NO. 1996

HANDBOOK OF THE

5-TON ARTILLERY TRACTOR

MODEL 1917

WITH INSTRUCTIONS FOR ITS CARE,
OPERATION AND MAINTENANCE

(ONE HUNDRED THIRTY-THREE PLATES)

JULY 15, 1918

WAR DEPARTMENT,
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This manual is published for the information and government of the Regular Army, National Guard, National Army and Reserve Corps of the United States.

By order of the Secretary of War:

C. C. WILLIAMS
***Maj. Gen., Chief** of Ordnance, U. S. A.*

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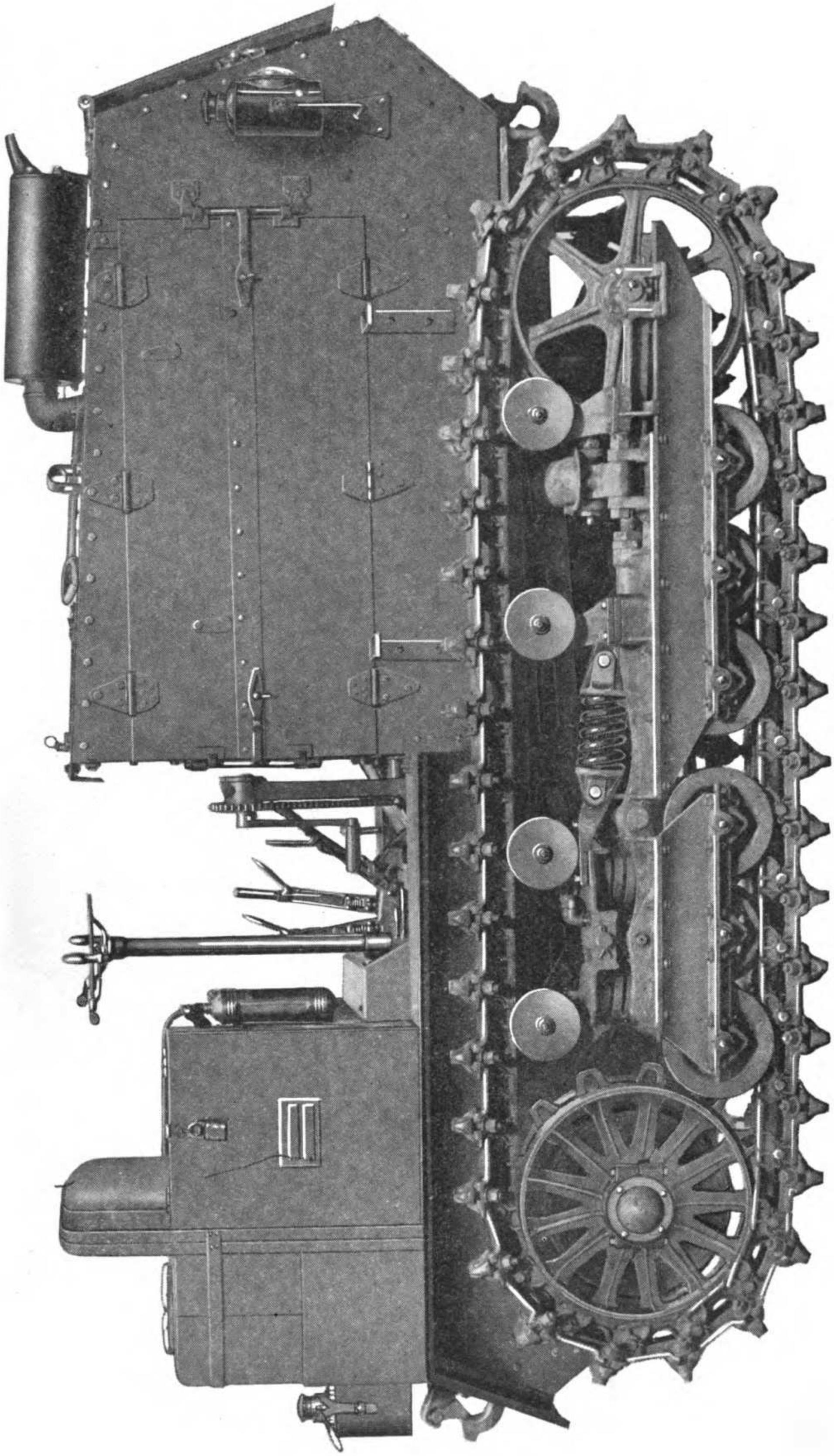


5-TON ARTILLERY TRACTOR—MODEL 1917

HANDBOOK OF ARTILLERY TRACTOR 5-TON MODEL 1917

CHAPTER I

TABLE OF WEIGHTS, DIMENSIONS, OUTLINE SPECIFICATIONS, ETC.

Overall Length (armored)	inches	133.5 (133½)
Overall Width	do.	63
Height (armored, to top of muffler)	do.	72.5 (72½)
Length of Ground Contact	do.	91
Ground Clearance	do.	11
Weight (complete, with full equipment)	pounds	9200
Ground Pressure (9 and 11 inch treads)	pounds per inch	5.6—4.5
Weight of Each Track	pounds	545
Weight of Each Track Shoe (9 inch)	do.	12
Width of Track Shoes	inches	9—11
Tread of Tracks (center to center of tracks)	do.	48.875 (48⅞)
Diameter of Turning Circle (overall clearance)	do.	176
Engine, Number of Cylinders		4
Bore	do.	4.75 (4¾)
Stroke	do.	6
Horsepower at 1200 Revolutions per Minute		56
Oil Reservoir Capacity	U. S. Gallons	3.25 (3¼)

Road Speed. Gear Used.	Miles per Hour
Low Speed at 1200 Revolutions per minute of engine	1.94
Direct Speed at 1200 do. do.	3.92
High Speed at 1200 do. do.	7.37
Rev. Speed at 1200 do. do.	1.41

Capacity of Main Gasoline Tanks (two) Combined	U. S. gallons	24
Capacity of Auxiliary Tank under Armor	do.	10
Capacity of Transmission Case	do.	3
Capacity of Track Oiler Tank	do.	2.5 (2½)

BRIEF DESCRIPTION OF THE 5-TON ARTILLERY TRACTOR MODEL 1917

The 5-Ton Artillery Tractor Model 1917 is a self-propelled road vehicle of the "track laying" type; that is, the power is transmitted to the ground through a flexible endless chain which acts as a track and is composed of steel links and shoes cast integral and connected by hardened steel pins. The advantage of this type of tractor as compared with the usual type of wheel tractor or truck, is its ability, due to very low unit ground pressure, to negotiate very soft and uneven

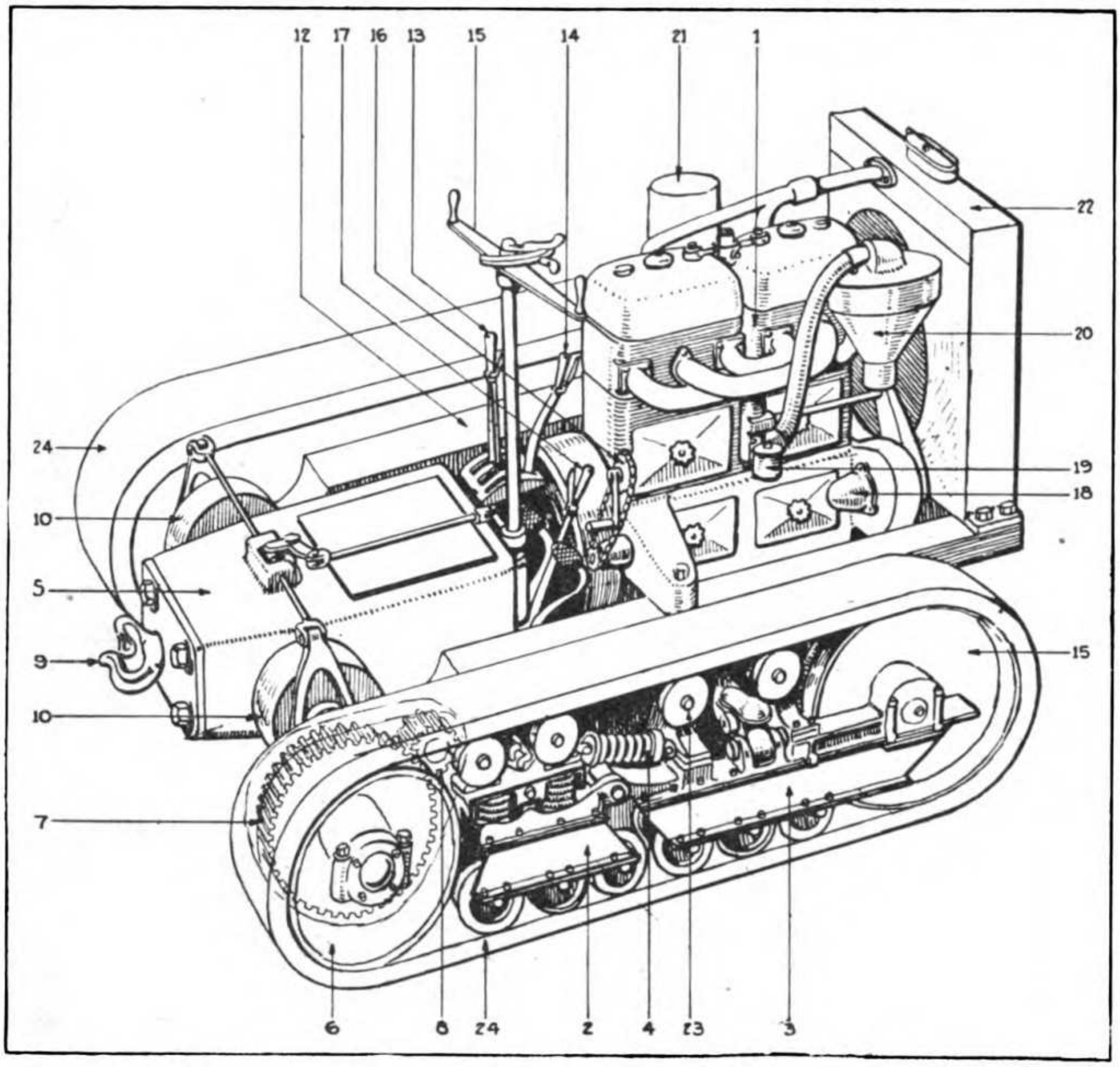


PLATE 2—DIAGRAM OF TRACTOR MAJOR ASSEMBLIES

Ref. No.	Name
1	Engine.
2	Rear roller frame.
3	Front roller frame.
4	Spring radius rod.
5	Transmission unit.
6	Track drive sprocket.
7	Drive sprocket gear (encased).
8	Intermediate shaft drive pinion.
9	Rear pintle.
10–10	Steering clutches and brakes.
12	Main frame.
13	Change gear lever.
14	Clutch lever.
15	Steering handles.
16	Hand starter.
17	Brake lever.
18	Governor housing.
19	Carbureter.
20	Air cleaner.
21	Vacuum tank.
22	Radiator.
23	Track supporting roller.
24–24	Tracks.

surfaces, impassable to the usual type of self-propelled vehicle except under the most extreme difficulties.

The general design and construction of the 5-Ton Tractor does not differ materially from that of the modern truck except in the method of transmitting the power from the transmission unit to the ground. It is used entirely as a power vehicle to be employed in the motorization of Guns and other Ordnance equipment heretofore drawn by other means.

ENGINE—Four cylinder, four cycle, valve-in-the-head type. Bore 4.75 (4¾) inches. Stroke 6 inches. Cylinders cast in pairs. Horse Power 56 at 1200 Revolutions per minute.

RADIATOR—Honeycomb-Tubular type. Eight separate headers.

IGNITION—Eisemann Model G-4 high tension Magneto with Automatic Impulse Starter.

CARBURETER—Model A Schebler carbureter with Stewart Vacuum Feed System. 1.5 (1½) inch.

GOVERNOR—Centrifugal flyball type mounted on special shaft and driven off Camshaft Gear.

MASTER CLUTCH—Dry Plate Multiple Disc Type.

TRANSMISSION—Selective sliding gear type. Three speeds forward, one reverse. Direct drive on second. Stepped up on high.

DRIVE—From Transmission through Bevel Gears to Steering Clutch Shaft through Steering Clutches to spur pinions, which mesh with intermediate spur gears, thence through outside gears, encased, to Sprocket Drive Sleeve and Drive Sprockets.

STEERING CLUTCHES—Two used of Dry Plate Multiple Disc type.

STEERING—By means of Steering Clutches operated from hand Steering Device and brake bands operated by foot pedals, which act on outside of Steering Clutch Drums.

CONTROL—Steering Gear located on right hand side. Change gear, Master Clutch Operating Lever, and Brake Lever, left of Steering Gear, left to right respectively. Spark and Throttle Levers operate on sector clamped to steering column. Steering Clutch Pedals right and left at bottom of, and in front of Steering Column.

BRAKES—One set. External contracting type. Raybestos or equal lined. Operate on steering clutch housings.

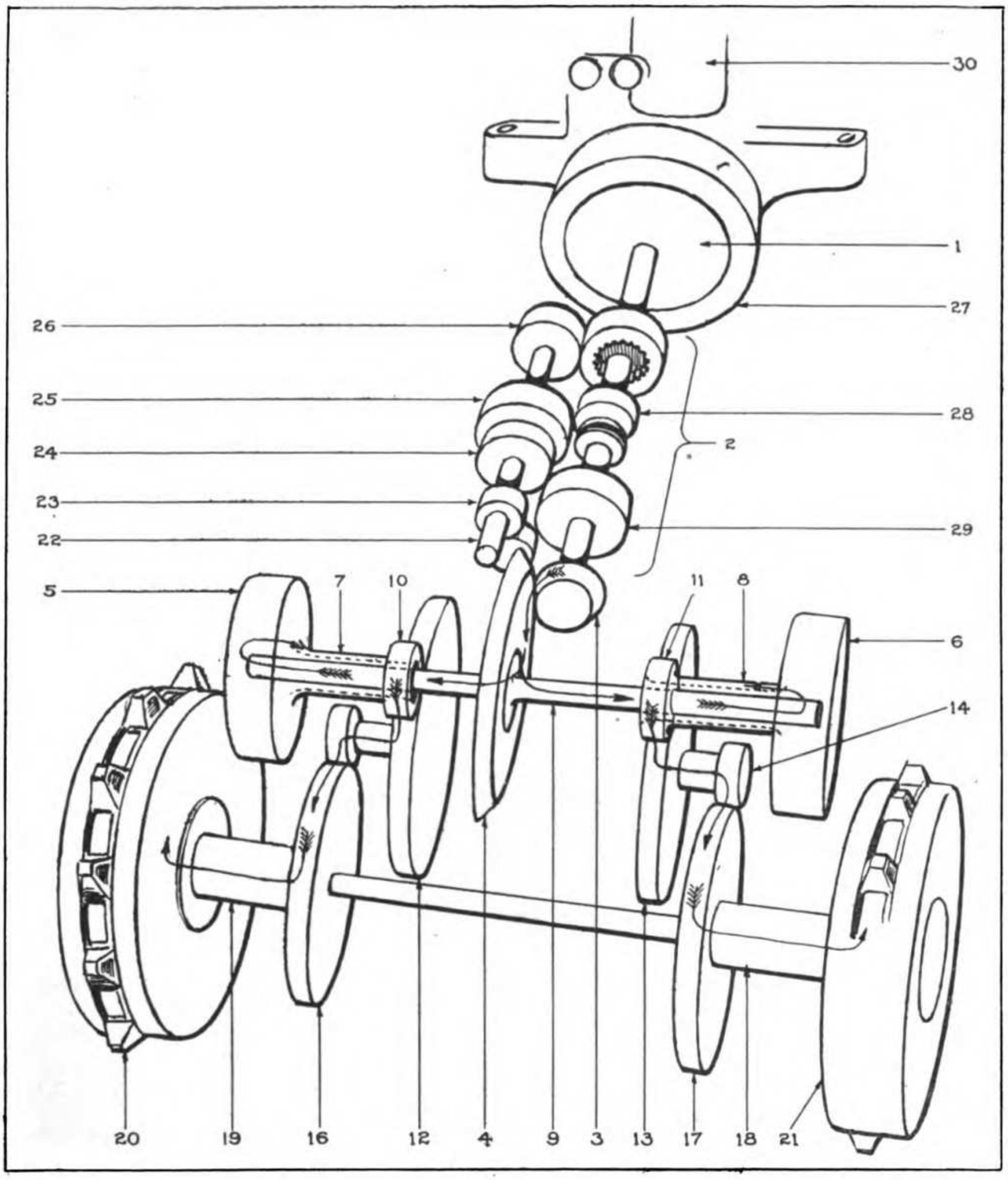


PLATE 3—DIAGRAM OF POWER TRANSMISSION SYSTEM

Ref. No.	Name	Ref. No.	Name
1	Master clutch in engine flywheel.	20–21	Track sprocket.
2	Transmission, gear shift.	22	Transmission countershaft.
3	Transmission, bevel pinion.	23	Reverse drive gear.
4	Steering clutch shaft bevel gear.	24	Low speed driving gear.
5– 6	Steering clutches.	25	High speed driving gear.
7– 8	Steering clutch housing (sleeve).	26	Countershaft driving gear.
9	Steering clutch shaft.	Unnumbered gear meshing with 26	Main drive pinion.
10–11	Intermediate (gear drive) pinion.	27	Engine flywheel.
12–13	Intermediate gears.	28	High speed driving.
14–15	Intermediate shaft drive pinions.	29	Pinion shaft gear.
16–17	Track drive sprocket gears.	30	Engine cylinders.
18–19	Track sprocket sleeve.		

TRANSMISSION SYSTEM.—From Engine (30) through Flywheel (27) to Master Clutch (1) to Transmission Gear Shift (2) through 3 and 4 to Steering Clutch Shaft (9), then in two similar paths, one of which is, 6–8–11–13–14–17–18–21 to Track Links.

GASOLINE TANK—Terne plate Tanks. Two independent duplicate tanks each of 12-gallon capacity. Auxiliary terne plate tank under Armor, 10-gallon capacity.

MAIN FRAME—Cast in one piece—open hearth steel.

ROLLER FRAMES—Four frames steel channel, joined by oscillating shaft. Two frames right and left front. Two frames right and left rear.

TRUCK ROLLERS—Six on each side tractor, fitted with roller bearings, turning on steel Gudgeons, flanged to follow Track Rail.

TRACK—Made up of malleable iron Track Shoes with Track Links integral, fitted with space blocks, and 1.25 (1¼) inch pins.

TRACK DRIVE SPROCKETS—Two. Teeth mesh with opening in tracks.

BLANK SPROCKETS—Two. Fitted with roller bearings which turn on steel gudgeons. Used to adjust Track tension.

TRACK SUPPORTING ROLLERS—Four on each side of tractor, two mounted on brackets attached to Front Roller Frame channel, and two in the rear mounted on spring bracket which is bolted to Main Frame.

SPRINGS—Four double coil springs at rear, two on each side between Rear Roller Frame and Bracket on Main Frame and, four—two on each side of Equalizing bar at front.

EQUALIZING BAR—Spring supported on front roller frame sections.

OPERATING INSTRUCTIONS

PLACING TRACTOR IN SERVICE

Inspection—Regardless of the condition under which the Tractor is received the *first* duty of anyone charged with its care and operation is to give it a systematic and detailed inspection.

This initial inspection should cover all possible shortages of easily removable parts, including accessories and tools, such defects as loose parts and any damage that may have been caused in shipment, or at the hands of the previous operator, and any other conditions that would affect its proper operation.

Refer to Chapter X for itemized list of Equipment.

Repairs and Replacements—Such repairs and replacements as are necessary to the proper operation of the Tractor must be given attention immediately. If permanent repairs cannot be made at once, temporary repairs should be made and advantage taken of the first opportunity to make these permanent.

General Lubrication—Just how long a Tractor will give first-class service depends more upon proper lubrication than any other feature of its care. This is particularly true of a new Tractor and no precaution should be overlooked to make certain that every lubricated part of a new Tractor has a full supply of lubricant. As a precautionary measure 5-Ton Tractors are shipped by the manufacturer fully lubricated with the exception of the Track Oiler and Engine. However, when placing the Tractor in service this fact should be completely ignored and every lubricated part given careful attention.

Turn to the lubrication charts on pages 24, 25, and make certain that every point indicated on these charts has been supplied with lubricant specified for the particular point before the tractor is put in operation. The lubricant specifications will also be found there.

SPECIAL INSTRUCTION WHEN FIRST RECEIVING TRACTOR

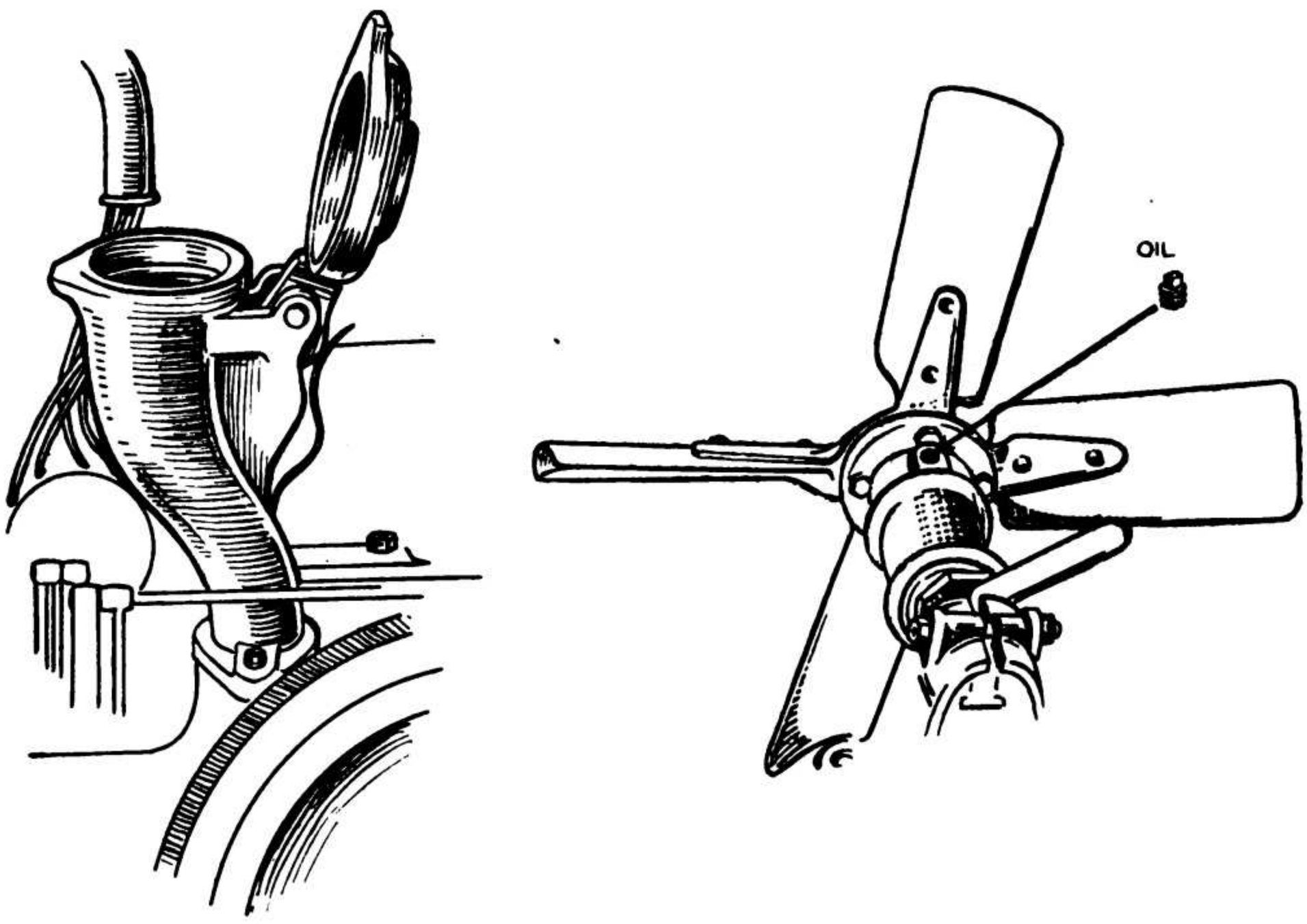


PLATE 4—OIL BREATHER AND FILLER—COOLING FAN

Engine—To prevent corrosion during shipment, in some cases the cylinder oil in the Crank Case of the Engine may have been drained and the Cylinder Walls, Connecting Rods and other exposed metallic surfaces covered with a heavy "slush." Before lubricating the Engine remove the Hand Hole Covers and carefully clean all surfaces covered with this "slush" if it has been used.

Kerosene applied with a cloth or brush will facilitate the complete removal of this protective covering.

Lubricate the Engine with cylinder oil, Ref. No. 2 Medium applied through the Breather located on the Crank Case to the left and rear of number 4 Cylinder. The capacity of the Oil Pan or Reservoir is 3.25 (3¼) U.S. gallons, the level of a full supply reaching the 4/4 mark on the Oil Gauge, a removable graduated rod projecting through the left rear motor supporting arm.

Fan Bearings—Lubricate the Fan Bearings with cup grease, Ref. No. 6. The lubricant is applied by removing the Pipe Plug protecting the hole in the Fan Hub just to the rear of the Blades. The hub should be well packed with grease.

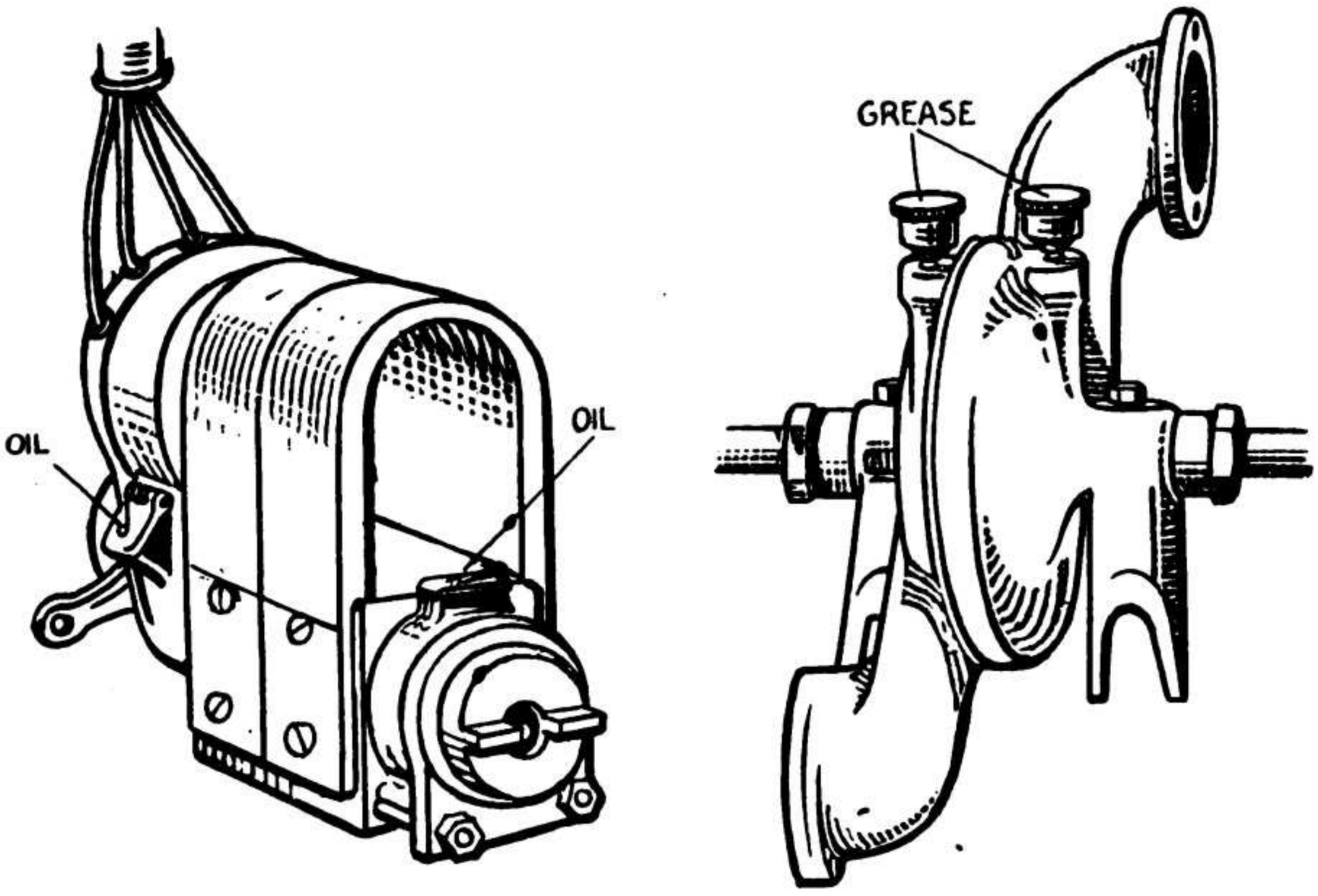


PLATE 5—MAGNETO AND WATER PUMP

Magneto—Lubricate the Magneto with "3 in 1" oil or when not available with cylinder oil, Ref. No. 2 Light, placing *one or two drops*, not more, in each of the two wells.

