or bolts that lock the teeth in place. Insert the dipper tooth wedge below the tooth in the shank and drive the tooth



1 Open end wrench
2 Box wrench
3 Puller
4 Bearing
5 Pulley

Figure 105. Pulling pulley bearing.

loose in the socket. Remove the tooth, turn it over, and reinstall it in the lip. Aline teeth properly with shims. Then install the pin or bolt to lock the tooth in place. Clamshell bucket teeth cannot be turned over but can be resharpened or replaced.

b. Shaping Teeth. Dipper teeth not worn down more than 2 inches can be reshaped by forging and drawing. Forging should be done with the metal at a temperature of 2000° F.

(light orange color). Retemper the tooth tip by heating it to 1475° F. (dull cherry red) and quench it in oil.

c. Rebuilding Teeth. Worn teeth can be rebuilt by welding as follows:

(1) The shape of the tooth stub is not important, but the welding job is easier if the stub is evenly rounded rather than sharp or worn off more on one side than the other.

(2) Tuck-weld a steel point, shaped from mild steel bar stock, to the tooth stub. Fill in the area between the steel point and the tooth stub with weld, making sure the amount of metal on the surface area of the stub is greater than on the end of the mild steel bearing point.

(3) Apply stringer beads of weld lengthwise on the tooth to establish the original shape of the tooth.

(4) Apply a layer of beads, either lengthwise or crosswise to the tooth end along the side, using a self-hardening weld rod.

Section XIII. CLUTCHES AND BRAKES

192. Hoist Shaft and Front Drum Clutches

a. General. The hoist shaft and front drum clutches have identical and similar parts. The maintenance procedure for both clutches is the same. The clutch carrier and the control wheel are illustrated for identification. Appendix II identifies the parts for each clutch. Separate instructions for adjusting the hoist shaft clutch and the front drum clutch are given in *e* below.

b. Removal and Disassembly.

(1) Remove the screws (3, fig. 106), lockwashers, and the band release bars (5). Remove the jamnuts (4) and screws from the bars.

(2) Loosen the jamnuts (15). Twist the turnbuckle (16) counterclockwise to loosen the clutch band assembly (1).

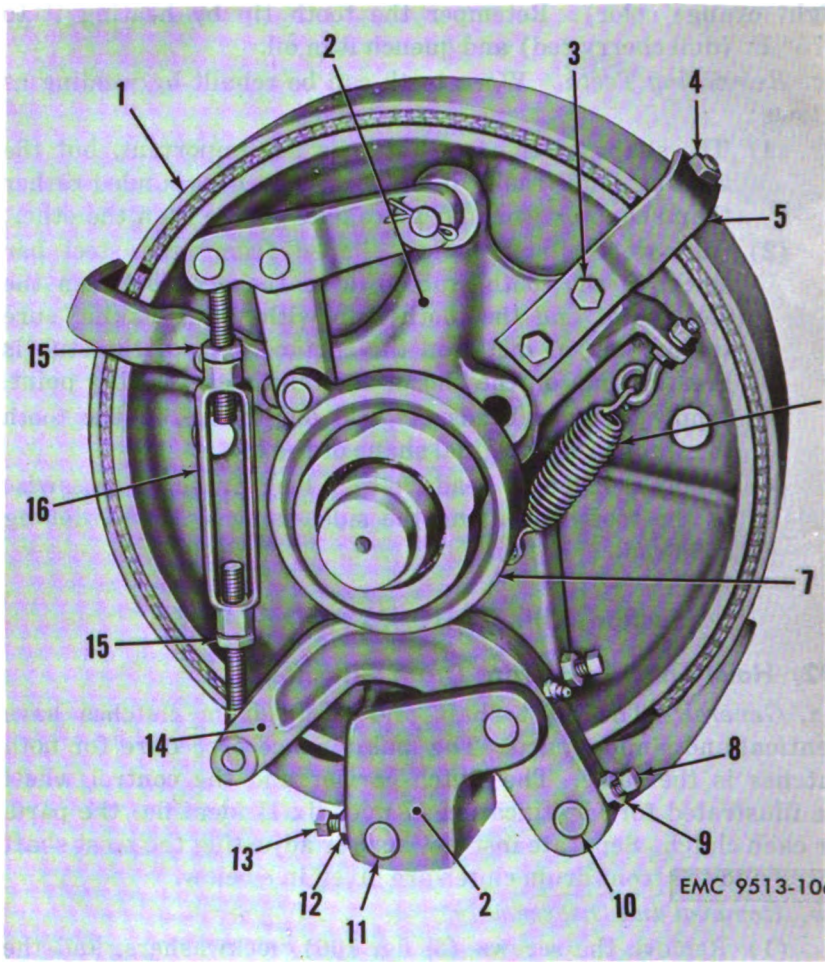
(3) Loosen the jamnut (9). Remove the setscrew (8) and jamnut (9). Using a driftpin and hammer, drive the pin (10) from the band end and clutch crank (14).

(4) Loosen the jamnut (12). Remove the setscrew (13) and jamnut (12). Using a driftpin and hammer, drive the pin (11) from the clutch carrier (2) and band end.

(5) Remove the clutch band assembly (1) from the drum.

(6) Remove the cotter pin (7, fig. 107), pin (13), and clutch adjusting rod end (17) from the clutch bellcrank (10).

(7) Remove the retaining ring (11, fig. 108), pin (12), and



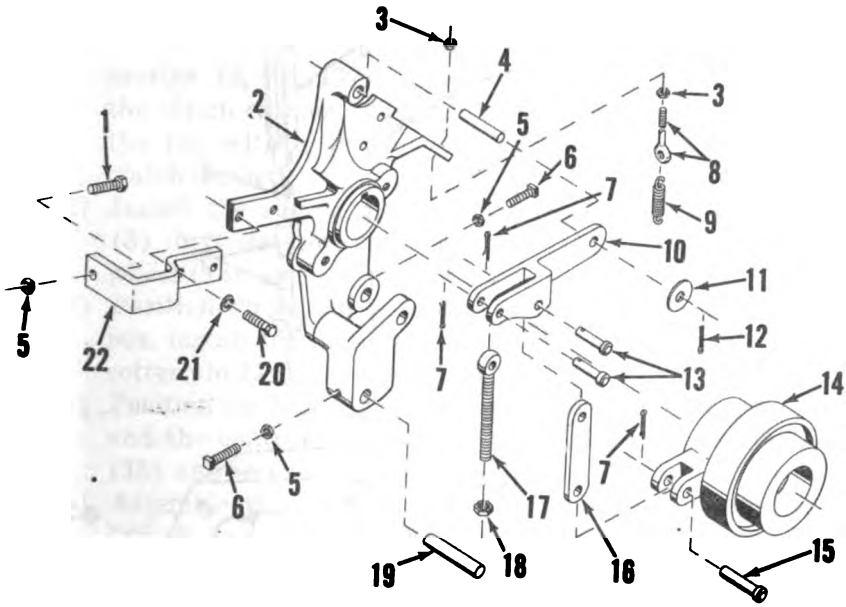
1	Clutch band assembly	9	Jamnut
2	Clutch carrier	10	Pin
3	Screw	11	Pin
4	Jamnut	12	Jamnut
5	Band release bar	13	Setscrew
6	Spring	14	Clutch crank
7	Control wheel	15	Jamnut
8	Setscrew	16	Turnbuckle

Figure 106. Hoist shaft and front drum clutches, installed.

clutch adjusting rod end (5) from the clutch crank (9). Remove the turnbuckle (3).

(8) Remove the cotter pins (7, fig. 107) and pins (13 and 15) from the clutch bellcrank (10) and the control wheel (14). Remove the link (16).

(9) Remove the cotter pin (12), plain washer (11), and the clutch bellcrank (10) from the clutch carrier (2).



EMC 9513-107

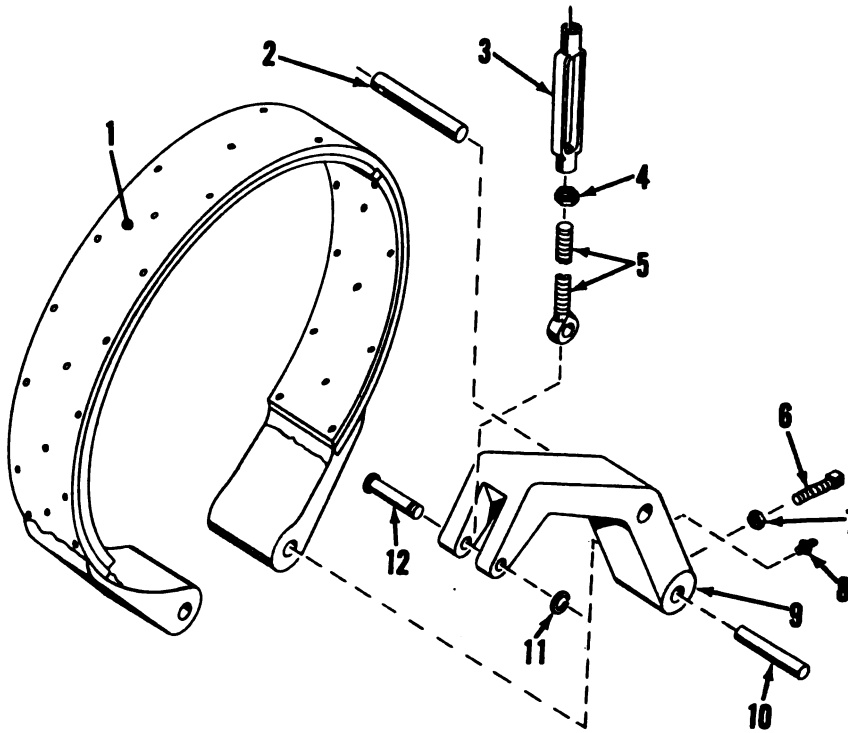
1	Screw, cap, hex hd, ½–13 NC x 1¼ (2 rqr)	11	Washer, plain, steel, ⅞
2	Clutch carrier	12	Pin, cotter, split, 5/32 x 1⅛
3	Nut, regular, hex, ⅝–16 NC (2 rqr)	13	Pin (2 rqr)
4	Pin	14	Control wheel
5	Jamnut, regular, hex, ½–13 NC (4 rqr)	15	Pin
6	Setscrew, sq hd, cup point, ½–13 NC x 1¼ (2 rqr)	16	Link
7	Pin, cotter, split, 5/32 x 1 (3 rqr)	17	Clutch adjusting rod end
8	Eyebolt	18	Jamnut, regular, hex, ⅝–11 NC
9	Tension spring	19	Pin
10	Clutch bellcrank	20	Screw, cap, hex hd, ½–13 NC x 1½ (4 rqr)
		21	Lockwashers, spring, std ⅜ (4 rqr)
		22	Band release bars (2 rqr)

Figure 107. Hoist shaft and front drum clutches bellcrank, link, and release bars, exploded view.

(10) Remove the nuts (3), eyebolt (8), and spring (9) from the clutch carrier (2) and control wheel (14).

(11) Rotate the drum until one of the holes in the drum alines with the pin (19). Loosen the jamnut (7, fig. 108). Remove the setscrew (6) and jamnut (7) from the clutch carrier (2, fig. 107). Using a driftpin and hammer, drive the pin (2, fig. 108) from the clutch carrier (2, fig. 107) and the clutch crank (9, fig. 108). Remove the crank.

c. Inspection and Repair. Soak and wash all metal parts in an approved cleaning solvent and blow them dry with clean com-



EMC 9513-108

1	Clutch band assembly	7	Jamnut, regular, hex, ½–13 NC
2	Pin	8	Fitting, lubrication, ⅛ straight
3	Turnbuckle	9	Clutch crank
4	Jamnut, regular, hex, ⅝–11 NC	10	Pin
5	Clutch adjusting rod end	11	Retaining ring
6	Setscrew, sq hd, cup point, ½–13 NC x 1¼	12	Pin

Figure 108. Hoist shaft and front drum clutches crank and band assembly, exploded view.

pressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the clutch bellcrank, clutch crank link, and band release bars for cracks, breaks, and distortion. Replace any defective parts.

(2) Inspect all pins for wear. Replace worn pins.

(3) Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace defective parts.

(4) Inspect all parts for good condition. Replace parts not in good condition.

(5) Inspect the clutch band lining for wear. If the lining is worn down to the rivet heads, replace the band assembly.

d. Reassembly and Installation.

(1) Position the clutch crank (9, fig. 108) in the clutch carrier (2, fig. 107). Drive the pin (2, fig. 108) into the clutch carrier and through the clutch crank. Secure the pin with a jamnut (7) and setscrew (6) in the clutch carrier.

(2) Install the spring (9, fig. 107), eyebolt (8), and nuts (3) between the clutch carrier (2) and the control wheel (14).

(3) Position the clutch bellcrank (10) on the clutch carrier pin, install the plain washer (11), and secure with the cotter pin (12).

(4) Position the link (16) between the clutch bellcrank (10) and the control wheel (14). Install the pins (13) and (15) and secure with cotter pins (7).

(5) Assemble the clutch adjusting rod ends (17, fig. 107) and (5, fig. 108), jamnuts (18, fig. 107) and (4, fig. 108), and turnbuckle (3). Position the turnbuckle assembly between the clutch crank (9) and clutch bellcrank (10, fig. 107). Install the pins (13 and 12, fig. 108). Secure the pin (13, fig. 107) with a cotter pin (7). Secure the pin (12, fig. 108) with a retaining ring (11).

(6) Place the clutch band assembly (1, fig. 106) on the drum. Position a clutch band end in the clutch carrier (2). Drive in the pin (11) and secure with the jamnut (12) and setscrew (13).

(7) Position the opposite clutch band end against the clutch crank (14). Drive the pin (10) in the clutch crank (14) and band end and secure with the jamnut (9) and setscrew (8).

(8) Install the screws and jamnuts (4) in the band release bars (5). Position the release bars over the clutch band assembly (1) and on the clutch carrier (2). Secure the bars with lockwashers and screws (3).

e. Adjustment (fig. 106).

(1) *Hoist shaft clutch band.* Adjust the band by loosening the jamnuts (15) and turning the turnbuckle (16). To obtain the correct adjustment, engage the clutch with the hand lever while the revolving frame machinery is stationary. Rotate the machinery slowly, using the engine clutch hand lever, until the stop on the control wheel (7) is about one-half inch away from the stop on the clutch carrier (2). When the stops are in this position, turn the turnbuckle (16) clockwise to tighten the band enough so it will pull the load. Tighten the jamnuts

(15) after the proper adjustment is obtained. If the band drags on the drum when released, adjust the jamnuts (4) and screws so they will take the weight of the band.

(2) *Front drum clutch band.*

(*a*) For dragline, shovel, and back hoe operation, the clutch band is adjusted the same as the hoist shaft clutch band ((1) above).

(*b*) For clamshell operation, the band must be adjusted for the clamshell bucket holding line. Adjust the band by loosening the jamnuts (15) and turning the turnbuckle (16). To obtain the correct adjustment, put the hand lever in vertical position, rotate the revolving frame machinery slowly, and turn the turnbuckle (16) clockwise until the band will turn the drum just enough to keep the holding line taut at all times. Do not adjust the band too tight as this will cause the holding line to take the load, thereby dumping the contents of the bucket. Tighten the jamnuts (15) after the proper adjustment is obtained.

193. Front Drum Reverse Crowd Clutch

a. General. The front drum reverse crowd clutch is used in shovel operation only. The clutch carrier and control wheel are illustrated for identification.

b. Removal and Disassembly.

(1) Remove a cotter pin and the pin (14, fig. 109) from the clutch crank (12) and the link (13).

(2) Rotate the drum until one of the holes in the drum alines with the pin (9). Loosen the jamnut (10). Remove the setscrew (11) and jamnut. Using a driftpin and hammer, drive the pin (9) from the clutch crank (12).

(3) Rotate the drum until one of the holes in the drum alines with the pin (8). Loosen the jamnut (7). Remove the setscrew (6) and the jamnut. Using a driftpin and hammer, drive the pin (8) from the clutch carrier (3).

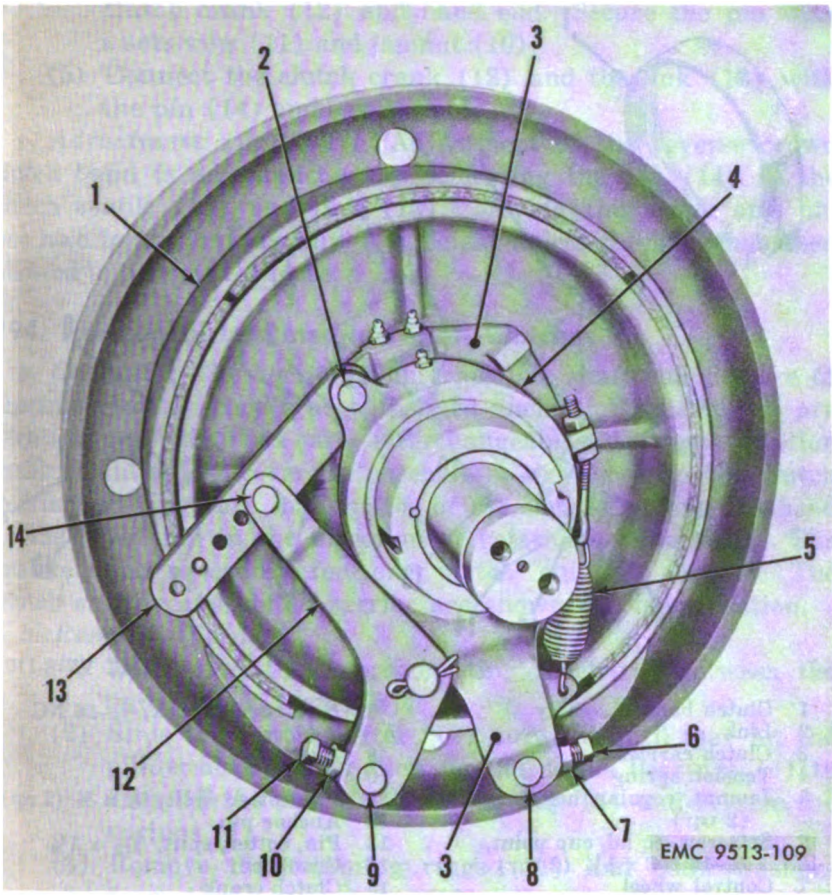
(4) Remove the clutch band assembly (1) from the drum.

(5) Remove the cotter pin (11, fig. 110), pin (10), and the link (2) from the control wheel (7).

(6) Remove the cotter pin (13). Remove the clutch crank (15) from the clutch carrier (3).

(7) Remove the nuts (8), eyebolt (9), and the spring (4) from the control wheel (7) and clutch carrier (3).

c. Inspection and Repair. Soak and wash all metal parts in



1	Clutch band assembly	8	Pin
2	Pin	9	Pin
3	Clutch carrier	10	Jamnut
4	Control wheel	11	Setscrew
5	Spring	12	Clutch crank
6	Setscrew	13	Link
7	Jamnut	14	Pin

Figure 109. Reverse crowd clutch, installed.

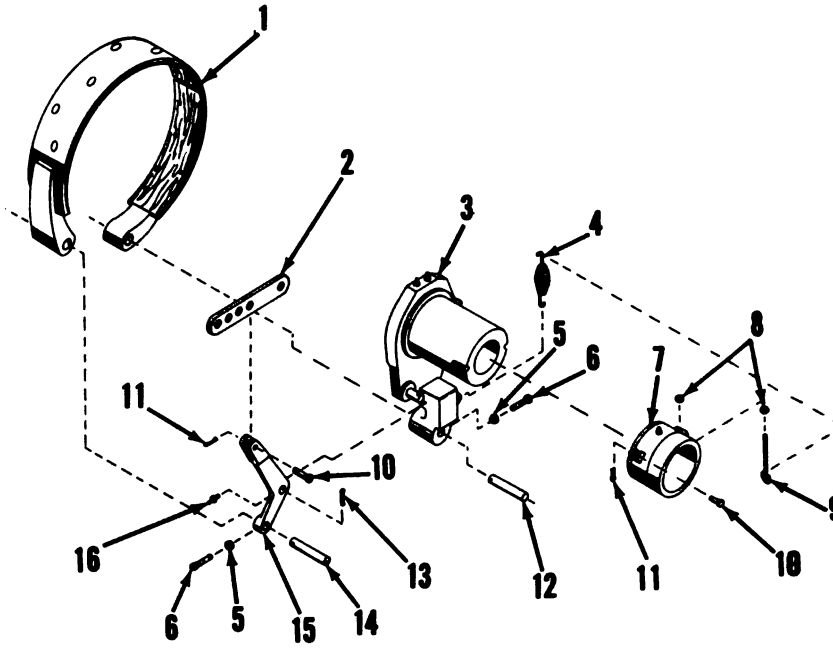
an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the clutch crank and the link for cracks, breaks, and distortion. Replace a clutch crank or link if defective.

(2) Inspect all pins for wear. Replace worn pins.

(3) Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace parts if defective.

(4) Inspect the clutch band lining for wear. If the lining



1	Clutch band assembly	8	Nut, regular, hex, ⅜–16 NC (2 rqr)
2	Link	9	Eyebolt
3	Clutch carrier	10	Pin
4	Tension spring	11	Pin, cotter, split, ⅛ x ⅞ (2 rqr)
5	Jamnut, regular, hex, ½–13 NC (2 rqr)	12	Anchor pin
6	Setscrew, sq hd, cup point, ½–13 NC x 1¼ (2 rqr)	13	Pin, cotter, split, 5/32 x 1¼
7	Control wheel	14	Crank pin
		15	Clutch crank
		16	Fitting, lubrication, ⅛ straight

Figure 110. Reverse crowd clutch, exploded view.

is worn down to the rivet heads, replace the band assembly.

(5) Inspect all parts for good condition. Replace parts not in good condition.

d. Reassembly and Installation.

(1) Install the spring (4, fig. 110), eyebolt (9), and nuts (8) on the control wheel (7) and clutch carrier (3).

(2) Position the clutch crank (15) on the pin of the clutch carrier (3) and secure with the cotter pin (13).

(3) Position the link (2) on the control wheel (7). Install the pin (10) and secure with a cotter pin (11).

(4) Position the clutch band assembly (1, fig. 109) in the drum. Drive the pin (8) in the clutch carrier (3) and band end. Secure the pin with a setscrew (6) and jamnut (7) in the clutch carrier. Drive the pin (9) in the

clutch crank (12) and band end. Secure the pin with a setscrew (11) and jamnut (10).

(5) Connect the clutch crank (12) and the link (13) with the pin (14) and a cotter pin.

e. Adjustment (fig. 109). Adjustment of the reverse crowd clutch band is accomplished by relocating the pin (14) in the clutch crank (12) and link (13). Moving the crank and pin one hole in the link usually is sufficient unless the band has been allowed to become too loose.

194. Horizontal Intermediate Shaft Clutches

a. General. The horizontal intermediate shaft clutches are of the internal two-shoe type with fixed anchor. Both clutches are identical and all parts are interchangeable. Extreme caution must be taken, however, in assembling the shoes on the clutch carrier, making sure that the toe of the shoe is leading or ahead of the pivot pin in the direction of rotation of the shaft. The maintenance procedure for one clutch only is covered. The clutch shifter and clutch carrier are shown for identification.

b. Removal (fig. 111).

(1) Disconnect the interconnecting reach rod between the two clutches (par. 208).

(2) Slide the clutch shifters (7) outward until they hit the pillow blocks, thus allowing the needle bearings (4) to drop off the end of the shifter key (5) and release the springs (1).

(3) Remove the retaining rings (11) and plain washers from the carrier pins (10). Remove the clutch shoe assemblies (6).

c. Disassembly (fig. 112).

(1) Remove the retaining rings (5). Remove the lever arm pins (4) and separate the clutch shoe assemblies (1) and lever arms (10).

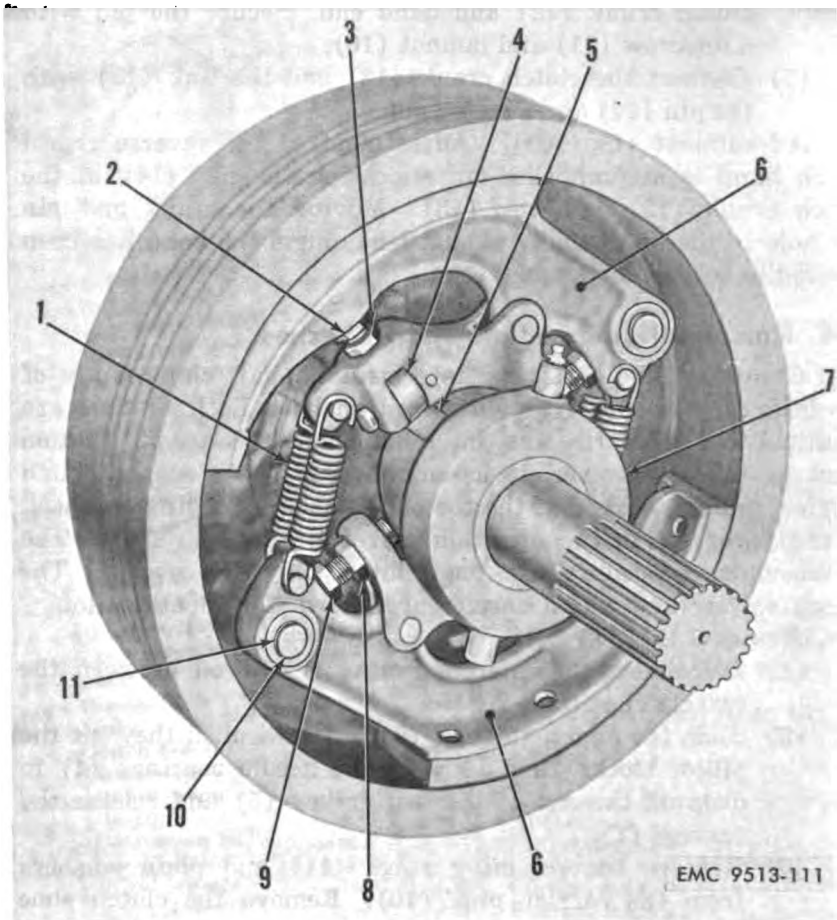
(2) Remove the setscrews (18), roller pins (19), and needle bearings (11) from the lever arms (10).

(3) Remove the adjusting bolts (8) and jamnuts (9) from the clutch shoes and lever arms.

(4) Remove the screws (14), lockwashers (15), and shifter keys (16) from the clutch shifter assemblies (17).

(5) Using an arbor press, press the bushings (2) from the clutch shoes (1).

d. Inspection and Repair. Soak and wash all metal parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

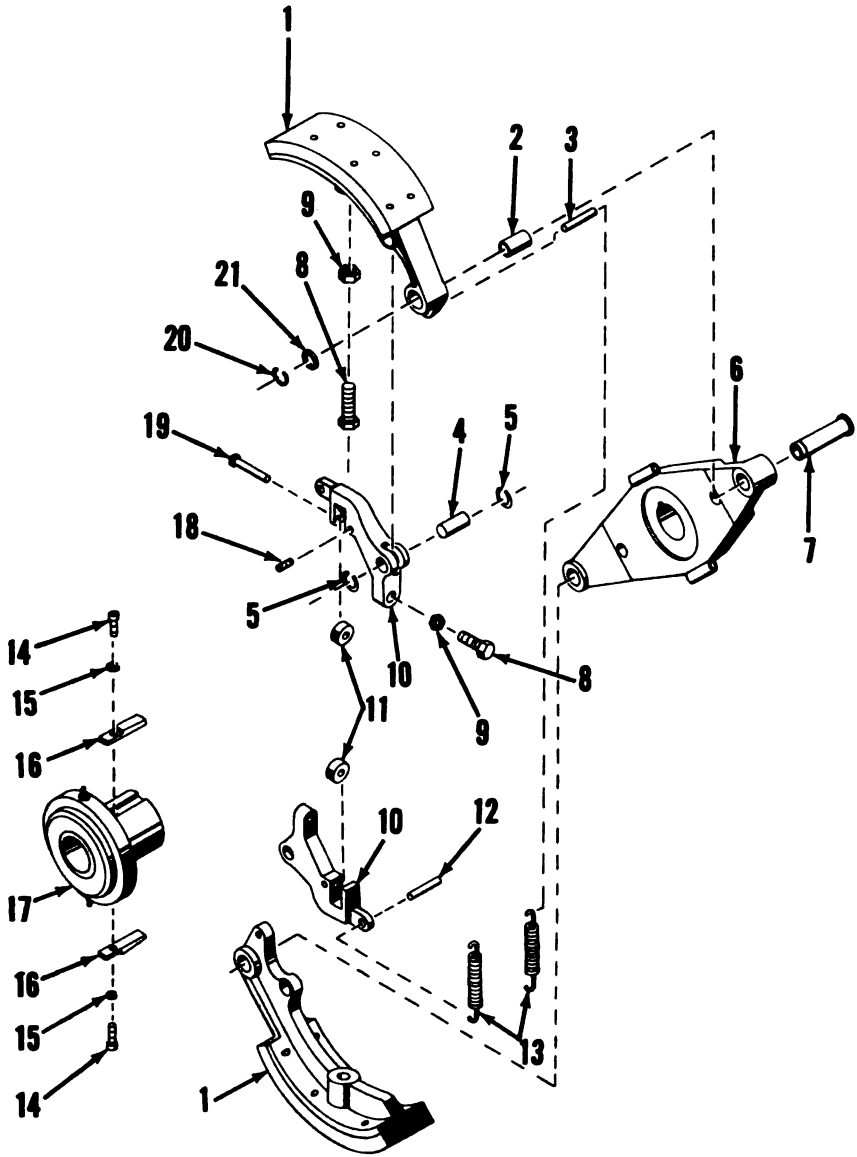


1 Spring
2 Jamnut
3 Adjusting bolt
4 Needle bearing
5 Shifter key
6 Clutch shoe assembly
7 Clutch shifter
8 Jamnut
9 Adjusting bolt
10 Carrier pin
11 Retaining ring

Figure 111. Horizontal intermediate shaft clutch, installed.

1 Clutch shoe assembly (4 rqr)
2 Bushing (4 rqr)
3 Anchor pin (4 rqr)
4 Lever arm pin (4 rqr)
5 Retaining ring (8 rqr)
6 Clutch carrier (2 rqr)
7 Carrier pin (4 rqr)
8 Adjusting bolt (8 rqr)
9 Jamnut, regular, hex, ¾–16 NF (8 rqr)
10 Lever arm (4 rqr)
11 Needle bearing (4 rqr)
12 Anchor pin (4 rqr)
13 Spring (8 rqr)
14 Screw, cap, hex socket, ⅜–24 NF x ¾ (4 rqr)
15 Lockwasher, spring, std, ⅜ (4 rqr)
16 Shifter key (4 rqr)
17 Clutch shifter assembly (2 rqr)
18 Setscrew, Unbrako, ⅜–24 NF x ½ (4 rqr)
19 Roller pin (4 rqr)
20 Retaining ring (4 rqr)
21 Washer, plain, steel, ⅞ (4 rqr)

(1) Inspect the clutch shoes and lever arms for cracks, breaks, and distortion. Replace a defective clutch shoe or lever arm.
(2) Inspect all pins for wear. Replace defective pins.
(3) Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace defective parts.



EMC 9513-112

Figure 112. Horizontal intermediate shaft clutches, exploded view.

(4) Inspect the clutch shoe lining for wear. If the lining is worn down to the rivet heads, replace the clutch shoe assembly.

(5) Inspect the needle bearings thoroughly, checking particularly for out-of-round condition caused by corrosion or wear. Check for overheating, which is evidenced by discoloration of the rollers. Examine the outer race for scoring or galling. Replace a bearing that is worn, scored, or galled, or has been overheated.

(6) Inspect all parts for good condition. Replace parts not in good condition.

e. Reassembly (fig. 112).

(1) Position the shifter keys (16) in the clutch shifter assemblies (17) and secure with lockwashers (15) and screws (14).

(2) Using an arbor press, press the bushing (2) in the clutch shoes (1).

(3) Install the jamnuts (9) and adjusting bolts (8) in the clutch shoes (1) and lever arms (10).

(4) Position the needle bearings (11) in the lever arms (10) and install the roller pins (19). Secure the roller pins in the lever arms with setscrews (18).

(5) Position the lever arms (10) in the clutch shoes (1). Install the lever arm pins (4) in the shoes and arms and secure with retaining rings (5).

f. Installation (fig. 111).

(1) Position the clutch shoe assembly (6) on the carrier pins (10), making sure that the toe of the shoe is leading or ahead of the pin in the direction of rotation of the shaft. Install plain washers on the carrier pins (10) and secure with retaining rings (11).

(2) Install the springs (1) between the lever arm of one clutch shoe assembly and the clutch shoe of the second assembly.

(3) Using a bar, pry the clutch shifter (7) back into position against the pull of the springs (1).

(4) Connect and adjust the interconnecting reach rod between the two clutches (par. 208).

(5) Adjust the clutch shoes (*g* below).

g. Adjustment (fig. 111).

(1) Loosen the jamnuts (8). Back off the adjusting bolts (9) from contact with the clutch shoe.

(2) Loosen the jamnuts (2). Adjust the clutch shoes in or out by turning the adjusting bolts (3) in the proper direction. Each shoe should be adjusted so that a 0.006-

inch clearance between any part of the lining and drum is obtained when adjusted cold, making sure that there is no lining drag on the drum, when the clutch is rotating freely. If adjustment is made after the drum has expanded due to heat, greater clearance between the lining and drum must be allowed so as to maintain the 0.006-inch minimum clearance when cold. When adjustment is correct, tighten the jamnuts (2).

(3) Tighten the adjusting bolts (9) to tight contact with the clutch shoe. Tighten the jamnuts (8).

195. Engine Clutches

a. Revolving Frame (fig. 113).

(1) *General.* The revolving frame engine clutch is of the twin-disk type. A single driving plate is engaged by the floating plate (6) and the clutch plate. The clutch plate is keyed to the clutch shaft. When the clutch is engaged, a sliding sleeve (2) is pushed toward the clutch plate. Clutch lever links (3), between the sliding sleeve (2) and the floating plate (6), force the floating plate toward the driving plate and clutch plate. When all three plates are engaged, engine power is delivered to the clutch shaft.

(2) *Adjustment.*

(*a*) Remove the screws, lockwashers, and inspection plate from the clutch housing.

(*b*) Turn the clutch unit until the adjusting lockpin (4) is accessible through the handhole.

(*c*) Tighten the clutch by pulling out the adjusting lockpin (4) and turning the adjusting yoke (5) clockwise.

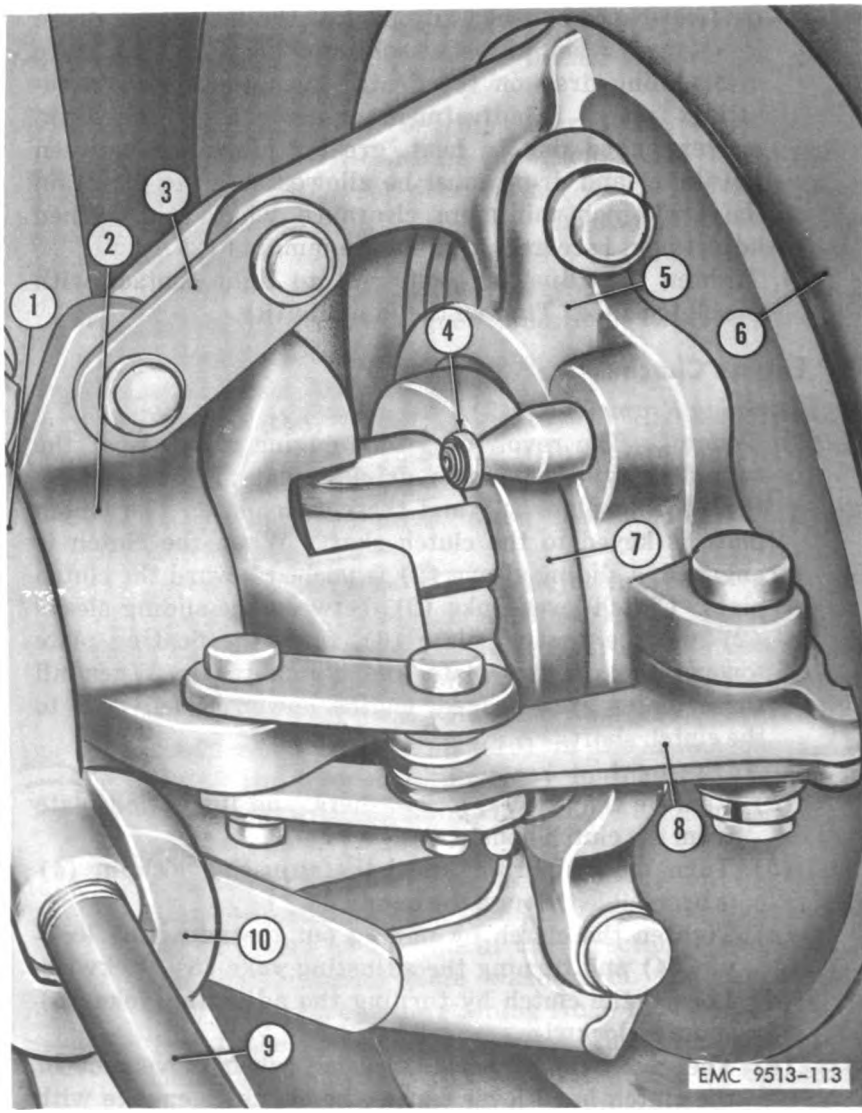
(*d*) Loosen the clutch by turning the adjusting yoke (5) counterclockwise.

(*e*) The clutch is properly adjusted when movement of the clutch hand lever causes the clutch to engage with a distinct snap. When proper adjustment has been made, lock the adjusting lockpin (4) into the nearest hole.

(*f*) Position the inspection plate on the clutch housing and secure with lockwashers and screws.

b. Carrier.

(1) *General.* The carrier engine clutch is of the adjustable, dry-disk, push type construction. Adjustment, to compensate for facing wear, is accomplished by removing shims. The clutch flywheel ring is attached to the engine flywheel by means of driving lugs of the pressure



1	Cone collar	6	Floating plate
2	Sliding sleeve	7	Back plate hub
3	Clutch lever link	8	Finger lever
4	Adjusting lockpin	9	Lubrication pipe
5	Adjusting yoke	10	Throwout yoke

Figure 113. Revolving frame engine clutch adjustment.

plate fitting into mating slots in the flywheel ring. To disengage the clutch, the release sleeve is pushed towards the engine flywheel by the clutch release bearing compressing the pressure spring, thus relieving the twenty pressure levers of spring pressure. The pressure

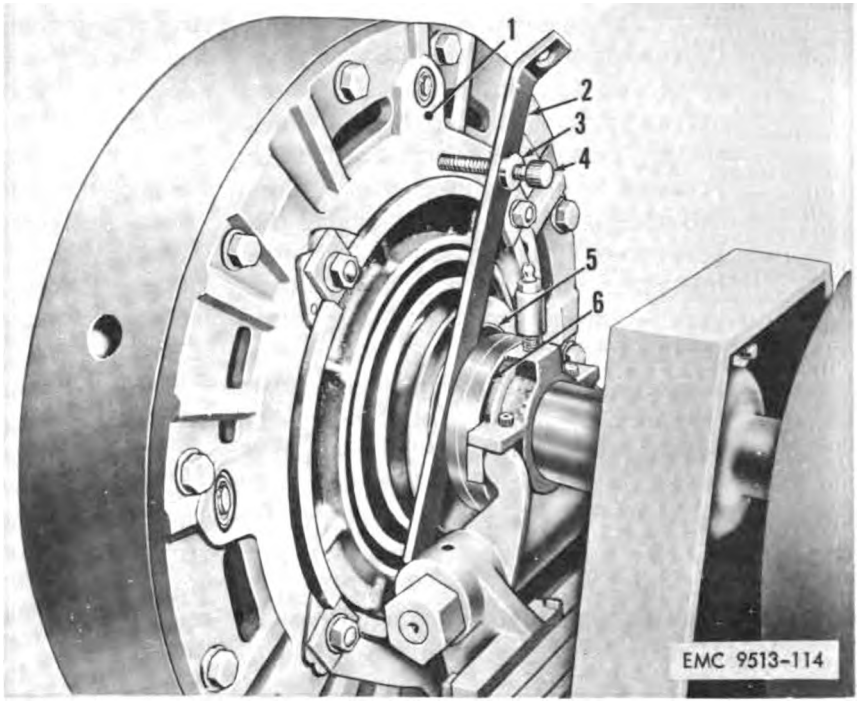
plate is retracted from contact with the driven disk assembly by means of pressure plate retractor springs, thus accomplishing complete clutch release. During engagement, the clutch release sleeve is allowed to move out away from the engine flywheel at which time the spring pressure is transmitted through the twenty pressure levers which multiply the spring pressure and deliver it to the pressure plate. These pressure levers bear against the continuous fulcrums of both the adjusting plate and the pressure plate which provides for parallel movement of the pressure plate toward the engine flywheel.

(2) *Adjustment.* Adjust the clutch when three-quarter inch free movement of the clutch pedal, with clutch engaged, can no longer be felt. When the pedal pad strikes the floor plate, readjust the clutch control (par. 210*a*(4)). Access to the clutch is gained by removing the top and bottom cover plates from the clutch housing.

(*a*) With the clutch in engaged position, measure the distance from the machined surface of the clutch cover (1, fig. 114) to the face of the clutch release sleeve (5), against which the clutch release bearing (6) acts. This can be done by means of a straightedge (2) which has been tapped for a thumb screw (4) and nut (3), and straightedge and scale, or with two scales. Hold the straightedge in place by pushing the clutch release bearing (6) into contact with the straightedge. This dimension should be one and three-sixteenths inch. Obtain this dimension by adding or removing adjusting shims (6, fig. 115) as required. Removing one shim from under each adjusting strap (7) reduces this dimension approximately three thirty-seconds inch. Likewise, adding one shim increases this dimension approximately three thirty-seconds inch.

(*b*) Block the clutch pedal in the released position. This prevents bending of the adjusting straps and facilitates loosening of the four adjusting nuts (8). Back off the adjusting nuts five full turns.

(*c*) Engage the clutch by removing the blocking. This will permit the adjusting plate (15) to move out of contact with the adjusting shims (6). Remove one shim from under each adjusting strap (7), using pliers, or inserting a cotter pin puller in the small



1 Clutch cover
2 Straightedge
3 Nut
4 Thumbscrew
5 Clutch release sleeve
6 Clutch release bearing

Figure 114. Carrier engine clutch adjustment check.

hole. Be sure no portion of the shim is torn off and remains under the corner of the adjusting strap; also that the same number of shims are removed from under each strap. Count the shims to be sure an equal number of shims remain under each strap.

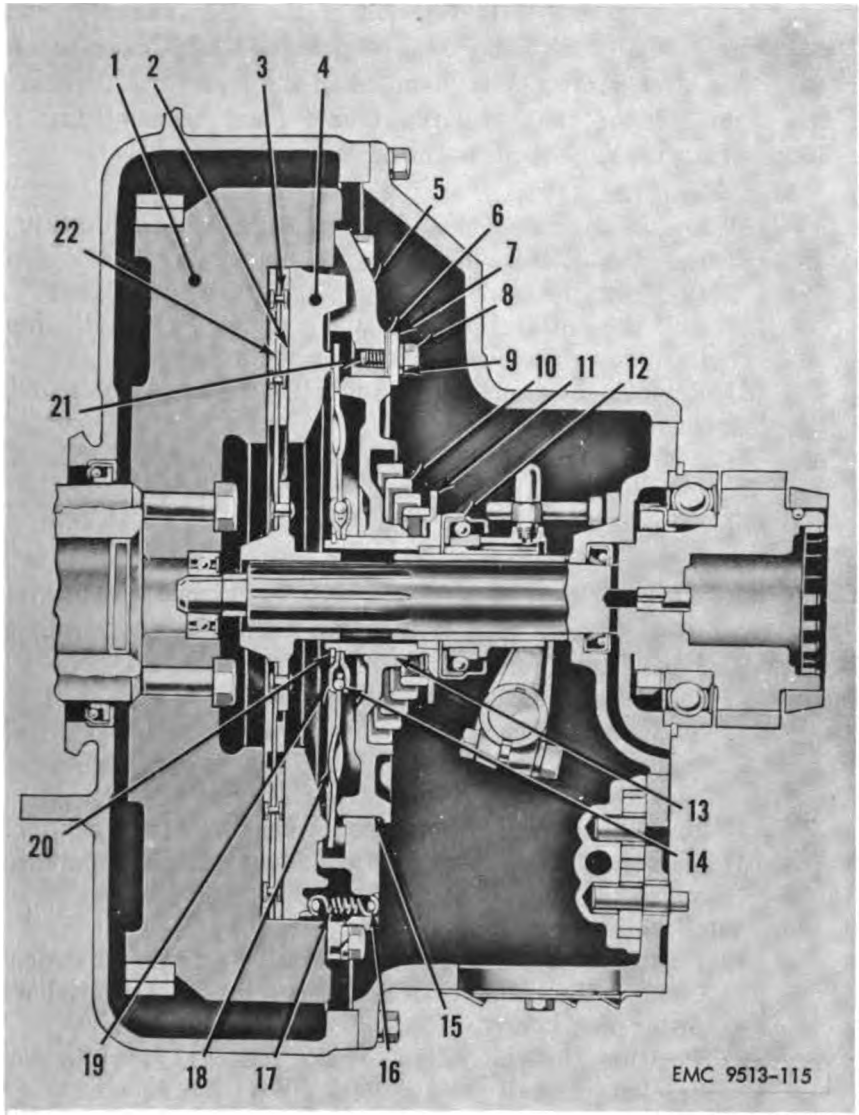
(*d*) Release the clutch by blocking the pedal in the released position. Tighten all adjusting nuts.

(*e*) Remove the blocking and recheck the dimension in (*a*) above.

(*f*) Check the clearance between the clutch release sleeve (13) and the clutch release bearing (12). If the clearance is not one-eighth inch, adjust the clutch control (par. 210*b*(4)) to obtain this clearance. This one-eighth inch clearance normally results in one and one-half inches of clutch pedal free travel.

196. Hoist Drum Brake

a. General (fig. 116). The live end of the hoist drum brake



1	Engine flywheel	12	Clutch release bearing
2	Driven disk facing	13	Sleeve
3	Facing rivets	14	Lever locking balls
4	Pressure plate	15	Adjusting plate
5	Clutch flywheel ring	16	Spring retainer pin
6	Adjusting shims	17	Retractor spring
7	Adjusting strap	18	Pressure levers
8	Flywheel ring stud nut	19	Fulcrum rings
9	Lockwasher	20	Snap ring
10	Pressure spring	21	Flywheel ring stud
11	Spring equalizer ring	22	Driven disk assembly

Figure 115. Sectional view of typical carrier engine clutch.

band is pin-connected to the eyebolt of the sleeve nut (3). The dead end of the brake band is pin-connected to the lever bracket (4). The lever shaft (1) is installed in the lever bracket and in the right side of the revolving frame base, transmitting the action of the brake controls to the brake band.

b. Removal (fig. 117).

(1) Loosen the nuts (11 and 13) and the sleeve nut (12).

(2) Pull the cotter pins (2) and remove the headless pin (9) from the brake hand (4) and the rod end (14).

(3) Pull the cotter pins (3) and remove the headless pin (15) from the lever bracket and brake band (1).

(4) Remove the jamnut (5), nut (6), eyebolt (7), and extension spring (8) from the A-frame and brake band.

(5) Separate the brake bands (1 and 4) by pulling the cotter pins (2) and removing the headless pins (16).

(6) Lift the brake bands from the drum.

c. Inspection and Repair. Soak and wash all metal parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the brake bands for cracks, breaks, and distortion. Replace defective brake band.

(2) Inspect the brake band lining for wear. Replace the brake band if the lining is worn to the rivet heads.

(3) Inspect all pins for wear. Replace defective pins.

(4) Inspect all parts for good condition. Replace parts not in good condition.

d. Installation (fig. 117).

(1) Position the brake bands (1 and 4) on the hoist drum. Connect the bands with headless pins (16) secured with cotter pins (2).

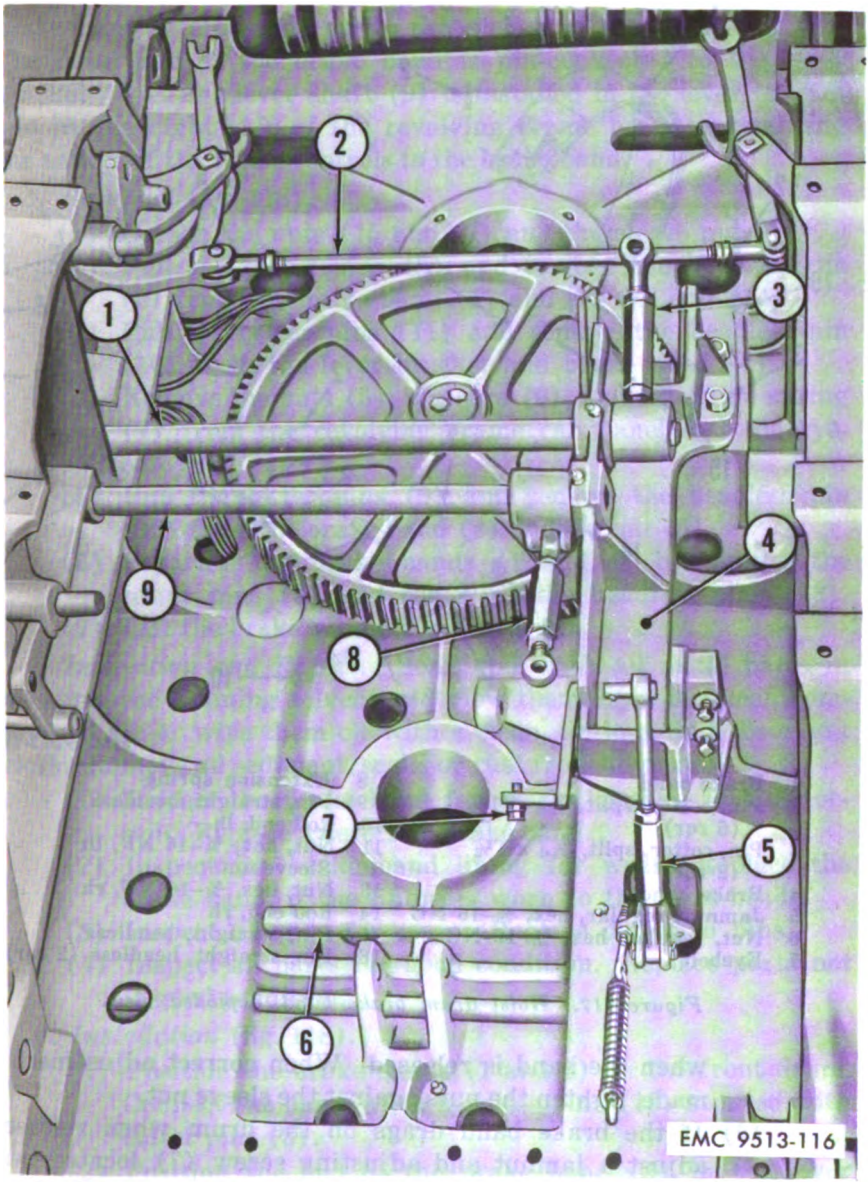
(2) Position the end of the brake band (1) in the lever bracket. Install the headless pin (15) and secure with cotter pins (3).

(3) Position the rod end (14) in the end of the brake band (4). Install the headless pin (9) and secure with cotter pins (2).

(4) Hook the extension spring (8) in the brake band (4) and eyebolt (7). Attach the eyebolt to the A-frame with a nut (6) and jamnut (5).

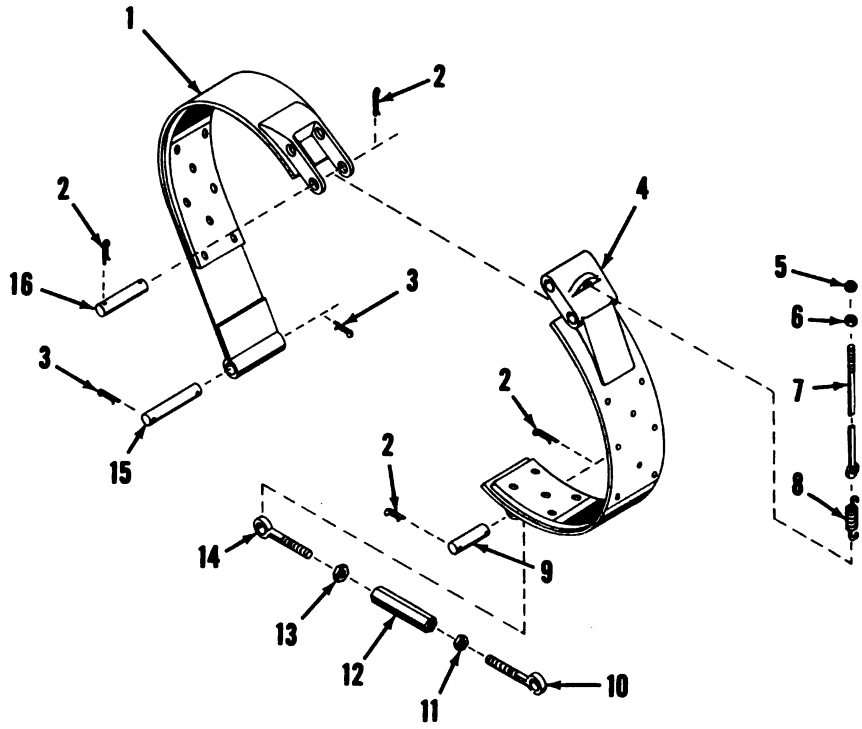
e. Adjustment.

(1) Loosen the nuts from the sleeve nut (3, fig. 116). To take up the brake band, turn the sleeve nut clockwise. Adjust the band so the hoist drum will turn freely



1 Hoist drum brake lever shaft
2 Horizontal intermediate shaft clutch reach rod
3 Sleeve nut
4 Lever bracket
5 Sleeve nut
6 Reverse crowd clutch lever shift
7 Adjusting screw
8 Sleeve nut
9 Front drum brake lever shaft

Figure 116. Lever bracket, lever shafts, and band adjusting sleeve nuts.



EMC 9513-117

1	Brake band	8	Extension spring
2	Pin, cotter, split, 5/32 x 1 1/8 (6 rqr)	9	Pin, straight, headless
3	Pin, cotter, split, 3/16 x 1 1/2 (2 rqr)	10	Rod end, lh
4	Brake band	11	Nut, hex, 3/4–16 NF, lh
5	Jamnut, regular, hex, 3/8–16 NC	12	Sleeve nut
6	Nut, regular, hex, 3/8–16 NC	13	Nut, hex, 3/4–16 NF, rh
7	Eyebolt	14	Rod end, rh
		15	Pin, straight, headless
		16	Pin, straight, headless (2 rqr)

Figure 117. Hoist drum brake band, exploded view.

when the band is released. When correct adjustment is made, tighten the nuts against the sleeve nut.

(2) If the brake band drags on the drum when released, adjust a jamnut and adjusting screw (7) located near the dead end of the brake band on the rear of the lever bracket (4) so the screw will take the weight of the band.

(3) Adjust the length of the eyebolt (7, fig. 117) and extension spring (8) to keep the brake band from dragging on the drum.

197. Front Drum Brake

a. General (fig. 116). The live end of the front drum

brake band is pin-connected to the eyebolt of the sleeve nut (8). The dead end of the brake band is pin-connected to the lever bracket (4). The lever shaft (9) is installed in the lever bracket and in the right side of the revolving frame base, transmitting the action of the brake controls to the brake band.

b. Removal (fig. 118).

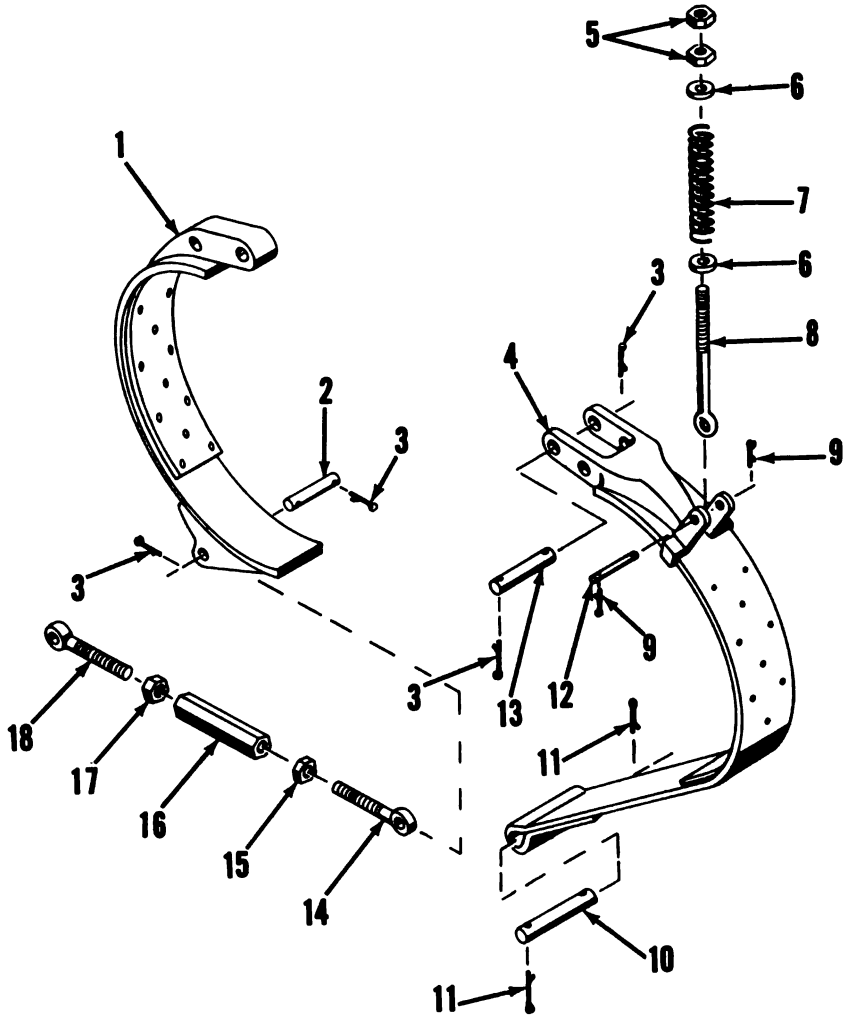
(1) Loosen the nuts (15 and 17) and the sleeve nut (16).
(2) Pull the cotter pins (3) and remove the headless pin (2) from the brake band (1) and the rod end (14).
(3) Pull the cotter pins (11) and remove the headless pin (10) from the lever bracket and brake band (4).
(4) Remove the nuts (5), washers (6), and extension spring (7) from the revolving frame cab panel and the eyebolt (8).
(5) Pull the cotter pins (9) and remove the headless pin (12) from the brake band (4) and eyebolt (8).
(6) Separate the brake bands (1 and 4) by pulling the cotter pins (3) and removing the headless pins (13).
(7) Lift the brake bands from the drum.

c. Inspection and Repair. Soak and wash all metal parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the brake band for cracks, breaks, and distortion. Replace a defective brake band.
(2) Inspect the brake band lining for wear. Replace the brake band, if the lining is worn to the rivet heads.
(3) Inspect all pins for wear. Replace defective pins.
(4) Inspect all parts for good condition. Replace parts not in good condition.

d. Installation (fig. 118).

(1) Position the brake bands (1 and 4) on the front drum. Connect the bands with headless pins (13) secured with cotter pins (3).
(2) Position the end of the brake band (4) in the lever bracket. Install the headless pin (10) and secure with cotter pins (11).
(3) Position the rod end (14) in the end of the brake band (1). Install the headless pin (2) and secure with cotter pins (3).
(4) Position the eyebolt (8) in the brake band (4). Install the headless pin (12) and secure with cotter pins (9).
(5) Install a washer (6), and the extension spring (7) on



1 Brake band
2 Pin, straight, headless
3 Pin, cotter, split, 5/32 x 1 1/8 (6 rqr)
4 Brake band
5 Nut, regular, hex, 3/8–16 NC (2 rqr)
6 Washer (2 rqr)
7 Extension spring
8 Eyebolt
9 Pin, cotter, split, 3/32 x 5/8 (2 rqr)
10 Pin, straight, headless
11 Pin, cotter, split, 3/16 x 1 1/2 (2 rqr)
12 Pin, straight, headless
13 Pin, sraight, headless (2 rqr)
14 Rod end, lh
15 Nut, hex, 3/4–16 NF, lh
16 Sleeve nut
17 Nut, hex, 3/4–16 NF, rh
18 Rod end, rh

Figure 118. Front drum brake band, exploded view.

the eyebolt (8). Secure the eyebolt to the revolving frame cab panel with a washer (6) and the nuts (5).

e. Adjustment.

(1) Loosen the nuts from the sleeve nut (8, fig. 116). To take up the brake band, turn the sleeve nut clockwise. Adjust the band so the front drum will turn freely when the band is released. When correct adjustment is made, tighten the nuts against the sleeve nut.

(2) If the brake band drags on the drum when released, adjust a jamnut and adjusting screw (7) so the screw will take the weight of the band.

(3) Adjust the length of the eyebolt (8, fig. 118) to keep the brake band from dragging on the drum.

198. Independent Boom Hoist Brake

a. General (fig. 119). The independent boom hoist brake is linked with the independent boom hoist clutch control. When the independent boom hoist clutch hand lever is in the neutral (vertical) position, the brake is set on the brake wheel of the independent boom hoist worm shaft assembly. When the hand lever is in either forward or rear operating position, the brake is released. The brake band assembly (4) is located in the revolving frame tailswing. The brake band is accessible from under the tailswing for adjustment. Removal of the revolving frame battery box is necessary for removal of the brake band.

b. Removal (fig. 120).

(1) Remove the revolving frame battery box (par. 141*d*).

(2) Loosen the nut (8) and sleeve nut (9). Pull the cotter pin (5) and remove the pin (6).

(3) Pull the cotter pins (2) and remove the pin (4) from the tailswing bracket and brake band assembly (3).

(4) Remove the nuts (1), eyebolt (30), and spring (29) from the brake band assembly and tailswing bracket. Remove the brake band from the brake wheel.

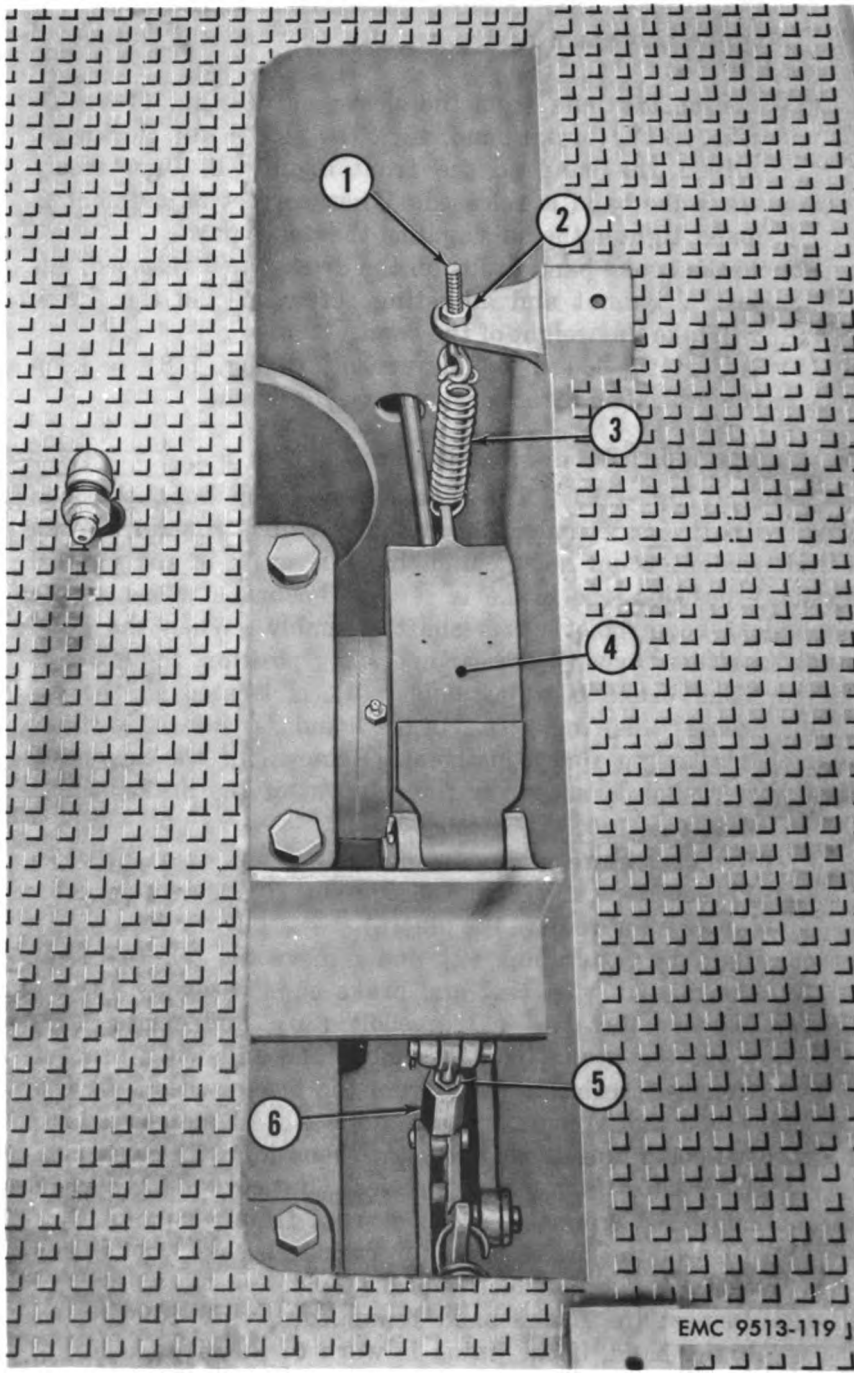
c. Inspection and Repair. Soak and wash all metal parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the brake band for cracks, breaks, and distortion. Replace a defective brake band.

(2) Inspect the brake band lining for wear. Replace the brake band, if the lining is worn to the rivet heads.

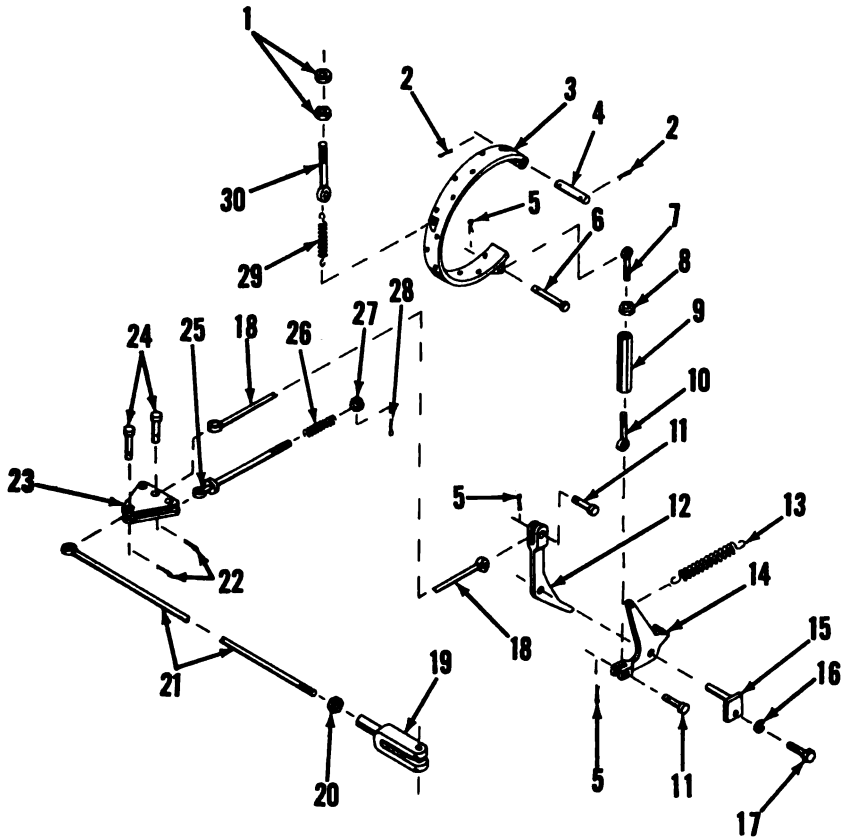
(3) Inspect all pins for wear. Replace defective pins.

(4) Inspect all parts for good condition. Replace parts not in good condition.



1	**Eyebolt**	4	**Brake band assembly**
2	**Nut**	5	**Nut**
3	**Spring**	6	**Sleeve nut**

Figure 119. Independent boom hoist brake, installed.



1	Nut, regular, hex, ⅝–16 NC (2 rqr)	16	Lockwasher, spring, std, ⅝
2	Pin, cotter, split, 3/32 x 1⅛ (2 rqr)	17	Screw, cap, hex hd, ⅝–16 NC x 1
3	Brake band assembly	18	Brake reach rod
4	Pin	19	Adjusting yoke end
5	Pin, cotter, split, ⅛ x ⅞ (3 rqr)	20	Nut, regular, hex, ⅝–18 NF
6	Pin	21	Reach rod
7	Adjustable rod	22	Pin, cotter, split, 3/32 x 1 (3 rqr)
8	Nut, regular, hex, ½–20 NF	23	Bellcrank
9	Sleeve nut	24	Pin (3 rqr)
10	Adjustable rod	25	Pivot rod (2 rqr)
11	Pin (2 rqr)	26	Compression spring (2 rqr)
12	Bellcrank	27	Nut, castle, ⅝–18 NF (2 rqr)
13	Tension spring	28	Pin, cotter, split, ⅛ x 1¼ (2 rqr)
14	Bellcrank	29	Tension spring
15	Bellcrank pin	30	Eyebolt

Figure 120. Independent boom hoist brake and control, exploded view.

d. Installation (fig. 120).

(1) Position the brake band (3) on the brake wheel.

(2) Install the spring (29), eyebolt (30), and nuts (1) on the brake band and tailswing bracket.

(3) Install the pin (4) in the tailswing bracket and end of the brake band. Secure the pin with cotter pins (2).

(4) Position the adjustable rod (7) in the brake band. Install the pin (6) and secure with a cotter pin (5).

e. Adjustment (fig. 119). Adjust the brake band (4) only when the independent boom hoist clutch hand lever is in the neutral (vertical) position.

(1) Loosen the nut (5). Turn the sleeve nut (6) clockwise to tighten the band on the brake wheel. Tighten the nut (5).

(2) If the brake band drags on the brake wheel when released, adjust the length of the eyebolt (1) and spring (3) to keep the band off the wheel.

199. Carrier Emergency Brake

a. General (fig. 121).

(1) The emergency brake is a four-shoe disk type, operating on a steel disk assembly (17) mounted on the flange yoke (16) of the drive shaft. Movement of the hand lever is transmitted through a reach rod to the shaft operating lever (1) on the cross shaft (5). The ends of the cross shaft are mounted in cross-shaft brackets (2), which allow the shaft to rotate. Shaft levers (3), keyed on the cross shaft, transfer this movement to the pull rods (22), front arms (21), brake operating levers (14), rear arms (11 and 20), and the brakeshoes (15). The brakeshoes are lined with molded lining and clamp against the disk. The disk is ventilated, drawing air from its center to carry off the heat generated when braking.

(2) Procedures in this paragraph are given for one side only, but are to be repeated on the opposite side.

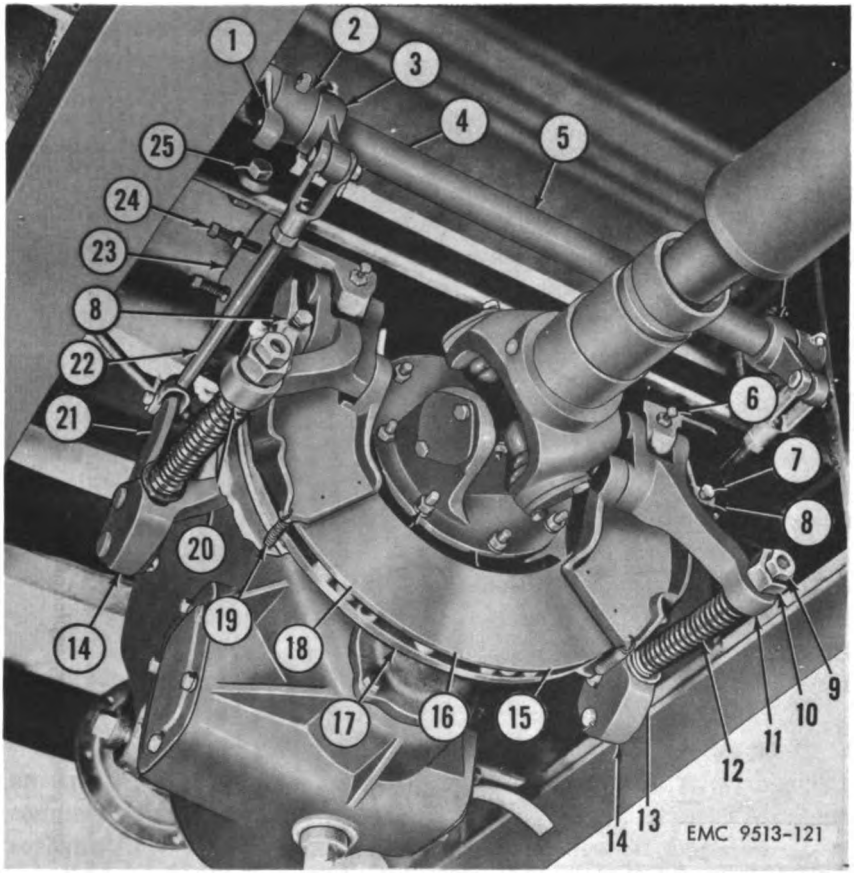
b. Removal.

(1) Remove the extension spring (19, fig. 121) from the brakeshoes (15).

(2) Pull the cotter pins and remove the clevis pins (4) from the shaft operating lever (1) and the pull rod (22).

(3) Support the brakeshoes. Remove the bolts and nuts (10, fig. 122) and plain washers (9) attaching the brackets (23, fig. 121) to the frame crossmember. Remove the brakeshoes.

(4) Remove the nuts, lockwashers, and cap screws (25) attaching the cross-shaft brackets (2) to the frame crossmember. Lift out the cross shaft (5).



1	Shaft operating lever	14	Brake operating lever
2	Cross-shaft bracket	15	Brakeshoe
3	Shaft lever	16	Flange yoke
4	Clevis pin	17	Disk assembly
5	Cross shaft	18	Cap screw
6	Anchor pin lockscrew	19	Extension spring
7	Hexagon head cap screw	20	Left hand rear arm
8	Brakeshoe pin retainer	21	Left hand front arm
9	Locknut	22	Pull rod
10	Spherical nut	23	Left hand bracket
11	Right hand rear arm	24	Shoe adjusting setscrew
12	Extension spring	25	Cap screw
13	Flat washer		

Figure 121. Emergency brake, installed.

(5) Remove the nuts, lockwashers, and cap screws (18) attaching the disk assembly (17) to the flange yoke (16). Leave the top cap screw in place to hold the disk assembly.

(6) Pry the flange yoke to the rear. Push the drive shaft to one side and tie it with wire so that the slip yoke will not slide off.

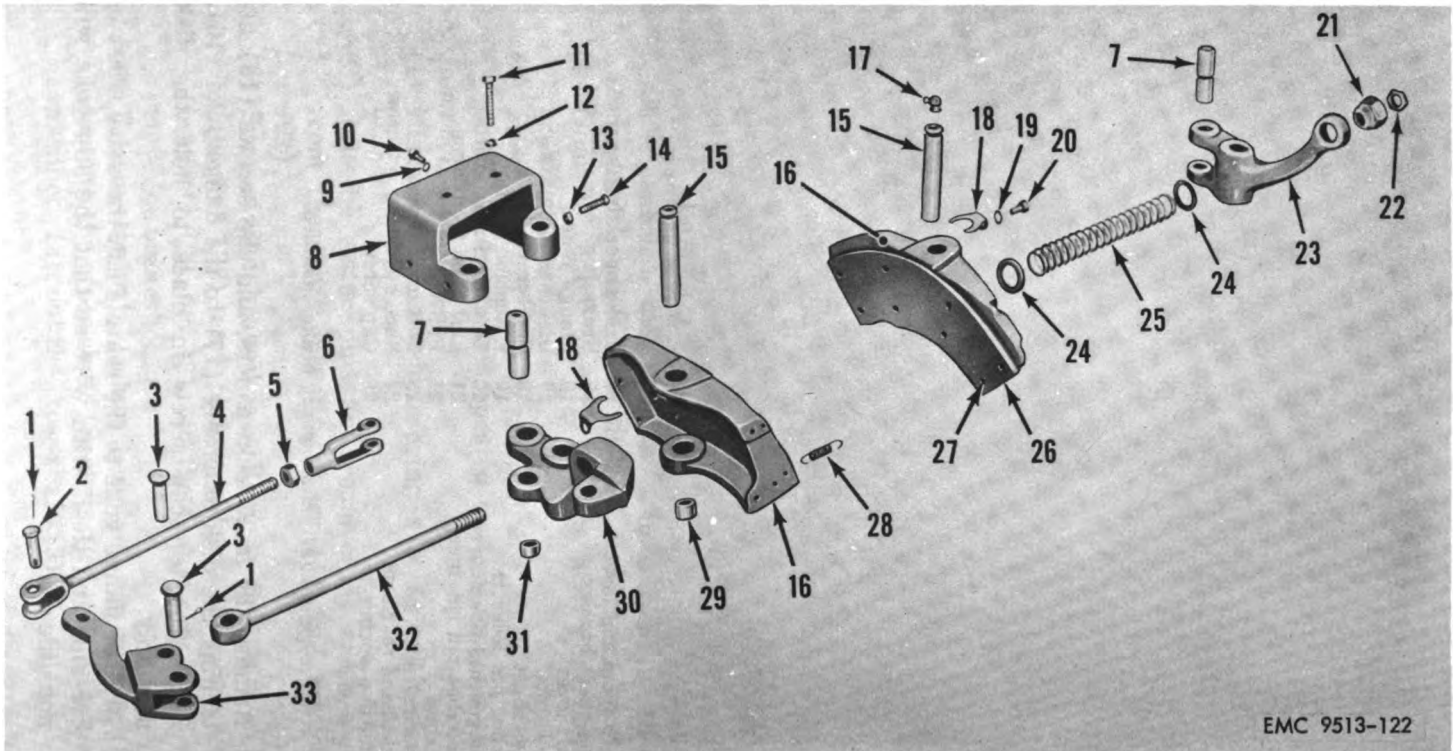


Figure 122. Emergency brake, exploded view.

(7) Remove the top cap screw and lift out the disk assembly.

c. Disassembly.

(1) Pull the cotter pin (1, fig. 122) and remove the clevis pin (2) from the pull rod (4) and the brake operating lever (33). Remove the pull rod.

(2) Remove the locknut (22) and the spherical nut (21) from the lever arm tie rod (32). Pull the cotter pins (1) and remove the clevis pins (3) from the brake operating lever. Remove the lever arm tie rod, the flat washers (24), and the extension spring (25).

(3) Loosen the locknuts (13) and anchor pin lockscrews (14). Drive out the lever arm anchor pins (7) and remove the bracket (8).

(4) Remove the hexagon head cap screws (20), lockwashers (19), and the brakeshoe pin retainers (18) from the brakeshoes (16). Drive out the brakeshoe pins (15) and remove the rear arm (23) and the brake operating lever (33).

(5) Remove the nuts (12, fig. 123), lockwashers (11), and the bolts (5) from the shaft operating lever (1) and the shaft levers (4). Pull the levers and the cross-shaft brackets (3) from the cross shaft (6). Remove the woodruff keys (8).

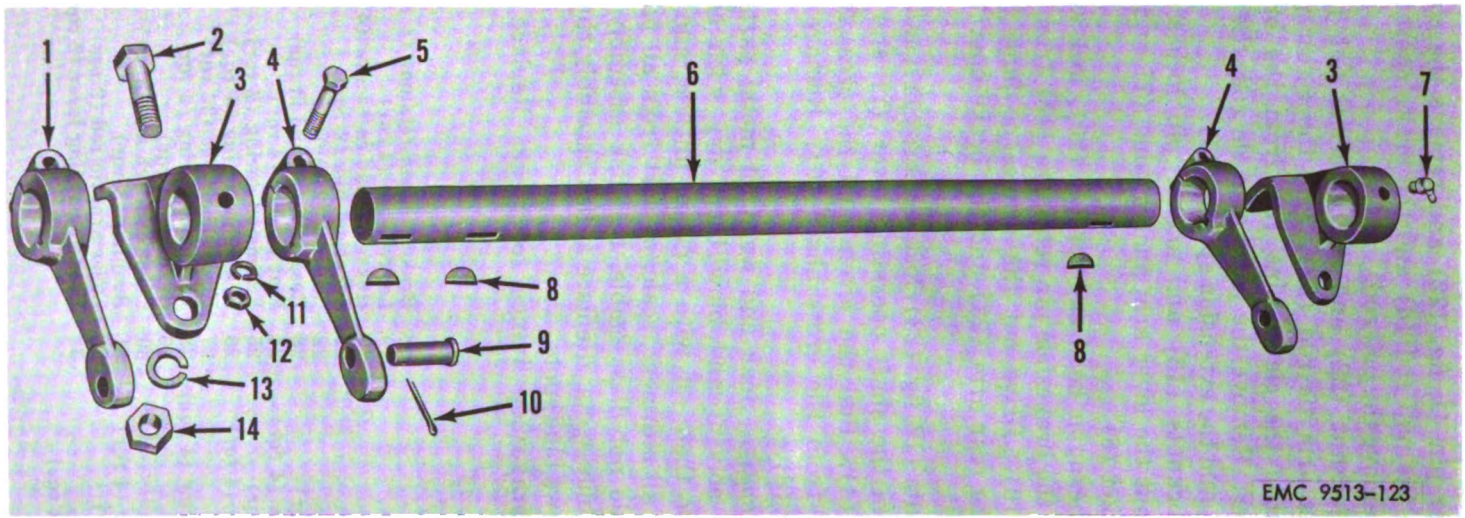
d. Inspection and Repair. Soak and wash all metal parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect, but do not disassemble, the disk assembly for warpage and blue spots. Replace a disk assembly that is warped or shows blue spots.

(2) Inspect the brakeshoe linings for wear. Replace the

←

1 Cotter pin (6 rqr)
2 Clevis pin (2 rqr)
3 Clevis pin (4 rqr)
4 Pull rod (2 rqr)
5 Nut (4 rqr)
6 Adjusting clevis (4 rqr)
7 Lever arm anchor pin (4 rqr)
8 Bracket (rh and lh rqr)
9 Washer, plain, std, ⅝ (4 rqr)
10 Bolt with nut (4 rqr)
11 Shoe adjusting setscrew (4 rqr)
12 Locknut (4 rqr)
13 Locknut (4 rqr)
14 Anchor pin lockscrew (4 rqr)
15 Brakeshoe pin (4 rqr)
16 Brakeshoe (4 rqr)
17 Lubrication fitting (2 rqr)
18 Brakeshoe pin retainer (4 rqr)
19 Lockwasher (4 rqr)
20 Hexagon head cap screw (4 rqr)
21 Spherical nut (2 rqr)
22 Locknut (2 rqr)
23 Rear arm (rh and lh rqr)
24 Flat washer (4 rqr)
25 Extension spring (2 rqr)
26 Brakeshoe lining (4 rqr)
27 Brakeshoe rivet (32 rqr)
28 Extension spring (2 rqr)
29 Bushing (8 rqr)
30 Front arm (rh and lh rqr)
31 Bushing (8 rqr)
32 Lever arm tie rod (2 rqr)
33 Brake operating lever (2 rqr)



1	Shaft operating lever	6	Cross shaft	12	Nut (3 rqr)
2	Screw, cap, hex hd, ½–13 NC x 1½ (4 rqr)	7	Lubrication fitting (2 rqr)	13	Lockwasher, spring, std, ½ (4 rqr)
3	Cross-shaft bracket (2 rqr)	8	Woodruff key (3 rqr)	14	Nut, regular, hex, ½–13 NC (4 rqr)
4	Shaft lever (2 rqr)	9	Clevis pin (2 rqr)		
5	Bolt (3 rqr)	10	Cotter pin (2 rqr)		
		11	Lockwasher (3 rqr)		

Figure 123. Emergency brake cross shaft, exploded view.

brakeshoes, in sets of four, if any one lining is worn to one-eighth inch, or less.

(3) Inspect all pins for wear. Replace worn pins.

(4) Inspect all bushings for wear. Using an arbor press, replace defective bushings.

(5) Inspect the arms, brackets, brakeshoes, clevises, levers, and rods for cracks, breaks, and distortion. Replace defective parts.

(6) Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace defective parts.

(7) Inspect all parts for good condition. Replace parts not in good condition.

e. Reassembly.

(1) Install the woodruff keys (8, fig. 123) for the shaft levers (4) in the cross shaft (6). Install the shaft levers on the cross shaft and woodruff keys. Install the bolts (5) in the levers and secure with lockwashers (11) and nuts (12). Position the cross-shaft brackets (3) on the cross shaft. Install a woodruff key in the cross shaft and position the shaft operating lever (1) on the cross shaft and woodruff key. Secure with a bolt (5), lockwasher (11), and a nut (12).

(2) Position the rear arm (23, fig. 122) and the brake operating lever (33) in the brakeshoes (16). Install the brakeshoe pins (15) and secure to the brakeshoes with the brakeshoe pin retainers (18), lockwashers (19), and the hexagon head cap screws (20).

(3) Position the rear arm and the brake operating lever in the bracket (8). Install the lever arm anchor pins (7) and secure by tightening the anchor pin lockscrews (14) and the locknuts (13) in the bracket and in the groove on the pin.

(4) Insert the lever arm tie rod through the front arm (30). Position a flat washer (24), the extension spring (25), and a second flat washer (24) on the lever arm tie rod and continue the rod through the rear arm (23). Turn a spherical nut (21) and a locknut (22) on the rod.

(5) Position the brake operating lever on the front arm and on the lever arm tie rod. Install the clevis pins (3) and secure with cotter pins (1).

(6) Install the pull rod (4) on the brake operating lever and secure with a clevis pin (2) and cotter pin (1).

f. Installation.

(1) Place eight cap screws (18, fig. 121) through the trans-

fer case universal joint flange and place the disk assembly (17) on the cap screws.

(2) Untie the drive shaft and aline the boltholes in the flange yoke (16) with the cap screws in the disk assembly. Push the cap screws through the flange yoke and secure with lockwashers and nuts.

(3) Position the cross-shaft brackets (2) on the frame crossmember and secure with cap screws (2, fig. 123), lockwashers (13), and nuts (14).

(4) Lift the brakeshoe assembly into position with the disk assembly between the shoes. Install and tighten the plain washers (9, fig. 122) and bolts and nuts (10) through the bracket (23, fig. 121) and the frame crossmember.

(5) Attach the pull rod (22) to the shaft lever (3) with a clevis pin (4) secured with a cotter pin. Attach the shaft operating lever (1) to the hand lever reach rod with a clevis pin (4) secured with a cotter pin.

(6) Attach the extension spring (19) to the brakeshoes (15).

(7) Lubricate the emergency brake assembly (LO 5–9513–3).

g. Adjustment (fig. 121).

(1) Position the hand lever in full release position.

(2) Disconnect the pull rods (22) from the shaft levers (3) by removing the clevis pins (4).

(3) Tighten each spherical nut (10) and locknut (9) until the extension spring (12) exerts sufficient pressure to make each front arm (21) rest solidly against each operating lever (14).

(4) Insert a one thirty-second inch shim between the front brakeshoe linings and the disk assembly (17).

(5) Further tighten the spherical nut and locknut so that the rear brakeshoe linings are firm against the disk assembly but so that the shim in front can be removed. Remove the shim.

(6) Make sure the extension springs (19) are in place. Loosen or tighten the shoe adjusting setscrews (24) and locknuts until the brakeshoe linings are parallel with the disk assembly.

(7) Make sure the hand lever is in full release position. Adjust the length of the pull rods (22) to connect to the shaft levers (3) and install the clevis pins (4) secured with cotter pins.

Section XIV. CONTROLS AND LINKAGE

200. Description

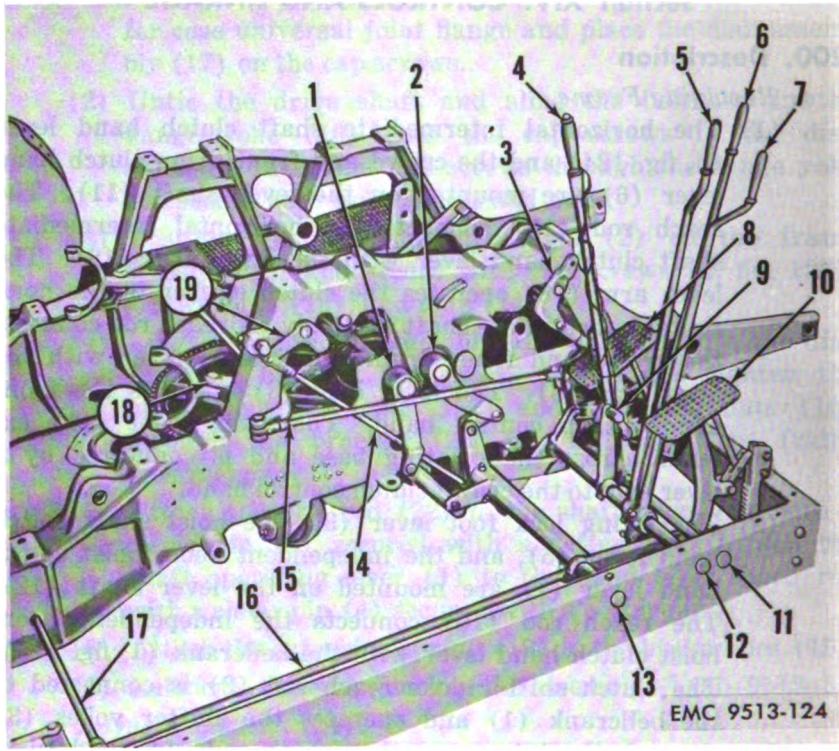
a. Revolving Frame.

(1) The horizontal intermediate shaft clutch hand lever (4, fig. 124) and the crowd and front drum clutch hand lever (6) are mounted on the lever shaft (11). The reach rod (15) connects the horizontal intermediate shaft clutch hand lever with the lever arm (18). The lever arm (18) operates the clutch shifter in the horizontal intermediate shaft assembly. A reach rod connects the crowd and front drum clutch hand lever with the lever arm (3). The lever arm (3) operates the front drum clutch control band. The lever shaft (11) extends across the rotating base and is connected by a lever arm to the crowd clutch control band.

(2) The swing lock foot lever (9), the hoist shaft clutch hand lever (5), and the independent boom hoist clutch hand lever (7) are mounted on the lever shaft (12). The reach rod (16) connects the independent boom hoist clutch hand lever with the bellcrank (1, fig. 125). The clutch shifter yoke reach rod (2) is connected to the bellcrank (1) and operates the shifter yokes (3) through the interconnecting reach rods (4) and turnbuckle (5). The link (13) connects the bellcrank (1) and the reach rod (12) for operation of the brake reach rod (9). The reach rod (14, fig. 124) connects the hoist shaft clutch hand lever with the lever arm (19). The lever arm (19) operates the hoist shaft clutch control band. The swing lock foot lever (9) is linked to a lever arm mounted on a separate lever shaft which extends across the rotating base. This lever shaft (1, fig. 126) raises and lowers the swing lock (4) through the action of the lever arm (6) and lever link (2) transmitted by the shaft and foot lever.

(3) The front drum brake foot pedal (8, fig. 124) and the hoist drum brake foot pedal (10) are mounted on the lever shaft (13). The front drum brake foot pedal is linked to the lever arm (2). The lever arm (2) is keyed to the lever shaft, which is linked to the front drum brake band. The hoist drum brake foot pedal is linked to the lever arm (1). The lever arm (1) is keyed to the lever shaft, which is linked to the hoist drum brake band.

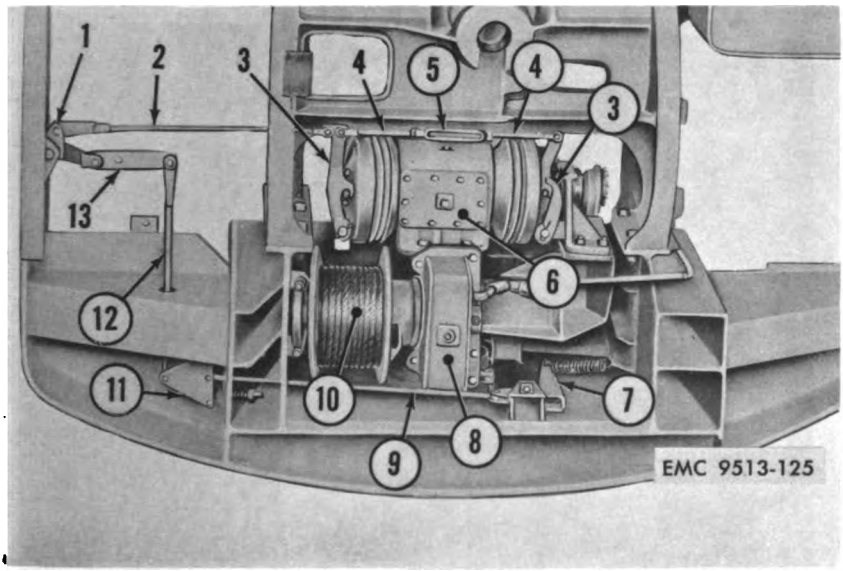
(4) The lever shaft (11, 12, and 13) can be removed in-



1 Hoist drum brake foot pedal lever arm
2 Front drum brake foot pedal lever arm
3 Crowd and front drum clutch hand lever arm
4 Horizontal intermediate shaft clutch hand lever
5 Hoist shaft clutch hand lever
6 Crowd and front drum clutch hand lever
7 Independent boom hoist clutch hand lever
8 Front drum brake foot pedal
9 Swing lock foot lever
10 Hoist drum brake foot pedal
11 Lever shaft
12 Lever shaft
13 Lever shaft
14 Hoist shaft clutch hand lever reach rod
15 Horizontal intermediate shaft clutch hand lever reach rod
16 Independent boom hoist clutch hand lever reach rod
17 Independent boom hoist clutch shifter yoke reach rod
18 Lever arm
19 Lever arm

Figure 124. Revolving frame controls and linkage installed, deck plate removed.

dividually. When necessary to remove a particular hand lever or brake pedal from a shaft, disconnect and remove the other hand levers or brake pedals on that shaft also and drive out the shaft. Removal, disassembly, reassembly, and installation of the hand levers and brake pedals can be accomplished from underneath the revolving frame without removing the deck plate. Before attempting to remove a lever shaft, remove all



1 Bellcrank
2 Clutch shifter yoke reach rod
3 Shifter yoke
4 Interconnecting reach rod
5 Turnbuckle
6 Clutch shaft assembly
7 Brake bellcrank
8 Worm gearcase cover
9 Brake reach rod
10 Boom hoist drum
11 Bellcrank
12 Reach rod
13 Link

Figure 125. Independent boom hoist controls and linkage installed bottom view.

dirt, grease, and paint from all exposed parts of the shaft.

(5) The engine clutch hand lever is mounted on a pin in the side of the rotating base. A reach rod connects the hand lever with a bellcrank mounted on the revolving frame engine and radiator support. A reach rod connects the bellcrank to a lever arm keyed on the engine clutch yoke lever.

(6) The revolving frame engine starter control is a flexible cable.

b. Carrier. A description of each carrier control is contained in a general subparagraph under the individual control.

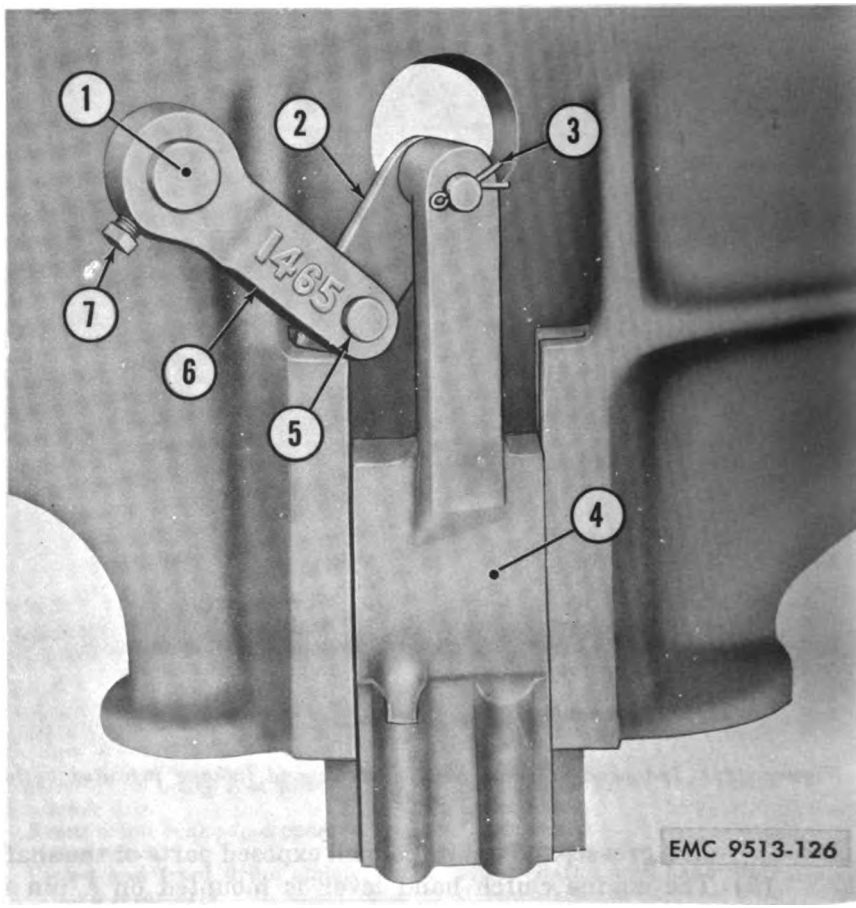
201. Hoist Drum Brake Control

a. Removal and Disassembly.

(1) Disconnect the reach rod (11, fig. 127) from the hoist shaft clutch lever.

(2) Remove the connecting link (9) from the hoist drum brake foot pedal lever (8).

(3) Remove the connecting link (3) from the front drum brake foot pedal lever (4).



1 Lever shaft
2 Lever link
3 Cotter pin
4 Swing lock
5 Pin
6 Lever arm
7 Setscrew

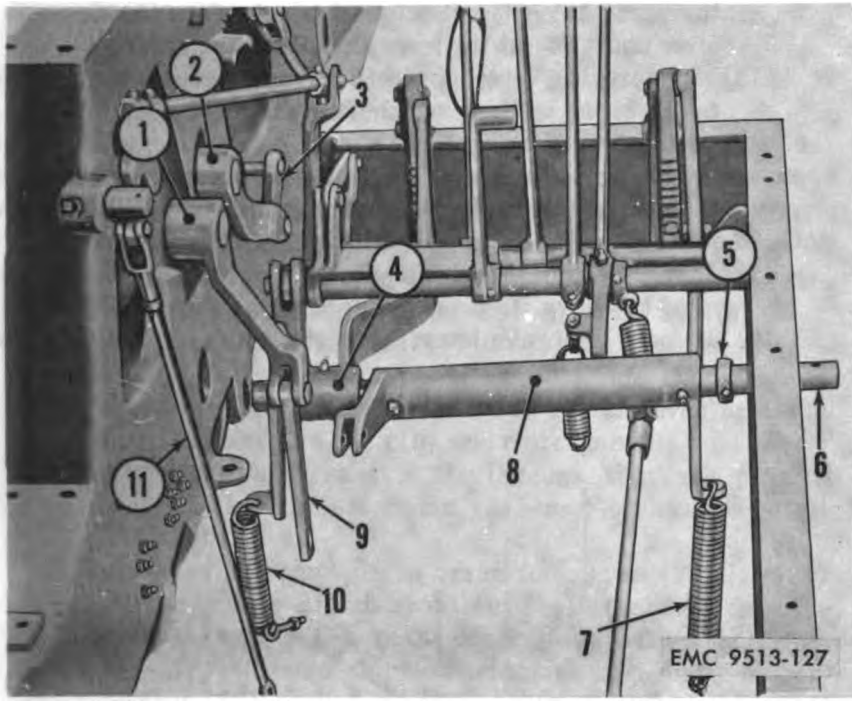
Figure 126. Revolving frame swing lock, installed.

(4) Remove the eyebolt and spring (10) from the rotating base. Remove the eyebolt and spring (7) from the deck channel.

(5) Loosen the set collar (5).

(6) Pull the cotter pins (11, fig. 128) from the pins (12 and 21). Remove the pins and the locking link (16). Remove the nut (17), lockwasher (22), cap screw (23), and the brake ratchet pawl (20) from the brake lever (26). Remove the nut (14), lockwasher (15), cap screw (27), and accelerator pedal (13) from the brake lever.

(7) Pull the cotter pins (11, fig. 129) from the pins (16 and 17). Remove the pins and the locking link (12).



1 Lever arm
2 Lever arm
3 Connecting link
4 Front drum brake foot pedal lever
5 Set collar
6 Lever shaft
7 Spring
8 Hoist drum brake foot pedal lever
9 Connecting link
10 Spring
11 Reach rod

Figure 127. Front drum brake foot pedal and hoist drum brake foot pedal lever shaft, partly removed.

Remove the nut (20), lockwasher (21), cap screw (24), and the brake ratchet pawl (15) from the brake lever (22). Remove the nut (9), lockwasher (10), cap screw (19), and accelerator pedal (18) from the brake lever.

(8) Remove the nut (17, fig. 128), lockwasher (22), and bolt (30) from the deck channel and lever shaft.

(9) Holding the brake levers steady, remove the lever shaft from the deck channel and rotating base. Remove the brake levers and set collar.

(10) Pull a cotter pin (8) and remove a pin (10) and the connecting link (9) from the lever arm (1).

(11) Using a center punch and hammer, drive out the tapered key (2). Remove the lever arm (1) from the lever shaft (3).

(12) Using a center punch and hammer, drive out the

tampered key (4). Remove the lever arm (5) from the lever shaft (3) at the lever shaft bracket.

(13) Remove the lever shaft (3) from the side of the rotating base and the lever shaft bracket.

b. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the lever shafts for wear, scoring, and damaged keyways. Replace a defective shaft.

(2) Inspect the brake lever, connecting link, and lever arms

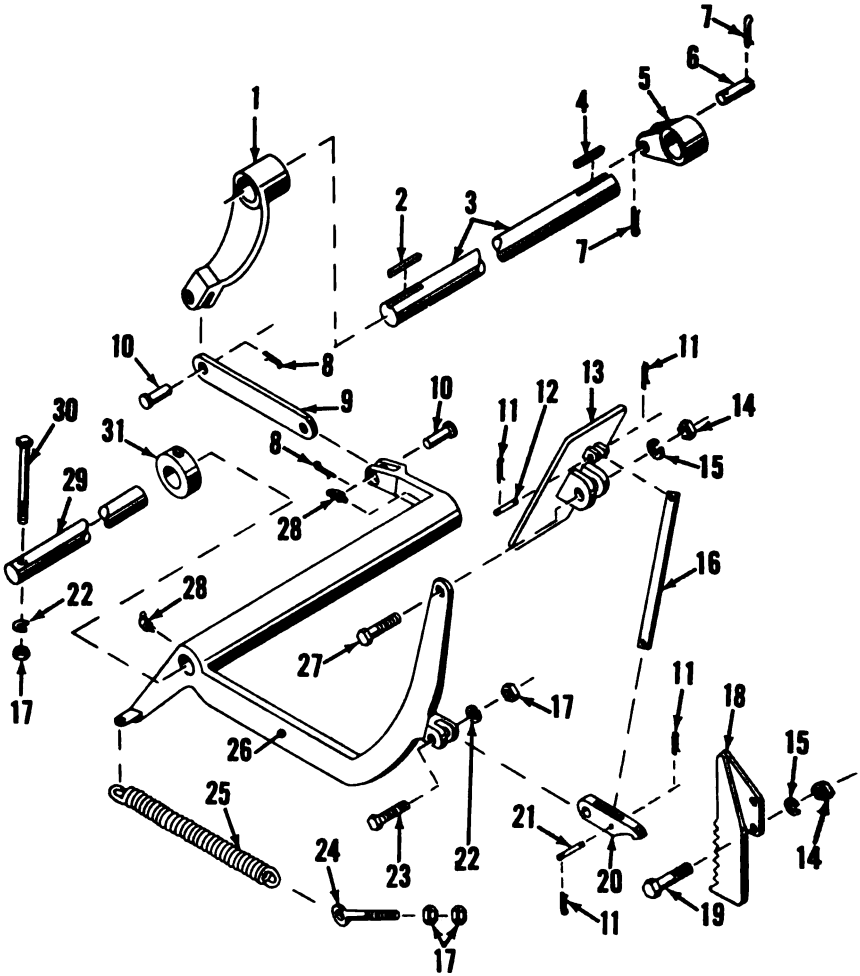


Figure 128. Hoist drum brake control, exploded view.

for cracks, breaks, and distortion. Replace all defective parts.

(3) Inspect all pins for wear. Replace defective pins.

(4) Inspect all parts for good condition. Replace parts not in good condition.

c. *Reassembly and Installation.*

(1) Install the lever shaft (3, fig. 128) in the side of the rotating base and the lever shaft bracket.

(2) Position the lever arm (5) on the lever shaft and secure by driving the tapered key (4) into the keyways.

(3) Position the lever arm (1) on the lever shaft and secure by driving the tapered key (2) into the keyways.

(4) Position the connecting link (9) in the lever arm (1) and secure with a pin (10) and cotter pin (8).

(5) Start the lever shaft (29) through the deck channel and position the set collar (31) and brake lever (26) on the shaft.

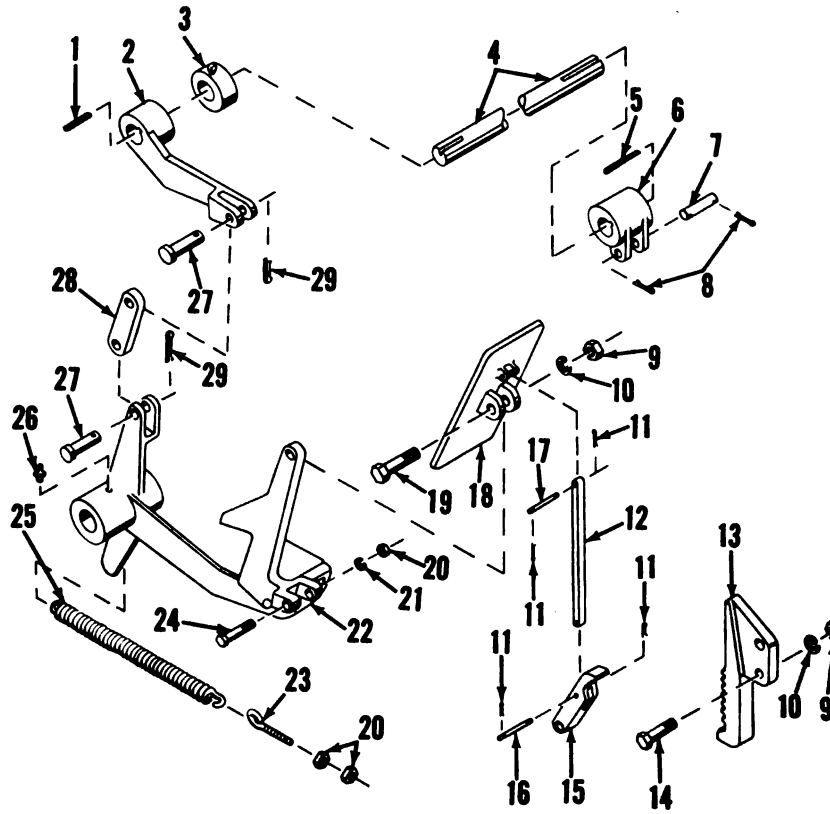
(6) Position the front drum brake foot lever (22, fig. 129) on the lever shaft and continue the lever shaft into the rotating base. Secure the lever shaft with a bolt (30, fig. 128) through the deck channel and shaft, a lockwasher (22), and a nut (17).

(7) Aline the brake levers (4 and 8, fig. 127) with the connecting links (3 and 9). When alined, tighten the set collar (5) on the lever shaft and against the brake lever (8).

(8) Connect the brake levers and connecting links with pins and cotter pins.

←

1 Lever arm
2 Key, std taper, plain, single, ⅜ x ⅜ x 2¼
3 Lever shaft
4 Key, std taper, plain, single, ⅜ x ⅜ x 2¾
5 Lever arm
6 Pin, straight, headless
7 Pin, cotter, split, 5/32 x 1⅛ (2 rqr)
8 Pin, cotter, split, 3/32 x 1 (2 rqr)
9 Connecting link
10 Headed pin (2 rqr)
11 Pin, cotter, split, 1/16 x 7/16 (4 rqr)
12 Pin
13 Accelerator pedal
14 Nut, regular, hex, ½–13 NC (3 rqr)
15 Lockwasher, spring, std, ½ (3 rqr)
16 Locking link
17 Nut, regular, hex, ⅜–16 NC (4 rqr)
18 Brake ratchet
19 Screw, cap, hex hd, ½–13 NC x 2 (2 rqr)
20 Brake ratchet pawl
21 Pin
22 Lockwasher, spring, std, ⅜ (2 rqr)
23 Screw, cap, hex hd, ⅜–16 NC x 2¼
24 Eyebolt
25 Extension spring
26 Brake lever
27 Screw, cap, hex hd, ½–13 NC x 2½
28 Lubrication fitting, ⅛ x 30° (2 rqr)
29 Lever shaft
30 Bolt, sq hd, regular, ⅜–16 NC x 4½
31 Collar, set, std, 1¼



1 Key, std taper, plain, single, 3/8 x 3/8 x 2 1/4
2 Lever arm
3 Collar, set, std, 1 7/16
4 Lever shaft
5 Key, std taper, plain, single, 3/8 x 3/8 x 2 3/4
6 Lever arm
7 Pin, straight, headless
8 Pin, cotter, split, 5/32 x 1 1/2 (2 rqr)
9 Nut, regular, hex, 1/2-13 NC (3 rqr)
10 Lockwasher, spring, std, 1/2 (3 rqr)
11 Pin, cotter, split, 1/16 x 7/16 (4 rqr)
12 Locking link
13 Brake ratchet
14 Screw, cap, hex hd, 1/2-13 NC x 2 (2 rqr)
15 Brake ratchet pawl
16 Pin
17 Pin
18 Accelerator pedal
19 Screw, cap, hex hd, 1/2-13 NC x 2 1/2
20 Nut, regular, hex, 3/8-16 NC (3 rqr)
21 Lockwasher, spring, std, 3/8
22 Brake lever
23 Eyebolt
24 Screw, cap, hex hd, 3/8-16 NC x 2 1/4
25 Extension spring
26 Lubrication fitting, 1/8 straight
27 Headed pin (2 rqr)
28 Connecting link
29 Pin, cotter, split, 3/32 x 1 (2 rqr)

Figure 129. Front drum brake control, exploded view.

(9) Position the accelerator pedal (18, fig. 129) on the brake lever (22) and secure with a cap screw (19), lockwasher (10), and nut (9). Position the brake ratchet pawl (15) in the brake lever and secure with a cap screw (24), lockwasher (21), and nut (20). Attach the locking link (12) to the accelerator pedal with the pin (17) and cotter pins (11). Attach the locking link to the brake ratchet pawl with the pin (16) and cotter pins (11).

(10) Position the accelerator pedal (13, fig. 128) on the brake lever (26) and secure with a cap screw (27), lockwasher (15), and nut (14). Position the brake ratchet pawl (20) in the brake lever and secure with a cap screw (23), lockwasher (22), and nut (17). Attach the locking link (16) to the accelerator pedal with the pin (12) and cotter pins (11). Attach the locking link to the brake ratchet pawl with the pin (21) and cotter pins (11).

(11) Install the eyebolt and spring (7, fig. 127) on the brake lever (8) and the deck channel.

(12) Install the eyebolt and spring (10) on the brake lever (4) and the rotating base.

(13) Connect the reach rod (11) to the hoist shaft clutch lever with a pin and cotter pin.

202. Front Drum Brake Control

a. Removal and Disassembly.

(1) Disconnect the reach rod (11, fig. 127) from the hoist shaft clutch lever.

(2) Remove the connecting link (9) from the hoist drum brake foot pedal lever (8).

(3) Remove the connecting link (3) from the front drum brake foot pedal lever (4).

(4) Remove the eyebolt and spring (10) from the rotating base. Remove the eyebolt and spring (7) from the deck channel.

(5) Loosen the set collar (5).

(6) Pull the cotter pins (11, fig. 128) from the pins (12 and 21). Remove the pins and the locking link (16). Remove the nut (17), lockwasher (22), cap screw (23), and the brake ratchet pawl (20) from the brake lever (26). Remove the nut (14), lockwasher (15), cap screw (27), and accelerator pedal (13) from the brake lever.

(7) Pull the cotter pins (11, fig. 129) from the pins (16 and 17). Remove the pins and the locking link (12). Re-

move the nut (20), lockwasher (21), cap screw (24), and the brake ratchet pawl (15) from the brake lever (22). Remove the nut (9), lockwasher (10), cap screw (19), and accelerator pedal (18) from the brake lever.

(8) Remove the nut (17, fig. 128), lockwasher (22), and bolt (30) from the deck channel and lever shaft.

(9) Holding the brake levers steady, remove the lever shaft from the deck channel and rotating base. Remove the brake levers and set collar.

(10) Pull a cotter pin (29, fig. 129) and remove a pin (27) and the connecting link (28) from the lever arm (2).

(11) Using a center punch and hammer, drive out the tapered key (1). Remove the lever arm (2) from the lever shaft (4).

(12) Loosen the set collar (3) from the lever shaft. Pull the lever shaft out of the lever shaft bracket.

(13) Using a center punch and hammer, drive out the tapered key (5). Remove the lever arm (6) from the lever shaft.

(14) Pull the lever shaft (4) from the side of the rotating base.

b. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the lever shafts for wear, scoring, and damaged keyways. Replace a shaft that is worn, scored, or has a damaged keyway.

(2) Inspect the brake lever, connecting link, and lever arms for cracks, breaks, and distortion. Replace a brake lever connecting link, or lever arm if cracked, broken, or distorted.

(3) Inspect all pins for wear. Replace defective pins.

(4) Inspect all parts for good condition. Replace parts not in good condition.

c. Reassembly and Installation.

(1) Install the lever shaft (4, fig. 129) in the side of the rotating base. Place the set collar (3) over the end of the lever shaft.

(2) Position the lever arm (6) on the lever shaft and secure by driving the tapered key (5) into the keyways. Install the lever shaft in the lever shaft bracket. Slide the set collar (3) up against the rotating base and tighten on the lever shaft.

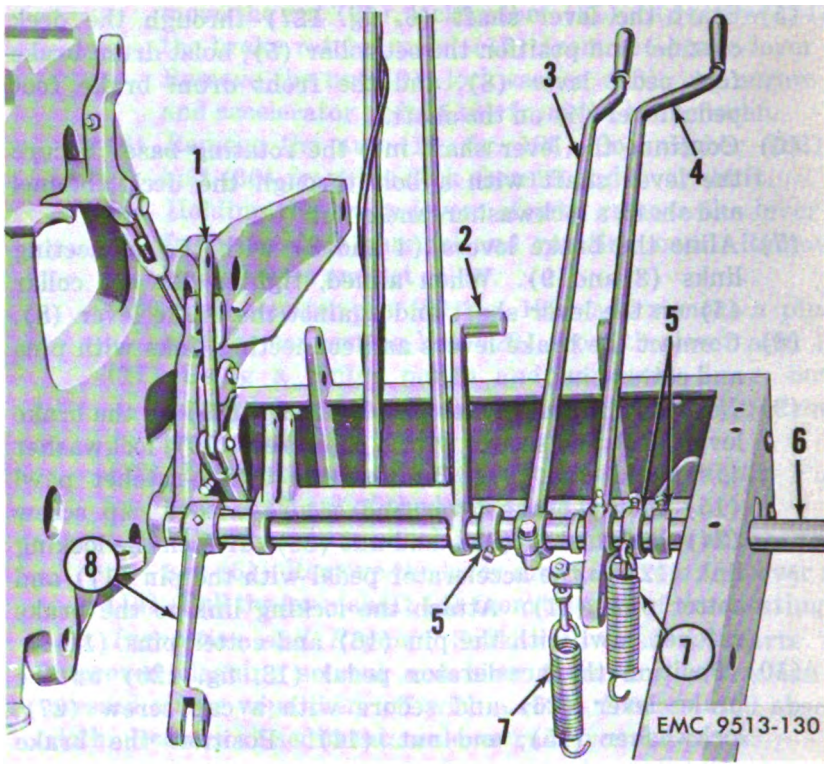
(3) Position the lever arm (2) on the lever shaft and secure by driving the tapered key (1) into the keyways.

(4) Position the connecting link (28) in the lever arm (2) and secure with a pin (27) and cotter pin (29).

(5) Start the lever shaft (6, fig. 127) through the deck channel and position the set collar (5), hoist drum brake foot pedal lever (8), and the front drum brake foot pedal lever (4) on the shaft.
(6) Continue the lever shaft into the rotating base. Secure the lever shaft with a bolt through the deck channel and shaft, a lockwasher, and a nut.
(7) Aline the brake levers (4 and 8) with the connecting links (3 and 9). When alined, tighten the set collar (5) on the lever shaft and against the brake lever (8).
(8) Connect the brake levers and connecting links with pins and cotter pins.
(9) Position the accelerator pedal (18, fig. 129) on the brake lever (22) and secure with a cap screw (19), lockwasher (10), and nut (9). Position the brake ratchet pawl (15) in the brake lever and secure with a cap screw (24), lockwasher (21), and nut (20). Attach the locking link (12) to the accelerator pedal with the pin (17) and cotter pins (11). Attach the locking link to the brake ratchet pawl with the pin (16) and cotter pins (11).
(10) Position the accelerator pedal (13, fig. 128) on the brake lever (26) and secure with a cap screw (27), lockwasher (15), and nut (14). Position the brake ratchet pawl (20) in the brake lever and secure with a cap screw (23), lockwasher (22), and nut (17). Attach the locking link (16) to the accelerator pedal with the pin (12) and cotter pins (11). Attach the locking link to the brake ratchet pawl with the pin (21) and cotter pins (11).
(11) Install the eyebolt and spring (7, fig. 127) on the brake lever (8) and the deck channel.
(12) Install the eyebolt and spring (10) on the brake lever (4) and the rotating base.
(13) Connect the reach rod (11) to the hoist shaft clutch lever with a pin and cotter pin.

203. Hoist Shaft Clutch Control

a. Removal and Disassembly.
(1) Disconnect the reach rod from the lever (8, fig. 130).
(2) Disconnect the lever link (1) from the swing lock foot lever (2).
(3) Disconnect the reach rod from the independent boom hoist clutch hand lever (4).
(4) Disconnect the springs (7) from the deck plate.
(5) Loosen all set collars (5) from the lever shaft (6).



1 Lever link
2 Swing lock foot lever
3 Hoist shaft clutch hand lever
4 Independent boom hoist clutch hand lever
5 Set collar
6 Lever shaft
7 Spring
8 Lever

Figure 130. Hoist shaft clutch hand lever, swing lock foot lever, and independent boom hoist clutch hand lever shaft, partly removed.

Loosen the setscrew in the lever (8). Loosen the nut and bolt in the hoist shaft clutch hand lever (3).

(6) Remove the lever shaft (6) from the rotating base and deck channel and, at the same time, remove the lever (8) and woodruff key, the swing lock foot lever (2), a set collar (5), the hoist shaft clutch hand lever (3) and woodruff key, the independent boom hoist clutch hand lever (4), and two set collars (5).

(7) Pull the cotter pin (27, fig. 131) and remove the pin (26), adjusting yoke end (25), nut (24), and reach rod (23) from the bellcrank (1).

(8) Unhook the spring (28) from the rotating base and the spring clip (30). Remove the setscrew (29), jamnut (3), and spring clip from the bellcrank (1).

(9) Pull the cotter pins (6) and remove the pin (14) from the bellcrank (1) and the rod end (13).

(10) Pull the cotter pin (9). Remove the control band (7) from the band anchor pin (8).

(11) Lift the control band from the control wheel. Pull a cotter pin (6) and remove the band pin (5).

(12) Remove the rod ends (10 and 13) and nut (11) from the sleeve nut (12).

(13) Remove the setscrew (2) and jamnut (3) from the rotating base and band anchor pin (8). Remove the band anchor pin (8) from the rotating base.

(14) Remove the setscrew (2) and jamnut (3) from the rotating base and pin (4). Remove the pin (4) and bellcrank (1) from the rotating base.

b. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the lever shaft for wear, scoring, and damaged keyways. Replace a shaft that is defective.

(2) Inspect the hand lever, lever, reach rod, and bellcrank for cracks, breaks, and distortion. Replace all defective parts.

(3) Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace all defective parts.

(4) Inspect the control band lining for wear. Replace the control band assembly if the lining is worn to the rivet heads.

(5) Inspect all pins for excessive wear. Replace excessively worn pins.

(6) Inspect all parts for good condition. Replace parts not in good condition.

c. Reassembly and Installation.

(1) Position the bellcrank (1, fig. 131) on the rotating base. Install the pin (4) in the rotating base and bellcrank and secure with a jamnut (3) and setscrew (2) through the rotating base.

(2) Install the band anchor pin (8) in the rotating base and secure with a jamnut (3) and setscrew (2) through the rotating base.

(3) Assemble the rod ends (10 and 13) and nut (11) on the sleeve nut (12).

(4) Install the band pin (5) in the band and rod end (10) and secure with a cotter pin (6). Position the control band on the control wheel.

(5) Install the control band on the band anchor pin (8) and secure with a cotter pin (9).
(6) Install the pin (14) in the rod end (13) and bellcrank (1) and secure with cotter pins (6).
(7) Position the spring clip (30) on the bellcrank and secure with a jamnut (3) and setscrew (29). Hook the spring (28) in the spring clip and in the rotating base.
(8) Assemble the reach rod (23), nut (24), and adjusting

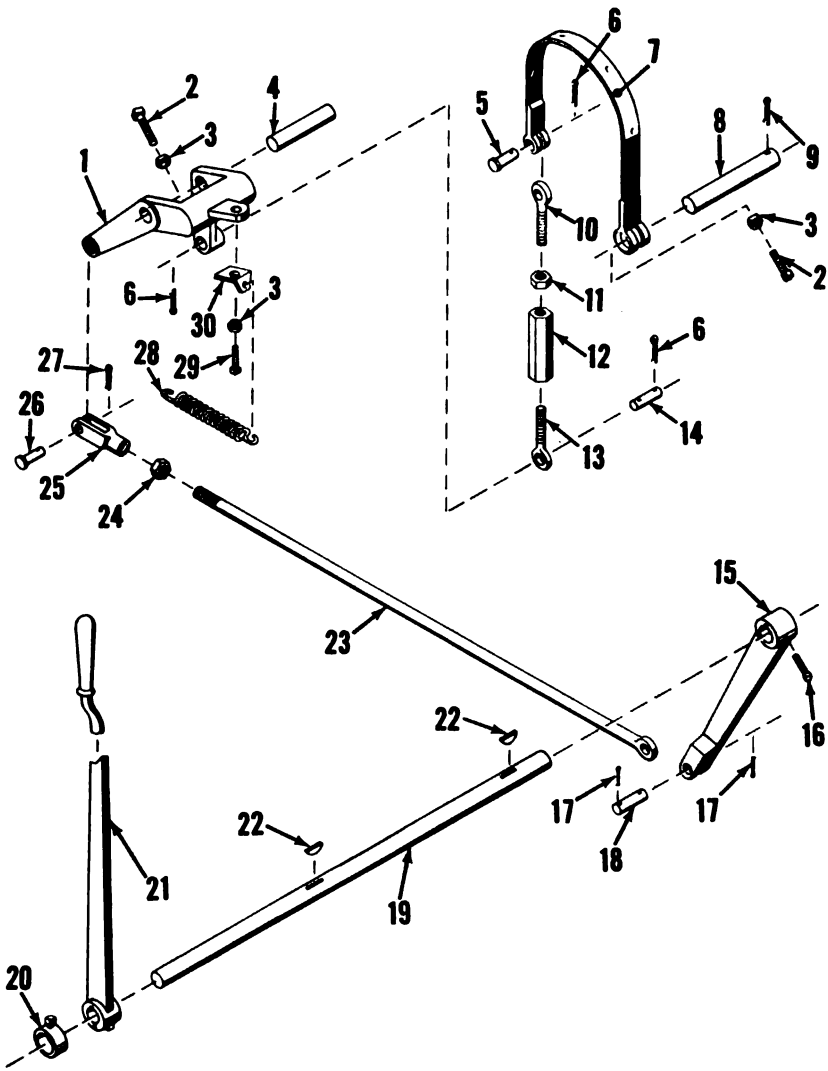


Figure 131. Hoist shaft clutch hand lever and linkage, exploded view.

yoke end (25). Position the yoke end on the bellcrank and secure with the pin (26) and cotter pin (27).

(9) Install the lever shaft (6, fig. 130) in the deck channel. In sequence, install the following parts on the lever shaft: two set collars (5), the independent boom hoist clutch hand lever (4), the hoist shaft clutch hand lever (3), a set collar (5), the swing lock foot lever (2), and the lever (8). Continue the lever shaft into the rotating base. Position a set collar (5) against the deck channel and tighten on the lever shaft.

(10) Install a woodruff key in the lever shaft (6). Position the hoist shaft clutch hand lever (3) on the woodruff key and secure by tightening the lever nut and bolt.

(11) Install a woodruff key in the lever shaft (6). Position the lever (8) on the shaft over the woodruff key and secure by tightening the lever setscrew.

(12) Aline the independent boom hoist clutch hand lever (4) with its reach rod and install with a pin and cotter pin. When alined, position a set collar (5) against the lever and tighten on the lever shaft.

(13) Connect the springs (7) to the deck plate.

(14) Connect the swing lock foot lever (2) to the lever link (1). Position a set collar (5) against the foot lever and tighten on the shaft.

(15) Connect the reach rod to the lever (8).

d. Adjustment (fig. 131).

(1) Adjust the control band (7) by loosening the nut (11) and turning the sleeve nut (12). Do not tighten the control band any more than necessary to keep the hoist clutch engaged while operating. Tighten the nut (12) against the sleeve nut when adjustment is completed.

←

1 Bellcrank
2 Setscrew, sq hd, cup point, ⅜–16 NC x 1 (2 rqr)
3 Jamnut, regular, hex, ⅜–16 NC (3 rqr)
4 Pin
5 Band pin
6 Pin, cotter, split, 5/32 x 1 (3 rqr)
7 Control band
8 Band anchor pin
9 Pin, cotter, split, 3/16 x 1½
10 Rod end
11 Nut, regular, hex, ⅝–11 NC
12 Sleeve nut
13 Rod end
14 Pin
15 Lever
16 Setscrew, sq hd, cup point, ⅜–16 NC x ¾
17 Pin, cotter, split, ⅛ x ⅞ (2 rqr)
18 Pin
19 Lever shaft
20 Collar, set, std, 1¼
21 Hand lever
22 Woodruff key (2 rqr)
23 Reach rod
24 Nut, regular, hex, ½–20 NF
25 Adjusting yoke end
26 Pin
27 Pin, cotter, split, 3/32 x ¾
28 Tension spring
29 Setscrew, sq hd, cup point, ⅜–16 NC x 1½
30 Spring clip

(2) Adjust the jamnut (3) and setscrew (29) on the bellcrank (1) so the control band will lock in easily.

(3) The vertical position of the hand lever (21) can be changed by adjusting the length of the reach rod (23) at the adjusting yoke end (25).

204. Swing Lock Control

a. Removal and Disassembly.

(1) Remove the lever shaft (par. 203*a*(1)–(6)).

(2) Remove the lever shaft (6, fig. 130) from the rotating base and deck channel far enough to remove the lever (8) and woodruff key and the swing lock foot lever (2).

(3) Block up the swing lock (13, fig. 132).

(4) Pull a cotter pin (7) and remove a pin (6) and the lever link (8) from the lever arm (1).

(5) Loosen the setscrew (5). Remove the lever arm (1), woodruff key (2), and pipe spacer (4) from the lever shaft (3).

(6) Pull the cotter pins (11) and remove the pin (12) from the swing lock (13).

(7) Pull a cotter pin (7) and remove a pin (6) and the lever link (14) from the lever arm (1).

(8) Remove the swing lock (13).

(9) Remove the lever shaft (3) from the swing lock side of the rotating base.

(10) Loosen a setscrew (5) and remove the lever arm (1) and woodruff key (2) from the lever shaft.

b. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the lever shaft for wear, scoring, and damaged keyways. Replace a defective shaft.

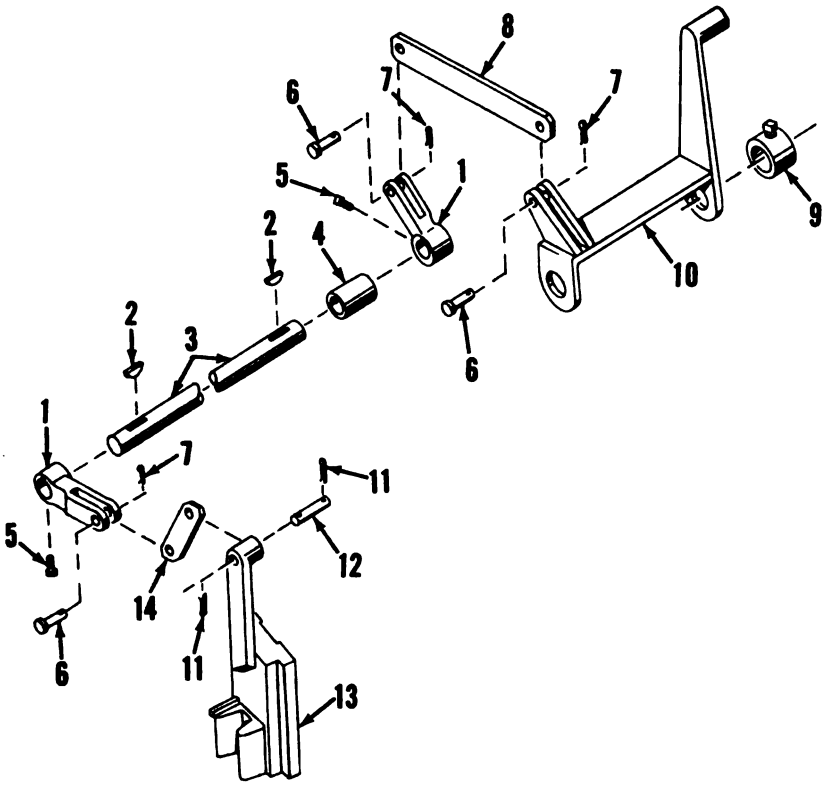
(2) Inspect the foot lever, lever arms, lever links, and the swing lock for cracks, breaks, and distortion. Replace defective parts.

(3) Inspect all pins for wear. Replace defective pins.

(4) Inspect all parts for good condition. Replace parts not in good condition.

c. Reassembly and Installation.

(1) Install a woodruff key (2, fig. 132) in the lever shaft (3). Install the lever arm (1) over the shaft and on the key. Secure the lever arm by tightening the setscrew (5).



EMC 9513-132

1	Lever arm (2 rqr)	8	Lever link
2	Woodruff key (2 rqr)	9	Collar, set, std, 1¼
3	Lever shaft	10	Foot lever
4	Spacer, pipe, std, 1 x 1⅞	11	Pin, cotter, split, ⅛ x ⅞ (2 rqr)
5	Setscrew, sq hd, cup point, ⅜–16 NC x ¾ (2 rqr)	12	Pin
6	Pin (3 rqr)	13	Swing lock
7	Pin, cotter, split, $\frac{3}{32}$ x ¾ (3 rqr)	14	Lever link

Figure 132. Swing lock foot lever and linkage, exploded view.

(2) Install the lever shaft (3) in the swing lock side of the rotating base.

(3) Install the pipe spacer (4) on the lever shaft. Install a woodruff key (2) in the lever shaft. Install the lever arm (1) over the shaft and on the key. Secure the lever arm by tightening the setscrew (5).

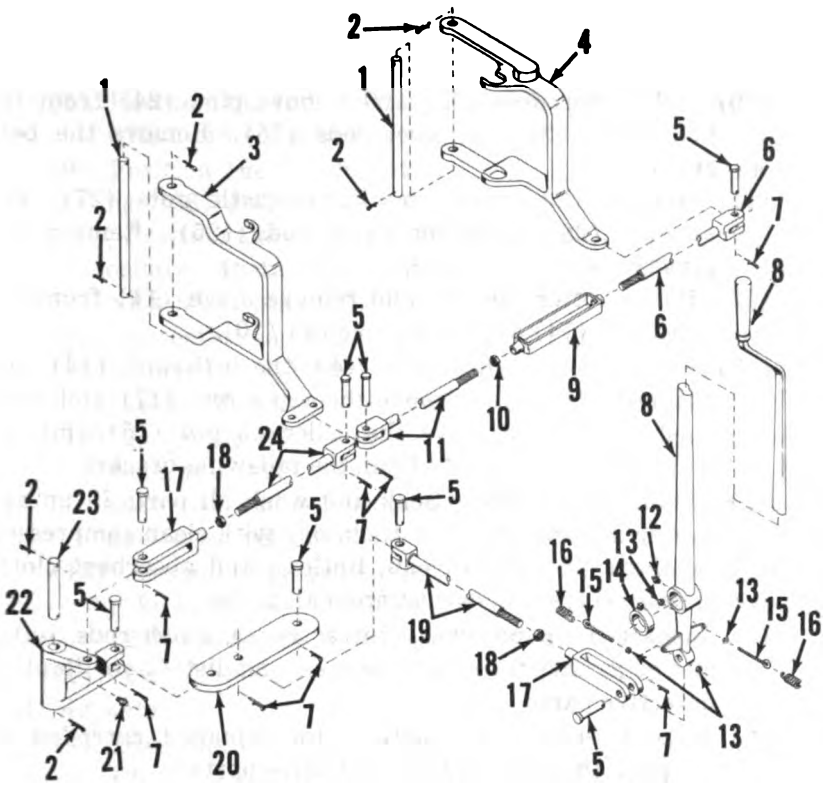
(4) Position the lever link (8) in the lever arm. Install a pin (6) in the lever arm and lever link and secure with a cotter pin (7).

(5) Install the swing lock (13) in the rotating base and block up.
(6) Position the lever link (14) on the swing lock. Install the pin (12) in the lever link and swing lock and secure with cotter pins (11).
(7) Install the lever link (14) and pin (6) in the lever arm (1). Secure the pin with a cotter pin (7).
(8) Remove the blocking from the swing lock (13).
(9) Install the swing lock foot lever (2, fig. 130) and the lever (8) on the lever shaft (6). Install the lever shaft into the rotating base. Position a set collar (5) against the deck channel and tighten on the lever shaft.
(10) Install a woodruff key in the lever shaft. Position the lever (8) on the shaft and key and secure by tightening the lever setscrew.
(11) Aline the independent boom hoist clutch hand lever (4) with its reach rod and install with a pin and cotter pin. While alined, position a set collar (5) against the lever and tighten on the lever shaft.
(12) Connect the springs (7) to the deck plate.
(13) Connect the swing lock foot lever (2) to the lever link (1). Position a set collar (5) against the foot lever and tighten on the shaft.
(14) Connect the reach rod to the lever (8).

205. Independent Boom Hoist Clutch Control

a. Removal and Disassembly.

(1) Remove the lever shaft (par. 203*a*(1)–(6)).
(2) Pull a cotter pin (7, fig. 133) and remove a pin (5) and the reach rod (19) from the link (20).
(3) Pull cotter pins (7) and remove pins (5) from each end of the reach rod (24). Remove the reach rod from the bellcrank (22) and the shifter yoke (3).
(4) Pull cotter pins (7) and remove pins (5) from the reach rods (6 and 11). Remove the reach rods from the shifter yokes (3 and 4). Loosen the nut (10) and turn the reach rods (6 and 11) out of the turnbuckle (9).
(5) Pull the cotter pins (2) and remove the shifter pivot pins (1) from the shifter yokes (3 and 4). Remove the shifter yokes.
(6) Pull cotter pins (7) and remove pins (5) from the reach rod (21, fig. 120) and the link (20, fig. 133). Remove the link.
(7) Pull cotter pins (2) and remove the pin (23) from the



1	Shifter pivot pin (2 rqr)	13	Nut, regular, hex, ⅜–16 NC (4 rqr)
2	Pin, cotter, split, 3/16 x 1½ (6 rqr)	14	Collar, set, std, 1¼
3	Shifter yoke, rh	15	Eyebolt (2 rqr)
4	Shifter yoke, lh	16	Tension spring (2 rqr)
5	Pin (8 rqr)	17	Adjusting yoke end (2 rqr)
6	Reach rod	18	Nut, regular, hex, ⅝–18 NF (2 rqr)
7	Pin, cotter, split, 3/32 x 1 (8 rqr)	19	Reach rod
8	Hand lever	20	Link
9	Turnbuckle	21	Lubrication fitting, ⅛ straight
10	Nut, regular, hex, ⅝–11 NC	22	Bellcrank
11	Reach rod	23	Pin
12	Lubrication fitting, ⅛ x 75°	24	Reach rod

Figure 133. Independent boom hoist clutch hand lever and linkage, exploded view.

deck channel and the bellcrank (22). Remove the bellcrank.

(8) Pull a cotter pin (22, fig. 120) and remove a pin (24) from the bellcrank (23) and the reach rod (21). Remove the reach rod.

(9) Pull a cotter pin (22) and remove a pin (24) from the bellcrank (23) and brake reach rod (18). Pull a cotter

pin (5) and remove a pin (11) from the bellcrank (12) and the brake reach rod. Remove the brake reach rod.

(10) Pull cotter pins (22) and remove pins (24) from the bellcrank (23) and pivot rods (25). Remove the bellcrank.

(11) Remove the cotter pins (28), castle nuts (27), and springs (26) from the pivot rods (25). Remove the pivot rods.

(12) Pull a cotter pin (5) and remove a pin (11) from the bellcrank (14) and adjustable rod (10).

(13) Unhook the spring (13) from the bellcrank (14) and the deck channel. Remove the cap screw (17) and lockwasher (16). Remove the bellcrank pin (15) and the bellcranks (12 and 14) from the tailswing bracket.

b. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the hand lever, shifter yokes, reach rods, links, and bellcranks for cracks, breaks, and distortion. Replace defective parts.

(2) Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace defective parts.

(3) Inspect all pins for wear. Replace defective pins.

(4) Inspect all parts for good condition. Replace parts not in good condition.

c. Reassembly and Installation.

(1) Position the bellcranks (12 and 14, fig. 120) in the tailswing bracket. Install the bellcrank pin (15) and secure with a lockwasher (16) and cap screw (17). Hook the spring (13) in the bellcrank (14) and the deck channel.

(2) Position the adjustable rod (10) in the bellcrank (14) and secure with a pin (11) and cotter pin (5).

(3) Install the pivot rods (25) in the tailswing. Install the springs (26), castle nuts (27), and cotter pins (28) on the pivot rods.

(4) Position the bellcrank (23) on the pivot rods and secure with pins (24) and cotter pins (22).

(5) Position the brake reach rod (18) in the bellcranks (12 and 23) and secure with pins (11 and 24) and cotter pins (5 and 22).

(6) Position the reach rod (21) in the bellcrank (23) and secure with a pin (24) and cotter pin (22).

(7) Position the bellcrank (22, fig. 133) in the deck channel and secure with the pin (23) and cotter pins (2).

(8) Position the link (20) in the bellcrank (22) and secure with a pin (5) and a cotter pin (7).

(9) Position the reach rod (21, fig. 120) in the link (20, fig. 133) and secure with a pin (5) and cotter pin (7).

(10) Position the shifter yokes (3 and 4) on the clutch cone collars. Install the shifter pivot pins (1) and secure with cotter pins (2).

(11) Assemble the reach rods (6 and 11), the nut (10), and turnbuckle (9). Position the reach rods on the shifter yokes and secure with pins (5) and cotter pins (7).

(12) Assemble the reach rod (24), nut (18), and adjusting yoke end (17). Position the assembly on the shifter yoke (3) and bellcrank (22) and secure with pins (5) and cotter pins (7).

(13) Assemble the reach rod (19), nut (18), and adjusting yoke end (17). Position the reach rod (19) on the link (20) and secure with a pin (5) and cotter pin (7).

(14) Install the lever shaft (par. 203*c*(9)–(15)).

d. Adjustment.

(1) Disconnect the reach rod (21, fig. 120) from the link (20, fig. 133).

(2) Disconnect the reach rod (19) from the link (20).

(3) Disconnect the reach rod (24) from the bellcrank (22).

(4) Adjust the length of the reach rods (6 and 11) at the turnbuckle (9) for neutral position, neither clutch engaged, of the shifter yokes (3 and 4). Tighten the nut (10) against the turnbuckle when proper adjustment is made. Check operation of the shifter yokes so that when one yoke is fully engaged the other yoke is fully released.

(5) Keeping the shifter yokes in the neutral position, adjust the length of the reach rod (24) at the adjusting yoke end (17) and connect the yoke end to the bellcrank (22). Tighten the nut (18) against the yoke end when proper adjustment is made.

(6) Adjust the tension of the springs (16) at the eyebolts (15) to hold the hand lever (8) in the vertical, neutral, position.

(7) With the hand lever in vertical position and the link (20) at right angle to the deck channel, adjust the length of the reach rod (19) at the adjusting yoke end (17) to connect the reach rod to the link. Tighten the nut (18)

against the yoke end when proper adjustment is made.

(8) Adjust the boom hoist brake band (par. 198*e*).

(9) Adjust the castle nuts (27, fig. 120) to put equal tension on the springs (26) and to maintain a clearance of ¼-inch between the bellcranks (12 and 14). Be sure to install the cotter pins (28) when proper adjustment is made.

(10) Adjust the length of the reach rod (21) at the adjusting yoke end (19) to connect to the link (20, fig. 133). Tighten the nut (20, fig. 120) against the yoke end (19) when proper adjustment is made.

(11) Check operation of the independent boom hoist.

206. Front Drum Clutch Control

a. Removal and Disassembly.

(1) Pull a cotter pin (22, fig. 134) and remove a pin (11) and the reach rod (23) from the lever arm (21).

(2) From the top left side of the rotating base, remove the nuts (13), eyebolt (16), and spring (15) from the lever arm (14) and base.

(3) Loosen a jamnut (17) and setscrew (18) from the lever arm (14). Remove the lever arm from the lever shaft (19).

(4) Disconnect the reach rod from the horizontal intermediate shaft clutch hand lever (3, fig. 135).

(5) Loosen the jamnut and setscrew in the lever arm (2). Loosen the set collar (6). Loosen the nut and bolt in the crowd and front drum clutch hand lever (4).

(6) Remove the lever shaft (5) from the rotating base and deck channel and, at the same time, remove the lever arm (2) and a woodruff key, the horizontal intermediate

➡

1 Band anchor pin
2 Band pin
3 Pin, cotter, split, 3/16 x 1½
4 Control band
5 Pin, cotter, split, 5/32 x 1 (3 rqr)
6 Rod end
7 Nut, regular, hex, ⅝–11 NC
8 Sleeve nut
9 Pin
10 Rod end
11 Pin (2 rqr)
12 Woodruff key (3 rqr)
13 Nut, regular, hex, ⅜–16 NC (2 rqr)
14 Lever arm
15 Tension spring
16 Eyebolt
17 Jamnut, regular, hex, ⅜–16 NC (5 rqr)
18 Setscrew, sq hd, cup point, ⅜–16 NC x 1¼ (3 rqr)
19 Lever shaft
20 Hand lever
21 Lever arm
22 Pin, cotter, split, 3/32 x 1 (2 rqr)
23 Reach rod
24 Nut, regular, hex, ⅝–18 NF
25 Adjusting yoke end
26 Setscrew, sq hd, cup point, ⅜–16 NC x 1
27 Pivot pin
28 Lever arm
29 Setscrew, sq hd, cup point, ⅜–16 NC x 2

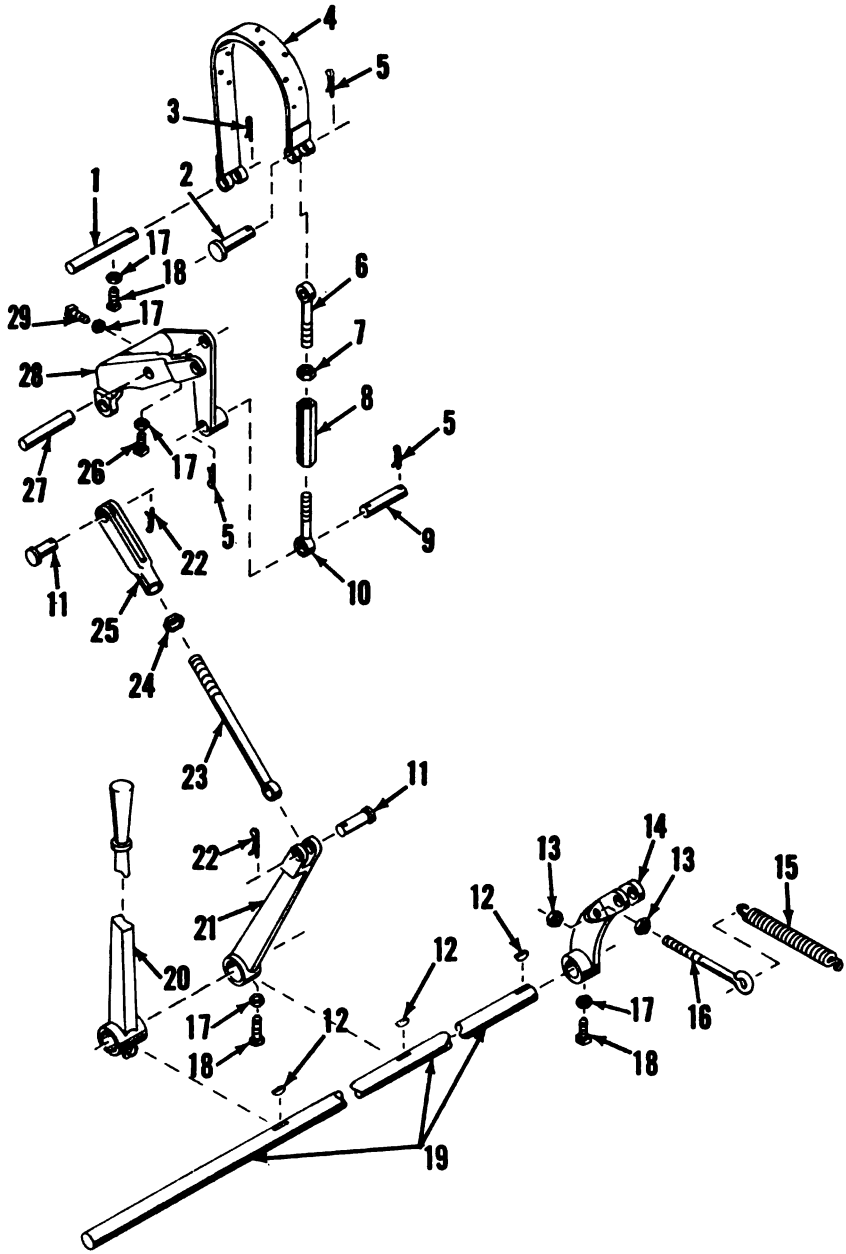
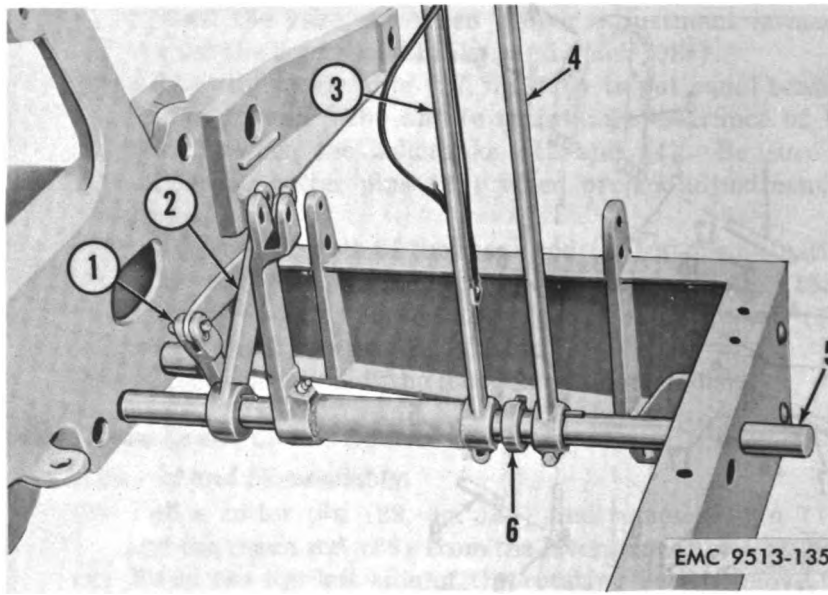


Figure 134. Front drum shaft clutch hand lever and linkage, exploded view.



1 Swing lock foot lever shaft arm
2 Lever arm
3 Horizontal intermediate shaft clutch hand lever
4 Crowd and front drum clutch hand lever
5 Lever shaft
6 Set collar

Figure 135. Horizontal intermediate shaft clutch hand lever and front drum clutch hand lever shaft, partly removed.

shaft clutch hand lever (3), the set collar (6), and the crowd and front drum clutch hand lever (4).

(7) Pull a cotter pin (22, fig. 134) and remove a pin (11) from the adjusting yoke end (25) and the lever arm (28).

(8) Pull the cotter pins (5) and remove the pin (9) from the rod end (10) and the lever arm (28).

(9) Remove the cotter pin (3) and the control band (4) from the band anchor pin (1). Remove the control band from the control wheel.

(10) Pull the cotter pin (5) and remove the band pin (2) from the control band (4) and the rod end (6).

(11) Remove the rod ends (6 and 10) and the nut (7) from the sleeve nut (8).

(12) Loosen a jamnut (17) and setscrew (18) from the rotating base and the band anchor pin (1). Remove the pin from the base.

(13) Loosen a jamnut (17) and setscrew (18) from the rotating base and the pivot pin (27). Remove the pivot pin and lever arm (28) from the rotating base.

b. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the lever shaft for wear, scoring, and damaged keyways. Replace a defective shaft.
(2) Inspect the hand lever, reach rod, and lever arms for cracks, breaks, and distortion. Replace any defective part.
(3) Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace defective parts.
(4) Inspect the control band lining for wear. Replace the control band assembly if the lining is worn to the rivet heads.
(5) Inspect all pins for wear. Replace defective pins.
(6) Inspect all parts for good condition. Replace parts not in good condition.

c. Reassembly and Installation.

(1) Position the lever arm (28, fig. 134) on the rotating base. Install the pivot pin (27) in the lever arm and base and secure with a jamnut (17) and setscrew (18).
(2) Install the band anchor pin (1) in the rotating base and secure with a jamnut (17) and setscrew (18).
(3) Install the rod ends (6 and 10) and the nut (7) in the sleeve nut (8).
(4) Install the rod end (6) in the control band (4) and secure with a band pin (2) and cotter pin (5).
(5) Position the control band (4) on the control wheel and install on the band anchor pin (1). Install the cotter pin (3) in the band anchor pin.
(6) Position the rod end (10) on the lever arm (28) and secure with the pin (9) and cotter pins (5).
(7) Install the lever shaft (5, fig. 135) in the deck channel. In sequence, install the crowd and front drum clutch hand lever (4), set collar (6), horizontal intermediate shaft clutch hand lever (3), and the lever arm (2).
(8) Continue the lever shaft into and across the rotating base. From the top left side of the rotating base, install a woodruff key (12, fig. 134) and the lever arm (14) on the lever shaft. Secure the lever arm with a jamnut (17) and setscrew (18).
(9) Install the eyebolt (16) and nut (13) on the lever arm (14). Hook the spring (15) in the eyebolt and rotating base.
(10) Install a woodruff key in the lever shaft (5, fig. 135)

Position the lever arm (2) on the key and secure with a jamnut (17, fig. 134) and setscrew (18).

(11) Install a woodruff key in the lever shaft. Position the crowd and front drum clutch hand lever (4, fig. 135) on the key and secure with the hand lever bolt and nut.

(12) Aline and connect the horizontal intermediate shaft clutch hand lever (3) to the reach rod (15, fig. 124). When alined, position the set collar (6, fig. 135) against the hand lever (3) and tighten on the lever shaft.

(13) Assemble the reach rod (23, fig. 134), nut (24), and adjusting yoke end (25). Attach the yoke end to the rear pin hole in the lever arm (28), using a pin (11) and cotter pin (22). Install the reach rod (23) in the lever arm (21) and secure with a pin (11) and cotter pin (22).

d. Adjustment (fig. 134).

(1) Adjust the length of the reach rod (23) at the adjusting yoke end (25) for the vertical position of the hand lever (20). Tighten the nut (24) against the yoke end when proper adjustment is made.

(2) Adjust the control band (4) by loosening the nut (7) and turning the sleeve nut (8). Do not tighten the control band any more than is necessary to keep the front drum clutch engaged while operating. Tighten the nut (7) against the sleeve nut when proper adjustment is completed.

(3) Adjust the jamnut (17) and setscrew (29) on the lever arm (28) so the control band will lock in easily.

207. Reverse Crowd Clutch Control

a. Removal and Disassembly (fig. 136).

(1) Pull the cotter pins (4) and remove the pins (9) from the reach rod (5) and rod end (8). Turn the reach rod, rod end, and nut (6) from the sleeve nut (7).

(2) Pull the cotter pins (4) and remove a pin (9) from the control band (1) and lever arm (12).

(3) Pull the cotter pin (10) from the anchor pin (13). Remove the control band from the anchor pin and control wheel.

➠

1 Control band
2 Jamnut, regular, hex, ⅛–13 NC (2 rqr)
3 Setscrew, sq hd, cup point, ⅛–13 NC x 1¼ (2 rqr)
4 Pin, cotter, split, 5/32 x 1 (6 rqr)
5 Reach rod
6 Nut, regular, hex, ⅝–18 NF
7 Sleeve nut
8 Rod end
9 Pin (3 rqr)
10 Pin, cotter, split, 3/16 x 1½ (2 rqr)
11 Pivot pin
12 Lever arm
13 Anchor pin

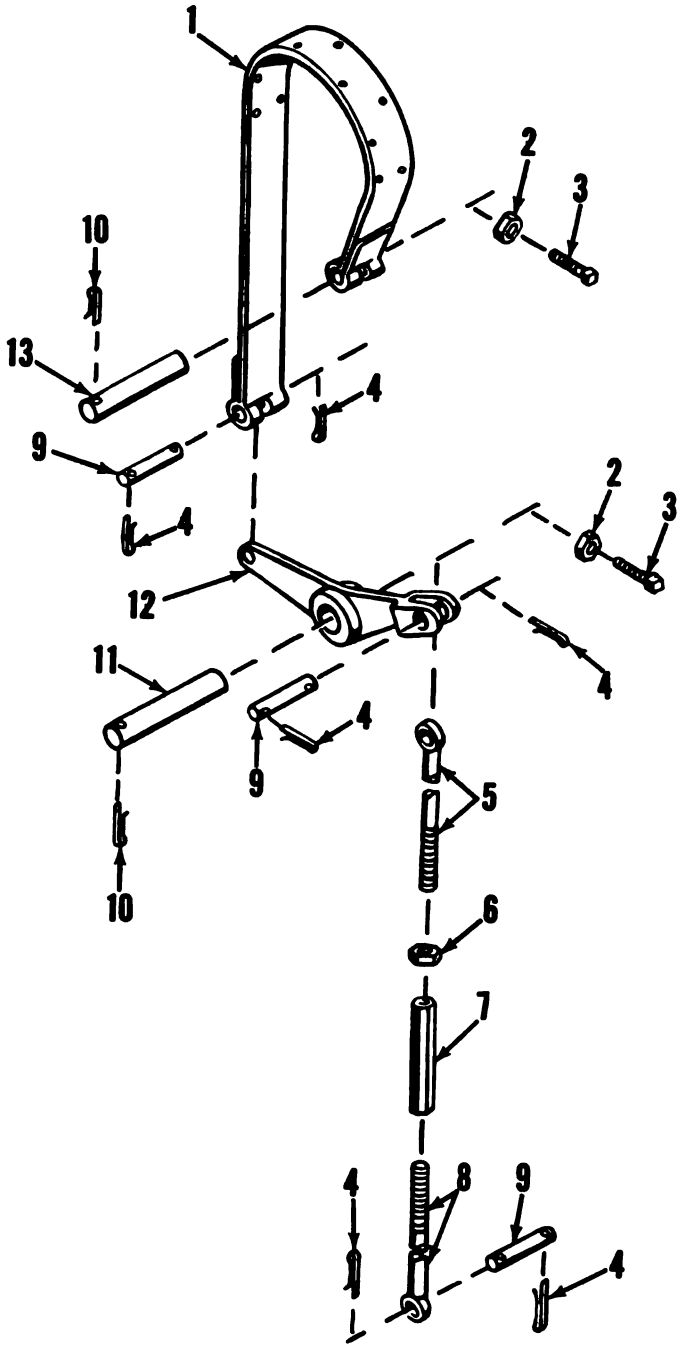


Figure 136. Reverse crowd clutch control.

(4) Remove a jamnut (2), a setscrew (3), and the anchor pin (13) from the lever bracket.

(5) Pull a cotter pin (10) and remove the lever arm (12) from the pivot pin (11).

(6) Remove a jamnut (2), a setscrew (3), and the pivot pin (11) from the lever bracket.

b. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the lever arm for cracks, breaks, or distortion. Replace a lever arm if defective.

(2) Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace defective parts.

(3) Inspect the control band lining for wear. Replace the control band assembly if the lining is worn to the rivet heads.

(4) Inspect all pins for wear. Replace defective pins.

(5) Inspect all parts for good condition. Replace parts not in good condition.

c. Reassembly and Installation.

(1) Install the pivot pin (11, fig. 136) in the lever bracket and secure with a jamnut (2) and setscrew (3).

(2) Install the anchor pin (13) in the lever bracket and secure with a jamnut (2) and setscrew (3).

(3) Install the lever arm (12) on the pivot pin (11) and secure with a cotter pin (10).

(4) Install the control band (1) on the control wheel and the anchor pin (13). Install a cotter pin (10) in the anchor pin.

(5) Assemble the reach rod (5), nut (6), rod end (8), and sleeve nut (7).

(6) Position the reach rod (5) in the lever arm (12) and secure with a pin (9) and cotter pins (4).

(7) Position the rod end (8) in the lever arm (14, fig. 134) and secure with a pin (9, fig. 136) and cotter pins (4).

d. Adjustment.

(1) Adjust the control band (1, fig. 136) by loosening the nut (6) and turning the sleeve nut (7). Do not tighten the control band any more than is necessary to keep the reverse crowd clutch engaged while operating. Tighten the nut (6) against the sleeve nut when proper adjustment is completed.

(2) Make sure that the adjusting yoke end (25, fig. 134) is

installed in the front pin hole on the lever arm (28) for shovel operation.

208. Horizontal Intermediate Shaft Clutch Control (fig. 137)

a. Removal and Disassembly.

(1) Remove the lever shaft (par. 206*a*(1)–(6)).

(2) Pull cotter pins (4) and remove the pin (16) from the lever arm (1) and rod end (5). Remove the rod ends (5) and nuts (6) from the reach rod (11).

(3) Pull the cotter pins (4) and remove the pins (3) from the lever arms (1 and 8) and the rod ends (5). Remove the rod ends (5) from the reach rod (7).

(4) Pull the cotter pins (9) and remove the pins (2) from the lever arm brackets and lever arms (1 and 8). Remove the lever arms from the clutch shifters.

b. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the hand lever, reach rods, and lever arms for cracks, breaks, and distortion. Replace defective parts.

(2) Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace defective parts.

(3) Inspect all pins for wear. Replace defective pins.

(4) Inspect all parts for good condition. Replace parts not in good condition.

c. Reassembly and Installation.

(1) Position the lever arms (1 and 8) on the clutch shifters and lever arm brackets. Install the pins (2) and cotter pins (9).

(2) Assemble the rod ends (5), nuts (6), and reach rod (7). Attach the rod ends to the lever arms (1 and 8), using pins (3) and cotter pins (4).

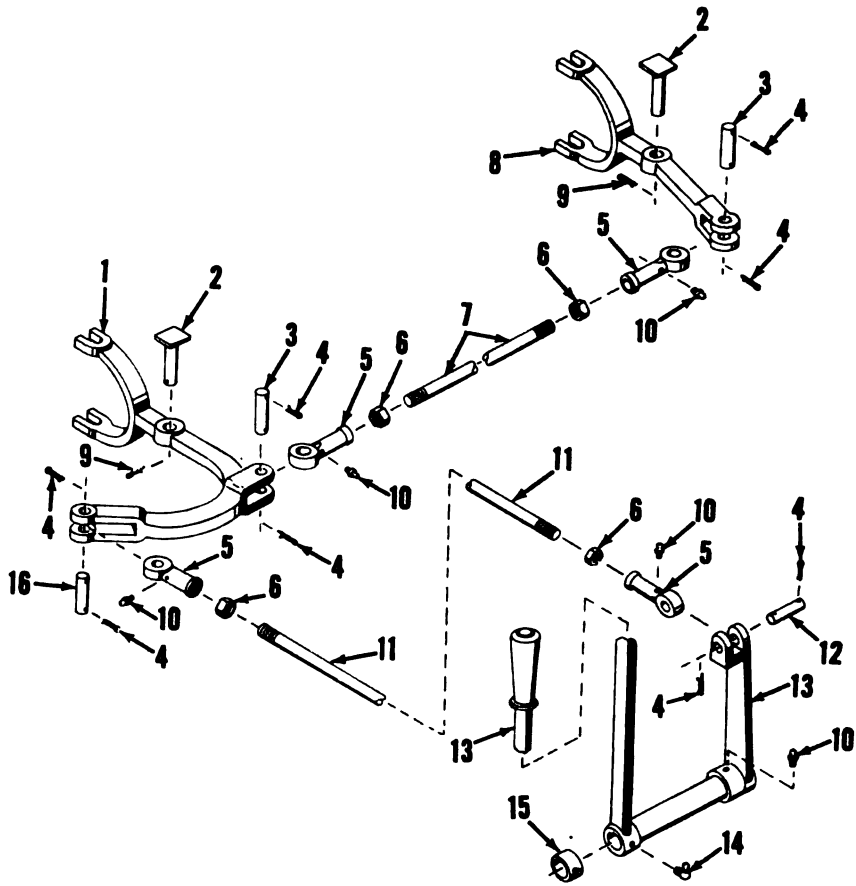
(3) Assemble the rod ends (5), nuts (6), and reach rod (11). Attach a rod end (5) to the lever arm (1), using pin (16) and cotter pins (4).

(4) Install the lever shaft (par. 206*c*(7)–(13)).

d. Adjustment.

(1) Adjust the crowd and front drum clutch hand lever (par. 206*d*).

(2) Adjust the length of the reach rod (7) at the rod ends (5) so that the clutch needle bearings just contact the slight vertical rise on each tapered shifter key. Tighten



1	Lever arm, rh	9	Pin, cotter, split, 5/32 x 1⅛ (2 rqr)
2	Pin (2 rqr)	10	Lubrication fitting, ⅛ straight (4 rqr)
3	Pin (2 rqr)	11	Reach rod
4	Pin, cotter, split, 5/32 x 1 (8 rqr)	12	Pin
5	Rod end (4 rqr)	13	Hand lever
6	Nut, regular, hex, ⅝–18 NF (4 rqr)	14	Lubrication fitting, ⅛ x 90°
7	Reach rod	15	Collar, set, std, 1¼
8	Lever arm, lh	16	Pin

Figure 137. Horizontal intermediate shaft clutch hand lever and linkage, exploded view.

the nuts (6) against the rod ends (5) after proper adjustment is made.

(3) Adjust the vertical position of the hand lever (13) only after the adjustment in (2) above is made. Adjust the length of the reach rod (11) at the rod ends (5) so that the hand lever is in the vertical, neutral, position.

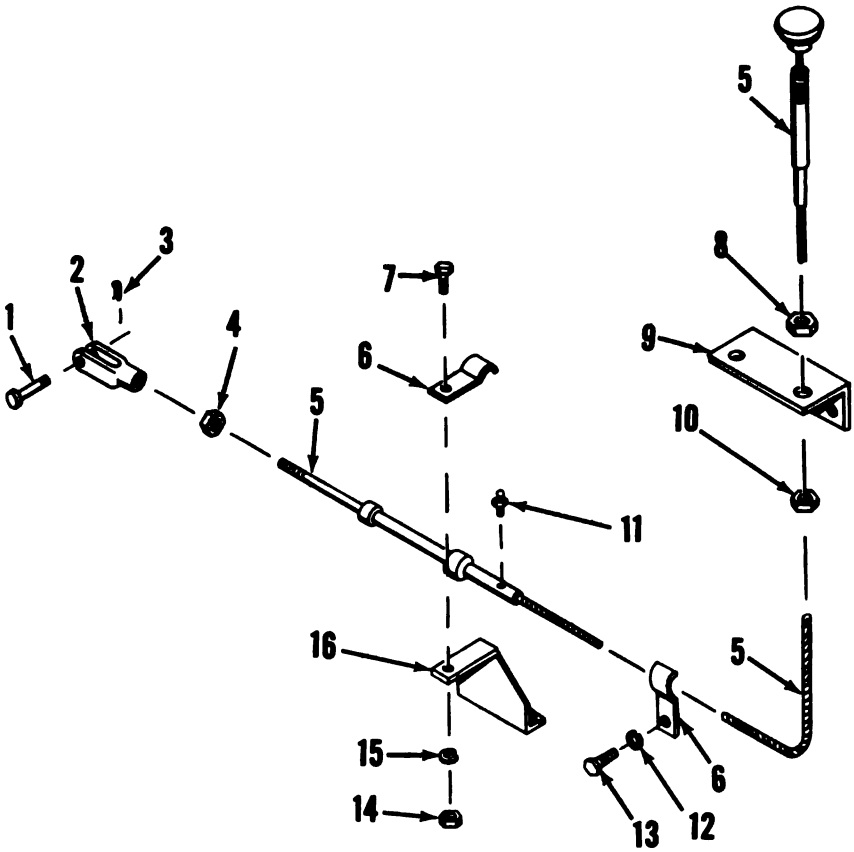
Tighten the nuts (6) against the rod ends (5) after proper adjustment is made.

209. Starter Controls

a. Revolving Frame (fig. 138).

(1) *Removal.*

(*a*) Pull the cotter pin (3) and remove the pin (1) from the adjusting yoke end (2) and the starter lever.



EMC 9513-138

1 Pin
2 Adjusting yoke end
3 Pin, cotter, split, 1/16 x 7/16
4 Nut, regular, hex, 1/4–28 NF
5 Flexible control
6 Clamp, cable, 1/4 (6 rqr)
7 Screw, cap, hex hd, 5/16–18 NC x 1 1/2
8 Nut
9 Bracket
10 Nut
11 Lubrication fitting, 1/8 straight
12 Lockwasher, spring, std, 3/8 (5 rqr)
13 Screw, cap, hex hd, 3/8–16 NC x 1 (5 rqr)
14 Nut, regular, hex, 5/16–18 NC
15 Lockwasher, spring, std, 5/16
16 Starter bracket

Figure 138. Revolving frame engine starter control and linkage, exploded view.

(*b*) Remove the adjusting yoke end and the nut (4) from the flexible control (5).

(*c*) Remove the nut (14), lockwasher (15), screw (7), and clamp (6) from the starter bracket (16).

(*d*) Remove the screws (13), lockwashers (12), and clamps (6) from the flexible control and rotating base.

(*e*) Remove the hand knob and nut (8) from the end of the flexible control cable (5). Pull the length of the control down through the cable bracket (9). Remove the nut (10).

(2) *Inspection and Repair.* Soak and wash all parts in an approved cleaning solvent and blow them dry with clean, compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(*a*) Inspect the adjusting yoke end, flexible control, cable clamps, bracket, lubrication fitting, and starter bracket for cracks, breaks, and distortion. Replace defective parts.

(*b*) Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace defective parts.

(*c*) Inspect all pins for wear or damage. Replace defective pins.

(*d*) Inspect all parts for good condition. Replace parts not in good condition.

(3) *Installation.*

(*a*) Install the nut (10) on the handle sleeve. Insert the end of the flexible control (5) up through the cable bracket. Install the nut (8) on the sleeve and against the bracket (9). Install the hand knob on the sleeve.

(*b*) Position the flexible control (5) along the rotating base and install the cable clamps (6) with lockwashers (12) and screws (13).

(*c*) Position the flexible control on the starter bracket (16) and secure with a cable clamp (6), screw (7), lockwasher (15), and nut (14).

(*d*) Assemble the nut (4) and adjusting yoke end (2) on the flexible control (5).

(*e*) Install the yoke end on the starter lever and secure with the pin (1) and cotter pin (3).

(4) *Adjustment.* Adjust the length of the flexible control (5) at the adjusting yoke end (2) so that the starter is fully engaged when the handle of the flexible control is

raised. Tighten the nut (4) against the yoke end after proper adjustment is made.

b. Carrier (fig. 139).

(1) *Removal.*

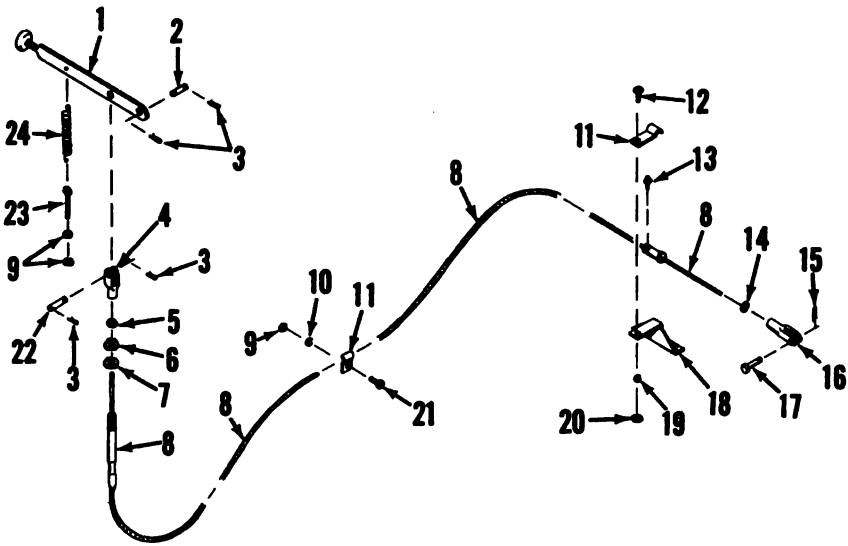
(*a*) Unhook the spring (24) from the lever (1) and eyebolt (23). Remove the nuts (9) and eyebolt from the floorplate.

(*b*) Pull the cotter pins (3) and remove the pin (2) from the floorplate bracket and the lever (1).

(*c*) Pull the cotter pins (3) and remove the pin (22) from the adjusting yoke end (4) and the lever (1).

(*d*) Remove the yoke end and nuts (5 and 6) from the flexible control (8).

(*e*) Remove the nuts (9), lockwashers (10), screws (21).



EMC 9513-139

1	Lever
2	Pin
3	Pin, cotter, split, 3/32 x 5/8 (4 rqr)
4	Adjusting yoke end
5	Nut, regular, hex, 3/8–24 NF
6	Nut
7	Nut
8	Flexible control
9	Nut, regular, hex, 3/8–16 NC (5 rqr)
10	Lockwasher, spring, std, 3/8 (3 rqr)
11	Clamp, cable, 1/4 (3 rqr)
12	Screw, cap, hex hd, 5/16–18 NC x 1 1/2
13	Lubrication fitting, 1/8 straight
14	Nut, regular, hex, 1/4–28 NF
15	Pin, cotter, split, 1/16 x 7/16
16	Adjusting yoke end
17	Pin
18	Starter bracket
19	Lockwasher, spring, std, 5/16
20	Nut, regular, hex, 5/16–18 NC
21	Screw, cap, hex hd, 3/8–16 NC x 1 1/4 (3 rqr)
22	Pin
23	Eyebolt
24	Spring

Figure 139. Carrier engine starter control and linkage, exploded view.

and cable clamps (11) from the flexible control and carrier frame.

(*f*) Remove the nut (20), lockwasher (19), screw (12), cable clamp (11), and the flexible control (8) from the starter bracket (18).

(*g*) Pull the cotter pin (15) and remove the pin (17) from the adjusting yoke end (16) and the starter lever.

(*h*) Remove the adjusting yoke end and the nut (14) from the flexible control. Remove the nut (7) from the opposite end of the control.

(*i*) Remove the flexible control from the carrier.

(2) *Inspection and Repair.* Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(*a*) Inspect the adjusting yoke ends, flexible control, cable clamps, lubrication fittings, lever, spring, and starter bracket for cracks, breaks, and distortion. Replace defective parts.

(*b*) Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace defective parts.

(*c*) Inspect all pins for wear or damage. Replace defective pins.

(*d*) Inspect all parts for good condition. Replace parts not in good condition.

(3) *Installation.*

(*a*) Assemble the nut (14) and adjusting yoke end (16) on the flexible control (8). Install the nut (7) on the opposite end of the control.

(*b*) Position the adjusting yoke end on the starter lever and secure with the pin (17) and cotter pin (15).

(*c*) Position the flexible control (8) on the starter bracket (18) and secure with a cable clamp (11), screw (12), lockwasher (19), and nut (20).

(*d*) Position the flexible control along the carrier frame and secure with cable clamps (11), screws (21), lockwashers (10), and nuts (9).

(*e*) Insert the end of the flexible control through the floorplate. Install the nut (6). Tighten the nuts (6 and 7) against the floorplate. Assemble the nut (5) and adjusting yoke end (4) on the flexible control.

(*f*) Install the pin (2) in the floorplate bracket and lever (1) and secure with cotter pins (3).

(*g*) Install the pin (22) in the adjusting yoke end (4) and the lever (1) and secure with cotter pins (3).

(*h*) Attach the eyebolt (23) to the floorplate with nuts (9). Hook the spring (24) in the eyebolt and in the lever (1).

(4) *Adjustment.* Adjust the length of the flexible control (8) at the adjusting yoke ends (4 and 16) so that the starter is fully engaged when the lever (1) is pulled up. Tighten the nuts (14 and 5) against the yoke ends after proper adjustment is made.

210. Clutch Controls

a. Revolving Frame (fig. 140).

(1) *Removal and Disassembly.*

(*a*) Pull a cotter pin (9) and remove a pin (1) from the adjusting yoke end (4) and hand lever (14).

(*b*) Pull a cotter pin (9) and remove a pin (1) from the reach rod (13) and bellcrank (12).

(*c*) Remove the reach rod. Remove the adjusting yoke end (4) and nut (3) from the reach rod.

(*d*) Pull the cotter pin (15) and remove the hand lever (14) from the pin (16).

(*e*) Remove the setscrew (6) and jamnut (7). Remove the pin (16) from the rotating base.

(*f*) Pull a cotter pin (9) and remove a pin (1) from the adjusting yoke end (4) and the lever arm (5).

(*g*) Pull a cotter pin (9) and remove a pin (1) from the reach rod (2) and bellcrank (12).

(*h*) Remove the reach rod. Remove the adjusting yoke end (4) and nut (3) from the reach rod.

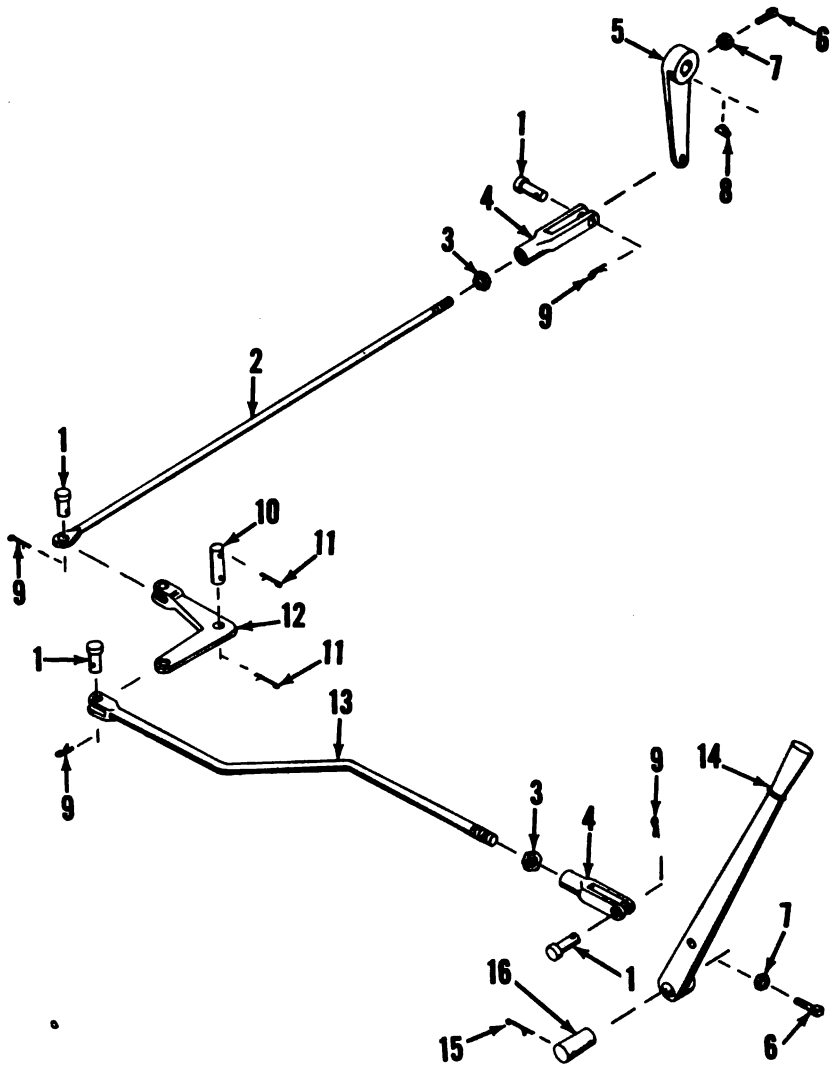
(*i*) Remove a setscrew (6) and jamnut (7) from the lever arm (5). Remove the lever arm and woodruff key (8) from the clutch yoke shaft.

(*j*) Pull the cotter pins (11). Remove the pin (10) and bellcrank (12) from the engine and radiator support.

(2) *Inspection and Repair.* Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(*a*) Inspect the hand lever, reach rods, lever arm, and bellcrank for cracks, breaks, and distortion. Replace all defective parts.

(*b*) Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace all defective parts.



1	Pin (4 rqr)	8	Woodruff key
2	Reach rod	9	Pin, cotter, split, $^{3}/_{32}$ x 1 (4 rqr)
3	Nut, regular, hex, $^{5}/_{8}$–18 NF (2 rqr)	10	Pin
4	Adjusting yoke end (2 rqr)	11	Pin, cotter, split, $^{3}/_{32}$ x 1¼ (2 rqr)
5	Lever arm	12	Bellcrank
6	Setscrew, sq hd, cup point, $^{3}/_{8}$–16 NC x 1 (2 rqr)	13	Reach rod
7	Jamnut, regular, hex, $^{3}/_{8}$–16 NC (2 rqr)	14	Hand lever
		15	Pin, cotter, split, $^{1}/_{16}$ x 1½
		16	Pin

Figure 140. Revolving frame engine clutch hand lever and linkage, exploded view.

(*c*) Inspect all pins for wear. Replace defective pins.

(*d*) Inspect all parts for good condition. Replace parts not in good condition.

(3) *Reassembly and Installation.*

(*a*) Position the bellcrank (12) in the engine and radiator support and secure with the pin (10) and cotter pins (11).

(*b*) Install the woodruff key (8) and lever arm (5) on the clutch yoke shaft. Tighten the setscrew (6) and jamnut (7) in the lever arm.

(*c*) Assemble a nut (3) and adjusting yoke end (4) on the reach rod (2).

(*d*) Position the reach rod assembly on the bellcrank (12) and lever arm (5) and secure with pins (1) and cotter pins (9).

(*e*) Install the pin (16) in the rotating base and secure with a jamnut (7) and setscrew (6).

(*f*) Position the hand lever (14) on the pin (16) and secure with a cotter pin (15).

(*g*) Assemble a nut (3) and adjusting yoke end (4) on the reach rod (13).

(*h*) Position the reach rod assembly on the bellcrank (12) and hand lever (14) and secure with pins (1) and cotter pins (9).

(4) *Adjustment.*

(*a*) Adjust the length of the reach rod (13) at the adjusting yoke end (4) for the desired position of the hand lever (14). Tighten the nut (3) against the yoke end when proper adjustment is made.

(*b*) Adjust the length of the reach rod (2) at the adjusting yoke end (4) so that the operating position of the hand lever corresponds with the operating position of the clutch yoke. Tighten the nut (3) against the yoke end when proper adjustment is made.

b. Carrier (fig. 141).

(1) *Removal and Disassembly.*

(*a*) Unhook the pedal return spring (18) from the rear lever arm (17) and the carrier frame.

(*b*) Pull the cotter pins (13) and remove the end pins (12) from the adjusting yoke ends (16). Lift out the reach rod (14).

(*c*) Loosen the jamnut (10) and setscrew (11) in the rear lever arm (17). Pull the arm from the woodruff key (7) and the clutch yoke shaft.

(*d*) Loosen the jamnut (10) and setscrew (11) in the

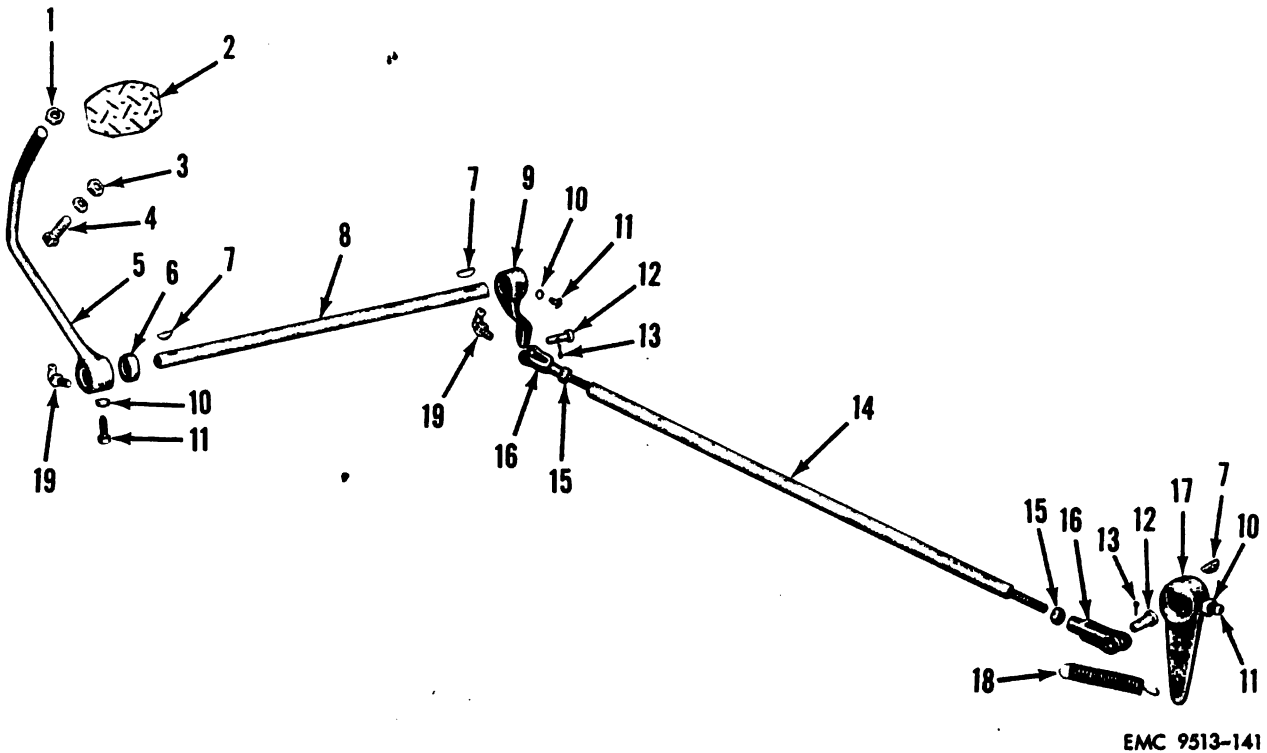


Figure 141. Carrier engine clutch foot lever and linkage, exploded view.

front lever arm (9). Pull the arm from the woodruff key (7) and the shifter shaft (8).

(*e*) Loosen the screw in the set collar (6). Loosen the jamnut (10) and setscrew (11) in the foot lever (5). Drive the shaft through the foot lever and the shaft brackets. Remove the foot lever.

(*f*) Pull off the set collar and remove the shifter shaft (8) from the shaft brackets. Loosen the jamnut (1) and turn off the accelerator pedal (2) from the foot lever (5).

(2) *Inspection and Repair.* Soak and wash all parts in an an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(*a*) Inspect the foot lever, reach rod, shifter shaft, and lever arms for cracks, breaks, and distortion. Replace all defective parts.

(*b*) Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace all defective parts.

(*c*) Inspect all pins for wear. Replace defective pins.

(*d*) Inspect all parts for good condition. Replace parts not in good condition.

(3) *Reassembly and Installation.*

(*a*) Start the shifter shaft (8) through the left shaft bracket. Position the set collar (6) on the end of the shaft and continue the shaft through the right shaft bracket.

(*b*) Install a woodruff key (7) in the shifter shaft (8) and install the foot lever (5) on the shaft and key. Secure the foot lever by tightening the setscrew (11) and jamnut (10). Swing the end of the foot lever up through the floorplate. Turn the accelerator pedal

←

1 Jamnut, regular, hex, ¾–16 NF
2 Accelerator pedal
3 Nut, regular, hex, ⅜–16 NC (2 rqr)
4 Setscrew, sq hd, cup point, ⅜–16 NC x 1¾
5 Foot lever
6 Collar, set, std, 1
7 Woodruff key (3 rqr)
8 Shifter shaft
9 Front lever arm
10 Jamnut, regular, hex, ⅜–16 NC (3 rqr)
11 Setscrew, sq hd, cup point, ⅜–16 NC x 1 (3 rqr)
12 End pin (2 rqr)
13 Pin, cotter, split, ⅛ x ⅞ (2 rqr)
14 Reach rod
15 Jamnut, regular, hex, ½–20 NF (2 rqr)
16 Adjusting yoke end (2 rqr)
17 Rear lever arm
18 Pedal return spring
19 Lubrication fitting, ⅛ x 90° (2 rqr)

(2) on the foot lever and secure by tightening the jamnut (1) against the pedal.

(*c*) Install a woodruff key (7) in the other end of the shifter shaft (8). Drive the front lever arm (9) on the shaft and key and secure by tightening the setscrew (11) and jamnut (10).

(*d*) Install a woodruff key (7) in the clutch yoke shaft. Install the rear lever arm (17) on the shaft and key and secure by tightening the setscrew (11) and jamnut (10).

(*e*) Install a jamnut (15) and an adjusting yoke end on each end of the reach rod (14). Install an end pin (12) through each yoke end and lever arm and secure with cotter pins (13).

(*f*) Hook the pedal return spring (18) in the rear lever arm (17) and in the carrier frame.

(4) *Adjustment.*

(*a*) Remove the cotter pins (13) and end pins (12).

(*b*) Loosen the jamnuts (15) and turn the adjusting yoke ends (16) as required to obtain proper free travel of the foot lever (5) before the clutch starts to release. Adjust to 2 inches free travel.

(*c*) Tighten the jamnuts (15) and reinstall the end pins (12) and cotter pins (13).

(*d*) Adjust the nuts (3) and setscrew (4) as a stop for the foot lever.

211. Accelerator Control

a. General. The throttle lever (3, fig. 85) transmits the action of the accelerator pedal (8, fig. 83) and reach rod (12) to the carrier engine carburetor throttle valve by the reach rod (1, fig. 85), levers (13), throttle shaft (14), and reach rod (25, fig. 83). The tension spring (11, fig. 85) returns the accelerator pedal to the idle position of the engine carburetor throttle valve.

b. Removal and Disassembly (fig. 83).

(1) Loosen the machine screw (14) and pull the throttle control block (15) from the end of the throttle control (6). Remove the stove bolts (7) and nuts fastening the wire clamp (11) to the throttle lever (13).

(2) Unhook the tension spring (16) from the throttle lever (13) and the carrier frame.

(3) Pull a cotter pin (1) and remove the reach rod (12) from the throttle lever (13), toeboard, and accelerator pedal (8).

(4) Pull cotter pins (1) and remove the reach rod (19) from the throttle lever and the lever (20).
(5) Pull cotter pins (1) and remove the reach rod (25) from the carburetor and the lever (20).
(6) Remove the nuts (21), lockwashers (22), and screws (24) from the levers (20). Remove the levers from the throttle shaft (23). Remove the throttle shaft from the support brackets.
(7) Remove the nuts (18), lockwashers (17), and carriage bolts (10) from the throttle lever (13) and the toeboard. Remove the throttle lever.
(8) Remove the nuts, lockwashers (9), and stove bolts (7) from the accelerator pedal (8) and the toeboard. Remove the accelerator pedal.

c. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the throttle lever, reach rods, throttle shaft, and levers for cracks, breaks, and distortion. Replace all defective parts.
(2) Inspect all parts for good condition. Replace parts not in good condition.

d. Reassembly and Installation (fig. 83).

(1) Position the accelerator pedal (8) on the toeboard and secure with stove bolts (7), lockwashers (9), and nuts.
(2) Position the throttle lever (13) under the toeboard and secure with carriage bolts (10), lockwashers (17), and nuts (18).
(3) Install the throttle shaft (23) in the support brackets. Install the levers (20) on the throttle shaft and secure with the screws (24), lockwashers (22), and nuts (21).
(4) Install the reach rod (25) in the carburetor throttle valve lever and the lever (20) and secure with cotter pins (1).
(5) Install the reach rod (19) in the throttle lever (13) and lever (20) and secure with cotter pins (1).
(6) Insert the reach rod (12) through the toeboard and against the accelerator pedal (8). Install the reach rod (12) in the throttle lever (13) and secure with a cotter pin (1).
(7) Hook the tension spring (16) in the throttle lever (13) and in the carrier frame.
(8) Thread the wire end of the throttle control (6) through the throttle lever and secure by attaching the throttle

control block (15) with machine screw (14). Clamp the throttle control cable to the throttle lever (13) with the wire clamp (11), stove bolts (7), and nuts. Do not crush the cable with the clamp.

e. Adjustment (fig. 83).

(1) Remove the reach rods (19 and 25) from the levers (20).

(2) Adjust the engine carburetor idling speed.

(3) Without disturbing the set position of either carburetor throttle lever or the throttle lever (13), reposition the levers (20) on the throttle shaft (23) to meet the reach rods (19 and 25). Secure the rods with cotter pins (1). Make sure the nuts (21) and screws (24) are tight in the levers (20) after proper adjustment is made.

(4) If necessary, reposition the throttle control block (15) against the throttle lever (13).

212. Footbrake Treadle Linkage
(fig. 142)

a. General. A connecting link (5) connects the footbrake treadle with the levers (8 and 14), lever shaft (13), and reach rod (17). The reach rod is connected by a pin (6) and cotter pin (7) to the emergency brake hand lever. When the emergency brake hand lever is pulled back to set the emergency brake, the footbrake treadle is depressed and sets the service brakes.

b. Removal and Disassembly.

(1) Pull a cotter pin (7) and remove a pin (6) from the reach rod (17) and the emergency brake hand lever.

(2) Pull a cotter pin (7) and remove a pin (6) from the adjusting yoke end (15) and the lever (14). Remove the reach rod.

(3) Pull the cotter pins (3) and remove the pin (4) from the bracket (2) and connecting link (5).

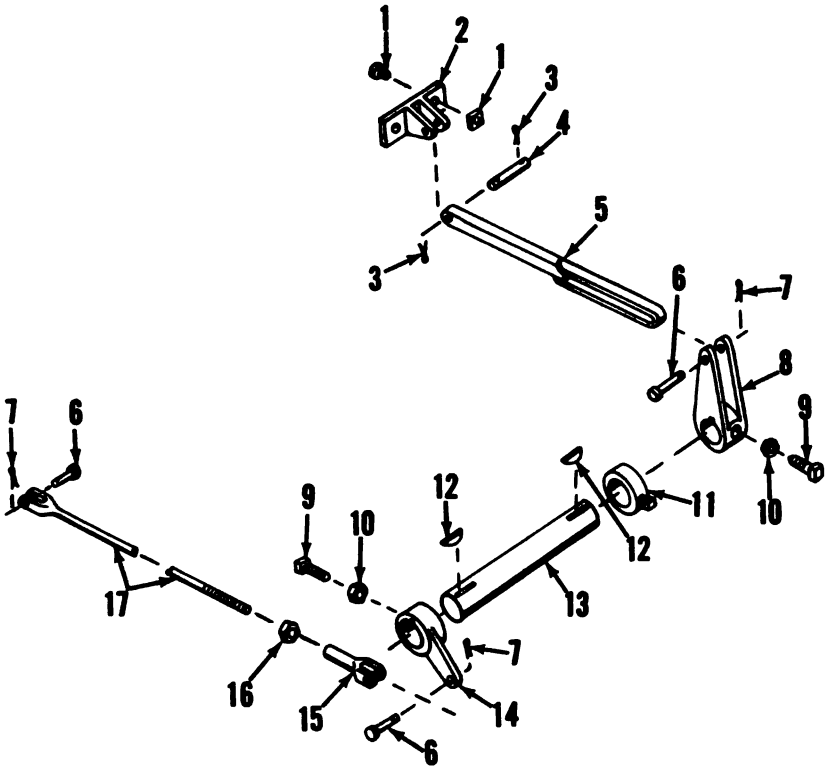
(4) Remove the stove bolts and square nuts (1) from the bracket (2) and foot brake treadle. Remove the bracket.

(5) Pull a cotter pin (7) and remove a pin (6) from the lever (8) and the connecting link (5). Remove the connecting link.

(6) Loosen the jamnuts (10) and setscrews (9) and remove the levers (8 and 14) and the woodruff keys (12) from the lever shaft (13).

(7) Loosen the set collar (11). Remove the lever shaft (13) and set collar from the carrier brackets.

c. Inspection and Repair. Soak and wash all parts in an ap-



1 Bolt, stove: steel; rd hd; w/sq nut; 3/16 x 5/8 (2 rqr)
2 Bracket
3 Pin, cotter, split, 1/16 x 7/16 (2 rqr)
4 Pin
5 Connecting link
6 Pin (3 rqr)
7 Pin, cotter, split, 3/32 x 5/8 (3 rqr)
8 Lever
9 Setscrew, sq hd, cup point, 3/8–16 NC x 1 (2 rqr)
10 Jamnut, regular, hex, 3/8–16 NC (2 rqr)
11 Collar, set, std, 1
12 Woodruff key (2 rqr)
13 Lever shaft
14 Lever
15 Adjusting yoke end
16 Nut, regular, hex, 3/8–24 NF
17 Reach rod

Figure 142. Foot brake treadle linkage,—exploded view.

proved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the bracket, connecting link, levers, lever shaft, and reach rod for cracks, breaks, and distortion. Replace a bracket, connecting link, lever, lever shaft, or reach rod if cracked, broken or distorted. Replace a lever shaft having a damaged keyway.

(2) Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace all defective parts.

(3) Inspect all pins for wear. Replace worn pins.
(4) Inspect all parts for good condition. Replace parts not in good condition.

d. Reassembly and Installation.

(1) Insert the lever shaft (13) through one carrier bracket, install the set collar (11) on the shaft, and continue the shaft through the opposite bracket. Position and tighten the set collar.
(2) Install the woodruff keys (12) in the lever shaft (13). Position the levers (8 and 14) on the key and lever shaft and secure with jamnuts (10) and setscrews (9).
(3) Position the bracket (2) on the foot brake treadle and secure with stove bolts and nuts (1).
(4) Install the connecting link (5) in the bracket (2) and secure with the pin (4) and cotter pins (3).
(5) Install the connecting link (5) in the lever (8) and secure with a pin (6) and cotter pin (7).
(6) Assemble the reach rod (17), nut (16), and adjusting yoke end (15). Install the adjusting yoke end on the lever (14) and secure with a pin (6) and cotter pin (7).

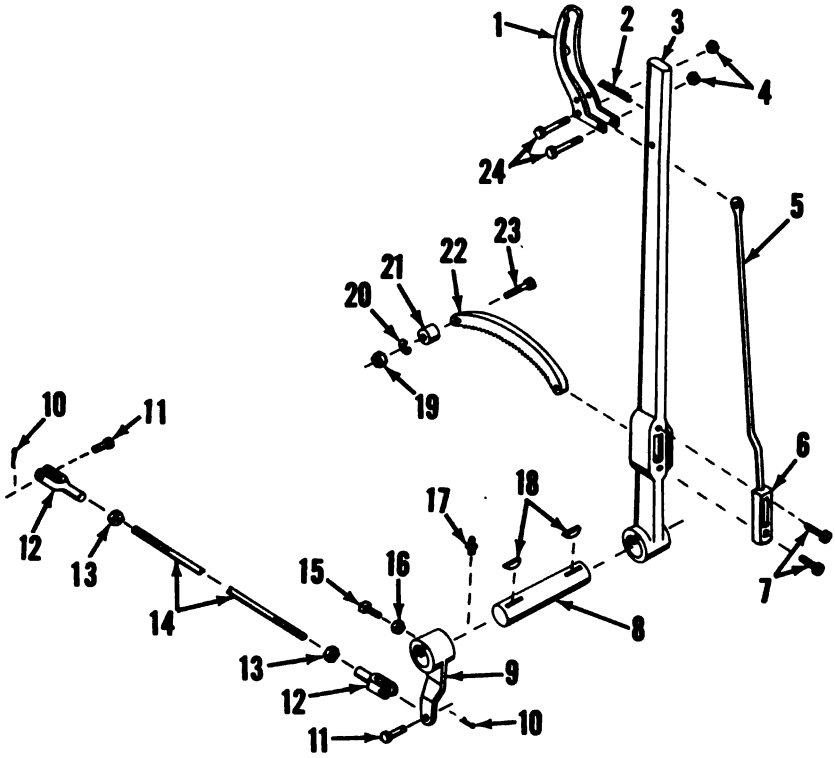
e. Adjustment. Adjust the length of the reach rod (17) at the adjusting yoke end (15) so that, when the emergency brake hand lever is set, the distance from the floor plate to the underside of the footbrake treadle will be $3\frac{15}{32}$ inches. Tighten the nut (16) against the yoke end after proper adjustment is made.

213. Emergency Brake Hand Lever and Linkage (fig. 143)

a. General. In addition to actuating the emergency brake assembly in back of the transfer case, the emergency brake hand lever is connected by a reach rod, shaft, levers, and a connecting link to the footbrake treadle. When the hand lever is pulled back to set the emergency brake, the footbrake treadle is depressed and sets the service brakes.

b. Removal and Disassembly.

(1) Pull a cotter pin (10) and remove a pin (11) and the adjusting yoke end (12) from the emergency brake cross-shaft lever.
(2) Pull a cotter pin (10) and remove a pin (11) and the adjusting yoke end (12) from the lever arm (9). Remove the reach rod (14). Remove the yoke ends (12) and nuts (13) from the reach rod.
(3) Disconnect the footbrake treadle reach rod from the side of the hand lever (3).
(4) Remove the nuts (19), lockwashers (20), pipe spacers



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1	Grip latch	15	Setscrew, sq hd, cup point, ⅜–16 NC x 1¾
2	Latch spring	16	Jamnut, regular, hex, ⅜–16 NC
3	Hand lever	17	Lubrication fitting, ⅛ straight
4	Nut (2 rqr)	18	Woodruff key (2 rqr)
5	Rod end connector	19	Nut, regular, hex, ⅜–16 NC (2 rqr)
6	Rod and pawl	20	Lockwasher, spring, std, ⅜ (2 rqr)
7	Pawl screw (2 rqr)	21	Spacer, pipe, std, ⅜ x ⅝ long (2 rqr)
8	Shaft	22	Ratchet
9	Lever arm	23	Screw, cap, hex hd, ⅜–16 NC x 2¼ (2 rqr)
10	Pin, cotter, split, ⅛ x ⅞ (2 rqr)	24	Latch screw (2 rqr)
11	Pins (2 rqr)		
12	Adjusting yoke end (2 rqr)		
13	Nut, regular, hex, ½–20 NF (2 rqr)		
14	Reach rod		

Figure 143. Emergency brake hand lever and linkage, exploded view.

(21), and screws (23) from the carrier frame and ratchet (22). Remove the ratchet.

(5) Loosen the jamnut (16) and setscrew (15) from the lever arm (9). Remove the lever arm and woodruff key (18) from the shaft (8).

(6) Remove the shaft (8) and woodruff key (18) from the hand lever and carrier frame.

(7) To disassemble the hand lever, remove the nuts (4), latch screws (24), latch spring (2), and the grip latch (1). Remove the pawl screws (7).

c. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the hand lever, ratchet, shaft, lever arm, and reach rod for cracks, breaks, and distortion. Replace all defective parts.

(2) Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace all defective parts.

(3) Inspect all pins for wear. Replace defective pins.

(4) Inspect all parts for good condition. Replace parts not in good condition.

d. Reassembly and Installation.

(1) Secure the rod and pawl (6) to the hand lever (3) with the pawl screws (7). Attach the grip latch (1), latch spring (2), and the rod and pawl to the hand lever with the latch screws (24) and nuts (4).

(2) Position the hand lever (3) in the cab deck plate. Install a woodruff key (18) in the shaft (8). Install the shaft and key in the hand lever (3).

(3) Install a woodruff key (18) and the lever arm (9) on the shaft (8). Secure the lever arm by tightening the setscrew (15) and jamnut (16).

(4) Insert the ratchet (22) through the hand lever. Install and secure the ratchet to the carrier frame with screws (23), pipe spacers (21), lockwashers (20), and nuts (19).

(5) Assemble the reach rod (14), nuts (13), and adjusting yoke ends (12). Attach the yoke ends to the emergency brake cross-shaft lever and the lever arm (9) and secure with pins (11) and cotter pins (10).

(6) Secure the footbrake treadle reach rod to the side of the hand lever (3) with a pin and cotter pin.

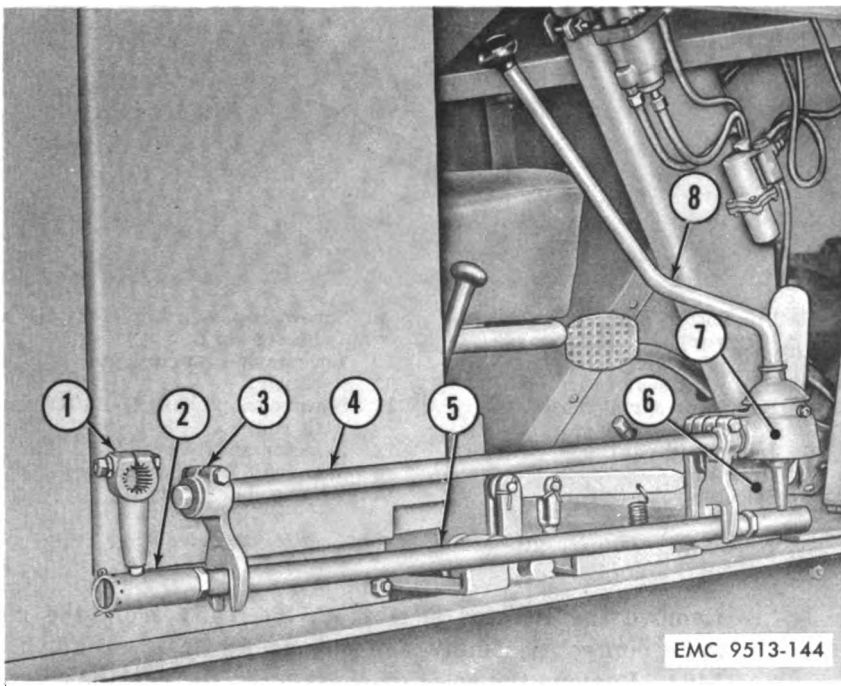
e. Adjustment.

(1) Adjust the length of the reach rod (14) at the adjusting yoke ends (12) so that the full forward position of the hand lever (3) corresponds to the fully released position of the emergency brake assembly. Tighten the nuts (13) against the yoke ends when proper adjustment is made.

(2) Adjust the footbrake treadle linkage (par. 212*e*).

214. Transmission Gearshift Lever and Linkage

a. General (fig. 144). The appropriate transmission gear ratio is selected by moving the gearshift lever (8) mounted on its bracket (6). The movement is transferred by the drag link (5) to the outer shift lever (1) of the control assembly on top of the transmission. The remote control assembly performs the actual shifting of the gears. Selector yokes (3) on the selector shaft (4) at the gearshift lever housing (7) and at the remote control aline the drag link during operation.



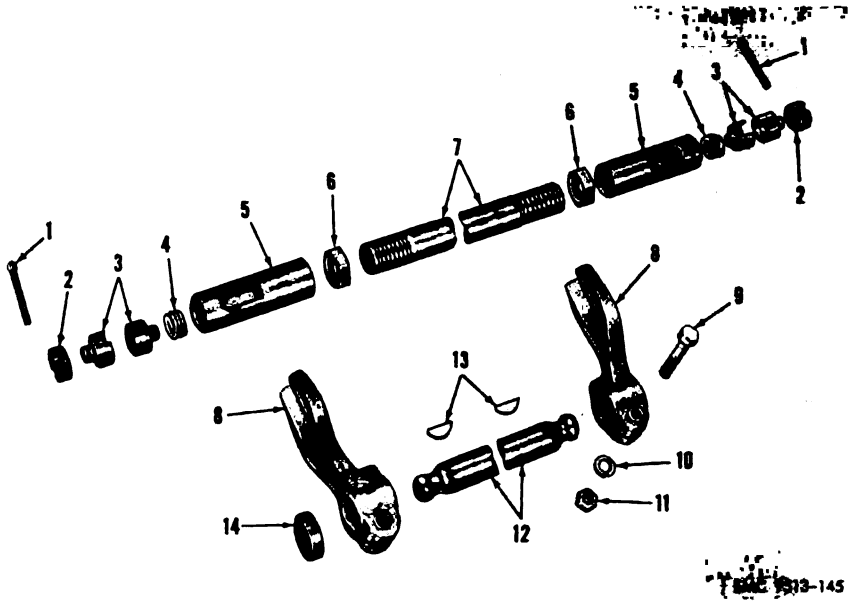
1 Outer shift lever
2 Ball joint
3 Selector yoke
4 Selector shaft
5 Drag link
6 Lever bracket
7 Gearshift lever housing
8 Gearshift lever

Figure 144. Drag link and selector shaft installed on gearshift lever.

b. Removal and Disassembly.

(1) Pull the cotter pin (1, fig. 145) and loosen the ball joint plug (2) at each end of the drag link (7). Pull the drag link from the gearshift lever and the remote control outer shift lever. Remove the drag link from the carrier.

(2) Remove the screws (11, fig. 146) and lockwashers (12) attaching the lever housing (13) to the carrier bracket.



1	Pin, cotter, split, ⅛ x 1¾ (2 rqr)	9	Screw, cap, hex hd, ⅜–24 NF x 1¾ (2 rqr)
2	Ball joint plug (2 rqr)	10	Lockwasher, spring, std, ⅜ (2 rqr)
3	Ball joint seat (4 rqr)	11	Nut, regular, hex, ⅜–24 NF (2 rqr)
4	Ball joint spring (2 rqr)	12	Selector shaft
5	Ball joint socket (2 rqr)	13	Woodruff key (2 rqr)
6	Jamnut (2 rqr)	14	Felt washer (2 rqr)
7	Drag link		
8	Selector yoke (2 rqr)		

Figure 145. Drag link and selector shaft, exploded view.

