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# TM 5-9119

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

1252  
DITCHER, PLOW TYPE  
TRACTOR DRAWN  
CABLE CONTROLLED  
PNEUMATIC TIRED  
8-12 INCH BOTTOM  
24 INCH DEPTH  
JOHN DEERE KILLEFER  
MODEL 360

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DEPARTMENT OF THE ARMY

MAY 1956



## SAFETY PRECAUTIONS

Do not operate the ditcher with a frayed or worn control wire rope.

Before highway towing, check the hydraulic braking system to make sure that the air hose is connected and that the brakes operate properly.

Check the hand-operated parking brakes to be sure that they are in good operating condition.

Stop operation of the ditcher if the towing vehicle labors under the load. Change to the panbreaker attachment or add another towing vehicle.

Do not operate the ditcher if the plow standard is bent or twisted.

Do not operate the ditcher if the tires are cut, bruised, or excessively worn.

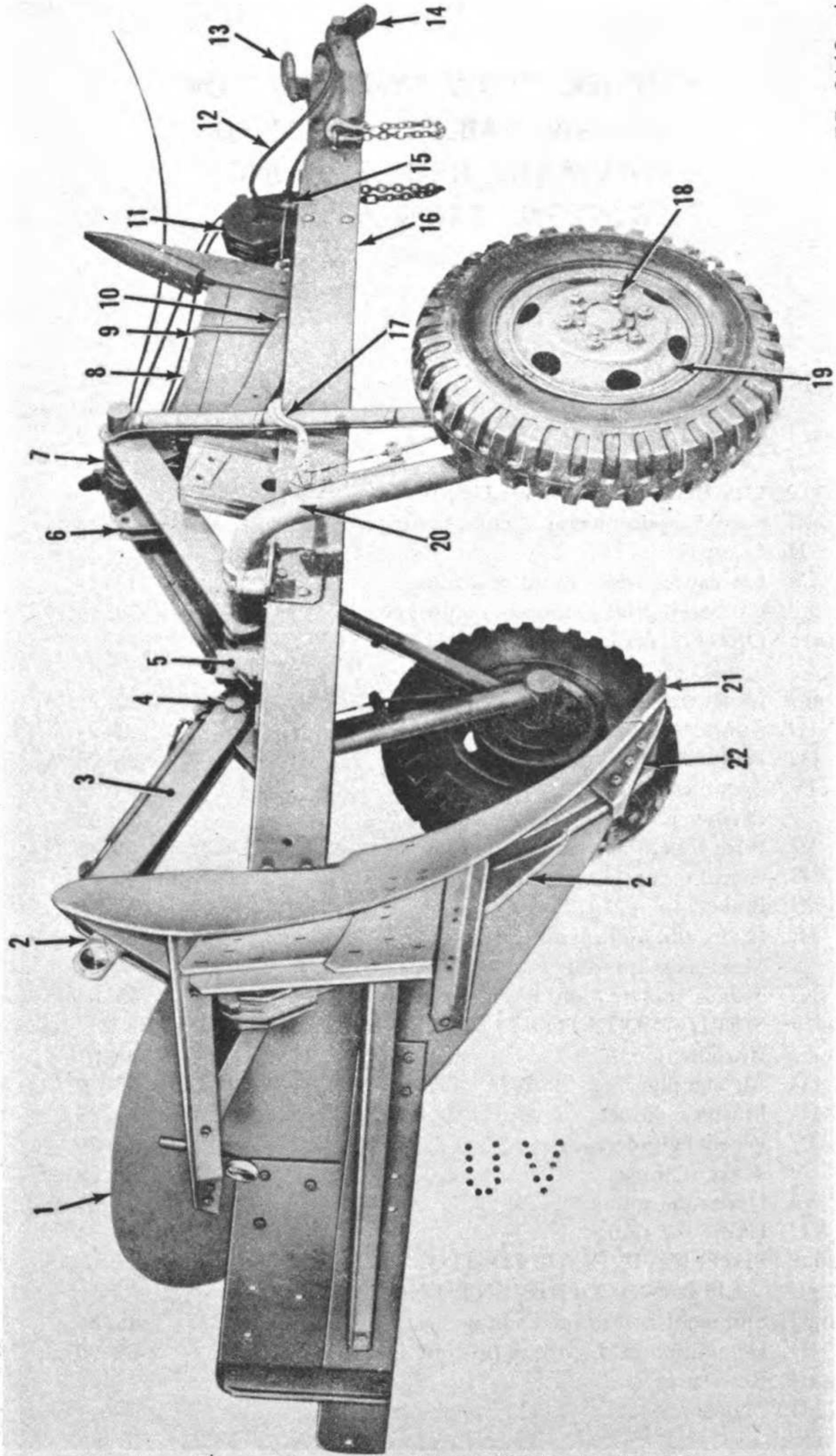
Be sure hydraulic pump valve is open during ditching operation.



**DITCHER, PLOW TYPE, TRACTOR  
 DRAWN, CABLE CONTROLLED,  
 PNEUMATIC TIRED, 8-12 INCH  
 BOTTOM, 24 INCH DEPTH,  
 JOHN DEERE KILLEFER MODEL 360**

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Figure 1. Ditcher, right side view.



# CHAPTER 1

## INTRODUCTION

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### Section I. GENERAL

#### 1. Scope

*a.* This manual is published for the use of personnel to whom this ditcher is issued. It contains information on the operation, organizational maintenance, and field and depot maintenance of the ditcher, as well as a description of the major units and their function in relation to other components of the materiel. It applies only to the John Deere Killefer, plow type ditcher, Model 360.

*b.* Any errors or suggestions for improvement of this manual should be brought to the attention of the Commandant, The Engineer School, Fort Belvoir, Va., Attention: TECES-TP. Direct communication is authorized.

#### 2. Record and Report Forms

*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 9-71 (Locator and Inventory Control Card).

*d.* DA Form 9-79 (Parts Requisition).

*e.* DA Form 9-81 (Exchange Part or Unit Identification Tag).

*f.* DA Form 285 (Accident Report of Personnel or Property Damage).

*g.* DA Form 446 (Issue Slip).

*h.* DA Form 447 (Turn-in Slip).

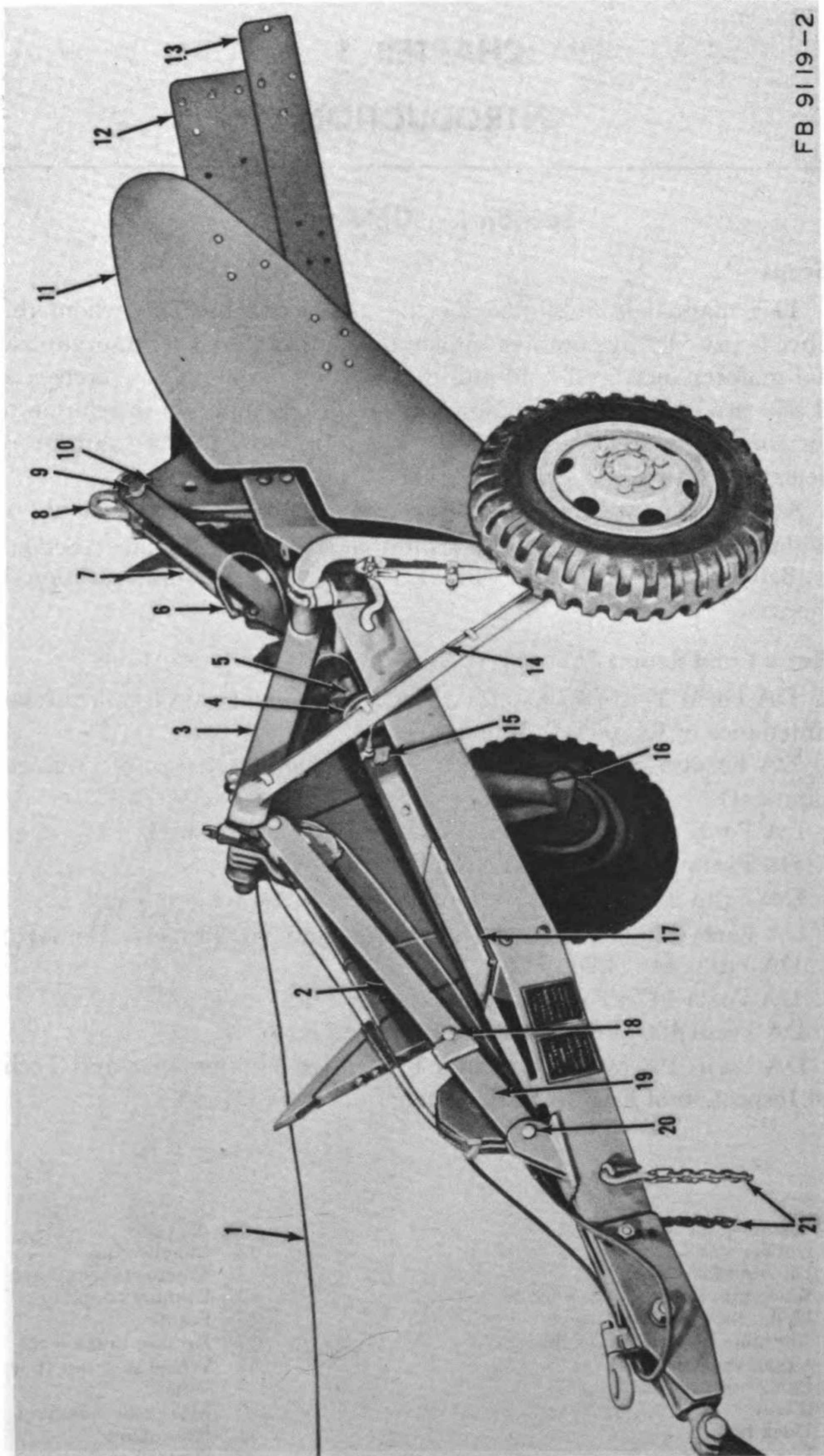
*i.* DA Form 460 (Preventive Maintenance Roster).

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

←

1	Ditcher plow	12	Air hose
2	Ditcher standard	13	Lunette ring
3	Ditcher brace	14	Tractor towing hitch
4	Brace pin, front, 2¼ in. x 6½ in.	15	Dummy coupling
5	Hydraulic pump and valve	16	Frame
6	Alternate hydraulic ram bracket	17	Parking brake lever
7	Upper sheave	18	Wheel-stud nut (6 rqr)
8	Panbreaker assembly	19	Wheel
9	U-bolt	20	Main axle assembly
10	Hook bolt	21	Plow share
11	Lower sheave	22	Share shoe





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Figure 2. Ditcher, left side view.



1 Control wire rope	12 Drift wing
2 Stop bar, upper	13 Drift wing extension
3 Frame member, upper sheave mounting	14 Hydraulic line, brake
4 Air chamber	15 Air filter
5 Hydraulic master cylinder	16 Stub axle
6 Hydraulic line, pump-to-ram	17 Toolbox
7 Hydraulic ram	18 Transport pin, 1¼ in. x 2 <sup>1</sup> / <sub>16</sub> in.
8 Lifting ring	19 Stop bar, lower
9 Brace pin, rear, 2¼ in. x 7¼ in.	20 Pivot pin, 1½ in. x 2 <sup>1</sup> / <sub>16</sub> in.
10 Cotter pin, ½ in. x 3½ in. (2 rqr)	21 Safety chains
11 Moldboard	

- ←
- k. DA Form 468 (Unsatisfactory Equipment Report).
  - l. DA Form 478 (Organizational Equipment File).
  - m. DA Form 811 (Work Request and Job Order).
  - n. DA Form 867 (Status of Modification Work Order).
  - o. DD Form 6 (Report of Damaged or Improper Shipment).
  - p. DD Form 110 (Vehicle and Equipment Operational Record).
  - q. DD Form 518 (Accident-Identification Card).

## Section II. DESCRIPTION AND DATA

### 3. Description

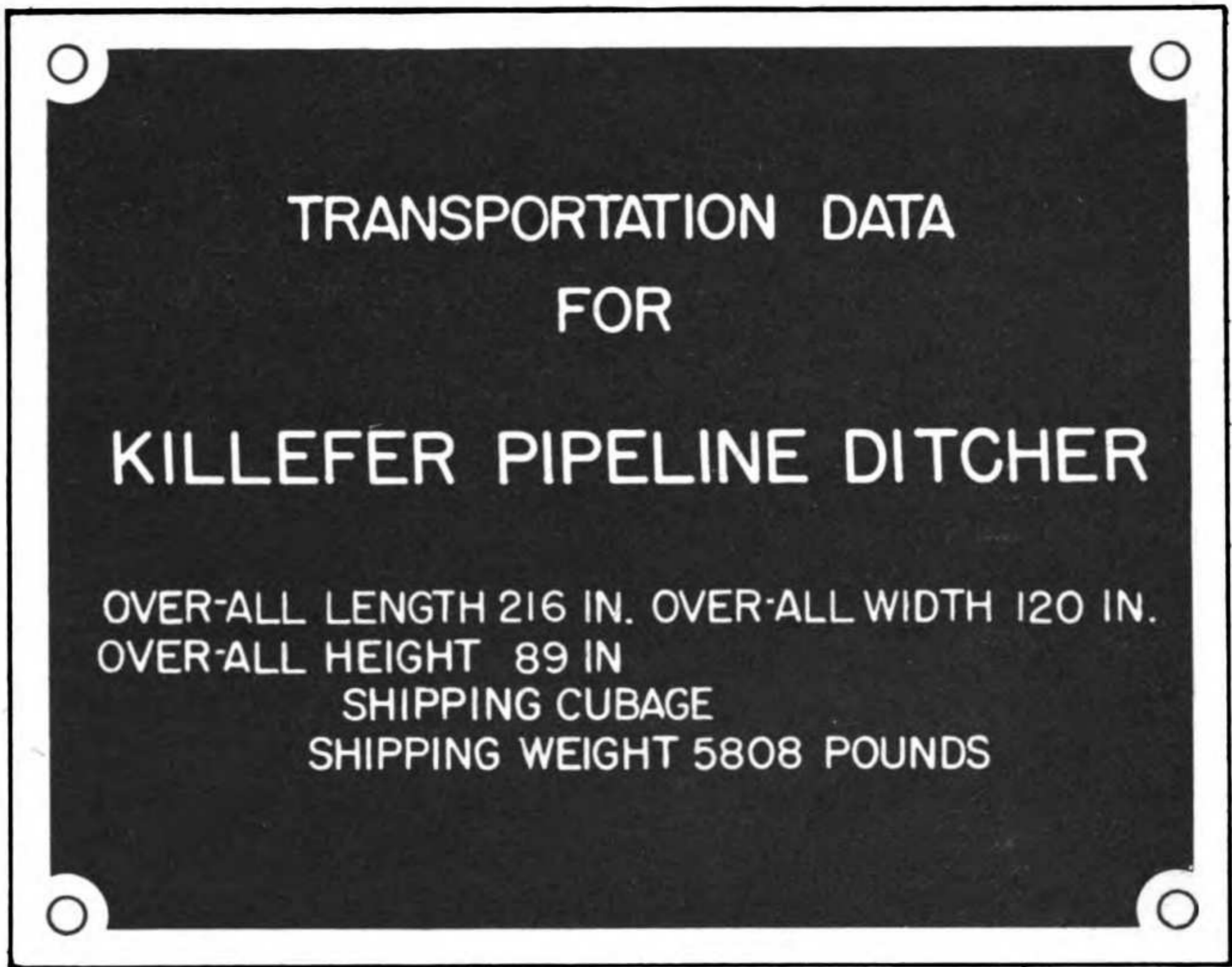
The Killefer Model 360 plow type ditcher (figs. 1 and 2) consists basically of a steel-channel frame (16, fig. 1) pivoted on an axle assembly (20) which mounts two pneumatic-tired, disk wheels (19) on stub axles (16, fig. 2), and a V-shaped, moldboard plow (1, fig. 1) which is equipped with drift wings (12, fig. 2) and drift wing extensions (13). The ditcher is equipped with a power lift consisting of a hand-operated hydraulic pump and valve (5, fig. 1) and a hydraulic ram (7, fig. 2). The plow penetrates, loosens, and moves earth to each side, assisted by the drift wings, forming irrigation and drainage ditches and ditches for laying or uncovering pipe lines. The ditcher is pulled by a prime mover attached to the tractor towing hitch (14, fig. 1), and controlled from the prime mover by a control wire rope (1, fig. 2) which is reeved through the upper and lower sheaves (7 and 11, fig. 1). When operating under adverse soil conditions, the panbreaker assembly (8) is used to break up the soil for easier operation of the plow. A lunette ring is provided for truck towing. The wheels are equipped with individual, hand-operated parking brakes, and air-hydraulic service brakes which operate from the towing vehicle.

### 4. Identification

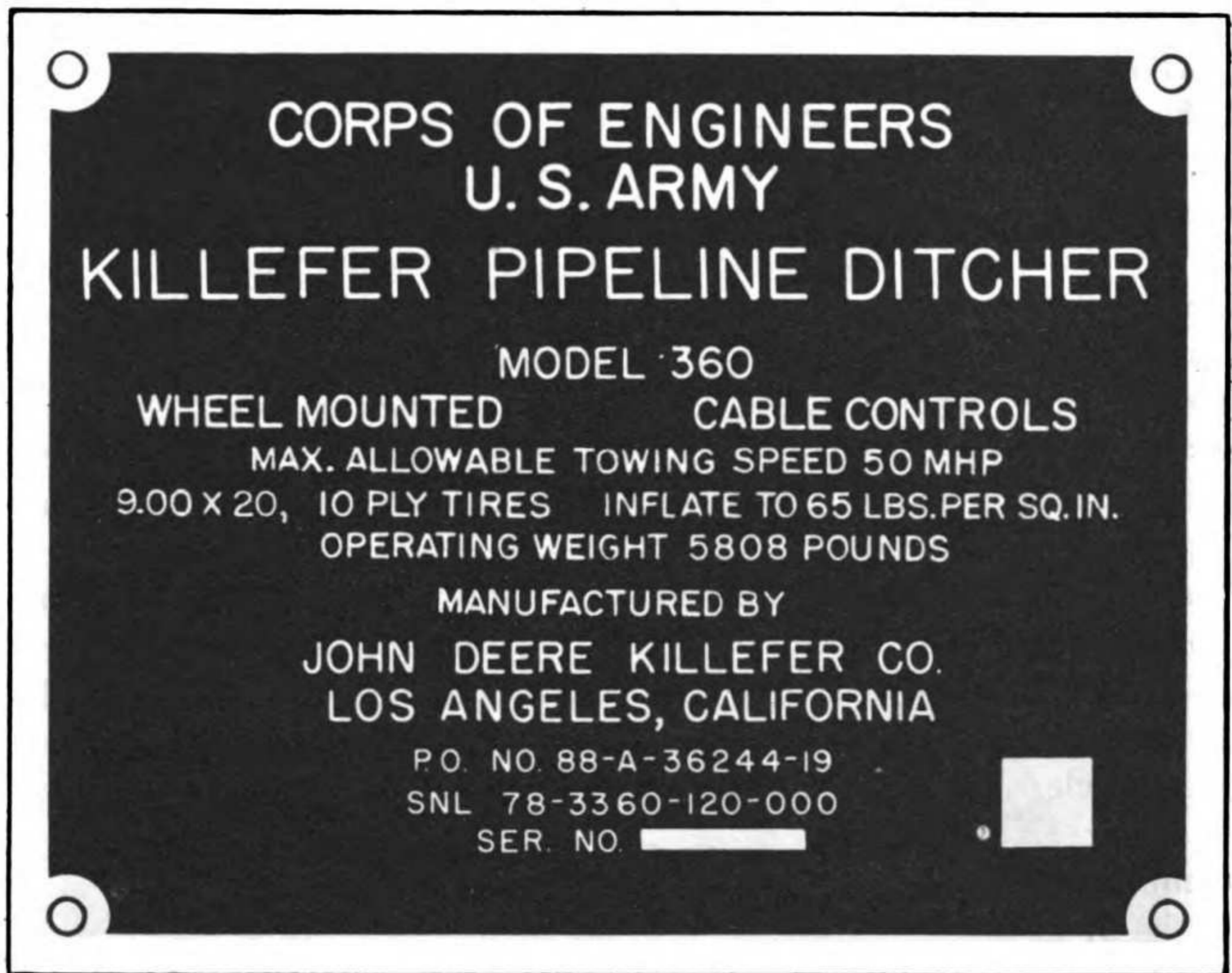
(fig. 3)

The ditcher has two identification plates. The Corps of Engineers identification plate (B), located on the frame directly behind the towing hitch,





A



B

B Corps of Engineers identification plate

A Transportation data plate

Figure 3. Identification plates.

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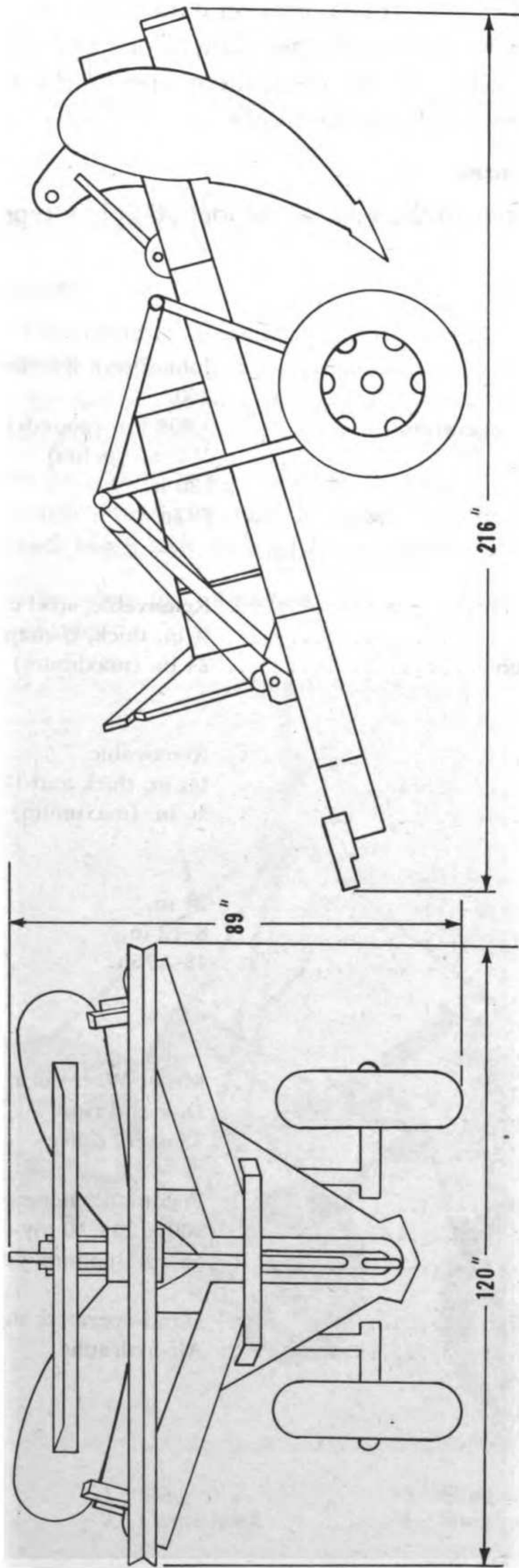


Figure 4. Dimensions of ditcher.



specifies the official nomenclature, the model number, and the serial number of the equipment. The transportation data plate (A), located beside the Corps of Engineers plate, specifies dimensions and weight. When requisitioning spare parts for this equipment, specify the Department of the Army registration and serial number.

## 5. Differences in Models

This manual applies to the Killefer Model 360 plow type ditcher only.

## 6. Tabulated Data

### a. General.

Manufacturer . . . . .	John Deere Killefer Co.
Model . . . . .	360
Weight (shipping and operating) . . . . .	5,808 lbs. (pounds)
Length, overall . . . . .	216 in. (inches)
Width, overall . . . . .	120 in.
Height, maximum . . . . .	89 in.

### b. Ditcher plow.

Plow share . . . . .	Removable, steel casting
Moldboards . . . . .	$\frac{3}{8}$ in. thick, U-shaped
Plow share penetration . . . . .	24 in. (maximum)

### c. Panbreaker.

Point . . . . .	Removable
Standard . . . . .	1 $\frac{1}{4}$ in. thick and 12 in. wide
Penetration . . . . .	36 in. (maximum)

### d. Ditch Dimensions.

Depth . . . . .	24 in.
Width, bottom . . . . .	8-12 in.
Width, top . . . . .	48-60 in.

### e. Wheel Mounting.

#### (1) Wheels.

Manufacturer . . . . .	Motor Wheel Corp.
Type . . . . .	Disk and rim
Bearings . . . . .	Timken, roller

#### (2) Tires.

Type . . . . .	Pneumatic, nondirectional
Size . . . . .	900 x 20—10 ply
Air pressure . . . . .	65 psi (pounds per square inch)

#### (3) Brakes.

Parking . . . . .	Hand-operated, mechanical
Transport . . . . .	Air-hydraulic



## CHAPTER 2

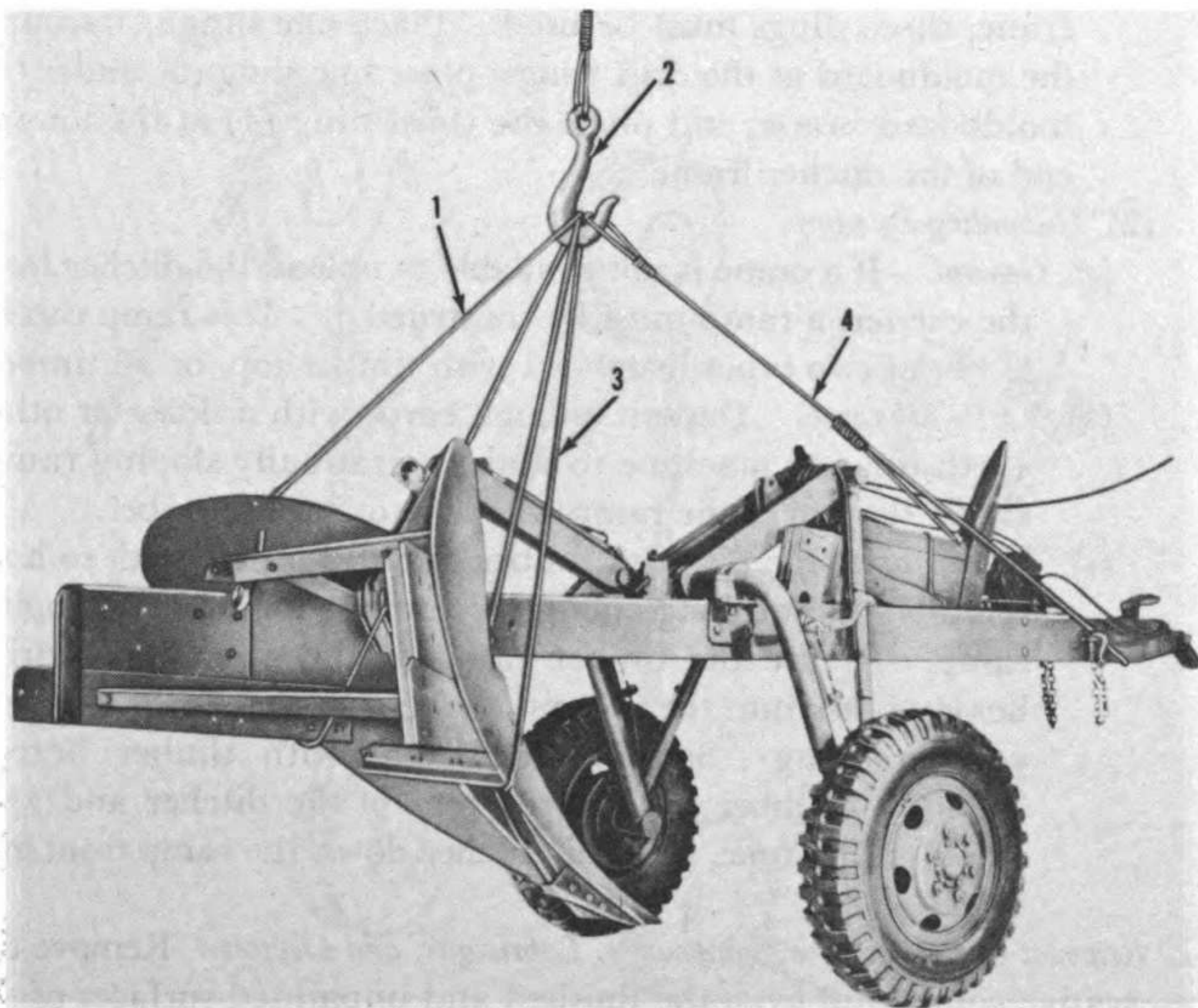
# OPERATING INSTRUCTIONS

### Section I. SERVICE UPON RECEIPT OF EQUIPMENT

#### 7. New Equipment

*a. General.* For domestic shipment, the ditcher is shipped uncrated and fully assembled except for the wire rope, which is shipped in a separate carton. The ditcher is secured to the bed of the carrier by heavy timbers and holddown guy lines. The wheels are secured, front and rear, by wooden chocks spiked to the bed of the carrier. Timbers along the outer edge of each wheel prevent sidewise shifting. The ditcher plow share and the tow hitch rest on timber supports.

*Note.* Check to be certain that all timbers and guy lines are removed before attempting to unload the ditcher.