Water Pump—Fill the grease cups with cup grease, Ref. No. 6, and give two complete turns every four hours.

Hand Starter—Lubricate the Hand Starter with cylinder oil—Ref. No. 2 Medium. Two oil holes are supplied for the lower bearing surfaces of the Starter but the upper bearing surfaces must be lubricated at the intersections of the various parts with an oil can.

Radial Bearings in Master Clutch—Lubricate the Radial Bearing supporting the Master Clutch Inner Disc Hub on the Crank Shaft with cylinder oil, Ref. No. 2 Medium. The lubricant is applied through an oil hole drilled in the shoulder of the Master Clutch Inner Disc Hub, and normally closed with a plug.

Master Clutch Shifter Yoke—Lubricate the Master Clutch Shifter Yoke with grease Ref. No. 6, by giving the Grease Cup two complete turns daily.

Transmission—Inspect the level of the lubricant in the Transmission Unit by removing the Pipe Cap from the Stand Pipe located just to the

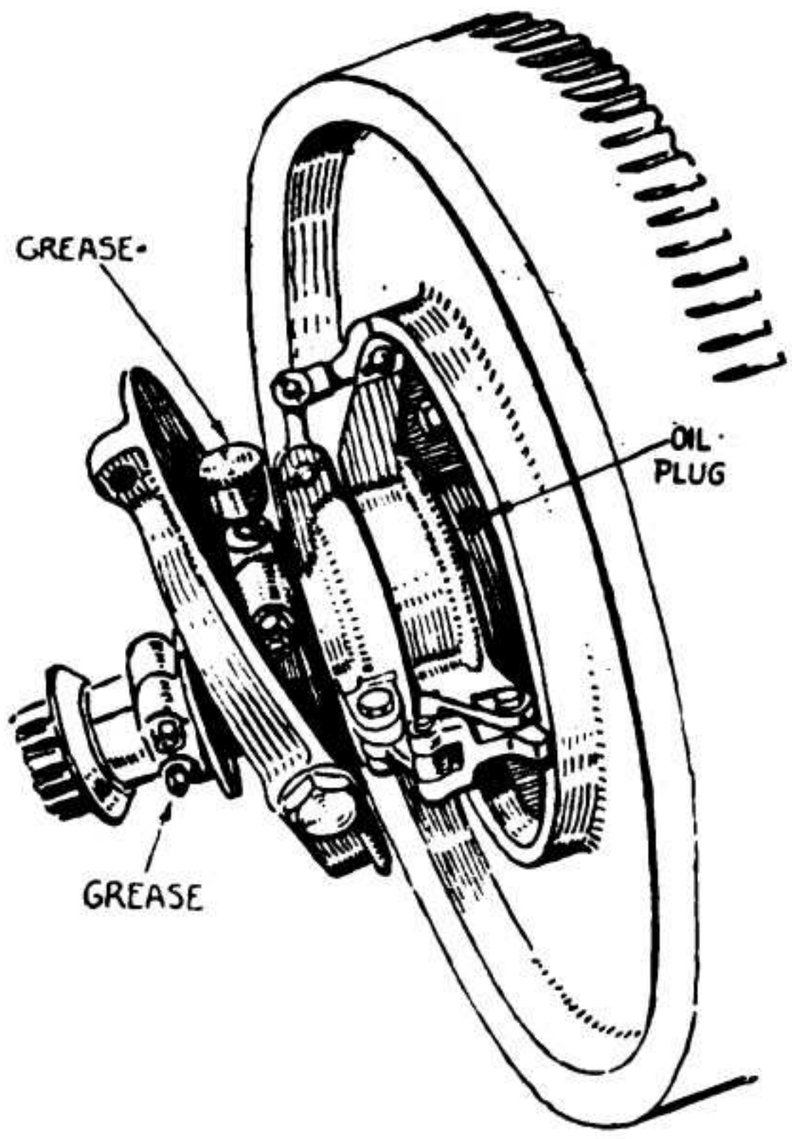


PLATE 6—MASTER CLUTCH AND SHIFTER YOKE

rear of the Track Drive Sprocket Shaft. If the level is below the top of the Stand Pipe, add more lubricant through the Oil Filler located on the Upper Half of the Transmission Unit (Transmission Grease Ref. No. 4 is specified for this unit but if not available any good grade of

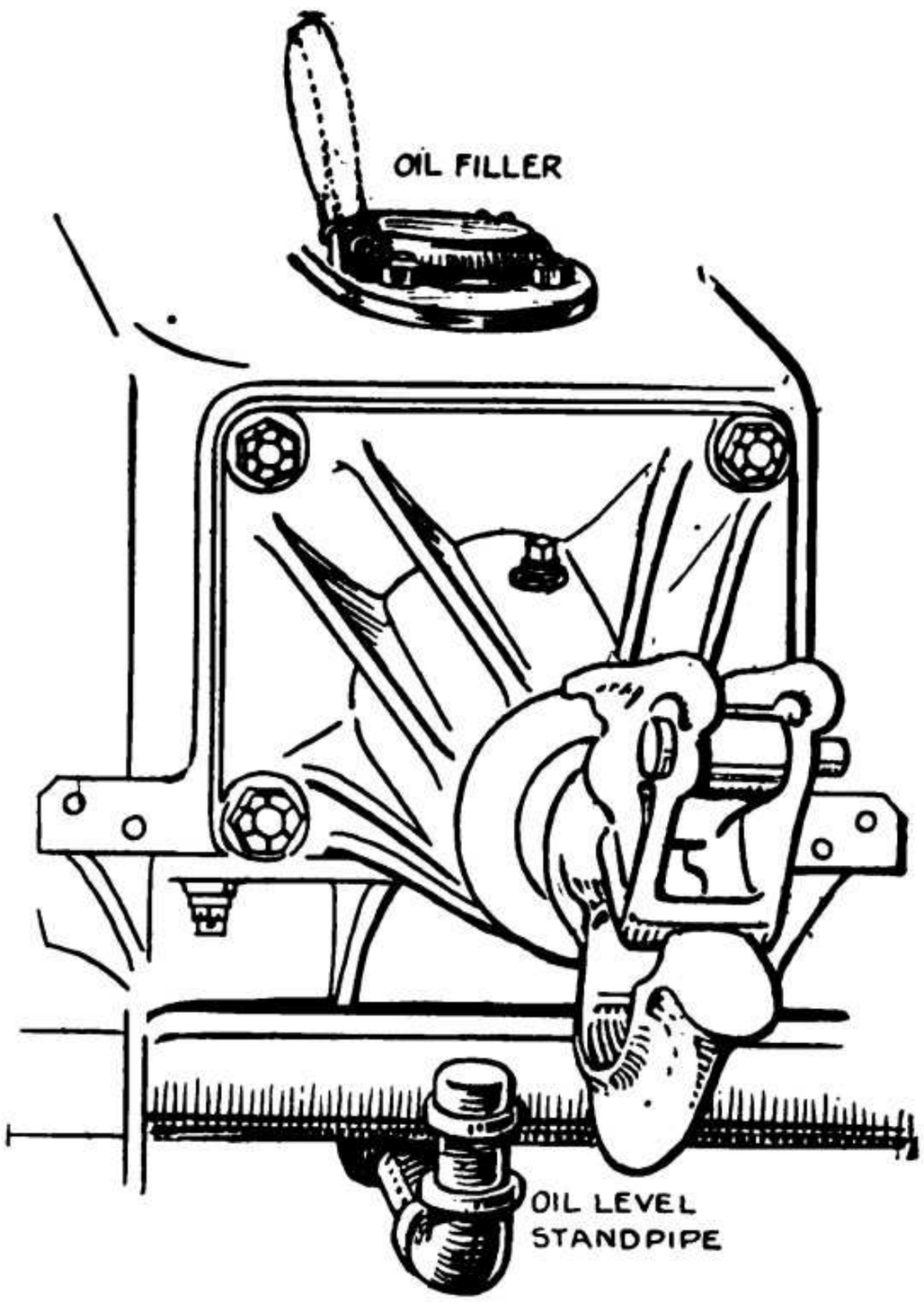


PLATE 7—TRANSMISSION LUBRICATION

Transmission Lubricant, such as Ref. No. 9, i. e. 600-W, may be substituted, but no grease should be used).

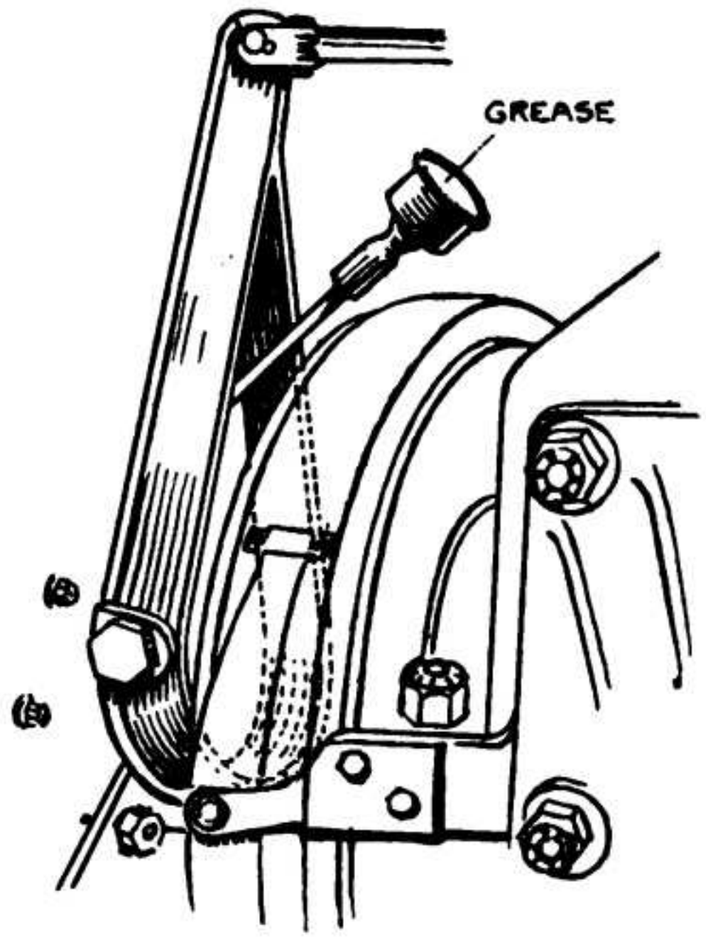


PLATE 8—STEERING CLUTCH YOKE

Steering Clutch Shifter Rings—Give grease cups, filled with grease Ref. No. 6, on Steering Clutch Shifter Rings two complete turns daily.

Track Drive Sprocket Gear—Inspect the level of the lubricant in the Track Drive Sprocket Gear Case by removing the Filler Plug in the side of this case. Use lubricant Ref. No. 8 for this when possible or Refs. No. 9 or No. 4 as alternatives when necessary.

Drive Sprocket Hub—Remove the ¼-inch Pipe Plug at the rear end of the Thrust Rod and with a Grease Gun, fill the chamber with Cup Grease, Ref. No. 6.

Blank Sprocket Shaft and Bearings—Lubricate with cup grease Ref. No. 6 by removing ⅜-inch Pipe Plug from hole in the end of shaft and inject with grease gun.

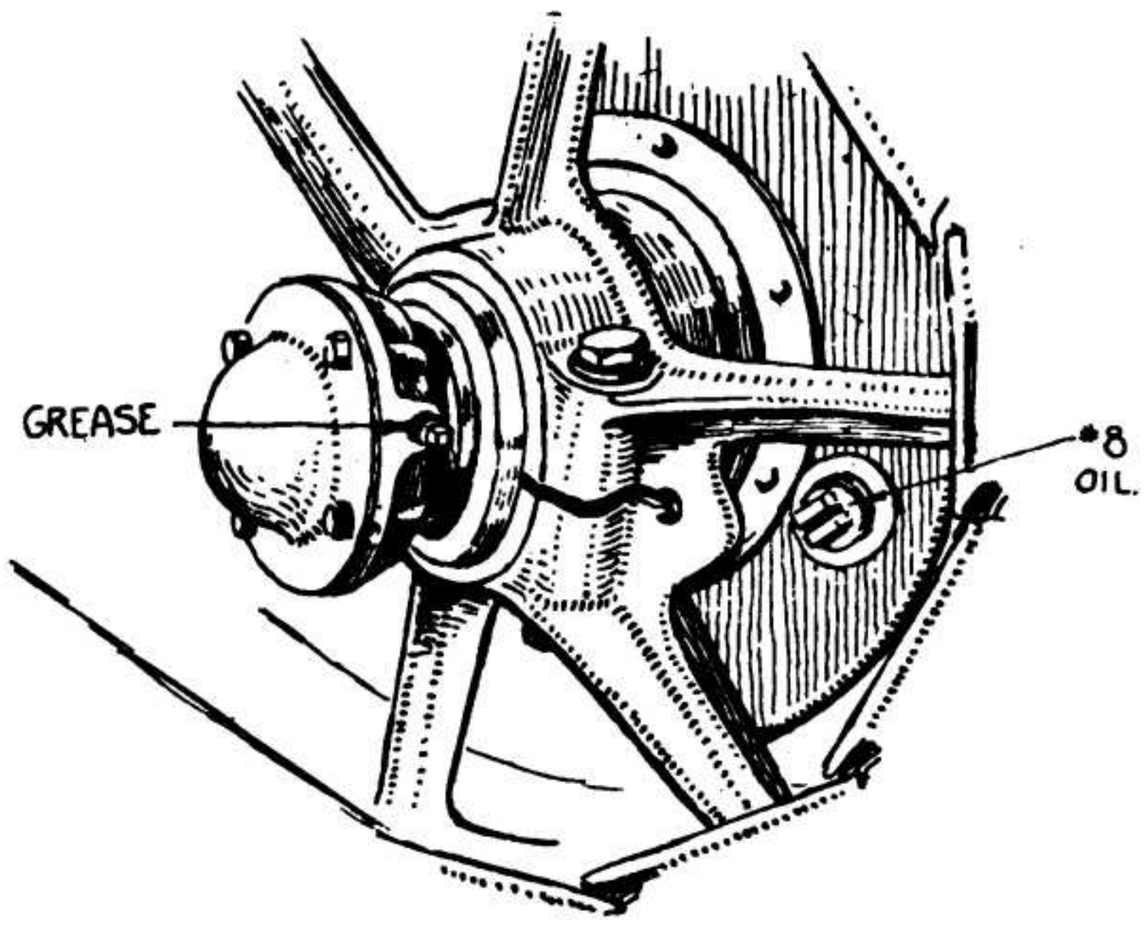


PLATE 9—DRIVE SPROCKET AND GEAR

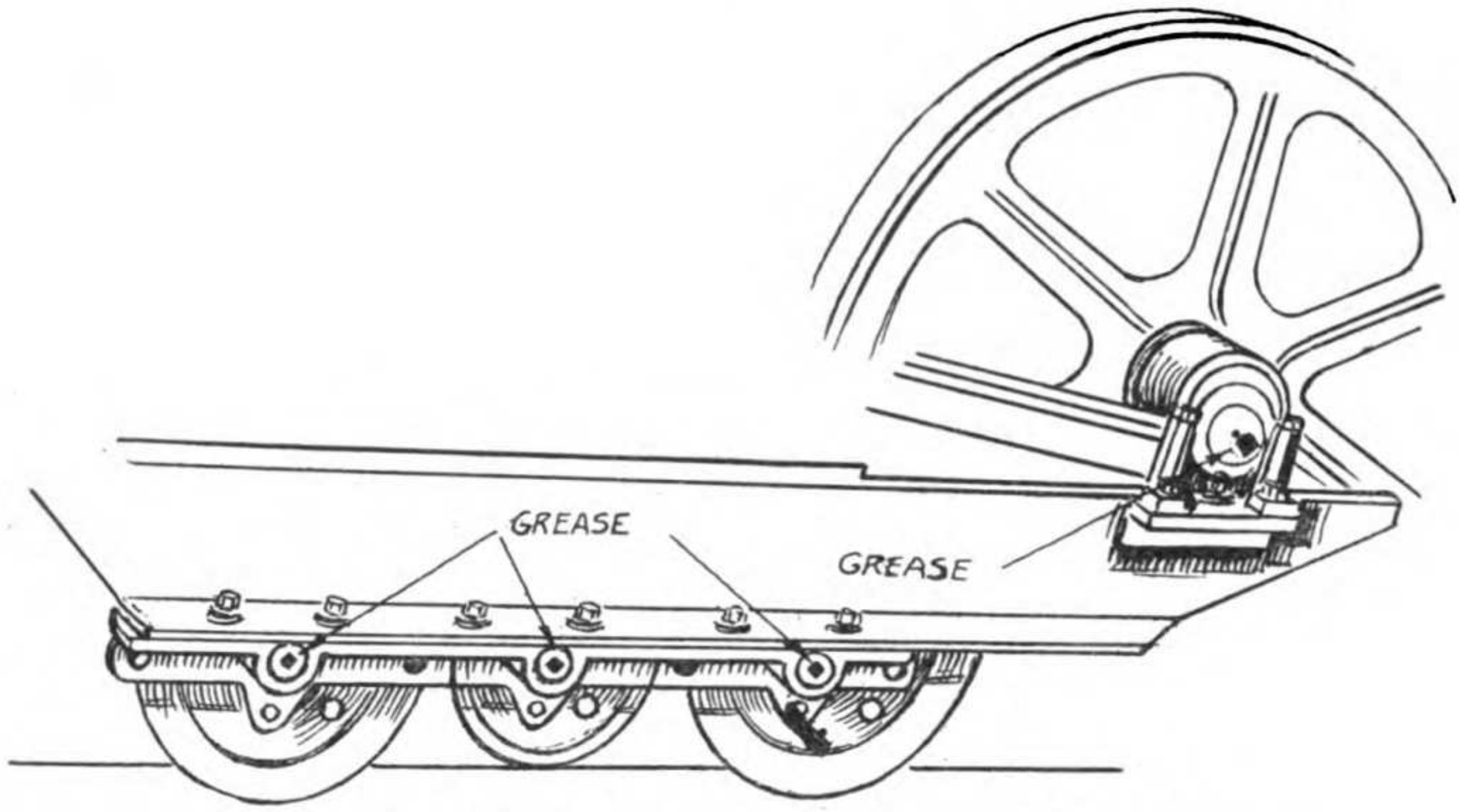


PLATE 10—TRUCK ROLLERS AND SPROCKET

Track Supporting Rollers—Lubricate with cup grease, Ref. No. 6, by removing ¼-inch Pipe Plug from end of Track Supporting Roller Shaft and inject lubricant with a grease gun.

Truck Wheels—Lubricate with cup grease, Ref. No. 6, by removing ⅜-inch Pipe Plug from end of Gudgeons and inject with a grease gun.

Fill the Cooling System—Fill the radiator and water circulating system with clean, soft water. Water containing lime and other impurities should not be used. Rain water is ideal for the purpose. If the temperature is below freezing (32 degrees F.) proceed as outlined in Chapter II under Cooling System.

Fill the Fuel Tanks—These Tanks, three in number, are located at the right and left rear corners of the Operator's Seat and in the upper left rear corner of the Armor, respectively. To open, turn the handle of the Angle Valve under each rear Fuel Tank to the left until it stops.

Prepare the Lamps for Service—Fill the two side Lamps and the Tail Lamp with kerosene. Light and trim the wicks so that immediate service can be depended on.

TO START ENGINE

Condition of Engine—It is assumed that the Tractor is in condition to operate, that is, that the instructions outlined in the preceding paragraphs on "Placing the Tractor in Service" have been complied with, and that all adjustments are correct or nearly so.

Establishing Lubricant Film in Cylinders—If an engine has been inoperative for more than three days, especially after undergoing the conditions to which it would be subjected in shipment, it is necessary to remove the Spark Plugs and with the aid of an oil can, lubricate the

cylinder walls. Turning the Engine over by hand a few times distributes this lubricant, establishing a film between the Piston Rings and the Cylinder Walls, and compression becomes effective.

Turn on the Fuel—Move the lever of the Three-Way Gasoline Valve and Strainer, located on the right side of the Reserve tank, to "Reserve." This permits the flow of gasoline from the Reserve Tank under the Armor to the Carbureter. It also facilitates starting, for in order to start on the Main tanks, it would be necessary to prime the Vacuum Tank.

Priming a Cold Engine—If the Engine is cold, or if it has been inoperative for some time, its starting will be greatly facilitated by priming the Cylinders. See that the priming cocks are closed, before filling them full of Gasoline. Then open them allowing the gasoline to run into the Cylinders. Close the Priming Cups as soon as they are empty. (Note: Overpriming is very detrimental to an Engine and should not be permitted. Only a priming cup full of liquid gasoline is necessary to furnish the proper explosive mixture and no more should be used. Over-priming will destroy the lubricant film between the Piston Rings and the Cylinder Walls, causing loss of compression and the possibility of scoring the Cylinders.)

Disengage the Master Clutch—The Master Clutch is disengaged when Master Clutch Hand Lever is in a position farthest to the rear.

Retard the Spark—Move the Spark Control Lever "S" toward "Retard" to a position about 1 inch from the rear end of the Quadrant.

Advance Hand Throttle Lever—Advance Throttle Lever to a position about one-quarter of the full advance on Quadrant.

Switch on the Ignition—Move the Ignition Switch on the Instrument Board to the "Mag." position. (Note: The Impulse Starter on the 5-ton Tractor is automatic in its operation so needs no setting.)

Choke the Carbureter—Pull the Carbureter Choke Ring located on the rear of the Armor, as far back as possible. The Carbureter

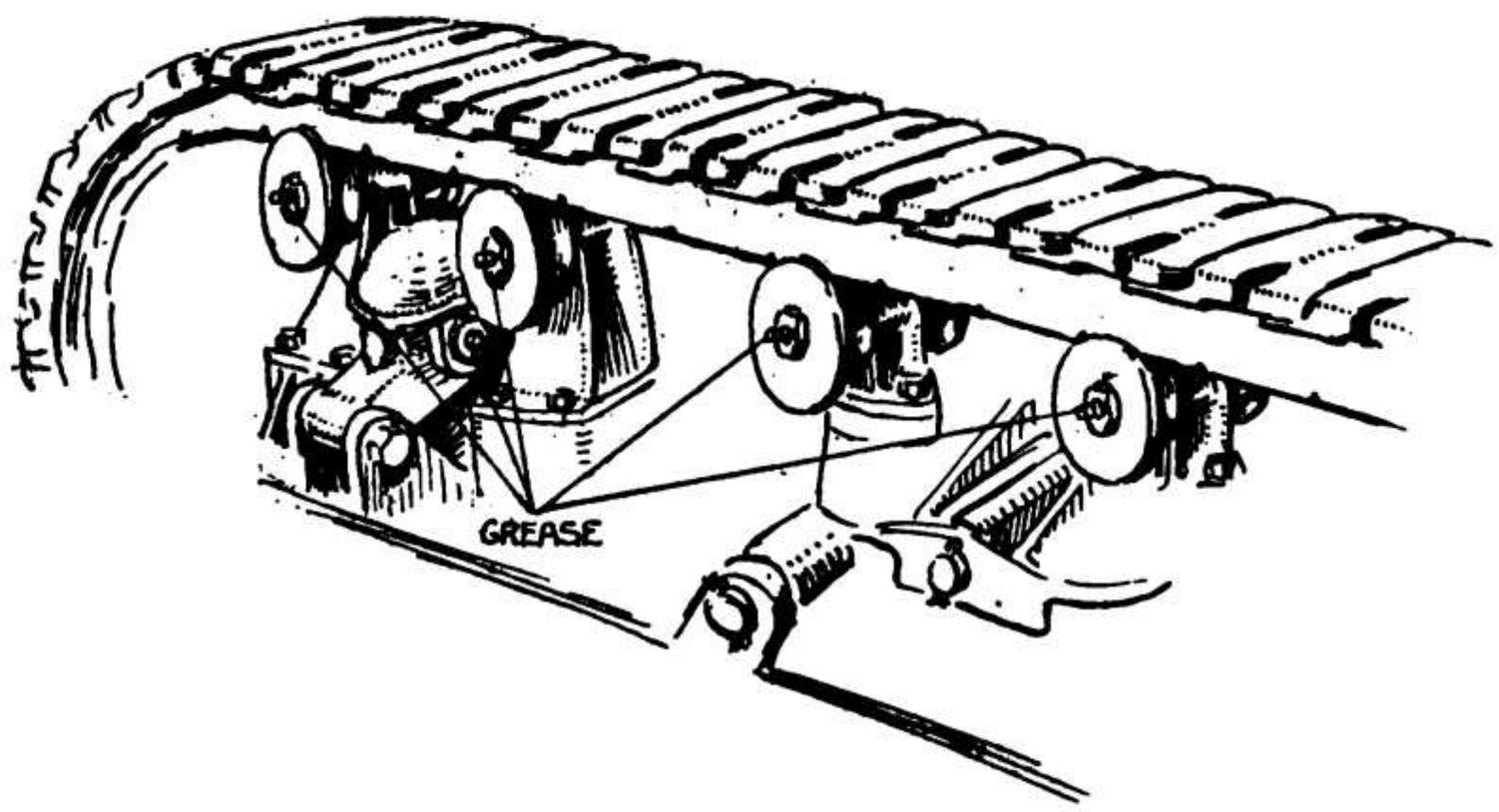


PLATE 11—TRACK SUPPORTING ROLLERS

should not be choked for more than two or three complete revolutions of the Flywheel.

Crank the Engine—Use the Hand Starter. To get the best results from the Hand Starter turn the Crank until the Starter Gear meshes with the teeth on the rim of the Flywheel. Turn slowly until on a compression stroke and then give the Flywheel a quick flip or pull past center and over compression.

(Note: There should be no occasion for continued cranking of an engine. An Engine that has been idle for a long period of time or a cold Engine necessitates a certain number of revolutions before the various related units such as the Oiling System, Carbureter, etc., will function properly, but after this no difficulty should be experienced. If the Engine does not start readily after a reasonable number of turns of the Starting Crank, look for the reason and correct the difficulty instead of attempting to make the Engine start by continued cranking.) See page 31.

WHAT TO DO WHEN ENGINE STARTS

Advance the Spark—Advance the Spark Lever "S" to a position about half way up on the Quadrant. This is the correct position for all ordinary driving.

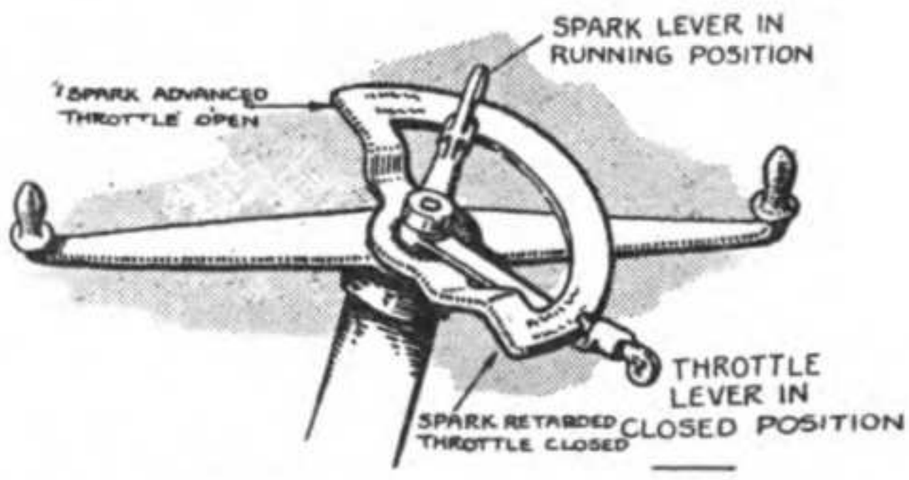


PLATE 12—SPARK AND THROTTLE CONTROLS

Adjust the Engine Speed—Place the Hand Throttle Lever in such a position that the Engine will idle at low speed. In cold weather the Engine should be allowed to run at a rather high rate of speed until warm.