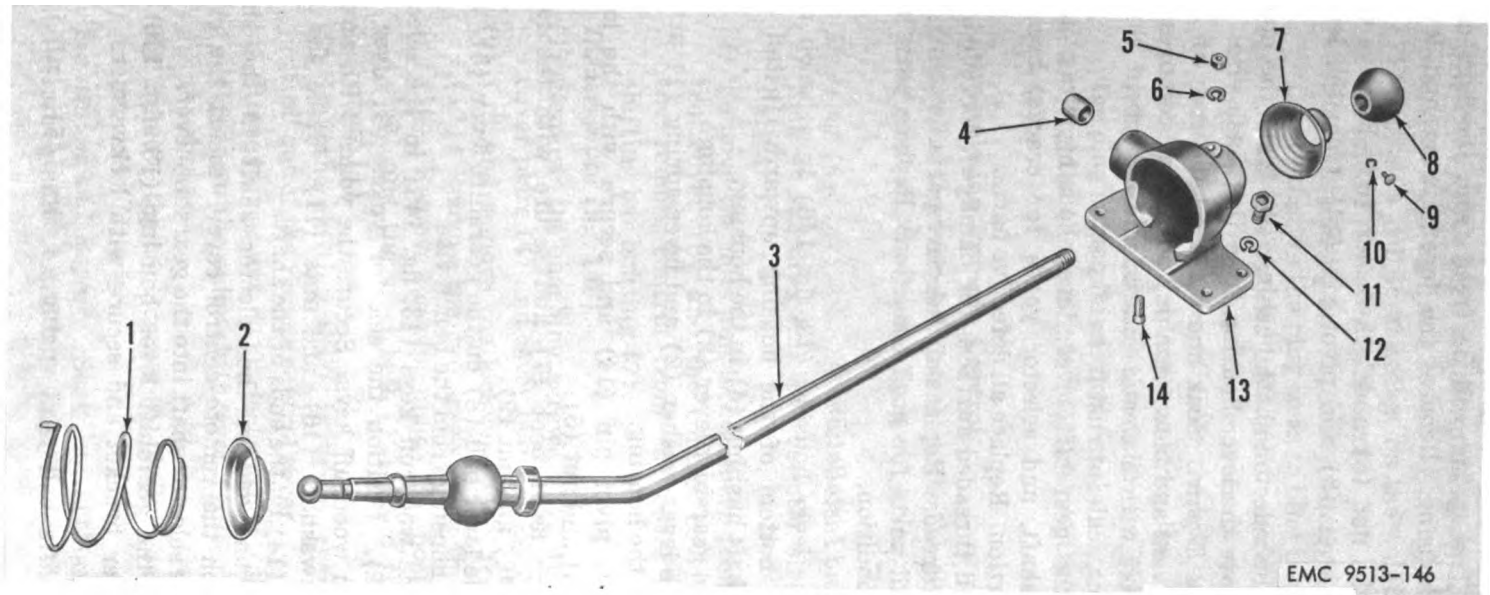
Remove the selector shaft (12, fig. 145) from the remote control assembly and the gearshift lever (3, fig. 146). Remove the selector shaft from the carrier.

(3) Remove the nuts (11, fig. 145), lockwashers (10), and cap screws (9) from the selector yokes (8). Remove the felt washers (14) and the selector yokes from the shaft and woodruff keys (13). Remove the woodruff keys from the shaft.

(4) Remove the ball joint plugs (2), ball joint seats (3), and the ball joint springs (4) from the ball joint sockets (5). Remove the ball joint sockets and the jamnuts (6) from the drag link (7).

(5) Remove the lever ball (8, fig. 146) from the gearshift lever (3). Remove the lever boot (7) up and off the gearshift lever.

(6) Mount the lever housing (13) in a bench vise with the bottom of the housing upward. Remove the lever spring



1 Lever spring
2 Lever washer
3 Gearshift lever
4 Selector shaft bushing
5 Nut
6 Lockwasher
7 Lever boot
8 Lever ball
9 Screw, cap, fil hd, 5/16–18 NC x 1/2
10 Lockwasher, spring, std, 5/16
11 Screw, cap, hex hd, 3/8–16 NC x 1 1/2 (4 rqr)
12 Lockwasher, spring, std, 3/8 (4 rqr)
13 Lever housing
14 Pivot pin

Figure 146. Transmission gearshift lever, exploded view.

(1) by twisting a heavy screwdriver between it and the housing. The spring will be freed from the lugs cast into the housing. Remove the lever spring and lever washer (2).

(7) Remove the nut (5) and lockwasher (6). Remove the gearshift lever (3) and pivot pin (14) from the lever housing.

(8) Remove the selector shaft bushing (4) from the housing. Remove the lever housing from the bench vise.

c. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the gearshift lever, lever housing, drag link, selector shaft, and selector yokes for cracks, breaks, and distortion. Replace all defective parts.

(2) Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace all defective parts.

(3) Inspect all parts for good condition. Replace parts not in good condition.

d. Reassembly and Installation.

(1) Mount the lever housing (13, fig. 146) in a bench vise with the bottom of the housing upward. Install the selector shaft bushing (4) in the housing.

(2) Install the gearshift lever (3) in the housing.

(3) Install the lever washer (2) and lever spring (1) in the bottom of the housing.

(4) Install the pivot pin (14) and secure with the lockwasher (6) and nut (5).

(5) Install the lever boot (7) and secure with the lockwasher (10) and nut (9).

(6) Install the lever ball (8) on the gearshift lever (3). Remove the housing from the bench vise.

(7) Install the woodruff keys (13, fig. 145) in the selector shaft (12). Position the selector yokes (8) over the shaft and woodruff keys. Secure the yokes with screws (9), lockwashers (10), and nuts (11). Place the felt washers (14) on the ends of the shaft.

(8) Position one end of the selector shaft in the shaft bracket on the remote control cover. Insert the other end of the selector shaft into the gearshift lever.

(9) Position the gearshift lever housing (13, fig. 146) on the carrier bracket and secure with lockwashers (12) and screws (11).

(10) Assemble a ball joint spring (4, fig. 145), ball joint

seat (3), and a ball joint plug (2) in each ball joint socket (5). Turn a jamnut (6) and a socket on each end of the drag link (7).

(11) Install a ball joint socket on the outer shift lever with the end of the lever between the ball joint seats. Tighten the ball joint plug (2) and install the cotter pin (1). Do not tighten the plug so as to bind the joint.

(12) Install the second ball joint socket on the gearshift lever with the end of the lever between the ball joint seats. Turn the drag link or the ball socket as necessary to shorten or lengthen the drag link. Tighten the ball joint plug and install the cotter pin (1). Do not tighten the plug so as to bind the joint.

(13) Tighten the jamnuts (6) against the ball joint sockets (5).

215. Transmission Remote Control

a. General. The remote control shifts the transmission gears upon movement of the gearshift lever, selector shaft, and drag link.

b. Removal (fig. 147).

(1) Remove the drag link and selector shaft (par. 214*b*(1) and (2)).

(2) Remove the nuts and lockwashers from the remote control cover (3) and the control cover studs (4). Lift the remote control from the cover adapter (6) and shifting bar housing (7).

c. Disassembly (fig. 148).

(1) Remove the machine screws (3). Lift off the control cover plate (4) and cover plate gasket (2).

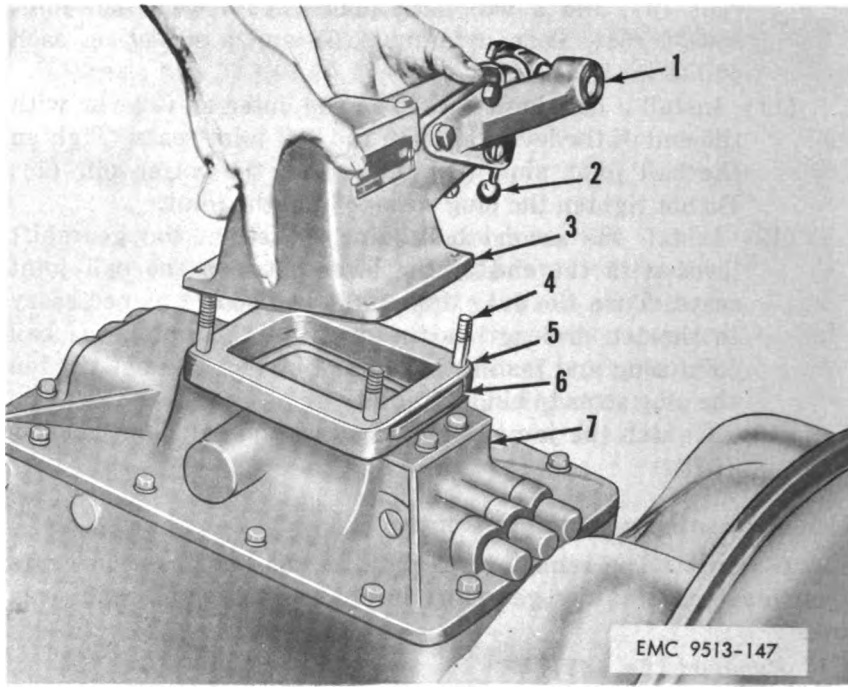
(2) Cut and remove the lockwire (16) from the cap screw (17). Remove the cap screw from the inner shift lever (15). Remove the pipe plug (14), position finder spring (13), and the steel ball (12) from the remote control cover (1).

(3) Pull the shifting shaft (8) from the inner shift lever and out of the remote control cover.

(4) Remove the nut (11), lockwasher (6), and cap screw (9) from the outer shift lever (10). Pull the lever from the shaft.

(5) Remove the cap screws (5), lockwashers (6), and shaft bracket (7).

d. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed



1 Shaft bracket
2 Outer shift lever
3 Remote control cover
4 Control cover stud
5 Control cover gasket
6 Cover adapter
7 Shifting bar housing

Figure 147. Transmission remote control removal.

air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the remote control cover, cover plate, shaft bracket, shift levers, and shifting shaft for cracks, breaks, and distortion. Replace all defective parts.

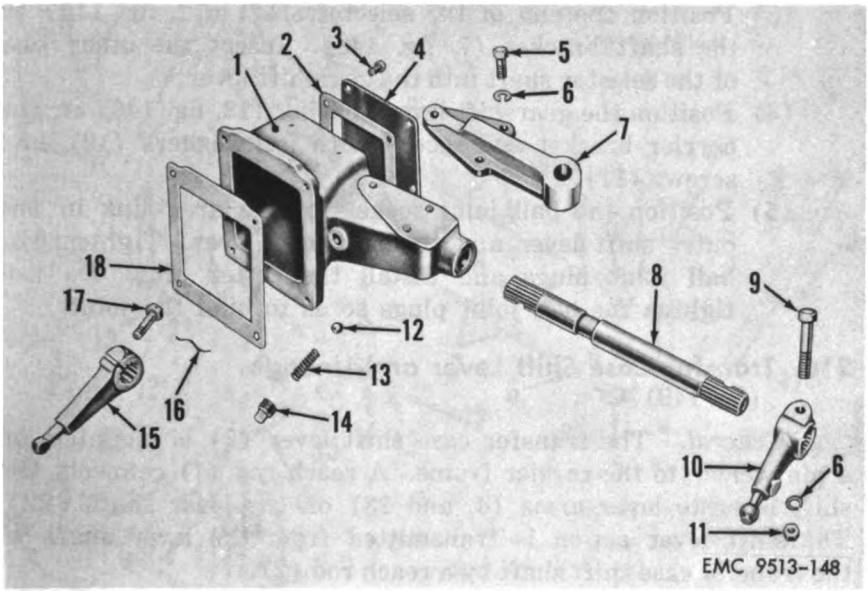
(2) Inspect the shifting shaft and shift levers for worn, chipped, scored, or twisted splines. Replace all defective parts.

(3) Inspect all parts for good condition. Replace parts not in good condition. Replace the control cover gasket and the cover plate gasket.

e. Reassembly (fig. 148).

(1) Position the outer shift lever (10) on the shifting shaft (8). Install the cap screw (9) and secure with a lockwasher (6) and nut (11).

(2) Insert the shaft into the remote control cover (1) and into the inner shift lever (15) held into position in the cover. Install and tighten the cap screw (17) in the



1 Remote control cover
2 Cover plate gasket
3 Screw, machine, rd hd, 5/16-24 NF x 1/2 (4 rqr)
4 Control cover plate
5 Screw, cap, hex hd, 3/8-24 NF x 1 (3 rqr)
6 Lockwasher, spring, std, 3/8 (4 rqr)
7 Shaft bracket
8 Shifting shaft
9 Screw, cap, hex hd, 3/8-24 NF x 2
10 Outer shift lever
11 Nut, regular, hex, 3/8-24 NF
12 Ball, steel, 1/2
13 Position finder spring
14 Plug, pipe, sq hd, 3/8
15 Inner shift lever
16 Lockwire
17 Screw, cap, hex hd, 3/8-24 NF x 1 3/4
18 Control cover gasket

Figure 148. Transmission remote control, exploded view.

lever. Secure the head of the cap screw with lockwire (16).

(3) Position the steel ball (12) and position finder spring (13) in the remote control cover and secure with the pipe plug (14).

(4) Position the cover plate gasket (2) and control cover plate (4) on the remote control cover (1) and secure with machine screws (3).

(5) Position the shaft bracket (7) on the remote control cover and secure with lockwashers (6) and cap screws (5).

f. Installation.

(1) Position the control cover gasket (5, fig. 147) on the control cover studs (4).

(2) Position the remote control cover (3) on the studs (4) and secure with lockwashers and nuts.

(3) Position one end of the selector shaft (12, fig. 145) in the shaft bracket (7, fig. 148). Insert the other end of the selector shaft into the gearshift lever.
(4) Position the gearshift lever housing (13, fig. 146) on the carrier bracket and secure with lockwashers (12) and screws (11).
(5) Position the ball joint sockets of the drag link in the outer shift lever and the gearshift lever. Tighten the ball joint plugs and install the cotter pins. Do not tighten the ball joint plugs so as to bind the joint.

216. Transfer Case Shift Lever and Linkage (fig. 149)

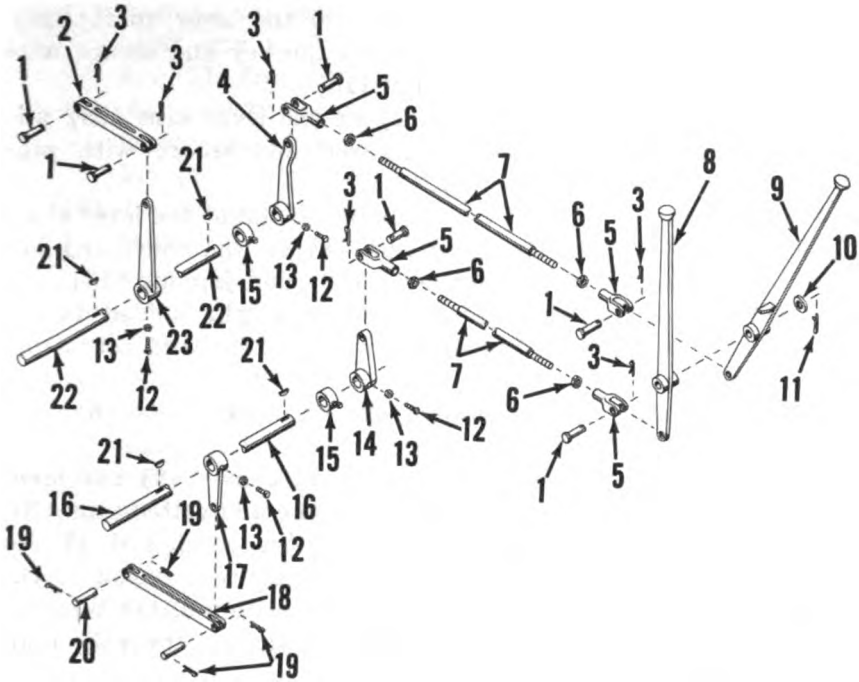
a. General. The transfer case shift lever (9) is mounted on a pin welded to the carrier frame. A reach rod (7) connects the shift lever to lever arms (4, and 23) on the lever shaft (22). The shift lever action is transmitted from the lever shaft to the transfer case shift shaft by a reach rod (2).

b. Removal and Disassembly.

(1) Pull the cotter pins (3) and pins (1) from the adjusting yoke ends (5) at the lever arm (4) and the shift lever (9). Remove the reach rod (7). Remove the adjusting yoke ends (5) and nuts (6) from the reach rod (7).
(2) Remove the cotter pin (11) and washer (10) from the pin on the carrier frame. Remove the shift lever (9) from the pin.
(3) Pull the cotter pins (3) and remove the pins (1) from the reach rod (2). Remove the reach rod.
(4) Remove the setscrew (12) and jamnut (13) from the lever arm (4). Remove the lever arm and woodruff key (21) from the lever shaft (22).
(5) Remove the setscrew (12) and jamnut (13) from the lever arm (23). Tap the lever arm off the woodruff key (21). Remove the woodruff key from the lever shaft.
(6) Loosen the set collar (15). Remove the lever shaft from the left carrier channel. Remove the lever arm (23) and set collar (15) while removing the lever shaft.

c. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the lever shaft, lever arms, reach rods, and shift lever for cracks, breaks, and distortion. Replace all defective parts.



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1 Pin (6 rqr)
2 Reach rod
3 Pin, cotter, split, ⅛ x ⅞ (6 rqr)
4 Lever arm
5 Adjusting yoke end (4 rqr)
6 Nut, regular, hex, ½–20 NF (4 rqr)
7 Reach rod (2 rqr)
8 Shift lever
9 Shift lever
10 Washer, plain, steel, 1
11 Pin, cotter, split, ¼ x 1½
12 Setscrew, sq hd, cup point, ⅜–16 NC x 1 (4 rqr)
13 Jamnut, regular, hex, ⅜–16 NC (4 rqr)
14 Lever arm
15 Collar set, std, 1 (2 rqr)
16 Lever shaft
17 Lever arm
18 Reach rod
19 Pin, cotter, split, 3/32 x ⅝ (4 rqr)
20 Pin (2 rqr)
21 Woodruff key (4 rqr)
22 Lever shaft
23 Lever arm

Figure 149. Transfer case shift lever linkage and front axle declutch shift lever linkage, exploded view.

(2) Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace all defective parts.

(3) Inspect all parts for good condition. Replace parts not in good condition.

d. Reassembly and Installation.

(1) Start the lever shaft (22) through the left carrier channel. Install a set collar (15) and then the lever arm (23) on the lever shaft. Continue the lever shaft to its bracket on the right carrier channel. Slide the set collar against the left carrier channel and tighten.

(2) Install a woodruff key (21) in the lever shaft (22). Slide the lever arm (23) over the key and secure with a setscrew (12) and jamnut (13).
(3) Position the reach rod (2) on the lever arm (23) and the transfer case shifting rod and secure with pins (1) and cotter pins (3).
(4) Install a woodruff key (21) in the end of the lever shaft (22). Install the lever arm (4) on the shaft and key and secure with a setscrew (12) and jamnut (13).
(5) Install the shift lever (9) on the pin welded to the carrier frame. Install the washer (10) and cotter pin (11).
(6) Assemble the adjusting yoke ends (5), nuts (6), and reach rod (7).
(7) Position the yoke ends on the shift lever (9) and lever arm (4) and secure with pins (1) and cotter pins (3).

e. Adjustment. Adjust the length of the reach rod (7) at the adjusting yoke ends (5) so that the neutral position of the shift lever (9) coincides with the neutral position of the transfer case shifter shaft. Tighten the nuts (6) against the yoke ends (5) after proper adjustment is made.

217. Front Axle Declutch Shift Lever and Linkage (fig. 149)

a. General. The front axle declutch shift lever (9) is mounted next to the transfer case shift lever (8) on a pin welded to the carrier frame. A reach rod (18) connects the shift lever to lever arms (14) and (17) on the lever shaft (16). The shift lever action is transmitted from the lever shaft to the front axle declutch assembly on the transfer case by a reach rod (18).

b. Removal and Disassembly.
(1) Pull the cotter pins (3) and remove the pins (1) from the adjusting yoke ends (5) at the lever arm (4) and the transfer case shift lever (9). Remove the reach rod (7) from the carrier. Remove the cotter pin (11), washer (10), and shift lever (9) from the pin on the carrier frame.
(2) Pull the cotter pins (3) and remove the pins (1) from the adjusting yoke ends (5) at the lever arm (14) and the shift lever (8). Remove the reach rod (7) from the carrier. Slide the shift lever off the pin on the carrier frame. Remove the adjusting yoke ends (5) and nuts (6) from the reach rod.
(3) Pull the cotter pins (19) and remove the pins (20) from the reach rod (18).

(4) Remove the setscrew (12) and jamnut (13) from the lever arm (14). Remove the lever arm and woodruff key (21) from the lever shaft (16).

(5) Remove the setscrew (12) and jamnut (13) from the lever arm (17). Tap the lever arm off the woodruff key (21). Remove the woodruff key from the lever shaft.

(6) Loosen the set collar (15). Remove the lever shaft from the left carrier channel. Remove the lever arm (17) and set collar (15) while removing the lever shaft.

c. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the lever shaft, lever arms, reach rods, and shift lever for cracks, breaks, and distortion. Replace all defective parts.

(2) Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace all defective parts.

(3) Inspect all parts for good condition. Replace parts not in good condition.

d. Reassembly and Installation.

(1) Start the lever shaft (16) through the left carrier channel. Install a set collar (15) and then the lever arm (17) on the lever shaft. Continue the lever shaft to its bracket on the right carrier channel. Slide the set collar against the left carrier channel and tighten.

(2) Install a woodruff key (21) in the lever shaft (16). Slide the lever arm (17) over the key and secure with a setscrew (12) and jamnut (13).

(3) Position the reach rod (18) on the lever arm (17) and the front axle declutch assembly and secure with pins (20) and cotter pins (19).

(4) Install a woodruff key (21) in the end of the lever shaft (16). Install the lever arm (14) on the shaft and key and secure with a setscrew (12) and jamnut (13).

(5) Install the shift lever (8) on the pin welded to the carrier frame and secure with the washer (10) and cotter pin (11).

(6) Assemble the adjusting yoke ends (5), nuts (6), and reach rod (7). Position the yoke ends on the shift lever (8) and lever arm (17) and secure with pins (1) and cotter pins (3).

(7) Install the transfer case shift lever (9) next to the shift lever (8). Install the reach rod (7) on the shift lever

(9) and lever arm (4) and secure with pins (1) and cotter pins (3).

e. Adjustment. Adjust the length of the reach rod (7) at the adjusting yoke ends (5) so that the released position of the shift lever (8) coincides with the released position of the lever on the front axle declutch assembly on the transfer case. Tighten the nuts (6) against the yoke ends (5) after proper adjustment is made.

Section XV. GEAR GUARDS AND MUDGUARD

218. Description

a. A guard for the hoist shaft driven gear is attached to the left deck plate, the gearcase, and the left pillow block of the front drum shaft assembly.

b. The front drum shaft gear and the wide gear on the hoist shaft are covered by a guard attached to the revolving frame cab and extending back and attached to the left rear strut.

c. A mudguard covers the opening around the front drum brake foot pedal.

219. Hoist Shaft Driven Gear Guard
(fig. 150)

a. Removal.

(1) Remove the mounting screw (7) and lockwasher from the guard bracket and pillow block.

(2) Remove the mounting screws (4), nuts, and lockwashers from the gearcase (5) and the gear guard (3).

(3) Remove the mounting bolts (6), lockwashers, and nuts from the gear guard (3) and the deck plate.

(4) Remove the gear guard from the revolving frame.

b. Inspection and Repair.

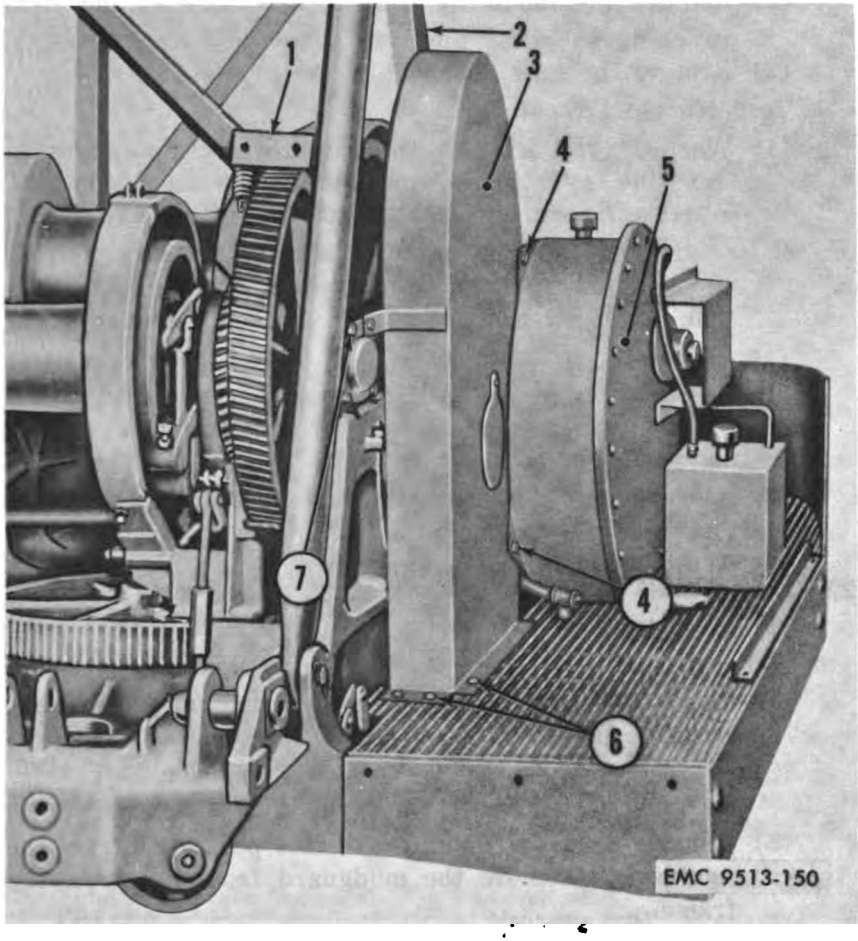
(1) Wash the gear guard with an approved cleaning solvent and wipe dry with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from the guard.

(2) Inspect the gear guard for cracks and breaks. Repair small cracks and breaks by welding the damaged portion. Replace a badly cracked or broken gear guard.

c. Installation.

(1) Position the gear guard (3) over the hoist shaft gear and onto the left deck plate. Attach the guard to the deck plate with mounting bolts (6), lockwashers, and nuts.

(2) Attach the gear guard to the gearcase with mounting screws (4), lockwashers, and nuts.



1 Gear guard
2 Rear strut
3 Hoist shaft gear guard
4 Mounting screw
5 Gearcase
6 Mounting bolt
7 Mounting screw

Figure 150. Gear guards, installed.

(3) Attach the guard bracket to the left pillow block of the front drum shaft assembly with a lockwasher and mounting screw (7).

220. Front Drum Shaft Gear and Hoist Shaft Gear Guard (fig. 150)

a. Removal.

(1) Remove the mounting screws, lockwashers, and nuts attaching the gear guard (1) to the revolving frame cab.

(2) Remove the mounting screws, lockwashers, and nuts attaching the gear guard (1) to the rear strut (2).
(3) Remove the gear guard from the revolving frame.

b. Inspection and Repair.

(1) Wash the gear guard with an approved cleaning solvent and wipe dry with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from the guard.
(2) Inspect the gear guard for cracks and breaks. Repair small cracks and breaks by welding the damaged portion. Replace a badly cracked or broken gear guard.

c. Installation.

(1) Position the gear guard (1) over the gears and attach to the revolving frame cab with screws, lockwashers, and nuts.
(2) Attach the gear guard to the rear strut (2) with screws, lockwashers, and nuts.

221. Mudguard
(fig. 151)

a. Removal.

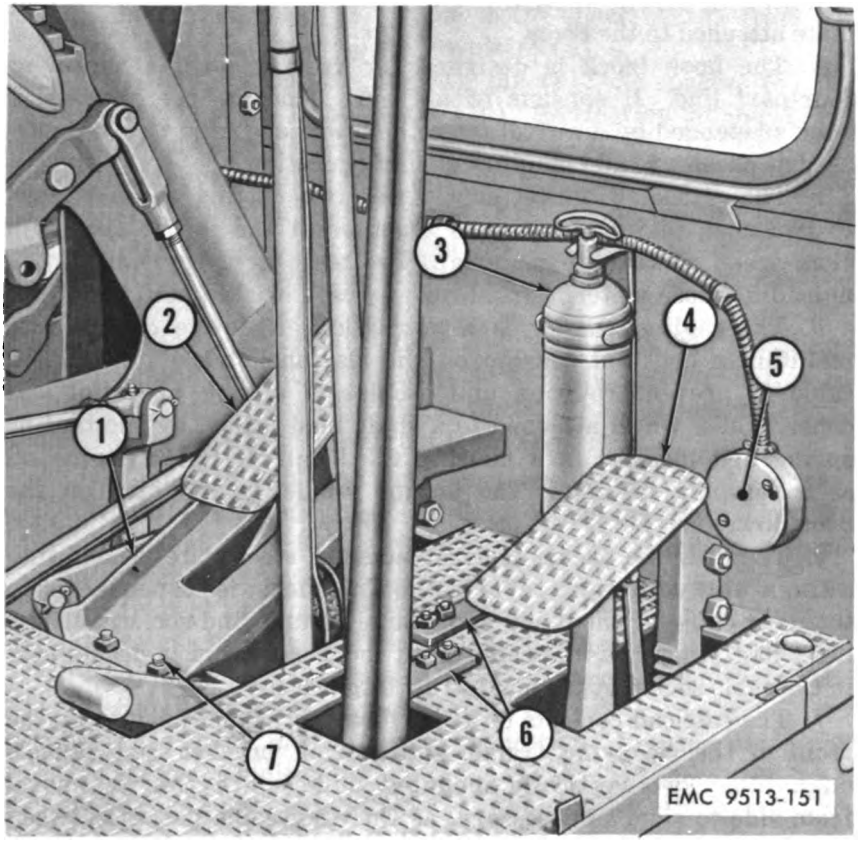
(1) Remove the nuts, lockwashers, and mounting bolts (7) from the mudguard (1) and deck plate.
(2) Remove the nuts, lockwashers, and mounting bolts from the mudguard (1) and the revolving frame cab.
(3) Remove the front drum brake foot pedal (2) from the foot lever. Remove the mudguard from the revolving frame.

b. Inspection and Repair.

(1) Wash the mudguard with an approved cleaning solvent and wipe dry with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from the mudguard.
(2) Inspect the mudguard for cracks and breaks. Repair small cracks and breaks by welding a patch over the damaged portion. Replace a badly cracked or broken mudguard.

c. Installation.

(1) Position the mudguard (1) over the front drum brake foot lever. Reinstall the brake foot pedal (2).
(2) Attach the mudguard (1) to the deck plate with bolts (7), lockwashers, and nuts.
(3) Attach the mudguard (1) to the revolving frame cab with bolts, lockwashers, and nuts.



1 Mudguard
2 Front drum brake foot pedal
3 Fire extinguisher
4 Hoist drum brake foot pedal
5 Floodlight junction box
6 Lever stop
7 Mounting bolt

Figure 151. Mudguard, installed.

Section XVI. CRANE BOOM AND ATTACHMENTS

222. Description

a. The crane boom is of the pin-connected type, completely welded, and of lattice construction. The lower and upper boom sections are each 15 feet long. The center boom section is 5 feet long. The two load pulleys at the boom point are ball-bearing mounted and are provided with head guards to eliminate cable jumping and jamming. Two cable-type boom stops provide additional safety when the boom reaches maximum operating angle. A boom angle indicator is installed on the boom lower section and shows the boom angle. The indicator consists of a weighted pointer, held to vertical by gravity, and mounted on a

ball-bearing pivot. The pointer moves against a calibrated sector plate attached to the boom.

b. The hook block is designed for reeving with a three- or four-part line. It consists of a frame inclosing the sheaves, a hook suspended by a swivel from the lower end, and two weights, used as cheeks, to add stability during operation.

c. The clamshell bucket consists of two cutting edges riveted to two shell plates and hinged together at the top so they will close when picking up material. The teeth are removable when unloading loose material from railway cars or ship bottoms.

d. The tagline winder is a spring-loaded device designed to maintain a constant tension on the clamshell bucket through a cable to prevent rotation and oscillation during operation. It consists of a wheel attached to a shaft held loaded by the tagline spring and inclosed in a housing filled halfway with engine oil as a damping medium. The tagline winder is mounted on the boom lower section.

e. The dragline bucket is constructed of steel plate welded into a single unit with replaceable teeth. The bucket is suspended from the hoist cable by the dump cable pulley frame and socket and the hoist bail. The dragline cable from the front drum is dead-ended in the cable socket at the end of the drag chains.

f. The fairlead consists of a rear bracket, which mounts on the front of the revolving frame, and a front bracket that swivels on a pin. Two vertically mounted pulleys are free to swivel from side to side, as necessary, as the drag cable passes between them. Two horizontal pulleys serve to hold the drag cable straight in front of the drum lagging as it winds in or pays out the drag cable.

g. The front drum shaft assembly has a straight barrel to accommodate removable lagging for various operations and full convertibility. The function of the lagging is to wind or unwind the cable during operation. A large-diameter, smooth, tapered lagging is used for crane, clamshell, and back hoe operation. A small-diameter, grooved, straight lagging is used for dragline operation. The lagging half-sections are positioned on the drum with dowels and attached to each other with flathead screws. The dowels vary in length to accommodate the size and the taper of the lagging. A cable wedge is anchored in the drum.

223. Hook Block
(fig. 152)

a. Removal and Disassembly.

(1) Unreeve the hook block (par. 11).

(2) Remove the cotter pins (16) and pin (17) to free the

hook assembly (18). Remove the spacers (15) from between the lower ends of the plates (4).

(3) Remove the cotter pins (1), pin (8), and spacers (6).

(4) Remove the cotter pins (10), lubrication fitting (11), and axle (9).

(5) Remove the hex nuts (20 and 22), lockwashers (19 and 21), machine bolts (12 and 13), and the spacers (14 and 15).

(6) Remove the weights (2), bars (3), plates (4), and sheaves (7).

b. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the sheaves for cracks, breaks, damaged grooves, and worn bushings. Replace a sheave if cracked or broken, or if it has a damaged groove. Replace a worn bushing (par. 189).

(2) Inspect the hook assembly, weights, bars, and plates for cracks, breaks, and distortion. Replace a hook assembly, weight, bar, or plate if cracked, broken, or distorted. Small cracks in a weight can be welded.

(3) Inspect all parts for good condition. Replace parts not in good condition.

c. Reassembly and installation.

(1) Install a cotter pin (10) in the axle (9).

(2) Insert the machine bolts (12 and 13) and the axle (9) into a weight (2) from the outside. Place the weight on a flat surface.

(3) Install a bar (3), plate (4), spacers (6 and 14), and a sheave (7) on the axle (9).

(4) Install a plate (4), sheave (7) with new bushings (5) if necessary, spacers (6 and 14), plate (4), bar (3), and weight (2) on the axle (9).

(5) Install the lockwashers (19 and 21) and hex nuts (20 and 22) on the machine bolts (12 and 13). Draw the nuts up securely.

(6) Install a cotter pin (10) in the axle.

(7) Install the pin (8) and secure with cotter pins (1).

(8) Slip the hook assembly (18) over the protruding bars (3). Install the spacers (15). Tap the pin (17) into place and secure with cotter pins (16).

(9) Install the lubrication fitting (11) and lubricate (LO 5–9513–1).

(10) Reeve the hook block (par. 11).

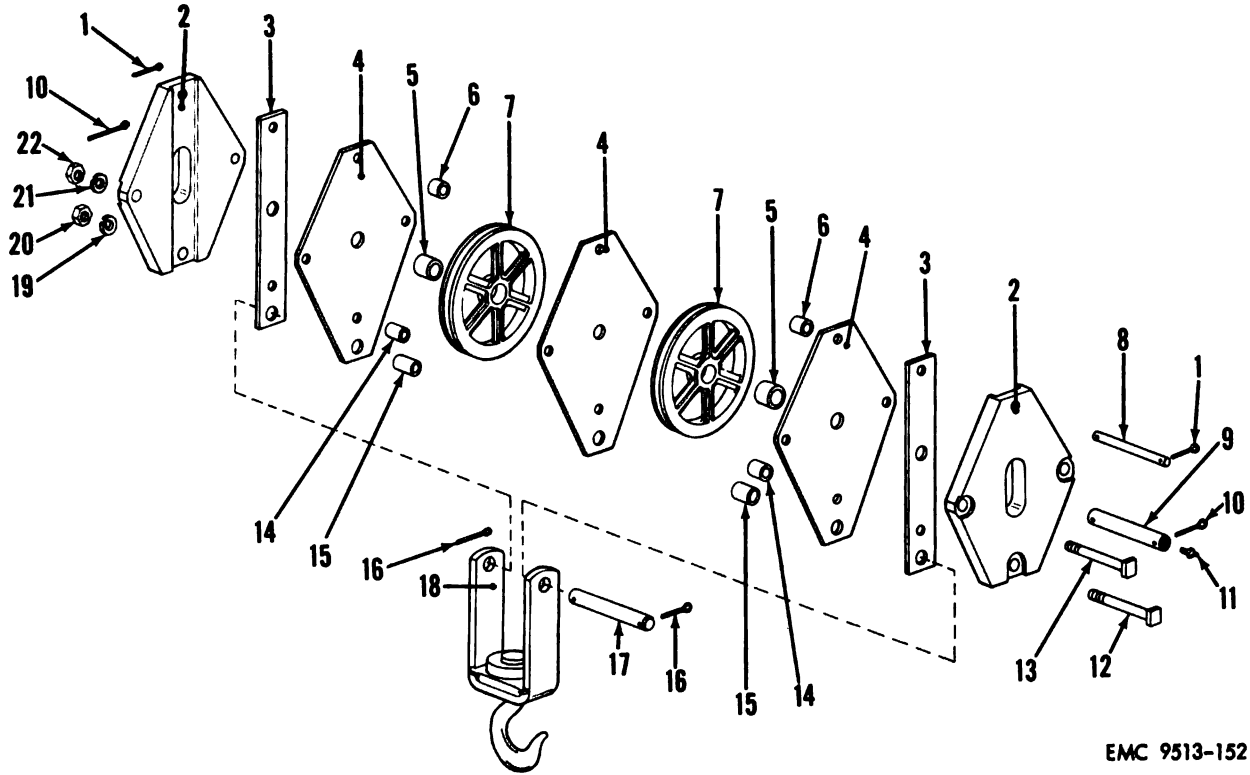


Figure 152. Hook block, exploded view.

224. Clamshell Bucket
(fig. 153).

a. Removal and Disassembly.

(1) Unreeve the clamshell bucket (par. 13).

(2) Close the bucket and place it on level ground before starting to disassemble it. Put blocking under the bottom side of both scoops to hold the bucket perpendicular while removing parts. This will facilitate the removal of the main hinge shaft.

(3) If counterweights (43) are attached, remove the two bolts (42), nuts (45), and lockwashers (44) holding each one, and remove the counterweights.

(4) Remove the lockpins (28) and bracket pins (30), releasing the head (57), with four corner bars (23) and (53), from the scoop assembly.

(5) Remove the head frame, with the four corner bars still attached, with a cable. Rest this assembly on the ground to facilitate removal of the corner bars.

(6) Remove the cotter pins (58) and pins (59) to disassemble the socket.

(7) Remove the lockpins (21), guide collar (18), and pin (22). This releases the two corner bars (23) and the guide sheave (19).

(8) Remove lockpins (14 and 16) and pins (13 and 15), thereby releasing the upper (12) and lower (17) rollers.

(9) Remove cotter pin (4) and pin (5) to release the sheave (8).

(10) Remove the cotter pin (4) and line pin (9).

(11) Remove the corner bars (53) from the head frame (57) by removing the bolts (54), nuts (55), and lockwashers (56).

(12) Remove the lockpin (41) and pin (40), which will release the arm sheaves (38).

(13) Remove the two end pins (49) and the hinge shaft (50) to release the scoops (33 and 52).

1 Cotter pin (2 rqr)
2 Weight (2 rqr)
3 Bar (2 rqr)
4 Plate (3 rqr)
5 Bushing (2 rqr)
6 Spacer (2 rqr)
7 Sheave (2 rqr)
8 Pin
9 Axle
10 Cotter pin (2 rqr)
11 Lubrication fitting
12 Machine bolt
13 Machine bolt (2 rqr)
14 Spacer (6 rqr)
15 Spacer (2 rqr)
16 Cotter pin (2 rqr)
17 Pin
18 Hook assembly
19 Lockwasher
20 Hex nut
21 Lockwasher (2 rqr)
22 Hex nuts (2 rqr)

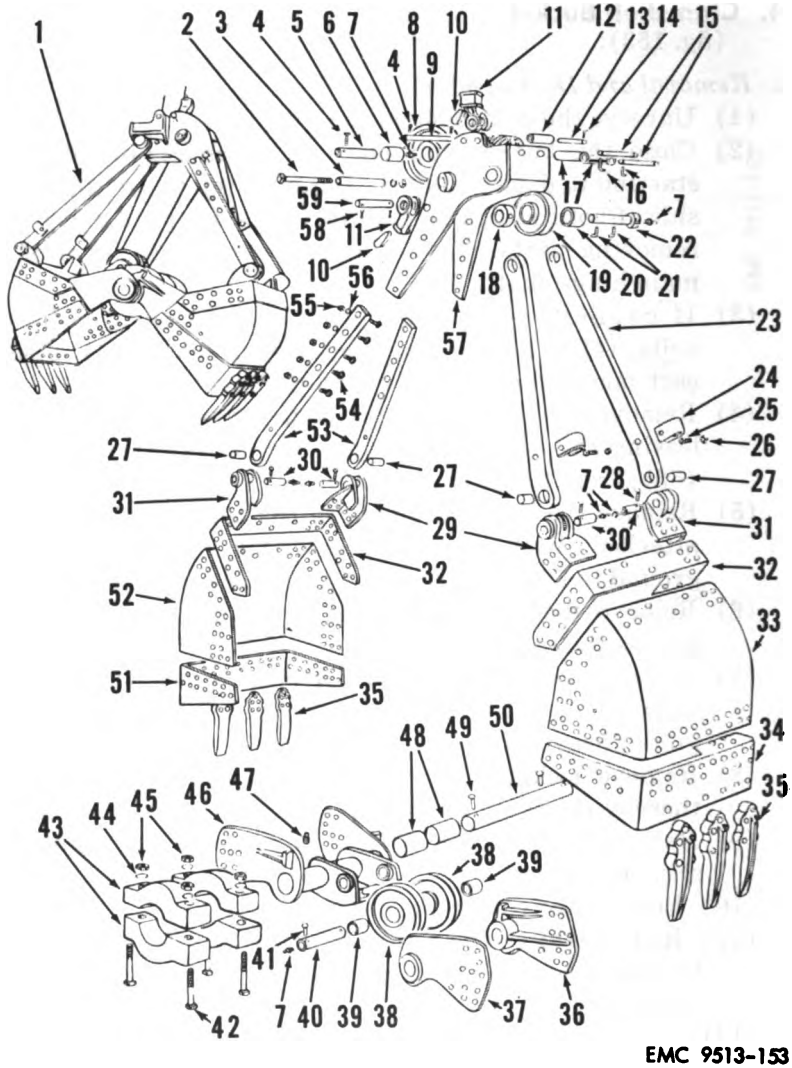


Figure 153. Clamshell bucket, exploded view.

(14) Remove the five bolts in each tooth (35) and remove the teeth.

b. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace parts having damaged, corroded, or stripped threads.

(2) Inspect the sheaves for cracks, breaks, damaged grooves,

1 Clamshell bucket assembly
2 Cable guard bolt
3 Cable guard
4 Lockpin
5 Upper sheave pin
6 Upper sheave bushing
7 Grease fitting (5 rqr)
8 Closing sheave
9 Line pin
10 Socket wedge
11 Holding cable socket
12 Upper roller
13 Roller pin
14 Lockpin
15 Guard pin (2 rqr)
16 Lockpin (2 rqr)
17 Lower roller (2 rqr)
18 Guide collar
19 Guide sheave
20 Guide sheave bushing
21 Lockpin (2 rqr)
22 Guide sheave pin
23 Corner bar (2 rqr)
24 Tagline clip (2 rqr)
25 Tagline clip bolt (2 rqr)
26 Tagline clip nut (2 rqr)
27 Bar bushing (4 rqr)
28 Lockpin (2 rqr)
29 Bar bracket, rh (2 rqr)
30 Bracket pin (4 rqr)
31 Bar bracket, lh (2 rqr)
32 Back band (2 rqr)
33 Scoop
34 Scoop lip
35 Digging tooth (6 rqr)
36 Right hinge
37 Left hinge
38 Arm sheave (2 rqr)
39 Arm sheave bushing (2 rqr)
40 Arm sheave pin
41 Lockpin (2 rqr)
42 Counterweight bolt (2 rqr)
43 Counterweight (2 rqr)
44 Counterweight lockwasher (4 rqr)
45 Counterweight nut (4 rqr)
46 Lever arm
47 Grease plug
48 Arm bushing (2 rqr)
49 End pin (2 rqr)
50 Hinge shaft
51 Scoop lip
52 Scoop
53 Corner bar (2 rqr)
54 Corner bar bolt (20 rqr)
55 Corner bar nut (20 rqr)
56 Corner bar lockwasher (20 rqr)
57 Frame head
58 Cotter pin (2 rqr)
59 Hold line pin

and worn bushings. Replace a sheave if cracked, broken, or has a damaged groove. Replace a worn bushing (par. 189).

(3) Inspect each pin and shaft carefully to see that they are not out-of-round. Replace a pin or shaft that is out-of-round.

(4) Inspect the scoops, backbands, and head frames for cracks and wear. Replace a scoop, backband, or head frame if cracked or worn.

(5) Inspect the corner brackets and the corner bars for cracks and wear. Replace a bracket or bar if defective.

(6) Inspect all parts for good condition. Replace parts not in good condition.

c. Reassembly and Installation.

(1) To assemble the main shaft with scoops, set the scoops (33 and 52) in a closed position and securely block them with the holes in the hinges and the holes in the lever arm in line. Insert the main hinge shaft (50) and end pins (49).

(2) Insert the two arm sheaves (38) and pin (40), and secure them with lockpin (41).

(3) Attach the two corner bars (53) to the corner brackets

(29 and 31) on the lever arm side of the scoop by inserting bracket pins (30). Secure with lockpins (28). Lay the two corner bars (23), into position, resting on the lever arm.

(4) Attach the sockets (11) and pins (59) and secure with cotter pins (58).

(5) Place the head (57) on the ground with the wing side down and the inside of the head up.

(6) Install the sheave (8) and pin (5), and secure with cotter pins (4).

(7) Insert the two lower rollers (17) and pins (15), and secure with lockpins (16).

(8) Install the upper rollers (12) and pin (13) and secure with a lockpin (14).

(9) Insert the pin (22) through the corner bar (23) into the head plate, through the guide sheave (19), through the opposite side of head, through the second corner bar (23), and secure it with the collar (18) and lockpins (21).

(10) Install the socket (11) and pin (9), and secure with the two cotter pins (4). Reeve the holding cable to the bucket (par. 13) and lift the head frame (57) into position.

(11) Hoist the head frame assembly with the two corner bars (23) attached over the scoop assembly. Place the corner bars into the corner brackets (29 and 31). Insert the pins (30) and secure with lockpins (28).

(12) Bolt the corner bars (53) to the head (57).

(13) Replace the counterweights, if they are being used, and secure each one in place with two bolts (42), lockwashers (44), and nuts (45).

(14) Reeve the clamshell bucket (par. 13).

225. Tagline Winder
(fig. 154)

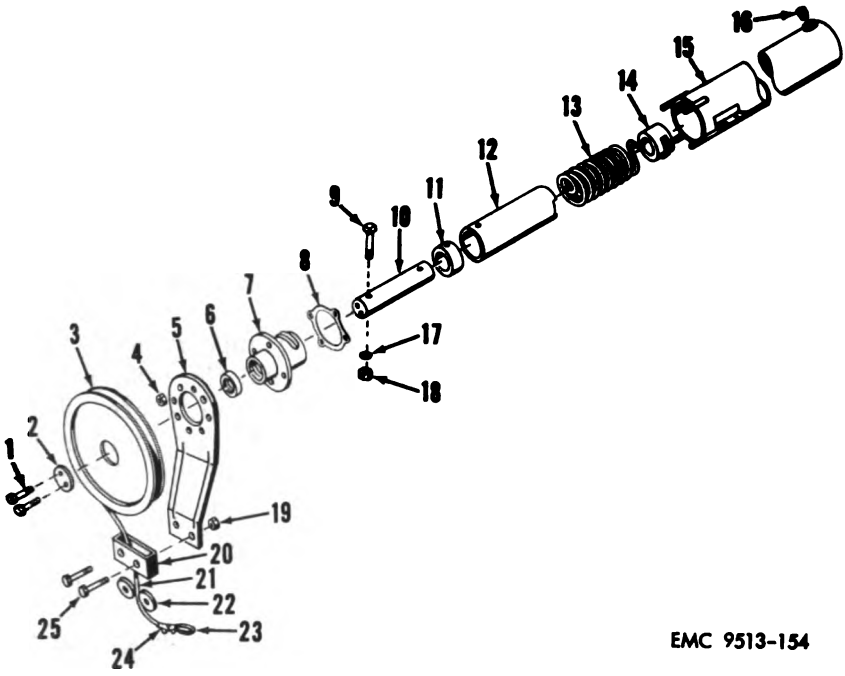
a. Removal and Disassembly.

(1) Remove the tagline winder (par. 12*c*).

(2) Remove the plug (16). Turn and tilt the assembly to drain oil from the housing (15).

(3) Remove the nuts (19) from the sheave pins (25). Remove the sheave pins from the cable guide (20). The fairlead sheaves (22) will drop out of the cable guard when it becomes free of the fairlead arm (5).

(4) Remove the safety plate (2) by unscrewing two cap



1	Screw, cap, hex hd, ½–13 NC x 3 (2 rqr)	13	Spring
2	Safety plate	14	Propeller
3	Wheel	15	Housing
4	Nut, regular, hex, ⅝–11 NC (4 rqr)	16	Plug, pipe, ¾
5	Fairlead arm	17	Lockwasher, spring, std, ⅝ (2 rqr)
6	Oil seal	18	Nut, regular, hex, ⅝–11 NC (2 rqr)
7	Head bearing	19	Sheave pin nut (2 rqr)
8	Head bearing gasket	20	Cable guide
9	Bolt, machine, sq hd, ⅝–11 NC x 4 (2 rqr)	21	Cable
10	Shaft	22	Fairlead sheave (2 rqr)
11	Bushing	23	Thimble, cable, 3/16
12	Tube	24	Clip, cable, 5/16 (2 rqr)
		25	Sheave pin (2 rqr)

Figure 154. Tagline winder, exploded view.

screws (1). Remove the nut (18) from the bolt (9) to free the wheel (3) from the shaft (10).

(5) Remove the four nuts (4) from the housing (15) to pull off the fairlead arm (5).

(6) Grasp the shaft (10) and head bearing (7) and twist, pulling the bearing and core assembly with its spring (13) from the housing (15).

(7) The spring can be removed after twisting the head bearing from the shaft.

(8) The core assembly consists of the shaft (10) and bushing

(11) attached at one end to the tube (12). The propeller (14) is welded to the opposite end of the tube.

b. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the spring for cracks and breaks. Replace the spring if cracked or broken. If the spring is overwound and pulled out of shape, bend a new hook on the end of the spring.

(2) Examine the oil seal. If the seal appears worn or if lubricant has leaked through around the seal, it must be replaced. Wrap a piece of shim stock around the end of the shaft so that the boltholes will not cut the new seal as it is forced over them. The lip of the seal must point toward the inside of the assembly.

(3) Inspect all parts for good condition. Replace parts not in good condition.

c. Reassembly and Installation.

(1) Place the spring (13) over the core assembly so that the lug on the propeller (14) will catch on the spring hook when rotated counterclockwise. Position the head bearing (7) with a new seal (6) and gasket (8) over the shaft (10) to catch the hook on the end of the spring.

(2) Place the core assembly with the spring, head bearing, and seal into the housing (15) so that the open end of the propeller will fit over the projection at the end of the housing. Make sure that the head bearing and gasket will register on the studs of the housing.

(3) Fasten the fairlead arm (5) over the studs and against the head bearing with nuts (4).

(4) Fasten the wheel (3) and safety plate (2) to the end of the shaft (10) with cap screws (1). Install the bolts (9) and nut (18) securing the wheel (3) to the shaft (10).

(5) Turn the wheel counterclockwise to check for tension on the spring.

(6) Install the cable guide (20), with the fairlead sheaves (22) and sheave pins (25), to the fairlead arm (5) with nuts (19).

(7) Install the tagline winder (par. 12*b*).

d. Adjustment.

(1) To adjust the tagline cable tension, turn the wheel (3) in a counterclockwise direction, and take up cable wraps by hand until the proper tension is reached. Approximate

full tension should be reached five to seven turns from neutral. Final tension is left to the operator. Attach the cable to the clamshell bucket chain with cable clamps.

(2) Rotate the tagline winder in its mounting so that the fairlead arm points to a spot midway between the highest and lowest positions of the bucket when it is in operation.

226. Dragline Bucket
(fig. 155)

a. Removal and Disassembly.

(1) Unreeve the dragline bucket (par. 15).

(2) Remove the two cotter pins (6) in each hoist trunnion pin (7) and slide each hoist trunnion pin out.

(3) Remove the two hoist trunnion spools (4) and the hoist chain (18).

(4) Remove the lock (9) from each of the two hitch pins (8). Remove the hitch pins.

(5) Remove the drag links (10), and remove the drag chains (17).

(6) Remove the cotter pin (15) from each bucket tooth (14). Using a wedge, drive out each tooth and shim set (13). To assure proper assembly, tie each shim set to the proper tooth.

Note. The two hoist trunnions (5), clevis plate (11), and bucket lip (12) are riveted to the bucket body (1), and are not usually removed.

(7) Remove the swivel pin holding the dump sheave assembly (20) to the hoist socket.

(8) Remove the three nuts and bolts from the sheave housing.

(9) Remove the sheave pin and separate the parts of the sheave housing. Remove the sheave.

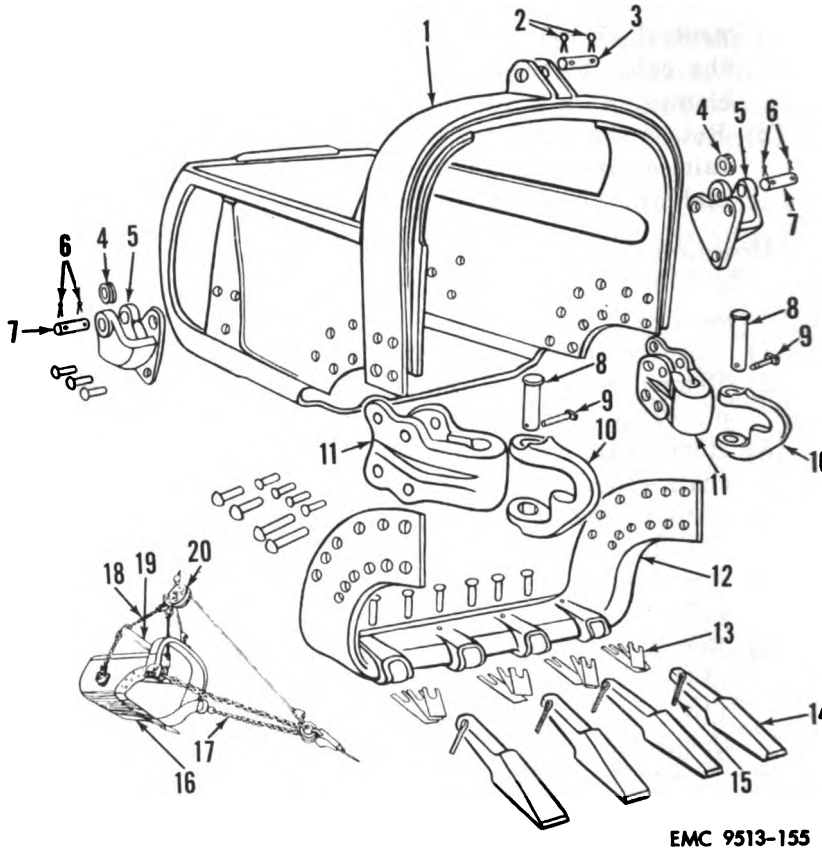
(10) Remove the lubrication fitting from the sheave pin.

b. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the bucket teeth for proper cutting edge. Sharpen or rebuild teeth as necessary (par. 191).

(2) Inspect the bucket body for cracks and breaks. Replace a badly cracked or broken body. Small cracks can be welded.

(3) Inspect the dump sheave for cracks, breaks, and worn bushing. Replace the sheave if cracked or broken. Replace a worn bushing (par. 189).



1	Body	11	Clevis plate (2 rqr)
2	Cotter pin (2 rqr)	12	Bucket lip
3	Arch pin	13	Shim set
4	Hoist trunnion spool (2 rqr)	14	Bucket tooth (4 rqr)
5	Hoist trunnion (2 rqr)	15	Cotter pin (4 rqr)
6	Cotter pin (4 rqr)	16	Bucket assembly
7	Hoist trunnion pin (2 rqr)	17	Drag chain (2 rqr)
8	Hitch pin (2 rqr)	18	Hoist chain
9	Hitch pin lock (2 rqr)	19	Spreader bar
10	Drag link (2 rqr)	20	Dump sheave assembly

Figure 155. Dragline bucket and dump sheave, exploded view.

(4) Inspect all parts for good condition. Replace parts not in good condition.

c. *Reassembly and Installation.*

(1) Place the three bolts and nuts in the dump sheave housing, but do not tighten.

(2) Place the sheave in the sheave housing and insert the sheave pin. Tighten nuts on the housing. Install the lubrication fitting in the sheave pin.

(3) Place assembled sheave housing in the hoist socket and insert the swivel pin.

(4) Insert the bucket tooth shims (13) in each socket to secure a tight fit.
(5) Insert the bucket teeth (14) and lock each in place with a cotter pin (15).
(6) Place the end of each drag chain (17) in the bucket clevis pins (10). To secure longer wear, reverse the chains end for end, and invert them top for bottom from the way they were before disassembly.
(7) Place the bucket clevis (10) in the clevis plates (11) and secure them in place with the clevis pin (8). Lock each clevis pin (8) in place with a lock (9).
(8) Place a hoist trunnion spool (4) in each hoist trunnion (5). Hold the left side of the hoist chain (18) in the trunnion while inserting the hoist trunnion pin (7).
(9) Lock the hoist trunnion pin in place with two cotter pins (6).
(10) Attach the right side of the hoist chain in a similar manner. Attach the drag chain (17).
(11) Lubricate the dragline bucket (LO 5–9513–1).
(12) Reeve the dragline bucket (par. 15).

d. Adjustment. The proper digging angle for the bucket is obtained by changing the position of the two drag links (10).
(1) Remove the lock (9) from each hitch pin (8) and remove the hitch pins.
(2) Adjust the digging angle by turning the drag links (10) over.
(3) Insert the hitch pins (8) and secure them in place with the locks (9).

227. Dragline Fairlead
(fig. 156)

a. Removal and disassembly.
(1) Remove the dragline fairlead (par. 14*c*).
(2) Remove the nuts (33), lockwashers (25), screws (37), and mudguard (2) from the rear fairlead bracket (8).
(3) Remove the screws (3), lockwashers (4), cover (5), and gasket (6).
(4) Remove the pin (9). Remove the pin (31) from the fairlead brackets (8 and 12). Remove the cotter pin (30) from the pin (31).
(5) Separate the fairlead brackets (8 and 12), being careful not to lose the bronze washers (7).
(6) From each pulley (11 and 23), remove the lockwire (15), screws (16), end cap (17), shim set (18), and sleeve (19).

(7) From each pulley (11 and 23), remove the screws (26), lockwashers (25), and lock bars (24).

(8) Remove the pulley pins (27) and pulleys (11) and (23) from the front fairlead bracket (12).

(9) From each pulley, remove the bearing seals (20), bearing cones (21), and bearing cups (22).

(10) Remove the nuts (29), lockwashers (28), bolts (14), and wear bars (13).

b. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed

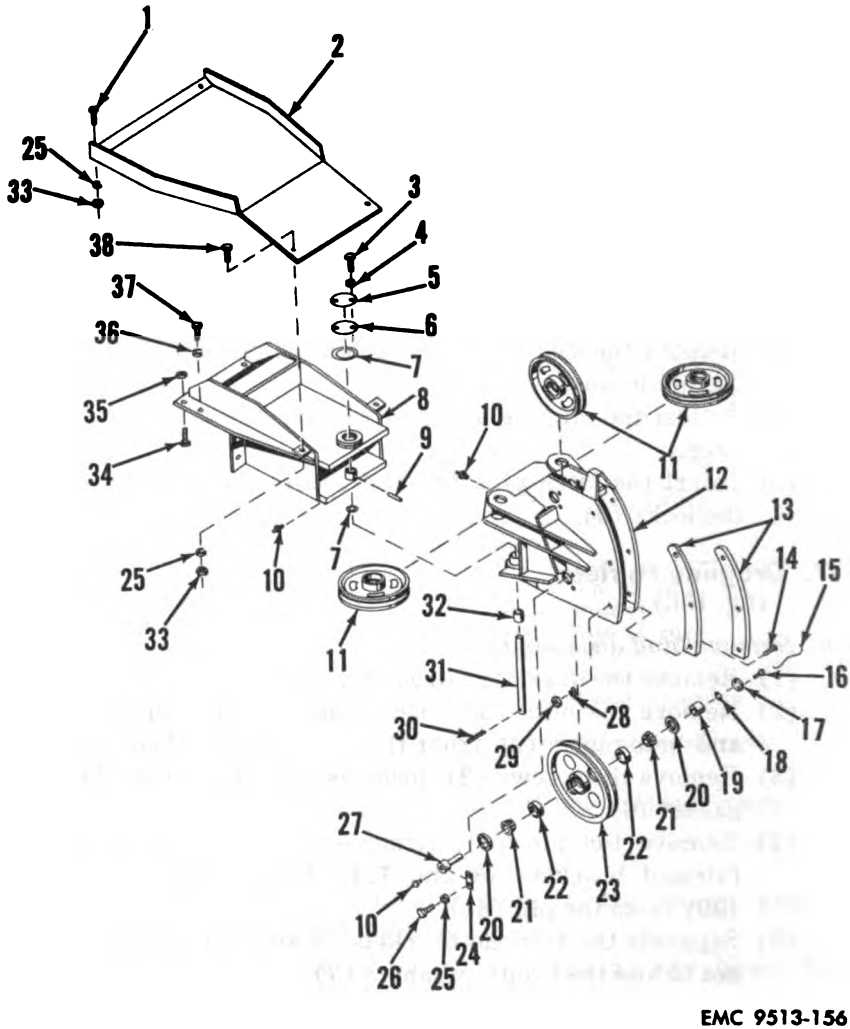


Figure 156. Dragline fairlead, exploded view.

air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the fairlead brackets and mudguard for cracks and breaks. Replace a broken or badly cracked bracket or mudguard. Small cracks in a bracket may be welded.

(2) Inspect the bracket bushings for wear. Replace worn bushings (par. 189).

(3) Inspect the pulley pins for wear and scoring. Replace a pulley pin that is worn or scored.

(4) Inspect all bearings thoroughly, checking particularly for out-of-round condition caused by corrosion or wear. Check for overheating, which is evidenced by discoloration of the rollers. Examine the bearing cups for scoring or galling. Replace a bearing that is worn, scored, or galled, or has been overheated.

(5) Replace the cover gasket and bearing seals.

(6) Inspect the wear bars for wear. Replace excessively worn wear bars.

(7) Inspect all parts for good condition. Replace parts not in good condition.

c. *Reassembly and Installation.*

(1) Position the wear bars (13) in the front fairlead bracket (12) and secure with bolts (14), lockwashers (28), and nuts (29).

←

1 Screw, cap, hex hd, ½–13 NC x 1¼ (2 rqr)
2 Mudguard
3 Screw, cap, hex hd, ⅝–16 NC x 1 (2 rqr)
4 Lockwasher, spring, std, ⅝ (2 rqr)
5 Cover
6 Gasket
7 Bronze washer (2 rqr)
8 Rear fairlead bracket
9 Pin
10 Lubrication fitting, ⅛ straight (6 rqr)
11 Pulley (3 rqr)
12 Front fairlead bracket
13 Wear bar (2 rqr)
14 Bolt, machine, flat hd, ⅝–11 NC x 2¼ (6 rqr)
15 Lockwire (as rqr)
16 Screw, cap, hex hd, 7/16–20 NF x 1 (8 rqr)
17 End caps (4 rqr)
18 Shim set (4 rqr)
19 Sleeve (4 rqr)
20 Bearing seal (8 rqr)
21 Bearing cone (8 rqr)
22 Bearing cup (8 rqr)
23 Pulley
24 Lock bar (4 rqr)
25 Lockwasher, spring, std, ½ (12 rqr)
26 Screw, cap, hex hd, ½–13 NC x ¾ (8 rqr)
27 Pulley pin (4 rqr)
28 Lockwasher, spring, std, ⅝ (6 rqr)
29 Nut, regular, hex, ⅝–11 NC (6 rqr)
30 Pin, cotter, split, ⅜ x 3
31 Pin
32 Bronze bushing (2 rqr)
33 Nut, regular, hex, ½–13 NC (4 rqr)
34 Screw, cap, hex hd, ¾–16 NF x 2¼ (11 rqr)
35 Nut, hex, Marsden, ¾–16 NF (11 rqr)
36 Lockwasher, spring, std, ¾
37 Screw, cap, hex hd, ¾–16 NF x 1½
38 Screw, cap, hex hd, ½–13 NC x 1½ (2 rqr)

(2) Install the bearing cups (22), bearing cones (21), and bearing seals (20) in each pulley (11) and (23).
(3) Position each pulley in the front fairlead bracket and install the pulley pins (27). Secure each pulley pin with lock bars (24), lockwashers (25), and screws (26).
(4) Install the sleeves (19) on the pulley pins. Position the shim sets (18) and end caps (17) on the sleeves. Secure the end caps to the pulley pins with screws (16). Install lockwire (15) in the screw heads.
(5) Position the front fairlead bracket (12) on the rear fairlead bracket (8). Install the bronze washers (7) between the brackets.
(6) Install the pin (31) in the brackets. Secure the pin with pin (9) in the lower part of the rear bracket. Install the cotter pin (30).
(7) Position the gasket (6) and cover (5) over the pin (31) and secure with lockwashers (4) and screws (3).
(8) Position the mudguard (2) on the rear fairlead bracket and secure with screws (38), lockwashers (25), and nuts (33).
(9) Lubricate the fairlead (LO 5–9513–1).
(10) Install the dragline fairlead (par. 14*b*).

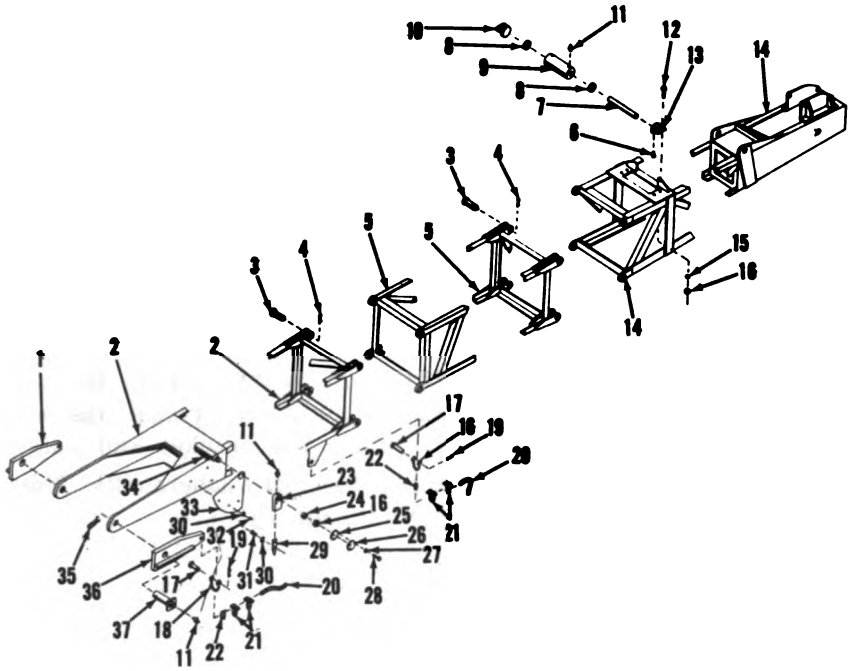
d. Adjustment.

(1) If end play is present at a sleeve (19), remove the lockwire (15), screws (16), and end cap (17). Remove a sufficient number of shims from the shim set (18) to remove all end play without preloading the bearings. Reinstall the end cap (17) and screws (16). Install new lockwire (15) in the screw heads.
(2) If no end play is present at a sleeve (19), remove the lockwire (15), screws (16), and end cap (17). Add a sufficient number of shims to remove bearing preload without adding end play at the sleeve. Reinstall the end cap (17) and screws (16). Install new lockwire (15) in the screw heads.

228. Crane Boom and Point Pulleys

a. Removal and Disassembly.

(1) If the boom stop cables (20, fig. 157) have not been removed from the boom lower section (2), pull the cotter pins (19) and remove the shackle pins (17) and chain shackles (18) from the boom. The cable brackets (1 and 36) are welded to the rotating base. The pins (37) must be left in the rotating base.
(2) Disconnect the boom lower section (2), the boom center



1 Cable bracket, lh
2 Boom lower section
3 Connection pin (8 rqr)
4 Pin, cotter, split, ⅜ x 2 (8 rqr)
5 Boom center section, 5 ft
6 Setscrew, sq hd, cup point, ½–13 NC x 1
7 Pin
8 Bronze bushing (2 rqr)
9 Roller
10 Bracket
11 Lubrication fittings, ⅛ straight (5 rqr)
12 Screw, cap, hex hd, ½–13 NC x 1½ (4 rqr)
13 Bracket
14 Boom upper section
15 Lockwasher, spring, std, ½ (4 rqr)
16 Nut, regular, hex, ½–13 NC (5 rqr)
17 Shackle pin (4 rqr)
18 Chain shackle, 1⅛ (4 rqr)
19 Cotter pin (4 rqr)
20 Cable ½ (2 rqr)
21 Cable clamp, ½ (8 rqr)
22 Cable thimble, ½ (4 rqr)
23 Housing
24 Ball bearing
25 Gasket
26 Cap
27 Lockwasher (3 rqr)
28 Screw (3 rqr)
29 Pointer
30 Lockwasher, spring, std, 5/16 (5 rqr)
31 Bolt, stove, flat hd, 5/16 x ¾ (2 rqr)
32 Screw, machine, rd hd, 5/16 x ½ (3 rqr)
33 Boom angle indicator
34 Shaft
35 Pin, cotter, split, ½ x 4 (2 rqr)
36 Cable bracket, rh
37 Pin (2 rqr)

Figure 157. Crane boom, exploded view.

section (5), and the boom upper section (14) by removing the cotter pins (4) and the connection pins (3).

(3) Remove the screws (28), lockwashers (27), cap (26), and gasket (25) from the housing (23).

(4) Remove a nut (16) from the shaft (34). Remove the

housing (23) from the shaft. The shaft is welded to the boom section.

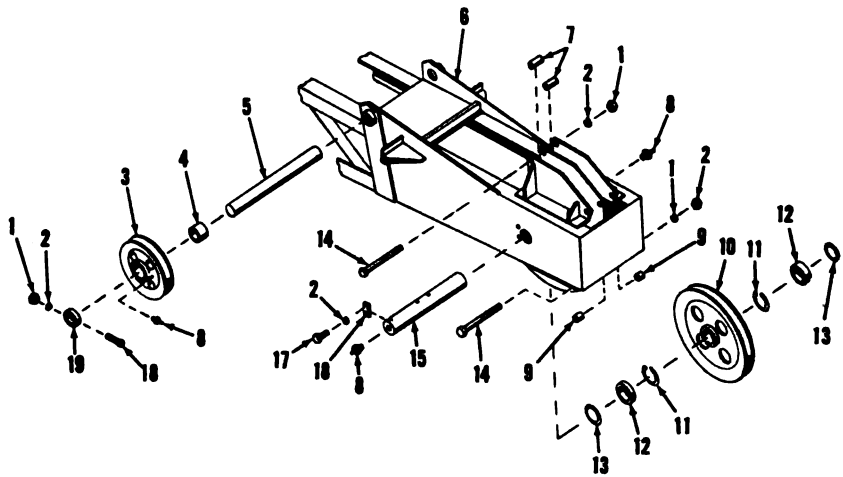
(5) Remove the ball bearing (24) from the housing. Remove the stove bolts (31), lockwashers (30), and the pointer (29) from the housing.

(6) Remove the machine screws (32), lockwashers (30), and boom angle indicator (33) from the boom section.

(7) Remove the nuts (16), lockwashers (15), and screws (12) from the brackets (10 and 13) and the boom upper section (14). Lift the roller assembly from the boom section.

(8) Remove the bracket (10) from the shaft (7). Remove the bracket (13) and shaft from the roller (9). Remove the setscrew (6) and separate the bracket and shaft.

(9) Remove the nuts (1, fig. 158), lockwashers (2), bolts (18), and collars (19) from the pin (5).



1	Nut, regular, hex, ½–13 NC (6 rqr)	10	Pulley (2 rqr)
2	Lockwasher, spring, std, ½ (8 rqr)	11	Retaining ring (4 rqr)
3	Pulley (2 rqr)	12	Ball bearing (4 rqr)
4	Bronze bushing (2 rqr)	13	Washer (4 rqr)
5	Pin	14	Bolt, hex hd, ½–13 NC x 6½ (4 rqr)
6	Boom upper section	15	Pin
7	Spacer, pipe, std, ½ x 2½ (4 rqr)	16	Lock bar
8	Lubrication fitting, ⅛ straight (4 rqr)	17	Screw, cap, hex hd, ½–13 NC x 1 (2 rqr)
9	Spacer, pipe, std, ½ x 1¾ (4 rqr)	18	Bolt, hex hd, ½–13 NC x 4 (2 rqr)
		19	Collar (2 rqr)

Figure 158. Boom point pulleys, exploded view.

(10) Remove the pulleys (3) from the pin (5). Remove the pin from the boom upper section (6).

(11) Remove the nuts (1), lockwashers (2), bolts (14), and spacers (7) and (9) from the boom point.

(12) Remove the screws (17), lockwashers (2), and lock bar (16), from the boom section and pin (15). Remove the pin (15) and pulleys (10) with washers (13) from the boom point.

(13) Remove the ball bearings (12) from the pulleys (par. 190). Use long nose pliers to remove the retaining rings (11).

b. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the boom sections for fractures, bent surfaces, or breaks in the frame and trusses. Weld cracks or breaks in the boom. Straighten bent surfaces by heating and pounding to alinement with a sledge and heavy bucking-up bar. If necessary, add a reinforcing member by welding next to or over the weakened angle.

(2) Inspect all pins and shafts for cracks, breaks, distortion, and wear. Replace a pin or shaft if cracked, broken, distorted, or worn.

(3) Inspect all bearings thoroughly, checking particularly for out-of-round condition caused by corrosion of wear. Check for overheating, which is evidenced by discoloration of the balls or retaining rings. Examine the outer race for scoring or galling. Replace a bearing that is worn, scored, or galled, or has been overheated.

(4) Inspect the pulleys for cracks, breaks, worn grooves, or worn bushings. Replace a pulley that is cracked or broken. Repair worn grooves (par. 188). Replace worn bushings (par. 189).

(5) Inspect all parts for good condition. Replace parts not in good condition.

c. Reassembly and Installation.

(1) Using long-nose pliers, install the retaining rings (11, fig. 158) in the pulleys (10). Install the ball bearings (12) in the pulleys (par. 190).

(2) Put a little chassis grease on the washers (13) to hold them on the pulleys (10). Position the pulley in the boom point. Making sure that the notched end of the pin (15) will be on the same side of the boom as the lock bar (16) mounting holes, insert the pin in the boom

section and the pulley. Position the second pulley (10) in the boom point and push the pin (15) through the pulley and boom section. Secure the pin with the lock bar (16), lockwashers (2), and screws (17).

(3) Position the spacers (7 and 9) in the boom point, install the bolts (14), and secure the bolts with lockwashers (2) and nuts (1).

(4) Lubricate the boom point pulleys (LO 5–9513–1).

(5) Install the pin (5) in the boom upper section (6). Install the pulleys (3) on the pin.

(6) Position the collars (19) on the pin. Install the bolts (18) through the collars and shaft. Secure the bolts with lockwashers (2) and nuts (1).

(7) Lubricate the pulleys (LO 5–9513–1).

(8) Install the pin (7, fig. 157) in the roller (9). Position the brackets (10 and 13) on the ends of the pin (7).

(9) Position the assembly on the upper boom section (14) and secure the brackets to the boom with screws (12), lockwashers (15), and nuts (16). After making sure that the pin (7) is centered between the brackets, install the setscrew (6) in the bracket (13) and onto the pin (7).

(10) Position the boom angle indicator (33) on the boom lower section (2) and secure with lockwashers (30) and machine screws (32).

(11) Position the pointer (29) on the housing (23) and secure with lockwashers (30) and stove bolts (31).

(12) Install the ball bearing (24) in the housing (23). Install the housing on the pin (34) and secure with a nut (16).

(13). Position the gasket (25) and the cap (26) on the housing (23) and secure with lockwashers (27) and screws (28).

(14) Lubricate the boom angle indicator (LO 5–9513–1).

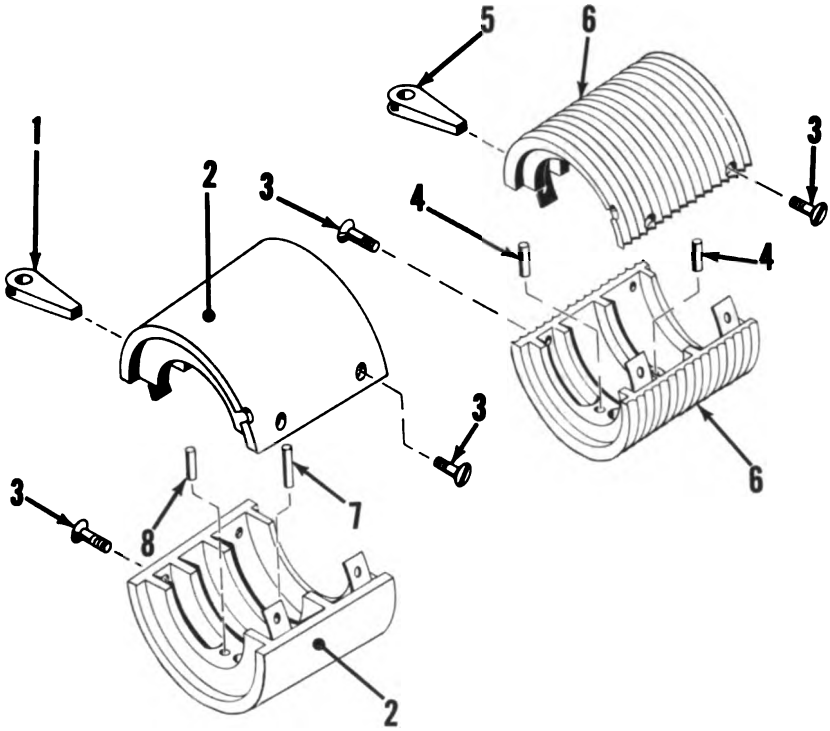
(15) Connect the boom lower section (2), the boom center section (5), and the boom upper section (14) by installing connection pins (3). Secure the connection pins with cotter pins (4).

229. Front Drum Lagging
(fig. 159)

a. Removal and Disassembly.

(1) Unreeve the cable from the front drum shaft assembly (par. 15).

(2) Block up the bottom lagging section (2) or (6). Remove



EMC 9513-159

1 Cable wedge, ½
2 Crane, clamshell, and back hoe lagging section
3 Screw, machine, flat hd, ⅝–11 NC x 1¼ (8 rqr)
4 Dowel (2 rqr)
5 Cable wedge, ⅝
6 Dragline lagging section
7 Long dowel
8 Short dowel

Figure 159. Front drum lagging, exploded view.

four flathead machine screws (3) from the lagging sections (2) or (6). Lift the top lagging section (2) or (6) from the front drum shaft assembly. Remove the blocking and bottom lagging section (2) or (6) from the front drum shaft assembly.

(3) Remove dowels (7 and 8) from the front drum, if lagging sections (2) have been installed.

(4) Remove the two dowels (4) from the front drum, if lagging sections (6) have been installed.

b. Inspection and Repair. Wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the lagging sections and the front drum for

cracks and breaks. Replace both lagging sections if either one is cracked or broken. Report a cracked or broken front drum to higher authority.

(2) Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace parts having damaged, corroded, or stripped threads.

(3) Inspect all parts for good condition. Replace parts not in good condition.

c. *Reassembly and Installation.*

(1) Install two dowels (4) in the front cable drum, if lagging sections (6) are to be installed.

(2) Install dowels (7 and 8) in the front cable drum, if lagging sections (2) are to be installed. The long dowel (7) must be in the front cable drum on the right side of the revolving frame.

(3) Position the bottom lagging section (2) or (6) on the dowels in front cable drum. Block up the lagging section.

(4) Position the top lagging section (2) or (6) on the front cable drum. Attach the sections to each other with four flathead machine screws (3). Remove the blocking from the bottom lagging section.

(5) Reeve the cable on the front drum lagging for the desired operation.

Section XVII. SHOVEL FRONT END ASSEMBLY

230. General

The instructions prepared in this section are for removal, disassembly, inspection and repair, reassembly, installation, and adjustment of the dipper padlock, dipper, handle, crowd chain and sprockets, shipper shaft, boom, boom point pulleys, and the electric dipper trip mechanism of the shovel front end assembly.

231. Shovel Dipper Padlock Block

a. *Removal* (fig. 160).

(1) Unreeve the dipper hoist cable (par. 17).

(2) Remove the cotter pin from the pin (7).

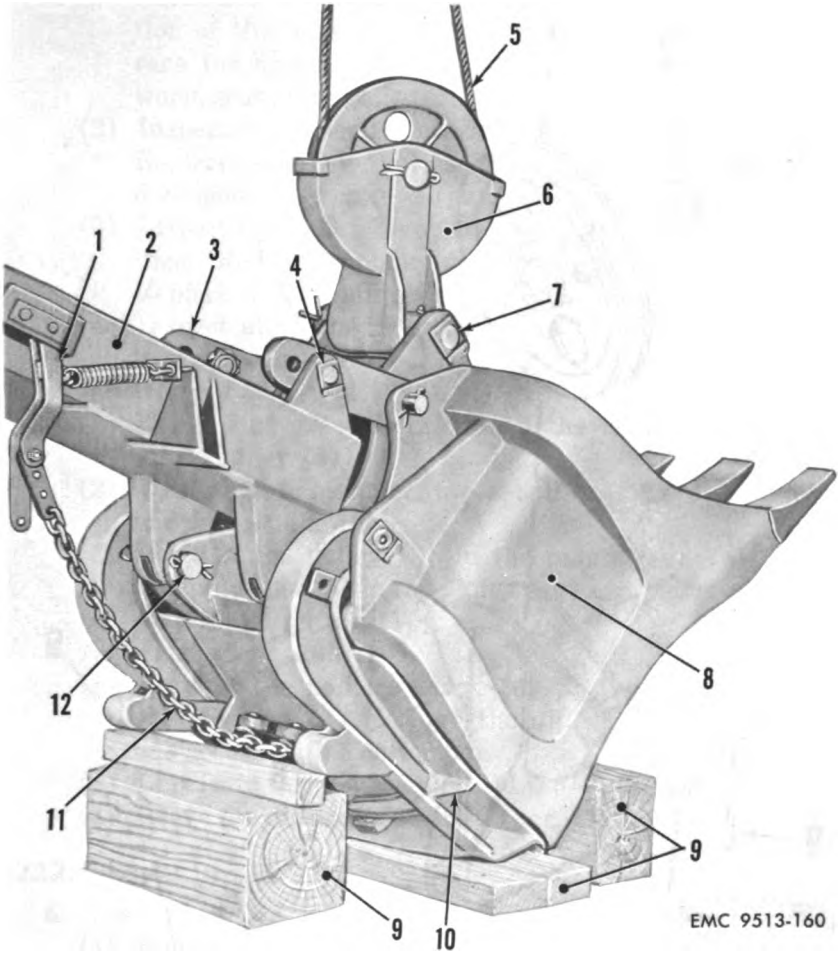
(3) Remove the pin (7) and the padlock block (6) from the dipper (8).

b. *Disassembly* (fig. 161).

(1) Remove the cotter pin (10) and the pulley pin (5) from the pulley cage (4) and pulley (3).

(2) Remove the pulley (3) from the pulley cage (4).

(3) Tap the hub of the pulley (3) with a soft hammer to dislodge the ball bearings (1).



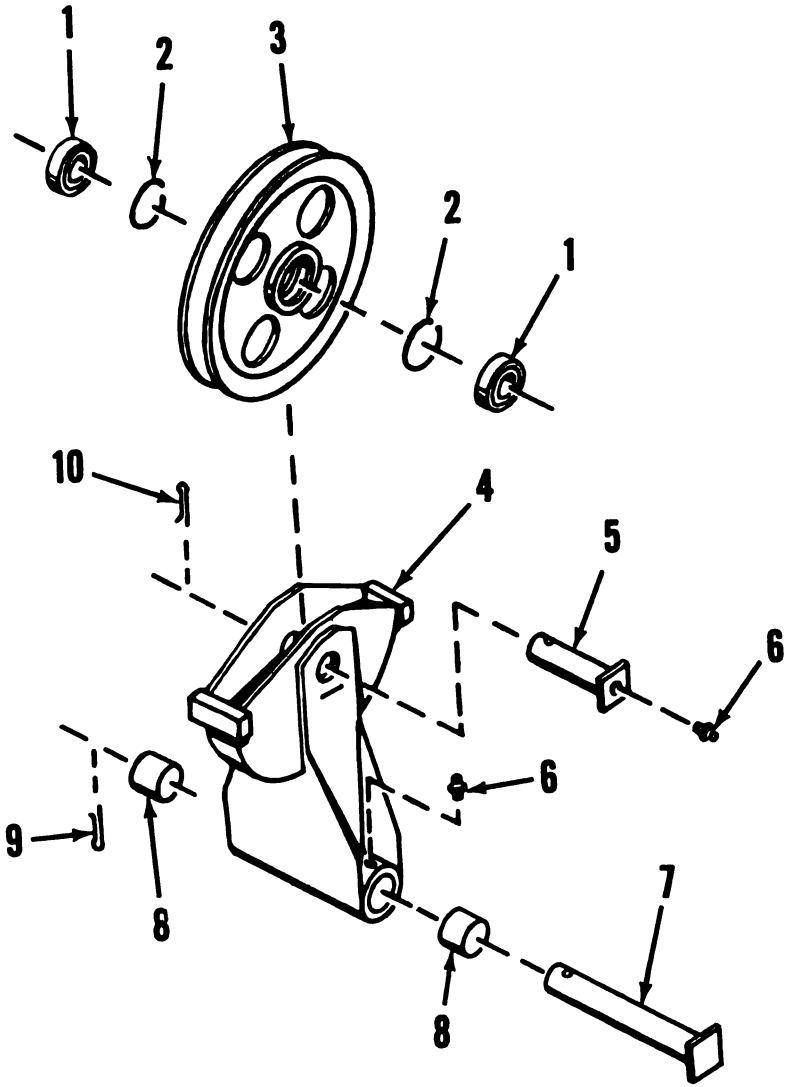
1	Trip lever	7	Pin
2	Handle	8	Dipper
3	Brace bar	9	Wood blocking
4	Pin	10	Dipper door
5	Dipper hoist cable	11	Dipper trip chain
6	Padlock block	12	Pin

Figure 160. Shovel dipper, padlock block, and handle, installed.

(4) Use long-nose pliers to remove the retaining rings (2) from the pulley (3).

c. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the bearings thoroughly, checking particularly for out-of-round condition caused by corrosion or wear.



1 Ball bearing (2 rqr)
2 Retaining ring (2 rqr)
3 Pulley
4 Pulley cage
5 Pulley pin
6 Lubrication fitting, ⅛ straight (2 rqr)
7 Pin
8 Bronze bushing (2 rqr)
9 Pin, cotter, split, 7/16 x 2½
10 Pin, cotter, split, ⅜ x 3¼

Figure 161. Shovel dipper padlock block, exploded view.

Check for overheating, which is evidenced by discoloration of the balls or retaining rings. Examine the outer race for scoring or galling. Replace a bearing that is worn, scored, or galled, or has been overheated.

(2) Inspect the pulley for cracks, breaks, or damaged groove. Replace a pulley that is cracked or broken. Repair a damaged pulley groove (par. 188).

(3) Inspect the pulley cage for cracks, breaks, or worn bushings. Replace a pulley cage that is cracked or broken. Replace worn bushings (par. 189).

(4) Inspect all parts for good condition. Replace parts not in good condition.

d. Reassembly (fig. 161).

(1) Using long-nose pliers, install the retaining rings (2) in the pulley (3).

(2) Using a soft hammer, tap a ball bearing (1) into each end of the pulley hub.

(3) Position the pulley (3) in the pulley cage (4). Install the pulley pin (5) in the pulley cage and pulley and secure with the cotter pin (10).

e. Installation (fig. 160).

(1) Position the padlock block (6) on the dipper (8). Install the pin (7) through the dipper and padlock block and secure with a cotter pin.

(2) Lubricate the padlock block (LO 5–9513–1).

(3) Reeve the dipper hoist cable (par. 17).

232. Shovel Dipper

a. Removal.

(1) Remove the shovel dipper padlock block (par. 231*a*(2) and (3)).

(2) Disconnect the dipper trip chain (11, fig. 160) from the trip lever (1) on the handle (2).

(3) Remove the cotter pins from the pins (12). Remove the pins from the handle (2) and dipper (8).

(4) Remove the nuts (9, fig. 162), lockwashers (8), screws (6), and collars (7) from the pins (4).

(5) Remove the pins (4, fig. 160) from the handle (2) and brace bars (3). Remove the dipper from the handle.

b. Disassembly.

(1) Remove a cotter pin (2, fig. 162) from the pin (3). Remove the pin and brace bars (5) from the front plate (19).

(2) Remove the dipper teeth (*g* page 428).

(3) Remove cotter pins (2) from the pins (18). Remove

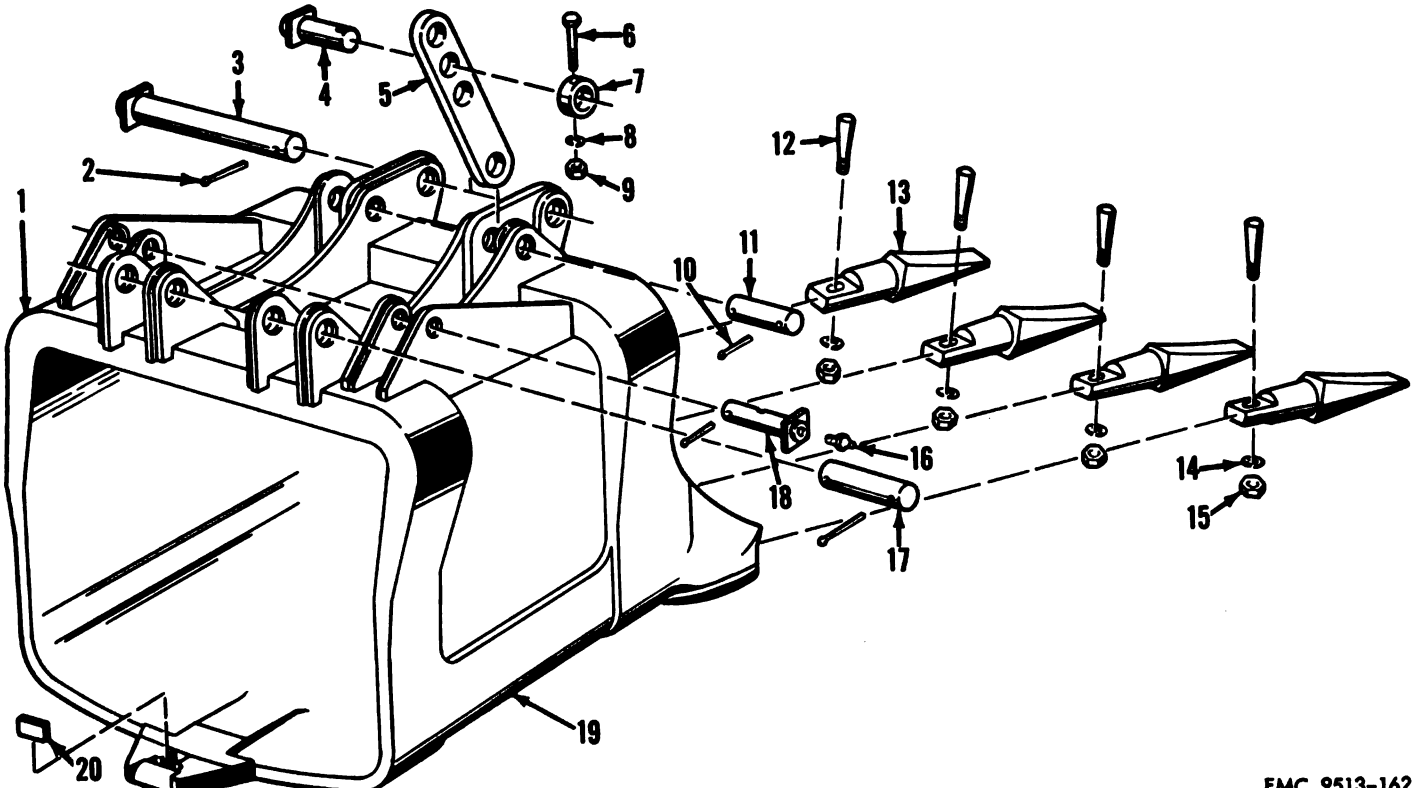


Figure 162. Shovel dipper, exploded view.

the pins (18) from the front plate (19) and the hinges (7, fig. 163). Remove the dipper door from the front plate.

(4) Remove the cotter pin (4), nut (5), screw (2), and the trip chain (1) from the latch lever (3).

(5) Remove the cotter pins (12), castle nuts (13), and cap screws (14 and 15) from the latch lever. Remove the latch lever and latch bar (6) from the dipper door.

(6) Remove the bottom locknut (10) from the latch yoke (11). Remove the latch yoke from the dipper door. Remove the locknuts (10) from the latch yoke.

c. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the dipper front plate and door for cracks, breaks, and distortion. Weld cracks or breaks in the dipper front plate and door. Straighten bent surfaces by heating and pounding to alinement with a sledge and heavy bucking-up bar. If necessary, add a reinforcing member by welding next to or over the weakened portion.

(2) Inspect the door hinge bushings for wear. Replace defective hinge bushings (par. 189).

(3) Inspect the latch keeper for wear. Replace a defective latch keeper. Using a cold chisel and hammer, break the defective latch keeper from the dipper front plate. Spot-weld the new latch keeper in place.

(4) Inspect the dipper teeth for wear. Repair defective teeth (par. 191).

(5) Inspect all pins for wear. Replace defective pins.

(6) Inspect all parts for good condition. Replace parts not in good condition.

←

1 Bucket
2 Pin, cotter, split, 7/16 x 2½ (7 rqr)
3 Pin
4 Pin (2 rqr)
5 Brace bar (2 rqr)
6 Screw, cap, hex hd, ½–13 NC x 3¼ (2 rqr)
7 Collar (2 rqr)
8 Lockwasher, spring, std, ½ (2 rqr)
9 Nut, regular, hex, ½–13 NC (2 rqr)
10 Pin, cotter, split, 5/16 x 2 (4 rqr)
11 Pin (2 rqr)
12 Tooth bolt (4 rqr)
13 Teeth (4 rqr)
14 Lockwasher, spring, std, ¾ (4 rqr)
15 Nut, regular, hex, ¾–10 NC (4 rqr)
16 Lubrication fitting, ⅛ straight (2 rqr)
17 Headless straight pin (2 rqr)
18 Pin (2 rqr)
19 Front plate
20 Latch keeper

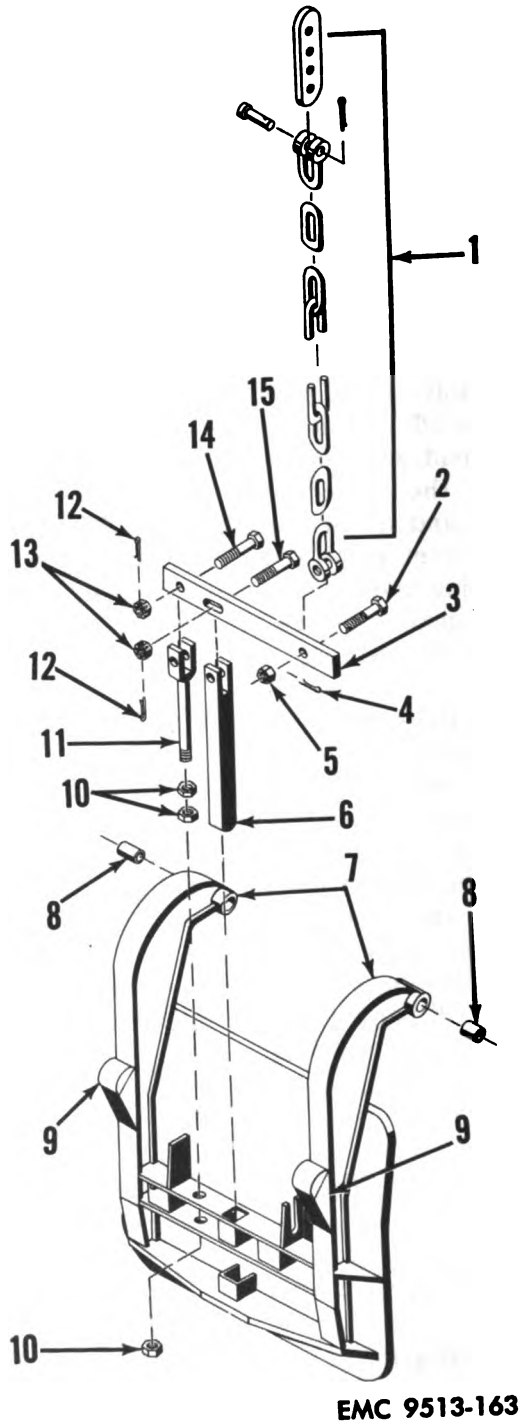


Figure 163. Dipper door, exploded view.

d. Reassembly.

(1) Install two locknuts (10, fig. 163) on the latch yoke (11). Install the latch yoke in the dipper door and secure with a third locknut (10).

(2) Position the latch lever (3) in the latch bar (6). Install the cap screw (15) through the latch bar and lever and secure with a castle nut (13) and cotter pin (12).

(3) Install the latch bar (6) in the dipper door. Position the latch lever (3) in the latch yoke (11). Install the cap screw (14) through the latch yoke and lever and secure with a castle nut (13) and cotter pin (12).

(4) Position the trip chain (1) on the latch lever (3). Install the screw (2) and secure with a nut (5) and cotter pin (4).

(5) Position the hinges (7) on the front plate (19, fig. 162). Install the pins (18) through the front plate and hinges and secure with cotter pins (2).

(6) Position the brace bars (5) on the front plate (19). Install the pin (3) through the front plate and brace bars and secure with a cotter pin (2).

e. Installation.

(1) Position the dipper (8, fig. 160) under the handle (2). Install the pins (12) through the dipper and dipper handle. Secure the pins with cotter pins.

(2) Install the pin (4) through the handle (2) and brace bars (3). Install the collar (7, fig. 162) on the pin. Insert the screw (6) through the collar and pin and secure with a lockwasher (8) and nut (9).

(3) Connect the dipper trip chain (11, fig. 160) to the trip lever (1) on the handle (2).

(4) Install the shovel dipper padlock block (par. 231*e*).

(5) Lubricate the shovel dipper (LO 5–9513–1).

f. Dipper Adjustment.

(1) *Dipper angle* (fig. 160). The angle of the dipper (8) in relation to the dipper handle (2), is adjustable at the brace bars (3). To increase the angle for a deeper cut,

←

1 Trip chain
2 Screw, cap, hex hd, ½–13 NC x 2¼
3 Latch lever
4 Pin, cotter, split, ⅛ x 1¼
5 Nut, regular, hex, ½–13 NC
6 Latch bar
7 Hinge (2 rqr)
8 Steel bushing (2 rqr)
9 Hinge stop (2 rqr)
10 Locknut, Marsden, 1–8 NC (3 rqr)
11 Latch yoke
12 Pin, cotter, split, 5/32 x 1 (2 rqr)
13 Nut, castle, ⅝–11 NC (2 rqr)
14 Cap screw
15 Cap screw

remove the pin (4) and reinstall in a top hole of the brace bar.

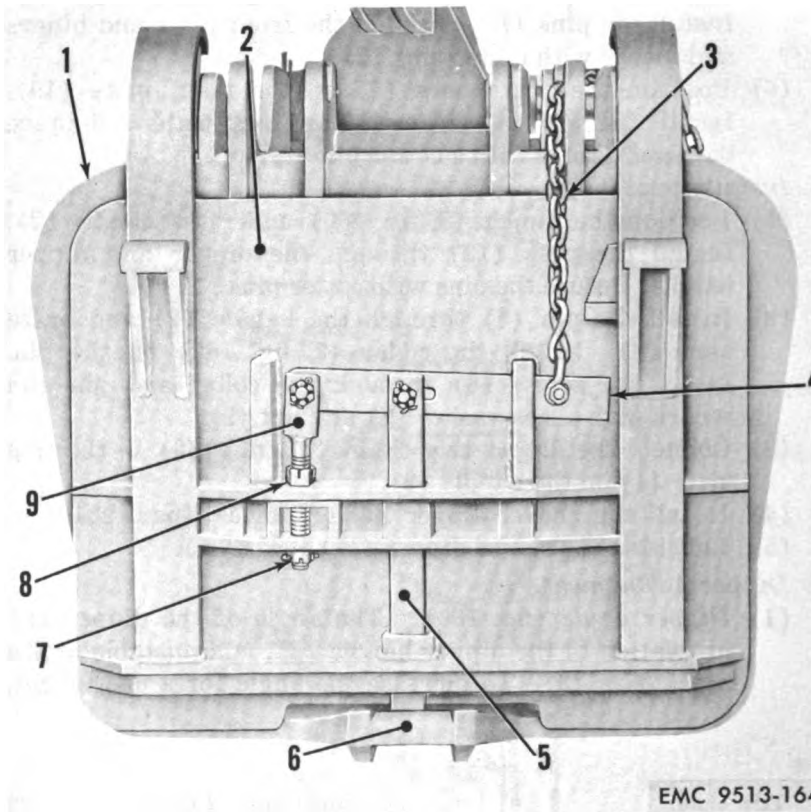
(2) *Dipper latch bar* (fig. 164). To adjust the latch bar (5), tighten the locknuts (8) on the latch yoke (9) until the latch bar will extend into the latch keeper (6) to hold the necessary load and still release when tripped. When proper adjustment is made, tighten the locknut (7) on the latch yoke against the dipper door.

g. Dipper Teeth (fig. 162).

(1) *Removal.*

(*a*) Remove the nuts (15) and lockwashers (14) from the tooth bolts (12).

(*b*) Using a hammer and driftpin, drive the tooth bolts



1 Dipper
2 Dipper door
3 Trip chain
4 Latch lever
5 Latch bar
6 Latch keeper
7 Locknut
8 Locknut
9 Latch yoke

Figure 164. Shovel dipper latch bar adjusting points.

from the front plate (19) and the teeth (13). Remove the teeth from the front plate.

(2) *Installation.*

(*a*) Position the teeth (13) in the front plate (19).

(*b*) Install the tooth bolts (12) in the front plate (19) and the teeth (13). Secure the tooth bolts with lockwashers (14) and nuts (15).

233. Shovel Dipper Handle

a. General. If desired, the shovel dipper and handle may be removed as an assembly. However, the instructions that follow are for removing the handle as a separate component.

b. Removal.

(1) Remove the shovel dipper (par. 232*a*).

(2) Unreeve the dipper trip cable from the handle (par. 17).

(3) Attach a cable to the padlock block and around the dipper handle not quite halfway upon the handle for balance. Place timber between the handle sticks at the point where the cable is placed, to avoid distortion of the handle when lifted.

(4) Making certain that the dipper handle is balanced, remove the shipper shaft yokes (par. 235*b*).

(5) Raise the dipper handle and place on wood blocks on the ground.

(6) Remove the cable from the dipper handle and padlock block.

c. Disassembly (fig. 165).

(1) Remove the outer nut (4) from the eyebolt (9). Remove the eyebolt and the extension spring (10).

(2) Remove the nut (19), lockwasher (20), and screw (21) from the lever pin (22) and the bracket welded to the side of the handle (2).

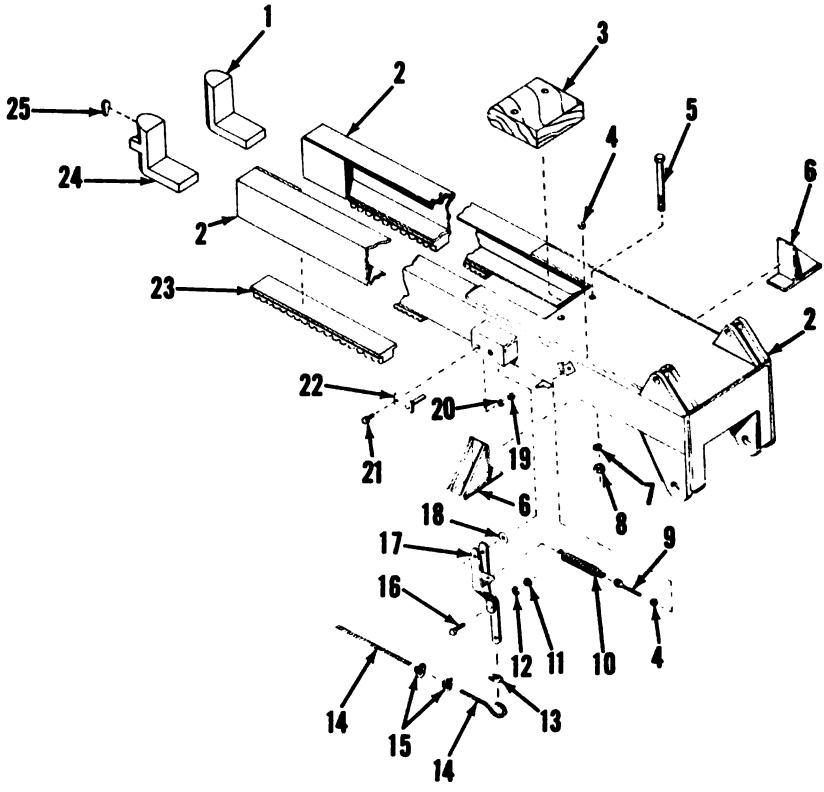
(3) Remove the lever pin, trip lever (17), and the washer (18).

(4) Remove the nuts (8), lockwashers (7), bolts (5), and the oak block (3) from the handle (2).

(5) The end plugs (1 and 24), the handle stops (6), and the rack sections (23) are welded on the dipper handle (2).

d. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the dipper handle for cracks, breaks, and distortion. Weld cracks or breaks. Straighten bent surfaces by heating and pounding to alinement with a



1	End plug, lh	13	Cable thimble, 3/16
2	Handle	14	Trip cable, 5/16 x 13½ ft
3	Oak block	15	Cable clip, 5/16 (2 rqr)
4	Nut, regular, hex, ⅜–16 NC (2 rqr)	16	Screw, cap, hex hd, ⅝–11 NC x 2½
5	Bolt, machine, hex hd, ¾–10 NC x 8½ (2 rqr)	17	Trip lever
6	Handle stop (2 rqr)	18	Washer, plain, std, ¾
7	Lockwasher, spring, std, ¾ (2 rqr)	19	Nut, regular, hex, ½–13 NC
8	Nut, regular, hex, ¾–10 NC (2 rqr)	20	Lockwasher, spring, std, ½
9	Eyebolt	21	Screw, cap, hex hd, ½–13 NC x 1½
10	Extension spring	22	Lever pin
11	Nut, regular, hex, ⅝–11 NC	23	Rack section (16 rqr)
12	Lockwasher, spring, std, ⅝	24	End plug, rh
		25	Cable wedge

Figure 165. Dipper handle, exploded view.

sledge and heavy bucking-up bar. If necessary, add a reinforcing member by welding next to or over the weakened portion.

(2) Inspect the end plugs, handle stops, and rack sections. If badly damaged, weld on a new end plug, handle stop, or rack section.

(3) Inspect the oak block for damage. Replace a badly battered oak block.

(4) Inspect all parts for good condition. Replace parts not in good condition.

e. Reassembly (fig. 165).

(1) Position the oak block (3) in the handle (2). Install the bolts (5) through the handle and block and secure with lockwashers (7) and nuts (8).

(2) Position the washer (18) and trip lever (17) in the bracket welded on the side of the handle. Install the lever pin (22) in the bracket and trip lever. Secure the lever pin with a screw (21), lockwasher (20), and nut (19) in the pin head.

(3) Install a nut (4) on the eyebolt (9). Install the eyebolt in its bracket on the side of the handle.

(4) Attach the extension spring (10) to the eyebolt (9) and the trip lever (17).

f. Installation.

(1) Attach a cable to the padlock block and around the dipper handle not quite halfway upon the handle for balance. Place timber between the handle sticks at the point where the cable is placed, to avoid distortion of the handle when lifted.

(2) Making certain that the handle is balanced, raise and guide the handle to its position on the shipper shaft assembly. Install the shipper shaft yokes (par. 235*d*).

Caution: Make certain that there are the same number of teeth between the rack pinion and the end plug on each stick of the handle.

(3) Reeve the dipper trip cable on the handle (par. 17).

(4) Install the shovel dipper (par. 232*e*).

(5) Lubricate the handle rack sections and the shipper shaft assembly (LO 5–9513–1).

234. Crowd Chain and Sprockets

a. Description. The crowd and retract mechanism consists of a split chain sprocket (2, fig. 166), mounted on the front drum shaft assembly (1), a crowd chain (4), a crowd chain takeup assembly (fig. 167), mounted on the front of the rotating base, and the chain sprocket (13, fig. 168) of the shipper shaft assembly.

b. Removal.

(1) Disconnect the crowd chain (4, fig. 166) at the connecting link. Remove the chain from the split chain sprocket (2), the crowd chain takeup assembly, and the chain sprocket (13, fig. 168).

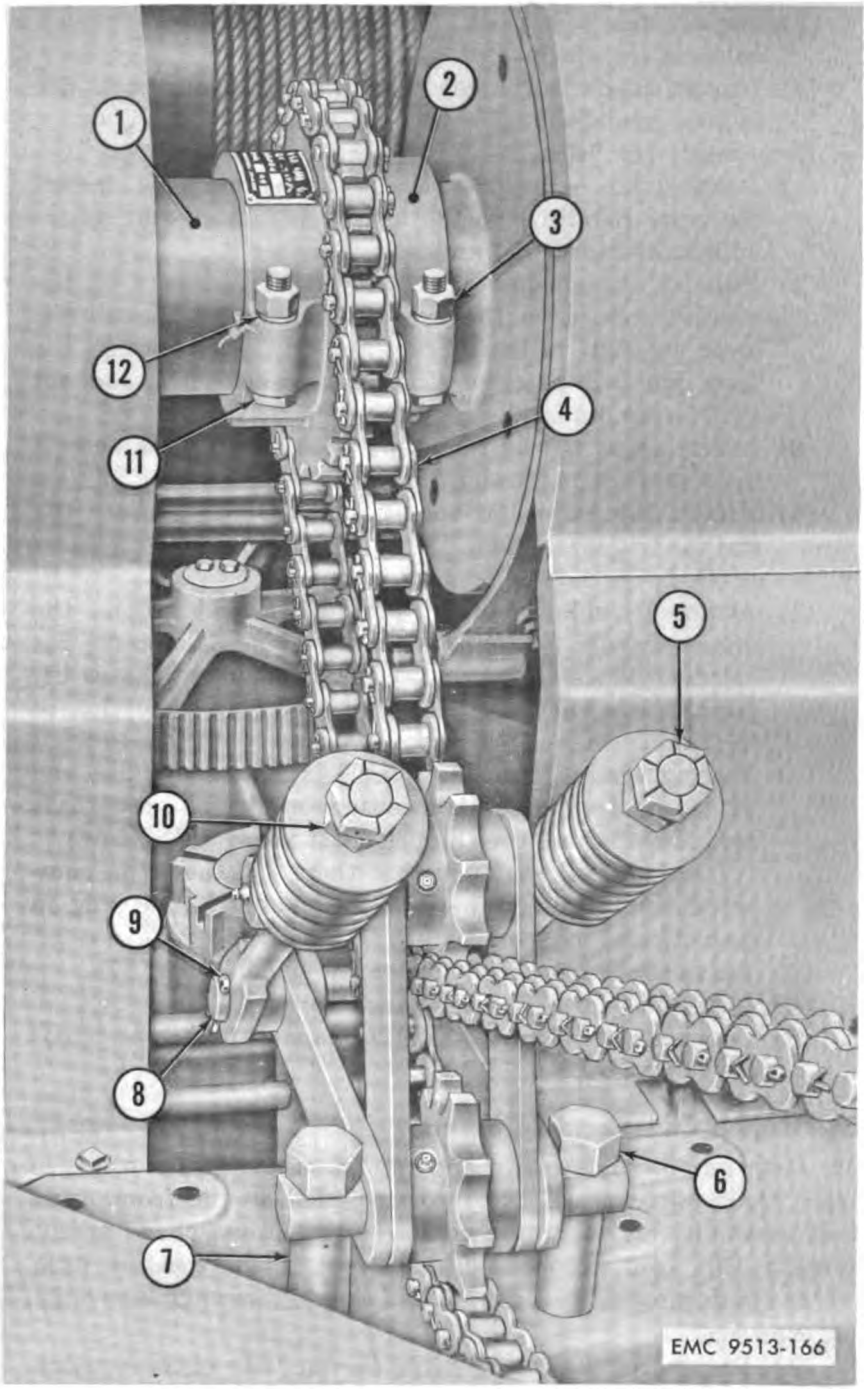


Figure 166. Crowd chain takeup and sprocket, installed.

(2) Remove the nuts (3, fig. 166), lockwashers (12), and screws (11) from the split chain sprocket (2). Remove the sprocket sections and dowels from the front drum shaft assembly.

(3) Remove cotter pins (9) and the pin (8) from the rotating base and chain takeup assembly.

(4) From underneath the rotating base, remove the cotter pins (19, fig. 167), castle nuts (18), washers (17), fabreeka washers (15), and spacers (16) from the anchor bolts (6, fig. 166). Remove the crowd chain takeup assembly from the rotating base.

(5) Remove the chain sprocket (13, fig. 168) as part of the shipper shaft disassembly (par. 235*b*).

c. Disassembly (fig. 167).

(1) Remove the pipe spacers (14) and anchor bolts (1) from the pin (2).

(2) Remove the pin (2) from the bars (23), links (11), and chain sprocket wheel (12). Remove the sprocket wheel.

(3) Remove the nuts (8 and 7), spring guides (6), and compression springs (9) from the takeup rods (22).

(4) Remove the takeup rods from the pin (10). Remove the pin from the links (11) and chain sprocket wheel (12).

d. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the links, bars, pins, anchor bolts, and takeup rods for cracks, breaks, and distortion. Replace a link, bar, pin, anchor bolt, or takeup rod if cracked, broken, or distorted.

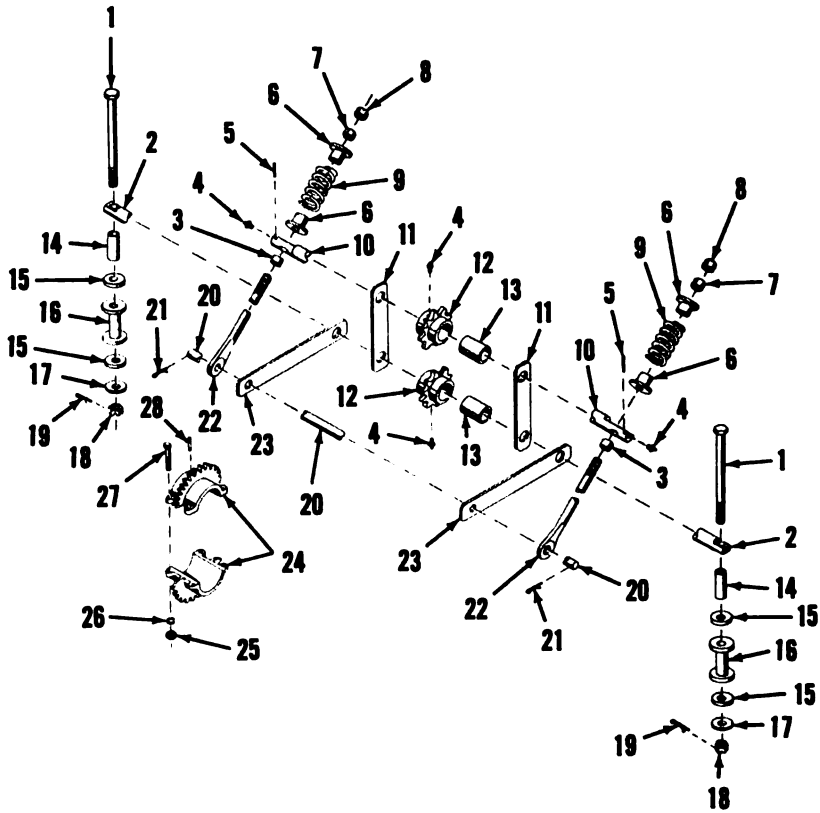
(2) Inspect the split chain sprocket and chain sprocket wheels for cracks, chipped or broken teeth, and evidences of wear. Replace a sprocket or sprocket wheel that is cracked, or has chipped, broken, or worn teeth.

(3) Inspect the chain sprocket wheel bushings for wear. Replace worn sprocket wheel bushing (par. 189).

(4) Inspect the rod bushings for wear. Replace worn rod bushing. Using a driftpin and hammer, drive a brass

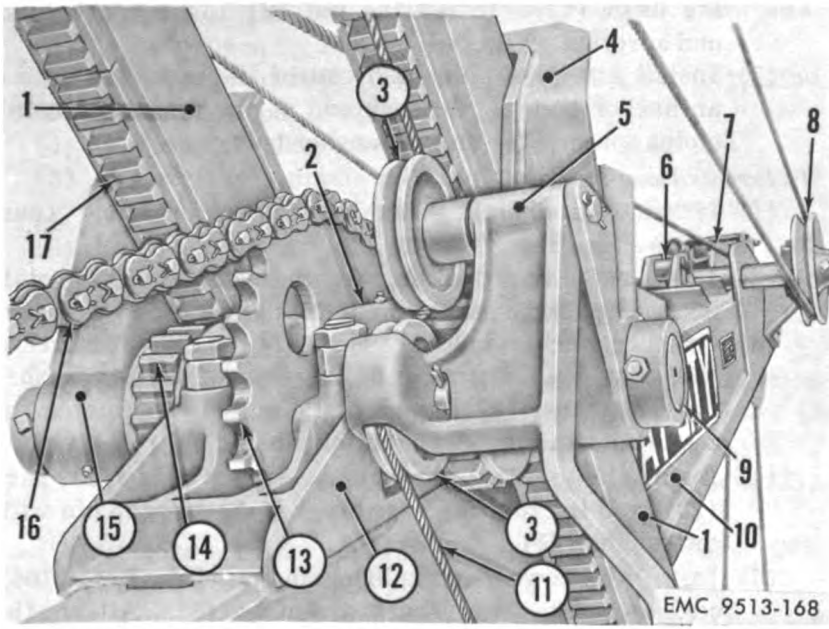
←

1 Front drum shaft assembly
2 Split chain sprocket
3 Hex nut
4 Crowd chain
5 Locknut
6 Anchor bolt
7 Pipe spacer
8 Pin
9 Cotter pin
10 Hex nut
11 Screw
12 Lockwasher



1 Anchor bolt (2 rqr)
2 Pin
3 Bronze bushing (2 rqr)
4 Lubrication fitting, ⅛ straight (4 rqr)
5 Rod, brass, ½ x 7/16 (2 rqr)
6 Spring guide (4 rqr)
7 Nut, regular, hex, 1⅛–12 NF (2 rqr)
8 Nut, Marsden, 1⅛–12 NF (2 rqr)
9 Compression spring (2 rqr)
10 Pin
11 Link (2 rqr)
12 Chain sprocket wheel (2 rqr)
13 Bronze bushing (2 rqr)
14 Spacer, pipe, std, 1¼ x 3½ (2 rqr)
15 Fabreeka washer (4 rqr)
16 Spacer (2 rqr)
17 Washer (2 rqr)
18 Nut, castle, 1⅛–7 NC (2 rqr)
19 Pin, cotter, split, 5/16 x 1¾ (2 rqr)
20 Pin
21 Pin, cotter, split, 5/16 x 2½ (2 rqr)
22 Takeup rod (2 rqr)
23 Bar (2 rqr)
24 Split chain sprocket
25 Nut, regular, hex, ¾–10 NC (4 rqr)
26 Lockwasher, spring, std, ¾ (4 rqr)
27 Screw, cap, hex hd, ¾–10 NC x 3½ (4 rqr)
28 Dowel (2 rqr)

Figure 167. Crowd chain takeup and sprocket, exploded view.



1	Dipper handle	10	Shovel boom
2	Bearing cap	11	Trip rope
3	Trip pulley	12	Bearing
4	Righthand yoke	13	Chain sprocket
5	Trip lever	14	Rack pinion
6	Wedge socket	15	Lefthand yoke
7	Boom point pulleys	16	Crowd chain
8	Hoist pulley	17	Rack section
9	Shaft		

Figure 168. Dipper handle and shipper shaft, installed.

rod from the rod and bushing, remove the bushing, install a new bushing, and secure with a new brass rod.

(5) Inspect all parts for good condition. Replace parts not in good condition.

e. Reassembly (fig. 167).

(1) Install one end of the pin (10), a spring guide (6), a compression spring (9), a spring guide (6), and nuts (7 and 8) on a takeup rod (22).

(2) Install a link (11), a chain sprocket wheel (12), and a second link (11) on the pin (10).

(3) Insert the second takeup rod (22) in the other end of the pin (10). Install a spring guide (6), a compression spring (9), a spring guide (6), and nuts (7) and (8) on the end of the takeup rod.

(4) Position the second chain sprocket wheel (12) between

the links (11). Install the pin (2) through the links and sprocket wheel.

(5) Install a bar (23) on each end of the pin (2). Install an anchor bolt (1) in each end of the pin (2). Install a pipe spacer (14) on each anchor bolt.

f. Installation.

(1) If removed, install the shipper shaft assembly (par. 235*d*).

(2) Position the crowd chain takeup assembly on the rotating base with the anchor bolts through the base.

(3) On each anchor bolt (1, fig. 167), install a fabreeka washer (15), a spacer (16), a second fabreeka washer (15), a washer (17), and a castle nut (18). Tighten the castle nuts and install the cotter pins (19).

(4) Install the pin (20) through the takeup rods (22), bars (23), and the rotating base bracket. Secure the pin with cotter pins (21).

(5) Install the dowels and split chain sprocket (2, fig. 166) on the front drum shaft assembly (1). Attach the sprocket sections with screws (11), lockwashers (12), and nuts (3).

(6) Install the crowd chain (4) on the split chain sprocket (2), in the crowd chain takeup assembly, and over the chain sprocket (13, fig. 168). Connect the chain with the connecting link.

(7) Lubricate the crowd chain takeup assembly (LO 5–9513–1).

g. Adjustment (fig. 166).

(1) Tighten the crowd chain (4) by turning the hex nuts (10) on the takeup rods. Be sure there is a little slack in the chain at all working positions of the shovel boom. When proper adjustment is made, turn the locknuts (5) against the hex nuts (10).

(2) If the takeup rod springs are compressed and the crowd chain is loose, disconnect the chain at the offset link and remove one or more links as required. Connect the chain and adjust.

235. Shipper Shaft

a. General (fig. 168). The dipper handle (1) should be removed before removing the shipper shaft (9). In dipper handle removal, the yokes (4 and 15) only are removed.

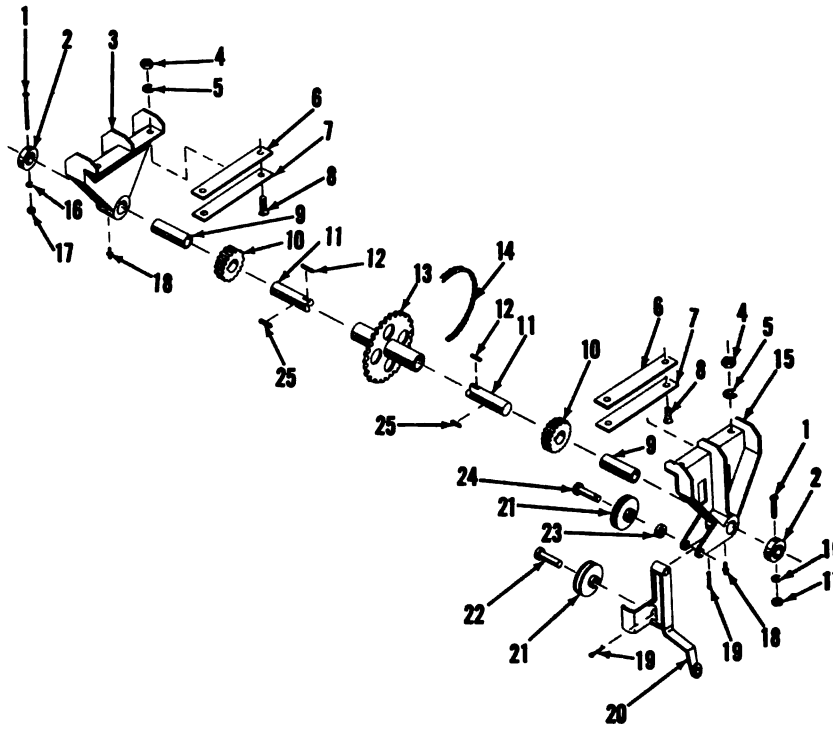
b. Removal and Disassembly.

(1) Remove the dipper handle (par. 233*b*).

(2) Disconnect and remove the sprocket wheel chain (14, fig. 169) from the chain sprocket (13).
(3) Remove the nuts (17), lockwashers (16), bolts (1), and collars (2) from the shaft (11).
(4) Remove the yokes (3 and 15) from the shaft (11).
(5) Remove the jamnuts (10, fig. 170), nuts (9), bearing caps (8), shims (6), and upper brass bushings (7).
(6) Remove the shaft (11, fig. 169) with rack pinions (10) and chain sprocket (13) from the bearing welded on the shovel boom. Remove the lower brass bushings (7, fig. 170).
(7) Remove the nuts (4, fig. 169) lockwashers (5), bolts (8), wear plates (7), and shims (6) from the yokes (3 and 15).
(8) Remove a cotter pin (19), pin (22), and pulley (21) from the trip lever (20).
(9) Remove a cotter pin (19), pin (24), trip lever (20), washer (23), and pulley (21) from the yoke (15).
(10) Remove the rack pinions (10) and keys (25) from the shaft (11).
(11) Remove the chain sprocket (13) and key (12) from the shaft (11).

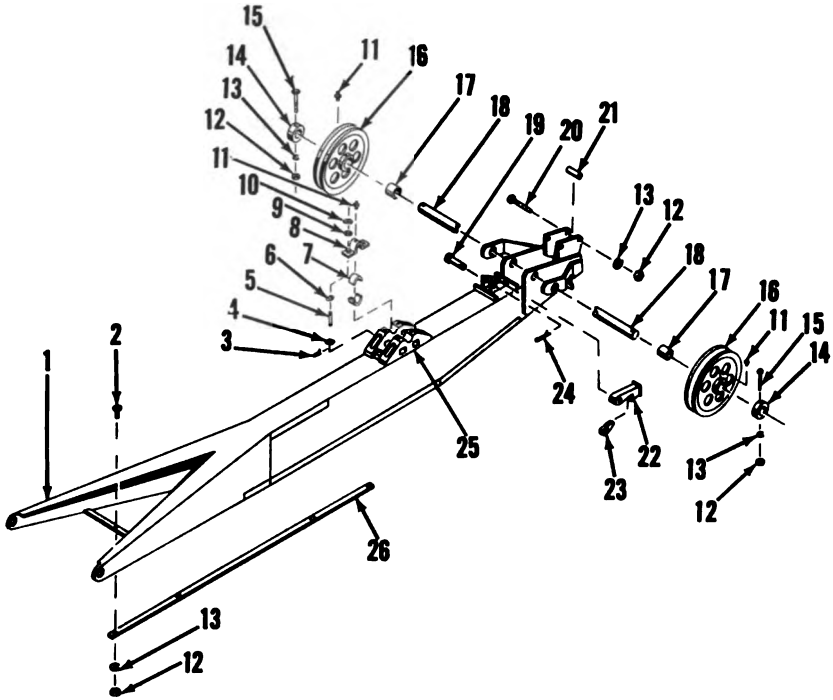
c. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the yokes and trip lever for cracks, breaks, and distortion. Replace a yoke or trip lever if cracked, broken, or distorted.
(2) Inspect the chain sprocket and rack pinions for cracks, chipped or broken teeth, evidences of wear, and damaged keyway. Replace a chain sprocket or rack pinion that is cracked or has chipped, broken, or worn teeth, or a damaged keyway.
(3) Inspect the shaft for wear, scoring, and damaged keyways. Replace a shaft that is worn, scored, or has a damaged keyway.
(4) Inspect the pulleys for cracks, breaks, or damaged groove. Replace a pulley that is cracked or broken. Repair a damaged pulley groove (par. 188).
(5) Inspect the yoke bushings for wear. Replace a worn bushing (par. 189).
(6) Inspect the wear plates for wear. Replace the plate if worn down to the machine bolt head.



1	Bolt, machine, sq hd, ½–13 NC x 5 (2 rqr)	14	Sprocket wheel chain
2	Collar (2 rqr)	15	Yoke, rh
3	Yoke, lh	16	Lockwasher, spring, std, ½ (2 rqr)
4	Nut, regular, hex, ⅝–11 NC (4 rqr)	17	Nut, regular, hex, ½–13 NC (2 rqr)
5	Lockwasher, spring, std, ⅝– (4 rqr)	18	Lubrication fitting, ⅛ straight (2 rqr)
6	Shim (as rqr)	19	Pin, cotter, split, 3/16 x 1½ (2 rqr)
7	Wear plate (2 rqr)	20	Trip lever
8	Bolt, machine, flat hd, ⅝–11 NC x 2¼ (4 rqr)	21	Pulley (2 rqr)
9	Bronze bushing (2 rqr)	22	Pin
10	Rack pinion (2 rqr)	23	Washer, plain, std, 1
11	Shaft	24	Pin
12	Key, std taper, plain, ¾ x ¾ x 9⅝	25	Key, std taper, plain, ¾ x ¾ x 3⅛ (2 rqr)
13	Chain sprocket		

Figure 169. Shipper shaft, exploded view.



EMC 9513-170

1	Boom
2	Bolt, machine, flat hd, ½–13 NC x 1¾ (3 rqr)
3	Pins, cotter, split, ¼ x 3 (4 rqr)
4	Nut, regular, square, 1¼–7 NC (4 rqr)
5	Threaded studs (4 rqr)
6	Shim (as rqr)
7	Brass bushings (2 rqr)
8	Bearing caps (2 rqr)
9	Nuts, regular, hex, 1¼–7 NC (4 rqr)
10	Jamnuts, regular, hex, 1¼–7 NC (4 rqr)
11	Lubrication fittings, ⅛ straight (4 rqr)
12	Nuts, regular, hex, ½–13 NC (7 rqr)
13	Lockwashers, spring, std, ½ (7 rqr)
14	Collars (2 rqr)
15	Screws, cap, hex hd, ½–13 NC x 4 (2 rqr)
16	Hoist pulleys (2 rqr)
17	Brass bushings (2 rqr)
18	Pin
19	Pin
20	Screws, cap, hex hd, ½–13 NC x 6½ (2 rqr)
21	Spacers, pipe, std, ½ x 5⅛ (2 rqr)
22	Socket
23	Wedge
24	Pin, cotter, split, ¼ x 2
25	Bearing
26	Guard

Figure 170. Shovel boom, exploded view.

(7) Inspect all parts for good condition. Replace parts not in good condition.

d. Reassembly and Installation.

(1) Install the key (12, fig. 169) and chain sprocket (13) on the shaft (11).

(2) Install the keys (25) and rack pinions (10) on the shaft (11).

(3) Install new lower brass bushings (7, fig. 170) in the bearing (25). Position the shaft assembly on the bushings and bearing.

(4) Position new upper brass bushings (7) on the bearing surface of the chain sprocket. Install shims (6), bearing caps (8), nuts (9), and jamnuts (10). Adjust the bearings by adding or removing shims (6) until all the play is taken up. Do not get the bearing too tight as this will cause wear on the bushings.

(5) Position the trip lever (20, fig. 169), washer (23), and a pulley (21) on the yoke (15). Install the pin (24) and secure with a cotter pin (19).

(6) Position a pulley (21) on the trip lever (20). Install the pin (22) and secure with a cotter pin (19).

(7) Install the dipper handle (par. 233*f*).

(8) Position the yokes (3) and (15) on the shaft (11) and dipper handle. Insert a wear plate (7) and a sufficient number of shims (6) between the yokes and handle sticks to provide a sliding fit of the handle sticks in the yokes. When the correct number of shims is obtained, slide the yokes away from the handle. Position the shims and wear plates on the yokes and secure with machine bolts (8), lockwashers (5), and nuts (4). Slide the yokes on the shaft and over the handle.

(9) Install the collars (2) on the shaft (11). Insert the machine bolts (1) through the collars and shaft and secure with lockwashers (16) and nuts (17).

(10) Install the chain on the chain sprocket.

(11) Lubricate the shipper shaft assembly (LO 5–9513–1).

236. Shovel Boom Point Pulley Assembly

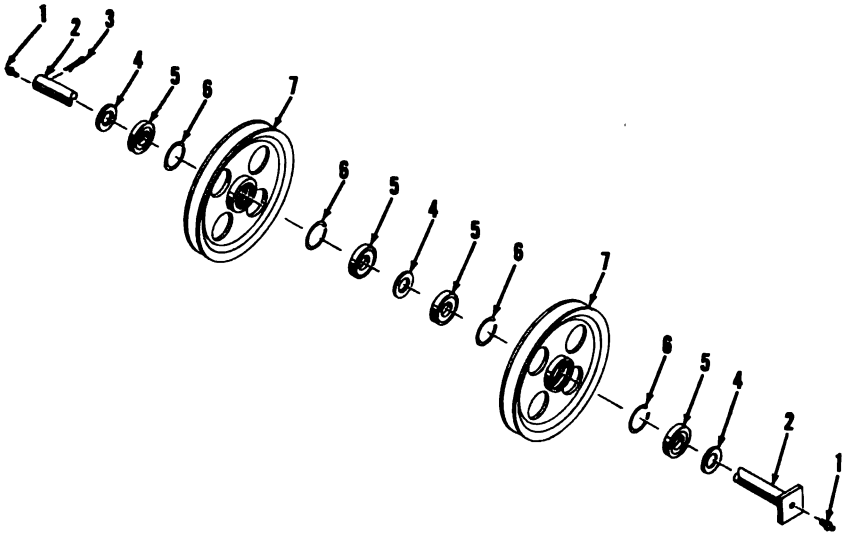
a. General. It is not necessary to completely unreeve the dipper hoist cable in order to disassemble the shovel boom point pulleys.

b. Removal and Disassembly.

(1) Lower the shovel dipper to the ground. Lower the shovel boom to rest on the dipper. Remove the dipper hoist cable and wedge from the wedge socket (6, fig. 168). Remove the dipper hoist cable from the boom point pulleys (7) and the padlock block.

(2) Remove the cotter pin (3, fig. 171) from the point pin (2).

(3) Withdraw the point pin from the boom point and, at the same time, remove the spacers (4) and pulleys (7).



1 Lubrication fitting, ⅛ straight (2 rqr)
2 Point pin
3 Pin, cotter, split, ⅜ x 3¼
4 Spacer (3 rqr)
5 Ball bearing (4 rqr)
6 Retaining ring (4 rqr)
7 Pulley (2 rqr)

Figure 171. Shovel boom point pulleys, exploded view.

(4) Using a soft hammer, tap the hub of the pulleys to dislodge the ball bearings (5).

(5) Use long nose-pliers to remove the retaining rings (6) from the pulleys.

c. Inspection and Repair. Soak and wash all parts in an approved cleaning solution and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the bearings thoroughly, checking particularly for out-of-round condition caused by corrosion or wear. Check for overheating, which is evidenced by discoloration of the balls or retaining rings. Examine the outer race for scoring or galling. Replace a bearing that is worn, scored, or galled, or has been overheated.

(2) Inspect the pulleys for cracks, breaks, or damaged grooves. Replace a pulley that is cracked or broken. Repair a damaged pulley groove (par. 188).

(3) Inspect the point pin for wear and scoring. Replace a point pin that is worn or scored.

(4) Inspect all parts for good condition. Replace parts not in good condition.

d. Reassembly and Installation.

(1) Using long-nose pliers, install the retaining rings (6) in the pulleys (7).

(2) Using a soft hammer, tap a ball bearing (5) into each end of the pulley hub.

(3) Start the point pin (2) in the boom point. In sequence, as the pin is pushed through the boom point, place a spacer (4), a pulley (7), a spacer (4), a pulley (7), and a spacer (4) over the end of the pin. Install the cotter pin (3).

(4) Lubricate the boom point pulleys (LO 5–9513–1).

(5) Reeve the dipper hoist cable over the right boom point pulley (7), down and under the padlock block pulley, up and over the left boom point pulley, and dead end in the wedge socket (6, fig. 168).

237. Shovel Boom

a. General. The shovel boom normally is repaired with all components installed. However, the instructions in this paragraph are prepared for repairing the shovel boom with all components removed.

b. Removal and Disassembly (fig. 170).

(1) Remove the shovel dipper (par. 232*a*).

(2) Remove the dipper handle (par. 233*b*).

(3) Remove the shipper shaft (par. 235*b*).

(4) Lower the shovel boom on cribbing and unreeve and remove the boom (par. 17).

(5) Remove the shovel boom point pulleys (par. 236*b*).

(6) Remove the nuts (12), lockwashers (13), screws (20), and pipe spacers (21) from the boom point.

(7) Remove the nuts (12), lockwashers (13), screws (15), collars (14), and hoist pulleys (16) from the pin (18). Remove the pin (18) from the boom (1).

(8) Remove the cotter pin (24), pin (19), and wedge socket (22) with wedge (23) from the boom.

(9) Remove the cotter pins (3) from the nuts (4) and studs (5). Turn the studs from the nuts. Remove the nuts from the bearing (25).

(10) Remove the nuts (12), lockwashers (13), machine bolts (2), and the guard (26) from the boom (1).

c. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the hoist pulleys for cracks, breaks, damaged

grooves, or worn bushings. Replace a pulley that is cracked or broken. Repair a damaged pulley groove (par. 188). Replace a worn bushing (par. 189).

(2) Inspect the pulley pin for wear and scoring. Replace a pin that is worn or scored.

(3) Inspect all parts for good condition. Replace parts not in good condition.

d. Reassembly and Installation (fig. 170).

(1) Secure the crowd chain guard (26) to the boom (1) with machine bolts (2), lockwashers (13), and nuts (12).

(2) Install the shipper shaft (par. 235*d*).

(3) Install the nuts (4) in the bearing (25). Turn the studs (5) in the bearing and nuts. Install the cotter pins (3).

(4) Position the socket (22) with wedge (23) on the boom. Install the pin (19) and secure with a cotter pin (24).

(5) Install the pin (18) in the boom. Install a hoist pulley (16) on each end of the pin.

(6) Position a collar (14) on each end of the pin. Install screws (15) through the collars and pin and secure with lockwashers (13) and nuts (12). Lubricate the hoist pulleys (LO 5–9513–1).

(7) Position the pipe spacers (21) in the boom. Install the screws (20) through the boom and spacers and secure with lockwashers (13) and nuts (12).

(8) Install the shovel boom point pulleys (par. 236*d*).

(9) Install and reeve the boom (par. 17).

(10) Install the dipper handle (par. 233*f*).

(11) Install the shovel dipper (par. 232*e*).

238. Electric Dipper Trip Assembly

a. General (fig. 172). The electric dipper trip assembly consists of a trip rope (19), connecting the boom trip lever and the cable drum (27), and a trip rope (4), connecting the cable drum and counterweight (33). The counterweight slides in the counterweight tube (32), which is attached to the cab rear section. The trip rope (19) is contained in a guide pipe (23), which extends from a pulley (3), mounted in the cab front section, to a pulley (3), mounted beneath the cable drum. The dipper trip cable drum and clutch assembly (27) is mounted on the end of the horizontal intermediate shaft. The dipper trip magnet and band assembly (26) is mounted on the rotating base. The electric dipper trip assembly is actuated by the pushbutton assembly (13) installed in the handle of the horizontal intermediate shaft clutch hand lever (14). All components of the electric dipper trip assem-

bly, excepting the trip rope (19), can be left installed on the revolving frame without interfering with the operation of any other front end attachment. It would be advisable to disconnect the primary cable (11) from the ignition switch (8) if any other front end attachment is used with the electric dipper trip assembly installed. However, the instructions in this paragraph are prepared for the removal and disassembly of all components of the electric dipper trip assembly.

b. Removal and Disassembly.

(1) Remove the wire rope clips (18, fig. 172) and wire rope thimble from the wire rope (19).

(2) Remove a cable wedge (28) and the wire rope (19) from the cable drum (27).

(3) Remove the wire rope from the pulleys (3) and cable guide pipe (23). Coil the wire rope, avoiding kinks and twists. Remove mud, grit, and sand from the wire rope while coiling. Lubricate the wire rope (LO 5–9513–1). After coiling, wrap the wire around the strands, in three or four places, to hold it together.

(4) Remove a cable wedge (28) and the wire rope (4) from the cable drum (27).

(5) Remove the nuts, lockwashers (31), and carriage bolts (1) from the counterweight tube (32) and the cab rear section.

(6) Lower the counterweight tube. Remove the wire rope (4) and counterweight (33) from the tube.

(7) Remove the cable clip (34) from the wire rope. Coil the wire rope, avoiding kinks and twists. Remove mud, grit, and sand from the wire rope while coiling. Lubricate the wire rope (LO 5–9513–1). After coiling, wrap wire rope around the strands, in three or four places, to hold it together.

(8) Remove the cotter pins (6) and pulley pins (5) and (24). Remove the pulleys (3) from the brackets.

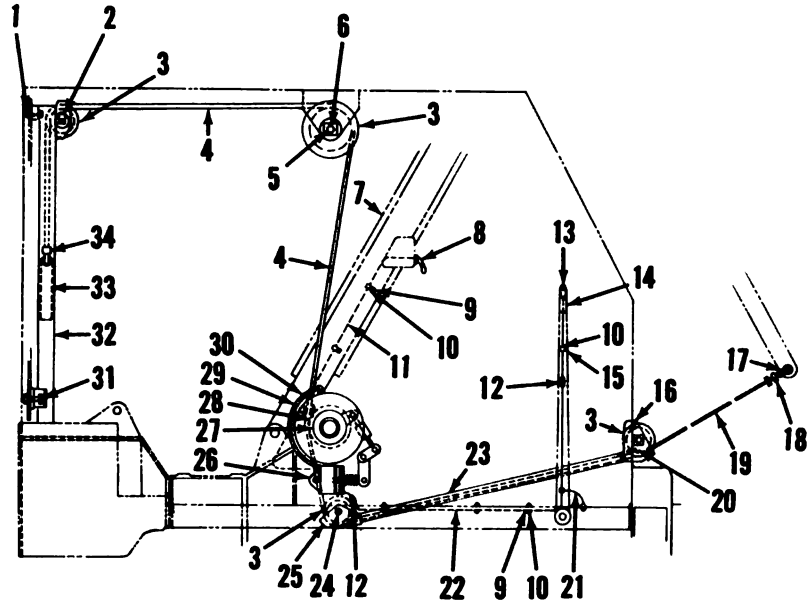
(9) Remove the nuts, lockwashers, and screws (20). Remove the pulley bracket (16) from the cab front section.

(10) Remove the cable guide pipe (23), with cable guide bracket (25), from the revolving frame.

(11) The top two pulley brackets are welded to the roof section.

(12) Disconnect the primary cable (11) at the ignition switch (8). Remove the stove bolts (9) and wire clamps (10) from the cable and the rear strut (7).

(13) Disconnect the primary cable (22) at the wire connector (12). Remove the stove bolts (9) and wire clamps



EMC 9513-172

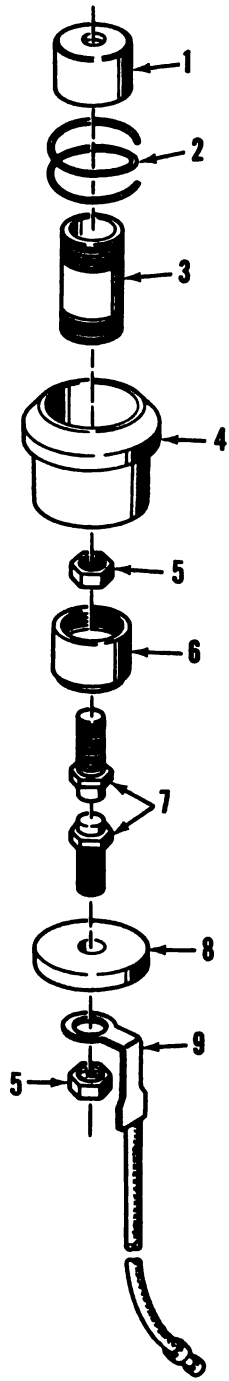
1 Bolt, carriage, regular, w/sq nuts, ⅜–16 NC x 1¾ (4 rqr)
2 Lubrication fitting, ⅛ x 30° (4 rqr)
3 Pulley (4 rqr)
4 Wire rope, ¼ x 14½ ft
5 Pulley pin (3 rqr)
6 Pin, cotter, split, 3/16 x 1½ (4 rqr)
7 Rear strut
8 Ignition switch
9 Bolt, stove, steel, flat hd, w/sq nut, 3/16 x ¾ (6 rqr)
10 Wire clamp, ¼ (7 rqr)
11 Primary cable, No. 14 AWG, 4½ ft
12 Wire connector (3 rqr)
13 Dipper trip pushbutton assembly
14 Horizontal intermediate shaft clutch hand lever
15 Bolt, stove, steel, flat hd, w/sq nuts, 3/16 x 1 (2 rqr)
16 Pulley bracket
17 Thimble, wire rope, 5/16
18 Clip, wire rope, 5/16 (2 rqr)
19 Wire rope, 5/16 x 20 ft
20 Screw, cap, hex hd, ½–13 NC x 1¼, w/lockwashers and hex nuts (4 rqr)
21 Primary cable, No. 14 AWG, 1 ft
22 Primary cable, No. 14 AWG, 6½ ft
23 Cable guide pipe
24 Pulley pin
25 Cable guide bracket
26 Dipper trip magnet and band assembly
27 Dipper trip cable drum and clutch assembly
28 Cable wedge (2 rqr)
29 Cable guard
30 Nut, regular, hex, ½–13 NC (4 rqr)
31 Lockwasher, spring, std, ⅝ (4 rqr)
32 Counterweight tube
33 Counterweight
34 Cable clip

Figure 172. Electric dipper trip installation.

(16) from the cable, hand lever (14), and rotating base. Remove the primary cable (21).

(14) Remove the pushbutton spring seat (4, fig. 173) from the handle of the horizontal intermediate shaft clutch hand lever.

(15) Remove the brass pipe cap (6) from the brass pipe



EMC 9513-173

Figure 173. Dipper trip pushbutton, exploded view.

nipple (3). Remove the brass pipe cap (1) and compression spring (2) from the nipple.

(16) Remove the nut (5) and electrical contact (7) from the brass pipe cap (6).

(17) Using long-nose pliers on the electrical contact (7), remove the contact, insulator (8), and button terminal (9).

(18) Remove the nut (5), button terminal (9), and insulator (8) from the electrical contact (7).

(19) Disconnect the wire connectors (14, fig. 174). Remove the primary cables.

(20) Remove cotter pins and the pins (6, 7, and 9) from the lever (8). Remove the lever.

(21) Remove three nuts, lockwashers, and mounting bolts (12). Remove the magnet assembly (13) from the rotating base.

(22) Remove the cotter pins (1, fig. 175) and headless straight pin (2). Remove and separate the eyebolt (4), jamnut (5), sleeve nut (6), and rod end connector (7).

(23) Remove the cotter pin (1) from the pin (26). Remove the setscrew (23), nut (25), and pin (26) from the rotating base. Remove the band shoe (3).

(24) Remove the nuts (19), lockwashers (18), and stove bolts (24) from the gasket (13) and the magnet case (17). Remove the eyebolt (11) from the case. Loosen the jamnuts (5) and turn the eyebolt from the magnet plunger (15). This releases the magnet case cover (14), gasket (13), and trip lever spring (12).

(25) Remove four nuts and the cable guard (1, fig. 174) from the rotating base.

(26) Remove the cotter pin (1) and jamnut (4) from the horizontal intermediate shaft. Remove the cable drum (2) from the shaft.

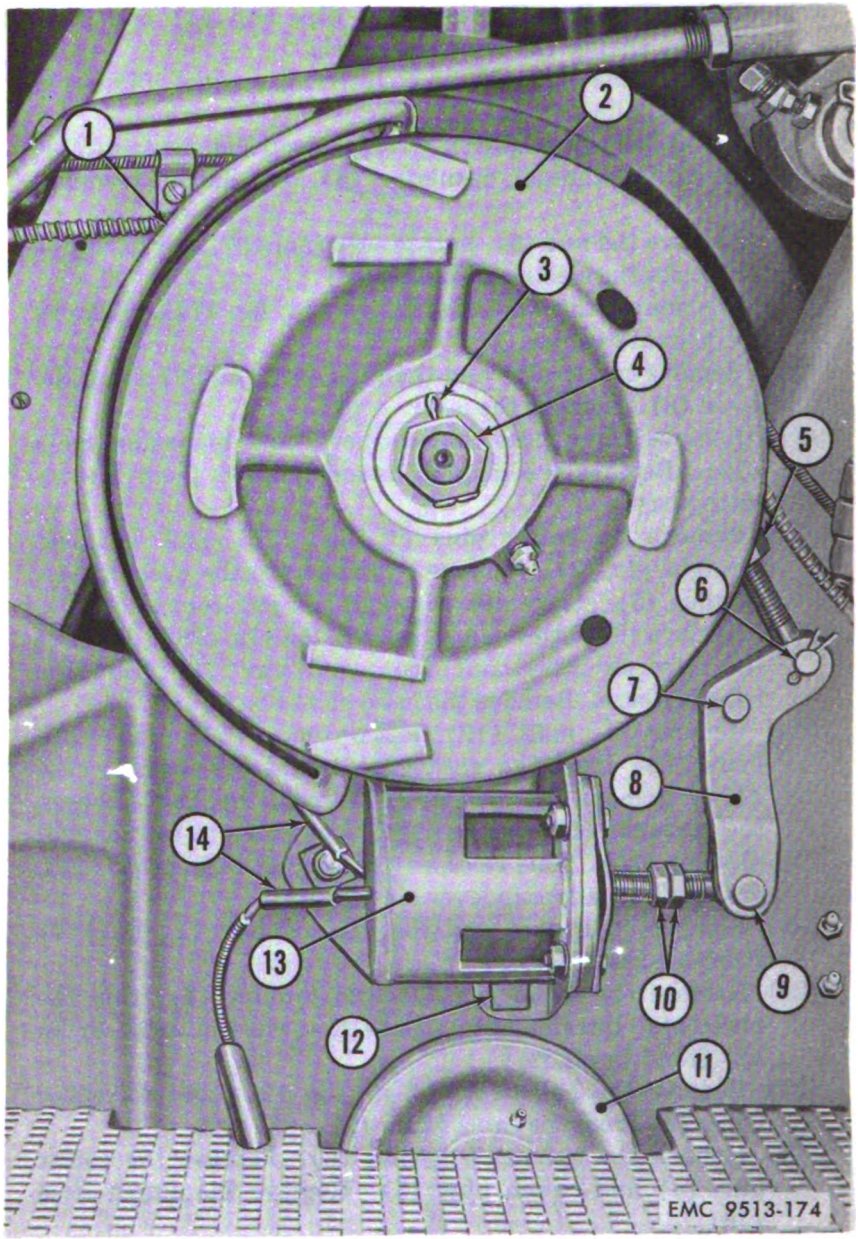
(27) Remove the ball bearings (7, fig. 176) and retaining rings (8) from the cable drum (9).

(28) Unhook the extension spring (6). Remove the cotter pins (4) and clutch pins (5). Remove the clutch shoe (16).

(29) Install the bearing splitter puller attachment (2, fig.

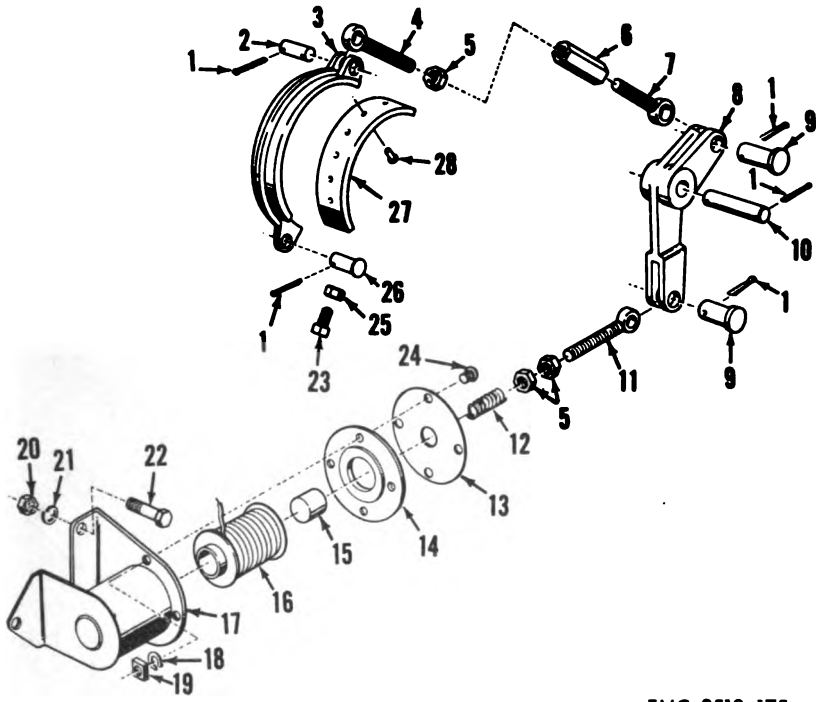
←

1 Brass pipe cap
2 Compression spring
3 Nipple, pipe, brass, std, ⅛ x 1
4 Pushbutton spring seat
5 Nut (2 rqr)
6 Brass pipe cap
7 Electrical contact (2 rqr)
8 Insulator
9 Button terminal



1	Cable guard	8	Lever
2	Cable drum	9	Pin
3	Cotter pin	10	Jamnut
4	Jamnut	11	Trip pulley
5	Sleeve nut	12	Mounting bolt
6	Pin	13	Magnet assembly
7	Pivot pin	14	Wire connector

Figure 174. Dipper trip cable drum and magnet assembly, installed.



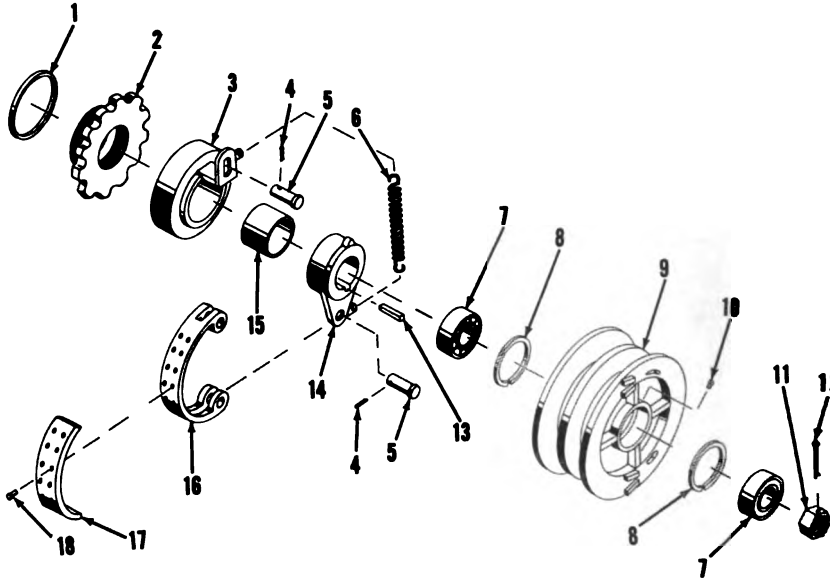
1 Pin, cotter, split, ⅛ x 1 (5 rqr)
2 Headless straight pin
3 Band shoe
4 Eyebolt
5 Jamnut, regular, hex, ⅛–20 NF (3 rqr)
6 Sleeve nut
7 Rod end connector
8 Lever
9 Headed straight pin (2 rqr)
10 Pivot pin
11 Eyebolt
12 Trip lever spring
13 Gasket
14 Magnet case cover
15 Magnet plunger
16 Magnet winding
17 Magnet case
18 Lockwasher, spring, std, ¼ (4 rqr)
19 Square nut (4 rqr)
20 Nut, regular, hex, ½–13 NC (3 rqr)
21 Lockwasher, spring, std, ½ (3 rqr)
22 Screw, cap, hex hd, ½–13 NC x 1¾ (3 rqr)
23 Setscrew, sq hd, cup point, ⅜–16 NC x ¾
24 Bolt, stove, steel, rd hd, ¼ x 1 (4 rqr)
25 Nut, regular, hex, ⅜–16 NC
26 Headed straight pin
27 Lining
28 Rivet, brass, 3/16 x ⅝ (7 rqr)

Figure 175. Dipper trip magnet and band, exploded view.

177) between the clutch carrier (3) and the control wheel (4). Pull the clutch carrier and key (6) from the shaft.

(30) Install the bearing splitter puller attachment (2) behind the control wheel (4). Pull the control wheel from the shaft.

(31) Remove the cap screws, lockwashers, and lock ring (5)



1	Oil seal	11	Jamnut, regular, hex, 1–8 NC
2	Outer adjusting ring	12	Pin, cotter, split, 5/16 x 2½
3	Control wheel	13	Key, std taper, plain ½ x ½ x 1¾
4	Pin, cotter, split, ⅛ x ⅞ (2 rqr)	14	Clutch carrier
5	Clutch pin (2 rqr)	15	Bushing
6	Extension spring	16	Clutch shoe
7	Ball bearing (2 rqr)	17	Lining
8	Retaining ring (2 rqr)	18	Rivet, brass, flat hd, 5/16 x ⅞ (7 rqr)
9	Cable drum		
10	Plug, pipe, sq hd, ⅛		

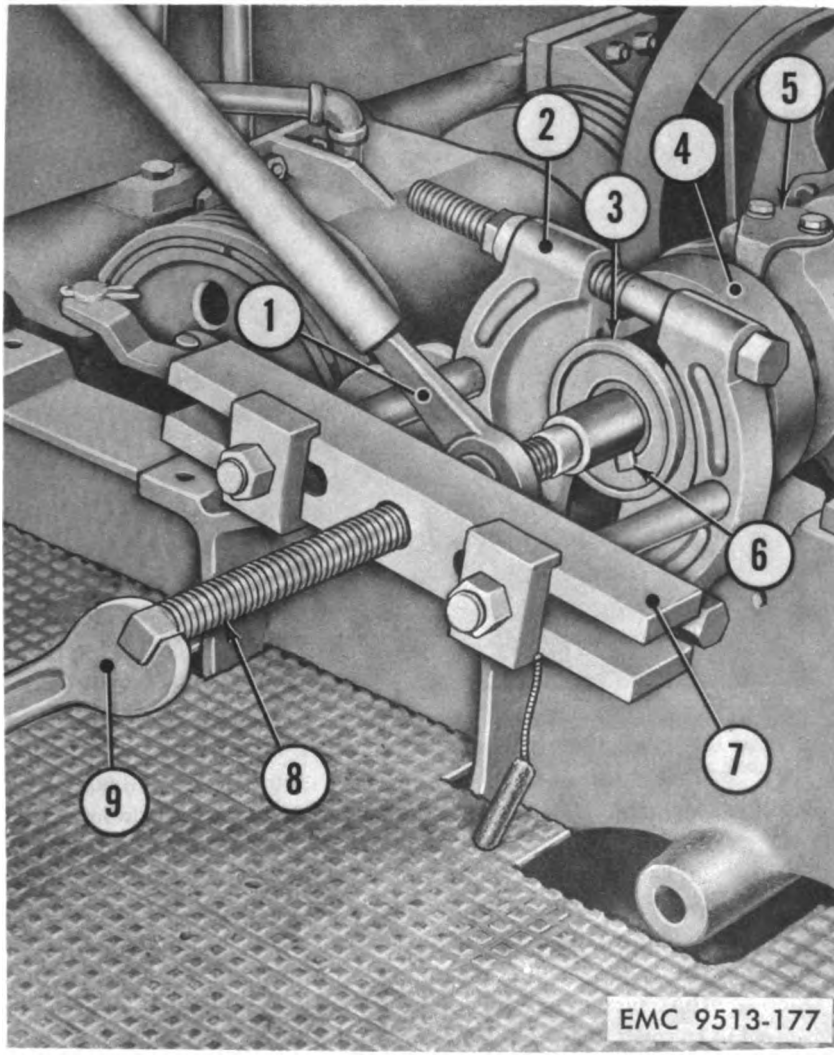
Figure 176. Dipper trip cable drum and clutch, exploded view.

from the pillow block. Remove the outer adjusting ring (2, fig. 176) and the oil seal (1) from the pillow block and shaft.

(32) If the crane-shovel is to continue in operation with a different front end attachment, the exposed end of the horizontal intermediate shaft must be covered. Remove the shaft cover (4, fig. 178) from the carrier battery and equipment box. Install a new oil seal (1, fig. 176) and the shaft cover on the shaft and into the pillow block (5, fig. 178). Install the lock ring (3) and secure with lockwashers (1) and cap screws (2).

c. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect pulleys for cracks, breaks, or damaged groove.



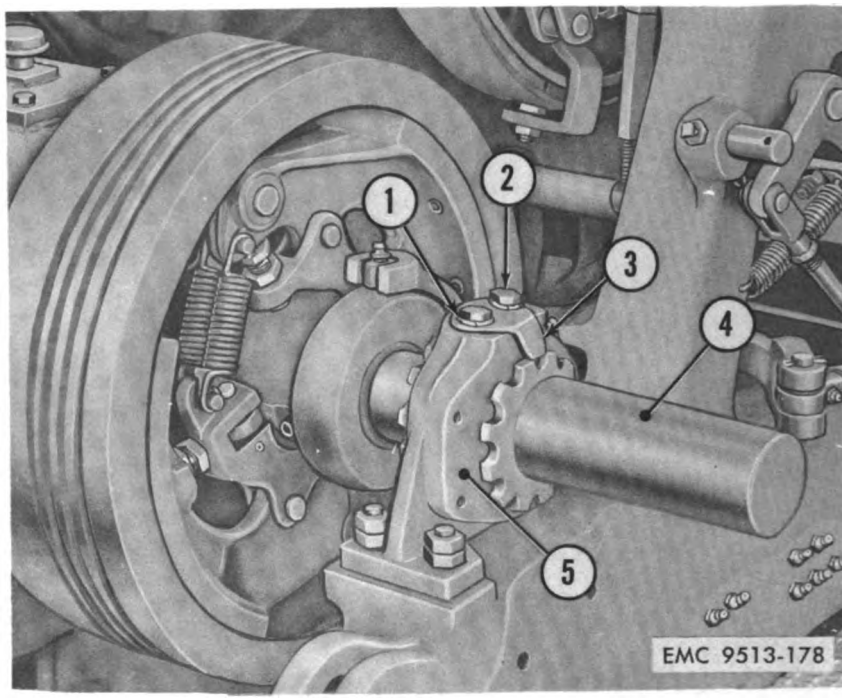
1 Puller wrench
2 Bearing splitter puller attachment
3 Clutch carrier
4 Control wheel
5 Lock ring
6 Key
7 Puller bar
8 Puller screw
9 Open end wrench

Figure 177. Pulling dipper trip clutch carrier.

Replace a pulley that is cracked or broken. Repair a damaged pulley groove (par. 188).

(2) Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace parts having damaged, corroded, or stripped threads.

(3) Inspect the ball bearings thoroughly, checking particu-



1 Lockwasher
2 Cap screw
3 Lock ring
4 Shaft cover
5 Pillow block

Figure 178. Horizontal intermediate shaft cover, installed.

larly for out-of-round condition caused by corrosion or wear. Check for overheating, which is evidenced by discoloration of the balls or retaining rings. Examine the outer race for scoring or galling. Replace a bearing that is worn, scored, or galled, or has been overheated.

(4) Inspect the clutch and band shoe linings for wear. Replace the clutch shoe assembly or the band shoe assembly if the lining is worn down to the rivet heads.

(5) Inspect the cable drum, control wheel, and clutch carrier for cracks, breaks, and distortion. Replace a cable drum, control wheel, or clutch carrier if cracked, broken, or distorted. Inspect the control wheel bushing for wear. Replace a worn control wheel bushing (par. 189).

(6) Inspect all parts for good condition. Replace parts not in good condition.

d. Reassembly and Installation.

(1) Remove the cap screws (2, fig. 178), lockwashers (1), and the lock ring (3). Remove the shaft cover (4) and store in the carrier battery and equipment box.

(2) Install a new oil seal (1, fig. 176) and the outer adjusting ring (2) in the pillow block.

(3) Install the control wheel (3) on the shaft. Install the key (13) and clutch carrier (14) on the shaft.

(4) Hook the extension spring (6) in the control wheel and clutch carrier. Position the clutch shoe (16), with lining (17), and rivets (18), on the clutch carrier and control wheel. Install the clutch pins (5) and secure with cotter pins (4).

(5) Install the retaining rings (8) and ball bearings (7) in the cable drum (9). Install the cable drum on the shaft and over the clutch shoe. Secure the cable drum with the jamnut (11) and cotter pin (12).

(6) Position the cable guard (1, fig. 174) over the cable drum and into the rotating base. Secure the cable guard with four hex nuts.

(7) Install the jamnuts (5, fig. 175) on the eyebolt (11). In sequence, place the trip lever spring (12) over the eyebolt, then the gasket (13), and magnet case cover (14). Turn the eyebolt into the magnet plunger (15).

(8) Position the magnet winding (16) in the magnet case (17). Insert the plunger and eyebolt assembly into the magnet winding. Insert the stove bolts (24) in the gasket, case cover, and magnet case and secure with lockwashers (18) and square nuts (19). Adjust the jamnuts to put enough tension on the spring to keep the eyebolt fully extended.

(9) Attach the eyebolt (11) to the lever (8) with a headed straight pin (9) and cotter pin (1). Attach the rod end connector (7) to the lever (8) with a headed straight pin (9) and cotter pin (1).

(10) Turn the sleeve nut (6) on the rod end connector. Turn the jamnut (5) on the eyebolt (4). Turn the eyebolt into the sleeve nut.

(11) Attach the eyebolt (4) to the band shoe (3) with the headless straight pin (2) and cotter pin (1). Position the magnet and band assembly on the rotating base. Install the pivot pin (10) and secure with a cotter pin (1). Install the headed straight pin (26) and secure with a cotter pin (1). Insert the setscrew (23) with nut (25) in the end of the band shoe and tighten. Secure the magnet case to the rotating base with the cap screws (22), lockwashers (21), and nuts (20).

(12) Insert an electrical contact (7, fig. 173) in the insula-

tor (8). Place the button terminal (9) over the threaded end of the contact and secure with a nut (5).

(13) Thread the wire end of the button terminal down, through, and out the side of the horizontal intermediate clutch shaft hand lever handle. Seat the insulator in the bottom of the handle.

(14) Insert an electrical contact (7) in the top of the brass pipe cap (6) and secure with a nut (5) in the cap. Turn the pipe cap (6) on the brass pipe nipple (3). Position the pushbutton spring seat (4) over the pipe nipple and down on the pipe cap (6). Place the compression spring (2) over the pipe nipple and into the spring seat. Turn the brass pipe cap (1) on the pipe nipple and on the spring. Depress the pipe cap (1) and measure the distance from the bottom of the pipe cap, as depressed, to the top of the spring seat. This distance must be one-eighth inch and can be adjusted by turning the pipe caps (1 and 6).

(15) Push the spring seat assembly into the hand lever handle.

(16) Position the cable guide bracket (25, fig. 172) guide pipe (23), and a pulley (3) on the rotating base. Install the pulley pin (24) and secure with a cotter pin (6).

(17) Position the pulley bracket (16) on the cab front section and on the end of the cable guide pipe (23). Secure the bracket to the cab with screws (20), lockwashers, and nuts. Position a pulley (3) in the bracket. Install a pulley pin (5) and secure with a cotter pin (6).

(18) Position a pulley (3) in each of the pulley brackets welded to the cab roof section. Install the pulley pins (5) and secure with cotter pins (6).

(19) Attach the wire rope (4) to the counterweight (33) with a cable clip (34). Slice the counterweight into the counterweight tube (32). Place the counterweight tube on the tailswing. Pass the free end of the wire rope (4) over the top rear pulley (3). Position the tube against the cab rear section and secure with carriage bolts (1), lockwashers (31), and nuts.

(20) Pass the wire rope (4) over the second top pulley (3) and down to dead end in the cable drum (27) with a cable wedge (28).

(21) Insert the wire rope (19) under the pulley (3) in the bracket (16), through the cable guide pipe (23), and around the pulley (3) in the bracket (25). Dead end the

wire rope in the cable drum (27) with a cable wedge (28).

(22) Attach the wire rope (19) to the trip lever on the boom with a thimble (17) and clips (18).

(23) Install the primary cable (21) from the hand lever (14) to ground on the rotating base. Position the primary cable (22) on the hand lever and rotating base and secure with wire clamps (10) and stove bolts (9). Connect the cable (22) to the pushbutton assembly and to the magnet winding with wire connectors (12). Position the primary cable (11) on the rear strut (7) and secure with wire clamps (10) and stove bolts (9). Connect the cable (11) to the magnet winding with a wire connector (12). Connect the cable (11) to the ignition switch (8).

e. Adjustment. To adjust the band shoe (3, fig. 175), loosen the jamnut (5) holding the sleeve nut (6) and turn the sleeve nut. Do not adjust the band shoe any closer to the trip wheel than is necessary to trip the dipper. When proper adjustment is made, tighten the jamnut (5).

Section XVIII. BACK HOE FRONT END ASSEMBLY

239. General

The succeeding paragraphs cover the removal, disassembly, inspection and repair, reassembly, and installation of each major component of the back hoe front end assembly.

240. Back Hoe Dipper Bail

a. Removal (fig. 179).

(1) Lower the hoe dipper (10) to the ground. Unreeve the drag cable (14) from the hoe bail (13).

(2) Remove the cotter pins and bail pins (12). Remove the bail from the dipper.

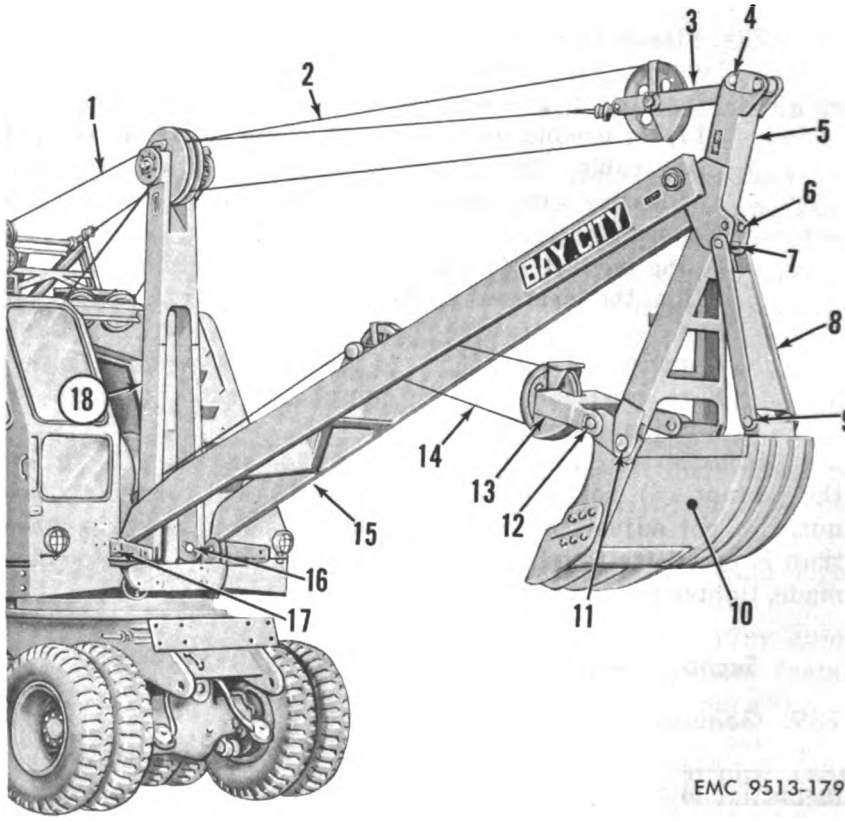
b. Disassembly (fig. 180).

(1) Remove the screws (7), lockwashers (6), and lock bar (5) from the pulley pin (8) and the bail (3).

(2) Remove the lockwire (18), screws (17), end cap (16), and shim set (14) from the pulley pin (8). Remove the pin and pulley (13) from the bail. Remove the sleeve (15) from the bail.

(3) Remove the collars (9), oil seals (10), and bearing cones (11) from the pulley hub.

(4) Using a bearing cup puller attachment, pull the bearing cups (12) from the pulley hub.

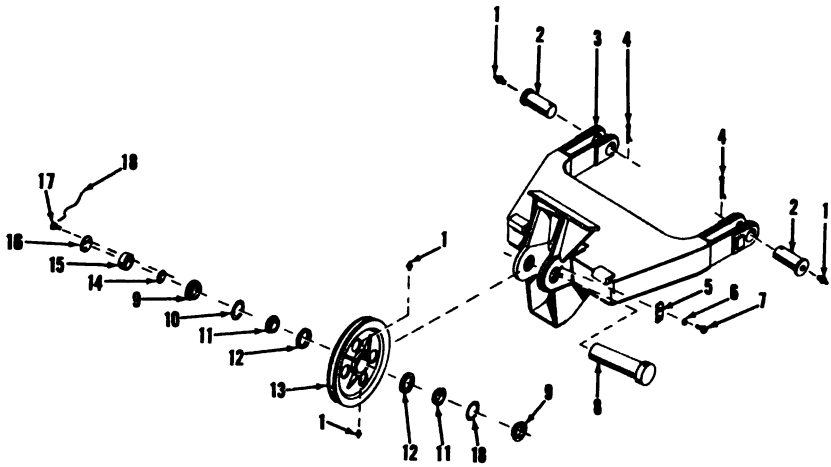


1	Mast hoist cable	10	Hoe dipper
2	Boom hoist cable	11	Pin
3	Bridle	12	Bail pin
4	Bridle alternate location	13	Hoe bail
5	Hoe handle	14	Drag cable
6	Brace alternate location	15	Hoe boom
7	Pin	16	Mast foot pin
8	Hoe brace	17	Boom foot pin
9	Pin	18	Hoe mast

Figure 179. Back hoe boom, mast, and dipper installed.

c. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and wipe dry with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the hoe bail for cracks, breaks, and distortion. Weld cracks or breaks in the bail. Straighten bent surfaces by heating and pounding to alinement with a sledge and heavy bucking-up bar. If necessary, add a reinforcing member by welding next to or over the weakened portion.



1	Lubrication fitting, ⅛ straight (4 rqr)	9	Collar (2 rqr)
2	Bail pin (2 rqr)	10	Oil seal (2 rqr)
3	Hoe bail	11	Bearing cone (2 rqr)
4	Pin, cotter, split, ½ x 4 (2 rqr)	12	Bearing cup (2 rqr)
5	Lock bar	13	Pulley
6	Lockwasher, spring, std, ½ (2 rqr)	14	Shim set
7	Screw, cap, hex hd, ½–13 NC x 1¼ (2 rqr)	15	Sleeve
8	Pulley pin	16	End cap
		17	Screw, cap, hex hd, ½–20 NF x 1 (3 rqr)
		18	Lockwire (as rqr)

Figure 180. Back hoe dipper bail, exploded view.

(2) Inspect the pulley for cracks, breaks, or damaged groove. Replace a pulley that is cracked or broken. Repair a damaged pulley groove (par. 188).

(3) Inspect the bearings thoroughly, checking particularly for out-of-round condition caused by corrosion or wear. Check for overheating, which is evidenced by discoloration of the rollers. Examine the bearing cups for scoring or galling. Replace a bearing that is worn, scored, or galled, or has been overheated.

(4) Inspect the pulley pin for wear and scoring. Replace the pin if worn or scored.

(5) Inspect all parts for good condition. Replace parts not in good condition. Replace the oil seals on reassembly.

d. Reassembly (fig. 180).

(1) Using an arbor press, press the bearing cups (12) in the pulley (13).

(2) Install the bearing cones (11), oil seals (10), and collars (9) in the pulley.

(3) Install the sleeve (15) in the bail (3). Position the

pulley (13) in the bail. Insert the pulley pin (8) in the bail and pulley.

(4) Position the lock bar (5) in the head of the pulley pin and on the bail. Secure the lock bar with lockwashers (6) and screws (7).

(5) Install the shim set (14) and end cap (16) on the end of the pulley pin (8). Install the screws (17) in the end cap and pin. Using lockwire (18), wire the heads of the screws (17) together.

e. Installation (fig. 179).

(1) Position the bail (13) on the dipper (10). Install the bail pins (12) and secure with cotter pins.

(2) Lubricate the hoe bail (LO 5–9513–1).

(3) Reeve the drag cable (14) to the hoe bail.

f. Adjustment (fig. 180).

(1) Remove lockwire (18), screws (17), and the end cap (16).

(2) Add a sufficient number of shims to the shim set (14) to fill the space between the end of the pulley pin (8) and the end of the sleeve (15). When this is accomplished, add an additional 0.005-inch shim.

(3) Install the end cap (16) and secure with screws (17). Wire the heads of the screws together.

(4) The pulley must rotate on the pulley pin without binding or wobbling.

241. Back Hoe Dipper

a. Removal (fig. 179).

(1) Remove the dipper bail (par. 240*a*).

(2) Remove cotter pins and the pins (9 and 11). Remove the dipper (10) from the hoe handle (5) and hoe brace (8).

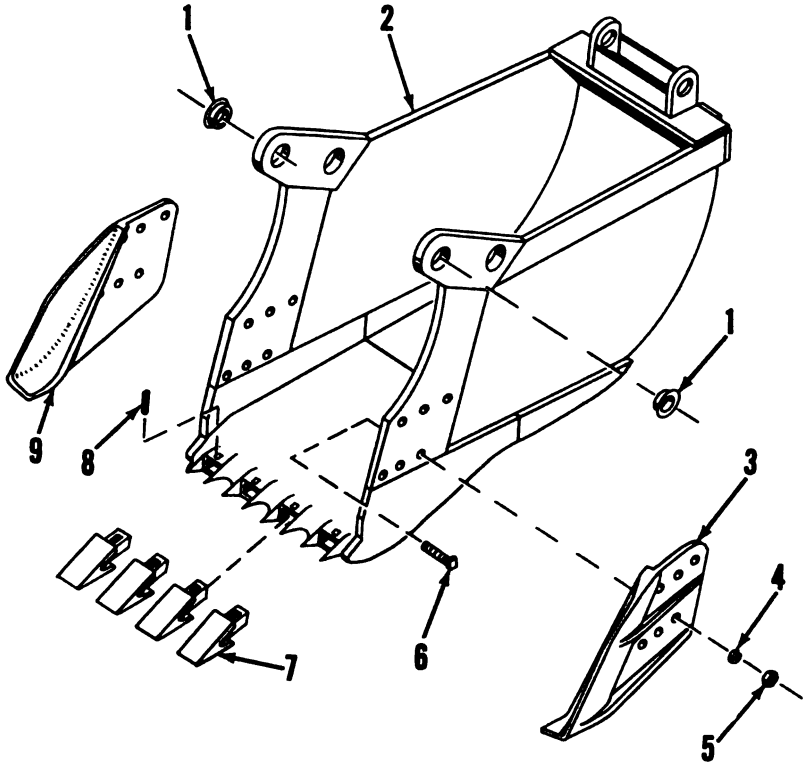
b. Disassembly (fig. 181).

(1) Remove the nuts (5), lockwashers (4), and bolts (6). Remove the side cutters (3 and 9) from the hoe dipper (2).

(2) Drive out the tooth wedge pins (8). Remove the teeth (7) from the dipper.

(3) If necessary to remove the steel bushings (1), remove the weld from around the bushing flange and drive out the bushing.

c. Inspection and Repair. Wash all parts in an approved cleaning solvent and blow dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.



1 Steel bushing (2 rqr)
2 Hoe dipper
3 Side cutter, lh
4 Lockwasher, spring, std, ⅞ (12 rqr)
5 Nut, regular, hex, ⅞–14 NF (12 rqr)
6 Bolt, machine, sq hd, ⅞–14 NF x 3 (12 rqr)
7 Teeth (4 rqr)
8 Tooth wedge pin (4 rqr)
9 Side cutter, rh

Figure 181. Back hoe dipper, exploded view.

(1) Inspect the hoe dipper for cracks or breaks. Weld cracks or breaks in the dipper.
(2) Inspect the dipper bushings for wear. Replace worn bushings.
(3) Inspect the side cutters for cracks, breaks, or wear. Replace a side cutter if cracked, broken, or worn.
(4) Inspect the dipper teeth for wear. Rebuild worn teeth (par. 191).

d. Reassembly (fig. 181).

(1) Install new steel bushings (1), if necessary, and weld the bushing flange to the hoe dipper (2).
(2) Position the side cutters (3 and 9) on the dipper and secure with bolts (6), lockwashers (4), and nuts (5).

(3) Install the teeth (7) in the dipper and secure by driving in the tooth wedge pins (8).

e. Installation (fig. 179).

(1) Position and attach the dipper (10) to the handle (5) and brace (8) with pins (9 and 11) secured by cotter pins.

(2) Install the dipper bail (par. 240*e*).

f. Adjustment (fig. 179).

(1) For trench digging or rocky and frozen ground, locate the bridle (3) and hoe brace (8) on the hoe handle (5) as shown in figure 179.

(2) For basement digging, install the bridle (3) in the alternate location (4) on the handle (5) and the hoe brace (8) in the alternate location (6) on the handle (5).

242. Back Hoe Dipper Handle

a. Removal (fig. 182).

(1) Remove the hoe dipper (par. 241*a*).

(2) Lower the bottom of the dipper handle to rest on the ground. Place blocking under the hoe boom (3). Remove the jamnut (5) and hex nut (6) from the boom point pin (4).

(3) Taking care not to damage the threads, drive the boom point pin from the boom (3) and handle (1).

(4) Lower the dipper handle to the ground. Remove the cotter pin (8) and the pin (7) from the handle (1) and bridle (2). Remove the bridle from the handle.

b. Disassembly (fig. 183).

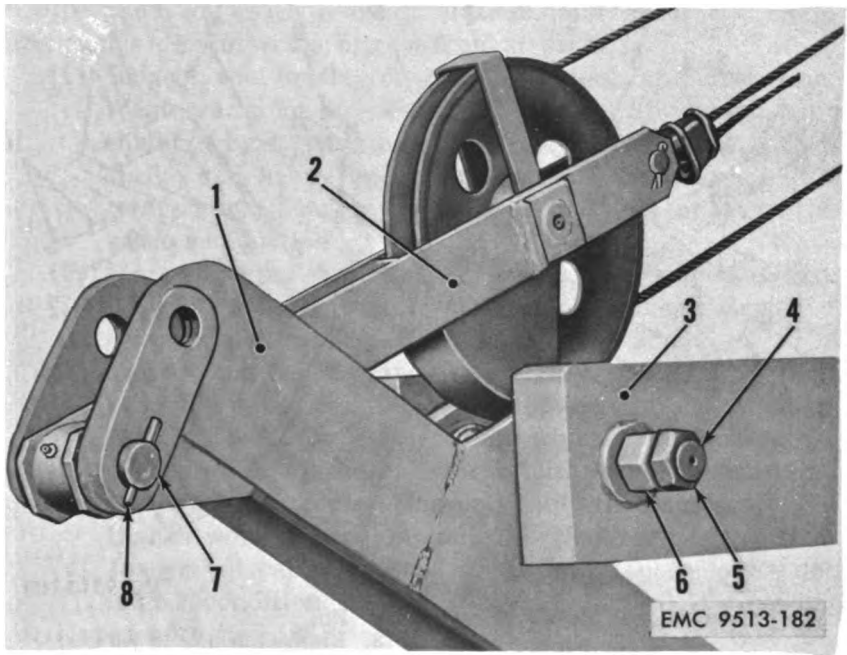
(1) Remove the cotter pins (9) and the pin (12). Remove the hoe brace (10) from the handle (8).

(2) If necessary, drive the bronze bushings (13) from the handle (8).

c. Inspection and Repair. Wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the hoe handle and brace for cracks, breaks, and distortion. Weld cracks or breaks in the handle or brace. Straighten bent surfaces by heating and pounding to alinement with a sledge and heavy bucking-up bar. If necessary, add a reinforcing member by welding next to or over the weakened portion.

(2) Inspect all pins for good condition. Replace pins not in good condition.



1 Hoe handle
2 Bridle
3 Hoe boom
4 Boom point pin
5 Jamnut
6 Hex nut
7 Pin
8 Cotter pin

Figure 182. Back hoe handle and bridle, installed.

d. Reassembly (fig. 183).

(1) Drive the bronze bushings (13) into the handle (8). When installed, drill through the lubrication fitting opening and the bronze bushing. Be sure to remove all chips and burs from the bushings.

(2) Position the hoe brace (10) on the hoe handle (8). Install the pin (12) and secure with cotter pins (9).

e. Installation (fig. 182).

(1) Position the bridle (2) on the hoe handle (1). Install the pin (7) and secure with a cotter pin (8).

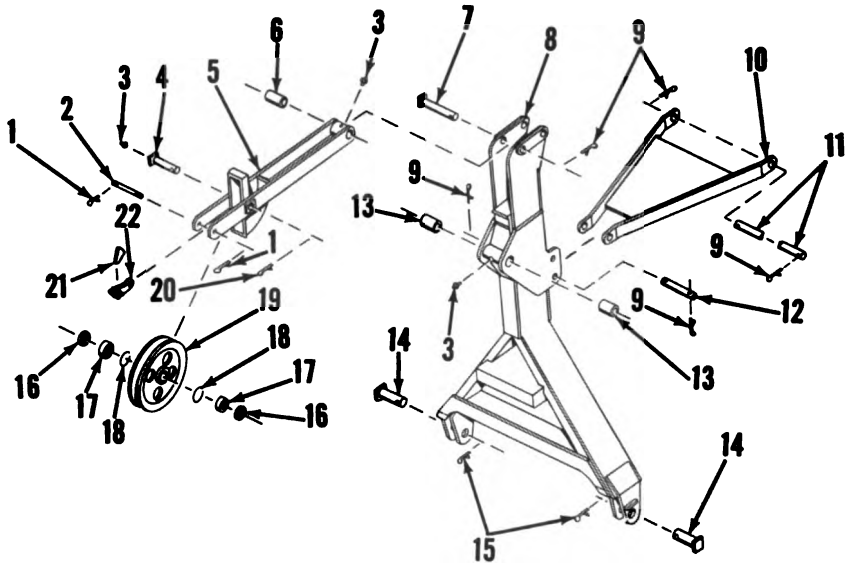
(2) Raise the bridle (2) and handle (1) and position in the boom (3). Install the boom point pin (4) and secure with the nut (6) and jamnut (5). Remove the blocking from under the hoe boom.

(3) Install the hoe dipper (par. 241*e*).

243. Back Hoe Bridle

a. Removal.

(1) Lower the hoe dipper to the ground. Remove the cotter



1	Pin, cotter, split, ¼ x 2 (2 rqr)	12	Pin
2	Pin	13	Bronze bushing (2 rqr)
3	Lubrication fitting, ⅛ straight (4 rqr)	14	Pin (2 rqr)
4	Pin	15	Pin, cotter, split, ½ x 5 (2 rqr)
5	Bridle	16	Steel washer (2 rqr)
6	Bronze bushing	17	Ball bearing (2 rqr)
7	Pin	18	Retaining ring (2 rqr)
8	Hoe handle	19	Pulley
9	Pin, cotter, split, ⅜ x 3 (5 rqr)	20	Pin, cotter, split, ⅜ x 3¼
10	Hoe brace	21	Cable wedge
11	Pin	22	Wedge socket

Figure 183. Back hoe handle and bridle, exploded view.

pin (8, fig. 182) and the pin (7) from the handle (1) and bridle (2). Lower the bridle to the ground.

(2) Remove the boom hoist cable from the wedge socket (22, fig. 183).

b. Disassembly (fig. 183).

(1) Remove the cotter pins (1) and pin (2). Remove the wedge socket (22) from the bridle (5).

(2) Remove the cotter pin (20) and pin (4). Remove the pulley (19) and steel washers (16) from the bridle.

(3) Using a soft hammer, tap the pulley hub to dislodge the ball bearings (17). Use long-nose pliers to remove the retaining rings (18).

(4) Drive the bronze bushing (6) from the bridle.

c. Inspection and Repair. Wash all parts in an approved cleaning solvent and blow them dry with clean compressed air

or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the bridle for cracks, breaks, and distortion. Weld cracks or breaks in the bridle. Straighten bent surfaces by heating and pounding to alinement with a sledge and heavy bucking-up bar. If necessary, add a reinforcing member by welding next to or over the weakened portion.

(2) Inspect the pulley for cracks, breaks, or damaged groove. Replace a pulley that is cracked or broken. Repair a damaged pulley groove (par. 188).

(3) Inspect the ball bearings thoroughly, checking particularly for out-of-round condition caused by corrosion or wear. Check for overheating, which is evidenced by discoloration of the balls or retaining rings. Examine the outer race for scoring or galling. Replace a bearing that is worn, scored, or galled, or has been overheated.

(4) Inspect all parts for good condition. Replace parts not in good condition.

d. Reassembly (fig. 183).

(1) Install the bronze bushing (6) in the bridle.

(2) Using long-nose pliers, install the retaining rings (18) in the pulley (19). Using a soft hammer, install the ball bearings (17) in the pulley.

(3) Position the pulley and steel washers (16) in the bridle (5). Install the pin (4) and secure with a cotter pin (20).

(4) Position the wedge socket (22) in the bridle. Install the pin (2) and secure with cotter pins (1).

e. Installation.

(1) Install the boom hoist cable and the cable wedge (21, fig. 183) in the wedge socket (22).

(2) Raise the bridle (2, fig. 182) and position on the handle (1). Install the pin (7) in the handle and bridle and secure with the cotter pin (8).

244. Back Hoe Mast
(fig. 184)

a. Removal.

(1) Position the back hoe front end attachment on cribbing and unreeve (par. 17).

(2) Remove the jamnuts (23), nuts (24), machine bolts (20), and the mast foot brackets (21 and 26) from the rotating base.

b. Disassembly.

(1) Remove the nuts (16), lockwashers (17), and ma-

chine bolts (12) from the collars (13). Remove the collars and the hoist pulleys (9) from the pulley pin (14).

(2) Remove a nut (16), lockwasher (17), and machine bolt (18). Remove the pipe spacers (6).

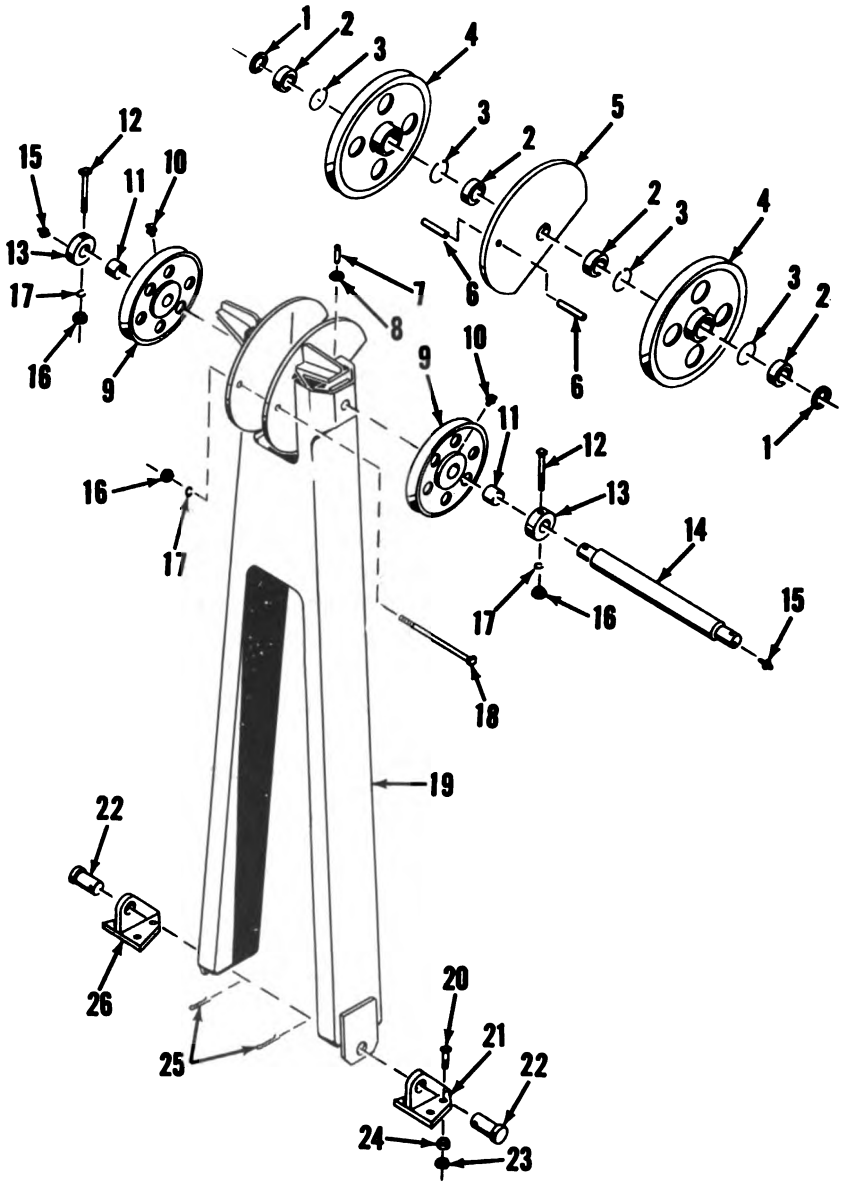


Figure 184. Back hoe mast, exploded view.

(3) Remove the setscrews (7) and jamnuts (8).

(4) Remove the pulley pin (14) from the mast (19) while lifting out the washers (1), pulleys (4), and the center guard plate (5).

(5) Using a soft hammer, tap the pulley hubs to dislodge the ball bearings (2). Use long-nose pliers to remove the retaining rings (3).

c. Inspection and Repair. Wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the hoe mast for cracks, breaks, and distortion. Weld cracks or breaks in the mast. Straighten bent surfaces by heating and pounding to alinement with a sledge and heavy bucking-up bar. If necessary, add a reinforcing member by welding next to or over the weakened portion.

(2) Inspect the pulleys for cracks, breaks, damaged groove, or worn bushing. Replace a pulley that is cracked or broken. Repair a damaged pulley groove (par. 188). Replace a worn bushing (par. 189).

(3) Inspect the ball bearings thoroughly, checking particularly for out-of-round condition caused by corrosion or wear. Check for overheating, which is evidenced by discoloration of the balls or retaining rings. Examine the outer race for scoring or galling. Replace a bearing that is worn, scored, or galled, or has been overheated.

(4) Inspect all parts for good condition. Replace parts not in good condition.

←

1 Washer (2 rqr)
2 Ball bearing (4 rqr)
3 Retaining ring (4 rqr)
4 Pulley (2 rqr)
5 Center guard plate
6 Spacer, pipe, std, ½ x 2 17/32 (2 rqr)
7 Setscrew, sq hd, cup point, ⅝–11 NC x 2½ (2 rqr)
8 Jamnut, regular, hex, ⅝–11 NC (2 rqr)
9 Hoist pulley (2 rqr)
10 Lubrication fitting, ⅛ x 75° (2 rqr)
11 Bronze bushing (2 rqr)
12 Bolt, machine, sq hd, ½–13 NC x 4 (2 rqr)
13 Collar (2 rqr)
14 Pulley pin
15 Lubrication fitting, ⅛ straight (2 rqr)
16 Nut, regular, hex, ½–13 NC (3 rqr)
17 Lockwasher, spring, std, ½ (3 rqr)
18 Bolt, machine, sq hd, ½–13 NC x 6½
19 Hoe mast
20 Bolt, machine, sq hd, ¾–10 NC x 2½ (6 rqr)
21 Mast foot bracket, lh
22 Mast foot pin (2 rqr)
23 Jamnut, regular, hex, ¾–10 NC (6 rqr)
24 Nut, regular, hex, ¾–10 NC (6 rqr)
25 Pin, cotter, split, ⅜ x 3 (2 rqr)
26 Mast foot bracket, rh

d. Reassembly.

(1) Using long-nose pliers, install the retaining rings (3) in the pulleys (4). Using a soft hammer, tap the ball bearings (2) in the pulleys.

(2) Start the pulley pin (14) in the mast (19). In sequence as the pin is installed in the mast, install a washer (1), a pulley (4), the center guard plate (5), a pulley (4), and a washer (1). Install and tighten the jamnuts (8) and setscrews (7) on the pulley pin.

(3) Position the pipe spacers (6), install the machine bolt (18) and secure with a lockwasher (17), and nut (16).

(4) Install a hoist pulley (9) and a collar (13) on each end of the pulley pin (14). Install the machine bolts (12) in the collar and pin and secure with lockwashers (17) and nuts (16).

(5) Lubricate the hoe mast (LO 5–9513–1).

e. Installation.

(1) Position the mast foot bracket (21 and 26) on the rotating base and secure with machine bolts (20), nuts (24), and jamnuts (23).

(2) Install and reeve the back hoe front end attachment.

245. Back Hoe Boom Guide Pulleys

a. Removal and Disassembly.

(1) Lower the hoe dipper to the ground with the hoe boom resting on the dipper.

(2) Remove the drag cable (1, fig. 185) and cable wedge from the wedge socket (10). Unreeve the drag cable from the pulleys (2).

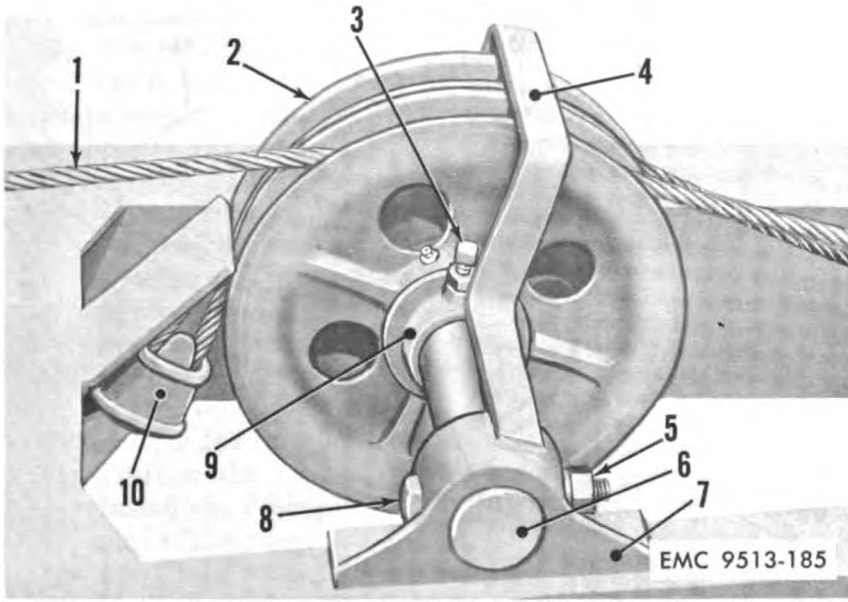
(3) Remove the setscrews (3) and jamnuts from the collars (9).

(4) Remove the nuts (5), lockwashers, and bolts (8) from the bearings (7) and pulley pin (6).

(5) Remove the pulley pin (21, fig. 186) from the bearings (3) and, at the same time, remove the collars (11), brass washers (12), and pulleys (15).

b. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the pulleys for cracks, breaks, damaged groove, or worn bushing. Replace a pulley that is cracked or broken. Repair a damaged pulley groove (par. 188). Replace a worn bushing (par. 189).



1	Drag cable	6	Pulley pin
2	Pulley	7	Bearing
3	Setscrew	8	Bolt
4	Guard	9	Collar
5	Nut	10	Wedge socket

Figure 185. Back hoe boom guide pulleys, installed.

(2) Inspect all parts for good condition. Replace parts not in good condition.

c. *Reassembly and Installation.*

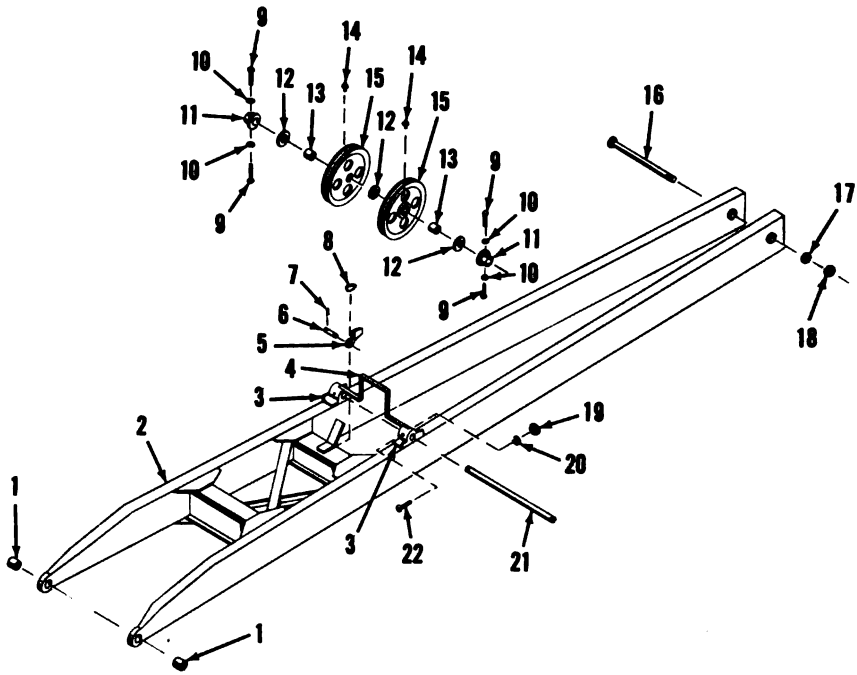
(1) Install the pulley pin (21, fig. 186) in one bearing (3). Install a collar (11) and a brass washer (12) on the pin.

(2) Position the pulleys (15), with a brass washer (12) between them, under the guard (4). Install the pulley pin in the pulleys and washer. Add a washer (12) and a collar (11) on the pin. Continue the pin through the opposite bearing (3).

(3) Install bolts (8, fig. 185) through the bearings (7) and pulley pin (6) and secure with lockwashers, and nuts (5).

(4) Install the setscrews (3) with jamnuts in the collars (9). Slide the collars and brass washers against the pulleys (2). Tighten the setscrews on the pin. Tighten the jamnuts on the collars.

(5) Lubricate the pulleys (LO 5–9513–1).



1	Bronze bushing (2 rqr)	13	Bronze bushing (2 rqr)
2	Hoe boom	14	Lubrication fitting, ⅛ straight (2 rqr)
3	Bearing (2 rqr)	15	Pulley (2 rqr)
4	Guard	16	Boom point pin
5	Wedge socket	17	Nut, hex, $2\frac{7}{16}$
6	Cable anchor pin	18	Jamnut, hex, $2\frac{7}{16}$
7	Pin, cotter, split, ¼ x 2 (2 rqr)	19	Nut, regular, hex, ¾–10 NC (2 rqr)
8	Cable wedge	20	Lockwasher, spring, std, ¾ (2 rqr)
9	Setscrew, sq hd, cup point, ⅝–11 NC x 1¾ (4 rqr)	21	Pulley pin
10	Jamnut, regular, hex, ⅝–11 NC (4 rqr)	22	Bolt, machine, sq hd, ¾–10 NC x 5½ (2 rqr)
11	Collar (2 rqr)		
12	Brass washer (3 rqr)		

Figure 186. Back hoe boom and guide pulleys, exploded view.

(6) Reeve the drag cable (1) on the pulleys (2) and dead end in the wedge socket (10) with a wedge.

246. Back Hoe Boom

a. Removal and Disassembly.

(1) Lower the hoe boom on cribbing and unreeve the drag cable and the boom hoist cable (par. 19).

(2) Remove the jamnut (18, fig. 186), nut (17), and the boom point pin (16) from the boom (2) and the dipper handle. Remove the handle from the boom.

(3) Remove the boom guide pulleys (par. 245*a*).

(4) Remove the cotter pins (7), cable anchor pin (6), and the wedge socket (5) from the boom.

(5) The bearings (3) are welded to the boom. The guard (4) is welded on the bearings.

b. Inspection and Repair. Wash all parts with an approved cleaning solvent and blow dry with clean compressed air.

(1) Inspect the hoe boom for cracks, breaks, and distortion. Weld cracks or breaks in the boom. Straighten bent surfaces by heating and pounding to alinement with a sledge and heavy bucking-up bar. If necessary, add a reinforcing member by welding next to or over the weakened portion.

(2) Inspect all parts for good condition. Replace parts not in good condition.

c. Reassembly and Installation.

(1) Position the wedge socket (5, fig. 186) in the boom. Install the cable anchor pin (6) and secure with cotter pins (7).

(2) Install the boom guide pulleys (par. 245*c*).

(3) Position the handle in the boom. Install the boom point pin (16) and secure with the nut (17) and jamnut (18).

(4) Reeve the drag cable and the boom hoist cable (par. 19).

Section XIX. REVOLVING FRAME ROLLERS

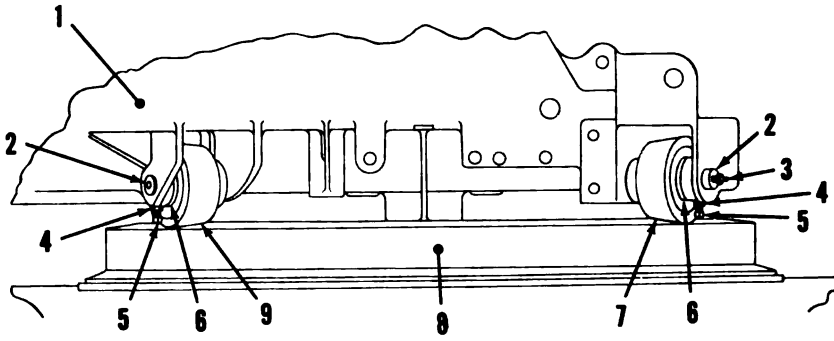
247. Description
(fig. 187)

Four steel conical rollers are mounted on the bottom of the rotating base (1) and positioned to rotate on the ring gear (8) of the carrier frame. The roller brackets are cast integral with the base. The two front rollers (7) and the two rear rollers (9) are identical, excepting for the method of lubricating. Each front roller is lubricated through a lubrication fitting (3) in the end of the roller pin (2) and is accessible from outside the revolving frame. The rear rollers are lubricated through lubrication fittings installed on the right side of the rotating base and lubrication lines to the inner ends of the rear roller pins.

248. Revolving Frame Rollers
(fig. 188)

a. Removal and Disassembly.

(1) Disconnect the lubrication lines from the tubing elbows in the inner end of the roller pins (2).

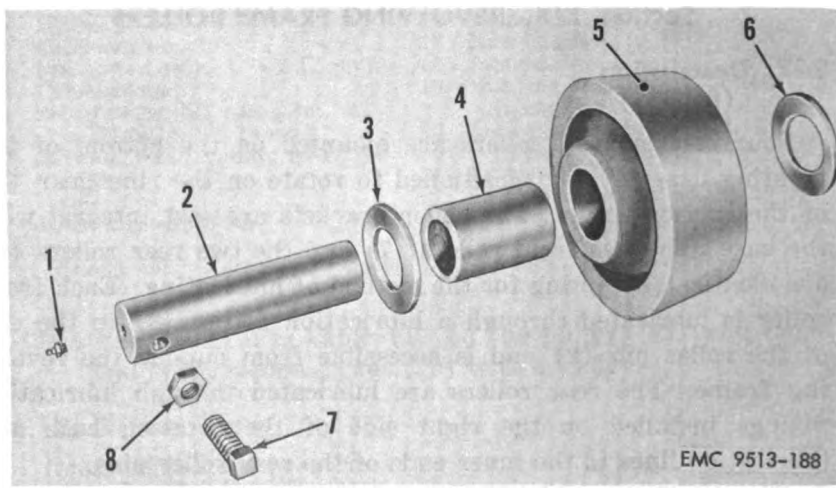


1 Rotating base
2 Roller pin
3 Lubrication fitting
4 Jamnut
5 Setscrew
6 Brass washer
7 Front roller
8 Ring gear
9 Rear roller

Figure 187. Revolving frame rollers resting on roller path of ring gear.