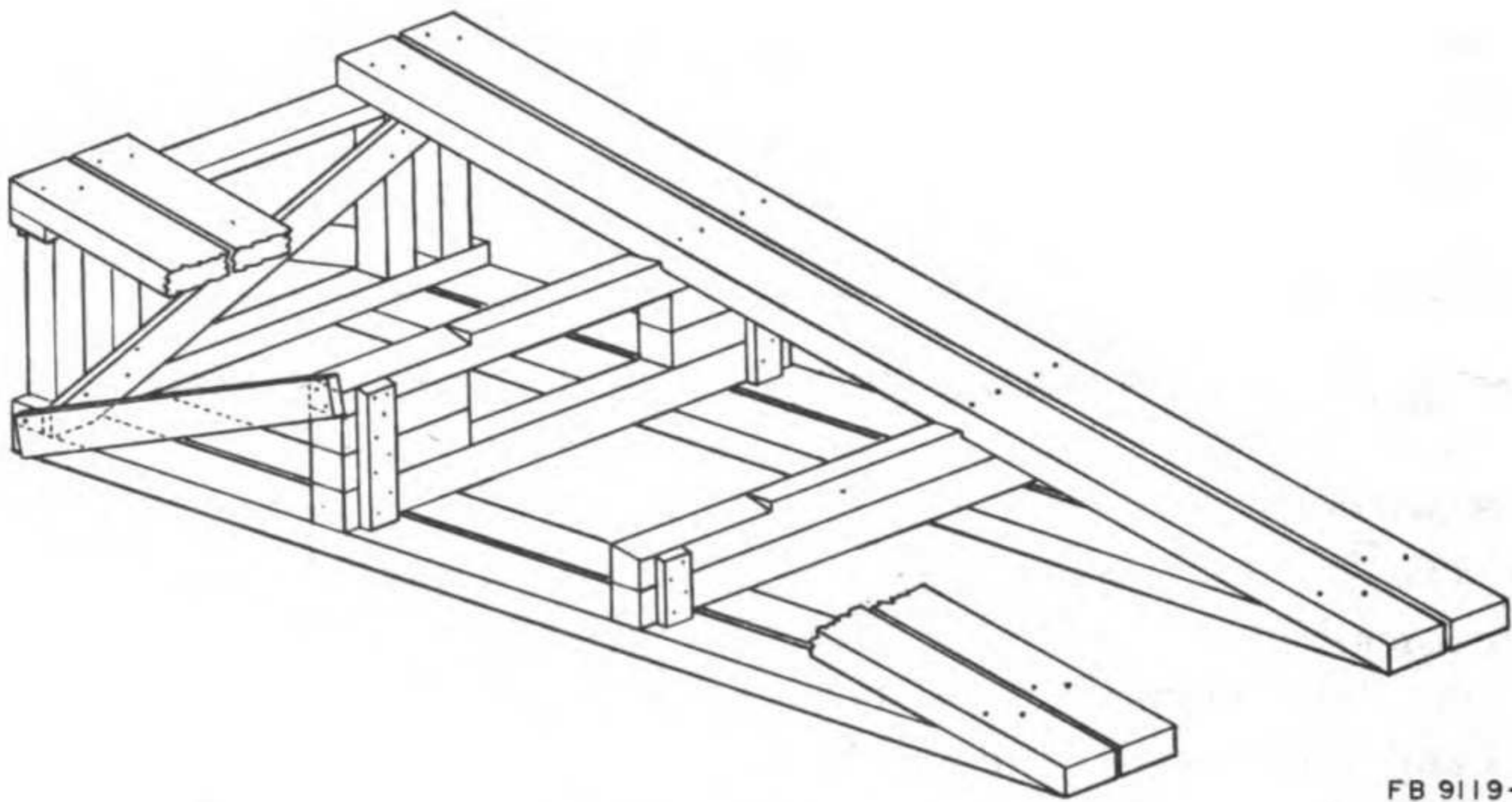


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- |              |         |
|--------------|---------|
| 1 Sling      | 3 Sling |
| 2 Crane hook | 4 Sling |

Figure 5. Sling lift points.





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Figure 6. Timber ramp.

*b. Unloading.*

(1) *Unloading by crane* (fig. 5). If the equipment is unloaded by crane, three slings must be used. Place one sling (1) around the moldboard at the drift wings; place one sling (3) under the moldboard brace; and place the third sling (4) at the tongue end of the ditcher frame.

(2) *Unloading by ramp.*

(a) *General.* If a crane is not available to unload the ditcher from the carrier, a ramp must be constructed. This ramp can be either of two types; earth-fill with timber top, or all timber.

(b) *Earth-fill ramp.* Deposit enough earth with a dozer or other earth moving machine to make a gradually sloping ramp. Cover the top of the ramp with logs or sawed timber.

(c) *Timber ramp* (fig. 6) Cut timber of sufficient strength to hold the ditcher, and long enough to provide a gradually sloping ramp. Secure the timber ramp to the carrier and drive heavy stakes into the ground at the end of the ramp to prevent creeping. Support the ramp with timber braces. Secure a snubber rope to the rear of the ditcher and with strain on the rope, ease the ditcher down the ramp front end first.

*c. Removal of Preservative Compounds, Lubricants, and Devices.* Remove the preservative compound from the finished and unpainted surfaces of the ditcher with cleaning solvent. Do not use cleaning solvent on bearings or bearing housings. Cover unpainted surfaces with a thin coat of light oil after the preservative compound is removed.

*d. Assembly.* The only assembly necessary is to reeve the control wire rope. Proceed as follows:



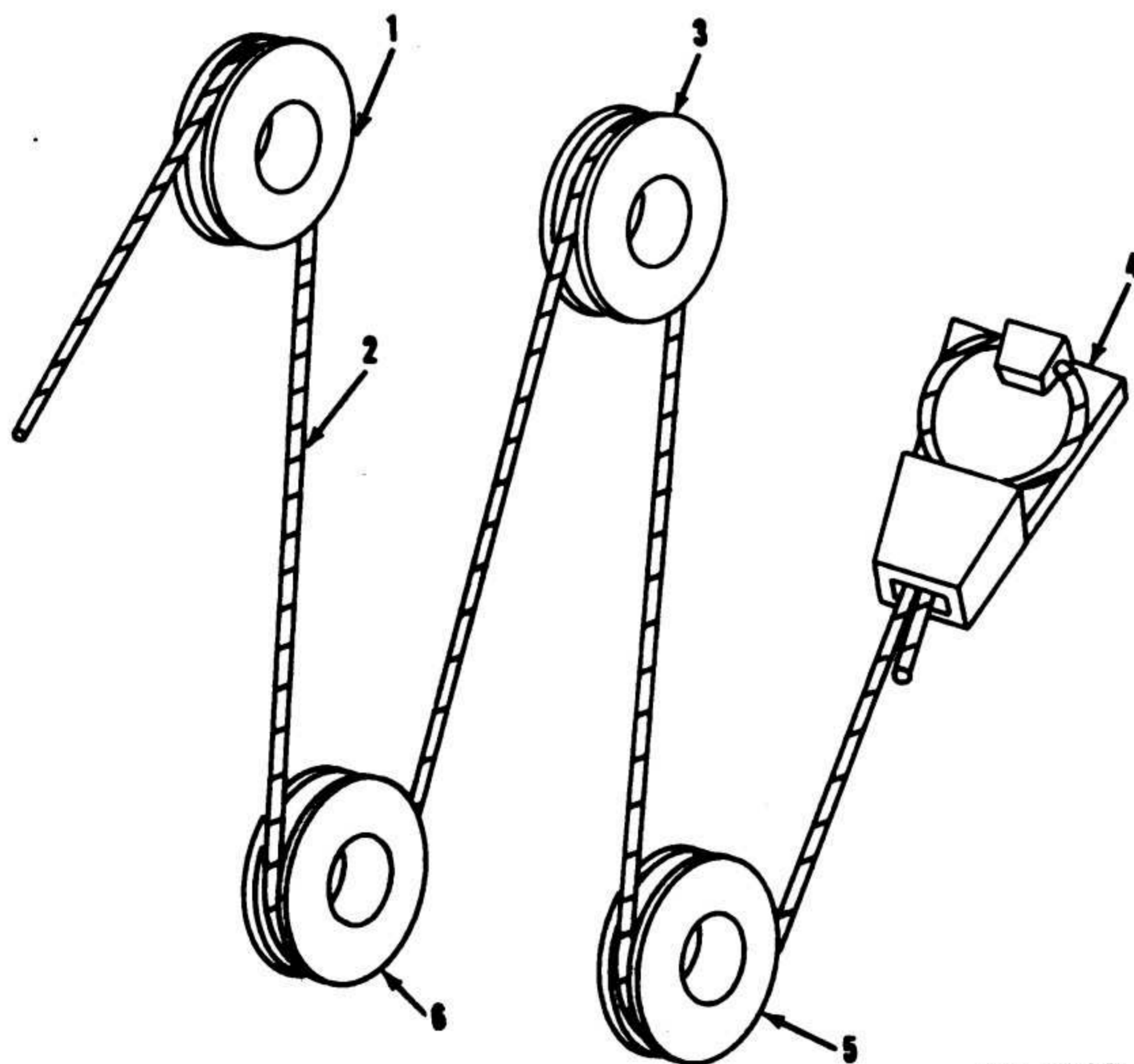
- (1) Attach one end of the wire rope (2, fig. 7) to the power unit of the prime mover, spooling it partially onto the cable drum.

*Note.* If a 2-drum power unit is used, the wire rope should be spooled onto the left-hand cable drum. Only one drum is required to operate the ditcher.

- (2) Draw the wire rope from the power unit over the upper left-hand sheave (1), mounted on the sheave bracket.
- (3) From this point draw the wire rope down to the lower sheaves, which are mounted on the ditcher frame, and pass it under the lower left-hand sheave (6).
- (4) Pass the rope back to the upper sheaves, over the upper right-hand sheave (3), down to the lower sheaves, under the lower right-hand sheave (5), and back up to the wedge block (4).
- (5) Loop the wire rope through the wedge block and pull it down tightly to secure it in the wedge block.

*e. Inspection.* Make a complete inspection of the ditcher, visually checking for loss or damage which may have occurred during shipment. Make the following specific checks.

- (1) Check for cracked welds, damaged threads, and loose or missing pins, washers, bolts, and nuts.



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- 1 Upper left-hand sheave
- 2 Wire rope
- 3 Upper right-hand sheave

- 4 Wedge block
- 5 Lower right-hand sheave
- 6 Lower left-hand sheave

Figure 7. Reeving diagram.



- (2) Check the sheaves for free turning, and the sheave shafts for secure mounting in the sheave mounting bracket.
- (3) Check for damaged or missing grease fittings.
- (4) Check the moldboards, drift wings, drift wing extensions, plow share shoe, and plow share for secure mounting.
- (5) Check the wheels for end play, and the tires for proper air inflation (65 p. s. i.).
- (6) Check the movement of the main axle assembly to make sure it does not bind in the pillow block bearings.
- (7) Check the air-hydraulic components for secure mounting, damaged lines, and for cut or bruised hose.
- (8) See that all pertinent tools, spare parts, and publications are with the equipment.

*f. Service.* Before placing the ditcher in operation, lubricate the entire unit as instructed in the current lubrication order.

## **8. Used Equipment**

*a. General.* Inspect and service used ditchers upon receipt in accordance with instructions for inspecting and servicing new equipment (par. 7), and make further inspection of parts subject to wear or damage in service.

*b. Welds.* Inspect all welds to see that they have not broken.

*c. Bearings.* Check the wheel bearings, the pillow block bearings, and the sheave bearings to see that they are not worn or damaged.

*d. Plow Share and Panbreaker Point.* Check the plow share and the panbreaker point for wear and damage. Sharpen or replace if necessary.

*e. Lubrication.* Lubricate in accordance with the current lubrication order.

## **Section II. CONTROLS**

### **9. General**

This section describes, locates, illustrates, and furnishes the operator of the towing vehicle sufficient information about the various controls for the proper operation of the ditcher.

### **10. Parking Brake Levers**

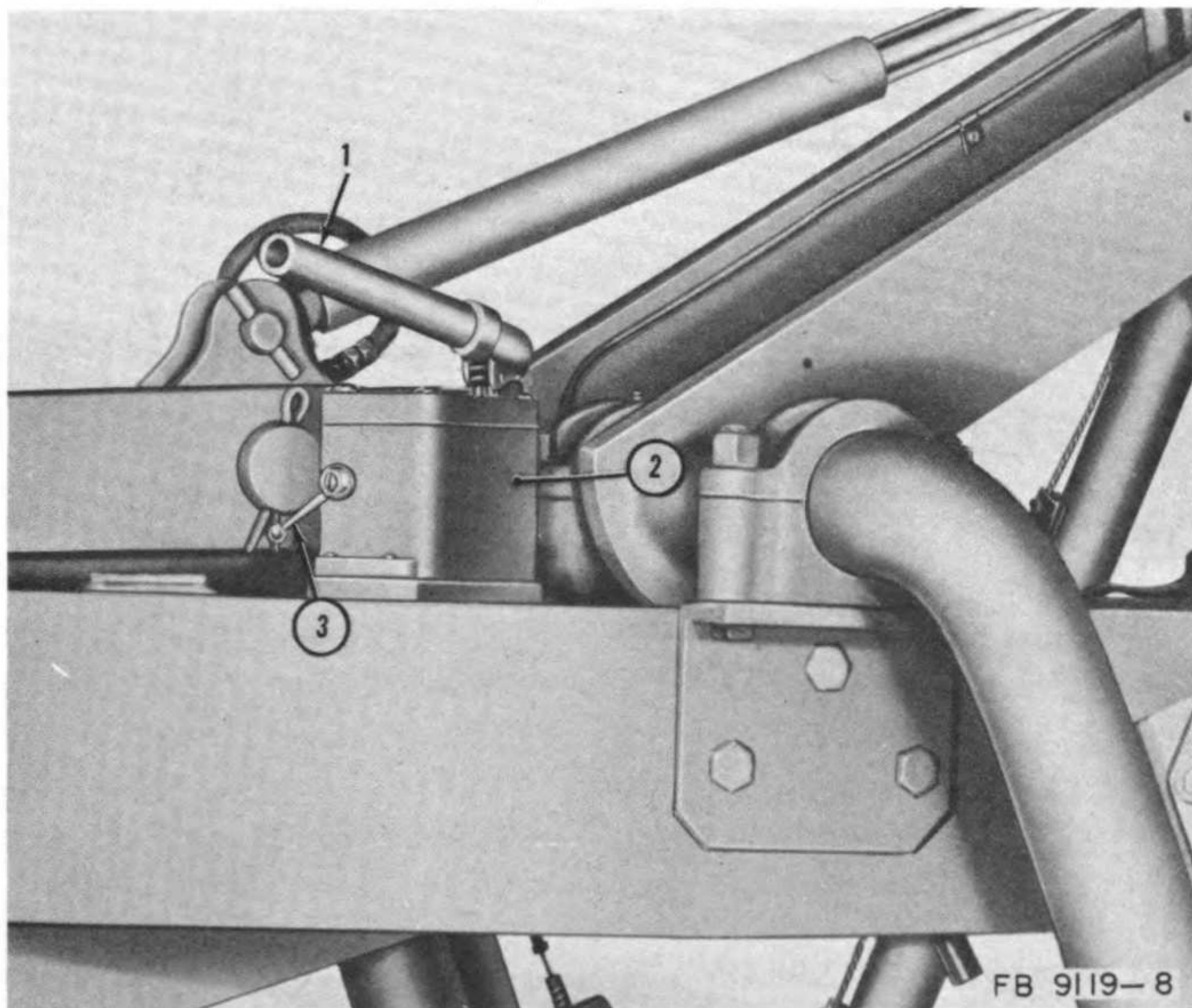
*a. Location.* There are two parking brake levers (17, fig. 1). One lever is mounted near the top of each throw arm on the main axle assembly (20).

*b. Purpose.* The parking brake levers operate the mechanical parking brakes which secure the ditcher when it is uncoupled from the towing vehicle.

### **11. Hydraulic Pump Handle**

*a. Location.* The hydraulic pump handle (1, fig. 8) is located on top of the hydraulic pump (2). It is demountable; and when not in use, it is stored in the toolbox (17, fig. 2).





1 Hydraulic pump handle      2 Hydraulic pump      3 Valve lever

*Figure 8. Hydraulic controls.*

*b. Purpose.* The handle is operated manually to furnish hydraulic pressure to the hydraulic ram.

## **12. Hydraulic Pump Valve Lever**

*a. Location.* The valve lever (3, fig. 8) is located on the front and toward the side of the hydraulic pump.

*b. Purpose.* This lever controls the hydraulic pump valve which controls the passage of hydraulic oil to and from the hydraulic ram.

## **Section III. OPERATION UNDER USUAL CONDITIONS**

### **13. General**

*a.* The instructions in this section are published for the use of the personnel responsible for the operation of this machine.

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



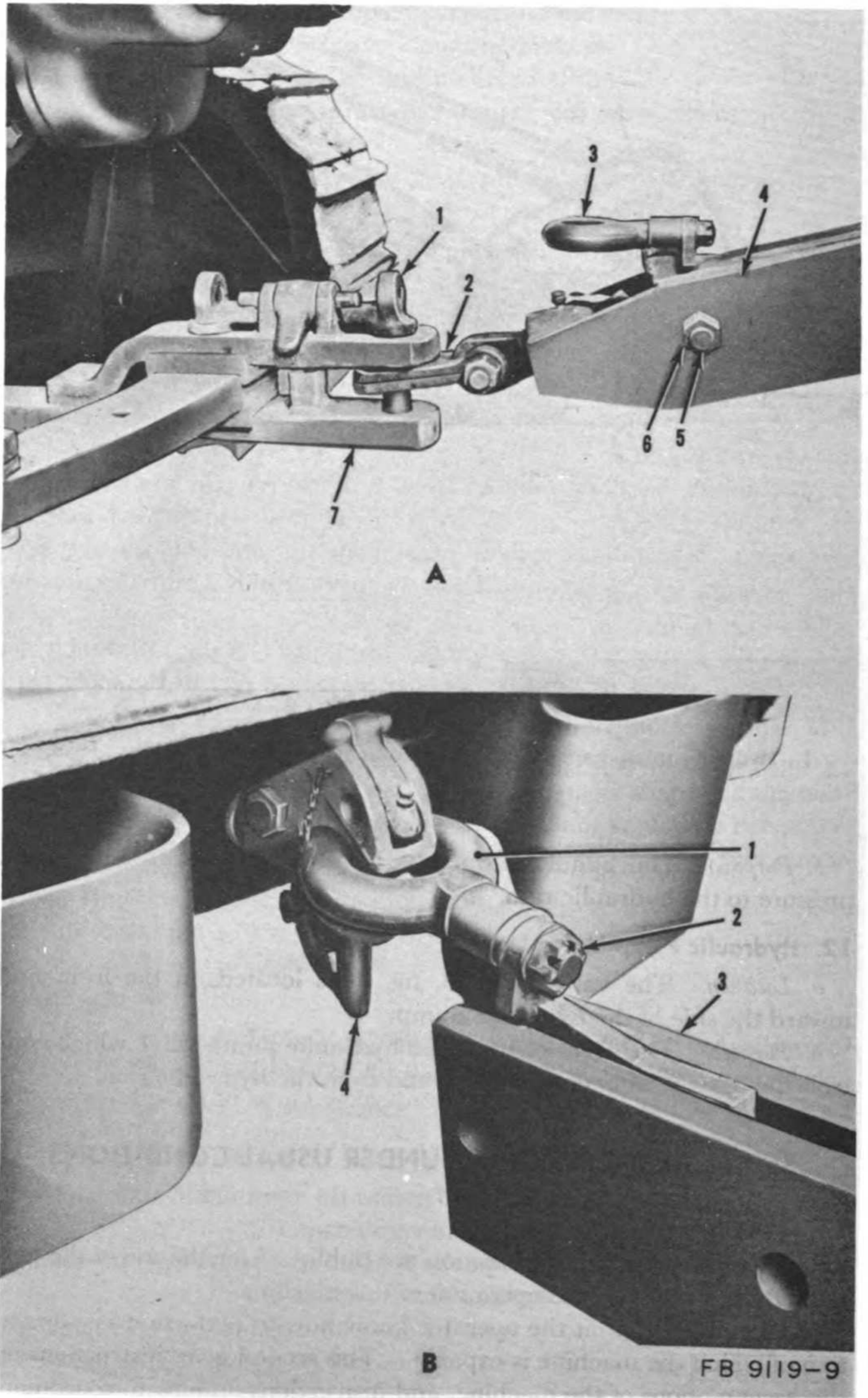


Figure 9. Tow hitch positions.



A Hitch in tractor towing position

- 1 Pin
- 2 Tractor towing hitch
- 3 Lunette ring
- 4 Hitch assembly

- 5 Bolt, 1½ in. x 7½ in.
- 6 Nut, 1½ in.
- 7 Tractor draw bar

B Hitch in truck towing position

- 1 Lunette ring
- 2 Nut

- 3 Ditcher tongue
- 4 Truck pintle hook



## 14. Conversion From Truck Towing to Tractor Towing

a. Disconnect the air hose (12, fig. 1) and fasten the coupling to the dummy coupling (15) provided on the ditcher frame.

b. Secure the safety towing chains (21, fig. 2) as illustrated.

c. Remove the lunette ring (1B, fig. 9) from the truck pintle (4), and then remove the lunette ring from the ditcher by removing cotter pin, nut (2), and washer.

d. Swing the hitch assembly (4A, fig. 9) down into the position shown in the figure. Secure the hitch assembly in this position with bolt (5) and nut (6). Install the lunette ring. The nut and bolt which secure the hitch are stored in the toolbox when the hitch is in truck towing position (B, fig. 9).

e. Attach the ditcher to the tractor, using pin (1A, fig. 9); attach the wire rope to the power unit spool (par. 7d); and reel in the loose wire rope.

## 15. Plowing With Ditcher Plow

a. Tow the ditcher to the location at which the plowing is to be done.

b. Remove the ditcher brace pin (9, fig. 2), using the hydraulic ram (7) to remove the load from the pin. The pin will be in the bottom hole of the ditcher standard; pin is shown in plowing position in figure 2.

c. Remove the 1-inch bolt from the frame just in front of the ditcher plow standard (2, fig. 1).

d. Open the hydraulic pump valve (3, fig. 8) and allow the ditcher plow to swing down into working position.

e. Install four 1-inch bolts through the rear of the ditcher frame and through the holes in the ditcher standard. Three of these bolts will be found in the toolbox, the other is the one removed from the frame (c above).

f. Swing ditcher brace (3, fig. 1) up to the top hole in standard, and pin in place with pin (9, fig. 2) and cotter pin (10).

g. Remove all pressure from the hydraulic ram by opening the hydraulic valve.

**Caution:** Hydraulic valve must be open during ditching operation.

h. Extend drift wings (12, fig. 2) and drift extensions (13) to the widest setting provided.

i. Take up the slack in the control wire rope (1), and remove the transport pin (18) from the upper and lower stop bars (2 and 19). Drop



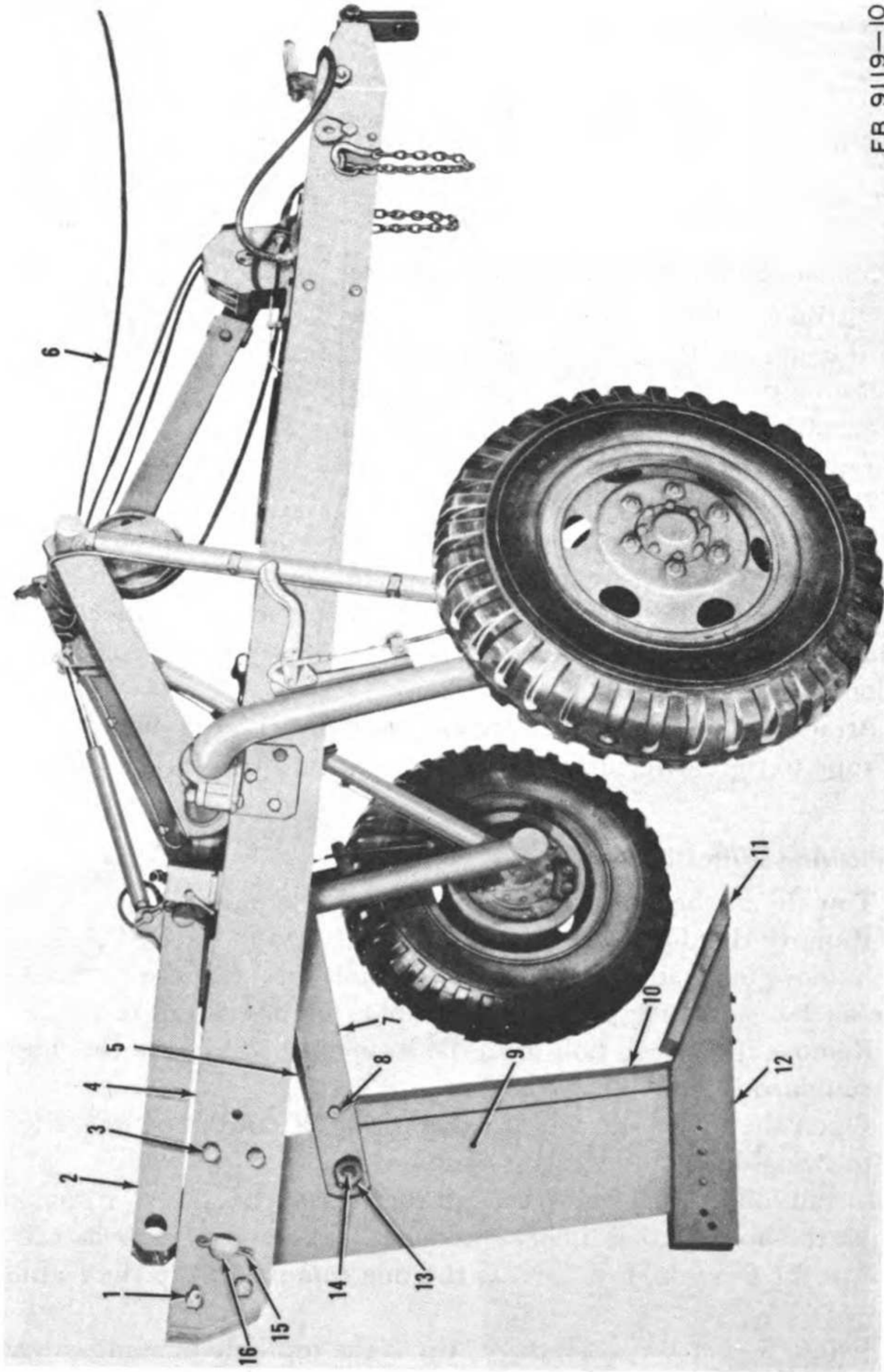


Figure 10. Ditcher with panbreaker attached.

- |                                |                                       |
|--------------------------------|---------------------------------------|
| 1 Bolt, 1 in. x 10 in. (4 rqr) | 9 Panbreaker standard                 |
| 2 Brace bar                    | 10 Cutting shin                       |
| 3 Nut, 1-in. (4 rqr)           | 11 Point                              |
| 4 Ditcher frame                | 12 Landside                           |
| 5 Left-hand panbreaker brace   | 13 Nut, 1½-in.                        |
| 6 Control wire rope            | 14 Bolt, 1½ in. x 4 in.               |
| 7 Right-hand panbreaker brace  | 15 Cotter pin, ½ in. x 3½ in. (2 rqr) |
| 8 Shin mounting bolt           | 16 Brace pin, 2¼ in. x 7¼ in.         |



the ditcher plow slightly by slacking off on the control wire rope. Install the transport pin in the upper stop bar after the slide on the upper bar has cleared the hole. This pin serves as a stop during ditching operation.

*j.* Release the parking brakes, and start pulling the ditcher forward. The depth of the ditch may be controlled up to a depth of 24 inches by the use of the control wire rope.

*k.* If the plowing operation is stopped, it may be necessary to begin again with the ditcher plow at a more shallow depth. This is done as follows: Back up the ditcher and reel in the control wire rope to raise the plow. Start pulling forward at the more shallow depth and pay out the wire rope until the required depth is reached.

*Note.* Make every effort to keep the ditcher moving once the plowing operation is started.

## **16. Attaching Panbreaker**

*a.* Stop the ditcher with the ditcher plow in the soil approximately 20 inches to facilitate removal of the plow.

*b.* Remove the pin attaching the upper end of the hydraulic ram, and install this end of the ram in the alternate bracket (6, fig. 1).

*c.* Remove cotter pin (10, fig. 2) and brace pin (9) from the plow standard.

*d.* Remove the four nuts and bolts and the swivel pin attaching the ditcher plow to the ditcher frame. These bolts are used to install the panbreaker.

*e.* Remove the panbreaker from its rack on the ditcher frame by removing the U-bolt (9, fig. 1) and the hook bolt (10).

*f.* Pull the frame away from the ditcher plow and raise the rear end of the frame about 3½ feet, using the control wire rope.

*g.* Install the panbreaker to the frame using the four bolts (1, fig. 10) and nuts (3) and the pin (16) and cotter pin (15). Two of the bolts go through holes in the panbreaker standard (9), the others go through the frame members only.

*h.* Loosen nut (13), swing the left and right hand braces up, and install the shin mounting bolt (8). Secure the front ends of the braces with the 1½-inch bolt found in the lower part of the center frame member. Tighten all nuts and bolts.

*i.* Move the ditcher forward and pay out wire rope simultaneously, coordinating these actions until the desired penetration is achieved. The panbreaker will break the ground to a depth of 36 inches. Depth can be controlled with the control wire rope for more shallow penetration.

## **17. Movement to New Location**

*a.* Set the parking brakes.

*b.* Remove the transport pin (18, fig. 2) from the upper stop bar (2). Take up the slack in the control wire rope until the slide in the upper



stop bar has passed the last hole in the lower stop bar. Reinstall the transport pin.

*c.* Move the drift wings (12) and drift wing extensions (13) to the narrowest setting provided.

*d.* Remove ditcher brace pin (9), and swing the ditcher brace (3, fig. 1) up to the top mounting hole. Install the brace pin and cotter pin (10, fig. 2).

*e.* Remove the four 1-inch nuts and bolts from the ditcher standard (2, fig. 1) and frame (16). Install one of the bolts in the frame, just ahead of the ditcher standard; stow the other three in the toolbox.

*f.* Unreel the control wire rope and stow it on the ditcher.

*g.* Remove the hitch from the tractor drawbar.

*h.* Remove the lunette ring (3A, fig. 9) by removing nut (2B, fig. 9), and remove nut (6A, fig. 9) and bolt (5) from the hitch assembly (4). Stow nut and bolt in toolbox.

*i.* Swing the hitch assembly up and back toward the ditcher, and install the lunette ring with the nut provided.

*j.* Attach the lunette ring to the towing truck pintle hook (4B, fig. 9), and secure the safety chains (21, fig. 2).

## **Section IV. OPERATION UNDER UNUSUAL CONDITIONS**

### **18. General**

Unusual weather conditions do not materially affect the operation of the ditcher. Therefore, no extra precautions need be taken beyond the usual preventive maintenance measures, except to lubricate the machine in accordance with the current lubrication order when unusually high or low temperatures are encountered, and to protect against rust and corrosion when operating near salt water or in areas of high humidity. When unusual ground conditions are encountered, proceed as instructed in the following paragraph.