Examine Oil Circulation—Examine the Oil Pressure shown on the Pressure Gauge, the dial of which is on the instrument board. If the pressure is below 25 lbs. at the governed motor speed, 1200 Revolutions Per Minute, after warming up for ten minutes, the reason should be investigated. Lack of oil, old thin oil or loose bearings may be the cause.

Examine Water Circulation—See that the Water is circulating freely. Fill the Cooling System to overflowing.

If the Engine Runs Irregularly (Misses)—Such a condition must not be neglected—the difficulty should be located and remedied immediately. The trouble can as a rule be traced to a comparatively few causes easily determined and remedied. See page 31.

After Starting Engine—After the Engine has been running not less than five minutes, turn the lever of the Three-way Gasoline Valve and Strainer to "Sup" or Supply. By this time the suction caused by

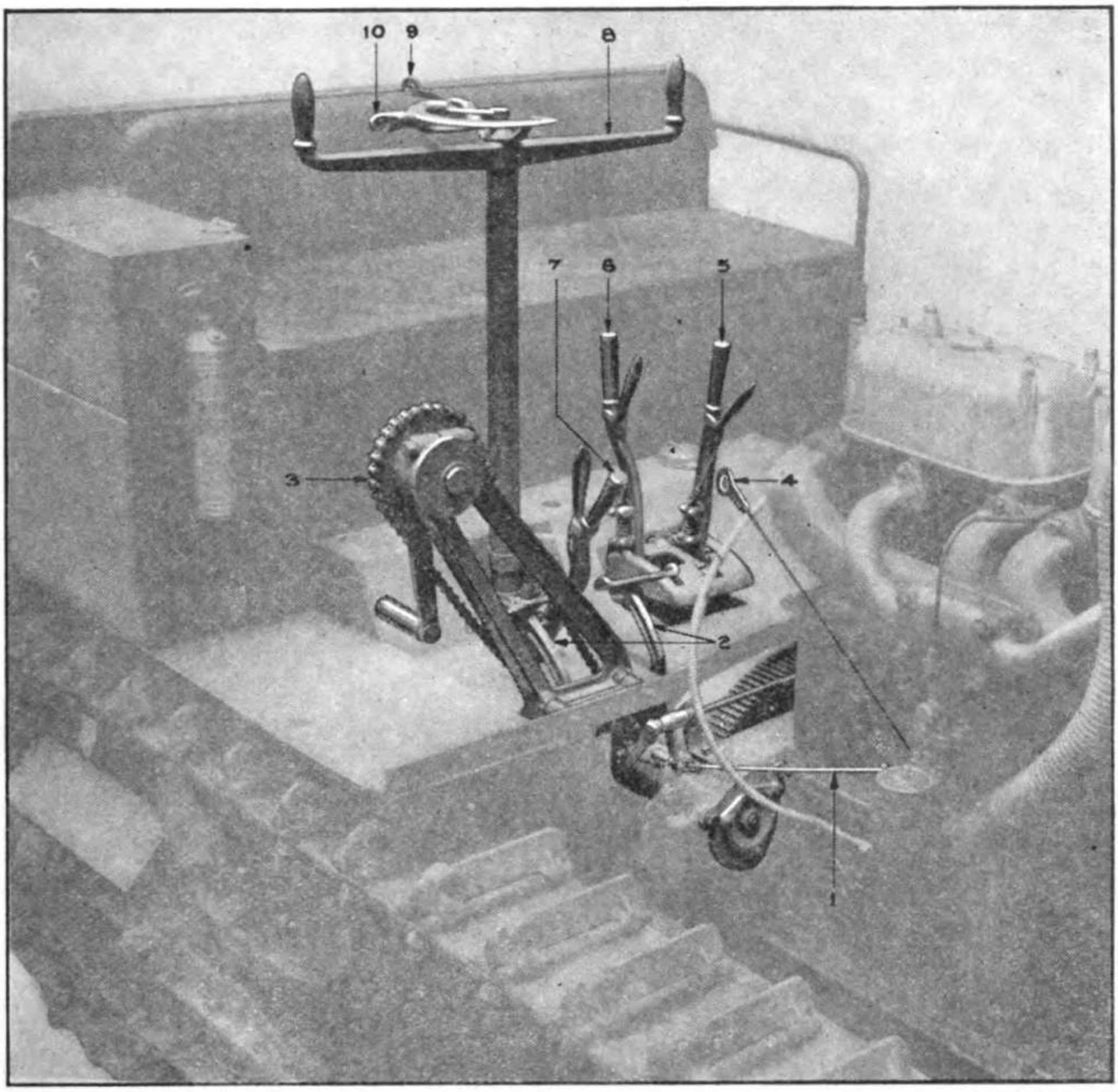


PLATE 13—5-TON ARTILLERY TRACTOR CONTROLS

Ref. No.	Ord. No.	Name
1	403F	Carbureter control rod, front.
2	67B	Brake foot pedals, right.
	67A	Brake foot pedals, left.
3	184F	Hand starter.
4	409E	Carbureter choke handle.
5	63A	Gear shift hand lever.
6	62C	Master clutch hand lever.
7	62A	Brake hand lever.
8	70A	Steering clutch hand lever.
9	70C	Spark control hand lever.
10	70B	Throttle control hand lever.

running Engine will have filled the Vacuum Tank, making it possible for the fuel from the rear Tanks to reach the Carbureter.

Gears—Select the Gear to be used, Low, Reverse, Direct or High, and through the medium of the Gear Shifting Lever engage the one selected. Starting and running is done without a change of Gears; gears must not be changed when the Tractor is in motion.

Clutch—Move the Master Clutch Hand Lever gently forward until the load is taken up and the Tractor is in motion, then push it forward firmly and without jerking.

DRIVING TRACTOR

Position of Operator—It is the duty of an Operator to remain in his seat at all times when the Tractor is in motion.

Steering—Steering is accomplished from the Operator's seat through the medium of a Steering Clutch Hand Lever operating the Steering Clutches located on either side of the Transmission Unit. These Steering Clutches control the power transmitted to either Track through the Track Drive Sprocket and Gears. If it is desired to turn in a certain direction the Steering Clutch Hand Lever is turned in the direction it is desired to go, which releases the Steering Clutch on that side and the Tractor will turn gradually in the direction toward the released Steering Clutch.

To Turn Quickly—If a shorter turn is desired, it is necessary to increase the resistance of the Track on the side toward the objective.

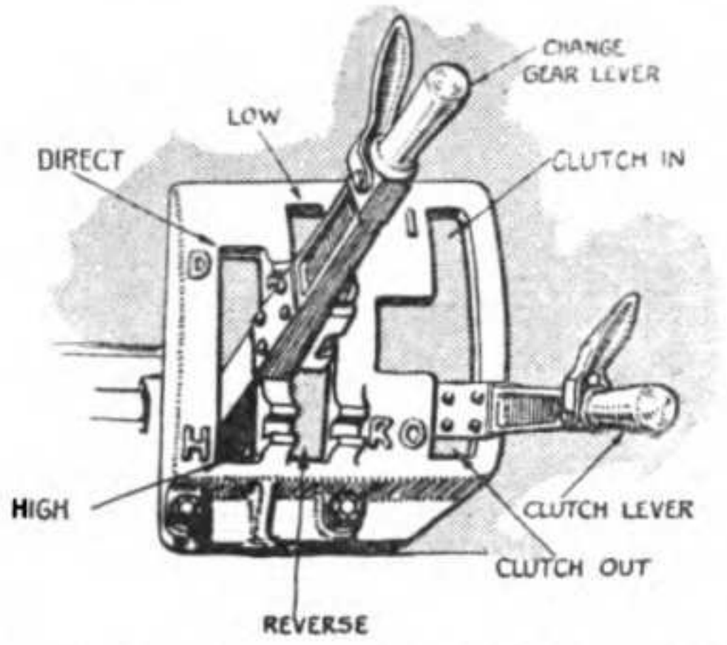


PLATE 14—POSITIONS OF GEAR SHIFT LEVER

This is accomplished through the medium of a brake operating on the drum of each Steering Clutch and controlled by two Foot Brake Pedals located on either side of the base of the Steering Column. The radius of a turning circle decreases in accordance with the amount of resistance thrown into the released Track. If the motion of the Track is stopped, it acts as a pivot on which the Tractor turns.

Turning with Load—With a load the effect of disengaging a Steering Clutch is more pronounced. Except for sharp right angle turns the use of the Brakes is not necessary, and should be used with discretion as the Tractor is liable to turn so quickly that it may foul the draw bar.

Changing the Gears—The Gears of the 5-Ton Tractor must not be changed while the Tractor is in motion.

To Change the Gears—Stop the Tractor by disengaging the Master Clutch. Engage the Gear desired by placing the Gear Shifter Lever in the slot designating the speed. If for any reason the Gears do not

mesh easily do not force them but engage the Master Clucth slightly and try again.

Lubrication of Tracks—The Tracks should be lubricated only while the Tractor is in motion. Cut off the flow of lubricant immediately on stopping the tractor.

Lubricant to Use—Any grade of lubricant of such consistency as will flow through the Track Oiling System is satisfactory for Track lubrication. Waste Engine Oil is ideal for this purpose. Crude Oil or Fuel Oil should never be used as they have practically no lubricating value and when used there is a greater tendency for the working joints of the Track to clog and prevent the entrance of lubricant to the Space Blocks and Track Pins than with other oils of higher lubricating value. Higher grades of oil give longer lubrication, a smaller amount is necessary and the wear and tear of the Track is reduced to a minimum.

Time to Lubricate—Driving conditions vary so greatly that it is impossible to specify just when the Tracks should be lubricated and an Operator will have to use his own judgment in the majority of cases. Tracks should be well lubricated when the Tractor is put into service and about once every two hours thereafter if the running is continuous. TRACK LUBRICANT MUST NOT BE USED IN SAND, heavy dust or loose dirt, as such a large amount of dirt and grit will become mixed with the lubricant that its action will be that of a grinding compound rather than of a lubricant.

Brakes—The Brake Bands operating on the Steering Clutch Drums are used not only to facilitate steering but to retard the motion of the Tractor or hold it in position. To facilitate steering these Brakes may be applied independently with the Foot Pedals. If it is desired to retard the motion of the Tractor or to hold it in position, both Foot Pedals or the Brake Hand Lever may be used. The Brake Hand Lever is equipped with a ratchet to hold the brakes on when required.

Driving Suggestions—While driving a constant watch must be kept on the Oil Pressure, and also of any tendency to overheat which would be indicated by steam from radiator. A full supply of lubricant must be kept in the Oil Reservoir at all times and any reduction in Oil Pressure below twenty-five (25) pounds should be given immediate attention.

Any unusual noise in the operation of the Tractor should be immediately investigated. A great amount of trouble can be avoided by giving attention to any unusual noises or performances as soon as they become evident, as the remedy at that time is generally simpler.

TO STOP TRACTOR TEMPORARILY

Disengage the Master Clutch—Pull the Master Clutch Control Lever as far to the rear as possible.

Engine Speed—Reduce the speed of the engine by moving the Hand Throttle Lever toward "Retard" until the engine runs at slowest speed.

Disengage the Gears—Disengage the Gears in mesh by moving the Gear Shifter Lever to the neutral position.

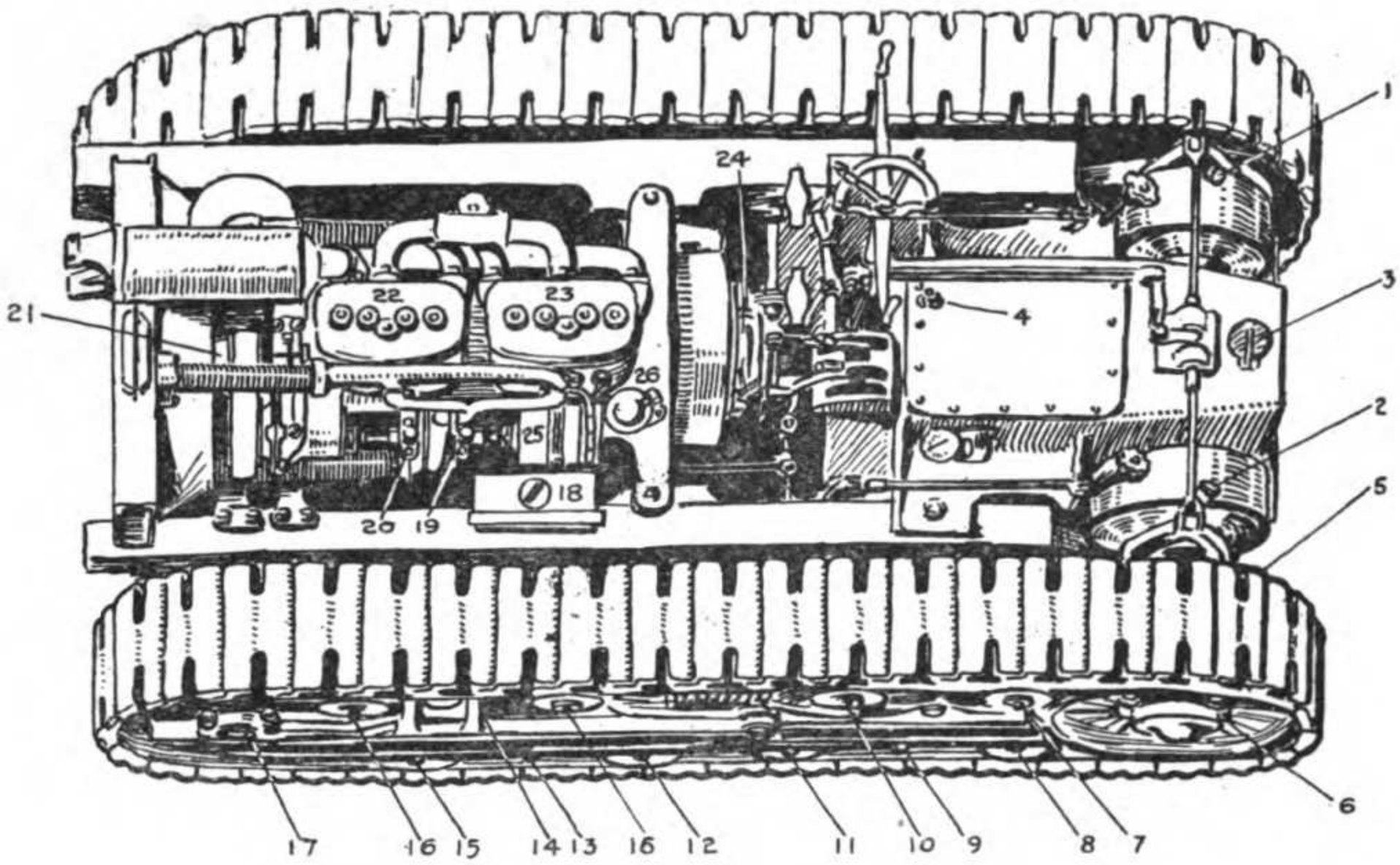


PLATE 15—LUBRICATING CHART

Ref. No.	Name	Lubricant
1-2	Steering clutch yoke	Grease No. 6.
3	Transmission unit	Trans. lubricant No. 4.
4	Pet cock to indicate oil circulation in transmission.	
5	Drive sprocket gears in housing	Heavy oil No. 8.
6	Drive sprocket shaft bearing	Grease No. 6.
7-10-16-16	Track supporting roller gudgeon pins	Grease No. 6.
8-9-11-12-13-15	Truck roller gudgeon pins	Grease No. 6.
14	Equalizing bar trunnions	Grease No. 6.
Not shown	Equalizing bar center pin	Grease No. 6.
17	Blank sprocket bearing	Grease No. 6.
18	Track oil tank	Black or waste Engine oil.
19-20	Water pump bearings	Grease No. 6.
21	Fan bearing	Grease No. 6.
22-23	Oil cups on top of engine (initial production only)	Cylinder oil No. 2 medium.
24	Clutch (see instructions, p. 27).	Grease No. 6. Oil No. 2 medium.
25	Magneto	"3 in 1"
26	Crank case breather	Cylinder oil No. 2 medium.

STOPPING THE TRACTOR AT THE END OF A RUN

To Stop the Tractor—Proceed as outlined in the preceding paragraphs.

To Stop the Engine—Move the Magneto Kick Switch to the "Off" position.

Inspection—At the end of each run the Tractor should be given a general inspection covering all loose or damaged parts, any defects that

LUBRICATING INSTRUCTIONS

After each assembly mentioned in the lubricating instructions herein will be found a number. The key to the various Reference Numbers is as follows:

Ref. No. E. M. Specification No.	Type of Lubricant
2 No. 3502	Cylinder oil furnished in light, medium and heavy.
4 No. 3504	Fluid transmission oil.
6 No. 3506	Medium cup grease.
8 No. 3508	Gear lubricant and slushing oil.
9 No. 3509	Usually known as 600-W.

NOTE: Use light oil only in freezing weather, or colder. Use medium oil regularly. Use heavy only on old, worn motors or in very hot weather.

PART	LUBRICANT REF. NO.	HOW APPLIED	HOW OFTEN
Fan Shaft	6	Grease gun	Weekly
Magneto	"3 in 1" or 2 Light	Dropper	See Magneto instructions
Engine Crank Case (See note under specifications, above)	2 Medium	Thru Breather	When required. Test by oil level indicator rod
Ball Bearings in Master Clutch	2 Heavy or Medium	Oil gun	Daily
Master Clutch Yoke	6	1 Grease cup	2 turns daily
Transmission	4	Through oil filler cap on top	As required to maintain level. Test at standpipe in rear of transmission case
Steering Clutch Shifter Ring	6	2 Grease cups	2 turns daily
External Sprocket Drive Gear, Dust Case	8	Grease gun	Sufficient to keep gears dipping. Fill up to plug hole
Drive Sprocket Hub	6	Through 2 plug holes	Daily
Track	Black oil—2 heavy, or 9; preferred in order named	Reservoir	Sufficient to keep space block and pin lubricated
Truck Wheels	6	With grease gun through 12 plugs	Daily
Track Supporting Rollers	6	Through 8 plugs with grease gun	Daily
Roller Frame Shaft	2 Medium	Oil can	Daily
Blank Sprocket Shaft	6	Through 2 plugs with grease gun	Daily
Water Pump Shaft	6	2 Grease cups	2 turns every 4 hours
Starting Crank Assembly	2 Medium	Oil can	Daily
Equalizing Bar	6	3 plugs	Daily

NOTE—All foot and hand brake rod clevises, change speed, steering gear and foot pedal connections, engine control rods and connections and all other working joints not provided with oil or grease cups should be lubricated with an oil can using cylinder oil No. 2 light or medium.

interfere with the proper operation of the Tractor, any shortages of parts or materials, and any conditions that might interfere with the proper functioning of any part.

Fuel and Lubricant—The supply of fuel and lubricant in all containers should be replenished and the Tractor otherwise made ready for immediate service.

Tractor Protection—After the Tractor is prepared for further service it should be covered with the Paulin carried under the Driver's seat, as a protection against the elements.

CLEANING OIL PUMP SCREENS

The oil pump screens which are placed at the bottom of the oil pans may become clogged by foreign matter collecting at this point. In order to clean these strainer screens, the whole oil reservoir or underpan does not have to be removed. Drain off the oil in both the front and rear oil reservoirs and take off the plates at the bottom of these oil reservoirs. The screens will be found on them and readily cleaned. This should be done every month, although every two weeks is more desirable. At the same time the lower Oil Pan should be removed and the screen in the top of this cleaned also.

The crank case of the engine should be washed at regular intervals. To do this first drain all oil from the oil reservoir by removing the bottom plates. Remove the hand hole plates on one side of the engine and with an oil gun or dipper wash the sides of the crank case with kerosene, allowing it to drain into the oil reservoirs. Then with a piece of clean soft canvas or other cloth that does not give off lint, wipe out kerosene on the bottom half of the crank case. Do not wipe the sides of the crank case. Wipe out the bottom of the oil reservoir, replace the hand plate cover and fill system with new oil through oil filler caps. BE SURE NO KEROSENE REMAINS IN RESERVOIRS. The proper oil level will be reached when the oil shows 4/4 on the oil gauging rod on the left hand rear arm of the crank case. DO NOT USE OLD OIL UNLESS NO OTHER IS AVAILABLE. Use old crank case oil for Track Oiling.

Every main and connecting rod bearing should be examined for looseness frequently. The main and connecting rod bearings of an engine that has a force feed lubrication must be kept up tighter than those of a splash lubricated one. If one bearing becomes looser than the rest, the oil will escape unduly, and cause the pressure throughout the entire system to drop, with the possibility of failure of lubrication at some point.

Before entering the crank case to examine the bearings for tightness, wipe the crank case side plates clean with a rag, or piece of waste saturated with gasoline or kerosene. Indeed, so essential is it that no dirt of any kind be admitted to the crank case that the operator's sleeves should be rolled up before he works on inside of the engine. All

wrenches and bars used in the crank case of the engine must be rinsed with gasoline before insertion, thus minimizing the possibility of putting dirt in the crank case. Keep the oil in the crank case scrupulously clean, for any dirt is sure to clog the oiling system and pump screen, and will result in damage.

If the oil is not drained from the engine or the crank case washed at regular intervals, foreign matter resulting from the breaking down of the oil may accumulate in the bottom of the reservoir so that circulation of oil will be clogged and engine ruined.

OIL PUMP

To Remove—First drain the oil from the rear reservoir in the crank case. Remove the rear oil reservoir from the bottom of the crank case by taking out the cap screws that hold it in place. The pump and rear oil reservoir will drop off together. Undo the cap screws holding the top of the pump onto the oil reservoir and remove pump assembly. The oil pump can then be completely disassembled for cleaning and inspection.

To Replace—Take off rear hand hole plate on crank case. Reach through this opening to guide pump drive shaft into place when replacing the rear oil reservoir on which the pump is mounted. Fasten oil pan in place, being careful to keep gasket unbroken. Close hand hole and fill system with Ref. No. 2 medium oil.

CARE OF MASTER CLUTCH

With the master clutch thrown to out position, put a couple of squirts of cylinder oil with an oil can on the friction surfaces on the bronze and cast iron friction ring thrust members twice a day. Use Ref. No. 2 medium oil. *Be careful not to over lubricate.*

It is advisable at frequent intervals to flush the Master Clutch Friction plates with gasoline to cut any gummy residue that may be left by the oil; keep the Shifting Ring oiled thoroughly, giving the grease cup thereon two turns per day.

On the Master Clutch there is located an oil plug through which oil is fed directly to the ball bearing which supports the master clutch on the crankshaft. Fill this with Ref. No. 2 medium or heavy oil. Oil the friction dog pins with Ref. No. 9 cylinder oil or Ref No. 2 medium or heavy oil, as also the bronze throw-out collar.

LUBRICATION OF TRANSMISSION

All parts of the transmission are lubricated by the transmission oil pump located within the gear case. The two bearings of the steering clutch assembly on the transmission are lubricated by the action of

the transmission oil pump. To test whether the pump is functioning open the pet cock at the top of the transmission case.

LUBRICATION OF TRACK DRIVE SPROCKET

Cup grease is applied through grease plugs on the end of the drive shaft, and through an oil hole for lubrication of the floating bushing. Holes are provided in both the oil tight dust guards, bolted to ends of the sprocket shaft through which Ref. No. 8 oil should be injected to lubricate the Track Sprocket Drive Gears.

LUBRICATION OF TRUCK WHEELS

Truck wheels are lubricated with Ref. No. 6 cup grease supplied through grease plugs by using a grease gun. These plugs are located on the ends of each roller gudgeon. Grease should be injected into each plug with a grease gun.

LUBRICATION OF TRACK

The tracks are lubricated while the tractor is in motion. They should be flooded with a black oil. Oil that has been drained from engine can be used. As long as the track pins and the space blocks have a film of oil additional lubrication will not be required. The track oil is carried in a reservoir under the driver's seat and is distributed to the tracks by pipe connections. Two valves under the foot boards govern the flow of oil.

MAGNETO LUBRICATION AND ADJUSTMENT

The lubrication of the circuit breaker is essential but over lubrication must be avoided. All parts of the magneto must be lubricated with a light oil like Three-in-One, or a household lubricant, or machine spindle oil. Since only a small quantity of oil is needed for magneto lubrication, an oil can ought never to be used. Use a tooth pick or a piece of wire with a notch filed in it near the end so that it resembles a crochet hook. The lubrication of the Eisemann Magneto, with which the tractor is provided, and particularly the circuit breaker, must be limited to one drop of oil at one place. Keep the circuit breaker scrupulously clean of excess oil and the breaker points adjusted to break 1-64 of an inch. Supply oil to each bearing once every two weeks.

MAINTENANCE ROUTINE

It is essential for the proper care and maintenance of the 5-Ton Artillery Tractor Model 1917, that the following maintenance routine schedule be rigidly adhered to. Preparedness for emergencies can only be obtained by keeping the tractor in excellent condition, and this necessitates proper adjustment at regular intervals of time.

The following items refer only to inspection and adjustments. Repair, or replacements detected as necessary should be made at the earliest opportunity.

DAILY MAINTENANCE ROUTINE

Engine

Examine all wiring terminals for tightness.
Clean magneto externally.
Note tension of fan belt.
Inspect oil pump for performing its function.
Inspect oil supply in engine crank case.
Inspect radiator water supply.
Inspect gasoline tanks for proper fuel supply.
Inspect pipe line and all connections for leaks.

Steering Clutch Brakes

Inspect for undue wear or looseness.
Inspect for proper operation.

General

Inspect and thoroughly clean all lamps.

MAINTENANCE ROUTINE WEEKLY

Engine

Inspect all wires for proper support and freedom from damage.
Thoroughly clean engine externally.
Inspect for oil leaks.
Inspect control connections for looseness.
Inspect all water connections for leaks.
Drain water and dirt from water trap in gasoline line.
Inspect carbureter control connections.

Do not attempt to alter adjustment of carbureter unless this is shown to be necessary when tractor is in service.

Inspect oil lines and drain plugs for loss of oil.
Test main and connecting rod bearings for looseness.

Master Clutch

Inspect clutch for oil leaks, clean externally.

Brakes

Examine thoroughly. Clean all brake connections and adjust.

Steering Clutches

Inspect clutches for proper action, and inspect clutch brakes for proper action and adjustment.

Springs

Inspect springs for breakage, both under frame bracket and on equalizing bar.

Tracks

Inspect tracks, rollers, carriers, drive sprocket, blank sprocket, equalizing bar for wear, breakage and proper adjustment.

Transmission

Clean and inspect all control connections.

Inspect action of transmission oil pump by opening test cock on top of transmission case.

General

Inspect armor bolts, fasteners, and all similar bolts for tightness.

Inspect tool equipment for completeness.

MAINTENANCE ROUTINE MONTHLY

Master Clutch

Thoroughly clean and inspect all lever connections.

Transmission

Clean externally and inspect for leaks, particularly in bearings covers at open ends in order to ascertain if undue leakage is occurring around shafts.

General

Inspect speedometer drive.

COMMON TROUBLES

IMPORTANT ADVICE

Do not touch any adjustments or tamper with any parts until you know what causes the trouble. Otherwise you may get everything out of adjustment.

ENGINE FAILS TO START

Lack of Gasoline—See that fuel tanks are full and shut-off cocks are open. If fuel line is free, gasoline will run out of drain cock on the bottom of the carbureter.

Lack of Ignition Current—This may be due to neglect in throwing on the switch or to a broken or disconnected wire. May also be caused by "grounding" on some part of Engine or frame of wire from magneto to ignition switch.

Dirty Spark Plugs—These are due to an excessive amount of oil in the Engine and too long service without attention, whereby the points become coated with carbon. Dirty spark plugs should be removed and cleaned with Gasoline.

Spark Plugs—Points are improperly set. (See under "Engine Misses".

ENGINE STOPS

Lack of gasoline.

Disconnected switch or wires, or "grounded" magneto switch wire.

Lack of oil or water.

Carbureter flooding.