(2) Remove the setscrew (7) and jamnut (8) from the roller bracket.

(3) Remove the roller pin (2) from the roller bracket and roller (5). If the roller pin is binding and hard to remove, lower the boom or pick up a load, on the side



1 Lubrication fitting, ⅛ straight (2 rqr)
2 Roller pin (4 rqr)
3 Brass washer (4 rqr)
4 Bushing (4 rqr)
5 Roller (4 rqr)
6 Steel washer (4 rqr)
7 Setscrew, sq hd, cup point, ⅝–11 NC x 1¾ (4 rqr)
8 Jamnut, regular, hex, ⅝–11 NC (4 rqr)

Figure 188. Roller, exploded view.

opposite the roller to be removed, to relieve the strain on the roller and pin.

(4) Remove the brass washer (3) and steel washer (6). Rotate the roller on the ring gear path to clear the roller bracket. Remove the roller from the ring gear.

b. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the rollers for cracks, breaks, wear, or flat spots. Replace a roller if cracked, broken, worn, or if it has a flat spot. Inspect the roller bushings for wear. Replace a worn roller bushing (par. 189).

(2) Inspect the roller pins for wear and scoring. Replace a roller pin if worn or scored.

(3) Inspect all washers for wear. Replace a worn washer.

(4) Inspect all parts for good condition. Replace parts not in good condition.

c. Reassembly and Installation.

(1) Place the roller (5) on the roller path of the ring gear. Rotate the roller to position in the roller bracket.

(2) Install the brass washer (3) and the steel washer (6). Install the roller pin (2) in the roller bracket and the roller. Secure the pin with a setscrew (7) and jamnut (8).

(3) Connect the lubrication lines to tubing elbows installed in the inner end of the roller pins (4).

(4) Lubricate the rollers (LO 5–9513–1).

249. Center Pin Adjustment
(fig. 189)

a. General. The revolving frame assembly pivots on the center pin (5) and is secured by the center pin nut (1). The center pin is welded to the carrier frame.

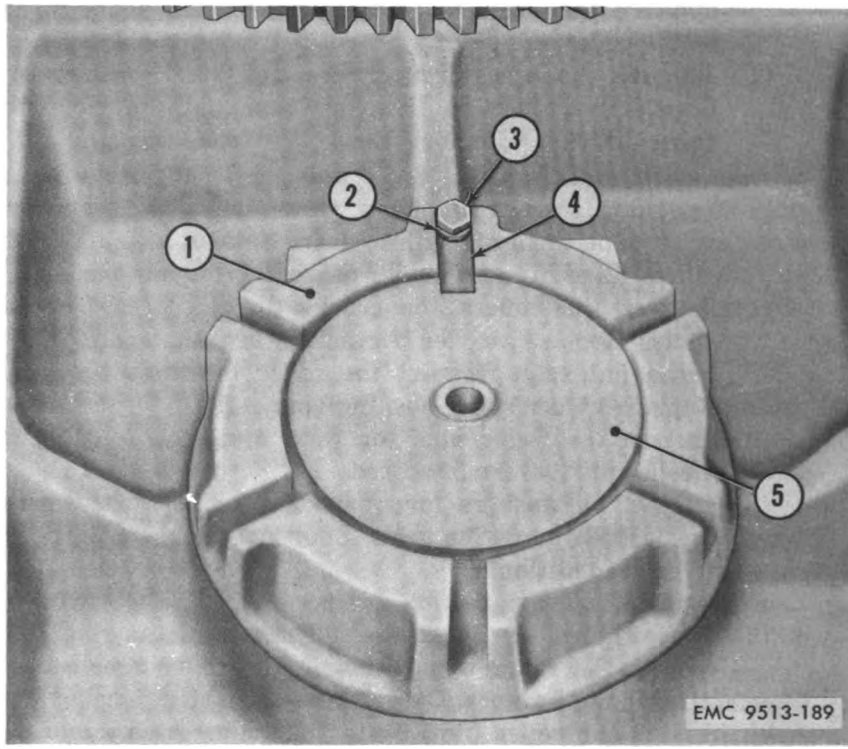
b. Adjustment.

(1) Make certain that all the revolving frame rollers are in contact with the roller path on the ring gear.

(2) Remove the cap screw (3) and lockwasher (2). Remove the center pin key (4) from the center pin nut (1) and the center pin (5).

(3) Using a piece of brass bar stock and a hammer, turn the center pin nut clockwise and tighten.

(4) Install the center pin key (4) in the slot of the nut and the pin. It may be necessary to loosen the nut a little in order to have the slots line up.



1 Center pin nut
2 Lockwasher
3 Cap screw
4 Center pin key
5 Center pin

Figure 189. Center pin nut and key, installed.

(5) Secure the key with a lockwasher (2) and cap screw (3).
(6) Lubricate the center pin washer and bushing (LO 5–9513–1).

Section XX. CAB ASSEMBLIES

250. Description

a. Revolving Frame. The revolving frame cab assembly consists of a left front panel (6, fig. 190), right front panel (13), left cab panel (10), cab back (8), a front window panel containing the lower window (15) and upper window (16), a center door (4) between the front panels, troughs (3 and 5), left sliding door (9), left cab roof (7), right cab roof (4, fig. 191), right rear door (8), right front door (6), a sliding back door (10) in the cab back (2), and a center cab roof (11). The center, left, and right cab roof sections are attached to the channels of the A-frame. The doors slide in guides welded to the roof

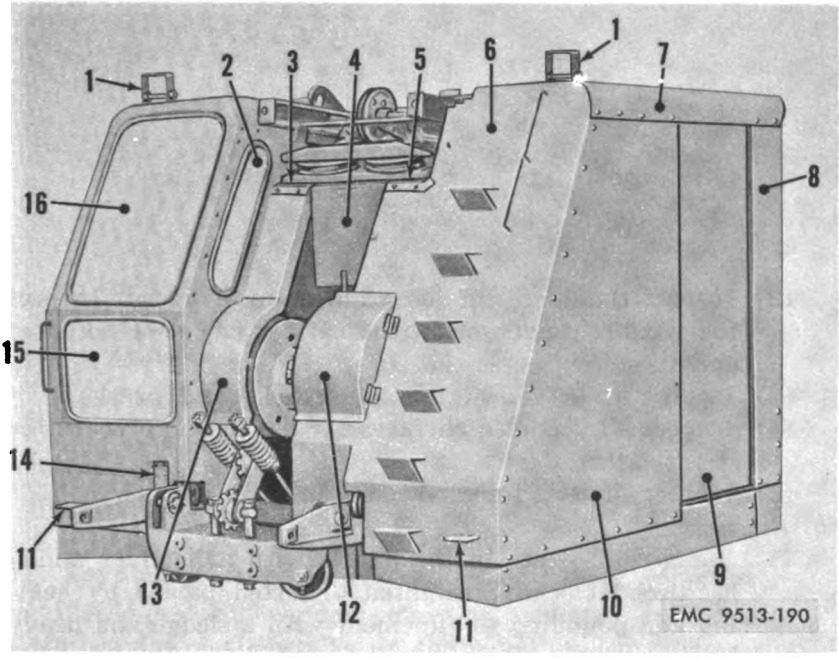
sections and mounted on the deck plates. The cab back is bolted to the tailswing and to the roof sections. The panels and doors are of sheet metal construction. Metal shields or guards are supplied for window protection in shipment.

b. Carrier. The carrier cab assembly is a completely inclosed full-vision coupe type cab, consisting of a left side (7, fig. 192), right side (1, fig. 193), radiator grille (7), rear grille (5, fig. 192), and cover assembly (4). The radiator grille, rear grille, and cover assembly inclose the carrier engine. The cab right side contains the carrier batteries and space for tools and equipment.

251. Inspection and Repair

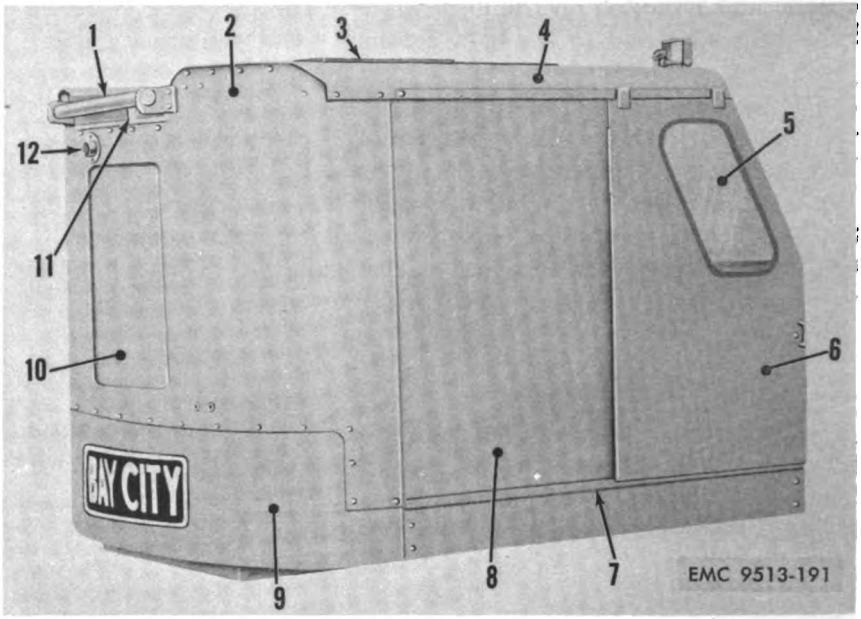
a. Inspection. Wash all parts in an approved cleaning solvent and wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect all panels for dents, cracks, or distortion.



1 Upper floodlight bracket
2 Side window
3 Trough, rh
4 Center door
5 Trough, lh
6 Left front panel
7 Cab roof, lh
8 Cab back
9 Door, lh
10 Left cab panel
11 Lower floodlight bracket
12 Gear guard
13 Right front panel
14 Cover plate
15 Lower window
16 Upper window

Figure 190. Revolving frame cab assembly, left front, three-quarter view.



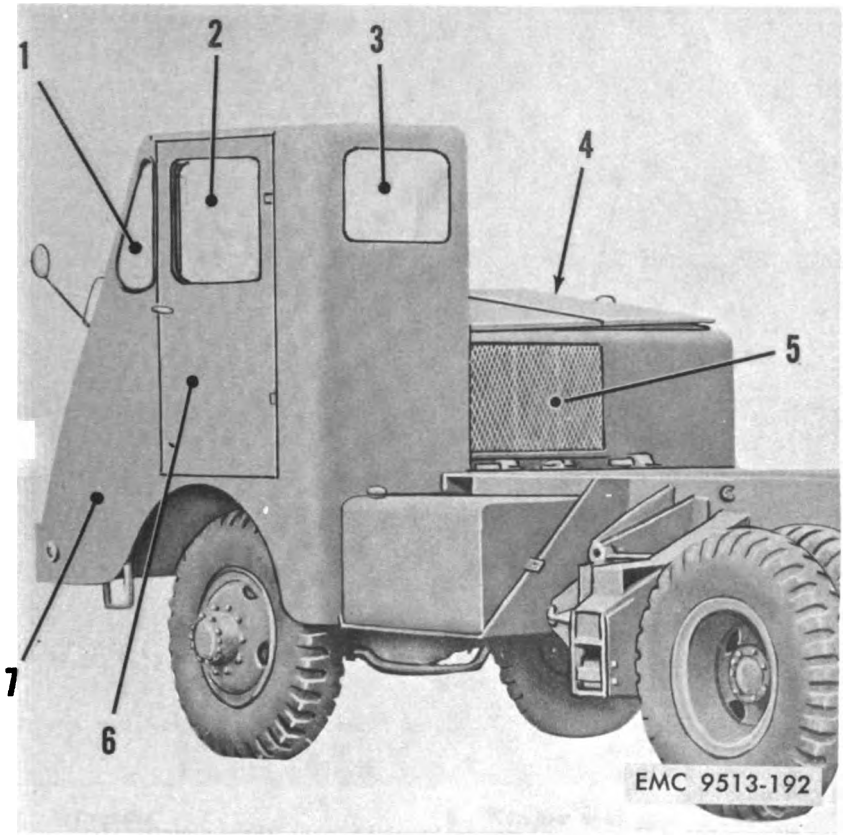
1	Sling rest bar	7	Door guide
2	Cab back	8	Right rear door
3	Sliding roof door	9	Tailswing
4	Cab roof, rh	10	Sliding back door
5	Door window	11	Center cab roof
6	Right front door	12	Engine exhaust pipe

Figure 191. Revolving frame cab assembly, right rear, three-quarter view.

(2) Inspect the doors for loose hinges or hangers. Inspect the window regulator in the carrier cab door for free operation.
(3) Inspect all window glass for cracks and breaks.
(4) Inspect all threaded surfaces for damaged, corroded, or stripped threads.
(5) Inspect all parts for good condition.

b. Repair.

(1) Remove all dents in the panels with a hammer and a hardwood block. Straighten distorted panels by heating and pounding to alinement with a sledge and heavy bucking-up bar. Repair cracks by welding.
(2) Tighten or replace loose door hinges or hangers. Replace the carrier cab door window regulator if its operation is not free.
(3) Replace any cracked or broken glass.
(4) Replace parts having damaged, corroded, or stripped threads.
(5) Repaint all surfaces from which the paint has been



1 Left side window
2 Door window
3 Rear window
4 Cover assembly
5 Rear grille
6 Cab door
7 Cab left side

Figure 192. Carrier cab assembly, left rear, three-quarter view.

removed. Repaint all sections that have been repaired or welded.

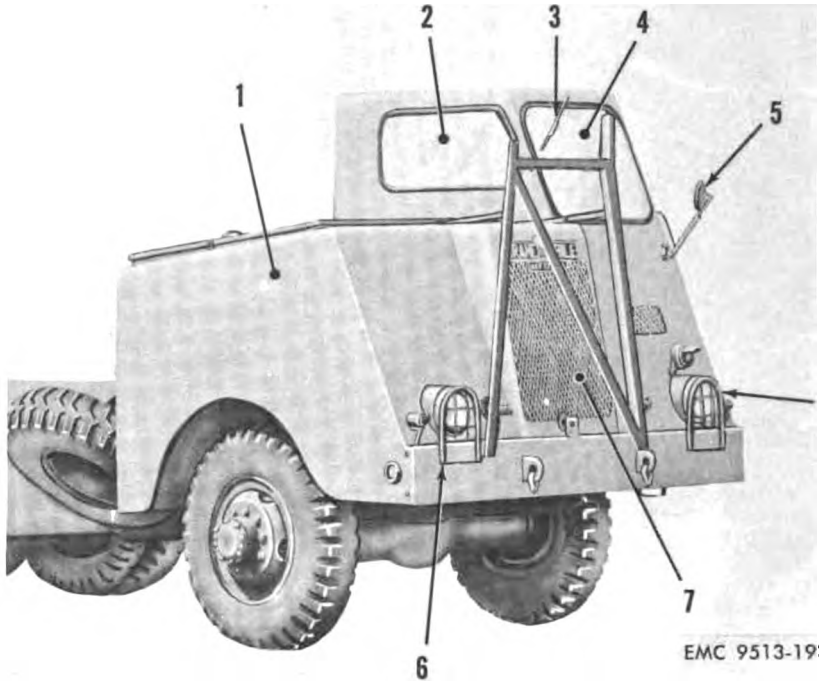
252. Revolving Frame Cab Window and Door Removal

a. Windows. All window glass is mounted in a strip of rubber window seal installed in the panel or door. The glass is locked in place in the seal with a strip of rubber window seal filler.

(1) Remove the window seal filler from the window seal. Work the window glass from the seal.

(2) Remove the window seal from the panel or door.

(3) The lower window (15, fig. 190) and the upper window (16) are mounted in removable sash (3, fig. 194). Re-



1 Cab right side
2 Right side window
3 Windshield wiper
4 Windshield
5 Rear vision mirror
6 Headlight guards
7 Radiator grille

Figure 193. Carrier cab assembly, right front, three-quarter view.

move two wingnuts (4) from each sash and lift the sash from the panel.

(4) The side window (2, fig. 190) is mounted in a removable sash (2, fig. 194). Remove four wingnuts (1) and lift the sash (2) from the panel.

b. Doors. The doors slide in guides welded on the roof sections and bolted to the deck plates.

(1) Remove the deck door guide (pars. 275 and 276).

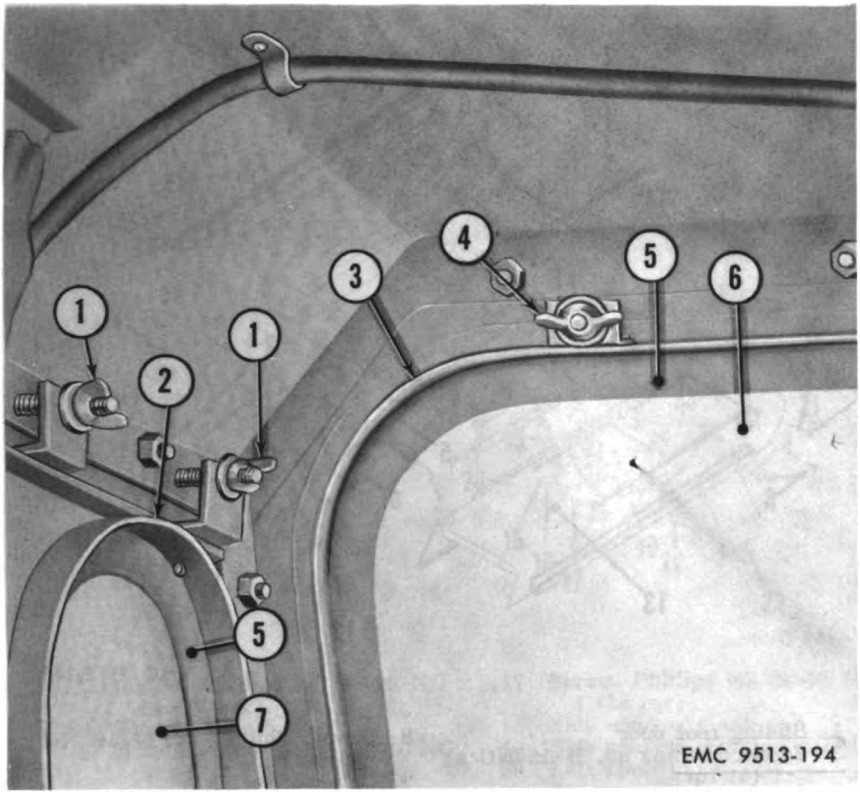
(2) Lift the door from the roof section guide. Remove the door from the cab.

(3) Slide the back door (10, fig. 191) out of the guides in the cab back (2). Remove the back door from the cab.

253. Revolving Frame Cab Roof Removal

a. Remove the nuts (6, fig. 195), lockwashers (5), and screws (2) from the A-frame channels and roof sections (9 and 13).

b. Remove the nuts (6), lockwashers (5), and screws (8) from the roof sections and left front panel.



1 Wingnuts
2 Side window sash
3 Front window sash
4 Wingnuts
5 Window seal
6 Upper window glass
7 Side window glass

Figure 194. Revolving frame cab side window sash and front window panel, installed.

c. Remove the nuts (15, fig. 196), lockwashers (16), and screws (1) from the cab back (6) and roof sections.

d. Remove the roof sections (9 and 13, fig. 195) from the cab. Remove the gaskets (7 and 14).

e. Remove the nuts (6), lockwashers (5), and screws (2) from the troughs (10 and 12), center door (11), and center cab roof (3).

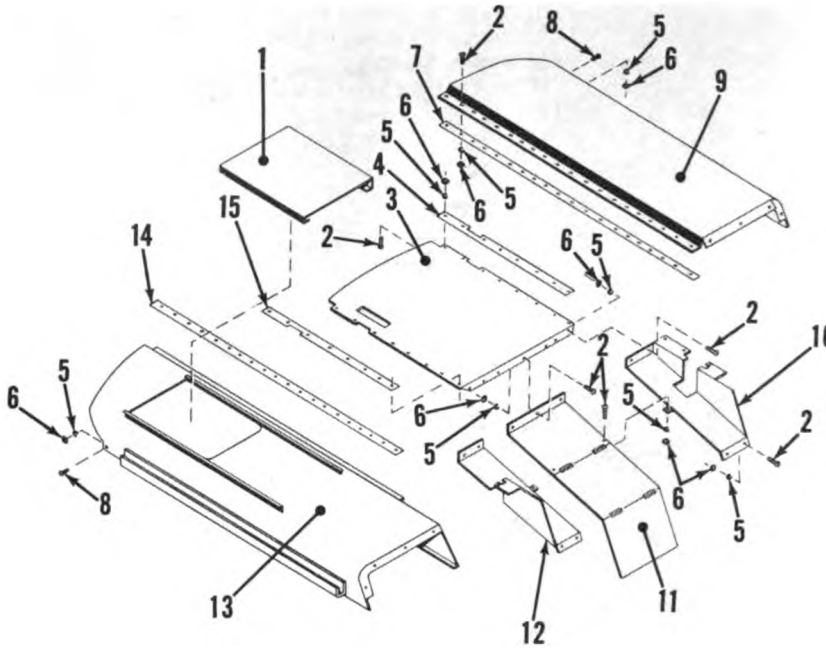
f. Remove the nuts (6), lockwashers (5), and screws (2) from the center roof (3) and the A-frame channels.

g. Remove the center cab roof (3) and gaskets (4 and 15) from the cab.

254. Revolving Frame Cab Front and Rear Panel Removal

a. Front Panels.

(1) Remove the nuts (15, fig. 196), lockwashers (16), and



1	Sliding roof door	8	Screw, Phillips hd, ⅜–16 NC x ¾ (4 rqr)
2	Screw, Phillips hd, ⅜–16 NC x 1 (51 rqr)	9	Cab roof section
3	Center cab roof	10	Trough, lh
4	Gasket	11	Center door
5	Lockwasher, spring, std, ⅜ (55 rqr)	12	Trough, rh
6	Nut, regular, sq, ⅜–16 NC (55 rqr)	13	Cab roof section
7	Gasket	14	Gasket
		15	Gasket

Figure 195. Revolving frame cab roof, exploded view.

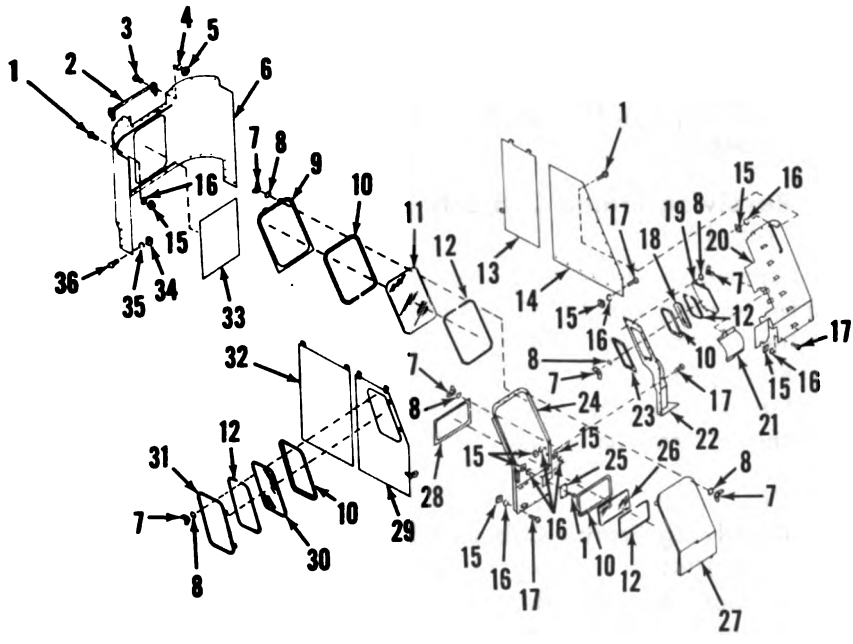
screws (1) from the left cab panel (14) and left front panel (20).

(2) Remove the nuts, lockwashers, and screws from the left front panel, the left roof section, and the trough.

(3) Remove the nuts (15), lockwashers (16), and screws (17) from the left front panel and the deck channels. Remove the left front panel.

(4) Remove the nuts (15), lockwashers (16), and screws (17) from the right front panel (22), the trough, and the front window panel (24). Remove the right front panel.

(5) Remove the nuts (15), lockwashers (16), and screws (17) from the front window panel (24) and the deck channel. Remove the front window panel.



1 Screw, Phillips hd, ⅜–16 NC x ¾ (35 rqr)
2 Sling rest bar
3 Bolt, machine, sq hd, ¾–10 NC x 1¾ (4 rqr)
4 Lockwasher, spring, std, ¾ (4 rqr)
5 Nut, regular, hex, ¾–10 NC (4 rqr)
6 Cab back
7 Nut, wing, regular, ⅜–16 NC (24 rqr)
8 Washer, plain, std, ⅜ (24 rqr)
9 Upper window sash
10 Window seal (30 ft rqr)
11 Upper window glass
12 Window seal filler (30 ft rqr)
13 Door, lh
14 Left cab panel
15 Nut, regular, sq, ⅜–16 NC (73 rqr)
16 Lockwasher, spring, std, ⅜ (73 rqr)
17 Screw, Phillips hd, ⅜–16 NC x 1 (38 rqr)
18 Side window glass
19 Side window shipping guard
20 Left front panel
21 Rear guard
22 Right front panel
23 Window sash
24 Front window panel
25 Cover plate
26 Lower window glass
27 Front window shipping guard
28 Lower window sash
29 Right front door
30 Door glass
31 Door glass guard
32 Right rear door
33 Sliding back door
34 Nut, regular, sq, ½–13 NC (19 rqr)
35 Lockwasher, spring, std, ½ (19 rqr)
36 Screw, Phillips hd, ½–13 NC x 1¼ (19 rqr)

Figure 196. Revolving frame cab front, sides, and rear, exploded view.

(6) Remove the nuts (6, fig. 195), lockwashers (5), and screws (2) from the troughs (10 and 12), the center door (11), and the center cab roof (3). Remove the troughs and center door.

b. Rear Panel (fig. 196).

(1) Remove the nuts (5), lockwashers (4), and screws (1) from the cab back (6) and roof sections.
(2) Remove the nuts (34), lockwashers (35), and screws (36) from the cab back and tailswing. Remove the cab back.

255. Revolving Frame Cab Left Side Panel Removal (fig. 196)

a. Remove the nuts (15), lockwashers (16), and screws (1) from the left cab panel (14) and left front panel (20).

b Remove the nuts, lockwashers, and screws from the left cab panel and roof section.

c. Remove the nuts (15), lockwashers (16), and screws (17) from the left cab panel and deck channel. Remove the left cab panel.

256. Revolving Frame Cab Left Side Panel Installation (fig. 196)

a. Position the left cab panel (14) on the deck channel, left front panel (20), and the cab roof section.

b. Attach the left cab panel (14) to the deck channel with screws (17), lockwashers (16), and nuts (15).

c. Attach the panel to the roof section with screws, lockwashers, and nuts.

d. Attach the left cab panel (14) to the left front panel (20) with screws (1), lockwashers (16), and nuts (15).

257. Revolving Frame Cab Front and Rear Panel Installation

a. Rear Panel (fig. 196).
(1) Position the cab back (6) on the tailswing and cab roof sections.
(2) Attach the cab back to the tailswing with screws (36), lockwashers (35), and nuts (34).
(3) Attach the cab back to the roof sections with screws (1), lockwashers (4), and nuts (5).

b. Front Panels.
(1) Position and attach the troughs (10 and 12, fig. 195) and the center door (11) to the center cab roof (3) with screws (2), lockwashers (5), and nuts (6).
(2) Position and attach the front window panel (24, fig. 196) to the deck channel and roof section with screws (17), lockwashers (16), and nuts (15).
(3) Position and attach the right front panel (22) to the trough and front window panel (24) with screws (17), lockwashers (16), and nuts (15).

(4) Position and attach the left front panel (20) to the deck channel and trough, and roof section with screws (17), lockwashers (16), and nuts (15).

(5) Attach the left front panel (20) to the left cab panel (14) with screws (1), lockwashers (16), and nuts (15).

258. Revolving Frame Cab Roof Installation

a. Position the gaskets (4 and 15, fig. 195) and the center cab roof (3) on the underside of the A-frame channels.

b. Attach the center cab roof to the channels, troughs (10 and 12), and the center door (11) with screws (2), lockwashers (5), and nuts (6).

c. Position the gaskets (7 and 14) and roof sections (9 and 13) on the topside of the A-frame channels. Attach the roof sections to the channel with screws (2), lockwashers (5), and nuts (6).

d. Attach the roof section (9) to the left front panel with screws (8), lockwashers (5), and nuts (6).

e. Attach the cab back (6, fig. 196) to the roof sections with screws (1), lockwashers (16), and nuts (15).

259. Revolving Frame Cab Window and Door Installation

a. Windows.

(1) Install the window seal (10, fig. 196) in the window sash or door panel.

(2) Install the window glass in the window seal. Lock the glass in the seal with the window seal filler (12) in the seal. Install the filler so the joint will be on the side opposite the seal joint.

(3) Install the side window sash (2, fig. 194) in the front window panel and secure with wingnuts (1).

(4) Install the front window sash (3) in the front window panel and secure with wingnuts (4).

b. Doors.

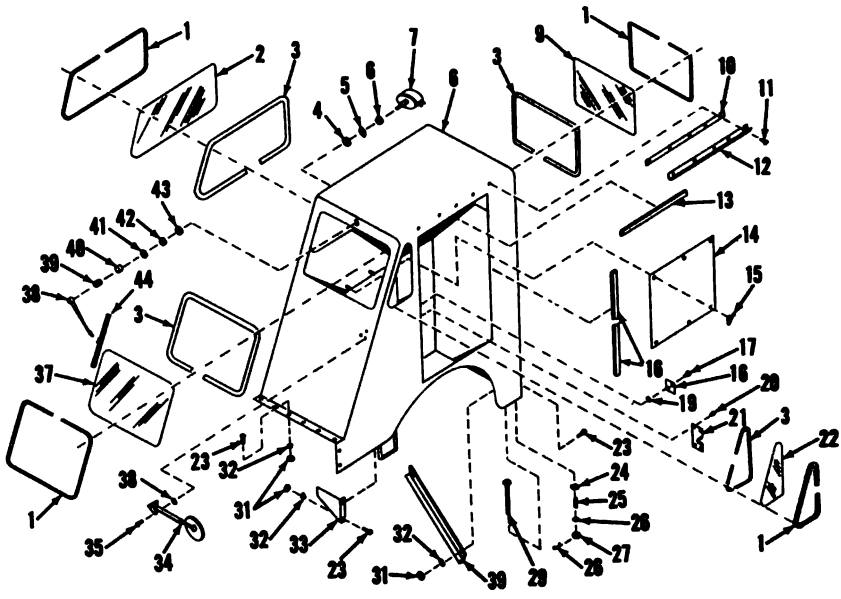
(1) Slide the back door (33, fig. 196) into the door guides in the cab back (6).

(2) Install the doors on the guides in the roof sections.

(3) Install the deck door guides (pars. 275 and 276).

260. Carrier Cab Window Removal (fig. 197)

Removal procedures for all carrier cab window glass, excepting the carrier cab door glass, are identical. See paragraph 262 for removal of the carrier cab door glass.



1 Window seal filler (22 ft rqr)
2 Glass, rh
3 Window seal (22 ft rqr)
4 Rubber washer
5 Angle nut
6 Locknut
7 Windshield wiper
8 Side, lh
9 Rear glass
10 Rubber gasket, 1/16 x 3/4 x 34
11 Screw, self-tapping, 5/16 x 1/2 (5 rqr)
12 Rain trough
13 Sponge rubber seal, 1/4 x 3/4 x 30 1/2
14 Insulation panel
15 Wingnut 3/8 (6 rqr)
16 Sponge rubber seal, 1/4 x 3/4 x 52 1/2
17 Bolt, stove, flat hd, w/sq nuts, 1/4 x 1 3/4 (2 rqr)
18 Striker plate
19 Lockwasher, spring, std, 1/4 (2 rqr)
20 Screw, cap, flat hd, 5/16 x 1/2 (4 rqr)
21 Female dovetail
22 Glass, lh
23 Bolt, carriage, regular, 3/8-16 NC x 1 (11 rqr)
24 Rubber washer (4 rqr)
25 Compression spring (4 rqr)
26 Washer, plain, steel, 1/2 (4 rqr)
27 Nut, castle, regular, 1/2-20 NF (4 rqr)
28 Pin, cotter, split, 1/8 x 7/8 (4 rqr)
29 Bolt (4 rqr)
30 Back brake
31 Nut, regular, hex, 3/8-16 NC (11 rqr)
32 Lockwasher, spring, std, 3/8 (11 rqr)
33 Step brace
34 Rear vision mirror
35 Bolt, stove, rd hd, w/sq nuts, 5/16 x 1/2 (4 rqr)
36 Lockwasher, spring, std, 5/16 (4 rqr)
37 Windshield glass
38 Wiper arm
39 Slotted nut
40 Arm adapter
41 Nut
42 Cup washer
43 Rubber washer
44 Windshield wiper blade

Figure 197. Carrier cab left side, exploded view.

a. Remove the window seal filler (1) from the window seal (3). Work the window glass from the seal.

b. Remove the window seal (3) from the cab side.

261. Carrier Cab Door Removal
(fig. 198)

a. Put the door in wide open position. Place blocking under the door.

b. Remove the nuts (14), lockwashers (15), and bolts (13) from the hinges (16) and the cab. Remove the door (10).

262. Carrier Cab Door Disassembly
(fig. 198)

a. Roll up the door glass (7). Remove the screws (17) and door handle (18). Remove the handle screw (1) and door lock handle (2). Remove the handle screw (3) and window regulator handle (4).

b. Remove the screws (6) from the top and sides of the cover (5). Carefully bend the cover away from the door (10) far enough to block up the door glass (7). Remove the screws (6) from the outside of the door (10). Remove the cover (5). Remove the door glass (7).

c. Remove the nuts (23), lockwashers (24), bolts (21), and the window regulator (25) from the cover (5).

d. Remove the nuts (14), lockwashers (15), bolts (13), and the door lock (26) from the cover (5).

e. Remove the screws (19) and the male dovetail (20). Remove the bolts (21) and the window stop (22).

f. Remove the channels (9 and 11) from the door (10).

263. Carrier Cab Left and Right Side Removal

a. Left side.

(1) Remove the wingnuts (7, fig. 199), washers (8), and the cover assembly (4).

(2) Remove the bolts (10) and the rear grille (9).

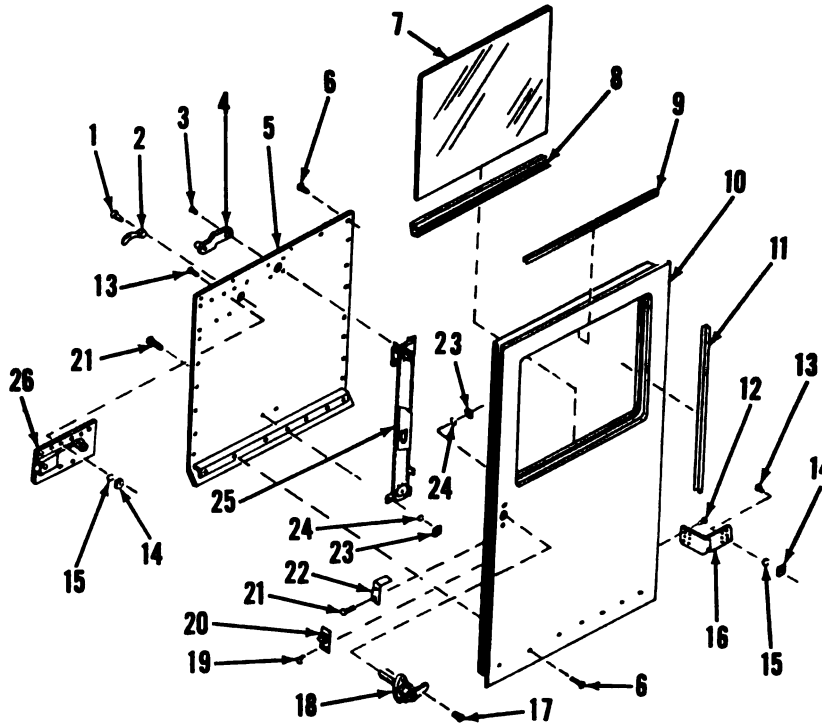
(3) Remove the nuts (13 and 16), lockwashers (14), bolts (10 and 15), and the radiator grille (17).

(4) Disconnect the leads from the left headlight (4, fig. 200), blackout headlight (6), left blackout marker light (3), and the windshield wiper (8).

(5) Make certain the air valve in back of the air hose coupling nipple (5) is closed. Remove the air hose coupling from the nipple (5).

(6) Remove the headlight guard from the carrier frame.

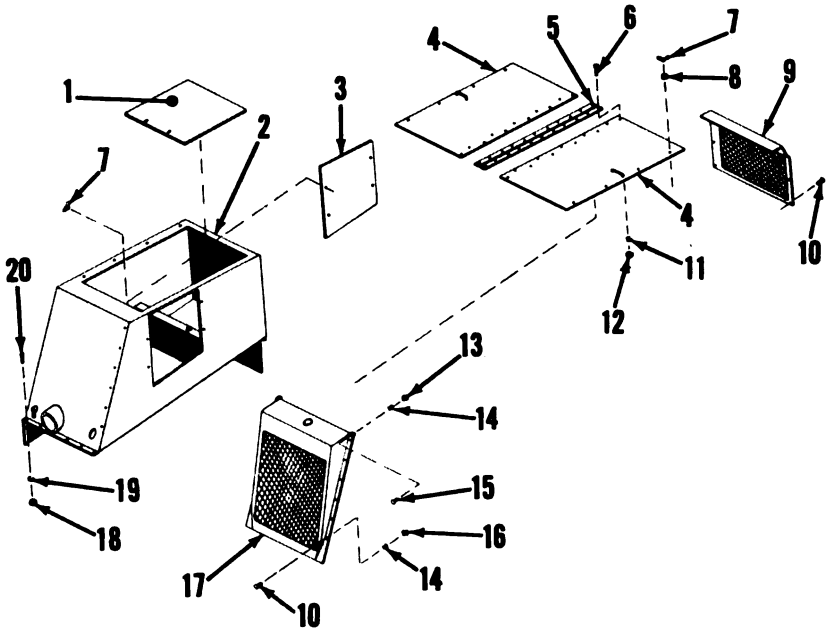
(7) Remove the wingnuts (15, fig. 197) and the insulation panel (14) from inside the cab side (8).



1	Handle screw	15	Lockwasher, spring, std, ¼ (24 rqr)
2	Door lock handle	16	Door hinge (2 rqr)
3	Handle screw	17	Screw, cap, flat hd, 5/16 x ¾ (2 rqr)
4	Window regulator handle	18	Door handle
5	Cover	19	Screw, cap, flat hd, 5/16 x ½ (6 rqr)
6	Screw, self-tapping, 5/16 x ½ (24 rqr)	20	Male dovetail
7	Door glass	21	Bolt, stove, flat hd, w/sq nuts, 5/16 x ½ (2 rqr)
8	Channel	22	Window stop
9	Channel	23	Square nut
10	Door	24	Lockwasher, spring, std, 5/16 (4 rqr)
11	Channel (2 rqr)	25	Window regulator
12	Screw, cap, flat hd, ¼-20 NC x ¾ (12 rqr)	26	Door lock
13	Bolt, stove, flat hd, w/sq nuts, ¼ x ¾ (24 rqr)		
14	Square nut		

Figure 198. Carrier cab door, exploded view.

(8) Roll down the cab door window. Install one end of a cable sling (1, fig. 200) on the lifting hook of an auxiliary lifting device. Pass the other end of the sling through the insulation panel opening and cab door window opening and install on the lifting hook. Take up the slack in the lifting sling.



EMC 9513-199

1	Battery cover	12	Square nut
2	Side, rh	13	Square nut
3	Access panel, rh	14	Lockwasher, spring, std, ¼ (14 rqr)
4	Cover assembly	15	Bolt, stove, flat hd, w/sq nut, ¼ x ⅜ (2 rqr)
5	Hinge	16	Square nut
6	Bolt, stove, flat hd, w/sq nut, 3/16 x ⅜ (22 rqr)	17	Radiator grille
7	Wingnut, ⅜ (8 rqr)	18	Nut, regular, hex, ⅜–16 NC (8 rqr)
8	Washer, plain, steel, ⅜ (4 rqr)	19	Lockwasher, spring, std, ⅜ (8 rqr)
9	Rear grille	20	Bolt, carriage, regular, ⅜–16 NC x 1 (8 rqr)
10	Bolt, stove, rd hd, w/sq nut, ¼ x ⅜ (18 rqr)		
11	Lockwasher, spring, std, 5/16 (22 rqr)		

Figure 199. Carrier cab right side and radiator grille, exploded view.

(9) Remove the nuts (31, fig. 197), lockwashers (32), bolts (23), and back brace (30) from the cab side (8) and carrier frame.

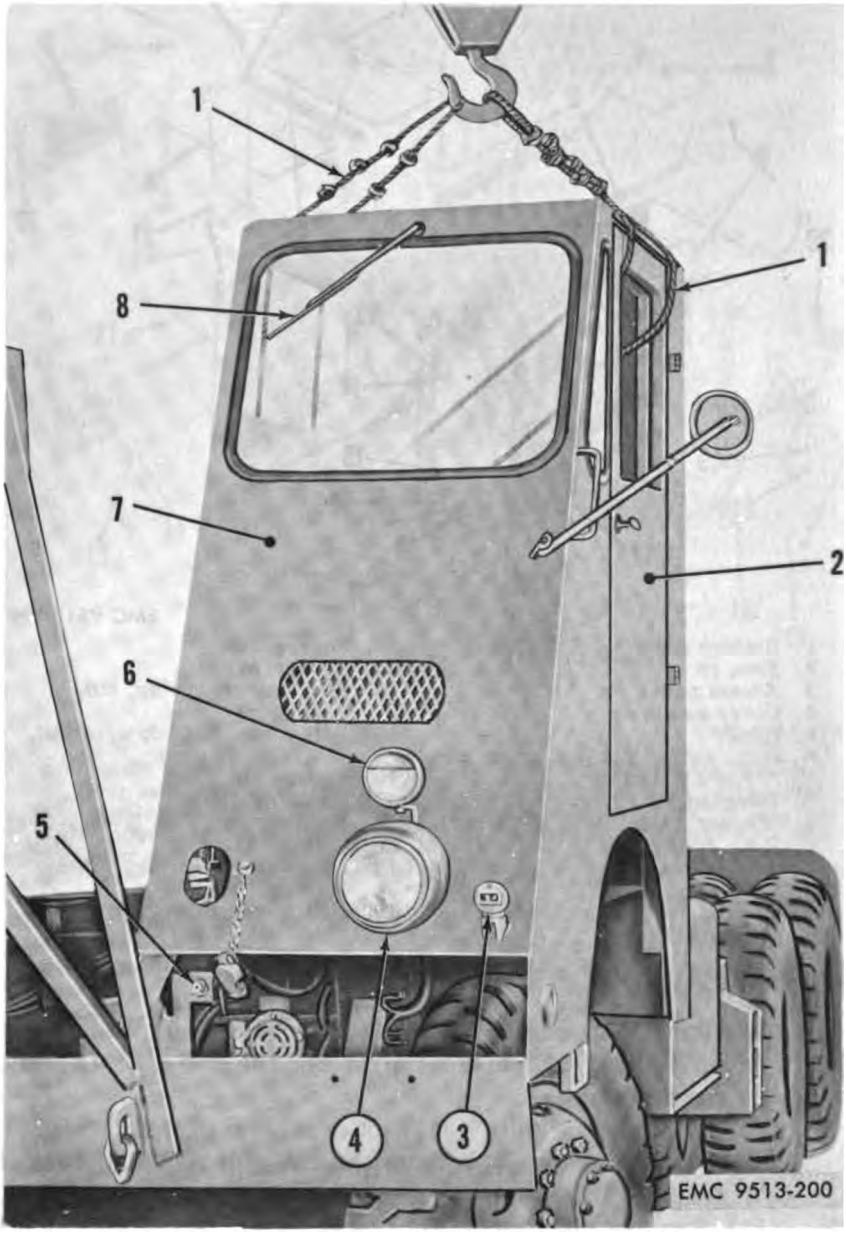
(10) Remove the nuts (31), lockwashers (32), bolts (23), and step brace (33) from the cab side (8) and carrier frame.

(11) Remove the nuts (31), lockwashers (32), and bolts (23) from the cab side (8) and the carrier frame.

(12) Lift the cab left side (7, fig. 200) from the carrier frame.

b. Right Side.

(1) Remove the wingnuts (7, fig. 199), washers (8), and the cover assembly (4).



1 Cable sling
2 Cab door
3 Blackout marker light
4 Headlight
5 Air hose coupling nipple
6 Blackout headlight
7 Cab left side
8 Windshield wiper

Figure 200. Removing carrier cab left side.

(2) Remove the bolts (10) and the rear grille (9).
(3) Remove the nuts (13 and 16), lockwashers (14), bolts (10 and 15), and the radiator grille (17).
(4) Disconnect the leads from the right headlight (5, fig. 201) and the right blackout marker light (6).
(5) Make certain the air valve in back of the air hose coupling nipple (4) is closed. Remove the air hose coupling from the nipple (4).
(6) Remove the headlight guard from the carrier frame.
(7) Remove the wingnuts (7, fig. 199) and the access panel (3) from the cab side (2).
(8) Remove the carrier batteries (par. 141*e*).
(9) Install one end of a cable sling (1, fig. 201) on the lifting hook of an auxiliary lifting device. Pass the other end of the sling around the cab right side (2) and install on the lifting hook. Take up the slack in the lifting sling.
(10) Remove the nuts (18, fig. 199), lockwashers (19), and bolts (20) from the cab side (2) and the carrier frame.
(11) Slide the cab side (2, fig. 201) to clear the boom support (3). Remove the cab side from the carrier frame.

264. Carrier Cab Window Installation
(fig. 197)

Installation procedures for all carrier cab window glass, excepting the carrier cab door glass, are identical. See paragraph 265 for installation of the carrier cab door glass.

a. Install the window seal (3) in the cab left side (8).

b. Install the window glass in the window seal (3). Lock the glass in the seal with the window seal filler (1) in the seal. Install the filler so the joint will be on the side opposite the seal joint.

265. Carrier Cab Door Reassembly
(fig. 198)

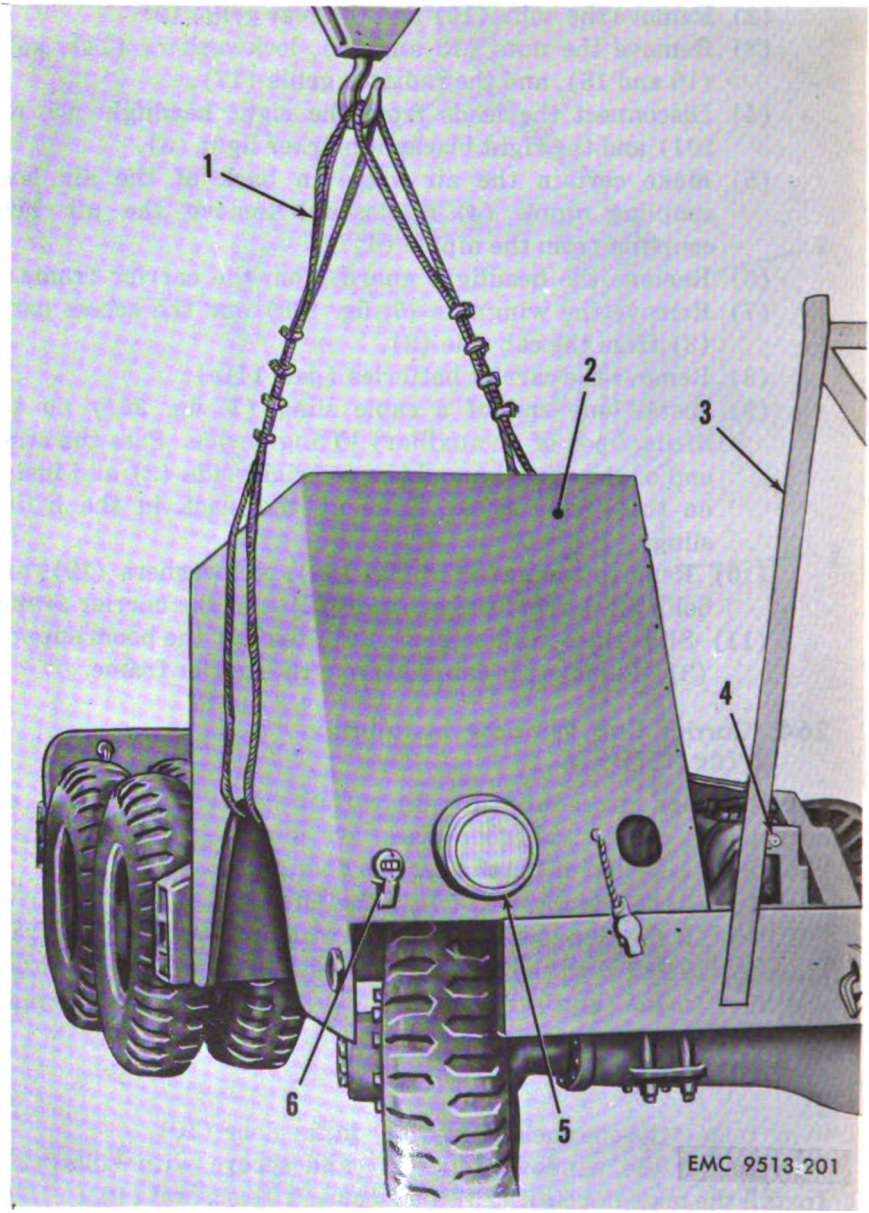
a. Install the channels (9 and 11) in the door (10).

b. Install the window stop (22) and secure with bolts (21). Install the male dovetail (20) and secure with screws (19).

c. Install the door lock (26) on the cover (5) and secure with bolts (13), lockwashers (15), and nuts (14).

d. Install the window regulator (25) on the cover (5) and secure with bolts (21), lockwashers (24), and nuts (23).

e. Install the door glass (7) in the channel (8). Install the door glass in the channels (9 and 11) in the door (10). Block up the door glass. Position the cover (5) on the door and install the bottom outside screws (6). Move the cover away from the



1 Cable sling
2 Cab right side
3 Boom support
4 Air hose coupling nipple
5 Headlight
6 Blackout marker light

Figure 201. Removing carrier cab right side.

door and install the hook on the window regulator (25) in the slot in the channel (8). Remove the blocking. Secure the cover to the door with screws (6).

f. Install the window regulator handle (4) and handle screw (3). Install the door lock handle (2) and handle screw (1). Install the door handle (18) and screws (17).

266. Carrier Cab Door Installation
(fig. 198)

a. Position and support the door (10) on the cab left side.

b. Secure the hinges (16) to the cab with bolts (13), lockwashers (15), and nuts (14).

267. Carrier Cab Left and Right Side Installation

a. Left Side.

(1) Roll down the cab door window. Install one end of a cable sling (1, fig. 200) on the lifting hook of an auxiliary lifting device. Pass the other end of the cable sling through the insulation panel opening and cab door window opening and install on the lifting hook. Raise the cab left side (7) and position on the carrier frame.

(2) Install the bolts (23, fig. 197), lockwashers (32), and nuts (31) in the cab side (8) and the carrier frame.

(3) Position the step brace (33) on the cab side and carrier frame and secure with bolts (23), lockwashers (32), and nuts (31).

(4) Position the back brace (30) on the cab side and carrier frame and secure with bolts (23), lockwashers (32), and nuts (31).

(5) Remove the cable sling from the cab side.

(6) Position the insulation panel (14) inside the cab and secure with wingnuts (15).

(7) Install the headlight guard on the carrier frame.

(8) Install the air hose coupling on the nipple (5, fig. 200).

(9) Connect the leads of the windshield wiper (8), blackout marker light (3), blackout headlight (6), and headlight (4).

(10) Install the radiator grille (17, fig. 199) and secure with bolts (10 and 15), lockwashers (14), and nuts (13 and 16).

(11) Install the rear grille (9) and secure with bolts (10).

(12) Install the cover assembly (4) and secure with washers (8) and wingnuts (7).

b. Right Side.

(1) Install one end of a cable sling (1, fig. 201) on the lifting

hook of an auxiliary lifting device. Pass the other end of the sling around the cab right side (2) and install on the lifting hook. Raise the cab side to carrier frame height and slide into position on the carrier frame.

(2) Install the bolts (20, fig. 199), lockwashers (19), and nuts (18) in the cab side and carrier frame.

(3) Remove the cable sling from the cab side.

(4) Install the carrier batteries (par. 141*g*).

(5) Install the access panel (3) in the cab side (2) and secure with wingnuts (7).

(6) Install the headlight guard on the carrier frame.

(7) Install the air hose coupling on the nipple (4, fig. 201).

(8) Connect the leads of the blackout marker light (6) and the headlight (5).

(9) Install the radiator grille (17, fig. 199) and secure with bolts (10 and 15), lockwashers (14), and nuts (13 and 16).

(10) Install the rear grille (9) and secure with bolts (10).

(11) Install the cover assembly (4) and secure with washers (8) and wingnuts (7).

268. Operator's Seat

a. Revolving Frame.

(1) *Removal and disassembly* (fig. 202).

(*a*) Remove the nuts (6), lockwashers (5), and bolts (3) from lower seat bracket (4) and the deck plate. Remove the seat assembly from the revolving frame.

(*b*) Remove the nuts (6), lockwashers (5), and bolts (3) and separate the upper seat bracket (2) from the lower seat bracket (4).

(*c*) Remove the setscrews (7) and jamnuts (8).

(2) *Reassembly and installation* (fig. 202).

(*a*) Install the setscrews (7) with jamnuts (8) in the upper seat bracket (2).

(*b*) Install the bolts (3), lockwashers (5), and nuts (6) in the upper seat bracket (2) and the lower seat bracket (4).

(*c*) Position the seat assembly on the deck plate. Install

→

1 Seat
2 Upper seat bracket
3 Bolt, machine, sq hd, ½–13 NC x 1¾ (4 rqr)
4 Lower seat bracket
5 Lockwasher, spring, std, ½ (4 rqr)
6 Nut, regular, hex, ½–13 NC (4 rqr)
7 Setscrew, sq hd, cup point, ¾–10 NC x 2½ (2 rqr)
8 Jamnut, regular, hex, ¾–10 NC (2 rqr)

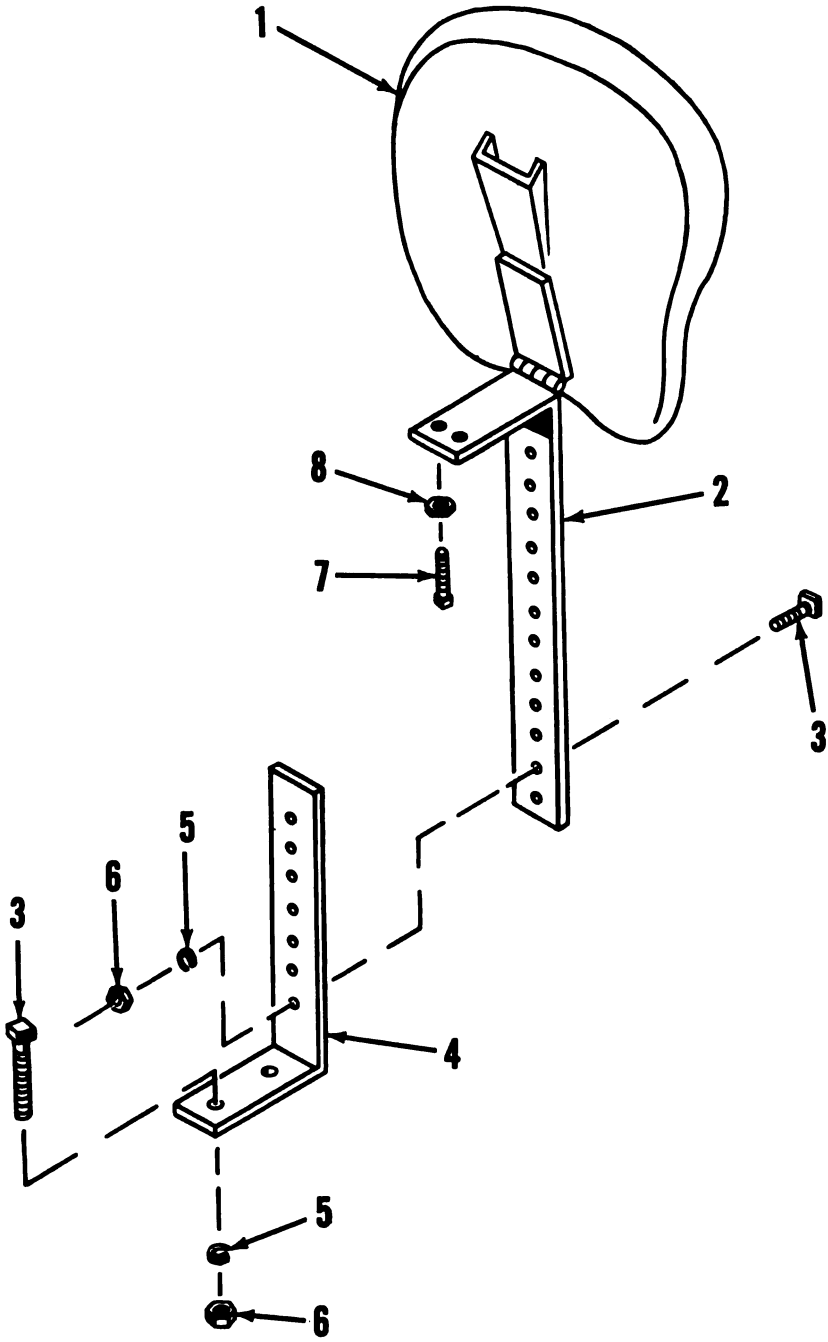


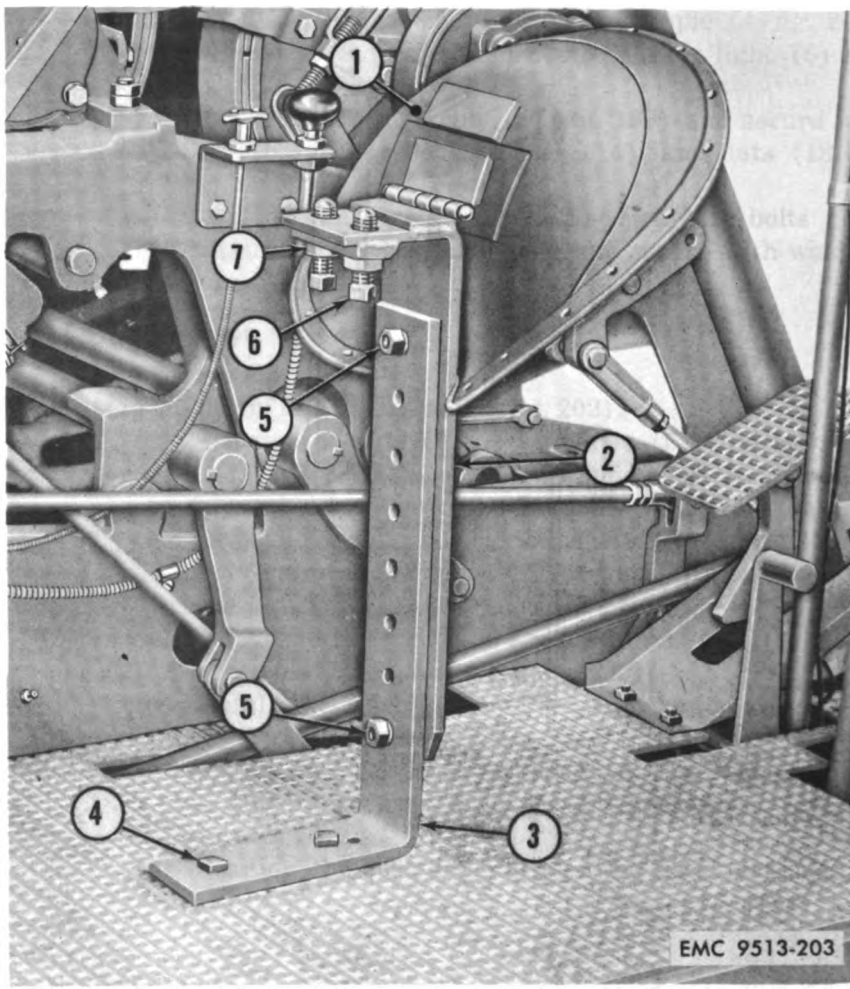
Figure 202. Revolving frame operator's seat, exploded view.

the bolts (3), lockwashers (5), and nuts (6) in the lower seat bracket (4) and the deck plate.

(3) *Adjustment* (fig. 203).

(*a*) Raise or lower the seat (1) by relocating the adjustment bolts, lockwashers, and nuts (5) in various holes in the upper seat bracket (2) and the lower seat bracket (3).

(*b*) Move the seat assembly forward or back by relocating the mounting bolts (4), lockwashers, and nuts in the lower seat bracket (3) and the deck plate.



1 Seat
2 Upper seat bracket
3 Lower seat bracket
4 Mounting bolt
5 Adjustment bolt nut
6 Setscrew
7 Jamnut

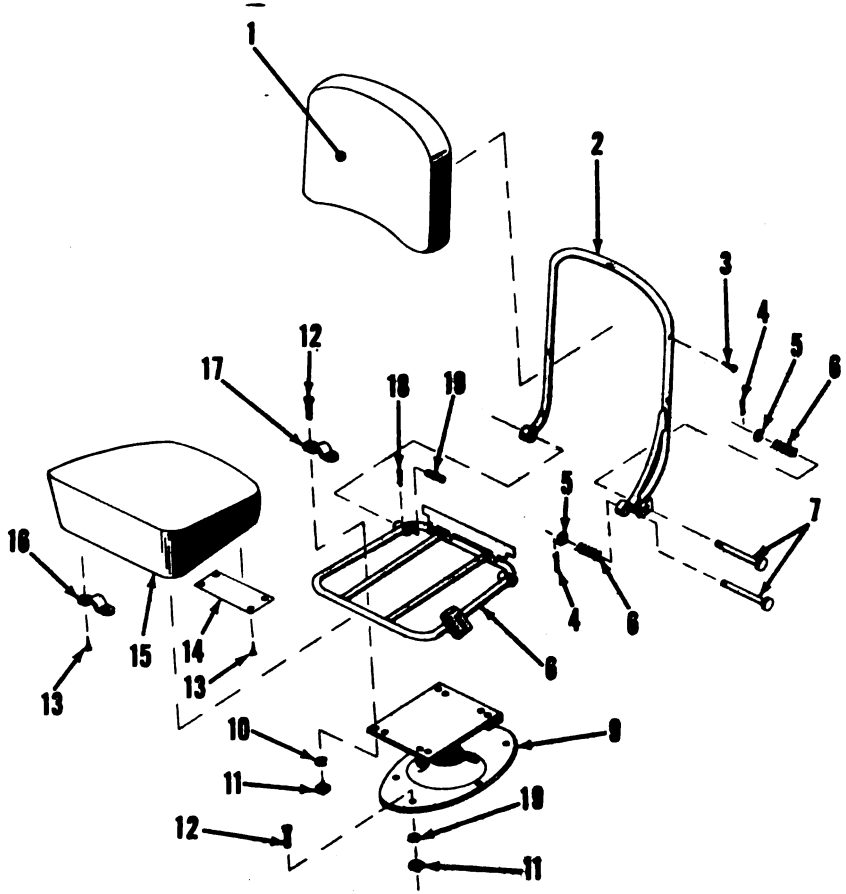
Figure 203. Revolving frame operator's seat, adjustment points.

(*c*) Tilt the seat (1) by loosening the jamnuts (7) and turning the setscrews in or out as desired. When desired adjustment is obtained, tighten the jamnuts.

b. Carrier.

(1) *Removal* (fig. 204).

(*a*) Remove the nuts (11), lockwashers (10), and bolts (12) from the seat pedestal (9) and pedestal base.



1	Back rest	11	Square nut
2	Tubular back frame	12	Bolt, stove, flat hd, w/sq nut, ¼ x ¾ (14 rqr)
3	Back rest screw (5 rqr)	13	Wood screw (8 rqr)
4	Cotter pin (2 rqr)	14	Plate
5	Washer (2 rqr)	15	Seat cushion
6	Spring (2 rqr)	16	Clamp (2 rqr)
7	Pin (2 rqr)	17	Clamp (4 rqr)
8	Tubular seat frame	18	Cotter pin (2 rqr)
9	Seat pedestal	19	Threaded pin (2 rqr)
10	Lockwasher, spring, std, ¼ (14 rqr)		

Figure 204. Carrier operator's seat, exploded view.

(*b*) Remove the seat assembly from the carrier cab.

(2) *Disassembly* (fig. 204).

(*a*) Remove the back rest screws (3) and back rest (1) from the tubular back frame (2).

(*b*) Remove the wood screws (13) and clamps (16) from the seat cushion (15). Remove the seat cushion from the tubular seat frame (8).

(*c*) Remove the nuts (11), lockwashers (10), bolts (12), and clamps (17) from the tubular seat frame (8) and seat pedestal (9). Remove the frame from the pedestal.

(*d*) Remove the cotter pins (4), washers (5), springs (6), and pins (7) from the tubular back frame (2).

(*e*) Remove the cotter pins (18). Remove the threaded pins (19) from the tubular seat frame (8) and tubular back frame (2).

(3) *Reassembly* (fig. 204).

(*a*) Position the tubular back frame (2) on the tubular seat frame (8). Install the threaded pins (19) and secure with cotter pins (18).

(*b*) Install the pins (7), springs (6), washers (5), and cotter pins (4) in the tubular back frame (2).

(*c*) Position the tubular seat frame (8) on the seat pedestal (9). Install the clamps (17) and secure with bolts (12), lockwashers (10), and nuts (11).

(*d*) Attach the clamps (16) to the bottom front of the seat cushion (15) with wood screws (13).

(*e*) Position the back rest (1) in the tubular back frame (2) and secure with back rest screws (3).

(4) *Installation* (fig. 204).

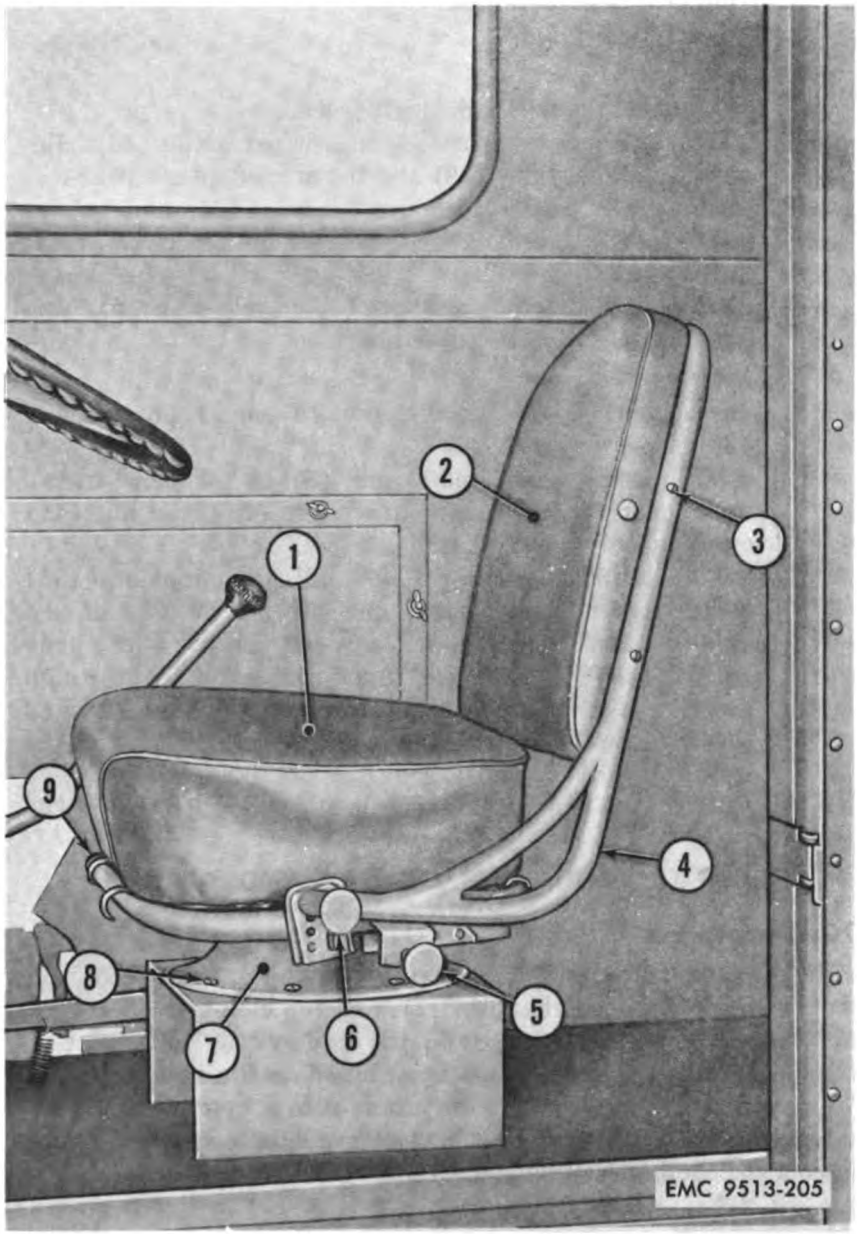
(*a*) Position the seat assembly on the pedestal base in the carrier cab.

(*b*) Secure the seat pedestal (9) to the pedestal base with bolts (12), lockwashers (10), and nuts (11).

(5) *Adjustment* (fig. 205).

(*a*) Move the seat frame (9) forward or back by pulling on the adjustment pin knob (5) and relocating the pin in various holes in the pedestal bracket.

(*b*) Tilt the back frame (4) forward or back by pulling on the adjustment pin knob (6) and relocating the pin in various holes in the seat frame bracket.



1 Seat cushion
2 Back rest
3 Back rest screws
4 Tubular back frame
5 Adjustment pin knob
6 Adjustment pin knob
7 Seat pedestal
8 Seat pedestal screws
9 Tubular seat frame

Figure 205. Carrier operator's seat, adjustment points.

269. Carrier Windshield Wiper
(fig. 197)

a. Removal.

(1) Disconnect the windshield wiper lead.

(2) Remove the wiper arm (38) and wiper blade (44). Remove the slotted nut (39) and the arm adapter (40).

(3) Remove the nut (41), cup washer (42), and rubber washer (43). Remove the windshield wiper (7) from the cab (8).

(4) Remove the rubber washer (4), angle nut (5), and locknut (6) from the wiper shaft.

b. Installation.

(1) Install the locknut (6), angle nut (5), and rubber washer (4) on the wiper shaft.

(2) Position the windshield wiper (7) in the cab. Install the rubber washer (43), cup washer (42), and nut (41) on the wiper shaft.

(3) Install the arm adapter (40) and the slotted nut (39) on the wiper shaft. Install the wiper arm (38) on the adapter. Install the wiper blade (44) on the wiper arm.

(4) Adjust the length of the wiper shaft sticking through the cab, if necessary, by loosening the locknut (6) and turning the angle nut (5) as necessary. Tighten the locknut (6) when proper length is obtained.

(5) Connect the windshield wiper lead.

Section XXI. EQUALIZER, GANTRY, AND A-FRAME

270. Description

The A-frame consists of pipe struts (10 and 12, fig. 206) rear struts (8 and 13), rear channels (7), and top channels (3 and 6) supporting the equalizer (4) and the gantry (fig. 42). The A-frame struts and rear channels are pinned to the rotating base. The gantry is raised (fig. 42) for crane-shovel operation and recessed (fig. 41) for traveling. The gantry, equalizer, and A-frame support the boom hoist cable pulleys.

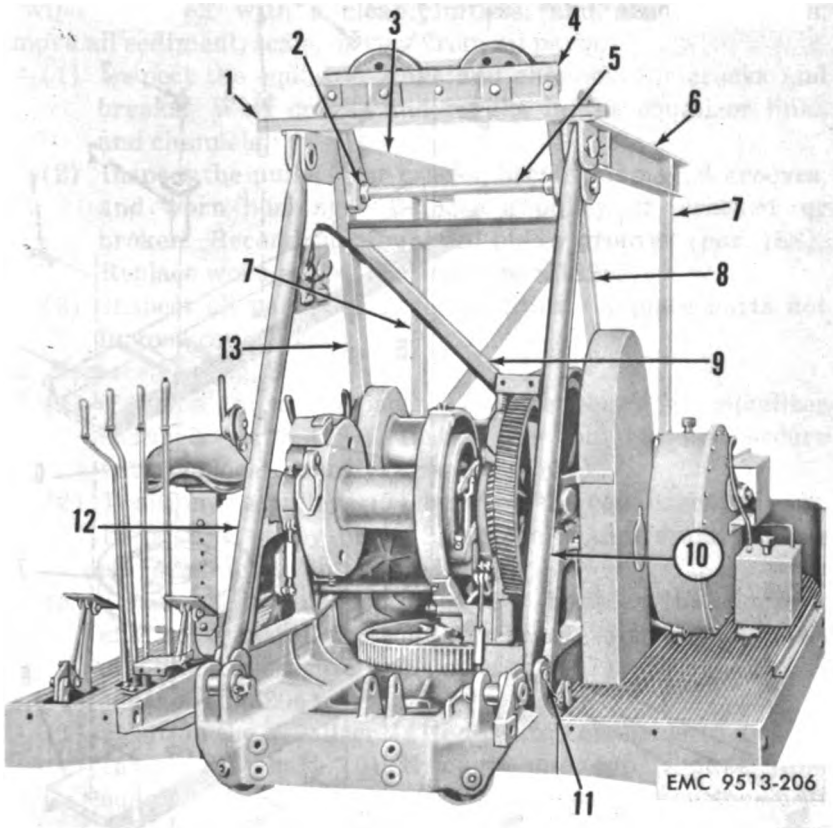
271. Equalizer

a. Removal (fig. 206).

(1) Unreeve the boom hoist cable (par. 11).

(2) Loosen two set collars (2) on the shaft (5). Place a wood support (1) between the equalizer (4) and the top channels (3, and 6).

(3) Remove the shaft (5) and set collars (2) from the rear



1	Wood support	8	Rear strut, lh
2	Set collar	9	Brace angles
3	Top channel, rh	10	Pipe strut, lh
4	Equalizer	11	Strut pin
5	Shaft	12	Pipe strut, rh
6	Top channel, lh	13	Rear strut, rh
7	Rear channels		

Figure 206. A-frame and equalizer installed, revolving frame cab and gantry removed.

struts (8 and 13) and the equalizer links. Remove the equalizer (4) from the revolving frame.

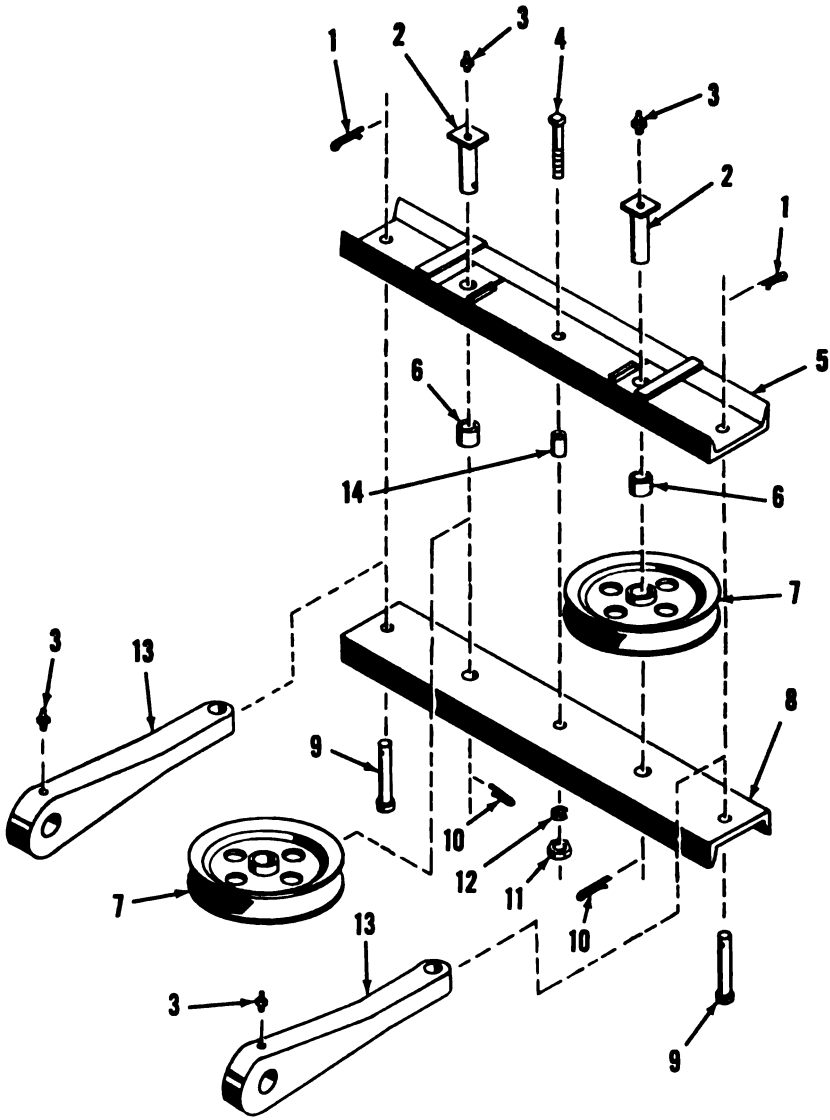
b. Disassembly (fig. 207).

(1) Remove the cotter pins (1), equalizer pins (9), and the equalizer links (13) from the equalizer channels (5 and 8).

(2) Remove the cotter pins (10), pulley pins (2,) and pulleys (7) from the equalizer channels (5 and 8).

(3) Remove the nut (11), lockwasher (12), bolt (4), and pipe spacer (14) from the equalizer channels (5 and 8).

c. Inspection and Repair. Wash all parts in an approved



1	Pin, cotter, split, 3/16 x 1½ (2 rqr)	7	Pulley (2 rqr)
2	Pulley pin	8	Equalizer channel
3	Lubrication fitting, ⅛ straight (4 rqr)	9	Equalizer pin (2 rqr)
4	Bolt, machine, sq hd, ⅝–11 NC x 4	10	Pin, cotter, split, ¼ x 2¼ (2 rqr)
5	Equalizer channel	11	Nut, regular, hex, ⅝–11 NC
6	Brass bushing (2 rqr)	12	Lockwasher, spring, std, ⅝
		13	Equalizer links (2 rqr)
		14	Spacer, pipe, std, ⅝ x 2 3/16

Figure 207. Equalizer, exploded view.

cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the equalizer links and channels for cracks and breaks. Weld cracks and breaks in the equalizer links and channels.

(2) Inspect the pulleys for cracks, breaks, damaged grooves, and worn bushings. Replace a pulley if cracked or broken. Recondition damaged pulley grooves (par. 188). Replace worn pulley bushings (par. 189).

(3) Inspect all parts for good condition. Replace parts not in good condition.

d. Reassembly (fig. 207).

(1) Position the pipe spacer (14) between the equalizer channels (5 and 8). Install the bolt (4) and secure with the lockwasher (12) and nut (11).

(2) Position the pulleys (7) between the equalizer channels. Install the pulley pins (2) in the channels and pulleys and secure with cotter pins (10).

(3) Position the equalizer links (13) between the equalizer channels. Install the equalizer pins (9) in the channels and links and secure with cotter pins (1).

e. Installation (fig. 206).

(1) Position the equalizer (4) on the top channels (3 and 6). Install the shaft (5) through one top channel and equalizer link. Position two set collars (2) on the shaft and continue the shaft through the opposite equalizer link and top channel.

(2) Tighten the set collars on the shaft and against the equalizer links.

(3) Lubricate the equalizer links and pulleys (LO 5–9513–1).

(4) Reeve the boom hoist cable (par. 11).

272. Gantry

a. Removal.

(1) Unreeve the boom hoist cable (par. 11).

(2) Recess the gantry (par. 66*i*).

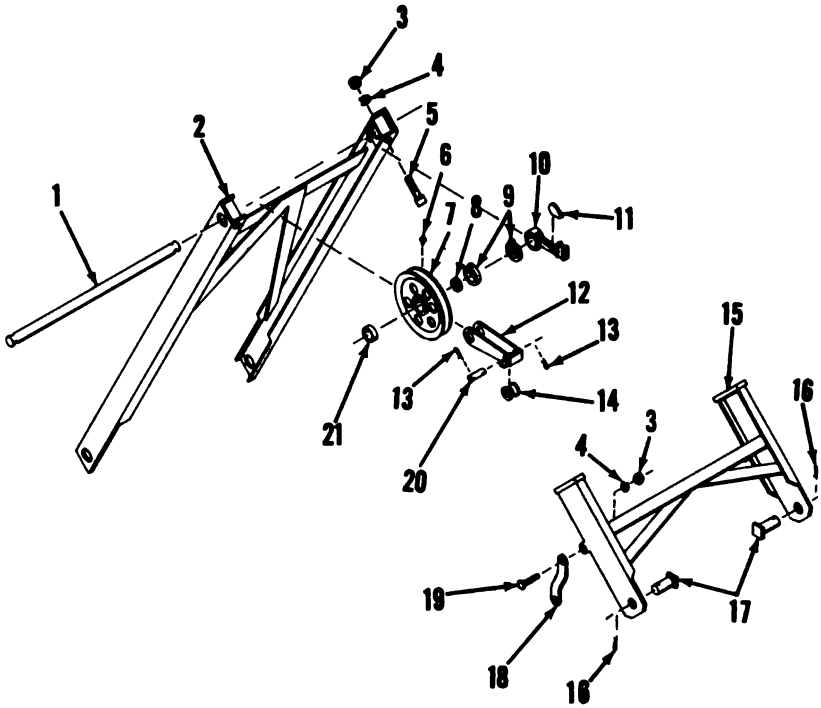
(3) Remove the nuts (3, fig. 208), lockwashers (4), bolts (19), and strut links (18) from the bridle strut (15).

(4) Remove the cotter pins (16) and strut pins (17). Remove the bridle strut (15) from the revolving frame.

(5) Remove the revolving frame cab rear panel (par. 254*b*).

(6) Remove the nuts (13, fig. 209), lockwashers (12), bolts (2), and collars (1) from the shaft (11).

(7) Loosen the set collar (9) on the shaft (11). Carefully



1	Bridle shaft	12	Cable guide
2	Bridle	13	Pin, cotter, split, 3/16 x 1½ (2 rqr)
3	Nut, regular, hex, ⅝–11 NC (6 rqr)	14	Cable guide pulley
4	Lockwasher, spring, std, ⅝ (6 rqr)	15	Bridle strut
5	Bolt, machine, sq hd, ⅝–11 NC x 5 (2 rqr)	16	Pin, cotter, split, 5/16 x 2½ (2 rqr)
6	Lubrication fitting, ⅛ straight	17	Strut pin (2 rqr)
7	Pulley	18	Strut link (2 rqr)
8	Brass bushing	19	Bolt, machine, sq hd, ⅝–11 NC x 2 (2 rqr)
9	Collar, set, std, 1 13/16 (2 rqr)	20	Pulley pin
10	Wedge socket	21	Spacer, pipe, std, 2 x ⅜ long
11	Wedge		

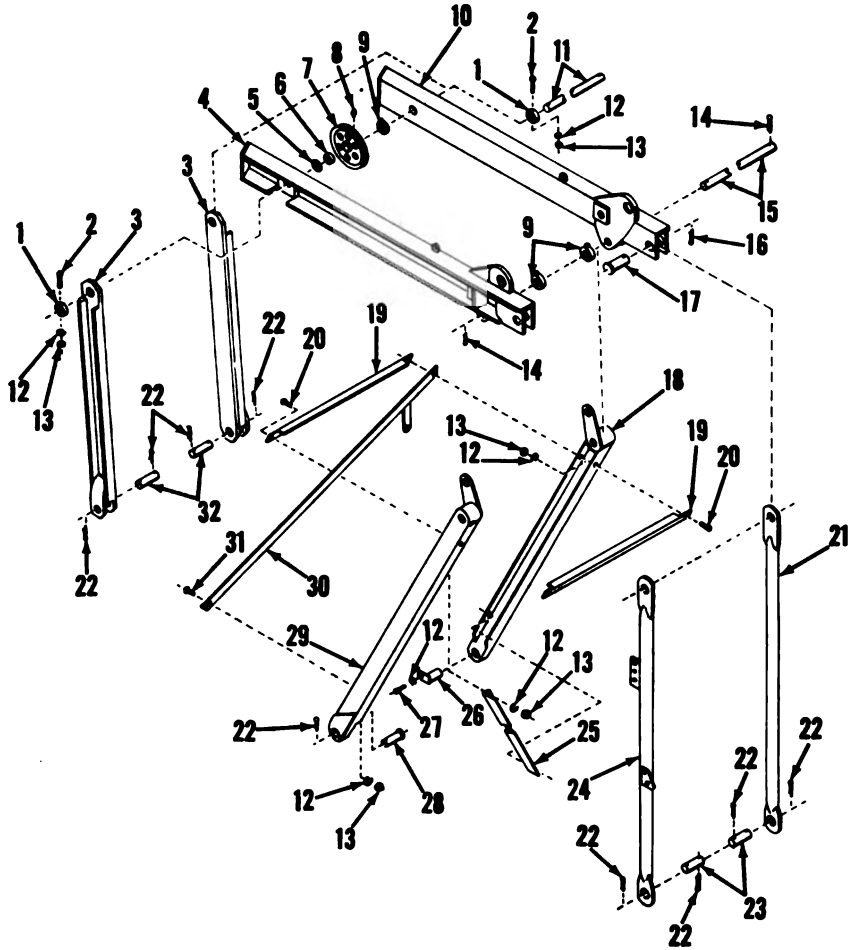
Figure 208. Gantry, exploded view.

remove the shaft (11), washer (5), pulley (7), and set collar (9) from the rear channels (3), top channels (4 and 10), and the bridle. Move the bridle aside and reinstall the shaft (11) in the rear channels and top channels. Remove the bridle from the revolving frame.

b. Disassembly (fig. 208).

(1) Remove the nuts (3), lockwashers (4), and bolts (5) from the bridle (2) and bridle shaft (1).

(2) Loosen the set collars (9). Remove the bridle shaft



1	Collar (2 rqr)	17	Strut pin (2 rqr)
2	Bolt, machine, sq hd, ½–13 NC x 4 (2 rqr)	18	Rear strut, lh
3	Rear channel (2 rqr)	19	Brace angle (2 rqr)
4	Top channel, rh	20	Bolt, machine, sq hd, ½–13 NC x 1¾ (2 rqr)
5	Steel washer	21	Pipe strut, lh
6	Brass bushing	22	Pin, cotter, split, 5/16 x 2½ (9 rqr)
7	Pulley	23	Strut pin (2 rqr)
8	Lubrication fitting, ⅛ straight	24	Pipe strut, rh
9	Collar, set, std, 1 15/16 (3 rqr)	25	Brace angle
10	Top channel, lh	26	Rear strut pin
11	Shaft	27	Screw, cap, hex hd, ½–13 NC x 1
12	Lockwasher, spring, std, ½ (7 rqr)	28	Pin
13	Nut, regular, hex, ½–13 NC (6 rqr)	29	Rear strut, rh
14	Pin, cotter, split, ⅜ x 3 (2 rqr)	30	Brace angle
15	Shaft	31	Bolt, machine, sq hd, ½–13 NC x 1½ (2 rqr)
16	Pin, cotter, split, ⅜ x 3¾ (2 rqr)	32	Pin (2 rqr)

Figure 209. A-frame, exploded view.

(1), pipe spacer (21), cable guide (12), pulley (7), set collars (9), and wedge socket (10) from the bridle (2).

(3) Remove the cotter pins (13), pulley pin (20), and cable guide pulley (14) from the cable guide (12).

c. Inspection and Repair. Wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the bridle, bridle strut, cable guide, and strut links for cracks, breaks, and distortion. Weld cracks or breaks in the bridle, bridle strut, cable guide, and strut links. Straighten bent surfaces by heating and pounding to alinement with a sledge and heavy bucking-up bar.

(2) Inspect the pulleys for cracks, breaks, damaged grooves, or worn bushings. Replace a pulley that is cracked or broken. Repair a damaged pulley groove (par. 188). Replace a worn pulley bushing (par. 189).

(3) Inspect all parts for good condition. Replace parts not in good condition.

d. Reassembly (fig. 208).

(1) Position the cable guide pulley (14) in the cable guide (12). Install the pulley pin (20) and secure with cotter pins (13).

(2) Install the bridle shaft (1) in the right side of the bridle (2) and, in sequence, install the pipe spacer (21), cable guide (12) with pulley (7), two set collars (9), and the wedge socket (10) on the bridle shaft. Continue the shaft through the left side of the bridle. Install the bolts (5) in the bridle and shaft and secure with lockwashers (4) and nuts (3).

(3) Slide the pipe spacer (21), cable guide (12) with pulley (7), and a set collar (9) against the right side of the bridle. Tighten the set collar on the shaft.

(4) Slide the wedge socket (10) and a set collar (9) against the left side of the bridle. Tighten the set collar on the shaft.

e. Installation.

(1) Remove the shaft (11, fig. 209) from the rear channels (3) and top channels (4 and 10). Position the feet of the bridle between the top channels. Install the shaft (11) in the right rear channel (3) and in the right top channel (4) and right bridle foot, and, in sequence, install the steel washer (5), pulley (7), and set collar

(9) on the shaft. Install the shaft in the left bridle foot, left top channel, and left rear channel.

(2) Install the collars (1) on the ends of the shaft. Install the bolts (2) in the collars and shaft and secure with lockwashers (12) and nuts (13).

(3) Slide the steel washer (5), pulley (7), and set collar (9) against the right top channel (4). Tighten the set collar on the shaft.

(4) Install the revolving frame cab rear panel (par. 257*a*).

(5) Position the bridle strut (15, fig. 208) between the top channels. Install the strut pins (17) and secure with cotter pins (16).

(6) Position the strut links (18) on the bridle strut (15) and top channels and secure with bolts (19), lockwashers (4), and nuts (3).

(7) Lubricate the gantry pulleys (LO 5–9513–1).

(8) Reeve the boom hoist cable (par. 11).

273. A-Frame
(fig. 209)

a. Removal.

(1) Remove the equalizer (par. 271*a*).

(2) Remove the gantry (par. 272*a*).

(3) Remove the revolving frame cab roof (par. 253), front panels (par. 254*a*), and left side panel (par. 255).

(4) Attach an auxiliary lifting device to the top channels (4 and 10). Take up the slack in the cable slings.

(5) Remove the cotter pins (22) and strut pins (23) from the rotating base and the pipe struts (21 and 24).

(6) Remove the cotter pins (22) and pins (32) from the rear channels (3) and the tailswing.

(7) Remove the cotter pin (22) and pin (28) from the rotating base and rear strut (29). Remove the screw (27), lockwasher (12), and rear strut pin (26) from the rotating base and rear strut (18).

(8) Remove the A-frame from the revolving frame and lower to the working area. Remove the auxiliary lifting device.

b. Disassembly.

(1) Remove the shaft (11) which was reinstalled during gantry removal. Remove the rear channels (3) from the top channels (4 and 10).

(2) Remove the cotter pins (16) and strut pins (17) from the top channels and the pipe struts (21 and 24). Remove the pipe struts.

(3) Loosen the set collars (9) on the shaft (15). Remove the cotter pins (14) from the shaft. Remove the shaft and set collars from the top channels and the rear struts (18 and 29). Remove the rear struts.

(4) Remove the nuts (13), lockwashers (12), bolts (20 and 31), and the brace angles (19, 25, and 30) from the rear struts.

c. Inspection and Repair. Wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the top channels, rear channels, rear struts, pipe struts, and brace angles for cracks, breaks, and distortion. Weld cracks or breaks in the channels, struts, and brace angles. Straighten bent surfaces by heating and pounding to alinement with a sledge and heavy bucking-up bar.

(2) Inspect all parts for good condition. Replace parts not in good condition.

d. Reassembly.

(1) Position the brace angles (19, 25, and 30) on the rear struts (18 and 29) and secure with bolts (20 and 31), lockwashers (12), and nuts (13).

(2) Position the top channels (4 and 10) on the rear struts. Install the shaft (15) in the top channel (10) and rear strut (18). Position the set collars (9) on the shaft. Install the shaft in the top channel (4) and rear strut (29). Install the cotter pins (14) in the shaft. Tighten the set collars on the shaft against the top channels.

(3) Position the pipe struts (21 and 24) on the top channels. Install the strut pins (17) and cotter pins (16).

(4) Position the rear channels (3) on the top channels and install the shaft (11).

e. Installation.

(1) Attach an auxiliary lifting device to the top channels. Locate the A-frame assembly in the revolving frame.

(2) Position the rear struts (18 and 29) on the rotating base. Install the pin (28) and cotter pin (22). Install the rear strut pin (26) and secure with the lockwasher (12) and screw (27).

(3) Position the rear channels (3) in the tailswing. Install the pins (32) and cotter pins (22).

(4) Position the pipe struts (21 and 24) in the rotating base. Install the strut pins (23) and cotter pins (22).

(5) Remove the auxiliary lifting device from the top channels.
(6) Install the revolving frame cab left side panel (par. 256), front panels (par. 257*b*), and the roof (par. 258).
(7) Install the gantry (par. 272*e*).
(8) Install the equalizer (par. 271*e*).

Section XXII. ROTATING BASE AND DECK

274. Lever Bracket
(fig. 210)

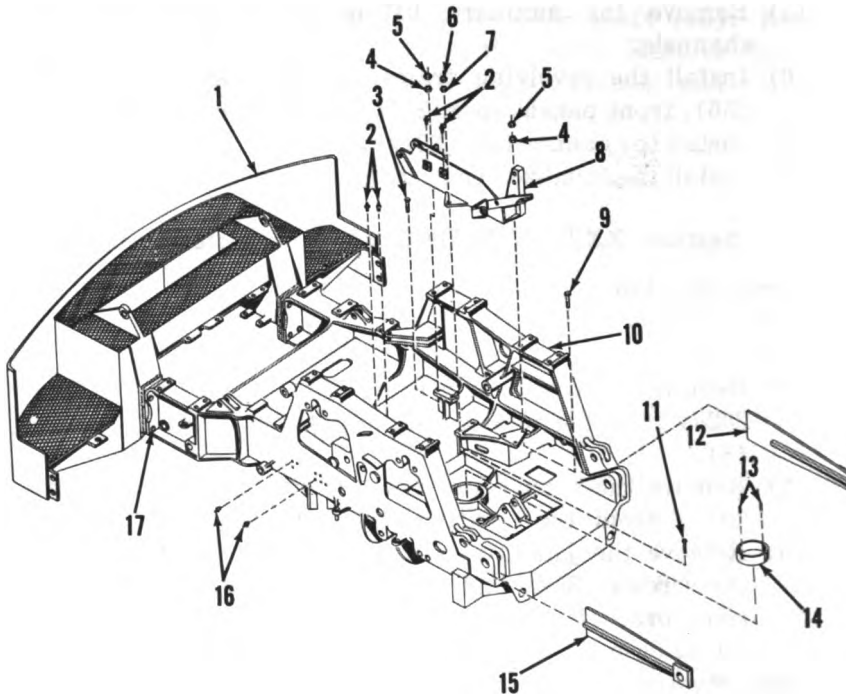
a. Removal.
(1) Remove the front drum brake control lever shaft (par. 202*a*) from the rotating base (10) and the lever bracket (8).
(2) Remove the hoist drum brake control lever shaft (par. 201*a*) from the rotating base and the lever bracket.
(3) Remove the jamnuts (5 and 6), nuts (4 and 7), and the screws (3, 9, and 11) from the rotating base and lever bracket. Remove the lever bracket from the rotating base.

b. Inspection and Repair. Wash the lever bracket in an approved cleaning solvent and blow dry with clean compressed air or wipe off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from the bracket.
(1) Inspect the lever bracket for cracks, breaks, and distortion. Weld cracks or breaks in the bracket. Straighten bent surfaces by heating and pounding to alinement with a sledge and heavy bucking-up bar.
(2) Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace parts having damaged, corroded, or stripped threads.

c. Installation.
(1) Position the lever brace (8) on the rotating base (10) and secure with screws (3, 9, and 11), nuts (4 and 7), and the jamnuts (5 and 6).
(2) Install the hoist drum brake control lever shaft (par. 201*c*) in the rotating base (10) and the lever bracket (8).
(3) Install the front drum brake control lever shaft (par. 202*c*) in the rotating base and the lever bracket.

275. Deck Plate and Channel Removal, Right Side
(fig. 211)

a. Remove the front window panel (par. 254*a*).
b. Remove the jamnuts (23), nuts (6), and the bolts (25)



1 Counterweight
2 Lubrication fitting, ⅛ straight (4 rqr)
3 Screw, cap, hex hd, ¾–16 NF x 3¾ (2 rqr)
4 Nut, regular, hex, ¾–16 NF (5 rqr)
5 Jamnut, regular, hex, ¾–16 NF (5 rqr)
6 Jamnut, regular, hex, ⅞–14 NF (2 rqr)
7 Nut, regular, hex, ⅞–14 NF (2 rqr)
8 Lever bracket
9 Screw, cap, hex hd, ¾–16 NF x 2¾ (3 rqr)
10 Rotating base
11 Screw, cap, hex hd, ⅞–14 NF x 3 (2 rqr)
12 Cable bracket, lh
13 Threaded dowel, 5/16 x 1 (2 rqr)
14 Brass bushing
15 Cable bracket, rh
16 Lubrication fitting, ⅛ x 30° (8 rqr)
17 Screw, cap, hex hd, ⅞–14 NF x 3¼ w/hex nut and jamnut (8 rqr)

Figure 210. Rotating base and lever bracket, exploded view.

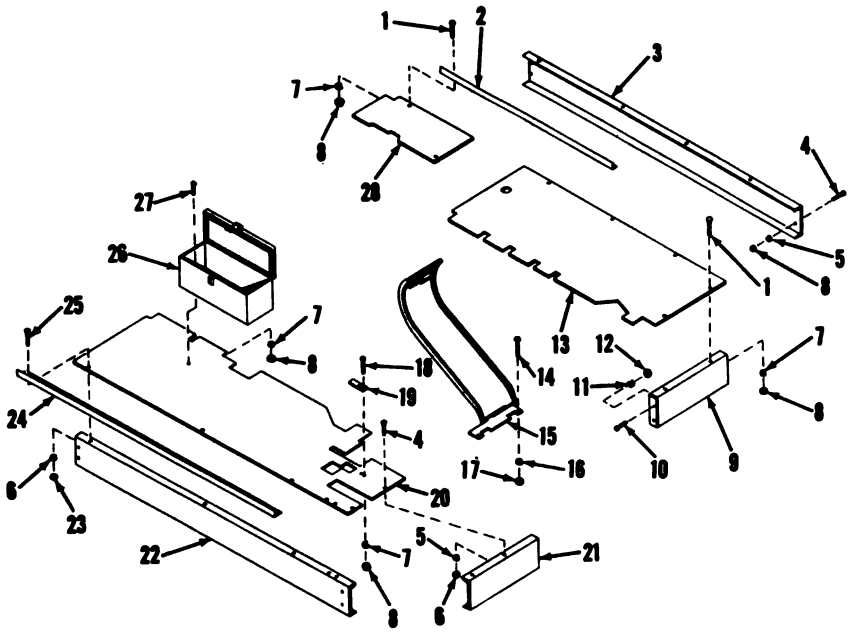
from the door guide (24), floor plate (20), and the deck channel (22). Remove the door guide and the right side cab doors from the revolving frame.

c. Remove the operator's seat (par. 268*a*(1)).

d. Remove the nuts (8), lockwashers (7), bolts (27), and toolbox (26) from the floor plate (20).

e. Remove the nuts (8), lockwashers (7), bolts (18), and lever stop (19) from the floor plate (20).

f. Remove the nuts (6), lockwashers (5), and bolts (4) from



1	Bolt, carriage, regular, ⅜–16 NC x 1¼ (8 rqr)	14	Screw, cap, hex hd, ¾–10 NC x 2¼ (2 rqr)
2	Door guide, lh	15	Mudguard
3	Deck channel, lh	16	Lockwasher, spring, std, ¾ (2 rqr)
4	Bolt, carriage, regular, ½–13 NC x 1½ (9 rqr)	17	Nut, regular, hex, ¾–10 NC (2 rqr)
5	Lockwasher, spring, std, ½ (9 rqr)	18	Bolt, machine, sq hd, ⅝–16 NC x 1 (2 rqr)
6	Nut, regular, hex, ½–13 NC (12 rqr)	19	Lever stop
7	Lockwasher, spring, std, ⅜ (12 rqr)	20	Floor plate, rh
8	Nut, regular, hex, ⅜–16 NC (12 rqr)	21	Deck bracket, rh
9	Deck bracket, lh	22	Deck channel, rh
10	Screw, cap, hex hd, ¾–16 NF x 2¼ (4 rqr)	23	Jamnut, regular, hex, ½–13 NC (3 rqr)
11	Nut, regular, hex, ¾–16 NF (4 rqr)	24	Door guide, rh
12	Jamnut, regular, hex, ¾–16 NF (4 rqr)	25	Bolt, machine, sq hd, ½–13 NC x 1¼ (3 rqr)
13	Front floor plate, lh	26	Toolbox
		27	Bolt, machine, sq hd, ⅜–16 NC x 1¼ (2 rqr)
		28	Rear floor plate, lh

Figure 211. Revolving frame floor plates and channels, exploded view.

the floor plate and the deck bracket (21). Remove the floor plate from the revolving frame.

g. Remove nuts (6), lockwashers (5), and bolts (4) from the deck channel (22), deck bracket (21), and the tailswing. Remove the deck channel.

h. Remove jamnuts (11), nuts (12), and screws (10) from the rotating base and deck bracket. Remove the deck bracket.

276. Deck Plate and Channel Removal, Left Side (fig. 211)

a. Remove the nuts (8), lockwashers (7), bolts (1), and door guide (2) from the floor plates (13 and 28). Remove the left side door from the revolving frame.

b. Remove the cab left side panel (par. 255).

c. Remove nuts (8), lockwashers (7), and bolts (1) from the floor plates (13 and 28) and the deck channel (3) and deck bracket (9). Remove the floor plates from the revolving frame.

d. Remove nuts (6), lockwashers (5), and bolts (4) from the deck channel (3), deck bracket (9), and the counterweight. Remove the deck channel.

e. Remove jamnuts (12), nuts (11), and screws (10) from the rotating base and deck bracket. Remove the deck bracket.

277. Deck Plate and Channel Inspection and Repair

a. Wash the deck plates, channels, and brackets with an approved cleaning solvent and blow dry with clean compressed air or wipe off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

b. Inspect the deck plates, channels, and brackets for cracks, breaks, and distortion. Weld cracks or breaks in the deck plates, channels, or brackets. Straighten bent surfaces by heating and pounding to alinement with a sledge and heavy bucking-up bar.

c. Inspect all parts for good condition. Replace parts not in good condition.

278. Deck Plate and Channel Installation, Right Side (fig. 211)

a. Position the deck bracket (21) on the rotating base and secure with screws (10), nuts (11), and jamnuts (12).

b. Position the deck channel (22) on the deck bracket (21) and counterweight and secure with bolts (4), lockwashers (5), and nuts (6).

c. Position the floor plate (20) on the deck channel (22) and deck bracket (21). Secure the floor plate to the deck bracket with bolts (4), lockwashers (5), and nuts (6).

d. Position the lever stop (19) on the floor plate and secure with bolts (18), lockwashers (7), and nuts (8).

e. Position the tool box (26) on the floor plate and secure with bolts (27), lockwashers (7), and nuts (8).

f. Install the operator's seat (par. 268*a*(2)).

g. Position the right side cab doors on the cab roof section. Position the door guide (24) in the cab doors and on the floor

plate. Secure the door guide to the floor plate and deck channel (22) with bolts (25), nuts (6), and jamnuts (23).

h. Install the front window panel (par. 257*b*).

279. Deck Plate and Channel Installation, Left Side (fig. 211)

a. Position the deck bracket (9) on the rotating base and secure with screws (10), nuts (11), and jamnuts (12).

b. Position the deck channel (3) on the deck bracket (9) and counterweight and secure with bolts (4), lockwashers (5), and nuts (6).

c. Position the floor plates (13 and 28) on the deck channel and deck bracket and secure with bolts (1), lockwashers (7), and nuts (8).

d. Install the cab left side panel (par. 256).

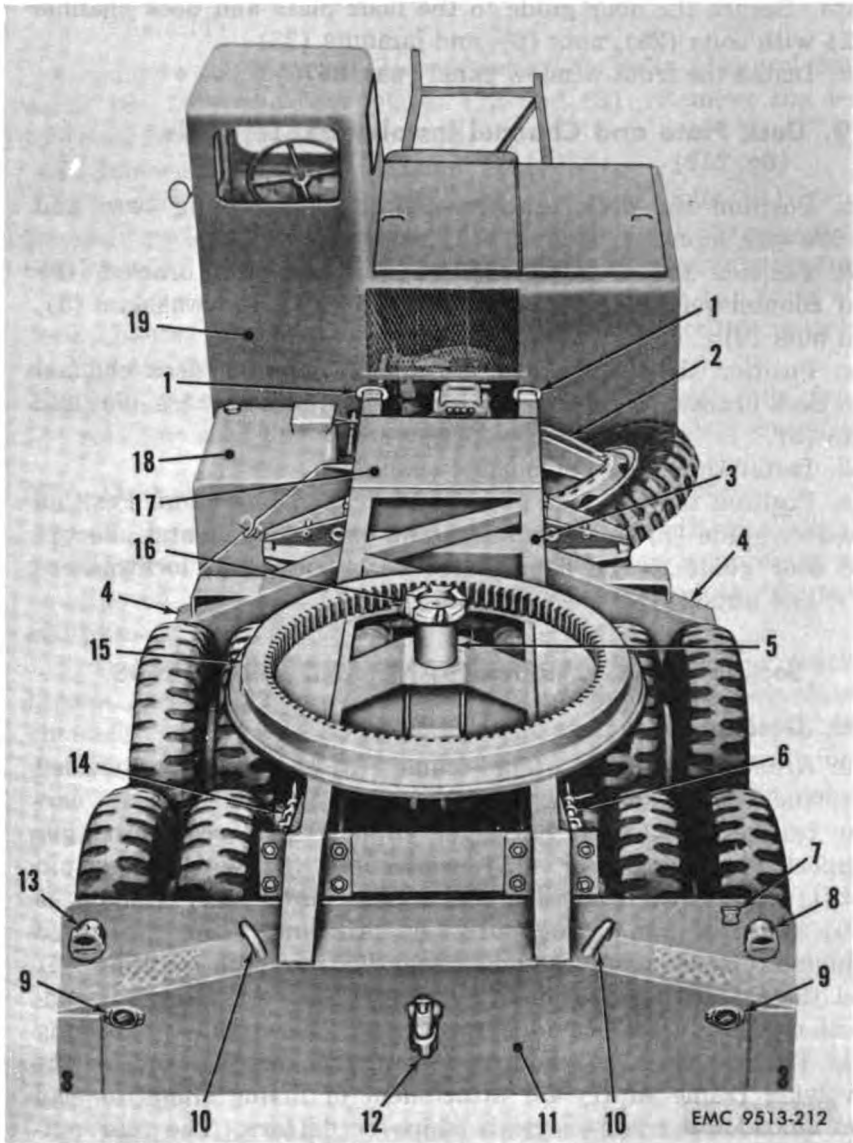
e. Position the left side door on the cab roof section. Position the door guide (2) in the cab door and on the floor plates. Secure the door guide to the floor plates with bolts (1), lockwashers (7), and nuts (8).

Section XXIII. CARRIER FRAME AND MOUNTINGS

280. Description

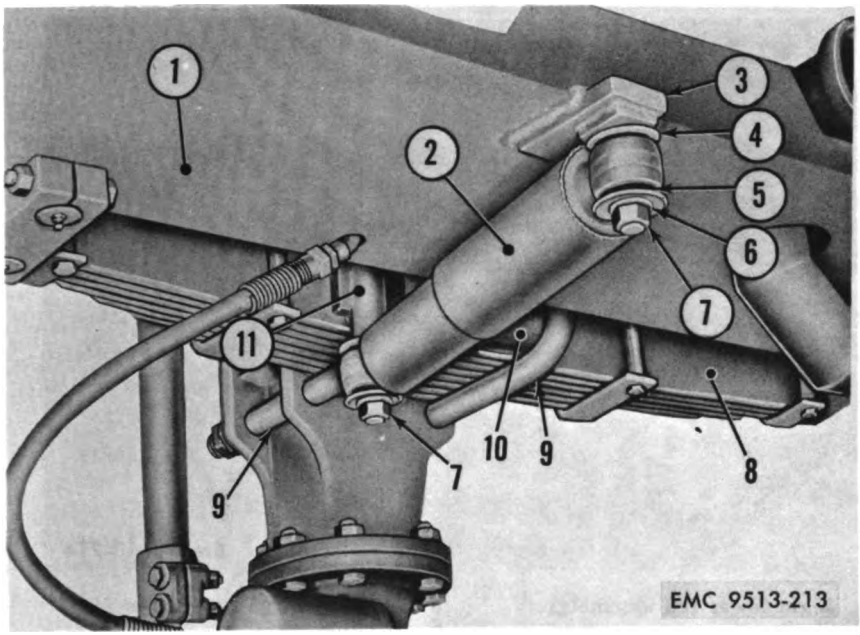
a. Frame (fig. 212). The frame (3) is of heavy welded construction and supports the cab assembly (19), spare tire carrier bracket (2), front outrigger support (4), rear outrigger support (11), ring gear (15), center pin (5) with center pin nut (16), and the fuel tank (18). The pintle (12) and hooks (10) are used for towing purposes. Air lines from the towed vehicle are attached to the emergency line air hose coupling (6) and the service line air hose coupling (14). An electrical connection (7) is also provided for trailer operation. The lifting eyes (1) are used in conjunction with the lifting eyes on the revolving frame gantry for attachment of lifting slings to load and unload the crane-shovel in ships or flatcars. The rear outrigger support (11) can be removed (par. 66*f*) to obtain maximum digging depth for shovel and back hoe operation.

b. Shock Absorbers (fig. 213). The direct-acting shock absorber (2) consists of an inner cylinder, filled with a special shock absorber oil, divided into an upper and lower chamber by a double-acting piston. The shock absorber is mounted on an upper bracket (3) welded to the frame (1) and a lower bracket (11) installed under the U-bolt seat (10) and U-bolts (9) of the front spring assembly (8). Washers (4) and rubber bushings (5) are fitted on both sides of each eye of the shock absorber to



1 Lifting eyes
2 Spare tire carrier bracket
3 Frame
4 Front outrigger support
5 Center pin
6 Emergency line air hose coupling
7 Trailer electrical connection
8 Combination blackout tail and stop lamp
9 Reflectors
10 Tow hooks
11 Rear outrigger support
12 Pintle
13 Combination blackout tail and service tail and stop lamp
14 Service line air hose coupling
15 Ring gear
16 Center pin nut
17 Cover
18 Fuel tank
19 Cab assembly

Figure 212. Chassis, overhead view.

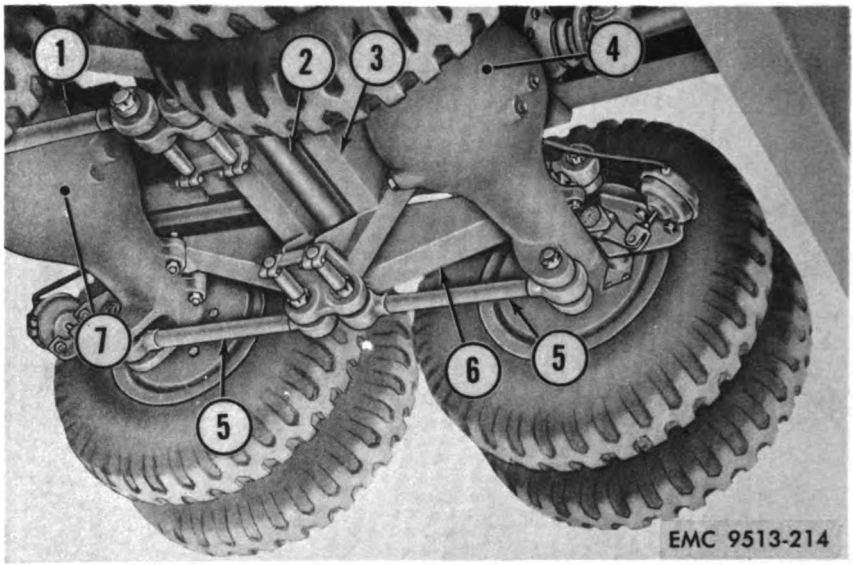


1 Carrier frame
2 Shock absorber
3 Upper bracket
4 Washer
5 Rubber bushing
6 Lockwasher
7 Mounting nuts
8 Front spring assembly
9 U-bolts
10 U-bolt seat
11 Lower bracket

Figure 213. Shock absorber, installed.

prevent metal-to-metal contact with the bracket studs. An outer metal cover protects the shock absorber from damage by stones and other material that are kicked up by the wheels.

c. Equalizers and Torque Rods. Alinement of the front rear axle assembly (4, fig. 214) and the rear axle assembly (7) is maintained by parallel torque rods, consisting of two lower rod assemblies (5) and two upper rod assemblies (1, fig. 215) on each of the axle assemblies. The load is equalized between the axles by equalizers (5) which oscillate on the shaft (9). The equalizers ride in the spring guide and support brackets mounted on the axle assemblies. One end of each upper rod assembly is attached to a spring guide and support bracket. The other end of each upper rod assembly is attached to a bracket (4) welded on the side of the carrier frame. The lower rod assemblies are anchored to a support (8) welded to the carrier frame and to hangers cast integral with the axle assemblies.



1 Right lower rod assembly
2 Shaft
3 Support
4 Front rear axle assembly
5 Left lower rod assemblies
6 Equalizer
7 Rear axle assembly

Figure 214. Equalizer and torque rods installed, bottom view.

281. Pintle
(fig. 216)

a. Removal. Remove the cotter pin (1) and nut (15) from the pintle (10). Remove the pintle from the carrier rear.

b. Disassembly.

(1) Remove the cotter pin (2), link (3), and chain (4) from the pintle (10) and latch (5).

(2) Remove the cotter pin (8), nut (9), and latch bolt (12). Remove the lock.

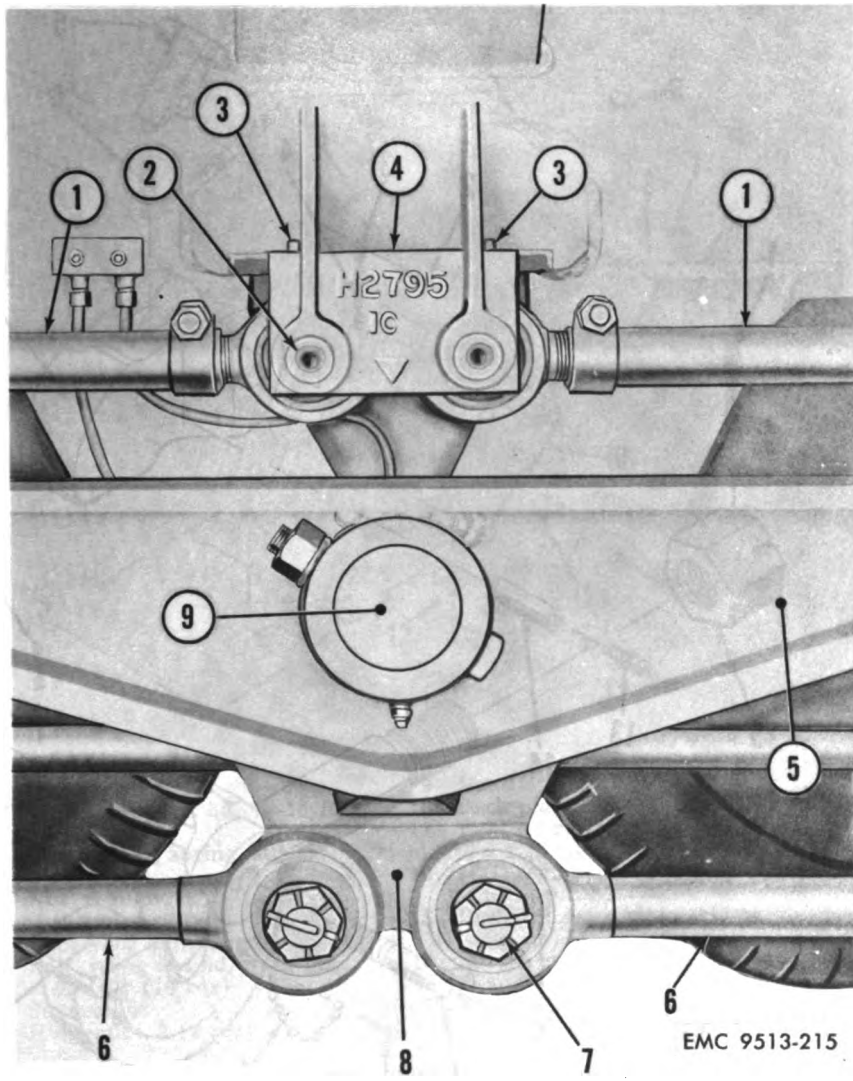
(3) Remove the latch pin (14), latch (5), and spring (6) from the lock.

c. Inspection and Repair. Wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the latch, lock, and pintle for cracks and breaks. Replace a latch, lock, or pintle if cracked or broken.

(2) Inspect the latch bolt and latch pin for wear. Replace a worn latch bolt or latch pin.

(3) Inspect all parts for good condition. Replace parts not in good condition.



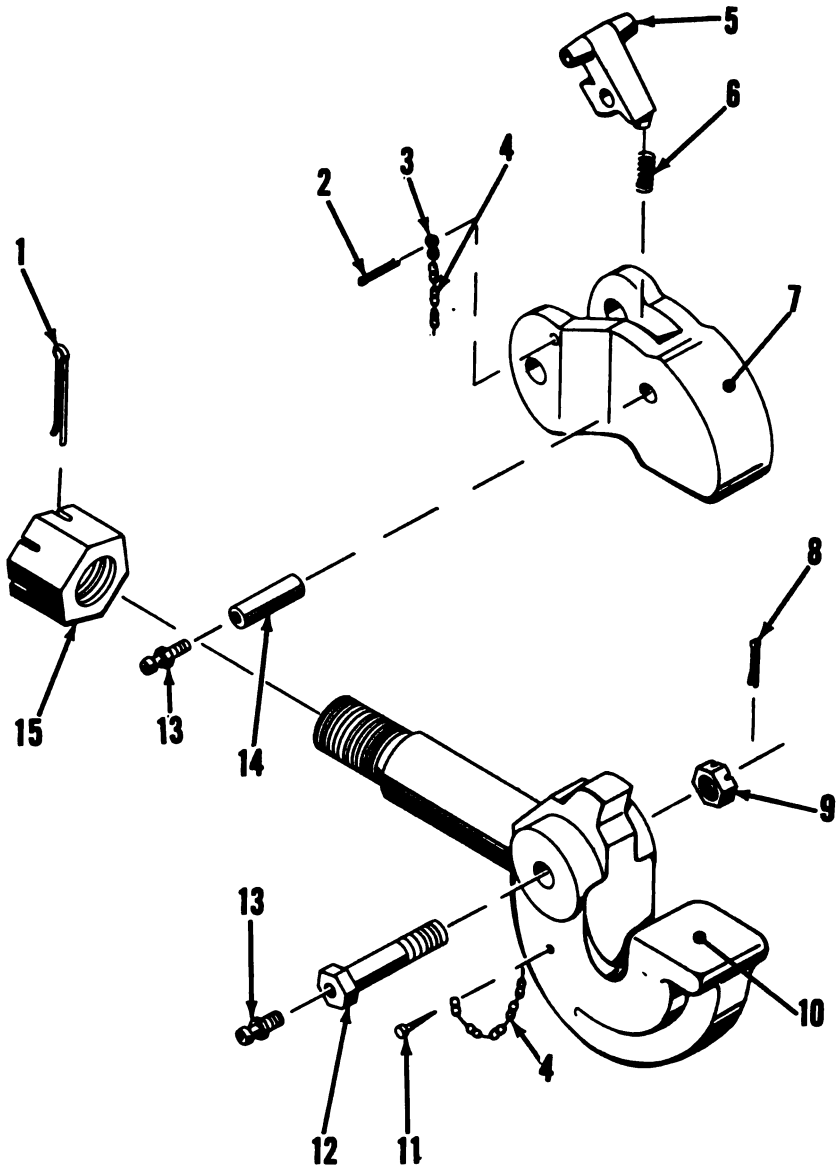
1 Upper rod assemblies
2 Pin
3 Key
4 Bracket
5 Equalizer
6 Lower rod assemblies
7 Pin and nut assembly
8 Support
9 Shaft

Figure 215. Equalizer and torque rods installed, side view.

d. Reassembly.

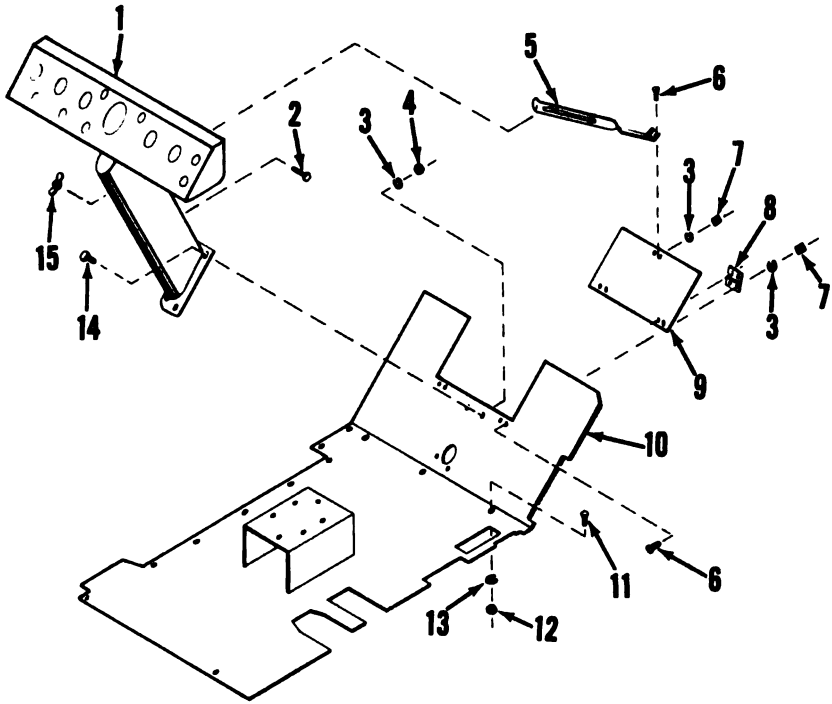
(1) Position the spring (6) on the latch (5). Position the spring and latch in the lock (7) and install the latch pin (14).

(2) Position the lock (7) in the pintle (10). Install the



1	Pin, cotter, split, 5/16 x 3½	9	Nut, slotted, hex, 1–14 NF
2	Pin, cotter, split, ¼ x 3½	10	Pintle
3	Link	11	Drive screw
4	Chain	12	Latch bolt
5	Latch	13	Lublication fitting, ⅛ straight (2 rqr)
6	Spring	14	Latch pin
7	Lock	15	Nut, slotted, hex, 2¼–12
8	Pin, cotter, split, ½ x 2		

Figure 216. Pintle, exploded view.



EMC 9513-217

1 Instrument panel
2 Screw, cap, hex hd, ⅜–16 NC x 1½
3 Lockwasher, spring, std, ¼ (14 rqr)
4 Nut, regular, hex, ¼–20 NC (4 rqr)
5 Ventilator adjusting bar
6 Bolt, stove, flat hd, w/sq nuts, ¼ x ⅜ (10 rqr)
7 Square nut
8 Hinge, flat, 2 (2 rqr)
9 Ventilator plate
10 Deck plate
11 Bolt, carriage, ribbed, ⅜–16 NC x 1 (3 rqr)
12 Nut, regular, hex, ⅜–16 NC (3 rqr)
13 Lockwasher, spring, std, ⅜ (3 rqr)
14 Screw, cap, hex hd, ¼–20 NC x ¾ (4 rqr)
15 Wingnut, regular, ⅜–16 NC

Figure 217. Carrier cab deck plate and instrument panel, exploded view.

latch bolt (12) and secure with the nut (9) and cotter pin (8).

(3) Install the cotter pin (2) with link (3) and chain (4) in the pintle (10) and latch (5).

(4) Lubricate the pintle (LO 5–9513–3).

e. Installation. Position the pintle (10) in the rear of the carrier and secure with the nut (15) and cotter pin (1).

282. Carrier Cab Deck Plate and Instrument Panel (fig. 217)

a. Removal and Disassembly.

(1) Remove the cab left side (par. 263*a*).

(2) Remove the operator's seat (par. 268*b*(1)).

(3) Remove all instruments and controls from the instrument panel (1). Remove the air compressor governor (par. 295*b*). Remove the handbrake valve (par. 297*b*).

(4) Remove the horn button assembly (par. 150*a*). Remove the steering wheel (par. 401*b*).

(5) Remove the wingnut (15) and screw (2). Remove the nuts (4), lockwashers (3), and screws (14). Remove the instrument panel (1) from the deck plate (10) and steering tube.

(6) Remove the headlight dimmer switch, clutch pedal and lever arm (par. 210*b*(1)), footbrake valve (par. 296*b*), and that portion of the accelerator control attached to the deck plate (par. 211*b*).

(7) Break spotwelds at side and rear of deck plate. Remove the nuts (12), lockwashers (13), and carriage bolts (11). Remove the deck plate (10) from the carrier frame.

(8) Remove the nuts (7), lockwashers (3), and bolts (6). Remove the ventilator adjusting bar (5), hinges (8), and ventilator plate (9).

b. Inspection and Repair. Wash all parts with an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the instrument panel, deck plate, ventilator plate, and ventilator adjusting bar for cracks or breaks. Weld cracks or breaks in the instrument panel, deck plate, ventilator plate, or ventilator adjusting bar.

(2) Inspect all parts for good condition. Replace parts not in good condition.

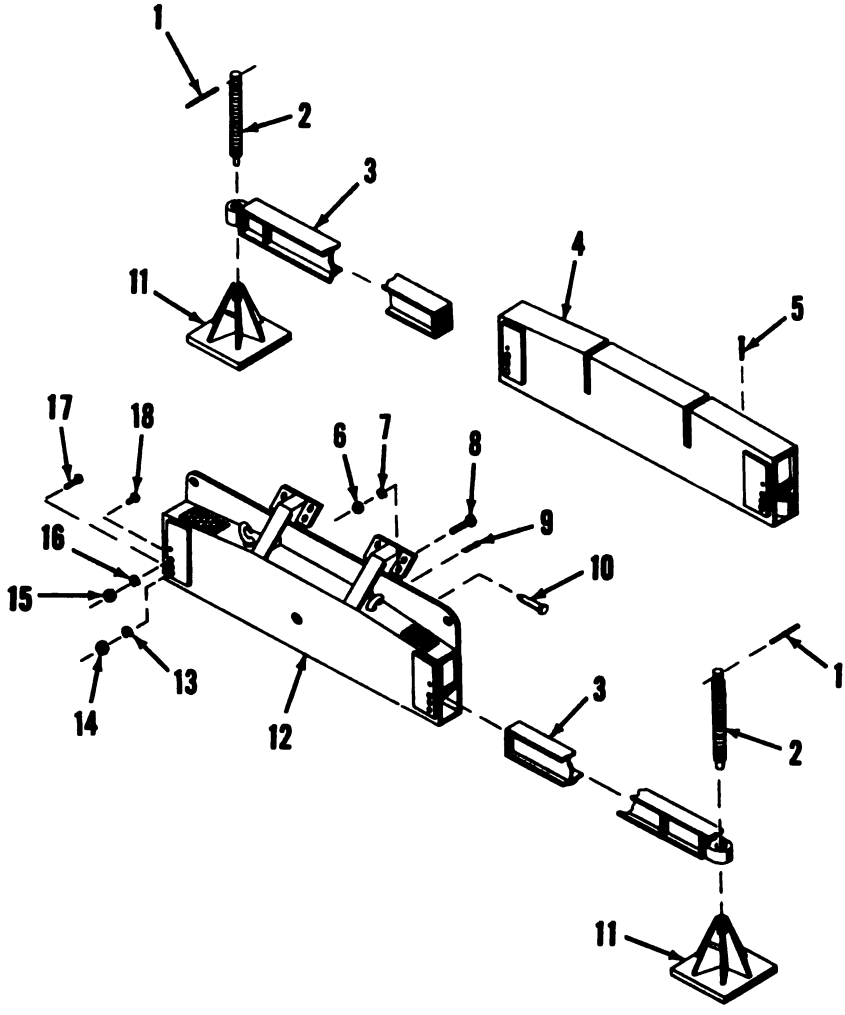
c. Reassembly and Installation.

(1) Position the ventilator plate (9) and hinges (8) on the deck plate (10) and secure with bolts (6), lockwashers (3), and nuts (7). Position the ventilator adjusting bar (5) on the ventilator plate and secure with bolts (6), lockwashers (3), and nuts (7).

(2) Position the deck plate (10) on the carrier frame and secure with carriage bolts (11), lockwashers (13), and nuts (12). Spotweld the side and rear of the deck plate to the carrier frame.

(3) Install that portion of the accelerator control that attaches to the deck plate. Install the footbrake valve (par. 296*c*), clutch pedal and lever arm (par. 210*b*(3)), and the headlight dimmer switch.

(4) Position the instrument panel (1) over the steering tube



1 Handle (4 rqr)
2 Jackscrews (4 rqr)
3 Beam (4 rqr)
4 Front outrigger
5 Float pin (4 rqr)
6 Nut, regular, hex, 1¼–12 NF (8 rqr)
7 Lockwasher, spring, std, 1¼ (8 rqr)
8 Bolt (8 rqr)
9 Pin, cotter, split, ⅜ x 4 (2 rqr)
10 Outrigger pin (2 rqr)
11 Support (4 rqr)
12 Rear outrigger
13 Lockwasher, spring, std, ¾ (8 rqr)
14 Nut, regular, hex, ¾–16 NF (8 rqr)
15 Nut, regular, hex, ⅝–11 NC (4 rqr)
16 Lockwasher, spring, std, ⅝ (4 rqr)
17 Screw, cap, hex hd, ¾–16 NF x 1½ (8 rqr)
18 Screw, cap, hex hd, ⅝–11 NC x 2¼ (4 rqr)

Figure 218. Outriggers, exploded view.

and on the deck plate and secure with screws (14), lockwashers (3), and nuts (4). Install the screw (2) and ventilator adjusting bar (5) and secure with the wingnut (15).

(5) Install the steering wheel (par. 403*b*). Install the horn button assembly (par. 403).

(6) Install the handbrake valve (par. 297*c*). Install the air compressor governor (par. 295*c*). Install all instruments and controls on the instrument panel.

(7) Install the operator's seat (par. 268*b*(4)).

(8) Install the cab left side (par. 267*a*).

283. Outriggers and Leveling Jacks
(fig. 218)

a. General. Outriggers are set up and retracted as instructed in paragraph 66*d* and *e*. The rear outrigger support (12) can be removed and installed as instructed in paragraph 66*f* and *g*. The front outrigger support (4) is welded to the carrier frame.

b. Removal of Outrigger Beams.

(1) Remove the nuts (14 and 15), lockwashers (13 and 16), and the screws (17 and 18).

(2) Remove the beams (3) from the front outrigger support (4) and the rear outrigger support (12).

c. Inspection and Repair. Wash all parts with an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the outrigger supports and beams for cracks and breaks. Weld cracks or breaks in the outrigger supports and beams.

(2) Inspect the jackscrews for damaged threads. Renew damaged threads in the jackscrews.

(3) Inspect all parts for good condition. Replace parts not in good condition.

d. Installation of Outrigger Beams.

(1) Position the beams (3) in the front outrigger support (4) and the rear outrigger support (12). Install the screws (17), lockwashers (13), and nuts (14).

(2) Push the beams all the way into the supports. Install the screws (18) in the side of the support and the beam and secure with lockwashers (16) and nuts (15).

284. Front Springs and Shock Absorbers

a. Shock Absorbers (fig. 213).

(1) *Removal.*

(*a*) Locate the carrier on level ground. Block the rear

wheels against both forward and backward movements. Pull the emergency brake lever back to its fully applied position.

(*b*) Remove the mounting nuts (7), lockwashers (6), and outer washers (4) from the stud of the upper bracket (3) and lower bracket (11).

(*c*) Remove the shock absorber (2). Remove the inner washers (4) from the bracket studs.

(2) *Installation.*

(*a*) Install inner washers (4) on the studs of the upper bracket (3) and the lower bracket (11). Install the shock absorber (2) on the brackets.

(*b*) Install the outer washers (4), lockwashers (6), and mounting nuts (7). Remove the blocking.

b. Front Springs (fig. 219).

(1) *Removal.*

(*a*) Remove the shock absorbers (*a*(1) above).

(*b*) Using two heavy-duty jacks, one on each side of the frame, raise the front of the carrier. Remove the cotter pins (8), nuts (9), and washers (10) from the front shackle bolts (18). Remove the shackle bolts from the frame.

(*c*) Remove the lower nuts (44), lockwashers (43), and screws (41) from the spring shackles (40). Remove the lower shackle pins (42).

(*d*) Remove the nuts (34) from the U-bolts (7). Raise the U-bolts from the U-bolt seats (13). Remove the seats and the lower brackets (14).

(*e*) Remove the spring assembly from the U-bolts and axle.

(2) *Disassembly.* Soak and wash the spring assembly in an approved cleaning solvent and blow dry with clean compressed air. Remove all sediment, scale, or rust from all parts, using a wire brush if necessary.

(*a*) Position the spring assembly in a hydraulic press providing space for removal of the nuts (15) and lockwashers (16).

(*b*) Apply pressure to the spring assembly and remove the nuts (39), lockwashers (38), spring clip bolts (24), spacers (37), and spring clips (23 and 30). Remove the nuts (15) and lockwashers (16).

(*c*) Slowly release the pressure. Remove the spring leaves.

(3) *Inspection and Repair.*

(*a*) Inspect the spring leaves for cracks, breaks, and cor-

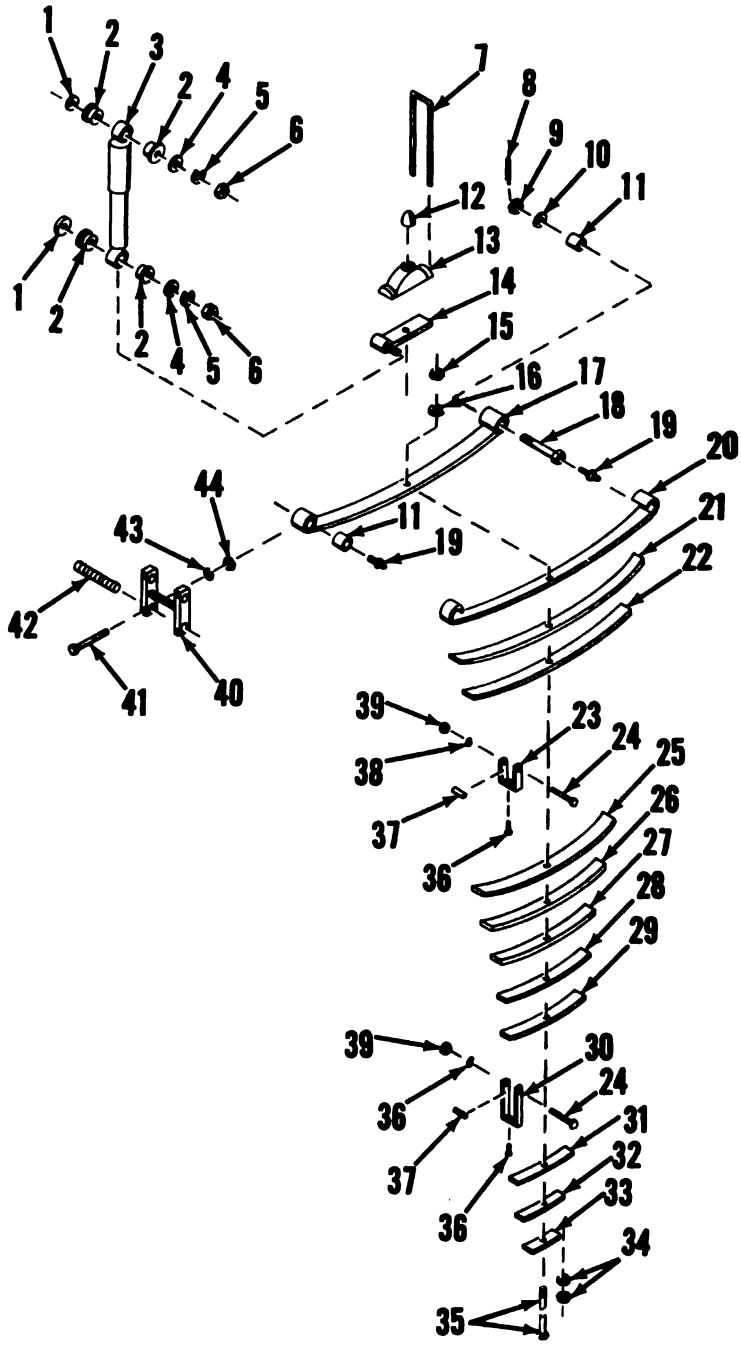


Figure 219. Front main spring and shock absorber, exploded view

rosion. Replace a spring leaf that is cracked, broken, or corroded.

(*b*) Inspect all parts for good condition. Replace parts not in good condition.

(4) *Reassembly.*

(*a*) Stack the spring leaves in proper sequence on the bolts (35). Apply pressure to the spring leaves until tight and install the lockwashers (16) and nuts (15) on the bolts (35).

(*b*) Install the spring clips (23 and 30), spacers (37), spring clip bolts (24), lockwashers (38), and nuts (39). Release the pressure from the spring assembly and remove from the press.

(5) *Installation.*

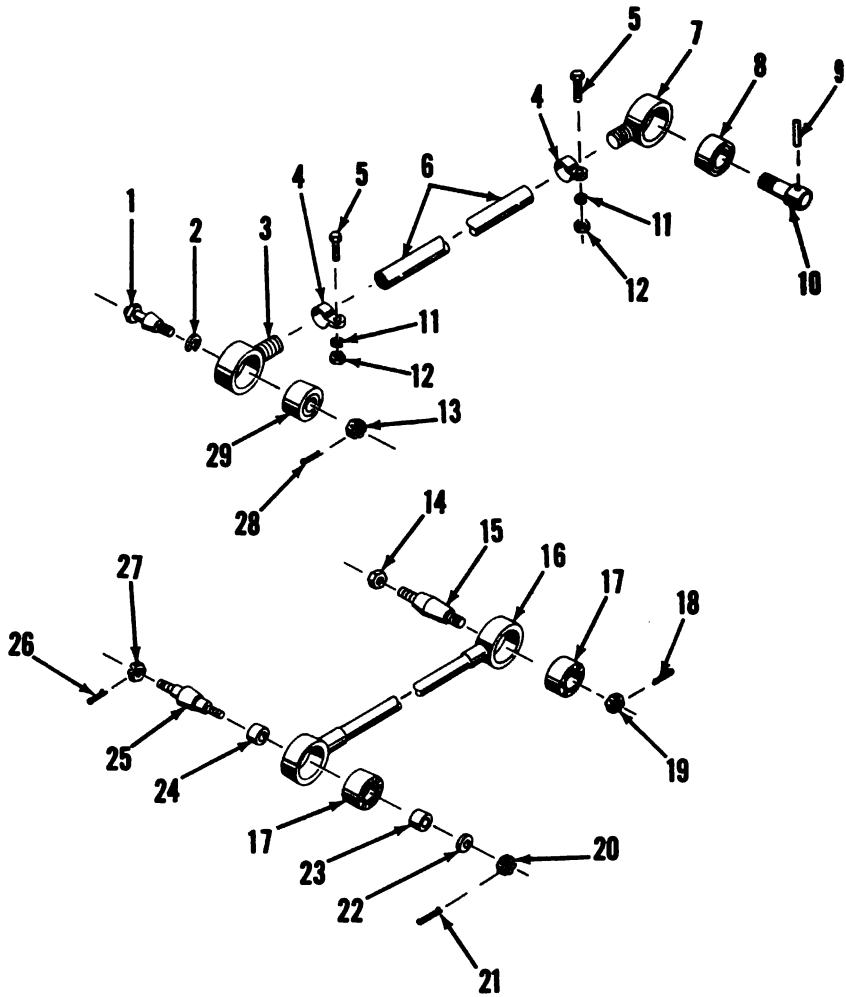
(*a*) Position the spring assembly under the U-bolts (7) and on the axle.

(*b*) Install the lower brackets (14) and U-bolt seats (13) under the U-bolts and on the spring assembly. Secure the U-bolts with nuts (34).

(*c*) Install the lower shackle pins (42). Install the screws (41) in the spring shackles (40) and secure with lockwashers (43) and nuts (44).

(*d*) Install the shackle bolts (18) and washers (10) and secure with nuts (9) and cotter pins (8). Lower the carrier to the ground. Remove the jacks.

1 Washer (2 rqr)
2 Rubber bushing (4 rqr)
3 Shock absorber (2 rqr)
4 Washer (2 rqr)
5 Lockwasher, spring, std, ⅝ (2 rqr)
6 Nut, regular, hex, ⅝–16 NF (2 rqr)
7 U-bolt (4 rqr)
8 Pin, cotter, split, 5/16 x 1½ (2 rqr)
9 Nut, castle, regular, 1–14 NF (2 rqr)
10 Washer, plain, steel, 1 (2 rqr)
11 Bushing (4 rqr)
12 Rubber bumper (2 rqr)
13 U-bolt seat (2 rqr)
14 Lower bracket (rh and lh rqr)
15 Nut (2 rqr)
16 Lockwasher (2 rqr)
17 Main spring first leaf (2 rqr)
18 Front shackle bolt (2 rqr)
19 Lubrication fitting, ⅛ straight (6 rqr)
20 Main spring second leaf (2 rqr)
21 Main spring third leaf (2 rqr)
22 Main spring fourth leaf (2 rqr)
23 Spring clip (4 rqr)
24 Spring clip bolt (8 rqr)
25 Main spring fifth leaf (2 rqr)
26 Main spring sixth leaf (2 rqr)
27 Main spring seventh leaf (2 rqr)
28 Main spring eighth leaf (2 rqr)
29 Main spring ninth leaf (2 rqr)
30 Spring clip (4 rqr)
31 Main spring tenth leaf (2 rqr)
32 Main spring eleventh leaf (2 rqr)
33 Main spring twelfth leaf (2 rqr)
34 Nut, regular, hex, 1–14 NF (16 rqr)
35 Bolt (2 rqr)
36 Rivet (8 rqr)
37 Spacer (8 rqr)
38 Lockwasher (8 rqr)
39 Nut (8 rqr)
40 Spring shackle (2 rqr)
41 Screw, cap, hex hd, ½–20 NF x 3¼ (8 rqr)
42 Shackle pin (4 rqr)
43 Lockwasher, spring, std, ½ (8 rqr)
44 Nut, regular, hex, ¼–20 NF (8 rqr)



1	Pin and nut assembly (4 rqr)	16	Lower rod assembly (4 rqr)
2	Lockwasher (4 rqr)	17	Ball bearing (8 rqr)
3	Rod end (4 rqr)	18	Cotter pin
4	Clamp (8 rqr)	19	Nut (4 rqr)
5	Clamp bolt (8 rqr)	20	Nut (4 rqr)
6	Upper rod assembly (4 rqr)	21	Cotter pin
7	Rod end (4 rqr)	22	Washer (4 rqr)
8	Ball bearing (4 rqr)	23	Dowel (4 rqr)
9	Key (4 rqr)	24	Dowel (4 rqr)
10	Pin (4 rqr)	25	Pin and nut assembly (4 rqr)
11	Lockwasher (8 rqr)	26	Cotter pin
12	Nut (8 rqr)	27	Nut (4 rqr)
13	Nut (4 rqr)	28	Cotter pin
14	Nut (4 rqr)	29	Ball bearing (4 rqr)
15	Pin and nut assembly (4 rqr)		

Figure 220. Torque rods, exploded view.

(*e*) Install the shock absorbers (*a*(2) above).

(*f*) Lubricate the shackle bolts and pins (LO 5–9513–3).

285. Torque Rods

(fig. 220)

a. General. Locate the carrier on level ground. Block the rear wheels against both forward and backward movement. Pull the emergency brake lever back to its fully applied position. Using two heavy-duty jacks, one on each side of the frame, raise the rear of the carrier until the weight is off the rear axles but with the rear wheels on the ground.

b. Upper Torque Rods.

(1) *Removal.*

(*a*) Remove the key (9) from the frame bracket and the pin (10).

(*b*) Screw a puller stud in the head of the pin (10) and tighten securely. Position a puller sleeve over the puller stud and install the puller nut. Tighten the puller nut and remove the pin. If the pin is not free when the nut bottoms on the puller stud threads, insert several washers under the puller nut and retighten.

(*c*) Remove the cotter pin (28) and nut (13) from the pin and nut assembly (1).

(*d*) Drive a steel wedge between the axle bracket and the rod end (3) and remove the rod end and pin from the bracket.

(*e*) Remove the upper torque rod from the carrier. Remove the pin and the lockwasher (2) from the rod end (3).

(2) *Installation.*

(*a*) Position the upper torque rod in the frame bracket and on the axle. Install the lockwasher (2) on the pin and nut assembly (1). Install the pin in the rod end (3) and in the axle bracket and secure with the nut (13) and cotter pin (28).

(*b*) Install the pin (10) in the frame bracket and rod end (7) with the serrated end toward the frame and the milled slot in the pin in line with the key hole in the bracket. Install the key (9) in the bracket and the pin (10).

c. Lower Torque Rods.

(1) *Removal.*

(*a*) Remove the cotter pins (21 and 26), the nuts (20 and 27), and washer (22) from the pin (25). Re-

install the nut (27), with a thick plain washer, on the pin. Insert a steel wedge between the rod (16) and the nut (27) side of the axle bracket. Tighten the nut (27) to remove the pin from the axle bracket. Remove the dowels (23 and 24) from the bracket.

(*b*) Remove the cotter pin (18) and nut (19). Drive a steel wedge between the rod (16) and the frame support and remove the rod from the pin (15).

(*c*) Loosen the nut (14) on the pin (15). Loosen the clamp bolt on the support bracket. Install a spacer and the nut (19) on the pin. Tighten the nut against the spacer and support bracket and remove the pin (15).

(2) *Installation.*

(*a*) Install the pin (15) in the front of the support bracket. Position the nut (14) between the bracket legs. Install the pin through the nut and into the rear of the support bracket. Tighten the nut (14) on the pin and against the support bracket. Tighten the clamp bolt on the support bracket. Install the rod (16) on the pin and secure with the nut (19) and cotter pin (18).

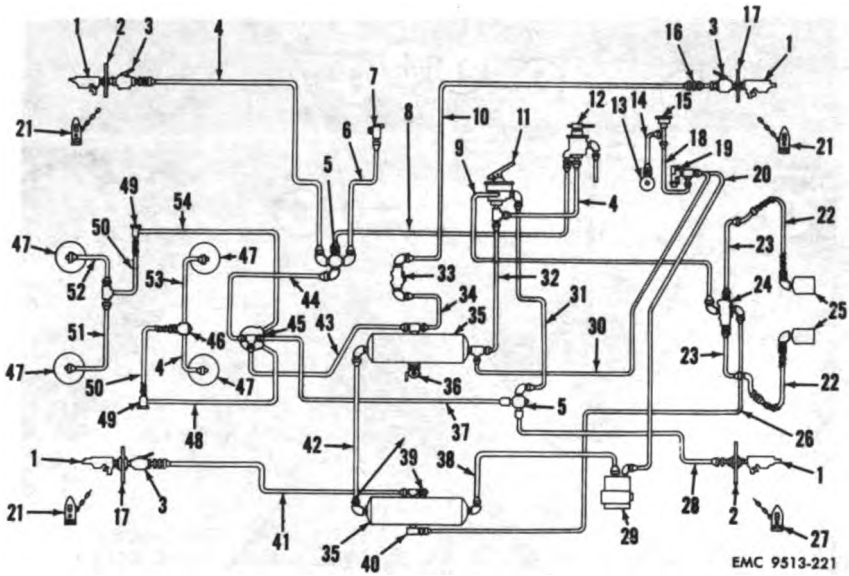
(*b*) Install the dowel (23) in the axle bracket. Position the dowel (24) on the pin (25). Position the rod (16) in the axle bracket. Install the pin (25) in the axle bracket and rod. Install the washer (22), nut (20), and cotter pin (21). Install the nut (27) and cotter pin (26).

Section XXIV. AIRBRAKE SYSTEM

286. Description

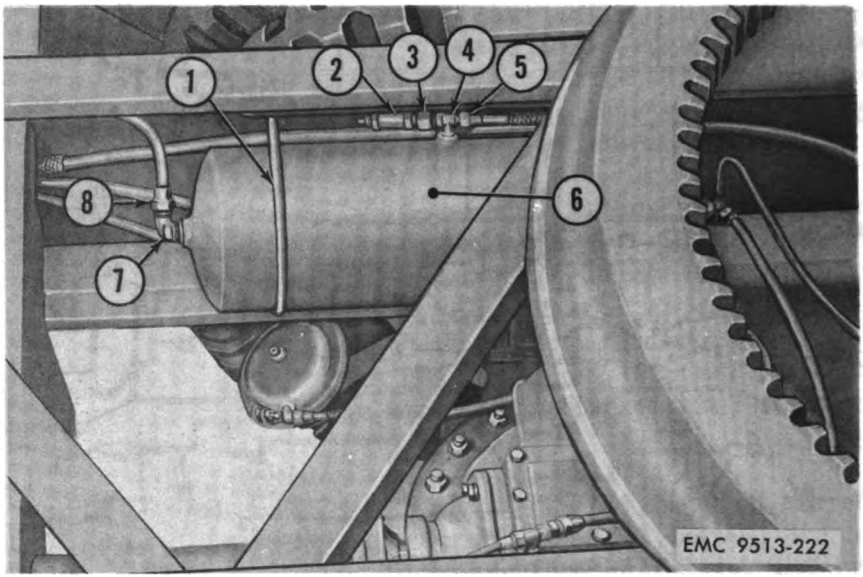
(fig. 221)

The carrier is equipped with air-operated internal expanding brake assemblies on all six wheels. Hose coupling assemblies (1) for trailer connections are provided at both the front and rear of the carrier for towing purposes. The airbrake system is divided into two general groups: the air compressor (29), air compressor governor (19), footbrake valve (11), handbrake valve (12), compression tanks (35), safety valve (39), relay valve (45), check valves (5) and (16), cylinder assemblies (25 and 47), the connecting tubing, valves, and hoses; and the mechanical portions which include the brakeshoes, drums, cams, camshafts, and slack adjusters.



1 Hose coupling assembly (4 rqr)
2 Service line tag (2 rqr)
3 Cutout valve (3 rqr)
4 Tubing, copper, ⅜ OD x 3 ft (3 rqr)
5 Doublecheck valve assembly (2 rqr)
6 Tubing, copper, ⅜ OD (as rqr)
7 Stoplight switch
8 Tubing, copper, ⅜ OD x 18 ft–9½ in.
9 Tubing, copper, ⅜ OD x 3 ft–4 in.
10 Tubing, copper, ⅜ OD x 8 ft–6 in.
11 Footbrake valve assembly
12 Handbrake valve assembly
13 Low pressure indicator
14 Tubing, copper, ⅜ OD x 1 ft–7 in.
15 Air pressure gage
16 Single check valve
17 Emergency line tag
18 Tubing, copper, ⅜ OD x 1 ft–6 in.
19 Air compressor governor
20 Tubing, copper, ⅜ OD x 5 ft
21 Dummy coupling (3 rqr)
22 Hose assembly (2 rqr)
23 Tubing, copper, ⅜ OD x 4 ft–2 in. (2 rqr)
24 Quick release valve assembly
25 Cylinder assembly (2 rqr)
26 Tubing, copper, ⅜ OD x 14 ft
27 Dummy coupling
28 Tubing, copper, ⅜ OD x 2 ft–8 in.
29 Air compressor assembly
30 Tubing, copper, ⅜ OD x 15 ft–9 in.
31 Tubing, copper, ⅝ OD x 4 ft–6¼ in.
32 Tubing, copper, ⅝ OD x 14 ft–10 in.
33 Air supply valve assembly
34 Tubing, copper, ⅜ OD x 6 ft–11 in.
35 Compression tank (2 rqr)
36 Draincock
37 Tubing, copper, ⅝ OD x 15 ft–9 in.
38 Tubing, copper, ⅝ OD x 16 ft
39 Safety valve assembly
40 Condensate valve
41 Tubing, copper, ⅜ OD x 4 ft–9 in.
42 Tubing, copper, ⅝ OD x 2 ft–1 in.
43 Tubing, copper, ½ OD x 2 ft–4 in.
44 Tubing, copper, ⅝ OD x 1 ft–7¼ in.
45 Relay valve
46 Anchor tee (2 rqr)
47 Cylinder assembly (4 rqr)
48 Tubing, copper, ½ OD x 1 ft–7¼ in.
49 Anchor elbow (2 rqr)
50 Hose assembly (2 rqr)
51 Tubing, copper, ⅜ OD x 2 ft–4 in.
52 Tubing, copper, ⅜ OD x 2 ft–5 in.
53 Tubing, copper, ⅜ OD x 2 ft–10½ in.
54 Tubing, copper, ½ OD x 5 ft–5½ in.

Figure 221. Airbrake system piping diagram.



1 U-bolt
2 Safety valve
3 Adapter
4 Tee
5 Tubing nut
6 Compression tank
7 Tubing elbow
8 Tubing nut

Figure 222. Compression tank and safety valve, installed.

287. Compression Tanks
(fig. 222)

a. General. Compression tanks (6) are cylindrical in shape and are made of sheet steel with electrically welded seams. The heads or ends are steel stampings and are securely held in place by the sides being spun over the ends before the end seams are welded. Pipe tapped ferrules are used at the openings and are welded in place. Compression tanks provide a place to store compressed air so there will always be an ample supply available for immediate use in brake operation. It also provides storage for sufficient compressed air to permit several brake applications even after the air compressor has stopped. Compression tanks also provide a place where the air, heated during compression, may cool and the oil and water vapors condense. The condensate as well as the airbrake system is drained by opening a draincock located in the bottom of the tank.

b. Removal and Disassembly.

(1) Stop the carrier engine (par. 65).

(2) Drain the airbrake system by opening the draincocks in the bottom of the compression tanks.

(3) Remove the tubing nuts (8) from the tubing elbows (7) or tee at each end of the compression tanks (6).

(4) Remove the tubing nut (5) from the tee (4).
(5) Support the tank and remove nuts, lockwashers, and U-bolts (1) from the carrier frame and tank. Remove the tank.
(6) Remove the tee (4) with safety valve (2), and tubing elbows (7) or tee from the tanks.

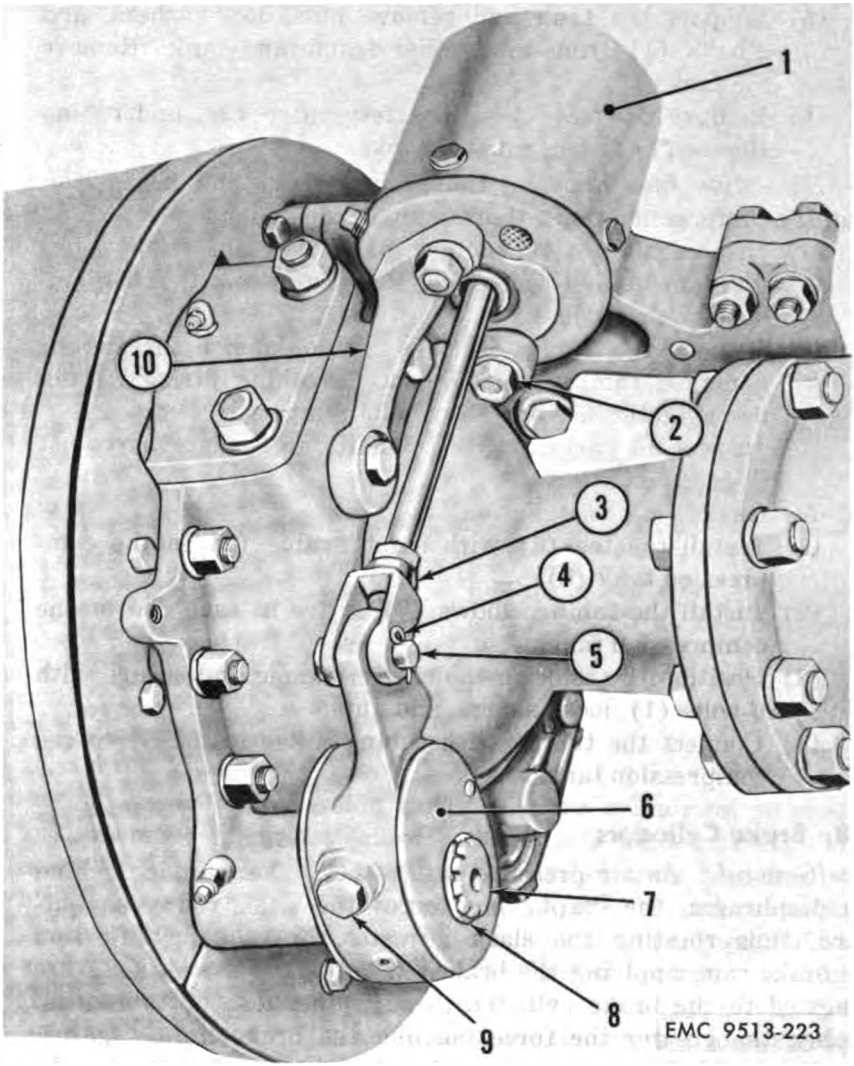
c. Inspection and Repair. Using live steam and hot water, clean the compression tanks thoroughly inside and out.
(1) Inspect the outer surface of the compression tanks for damage and corrosion. Replace a tank that is damaged or corroded.
(2) Inspect the tubing fittings for damaged threads or damaged tubing seat. Replace a tubing fitting having damaged threads or a damaged tubing seat.
(3) Inspect all parts for good condition. Replace parts not in good condition.

d. Reassembly and Installation.
(1) Install the tee (4) with safety valve (2) in the compression tank (6).
(2) Install the tubing elbows (7) or tee in each end of the compression tank.
(3) Position the tank on the carrier frame and secure with U-bolts (1), lockwashers, and nuts.
(4) Connect the tubing with tubing nuts (8 and 5) to the compression tanks.

288. Brake Cylinders

a. General. As air pressure enters the brake cylinder behind the diaphragm, the diaphragm forces the push rod yoke outward, thus rotating the slack adjuster, brake camshaft, and the brake cam, applying the brakes. The higher the air pressure admitted to the brake cylinder through the hose or tubing assembly, the greater the force pushing the brake lining against the drum and the greater the retarding force. Conversely, the lower the air pressure, the lesser the retarding force. If all air pressure is released from the brake cylinder, the brakeshoe return springs and the brake cylinder release springs return the brakeshoes, brake cam, slack adjuster, brake cylinder push rod, and diaphragm to released position, releasing the brakes.

b. Front Brake Cylinders (fig. 223).
(1) *Removal.*
(*a*) Stop the carrier engine and open the draincocks in the compression tanks.
(*b*) Disconnect the hose assembly from the top of the brake cylinder (1).



1	Cylinder	6	Slack adjuster
2	Mounting stud nut	7	Camshaft
3	Yoke	8	Retaining ring
4	Cotter pin	9	Adjusting screw
5	Yoke pin	10	Cylinder bracket

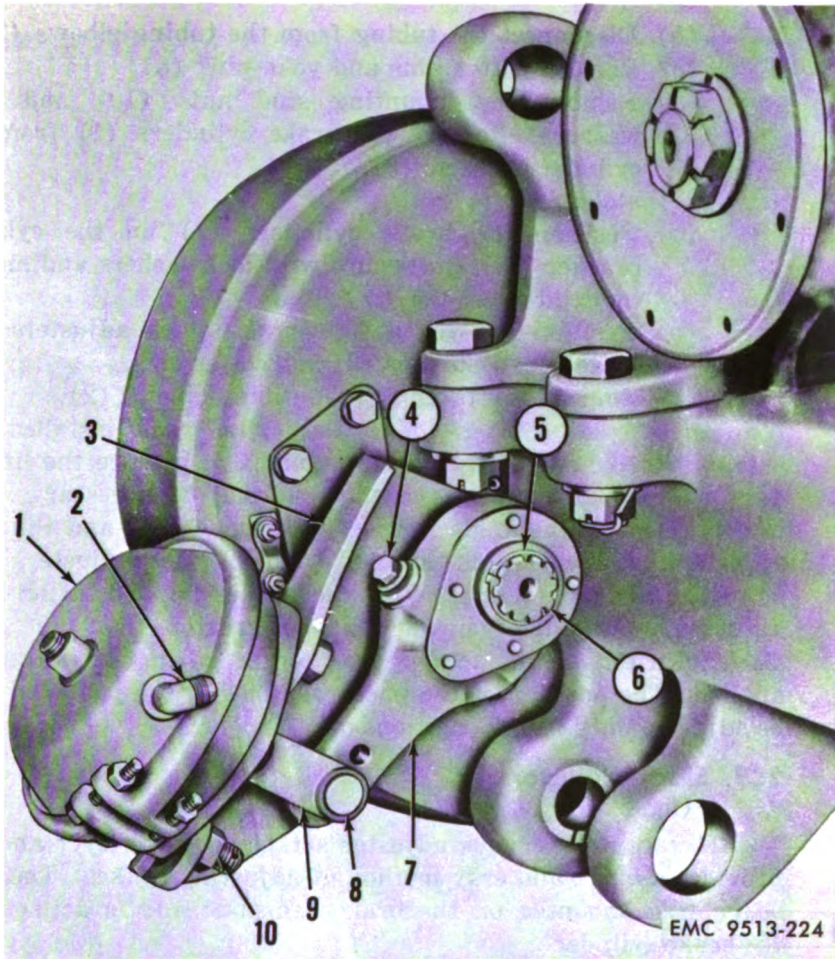
Figure 223. Front brake cylinder and slack adjuster, installed.

(*c*) Remove the cotter pins (4) and yoke pin (5).

(*d*) Remove the mounting stud nuts (2) and lockwashers. Remove the brake cylinders from the cylinder brackets (10).

(2) *Installation.*

(*a*) Position the brake cylinders (1) on the cylinder



1	Cylinder	6	Camshaft
2	Tubing elbow	7	Slack adjuster
3	Cylinder bracket	8	Yoke pin
4	Adjusting screw	9	Yoke
5	Retaining ring	10	Mounting stud nut

Figure 224. Rear brake cylinder and slack adjuster, installed.

brackets (10) and secure with lockwashers and mounting stud nuts (2).

(*b*) Position the yoke (3) on the slack adjuster (6). Install the yoke pin (5) and cotter pin (4).

(*c*) Connect the hose assembly to the top of the brake cylinder.

c. Rear Brake Cylinders (fig. 224).

(1) *Removal.*

(*a*) Stop the carrier engine and open the draincocks in the compression tanks.

(*b*) Disconnect the tubing from the tubing elbows (2).
(*c*) Remove cotter pins and yoke pins (8).
(*d*) Remove the mounting stud nuts (10) and lockwashers. Remove the brake cylinders (1) from the cylinder brackets (3).

(2) *Installation.*
(*a*) Position the brake cylinders (1) on the cylinder brackets (3) and secure with lockwashers and mounting stud nuts (10).
(*b*) Position the yokes (9) on the slack adjusters (7). Install the yoke pins (8) and cotter pins.
(*c*) Connect the tubing to the tubing elbows (2).

d. Adjustment. After the brake cylinder is installed, the brakes must be adjusted and checks made to be sure the linkage does not bind. Adjustment of the yoke may be necessary. With brakes released, the angle formed by the push rod and the slack adjuster must be greater than 90°, and all slack adjusters must be set at the same angle. With the brakes applied, after being adjusted, this angle should still be greater than 90°. The slack adjuster should not go over center when the brakes are applied. The position of the push rod yoke on the push rod must be adjusted until these conditions prevail.

289. Slack Adjusters
(fig. 223)

a. General. The slack adjuster acts as a brake lever and also provides a quick and easy method of adjusting brakes. The slack adjuster is mounted on the brake camshaft and is actuated by the brake cylinder.

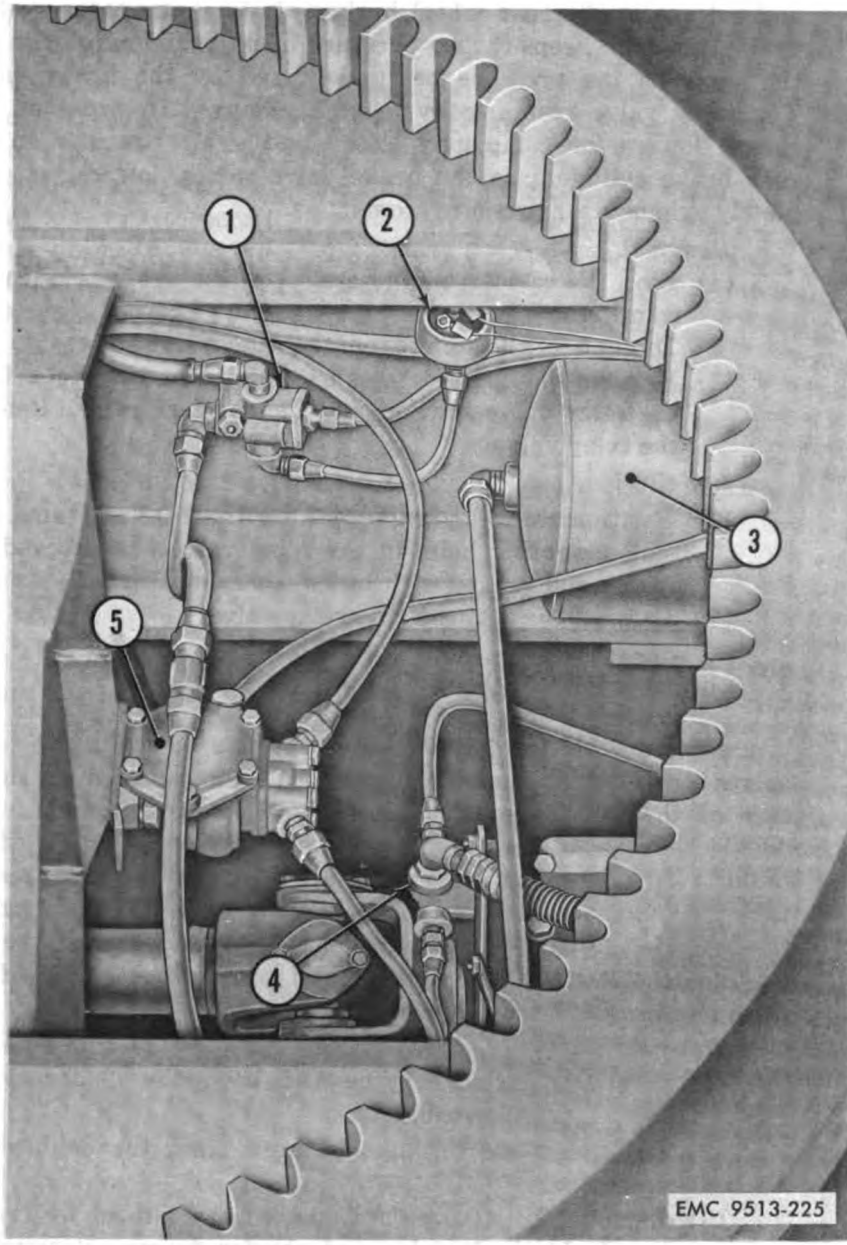
b. Removal.
(1) Stop the carrier engine and open the draincocks in the compression tanks.
(2) Remove the cotter pins (4) and yoke pins (5).
(3) Remove the retaining rings (8).
(4) Remove the slack adjusters (6) from the camshafts (7).

c. Installation.
(1) Install the slack adjusters (6) on the camshafts (7).
(2) Install the retaining rings (8).
(3) Position the yokes (3) on the slack adjusters and secure with yoke pins and cotter pins.

d. Adjustment. Adjust the slack adjusters in conjunction with the brake cylinders (par. 288*d*).

290. Relay Valve
(fig. 225)

a. General. The relay valve (5) speeds up the application



1 Doublecheck valve
2 Stoplight switch
3 Compression tank
4 Anchor tee
5 Relay valve

Figure 225. Relay valve, doublecheck valve, and stoplight switch, installed.

and release of the rear wheel brakes. It is controlled by either brake valve and keeps the air pressure in the rear brake cylinders the same as the pressure being delivered by the brake valve. The relay valve reacts to even slight changes in pressure and raises, lowers, or completely exhausts the air pressure in the rear brake cylinders as the brake valve raises, lowers, or completely exhausts air pressure from it.

b. Removal.

(1) Stop the carrier engine and open the draincocks in the compression tanks.

(2) Disconnect all tubing from the relay valve (5).

(3) Remove the nuts, lockwashers, and mounting bolts from the relay valve bracket and the carrier frame. Remove the relay valve.

c. Installation.

(1) Position the relay valve (5) on the carrier frame. Install mounting bolts in the relay valve bracket and the frame and secure with lockwashers and nuts.

(2) Connect the tubing to the relay valve.

291. Doublecheck Valves
(fig. 225)

a. General. A doublecheck valve (1) is used when two brake valves are used to control brakes of a vehicle, such as in the case of the independent trailer brake control equipment. If a doublecheck valve were not used in such cases and either of the brake valves were moved to the applied position, compression tank pressure would escape through the open exhaust port of the other brake valve. The doublecheck valve blanks off the line leading to the other brake valve and prevents any loss of air through the other brake valve.

b. Removal.

(1) Stop the carrier engine and open the draincocks in the compression tanks.

(2) Disconnect all tubing and hose from the doublecheck valve (1).

(3) Remove the nut, lockwasher, and mounting bolt from the doublecheck valve and carrier frame. Remove the doublecheck valve.

c. Installation.

(1) Position the doublecheck valve (1) on the carrier frame. Install the mounting bolt in the doublecheck valve and frame and secure with a lockwasher and nut.

(2) Connect the hose and tubing to the doublecheck valve.

292. Quick Release Valve
(fig. 226)

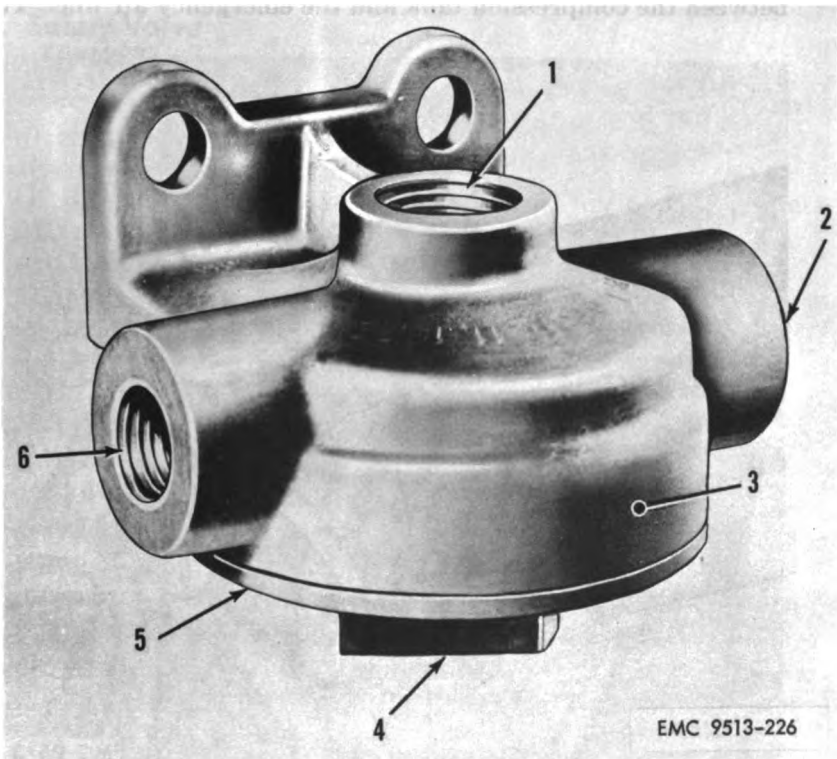
a. General. The quick release valve reduces the time required to release the front brakes by hastening the exhaust of air pressure from the front brake cylinders. The quick release valve consists of a body (3) containing a spring-loaded diaphragm so arranged as to permit air pressure to flow through the valve in one direction but when the supply pressure is reduced, the air which has passed through the valve is permitted to escape through the exhaust port (4).

b. Removal.

(1) Disconnect the brake valve air line at the port (1). Disconnect the brake cylinder air lines at the ports (2 and 6).

(2) Remove the nuts, lockwashers, and mounting bolts. Remove the quick release valve.

c. Installation.



1 Brake valve port
2 Brake cylinder port
3 Body
4 Exhaust port
5 Cover
6 Brake cylinder port

Figure 226. Quick release valve.

(1) Position the quick release valve and install the mounting bolts, lockwashers, and nuts.

(2) Connect the brake cylinder air lines to the ports (2 and 6). Connect the brake valve air line to the port (1).

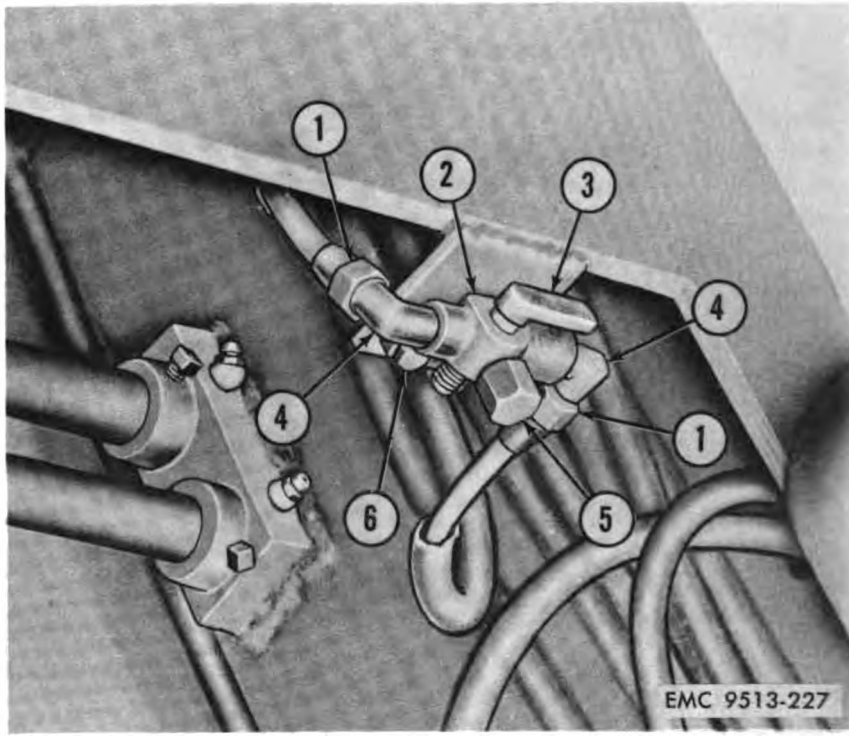
d. Operating Test.

(1) Apply the brakes and observe that when the brakes are released, air pressure is quickly exhausted through the exhaust port of the valve. Be sure the exhaust port is not restricted in any way.

(2) With the brakes applied, coat the exhaust port with soap suds to detect leakage. Leakage in excess of a 1-inch soap bubble in one second is not permissible and the valve must be replaced.

293. Air Supply Valve
(fig. 227)

a. General. The air supply valve (2) is installed in the line between the compression tank and the emergency air line. Tubing



1 Tubing nuts
2 Air supply valve
3 Handle
4 Tubing elbows
5 Air supply connection cap
6 Mounting bolt

Figure 227. Air supply valve, installed.

or hose can be connected to the valve under the cap (5) for a supply of compressed air for use such as tire inflation. The handle (3), when set at right-angle to the valve body, supplies the air.

b. Removal.

(1) Stop the carrier engine and open the draincocks in the compression tanks.

(2) Remove the tubing nuts (1) from the tubing elbows (4).

(3) Remove the nuts, lockwashers, and mounting bolts (6). Remove the air supply valve (2).

c. Installation.

(1) Position the air supply valve (2) on the carrier frame. Install the mounting bolts (6) and secure with lockwashers and nuts.

(2) Install the tubing nuts (1) on the tubing elbows (4).

(3) Make sure the handle (3) is in line with the valve body. Make sure the air supply connection cap (5) is secure on the valve body.

294. Safety Valve
(fig. 222)

a. General. The safety valve protects the airbrake system against air pressure in excess of 150 psi.

b. Removal.

(1) Stop the carrier engine and open the draincocks in the compression tanks.

(2) Remove the safety valve (2) from the adapter (3).

c. Installation.

(1) Install the safety valve (2) in the adapter (3).

(2) Close the draincocks in the compression tanks.

295. Air Compressor Governor
(fig. 228)

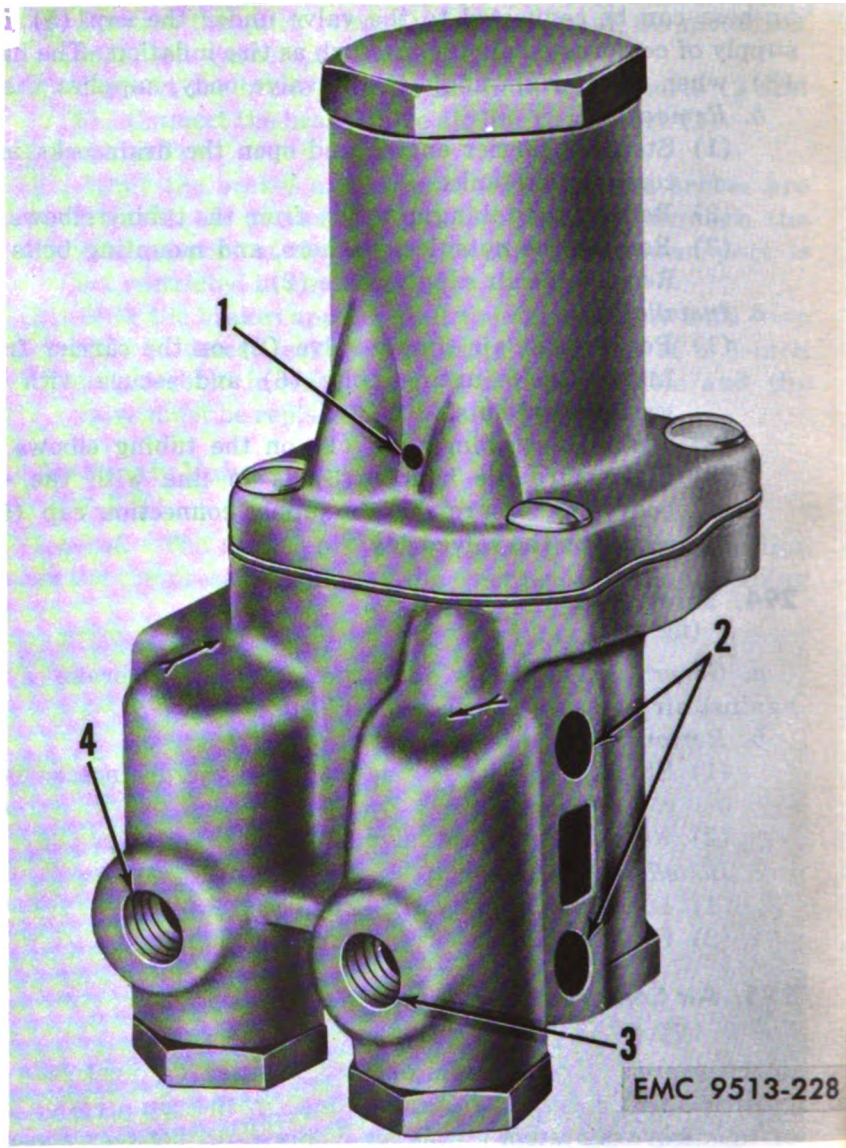
a. General. The air compressor governor automatically controls the air pressure being maintained in the compression tanks of the airbrake system by the air compressor, between the maximum pressure desired (100–105 psi) and the minimum pressure required for safe brake operation (80–85 psi).

b. Removal.

(1) Stop the carrier engine and open the draincocks in the compression tanks.

(2) Remove all tubing and fittings from the governor ports (3 and 4).

(3) Remove the nuts, lockwashers, and mounting bolts from the governor mounting holes (2) and the steering tube. Remove the governor.



1 Exhaust vent
2 Mounting holes
3 Port to unloading mechanism
4 Port to compression tank

Figure 228. Air compressor governor.

c. Installation.

(1) Position the governor on the steering tube. Install the mounting bolts in the governor mounting holes (2) and the steering tube and secure with lockwashers and nuts.

(2) Install the tubing and fittings in the governor ports (3 and 4).

d. Operating Test.

(1) With the carrier engine running, build up air pressure in the airbrake system and observe at what pressure, registered by the air pressure gage, the governor cuts out, stopping further compression. The governor must cut out between 100 and 105 psi.

(2) With the carrier engine running, slowly reduce the air pressure in the airbrake system by applying and releasing the brakes and observe at what pressure, registered by the air pressure gage, the governor cuts in and compression is resumed. The governor must cut in between 80 and 85 psi.

(3) Replace a governor that does not perform as in (1) and (2) above.

296. Footbrake Valve

(fig. 229)

a. General. Movement of the footbrake valve treadle controls the movement of an inlet valve and exhaust valve in the valve body which, in turn, control the air pressure being delivered to or released from the brake cylinders on the carrier. To fully apply the brakes, the treadle must be fully depressed, whereas, when the treadle is only partially depressed, correspondingly less braking force is developed. The farther the driver depresses the treadle, the greater the air pressure delivered to the brake cylinders and the more effective the brake application. At any time the brakes of the carrier may be partially released by the driver permitting the treadle to partially return towards released position or they may be entirely released by permitting the treadle to return to full released position. In this manner the amount of force being applied to the brakes of the carrier is always under control of the driver.

b. Removal.

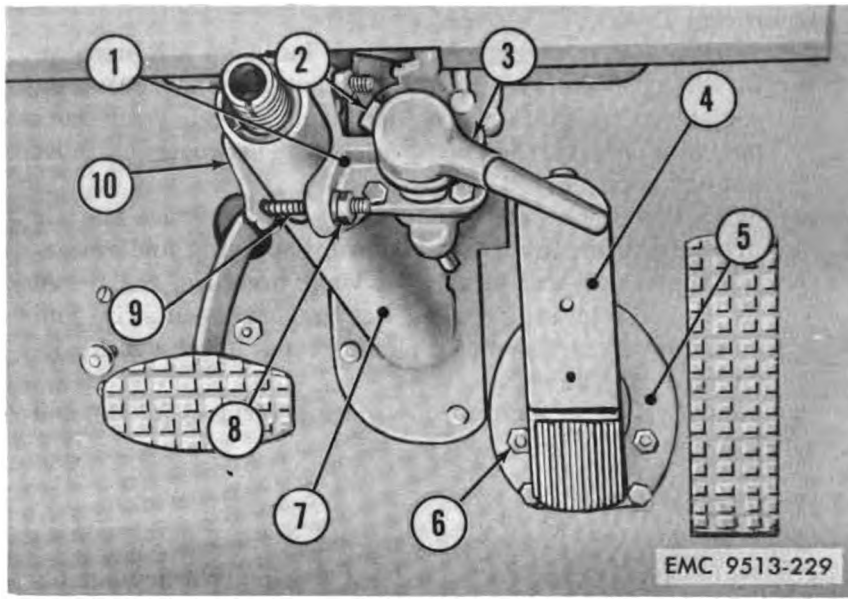
(1) Stop the carrier engine and open the draincocks in the compression tanks.

(2) Disconnect all air lines at the footbrake valve assembly (4) under the carrier deck plate.

(3) Remove the mounting nuts (6), lockwashers, and bolts from the mounting plate (5). Life the footbrake valve assembly (4) from the deck plate.

c. Installation.

(1) Position the footbrake valve assembly (4) in the deck plate. Install the mounting bolts in the deck plate and the mounting plate (5) and secure with lockwashers and mounting nuts (6).



1	Handbrake valve assembly	6	Mounting nut
2	Setscrew boss	7	Steering tube
3	Handle	8	Nut
4	Footbrake valve assembly	9	Bolt
5	Mounting plate	10	Clamp

Figure 229. Handbrake valve assembly and footbrake valve assembly, installed.

(2) Connect the air lines to the footbrake assembly (4) under the deck plate.

297. Handbrake Valve
(fig. 229)

a. General. The handbrake valve assembly (1) is used for controlling the brakes on a trailer independently of the brakes on the carrier. The driver may put the handle (3) in any one of several positions between brakes released and brakes fully applied position so the brakes on the trailer are kept applied until the brake valve handle is returned to released position. The distance the handle is moved in a clockwise direction toward applied position determines the severity of the brake application. If desired, when a trailer is not being towed, the handle (3) may be lifted from the handbrake valve assembly (1) by removing the setscrew located in the setscrew boss (2).

b. Removal.

(1) Stop the carrier engine and open the draincocks in the compression tanks.

(2) Disconnect the air lines at the valve assembly.

(3) Remove the nuts (8), lockwashers, bolts (9), clamp (10), and the valve assembly (1) from the steering tube (7).

c. Installation.

(1) Position the handbrake valve assembly (1) and the clamp (10) on the steering tube (7). Install the bolts (9) and secure with lockwashers and nuts (8).

(2) Connect the air lines to the valve assembly.

298. Hose Couplings
(fig. 230)

a. General.

(1) Hose couplings are used to connect and disconnect air lines between carriers and trailers. The design of the hose coupling is such that, when two of them are coupled together, pressure is put on two rubber gaskets making an airtight seal and, at the same time, providing a joint which can be easily connected or disconnected by hand.

(2) Dummy couplings are attached to the carrier frame with chain and are installed in the hose couplings when the airbrake lines are not being used.

b. Removal.

(1) Put the cutout valve handle in the off position.

(2) Remove the dummy coupling from the hose coupling.

(3) Using a wrench on the hex portion of the coupling body (1), remove the coupling.

c. Disassembly.

(1) Using a screwdriver, pry the packing ring (6) from the body (1).

(2) Remove the spring plug (5), compression spring (4), and plunger (3).

(3) Remove the nipple (2) if installed.

d. Inspection and Repair. Soak and wash all metal parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

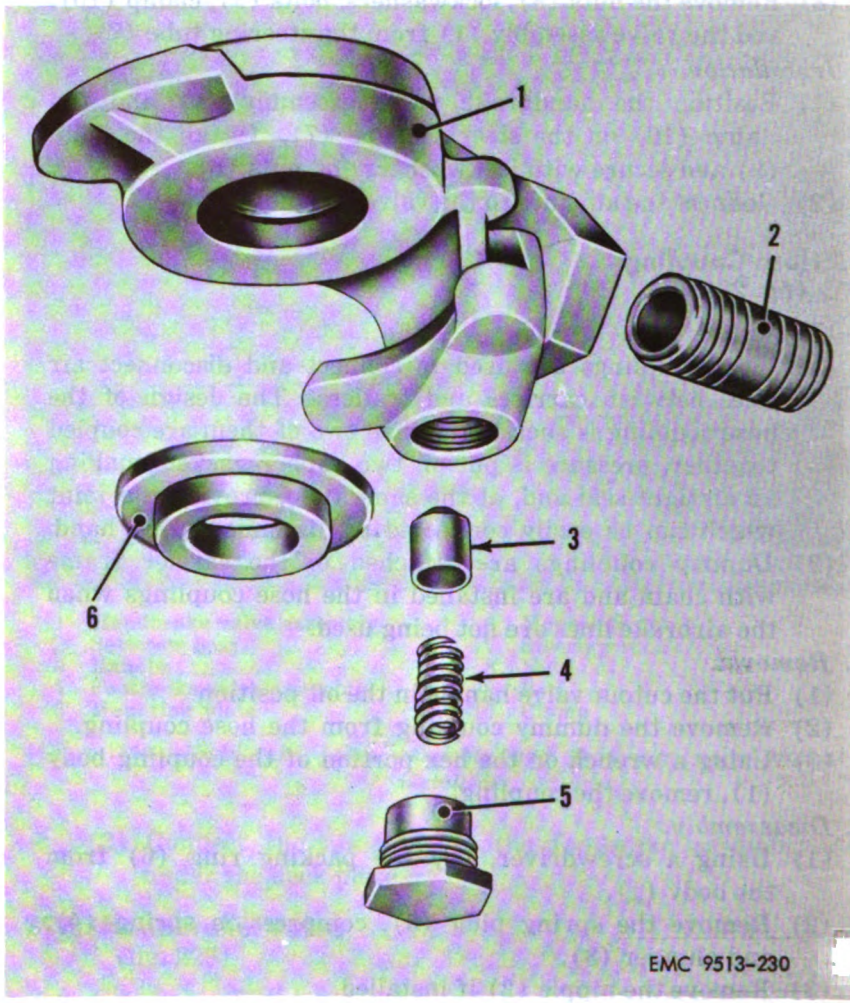
(1) Inspect the packing ring for cuts and signs of deterioration. Replace a ring that is cut or shows signs of deterioration.

(2) Inspect all parts for good condition. Replace parts not in good condition.

e. Reassembly.

(1) Install the plunger (3), compression spring (4), and spring plug (5) in the body (1).

(2) Partially collapse the packing ring (6) with the fingers and enter one side of the ring flange in the groove of the



1	Bodies (4 rqr)	4	Compression springs (4 rqr)
2	Nipple (as rqr)	5	Spring plugs (4 rqr)
3	Plungers (4 rqr)	6	Packing rings (4 rqr)

Figure 230. Hose coupling, exploded view.

body (1). Use a blunt-nose screwdriver or similar instrument to complete pushing the ring in place. When properly installed, the exposed face of the packing ring must be flat and not twisted or bulged at any point.

(3) Install the nipple (2) if required.

f. Installation.

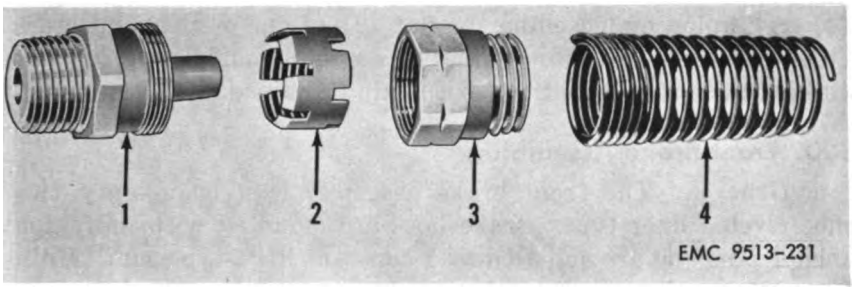
(1) Install the hose coupling in the air line of the carrier, using a wrench on the hex portion of the body to tighten.

(2) Install the dummy coupling in the hose coupling.

299. Hose Assemblies
(fig. 231)

a. General. Hose assemblies are used as the air lines from the carrier frame mountings to the front brake cylinders and the connecting tees to the rear brake cylinders. Except for the hose itself, all items of the hose assembly are identical. The hose varies only in length.

b. Removal. When removing a hose, where both ends are permanently connected, use one of the hose connectors (1) as a union by loosening the nut (3) of one of the connectors. Turn



1 Connectors (8 rqr)
2 Sleeves (8 rqr)
3 Nuts (8 rqr)
4 Compression springs (8 rqr)

Figure 231. Hose connection assembly, exploded view.

the hose by hand in the loose connector while disconnecting the other end of the hose assembly.

c. Disassembly. Remove the nut (3) from the connector (1) and pull the hose out of the connector. Do not remove the sleeve (2) from the hose. If a new piece of hose is to be installed, use a new sleeve. Remove the spring (4).

d. Inspection and Repair. Soak and wash all metal parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the hose for abrasions, wear, swelling, or kinking. Replace a damaged hose.
(2) Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace parts having damaged, corroded, or stripped threads.
(3) Inspect all parts for good condition. Replace parts not in good condition.

e. Reassembly.

(1) Slide the spring (4) on the hose. Position the nut (3) and a new sleeve (2) on the hose, being sure the barbs

on the inside of the sleeve point toward the end of the hose.

(2) Insert the end of the hose in the connector (1), making sure the end of the hose is against the bottom of the recess in the connector.

(3) Move the sleeve, if necessary, until it is against the edge of the connector. Then tighten the nut (3). It is only necessary to tighten the nut sufficiently to insure a good airtight joint.

(4) Position the end of the spring (4) on the nut.

f. Installation. When installing a hose assembly, where both ends are permanently connected, use one of the hose connectors (1) as a union by loosening the nut (3) of one of the connectors. Turn the hose in the loose connector assembly sufficiently to avoid kinking the hose before the nut is again tightened.

300. Front Brake Assemblies

a. General. The front brake assembly is a heavy-duty two-shoe riveted liner type. Brakeshoes are mounted with individual anchor pins and are actuated by a constant lift S-type cam. Maintenance procedures in this paragraph cover one front brake assembly only but are applicable to both front brake assemblies.

b. Removal and Disassembly.

(1) Remove the front axle bearings and hub (par. 304*a*).

(2) Remove the extension springs (1, fig. 232).

(3) Remove the cotter pin, castle nut (5), and anchor pin link (4).

(4) Slide the breakshoe assemblies (2) off the anchor pins (3).

(5) Remove the nuts (16, fig. 233) and lockwashers (15). Remove the anchor pins (4).

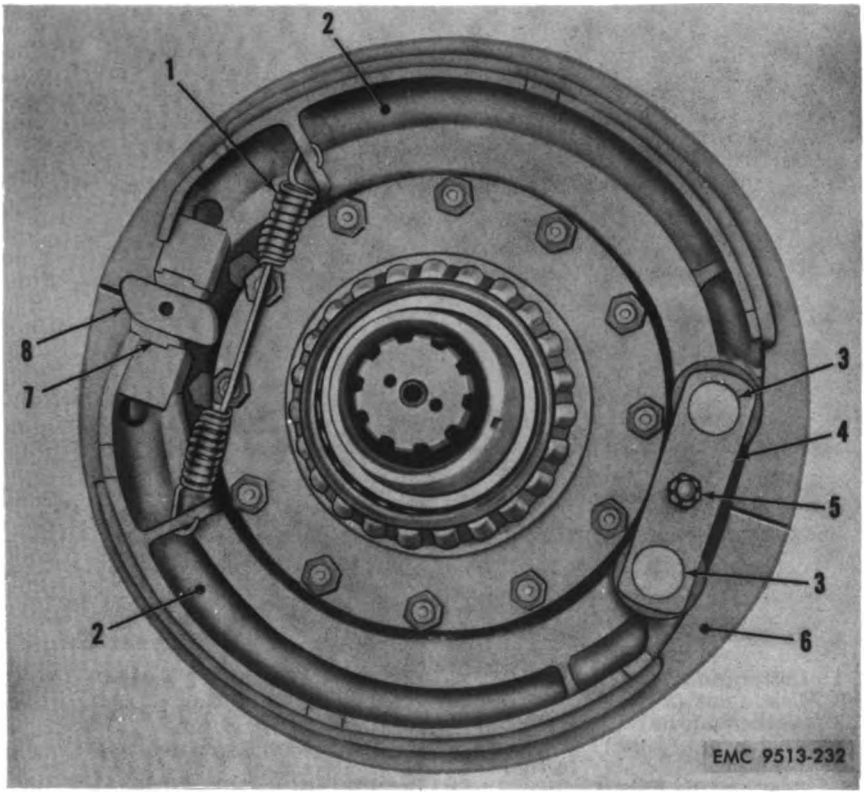
(6) Remove the slack adjuster (par. 289*b*). Remove the camshaft (12).

c. Inspection and Repair. Soak and wash all metal parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the brake lining for wear. If brake lining is worn down to the rivet heads, replace the brakeshoe assembly.

(2) Inspect the brakeshoe for cracks or breaks. Replace the brakeshoe assembly if the shoe is cracked or broken.

(3) Inspect the camshaft for worn, chipped, scored, or twisted splines. Replace a camshaft that has worn, chipped, scored, or twisted splines.



1	Extension spring	5	Castle nut
2	Brakeshoe assemblies	6	Dust shield
3	Anchor pins	7	Wear plate
4	Anchor pin link	8	Camshaft

Figure 232. Front brakeshoes, installed.

(4) Inspect all parts for good condition. Replace parts not in good condition.

d. Reassembly and Installation.

(1) Install the camshaft (12, fig. 233). Install the slack adjuster (par. 289*c*).

(2) Install the anchor pins (4) and secure with lockwashers (15) and nuts (16).

(3) Install the brakeshoe assemblies (2, fig. 232) on the anchor pins (3).

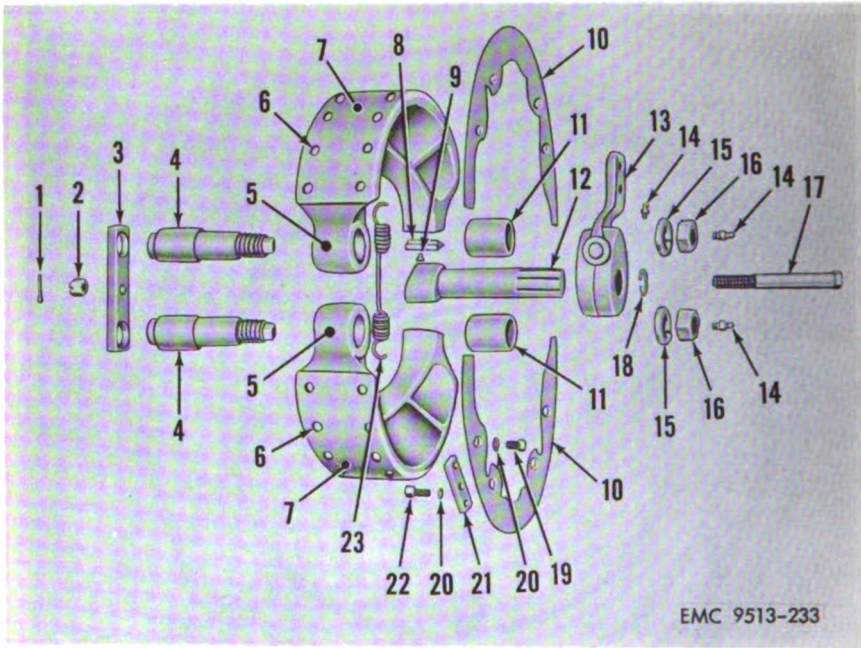
(4) Install the anchor pin link (4) and secure with the castle nut (5) and a cotter pin.

(5) Install the extension springs (1).

(6) Install the front axle bearings and hub (par. 304*c*).

e. Adjustment (fig. 234).

(1) Insert a 0.012 inch thickness gage between the brake lining and brakedrum at the brake anchor end.



1	Cotter pin (2 rqr)	13	Slack adjuster (2 rqr)
2	Castle nut (2 rqr)	14	Lubrication fitting (6 rqr)
3	Anchor pin link (2 rqr)	15	Lockwasher (4 rqr)
4	Anchor pin (4 rqr)	16	Nut (4 rqr)
5	Brakeshoe assembly (4 rqr)	17	Bolt (2 rqr)
6	Brake lining rivet (64 rqr)	18	Retaining rings (2 rqr)
7	Brake lining (4 rqr)	19	Cap screw (16 rqr)
8	Wear plate (4 rqr)	20	Lockwasher (24 rqr)
9	Wear plate pin (4 rqr)	21	Dust shield plate (8 rqr)
10	Dust shield (4 rqr)	22	Cap screw (8 rqr)
11	Brakeshoe bushing (4 rqr)	23	Extension spring (2 rqr)
12	Camshaft (2 rqr)		

Figure 233. Front brake assembly, exploded view.

(2) Turn the adjusting screw of the slack adjuster clockwise until the thickness gage pulls out with a slight pressure. Make certain the locking sleeve is held in, disengaging the adjusting screw, when making adjustments. Never use a wrench on the sleeve portion of the adjusting screw.

301. Rear Brake Assemblies

a. General. The rear brake assembly is a heavy-duty two-shoe riveted liner type. Brakeshoes are mounted with individual anchor pins and are actuated by a constant lift S-type cam. Maintenance procedures in this paragraph cover one rear brake assembly only but are applicable to both rear axle brake assemblies.

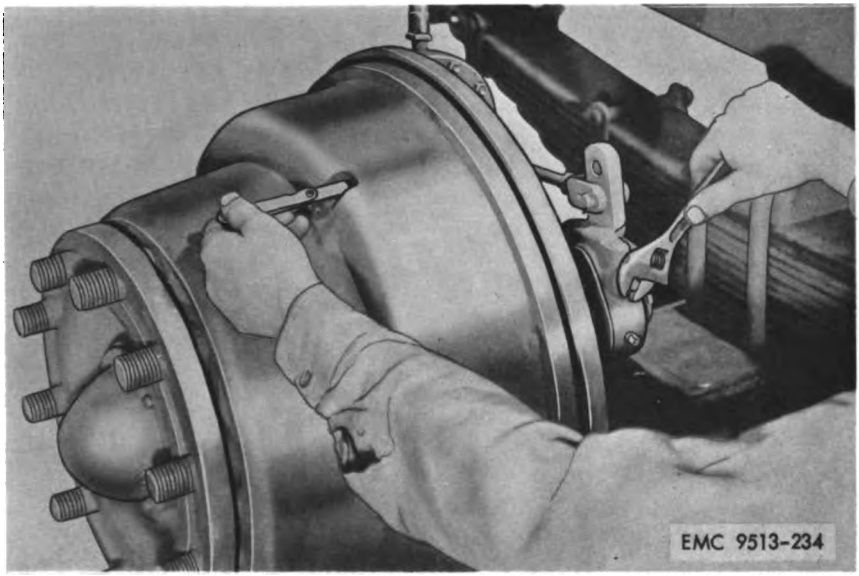


Figure 234. Adjusting brakes.

b. Removal and Disassembly.

(1) Remove the rear wheel bearings and hub (par. 306*a*).

(2) Remove the extension springs (3, fig. 235).

(3) Remove the springs (10), retainers (8), and felts (3, fig. 236) from the anchor pins (7).

(4) Remove the lockwires (33) and lockscrews (32) from the spider assembly (19). Remove the anchor pins and brakeshoe assemblies (4).

(5) Remove the slack adjuster (par. 289*b*). Remove the camshaft (24), washer (25), oil seal felt (26), and retainer (27).

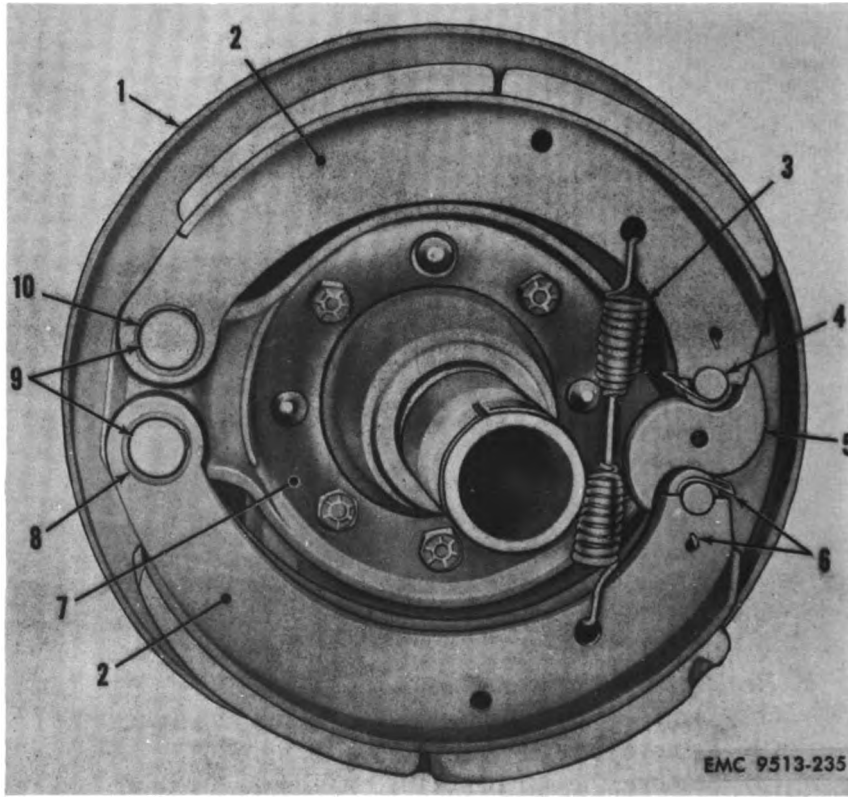
c. Inspection and Repair. Soak and wash all metal parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the brake lining for wear. If brake lining is worn down to the rivet heads, replace the brakeshoe assembly.

(2) Inspect the brakeshoe for cracks or breaks. Replace the brakeshoe assembly if the shoe is cracked or broken.

(3) Inspect the camshaft for worn, chipped, scored, or twisted splines. Replace a camshaft that has worn, chipped, scored, or twisted splines.

(4) Replace all felts.



1	Dust shield	6	Roller pin retainer
2	Brakeshoe assemblies	7	Spider assembly
3	Extension spring	8	Retainer
4	Brake shoe roller pin	9	Anchor pins
5	Camshaft	10	Spring

Figure 235. Rear brakeshoes, installed.

(5) Inspect all parts for good condition. Replace parts not in good condition.

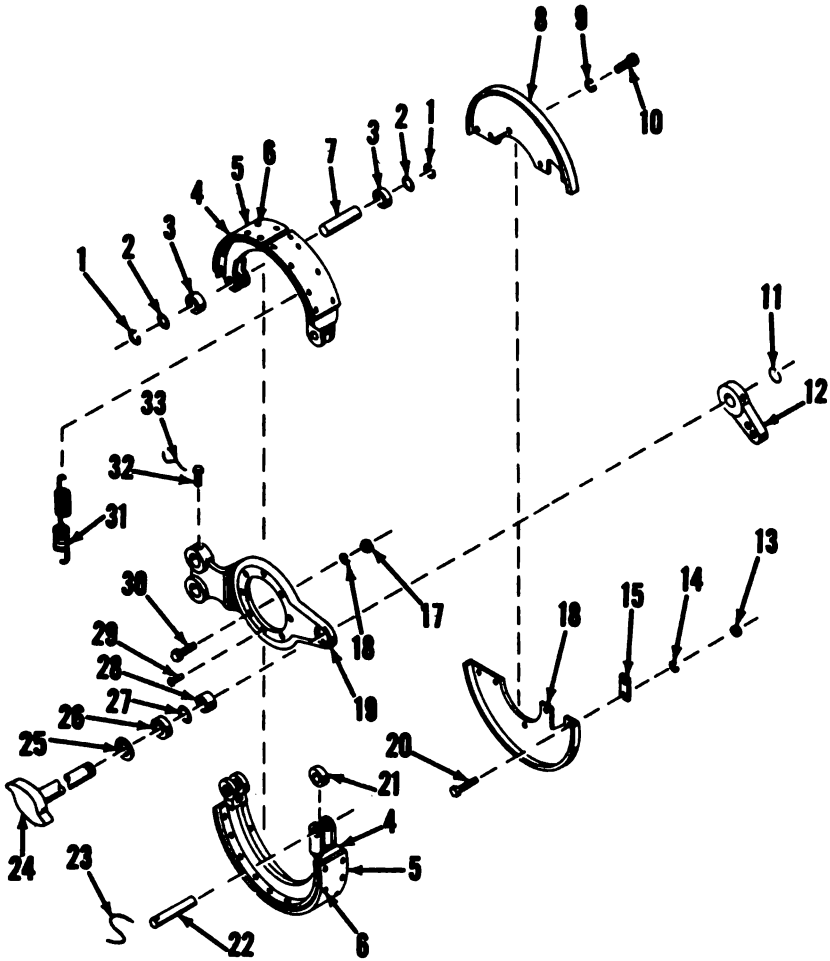
d. Reassembly and Installation.