### **19. Operation in Heavily Obstructed Ground**

To operate the ditcher in heavily obstructed ground, extra weight sometimes must be placed on the equipment to force the ditcher point into the ground. To provide the extra weight, obtain ballast, such as sandbags, and secure it on the rear of the frame or between the moldboards. If the ballast overtaxes the towing vehicle, remove the ditcher plow and attach the panbreaker assembly (par. 16). Open up the ditch as far as necessary, and then replace the panbreaker with the ditcher plow and continue the ditching operation.



## CHAPTER 3

# ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

---

### Section I. ORGANIZATIONAL TOOLS AND EQUIPMENT

#### 20. General

The tools and equipment necessary to perform organizational maintenance on this ditcher are standard mechanic's hand tools. Tools used for operator maintenance are enumerated in appendix II.

#### 21. Special Tools

No special tools are required for the maintenance of this ditcher.

### Section II. LUBRICATION AND PAINTING

#### 22. General Lubrication Information

a. The lubrication order prescribes first and second echelon lubrication maintenance for the ditcher.

b. A lubrication order is published for each item of equipment. The lubrication order shown in figure 11 is a reproduction of an approved lubrication order for this materiel. For current LO 5-9119, refer to DA Pam 310-4.

c. Lubrication orders prescribe approved first and second echelon lubrication procedures. The instructions contained therein are mandatory.

#### 23. Detailed Lubrication Information

a. *Care of Lubricant.* When storing and handling lubricants, make certain that containers are clean and securely covered to prevent dirt, dust, or other foreign matter from entering. Be sure that the lubricant is clean before using.

b. *Cleaning.* Clean all surfaces surrounding the points of application and the fitting itself before applying lubricants. Wipe off excess lubricant after lubricating.

c. *Points of Application.* Follow the detailed instructions given beneath each lubrication point illustration (fig. 11) indicating procedures to be followed at each point. Apply the lubricant indicated on the lubrication chart.

#### 24. Painting

Paint surfaces which show signs of rust or corrosion. Do not allow the paint to enter lubricated working parts. Mask all nomenclature plates prior to painting. General instructions for surface treatment and paint application are contained in TM 9-2851.



# LO 5-9119

7 February 1956

## LUBRICATION ORDER

### DITCHER, PLOW TYPE, TRACTOR DRAWN, CABLE CONTROLLED, PNEUMATIC TIRED, 8-12 INCH BOTTOM, 24 INCH DEPTH, JOHN DEERE KILLEFER MODEL 360

Reference: TB5-9119-1

Intervals given are maximums for normal 10-hour day or 60-hour week operation. For abnormal conditions or activities, intervals should be shortened to compensate.  
Clean fittings before lubricating.

Clean parts with SOLVENT, dry-cleaning or with OIL, fuel, Diesel. Dry before lubricating.

Lubricate points indicated by dotted arrow shafts on both sides of equipment.

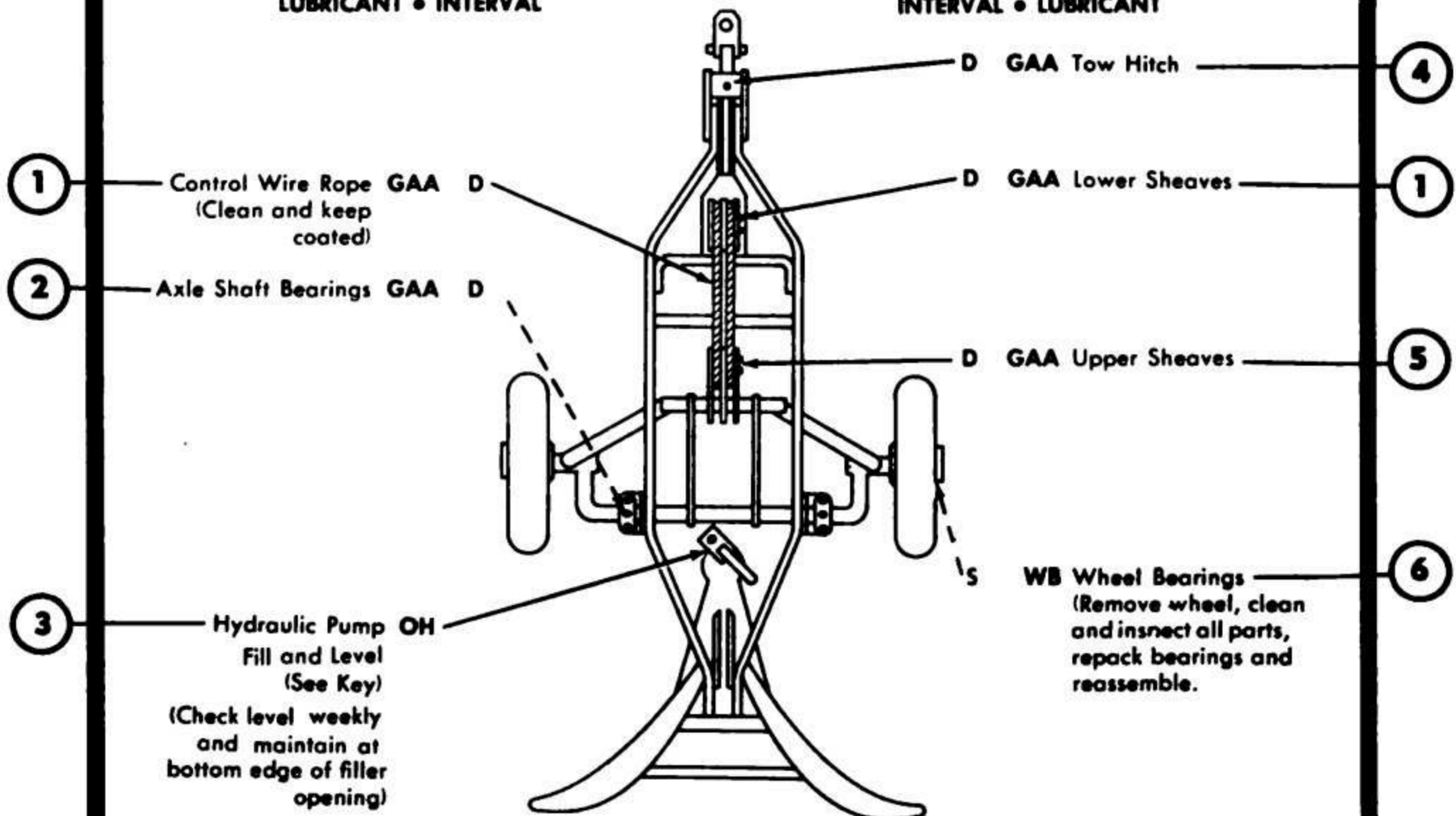
Relubricate after washing or fording.

#### KEY

LUBRICANT	CAPACITY	EXPECTED TEMPERATURE		INTERVALS
		Above +32°F	+32°F to 3-18°F	
OE—OIL, Engine, Heavy Duty. OIL Can Points		OE 30 or 9250	OE 10 or 9110	D—Daily S—Semi- annually
OH—OIL, Hydraulic Hydraulic Pump	1/2 qt	OH	OH	
GAA—GREASE, Automotive and Artillery				
WB—GREASE, General purpose				

LUBRICANT • INTERVAL

INTERVAL • LUBRICANT



#### NOTES:

1. OIL CAN POINTS—Weekly lubricate the tow hitch, brake linkage, clevises and exposed threads and surfaces and clean and coat ditcher plow 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:

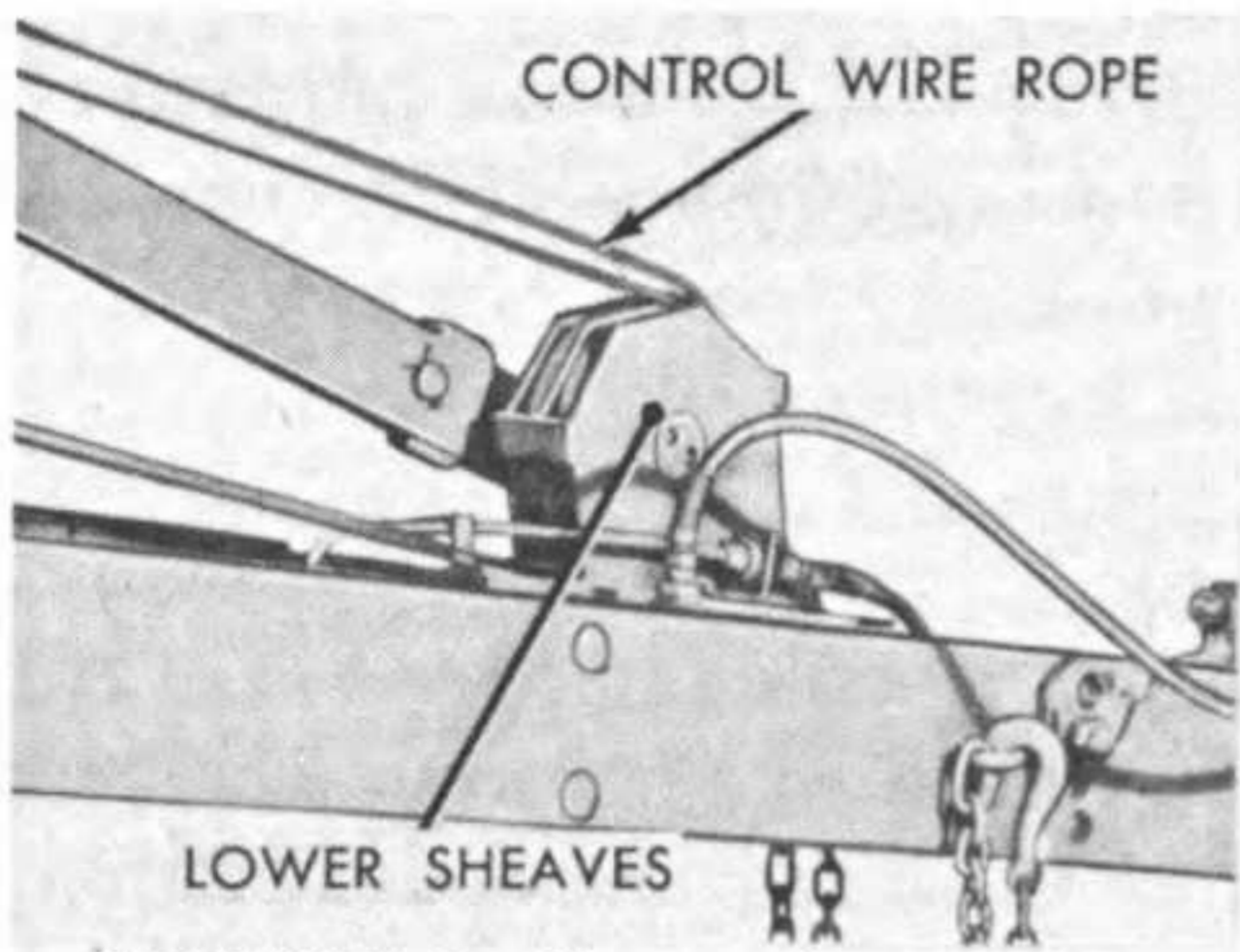
Official: JOHN A. KLEIN,  
Major General, United States Army,  
The Adjutant General.

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

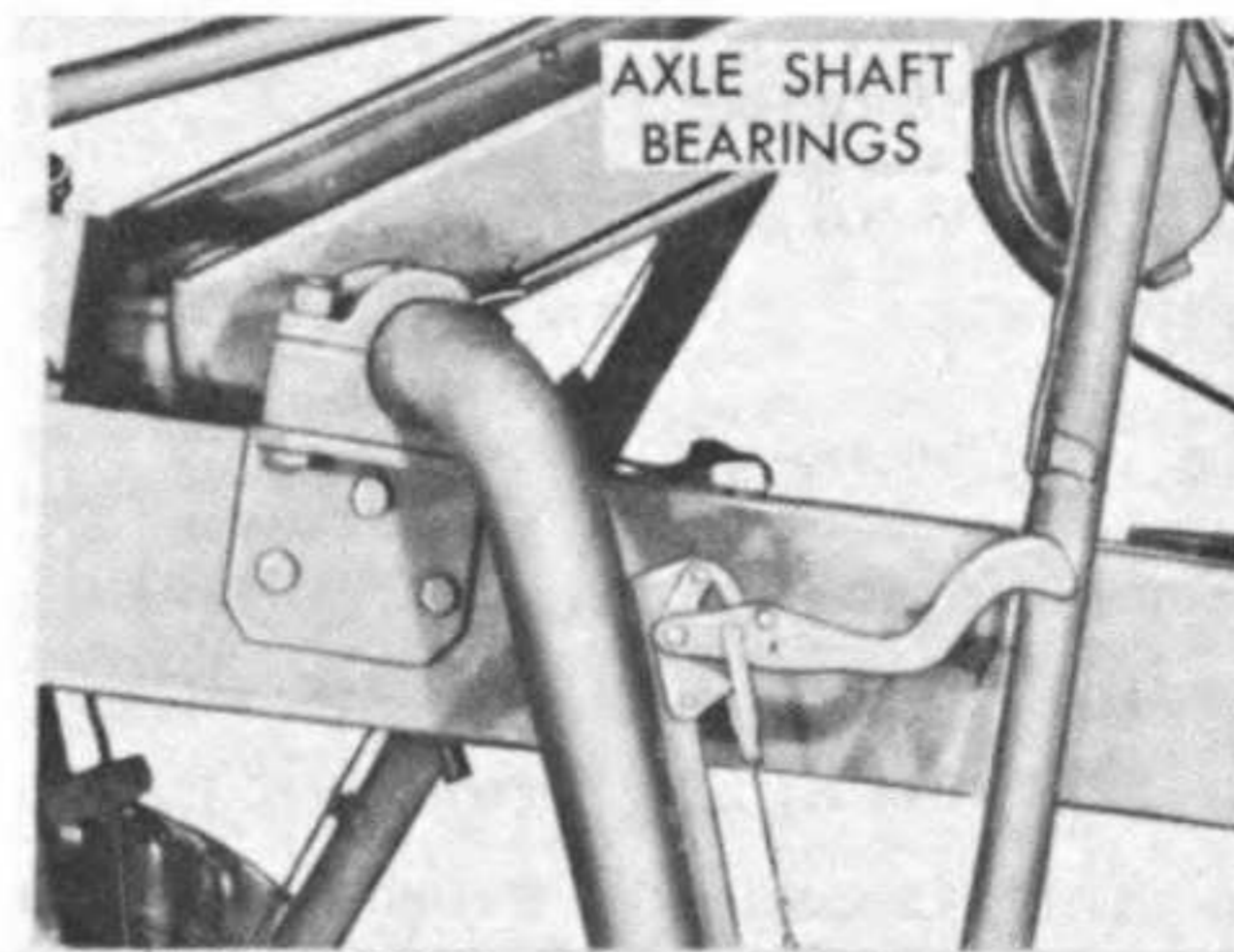
FB 9119-11

Figure 11. Lubrication Order.

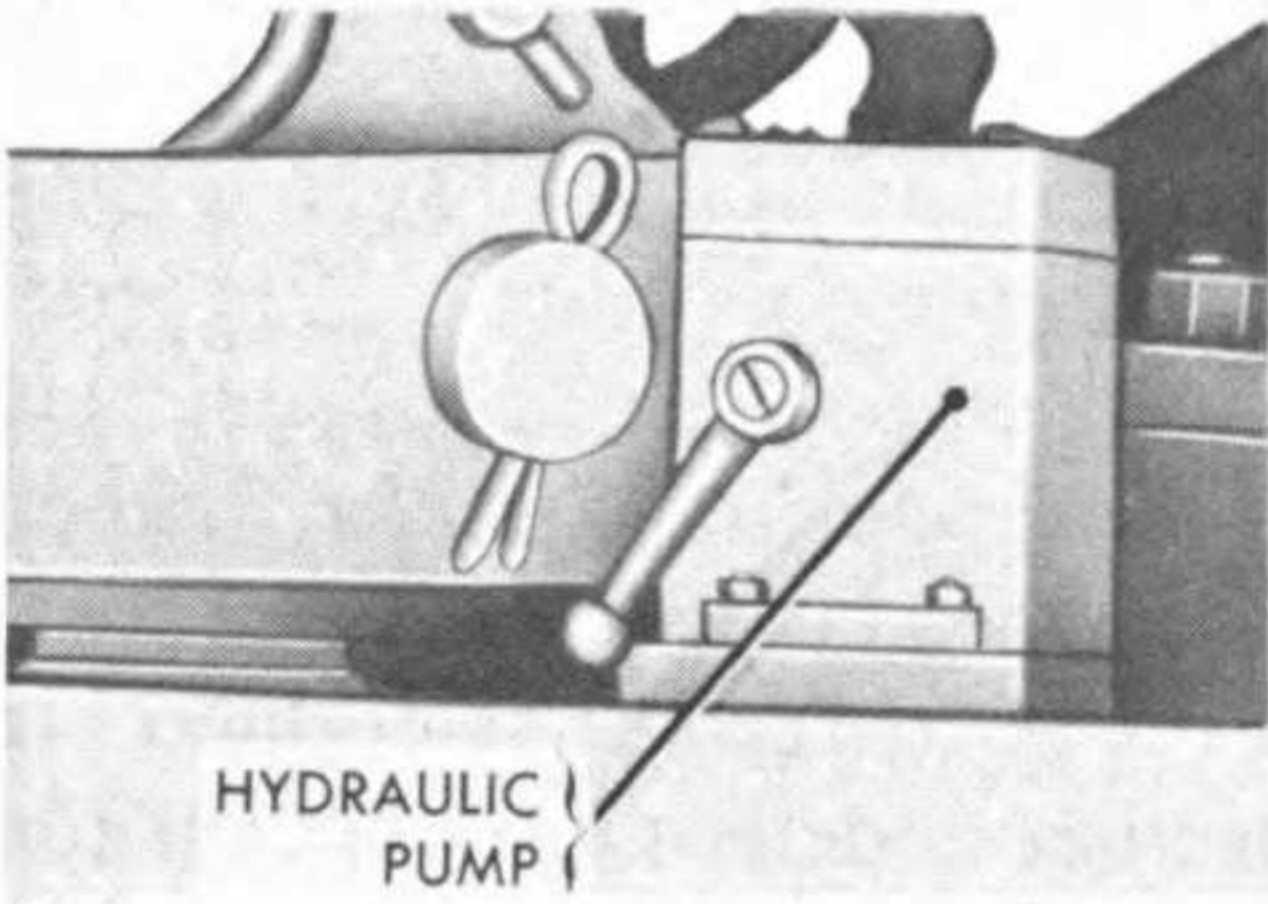




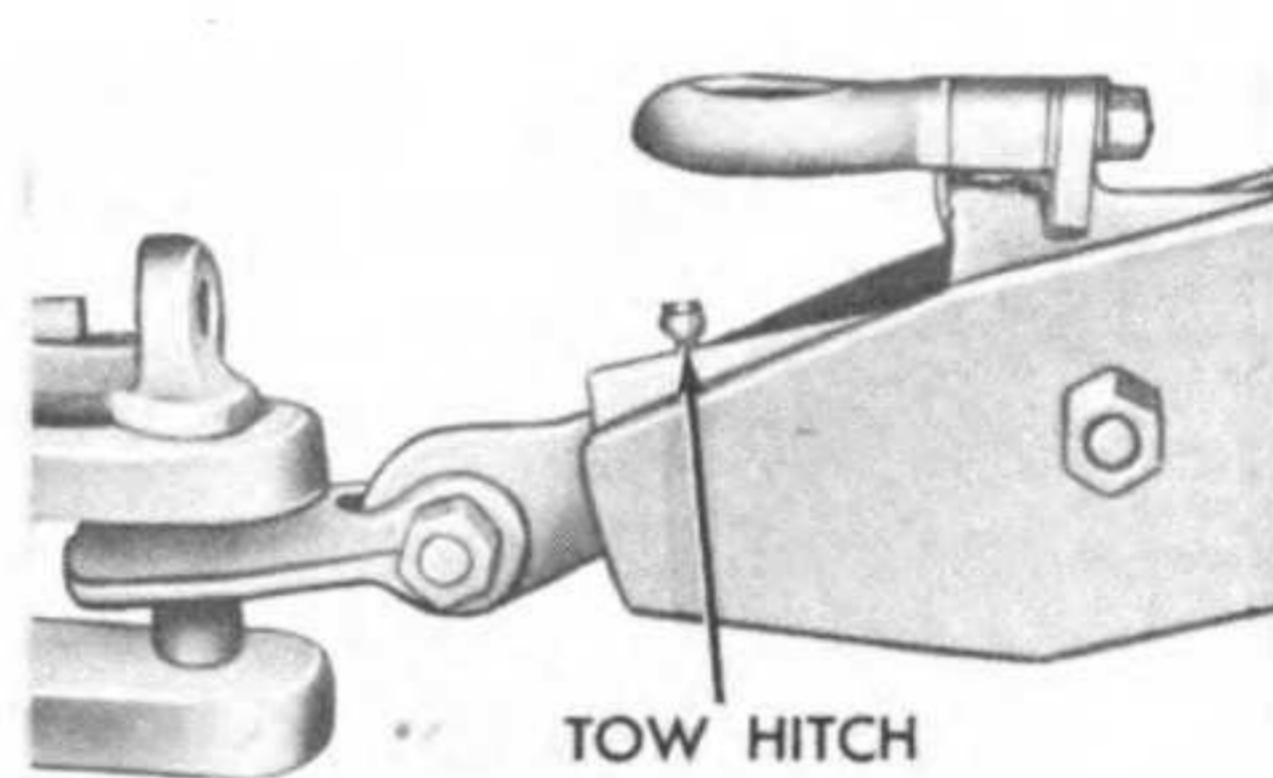
**REFERENCE 1:** Clean and coat wire rope. Clean fittings and lubricate with grease gun.



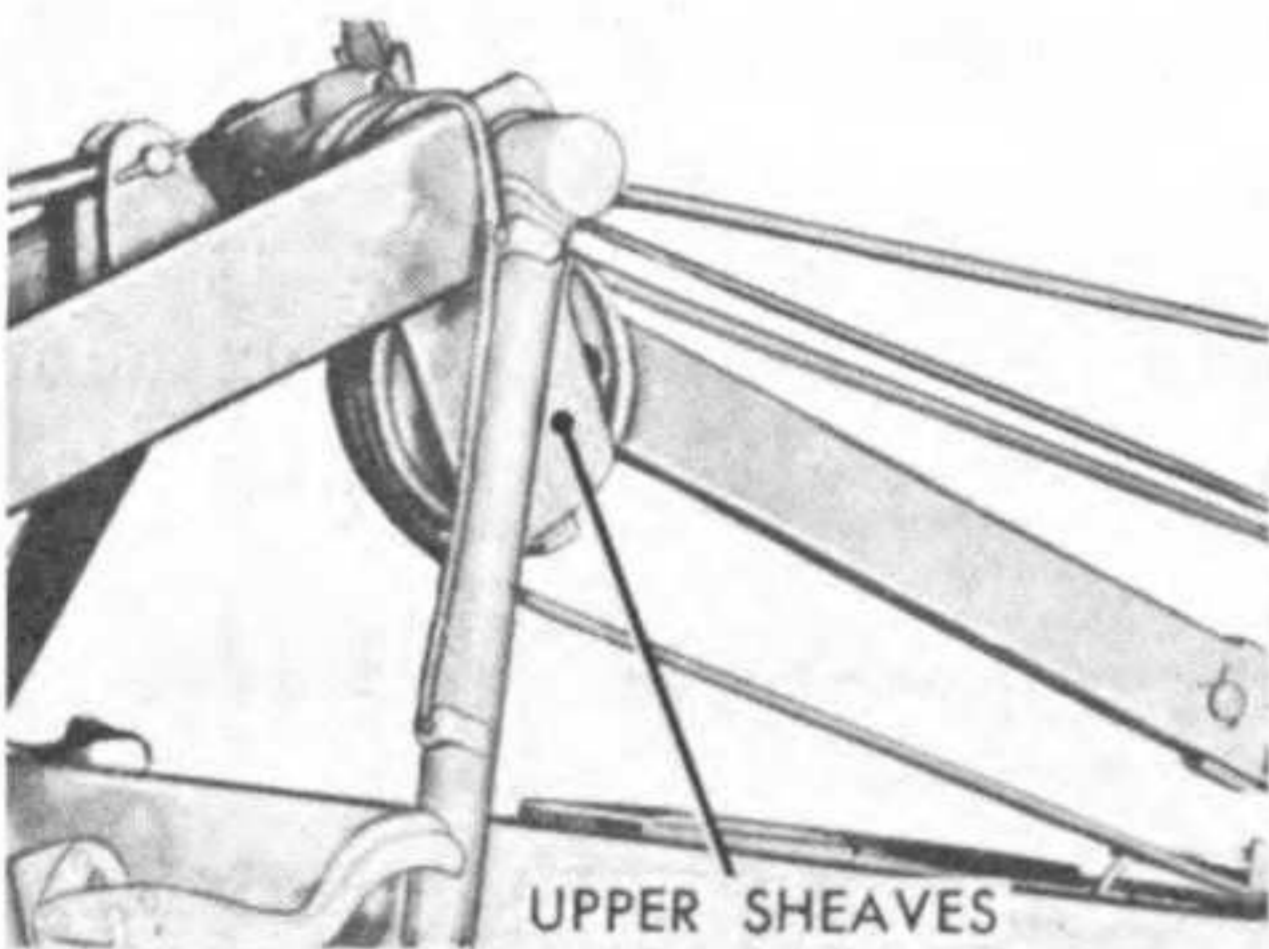
**REFERENCE 2:** Clean fittings and lubricate with grease gun.



**REFERENCE 3:** Fill to bottom edge of filler opening.



**REFERENCE 4:** Clean fitting and lubricate with grease gun.



**REFERENCE 5:** Clean fittings and lubricate with grease gun.



**REFERENCE 6:** Remove wheel, clean and inspect all parts, repack bearings and reassemble.

FB 9119-11  
(CONT'D)

*Figure 11.—Continued.*



## Section III. PREVENTIVE MAINTENANCE SERVICES

### 25. General

The operator and the organizational maintenance personnel must perform their preventive maintenance services regularly to insure satisfactory operation of the ditcher and to reduce the possibility of mechanical failures.

### 26. Operator Maintenance

*a. Inspections.* Inspections must be made before operation, during operation, at halt, and after operation, as described in this section. All inspections of assemblies, or parts, must include any supporting members or connections and must determine whether the unit is in good condition, correctly assembled, secure, or excessively worn. Any mechanical condition which may result in further damage to the unit must be corrected before the equipment is operated.

- (1) The inspection for "good condition" is usually an external visual inspection to determine whether the unit is damaged beyond safe or serviceable limits, or to determine if it is in such a condition that damage will result from the operation. The term "good condition" is further defined as: not bent or twisted; not chafed or burned; not broken or cracked; not bare or frayed; not dented or collapsed; not cut or torn; adequately lubricated.
- (2) Inspection of a unit to see that it is "correctly assembled" is usually an external visual inspection to determine whether it is in its normal assembled position in the equipment.
- (3) Check of a unit to determine if it is "secure" is usually an external inspection, a hand-feel, or a pry-bar or wrench check for looseness in the unit. Such an inspection should include brackets, lockwashers, locknuts, locking wires, or cotter pins used in the assembly.
- (4) "Excessively worn" means worn close to or beyond serviceable limits, a condition likely to result in a failure if a replacement of the affected part is not made before the next scheduled inspection.

*b. Reporting Deficiencies.* The operator will report all deficiencies on DD Form 110.

*c. Before-Operation Services.* The following services will be performed to determine if the condition of the equipment has changed since it was last operated, and to make sure the equipment is ready for operation. Any deficiencies must be corrected or the deficiency reported to the proper authority before the unit is put into operation.

- (1) *Visual Inspection.* Make a visual inspection of the entire unit, checking for cracks, broken welds, and loose or missing nuts, bolts, and pins. Check for missing or damaged grease fittings. Inspect for frayed or worn control wire rope. Inspect the



sheaves for cracked or broken flanges. Inspect the tractor towing hitch and the lunette ring for wear and ease of turning.

- (2) *Lubrication.* See that the ditcher is lubricated as specified in LO 5-9119.
- (3) *Leaks, general.* Check on and under the equipment for evidence of leaking hydraulic oil.
- (4) *Ditcher plow.* Check the plow for secure mounting to the frame. Check the moldboards and drift wings for cracks and secure mounting. Check the plow share and share shoe for cracks, wear, and secure mounting.
- (5) *Wheels and tires.* Check the wheels for lost motion and end play on the axles. Check the air pressure in the tires (normal is 65 p.s.i.).
- (6) *Ballast.* If ballast is used, check for secure mounting on the ditcher.
- (7) *Parking brakes.* Check the parking brakes; actuate the hand levers for ease of operation and wheel braking.

*d. During-Operation Services.* The operator is responsible for correcting or reporting unusual sounds or deficiencies in performance, or other signs of abnormal operation. He will perform the following specific services.

- (1) *Unusual operation.* If any of the following conditions are noted, stop the operation of the ditcher and make the necessary corrections, or report the condition to the proper authority.
  - (a) Wobbling wheels.
  - (b) Action of the towing hitch frozen.
  - (c) No control of plow share penetration.
  - (d) Control wire rope slipping on the power unit.

- (2) *Unusual noises.* Check for unusual noises. If any are noted, stop operation and report to proper authority.

*e. At-Halt Services.* During halts, even if only for short periods, the operator should make a general check of the equipment and correct or report any deficiencies noted, in addition to performing the following specific duties.

*Note.* Do not stop the ditcher until the plow share is clear of the ground.

- (1) *Visual inspection.* Visually inspect the complete unit for loose, missing, or damaged bolts, nuts, pins, and grease fittings. See that the plow share is in place and secure, and that the parking brakes are engaged.
- (2) *Power control unit and wire rope.* Check the power control unit; see that it is securely mounted on the towing vehicle. Check for frayed or damaged control wire rope.
- (3) *Tow hitch.* Check the tractor tow hitch for damage and secure mounting to the towing vehicle.

*f. After-Operation Services.* To insure that the equipment is ready to operate at any time, the following services must be performed by the op-



erator or crew immediately after any operation period. All deficiencies must be corrected or the condition reported to the proper authority.