ENGINE MISSES

Broken or Disconnected Wiring—If the Engine misses, short circuit the spark plugs one after another, by touching a hammer or screw

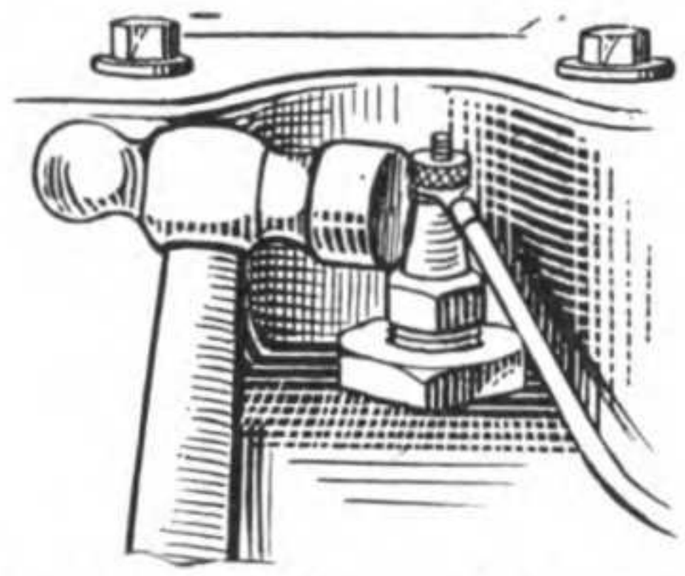


PLATE 16—TESTING SPARK PLUGS

driver from the metal of the cylinders to the terminals of the spark plugs. When one is reached which makes no difference in the running of the Engine, this is probably the plug at fault. Opening of the pet cocks will also show which cylinders are firing as the flame will show.

Dirty or Broken Spark Plugs—Remove and clean. Be sure porcelain insulator is not cracked.

Points of Spark Plugs Improperly Set—If these points are too close together or too far apart, missing may result. Spark plug points should be set approximately .025-inch apart—about the thickness of a dime.

Defective Carbureter Adjustment.

Loss of Compression in any Cylinder—Valve may be stuck or there may be dirt under it. Examine the valve tappet to see whether the valve seats properly. To locate cylinder that is weak on compression, turn over the engine by hand, testing each cylinder in turn.

Water in Gasoline—Indicated by engine running and stopping and running again by fits and starts.

Overheating—Engine runs with some pounding and slowly. Close throttle completely. See "Engine Overheats."

LOSS OF POWER

The engine will run but will not pull the tractor under a heavy load.

May be due to:

Loss of compression.

Too rich a mixture through carbureter flooding.

Valves not seating properly and not holding compression.

Weak ignition.

Lack of oil or water.

Lack of gasoline. If this is due to the stoppage of the gasoline pipe, the engine will spit back through the carbureter when the throttle is opened.

LACK OF GOOD COMPRESSION

This is generally due to leaky valves. These should be adjusted or their seats reground. Scored cylinders are a very common cause and are the result of insufficient lubrication.

POPPING BACK THROUGH CARBURETER

This usually indicates too weak a mixture and may be caused by:

Dirt in gasoline passage or nozzle—Try pet cock on carbureter.

Air leak in the intake passage or vacuum tank and connections.

Inlet valves holding open.

Water in gasoline.

ENGINE OVERHEATS

Lack of Proper Lubrication.

Defective Water Circulation—Inspect all water passages, making sure that the gaskets (washers) at flange joints have not swollen in such a way as to cut down the opening.

Slipping Fan Belt—Belt should be tightened.

Too Much Gasoline—Too rich a mixture is indicated by black smoke at the exhaust. The engine will sometimes continue to fire after the switch has been turned off, even though the water is not hot enough to indicate overheating. This firing is caused by a carbon deposit in the cylinders, which becomes incandescent.

Too Little Gasoline—Too lean a mixture is indicated by lack of acceleration, popping in the carbureter or back-firing when the throttle is suddenly thrown open.

ENGINE KNOCKS

Connecting Rod Bearings too Loose or Burned Out—Loose bearings give a light knock at high speed. Burned out bearings knock whether running under load or idling and low pressure is shown on Oil Gauge.

Lack of Proper Lubrication of Engine.

Faulty Carbureter Adjustment.

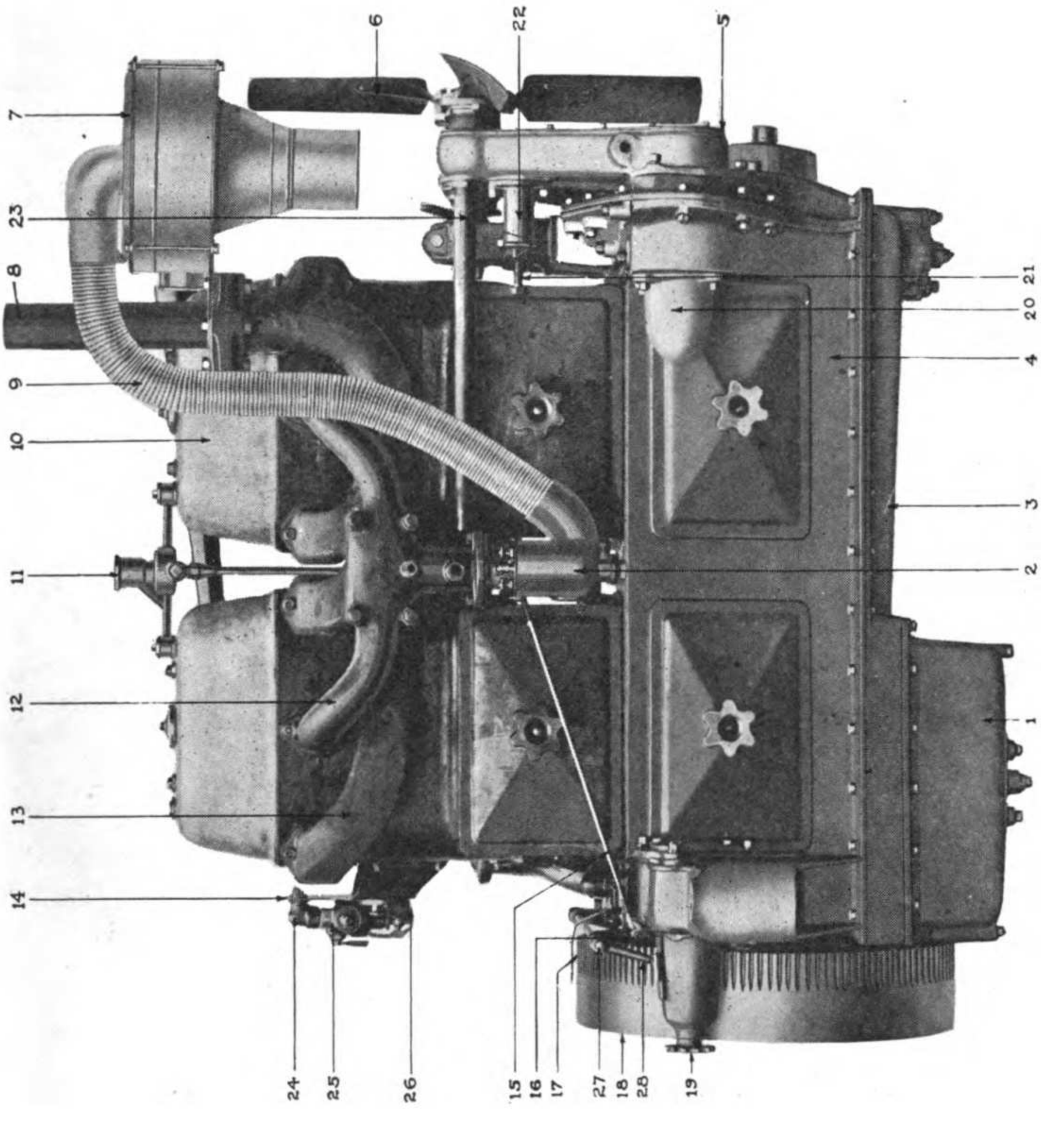
A Loose Piston in One of the Cylinders—Knocks only under full load at low speeds.

Carbon in Cylinders—This carbon becomes heated and may cause premature ignition. Remove cylinder heads and clean cylinders.

Crankshaft Bearing Loose—Heavy pound at slow engine speed under heavy load. The adjustment of this bearing should by all means be made as soon as possible.

Overheating Due to Lack of Water.

PLATE 17



RIGHT HAND SIDE OF ENGINE

PLATE 17—RIGHT HAND SIDE OF ENGINE

Ref. No.	Ord. No.	Name
1	340A	Lower oil pan.
2	407A	Carbureter assembly.
3	341A	Upper oil pan.
4	322A	Crank case—upper.
5	309A	Governor lever housing.
6	281A	Fan.
7	408A	Air cleaner.
8	241C	Exhaust pipe.
9	407B	Air cleaner flexible
10	304A	Cylinder head cover
11	429A	Valve cover oil reli
12	394A	Intake manifold.
13	393A	Exhaust manifold.
14	415A	Instrument bracket
15	403F	Carbureter control
16	403A	Carbureter control
17	331B	Flywheel pointer.
18	261A	Flywheel.
19	181A	Eclipse-Bendix sta
20	310A	Generator shaft co
21	313C	Governor adjusting
22	313E	Governor adjusting
23	311E	Governor rod tube.
24	416D	3-way gasoline valv
25	416C	3-way gasoline valv
26	416B	Magneto switch.
27	401E	Spark control shaft
28	401D	Spark and carburet

CHAPTER II

ENGINE GROUP

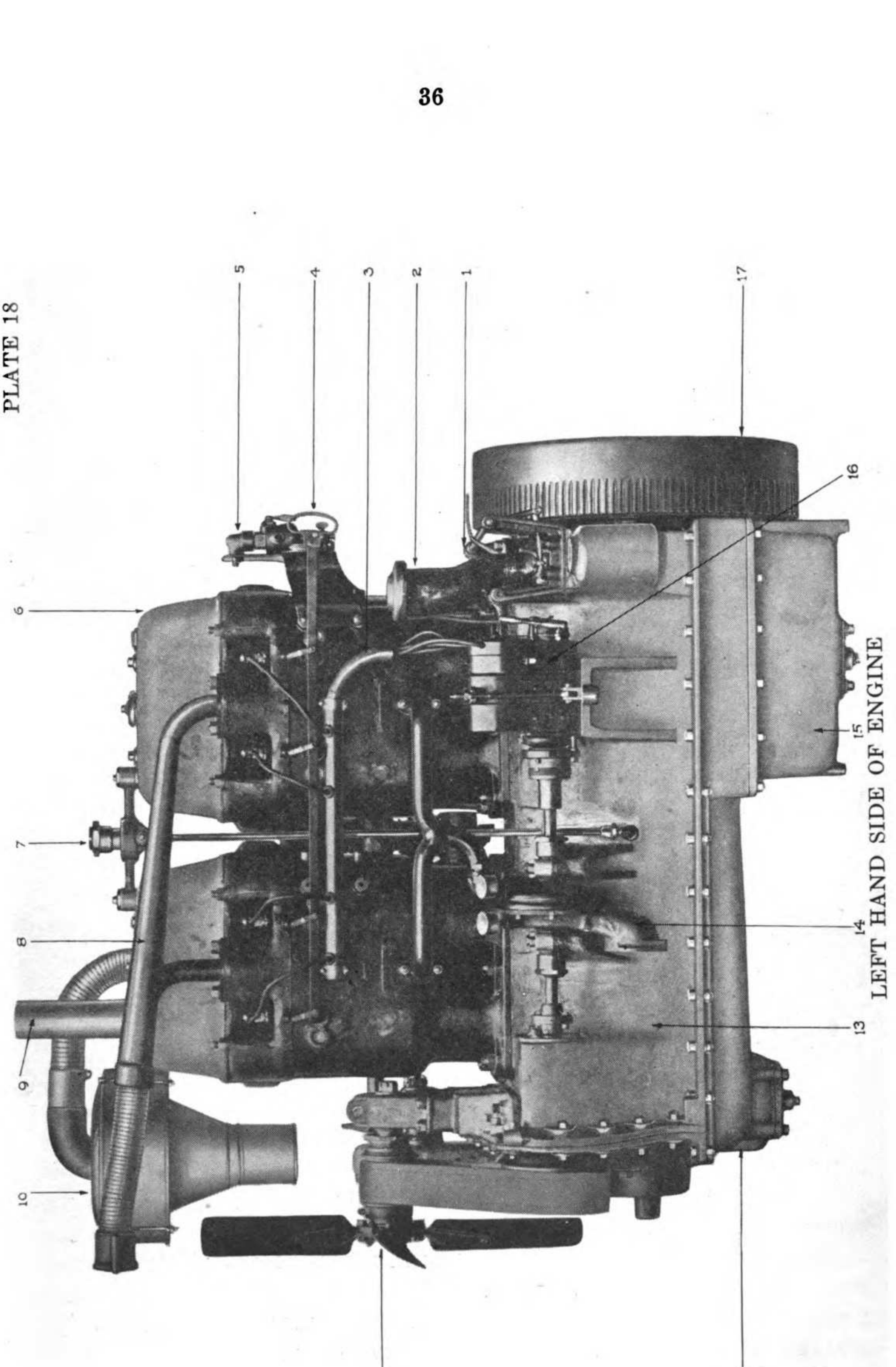
ENGINE

CHAPTER CONTENTS

BRIEF DESCRIPTION

The Engine Group consists of the parts which together develop the power to propel the Tractor. It includes the Engine Complete, the Fuel Supply System, the Ignition System, the Cooling System and the Starting Units. The engine is of the four-cylinder type with the Cylinders cast in pairs and mounted upon a two-piece Crankcase of cast aluminum. The latter is mounted in the Main Frame on a three point suspension, two of the points being on either side of the Flywheel and the third at the front end of the motor on the Timing Gear Cover Plate. The Cylinders have detachable heads in which the Intake and Exhaust Valves are located. The Ignition is obtained with a Magneto which has an Impulse Starter for ease in starting the engine. Carburetion is obtained with a Schebler Carbureter. A "hot spot" Manifold is provided to insure the vaporization of even poorer grades of fuel. The

PLATE 18



LEFT HAND SIDE OF ENGINE

PLATE 18—LEFT HAND SIDE OF ENGINE

Ref. No.	Name
1	Spark and throttle control.
2	Oil filler and breather.
3	Ignition cable tube.
4	Gang hand lever.
5	Instrument assembly.
6	Rocker arm covers.
7	Oil pressure relief valve.
8	Water outlet pipe.
9	Exhaust pipe.
10	Air cleaner.
11	Cooling fan.
12	Upper oil pan.
13	Crank case, upper.
14	Water pump.
15	Lower oil pan.
16	Magneto.
17	Flywheel.

speed of the Engine is regulated by means of a flyball Governor located in the Timing Gear Case and operating a butterfly throttle above the Carbureter. Cooling is accomplished by means of a flat tube type of Radiator in conjunction with a centrifugal Water Pump and a belt-driven four-bladed Fan. The Lubricating System is unique in that it has been designed to deliver a uniform quantity of oil to the bearings at all times whether the tractor is going up or down a 100 per cent grade. This is accomplished by the use of three oil pumps, pressure feed, and a dry crankcase.

ENGINE OPERATION.

The engine operates on the four-stroke cycle which is conventional on all truck and passenger car engines made in the United States. There are four distinct strokes of the pistons necessary for the completion of a cycle, these four strokes being called: Intake, Compression, Firing, or working stroke, and Exhaust.

Upon being cranked by hand, a Piston descends while its Intake Valve is open, and draws into the Cylinder through the Carbureter and the intake manifold, a charge of gas. When the Piston is just past the bottom of its stroke, and again returning upwards the Intake Valve closes, and as the Exhaust Valve is also closed at this time, the gas is trapped within the Cylinder and compressed by the Piston's upward motion.

When Piston reaches top of its stroke, the spark occurs and explodes the mixture which, due to its increase in pressure, drives down the

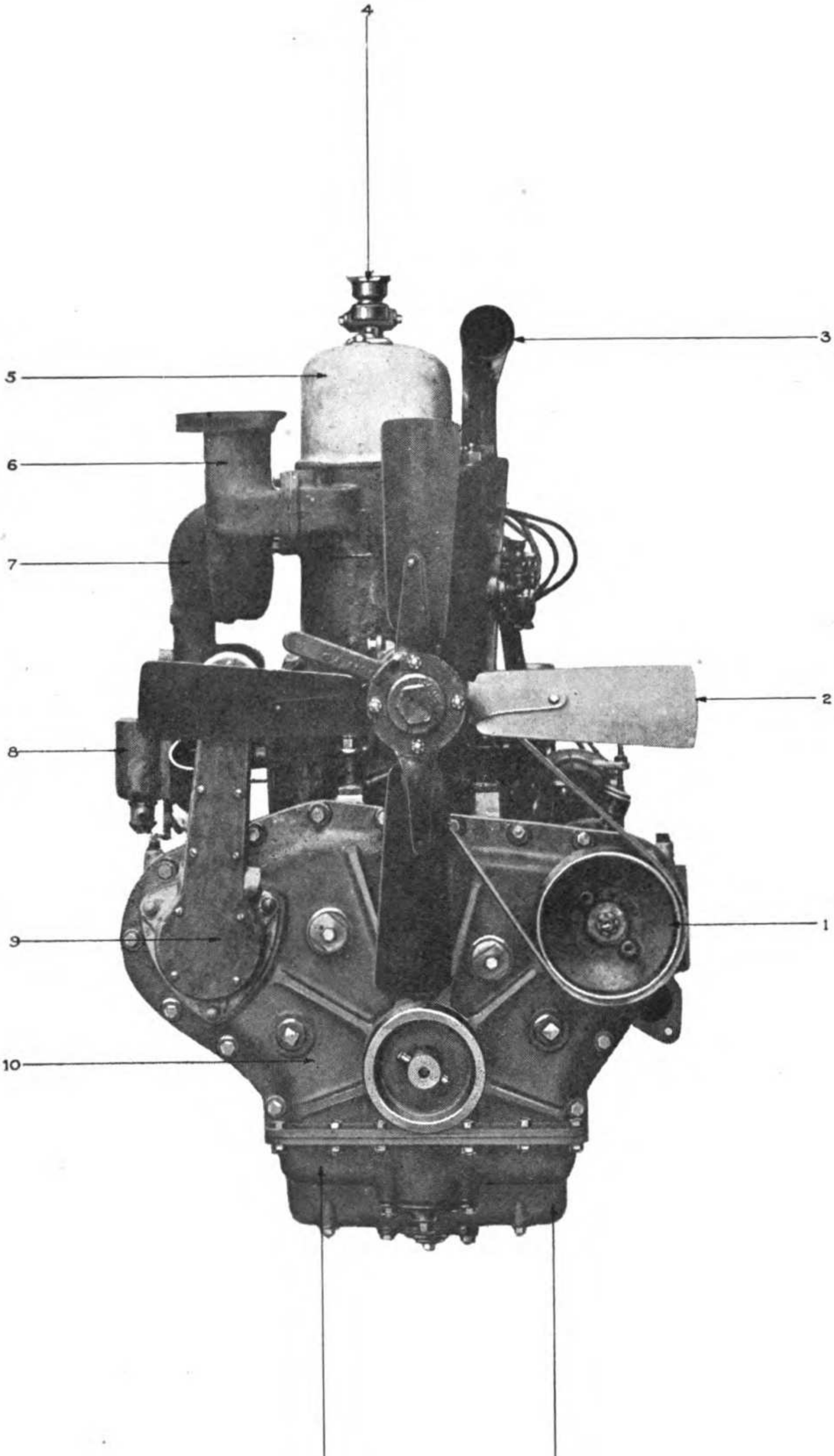


PLATE 19—FRONT VIEW OF ENGINE

PLATE 19—FRONT VIEW OF ENGINE.

Ref. No.	Name
1	Fan drive pulley.
2	Cooling fan.
3	Water outlet manifold.
4	Oil pressure relief valve.
5	Rocker arm covers.
6	Exhaust manifold.
7	Intake manifold.
8	Carbureter.
9	Governor lever housing.
10	Timing gear cover plate.
11	Upper oil pan.
12	Lower oil pan.

Piston with considerable force, thus storing up energy inthe Flywheel for the succeeding stroke.

When the Piston nears the bottom of its stroke the exhaust valve opens, allowing the expanded, and now useless gases to escape, and stays open during the following upward movement of the piston, allowing the ejection of the remaining burned gases.

ENGINE GROUP

The Engine used in the Five-ton Artillery Tractor has four Cylinders with a bore of 4.75 ($4\frac{3}{4}$) inches and stroke of 6 inches, giving a Piston Displacement of 425.3 cubic inches. The Cylinders are cast in pairs and mounted upon an aluminum Crankcase, which is supported by the Main Frame at three points. The Cylinder Head is detachable and carries all of the valves which are located in the top of the Cylinder Head. The Engine Assembly comprises the following sub assemblies, namely: Cylinder, Rocker Arm Cover, Piston and Connecting Rod, Crankshaft, Crankcase, Oiling System, Governor, Fan, Water Pump, Manifolds and Muffler.

CYLINDER ASSEMBLY

The Cylinder Assembly consists not only of the two Cylinders, which are cast integrally together, but also the Cylinder Head with its Valves, Rocker Arms and Valve Springs, Valve Push Rods, and Valve Tappets and Guides.

CYLINDER

The Cylinders are cast in pairs without the Cylinder Heads and have a bore 4.75 ($4\frac{3}{4}$) inches and total over all length for piston travel of 11.625 ($11\frac{5}{8}$) inches. The cylinder walls are 0.312 ($\frac{5}{16}$) inch thick. The Cylinders are surrounded by water jackets the walls of which are 0.187 ($\frac{3}{16}$) inch thick. The Cylinders are cast from gray iron. They

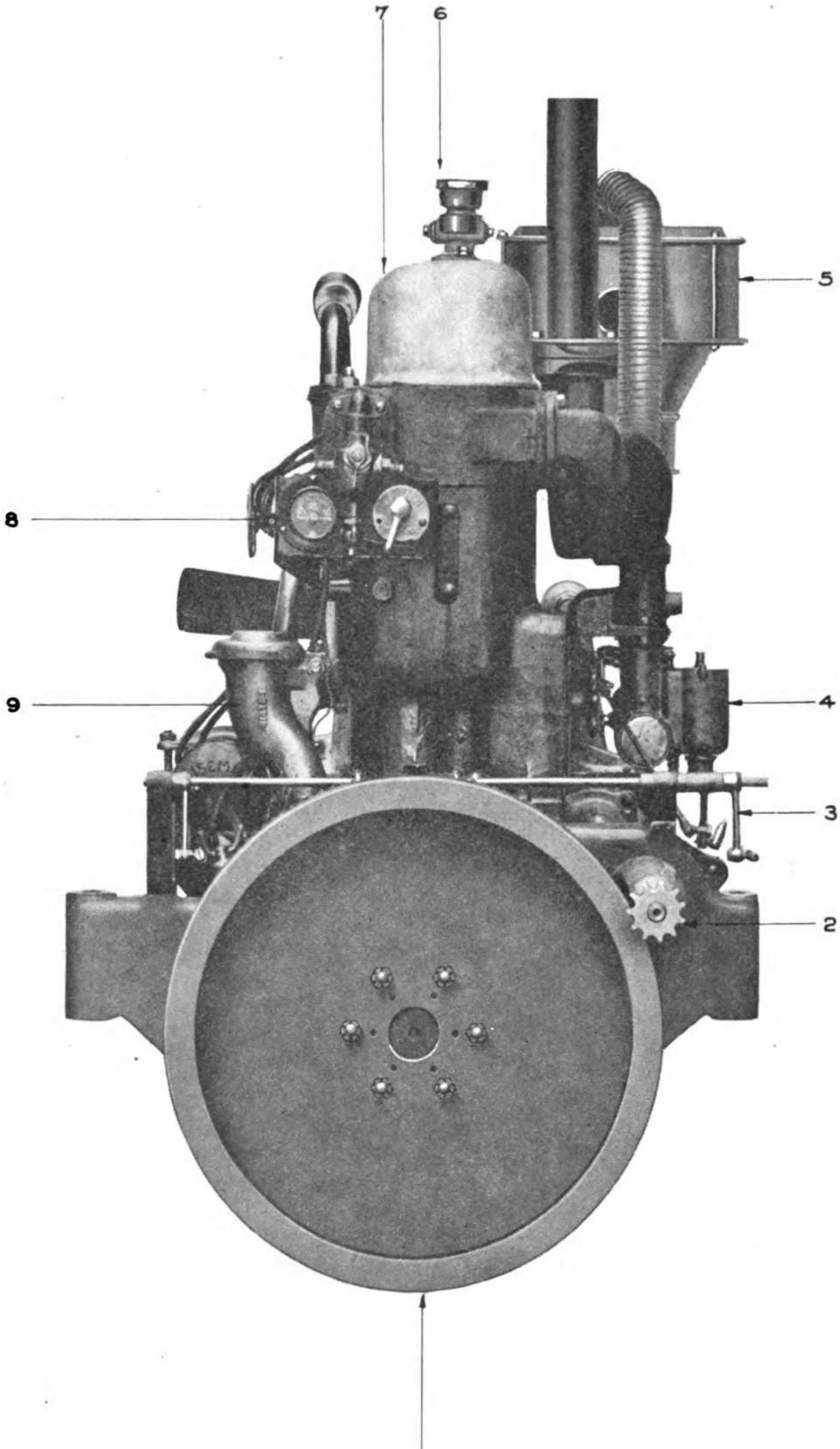


PLATE 20—REAR VIEW OF ENGINE

PLATE 20—REAR VIEW OF ENGINE

Ref. No.	Ord. No.	Name
1	261A	Flywheel.
2	181A	Bendix starting drive.
3	401D	Spark control lever.
4	407A	Carbureter.
5	408A	Air cleaner.
6	301F	Sight feed oil cup.
7	303A 304A	Cylinder head cover.
8	415A	Instrument bracket.
9	274A	Breather.

are held in place upon the Crankcase by seven 0.625 (5/8) inch steel studs. Two of the nuts on these Studs which hold the cylinder casting in place are inside of the Valve Cover Plate. In the head of the Cylinder there are eleven 0.5 (1/2) inch steel Studs which hold down the Cylinder Head. In the side of the Cylinder are two 0.125 (1/8) inch Street Elbows, one for each Cylinder, into which are screwed the priming cups. The four priming cups on the assembled engine are connected together by means of a Gang Hand Lever which extends backward and through the armor plate which forms the dashboard of the Tractor. The Gang Lever Handle is within easy reach of the driver at this point. The Gang Lever was eliminated after first production.

On the opposite side of the Cylinder Block there is a Valve Cover Plate of pressed steel which keeps the dirt and dust from working into the Push Rod Guides and Valve Tappets. In order to make this oil tight a Valve Cover Plate Gasket of cork is inserted between the Cylinder body and the Valve Cover Plate. A 0.375 (3/8) inch standard Stud provides anchorage for the Valve Cover Nut used to hold the Valve Cover Plate in place. A small wire ring is placed on the inside end of the Valve Cover Plate Nut to prevent its loss when the Valve Cover Plate is removed.

CYLINDER SCORED

Cylinders may become scored because of engine operation for long periods when overheated, lack of lubrication, tight pistons, loose or broken wrist pin, piston out of round, connecting rod out of alignment.

CYLINDER HEAD

The Cylinder Head carries all of the overhead valve gear, which comprises the four Valves; the eight Valve Springs, the four Valve Spring Seats and Locks, the four Rocker Arms and the two Rocker Arm Brackets and in addition the two Spark Plugs.