(1) Install the washer (25, fig. 236), oil seal felt (26), and retainer (27) on the camshaft (24). Install the camshaft in the spider (19). Install the slack adjuster (par. 289*c*).

(2) Position the brakeshoe assembly (4) on the spider. Install the anchor pin (7) in the brakeshoe and spider. Install the lockscrew (32) in the spider and on the flat of the anchor pin. Secure the head of the lockscrew with lockwire (33) attached to the spider.

(3) Install the felts (3), retainers (8, fig. 235), and springs (10) on each end of the anchor pins (9).

(4) Install the extension spring (3).



1	Spring (16 rqr)	17	Nut (20 rqr)
2	Retainer (16 rqr)	18	Lockwasher (20 rqr)
3	Felt (16 rqr)	19	Spider and needle assembly (4 rqr)
4	Brakeshoe (8 rqr)	20	Screw (16 rqr)
5	Brake lining (16 rqr)	21	Roller (8 rqr)
6	Rivet (128 rqr)	22	Roller pin (8 rqr)
7	Anchor pin (8 rqr)	23	Retainer (8 rqr)
8	Dust shield and spacer assembly (4 rqr)	24	Camshaft (4 rqr)
9	Lockwasher (24 rqr)	25	Washer (4 rqr)
10	Cap screw (24 rqr)	26	Oil seal felt (4 rqr)
11	Retaining ring (4 rqr)	27	Retainer (4 rqr)
12	Slack adjuster (4 rqr)	28	Bushing (4 rqr)
13	Nut (16 rqr)	29	Rivet (12 rqr)
14	Lockwasher (16 rqr)	30	Bolt (20 rqr)
15	Connector (8 rqr)	31	Spring (4 rqr)
16	Dust shield and spacer assembly (4 rqr)	32	Lockscrew (8 rqr)
		33	Lockscrew (8 rqr)

Figure 236. Rear brake assembly, exploded view.

(5) Install the rear wheel bearings and hub (par. 306).

e. Adjustment. Adjust the brakes as instructed in paragraph 300*e*.

Section XXV. DRIVE SYSTEM

302. Description

a. Front Axle. The front axle is of the driving type. Specially designed steering knuckles are provided to transmit driving torque. The axle shafts themselves transmit driving and braking torque, therefore, the load is carried by the cast housing. The driving unit is mounted in a conventional manner with the exception that the pinion shaft is pointing to the rear of the carrier. Power is delivered from the engine through the transmission, a close coupled drive shaft to the transfer case, through the transfer case, and the forward drive shaft.

b. Rear Axles. The rear axles are full floating with double reduction and of the through-drive type providing direct transmittal of engine torque through the forward driving axle to the rear driving axle, which are connected by an interaxle drive shaft. Strongly reinforced solid equalizer beams and parallel torque rods equalizes weight distribution and insures correct alinement. Maintenance procedures in this section cover one axle shaft only but are applicable to all rear axle shafts.

c. Drive Shafts. There are four drive shafts used on the carrier. Each drive shaft assembly consists of a tubular shaft with a nonslip joint at one end and a slip joint at the other. The slip joint permits variations in length between connecting units, caused by flexing of the springs while the carrier is in motion.

(1) The transfer case drive shaft assembly is furnished with a flange yoke at the slip joint, which is bolted to the companion flange on the transmission, and an identical flange yoke on the nonslip joint which bolts to the companion flange on the transfer case.

(2) The rear axle drive shaft assembly is furnished with a flange yoke at each end. The flange yoke on the slip joint end is bolted to the emergency brake disk assembly which is mounted on the companion flange at the transfer case. The flange yoke on the nonslip joint is bolted to the companion flange at the forward rear axle.

(3) The spider and bearing assemblies of the interaxle drive shaft are installed in the end yokes of the differential carriers on the tandem rear axles to complete the inter-

axle drive shaft assembly. The interaxle drive shaft has no flange yokes.

(4) The spider and bearing assembly of the slip joint end of the front axle drive shaft is installed in the end yoke of the transfer case. The flange yoke on the nonslip joint is bolted to the companion flange on the front axle differential carrier.

d. Wheels and Tires. There are eight rear and two front wheels and tires on the carrier. All wheels and tires on the carrier are interchangeable and can be mounted at any position on any axle. The wheels on the right side of the carrier are held by wheel studs and cap nuts having righthand threads. Righthand threaded studs and nuts are removed by turning counterclockwise. The wheels on the left side of the carrier are held by wheel studs and cap nuts with lefthand threads. Lefthand threaded studs and nuts are removed by turning clockwise. All studs and cap nuts are marked R and L and must be installed accordingly on the proper side of the carrier. All front and rear tires must carry 70 pounds of air pressure.

303. Drive Shafts
(fig. 237)

a. Removal.

(1) On drive shafts having flange yokes, remove the nuts, lockwashers, and cap screws attaching the yoke to the companion flange. Lower the drive shaft assembly.

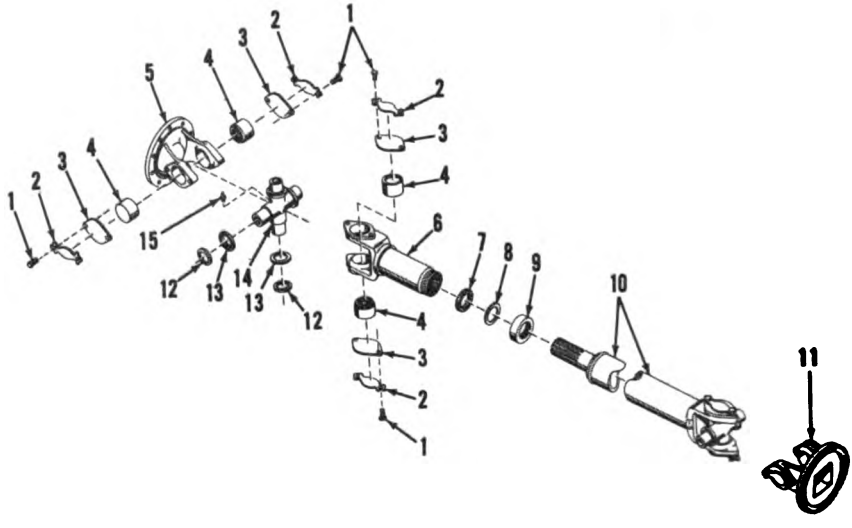
(2) Remove the drive shaft spider and bearing assemblies installed in end yokes as in *b* below.

b. Disassembly. Look for alinement marks on the drive shaft. If the marks are not easily seen, mark the units with a punch and hammer so that they can be reassembled in exactly the same relative position.

(1) Straighten out the lugs on the lock plate (2). Remove the cap screws (1) on each end of the yoke. Lift off the lock plate and the cover plate (3).

(2) Tap on the end of the needle cup assembly (4) until the opposite needle cup assembly is forced out of the yoke. Then turn the assembly over and drive the first needle cup assembly back out of its lug by driving on the exposed end of the spider assembly (14). Repeat this operation for the other needle cup assemblies in the drive shaft.

(3) Lift out the spider assembly (14) by sliding to one side and tilting over the top of the yoke lug.



1	Cap screw	9	Dust cap
2	Lock plate	10	Shaft subassembly
3	Cover plate	11	Flange yoke
4	Needle cup assembly	12	Gasket
5	Flange yoke	13	Gasket retainer
6	Slip yoke assembly	14	Spider assembly
7	Felt packing	15	Lubrication fitting
8	Flat washer		

Figure 237. Drive shaft, exploded view.

(4) Remove the gaskets (12) and gasket retainers (13) from the spider assembly.

(5) Remove the lubrication fitting (15) from the spider assembly.

(6) Unscrew the dust cap (9). Withdraw the slip yoke assembly (6). Remove the dust cap from the shaft subassembly (10). Remove the felt packing (7) and the flat washer (8) from the dust cap.

c. Inspection and Repair. Soak and wash all metal parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the slip joints and shafts for worn, chipped, scored, or twisted splines. Replace a slip joint or shaft that has worn, chipped, scored, or twisted splines.

(2) Inspect the needle cup assemblies for out-of-round condition, scoring, or wear. Replace a needle cup assembly if out-of-round, scored, or defective.

(3) Inspect the spider assemblies for cracks, breaks, and

distortion. Replace a spider assembly if cracked, broken, or distorted.

(4) Inspect all parts for good condition. Replace parts not in good condition.

d. Reassembly.

(1) Insert the flat washer (8) followed by the felt packing (7) in the dust cap (9). Slip the dust cap over the spline end of the shaft subassembly (10) with the open end away from the shaft yoke.

(2) Lubricate the splines (LO 5–9513–3). Insert the splines of the shaft subassembly into the slip joint (6) so that the alinement arrows or marks are in line. Install the dust cap on the slip joint.

(3) Install the lubrication fitting (15) in the spider assembly (14). Install the gasket retainers (13) and gaskets (12) on the spider trunnions.

(4) Insert one trunnion of the spider assembly into the bearing hole in the lug of the yoke from the inside between the lugs, and tilt until the trunnions will enter the opposite hole in the lug.

(5) Pack the needle cup assemblies (4) with lubricant (LO 5–9513–3). Install the needle cup assemblies from outside of the yoke, tapping them into place, using a soft hammer.

(6) Install the cover plates (3), making certain that the key on the plate lines up with the slot in the cup.

(7) Install new lock plates (2) and secure with cap screws (1). Bend up the lugs on the lock plate around the flat side of the cap screws.

(8) Lubricate the drive shaft (LO 5–9513–3).

e. Installation.

(1) On drive shafts having flange yokes, position the shaft and attach to the companion flanges with cap screws, lockwashers, and nuts.

(2) Install the drive shaft spider and bearing assemblies in end yokes as instructed in *d* above.

304. Front Axle Bearings and Hub

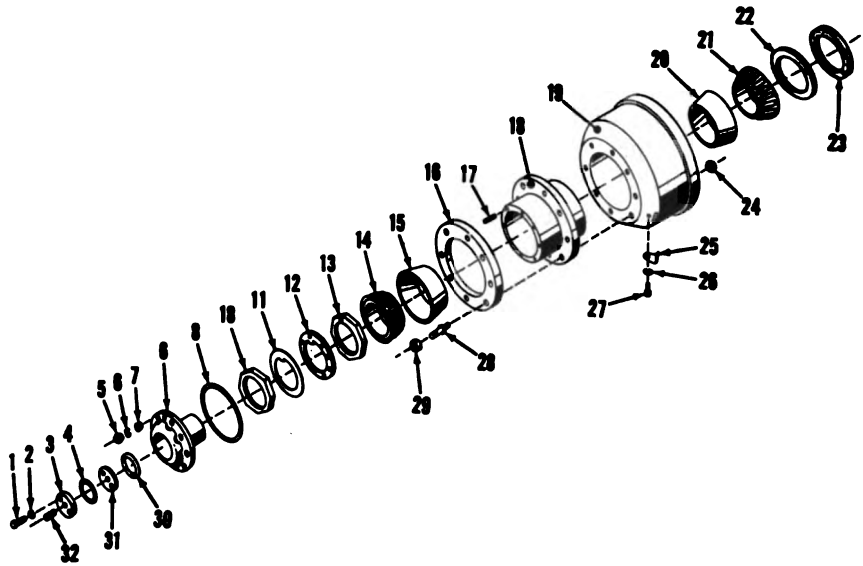
(fig. 238)

a. Removal.

(1) Remove the wheel (par. 307*a*) and the spacer (16).

(2) Remove the cap screws (1) and lockwasher (2) which secure the retainer (3). Remove the retainer with the gasket (4), washer (31), and packing (30).

(3) Remove the nuts (5) and lockwashers (6) from the



1	Screw, cap, hex hd, 5/16-24 NF x 7/8 (4 rqr)	18	Hub and cup assembly (2 rqr)
2	Lockwasher, spring, std, 5/16 (4 rqr)	19	Brakedrum (2 rqr)
3	Retainer (2 rqr)	20	Cup (2 rqr)
4	Gasket (2 rqr)	21	Cone and rollers (2 rqr)
5	Nut (16 rqr)	22	Felt retainer washer (2 rqr)
6	Lockwasher (16 rqr)	23	Packing (2 rqr)
7	Dowel (8 rqr)	24	Nut (20 rqr)
8	Drive flange (2 rqr)	25	Inspection cover (2 rqr)
9	Gasket (2 rqr)	26	Lockwasher, spring, std, 1/4 (2 rqr)
10	Plain nut (2 rqr)	27	Screw, cap, hex hd, 1/4-20 NC x 1/2 (2 rqr)
11	Key washer (2 rqr)	28	Threaded stud (10 rh and lh rqr)
12	Adjusting nut washer (2 rqr)	29	Cap nut (10 rh and lh rqr)
13	Bearing adjusting nut (2 rqr)	30	Packing (2 rqr)
14	Cone and rollers (2 rqr)	31	Washer (2 rqr)
15	Cup (2 rqr)	32	Plug (2 rqr)
16	Spacer (2 rqr)		
17	Stud (16 rqr)		

Figure 238. Front hub and bearing assembly, exploded view.

studs (17) in the drive flange (8) and hub (18). Tap the flange with a hammer to loosen it from the studs.

(4) Thread two long cap screws through the puller holes in the flange and pull the flange loose from the hub.

(5) Straighten the lip of the key washer (11) to free the plain nut (10). Using the wheel bearing nut wrench and bar, turn off the plain nut.

(6) Remove the key washer and the adjusting nut washer (12).

(7) Using the wheel bearing nut wrench and bar, turn off the bearing adjusting nut (13).

(8) Remove the cone and rollers (14). Lift off the hub (18) and the brakedrum (19). Separate the hub from the drum by turning off the nuts (24).
(9) Pull off the cone and rollers (21).
(10) Remove the felt retainer washer (22) and the packing (23) from the steering knuckle.

b. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect all bearings thoroughly, checking particularly for out-of-round condition caused by corrosion or wear. Check for overheating, which is evidenced by discoloration of the rollers. Examine the cups for scoring or galling. Replace a bearing or cup that is worn, scored, or galled, or has been overheated.
(2) Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace parts having damaged, corroded, or stripped threads.
(3) Inspect all parts for good condition. Replace parts not in good condition.

c. Installation.

(1) Position and install new packing (23) and the felt retainer washer (22) on the steering knuckle.
(2) Install the cup (20) in the brakedrum. Install the cup (15) in the hub (18). Attach the brakedrum to the hub with the threaded studs (28) and nuts (24).
(3) Install the cone and roller (21). Pack the rollers with grease (LO 5–9513–3). Lift the hub and drum into position.
(4) Install the cone and roller (14). Pack the rollers with grease (LO 5–9513–3). Using the wheel bearing nut wrench and bar, install the bearing adjusting nut (13). Adjust the bearing as in *d* on next page.
(5) Install the adjusting nut washer (12) and the key washer (11). Tighten the plain nut (10) against the washers. Turn over the lip of the key washer to secure the nut.
(6) Position the gasket (9) on the drive flange (8). Install the flange in the hub. Insert the dowels (7) in the flange. Secure the flange with lockwashers (6) and nuts (5) on the studs (17).
(7) Assemble the retainer (3), gasket (4), washer (31), and the packing (30). Install and secure the retainer to the drive shaft with the lockwashers (2) and cap screws (1). Install the plug (32).

(8) Install the spacer (16). Install the wheel (par. 307*c*).
(9) Lubricate the front axle assembly (LO 5–9513–3).

d. Adjustment.
(1) Perform the operations in *a*(2) through (6) above.
(2) Using the wheel bearing nut wrench and bar, draw the bearing adjusting nut (13) up tight; then back off one-quarter turn.
(3) Spin the wheel in both directions and inspect for free rotation. Readjust the nut as necessary.
(4) Perform the operations in *c*(5), (6), and (7) above.

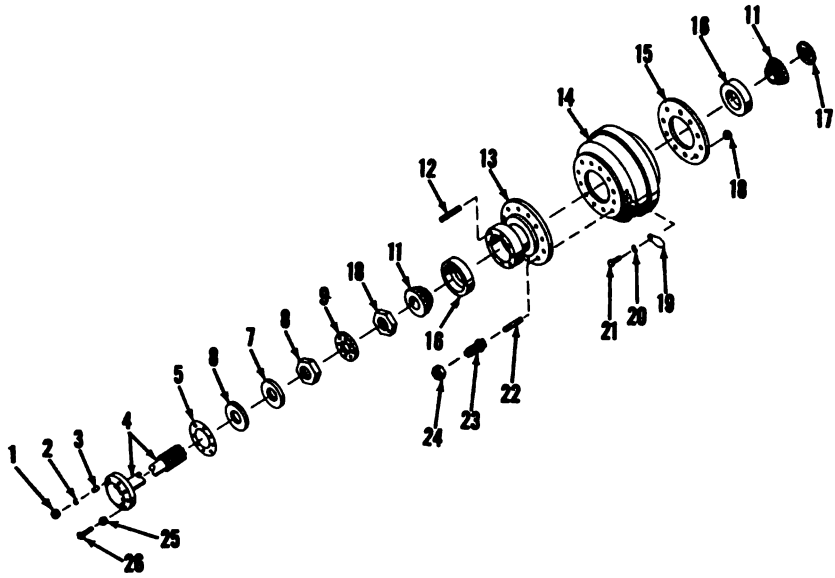
305. Rear Axle Shafts
(fig. 239)

a. Removal.
(1) Place a hydraulic jack under the axle housing. Raise the jack until the tire is off the ground.
(2) Remove the nuts (1) and lockwashers (2) from the studs (12).
(3) Loosen the puller screw nuts (25). Turn the puller screws (26) in alternately until the axle shaft (4) can be withdrawn. Remove the axle shaft, gasket (5), wiper assembly (6), and oil seal assembly (7).

b. Installation.
(1) Position a new gasket (5) over the studs (12) and against the hub (13).
(2) Position the wiper assembly (6) and the oil seal assembly (7) on the axle shaft (4) against the cap.
(3) Back out the puller screws (26) until they no longer extend through the axle shaft cap. Tighten the puller screw nuts (25) against the axle shaft cap.
(4) Slide the axle shaft in the housing by hand and position the axle shaft cap on the studs (12). Install the dowels (3) in the cap and over the studs. Secure the axle shaft with lockwashers (2) and nuts (1).
(5) Lower and remove the hydraulic jack.

306. Rear Axle Bearings and Hub
(fig. 239)

a. Removal.
(1) Remove the wheel (par. 307*a*).
(2) Remove the rear axle shaft (par. 305*a*).
(3) Using the wheel bearing nut wrench and bar, turn off the plain nut (8).
(4) Remove the bearing nut washer (9).



EMC 9513-239

1	Nut (28 rqr)	14	Brakedrum (4 rqr)
2	Lockwasher (28 rqr)	15	Slinger (4 rqr)
3	Dowel (28 rqr)	16	Cup (8 rqr)
4	Axle shaft	17	Oil seal assembly (4 rqr)
5	Gasket (4 rqr)	18	Nut (40 rqr)
6	Wiper assembly (4 rqr)	19	Inspection hole cover (4 rqr)
7	Oil seal assembly (4 rqr)	20	Lockwasher (4 rqr)
8	Plain nut (4 rqr)	21	Cap screw (4 rqr)
9	Bearing nut washer (4 rqr)	22	Threaded stud (20 rh and lh rqr)
10	Adjusting nut (4 rqr)	23	Capnut (20 rh and lh rqr)
11	Cone and rollers (8 rqr)	24	Nut (20 rh and lh rqr)
12	Threaded stud (28 rqr)	25	Puller screw nut (8 rqr)
13	Hub and cup assembly (4 rqr)	26	Puller screw (8 rqr)

Figure 239. Rear axle, exploded view.

(5) Using the wheel bearing nut wrench and bar, turn off the adjusting nut (10).

(6) Remove the cone and rollers (11).

(7) Lift off the hub (13) and the brakedrum (14). Remove the nuts (18) and separate the hub (13), brakedrum (14), slinger (15), and oil seal assembly (17).

(8) If necessary, remove the rear bearing cone and rollers (11) from the axle housing sleeve.

b. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts. Remove all grease from the axle housing sleeve and bearing cone and rollers.

(1) Inspect all bearings thoroughly, checking particularly

for out-of-round condition caused by corrosion or wear. Check for overheating, which is evidenced by discoloration of the rollers. Examine the cups for scoring or galling. Replace a bearing or cup that is worn, scored, or galled, or has been overheated.

(2) Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace parts having damaged, corroded, or stripped threads.

(3) Inspect all parts for good condition. Replace parts not in good condition.

c. Installation.

(1) If removed, install the rear cone and rollers (11) on the axle housing sleeve. Pack the rollers with grease (LO 5–9513–3).

(2) Install the oil seal assembly (17) on the sleeve. Assemble the slinger (15), brakedrum (14), and hub (13) and secure with nuts (18).

(3) Position the hub assembly on the axle housing sleeve with the brakedrum over the brakeshoe assembly.

(4) Install the front cone and roller (11) on the sleeve and in the hub. Pack the rollers with grease (LO 5–9513–3).

(5) Turn the adjusting nut (10) on the sleeve, using the wheel bearing nut wrench and bar. Adjust the bearing as in *d* below.

(6) Position the bearing nut washer (9) on the sleeve. Rotate the adjusting nut to engage the pin in the nearest hole in the washer.

(7) Install and tighten the plain nut (8) against the washer.

(8) Install the axle shaft (par. 305*b*).

(9) Install the wheel (par. 307*c*).

(10) Lubricate the rear axle assembly (LO 5–9513–3).

d. Adjustment.

(1) Remove the axle shaft (par. 305*a*).

(2) Using the wheel bearing nut wrench and bar, turn off the plain nut (8).

(3) Remove the bearing nut washer (9).

(4) Using the wheel bearing nut wrench and bar, draw the adjusting nut (10) up tight; then back off one-quarter turn.

(5) Spin the wheel in both directions and inspect for free rotation. Readjust the nut as necessary.

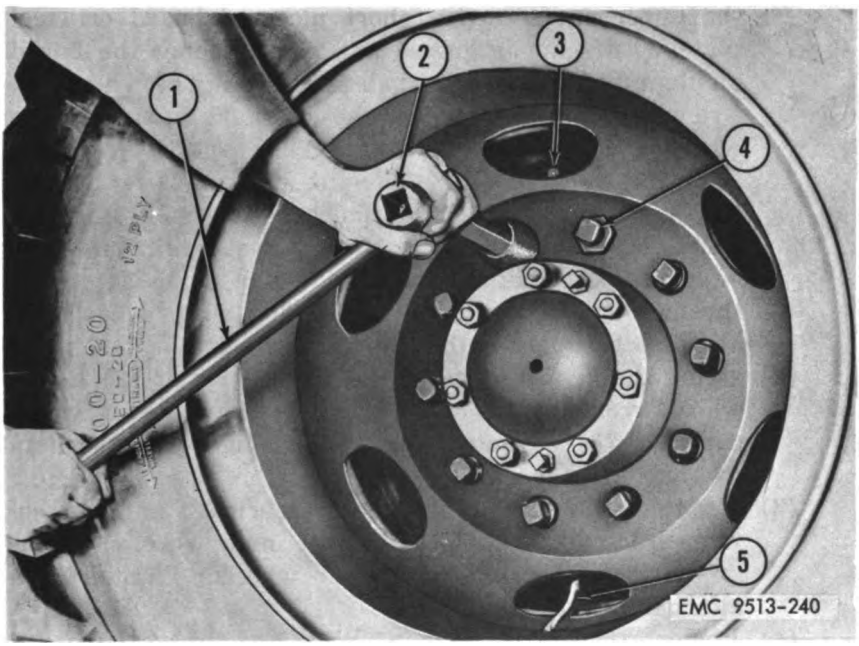
(6) Install the bearing nut washer (9). Rotate the adjusting nut to engage the pin in the nearest hole in the washer.

(7) Using the wheel bearing nut wrench and bar, install and tighten the plain nut (8) against the washer.
(8) Install the axle shaft (par. 305*b*).

307. Wheels
(fig. 240)

a. Removal.

(1) Block the wheels on the side of the carrier opposite to the wheel being removed. Pull the emergency brake hand lever all the way back.
(2) Place a hydraulic jack under the axle housing near the tire.
(3) Use the hexagon end of the wheel wrench (2) and a wheel wrench handle (1) and remove the outer wheel cap nuts (4) on outer rear wheels.
(4) Use the square end of the wheel wrench (2) and a wheel wrench handle (1) and remove the inner wheel cap nuts on front wheels and inner rear wheels.
(5) The wheel can be lifted off by two men or by using a short piece of board or steel plate with its upper surface



1 Wheel wrench handle
2 Wheel wrench
3 Inner tire valve
4 Outer wheel capnut
5 Outer tire valve

Figure 240. Removing wheel.

coated with grease or soap. Then slide the board or plate under the tire. Lower the hydraulic jack until the tire just touches the board or plate. Ease the wheel and tire off the hub and drum studs and onto the greased surface of the board or plate. Slide the wheel and tire on the board or plate until it is clear of the carrier. Roll the wheel and tire aside.

b. Inspection and Repair. Wash the wheel with a stiff brush and water. Clean all rust off the wheel with a wire brush and sandpaper. Remove dirt, grease, or paint from the countersunk hub and wheel capnut holes in the wheel, using an approved cleaning solvent and fine-grit sandpaper. Do not get any solvent on the tires, as it will cause the rubber to deteriorate. Soak and wash all hub and wheel capnuts in an approved cleaning solvent. Remove any paint on the face of the nuts with fine-grit sandpaper.

(1) Visually inspect the wheel for bends or dents that might affect operation. Replace a badly bent or dented wheel.

(2) Inspect the capnuts and studs for damaged, corroded, or stripped threads. Replace a capnut or stud having damaged, corroded, or stripped threads.

c. Installation.

(1) The wheel can be lifted on by two men or by coating the upper surface of a short piece of board or steel plate with soap or grease and then placing the board or plate under the wheel hub and rolling the wheel and tire onto it. Raise or lower the hydraulic jack until the wheel or tire lines up with the hub and drum studs. Slide the wheel and tire onto the studs, making certain the brakedrum inspection hole is accessible through one of the wheel openings. Dual wheels and tires must be installed so that the inner tire valve (3) is accessible through one of the openings of the outer wheel and also directly opposite the outer tire valve (5).

(2) Using the hexagon end of the wheel wrench (2) and a wheel wrench handle (1) and install the outer wheel cap nuts (4) on outer rear wheels. Tighten nuts alternately, a little at a time.

(3) Use the square end of the wheel wrench (2) and a wheel wrench handle (1) and install the inner wheel cap nuts on front wheels and inner rear wheels. Tighten nuts alternately, a little at a time.

(4) Remove the board or plate. Wipe any grease from the tire with a dry cloth. Do not use cleaning solvent.

(5) Lower and remove the hydraulic jack from under the carrier.

308. Tires and Tubes
(fig. 241)

a. Removal.

(1) Remove the wheel (par. 307*a*).

(2) Lay the wheel down with the wheel ring face up.

(3) Remove the valve core and allow all air to escape from the inner tube.

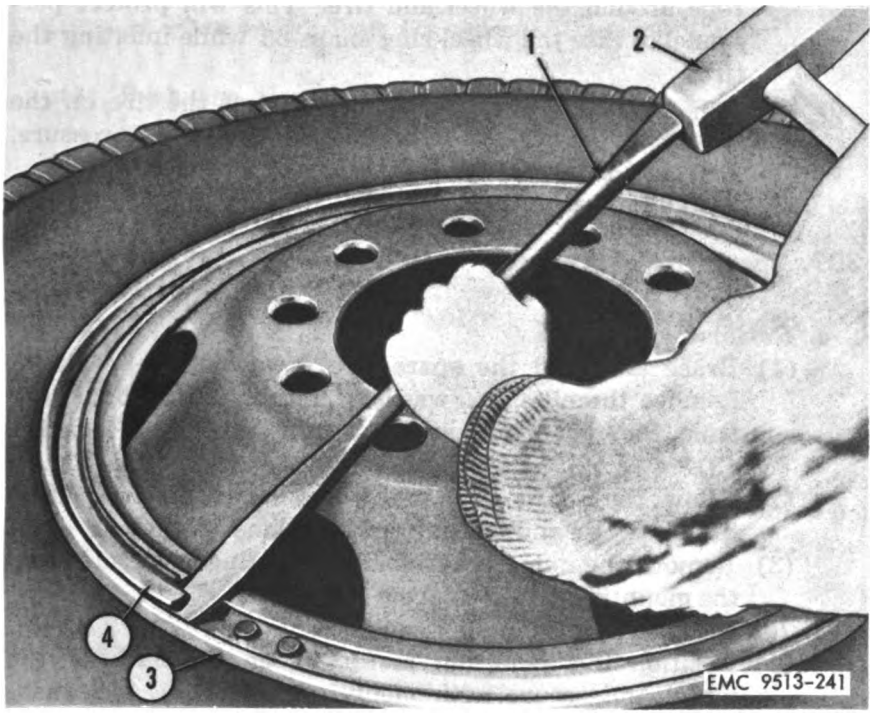
(4) Loosen the bead of the tire from the rim by pounding on the outer rim with a heavy hammer until it shows release from the rim.

(5) Drive a flat-tipped tire iron (1) under the outer locking ring (4) and pry loose about three-fourths around to where the ring is riveted to the inner locking ring (3).

(6) Place tire irons under both rings and pry from the wheel rim.

(7) Turn wheel and tire over and pound the tire bead loose from the wheel rim. Pound the wheel from the outer side, driving it from the tire and tube assembly.

(8) Remove the inner tube from the tire.



1 Tire iron
2 Hammer
3 Inner locking ring
4 Outer locking ring

Figure 241. Removing tire from wheel.

b. Inspection and Repair. Wash the tire and tube with a brush and water. Remove all dirt from the valve cap and valve core.

(1) Inspect the tire for imbedded nails, glass, or other foreign material. Remove all foreign material from the tire.

(2) Inspect the tire tread. Replace a tire having damaged tread or exposed cords.

c. Installation.

(1) Position the tube in the tire.

(2) Place the tire and tube assembly on the rim with the valve stem in proper position.

(3) Position the double lock ring and secure by pounding the outer locking ring (4) into wheel rim locking position.

(4) Tie a manila rope through the ventholes in the wheel and over the tire.

(5) Install the valve core and inflate the tire to about 30 pounds air pressure.

Warning: Never inflate the tire before tying a manila rope around the wheel and tire. This will protect personnel in case the wheel ring snaps off while inflating the tire.

(6) Inspect the valve, rims, and position of the tire on the wheel. If correct, inflate the tire to 70 pounds air pressure.

(7) Remove the manila rope. Install the valve cap.

(8) Install the wheel (par. 307*c*).

309. Spare Tire and Wheel
(fig. 242)

a. Removal.

(1) Brace and hold the spare tire and wheel in position. Remove the nuts, lockwashers, and mounting bolts (4) from the mounting plate (2) and the frame bracket (3).

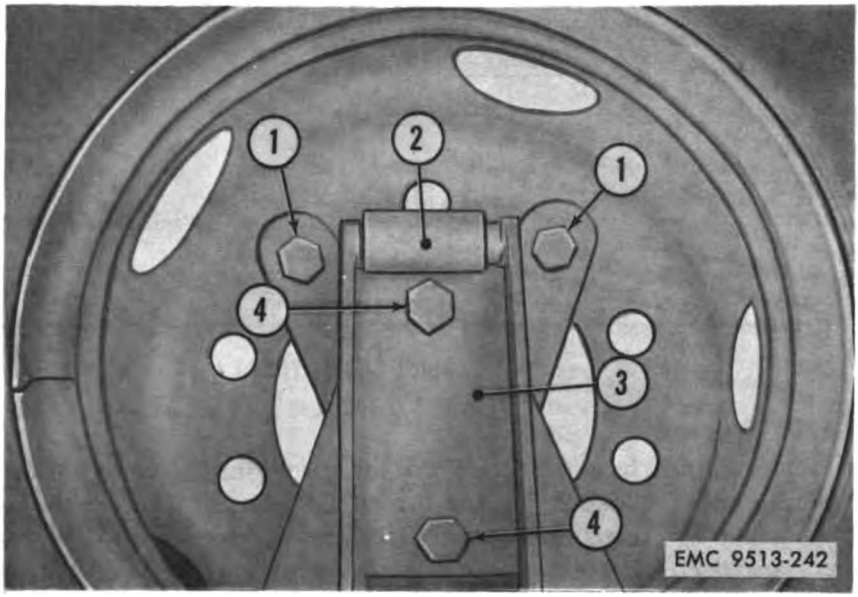
(2) Allow the spare tire and wheel to swing free. Lift the spare tire and wheel from the frame bracket.

(3) Remove the nuts, lockwashers, mounting bolts (1), and the mounting plate (2) from the wheel.

b. Installation.

(1) Position the mounting plate (2) on the back of the wheel and secure with mounting bolts (1), lockwashers, and nuts.

(2) Lift the tire and wheel and hang the mounting plate on the frame bracket (3).



1 Mounting bolt (3 rqr)
2 Mounting plate
3 Frame bracket
4 Mounting bolt (2 rqr)

Figure 242. Spare tire and wheel, installed.

(3) Push the tire and wheel against the frame bracket. Install the mounting bolts (4) in the frame bracket and mounting plate and secure with lockwashers and nuts.

CHAPTER 4

FIELD AND DEPOT MAINTENANCE

Section I. INTRODUCTION

310. General

Instructions in this section and in succeeding sections of this chapter are published for the use of maintenance personnel responsible for third and higher echelons of maintenance of the crane-shovel. Chapter 4 contains information on maintenance which is beyond the scope of the tools, equipment, or supplies normally available to using organizations.

311. Procedure

The following sections describe the complete disassembly, repair, and reassembly of each major unit or system comprising the crane-shovel. Before proceeding with overhaul, check to see that replacement parts are available.

Section II. TOOLS AND EQUIPMENT

312. General

The tools and equipment as listed in this section are those that are required to perform field and depot maintenance on the crane-shovel. Common mechanic's handtools have not been enumerated in this section. Specially designed tools and equipment have been listed in paragraph 314 to enable field and depot maintenance organizations to fabricate the tools and equipment. The tools and equipment in this listing are not available through normal supply channels.

313. Field and Depot Maintenance Tools and Equipment

The tools and equipment in Table V bearing identification are listed in Department of the Army supply manuals as shown in appendix I. The tabulation contains only the tools and equipment necessary to perform the operations illustrated and/or de-

Table V. Field and Depot Maintenance Tools and Equipment

Item	Stock No.	References		Use
		Fig.	Par.	
BIT, valve grinding.....	4910–473–6960	355	388*b*	Unloader valves.
DISK, lapping.....	5345–541–1951	.....	388*b*	Discharge valve seats.
DRIFT, metering well....	5120–534–4377	268	334*b*	Removal of metering well.
DRIVER, bushing.....	5120–473–7007	273	335*a*	Installation of throttle plate shaft bushings.
EXTRACTOR, plug.....	5120–355–6175	260	331*b*	Removal of channel plugs.
		261	334*b*	
GAGE, bending.....	5110–422–8969	272	355*a*	Adjust float setting.
JACK, hydraulic, hand...	5120–293–0077	321	360*d*	Pulling gears and clutch carriers.
		336	366*c*	
		337	366*c*	
		342	372*c*	
		346	375*c*	
		347	375*c*	
PUNCH, lead shot.....	5120–359–6542	264	333*a*	Installation of lead channel plugs.
REAMER.....	5110–422–8970	274	355*a*	Line-reaming throttle plate shaft bushings.
REAMER.....	5110–473–7294	356	388*b*	Unloader valve seats.
REAMER, carbon steel, hand.	5110–473–7274	359	388*b*	Discharge valve seats.
TOOL, check valve.....	5120–473–7599	258	331*b*	Removal and installation of pump and air vent check valves.
		259	333*a*	
		266	334*b*	
			335*a*	
TOOL, check valve.....	5120–359–6581	265	333*a*	Installation of accelerating pump check valve.
		270	335*a*	
TOOL KIT, tractor.....	5780–596–1201	319	360*c*	Pulling bearings and gears.
		323	360*e*	
		330	363*c*	
		335	366*c*	
		351	381*b*	
TOOL, lapping.....	5120–473–7612	.....	338*b*	Discharge valve seats.
TOOL, valve grinding....	5120–387–9640	355	388*b*	Unloader valves.
WRENCH, carburetor fuel valve seat.	5120–317–8074	253	331*b*	Removal and installation of fuel valve seat.
			333*a*	
			334*b*	
			335*a*	
WRENCH, carbuertor wellvent.	5120–317–8098	254	331*b*	Removal and installation of vacuum piston assembly.
		255	333*a*	
			334*b*	
			335*a*	
WRENCH, carburetor power jet valve.	5120–317–8082	256	331*b*	Removal and installation of power jet valve.
			333*a*	
WRENCH, carburetor cap jet and idle jet.	5110–355–6278	262	331*b*	Removal of throttle shaft nut and pump lever.

Item	Stock No.	References		Use
		Fig.	Par.	
WRENCH, carburetor power jet valve.	5120-317-8083	269	334*b* 335*a*	Removal and installation of power jet valve.
WRENCH, socket, carburetor main jet.	5120-317-8079	257	331*b* 333*a*	Removal and installation of main discharge jet.

scribed in this chapter. This table is included for information only and is not to be used for requisitioning tools or equipment.

314. Specially Designed Tools and Equipment

Tools and equipment in table VI are for the use of field and depot maintenance personnel performing major overhaul work on the crane-shovel. The tools and equipment are required by maintenance organizations engaged in rebuilding and/or overhauling a large number of identical components. The tools and equipment are listed in table VI and are not available for issue. The list of tools and equipment and illustrations are furnished for information only.

Section III. GENERAL REPAIR INSTRUCTIONS

315. General

This section contains service and maintenance instructions that are common to similar items used in different assemblies throughout the crane-shovel. Procedures for the removal, inspection, repair, and reassembly or installation of these items apply, regardless of the assembly. Slight modifications on the part of personnel should be made as necessary to facilitate the work on any particular item.

316. Ball Bearings

a. General. Bearings are usually a press fit on a shaft, but occasionally they may be pressed in the bore of a bearing housing. When removing or installing a bearing on a shaft, always apply the pressure on the inner race. When removing or installing in a bore, always apply the pressure on the outer race. Do not transmit lateral pressures through the bearing from one race to another.

b. Removal.

(1) *Pressing.* Press bearings from shafts or out of hous-

Table VI. Specially Designed Tools and Equipment

Item	References		Use
	Fig.	Par.	
BAR, puller	321	360*d*	Pulling gears and clutch carriers.
	336	366*c*	
	337	366*c*	
	342	372*c*	
	346	373*c*	
	347	373*c*	
FIXTURE	358	388*b*	Testing air compressor unloading valves.
PLATE, puller	321	360*d*	Pulling gears.
	336	366*c*	

ings whenever possible. Use firm, steady pressure and do not allow the bearing, shaft, or housing to drop on the floor or ground.

(2) *Pulling.* Bearings may be pulled if a press is not available. The puller must be arranged to apply pressure on the retained race only.

(3) *Driving.* Bearings can be removed by driving, using a soft drift carefully placed against the held race. Split pipe or tubing with welded lugs can be used to control application of the driving pressure. Alternate the blows on opposite sides of the race to prevent wedging the bearing. Be careful not to damage threads on the shaft or in the housing.

c. Inspection and Repair. Wipe off as much lubricant as possible. Agitate the bearing in an approved cleaning solvent, being careful not to spin the races. Remove the bearing from the solvent and flat-slap the bearing against a wood block to remove the cleaning solvent and shake loose any coagulated lubricant. Place bearing back in clean solvent and continue agitating until all traces of old lubricant are removed. When the bearing is clean, remove it from the solvent, shake out as much solvent as possible, and blow dry with clean compressed air directed across the races. Do not allow the air to spin unlubricated balls or rollers in their races. As soon as the bearing is dry, dip it in clean, light oil to prevent corrosion and continued contact of unlubricated bearing surfaces. Drain off the excess oil and place the bearing in a clean container or wrap until ready for inspection. The following defects cannot be rectified and require replacement of the bearing.

(1) Rust spots on balls or races.

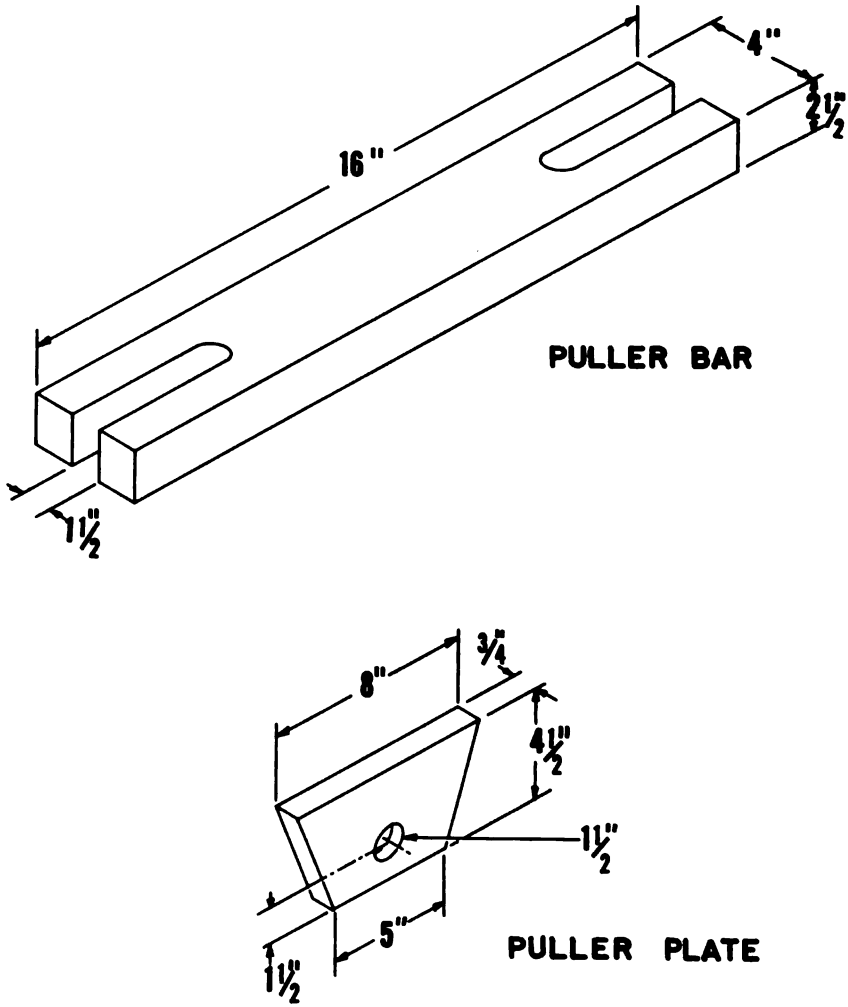
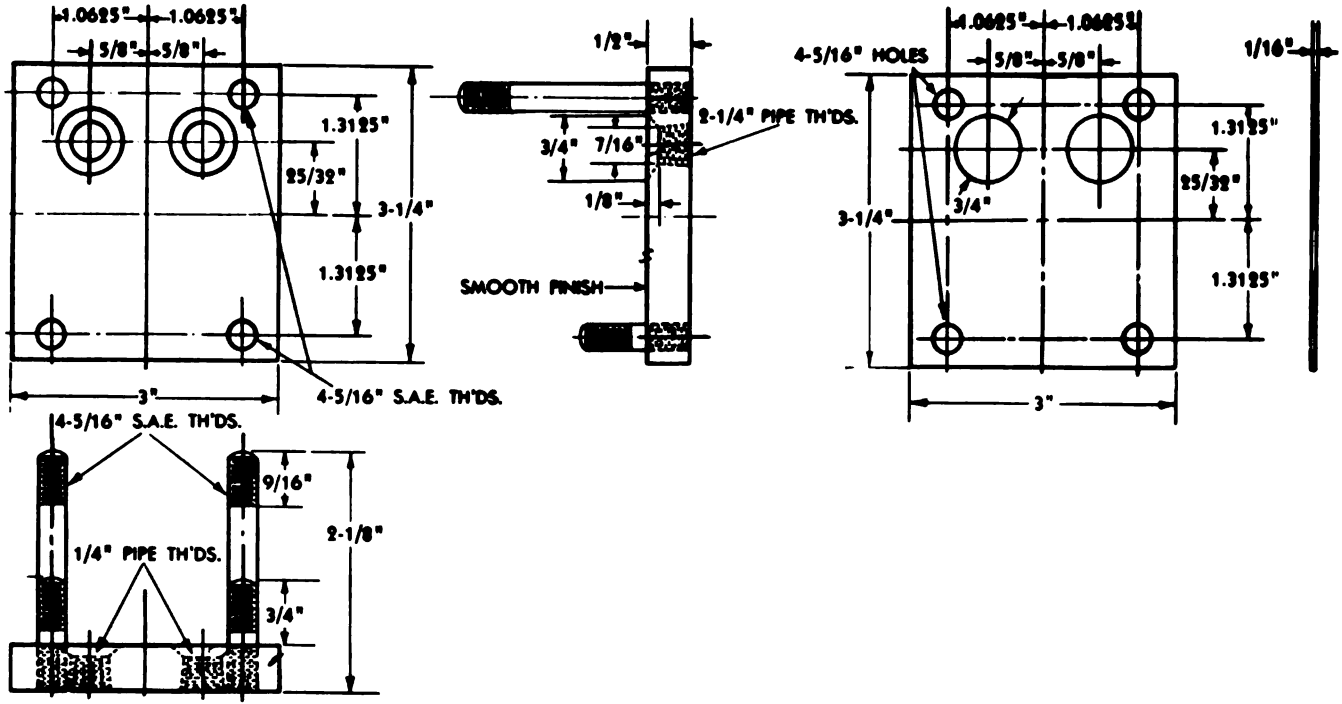


Figure 243. Puller Bar and Puller Plate.

(2) Worn or badly scored surfaces.
(3) Cracked race.
(4) Defective shield, seal, or separator.
(5) Badly discolored balls or races caused by overheating.
(6) Roughness.
(7) Bearing catching at one or more points caused by damage and not by dirt.
(8) Looseness or end play noticeable.

d. Installation. Clean the shaft or housing before replacing a bearing. Pack the bearing with the proper lubricant. Install



EMC 9513-244

Figure 244. Fixture for Testing Air Compressor Unloading Values.

by pressing, the preferred method, or driving. Coating a shaft with white lead before attempting to install press-fit parts will prevent binding and simplify installation. If necessary, heat a very tight fitted bearing to 250° F. in a clean oil bath. Always clean, dry, and repack bearings that have been preheated.

(1) *Pressing.* Apply pressure on the held race only. When pressing on a shaft, support the bearing so that the inner race takes the pressure. When installing in a housing, apply pressure against the outer race. Use a suitable mandrel and blocks so that pressure is applied evenly around the race.

(2) *Driving.* When a press is not available, drive the bearing to its seat by using a soft drift against the held race. Alternate blows around the bearing to prevent cocking and possible wedging. Start bearing straight and be careful not to damage the shaft or housing.

317. Oil Seals

a. Removal. It is almost impossible to remove an oil seal without damaging it. Therefore, if a new seal is not immediately available, the old seal should be inspected in place. Seals are removed by prying them out. They should then be discarded.

b. Inspection. Examine oil seals and discard if the following defects are observed: damaged case, worn sealing member, nicked sealing member, distorted inner diameter, or incorrectly seated seal.

c. Installation. New seals should always be inspected to assure that they are the right size. All burs or sharp edges should be removed from the shaft to be sealed and the sealing element lubricated. The seal must be installed with the wiping edge of the sealing element toward the lubricant or fluid to be sealed.

318. Bushings

a. General. Bushings are generally press-fit in the part in which they are installed. Replacement bushings are carefully machined so that when correctly installed they fit the shafts without reaming or scraping. Three methods most generally used for replacing bushings are pressing, pulling, and driving. All bushings can be removed and replaced by driving, but it is recommended that a press or puller be used wherever possible. There is less danger of distortion or other damage that frequently occurs when bushings are driven in or out of retainers.

b. Removal. Clean the part thoroughly with an approved cleaning solvent. Using the method best suited to the job, pull, press, or drive out the bushing. In some cases, where bushings

are extremely tight or frozen, it may be necessary to use a round-nose or diamond-point chisel and split the bushings.

Caution: When splitting bushings, be careful not to damage the surface of the retaining bores.

c. Inspection.

(1) Inspect the bushing for wear. If a bushing is worn, it should be replaced.

(2) Position, function, and availability of a replacement bushing should be taken into consideration in determining when a bushing must be replaced.

(3) Inspection of the bushing should include examination of lubrication fittings, tubing, and ducts. Be sure lubricant reaches the bushing. If bushings run dry, check the lubrication fittings and ducts immediately for clogging by dirt or hard dried grease.

d. Installation. File the ends of the retaining bore and outside surface of the bushing just enough to take off any sharp edges. Clean all burs from surfaces of the bore and bushing. Coat surface with white lead. Start the bushing straight, tapping it lightly with a hammer; then press, pull, or drive it in. It is extremely important that a bushing be started straight and kept straight. Forcing a bushing, if it is not started straight, will cause distortion and necessitate reaming or scraping it for fit.

319. Shafts

a. Removal and Installation. A driftpin or a block of wood should always be used to protect the end of a shaft when it requires hammering to drive it out or reinstall it. To avoid distortion and damage, never hammer directly on the end or any part of the shaft.

b. Inspection and Repair.

(1) Inspect a shaft for wear, scoring, and damaged keyways. Replace a shaft that is worn, scored, or has a damaged keyway.

(2) Replace a shaft that is bent, twisted, broken, or has worn or chipped splines.

(3) A shaft with small nicks and burs must be polished with a fine stone.

320. Brake and Clutch Linings

a. General. Brake and clutch linings should be replaced when they are worn to the point that lining rivets are flush with the surface. Any linings that are oil- or grease-soaked should also be replaced. Both halves of a paired lining should be replaced, if one half is worn or defective.

b. Cleaning and Inspection. If grease or oil is found between the lining and drum or housing, take a clean cloth dampened with an approved cleaning solvent and force it between the lining and housing at a point between the live and dead ends. Turn the machinery over several times. Remove the cloth and repeat the operation until the lining is thoroughly cleaned. If this procedure does not clean the lining, remove the band and lining and wash the lining thoroughly with an approved cleaning solvent. Examine the lining for excessive wear, uneven wear, or signs of possible failure. Replace the lining if necessary.

c. Replacing Old Linings. Support the band, with the lining rivets to be removed, lying over a hollow tube or pipe. Working from the band side, remove the rivets with a punch and detach the lining from the band. Clamp a new piece of lining of the proper size, length, and thickness to the band. Using the band holes as a guide, drill lining holes with a hand drill. Countersink holes in the lining to a depth one-eighth inch less than the lining thickness. Rivet the lining to the band with a rivet press or driftpin and rivet set, working from the center of the band out. The lining must bed perfectly on the band. Bevel the edges and ends of the lining with a file. Check all rivet heads to make certain that none will contact the drum.

d. Installation. Install the band assembly and check the band and drum for uneven clearances. Insert a flat wedge with smooth surfaces between the lining and the drum at the point of drag. Operate the control lever and bend the band tightly over the wedge. If necessary, use a mallet to achieve additional shaping of the band to remove any high spots. When the band is shaped, remove the wedge.

Section IV. REMOVAL AND INSTALLATION OF REVOLVING FRAME AS UNIT

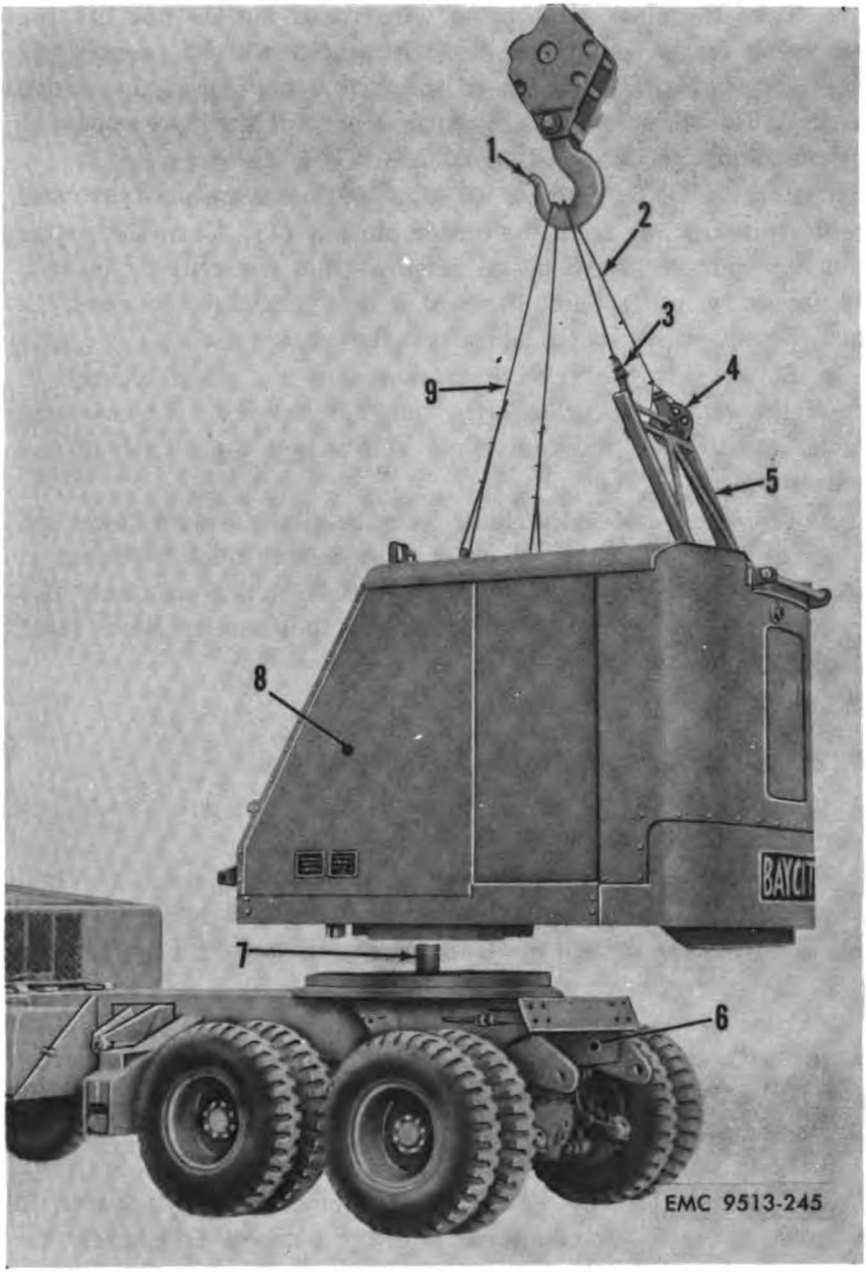
321. Removal of Revolving Frame as Unit

a. Remove the front end attachment (pars. 10–20).

b. Lower the lifting hook (1, fig. 245) of a suitable lifting device over the revolving frame (8). The lifting device must have a capacity of at least 35 tons.

c. Pass one end of the wire rope (9) around the pulley (4) and install cable clamps to make a loop. Position the wire rope on the lifting hook and dead end in the wedge socket (3).

d. Position the center of the wire rope (9) on the lifting hook. Using cable clamps, make loops on the ends of the wire rope to reach the lifting eyes on the A-frame top channels. Install the loops in the eyes with shackles and pins.



1 **Lifting hook**
2 **Wire rope, ⅝ x 14½ ft**
3 **Wedge socket**
4 **Pulley**
5 **Bridle**
6 **Carrier**
7 **Center pin**
8 **Revolving frame**
9 **Wire rope, ⅝ x 21½ ft**

Figure 245. Removal and installation of revolving frame as a unit.

e. Take the slack out of the wire ropes but do not lift the revolving frame. Notice if the wire ropes will lift evenly. If necessary, adjust the length of the wire rope (2) at the wedge socket (3). If necessary, adjust the length of the wire rope (9) by remaking each loop.

f. Remove the cap screw (3, fig. 189), lockwasher, (2), and center pin key (4) from the center pin nut (1). Turn the center pin nut counterclockwise and remove from the center pin (5). If necessary, use a blunt bar and a heavy hammer to start the nut. Remove the thrust washer from the center pin.

g. Slowly lift the revolving frame but not high enough to clear the center pin. Check the unit for balance. If necessary, lower the unit on the center pin and adjust the length of the wire ropes as in *e* above.

h. Lift the revolving frame from the carrier and lower on blocking placed on the ground. Provide sufficient blocking at each corner of the revolving frame to level the unit and also provide clearance for the fuel tank and independent boom hoist assembly.

i. Remove the wire ropes.

322. Installation of Revolving Frame as Unit

a. Install the wire ropes (2 and 9, fig. 245) as instructed in paragraph 321*a* through *e*.

b. Slowly lift the revolving frame and check the unit for balance. If necessary, lower the unit on the blocking and adjust the length of the wire ropes as instructed in paragraph 321*e*.

c. Lift the revolving frame from the blocking and install on the crane-carrier center pin. Guide the vertical swing shaft gear too mesh in the carrier ring gears. Be sure the four revolving frame rollers are in contact with the roller path of the ring gear.

d. Install the thrust washer and center pin nut (1, fig. 189) on the center pin (5). Turn the nut clockwise to tighten. If necessary, use a blunt bar and a heavy hammer to tighten the nut until the slot in the nut and the slot in the center pin aline.

e. Position the center pin key (4) in the slots and secure with the lockwasher (2) and cap screw (3).

f. Remove the wire ropes.

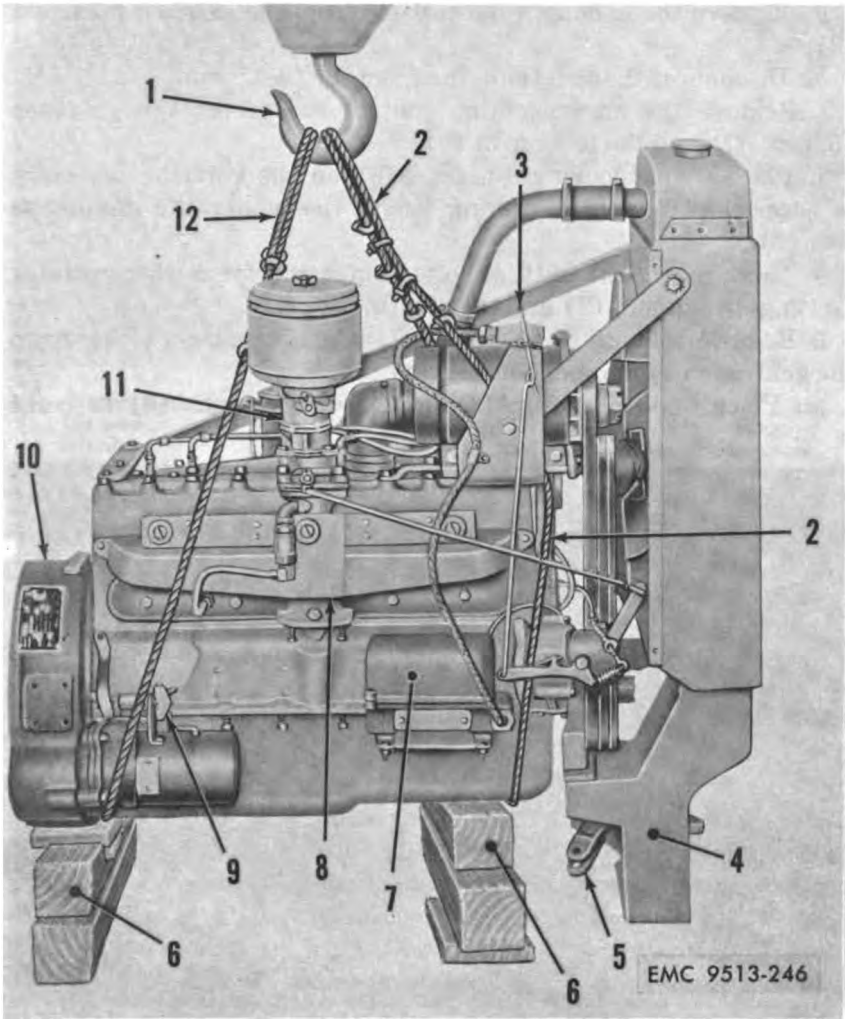
g. Operate and swing the revolving frame. If necessary, adjust the center pin nut.

Section V. REMOVAL AND INSTALLATION OF ENGINES

323. Revolving Frame Engine Removal

a. Remove the battery cables from ground and the starter switch (9, fig. 246). Tape the ends of the battery cables.

b. Remove the ammeter lead from the voltage regulator (7). Remove the ignition switch lead at the distributor. Remove



1	Lifting hook	7	Voltage regulator
2	Wire rope sling	8	Exhaust manifold
3	Throttle control rod bellcrank	9	Starter switch
4	Radiator and engine support	10	Bellhousing
5	Clutch control rod bellcrank	11	Carburetor
6	Wood blocking	12	Wire rope sling

Figure 246. Revolving frame engine removal points.

the lead from the oil pressure gage sending unit and the water temperature gage sending unit.

c. Remove the starting motor control cable from the starting motor lever.

d. Disconnect the throttle control rod from the ballcrank (3).

e. Disconnect the choke control from the carburetor (11).

f. Drain the lubricating oil from the engine oil pan and remove the drain line piping.

g. Remove the exhaust pipe casting from the exhaust manifold (8).

h. Disconnect the fuel tank line from the fuel-pump.

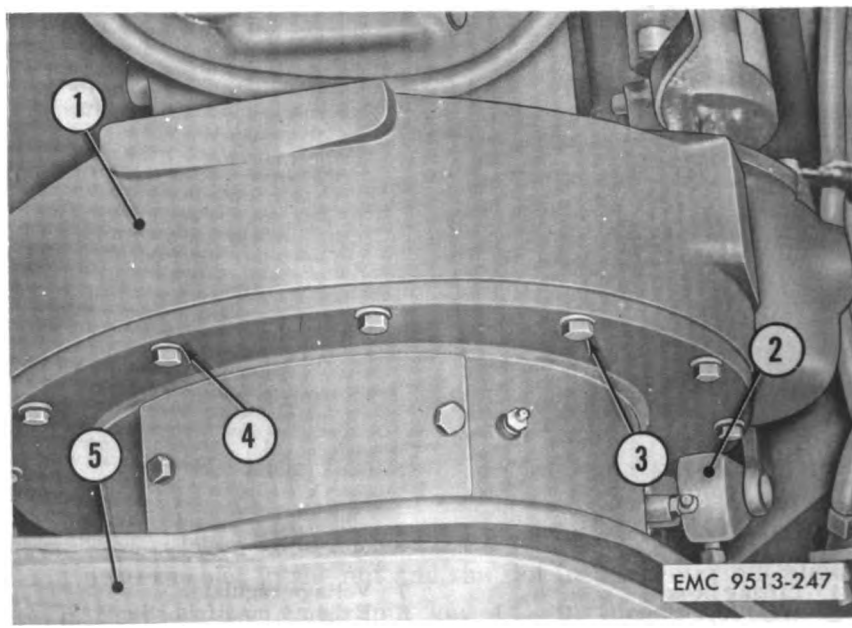
i. Remove the engine clutch control rods from the gearcase (5, fig. 247) and the lever arm (2).

j. Place wood blocking (4, fig. 248) on the rotating base (5) to support planks (3) running lengthwise under the engine oil pan (2).

k. Remove the mounting bolts and nuts from the radiator and engine support (7) and the rotating base.

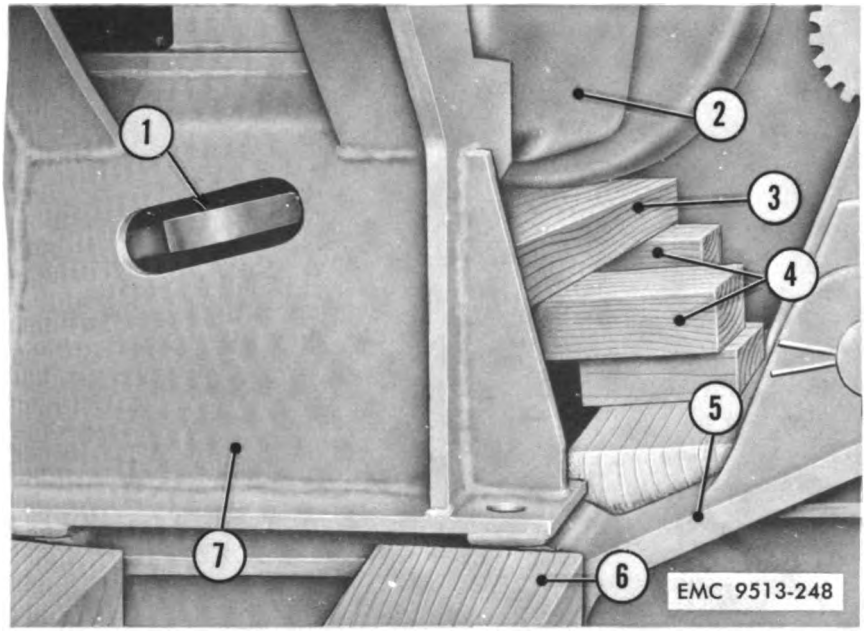
l. Remove the screws (3, fig. 247) and lockwashers (4) from the gearcase (5) and bellhousing (1).

m. Place wood blocking, (4, fig. 248) and planks (6) in front



1 Bellhousing
2 Clutch control rod lever arm
3 Cap screw
4 Lockwasher
5 Gearcase

Figure 247. Revolving frame engine bellhousing, installed.



1 Clutch control rod bellcrank
2 Oil pan
3 Plank
4 Wood blocking
5 Rotating base
6 Plank
7 Radiator and engine support

Figure 248. Revolving frame engine blocking.

of the support (7). Using prybars, slide the engine on the planks out the side door to the cribbing (3, fig. 249) and planks (4) built from the ground up to rotating base level.

n. Using an auxiliary lifting device and wire rope slings (2 and 12, fig. 246) remove the engine from the cribbing.

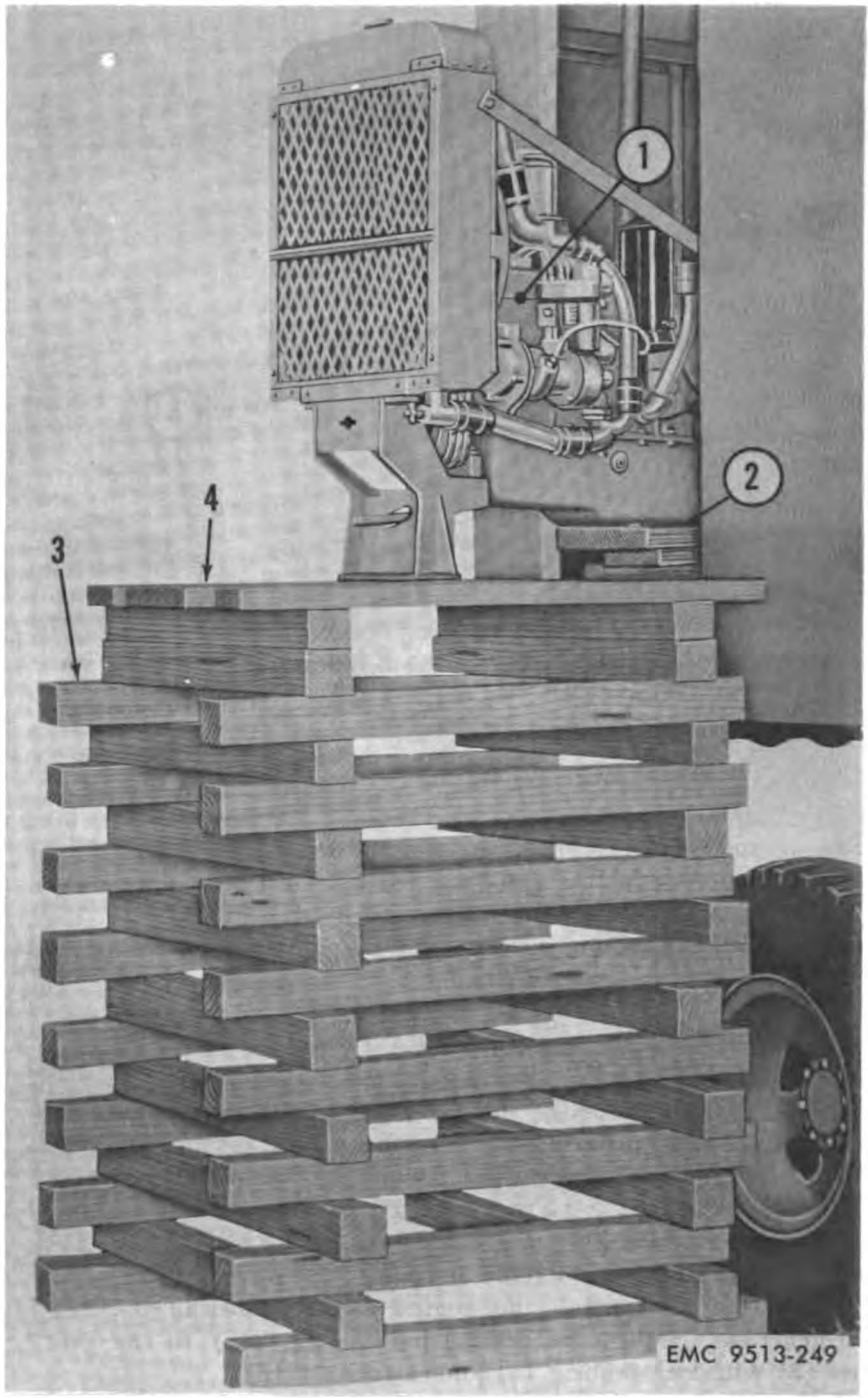
324. Revolving Frame Engine Installation

a. Using an auxiliary lifting device and wire rope slings (2 and 12, fig. 246) place the engine (1, fig. 249) on cribbing (3) and planks (4) built from the ground up to rotating base level. Place blocking and planks (2) under the oil pan against the rotating base. Remove the wire rope slings.

b. Using prybars, slide the engine on the planks (6, fig. 248) and (3) to position on the rotating base and gearcase.

c. Position and install the engine on the rotating base and the gearcase. Secure the bellhousing (1, fig. 247) to the gearcase (5) with lockwashers (4) and cap screws (3).

d. Secure the radiator and engine support (4, fig. 246) to the rotating base with mounting bolts and nuts. Remove the wire rope slings.



1 Engine **2 Plank** **3 Cribbing** **4 Plank**

Figure 249. Revolving frame engine removal.

e. Install the engine clutch control rods on the bellcrank (5) and the lever arm (2, fig. 247).

f. Connect the fuel tank line to the fuel pump.

g. Install the exhaust pipe casting on the exhaust manifold (8, fig. 246).

h. Install the oil pan drain line piping.

i. Connect the choke control to the carburetor (11).

j. Connect the throttle control rod to the bellcrank (3).

k. Install the starting motor control cable on the starting motor lever.

l. Install the leads to the water temperature gage sending unit and the oil pressure gage sending unit. Install the ignition switch lead on the distributor. Install the ammeter lead on the voltage regulator (7).

m. Remove the protective taping from the battery cable ends. Install the battery cable to the starter switch (9). Install the battery ground cable.

n. Lubricate the engine (LO 5–9513–3).

325. Carrier Engine Removal and Installation (fig. 250)

a. Removal.

(1) Remove the cover, cab insulation panel, righthand access panel, rear grille, and radiator grille (par. 263).

(2) Disconnect the battery to magnetic switch and the ground cables. Tape the ends of the battery cables. Disconnect the leads from the oil pressure gage sending unit and the water temperature gage sending unit.

(3) Remove the engine air cleaner, crankcase ventilation valve, ammeter lead at voltage regulator, ignition switch lead at distributor, fan blade assembly, air line at air compressor, and the fuel pump intake line as instructed in TM 5–5252.

(4) Remove the radiator (par. 178*b*(1)).

(5) Disconnect the throttle control and choke control from the carburetor.

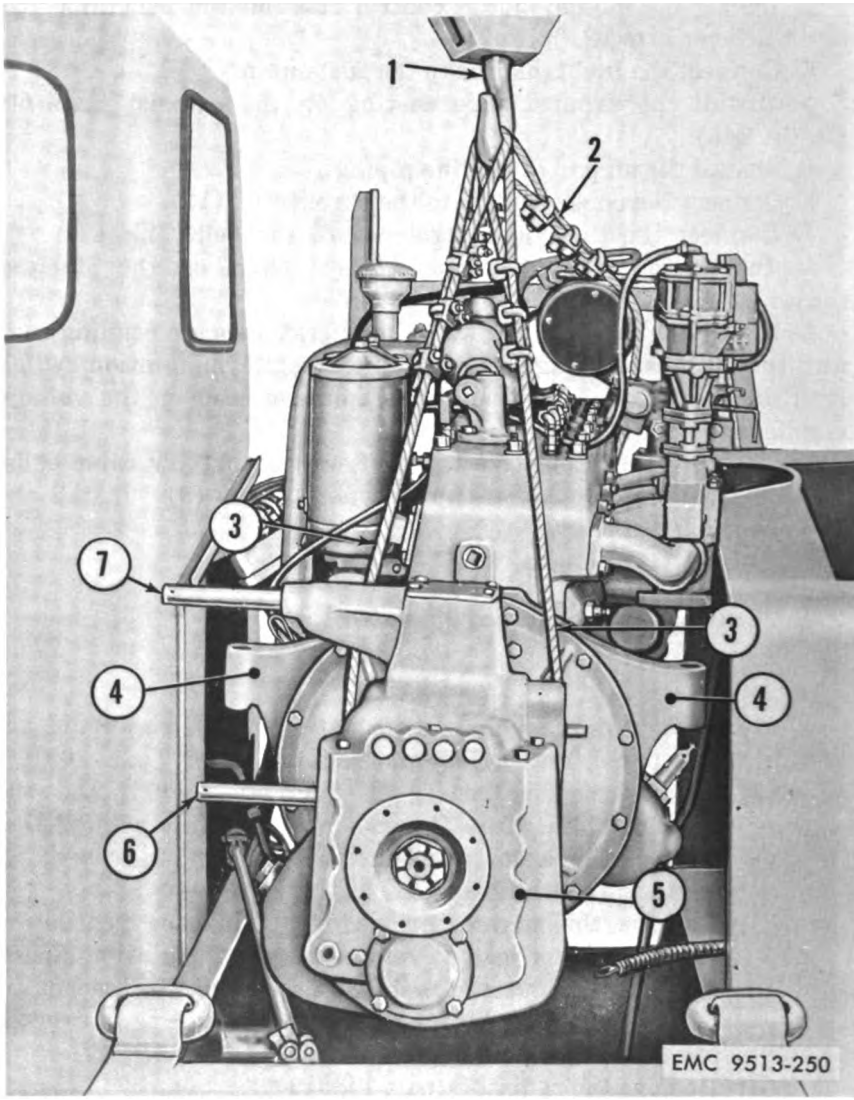
(6) Remove the exhaust pipe companion flange from the exhaust manifold (par. 181*a*).

(7) Remove the shift lever from the transmission remote control shifting shaft (par. 215*b*).

(8) Remove the lever arm from the clutch shifter shaft (par. 210*b*).

(9) Remove the mounting bolts, lockwashers, and nuts from the drive shaft and transmission companion flanges.

(10) Remove the mounting bolts, lockwashers, and nuts



1 Lifting hook
2 Wire rope sling
3 Wire rope sling
4 Rear engine supports
5 Transmission
6 Clutch shifter shaft
7 Transmission remote control shifting shaft

Figure 250. Carrier engine and transmission removal.

from the rear engine supports (4) and the front engine supports located in back of the timing gear cover.

(11) Install wire rope slings (2 and 3) on the engine and transmission and the lifting hook (1) of an auxiliary lifting device.

(12) Slowly raise and remove the engine and transmission from the carrier.

b. Installation.

(1) Install wire rope slings (2 and 3) on the engine and transmission and the lifting hook (1) of an auxiliary lifting device.

(2) Slowly raise and install the engine and transmission in the carrier. Install mounting bolts, lockwashers, and nuts in the carrier and the rear engine supports (4) and the front engine supports located in back of the timing gear cover. Remove the wire rope slings.

(3) Position the drive shaft companion flange on the transmission companion flange and secure with bolts, lockwashers, and nuts.

(4) Install the lever arm on the clutch shifter shaft (par. 210*b*(3)).

(5) Install the shift lever on the transmission remote control shifting shaft (par. 215*f*).

(6) Install the exhaust pipe companion flange on the exhaust manifold.

(7) Connect the throttle control and the choke control to the carburetor.

(8) Install the radiator (par. 178*b*(6)).

(9) Install the fuel pump intake line, air line at air compressor, ignition switch lead at distributor, ammeter lead at voltage regulator, crankcase ventilation valve, and the engine air cleaner as instructed in TM 5–5252.

(10) Connect the leads to the water temperature gage sending unit and the oil pressure gage sending unit. Remove the protective tape from the battery cable ends. Install the battery to magnetic switch and the ground cables.

(11) Install the radiator grille, rear grille, righthand access panel, cab insulation panel, and cover (par. 267).

Section VI. FUEL PUMPS

326. General

The same model fuel pump is used on the revolving frame engine and the carrier engine and therefore disassembly and reassembly procedures are identical. For revolving frame engine fuel pump removal procedures, refer to paragraph 167. For carrier engine fuel pump removal procedures, refer to TM 5–5252.

327. Fuel Pump Disassembly
(fig. 251)

a. Mark edges of the cover (3) and body (9) with a file so that they may be reassembled in the same relative position.

b. Remove the screws (1) and lockwashers (2). Separate the cover (3) from the body (9) by jarring the cover loose with a light plastic hammer.

c. Rest the body on the edge of a bench vise and drive out the rocker arm pin (13) with a drift punch and hammer. Remove the rocker arm (16), rocker arm spring (17), bushing (15), and link (14). Lift out the diaphragm (18) and diaphragm spring (8).

d. Remove the screws (12), lower cover (11), and gasket (10) from the body (9).

e. Loosen the bail (7) nut. Remove the bowl (6), bowl gasket (5), and screen (4). Spring the bail (7) out of the retaining holes in the cover (3).

f. Remove the screws (19), retainer (20), valve and cage assemblies (21), and the gasket (22).

328. Fuel Pump Inspection and Repair

Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

a. Inspect the covers, body, link, and rocker arm for cracks, breaks, and distortion. Replace a cover, body, link, or rocker arm if cracked, broken, or distorted.

b. Inspect the valve and cage assemblies and the rocker arm bushing for wear. Replace a worn valve and cage or rocker arm bushing.

c. Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace parts having damaged, corroded, or stripped threads.

→

1 Screw (6 rqr)
2 Lockwasher (6 rqr)
3 Cover
4 Screen
5 Gasket
6 Bowl
7 Bail
8 Diaphragm spring
9 Body
10 Gasket
11 Lower cover
12 Screw (3 rqr)
13 Rocker arm pin
14 Link
15 Bushing
16 Rocker arm
17 Rocker arm spring
18 Diaphragm
19 Screw (2 rqr)
20 Retainer
21 Valve and cage (2 rqr)
22 Gasket

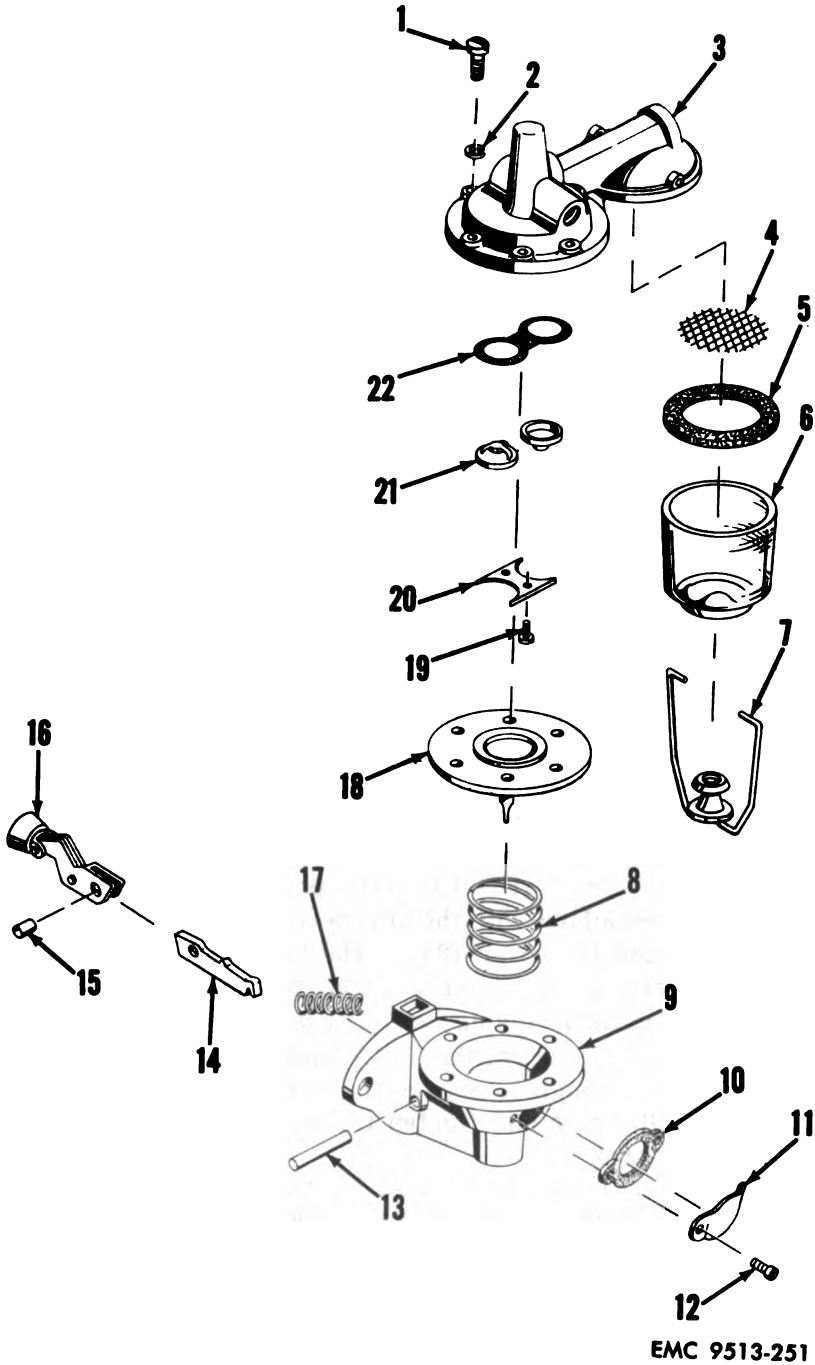


Figure 251. Fuel pump, exploded view.

d. Inspect all parts for good condition. Replace parts not in good condition.

329. Fuel Pump Reassembly
(fig. 251)

a. Assemble the rocker arm (16), link (14), and bushing (15). Place the assembly in the body (9) with the link hook down. Aline the rocker arm pin hole with the hole in the body and drive in the rocker arm pin (13). Install the rocker arm spring (17).

b. Soak a new diaphragm spring (18) in kerosene. Position the diaphragm spring (8) over the pull rod well. Position the diaphragm on the spring. Hold the body (9) upside down and press the diaphragm against the spring. At the same time, tilt the diaphragm so the pull rod angles away from the link. Bring the diaphragm back to level position so that the link engages the pull rod.

c. Position the gasket (10) and lower cover (11) on the body (9) and secure with screws (12).

d. Position the gasket (22) in the cover (3). Install the valve and cage assemblies (21) in the cover. The outlet valve must have the three-legged spider facing into the cover. The inlet valve must have the three-legged spider facing out of the cover.

e. Install the retainer (20) and secure with screws (19).

f. Position the screen (4), gasket (5), and bowl (6) in the cover (3). Spring the bail (7) into the retaining holes in the cover (3). Swing the bail into position to retain the bowl. Tighten the bail nut with the fingers only.

g. Position the cover (3) on the body (9), making sure that the file marks on the cover and body line up. Push on the rocker arm (16) until the diaphragm (18) is flat across the body flange.

h. Install the lockwashers (2) and screws (1). Tighten the screws just enough to engage the lockwashers. Push the rocker arm in full stroke and tighten the screws (1) securely. Release the rocker arm.

Note. The diaphragm must be held in a flexed position while tightening the cover screws or the pump will deliver too much pressure.

Section VII. CARBURETORS

330. Description

a. Revolving Frame Engine. The revolving frame engine carburetor is a downdraft unit of the double-venturi design. It is a "balanced" carburetor which maintains proper air-fuel mixtures when the air cleaner becomes dirty. This construction protects the

bowl vent and other air passages from admitting dirt because all air must enter through the air cleaner. The accelerating pump is mechanically operated, and the power jet is controlled by manifold vacuum.

b. Carrier Engine. The carrier engine carburetor is a downdraft unit with a concentric float bowl. This type bowl assists in the proper metering of air and fuel to the engine, without flooding, when the carrier is operated on extreme angles. It is a "sealed" and "balanced" carburetor in that all air for the fuel bowl chamber ventilation and idling must come through the air cleaner. Air cleaner restrictions have an influence on fuel-air ratio. A double venturi is employed to aid in the complete vaporization of the fuel. The power jet and accelerating pump systems are operated by engine vacuum and are completely inclosed and protected from dirt. These auxiliary jet systems are to provide the extra fuel needed for certain operations.

331. Carburetor Disassembly—Revolving Frame Engine

a. Removal. Refer to paragraph 168 for removal of the revolving frame engine carburetor.

b. Disassembly.

(1) *Remove air intake body* (fig. 252).

(*a*) Remove the filter head (3), fiber washer (4), and fuel filter element (5) from the air intake body (8).

(*b*) Remove the screws (6) and lockwashers (7) from the air intake body and the fuel bowl (22).

(*c*) Raise the air intake body slightly and loosen the gasket (14) from the fuel bowl. Lift the air intake body, with gasket, clear of the bowl. Avoid damage to the float (12).

(2) *Disassemble air intake body.*

(*a*) Remove the gasket (14, fig. 252) from the air intake body (8).

(*b*) Press a screwdriver against the float axle (13) at the slotted side of the float hinge bracket and force the axle through the hinge bracket. Remove the axle completely with fingers from the opposite side and remove the float (12).

(*c*) Remove the fuel valve (11).

(*d*) Using the wrench (2, fig. 253), remove the fuel valve seat (10, fig. 252) and fiber washer (9) from the air intake body.

(*e*) Using the wrench (2, fig. 254), remove the vacuum cylinder (54, fig. 252) and fiber washer (55) from the air intake body.

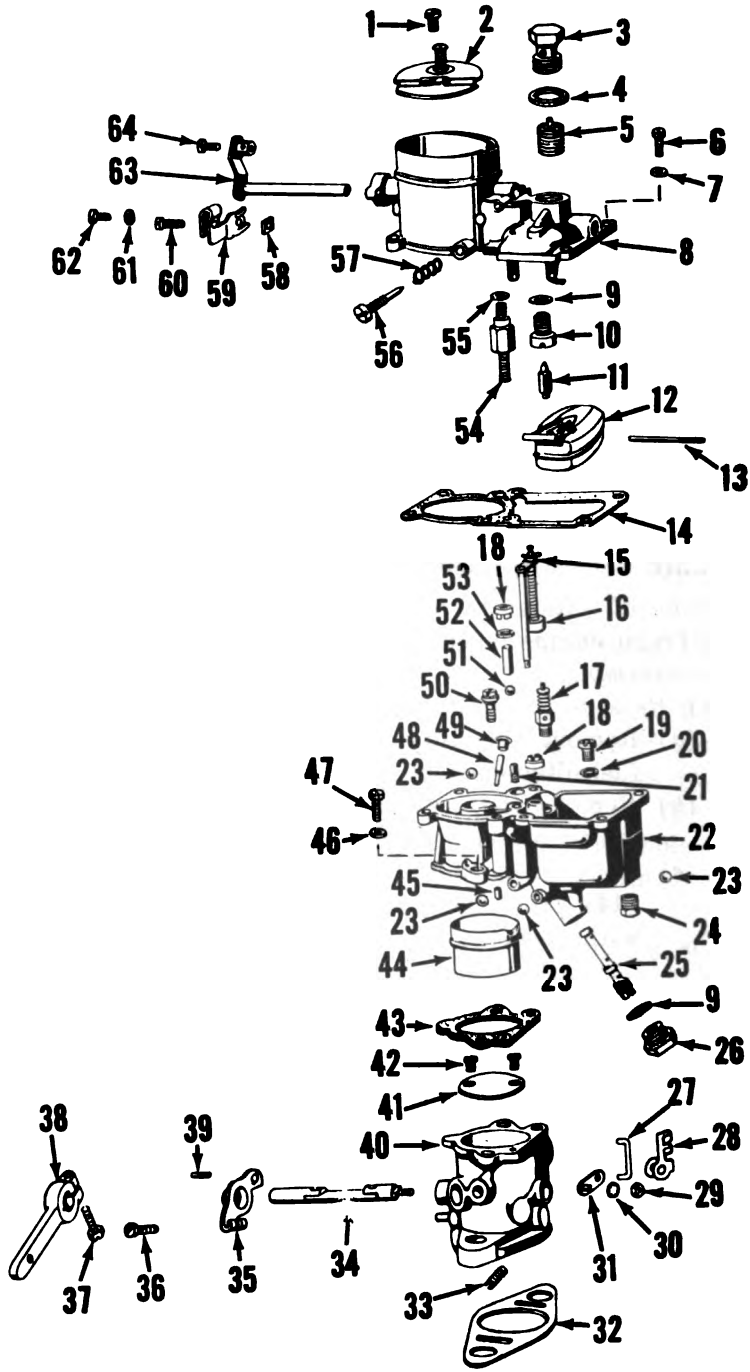


Figure 252. Revolving frame engine carburetor, exploded view.

(*f*) Remove the idle adjusting needle (56) and adjusting needle spring (57) from the side of the air intake body.

(*g*) File off the riveted end of the choke plate screw (1) and remove the screw. Pull out the choke shaft and lever (63) and choke plate (2). Remove the choke bracket (59).

Note. The choke bracket can be assembled in two positions. To insure correct reassembly, place a mark on the air intake body on the side from which the bracket was removed.

(3) Separate fuel bowl and throttle body (fig. 252).

(*a*) Remove the passage plug (26) and fiber washer (9) from the bottom of the fuel bowl (22).

(*b*) Remove the accelerating pump link retainer clip (28) and pump lever link (27).

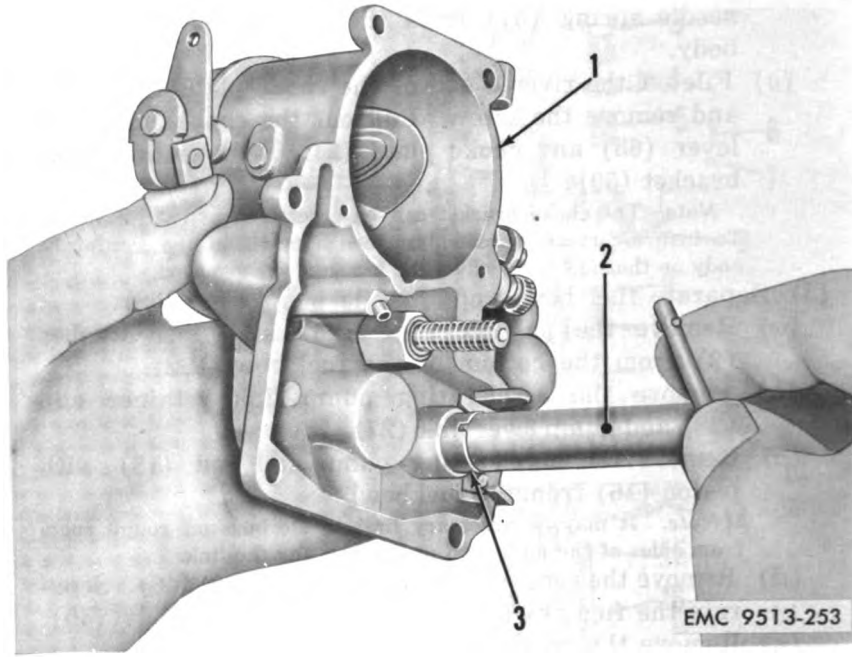
(*c*) Remove the accelerating pump and rod (15) with piston (16) from the fuel bowl.

Note. It may be necessary first to file burs off rough spots from sides of the pump rod at the hole for the link.

(*d*) Remove the screws (47) and lockwashers (46). Separate the fuel bowl (22) from the throttle body (40).

(*e*) Remove the venturi (44) and gasket (43).

1 Choke plate screw
2 Choke plate
3 Filter head
4 Fiber washer
5 Fuel filter element
6 Screw (6 rqr)
7 Lockwasher (6 rqr)
8 Air intake body
9 Fiber washer (2 rqr)
10 Valve seat
11 Fuel valve
12 Float
13 Float axle
14 Gasket
15 Pump and rod
16 Pump piston
17 Power jet valve
18 Check valve (2 rqr)
19 Main jet
20 Fiber washer
21 Well vent jet
22 Fuel bowl
23 Channel plug (4 rqr)
24 Bowl drain plug
25 Discharge jet
26 Passage plug
27 Pump lever link
28 Link retainer clip
29 Throttle shaft nut
30 Lockwasher
31 Pump lever
32 Flange gasket
33 Channel screw
34 Throttle shaft
35 Throttle stop lever
36 Lever stop screw
37 Lever clamp screw
38 Throttle clamp lever
39 Stop lever pin
40 Throttle body
41 Throttle plate
42 Throttle plate screw (2 rqr)
43 Gasket
44 Venturi
45 Channel bushing
46 Lockwasher (2 rqr)
47 Screw (2 rqr)
48 Accelerator jet
49 Passage plug
50 Idle jet
51 Check ball
52 Check ball weight
53 Retainer washer
54 Vacuum cylinder
55 Fiber washer
56 Idle adjusting needle
57 Adjusting needle spring
58 Nut
59 Choke bracket
60 Tube clamp screw
61 Lockwasher
62 Screw
63 Choke shaft and lever
64 Swivel screw



1 Air intake body 2 Wrench 3 Fuel valve seat

Figure 253. Removing fuel valve seat from air intake body.

(4) *Disassemble fuel bowl.*

(*a*) Remove the idling jet (50) from the top surface of the fuel bowl (22).

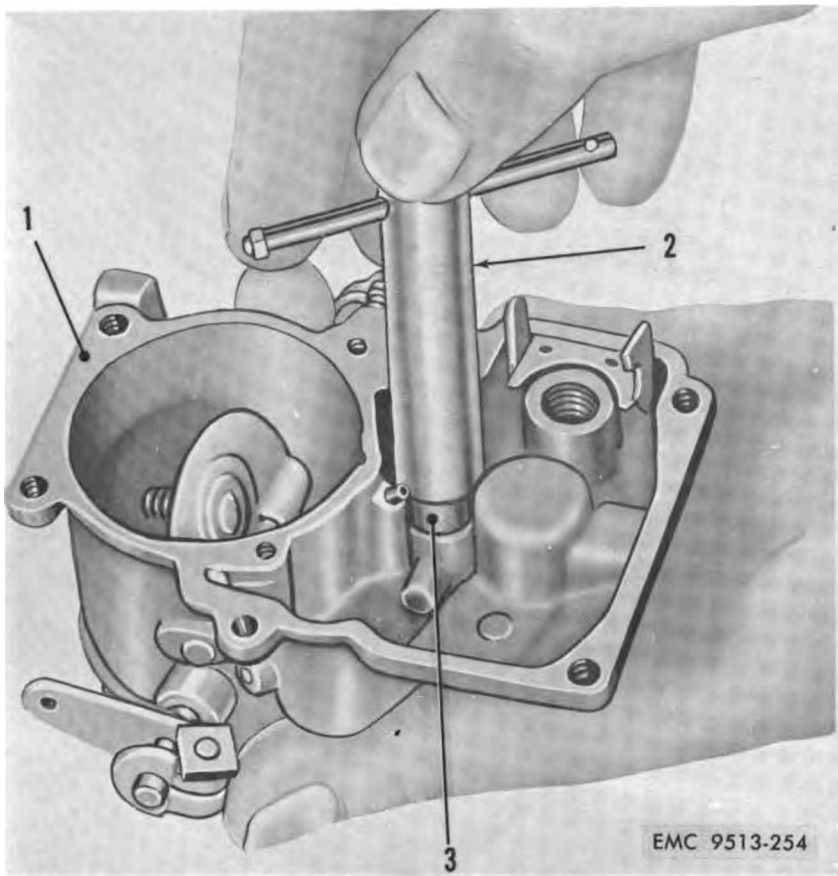
(*b*) Using the wrench (2, fig. 255), remove the well vent jet (21, fig. 252) from the top surface of the fuel bowl.

(*c*) Remove the main jet (19) and fiber washer (20) from the inside bottom of the fuel bowl.

(*d*) Using the wrench (2, fig. 256), remove the power jet valve (17, fig. 252) from the inside bottom of the fuel bowl.

(*e*) Using the wrench (3, fig. 257), remove the main discharge jet (25, fig. 252) from the passage in the outside bottom of the fuel bowl.

(*f*) Turn back the "ears" of the accelerating pump check valve (18). Turn the fuel bowl over and allow the check valve disk to fall out. Insert the tapered thread end of the check valve tool (1, fig. 258) into the check valve and screw down, counterclockwise, until the tool is firmly fastened into the check valve body. Then, raise the sliding weight up sharply against



1 Air intake body 2 Wrench 3 Vacuum cylinder assembly

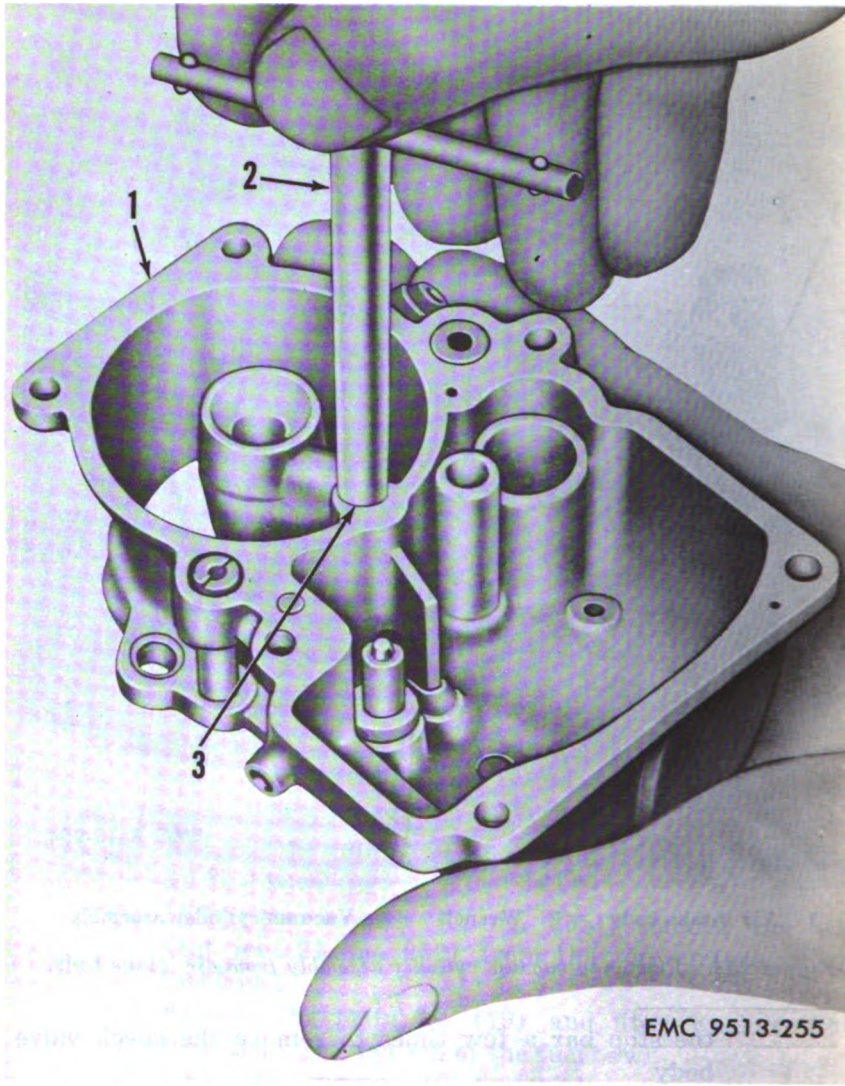
Figure 254. Removing vacuum cylinder assembly from air intake body.

the stop bar a few times to remove the check valve body.

(*g*) Remove the air vent check valve (18) from the passage in the top surface of the fuel bowl by inserting the tapered thread end of the check valve tool (3, fig. 259) into the check valve and screwing down, counterclockwise, until the tool is firmly fastened into the valve. Raise the sliding weight up sharply against the stop bar a few times to remove the check valve.

(*h*) Turn the fuel bowl over and allow the retainer washer (53, fig. 252), check ball weight (52), and check ball (51) to fall into hand.

(*i*) Remove the channel plugs (23) and the accelerator



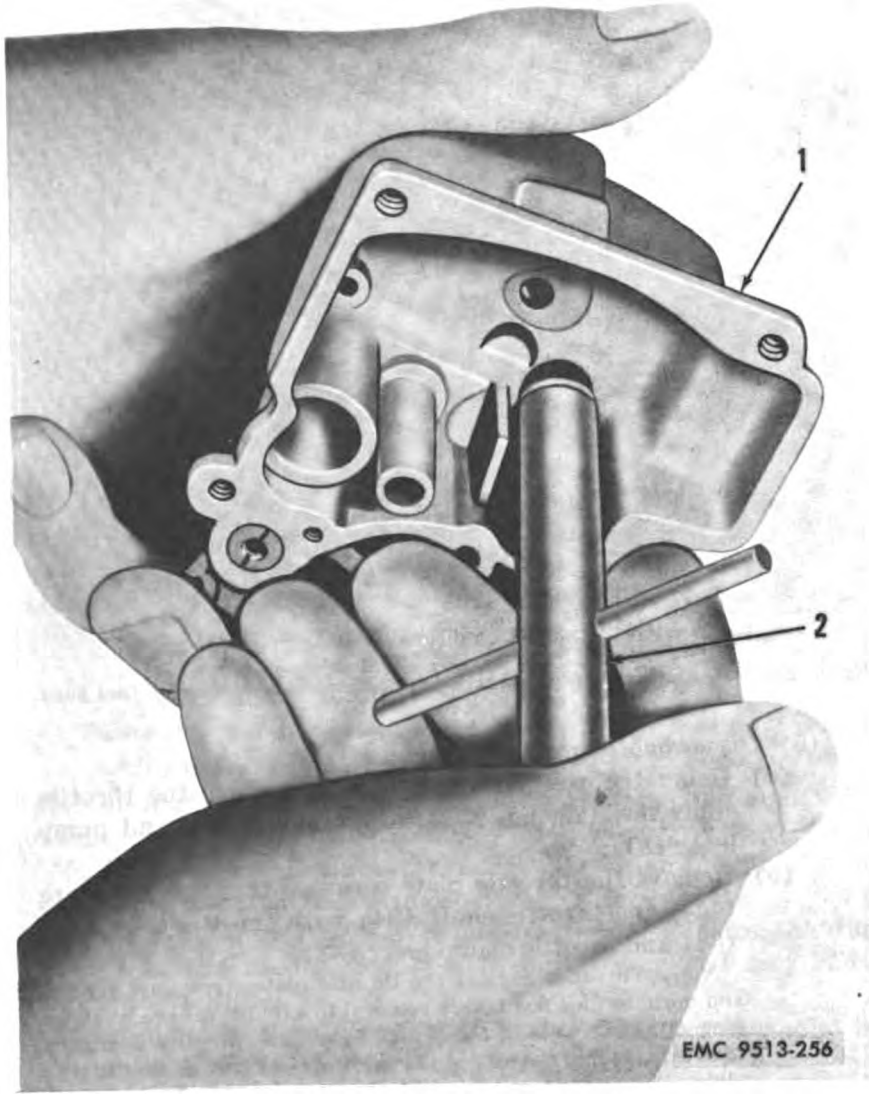
1 Fuel bowl 2 Wrench 3 Well vent jet

Figure 255. Removing well vent jet from fuel bowl.

jet passage plug (49) by first making a center-punch mark in the center of each plug. Drill a No. 46 (0.0810-inch) hole in the center of each plug.

Note. Be careful to drill only through the plug to avoid damage to the casting.

(*j*) Insert the tapered thread end of the plug extractor tool (3, fig. 260) into the holes just drilled and screw down, counterclockwise, until the tool is firmly fastened into the plug. Then strike the opposite end of

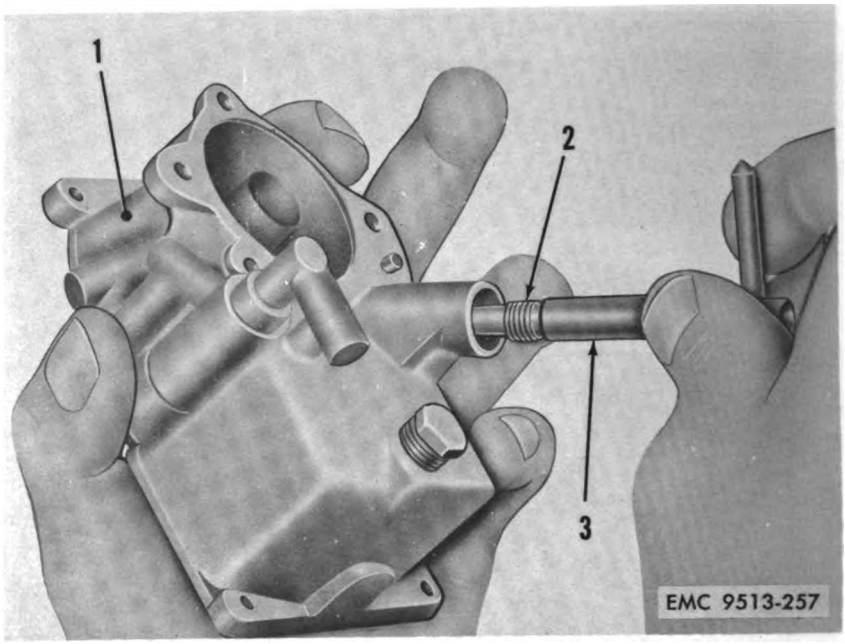


1 Fuel bowl 2 Wrench

Figure 256. Removing power jet valve from fuel bowl.

the tool sharply with a light hammer, drawing the plugs out of the casting. Use plug extractor tool (1, fig. 261) for the accelerator jet passage plug (49, fig. 252).

Note. The threaded tip of the extractor tool can easily break off unless the casting and tool are held firmly and the extractor driven away from the casting without tipping.



1 Fuel bowl 2 Main discharge jet 3 Wrench

Figure 257. Removing main discharge jet from outside bottom of fuel bowl.

(5) *Disassemble throttle body.*

(*a*) Using the wrench (2, fig. 262), remove the throttle shaft nut (29, fig. 252), lockwasher (30), and pump lever (31).

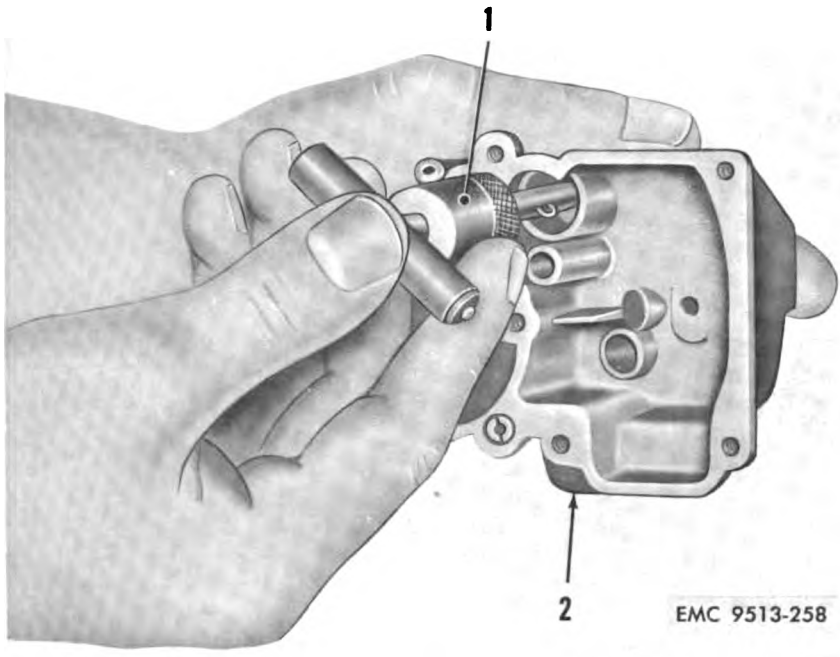
(*b*) Remove the throttle plate screws (42), throttle plate (41), and throttle shaft (34) with throttle stop lever (35) and throttle clamp lever (38).

Note. **Threaded ends of the throttle plate screws are riveted and must be filed flat before removal to avoid breakage or stripping of the threads in the shaft. Use caution in this operation to avoid scarring the side of the throttle body bore or the throttle plate. Do not attempt to remove the idle port plug from the side of the throttle body.**

332. Carburetor Inspection and Repair

Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, gum, scale, or rust from all parts. Blow out all passages, reversing the flow of compressed air to insure all dirt has been removed. Do not use a wire or drill to clean out the jets.

a. Float Assembly. Replace the float assembly if loaded with fuel, damaged, or if the float axle bearing is worn. Inspect top



1 Check valve tool 2 Fuel bowl

Figure 258. Removing accelerator pump check valve from fuel bowl.

side of float hinge for wear where it contacts the fuel valve needle.

b. Float Axle. Replace the float axle if any wear can be visually detected on the bearing surface.

c. Fuel Valve Seat and Needle Assembly. Replace the fuel valve seat and needle because both parts wear and may cause improper float level.

d. Idling Adjusting Needle and Spring. Inspect the point of the needle. This must be smooth and free of ridges.

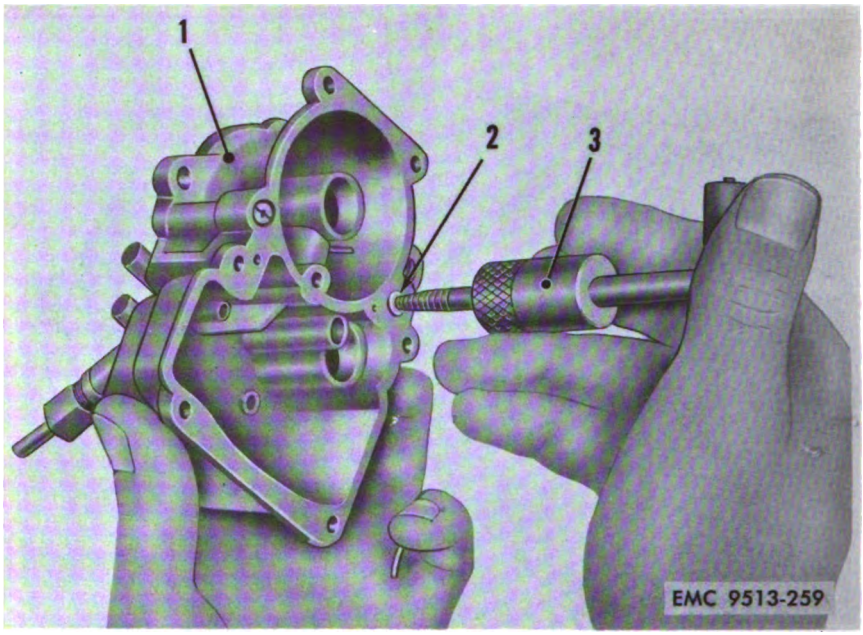
e. Throttle Plate. Inspect the throttle plate for burs or damage. Never clean a throttle plate with a buffing wheel or a sharp instrument.

f. Throttle Shaft and Lever. Replace the throttle shaft and lever if the shaft is badly worn or if the lever is loose on the shaft.

g. Accelerating Pump and Rod Assembly. Examine for wear of pump piston, rod, and pump link hole. Replace with a complete assembly.

h. Power Jet Valve. Replace the power jet valve because the extent of the wear cannot be determined by visual inspection.

i. Vacuum Cylinder Assembly. Replace the vacuum cylinder



1 Fuel bowl 2 Check valve 3 Check valve tool

Figure 259. Removing air vent check valve from top surface of fuel bowl.

assembly because the extent of the wear cannot be determined by visual inspection. Worn cylinders result in poor idling and power jet action.

j. Pump Lever. Inspect the pump lever for wear in the pump link hole.

k. Air Shutter Assembly. Inspect the air shutter assembly for bends, burs, or damaged edges. See that the poppet valve is in good condition and works freely.

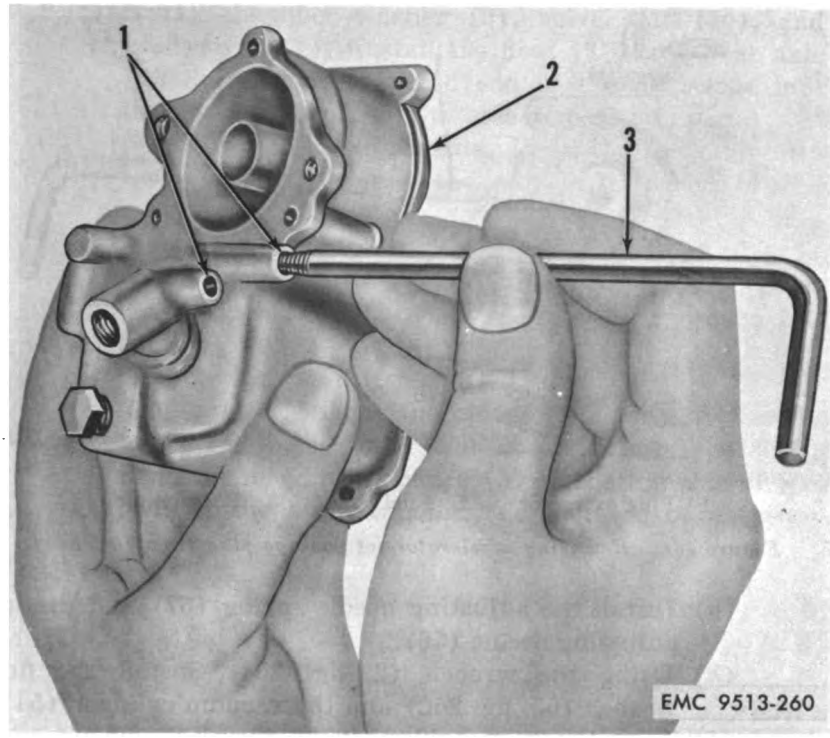
l. Air Shutter Shaft and Lever Assembly. Check bearing surfaces for wear; see that the shaft is straight and that the lever is tight on the shaft.

m. Pump Check Valve and Air Vent Check Valve. Replace the check valves because they have been damaged in removal.

n. Air Intake Assembly. Inspect machined surfaces of the air intake for dents, warpage, or other damage. The air cleaner must fit tight or otherwise dirt will get into the engine at this point.

o. Fuel Bowl. Examine the fuel bowl for loose discharge nozzle bushing. Examine inside bottom of the bowl and all passages for evidence of corrosion or gum deposits.

p. Gaskets and Washers. Replace all gaskets and fiber washers every time the carburetor is disassembled.



1 Channel plugs 2 Fuel bowl 3 Plug extractor

Figure 260. Removing channel plugs from outside fuel bowl.

333. Carburetor Reassembly—Revolving Frame Engine

a. Reassembly.

(1) *Assemble parts to air intake body.*

(*a*) Install the choke bracket (59, fig. 252) on the air intake body (8) and secure with the screw (62), lockwasher (61), and nut (58).

Note. Refer to marks placed on the air intake body during disassembly when installing the choke bracket.

(*b*) Place the choke plate (2) in the air intake body with the poppet valve toward the gasket surface.

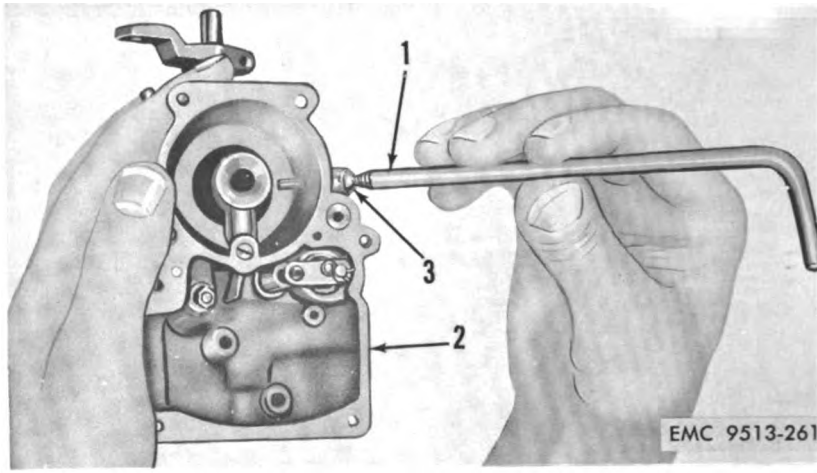
(*c*) Insert the choke shaft and lever (63).

(*d*) Close the choke plate and observe that the poppet valve spring faces the air entrance.

(*e*) With the choke plate closed, aline the hole in the choke shaft with the hole in the plate, and with the lever pointing toward the choke bracket.

(*f*) Center the choke plate in a closed position and tighten the choke plate screw (1).

Note. Do not attempt to rivet the threaded end of the screw.



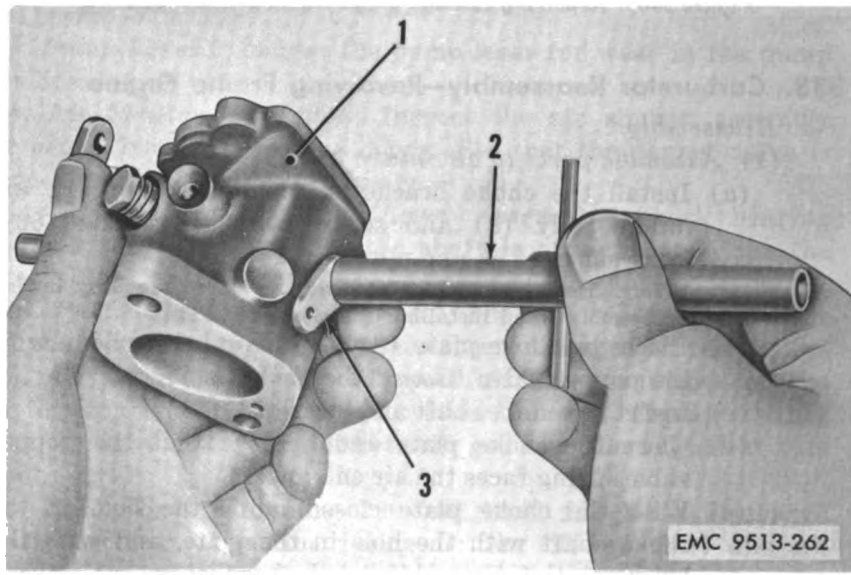
1 Plug extractor 2 Fuel bowl 3 Passage plug

Figure 261. Removing accelerator jet passage plug from fuel bowl.

(*g*) Install the adjusting needle spring (57) and the idle adjusting needle (56).

(*h*) Using the wrench (2, fig. 254), install the fiber washer (55, fig. 252) and the vacuum cylinder (54).

(*i*) Using the wrench (2, fig. 253), install the fiber washer (9, fig. 252) and fuel valve seat (10).

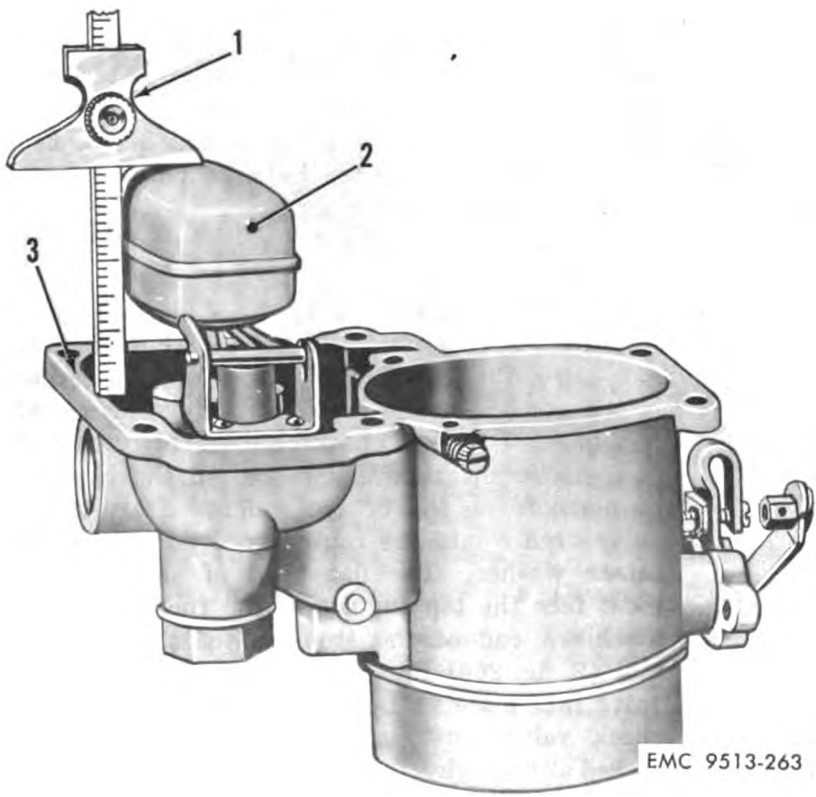


1 Throttle body 2 Wrench 3 Pump lever

Figure 262. Removing throttle shaft nut, lockwasher, and pump level from throttle body.

(*j*) Install the fiber washer (9), valve seat (10), and fuel valve (11). Install the float (12) and float axle (13). Insert the tapered end of the float axle into the float bracket on the side opposite the slot and push through the other side. Press the float axle into the slotted side until the axle is centered in the bracket.

(*k*) Using a depth gage (1, fig. 263), check the float level which should be $1\frac{17}{32}$–$1\frac{15}{32}$ inch. Adjust if necessary. Do not bend, twist, or apply pressure on the float body (2). With the air intake body in an inverted position viewed from the free end of the float, the float should be centered and at right angle to the fuel bowl cover. The float setting is measured from the machined surface (3) to the top side of the float at the highest point. To increase or decrease



1 Depth gage 2 Float 3 Air intake body machined surface

Figure 263. Measuring float position.

distances between the float and the machined surface of the air intake body, use long-nosed pliers and bend the float lever close to the float body.

(2) *Assemble parts in fuel bowl.*

(*a*) Using the punch (2, fig. 264) and a light hammer (1), drive the channel plugs (23, fig. 252) into the channels until the plug heads are flush with the surface of the casting.

Note. Only one or two light blows are required to seal the plug in the channel. Avoid driving the plug in too deep as the plug may block off other fuel passages.

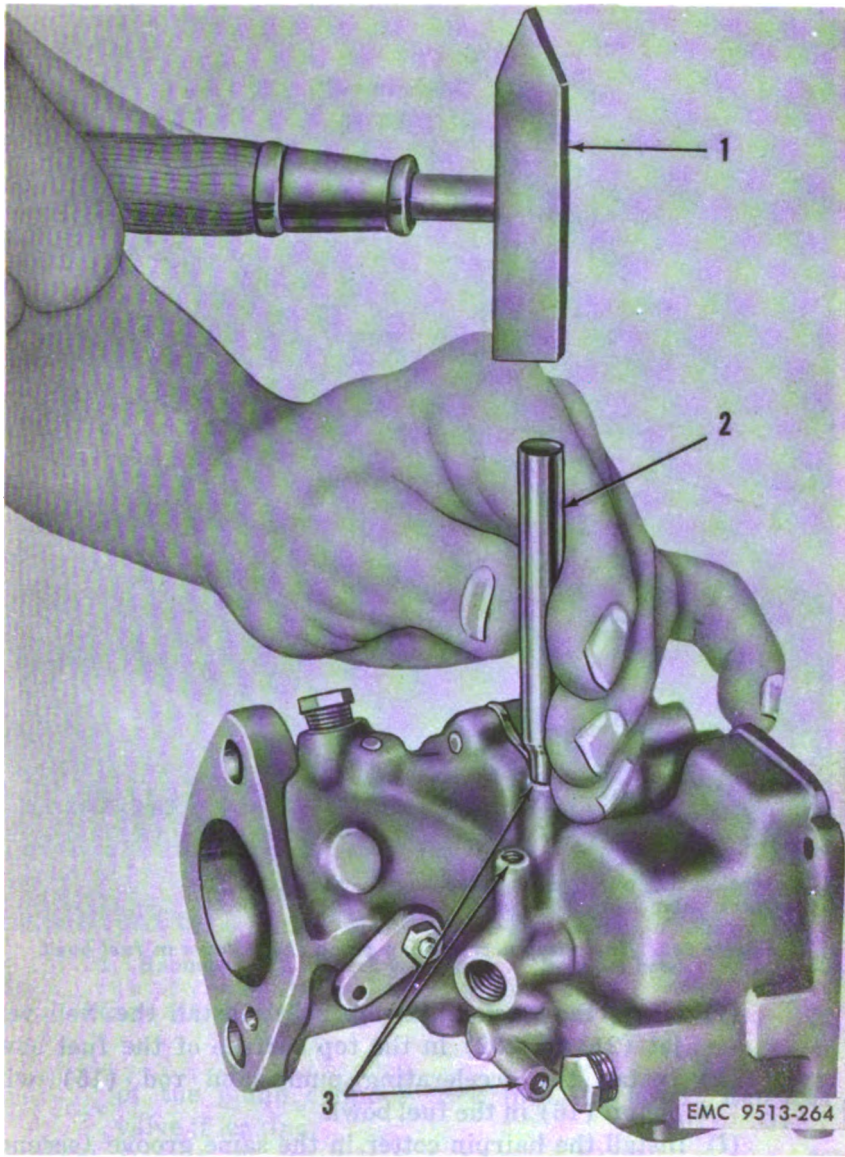
(*b*) Position the accelerator jet passage plug (49) and drive in place with a hammer.

(*c*) Using the check valve tool (2, fig. 265), install the accelerating pump check valve (18, fig. 252) in the bottom of the pump cylinder. Place the check valve on the formed end of the tool and press firmly into the counterbore. Turn the fuel bowl (22) upside down. Start the check valve tool into the pump cylinder with the guide bar in the pump rod passage and press hard to start the check valve into its seat. Turn the fuel bowl over, hold firmly in hand, and drive check valve into its seat with a few sharp blows, using a light hammer. Be sure that the check valve bottoms completely.

(*d*) Install the idle jet (50) in the top surface of the fuel bowl.

(*e*) Install the check ball (51), check ball weight (52), retainer washer (53), and the air vent check valve (18). Drop the check ball into the vertical passage next to the accelerator jet (48) in the top surface of the fuel bowl. Drop the check ball weight on top of the ball. Place the retainer washer in the check valve counterbore on top of the weight. Start the check valve evenly into the counterbore on top of the retainer washer. The flat head of the check valve must face the top surface of the fuel bowl. Fit the machined end of the stop bar of the check valve tool (2, fig. 266) into the valve and lightly drive the valve into place as far as the tool will permit. The check valve must seat evenly and should not be cocked at an angle.

(*f*) Install the fiber washer (20, fig. 252) and main jet (19) in the bottom of the fuel bowl (22) and seat firmly with a light screwdriver.



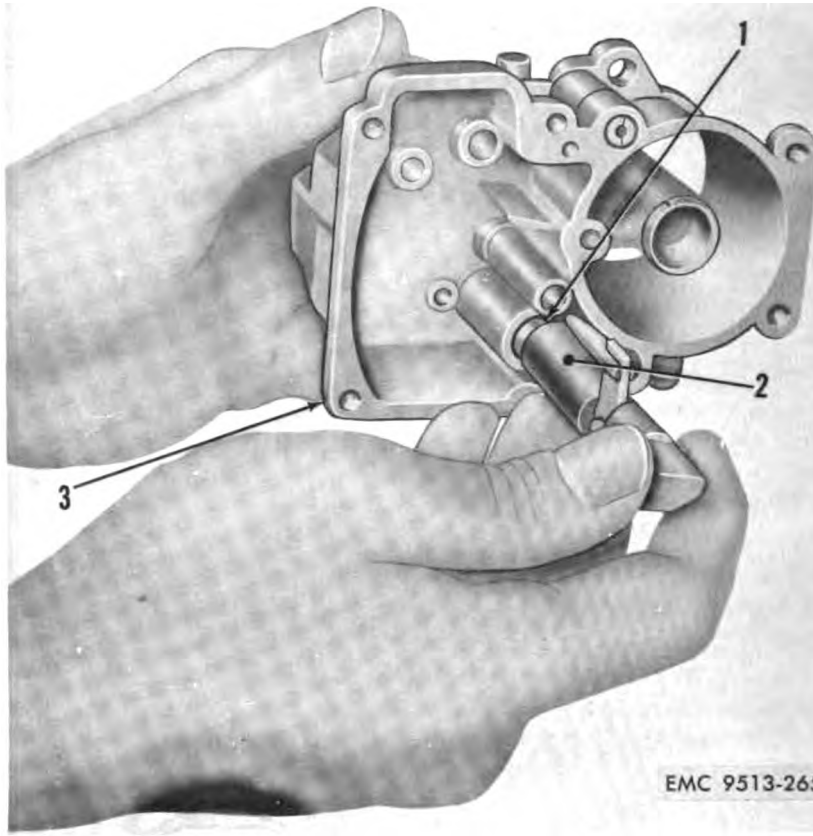
1 Hammer 2 Punch 3 Channels

Figure 264. Installing channel plugs in fuel bowl.

(*g*) Using the wrench (2, fig. 256), install the power jet valve (17, fig. 252).

(*h*) Using the wrench (3, fig. 257), install the main discharge jet (25, fig. 252) into the passage in the outside bottom of the fuel bowl.

(*i*) Install the fiber washer (9) and passage plug (26).



1 Accelerating pump check valve
2 Check valve tool
3 Fuel bowl

Figure 265. Installing accelerating pump check valve in fuel bowl.

(*j*) Using the wrench (2, fig. 255), install the well vent jet (21, fig. 252) in the top surface of the fuel bowl.

(*k*) Install the accelerating pump and rod (15) with piston (16) in the fuel bowl.

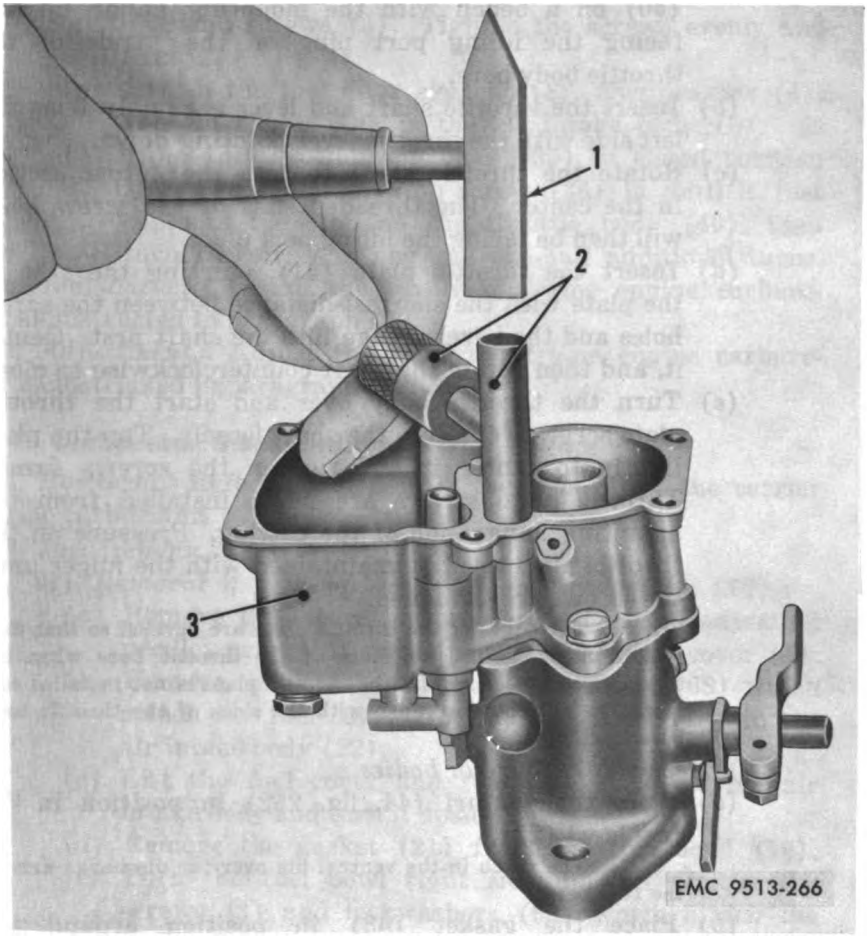
(*l*) Install the hairpin cotter in the same groove (second) of the pump rod as when removed, for a three-quarter stroke.

(3) *Check action of accelerating pump.*

(*a*) Fill the fuel bowl with fuel.

(*b*) Force the pump piston downward in the pump cylinder and notice if the air vent check valve leaks. Replace valve if leaking.

(*c*) Repeat this operation, noticing if the pump check valve leaks, allowing fuel to be forced back into the fuel bowl through the channel leading from the bottom



1 Hammer 2 Check valve tool 3 Fuel bowl

Figure 266. Installing air vent check valve in fuel bowl.

of the pump cylinder back into the bowl. Replace valve if leaking.

(*d*) Repeat this operation and observe the discharge of fuel at the accelerating jet.

Note. **It is mandatory to make this check at all times, whether or not new check valves have been installed.**

(4) Assemble parts to throttle body.

Note. **Any deviation from the following instructions will result in poor idle and low speed performance. Use new screws and do not attempt to rivet threaded ends. A drop of shellac may be placed upon them.**

(*a*) Back out the lever stop screw (36, fig. 252) in the throttle stop lever (35). Place the throttle body

(40) on a bench with the mounting flange up and facing the idling port plug on the inside of the throttle body bore.

(*b*) Insert the throttle shaft and lever assembly from the left side with the throttle lever pointing down.

(*c*) Rotate the throttle shaft to face the cutout section in the center. The threaded ends of the screw holes will then be facing the idling port plug.

(*d*) Insert the throttle plate (41), starting the side of the plate with the shortest distance between the screw holes and the beveled edge into the shaft first. Center it, and then rotate the shaft counterclockwise to close.

(*e*) Turn the throttle body over and start the throttle plate screws (42) into the shaft loosely. Tap the plate lightly to center it and tighten the screws firmly. Throttle plate screws are never installed from the mounting flange side of the casting. Pressure on the throttle plate must be maintained with the finger until the screws are tightened.

Note. The edges of the throttle plate are beveled so that they will fit flush against the sides of the throttle bore when the throttle plate is closed. If the throttle plate is not installed correctly, it will not close flush with the sides of the throttle body bore.

(5) *Assemble carburetor bodies.*

(*a*) Place the venturi (44, fig. 252) in position in the fuel bowl (22).

Note. The notch in the venturi fits over the discharge arm of the fuel bowl.

(*b*) Place the gasket (43) in position around the venturi.

Note. One hole in this gasket is reinforced with a metal ring. The idle channel bushing in the fuel bowl must pass through this ring.

(*c*) Using the wrench (2, fig. 262), install the pump lever (31, fig. 252), lockwasher (30), and throttle shaft nut (29).

Note. The pump lever must be mounted on the throttle shaft so the pump link hole will be under the pump rod, and the lever pointing upward when the throttle is closed.

(*d*) Position the throttle body (40) on the fuel bowl (22) and secure with lockwashers (46) and screws (47).

(*e*) Install the pump lever link (27), inserting long end of the link into the pump rod. Install the link retainer clip (28).

(*f*) Position the gasket (14) and the air intake body (8)

on the fuel bowl (22) and secure with lockwashers (7) and screws (6). Tighten the screws evenly and firmly.

(*g*) Install the fuel filter element (5), fiber washer (4), and filter head (3) in the air intake body (8).

(*h*) Hold the throttle stop lever (35) in closed position and turn the lever stop screw (36) in until it just contacts the stop on the throttle body (40), then turn the screw in one and one-half additional turns.

b. Installation. Install the revolving frame engine carburetor as instructed in paragraph 168.

c. Adjustment. Adjust the revolving frame engine carburetor as instructed in paragraph 168.

334. Carburetor Disassembly—Carrier Engine

a. Removal. Refer to TM 5–5252 for removal of the carrier engine carburetor.

b. Disassembly.

(1) *Removal of fuel bowl and fuel bowl cover* (fig. 267).

(*a*) Remove the idle adjusting needle (2) and adjusting needle spring (3) from the top of the fuel cover (4).

(*b*) Remove the screws (1) and lockwashers (68) which attach the fuel cover (4) and fuel bowl (18) to the air intake body (22).

(*c*) Lift the fuel cover and fuel bowl clear of the air intake body and turn it upside down.

(*d*) Remove the gasket (21) from the fuel bowl (18).

(*e*) Turn the fuel bowl right side up and remove the screws (1) and lockwashers (68) which attach the fuel cover to the fuel bowl.

(*f*) Remove the fuel cover and gasket (11) from the fuel bowl.

(*g*) Remove the discharge jet (20) and fiber washer (19) from the fuel bowl.

(2) *Disassembly of fuel bowl cover.*

(*a*) Turn the fuel cover (4, fig. 267) upside down. Remove the pump (66).

(*b*) Remove the float axle (9), using a screwdriver to push the axle through the slotted end of the hinge bracket and use the fingers to remove it the rest of the way.

(*c*) Remove the float (10) and fuel valve (8).

(*d*) Using the wrench (2, fig. 253), remove the valve seat (7, fig. 267). Remove the fiber washer (6).

(*e*) Using the check valve tool (1, fig. 258), remove the

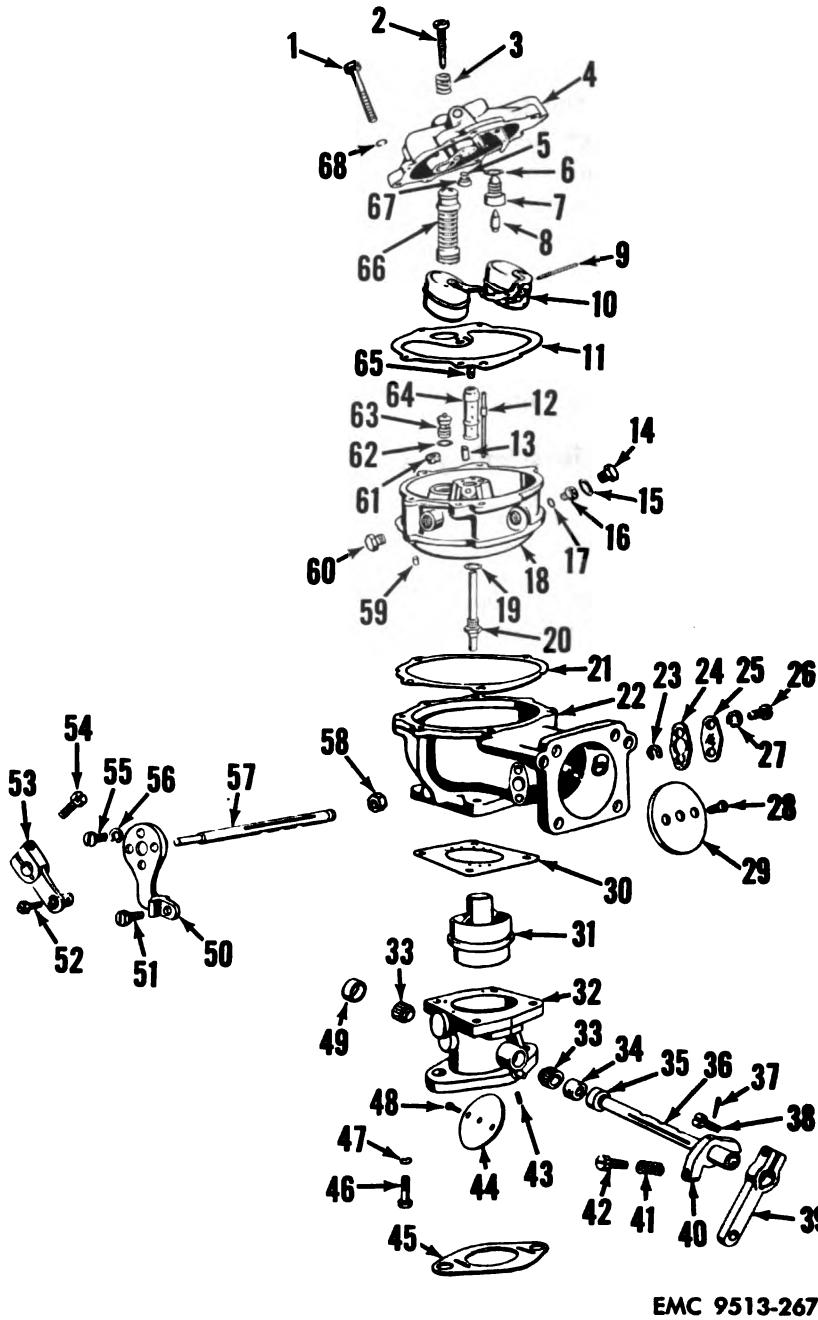


Figure 267. Carrier engine carburetor, exploded view.

check valve body (67, fig. 267). Insert the tapered thread end of the tool into the valve body and screw in (counterclockwise) until the tool is firmly attached to the body; then raise the sliding weight up sharply against the stop bar a few times to remove the body. Be careful to avoid screwing the tool too deeply into the valve body as it may damage the air vent check valve seat that is pressed into the cover directly above this point. If the hole in the valve body becomes enlarged, grind a little off the end of the tool so it will start to grip the body sooner. Remove the check valve disk (5).

(3) *Disassembly of fuel bowl.*

(*a*) Remove the idle jet (12, fig. 267), using fingers only to lift it out of the fuel bowl (18).

(*b*) Using the wrench (2, fig. 255), remove the well vent jet (13, fig. 267).

(*c*) Remove the metering well (64) by inserting the hollow end of the metering well drift (2, fig. 268) into the threaded passage in the bottom of the fuel bowl

1 Screw (4 rqr)
2 Idle adjusting needle
3 Adjusting needle spring
4 Fuel cover
5 Check valve disk
6 Fiber washer
7 Valve seat
8 Fuel valve
9 Float axle
10 Float
11 Gasket
12 Idle jet
13 Well vent jet
14 Passage plug
15 Fiber washer
16 Main jet
17 Fiber washer
18 Fuel bowl
19 Fiber washer
20 Discharge jet
21 Gasket
22 Air intake body
23 Shaft thrust washer
24 Cover plate gasket
25 Cover plate
26 Screw (2 rqr)
27 Lockwasher (2 rqr)
28 Choke plate screw (3 rqr)
29 Choke plate
30 Gasket
31 Venturi
32 Throttle body
33 Throttle shaft bushing (2 rqr)
34 Shaft packing washer
35 Packing retainer
36 Throttle shaft
37 Stop lever pin
38 Lever clamp screw
39 Throttle clamp lever
40 Throttle stop lever
41 Stop screw spring
42 Lever stop screw
43 Vacuum channel screw
44 Throttle plate
45 Flange gasket
46 Screw (4 rqr)
47 Lockwasher (4 rqr)
48 Throttle plate screw (3 rqr)
49 Shaft hole plug
50 Choke bracket
51 Tube clamp screw
52 Lever swivel screw
53 Choke lever
54 Lever clamp screw
55 Bracket screw (2 rqr)
56 Lockwasher (2 rqr)
57 Choke shaft
58 Shaft packing washer
59 Channel bushing (2 rqr)
60 Fuel level plug
61 Pump cover valve
62 Fiber washer
63 Power jet valve
64 Metering well
65 Accelerator jet
66 Pump
67 Check valve body
68 Lockwasher (4 rqr)

until it strikes the upper end of the metering well. Tap the end of the drift with a light hammer, pushing the metering well and accelerator jet (65, fig. 267) up far enough to provide a finger hold to remove it.

(*d*) Using a small screwdriver, remove the accelerator jet from the metering well.

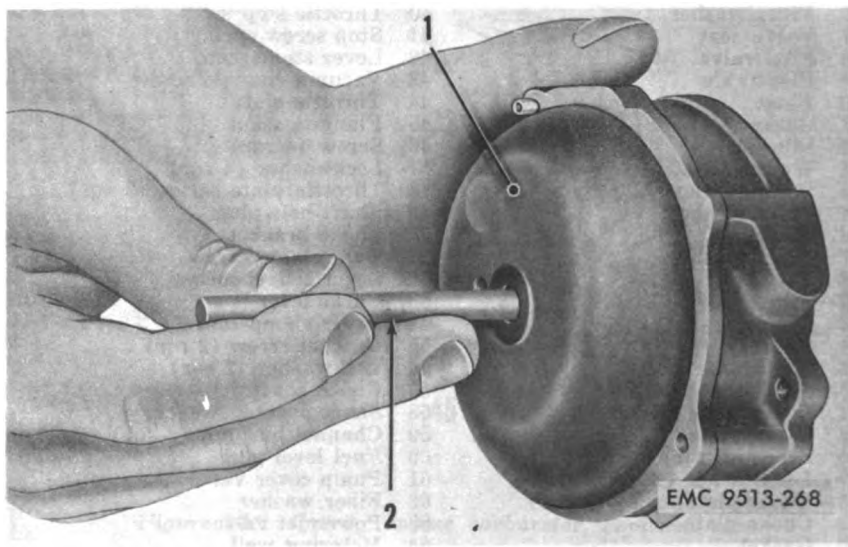
(*e*) Using the wrench (1, fig. 269), remove the power jet valve (63, fig. 267) from the bottom of the accelerating pump cylinder. Be sure to have the wrench properly centered on the valve head. Remove the fiber washer (62).

(*f*) Remove the passage plug (14) and fiber washer (15).

(*g*) Using a screwdriver inserted through the opening from which the plug (14) was removed, remove the main jet (16) and the fiber washer (17).

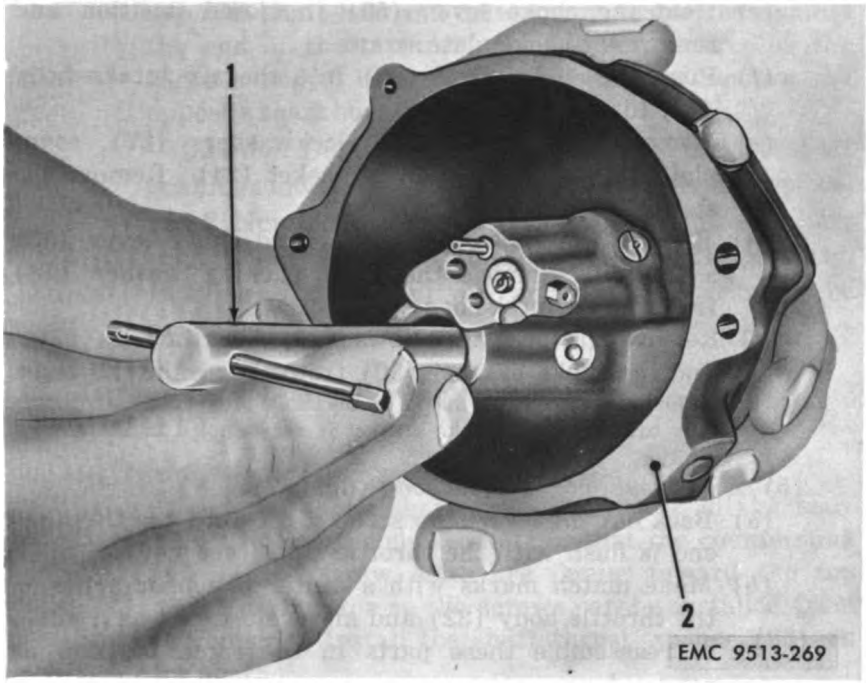
(*h*) Using the plug extractor (1, fig. 261), remove the pump cover valve (61, fig. 267) from the fuel bowl. Insert the tapered thread end of the extractor into the valve and screw in (counterclockwise) until the tool is firmly attached to the valve body, then strike the bent end with a hammer squarely and sharply a few times to pull the valve out.

Note. If the extractor pushes the valve disk out, be sure the disk is not left in the carburetor channel.



1 Fuel bowl 2 Metering well drift

Figure 268. Removing metering well from fuel bowl.



1 Wrench 2 Fuel bowl

Figure 269. Removing power jet valve from fuel bowl.

(4) *Disassembly of air intake body* (fig. 267).

(*a*) Turn the air intake body (22) upside down. Remove the screws (46) and lockwashers (47).

(*b*) Lift the throttle body (32) clear of the air intake body (22) and, at the same time, notice carefully that the holes in the gasket (30) line up with the channels in the throttle body and that there is a locating pin to prevent assembling the throttle body and air intake body incorrectly.

Note. To avoid confusion in reassembly, scribe scratch marks on the side of the throttle body and air intake body before separating them.

(*c*) Lift the venturi (31) and gasket (30) clear of the air intake body, noticing that there is a locating boss on the side of the venturi to hold the venturi in the correct position; also notice that the gasket blanks off one channel in the intake body.

(*d*) To remove the choke plate screws (28), it is first necessary to file off the riveted or peened ends of the screws.

(*e*) Hold the choke lever (53) in closed position and remove the choke plate screws.

(*f*) Push the choke plate (29) into the air intake body (22) to remove the plate.

(*g*) Remove the screws (26), lockwashers (27), cover plate (25), and cover plate gasket (24). Remove the shaft thrust washer (23).

(*h*) Remove the choke shaft (57) and choke lever (53) as a unit. Remove the shaft packing washer (58) from the air intake body.

(*i*) Remove the bracket screws (55), lockwashers (56), and the choke bracket (50) from the air intake body.

Note. Scribe scratch marks on the choke bracket and air intake body to be sure the choke bracket is reassembled in the correct position.

(5) *Disassembly of throttle body* (fig. 267).

(*a*) Back out the lever stop screw (42) until the threaded end is flush with the throttle stop lever (40).

(*b*) Make match marks with a center punch or a file on the throttle body (32) and all levers to act as a guide to reassemble these parts in the same position as removed.

(*c*) Loosen the lever clamp screw (38) and remove the throttle clamp lever (39) from the throttle shaft (36).

(*d*) Remove the throttle plate screws (48) and pull out the throttle plate (44).

Note. The threaded end of the throttle plate screws are riveted or peened and must be filed flat before removal to avoid breakage or stripping of threads in the throttle shaft. In some cases, it may be necessary to use a ¼-inch round file and cut slightly below the surface of the throttle shaft, because of a slight counterbore around the throttle shaft screw hole. Be sure to avoid striking and cutting the side of the throttle body bore or the throttle plate when filing the screws.

(*e*) Remove the throttle shaft and stop lever assembly from the throttle body.

(*f*) Remove the shaft hole plug (49). Screw a fine-thread taper tap into the packing retainer (35) until it is firmly seated. Insert a long punch or rod through the plug (49) hole and drive the punch or rod against the end of the tap until the retainer is free of the throttle body. Remove the shaft packing washer (35) from the retainer.

(*g*) Screw a taper tap, $\frac{1}{16}$-inch larger than the throttle shaft hole, into the throttle shaft bushing (33) until it is firmly seated. Insert a long punch or rod in the

opposite shaft hole and drive the punch or rod against the end of the tap until the bushing is free of the throttle body. Repeat this operation to remove the opposite shaft bushing.

Caution: Do not attempt to remove the throttle shaft bushings unless new bushings are available for replacement. New bushings are undersize and require reaming with a line reamer to fit the throttle shaft properly. Bushings, bushing driver, and line reamer must be available to successfully complete this operation.

335. Carburetor Reassembly—Carrier Engine

a. Reassembly.

(1) *Installation of parts in air intake body* (fig. 267).

(*a*) Insert the choke shaft (57) in the air intake body (22). Rotate the choke shaft so that the countersunk side of the screw holes are facing toward the top of the carburetor so the screws can be installed from the outside. Install the shaft thrust washer (23) on the shaft.

(*b*) Install the choke plate (29) from inside the air intake, with the relief valve stem up.

(*c*) Hold the choke plate in closed position to start the choke plate screws (28), then snap the plate shut a few times to aid in properly centering it, then tighten the screws securely.

(*d*) Install the cover plate gasket (24) and cover plate (25) and secure with lockwashers (27) and screws (26).

(*e*) Position the shaft packing washer (58) on the choke shaft (57). Install the choke bracket (50), lockwashers (56), and bracket screws (55) in the same position on the side of the air intake body as they were before removal. Refer to the scratch marks made on the choke bracket and the air intake body during disassembly.

(*f*) Install the choke lever (53) on the choke shaft (57) with the swivel facing the air intake body and adjust the lever so that the swivel is alined with the tube clamp screw (51) when the choke plate is closed. Tighten the lever clamp screw (54) securely.

(2) *Installation of parts in fuel bowl.*

(*a*) Using the wrench (1, fig. 269), install the fiber

washer (62, fig. 267) and power jet valve (63) in the bottom of the accelerating cylinder.

Note. Tip the fuel bowl on its side as an aid in getting the washer and valve into place more easily.

(*b*) Using a suitable screwdriver, install the fiber washer (17) and main jet (16). Install the fiber washer (15) and passage plug (14).

(*c*) Install the accelerator jet (65), with jet end up, in the metering well (64), using a small screwdriver while holding the metering well with hand only.

(*d*) Install the metering well (64) in the well channel of the fuel bowl.

Note. The metering well is designed to extend not more than 0.015-inch above the fuel bowl casting to insure a good seal at that point when the gasket and fuel cover are in place.

(*e*) Using the wrench (2, fig. 255), install the well vent jet (13, fig. 267) in the threaded passage in the center of the fuel bowl.

(*f*) Start the pump cover valve (61) into the counterbore, with the small opening out, and aline evenly so that it is not cocked. Insert formed end of the tool (2, fig. 270) into the valve and drive the valve into the counterbore with a light hammer until it strikes bottom.

Caution: Do not drive the pump cover valve more than enough to bottom the tool.

(*g*) Install the fiber washer (19, fig. 267) and the discharge jet (20) in the threaded discharge passage in the outside bottom of the fuel bowl.

(*h*) Install the idle jet (12) in the counterbored idle jet passage alongside the metering well with the long end of the tube down and using fingers only.

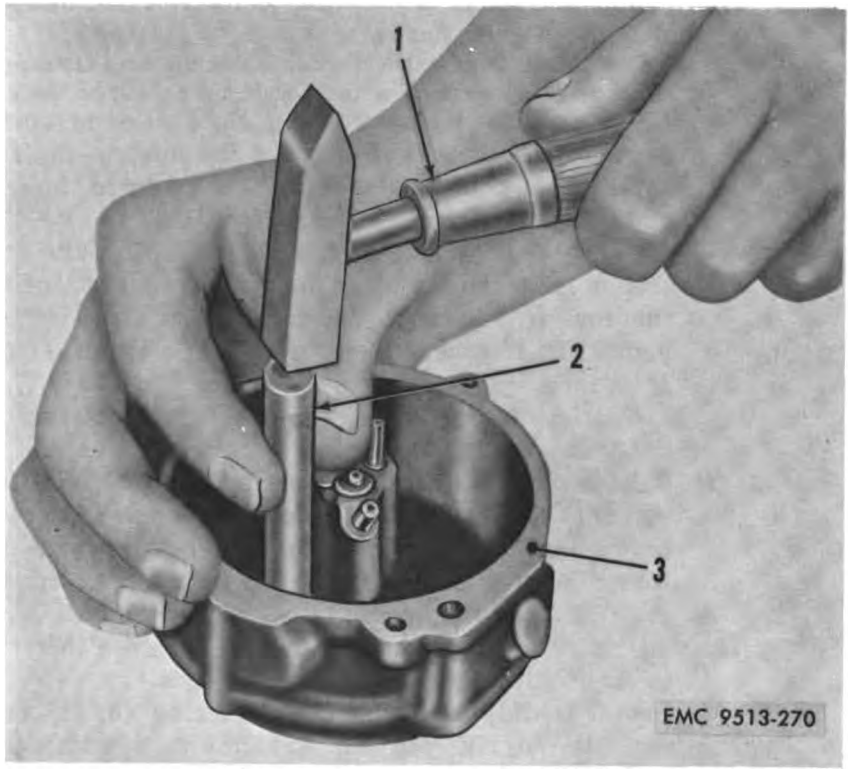
Note. The shoulder on the idle jet will be slightly above the machined surface of the fuel bowl to insure a good gasket seal between the idle jet and the metering well.

(*i*) If removed, install the fuel level plug (60).

(*j*) Check action of the pump by filling the fuel bowl with fuel and forcing the pump piston downward in the cylinder. Repeat this operation, noticing if the check valve leaks, allowing fuel to be forced back into the fuel bowl.

(3) *Installation of parts in fuel cover.*

(*a*) Place the check valve disk (5, fig. 267) in the large opening in the check valve body (67). Hold the fuel cover (4) with the machined surface down, and start the valve assembly into the counterbored passage with the small opening out. Press the body firmly



1 Hammer 2 Tool 3 Fuel bowl

Figure 270. Installing pump cover valve in fuel bowl.

into place with fingers, keeping the machined surface of the fuel cover facing down.

Note. **The check valve disk will fall out of place if the fuel cover is turned over with machined surface up.**

(*b*) Place fuel cover with check valve body resting on flat surface, and strike top side of fuel cover with a light hammer several moderate blows to drive the valve body into the counterbore.

(*c*) Turn the fuel cover over with the machined surface facing up, and lightly drive the valve body into place until the valve body surface is just flush with the fuel cover.

(*d*) Using the wrench (2, fig. 253), install the fiber washer (6, fig. 267) and valve seat (7).

(*e*) Place the fuel valve (8) in the valve seat (7).

(*f*) Position the float (10) and insert the tapered end of the float axle (9) on the side opposite the slot, using fingers to push it through to the slot, and the

handle end of a screwdriver to force it through the slotted end of the float hinge.

Note. The float axle should extend about the same distance on both sides of the hinge. The float should move freely on the axle.

(*g*) Check the float level by placing the fuel cover upside down to observe the relation of the float to the fuel cover; the float bodies must be centered and at right angles to the machined surface.

(*h*) Using a depth gage (2, fig. 271), measure the float setting from the machined surface (no gasket) of the fuel cover (3) to the top side of the float at the highest point. This measurement must be between $1^{43}/_{64}$–$1^{47}/_{64}$ inch.

Caution: Do not bend, twist, or apply pressure on the float bodies.

(*i*) If necessary to adjust the float setting, hold the fuel cover (4, fig. 272) upside down and press the float hinge down firmly against the fuel valve with the thumb of the left hand. Engage the slot on the gage (2) over the horizontal section of the float hinge (3), and bend the section up or down on either side to change the float position.

(*j*) Install the idle adjusting needle spring (3, fig. 267) and idle adjusting needle (2) in the threaded passage in the top surface of the fuel cover (4). Seat the needle lightly with fingers and back out 1¼ turns.

(*k*) Position the pump assembly (66) in the pump cylinder. Check the pump piston for free movement.

(4) *Assemble parts to throttle body.*

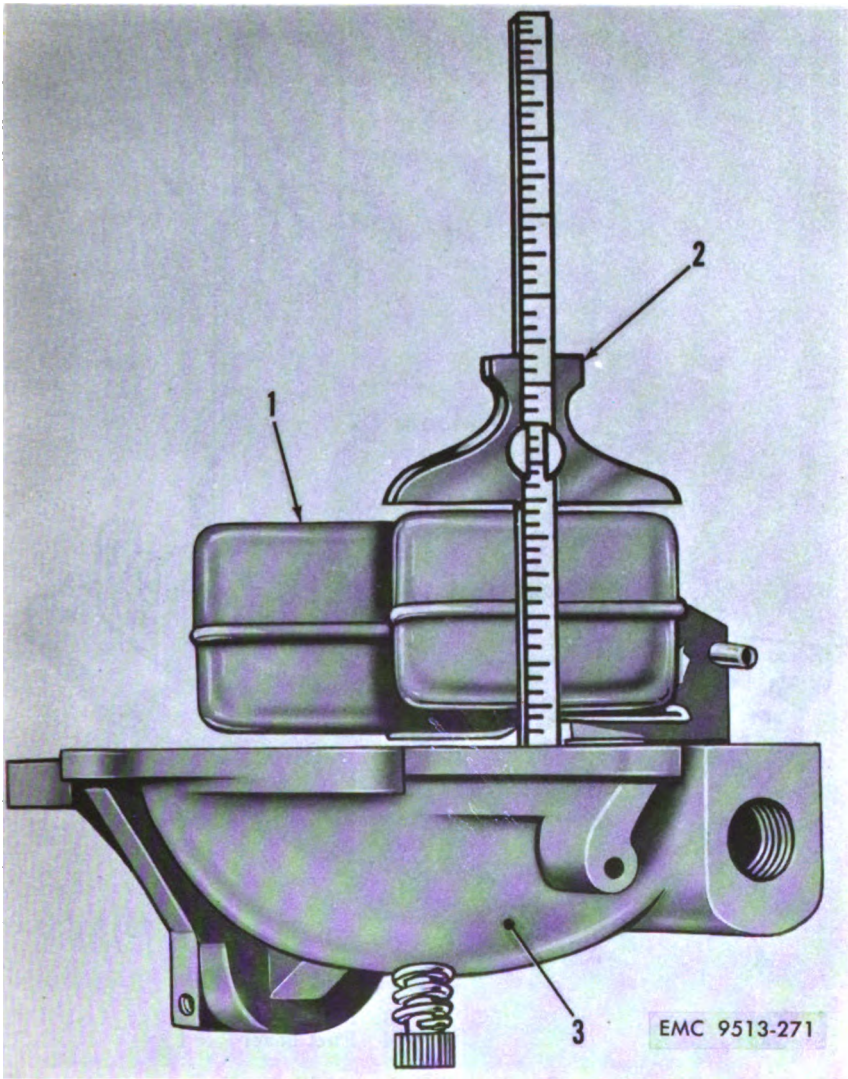
(*a*) Place new throttle shaft bushing on the bushing driver (2, fig. 273) with taper end of bushing away from the shoulder.

(*b*) Start the bushing into the shaft hole in the throttle body (3) and drive it in until it bottoms, using a light hammer (1).

(*c*) Using a line reamer (1, fig. 274), ream the bushings.

(*d*) Assemble the shaft packing washer (34, fig. 267) and packing retainer (35) and place the assembly on the bushing driver (2, fig. 273) with the packing washer facing the small end of the driver.

(*e*) Insert the small end of the driver into the throttle shaft bushing. Start the packing retainer into the counterbore in the throttle body (32, fig. 267) and drive the retainer lightly into the body until it is flush with the machined surface.



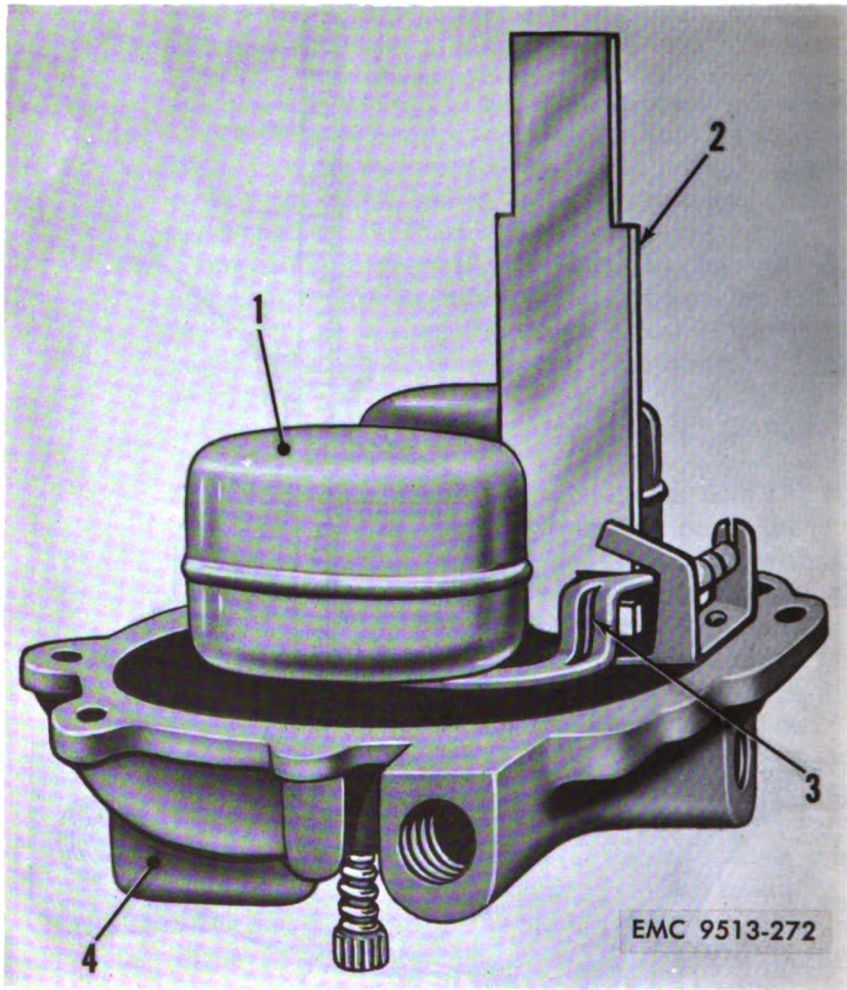
1 Float 2 Depth gage 3 Fuel cover

Figure 271. Measuring float position.

(*f*) Place the throttle body on a bench with the two-hole mounting flange up and facing the idle port plug on the inside of the throttle body bore.

(*g*) Insert the throttle shaft (36) and throttle stop lever (40) assembly in the correct position to allow the levers to be assembled in the same position as removed.

Note. **Refer to the scratch marks placed on the throttle stop lever and throttle body during disassembly.**



1 Float
2 Gage
3 Float hinge
4 Fuel cover

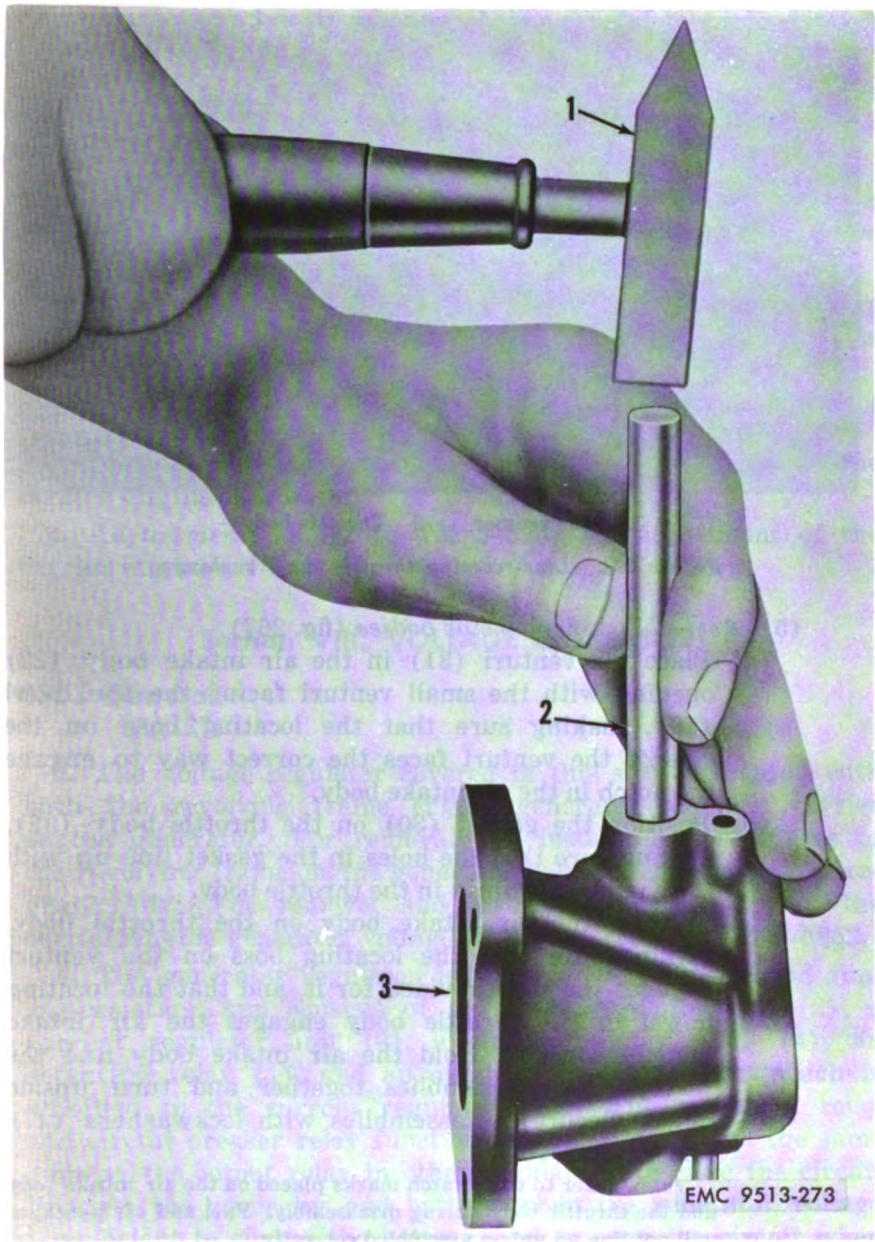
Figure 272. Bending float lever with bending gage.

(*h*) Rotate the throttle shaft to face the counter-sunk side of the throttle shaft screw holes with the slot in a vertical position.

(*i*) Insert the throttle plate (44), center it, and then rotate the throttle shaft counterclockwise to close it.

Note. The throttle plate is made with the two opposite edges beveled to fit the throttle body bore when closed. The throttle plate will not close tightly if installed upside down.

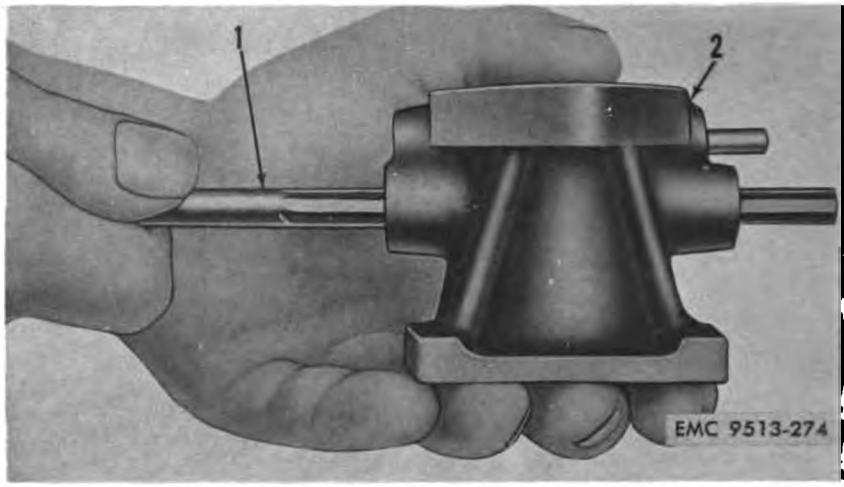
(*j*) Turn the throttle body over to start the throttle plate screws (48) into the throttle shaft loosely.



1 Hammer 2 Bushing driver 3 Throttle body

Figure 273. Installing throttle shaft bushing.

(*k*) Tap the throttle plate lightly to center it; and tighten the throttle plate screws securely, maintaining pressure on the throttle plate until screws are tightened.



1 Line reamer 2 Throttle body

Figure 274. Line-reaming throttle shaft bushings.

(5) *Assembly of carburetor bodies* (fig. 267).

(*a*) Place the venturi (31) in the air intake body (22) opening with the small venturi facing the fuel bowl (18), making sure that the locating boss on the side of the venturi faces the correct way to engage the notch in the air intake body.

(*b*) Position the gasket (30) on the throttle body (32), making sure that the holes in the gasket line up with the channel openings in the throttle body.

Position the air intake body on the throttle body, making sure that the locating boss on the venturi engages the slot provided for it, and that the locating dowel in the throttle body engages the air intake flange properly. Hold the air intake body and the throttle body assemblies together and turn upside down. Secure the assemblies with lockwashers (47) and screws (46).

Note. Refer to the scratch marks placed on the air intake body and the throttle body during disassembly. Fuel and air passages will not line up unless assembled correctly.

(*d*) Position the gasket (11) on the fuel bowl (18) and aline the holes in the gasket with the channel openings in the fuel bowl.

Note. Make certain the gasket holes are as large as the passages in the fuel cover and aline properly to prevent any possibility of restriction.

(*e*) Hold the fuel cover (4) over the fuel bowl and guide the pump (66) into the cylinder and the idle jet

(12) into its channel, being careful to avoid damage to the float and other parts.

(*f*) Place the gasket (21) on the fuel bowl, alining holes in the gasket with the passages and bushings in the fuel bowl.

(*g*) Position the fuel bowl assembly on the air intake body and secure with lockwashers (68) and screws (1). Tighten the screws evenly and firmly.

(*h*) Install the throttle clamp lever (39) and lever clamp screw (38) on the throttle shaft (36) in the same position as removed.

Note. Refer to the scratch marks placed on the lever and the throttle body during disassembly.

b. Installation. Refer to TM 5–5252 for installation of the carrier engine carburetor.

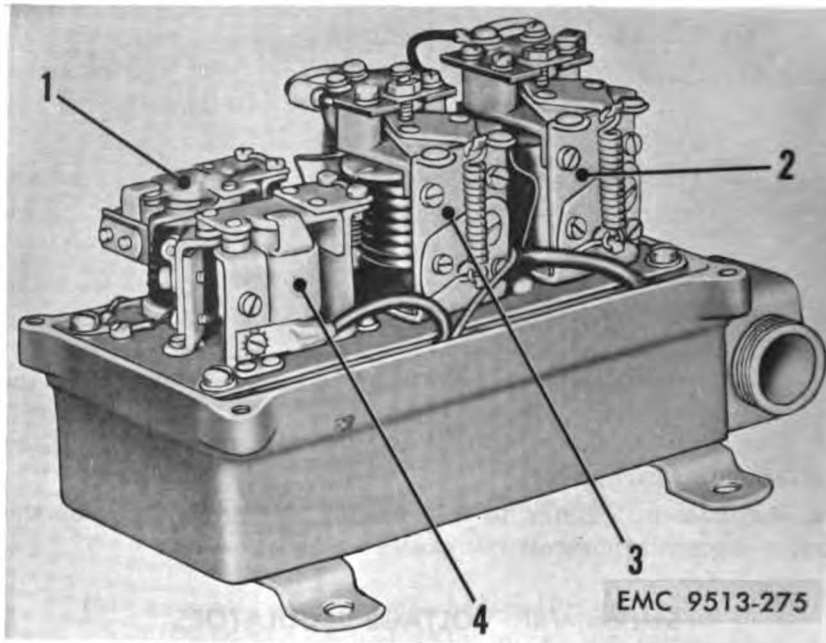
c. Adjustment. Refer to TM 5–5252 for adjustment of the carrier engine carburetor.

Section VIII. VOLTAGE REGULATORS

336. General
(fig. 275)

a. The voltage regulator covered in this section is used with both the revolving frame engine generator and the carrier engine generator. For removal and installation procedures of the revolving frame engine generator voltage regulator, see paragraph 142. For removal and installation procedures of the carrier engine generator voltage regulator, refer to TM 5–5252.

b. The generator regulator is waterproof, corrosion-and fungus-resistant, and consists of a voltage regulator unit (2), a current regulator unit (3), a circuit breaker relay (4), an actuating relay (1), and an overload circuit breaker which is attached to the current regulator unit. The actuating relay and circuit breaker relay function together to perform the same duty as the cutout relay in other regulators, to close the circuit between the generator and battery when the generator voltage is sufficient to charge the battery, and to open the circuit when the generator voltage falls below battery voltage. The voltage regulator unit maintains a constant generator voltage once voltage has been allowed by circuit valves to build up to the operational setting. The current regular unit limits the generator current output to the maximum safe value. The overload circuit breaker is primarily a safety switch which opens the circuit breaker relay should it fail to open normally.



1 Actuating relay
2 Voltage regulator unit
3 Current regulator unit
4 Circuit breaker relay

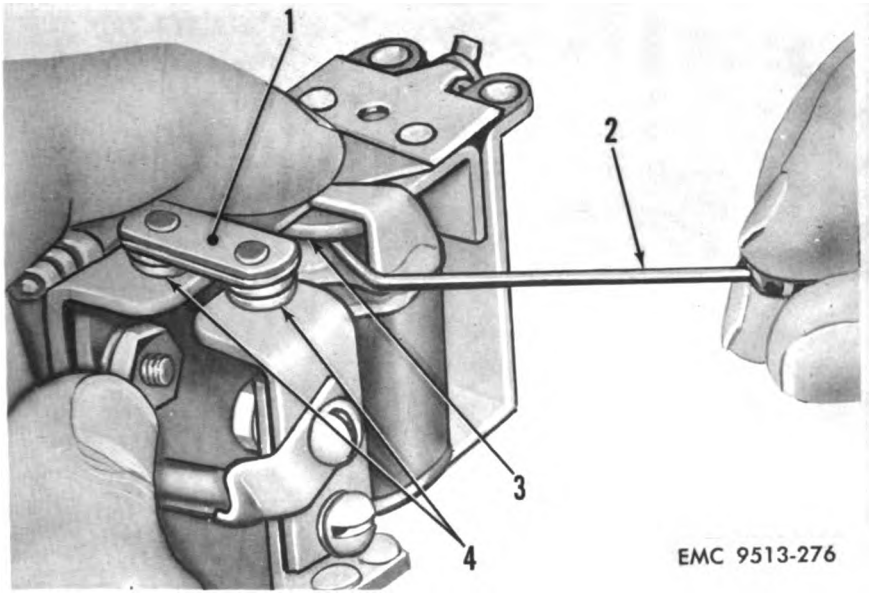
Figure 275. Voltage regulator, cover removed.

337. Voltage Regulator Adjustment

a. Circuit Breaker Relay. The circuit breaker relay is the first unit in the regulator to be checked and adjusted. Mechanical adjustments should be made with the regulator disconnected from the battery and preferably off the engine. Electrical checks and adjustments can be made with the regulator on or off the engine. If checked off the engine, the regulator must be in the position in which it mounts on the engine when being electrically checked, and it must be at operating temperature.

(1) *Air gap.* Be sure the regulator is disconnected. Place finger on the center of the armature (1, fig. 276) and push down until the armature points and the points (4) just touch. Using a pin gage (2), measure the air gap (3) between the armature and the center of the core. The air gap must measure 0.042-inch. Adjust to this dimension, if necessary, by loosening the attaching screws (2, fig. 277) and raising or lowering the contact brackets (1) as required. Be sure the points are in accurate alinement and that both sets of points close simultaneously before tightening the screws.

(2) *Point opening.* Be sure the regulator is disconnected.



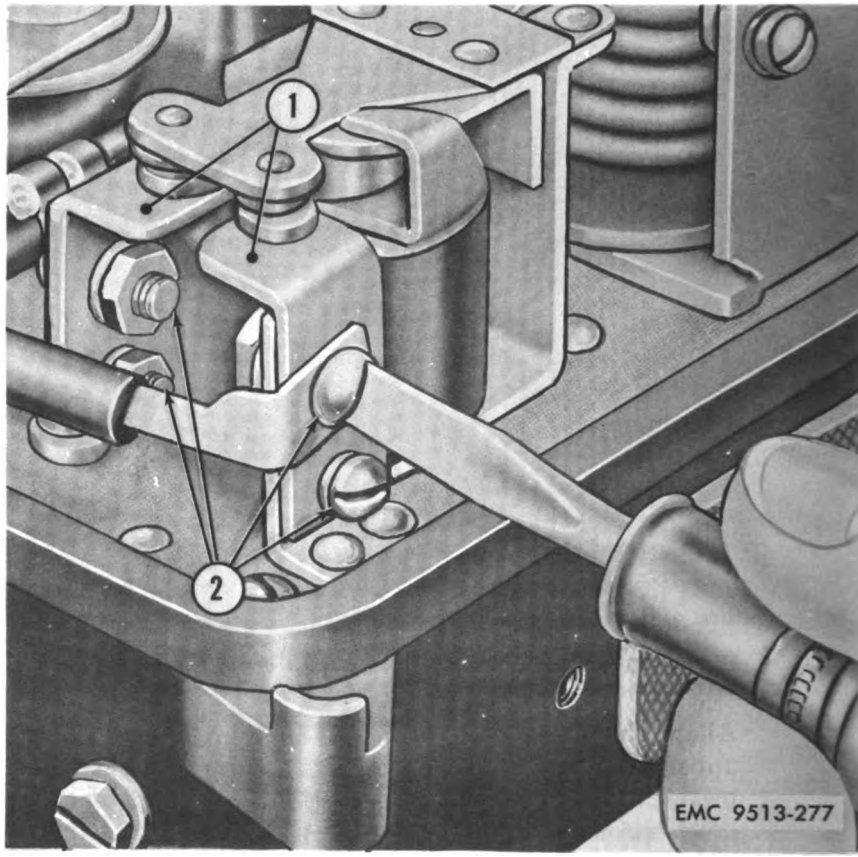
1 Armature 2 Pin gage 3 Air gap 4 Points

Figure 276. Checking air gap on circuit breaker relay.

Allow the armature (1, fig. 278) to rest against the upper armature stop (2). Using a thickness gage (4), measure the point opening (5). The point opening must measure 0.040-inch. Using a bending tool (3), adjust to this dimension, if necessary, by bending the upper armature stop (2) as required.

Caution: Do not break the winding lead soldered to the lower part of the upper armature stop.

(3) *Closing voltage.* Disconnect the instrument panel ammeter (3, fig. 279), load line (4), and battery (5) from the four-terminal connector (8) of the voltage regulator (10). Connect the improvised relay test wiring harness (7) to the generator (6) and voltage regulator (10). Connect a test voltmeter (2) between the regulator armature terminal (A) and the regulator ground (1). Start the generator and slowly increase its speed. While doing so, hold the actuating relay armature down in order to keep the upper contacts open and the lower contacts closed. Notice the voltmeter reading at which the circuit breaker relay contact points close. The voltmeter should read 14.0–17.0 volts. Adjust, if necessary, by using a bending tool (2, fig. 280) to bend the lower spring hanger up to

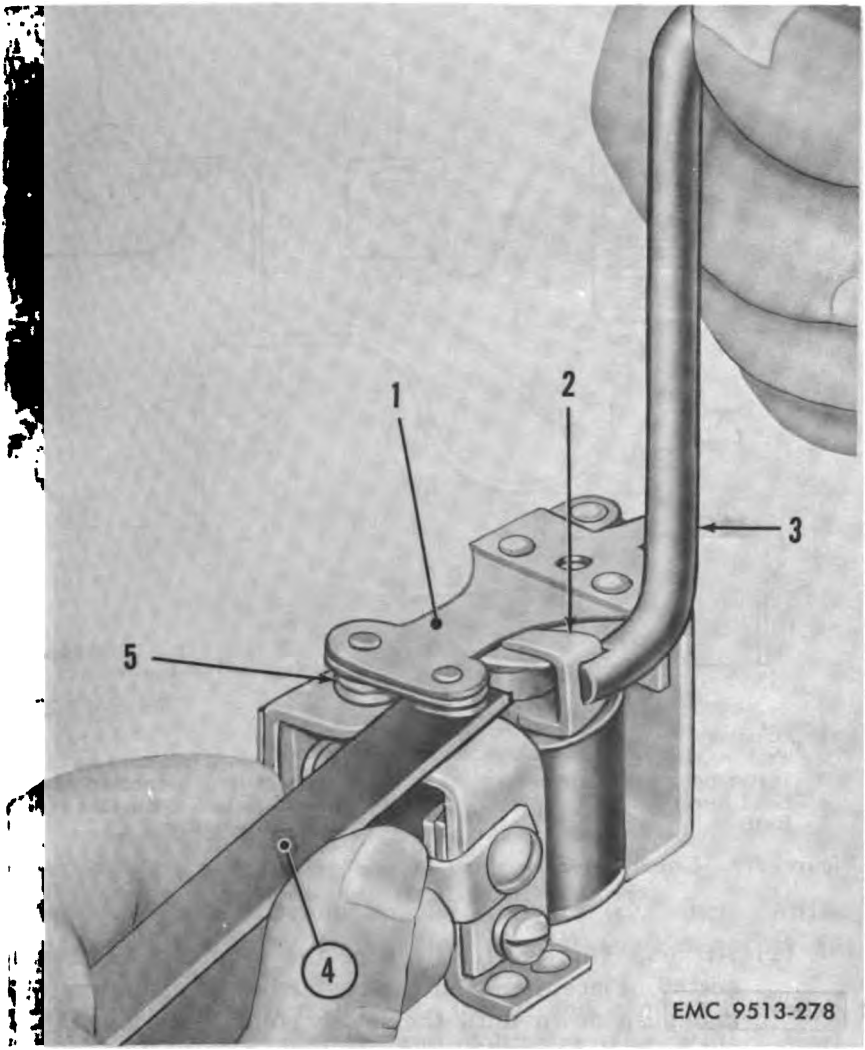


1 Contact brackets 2 Attaching screws

Figure 277. Adjusting air gap on circuit breaker relay.

decrease or down to increase the closing voltage. After each change of adjustment and before taking the closing voltage reading, reduce the generator speed and manually open the voltage regulator unit points momentarily. This will cause the voltage to drop so that the effect of residual magnetism in the relay core is nullified. Then allow the voltage regulator unit points to close and slowly increase generator speed to check the circuit breaker relay closing voltage. It may be necessary to repeat this operation several times in order to get an accurate check of the closing voltage.

(4) *Sealing voltage.* After the circuit breaker relay closing voltage has been adjusted, the sealing voltage should be checked. The sealing voltage is the voltage at which the armature seals against the winding core.

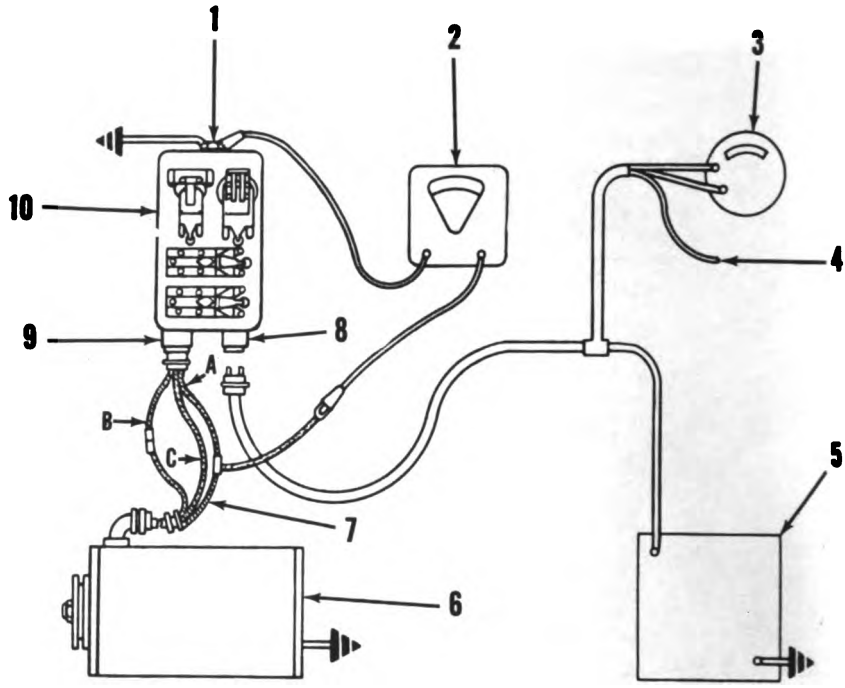


1 Armature
2 Armature stop
3 Bending tool
4 Thickness gage
5 Point opening

Figure 278. Checking and adjusting point opening on circuit breaker relay.

The sealing voltage should be 19.5–23.0 volts. Adjustment is made, if necessary, by bending the armature flat hinge spring. Use care to avoid distorting the spring. After sealing voltage adjustment is made, readjust the point opening ((2) page 616) and the air gap ((1) page 616).

b. Actuating Relay. The actuating relay should be checked and adjusted after the circuit breaker relay.

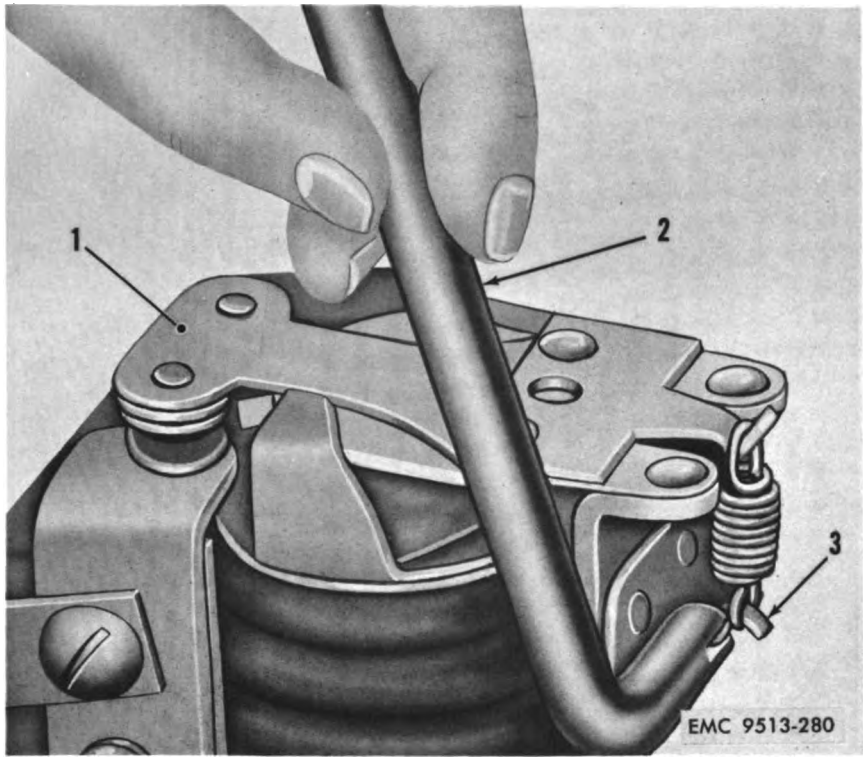


1	Ground	6	Generator
2	Test voltmeter	7	Relay test wiring harness
3	Instrument panel ammeter	8	Four-terminal connector
4	Load line	9	Three-terminal connector
5	Battery	10	Voltage regulator

Figure 279. Circuit breaker relay closing voltage and actuating relay operating voltage test wiring diagram.

(1) *Air gap* (fig. 281). Be sure the regulator is disconnected. Place finger on the center of the armature (1) and push down until the lower points just touch. Do not push down on the support spring (2). Using a pin gage (5), measure the air gap between the armature and the center of the core. The air gap should be 0.038-inch. Make certain the measure is not taken at the brass pin in the armature. Adjust, if necessary, by loosening the contact bracket attaching screws (3) and raising or lowering the bracket as necessary. Be sure the contact bracket is square on the mounting bracket before tightening the screws.

(2) *Point opening* (fig. 281). Be sure the regulator is disconnected. Place finger on the center of the armature (1) and push down until the upper points open; then release until the upper points just touch. Using a thickness gage, measure the point opening (4). The

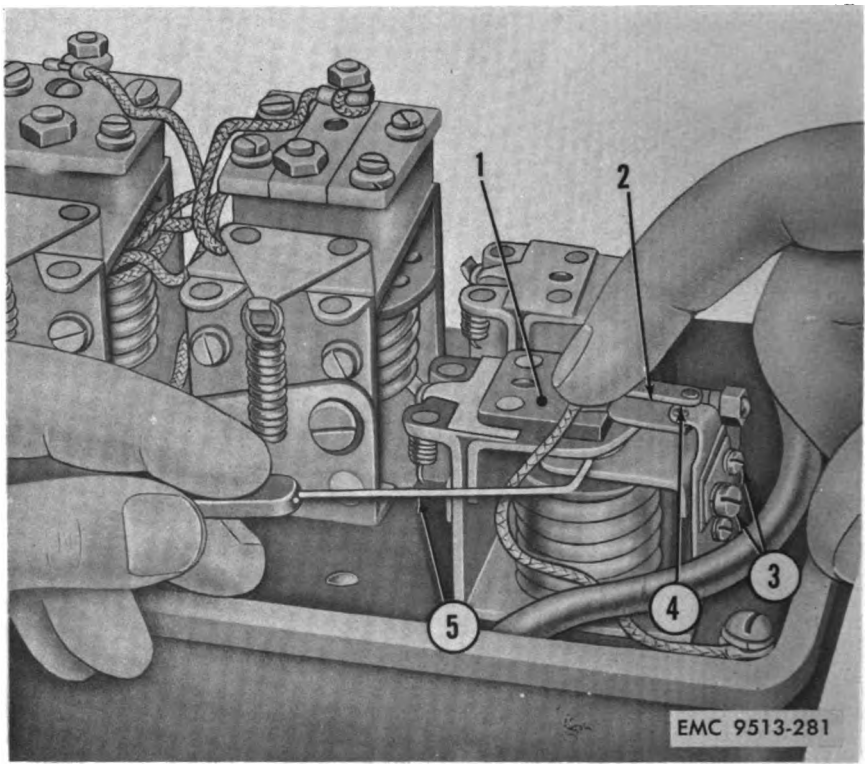


1 Armature 2 Bending tool 3 Lower spring hanger

Figure 280. Adjusting closing voltage on circuit breaker relay.

point opening should measure 0.037-inch. Adjust, if necessary, by bending the flat support spring (2) as required.

(3) *Operating voltage.* Install and connect the relay test wiring harness and voltmeter (fig. 279). Start the generator and slowly increase its speed. Notice the voltmeter reading at which the relay lower contact points close. An aid toward accurate checking is provided by the sharp click produced as the circuit breaker relay contact points close in response to the closing of the actuating relay lower contacts. The voltmeter reading should be 26.0 volts. Adjust, if necessary, by using a bending tool (2, fig. 282) to bend the lower spring hanger (3) down to increase and up to decrease the operating voltage. After each change of adjustment and before taking the operating voltage reading, reduce the generator speed and open the voltage regulator points momentarily. This will cause the voltage to



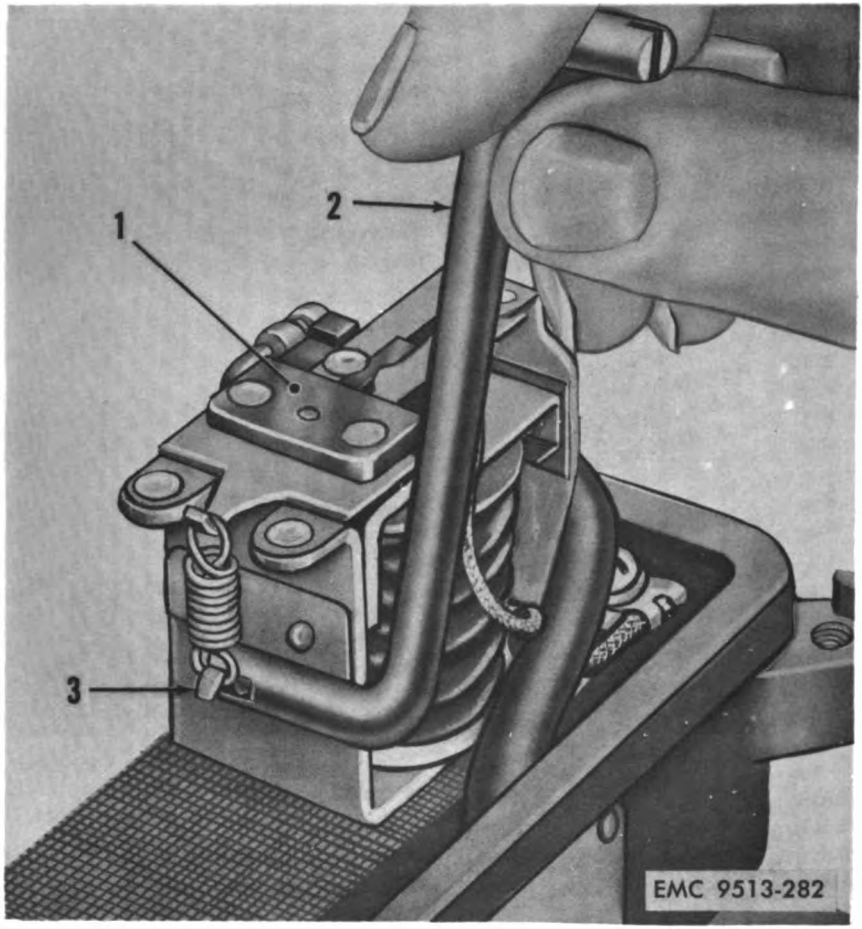
1 Armature
2 Support spring
3 Bracket attaching screws
4 Point opening
5 Pin gage

Figure 281. Actuating relay air gap and point opening check and adjustment.

drop so that the effect of residual magnetism is nullified. Then allow the voltage regulator points to close and slowly increase generator speed to check the relay operating voltage. It may be necessary to repeat this operation several times in order to get an accurate check of the closing voltage.

c. Voltage Regulator Unit.

(1) *Air gap.* Be sure the regulator is disconnected. Push the armature (1, fig. 283) down until the points open, then release until the points barely close. Using a pin gage (2), measure the air gap between the armature and the part of the core next to the residual pin. In taking the measurement, do not push the contact screw flat supporting spring off the fiber insulator. The air gap should measure 0.084-inch. Adjust the air gap, if necessary, by loosening the locknut (2, fig. 284) and turning the contact screw (1). A convenient method

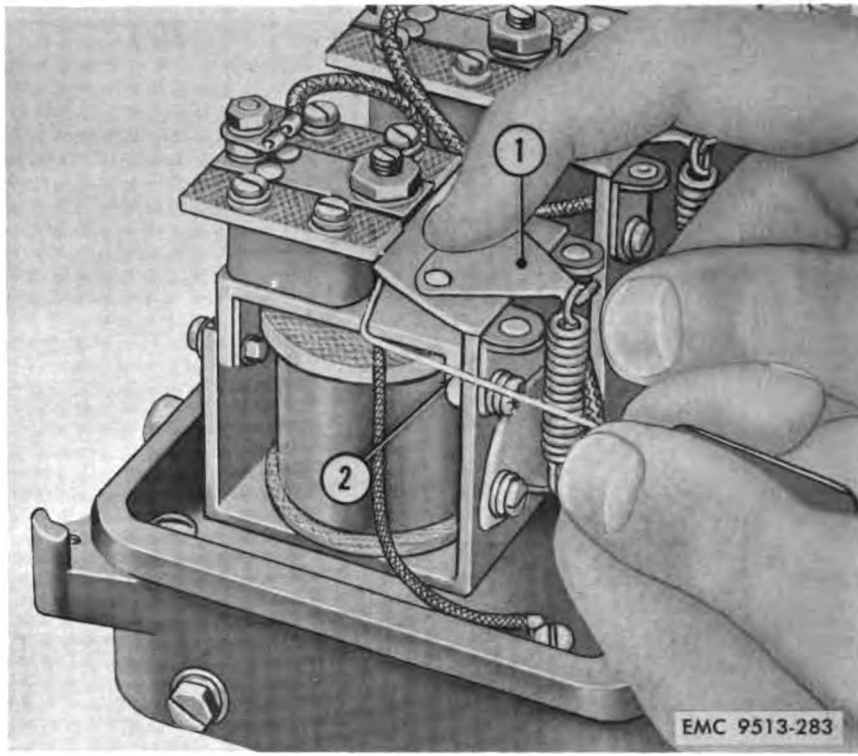


1 Armature 2 Bending tool 3 Lower spring hanger

Figure 282. Adjusting actuating relay operating voltage.

of adjusting the air gap is to insert the gage, push the armature down against it, and turn the contact screw until the contact points barely touch.

(2) *Voltage setting.* Using an improvised test wiring harness, connect the regulator as shown in figure 285. With the regulator cover in place, operate the generator at the specified speed for 30 minutes to bring the regulator to operating temperature. Retard the generator, then slowly bring it back to 50 percent above specified speed. Notice the voltmeter reading which should be 28.5 volts. Adjust, if necessary, by loosening the lockscrew (1, fig. 286) and turning the eccentric screw (2) to change the spiral spring tension. Increas-



1 Armature 2 Pin gage

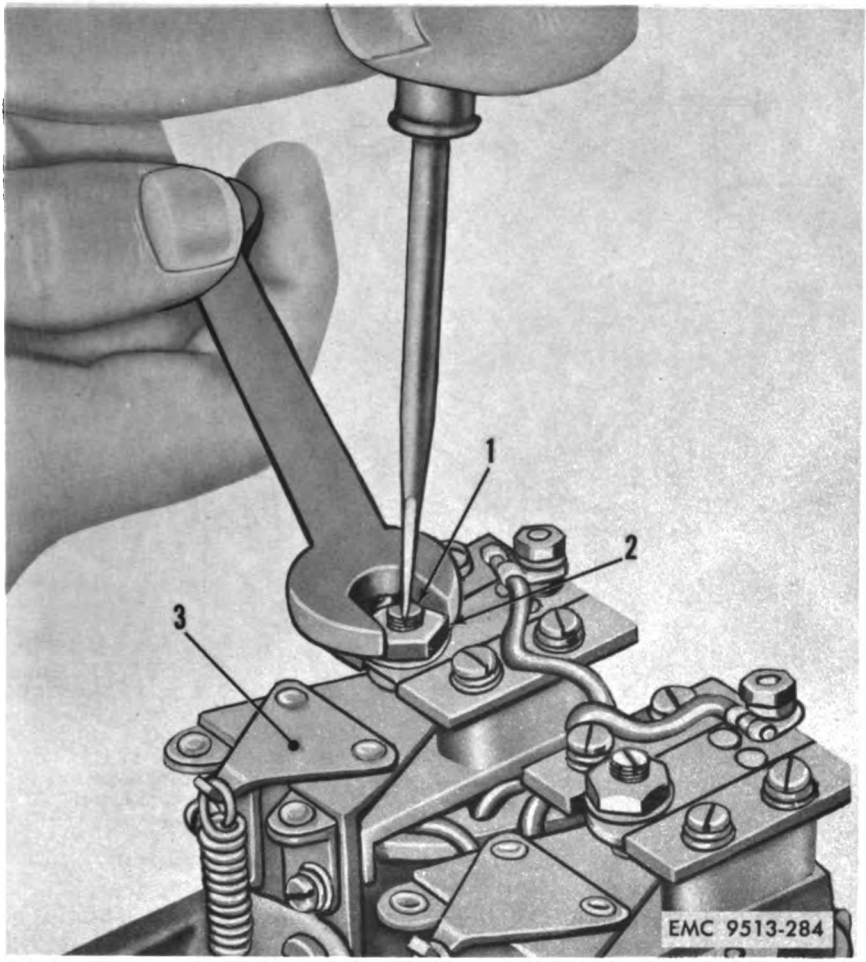
Figure 283. Checking air gap on voltage and current regulator units.

ing spring tension increases, and decreasing spring tension decreases, the voltage setting. After each change of adjustment, momentarily open the voltage regulator points by hand before taking the voltage readings.

d. Current Regulator Unit.

(1) *Air gap.* Adjust the air gap of the current regulator unit in the same manner as for the voltage regulator unit (*c*(1) page 622).

(2) *Current setting.* Using an improvised test wiring harness, connect the regulator as shown in figure 287. To prevent voltage regulator action from interfering with the check, remove the regulator cover and place a jumper lead across the voltage regulator unit contact points. Operate the generator at the specified speed for 30 minutes to bring the regulator to operating temperature. Lights and accessories should be turned on during the test to prevent high voltage. Notice the



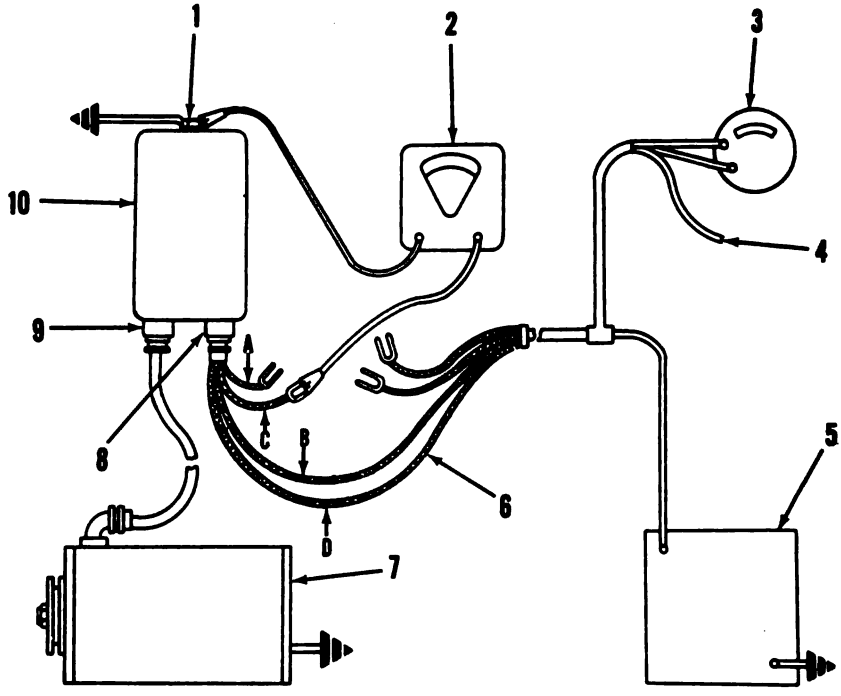
1 Contact screw 2 Locknut 3 Armature

Figure 284. Adjusting air gap on voltage and current regulator units.

reading on the test ammeter which should be 40 amperes. Adjust, if necessary, by loosening the lockscrew (1, fig. 286) and turning the eccentric screw (2) to change the spring tension. Increasing spring tension increases, and decreasing spring tension decreases, the current setting.

Caution: Do not, under any condition, adjust the current setting above the rated output of the generator.

e. Overload Circuit Breaker (fig. 288). To check mounting height of the overload circuit breaker (3), insert a 0.050-inch gage at point (6) between the current regulator armature (1) and core and push the armature down. With the armature rest-



1	Ground	6	Test wiring harness
2	Test voltmeter	7	Generator
3	Instrument panel ammeter	8	Four-terminal connector
4	Load line	9	Three-terminal connector
5	Battery	10	Voltage regulator

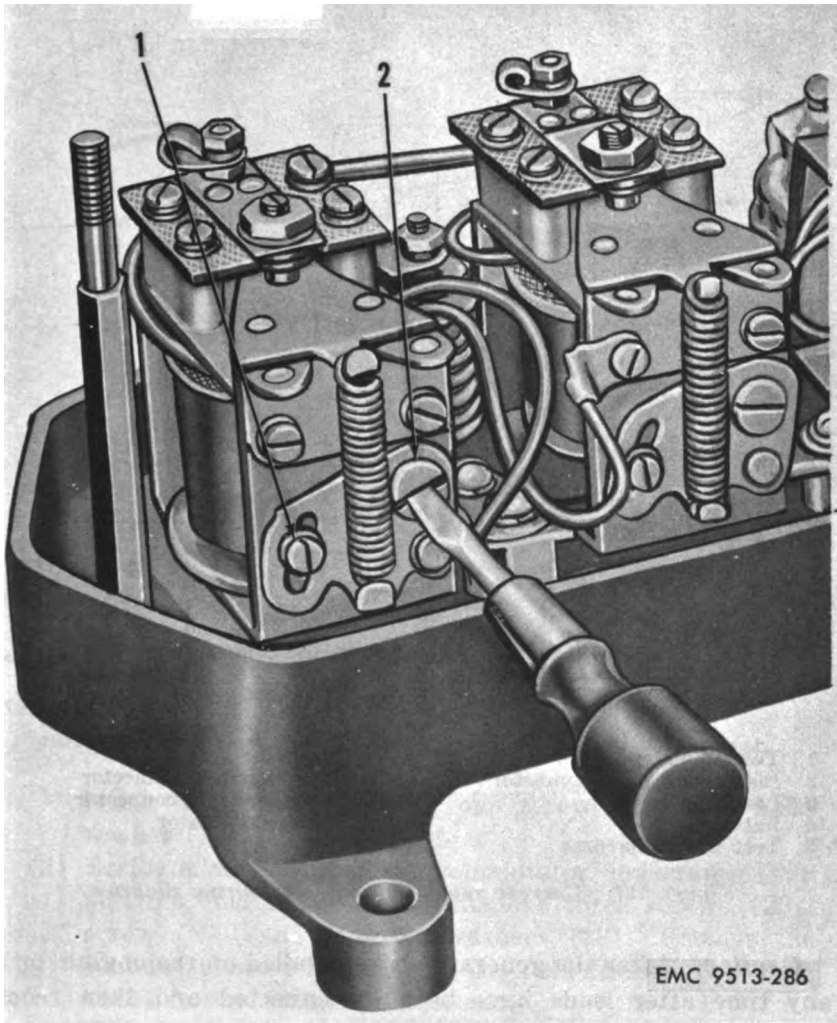
Figure 285. Voltage regulator unit test wiring diagram.

ing against the gage, the underside of the armature should be just touching the fiber bumper (5). Adjust, if necessary, by loosening the attaching screws (4) and raising or lowering the overload circuit breaker (3). After adjusting, check to see that the point opening (2) is at least 0.020-inch. Less clearance may result in interference with normal current regulator action. To achieve proper clearance, it may be necessary to adjust the current regulator air gap (*d*(1) page 624). When the current regulator armature seals against the core, the contact points of the overload circuit breaker should also open at least 0.020 inch. Initial tension on the overload circuit breaker points should be 7 to 9 ounces.