- (1) *Shutdown precautions.* Lift the plow share well above the ground, and tow the ditcher to the parking or storage area. If the ditcher is to be disconnected, lift the tractor towing hitch free of the towing vehicle. Be sure the handbrake is engaged.
- (2) *Cleaning.* Clean the unit thoroughly, removing dirt, oil, and excess grease.
- (3) *Lubrication.* Check for damaged, loose, or missing grease fittings. Lubricate the unit as necessary, following the instruction in LO 5-9119.
- (4) *Tools and equipment.* See that all tools and equipment assigned to the ditcher are in serviceable condition, clean, and properly stowed or mounted.
- (5) *Visual inspection.* Check the entire ditcher for damage and for loose or missing bolts, nuts, and pins.
- (6) *Brakes.* Check the hand-operated parking brakes for ease of operation and secure setting. Check the master cylinder, air chamber, and filter of the hydraulic brake system for secure mounting on the ditcher frame. Check the copper lines for kinks and damage; check the rubber lines for cuts and dry rot; and check the connections. Make any corrections necessary or report the deficiencies to the proper authority.
- (7) *Hydraulic system.* Operate the hydraulic hand pump, and test the operation of the ram. Check the connections for damage and tightness. Make any corrections necessary, or report deficiencies to the proper authority.
- (8) *Protection.* If possible, park the ditcher in an enclosure, or completely cover it with a tarpaulin or other suitable cover.

## **27. Maintenance and Safety Precautions**

*a.* Correct or report to the proper authority any mechanical deficiencies that may result in further damage to the ditcher if operation is continued.

*b.* Before performing maintenance procedures, be sure that the ditcher is properly blocked up and supported, and that the wheels are chocked.

*c.* When checking for frayed wire rope, do not run bare hands over the wire rope as a frayed or broken strand can penetrate the hand and cause serious injury.

## **28. 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 60 hours; the monthly interval, 4 weeks, or 240 hours, whichever occurs first.



b. The technical inspection column is provided for the use of personnel performing technical inspection and constitutes the minimum inspection requirements for the ditcher.

c. 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 corresponding numbers appearing on DA Form 464, and indicate that a report of the service should be made at that particular number on Form 464. These numbers appear in either the second, third, or both columns, as an indication of the interval at which the service is to be performed.

Technical inspection	Service		
	Monthly	Weekly	
1	1	1	<i>Before-operation services.</i> Check and perform services listed in paragraph 26c.
2	2	2	<i>Lubrication.</i> Check the entire unit for missing or damaged grease fittings, and for signs of inadequate or improper lubrication. Check to see that the current lubrication order is on or with the equipment and is legible.
	2	2	Tighten loose fittings; replace missing or damaged fittings and lubricate as necessary (refer to LO 5-9119). Record the lubrication order number and its date in the spaces provided on DA Form 464.
3	3	3	<i>Tools and equipment.</i> Inspect the condition of all tools and equipment assigned to the ditcher.
	3	3	See that all tools and equipment are clean and properly stowed in the toolbox.
5	5	5	<i>Publications.</i> See that a copy of this technical manual, TB 5-9119-1, and DA Form 285 are with the ditcher, and in good condition.
6	6	6	<i>Appearance.</i> Inspect the general appearance of the ditcher, paying particular attention to cleanness, legibility of identification markings, and condition of paint.
	6	6	Correct or report any deficiencies noticed.
7	7	7	<i>Modifications.</i> See if all available modification work orders applying to the ditcher have been completed and are recorded on DA Form 478.
68	68	68	<i>Sheaves, wire rope.</i> Inspect the sheaves for loose mounting bolts, and for excessive wear and damage; check the condition of the guard, and see that the sheaves turn freely. Check the wire rope for wear or fraying, and for secure mounting on the wedge block. Examine the welded seams of the sheave housing for cracks.



Technical inspection	Service		
	Monthly	Weekly	
	68	68	Replace frayed or excessively worn wire rope. File smooth with a fine file any rough flanges on the sheaves. Weld all cracks if possible.
76	76	76	<i>Tires.</i> Check the tires for bruises, cuts, and cracks. Examine the tread for wear, and check the inflation (should be 65 psi).
	76	76	Replace cut, bruised, or excessively worn tires (par. 46). When replacing tires, replace tubes if necessary.
100	100	100	<i>Hand-operated parking brakes.</i> Check the parking brakes to see if they function properly to hold the ditcher. Check the toothed segment, pawl, and linkage to see if they are in good condition, correctly assembled, securely mounted, and functioning properly. Check the cable for free operation within the conduit.
	100	100	If the brakes do not hold the wheels securely, file the pawl and toothed segment; replace if necessary (par. 50). If the brakes need adjustment, loosen the clevis locknut and adjust the linkage until the brakes lock the wheels. Replace any missing or loose screws, bolts, or excessively worn linkage parts. Replace brake shoe and lining as necessary (par. 50). If necessary, lubricate the operating cable.
101	101	101	<i>Air-hydraulic brakes.</i> Check the brake levers, fittings, and hose for leaks and secure mounting. Check the fittings for leaks and wear. Check the master cylinder for good condition and secure mounting. Check the level of the fluid. Check to see if the air chamber and filter are in good condition and securely mounted and connected. Examine the coupling on the air hose for damage, and see if it fits the towing vehicle coupling properly.
	101	101	Renew any worn or damaged brake lines or fittings that may cause leaks if allowed to remain in the system. Tighten all connections. See that the filter and air chamber are securely mounted. Add fluid to the master cylinder if necessary. Clean the hose coupling.
133	133	133	<i>Frame.</i> Check the frame, bracket, and cross-members for cracks, broken welds, and misalignment.
	133	133	Weld all cracks and broken welds if possible.
134	134	134	<i>Main axle assembly.</i> Check the axle shaft (trunnion), sheave bracket, and axle brace for cracks



Technical inspection	Service		
	Monthly	Weekly	
			or broken welds. Check the axle shaft for secure mounting in the pillow block bearings. Check the bearings for secure mounting on the ditcher frame. Check the wheel axle welds at the base of the axle shaft.
	134	134	Tighten or replace loose, missing, or damaged nuts, bolts, and lockwashers. Weld all cracks and repair broken welds if possible.
135	135	135	<i>Stop bar.</i> Check the stop bar for cracks or misalignment. Check the lower stop bar for ease of sliding in the upper stop bar. Check the transport and pivot pins for correct fit and good condition. Check the stop bar clevis for cracked or broken welds.
	135	135	If the lower stop bar does not slide easily in the upper stop bar, it is either twisted or bent. Make the necessary corrections, or report the condition to the proper authority. Check to see if the transport and pivot pins fit the stop bars with little lost motion.
136	136	136	<i>Hitch assembly.</i> Check the highway towing lunette ring for cracks and wear. Check the locking nut and washer which secure the lunette ring to the adapter. Check the tractor tow hitch clevis for bent or twisted lockbar. Check the locking pin for damage. Check to see if the tractor towing hitch is securely bolted to the ditcher tongue.
	136	136	Tighten or replace all loose, missing, or damaged bolts, nuts, and pins. Replace the lunette ring or clevis bar as necessary (par. 64).
137	137	137	<i>Ditcher plow.</i> Check the plow standard in the toolhead to see if it fits properly and is held securely in place by the toolhead bolts, nuts, and lockwashers. Check the bolts and nuts for wear and damage. Check the moldboards, drift wings, and plow share for secure mounting, and for missing or damaged mounting bolts, nuts, and lockwashers. Check the side and rear reflectors.
	137	137	If cracks are noticed in any of the assembly parts, replace with a new part (par. 37). If replacement is not available, report the condition to the proper authority for correction. If the standard is bent or twisted out of alignment, replace with a new or reconditioned standard (par. 37). Replace any missing or excessively worn bolts, nuts, and lockwashers. Repair or replace reflector fixtures if necessary.



Technical inspection	Service		
	Monthly	Weekly	
138	138	138	<i>Panbreaker assembly.</i> Check the panbreaker for missing and worn or damaged bolts, nuts, and lockwashers. Check the cutter point for damage and wear. Examine the landside for proper fit on the base of the standard, and for secure mounting. Check the cutting shin for secure mounting on the standard. Examine the locating pin in the toolhead for ease of removal and installation.
	138	138	If the panbreaker point is dull, or worn to the point where further use would damage the standard, replace it (par. 38). The shin is of hardened steel and all rough surface must be removed with a grinding wheel. Replace excessively worn bolts, nuts, and lockwashers.
139	139	139	<i>Hydraulic ram.</i> Check the hydraulic ram, hose, and fittings for damage and insecure mounting. Check for loose or damaged fittings. Check for air leaks. Check the operation of the ram by pumping the hydraulic hand pump until the correct pressure has been attained to swivel the standard and plow assembly in the toolhead. Open the system valve and let the air out of the system.
	139	139	If the hydraulic hose is frayed, cut, or bruised, replace with a new hose. Tighten loose fittings if necessary to stop air leaks. Make necessary repairs and adjustments.
140	140	140	<i>Axles and wheel assembly.</i> Check the wheel axle-to-axle shaft welding for cracks and breaks. Check the wheels for damage, and for end play on the axle. Remove the hubcaps and check the adjusting nuts for wear and damage. Inspect the hubcap gasket, oil seal, and the tongue washer for leaks and damage. Check for missing or damaged bolts, nuts, and lockwashers.
	140	140	Repair cracked or broken welds. Take up end play on the axle with the adjusting nut. If the wheel shows signs of leaking grease, remove the wheel from the axle and replace the grease seal, tongue washer, and hubcap gasket.
185	185	185	<i>Hydraulic hand pump.</i> Check the hydraulic pump for damage and secure mounting. Operate the pump to see if it is working properly. Operate the pump valve to see if it is working properly.
	185	185	Tighten or replace all loose, missing, or damaged nuts, bolts, and lockwashers. If the pump or ram does not operate properly, replace it (pars. 57 and 58).



## Section IV. TROUBLESHOOTING

### 29. Use of Troubleshooting Section

This section provides information useful in diagnosing and correcting unsatisfactory operation of the ditcher. Each trouble symptom stated is followed by a list of probable causes of the trouble. The possible remedy recommended is described opposite the probable cause. The troubles enumerated apply only to the ditcher; however, the ditcher is dependent upon a towing vehicle for its operational functions (see applicable technical manual).

### 30. Plow Bears to Left or Right

<i>Probable cause</i>	<i>Possible remedy</i>
Standard is bent.	Straighten standard, or replace (par 37).
Plow share is loose on standard.	Tighten attaching bolts.
Standard is loose in toolhead.	Tighten toolhead bolts and nuts.

### 31. Parking Brake Fails to Hold Wheel

<i>Probable cause</i>	<i>Possible remedy</i>
Loose cable.	Adjust the cable.
Service brake out of adjustment.	Adjust the brake (par. 50e).
Cable stuck or not moving freely in conduit.	Free the cable.
Defective toothed segment or pawl.	Repair or replace lever assembly (par. 50).

### 32. No Brakes or Weak Brakes

<i>Probable cause</i>	<i>Possible remedy</i>
Shutoff valve closed on towing vehicle.	Open valve.
Low or no air pressure.	Check the air pressure gage on towing vehicle. Check for restriction in the air line.
Clogged air filter.	Clean or replace element (par. 55).
Air in hydraulic system.	Bleed hydraulic system (par. 51b).
Worn brake lining.	Adjust brakes or replace shoe and lining (par. 50).

### 33. Brakes Will Not Release

<i>Probable cause</i>	<i>Possible remedy</i>
Brake air hose improperly connected to towing vehicle.	Connect lines properly
Brake valve on towing vehicle in applied position.	Move brake valve to release position.
Restriction in tubing, or hose shutoff valve closed.	Check all tubing and hose. Open valve.

### 34. Slow Application or Slow Brakes

<i>Probable cause</i>	<i>Possible remedy</i>
Low air pressure.	Check air supply. Make leakage test (par. 51a).
Restriction in the air line.	Look for bent or dented tubing.
Clogged air filter.	Clean or replace element (par. 55).
Air in hydraulic system.	Bleed system (par. 51b).



### 35. Grabbing Brakes

*Probable cause*  
Moisture in filter.  
Loose or worn wheel bearings.

*Possible remedy*  
Drain filter.  
Adjust or replace bearings (par. 48).

### 36. Dragging Brakes

*Probable cause*  
Brake adjusted too tightly.  
Parking brake not released fully.

*Possible remedy*  
Adjust brakes (par. 50).  
Release parking brake. Adjust if necessary.

## Section V. DITCHER PLOW AND PANBREAKER

### 37. Ditcher Plow

*a. Description.* The ditcher plow consists of the plow standard (3, fig. 12) which is a heavy reinforced steel member, moldboards (1), drift wings (9), drift wing extensions (11), plow share (14), and plow share shoe (15). The components are braced and held in their typical V-shape by three cross braces (2, 10, and 19), two tie braces (4), two supports (8), and two frogs (18), all attached by nuts and bolts. The standard is secured to the ditcher toolhead by four bolts, nuts, and lockwashers. It swivels on a large pin. To swing the plow up and away from the ground, pressure is exerted by the hydraulic ram.

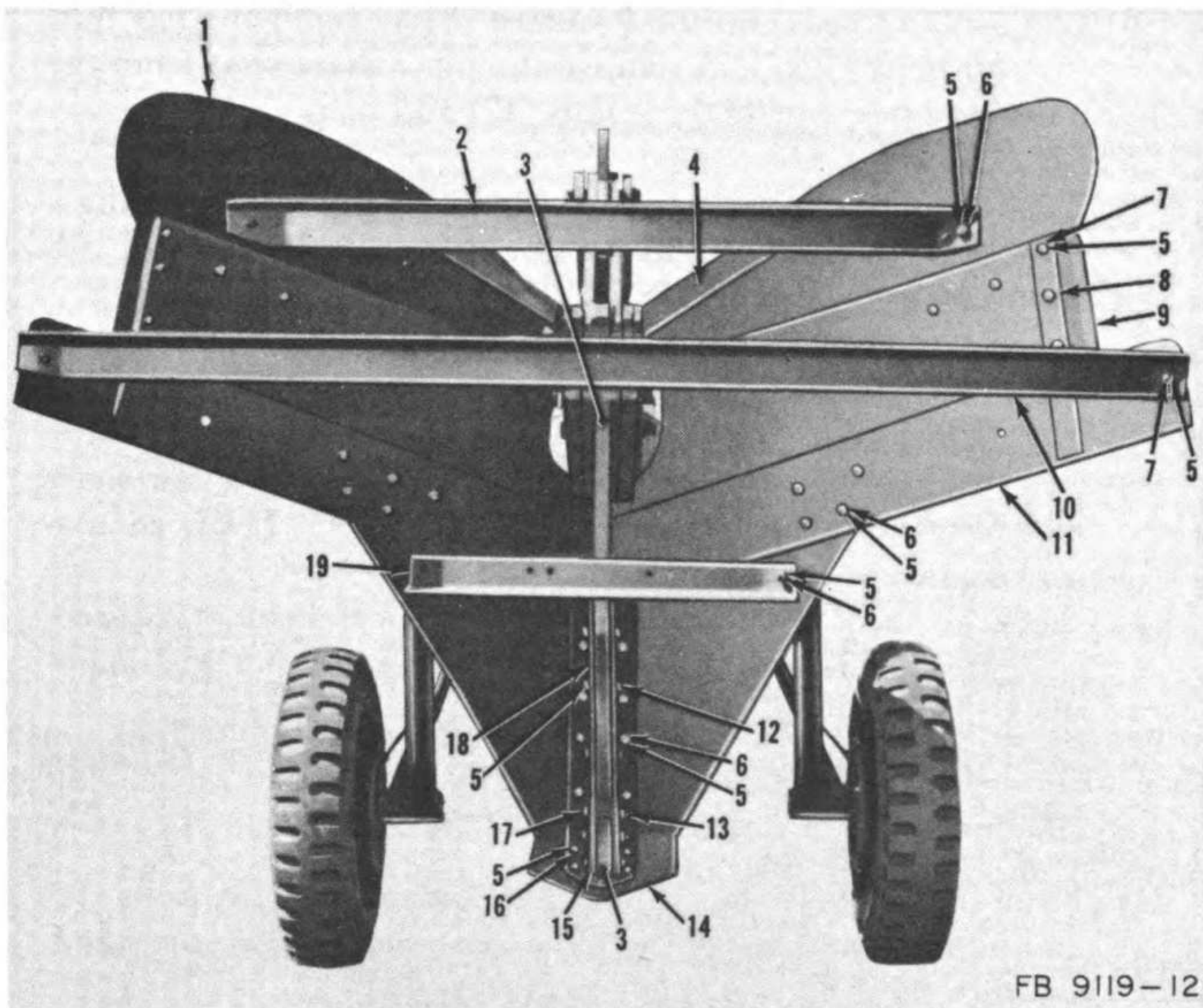
*b. Removal.* The ditcher plow is removable as a unit as follows:

- (1) Secure the transport pin (18, fig. 2) in the transporting position (par. 17*b*).
- (2) Chock the ditcher wheels and support the frame with suitable blocking.
- (3) Attach a sling from an A-frame block and fall or a small boom crane to the lifting ring (8, fig. 2) of the ditcher plow, and tighten the sling enough to take up any slack.
- (4) Remove the pin attaching the upper end of the hydraulic ram (7), and install this end of the ram in the alternate bracket (6, fig. 1).
- (5) Remove cotter pin (10, fig. 2) and brace pin (9) from the plow standard.
- (6) Remove the four nuts and bolts and the swivel pin which attach the plow to the ditcher frame.
- (7) Lift the plow away from the ditcher and lower it to the ground.

*c. Disassembly.*

- (1) Remove the drift wing brace (10, fig. 12) by removing two nuts (5) and two bolts (7).
- (2) Remove the two drift wing supports (8) by removing ten nuts (5) and bolts (7).
- (3) Remove the drift wing extensions (11) by removing eight nuts (5) and bolts (6).





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- |    |   |    |   |
|----|---|----|---|
| 1  | Moldboard   | 11 | Drift wing extension  |
| 2  | Upper moldboard brace   | 12 | Bolt, mach, $\frac{5}{8}$ -11 x $3\frac{1}{2}$ (5 rqr)      |
| 3  | Standard  | 13 | Bolt, mach, $\frac{3}{4}$ -10 x 4 (3 rqr)                   |
| 4  | Tie brace   | 14 | Plow share  |
| 5  | Nut, $\frac{5}{8}$ -11 (51 rqr)                               | 15 | Plow share shoe   |
| 6  | Bolt, No. 3 plow, $\frac{5}{8}$ -11 x $1\frac{1}{2}$ (30 rqr) | 16 | Bolt, No. 3 plow $\frac{5}{8}$ -11 x $2\frac{1}{2}$ (4 rqr) |
| 7  | Bolt, No. 3 plow, $\frac{5}{8}$ -11 x $1\frac{3}{4}$ (12 rqr) | 17 | Nut, $\frac{3}{4}$ -10 (3 rqr)                              |
| 8  | Support, angle-iron   | 18 | Frog  |
| 9  | Drift wing  | 19 | Lower moldboard brace                                       |
| 10 | Drift wing brace  |    |   |

Figure 12. Ditcher plow, rear view.

- (4) Remove the drift wings (9) by removing six nuts (5) and bolts (6).
- (5) Remove the upper moldboard brace (2) by removing four nuts (5) and bolts (6); remove the lower moldboard brace (19) by removing two nuts (5) and bolts (6).
- (6) Remove the two tie braces (4) by removing the two nuts and bolts attaching them to the moldboards. (The opposite ends of the tie braces are attached to the ditcher toolhead with the plow standard.)
- (7) Remove the plow share (14) by removing four nuts (5) and bolts (16).
- (8) Remove the moldboards (1) by removing 14 nuts (5) and bolts (6) attaching the moldboards to the frogs (18) and plow share shoe (15).



- (9) Remove the frogs from the standard (3) by removing five nuts (5) and bolts (12), and remove the plow share shoe from the standard by removing three nuts (17) and bolts (13).

*d. Cleaning.*

- (1) Wash the ditcher plow assembly with a hose and water, using a stiff-bristle brush to help in the cleaning process.
- (2) Clean the assembly nuts and bolts in cleaning solvent.
- (3) After cleaning, dry all the parts and then wipe them with an oily rag.

*e. Inspection and Repair.*

- (1) Check the moldboards, drift wings and extensions, share, share shoe, frogs, supports, and standard for cracks. If any component is cracked, repair or replace it.
- (2) Check for bent or twisted components. If bent or twisted, straighten where possible. If the component cannot be straightened, replace it with a new component.
- (3) Check the bolts and nuts for excessively worn or damaged threads. Make the necessary replacements.

*f. Reassembly.*

- (1) Install the frogs (18, fig. 12) on the standard with five bolts (12) and nuts (5), and install the plow share shoe (15) on the standard with three bolts (13) and nuts (17).
- (2) Position the moldboards on the frogs and shoe and secure with 14 bolts (6) and nuts (5).
- (3) Install the plow share with four bolts (16) and nuts (5).
- (4) Install the two tie braces (4) on the moldboards (1) with the two bolts and nuts provided.
- (5) Install the upper and lower moldboard braces (2 and 19); the upper brace attaches with four bolts (6) and nuts (5), and the lower brace attaches two bolts (6) and nuts (5).
- (6) Attach the drift wings (9) with six bolts (6) and nuts (5).
- (7) Attach the drift wing extensions (11) with eight bolts (6) and nuts (5).
- (8) Install the two drift wing supports (8) with ten bolts (7) and nuts (5).
- (9) Install the drift wing brace (10) with two bolts (7) and nuts (5).
- (10) Be sure all nuts and bolts are installed and securely tightened.

*g. Installation.*

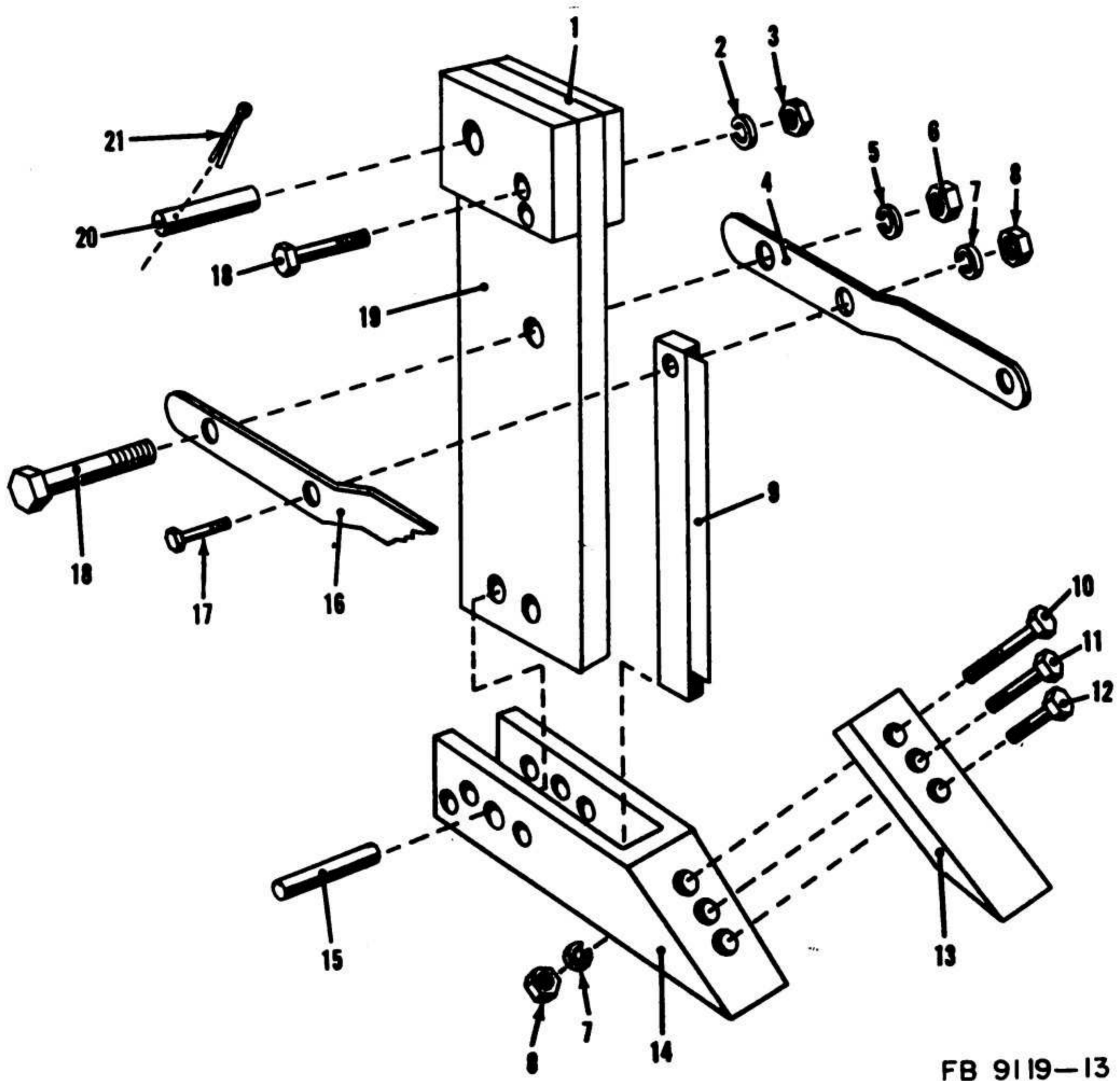
- (1) Lift the ditcher plow into position in the toolhead with the same equipment used for removal.
- (2) Insert the swivel pin through the toolhead and standard, and secure the standard to the toolhead with the four bolts and nuts provided.
- (3) Remove the upper end of the hydraulic ram (7, fig. 2) and install it in the bracket provided on the ditcher plow.



- (4) Secure the brace bar to the ditcher standard with pin (9) and cotter pins (10).
- (5) If the ditcher is to be operated, secure the transport pin (18) in the working position (par. 15*t*).

### 38. Panbreaker

*a. Description.* The panbreaker (fig. 10) is used before plowing with the ditcher plow to break up rock-strewn or hard-packed soil, and soil that contains large tree roots. The panbreaker standard (9) is constructed of heavy steel plate and is provided with a mounting head which has two



FB 9119-13

- |    |   |    |  |
|----|---|----|--|
| 1  | Mounting head                           | 12 | Bolt, $\frac{3}{4}$ in. x 5 in.                |
| 2  | Lockwasher, 1-inch (2 rqr)              | 13 | Point  |
| 3  | Nut, 1-inch (2 rqr)                     | 14 | Landside                                       |
| 4  | Left-hand brace                         | 15 | Pin (2 rqr)                                    |
| 5  | Lockwasher, 1½-inch                     | 16 | Right-hand brace                               |
| 6  | Nut, 1½-inch                            | 17 | Bolt, $\frac{3}{4}$ in. x 4 in.                |
| 7  | Lockwasher, $\frac{3}{4}$ -inch (4 rqr) | 18 | Bolt, 1½ in. x 4 in. (2 rqr)                   |
| 8  | Nut, $\frac{3}{4}$ -inch (4 rqr)        | 19 | Standard                                       |
| 9  | Cutting shin                            | 20 | Pin  |
| 10 | Bolt, $\frac{3}{4}$ in. x 6½ in.        | 21 | Cotter pin, $\frac{1}{2}$ in. x 3½ in. (2 rqr) |
| 11 | Bolt, $\frac{3}{4}$ in. x 5½ in.        |    |  |

Figure 13. Panbreaker, exploded view.



bolt holes and one pin hole for securing the panbreaker in the ditcher toolhead. A cutting shim (10) is secured to the front edge of the standard, a landside (12) is mounted at the base of the standard and secured with two heavy pins, and a hardened-steel point (11) is attached to the landside at an angle by three heavy bolts, lockwashers, and nuts.

*b. Removal.* When the panbreaker is attached to the ditcher as shown in figure 10, remove cotter pin (15), pin (16), two bolts (3), and the single bolt which attaches the braces (5 and 7) to the center frame member. If the panbreaker is stowed on the ditcher frame, remove the U-bolt (9, fig. 1) and the hook bolt (10), and lift out the panbreaker.

*c. Disassembly.*

- (1) Remove the three bolts (10, 11, and 12, fig. 13), nuts (8) and lockwashers (7) that secure the point (13) to the landside (14).
- (2) Drift out the two locking pins (15) that secure the landside to the standard (19).
- (3) Remove the bolt (17), nut (8), and lockwasher (7) that secure the cutting shin (9) to the braces (4 and 16).
- (4) Remove the large bolt (18), nut (6), and lockwasher (5) attaching the left-hand and right-hand braces (4 and 16) to the standard.

*d. Cleaning.*

- (1) Wash the panbreaker standard and all components with a hose and water. Use a stiff-bristle brush to help in the cleaning process.
- (2) Clean the assembly nuts and bolts in cleaning solvent.
- (3) After cleaning, dry all the parts and then lightly oil exposed metal surfaces to prevent rusting.

*e. Inspection and Repair.*

- (1) Inspect the standard for cracks, heavy dents, or burs caused by operations in rocky or hard-packed soil. Smooth the surface with a file or emery wheel if necessary. Weld a cracked standard if possible, or replace.
- (2) Check the landside for wear and damage. Remove the rough outer surface with a file or emery wheel. Replace the landside if excessively worn or damaged.
- (3) Check the point for excessive wear and damage. If the point shows signs of weakness owing to excessive wear, replace the point. Sharpen a dull point, if possible.
- (4) Check the cutter shin for distortion and wear. If the cutter shin is bent or twisted, replace it. If it is burred, remove the burs with a file or emery wheel.
- (5) Check the assembly nuts, bolts, lockwashers, and pins for excessive wear and damage. Replace as necessary.
- (6) When replacing the point or cutter shin use new bolts, nuts, and lockwashers.



*f. Assembly.*

- (1) Attach the left- and right-hand braces (4 and 16) to the standard (19) with the bolt (18), lockwasher (5), and nut (6).
- (2) Position the cutting shin (9) on the face of the standard, and secure it to the braces with the bolt (17), lockwasher (7), and nut (8).
- (3) Position the landside (14) on the base of the standard and cutting shin, and drive in the two locking pins (15), using a driving tool.
- (4) Position the point (13) on the landside, and secure it with three bolts (10, 11, and 12), lockwashers (7), and nuts (8).

*g. Installation.* Stow the panbreaker on the ditcher frame, using the U-bolt (9, fig. 1) and the hook bolt (10); or, if putting it into operation, install it as instructed in paragraph 16.

## **Section VI. WIRE ROPE, SHEAVES, AND HOUSING**

### **39. Description**

The lower sheave housing (3, fig. 14) is fabricated of heavy steel plate and welded in place on the housing base plate (7). The sheaves (9) revolve on roller bearings (10) which are in the hub of each sheave; the bearings revolve on inner bearing races (11). The sheave shaft (2) is held in position by a flat pinlock (4) which is held by two cap screws (6). The upper sheaves (7, fig. 1) are identical to those shown in figure 14; their housing is part of the main axle assembly (20, fig. 1). The procedures in paragraphs 40 through 43 describe the lower sheaves; however, they apply also to the upper sheaves.