The Cylinder Head, like the Cylinder Body, is cast from gray iron and is made up so as to form the head for a pair of Cylinders, hence each Engine requires two Cylinder Heads. There are two Valves for each Cylinder, one an exhaust and one an inlet. Hence the Cylinder

Head carries four Valves, the two outside Valves being for the exhaust and having separate outlet passages, while two located at the center of the Head and having a common inlet passage are for the intake. The Valves have a clear opening 2.125 (2⅛) inches. The Cylinder Head is held in place by eleven 0.5 (½) inch Studs. The nuts which hold down the Cylinder Head have brass washers beneath them, which prevent injury to the Cylinder Head casting, compensate for expansion

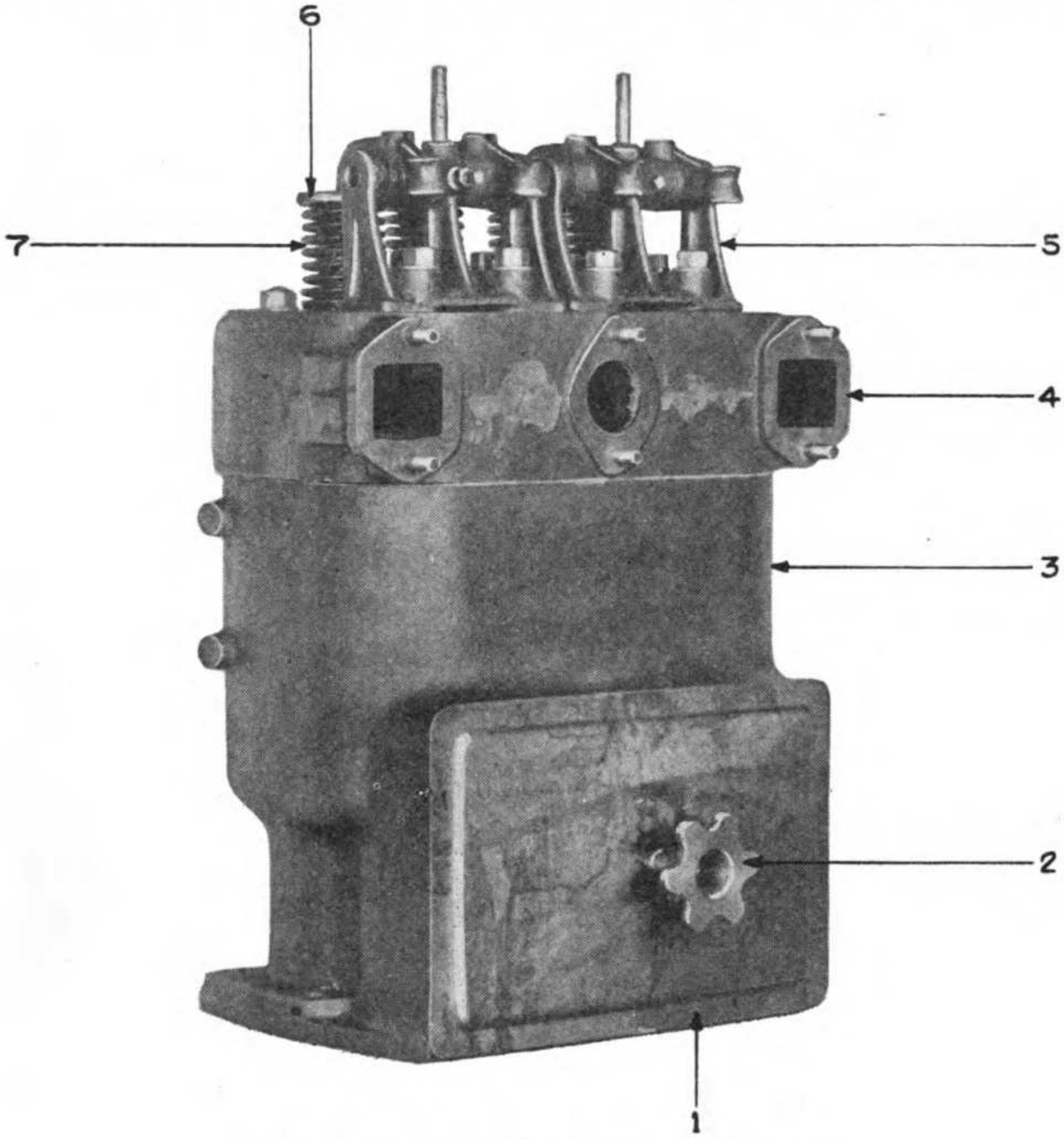


PLATE 21—CYLINDER ASSEMBLY

Ref. No.	Ord. No.	Name
1	299A	Valve cover plate.
2	297F	Valve cover nut.
3	291A	Cylinder.
4	292A	Cylinder head.
5	298D	Rocker arm bracket.
6	296B	Valve spring seat.
7	300A	Main valve spring.

and act as packing when tightening down the Cylinder Head nuts. Pockets are cast in the left side of the Cylinder Head in which the Spark Plugs are located. These are tapped out for 0.875 (⅞) inch S. A. E. Spark Plugs. This is the standard size of S. A. E. Spark Plug and

should be distinguished from the 0.5 (½) inch or Metric Plug, which is common on European and Aviation Engines.

Between the bottom of the Cylinder Head and the top of the Cylinder Block is pressed an 0.093 ($\frac{3}{32}$) inch thick copper-asbestos gasket. Whenever there are any indications of lost compression or leakage of water into the Cylinder bore, the condition of the Cylinder Head Gasket should be immediately investigated. This can readily be done by removing the Cylinder Head.

CYLINDER HEAD GASKETS MUST NOT LEAK WATER

The joint between the cylinder and cylinder head is made water tight by using a copper-asbestos cylinder head gasket. If the cylinder head has not been bolted down evenly and tightly into place, the cylinder head gasket may leak water into the cylinder, or the water may leak on the outside of the engine. To determine if gasket is leaking due to cylinder head being improperly bolted down, proceed as follows:

Slack off the nuts on the cylinder head studs a few turns, seat cylinder head on cylinder head gasket by using a large hammer on the cylinder head and a block of wood to cushion the blows, then commence to bring cylinder head into place with the nuts on the cylinder head studs by giving each nut in rotation around the cylinder head one turn, until firmly bolted down. If the cylinder head gasket still leaks, remove the gaskets and replace with a new one. If a new cylinder head gasket is not at hand, an emergency repair may be made by drying the cylinder head and cylinder surface and gasket, shellac the gasket allowing to dry until very tacky and bolt into place. This practice is not to be recommended but can be used in case of an emergency repair.

VALVE GEAR

The Valve Gear consists of the following parts between the Cam on the Cam Shaft, located in the Crankcase, and the Valve, located in the Cylinder Head; the Valve with the Rocker Arm, the Push Rod, the Valve Tappet and Roller. The Valves have an outside diameter of 2.375 (2⅜) inches with forty-five degree beveled seats 0.125 (⅛) inch in width. The Valve Head is 0.325 ($\frac{5}{16}$) inch thick and is made of cast iron electrically welded onto the steel stem which is 7.312 (7 $\frac{5}{16}$) inches long and 0.434 ($\frac{7}{16}$) inch in diameter. The upper end of the Valve Stem, against which the Valve Tappet Rocker Arm acts, is hardened in Cyanide.

The Valve is guided in the Cylinder Head by a cast iron Valve Stem Guide 4.5 (4½) inches long and held against its seat by means of two Valve Springs and a Pressed Steel Spring Seat which is attached to the top of the Valve by means of a Valve Spring Seat Lock. The Valve Spring Seat Lock is tapered 3 inches per foot so that when the Valve

Spring Seat is crowded up against it by the Valve Springs it will tend to clamp tighter and thereby prevent any wear. There should be no difficulty in assembling the Valve Spring Seat and Valve Spring Seat Lock if one observes the directions of the taper on the Valve Spring Seat Lock, which should have the small end down or towards the Valve or Cylinder Head.

The Valves are held in place by two Springs, the Main Valve Spring being the larger and outside, and the Auxiliary Valve Spring the smaller or inside one. The Main Valve Spring is 2 inches outside diameter and when compressed to its normal length, 2.468 (2 15/32) inches, should have a tension of about seventy to seventy-three pounds, and when free a height of approximately 4.25 (4 1/4) inches. The Auxiliary Valve Spring is lighter and measures 1.0625 (1 1/16) inches inside diameter. When this spring is compressed to its normal length, 2.343 (2 11/32) inches, it should show a tension of thirty-two to thirty-four pounds and when free should be approximately 4.125 (4 1/8) inches in length.

VALVE GRINDING

To grind the valves of the 5-ton Artillery Tractor Engine, remove the cylinder head and place it in a vise so that a good hold may be obtained in grinding. Compress each valve spring enough to remove the clip that holds it onto the valve stem. Note the order of removing valves and springs so that they may be reassembled in their original position.

An effective valve grinding tool can be made by forging a bit to fit the slot in the valve head and work in the socket of a brace. This method is much to be preferred over using a screw driver. Placing a light spring under the valve head—just enough to raise it off its seat—will facilitate grinding.

Use carborundum powder mixed into a paste with cup grease, or use a reliable valve grinding compound. If the valve or valve seat is pitted badly, use a coarse compound first, finishing with a fine compound.

In grinding valves do not use a circular motion. Grind valves with a back and forth motion, turning about 1/4 of the way around, then lift the valve off its seat and bring it about 1/4 of a turn toward the right, then seat valve and grind as before. This is where the spring under the valve head helps. Continue this stepping the valve around, so that all the high spots will come in contact with each other, until the valve is ground to an even seat. To watch the progress of the work wash the valve and valve seat with kerosene.

When the grinding is finished, flush the valve stem, valve stem guide, valve seat and cylinder head thoroughly with kerosene to remove all traces of grinding compound. *Never allow the least trace of any grinding compound to get into the Cylinders.*

TESTING VALVE GRINDING

With a soft lead pencil make six or eight marks at regular intervals around the valve seat, drawing the pencil from the inner edge of the valve seat to the outer edge in a straight line. Place valve on seat and rotate in a circular direction several times. If the valve and seat are evenly ground, all the lead pencil marks will be removed. If part of the lines remain, it indicates that the valve seat and valve are still uneven and grinding must be continued until the lead pencil marks are removed.

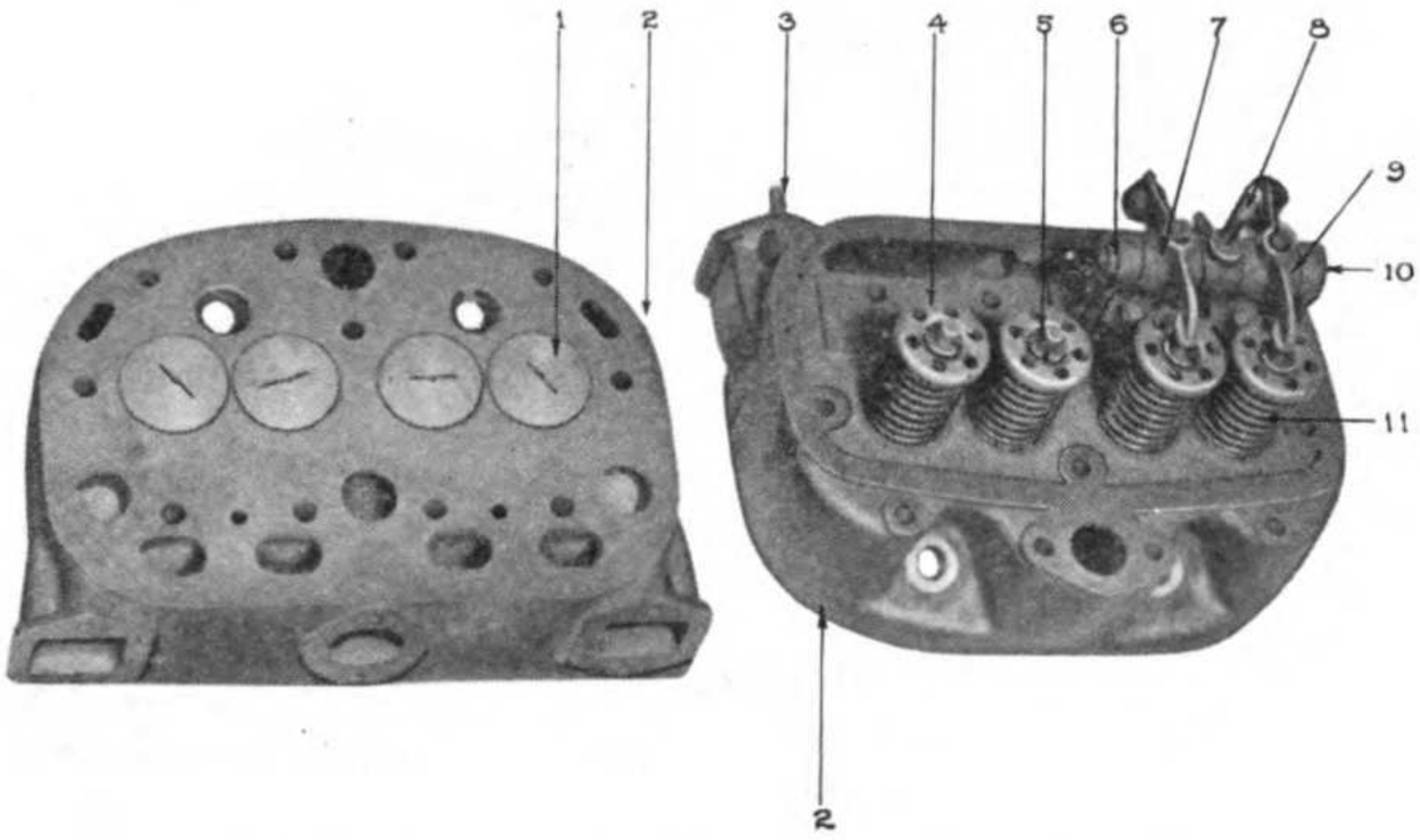


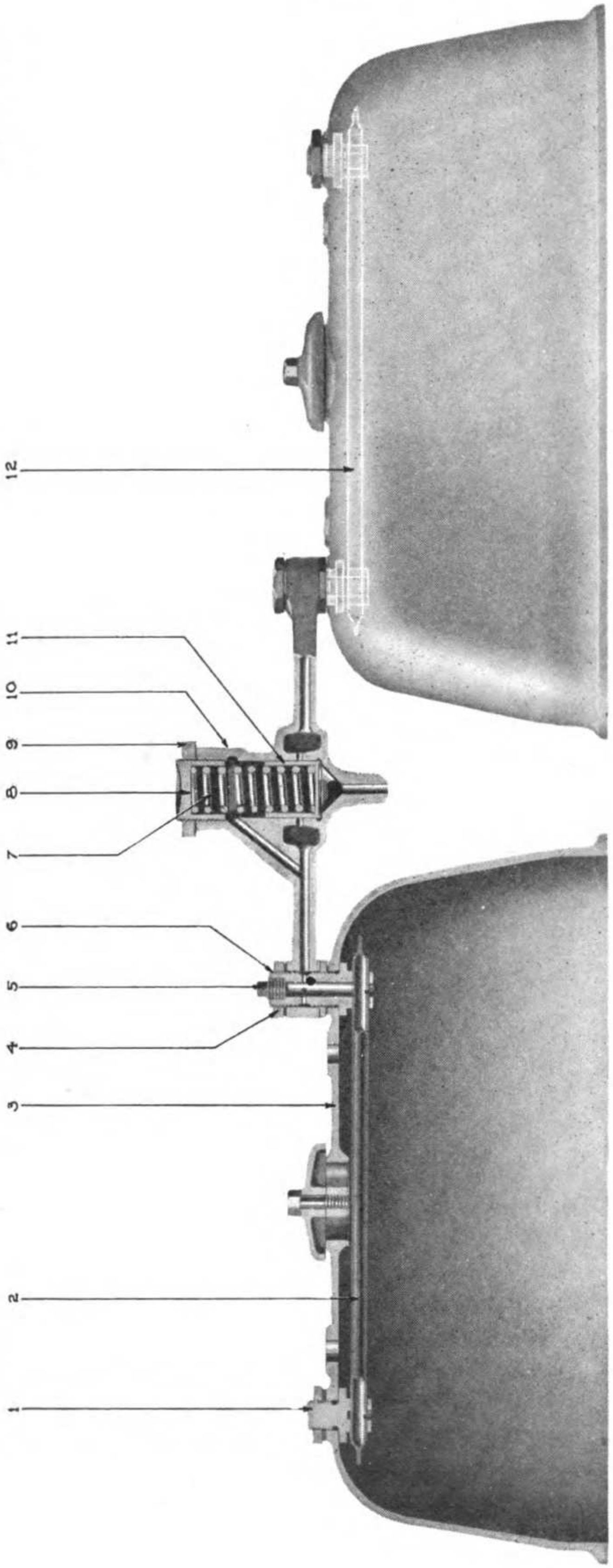
PLATE 22—CYLINDER HEAD AND PARTS

Ref. No.	Ord. No.	Name
1	296A	Valve.
2	292A	Cylinder head.
3	302D	Manifold stud.
4	296B	Valve spring seat.
5	297A	Valve spring seat lock.
6	296F	Rocker arm shaft.
7	298C	Rocker arm, straight.
8	302H	Cylinder head cover stud.
9	298B	Rocker arm, left.
	298A	Rocker arm, right.
10	298D	Rocker arm bracket.
11	300A	Main valve spring.
	300B	Auxiliary valve spring (inside).

CORRECT VALVE OPERATION

To keep valves in perfect condition, maintain compression and secure a perfect carbureter adjustment, the valves must seat uniformly and open and close correctly. Before proceeding with a carbureter adjustment, it is absolutely necessary to be sure that when the tappet is standing on the heel of the cam and all slack taken up from the rocker arm down a clearance of .008 of an inch exists between the rocker arm and valve stem.

PLATE 23



ROCKER ARM COVERS AND OILING SYSTEM

PLATE 23—ROCKER ARM COVERS AND OILING SYSTEM

Ref. No.	Ord. No.	Name
1	430D	Pipe support stud.
2	430A	Valve cover feed pipe, right.
3	304A	Cylinder head cover.
4	430E	Oil pipe stud lock nut.
5	176F	Pipe plug.
6	430C	Oil pipe stud.
7	429B	Oil relief spring.
8	429C	Oil relief adjustment plug.
9	431C	Adjusting lock nut.
10	429A	Valve cover oil relief body.
11	429D	Oil relief plunger.
12	430B	Valve cover feed pipe, left.

ROCKER ARM COVER ASSEMBLY

The Rocker Arms on the Cylinder Head are assembled in groups of two Rocker Arms each, mounted upon a Rocker Arm Bracket, which is attached to the Cylinder Head by two small cap screws when the Cylinder Head is not in place, but when in place by two of the Cylinder Head Holding Nuts in addition. These Rocker Arm Brackets are made from cast steel. The Rocker Arm Shaft is held stationary in the Rocker Arm Bracket by means of a 0.25 (¼) inch dog point set screw which is prevented from rotating by a 0.25 (¼) inch lock nut. The Rocker Arm Shaft is made from steel tubing, case hardened and ground. Its inside diameter is 0.437 ($\frac{7}{16}$) inch and its outside diameter 0.7485 (¾) inch with an overall length of 5.375 (5⅜) inches.

The Rocker Arms are not interchangeable, there being three types, the Rocker Arm, Straight; the Rocker Arm, Left and the Rocker Arm, Right. The Rocker Arm, Straight, is used on the intake valves only; the Rocker Arm, Right, is always used on the front Exhaust Valve of each Cylinder Head, while the Rocker Arm, Left, is used on the rear Exhaust Valve of each Cylinder Head. The Rocker Arms are not symmetrical about the fulcrum or center of the Rocker Arm Shaft. The distance from the center of the Rocker Arm Shaft to the center of the Valve Stem is 2.156 ($2\frac{5}{32}$) inches, while the distance from the center of the Push Rod to the center of the Rocker Arm Shaft is 1.843 ($1\frac{47}{32}$) inches, giving a ratio of 1.171 to 1. The bent Rocker Arms have a 0.5 (½) inch offset. The Rocker Arms are all bushed with a bronze Rocker Arm Bushing, 1.496 (1½) inches long with an inside diameter 0.75 (¾) inch and outside diameter 1.0325 ($1\frac{1}{32}$) inch.

The Rocker Arms are operated by Push Rods, which are located inside of the Valve Cover Plates and enclosing cored passages provided for this purpose in both the Cylinder Head and the Cylinder Block. These Push Rods are made from 0.562 ($\frac{9}{16}$) inch seamless steel tubing with 0.093 ($\frac{3}{32}$) inch walls. Into the ends of these tubes are inserted and welded the Valve Push Rod Balls, which are case hardened and have 0.562 ($\frac{9}{16}$) inch diameter. The overall length of the complete Push Rod from center to center of the balls is 18.9325 ($18\frac{13}{16}$) inches. The upper end of the Push Rod fits into a socket in the Rocker Arm, which is oiled by means of a groove cut in the top of the Rocker Arm. The Rocker Arm Bushing is drilled and there is a 0.625 ($\frac{5}{8}$) inch opening in the top of the Rocker Arm immediately above it which acts as an oil reservoir.

ROCKER ARM OILING SYSTEM

The Rocker Arm Oiling System requires separate explanation because the first of the Five-ton Artillery Tractors were not equipped with it in the form which is now regularly used. The first Tractors of the Model 1917 were equipped with separate Oil Cups, eight in number, each of which served to lubricate the one Rocker Arm on each Rocker Arm Bracket. These cups had to be filled daily and the operator had to turn them on before starting the Engine. Now they have been replaced by the Rocker Arm Oiling System, which is an integral part of the Pressure Feed Oil System of the Engine.

The Rocker Arm Oiling System is located in the Cylinder Head Covers and not only includes the Valve Cover Feed Pipes, through which the oil is fed to the Rocker Arms, but also the Oil Relief Valve for the Main Oil Supply.

MAIN OIL RELIEF VALVE

The Main Oil Relief Valve is now located in the Valve Cover Oil Relief Body, which is mounted on top of the Cylinder Head Covers at the center of the Engine and from which oil is distributed into both Front and Rear Valve Cover Feed Pipes. The Oil Relief Valve is kept closed by the Oil Relief Spring, but is opened when the pressure reaches 25 pounds or more, and the surplus oil escaping at this point is conveyed to each of the Valve Cover Feed Pipes. This oil runs down over the Rocker Arms, lubricates the Rocker Arm Shafts and then drains down over the side of the Cylinder Head to the Crankcase, thoroughly lubricating on its way the Valve Tappets and Push Rods.

CONSTRUCTION OF OIL RELIEF VALVE

The Oil Relief Valve is made up of the Valve Cover Oil Relief Body, the Oil Relief Adjusting Plug, the Oil Relief Spring and the Oil Relief Plunger.

The latter fits into the bottom of the Valve Cover Oil Relief Head and is 1.122 (1⅛) inches in diameter and 1.062 (1$\frac{1}{16}$) inches in height. When it is raised by the oil pressure 0.5625 ($\frac{9}{16}$) inch, it uncovers a groove in the wall of the Valve Cover Oil Relief Body 0.125 (⅛) inch wide which communicates with the Valve Cover Feed Pipes. This Plunger is held in place by a 0.875 (⅞) inch outside diameter spring that has a free length of 2.375 (2⅜) inches, but when compressed to 30 pounds, has a length of 1.687 (1$\frac{11}{16}$) inches. The Oil Relief Adjusting Plug is very accessibly located in the top of the Valve Cover Oil Relief Body and when properly adjusted is locked by a check nut provided for this purpose.

VALVE COVER FEED PIPES

The Valve Cover Feed Pipes are held in the Cylinder Head by an Oil Pipe Stud and a Pipe Support Stud. The first of these is hollow and conveys the oil from the Valve Cover Oil Relief to the Valve Cover Feed Pipes. The latter only serves as a support for the other end of the Feed Pipe. There are two Valve Cover Feed Pipes, one for the Rear and one for the Front Cylinder Head Cover. This is made necessary because the Valve Cover Feed Pipe is not symmetrical. The Valve Cover Head Pipe is made from 0.312 ($\frac{5}{16}$) inch copper pipe with 0.031 inch number 20 B. & S. gage wall, the ends of which are pinched together and soldered.

VALVE TAPPETS

The Valve Tappets are of the roller type and are mounted in the Valve Tappet Guides, which are clamped in the upper half of the Crankcase. The Valve Tappet Guides are made from cast iron and are held in the Crankcase by means of a Valve Tappet Guide Crab. The latter is in the form of a yoke which holds the two adjacent Valve Tappet Guides in place. Since the Roller Tappets are used, it is essential that these Guides be prevented from turning, which is accomplished by means of a keyway, 0.156 ($\frac{5}{32}$) inch wide, cut in one side of the Valve Tappet Guides and engaging with a pin in the Crankcase. The Valve Tappet carries an 0.9355 ($\frac{15}{16}$) inch diameter roller with 0.437 ($\frac{7}{16}$) inch face. This roller is mounted on a Valve Tappet Roller Pin, 0.5 (½) inch diameter, the ends of which are flattened off so as to engage 0.25 (¼) inch slots in the sides of the Valve Tappet Guide, which prevents the Roller Pin from rotating.

In the upper end of the Valve Tappet are inserted the two pieces which provide for the Valve adjustment. One of these is the Valve Tappet Adjusting Screw; the other is the 0.875 (⅞) inch 18 U. S. Standard Thread Nut which locks the adjusting screw in place. The Valve Tappet Adjusting Screw is made from case hardened steel with the upper end of it cupped out to receive the Roller Ball on the end of the Valve Push Rod.

VALVE TIMING

The Intake and Exhaust Valves both have the same lift, namely: 0.396 ($\frac{13}{32}$) inch. When the Valves are properly timed, there should be 0.006 inch clearance between the Valve Stem and the end of the Rocker Arm. The Timing Gears at the front of the Engine are marked so that there should be no difficulty in replacing them and putting the Engine in proper time if it has been disassembled. However, in case some difficulty in the timing is encountered, the following information will be invaluable. The Valve timing in degrees is as follows: The Intake Valve is open over a period, measured on the Crankshaft circle, of 200 degrees. In the same way the period of opening of the Exhaust Valve is 230 degrees. The Exhaust Valve closes 5 degrees past the Upper Dead Center and opens 45 degrees ahead of the Bottom Center. The Intake Valve opens 15 degrees past the Upper Dead Center and closes 35 degrees past the Lower Dead Center.

FLYWHEEL TIMING MEASUREMENTS

To facilitate in timing the Engine, the degrees mentioned in above paragraph are here given in inches measured on the circumference of the Flywheel. According to this, the Exhaust Valve closes 0.867 ($\frac{7}{8}$) inch past the Upper Dead Center and the Intake Valve opens 2.601 ($2\frac{39}{64}$) inches past the Upper Dead Center. In timing the Engine, it is necessary that there be this difference in the timing between the closing of the Exhaust Valve and the Opening of the Intake. If this is observed and checked, for one Cylinder, the rest of the Valves will be timed properly. Due to a slight variation in the workmanship and adjustment, an allowance of $\frac{3}{4}$ inch is made in the adjustment of the Exhaust Valve closing and the Intake Valve opening. In other words, the Exhaust Valve may close $\frac{3}{8}$ inch earlier or $\frac{3}{8}$ inch later when measured on the Flywheel circumference than the 0.867 ($\frac{7}{8}$) inch dimention given above.

For further checking the following figures are given: The Exhaust Valve should open 45 degrees or 7.803 ($7\frac{13}{16}$) inches before the Lower Dead Center and the Intake Valve close 35 degrees or 6.069 ($6\frac{1}{16}$) inches past the Lower Dead Center.

FIRING ORDER

The Cylinders of the Engine are numbered from the Radiator back, calling the first one, or one nearest the Radiator, Number 1, the second one Number 2, and so on. Having this order of cylinder location in mind, the Firing Order of the Engine is 1-3-4-2.

PISTON AND CONNECTING ROD ASSEMBLY

The Piston and Connecting Rod Assembly consists of the Piston proper, the Piston Rings, the Piston Pin and Piston Pin Locking Screw, the Connecting Rod and Connecting Rod Cap, the Piston Pin Bushing and Connecting Rod or Crank Pin Bushings. Four of these assemblies are required per Engine.

CONNECTING ROD

The Connecting Rod is a steel drop forging of "I" beam section, S.A.E. Specification Number 1035, with heat treatment "D." The Connecting Rod length from the center of the Piston Pin to the center of the Crank Pin is 13.25 (13¼) inches. The "I" section of the Connecting Rod tapers slightly, but just above the big end is 0.75 (¾) x 1.625 (1⅝) inches and 0.125 (⅛) inch thick. The Connecting Rod Caps are held in place by four special nickel steel bolts 0.498 (½) inch in diameter. Between the Connecting Rod and the Connecting Rod Cap are inserted the Connecting Rod Shims. Two sets of Shims are used on each Connecting Rod, one set of Laminated Shims composed of eight Shims 0.003 inches thick and one pair of sheet brass Shims Number 18 B. & S. gauge, 0.050 (1/16) inch thick. The latter Shims are interchangeable with part Number 1067-V on the Class A and B trucks.

TO REMOVE CONNECTING ROD

To remove connecting rod and piston, drain off oil, and remove oil pan, turn engine over by hand until lower end of connecting rod to be removed is half way down on side of engine towards camshaft; remove connecting rod bearing nuts, take off cap and lower rod and piston down and out.