Section IX. GENERATORS

338. General

a. The generator covered in this section is a 24-volt, heavy-duty, ventilated, four-brush, shunt type unit with sealed ball

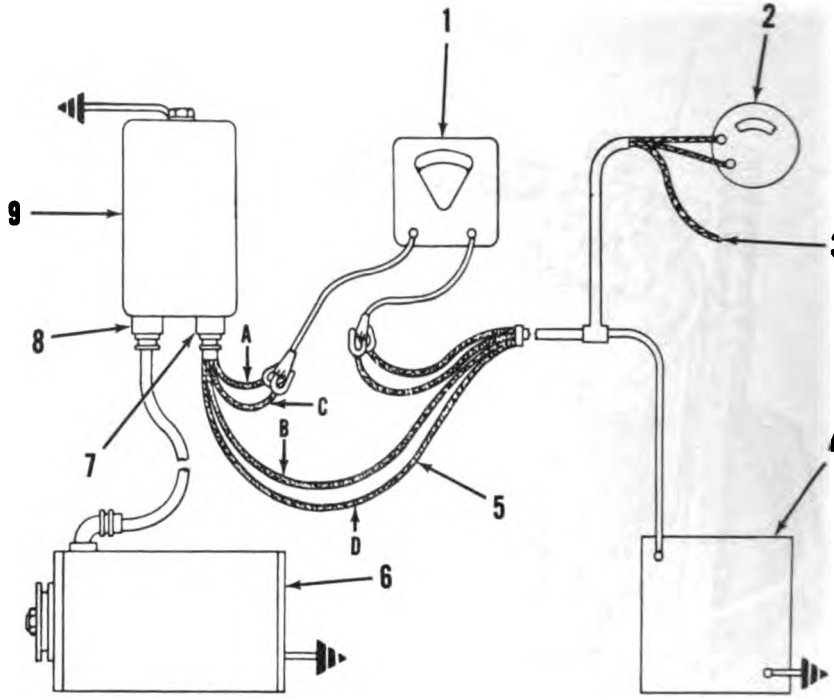


1 Lockscrew 2 Eccentric screw

Figure 286. Adjusting voltage regulator and current regulator setting.

bearings in both the drive end and the commutator end. A special terminal housing is incorporated on the field frame and houses the armature and field terminals and also a concentric condenser in the armature circuit. The generator is fungicidal- and corrosion-resistant treated.

b. Except for the drive pulley, the generator is applicable to both the carrier engine and the revolving frame engine. For removal and installation procedures for the revolving frame generator, see paragraph 144. For removal and installation procedures for the carrier engine generator, refer to TM 5–5252.



1 Test ammeter
2 Instrument panel ammeter
3 Load line
4 Battery
5 Test wiring harness
6 Generator
7 Four-terminal connector
8 Three-terminal connector
9 Voltage regulator

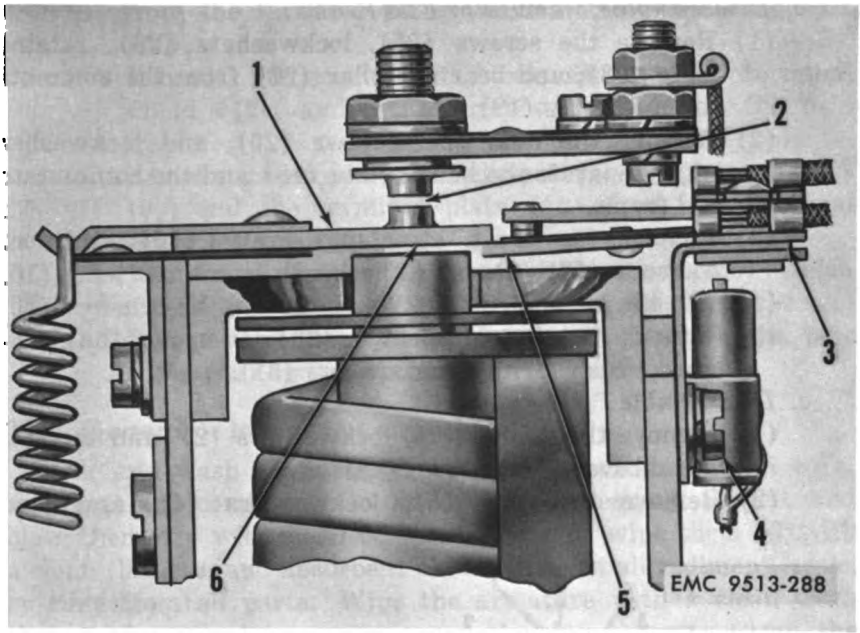
Figure 287. Current regulator unit test wiring diagram.

Caution: After the generator is reinstalled on the engine, or at any time after leads have been disconnected and then reconnected to the generator, disconnect the lead from the "F" terminal of the generator, and then momentarily connect between this terminal and the "BATTERY" terminal of the voltage regulator or the insulated battery terminal with a jumper lead. This allows a momentary surge of current from the battery to the generator which correctly polarizes the generator with respect to the battery it is to charge.

339. Generator Disassembly
(fig. 289)

a. Disassemble Into Main Subassemblies.

(1) Remove the screws (25), lockwashers (4), and the cover (24). Disconnect the field lead terminal from the



1 Current regulator unit armature
2 Point opening
3 Overload circuit breaker
4 Attaching screw
5 Fiber bumper
6 Gage point

Figure 288. Overload circuit breaker mounting height adjustment.

brush holder by removing one screw (16) and lockwasher (17).

(2) Scribe a mark across the commutator end frame (19) and the field frame (14). Remove three screws (29), screw (27), and four lockwashers (28). Remove the commutator end frame from the field frame. Tap loose with a rawhide mallet, if necessary.

(3) Remove the cotter pin (47), shaft nut (46), shaft washer (45), shaft collar (44), and pulley (43). Remove the screws (35) and lockwashers (34) and separate the pulley and the fan and baffle assembly (42).

(4) Scribe a mark across the drive end frame (36) and the field frame (14). Remove four screws (29) and lockwashers (28). Remove the drive end frame and the armature (39) from the field frame.

(5) Remove the screws (41), lockwashers (26), and the retainer plate (40) from the drive end frame. Remove the drive end frame from the armature.

(6) Using a bearing puller, remove the ball bearings (21 and 37) from the armature. Remove the retainer plate (38) from the drive end of the armature.

b. Disassemble Commutator End Frame.

(1) Remove the screws (25), lockwashers (26), retainer plate (23), and bearing collar (22) from the commutator end frame (19).

(2) Remove the nuts (5), screws (20), and lockwashers (4). Separate the brush plate (18) and the commutator end frame.

(3) Remove the brush attaching screws (16) and lockwashers (17). Remove the brush connector lead (15).

(4) Lift the brush arms (32) and remove the brushes (30).

(5) Unhook the brush springs (33). Remove the brush arms, brush springs, and spacers (31).

c. Disassemble Field Frame.

(1) Remove the screws (7), lockwashers (2), and terminal shield cover (6).

(2) Remove the nuts (5), lockwashers (4), and leads

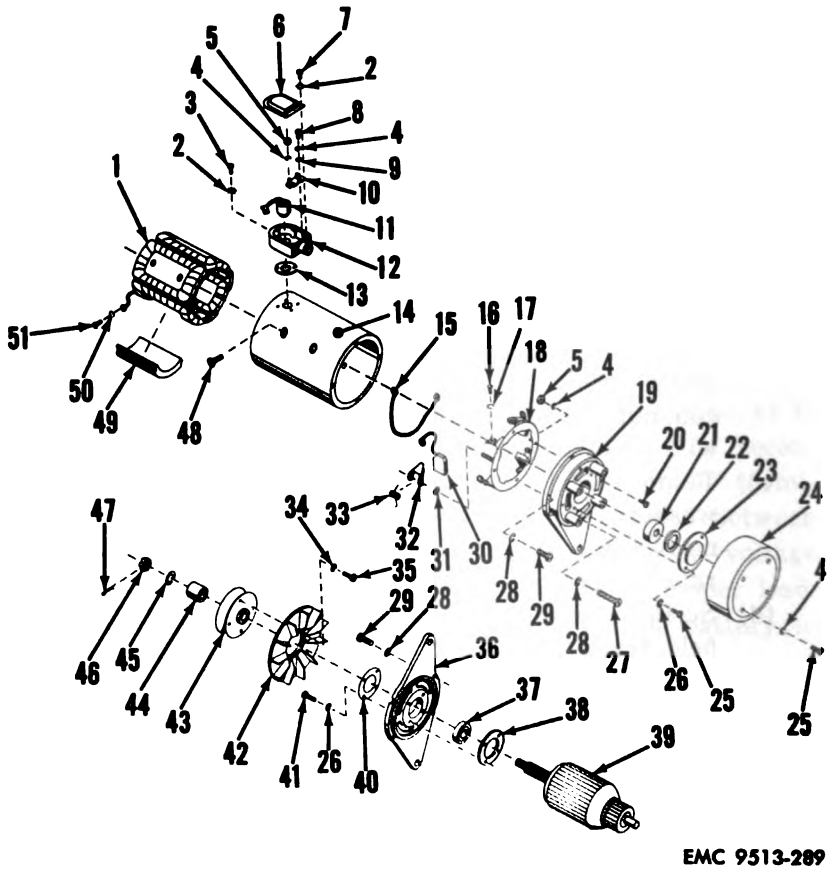


Figure 289. Generator, exploded view.

from the terminal plate (10). Remove the condenser (11).

(3) Remove the screws (3), lockwashers (2), terminal shield (12), and mounting plate (13) from the field frame.

(4) Remove the screws (8), lockwashers (4), plain washers (9), and the terminal plate (10) from the terminal shield (12).

(5) Remove the screw (51) and lockwasher (50) which attaches the field coil ground lead to the field frame.

(6) Remove the pole shoe screws (48). Remove the pole shoes (49) and field coils (1).

340. Generator Inspection and Repair

Soak and wash all parts, excepting the armature, field coils, brushes, and condenser, in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts. Wipe the armature with a clean cloth slightly dampened in an approved cleaning solvent. Clean the commutator with 00 sandpaper. Blow off sand particles and wipe dirt from between commutator bars. Clean the field coils by wiping with a clean, dry cloth.

1 Field coil (4 rqr)
2 Lockwasher, external tooth (9 rqr)
3 Screw (4 rqr)
4 Lockwasher (12 rqr)
5 Nut (6 rqr)
6 Terminal shield cover
7 Screw (5 rqr)
8 Screw (2 rqr)
9 Plain washer (2 rqr)
10 Terminal plate
11 Condenser
12 Terminal shield
13 Mounting plate
14 Field frame
15 Brush connector lead
16 Brush attaching screw (4 rqr)
17 Lockwasher (4 rqr)
18 Brush plate
19 Commutator end frame
20 Screw (4 rqr)
21 Ball bearing
22 Bearing collar
23 Retainer plate
24 Cover
25 Screw (8 rqr)
26 Lockwasher (8 rqr)
27 Screw
28 Lockwasher (8 rqr)
29 Screw (7 rqr)
30 Brush (4 rqr)
31 Spacer (4 rqr)
32 Brush arm (4 rqr)
33 Brush spring
34 Lockwasher, internal tooth, No. 12 (4 rqr)
35 Screw, machine, rd hd, No. 12–24 x ⅝ (4 rqr)
36 Drive end frame
37 Ball bearing
38 Retainer plate
39 Armature
40 Retainer plate
41 Screw (4 rqr)
42 Fan and baffle assembly
43 Pulley
44 Shaft collar
45 Shaft washer
46 Shaft nut
47 Cotter pin
48 Pole shoe screw (8 rqr)
49 Pole shoe (4 rqr)
50 Lockwasher
51 Screw

Caution: Never clean the armature or field coils by any degreasing method since this would damage the insulation and ruin the armature or field coils.

a. Armature.

(1) *Visual.* Inspect the commutator for roughness, high mica, or burning. Turn down in a lathe (fig. 290), if rough or if mica is high. Cut not deeper than necessary. Undercut mica of a turned commutator to a depth of one thirty-second inch (fig. 291). Use care in undercutting not to widen commutator slots by removing metal from bars. Do not leave thin edge of mica next to bars. Figure 291 shows examples of good and bad undercutting. Inspect to see that windings are not loose from core and not unsoldered from commutator risers. Replace armature if windings are loose. Solder windings to risers, if armature is otherwise in good condition. Inspect ends of armature shaft which ride in bearings for burs, pits, or wear. Take out small burs with a handstone. Replace armature if shaft is pitted, worn, or has damaged spline. Inspect armature shaft for straightness. Replace armature if shaft is bent.

(2) *Commutator out-of-round.* Place each end of the armature shaft on V-blocks and set up a dial gage so that the plunger rides against the commutator (fig. 293).

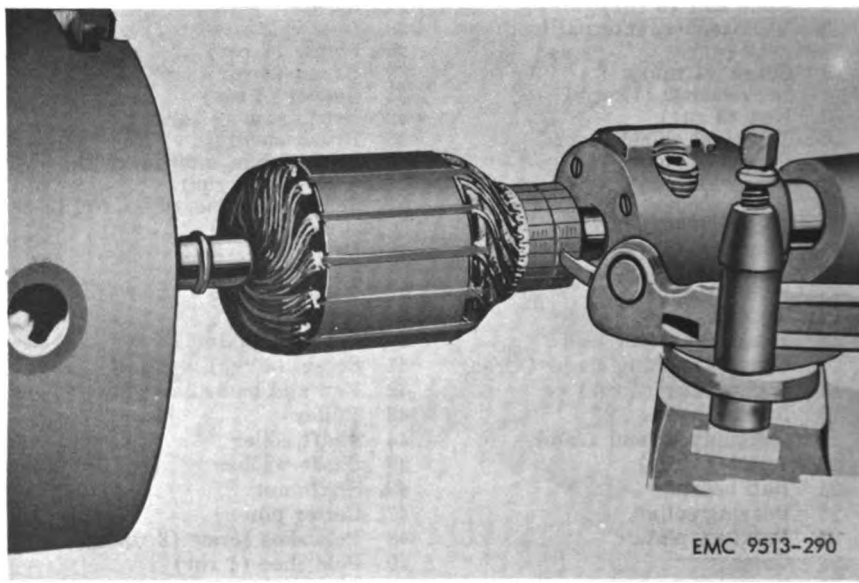


Figure 290. Truing commutator on a lathe.

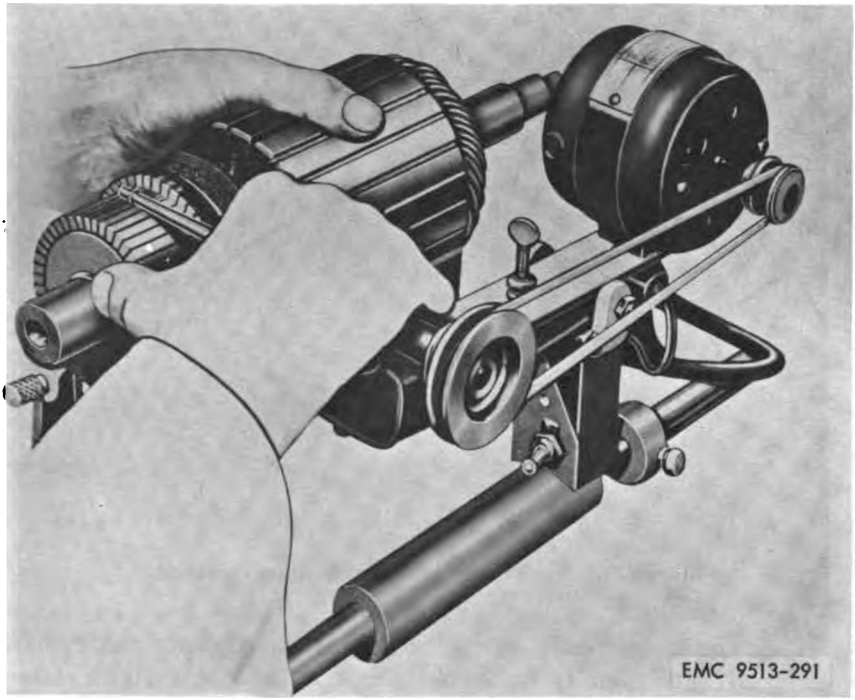


Figure 291. Undercutting commutator mica.

Rotate the armature and note the movement on the dial. If total out-of-round reading is greater than 0.001-inch, turn down the commutator in a lathe (fig. 290).

(3) *Check for short.* Place the armature on a growler (fig. 294). Turn on the switch. Holding a thin steel strip on the armature core, rotate the armature slowly. The steel strip will vibrate against the armature when an area in which a short is present passes beneath it. Before discarding an armature in which a short is indicated, inspect the commutator slots carefully. Copper or brush dust sometimes collects in the slots and shorts the adjacent bars.

(4) *Check for ground.* Touch one probe of a continuity test lamp to the armature shaft or core and the other, in turn, to each commutator bar riser (fig. 295). Lighting of the test lamp indicates a ground. If ground is present, the armature must be replaced.

Note. **Do not touch the probes to the commutator bars or the shaft bearing surfaces, for arcing may mar the smooth finish.**

(5) *Check for open.* Touch the probes of a continuity test lamp to each of a pair of adjacent commutator bar risers. Failure of the lamp to light indicates an open. Repeat

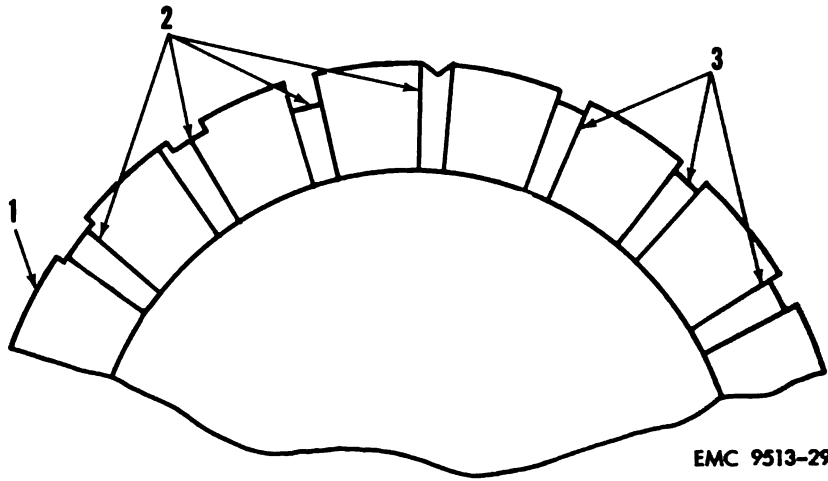


Figure 292. Samples of good and bad undercutting.

the test on each pair of adjacent commutator bar risers. If an open is indicated, inspect the commutator bars for burning which invariably accompanies an open. The armature may be saved, provided that the commutator bars are not too badly burned and the commutator can be turned down.

b. *Field Coils.*

(1) *Visual.* Inspect the field coils for worn or frayed insulation or defective connections. If the field insulator is charred or worn away so that the field circuit is, or could become, grounded, it may sometimes be repaired by wrapping the field coils. This operation must be executed with care and neatness since excessive bulkiness of the wrappings will prevent assembling the coils under the pole shoes in the proper manner. Make all soldered connections with the use of rosin flux solder. If the connections between the coils to clips or studs are defective, solder, using a rosin core flux.

(2) *Check for open.* Touch one probe of a continuity test lamp to the end of each field coil lead. If the lamp does not light, the field is open. If the open is inside the winding, replace the field coil.

(3) *Check generator field current draw.* Connect batteries, a variable resistance, and an ammeter in series with the two field coil leads. Connect the ammeter in its highest range first. Apply the current and, after noticing the ammeter reading, connect the ammeter to the range

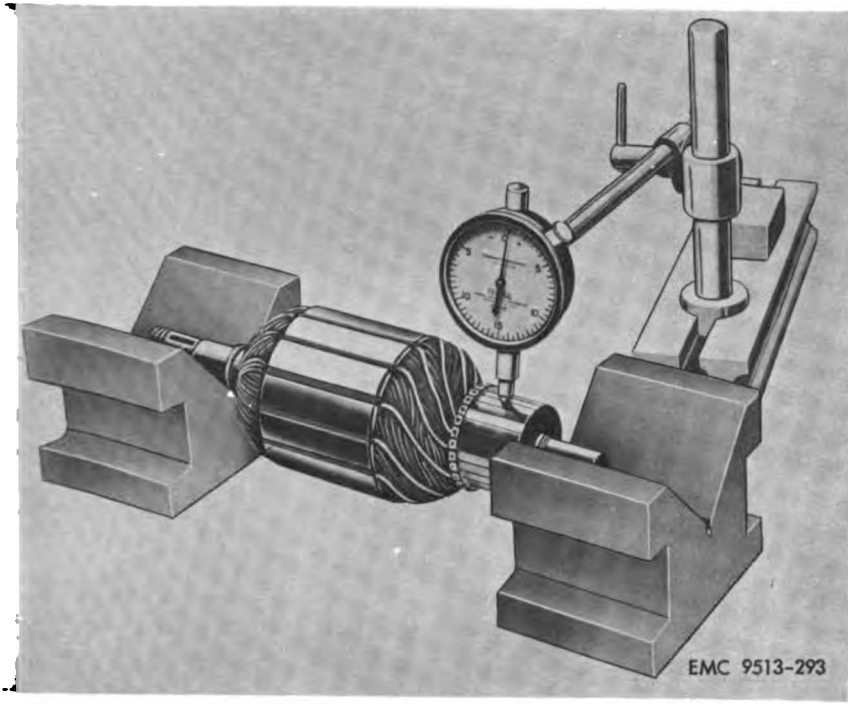


Figure 293. Measuring commutator out-of-round.

which will safely carry the indicated current. Connect a voltmeter across the two field coil leads. Adjust the voltage through the use of the variable resistor to 24 volts and notice the reading on the ammeter. The ammeter should read 0.85 to 0.89 ampere at 24 volts. Replace the coils if the current draw is not within these limits.

c. Frames. Inspect the frames for cracks or warpage. Replace cracked or warped frames. Inspect brushes and replace, if cracked, oil-soaked, loose pigtail leads, or worn to less than half their original length. Inspect brush springs for signs of burning or overheating. An overheated spring becomes blued. Replace a burned or blued spring. Replace bearings which appear to roll roughly or sloppily. Replace bent brush arms.

341. Generator Reassembly

a. Assemble Field Frame.

(1) Assemble the field coils (1, fig. 289) on the pole shoes (49) and install in the field frame (14). Hold the pole shoes in position in the field frame and screw in the pole shoe screws (48) which should be coated with thread sealer. The field lead should be near the terminal opening in the frame.

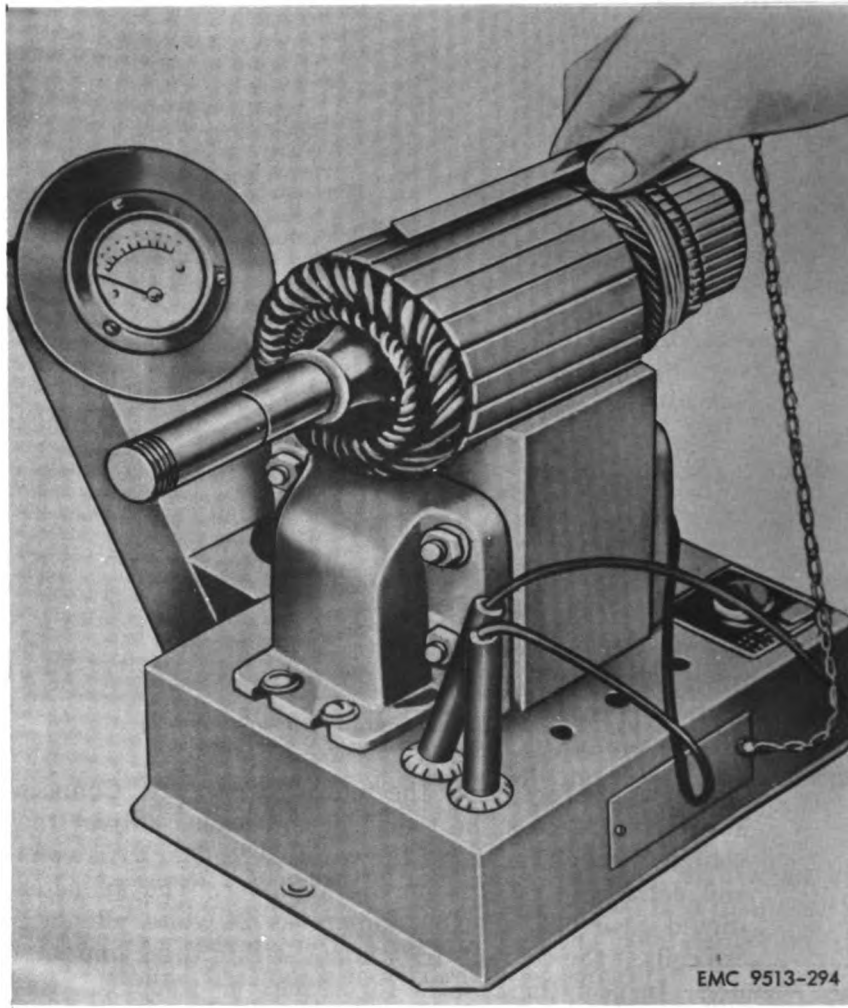


Figure 294. Testing armature for short on growler.

(2) Attach the field coil ground lead to the field frame with the lockwasher (50) and the screw (51).
(3) Position the terminal plate (10) in the terminal shield (12) and secure with screws (8), plain washers (9), and lockwashers (4).
(4) Position the mounting plate (13) and terminal shield (12) on the field frame and secure with lockwashers (2) and screws (3).
(5) Position the condenser (11) in the terminal shield. Make connections as shown in schematic wiring diagram (fig. 296).
(6) Position the terminal shield cover (6, fig. 289) on the

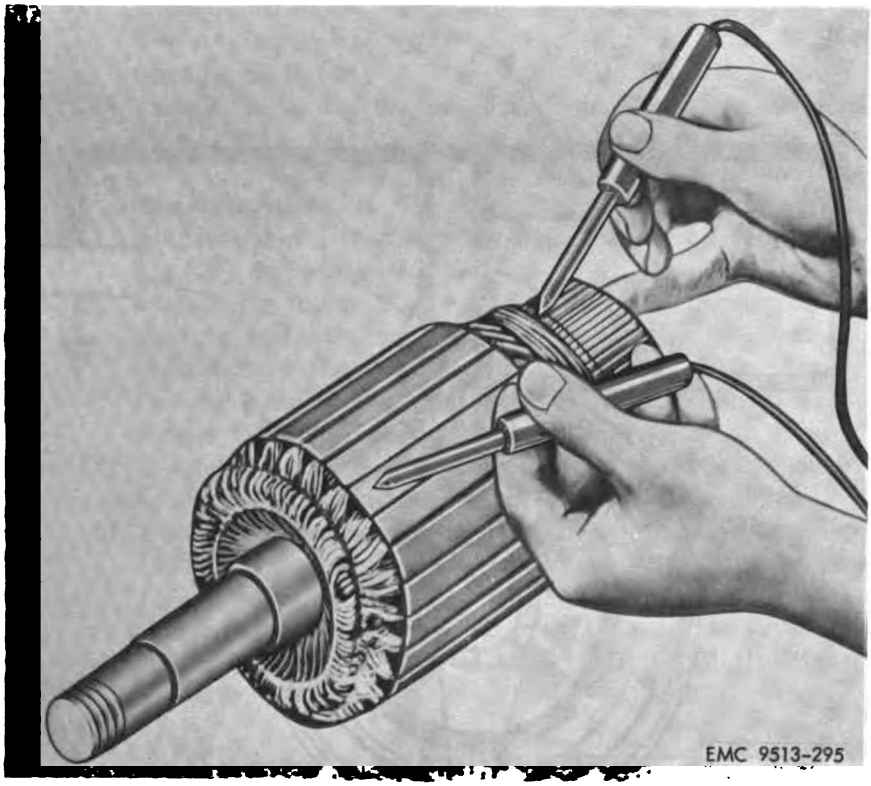


Figure 295. Testing armature for shorts.

terminal shield and secure with lockwashers (2) and screws (7).

b. Assemble Commutator End Frame (fig. 289).

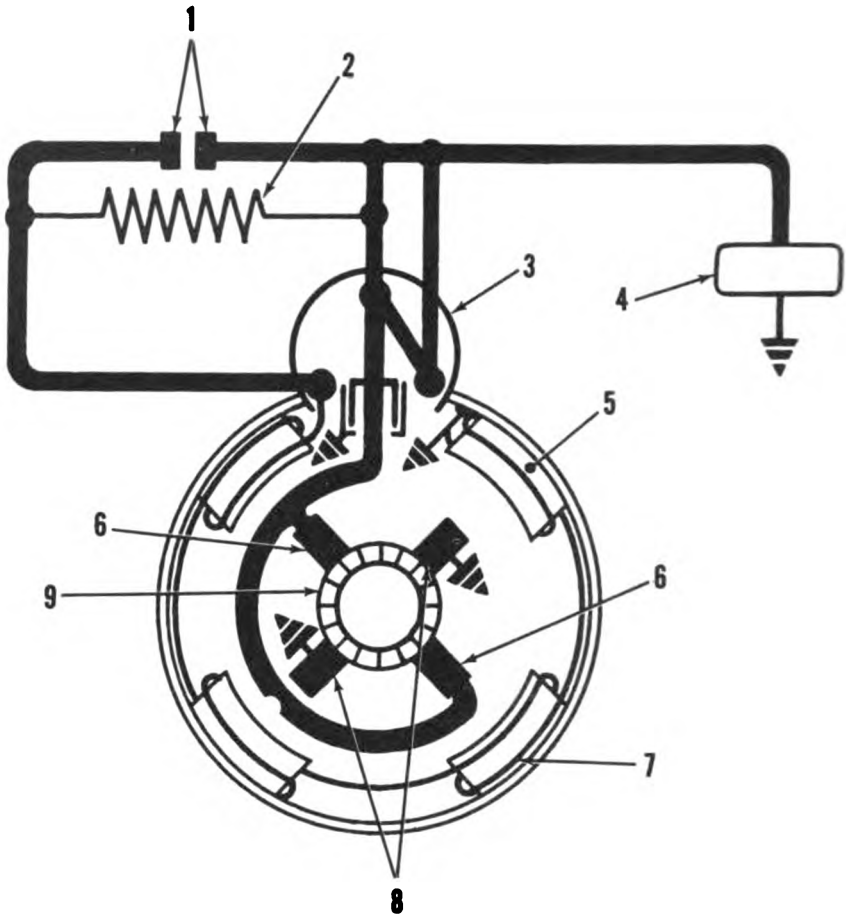
(1) Install the spacers (31), brush springs (33), and brush arms (32) on the brush plate pins. Insert one end of spring into the hole in the brush arm and bend the other end of the spring into place under the stop on the brush holder.

(2) Lift the brush arms and insert the brushes (30) into the brush holders so that the direction of the commutator rotation is into the toe of the brush.

(3) Connect the brush leads and brush connector lead (15) to the brush holders with lockwashers (17) and brush attaching screws (16). One end of the brush connector lead goes to each insulated brush.

(4) Position the brush plate (18) on the commutator end frame (19) and secure with screws (20), lockwashers (4), and nuts (5).

(5) Position the retainer plate (23) on the commutator end



EMC 9513-296

1	Voltage regulator points	6	Insulated brushes
2	Resistance	7	Field coil
3	Connector	8	Ground brushes
4	Load	9	Commutator
5	Pole shoe		

Figure 296. Generator schematic wiring diagram.

frame and secure with lockwashers (26) and screws (25). Install the bearing collar (22) in the retainer plate.

c. Assemble Generator (fig. 289).

(1) Position the retainer plate (38) on the drive end of the armature (39). Using an arbor press, install the ball bearings (21 and 37) on the armature.

(2) Install the drive end frame (36) on the armature and bearing. Position the retainer plate (40) on the end

frame. Install the lockwashers (26) and screws (41) in the retainer plate (40) and end frame and into the retainer plate (38).

(3) Install the armature and drive end frame on the field frame (14) with the drive end frame exactly in the position indicated by the marks scribed at disassembly. Tap into place, if necessary, using a rawhide mallet. Secure the end frame to the field frame with lockwashers (28) and screws (29).

(4) Install the commutator end frame on the armature bearing and to the field frame in exactly the position indicated by the marks scribed at disassembly. Secure the end head to the field frame with lockwashers (28), screws (29), and screw (27).

(5) Connect the field lead terminal to the brush holder, using the brush attaching screw and lockwashers.

(6) Position the fan and baffle assembly (42) on the pulley (43) and secure with lockwashers (34) and screws (35). Install the pulley assembly, shaft collar (44), shaft washer (45), and shaft nut (46) on the armature shaft. Tighten the nut securely and install the cotter pin (47).

Section X. STARTING MOTORS

342. General

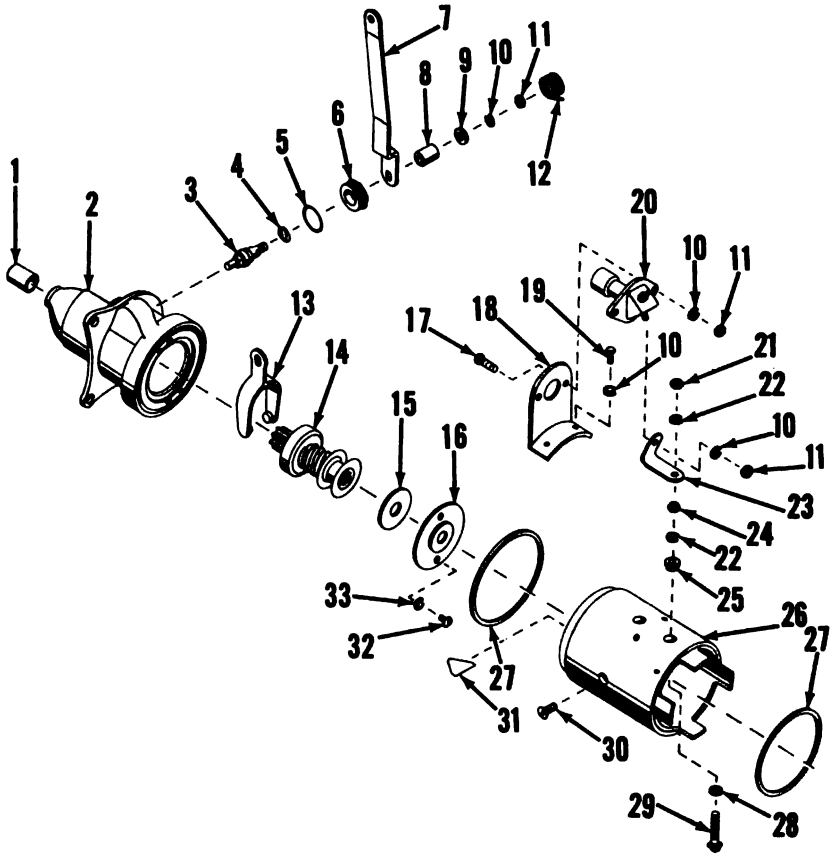
a. Revolving Frame Engine. The revolving frame engine starting motor is a watertight, corrosion- and fungus-resistant unit. The starting motor is a 24-volt, 4-pole, 4-brush unit with three field coils connected in series and one in shunt. The armature is supported by rolled bronze graphite bushings in the drive housing, commutator end frame, and at the center bearing. The starting motor employs an overrunning clutch-type drive, operated manually by a shift lever. For removal and installation procedures of the revolving frame engine starting motor, see paragraph 145.

b. Carrier Engine. The carrier engine starting motor is a watertight, corrosion- and fungus-resistant unit. The starting motor is a 24-volt, 4-pole, 8-brush unit with a series field and no shunt field. The armature is supported by rolled bronze graphite bushings in the drive housing, commutator end frame, and at the center bearing. The starting motor employs an overrunning clutch-type drive, operated manually by a shift lever. Refer to TM 5–5252 for removal and installation procedures of the carrier engine starting motor.

343. Starting Motor Disassembly—Revolving Frame Engine (fig. 297)

a. Remove Commutator End Frame Assembly.

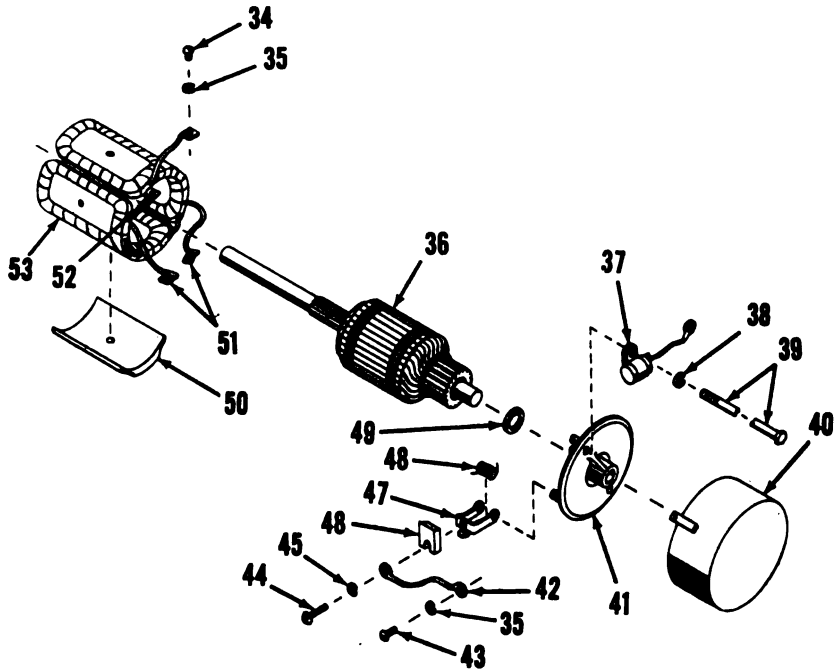
(1) Bend up the locking ears of the cover (40) and tap cover off starter, using a flat piece of wood.



EMC 9513-297/1

1	Housing bushing	11	Nut (3 rqr)
2	Drive end housing	12	Shift lever spring
3	Shift lever shaft	13	Lower shift lever
4	Shift lever seal	14	Overrunning clutch
5	Shift lever gasket	15	Brake washer
6	Shift lever bearing nut	16	Center bearing
7	Upper shift lever	17	Screw (2 rqr)
8	Spring support	18	Switch mounting bracket
9	Shift lever shaft washer	19	Screw (2 rqr)
10	Lockwasher (5 rqr)	20	Switch

Figure 297. Revolving frame engine starting motor, exploded view.



EMC 9513-297/2

21	Terminal nut	38	Lockwasher (2 rqr)
22	Lockwasher (2 rqr)	39	Thru-bolt (2 rqr)
23	Connector	40	Cover
24	Terminal nut	41	Commutator end frame
25	Insulating bushing	42	Brush lead (2 rqr)
26	Field frame	43	Screw (2 rqr)
27	Seal (2 rqr)	44	Screw (4 rqr)
28	Insulating washer	45	Lockwasher (4 rqr)
29	Terminal stud	46	Brush (4 rqr)
30	Pole shoe screw (4 rqr)	47	Brush holder (4 rqr)
31	Triangle insulator	48	Brush spring (4 rqr)
32	Screw (2 rqr)	49	Thrust washer
33	Lockwasher (2 rqr)	50	Pole shoe (4 rqr)
34	Ground screw	51	Field coil leads
35	Lockwasher (2 rqr)	52	Terminal stud lead
36	Armature	53	Field coils
37	Condenser		

Figure 297—Continued.

(2) Remove a screw (43) and lockwasher (35) and detach one field, jumper, condenser, and one brush lead.

(3) Scribe a mark across the commutator end frame (41), drive end housing (2), and the field frame (26). Remove the thru-bolts (39) and lockwashers (38). Remove the condenser (37) and commutator end frame assembly.

(4) Pull out the armature (36) and remove the thrust washer (49) from the armature shaft.
(5) Remove the drive end housing assembly (2).
(6) Remove the seals (27) from the field frame.

b. Disassemble Commutator End Frame Assembly.

(1) Remove the brush attaching screws (44) and lockwashers (45) and remove the brushes (46).
(2) The two brush leads to the field leads (51) can now be removed.
(3) Slip the short arm of the brush springs (48) off the insulated stop pins on the commutator end frame (41). Slide the brush holders (47) and brush spring off the insulated hinge pins on the commutator end frame.

c. Remove Switch.

(1) Remove a nut (11) and lockwasher (10) and detach the connector (23) from the switch terminal.
(2) Remove the nuts (11), lockwashers (10), screws (17), and the switch (20) from the switch mounting bracket (18).
(3) Remove the screws (19), lockwashers (10), and mounting bracket (18) from the field frame (26).

d. Disassemble Field Frame.

(1) Unsolder the field leads (52) from the terminal stud (29). Remove the ground screw (34) and lockwasher (35).
(2) Remove the pole shoe screws (30). Remove the pole shoes (50) and field coils (53) from the field frame. Be careful with the coil assembly to avoid damaging the insulation.
(3) Remove the terminal nut (21), lockwasher (22), connector (23), terminal nut (24), lockwasher (22), and insulating bushing (25) from the terminal stud (29). Remove the terminal stud from inside of the field frame. Remove the insulating washer (28) from the stud.

Note. The stackup of the insulating bushing and the insulating washers may vary. Note the relationship of parts during disassembly so that they can be assembled correctly.

e. Disassemble Drive End Housing.

(1) Remove the screws (32), lockwasher (33), center bearing (16), and brake washer (15).
(2) Disengage the shift lever spring (12) by forcing the end of the spring off the stop with a screwdriver. Hold a hand over the spring support (8) to keep the spring from flying off.
(3) Remove the nut (11), lockwasher (10), and shaft

washer (9). Tap off the spring support (8) and the upper shift lever (7).

(4) Remove the shift lever bearing nut (6), shift lever gasket (5), and shift lever shaft (3). Remove the shift lever seal (4) from the shift lever shaft.

(5) From the cavity of the drive housing (2), remove the lower shift lever (13) and the overrunning clutch (14).

344. Starting Motor Inspection and Repair

a. Follow cleaning, inspection, and repair instructions for the revolving frame and carrier engine starting motors as outlined for the generator in paragraph 340.

b. Inspect the overrunning clutch for worn, broken, or otherwise defective parts. Replace defective parts. Turn drive pinion and, if movement is restricted or binding, replace the overrunning clutch.

c. Inspect the shift lever spring for breaks and weakness. Replace a broken or weak spring.

d. Replace all seals and gaskets.

e. Inspect bushings (1, fig. 297), (3, 39, 59, and 68, fig. 298), for wear, scoring, or pitting. Using an arbor press, replace defective bushings.

345. Starting Motor Reassembly—Revolving Frame Engine (fig. 297)

a. Assemble Drive End Housing.

(1) Insert the shift lever shaft (3) into the drive end housing (2). Install the shift lever seal (4) and shift lever gasket (5) on the shaft. Apply thread sealer to threads of the shift lever bearing nut (6). Install nut.

(2) Install the lower shift lever (13) on the shift lever shaft from inside the cavity of the drive end housing. Insert the overrunning clutch (14) so that the lower shift lever rides in the clutch collar.

(3) Install the upper shift lever (7), spring support (8), and shift lever shaft washer (9) on the lever shaft and secure with a lockwasher (10) and nut (11).

(4) Install the shift lever spring (12).

(5) Position the brake washer (15) and center bearing (16) and secure with lockwashers (33) and screws (32). The hub of the center bearing is toward the field frame.

b. Assemble Field Frame.

(1) Position the field coils (53) and pole shoes (50) in the field frame (26) and secure with the pole shoe screws

(30). Be careful with the coil assembly to avoid damaging the insulation. Position the triangle insulators (31) so that the field coils will not short to the frame. Coat the pole shoe screws with thread sealer prior to installation.

(2) Install the insulating washer (28) on the terminal stud (29). Install the stud in the field frame (26). Install on the terminal stud in this order: the insulating bushing (25), lockwasher (22), terminal nut (24), connector (23), lockwasher (22), and terminal nut (21).

Note. The stackup of the insulating bushing and the insulating washers may vary. Install parts as noted during disassembly.

(3) Solder the field coil leads (52) to the terminal stud with rosin flux. Install the ground screw (34) and lockwasher (35).

c. Install Switch.

(1) Position the switch mounting bracket (18) on the field frame (26) and secure with lockwashers (10) and screws (19). Coat the screws with thread sealer before installing.

(2) Position the switch (20) in the switch mounting bracket (18) and secure with screws (17), lockwashers (10), and nuts (11).

(3) Attach the connector (23) to the switch terminal with a lockwasher (10) and nut (11).

d. Assemble Commutator End Frame.

(1) Slip brush springs (48) and brush holders (47) over the insulated hinge pins on the commutator end frame (41). Hook end of spring hooks around the small insulated stop pins in the frame.

(2) Install the brushes (46) and field leads (51) in the brush holders and secure with lockwashers (45) and brush attaching screws (44).

Note. Holes in the brushes are not located centrally. Attach brushes with the longer side facing away from the end head with lettering on the brushes facing outward.

(3) Install the grounded brush leads (42) and secure with lockwashers (35) and screws (43).

e. Assemble Starting Motor Components.

(1) Insert the armature shaft through the center bearing (16) until seated firmly in the drive end housing bushing.

(2) Position the seals (27) on the field frame (26).

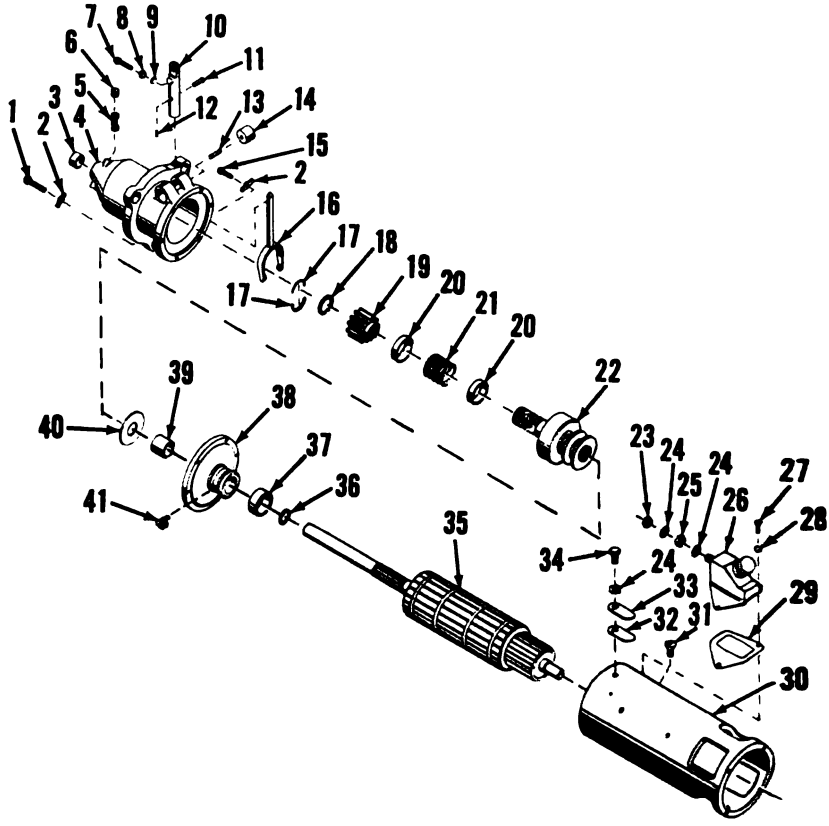
(3) Tap the field frame assembly into position on the drive end housing.

(4) Position the thrust washer (49) on the armature shaft.
(5) Position the condenser (37) lead in the notch in the end frame, lift the brushes, and slip the commutator end frame assembly in position on the armature.
(6) Position the condenser bracket so that one of the thru-bolts will secure it. Insert the thru-bolts (39) with lockwashers (38) through the end frame and tighten securely.
(7) Attach one brush lead, condenser, jumper, and one field lead together with the lockwasher (35) and screw (43).
(8) Slip the cover (40) over the commutator, alining the locking ears with pins on the field frame. Tap on securely and bend down the locking ears.

346. Starting Motor Disassembly—Carrier Engine (fig. 298)

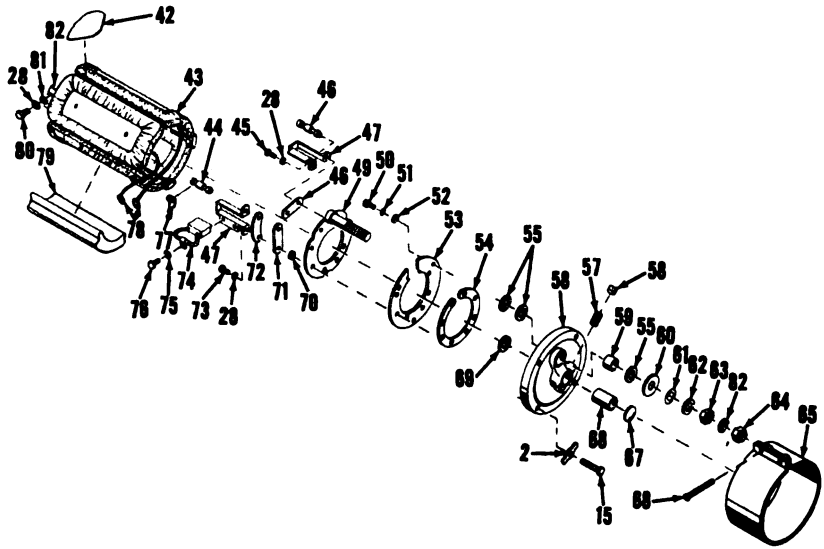
a. Remove Starting Switch.
(1) Remove the screws (27), lockwashers (28), starting switch (26), and gasket (29) from the field frame (30). Remove the terminal nut (23), lockwasher (24), terminal nut (25), and lockwasher (24) from the starting switch (26).
(2) Remove the screw (34), lockwasher (24), switch contact (33), and contact insulation (32) from the field frame.

b. Remove Starting Motor Components.
(1) Loosen the cover band screws (66) and remove the cover band (65) from the field frame.
(2) Disconnect the field coil leads (78) to the brushes (74) by removing three brush lead attaching screws (76) and lockwashers (75). Note relationship of brush leads and brushes to lessen the chance of improper assembly.
(3) Bend up the tangs of the lockwashers (2). Remove the screws (15) and lockwashers (2) from the commutator end frame (56).
(4) Remove the commutator end frame assembly from the field frame. Tap off with a rawhide mallet, if necessary. Remove the brake washer (69) from the armature shaft.
(5) Bend up the tangs of the lockwashers (2). Remove the screws (1 and 15) from the drive end housing (4).
(6) Remove the drive end housing assembly from the field frame. The center bearing plate (38) and the armature (35) will come away with the drive end housing.



1	Screw, cap, hex hd, ¼–28 NF x 1⅜ (4 rqr)	24	Lockwasher (3 rqr)
2	Lockwasher (9 rqr)	25	Terminal nut
3	Bushing	26	Starting switch
4	Drive end housing	27	Screw (2 rqr)
5	Oil wick	28	Lockwasher (11 rqr)
6	Pipe plug	29	Gasket
7	Adjusting screw	30	Field frame
8	Nut	31	Pole shoe screw (8 rqr)
9	Lockwasher	32	Contact insulation
10	Shift lever extension	33	Switch contact
11	Shaft extension pin	34	Screw
12	Cotter pin	35	Armature
13	Dowel pin	36	Spacer
14	Lever shaft	37	Wick retainer
15	Screw, cap, hex hd, ¼–28 NF x 1 (5 rqr)	38	Center bearing plate
16	Lower shift lever	39	Bushing
17	Split washer	40	Brake washer
18	Pinion stop cup	41	Oil wick
19	Pinion	42	Insulation strip
20	Spring retainer cup (2 rqr)	43	Field coil assembly
21	Spring	44	Insulated brush spring post (2 rqr)
22	Shift sleeve	45	Brush holder screw (2 rqr)
23	Terminal nut	46	Ground brush spring post (2 rqr)

Figure 298. Carrier engine starting motor, exploded view.



47	Brush holder (4 rqr)	65	Cover band
48	Ground brush spacer plate (2 rqr)	66	Cover band screw (2 rqr)
49	Brush plate and stud	67	End plug
50	Brush plate attaching screw (3 rqr)	68	Bushing
51	Lockwasher (3 rqr)	69	Brake washer
52	Plain washer (3 rqr)	70	Insulating washer (8 rqr)
53	Insulating plate	71	Insulating brush spacer plate (2 rqr)
54	Brush holder attaching plate	72	Insulating plate (2 rqr)
55	Insulation washer (3 rqr)	73	Brush holder screw (2 rqr)
56	Commutator end frame	74	Brush (8 rqr)
57	Oil wick	75	Lockwasher (8 rqr)
58	Pipe plug	76	Brush lead attaching screw (8 rqr)
59	Terminal stud bushing	77	Brush spring (8 rqr)
60	Insulation washer	78	Field coil lead
61	Plain washer	79	Pole shoe (4 rqr)
62	Lockwasher (2 rqr)	80	Field lead ground screw
63	Terminal stud nut	81	Plain washer
64	Terminal stud nut	82	Ground lead

Figure 298—Continued.

(7) Using a rawhide mallet, tap the drive end housing assembly and the center bearing plate from the armature shaft. Do not lose the brake washer (40). Remove the spacer (36) from the armature shaft.

(8) Remove the wick retainer (37) and oil wick (41) from the center bearing plate (38).

c. Disassemble Drive End Housing Assembly.

(1) Remove the cotter pin (12) and shaft extension pin (11) from the shift lever extension (10). Remove the shift lever extension from the lower shift lever (16).

Remove the adjusting screw (7), nut (8), and lockwasher (9).

(2) Using a small driftpin, remove the dowel pin (13) and lever shaft (14) from the drive end housing.

(3) Remove the lower shift lever and shift sleeve (22) assembly from the drive end housing. Remove the oil wick (5) and pipe plug (6) from the housing.

(4) Remove the pinion stop cup (18) with split washer (17). Remove the pinion (19) from the shift sleeve (22). Remove the spring retainer cups (20) and spring (21) from the shift sleeve.

d. Disassemble Commutator End Frame Assembly.

(1) In sequence, remove the terminal stud nut (64), lockwasher (62), terminal stud nut (63), lockwasher (62), plain washer (61), insulation washer (60), and insulation washer (55). Remove the pipe plug (58), oil wick (57), and end plug (67).

(2) Remove the brush plate attaching screws (50), lockwashers (51), and plain washers (52). Remove the brush plate and stud assembly (49) from the commutator end frame (56). Remove the insulation washers (55) from the terminal stud.

(3) Remove the brush lead attaching screws (76) and lockwashers (75). Lift up the brush springs (77) and remove the brushes (74).

(4) Remove the insulated brush spring posts (44), ground brush spring posts (46), and lockwashers (28). Remove the brush springs (77) from the spring posts.

(5) Remove the brush holder screws (45 and 73) and lockwashers (28). Remove the brush holders (47). Separate the brush plate and stud (49), insulating plate (53), and brush holder attaching plate (54).

(6) Remove the ground brush spacer plates (48), insulating plates (72), insulating brush spacer plates (71), and insulating washers (70).

e. Disassemble Field Frame Assembly.

(1) Remove the field lead ground screw (80), lockwasher (28), and plain washer (81) from the coil lead (82) and field frame.

(2) Remove the pole shoe screws (31). Remove the pole shoes (79) and field coil assembly (43) from the field frame. Note position of the insulation strip (42) so that grounding of the coil leads against the field frame can be avoided upon assembly. Be careful when removing

the field coil assembly to prevent damaging the insulation.

347. Starting Motor Reassembly—Carrier Engine (fig. 298)

a. Assemble Field Frame.

(1) Position the pole shoes (79) and field coil assembly (43) in the field frame (30). Be careful when installing the field coil assembly not to damage the insulation. Apply thread sealer to the pole shoe screws (31). Install the insulation strip (42) so as to insulate the field coils from the frame assembly. Install and tighten the pole shoe screws in the field frame and pole shoes.

(2) Ground the coil lead (82) to the field frame, using the ground screw (80), lockwasher (28), and plain washer (81).

b. Assemble Commutator End Frame.

(1) On one of the insulated brush spring posts (44), slip on two brush springs (77) and a lockwasher (28). Insert post assembly through hole in a brush holder (47) on opposite side from the brush lead mounting flange. Insert a brush holder screw (73) and lockwasher (28) through the hole below the brush lead mounting flange side. Mount the brush springs so that the hook ends will bear against the brushes when installed.

(2) Install an insulating plate (72) and insulating brush spacer plate (71) over the threaded ends of the post and screw, and place four insulating washers (70), two each hole, in two of the larger holes in the brush plate and stud (49). Mount the brush holder assembly in these holes.

(3) Position the insulating plate (53) and the brush holder attaching plate (54) on bottom side of the brush plate and stud (49) and secure by tightening the post (44) and screw (73).

(4) Assemble the second insulated brush holder as in (1) through (3) above. Locate insulated brush holders 90° apart.

(5) Assemble the remaining brush holders without insulating plates (72) and insulating washers (70) as in (1) through (3) above. Use spacer plates (48).

(6) Place two insulation washers (55) on the terminal stud. Position the commutator end frame (56) on the

brush plate and stud (49) and secure with brush plate attaching screws (50), lockwashers (51), and plain washers (52).

(7) Slip over the terminal stud an insulation washer (55), insulation washer (60), plain washer (61), lockwasher (62), and terminal stud nut (63). Tighten the nut. Install lockwasher (62) and terminal stud nut (64). Install the oil wick (57), pipe plug (58), and end plug (67).

(8) Place the brushes (74) in the brush holders and secure the brush leads to the mounting flange with lockwashers (75) and brush lead attaching screws (76). Be sure brush springs are acting to exert pressure against brushes.

c. Assemble Drive End Housing.

(1) Install the spring retainer cups (20), spring (21), pinion (19), and the pinion stop cup (18) with split washer (17) on the shift sleeve (22).

(2) Position the lower shift lever (16) in the drive end housing (4). Position the shift sleeve assembly in the housing, making sure that the shift lever fits over the shift sleeve collar. Install the oil wick (5) and pipe plug (6) in the housing.

(3) Install the lever shaft (14) in the housing with the dowel pin (13) in the shift lever (16).

(4) Position the shift lever extension (10) on the lever shaft. Install the shaft extension pin (11) and secure with the cotter pin (12). Install the lockwasher (9), nut (8), and adjusting screw (7).

d. Assemble Starting Motor Components.

(1) Position the spacer (36) on the armature shaft. Position the oil wick (41) on the center bearing plate (38) and hold in place with the wick retainer (37).

(2) Install the center bearing plate and brake washer (40) on the armature shaft.

(3) Install the drive end housing assembly on the armature shaft.

(4) Install the armature and drive end housing assembly in the field frame assembly. Install the screws (1 and 15) with lockwashers (2) into the drive end housing, center bearing plate, and field frame. After tightening the screws, bend the tangs of the lockwashers.

(5) Install the brake washer (69) on the commutator end of the armature shaft. Position the commutator end frame assembly on the armature shaft and field

frame. Lift the brushes to slide on the commutator. Install the screws (15) with lockwashers (2). After tightening the screws, bend the tangs of the lockwashers.

(6) Connect the field coil leads to the brushes as noted during disassembly.

(7) Position the cover band (65) on the field frame and secure by tightening the cover band screw (66).

e. Install Starter Switch.

(1) Position the contact insulation (32) and switch contact (33) on the field frame (30) and secure with the lockwasher (24) and screw (34).

(2) Position the gasket (29) and starting switch (26) on the field frame and over the switch contact and secure with lockwashers (28) and screws (27). Install lockwashers (24) and terminal nuts (23 and 25) on the starting switch (26).

Section XI. DISTRIBUTORS

348. General

a. The revolving frame engine distributor and the carrier engine distributor are identical with the exception of the driven gear. Maintenance procedures in this section are applicable to both engine distributors. For removal and adjustment procedures for the revolving frame engine distributor, see paragraph 147. For removal and adjustment procedures for the carrier engine distributor, refer to TM 5–5252.

b. The distributor is a 6-cylinder, automatic, 24-volt, grounded type with a flange mounting. A waterproof primary connection on the distributor housing incloses a feed-through capacitor which is part of the radio interference suppression circuit built into the distributor. The distributor has built-in shaft lubrication and is gear-driven. The ignition coil is an oil-filled, hermetically-sealed unit, mounted in the housing assembly. The primary circuit is in series with a separate resistor. A clamp plate holds the ignition coil in the housing with a flange of the coil case compressing a sealing gasket. A molded one-piece cap covers both the distributor bowl and the ignition coil high-tension outlet, making a connection between the coil and the distributor rotor by means of a built-in lead having spring-loaded terminals. A one-piece metal cover, to which the molded cap is attached by screws and containing six threaded couplings for high-tension leads, fits over the entire assembly. The joint is sealed by a gasket. Radio suppression is employed in the distributor by built-in resistors at each high-tension outlet of the

molded cap and also one built into the rotor. Two capacitors are used for suppression. One capacitor is the above-mentioned feed-through capacitor at the distributor primary terminal, while the other is inclosed in the housing and is connected between the ignition coil positive terminals and ground. The third capacitor is the standard ignition capacitor. The distributor is timed to the engine by rotating the distributor in its mounting. The only adjustment provided is the point opening.

349. Distributor Disassembly
(fig. 299)

a. Remove the screws (1), lockwashers (2), cover assembly (3), and cover gasket (70) from the housing (33).

b. Remove the screws (65), lockwashers (66), and washers (67). Remove the cap assembly (39) and the gaskets (68) from the cover. Remove the coil contact spring (64) with carbon button (63) from the cap. Do not remove the cap studs (69).

c. Remove the rotor (40).

d. Remove the nuts (53) and lockwashers (54) from the

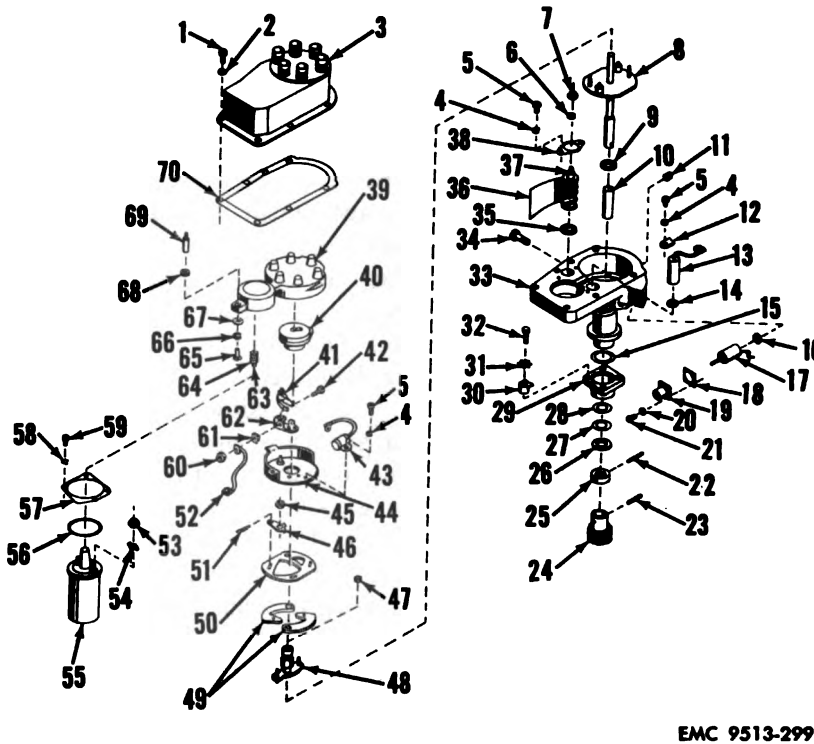


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Figure 299. Distributor, exploded view.

terminals of the ignition coil (55). Remove the nut (7) and lockwasher (6) from the resistor (37) and take off the primary lead. Remove the screw (5), lockwasher (4) attaching the bracket (38) and breaker plate (44). Loosen the remaining screw. Rotate the breaker plate clockwise until the notch in the plate alines with the primary lead. Lift off the breaker plate.

e. Remove one screw (42), nut (60), lead (52), and spring clamp (61). Remove the breaker lever (41) from the breaker plate. Remove the contact and support (62). Remove the screw (5), lockwasher (4), and condenser (43).

f. Remove the screw (5), lockwasher (4), and bracket (38). Carefully remove the resistor (37), resistor insulation (36), and spring washer (35).

g. Remove the screws (59), lockwashers (58), holddown plate (57), gasket (56), and ignition coil (55).

h. Remove the screw (5), lockwasher (4), clamp (12), condenser (13), and spring washer (14).

i. Remove the screws (21), lockwashers (20), terminal

←

1 Screw (8 rqr)
2 Lockwasher (8 rqr)
3 Cover assembly
4 Lockwasher (5 rqr)
5 Screw (5 rqr)
6 Lockwasher
7 Nut
8 Main shaft and weight plate
9 Space washer
10 Bushing
11 Pipe plug
12 Clamp
13 Condenser
14 Spring washer
15 O-ring seal
16 Spring washer
17 Condenser
18 Gasket
19 Terminal coupling
20 Lockwasher (4 rqr)
21 Screw (4 rqr)
22 Collar pin
23 Gear pin
24 Driven gear
25 Shaft collar
26 Space washer
27 Shim, 0.005 inch (as rqr)
28 Shim, 0.010 inch (as rqr)
29 Adapter
30 Holddown clamp (2 rqr)
31 Lockwasher (2 rqr)
32 Clamp screw (2 rqr)
33 Housing
34 Cap screw
35 Spring washer
36 Resistor insulation
37 Resistor
38 Bracket
39 Cap assembly
40 Rotor
41 Breaker lever
42 Screw
43 Condenser
44 Breaker plate
45 Nut (2 rqr)
46 Lock plate (2 rqr)
47 Felt wick
48 Cam
49 Weight (2 rqr)
50 Weight holddown plate
51 Spring (2 rqr)
52 Lead
53 Nut (2 rqr)
54 Lockwasher (2 rqr)
55 Ignition coil
56 Gasket
57 Holddown plate
58 Lockwasher (4 rqr)
59 Screw (4 rqr)
60 Nut
61 Spring clamp
62 Contact and support
63 Carbon button
64 Coil contact spring
65 Screw (5 rqr)
66 Lockwasher (5 rqr)
67 Washer (5 rqr)
68 Gasket (5 rqr)
69 Cap stud (5 rqr)
70 Cover gasket

coupling (19), gasket (18), condenser (17), and spring washer (16).

j. Remove the gear pin (23) and driven gear (24) from the main shaft and weight plate (8).

k. Remove the collar pin (22) and shaft collar (25) from the main shaft. Remove the spacer washer (26), shims (27 and 28), clamp screws (32), lockwashers (31), holddown clamps (30), adapter (29), and O-ring seal (15).

l. Remove the main shaft and weight plate (8) and the space washer (9) from the housing (33).

m. Bend down the ears of the lock plates (46). Remove the nuts (45), lock plates, and the weight holddown plate (50).

n. Release the springs (51) and remove the cam (48) and weights (49) from the main shaft and weight plate (8). Remove the felt wick (47) from the cam, if necessary.

o. If the bushing (10) needs replacement, remove by pressing out with an arbor press.

p. Remove the pipe plug (11) from the housing (33).

350. Distributor Inspection and Repair

Clean the outside of the distributor with a clean, soft cloth dampened with an approved cleaning solvent. Clean all parts with a clean, dry, lint-free cloth. Use dry compressed air to blow dust or dirt from parts. Clean points with a clean fine-cut contact file.

Caution: Do not wash distributor parts in a cleaning compound or in a degreasing tank as they may damage the part. Never use emery cloth to clean points.

a. Inspect the cap for cracks, chipped areas, or carbonized paths which would permit high-tension leakage to ground. Replace the cap, if any defect is evident.

b. Inspect the rotor for cracks or chipped spots. If rotor is defective, replace rotor. Check rotor spring for looseness or cracks. If found defective, replace rotor. Inspect the rotor segment for burned condition. If a burned condition is found only on the end of the segment, the rotor is satisfactory. If a burned condition is found on the top of the rotor segment, replace rotor, as there is arcing between the segment and the metal inserts in the cap. When this condition is found, inspect the cap for burned spots and replace rotor and cap, if necessary.

c. Inspect the breaker plate for bent or broken ears. Replace the plate if damaged, cracked, or bent.

d. Inspect resistors and condensers for broken cable, frayed insulation, and a loose or corroded terminal. Replace the resistor or condenser if any of the above conditions exist.

e. Inspect the contacts for burned condition, or pitting and, if found, replace the contacts.

f. Inspect all gaskets and seals for wear or deterioration. Replace a gasket or seal if hard, worn, or cracked.

g. Examine the shaft bushing for wear, scratches, or scuffed areas. Replace the bushing if these conditions exist.

Note. Do not attempt to ream, scrape, or otherwise repair the bushing as the porosity will be destroyed, causing poor lubrication. Always replace a defective bushing.

351. Distributor Reassembly
(fig. 299)

a. Place the cam (48) on the main shaft and weight plate (8). Slide on the weights (49) and springs (51). Slip the weight holddown plate (50) over the weights and secure in position with the lock plates (46) and nuts (45). Turn the ears of the lock plates up over the nuts.

b. Slip the space washer (9) over the bottom end of the main shaft until seated. Slide the main shaft and weight plate assembly into the housing (33) until seated.

c. Insert the space washer (26) with a sufficient number of shims (27 and 28) on the drive end of the main shaft so that there is very little end play between the washer and the housing after the shaft collar (25) is installed. Install the collar and secure with the collar pin (22). Peen ends of the pin flush with the collar for a tight fit.

d. Install the driven gear (24) on the main shaft and secure with the gear pin (23). Peen the ends of the pin flush with the gear hub for a tight fit.

e. Position the O-ring seal (15) in the adapter (29). Install the adapter on the housing and secure with holddown clamps (30), lockwashers (31), and clamp screws (32).

f. Attach the contact and support (62) to the breaker plate (44). Apply a trace of light lubricating grease on the breaker lever post on the breaker plate. Install the breaker lever (41).

g. Assemble the condenser (43) and lead on the screw (42) and locate on the fiber terminal block. Also assemble the spring clamp (61) and lead (52) on the screw (42) and secure with the nut (60). Secure the condenser to the breaker plate with lockwasher (4) and screw (5).

h. Position the breaker plate assembly in the housing (33).

i. Position the spring washer (14) and the condenser (13) in the housing.

j. Position the ignition coil (55) in the housing with the negative terminal nearest the condenser. Position the gasket (56)

and holddown plate (57) over the coil and secure to the housing with lockwashers (58) and screws (59).

k. Wrap the resistor insulation (36) around the resistor (37). Position the spring washer (35) and the wrapped resistor in the housing. Place the bracket (38) with one ear over the breaker plate ear and secure to the housing with lockwashers (4) and screws (5).

l. Position the clamp (12) over the condenser (13) and secure to the housing with lockwasher (4) and screw (5).

m. Apply an approved insulating and sealing compound to the spring washer (16). Install the washer and the condenser (17) in the housing. Position the gasket (18) and terminal coupling (19) on the housing and secure with lockwashers (20) and screws (21).

n. Attach the lead of the condenser (17) to the terminal of the resistor (37) and secure with lockwasher (6) and nut (7).

o. Connect the lead (52) to the negative terminal of the ignition coil (55) and secure with a lockwasher (54) and nut (53).

p. Connect the coil condenser lead and the resistor lead to the positive terminal of the ignition coil and secure with lockwasher (54) and nut (53).

q. Lubricate the distributor (LO 5–9513–2 and LO 5–9513–3).

r. Install the rotor (40).

s. Install the coil contact spring (64) with carbon button (63) in the cap (39). Position gaskets (68) on the cap studs (69) in the cover (3). Position the cap (39) on the studs and secure with washers (67), lockwashers (66), and screws (65).

t. Apply a layer of an approved insulating and sealing compound to the cover gasket (70). Position the cover gasket and the cover assembly (3) on the housing (33) and secure with lockwashers (2) and screws (1). Install the pipe plug (11) and screw (34).

Section XII. ROTARY PUMP

352. Description

The rotary geared pump circulates lubricating oil from one supply tank to the independent boom hoist assembly, thereby cooling the oil. The pump is mounted on the revolving frame engine gearcase and is driven by a pulley and vee belt from the engine clutch shaft assembly.

353. Rotary Pump Disassembly

(fig. 300)

a. Removal. Remove the rotary pump as instructed in paragraph 186*a*.

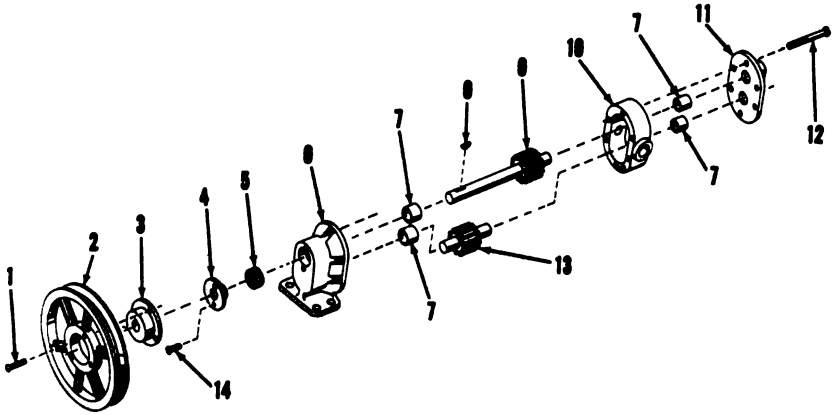
b. Disassembly.

(1) Remove the hub screws (1) and the pulley (2) from the pulley hub (3). Remove the hub and woodruff key (8) from the driving gear (9).

(2) Remove the gland screws (14) and the packing gland (4) from the flanged mounting (6).

(3) Remove the stand screws (12). Separate the cap (11), housing (10), and flanged mounting (6). Remove the driving gear (9) and the driven gear (13).

(4) Remove the compression packing (5) from the flanged mounting (6).



1	Hub screw (3 rqr)	8	Woodruff key
2	Pulley	9	Driving gear
3	Pulley hub	10	Housing
4	Packing gland	11	Cap
5	Compression packing	12	Stand screw (6 rqr)
6	Flanged mounting	13	Driven gear
7	Bushing (4 rqr)	14	Gland screw (2 rqr)

Figure 300. Rotary pump, exploded view.

354. Rotary Pump Inspection and Repair

Soak and wash all metal parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

a. Inspect the pulley for cracks, breaks, or damaged groove. Replace the pulley if cracked or broken. Repair a damaged pulley groove (par. 188).

b. Inspect the gears for cracks, chipped or broken teeth, and evidences of wear. Replace a gear that is cracked or has chipped, broken, or worn teeth. Inspect the shaft of the gear for wear,

scoring, and damaged keyway. Replace the gear if the shaft is worn, scored, or has a damaged keyway.

c. Inspect the flanged mounting, cap, and housing for cracks, breaks, and distortion. Replace a flanged mounting, cap, or housing if cracked, broken, or distorted. Inspect the bushings in the flanged mounting and cap for wear. Replace excessively worn bushings, using an arbor press.

d. Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace parts having damaged, corroded, or stripped threads.

e. Inspect all parts for good condition. Replace parts not in good condition.

355. Rotary Pump Reassembly
(fig. 300)

a. Reassembly.

(1) Position the driving gear (9) and the driven gear (13) in the flanged mounting (6).

(2) Position the housing (10) over the gears and on the flanged mounting. Position the cap (11) on the flanged mounting. Install the stand screws (12) and tighten into the flanged mounting.

(3) Install the compression packing (5) on the driving gear shaft and into the flanged mounting. Install the packing gland (4) and gland screws (14). Tighten the gland screws to seat the packing and not bind the driving shaft.

b. Installation. Install the rotary pump as instructed in paragraph 186*b*

Section XIII. ENGINE CLUTCH SHAFT AND CLUTCHES

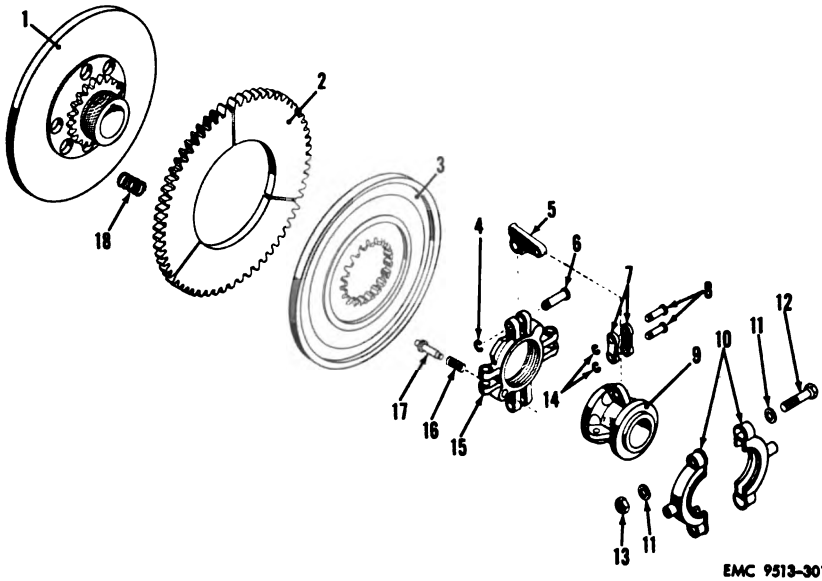
356. Revolving Frame Engine Clutch
(fig. 301).

a. General. The clutch engages by toggle action. When the cone collar (10) and sliding sleeve (9) are moved toward the clutch, the machined ends of the finger levers (5) contact the machined ring on the floating plate (3). This action causes the levers to go over center and engage the clutch. When the cone collar and sliding sleeve move back from the clutch, pressure against the floating plate is relieved and the clutch is disengaged.

b. Removal.

(1) Remove the engine from the revolving frame (par. 323).

(2) Remove the jamnut and lockwasher from the end of the engine clutch shaft (par. 358).



1	Hub and back plate	10	Cone collar
2	Driving plate	11	Washer (4 rqr)
3	Floating plate	12	Bolt (2 rqr)
4	Retaining ring (4 rqr)	13	Nut (2 rqr)
5	Finger lever (4 rqr)	14	Retaining ring (8 rqr)
6	Straight pin (4 rqr)	15	Adjusting yoke
7	Lever link (8 rqr)	16	Adjusting lockpin spring
8	Lever link pin (8 rqr)	17	Adjusting lockpin
9	Sliding sleeve	18	Release spring (6 rqr)

Figure 301. Revolving frame engine clutch, exploded view.

(3) Remove the clutch assembly from the engine clutch shaft. Remove the key from the shaft.

c. Disassembly.

(1) Remove the nuts (13), washers (11), and bolts (12) securing the halves of the cone collar (10). Remove the collar.

(2) Remove the retaining rings (14) and lever link pins (8) securing the lever links (7) to the sliding sleeve (9) and the finger levers (5). Remove the lever links.

(3) Remove the retaining rings (4) and pins (6) securing the finger levers (5) to the adjusting yoke (15). Remove the finger levers.

(4) Pull out the adjusting lockpin (17) to disengage it from the gear teeth in the floating plate (3). Turn the adjusting yoke counterclockwise to remove it from the hub and back plate (1), freeing the floating plate (3),

the segments of the driving plate (2), and the release springs (18).

(5) Remove the adjusting lockpin (17) and adjusting lockpin spring (16) from the adjusting yoke (15).

d. Inspection and Repair. Soak and wash all metal parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the driving plate segments for uneven wear, broken or worn teeth, and for grease soaking. Replace the complete driving plate if any segments are unsuited for further service.

(2) Inspect the cone collar for bends, dents, wear, or damage. Replace the cone collar if damaged or if the groove has worn in excess of one thirty-second of an inch.

(3) Inspect all parts for cracks, breaks, or wear. Replace parts that are cracked, broken, or worn.

e. Reassembly.

(1) Install the driving plate (2) and release springs (18) on the hub and back plate (1). Install the floating plate (3) on the hub, using care to aline the spring seats with the release springs.

(2) Position the finger levers (5) in the adjusting yoke (15) and secure with pins (6) and retaining rings (4).

(3) Install the adjusting lockpin spring (16) and adjusting lockpin (17) in the adjusting yoke (15). Pull the lockpin outward and install the adjusting yoke on the hub and back plate. Turn the yoke clockwise on the threaded hub.

(4) Install two lever links (7) on the ends of each finger lever (5) and secure with lever link pins (8) and retaining rings (14). Install the sliding sleeve (9), with the lever link bosses between each pair of lever links, and secure with lever link pins (8) and retaining rings (14).

(5) Install the cone collar (10) on the sliding sleeve (9) and secure with bolts (12), washers (11), and nuts (13).

f. Installation.

(1) Install the key in the keyway of the engine clutch shaft. Install the clutch assembly on the clutch shaft while guiding the clutch yoke on the cone collar.

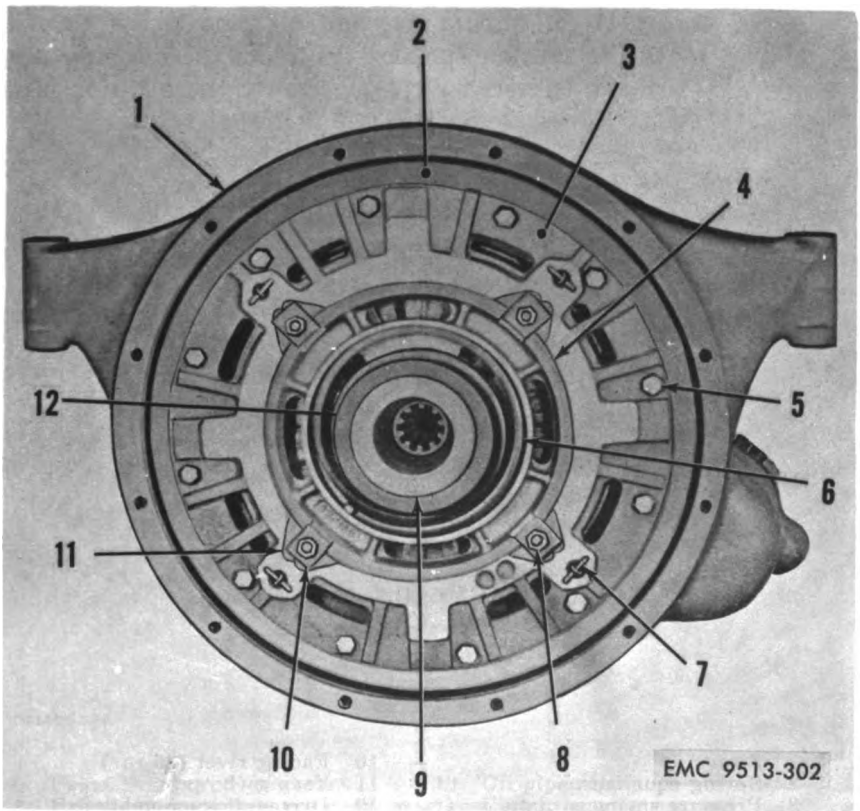
(2) Install and tighten the lockwasher and jamnut on the end of the engine clutch shaft (par. 358).

(3) Install the engine in the revolving frame (par. 324).

g. Adjustment. Adjust the revolving frame engine clutch as instructed in paragraph 195*a*(2).

357. Carrier Engine Clutch

a. General. The clutch flywheel ring (3, fig. 302) is attached to the engine flywheel (2) by means of driving lugs of the pressure plate (9, fig. 303) fitting into mating slots in the flywheel ring. To disengage the clutch, the sleeve (9, fig. 302) is pushed towards the engine flywheel by the clutch release bearing, compressing the pressure spring (6), thus relieving the pressure levers (7, fig. 303) of spring pressure. The pressure plate is retracted from contact with the driven disk assembly (12) by means of retractor springs (13), thus accomplishing complete clutch release. During engagement, the release sleeve (1) is allowed to move out away from the engine flywheel, at which time the spring pressure is



1 Bellhousing
2 Engine flywheel
3 Clutch flywheel wing
4 Adjusting plate
5 Mounting screw
6 Pressure spring
7 Retractor spring retaining pin
8 Stud nut
9 Sleeve
10 Adjusting strap
11 Adjusting shims
12 Pressure spring equalizer

Figure 302. Carrier engine clutch, installed.

transmitted through the pressure levers which multiply the spring pressure and deliver it to the pressure plate. The pressure levers bear against the continuous fulcrum rings (6) of both the adjusting plate (4) and the pressure plate (9) which provides for parallel movement of the pressure plate toward the engine flywheel.

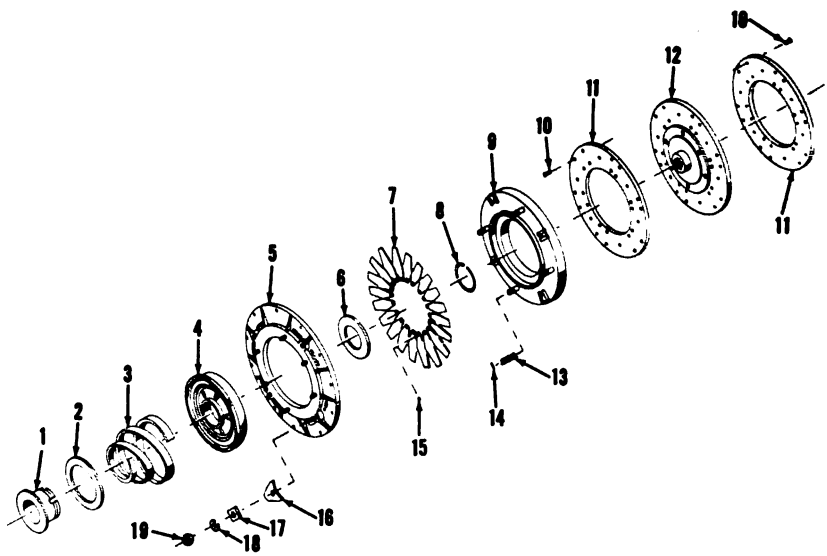
b. Removal.

(1) Remove the transmission (par. 404*b*).

(2) Remove the mounting screws (5, fig. 302) and lockwashers. Remove the clutch assembly from the engine flywheel (2).

Note. Loosen screws evenly to avoid cracking or damaging the pressure plate.

(3) Remove the lubrication fitting, oil pipe coupling (14, fig. 304), oil pipe (13), and oil pipe elbow (8). Remove the tension springs (9) from the oil pipe nipple (10) and cap screws (4). Remove the oil pipe nipple.



EMC 9513-303

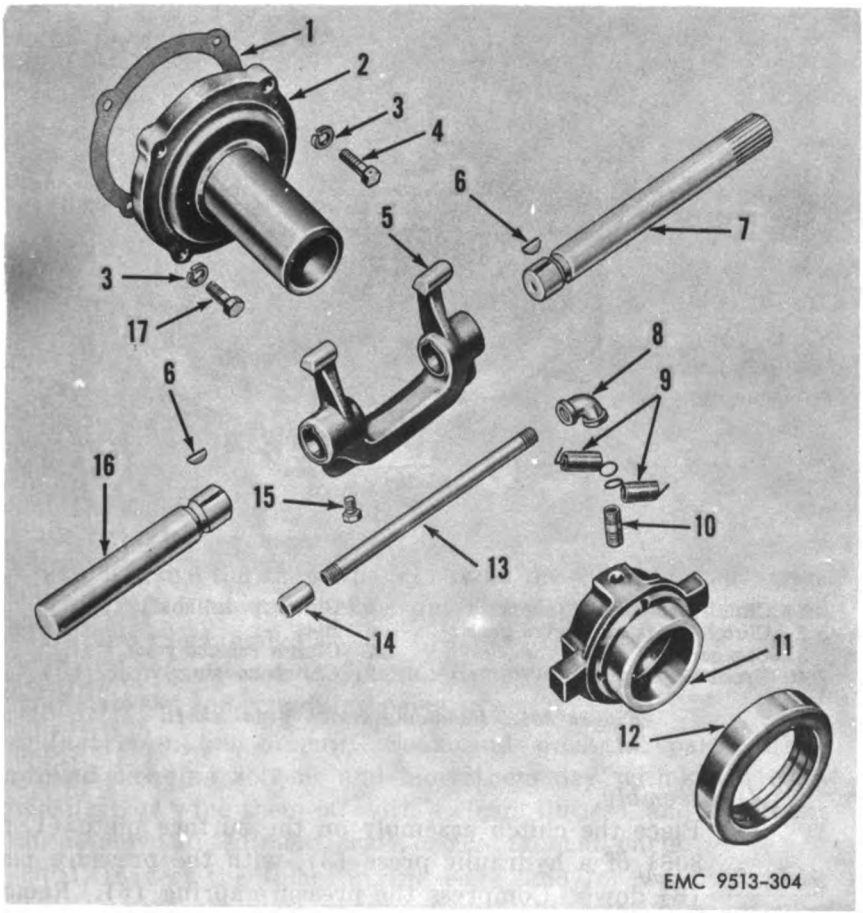
1	Sleeve	10	Facing rivet (36 rqr)
2	Spring equalizer	11	Facing (2 rqr)
3	Pressure spring	12	Driven disk assembly
4	Adjusting plate	13	Retractor spring (4 rqr)
5	Flywheel ring and stud assembly	14	Spring retaining pin (4 rqr)
6	Fulcrum ring (2 rqr)	15	Lever locking ball (20 rqr)
7	Pressure lever (20 rqr)	16	Adjusting shim (28 rqr)
8	Snap ring	17	Adjusting strap (4 rqr)
9	Pressure plate	18	Lockwasher (4 rqr)
		19	Nut (4 rqr)

Figure 303. Carrier engine clutch, exploded view.

Slide the clutch bearing carrier (11) and release bearing (12) from the front bearing cover (2).

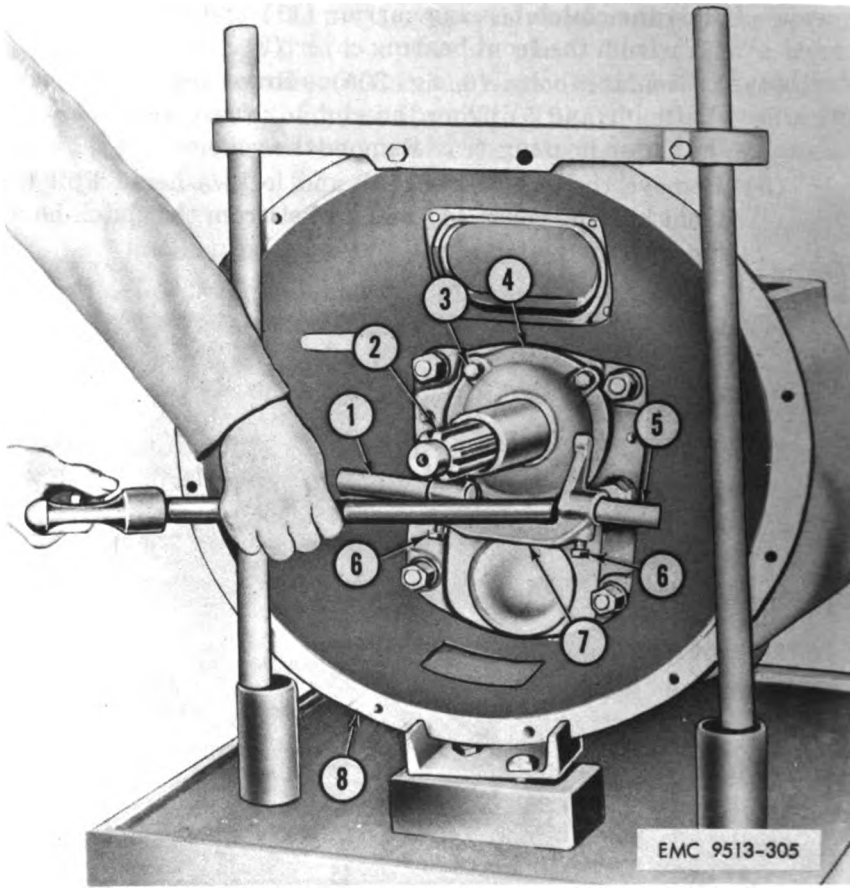
(4) Loosen the bolts (6, fig. 305). Drive the clutch pedal shafts (1 and 5) from the clutch release yoke (7) and the clutch housing (8). Remove the yoke.

(5) Remove the cap screws (3) and lockwashers. Pull the front bearing cover (4) and gasket from the clutch housing and the clutch shaft and drive gear (2).



1	Front bearing cover gasket	10	Oil pipe nipple
2	Front bearing cover	11	Clutch bearing carrier
3	Lockwasher (4 rqr)	12	Clutch release bearing
4	Cap screw (2 rqr)	13	Oil pipe
5	Clutch release yoke	14	Oil pipe coupling
6	Woodruff key (2 rqr)	15	Bolt (2 rqr)
7	Clutch pedal shaft	16	Clutch pedal shaft, short
8	Oil pipe elbow	17	Cap screw (2 rqr)
9	Tension spring (2 rqr)		

Figure 304. Clutch release assembly, exploded view.



1 Clutch pedal shaft, short
2 Clutch shaft and drive gear
3 Cap screw
4 Front bearing cover
5 Clutch pedal shaft
6 Bolt
7 Clutch release yoke
8 Clutch housing

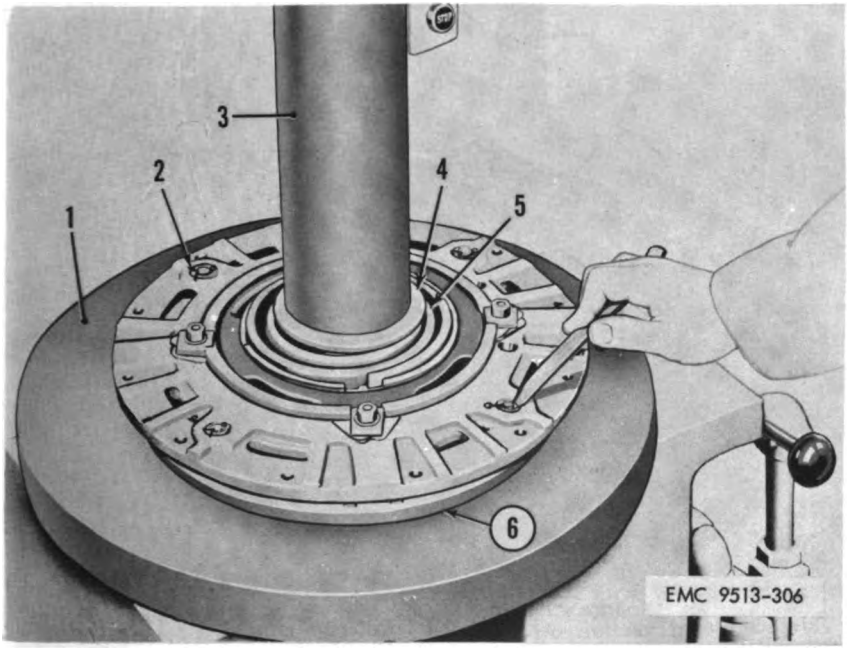
Figure 305. Removing clutch pedal shaft.

c. Disassembly.

(1) Place the clutch assembly on the surface plate (1, fig. 306) of a hydraulic press (3), with the pressure plate (6) down. Compress the pressure spring (5). Remove the spring retaining pins (2) and the retractor springs.

(2) Slowly release the press. Lift the flywheel ring from the assembly. Remove the driven disk assembly and pressure plate from the surface plate.

(3) Place the flywheel ring (6, fig. 307) on the surface plate (1), with the face of the sleeve (2) down. Using a metal yoke (4), or suitable blocks of wood, compress the assembly and lock the press in position.



1 Surface plate
2 Spring retaining pin
3 Hydraulic press
4 Sleeve
5 Pressure spring
6 Pressure plate

Figure 306. Removing spring retaining pin.

(4) Remove the snap ring (7) from the groove of the sleeve (2). Remove the fulcrum rings, pressure levers, and lever locking balls.

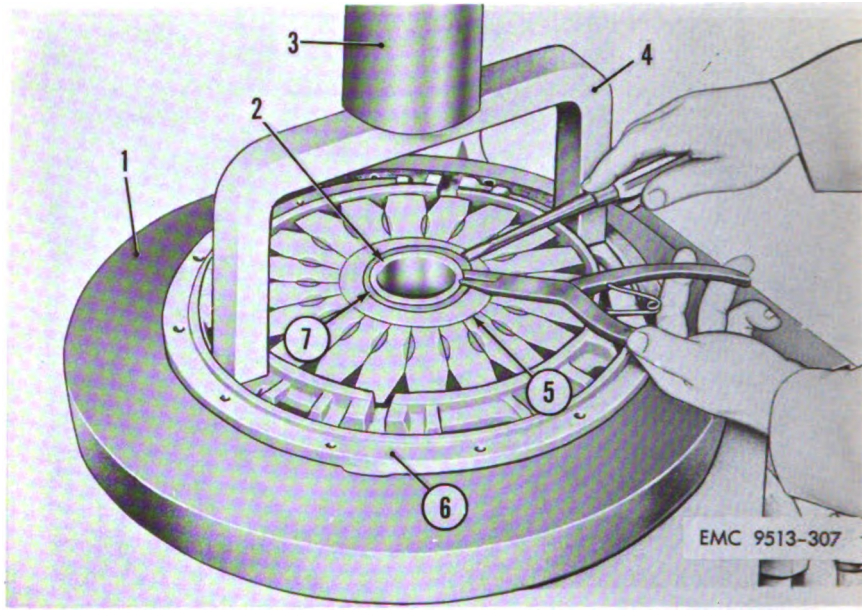
(5) Slowly release the press. Remove the pressure spring, sleeve, and remaining parts.

d. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the fulcrum ring edge land for wear. Replace a pressure plate or adjusting plate if the fulcrum edge land exceeds $\frac{1}{16}$-inch in width.

(2) Inspect the friction surface of the pressure plate for scoring, burning, heat cracking, and distortion. Replace a pressure plate having a surface that is badly scored, heat-cracked, or warped.

(3) Inspect the flywheel ring for cracks. Inspect the slots for indentation caused by the pressure plate lugs. Replace a cracked flywheel ring. Replace a flywheel ring in which the slots are indented.



1 Surface plate
2 Sleeve
3 Hydraulic press
4 Yoke
5 Fulcrum ring
6 Flywheel ring
7 Snap ring

Figure 307. Removing snap ring.

(4) Inspect the adjusting straps for wear and bent condition. Replace worn or bent adjusting straps.

(5) Inspect the adjusting plate bore for wear. The release sleeve must be a sliding fit in the bore. Inspect bottom of adjusting strap slots for wear. Replace an adjusting plate having a worn bore.

(6) Inspect the sleeve for wear or indentations of the flange. Inspect the snap ring groove for wear, nicks, or burs. Replace a worn or dented sleeve.

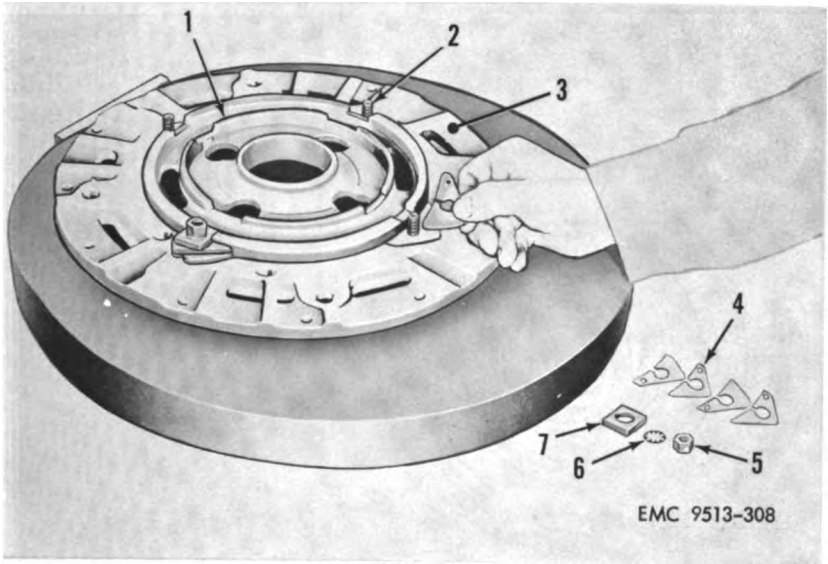
(7) Inspect the pressure levers to see that they are not bent or worn. Replace bent or worn pressure levers.

(8) Inspect the disk assembly for cracks, worn splines, and warped condition. Replace a cracked, worn, or warped disk assembly.

(9) Inspect all parts for good condition. Replace all unserviceable parts.

e. Reassembly.

(1) Position the adjusting plate (1, fig. 308) in the flywheel ring (3). Install the adjusting shims (4) and the adjusting straps (7) on the flywheel ring studs (2) and secure with lockwashers (6) and nuts (5).



1 Adjusting plate
2 Flywheel ring stud
3 Flywheel ring
4 Adjusting shims
5 Nut
6 Lockwasher
7 Adjusting strap

Figure 308. Installing clutch adjusting plate and shims.

(2) Place the sleeve (5, fig. 309) on an arbor press (4) with face down. Set the spring equalizer (6) over the sleeve onto beveled edge of sleeve flange with flat side of spring equalizer down. Place pressure spring (3) on the adjusting plate (2) with end of the large coil abutting the small boss in the adjusting plate. Place the flywheel ring (1) with adjusting plate and pressure spring over the sleeve, seating the small coil of the spring in position on the spring equalizer.

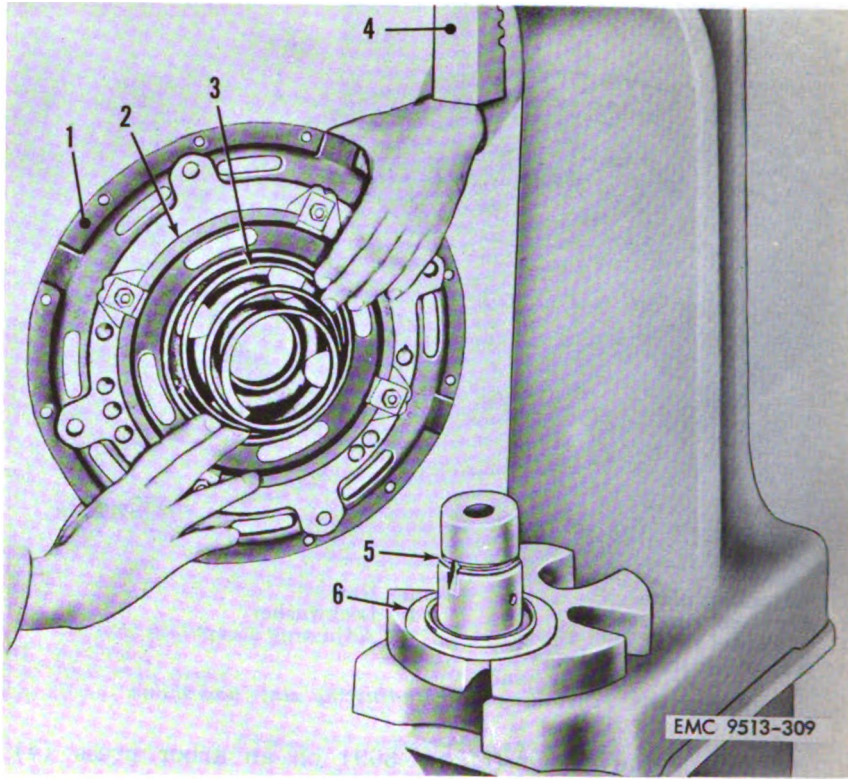
(3) Using a yoke (1, fig. 310) assembled from blocks, compress slowly the assembly to allow the sleeve (4) to slip through the bore of the adjusting plate. Be sure the spring equalizer is seated properly on the top coil of the pressure spring. Lock the press.

(4) Place one of the fulcrum rings (3), cupped side up, over the sleeve until it is seated firmly.

(5) Arrange the 20 pressure levers around the sleeve (fig. 311).

(6) Insert a lever locking ball in the hole at the end of each pressure lever (fig. 312).

(7) Place the other fulcrum ring (7, fig. 313), cupped side down, over the sleeve (5), making sure the pressure levers (8) do not overlap.



1 Flywheel ring
2 Adjusting plate
3 Pressure spring
4 Arbor press
5 Sleeve
6 Spring equalizer

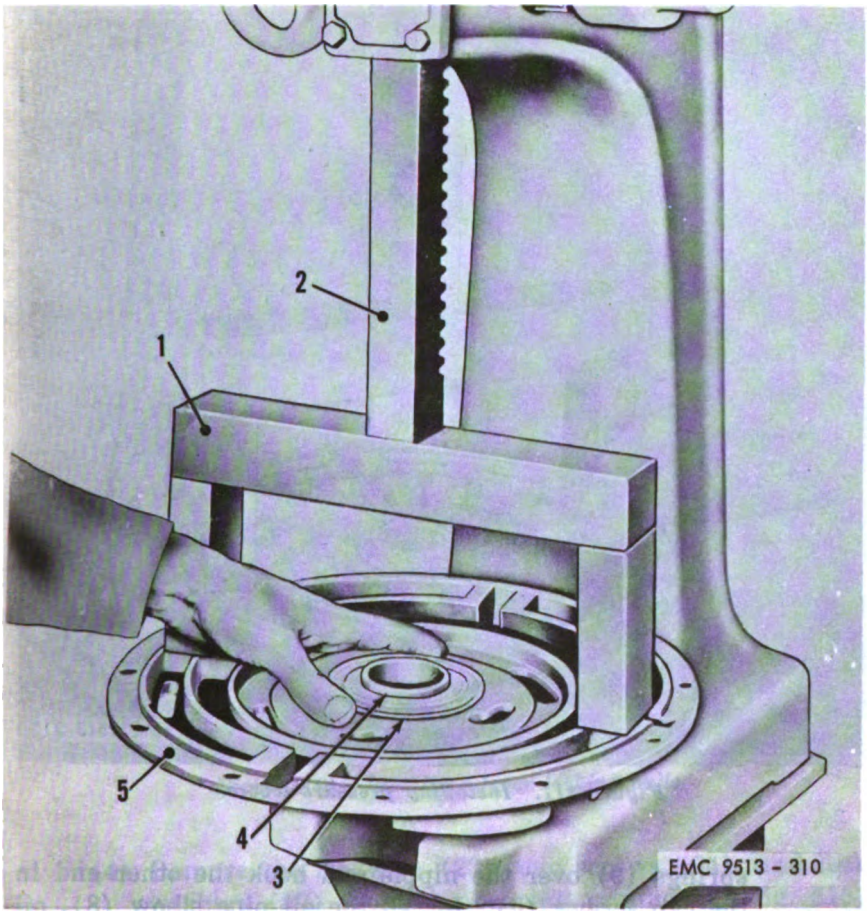
Figure 309. Installing pressure spring and sleeve.

(8) Press the snap ring (6) on the sleeve and tap lightly around the ring until it seats on the fulcrum ring (7). Place the opening in the snap ring away from the slots in the sleeve. Using a staking tool (1), tap the snap ring securely into the sleeve groove.

(9) Test each of the 20 pressure levers (8) to see that they are locked securely by a ball and that they do not overlap. Release the arbor press (2) slowly and remove the yoke (3).

(10) Hold the pressure plate and line up the O marks on the rims of the flywheel ring and the pressure plate. Lower the pressure plate, guiding the driving lugs into the slots of the flywheel ring. When these are engaged, turn the assembly over while holding the units together.

(11) Install the retractor springs (13, fig. 303). Compress the pressure spring and sleeve (1) and install the spring retaining pins (14). Release the press.



1 Yoke
2 Arbor press
3 Fulcrum ring
4 Sleeve
5 Flywheel ring

Figure 310. Installing fulcrum ring.

f. Installation.

(1) Position the gasket and front bearing cover (4, fig. 305) on the clutch shaft and drive gear (2) and in the clutch housing (8). Secure the cover with lockwashers and the cap screws (3).

(2) Position the clutch release yoke (7) and drive the clutch pedal shafts (1 and 5), with woodruff keys, through the clutch housing and yoke. Tighten the bolts (6).

(3) Install the clutch release bearing (12, fig. 304) on the clutch bearing carrier (11). Slide the clutch bearing carrier (11) on the front bearing cover (2). Install the oil pipe nipple (10). Slip the end of the tension

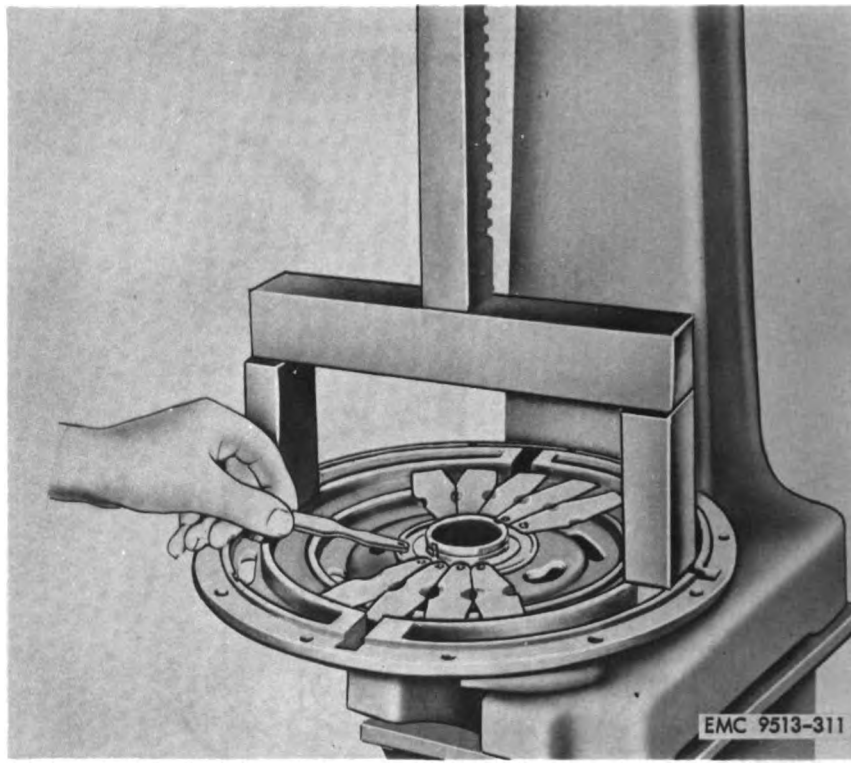


Figure 311. Installing pressure levers.

springs (9) over the nipple and hook the other end in the cap screws (4). Install the oil pipe elbow (8), oil pipe (13,) oil pipe coupling (14), and a lubrication fitting.

(4) Install the clutch assembly in the engine flywheel (2, fig. 302) and secure with lockwashers and mounting screws (5).
(5) Lubricate the clutch assembly (LO 5–9513–3).
(6) Install the transmission (par. 406*b*).
(7) Adjust the clutch (par. 195*b*(2)).

358. Engine Clutch Shaft Assembly

a. Removal and Disassembly.

(1) Remove the revolving frame engine clutch assembly (par. 356*b*).
(2) Remove the gearcase cover (par. 360*a*).
(3) Remove the lubrication fitting (26, fig. 314) and jamnuts (25) from the shaft (17). Remove the pulley (6) and key (16) from the shaft.

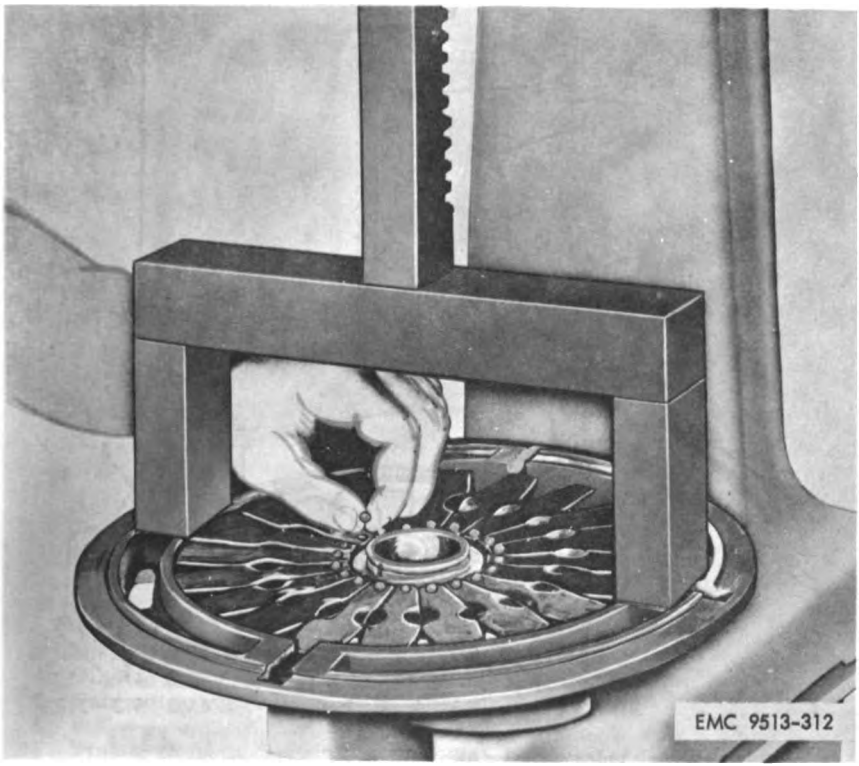


Figure 312. Installing lever locking balls.

(4) Remove the lockwire (23), cap screws (24), and lockwashers (22) from the bearing retainer (2, fig. 315). Remove the shaft (4) with pinion (3), oil slinger (1), and bearing retainer (2) from the gearcase.

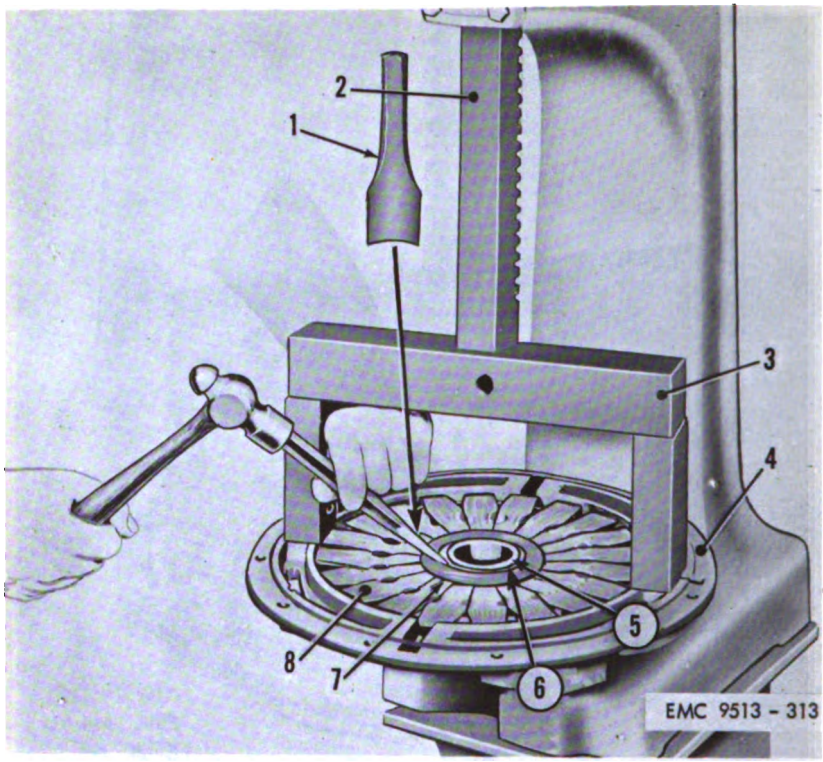
(5) Remove the pinion (7, fig. 314), oil slinger (8), bearing retainer (9), and ball bearing (10) from the shaft. Remove the oil seal (15) from the gearcase.

b. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the shaft for wear, scoring, and damaged keyways. Replace a shaft that is worn, scored, or has a damaged keyway.

(2) Inspect the shafts and gears for worn, chipped, scored, or twisted splines or teeth. Replace a shaft or gear that has worn, chipped, scored, or twisted splines or teeth.

(3) Inspect all parts for good condition. Replace parts not in good condition.



1 Staking tool
2 Arbor press
3 Yoke
4 Flywheel ring
5 Sleeve
6 Snap ring
7 Fulcrum ring
8 Pressure lever

Figure 313. Installing snap ring.

c. Reassembly and Installation (fig. 314).

(1) Install the pinion (7) on the shaft (17). Install the oil slinger (8), bearing retainer (9), and ball bearing (10) on the shaft.

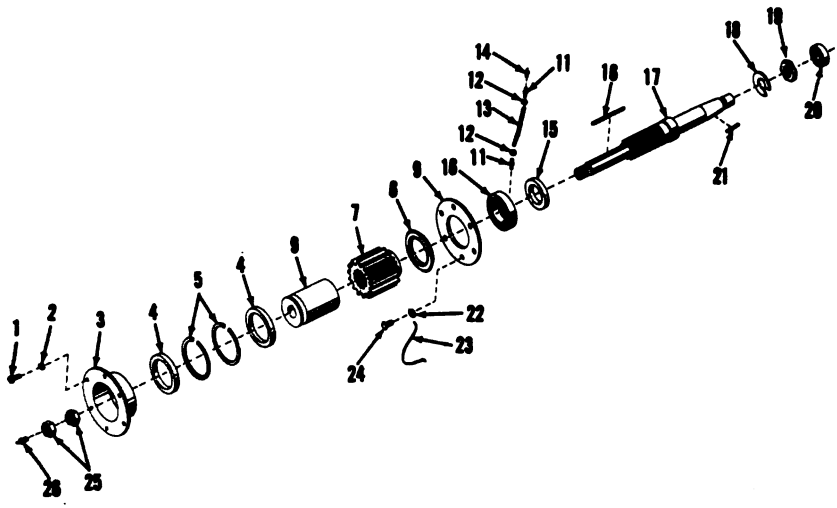
(2) Position the shaft assembly in the gearcase. Secure the bearing retainer (9) to the gearcase with lockwashers (22) and cap screws (24). Install lockwire (23) in heads of screws when tightened.

(3) Install the oil seal (15) on the shaft and in the gearcase.

(4) Position the key (16) in the shaft (17). Install the pulley (6) on the key and shaft. Install and tighten the jamnuts (25) on the shaft. Install the lubrication fitting (26) in the shaft.

(5) Install the gearcase cover (par. 362*e*).

(6) Install the clutch assembly (par. 356*f*).



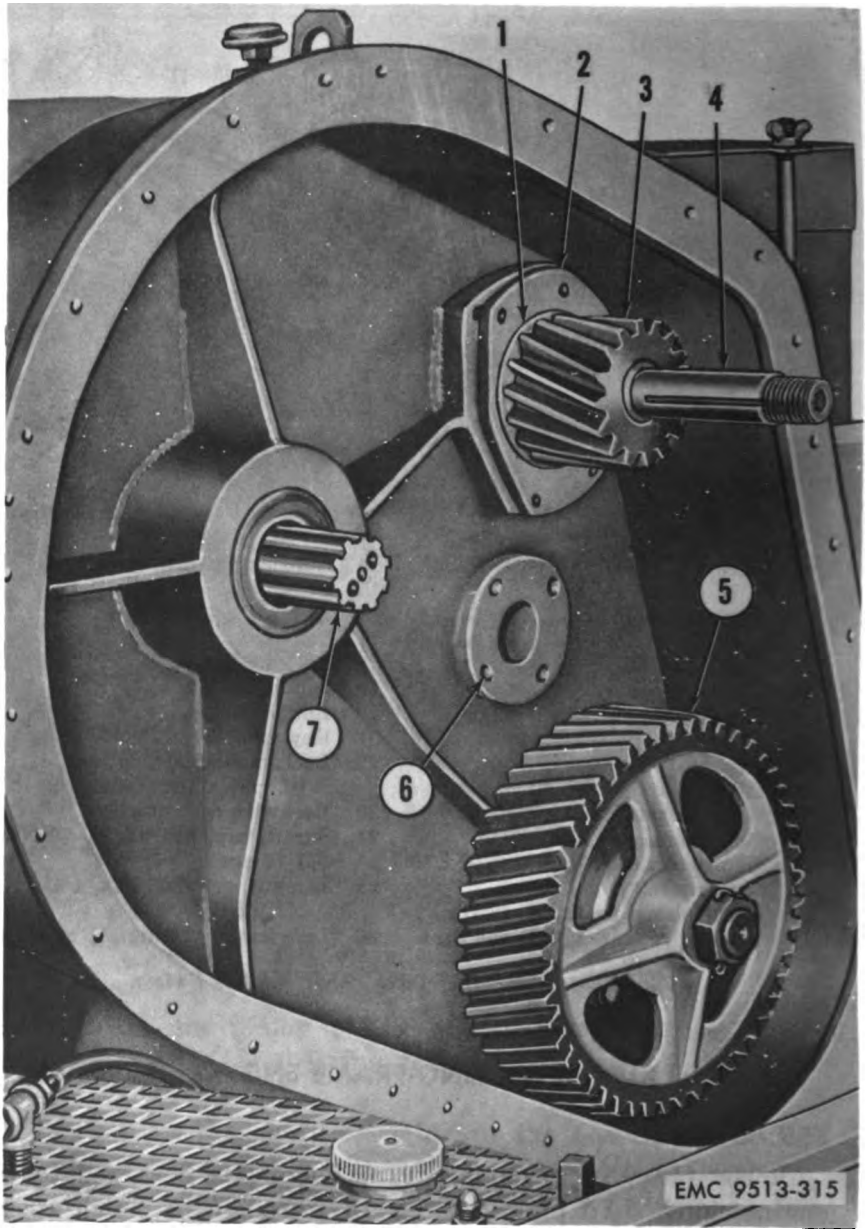
1	Screw, cap, hex hd, ⅝–16 NC x ¾ (6 rqr)	14	Lubrication fitting, ⅛ x 30°
2	Lockwasher, spring, std, ⅝ (6 rqr)	15	Oil seal
3	Oil seal retainer	16	Key, std, ⅜ x ⅜ x 4
4	Oil seal (2 rqr)	17	Shaft
5	Retaining ring (2 rqr)	18	Lockwasher
6	Pulley	19	Jamnut
7	Pinion, 16 tooth	20	Ball bearing
8	Oil slinger	21	Key, std, ¼ x ¼ x 2 5/16
9	Bearing retainer	22	Lockwasher, spring, std, ½ (6 rpr)
10	Ball bearing	23	Lockwire (as rqr)
11	Connector, tubing, brass, ⅛ x ¼ (2 rqr)	24	Screw, cap, hex hd, ½–20 NF x 1 (6 rqr)
12	Nut, tubing, brass, ¼ (2 rqr)	25	Jamnut, regular, hex, 1¼–12 NF (2 rqr)
13	Tubing, copper, ¼ OD (as rqr)	26	Lubrication fitting, ⅛ straight

Figure 314. Engine clutch shaft, exploded view.

Section XIV. REVOLVING FRAME ENGINE GEARCASE

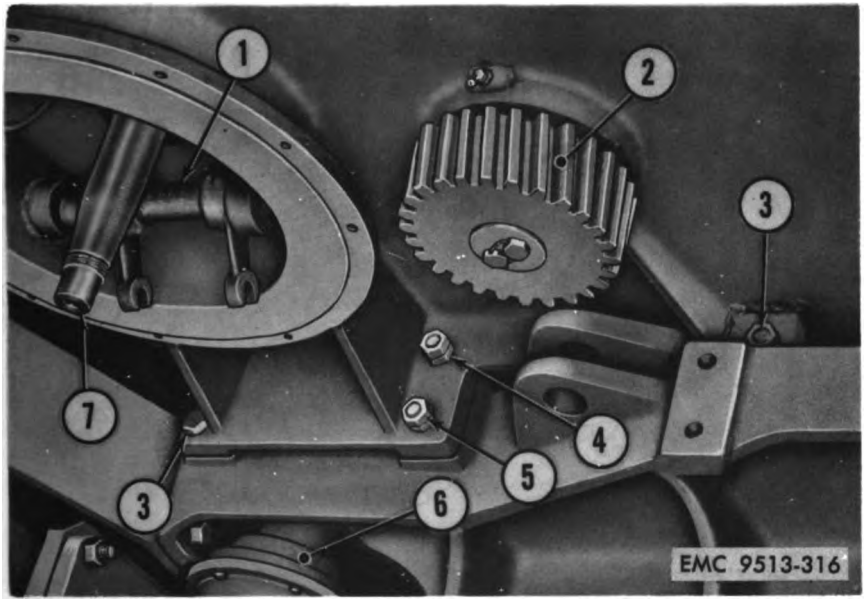
359. General

Power from the revolving frame engine is delivered to the engine clutch shaft pinion (2, fig. 13) through the clutch assembly. The clutch shaft pinion drives the jackshaft spur gear (5) inside the gearcase. The jackshaft pinion (2, fig. 316) drives the horizontal intermediate shaft gear which is part of the revolving frame machinery power train. The independent boom hoist drive pinion (4, fig. 13) is driven by the idler shaft pinion. The drive shaft is connected by the flexible coupling (6, fig. 316) to the independent boom hoist assembly.



1 Oil slinger
2 Bearing retainer
3 Pinion
4 Shaft
5 Independent boom hoist drive gear
6 Idler shaft mounting
7 Jackshaft

Figure 315. Engine gearcase, clutch shaft and pinion, partially removed.



1 Clutch yoke
2 Jackshaft pinion
3 Mounting bolts
4 Hex nuts
5 Hex jamnuts
6 Flexible coupling
7 Clutch shaft

Figure 316. Gearcase installed, rear view.

360. Gearcase Disassembly

a. Remove Gearcase Cover.

(1) Remove the magnetic pipe plug (21, fig. 317) from the gearcase (4) and drain the lubricant.

(2) Remove the rotary pump and the oil tank (par. 186*a*).

(3) Remove the screws (1, fig. 314), lockwashers (2), and oil seal retainer (3) from the gearcase cover (2, fig. 317).

(4) Remove the bolts (1), lockwashers (5), nuts (6), cover (2), and gasket (3) from the gearcase (4).

b. Remove Engine Clutch Shaft.

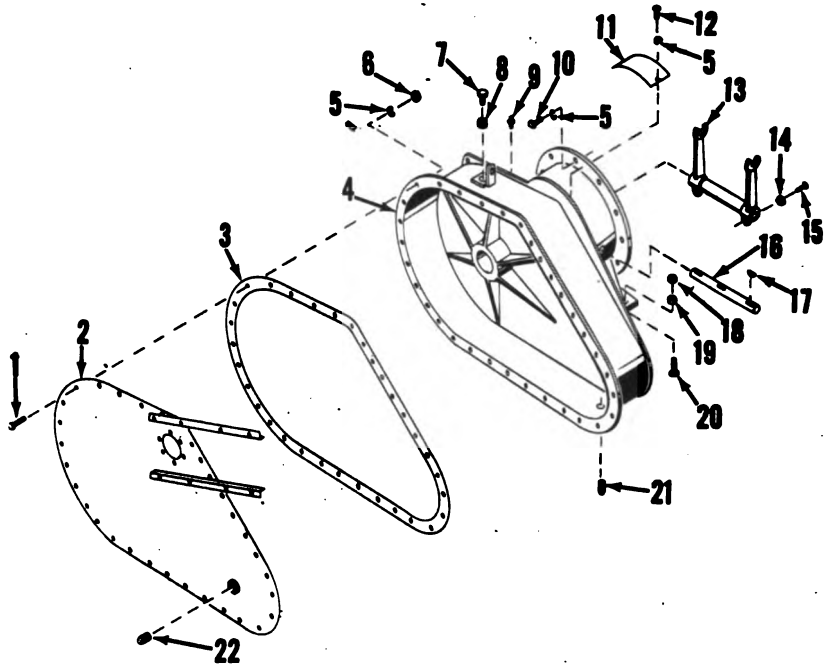
(1) Remove engine clutch shaft assembly (par. 358*a*).

(2) Loosen the jamnut (14, fig. 317) and setscrew (15). Remove the lever shaft (16), keys (17), and the clutch yoke (13).

c. Remove Idler Shaft Assembly.

(1) Remove the cotter pin (2, fig. 318) and jamnut (1) from the shaft (5).

(2) Using threaded rods (4, fig. 319), puller bar (5), puller screw (6), and wrenches (7 and 9), remove the idler pinion (3) from the shaft.



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1	Bolt, hex hd, ⅝–16 NC x 1 (37 rqr)	12	Screw, cap, hex hd, ⅝–16 NC x ¾ (2 rqr)
2	Gearcase cover	13	Clutch yoke
3	Gasket	14	Jamnut, regular, hex, ⅝–16 NC
4	Gearcase	15	Setscrew, sq hd, cup point, ⅝–16 NC x 1
5	Lockwasher, spring, std, ⅝ (51 rqr)	16	Lever shaft
6	Nut, regular, hex, ⅝–16 NC (37 rqr)	17	Key, woodruff No. A (3 rqr)
7	Breather	18	Jamnut, regular, hex, ⅝–18 NF (5 rqr)
8	Bushing, reducing, ¾ x ⅜	19	Nut, regular, hex, ⅝–18 NF (5 rqr)
9	Lubrication fitting, ⅛ straight	20	Bolt, hex hd, ⅝–18 NF x 2½ (5 rqr)
10	Screw, cap, hex hd, ⅜–16 NC x 1¼ (12 rqr)	21	Pipe plug, magnetic
11	Inspection plate	22	Plug, pipe, ¾

Figure 317. Gearcase, exploded view.

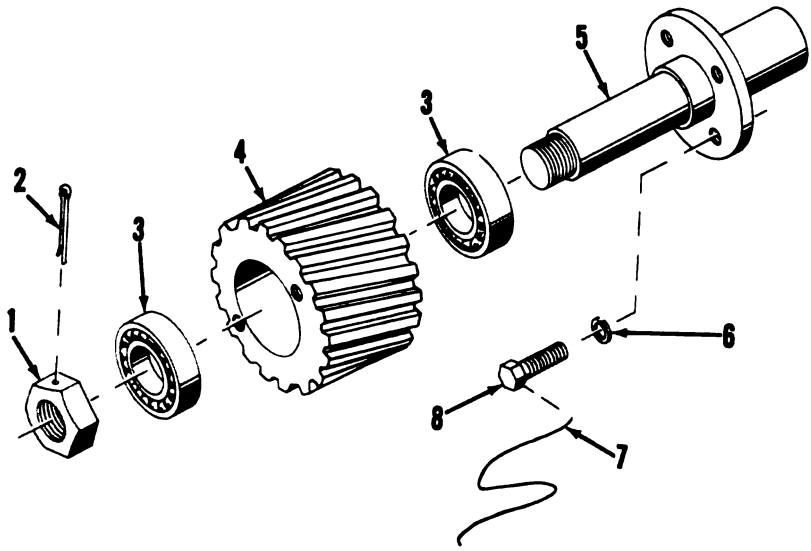
(3) Remove the ball bearings (3, fig. 318) from the pinion (4).

(4) Remove the lockwire (7), screws (8), lockwashers (6), and the shaft (5) from the gearcase.

d. Remove Jackshaft Assembly.

(1) Remove the lockwire (9, fig. 320), screws (1), and end washer (2).

(2) Using the push-pull unit (4, fig. 321), and the pump unit (7) of the hydraulic jack set, a puller bar (5),



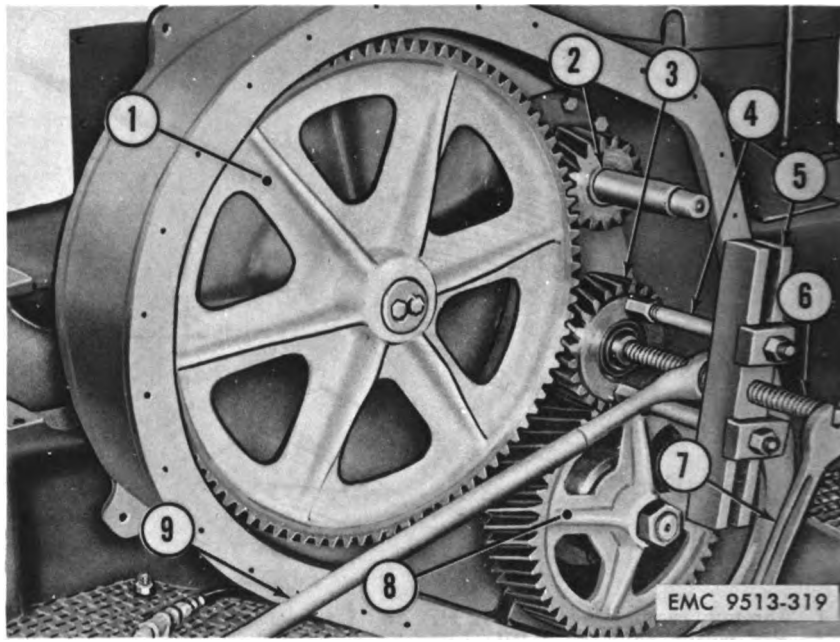
EMC 9513-318

1 Jamnut, regular, hex, 1½–12 NF
2 Pin, cotter, split, 5/16 x 2½
3 Ball bearing (2 rqr)
4 Pinion, 23 tooth
5 Shaft
6 Lockwasher spring, std, ⅜ (4 rqr)
7 Lockwire (as rqr)
8 Screw, cap, hex hd, ½–20 NF x 1¼ (4 rqr)

Figure 318. Idler shaft, exploded view.

puller plates (2), and threaded rods (3), pull the jackshaft gear (1) from the shaft. Attach the puller plates to the threaded rods with plain washers and nuts. Position the puller plates on the inside of the gear spokes and as close to the gear hub as possible. Position the threaded rods in the puller bar and install plain washers and nuts on the rods. Position the push-pull unit on the puller bar and install a spacer (6) between the shaft and push-pull unit. Make sure the outside diameter of the spacer is smaller than the outside diameter of the shaft. Operate the pump unit to tighten the push-pull unit against the spacer and puller bar. Check to make sure that all components are located properly to perform the gear pulling operation in the same plane as the shaft and at right-angle to the gear. Operate the pump unit to extend the push-pull unit and pull the gear from the shaft.

Warning: Do not stand or walk in front of the gear and puller bar during the gear pulling operation. Caution other personnel in the immediate area of the gear pulling operation.



1 Jackshaft gear
2 Clutch shaft assembly
3 Idler pinion
4 Threaded rod
5 Puller bar
6 Puller screw
7 Wrench
8 Independent boom hoist drive gear
9 Socket wrench and extension

Figure 319. Pulling idler pinion.

(3) Remove the shaft (6, fig. 320) with the pinion (8) from the gearcase.

(4) Remove the lockwire (9), screws (1), and end washer (2) from the shaft. Using an arbor press, press the pinion from the shaft.

(5) Remove the bearings (4 and 7) and the oil seal (5).

e. Remove Independent Boom Hoist Drive Shaft Assembly.

(1) Remove the cotter pin (2, fig. 322) and jamnut (1).

(2) Using a puller (3, fig. 323), puller screw (4), and wrench (5), remove the drive gear (2) from the drive shaft.

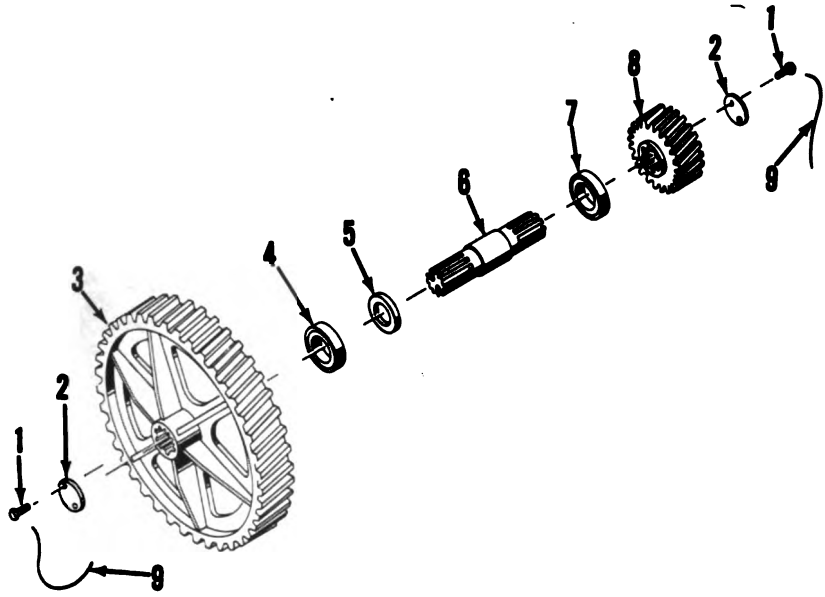
(3) Separate the flexible coupling (par. 363*b*).

(4) Remove the screws (8, fig. 322) and lockwashers (9). Remove the bearing housing (15) with drive shaft (6) from the gearcase.

(5) Remove the shaft, bearings (5 and 16), and oil seal (11).

361. Gearcase Inspection and Repair

Soak and wash all metal parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off



EMC 9513-320

1	Screw, cap, hex hd, ⅝–24 NF X1 (4 rqr)	5	Oil seal
2	End washer (2 rqr)	6	Shaft
3	Gear, 88 tooth	7	Ball bearing
4	Ball bearing	8	Pinion, 26 tooth
		9	Lockwire (as rqr)

Figure 320. Jackshaft, exploded view.

with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

a. Inspect all gears for cracks, chipped or broken teeth, and evidences of wear. Replace a gear that is cracked, or has chipped, broken, or worn teeth.

b. Inspect all bearings (par. 316).

c. Inspect the shafts (par. 319).

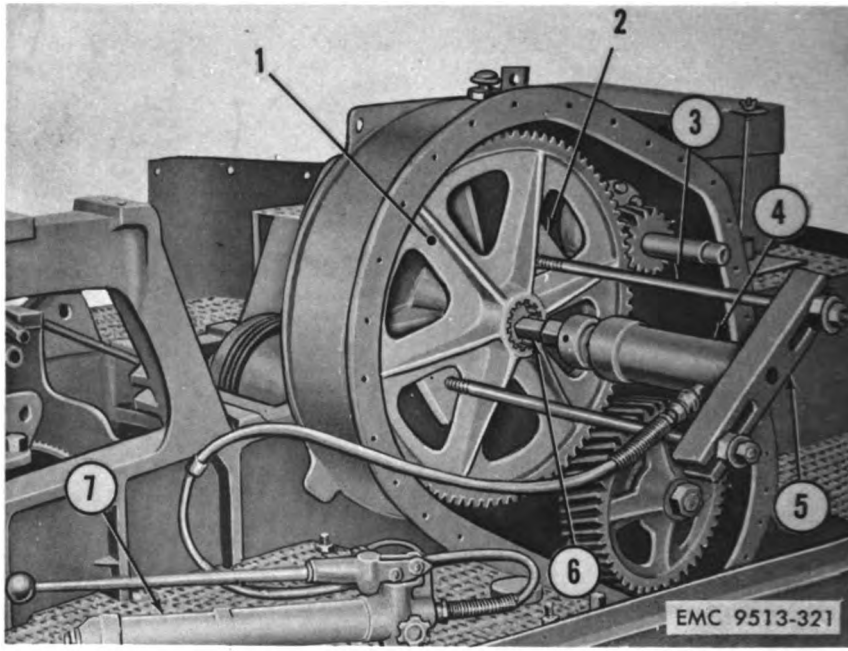
d. Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace parts having damaged, corroded, or stripped threads.

e. Inspect all parts for good condition. Replace parts not in good condition.

362. Gearcase Reassembly

a. Install Independent Boom Hoist Drive Shaft Assembly (fig. 322).

(1) Install the ball bearing (16) on the drive shaft (6). Install the bearing housing (15) on the shaft and bearing. Install the oil seal (11) on the shaft and into the housing.



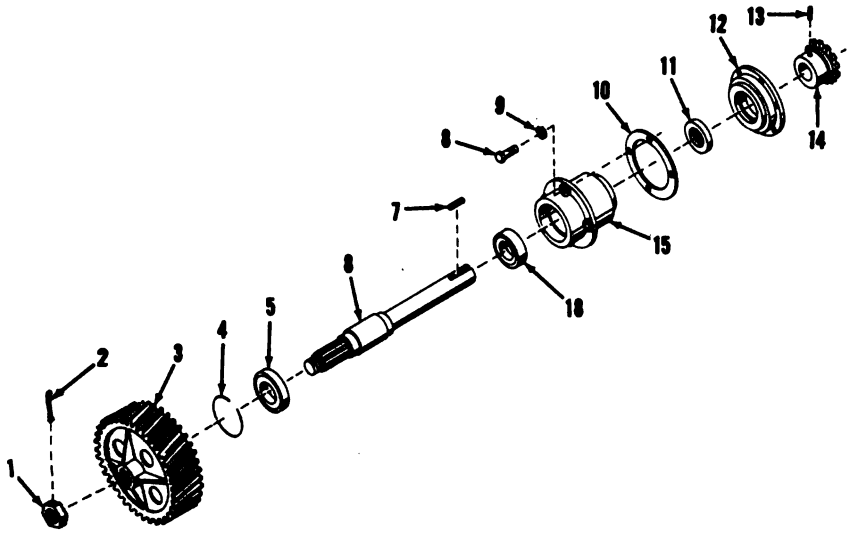
1 Jackshaft gear
2 Puller plate
3 Threaded rod
4 Push-pull unit
5 Puller bar
6 Spacer
7 Pump unit

Figure 321. Pulling jackshaft gear.

(2) Install the ball bearing (5) on the shaft and into the housing and secure with the retaining ring (4).
(3) Position the shaft with bearing housing and gasket in the gearcase and secure with screws (8) and lockwashers (9).
(4) Install the flexible coupling cover half (12), key (7), and flexible coupling half (14) on the shaft. Install the setscrew (13).
(5) Connect the flexible coupling halves (par. 365*b*).
(6) Install the drive gear (3) on the shaft and secure with the jamnut (1) and cotter pin (2).

b. Install Jackshaft Assembly (fig. 320).

(1) Install the ball bearing (7) and pinion (8) on the shaft (6). Install the end washer (2) and secure with screws (1) and lockwire (9).
(2) Install the shaft in the gearcase from the rear.
(3) Install the oil seal (5) and ball bearing (4) on the shaft and in the gearcase.
(4) Install the gear (3) on the shaft. Install the end washer (2) and secure with screws (1) and lockwire (9).



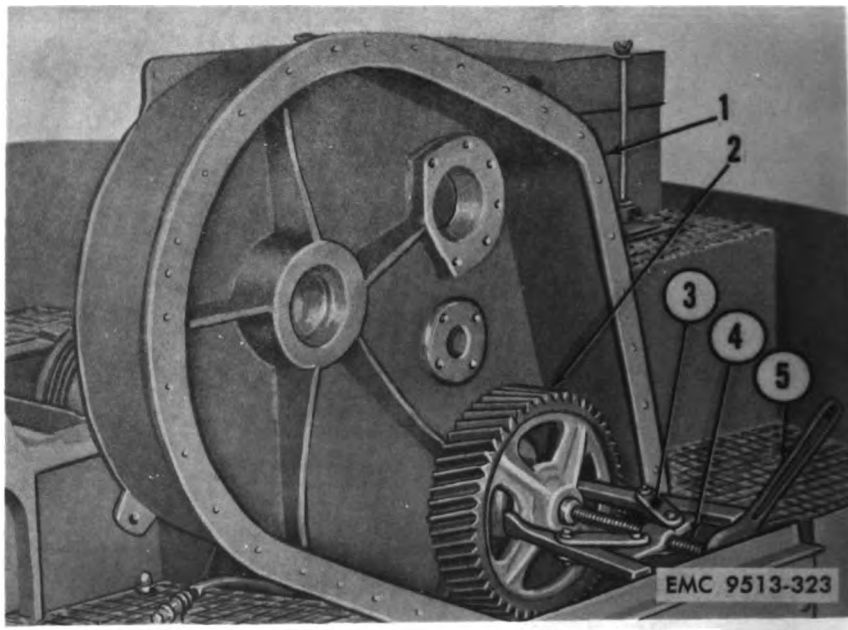
1	Jamnut, regular, hex, 1½–12 NF	9	Lockwasher, spring, std, ½ (4 rqr)
2	Pin, cotter, split, 3/16 x 2½	10	Gasket
3	Drive gear, 49 tooth	11	Oil seal
4	Retaining ring	12	Flexible coupling cover half
5	Ball bearing	13	Setscrew
6	Drive shaft	14	Flexible coupling half
7	Key, std, ½ x ½ x 2	15	Bearing housing
8	Screw, cap, hex hd, ½–20 NF x 1½ (4 rqr)	16	Ball bearing

Figure 322. Independent boom hoist drive shaft, exploded view.

c. *Install Idler Shaft Assembly* (fig. 318).
   (1) Position the shaft (5) in the gearcase and secure with lockwashers (6), screws (8), and lockwire (7).
   (2) Install the ball bearings (3) in the pinion (4). Install the pinion on the shaft. Install the jamnut (1) and cotter pin (2).

d. *Install Engine Clutch Shaft Assembly* (fig. 317).
   (1) Position the clutch yoke (13) in the gearcase. Install the lever shaft (16), with keys (17), in the clutch yoke and support. Install the setscrew (15), with jamnut (14), in the yoke.
   (2) Install the engine clutch shaft assembly (par. 358c).

e. *Install Gearcase Cover.*
   (1) Position the gasket (3, fig. 317) and cover (2) on the gearcase (4) and secure with screws (1), lockwashers (5), and nuts (6).
   (2) Install the oil seals (4, fig. 314) and retaining rings (5) in the oil seal retainer (3).



1 Gearcase
2 Drive gear
3 Puller
4 Puller screw
5 Wrench

Figure 323. Pulling independent boom hoist drive gear.

(3) Position the oil seal retainer (3) over the pulley (6) and secure to the gearcase cover with screws (1) and lockwashers (2).

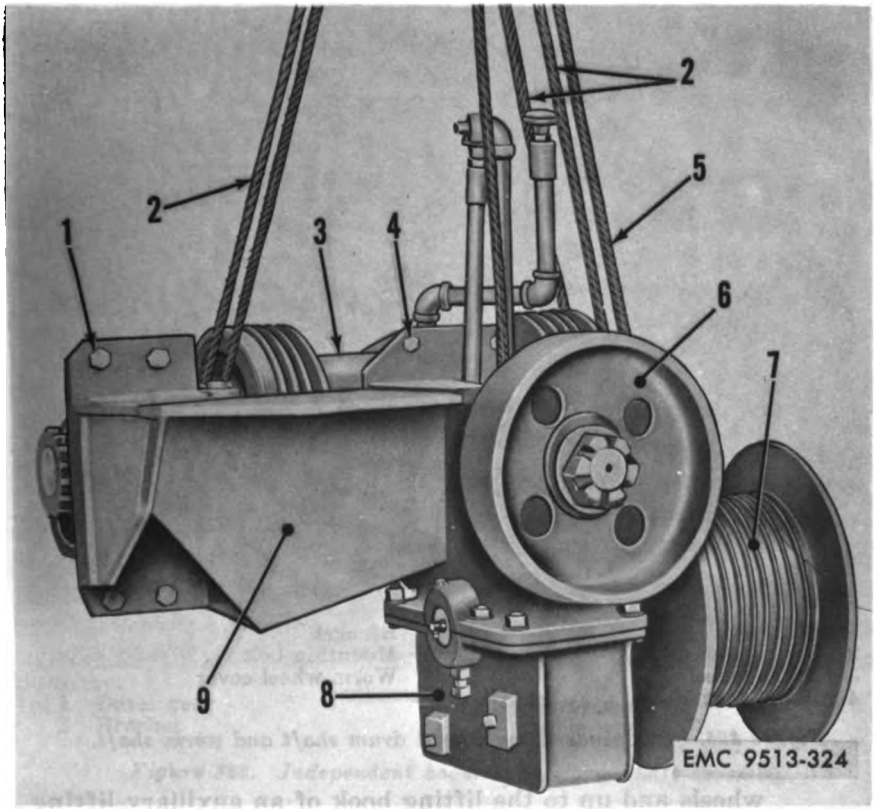
(4) Install the rotary pump and oil tank (par. 186*b*).

(5) Install the magnetic pipe plug (21, fig. 317). Lubricate the gearcase (LO 5–9513–2).

Section XV. INDEPENDENT BOOM HOIST ASSEMBLY

363. Independent Boom Hoist Removal and Disassembly

a. Description. The independent boom hoist assembly consists of a clutch shaft assembly (3, fig. 324), a drum shaft assembly (fig. 325), and a worm shaft assembly (fig. 326), mounted in the counterweight of the revolving frame. The independent boom hoist assembly raises or lowers the boom and load under power operated by separate friction clutches, either independently of, or simultaneously with, any other combination of crane motions. The independent boom hoist will automatically lock in any position. The final drive between the reversing friction clutches and the boom hoist drum (2, fig. 325) in through the bevel gear (1, fig. 326) and worm shaft (3) to the worm wheel on the brakedrum



1 Pillow block mounting bolt
2 Lifting sling
3 Clutch shaft assembly
4 Mounting bolt
5 Lifting sling
6 Brake wheel
7 Boom hoist drum
8 Worm wheel cover
9 Bracket

Figure 324. Independent boom hoist assembly.

in the cover (7, fig. 325) running in oil, with the addition of an automatic safety brake.

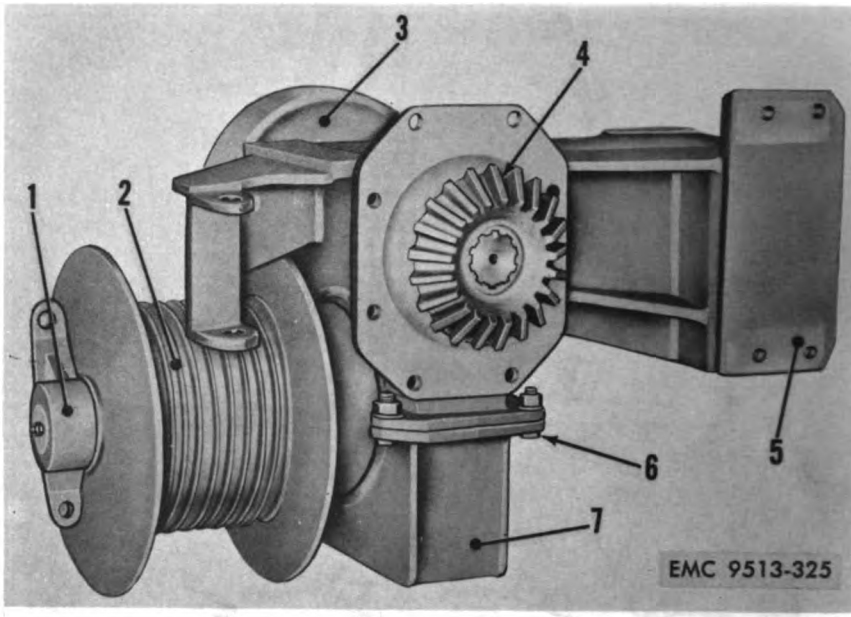
b. Removal.

(1) Drain the independent boom hoist circulating oil system (LO 5–9513–2). Remove the oil piping from the boom hoist assembly.

(2) Remove the clutch control (par. 205*a*) and the brake control (par. 198*b*).

(3) Separate the flexible coupling covers (3, fig. 327). Remove the link lock plate (2), connecting link plate (1), and connecting link (5) from the roller chain (4). Remove the chain.

(4) Position lifting slings (2, fig. 324) around the friction



1 Bearing
2 Boom hoist drum
3 Brake wheel
4 Bevel gear
5 Bracket
6 Mounting bolt
7 Worm wheel cover

Figure 325. Independent boom hoist drum shaft and worm shaft.

wheels and up to the lifting hook of an auxiliary lifting device.

(5) Position a lifting sling (5) around the brake wheel and up to the lifting hook. Take up the slack.

(6) Remove the nuts, lockwashers, and mounting bolts (3, fig. 328). Remove the nuts, lockwashers, and mounting bolts from the bearing (1, fig. 325).

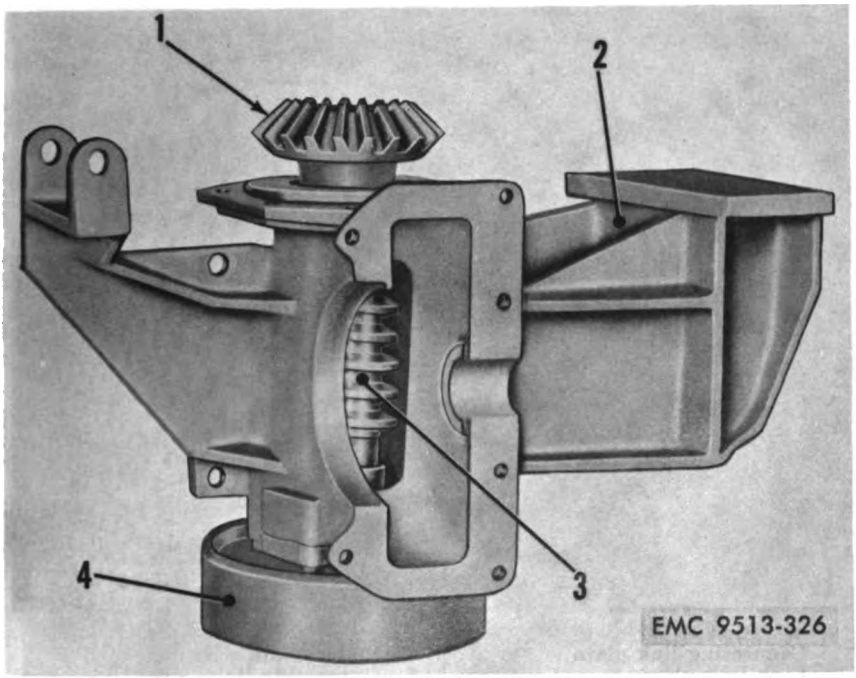
(7) Lower the independent boom hoist assembly to the ground or a movable platform. Remove the lifting slings.

c. *Disassembly.*

(1) Remove the nuts, lockwashers, and mounting bolts (4, fig. 324). Remove the clutch shaft assembly (3) from the drum shaft and worm shaft (fig. 325). Remove the nuts, lockwashers, and mounting bolts (6, fig. 325). Remove the worm shaft assembly (fig. 326) from the drum shaft.

(2) Loosen the setscrew (48, fig. 329). Remove the coupling half (47) and key (46) from the shaft (26). Remove the coupling cover half (42).

(3) Remove the nuts (12), lockwashers (13), screws (18), and split collar (40) from the shaft (26).



1 Bevel gear
2 Bracket
3 Worm shaft
4 Brake wheel

Figure 326. Independent boom hoist worm shaft assembly.

(4) Remove the nuts (12), lockwashers (13), and screws (39). Remove the pillow block caps (38 and 31), pillow block (34), shims (33), ball bearing (2), felt washer (32), spacer (6), and thrust collar (49).

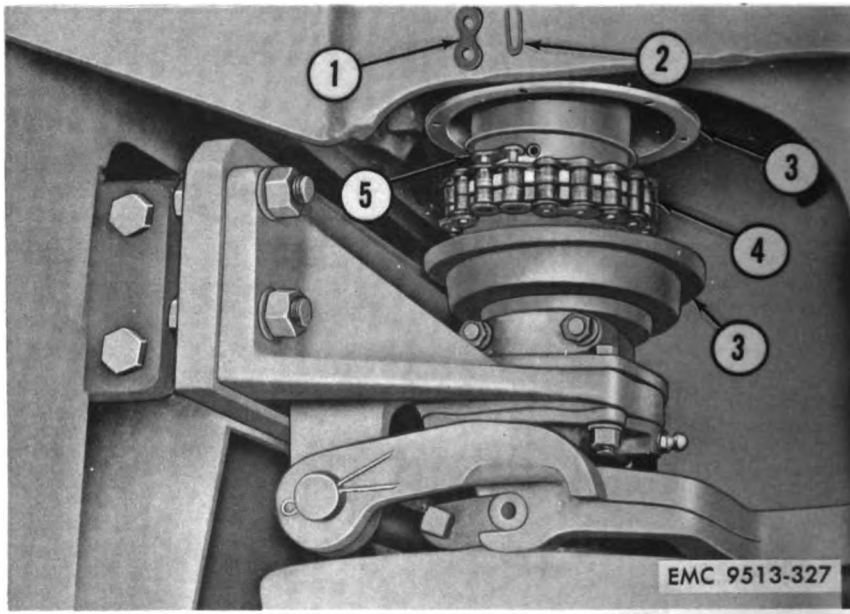
(5) Remove the lockwire (17), screws (16), lockwashers (8), and end washer (15) from the shaft (26).

(6) Pull the split collars (14) and clutch cones (11) from the shaft. Remove the keys (25 and 27) from the shaft. Remove the nuts (12), lockwashers (13), and screws (18) from the split collars. Remove the collars.

(7) Remove the screws (22), lockwashers (13), bearing cover (23), and gasket (24) from the clutch shaft bearing (28).

(8) Remove the lockwire (17), screws (9), and lockwashers (8) from the friction wheels (7) and bevel gears (3). Remove the friction wheels, spacers (6), and oil seals (5) from the shaft (26).

(9) Remove the oil seals (4) and the bevel gears (3) from the clutch shaft bearing (28). Remove the ball bearings (2) from the bevel gears (3).



1 Connecting link plate
2 Link lock plate
3 Cover
4 Roller chain
5 Connecting link

Figure 327. Flexible coupling chain removal.

(10) Remove the shaft (26) from the ball bearing (1) and the clutch shaft bearing (28). Remove the ball bearing from the clutch shaft bearing.

(11) Using a bearing splitter puller attachment (1, fig. 330), puller bar (2), puller screw (3), and wrenches (4 and 5), remove the bevel gear (6) from the shaft.

(12) Remove the screws (5, fig. 331) and lockwashers (6). Remove the brake wheel (4) and worm shaft (12) assembly from the bracket (23).

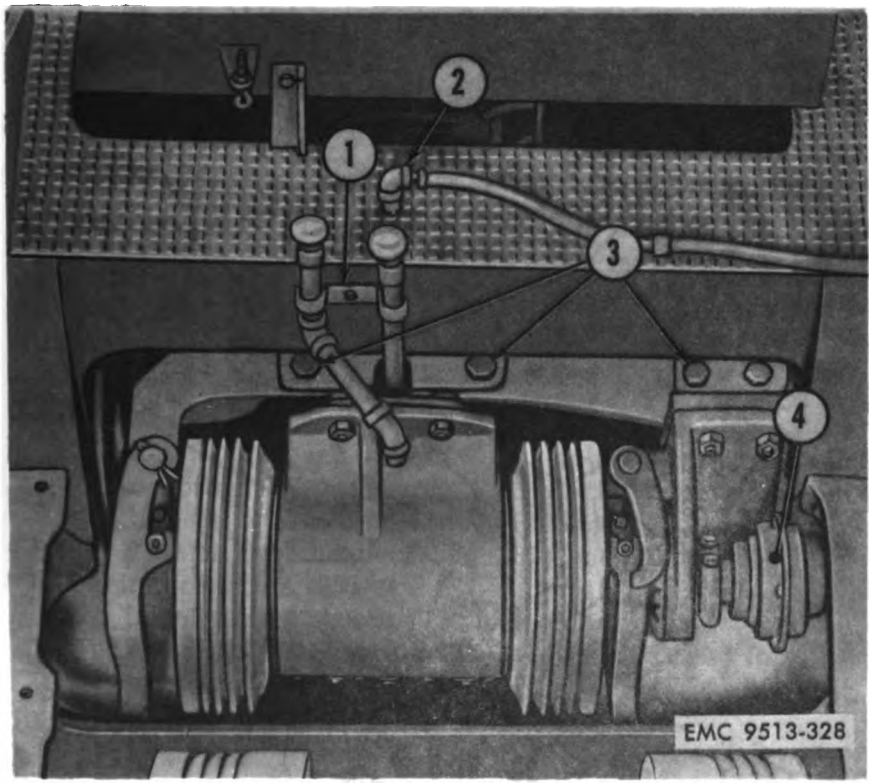
(13) Remove the cotter pin (2) and nut (1) from the worm shaft (12). Remove the brake wheel (4), bearing cap (7), oil seal (9), gasket (10), and ball bearing (11) from the worm shaft (12).

(14) Remove the ball bearing (18) and oil seal (17) from the bracket (23).

(15) Remove the setscrew (20, fig. 332) and jamnut (21) from the cover (15) and shaft (2). Remove the cover.

(16) Remove the shaft, brass washers (9) and bearing (10).

(17) Remove the screws (3) and lockwashers (4). Remove the worm wheel (5) and oil seal (6) from the boom hoist drum (7).



1 Clamp
2 Elbow
3 Mounting bolts
4 Flexible coupling

Figure 328. Independent boom hoist assembly installed.

364. Independent Boom Hoist Inspection and Repair

Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

a. Inspect the shafts (par. 319), bearings (par. 316), and bushings (par. 318).

b. Inspect all gears for cracks, chipped or broken teeth, and evidences of wear. Replace a gear that is cracked or has chipped, broken, or worn teeth.

c. Inspect spacers and brass washers for scoring and wear. Replace a spacer or brass washer if scored or worn.

d. Inspect the pillow block, pillow block caps, and all castings for cracks, breaks, and distortion. Replace a pillow block, pillow block cap, or casting if cracked, broken, or distorted.

e. Inspect all threaded surfaces for damaged, corroded, or

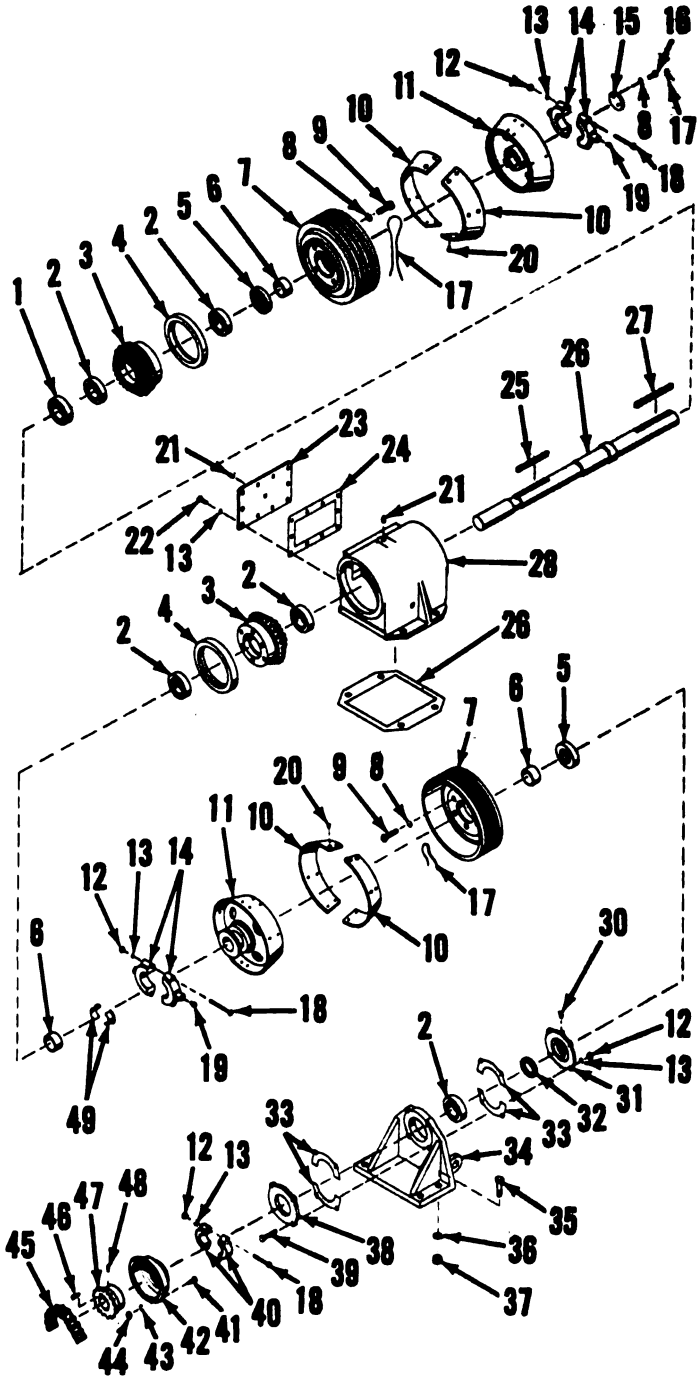


Figure 329. Independent boom hoist clutch shaft, exploded view.

stripped threads. Replace parts having damaged, corroded, or stripped threads.

f. Inspect all parts for good condition. Replace parts not in good condition. Replace oil seals and felt washers.

365. Independent Boom Hoist Reassembly and Installation

a. Reassembly.

(1) Position the oil seal (6, fig. 332) on the boom hoist drum (7). Install the worm wheel (5) on the drum and secure with lockwashers (4) and screws (3).

(2) Install the shaft (2) in the drum. Place brass washers (9) on each end of the shaft.

(3) Position the worm wheel in the cover (15). Install the jamnut (21) and setscrew (20) in the cover (15) and to bottom in the shaft. Tighten the jamnut. Install the bearing (10) on the end of the shaft.

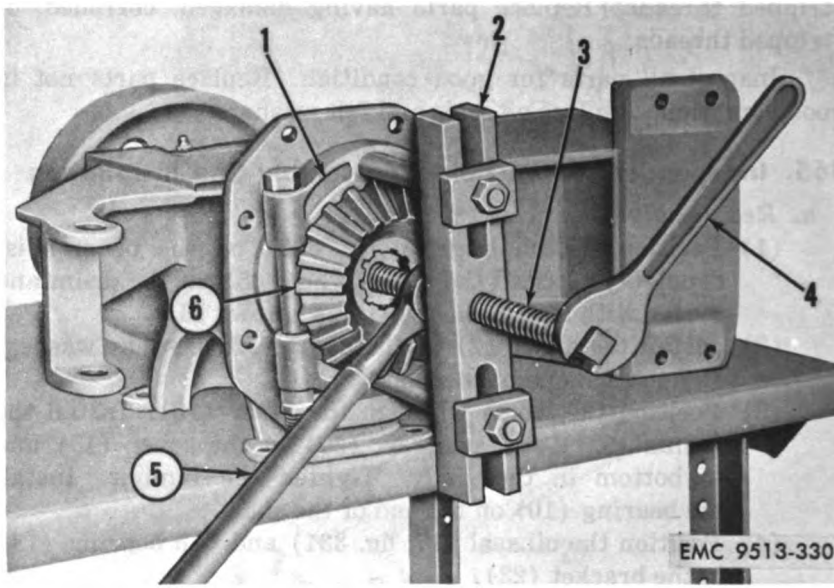
(4) Position the oil seal (17, fig. 331) and ball bearing (18) in the bracket (23).

(5) Install the wormshaft (12) in the bracket.

(6) Install the ball bearing (11) on the shaft and into the bracket.

←

1 Ball bearing
2 Ball bearing (5 rqr)
3 Bevel gear (2 rqr)
4 Oil seal (2 rqr)
5 Oil seal (2 rqr)
6 Spacer (3 rqr)
7 Friction wheel (2 rqr)
8 Lockwasher, spring, std, ½ (14 rqr)
9 Screw, cap, hex hd, ½–20 NF x 1¾ (12 rqr)
10 Lining (4 rqr)
11 Clutch cone (2 rqr)
12 Nut, regular, hex, ⅝–24 NF (6 rqr)
13 Lockwasher, spring, std, ⅝ (6 rqr)
14 Split collar (2 rqr)
15 End washer
16 Screw, cap, hex hd, ½–20 NF x 1¼ (2 rqr)
17 Lockwire (as rqr)
18 Screw, cap, hex hd, ⅝–24 NF x 3 (6 rqr)
19 Lubrication fitting, ⅛ x 45° (2 rqr)
20 Lining rivet
21 Plug, pipe, ½ (2 rqr)
22 Screw, cap, hex hd, ⅝–16 NC x ¾ (10 rqr)
23 Bearing cover
24 Gasket
25 Key
26 Shaft
27 Key
28 Clutch shaft bearing
29 Gasket
30 Lubrication fitting, ⅛ x 90°
31 Pillow block cap
32 Felt washer, 2½ ID x 3¼ OD x ⅝
33 Shim (2 rqr)
34 Pillow block
35 Bolt, hex hd, ⅝–18 NF x 2¼ (4 rqr)
36 Lockwasher, spring, std, ⅝ (4 rqr)
37 Nut, regular, hex, ⅝–18 NF (4 rqr)
38 Pillow block cap
39 Screw, cap, hex hd, ⅝–24 NF x 2 (4 rqr)
40 Split collar
41 Cover screw
42 Coupling cover half
43 Lockwasher
44 Nuts
45 Coupling chain
46 Key, ½ x ½ x 2
47 Coupling half
48 Setscrew
49 Thrust collar



1 Bearing splitter puller attachment
2 Puller bar
3 Puller screw
4 Wrench
5 Wrench and extension
6 Bevel gear

Figure 330. Pulling worm shaft bevel gear.

(7) Position the oil seal (9) in the bearing cap (7). Position the gasket (10) and bearing cap on the bracket. Secure the bearing cap to the bracket with lockwashers (6) and screws (5). Install the brake wheel on the wormshaft.

(8) Install the washer (3) and nut (1) on the shaft. Install cotter pin (2) when nut is tight.

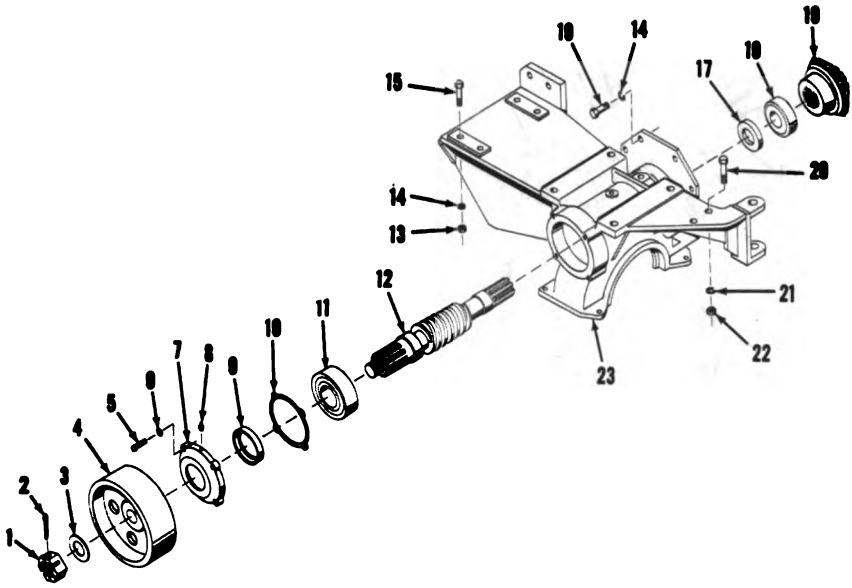
(9) Install the bevel gear (19) on the other end of the shaft.

(10) Position gaskets (17, fig. 332) on the cover (15). Position the bracket (23, fig. 331) on the cover (15, fig. 332) and secure with screws (16), lockwashers (18), and nuts (19).

(11) Install the ball bearings (2, fig. 329) in the bevel gears (3). Position the oil seals (4) on the bevel gears.

(12) Install the oil seals (5) and spacers (6) in the friction wheels (7). Position the wheels on the bevel gears and secure with lockwashers (8) and screws (9). When tightened, wire heads of screws together with lockwire (17).

(13) Install the ball bearing (1) and shaft (26) in the clutch shaft bearing (28). Install the friction wheel



EMC 9513-331

1	Nut	14	Lockwasher, spring, std, ⅝ (10 rqr)
2	Pin, cotter, split, 5/16 x 3½	15	Bolt, hex hd, ⅝–18 NF x 2 (4 rqr)
3	Washer	16	Bolt, hex hd, ⅝–18 NF x 1½ (6 rqr)
4	Brake wheel	17	Oil seal
5	Screw, cap, hex hd, ½–20 NF x 1½ (4 rqr)	18	Ball bearing
6	Lockwasher spring, std, ½ (4 rqr)	19	Bevel gear, 21 tooth
7	Bearing cap	20	Bolt, hex hd, ¾–16 NF x 2¼ (4 rqr)
8	Lubrication fitting, ⅛ straight	21	Lockwasher, spring, std, ¾ (4 rqr)
9	Oil seal	22	Nut, regular, hex, ¾–16 NF (4 rqr)
10	Gasket	23	Bracket
11	Ball bearing		
12	Worm shaft		
13	Nut, regular, hex, ⅝–18 NF (4 rqr)		

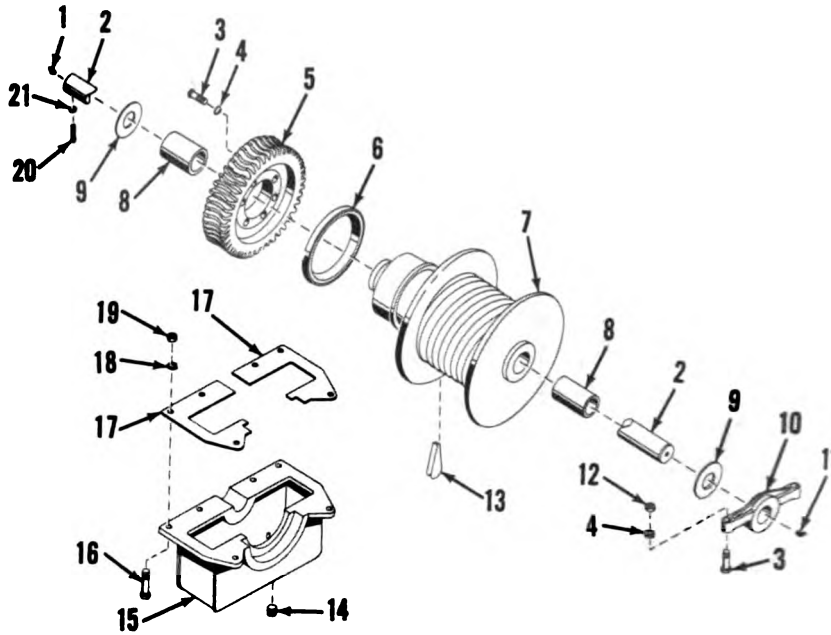
Figure 331. Independent boom hoist worm shaft, exploded view.

and gear assemblies on the shaft and in the bearing (28).

(14) Install the keys (25 and 27) in the shaft. Install the clutch cones (11) on the keys and shaft. Position the split collars (14) on the cones and secure with screws (18), lockwashers (13), and nuts (12).

(15) Position the end washer (15) on the shaft and secure with lockwashers (8) and screws (16). Wire the screw heads together with lockwire (17).

(16) Position the spacer (6) and thrust collar (49) on the shaft. Install the felt washer (32) in the pillow block cap (31).



EMC 9513-332

1	Lubrication fitting, ⅛ x 67–½°	13	Cable wedge, ⅝
2	Shaft	14	Plug, pipe, countersunk, 1
3	Screw, cap, hex hd, ⅝–18 NF x 2½ (8 rqr)	15	Cover
4	Lockwasher, spring, std, ⅝ (8 rqr)	16	Bolt, hex hd, ½–13 NC x 1¾ (6 rqr)
5	Worm wheel	17	Gasket half (2 rqr)
6	Oil seal	18	Lockwasher, spring, std, ½ (6 rqr)
7	Boom hoist drum	19	Nut, regular, hex ½–13 NC (6 rqr)
8	Bushing (2 rqr)	20	Setscrew, sq hd, cup point, ⅝–11 NC x 1¾
9	Brass washer (2 rqr)	21	Jamnut, regular, hex, ⅝–11 NC
10	Bearing		
11	Lubrication fitting, ⅛ x 90°		
12	Nut, regular, hex, ⅝–18 NF (2 rqr)		

Figure 332. Independent boom hoist drum shaft, exploded view.

(17) Install the pillow block cap (31), pillow block (34) with ball bearing (2), shims (33), and pillow block cap (38) on the shaft and spacer and secure with screws (39), lockwashers (13), and nuts (12).

(18) Position the split collar (40) on the shaft and install the screws (18), lockwashers (13), and nuts (12).

(19) Position the coupling cover half (42) on the shaft. Install the key (46) in the shaft. Install the coupling half (47) on the key and shaft. Tighten the setscrew (48) on the key.

(20) Position the gasket (24) and bearing cover (23) on the

clutch shaft bearing (28) and secure with lockwashers and screws (22).

(21) Position the bracket (23, fig. 331) on the clutch shaft bearing (28, fig. 329) and gasket (29) and secure with lockwashers (14) and screws (16).

(22) Attach the pillow block (34, fig. 329) to the bracket (23, fig. 331) with bolts (35, fig. 329), lockwashers (36), and nuts (37).

b. Installation.

(1) Position the independent boom hoist assembly under the counterweight. Position lifting slings (2 and 5, fig. 324) around the friction wheels and the brake wheel and up to the lifting hook.

(2) Carefully raise the assembly to position in the counterweight. Install the mounting bolts (3, fig. 328), lockwashers, and nuts. Install mounting bolts, lockwashers, and nuts in the bearing (1, fig. 325). Remove the lifting slings.

(3) Install the roller chain (4, fig. 327), connecting link (5), connecting link plate (1), and link lock plate (2). Attach the covers (3) with screw, lockwashers, and nuts.

(4) Install the clutch control (par. 205*c*) and the brake control (par. 198*d*).

(5) Install the circulating oil system piping on the independent boom hoist assembly. Lubricate the independent boom hoist assembly (LO 5–9513–2).

Section XVI. FRONT DRUM SHAFT ASSEMBLY

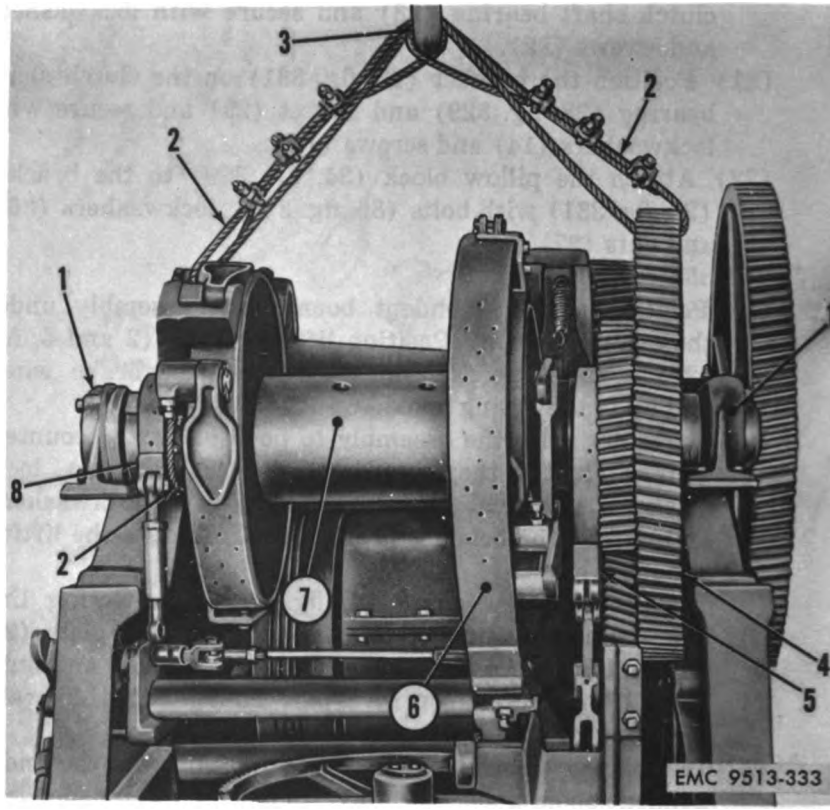
366. Front Drum Shaft Removal and Disassembly

a. Description. The front drum shaft assembly consists of a gear keyed on the shaft, a cable drum mounted on ball bearings which rotate on the shaft, and the clutch carriers. The clutch control wheel is mounted on roller bearings which rotate on the shaft. The reverse crowd clutch carrier supports the control wheel and crowd gear. The shaft is supported on the rotating base by pillow blocks.

b. Removal.

(1) Remove the A-frame (par. 273*a*) and the gear guards (pars. 219*a* and 220*a*).

(2) Disconnect the reverse crowd clutch control band assembly (5, fig. 333), the brake band assembly (6), and the clutch control band assembly (8) from their control levers and the rotating base. Remove the band assemblies from the front drum shaft assembly (7).



1 Pillow blocks
2 Wire rope sling
3 Lifting hook
4 Gear
5 Reverse crowd clutch control band assembly
6 Brake band assembly
7 Front drum shaft assembly
8 Clutch control band assembly

Figure 333. Removing front drum shaft assembly.

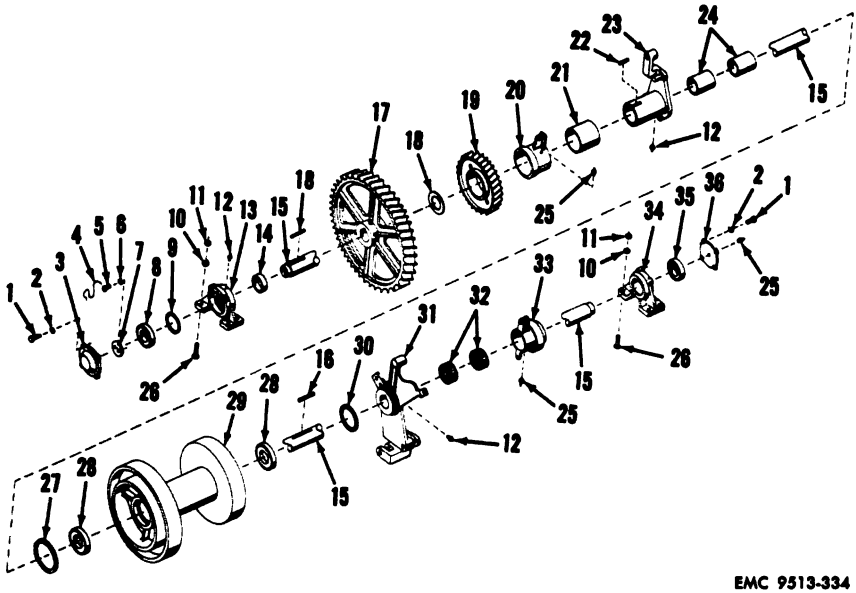
(3) Position the end loops of a wire rope sling (2) around the clutch control wheel and the gear (4). Install the center of the sling and each end loop on the lifting hook (3) of an auxiliary lifting device.

(4) Remove the jamnuts (11, fig. 334), nuts (10), and screws (26) from the rotating base and pillow blocks (13 and 34).

(5) Raise the lifting hook slowly and remove the front drum shaft assembly from the revolving frame. Slide the lifting hook on the sling as necessary to balance the load.

c. *Disassembly.*

(1) Remove the screws (1, fig. 334), lockwashers (2), and pillow block cap (3) from the pillow block (13).



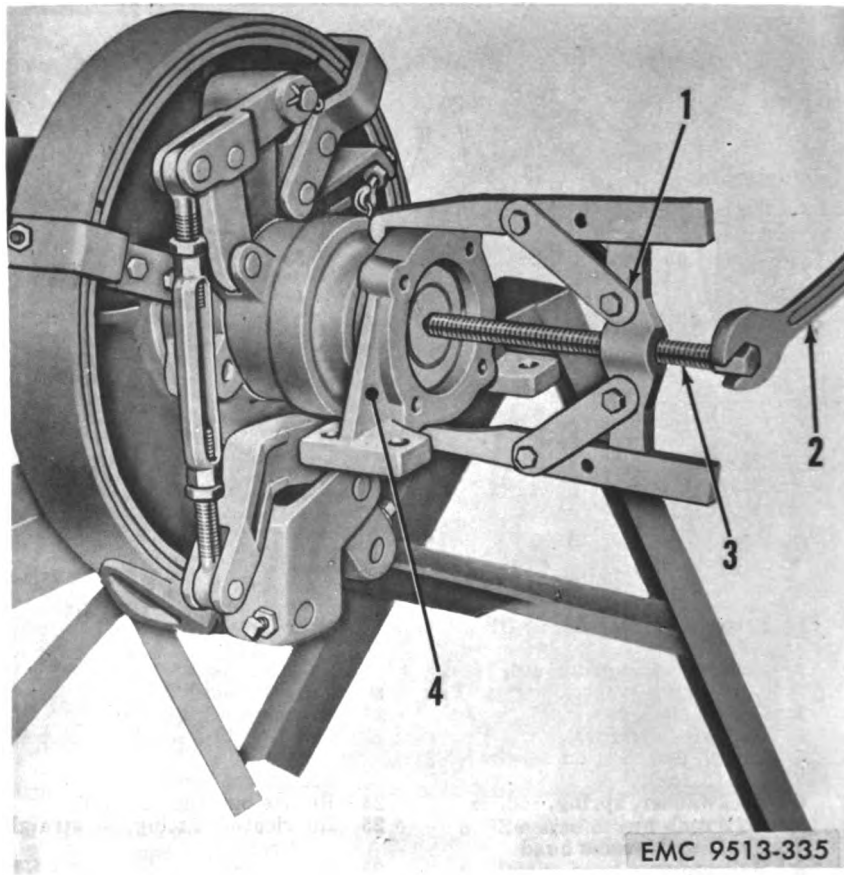
EMC 9513-334

1	Screw, cap, hex hd, ⅛–13 NC x 1 (8 rqr)	17	Gear, 98 tooth
2	Lockwasher, spring, std, ⅛ (8 rqr)	18	Brass washer
3	Pillow block cap	19	Gear, 49 tooth
4	Lockwire (as rqr)	20	Control wheel
5	Screw, cap, hex hd, ⅝–18 NF x 1 (2 rqr)	21	Bronze bushing
6	Lockwasher, spring, std, ⅝ (2 rqr)	22	Key, std taper, plain, ⅛ x ⅛ x 2¼
7	Shaft end washer	23	Clutch carrier
8	Ball bearing	24	Bronze bushing (2 rqr)
9	Felt washer, 3½ ID x 4¼ OD x ⅜	25	Lubrication fitting, ⅛ straight (3 rqr)
10	Nut, regular, hex, ⅝–18 NF (8 rqr)	26	Screw, cap, hex hd, ⅝–18 NF x 2¾ (8 rqr)
11	Jamnut, regular, hex, ⅝–18 NF (8 rqr)	27	Brass washer
12	Lubrication fitting, ⅛ x 30° (4 rqr)	28	Ball bearing (2 rqr)
13	Pillow block	29	Cable drum
14	Spacer	30	Felt washer, 4½ ID x 5¼ OD x ⅜
15	Front drum shaft	31	Clutch carrier
16	Key, std taper, plain ¾ x ¾ x 3⁹⁄₁₆ (2 rqr)	32	Roller bearing (2 rqr)
		33	Control wheel
		34	Pillow block
		35	Ball bearing
		36	Pillow block cap

Figure 334. Front drum shaft, exploded view.

(2) Remove the lockwire (4), screws (5), and shaft end washer (7). Using a puller (1, fig. 335), remove the pillow block (13, fig. 334) and ball bearing (8) from the front drum shaft (15). Remove the felt washer (9) from the pillow block. Remove the spacer (14) from the shaft.

(3) Using the push-pull unit (2, fig. 336) and the pump



1 Puller
2 Wrench
3 Puller screw
4 Pillow block

Figure 335. Pulling pillow block and bearing.

unit (4) of the hydraulic jack set, a puller bar (3), puller plates (7), and threaded rods (5), pull the gear (6) from the shaft. Attach the puller plates to the threaded rods with plain washers and nuts. Position the puller plates on the inside of the gear spokes and as close to the gear hub as possible. Position the threaded rods in the puller bar and install plain washers and nuts on the rods. Position the push-pull unit on the puller bar and install a spacer (1) between the shaft and push-pull unit. Make sure the outside diameter of the spacer is smaller than the outside diameter of the shaft. Operate the pump unit to tighten the push-pull unit against the spacer and puller bar. Check to make sure that all

components are located properly to perform the gear pulling operation in the same plane as the shaft and at right-angle to the gear. Operate the pump unit to extend the push-pull unit and pull the gear from the shaft. If the gear is extremely tight on the shaft, apply heat evenly around the inner gear hub during the pulling operation.

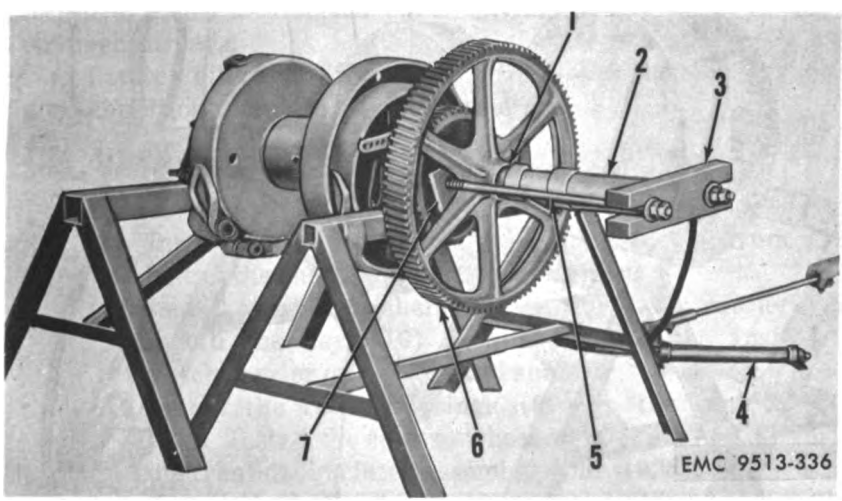
Warning: Do not stand or walk in front of the gear and puller bar during the gear pulling operation. Caution other personnel in the immediate area of the gear pulling operation.

(4) Remove the key (16, fig. 334) and brass washer (18) from the shaft (15). Remove the reverse crowd clutch assembly (par. 193*b*).

(5) Remove the clutch carrier (23) and brass washer (27) from the shaft (15). Remove the gear (19) and key (22) from the clutch carrier. Remove the control wheel (20) from the clutch carrier. Remove the bronze bushing (21) from the control wheel. Remove the bronze bushings (24) from the clutch carrier.

(6) Remove the screws (1), lockwashers (2), and pillow block cap (36) from the pillow block (34).

(7) Using a puller (1, fig. 335), remove the pillow block (34, fig. 334) and ball bearing (35) from the shaft (15).



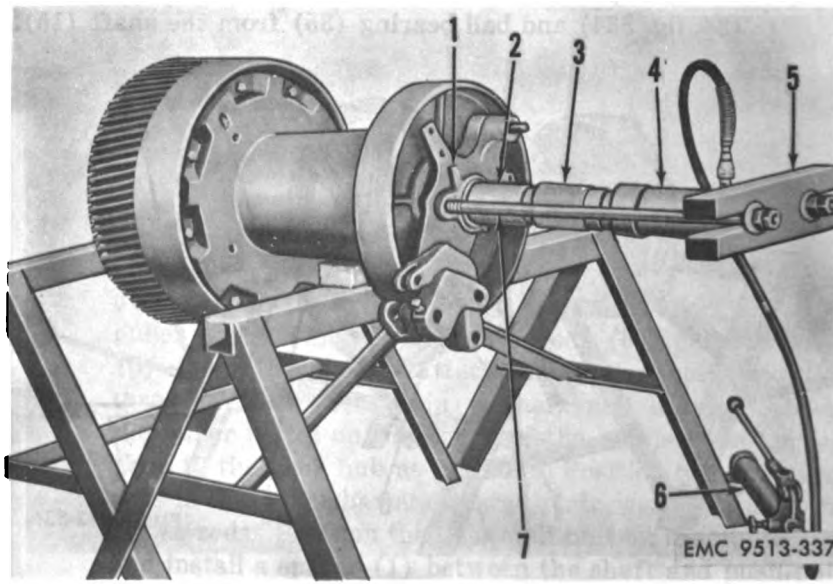
1 Spacer
2 Push-pull unit
3 Puller bar
4 Pump unit
5 Threaded rods, 1¼–7 NC x 27 (2 rqr)
6 Gear
7 Puller plates (2 rqr)

Figure 336. Pulling front drum shaft gear.

(8) Remove the front drum clutch assembly (par. 192*b*). Remove the control wheel (33) from the shaft. Remove the roller bearings (32) from the control wheel.

(9) Using the push-pull unit (4, fig. 337) and the pump unit (6) of the hydraulic jack set, a puller bar (5), and threaded rods (7), pull the clutch carrier (1) from the shaft (2). Install the threaded rods in the holes provided in the clutch carrier. Position the puller bar on the threaded rods. Install plain washers and nuts on the rods. Position the push-pull unit on the puller bar and install a spacer (3) between the shaft and push-pull unit. Operate the pump unit to tighten the push-pull unit against the spacer and puller bar. Check to make sure that all components are located properly to perform the clutch carrier pulling operation in the same plane as the shaft and at right-angle to the clutch carrier. Operate the pump unit to extend the push-pull unit and pull the clutch carrier from the shaft.

Warning: Do not stand or walk in front of the puller bar during the clutch carrier pulling operation. Caution other personnel in the immediate area of the clutch carrier pulling operation.



1 Clutch carrier
2 Shaft
3 Spacer
4 Push-pull unit
5 Puller bar
6 Pump unit
7 Threaded rods, ⅝–10 NC x 24 (2 rqr)

Figure 337. Pulling clutch carrier.

(10) Remove the felt washer (30, fig. 334) from the clutch carrier. Remove the key (16) from the shaft (15).
(11) Drive the shaft (15) from the cable drum (29). Do not hammer directly on the shaft; use a wood block to protect the shaft from the hammer blows.
(12) Remove the ball bearings (28) from the cable drum.

367. Front Drum Shaft Inspection and Repair

Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

a. Inspect the shaft (par. 319), bearings (par. 316), and bushings (par. 318).

b. Inspect the gears for cracks, chipped or broken teeth, and evidences of wear. Replace a gear that is cracked, or has chipped, broken, or worn teeth.

c. Inspect the pillow block, pillow block caps, control wheels, and clutch carriers for cracks, breaks, and distortion. Replace a pillow block, pillow block cap, control wheel, or clutch carrier if cracked, broken, or distorted.

d. Inspect the spacer and brass washers for scoring and wear. Replace a spacer or brass washer if scored or worn.

e. Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace parts having damaged, corroded, or stripped threads.

f. Inspect all parts for good condition. Replace parts not in good condition. Replace the felt washers.

368. Front Drum Shaft Reassembly and Installation

a. Reassembly (fig. 334).
(1) Install the ball bearings (28) in the cable drum (29). Install the shaft (15) in the cable drum.
(2) Install the felt washer (30) on the clutch carrier (31). Install the key (16) in the shaft (15). Install the clutch carrier on the key and shaft.
(3) Install the roller bearings (32) in the control wheel (33). Install the control wheel on the shaft (15). Install the front drum clutch assembly (par. 192*d*).
(4) Install the ball bearing (35) in the pillow block (34). Install the pillow block and bearing on the shaft (15). Position and secure the pillow block cap (36) to the pillow block (34) with lockwashers (2) and screws (1).
(5) Install the bronze bushings (24) in the clutch carrier

(23). Install the bronze bushing (21) in the control wheel (20). Install the control wheel on the clutch carrier.

(6) Install the key (22) in the clutch carrier. Install the gear (19) on the key and clutch carrier. Install the brass washer (27) in the clutch carrier. Install the clutch carrier on the shaft (15).

(7) Install the reverse crowd clutch assembly (par. 193*d*).

(8) Install the brass washer (18) on the shaft (15). Install the key (16) in the shaft. Install the gear (17) on the key and shaft.

(9) Install the ball bearing (8) in the pillow block (13). Install the felt washer (9) in the pillow block. Install the spacer (14) on the shaft (15). Install the pillow block assembly on the shaft and spacer.

(10) Position the shaft end washer (7) on the shaft and secure with lockwashers (6) and screws (5). Lock the screw heads with lockwire (4).

(11) Position the pillow block cap (3) on the pillow block (13) and secure with lockwashers (2) and screws (1).

(12) Lubricate the front drum shaft assembly (LO 5–9513–2).

b. Installation.

(1) Position the end loops of a wire rope sling (2, fig. 333) around the clutch control wheel and the gear (4). Install the center of the sling and each end loop on the lifting hook (3) of an auxiliary lifting device.

(2) Raise the lifting hook slowly and position the front drum shaft assembly (7) on the rotating base. Slide the lifting hook on the sling as necessary to balance the load.

(3) Install screws (26, fig. 334) in the rotating base and the pillow blocks (13 and 34) and secure with nuts (10) and jamnuts (11).

(4) Install the reverse crowd clutch control band assembly (5, fig. 333), the brake band assembly (6), and the clutch control band assembly (8) on the front drum shaft assembly. Connect the band assemblies to their control linkage and the rotating base.

(5) Install the A-frame (par. 273*e*) and the gear guards (pars. 219*c* and 220*c*).

Section XVII. REVERSE CROWD IDLER

369. Reverse Crowd Idler Removal and Disassembly

a. General. The reverse crowd idler is mounted on the inner side of the left machinery frame. The idler gear transmits power from the inner gear on the hoist shaft to operate the reverse crowd on the front drum shaft assembly in shovel operation.

b. Removal and Disassembly.

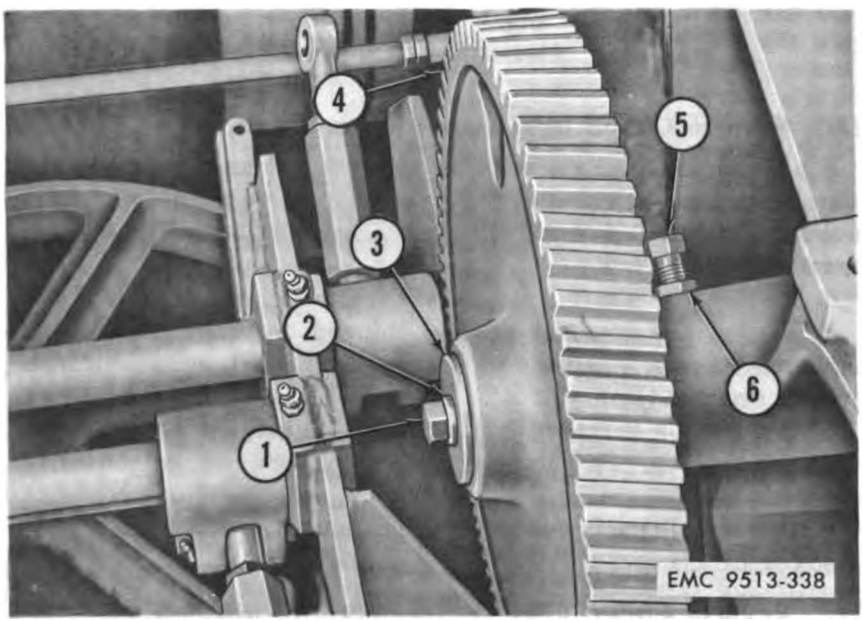
(1) Install wood wedges between the gear (4, fig. 338) and the revolving frame base to maintain the position of the gear.

(2) Loosen and remove the jamnut (6) and setscrew (5) from the idler shaft and the machinery frame.

(3) Remove the screw (1), lockwasher (2), and steel washer (3).

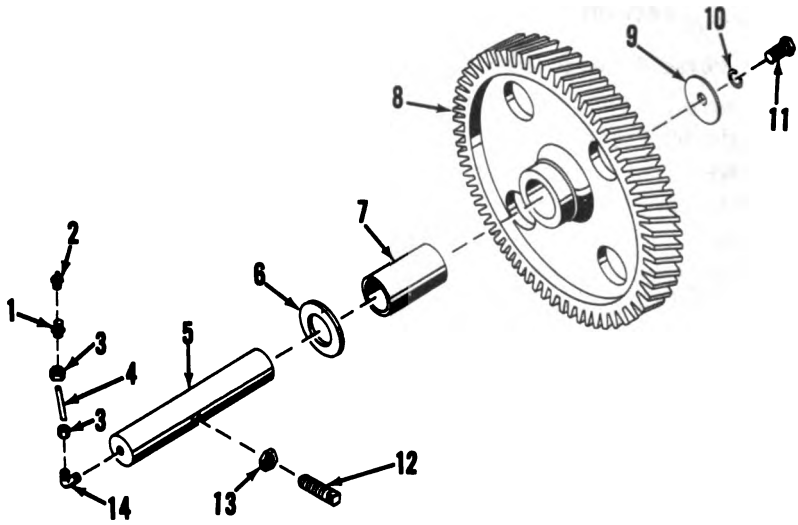
(4) Remove the tubing nuts (3, fig. 339) and tubing (4) from the connector (1) and elbow (14).

(5) Drive the idler shaft (5) through the gear (8) and the machinery frame. Remove the brass washer (6) from the shaft. Remove the gear from the revolving frame.



1 Screw
2 Lockwasher
3 Steel washer
4 Gear
5 Setscrew
6 Jamnut

Figure 338. Reverse crowd idler, installed.



EMC 9513-339

1	Connector, tubing, brass, ¼	9	Steel washer
2	Lubrication fitting, ⅛ straight	10	Lockwasher, spring, std, ⅝
3	Nut, tubing, brass, ¼ (2 rqr)	11	Screw, cap, hex hd, ⅝–11 NC x 1¼
4	Tubing, copper, ¼ OD x 12⅛	12	Setscrew, sq hd, cup point, ⅝–11 NC x 1¾
5	Idler shaft	13	Jamnut, regular, hex, ⅝–11 NC
6	Brass washer	14	Elbow, tubing, brass, ¼
7	Bronze bushing		
8	Gear, 67 tooth		

Figure 339. Reverse crowd idler, exploded view.

370. Reverse Crowd Idler Inspection and Repair

Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

a. Inspect the shaft (par. 319) and bushings (par. 318).

b. Inspect the gear for cracks, chipped or broken teeth, and evidences of wear. Replace a gear that is cracked, or has chipped, broken, or worn teeth.

c. Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace parts having damaged, corroded, or stripped threads.

d. Inspect all parts for good condition. Replace parts not in good condition.

371. Reverse Crowd Idler Reassembly and Installation

a. Place the gear (8, fig. 339) on wood wedges on the revolving frame base and aline the bore of the gear with the shaft opening

in the machinery frame. Position the brass washer (6) on the gear hub.

b. Install the idler shaft (5) in the machinery frame and through the brass washer and the gear bore. Install the steel washer (3, fig. 338), lockwasher (2), and screw (1).

c. Aline the setscrew threaded hole in the machinery frame with the drilled hole in the idler shaft. Install and tighten the jamnut (6) and setscrew (5).

d. Install the tubing elbow (14, fig. 339) in the end of the idler shaft (5).

e. Install tubing (4) and nuts (3) to the connector (1) and elbow (14).

f. Lubricate the reverse crowd idler (LO 5–9513–2).

Section XVIII. HOIST SHAFT ASSEMBLY

372. Hoist Shaft Removal and Disassembly

a. Description. The hoist shaft assembly consists of a driven gear, a driving gear, a cable drum mounted on ball bearings which rotate on the shaft, and the clutch carrier. The clutch control wheel is mounted on roller bearings which rotate on the shaft. The driven gear receives power from the horizontal intermediate shaft gear. The driving gear provides the power for the front drum shaft assembly. The shaft is supported on the rotating base by pillow blocks.

b. Removal (fig. 340).

(1) Remove the A-frame (par. 273*a*) and the gear guards (pars. 219*a* and 220*a*).

(2) Disconnect the brake band assembly (5) and the clutch control band assembly (8) from their control levers and the rotating base. Remove the band assemblies from the hoist shaft assembly.

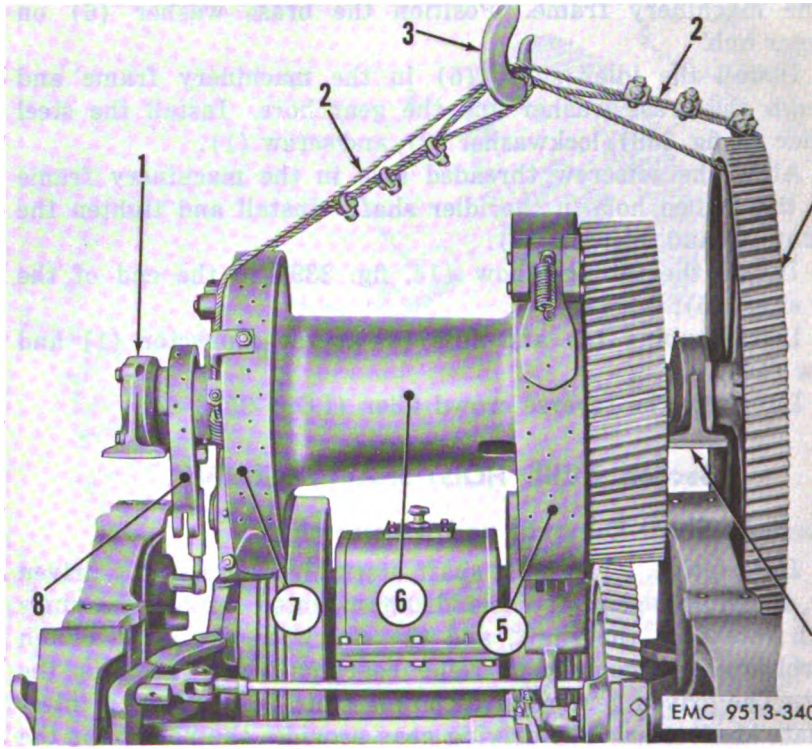
(3) Position the end loops of a wire rope sling (2) around the clutch control wheel and the gear (4). Install the center of the sling and each end loop on the lifting hook (3) of an auxiliary lifting device.

(4) Remove the jamnuts (13, fig. 341), nuts (12), and screws (32) from the rotating base and pillow blocks (14 and 31).

(5) Raise the lifting hook slowly and remove the hoist shaft assembly from the revolving frame. Slide the lifting hook on the sling as necessary to balance the load.

c. Disassembly.

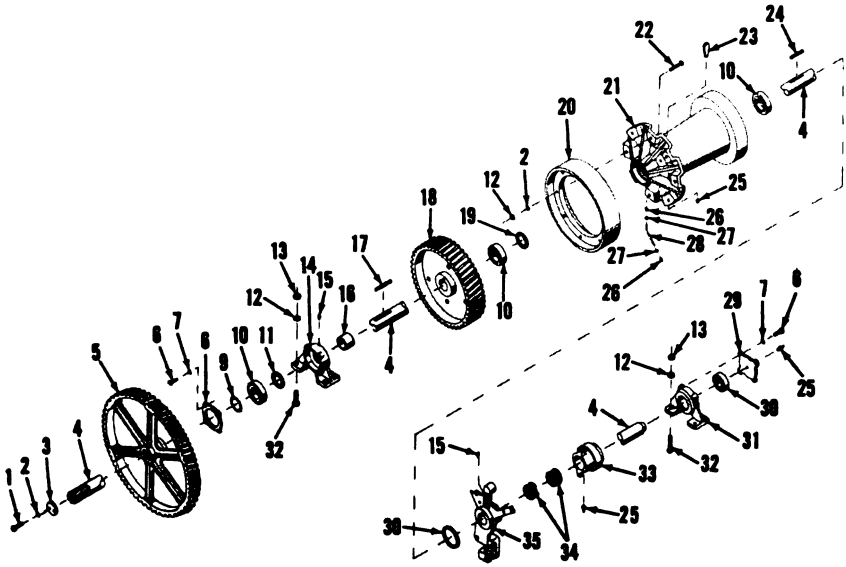
(1) Remove the screws (1, fig. 341), lockwashers (2), and end washer (3) from the shaft (4).



1 Pillow blocks
2 Wire rope sling
3 Lifting hook
4 Gear
5 Brake band assembly
6 Hoist drum
7 Clutch band assembly
8 Clutch control band assembly

Figure 340. Removing hoist shaft assembly.