### **40. Sheave Removal**

*a.* Remove the wire rope (1, fig. 2) by removing the dead end of the rope from the wedge block (4, fig. 7) and withdrawing the rope from the sheaves.

*b.* Remove the two cap screws (6, fig. 14) and lockwashers (5), and remove the pinlock (4).

*c.* Remove the sheave shaft (2).

*d.* Remove the sheaves (9) and spacers (8) from the housing (3).

*e.* Remove the roller bearing (10) and the bearing races (11) from the sheave hubs.

### **41. Cleaning**

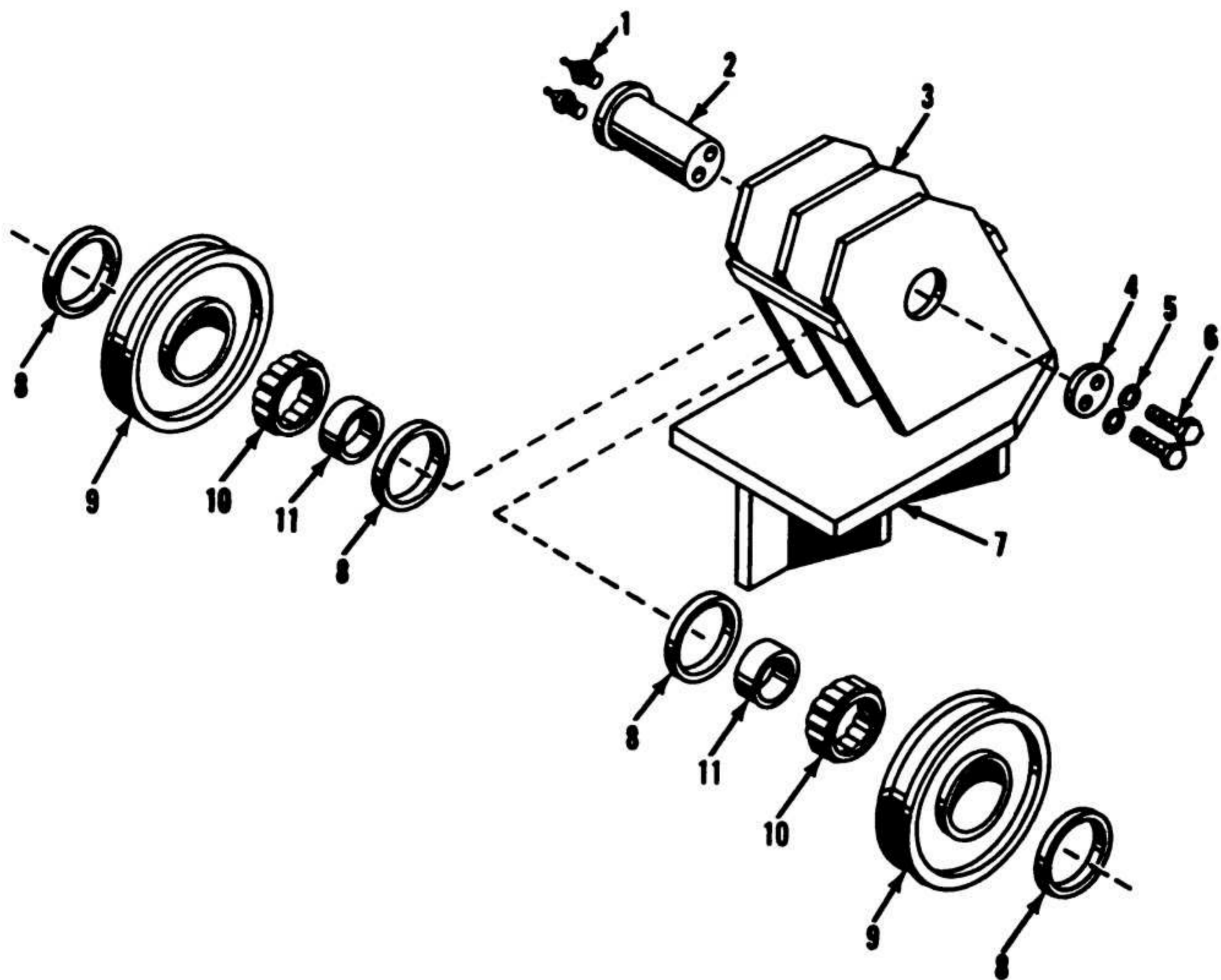
*a.* Clean the sheaves, spacers, shaft, pinlock, and cap screws in cleaning solvent.

*b.* Clean all grease and dirt accumulations from the sheave housing.

*c.* Clean the roller bearings in a light diesel oil, and dry.

*d.* Clean the wire rope in cleaning solvent.





FB 9119-14

- 1 Grease fitting
- 2 Sheave shaft
- 3 Sheave housing
- 4 Pinlock
- 5 Lockwasher, 1/2-in. (2 rqr)
- 6 Cap screw, 1/2 in. x 1 1/4 in. (2 rqr)

- 7 Housing base plate
- 8 Spacer
- 9 Sheave
- 10 Roller bearing
- 11 Bearing race

Figure 14. Lower sheaves and housing.

## 42. Inspection and Repair

a. Check the sheaves for cracks and chipped flanges, and check the hub bearings surfaces for scoring and pitting. Replace if necessary.

b. Check the shaft for rough surfaces and burs. Remove all rough surfaces and burs with a fine file or emery cloth. Be sure the lubrication holes are not plugged. Replace shaft if necessary.

c. Inspect the spacers for wear and damage. Replace if necessary.

d. Inspect the roller bearings and races for wear and signs of damage. If excessively worn, or signs of damage appear after cleaning, replace with new bearing assemblies.

e. Inspect the wire rope for frayed or broken strands. Replace if necessary.

## 43. Sheave Installation

a. Use a light grease to hold the roller bearings (10, fig. 14), and install them in the sheave hubs. Install the bearing races (11).



- b. Position the sheaves (9) and spacers (8) in the sheave housing (3), and insert the sheave shaft (2).
- c. Secure the sheave shaft with the pinlock (4), lockwashers (5), and cap screws (6).
- d. Install the wire rope according to the instructions in paragraph 7d.
- e. Lubricate as instructed in LO 5-9119.

## **Section VII. WHEEL MOUNTING**

### **44. General**

The wheels and hubs are mounted on stub axles (16, fig. 2) which are part of the main axle assembly (20, fig. 1), and may be removed and installed separately or as a unit. The hub is removed only to make repairs or adjustments to the brakes or to repack the bearings. The brakes are conventional, air-hydraulic type brakes actuated from the towing vehicle. Mechanical, hand-operated parking brakes are provided by linkage which runs from hand levers (17) to the brakes.

### **45. Wheel Removal**

- a. Block and jack up the ditcher.
- b. Remove the six wheel-stud nuts (18, fig. 1) and remove the wheel. Nuts on the right side (marked R) have right-hand threads and those on the left-hand side marked L) have left-hand threads. The nuts must be removed accordingly.

### **46. Split Lockrings and Tires**

- a. *Split Lockring Removal.*
  - (1) With the wheel removed from the hub (par. 45), deflate the tire by unscrewing and removing the valve core with the valve cap.
  - (2) Force the bead from the split lockring with a tire tool.
  - (3) Place the small end of the tire tool in the slot between the split lockring and the wheel rim.
  - (4) Pry the end of the lockring from its groove in the wheel rim.
  - (5) Place the tire iron under the pried-up end of the lockring to hold it in place until the next successive arc of the ring is pried from place.
- b. *Tire and Tube Removal.*
  - (1) Turn the wheel over, and force the tire bead free of the wheel rim.
  - (2) Force the inner tube valve stem into the tire casing through the slot in the wheel rim.
  - (3) Press and pry first one tire bead and then the other from the wheel rim.
  - (4) Remove the tire flap and tube from the tire.
- c. *Tire and Tube Installation.*
  - (1) Install the valve core in the tube valve stem with the valve cap, and inflate the tube until it is just rounded out.



- (2) Place the tube inside the tire, and insert the flap.
- (3) With the beaded edge of the rim downward, place the wheel on blocks large enough to raise the rim an inch or more off the ground.
- (4) Lower the tire onto the wheel, with the valve stem lined up with the valve slot in the wheel rim.
- (5) Stand on the tire on the side opposite the stem to force the tire on the rim.

*d. Split Lockring Installation.*

- (1) Place the split lockring on the wheel; begin installation at the end of the ring, forcing it into the groove on the rim of the wheel.
- (2) Use a heavy mallet, or stand on the ring, to force it into place.
- (3) Pound the tire casing with a heavy mallet in several places to make the inner tube fit smoothly inside the casing.

*Caution:* Before inflating a tire after mounting it on the rim, tie chains or heavy ropes around the tire and rim and through the holes in the wheels in at least three places to avoid injury if the ring flies off. Stand to one side, or place the wheel so that the ring is toward a wall.

- (4) Inflate the tire to proper pressure (65 p.s.i.).

#### 47. Wheel Installation

- a.* Place the wheel on the six wheel studs.
- b.* Install the wheel-stud nuts, and tighten with a lug wrench. Tighten the nuts alternately, to insure that they will be tightened evenly.
- c.* Remove the blocking from under the ditcher and lower the jack. Check the tightness of the wheel-stud nuts.

#### 48. Hub and Brakedrum

*a. Removal and Disassembly.*

- (1) Remove the wheel from the hub (par. 45).
- (2) Remove the eight hubcap mounting screws (27, fig. 15) and lockwashers (26), and remove the hubcap (1) and gasket (2) from the hub (10).

1	Hubcap	15	Brakedrum
2	Gasket	16	Adapter plate
3	Locking nut	17	Oil slinger
4	Lockwasher	18	Lockwasher (8 rqr)
5	Adjusting nut	19	Cap screw (8 rqr)
6	Tongue washer	20	Spindle
7	Outer bearing	21	Brake flange
8	Outer cup	22	Bolt (10 rqr)
9	Wheel stud (6 rqr)	23	Lockwasher (10 rqr)
10	Hub	24	Nut (10 rqr)
11	Inner cup	25	Wheel-stud nut
12	Inner bearing	26	Lockwasher, ½-in. (8 rqr)
13	Grease seal	27	Bolt, ½ in. x ½ in. (8 rqr)
14	Inspection hole cover		







- (3) Remove the locking nut (3), lockwasher (4), adjusting nut (5), and tongue washer (6).
- (4) Slightly move the hub (10) on the spindle (20) to loose the outer bearing (7).
- (5) Remove the outer bearing, and lift the hub and brakedrum assembly from the spindle.
- (6) Remove the grease seal (13) from inside the hub, and remove the inner bearing (12).

*Note.* Do not remove the bearing cups (8 and 11) from the hub unless they require replacement.

- (7) Remove the brakedrum (15), adapter (16), and oil slinger (17) from the hub by removing eight cap screws (19) and lockwasher (18).
- (8) Remove the oil slinger and adapter plate from the brakedrum by removing ten nuts (24), lockwashers (23), and bolts (22). The inspection hole cover (14) will fall away.

*b. Cleaning.*

- (1) Wash all parts, except the grease seal, in cleaning solvent, using a stiff-bristle brush to help remove the dirt and accumulated grease.
- (2) Handle the bearing cones separately, and do not spin them with compressed air. Dry with a clean, lint-free rag.
- (3) Clean the spindle with cleaning solvent. Wipe dry with a clean rag if compressed air is not available.

*c. Inspection and Repair.*

- (1) Check the hub, adapter, and brakedrum for cracks and damage. Inspect the mounting studs and nuts for looseness or replacements necessary.
- (2) Check the inner spindle grease seal for damage. If grease is leaking from the grease seal, replace the seal.
- (3) Inspect the hubcap and oil slinger for cracks and damage. If either is bent or twisted, replace it.
- (4) Check the adjusting nuts and the lockwasher for damage or loose fit on the spindle. Replace if necessary.
- (5) Inspect all mounting and assembly cap screws, bolts and nuts. Replace those that are worn or loosefitting.
- (6) Check the bearing cups and cones. If the cones are discolored due to heating, which may have damaged the cones and cups, replace the complete bearing.

*d. Reassembly and Installation.* When reassembling the bearing cones and cups, refer to LO 5-9119 for the correct lubricant to use. Use lubricant sparingly; do not pack or fill the hub with lubricant, as doing so may cause grease leakage onto the brake linings.

- (1) If the bearing cups (8 and 11, fig. 15) are being replaced, press new cups into the hub and cover them with a thin coat of lubricant.



- (2) Install the adapter plate (16) and oil slinger (17) on the brake-drum with the bolts (22), lockwashers (23), and nuts (24). Be sure to include the inspection hole cover (14).
- (3) Install the adapter to the hub (10) with the eight cap screws (19) and lockwashers (18).
- (4) Install the inner bearing cone (12) and the grease seal (13).
- (5) Lubricate the spindle (20) and the bearing cone, and slide the hub onto the axle.
- (6) Lubricate the outer bearing cone (7) and install it in its bearing cup.
- (7) Install the tongue washer (6) and the adjusting nut (5).
- (8) Turn the adjusting nut up tight, then back it off until the wheel turns freely without end play. Install the lockwasher (4) and the locking nut (3).
- (9) Use a new gasket (2) and install the hubcap (1) with the cap screws (27) and lockwashers (26).
- (10) Install the wheel on the hub (par. 47).

## Section VIII. BRAKES

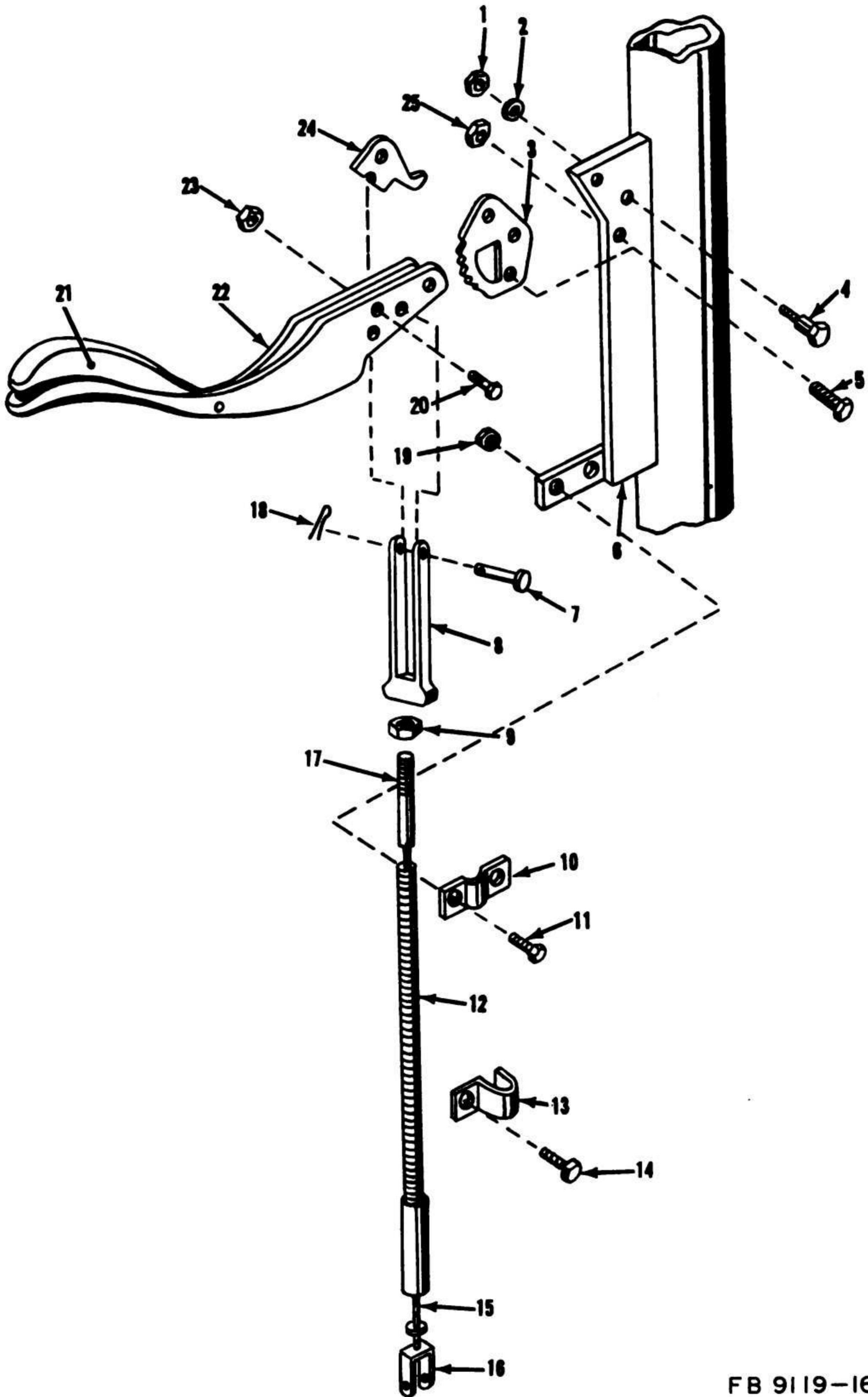
### 49. Description

There are two braking systems on the ditcher: the parking brake system, which is hand-operated; and the service brake system, which is operated from the towing vehicle. Both systems utilize the same internal brake mechanism.

*a. Parking Brakes.* The parking brake system consists of linkage (fig. 16) connected between hand levers (22) and a lever (7, fig. 17) and strut (4) arrangement within the wheels. Leverage is applied manually to the hand lever and is transmitted by cable (15, fig. 16) through a spring type conduit (12) to the lever and strut, which move the brakeshoes (9, fig. 17) against the brakedrum. The conduit passes through the brake backing plate and is clamped to a bracket (13) with a clamp (14) and bolts, nuts, and lockwashers. The cable is connected to the lever (7) by a clevis (10) and pin. Brake release is provided by a return spring which moves the brakeshoes away from the brakedrum when the parking brake lever is released. The hand lever is provided with a pawl (24, fig. 16) and toothed segment (3) for locking the brakes in the on position, and a pawl release mechanism (21) in the lever grip.

*b. Service Brakes.* The service brakes are of the "air-over-hydraulic" type and consist of an air chamber (4, fig. 2), a master cylinder (5), two hydraulic wheel cylinders (3, fig. 17), an air service line (12, fig. 1), copper hydraulic lines (14, fig. 2), and an air filter (15). These components all serve to operate the internal brake mechanism shown in figure 17. When the air service line is connected between the towing vehicle and the ditcher, air from the towing vehicle's air system flows into the ditcher system and the pressure is equalized between the two units. Any sub-





FB 9119-16

Figure 16. Parking brake linkage.



1	Nut	14	Cap screw
2	Lockwasher	15	Cable
3	Toothed segment	16	Clevis, lower
4	Pivot bolt	17	Cable head
5	Bolt (2 rqr)	18	Cotter pin (2 rqr)
6	Bracket	19	Nut (2 rqr)
7	Pivot pin (2 rqr)	20	Bolt
8	Clevis, upper	21	Pawl release mechanism
9	Locking nut	22	Lever
10	Upper clamp	23	Nut
11	Bolt (2 rqr)	24	Pawl
12	Conduit	25	Nut (2 rqr)
13	Clip		



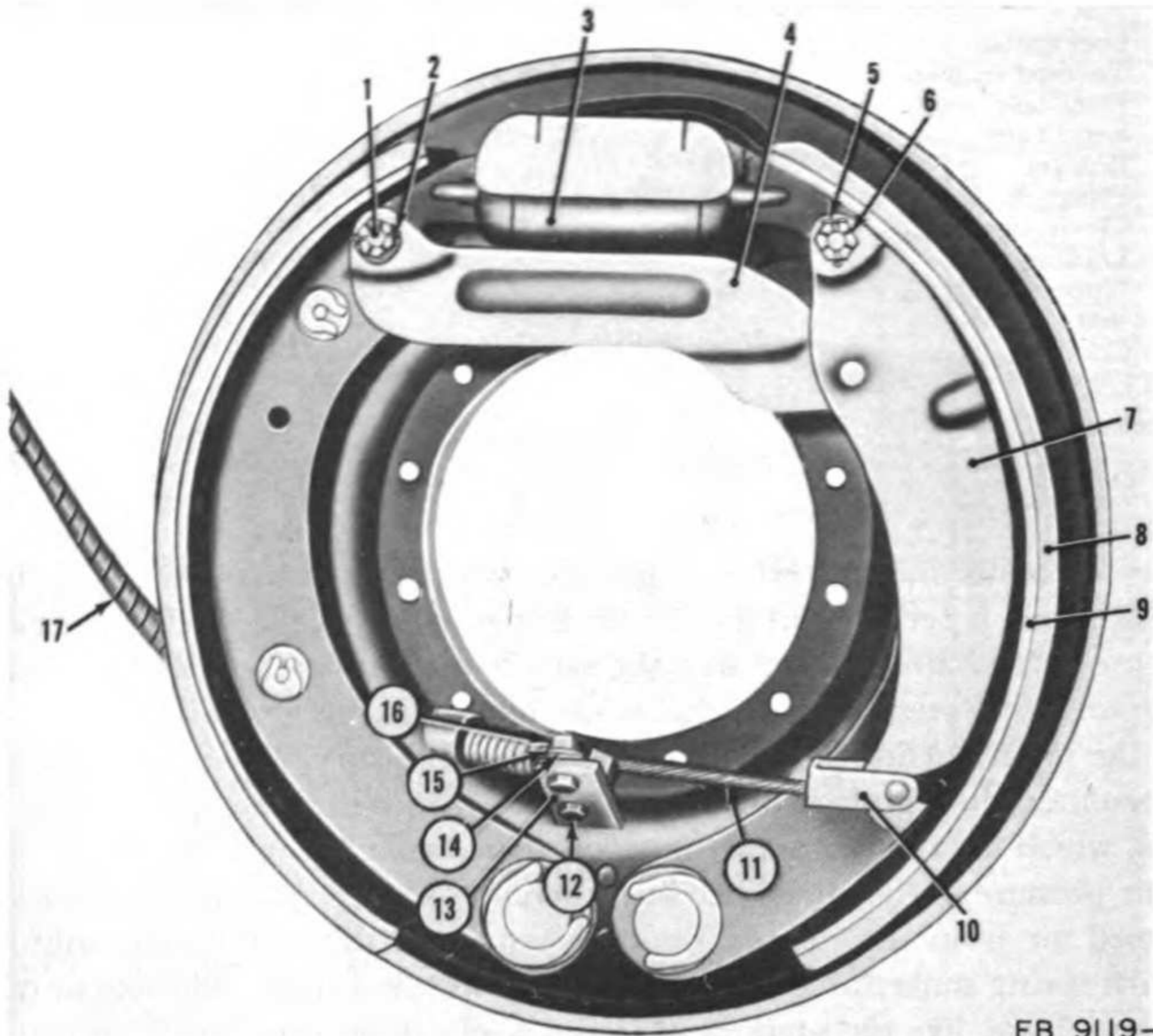
sequent change in air pressure, through movement of the towing vehicle brake pedal, is reflected in the service brake system of the ditcher. The air pressure is directed through the service air line to the air filter and then to the air chamber attached to the hydraulic master cylinder, causing the master cylinder to develop hydraulic pressure. This pressure is transmitted through hydraulic lines to the hydraulic wheel cylinder pistons, which force the brakeshoes against the brakedrum. With a drop in air pressure in the air service line, the air chamber valve releases compressed air from the ditcher brake system, and the brake mechanism return spring pulls the brakeshoes away from the drum. The extent of brake release, like the amount of brake application, is in direct proportion to the pedal movement on the towing vehicle.

## 50. Parking Brake Linkage and Brake Mechanism

### a. Removal and Disassembly.

- (1) Remove the wheel, hub, and brakedrum (par. 48a). Be sure the parking brake is released.
- (2) Remove the upper clevis (8, fig. 16) from the hand lever (22) by removing cotter pin (18) and pivot pin (7).
- (3) Remove the lever assembly from the mounting bracket (6) by removing the pivot bolt (4), lockwasher (2), and nut (1), and the two bolts (5) and nuts (25). The toothed segment (3) will drop out.
- (4) Remove pawl (24) by removing bolt (20) and nut (23).
- (5) Unscrew the upper clevis from the cable head (17), and remove the locking nut (9).
- (6) Remove the clamp (10) attaching the conduit (12) to the bracket by removing two nuts (19) and bolts (11), and remove the clip (13) attaching the conduit to the lower part of the axle brace by removing the cap screw (14).
- (7) Unhook the lower clevis (10, fig. 17) from the lever (7).
- (8) Remove the clamp (14) attaching the conduit to the bracket (13) by removing two bolts (12), nuts (16), and lockwashers (15).





FB 9119-17

- |                            |                       |
|----------------------------|-----------------------|
| 1 Bolt (2 rqr)             | 10 Lower clevis       |
| 2 Washer (2 rqr)           | 11 Cable              |
| 3 Hydraulic wheel cylinder | 12 Bolt (2 rqr)       |
| 4 Strut                    | 13 Bracket            |
| 5 Cotter pin (2 rqr)       | 14 Clamp              |
| 6 Slotted nut (2 rqr)      | 15 Lockwasher (2 rqr) |
| 7 Lever                    | 16 Nut (2 rqr)        |
| 8 Brake lining             | 17 Conduit            |
| 9 Brakeshoe                |                       |

Figure 17. Internal brake mechanism.

- (9) Remove the conduit and cable assembly by drawing it through the brake backing plate.
- (10) Remove the cotter pin (11, fig. 18) and unscrew the slotted nuts (10) from the bolts (5) that attach the strut (12) and lever (8) to the upper ends of the brakeshoes (6).
- (11) Remove the strut and lever as an assembly and then separate the components.
- (12) Remove the four spring clips (7) and washers (4) which hold the brakeshoes (6) in position on the guide pins (2 and 18).
- (13) Remove the C washers (13) and washers (14) from the anchor pins (17).
- (14) Disconnect the return spring (15), and remove the brakeshoes.



- (15) Remove the washers (4) and springs (3) from the short guide pins (18), the washers (4) and springs from the long guide pins (2), and remove the felts (16) from the anchor pins.

*b. Cleaning.*

- (1) Clean all components of the parking brake linkage in cleaning solvent, using a stiff-bristle brush to aid in the removal of encrusted dirt and grease. Dry with compressed air.
- (2) With the exception of the brakeshoes, clean all components of the brake mechanism in cleaning solvent.
- (3) Clean the brakeshoes with a solvent-soaked rag, being careful not to saturate the brake linings with solvent.
- (4) Use a solvent-soaked rag to wipe out inside of the brakedrum.

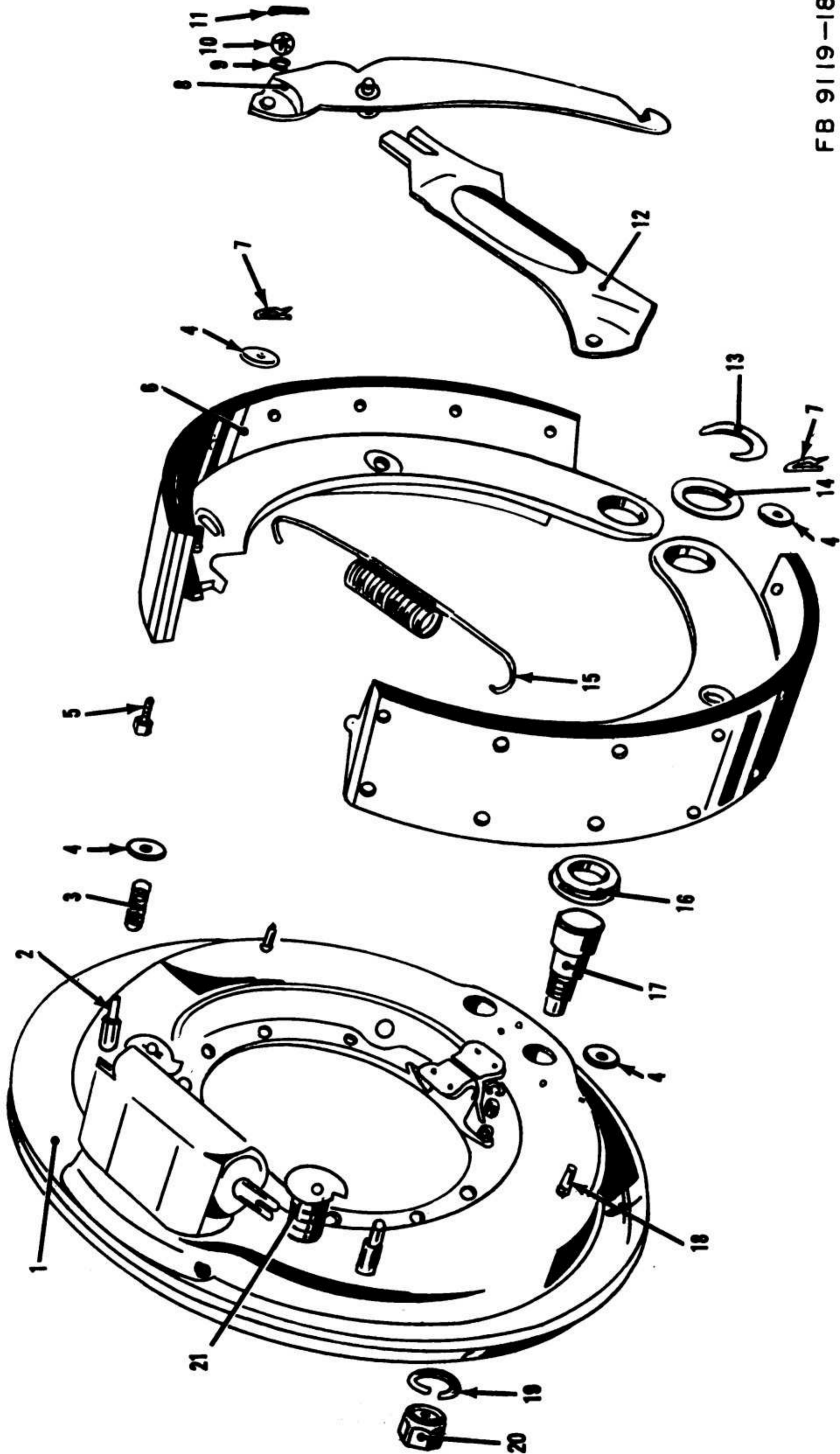
*c. Inspection and Repair.*

- (1) Test the pawl release mechanism (21, fig. 16) for effective operation. Replace if necessary.
- (2) Inspect the pawl for excessive wear, and the toothed segment for worn teeth. File the pawl or segment if possible; replace if excessively worn.
- (3) Make sure that the cable head does not have crossed or damaged threads, and that the cable operates freely in the conduit. Work the cable back and forth by hand to be sure that broken strands do not cause binding. Use a penetrating lubricant to free up the cable in the conduit. Replace the cable and conduit assembly if defective.
- (4) Inspect the lever and strut for wear or warping; straighten if required. These parts are seldom worn sufficiently to require replacement.
- (5) Inspect the pivot surfaces of the shoes for wear.
- (6) Check for a broken or weak return spring. Replace broken or ineffective springs.
- (7) Check the anchor pins for wear and damage. If rough, smooth off with a file or with emery cloth. If excessively worn, replace.
- (8) Inspect the backing plate for cracks and damage. Replace if necessary.
- (9) Check the brakeshoe lining for wear and damage. If the lining is glazed, rough it up with a file. If the lining is worn to the rivet heads, replace the shoe and lining.