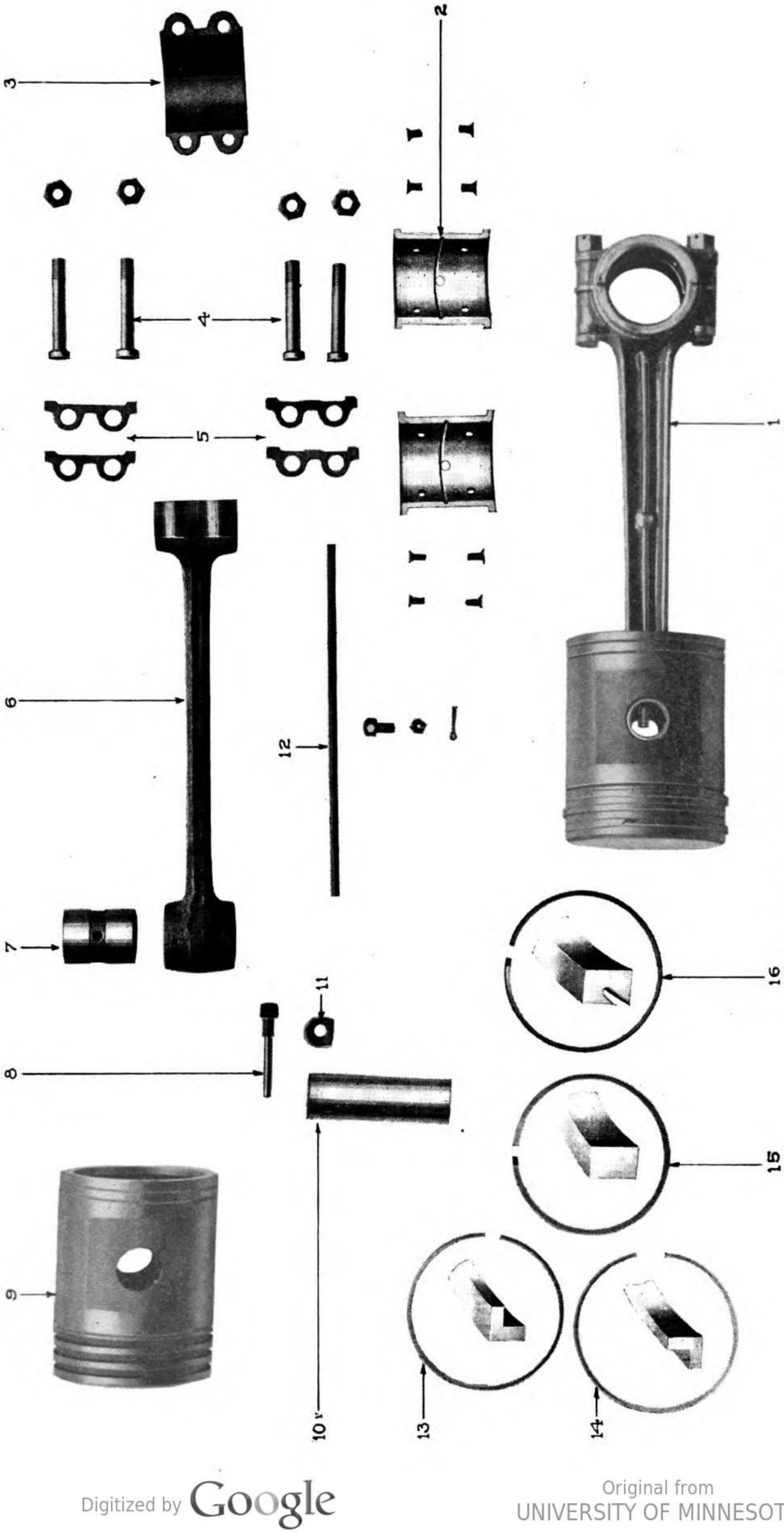
TO REPLACE CONNECTING ROD BUSHING

To replace a connecting rod bushing, remove oil pan, disconnect connecting rod bearing and pull out piston; take out bushings by removing countersunk screws which hold bushings in place in connecting rod and cap; insert new bushings and fit to shaft, leaving enough end play, but no looseness up and down.

In replacing connecting rod bushings (if the crankshaft is out of the crankcase) it is best to place the crankshaft in a vise and adjust the bushings to the shaft while in this position, as the work can be done more readily.

The ends and round corners of the connecting bushings may be sized before they are placed in the rod or cap. In case an end flange should be broken off the bearing liner, it may be soldered on with half and half solder, care being taken to prevent melting the bushing with the soldering iron.

PLATE 24



PISTON AND CONNECTING ROD ASSEMBLY

PLATE 24.

PISTON AND CONNECTING ROD ASSEMBLY

Ref. No.	Ord. No.	Name
1	384A	Connecting rod.
2	330B	Crank shaft bushing.
	330C	Crank shaft bushing.
3	384B	Connecting rod cap.
4	383C	Connecting rod bolt.
5	383A, 383B	Connecting rod shim.
6	384A	Connecting rod.
7	382B	Piston pin bushing.
8	382C	Piston pin lock screw.
9	385A	Piston.
10	382A	Piston pin.
11	382D	Piston pin lock.
12	384C	Connecting rod oil tube.
13	386B	Piston ring, leak proof, upper half.
14	386B	Piston ring, leak proof, lower half.
15	386A	Piston ring, plain.
16	386C	Piston ring, oil.

The sides of the bushing (liner or bronze back) next to shaft should be filed or scraped down to prevent contact with crankshaft and prevent side pressure, also to aid lubrication.

After the connecting rod has been so fitted, the piston should be lined up with the top of crankcase. When the bushing has been scraped in and bears well all over, it should be adjusted just so tight that the piston and rod (when same are at an angle of 45 degrees to the vertical) will just maintain their position and slight pressure down will cause them to fall (rotate).

CONNECTING ROD BEARING SHIMS

The tightness of the bearings is controlled by the thickness of the shims against which the caps are drawn up snug after a bushing has been properly scraped in and every nut must be tightened up, drawing the caps against the shims solidly, but never strained. If a castellated nut is tight when in such a position that cotter pin hole does not line up, the nut should be removed and light cut taken off face of nut (with a file), permitting its being turned to a proper position, so that the cotter pin can be inserted when tight.

PISTON PIN BUSHING

At the upper end of the Connecting Rod there is a bronze Piston Pin Bushing with the following dimensions: Inside diameter 1.375 (1⅜) inches, outside diameter 1.628 (1⅝) inches and length 2.125 (2⅛) inches. There are three 0.25 (¼) inch equally spaced holes drilled through this Bushing at its center to permit lubricating oil

working to the center of the Bushing from the Oil Supply Tube attached to the side of the Connecting Rod. The metal specifications of this bronze Bushing are S. A. E. Number 26. The part is interchangeable with part Number 1070-V on Class A and B trucks.

TO LOCATE WEAR OF PISTON PIN BUSHING

If the Piston is in place in the Engine and the lower half of the crankcase is down, remove the Cylinder Head, turn the Engine Flywheel until the Piston to be tested is on the top dead center. Then with the fingers or a rod press down upon the top of the Piston and upward from the underside of the case with a rod or some similar device so that by alternately moving the Piston up and down any play may be detected.

In case the Piston and Connecting Rod have been removed from the Engine, place the Connecting Rod in a vice and then try to rock the Piston on the Piston Pin. Rocking the Piston must not be confused with sliding it endwise on the Piston Pin, as there is a clearance between the Piston Pin Bushing and the Piston Bosses.

FITTING PISTON PINS

The end of the Piston Pin that carries the hole for the Piston Pin Set Screw is smaller than the blank end and must be inserted through the hole in the Piston opposite the boss carrying the Piston Pin Set Screw. *Piston Pins should fit in the Piston with a light tapping fit.* Always use a bronze or babbitt plug between Piston Pin and hammer when putting Piston Pins into place. In fitting new Pistons to Piston Pins, there is always a chance that the operator in the field may get the Piston badly out of round by forcing the Piston Pin into the Piston. *Never force a Piston Pin into the Piston.* The Piston Pin is held in position by one Piston Pin Set Screw, this allows the expansion of the case-hardened steel Piston Pin to occur without forcing the Piston out of round, as only one end is anchored. The Piston Pin Set Screw should be accurately inserted in the place provided on the inside of the Piston Pin and should be kept tight and accurate in its position.

PISTONS

The Pistons are cast from gray iron and are carefully annealed and should weigh within plus or minus of 0.5 (½) ounce of one another. The Piston carries three packing rings, all located at the top, one oil groove immediately below the three packing rings and two oil grooves at the bottom of the Piston skirt. The three Oil Grooves mentioned are 0.125 (⅛) inch wide and 0.031 ($\frac{1}{32}$) inch deep.

Provision is made for fastening the Piston Pin into one of the Piston Bosses. The other end of the Piston Pin is not fastened so that it may

float as it expands and contracts with the changes of temperature. The Piston is ground straight and parallel from the upper edge of the Piston Ring Land between the Middle and Bottom Packing Rings to the bottom of the Piston. The clearance of the Piston is 0.005 inch over this portion of the skirt. The Piston Ring Land between the Top and the Middle Packing Rings has more clearance, 0.012 inch, while the top of the Piston has 0.020 inch clearance. This difference is provided in order to allow for the greater expansion of the head end of the Piston. The outside diameter of the finished Piston is 4.745 (4¾) inches with the clearances located and of the amounts as mentioned above, and 6.125 (6⅛) inches long. The Piston has an eccentric relief located over that portion of the Piston wall to which the Piston bosses are cast. This relief is 0.015 ($\frac{1}{64}$) inch deep on the center line of the Piston Pin Hole and is 2.75 (2¾) inches in width, measuring 1.25 (1¼) inches above the center line of Piston Pin and 1.5 (1½) inches below.

PISTON TROUBLES

The piston moving up and down in the cylinder must constantly be protected by a film of oil otherwise both it and the cylinder wall will be scored. If run long enough without oil the piston will seize in the cylinder. The usual piston trouble encountered is due to excessive piston wear which causes oil leakage into the combustion chamber and gas leakage downward into the crankcase. Also piston pin wear is not unusual. This latter causes knocking. Both are brought about by lack of or insufficient lubrication. Piston and rod may be removed through the crankcase.

PISTON RINGS

Three different kinds of Piston Rings are used upon each Piston. The top ring, which is used to arrest the immediate explosion pressure is of the compound type, made up of an inner and an outer piece. The MaQuay-Norris Ring or a similar type is used at this point. The Center or Intermediate Ring is a plain concentric ring with a 45 degree slot 0.010 inch wide. The third or bottom ring is similarly a concentric ring with a 45 degree slot 0.010 inch wide, but has in addition an oil scraping groove which distinguishes it from the Intermediate Ring. All the rings are the same diameter, 4.75 (4¾) inches, when compressed, and the same width, 0.249 (¼) inch. The Piston Pin is made from steel tubing 4.437 ($4\frac{7}{16}$) inches long and is 1.374 (1⅜) inches outside diameter with 0.1875 ($\frac{3}{16}$) inch wall. It is case hardened and ground, and is interchangeable with part Number 1075 on the Class A and B trucks.

PISTON RING PRECAUTIONS

Great care should be exercised so that loose piston rings are not allowed to wear the square faces of the piston ring slot to a bevel. If

these square edges are worn to a bevel it will be impossible to prevent the passage of gases above, behind and below the piston ring and the edges of the slot. Compression will be lost and carbon will form behind the rings.

FITTING PISTON RINGS

Accuracy and care should be used in fitting Piston Rings to a Piston. Four factors have to be taken into consideration:

1st. *The fit of the Piston Ring in the Cylinder to get proper ring "break."*

2d. *To get the proper ring.*

3d. *The fit of the Piston Ring in the slot on the outside of the Piston.*

4th. *The fit of the Piston Ring when placed on the Piston.*

The average engineer should be able to get perfect adjustment on new Piston Rings if the following precautions are observed.:

INSTALLATION OF PISTON RINGS

Fit the piston ring in the cylinder first. With a fine file remove any wire edge or burrs from the top or bottom outside edge of piston ring. There are two methods of placing the piston ring square in the cylinder in order to get the proper ring "break."

1st. If the cylinder heads are removed one of the pistons can be left in the cylinder and the piston ring placed squarely against the head of the piston and then the piston dropped away for an inch or so, to afford an examination of the "break."

2d. In case that it is not desired to remove the cylinder heads, the piston can be removed through the crank case piston ring inserted squarely in the bottom of the cylinder by taking accurate measurement from the bottom edge of cylinder. When the piston ring is fitted in the bottom of the cylinder, using a small hand mirror will make examination of the "break" an easy matter.

Allowance has to be made for the piston ring's expansion lengthwise so that when the piston and cylinder are up to operating temperature the free ends of the piston ring will not meet and cause binding of the ends of the piston ring and in turn the piston ring against the cylinder wall. The top piston ring should have a "break" of .024 (twenty-four thousandths) of an inch, as this ring is close to the hottest part of the piston, and the second and third piston rings should have .012 (twelve thousandths) of an inch "break." A steel shim out of the connecting rod bearing is .012 (twelve thousandths) of an inch thick and can be used as a gauge in obtaining piston ring "break."

When material has to be removed from the end of the piston ring, split to provide the necessary "break" for expansion, clamp a fine mill file in a vice, open the piston ring and clamp the ends of the piston

ring squarely over it and remove material. Be careful never to damage the piston ring split surfaces where they come together horizontally.

USE CARE IN HANDLING PISTON RINGS

Piston rings should be handled carefully and when opened to put on the piston should not be sprung sideways. The piston ring can be easily sprung so that it will produce a rocking motion when laid on a flat board or bench. It is impossible to fit a rocking or warped piston ring. Piston rings should not be carried indiscriminately with other tools in the tool box. Make provision to carry piston rings separately and stack one on top of the other.

TO ALIGN PISTON AT RIGHT ANGLES TO CRANKSHAFT

With the cylinder removed and the connecting rod and piston in position, a level may be used to ascertain parallelism between the top of the piston and the top of the crankcase, which is parallel to the center lines of the crankshaft. Or a pair of calipers may be used to determine uniformity of distance between the top of the crankcase and the underside of a piston ring on all sides of the piston. Or with a straight edge laid across the top of the piston lengthwise of the engine, the distance of the crankcase under scale may be measured at its ends.

FITTING RINGS TO PISTON SLOTS

The piston ring slot should be scraped absolutely clean of all carbon deposits and washed off with kerosene. It is useless to fit a piston ring unless this condition exists, because the deposits will produce a bind, interfering with accurate fitting. Scrape the piston ring slot clean with a flat metal scraper. If it is not possible to remove all of the carbon, 000 sand paper used under a flat stick should be used bearing on it lightly while cleaning the slot. Never use a file in the piston ring slot. Never use emery cloth for cleaning piston ring slots. Rinse the slots when finished, cleaning with kerosene, and wipe dry with a cloth.

After the piston ring has been fitted in the cylinder it should be fitted to the piston slot by revolving the piston ring on the outside of the piston and inside the slot. The vertical expansion of the piston ring in the slot has to be provided for. The top ring should have a clearance of .004 (four thousandths) of an inch and the bottom two rings should have a clearance of .003 (three thousandths) of an inch. If the piston ring does not have free movement in the slot some of the material will have to be removed from the top or bottom edge of the ring. Obtain a flat board over which spread a quantity of fine carborundum powder and cup grease mixed into a paste, or use a reliable valve grinding compound; lay the ring flat in this mixture and rotate

until the sufficient quantity of material has been removed to secure the necessary clearance. Wash the piston ring with kerosene and wipe clean before trying the piston ring in the slot.

MOUNTING RINGS ON PISTON

One of the most convenient tools to have is a piston ring remover, as by its use the piston ring will not be sprung out of round by careless handling or forcing. If removers are not available, three or four metal guides 0.25 (¼) to 0.5 (½) inch wide, 0.0325 (1/32) inch or less thick, and about 6 inches long should be provided. Hack saw blades ground

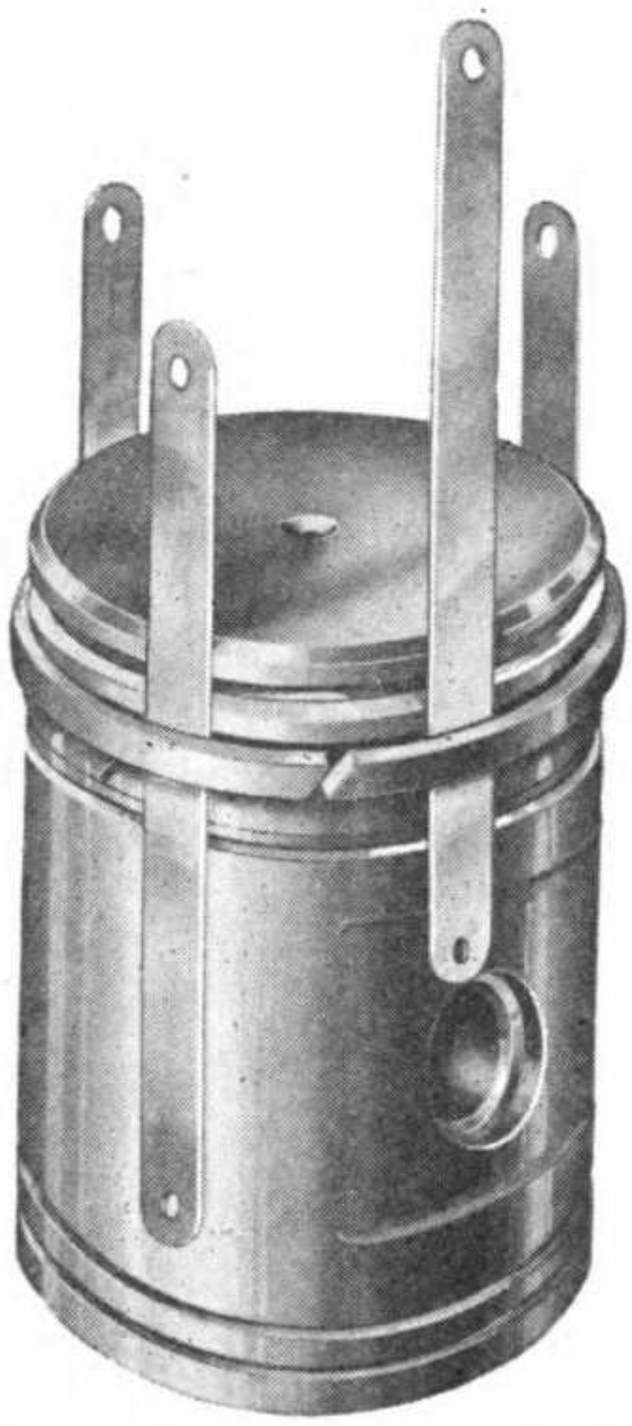


PLATE 25—REPLACING PISTON RINGS ON PISTON

off smooth are ideal for this purpose. In taking off or replacing piston rings, these guides should be spaced equally around the piston and underneath the piston ring.

Place the piston ring in the piston slot to test for freedom of movement horizontally and for correct clearance in the vertical direction.

INSERTING PISTON

Inserting the piston after cleaning or repairing is accomplished in the reverse direction given above, except that a light bar must be used under the piston with a light purchase on cam shaft to slip it into the cylinder. The bottom edge of the cylinder is beveled to aid in compressing the piston rings and make the insertion of the pistons an easy matter.

Never insert a piston through the top of the cylinder as the necessary bevel is not provided to compress the rings and the piston rings can be damaged on one edge. After piston has been inserted in the cylinder and the lower half of the connecting rod replaced on the connecting rod be sure that all cotter keys are placed on the connecting rod bolts.

CRANKSHAFT ASSEMBLY

The Crankshaft Assembly is composed of the Crankshaft, the Flywheel, the Crankshaft Gear and Crankshaft Oil Sling.

CRANKSHAFT

The Crankshaft is a steel drop forging of S. A. E. specifications number 1045 with heat treatment E. The Crankshaft is interchangeable with that on the Class A and B trucks where part number 1043-Y has been assigned.

The Crankshaft is drilled with four Oilways 0.25 (1/4) to 0.375(3/8) inch in diameter. These Oilways are from the Front Bearing to the number 1 Crank Pin, from the Middle Bearing in both directions, so as to reach both number 2 and number 3 Crank Pins, and from the Rear Bearing to number 4 Crank Pin. At the rear end of the Crankshaft a Flange 6.127 (6 1/8) inches in diameter and 0.687 (11/16) inch thick is provided to carry the Flywheel.

At the front end a Keyway for a number 18 Whitney Key is cut for a key which drives the Crankshaft Gear. At the very front end of the Shaft there is inserted a pin 0.5 (1/2) inch in diameter and 2.375 (2 3/8) inches long for the Starting Crank. This pin is held in place by means of the Starting Pin Lock Screw, which is a 0.312 (5/16) inch diameter, 24 thread set screw.

The dimensions of the Bearings of the Crankshaft are as follows: The front main bearing is 2.375 (2 3/8) inches in diameter and 3.062 (3 1/16) inches long; the center bearing and the rear main bearings are 2.5 (2 1/2) inches in diameter and 4.062 (4 1/16) inches and 4.002 (4) inches in length respectively. The Connecting Rod or Crank Pin Bearings are 2.375 (2 3/8) inches in diameter and 2.999 (3) inches in length.

KNOCKS IN BEARINGS

The center bearing is that most liable to develop looseness, because of the fact that it carries a greater load than the two other bearings. The bearing next most likely to show signs of wear is the front one, while the rear bearings show longest life in service.

PLATE 26

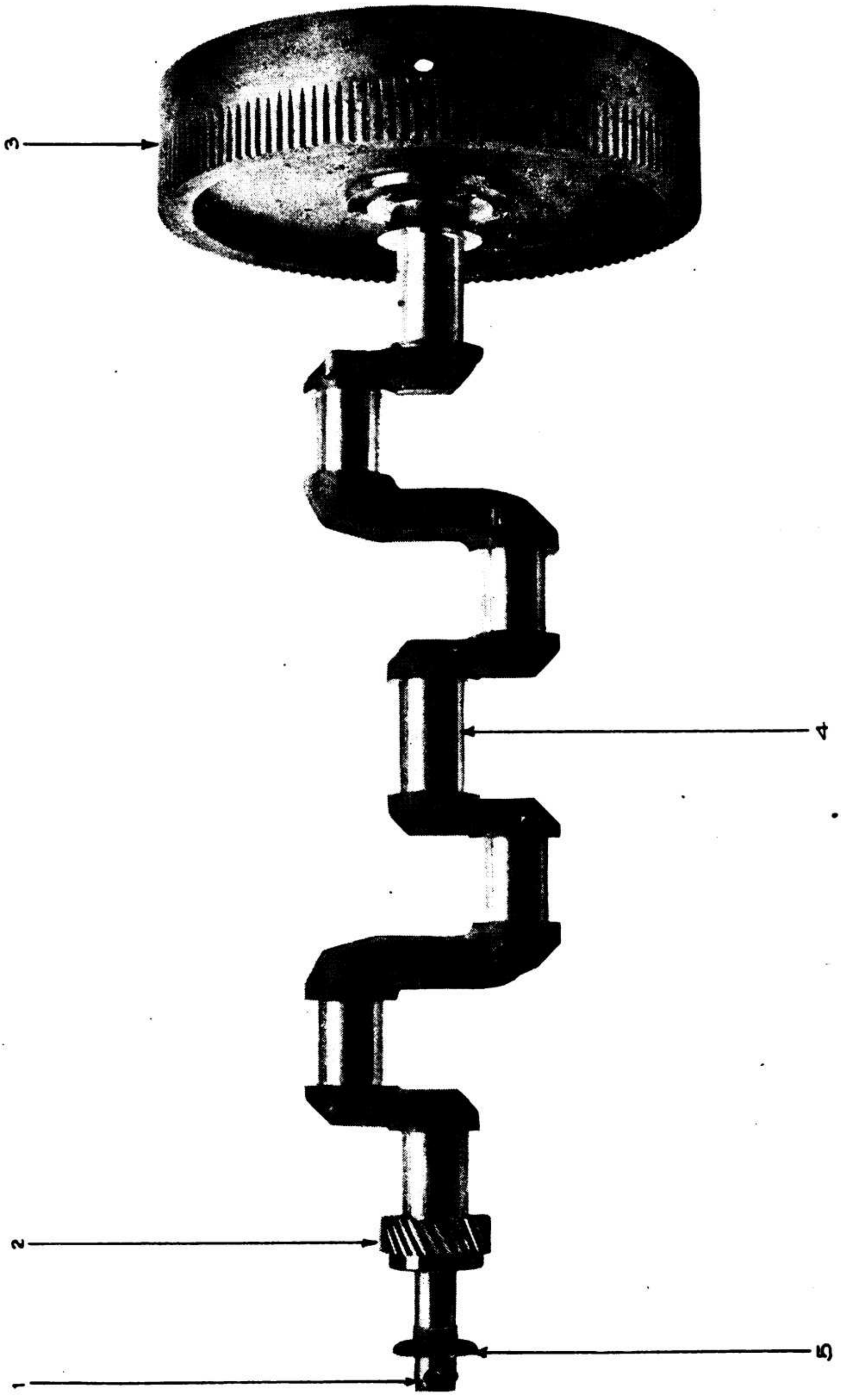


PLATE 26—CRANKSHAFT ASSEMBLY

Ref. No.	Ord. No.	Name
1	262D	Starting crank pin.
2	262A	Crankshaft gear.
3	261A	Flywheel.
4	260A	Crankshaft.
5	262B	Crankshaft oil sling.

TO DETERMINE A LOOSE CRANK PIN BEARING

The crank pin bearing is commonly called the connecting rod bearing. This bearing is located in the lower end of the connecting rod. To determine any looseness in the crank pin bearings turn the engine over with the flywheel until the crank pins of No. 1 and No. 4 connecting rods are close to the crank case door. Place the bar under the bearing, using the crank case as a fulcrum, with one hand partly on the web of the crankshaft and partly on the crank pin bearing, pry up on bar. There should be absolutely no vertical movement. Repeat for No. 2 and No. 3. Connecting rod bearings, however, should be able to move sideways the thickness of a crank pin bearing shim, .012 (twelve thousandths) of an inch.

TO ADJUST CONNECTING ROD BEARINGS

Remove the spark plugs to release compression, blue the crank pin with a thin film of color, insert piston in the cylinder and mount the upper half of the connecting rod bearing on the crank pin and revolve crank shaft slowly. Remove connecting rod and piston, scrape all high spots and continue blueing and scraping until a majority of the bushing shows solid blue. Give relief to edges of bushings about 3/8 of an inch down where the two halves of bushing meet. When the upper half of bushing has been accurately spotted and scraped place an equal number of shims on each side of the bushing and bring the lower half of the bushing into place by tightening on the connecting rod nuts, and fit cap by spotting and scraping as above outlined. The fit on both the connecting rod bushing and the main bearings must be very close in order that undue escape of oil at one bearing, which will cause a drop of pressure throughout entire system, may be avoided.

NOTE—One side of each connecting rod and cap contains the same figure on the upper and lower half as 1, 2, 3, 4. Always have these numbers on the same side as the lower part of the bearing will match in the way that it was sawed from the original drop forging, and the connecting rod bolt holes will always line up. When one connecting rod bushing has been satisfactorily scraped in and bolted to the final fit, slack off on the connecting rod bolts and proceed to the next connecting rod. It is not possible to scrape a connecting rod bushing properly without having the piston in the cylinder, as the bushing

must be blued and scraped so that the piston will be square in the cylinder.

TIGHTENING CRANKSHAFT BEARINGS

Should the crankshaft bearings knock, usually the removal of a lamination of the shims placed between the bearing halves returns them to proper adjustment. In removing the laminations it is necessary that an equal number be taken from each side of the bearing cap.

If one or more layers are removed and that is found to be too much, substitute a thin shim of paper for one of the metal layers removed.

If the above is not successful, it will be necessary to replace the bushing and scrape to a perfect bearing. A perfect bearing surface is important.

BEDDING THE CRANKSHAFT

Bedding the crankshaft may be divided into two operations:

1st. Bedding the main bearings, in crank case cradles.

2d. Bedding the crankshaft in the main bearings.

Assuming that crankshaft has not been placed in engine, (a) blue one end of crankshaft bearing and rotate the babbitted parts of all the lower halves on the crankshaft and scrape to remove high spots. This fitting is not final but is the starting point for fitting the lower halves. (b) Clean crank case cradle thoroughly, then blue entire crank case cradle surface. (c) Put bottom half of main bearing that is to work in that particular cradle in place, rock back and forth a few times then remove lower half from cradle and examine aluminum back of bushing for high spots. (d) Remove any high spots with a fine mill file and continue filing on back until a perfect seat is secured. This is important. (e) After all backs of main bushings have been fitted to crank case cradles, insert crankshaft which had previously been blued on every main bearing and revolve crankshaft in upper halves. (f) Either lift up and block crankshaft or remove bottom half bearing by rotating around crankshaft, and scrape all high bearings until they are on line. Never shim up under a low bearing but scrape all high bearings down to a level. (g) Give relief to ends of babbitt in bearing so that the crankshaft can float endwise the thickness of a shim out of the connecting rod bearing .012 (twelve thousandths) of an inch. Use a curved babbitt scraper to fit inside edge to fillet of crankshaft. Use a flat babbitt scraper to work on inside of bearing. Use a file, applying it level on top of bottom half of bearing to bring babbitt down to level of aluminum back of bearing. Give the upper edge of bushing $\frac{3}{8}''$ of babbitted surface relief, so that when pressure is applied to shims the pressure will not be transferred to the babbitt and pinch the crankshaft at the point where the two halves of the bushing meet.