(2) Using the push-pull unit (2, fig. 336) and the pump unit (4) of the hydraulic jack set, a puller bar (3), puller plates (7), and threaded rods (5), pull the driven gear from the shaft. Attach a wire rope sling to the driven gear and the lifting hook of an auxiliary lifting device. Attach the puller plates to the threaded rods with plain washers and nuts. Position the puller plates on the inside of the gear spokes and as close to the gear hub as possible. Position the threaded rods in the puller bar and install plain washers and nuts on the rods. Position the push-pull unit on the puller bar and install a spacer (1) between the shaft and push-pull unit. Make sure the outside diameter of the spacer is smaller than the outside diameter of the shaft. Operate the pump unit to tighten the push-pull unit against the spacer and puller bar. Check to make sure that all



1	Screw, cap, hex hd, ⅝–11 NC x 1½ (2 rqr)	17	Key, std taper, ¾ x ¾ x 4
2	Lockwasher, spring, std, ⅝ (10 rqr)	18	Gear, 83 tooth
3	End washer	19	Felt washer, 3 ID x 3¾ OD x ⅜
4	Shaft	20	Brake flange
5	Gear, 122 tooth	21	Hoist drum
6	Screw, cap, hex hd, ½–13 NC x 1 (8 rqr)	22	Bolt (8 rqr)
7	Lockwasher, spring, std, ½ (8 rqr)	23	Cable wedge
8	Pillow block cap	24	Key, std taper, ¾ x ¾ x 3 11/16
9	Shim	25	Lubrication fittings, ⅛ straight (3 rqr)
10	Ball bearing (3 rqr)	26	Connector, tubing, brass, ¼ (2 rqr)
11	Felt washer, 3½ ID x 4¼ OD x ⅜	27	Nut, tubing, brass, ¼ (2 rqr)
12	Nut, regular, hex, ⅝–18 NF (16 rqr)	28	Tubing, copper, ¼ OD x 6
13	Jamnut, regular, hex, ⅝–18 NF (8 rqr)	29	Pillow block cap
14	Pillow block	30	Ball bearing
15	Lubrication fitting, ⅛ x 30° (2 rqr)	31	Pillow block
16	Spacer	32	Bolt, hex hd, ⅝–18 NF x 2¾ (8 rqr)
		33	Control wheel
		34	Roller bearing (2 rqr)
		35	Clutch carrier
		36	Felt washer, 4½ ID x 5¼ OD x ⅜

Figure 341. Hoist shaft, exploded view.

components are located properly to perform the gear pulling operation in the same plane as the shaft and at right-angle to the gear. Operate the pump unit to extend the push-pull unit and pull the gear from the shaft. If the gear is extremely tight on the shaft, apply heat evenly around the inner gear hub during the pulling operation.

Warning: Do not stand or walk in front of the gear and puller bar during the gear pulling operation. Caution other personnel in the immediate area of the gear pulling operation.

(3) Remove the screws (6, fig. 341), lockwashers (7), pillow block cap (8), and shim (9) from the pillow block (14).

(4) Using a puller (1, fig. 335), remove the pillow block (14, fig. 341) and ball bearing (10) from the shaft.

(5) Remove the felt washer (11) from the pillow block. Remove the spacer (16) from the shaft.

(6) Remove the screws (6), lockwashers (7), and pillow block cap (29) from the pillow block (31).

(7) Using a puller (1, fig. 335), remove the pillow block (31, fig. 341) and ball bearing (30) from the shaft.

(8) Remove the hoist shaft clutch assembly (par. 192*b*). Remove the control wheel (33) from the shaft. Remove the roller bearings (34) from the control wheel.

(9) Remove the clutch carrier (35) as instructed in paragraph 366*c*(9).

(10) Remove the felt washer (36) from the clutch carrier. Remove the key (24) from the shaft.

(11) Remove the hoist drum (21) from the shaft. Remove the ball bearings (10) and felt washer (19) from the drum.

(12) Using the push-pull unit (5, fig. 342) and the pump unit (6) of the hydraulic jack set, a puller bar (7), and threaded rods (4), pull the driving gear (2) from the shaft (1). Place the gear on wood blocking and steady with wood wedges (8). Brace the rear of the shaft with wood blocking (9). Install the threaded rods in holes provided in the gear and attach plain washers and nuts to the rods. Position the threaded rods in the puller bar and install plain washers and nuts on the rods. Position the push-pull unit on the puller bar and the shaft. Operate the pump unit to tighten the push-pull unit against the shaft and bar. Check to make sure that all components are located properly to perform the gear pulling operation in the same plane as the shaft and at right-angle to the gear. Operate the pump unit to extend the push-pull unit and pull the gear from the shaft. If the gear is extremely tight on the shaft and key, apply heat evenly around the inner gear hub during the pulling operation.

Warning: Do not stand or walk in front of the gear

and puller bar during the gear pulling operation. Caution other personnel in the immediate area of the gear pulling operation.

373. Hoist Shaft Inspection and Repair

Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

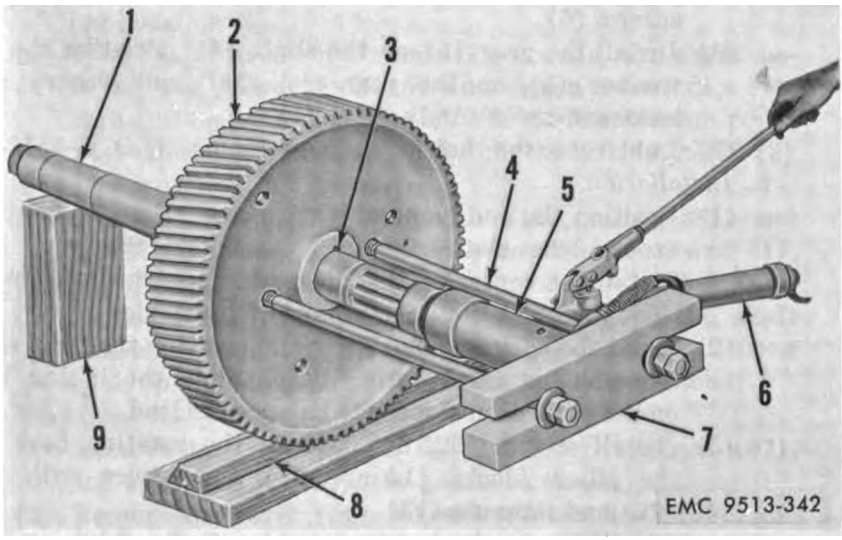
a. Inspect the shaft (par. 319) and bearings (par. 316).

b. Inspect the pillow blocks, pillow block caps, control wheel, clutch carrier, and hoist drum for cracks, breaks, and distortion. Replace a pillow block, pillow block cap, control wheel, clutch carrier, and hoist drum if cracked, broken or distorted.

c. Inspect the gears for cracks, chipped or broken teeth, and evidences of wear. Replace a gear that is cracked or has chipped, broken, or worn teeth.

d. Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace parts having damaged, corroded, or stripped threads.

e. Inspect all parts for good condition. Replace parts not in good condition. Replace the felt washers.



1 Shaft
2 Driving gear
3 Key
4 Threaded rods, 1–8 NC x 20 (2 rqr)
5 Push-pull unit
6 Pump unit
7 Puller bar
8 Wood wedge
9 Wood blocking

Figure 342. Pulling hoist shaft driving gear.

374. Hoist Shaft Reassembly and Installation

a. Reassembly (fig. 341).

(1) Position the key (17) in the shaft (4). Install the gear (18) on the shaft and key.

(2) Install the ball bearings (10) and felt washer (19) in the hoist drum (21). Install the hoist drum on the shaft.

(3) Install the felt washer (36) on the clutch carrier (35). Install the key (24) in the shaft. Install the clutch carrier on the shaft and key.

(4) Install the roller bearings (34) in the control wheel (33). Install the control wheel on the shaft (4). Install the hoist shaft clutch assembly (par. 192*d*).

(5) Install the ball bearing (30) in the pillow block (31). Install the pillow block and bearing on the shaft (4). Position and secure the pillow block cap (29) to the pillow block with lockwashers (7) and screws (6).

(6) Install the ball bearing (10) and felt washer (11) in the pillow block (14). Install the spacer (16) on the shaft (4). Install the pillow block assembly on the shaft and spacer.

(7) Install the shim (9) and pillow block cap (8) on the pillow block and secure with lockwashers (7) and screws (6).

(8) Install the gear (5) on the shaft (4). Position the end washer (3) on the gear and shaft and secure with lockwashers (2) and screws (1).

(9) Lubricate the hoist shaft assembly (LO 5–9513–2).

b. Installation.

(1) Position the end loops of a wire rope sling (2, fig. 340) around the clutch control wheel and the gear (4). Install the center of the sling and each end loop on the lifting hook (3) of an auxiliary lifting device.

(2) Raise the lifting hook slowly and position the hoist shaft assembly on the rotating base. Slide the lifting hook on the sling as necessary to balance the load.

(3) Install screws (32, fig. 341) in the rotating base and the pillow blocks (14 and 31) and secure with nuts (12) and jamnuts (13).

(4) Install the brake band assembly (5, fig. 340) and the clutch control band assembly (8) on the hoist shaft assembly. Connect the band assemblies to their control linkage and the rotating base.

(5) Install the A-frame (par. 273*e*) and the gear guards (pars. 219*c* and 220*c*).

Section XIX. HORIZONTAL INTERMEDIATE SHAFT ASSEMBLY

375. Horizontal Intermediate Shaft Removal and Disassembly

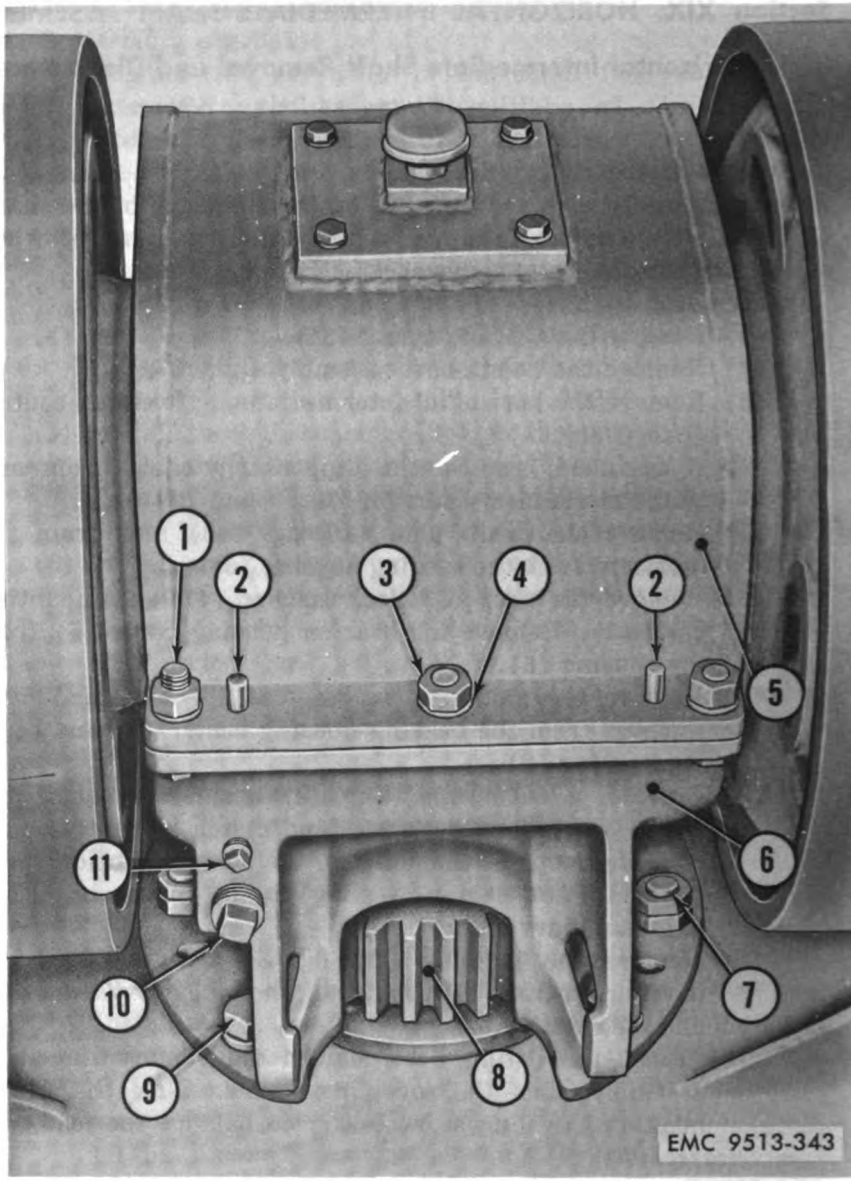
a. General. In addition to transmitting power for swing operation, the horizontal intermediate shaft assembly includes the power dipper trip for shovel operation. The trip cable drum and clutch mechanism are installed on the right end of the shaft. Once installed, the power dipper trip need not be removed when converting for other crane-shovel attachments.

b. Removal.

(1) Remove the A-frame (par. 273*a*).
(2) Remove the hoist shaft assembly (par. 372*b*).
(3) Remove the horizontal intermediate shaft clutch control (par. 208*a*).
(4) If installed, remove the dipper trip cable drum and clutch mechanism (par. 238*b*).
(5) Remove the drain plug (10, fig. 343) and drain the lubricant from the bearing housing (6).
(6) Remove the nuts (3), lockwashers (4), and mounting bolts (1). Remove the bearing housing cover (5) from the housing (6).
(7) Remove the mounting screws (7, fig. 344) and lockwashers from the bearing housing center (6) and bearing housing (8).
(8) Position a wire rope sling (2) around the shaft between the pillow block (5) and clutch wheel (1). Install end loops of the sling on the shaft extension cover (4). Position center of sling on the lifting hook (3) of an auxiliary lifting device.
(9) Remove the jamnuts (38, fig. 345), nuts (39), and mounting bolts (40) from the pillow blocks (7 and 41), and the rotating base.
(10) Raise the lifting hook slowly and remove the shaft assembly from the revolving frame. Slide the lifting hook on the sling as necessary to balance the load.

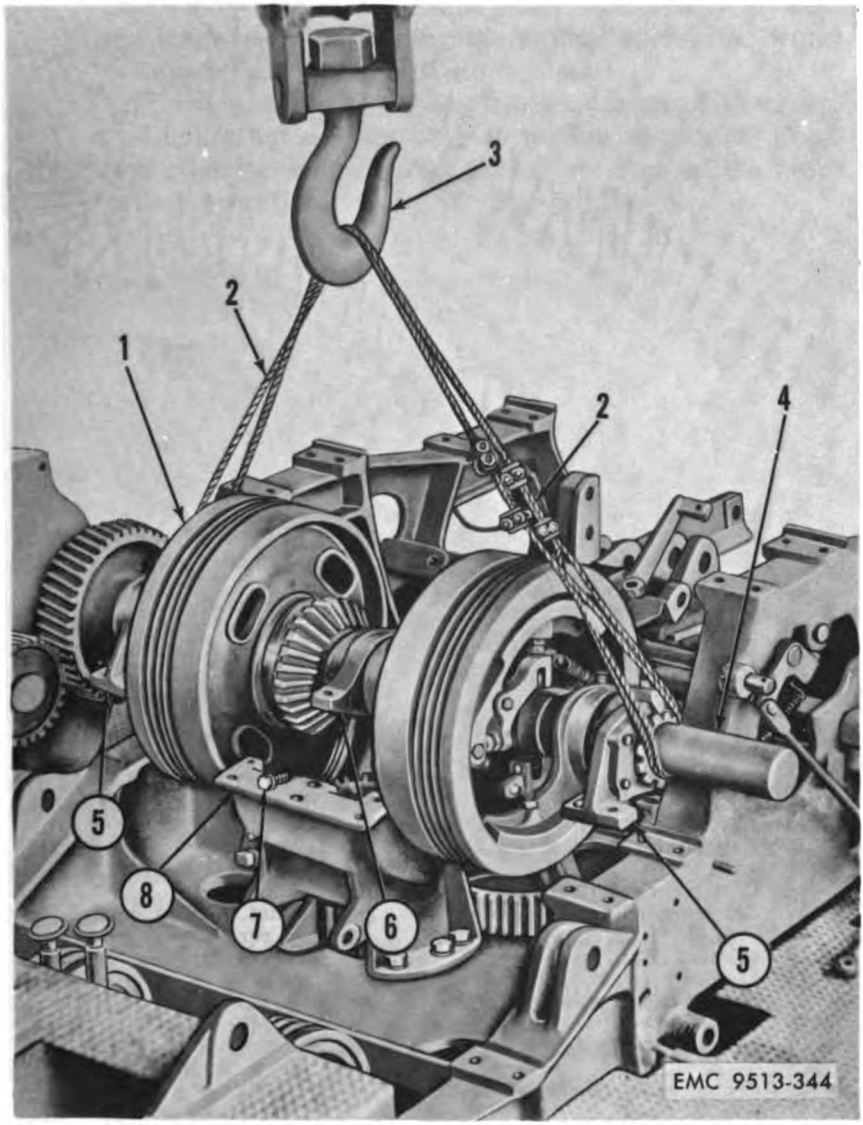
c. Disassembly.

(1) Remove the screws (30, fig. 345), lockwashers (31), and lock bar (32) from the pillow block (41).
(2) Remove the cover (34), oil seal (33), locknut (35), and lockwasher (36) from the shaft (2). Remove the pillow block (41), ball bearing (37), and inner adjusting ring (42) from the shaft.
(3) Remove the retaining ring (1) from the shaft (2).
(4) Using the push-pull unit (2, fig. 346) and the pump unit (4) of the hydraulic jack set, a puller bar (3), and



1 Mounting bolt
2 Taper dowel
3 Nut
4 Lockwasher
5 Bearing housing cover
6 Bearing housing
7 Mounting bolt
8 Vertical intermediate shaft spur pinion
9 Mounting bolt
10 Drain plug
11 Level plug

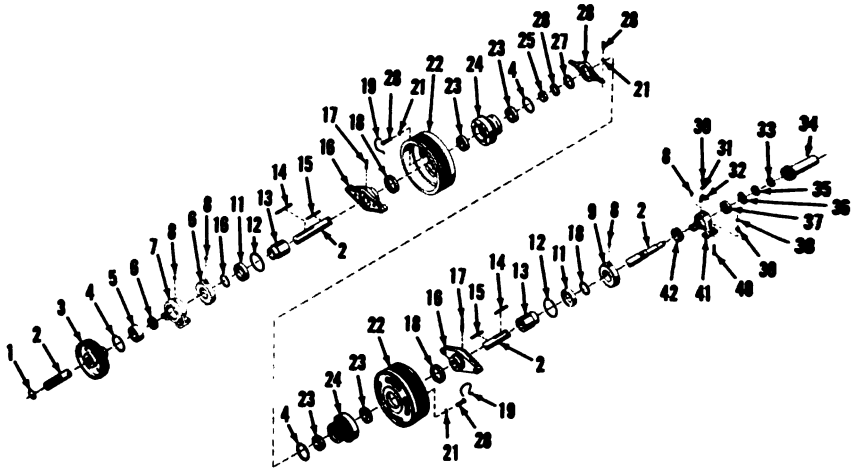
Figure 343. Intermediate shaft bearing housing installed.



1	Clutch wheel	5	Pillow blocks
2	Wire rope sling	6	Bearing housing center
3	Lifting hook	7	Mounting screw
4	Shaft extension cover	8	Bearing housing

Figure 344. Removing horizontal intermediate shaft assembly.

threaded rods (5), pull the gear (1) from the shaft. Tighten the threaded rods into holes provided in the gear. Position the puller bar on the threaded rods and install plain washers and nuts on the rods. Position the push-pull unit on the puller bar and install a



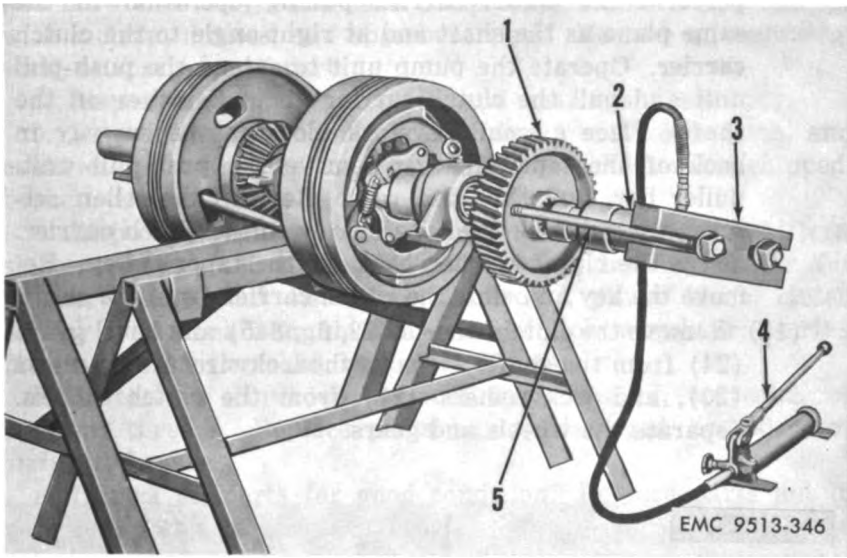
1	Retaining ring	23	Ball bearing (4 rqr)
2	Shaft	24	Bevel gear (2 rqr)
3	Gear, 45 tooth	25	Inner race
4	Retaining ring (3 rqr)	26	Bearings
5	Ball bearing	27	Outer race
6	Oil seal	28	Bearing housing center
7	Pillow block	29	Screw, cap, hex hd, ⅝–18 NF x 2 (2 rqr)
8	Lubrication fitting, ⅛ straight (4 rqr)	30	Screw, cap, hex hd, ⅜–16 NC x ¾ (2 rqr)
9	Clutch shifter (2 rqr)	31	Lockwasher, spring, std, ⅜ (2 rqr)
10	Retaining ring (2 rqr)	32	Lock bar
11	Ball bearing (2 rqr)	33	Oil seal
12	Retaining ring (2 rqr)	34	Cover
13	Shifter sleeve (2 rqr)	35	Locknut
14	Key, ⅝ x 7/16 x 3 (2 rqr)	36	Lockwasher
15	Key, std taper, ⅝ x ⅝ x 2 9/16 (2 rqr)	37	Ball bearing
16	Clutch carrier (2 rqr)	38	Jamnut, regular, hex, ⅝–18 NF (8 rqr)
17	Setscrew, Allen, cone point, ½–20 NF x ¾ (4 rqr)	39	Nut, regular, hex, ⅝–18 NF (8 rqr)
18	Oil seal (2 rqr)	40	Bolt, hex hd, ⅝–18 NF x 2¾ (8 rqr)
19	Lockwire (as rqr)	41	Pillow block
20	Screw, cap, hex hd, ⅝–18 NF x 2¼ (16 rqr)	42	Inner adjusting ring
21	Lockwasher, spring, std, ⅝ (18 rqr)		
22	Clutch wheel (2 rqr)		

Figure 345. Horizontal intermediate shaft, exploded view.

spacer between the shaft and push-pull unit. Make sure the outside diameter of the spacer is smaller than the outside diameter of the shaft. Operate the pump unit to tighten the push-pull unit against the spacer and puller bar. Check to make sure that all components are located properly to perform the gear pulling operation in the same plane as the shaft and at right-angle to the gear. Operate the pump unit to extend the push-pull unit and pull the gear from the shaft. If the gear is

extremely tight on the shaft, apply heat evenly around the inner gear hub during the pulling operation, being careful not to overheat the pillow block.

Warning: Do not stand or walk in front of the gear and puller bar during the gear pulling operation. Caution other personnel in the immediate area of the gear pulling operation.



1 Gear
2 Push-pull unit
3 Puller bar
4 Pump unit
5 Threaded rods, 1–8 NC x 20 (2 rqr)

Figure 346. Pulling horizontal intermediate shaft gear.

(5) Using a puller (1, fig. 335), remove the pillow block (7, fig. 345) from the shaft. Remove the retaining ring (4), ball bearing (5), and oil seal (6) from the pillow block.

(6) Remove the clutch shoe assemblies (par. 194*b*).

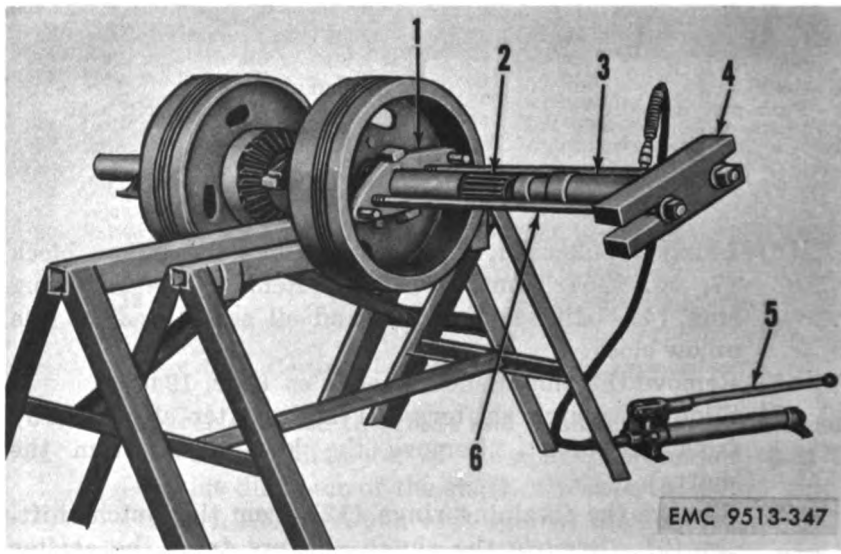
(7) Slide the clutch shifters (9) and shifter sleeves (13) from the shaft. Remove the keys (14) from the shaft.

(8) Remove the retaining rings (12) from the clutch shifters (9). Remove the clutch shifters from the shifter sleeves (13). Remove the retaining rings (10) and ball bearings (11) from the shifter sleeves.

(9) Using the push-pull unit (3, fig. 347) and the pump unit (5) of the hydraulic jack set, a puller bar (4), and

the threaded rods (6), pull the clutch carriers (1) from the shaft. Tighten the threaded rods into holes provided in the clutch carrier. Position the puller bar on the threaded rods and install plain washers and nuts on the rods. Position the push-pull unit on the puller bar and the shaft. Operate the pump unit to tighten the push-pull unit against the shaft and puller bar. Check to make sure that all components are located properly to perform the clutch carrier pulling operation in the same plane as the shaft and at right-angle to the clutch carrier. Operate the pump unit to extend the push-pull unit and pull the clutch carrier about 3 inches on the shaft. Place a small keystock block in the keyway in back of the tapered key. Remove the push-pull unit, puller bar, and threaded rods. Remove the Allen set-screws which lock the tapered key to the clutch carrier. Drive the clutch carrier back off the tapered key. Remove the key and slide the clutch carrier from the shaft.

(10) Remove the clutch wheels (22, fig. 345) and bevel gears (24) from the shaft. Remove the lockwire (19), screws (20), and lockwashers (21) from the clutch wheels. Separate the wheels and gears.



1 Clutch carrier
2 Shaft
3 Push-pull unit
4 Puller bar
5 Pump unit
6 Threaded rods, ⅞–14 NF x 33 (2 rqr)

Figure 347. Pulling horizontal intermediate shaft clutch carrier.

(11) Remove the oil seals (18) from the clutch wheels. Remove the ball bearings (23) from the bevel gears.

(12) Slide the bearing housing center (28) from the shaft. Remove the retaining rings (4), inner race (25), bearings (26), and outer race (27).

376. Horizontal Intermediate Shaft Inspection and Repair

Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

a. Inspect the shaft (par. 319) and bearings (par. 316).

b. Inspect the gears for cracks, chipped or broken teeth, and evidences of wear. Replace a gear that is cracked or has chipped, broken, or worn teeth.

c. Inspect the pillow blocks, clutch carriers, clutch shifters, shifter sleeves, clutch wheels, and bearing housing center for cracks, breaks, and distortion. Replace a pillow block, clutch carrier, clutch shifter, shifter sleeve, clutch wheel, or bearing housing center if cracked, broken, or distorted

d. Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace parts having damaged, corroded, or stripped threads.

e. Inspect all parts for good condition. Replace parts not in good condition. Replace the oil seals.

377. Horizontal Intermediate Shaft Reassembly and Installation

a. Reassembly (fig. 345).

(1) Position the inner race (25), bearings (26), and outer race (27) in the bearing housing center (28) and secure with retaining rings (4).

(2) Slide the bearing housing center on the shaft (2).

(3) Install the ball bearings (23) in the bevel gears (24). Position the clutch wheels (22) on the bevel gears and secure with lockwashers (21) and screws (20). When screws are tight, tie the heads together with lockwire (19). Install oil seals (18) in the clutch wheels.

(4) Install the clutch wheels and bevel gears on the shaft (2) against the bearing housing center.

(5) Position the keys (15) in the shaft. Install the clutch carriers (16) on the shaft and keys. Install the setscrews (17) in the clutch carriers and onto the keys.

(6) Install the ball bearings (11) on the shifter sleeves (13) and secure with retaining rings (10). Position

the clutch shifters (9) over the bearings (11) and install the retaining rings (12).

(7) Position the key (14) in the shaft (2). Install the shifter sleeves and clutch shifters on the shaft and key.

(8) Install the clutch shoe assemblies (par. 194*f*).

(9) Install the oil seal (6) and ball bearing (5) in the pillow block (7) and secure with the retaining ring (4). Install the pillow block on the shaft (2).

(10) Install the gear (3) on the shaft. Install the retaining ring (1) in the end of the shaft.

(11) Place the inner adjusting ring (42) and pillow block (41) on the shaft. Install the ball bearing (37) on the shaft and in the pillow block. Secure the bearing with the lockwasher (36) and locknut (35).

(12) Install the inner adjusting ring (42) in the pillow block (41). Install the oil seal (33) on the shaft. Turn the cover (34) into the pillow block.

(13) Turn the inner adjusting ring and the cover to remove end play. Install the lockbar (32) and secure with lockwashers (31) and screws (30).

(14) Lubricate the horizontal intermediate shaft assembly (LO 5–9513–2).

b. Installation.

(1) Position a wire rope sling (2, fig. 344) around the shaft between the pillow block (5) and clutch wheel (1). Install end loops of the sling on the shaft extension cover (4). Position center of sling on the lifting hook (3) of an auxiliary lifting device.

(2) Raise the lifting hook slowly and position the shaft assembly on the rotating base and bearing housing (8). Slide the lifting hook on the sling as necessary to balance the load.

(3) Secure the pillow blocks (7 and 41, fig. 345) to the rotating base with mounting bolts (40), nuts (39), and jamnuts (38).

(4) Secure the bearing housing center (6) to the bearing housing (8) with lockwashers and mounting screws (7).

(5) Install the bearing housing cover (5, fig. 343) on the bearing housing (6) and secure with mounting bolts (1), lockwashers (4), and nuts (3). Install the drain plug (10).

(6) Lubricate the bearing housing (LO 5–9513–2).

(7) If required, install the trip cable drum and clutch mechanism (par. 238*d*).

(8) Install the horizontal intermediate shaft clutch control (par. 208*c*).
(9) Install the hoist shaft assembly (par. 374*b*).
(10) Install the A-frame (par. 273*e*).

Section XX. VERTICAL INTERMEDIATE SHAFT ASSEMBLY

378. Vertical Intermediate Shaft Removal and Disassembly

a. General. The vertical intermediate shaft assembly transmits power from the horizontal intermediate shaft assembly to the vertical swing shaft assembly to turn the revolving frame.

b. Removal.
(1) Remove the horizontal intermediate shaft assembly (par. 375*b*).
(2) Remove the mounting bolts (7 and 9, fig. 343), jamnuts, and nuts.
(3) Attach a wire rope sling (1, fig. 348) to the bearing housing (3) and the lifting hook (2) of an auxiliary lifting device.
(4) Carefully remove the vertical intermediate shaft assembly and bearing housing from the revolving frame.
(5) Remove the ball bearing (5) from the rotating base.

c. Disassembly (fig. 349).
(1) Using an arbor or hydraulic press, press the shaft (19) from the spur pinion (20).
(2) Remove the bevel gear (10) and the shaft (19) from the bearing housing (13).
(3) Using an arbor or hydraulic press, press the shaft (19) from the bevel gear (10).
(4) Remove the ball bearing (11) and oil seal (12) from the bearing housing (13).

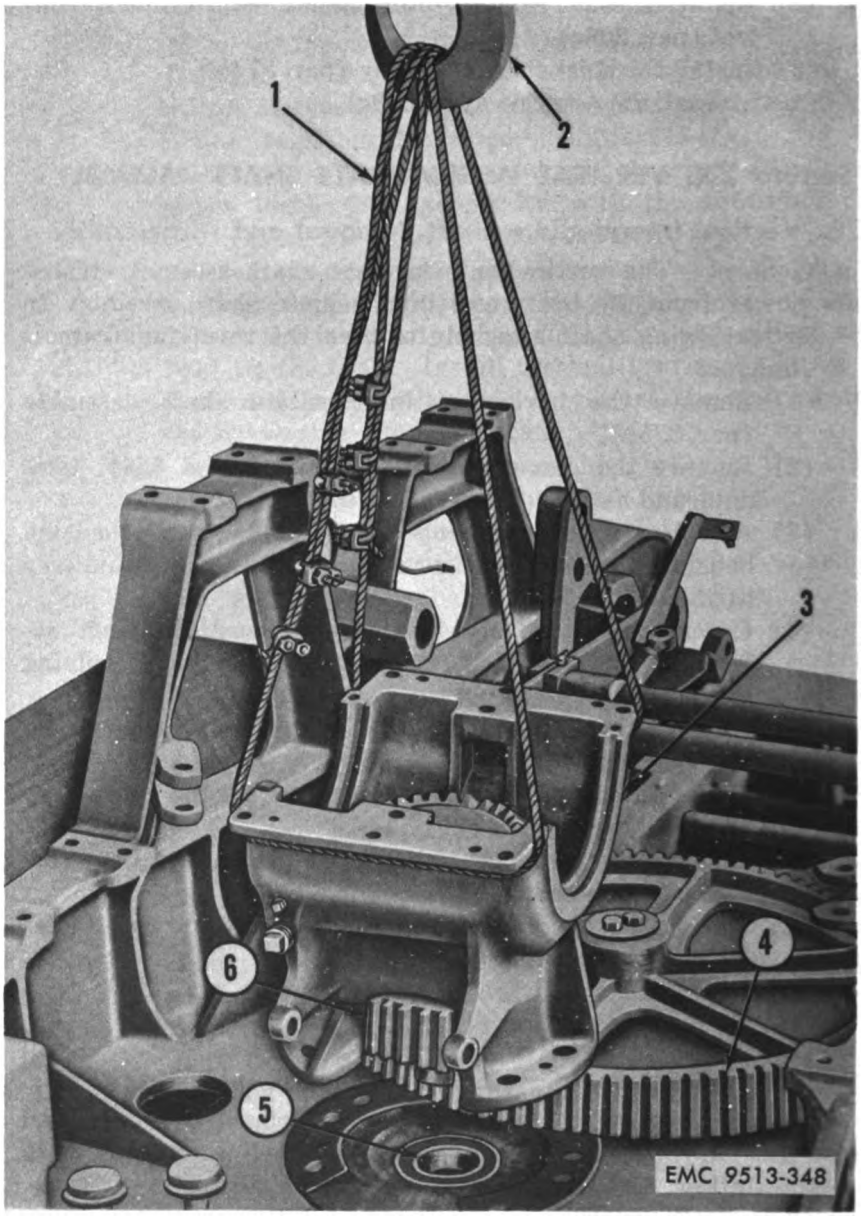
379. Vertical Intermediate Shaft Inspection and Repair

Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

a. Inspect the shaft (par. 319) and bearings (par. 316).

b. Inspect the gears for cracks, chipped or broken teeth, and evidences of wear. Replace a gear that is cracked or has chipped, broken, or worn teeth.

c. Inspect the bearing housing and bearing housing cover for cracks, breaks, and distortion. Replace a bearing housing or bearing housing cover if cracked, broken, or distorted.



1	Wire rope sling	4	Swing gear
2	Lifting hook	5	Ball bearing
3	Bearing housing	6	Spur pinion

Figure 348. Removing vertical intermediate shaft assembly.

d. Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace parts having damaged, corroded, or stripped threads.

e. Inspect all parts for good condition. Replace parts not in good condition. Replace gaskets and seals.

380. Vertical Intermediate Shaft Reassembly and Installation (fig. 849)

a. Reassembly.

(1) Using an arbor or hydraulic press, press the bevel gear (10) on the shaft (19).

(2) Install the oil seal (12) on the ball bearing (11) in the bearing housing (13). Pack the bearing with lubricant (LO 5–9513–2) before installing.

(3) Install the shaft (19) in the bearing, oil seal, and bearing housing.

(4) Using an arbor or hydraulic press, press the spur pinion (20) on the shaft.

b. Installation.

(1) Install the ball bearing (21) in the rotating base.

(2) Position shims (18 and 23) on the rotating base. Using an auxiliary lifting device, position the shaft (19) in the ball bearing (21) and the bearing housing (13) on the shims and rotating base. Secure the housing with screws (14) and lockwashers (15) and with bolts (22), nuts (24), and jamnuts (25).

(3) Install seals (7) in the bearing housing (13) and bearing housing cover (6).

(4) Install the horizontal intermediate shaft assembly (par. 377*b*).

Section XXI. VERTICAL SWING SHAFT ASSEMBLY

381. Vertical Swing Shaft Removal and Disassembly

a. General. The vertical swing shaft assembly is located in the rotating base. Power from the vertical intermediate shaft assembly turns the swing gear to revolve the base around the ring gear and the center pin mounted on the carrier.

b. Removal and Disassembly.

(1) Remove the revolving frame from the carrier (par. 321).

(2) Remove the vertical intermediate shaft assembly (par. 378*b*).

(3) Remove the screws (1, fig. 350), lockwashers (2), and end washer (3).

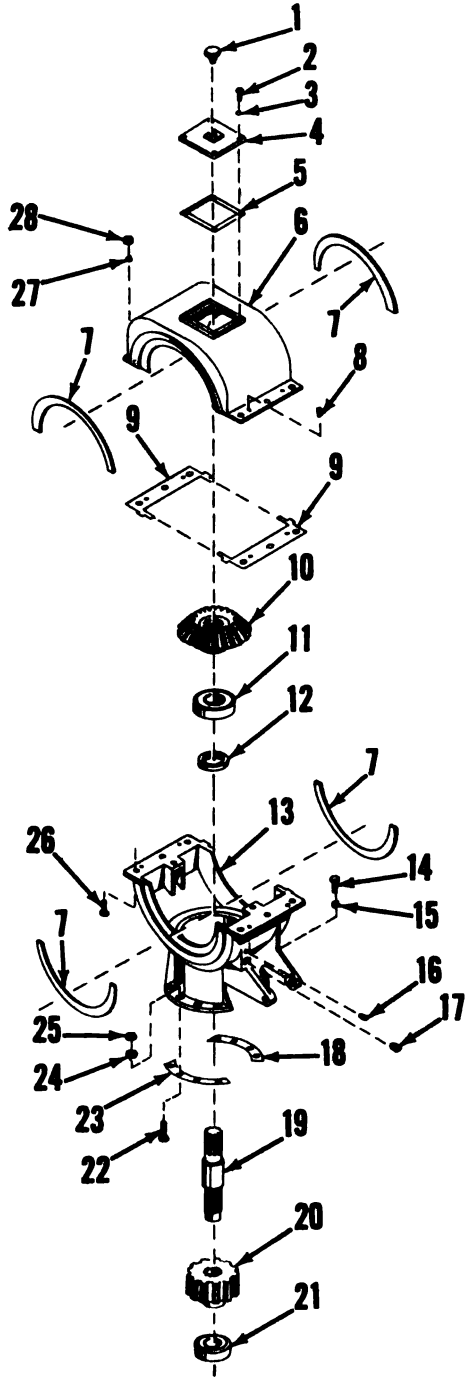


Figure 349. Vertical intermediate shaft, exploded view.

(4) Using the threaded rods (6, fig. 351), puller bar (3), puller screw (2), and wrenches (1 and 4) from the maintenance set, pull the swing gear (5).
(5) Using a soft hammer, drive the shaft (7, fig. 350) and swing pinion (9) from the rotating base. The swing pinion is keyed and then welded to the shaft.
(6) Remove the ball bearings (5 and 6) from the rotating base.

382. Vertical Swing Shaft Inspection and Repair

Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

a. Inspect the shaft (par. 319) and bearings (par. 316).

b. Inspect the gears for cracks, chipped or broken teeth, and evidences of wear. Replace a gear that is cracked or has chipped, broken, or worn teeth.

c. Inspect all parts for good condition. Replace parts not in good condition.

383. Vertical Swing Reassembly and Installation (fig. 350)

a. Install the ball bearing (6) in the rotating base.

b. Install the shaft (7) with swing pinion (9) in the ball bearing (6) and the rotating base.

c. Install the ball bearing (5) over the shaft and in the rotating base.

d. Install the gear (4) on the shaft and secure with the end washer (3), lockwashers (2), and screws (1).

←

1 Breather
2 Screw, cap, hex hd, ⅜–16 NC x ¾ (4 rqr)
3 Lockwasher, spring, std, ⅜ (4 rqr)
4 Cover top
5 Gasket
6 Bearing housing cover
7 Seal (4 rqr)
8 Dowel, taper, No. 6 (4 rqr)
9 Gasket (2 rqr)
10 Bevel gear
11 Ball bearing
12 Oil seal
13 Bearing housing
14 Screws, cap, hex hd, ¾–10 NC x 1¾ (2 rqr)
15 Lockwasher, spring, std, ¾ (2 rqr)
16 Plug, pipe, sq hd, ¼
17 Plug, pipe, sq hd, ¾
18 Shim
19 Shaft
20 Spur pinion
21 Ball bearing
22 Bolt, hex hd, ¾–16 NF x 2½ (4 rqr)
23 Shim
24 Nut, regular, hex, ¾–16 NF (4 rqr)
25 Jamnut, regular, hex, ¾–16 NF (4 rqr)
26 Bolt, hex hd, ½–20 NF x 1½ (6 rqr)
27 Lockwasher, spring, std, ½ (6 rqr)
28 Nut, regular, hex, ½–20 NF (6 rqr)

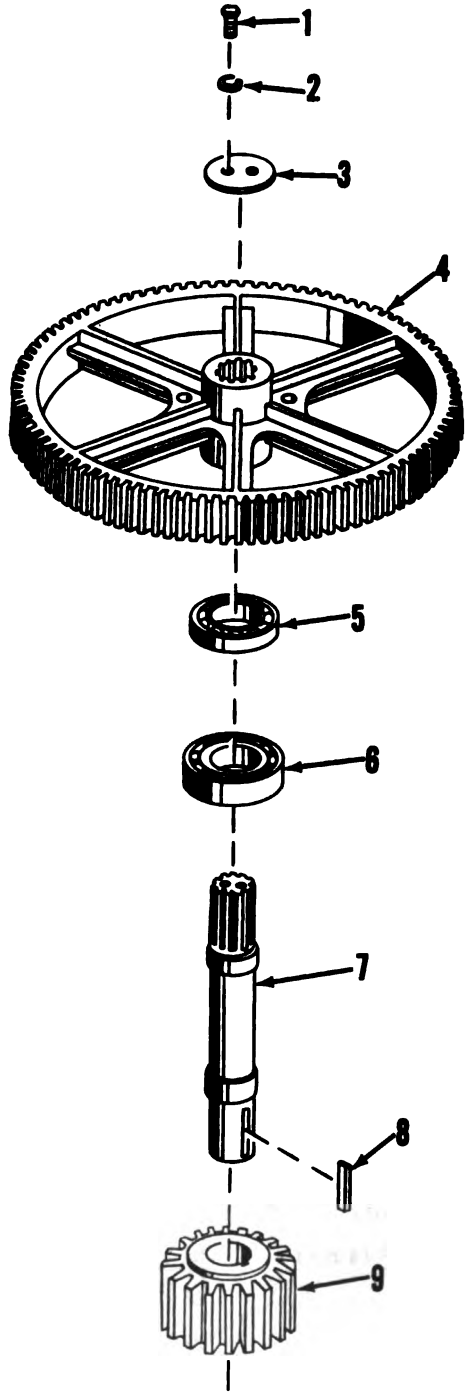


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Figure 350. Vertical swing shaft, exploded view.

1 Screw, cap, hex hd, ½–20 NF x 1¼ (2 rqr)
2 Lockwasher, spring, std, ½ (2 rqr)
3 End washer
4 Gear, 100 tooth
5 Ball bearing
6 Ball bearing
7 Shaft
8 Key, ¾ x ¾ x 3⅝
9 Swing pinion

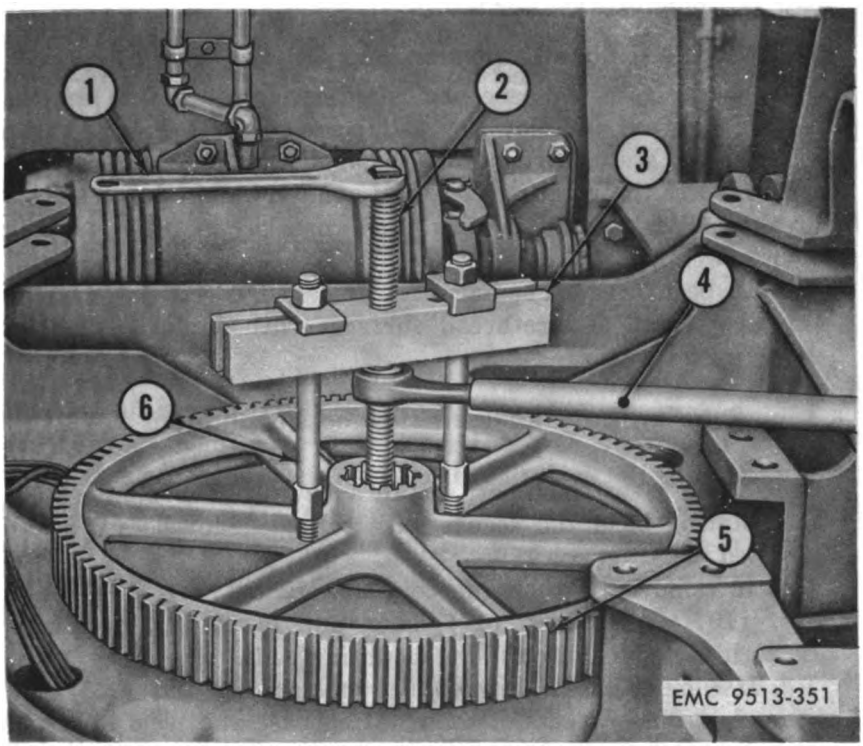
←

e. Install the vertical intermediate shaft assembly (par. 380*b*).
f. Install the revolving frame on the carrier (par. 322).

Section XXII. ROTATING BASE

384. Rotating Base Removal and Disassembly

a. General. The rotating base supports the revolving frame engine, the operating shaft assemblies and controls, the deck assembly, and the cab assembly. The various booms attach to brackets on the base with boom foot pins. The counterweight is welded to the rear of the rotating base.



1 Wrench
2 Puller screw
3 Puller bar
4 Wrench and extension
5 Swing gear
6 Threaded rod

Figure 351. Pulling swing gear.

b. Removal and Disassembly (fig. 210).

(1) Remove the revolving frame from the carrier (par. 321).
(2) Remove the front drum shaft assembly (par. 366*b*).
(3) Remove the vertical intermediate shaft assembly (par. 378*b*).
(4) Remove the revolving frame engine (par. 323).
(5) Remove the independent boom hoist assembly (par. 363*b*).
(6) Remove the deck assembly (pars. 275 and 276).
(7) Remove the lever bracket (par. 274*a*).
(8) Cable brackets (12 and 15) are welded to the rotating base (10). Break the weld to remove the brackets.
(9) The counterweight (1) is attached to the rotating base (10) with screws (17), nuts, and jamnuts and then welded at the mounting pads. To remove counterweight, remove the screws and nuts and break the weld around the pads.
(10) Remove the threaded dowels (13) and drive out the brass bushing (14).

385. Rotating Base Inspection and Repair

Wash the rotating base and counterweight with an approved cleaning solvent and blow dry with clean compressed air. Remove all sediment, scale, or rust from all parts.

a. Inspect the rotating base and counterweight for cracks and breaks. Weld small cracks and breaks in the base and counterweight.

b. Inspect threaded surfaces for damaged, corroded, or stripped threads. Clean and rethread surfaces with damaged, corroded, or stripped threads.

386. Rotating Base Reassembly and Installation (fig. 210)

a. Using a soft hammer, install a new brass bushing (14) in the rotating base and secure with threaded dowels (13) as instructed in paragraph 189.

b. If removed, attach the counterweight (1) to the rotating base (10) with screws (17), nuts, and jamnuts. After screws are tightened, weld around the mounting pads.

c. If removed, position cable brackets (12) and (15) on the boom foot pin brackets of the rotating base and weld all around.

d. Install the lever bracket (par. 274*c*).

e. Install the deck assembly (pars. 278 and 279).

f. Install the independent boom hoist assembly (par. 365*b*).

g. Install the revolving frame engine (par. 324).

h. Install the vertical intermediate shaft assembly (par. 380*b*).

i. Install the front drum shaft assembly (par. 368*b*).

j. Install the revolving frame on the carrier (par. 322).

Section XXIII. AIRBRAKE SYSTEM

387. General

a. Air Compressor. The air compressor supplies the compressed air to operate the brakes.

b. Air Compressor Governor. The governor controls the compression of air by the compressor. Although the compressor runs continuously when the engine is running, the governor, acting in conjunction with the unloading mechanism in the compressor cylinder head, stops and starts the compression of air by the compressor when the desired maximum and minimum air pressures are present in the airbrake system.

c. Relay Valve. The relay valve speeds up the application and release of the rear wheel brakes. It is controlled by the brake valve and keeps the air pressure in the rear brake cylinders the same as the pressure being delivered by the brake valve.

d. Quick Release Valve. The quick release valve speeds the release of air pressure from the front brake cylinders.

e. Brake Valves. The brake valves control the air pressure being delivered to the brake cylinders and in this way controls the operation of the brakes.

f. Brake Cylinders. Brake cylinders transform the energy of compressed air into the mechanical force and motion necessary to apply the brakes. One cylinder is used to operate the brakes on each wheel.

g. Slack Adjusters. Slack adjusters provide a quick and easy method of adjusting the brakes to compensate for brake lining wear. One slack adjuster is used for the brakes on each wheel. Maintenance procedures are identical for all slack adjusters.

h. Safety Valve. The safety valve protects the airbrake system against air pressure in excess of 150 psi.

i. Stoplight Switch. The air-operated stoplight switch provides a simple means of controlling the stoplight on the crane-carrier.

j. Air Supply Valve. The air supply valve permits higher air pressures to be obtained from the system without requiring the compressor to work against such high pressures continuously. When the handle of the valve is turned to its air supply position, the governor cannot operate, therefore the compressor operates continuously under these conditions and pressures as high as the

setting of the safety valve may be obtained through the air supply outlet of the air supply valve.

k. Single Check Valve. The single check valve is a small device placed in an air line when it is important to allow air passage in one direction only and prevent passage in the reverse direction.

l. Doublecheck Valve. Doublecheck valves are used in an air-brake system when it is necessary to automatically direct the flow of air pressure into a common line from either of two other lines.

388. Air Compressor

a. Disassembly.

(1) Remove the air compressor as instructed in TM 5–5252.

(2) Remove all grease or dirt from the exterior of the compressor by scraping, if necessary, followed by the use of an approved cleaning solvent and a brush.

(3) The cylinder head, cylinder block, air strainer, and crankshaft of many compressors can be assembled in several different ways to meet installation requirements. In order to insure correct assembly, such parts should be marked before disassembly, where necessary, to show their correct position in relation to each other. This can be done best by making center punch marks in the related parts to act as guides during assembly. The following parts should be marked:

(*a*) Position a cylinder head in relation to cylinder block.

(*b*) Position of air strainer in relation to cylinder block.

(*c*) Position of cylinder block in relation to crankcase.

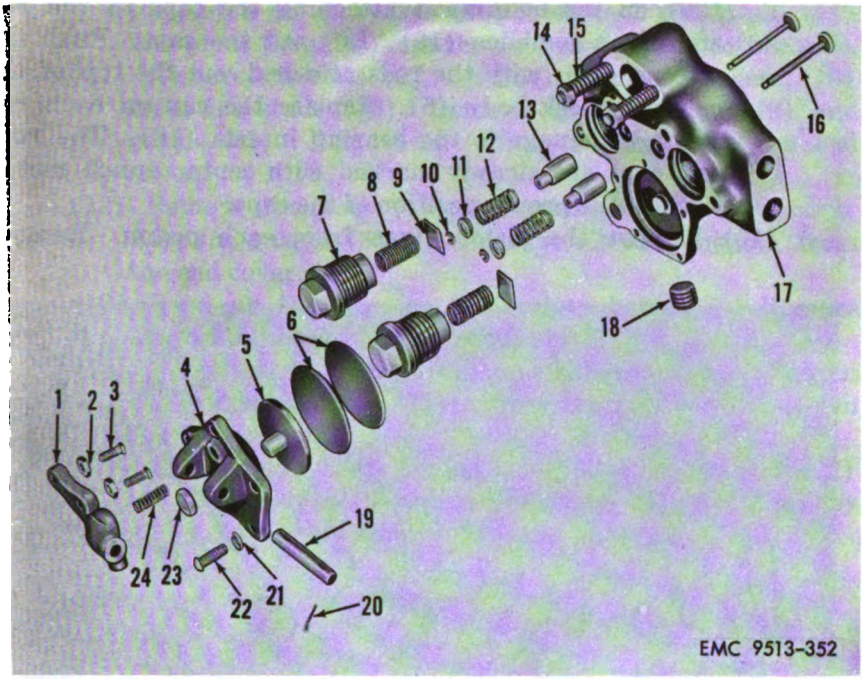
(*d*) Position of front end cover (drive end of crankshaft) in relation to the crankcase. Make one punch mark on each.

(*e*) All crankshafts are already marked with one punch mark on the throw nearest the drive end. Marking the crankcase with one punch mark at the drive end will permit the crankshaft to be properly positioned in the crankcase during assembly.

(4) Remove the cylinder head assembly and the air strainer as instructed in TM 5–5252.

(5) Remove the cotter pins (20, fig. 352) from the straight pin (19). Drive out the pin and remove the lever (1), compression spring (24), and the diaphragm dust guard (23).

(6) Remove the screws (22) and lockwashers (21) attaching the diaphragm cover (4) to the cylinder head body



1	Lever	13	Unloader valve bushing (2 rqr)
2	Locknut (2 rqr)	14	Nut (2 rqr)
3	Adjusting screw (2 rqr)	15	Stud (2 rqr)
4	Diaphragm cover	16	Unloader valve (2 rqr)
5	Diaphragm follower	17	Cylinder head body
6	Diaphragm (2 rqr)	18	Pipe plug
7	Discharge valve capnut (2 rqr)	19	Straight pin
8	Compression spring (2 rqr)	20	Cotter pin (2 rqr)
9	Discharge valve (2 rqr)	21	Lockwasher (5 rqr)
10	Spring retainer ring (2 rqr)	22	Screw (5 rqr)
11	Unloader valve stop (2 rqr)	23	Diaphragm dust guard
12	Unloader valve spring (2 rqr)	24	Compression spring

Figure 352. Cylinder head, exploded view.

(17). Lift off the cover and remove the diaphragm follower (5) and the diaphragms (6).

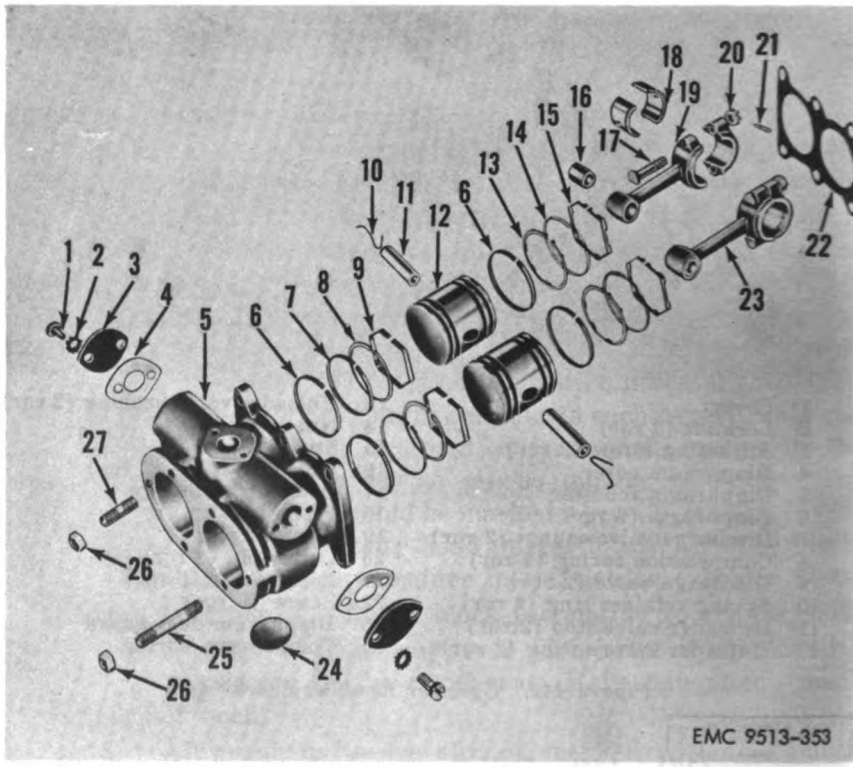
(7) Remove the discharge valve capnuts (7) and lift out the compression springs (8) and the discharge valves (9).

(8) By hand, compress the unloader valve springs (12) and remove the spring retainer rings (10). Remove the unloader valve stops (11) and unloader valve springs (12). Remove the unloader valves (16) by pushing them out the bottom of the cylinder head body. If necessary, press the unloader valve bushings (13) from the bottom of the cylinder head body.

(9) Remove the cotter pins (21, fig. 353) from the nuts

(20) on the bolts (17) attaching the caps to the rod and cap assemblies (19). Lift out the caps. Push the pistons (12), with the rods attached, out the top of the cylinder block body (5). Replace the cap on each rod to avoid damage to the bearing inserts (18). The rods and caps are already marked with center punch marks to show the proper position of the caps.

(10) Remove the piston rings from each piston. Remove



1 Screw (4 rqr)
2 Lockwasher (4 rqr)
3 Inlet chamber cover (2 rqr)
4 Gasket (2 rqr)
5 Cylinder block body
6 Piston compression ring (4 rqr)
7 Piston scraper ring (2 rqr)
8 Piston segment ring (2 rqr)
9 Piston expander ring (2 rqr)
10 Piston pin lockwire (2 rqr)
11 Piston pin (2 rqr)
12 Piston (2 rqr)
13 Piston oil ring (2 rqr)
14 Piston segment ring (2 rqr)
15 Piston expander ring (2 rqr)
16 Wrist pin bushing (2 rqr)
17 Bolt (4 rqr)
18 Bearing insert (4 rqr)
19 Rod and cap assembly (2 rqr)
20 Nut (4 rqr)
21 Cotter pin (4 rqr)
22 Gasket
23 Connecting rod (2 rqr)
24 Plug
25 Stud (4 rqr)
26 Nut (6 rqr)
27 Stud (2 rqr)

Figure 353. Cylinder block, exploded view.

the piston pin lockwires (10) from each piston pin (11) and press the pins from the pistons and connecting rods.

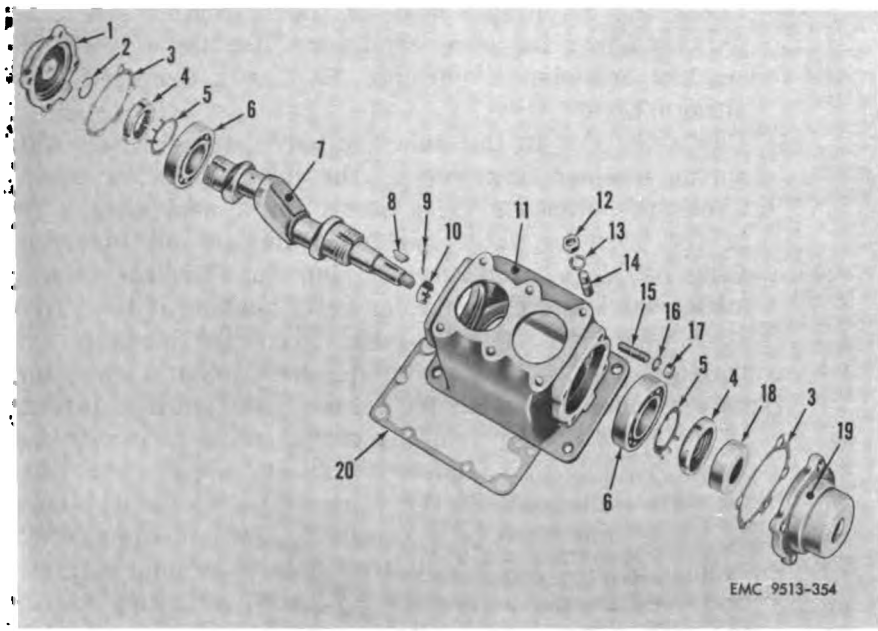
(11) Remove the nuts (17, fig. 354) and lockwashers (16) from the studs (15). Remove the end cover (19) and gasket (3). Remove the oil seal (18) from the end cover.

(12) Remove the nuts (17), lockwashers (16), end cover (1), and gasket (3). Remove the oil seal ring (2) from the end cover.

(13) Bend up the lugs on the lockwashers (5). Remove the locknuts (4) and the lockwashers.

(14) Press the crankshaft (7) and ball bearings (6) from the crankcase body (11). Press the ball bearings from the crankshaft.

(15) The cylinder block body (5, fig. 353) and gasket (22) are attached to the crankcase body (11, fig. 354) by studs (14), lockwashers (13), and nuts (12).



1	End cover	11	Crankcase body
2	Oil seal ring	12	Nut (6 rqr)
3	Gasket (2 rqr)	13	Lockwasher (6 rqr)
4	Locknut (2 rqr)	14	Stud (6 rqr)
5	Lockwasher (2 rqr)	15	Stud (8 rqr)
6	Ball bearing (2 rqr)	16	Lockwasher (8 rqr)
7	Crankshaft	17	Nut (8 rqr)
8	Woodruff key	18	Oil seal
9	Cotter pin	19	End cover
10	Nut	20	Gasket

Figure 354. Crankcase, exploded view.

b. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the cylinder head body for cracks or breaks. Check condition of the unloader diaphragm seat in the unloader diaphragm cavity in the cylinder head. Replace a cracked or broken cylinder head body. Replace the cylinder head body if the unloader diaphragm seat is pitted or damaged in any way.

(2) After cleaning, test the water jacket for leakage, using air pressure. Replace the cylinder head body if any leakage is found in the water jacket.

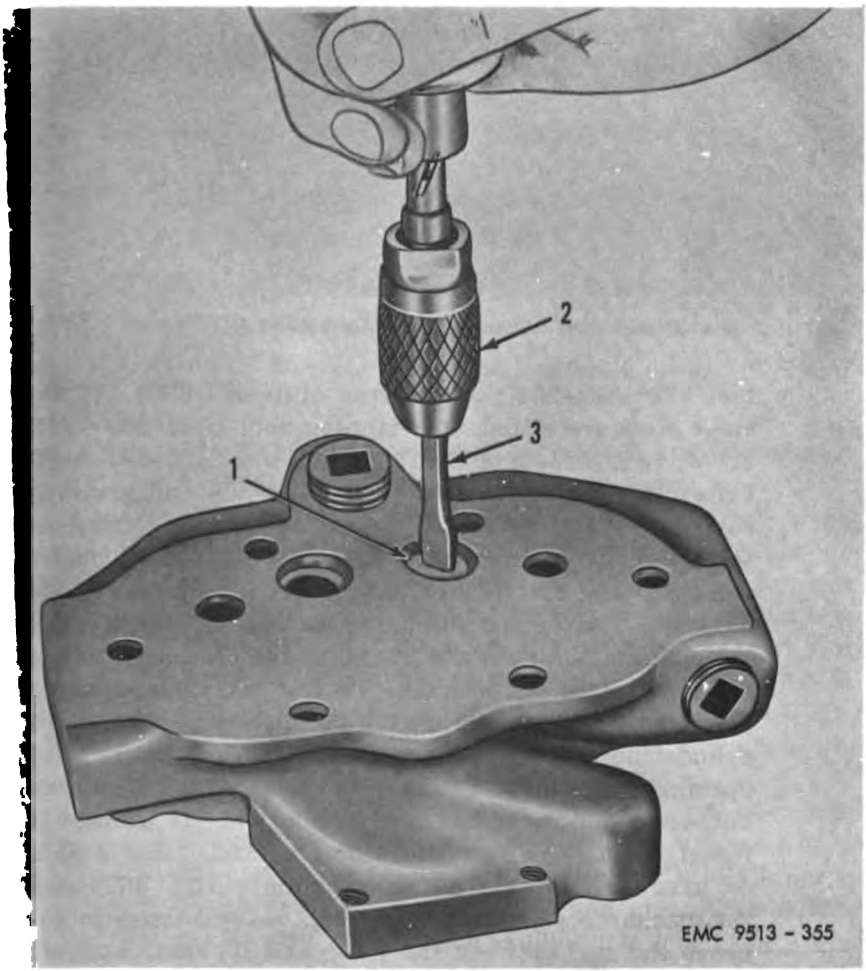
(3) Check the fit of the unloader pin in the unloader lever for looseness. Replace a worn unloader pin or lever or both.

(4) Check the unloader diaphragms for wear or cracking. Check the diaphragm seat on the bottom of the diaphragm cover for good condition. Replace a worn or cracked unloader diaphragm. Replace a damaged diaphragm cover.

(5) Check the slot in the unloader valve stems, where the spring retainer rings contact the valve stems, for wear. Check the unloader valve stems for a neat sliding fit in the unloader valve bushings. Replace an unloader valve having a worn retainer ring slot. Replace an unloader valve and the unloader valve bushing if the valve stem wear exceeds 0.002-inch. Press the bushing out through the top of the cylinder head. Grind unloader valves (fig. 355) which are not too badly worn or pitted, to their seats using grinding compound, a reciprocating valve grinding tool 5120–387–9640 and a valve grinding bit 4910–473–6960. If the valve seats are badly pitted or worn, they must be reamed (fig. 356), using special reamer 5110–473–7294. Valves must be ground to their seats and cleaned after reaming. After grinding, install the unloader valves, unloader valve springs, unloader valve stops, and spring retainer rings in the cylinder head (fig. 357) and test the unloader valves for leakage. Test the unloader valves for leakage by clamping the cylinder head in a special fixture (fig. 358) and using 75-pound air pressure and soap suds. Apply the soap suds to the exhaust port of the fixture while holding the other unloader valve down off its seat. Leakage in excess of a 1-inch soap bubble in three seconds for any

one unloading valve is not permissible. If leakage is found, grind the unloader valve to its seat.

(6) Inspect the discharge valves and valve seats for grooves. Replace all used discharge valve springs. If the discharge valves are grooved deeper than 0.003-inch where they contact the seats, they must be replaced. If the discharge valve seats are worn to the extent that there is no longer sufficient metal left to reclaim the seat by reaming, the cylinder head body must be replaced. If the discharge valve seats merely show signs of slight scratches, they can usually be reclaimed by using grinding compound, lapping disk 41–D–1261–500, grinding



1 Unloader valve 2 Valve grinding tool 3 Driver tool

Figure 355. Grinding unloader valve.

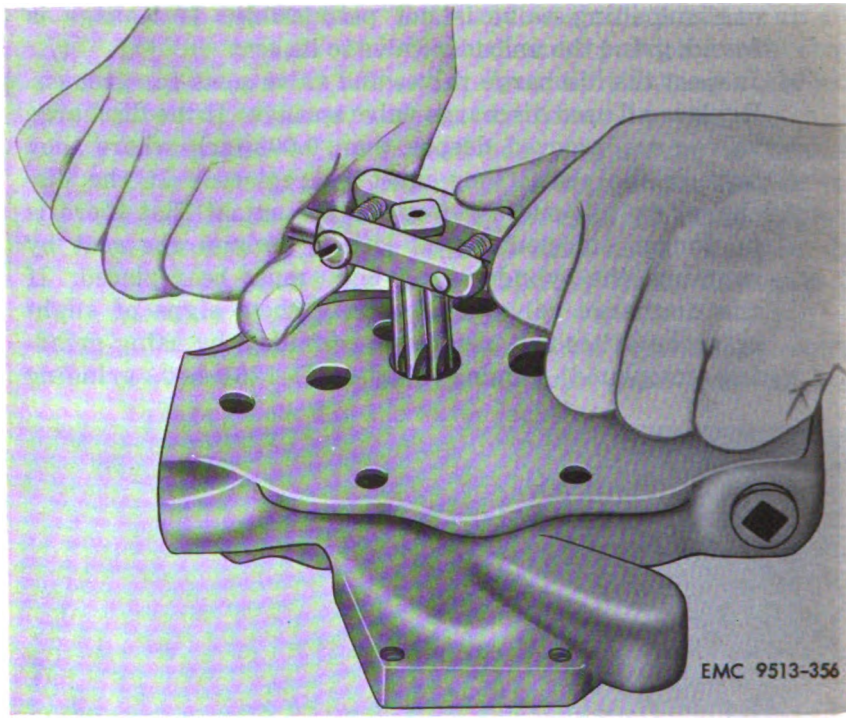
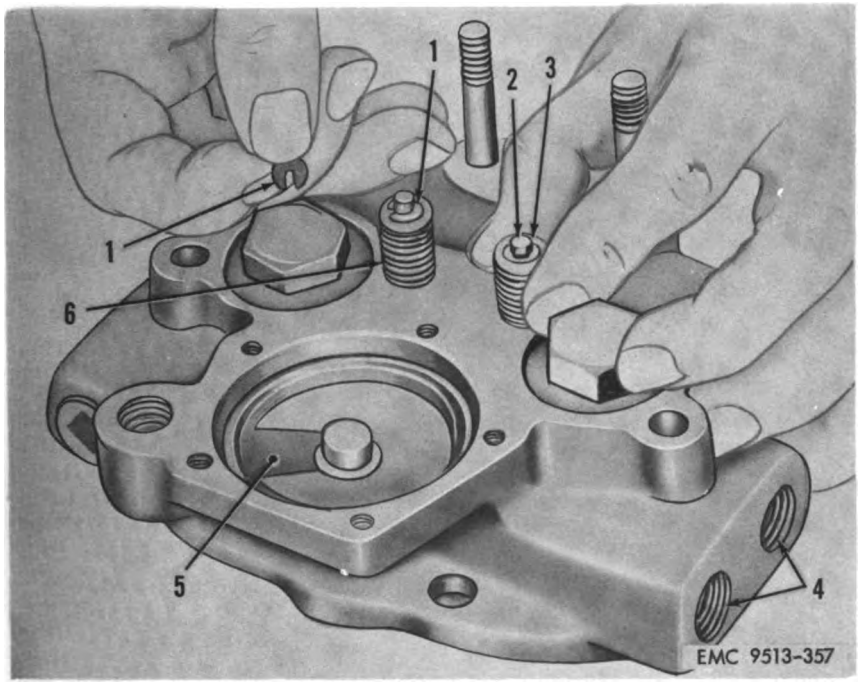


Figure 356. Reaming unloader valve seat.

tool 5120–387–9640, and driver 4910–473–6960. If the valve seats are pitted, use lapping tool 5120–473–7612, driver 4910–473–6960, and grinding tool 5120–387–9640, before using lapping disk 41–D–1261–500 and grinding compound. If the valve seats are badly pitted or scratched, use reamer 5110–473–7274 (fig. 359), before using lapping tool 5120–473–7612 or lapping disk 5345–541–1951. After the discharge valves, discharge valve springs, and capnuts are installed, the discharge valves must be tested for leakage. To test for leakage, apply 75-pound air pressure through the discharge port of the cylinder head, and apply soap suds to the discharge valve openings (fig. 360). Leakage in excess of a 1-inch soap bubble in one second is not permissible. If leakage is found, leave the air pressure applied and, using a fibre or hardwood dowel and light hammer (fig. 361), tap the discharge valves off their seats several times to improve the seal between the valve and its seat. Leakage will be decreased if the valves and valve seats have been reconditioned correctly. Leakage tests must also be made by applying soap suds around the top of the discharge



1 Spring retainer ring
2 Unloader valve
3 Unloader valve stop
4 Water connections
5 Unloader diaphragm cavity
6 Unloader valve spring

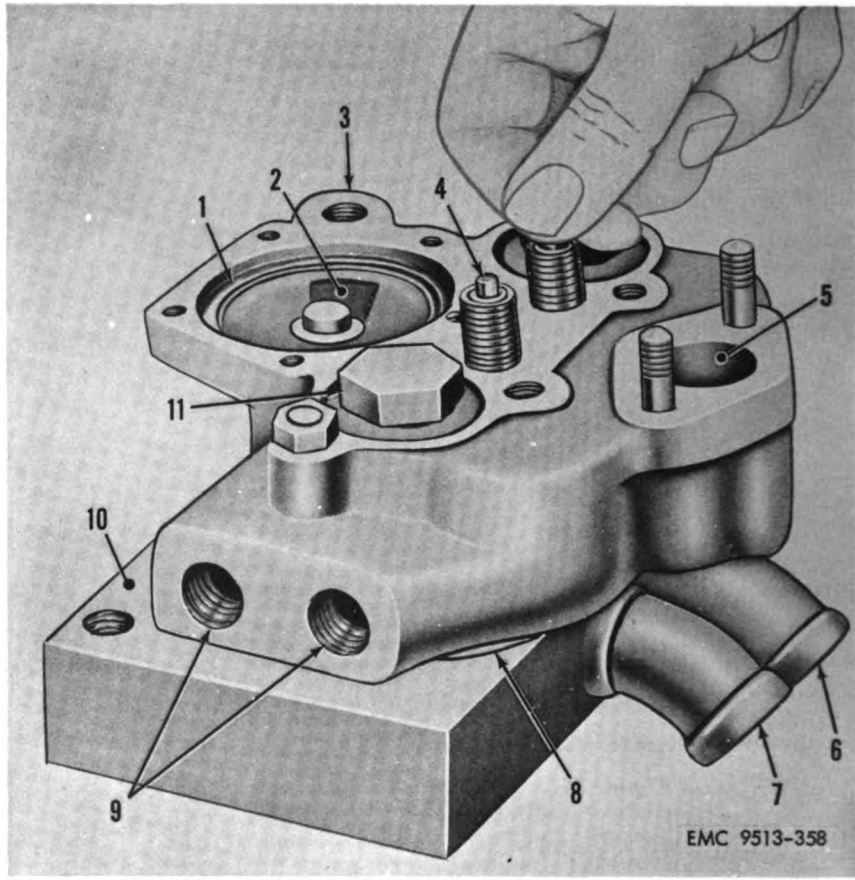
Figure 357. Installing unloader valve.

valve capnuts. Leakage here must not exceed a 1-inch soap bubble in five seconds.

(7) Inspect the crankcase, cylinder block, and end covers for cracks and broken lugs. Replace a cracked or broken cylinder block, crankcase, or end cover. Replace the crankcase if the bearing bores are worn or damaged.

(8) Inspect the crankcase bearing bores for wear or damage. Replace the end cover oil seal if the clearance at the gap when placed in the end bore of the crankshaft does not measure 0.008- to 0.015-inch. If the lip of the oil seal ring is worn thin, replace the ring.

(9) Inspect the cylinder bores for wear, out-of-roundness, or scoring. Check cylinder bores for evidence of wear, out-of-roundness, or scoring (fig. 362). Cylinder bores which are scored or out-of-round more than 0.003-inch or tapered more than 0.003-inch must be rebored, ground, or honed oversize. Cylinder blocks should be finish-ground while bolted to the crankcase. Oversize pistons are 0.010-inch, 0.020-inch, or 0.030-inch oversize.



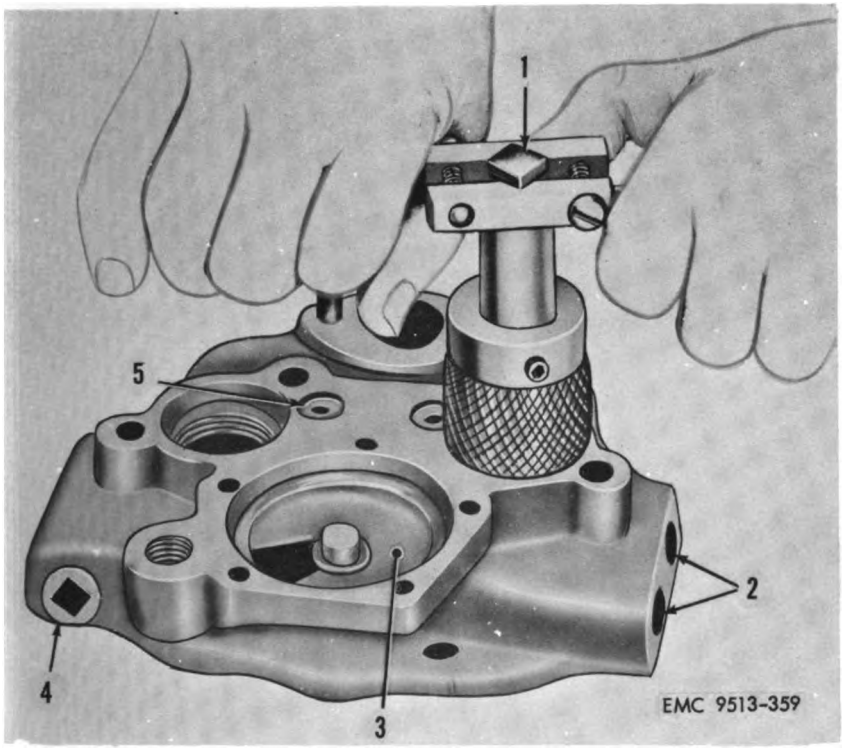
1 Unloader diaphragm seat
2 Unloader diaphragm cavity
3 Governor port
4 Unloader valve stem
5 Discharge port
6 Test fixture exhaust port
7 Air supply inlet
8 Gasket
9 Water connections
10 Test fixture
11 Discharge valve capnut

Figure 358. Testing unloader valve for leakage.

Cylinder bores must be smooth, straight, and round and should be finished with a 320-grit hone. Clearance between pistons and cylinder blocks must be 0.002-inch minimum and 0.004-inch maximum

(10) Inspect the pistons for scores, cracks, or damage of any kind. Replace a scored, cracked, or damaged piston. Check each piston with a micrometer in relation to the cylinder bore diameter to be sure the clearance is between 0.002-inch minimum and 0.004-inch maximum.

(11) Check the fit of the piston rings in the ring grooves of the piston. Clearance between the piston ring and

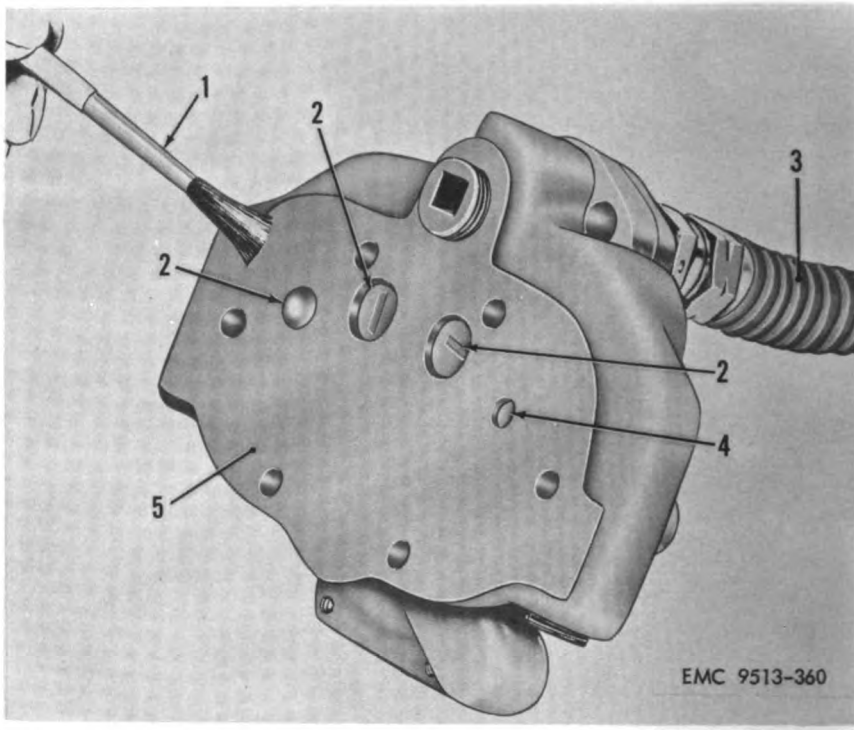


1 Reamer
2 Water connections
3 Unloader diaphragm cavity
4 Drain plug
5 Unloader valve bushing

Figure 359. Reaming discharge valve seat.

the ring groove should not be less than 0.0015-inch nor more than 0.0025-inch. Piston rings which have a gap of more than 0.020-inch, when positioned in the cylinder, must be replaced. Clearance at the gap of new piston rings, when installed in the cylinder, must not be less than 0.010-inch nor more than 0.015-inch (fig. 363). With the expander type rings the clearance between the rings and ring groove must not be less than 0.0015-inch nor more than 0.0020-inch, and if the gap is more than 0.015-inch, when the rings are positioned in the cylinder, the rings must be replaced. Gap clearance of new expander type rings, when installed in the cylinder, must not be less than 0.008-inch nor more than 0.010-inch.

(12) Check the piston pin for a light press fit in the piston. Piston pins must be a light press fit in the piston. If piston pin is a loose fit in the piston, the pin, piston, or both must be replaced. Check fit of piston pin in the



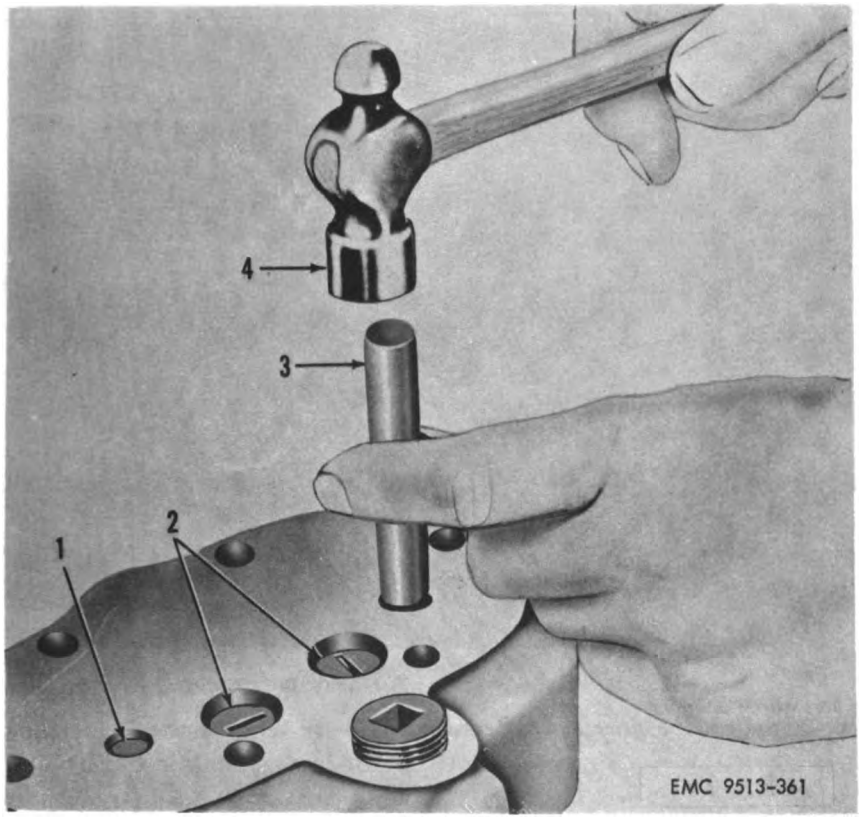
1 Brush
2 Unloader valve
3 Air line to discharge port
4 Discharge valve
5 Cylinder head

Figure 360. Testing discharge valves for leakage.

connecting rod bushing by rocking the piston. If excessive clearance is apparent, replace the wrist pin bushings in the connecting rod. Wrist pin bushings must be reamed after being pressed in place. Discard all used piston pin lockwires.

(13) Inspect the connecting rod bearing inserts for wear, cracks, or breaks. Replace worn, cracked, or broken connecting rod bearing inserts. Position the connecting rod cap so that the two locking slots are both located adjacent to the same cap screw. Clearance between the connecting rod journal and the connecting rod bearing must not be less than 0.001-inch and not more than 0.002-inch.

(14) Check the crankshaft for wear or breaks. Crankshaft journals which are more than 0.001-inch out-of-round or bruised, must be reground. When regrinding, the fillets at the ends of the journals must be maintained. Connecting rod bearing inserts are made for standard



1 Discharge valve
2 Unloader valve
3 Fibre dowel
4 Small hammer

Figure 361. Seating discharge valve with dowel.

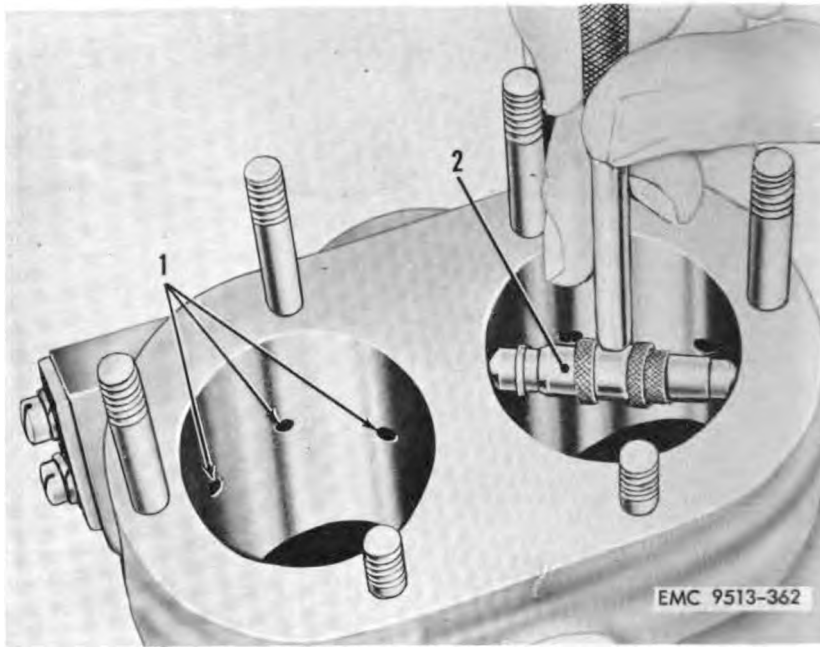
and 0.010-inch, 0.020-inch, and 0.030-inch undersize reground crankshafts. Screw threads, keyways, tapered ends, and all ground and machined surfaces of the crankshaft must not be mutilated or worn. Main bearing journals must not be worn sufficiently to prevent the ball bearings being a light press fit.

(15) Inspect the ball bearings for wear or flat spots. Replace a ball bearing that is worn or has flat spots.

(16) Inspect all parts for good condition. Replace parts not in good condition.

c. Reassembly.

(1) Place a new gasket (22, fig. 353) on the studs (14, fig. 354) on the crankcase body (11). Position the cylinder block (5, fig. 353) on the crankcase in accordance with markings made before disassembly. Install the lock-



1 Intake ports 2 Inside micrometer

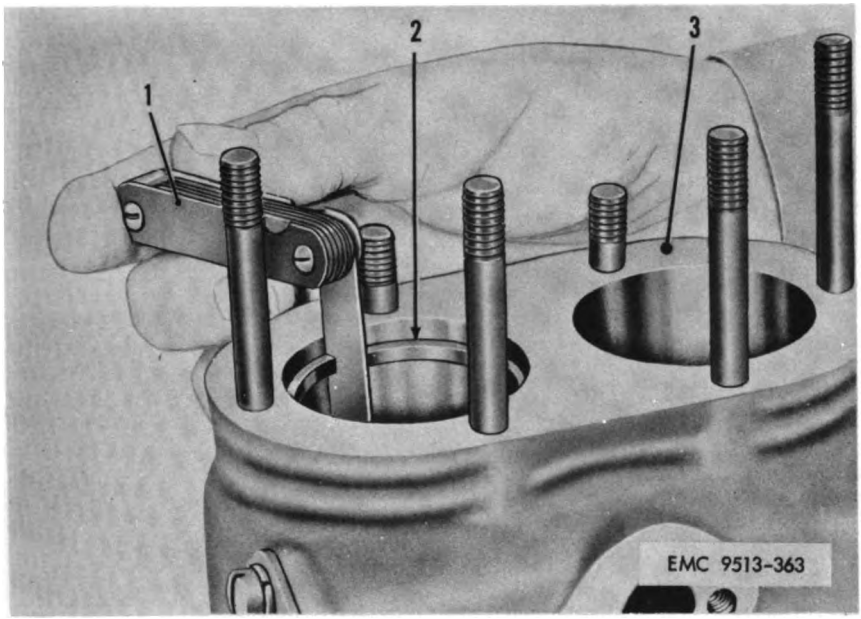
Figure 362. Measuring cylinder bore diameter.

washers (13, fig. 354) and nuts (12) securing the cylinder block to the crankcase.

(2) Press the ball bearings (6) on the crankshaft (7). Position the crankshaft and bearings in the crankcase, being sure that the drive end of the crankshaft is positioned at the end of the crankcase marked with one punch mark before disassembly. Using an arbor press, press the crankshaft and bearings into the crankcase (fig. 364).

(3) Install the lockwashers (5, fig. 354) and locknuts (4). Tighten the locknut and bend one lug on each lockwasher into one of the slots in each locknut.

(4) Place a new gasket (3) over studs (15) on rear end of the crankcase, being sure the oilhole in the gasket lines up with the oilhole in the crankcase. Install the oil seal ring (2) in the end cover (1). Install the end cover on the studs, being sure that the oilhole in the end cover lines up with the oilhole in the gasket and crankcase. Secure the end cover with lockwashers (16) and nuts (17). Install pipe plugs in any oil openings in the end cover.



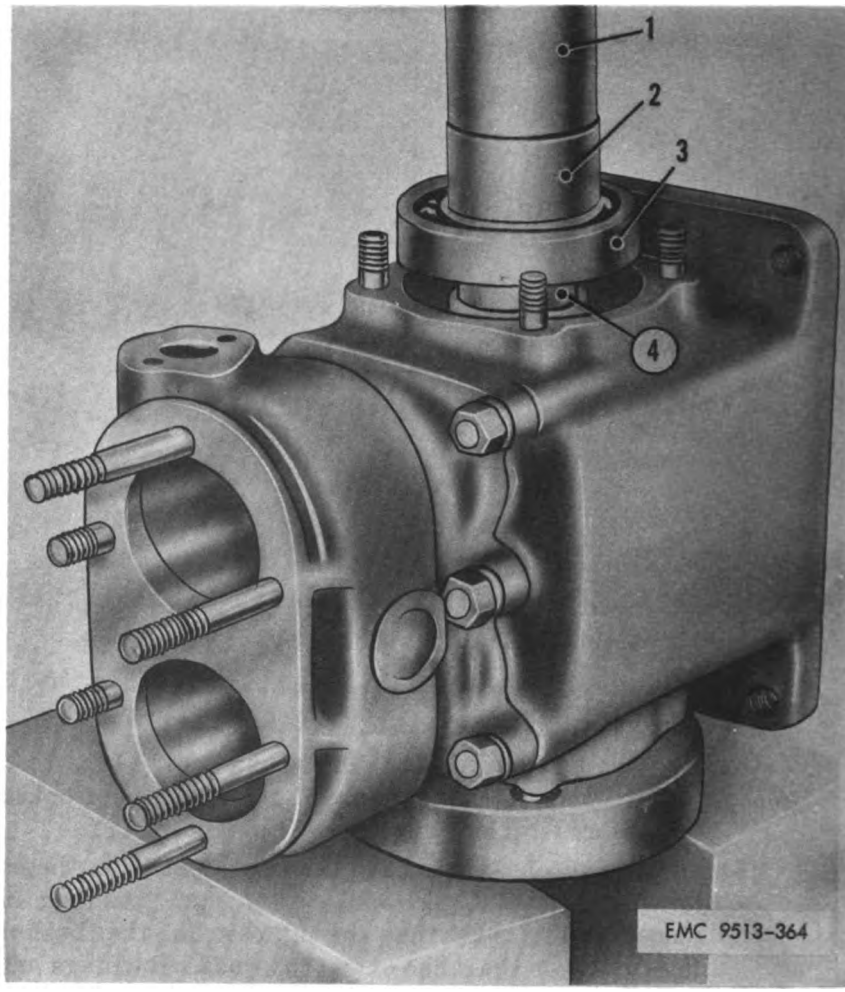
1 Thickness gage 2 Piston ring 3 Cylinder block

Figure 363. Checking ring gap clearance in cylinder.

(5) Install a new oil seal (18) in the end cover (19). Install a new gasket (3) and the end cover on the crankcase and secure with lockwashers (16) and nuts (17).

(6) If wrist pin bushings have been removed from the connecting rods (19, fig. 353), press new bushings into place, making sure that the oilholes in the bushings line up with the oilholes in the rods. Bushings must then be reamed, honed, or bored, to provide between 0.0005- and 0.001-inch clearance on the piston pin. Position the connecting rod in the piston (12) and press the piston pin (11) into the piston with the lockwire hole in the pin alining with the lockwire hole in the piston. Install new lockwire (10) in the piston pin so that the end of the wire engages the hole in the piston.

(7) Install the piston rings by hand. Four rings are used in each piston and they must be installed in their proper location (fig. 365). Careful inspection is necessary to determine which side of the tapered oil ring has the largest diameter. Tapered oil rings are marked with a small diamond-shaped trademark on the top side of the ring opposite the gap and must be installed with the trademark side of the ring toward the top of the piston.



1 Arbor press
2 Collar
3 Ball bearing
4 Crankshaft

Figure 364. Installing crankshaft and bearings, using arbor press.

Compression rings are marked with a small diamond-shaped trademark near the gap in the ring and can be installed with either side toward the top of the piston. Ventilated oil rings are installed with either side uppermost. Stagger the position of the ring gaps.

(8) Before installing pistons and connecting rods, thoroughly lubricate the pistons, piston rings, piston pin bearings, and connecting rod bearings with clean engine oil.

(9) Turn the crankshaft so as to position No. 1 crankshaft journal downward. Remove the bearing cap from the

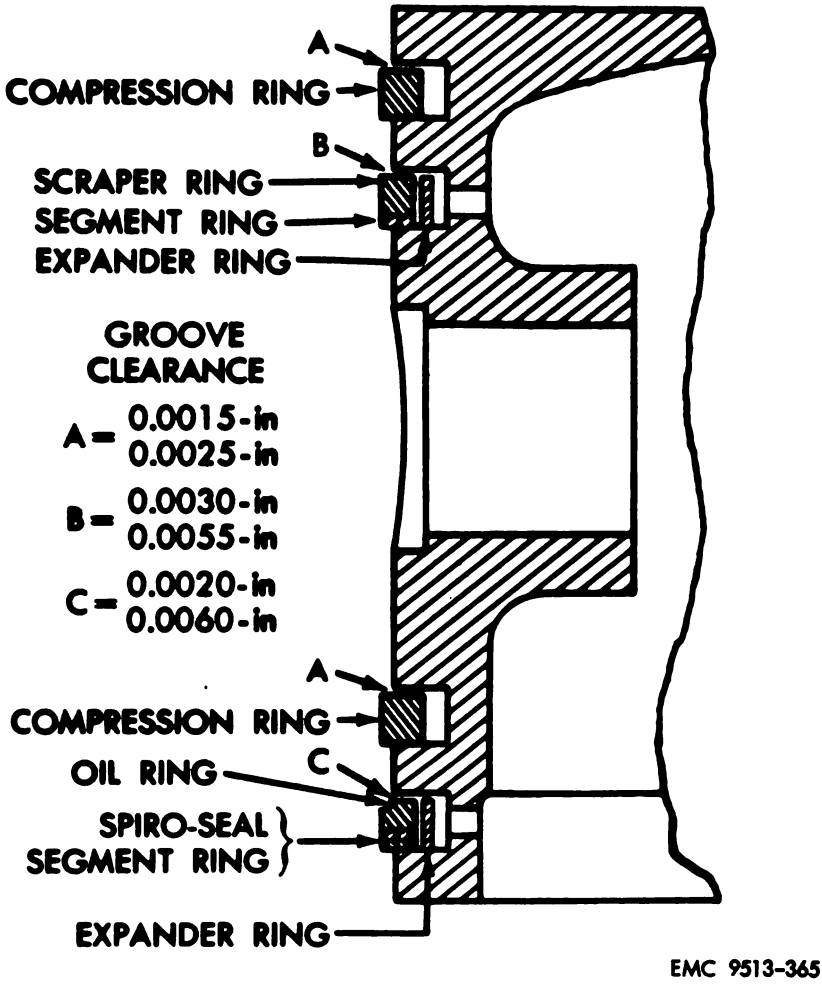


Figure 365. Position of piston rings.

No. 1 connecting rod, leaving the connecting rod bolts in the rod.

(10) Insert the No. 1 connecting rod and piston through the top of the No. 1 cylinder, being sure the connecting rod bearing engages the connecting rod journal in the same position as that in which it was fitted.

(11) Position and attach the lower bearing cap to the connecting rod and install the nuts and cotter pins.

(12) Install No. 2 piston in the same manner.

(13) If the unloader valve bushings (13, fig. 352) have been removed, press new bushings into place. The bushings must be pressed in from the top of the cylinder head and then reamed.

(14) Insert each unloader valve (16) into the cylinder head body (17) from the bottom side. Place a small wooden block or a nut under the valve to keep it in position. Install an unloader valve spring (12) over each valve and place an unloader valve stop (11) over each spring. Then compress each spring by hand until the spring retainer ring (10) can be inserted over the stop (11).

(15) Position each discharge valve (8, fig. 366) on its seat through the opening in the top of the cylinder head body (9). Position the discharge valve spring (7) and discharge valve capnut (6) by inserting them into the cylinder head body over the discharge valve. Tighten each discharge valve capnut.

(16) Position the diaphragms (12) in the cavity (4), after lubricating the diaphragms with a thin coating of light engine oil. Position the diaphragm follower (2) on the diaphragms with the post upward. Place the diaphragm cover (13) over the follower post. Attach the cover to the cylinder head body with the lockwashers (21, fig. 352) and screws (22). Tighten all screws gradually and evenly.

(17) Check for leakage past the diaphragms by applying 100 pounds air pressure through the diaphragm cavity port (5, fig. 366) and applying soap suds all over the diaphragm cover. Leakage in excess of a 1-inch soap bubble in three seconds is not permissible.

(18) Position the diaphragm dust guard (23, fig. 352) on the diaphragm cover (4).

(19) Place the unloader lever spring (24) in position on the diaphragm cover and position the unloader lever (1) over the spring. Insert the lever pin (19) through the cover and the lever. Install the cotter pins (20) in the lever pin.

(20) Adjust the unloader valve clearance as instructed in TM 5–5252.

(21) Install a new cylinder head gasket so the cutaway portions of the gasket will line up with the unloader valves when the cylinder head is in position.

(22) Position the cylinder head on the cylinder block in accordance with markings made before disassembly and install and tighten the nuts on the cylinder head studs.

(23) Install the air strainer as instructed in TM 5–5252.

(24) Install the air compressor as instructed in TM 5–5252.

1 Diaphragm seat
2 Diaphragm follower
3 Diaphragm seat
4 Diaphragm cavity
5 Diaphragm cavity port
6 Discharge valve capnut
7 Discharge valve spring
8 Discharge valve
9 Cylinder head body
10 Discharge port
11 Unloader valves
12 Diaphragms
13 Diaphragm cover

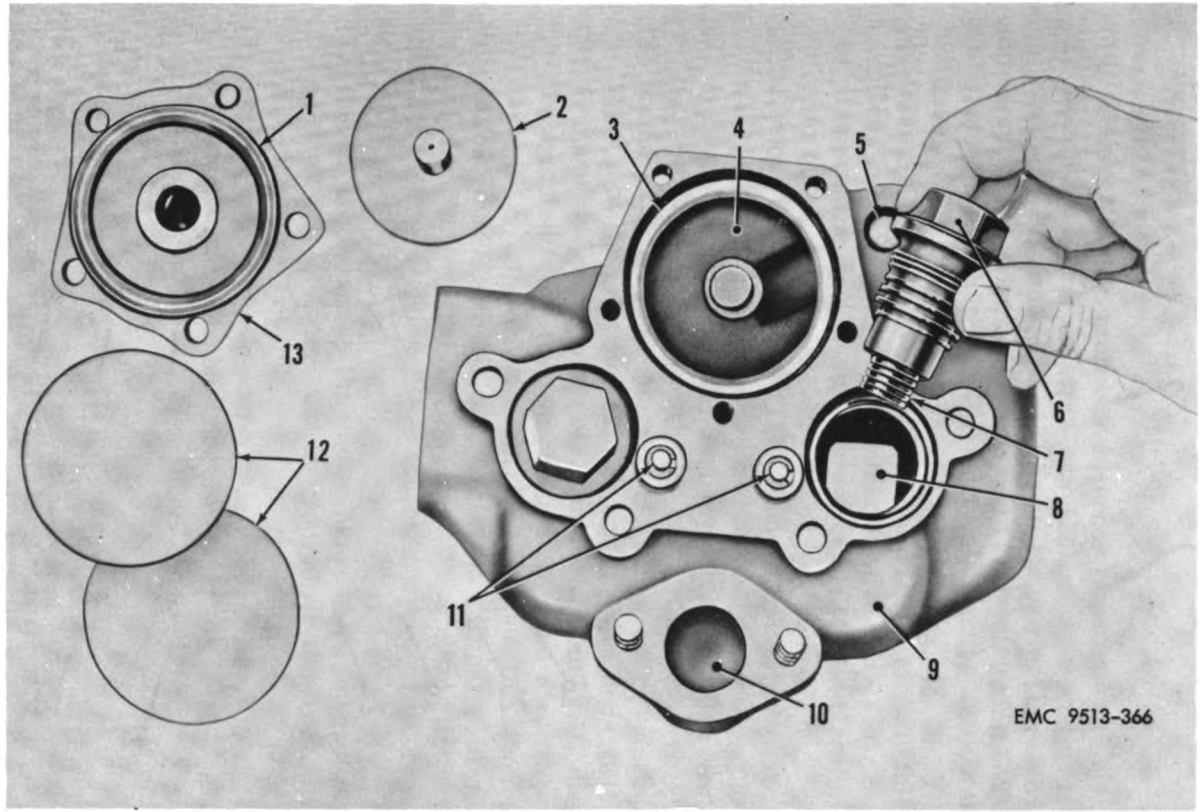


Figure 366. Installing discharge valves.

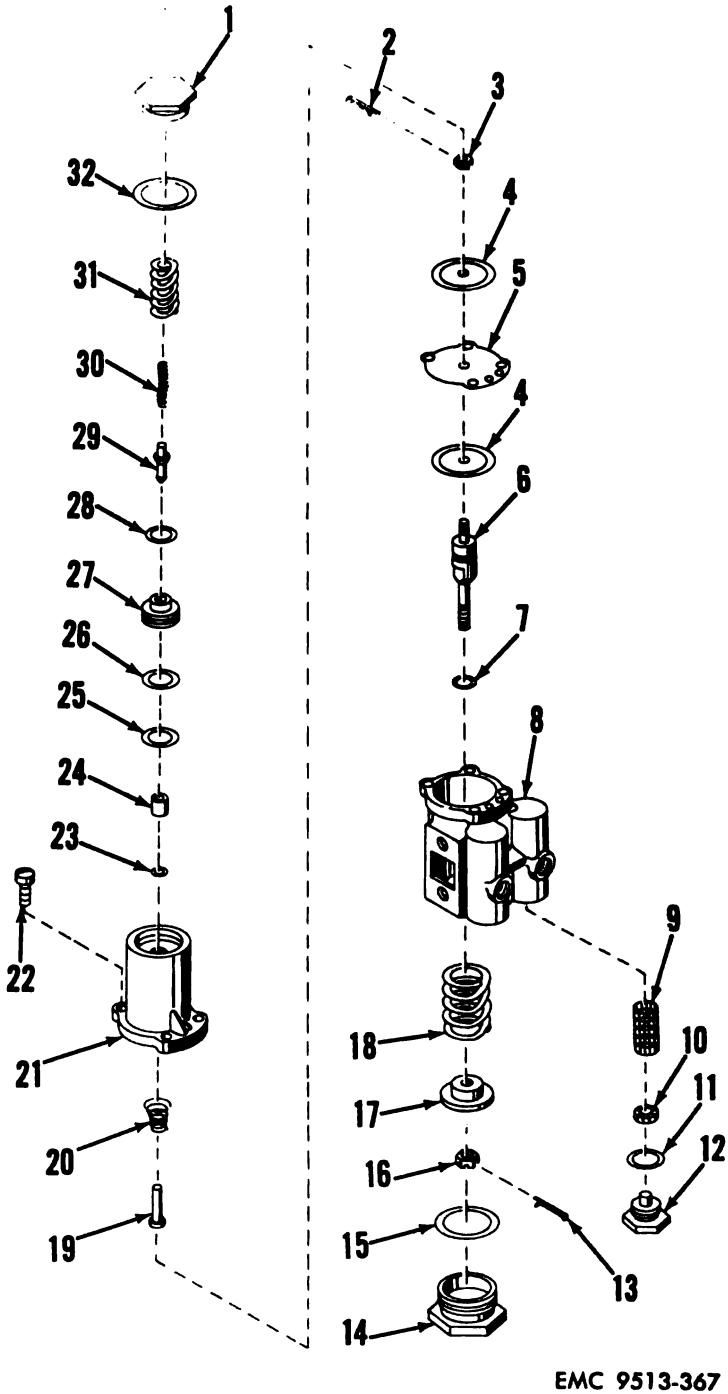


Figure 367. Air compressor governor, exploded view.

389. Air Compressor Governor
(fig. 367)

a. Disassembly.

(1) Remove the air compressor governor (par. 295*b*).

(2) Remove the strainer screw cap (12), sealing ring (11), washer (10), and filter (9) from the spring cage (8).

(3) Remove the valve body screw cap (1), sealing ring (32), seat retaining spring (31), inlet valve spring (30), and inlet-exhaust valve (29).

(4) Remove the inlet valve seat (27) and shims (25 and 26). Remove the grommet (28) from the valve seat.

(5) Remove the spring cage screw cap (14) and sealing ring (15).

(6) Remove the cotter pin (13). Remove the adjusting nut (16), spring seat (17), and pressure setting spring (18).

(7) Remove the screws (22) and separate the valve body (21) and the spring cage (8).

(8) Remove the exhaust stem (19), exhaust stem spring (20), and the grommet (23) from the valve body (21).

(9) Remove the cotter pin (2). Remove the nut (3), diaphragm followers (4), diaphragm (5), and diaphragm stem (6). Remove the grommet (7) from the stem.

b. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and wipe dry with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect both seats on the inlet-exhaust valve for grooves or damage. If either seat is grooved or damaged, replace the valve.

(2) Inspect inlet valve seat for wear or damage. Replace a worn or damaged inlet valve seat.

←

1 Valve body screw cap
2 Cotter pin
3 Nut
4 Diaphragm follower (2 rqr)
5 Diaphragm
6 Diaphragm stem
7 Grommet
8 Spring cage
9 Filter (2 rqr)
10 Washer (2 rqr)
11 Sealing ring (2 rqr)
12 Strainer screw cap (2 rqr)
13 Cotter pin
14 Spring cage screw cap
15 Sealing ring
16 Adjusting nut
17 Spring seat
18 Pressure setting spring
19 Exhaust stem
20 Exhaust stem spring
21 Valve body
22 Screw (4 rqr)
23 Grommet
24 Guide bushing
25 Shim, 0.010 (as rqr)
26 Shim, 0.003 (as rqr)
27 Inlet valve seat
28 Grommet
29 Inlet-exhaust valve
30 Inlet valve spring
31 Seat retaining spring
32 Sealing ring

(3) Inspect seat on exhaust plunger for wear or damage. If seat is worn or damaged, it must be replaced.

(4) Check fit of exhaust stem in valve body. Stem should have a neat sliding fit.

(5) Inspect all parts for good condition. Replace parts not in good condition. Replace sealing rings and grommets.

c. *Reassembly.*

(1) Install greased grommet (23) in groove in valve body (21). Install the exhaust stem spring (20) and exhaust stem (19) in body.

(2) Install the grommet (7) on the diaphragm stem (6). Assemble the diaphragm followers (4) and diaphragm (5) on the diaphragm stem (6), making sure that the beveled side of both followers is toward the diaphragm.

(3) Install the nut (3) on the stem. Install the cotter pin (2), bending both legs toward the diaphragm.

(4) Assemble the valve body and spring cage and secure with screws (22).

(5) Install the filters (9) and washers (10) in the spring cage (8). Install the sealing rings (11) on the strainer screw caps (12). Install the caps in the cage.

(6) Install grommet (23) in the valve body (21). Install grommet (28) on the inlet valve seat (27).

(7) Install the inlet valve seat and inlet-exhaust valve (29) in the valve body. Using a dial indicator on end of inlet valve, measure inlet valve travel. Add or remove shims (25 and 26) until inlet valve travel is 0.030-0.040 inch.

(8) Install the inlet valve spring (30) and the seat retaining spring (31). Install the sealing ring (32) on the valve body screw cap (1). Install the cap in the valve body.

(9) Install the pressure setting spring (18) and the spring seat (17) in the spring cage (8). Install the adjusting nut (16) on the diaphragm stem (6).

(10) Mount the governor on a suitable test rack or on the carrier and, with the spring cage screw cap (14) off, build up reservoir pressure from zero and note pressure at which air starts to escape from the spring cage. If pressure is below 100 pounds, turn the adjusting nut (16) clockwise, and, if the pressure is above 105 pounds, turn the adjusting nut counterclockwise. After final adjustment, leakage should start at 100–105 pounds. After final adjustment, install the cotter pin (13).

(11) Install the sealing ring (15) on the spring cage screw cap (14). Install the cap in the spring cage.
(12) Install the air compressor governor (par. 295*c*).

390. Relay Valve
(fig. 368)

a. Disassembly.
(1) Remove the relay valve (par. 290*b*).
(2) Remove the screws (12) and lockwashers (2). Remove the adapter (10) and gasket (13) from the relay valve body (14).
(3) Remove the screws (1) and lockwashers (2). Remove the cover (3), diaphragm (5), and lock plate (6), with filter (4) and grommet (7), from the body (14).
(4) Remove the diaphragm guide (8) and ring dampener (9) from the body.
(5) Remove the supply valve capnut (18). Remove the supply valve spring (20), seat retainer spring (21), and supply valve (22). Remove the supply valve seat (23) and grommet (24) only if valve or seat is defective.
(6) Remove the retaining ring (17), strainer plates (15), and strainer (16) from the body.

b. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and wipe dry with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.
(1) Inspect fit of diaphragm guide in relay valve body. It must be a free sliding fit.
(2) Inspect condition of ring dampener. When lying on a flat surface, the ends of the ring dampener should not be in line like the ends of a piston ring. The ring dampener must be twisted so one end is about three-eighths inch higher than the other end.
(3) Inspect diaphragm seat on top of body for dents or scratches. Slight scratches or dents can be removed by lapping the body on a flat plate covered with crocus cloth. Maintain original shape of the seat as closely as possible.
(4) Inspect the cover and lock plate for nicks, scratches, burs, and sharp edges. Replace a cover or lock plate that is nicked, scratched, burred, or has sharp edges.
(5) Inspect all parts for good condition. Replace parts not in good condition. Replace grommets.

c. Reassembly.
(1) Install the grommet (24) on the supply valve seat (23).

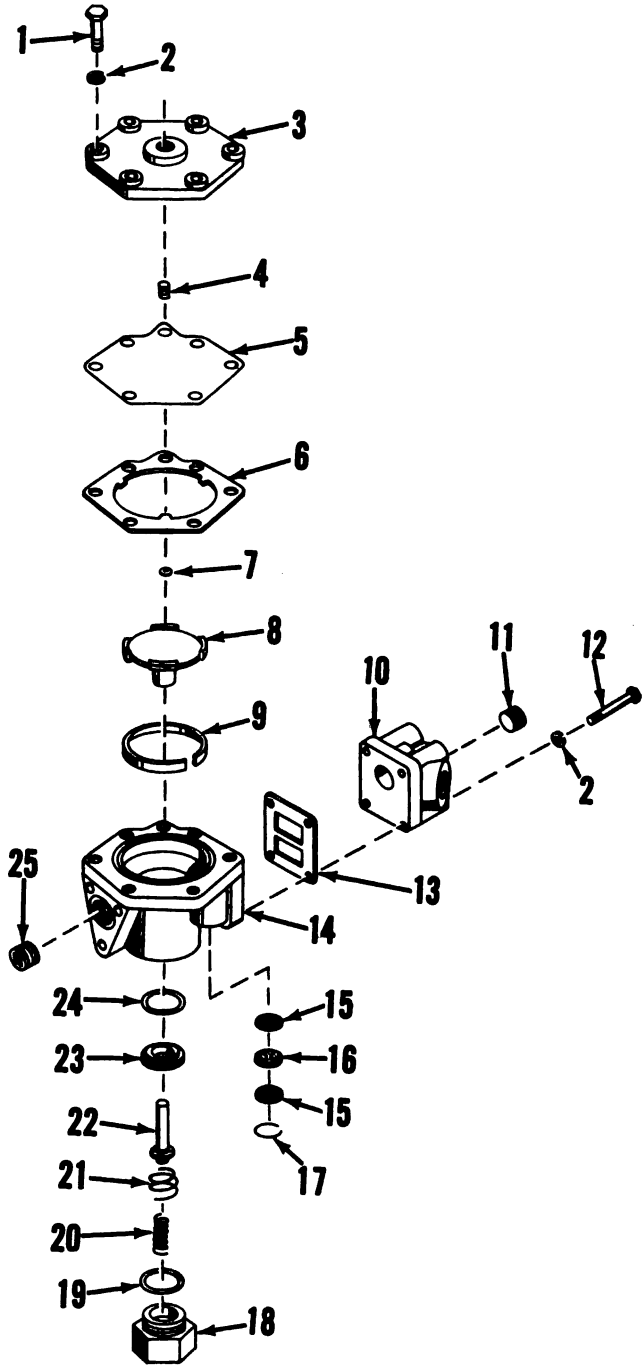


Figure 368. Relay valve, exploded view.

Using an arbor press, install the supply valve seat in the relay valve body (14). Use care so as not to damage the grommet.

(2) Install the supply valve (22), seat retainer spring (21), and supply valve spring (20) in the relay valve body (14).

(3) Install the grommet (19) on the supply valve capnut (18). Install the capnut in the relay valve body (14).

(4) Position the ring dampener (9) in groove of the diaphragm guide (8) and, holding it in place with the fingers, push the diaphragm guide into place.

(5) Install the bleeder passage grommet (7) in the body.

(6) Position the lock plate (6) and the diaphragm (5) on the body. Install the filter (4).

(7) Position the cover (3) on the diaphragm and body.

Note. Use care to see that the bleeder passage openings in the body, lock plate, diaphragm, and cover line up.

(8) Install the lockwashers (2) and screws (1).

(9) Position the gasket (13) and adapter (10) on the body and secure with lockwashers (2) and screws (12).

(10) Install the relay valve in the carrier (par. 290*c*).

391. Quick Release Valve
(fig. 369)

a. Disassembly.

(1) Remove the quick release valve (par. 292*b*).

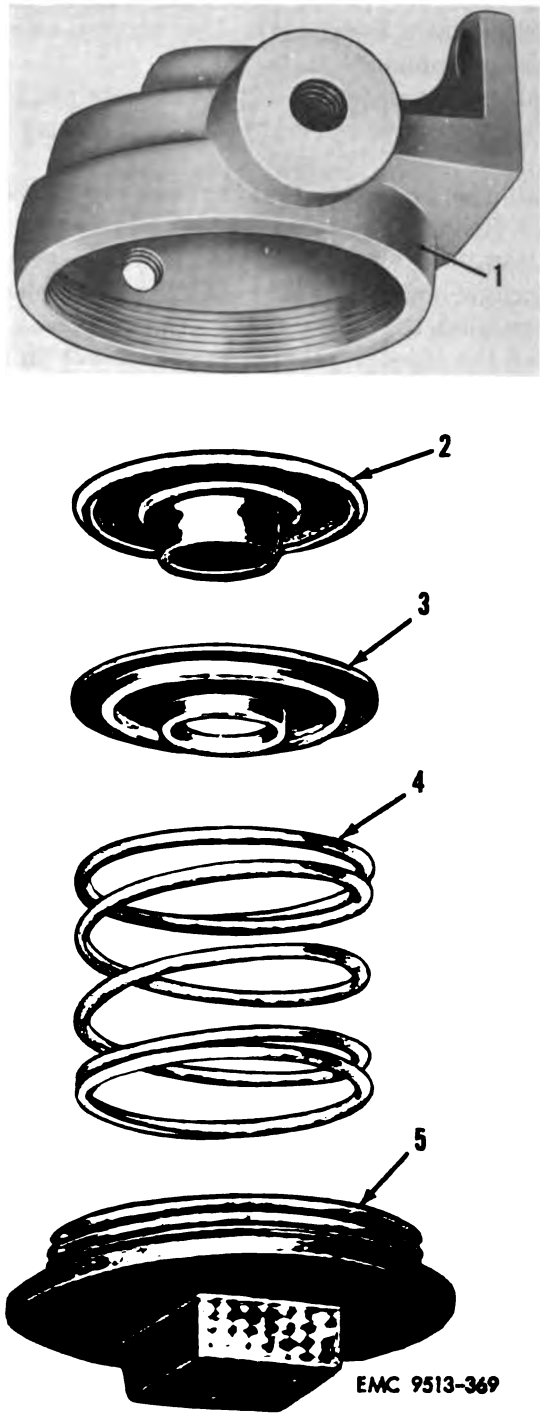
(2) Unscrew the cover (5), lift out the diaphragm spring (4), spring seat (3), and the diaphragm (2).

b. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the diaphragm for signs of cracking, wear, or damage, and for pitting or grooving of the lower face.

←

1 Cap screw (6 rqr)
2 Lockwasher (10 rqr)
3 Cover
4 Filter
5 Diaphragm
6 Lock plate
7 Grommet
8 Diaphragm guide
9 Ring dampener
10 Adapter
11 Pipe plug
12 Cap screw (4 rqr)
13 Gasket
14 Relay valve body
15 Strainer plate (2 rqr)
16 Strainer
17 Retaining ring
18 Supply valve capnut
19 Grommet
20 Supply valve spring
21 Seat retainer spring
22 Supply valve
23 Supply valve seat
24 Grommet
25 Pipe plug



1 Body 2 Diaphragm 3 Spring seat 4 Spring 5 Cover

Figure 369. Quick release valve, exploded view.

Replace a cracked, worn, damaged, pitted, or grooved diaphragm.

(2) Inspect the exhaust port seat on the cover for signs of pitting. Replace a cover that is pitted on the exhaust port seat.

(3) Inspect the spring seat for damage or wear. Replace a worn or damaged spring seat.

(4) Inspect the body and cover for cracks or breaks. Replace a cracked or broken body or cover.

c. Reassembly.

(1) Insert the diaphragm (2) into the spring seat (3). Position the diaphragm and spring seat in the body (1) and, with the spring (4) in place, install and tighten the cover (5) securely.

(2) Install the quick release valve (par. 292*c*).

392. Footbrake Valve

a. Disassembly.

(1) Remove the footbrake valve (par. 296*b*).

(2) Mark the position of the lower body (23, fig. 370) to the upper body (13) with strict attention on the position of at least one long cap screw (33).

(3) Remove the nuts (12), lockwashers (37), and cap screw (25 and 33) attaching the upper body (4, fig. 371) to the lower body (1). Remove the upper body.

(4) Remove the diaphragm and spring assembly (5) from the upper body. Remove the boot (9, fig. 370).

(5) Remove the grommet (14) from the upper body (13).

(6) Do not disassemble the pressure regulating spring (15) and diaphragm assembly (18) unless the diaphragm assembly or the exhaust seat have to be replaced. If the diaphragm assembly is disassembled, extreme care must be used to be sure the same shims (16 and 36) are replaced and the measurements are maintained.

(7) Remove the grommet (19) from the valve seat (20) of the plunger assembly.

(8) Remove the diaphragm return spring (22) from the lower body.

(9) Remove the nuts (29) and lockwashers (30) attaching the inlet body (28) to the lower body. Remove the inlet body (1, fig. 372).

(10) Lift the grommet (2), inlet and exhaust valve assembly (7), and the shims (3) out of the lower body (4). Do not disassemble the inlet and exhaust valve assembly.

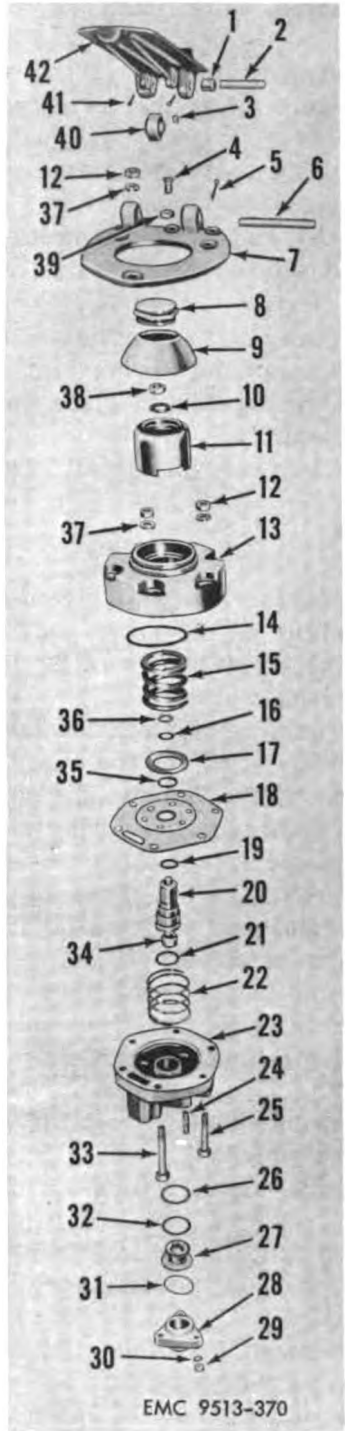


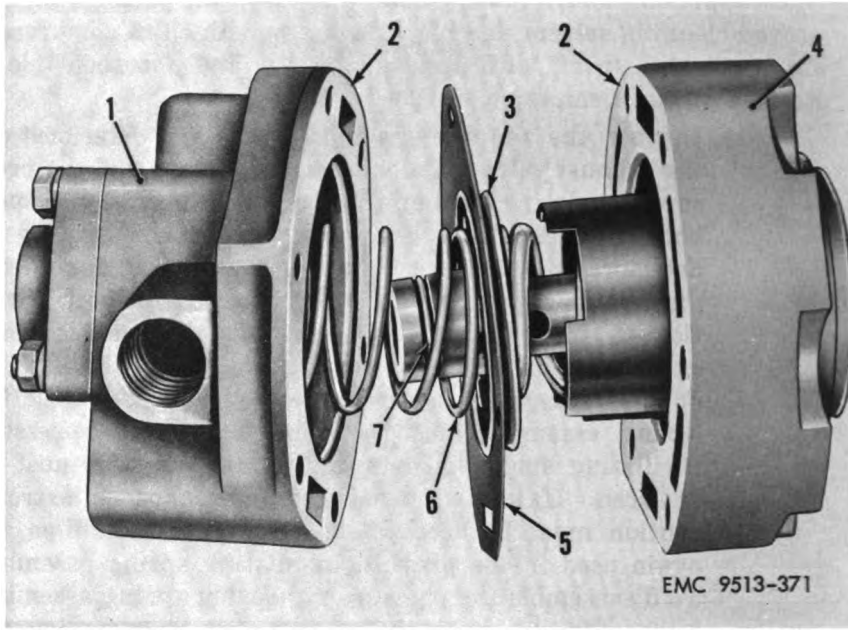
Figure 370. Footbrake valve, exploded view.

b. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the diaphragms for cracks or deterioration, the exhaust valve seat for wear or damage, and the pressure regulating spring for damage. Carefully inspect both diaphragms to be sure they are not cracked or deteriorated. If cracks or deterioration are found, the diaphragm assembly must be replaced. Inspect condition of the exhaust valve seat. If the seat is worn excessively or if it is damaged in any way, the plunger or the complete diaphragm and pressure regulating spring assembly must be replaced. If the pressure regulating spring is damaged in any way, it must be replaced. If it is necessary to replace parts, extreme caution must be used to be sure the same shims are again used in the pressure regulating spring assembly. To disassemble the pressure regulating spring assembly, loosen the cap from the spring cage by clamping the spring cage in a strap wrench to hold the spring cage at the step at the bottom. Be sure not to score or damage the spring cage in any way. Remove the cap. Loosen the nut in the spring cage by holding the plunger with a rod through the exhaust hole in the plunger. Remove the nut and flat washer, spring cage, and pressure regulating spring. Remove the retaining ring which holds the diaphragm assembly in place. Posi-

←

1 Bushing (2 rqr)
2 Roller pin
3 Stop pin
4 Adjusting screw
5 Cotter pin
6 Treadle pin
7 Mounting plate
8 Cap
9 Boot
10 Washer
11 Spring cage
12 Nut (9 rqr)
13 Upper body
14 Grommet
15 Pressure regulating spring
16 Shim (as rqr)
17 Shim (as rqr)
18 Diaphragm assembly
19 Grommet
20 Valve seat
21 Grommet
22 Diaphragm return spring
23 Lower body
24 Stud (3 rqr)
25 Cap screw (3 rqr)
26 Shim (as rqr)
27 Inlet valve assembly
28 Inlet body
29 Nut (3 rqr)
30 Lockwasher (3 rqr)
31 Grommet
32 Shim (as rqr)
33 Cap screw (3 rqr)
34 Plunger
35 Retaining ring
36 Shim (as rqr)
37 Lockwasher (9 rqr)
38 Nut
39 Locknut
40 Roller
41 Cotter pin (2 rqr)
42 Treadle



1 Lower body
2 Diaphragm seat
3 Diaphragm follower
4 Upper body
5 Diaphragm and spring assembly
6 Diaphragm return spring
7 Grommet

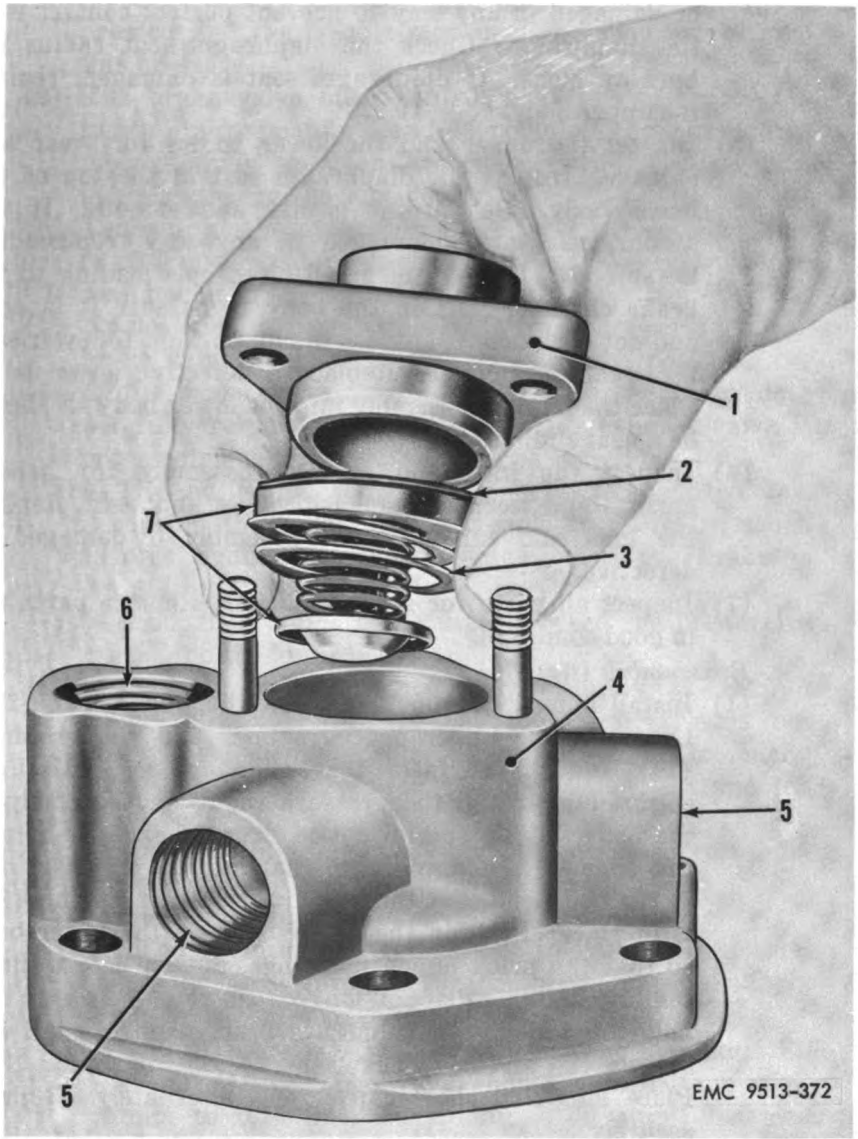
Figure 371. Removing upper body from lower body.

tion a new grommet in the diaphragm assembly. After all parts are positioned, the nut in the spring cage must be screwed down until the nut is tight. Prick punch the nut. Replace, tighten, and prick punch the cap in place.

(2) Inspect the treadle pin and roller for wear. The treadle pin must be a neat free fit. If the bushings in the mounting plate are worn, they must be pressed out and replaced. Inspect the roller for fit on the roller pin, also for flat spots. Roller must be a free rolling fit on the pin. If excessive wear is found or if the roller has any flat spots, the pin, the roller, or both must be replaced. Check to be sure the stop button at the top of the treadle and the stop pin at the heel of the treadle are in place and in good condition. Replace if necessary.

(3) Inspect the mounting plate for cracks or breaks. Replace a cracked or broken mounting plate. Replace a worn or damaged adjusting screw or locknut.

(4) Check the spring cage for a sliding fit in the upper body. Replace the grommet in the upper body. The



1 Inlet body
2 Grommet
3 Shims
4 Lower body
5 Brake chamber ports
6 Exhaust port
7 Inlet and exhaust valve assembly

Figure 372. Removing inlet and exhaust valve assembly.

spring cage must be a neat sliding fit in the upper body. Check to be sure the diaphragm follower seat on the bottom of the upper body is not damaged in any way to prevent perfect contact with the diaphragm follower. Inspect the diaphragm seat to be sure it is not nicked

or damaged in any way to prevent perfect contact with the diaphragm. Check the diaphragm seat radius for burs or nicks. If diaphragm seat is damaged, replace the upper body.

(5) Inspect the upper and the lower bodies for wear and damage. Inspect the diaphragm seat in the top of the lower body. Be sure it is flat and smooth. If the diaphragm seat is damaged in any way, replace the lower body. Inspect the small bleed hole leading to the brake chamber port in the body to be sure it is open and not obstructed. Inspect the diaphragm follower seat for wear or damage. Replace a defective lower body. Place the plunger assembly into the lower body; it should be a neat sliding fit.

(6) Inspect the inlet and exhaust assembly for broken springs and worn or damaged valves and seat. Replace the inlet and exhaust valve assembly if damaged or defective.

(7) Inspect all parts for good condition. Replace parts not in good condition.

c. Reassembly (fig. 370).

(1) Install a new grommet (19) on the upper seat (20). Lubricate the upper seat grommet and the grommet (14) and the surfaces they slide against with light engine oil. Install the pressure regulating assembly in the body, taking special notice that the exhaust hole at the edge of the diaphragm matches the exhaust hole in the body and that the diaphragm return spring (22) is in place. Position the upper body on the lower body so that the prick punch markings, put on before disassembly, match. Place a long cap screw (33) into the hole for which a marking has been made. Install cap screws (25 and 33), lockwashers (37), and nuts (12). Place long and short cap screws alternately. Tighten securely.

(2) Place the shims (26 and 32) in the recess at the bottom of the inlet body (28). Install the inlet and outlet exhaust valve assembly with the spring and exhaust valve uppermost in the body. Position the grommet (31) in place against the inlet valve seat (27). Position the inlet body and secure with the lockwashers (30) and nuts (29).

(3) Install the foot brake valve (par. 296*c*).

d. Operating Tests and Adjustments.

(1) The brake valve must deliver approximately full com-

pression tank pressure when the treadle is fully depressed and the treadle stop must be adjusted to give this pressure.

(2) The brake valve must control delivered pressures between approximately 5 and 75 pounds. These pressures must rapidly vary in accordance with the position in which the treadle is held.

(3) Leakage at the exhaust port in both the fully applied or fully released positions must not exceed a 1-inch soap bubble in one second.

(4) No leakage is permissible at any other point on the brake valve with the treadle in depressed position.

(5) If the brake valve does not release promptly, or does not fully release, it indicates that the exhaust valve is not opening sufficiently. This can be caused by—

(*a*) The adjusting screw being screwed out too far, causing the roller on the treadle to exert too much force against the spring cage when the brake is released.

(*b*) Insufficient shims being used between the inlet valve seat and the lower body.

(6) If the brake valve does not apply promptly, or does not apply fully, it indicates that the inlet valve is not opening sufficiently. This can be caused by too many shims being used between the inlet valve seat and the lower body.

(7) Adjustment of the brake valve to obtain correct inlet and exhaust valve opening is as follows:

(*a*) Check to be sure the inlet valve is seated.

(*b*) Place a depth gage against the inlet valve by inserting the gage through the compression tank supply port in the inlet valve body.

(*c*) Apply the brake valve and measure the maximum inlet valve travel. The travel should be 0.148-inch minimum to 0.156-inch maximum. Add shims between the inlet valve seat and the body to decrease the travel. Remove shims to increase the travel. Adding shims increases the exhaust valve opening, when the brake is released, and decreases the inlet valve opening, when the brake is being applied. Removing shims decreases the exhaust valve opening, when the brake is released, and increases the inlet valve opening, when the brake is being applied.

(*d*) Insert a 0.109-inch thickness gage between the treadle roller and the cap on the spring cage and turn the

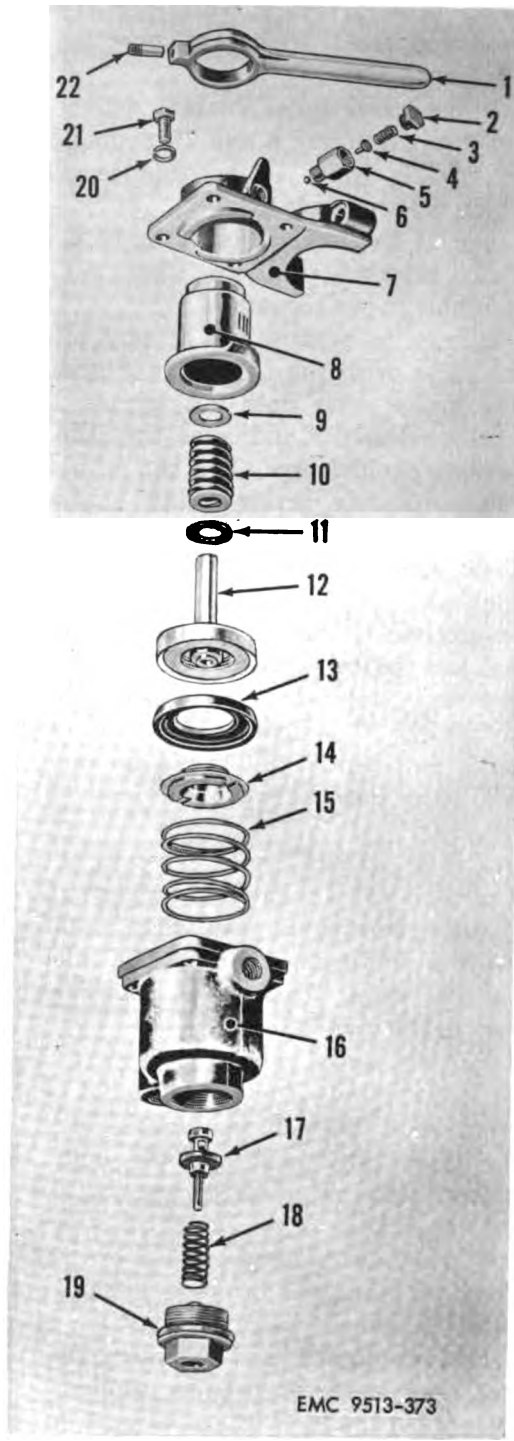


Figure 373. Handbrake valve, exploded view.

adjusting screw until the valve delivers 2- to 7-pounds air pressure, then lock the adjusting screw.

(8) If the brake valve does not graduate the delivery properly, check to be sure the bleed hole to the cavity immediately below the diaphragm is not restricted.

393. Handbrake Valve

a. Disassembly.

(1) Remove the handbrake valve (par. 297*b*).

(2) Unscrew the lock body (5, fig. 373) and remove the lock ball (6). Unscrew the spring plug (2) and remove the spring (3) and lock plunger (4).

(3) Remove the cap screws (21) and lockwashers (20) and lift off the cover (7) from the valve body (16).

(4) Remove the spring cage (8), washer (9), spring (10), shims (11), piston (12) assembly, and the exhaust valve spring (15).

(5) Engage the slots in the piston nut (2, fig. 374) with a steel rod (3). Remove the piston cup (4).

(6) Remove the capnut (19, fig. 373) and lift out the spring (18) and the intake and exhaust valve (17).

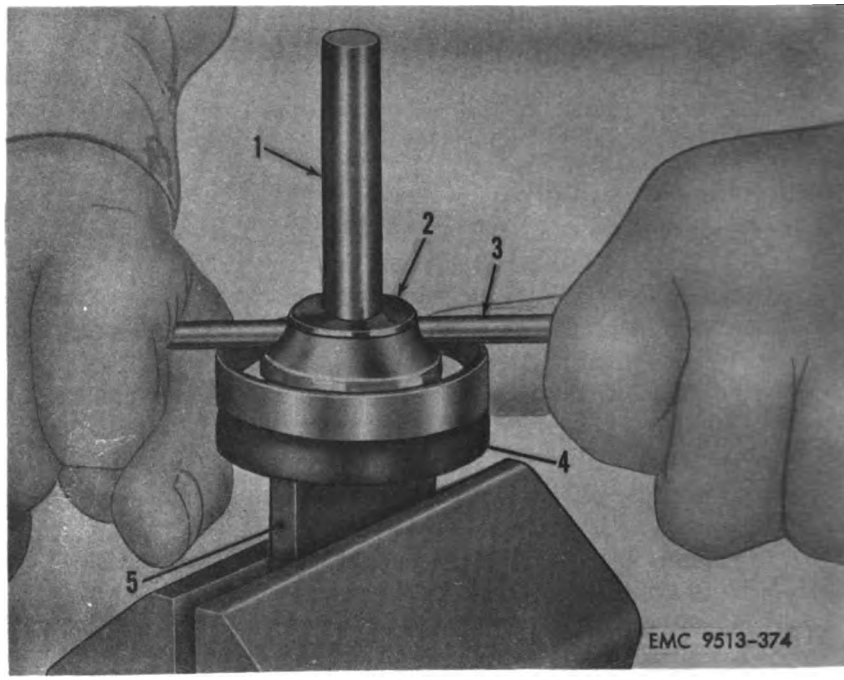
b. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the piston cup for wear or damage. Replace a worn or damaged piston cup.

(2) Inspect the piston bore in the valve body for wear, scoring, or out-of-roundness. Piston bore in the valve body must be smooth and round. If the diameter of the bore exceeds 2.133 inches, the body must be replaced. The piston must be a neat sliding fit in the valve body.

(3) Inspect the intake and exhaust valve for wear and damage. Replace a worn or damaged intake and exhaust valve assembly.

1 Handle
2 Spring plug
3 Compression spring
4 Lock plunger
5 Lock body
6 Lock ball
7 Cover
8 Spring cage
9 Washer
10 Compression spring
11 Shim (as rqr)
12 Piston
13 Piston cup
14 Piston nut
15 Exhaust valve spring
16 Valve body
17 Intake and exhaust valve
18 Compression spring
19 Capnut
20 Lockwasher (4 rqr)
21 Cap screw (4 rqr)
22 Setscrew



1 Piston 2 Piston nut 3 Steel rod 4 Piston cup 5 Steel bar

Figure 374. Disassembly of piston.

(4) Inspect all parts for good condition. Replace all parts not in good condition.

c. *Reassembly* (fig. 373).

(1) Position the piston cup (13) in the bottom of the piston (12). Screw the piston nut (14) into the piston sufficiently tight to make a good air seal at the piston cup, but not tight enough to distort or damage the cup.

(2) Place the spring (18) over the intake and exhaust valve (17). Position the two parts in the capnut (19) and enter the assembled parts into the valve body (16) with the seats of the valves toward the top of the body. Tighten the capnut.

(3) Lubricate the piston cup with graphite grease, then place the exhaust valve spring (15) into the top of the valve body and enter the piston assembly into the body over the exhaust valve spring.

(4) Place the shims (11) over the piston stem and install the spring (10). Place the washer (9) over the piston stem and on top of the spring.

(5) Enter the spring cage (8) into the bottom of the cover (7). Place the cover in position on the body with the

spring cage over the end of the piston next to the washer. Position the cover so the mounting bracket is at the rear when the brake chamber port is at the left. Install the lockwashers (20) and cap screws (21) attaching the cover to the body.

(6) Assemble the lock plunger (4), the spring (3), and the spring plug (2) in the lock body (5). Position the lock ball (6) in the cover and install the lock body assembly.

(7) Install the handbrake valve (par. 297*c*).

d. Operating Tests and Adjustments.

(1) The brake valve must deliver at least 60 pounds when the handle is moved to the fully applied position. If the delivered pressure is below 60 pounds, additional shims may be needed beneath the pressure regulating spring. If this does not correct the condition, the pressure regulating spring must be replaced. Care must be used in installing the shims to be sure the exhaust valve opening is not reduced to cause slow release.

(2) The brake valve must graduate the delivered pressure, depending on the position in which the brake valve handle is placed.

(3) Leakage at the exhaust port in both the fully applied or fully released positions must not exceed a 1-inch soap bubble in one second.

(4) No leakage is permissible at any other point on the brake valve with the brake valve handle in applied position.

394. Brake Cylinders

a. Disassembly.

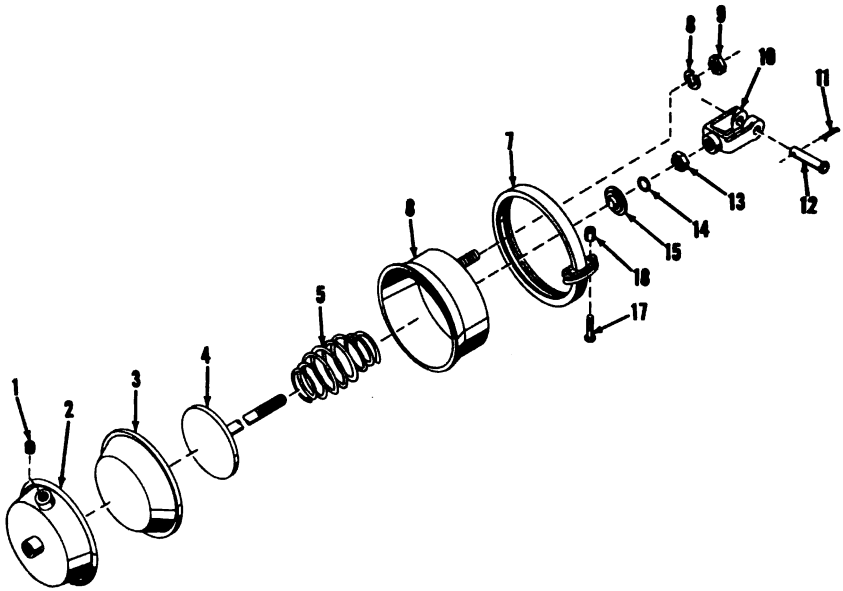
(1) Rear axle brake cylinder (fig. 375).

(*a*) Remove the brake cylinder (par. 288*c*(1)). Mark the pressure plate (2), the nonpressure plate (6), and the clamp ring (7) so that the air inlet opening in the pressure plate will be at the correct angle with the mounting when the brake cylinder is reassembled.

(*b*) Remove the yoke (10) and yoke locknut (13).

(*c*) Remove the nuts (16) and bolts (17). Spread the clamp ring (7) slightly and push the clamp ring onto the pressure plate (2) and off the nonpressure plate (6). Remove the pressure plate and diaphragm (3).

(*d*) Remove the push rod assembly (4), spring (5), push rod seal (15), and grommet (14) from the nonpressure plate (6).



1	Pipe plug	10	Yoke
2	Pressure plate	11	Cotter pin
3	Diaphragm	12	Pin
4	Push rod assembly	13	Yoke locknut
5	Spring	14	Grommet
6	Nonpressure plate	15	Push rod seal
7	Clamp ring	16	Nut (2 rqr)
8	Lockwasher (2 rqr)	17	Bolt (2 rqr)
9	Nut (2 rqr)		

Figure 375. Rear axle brake cylinder, exploded view.

(2) *Front axle brake cylinder* (fig. 376).

(*a*) Remove the brake cylinder (par. 288*b*(1)).

(*b*) Remove the yoke (25) and yoke locknut (23). Remove the screws (16) and lockwashers (15). Remove the end cover (14) from the cylinder body (1).

(*c*) Remove the piston rod (8), piston guide (11), and piston (6) as an assembly from the cylinder body (1).

(*d*) Loosen the locknut (10) and turn off the piston (6). Pull out the piston rod (8) and the piston rod retainer (9). Identify the shims (7) for reassembly.

(*e*) Remove the piston nut (2), piston cup (4), and shim washer (3).

(*f*) Remove the retaining ring (22), felt washer (21), and felt oil seal (20).

(*g*) Remove the breather cover (19), strainer (18), and strainer plate (17).

b. Inspection and Repair. Soak and wash all parts in an ap-

proved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust form all parts.

(1) Inspect pressure plates, nonpressure plates, cylinder bodies, and end covers for cracks, breaks, and distortion. Replace a plate, body, or cover if cracked, broken, or distorted.

(2) Inspect diaphragms and piston cups for signs of checking or wear. Replace a worn or checked diaphragm or piston cup.

(3) Inspect all parts for good condition. Replace parts not in good condition. Replace felt oil seals, strainer plates, piston oilers, and scraper seals.

c. Reassembly.

(1) *Rear axle brake cylinder* (fig. 375).

(*a*) Position the push rod seal (15) and grommet (14) in the nonpressure plate (6).

(*b*) Rest the push rod assembly (4) on a flat surface and position the spring (5) and nonpressure plate over rod. Force down the nonpressure plate until it rests on the flat surface. Holding the nonpressure plate in this position, against the tension of the spring, clamp the push rod at the nonpressure plate with vise grip pliers or similar tool. After the push rod is held secure, place the clamp ring (7) over the clamping surface of the nonpressure plate, alining the marks made before disassembly.

(*c*) Position the diaphragm (3) in the pressure plate (2) and join with open end of the nonpressure plate, working the clamp ring over the clamping surface of the pressure plate.

(*d*) Draw clamp ring together and install the bolts (17) and nuts (16). Tighten each bolt and nut only sufficiently to eliminate leakage at the clamping ring surface.

(*e*) Install the yoke locknut (13) and yoke assembly (10). Remove the vise grip pliers.

(*f*) Install the brake cylinder in the carrier (par. 288*c*(2)).

(2) *Front axle brake cylinder* (fig. 376).

(*a*) Install the piston cup (4), shim washer (3), and piston nut (2) on the piston (6). Install the piston oiler (5).

(*b*) Install the locknut (10) on the piston guide (11). Position the piston rod retainer (9) and piston rod

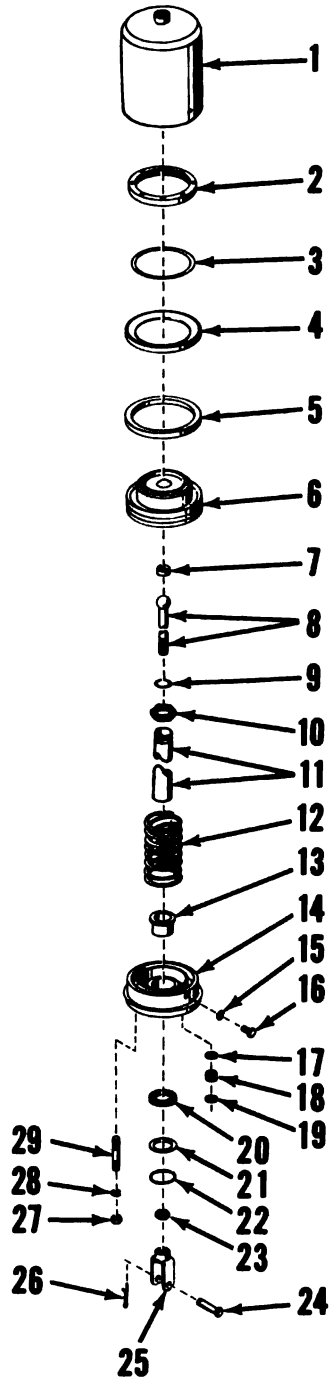


Figure 376. Front axle brake cylinder, exploded view.

(8) in the piston guide. Install the shims (7) and turn the piston on the piston guide. Tighten the locknut against the piston.

(*c*) Install the felt oil seal (20), felt washer (21), and retaining ring (22) in the end cover (14). Install the strainer plate (17), strainer (18), and breather cover (19) in the end cover.

(*d*) Position the piston and piston guide assembly in the cylinder body (1). Install the spring (12) and the end cover and secure with lockwashers (15) and screws (16).

(*e*) Install the yoke locknut (23) and yoke assembly (25).

(*f*) Install the brake cylinder in the carrier (par. 288*b* (2)).

395. Slack Adjusters

(fig. 377)

a. Disassembly.

(1) Remove the slack adjusters (par. 289*b*).

(2) Remove the rivets (1), holding the covers (2) and worm gear (3) in place.

(3) Remove the welch plug (5).

(4) Press out the worm shaft (11) from the worm (4) by pressing on the end of the shaft opposite the worm shaft lock (9). Remove the worm shaft, worm shaft lock, and worm lock spring.

(5) Remove the worm and worm gear.

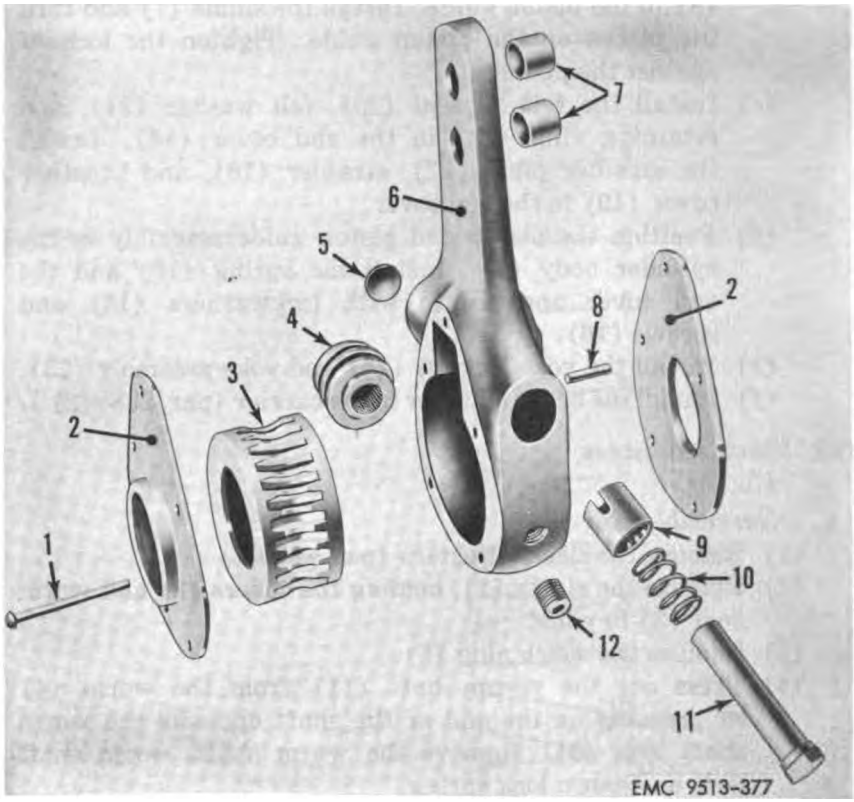
b. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the body for cracks or distortion. Replace a cracked or distorted body.

(2) Inspect the worm gear for broken teeth or damaged

←

1 Cylinder body
2 Piston nut
3 Shim washer
4 Piston cup
5 Piston oiler
6 Piston
7 Shim (as rqr)
8 Piston rod
9 Piston rod retainer
10 Locknut
11 Piston guide
12 Spring
13 Bushing
14 End cover
15 Lockwasher (4 rqr)
16 Cap screw (4 rqr)
17 Strainer plate
18 Strainer
19 Breather cover
20 Felt oil seal
21 Felt washer
22 Retaining ring
23 Yoke locknut
24 Pin
25 Yoke assembly
26 Cotter pin
27 Nut (2 rqr)
28 Lockwasher (2 rqr)
29 Stud (2 rqr)



1	Rivet (5 rqr)	7	Bushing (2 rqr)
2	Cover (2 rqr)	8	Pin
3	Worm gear	9	Worm shaft lock
4	Worm	10	Worm lock spring
5	Welch plug	11	Worm shaft
6	Body	12	Pipe plug

Figure 377. Slack adjuster, exploded view.

spline. Replace a worm gear having broken teeth or a damaged spline.

(3) Inspect the worm for bent, broken, or deeply scored threads. Replace a worm having bent, broken, or deeply scored threads.

(4) Check play in yoke pin holes. If yoke pin is loose in hole or if hole is out-of-round, press bushing out and press in replacement.

(5) Inspect all parts for good condition. Replace all parts not in good condition.

c. *Reassembly.*

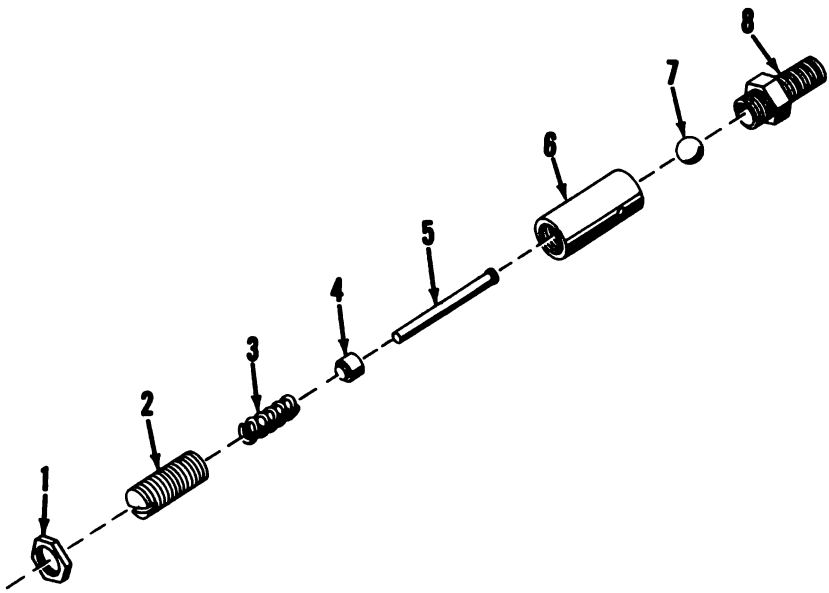
(1) Position the worm gear (3) and the worm (4) in the body (6).

(2) Position and press the worm shaft (11), worm shaft lock (9), and the worm lock spring (10) into the body and the worm. Press the worm shaft into the body approximately five-eighth inch. Be sure to line up the recess in the worm shaft lock with the pin (8) in the body before pressing into position.
(3) Install a new welch plug (5).
(4) Position the covers (2) and secure with the rivets (1).
(5) Install the slack adjusters (par. 289*c*).

396. Safety Valve
(fig. 378)

a. Disassembly.
(1) Remove the safety valve (par. 294*b*).
(2) Unscrew the spring cage (6) from the body (8). Remove the steel ball (7), release pin (5), spring seat (4), and the spring (3). If necessary, loosen the locknut (1) and unscrew the adjusting screw (2).

b. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.



1 Locknut
2 Adjusting screw
3 Spring
4 Spring seat
5 Release pin
6 Spring cage
7 Steel ball
8 Body

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Figure 378. Safety valve, exploded view.

(1) Inspect the steel ball for signs of pitting or scratching. Replace a pitted or scratched steel ball.

(2) Inspect the body and spring cage for cracks. Be sure the exhaust port in the spring cage is not plugged. Replace a cracked body or spring cage.

(3) Inspect all parts for good condition. Replace all parts not in good condition.

c. Reassembly.

(1) Turn the spring cage (6) on the body (8). Drop the steel ball (7) into the spring cage. Install the spring seat (4) on the release pin (5) and insert into the spring cage and on the steel ball.

(2) Insert the spring (3), being sure the lower end of the spring properly engages the spring seat. Install the adjusting screw (2) and locknut (1).

(3) Install the safety valve (par. 294*c*).

d. Operating Test and Adjustment.

(1) Leakage at the exhaust port must not exceed a 1-inch soap bubble in one second.

(2) The safety valve must be set to blow off at 150 pounds. The pressure setting can be adjusted by loosening the locknut and turning the adjusting screw. Turning the adjusting screw clockwise raises the pressure setting. Turning the adjusting screw counterclockwise lowers the pressure setting. Tighten the locknut after each adjustment.

397. Stoplight Switch
(fig. 379)

a. Disassembly.

(1) Remove the stoplight switch from the carrier frame.

(2) Unscrew the cover (4) from the body (12). Lift out the spring (8), contact plunger (9), shim washer (10), and the diaphragm (11).

(3) Remove the remaining nuts (1) and washers (2). Remove the terminal screws (6 and 7) and the terminal connector (5).

b. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the diaphragm for cracks, wear, or damage. Replace a cracked, worn, or damaged diaphragm.

(2) Inspect the contact surfaces of the terminal screws for

pitting or wear. Replace a terminal screw if the contact surface is pitted or worn.

(3) Inspect the body and cover for cracks or damage. Replace a cracked or damaged body or cover.

(4) Inspect all parts for good condition. Replace parts not in good condition.

c. Reassembly.

(1) Position the diaphragm (11) and shim washer (10) in the body (12). Position the contact plunger (9) on the diaphragm and the spring (8) on the plunger.

(2) Install the terminal connector (5) with terminal screw (6) and the terminal screw (7) in the cover (4). Secure the screws with washers (2) and nuts (1).

(3) Screw the cover in the body.

(4) Install the stoplight switch on the carrier frame.

398. Air Supply Valve

(fig. 380).

a. Disassembly.

(1) Remove the air supply valve (par. 293*b*).

(2) Remove the cotter pin (1) from the end of the key (8). Lift off the washer (2), spring (3), and washer (4). Remove the key.

(3) Remove the cap (5) from the air supply outlet on the body (6).

b. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the key and the key seat in the body for scoring or damage. Replace the key and the body if either one is scored or damaged.

(2) Inspect all parts for good condition. Replace parts not in good condition.

c. Reassembly.

(1) Put a thin coating of grease on the key (8) and the key seat in the body (6). Position the key in the body and install the washer (4), spring (3), washer (2), and the cotter pin (1).

(2) Install the cap (5) on the body.

(3) Install the air supply valve (par. 293*c*).

399. Single Check Valve

(fig. 381).

a. Disassembly.

(1) Remove the single check valve from the air line.

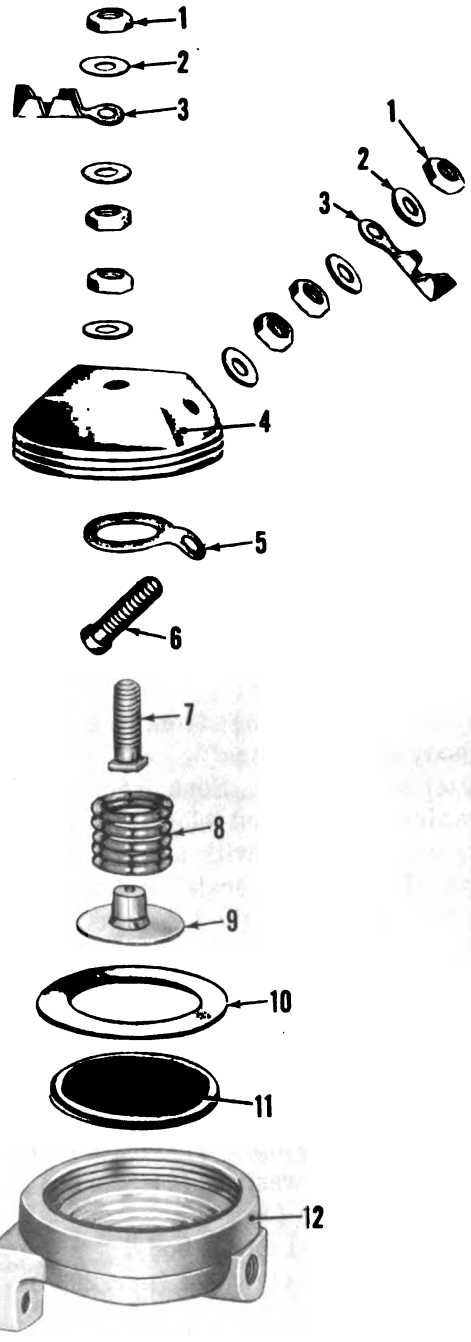


Figure 379. Stoplight switch, exploded view.

(2) Unscrew the capnut (6) from the body (1). Remove the steel ball (5), spring (4), and spring seat (3) from the body. Discard the gasket (2).

b. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the steel ball and ball seat for pitting or corrosion. Replace a pitted or corroded steel ball. Replace the capnut if the ball seat is pitted or corroded.

(2) Inspect the body and capnut for cracks or damage. Replace a cracked or damaged capnut or body.

(3) Inspect all parts for good condition. Replace parts not in good condition.

c. Reassembly.

(1) Position the spring seat (3), spring (4), and steel ball (5) in the body (1). Install a new gasket (2) on the capnut (6). Screw the capnut into the body and tighten securely.

(2) Install the single check valve in the air line.

400. Doublecheck Valve

(fig. 382)

a. Disassembly.

(1) Remove the doublecheck valve (par. 291*b*).

(2) Remove the cap screws (7) and lockwashers (6) and lift off the cover (5). Remove the grommet (4) from the cover.

(3) Lift the valve guide (3) and the valve (2) from the body (1).

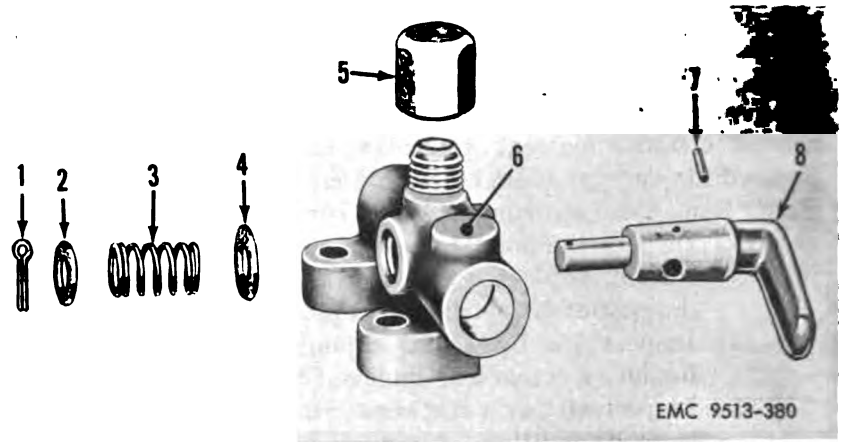
b. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the valve for cracks, wear, or damage. Replace a cracked, worn, or damaged valve.

(2) Inspect the seat in the cap for pitting, scratches, or damage. Replace the cover if the seat is pitted, scratched, or damaged.

←

1 Terminal nut (6 rqr)
2 Terminal washer (6 rqr)
3 Terminal (2 rqr)
4 Cover
5 Terminal connector
6 Terminal screw
7 Terminal screw
8 Spring
9 Contact plunger
10 Shim washer
11 Diaphragm
12 Body



1	Cotter pin	5	Cap
2	Washer	6	Body
3	Spring	7	Stop pin
4	Washer	8	Key

Figure 380. Air supply valve, exploded view.

(3) Inspect the cover, body, and valve guide for cracks or damage. Replace a cracked or damaged cover, body, or valve guide.

c. Reassembly.

(1) Insert the valve guide (3) in the body (1). Insert the valve (2) in the valve guide.

(2) Install a new grommet (4) in the cover (5). Position the cover on the body and secure with the lockwashers (6) and cap screws (7).

(3) Install the doublecheck valve (par. 291*c*).

Section XXIV. STEERING GEAR AND WHEEL

401. Steering Gear and Wheel Removal and Disassembly

a. Description. The mechanical steering gear is of the cam and twin-lever roller mounted type. The gear housing is mounted by a bracket on the left front side of the carrier frame.

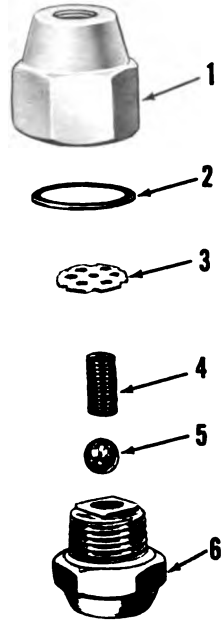
b. Removal.

(1) Remove the drain plug (7, fig. 383) and drain the lubricant from the steering gear. Remove the hand brake valve (par. 297*b*).

(2) Disconnect the horn cable (4) from the horn assembly.

(3) Remove the cotter pin (11). Turn out the ball joint plug (12) until the drag link (10) can be removed from the steering gear arm (9).

(4) Mark the steering gear arm (9) and lever shaft (3) to



EMC 9513-381

1 Body
2 Gasket
3 Spring seat
4 Spring
5 Steel ball
6 Capnut

Figure 381. Single check valve, exploded view.

insure correct reassembly. Remove the locknut (13) and lockwasher (2). Using a soft mallet, carefully tap the steering gear arm from the lever shaft.

(5) Remove the cover screws (6), lockwashers, and the housing side cover (5).

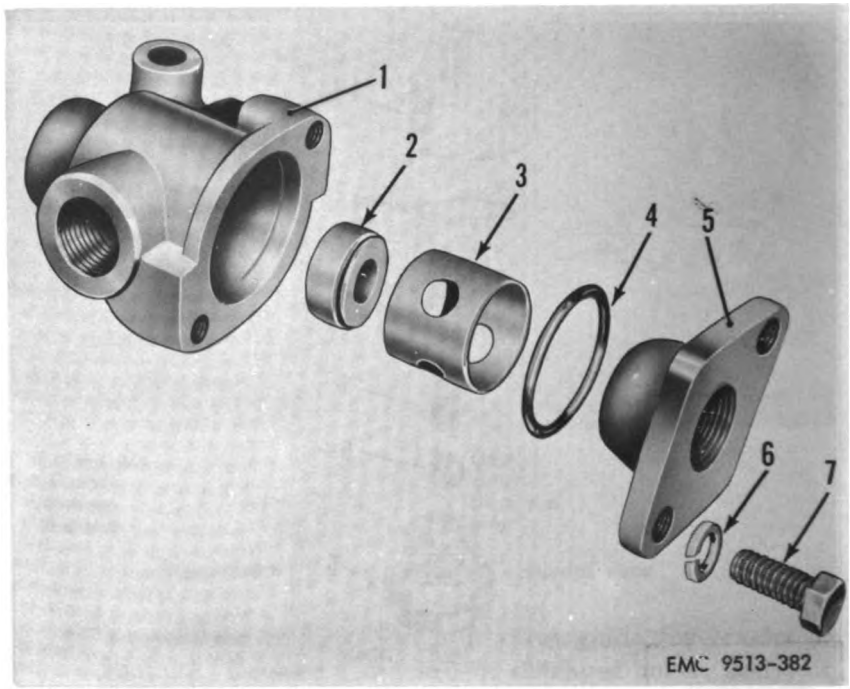
(6) Remove the lever shaft (3, fig. 384) from the housing (4).

(7) Remove the horn button (22, fig. 385) by pressing down on the button and twisting to the right. Lift off the button, contact cup (23), contact spring (24), and contact washer (25).

(8) Remove the mounting screws (32). Pull out the ferrule (27) and horn cable (31), base plate (28), contact spring (29), and contact cap (30).

(9) Remove the wheel nut (20) from the hub of the steering wheel (21).

(10) Place the steering wheel puller adapter (4, fig. 386) in the horn well. Place steering wheel adapter ring (2) around the steering column and place the puller arms



1 Body
2 Valve
3 Valve guide
4 Grommet
5 Cover
6 Lockwasher (2 rqr)
7 Cap screw (2 rqr)

Figure 382. Doublecheck valve, exploded view.

(1) around the ring. Center the puller stud on the adapter, and tighten until the wheel comes off.

(11) Lift off the spring (19, fig. 385), ring (18), and upper bearing unit (17).

(12) Remove the mounting bolts (8, fig. 383) and lockwashers and the mounting bolts (1, fig. 384) with nuts and jamnuts.

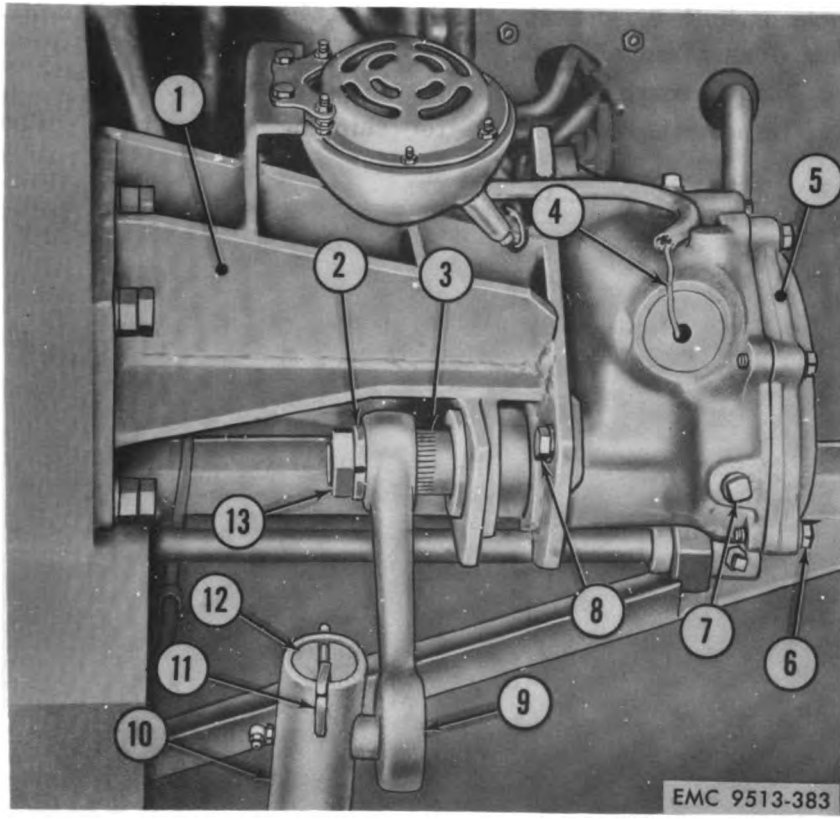
(13) Lower and remove the steering gear from the carrier.

c. *Disassembly* (fig. 385).

(1) Remove the cover screws (33) and lockwashers (34). Remove jacket tube (15), upper cover (14), and shims (13). Tag the shims to insure proper adjustment on reassembly.

(2) Withdraw the cam (12) and wheel tube (16) assembly. Remove the thrust bearing retaining rings (9) and cups (10). Catch the steel balls (11) upon removal.

(3) Remove the oil seal (4). Press out the bushings (5



1	Bracket	8	Mounting bolt
2	Lockwasher	9	Steering gear arm
3	Lever shaft	10	Drag link
4	Horn cable	11	Cotter pin
5	Housing side cover	12	Ball joint plug
6	Cover screws	13	Locknut
7	Drain plug		

Figure 383. Steering gear, installed.

and 6) if worn. Press out the end cover and oil seal tube assembly (44).

(4) Remove the bearing units (41) from the lever shaft (42). To disassemble bearing units, straighten out prong on the lockwasher, remove the nut, and press out the stud. Remove the cones and rollers.

Note. Only the nut and washer of a bearing unit are separately replaceable. If any of the other parts need replacing, both bearing units must be replaced since they are a matched set.

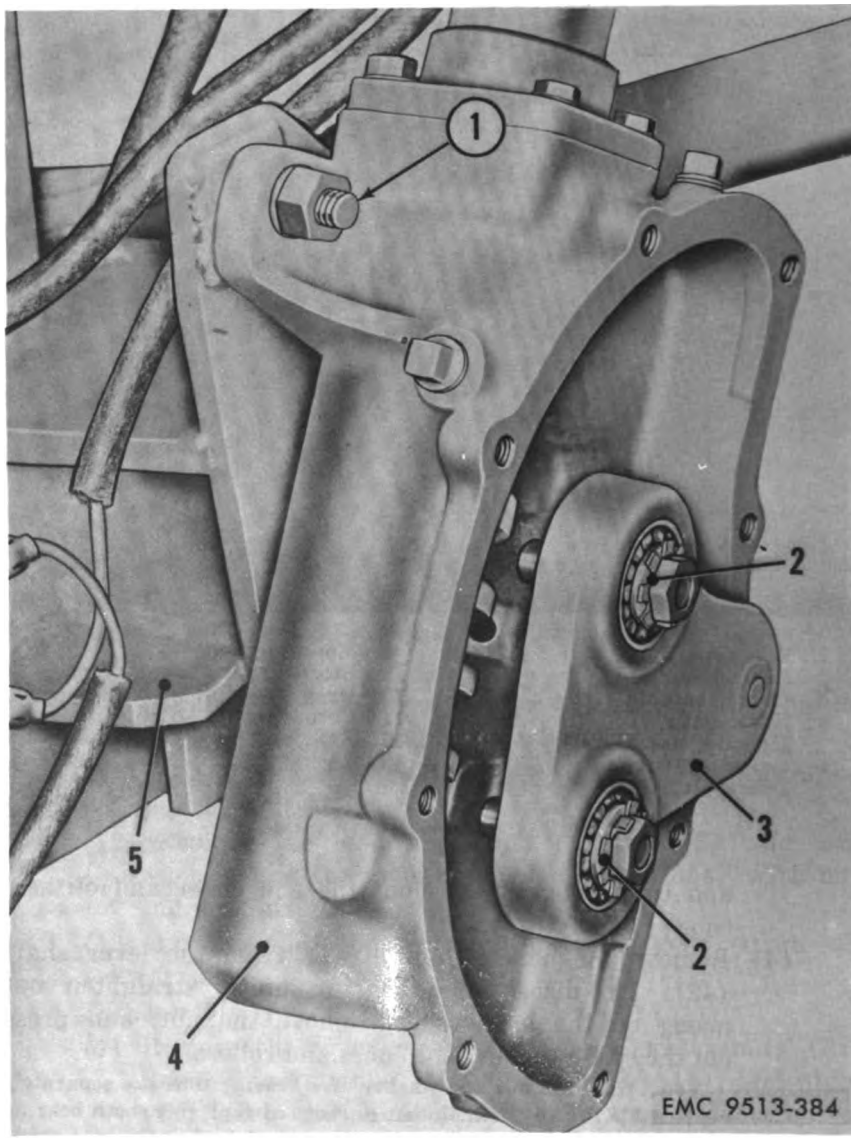
402. Steering Gear and Wheel Inspection and Repair

Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with

a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

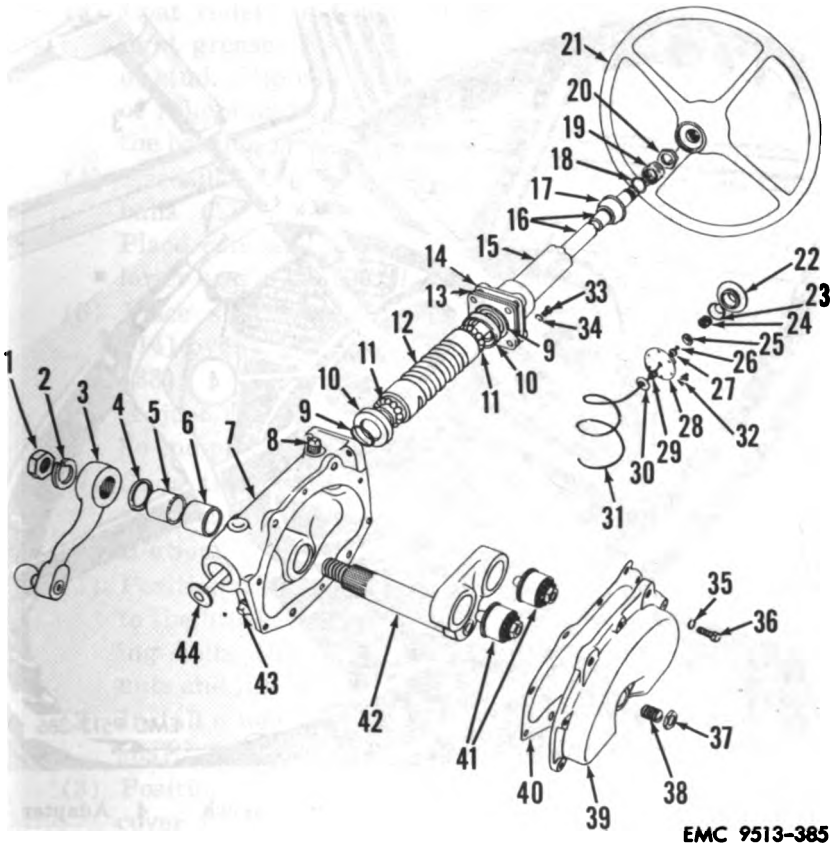
a. Inspect bearings (par. 316) and bushings (par. 318).

b. Inspect the cam groove for chipping and scoring. The



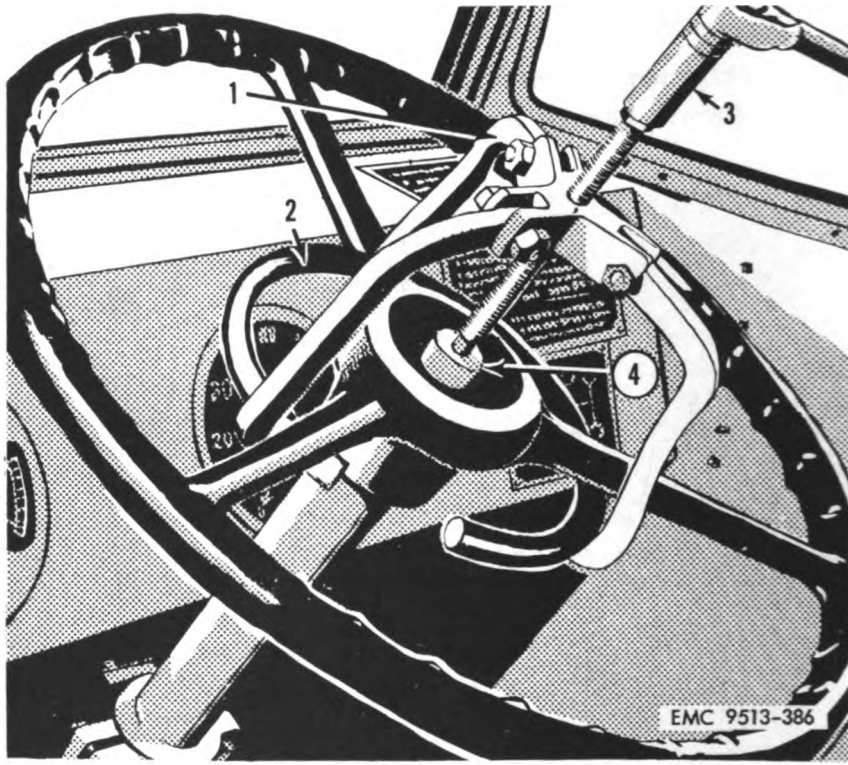
1 Mounting bolt
2 Stud roller bearing units
3 Lever shaft
4 Housing
5 Bracket

Figure 384. Steering gear housing side cover removed.



1 Lever shaft nut
2 Lever shaft lockwasher
3 Steering gear arm
4 Oil seal
5 Outer bushing
6 Inner bushing
7 Housing
8 Plug, pipe, sq hd, ⅜
9 Retaining ring (2 rqr)
10 Ball bearing cup (2 rqr)
11 Steel ball (28 rqr)
12 Steering cam
13 Shim set (as rqr)
14 Upper cover
15 Jacket tube
16 Steering wheel tube
17 Upper bearing unit
18 Spring seat
19 Spring
20 Wheel nut
21 Steering wheel
22 Horn button
23 Contact cup
24 Spring
25 Contact washer
26 Horn cable upper contact
27 Ferrule
28 Base plate
29 Contact spring
30 Contact cap
31 Horn cable
32 Wood screw (3 rqr)
33 Screw (4 rqr)
34 Lockwasher, spring, std, ⅜ (4 rqr)
35 Lockwasher, spring, std, ⅜ (8 rqr)
36 Screw (8 rqr)
37 Locknut
38 Adjusting screw
39 Housing side cover
40 Housing gasket
41 Stud roller bearing unit
42 Lever shaft
43 Plug, pipe, sq hd, ⅜
44 End cover and oil seal tube assembly

Figure 385. Steering gear, exploded view.



1 Puller arm 2 Adapter ring 3 Socket wrench 4 Adapter

Figure 386. Steering wheel puller.

smallest nick or mar on the cam groove is sufficient cause for replacement of the cam.

c. Inspect the housing and cover for cracks, breaks, and distortion. Replace a housing or cover if cracked, broken, or distorted.

d. Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace parts having damaged, corroded, or stripped threads.

e. Inspect all parts for good condition. Replace parts not in good condition.

403. Steering Gear and Wheel Reassembly and Installation

a. Reassembly (fig. 385).

(1) Press the end cover and oil tube assembly (44) into the housing (7).

(2) Press the bearing unit (17) into the upper end of the jacket tube (15) until the flange seats against the tube and rests uniformly against it.

(3) Coat rollers and cone of the bearing units (41) with light grease. Put rollers in place on cone on taper end of stud. Slip cup over the assembly. Insert opposite set of rollers and cones. Install lockwasher and nut. Press the bearing units into the lever shaft (42).

(4) Assemble cam thrust bearings in place and secure the balls (11) and cups (10) with retaining rings (9). Place cam and wheel tube in the housing so that the lower bearing cap seats well in the housing.

(5) Place shims (13) over the studs. Slip upper cover (14) over studs and install lockwashers (34) and screws (33).

(6) Adjust the bearings to a barely perceptible drag with no end play by adding or removing shims.

(7) Slide the jacket tube and bearing assembly over the wheel tube (16) to seat inside the upper cover.

b. Installation.

(1) Position the steering gear in the carrier and secure to the bracket (1, fig. 383) with lockwashers and mounting bolts (8), and mounting bolts (1, fig. 384) with nuts and jamnuts.

(2) Install a new oil seal over the threaded end of the lever shaft. Install the lever shaft (3) in the housing (4).

(3) Position a new cover gasket and the housing side cover (5, fig. 383) on the housing and secure with lockwashers and cover screws (6). Make sure that the lever shaft adjusting screw (38, fig. 385) is loose so that it will not rub against the end of the lever shaft when the cover is tightened.

(4) Aline the marks and slip the steering gear arm (9, fig. 383) over the serrated end of the lever shaft (3). Install and tighten the lockwasher (2) and locknut (13).

(5) Lubricate the steering gear (LO 5–9513–3).

(6) Fit the drag link (10) and ball on steering gear arm together and tighten the ball joint plug (12) until there is a slight drag on the ball. Install the cotter pin (11).

(7) Install the ring (18, fig. 385) and spring (19) on the steering wheel tube (16).

(8) Install the steering wheel (21) and seat on steering column with a hammer and block of wood. Seat carefully so as not to crack the steering wheel.

(9) Install the wheel nut (20) in the horn well and tighten.

(10) Position the contact cap (30) and contact spring (29)

in the steering column. Install the base plate (28) with horn cable (31) and ferrule (27) in the steering column and secure with mounting screws (32).

(11) Position the contact washer (25), spring (24), contact cup (23), and the horn button (22) in the steering column. Twist the horn button to the left to secure in place.

(12) Connect the horn cable to the horn assembly.

(13) Install the hand brake valve (par. 297*c*).

c. Adjustment.

(1) *General.* Before making an adjustment for play or binding in the steering gear, jack up the front wheels and make sure that the trouble is not due to some other cause. Do not make adjustments in the steering gear to correct hard steering, shimmy, or steering wander.

(2) *Vertical thrust.* End play in the cam shows up as play in the steering tube, indicated by up and down movement of the steering wheel. When this adjustment is correct, the steering wheel should turn freely with the thumb and forefinger lightly gripping the steering wheel rim, and without any up and down movement of the column tube. If end play is less than 0.010 inch, no adjustment is required.

(*a*) Loosen the locknut (37, fig. 385). Loosen the lever shaft adjusting screw (38) several turns to free the tapered studs of the bearing units (41) in the steering cam (12) grooves.

(*b*) Loosen the nuts (33) to permit raising the upper cover (14) for the removal of shims (13) as necessary.

(*c*) To decrease bearing clearance, clip and remove a shim as required. Add or remove shims until there is a very slight drag when turning the steering wheel.

(*d*) Position the upper cover (14) and secure with lockwashers and nuts (33).

Caution: The cover should always be drawn tightly against the shims to provide a tight assembly. Be careful, however, in the event that too much shim thickness has been removed, not to draw so tight as to break the ball races.

(3) *Horizontal backlash.* Backlash of the bearing unit tapered studs in the cam groove shows up as horizontal backlash on the lever shaft at the steering arm ball. The cam groove is purposely cut shallower and narrower in the straight-ahead position of the gear and the gear

is designed to be adjusted to a slight drag in the straight-ahead position. Backlash, when the steering gear is turned off the straight-ahead position, is normal and not objectionable.

(*a*) Count the number of revolutions the steering wheel takes to turn from one extreme to the other. One-half this number is the straight-ahead position of the gear.

(*b*) Tighten the adjusting screw (38, fig. 385) until tight. Turn the steering wheel slowly through its entire range. A very slight increase in drag should be felt through the straight-ahead position. Tighten the locknut (37) to hold the adjustment.

Section XXV. MAIN TRANSMISSION

404. Transmission Removal and Disassembly

a. Description. The transmission is the selective-gear type, having one reverse and five forward speeds, direct drive being in fifth speed. The gears are selected or shifted manually by means of yoke bars, with attached shifting yokes and lugs, which are supported in and inclosed by a shifting bar housing attached to the top of the transmission case. The engine clutch housing bolts to the front of the transmission case and serves as the support for the clutch release yoke which operates the clutch release bearing. The splined section of the clutch shaft and drive gear, extending out from the front of the transmission case, meshes with a corresponding splined section of the engine clutch disk to transmit the power output of the engine. The splined section of the main shaft, extending out from the rear of the transmission case, provides the mounting for the companion flange by means of which the transmission is connected to the carrier drive shaft.

b. Removal.

(1) Remove the carrier engine and transmission assembly from the carrier (par. 325*a*).

(2) Remove the cap screws (21, fig. 389) and lockwashers (5). Separate the carrier engine and transmission assemblies.

(3) Remove the engine clutch assembly (par. 357*b*).

(4) Drain lubricant from transmission case.

c. Disassembly.

(1) Remove the remote control assembly (par. 215*b*).

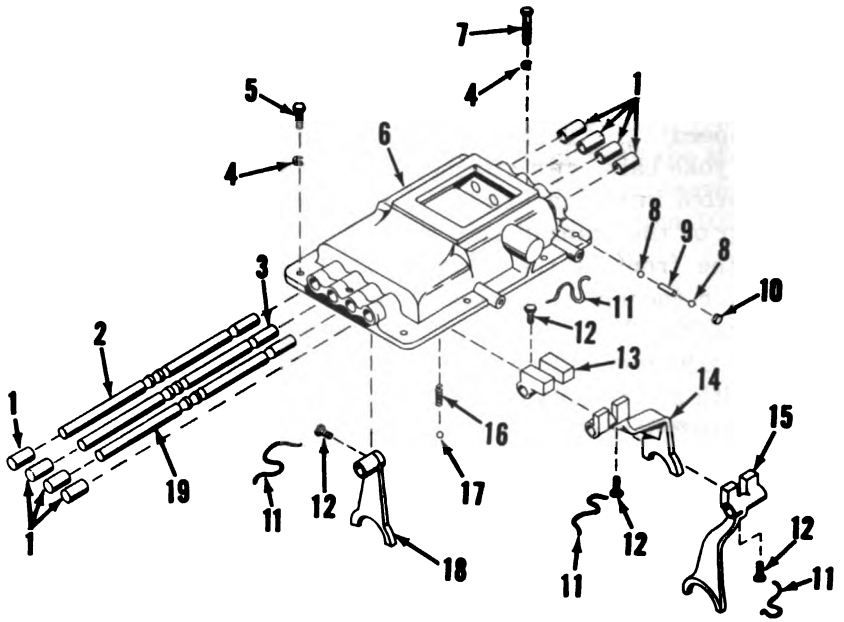
(2) Remove the screws (5 and 7, fig. 387) and lockwashers (4) from the shifting bar housing (6).

(3) Lift the shifting bar housing assembly (1, fig. 388) straight up until the shifting yokes (2) are clear of the main shaft gears (3).

(4) Clamp the shifting bar housing (6, fig. 387) in a bench vise on edge, with the bottom facing the repairman. Using a sharp chisel that will cut into the surface of the thimbles (1), drive the thimbles out of the housing.

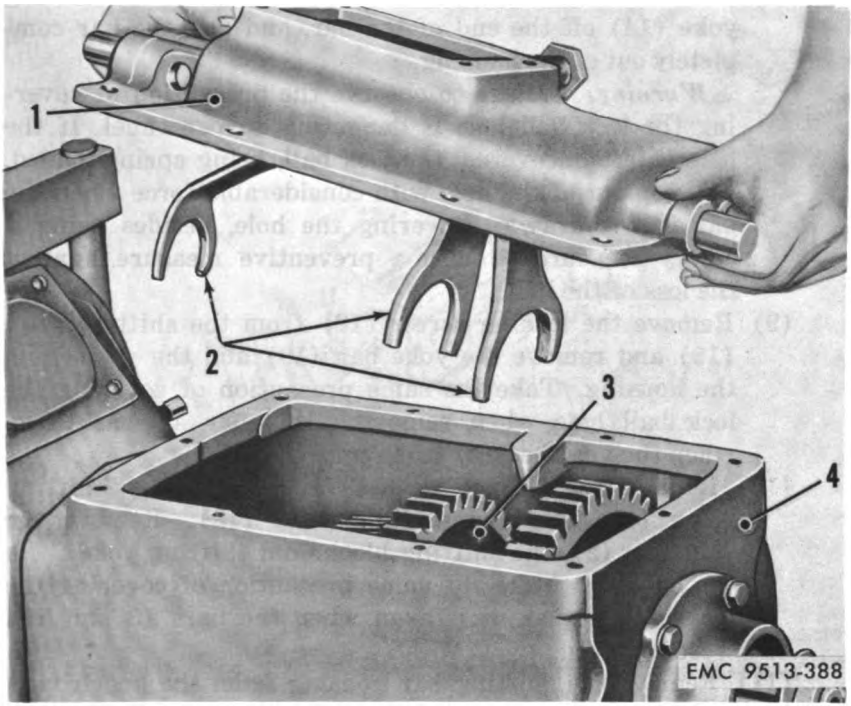
Caution: To avoid any possibility of damaging the yoke bars during this operation, move each yoke bar to the opposite end of the housing before removing the thimble.

(5) Pierce the interlock ball hole plug (10), using a sharp chisel or punch, and pry it from the hole in the side of the housing.



1	Thimble (8 rqr)	9	Interlock cross pin
2	Yoke bar, first and reverse	10	Plug
3	Yoke bar, fourth and fifth	11	Lockwire (as rqr)
4	Lockwasher, spring, std, ⅜ (10 rqr)	12	Locking screw (4 rqr)
5	Screw, cap, hex hd, ⅜–16 NC x 1 (8 rqr)	13	Shifting block, first and reverse
6	Shifting bar housing	14	Shifting yoke, fourth and fifth
7	Screw, cap, hex hd, ⅜–16 NC x 2¼ (2 rqr)	15	Shifting yoke, second and third
8	Ball, steel, ¾ (2 rqr)	16	Position finder spring (3 rqr)
		17	Ball, steel, ½ (3 rqr)
		18	Shifting yoke, first and reverse
		19	Yoke bar, second and third

Figure 387. Shifting bar housing, exploded view.



1 Shifting bar housing assembly
2 Shifting yokes
3 Main shaft assembly
4 Transmission case

Figure 388. Removing shifting bar housing assembly.

(6) Cut and remove all lockwire (11) from the locking screws (12) and the shifting yokes. Remove the locking screw (12) from the fourth and fifth shifting yoke (14). Slide all yoke bars (2, 3, and 19) into the neutral positions.

Note. There is no fixed sequence that must be followed to remove the yoke bars. However, there will be less chance of the interlocking mechanism causing interference if the yoke bar containing the interlock, fourth and fifth yoke bar, is removed first.

(7) Start the yoke bar (3) out through the hole in the forward end of the shifting bar housing. Pull the bar straight out, without turning or twisting it, until the interlock hole in the bar is beyond the end of the housing. Twist the bar slightly to cause the interlock lock steel ball (8) to drop out of the interlock hole in the yoke bar. Catch the ball in the free hand as it drops from the hole in the bar.

(8) Pull the bar through the shifting bar housing center support, while holding the free hand over the yoke bar

lock ball hole in the center support. Slide the shifting yoke (14) off the end of the bar, and pull the bar completely out of the housing.

Warning: Failure to observe the precaution of covering the lock ball hole is dangerous to personnel. If the hole is left uncovered, the lock ball, being spring-loaded, will pop out of the hole with considerable force when the bar is withdrawn. Covering the hole, besides being a safety measure, is also a preventive measure against the loss of the ball.

(9) Remove the locking screw (12) from the shifting yoke (15) and remove the yoke bar (19) and the yoke from the housing. Take the same precaution of covering the lock ball hole when removing this bar as was taken when the yoke bar (3) was removed.

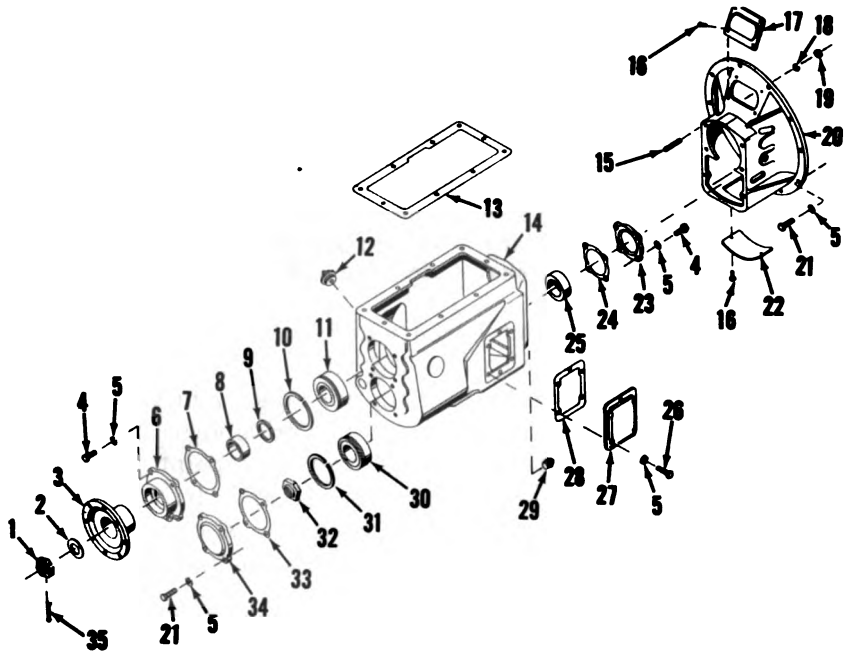
(10) Remove the locking screws (12) from the shifting block (13) and the shifting yoke (18). Remove the yoke bar (2), the shifting block, and shifting yoke from the housing. Take the same precaution of covering the lock ball hole as was taken when the bars (3 and 19) were removed.

(11) Remove the shifting bar housing from the bench vise. Hold the housing suspended (top side up) just above the surface of the work bench and shake or jar the housing, as necessary, to dislodge the loose lock balls, position finder springs, and interlock balls. If necessary, bend a piece of wire to form a hook to pull the springs from their seats. Count the balls and springs to make sure none have been lost or remain in the housing. There should be three position finder springs (16), three steel balls (17), and two steel balls (8).

(12) Shifting by hand, engage two main shaft gears at the same time to lock and prevent the main shaft from turning. Remove the cotter pin (35, fig. 389), shaft nut (1), and washer (2) from the rear end of the main shaft. Remove the companion flange (3).

(13) Remove the screws (4), lockwashers (5), rear bearing cover (6), and the gasket (7). Remove the speedometer gear replacement (8) and the bearing washer (9) from the end of the main shaft.

(14) Remove the screws (21), lockwashers (5), rear bearing cover (34), and gasket (33). Force the countershaft rear bearing nut (32) staking metal out of the slots, using a narrow chisel as a wedge. Insert the point of the chisel between the countershaft and the nut and



1	Shaft nut	19	Nut, regular, hex, ⅝–18 NF (6 rqr)
2	Washer	20	Clutch housing
3	Companion flange	21	Screw, cap, hex hd, ⅝–16 NC x 1¼ (16 rqr)
4	Screw, cap, hex hd, ⅜–16 NC x 1 (8 rqr)	22	Handhold cover plate
5	Lockwasher, spring, std, ⅜ (36 rqr)	23	Front bearing cover
6	Rear bearing cover	24	Gasket
7	Gasket	25	Roller bearing
8	Speedometer gear replacement	26	Screw, cap, hex hd, ⅜–16 NC x ⅝ (12 rqr)
9	Bearing washer	27	Cover (2 rqr)
10	Bearing snap ring	28	Gasket (2 rqr)
11	Ball bearing	29	Plug, pipe, sq hd, ¾
12	Plug, pipe, sq hd, 1¼	30	Ball bearing
13	Gasket	31	Bearing snap ring
14	Transmission case	32	Bearing nut
15	Clutch housing stud (6 rqr)	33	Gasket
16	Screw, machine, rd hd, 5/16–18 NC x ½ (6 rqr)	34	Rear bearing cover
17	Handhole cover	35	Pin, cotter, split, ⅛ x 2½
18	Lockwasher, spring, std, ⅝ (6 rqr)		

Figure 389. Transmission case and clutch housing, exploded view.

drive it into the slots just far enough to clear the slots of the staked metal. Remove the nut from the end of the countershaft. Slide the main shaft gears out of mesh to their neutral positions.

(15) Remove the mounting screws (2, fig. 390), lockwashers, and front bearing cover (3). Remove the clutch shaft

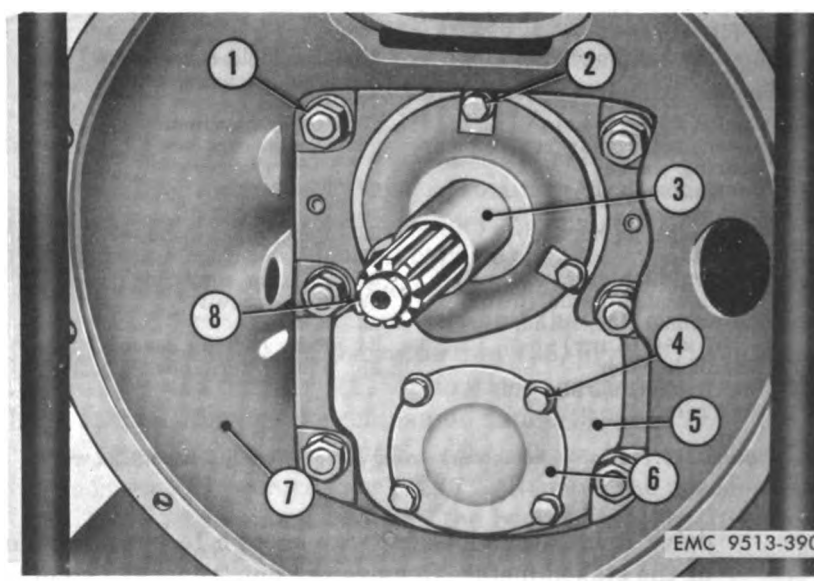
and drive gear (8) from the front of the transmission case by tapping against the gear at the rear of the shaft to drive the assembly forward and out of the transmission case.

Note. The main shaft front roller bearing may or may not remain in the recess in the rear of the drive gear as the clutch shaft is removed from the transmission case. Therefore, when removing the clutch shaft and drive gear assembly, handle it carefully to avoid the possibility of dropping and thus damaging the roller bearing.

(16) Clamp the clutch shaft and drive gear assembly upright in a bench vise with the bearing nut (5, fig. 391) on top. Force the bearing nut staking metal out of the grooves of the clutch shaft and drive gear (2). Using a narrow chisel as a wedge, insert the point of the chisel between the shaft and the nut and drive it into the slots just far enough to clear the slots of the metal. Back the nut off the shaft when the staking slots have been cleared.

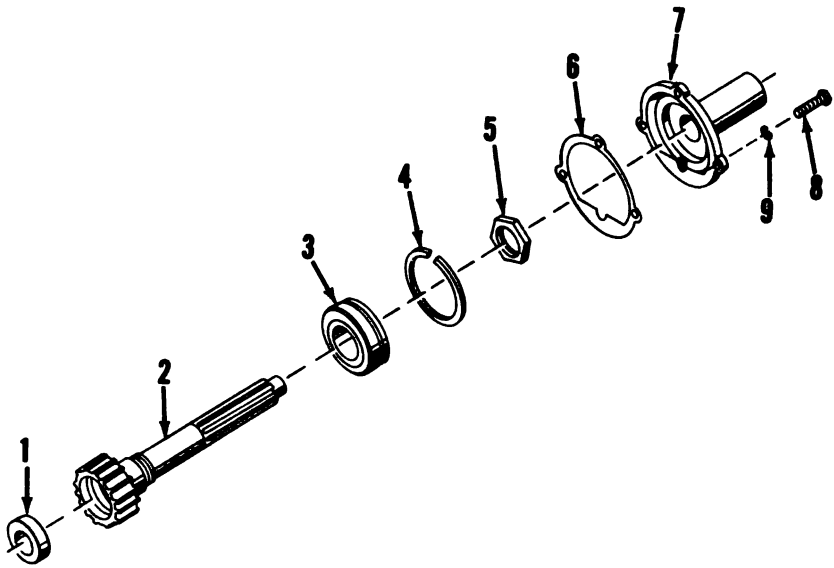
Note. This nut has a lefthand thread.

(17) Remove the ball bearing (3) from the shaft, using a bearing puller.



1 Mounting stud nut
2 Mounting screw
3 Front bearing cover
4 Mounting screw
5 Transmission case
6 Countershaft front bearing cover
7 Clutch housing
8 Clutch shaft and drive gear

Figure 390. Clutch shaft and drive gear bearing cover.



EMC 9513-391

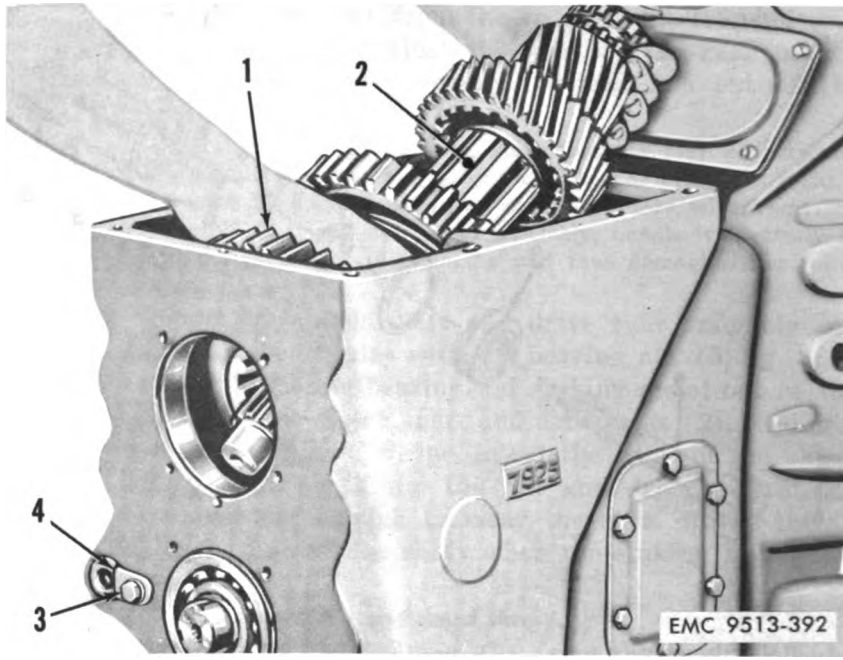
1 Roller bearing
2 Clutch shaft and drive gear
3 Ball bearing
4 Bearing snap ring
5 Bearing nut
6 Gasket
7 Front bearing cover
8 Screws, cap, hex hd, ⅜–16 NC x 1 (4 rqr)
9 Lockwashers, spring, std, ⅜ (4 rqr)

Figure 391. Clutch shaft and drive gear, exploded view.

Caution: The construction of the parts will not permit the bearing puller to be attached to the inner bearing race as normally should be done. The puller can only be attached to the outer race, therefore, extreme care must be exercised when removing the bearing. Position the puller frequently and try to work the bearing off in stages, rather than exerting considerable pressure and pulling in one operation.

(18) Push the main shaft assembly to the rear of the transmission case as far as possible to clear the main shaft bearing (11, fig. 389) from the case. Use a bearing puller to remove the bearing. Observe the caution in (17) above.

(19) Remove the main shaft assembly (2, fig. 392) by tilting the assembly so that the front end of the main shaft clears the transmission case. Remove the assembly by lifting it up to allow the main shaft first-speed sliding gear (1) to slide off the rear end of the shaft and remain



1 Main shaft first-speed sliding gear
2 Main shaft assembly
3 Shaft lock screw
4 Shaft lock

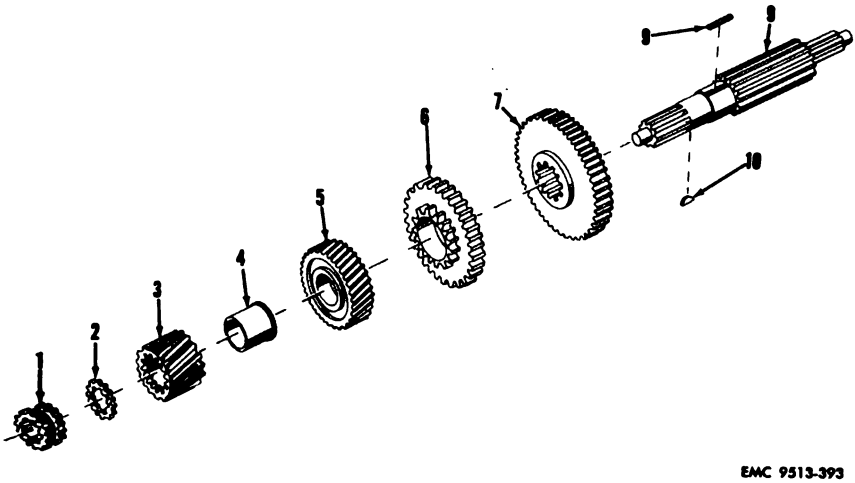
Figure 392. Removing main shaft assembly.

in the case. After removing the assembly, lift the gear out of the case.

(20) Slide the second-speed gear (6, fig. 393) off the rear end of the main shaft (9). Slide the sliding clutch (1) off the front end of the shaft.

(21) Clamp the remaining assembly upright in the bench vise, nonthreaded end up. Insert a sharp awl or prick punch behind the key (8) and force the upper end of the key out of the key slot in the main shaft. Remove the key, lifting it straight up and out of its seat in the main shaft.

(22) Insert a small drift punch, or other comparable tool, between the fourth-speed gear (3) internal clutching teeth so that the lower end of the punch enters one of the slots between the external teeth of the gear washer (2). Holding the punch in this position, turn the gear to aline the internal teeth of the washer with the grooves of the main shaft. Lift the gear and the washer up and off the main shaft.