*d. Reassembly and Installation.*

- (1) Install the felts (16, fig. 18) on the anchor pins (17), install the springs and inner washers (4) on the short guide pins (18), and install the springs (3) and inner washers (4) on the long guide pins (2).
- (2) Position the brakeshoes (6) over the anchor pins and guide pins, and install the return spring (15).
- (3) Install the washers (14) and C washers (13) on the anchor pins,





FB 9119-18

Figure 18. Brake mechanism, exploded view.



1 Backing plate  
 2 Long guide pin  
 3 Spring  
 4 Washer (8 rqr)  
 5 Bolt (2 rqr)  
 6 Brakeshoe  
 7 Spring clip (4 rqr)  
 8 Lever  
 9 Washer  
 10 Slotted nut  
 11 Cotter pin (2 rqr)

12 Strut  
 13 C-washer (2 rqr)  
 14 Washer (2 rqr)  
 15 Return spring  
 16 Washer, felt (2 rqr)  
 17 Anchor pin  
 18 Short guide pin  
 19 Lockwasher (2 rqr)  
 20 Nut (2 rqr)  
 21 Shoe adjusting cam



and install the spring clips (7) and washers (4) on the guide pins.

- (4) Assemble the strut (12) and lever (8), and position the assembly; secure it with bolts (5), lockwashers (9), slotted nuts (10), and cotter pins (11).
- (5) Feed the conduit and cable assembly through the backing plate and hook the lower clevis (10, fig. 17) over the lower part of the lever (7).
- (6) Position the end of the conduit (17) over the bracket (13) and secure it with the clamp (14) and two bolts (12), lockwashers (15), and nuts (16).
- (7) Screw the locking nut (9, fig. 16) onto the cablehead (17) a few turns, and then screw on the upper clevis (8).
- (8) Install the pawl (24) on the hand lever (22) with the bolt (20) and nut (23).
- (9) Position the toothed segment (3) and the lever on the mounting bracket and secure them with pivot bolt (4), lockwasher (2), and nut (1) and two bolts (5) and nuts (25).
- (10) Attach the upper clevis to the hand lever with pivot pins (7) and cotter pin (18).
- (11) Secure the conduit with the clamp (10) and clip (13).
- (12) Adjust the cable to an even tension by turning the upper clevis on the threaded cable head. Maintain adjustment with the locking nut.

*Note.* Be sure the parking brake is in the release position when adjusting cable tension.

- (13) Install the wheel, hub, and brakedrum (par. 48*d*).

*e. Brake Adjustment.* After the brake mechanism and linkage have been installed and the cable adjustment made, the brakeshoes must be adjusted for proper operation.

*Note.* Always check the wheel bearing adjustment before adjusting brakes. Satisfactory brake adjustment cannot be obtained unless the wheel bearings are in proper adjustment. Do not adjust the brakes when the drums are hot.

- (1) Release the parking brakes. Release all pressure from the braking system. Jack up the wheel so that the drum can be rotated freely.



- (2) The shoe-adjusting cam nuts are located on the upper rear face of the backing plate, one for each brakeshoe. Turn one of these nuts to bring the brake lining in contact with the drum until the lining drags slightly when the drum is rotated by hand.
- (3) Rotate the drum in the opposite direction while turning the other nut to adjust the other brakeshoe.
- (4) Make both adjustments at each wheel as uniform as possible. The shape of the cam (21, fig. 18) permits only limited adjustment, and the cams are provided with friction springs to maintain the adjustment.

## **51. Testing and Bleeding Hydraulic Brake System**

### *a. Leakage Test.*

- (1) Couple the air service line to the towing vehicle and coat the hose couplings, the hose connections, and the air line with soap suds.
- (2) Apply the brakes and examine all lines, couplings, and connections for signs of leakage; none is permissible.
- (3) Leakage of the coupling is usually caused by a worn, damaged, or improperly installed packing ring. If the coupling leaks, install a new ring.
- (4) Tighten the hose connections to check leakage. Replace the sleeve or entire connector if necessary.
- (5) Tighten all tubing fittings, and tighten the screws attaching the tube clips to the frame. Inspect the tubing for restrictions caused by dents and kinks. Replace tubing or fitting if damaged, or if the leak cannot be stopped.

*b. Bleeding Hydraulic Brakes.* Proper operation of the hydraulic braking system requires a solid column of fluid without air bubbles. If any air enters the system, indicated by poor braking action, it is necessary to bleed the air from the system. Bleeding can be done manually or with a pressure feed filler.

- (1) For manual bleeding, couple the air service line to the towing vehicle so that the brakes can be applied. Fill the master cylinder reservoir with brake fluid and refill as necessary during the bleeding procedure to prevent more air from entering the system.
- (2) Clean the bleeder screw at the top of the brake backing plate. Attach a bleeder tube, and submerge the free end in a container of hydraulic brake fluid. The free end of the bleeder tube must never leave the fluid in the container.
- (3) Have a helper on the towing vehicle apply and release the brakes slowly. At the same time, open the bleeder screw by making a three-quarter turn clockwise. Open the bleeder screw during the depressing of the pedal, and close it before the pedal makes its return. Brake fluid will be freed through the



bleeder tube to expel the air, which will show as bubbles in the fluid coming out of the tube.

- (4) Repeat this operation about ten times, keeping the tube submerged in the fluid. When the air bubbles cease and the stream is a clean, solid mass, close the bleeder screw firmly and remove the tube. Refill the fluid reservoir.
- (5) Repeat steps (2, 3, and 4) on the other wheel.
- (6) When bleeding the hydraulic brake system with the pressure feed filler, connect the hose of the pressure feed filler to the master cylinder filler opening, using the proper size adapter. The filler should be under 10–20 p.s.i. air pressure, and contain sufficient fluid to maintain a constant fluid level in the master cylinder. Bleed the system as in the manual bleeding method, except operation of the brake pedal is not required and it is unnecessary to replenish the brake fluid.

## **52. Air Chamber and Master Cylinder**

*a. Description.* The brake air chamber and master cylinder are integrally mounted on a bracket which is secured to the inside of the ditcher frame. The air chamber converts air pressure into mechanical motion to operate the hydraulic master cylinder. It consists of two disked plates separated by a diaphragm of rubberized fabric. The diaphragm is airtight and divides the chamber into a pressure side and a nonpressure side. Slight variation in air pressure are admitted to the pressure side and transmitted to a pushrod which is attached to the diaphragm and directly connected to the piston of the master cylinder. Displacement of the piston by the pushrod creates hydraulic pressure to apply the brakes. When the pressure is released a spring returns the piston to its former position, and the fluid returns to the master cylinder through a double check valve. The upper part of the master cylinder is a fluid reservoir; it is provided with inlet and by-pass ports through which the master cylinder is constantly replenished with fluid. A ventilating tube assembly attaches to the master cylinder at the top.

### *b. Removal.*

- (1) Release the air pressure in the system by uncoupling the air service line from the towing vehicle.
- (2) Disconnect the tubing between the air filter (11, fig. 19) and the air chamber (13), and disconnect the hydraulic hose connection (9) from the master cylinder (14). Plug this pipe.
- (3) Remove the mounting bolts and lockwashers, and remove the complete air chamber and master cylinder assembly, including the mounting bracket.
- (4) Remove the air chamber and master cylinder from the mounting bracket by removing the nuts and lockwashers from the cylinder studs, and separate the two components.
- (5) Drain the fluid from the master cylinder.



*c. Installation.*

- (1) Assemble the air chamber (13, fig. 19) and master cylinder (14), and fasten them to the mounting bracket (22) with the nuts and lockwashers.
- (2) Install the bracket on the ditcher frame with the mounting bolts.
- (3) Connect the hydraulic hose connection (9) to the master cylinder, refill the master cylinder with hydraulic fluid, and connect the tubing (12) between the air chamber and the air filter (11).
- (4) Couple the air service line (5) to a towing vehicle and check brake operation. Make the leakage test (par. 51*a*), and bleed the brakes (par. 51*b*) as necessary.

### **53. Wheel Cylinder**

*a. General.* The hydraulic brake wheel cylinders (3, fig. 17) are mounted on the brake backing plate between the upper ends of the brakeshoes. The piston rods, which extend from either end of the cylinder, are grooved to mesh with another groove in the brakeshoes. When fluid enters the cylinder through a fitting at the back, it displaces the pistons toward each end of the cylinder, moving the brakeshoes against the brakedrum. The pistons are rubber sealed to prevent loss of fluid.

*b. Cylinder Replacement.* When a leaking or defective wheel cylinder is noticed, replace it with a new or reconditioned one as follows:

- (1) Remove the wheel, hub, and brakedrum (par. 48*a*).
- (2) Remove the hydraulic line at the backing plate and plug the line.
- (3) Remove the hydraulic fitting from the rear of the cylinder.
- (4) Remove one end of the brake return spring.
- (5) Remove the two cap screws and lockwashers attaching the wheel cylinder to the backing plate, and slide the cylinder from the front of the backing plate.
- (6) Position the replacement cylinder between the brakeshoes and secure it with the two attaching cap screws and lockwashers.
- (7) Install the hydraulic fitting and tubing.
- (8) Install the brake return spring.
- (9) Install the wheel, hub, and brakedrum (par. 48*d*).
- (10) Bleed the brakes (par. 51*b*).

### **54. Air and Hydraulic Lines and Hoses**

*a. General* (fig. 19). The lines and hoses on the ditcher include: the service air line (5), which is a rubber hose assembly coupled to the towing vehicle and to a coupling (6) at the air line bracket (23); air tubing (10) from the air service line to the air filter (11); air tubing (12) from the air filter to the air chamber (13); flexible hydraulic hose (20) from



the master cylinder (14) to a hydraulic tee fitting (19); and copper hydraulic brake lines (17); which run to the two wheel cylinders (16). These lines and hoses are not ordinarily removed except for replacement.

*b. Removal (fig. 19).*

(1) *Air service line (5).*

- (a) Remove the connector body (2) from the coupling (6).
- (b) Remove the coupling assembly (1) from the air service line by unscrewing the connector body (2) from the coupling assembly end.
- (c) Disconnect the tubing connector (9) from the end of the terminal bolt (7), and remove the nut (8) and lockwasher (23).
- (d) Withdraw the terminal bolt (7) from the bracket (23), and remove the terminal bolt from the coupling (6).

(2) *Air service line-to-air filter tubing (10).* Disconnect the tubing connector (9) at both ends of the tubing and remove the tubing.

(3) *Air filter-to-air chamber tubing (12).* Disconnect the tubing connectors at both ends of the tubing.

(4) *Flexible hydraulic hose (20).* Disconnect the tubing connector (9) from the adapter in the master cylinder (14); disconnect the tubing connector (9) at the hydraulic tee fitting (19); and remove the hose.

(5) *Hydraulic brake lines (17).*

- (a) Remove the clips (18) attaching the hydraulic lines to the ditcher frame and axle brace.
- (b) Disconnect the tubing connectors (9) at the hydraulic tee fitting (19) and at the wheel cylinders (16), and remove the lines.

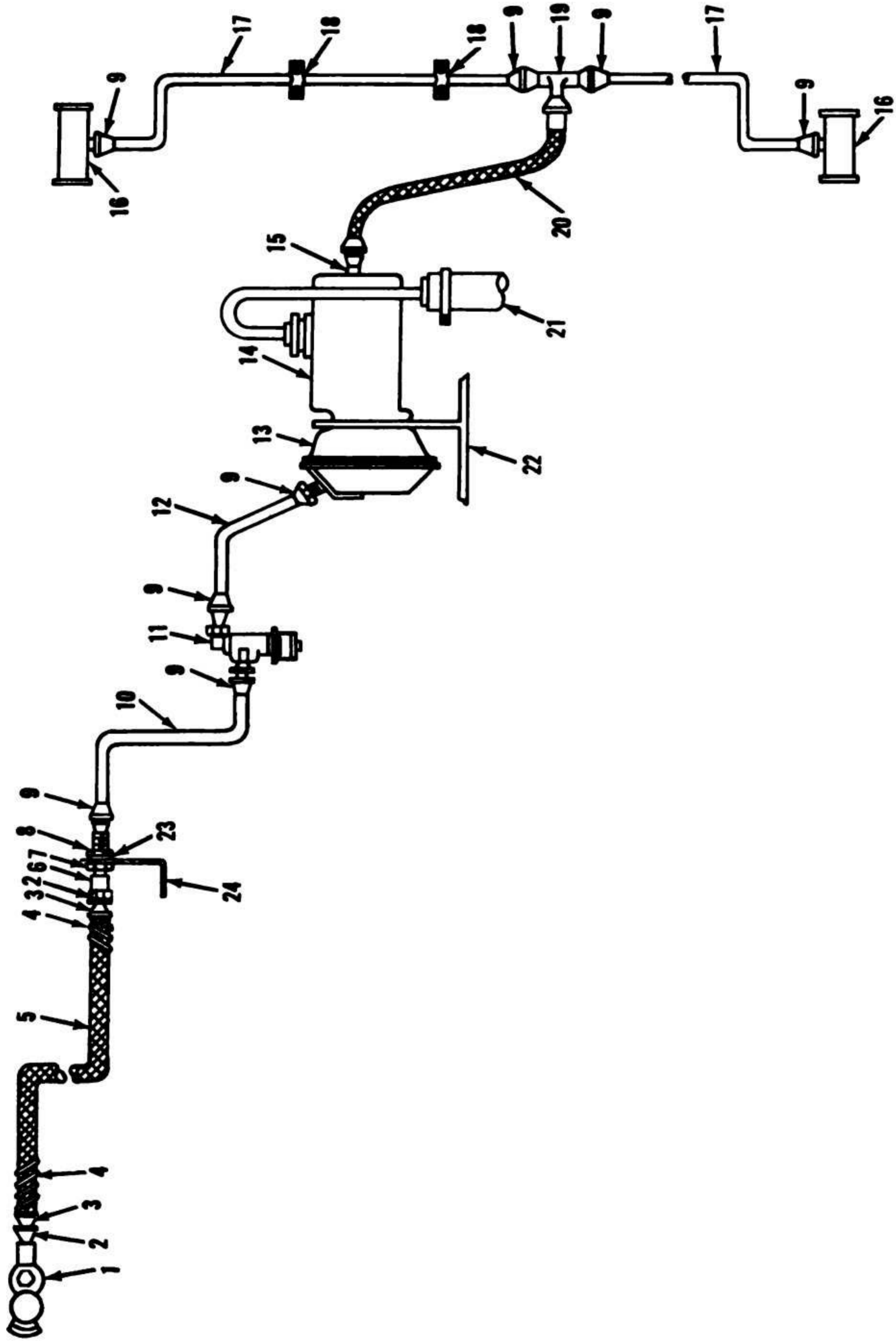
*c. Cleaning, Inspection, and Repair.*

- (1) Clean all components of the air hose, the tubing, and the fittings with cleaning solvent.
- (2) Clean the air hose coupling and all coupling components in cleaning solvent.
- (3) Check all tubing for damage and kinks, and check all fittings and connections for damage or looseness which might cause leaks. Bent, twisted, kinked, or damaged lines must be replaced (see *d* and *e* below).

*d. Replacing Hose Connectors.*

- (1) Cut hose to the desired length, using the hose being replaced as a pattern. Be sure the cut is made at right angles to the outside wall of the hose, and that the end of the hose is smooth.
- (2) Blow out the hose with compressed air to remove all cuttings.
- (3) Position the connector nut and sleeve on the hose, being sure the barbs on the inside of the sleeve point toward the end of the hose.
- (4) Put the end of the hose in the connector body making sure the





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Figure 19. Schematic diagram of air hydraulic service brakes.



1	Coupling assembly	14	Master cylinder
2	Connector body	15	Adapter
3	Connector nut	16	Wheel cylinder
4	Spring guard	17	Hydraulic brake line
5	Air service line	18	Clip
6	Coupling	19	Hydraulic tee fitting
7	Terminal bolt	20	Flexible hydraulic hose
8	Nut	21	Ventilating tube assembly
9	Tubing connector	22	Bracket air chamber and master cylinder
10	Air service line-to-air filter	23	Lockwasher
11	Air filter	24	Bracket, air line
12	Air filter-to-air chamber tubing		
13	Air chamber		



end of the hose is against the bottom of the recess in the connector body.

- (5) Move the sleeve, if necessary, until it is against the edge of the connector body; then tighten the connector nut. Tighten only enough to secure a good airtight joint.

*e. Replacing Tubing Fittings.*

- (1) Use the old tubing as a pattern for the new one.
- (2) Cut tubing with a hacksaw or tubing cutter. Make sure that the end of the tubing is smooth and that it is cut squarely with the outside wall. Make sure that the ends are not crimped or partially closed. Ream or file the ends of the tubing if necessary.
- (3) Blow out tubing with compressed air to remove all cuttings and filings.
- (4) Place nut and sleeve on tubing and put the end of the tubing in the recess in the body. Always use a new sleeve when replacing tubing lines.
- (5) Do not make tubing connections tighter than necessary. It is better to retighten to stop leaks, than to distort tubes and fittings at the initial installation.

*f. Installation (fig. 19).*

- (1) *Hydraulic brake lines (17).*
  - (a) Position the hydraulic lines between the hydraulic tee fitting (19) and the wheel cylinder (16), and connect the tubing connectors (9) at each end.
  - (b) Install the clips (18) attaching the lines to the ditcher frame and axle brace.
- (2) *Flexible hydraulic hose (20).* Connect one end of the hose to the hydraulic tee fitting (19) and the other to the adapter (15) in the master cylinder (14) by connecting the tubing connectors (9) at either end.
- (3) *Air filter-to-air chamber tubing (12).* Position the tubing assembly between the air filter (11) and the air chamber (13), and connect the tubing connectors (9).



- (4) *Air service line-to-air filter tubing (10)*. Position the tubing assembly between the air filter (11) and the air service line terminal bolt (7), and connect the tubing connectors (9).
- (5) *Air service line (5)*.
  - (a) Position the terminal bolt (7) in the bracket (24) with the long end in the bracket and install the lockwasher (23) and nut (8).
  - (b) Connect the tubing connector (9) on the air service line-to-air filter tubing (10) to the terminal bolt.
  - (c) Screw the coupling (6) on the terminal bolt.
  - (d) Connect one connector body (2) to the coupling (6) and connect the other to the coupling assembly (1).

## 55. Air Filter

*a. General.* The purpose of the air filter (fig. 20) is to remove moisture and foreign matter from the air as it passes through it. The filter is fitted with a renewable filter element (2), held in place by a spring (4) and spring seat (3). Collected moisture is drained at the base where a drain plug (7) is fitted. The air filter is attached to the ditcher frame with a U-bolt.

### *b. Removal.*

- (1) Remove the tubing connectors at the air filter for the air service line-to-air filter tubing (10, fig. 19) and the air filter-to-air chamber tubing (12).
- (2) Remove the nuts and lockwashers attaching the U-bolt to the frame member.
- (3) Remove the air filter.

### *c. Disassembly.*

- (1) Fasten the air filter body (1, fig. 20) in a vise; remove the base plug (6) with wrench.
- (2) When the base plug is removed the washer (5), spring (4), spring seat (3), and element (2) may be withdrawn.
- (3) Remove the drain plug (7) from the base plug.

*d. Cleaning.* Clean all parts of filter in cleaning solvent. Dry with compressed air if available.

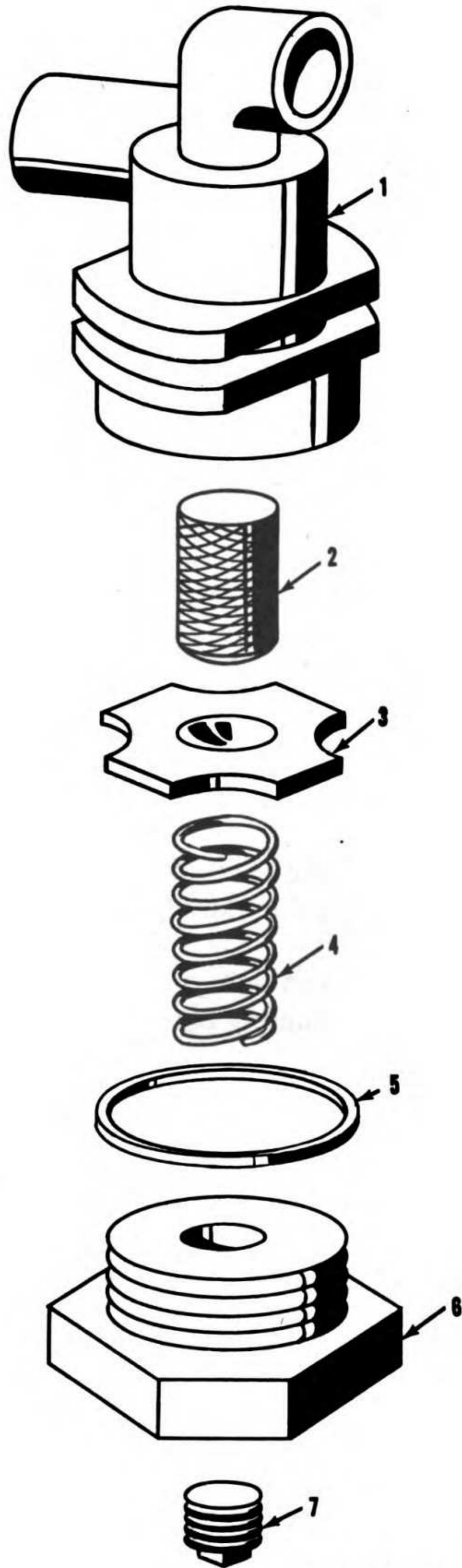
### *e. Inspection and Repair.*

- (1) Check the body and base plug for cracks, worn threads, and damage. Replace either part if excessively worn or damaged.
- (2) Check the spring for proper tension. If the spring is weak, replace with a new spring.
- (3) Check the spring seat for damage and wear. If worn or damaged, replace it.
- (4) If the filter element is damaged or is impregnated with oil or a gummy deposit, replace with a new element.

### *f. Reassembly.*

- (1) Hold the filter body (1, fig. 20) with the open side up and install





- 1 Filter body
- 2 Element
- 3 Spring seat
- 4 Spring
- 5 Washer
- 6 Base plug
- 7 Drain plug

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Figure 20. Air filter, exploded view.



the parts in the following order: element (2), spring seat (3), spring (4), washer (5), and base plug (6).

(2) Install the drain plug (7) in the base plug.

*g. Installation.*

(1) Position the filter on the ditcher frame, and secure it with the attaching U-bolt, lockwashers, and nuts.

(2) Position the tubing in the inlet and outlet ports, and secure the tube connectors.

(3) Check the air connections for leaks.

## **Section IX. HYDRAULIC PUMP AND RAM**

### **56. Description**

The ditcher is provided with a small, hand-operated hydraulic pump (5, fig. 1) mounted on a bracket attached to the rear frame crossmember. The pump supplies hydraulic pressure to a ram (7, fig. 2) mounted between the ditcher plow standard and the axle assembly. The ram provides aid in swivelling the ditcher plow when converting from transport position to plow position. A valve is incorporated in the pump housing to direct the flow of hydraulic oil to and from the ram through a flexible hose assembly (6).

### **57. Hydraulic Pump**

*a. Removal.*

(1) Open the hydraulic valve to release the pressure in the ram.

(2) Disconnect the hydraulic line from the lower end of the hydraulic ram.

(3) Remove the six nuts and bolts attaching the pump mounting flange to the pump mounting bracket.

(4) Remove the pump and hydraulic hose.

*b. Cleaning, Inspection, and Repair.*

(1) Clean the outside of the pump with cleaning solvent. Flush the pump with light diesel oil.

(2) Clean the outside of the air hose, and blow out the inside of the hose.

(3) Operate the pump handle and the valve lever to check the operation of the pump. If defective, replace the pump.

(4) Inspect the pump for leaks around the cover gasket. Replace the gasket if necessary.

(5) Inspect the hose and connections for damage. If the connections are loose-fitting, replace them. Replace the hose if necessary. When replacing the hose and connections, follow the general instructions in paragraph 54d(1).

*c. Installation.*

(1) Position the pump on the pump mounting bracket and secure the pump flange with the six mounting bolts and nuts.



- (2) Connect the hydraulic hose to the power end of the hydraulic ram.

## **58. Hydraulic Ram**

### *a. Removal.*

- (1) Open the hydraulic valve to release the pressure in the ram.
- (2) Remove the hose connection from the lower end of the ram.
- (3) Remove the locking pins and pivot pins attaching each end of the ram to the brackets on the ditcher frame and plow standard.
- (4) Remove the ram.

### *b. Cleaning, Inspection, and Repair.*

- (1) Clean the ram with cleaning solvent, and flush out the interior with light diesel oil.
- (2) Inspect the ram for proper operation, signs of leakage, or damage to the cylinders. If defective, replace.

### *c. Installation.*

- (1) Position the ram between the mounting brackets and attach it with the pivot pins and locking pins provided.
- (2) Connect the hydraulic hose to the lower end of the ram.

## **Section X. MAIN AXLE ASSEMBLY**

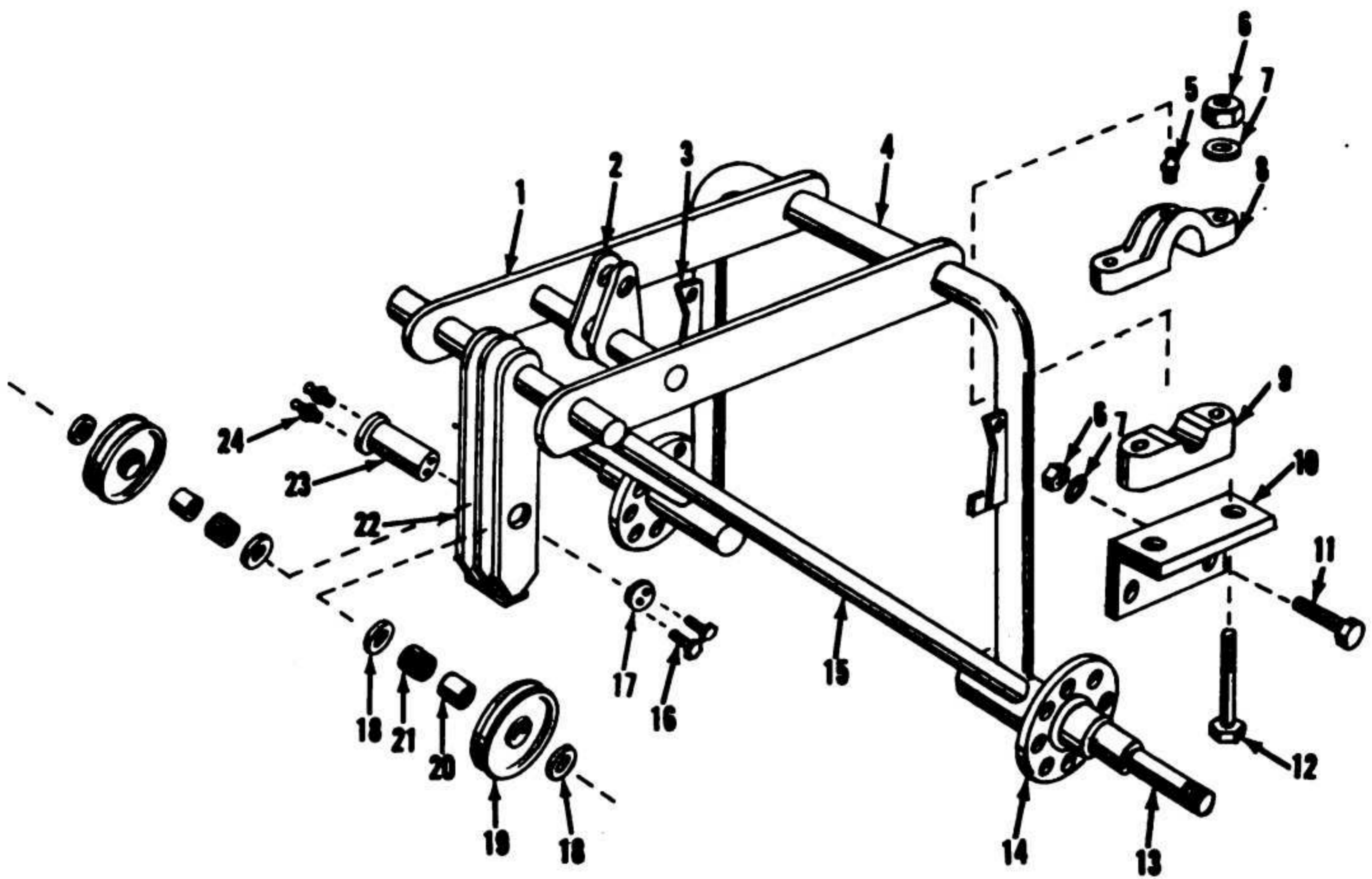
## **59. Description**

The main axle assembly (fig. 21) is a welded fabrication of heavy round bar stock. It consists of an axle shaft (4), two flat braces (1) and two round braces (15), stub axles (13), brake flanges (14), and the upper sheave housing (22). The axle shaft is supported in four large pillow block bearings (9) mounted on brackets (10) to the side and center members of the ditcher frame. The parking hand brake linkage attaches to a bracket (3) on the axle shaft.