The crankshaft bedding operation has to be accurately done as all

the strains are transmitted to the bottom bushing and if one bearing is lower than the others there will be a weave and strain on the crankshaft that will start crystallization and ultimately result in a broken crankshaft.

FLYWHEEL

The Flywheel is made of cast iron and is bolted onto the Crankshaft with six ½ inch steel bolts located on a 5.25 (5¼) inch bolt circle and equally spaced. On the outside, or periphery, of the Flywheel is cut the Starting Gear. This gear has 1.25 (1¼) inch face, an outside diameter of 19.911(19 29/32) inches, a pitch diameter 19.694 (19 45/64) inches, 138 teeth of 20 degree Fellows Stub Tooth Form. The outside diameter of the Flywheel Rim is 19.875 (19⅞) inches, the inside of the Flywheel Rim, into which the Master Clutch fits, is 17.25 (17¼) inches in diameter and the depth of the recess for the Clutch is 2.875 (2⅞) inches. Four 0.75 (¾) inch holes are provided in the Rim of the Flywheel for the Clutch Driving Keys. These holes are drilled in radially, are equally spaced and their center is 1.875 (1⅞) inches from the rear face of the Flywheel.

On the outside, or periphery, of the Flywheel Rim are the Valve Timing Marks, which give the following information for each Cylinder: Dead Center, Inlet Opens, Exhaust Opens, Dead Center, and Inlet Closes.

CRANKSHAFT GEAR

The Crankshaft Gear is made from a steel forging S. A. E. specification number 1035 with heat treatment H. This gear has an outside diameter of 3.971 (3 31/32) inches, pitch diameter 3.75 (3¾) inches, 30 teeth, with a left hand helical angle of 27 degrees 15 minutes. It is interchangeable with the same part on Class A and B trucks, part number 1126-W. It is driven by a number 18 Whitney Key, which is 0.25 (¼) inch thick and the gear is held in place on the end of the Crankshaft by means of a Crankshaft Gear Pin, 0.25 (¼) inch diameter and 3.375 (3⅜) inches in length.

UPPER CRANK CASE ASSEMBLY

The Upper Crank Case Assembly consists of the cast aluminum Crank Case proper on which are mounted the Magneto, Water Pump and Fan Assemblies, the Governor Assembly and the Cylinder Blocks. Provision is also made in the right rear engine arm for the Bendix Starter. On the right hand side of the Crank Case there are two hand holes 11.125 (11⅛) inches wide and 6.75 (6¾) inches high. These openings are closed by Crank Case Hand Hole Covers which are interchangeable with the Valve Cover Plates used on the side of the Cylinder Block. The same Valve Cover Nut used on the Cylinder block is also used here, but instead of a stud screwed into the Cylinder

Block being used to hold it in place, a yoke called the Crank Case Hand Hole Clamp is employed.

CRANK CASE—UPPER

The Crank Case, Upper Assembly, includes the Gear Case Cover, which is bolted onto the front end, the fourteen Cylinder Block Holding Studs and Nuts, and the three Main Bearing Caps with bushings.

Each of the Main Bearing Caps is held in place by four 0.5 (½) inch bolts. They are set into a milled slot in the upper part of the Crank Case so that there is no chance of their twisting into disalignment with the Crankshaft.

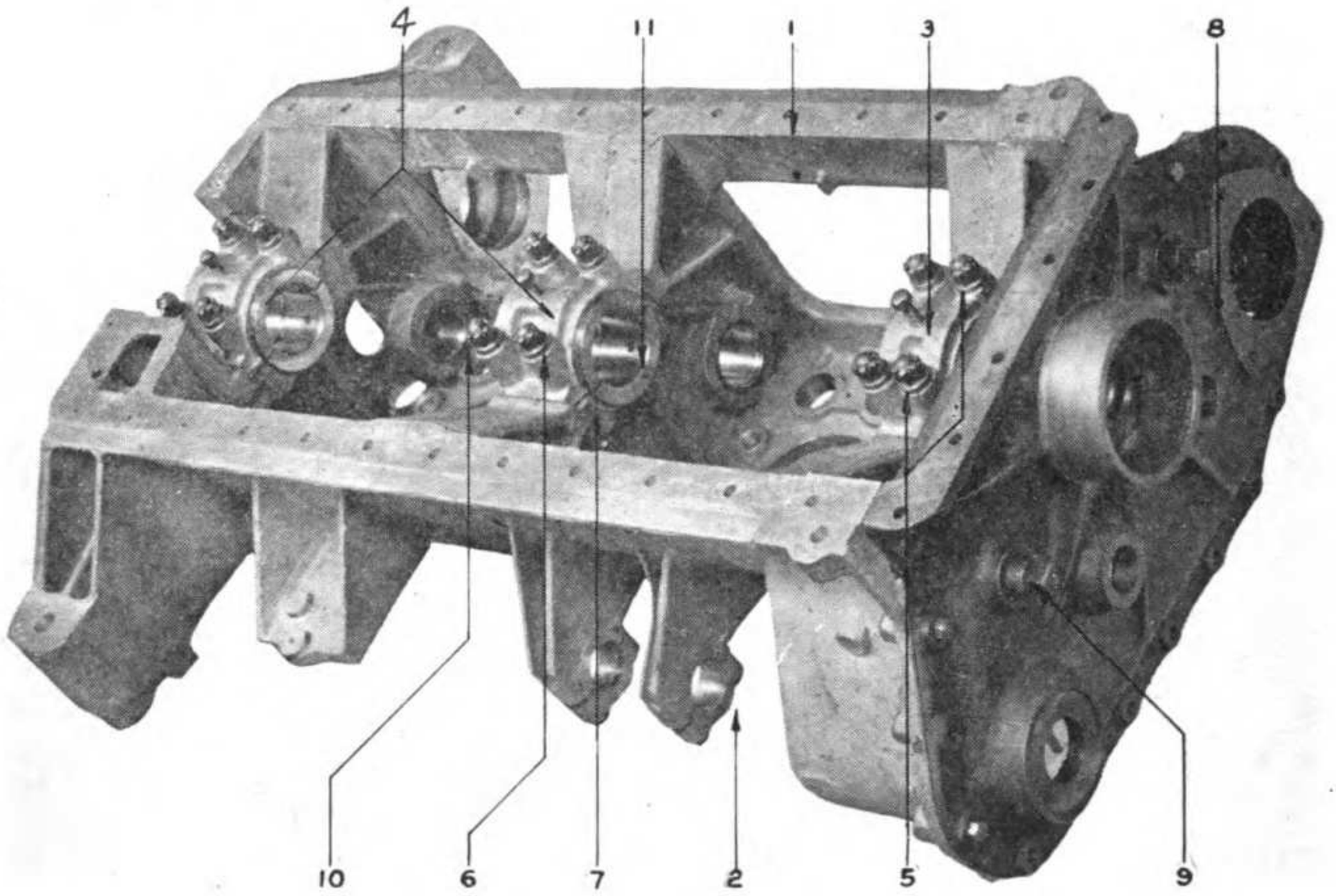


PLATE 27—CRANK CASE ASSEMBLY, UPPER

Ref. No.	Ord. No.	Name
1	322A	Crank case, upper half.
2	333C	Water pump bracket cap.
3	330A	Front bearing cap.
4	329A	Center and rear bearing caps.
5	330E	Front main bearing stud.
6	229E	Main bearing bolt.
7	229D	Bearing shim, center.
8	226A	Gear case cover.
9	113E	Pipe plug.
10	328E	Cam shaft bushing, rear.
11	329C	Crankshaft bushing, center, upper half.

At the front end of the Upper Crank Case there is located a Timing Gear Oil Tray, which is a trough located immediately below the Crank Shaft Timing Gear and into which the teeth of this gear dip. Its purpose is to throw oil onto the Governor Gear located on the right hand side of the Engine and insure an adequate supply of oil to the Governor

parts and Governor Bearing. If this part should be left out accidentally in assembling the Engine, there is danger of the Governor Bearing seizing when in operation.

CAMSHAFT BUSHINGS

Three bushings are provided to carry the Camshaft. The front one is also provided with a flange so as to take the Camshaft Gear thrust while the other two are plain bushings. The inside diameter of the Front Bushing is 2.25 (2¼) inches, outside diameter 2.625 (2⅝) inches, and length 2.55 (2½) inches. The outside diameter of the thrust flange is 3 inches. The intermediate or middle Camshaft Bushing has 2.125 (2⅛) inches inside diameter and 2.5 (2½) inches outside diameter and 2.25 (2¼) inches length. The rear Camshaft Bushing has 2 inches inside diameter, 2.375 (2⅜) inches outside diameter and 1.468 (1$\frac{15}{32}$) inches length.

All of these bushings are bronze backed babbitt lined. The babbitt is 0.05 ($\frac{1}{16}$) inch thick. The bronze specification is S. A. E. Number 27, while the babbitt is S. A. E. specification Number 24. It should be noted at this time, also, that the Front, Intermediate and Rear Camshaft Bushings are respectively parts number 1042-V, 1042-V and 1044-V of Class "A" and "B" trucks.

MAIN BEARING BUSHINGS

There are three Split Bushings upon which the Crankshaft runs. Of these the Center and Rear Bushings are interchangeable. The Front Bushing is shorter so is not interchangeable with the other Crankshaft Bushings but is interchangeable with the Connecting Rod Bushings. From this it will be seen that there are only two sizes of Split Bushings required for the Main and Connecting Rod Bearings.

The Center and Rear Main Bearing Bushings have the following dimensions: Inside diameter 2.502 (2½) inches, outside diameter 3 inches and overall length 4 inches. They are of bronze, lined with babbit 0.0625 ($\frac{1}{16}$) inch thick. The dimensions of the Front and Connecting Rod Bushings are as follows: Inside diameter 2.376 (2⅜) inches, outside diameter 2.875 (2⅞) inches and overall length 2.998 (3) inches. These Bushings are likewise bronze with babbitt facing 0.0625 ($\frac{1}{16}$) inch thick. The specifications of the bronze and babbitt are respectively S. A. E. number 24 and S. A. E. Number 27. These Bushings are interchangeable with the similarly used bushings in the Class "A" and "B" trucks. The large Bushing used in the Center and Rear Main Bearings has truck part number 1034-W, while the smaller bushing has truck part number 1033-W.

MAIN OIL DISTRIBUTING LINE

The Main Oil Distributing Line is cast integral with the aluminum Crank Case, Upper, and is made from 0.375 (3/8) inch steel tubing with Number 20 B and S Gage (0.031 inch) wall. The tubing is welded together prior to inserting in the mold and the aluminum cast around it. With this construction there is no chance of oil leakage through porosity in the aluminum casting.

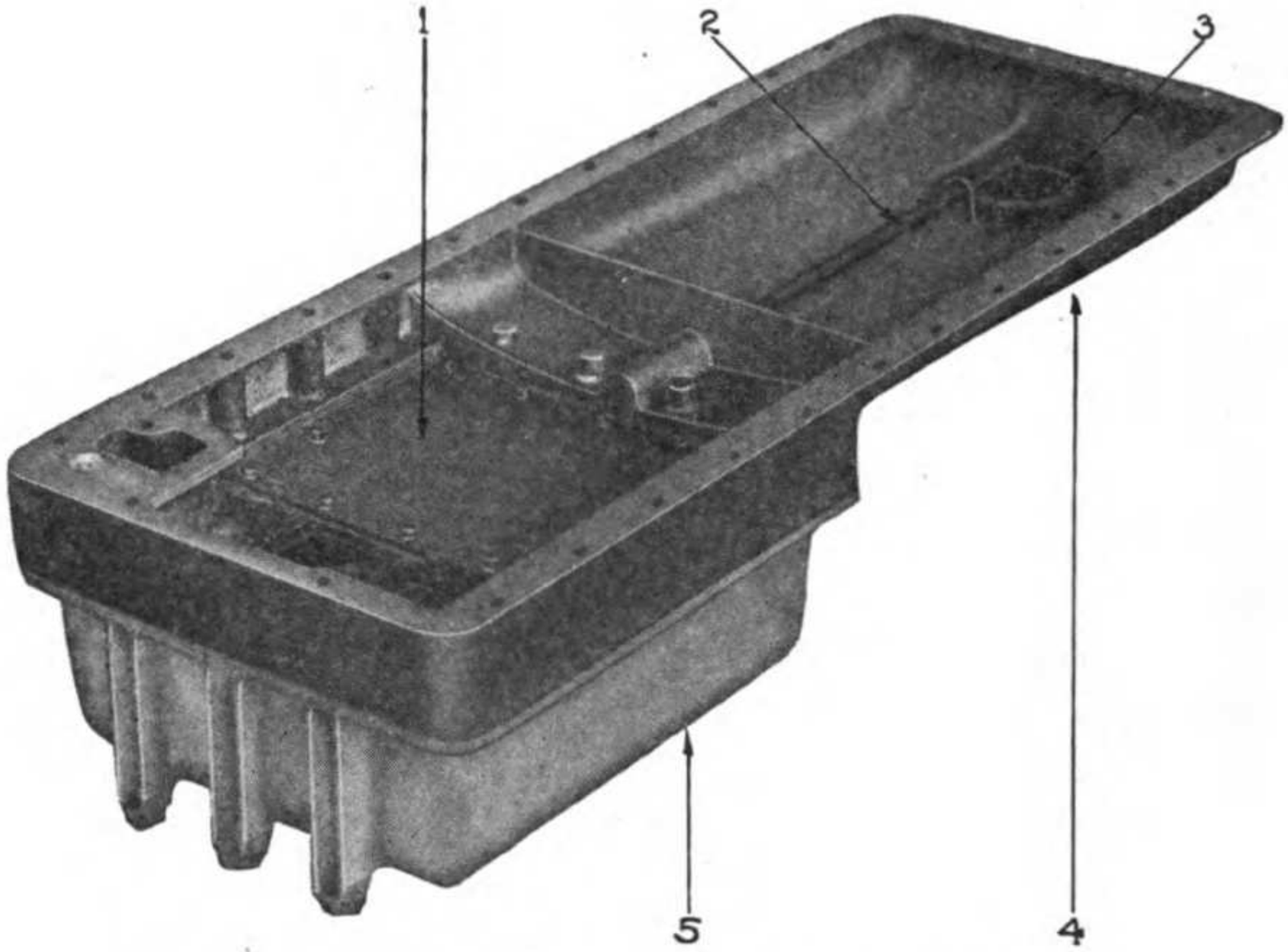


PLATE 28—CRANKCASE ASSEMBLY OIL PANS

Ref. No.	Ord. No.	Name
1	346B	Oil partition plate.
2	345A	Upper oil pan pipe.
3	342A	Oil screen body.
4	341A	Upper oil pan.
5	340A	Lower oil pan.

LOWER CRANK CASE ASSEMBLY

The Lower Crank Case Assembly consists of two parts, the Upper Oil Pan and the Lower Oil Pan, both of which are made from cast aluminum.

LOWER OIL PAN

The Lower Oil Pan covers an opening in the rear half of the Upper Oil Pan. The reason for this rather complicated construction is that the Equalizing Bar of the Tractor passes under the center of the Engine and, were it not for this subdivision of the lower portion of the Crankcase, it would be impossible to remove the Oil Pan without first lifting the entire Engine. As it now is, the Lower Oil Pan may be dropped off

first and then the Upper Oil Pan withdrawn over the Equalizing Bar. thus giving access to the inside of the Crankcase and permitting the removal of the Crankshaft, Pistons and Connecting Rods.

UPPER OIL PAN

The Upper Oil Pan is divided into two compartments by means of a dam or rib cast integral with it and running transversely at the center of the Crankcase. The Upper Oil Pan serves only as an oil catcher and does not carry the oil supply. The Lower Oil Pan forms the oil sump or oil reservoir for the Lubricating System. At the front end of the Upper Oil Pan is located an Oil Pump Screen mounted upon an Oil Screen Body, which is a brass casting held to the body of the Upper Oil Pan by four 0.375 (3/8) inch cap screws. The purpose of this screen, which is number 30 mesh brass wire, is to prevent any dirt or sediment from being drawn out of the Oil Pan and into the Lubricating System.

LOWER OIL PAN CONSTRUCTION

The Lower Oil Pan closes an opening through the bottom of the rear half of the Upper Oil Pan. In the upper portion of the Lower Oil Pan there is cast a small cup, over which is placed an oil filtering screen. This serves the same purpose at the rear end of the Crankcase as does the Oil Screen at the forward end of the Upper Oil Pan. It, however, has no connection whatever with the oil reservoir located immediately below it.

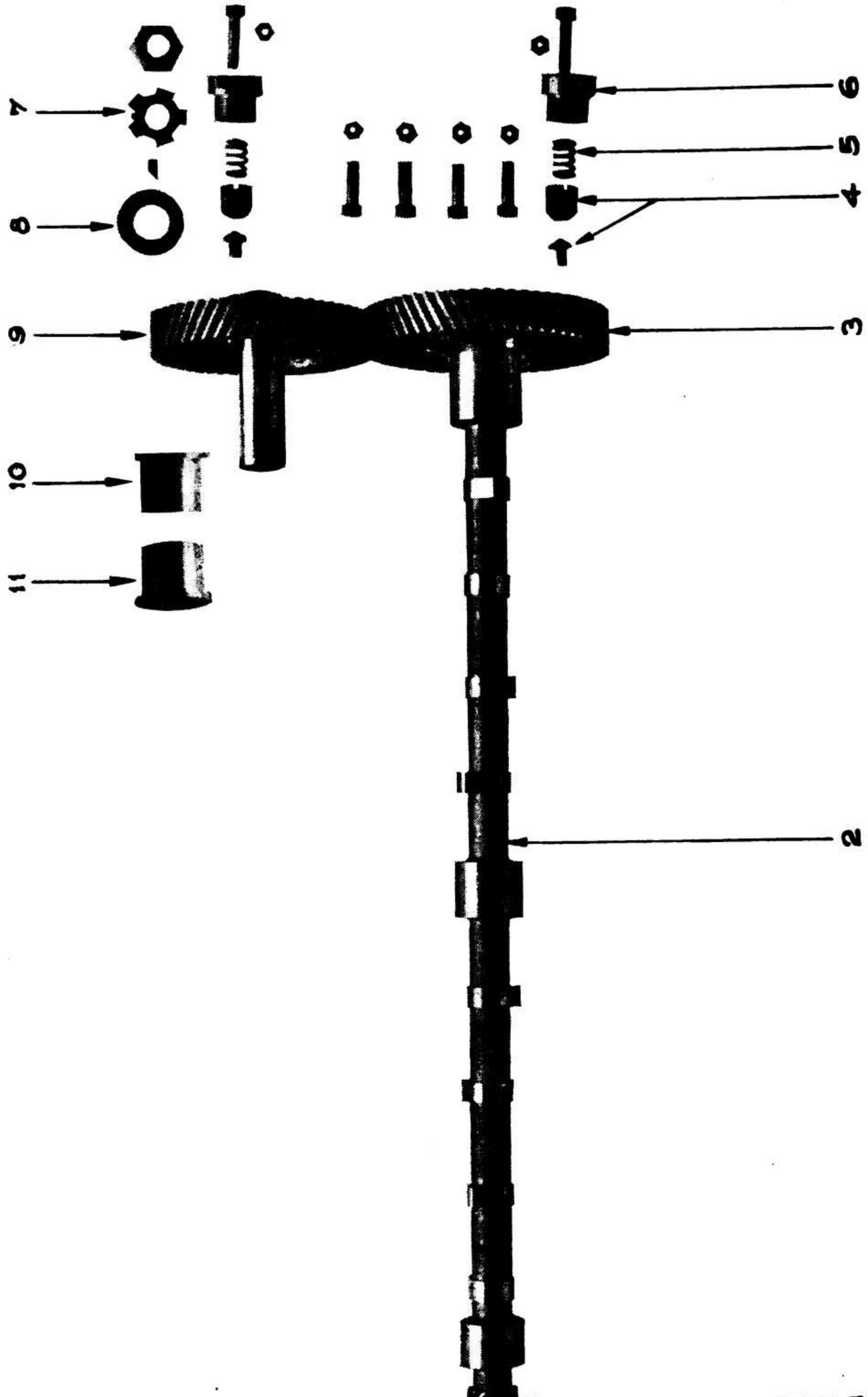
An opening is provided in the top of the Lower Oil Pan through which the oil reservoir may be inspected and cleaned. This, however, is closed by a sheet steel Oil Partition Plate so that there is no direct connection between the Upper Oil Pan and the oil reservoir in the Lower Oil Pan. Through another opening in the upper portion of the Lower Oil Pan the Oil Pump is inserted, and in service the Oil Pump will usually be found as part of this assembly, but for the sake of clearness it is not included in this assembly.

CAMSHAFT ASSEMBLY

The Camshaft Assembly consists of the Camshaft, the Camshaft Gear, the Idler Gear, the Pump Drive Gear and the Idler Shaft and Bushings.

The Camshaft is a steel drop forging with case hardened cams and bearings, which are forged integral with the Shaft and ground. The Front Camshaft Bearing is 2.25 (2 1/4) inches long and 2.249 (2 1/4) inches in diameter. The Center Camshaft Bearing is 1.75 (1 3/4) inches long and 2.124 (2 1/8) inches in diameter. The Rear Camshaft Bearing is 1.375 (1 3/8) inches long and 1.999 (2) inches in diameter. At the rear

PLATE 29



CAMSHAFT AND IDLER ASSEMBLY

PLATE 29—CAMSHAFT AND IDLER ASSEMBLY

Ref. No.	Ord. No.	Name
1	268E	Oil pump drive gear.
2	266A	Camshaft.
3	268A	Camshaft gear.
4	269C	Thrust plunger.
5	269B	Thrust plunger spring.
6	269A	Thrust plunger housing.
7	267C	Idler shaft nut lock washer.
8	267E	Idler gear thrust washer.
9	267A	Idler gear.
10	268B	Inner idler bushing.
11	268C	Outer idler bushing.

end of the Camshaft the Oil Pump Drive Gear is keyed and pinned. This is a steel gear with twelve helically cut teeth of twelve pitch and 45 degree right hand helical angle. It has a 0.5 (½) inch face. The Camshaft diameter between the Cams is 1.25 (1¼) inches in diameter. The Cams are 0.625 (⅝) inch wide. Both the intake and exhaust have a base circle diameter 1.375 (1⅜) inches. Both the intake and exhaust Tappets have a lift of 0.3385 ($\frac{21}{64}$) inch.

To the front end of the Camshaft is bolted the Camshaft Gear, which is made from cast iron, has a 1.25 (1¼) inch face, 7.72 (7¾) inches outside diameter, 7.5 (7½) inches pitch diameter, 9 diametral pitch, 27 degree 15 minutes left hand helical angle. The Gear is held in place with four 0.375 (⅜) inch bolts.

The Idler Gear, which meshes with it, is made from semi-steel, has 1.25 (1¼) inch face, 6.97 ($6\frac{31}{32}$) inches outside diameter, 6.75 (6¾) inches inside diameter, fifty-four teeth, 9 diametral pitch and right hand helical angle of 27 degrees and 15 minutes. The Idler Gear is mounted on a separate shaft, the bearing length of which is 4.062 ($4\frac{1}{16}$) inches long and diameter 1.499 (1½) inches. This runs on two babbitt lined bushings 1.5 (1½) inches inside diameter, 1.877 (1⅞) inches outside diameter and 1.812 ($1\frac{13}{16}$) inches overall length. These are interchangeable with the Rear Governor and Pump Bushings used on the Tractor Engine and part Number 1045-V, on Class A and B truck Engine.

In order to hold the Camshaft and Idler Gear accurately in place and prevent any axial movement, a thrust device is used at the front end of each of these Shafts. The thrust device is carried in the Timing

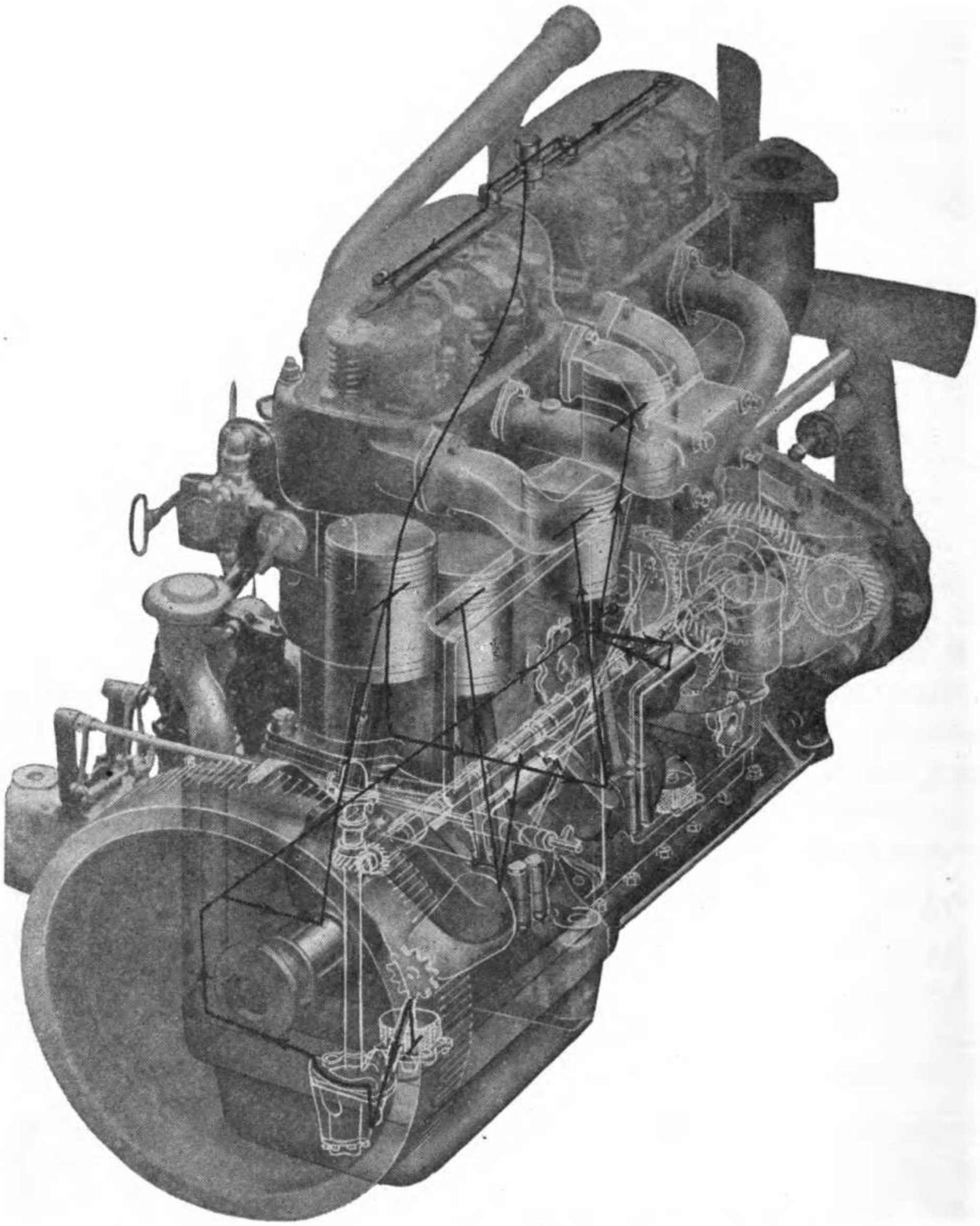


PLATE 30—PHANTOM DRAWING OF ENGINE OILING SYSTEM

Gear Cover and is composed of the following parts: The Thrust Plunger Housing, the Thrust Plunger, the Thrust Plunger Spring, and the Thrust Plug which bears against the Thrust Plunger and is pressed into the ends of both the Camshaft, and the Idler Shaft.

TO REMOVE CAMSHAFT

In order to remove the Camshaft it is necessary to take off the Timing Gear Cover Plate on the front end of the Engine and also to take out the Valve Tappets which would interfere with the removal of the shaft. The Timing Gear Cover Plate cannot be removed until the Front Engine Support is removed. This may be removed if the weight of the Engine is first taken off it by placing a jack under the Engine. When it is removed it is not necessary to keep the jack under the Engine because two arms are provided on either side of the Engine to hold it in place. If a jack is not available wooden wedges may be driven in between the Engine and the arms provided on the side of the Main Frame. This will hold the front end of the Engine while the Front Engine Support is removed. After this is off it is not difficult to remove the Timing Gear Cover Plate. A pry bar will pull the timing gear out of the case and free the Camshaft so that it can readily be removed. In removing the Radiator prior to getting into the Timing Gear Case follow the instructions under Removing Radiator, under Cooling System.