EMC 9513-393

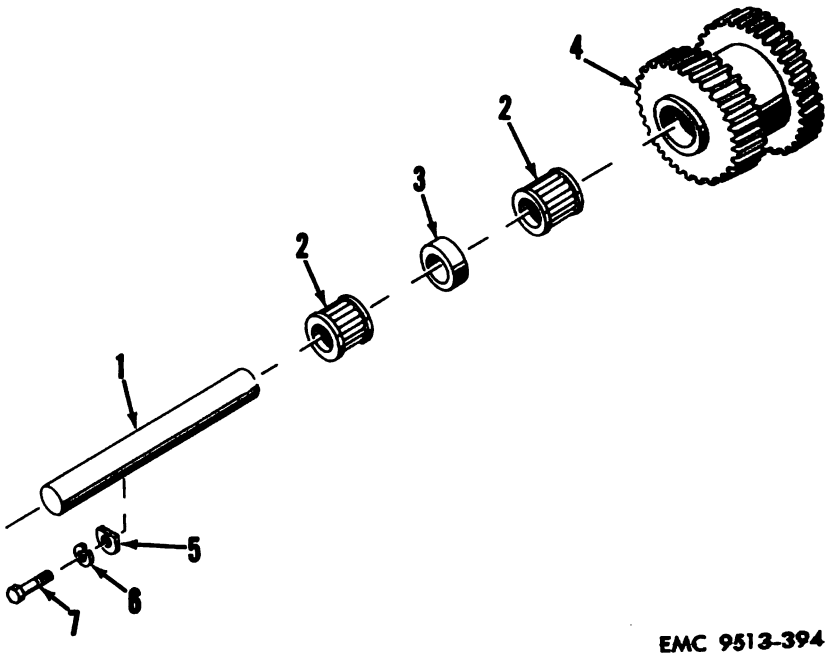
1	Sliding clutch	6	Second-speed sliding gear
2	Gear washer	7	First-speed sliding gear
3	Fourth-speed gear	8	Key
4	Gear sleeve	9	Main shaft
5	Third-speed gear	10	Woodruff key

Figure 393. Main shaft assembly, exploded view.

(23) Remove the main shaft from the bench vise and place on a block of wood, threaded end up. Jar the shaft on the block and the weight of the third-speed gear (5) will force the gear sleeve (4) towards the nonthreaded end of the main shaft. When the sleeve has moved down one-fourth inch, insert an improvised C-shaped spacer between the sleeve and the gear and continue to jar the shaft on the block until the woodruff key (10) is completely exposed. Remove the key and the improvised spacer and again jar the shaft on the block to complete removal of the sleeve (4) and the third-speed gear (5).

Caution: If more than a one-fourth inch gap is opened between the sleeve and the gear before the improvised C-shaped spacer is inserted, both the woodruff key and the sleeve will be damaged.

(24) Remove the screw (7, fig. 394), and lockwasher (6). Remove the shaft lock (5) from the reverse idler shaft (1). Using an improvised idler gear shaft remover or slide hammer, start the reverse idler gear shaft out of the reverse idler gear bores in the transmission case. After loosening the shaft from its position, complete the shaft removing operation by hand. When the shaft (3, fig. 395) has been withdrawn, lift the reverse idler gear



EMC 9513-394

1 Reverse idler shaft
2 Roller bearing (2 rqr)
3 Bearing spacer
4 Reverse idler gear
5 Shaft lock
6 Lockwasher, spring, std, ⅝
7 Screw, cap, hex hd, ⅝–16 NC x 1

Figure 394. Reverse idler gear assembly, exploded view.

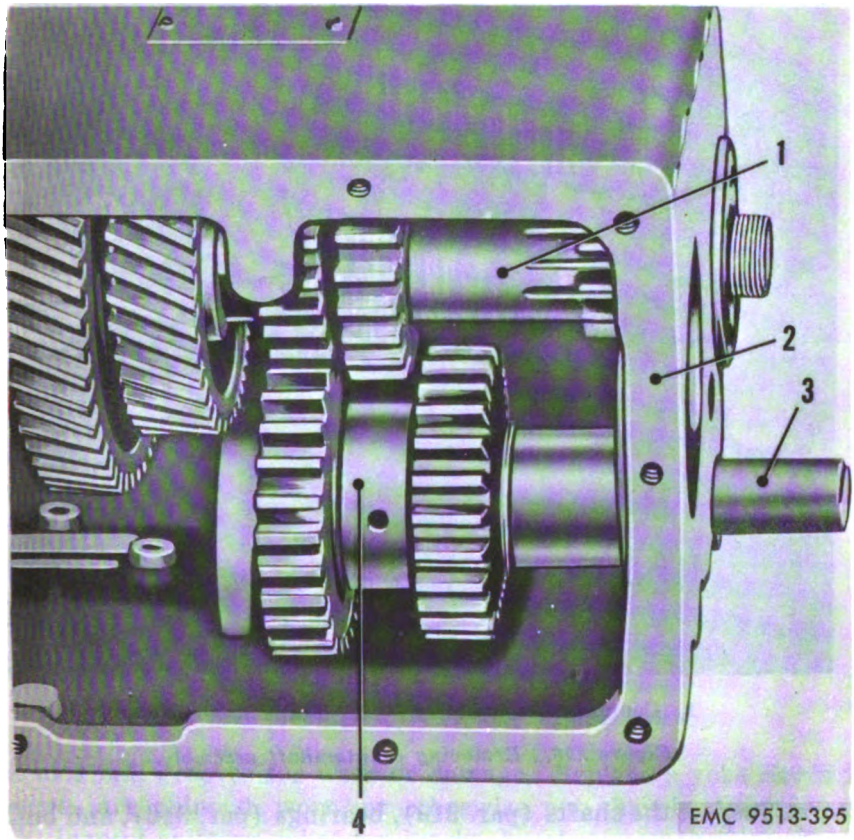
(4) out through the top opening of the transmission case. Remove the roller bearings (2, fig. 394) and bearing spacer (3) from the reverse idler gear (4).

(25) Push the countershaft assembly to the rear of the transmission case as far as possible so that the rear bearing (30, fig. 389) clears the case. Remove the bearing in the same manner as was used to remove the main shaft bearing. Observe the caution in (17) above.

(26) Tilt the front end of the countershaft assembly (1, fig. 396) up and lift the assembly up and out of the transmission case (2), twisting it slightly to one side to allow the countershaft drive gear to clear the sides of the case.

(27) Clamp the countershaft assembly upright in the bench vise, nonthreaded end up, and remove the retaining ring (7, fig. 397).

(28) Mount the countershaft assembly in an arbor press and press the countershaft (1) from the drive gear (6), fourth-speed gear (4), and third-speed gear (3). Re-



1 Countershaft assembly
2 Transmission case
3 Reverse idler shaft
4 Reverse idler gear

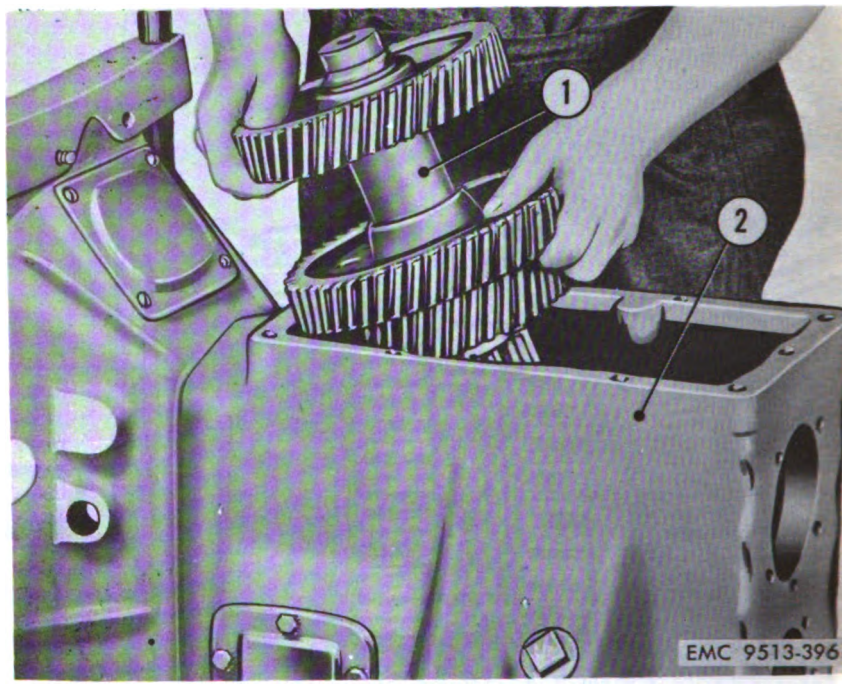
Figure 395. Reverse idler gear and shaft.

move a woodruff key (2) and the power takeoff gear replacement (5) after pressing off the drive gear (6). Remove woodruff keys after each gear is removed and before removing the next gear.

(29) If necessary, separate the clutch housing (20, fig. 389) and the transmission case (14) by removing the nuts (19) and lockwashers (18) and driving against the clutch housing dowels from inside the transmission case.

405. Transmission Inspection and Repair

Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.



1 Countershaft assembly 2 Transmission case

Figure 396. Removing countershaft assembly.

a. Inspect the shafts (par. 319), bearings (par. 316), and bushings (par. 318).

b. Inspect all gears for cracks, chipped or broken teeth, and evidences of wear. Replace a gear that is cracked or has chipped, broken, or worn teeth.

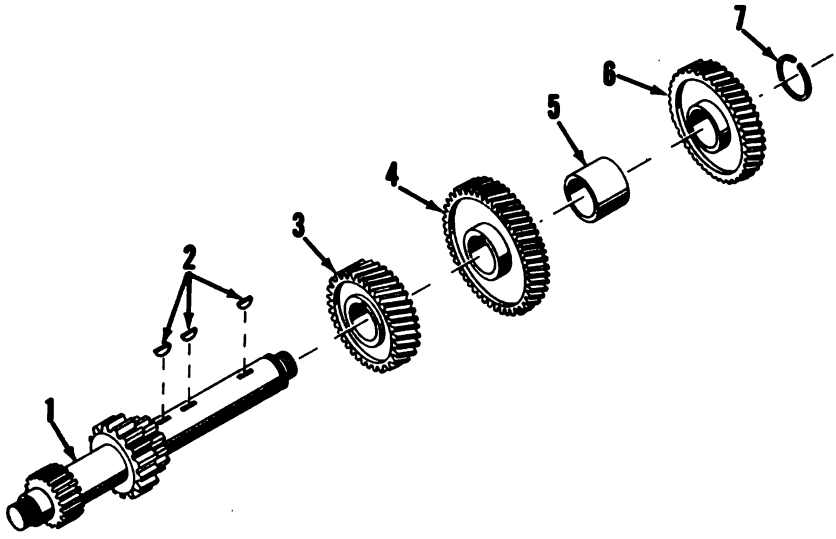
c. Inspect the gasket surfaces of the transmission case and remove any burs, scratches, or gouges from these surfaces. Clean all burs or foreign material from snap ring grooves. Check the entire case for cracks or small pin holes. Cracks which do not extend into the bearing bores or the mounting holes may be repaired by welding or brazing.

d. Inspect the clutch housing and shifting bar housing for breaks or cracks. Small cracks which do not extend into the mounting holes may be repaired by welding or brazing.

e. Inspect all bearing caps for burs, gouges, or scratches on the gasket surface, and smooth out, if necessary.

f. Reject all lock balls with flat spots and all weak or broken springs. Use only those parts which are satisfactory beyond doubt.

g. Inspect yoke bars for misalinement by rolling them across a smooth level surface. Replace bent or sprung bars. Inspect



EMC 9513-397

1 Countershaft
2 Woodruff key (3 rqr)
3 Third-speed gear
4 Fourth-speed gear
5 Power takeoff gear replacement
6 Drive gear
7 Retaining ring

Figure 397. Countershaft assembly, exploded view.

the lock ball grooves for wear or damage. Replace a yoke bar if grooves are chipped, worn, or otherwise not sharply defined.

h. Inspect shifting yokes for cracks, breaks, or distortion. Replace a yoke if cracked, broken, or distorted.

i. Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace parts having damaged, corroded, or stripped threads.

j. Inspect all parts for good condition. Replace parts not in good condition.

406. Transmission Reassembly and Installation

a. Reassembly.

(1) If the clutch housing (20, fig. 389) was removed, stand the transmission case (14) on end and lower the clutch housing onto the case and secure it in place with lockwashers (18) and nuts (19).

(2) Install a woodruff key (2, fig. 397) in the slot closest to the center of the countershaft (1). Line up the keyway in the third-speed gear (3) with the key in the countershaft, and press the gear onto the countershaft and down against the shoulder.

(3) Install a woodruff key (2) in the next key slot and

press the fourth-speed gear (4) onto the countershaft and against the third-speed gear (3).

(4) Install the power takeoff gear replacement (5) on the countershaft.

(5) Install a woodruff key (2) in the end key slot and press the drive gear (6) onto the countershaft and against the power takeoff gear replacement (5).

(6) Install the retaining ring (7) in the end of the countershaft (1).

(7) Coat the gasket (24, fig. 389) with an approved gasket cement. Lightly coat the threads of the screws (4) with the same type gasket cement. Position the gasket (24) and the front bearing cover (23) on the transmission case (14) and secure with lockwashers (5) and screws (4).

(8) Install the roller bearing (25) in the transmission case, from inside the case. Seat the bearing firmly against the back of the front bearing cover (23).

(9) Install the countershaft assembly in the transmission case, tipping and sliding the assembly forward while guiding the front end of the countershaft into the roller bearing (25).

(10) Start the ball bearing (30) squarely onto the rear end of the countershaft with the bearing snap ring (31) toward the rear. Drive the bearing onto the shaft and into the bore of the transmission case. Install the bearing nut (32) and stake it into place.

(11) Coat the gasket (33) and threads of screws (21) with an approved gasket cement. Position the gasket (33) and rear bearing cover (34) on the transmission case and secure with lockwashers (5) and screws (21).

(12) Install the roller bearings (2, fig. 394) and bearing spacer (3) in the reverse idler gear (4). Lower the gear into the transmission case with the narrower gear closest to the front of the case. Install the reverse idler shaft (1) in the shaft bore in the case and the gear.

Note. The reverse idler shaft is a snug fit and must be driven into position. Make sure the slot in the end of the shaft is properly alined with the shaft lock attaching screw hole.

(13) Install the shaft lock (5) in the slot in the shaft and secure in place with a lockwasher (6) and screw (7).

(14) Clamp the main shaft (9, fig. 393) upright in the bench vise, nonthreaded end up. Lower the third-speed gear (5) onto the shaft with the toothed hub facing the rear, threaded end, of the shaft.

(15) Insert the woodruff key (10) in the key slot on the main shaft. Install the gear sleeve (4), lining up the keyway in the sleeve with the key in the shaft. Tap the sleeve down firmly against the shoulder of the main shaft.

(16) Check the third-speed gear (5) end play, using a dial indicator and an improvised dial indicator stand. Set two improvised support bars on the gear so that they span the gear and straddle the sleeve. Set the dial indicator up or down, as necessary, to bring the end of the dial indicator plunger into contact with the end of the main shaft. Adjust the face of the dial so that the indicator hand is at the O-mark. Move the body of the indicator down on the indicator support rod until the indicator hand makes one complete revolution of the dial face (or approximately 0.030-inch). Grasp the gear (5) and endeavor to lift it up lengthwise along the main shaft. The amount of movement (end play) that occurs before the gear stops against the gear sleeve will be indicated on the dial indicator. The end play should not be less than 0.005-inch and not more than 0.010-inch. If the end play does not fall between these two limits, the gear must be replaced.

(17) Lower the fourth-speed gear (3) onto the main shaft with the internal clutching teeth facing the front (nonthreaded) end of the shaft. Line up the internal teeth of the gear washer (2) with the splines of the main shaft and drop the gear washer down inside the fourth-speed gear (3).

(18) Insert a drift punch, or comparable tool, in one of the grooves between the fourth-speed gear internal clutching teeth so that the lower end of the punch engages between two of the external teeth of the gear washer. Turn the gear one-fourth inch with the punch held in this position. This action will cause the external teeth of the gear washer to move behind the splines of the main shaft and thus lock the washer in place.

(19) Check the end play of the fourth-speed gear in the same manner used to check the end play of the third-speed gear ((16) above) except that support bars are not required.

(20) Remove the partially completed main shaft assembly from the bench vise. Slide the sliding clutch (1) onto the front (nonthreaded) end of the main shaft.

(21) Slide the second-speed gear (6) onto the rear (threaded)

end of the main shaft with the shifting yoke groove in the gear facing the rear end of the shaft.

(22) Set the first-speed sliding gear (7) inside the transmission case against the rear wall, with the shifter fork groove in the gear facing the front (nonthreaded) end of the transmission case. Install the main shaft assembly in the transmission case by tilting the front end of the assembly up. Guide the rear end of the main shaft through the bore of the first-speed sliding gear, then through the bore in the rear of the transmission case, and lower the front end in line with the bore in the front of the case.

(23) Start the ball bearing (11, fig. 389) onto the rear end of the main shaft by hand, with the bearing snap ring (10) toward the rear of the shaft. Drive the bearing onto the main shaft and into the bore of the transmission case.

(24) Install the bearing washer (9) and the speedometer gear replacement (8) on the main shaft.

(25) Coat the gasket (7) and the threads of screws (4) with an approved gasket cement. Position the gasket (7) and rear bearing cover (6) over the main shaft and on the transmission case (14) and secure with lockwashers (5) and the screws (4).

(26) Install the companion flange (3) on the rear end of the main shaft. Install the washer (2). Secure the flange with the shaft nut (1) and cotter pin (35).

(27) Using an arbor press, install the ball bearing (3, fig. 391) on the clutch shaft and drive gear (2) with the bearing snap ring (4) end nearest the threaded portion of the shaft.

(28) Clamp the shaft in a bench vise and install the bearing nut (5) on the shaft, pulling the nut down tight against the bearing.

Note. This nut has a lefthand thread.

(29) When the nut has been securely tightened, stake it in place. Using an improvised staking tool and a machinist hammer, drive against the outer edge of the nut opposite the staking slots in the shaft, wedging the nut metal firmly into the staking slots.

(30) Install the roller bearing (1) on the front end of the main shaft. Install the clutch shaft and drive gear assembly in the bore in the front of the transmission case, while carefully guiding the front end of the main shaft (with roller bearing (1)) into the recess in the rear

of the drive gear. Tap the shaft into the transmission case until the bearing snap ring seats in the counterbore in the case.

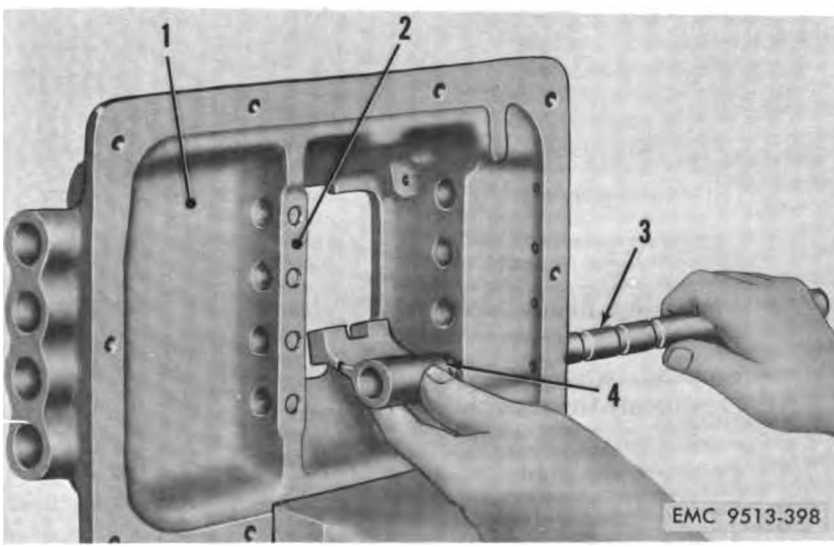
(31) Coat the gasket (6) and threads of screws (8) with an approved gasket cement. Lay the gasket on the front bearing cover (7), matching the mounting holes and the oil return grooves in the gasket with the similar holes in the cover. Slide the cover over the clutch shaft and up against the front of the transmission case. Secure the cover in place with lockwashers (9) and screws (8). Install the drilled-head screw in the upper left corner as viewed from the front of the transmission case.

Caution: Make certain the oil groove in the bearing cover is in line with the oil return hole in the transmission case. This passage must be open and clear.

(32) Clamp the shifting bar housing (6, fig. 387) on edge in the bench vise with the handbrake support shaft boss at the top and the bottom of the housing facing the repairman.

(33) Slide the first and reverse yoke bar (3, fig. 398) in the lower bore of the shifting bar housing (1) and slide the shifting block (4) onto the end of the bar.

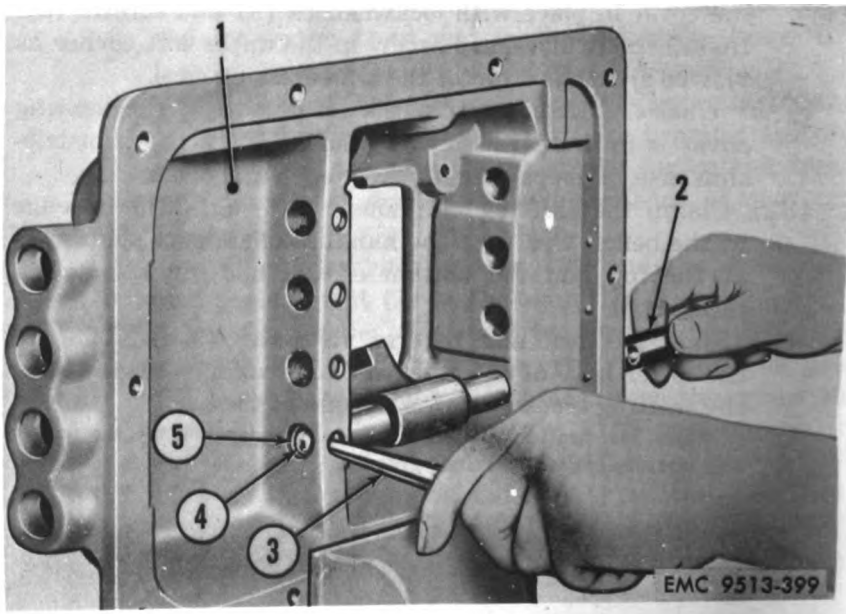
Note. **The first and reverse yoke bar is identified by the widely and equally spaced lock ball grooves.**



1 Shifting bar housing
2 Shifting bar housing center support
3 First and reverse yoke bar
4 Shifting block

Figure 398. Installing first and reverse yoke bar and shifting block.

(34) Insert a position finder spring (5, fig. 399) and steel lock ball (4) in the first and reverse yoke bar ball hole. Using a blunt drift punch (3) or other comparable tool, press against the steel ball (4) to compress the position finder spring (5) and force the ball into the hole below the level of the yoke bar bore. Holding the ball depressed in this manner, push the yoke bar into the housing until it stops against the punch.



1 Shifting bar housing center support
2 First and reverse yoke bar
3 Drift punch
4 Steel ball
5 Position finder spring

Figure 399. Compressing first and reverse yoke bar position finder spring.

(35) Pressing firmly against the end of the yoke bar to prevent the bar from being forced backwards out of the housing, withdraw the punch and force the yoke bar completely through the center support.

Warning: Do not stand with your face directly in front of the center support, for if the yoke bar or the punch slips, the lock ball may pop out of the center support with considerable force.

(36) Slide the first and reverse shifting yoke (18, fig. 387) onto the yoke bar and push the bar into the bore in the shifting bar housing rear support.

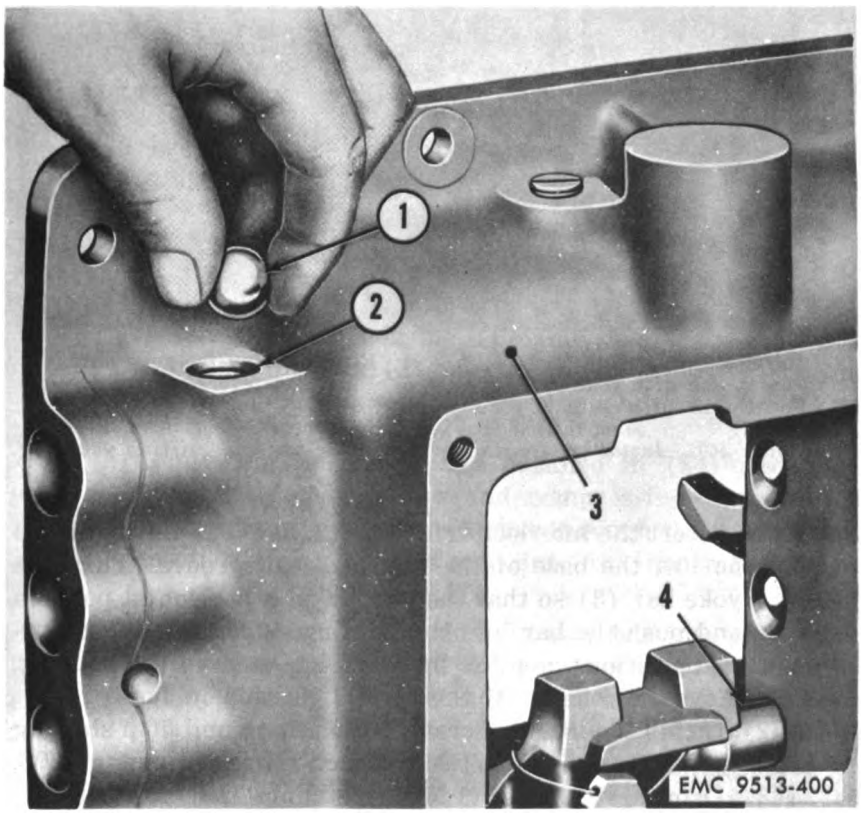
(37) Install locking screws (12) in the yoke (18) and block

(13), making sure the points of the screws enter the holes in the yoke bars. Tighten the screws and secure them in place with lockwire (11). Run the wire through the drilled heads of the screws and around the yoke bars. Twist the ends together and cut off the excess wire. Bend the joint back against the screws to prevent any possibility of their interfering with the operation of the assembly.

(38) Drop one steel ball (1, fig. 400) into the interlock ball hole (2), making sure the ball bottoms against the yoke bar (4).

(39) Start the fourth and fifth yoke bar (2, fig. 401) into the center yoke bar bore in the shifting bar housing (1). Slide the fourth and fifth shifting yoke (3) onto the yoke bar.

Note. The fourth and fifth yoke bar can be identified by the narrowly and equally spaced lock ball grooves, also, by the inter-



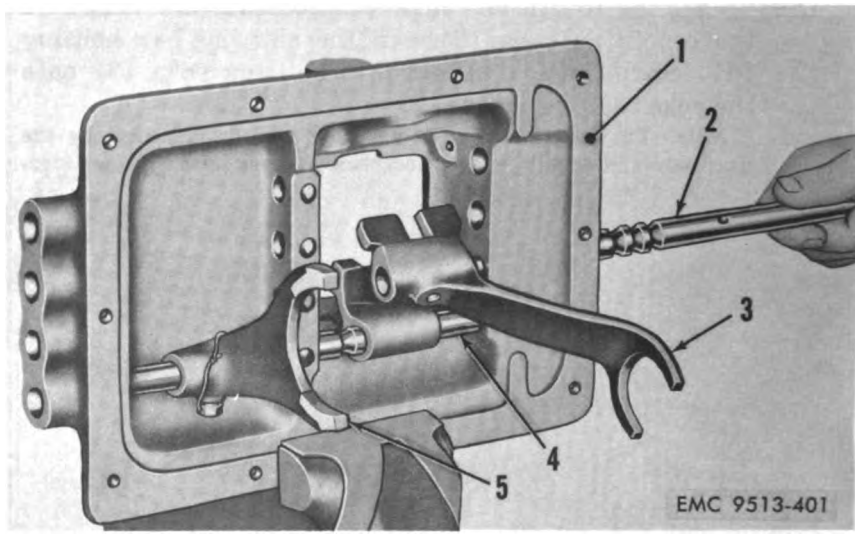
1 Steel ball
2 Interlock ball hole
3 Shifting bar housing
4 First and reverse yoke bar

Figure 400. Installing yoke bar interlock ball.

lock hole drilled through the center of the bar at the base of the interlock ball groove.

(40) Follow the procedures in (34) and (35) page 798, for installing and compressing the position finder spring. Push the yoke bar through the center support.

Note. Do not drive against the bar to force it through the center support; a light bump with the heel of the hand will usually be sufficient. If difficulty is encountered, it can usually be traced to the fact that the adjacent yoke bar is not in the neutral position with the result that the interlocking ball is projecting into the bore of the yoke bar about to be installed.



1 Shifting bar housing
2 Fourth and fifth yoke bar
3 Fourth and fifth shifting yoke
4 First and reverse yoke bar
5 First and reverse shifting yoke

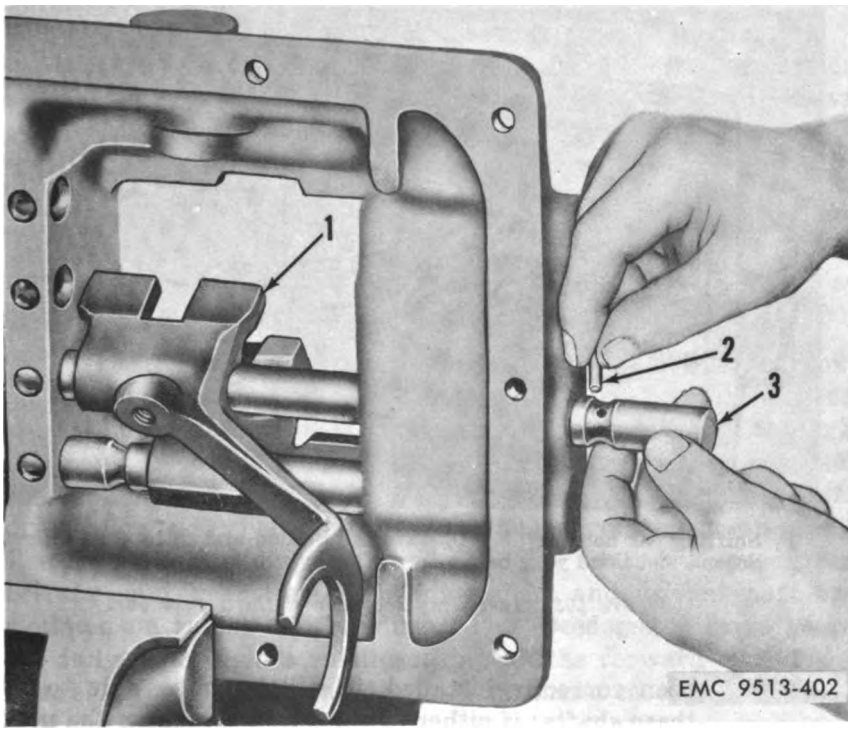
Figure 401. Installing fourth and fifth yoke bar and shifting yoke.

(41) Insert the interlock cross pin (2, fig. 402) in the drilled hole at the base of the interlock ball groove. Turn the yoke bar (3) so that the pin lies in a horizontal position and push the bar into the housing, turning it to its normal position when the interlock has entered the housing. Move the yoke bar to the neutral position.

(42) Install the locking screw in the fourth and fifth shifting yoke (1), following the instructions in (37) page 798.

(43) Drop a steel ball (1, fig. 400) into the interlock ball hole (2), making sure the ball bottoms against the yoke bar.

(44) Start the second and third yoke bar (2, fig. 403) into



1 Fourth and fifth shifting yoke
2 Interlock cross pin
3 Fourth and fifth yoke bar

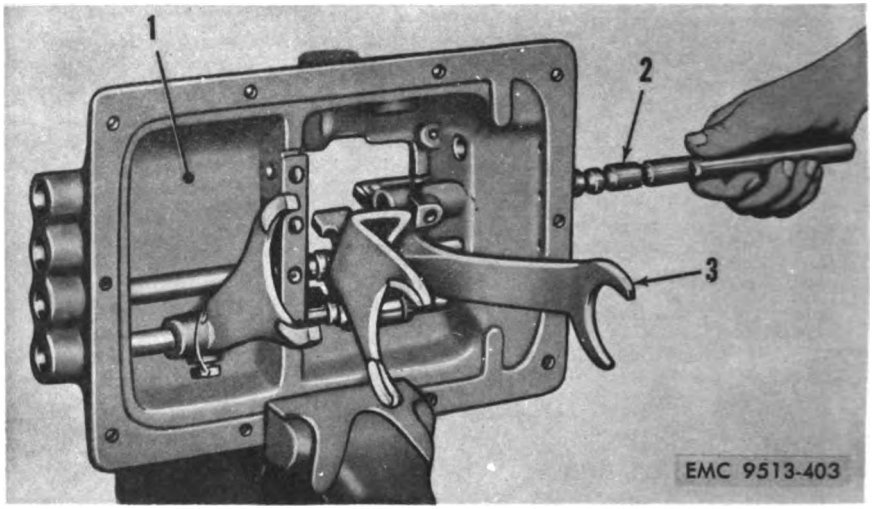
Figure 402. Installing interlock cross pin in fourth and fifth yoke bar.

the shifting bar housing (1) and slide the second and third shifting yoke (3) onto the end of the bar.

Note. The second and third yoke bar can be identified by the widely and unequally spaced lock ball grooves.

(45) Following the procedures outlined in (34) and (35) page 798 for installing and compressing the position finder spring, push the yoke bar through the shifting bar housing center support and into the neutral position. See note in (40) page 800.

(46) Test the assembly by shifting each bar into and out of its in-gear positions. The bars should slide smoothly but not loosely. They should enter or leave the in-gear positions with a definite snap action. Test for the correctness of the assembly of the interlocking parts by shifting the fourth and fifth speed yoke bar forward into the fourth speed position. Now try to shift either one or both of the other yoke bars into an in-gear position. If the parts of the interlocking mechanism have



1 Shifting bar housing
2 Second and third yoke bar
3 Second and third shifting yoke

Figure 403. Installing second and third yoke bar.

been correctly installed, it will be impossible to move these shafts; if either of the bars move from the neutral position to an in-gear position, it indicates that some part or parts of the interlocking mechanism have been omitted or improperly installed. In this event, the assembly must be disassembled and reassembled properly.

(47) Install the thimbles (1, fig. 387) in the shifting bar holes in the end of the housing. Drive the thimbles in until they seat against the shoulders in the housing.

Note. There is very little tolerance in the fit of yoke bars in the thimbles; therefore, to avoid any possibility of their interfering with the operation of the yoke bars, make sure that the thimbles are maintained straight and true with the bore as they are driven into the housing. Remove and replace any thimbles which are bent, flattened, or mushroomed during their installation.

(48) Install the plug (10) in the lock ball hole in the side of the shifting bar housing.

(49) Coat the gasket (12) and threads of the screws (5, fig. 387) and (7) with an approved gasket cement. Position the gasket and shifting bar housing on the transmission case, making sure the shifting yokes engage the slots in the sliding gears. Secure the housing in position with lockwashers and screws.

(50) Install the remote control assembly (par. 215*f*).

(51) Lubricate the transmission (LO 5–9513–3).

b. Installation.

(1) Install the engine clutch assembly (par. 357*f*).

(2) Attach the clutch housing (20, fig. 389) to the carrier engine assembly with lockwashers (5) and cap screws (21).

(3) Install the carrier engine and transmission assembly in the carrier (par. 325*b*).

Section XXVI. TRANSFER CASE

407. Transfer Case Removal and Disassembly

a. Description. The transfer case is a two-speed gearbox, mounted on a support bracket behind the transmission between the frame siderails. The front and rear axles are driven through this unit. A declutching device is provided for engaging and disengaging the front axle. The main drive gear, idler shaft drive gear, and driven shaft gear are helical constant-mesh gears. The main shaft sliding gear and the idler shaft low speed gear are the spur gear type. The idler shaft and driven shaft are mounted on radial ball bearings. The speedometer drive gears are fully inclosed in a small housing on the forward end of the idler shaft and are lubricated from the transfer case.

b. Removal (fig. 404).

(1) Drain the lubricant from the transfer case (LO 5–9513–3).

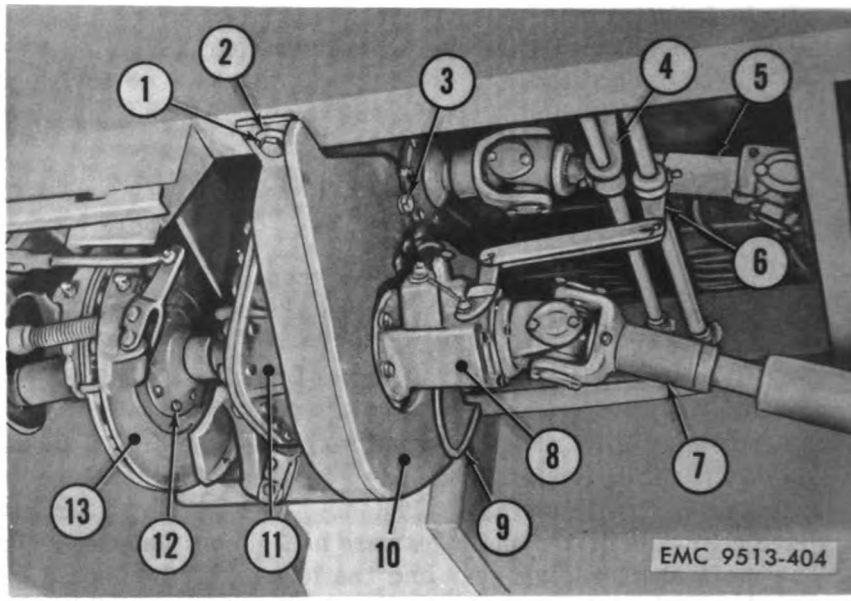
(2) Disconnect the transfer case gearshift control lever arm (4) and reach rod from the transfer case (par. 216*b*). Disconnect the front axle declutch control lever arm (6) and reach rod from the front axle declutch unit (8) lever (par. 217*b*).

(3) Disconnect the transfer case drive shaft (5) from the transfer case (par. 303*a*). Disconnect the front axle drive shaft (7) from the declutch unit (par. 303*a*).

(4) Remove the nuts, lockwashers, and flange mounting bolts (12).

(5) Disconnect the speedometer cable (9) from the idler cap on the front of the transfer case.

(6) Install a wire rope sling around the transfer case (11) and support bracket (10) and up through the carrier frame to the lifting hook of an auxiliary lifting device. Raise the hook and take out slack in the sling. Remove cotter pins, castle nuts, and plain washers from the mounting bolts (1). Remove the mounting bolts and fabreeka washers (2). Lower the transfer case to the ground, removing fabreeka washers from between the



1 Mounting bolt
2 Fabreeka washer
3 Mounting screw
4 Transfer case gearshift control lever arm
5 Transfer case drive shaft
6 Front axle declutch control lever arm
7 Front axle drive shaft
8 Front axle declutch unit
9 Speedometer cable
10 Support bracket
11 Transfer case
12 Flange mounting bolt
13 Emergency brake assembly

Figure 404. Transfer case, installed.

support bracket and carrier frame. Remove the wire rope sling. Slide transfer case and support bracket from under carrier.

(7) Remove mounting screws (3) and lockwashers and separate the support bracket and transfer case.

c. *Disassembly.*

(1) Remove the cotter pin, nut (1, fig. 405), and yoke (2) from the main shaft (12). Remove the cotter pin, nut (1), and flange (37) from the driven shaft (42). Remove the keys (11) from the shafts.

(2) Use a hammer and punch to loosen the oil slingers (1, fig. 406) on the front of the main shaft (2) and rear of the driven shaft. Slide off the oil slingers.

(3) Punchmark the transfer case (68, fig. 405), declutch carrier (62), and bearing cap (60) to facilitate assembly. Remove the cotter pin, nut (1), and yoke (58) from the declutch shaft (65). Remove the screws (6) and lockwashers from the declutch carrier (62). Remove

the declutch carrier and gasket (64) from the transfer case.

(4) Remove the cap screw (4, fig. 407) and washer, the spring (5), and the steel ball (6).

(5) Disconnect the declutch lever screw (56, fig. 405) from the declutch carrier (62). Swing lever at right angle to the declutch shift shaft and grasp it with one hand. Remove oil plug (63). Loosen setscrew (48) in the declutch shift fork (47) and pull the shift shaft (53) and declutch lever (54) assembly out of the declutch carrier. Remove cotter pin and clevis pin (55) which holds the lever to the shift shaft.

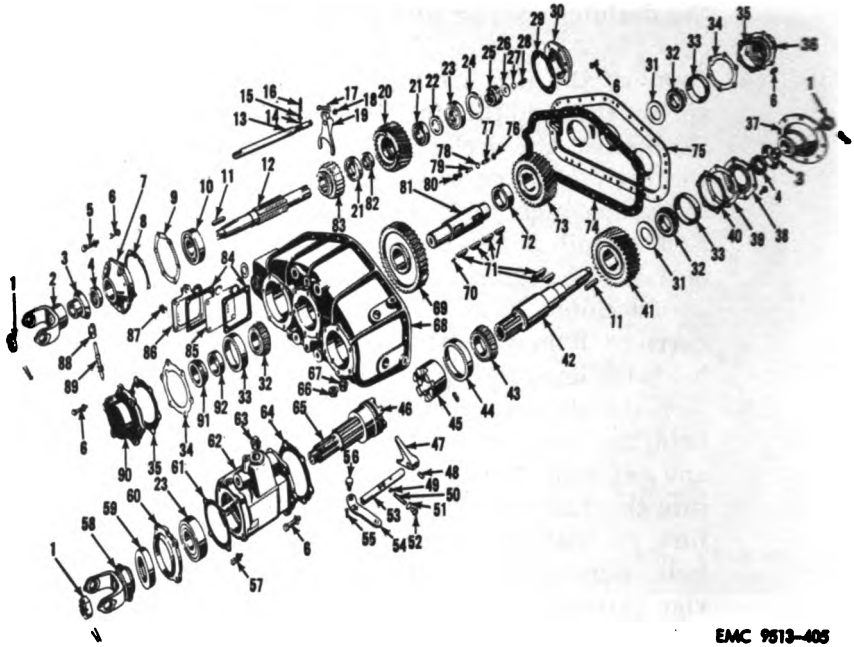
(6) Remove the cap screws (57) and lockwashers which hold the bearing cap (60) to the carrier. Remove cap and oil seal (59) assembly and gasket (61). Reach into the declutch carrier from the rear and lift the shift fork so that it clears the collar on the sliding clutch hub. Remove the shaft assembly from the declutch carrier through the front opening, and take the fork out from the back. Drive the shaft (65) assembly out of the declutch carrier from the rear end, using a soft hammer. Remove the sliding clutch hub (46) from the shaft splines. Pull the ball bearing (23) from the shaft.

(7) Using a setscrew wrench, loosen the setscrew (1, fig. 408) which holds the front axle drive clutch (2) on the splines at the front end of the driven shaft (3). Slide the front axle clutch from the shaft.

(8) Remove the speedometer gear sleeve (88, fig. 405) and driven gear (89) from the idler shaft front bearing cap (90). Punchmark the idler shaft front bearing cap and transfer case to facilitate assembly. Remove the cap screws (6) and lockwashers, front bearing cap (90), gasket (35), and shim set (34) from the transfer case (68). Tie shim set intact and keep with cap. Remove the speedometer drive gear (91) and gear spacer (92) from the idler shaft (81).

(9) Punchmark the main shaft front bearing cap (7) and transfer case (68) to facilitate assembly. Remove the cap screws (5 and 6) and lockwashers from the bearing cap. Insert two of the screws into the cap puller screw holes. Tighten the screws to pull the cap from the case. Remove the cap, oil seal (4), gasket (8), and shim set (9). Tie the shim set together and keep with the cap.

(10) Punchmark the transfer case cover (75) and main shaft rear bearing cap (30) to facilitate assembly. Remove



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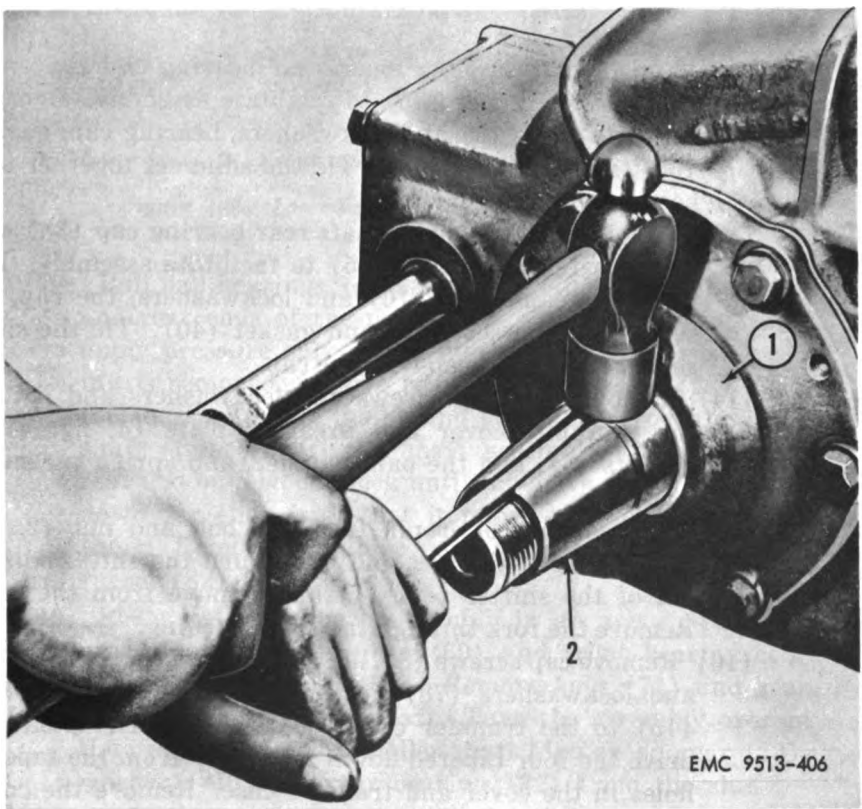
1	Nut (3 rqr)	35	Gasket (2 rqr)
2	Main shaft yoke	36	Idler shaft rear bearing cap
3	Oil slinger (2 rqr)	37	Driven shaft flange
4	Oil seal (2 rqr)	38	Rear bearing cap
5	Main shaft cap screw	39	Rear bearing shim set
6	Cap screw (24 rqr)	40	Cap gasket
7	Bearing cap	41	Driven gear
8	Gasket	42	Driven shaft
9	Bearing cap shim set	43	Front bearing cone
10	Front bearing	44	Front bearing cap
11	Key (2 rqr)	45	Declutch driving clutch
12	Main shaft	46	Declutch sliding clutch
13	Gearshift shaft	47	Shift fork
14	Lock ball	48	Shift fork screw
15	Plunger	49	Lock ball
16	Lock spring	50	Lock spring
17	Fork bolt	51	Lockwasher
18	Fork bolt nut	52	Lock spring screw
19	Transfer gearshift fork	53	Shift shaft
20	Main drive gear	54	Shifting lever
21	Bearing (2 rqr)	55	Clevis pin
22	Rear bearing spacer	56	Declutch lever screw
23	Bearing (2 rqr)	57	Cover cap screw (4 rqr)
24	Rear bearing washer	58	Companion yoke
25	Power takeoff drive clutch	59	Declutch shaft oil seal
26	Power takeoff drive clutch washer	60	Bearing cap
27	Lockwasher	61	Cap gasket
28	Clutch cap screw	62	Declutch carrier
29	Main shaft rear cap gasket	63	Oil plug
30	Rear bearing cap	64	Carrier gasket
31	Washer (2 rqr)	65	Declutch shaft
32	Bearing cone (3 rqr)	66	Drain plug
33	Bearing cup (3 rqr)	67	Filler plug
34	Shim set (2 rqr)	68	Transfer case
		69	Idler low speed drive gear

Figure 405. Transfer case, exploded view.

70 Speedometer gear key
71 Key (6 rqr)
72 Idler gear spacer
73 Idler high speed gear
74 Cover gasket
75 Transfer case cover
76 Bolt nut (18 rqr)
77 Bolt (18 rqr)
78 Lockwasher (58 rqr)
79 Taper pin (4 rqr)
80 Cap screw (2 rqr)
81 Idler shaft
82 Main drive gear bearing spacer
83 Low speed sliding gear
84 Cover gasket (2 rqr)
85 Oil breather plate
86 Transfer shift cover
87 Cover cap screw (4 rqr)
88 Speedometer gear sleeve
89 Speedometer driven gear
90 Front bearing cap
91 Speedometer drive gear
92 Gear spacer

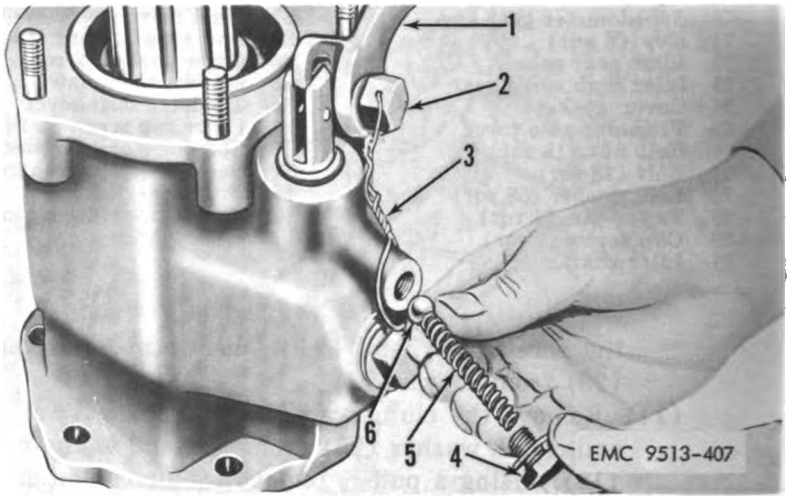
the screws (6) and lockwashers, cap, and cap gasket (29) from the case.

(11) Remove the clutch cap screw (28), lockwasher (27), and clutch washer (26) from rear end of the main shaft (12). Using a puller, remove the drive clutch from the main shaft (fig. 409). Remove the rear bearing washer (24, fig. 405) from the shaft.



1 Oil slinger 2 Main shaft

Figure 406. Removing oil slinger.



1 Shift lever
2 Cap screw and washer
3 Lockwire
4 Cap screw
5 Spring
6 Steel ball

Figure 407. Removing front axle declutch lock ball assembly.

(12) Punchmark the idler shaft rear bearing cap (36) and transfer case cover (75) to facilitate assembly. Remove the cap screws (6) and lockwashers, bearing cap, gasket (35), and shim set (34). Tie the shim set together and keep with the cap.

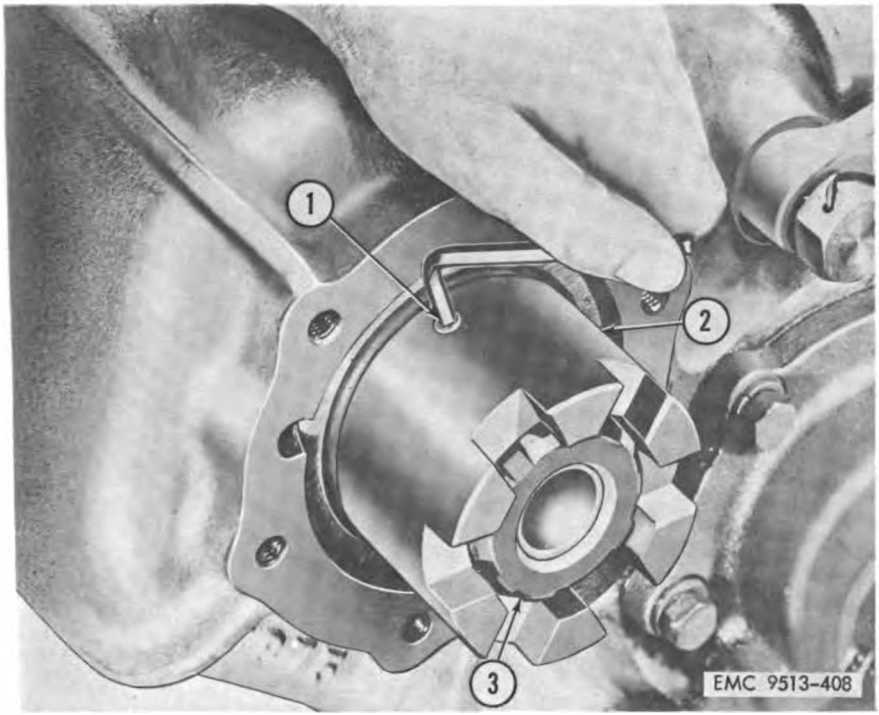
(13) Punchmark the driven shaft rear bearing cap (38) and the transfer case cover (75) to facilitate assembly. Remove the cap screws (6) and lockwashers, the cap, oil seal (4), shim set (39), and gasket (40). Tie the shim set together and keep with the cap.

(14) Remove four cap screws and lockwashers and lift off the gearshift cover and breather plate (4, fig. 410), gaskets (5), and the ball, plunger, and spring assembly (3).

(15) Remove the cotter pin from the bolt and nut (2, fig. 411). Loosen the bolt and nut. Turn the shift rod (3) out of the shifter fork (1) and remove from the case. Remove the fork through the cover opening.

(16) Remove cap screws (80, fig. 405), nuts (76), studs (77), and lockwashers (78) holding the transfer case cover (75) to the transfer case (68). Use a drift punch to drive the four tapered dowel pins (79) from the tapered holes in the cover and transfer case. Remove the cover and the gasket (74).

(17) Remove the driven shaft (1, fig. 412), idler shaft (2), and main shaft (3) from the transfer case (4).



1 Setscrew 2 Front axle drive clutch 3 Driven shaft

Figure 408. Loosening driving clutch setscrew.

(18) Pull ball bearings (10 and 23, fig. 405) from the front and rear ends of the main shaft (12), being careful to apply pressure only at the inner race. After rear bearing is removed, remove rear bearing spacer (22) from the shaft. Remove the sliding gear (83) from the drive shaft splines. Lift the shaft assembly and pound the rear end on a wood block until the drive gear (20) slides down far enough so that it may be removed from the shaft. Remove the drive gear (20), bearing (21), and spacer (82).

(19) Place the idler shaft assembly in an arbor press and press the low speed gear (69) and front bearing cone (32) from the shaft (81). Remove keys (71) and gear spacer (72) from the shaft. Turn the assembly over in the press and force the idler shaft high speed gear (73), washer (31), and rear bearing (32) from the shaft.

(20) Pull the driven shaft front bearing cone (43) from the shaft (42). Place the assembly in an arbor press and press the driven shaft rear bearing cone (32), washer

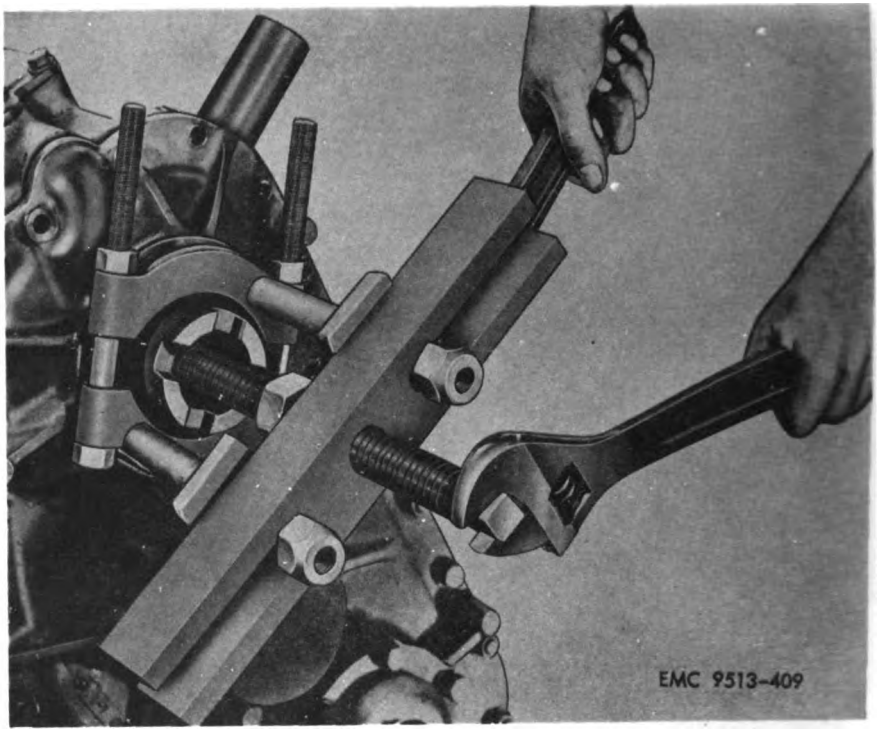


Figure 409. Pulling drive clutch from main shaft.

(31), and gear (41) from the shaft. Remove the keys (71) from the shaft.

408. Transfer Case Inspection and Repair

Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

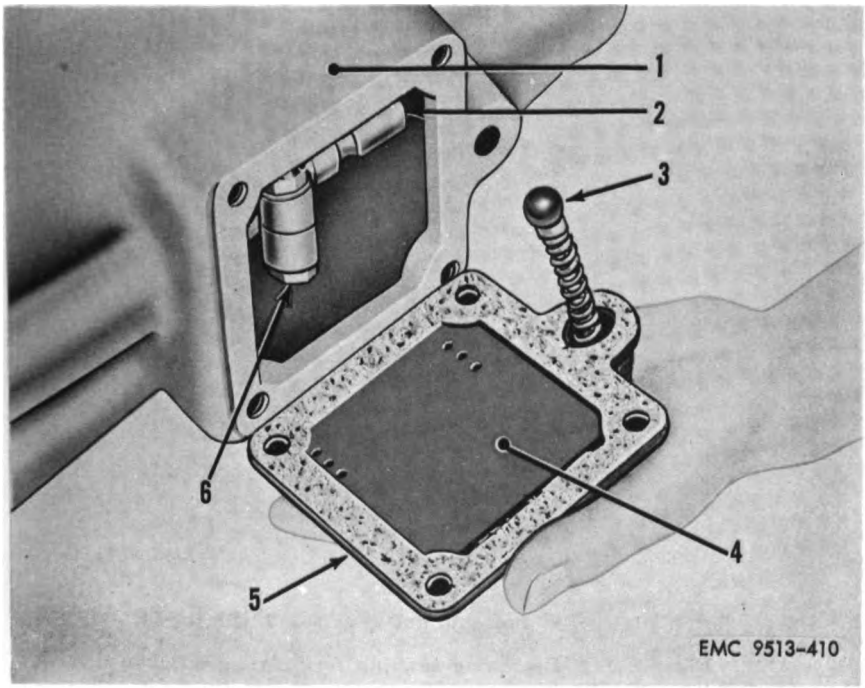
a. Inspect the shafts (par. 319), bearings (par. 316), and bushings (par. 318).

b. Inspect all gears for cracks, chipped or broken teeth, and evidences of wear. Replace a gear that is cracked, or has chipped, broken, or worn teeth.

c. Inspect the declutch carrier, transfer case, and cover for cracks, breaks, and distortion. Replace the carrier, case, or cover if cracked, broken, or distorted.

d. Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace parts having damaged, corroded, or stripped threads.

e. Inspect all parts for good condition. Replace parts not in good condition. Replace all gaskets and oil seals.



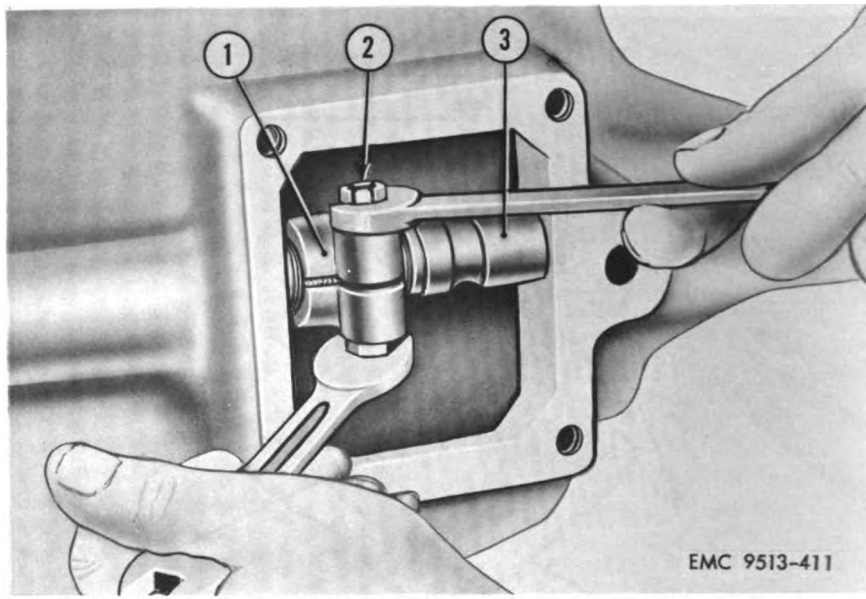
1 Transfer case
2 Shift rod
3 Steel ball, plunger, and spring assembly
4 Gearshift cover and breather plate
5 Gasket (2 rqr)
6 Bolt

Figure 410. Removing gearshift cover.

409. Transfer Case Reassembly and Installation

a. Reassembly (fig. 405).

(1) Install inner main drive gear bearing (21) over the rear end of main shaft (12), with the shielded edge of bearing facing toward the front. Seat it against the shoulder of the shaft spline. Install the bearing spacer (82) against the rear of the bearing. Slide the main drive gear (20) into place over the bearing with the internal teeth facing the front. Install outer main drive gear bearing (21) inside the hub of the gear (20) with the shielded side of the bearing facing the rear of the shaft. Install the main shaft rear bearing spacer (22) up against the bearing. Drive the main shaft rear bearing (23) up against the spacer, with the shielded side facing the front of the shaft. Apply pressure only on the inner race of the bearings. Install main shaft sliding gear (88) from the front end of the shaft onto the splines. The shift fork collar on the sliding gear must



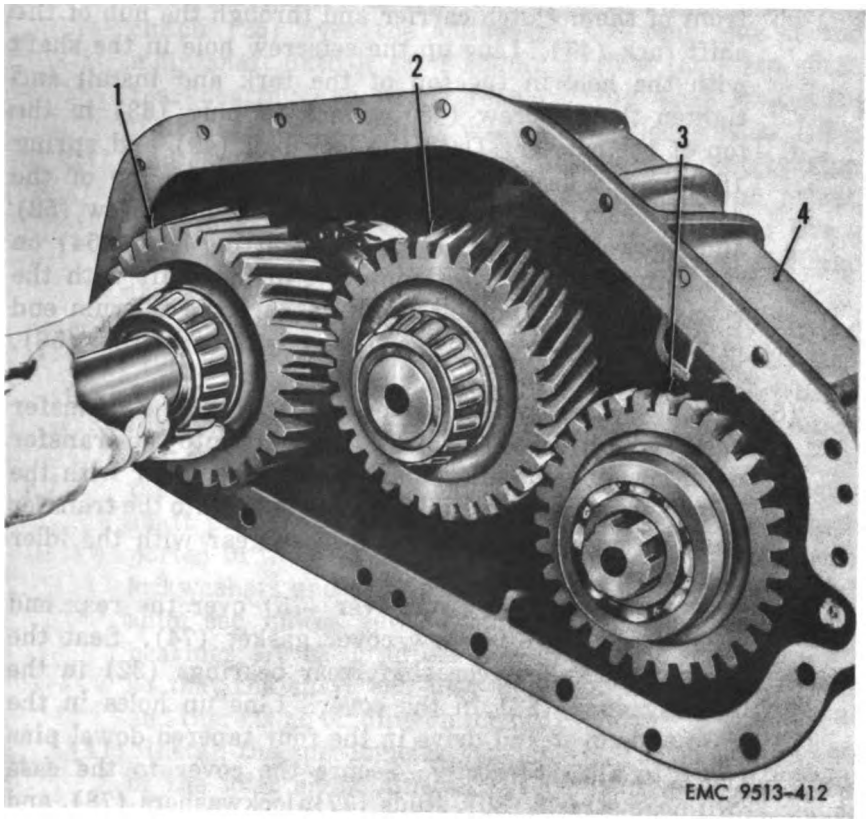
1 Shifter fork 2 Bolt and nut 3 Shift rod

Figure 411. Loosening shifting fork clamp nut.

be facing the front of the shaft. Drive the main shaft front bearing (10) to seat against the shoulder of the shaft spline, with the shielded side facing the shoulder. Apply pressure only on the inner race.

(2) Install the idler shaft direct speed gear keys (71) in their slots on the rear end of the idler shaft (81). Press the direct speed gear (73) into position over the keys. Install the spacer (72) over the front end of the shaft and up against the idler shaft high speed gear, and install the idler shaft low speed gear keys. Press the low speed gear (69) over the front end of the shaft to seat against the spacer, with long end of gear hub facing the rear of the shaft. Install the idler shaft rear bearing washer (31) over the rear end of the shaft. Drive bearing cones (32) into place over the ends of the shaft, applying pressure only on the inner race.

(3) Install driven shaft gear keys (71) and press driven gear (41) to seat against the shoulder on the shaft (42). Install driven shaft rear bearing spacer (31) up against the gear and drive the front bearing cone (43) and rear bearing cone (32) into place over the ends of the shaft. Apply pressure only on the inner race of the bearing cones.



1 Driven shaft
2 Idler shaft
3 Main shaft
4 Transfer case

Figure 412. Removing driven shaft assembly.

(4) Drive the declutch shaft front bearing (23) to seat against the shoulder on the shaft spline (65) with the shielded side of the bearing facing toward the front. Install the declutch sliding clutch hub (46) over the splines in the shaft with jaws facing toward the rear. Place the shift fork (47) in the declutch carrier with the boss on the fork hub facing toward the rear, and lift it into the oil plug opening at the top of the carrier. Hold the shift fork up and install the assembled declutch shaft (65) through the front opening in the carrier. Drop the fork so that it engages the groove in the sliding clutch (46). Install the declutch shaft bearing cap (60) on the front of the declutch carrier (62). Use a new gasket between the cap and the carrier. Secure in place with cap screws (57) and lockwashers. Slide the shift shaft (53) through the opening in the

front of the declutch carrier and through the hub of the shift fork (47). Line up the setscrew hole in the shaft with the hole in the top of the fork and install and tighten the setscrew (48). Place oil plug (63) in the top of the carrier. Drop the lock ball (49) and spring (50) in the declutch shift lock well on the top of the declutch carrier and install the declutch shift screw (52) and lockwasher (51). Install the shifting lever (54) on the shift shaft (53), attaching it to the shaft with the clevis pin (55) and cotter pin. Secure the fulcrum end of the shifting lever to the carrier with cap screw (56). Lock with lockwire.

(5) Install the assembled driven shaft into the transfer case. Install the assembled idler shaft into the transfer case, meshing the idler shaft direct speed gear with the driven shaft gear. Install the main shaft into the transfer case, meshing the main shaft loose gear with the idler shaft direct speed gear.

(6) Install the transfer case cover (75) over the rear end of the case, using a new cover gasket (74). Seat the idler shaft and driven shaft rear bearings (82) in the bearing cups (88) in the cover. Line up holes in the case and cover and drive in the four tapered dowel pins (79) to aline correctly. Secure the cover to the case with cap screws (80), studs (77), lockwashers (78), and nuts (76).

(7) Slide the declutch driving clutch (45) over the splines on the front end of the driven shaft (42) and secure in place by tightening the setscrews in the hub of the clutch. Place the declutch carrier assembly in position on the transfer case and attach it in place with the cap screws (6) and lockwashers. Use a new gasket (64) between the declutch carrier and transfer case.

(8) Wrap a piece of shim stock over the keyway on the end of the driven shaft (42). Slide the driven shaft rear bearing cap (88) and oil seal (4) assembly into position against the case, with a new gasket (40) and the original shim set (89) between the bearing cap and the transfer case cover. It will not be necessary to adjust the shaft end play unless new bearings have been installed. If new bearings are used, adjust the thickness of the shim set so that shaft end play will be between 0.008- and 0.005-inch. Secure bearing cap with lockwashers and cap screws (6).

(9) Install main shaft rear bearing washer (24) against the

main shaft rear bearing. Drive the power takeoff drive clutch (25) over the splines on the rear end of the main shaft until it seats solidly against the main shaft rear bearing and inside rear bearing washer. Secure it in place with retaining washer (26), lockwasher (27), and cap screw (28). Place the main shaft rear bearing cap (30) in position on the transfer case and attach it in place with lockwashers and cap screws (6). Use a new gasket (29) between the bearing cap and the transfer case cover.

(10) Wrap a piece of shim stock over the keyway on the front of the main shaft (12). Place shim set (9) and gasket (8) in position and slide main shaft front bearing cap (7) and oil seal (4) assembly over the end of the shaft up against the case. Use a soft hammer to tap the cap into position. It is necessary to aline the shaft properly as the front drive shaft bearing is supported in the cap. When cap is in position, secure with lockwashers and cap screws (5 and 6). Use the original shim set, unless new bearings were installed. If new bearings are used, adjust the thickness of the shim set so that the shaft end play does not exceed 0.005-inch, and there is no binding on the bearing.

(11) Install the speedometer gear spacer (92) over the end of the idler shaft. Install speedometer gear key (70) and the speedometer drive gear (91). Place idler shaft front bearing cap (90) in position on the transfer case, using a new gasket (35) and the original shim set (34) between the cap and case. Attach the bearing cap to the case with lockwashers and cap screws (6). Slide the speedometer driven gear (89) into the bearing cap, meshing it with the speedometer drive gear. Secure with the sleeve (88).

(12) Place the idler shaft rear bearing cap (36) in position against the transfer case cover, using a new gasket (35) and the original shim set (34) between the cap and cover. If new bearings were installed on the idler shaft, it is necessary to adjust the thickness of the shim set so that shaft end play will be between 0.008- and 0.005-inch. Secure the idler shaft rear bearing cap in place with lockwashers and screws (6).

(13) Install the transfer fork (19) through the breather opening in the top of the case, with the boss on the hub of the fork facing toward the rear. Engage the fork in the collar groove on the main shaft sliding gear

(83). Insert the shift shaft (13) through the opening in the front of the transfer case and into the hub of the fork. Screw the shift shaft into the fork to approximately the original position. Drop the shift lock ball (14), spring plunger (15), and lock spring (16) into the poppet well in the top of the transfer case. Hold down the shift lock spring with finger. Pull the shift shaft, and hold locked. Turn the shift shaft to position the fork until it holds the sliding gear correctly positioned halfway between the main drive gear (20) and the idler shaft low speed gear (69). Test shift into the low and high range to see that there is no binding. Tighten clamp screw (17) in the shift fork hub and insert a cotter pin through the slotted nut (18) to lock the adjustment.

(14) Place a new gasket (84) over the breather cover opening and install breather plate (85) with breather plate holes toward the right side of the transfer case. Place another new gasket over the breather plate and install the cover (86) with holes toward the right side of the case. Press the cover onto the case against the pressure of the shift lock spring and secure with lockwashers and cap screws (87).

(15) Slide the oil slingers (3) into place on the front of the main shaft and rear of the driven shaft. Holding the end of a punch over the portion of the slinger hub which is over the keyway in the shaft, hammer the punch to bend the hub of the slinger into the keyway. This will lock the slinger in position and keep it from turning on the shaft.

(16) Remove shim stock covering keyway in rear of driven shaft and install key (11). Slip the companion flange (37) onto the driven shaft and drive to seat. Secure in place with nut (1) and cotter pin.

(17) Remove shim stock covering keyway in front end of main shaft and install key (11). Slip yoke (2) into position on main shaft, lining up key, and drive to seat. Secure in place with nut (1) and cotter pin.

(18) Slip companion yoke (58) into position on front axle declutch shaft splines and drive to seat. Secure in place with nut (1) and cotter pin.

(19) Lubricate the transfer case (LO 5–9513–3).

Note. Fill declutch carrier through oil plug when filling transfer case for first time after disassembly. Give transfer case rotary power test by attaching main shaft to power source. Test in both speeds, stopping unit to shift gears to avoid breaking gear teeth.

Any undue noise indicates faulty assembly, which must be checked step-by-step. If unit operates smoothly in both speeds, it is ready to install on carrier.

b. Installation (fig. 404).

(1) Position the support bracket (10) against the front of the transfer case. Tap the bracket until pins on the bracket seat in the case. Secure bracket with lockwashers and mounting screws (3).

(2) Slide the transfer case and support bracket into position under the carrier. Attach a wire rope sling around the transfer case and bracket and up through the carrier frame to the lifting hook of an auxiliary lifting device. Raise the lifting hook and transfer case to position between the frame siderails. Install fabreeka washers (2) between the support bracket and carrier frame. Place fabreeka washers on the mounting bolts (1) and install through bracket and frame. Install plain washers on the mounting bolts. Secure bolts with castle nuts and cotter pins. Remove the wire rope sling.

(3) Connect the speedometer cable (9) to the idler cap on the front of the transfer case.

(4) Connect the flange and emergency brake assembly (13) with mounting bolts (12), lockwashers, and nuts.

(5) Connect the transfer case drive shaft (5) to the transfer case (par. 303*e*). Connect the front axle drive shaft (7) to the declutch unit (8) (par. 303*e*).

(6) Connect the transfer case gearshift control lever arm (4) reach rod to the transfer case (par. 316*d*). Connect the front axle declutch control lever arm (6) reach rod to the front axle declutch unit (8) lever (par. 217*d*).

(7) Lubricate transfer case, drive shafts, and emergency brake (LO 5–9513–3).

Section XXVII. REAR AXLE HOUSING AND DIFFERENTIAL

410. Description

The tandem driving rear axle units are of the double-reduction, full-floating type. Reduction is accomplished by hypoid first reduction and helical spur gear second reduction. The thru-shafts of the hypoid gear drive units are supported at the forward end by tapered roller bearings in a cage and at the rear end by a straight roller bearing. Pinion bearing preload is adjusted and maintained by a hardened precision spacer between the inner and outer tapered bearings which are held in place on

the pinion journal by large nuts. Yokes are held in place on the thru-shaft by separate shaft nuts. The large differential drive gear is mounted in the differential gearcase and bolted to it between the two halves of the case. The differential case is mounted in the carrier on tapered roller bearings. The two axle assemblies are the same except that they face in opposite directions. In view of this similarity, the maintenance procedures in this section will cover one axle assembly only.

411. Rear Axle Housing Removal and Disassembly

a. Removal.

(1) Drain the compression tanks and disconnect the air-brake lines at the axle assemblies.

(2) Remove the rear axle and interaxle drive shafts (par. 303*a*).

(3) Remove the torque rods (par. 285).

(4) Roll the axle assembly from beneath the crane-carrier.

b. Disassembly (fig. 413).

(1) Drain the lubricant from the rear axle assembly (LO 5–9513–3).

(2) Remove the brake cylinders (par. 288*c*(1)), slack adjusters (par. 289*b*), axle shafts (par. 305*a*), and the rear wheel bearings and hubs (par. 306*a*).

(3) Remove the stud nuts (7) and lockwashers (8) from the studs (9).

(4) Using a rawhide mallet, break the differential carrier from the housing (2) and remove the tapered dowels (5). The dowels must be removed.

(5) Punchmark the carrier and housing to facilitate reassembly. Using an auxiliary lifting device, remove the differential carrier (1, fig. 414) straight out of the housing (3). Remove the housing gasket (6, fig. 413).

(6) If necessary, remove the setscrews (3) and, using a hydraulic press, press the housing sleeves (1) from the housing.

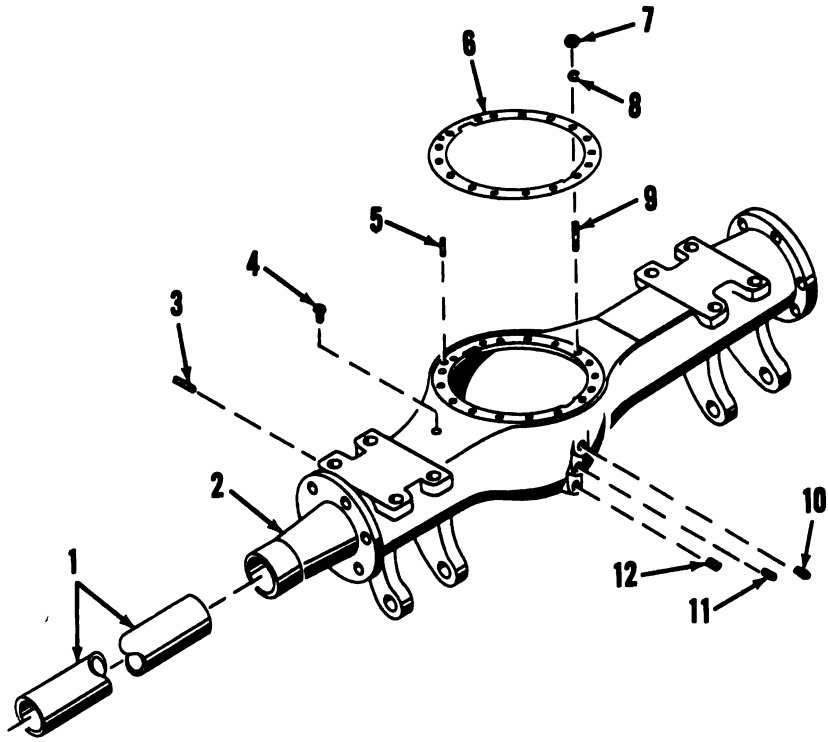
412. Rear Axle Housing Inspection and Repair

Wash all parts in an approved cleaning solvent and blow them dry with clean compressed air. Remove all sediment, scale, or rust from all parts.

a. Inspect the housing for cracks and breaks. Replace a housing, if badly cracked or broken. Small cracks may be welded.

b. Inspect the housing sleeves for wear, cracks, and breaks. Replace a housing sleeve if defective.

c. Inspect all threaded surfaces for damaged, corroded, or



EMC 9513-413

1	Housing sleeve (4 rqr)	7	Stud nut (36 rqr)
2	Housing assembly	8	Lockwasher (36 rqr)
3	Setscrew (4 rqr)	9	Stud (36 rqr)
4	Breather assembly (2 rqr)	10	Plug (2 rqr)
5	Dowel (4 rqr)	11	Plug (2 rqr)
6	Housing gasket (2 rqr)	12	Plug (2 rqr)

Figure 413. Rear axle housing, exploded view.

stripped threads. Replace parts having damaged, corroded, or stripped threads.

d. Inspect all parts for good condition. Replace parts not in good condition. Replace the housing gasket.

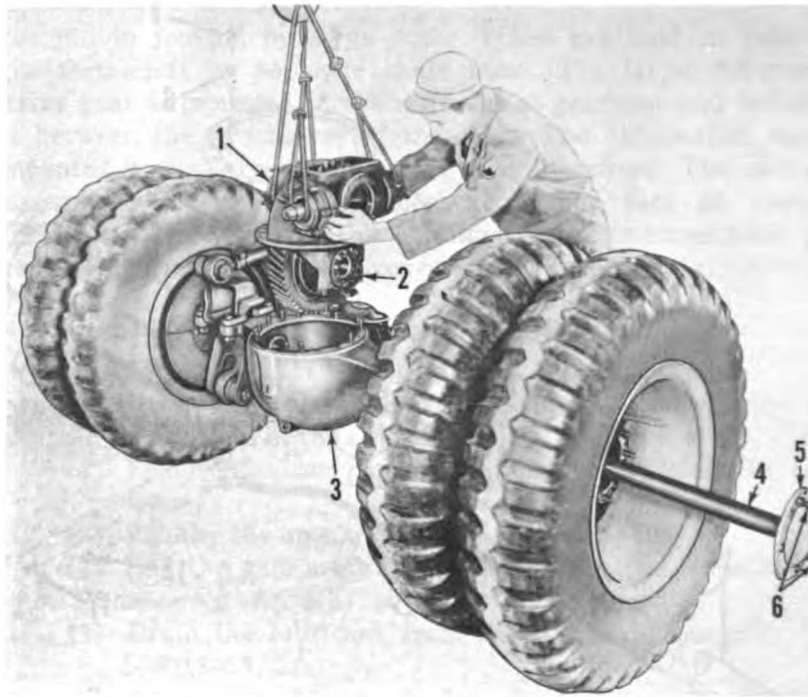
413. Rear Axle Housing Reassembly and Installation

a. Reassembly (fig. 413).

(1) If removed, press the housing sleeves (1) in the housing (2), using a hydraulic press. Secure the sleeves in the housing with setscrews (3).

(2) Position a gasket (6) on the housing. Using an auxiliary lifting device, carefully lower the differential carrier in the housing and on the housing studs.

(3) Drive in the tapered dowels (5). Secure the carrier with lockwashers (8) and stud nuts (7).



EMC 9513-414

1 Differential carrier
2 Differential
3 Axle housing
4 Axle shaft
5 Drive flange
6 Drive flange puller screws

Figure 414. Removing axle shaft and differential carrier.

(4) Install the rear wheel bearings and hubs (par. 306*c*), axle shafts (par. 305*b*), slack adjusters (par. 289*c*), and brake cylinders (par. 288*c*(2)).

(5) Lubricate the rear axle assembly (LO 5–9513–3).

b. Installation.

(1) Roll the axle assembly into position beneath the crane carrier.

(2) Install the torque rods (par. 285).

(3) Install the rear axle and interaxle drive shafts (par. 303*e*).

(4) Connect the airbrake lines to the axle assemblies. Check for air leaks.

(5) Lubricate the drive shafts (LO 5–9513–3).

414. Differential Removal and Disassembly

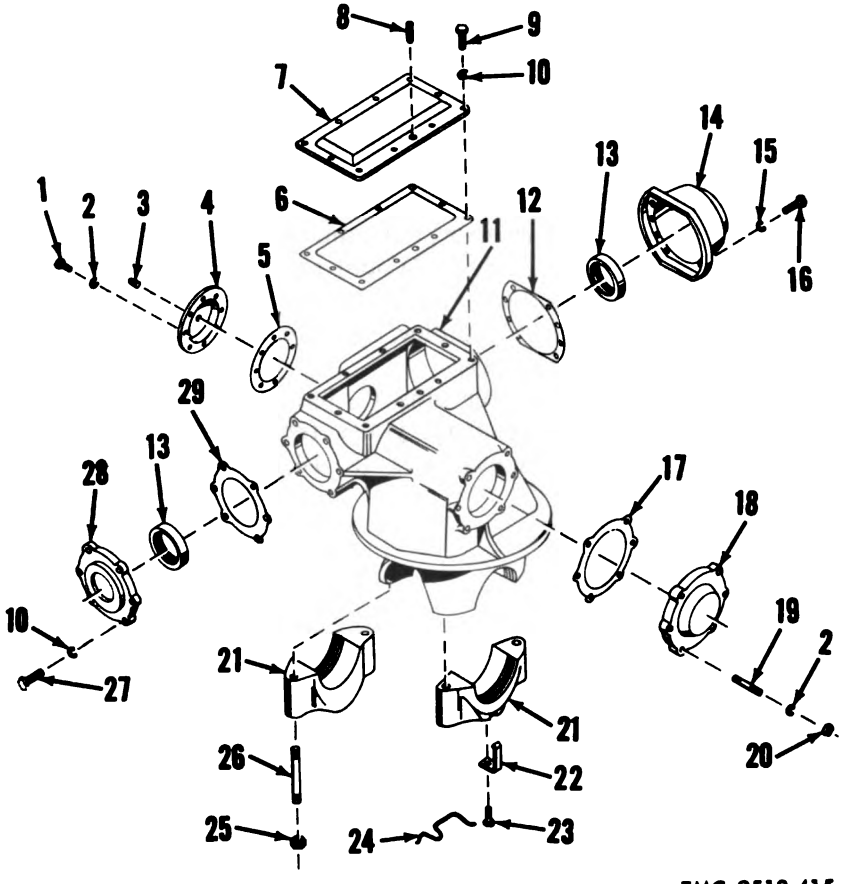
a. Removal.

(1) Remove the rear axle assembly (par. 411*a*).

(2) Disassemble the rear axle (par. 411*b*).

b. Disassembly.

(1) Punchmark the carrier (11, fig. 415) and caps (21) on both sides at the differential to insure correct assembly. Remove the lockwires (24) from the nuts (25)



EMC 9513-415

1	Cap screw (16 rqr)	15	Lockwasher (16 rqr)
2	Lockwasher (28 rqr)	16	Cap screw (16 rqr)
3	Plug (2 rqr)	17	Gasket (2 rqr)
4	Cover (2 rqr)	18	Bearing cage cover (2 rqr)
5	Gasket (2 rqr)	19	Stud (12 rqr)
6	Gasket (2 rqr)	20	Nut (12 rqr)
7	Cover (2 rqr)	21	Cap (4 rqr)
8	Screw (2 rqr)	22	Lock (4 rqr)
9	Cap screw (20 rqr)	23	Cap screw (4 rqr)
10	Lockwasher (32 rqr)	24	Lockwire (4 rqr)
11	Carrier and cap assembly (2 rqr)	25	Nut (8 rqr)
		26	Stud (8 rqr)
12	Gasket (2 rqr)	27	Cap screw (12 rqr)
13	Oil seal (4 rqr)	28	Cover (2 rqr)
14	Cover (2 rqr)	29	Gasket (2 rqr)

Figure 415. Rear axle differential carrier and covers, exploded view.

and cap screws (23). Remove the cap screws and the locks (22). Loosen, but do not remove, the nuts (25).

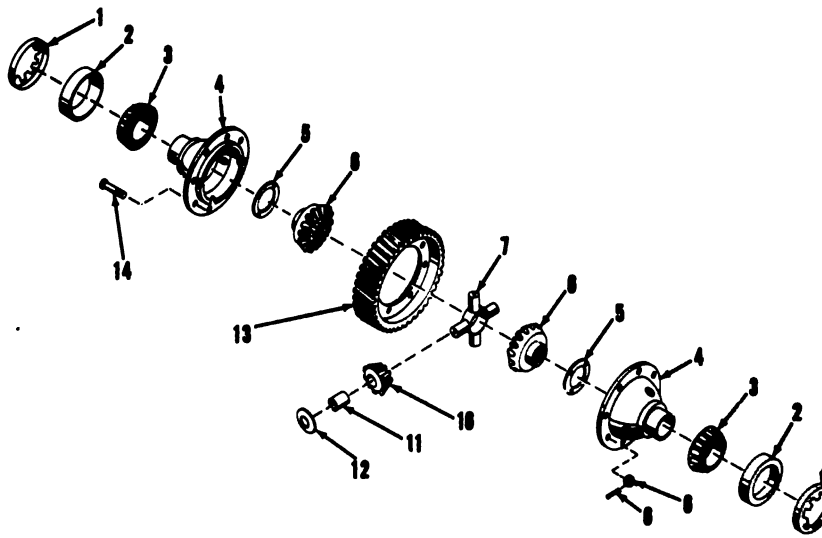
(2) Screw out the adjusting rings (1, fig. 416). Remove the nuts (25, fig. 415) and caps (21) and lift out the differential assembly. Remove the bearing cups (2, fig. 416) from the bearing cones (3).

(3) Place the differential gear and case assembly in a vise. Punchmark both sides of the gear (13, fig. 416) and the differential cases (4) to assure correct assembly. Remove the cotter pins (9), nuts (8), and case bolts (14). Tap and separate the cases (4).

(4) Place the case on a bench, open end up. Remove the first thrust washer (5) and side gear (6) by hand. Pry out the spider (7) and spider gears (10) and the remaining side gear and thrust washers with a screwdriver. Using a puller, remove the bearing cones (3) from the cases (4).

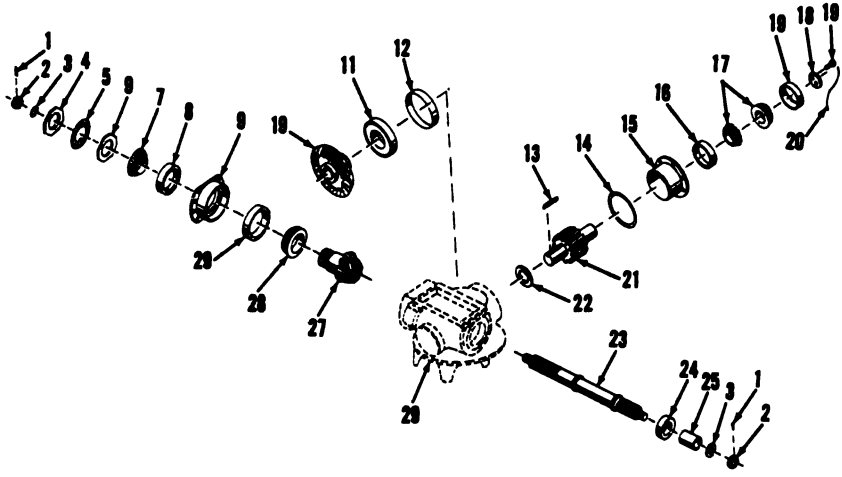
(5) Remove the cotter pins (1, fig. 417), nuts (2), washers (3), and drive shaft yokes from the thru-shaft (23).

(6) Remove the cap screws (8, 16, and 27, fig. 415), lock-



1	Adjusting ring (4 rqr)	8	Nut (16 rqr)
2	Bearing cup (4 rqr)	9	Cotter pin (16 rqr)
3	Bearing cone (4 rqr)	10	Spider gear (8 rqr)
4	Differential case (2 rqr)	11	Bushing (8 rqr)
5	Thrust washer (4 rqr)	12	Thrust washer (8 rqr)
6	Side gear (4 rqr)	13	Helical gear (2 rqr)
7	Spider (2 rqr)	14	Case bolt (16 rqr)

Figure 416. Differential assembly, exploded view.



1	Cotter pin (4 rqr)	16	Bearing cup (4 rqr)
2	Nut (4 rqr)	17	Bearing cone (4 rqr)
3	Washer (4 rqr)	18	Washer (2 rqr)
4	Adjusting nut jamnut (2 rqr)	19	Cap screw (6 rqr)
5	Jamnut lock (2 rqr)	20	Lockwire (2 rqr)
6	Adjusting nut (2 rqr)	21	Pinion shaft (2 rqr)
7	Bearing cone (2 rqr)	22	Spacer (2 rqr)
8	Bearing cup (2 rqr)	23	Thru-shaft (2 rqr)
9	Bearing cage (2 rqr)	24	Bearing (2 rqr)
10	Hypoid gear (2 rqr)	25	Spacer (2 rqr)
11	Bearing (2 rqr)	26	Differential carrier
12	Sleeve (2 rqr)	27	Hypoid pinion (2 rqr)
13	Key (2 rqr)	28	Bearing cone (2 rqr)
14	Shim (as rqr)	29	Bearing cup (2 rqr)
15	Bearing cage (2 rqr)		

Figure 417. Rear axle hypoid pinion, thru-shaft, and cross shaft, exploded view.

washers (15 and 10), covers (7, 14, and 28), and gaskets (6, 12, and 29) from the carrier (11). Remove the oil seals (13) from the covers (14 and 28). Remove the spacer (15) from the shaft.

(7) Carefully tap the pinion (27, fig. 417), bearing cage (9), and thru-shaft (23) assembly from the carrier.

(8) Hold the bearing cage (9) assembly in a vise. Remove the jamnut (4) from the pinion (27). Slide off the lock (5). Remove the adjusting nut (6) from the pinion.

(9) Remove the bearing cone (7) and bearing cage (9) with bearing cups (8 and 29) from the pinion (27).

(10) Using an arbor press, press the bearing cone (28) from the pinion.

(11) Remove the bearing (24) from the thru-shaft (23).

(12) Remove cap screws (1, fig. 415), lockwashers (2),

cover (4), and gasket (5) from the carrier (11). Remove the nuts (20), lockwashers (2), bearing cage cover (18), and gasket (17) from the studs (19) and carrier (11).

(13) Remove the lockwire (20, fig. 417), cap screws (19), and washer (18) from the pinion shaft (21).

(14) Insert hardwood block between end of cross shaft and outer thru-shaft chamber wall (fig. 418). Remove bearing cage (15, fig. 417) and bearing cones (17) with a puller, using $\frac{3}{8}$–16 puller screws in the cage flange tapped holes. Attach the shims (14), which control gear backlash, to the cage to facilitate adjustment when reassembling.

(15) Remove the studs (19, fig. 415) to facilitate positioning the carrier (11) in a press.

(16) Two pieces of three-quarter inch steel square bar stock, approximately 10 inches long, bent to form segments of an 18-inch diameter circle, will facilitate cross-shaft removal. Tap the cross-shaft and gear assembly toward

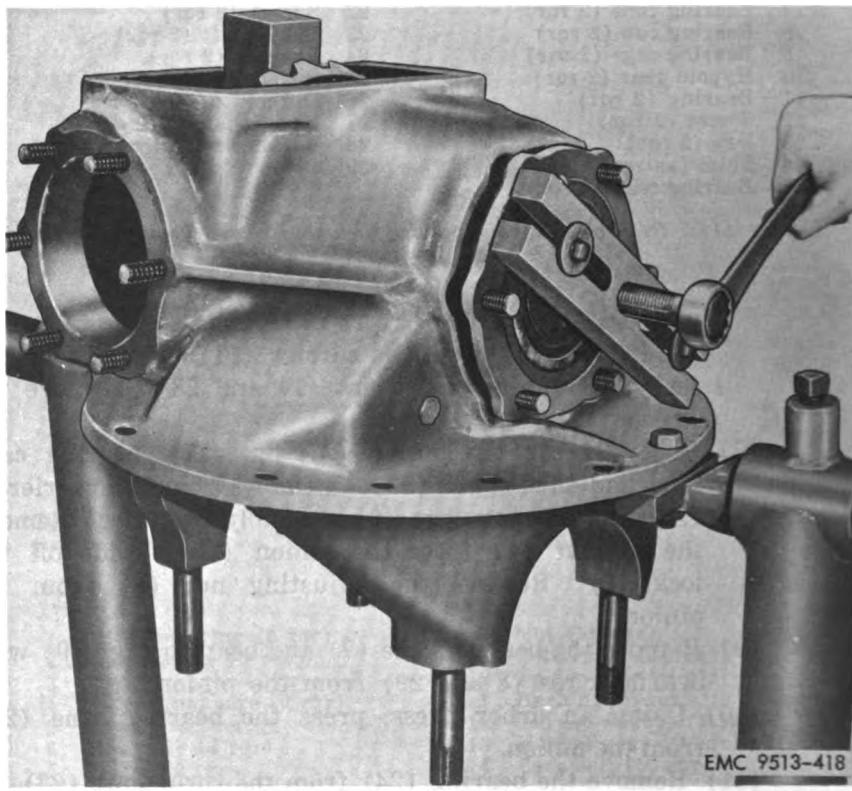


Figure 418. Removing cross-shaft bearing cage.

the thru-shaft chamber, so the formed bar stock can be inserted between the back of the gear and the inner thru-shaft chamber wall.

(17) Position the carrier in the press, thru-shaft chamber up, and press the cross-shaft (21, fig. 417) from the gear (10). Be sure the formed bar stock is under the gear. Provide a rigid support on the press bed for the carrier during this operation.

(18) Lift or tap out the radial bearing (11) and gear (10) assembly from the carrier. Do not lose the spacer (22). Remove the bearing from the gear with prybars or a puller.

(19) Do not remove the sleeve (12) from the carrier unless replacement of the sleeve is necessary.

(20) Using an arbor press, remove the bearing cones (17) and cups (16) from the bearing cage (15).

415. Differential Inspection and Repair

Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

a. Inspect shafts (par. 319) and bearings (par. 316).

b. Inspect the gears for cracks, chipped or broken teeth, and evidences of wear. Replace a gear that is cracked or has chipped, broken, or worn teeth.

c. Inspect the case and covers for cracks, breaks, and distortion. Replace a case or cover if cracked, broken, or distorted.

d. Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace parts having damaged, corroded, or stripped threads.

e. Inspect all parts for good condition. Replace parts not in good condition. Replace gaskets and oil seals.

416. Differential Reassembly and Installation

a. Reassembly.

(1) Check the sleeve (12, fig. 417) inside diameter and the radial bearing (11) outside diameter. Replace the sleeve and/or bearing if the parts are damaged, or if there is more than 0.006-inch clearance between the sleeve and bearing. When these parts are new, the sleeve inside diameter should be 0.0024- to 0.004-inch larger than the bearing outside diameter. The radial bearing must be free to float in the sleeve. If the sleeve is to be replaced, press the new sleeve firmly against the

carrier housing shoulder and secure with the setscrew (8, fig. 415).

(2) Install the studs (19) in the carrier (11).

(3) Assemble the radial bearing (11, fig. 417) on the gear (10) hub, large radius of the bearing inner race toward the back of the gear.

(4) Install the spacer (22) on the gear hub against the bearing with the chamfer of the spacer away from the housing.

(5) Position the gear assembly in the carrier and block up to hold in place.

(6) Install the key (13) in the shaft (21). Inspect entering end of cross shaft and remove any nicks or burs. Coat the outside of the shaft and the bore of the gear with a heavy lubricant.

(7) Position the carrier in a hydraulic press, thru-shaft chamber down, with the gear supported on a suitable sleeve.

(8) Aline the key in the shaft with the keyway in the gear hub and press the shaft firmly against the gear, bearing, and spacer. Continue pressing operation to exert 10- to 20-tons pressure in excess of that required for secure assembly.

Note. Begin the assembly operation in the press, making sure the parts are properly alined. Press the parts together about one-quarter to three-eighth inch, then relieve the press pressure to permit them to realine themselves to prevent distortion and damage. Continue the pressing operation until the parts are correctly assembled.

(9) Install the shims (14) (which control gear position) over the shaft cage studs.

(10) Apply graphite lubricant to the shaft tapered bearing journal and assemble the inner and outer bearing cones (17).

(11) Install the bearing cage (15) and bearing assembly in the carrier, pressing against the outer bearing cone. Be sure the oil holes in the cage are properly alined with the oilholes in the carrier. Install the washer (18) and secure with cap screws (19) and lockwire (20).

(12) Position the gasket (17, fig. 415) and bearing cage cover (18) on the studs (19) and secure with lockwashers (2) and nuts (20).

(18) Measure shaft bearing preload torque (fig. 419). Wrap strong cord around the pinion and pull on horizontal line with a pound scale. The preload torque specifica-

tion for tapered roller bearings, mounted close together in the bearing cage, is 5- to 15-pounds-inch (rear rotating pounds pull, not starting pounds pull). Add shims between cover and cage to decrease or remove shims to increase shaft bearing preload torque.

(14) Press bearing cups (8 and 29, fig. 417) in the bearing cage (9) firmly against the shoulder.

(15) Press the bearing (24) against the shoulder of the thru-shaft (23).

(16) Lubricate all bearing journals only with a few drops of engine oil and press the bearing cone (28) on the pinion (27). Install the cage and cup assembly and bearing cone (7). Rotate the cage assembly to assure normal bearing contact.

(17) Install and tighten the adjusting nut (6) to 1000 to 1200 pounds-foot pressure with a torque wrench. Install the lock (5). Install and tighten the jamnut.

(18) Carefully tap the pinion, bearing cage, and thru-shaft assembly in place. Install and tighten four cap screws over flat washers to hold the pinion cage assembly firmly in place while checking hypoid gear tooth contact

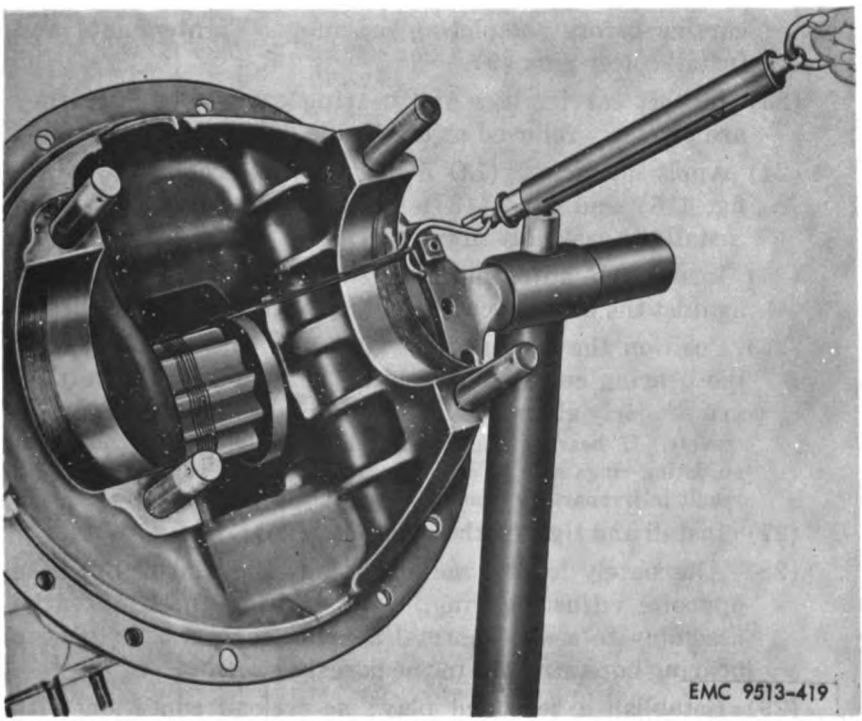


Figure 419. Measuring shaft bearing preload.

(fig. 420). Alter shim packs under cross-shaft bearing cage and pinion bearing cage to secure correct gear tooth contact. Remove cap screws and washers.

(19) Install oil seals (13, fig. 415) in covers (14 and 28). Lubricate seals. Position gaskets (12 and 29) on the carrier. Install the spacer (25, fig. 417) on the shaft. Install the covers (14 and 28, fig. 415) and secure with lockwashers (10 and 15) and cap screws (16 and 27).

(20) Position the gasket (6) and cover (7) on the carrier and secure with lockwashers (10) and cap screws (9).

(21) Press the bearing cones (3, fig. 416) firmly against the cases (4). Coat inside of case and all differential parts with lubricant (LO 5–9513–3).

(22) Assemble case and gear (13). Install thrust washers (5), side gears (6), spider gears (10), thrust washers (12), and spider (7). Note case alinement marks and assemble opposite case half. Hold assembly together with four bolts (14) and nuts (8) and check for free rotation of parts. Install remaining differential case bolts so heads are locked by machined relief in case half. Be sure case halves are assembled to gear so there is adequate nut clearance. Check clearance in carrier before completing assembly. Tighten nuts and install cotter pins (9).

(23) Inspect carrier legs and bearing caps to be sure they are properly relieved at the inside diameter parting line.

(24) Apply lubricant (LO 5–9513–3) to bearing cups (2, fig. 416) and cones (3). Position cups over cones and install the assembly in the carrier.

(25) Insert the adjusting rings (1) and turn handtight against the bearing cups.

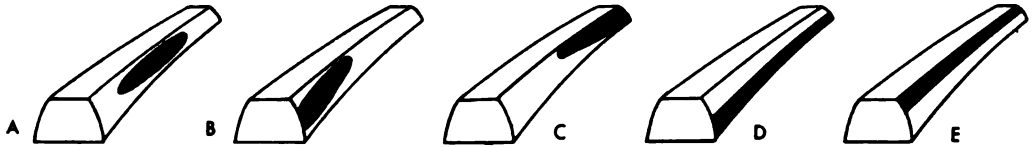
(26) Position the bearing caps (21, fig. 415) in place over the bearing cups and adjusting rings, making sure they are properly alined.

Note. If bearing caps do not seat easily and correctly, the adjusting rings may be cross threaded. Forcing caps in place will result in irreparable damage to the carrier and caps.

(27) Install and tighten the stud nuts (25).

(28) Alternately loosen one adjusting ring and tighten the opposite adjusting ring, while turning the differential assembly to assure normal bearing contact and to keep bearing cups straight in the bores.

(29) Establish a zero end play; no-preload condition with a dial indicator. Tighten the adjusting rings 1¼ to



CORRECT TOOTH CONTACT

SHOWS BLUE OVER TWO-THIRDS OF TOOTH (CENTERED).

INCORRECT TOOTH CONTACT

SHOWS BLUE AT HEEL OF TOOTH–CAUSES TOOTH BREAKAGE.

TO CORRECT, MOVE BEVEL GEAR (2) TOWARD PINION (1). BACK PINION AWAY FROM GEAR TO SECURE CORRECT BACKLASH. THIS IS DONE BY:

REMOVING SHIMS AT (3), ADDING SHIMS AT (4), & ADDING SHIMS AT (5).

INCORRECT TOOTH CONTACT

SHOWS BLUE AT TOE OF TOOTH – CAUSES TOOTH BREAKAGE.

TO CORRECT, MOVE BEVEL GEAR (2) AWAY FROM PINION (1). MOVE PINION TOWARD BEVEL GEAR TO SECURE CORRECT BACKLASH. THIS IS DONE BY:

ADDING SHIMS AT (3), REMOVING SHIMS AT (4), & REMOVING SHIMS AT (5).

INCORRECT TOOTH CONTACT

SHOWS BLUE AT FLANK OF TOOTH – GEARS WILL BE NOISY.

TO CORRECT, MOVE PINION (1) AWAY FROM GEAR (2). MOVE GEAR TOWARD PINION TO SECURE CORRECT BACKLASH. THIS IS DONE BY:

ADDING SHIMS AT (5), REMOVING SHIMS AT (3), & ADDING SHIMS AT (4).

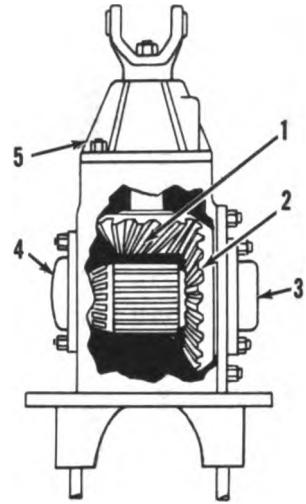
INCORRECT TOOTH CONTACT

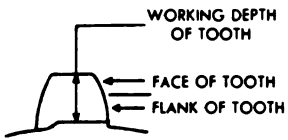
SHOWS BLUE AT FACE OF TOOTH–GEARS WILL BE NOISY.

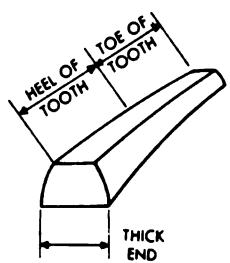
TO CORRECT, MOVE PINION (1) TOWARD GEAR (2). MOVE GEAR AWAY FROM PINION TO SECURE CORRECT BACKLASH. THIS IS DONE BY:

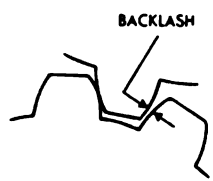
REMOVING SHIMS AT (5), ADDING SHIMS AT (3), & REMOVING SHIMS AT (4).

NOTE: ALWAYS ADD THE SAME NUMBER OF SHIMS UNDER (3) OR (4) AS IS REMOVED FROM THE OPPOSITE SIDE. THIS KEEPS THE SPUR PINION BEARING CORRECTLY ADJUSTED, AND MOVES THE BEVEL GEAR SIDEWAYS.









① BEVEL PINION
② BEVEL GEAR
③ SPUR PINION BEARING COVLR
④ SPUR PINION BEARING CAP
⑤ BEVEL PINION BEARING CAGE

EMC 9513-420

Figure 420. Inspection and adjustment of bevel gear and bevel pinion.

2½ notches (total for both nuts) tight to correctly preload the bearings.

(30) Install the locks (22) and cap screws (23). Lock all parts in place with lockwire (24).

b. Installation.

(1) Assemble the rear axle (par. 413*a*).

(2) Install the rear axle assembly (par. 413*b*).

Section XXVIII. FRONT AXLE AND DIFFERENTIAL

417. Description

The front axle is a double-reduction, full-floating type driving unit. The double reduction is accomplished by a hypoid pinion and gear for the first reduction and widefaced helical spur pinion and gear for the second reduction. Both gear sets are mounted on tapered roller bearings. Power is transmitted to the front axle from the engine through the transfer case and a drive shaft. Constant velocity type universal joints transmit power from the axle to the driving wheels and permit the wheels to be turned for steering while driving.

418. Front Axle Removal and Disassembly

a. Removal.

(1) Locate the crane-carrier on a level spot, block the rear wheels securely, and pull the emergency brake hand lever to the full on position.

(2) Drain the compression tanks and disconnect the air-brake lines at the front axle assembly.

(3) Disconnect the drag link from the steering arm.

(4) Remove the front axle springs (par. 284*b*(1)).

(5) Place a support under the differential housing, just forward of the drive shaft yoke. Disconnect the drive shaft from the front axle.

(6) Roll the axle assembly from beneath the crane-carrier.

b. Disassembly.

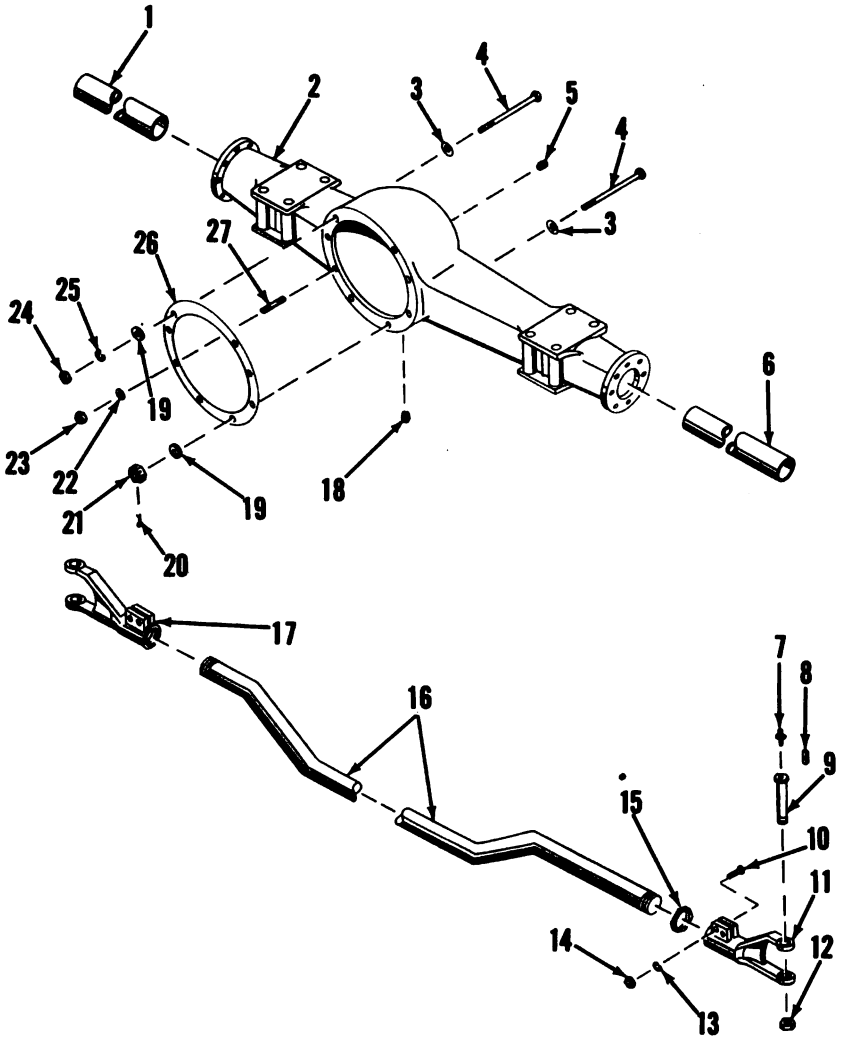
(1) Drain the lubricant from the front axle assembly (LO 5–9513–3).

(2) Remove the brake cylinders (par. 288*b*(1)), slack adjusters (par. 289*b*), and front axle bearings and hub (par. 304*a*).

(3) Remove the brake assembly (par. 300*b*).

(4) Remove the bolt lockpins (8, fig. 421). Remove the nuts (12). Using a soft drift, drive out the yoke bolts (9). Remove the tie rod (16) assembly.

(5) Remove the nuts (14, fig. 422), lockwashers (13), and

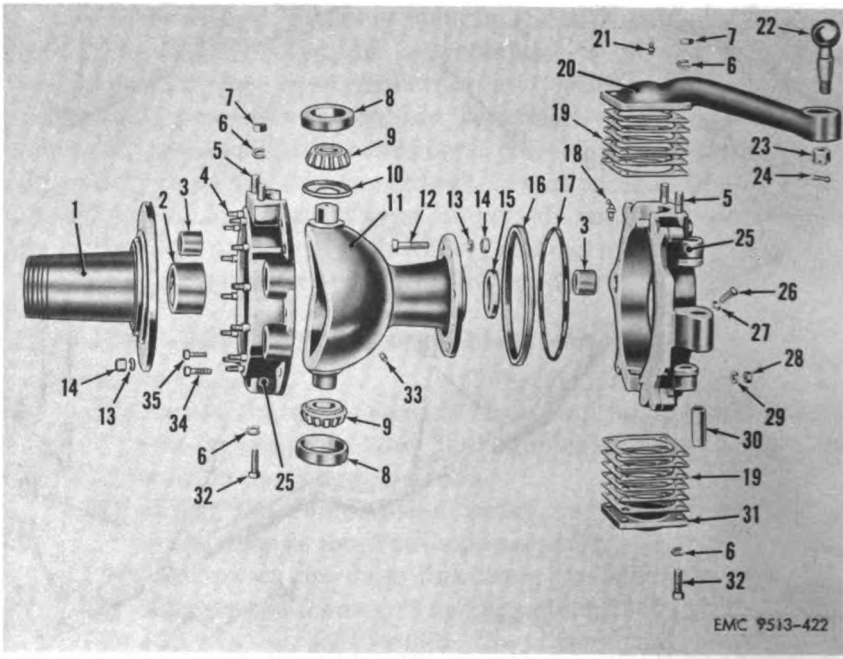


1	Housing tube—short	15	Locknut
2	Housing	16	Tie rod
3	Washer (4 rqr)	17	Tie rod yoke
4	Thru-bolt (4 rqr)	18	Plug
5	Plug	19	Washer (4 rqr)
6	Housing tube—long	20	Cotter pin (2 rqr)
7	Lubrication fitting (2 rqr)	21	Nut (2 rqr)
8	Lockpin (2 rqr)	22	Lockwasher (8 rqr)
9	Yoke bolt (2 rqr)	23	Nut (8 rqr)
10	Cap screw (4 rqr)	24	Nut (2 rqr)
11	Tie rod yoke	25	Lockwasher (2 rqr)
12	Nut (2 rqr)	26	Gasket
13	Lockwasher (4 rqr)	27	Stud (8 rqr)
14	Nut (2 rqr)		

Figure 421. Front axle housing and tie rod, exploded view.

cap screws (12) holding the knuckle assembly (11) to the axle housing. Tap the upper inside of the flange assembly and the unit will separate from the axle housing. Repeat on opposite side.

(6) Attach an auxiliary lifting device to the differential carrier. Remove the stud nuts (23, fig. 421) and lockwashers (22). Remove the nuts (24), lockwashers (25), and washers (19) from the top thru-bolts (4). Remove the cotter pins (20), nuts (21), and washers (19) from the bottom thru-bolts (4). Remove the thru-bolts



1 Steering knuckle (2 rqr)
2 Steering knuckle bushing (2 rqr)
3 Brake shaft bushing (4 rqr)
4 Threaded stud (24 rqr)
5 Threaded stud (4 rqr)
6 Lockwasher (16 rqr)
7 Nut (4 rqr)
8 Bearing cup (4 rqr)
9 Bearing cone and roller (4 rqr)
10 Grease retainer (2 rqr)
11 Knuckle assembly (2 rqr)
12 Cap screw (16 rqr)
13 Lockwasher (30 rqr)
14 Nut (30 rqr)
15 Oil seal (2 rqr)
16 Packing (2 rqr)
17 Retaining ring (2 rqr)
18 Lubrication fitting (2 rqr)
19 Shim (24 rqr)
20 Steering arm
21 Lubrication fitting (2 rqr)
22 Steering arm ball
23 Nut
24 Pin
25 Knuckle flange (lh and rh rqr)
26 Stop screw (2 rqr)
27 Nut (2 rqr)
28 Flange bolt nut
29 Flange bolt lockwasher
30 Bushing (2 rqr)
31 Cap (3 rqr)
32 Cap screw (12 rqr)
33 Plug (4 rqr)
34 Flange bolt
35 Flange screw

Figure 422. Steering knuckle, exploded view.

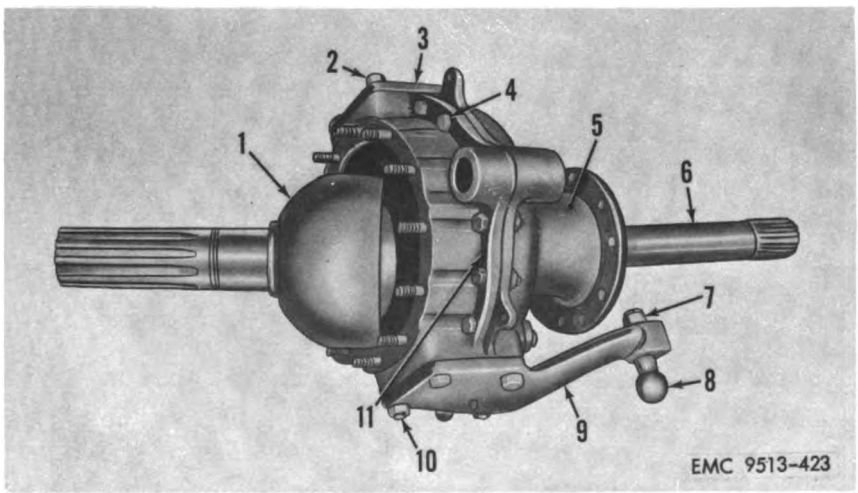
(4) with washers (3) from the differential and axle housing (2). Lift the carrier from the housing. Remove the gasket (26). Lower the carrier to the working area.

(7) Remove the nuts (14, fig. 422) and lockwashers (13) holding the steering knuckle (1) to the knuckle flange (25). Tap lightly with a soft hammer to loosen it on the studs (4), and then pry it off with a screwdriver.

(8) Withdraw the universal joint assembly (1, fig. 423) and attached axle shaft (6) from the knuckle flange and trunnion socket (5) assembly.

(9) The steering arm (9) is on the lefthand trunnion socket assembly, opposite the lower knuckle bearing cap (3). The right hand trunnion socket assembly has upper and lower knuckle bearing caps. Remove the nuts (10) and lockwashers, which hold the front axle steering arm to the knuckle flange (11). Lift off the steering arm. Remove the cap shims from the studs. Tie the shims together and tag them to assure correct reassembly.

(10) Place the knuckle flange assembly in a vise. Remove the cap screws (2) from the lower knuckle bearing cap (3). Remove the cap and lift off the knuckle bearing cap shims. Tie the shims together and tag them to



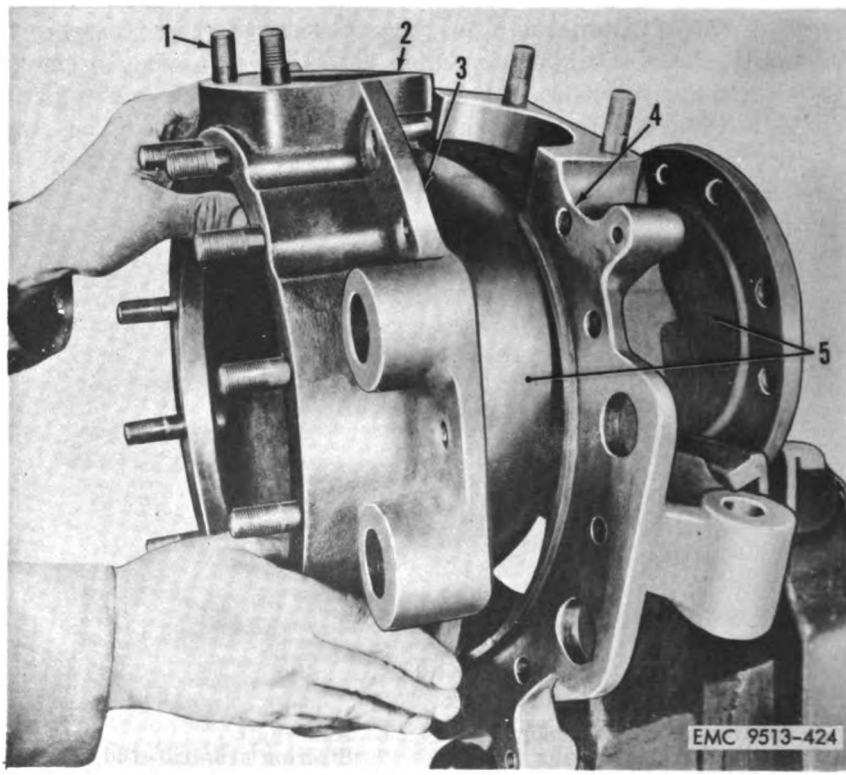
1 Universal joint assembly
2 Lower knuckle bearing cap screw
3 Lower knuckle bearing cap
4 Flange bolt
5 Trunnion socket
6 Axle shaft
7 Steering arm ball stud nut
8 Steering arm ball stud
9 Front axle steering arm
10 Upper cap stud nut
11 Knuckle flange

Figure 423. Trunnion socket assembly partially disassembled.

assure correct assembly. Remove flange (11), bolts (4), nuts, and lockwashers holding trunnion socket to the knuckle flange. Tap the outer half (3, fig. 424) of the knuckle flange assembly with a soft hammer until the two halves can be separated. Lift out the trunnion socket (5). Remove the packing (16, fig. 422) and retaining ring (17) from the inner half of the knuckle flange assembly.

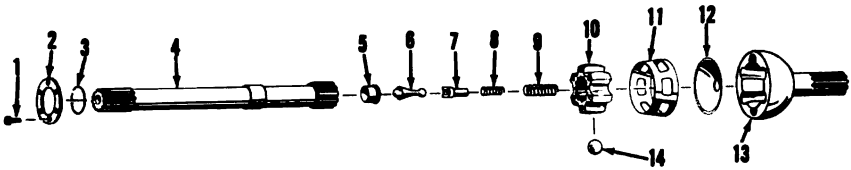
(11) Using a screwdriver, pry off the upper and lower bearing cups (8). Using a soft drift and hammer, tap the upper and lower bearing cones (9) from the knuckle (11). Lift off the grease retainer (10). Pry the drive shaft oil seal (15) from the hub of the knuckle (11).

(12) The axle shaft (4, fig. 425) is fastened to the universal joint assembly by a retainer (2). The retainer slips over the axle shaft and is fastened to the inner race



1 Upper knuckle bearing cap stud
2 Upper knuckle bearing cup
3 Outer half of knuckle flange
4 Inner half of knuckle flange
5 Trunnion socket

Figure 424. Removing trunnion socket from knuckle flange.



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1 Screw (12 rqr)
2 Axle shaft retainer (2 rqr)
3 Spacer ring (2 rqr)
4 Axle shaft
5 Pilot pin seat (2 rqr)
6 Pilot pin (2 rqr)
7 Pin plunger (4 rqr)
8 Pilot plunger spring (4 rqr)
9 Pilot pin spring (4 rqr)
10 Inner race (2 rqr)
11 Ball cage (2 rqr)
12 Cage pilot (2 rqr)
13 Outer race (2 rqr)
14 Ball (12 rqr)

Figure 425. Axle shaft and universal joint, exploded view.

(10) by screws (1). Remove the screws and lift off the axle shaft, with the shaft retainer. Use a screwdriver to pry out the pilot pin seat (5), which is thumb-pressed into the universal joint end of the axle shaft.

(13) With the universal joint assembly clamped in a vise, pry off the spacer ring (3). Lift out the pilot pin (6). Tilt the inner race (3, fig. 426) to one side, to permit removal of any one ball (4). Revolve the cage and remove the remaining balls. Rotate the cage to bring the cage pilot to the top and lift off the pilot (5). Rotate the cage and inner race until the inner race slips into one of the two vise slots of the cage, thus permitting removal of the inner race. Remove the inner race and lift out the cage. Tilt the outer race (13, fig. 425) and the pin plungers (7) and springs (8 and 9) will drop out.

Caution: Do not attempt to force any parts. Manipulate the balls, pilot, inner race, and cage until they can be freely removed.

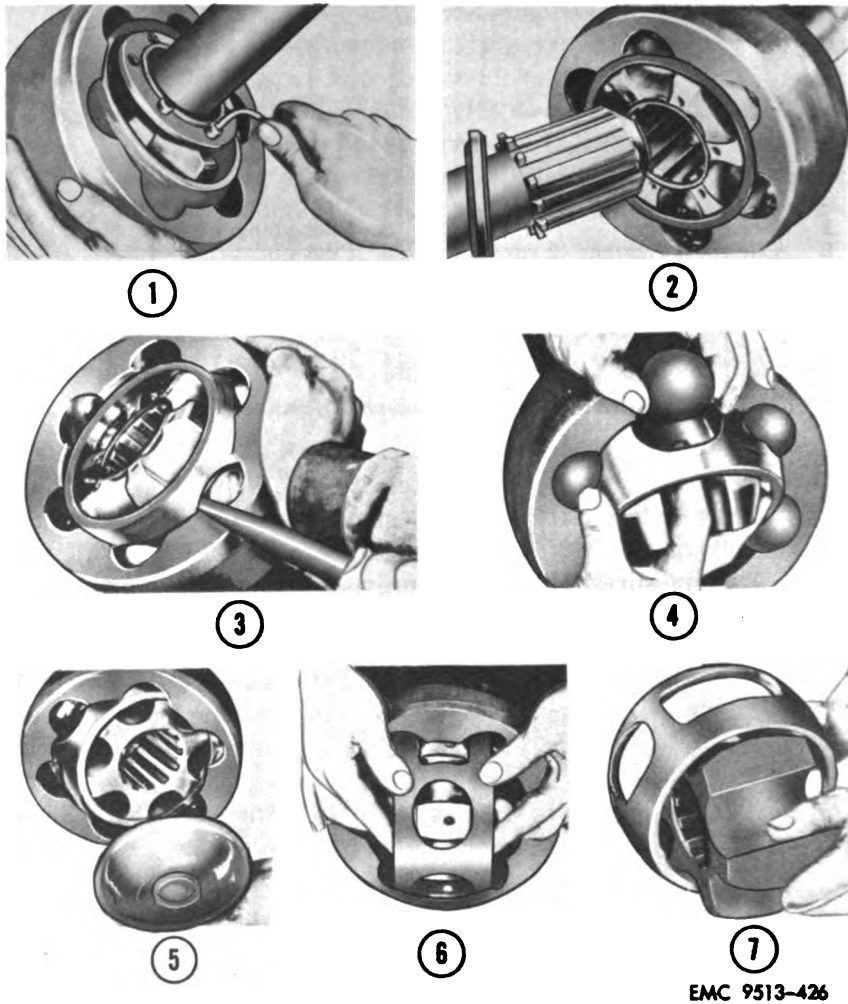
419. Front Axle Inspection and Repair

Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

a. Inspect the shafts (par. 319) and bearings (par. 316).

b. Inspect the axle housing and knuckle flange for cracks, breaks, and distortion. Weld small cracks in the axle housing. Replace the knuckle assembly if cracked, broken, or distorted.

c. Inspect all threaded surfaces for damaged, corroded, or



1 Removing retaining screw
2 Removing axle shaft
3 Tilting inner race
4 Removing first ball
5 Removing pilot
6 Rolling out cage and inner race assembly
7 Removing inner race

Figure 426. Disassembling universal joint.

stripped threads. Replace parts having damaged, corroded, or stripped threads.

d. Inspect all parts for good condition. Replace parts not in good condition. Replace gaskets and oil seals.

420. Front Axle Reassembly and Installation

a. Reassembly.

(1) Clamp the shaft of the universal joint outer race (13, fig. 425) in a vise. Drop the pin plunger (7), with

its encasing springs (8 and 9), into the outer race with the curved socket end of the plunger facing upward. Place the ball cage (11) in the outer race. The two elongated slots of the cage must fit down over opposite ribs of the outer race. Rotate the cage to vertical position and insert the inner race (10) by lining up any two opposite ribs of the inner race with the two elongated slots in the cage, and rotating the inner race to position in the cage.

Caution: Exercise extreme care in this assembly. Do not force or jam parts together. They will slip together easily when properly installed.

(2) With the shaft of the outer race still clamped in the vise, rotate the cage (11) and inner race (10) so that the holes provided in the inner race for the screws (1) face down. Place the cage pilot (12) face down on the cage and roll all internal parts one-half turn to normal position. The pilot should be at the bottom and the screw holes at the top. Pack the entire assembly with lubricant (LO 5–9513–3).

(3) With the assembly in the vise, tilt the inner race and cage, using finger pressure. This will bring one of the ball sockets of the cage in line with one of the six raceways in the outer race, and toward the top sufficiently to allow one ball (14) to be dropped into place. Tilt the inner race and cage to the other five positions in turn and install the remaining balls.

(4) With the assembly still in the vise, drop the pilot pin (6) into the assembly, small end down, so that it will seat on the head of the pin plunger (7). Place the spacer ring (3) on the inner race. Thumb-press the pilot pin seat (5) into the universal joint end of the axle shaft (4), then insert the axle shaft into the inner race. Place the retainer (2) over the axle shaft and in position against the inner race. Install and tighten the screws (1).

(5) Place the grease retainer (10, fig. 422) on the upper knuckle bearing pin, with the retainer opposite the oilhole in the knuckle (11). Using a soft hammer, tap the upper and lower bearing cones (9) on the knuckle bearing pins. The taper of the cones must slant away from the socket. Install the oil seal (15) in the hub of the knuckle.

(6) Place the inner half of the knuckle flange (25) on a bench. Insert a new packing (16) in the groove and

clamp in place with the retaining ring (17). Place the knuckle (11), wide face down, on a bench and slip the inner half of the knuckle flange over the knuckle. Lift as a unit and clamp the two parts in a vise. Place the outer half of the knuckle flange in position on the knuckle so the two halves of the flange meet around the upper and lower bearing cones. Install four of the flange bolts (34), lockwashers (29), and nuts (28). Tighten the nuts just enough to hold the two halves in position. Pack the upper and lower bearing cones (9) with lubricant (LO 5–9513–3). Tap the upper and lower bearing cups (8) into position. Install the remaining flange bolts (34), lockwashers (29), and nuts (28) and tighten securely.

(7) Position the shims (19) on the studs (5). These were tagged at disassembly and should total approximately 0.045-inch thickness required for correct assembly. Position the steering arm (20) on the studs and secure with lockwashers (6) and nuts (7).

(8) Remove the knuckle flange assembly from the vise and place it on a bench. Install the lower cap (31), placing between it and the flange assembly the shims which were removed and tagged at disassembly. Add shims to decrease resistance to turning and remove shims to increase resistance to turning. These should total about 0.045-inch thickness. Secure the caps with lockwashers (6) and cap screws (32).

(9) Clamp the knuckle flange assembly in a vise. Pack the inside of the knuckle with lubricant (LO 5–9513–3). Slide the universal joint assembly (1, fig. 423), axle shaft end first, part way into the wide end of the knuckle flange assembly (11). Apply lubricant to the universal joint assembly and push the assembly the rest of the way into position.

(10) Place the steering knuckle (1, fig. 422) over the universal joint shaft and against the knuckle flange (25). Make sure the keyway in the outer end of the steering knuckle is in line with the steering arm. Secure the steering knuckle with lockwashers (13) and nuts (14).

(11) Place a $^{15}/_{16}$-inch socket wrench, with torque wrench handle, on one of the stud nuts (7) which hold the steering arm (20) to the knuckle flange assembly (25). Then turn the knuckle flange assembly back and forth on the knuckle. Torque resistance to the turning motion, shown on the torque wrench scale, should be 50 to 75

pounds. If resistance is more than 75 pounds, add shims (19) under the steering arm (20) and cap (31). If resistance is under 50 pounds, remove shims (19) to increase resistance. Replace steering arm and cap. Again test torque resistance to turning. Repeat the operation until correct torque resistance is obtained. Tighten all nuts, bolts, and cap screws.

(12) Position a new gasket (26, fig. 421) on the housing (2). Attach an auxiliary lifting device to the differential carrier. Carefully install the carrier on the housing. Install the thru-bolts (4) with washers (3) in the housing and carrier. Secure the top bolts with washers (19), lockwashers (25), and nuts (24). Secure the bottom bolts with washers (19), nuts (21), and cotter pins (20). Remove the lifting device. Install the lockwashers (22) and stud nuts (23). Tighten the nuts securely.

(13) Use an auxiliary lifting device to lift the knuckle assembly (11, fig. 422). Slide the axle shaft into the axle housing. Rotate the differential carrier front yoke slightly to mesh the splines of the axle shaft and differential. Secure the knuckle assembly to the housing flange with cap screws (12), lockwashers (13), and nuts (14).

(14) Assemble the tie rod (16, fig. 421), locknut (15), and tie rod yokes (11 and 17). Install the cap screws (10), lockwashers (13), and nuts (14) in the yokes. Position the yokes on the axle knuckle arms, install the yoke bolts (9) in the yokes and arms and secure with the bolt lockpin (8) and the nut (12). Adjust the toe-in (*c* page 840).

(15) Install the brake assembly (par. 300*d*).

(16) Install the front axle bearings and hub (par. 304*c*), slack adjusters (par. 289*c*), and brake cylinders (par. 288*b*(2)).

(17) Lubricate the front axle assembly (LO 5–9513–3). Attach the differential yoke to a rotary power source and test. Any undue noise will indicate faulty assembly, which must be checked step by step. If unit operates quietly and smoothly, it is ready for installation.

b. Installation.

(1) Roll the axle assembly to position under the crane carrier.

Warning: Before moving under the carrier, check supports holding carrier and make sure they are secure. Check that rear wheel blocking is in place.

(2) Install the front axle drive shaft.
(3) Install the front axle springs (par. 284*b*(5)).
(4) Connect the drag link to the steering arm.
(5) Connect the airbrake lines to the front axle assembly.

c. Adjustment.

(1) *Toe-in.* Toe-in is the amount the front wheels point inward from the back to the front of the wheels.

(*a*) *Test* (fig. 427). Position wheels straight ahead on level ground. Mark both tires at the front tire centerlines. Measure the distance between the lines at the center height of the wheels. Measure the distance between the centerlines at rear of the front wheels at center height. The difference between the front and the rear cross measurements determine the amount of toe-in. This must be one-sixteenth to one-eighth inch. Adjust if necessary ((*b*) below).

(*b*) *Adjustment* (fig. 428). Adjustment is made by lengthning or shortening the tie rod assembly (1). Disconnect the right hand yoke (3), and loosen the locknut (4) and the two binder bolts on each yoke. Swing the right hand yoke toward the rear of the carrier about 18 inches. Hold the right yoke from turning and give the center of the tie rod a complete turn

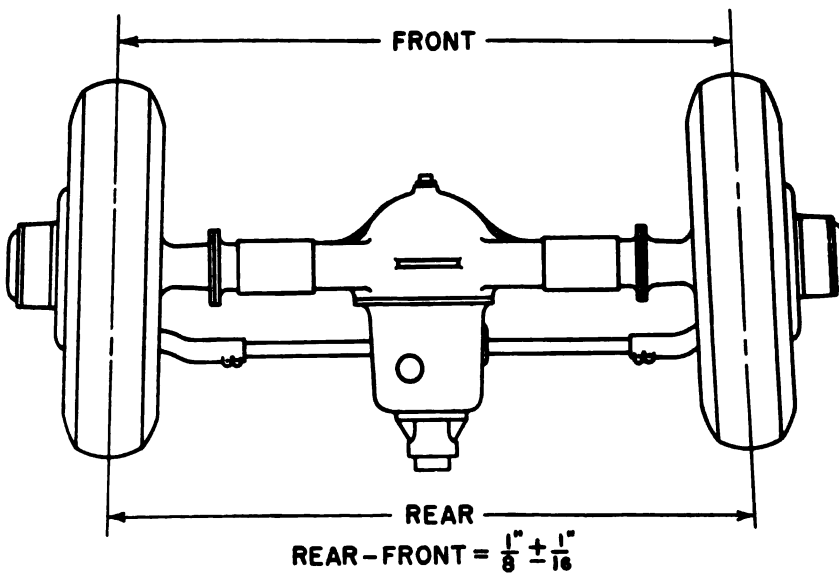
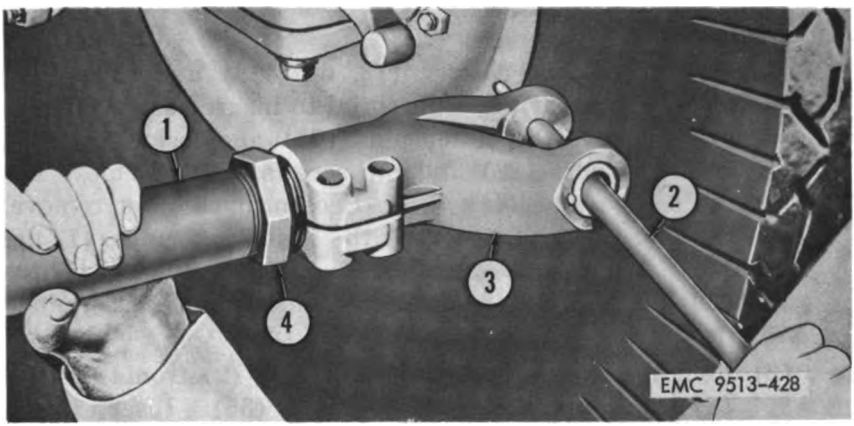


Figure 427. Toe-in of front wheels.

as if cranking a shaft. The effective length of the tie rod is increased 1/16-inch when the tie rod is cranked one turn in a clockwise direction, or decreased 1/16-inch when the tie rod is cranked one turn in a counterclockwise direction. When toe-in is correct, tighten the locknut and yoke binder bolts. Install the right yoke.

(2) *Caster.* Front axle caster is the inclination of the center line through the upper-and-lower steering knuckle sleeves toward the rear of the carrier. The caster angle of 5° is established by design and will be changed



1 Tie rod
2 Driftpin
3 Tie rod yoke
4 Locknut

Figure 428. Adjusting front wheel toe-in.

only by the shifting of the front axle on the springs or by the distortion of the chassis frame or springs. There is no adjustment for caster.

(3) *Camber.* Front-wheel camber is the outward inclination of the wheels as viewed from the front of the carrier, that is, the wheels are farther apart at the top than at the bottom. There is no adjustment for camber; however, loose wheel bearings, worn knuckle-sleeve bearings, bent steering knuckle or bent axle housing will affect camber.

(4) *Turning angle.* Front-wheel angle is the maximum angle through which the wheels may be turned from the straight-ahead position. This angle, 56°, is limited by turning stops that are welded after adjustment. To adjust, remove tack welds with a hammer. Loosen nut

and turn screw in or out, as required. When correct adjustment of 56° is obtained, tighten nuts securely. Tack-weld nut to steering knuckle and to screw.

421. Differential Removal and Disassembly

a. Removal.

(1) Remove the front axle assembly (par. 418*a*).

(2) Drain the lubricant from the front axle assembly (LO 5–9513–3).

(3) Remove the tie rod assembly, separate the knuckle assemblies and axle housing, and lift out the differential carrier (par. 418*b*(4), (5), and (6)).

b. Disassembly.

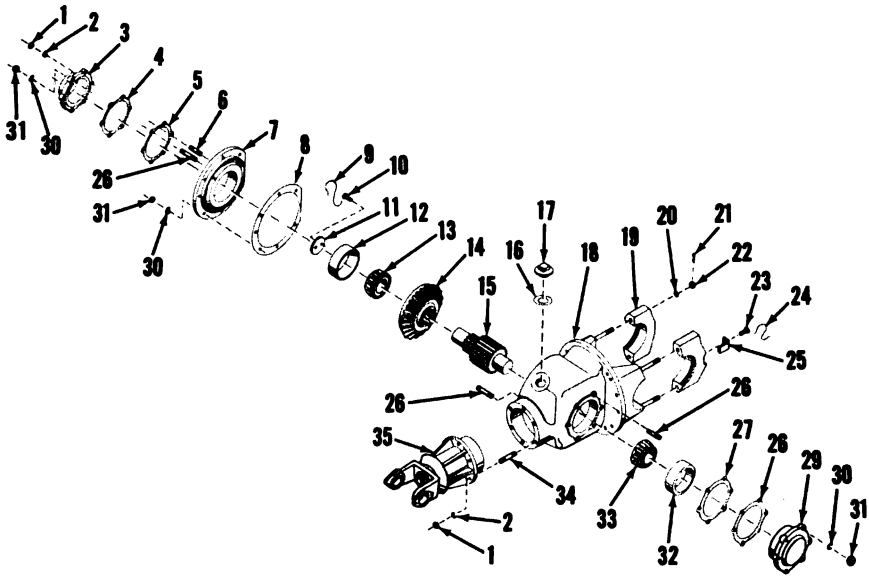
(1) Punchmark the carrier (18, fig. 429) and caps (19) on both sides at the differential to insure correct assembly. Remove the cotter pins (21) and lockwires (24) from the nuts (22) and cap screws (23). Remove the cap screws and locks (25). Loosen, but do not remove, the nuts (22). Screw out the adjusting rings (1, fig. 416). Remove the nuts (22, fig. 429) and lockwashers (20) and lift out the differential assembly. Disassemble the differential (par. 414*b*(3) and (4)).

(2) Remove the nuts (1) and lockwashers (2) from the studs (34) and bearing cage assembly (35). Insert puller screws in the holes tapped between the bearing cage studs. Tighten puller screws until the bearing cage is loosened enough to be removed. Remove the bearing cage assembly.

Caution: Do not pry the bearing cage loose, as this will damage the shims and machined surfaces and cause leaks.

(3) Place the bearing cage in a vise. Remove the cotter pin (2, fig. 430), nut (1), washer (3), and companion yoke (4), with dirt deflector (5), from the bevel pinion (15). Place bearing cage in an arbor press and press out the bevel pinion (15) and bearing cone (14). Lift the spacer (12) and shims (11) off the pinion. Using an arbor press, press the bearing cone (14) from the pinion (15). Place the bearing cage in a vise. Using a soft drift and hammer, drive the bearing cone (7), bearing cup (8), and oil seal (6) out of the cage. Using a puller, remove the bearing cup (13) from the cage.

(4) Remove the nuts (31, fig. 429), lockwashers (30), bearing cage (29), gasket (28), and shims (27) from the



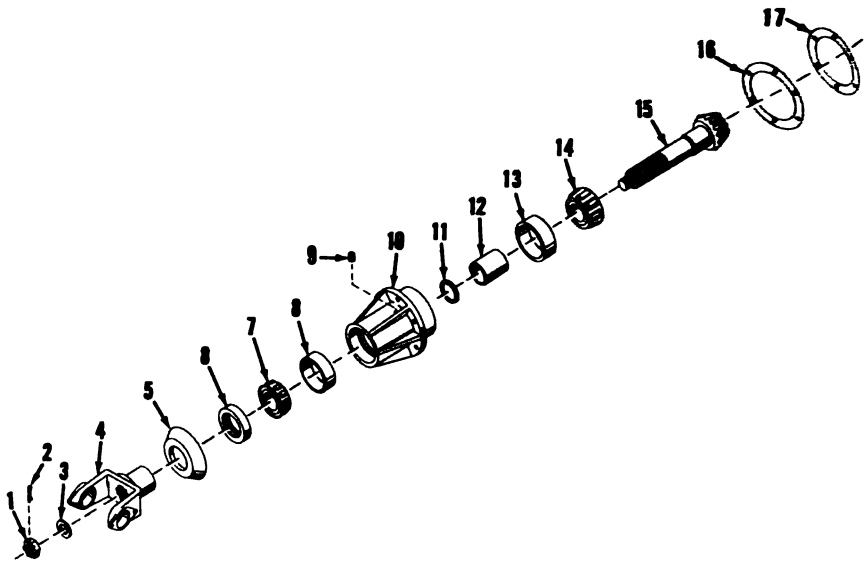
1	Nut (7 rqr)	19	Cap
2	Lockwasher (7 rqr)	20	Lockwasher (4 rqr)
3	Bearing cap	21	Cotter pin (4 rqr)
4	Gasket	22	Nut (4 rqr)
5	Shim (as rqr)	23	Cap screw (2 rqr)
6	Stud (6 rqr)	24	Lockwire (2 rqr)
7	Side cover	25	Lock (2 rqr)
8	Gasket	26	Stud (18 rqr)
9	Lockwire	27	Shim (as rqr)
10	Cap screw (2 rqr)	28	Gasket
11	Washer	29	Bearing cage
12	Bearing cup	30	Lockwasher (18 rqr)
13	Bearing cone	31	Nut (18 rqr)
14	Bevel gear	32	Bearing cup
15	Helical pinion	33	Bearing cone
16	Gasket	34	Stud (6 rqr)
17	Inspection hole cap	35	Bearing cage assembly
18	Differential carrier		

Figure 429. Front axle differential carrier.

carrier (18). Using a soft drift, drive the bearing cup (32) from the bearing cage.

(5) Remove the nuts (31), lockwashers (30), side cover (7), and gasket (8) from the carrier (18). Remove the nuts (1 and 31), lockwashers (2 and 30), gasket (4), and shims (5) from the side cover (7). Using a soft drift, drive the bearing cup (12) from the side cover. Remove the bevel gear (14) and helical pinion (15) from the carrier.

(6) Place the assembly in a vise. Remove the lockwire (9), cap screws (10), and washer (11) from the pinion (15).



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1	Nut	10	Bearing cage
2	Cotter pin	11	Shim (as rqr)
3	Washer	12	Spacer
4	Companion yoke	13	Bearing cup
5	Dirt deflector	14	Bearing cone
6	Oil seal	15	Bevel pinion
7	Bearing cone	16	Gasket
8	Bearing cup	17	Shim (as rqr)
9	Plug		

Figure 430. Pinion assembly, exploded view.

Remove the bearing cone (13) and bevel gear (14) from the pinion (15). Using a puller, pull the bearing cone (14, fig. 430) from the pinion (15).

422. Differential Inspection and Repair

Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

a. Inspect shafts (par. 319), and bearings (par. 316).

b. Inspect the gears for cracks, chipped or broken teeth, and evidences of wear. Replace a gear that is cracked or has chipped, broken, or worn teeth.

c. Inspect the case and covers for cracks, breaks, and distortion. Replace a case or cover if cracked, broken, or distorted.

d. Inspect all threaded surfaces for damaged, corroded, or stripped threads. Replace parts having damaged, corroded, or stripped threads.

e. Inspect all parts for good condition. Replace parts not in good condition. Replace gaskets and oil seals.

423. Differential Reassembly and Installation

a. Reassembly.

(1) Place the bevel gear (14, fig. 429), teeth upward, on a collar in an arbor press. Press the splined end of the pinion (15) into the gear. Press the bearing cone (33) on the pinion. The taper of the cone must slant away from the gear. Reverse the assembly in the press and press the bearing cone (13) on the pinion. The cone must seat against the splined shoulder of the pinion. Position the washer (11) on the pinion and secure with cap screws (10) and lockwire (9).

(2) Install shims (27) and gasket (28) on the studs (26). The shims should total about 0.045-inch. Be sure the oil groove holes in the gasket and shims line up with the oil groove holes in the bearing cage (29). Install the bearing cup (32) in the cage (29). Position the cage on the carrier (18) and secure with lockwashers (30) and nuts (31). Place the pinion assembly in the carrier. Install the bearing cup in the side cover (7). Install gasket (8) and side cover (7) on the carrier and secure with lockwashers (2) and nuts (1). Install the shims (5), gasket (4), and bearing cap (3) on the cover and secure with lockwashers (30) and nuts (31). Shims should total about 0.045-inch. Make sure the oil-holes in the gasket and shims line up with the oilholes in the cover.

(3) Rotate the bevel gear several revolutions before checking bearing preload. Check bearing preload by wrapping cable attached to a spring scale around the pinion. While pulling on a horizontal plane, note the reading on the spring scale. Bearing preload should be between 12- to 18-inch pounds. To obtain the bearing preload, multiply the radius of the pinion by the reading on the scale. Add shims to loosen, take out shims to tighten the bearing adjustment.

(4) Using a soft hammer, tap the bearing cup (8 and 13, fig. 430) in the bearing cage (10). Using an arbor press, press the bearing cone (14) on the bevel pinion (15). The taper of the cone slants away from the teeth of the pinion. Place the bearing cage in an arbor press. Install the spacer (12) and shims (11) on the pinion. The shims should total about 0.045-inch. Press the as-

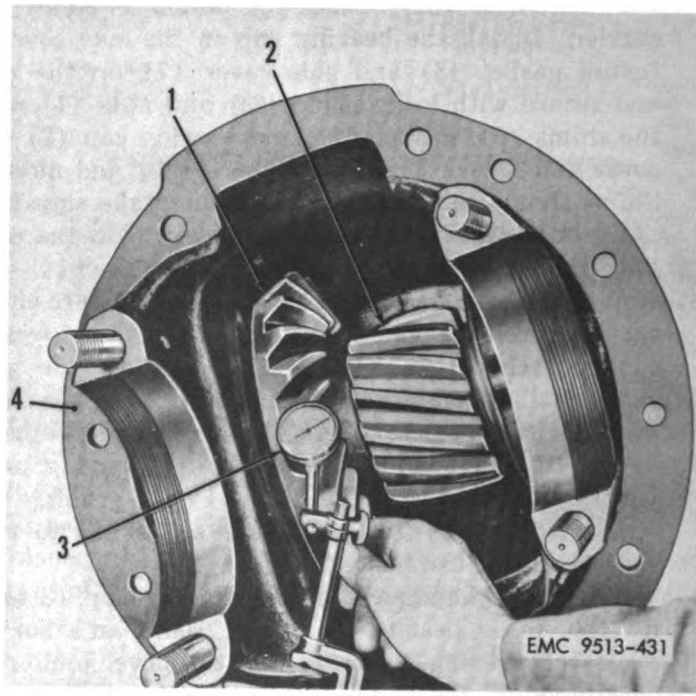
sembled pinion into the bearing cage. Press the bearing cone (7) on the pinion (15).

(5) Leave out the oil seal and press the companion yoke (4) on the pinion firmly, seating on the bearing cone (7). Install the washer (3) and nut (1) drawing down tight against the yoke. Check end play. The proper bearing drag is between 4- and 8-inch-pounds of torque. Remove shims (11) to increase drag and decrease end play. Add shims to decrease drag. When end play or drag is correct, remove the nut, washer, and yoke. Install the oil seal (6) and reinstall the yoke with dirt deflector, washer, and nut. Lock the nut with cotter pin (2).

(6) Install shims (17), gasket (16), and bearing cage assembly (35, fig. 429) and secure with lockwashers (2) and nuts (1). The shims should total 0.065-inch.

(7) Check tooth contact between the bevel pinion (15, fig. 430) and bevel gear (14, fig. 429). Refer to figure 420 for correct procedure.

(8) Check the clearance or backlash between the teeth of the bevel pinion and bevel gear. To check backlash,



1 Bevel gear
2 Spur gear
3 Dial indicator
4 Carrier

Figure 431. Testing backlash adjustment.

fasten a dial indicator (3, fig. 431) to contact a bevel gear tooth and set the indicator at zero. Rotate the bevel gear forward and back without turning the bevel pinion. A correct reading will show from 0.008- to 0.012-inch movement. If the movement is more than 0.012-inch, remove a shim (5, fig. 429) and add a shim of equal thickness under the bearing cage (29). Install the cap and cage. Tap the side to make sure the bevel gear has moved. Several adjustments may be necessary in order to obtain correct backlash.

(9) Reassemble and install the differential (par. 416*a*(21)–(30)).

b. Installation.

(1) Install the differential carrier, knuckle assemblies, and tie rod (par. 420*a*(12), (13), and (14)).

(2) Lubricate the front axle assembly (LO 5–9513).

(3) Install the front axle assembly (par. 420*b*).

Section XXIX. CARRIER FRAME

424. Equalizer

(fig. 432)

a. Removal and Disassembly.

(1) Remove the rear axle assemblies (par. 411*a*). Remove the cotter pins (12), nuts (11), washers (10), bolts (9), and support brackets (8 and 13).

(2) Remove the nuts (4), lockwashers (3), and bolts (4) from the collars (2) and shaft (1). Remove the collars and the felt washers (5). Remove the lubrication fittings (15).

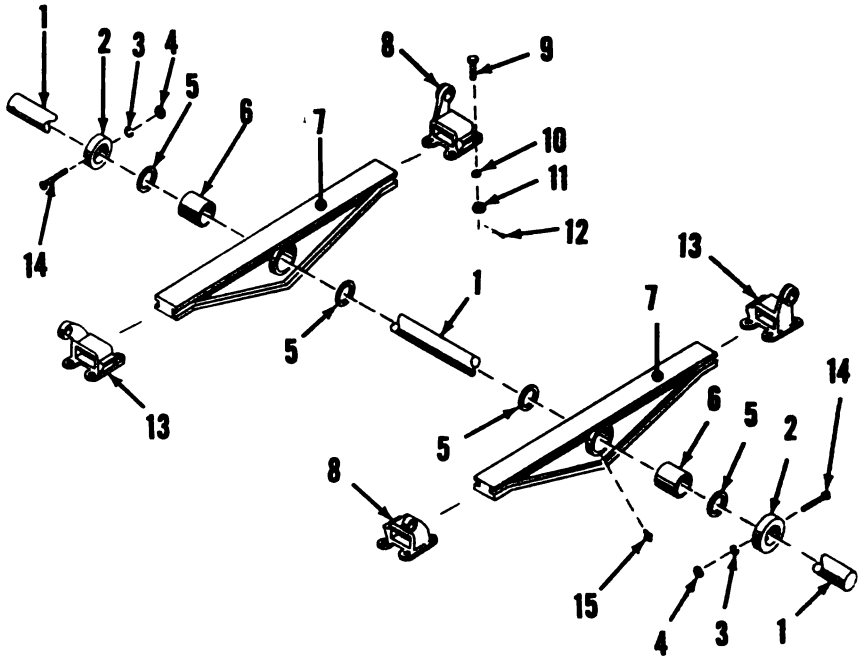
(3) Using an auxiliary lifting device, remove the equalizer (7) from the shaft (1). Remove the inner felt washers (5).

(4) Attach an auxiliary lifting device to the end of the shaft (1) and pull the shaft from the shaft brackets on the carrier frame.

(5) Using an arbor press, press the bushings (6) from the equalizers.

b. Inspection and Repair. Soak and wash all parts in an approved cleaning solvent and blow them dry with clean compressed air or wipe them off with a clean, lintless, and absorbent cloth. Remove all sediment, scale, or rust from all parts.

(1) Inspect the shaft, equalizers, and collars for cracks, breaks, and wear. Replace a shaft, equalizer, or collar if cracked, broken, or worn.



1	Shaft	9	Bolt (16 rqr)
2	Collar (2 rqr)	10	Washer (16 rqr)
3	Lockwasher, spring, std, ⅞ (2 rqr)	11	Nut (16 rqr)
4	Nut, regular, hex, ⅞–9 NC (2 rqr)	12	Cotter pin (16 rqr)
5	Washer, felt, 3½ ID x 4¼ OD x ⅜ (4 rqr)	13	Spring guide and support bracket (2 rqr)
6	Bushing (2 rqr)	14	Bolt, machine, sq hd, ⅞–9 NC x 6½ (2 rqr)
7	Equalizer (2 rqr)	15	Lubrication fitting, ⅛ x 30° (2 rqr)
8	Spring guide and support bracket (2 rqr)		

Figure 432. Equalizers and shaft, exploded view.

(2) Inspect all parts for good condition. Replace parts not in good condition. Replace the felt washers.

c. *Reassembly and Installation.*

(1) If removed, press the bushings (6) into the equalizers (7).

(2) Attach an auxiliary lifting device to the shaft (1), lift, and install the shaft in the carrier frame brackets.

(3) Install a felt washer (5) on each end of the shaft. Using an auxiliary lifting device, position the equalizers (7) on the shaft. Position support brackets (8 and 13) on the axle housings and secure with bolts (9), washers (10), nuts (11), and cotter pins (12).

(4) Position felt washers (5) and the collars (2) on the shaft. Install the bolts (14) and secure with lockwashers (3) and nuts (4).
(5) Install the lubrication fittings (15). Lubricate the shaft (LO 5–9513–3).
(6) Install the rear axle assemblies (par. 413*b*).

425. Carrier Frame
(fig. 433)

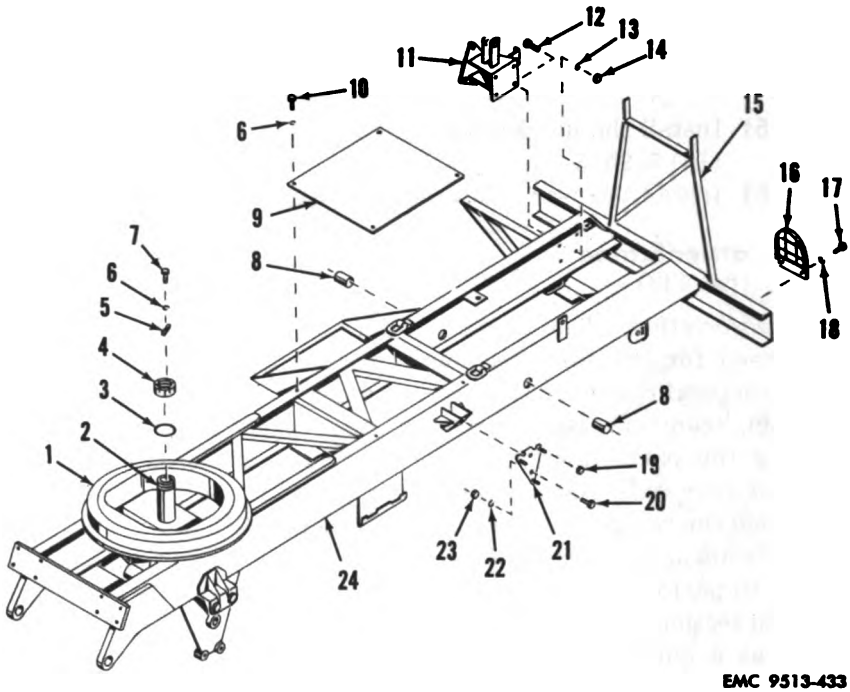
a. Description. The frame (24) is fabricated from steel members used for the siderails, bumpers, and cross members. It is the structural center of the carrier, supporting the engine, transmission, transfer case, axles, and other parts as well as maintaining the parts in alinement. Welded to the frame over the tandem rear axle unit is the center pin (2) and ring gear (1) on which the revolving frame mounts and rotates.

b. Removal and Installation. The removal and installation of items, to perform maintenance on the carrier frame, is dependent on the section to be serviced. The assemblies referenced here serve as a guide to uncover that section but may not be in the correct or complete sequence. Personnel will ascertain the proper procedure for the maintenance to be performed.

(1) Revolving frame (pars. 321 and 322).
(2) Remove bolts (17), lockwashers (18), and headlight guards (16).
(3) Carrier cab deck plate and instrument panel (par. 282).
(4) Carrier engine (par. 325).
(5) Steering gear (pars. 401 and 403).
(6) Remove nuts (14), lockwashers (13), bolts (12), and bracket (11).
(7) Remove cap screws (10), lockwashers (6), and cover (9).
(8) Transfer case (pars. 407 and 409)
(9) Outriggers and leveling jacks (par. 283).
(10) Spare tire and wheel (par. 309).
(11) Remove nuts (23), washers (22), bolts (20), and mounting plate (21).
(12) Front axle (pars. 418 and 420).
(13) Rear axles (pars. 411 and 413).

c. Alinement.

(1) The best measuring method of checking, known as X checking, of the frame rail alinement is simply an application of the principal that the diagonals of a true rectangle will be equal in length. The measuring device used to check alinement by this method is called a tram.



1 Ring gear
2 Center pin
3 Washer
4 Nut
5 Center pin key
6 Lockwasher, spring, std, ⅜ (5 rqr)
7 Screw, cap, hex hd, ⅜–16 NC x 1¼
8 Bushing (2 rqr)
9 Cover
10 Screw, cap, hex hd, ⅜–16 NC x 1 (4 rqr)
11 Bracket
12 Bolt, hex hd, regular, ¾–16 NF x 2 (4 rqr)
13 Lockwasher, spring, std, ¾ (4 rqr)
14 Nut, regular, hex, ¾–16 NF (4 rqr)
15 Boom support
16 Headlight guard (2 rqr)
17 Bolt, machine, hex hd, ½–13 NC x 1½ (4 rqr)
18 Lockwasher, spring, std, ½ (4 rqr)
19 Nut (3 rqr)
20 Bolt, hex hd, regular, ¾–16 NF x 1¾ (2 rqr)
21 Mounting plate
22 Washer, plain, steel, ¾ (2 rqr)
23 Nut, slotted, ¾–16 NF (2 rqr)
24 Frame

Figure 433. Carrier frame.

It is a telescoping tube equipped with an extension clamp which fixes it at the measurement of the diagonal for comparison with the other.

(2) Divide the frame into rectangles. Lay the tram at one diagonal of each rectangle and clamp it to the exact length of the diagonal. Move the tram across to the other diagonal for the same rectangle. If the diagonals of each rectangle do not measure the same length, the

frame is misalined within the area of that rectangle. Repeat this procedure until the location of any possible misalinement is established.

(3) If the tram is not available for checking and the damage to the frame is not extensive, cut a piece of metal or board slightly shorter than the exact distance between the frame rails. Move this piece along between the rails from one end of the frame to the other. If the slight interval between the piece and the rails increases at any point, the frame siderails are out of alinement. Use a straightedge to determine the exact location and extent of misalinement.

(4) Use a straightedge to check damaged panels, brackets, and angles.

d. Repair.

(1) Remove any mounted parts and accessories as necessary.

(2) Heat the twisted or bent pieces with an acetylene torch.

(3) Exert a strong force opposite to the direction of the damaging impact with a hydraulic jack. Push or pull with the jack to bend or spread. Be sure not to bend the metal farther than necessary to obtain proper alinement.

(4) Whenever possible, cut a steel strip that overlaps the damaged area on each side to an extent at least equal to the damaged area and not less than 18 inches on each side in any case. Weld the strip against the side of the damaged piece opposite the direction from which the damaging impact came. However, if it is necessary to add so much metal that the carrier may become unbalanced, the damaged part or welded subassembly should be replaced rather than repaired.

(5) If the frame is damaged to the extent that the metal has cracked apart, straighten and weld the damaged area together. It is necessary to install a reinforcing plate after welding cracks on any piece such as the frame rails or cross pieces upon which stress or strain will be exerted. Be sure that the reinforcing plates overlap to the fullest practical extent. If this is not done, strain and stress will crack the weld open.

(6) Clean and paint all welds with care as they are especially susceptible to rust and corrosion.

426. Revolving Frame and Deck Machinery

Points of measurement	Manufacturers' fits, limits, tolerances and/or dimensions Min (inches)	Desired (inches)	Max (inches)
Revolving base:			
Bronze bushing:			
Outside diameter	6.629	....	6.630
Inside diameter	6.012	....	6.014
Roller pins:			
Outside diameter	1.9335	....	1.9375
Roller pin bushings:			
Outside diameter	2.440	....	2.441
Inside diameter	1.944	....	1.946
	(⅛ in. allowable additional wear)		
Engine clutch shaft assembly:			
Clutch shaft (clutch end):			
Outside diameter	1.749	....	1.750
		(Taper to 1.460/1.461)	
No. of splines—keyed:			
Clutch shaft (gear end):			
Outside diameter	2.218	....	2.219
No. of splines—10			
Depth of spline	....	0.101	....
Pinion gear:			
Outside diameter	4.693	....	4.695
No. of teeth—16			
Depth of teeth	....	0.5393	....
Inside diameter	2.030	....	2.031
No. of splines—10			
Depth of spline	....	0.199	....
Jackshaft assembly:			
Jackshaft:			
Outside diameter	2.218	....	2.219
No. of splines—10			
Depth of spline	....	0.101	....
Pinion gear:			
Outside diameter	....	7.117	....
No. of teeth—26			
Depth of teeth	....	0.5392	....
Inside diameter	2.035	....	2.050
No. of splines—10			
Depth of spline	....	0.187	....
Gear:			
Outside diameter	23.553	....	23,555
No. of teeth—88			
Depth of teeth	....	0.5393	....
Inside diameter	2.030	....	2.031
No. of splines—10			
Depth of splines	....	0.199	....

Points of measurement	Manufacturers' fits, limits, tolerances and/or dimensions Min (inches)	Desired (inches)	Max (inches)
Idler shaft assembly (Independent boom hoist):			
Idler shaft:			
Outside diameter	1.7719	----	1.7722
Pinion:			
Outside diameter	6.528	----	6.530
No. of teeth—23			
Depth of teeth	----	0.5393	----
Inside diameter	3.3463	----	3.3473
Drive shaft assembly (Independent boom hoist):			
Drive shaft:			
Outside diameter	1.749	----	1.750
No. of splines—6			
Depth of splines	----	0.260	----
Gear:			
Outside diameter	13.343	----	13.345
No. of teeth—49			
Depth of teeth	----	0.5393	----
Inside diameter	1.492	----	1.493
No. of splines—6			
Depth of splines	----	0.260	----
A-frame assembly:			
A-frame sheaves:			
Outside diameter	----	10 15/16	----
Bore	2.4385	----	2.4395
Bushing:			
Outside diameter	2.440	----	2.441
Inside diameter	1.944	----	1.946
	(⅛ in. allowable additional wear)		
Shaft:	----	1 15/16	----
Outside diameter	----	1 15/16	----
Equalizer sheaves:			
Outside diameter	----	10 15/16	----
Bore	1.9375	----	1.9385
Bushing:			
Outside diameter	1.939	----	1.940
Inside diameter	1.444	----	1.446
	(⅛ in. allowable additional wear)		
Shaft:	----	1 7/16	----
Outside diameter	----	1 7/16	----
Horizontal intermediate shaft assembly:			
Pinion gear:			
Outside diameter	11.942	----	11.952
No. of teeth—45			
Depth of teeth	----	0.539	----
Inside diameter	2.292	----	2.294
No. of splines—20			
Depth of splines	0.291	----	0.300

Points of measurement	Manufacturers' fits, limits, tolerances and/or dimensions Min (inches)	Desired (inches)	Max (inches)
Bevel gears:			
Outside diameter	8.748	....	8.752
No. of teeth—26			
Depth of teeth	....	0.719	....
Bore	4.7238	....	4.7248
Hoist shaft assembly:			
Gear:			
Outside diameter	....	31.548	....
No. of teeth—122			
Depth of teeth	....	0.539	....
Inside diameter	2.588	....	2.590
No. of splines—10			
Depth of splines	0.348	....	0.370
Gear:			
Outside diameter	....	21.594	....
No. of teeth—83			
Depth of teeth	....	0.539	....
Bore	3.000	....	3.001
Front drum shaft assembly:			
Gear:			
Outside diameter	....	25.406	....
No. of teeth—98			
Depth of teeth	....	0.539	....
Inside diameter	2.9375	....	2.9385
Gear:			
Outside diameter	....	12.954	....
No. of teeth—49			
Depth of teeth	....	0.539	....
Bore	4.9365	....	4.9375
Idler gear shaft assembly:			
Shaft:			
Outside diameter	....	1 15/16	....
Gear:			
Outside diameter	....	17.528	....
No. of teeth—67			
Depth of teeth	....	0.539	....
Bore	....	2 7/16	....
Vertical intermediate shaft assembly:			
Shaft:			
Outside diameter	2.218	....	2.219
No. of splines—10			
Depth of splines	0.200	....	0.203
Gear:			
Outside diameter	....	6½	....
No. of teeth—24			
Depth of teeth	....	0.539	....
Inside diameter	2.035	....	2.050
No. of splines—10			
Depth of splines	0.169	....	0.204

Points of measurement	Manufacturers' fits, limits, tolerances and/or dimensions Min (inches)	Desired (inches)	Max (inches)
Bevel gear:			
Outside diameter		9.137	
No. of teeth—26			
Depth of teeth		0.719	
Inside diameter	2.030		2.031
No. of splines—10			
Depth of splines	0.188		0.209
Vertical swing shaft assembly:			
Shaft:			
Outside diameter	2.684		2.685
No. of splines—10			
Depth of spline	0.375		0.378
Gear:			
Outside diameter		25.500	
No. of teeth—100			
Depth of teeth		0.539	
Inside diameter	2.316		2.317
No. of splines—10			
Depth of spline	0.368		0.389
Swing pinion:			
Outside diameter		7 5/16	
No. of teeth—13			
Depth of teeth		1.0785	
Inside diameter	2.749		2.750
Independent boom hoist clutch shaft assembly:			
Bevel gear:			
Outside diameter	7.461		7.471
No. of teeth—21			
Depth of teeth		0.719	
Bore	3.5427		3.5437
Independent boom hoist worm shaft assembly:			
Shaft:			
Outside diameter brake wheel end.	2.9365		2.9375
No. of splines—10			
Depth of splines	0.3585		0.3615
Outside diameter at threads.		4.194	
No. of threads—1			
Depth of threads		0.722	
Outside diameter at gear.	2.218		2.219
No. of splines—10			
Depth of splines	0.200		0.203
Brake wheel:			
Outside diameter		11	
Inside diameter	2.588		2.590

Manufacturers' fits, limits, tolerances and/or dimensions

Points of measurement	*Min (inches)*	*Desired (inches)*	*Max (inches)*
No. of splines—10			
Depth of splines	0.348	—	0.365
Bevel gear:			
Outside diameter	7.461	—	7.471
No. of teeth—21			
Depth of teeth	—	0.719	—
Inside diameter	2.000	—	2.010
No. of splines—10			
Depth of splines	0.348	—	0.365
Bevel gear:			
Outside diameter	7.461	—	7.471
No. of teeth—21			
Depth of teeth	—	0.719	—
Inside diameter	2.000	—	2.010
No. of splines—10			
Depth of splines	0.020	—	0.031
Independent boom hoist drum shaft assembly:			
Drum shaft:			
Outside diameter	—	1 15/16	—
Bushings:			
Outside diameter	2.440	—	2.441
Inside diameter	1.944	—	1.946
	(⅛ in. allowable additional wear)		
Worm wheel:			
Outside diameter	—	11.553	—
No. of teeth—31			
Depth of teeth	—	0.722	—
Bore	3.750	—	3.752
Crane boom assembly:			
Boom point sheaves:			
Outside diameter	—	18	—
Bore	3.9357	—	3.9365
Boom hoist sheaves:			
Outside diameter		12 1/4	
Bore	—	2 7/16	—
Boom hoist sheave bushings:			
Outside diameter	2.627	—	2.628
Inside diameter	2.256	—	2.258
	(⅛ in. allowable additional wear)		
Fairlead assembly:			
Front casting bushing:			
Outside diameter	2.190	—	2.191
Inside diameter	1.700	—	1.702
	(⅛ in. allowable additional wear)		
Large sheave:			
Outside diameter	—	14⅝	—
Bore	3.263	—	3.264
Small sheaves:			
Outside diameter	—	11¾	—
Bore	3.263	—	3.264

Points of measurement	Manufacturers' fits, limits, tolerances and/or dimensions		
	Min (inches)	Desired (inches)	Max (inches)
Shovel boom assembly:			
Boom point sheaves:			
Outside diameter	....	18	....
Bore	3.9357	....	3.9365
Boom hoist sheaves:			
Outside diameter	....	10 15/16	....
Bore	....	2 5/8	....
Boom hoist sheave bushing:			
Outside diameter	2.627	....	2.628
Inside diameter	2.256	....	2.258
	(1/8 in. allowable additional wear)		
Shipper shaft bearing bushing:			
Outside diameter	5.124	....	5.125
Inside diameter	4.508	....	4.510
	(1/8 in. allowable additional wear)		
Shipper shaft assembly:			
Chain sprocket:			
Outside diameter	....	17.130	....
No. of teeth—29			
Depth of teeth	....	0.972	....
Bore	2.9375	....	2.9385
Dipper handle rock pinion:			
Outside diameter	....	7.912	....
No. of teeth—18			
Depth of teeth	....	3/8	....
Bore	2.9395	....	2.9405
Yoke bushings:			
Outside diameter	3.440	....	3.441
Inside diameter	2.944	....	2.946
	(1/8 in. allowable additional wear)		
Sheaves:			
Outside diameter	....	5 1/2	....
Bore	1.005	....	1.010
Crowd chain takeup assembly:			
Crowd sprocket:			
Outside diameter	....	6.44	....
No. of teeth—10			
Depth of teeth	....	0.8885	....
Bore	2.4385	....	2.4395
Crowd sprocket bushing:			
Outside diameter	2.440	....	2.441
Inside diameter	1.944	....	1.946
	(1/8 in. allowable additional wear)		
Dipper assembly:			
Dipper hinge bushing:			
Outside diameter	....	1 15/16	....
Inside diameter	....	1 29/64	....
	(1/8 in. allowable additional wear)		

Points of measurement	Manufacturers' fits, limits, tolerances and/or dimensions Min (inches)	Desired (inches)	Max (inches)
Padlock sheave:			
Outside diameter		16	
Bore	3.9357		3.9365
Padlock bushing:			
Outside diameter	2.440		2.441
Inside diameter	1.944		1.946
	(⅛ in. allowable additional wear)		
Electric dipper trip assembly:			
Dipper trip sheaves:			
Outside diameter		5½	
Bore	1.005		1.010
Hoe boom assembly:			
Boom foot bushings:			
Outside diameter	2.440		2.441
Inside diameter	1.944		1.946
	(⅛ in. allowable additional wear)		
Boom sheave:			
Outside diameter		16	
Bore		3 7/16	
Boom sheave bushing:			
Outside diameter	3.440		3.441
Inside diameter	2.944		2.946
	(⅛ in. allowable additional wear)		
Hoe mast assembly:			
Hoe mast sheaves:			
Outside diameter		18	
Bore	3.9357		3.9365
Mast hoist sheaves:			
Outside diameter		10 15/16	
Bore	2.4385		2.4395
Mast hoist sheave bushing:			
Outside diameter	2.440		2.441
Inside diameter	1.944		1.946
	(⅛ in. allowable additional wear)		
Hoe bucket and handle assembly:			
Hoe bail sheave:			
Outside diameter		17½	
Bore	4.7214		4.7224
Bridle sheave:			
Outside diameter		18	
Bore	3.9357		3.9365
Point pin handle bushings:			
Outside diameter	2.940		2.941
Inside diameter	2.444		2.446
	(⅛ in. allowable additional wear)		

Points of measurement	Manufacturers' fits, limits, tolerances and/or dimensions: Min (inches)	Desired (inches)	Max (inches)
Bail bucket bushing:			
Outside diameter	2.998	....	3.000
Inside diameter	2.450	....	2.452
	(⅛ in. allowable additional wear)		

427. Transmission

a. First Speed Sliding Gear.

Material	Forging: H.R.O.H.–8620–H
Number of teeth	45
Pitch	5–6
Pitch angle	20°
Number of splines	10
Spline chamfer	1/32 x 45°
Spline width	0.429 in.–0.426 in.
Outside diameter:	
after turning	9.294–9.284 in.
after grinding, minimum	9.280 in.
Width of teeth	1 5/16 in.
Width, overall	2 3/32 in.
Teeth chamfer	3/32 round bullet form
Rim, inside diameter, maximum	7 17/16 in. (both side)
Inside diameter, spline to spline, after grinding and broaching.	2.420–2.419 in.
Inside diameter, groove to groove, after broaching.	2.805–2.804 in.

b. Shifting Yoke Spring.

Material	Oil tempered spring steel
Carbon content	0.75 to 0.90
Outside diameter	7/16 in.
Free length	1½ in.
Compression	To 1 in., steady load of 40 to 50 lbs.
Compression requirement	Must compress to ⅞ in. before all coils are tight.
Number of coils	9
Closed ends	Ground square

c. Clutch Pedal Shaft.

Material	C. D. Bessemer S.A.E. 1112
Length	12¼ in.
Chamfer, both ends	3/32 x 45°
Stock size	1.000–0.998 in.
Groove diameter	13/16 in.
Groove angle	120°
Groove end key	Woodruff No. 607
Groove end key in shaft, overall height	1.098–1.088 in.
Groove end key center to end of shaft	½ in.
Groove center to end of shaft	1 in.
Groove width, bottom diameter	1/16 in.
Plain end key	Woodruff No. 807
Plain end key in shaft, overall height	1.120–1.110 in.

Plain end key center to end of shaft	5/8 in.
Plain end key angle off-center	7°

d. Main Shaft Fourth Speed Gear Washer.

Material	Steel, brightmanized, S.A.E. 4620–H
Stock size	2¾ in. ± 0.005 in.
Number of teeth	16
Pitch diameter	6
Pitch angle	20°
Outside diameter, at root	2.505–2.495 in.
Inside diameter:	
after boring	1.803–1.798 in.
after broaching	1.812–1.807 in.
Inside diameter, at root, after broaching.	2.055–2.045 in.
Thickness:	
after turning	0.310–0.305 in.
after grinding	0.295–0.293 in.
Chamfer, before grinding	1/32 x 45°

e. Main Shaft Gear Bushing.

Material	Steel backed bronze
Bore	2.3155–2.3150 in.
Width	1.737–1.717 in.
Wall thickness	0.070–0.067 in.
Fits:	
Press	2.441–2.440 in. hole
Hand push, go	2.4475 in. ring gage
Hand push, no-go	2.4455 in. ring gage
Chamfer	1/32 to 3/64 x 45°

f. Speedometer Gear Replacement.

Material	S.A.E. 1112
Stock size	2¼ in.
Width	15/16 in.
Inside diameter	1.760–1.755 in.

g. Low Reverse Idler Bearing Spacer.

Material	C. D. Seamless steel tubing
Thickness of wall	No. 11 BW gage (0.120 in.)
Stock size	1 13/16 in.

h. Low Reverse Idler Shaft.

Material	C.D.O.H.–S.A.E.–8622–H
Stock size	1.262–1.258 in.
Finish grind, diameter	1.246–1.245 in.
Tap	½–13 U.S. std.
Drill	27/64 in.
Counterbore	33/64 in., ¼ in. deep
Overall length	9 3/16 in.

i. Low Speed Reverse Idler Gear.

Material	H.R.O.H. WE–3620–H forging
Overall width	4.531–4.526 in.
Large gear, number of teeth	29
Large gear, pitch and angle	5–6 pitch 20° P.A.
Small gear, number of teeth	25
Small gear, pitch and angle	5–6 pitch 20° P.A.
Small gear, teeth width	1 11/32 in.

Large gear, teeth width	1⅛ in.
Large gear, diameter	6.115–6.105 in.
Small gear, diameter	5.405–5.395 in.
Inside diameter:	
after broaching	1.856–1.855 in.
after grinding	1.8725–1.8715 in.
Flange diameter	2½ in.
Chamfer, both ends	1/32 x 45°
Body hole	⅜ drill
Teeth chamfer, both gears	3/32–round bullet form

j. Main Shaft Gear Sleeve.

Material	S.A.E. 4620–H, brightmanized
Stock size	2¾ in. ± 0.005 in.
Outside diameter:	
after turning	2.335–2.330 in.
after grinding	2.3125–2.3120 in.
Inside diameter:	
after boring	1.990–1.985 in.
after grinding	2.0005–2.0000 in.
Flange outside diameter	2.740–2.730 in.
Width, after grinding	1.940–1.937 in.
Width, plain end to flange	1.751–1.748 in.
Flange thickness	0.201–0.198 in.

k. Clutch Shaft and Drive Gear.

Material	H.R.O.H. 8620–H forging
Overall length	12 3/16 in.
External teeth	21, helix angle 23°–25°, left hand, 6 pitch, 20° P.A. diametral plane, 6.539 pitch, 18°–28° P.A. normal plane.
Internal teeth	16, 6–8 pitch, 20° P.A.; must pass gage 2.675 P.D. and 2.838 O.D. with pilot in 2.430–2.424 hole before heat treating; teeth must not exceed these sizes after heat treat.
Chamfer	0.040–0.030 flat on acute angle of teeth, both ends.
External teeth diameter	3.878–3.868 in.
Internal teeth diameter	2.550–2.540 in.
Spline angle	36°
Spline radius	0.605 in.
Spline diameter:	
after turning	1.515–1.510 in.
after grinding	1.497–1.496 in.
Holes in external gear	3/32 drill
Hole angle	35°

l. Countershaft.

Material	H.R.O.H. S.A.E. 8620–H
Overall Length	18⅜ in.
Small gear:	
diameter	3.004–2.994 in.
teeth	13
pitch	5–6, 20° P.A.

Medium gear:
- diameter — 3.382–3.372 in.
- teeth — 15
- pitch — 5–6, 20° P.A.

Large gear:
- diameter — 4.420–4.419 in.
- teeth — 19
- pitch — 5–6, 20° P.A.

Keyways:
- number — 4
- width — 0.379–0.375 in.
- corner radius, maximum — 1/64 in.

Shaft diameter, keyway end:
- after turning — 2.278–2.272 in.
- after grinding — 2.2525–2.515 in.

Shaft diameter, gear end — 2.310–2.300 in.
Teeth chamfer — 3/32 round bullet form
Shaft threads — 1½–18 NF

m. Splined Main Shaft.

Material — H.R.O.H. S.A.E. 8622–H
Overall length — 20 5/32 in.
Stock size — 2¾ in., – 3/64 in.; – 0 in.
Shaft threads — 1¼–18 NF
Small end splines, diameter — 1.747–1.746 in.
Large end splines, diameter — 1.845–1.835 in.
Center splines, diameter — 2¾ in.
Center splines — Hobbed and ground with a right hand wind of 0.008 to 0.010 in total length of splines.
Number of splines — 10

428. Transfer Case

Points of measurement	*Manufacturers' fits, limits, tolerances and/or dimensions* Min (inches)	Desired (inches)	Max (inches)
End play:			
Main drive shaft	.....	.....	0.010
Driven shaft	0.003	.....	0.005
Idler shaft	0.003	.....	0.005
Declutch shaft	0.003	.....	0.005
Gear backlash:			
Helical gears	0.005	.....	0.008
Spur gears	0.005	.....	0.010
Gear to shifter fork	0.010	.....	0.024
Gear to main shaft	0.001	.....	0.004

429. Front Axle

Backlash: bevel pinion	0.008	.....	0.012
Roller bearing clearances:			
Differential side bearings		Zero clearance	
Between spider and pinion	0.003	.....	0.006
Between side gear and case	0.006	.....	0.012
Pinion shaft bearing	0.005	.....	0.015

Points of measurement	Manufacturers' fits, limits, tolerances and/or dimensions Min (inches)	Desired (inches)	Max (inches)
Steering knuckle (up and down)	.....	.....	0.010
Side gear to axle shaft	0.001	.....	0.005
New limits:			
Side gear thrust washer	0.004	.....	0.008
		(0.004 in. allowable additional wear)	
Pinion gear thrust washer	0.001	.....	0.004
		(0.004 in. allowable additional wear)	
Steering data:			
Caster	.....	.....	5°
Camber	.....	.....	0°
Toe-in	3/16	.....	5/16
Turning angle	.....	.....	56°
Axle shaft:			
Diameter at differential end—2¼ in.			
Splines at differential end—16 in.			
Splines at hub end—12 in.			
Torque limits:			
Pinion cage stud nuts			120 ft-lbs
Cross-shaft bearing stud nuts			85 ft-lbs
Cage and cover cap screws			85 ft-lbs
Carrier to housing stud nuts:			
½ in.			85 ft-lbs
⅝ in.			165 ft-lbs
Differential bearing cap stud nuts			295 ft-lbs
Pinion shaft nut			900 ft-lbs

430. Rear Axle

Bevel pinion:			
Backlash	0.008	.....	0.012
Clearance between:			
Pinion and spider	0.003	.....	0.006
Side gear and case	0.027	.....	0.037
New limits:			
Side gear thrust washer	0.058	.....	0.062
Pinion gear thrust washer	0.0585	.....	0.0625
Bearing adjustments:			
Differential	15 in.-lbs	.....	35 in.-lbs
Thru shaft bearing	0 in.-lbs	.....	5 in.-lbs
Bevel pinion bearing	0 in.-lbs	.....	5 in.-lbs
Runout:			
Bevel ring gear	0.000	.....	0.007
Differential case	0.000	.....	0.003
Axle shaft	.....	.....	0.005

431. Air Compressor

a. Connecting Rod Bearing to Crank.

Minimum	0.0010 in.
Maximum	0.0020 in.

b. Connecting Rod Wrist Pin to Bushing.

Minimum ..... 0.0005 in.
Maximum ..... 0.0010 in.

c. Crankcase Main Bearing Bores to Bearing (Cast Iron).

Minimum ..... 0.0002 in.
Maximum ..... 0.0010 in.

d. Crankcase Main Bearing Bores to Bearing (Aluminum).

Minimum ..... 0.0008 in.
Maximum ..... 0.0020 in.

e. Crankshaft Main Journal Diameter.

Minimum ..... 1.3779 in.
Maximum ..... 1.3784 in.

f. Crankshaft Crank Pin Diameter.

Minimum ..... 1.1242 in.
Maximum ..... 1.1250 in.

g. Crankshaft Ground Undersize.

Minimum ..... 0.010 in.
Maximum ..... 0.030 in.

h. Cylinder Block Bore Diameter.

Minimum ..... 2.0630 in.
Maximum ..... 2.0620 in.

i. Cylinder Block Ground Oversize.

Minimum ..... 0.010 in.
Maximum ..... 0.030 in.

j. Cylinder Bore Out-Of-Round.

Maximum ..... 0.003 in.

k. Cylinder Bore Taper.

Maximum ..... 0.003 in.

l. Cylinder Bore Clearance to Piston.

Minimum ..... 0.002 in.
Maximum ..... 0.064 in.

m. Cylinder Head Unloader Valve Stem.

Minimum ..... 0.2475 in.
Maximum ..... 0.2495 in.

n. Cylinder Head Clearance to Bushing.

Minimum ..... 0.001 in.
Maximum ..... 0.003 in.

o. Valve Stem Bushing Reaming.

Minimum ..... 0.2495 in.
Maximum ..... 0.2505 in.

p. Valve Stem to Unloader Adjusting Screw Clearance.

Minimum ..... 0.010 in.
Maximum ..... 0.015 in.

q. Piston Diameter.

Minimum ..... 2.0610 in.
Maximum ..... 2.0615 in.

r. Piston Oversize.

Minimum ..... 0.010 in.
Maximum ..... 0.030 in.

s. Piston Out-of-Round.

Maximum	0.003 in.

t. Piston Taper.

Maximum	0.003 in.

u. Piston to Cylinder Wall Clearance.

Minimum	0.0015 in.
Maximum	0.0075 in.

v. Piston Pin Clearance in Piston.

Minimum	0.0001 in.
Maximum	0.0003 in.

w. Piston Pin Clearance in Connecting Rod.

Minimum	0.0001 in.
Maximum	0.0006 in.

432. Torque Wrench Data

Specifications given apply to clean, dry threads. Reduce the torque 10 percent when the threads are clean and oiled.

a. Stud Nuts.

Diameter	Number of threads	Stud nut thickness	Minimum (Foot-pounds)	Maximum (Foot-pounds)
3/8	24	....	25	35
7/16	20	....	62	69
1/2	20	....	85	95
1/2	20	7/16	85	95
1/2	20	3/8	65	75
9/16	18	....	115	126
5/8	18	35/64	140	155
3/4	16	....	295	340
1	20	....	300	....
1 1/4	18	....	700	....
1 1/2	12	....	800	....
1 1/2	18	....	800	....
1 3/4	12	....	800	....

b. Screws.

Diameter	Number of threads	Minimum (Foot-pounds)	Maximum (Foot-pounds)
5/16	18	15	20
3/8	16	25	35
7/16	14	35	44
1/2	13	78	88
9/16	12	87	97
5/8	11	160	175

CHAPTER 5

SHIPMENT, LIMITED STORAGE, AND DEMOLITION TO PREVENT ENEMY USE

Section I. SHIPMENT AND LIMITED STORAGE

433. Limited Storage

a. Inspection and Service Before Placement in Storage.

(1) *Storage site selection.* Store the crane-shovel on firm, dry ground. If necessary, place solid timber blocks under the front and rear axles.

(2) *Inspection.* Refer to organizational maintenance services (par. 98) for inspection procedures.

(3) *Lubrication.* Lubricate the crane-shovel as required by LO 5–9513–1, LO 5–9513–2, and LO 5–9513–3.

(4) *Cleaning and painting.* Use an approved cleaning solvent and clean all accumulated dust, dirt, oil, and grease from the crane-shovel. Use a soft cloth moistened in an approved cleaning solvent and wipe off all wiring and cables. Repaint all corroded spots and areas where the paint has been chipped off.

b. Inspection, Protection, and Service in Storage.

(1) *Inspection.* Every 10 days, inspect the crane-shovel for any unusual conditions such as damage, rusting, accumulation of water, pilferage, and leakage of lubricants, fuels, or coolant. Check the antifreeze solution in the cooling systems with a hydrometer.

(2) *Protection.* Take necessary precautions to protect the crane-shovel from the weather and elements by covering as much as possible with a suitable cover.

(3) *Exercising.* At least once every 10 days, operate the crane-shovel long enough to bring it up to normal operating temperature.

c. Inspection If in Storage More Than 30 Days.

(1) *Inspection and lubrication.* Refer to *a*(2) and (3) above for inspection procedures and lubrication.

(2) *Draining.* Drain the radiators and fuel tanks. Attach

tags to the radiators and fuel tanks, indicating that they have been drained.

(3) *Protection.* Cover all intake and exhaust openings with an approved sealing tape. Install window guards or cover glass with wood strips.

434. Domestic Shipment

a. Loading and Blocking for Rail Shipment.

(1) Whenever possible, load and unload the crane-shovel from open flatcars under its own power, with the front end attachments removed. The crane-shovel may be moved fron one flatcar to another, along the length of the train, on crossover plates or spanning platforms with a capacity of 45,000 pounds. If a permanent end ramp is not available, an improvised ramp can be made, using railroad ties for cribbing and nailing runner boards to the ties (fig. 18).

(2) Position the crane-shovel on the flatcar with a flatcar brakewheel clearance of at least 6 inches. Apply the brakes of the carrier and place the transmission in low gear.

(3) Disconnect both battery cables from the battery. Tape the cable terminals.

(4) Use the following method to secure the crane-shovel for rail shipment:

(*a*) See that the front of the revolving frame is facing the rear end of the carrier, that the swing lock is in locking position, and that both front and rear outriggers are bolted in the closed position.

(*b*) If possible, position the carrier on the flatcar (13, fig. 17) so that a stake pocket (14) is on the centerline between the front rear and rear tires.

(*c*) Position triangular-shaped wood blocks (17) at front and rear of each front tire. Toenail each block to the flatcar (13). Position wood blocks (18) along the outside of each front tire and long enough to overlap the blocks (17). Place heavy waterproof paper (21) between the blocks (18) and the tires. Toenail the blocks (18) to the flatcar (13) and blocks (17). Place wood cleats (16) against the blocks (17) and nail to the flatcar and blocks (17).

(*d*) Position wood blocks (27), wedge-shaped at one end to fit the tires and long enough to clear the front and rear outrigger supports (24 and 31) by at least 6 inches, against the front and rear of each outside

rear tire. Toenail each block (27) to the flatcar. Position a wedge-shaped wood block (30) between and against the front rear and rear tires. Toenail the blocks (27 and 30) to the flatcar.

(*e*) Drill holes for bolts (26) through the wood blocks (27 and 30) and the flatcar (13). Insert bolts with plain washers through the blocks and flatcar and secure with nuts.

(*f*) Position wood blocks (29) along the outside of both rear tires and overlapping the wood blocks (27). Place heavy waterproof paper (21) between the blocks and tires. Nail the blocks (29) to the flatcar and blocks (27 and 30).

(*g*) Drive wood blocks (25) between the blocks (27) and the front and rear outrigger supports (24 and 31). Nail wood cleats (28) to the blocks (25 and 27).

(*h*) Construct a cover (7) of lumber over the carrier cab windshield, windows, and door glass and secure to the carrier.

(*i*) Attach metal shields, or construct a cover of lumber, to protect the revolving frame side window (35) and the front upper and lower windows (36 and 45).

(*j*) Lock or wire all doors and covers closed in the revolving frame cab and carrier cab.

(*k*) Wire covers (8), made of lumber, to the headlight guards as protection for the headlights.

(*l*) Use heavy waterproof paper, held in place with masking tape, to cover the openings at the carrier radiator (40), carrier engine compartment (4), the revolving frame engine exhaust pipe (41), carrier cab ventilator (42), and any other openings noticed.

(*m*) Use masking tape to cover the faces of the reflectors (15), tail and stoplight (32), tail, stop, and blackout light (44), blackout light (43), and marker lights (39).

(*n*) Place four strands, two wrappings, of heavy black annealed wire (38) around the gantry and bridle (37) and through the boom stop cable brackets (33) openings. Twist the wire strands to tighten.

(*o*) Deflate all front and rear tires to about 35 psi each.

(*p*) Attach a cable (12), using cable thimbles (10) and cable clamps (11), to an installed boom foot pin (34) and to the nearest stake pocket (14) on the opposite side of the flatcar beyond the rear of the carrier. In like manner, attach a cable to the other

boom foot pin and its opposite stake pocket. Pull the cables tight and secure with cable clamps.

(*q*) Attach a cable (12), using cable thimbles (10) and cable clamps (11), to a tow hook eye (9) on the front of the carrier and to the nearest stake pocket (14) on the opposite side of the flatcar beyond the front of the carrier. In like manner, attach a cable to the other tow hook and its opposite stake pocket. Pull the cables tight and secure with cable clamps.

(*r*) Attach a cable (12), using cable thimbles (10) and cable clamps (11), to an opening on the right side under the counterweight (3). Place the cable over the carrier frame and attach to the nearest stake pocket (14) on the opposite side of the flatcar. In like manner, attach a cable to the left underside of the counterweight and its opposite stake pocket.

(*s*) Place four strands, two wrappings, of heavy black annealed wire (23) through each tiedown eye (6) at the rear and on each side of the carrier frame and through the nearest stake pocket to the individual tiedown eye. Twist the wire strands to tighten.

(*t*) Inflate all front and rear tires to 70 psi each.

(*u*) Fill all space between blocks (18 and 29) and the stake pockets with fill lumber (19). Drive wood stakes (20) into the stake pockets and against the fill lumber (19). Drive nails through the hole in the stake pocket and into the stake, bending over the nailheads to secure. Drive nails through the fill lumber (19) into the blocks (18 and 29), stakes (20), and flatcar.

(*v*) Use triangular-shaped wood blocks (22) to brace blocks (18 and 29) when a stake pocket is not adjacent. Toenail the blocks (22) to blocks (18 and 29) and the flatcar.

(*w*) See that all cables and wire are in position and tight.

(*x*) See that all stakes, fill lumber, cleats, and blocks are in position and nailed down.

(*y*) Place any front end attachments and boxes on the flatcar and around the crane-shovel. Use wood blocks for braces and steel strapping for tiedowns to the stake pockets.

b. Preparing Crane-Shovel for Travel Under Its Own Power. Prepare the crane-shovel for traveling under its own power as described in paragraphs 77 through 80.

Section II. DEMOLITION OF CRANE-SHOVEL TO PREVENT ENEMY USE

435. General

When capture or the abandonment of the crane-shovel to an enemy is imminent, the responsible unit commander makes the decision either to destroy the unit or to render it inoperative. Based on this decision, orders are issued which cover the desired extent of destruction. Whatever method of demolition is employed, it is essential to destroy the same vital parts of all crane-shovels, and all corresponding repair parts.

436. Preferred Demolition Methods

Explosives and mechanical means, either alone or in combination, are the most effective methods to employ. Listed below are the vital parts in order of priority of demolition for each preferred method. In each case, completion of the first two steps will render the unit inoperative. Completion of the additional steps listed will further destroy the unit.

a. Demolition by Explosives. Place as many of the following charges as the situation permits and detonate them simultaneously with detonating cord and a suitable detonator:

(1) *Machinery deck* (fig. 434).

(*a*) Four 1-pound charges on each machinery side frame.

(*b*) Four 1-pound charges on engine block under the intake manifold.

Note. The above charges are the minimum requirements for this method.

(*c*) Four 1-pound charges on each drum clutch.

(*d*) Four 1-pound charges on the engine clutch.

(*e*) Four 1-pound charges on the boom hoist drum.

(*f*) Two 1-pound charges on each boom foot bracket.

(2) *Attachments* (fig. 435).

(*a*) A 1-pound charge on each dipper hoist pulley.

(*b*) Six 1-pound charges on the saddle block.

(*c*) Eight 1-pound charges on top of shovel.

(*d*) Four 1-pound charges on roller path against each roller.

(*e*) Four 1-pound charges on back hoe stick point.

(*f*) Four 1-pound charges on back hoe stick pivot.

(*g*) Eight 1-pound charges on back hoe bucket connection.

(*h*) Six 1-pound charges between the boom point pulleys.

(*i*) Four 1-pound charges on the clamshell pulley.

(*j*) Four 1-pound charges on each clamshell bucket hinge.

(*k*) Two 1-pound charges on each side of drag chain connections on the dragline bucket.

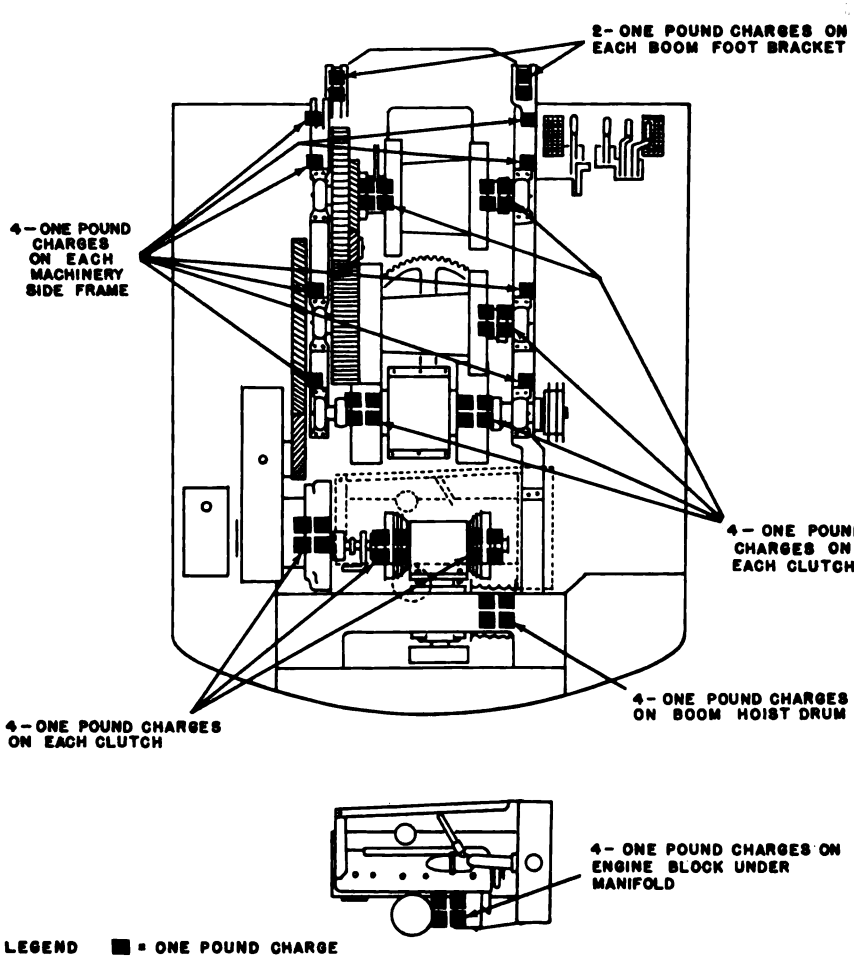


Figure 434. Placement of charges on machinery deck.

(*l*) Four 1-pound charges on each side of dragline cable connections.

(*m*) A 1-pound charge on each corner angle at the midpoint of the crane boom.

(3) *Carrier* (fig. 436).

(*a*) Two 1-pound charges on each differential housing.

(*b*) Two 1-pound charges on the transmission case.

(*c*) Two 1-pound charges on the transfer case.

(*d*) Two 1-pound charges on the engine block under the intake manifold.

(*e*) Two 1-pound charges on the engine block against the oil filters.

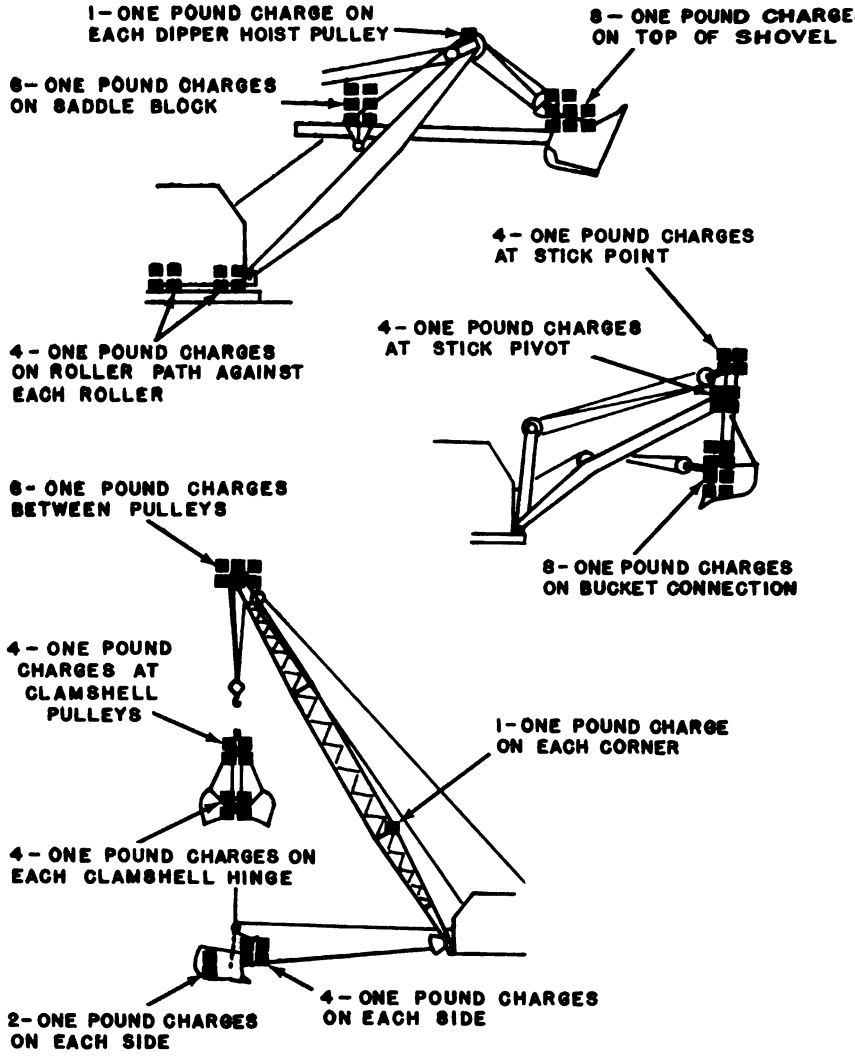


Figure 435. Placement of charges on attachments.

(*f*) A 1-pound charge between each front tire and each pair of rear tires and the ground.

b. Demolition by Mechanical Means. Use sledge hammers, crowbars, picks, axes, or any other heavy tools which may be available, together with the tools normally included with the crane-shovel, to destroy the following:

(1) The machinery side frame.

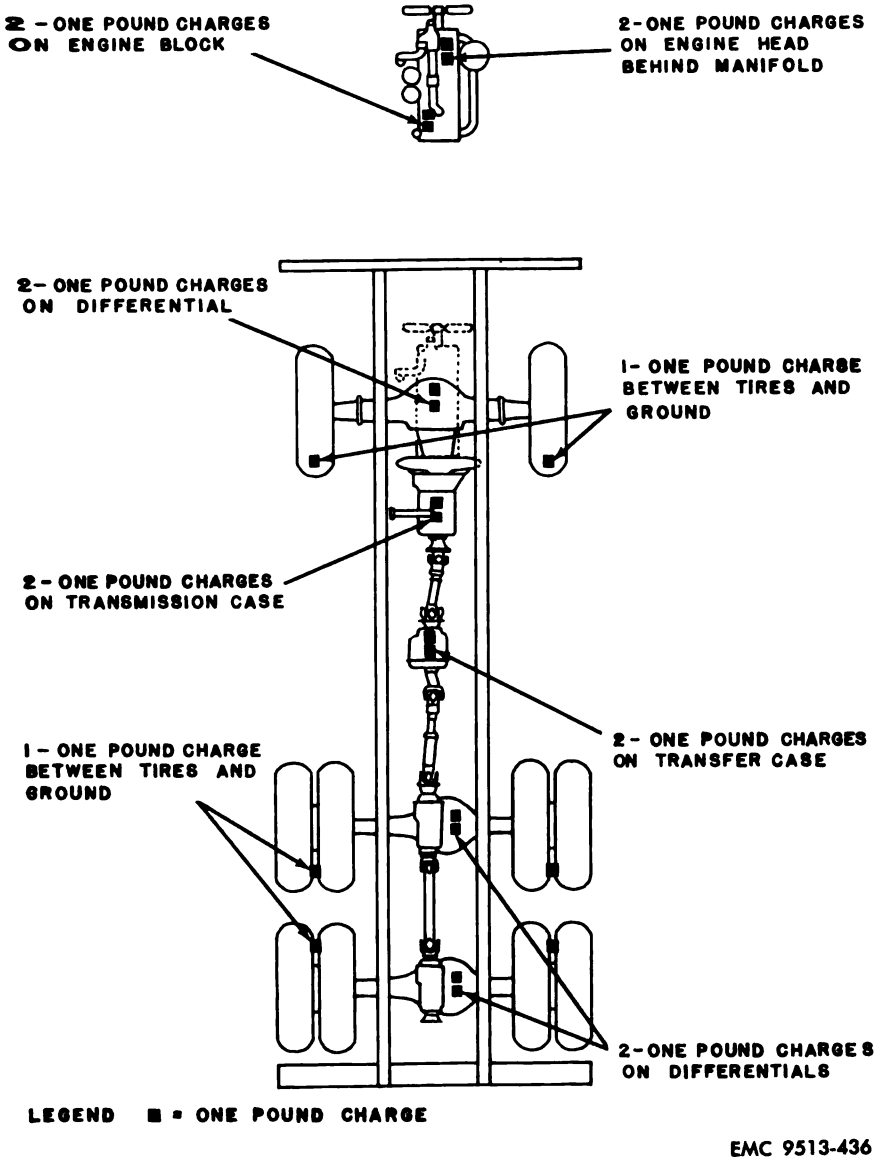


Figure 436. Placement of charges on carrier.

(2) The engine carburetors.

Note. The above steps are the minimum requirement for this method.

(3) The main clutch, swing clutch, and the boom hoist clutch.

(4) All control mechanisms.

(5) Boom foot brackets.

(6) The shovel boom assembly.
(7) The back hoe assembly.
(8) The crane boom.
(9) The clamshell and dragline buckets.
(10) The gantry assembly.
(11) The rollers.
(12) All cables.
(13) The carrier transfer case and differential drive housings.
(14) The carrier engine and transmission.
(15) All tires.

437. Other Demolition Methods

If the situation prohibits employing either of the preferred methods of demolition, use the following, either singly or in combination.

a. By Weapons Fire. Fire on the crane-shovel with the heaviest weapons available.

b. By Scattering and Concealment. Remove all easily accessible vital parts such as the engine carburetors, parts of the deck machinery clutches, and the swing rollers, and scatter them through dense foliage, bury them in dirt or sand, or throw them in a lake, stream, well, or other body of water.

c. By Burning. Pack rags, clothing, or canvas around the crane-shovel, especially around the clutches, brakes, and engines. Saturate this packing with gasoline, oil, or diesel fuel, and ignite it.

d. By Submersion. Totally submerge the operating machinery of the crane and carrier in a body of water to afford some water damage and concealment. Salt water will do the greatest damage to metal parts.

e. By Misuse. Perform the steps listed below to make the crane-shovel inoperative.

(1) Drain the engine radiators and crankcases.
(2) Throw sand or other abrasive into the transmission case.
(3) Start the engine and engage the drive clutch.
(4) Drop bolts, nuts, and tools into the gear trains.
(5) Operate the front end attachment forcibly into a bank, tree, or some heavy object to damage the boom and break the cables.
(6) Operate the unit until failure occurs.
(7) Drive the crane-shovel over a bank or into a solid object to damage it.

438. Training

All operators should receive thorough training in the destruction of the crane-shovel. Simulated destruction, using all the methods listed above, should be included in the operator training program. It must be emphasized in training that demolition operations are usually necessitated by critical situations, when the time available for destruction is limited. For this reason, it is necessary that operators be thoroughly familiar with all methods of destruction and be able to carry out demolition instructions without reference to this or any other manual.

APPENDIX I

REFERENCES

1. Accessory Equipment

TM 5–687	Repairs and Utilities; Fire Protection Equipment and Appliances Inspections, Operations, and Preventive Maintenance.
TM 9–1799	Ordnance Maintenance: Fire Extinguishers.
TM 5–5219	Engine, Gasoline, Hercules, JX and JXL Series.
TM 5–5252	Engine, Gasoline, Hercules Model TDXC.

2. Dictionaries of Terms and Abbreviations

AR 320–50	Military Terms, Abbreviations and Symbols: Authorized Abbreviations.
SR 320–5–1	Dictionary of United States Army Terms.