## **60. Main Axle Assembly Removal**

- a.* Provide suitable blocking under the ditcher frame.
- b.* Remove the wire rope and upper sheaves (par. 40).
- c.* Remove the wheels, hubs, and brakedrums (par. 48*a*).
- d.* Remove the parking brake linkage (par. 50*a*).
- e.* Remove the hydraulic brake lines (par. 54*b*(5)).
- f.* Disconnect the upper stop bar (2, fig. 2) by removing the pin attaching it to the bracket.
- g.* Remove the four bearing caps (8, fig. 21) by removing the eight nuts (6), washers (7), and bolts (12). Remove the grease fittings (5).
- h.* Remove the main axle assembly, using a chain fall and a small crane.
- i.* Remove the pillow block bearings (9). Remove the bearing mounting brackets (10) by removing the twelve nuts (6), washers (7), and bolts (11).





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- |  |  |
|--|--|
| 1 Flat brace   | 13 Stub axle   |
| 2 Alternate hydraulic ram bracket                        | 14 Brake flange  |
| 3 Parking brake bracket                                  | 15 Round brace   |
| 4 Axle shaft   | 16 Cap screw, $\frac{1}{2}$ in. x $1\frac{1}{2}$ in. (2 rqr) |
| 5 Grease fitting   | 17 Pin lock  |
| 6 Nut, $\frac{3}{4}$ in. (20 rqr)                        | 18 Spacer  |
| 7 Washer, $\frac{3}{4}$ in. (4 rqr)                      | 19 Sheave  |
| 8 Bearing cap  | 20 Inner race  |
| 9 Pillow block bearing                                   | 21 Roller bearing  |
| 10 Bearing mounting bracket                              | 22 Upper sheave housing                                      |
| 11 Bolt, $\frac{3}{4}$ in. x $2\frac{1}{2}$ in. (12 rqr) | 23 Sheave shaft  |
| 12 Bolt, $\frac{3}{4}$ in. x $4\frac{1}{4}$ in. (8 rqr)  | 24 Grease fitting  |

Figure 21. Main axle assembly.

### 61. Main Axle Assembly, Cleaning, Inspection, and Repair

a. Clean the assembly with a rag soaked in cleaning solvent. If necessary, use a stiff brush to remove accumulation of dirt and grease.

b. Clean the pillow block bearings and bearing caps with cleaning solvent, being careful to keep the solvent away from the bearing surfaces. Clean the bearing surfaces with light lubricating oil.

c. Check the welding seams on the main axle assembly for cracks and breaks. If any of the welds show signs of weakness, or cracks, make the necessary repairs, or report the condition to the proper authority.

d. Check the assembly bolts and nuts for worn or stripped threads. Replace if necessary.

e. Check the axle shaft for rough surfaces and excessive wear at the bearing journals. If there are any burrs or rough spots on the shaft, smooth the surface with a fine file. Be sure to clean the smoothed bearing surfaces.



*f.* Check the bearings and caps for wear, scoring, or pitting. Replace as necessary.

## **62. Main Axle Assembly Installation**

*a.* Secure the bearing mounting brackets (10, fig. 21) with twelve bolts (11), washers (7), and nuts (6), and position the pillow block bearings (9) on the mounting brackets.

*b.* Using the same lifting equipment as in removal, position the main axle assembly in the bearings.

*c.* Install the bearing caps (8) using eight bolts (12), washers (7), and nuts (6). Install the grease fittings (5).

*d.* Connect the upper stop bar (2, fig. 2) to the axle assembly bracket with the attaching pin.

*e.* Install the parking brake linkage (par. 50*d*).

*f.* Install the wheels, hubs, and brakedrum (par. 48*d*).

*g.* Install the hydraulic brake lines (par. 54*d*).

*h.* Install the upper sheaves (par. 43), and reeve the control wire rope (par. 7*d*).

*i.* Remove the blocking from the frame.

## **Section XI. FRAME, TOOLBOX, AND HITCH ASSEMBLY**

### **63. Frame and Toolbox**

*a. General.* The frame (16, fig. 1) is constructed of heavy steel side channels angled at both ends to form a boxlike structure with A-shaped ends. Running longitudinally through the center of the frame are two rigid steel beams which are welded at both ends of the frame. The forward end forms the ditcher tongue, and the rear end forms the toolhead for attaching the ditcher plow or the panbreaker. The toolbox is welded to the frame and cannot be removed, nor can the frame be disassembled. The frame is prepared for inspection and service by removing the various ditcher components.

(1) Remove the air filter (par. 55*b*), the air chamber and master cylinder (par. 52*b*), and all connecting lines and hoses (par. 54*b*).

(2) Remove the hydraulic pump (par. 57*a*) and ram (par. 58*a*).

(3) Remove the main axle assembly (par. 60).

(4) Remove the lower sheaves and bracket (par. 40).

(5) Remove the panbreaker from its stowage position on the frame.

*b. Cleaning.* Clean the entire frame with cleaning solvent. Remove corrosion or rust spots down to bright metal with a wire brush and scrapers.

*c. Inspection and Repair.*

(1) Inspect the frame for cracks or weak or cracked welding seams. Weld all cracks or breaks.

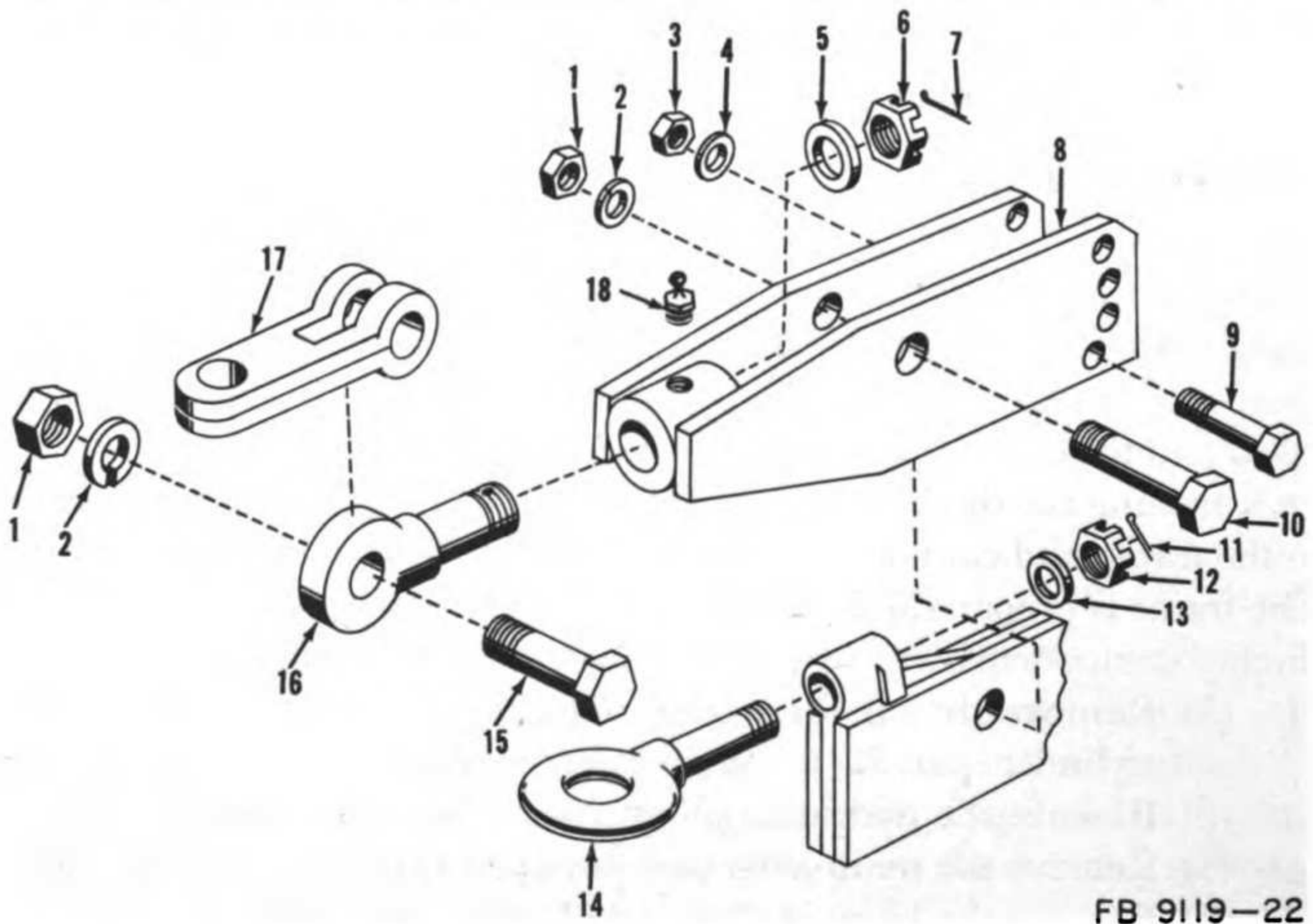
(2) Inspect the frame for bent condition. Straighten a bent frame if possible. If the frame is badly bent, it will be necessary to replace it. Report this condition to the proper authority.



- (3) Paint the entire frame, following the general painting procedures given in TM 9-2851.
- (4) After inspecting the ditcher and making the necessary repairs, reassemble it as follows:
  - (a) Install the main axle assembly (par. 62).
  - (b) Install the hydraulic pump (par. 57c) and ram (par. 58c).
  - (c) Install the lower sheaves and bracket (par. 43).
  - (d) Install the air filter (par. 55g), the air chamber and master cylinder (par. 52d), and all connecting lines and hoses (par. 54f).
  - (e) Stow the panbreaker on the frame.

#### 64. Hitch Assembly

a. *General.* The ditcher is provided with a tractor hitch assembly (fig. 22) which is used in ditching operations. A lunette ring (14) is provided for highway towing, and is attached directly to the ditcher frame. Safety chains are secured to the tongue of the ditcher, and are attached to the towing truck as a safety measure in the event the lunette ring fails.



- |   |                            |    |                       |
|---|----------------------------|----|-----------------------|
| 1 | Nut, 1½ in. (2 rqr)        | 10 | Bolt, 1½ in. x 7½ in. |
| 2 | Lockwasher, 1½ in. (2 rqr) | 11 | Cotter pin            |
| 3 | Nut, 1¼ in.                | 12 | Slotted nut           |
| 4 | Lockwasher, 1¼ in.         | 13 | Washer                |
| 5 | Washer                     | 14 | Lunette ring          |
| 6 | Slotted nut                | 15 | Bolt, 1½ in. x 6 in.  |
| 7 | Cotter pin                 | 16 | Swivel                |
| 8 | Hitch frame                | 17 | Hitch clevis          |
| 9 | Bolt, 1¼ in. x 7 in.       | 18 | Grease fitting        |

Figure 22. Hitch assembly, exploded view.



*b. Removal and Disassembly (fig. 22).*

- (1) Remove the two nuts (1 and 3), lockwashers (2 and 4), and bolts (9 and 10) attaching the hitch frame (8) to the ditcher. Remove the hitch assembly.
- (2) Remove the lunette ring (14) by removing cotter pin (11), nut (12), and washer (13) and withdrawing the ring.
- (3) Remove the hitch clevis (17) by removing nut (1), lockwasher (2), and bolt (15).
- (4) Remove the swivel (16) by removing cotter pin (7), nut (6), and washer (5) and withdrawing the swivel.
- (5) Remove the grease fitting (18).

*c. Cleaning, Inspection, and Repair.*

- (1) Clean the hitch assembly with hose and water, removing clay and caked mud. Clean off grease accumulations with cleaning solvent. When cleaned, wipe with an oily rag.
- (2) Inspect the tow hitches and safety chains for cracks, damage, and excessively worn chain links and bolt threads. Make necessary replacements.
- (3) Inspect the hitch frame, clevis, swivel, and lunette ring for damage or cracks. Weld cracks in the hitch frame if possible. Replace all other cracked or damaged parts.

*d. Reassembly and Installation.*

- (1) Install the swivel (16, fig. 22) in the hitch frame (8), and secure it with the washer (5), nut (6), and cotter pin (7).
- (2) Install the grease fitting (18).
- (3) Install the hitch clevis (17) on the swivel with the bolt (15), lockwasher (2), and nut (1).
- (4) Install the hitch frame on the ditcher frame with the two bolts (9 and 10), lockwasher (2 and 4), and nuts (1 and 3).
- (5) Install the lunette ring (14) on the ditcher frame with the washer (13), nut (12), and cotter pin (11).



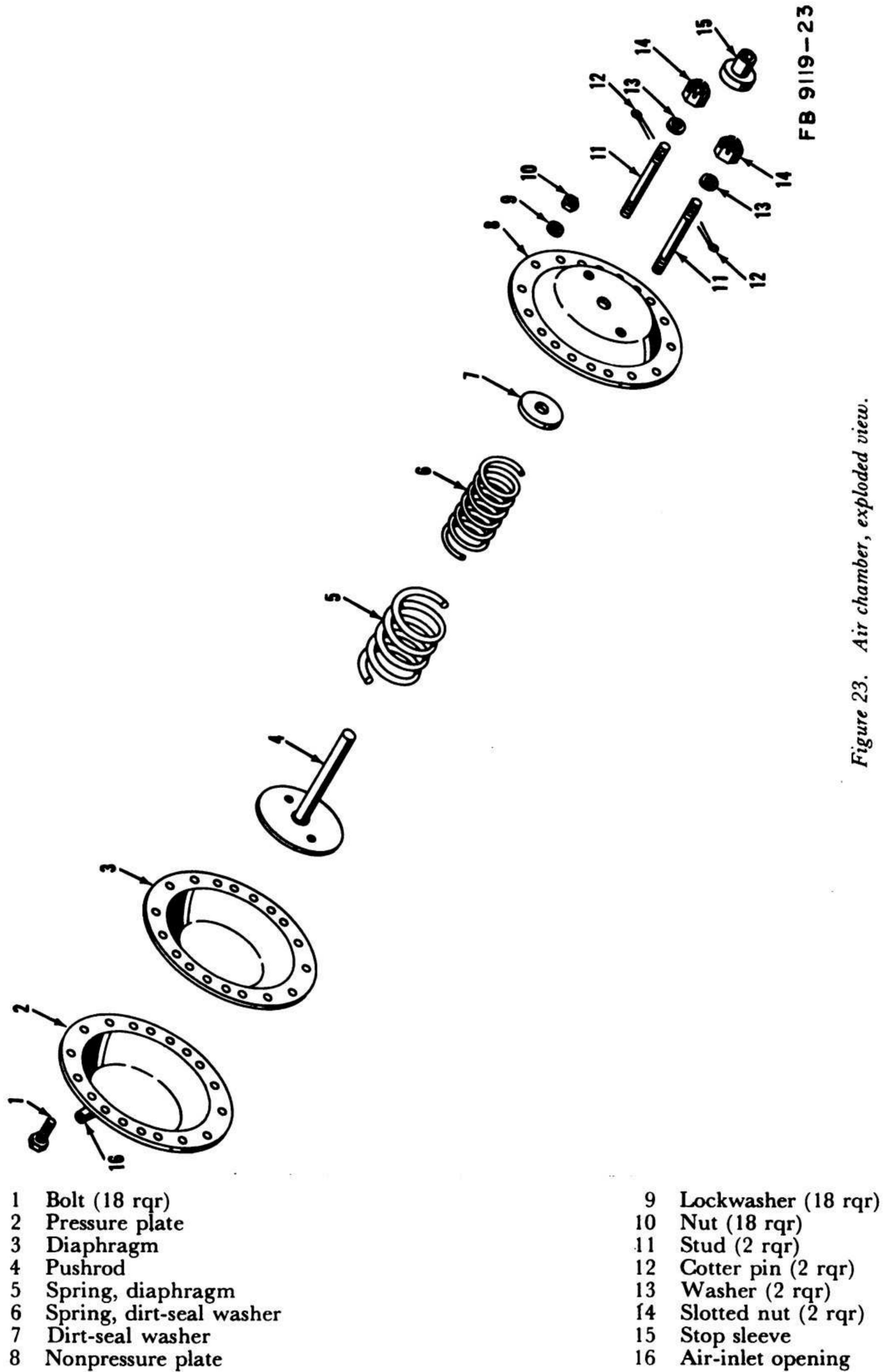


Figure 23. Air chamber, exploded view.

- |                            |                        |
|----------------------------|------------------------|
| 1 Bolt (18 rqr)            | 9 Lockwasher (18 rqr)  |
| 2 Pressure plate           | 10 Nut (18 rqr)        |
| 3 Diaphragm                | 11 Stud (2 rqr)        |
| 4 Pushrod                  | 12 Cotter pin (2 rqr)  |
| 5 Spring, diaphragm        | 13 Washer (2 rqr)      |
| 6 Spring, dirt-seal washer | 14 Slotted nut (2 rqr) |
| 7 Dirt-seal washer         | 15 Stop sleeve         |
| 8 Nonpressure plate        | 16 Air-inlet opening   |



# CHAPTER 4

## FIELD AND DEPOT MAINTENANCE

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### Section I. INTRODUCTION

#### 65. General

Instructions in this chapter are for the use of maintenance personnel responsible for third and higher echelons of maintenance of the John Deere Killefer Ditcher, Model 360. They contain information on maintenance which is beyond the scope of the tools, equipment, or supplies normally available to using organizations.

#### 66. Procedure

The following sections describe the complete disassembly, repair, and reassembly of the components of the service brake system and the hydraulic pump and ram on the ditcher. Before proceeding with the overhaul, check to see that replacement parts are available.

#### 67. Special Tools and Equipment

No special tools or equipment are required for the overhaul of this equipment.

### Section II. AIR CHAMBER

#### 68. Air Chamber Removal and Disassembly

*a. Removal.* Remove the air chamber from the ditcher as instructed in paragraph 52*b*.

*b. Disassembly* (fig. 23).

- (1) Before disassembly mark the relative position of the pressure plate (2) and the nonpressure plate (8) so that the air inlet opening (16) in the pressure plate will be at the correct angle with the mounting bracket when the air chamber is reassembled and installed.
- (2) Remove the stop sleeve (15) from the pushrod (4).
- (3) Remove the 18 nuts (10), lockwashers (9), and bolts (1) which fasten the pressure and nonpressure plate together.
- (4) Disassemble the plates, the dirt-seal washer (7), the seal spring (6), the diaphragm spring (5), the pushrod (4), and the diaphragm (3).
- (5) Remove the studs (11) from the nonpressure plate.



## **69. Air Chamber Cleaning, Inspection, and Repair**

*a. Cleaning.* Clean all metal parts in cleaning solvent. Wipe the diaphragm and dirt-seal washer with a cloth, or wash in soap and water if necessary; dry thoroughly.

*b. Inspection and Repair.*

- (1) Inspect the pushrod for signs of wear and damage; replace as necessary.
- (2) Inspect the studs for signs of wear and for damaged threads. Minor thread damage can be corrected with a standard thread chaser. Loose or bent studs must be replaced.
- (3) Inspect the diaphragm and seal for signs of cracking or deterioration; replace as necessary.
- (4) Replace all defective parts, including standard hardware.

## **70. Air Chamber Reassembly and Installation**

*a. Reassembly (fig. 23).*

- (1) Position the dirt-seal washer (7) in the nonpressure plate (8). Position the pushrod (4) and the springs (5 and 6) in the nonpressure plate. Pull the pushrod through the plate and lock in this position with a pair of vise grip pliers or similar tool, holding against the nonpressure plate.
- (2) Position the diaphragm (3) and pressure plate (2). Be sure that the air-inlet opening (16) in the pressure plate is in proper relation to the mounting bracket as marked before disassembly (par. 68b(1)).
- (3) Install the 18 bolts (1), lockwashers (9), and nuts (10) which hold the diaphragm between the plates. Tighten all bolts evenly and sufficiently to insure an airtight seal between the pressure plate and the diaphragm. Do not distort the diaphragm by overtightening the bolts.
- (4) Install the stop sleeve (15) on the pushrod.

*b. Installation.* Install the air chamber on the ditcher as instructed in paragraph 52c.

## **Section III. MASTER CYLINDER**

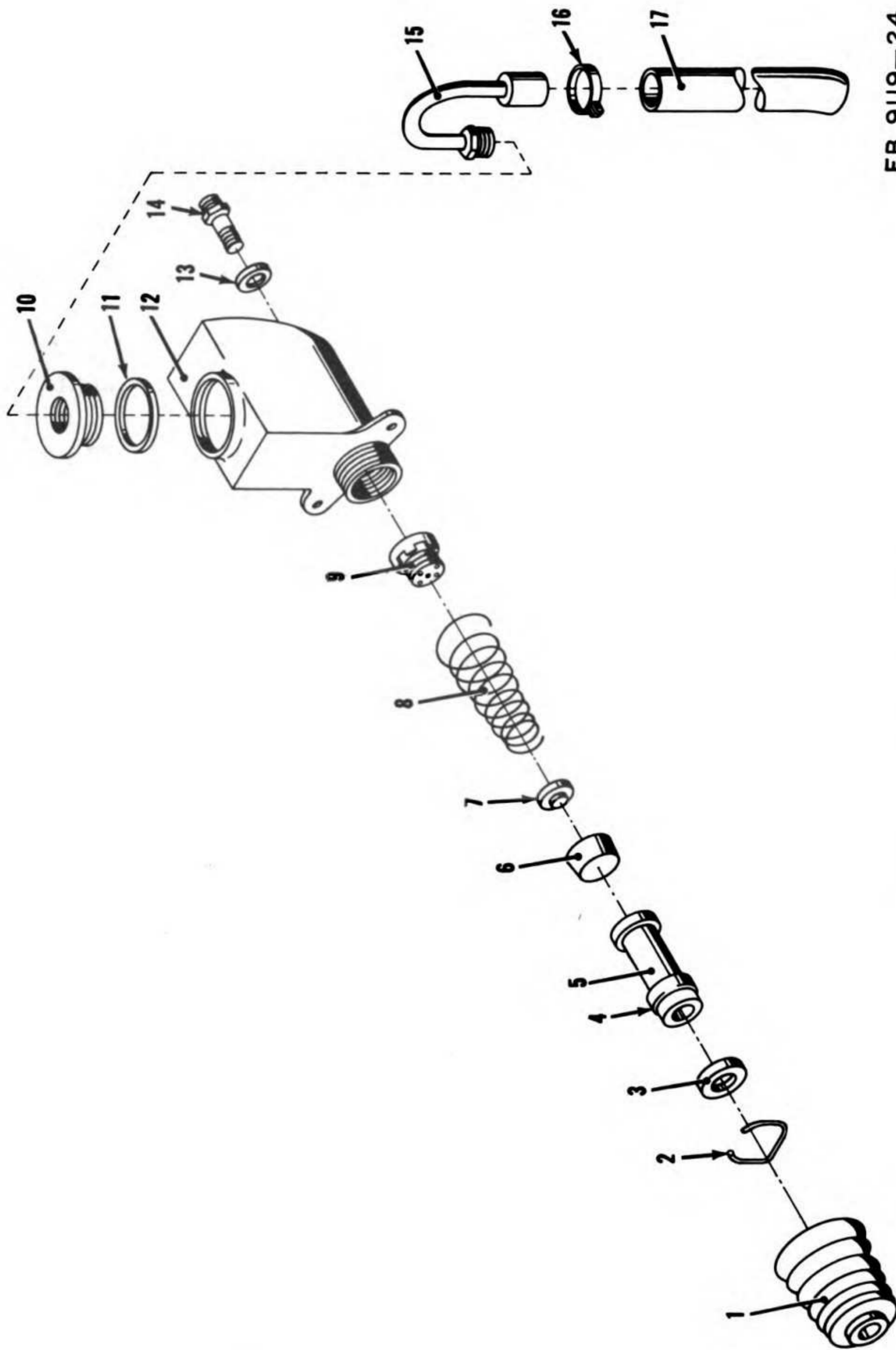
### **71. Master Cylinder Removal and Disassembly**

*a. Removal.* Remove the master cylinder from the ditcher as instructed in paragraph 52b.

*b. Disassembly (fig. 24).*

- (1) Be sure the cylinder and reservoir (12) are drained of all fluid before disassembly.
- (2) Remove the outlet fitting (14) and gasket (13).
- (3) Remove the tube assembly (15) from the adapter fitting (10), and then remove the hose (17) from the tube assembly by loosening the hose clamp (16). Remove the clamp from the hose.





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- 1 Boot
- 2 Locking wire
- 3 Piston stop plate
- 4 Piston secondary cup
- 5 Piston
- 6 Piston primary cup
- 7 Spring retainer
- 8 Spring
- 9 Check valve

- 10 Adapter fitting
- 11 Gasket
- 12 Cylinder and reservoir
- 13 Gasket
- 14 Outlet fitting
- 15 Tube assembly
- 16 Hose clamp
- 17 Hose

Figure 24. Master cylinder, exploded view.



- (4) Remove the adapter fitting (10) and gasket (11).
- (5) Remove the rubber boot (1).
- (6) Remove the locking wire (2) and piston stop plate (3), and remove the piston (5) from the cylinder.
- (7) Remove the piston secondary cup (4) from the piston.
- (8) Remove the piston primary cup (6), spring retainer (7), spring (8), and check valve (9) from the cylinder. Do not attempt to disassemble the check valve; it is an integral unit.
- (9) Discard all rubber parts and gaskets.

## **72. Master Cylinder Cleaning, Inspection, and Repair**

*a. Cleaning.* Wash the cylinder and reservoir and all metal parts in approved cleaning solvent, and dry thoroughly with filtered, compressed air.

*Caution:* The master cylinder must be immaculately clean. The presence of any foreign substance will hinder proper operation and eventually cause failure. Dry-cleaning solvent must not be permitted to come in contact with the rubber parts. Any petroleum base product will cause rubber to expand, become spongy, and deteriorate. Therefore, when cleaning solvent is used to clean metal parts, all traces of the cleaner must be removed.

*b. Inspection and Repair.*

- (1) Inspect the cylinder bore for roughness, scratches, or pitted condition. If necessary, recondition the bore with a hone. The permissible oversize dimension is 0.004 inch. If the cylinder cannot be honed to stay within this limit, replace it.
- (2) Inspect the piston for burs, cracks, or wear. Replace the piston if any of these are noticed.
- (3) Inspect the threaded surfaces for worn or stripped threads. Replace parts as necessary.

## **73. Master Cylinder Reassembly, Test, and Installation**

*a. Reassembly (fig. 24).*

- (1) Replace all rubber parts and gaskets.
- (2) Install a new check valve (9) in the cylinder with the spring toward the open end of the cylinder.
- (3) Install the spring (8) and spring retainer (7) so that the spring retainer faces the open end of the cylinder.
- (4) Install the piston primary cup (6), with the flared end facing the open end of the cylinder.
- (5) Assemble the piston secondary cup (4) on the piston (5), and install the piston, with the piston secondary cup toward the open end of the cylinder.
- (6) Install the piston stop plate (3), locking wire (2), and rubber boot (1).



- (7) Assemble the hose (17) and clamp (16) on the tube assembly (15) and tighten the clamp.
- (8) Install the gasket (11) and adapter fitting (10) in the cylinder and reservoir (12), and install the tube assembly in the adapter fitting.
- (9) Install the gasket (13) and outlet fitting (14).

*b. Leakage Test.* Before the master cylinder is installed, test it to determine whether an adequate seal exists between the piston primary cup and the cylinder wall. If leakage exists, it is caused by inadequate finishing of the cylinder bore, oversize bore, or a defective piston or piston primary cup. Test as follows:

- (1) Fill an open tank or receptacle with brake fluid so that the master cylinder can be completely submerged and observed during the test.
- (2) Connect a compressed air line to the outlet port of the master cylinder to permit the injection of compressed air into the cylinder. Plug all other openings.
- (3) Secure the piston in the on position, and submerge the cylinder in the container of brake fluid.
- (4) Apply compressed air at approximately 100 p. s. i. (pounds per square inch) to the outlet port of the cylinder.
- (5) Carefully observe if any air bubbles leak from the unit. Air bubbles indicate a defective unit requiring further rebuild.
- (6) Remove the master cylinder from the test tank, release the piston from the on position, disconnect the air line from the outlet port, and wipe the coating of brake fluid from the exterior of the unit.

*Caution:* Take care to prevent the entry of dirt or other foreign substance into the cylinder.

*c. Installation.* Install the master cylinder on the ditcher as instructed in paragraph 52c.

## **Section IV. WHEEL CYLINDERS**

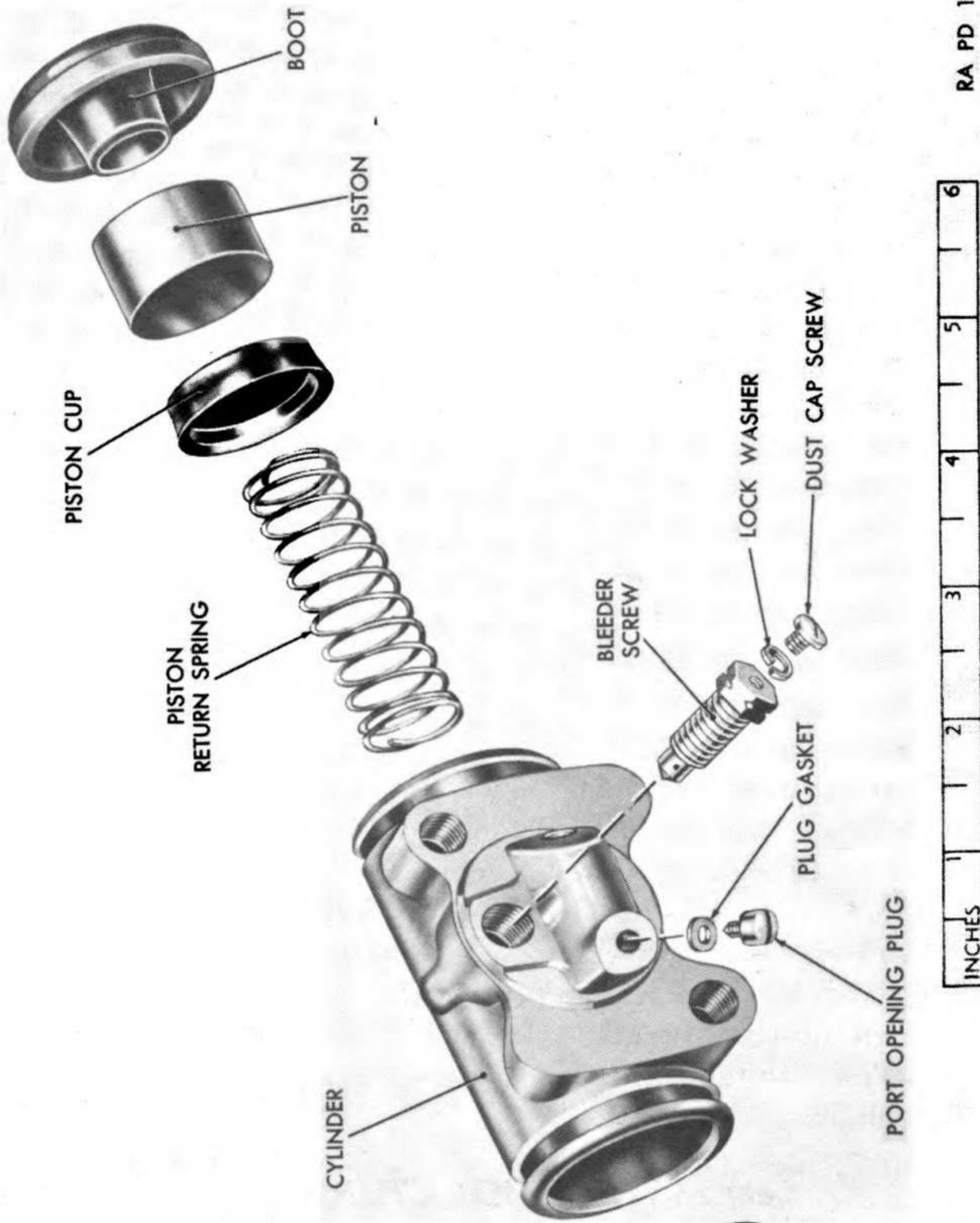
### **74. Wheel Cylinder Removal and Disassembly**

*a. Removal.* Remove the wheel cylinder from the wheel as instructed in paragraph 53b(1) through (4).