3. Lubrication and Painting

LO 5–9513–1	Crane-Shovel, Power Unit, Revolving, Truck–Mounted, Pneumatic Tired, 6x6, Two Engine Drive, Gasoline Driven, 10-Ton, ½ Cu Yd, Bay City Model 150M.
LO 5–9513–2	Crane-Shovel, Power Unit, Revolving, Truck Mounted, Pneumatic Tired, 6x6, Two Engine Drive, Gasoline Driven, 10 Ton, ½ Cu Yd, Bay City Model 150M.
LO 5–9513–3	Crane-Shovel, Power Unit, Revolving, Truck Mounted, Pneumatic Tired, 6x6, Two Engine Drive, Gasoline Driven, 10 Ton ½ Cu Yd, Bay City Model 150M.
TM 9–2851	Painting Instructions for Field Use.

4. Preventive Maintenance

TB 5–9513–1	Preventive Maintenance Services: Crane-Shovel, Power Unit, Revolving, Truck Mounted, Pneumatic Tired, 6x6, Two Engine Drive, Gasoline Driven, 10-Ton, ½

Cu Yd, Bay City Model 150M (Less Engines).

TM 5–505 Maintenance of Engineer Equipment.

TB 5–5252–1 Preventive Maintenance Services, Engine, Gasoline, Hercules Model TDXC.

5. Publication Indexes

DA Pam 108–1 Index of Army Motion Pictures, Film Strips, Slides, and Phono-Recordings.

DA Pam 310–1 Index of Administrative Publications.

DA Pam 310–2 Index of Blank Forms.

DA Pam 310–3 Index of Training Publications.

DA Pam 310–4 Index of Technical Manuals, Technical Regulations, Technical Bulletins, Supply Bulletins, Lubrication Orders, and Modification Work Orders.

DA Pam 310–5 Index of Graphic Training Aids and Devices.

DA Pam 310–25 Index of Supply Manuals—Corps of Engineers.

6. Radio Interference

TM 11–483 Radio Interference Suppression.

7. Supply Manuals

SM ENG 7, 8, and 9–9513 Crane-Shovel, Power Unit: Revolving; Truck-Mounted, Pneumatic-Tired, 6x6; Two-Engine-Drive; 10–Ton Capacity at 10-Foot Radius, ½-Cubic Yard; Gasoline-Driven; MIL–C–10466; Class 2–2; Size 10TA; Bay City Model 150M.

SM 5–1–3800 Stock List of All Items Except Repair Parts, FSC Group 38, Construction, Mining, Excavating, and Highway Maintenance Equipment.

SM 5–1–4900 Stock List of All Items, FSC Group 49, Maintenance and Repair Shop Equipment.

SM 5–5–5100 Stock List of All Items, FSC Group 51, Hand Tools.

SM 5–1–7600 Stock List of All Items, FSC Group 76, Books, Maps, and Other Publications.

SM 9–1–4900 Stock List of All Items, FSC Group 49, Maintenance and Repair Shop Equipment.

SM 9–1–5100 Stock List of All Items, FSC Group 51, Hand Tools.

8. Training

FM 21–5	Military Training.
FM 21–6	Techniques of Military Instruction.
FM 21–30	Military Symbols.

APPENDIX II

IDENTIFICATION OF REPLACEABLE PARTS

These data will not be used as a basis for requisitions for spare parts. Refer to the appropriate published Department of the Army supply manual for requisitioning data.

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
							Section I. STANDARD HARDWARE	
							BALL, steel:	
							⅜	1
							½	4
							¾	2
							BOLT, carriage, regular:	
							⅜-16NC x ¾	2
							⅜-16NC x 1	22
							⅜-16NC x 1¼	10
							⅜-16NC x 1¾	4
							½-13NC x 1½	9
							BOLT, hex head:	
							⅜-16NC x 1	37
							½-20NF x 1½	6
							½-13NC x 1¾	6
							½-13NC x 4	2
							½-13NC x 6½	4
							⅝-18NF x 1½	6
							⅝-18NF x 2	4
							⅝-18NF x 2¼	4
							⅝-18NF x 2½	5
							⅝-18NF x 2¾	16
							¾-16NF x 1¾	2
							¾-16NF x 2	4
							¾-16NF x 2¼	4

¾–16NF x 2½	4
BOLT, machine, flat head:	
½–13NC x 1¾	3
⅝–11NC x 2¼	10
BOLT, machine, hex head:	
½–13NC x 1½	4
¾–10NC x 8½	2
BOLT, machine, square head:	
⅜–16NC x 1	2
⅜–16NC x 1¼	2
⅜–16NC x 1½	4
⅜–16NC x 4½	1
½–13NC x 1¼	3
½–13NC x 1½	2
½–13NC x 1¾	6
½–13NC x 4	4
½–13NC x 5	2
½–13NC x 6½	1
⅝–11NC x 2	4
⅝–11NC x 2¼	8
⅝–11NC x 4	3
⅝–11NC x 5	2
¾–10NC x 1¾	4
¾–10NC x 2½	6
¾–10NC x 5½	2
⅞–9NC x 6½	2
⅞–14NF x 3	12
BOLT, stove: steel; flat head; w/square nut:	
3/16 x ⅜	22
3/16 x ½	6
3/16 x 1	2

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
							¼ x ⅝	10
							¼ x ¾	52
							¼ x 1¾	2
							BOLT, stove: steel; round head; w/square nut:	
							5/16 x ½	9
							5/16 x ⅝	2
							¼ x ¾	18
							¼ x 1	4
							¼ x 1½	2
							¼ x 2	1
							BOLT, stud:	
							5/16 x 1 3/16	10
							⅜ x 1¼	6
							½ x 1⅞	2
							½ x 2	8
							⅝ x 2	6
							BUSHING, pipe, reducing:	
							⅜ x ¼	1
							⅜ x ½	2
							⅜ x ¾	3
							CABLE, automotive: battery to switch; 30 in.	1
							CABLE, automotive: battery to switch; 34 in.	1
							CABLE, automotive: No. 1 AWG; 10 in.	1

CABLE, primary, No. 14 AWG; 12 ft..	1
CAP, pipe, 1¼	1
CLAMP, cable:	
¼	19
5/16	5
½	8
CLAMP, hose, universal	14
CLAMP, tubing, 1	1
CLAMP, wire, ¼	8
COCK, drain, 3/8	2
COLLAR, set, standard:	
1	3
1¼	5
1 7/16	1
1 15/16	5
CONNECTOR, tubing, brass:	
⅛ x ¼	5
¼ x ⅜	1
5/16 x ⅛	1
5/16 x ¼	4
COUPLING, pipe, standard:	
⅜	1
½	2
ELBOW, pipe:	
⅜ x 45°	2
⅜ x 90°	3
½ x 90°	2
ELBOW, pipe, street:	
⅜ x 90°	2
ELBOW, tubing, brass, ¼	4
FITTING, lubrication:	
⅛ x 30°	23

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
							⅛ x 45°	2
							⅛ x 67½°	1
							⅛ x 75°	3
							⅛ x 90°	5
							⅛ straight	89
							HINGE, flat, 2	2
							HOSE:	
							2ID x 3	4
							2¼ID x 3	2
							2¼ID x 10½	1
							KEY, std taper, plain, single:	
							¼ x ¼ x 2⅛	1
							⅜ x ⅜ x 2¼	2
							⅜ x ⅜ x 2¾	2
							⅜ x ⅜ x 4	1
							½ x ½ x 1¾	1
							½ x ½ x 2	2
							½ x ½ x 2¼	1
							⅝ x ⅝ x 2⅛	2
							⅝ x ⅝ x 3	2
							¾ x ¾ x 3⅛	2
							¾ x ¾ x 3⅝	1
							¾ x ¾ x 3⅛	3
							¾ x ¾ x 4	1
							¾ x ¾ x 9⅝	1
							⅞ x ⅞ x 2	2

KEY, woodruff:	
1/8 x 1/2	2
1/8 x 5/8	1
3/16 x 7/8	4
1/4 x 7/8	22
3/8 x 1 1/4	3
NIPPLE, pipe, brass:	
1/8 x 1	1
1/4 close	1
NIPPLE, pipe, regular:	
3/8 close	2
3/8 x 2 1/2	1
3/8 x 6	2
3/8 x 11 1/4	1
3/8 x 15 1/4	1
3/8 x 25	1
1/2 x 2	1
1/2 x 4	1
1/2 x 5	1
1/2 x 10	1
NUT, castellated, regular:	
5/16-18NC	4
3/8-16NC	1
1/2-20NF	6
9/16-12NC	32
5/8-11NC	4
5/8-18NF	2
3/4-10NC	5
1-14NF	2
1 1/8-7NC	2
NUT, jam, regular, hex:	
3/8-16NC	35

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manfacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
							7/16–14NC	2
							1/2–13NC	19
							1/2–20NF	5
							5/8–11NC	16
							5/8–18NF	38
							3/4–10NC	8
							3/4–16NF	16
							7/8–14NF	11
							1–8NC	1
							1 1/4–7NC	4
							1 1/4–12NF	2
							1 1/2–12NF	2
							2 1/16	1
							NUT, lock, hex, Marsden:	
							3/4–16NF	11
							1–8NC	3
							1 1/8–12NF	2
							NUT, machine screw:	
							No. 10–24NC	6
							NUT, plain, hexagon:	
							No. 10–24NC	2
							1/4–20NC	8
							5/16–18NC	17
							3/8–16NC	2
							1/2–13NC	12
							5/8–11NC	3

NUT, plain, square, No. 6–32NC	1
NUT, regular, hex:	
No. 8–32NC	9
¼–20NC	25
¼–28NF	5
5/16–18NC	11
⅜–16NC	165
⅜–24NF	15
7/16–14NC	18
½–13NC	121
½–20NF	24
9/16–12NC	7
⅝–11NC	141
⅝–18NF	68
¾–10NC	44
¾–16NF	42
⅞–9NC	2
⅞–14NF	23
1–14NF	16
1⅛–12NF	2
1¼–7NC	4
1¼–12NF	8
2 7/16	1
NUT, regular, square:	
¼–20NC	2
⅜–16NC	132
½–13NC	19
1¼–7NC	4
NUT, self-locking, hexagon:	
⅜–16NC	2
NUT, slotted, hex:	
½–13NC	10

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
							¾–16NF	2
							⅞–9NC	16
							1–14NF	1
							2¼–12	1
							NUT, tubing, brass:	
							¼	6
							5/16	6
							NUT, wing, standard:	
							⅜–16NC	41
							⅝–11NC	2
							PIN, cotter, split:	
							1/16 x 7/16	12
							1/16 x ⅜	1
							1/16 x ½	8
							1/16 x 1	7
							3/32 x 5/8	11
							3/32 x ¾	4
							3/32 x 1	24
							3/32 x 1¼	1
							⅛ x ½	5
							⅛ x ⅞	25
							⅛ x 1	6
							⅛ x 1¼	3
							⅛ x 1¾	2
							⅛ x 2	42
							⅛ x 2¼	16

1/8 x 2 1/2	1
5/32 x 1	28
5/32 x 1 1/8	22
5/32 x 1 1/4	3
5/32 x 2 1/2	16
3/16 x 1 1/2	27
3/16 x 1 3/4	2
3/16 x 2 1/2	3
1/4 x 1 1/2	1
1/4 x 2	3
1/4 x 2 1/4	2
1/4 x 3	4
1/4 x 3 1/2	1
5/16 x 2	4
5/16 x 2 1/2	13
5/16 x 3 1/2	2
3/8 x 2	8
3/8 x 3	8
3/8 x 3 1/4	3
3/8 x 3 3/4	2
3/8 x 4	2
7/16 x 2 1/2	8
1/2 x 4	4
1/2 x 5	2
PIN, straight headless:	
1/8 x 7/8	1
1/8 x 1	1
PIN, tapered, plain, No. 6 x 4	4
PLUG, pipe, countersunk, 1	2
PLUG, pipe, square head:	
1/8	2
1/4	1

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
							3/8	9
							1/2	3
							3/4	4
							1	1
							1 1/4	2
							RIVET, brass, flat head:	
							3/16 x 5/8	7
							3/16 x 7/8	7
							RIVET, solid: 5/8 x 2	12
							RIVET, tubular:	
							No. 5–6	36
							No. 7; 1/2	32
							No. 8; 1/2	128
							ROD, brass, 1/2 x 7/16	2
							SCREW, cap, hex head:	
							1/4–20NC x 3/4	4
							1/4–20NC x 1 1/4	3
							1/4–20NC x 1 3/8	4
							1/4–28NF x 1	5
							5/16–18NC x 5/8	4
							5/16–18NC x 3/4	4
							5/16–18NC x 1	27
							5/16–18NC x 1 1/2	2
							5/16–18NC x 2	4
							5/16–18NC x 3	3
							5/16–24NF x 7/8	6

⅜–16NC x ½	16
⅜–16NC x ⅝	12
⅜–16NC x ¾	56
⅜–16NC x ⅞	13
⅜–16NC x 1	48
⅜–16NC x 1⅛	4
⅜–16NC x 1¼	26
⅜–16NC x 1½	15
⅜–16NC x 1¾	2
⅜–16NC x 2¼	6
⅜–16NC x 2½	2
⅜–24NF x 1	7
⅜–24NF x 1¼	4
⅜–24NF x 1¾	3
⅜–24NF x 2	5
⅜–24NF x 3	6
7/16–14 NC x 1¼	2
7/16–20NF x 1	10
½–13NC x ¾	10
½–13NC x 1	21
½–13NC x 1¼	18
½–13NC x 1½	19
½–13NC x 1⅝	3
½–13NC x 1¾	3
½–13NC x 1⅞	2
½–13NC x 2	4
½–13NC x 2¼	1
½–13NC x 2½	2
½–13NC x 3	2
½–13NC x 3¼	2
½–13NC x 3½	2
½–13NC x 4	2

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
							½–13NC x 6½	2
							½–20NF x 1	9
							½–20NF x 1¼	8
							½–20NF x 1½	8
							½–20NF x 1¾	12
							½–20NF x 3¼	8
							⅝–11NC x 1¼	1
							⅝–11NC x 1½	2
							⅝–11NC x 2¼	4
							⅝–11NC x 2½	1
							⅝–18NF x 1	2
							⅝–18NF x 2	2
							⅝–18NF x 2¼	16
							⅝–18NF x 2½	10
							⅝–18NF x 2¾	8
							¾–10NC x 1¾	2
							¾–10NC x 2¼	2
							¾–10NC x 3½	4
							¾–16NF x 1½	9
							¾–16NF x 2¼	15
							¾–16NF x 2¾	3
							¾–16NF x 3¾	2
							⅞–14NF x 3	2
							⅞–14NF x 3¼	8
							SCREW, cap, hex socket:	
							⅜–24NF x ¾	4

SCREW, drive: No. 10–24NC x ½	1
SCREW, machine:	
No. 6–32NC x 5/16	1
No. 6–32NC x ½	5
No. 8–32NC x 5/16	1
No. 8–32NC x ⅜	1
No. 8–32NC x 5/8	1
¼–20NC x ½	4
¼–20NC x ¾	5
SCREW, machine, fil hd:	
¼–20NC x 1½	2
5/16–18NC x ½	1
SCREW, machine, flat head:	
3/16 x ½	6
3/16 x ¾	2
¼–20NC x ¾	12
5/8–11NC x 1¼	8
SCREW, machine, round head:	
No. 8–32NC x ¼	8
No. 8–32NC x 5/16	4
No. 8–32NC x ⅜	6
No. 8–32NC x 7/16	16
No. 10–32NC x ¼	4
No. 12–24NC x ⅜	4
3/16 x ⅜	1
3/16 x ½	3
¼–20NC x ¾	17
5/16–18NC x ½	6
5/16–24NF x ½	4
SCREW, machine, rd hd, brass:	
No. 10–24NC x ⅜	2

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
							SCREW, Phillips head:	
							⅜-16NC x ¾	30
							⅜-16NC x 1	89
							½-13NC x 1¼	19
							SCREW, self-tapping:	
							No. 8 x ⅜	2
							5/16 x ½	29
							SCREW, set, soc hd, cone point:	
							⅜-24NF x ½	4
							½-20NF x ¾	4
							SCREW, set, sq hd, cup point:	
							⅜-16NC x ¾	4
							⅜-16NC x 1	15
							⅜-16NC x 1¼	3
							⅜-16NC x 1½	1
							⅜-16NC x 1¾	2
							⅜-16NC x 2	1
							½-13NC x ¾	4
							½-13NC x 1	1
							½-13NC x 1¼	10
							⅝-11NC x 1¾	10
							⅝-11NC x 2½	2
							¾-10NC x 2½	2
							SCREW, wood, No. 10 x ¾	3
							SEPARATOR, sediment, ⅜Y	1
							SHACKLE, chain, 1⅛	4

SPACER, pipe, std:	
3/8 x 5/8	2
1/2 x 1 3/4	4
1/2 x 2 1/2	4
1/2 x 5 1/8	2
1/2 x 2 17/32	2
3/4 x 2 3/16	1
1 x 1 7/8	1
1 1/4 x 3 1/2	2
2 x 3/8	1
TEE, pipe, regular, 3/8	4
THIMBLE, cable:	
5/16	3
1/2	4
TUBING, copper:	
5/16 O. D.	AR
1/4 O. D.	AR
WASHER, flat:	
7/32	6
13/16	4
WASHER, lock, internal teeth:	
No. 10	4
No. 12	4
WASHER, lock, spring, brass, No. 10	2
WASHER, lock, spring, std:	
No. 6	4
No. 8	17
No. 10	69
3/16	41
1/4	135
5/16	67
3/8	448

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
							7/16	60
							1/2	249
							9/16	37
							5/8	217
							3/4	40
							7/8	14
							1	4
							1 1/8	1
							1 1/4	8
							WASHER, plain, steel:	
							3/8	30
							1/2	4
							5/8	4
							3/4	3
							7/8	5
							1	4
							Section II. PARTS LIST	
56	1		910	17-2100-468-027	008	1-B6891	CABLE, battery ground	1
56	4		008	6TNR-US	008	6TNR-US	BATTERY, 12-volt	2
56	5		ORD	5305-263-7687	008	6-B6831	BOLT, battery box	2
56	8		008	B6831	008	B6831	BOX, battery (includes Index No. 2)	1
56	9		008	10-B6891	008	10-B6891	CABLE, battery-to-starter switch	1
56	10		008	5-B6891	008	5-B6891	CABLE, battery	1
57	3		ORD	HO15-0500908	008	8TR-US	BATTERY, 12-volt	2

57	7	.....	008	17-B6899	008	17-B6899	BOLT, battery holddown.....	2
71	1	.....	244	5942939	244	5942939	DOOR.....	4
71	2	.....	.....	6220-353-0951	244	5939056	GASKET, door.....	4
71	3	.....	244	453090	244	453090	SEALED UNIT ASSEMBLY.....	4
71	4	.....	.....	6220-353-0950	244	5939055	PLATE, retaining.....	4
71	6	.....	244	5944311	244	5944311	SCREW.....	12
71	7	.....	244	5944312	244	5944312	SCREW.....	16
71	12	.....	244	5935457	244	5935457	TERMINAL PLATE ASSEMBLY.....	4
71	13	.....	.....	6220-374-1844	244	5936043	CLIP, terminal plate.....	8
71	15	.....	244	5942887	244	5942887	BODY ASSEMBLY.....	4
71	18	.....	244	5942382	244	5942382	WASHER, mounting.....	4
71	20	.....	.....	6150-299-6354	244	5942886	WIRING AND CONNECTOR ASSEMBLY.....	4
72	1	.....	244	5931318	244	5931318	DOOR.....	2
72	2	.....	.....	6220-353-0941	244	5930594	GASKET, door.....	2
72	3	.....	244	924552	244	924552	SCREW.....	6
72	4	.....	244	5941092	244	5941092	RING, retaining.....	2
72	5	.....	244	456780	244	456780	SEALED UNIT.....	2
72	6	.....	.....	5305-353-0969	244	924561	SCREW, adjusting.....	4
72	7	.....	244	5939791	244	5939791	SPRING, adjusting screw.....	4
72	8	.....	244	5943622	244	5943622	CONNECTOR AND WIRING ASSEMBLY.....	2
72	9	.....	244	5931832	244	5931832	BODY ASSEMBLY.....	2
72	10	.....	.....	6220-374-1848	244	924535	RING, mounting.....	2
72	11	.....	.....	6220-353-0970	244	924568	SPRING, door.....	6
73	1	.....	244	5936189	244	5936189	SCREW.....	6
73	2	.....	.....	6220-353-0953	244	5939712	DOOR ASSEMBLY.....	1
73	3	.....	.....	6220-732-0642	244	5936190	RING, screw retaining.....	6
73	4	.....	.....	6220-732-0658	244	5936191	GASKET, door.....	1
73	5	.....	GE	6240-019-0877	244	190877	BULB, 3 cp, 24-28 volt.....	1
73	6	.....	244	5944788	244	5944788	SOCKET AND WIRING ASSEMBLY.	1
73	7	.....	244	5939694	244	5939694	BODY.....	1

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
73	8	.....	244	5291593	244	5291593	SHELL	3
73	9	.....	244	5291599	244	5291599	BUSHING	3
73	10	.....	244	5291587	244	5291587	GROMMET	3
73	11	.....	GE	6240-044-6914	244	446914	BULB, 32 cp, 24-28 volt	1
74	1	.....	244	5936189	244	5936189	SCREW	6
74	2	.....	.....	6220-353-0954	244	5939714	DOOR ASSEMBLY	1
74	3	.....	.....	6220-732-0642	244	5936190	RING, screw retaining	6
74	4	.....	.....	6220-732-0658	244	5936191	GASKET, door	1
74	5	.....	GE	6240-019-0677	244	190877	BULB, 3 cp, 24-28 volt	2
74	6	.....	244	5944789	244	5944789	SOCKET AND WIRING ASSEMBLY	1
74	7	.....	244	5939694	244	5939694	BODY	1
74	8	.....	244	5291593	244	5291593	SHELL	2
74	9	.....	244	5291599	244	5291599	BUSHING	2
74	10	.....	244	5291587	244	5291587	GROMMET	2
75	1	.....	244	5940558	244	5940558	SCREW	3
75	2	.....	244	5939723	244	5939723	DOOR	1
75	3	.....	244	5938852	244	451989	SEALED UNIT AND WIRING ASSEMBLY	1
75	4	.....	.....	6220-732-0642	244	5936190	RING, retaining	3
75	5	.....	244	5939720	244	5939720	BODY ASSEMBLY	1
75	6	.....	244	5940258	244	5940258	GROUND WIRE ASSEMBLY	1
75	7	.....	244	5940257	244	5940257	WIRE ASSEMBLY	1
75	8	.....	244	921243	244	921243	WASHER, bearing	1
75	11	.....	244	5939725	244	5939725	GROMMET	1
75	12	.....	244	238288	244	238288	SPRING	3
76	1	.....	244	5936222	244	5936222	SCREW, door	4

76	2	.....	244	5936221	244	5936221	DOOR ASSEMBLY.....	2
76	3	.....	.....	5330-732-0689	244	5936220	GASKET, door.....	2
76	4	.....	GE	6240-019-0877	244	190877	BULB, 3 cp, 24-28 volt.....	2
76	5	.....	244	5940610	244	5940610	SOCKET AND WIRING ASSEMBLY.	2
76	6	.....	244	5940589	244	5940589	BODY.....	2
76	7	.....	244	5291593	244	5291593	SHELL.....	2
76	8	.....	244	5291599	244	5291599	BUSHING.....	2
76	9	.....	244	5291587	244	5291587	GROMMET.....	2
76	10	.....	244	5940607	244	5940607	STUD.....	2
76	11	.....	.....	6220-353-0946	244	5936217	GROMMET.....	4
76	12	.....	244	5936219	244	5936219	WASHER.....	2
76	13	.....	244	5936218	244	5936218	SCREW, socket mounting.....	4
77	1	.....	79960 (699)	2910-506-4958 (0-11754A)	646	140610-BS	CARBURETOR.....	1
77	5	.....	600	5594198	600	5594198	FUEL PUMP.....	1
77	7	.....	008	4739-4	008	4739-4	FITTING, swivel.....	2
77	8	.....	008	124-4	008	1524-4	HOSE.....	1
77	9	.....	.....	6620-374-3540	600	1515318	GAGE, fuel level.....	1
77	10	.....	008	GC-497-15-B7016	008	GC-497-15-B7016	TANK CAP ASSEMBLY.....	1
77	11	.....	008	3973	008	3973	STRAINER.....	1
77	12	.....	008	1B-6842	008	1-B6842	TANK, fuel.....	1
78	1	.....	79960 (699)	2910-038-4257 (0-10769)	646	150600-CS	CARBURETOR.....	1
78	6	.....	70040	2910-506-4833	600	5594198	FUEL PUMP.....	1
78	8	.....	008	4739-6	008	4739-6	FITTING, swivel.....	2
78	9	.....	008	1525-6	008	1525-6	HOSE.....	1
78	13	.....	008	13-B5087	008	13-B5087	COVER.....	1
78	16	.....	807	1516356	807	1516356	SENDING UNIT, fuel gage.....	1
78	17	.....	008	GC-497-15-B7016	008	GC-497-15-B7016	TANK CAP.....	1
78	18	.....	008	3973	008	3973	STRAINER.....	1
78	20	.....	008	B-6826	008	B6826	TANK, fuel.....	1
78	27	.....	008	854107	008	854107	FILTER, fuel.....	1

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
79	2	.....	602	F140-800	602	F140-800	TOP ASSEMBLY.....	1
79	3	.....	602	F140-166	602	F140-166	GASKET, cork.....	1
79	4	.....	602	F140-07	602	F140-07	ELEMENT, filter.....	1
79	5	.....	602	F140-851	602	F140-851	BOWL.....	1
79	6	.....	602	30B-06	602	30B-06	GASKET, base.....	1
79	7	.....	602	71F-853	602	71F-853	BASE.....	1
79	9	.....	602	370BF-805	602	370BF-805	CLAMP, base.....	1
82	3	.....	008	3D800-SN-125	008	3-D800-SN-125	CONTROL, flexible choke.....	1
82	4	.....	008	10-B6866	008	10-B6866	ROD, control.....	1
82	5	.....	008	5-B3915	008	5-B3915	BELLCRANK.....	1
82	6	.....	008	9-B4195	008	9-B4195	PIN.....	1
82	7	.....	008	4-B4195	008	4-B4195	YOKE END, adjustable.....	1
82	10	.....	.....	5306-269-6684	008	11-B3735	EYEBOLT.....	1
82	11	.....	008	12-B6709	008	12-B6709	ROD, control.....	1
82	12	.....	008	1-B6733	008	1-B3763	THROTTLE HAND LEVER.....	1
82	13	.....	008	25-B3915	008	25-B3915	PIN.....	1
82	15	.....	008	20-B6891	008	20-B6891	BRACKET, cable.....	1
82	21	.....	28265	2805-374-4974	646	1411B	JOINT, ball.....	1
82	22	.....	646	140714B	646	140714B	ROD, governor.....	1
83	3	.....	896	3554-10	008	8229272	CONTROL, choke.....	1
83	6	.....	008	885190	008	885190	CONTROL, throttle.....	1
83	8	.....	008	17-B6117	008	17-B6117	PEDAL, accelerator.....	1
83	12	.....	008	21-B6117	008	21-B6117	ROD, reach.....	1
83	13	.....	008	3-B5985	008	3-B5985	LEVER, throttle.....	1
83	15	.....	008	4-B3896	008	4-B3896	BLOCK, throttle control.....	1
83	16	.....	.....	5340-249-5887	008	6-B620	SPRING, tension.....	1

83	19	.....	008	9–B6117	008	9–B6117	ROD, reach 1
83	20	.....	008	6–B3466	008	6–B3466	LEVER 2
83	23	.....	008	9–B6904	008	9–B6904	SHAFT, throttle 1
83	25	.....	008	12–B6060	008	12–B6060	ROD, reach 1
84	2	.....	008	15042D	008	15042D	RETAINER, spring 1
84	3	.....	.....	5340–664–3910	008	48358D	SPRING, compression 1
84	4	.....	008	6649D	008	6649D	CAP, spring 1
84	5	.....	.....	2990–355–3684	008	48356D	DISK, friction 2
84	6	.....	008	54210D	008	54210D	BRACKET 1
84	7	.....	008	8264DX	008	8264DX	BODY, control 1
84	10	.....	008	8265DX	008	8265DX	LEVER, control 1
84	13	.....	008	39482	008	39482D	PIN 1
91	1	.....	646	44733C	646	44733C	HOUSING, thermostat 1
91	2	.....	646	73704A	646	43704A	GASKET, housing attaching 1
91	3	.....	.....	6680–514–3969	646	200077B	THERMOSTAT 1
91	8	.....	646	43700C	646	43700C	PIPE, water outlet 1
92	2	.....	646	202412A	646	202412–A	NUT 1
92	3	.....	646	201618A	646	201618–A	WASHER, clamp 1
92	4	.....	646	202413A	646	202413–A	SCREW, adjusting 1
92	7	.....	646	140498D	646	140498–D	BRACKET 1
92	8	.....	646	202119A	646	202119–A	WASHER, clamp 1
92	9	.....	.....	5340–281–6667	646	15298–A	RING, snap 1
92	10	.....	.....	5330–429–0237	646	17382–A	RETAINER, seal 1
92	11	.....	.....	5330–234–8756	646	17383–A	WASHER, seal 1
92	12	.....	.....	5310–429–0239	646	17384–A	RETAINER, seal washer 1
92	13	.....	.....	5330–429–0680	646	45926–A	GASKET 1
92	14	.....	646	140595B	646	140595–B	SPINDLE 1
92	15	.....	.....	3110–100–3699	646	4012–A	CONE, bearing 1
92	16	.....	.....	3110–100–0637	646		CUP, bearing 1
92	17	.....	646	140594C	646	140594–C	HUB 1
92	19	.....	892	09196	646	2132–A	CUP, bearing 1
92	20	.....	892	09078	646		CONE, bearing 1

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
92	21	.....	646	40529A	646	40529-A	WASHER, cone clamp.....	1
92	23	.....	.....	5310-199-6477	646	2134-A	NUT.....	1
92	24	.....	646	145327A	646	145327-A	GASKET.....	1
92	25	.....	646	140649C	646	140649-C	BLADE ASSEMBLY.....	1
92	26	.....	646	89610A	646	89610-A	PILOT, spider.....	1
92	27	.....	646	202414-AS	646	202414-AS	CAP SCREW.....	4
92	29	.....	.....	3030-294-9815	646	140660-B	BELT.....	2
94	1	.....	205	D201624	205	D-201624	GUARD, radiator.....	1
94	2	.....	205	DA236000	205	DA-236000	RADIATOR.....	1
94	3	.....	205	145812	205	145812	CAP, radiator.....	1
94	6	.....	008	16-B6258	008	16-B6258	TUBE, upper radiator.....	1
94	10	.....	008	6-B6866	008	6-B6866	BRACE, radiator.....	1
94	14	.....	205	D-236023	205	D-236023	GUARD, fan.....	1
94	15	.....	008	10-B6258	008	10-B6258	TUBE, lower radiator.....	1
94	17	.....	008	B-6807	008	B-6807	SUPPORT.....	1
94	22	.....	008	16-B6104	008	16-B6104	BAR, radiator brace.....	1
94	23	.....	008	8-B6782	008	8-B6782	BRACE, radiator.....	1
96	1	.....	205	DA236700	205	DA-236700	RADIATOR.....	1
96	2	.....	205	145812	205	145812	CAP, radiator.....	1
96	5	.....	008	3-B6904	008	3-B6904	BRACE, radiator.....	1
96	13	.....	205	D-203923	205	D-203923	GUARD, fan.....	1
96	14	.....	QM	34-B-900-55	008	2-B6076	PAD, rubber.....	2
96	15	.....	008	3-B6076	008	3-B6076	WASHER, square.....	2
96	19	.....	008	M835-B6645	008	M835-B6645	CASTING, lower base.....	1
96	22	.....	008	4-B6076	008	4-B6076	BOLT, mounting.....	1
96	23	.....	ORD	H001-1518015	008	1-B6076	PAD, fabreeka.....	2

96	26	.....	008	1-B6904	008	1-B6904	BRACE, radiator.....	1
97	1	.....	008	18-B6786	008	18-B6786	PIPE, exhaust.....	1
97	3	.....	008	15-B4694	008	15-B4694	FLANGE, rear exhaust.....	1
97	6	.....	088	5-B4665	008	5-B4665	BRACKET, exhaust.....	1
97	8	.....	008	15-B4738	008	15-B4738	PAD, rubber.....	1
97	11	.....	008	10-B3841	008	10-B3841	GASKET.....	1
97	12	.....	008	M830-B6829	008	M830-B6829	CASTING, exhaust pipe.....	1
97	16	.....	008	15-B3526	008	15-B3526	CLAMP, exhaust pipe.....	1
98	1	.....	.....	5330-696-4838	646	67366A	GASKET, flange.....	1
98	2	.....	008	8-B6769	008	8-B6769	PIPE, exhaust.....	1
98	4	FABRI FROM	GE	46-6176-500-030	STEEL	FT 1	CLAMP, muffler, 3¼.....	2
98	5	.....	008	M60009	008	M60009	MUFFLER.....	1
98	6	.....	008	12-B6886	008	12-B6886	ROD.....	4
98	8	.....	008	12-B6833	008	20-B6833	BRACKET, muffler.....	2
98	9	.....	008	5-B6769	008	5-B6769	PIPE, exhaust.....	1
98	10	.....	008	14-B6886	008	14-B6886	STRAP, muffler.....	2
98	11	.....	.....	5340-253-7007	008	5-B933	SPRING.....	4
98	13	.....	646	67365B	646	67365B	FLANGE, companion.....	1
99	2	.....	008	2000-6-6	008	2000-6-6	CONNECTOR.....	6
99	3	.....	008	4739-6	008	4739-6	HOSE FITTING.....	6
99	4	.....	008	1525-6	008	1525-6	HOSE, 26½ long.....	1
99	11	.....	008	4L370	008	4L370	BELT.....	1
99	12	.....	150	N70-1	008	No. 1	ROTARY PUMP.....	1
99	13	.....	008	1525-6	008	1525-6	HOSE, 12½ long.....	1
99	14	.....	008	1525-6	008	1525-6	HOSE, 42 long.....	1
99	16	.....	.....	3810-352-1794	008	14132	BREATHER.....	2
99	22	.....	GE	45-7244-500-005	008	10-B3883	CLIP, pipe.....	1
99	37	.....	GE	45-7244-500-005	008	6-B3784	CLAMP, pipe.....	1
99	44	.....	008	5-B5868	008	5-B5868	GUARD, pulley.....	1
99	47	.....	008	5-B6812	008	5-B6812	RESERVOIR, oil.....	1
100	1	.....	73370	5305-374-1121	646	17262A	SCREW, cover center.....	1
100	2	.....	.....	5310-262-3000	646	11382A	GASKET, center screw.....	1

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manfacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
100	3	.....	646	17261B	646	17261B	COVER, oil filter	1
100	4	.....	646	42847A	646	42847A	WASHER, body	1
100	5	.....	646	42844CS	646	42844CS	BODY, oil filter	1
100	7	.....	.....	5330-245-5424	646	17265A	GASKET, body	1
100	8	.....	646	42247D	646	42247D	BASE, oil filter	1
100	11	.....	646	42852A	646	42852A	GASKET, attaching	1
100	12	.....	646	42846A	646	42846A	ADAPTER, center tube	1
100	13	.....	646	42845B	646	42845B	TUBE, center	1
100	14	.....	.....	2940-447-2062	646	83254DS	CARTRIDGE, oil filter	1
100	15	.....	097	11582	646	32249A	GASKET, cover	1
100	16	.....	.....	5340-253-7257	646	17263A	SPRING, cover	1
101	1	.....	646	38939BS	646	38939BS	CAP, breather	1
101	2	.....	646	42578CS	646	42578CS	PIPE, oil filler	1
101	3	.....	646	40713A	646	40713A	GASKET, attaching	1
107	4	.....	GE	5315-276-0194	008	2-B1874	PIN	1
107	8	.....	.....	5306-269-6684	008	11-B3735	EYEBOLT	1
107	9	.....	.....	5340-205-4629	008	1-B1245	SPRING, tension	1
107	10	.....	008	H2344-B2255	008	H2344-B2255	BELLCRANK, clutch	1
107	13	.....	.....	5315-276-4460	008	4-B613	PIN	2
107	15	.....	.....	5315-276-3692	008	1-B1165	PIN	1
107	16	.....	.....	3810-374-0078	008	1-B1879	LINK	1
107	17	.....	.....	5340-209-7210	008	6-B754	ROD END, clutch adjusting	1
107	19	.....	.....	5315-371-2718	008	9-B3806	PIN	1
107	22	.....	008	1-B2257	008	1-B2257	BAR, band release	2
108	1	.....	.....	3810-352-1773	008	10-B3824	CLUTCH, band assembly, hoist shaft	1
108	....	.....	.....	3010-391-4140	008	12-B3824	BAND LINING AND RIVETS	3

108	2	.....	.....	5315-371-2716	008	8-B3806	PIN	1
108	3	.....	.....	5340-200-7557	008	17-B3746	TURNBUCKLE	1
108	5	.....	.....	5306-272-6587	008	1-B1882	ROD END, clutch adjusting	1
108	9	.....	008	H2350-B2257	008	H2350-B2257	CRANK, clutch, hoist shaft	1
108	10	.....	.....	5315-242-6095	008	6-B1882	PIN	1
108	11	.....	008	8-F1018	008	8-F1018	RING, retaining	1
108	12	.....	.....	3810-371-2713	008	3-B1155	PIN	1
110	1	.....	008	8-B4163	008	8-B4163	CLUTCH BAND ASSEMBLY	1
110	....	.....	.....	3810-204-0186	008	10-B4163	BAND LINING AND RIVETS	2
110	2	.....	008	1-B2271	008	1-B2271	LINK	1
110	4	.....	008	2-B534	008	2-B534	SPRING, tension	1
110	9	.....	.....	5306-269-6684	008	11-B3735	EYEBOLT	1
110	10	.....	008	2-B919	008	2-B919	PIN	2
110	12	.....	.....	3810-371-2714	008	3-B1952	PIN, anchor	1
110	14	.....	.....	5315-352-1807	008	2-B1952	PIN, crank	1
110	15	.....	008	H2311-B2266	008	H2311-B2266	CRANK, clutch	1
112	1	.....	.....	3810-698-8005	008	H2646-F1047	CLUTCH SHOE ASSEMBLY	4
112	....	.....	008	1-F1054	008	1-F1054	LINING, clutch	4
112	....	.....	ORD	5320-058-9891	.....	NPN	RIVET, 8/10, ¼	32
112	2	.....	.....	3120-661-8712	008	76-F1107	BUSHING, Gramix	4
112	3	.....	.....	5315-664-2669	008	1-F1048	PIN, anchor	4
112	4	.....	008	1-F1049	008	1-F1049	PIN, lever arm	4
112	5	.....	008	8-F1018	008	8-F1018	RING, retaining	8
112	6	.....	008	H2647-F1049	008	H2647-F1049	CARRIER, clutch	2
112	7	.....	008	5-F1047	008	5-F1047	PIN, carrier	4
112	8	.....	008	1-F1047	008	1-F1047	BOLT, adjusting	8
112	10	.....	008	H2645-F1044	008	H2645-F1044	ARM, lever	4
112	11	.....	381	FT10	008	FT-10	BEARING, needle	4
112	12	.....	008	5-F1045	008	5-F1045	PIN, anchor	4
112	13	.....	.....	5340-664-4260	008	5-F1088	SPRING	8
112	16	.....	008	5-F1048	008	5-F1048	KEY, shifter	4
112	19	.....	.....	3810-698-8010	008	1-F1044	PIN, roller	4

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manfacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
112	20	.....	008	1-F1055	008	1-F1055	RING, retaining.....	4
117	1	.....	008	2-B6888	008	2-B6888	BAND, brake.....	1
117	....	.....	.....	3810-204-0175	008	3-B6888	LINING, woven, w/rivets.....	4
117	4	.....	008	4-B6890	008	4-B6890	BAND, brake.....	1
117	....	.....	.....	3810-510-5917	008	5-B6890	LINING, woven, w/rivets.....	4
117	7	.....	.....	5306-266-7569	008	8-B3827	EYEBOLT.....	1
117	8	.....	.....	5340-260-3918	008	7-B616	SPRING, helical, extension.....	1
117	9	.....	008	1-B1322	008	1-B1322	PIN, straight, headless.....	1
117	10	.....	008	15-B6774	008	15-B6774	ROD END, lh.....	1
117	12	.....	008	1-F1263	008	1-F1263	NUT, sleeve.....	1
117	14	.....	008	1-B6767	008	10-B6767	ROD END, rh.....	1
117	15	.....	.....	5315-276-0171	008	15-B3868	PIN, straight, headless.....	1
117	16	.....	.....	5315-245-6615	008	5-B1322	PIN, straight, headless.....	2
118	1	.....	008	2-B6879	008	2-B6879	BAND, brake.....	1
118	....	.....	.....	3810-294-7250	008	3-B6879	LINING, woven, w/rivets.....	4
118	2	.....	008	1-B1322	008	1-B1322	PIN, straight, headless.....	1
118	4	.....	008	2-B6839	008	2-B6839	BAND, brake.....	1
118	....	.....	.....	3810-294-7251	008	3-B6839	LINING, woven, w/rivets.....	4
118	6	.....	008	15-F1233	008	15-F1233	WASHER.....	2
118	7	.....	.....	5340-425-2567	008	1-B824	SPRING, helical, extension.....	1
118	8	.....	008	9-F1410	008	9-F1410	EYEBOLT.....	1
118	10	.....	008	4-B1235	008	4-B1235	PIN, straight, headless.....	1
118	12	.....	.....	5315-664-8800	008	5-B3221	PIN, straight, headless.....	1
118	13	.....	008	2-B1163	008	2-B1163	PIN, straight, headless.....	2
118	14	.....	.....	5315-242-6088	008	15-B6774	ROD END, lh.....	1
118	16	.....	008	1-F1263	008	1-F1263	NUT, sleeve.....	1

118	18	.....	008	10–B6767	008	10–B6767	ROD END, rh.....	1
120	3	.....	.....	3810–493–7891	008	6–B3123	BRAKE BAND ASSEMBLY.....	1
120	....	.....	.....	3010–474–7017	008	7–B3123	LINING, band w/rivets.....	1
120	4	.....	.....	5315–242–6088	008	2–B1163	PIN.....	1
120	6	.....	008	2–B1169	008	2–B1169	PIN.....	1
120	7	.....	008	10–B3131	008	10–B3131	ROD, adjustable.....	1
120	9	.....	008	2–B–3114	008	2–B3114	NUT, sleeve.....	1
120	10	.....	008	11–B3131	008	11–B3131	ROD, adjustable.....	1
120	11	.....	.....	5305–430–3594	008	5–B613	PIN.....	2
120	12	.....	008	26–B3108	008	26–B3108	BELLCRANK.....	1
120	13	.....	.....	5340–260–3918	008	7–B616	SPRING, tension.....	1
120	14	.....	008	H2453–B3114	008	H2453–B3114	BELLCRANK.....	1
120	15	.....	008	2–B3123	008	2–B3123	PIN, bellcrank.....	1
120	18	.....	008	1–B3123	008	1–B3123	ROD, brake reach.....	1
120	19	.....	.....	5340–200–7557	008	8–B3746	YOKE END, adjusting.....	1
120	21	.....	008	6–B3104	008	6–B3104	ROD, reach.....	1
120	23	.....	008	23–B3111	008	23–B3111	BELLCRANK.....	1
120	24	.....	.....	5315–276–4460	008	4–B613	PIN.....	3
120	25	.....	008	8–B3112	008	8–B3112	ROD, pivot.....	2
120	26	.....	008	9–B3645	008	9–B3645	SPRING, compression.....	2
120	29	.....	.....	5340–209–9216	008	2–B534	SPRING, tension.....	1
120	30	.....	.....	5306–269–6684	008	11–B3735	EYEBOLT.....	1
122	2	.....	707	RA12–6	008	RA–12–6	PIN, clevis, ½.....	2
122	3	.....	707	RA12–7	008	RA–12–7	PIN, clevis, ⅝.....	4
122	4	.....	707	C1052	008	C–1052	ROD, pull.....	2
122	6	.....	707	C354	008	C–354	CLEVIS, adjusting.....	4
122	7	.....	707	C524	008	C–524	PIN, anchor, lever arm.....	4
122	8	.....	707	C548–1	008	C–548–1	BRACKET, rh.....	1
122	....	.....	707	C549	008	C–549	BRACKET, lh.....	1
122	10	.....	008	10B3800	008	10–B3800	BOLT, with nut.....	4
122	11	.....	707	C604	008	C–604	SETSCREW, shoe adjusting.....	4
122	14	.....	707	C512–1	008	C–512–1	SCREW, anchor pin lock.....	4

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
122	15	.....	707	C522	008	C-522	PIN, brakeshoe.....	4
122	16	.....	707	C533	008	C-533	SHOE, brake shoe assembly.....	4
122	17	.....	707	C954	008	C-954	FITTING, lubrication.....	2
122	18	.....	707	C534	008	C-534	RETAINER, brakeshoe pin.....	4
122	21	.....	707	C539	008	C-539	NUT, spherical.....	2
122	23	.....	707	CA530	008	CA-530	ARM, rear, rh.....	1
122	....	.....	707	CA529	008	CA-529	ARM, rear, lh.....	1
122	25	.....	707	C523	008	C-523	SPRING, helical, extension.....	2
122	26	.....	707	C33	008	C-33	LINING, brakeshoe.....	4
122	28	.....	707	C514	008	C-514	SPRING, helical, extension.....	2
122	29	.....	707	C598-3	008	C-598-3	BUSHING.....	8
122	30	.....	707	CA532	008	CA-532	ARM, front, rh.....	1
122	....	.....	707	CA531	008	CA-531	ARM, front, lh.....	1
122	31	.....	707	C598-1	008	C-598-1	BUSHING.....	8
122	32	.....	707	C521	008	C-521	ROD, tie, lever arm.....	2
122	33	.....	707	C537	008	C-537	LEVER, brake operating.....	2
122	....	.....	707	65S	008	65S	DISK ASSEMBLY.....	1
123	1	.....	707	C413	008	C-413	LEVER, shaft operating.....	1
123	3	.....	707	C565	008	C-565	BRACKET, cross shaft.....	2
123	4	.....	707	C351	008	C-351	LEVER, shaft.....	2
123	6	.....	707	C570-2	008	C-570-2	SHAFT, cross.....	1
123	7	.....	707	C954	008	C-954	FITTING, lubrication.....	2
123	8	.....	707	C356	008	C-356	KEY, woodruff.....	3
123	9	.....	707	RA12-6	008	RA-12-6	PIN, clevis, ½.....	2
128	1	.....	008	H1959-B1238	008	H1959-B1238	ARM, lever.....	1
128	3	.....	008	3-B1237	008	3-B1237	SHAFT, lever.....	1

128	5	.....	008	H32026-B6833	008	H3026-B6833	ARM, lever.....	1
128	6	.....	.....	5315-276-0175	008	8-B1151	PIN, straight, headless.....	1
128	9	.....	.....	5315-276-0175	008	2-B1238	LINK, connecting.....	1
128	10	.....	347	2708-1-2-7A	008	4-B613	PIN, straight, headed (IMO 10).....	2
128	12	.....	.....	5315-276-0172	008	5-B3736	PIN.....	1
128	13	.....	008	H960-B976	008	H960-B976	PEDAL, accelerator.....	1
128	16	.....	008	1-B738	008	1-B738	LINK, locking.....	1
128	18	.....	008	H1440-B738	008	H1440-B738	RATCHET, brake.....	1
128	20	.....	008	H1441-B738	008	H1441-B738	PAWL, brake ratchet.....	1
128	21	.....	.....	5315-276-0174	008	7-B1160	PIN.....	1
128	24	.....	.....	5306-269-6684	008	11-B3735	EYEBOLT.....	1
128	25	.....	.....	5340-249-1705	008	3-B1163	SPRING, helical, extension.....	1
128	26	.....	008	H1444-B1238	008	H1444-B1238	LEVER, brake.....	1
128	29	.....	008	3-B1238	008	3-B1238	SHAFT, lever.....	1
129	2	.....	008	H3026-B6833	008	H3026-B6833	ARM, lever.....	1
129	4	.....	008	3-B1235	008	3-B1235	SHAFT, lever.....	1
129	6	.....	008	H3026-B6833	008	H3026-B6833	ARM, lever.....	1
129	7	.....	.....	5315-276-0175	008	8-B1151	PIN, straight, headless.....	1
129	12	.....	.....	3810-352-1778	008	1-B738	LINK, locking.....	1
129	13	.....	008	H1440-B738	008	H1440-B738	RATCHET, brake.....	1
129	15	.....	008	H1441-B738	008	H1441-B738	PAWL, brake ratchet.....	1
129	16	.....	.....	5315-276-0174	008	7-B1160	PIN.....	1
129	17	.....	.....	5315-276-0172	008	5-B3736	PIN.....	1
129	18	.....	008	H960-B976	008	H960-B976	PEDAL, accelerator.....	1
129	22	.....	008	H1946-B1229	008	H1946-B1229	LEVER, brake.....	1
129	23	.....	.....	5306-269-6684	008	11-B3735	EYEBOLT.....	1
129	25	.....	.....	5340-249-5886	008	7-B3645	SPRING, tension.....	1
129	27	.....	347	2708-1-2-7A	008	4-B613	PIN, straight, headed (IMO 10).....	2
129	28	.....	008	1-B1235	008	1-B1235	LINK, connecting.....	1
131	1	.....	008	H1916-B1186	008	H1916-B1186	BELLCRANK.....	1
131	4	.....	.....	5315-276-0178	008	12-B3804	PIN.....	1
131	5	.....	.....	3810-371-2713	008	3-B1155	PIN, band.....	1

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
131	7	.....	.....	3810-352-1816	008	23-B2671	BAND, control	1
131	....	.....	.....	3120-352-1818	008	25-B2671	BAND LINING AND RIVETS	1
131	8	.....	.....	5315-276-0173	008	6-B1157	PIN, band anchor	1
131	10	.....	.....	5306-141-4402	008	2-B724	ROD END	1
131	12	.....	008	3-B724	008	3-B724	NUT, sleeve	1
131	13	.....	008	1-B724	008	1-B724	ROD END	1
131	14	.....	.....	5315-425-2664	008	3-B1129	PIN	1
131	15	.....	008	H1936-B1217	008	H1936-B1217	LEVER	1
131	18	.....	.....	5315-132-8080	008	2-B1129	PIN	1
131	19	.....	008	5-B3100	008	5-B3100	SHAFT, lever	1
131	21	.....	.....	3810-352-1795	008	15-B3096	LEVER, hand	1
131	23	.....	008	4-B1129	008	4-B1129	ROD, reach	1
131	25	.....	.....	5340-353-1295	008	11-B3746	YOKE END, adjusting	1
131	26	.....	.....	5305-430-3594	008	5-B613	PIN	1
131	28	.....	.....	5340-209-9216	008	2-B534	SPRING, tension	1
131	30	.....	.....	3810-371-2704	008	1-B3841	CLIP, spring	1
132	1	.....	008	H1465B-B1227	008	H1465B-B1227	ARM, lever	2
132	3	.....	008	3-B1227	008	3-B1227	SHAFT, lever	1
132	6	.....	.....	5305-430-3594	008	5-B613	PIN	3
132	8	.....	008	4-B1227	008	4-B1227	LINK, lever	1
132	10	.....	008	H1956-B1234	008	H1956-B1234	LEVER, foot	1
132	12	.....	.....	5315-245-6614	008	1-B1111	PIN	1
132	13	.....	.....	3810-352-1798	008	15-B4832	LOCK, swing	1
132	14	.....	008	4-B1166	008	4-B1166	LINK, lever	1
133	1	.....	008	9-B1445	008	9-B1445	PIN, shifter pivot	2
133	3	.....	008	H2452-B3100	008	H2452-B3100	YOKE, shifter, rh	1

133	4	.....	008	H2451-B3100	008	H2451-B3100	YOKE, shifter, lh.....	1
133	5	.....	.....	5315-276-4460	008	4-B613	PIN.....	8
133	6	.....	008	7-B3093	008	7-B3093	ROD, reach.....	1
133	8	.....	008	21-B3086	008	21-B3086	LEVER, hand.....	1
133	9	.....	.....	5340-200-7557	008	17-B3746	TURNBUCKLE.....	1
133	11	.....	008	21-B3077	008	21-B3077	ROD, reach.....	1
133	15	.....	.....	5306-269-6684	008	11-B3735	EYEBOLT.....	2
133	16	.....	.....	5340-260-3918	008	7-B616	SPRING, tension.....	2
133	17	.....	.....	5340-200-7557	008	8-B3746	YOKE END, adjusting.....	2
133	19	.....	008	17-B3096	008	17-B3096	ROD, reach.....	1
133	20	.....	008	6-B3093	008	5-B3093	LINK.....	1
133	22	.....	008	H2450-B6546	008	H2450-B6546	BELLCRANK.....	1
133	23	.....	008	9-B3123	008	9-B3123	PIN.....	1
133	24	.....	008	24-B3077	008	24-B3077	ROD, reach.....	1
134	1	.....	.....	5315-276-0173	008	6-B1157	PIN, band anchor.....	1
134	2	.....	.....	3810-371-2713	008	3-B1155	PIN, band.....	1
134	4	.....	.....	3810-352-1816	008	23-B2671	BAND, control.....	1
134	....	.....	.....	3120-352-1818	008	25-B2671	BAND LINING AND RIVETS.....	1
134	6	.....	.....	5306-141-4402	008	2-B724	ROD END.....	1
134	8	.....	008	3-B724	008	3-B724	NUT, sleeve.....	1
134	9	.....	.....	5315-425-2664	008	3-B1129	PIN.....	1
134	10	.....	008	1-B724	008	1-B724	ROD END.....	1
134	11	.....	.....	5315-276-4460	008	4-B613	PIN.....	2
134	14	.....	008	H1461-B753	008	H1461-B753	ARM, lever.....	1
134	15	.....	.....	5340-209-9216	008	2-B534	SPRING, tension.....	1
134	16	.....	.....	5306-269-6684	008	11-B3735	EYEBOLT.....	1
134	19	.....	008	5-B1219	008	5-B1219	SHAFT, lever.....	1
134	20	.....	008	B1562	008	B1562	LEVER, hand.....	1
134	21	.....	008	H1941-B1219	008	H1941-B1219	ARM, lever.....	1
134	23	.....	008	6-B755	008	6-B755	ROD, reach.....	1
134	25	.....	.....	5340-200-7557	008	8-B3746	YOKE END, adjusting.....	1
134	27	.....	.....	5315-276-0178	008	12-B3804	PIN, pivot.....	1

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
134	28	.....	008	H1927-B1210	008	H1927-B1210	ARM, lever	1
136	1	.....	.....	3810-569-0535	008	10-B2756	BAND, control	1
136	....	.....	.....	3810-294-7249	008	11-B2756	BAND LINING AND RIVETS	1
136	5	.....	008	5-B968	008	6-B968	ROD, reach	1
136	7	.....	.....	5340-496-1116	008	3-B960	NUT, sleeve	1
136	8	.....	.....	5306-425-2700	008	4-B960	ROD END	1
136	9	.....	.....	5315-253-3011	008	2-B1158	PIN	3
136	11	.....	008	4-B755	008	4-B755	PIN, pivot	1
136	12	.....	008	H1893-B1156	008	H1893-B1156	ARM, lever	1
136	13	.....	008	3-B755	008	3-B755	PIN, anchor	1
137	1	.....	008	H2749-F1098	008	H2749-F1098	ARM, lever, rh	1
137	2	.....	008	10-B6251	008	10-B6251	PIN	2
137	3	.....	008	4-B1571	008	4-B1571	PIN	2
137	5	.....	008	HF-10	008	HF-10	ROD END	4
137	7	.....	008	3-F1098	008	3-F1098	ROD, reach	1
137	8	.....	008	H2748-F1098	008	H2748-F1098	ARM, lever, lh	1
137	11	.....	008	5-F1098	008	5-F1098	ROD, reach	1
137	12	.....	.....	5315-253-3011	008	2-B1158	PIN	1
137	13	.....	008	10-F1070	008	10-F1070	LEVER, hand	1
137	16	.....	008	13-B2209	008	13-B2209	PIN	1
138	1	.....	008	9-B4195	008	9-B4195	PIN	1
138	2	.....	008	4-B4195	008	4-B4195	YOKE END, adjusting	1
138	5	.....	008	3-D800-SN-125	008	3-D800-SN-125	CONTROL, flexible	1
138	9	.....	008	20-B6891	008	20-B6891	BRACKET	1
138	16	.....	008	15-B6891	008	15-B6891	BRACKET, starter	1
139	1	.....	008	1-B7016	008	1-B7016	LEVER	1

139	2	.....	008	12-B1905	008	12-B1905	PIN.....	1
139	4	.....	008	14-B3736	008	14-B3746	YOKE END, adjusting.....	1
139	8	.....	896	8354-10	008	3-D800-SN-125	CONTROL, flexible.....	1
139	16	.....	008	4-B9195	008	4-B4195	YOKE END, adjusting.....	1
139	17	.....	008	9-B4195	008	9-B4195	PIN.....	1
139	18	.....	008	23-B6891	008	23-B6891	BRACKET, starter.....	1
139	22	.....	008	6-B4090	008	6-B4090	PIN.....	1
139	23	.....	.....	5306-269-6684	008	11-B3735	EYEBOLT.....	1
139	24	.....	.....	5340-209-9216	008	2-B534	SPRING.....	1
140	1	.....	.....	5315-276-4460	008	4-B613	PIN.....	4
140	2	.....	008	6-B3840	008	6-B3840	ROD, reach.....	1
140	4	.....	.....	5340-200-7557	008	8-B3746	YOKE END, adjusting.....	2
140	5	.....	008	H1643-B878	008	H1643-B878	ARM, lever.....	1
140	10	.....	008	6-B1322	008	6-B1322	PIN.....	1
140	12	.....	008	H2561-B3840	008	H2561-B3840	BELLCRANK.....	1
140	13	.....	008	15-B6866	008	15-B6866	ROD, reach.....	1
140	14	.....	008	H1510-B794	008	H1510-B794	LEVER, hand.....	1
140	16	.....	008	4-B1241	008	4-B1241	PIN.....	1
141	2	.....	008	24-B3876	008	24-B3876	PEDAL, accelerator.....	1
141	5	.....	008	10-B3879	008	10-B3879	LEVER, foot.....	1
141	8	.....	008	5-B6963	008	5-B6963	SHAFT, shifter	1
141	9	.....	008	5-B3418	008	5-B3418	ARM, lever, front.....	1
141	12	.....	.....	5305-430-3594	008	5-B613	PIN, end.....	3
141	14	.....	008	15-B6842	008	15-B6842	ROD, reach.....	1
141	16	.....	.....	5340-353-1295	008	11-B3746	YOKE END, adjusting.....	2
141	17	.....	008	1-B6970	008	1-B6970	ARM, lever, rear.....	1
141	18	.....	.....	5340-209-9216	008	2-B534	SPRING, pedal return.....	1
142	2	.....	008	6-B5606	008	6-B5606	BRACKET.....	1
142	4	.....	.....	5315-276-0172	008	5-B3736	PIN.....	1
142	5	.....	008	1-B5606	008	1-B5606	LINK, connecting.....	1
142	6	.....	008	6-B4090	008	6-B4090	PIN.....	3
142	8	.....	008	11-B4171	008	11-B4171	LEVER.....	1

Figure No	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
142	13	.....	008	3–B4171	008	3–B4171	SHAFT, lever	1
142	14	.....	008	5–B4450	008	5–B4450	LEVER	1
142	15	.....	008	14–B3746	008	14–B3746	YOKE END, adjusting	1
142	17	.....	008	12–B6972	008	12–B6972	ROD, reach	1
143	1	.....	008	X–02	008	X–02	LATCH, grip	1
143	2	.....	020	X–03	008	X–03	SPRING, latch	1
143	3	.....	008	X–01–C–26–B4450	008	X–01–C–26–B4550	LEVER, hand	1
143	5	.....	190	32693	008	X–06–4	CONNECTOR, rod end	1
143	6	.....	190	32691	008	X–07–C	ROD AND PAWL	1
143	7	.....	190	32692	008	X–08	SCREW, pawl	2
143	8	.....	008	1–B6066	008	1–B6066	SHAFT	1
143	9	.....	008	16–B6954	008	15–B6954	ARM, lever	1
143	11	.....	.....	5305–430–3594	008	5–B613	PIN	2
143	12	.....	.....	5340–353–1295	008	11–B3746	YOKE END, adjusting	2
143	14	.....	008	11–B6900	008	11–B6900	ROD, reach	1
143	22	.....	008	X–14–4	008	X–14–4	RATCHET	1
143	24	.....	190	37476	.....	X–04	SCREW, latch	2
145	2	.....	.....	4730–447–2179	041	4602	PLUG, ball joint	2
145	3	.....	73460	2520–447–2180	041	4607	SEAT, ball joint	4
145	4	.....	.....	5340–246–7580	041	4553	SPRING, ball joint	2
145	5	.....	73460	2520–425–7099	041	4601	SOCKET, ball joint	2
145	7	.....	041	5197	041	5197	LINK, drag	1
145	8	.....	.....	2520–039–7119	041	4599	YOKE, selector	2
145	12	.....	041	5196	041	5196	SHAFT, selector	1
145	14	.....	.....	5330–233–5858	041	4608	WASHER, felt	2
146	1	.....	.....	5340–664–6198	041	2536	SPRING, lever	1

146	2	.....	73460	5310-352-9157	041	2538	WASHER, lever.....	1
146	3	.....	008	10B6886	008	10-B6886	LEVER, gearshift.....	1
146	4	.....	.....	3120-425-7100	041	4606	BUSHING, selector shaft.....	1
146	7	.....	041	10427	041	10427	BOOT, lever.....	1
146	8	.....	.....	2520-391-3200	041	1075	BALL, lever.....	1
146	13	.....	73460	2520-569-3662	041	4609	HOUSING, lever.....	1
146	14	.....	.....	5306-263-8912	041	2271	PIN, pivot.....	1
148	1	.....	73460	2520-352-4527	041	4600	COVER, remote control.....	1
148	2	.....	.....	5330-371-2934	041	1513	GASKET, cover plate.....	1
148	4	.....	73460	2520-371-2933	041	1512	PLATE, control cover.....	1
148	7	.....	041	6902	041	6902	BRACKET, shaft.....	1
148	8	.....	041	6139	041	6139	SHAFT, shifting.....	1
148	10	.....	73460	2520-352-4526	041	4598	LEVER, outer shift.....	1
148	13	.....	.....	5340-246-7579	041	5549	SPRING, position finder.....	1
148	15	.....	73460	2520-425-7098	041	4597	LEVER, inner shift.....	1
148	16	.....	GE	22-8011-500-380	041	1819	LOCKWIRE.....	1
148	18	.....	.....	2520-569-3663	041	1642	GASKET, control cover.....	1
149	1	.....	.....	5305-430-3594	008	5-B613	PIN.....	6
149	2	.....	008	5-B3425	008	5-B3425	ROD, reach.....	1
149	4	.....	008	2-B2433	008	2-B3423	ARM, lever.....	1
149	5	.....	.....	5340-353-1295	008	11-B3746	YOKE END, adjusting.....	4
149	7	.....	008	3-B6822	008	3-B6822	ROD, reach.....	2
149	8	.....	008	H2499-B3407	008	H2499-B3407	LEVER, shift.....	1
149	9	.....	008	15-B4906	008	15-B4906	LEVER, shift.....	1
149	14	.....	008	7-B6822	008	7-B3419	ARM, lever.....	1
149	16	.....	008	2-B6822	008	2-B6822	SHAFT, lever.....	1
149	17	.....	.....	28-B3420	008	28-B3420	ARM, lever.....	1
149	18	.....	008	5-B6896	008	5-B6896	ROD, reach.....	1
149	20	.....	008	5-B1985	008	5-B1985	PIN.....	2
149	22	.....	008	1-B6822	008	1-B6822	SHAFT, lever.....	1
149	23	.....	008	5-B6970	008	5-B6970	ARM, lever.....	1
152	2	.....	255	M2520	255	M2520	WEIGHT.....	2

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
152	3	.....	255	36658–15	255	36658–15	BAR	2
152	4	.....	255	36658–2	255	36658–2	PLATE	3
152	5	.....	.....	3120–352–5021	255	20270AB	BUSHING	2
152	6	.....	255	36658–7	255	36658–7	SPACER	2
152	7	.....	.....	3020–288–3078	255	CS21103AN	SHEAVE	2
152	8	.....	255	36658–27	255	36658–27	PIN	1
152	9	.....	255	36658–34	255	36658–34	AXLE	1
152	11	.....	255	1980	255	1980	FITTING, lubrication	1
152	12	.....	255	36658–9	255	36658–9	BOLT, machine	1
152	13	.....	255	36658–8	255	36658–8	BOLT, machine	2
152	14	.....	255	36658–6	255	36658–6	SPACER	6
152	17	.....	255	37739–42	255	37739–42	PIN	1
152	18	.....	.....	4030–217–3423	255	37739	HOOK ASSEMBLY	1
153	1	.....	090	91114	090	91114	CLAMSHELL BUCKET ASSEMBLY	1
153	2	.....	.....	.....	090	XO–46	BOLT, cable guard	1
153	3	.....	.....	.....	090	XO–45	GUARD, cable	1
153	4	.....	090	XO–19–1	090	XO–19–1	LOCKPIN	1
153	5	.....	.....	.....	090	XO–19	PIN, upper sheave	1
153	6	.....	090	XO20	090	XO–20	BUSHING, upper sheave	1
153	7	.....	806	1627	090	XO–17	FITTING, grease	5
153	8	.....	090	XO9	090	XO–9	SHEAVE, closing	1
153	9	.....	.....	.....	090	XO–2–26	PIN, line	1
153	10	.....	.....	.....	090	XO–30	WEDGE, socket	1
153	11	.....	090	X1–29	090	XO–29	SOCKET, holding cable	1
153	12	.....	090	XO15	090	XO–15	ROLLER, upper	1
153	13	.....	090	XO13	090	XO–13	PIN, roller	1

153	14		090	XO37	090	XO–47	LOCKPIN	1
153	15				090	XO–28	PIN, guard	2
153	16		090	XO–28–1	090	XO–28–1	LOCKPIN	2
153	17		090	XO15	090	XO–16	ROLLER, lower	2
153	18		090	XO18	090	XO–18	COLLAR, guide	1
153	19		090	XO12	090	XO–12	SHEAVE, guide	1
153	20		150	N38–3A	090	XO–34	BUSHING, guide sheave	1
153	21		090	XO–22–1	090	XO–22–1	LOCKPIN	2
153	22		090	XO22	090	XO–22	PIN, guide sheave	1
153	23		090	XO14	090	XO–14	BAR, corner	2
153	24		090	XO39	090	XO–39	CLIP, tagline	2
153	25				090	XO–40	BOLT, tagline clip	2
153	26				090	XO–40–1	NUT, tagline clip	2
153	27		090	XO32	090	XO–32	BUSHING, bar	4
153	28		090	XO24–1	090	XO–24–1	LOCKPIN	2
153	29		090	XO4	090	XO–4	BRACKET, bar, rh	2
153	30		090	XO24	090	XO–24	PIN, bracket	4
153	31				090	XO–25	BRACKET, bar, lh	2
153	32		090	XO36	090	XO–36	BAND, back	2
153	33		090	XO37	090	XO–37	SCOOP	1
153	34		090	XO41	090	XO–41	LIP, scoop	1
153	35		090	XO43	090	XOL–43	TOOTH, digging	6
153	36		090	XO2	090	XO–2	HINGE, right	1
153	37		090	XO3	090	XO–3	HINGE, left	1
153	38		090	XO9	090	XO–11	SHEAVE, arm	2
153	39		150	N38–3A	090	XO–33	BUSHING, arm sheave	2
153	40		090	XOA–1	090	XOA–1	PIN, arm sheave	1
153	41		090	XOA–2	090	XOA–2	LOCKPIN	2
153	42				090	XO–51	BOLT, counterweight	2
153	43		090	XO50	090	XO2–50	COUNTERWEIGHT	2
153	44		090	95907	090	95907	LOCKWASHER, counterweight	4
153	45		090	XO51–1	090	XO–51–1	NUT, counterweight	4

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
153	46		090	XO1	090	XO–1	ARM, lever	1
153	47				090	XO–6	PLUG, grease	1
153	48		090	XO31	090	XO–31	BUSHING, arm	2
153	49		090	XO23–1	090	XO–23–1	PIN, end	2
153	50				090	XO–23	SHAFT, hinge	1
153	51		090	XO41	090	XO–41	LIP, scoop	1
153	52		090	XO38	090	XO–38	SCOOP	1
153	53		090	XO13	090	XO–13	BAR, corner	2
153	54				090	XO–7	BOLT, corner bar	20
153	55		090	XO7	090	XO–7	NUT, corner bar	20
153	56		090	XO7–1	090	XO–7–1	LOCKWASHER, corner bar	20
153	57		090	XO8	090	XO–8	HEAD, frame	1
153	58		090	XO2–26–2	090	XO2–26–2	PIN, cotter	2
153	59				090	XO2–26	PIN, hold line	1
154	2			3815–371–6360	764	Y34	PLATE, safety	1
154	3			3815–371–6359	764	Y26	WHEEL	1
154	5			3815–354–6212	764	NSF100	ARM, fairlead	1
154	6		367	50441	764	50441	SEAL, oil	1
154	7			3815–354–6215	764	Y27	BEARING, head	1
154	8			5330–641–2065	764	NSF101	GASKET, head bearing	1
154	10			3815–354–6218	764	Y35	SHAFT	1
154	11			3815–354–6216	764	Y28	BUSHING	1
154	12		764	Y40	764	636–40	CORE ASSEMBLY	1
154	13			5340–664–4498	764	Y38	SPRING	1
154	14			3815–354–6217	764	Y29	PROPELLER	1
154	15			3815–354–6220	764	Y39	HOUSING	1

154	19	.....	.....	ORD5310-266-0389	764	NSF104	NUT, sheave pin.....	2
154	20	.....	.....	.....	764	NSF102	GUIDE, cable.....	1
154	21	.....	.....	.....	.....	.....	CABLE.....	AR
154	22	.....	.....	3020-352-0998	764	NSF103	SHEAVE, fairlead.....	2
154	25	.....	.....	3815-354-6214	764	NSF105	PIN, sheave.....	2
155	1	.....	020	211653	020	211653	BODY.....	1
155	2	.....	020	942033	020	942033	PIN, cotter.....	2
155	3	.....	011	942032	011	942032	PIN, arch.....	1
155	4	.....	09348	3815-125-5790	020	194757A	SPOOL, hoist trunnion.....	2
155	5	.....	09348	3815-125-3090 NS	4020	197498AA	TRUNNION, hoist.....	2
155	6	.....	020	942040	020	942040	PIN, cotter.....	4
155	7	.....	.....	.....	011	942039	PIN, hoist trunnion.....	2
155	8	.....	.....	.....	011	942036	PIN, hitch.....	2
155	9	.....	020	9340408	020	9340408	LOCK, hitch pin.....	2
155	10	.....	011	934047	011	934047	LINK, drag.....	2
155	11	.....	09348	3815-425-4557	020	281895A	PLATE, clevis.....	2
155	12	.....	020	221323AD NS 4	020	221323AD	LIP, bucket.....	1
155	13	.....	09348	3815-425-4360	020	13-295412	SHIM SET.....	1
155	14	.....	011	942029	011	942029	TOOTH, bucket.....	4
155	15	.....	020	942030	020	942030	PIN, cotter.....	4
155	16	.....	011	91118	011	91118	BUCKET ASSEMBLY.....	1
155	17	.....	011	915073	011	915073	CHAIN, drag.....	2
155	18	.....	011	915071	011	915071	CHAIN, hoist.....	1
155	19	.....	011	911095	011	911095	BAR, spreader.....	1
155	20	.....	011	911076	011	911076	DUMP SHEAVE ASSEMBLY.....	1
156	2	.....	008	1-B5864	008	1-B5864	MUDGUARD.....	1
156	5	.....	008	7-B5852	008	7-B5852	COVER.....	1
156	6	.....	008	10-B5856	008	10-B5876	GASKET.....	1
156	7	.....	008	5-B5852	008	5-B5852	WASHER, bronze.....	2
156	8	.....	008	B6163	008	B6193	BRACKET, fairlead, rear.....	1
156	9	.....	008	15-B5399	008	15-B5399	PIN.....	1
156	11	.....	008	H2740-B5841	008	H2740-B5841	PULLEY.....	3

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
156	12	.....	008	D2366	008	D2366	BRACKET, fairlead, front.....	1
156	13	.....	008	H2741–B5399	008	H2741–B5399	BAR, wear.....	2
156	17	.....	008	10–B5850	008	10–B5850	CAP, end.....	4
156	18	.....	.....	17B 5850 SHIM..... 0.005 EA 2. 1B 5852 SHIM 0.007 EA 3. 3B5852 SHIM 0.020 EA 1.	008	.....	SHIM SET.....	4
156	19	.....	008	12–B5850	008	12–B5850	SLEEVE.....	4
156	20	.....	008	15–B5850	008	15–B5850	SEAL, bearing.....	8
156	21	.....	008	25580	008	25580	CONE, bearing.....	8
156	22	.....	008	25520	008	25520	CUP, bearing.....	8
156	23	.....	008	H2739–B5840	008	H2739–B5840	PULLEY.....	1
156	24	.....	008	5–B5850	008	5–B5850	BAR, lock.....	4
156	27	.....	008	1–B5850	008	1–B5850	PIN, pulley.....	4
156	31	.....	008	9–B5852	008	9–B5852	PIN.....	1
156	32	.....	008	73–B5852	008	73–B5852	BUSHING, bronze.....	2
157	1	.....	008	2–B6426	008	2–B6426	BRACKET, cable, lh.....	1
157	2	.....	008	D3269	008	D3269	BOOM LOWER SECTION.....	1
157	3	.....	.....	5315–423–7022	008	1–B2864	PIN, connection.....	8
157	5	.....	GE	78–2841–052–305	008	B6837	BOOM CENTER SECTION, 5 ft.....	1
157	7	.....	008	10–B3834	.....	10–B3834	PIN.....	1
157	8	.....	.....	3120–425–2574	008	10–B3657	BUSHING, bronze.....	2
157	9	.....	008	13–B3834	008	13–B3834	ROLLER.....	1
157	10	.....	008	23–B3835	008	23–B3835	BRACKET.....	1

157	13	.....	008	18-B3835	008	18-B3835	BRACKET.....	1
157	14	.....	008	D3273	008	D3273	BOOM UPPER SECTION.....	1
157	23	.....	008	3-B5095	008	3-B5095	HOUSING.....	1
157	24	.....	522	5503D	008	5503	BEARING, ball.....	1
157	26	.....	008	7-B5095	008	7-B5095	CAP.....	1
157	29	.....	008	5-B5095	008	5-B5095	POINTER.....	1
157	33	.....	008	D3266	008	D3266	INDICATOR, radius.....	1
157	34	.....	008	1-B5095	008	1-B5095	SHAFT.....	1
157	36	.....	008	1-B6426	008	1-B6426	BRACKET, cable, rh.....	1
157	37	.....	008	10-B6426	008	10-B6426	PIN.....	2
158	3	.....	008	T14-Y113	008	T14-Y113	PULLEY.....	2
158	4	.....	008	9-B3657	008	9-B3657	BUSHING, bronze.....	2
158	5	.....	008	15-B3717	008	15-B3717	PIN.....	1
158	10	.....	.....	3020-200-1539	008	H2049-B3955	PULLEY.....	2
158	11	.....	.....	5340-285-2102	008	3-B3576	RING, retaining.....	4
158	12	.....	.....	3110-155-6757	008	77211	BEARING, ball.....	4
158	13	.....	008	1-B1170	008	1-B1170	WASHER.....	4
158	15	.....	008	3-B6785	008	3-B6785	PIN.....	1
158	16	.....	008	15-B3549	008	15-B3549	BAR, lock.....	1
158	19	.....	008	4-B1151	008	4-B1151	COLLAR.....	2
159	1	.....	008	H1560-B827	008	H1560-B827	WEDGE, cable, ½.....	1
159	2	.....	.....	3810-395-4515	008	H2433-H2433A-B3046	LAGGING: crane, clamshell, backhoe	1
159	4	.....	008	3-B1627	008	3-B1627	DOWEL.....	2
159	5	.....	.....	4030-374-1502	008	H1556-B826	WEDGE, cable, ⅝.....	1
159	6	.....	008	H2738-H2738A-B5840	008	H2738-H2738A-B5840	LAGGING: dragline.....	1
159	7	.....	008	1-B1627	008	1-B1627	DOWEL, long.....	1
159	8	.....	008	6-B1627	008	2-B1627	DOWEL, short.....	1
161	1	.....	.....	3110-155-6757	008	77211	BEARING, ball.....	2
161	2	.....	.....	5340-285-2102	008	3-B3576	RING, retaining.....	2
161	3	.....	008	H1915A-B3958	008	H1915A-B3958	PULLER.....	1

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
161	4	.....	008	B-6924	008	B6924	CAGE, pulley	1
161	5	.....	008	5-B4990	008	5-B4990	PIN, pulley	1
161	7	.....	008	30-B4956	008	30-B4956	PIN	1
161	8	.....	008	9-B3657	008	9-B3657	BUSHING, bronze	2
162	1	.....	008	D1699	008	D1699	BUCKET	1
162	3	.....	008	30-B4956	008	30-B4956	PIN	1
162	4	.....	008	20-B4982	008	20-B4982	PIN	2
162	5	.....	008	10-B4737	008	10-B4737	BAR, brace	2
162	7	.....	008	12-B5126	008	12-B5126	COLLAR	2
162	11	.....	008	7-B650	008	7-B650	PIN	2
162	12	.....	.....	5306-423-7030	008	1-B957	BOLT, tooth	4
162	13	.....	.....	3815-371-2703	008	H2191-B1837	TOOTH	4
162	17	.....	008	15-B4978	008	15-B4978	PIN, straight, headless	2
162	18	.....	008	10-B4978	008	10-B4978	PIN	1
162	19	.....	008	H2661-B4944	008	H2661-B4944	PLATE, front	1
162	20	.....	.....	3815-425-2575	008	10-B4777	KEEPER, latch	1
163	1	.....	008	12-B4982	008	12-B4982	CHAIN, trip	1
163	3	.....	008	10-B4970	008	10-B4970	LEVER, latch	1
163	6	.....	008	15-B4971	008	15-B4971	BAR, latch	1
163	7	.....	008	7-B4971	008	7-B4971	HINGE	2
163	8	.....	008	1-B3800	008	1-B3800	BUSHING, steel	2
163	9	.....	008	20-B4958	008	20-B4958	STOP, hinge	2
163	11	.....	008	11-B4970	008	11-B4970	YOKE, latch	1
163	14	.....	ORD	H101-O179933	008	5-B6108	SCREW, cap	1
163	15	.....	008	7-B6108	008	7-B6108	SCREW, cap	1
165	1	.....	008	H2196-B1845	008	H2196-B1845	PLUG, end, lh	1

165	2	.....	008	B6832	008	B6832	HANDLE.....	1
165	3	.....	008	10–4158	008	10–B4158	BLOCK, oak.....	1
165	6	.....	008	13–B4979	008	13–B4979	STOP, handle.....	2
165	9	.....	.....	5306–269–6684	008	11–B3735	EYEBOLT.....	1
165	10	.....	.....	5340–249–5886	008	7–B3645	SPRING, extension.....	1
165	17	.....	008	15–B4980	008	15–B4980	LEVER, trip.....	1
165	22	.....	008	13–B4976	008	13–B4976	PIN, lever.....	1
165	23	.....	008	T389C–B1842	008	T389C–B1842	RACK SECTION.....	16
165	24	.....	008	H2195–B1845	008	H2195–B1845	PLUG, end, rh.....	1
165	25	.....	.....	4030–125–2997	008	H1649–B902	WEDGE, cable.....	1
167	1	.....	008	15–B5260	008	15–B5260	BOLT, anchor.....	2
167	2	.....	008	3–B1414	008	3–B1414	PIN.....	1
167	3	.....	.....	3120–352–1857	008	64–B5276	BUSHING, bronze.....	2
167	6	.....	.....	3810–352–1799	008	15–B5239	GUIDE, spring.....	4
167	9	.....	.....	5340–257–2168	008	5–B1074	SPRING, compression.....	2
167	10	.....	008	19–B5250	008	19–B5250	PIN.....	1
167	11	.....	008	4–B414	008	4–B414	LINK.....	2
167	12	.....	008	H1976B–B1414	008	H1976B–B1414	WHEEL, chain sprocket.....	2
167	13	.....	008	46–B3662	008	46–B3662	BUSHING, bronze.....	2
167	15	.....	.....	5330–569–3571	008	1–B5239	WASHER, fabreeka.....	4
167	16	.....	008	10–B5260	008	10–B5260	SPACER.....	2
167	17	.....	008	20–B5257	008	20–B5257	WASHER.....	2
167	20	.....	008	20–B5255	008	20–B5255	PIN.....	1
167	22	.....	.....	3810–374–0081	008	10–B5239	ROD, takeup.....	2
167	23	.....	008	4–B1401	008	4–B1401	BAR.....	2
167	24	.....	008	H2197–B1843	008	H2197–B1843	SPROCKET, split chain.....	1
167	28	.....	008	2–B809	008	2–B809	DOWEL.....	2
169	2	.....	008	M55–B641	008	M55–B641	COLLAR.....	2
169	3	.....	008	1–B6827	008	1–B6827	YOKE, lh.....	1
169	6	.....	008	7–B3942	008	7–B3942	SHIM.....	AR
169	7	.....	008	8–B646	008	8–B646	PLATE, wear.....	2
169	9	.....	008	22–B3660	008	22–B3660	BUSHING, bronze.....	2

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
169	10	.....	008	T390A–B917	008	T390A–B917	PINION, rack	2
169	11	.....	008	1–W600	008	1–W600	SHAFT	1
169	13	.....	008	H2198–B1843	008	H2198–B1843	SPROCKET, chain	1
169	14	.....	008	474–179	008	474–179	CHAIN, sprocket wheel	1
169	15	.....	008	B6828	008	B6828	YOKE, rh	1
169	20	.....	.....	3810–492–6881	008	H1764A–B1776	LEVER, trip	1
169	21	.....	.....	3815–204–0253	008	M150A–B1049	PULLEY	2
169	22	.....	.....	5315–265–0434	008	2–B1032	PIN	1
169	24	.....	.....	5315–263–9002	008	1–B1032	PIN	1
170	1	.....	008	D3341	008	D3341	BOOM	1
170	5	.....	008	1–B1403	008	1–B1403	STUD, threaded	4
170	6	.....	008	5–B3952	008	5–B3952	SHIM	AR
170	7	.....	008	M573–B1403	008	M573–B1403	BUSHING, brass	2
170	8	.....	008	H2048–B1403	008	H2048–B1403	CAP, bearing	2
170	14	.....	008	6–B2491	008	6–B2491	COLLAR	2
170	16	.....	008	M48C–B1656	008	M48C–B1656	PULLEY, hoist	2
170	17	.....	008	12–B3657	008	12–B3657	BUSHING, brass	2
170	18	.....	008	17–B2489	008	17–B2489	PIN	1
170	19	.....	008	4–B1225	008	4–B1225	PIN	1
170	22	.....	.....	4030–352–1663	008	H1555–B826	SOCKET	1
170	23	.....	.....	4030–374–1502	008	H1556–B826	WEDGE	1
170	25	.....	008	H2047A–B1860	008	H2047A–B1860	BEARING	1
170	26	.....	008	28–D1092	008	28–D1092	GUARD	1
171	2	.....	008	1–B2491	008	1–B2491	PIN, point	1
171	4	.....	008	1–B1170	008	1–B1170	SPACER	3
171	5	.....	.....	3110–155–6757	008	77211	BEARING, ball	4

171	6	.....	.....	5340–285–2102	008	3–B3576	RING, retaining.....	4
171	7	.....	.....	3020–200–1539	008	H2049–B3955	PULLEY.....	2
172	3	.....	.....	3815–204–0253	008	M150A–B1049	PULLEY.....	4
172	5	.....	.....	3815–425–2595	008	18–B1716	PIN, pulley.....	3
172	12	.....	229	2208	008	2321	CONNECTOR, wire.....	3
172	16	.....	008	3–B1707	008	3–B1707	BRACKET, pulley.....	1
172	23	.....	008	9–B1707	008	9–B1707	GUIDE PIPE, cable.....	1
172	24	.....	008	10–B1707	008	10–B1707	PIN, pulley.....	1
172	25	.....	008	1–B1707	008	1–B1707	BRACKET, cable guide.....	1
172	28	.....	.....	4030–125–2997	008	H1649–B902	WEDGE, cable.....	2
172	29	.....	008	1–B1709	008	1–B1709	GUARD, cable.....	1
172	32	.....	008	9–B6804	008	9–B6804	TUBE, counterweight.....	1
172	33	.....	008	2–B1083	008	2–B1083	COUNTERWEIGHT.....	1
172	34	.....	008	2–B3765	008	8–B3765	CLIP, cable.....	1
173	1	.....	896	3129X2	896	3129X2	CAP, brass pipe: std.....	1
173	2	.....	008	10–B3765	008	10–B3765	SPRING, helical, compression.....	1
173	4	.....	008	3–B2864	008	3–B2864	SEAT, pushbutton spring.....	1
173	5	.....	606	IB23	606	IB23	NUT.....	2
173	6	.....	914	45–2036–500–001	008	7–B3765	CAP, brass pipe.....	1
173	7	.....	.....	2920–362–2293	606	IGP33	CONTACT, electrical.....	2
173	8	.....	008	2–B2864	008	2–B2864	INSULATOR.....	1
173	9	.....	008	12–B3765	008	12–B3765	TERMINAL, button.....	1
175	2	.....	.....	5315–242–6085	008	1–B1126	PIN, straight, headless.....	1
175	3	.....	.....	3815–492–6882	008	H1855–B1132	SHOE, band.....	1
175	4	.....	.....	5306–352–1822	008	3–B1132	BOLT, eye.....	1
175	6	.....	.....	5340–664–4542	008	2–B1132	NUT, sleeve.....	1
175	7	.....	.....	5306–276–8449	008	4–B1132	CONNECTOR, rod end.....	1
175	8	.....	008	H1979–B1271	008	H1979–B1271	LEVER.....	1
175	9	.....	.....	5305–430–3594	008	5–B613	PIN, straight, headed.....	2
175	10	.....	.....	5315–265–9449	008	5–B3968	PIN, pivot.....	1
175	11	.....	.....	5306–425–2604	008	2–B1136	BOLT, eye.....	1
175	12	.....	.....	5340–425–2690	008	4–B1136	SPRING, compression, trip lever.....	1

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
175	13	.....	.....	5330-245-5470	008	3-B1136	GASKET	1
175	14	.....	.....	3815-352-1843	008	4-B901	COVER, case, magnet	1
175	15	.....	.....	3815-425-2550	008	1-B1136	PLUNGER, magnet	1
175	16	.....	.....	5950-234-4688	008	1-B901	WINDING, magnet	1
175	17	.....	008	1-B4397	008	1-B4397	CASE, magnet	1
175	26	.....	008	3-B666	008	3-B666	PIN, straight, headed	1
175	27	.....	.....	3010-425-2548	008	1-B1132	LINING	1
176	1	.....	816	60808	008	60808	SEAL, oil	1
176	2	.....	008	H2743-F1093	008	H2743-F1093	RING, adjusting, outer	1
176	3	.....	.....	3810-352-1676	008	H1647-B901	WHEEL, control	1
176	5	.....	.....	5315-425-2745	008	7-B901	PIN, clutch	2
176	6	.....	.....	5340-249-1707	008	6-B953	SPRING, extension	1
176	7	.....	.....	3110-155-6683	008	77207	BEARING, ball	2
176	8	.....	.....	5340-663-2381	008	1-B4592	RING, retaining	2
176	9	.....	008	H2648-B4592	008	H2648-B4592	DRUM, cable	1
176	14	.....	.....	3810-352-1677	008	H1648-B901	CARRIER, clutch	1
176	15	.....	.....	3120-425-2674	008	3-B3671	BUSHING	1
176	16	.....	.....	3810-162-8109	008	H1751-B1006	SHOE, clutch	1
176	17	.....	.....	3010-423-7052	008	4-B1006	LINING	1
180	2	.....	008	16-B6640	008	16-B6640	PIN, bail	2
180	3	.....	008	B6880	008	B6880	BAIL, hoe	1
180	5	.....	008	9-B6020	008	9-B6020	BAR, lock	1
180	8	.....	008	4-B6270	008	4-B6270	PIN, pulley	1
180	9	.....	008	15-B6261	008	15-B6251	COLLAR	2
180	10	.....	008	T58691	008	T58691	SEAL, oil	2
180	11	.....	008	477	008	477	CONE, bearing	2

180	12	.....	008	472D	008	472D	CUP, bearing.....	2
180	13	.....	008	H2932-B6251	008	H2932-B6251	PULLEY.....	1
180	15	.....	008	1-B6270	008	1-B6270	SLEEVE.....	1
180	16	.....	008	17-B6251	008	17-B6251	CAP, end.....	1
181	1	.....	008	15-B6633	008	15-B6633	BUSHING, steel.....	2
181	2	.....	008	D3165	008	D3165	DIPPER, hoe.....	1
181	3	.....	008	H2757-B5892	008	H2757-B5892	CUTTER, side, lh.....	1
181	7	.....	.....	3815-698-8007	008	H2755-B5886	TOOTH.....	4
181	8	.....	008	WP-40	008	WP-40	PIN, tooth wedge.....	4
181	9	.....	008	H2756-B5892	008	H2756-B5892	CUTTER, side, rh.....	1
183	2	.....	008	4-B1513	008	4-B1513	PIN.....	1
183	4	.....	008	2-B1492	008	2-B1492	PIN.....	1
183	5	.....	008	1-B6154	008	1-B6154	BRIDLE.....	1
183	6	.....	008	11-B3657	008	11-B3657	BUSHING, bronze.....	1
183	7	.....	008	15-B6156	008	15-B6156	PIN.....	1
183	8	.....	008	D2790	008	D2790	HANDLE, hoe.....	1
183	10	.....	008	11-B6640	008	11-B6640	BRACE, hoe.....	1
183	11	.....	008	5-B6646	008	5-B6646	PIN.....	1
183	12	.....	008	20-B6156	008	20-B6156	PIN.....	1
183	13	.....	.....	3120-661-6679	008	16-B3659	BUSHING, bronze.....	2
183	14	.....	008	25-B6163	008	25-B6153	PIN.....	2
183	16	.....	008	1-B1170	008	1-B1170	WASHER, steel.....	2
183	17	.....	008	3110-155-6757	008	77211	BEARING, ball.....	2
183	18	.....	.....	5340-285-2102	008	3-B3576	RING, retaining.....	2
183	19	.....	.....	3020-200-1539	008	H2049-B3955	PULLEY.....	1
183	21	.....	008	H1556-B826	008	H1556-B826	WEDGE, cable.....	1
183	22	.....	.....	4030-352-1663	008	H1555-B826	SOCKET, wedge.....	1
184	1	.....	008	1-B1170	008	1-B1170	WASHER.....	2
184	2	.....	.....	3110-155-6757	008	77211	BEARING, ball.....	4
184	3	.....	.....	5340-285-2102	008	3-B3576	RING, retaining.....	4
184	4	.....	.....	3020-200-1539	008	H2049-B3955	PULLEY.....	2
184	5	.....	008	2-B1620	008	2-B1620	PLATE, center guard.....	1

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
184	9			3020-288-3084	008	M48B-B1608	PULLEY, hoist	2
184	11			3120-352-1790	008	13-B3659	BUSHING, bronze	2
184	13		008	4-B1151	008	4-B1151	COLLAR	2
184	14		008	10-B4022	008	10-B4022	PIN, pulley	1
184	19		008	D1083	008	D1083	MAST, hoe	1
184	21		008	19-B1503	008	19-B1503	BRACKET, mast foot, lh	1
184	22		008	1-B604	008	1-B604	PIN, mast foot	2
184	26		008	18-B1503	008	18-B1503	BRACKET, mast foot, rh	1
186	1		008	33-B3962	008	33-B3972	BUSHING, bronze	2
186	2		008	B6577	008	B6577	BOOM, hoe	1
186	3		008	H2043A-B1388	008	H2043A-B1388	BEARING	2
186	5			4030-352-1662	008	H1555-B826	SOCKET, wedge	1
186	6		008	3-B1451	008	3-B1451	PIN, cable anchor	1
186	8			4030-374-1502	008	H1556-B826	WEDGE, cable	1
186	11		008	H1251A-B1389	008	H1251A-B1389	COLLAR	2
186	12			5310-595-5767	008	10-B3830	WASHER, brass	3
186	13		008	23-B3660	008	23-B3660	BUSHING, bronze	2
186	15		008	H1915B-B1389	008	H1915B-B1389	PULLEY	2
186	16		008	3-B1389	008	3-B1389	PIN, boom point	1
186	21		008	24-B2096	008	24-B2096	PIN, pulley	1
188	2			3810-352-1811	008	2-B699	PIN, roller	4
188	3			5310-276-2929	008	3-B1157	WASHER, brass	4
188	4		008	11-B3657	008	11-B3657	BUSHING	4
188	5			3810-352-1660	008	H1417-B699	ROLLER	4
188	6			5310-276-2931	008	3-B1123	WASHER, steel	4
195	1		008	4-B2356	008	4-B2356	DOOR, sliding roof	1

195	3	.....	008	1–B6899	008	1–B6899	ROOF, center cab.....	1
195	4	.....	008	9–B6905	008	9–B6905	GASKET.....	1
195	7	.....	008	8–B6901	008	8–B6901	GASKET.....	1
195	9	.....	008	B6898	008	B6898	ROOF, cab, lh.....	1
195	10	.....	008	1–B6901	008	1–B6901	TROUGH, lh.....	1
195	11	.....	008	3–B2952	008	3–B2952	DOOR, center.....	1
195	12	.....	008	1–B6905	008	1–B6905	TROUGH, rh.....	1
195	13	.....	008	B6916	008	B6916	ROOF, cab, rh.....	1
195	14	.....	008	9–B6901	008	9–B6901	GASKET.....	1
195	15	.....	008	8–B6905	008	8–B6905	GASKET.....	1
196	2	.....	008	D3309–1	008	D3309–1	BAR, sling rest.....	1
196	6	.....	008	D3312	008	D3312	BACK, cab.....	1
196	9	.....	008	1–B4502	008	1–B4502	SASH, upper window.....	1
196	10	.....	.....	5330–510–6655	008	102–31	SEAL, window.....	30 ft
196	11	.....	008	2–B3563	008	2–B3563	GLASS, upper window.....	1
196	12	.....	.....	.....	008	.....	FILLER, window seal.....	30 ft
196	13	.....	008	1–B1759	008	1–B1759	DOOR, lh.....	1
196	14	.....	008	1–B1758	008	1–B1758	PANEL, left cab.....	1
196	18	.....	008	10–B6960	008	10–B6960	GLASS, side window.....	1
196	19	.....	.....	.....	008	.....	GUARD, side window shipping.....	1
196	20	.....	008	B6919	008	B6919	PANEL, left front.....	1
196	21	.....	008	9–B1686	008	9–B1686	GUARD, gear.....	1
196	22	.....	008	1–B6960	008	1–B6960	PANEL, right front.....	1
196	23	.....	008	1–B6964	008	1–B6964	SASH, window.....	1
196	24	.....	008	B6830	008	B6830	PANEL, front window.....	1
196	25	.....	008	15–B3561	008	15–B3561	PLATE, cover.....	1
196	26	.....	008	3–B3563	008	3–B3563	GLASS, lower window.....	1
196	27	.....	008	15–B3578	008	15–B3578	GUARD, front window shipping.....	1
196	28	.....	008	10–B4502	008	10–B4502	SASH, lower window.....	1
196	29	.....	008	B6925	008	B6925	DOOR, right front.....	1
196	30	.....	008	1–B3563	008	1–B3563	GLASS, door.....	1
196	32	.....	008	1–B3565	008	1–B3565	DOOR, right rear.....	1

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			Code No.	Part No.	Code No.	Part No.		
196	33	.....	008	21-B6795	008	21-B6795	DOOR, sliding back.....	1
197	1	.....	.....	5330-510-6655	008	33197-R	FILLER, window seal.....	22 ft
197	2	.....	008	1-B3450	008	1-B3450	GLASS, rh.....	1
197	3	.....	.....	9320-379-2614	008	33195-R	SEAL, window.....	22 ft
197	7	.....	008	WWA-24C-388	008	WWA-24C-388	WIPER, windshield.....	1
197	8	.....	008	D3303A	008	D3303A	SIDE, lh.....	1
197	9	.....	008	1-B3876	008	1-B3876	GLASS, rear.....	1
197	12	.....	008	15-B3682	008	15-B3682	TROUGH, rain.....	1
197	14	.....	008	1-B6893	008	1-B6893	PANEL, insulation.....	1
197	18	.....	008	63801-H	008	63801-H	PLATE, striker.....	1
197	21	.....	008	50249-H	008	50249-H	DOVETAIL, female.....	1
197	22	.....	008	10-B3430	008	10-B3430	GLASS, lh.....	1
197	24	.....	ORD	H001-1518005	008	12-B2647	WASHER, rubber.....	4
197	25	.....	008	21-B3468	008	21-B3468	SPRING, compression.....	4
197	29	.....	008	7-B3931	008	7-B3931	BOLT.....	4
197	30	.....	008	18-B6057	008	18-B6057	BRACE, back.....	1
197	33	.....	008	5-B3934	008	5-B3934	BRACE, step.....	1
197	34	.....	.....	2540-278-6478	008	218UV	MIRROR, rear vision.....	1
197	37	.....	008	25-B3423	008	25-B3423	GLASS, windshield.....	1
198	5	.....	008	5-B3876	008	5-B3876	COVER.....	1
198	7	.....	008	6-B3115	008	6-B3115	GLASS, door.....	1
198	8	.....	008	83546-H-25	008	83546-H-25	CHANNEL.....	1
198	9	.....	008	83546-H-23-½	008	83546-H-23-½	CHANNEL.....	1
198	10	.....	008	D771	008	D771	DOOR.....	1
198	11	.....	008	83546-H-44	008	83546-H-44	CHANNEL.....	2
198	16	.....	008	50808-H	008	50808-H	HINGE, door.....	2

198	18	.....	008	64754HA-B3622	008	64754HA-B3622	HANDLE, door.....	1
198	20	.....	008	50248-H	008	50248-H	DOVETAIL, male.....	1
198	22	.....	008	10-B3876	008	10-B3876	STOP, window.....	1
198	25	.....	008	85-22	008	85-22	REGULATOR, window.....	1
198	26	.....	008	60	008	60	LOCK, door.....	1
199	1	.....	008	8-B6914	008	8-B6914	COVER, battery.....	1
199	2	.....	008	D3318	008	D3318	SIDE, rh.....	1
199	3	.....	008	10-B6899	008	10-B6899	PANEL, access, rh.....	1
199	4	.....	008	B6118	008	B6118	COVER ASSEMBLY.....	1
199	5	.....	008	R47044	008	R47044	HINGE.....	1
199	9	.....	008	7-B4885	008	7-B4885	GRILLE, rear.....	1
199	17	.....	008	B6913	008	B6913	GRILLE, radiator.....	1
202	1	.....	008	DO28	008	DO28	SEAT.....	1
202	2	.....	008	11-B3820	008	11-B3820	BRACKET, upper seat.....	1
202	4	.....	008	17-B3479	008	17-B3479	BRACKET, lower seat.....	1
207	2	.....	.....	3810-371-2705	008	12-B2509	PIN, pulley.....	2
207	5	.....	.....	3810-352-1856	008	6-B2932	CHANNEL, equalizer.....	1
207	6	.....	.....	3120-287-7182	008	4-B3653	BUSHING, brass.....	2
207	7	.....	008	M48-B2581	008	M48-B2581	PULLEY.....	2
207	8	.....	.....	3810-352-1779	008	10-B2932	CHANNEL, equalizer.....	1
207	9	.....	.....	5315-263-8987	008	3-B1362	PIN, equalizer.....	2
207	13	.....	008	H2573-B3963	008	H2573-B3963	LINK, equalizer.....	2
208	1	.....	008	8-B2948	008	8-B2948	SHAFT, bridle.....	1
208	2	.....	008	6-B2941	008	6-B2941	BRIDLE.....	1
208	7	.....	.....	3020-288-3084	008	M48B-B1608	PULLEY.....	1
208	8	.....	.....	3120-352-1790	008	13-B3659	BUSHING, brass.....	1
208	10	.....	.....	4030-352-1700	008	H2261-B1148	SOCKET, wedge.....	1
208	11	.....	.....	4030-374-1502	008	H1556-B826	WEDGE.....	1
208	12	.....	008	6-B2968	008	6-B2968	GUIDE, cable.....	1
208	14	.....	008	M-B-635	008	M-B635	PULLEY, cable guide.....	1
208	15	.....	008	14-B2932	008	14-B2932	STRUT, bridle.....	1
208	17	.....	008	12-B2941	008	12-B2941	PIN, strut.....	2

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			Code No.	Part No.	Code No.	Part No.		
208	18	.....	008	7-B2948	008	7-B2948	LINK, strut	2
208	20	.....	.....	5315-132-6756	008	10-B3133	PIN, pulley	1
209	1	.....	008	4-B1151	008	4-B1151	COLLAR	2
209	3	.....	008	1-B5873	008	1-B5873	CHANNEL, rear	2
209	4	.....	008	1-B6829	008	1-B6829	CHANNEL, top, rh	1
209	5	.....	.....	5310-276-2935	008	6-B597	WASHER, steel	1
209	6	.....	008	13-B3659	008	13-B3659	BUSHING, brass	1
209	7	.....	.....	3020-288-3084	008	M48B-B1608	PULLEY	1
209	10	.....	008	1-B6814	008	1-B6814	CHANNEL, top, lh	1
209	11	.....	008	6-B2935	008	6-B2935	SHAFT	1
209	15	.....	008	1-B2947	008	1-B2947	SHAFT	1
209	17	.....	008	7-B6885	008	7-B6885	PIN, strut	2
209	18	.....	008	9-B6251	008	9-B6251	STRUT, rear, lh	1
209	19	.....	008	1-B2948	008	1-B2948	ANGLE, brace	2
209	21	.....	008	1-B2937	008	1-B2937	STRUT, pipe, lh	1
209	23	.....	.....	5315-263-8116	008	5-B734	PIN, strut	2
209	24	.....	008	5-F1409	008	5-F1409	STRUT, pipe, rh	1
209	25	.....	008	27-B5874	008	27-B5874	ANGLE, brace	1
209	26	.....	.....	3810-371-2715	008	8-B3299	PIN, rear strut	1
209	28	.....	008	7-B939	008	7-B939	PIN	1
209	29	.....	008	1-B6251	008	1-B6251	STRUT, rear, rh	1
209	30	.....	008	4-B2947	008	4-B2947	ANGLE, brace	1
209	32	.....	008	5315-263-8998	008	10-B2937	PIN	2
210	1	.....	008	D3281	008	D3281	TAILSWING	1
210	8	.....	008	D3291	008	D3291	BRACKET, lever	1
210	10	.....	008	H1958B-D3278	008	H1958B-D3278	BASE, rotating	1

210	12	.....	008	2-B6426	008	2-B6426	BRACKET, cable, lh.....	1
210	13	.....	.....	.....	.....	.....	DOWEL, threaded, 5/16 x 1.....	2
210	14	.....	008	36-B1179	008	36-B1179	BUSHING, brass.....	1
210	15	.....	008	1-B6426	008	1-B6426	BRACKET, cable, rh.....	I
211	2	.....	008	11-B1688	008	11-B1688	GUIDE, door, lh.....	1
211	3	.....	008	1-B6546	008	1-B6546	CHANNEL, deck, lh.....	1
211	9	.....	008	9-B6540	008	9-B6540	BRACKET, deck, lh.....	1
211	13	.....	008	15-B6904	008	15-B6904	PLATE, front floor, lh.....	1
211	15	.....	008	1-B4823	008	1-B4823	GUARD, mud.....	1
211	19	.....	008	2-B3619	008	2-B3619	STOP, lever.....	1
211	20	.....	008	10-B3100	008	10-B3100	PLATE, floor, rh.....	1
211	21	.....	008	16-B6541	008	16-B6541	BRACKET, deck, rh.....	1
211	22	.....	008	5-B6546	008	5-B6546	CHANNEL, deck, rh.....	1
211	24	.....	008	1-B1690	008	1-B1690	GUIDE, door, rh.....	1
211	26	.....	008	B4322	008	B4322	TOOLBOX.....	1
211	28	.....	008	3-B6885	008	3-B6885	PLATE, rear floor, lh.....	1
216	3	.....	.....	4030-176-7949	252	127	LINK.....	1
216	6	.....	.....	5340-706-2003	252	78	SPRING.....	1
216	7	.....	.....	.....	252	764	LOCK.....	1
216	10	.....	.....	.....	252	776	PINTLE.....	1
216	12	.....	.....	.....	252	766	BOLT, latch.....	1
216	14	.....	.....	.....	252	765	PIN, latch.....	1
217	1	.....	008	B6824	008	B6824	PANEL, instrument.....	1
217	5	.....	008	6-B5913	008	6-B5913	BAR, ventilator adjusting.....	1
217	9	.....	008	3-B5913	008	3-B5913	PLATE, ventilator.....	1
217	10	.....	008	B6915	008	B6915	PLATE, deck.....	1
218	1	.....	.....	3810-374-0085	008	25-B4904	HANDLE.....	4
218	2	.....	008	15-B6899	008	15-B6899	SCREW, jack.....	4
218	3	.....	008	18-B6814	008	18-B6814	BEAM.....	4
218	4	.....	008	D3290	008	D3290	OUTRIGGER, front.....	1
218	5	.....	008	12-B6810	008	12-B6810	PIN, float.....	4
218	8	.....	008	10-B6842	008	10-B6842	BOLT.....	8

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
218	10	.....	008	11-B6810	008	11-B6810	PIN, outrigger	2
218	11	.....	008	9-B6988	008	9-B6988	SUPPORT	4
218	12	.....	008	D3302	008	D3302	OUTRIGGER, rear	1
219	1	.....	008	F-1012	008	F-1012	WASHER	2
219	2	.....	.....	5340-569-3570	008	F-1013	BUSHING, rubber	4
219	3	.....	008	FB-900	008	FB-900	SHOCK ABSORBER	2
219	4	.....	008	F-1011	008	F-1011	WASHER	2
219	7	.....	008	15-B6822	008	15-B6822	U-bolt	4
219	12	.....	008	1134	008	1134	BUMPER, rubber	2
219	13	.....	008	H2811-B6822	008	H2811-B6822	SEAT, U-bolt	2
219	14	.....	008	15-B6795	008	15-B6795	BRACKET, lower, rh	1
219	....	.....	008	16-B6795	008	16-B6795	BRACKET, lower, lh	1
219	18	.....	008	5306-569-0540	008	5-B2964	BOLT, front shackle	2
219	40	.....	.....	2510-569-3573	008	2-B6020	SHACKLE, spring	2
219	42	.....	.....	5315-371-2717	008	9-B2964	PIN, shackle	4
220	1	.....	78500	2530-353-2321	290	A-2110-T-98	PIN AND NUT ASSEMBLY	4
220	2	.....	.....	5310-339-1379	290	1229-D-758	LOCKWASHER	4
220	3	.....	290	A93144S149	290	A9-3144-S-149	ROD END	4
220	4	.....	290	2257F6	290	2257-F-6	CLAMP	8
220	6	.....	290	A22-3102Z286	290	A22-3102-Z-286	UPPER ROD ASSEMBLY	4
220	7	.....	.....	2530-568-7657	290	A3-3144-R-148	ROD END	4
220	8	.....	78500	2530-353-2325	290	A2297-D-602	BALL AND BEARING ASSEMBLY	4
220	9	.....	78500	5315-325-4379	290	7-X-8	KEY	4
220	10	.....	78500	2530-024-6538	290	1246-R-174	PIN	4
220	15	.....	.....	5310-353-2320	290	A-2110-H-60	PIN AND NUT ASSEMBLY	4
220	16	.....	290	A25-3102A287	290	A25-3102-A-287	LOWER ROD ASSEMBLY	4

220	17	.....	78500	2530-353-2326	290	A-2297-E-603	BALL AND BEARING ASSEMBLY...	8
220	22	.....	.....	5310-595-5302	290	1229-L-272	WASHER.....	4
220	23	.....	290	1246E343	290	1246-E-343	DOWEL.....	4
220	24	.....	290	1246F344	290	1246-F-344	DOWEL.....	4
220	25	.....	78500	2530-377-6173	290	A-2110-U-73	PIN AND NUT ASSEMBLY.....	4
220	29	.....	78500	2530-353-2324	290	A-2297-C-601	BALL AND BEARING ASSEMBLY...	4
230	1	.....	203	212953	203	212953	BODY.....	4
230	2	.....	GE	4730-188-1877	203	212324	NIPPLE.....	AR
230	3	.....	203	212108	203	212108	PLUNGER.....	4
230	4	.....	203	212109	203	212109	SPRING, helical, compression.....	4
230	5	.....	203	212107	203	212107	PLUG, spring.....	4
230	6	.....	.....	5340-634-6784	203	213630	PACKING, ring.....	4
231	1	.....	.....	2530-028-2525	203	215536	CONNECTOR.....	8
231	2	.....	.....	2530-506-4571	203	203610	SLEEVE (IMO 10).....	8
231	3	.....	203	203613	203	203613	NUT (IMO 2).....	8
231	4	.....	.....	5340-253-7268	203	201045	SPRING, helical, compression (IMO 5)..	8
231	....	.....	.....	4720-353-0391	203	203647	HOSE: 1 ft, 11½ in. long.....	2
231	....	.....	.....	4720-353-0391	203	202861	HOSE: 2 ft, 5 in. long.....	2
233	3	.....	78500	2530-569-4052	290	1845-A-1	LINK, anchor pin.....	2
233	4	.....	78500	2530-371-4118	290	1859-B-2	PIN, anchor, brakeshoe.....	4
233	5	.....	.....	2530-343-0543	290	A6-3822-E-5	BRAKESHOE ASSEMBLY: lh, upper.	1
233	....	.....	.....	2530-343-0542	290	A5-3822-F-6	BRAKESHOE ASSEMBLY: lh, lower..	1
233	....	.....	.....	2530-343-0544	290	A6-3822-F-6	BRAKESHOE ASSEMBLY: rh, upper.	1
233	....	.....	.....	2530-343-0541	290	A5-3822-E-5	BRAKESHOE ASSEMBLY: rh, lower.	1
233	6	.....	ORD	H101-0589882	290	17-X-40	RIVET, brake lining.....	64
233	7	.....	.....	2530-294-6431	290	2740-H-86	LINING, brake.....	4
233	8	.....	78500	2530-615-9588	290	2817-A-1	PLATE, wear.....	4
233	9	.....	.....	5315-276-3662	290	1846-M-65	PIN, wear plate, brakeshoe.....	4
233	10	.....	78500	2530-377-4861	290	3836-N-144	SHIELD, dust.....	4
233	11	.....	.....	3120-353-2475	290	1825-K-37	BUSHING, brakeshoe.....	4
233	12	.....	78500	2530-353-2653	290	2810-E-239	CAMSHAFT, actuating, airbrake shoe: rh.	1

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
233	....	.....	78500	2530-495-7888	290	2810-F-240	CAMSHAFT, actuating, airbrake shoe: lh.	1
233	13	.....	290	A4-3275Z520	290	Ae-3275-Z-520	SLACK ADJUSTER: rh	1
233	....	.....	.....	2530-288-1465	290	A5-3275-Z-520	SLACK ADJUSTER: lh	1
233	14	.....	.....	4730-050-4208	806	1610B	FITTING, lubrication	6
233	16	.....	.....	5310-264-3490	290	1827-Z-130	NUT	4
233	17	.....	.....	5306-207-2423	290	10-X-189	BOLT	2
233	18	.....	.....	5340-281-6692	290	1854-B-80	RING, retaining	2
233	21	.....	.....	2530-753-5092	290	1898-E-213	PLATE, dust shield	8
233	23	.....	.....	5340-353-2675	290	2858-S-97	SPRING, helical, extension	2
236	1	.....	56697	5340-374-2124	290	1218-M-13	SPRING	16
236	2	.....	.....	5330-427-2193	290	1205-K-193	RETAINER	16
236	3	.....	.....	5330-247-8648	290	5X-180	FELT	16
236	4	.....	290	A2-3722L64	290	A2-3722-L-64	BRAKESHOE ASSEMBLY: primary	4
236	....	.....	290	A3-3722L64	290	A3-3722-L-64	BRAKESHOE ASSEMBLY: secondary	4
236	5	.....	78500	2530-353-2557	290	2240-W-1245	LINING, brake	4
236	....	.....	290	2240X1246	290	2240-X-1246	LINING, brake	4
236	....	.....	290	2240Y1247	290	2240-Y-1247	LINING, brake	4
236	....	.....	78500	2530-353-2561	290	2240-Z-1248	LINING, brake	4
236	7	.....	.....	5315-025-3034	290	1759-M-13	PIN, anchor	8
236	8	.....	290	A3236C1069	290	A-3236-C-1069	DUST SHIELD AND SPACER ASSEMBLY.	4
236	11	.....	.....	5340-205-4693	290	1229-B-1302	RING, retaining	4
236	12	.....	290	A25-3275G501	290	A25-3275-G-501	SLACK ADJUSTER	4
236	15	.....	78500	2530-353-2413	290	1199-W-1115	CONNECTOR	8

236	16	.....	290	A3236D1070	290	A3236–D–1070	DUST SHIELD AND SPACER ASSEMBLY.	4
236	19	.....	290	A3211L1182	290	A–3211–L–1182	SPIDER AND NEEDLE ASSEMBLY..	2
236	....	.....	290	A3211M1183	290	A–3211–M–1183	SPIDER AND NEEDLE ASSEMBLY..	2
236	20	.....	290	10X381	290	10–X–381	SCREW.....	16
236	21	.....	78500	2530–322–6430	290	1779–R–18	ROLLER.....	8
236	22	.....	56697	2530–374–2127	290	1246S227	PIN, roller.....	8
236	23	.....	.....	2530–332–5729	290	1718–Y–103	RETAINER.....	8
236	24	.....	290	2210C2395	290	2210–C–2395	CAMSHAFT.....	2
236	....	.....	290	2210D2396	290	2210–D–2396	CAMSHAFT.....	2
236	25	.....	290	1229N326	290	1229–N–326	WASHER.....	4
236	26	.....	.....	5330–245–6159	290	5X–191	FELT, oil seal.....	4
236	27	.....	.....	5330–353–2419	290	1205–W–205	RETAINER.....	4
236	28	.....	.....	3120–661–9349	290	1225–N–378	BUSHING.....	4
236	30	.....	.....	5306–206–0365	290	3X–138	BOLT.....	20
236	31	.....	.....	5340–427–2195	290	2258–P–354	SPRING.....	4
236	32	.....	.....	5306–272–4221	290	S–265–D	LOCKSCREW.....	8
236	33	FABRI FROM	GE	22–8011–500–340	290	11725	LOCKWIRE, 1 ft.....	8
237	....	.....	014	12517	014	12517	SHAFT ASSEMBLY, drive, rear axle...	1
237	1	.....	014	5N7	014	5N7	SCREW, cap.....	16
237	2	.....	014	6N9	014	6N9	PLATE, lock.....	8
237	3	.....	014	6N81	014	6N81	PLATE, cover.....	8
237	4	.....	014	6N41A	014	6N41A	NEEDLE CUP ASSEMBLY.....	8
237	5	.....	014	60NF48	014	60NF48	YOKE, flange.....	1
237	6	.....	70960	2520–352–2187	014	60NLS32–30	SLIP YOKE ASSEMBLY.....	1
237	7	.....	.....	5330–239–8396	014	31002	PACKING, felt.....	1
237	8	.....	.....	5310–425–3312	014	31102	WASHER, flat.....	1
237	9	.....	.....	2520–425–3310	014	30902	CAP, dust.....	1
237	10	.....	014	SA12517	014	SA12517	SHAFT SUBASSEMBLY.....	1
237	11	.....	70960	2520–352–2186	014	60NF49	YOKE, flange.....	1
237	12	.....	.....	5330–247–8640	014	6N3	GASKET.....	8
237	13	.....	.....	5330–425–3336	014	6N2	RETAINER, gasket.....	8

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
237	14			3810-773-6090	014	6N1A	SPIDER ASSEMBLY	2
237	15			4730-172-0034	806	1613B	FITTING, lubrication	2
237			014	12518	014	12518	SHAFT ASSEMBLY, drive, transfer case.	1
237	1		014	5N7	014	5N7	SCREW, cap	16
237	2		014	6N9	014	6N9	PLATE, lock	8
237	3		014	6N81	014	6N81	PLATE, cover	8
237	4		014	6N41A	014	6N41A	NEEDLE CUP ASSEMBLY	8
237	5		70960	2520-352-2186	014	60NF49	YOKE, flange	1
237	6		70960	2520-352-2187	014	60NLS32-30	SLIP YOKE ASSEMBLY	1
237	7			5330-239-8396	014	31002	PACKING, felt	1
237	8			5310-425-3312	014	31102	WASHER, flat	1
237	9			2520-425-3310	014	30902	CAP, dust	1
237	10		014	G8363N613	014	G8363N613	SHAFT SUBASSEMBLY	1
237	12			5330-247-8640	014	6N3	GASKET	8
237	13			5330-425-3336	014	6N2	RETAINER, gasket	8
237	14			3810-773-6090	014	6N1A	SPIDER ASSEMBLY	2
237	15			4730-172-0034	806	1613B	FITTING, lubrication	2
237			014	12516	014	12516	SHAFT ASSEMBLY, drive, interaxle	1
237	1		014	5N7	014	5N7	SCREW, cap	16
237	2		014	6N9	014	6N9	PLATE, lock	8
237	3		014	6N81	014	6N81	PLATE, cover	8
237	4		014	6N41A	014	6N41A	NEEDLE CUP ASSEMBLY	8
237	6		014	6NLS32-15	014	6NLS32-15	SLIP YOKE ASSEMBLY	1
237	7			5330-239-8396	014	31002	PACKING, felt	1
237	8			5310-425-3312	014	31102	WASHER, flat	1

237	9	.....	.....	2520-425-3310	014	30902	CAP, dust.....	1
237	10	.....	014	SA12516	014	SA12516	SHAFT SUBASSEMBLY.....	1
237	12	.....	.....	5330-247-8640	014	6N3	GASKET.....	8
237	13	.....	.....	5330-425-3336	014	6N2	RETAINER, gasket.....	8
237	14	.....	.....	3810-773-6090	014	6N1A	SPIDER ASSEMBLY.....	2
237	15	.....	.....	4730-172-0034	806	1613B	FITTING, lubrication.....	2
237	....	.....	014	12514	014	12515	SHAFT ASSEMBLY, drive, front axle...	1
237	1	.....	014	5N7	014	5N7	SCREW, cap.....	16
237	2	.....	014	6N9	014	6N9	PLATE, lock.....	8
237	3	.....	014	6N81	014	6N81	PLATE, cover.....	8
237	4	.....	014	6N41A	014	6N41A	NEEDLE CUP ASSEMBLY.....	8
237	6	.....	70960	2520-352-2187	014	60NLS32-30	SLIP YOKE ASSEMBLY.....	1
237	7	.....	.....	5330-239-8396	014	31002	PACKING, felt.....	1
237	8	.....	.....	5310-425-3312	014	31102	WASHER, flat.....	1
237	9	.....	.....	2520-425-3310	014	30902	CAP, dust.....	1
237	10	.....	014	SA12515	014	SA12515	SHAFT SUB ASSEMBLY.....	1
237	12	.....	.....	5330-247-8640	014	6N3	GASKET.....	8
237	13	.....	.....	5330-425-3336	014	6N2	RETAINER, gasket.....	8
237	14	.....	.....	3810-773-6090	014	6N1A	SPIDER ASSEMBLY.....	2
237	15	.....	.....	4730-172-0034	806	1613B	FITTING, lubrication.....	2
238	3	.....	78500	2530-353-2490	290	1829-L-402	RETAINER.....	2
238	4	.....	.....	2530-344-8276	290	2808-U-723	GASKET.....	2
238	7	.....	.....	5315-353-2448	290	1246-Y-233	DOWEL.....	8
238	8	.....	78500	2520-353-2711	290	3870-E-57	FLANGE, drive.....	2
238	9	.....	.....	2808H164	290	2808-H-164	GASKET.....	2
238	10	.....	.....	5310-276-3399	290	1827-X-50	NUT, plain.....	2
238	11	.....	.....	5310-222-0722	290	1829-W-153	WASHER, key.....	2
238	12	.....	.....	2520-353-2497	290	1829-V-152	WASHER, adjusting nut.....	2
238	13	.....	.....	5310-275-8275	290	A-1827-W-49	NUT, bearing adjusting.....	2
238	14	.....	.....	3110-100-3621	892	52400	CONE AND ROLLERS.....	2
238	15	.....	.....	3110-100-0595	892	52637	CUP, tapered roller bearing.....	2
238	16	.....	290	3897H190	290	3897-H-190	SPACER.....	2

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
238	17	.....	ORD	H101-8456578	290	4-X180	STUD	16
238	18	.....	290	A322-107	290	A-322-107	HUB AND CUP ASSEMBLY	2
238	19	.....	.....	2530-033-6028	290	3819-Q-17	BRAKEDRUM	2
238	20	.....	.....	3110-100-0614	892	71750	CUP	2
238	21	.....	.....	3110-100-3655	892	71450	CONE AND ROLLERS	2
238	22	.....	.....	5310-270-2119	290	1829-B-158	WASHER, felt retainer	2
238	23	.....	.....	5330-233-5863	290	5-X-328	PACKING	2
238	25	.....	290	1807B2	290	1807-B-2	COVER, inspection	2
238	27	.....	.....	.....	.....	.....	SCREW, cap, hex hd, 1/4-20 NC x 1/2	2
238	28	.....	204	5307-637-1425	290	20-X-66	STUD, threaded: lh	10
238	....	.....	204	5307-637-1327	290	20-X-67	STUD, threaded: rh	10
238	29	.....	.....	5310-273-7771	290	1199-G-111	NUT, cap: lh	10
238	....	.....	.....	5310-273-7770	290	1199-H-112	NUT, cap: rh	10
238	30	.....	.....	5330-247-8635	290	5-X-385	PACKING	2
238	31	.....	.....	5310-350-5548	290	1829-K-401	WASHER	2
238	32	.....	GE	4730-278-3397	290	P-32	PLUG	2
239	3	.....	.....	2530-427-2282	290	1246-D-290	DOWEL	28
239	4	.....	.....	2530-519-2912	290	A-3202-L-1390	AXLE SHAFT: long	2
239	....	.....	.....	2530-519-2895	290	A-3202-J-1388	AXLE SHAFT: short	2
239	5	.....	.....	2530-353-2536	290	2208-Y-337	GASKET	4
239	6	.....	290	A1199F1254	290	A-1199-F-1254	WIPER ASSEMBLY	4
239	7	.....	78500	5330-694-0553	290	A-1205-W-673	OIL SEAL ASSEMBLY	4
239	8	.....	290	1227H346	290	1227-H-346	NUT, plain	4
239	9	.....	290	1229R1058	290	1229-R-1058	WASHER, bearing nut	4
239	10	.....	290	A1227J348	290	A-1227-J-348	NUT, adjusting	4
239	11	.....	.....	3110-100-0642	892	575	CONE AND ROLLERS	8

239	12	.....	.....	5307-281-6820	290	4X-1077	STUD, threaded.....	28
239	13	.....	290	A333P848	290	A-333-P-848	HUB AND CUP ASSEMBLY.....	4
239	14	.....	78500	2530-495-7683	290	A-3219-E-1357	BRAKEDRUM.....	4
239	15	.....	09386	2530-374-1764	290	3286-V-22	SLINGER.....	4
239	16	.....	.....	3110-100-0329	892	572	CUP.....	8
239	17	.....	.....	5330-141-4217	290	A-1205-L-324	OIL SEAL ASSEMBLY.....	4
239	18	.....	290	1227J452	290	1227-J-452	NUT.....	40
239	19	.....	290	1107C29	290	1107-C-29	COVER, inspection hole.....	4
239	21	.....	ORD	5305-261-2765	290	S264	SCREW, cap.....	4
239	22	.....	.....	5307-426-8414	290	20-X-86	STUD, threaded: rh.....	20
239	....	.....	.....	5307-353-2524	290	20-X-85	STUD, threaded: lh.....	20
239	23	.....	.....	4730-289-0230	290	1199-N-118	NUT, cap: rh.....	20
239	....	.....	.....	5310-637-7760	290	1199-M-117	NUT, cap: lh.....	20
239	24	.....	.....	5310-359-1162	290	1199-J-114	NUT: rh.....	20
239	....	.....	.....	5310-359-1161	290	1199-K-115	NUT: lh.....	20
239	26	.....	.....	5305-281-4524	290	X-1680	SCREW, puller.....	8
251	1	.....	600	855493	600	855493	SCREW.....	6
251	3	.....	600	5593510	600	5593510	COVER.....	1
251	4	.....	.....	2910-362-3247	600	854009	SCREEN.....	1
251	5	.....	.....	5330-291-9825	600	5590037	GASKET.....	1
251	6	.....	.....	2910-474-6443	600	5590156	BOWL.....	1
251	7	.....	600	5590152	600	5590152	BAIL.....	1
251	8	.....	600	1537353	600	1537353	SPRING, diaphragm.....	1
251	9	.....	600	1523355	600	1523355	BODY.....	1
251	10	.....	70040	2910-741-0273	600	855585	GASKET.....	1
251	11	.....	600	855573	600	855573	COVER, lower.....	1
251	12	.....	600	5593521	600	5593521	SCREW.....	3
251	13	.....	.....	.....	.....	.....	PIN, rocker arm.....	1
251	14	.....	600	1521972	600	1521972	LINK.....	1
251	16	.....	70040	2910-358-4260	600	1537397	ARM, rocker.....	1
251	17	.....	600	855253	600	855253	SPRING, rocker arm.....	1
251	18	.....	600	5593601	600	5593601	DIAPHRAGM.....	1

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
251	21	.....	600	5593488	600	5593488	VALVE AND CAGE	.....
251	22	.....	600	1523120	600	1523120	GASKET	1
252	2	.....	699	C101 -1	699	C101–1	PLATE, choke	1
252	3	.....	699	C138–46	699	C138–46	HEAD, filter	1
252	4	.....	699	T56–3	699	T56–3	WASHER, fiber	1
252	5	.....	.....	2910–354–5014	699	F2X1T3	FILTER ELEMENT, fuel	1
252	6	.....	699	T301S10–9	699	T301S10–9	SCREW	6
252	8	.....	699	B4–16	699	B4–16	BODY, air intake	1
252	9	.....	699	T56–23	699	T56–23	WASHER, fiber	2
252	10	.....	79960	2910–364–6862	699	C81–1–40	SEAT, valve	1
252	12	.....	79960	2910–354–4966	699	C85–1	FLOAT	1
252	13	.....	699	C120–4	699	C120–4	AXLE, float	1
252	14	.....	699	C143–16	699	C143–16	GASKET	1
252	15	.....	79960	2910–506–4953	699	C35–45X3	PUMP AND ROD	1
252	16	.....	699	C34–77	699	C34–77	PISTON, pump	1
252	17	.....	79960	2910–354–4999	699	C97–12–19	VALVE, power jet	1
252	18	.....	79960	2910–354–4639	699	CR–41–1	VALVE, check	2
252	19	.....	699	C52–7–31	699	C52–7–31	JET, main	1
252	20	.....	699	T56–24	699	T56–24	WASHER, fiber	1
252	21	.....	79960	2910–354–4931	699	C77–14–23	JET, well vent	1
252	22	.....	699	A3–52	699	A3–52	BOWL, fuel	1
252	23	.....	699	CR137–37	699	CR137–37	PLUG, channel	4
252	24	.....	.....	4730–287–1554	699	CT91–3	PLUG, bowl drain	1
252	25	.....	79960	2910–354–4879	699	C66–23–1–75	JET, discharge	1
252	26	.....	79960	2910–364–0903	699	C138–23	PLUG, passage	1
252	27	.....	699	CR32–13	699	CR32–13	LINK, pump lever	1

252	28	.....	699	C114-14	699	C114-14	CLIP, link retainer.....	1
252	31	.....	699	CR31-6	699	CR31-6	LEVER, pump.....	1
252	32	.....	79960	2910-030-3819	699	C141-4-2	GASKET, flange.....	1
252	33	.....	699	C138-38	699	C138-38	SCREW, channel.....	1
252	34	.....	699	C23-163	699	C23-163	SHAFT, throttle.....	1
252	35	.....	699	CR28-47	699	CR28-47	LEVER, throttle stop.....	1
252	37	.....	.....	5305-276-8500	699	T8S10-9	SCREW, lever clamp.....	1
252	38	.....	699	C24-11ACX3	699	C24-11ACX3	LEVER, throttle clamp.....	1
252	39	.....	.....	5315-119-2337	699	CT63-9	PIN, stop lever.....	1
252	40	.....	699	B12-11754	699	B12-11754	BODY, throttle.....	1
252	41	.....	699	C21-54	699	C21-54	PLATE, throttle.....	1
252	42	.....	699	C136-15	699	C136-15	SCREW, throttle plate.....	2
252	43	.....	699	C142-1	699	C142-1	GASKET.....	1
252	44	.....	699	C38-1-31	699	C38-1-31	VENTURI.....	1
252	45	.....	699	CR67-1	699	CR67-1	BUSHING, channel.....	1
252	47	.....	699	T311S25-12	699	T311S25-12	SCREW.....	2
252	48	.....	79960	2910-354-4856	699	C55-8-12	JET, accelerator.....	1
252	49	.....	699	C137-31	699	C137-31	PLUG, passage.....	1
252	50	.....	79960	2910-354-4863	699	C56-3-15	JET, idle.....	1
252	51	.....	699	T82-3	699	T82-3	BALL, check.....	1
252	52	.....	699	C120-12	699	C120-12	WEIGHT, check ball.....	1
252	53	.....	699	C135-2	699	C135-2	WASHER, retainer.....	1
252	54	.....	699	C91-1	699	C91-1	CYLINDER, vacuum.....	1
252	55	.....	699	T56-52	699	T56-52	WASHER, fiber	1
252	56	.....	79960	2910-354-4751	699	C46-25	NEEDLE, idle adjusting.....	1
252	57	.....	79960	5340-351-6935	699	C111-9	SPRING, adjusting needle.....	1
252	59	.....	699	C109-1	699	C109-1	BRACKET, choke.....	1
252	62	.....	699	T301S8-6	699	T301S8-6	SCREW.....	1
252	63	.....	699	C108-1	699	C108-1	SHAFT AND LEVER, choke.....	1
267	1	.....	699	T308S25-50	699	T308S25-50	SCREW.....	4
267	2	.....	.....	5305-354-4754	699	C46-47	NEEDLE, idle adjusting.....	1
267	3	.....	79960	5340-322-1209	699	C111-17	SPRING, adjusting needle.....	1

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
267	4	.....	699	B6–17	699	B6–17	COVER, fuel	1
267	5	.....	699	C44–21	699	C44–21	VALVE DISK, check	1
267	6	.....	699	T56–10	699	T56–10	WASHER, fiber	1
267	7	.....	699	C81–15–70	699	C81–15–70	SEAT, valve	1
267	9	.....	699	C120–3	699	C120–3	AXLE, float	1
267	10	.....	79960	2910–354–4987	699	C85–93	FLOAT	1
267	11	.....	699	C144–11	699	C144–11	GASKET	1
267	12	.....	79960	2910–429–5104	699	C54–22–20	JET, idle	1
267	13	.....	79960	2910–354–4944	699	C77–23–22	JET, well vent	1
267	14	.....	699	C138–47	699	C138–47	PLUG, passage	1
267	15	.....	699	T56–51	699	T56–51	WASHER, fiber	1
267	16	.....	699	C52–25–42	699	C52–25–42	JET, main	1
267	17	.....	699	T56–19	699	T56–19	WASHER, fiber	1
267	18	.....	699	B3–94	699	B3–94	BOWL, fuel	1
267	19	.....	699	T56–58	699	T56–58	WASHER, fiber	1
267	20	.....	79960	2910–354–4896	699	C66–65–110	JET, discharge	1
267	21	.....	699	C143–21	699	C143–21	GASKET	1
267	22	.....	699	B3–34	699	B4–34	BODY, air intake	1
267	23	.....	699	C132–4	699	C132–4	WASHER, shaft thrust	1
267	24	.....	699	C146–13	699	C146–13	GASKET, cover plate	1
267	25	.....	699	C135–14	699	C135–14	PLATE, cover	1
267	26	.....	699	C140–39	699	C140–39	SCREW	2
267	27	.....	699	CT43–108	699	CT43–108	LOCKWASHER	2
267	28	.....	699	C136–12	699	C136–12	SCREW, choke plate	3
267	29	.....	699	C102–44	699	C102–44	PLATE, choke	1
267	30	.....	699	C142–52	699	C142–52	GASKET	1

267	31	.....	699	C38–60–42	699	C38–60–42	VENTURI.....	1
267	32	.....	699	B12–10769	699	B12–10769	BODY, throttle.....	1
267	33	.....	699	CR9–27	699	CR9–27	BUSHING, throttle shaft.....	2
267	34	.....	699	CT57–2	699	CT57–2	WASHER, shaft packing.....	1
267	35	.....	699	C131–5	699	C131–5	RETAINER, packing.....	1
267	36	.....	699	C23–413	699	C23–413	SHAFT, throttle.....	1
267	37	.....	699	CT63–4	699	CT63–4	PIN, stop lever.....	1
267	38	.....	.....	5305–276–8500	699	T8S10–9	SCREW, lever clamp.....	1
267	39	.....	699	C24–11BX8	699	C24–11BX8	LEVER, throttle clamp.....	1
267	40	.....	699	C28–92AX5	699	C28–92AX5	LEVER, throttle stop.....	1
267	41	.....	699	C111–62	699	C111–62	SPRING, stop screw.....	1
267	42	.....	699	T8S10–15	699	T8S10–15	SCREW, lever stop.....	1
267	43	.....	699	C138–38	699	C138–38	SCREW, vacuum channel.....	1
267	44	.....	699	C21–33	699	C21–33	PLATE, throttle.....	1
267	45	.....	79960	5330–318–9010	699	C141–4–8	GASKET, flange.....	1
267	46	.....	699	T308S31–14	699	T308S31–14	SCREW.....	4
267	48	.....	699	C136–12	699	C136–12	SCREW, throttle plate.....	3
267	49	.....	699	C131–22	699	C131–22	PLUG, shaft hole.....	1
267	50	.....	699	C109–40–1	699	C109–40–1	BRACKET, choke.....	1
267	51	.....	699	C140–38	699	C140–38	SCREW, tube clamp.....	1
267	52	.....	699	T8S8–9	699	T8S8–9	SCREW, lever swivel.....	1
267	53	.....	699	C24–7EX3	699	C24–7EX3	LEVER, choke.....	1
267	54	.....	.....	5305–276–8500	699	T8S10–9	SCREW, lever clamp.....	1
267	55	.....	699	C140–39	699	C140–39	SCREW, bracket.....	2
267	56	.....	699	CT43–108	699	CT43–108	LOCKWASHER.....	2
267	57	.....	699	C105–188	699	C105–188	SHAFT, choke.....	1
267	58	.....	699	CT57–19	699	CT57–19	WASHER, shaft packing.....	1
267	59	.....	699	C67–31	699	C67–31	BUSHING, channel.....	2
267	60	.....	.....	4730–287–1554	699	CT91–3	PLUG, fuel level.....	1
267	61	.....	79960	2910–354–4750	699	C41–18	VALVE, pump cover.....	1
267	62	.....	699	T56–23	699	T56–23	WASHER, fiber.....	1
267	63	.....	79960	2910–331–7793	699	C97–24–24	VALVE, power jet.....	1

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
267	64	.....	699	C76-37-2	699	C76-37-2	WELL, metering.....	1
267	65	.....	699	C55-19-16	699	C55-19-16	JET, accelerator.....	1
267	66	.....	79960	2910-354-4741	699	C36-56X1	PUMP.....	1
267	67	.....	699	CR42-17	699	CR42-17	BODY, check valve.....	1
289	1	.....	.....	2920-570-1238	623	1916143	COIL, field, upper, rh.....	1
289	1	.....	.....	2920-570-1238	623	1916140	COIL, field, upper, lh.....	1
289	1	.....	.....	2920-570-1238	623	1916141	COIL, field, lower, rh.....	1
289	1	.....	.....	2920-570-1238	623	1915853	COIL, field, lower, lh.....	1
289	2	.....	ORD	H001-7017561	623	453473	LOCKWASHER, external tooth.....	9
289	3	.....	623	1914569	623	1914569	SCREW.....	4
289	5	.....	ORD	H001-4135680	623	453284	NUT.....	6
289	6	.....	.....	2920-371-5208	623	1920691	COVER, terminal shield.....	1
289	7	.....	ORD	H001-1030080	623	453804	SCREW.....	5
289	8	.....	623	453659	623	453659	SCREW.....	2
289	9	.....	623	1913784	623	1913784	WASHER, plain.....	2
289	10	.....	.....	5940-377-8920	623	1920677	PLATE TERMINAL.....	1
289	11	.....	.....	5910-389-6283	623	1922736	CONDENSER.....	1
289	12	.....	.....	2920-386-3317	623	1920680	SHIELD, terminal.....	1
289	13	.....	.....	2920-371-5207	623	1920676	PLATE, mounting.....	1
289	14	.....	623	1922713	623	1922713	FRAME, field.....	1
289	15	FABRI FROM	910	15-2559-460-100	1 ft			
.....	.....	.....	793	7520 2 ea	623	1916325	LEAD, brush connector.....	1
289	16	.....	ORD	H101-0453292	623	453292	SCREW, brush attaching.....	4
289	17	.....	ORD	H001-151003	623	1914578	LOCKWASHER.....	4
289	18	.....	.....	5977-354-0155	623	1922719	PLATE, brush.....	1
289	19	.....	.....	2920-354-0154	623	1922717	FRAME, commutator end.....	1

289	20			5306-261-3398	623	1920155	SCREW	4
289	21			3110-156-3510	623	954699	BEARING, ball	1
289	22			5310-374-4506	623	1922158	COLLAR, bearing	1
289	23		623	1922726	623	1922726	PLATE, retainer	1
289	24		623	1922722	623	1922722	COVER	1
289	25		ORD	H001-5127341	623	453661	SCREW	8
289	27		623	454337	623	454337	SCREW	1
289	28		623	453708	623	453708	LOCKWASHER	8
289	29		ORD	H101-0453307	623	453307	SCREW	7
289	30			5977-285-0009	623	1906927	BRUSH	4
289	31			5310-220-6573	623	1916160	SPACER	4
289	32			2920-353-9712	623	1904514	ARM, brush	4
289	33			5340-597-4153	623	1916542	SPRING, brush	4
289	36			2920-354-0156	623	1922721	FRAME, drive end	1
289	37			3110-156-3548	623	954704	BEARING, ball	1
289	38			2920-354-0157	623	1922724	PLATE, retainer	1
289	39			2920-354-0153	623	1922716	ARMATURE	1
289	40			2920-353-9947	623	1916545	PLATE, retainer	1
289	41		ORD	H101-0132133	623	454308	SCREW	4
289	42		623	1902196	623	1902196	FAN AND BAFFLE ASSEMBLY	1
289	43		646	150860B	646	150860B	PULLEY, carrier generator	1
289	....		646	140585B	646	140585B	PULLEY, revolving frame generator	1
289	44			5340-142-0321	623	1922727	COLLAR, shaft	1
289	45			5310-274-9634	623	1905406	WASHER, shaft	1
289	46		ORD	H001-4220741	623	453324	NUT, shaft	1
289	48			5305-019-1720	623	453308	SCREW, pole shoe	8
289	49		623	1921755	623	1921755	SHOE, pole	4
297	1			3120-288-0957	623	810620	BUSHING, housing	1
297	2		623	1916258	623	1916258	HOUSING, drive end	1
297	3		623	1916269	623	1916269	SHAFT, shift lever	1
297	4		623	1911165	623	1911165	SEAL, shift lever	1
297	5		623	1916267	623	1916267	GASKET, shift lever	1

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
297	6	.....	623	1916268	623	1916268	NUT, bearing, shift lever	1
297	7	.....	623	1916265	623	1916265	LEVER, upper shift	1
297	8	.....	.....	2920-753-9625	623	1916270	SUPPORT, spring	1
297	9	.....	623	1914691	623	1914691	WASHER, shaft, shift lever	1
297	12	.....	623	1916271	623	1916271	SPRING, shift lever	1
297	13	.....	623	1916264	623	1916264	LEVER, lower shift	1
297	14	.....	623	1904438	623	1904438	CLUTCH, overrunning	1
297	15	.....	.....	5330-291-4619	623	821453	WASHER, brake	1
297	16	.....	.....	2920-705-1829	623	1904444	BEARING, center	1
297	17	.....	623	455917	623	455917	SCREW	2
297	18	.....	623	1916262	623	1916262	BRACKET, switching mounting	1
297	19	.....	623	1904991	623	1904991	SCREW	2
297	20	.....	.....	5930-428-6573	623	1996466	SWITCH	1
297	21	.....	.....	5310-268-7271	623	1904419	NUT, terminal	1
297	22	.....	ORD	5310-012-0382	623	453290	LOCKWASHER	2
297	23	.....	623	1916263	623	1916263	CONNECTOR	1
297	25	.....	623	1916277	623	1916277	BUSHING, insulating	1
297	27	.....	.....	5330-599-2321	623	1916272	SEAL	2
297	28	.....	623	1923786	623	1923786	WASHER, insulating	1
297	29	.....	ORD	H001-5151561	623	811601	STUD, terminal	1
297	30	.....	.....	5305-281-5670	623	453309	SCREW, pole shoe	4
297	31	.....	.....	2920-737-3225	623	1914873	INSULATOR, triangle	1
297	32	.....	ORD	H001-5148821	623	1915099	SCREW	2
297	34	.....	ORD	H001-5148821	623	453286	SCREW, ground	1
297	36	.....	.....	6105-510-7581	623	1916255	ARMATURE	1
297	37	.....	.....	5910-280-9965	623	1916592	CONDENSER	1

297	38		ORD	H001-7025681	623	453294	LOCKWASHER	2
297	39		623	1914243	623	1914243	BOLT, through	2
297	40		623	1916259	623	1916259	COVER	1
297	41		623	1916249	623	1916249	FRAME, commutator end	1
297	42			6150-279-6682	623	1914952	LEAD, brush	2
297	43		623	1914857	623	1914857	SCREW	2
297	46			5977-237-1592	623	828448	BRUSH	4
297	47			2920-353-9857	623	1914954	BRUSH HOLDER	4
297	48			5340-248-9594	623	1904303	SPRING, brush	4
297	49		623	1916274	623	1916274	WASHER, thrust	1
297	50		623	1904418	623	1904418	SHOE, pole	4
297	53		623	1916246	623	1916246	COIL, field, lower half	1
297	53			2920-353-9728	623	1905870	COIL, field, upper, rh	1
297	53			2920-353-9729	623	1905872	COIL, shunt	1
298	2		623	1913130	623	1913130	LOCKWASHER	9
298	3			3120-700-1920	623	1904083	BUSHING	1
298	4			2920-354-0107	623	1921178	HOUSING, drive end	1
298	5			9390-276-9469	623	1909654	WICK, oil	1
298	6			4730-278-3022	623	118831	PLUG, pipe	1
298	7			5306-268-6010	623	1918656	SCREW, adjusting	1
298	10			2920-354-0112	623	1921314	LEVER EXTENSION, shaft	1
298	11			5315-276-4340	623	1921315	PIN, shaft extension	1
298	13		623	455828	623	455828	PIN, dowel	1
298	14			2920-354-0114	623	1921317	SHAFT, lever	1
298	16			2920-354-0113	623	1921316	LEVER, lower shift	1
298	17		623	1932034	623	1932034	WASHER, split	1
298	18		623	1932035	623	1932035	CUP, pinion stop	1
298	19		623	1932546	623	1932546	PINION	1
298	20			2920-214-2341	623	1918714	CUP, spring retainer	2
298	21			5340-200-4394	623	1923134	SPRING	1
298	22			3020-517-0642	623	1932545	SLEEVE, shift	1
298	25			5310-268-7271	623	1904419	NUT, terminal	1

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
298	26			5930-351-9664	623	1919745	SWITCH, starting	1
298	27		ORD	H001-5148821	623	1915099	SCREW	2
298	29		GE	33-8008-002-360	623	1921340	GASKET	1
298	30			NA	623	1922853	FRAME, field	1
298	31			5305-275-1540	623	1913100	SCREW, pole shoe	8
298	32			5970-312-8678	623	1919769	INSULATION, contact	1
298	33		623	1857271	623	1857271	CONTACT, switch	1
298	34		623	453466	623	453466	SCREW	1
298	35			2920-344-1070	623	1922856	ARMATURE	1
298	36			5310-262-4775	623	1921319	SPACER	1
298	37			5340-309-8369	623	1916386	RETAINER, wick	1
298	38			2920-354-0115	623	1921320	PLATE, center bearing	1
298	39			3120-288-1022	623	1916389	BUSHING	1
298	40			5330-297-7319	623	1911644	WASHER, brake	1
298	41			8305-205-0764	623	1916387	WICK, oil	1
298	42			2920-737-3225	623	1914873	STRIP, insulation	1
298	43			2920-344-1069	623	1922855	FIELD COIL ASSEMBLY	1
298	44		623	1861786	623	1904982	POST, insulated brush spring	2
298	45		ORD	H001-5127331	623	446646	SCREW, brush holder	2
298	46			5305-371-5138	623	1904983	POST, ground brush spring	2
298	47			5977-284-7628	623	1907475	BRUSH HOLDER	4
298	48		623	1914640	623	1914640	PLATE, ground brush spacer	2
298	49			5977-097-5975	623	1914636	BRUSH PLATE AND STUD	1
298	50		ORD	H001-5147551	623	453293	SCREW, brush plate attaching	3
298	51		ORD	H001-1518004	624	1914107	LOCKWASHER	3
298	52		623	1913086	623	1913086	WASHER, plain	3

298	53			5970-353-9838	623	1914639	PLATE, insulating	1
298	54		623	1914641	623	1914641	PLATE, brush holder attaching	1
298	55			5330-297-6084	623	1921643	WASHER, insulation	3
298	56			2920-353-9836	623	1914633	FRAME, commutator end	1
298	57			9390-276-9470	623	1909560	WICK, oil	1
298	58		914	45-6040-500-001	623	453465	PLUG, pipe	1
298	59			3120-279-0533	623	1914645	BUSHING, terminal stud	1
298	60			5330-298-0772	623	1914646	WASHER, insulation	1
298	61		623	1914647	623	1914647	WASHER, plain	1
298	62			5310-276-2746	623	1914648	LOCKWASHER	2
298	64		ORD	H001-4018561	623	453285	NUT, terminal stud	1
298	65			5977-374-4460	623	1914877	BAND, cover	1
298	66		623	453479	623	453479	SCREW, cover band	2
298	67		623	1914634	623	1914634	PLUG, end	1
298	68			3120-287-8943	623	38273	BUSHING	1
298	69			5330-297-0287	623	1914649	WASHER, brake	1
298	70		623	1913080	623	1913080	WASHER, insulating	8
298	71		623	1914644	623	1914644	PLATE, insulating brush spacer	2
298	72			5970-353-9841	623	1914643	PLATE, insulating	2
298	73		623	1914642	623	1914642	SCREW, brush holder	2
298	74			5977-734-8900	623	1906902	BRUSH	8
298	76		ORD	H001-5147531	623	453461	SCREW, brush lead attaching	8
298	77			5340-363-3573	623	1904981	SPRING, brush	8
298	79		623	1914872	623	1914872	SHOE, pole	4
298	80			5306-268-6013	623	454443	SCREW, field lead ground	1
298	81			5310-269-6908	623	1918657	WASHER, plain	1
299	1			5305-281-6292	623	454429	SCREW	8
299	3			2920-353-9920	623	1915961	COVER ASSEMBLY	1
299	5		623	453696	623	453696	SCREW	5
299	7			5310-266-4150	623	453996	NUT	1
299	8			2920-333-0375	623	1929160	MAIN SHAFT AND WEIGHT PLATE.	1

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
299	9		623	1914935	623	1914935	WASHER, space	1
299	10			3120-293-5832	623	1909003	BUSHING	1
299	11		914	45-6040-500-001	623	453465	PLUG, pipe	1
299	12			2920-753-9573	623	1916622	CLAMP	1
299	13			5910-753-9574	623	1916625	CONDENSER	1
299	14		623	1916003	623	1916003	WASHER, spring	1
299	15			5330-599-2556	646	201657A	SEAL, O-ring	1
299	16			5310-270-2046	623	1913003	WASHER, spring	1
299	17			5910-256-9729	623	1915978	CONDENSER	1
299	18			5330-599-6123	623	1916621	GASKET	1
299	19			2920-374-4543	623	1916620	COUPLING, terminal	1
299	21			5305-281-6390	623	453698	SCREW	4
299	24			3020-273-8974	646	18598A	GEAR, driven, carrier distributor	1
299			28265	3020-569-1321	646	22335A	GEAR, driven, revolving frame distributor.	1
299	25		623	1926097	623	1926097	COLLAR, shaft	1
299	26		623	1914935	623	1914935	WASHER, spacer	1
299	27			5310-262-5421	623	1912128	SHIM, 0.005 inch	AR
299	28			5310-264-1387	623	1912129	SHIM, 0.010 inch	AR
299	29		646	150883A	646	150883A	ADAPTER	1
299	30		646	13936A	646	13936A	CLAMP, holddown	2
299	33		623	1924115	623	1924115	HOUSING	1
299	34		914	45-6040-500-001	623	453465	PLUG, cap	1
299	35		623	1916003	623	1916003	WASHER, spring	1
299	36			5970-389-6578	623	1916501	INSULATION, resistor	1
299	37			5905-371-5190	623	1915973	RESISTOR	1

299	38			2920-353-9925	623	1915998	BRACKET	1
299	39			2920-353-9919	623	1915950	CAP ASSEMBLY	1
299	40			2920-753-9588	623	1915959	ROTOR	1
299	41			2920-428-6486	623	1905344	LEVER, breaker	1
299	42			5305-428-6540	623	1914916	SCREW	1
299	43			5910-248-5466	623	1915976	CONDENSER	1
299	44			2920-353-9922	623	1915968	PLATE, breaker	1
299	45		623	1924828	623	1924828	NUT	2
299	46		623	1915009	623	1915009	PLATE, lock	2
299	47			9390-753-9570	623	1916408	WICK, felt	1
299	48		623	1926096	623	1926096	CAM	1
299	49			2920-428-6549	623	1915008	WEIGHT	2
299	50			2920-428-6548	623	1915007	PLATE, weight holddown	1
299	51			2920-333-0374	623	1926035	SPRING	2
299	52			6150-279-7435	623	1916615	LEAD	1
299	53		ORD	H001-4135680	623	453284	NUT	2
299	54		623	1914615	623	1914615	LOCKWASHER	2
299	55			2920-257-1346	623	1915992	COIL, ignition	1
299	56			5330-297-7334	623	1915999	GASKET	1
299	57			2920-353-9926	623	1916000	PLATE, holddown	1
299	59			5305-292-6482	623	453699	SCREW	4
299	60		623	1913199	623	1913199	NUT	1
299	61			2920-753-9564	623	1915996	LOCKWASHER, spring	1
299	62			2920-371-5189	623	1915969	CONTACT AND SUPPORT	1
299	63			5977-354-0211	623	821604	BUTTON, carbon	1
299	64			5340-597-2108	623	1915957	SPRING, coil contact	1
299	65			5305-276-8542	623	453697	SCREW	5
299	67			5310-350-3587	623	1906367	WASHER	5
299	68			5330-297-7332	623	1916006	GASKET	5
299	70			2920-753-9568	623	1916005	GASKET, cover	1
300	1						SCREW, hub	3
300	2		008	WA-1-70	008	WA-1-70	PULLEY	1

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
300	4		008	1A-52620-10	008	1A-52620-10	GLAND, packing	1
300	5		008	1A-52620-11	008	1A-52620-11	PACKING, compression	1
300	6		008	1A-52620-1	008	1A-52620-1	MOUNTING, flanged	1
300	7		008	1A-52620-8	008	1A-52620-8	BUSHING	4
300	9		008	1A-52620-6	008	1A-52620-6	GEAR, driving	1
300	10		008	1A-52620-2	008	1A-52620-2	HOUSING	1
300	11		008	1A-52620-3	008	1A-52620-3	CAP	1
300	12		008	1A-52620-5	008	1A-52620-5	SCREW, stand	6
300	13		008	1A-52620-7	008	1A-52620-7	GEAR, driven	1
300	14		008	1A-52620-12	008	1A-52620-12	SCREW, gland	2
301	1		61208	2520-447-8870	092	6030	HUB AND BACKPLATE	1
301	2			3895-365-2018	092	5878S	PLATE, driving	1
301	3			3895-363-9041	092	5752	PLATE, floating	1
301	4			5340-426-1774	092	M641	RING, retaining	4
301	5			3810-463-6970	092	103F	LEVER, finger	4
301	6			5315-244-3913	092	106A	PIN, straight	4
301	7		61208	3895-360-4149	092	119B2	LINK, lever	8
301	8			5315-281-7514	092	1968A	PIN, lever link	8
301	9			3810-463-6973	092	2137	SLEEVE, sliding	1
301	10		092	117C8S	092	117C8S	COLLAR, cone	1
301	11			5310-426-1830	092	1395A	WASHER	4
301	14			5340-281-6700	092	M642	RING, retaining	8
301	15			3810-463-6969	092	1990	YOKE, adjusting	1
301	16			5340-205-5422	092	115	SPRING, adjusting lockpin	1
301	17		61208	5315-363-6432	092	2245	LOCKPIN, adjusting	1
301	18			5340-664-7844	092	A1069	SPRING, release	6

303	1	.....	.....	2520-352-5511	058	C4-28	SLEEVE.....	1
303	2	.....	36479	2520-213-0970	058	C37-6	EQUALIZER, spring.....	1
303	3	.....	.....	5340-257-2171	058	C5-4	SPRING, pressure.....	1
303	4	.....	058	C3-25	058	C3-76	PLATE, adjusting.....	1
303	5	.....	36479	2520-734-9577	058	AC2-7	FLYWHEEL RING AND STUD ASSEMBLY.	1
303	6	.....	36479	2520-734-9560	058	C13-7	RING, fulcrum.....	2
303	7	.....	058	C8-43	058	C8-43	LEVER, pressure.....	20
303	8	.....	.....	5340-281-6716	058	C11-4	RING, snap.....	1
303	9	.....	.....	3810-352-6002	058	C1-24	PLATE, pressure.....	1
303	11	.....	.....	2520-352-5706	058	C18-96	FACING.....	2
303	12	.....	36479	2520-734-9299	058	140-6-071	DRIVEN DISK ASSEMBLY.....	1
303	13	.....	.....	5340-209-9215	058	C6-2	SPRING, retractor.....	4
303	14	.....	ORD	H101-0141117	058	C7-2	PIN, spring retaining.....	4
303	15	.....	912	42-1100-500-032	058	X17-7	BALL, lever locking.....	20
303	16	.....	36479	2520-383-9167	058	C20-1	SHIM, adjusting.....	28
303	17	.....	058	C10-6	058	C10-6	STRAP, adjusting.....	4
304	1	.....	.....	2520-039-6537	041	4461	GASKET, front bearing cover.....	1
304	2	.....	.....	2520-734-8016	041	5320	COVER, front bearing.....	1
304	4	.....	.....	5305-282-9804	041	X-8-613	SCREW, cap.....	2
304	5	.....	73460	3820-569-0700	041	2772	YOKE, clutch release.....	1
304	7	.....	.....	3120-661-4646	041	9130	SHAFT, clutch pedal.....	1
304	8	.....	914	45-3716-970-001	041	3231	ELBOW, oil pipe.....	1
304	9	.....	.....	5340-265-2023	041	4425	SPRING, tension.....	2
304	10	.....	.....	4730-253-6339	041	3230	NIPPLE, oil pipe.....	1
304	11	.....	.....	3040-164-9346	041	4734	CARRIER, clutch bearing.....	1
304	12	.....	.....	3110-157-3726	041	4694	BEARING, clutch release.....	1
304	13	.....	914	45-5750-001-055	041	3232	PIPE, oil	1
304	14	.....	914	45-2736-500-001	041	3233	COUPLING, oil pipe.....	1
304	15	.....	.....	5306-272-4210	041	X-7-603	BOLT.....	2
304	16	.....	.....	3040-734-9682	041	3501	SHAFT, clutch pedal, short.....	1
314	3	.....	008	H2830-B5183	008	H2830-B5183	RETAINER, oil seal.....	1

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
314	4	.....	008	61070	008	61070	SEAL, oil	2
314	5	.....	008	RR-450	008	RR-450	RING, retaining	2
314	6	.....	008	1-B5856	008	1-B5868	PULLEY	1
314	7	.....	008	2-B4147	008	2-B4147	PINION, 16 tooth	1
314	8	.....	008	12-B3905	008	12-B3905	SLINGER, oil	1
314	9	.....	008	1-B3748	008	1-B3748	RETAINER, bearing	1
314	10	.....	.....	3110-155-6774	008	77212	BEARING, ball	1
314	15	.....	.....	5330-291-1639	008	60905	SEAL, oil	1
314	17	.....	008	7-B6418	008	7-B6418	SHAFT	1
314	18	.....	008	A1588	008	A1588	LOCKWASHER	1
314	19	.....	008	1092A	008	1092A	JAMNUT	1
314	20	.....	008	7206	008	7206	BEARING, ball	1
317	2	.....	008	10-B5862	008	10-B5862	COVER, gearcase	1
317	3	.....	008	20-B4842	008	20-B4842	GASKET	1
317	4	.....	008	D2401	008	D2401	CASE, gear	1
317	7	.....	.....	3810-352-1794	008	14132	BREATHER	1
317	11	.....	008	7-B3336	008	7-B3336	PLATE, inspection	1
317	13	.....	008	1037	008	1037	YOKE, clutch	1
317	16	.....	008	20-B3863	008	20-B3863	SHAFT, lever	1
317	21	.....	008	403PQ	008	403PQ	PLUG, pipe, magnetic	1
318	3	.....	.....	3110-155-6720	008	77209	BEARING, ball	2
318	4	.....	008	3-B4147	008	3-B4147	PINION, 23 tooth	1
318	5	.....	008	3-B2970	008	3-B2970	SHAFT	1
320	2	.....	.....	5310-352-1854	008	6-B1342	WASHER, end	2
320	3	.....	.....	3020-260-1528	008	H1613B-B4147	GEAR, 88 tooth	1
320	4	.....	.....	3110-155-6774	008	77212	BEARING, ball	1

320	5	.....	.....	5330-291-1639	008	60905	SEAL, oil	1
320	6	.....	.....	3810-162-4644	008	4-B1345	SHAFT	1
320	7	.....	.....	3110-155-6779	008	77312	BEARING, ball	1
320	8	.....	.....	3020-274-2905	008	H1676-B926	PINION, 26 tooth	1
322	3	.....	.....	3020-274-6589	008	H2658-B4836	GEAR, drive, 49 tooth	1
322	4	.....	.....	5340-285-2102	008	3-B3576	RING, retaining	1
322	5	.....	.....	3110-155-6757	008	77211	BEARING, ball	1
322	6	.....	008	1-B2977	008	1-B2977	SHAFT, drive	1
322	10	.....	008	1-B3887	008	1-B3887	GASKET	1
322	11	.....	226	306130	008	60773	SEAL, oil	1
322	15	.....	008	H2424-B2969	008	H2424-B2969	HOUSING, bearing	1
322	16	.....	.....	3110-155-6738	008	77210	BEARING, ball	1
329	1	.....	.....	3110-155-6757	008	77211	BEARING, ball	1
329	2	.....	.....	3110-155-6738	008	77210	BEARING, ball	5
329	3	.....	.....	3020-517-7571	008	H2423-B2972	GEAR, bevel	2
329	4	.....	008	61404	008	61404	SEAL, oil	2
329	5	.....	.....	5330-291-1639	008	60905	SEAL, oil	2
329	6	.....	008	1-B4162	008	1-B4162	SPACER	3
329	7	.....	008	M657-B2972	008	M657-B2972	WHEEL, friction	2
329	10	.....	.....	3810-352-1861	008	7-B3875	LINING	4
329	11	.....	.....	3810-698-8003	008	H2427-B2972	CONE, clutch	2
329	14	.....	.....	3810-698-8008	008	M658-B2972	COLLAR, split	2
329	15	.....	008	2-B1400	008	2-B1400	WASHER, end	1
329	23	.....	008	1-B3055	008	1-B3055	COVER, bearing	1
329	24	.....	.....	5330-641-2367	008	3-B3803	GASKET	1
329	25	.....	008	5-B4162	008	5-B4162	KEY	1
329	26	.....	008	1-B3942	008	1-B3942	SHAFT	1
329	27	.....	008	7-B4162	008	7-B4162	KEY	1
329	28	.....	008	H2448-B3055	008	H2448-B3055	BEARING, clutch shaft	1
329	29	.....	.....	5330-641-2368	008	6-B3803	GASKET	1
329	31	.....	008	H2435-B3050	008	H2435-B3050	CAP, pillow block	1
329	32	.....	.....	.....	.....	.....	WASHER, felt, 2½ ID x 3¼ OD x ⅜	1

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
329	33	.....	008	4–B3574	008	4–B3574	SHIM.....	2
329	34	.....	008	H2563–B3870	008	H2563–B3870	BLOCK, pillow.....	1
329	38	.....	008	2–B3574	008	2–B3574	CAP, pillow block.....	1
329	40	.....	.....	3810–698–8004	008	H2434–B3050	COLLAR, split.....	1
329	49	.....	008	3–B4162	008	3–B4162	COLLAR, thrust.....	1
331	1	.....	008	K–8112	008	K–8112	NUT.....	1
331	3	.....	008	K–6141	008	K–6141	WASHER.....	1
331	4	.....	008	M732–B4592	008	M732–B4592	WHEEL, brake.....	1
331	7	.....	008	10–B4593	008	10–B4593	CAP, bearing.....	1
331	9	.....	008	61070	008	61070	SEAL, oil.....	1
331	10	.....	008	5–B3881	008	5–B3881	GASKET.....	1
331	11	.....	008	55515	008	55515	BEARING, ball.....	1
331	12	.....	008	1–B5813	008	1–B5813	SHAFT, worm.....	1
331	17	.....	.....	5330–291–1631	008	60905	SEAL, oil.....	1
331	18	.....	.....	3110–155–6774	008	77212	BEARING, ball.....	1
331	19	.....	008	H2428–B3023	008	H2428–B3023	GEAR, bevel, 21 tooth.....	1
331	23	.....	008	D1512	008	D1512	BRACKET.....	1
332	2	.....	008	1–B3077	008	1–B3077	SHAFT.....	1
332	5	.....	008	M781–B5813	008	M781–B5813	WHEEL, worm.....	1
332	6	.....	008	61404	008	61404	SEAL, oil.....	1
332	7	.....	008	H2446–B3076	008	H2446–B3076	DRUM, boom hoist.....	1
332	8	.....	.....	3120–352–1844	008	43–B3662	BUSHING.....	2
332	9	.....	.....	5310–276–2929	008	3–B1157	WASHER, brass.....	2
332	10	.....	008	H2557–B3803	008	H2557–B3803	BEARING.....	1
332	13	.....	.....	4030–374–1502	008	H1556–B826	WEDGE, cable, 5/8.....	1
332	15	.....	008	B5877	008	B5877	COVER.....	1

332	17	.....	008	3-B3810	008	3-B3810	GASKET HALF.....	2
334	3	.....	008	H1378B682	008	H1378-B682	CAP, pillow block.....	1
334	7	.....	.....	3810-374-0079	008	1-B703	WASHER, shaft end.....	1
334	8	.....	.....	3110-155-6808	008	77214	BEARING, ball.....	1
334	9	.....	.....	.....	.....	.....	WASHER, felt, 3½ ID x 4¼ OD x ⅜...	1
334	13	.....	008	M1376A-B1848	008	M1376A-B1848	BLOCK, pillow.....	1
334	14	.....	008	2-B810	008	2-B810	SPACER.....	1
334	15	.....	008	1-B2255	008	1-B2255	SHAFT, front drum.....	1
334	17	.....	008	H1357A-B810	008	H1357A-B810	GEAR, 98 tooth.....	1
334	18	.....	.....	5310-595-5767	008	10-B3830	WASHER, brass.....	1
334	19	.....	008	H1364A-B1887	008	H1364A-B1887	GEAR, 49 tooth.....	1
334	20	.....	008	H2354-B2266	008	H2354-B2266	WHEEL, control.....	1
334	21	.....	.....	3120-661-5494	008	54-B2282	BUSHING, bronze.....	1
334	23	.....	008	H2353-B2266	008	H2353-B2266	CARRIER, clutch.....	1
334	24	.....	008	21-B3660	008	21-B3660	BUSHING, bronze.....	2
334	27	.....	.....	5310-595-5766	008	2-B3951	WASHER, brass.....	1
334	28	.....	.....	3110-155-6418	008	77215	BEARING, ball.....	2
334	29	.....	.....	3810-352-1743	008	M661-B3034	DRUM, cable.....	1
334	31	.....	008	H2347-B2257	008	H2347-B2257	CARRIER, clutch.....	1
334	32	.....	008	212-RA	008	212-RA	BEARING, roller.....	2
334	33	.....	.....	3810-352-1708	008	H2342-B2255	WHEEL, control.....	1
334	34	.....	008	H1377-B1848	008	H1377-B1848	BLOCK, pillow.....	1
334	35	.....	.....	3110-155-6774	008	77212	BEARING, ball.....	1
334	36	.....	008	H1381-B682	008	H1381-B682	CAP, pillow block.....	1
339	5	.....	008	5-B809	008	5-B809	SHAFT, idler.....	1
339	6	.....	.....	5310-276-2929	008	3-B1157	WASHER, brass.....	1
339	7	.....	008	11-B3657	008	11-B3657	BUSHING, bronze.....	1
339	8	.....	008	H1424A-B1840	008	H1424A-B1840	GEAR, 67 tooth.....	1
339	9	.....	.....	5310-374-0083	008	2-B912	WASHER, steel.....	1
341	3	.....	.....	5310-371-2709	008	2-B2274	WASHER, end.....	1
341	4	.....	008	1-B2274	008	1-B2274	SHAFT.....	1
341	5	.....	.....	3020-273-3270	008	H1366C-B2274	GEAR, 122 tooth.....	1

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
341	8	.....	008	2-B2277	008	2-B2277	CAP, pillow block.....	1
341	9	.....	008	3-B3804	008	4-B3804	SHIM.....	1
341	10	.....	.....	3110-155-6418	008	77215	BEARING, ball.....	3
341	14	.....	008	H1376B-B2274	008	H1376B-B2274	BLOCK, pillow.....	1
341	16	.....	008	1-B2277	008	1-B2277	SPACER.....	1
341	20	.....	008	M632-B2314	008	M632-B2314	FLANGE, brake.....	1
341	21	.....	008	H2430-B3035	008	H2430-B3035	DRUM, hoist.....	1
341	22	.....	008	6-B5900	008	6-B5900	BOLT.....	8
341	23	.....	.....	4030-374-0075	008	H1560-B827	WEDGE, cable, ½.....	1
341	....	.....	.....	4030-374-1502	008	H1556-B826	WEDGE, cable, ⅝.....	1
341	29	.....	008	H1381-B682	008	H1381-B682	CAP, pillow block.....	1
341	30	.....	.....	3110-155-6774	008	77212	BEARING, ball.....	1
341	31	.....	008	H1377-B1848	008	H1377-B1848	BLOCK, pillow.....	1
341	33	.....	.....	3810-352-1708	008	H2342-B2255	WHEEL, control.....	1
341	34	.....	008	RA-212	008	RA-212	BEARING, roller.....	2
341	35	.....	008	H2348-B2257	008	H2348-B2257	CARRIER, clutch.....	1
345	1	.....	008	5-F1012	008	5-F1012	RING, retaining.....	1
345	2	.....	008	1-F1093	008	1-F1093	SHAFT.....	1
345	3	.....	008	H2751-F1094	008	H2751-F1094	GEAR, 45 tooth.....	1
345	4	.....	008	5-F1049	008	5-F1049	RING, retaining.....	3
345	5	.....	008	5513	008	5113	BEARING, ball.....	1
345	6	.....	008	60925	008	60925	SEAL, oil.....	1
345	7	.....	008	H2744-F1094	008	H2744-F1094	BLOCK, pillow.....	1
345	9	.....	008	H2651-F1054	008	H2651-F1054	SHIFTER, clutch.....	2
345	10	.....	008	1-F1051	008	1-F1051	RING, retaining.....	2
345	11	.....	008	73L17	008	73L17	BEARING, ball.....	2

345	12	.....	008	2–F1081	008	2–F1018	RING, retaining.....	2
345	13	.....	008	5–F1054	008	5–F1054	SLEEVE, shifter.....	2
345	16	.....	008	H2647–F1049	008	H2647–F1049	CARRIER, clutch.....	2
345	18	.....	367	35051	008	35051	SEAL, oil.....	2
345	22	.....	008	M736–F1050	008	M736–F1050	WHEEL, clutch.....	2
345	23	.....	.....	3110–155–6792	008	77213	BEARING, ball.....	4
345	24	.....	008	H2652–F1055	008	H2652–F1055	GEAR, bevel.....	2
345	25	.....	526	A5213	526	A5213	RACE, inner.....	1
345	26	.....	526	A5213–1213TS	526	A5213–1213TS	BEARING.....	
345	27	.....	.....	3110–155–6617	526	1213TS	RACE, outer.....	1
345	28	.....	008	H2656–F1059	008	H2656–F1059	CENTER, bearing housing.....	1
345	32	.....	008	3–F1061	008	3–F1061	BAR, lock.....	1
345	33	.....	816	60808	008	60808	SEAL, oil.....	1
345	34	.....	008	H2743–F1097	008	H2743–F1097	COVER.....	1
345	35	.....	008	N–11	008	N–11	LOCKNUT.....	1
345	36	.....	008	W–11	008	W–11	LOCKWASHER.....	1
345	37	.....	.....	3110–155–6757	008	77211	BEARING, ball.....	1
345	41	.....	008	H2746–F1094	008	H2746–F1094	BLOCK, pillow.....	1
345	42	.....	008	H2743–F1101	008	H2743–F1101	RING, inner adjusting.....	1
349	1	.....	.....	3810–352–1794	008	14132	BREATHER.....	1
349	4	.....	008	19–B4254	008	19–B4254	TOP, cover.....	1
349	5	.....	.....	5330–248–1000	008	24–B4254	GASKET.....	1
349	6	.....	008	F1096	008	F1096	COVER, bearing housing.....	1
349	7	.....	.....	3810–698–8012	008	10–F1140	SEAL.....	4
349	9	.....	008	1–F1098	008	1–F1098	GASKET.....	2
349	10	.....	008	H2745–1068	008	H2745–F1068	GEAR, bevel.....	1
349	11	.....	.....	3110–155–6779	008	77312	BEARING, ball.....	1
349	12	.....	367	35380	008	35380	SEAL, oil.....	1
349	13	.....	008	H2747–F1095	008	H2747–F1095	HOUSING, bearing.....	1
349	18	.....	008	2–F1068	008	2–F1068	SHIM.....	1
349	19	.....	008	5–F1089	008	5–F1089	SHAFT.....	1
349	20	.....	008	H1951–B1109	008	H1951–B1109	PINION, spur.....	1

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
349	21	.....	.....	3110-155-6745	008	77310	BEARING, ball	1
349	23	.....	008	1-F1068	008	1-F1068	SHIM	1
350	3	.....	.....	5310-425-2600	008	2-B1038	WASHER, end	1
350	4	.....	008	H2449-B3093	008	H2449-B3093	GEAR, 100 tooth	1
350	5	.....	.....	3110-155-6808	008	77214	BEARING, ball	1
350	6	.....	.....	3110-155-6422	008	77314	BEARING, ball	1
350	7	.....	008	1-B3093	008	1-B3093	SHAFT	1
350	9	.....	008	H2192-B1835	008	H2192-B1835	PINION, swing	1
352	1	.....	.....	2530-534-0141	203	215210	LEVER	1
352	3	.....	.....	5306-367-4276	203	202846	SCREW, adjusting	2
352	4	.....	.....	4310-383-9865	203	203115	COVER, diaphragm	1
352	5	.....	.....	4310-359-0439	203	203108	FOLLOWER, diaphragm	1
352	6	.....	.....	2530-371-3910	203	203109	DIAPHRAGM	2
352	7	.....	.....	5310-384-8659	203	210469	NUT, discharge valve cap	2
352	8	.....	.....	5340-246-7012	203	210468	SPRING, helical, compression	2
352	9	.....	.....	2530-568-7620	203	203102	VALVE, discharge	2
352	10	.....	.....	5310-264-0171	203	230580	RING, spring retainer	2
352	11	.....	.....	2530-753-9379	203	230578	STOP, unloader valve	2
352	12	.....	.....	5340-256-7223	203	203112	SPRING, unloader valve	2
352	13	.....	.....	2530-359-0324	203	230577	BUSHING, unloader valve	2
352	15	.....	.....	5307-752-9389	203	212339	STUD	2
352	16	.....	.....	4820-569-4013	203	231698	VALVE, unloader	2
352	17	.....	.....	2530-422-7656	203	212340	BODY, cylinder head	1
352	18	.....	GE	4730-263-3123	203	203679	PLUG, pipe	1
352	19	.....	.....	5315-248-1941	203	203101	PIN, straight, headless	1
352	23	.....	.....	2530-383-9864	203	203106	GUARD, diaphragm dust	1

352	24	.....	.....	5340-246-7022	203	203113	SPRING, helical, compression.....	1
353	3	.....	203	203243	203	203243	COVER, inlet chamber.....	2
353	4	.....	.....	5330-245-5499	203	203242	GASKET.....	2
353	5	.....	203	203448	203	203448	BODY, cylinder block.....	1
353	6	.....	203	232443	203	232443	RING, piston, compression.....	4
353	7	.....	203	232441	203	232441	RING, piston, scraper.....	2
353	8	.....	203	232440	203	232440	RING, piston, segment.....	2
353	9	.....	203	232438	203	232438	RING, piston, expander.....	2
353	10	.....	.....	2530-374-1720	203	202990	LOCKWIRE, piston pin.....	2
353	11	.....	.....	2530-294-1885	203	203449	PIN, piston.....	2
353	12	.....	203	203457	203	203457	PISTON.....	2
353	13	.....	203	232442	203	232442	RING, piston, oil.....	2
353	14	.....	203	232439	203	232439	RING, piston, segment.....	2
353	15	.....	203	232437	203	232437	RING, piston, expander.....	2
353	16	.....	.....	3120-288-0977	203	202988	BUSHING, wristpin.....	2
353	17	.....	203	202893	203	202893	BOLT.....	4
353	18	.....	.....	3120-569-0969	203	232198	INSERT, bearing.....	4
353	19	.....	.....	2530-028-2526	203	216248	ROD AND CAP ASSEMBLY.....	2
353	22	.....	.....	5330-534-0174	203	202898	GASKET.....	1
353	23	.....	.....	2530-028-2526	203	216248	ROD, connecting.....	2
353	24	.....	.....	5340-050-1595	203	202892	PLUG.....	1
353	25	.....	.....	5307-292-5844	203	203000	STUD.....	4
354	1	.....	203	230529	203	230529	COVER, end.....	1
354	2	.....	.....	5340-534-0169	203	203028	RING, oil seal.....	1
354	3	.....	GE	33-8008-001-360	203	203052	GASKET.....	2
354	4	.....	.....	3110-185-6464	203	202894	LOCKNUT.....	2
354	5	.....	.....	3110-186-0966	203	202895	LOCKWASHER.....	2
354	6	.....	522	207K	203	SAE207	BEARING, ball, annular.....	2
354	7	.....	.....	2530-753-9362	203	230527	CRANKSHAFT.....	1
354	8	.....	.....	5315-223-6111	203	211347	KEY, Woodruff.....	1
354	10	.....	.....	5310-189-4412	203	203571	NUT.....	1
354	11	.....	203	203035	203	203035	BODY, crankcase.....	1

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
354	18	.....	266	174F1	203	212735	SEAL, oil	1
354	19	.....	203	230528	203	230528	COVER, end	1
354	20	.....	.....	2530-463-3620	203	211376	GASKET	1
367	1	.....	203	233489	203	233489	CAP, valve body screw	1
367	3	.....	203	233704	203	233704	NUT	1
367	4	.....	203	233963	203	233963	FOLLOWER, diaphragm	2
367	5	.....	203	233964	203	233964	DIAPHRAGM	1
367	6	.....	203	234929	203	234929	STEM, diaphragm	1
367	7	.....	203	214324	203	214324	GROMMET	1
367	8	.....	203	233961	203	233961	CAGE, spring	1
367	9	.....	203	233490	203	233490	FILTER	2
367	10	.....	203	233695	203	233695	WASHER	2
367	11	.....	203	237056	203	237056	RING, sealing	2
367	12	.....	203	233491	203	233491	CAP, strainer screw	2
367	13	.....	203	234695	203	234695	PIN, cotter	1
367	14	.....	203	233489	203	233489	CAP, spring cage screw	1
367	15	.....	203	237018	203	237018	RING, sealing	1
367	16	.....	203	235377	203	235377	NUT, adjusting	1
367	17	.....	203	233488	203	233488	SEAT, spring	1
367	18	.....	203	234899	203	234899	SPRING, pressure setting	1
367	19	.....	203	233481	203	233481	STEM, exhaust	1
367	20	.....	.....	5340-246-7007	203	210002	SPRING, exhaust stem	1
367	21	.....	203	233957	203	233957	BODY, valve	1
367	22	.....	203	237447	203	237447	SCREW	4
367	23	.....	.....	5330-290-8762	203	232068	GROMMET	1
367	24	.....	203	233474	203	233474	BUSHING, guide	1

367	25	.....	203	212670	203	212670	SHIM, 0.010	AR
367	26	.....	203	233958	203	233958	SHIM, 0.003	AR
367	27	.....	203	233960	203	233960	SEAT, inlet valve	1
367	28	.....	203	233959	203	233959	GROMMET	1
367	29	.....	203	234699	203	234699	VALVE, inlet-exhaust	1
367	30	.....	203	233477	203	233477	SPRING, inlet valve	1
367	31	.....	203	212609	203	212609	SPRING, seat retaining	1
367	32	.....	203	237018	203	237018	RING, sealing	1
368	1	.....	203	203788	203	203788	SCREW, cap	6
368	2	.....	ORD	H001-7043711	203	232850	LOCKWASHER	10
368	3	.....	203	233803	203	233803	COVER	1
368	4	.....	203	234761	203	234761	FILTER	1
368	5	.....	.....	5230-353-0485	203	233794	DIAPHRAGM	1
368	6	.....	203	232069	203	232069	PLATE, lock	1
368	7	.....	203	230175	203	230175	GROMMET	1
368	8	.....	203	237599	203	237599	GUIDE, diaphragm	1
368	9	.....	203	237598	203	237598	DAMPENER, ring	1
368	10	.....	203	232949	203	232949	ADAPTER	1
368	11	.....	914	45-6030-500-003	203	230576	PLUG, pipe	1
368	13	.....	203	202735	203	202735	GASKET	1
368	14	.....	203	233795	203	233795	BODY, relay valve	1
368	15	.....	203	233937	203	233937	PLATE, strainer	2
368	16	.....	203	238026	203	238026	STRAINER	1
368	17	.....	203	233938	203	233938	RING, retaining	1
368	18	.....	203	233800	203	233800	CAPNUT, supply valve	1
368	19	.....	203	214314	203	214314	GROMMET	1
368	20	.....	203	211170	203	211170	SPRING, supply valve	1
368	21	.....	203	234560	203	234560	SPRING, seat retainer	1
368	22	.....	203	237605	203	237605	VALVE, supply	1
368	23	.....	203	237606	203	237606	SEAT, supply valve	1
368	24	.....	203	233797	203	233797	GROMMET	1
368	25	.....	914	45-6068-500-004	203	233057	PLUG, pipe	1

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
369	1		203	230931	203	230931	BODY	1
369	2			2805-447-1150	203	232017	DIAPHRAGM	1
369	3			2530-698-6974	203	202587	SEAT, spring	1
369	4			5340-246-7004	203	202588	SPRING	1
369	5		203	211028	203	211028	COVER	1
370	1			3120-353-0458	203	230906	BUSHING	2
370	2			5315-273-7869	203	231677	PIN, roller	1
370	3			5315-273-7868	203	230907	PIN, stop	1
370	4		203	232419	203	232419	SCREW, adjusting	1
370	6			5315-389-6434	203	230908	PIN, treadle	1
370	7		203	230901	203	230901	PLATE, mounting	1
370	8		203	230894	203	230894	CAP	1
370	9			2530-426-8380	203	230900	BOOT	1
370	10		203	230893	203	230893	WASHER	1
370	11			2530-391-2853	203	232713	CAGE, spring	1
370	13		203	230896	203	230896	UPPER BODY	1
370	14			5330-292-1460	203	230897	GROMMET	1
370	15			5340-200-4380	203	232576	SPRING, pressure regulating	1
370	16			2530-378-9967	203	230887	SHIM	AR
370	17			2530-378-9968	203	230888	SHIM	AR
370	18			2530-426-8359	203	221964	DIAPHRAGM ASSEMBLY	1
370	19		203	231008	203	231008	GROMMET	1
370	20			2530-392-4426	203	230882	SEAT, valve	1
370	21			5330-291-4857	203	230895	GROMMET	1
370	22			5340-201-1641	203	230880	SPRING, diaphragm return	1
370	23		203	230870	203	230870	LOWER BODY	1

370	24	.....	203	230871	203	230871	STUD.....	3
370	25	.....	203	230898	203	230898	SCREW, cap.....	3
370	26	.....	.....	2530-378-9965	203	230872	SHIM.....	AR
370	27	.....	.....	2530-426-8357	203	221958	INLET VALVE ASSEMBLY.....	1
370	28	.....	203	230879	203	230879	INLET BODY.....	1
370	31	.....	.....	2530-290-8763	203	230878	GROMMET.....	1
370	32	.....	.....	2530-378-9966	203	230873	SHIM.....	AR
370	34	.....	.....	2530-426-8358	203	221963	PLUNGER.....	1
370	35	.....	.....	5340-282-5053	203	204149	RING, retaining.....	1
370	36	.....	.....	2530-378-9968	203	230888	SHIM.....	AR
370	40	.....	.....	2530-422-7770	203	211026	ROLLER.....	1
370	41	.....	203	231664	203	231664	PIN, cotter.....	2
370	42	.....	203	230904	203	230904	TREADLE.....	1
373	1	.....	203	203259	203	203259	HANDLE.....	1
373	2	.....	203	203456	203	203456	PLUG, spring.....	1
373	3	.....	203	203459	203	203459	SPRING, helical, compression.....	1
373	4	.....	203	203451	203	203451	PLUNGER, lock.....	1
373	5	.....	203	203450	203	203450	BODY, lock.....	1
373	6	.....	203	203453	203	203455	BALL, lock.....	1
373	7	.....	203	203453	203	203453	COVER.....	1
373	....	.....	203	203454	203	203454	CLAMP.....	1
373	8	.....	203	203452	203	203452	CAGE, spring.....	1
373	9	.....	203	203268	203	203268	WASHER.....	1
373	10	.....	203	203269	203	203269	SPRING, helical, compression.....	1
373	11	.....	203	203764	203	203764	SHIM.....	AR
373	....	.....	203	213696	203	213696	SHIM.....	AR
373	12	.....	.....	2530-422-7763	203	203254	PISTON.....	1
373	13	.....	.....	5340-275-6129	203	203525	CUP, piston.....	1
373	14	.....	203	203256	203	203256	NUT, piston.....	1
373	15	.....	.....	5340-246-7023	203	203253	SPRING, exhaust valve.....	1
373	16	.....	203	203252	203	203252	BODY, valve.....	1
373	17	.....	.....	2530-569-3987	203	215306	VALVE, intake and exhaust.....	1

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
373	18	.....	.....	5340-246-7024	203	203265	SPRING, helical, compression.....	1
373	19	.....	203	203266	203	203266	NUT, cap.....	1
373	22	.....	203	203260	203	203260	SETSCREW.....	1
375	1	.....	.....	5307-141-2621	203	230576	PLUG, pipe.....	1
375	2	.....	203	225643	203	225643	PLATE, pressure.....	1
375	3	.....	203	234100	203	234100	DIAPHRAGM.....	1
375	4	.....	203	225263	203	225263	PUSH ROD ASSEMBLY.....	1
375	5	.....	203	234130	203	234130	SPRING.....	1
375	6	.....	203	225954	203	225954	PLATE, nonpressure.....	1
375	7	.....	203	237891	203	237891	RING, clamp.....	1
375	10	.....	290	1245C185	290	1245-C-185	YOKE.....	1
375	12	.....	290	19X41	290	19X-41	PIN.....	1
375	14	.....	203	235768	203	235768	GROMMET.....	1
375	15	.....	203	255805	203	225805	SEAL, push rod.....	1
375	16	.....	203	237887	203	237887	NUT.....	2
375	17	.....	203	237886	203	237886	BOLT.....	2
376	1	.....	203	212365	203	212365	BODY, cylinder.....	1
376	2	.....	.....	5310-385-0611	203	212383	NUT, piston.....	1
376	3	.....	.....	2530-378-9961	203	211024	WASHER, shim.....	1
376	4	.....	.....	5340-426-8186	203	211022	CUP, piston.....	1
376	5	.....	.....	9390-426-8185	203	211020	OILER, piston.....	1
376	6	.....	.....	2530-392-4419	203	212367	PISTON.....	1
376	7	.....	.....	2530-378-9962	203	212384	SHIM, 0.010.....	AR
376	....	.....	.....	2530-378-9963	203	212385	SHIM, 0.005.....	AR
376	8	.....	.....	2530-734-9692	203	212379	ROD, piston.....	1
376	9	.....	.....	2530-391-2851	203	230696	RETAINER, piston rod.....	1

376	10			5310-275-3433	203	212382	LOCKNUT	1
376	11			2530-426-8200	203	212381	GUIDE, piston	1
376	12			5340-598-6731	203	212368	SPRING	1
376	13			3120-426-8201	203	212386	BUSHING	1
376	14		203	212366	203	212366	COVER, end	1
376	16		ORD	5305-266-6271	203	212387	SCREW, cap	4
376	17			2530-426-8161	203	204145	PLATE, strainer	1
376	18					ID	STRAINER	1
376	19			2530-361-6659	203	212369	COVER, breather	1
376	20			5330-233-5864	203	212371	SEAL, felt oil	1
376	21			5310-274-8042	203	212372	WASHER, felt	1
376	22			5340-426-8199	203	212373	RING, retaining	1
376	24			5315-281-6614	203	200054	PIN	1
376	25			5340-367-3646	203	205948	YOKE ASSEMBLY	1
376	29			5307-275-8543	203	214657	STUD	2
377	....		203	220269	203	222487	SLACK ADJUSTER, rear axle	4
377	1		203	232215	203	232215	RIVET	5
377	2		203	212631	203	212631	COVER	2
377	3		203	214465	203	214465	GEAR, worm	1
377	4		203	214463	203	214463	WORM	1
377	5		203	212357	203	212357	PLUG, welch	1
377	6		203	231762	203	231762	BODY	1
377	7			3120-288-0967	203	201225	BUSHING	2
377	8		203	231746	203	231746	PIN	1
377	9		203	231885	203	231885	LOCK, worm shaft	1
377	10		203	231883	203	231883	SPRING, worm lock	1
377	11		203	234248	203	234248	SHAFT, worm	1
377	12			4730-278-3445	203	233410	PLUG, pipe	1
377	....			2530-288-2135	203	222978	SLACK ADJUSTER, front axle	2
377	1		203	214041	203	214041	RIVET	5
377	2		203	232169	203	232169	COVER	2
377	3		203	232164	203	232164	GEAR, worm	1

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
377	4		203	232163	203	232163	WORM	1
377	5		203	214050	203	214050	PLUG, welch	1
377	6		203	232278	203	232278	BODY	1
377	7			3120-288-0967	203	201225	BUSHING	2
377	8		203	232162	203	232162	PIN	1
377	9		203	232167	203	232167	LOCK, worm shaft	1
377	10		203	232168	203	232168	SPRING, worm lock	1
377	11		203	234249	203	234249	SHAFT, worm	1
377	12			4730-278-3445	203	233410	PLUG, pipe	1
378	1		203	201612	203	201612	LOCKNUT	1
378	2		203	201611	203	201611	SCREW, adjusting	1
378	3			5340-246-7003	203	201614	SPRING	1
378	4			2530-422-7827	203	201615	SEAT, spring	1
378	5		203	201613	203	201613	PIN, release	1
378	6			2320-422-7669	203	201610	CAGE, spring	1
378	7		912	42-1100-500-045	203	213203	BALL, steel	1
378	8		203	232947	203	232947	BODY	1
379	3			5940-050-7106	203	203063	TERMINAL	2
379	4		203	203621	203	203621	COVER	1
379	5			5930-424-0887	203	203622	CONNECTOR, terminal	1
379	6			5306-272-4269	203	203623	SCREW, terminal	1
379	7		203	215959	203	215959	SCREW, terminal	1
379	8		203	203620	203	203620	SPRING	1
379	9			5930-447-1125	203	215538	PLUNGER, contact	1
379	10		203	213873	203	213873	WASHER, shim	1
379	11			5930-569-3980	203	203381	DIAPHRAGM	1

379	12			5930-241-2314	203	203380	BODY	1
380	1		203	203372	203	203372	PIN, cotter	1
380	2		203	202678	203	202678	WASHER	1
380	3		203	202677	203	202677	SPRING, helical, compression	1
380	4		203	202676	203	202676	WASHER	1
380	5		203	204866	203	204866	CAP	1
380	6		203	214489	203	214489	BODY	1
380	7		203	214456	203	214456	PIN, stop	1
380	8			2530-371-3932	203	202675	KEY	1
381	1		203	213237	203	213237	BODY	1
381	2		203	213234	203	213234	GASKET	1
381	3		203	213236	203	213236	SEAT, spring	1
381	4			5340-598-6756	203	213235	SPRING	1
381	5		203	213202	203	213202	BALL, steel	1
381	6			5310-495-1275	203	213231	NUT, cap	1
382	1		203	233461	203	233461	BODY	1
382	2			2530-392-4431	203	233466	VALVE	1
382	3		203	233465	203	233465	GUIDE, valve	1
382	4		203	231592	203	231592	GROMMET	1
382	5		203	233463	203	233463	COVER	1
385	1			5310-274-7744	086	025003	NUT, lever shaft	1
385	3		086	504887	086	504887	ARM, steering gear	1
385	4		77640	2530-393-3187	086	504085	SEAL, oil	1
385	5		77640	2530-377-4575	086	069501	BUSHING, outer	1
385	6		77640	2530-377-4575	086	069501	BUSHING, inner	1
385	7		086	504964	086	504964	HOUSING	1
385	9			5340-282-6348	086	400005	RING, retaining	2
385	10			3110-227-4830	086	400020	CUP, ball bearing	2
385	11			3110-100-6155	086	400014	BALL, steel	28
385	12		086	8864-51-1-4	086	8864-51-1/4	CAM, steering	1
385	13						SHIM SET	AR
385				2530-517-5262	086	033036	SHIM, 0.003	

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
385	....	.....	.....	2530-518-6512	086	033037	SHIM, 0.010	.....
385	....	.....	086	033042	086	033042	SHIM, 0.002	.....
385	14	.....	086	TA666002	086	TA666002	COVER, upper	1
385	15	.....	086	097011-39-1-4	086	097011-39-1/4	TUBE, jacket	1
385	16	.....	086	8757-39-5-16	086	8757-39-5/16	TUBE, steering wheel	1
385	17	.....	.....	2530-352-5612	086	066988	BEARING UNIT, upper	1
385	18	.....	77640	2530-359-1710	086	028110	SEAT, spring	1
385	19	.....	.....	5340-197-5879	086	401103	SPRING	1
385	20	.....	.....	5310-262-5128	086	E-20	NUT, wheel	1
385	21	.....	.....	3920-449-5596	086	404811	WHEEL, steering	1
385	22	.....	77640	5930-371-3137	086	450029	BUTTON, horn	1
385	23	.....	77640	2540-521-4327	086	029037	CUP, contact	1
385	24	.....	.....	5340-253-7229	086	401081	SPRING	1
385	25	.....	77640	5310-371-3128	086	029036	WASHER, contact	1
385	26	.....	.....	5975-214-2143	086	032089	CONTACT, upper, horn cable	1
385	27	.....	77640	5970-303-0089	086	051036	FERRULE	1
385	28	.....	77640	2590-569-3685	086	454895	PLATE, base	1
385	29	.....	.....	5340-253-7230	086	401082	SPRING, contact	1
385	30	.....	77640	2540-374-0826	086	029031	CAP, contact	1
385	31	.....	086	8034-72	086	8034-72	CABLE, horn	1
385	37	.....	.....	5310-220-6660	086	025031	LOCKNUT	1
385	38	.....	086	021065	086	021065	SCREW, adjusting	1
385	39	.....	086	TA715000	086	TA715000	COVER, housing side	1
385	40	.....	GE	5330-233-5846	086	TA719000	GASKET, housing	1
385	41	.....	.....	2530-377-8668	086	503982	BEARING UNIT, stud roller	1
385	42	.....	086	8691-8-1-2	086	8691-8-1/2	SHAFT, lever	1

385	44	.....	086	8645-13-1-4	086	8645-13-1/4	END COVER AND OIL SEAL TUBE ASSEMBLY.	1
387	1	.....	73460	3820-374-0567	041	2947	THIMBLE	8
387	2	.....	041	8659	041	8659	BAR, yoke, first and reverse	1
387	3	.....	041	4459	041	4459	BAR, yoke, fourth and fifth	1
387	6	.....	041	10319	041	10319	HOUSING, shifting bar	1
387	9	.....	.....	5315-193-6465	041	1634	PIN, interlock cross	1
387	10	.....	GE	4730-010-3867	041	X12-601	PLUG	1
387	12	.....	.....	5305-275-8530	041	3220	SCREW, locking	4
387	13	.....	041	8658	041	8658	BLOCK, shifting, first and reverse	1
387	14	.....	041	9677	041	9677	YOKE, shifting, fourth and fifth	1
387	15	.....	041	8656	041	8656	YOKE, shifting, second and third	1
387	16	.....	.....	5340-253-7013	041	1064	SPRING, position finder	3
387	18	.....	73460	2520-734-9579	041	5145	YOKE, shifting, first and reverse	1
387	19	.....	041	5133	041	5133	BAR, yoke, second and third	1
389	1	.....	.....	5310-268-6158	041	1792	NUT, shaft	1
389	2	.....	.....	5310-269-5903	041	5423	WASHER	1
389	3	.....	.....	.....	041	3-WCS-28	FLANGE, companion	1
389	6	.....	.....	3825-378-1175	041	4462	COVER, rear bearing	1
389	7	.....	.....	2520-039-6539	041	4463	GASKET	1
389	8	.....	.....	5340-425-7109	041	4920	GEAR REPLACEMENT, speedometer	1
389	9	.....	.....	5310-269-5901	041	4590	WASHER, bearing	1
389	10	.....	.....	.....	.....	.....	RING, bearing snap	1
389	11	.....	.....	3110-155-6263	041	310SG	BEARING, ball	1
389	13	.....	.....	2520-696-4789	041	3401	GASKET	1
389	14	.....	041	10320	041	10320	CASE, transmission	1
389	17	.....	73460	3820-374-0564	041	1565	COVER, handhole	1
389	20	.....	.....	2520-390-9458	041	8040	HOUSING, clutch	1
389	22	.....	.....	2520-301-3952	041	4398	PLATE, handhole cover	1
389	23	.....	.....	2520-708-6600	041	4464	COVER, front bearing	1
389	24	.....	73460	2520-371-2937	041	4465	GASKET	1
389	25	.....	.....	3110-155-7422	041	5243	BEARING, roller	1

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
389	27		041	2840	041	2840	COVER	2
389	28			2520-377-8648	041	1684	GASKET	2
389	30		396	3110-155-6726	041	309MFG	BEARING, ball	1
389	32		041	4900	041	8336	NUT, bearing	1
389	33			5330-297-5239	041	5142	GASKET	1
389	34		73460	2520-734-8011	041	5141	COVER, rear bearing	1
391	1			3110-100-7333	041	7835	BEARING, roller	1
391	2		73460	2520-425-7116	041	5269	CLUTCH SHAFT AND DRIVE GEAR	1
391	3		522	310WDG	041	310MFG	BEARING, ball	1
391	5		041	5823	041	8344	NUT, bearing	1
391	6			2520-039-6537	041	4461	GASKET	1
391	7			2520-734-8016	041	5320	COVER, front bearing	1
393	1		041	6075	041	6075	CLUTCH, sliding	1
393	2			5310-395-4808	041	6342	WASHER, gear	1
393	3			2520-708-6560	041	5271	GEAR, fourth-speed	1
393	4		73460	2520-371-2941	041	5223	SLEEVE, gear	1
393	5		73460	2520-700-1503	041	5231	GEAR, third-speed	1
393	6			2520-700-1507	041	5235	GEAR, second-speed sliding	1
393	7			3020-317-9796	041	5136	GEAR, first-speed sliding	1
393	8			5315-271-4095	041	6341	KEY	1
393	9			2520-374-0906	041	6340	MAIN SHAFT	1
394	1			2520-374-0568	041	3413	SHAFT, reverse idler	1
394	2			3110-108-8011	041	5242	BEARING, roller	2
394	3			5340-734-9458	041	5143	SPACER, bearing	1
394	4			2520-696-4792	041	5140	GEAR, reverse idler	1
394	5		73460	2520-371-2935	041	1638	LOCK, shaft	1

397	1	.....	.....	2520-393-3221	041	5234	COUNTERSHAFT.....	1
397	3	.....	.....	3020-254-2097	041	5219	GEAR, third-speed.....	1
397	4	.....	.....	3020-265-7747	041	5270	GEAR, fourth-speed.....	1
397	5	.....	041	4467	041	4467	GEAR REPLACEMENT, power takeoff.	1
397	6	.....	.....	3020-425-7115	041	5220	GEAR, drive.....	1
397	7	.....	.....	5340-281-6719	041	4504	RING, retaining.....	1
405	1	.....	.....	5310-753-5081	290	14-X-57	NUT, pinion shaft, differential.....	3
405	2	.....	290	3897X362	290	3897-X-362	YOKE, main shaft.....	1
405	3	.....	.....	2540-293-1632	290	2847-Y-311	SLINGER, oil: main shaft front and drive shaft.	2
405	4	.....	.....	5330-285-9475	816	49459	SEAL, oil, driven and main shaft.....	2
405	5	.....	.....	5305-292-8947	290	S-2710-1	SCREW, cap, main shaft front cap.....	1
405	6	.....	.....	5305-292-8947	290	S-2710-1	SCREW, cap (bearing cap).....	24
405	7	.....	290	3838H86	290	3838-H-86	CAP, main shaft front bearing.....	1
405	8	.....	.....	2520-353-2649	290	2808-Y-363	GASKET, main shaft front cap.....	1
405	9	.....	78500	2520-353-2597	290	2803-R-616	SHIM, front bearing cap, main shaft....	1
405	10	.....	.....	3110-155-6217	290	7610	BEARING, front, main shaft.....	1
405	12	.....	78500	2520-353-2720	290	3880-M-325	SHAFT, main drive.....	1
405	13	.....	78500	2520-374-2175	290	2843-R-122	SHAFT, gearshift.....	1
405	14	.....	.....	3110-100-6156	290	1898-E-57	BALL, shift lock.....	1
405	15	.....	78500	2520-514-3782	290	1846-B-2	PLUNGER, lock spring, gearshift.....	1
405	16	.....	.....	5340-597-9007	290	2858-A-1	SPRING, lock, gearshift.....	1
405	17	.....	.....	5305-292-4989	290	S-1614-X1	BOLT, transfer shift fork.....	1
405	19	.....	78500	2520-353-2672	290	2849-R-96	FORK, gear shifter.....	1
405	20	.....	78500	2520-353-2753	290	3892-T-722	GEAR, main drive, transfer case.....	1
405	21	.....	.....	3110-156-8058	522	7209	BEARING, main drive gear.....	2
405	22	.....	.....	3120-353-2484	290	1829-C-393	SPACER, main drive gear bearing.....	1
405	23	.....	.....	3110-155-6213	522	7609	BEARING (main shaft rear and declutch shaft front).	2
405	24	.....	.....	3120-353-2480	290	1829-A-391	WASHER, rear bearing, main shaft.....	1
405	25	.....	78500	2520-353-2668	290	2848-Q-95	CLUTCH, drive, power takeoff.....	1

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
405	26	.....	.....	5310-262-4712	290	1829-D-394	WASHER, power takeoff clutch.....	1
405	28	.....	.....	5305-292-8943	290	S-1810-1	SCREW, cap, power takeoff clutch.....	1
405	29	.....	.....	2520-353-2644	290	2808-W-361	GASKET, main shaft rear.....	1
405	30	.....	290	3866T384	290	3866-T-384	CAP, bearing, main shaft rear.....	1
405	31	.....	.....	3120-353-2482	290	1829-B-392	WASHER (idler and driven shaft).....	2
405	32	.....	.....	3110-100-3617	892	49585	CONE, tapered roller bearing: single row.	3
405	33	.....	.....	3110-100-0593	892	49520	CUP; tapered roller bearing: single row..	3
405	34	.....	78500	78500-353-2590	290	2803-N-612	SHIM, front and rear bearing cap.....	2
405	35	.....	.....	2520-353-2647	290	2808-X-362	GASKET, idler shaft forward and rear cover.	2
405	36	.....	290	3866Q381	290	3866-Q-381	CAP, rear bearing, idler shaft.....	1
405	37	.....	290	3897M325	290	3897-M-325	FLANGE, driven shaft.....	1
405	38	.....	290	3866R382	290	3866-R-382	CAP, driven shaft rear bearing.....	1
405	39	.....	78500	2520-353-2602	290	2803-U-619	SHIM, rear bearing cap, driven shaft....	1
405	40	.....	.....	5330-353-2651	290	2808-Z-364	GASKET, rear cap, driven shaft.....	1
405	41	.....	.....	3810-353-2751	290	3892-S-721	GEAR, driven.....	1
405	42	.....	290	3880N326	290	3880-N-326	SHAFT, driven.....	1
405	43	.....	.....	3110-100-3113	892	3979	CONE AND ROLLERS, tapered bearing: single row; straight.	1
405	44	.....	.....	3110-100-0380	892	3920	CUP, tapered, roller bearing: single row.	1
405	45	.....	78500	2520-353-2669	290	2848-W-23	CLUTCH, driving.....	1
405	46	.....	.....	2520-033-6016	290	2848-V-22	CLUTCH, positive, sliding.....	1
405	47	.....	.....	2520-353-2671	290	2849-P-94	FORK, clutch shifter.....	1
405	48	.....	.....	5305-206-0112	290	26-X-52	SCREW, fork, declutch shift.....	1

405	50	.....	.....	5340-253-7280	290	2858-S-45	SPRING, helical, compression.....	1
405	52	.....	.....	5305-206-5836	290	3-X-146	SCREW, lock spring, declutch shift.....	1
405	53	.....	.....	2520-563-8308	290	2843-F-110	SHAFT, declutch shift.....	1
405	54	.....	290	2847G293	290	2847-G-293	LEVER, declutch shifting.....	1
405	55	.....	78500	2520-734-7880	290	1846-F-136	PIN, declutch shift lever.....	1
405	56	.....	.....	5306-281-8299	290	10-X-156	SCREW, declutch shift lever.....	1
405	57	.....	.....	5305-292-8946	290	S-2610-1	SCREW, cap, declutch carrier cover.....	4
405	58	.....	290	3897Z338	290	3897-Z-338	YOKE, declutch shaft companion.....	1
405	59	.....	367	35147S24	290	A1805-Z-104	SEAL, oil, declutch shaft.....	1
405	60	.....	290	3866P354	290	3866-P-354	CAP, bearing, declutch shaft.....	1
405	61	.....	.....	2520-353-2635	290	2808-P-94	GASKET, declutch carrier cap.....	1
405	62	.....	290	3826C185	290	3826-C-185	CARRIER, declutch.....	1
405	63	.....	.....	4730-142-1629	290	1850-Q-43	PLUG, oil, declutch carrier.....	1
405	64	.....	.....	2520-353-2642	290	2808-V-360	GASKET, declutch carrier.....	1
405	65	.....	78500	2520-353-2722	290	3880-T-46	SHAFT, declutch.....	1
405	66	.....	GE	4730-010-3875	290	P-212	PLUG, drain.....	1
405	67	.....	290	1898R200	290	1898-R-200	PLUG, filler.....	1
405	68	.....	290	3875C133	290	3875-C-133	TRANSFER CASE.....	1
405	69	.....	.....	3020-353-2748	290	3892-Q-719	GEAR, drive, low-speed.....	1
405	71	.....	ORD	H101-0588588	290	16-X-65	KEY, idler shaft and driven shaft.....	6
405	72	.....	78500	2520-773-5559	290	1844-S-175	SPACER, idler gear.....	1
405	73	.....	.....	2520-353-2754	290	3892-U-723	GEAR, idler, direct speed.....	1
405	74	.....	.....	2520-353-2614	290	2808-A-365	GASKET, cover.....	1
405	75	.....	290	3876L90	290	3876-L-90	COVER, transfer case.....	1
405	77	.....	.....	5305-292-8942	290	S-1713-1	BOLT, transfer case to cover.....	18
405	79	.....	.....	5315-267-3511	290	X-1997	PIN, taper, transfer case to cover.....	4
405	80	.....	.....	5305-292-4994	290	S-2714-1	SCREW, cap, transfer case to cover.....	2
405	81	.....	.....	3040-353-2719	290	3880-L-324	SHAFT, idler.....	1
405	82	.....	76500	2520-773-5579	290	1844-R-174	SPACER, bearing, main drive gear.....	1
405	83	.....	.....	3810-353-2750	290	3892-R-720	GEAR, sliding low-speed.....	1
405	84	.....	.....	2520-353-2626	290	2808-H-216	GASKET, shifter fork cover.....	2
405	85	.....	.....	2520-619-2239	290	2847-B-106	PLATE, oil breather.....	1

Figure No.	Index No.	Federal supply class and item ident. No.	Engineer stock No.		Manufacturer's part No.		Description	Quantity per unit
			Code No.	Part No.	Code No.	Part No.		
405	86		290	3855H60	290	3855-H-60	COVER, transfer shift	1
405	88			6680-352-6409	887	78744	SLEEVE, speedometer driven gear	1
405	89			6680-024-1936	290	1199-R-1110	GEAR, speedometer driven	1
405	90		290	3866S383	290	3866-S-383	CUP, front bearing, idler shaft	1
405	91		290	1199S1111	290	1199-S-1111	GEAR, speedometer drive	1
405	92		290	1844T176	290	1844-T-176	SPACER, speedometer gear	1
413	1		290	3216S1553	290	3216-S-1553	SLEEVE, housing	4
413	2		290	A3-3201P1446	290	A3-3201-P-1446	HOUSING: rear	1
413			290	A3-3201Q1447	290	A3-3201-Q-1447	HOUSING: front	1
413	4		290	A1199P1394	290	A-1199-P-1394	BREATHER ASSEMBLY	2
413	5			2530-427-2282	290	1246-D-290	DOWEL	4
413	6		290	2208C315	290	2208-C-315	GASKET, housing	2
413	9		290	4X1240	290	4-X-1240	STUD	36
413	10		GE	4730-278-3393	290	P-116	PLUG	2
413	11		290	P18	290	P-18	PLUG	2
413	12		290	1250M143	290	1250-M-143	PLUG	2
415	1		290	S2813-1	290	S-2813-1	SCREW, cap	16
415	3		GE	4730-278-3397	290	P-32	PLUG	2
415	4		290	A3866D550	290	A-3866-D-550	COVER	2
415	5		290	2808A651	290	2808-A-651	GASKET	2
415	6			2520-353-2616	290	2808-C-3	GASKET	2
415	7		290	3866K557	290	3866-K-557	COVER	2
415	8		290	10X495	290	10-X-495	SCREW	2
415	11		290	A2-3800Y493	290	A2-3800-Y-493	CARRIER AND CAP	2
415	13			5330-291-9120	226	400N230	SEAL, oil	4
415	14		290	A3866J556	290	A-3866-J-556	COVER AND SEAL ASSEMBLY	2