*b. Disassembly* (fig. 25).

- (1) Remove the port opening plug and gasket and remove the bleeder screw, lockwasher, and dust cap screw. Drain the fluid from the cylinder.
- (2) Remove the rubber boots from each end of the cylinder by pulling the beads on the boots from the grooves on the cylinder.
- (3) Remove the pistons, piston cups, and return spring from the cylinder.
- (4) Discard the cups and boots.





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Figure 25. Wheel cylinder, exploded view.



## 75. Wheel Cylinder Cleaning, Inspection, and Repair

a. *Cleaning.* Wash all metal parts in cleaning solvent and dry thoroughly with compressed air. (See CAUTION, par. 72a.)

b. *Inspection and Repair.*

- (1) Inspect the cylinder bore for roughness, scratches, or pitted condition. If necessary, recondition the bore with a hone.
- (2) Inspect the piston for burs, cracks, or wear. Replace the pistons if any of these are noticed.
- (3) Inspect the threaded surfaces for worn or stripped threads. Replace parts as necessary.

## 76. Wheel Cylinder Reassembly, Test, and Installation

a. *Reassembly* (fig. 25).

- (1) Dip the cylinder and all the internal brake parts in brake fluid.
- (2) Install one boot on one end of the cylinder and hold the cylinder with the open end up.
- (3) Install one of the pistons by placing it in the cylinder, with the socket end toward the booted end of the cylinder.
- (4) Install the piston cups, with the piston return spring between them, making certain that the lips of the cups face each other.
- (5) Install the other piston and boot.
- (6) Install the bleeder screw, lockwasher, and dust cap screw, and install the port opening plug and gasket.

b. *Leakage Test.* Before the wheel cylinder is installed test it to determine whether an adequate seal exists between the piston and the cylinder walls. If leakage exists it is caused by inadequate finishing of the cylinder bore, oversize bore, or defective piston cups or pistons. Test as follows:

- (1) Fill an open tank or receptacle with brake fluid so that the wheel cylinder can be completely submerged and observed during the test.
- (2) Connect a compressed air line to the inlet port of the wheel cylinder to permit the injection of compressed air into the cylinder. Make certain that the port opening plug and bleeder screw and dust cap are closed.
- (3) Place a clamp across the wheel cylinder.

*Caution:* The clamp must be strong enough to withstand air pressure of 100 p. s. i. Ordinary wheel cylinder clamps are not heavy enough for this purpose.

- (4) Submerge the wheel cylinder in the tank of brake fluid.
- (5) Apply compressed air at 100 p. s. i. to the inlet port of the cylinder.
- (6) Carefully observe if any air bubbles leak from the unit. Air bubbles indicate a defective unit requiring further rebuild.
- (7) Remove the wheel cylinder from the test tank, remove the



clamp, disconnect the air line from the inlet, and wipe the coating of brake fluid from exterior of the unit.

*Caution:* Take care to prevent the entry of dirt or other foreign substance into the cylinder.

*c. Installation.* Install the wheel cylinders as instructed in paragraph 53b(5) through (8).

## **Section V. BRAKE RELINING**

### **77. General**

Each internal brake mechanism (see fig. 17) of the ditcher includes a pair of brakeshoes (9) which are fitted with linings (8); the linings are riveted to the brakeshoes. If periodic inspection shows that the linings are worn unevenly, or are worn down to the rivet heads, replace them as instructed in paragraph 78.

### **78. Relining Brakeshoes**

*a. Brakeshoe Removal.* Remove the brakeshoes by following the removal and disassembly procedure given in paragraph 50a.

*b. Relining.*

- (1) Remove the brakeshoe rivets, and remove the old brake linings.
- (2) Clean the brakeshoes with cleaning solvent, dry thoroughly.
- (3) Check the shoe for out-of-roundness, and prepare shims to be placed under the linings to the extent of the metal removed if the brakeshoe was ground down in operation.
- (4) Install new lining, with shims as necessary, and rivet the lining to one end of the brakeshoe, through the two end holes.
- (5) In order to eliminate air pockets between the lining and the shoe, which might cause uneven contact or squeaky brakes, use a C clamp to force the lining against the entire surface of the shoe.
- (6) Aline the remaining holes in the brakeshoe and lining and rivet lining to the brakeshoe. Remove the lining clamp.

*c. Brakeshoe Installation.* Install the brakeshoes by following the re-assembly and installation instructions given in paragraph 50d.

## **Section VI. HYDRAULIC PUMP**

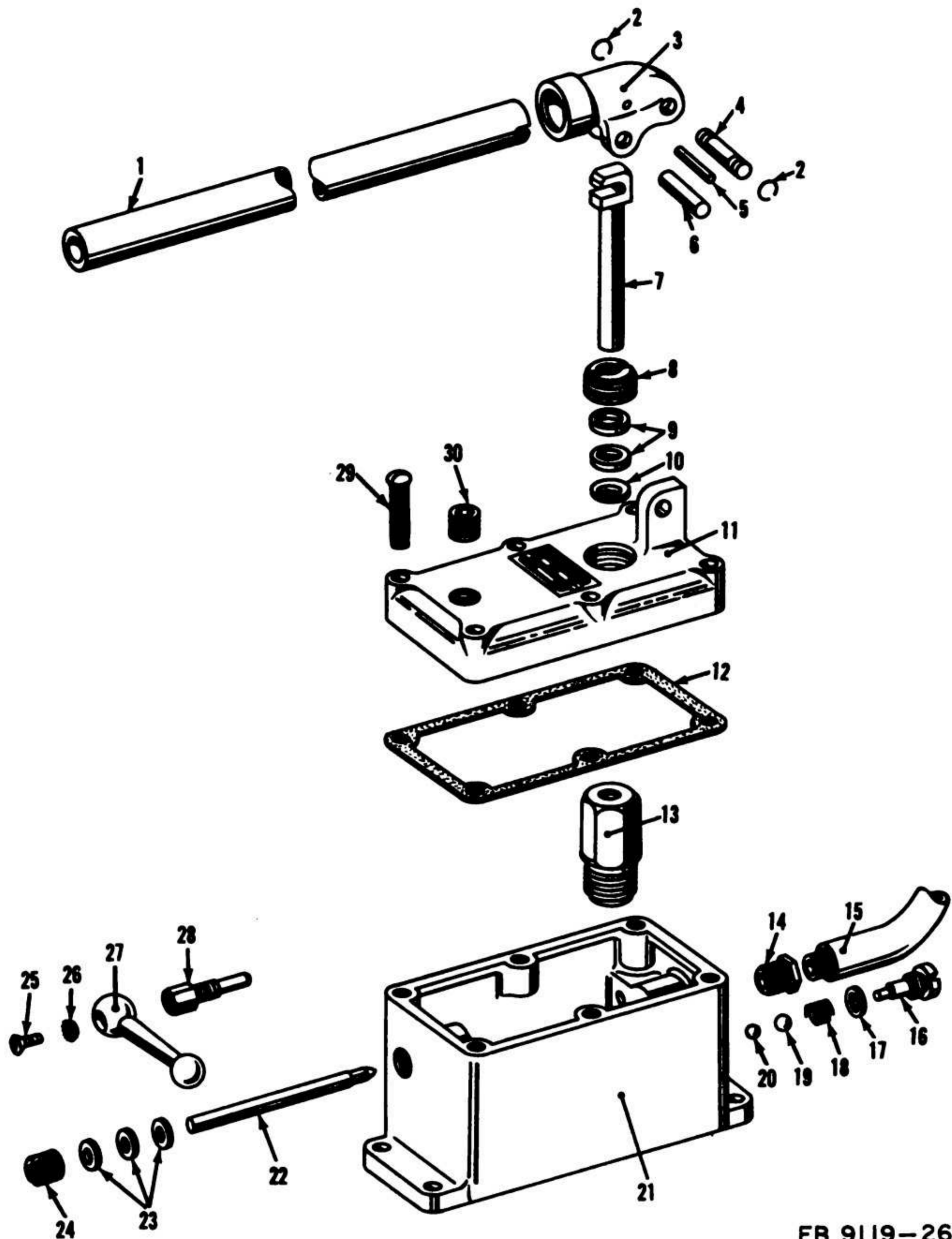
### **79. Pump Removal and Disassembly**

*a. Removal.* Refer to paragraph 57a.

*b. Disassembly* (fig. 26).

- (1) Remove the handle (1) from the beam (3).
- (2) Remove the two retaining rings (2) from the ends of the beam pin (4), and remove the pin.





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- |    |                         |    |                                   |
|----|-------------------------|----|-----------------------------------|
| 1  | Handle                  | 16 | Valve plug spacer                 |
| 2  | Retaining ring (2 rqr)  | 17 | Valve plug gasket                 |
| 3  | Beam                    | 18 | Check ball spring                 |
| 4  | Beam pin                | 19 | Check ball, $\frac{3}{8}$ in. dia |
| 5  | Handle pin              | 20 | Check ball, $\frac{1}{2}$ in. dia |
| 6  | Cross pin, pump plunger | 21 | Pump body                         |
| 7  | Plunger                 | 22 | Release valve spindle             |
| 8  | Packing nut             | 23 | Packing, spindle                  |
| 9  | Packing                 | 24 | Packing nut                       |
| 10 | Packing nut washer      | 25 | Screw                             |
| 11 | Pump cover              | 26 | Lockwasher                        |
| 12 | Cover gasket            | 27 | Release valve handle              |
| 13 | Cylinder                | 28 | Spindle extension                 |
| 14 | Pipe bushing            | 29 | Cover screw (6 rqr)               |
| 15 | Hose assembly           | 30 | Filler plug                       |

Figure 26. Hydraulic pump, exploded view.



- (3) Remove the pump plunger cross pin (6), and remove the beam from the pump cover (11).
- (4) Loosen the packing nut (8), and withdraw the pump plunger (7).
- (5) Remove the cover (11) and gasket (12) by removing the six cover nuts (29). Remove the filler plug (30), packing nut (8), packing (9), and packing nut washer (10) from the cover. Discard the packing.
- (6) Remove the hose assembly (15) from the pipe bushing (14) and the pipe bushing from the pump body.
- (7) Remove the release valve handle (27) by removing the screw (25) and washer (26).
- (8) Remove the release valve spindle extension (28).
- (9) Remove the release valve packing nut (24), packing (23), and spindle (22). Discard the packing.
- (10) Remove the valve plug spacer (16), and withdraw the valve plug gasket (17), check ball spring (18), and check balls (19 and 20).
- (11) Unscrew the pump cylinder (13) from the pump body (21).

## **80. Pump Cleaning, Inspection, and Repair**

*a. Cleaning.* Clean all parts in cleaning solvent. Make sure that all openings are clear and that no gummy deposits remain on any of the parts.

### *b. Inspection and Repair.*

- (1) Inspect the handle and beam for cracks or breaks; repair, or replace if necessary. Inspect the pins and retaining rings for wear; replace as necessary.
- (2) Inspect the fit of the plunger in the cylinder. Check the plunger and cylinder surfaces. If any defects are noticed, replace both the cylinder and plunger. Inspect the packing nut and washer; replace as necessary.
- (3) Check the fit of the spindle tip in the valve seat in the body. If not seating properly, replace the spindle. Check the spindle extension, lever, and packing nut for damage; replace as necessary.
- (4) Check the valve balls for flat or pitted surfaces; replace as necessary. Check the spring and gasket; replace if damaged or worn.
- (5) Inspect the body and cover for cracks; repair if possible, or replace. Check the body for worn, scored, or pitted valve seats. Repair scored or slightly pitted surfaces with fine emery cloth; if necessary replace the body.
- (6) Check all hardware and threads for wear and damage. Repair damaged threads if possible, or replace the affected part.



## 81. Pump Reassembly and Installation

### a. Reassembly (fig. 26).

- (1) Screw the pump cylinder (13) into the pump body (21).
- (2) Position the check balls (20 and 19), spring (18), and gasket (17) in the body, and install the valve plug spacer (16).
- (3) Install the spindle (22) and packing (23); secure the packing with the packing nut (24).
- (4) Install the spindle extension (28), position the release valve lever (27), and secure the lever with the lockwasher (26) and screw (25).
- (5) Screw the pipe bushing (14) into the body, and screw the hose assembly (15) into the bushing.
- (6) Position the gasket (12) and cover (11) on the body, and secure them with the six cover screws (29).
- (7) Fit the packing nut washer (10) and packing (9) into the body, and loosely screw in the packing nut. Install the plunger (7), and then tighten the packing nut.
- (8) Position the beam (3) and secure it to the plunger with the plunger pin (6), and to the cover with the beam pin (4); secure the pin with the two retaining rings (2).
- (9) Install the handle (1).

b. *Installation.* Install the pump on the ditcher as instructed in paragraph 57c. Fill the pump with hydraulic oil as instructed in LO 5-9119, and install the filler plug (30).

## Section VII. HYDRAULIC RAM

## 82. Ram Removal and Disassembly

### a. Removal. Refer to paragraph 58a.

### b. Disassembly (fig. 27).

- (1) Pry the grommet (1) from the cylinder (11), and remove the backup spring (2) and plunger wiper (3).
- (2) Unscrew the gland stop ring (4) from the cylinder, and pull the plunger (5) from the cylinder.
- (3) Remove the nut (10) from the plunger, and then disassemble the spreader (9), plunger cup (8), and disk (6).
- (4) Remove the O-ring (7) from inside the disk.
- (5) Discard the grommet, plunger wiper, O-ring, and plunger cup.

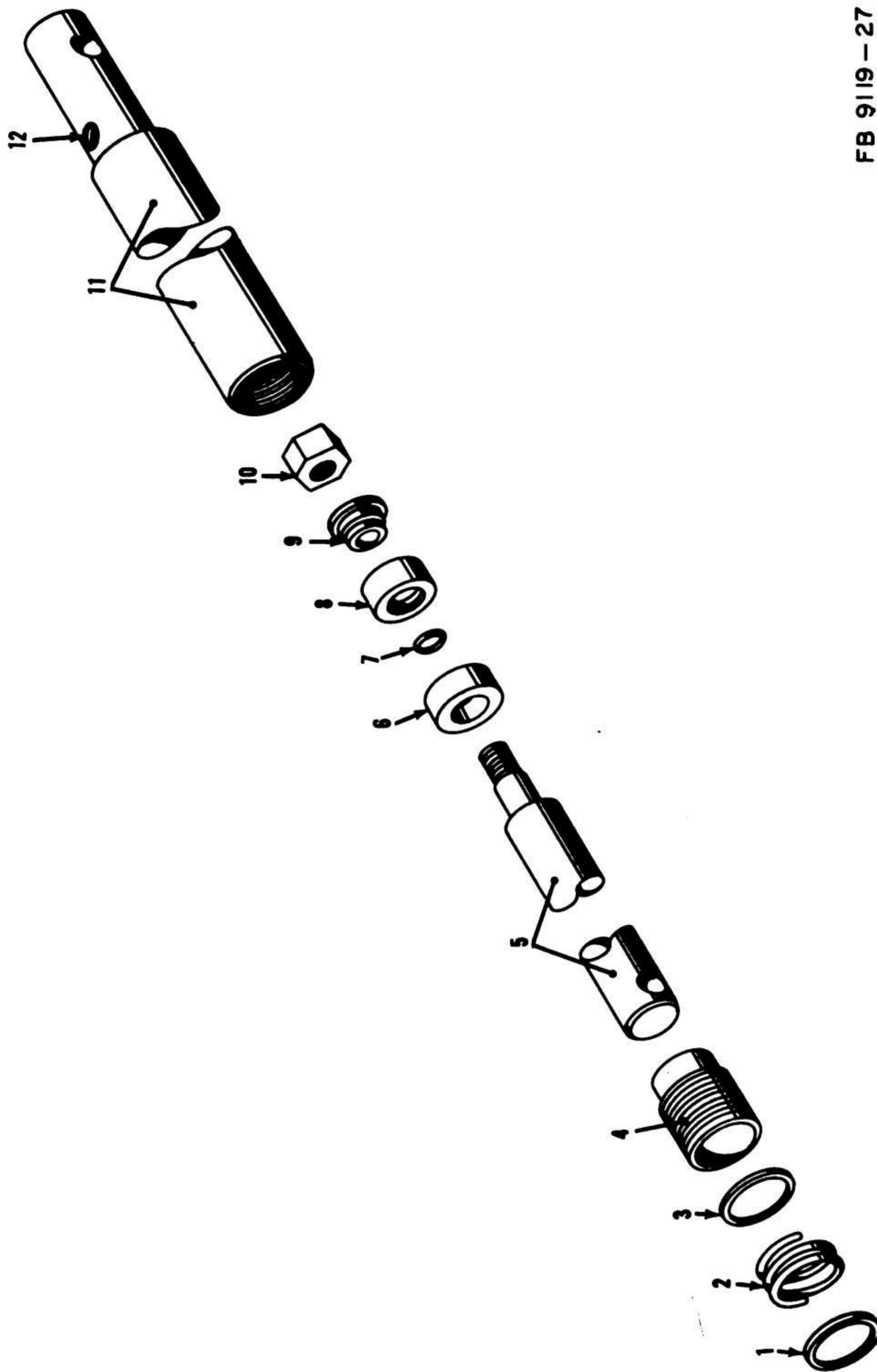
## 83. Ram Cleaning, Inspection, and Repair

a. Clean all parts in cleaning solvent; dry with compressed air. If air is not available, use a clean, lint-free cloth.

### b. Inspection and Repair.

- (1) Inspect the plunger for scored or pitted surface, and for bent or out-of-round condition. Remove scoring and pitting with fine





- 1 Grommet
- 2 Backup spring
- 3 Plunger wiper
- 4 Gland stop ring
- 5 Plunger
- 6 Disk

- 7 O-ring
- 8 Plunger cup
- 9 Spreader
- 10 Nut, 5/18-18 NF
- 11 Cylinder
- 12 Oil inlet

Figure 27. Hydraulic ram. exploded view.



emery cloth. Straighten a bent plunger if possible. Inspect the threads for damage or wear; repair if possible. Replace the plunger if necessary.

- (2) Inspect the cylinder for cracks, dents, or other damage; repair if possible. Inspect the threads of the cylinder and gland stop ring; if damaged, repair. If the cylinder cannot be repaired, replace it.

#### **84. Ram Reassembly and Installation**

*a. Reassembly (fig. 27).*

- (1) Fit the O-ring (7) inside the disk (6), and install the disk on the plunger (5).
- (2) Assemble the plunger cup (8) and spreader (9) on the plunger, and secure with the plunger packing nut (10).
- (3) Slip the plunger part of the way into the cylinder (11), slide the gland stop ring (4) over the plunger, and screw the gland stop ring into the cylinder.
- (4) Slide the plunger wiper (3) and spring (2) over the plunger and into the cylinder; secure with the grommet (1).

*b. Installation. Refer to paragraph 58c.*



## CHAPTER 5

# SHIPMENT, LIMITED STORAGE, AND DEMOLITION TO PREVENT ENEMY USE

---

### Section I. SHIPMENT AND LIMITED STORAGE

#### 85. Limited Storage

- a. Inspection and Maintenance Before Placing in Storage.*
- (1) *Inspection.* Make a complete inspection of the ditcher as described in paragraph 28.
  - (2) *Cleaning and painting.* Clean all of the outside surfaces of the ditcher that can be reached without disassembly. Remove all rust or other forms of corrosion. Paint all surfaces where the paint film has been damaged. Refer to paragraph 24 for painting instructions.
  - (3) *Lubrication.* Lubricate the ditcher as directed in LO 5-9119.
  - (4) *Protection.* Store the ditcher within an enclosure if possible; otherwise, protect the ditcher by covering it with a tarpaulin or other suitable cover.
- b. Scheduled Preventive Maintenance While the Equipment Is in Storage.*
- (1) *Inspection.* Every ten days, while the equipment is in storage, check for evidence of damage such as rust or corrosion, accumulation of water, and pilferage.
  - (2) *Maintenance.* Perform any reasonable or necessary maintenance on the ditcher to prevent further deterioration of the equipment.
- c. Inspection.* Perform an inspection of the equipment every 30 days, as outlined in paragraph 28.

#### 86. Domestic Shipment

Before shipping the ditcher in domestic service perform the procedures which prepare it for limited storage (par. 85), and movement to a new location (par. 17).

*a. Shipment by Carrier.* The ditcher can be transported by flatcar or trailer truck. In either case, the ditcher is loaded and unloaded by crane or ramp (par. 7), and must be blocked and tied down to the carrier bed during shipment.

*b. Shipment by Towing.* The ditcher is equipped with pneumatic tires and a special tow hitch, and can be towed from shipping point to destination by truck or other towing vehicle. Safe speed may be as high as 50 miles per hour over class A highways.



## Section II. DEMOLITION OF DITCHER TO PREVENT ENEMY USE

### 87. General

When capture or abandonment of the ditcher 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 ditchers and all corresponding repair parts.

### 88. 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.

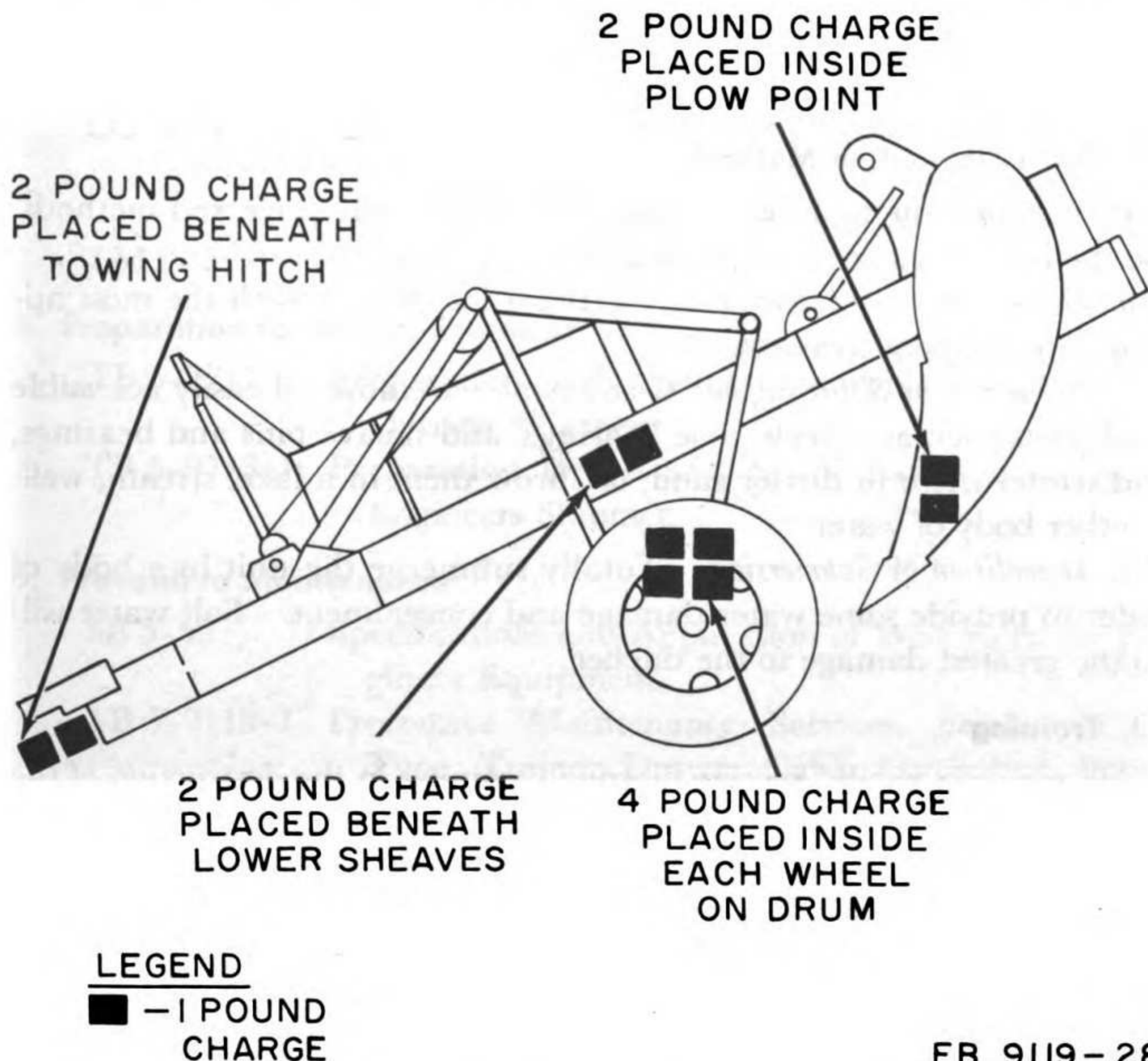


Figure 28. Placement of charges.



a. *Demolition by Explosives* (fig. 28). Place as many of the following charges as the situation permits and detonate them simultaneously with detonating cord and a suitable detonator.

- (1) Place a 4-pound charge on both wheel axles, between the wheel and the axle shaft.
- (2) Place a 2-pound charge on the hitch assembly.

*Note.* The above charges are the minimum requirements for this method.

- (3) Place a 2-pound charge on the lower sheaves.
- (4) Place a 2-pound charge between the plow moldboards.

b. *Demolition by Mechanical Means.* Use sledge hammers, crowbars, picks, axes, or any other heavy tools which may be available, together with tools normally included with the ditcher, to destroy the following:

- (1) Tires, wheels, hubs, and brakedrums.
- (2) Control wire rope and sheaves.

*Note.* The above steps are the minimum requirements for this method.

- (3) Ditcher plow and plow share.
- (4) Towing hitch assembly.
- (5) Panbreaker.
- (6) Hydraulic pump and ram air-hydraulic brake components.

## 89. Other Demolition Methods

If the situation prohibits employing either of the preferred methods, use the following, either singly or in combination.

a. *Demolition by Weapons Fire.* Fire on the ditcher with the most appropriate weapons available.

b. *Demolition by Scattering and Concealment.* Remove all easily accessible vital parts such as wheels, axle bearings, and sheave pins and bearings, and scatter them in dirt or sand, or throw them in a lake, stream, well, or other body of water.

c. *Demolition by Submersion.* Totally submerge the unit in a body of water to provide some water damage and concealment. Salt water will do the greatest damage to the ditcher.

## 90. Training

All operators should receive thorough training in the destruction of the ditcher. Refer to FM 5-25. Simulated destruction, using all 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 instruction without reference to this or any other manual.



# APPENDIX I

## REFERENCES

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### 1. Accessory Equipment

TM 5-3040 Tractor, Crawler-Type, Diesel-Driven, 28,100 to 38,000 Lbs. Drawbar-Pull, Standard Caterpillar D-8, 78-In. Gage (Tractor Serial Numbers 1H5729 to 1H9999 and 8R1 and Up) . . Operation and Maintenance Instructions.

### 2. Dictionaries of Terms and Abbreviations

SR 320-5-1 Dictionary of United States Army Terms.  
SR 320-50-1 Authorized Abbreviations.

### 3. Lubrication and Painting

LO 5-9119 Ditcher, Plow Type, Tractor Drawn, Cable Controlled, Pneumatic Tired, 8-12 Inch Bottom, 24 Inch Depth, John Deere Killefer Model 360.  
TM 9-2851 Painting Instructions for Field Use.

### 4. Preparation for Export Shipment

TB 5-9711-1 Preparation of Corps of Engineers Equipment for Oversea Shipment.  
TB 5-9713-1 Preparation for Export, Spare Parts for Corps of Engineers Shipment.

### 5. Preventive Maintenance

SB 5-59 Specifications and Application of Wire Rope for Engineer Equipment.  
TB 5-9119-1 Preventive Maintenance Services, Ditcher, Plow Type, Tractor Drawn, Cable Controlled, Pneumatic Tired, 8-12 Inch Bottom, 24 Inch Depth, John Deere Killefer Model 360.  
TM 5-505 Maintenance of Engineer Equipment.

### 6. Publication Indexes

DA Pam 108-1 Index of Army Motion Pictures, Television Recordings, and Filmstrips.  
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 310-25 Index of Supply Manuals—Corps of Engineers.

## **7. Supply Manuals**

ENG 1 Introduction.

ENG 3-41 Hand Tools.

ENG 5-41 Hand Tools.

## **8. Training Aids**

DA Pam 310-5 Index of Graphic Training Aids and Devices.

## **9. Demolition**

FM 5-25 Demolition and Explosives.



## APPENDIX II

### TOOL SET

The tools listed herein are those required to perform the operator maintenance services on the John Deere Killefer Model 360 ditcher. To insure that a surplus of tools is not supplied and the proper accounting is maintained, the tool set will be requisitioned as a separate item.

Quantity	Nomenclature	Engineer stock No.
1	Plier, slip joint, 6-in.....	41-5976. 300. 060
1	Wrench, adjustable, crescent, 12 in.....	41-9587. 500. 400
1	Wrench, wheel, 1½ hex opening by 13/16 sq opening by 147/8 in. long.	41-9702. 105. 150



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For explanation of abbreviations used, see SR 320-50-1.



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