LUBRICATING SYSTEM

The Lubricating System used on the Five-ton Artillery Tractor appears at first hand to be decidedly complicated, but when carefully analyzed will be found quite simple.

It is distinctive from that used in most automotive engines because it is not affected by the position of the engine, no matter how steep the grade which the Tractor is ascending or descending. This is because it is of the Dry Crank Case Type. The Dry Crank Case is maintained so that all the superfluous oil which flies off of the Crankshaft and Gears and drains from the Cylinder Walls is not left in the Oil Pan to be splashed about by the Connecting Rods, but is immediately pumped out of the Oil Pan and delivered into the Oil Reservoir. From the Oil Reservoir it is re-circulated through the Engine Bearings under pressure.

OIL CIRCULATING SYSTEM

The oil is drawn from the Oil Reservoir, in the Lower Oil Pan, by a Gear Pump and delivered to the Main Oil Line, which is cast integral with the Upper Crankcase. This Oil Line delivers the supply from the Pump to each of the three Main Bearings, to the Rocker Arm Oil System, to the Oil Pump Drive Shaft Bracket and to the Timing Gears. From the Main Bearings it is delivered through drilled passages in the Crankshaft to each of the Connecting Rods, runs up a tube provided on the side of the Connecting Rod to the Piston Pins and thence to the Cylinder Walls. At the front end of the Engine this oil is delivered to the inside of the Idler Gear, which has a groove machined on the inside of the rim for this purpose and holes through the rim by means of which

the oil is distributed over the Camshaft Gear Face, the Water Pump and Magneto Gear and the Crankshaft Gear. The Oil Line which goes from the Main Line in the Crankcase to the Rocker Arm Oil System at the top of the Engine terminates in the Oil Relief Valve.

THE OIL RELIEF VALVE

The Oil Relief Valve is a piston held in place by means of the Oil Relief Valve Spring, and provision is made for the adjustment of the spring tension so that the oil pressure in the Lubricating Oil System may be regulated at this point. The Oil Relief Valve Body is conveniently located between the two Rocker Arm Covers at the top of the Engine and should be adjusted so that, after the Engine has been running ten minutes, the Oil Pressure Gage, located in the Instrument Bracket at the rear of the Engine, shows 25 pounds pressure.

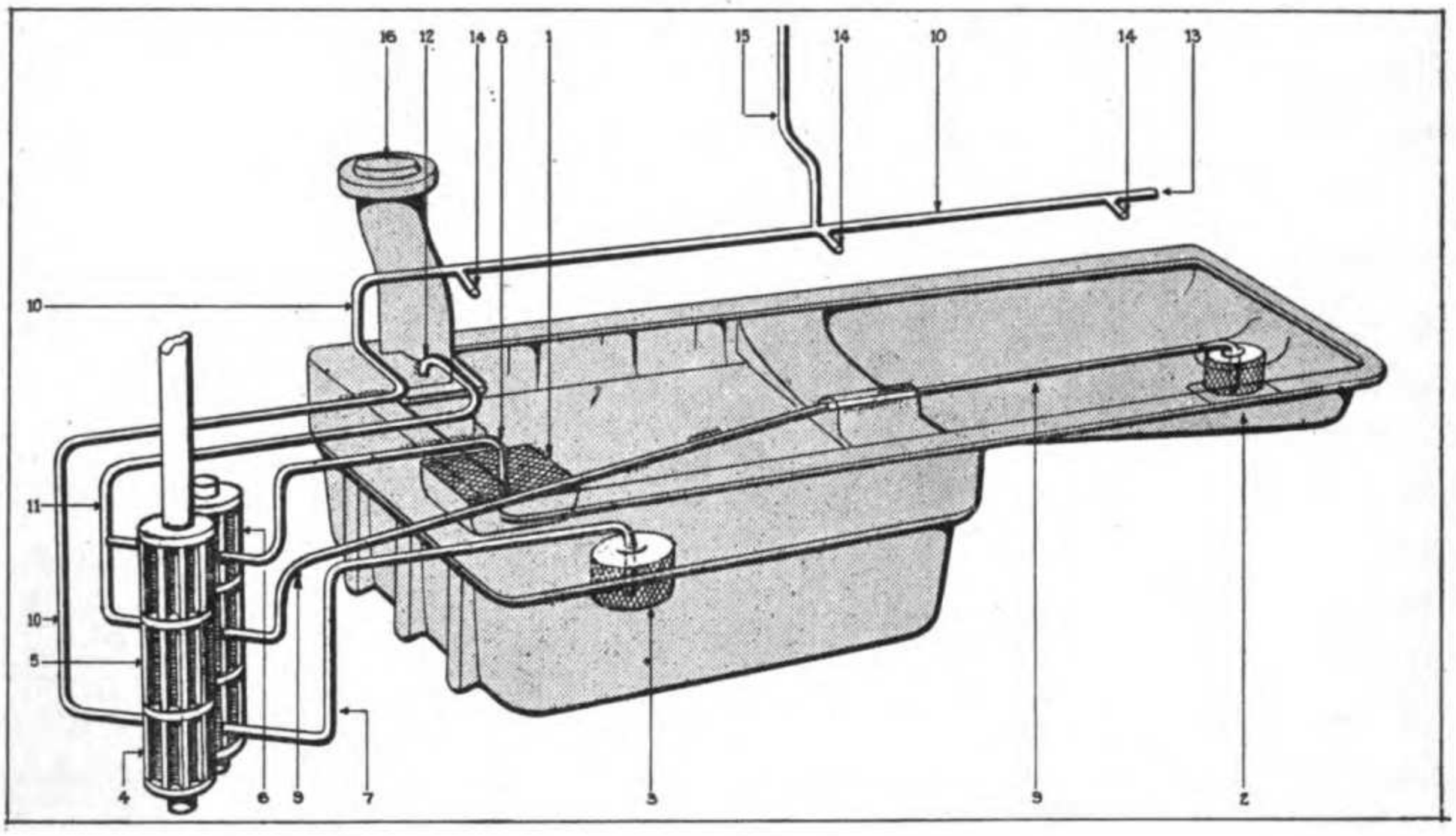


PLATE 31—DIAGRAM OF OILING SYSTEM

Ref. No.	Name
1	Rear upper oil pan oil screen.
2	Front upper oil pan oil screen.
3	Main oil line screen in oil reservoir.
4	Main oil pump.
5	Oil pump draining front upper oil pan.
6	Oil pump draining rear upper oil pan.
7	Suction line from oil reservoir to main oil pump.
8	Suction line from rear upper oil pan.
9	Suction line from front upper oil pan.
10	Delivery line from main oil pump to bearings.
11	Delivery line from suction pumps, 5 and 6, to oil reservoir.
12	Outlet of line 11 into main oil reservoir.
13	Outlets from main oil line to lubricate gears.
14	Outlets from main oil line to lubricate main crankshaft bearing.
15	Main oil line to rocker arm cover oiling system.
16	Breather and oil reservoir filler opening.

OIL PUMP ASSEMBLY

The Oil Pump is a triplex pump, that is, in one pump body there are three independent Gear Pumps. The Bottom or Lowest Pump delivers oil from the Oil Reservoir to the Main Oil Line in the Crankcase; the Intermediate Pump draws oil from the front end of the Upper Oil Pan and delivers it into the Oil Reservoir in the Lower Oil Pan; the Top Gear Pump draws oil from the rear end of the Upper Oil Pan and also delivers it into the Oil Reservoir in the Lower Oil Pan. These two Upper Pumps, therefore, do not serve to lubricate the Engine but to drain the Upper Oil Pan as fast as the oil accumulates in either end of it.

OIL PUMP BODY

The Oil Pump Body is made from cast iron and not only houses the three Gear Pumps but also carries most of the oil distribution passages. The remaining oil distribution passages are in the Oil Pump, Upper Cover, which is clamped down upon the Lower Oil Pan. The Oil Pump, Lower Cover, merely serves to close the bottom end of the Pump and support the Oil Pump Idler Shaft and Oil Pump Drive Shaft. The Oil Pump Gears have 1.25 (1¼) inches face, 1 inch pitch diameter and twelve 12-pitch teeth. The three Driving Gears are steel and the three Driven Gears are bronze. Between the Bronze Gears there are two Steel Spacing Washers, while between the three steel gears there are two Bronze Washers. This combination of washers and gears should be carefully noted when assembling the Pump. The Oil Pump is driven by a small helical gear located on the rear end of the Camshaft.

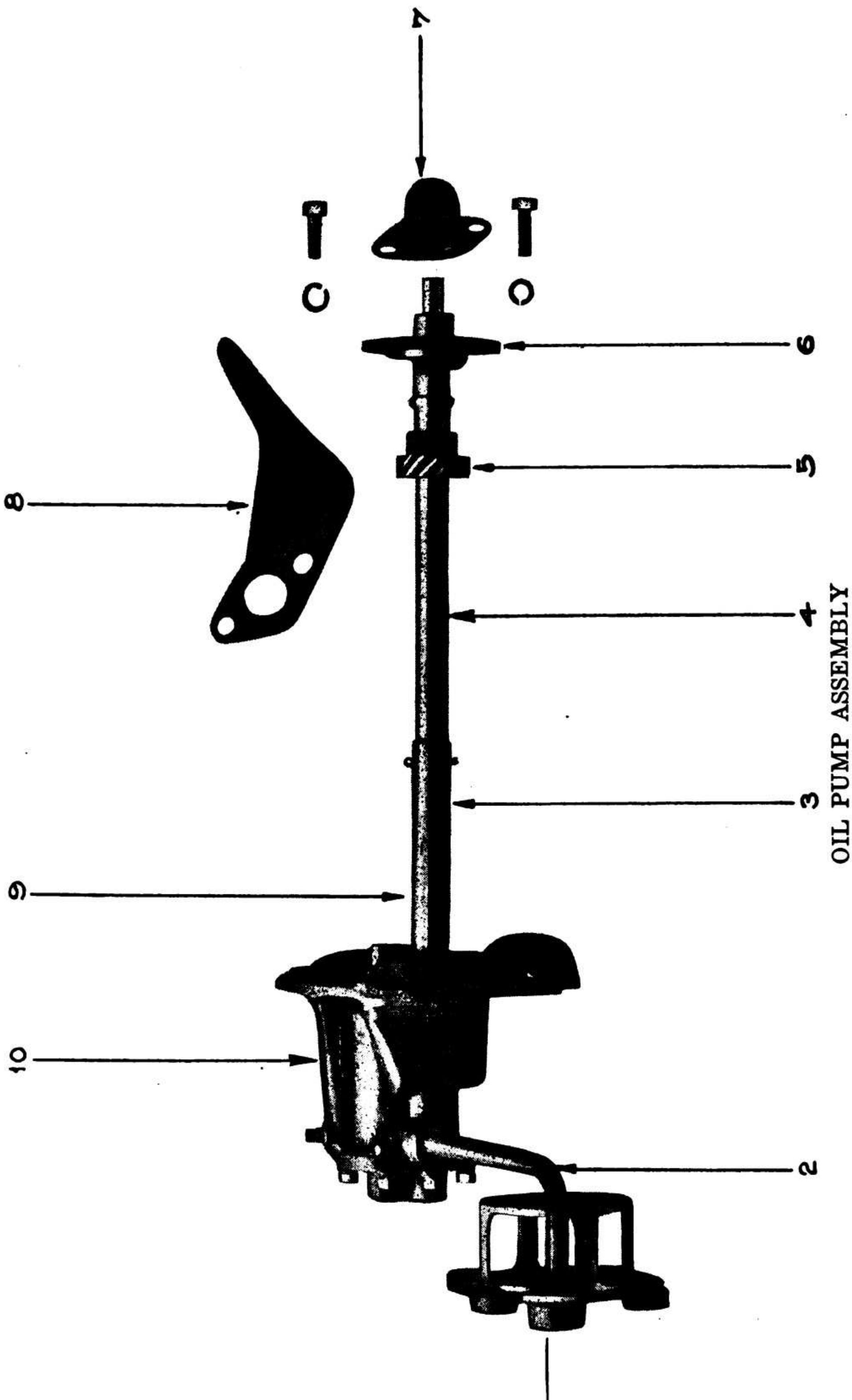
OIL PUMP DRIVE

The Gear on the Camshaft and the Gear on the Upper Oil Pump Drive Shaft are interchangeable. The Upper Oil Pump Drive Shaft is supported by a collar at the top of the Oil Pump Drive Shaft Bracket. It is also guided by a bushing located in the Crankcase above the Oil Pump Shaft and designated the Drive Shaft Bushing, Lower. The Oil Pump Coupling Shaft forms a sort of Oldham coupling between the Oil Pump and the Oil Pump Drive Shaft, Upper. The Oil Pump Coupling Shaft is attached to the Oil Pump Drive Shaft, Upper, by means of a 0.125 (⅛) inch split pin. When removing the Lower Oil Pan or when replacing it, it is only necessary to guide the Oil Pump Coupling Shaft into the Oil Pump Shaft Collar as the Lower Oil Pan is lifted into position. This can be done readily by removing the rear Crankcase Hand Hole Cover Plate and reaching into the Crankcase.

CLEANING OIL PUMP

The 5-ton artillery tractor has three oil filtering screens, which may become clogged by foreign matter collecting upon them. For this

PLATE 32



OIL PUMP ASSEMBLY

PLATE 32—OIL PUMP ASSEMBLY

Ref. No.	Ord. No.	Name
1	342A	Oil screen body.
2	374G	Oil pump suction pipe.
3	373G	Oil pump coupling shaft.
4	377D	Oil pump drive shaft, upper.
5	268E	Oil pump drive gear driven.
6	377F	Oil pump drive shaft bracket.
7	377B	Drive shaft cover.
8	331B	Flywheel pointer.
9	377G	Oil pump shaft collar.
10	372A	Oil pump body.

reason it is desirable to clean them at least once each month. The most common agent in clogging the screen is the particles of waste or lint from rags that are used for cleaning the Crankcase.

The three screens are located as follows: The main oil supply screen is mounted upon the oil screen body, a brass casting that is inserted in the bottom of the lower oil pan and held in place with four cap screws; the front oil pump screen is held in a similar brass oil pump screen body casting fastened to the bottom of the upper oil pan toward the front end. Each of these screens may be readily cleaned by removing the oil pump screen body after the oil reservoir and the upper oil pan have been drained of oil. The screen which protects the pump for the rear portion of the upper oil pan is located in the cover of the lower oil pan so that, in order to clean it, the lower oil pan must be removed.

REMOVING OIL PUMP.

To remove the Oil Pump:

1st. Drain the oil reservoir and the upper oil pan.
2nd. Remove the lower oil pan from the bottom of the crankcase.
3rd. Take out cap screws holding pump body on lower oil pan.
4th. Oil pump can then be disassembled for cleaning and inspection.

REPLACING OIL PUMP.

In replacing oil pump body,

1st. Insert pump in lower oil pan, being careful not to damage the gaskets.
2nd. Remove rear crankcase hand hole cover.
3rd. Reach through hand hole in crankcase and guide oil pump coupling shaft into upper oil pump drive shaft after the lower oil pan is replaced on the bottom of the engine.

GOVERNOR ASSEMBLY

The Governor Assembly is located on the right hand side of the Motor and carries not only the Governor mechanism, the Governor Lever and Governor Spring, Governor Rod and Tube, but also the

Governor and Generator Drive Shaft and that portion of the Shaft provided to drive an electric generator when this is necessary. The Governor Lever Housing is bolted onto the front of the Timing Gear Cover and is independent of the rest of the Governor Assembly, as the

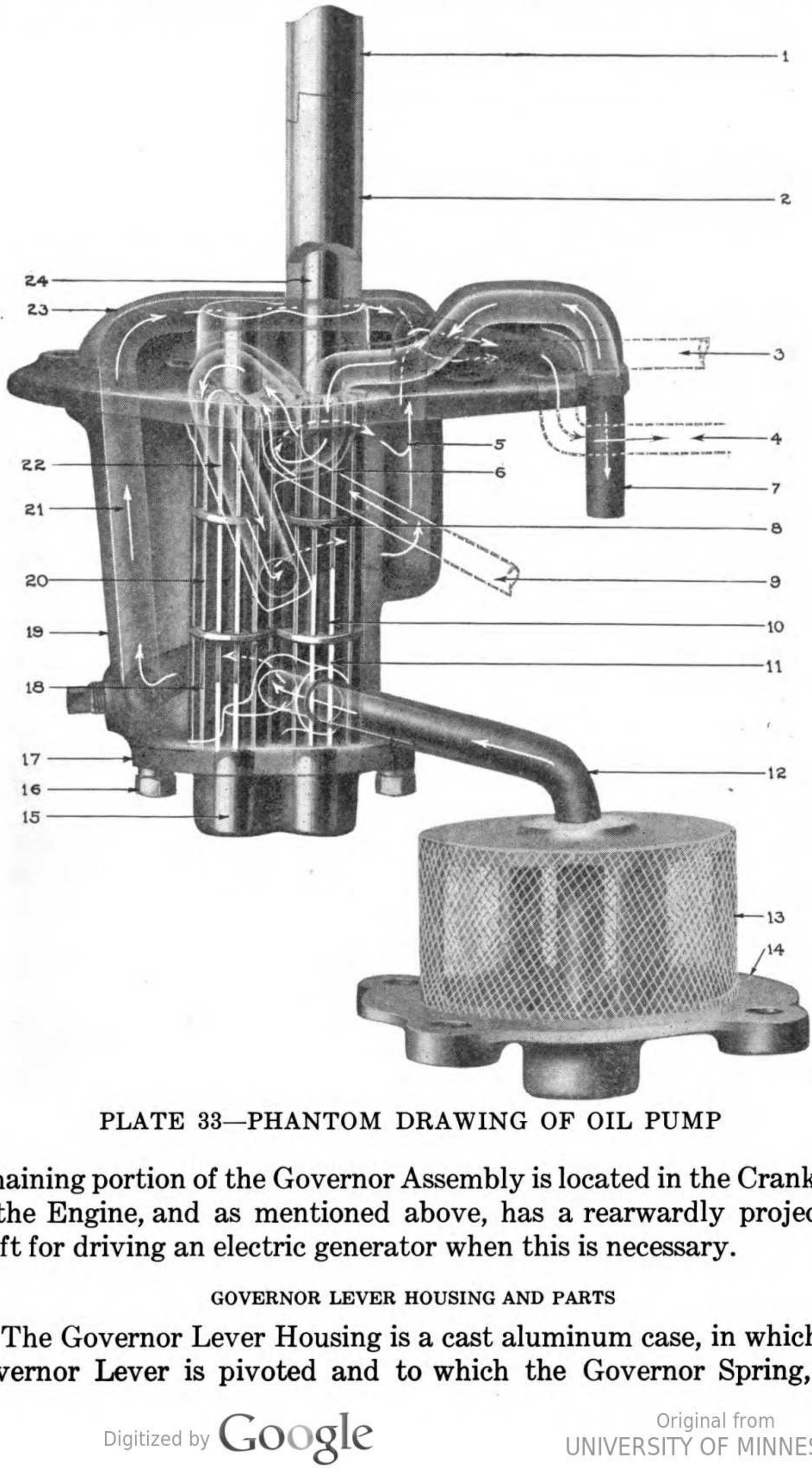


PLATE 33—PHANTOM DRAWING OF OIL PUMP

remaining portion of the Governor Assembly is located in the Crankcase of the Engine, and as mentioned above, has a rearwardly projecting shaft for driving an electric generator when this is necessary.

GOVERNOR LEVER HOUSING AND PARTS

The Governor Lever Housing is a cast aluminum case, in which the Governor Lever is pivoted and to which the Governor Spring, the

PLATE 33—PHANTOM DRAWING OF OIL PUMP

Ref. No.	Ord. No.	Name
1	373G	Oil pump coupling shaft.
2	377G	Oil pump shaft collar.
3	. . .	Main oil delivery tube to bearings.
4	. . .	Return oil tube from pumps to oil reservoir.
5	. . .	Discharge passage connecting two upper pumps with tube 4.
6	373C	Oil pump gear driver.
7	375D	Oil pump upper cover nipple, suction line from rear upper oil pan.
8	375B	Oil pump spacing collar.
9	. . .	Suction oil line from front upper oil pan.
10	373C	Oil pump gear driver.
11	373C	Oil pump gear driver.
12	374G	Oil pump suction pipe from oil reservoir to main oil pump.
13	342C	Main oil pump screen.
14	342A	Oil screen body.
15	373E	Oil pump idler shaft.
16	376C	Cap screw.
17	373A	Oil pump cover, lower.
18	373D	Oil pump gear, driven.
19	372A	Oil pump body.
20	373D	Oil pump gear, driven.
21	. . .	Discharge passage from main oil pump connecting pump 11-18 with discharge tube 3.
22	373D	Oil pump gear, driven.
23	372B	Oil pump upper cover.
24	373B	Oil pump drive shaft, lower.

Oil Circuits:

A—Main lubricating system: Suction 12; through pump 11-18; through passage 21 to delivery line 3.

B—Front oil pan draining system: Suction 9; through pump 10-20; through passage 5 to return tube 4 leading to main oil reservoir.

C—Rear oil pan draining system: Suction 7; through pump 6-22; through passage 5 to return tube 4 leading to main oil reservoir.

Governor Adjusting Spring Gage, the Governor Adjusting Screw and the Governor Adjusting Screw Lock Nut are applied.

In order to protect the Governor Rod, which extends from the Governor Lever to the Throttle Valve located in the Intake Manifold, a Governor Rod Tube has been provided. This slips into a hole provided in the Intake Manifold, but is screwed into the Governor Lever Housing and held in place by the Governor Tube Lock Nut. There is a sheet steel Governor Lever Housing Cover which incloses the forward side of the Governor Lever Housing. It is kept oil tight by means of a manila paper gasket, 0.010-inch thick and is held in place by eleven 0.25 (¼) inch A. S. M. E. Machine Screws.

GOVERNOR ADJUSTMENT

The tension of the Governor Spring is varied by means of the Governor Adjusting Screw. A Governor Adjusting Screw Lock Nut is provided with eight 0.125 (⅛) inch holes equally spaced so that a wire may be slipped through it, and a similar diameter hole in the Governor

Adjusting Spring Gage and then sealed so that the Engine speed can not be varied or the Governor readjusted without the knowledge of the Commanding Officer.

The Governor and Generator Drive Shaft runs upon two bronze bushings, babbitt lined, that are interchangeable with similarly placed bushings used on the Water Pump and Magneto Drive Shaft. On page 83 their dimensions will be found in detail. The end of this

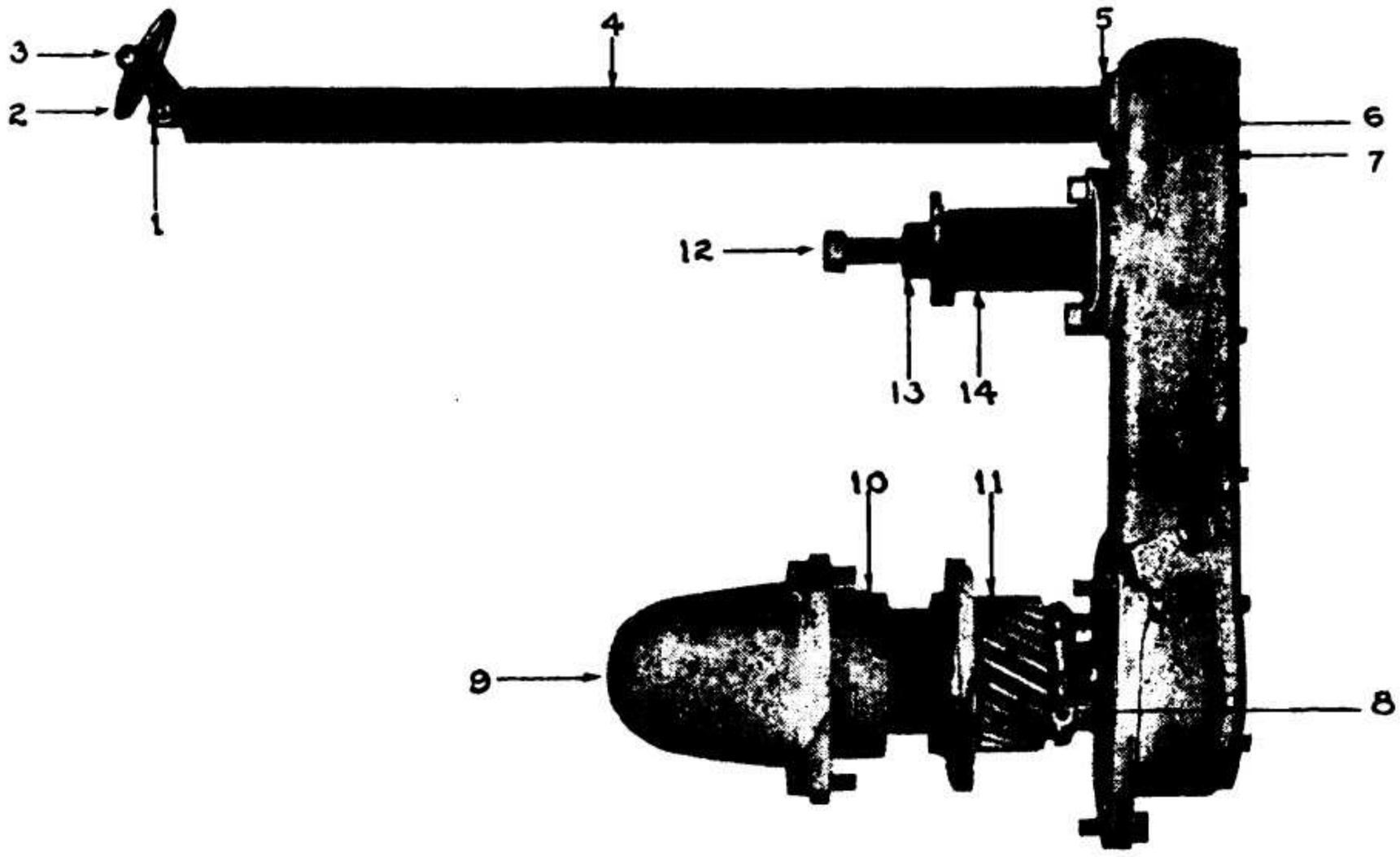


PLATE 34—GOVERNOR ASSEMBLY

Ref. No.	Ord. No.	Name
1	312D	Throttle lever.
2	312E	Governor throttle valve.
3	312H	Throttle spindle.
4	311E	Governor rod tube.
5	311F	Governor tube lock nut.
6	309A	Governor lever housing.
7	309C	Governor lever housing cover.
8	311C	Governor weight.
9	310A	Generator shaft cover.
10	310D	Shaft bearing cage.
11	314C	Generator gear.
12	313C	Governor adjusting screw.
13	313D	Adjusting screw lock nut.
14	313E	Governor adjusting spring case.

Shaft is covered by the Generator Shaft Cover that takes the place of the electric Generator, which is not used on the five-ton Artillery Tractor. The Generator, or Governor Gear, is steel, of S. A. E. specification number 1035 with heat treatment H. It has a face of 1.25 (1¼) inches, an outside diameter of 2.97 (2 31/32) inches, a pitch diameter of 2.75 (2¾) inches, 22 teeth, 9 diametral pitch with right hand helical angle of 27 degrees 15 minutes. On the front end of this are four 0.25 (¼) inch holes tapped 0.5 (½) inch deep. These holes are for the Cap Screws which hold the Governor Spider in place on the Gear.

The Governor Spider is a drop forging with provisions for carrying the four drop forged Governor Weights, which are 1 inch wide and 0.625 (5/8) inch in diameter. They are forged integral with a small bell crank, the Long Arm of which is 1.687 (1 11/16) inches and the Short Arm 0.562 (9/16) inch long. Between the Governor Shifting Collar and the Short Arm of the governor bell crank is imposed a governor Ball Thrust Bearing.

FAN ASSEMBLY

The Fan Assembly consists of the Fan Bracket, Fan Shaft, Fan Bearings, Fan Hub, Fan Blade Assembly, and Fan Belt. The Fan is 24 inches in diameter and has a projected area of 2.25 (2¼) inches; i. e. the thickness from front to rear of the Fan Blade Path. The Fan Belt Assembly is bolted to the front of the Fan Hub by means of four 0.375 (3/8) inch bolts. The Fan has four stamped steel blades made from 0.062 (1/16) inch sheet steel stock.

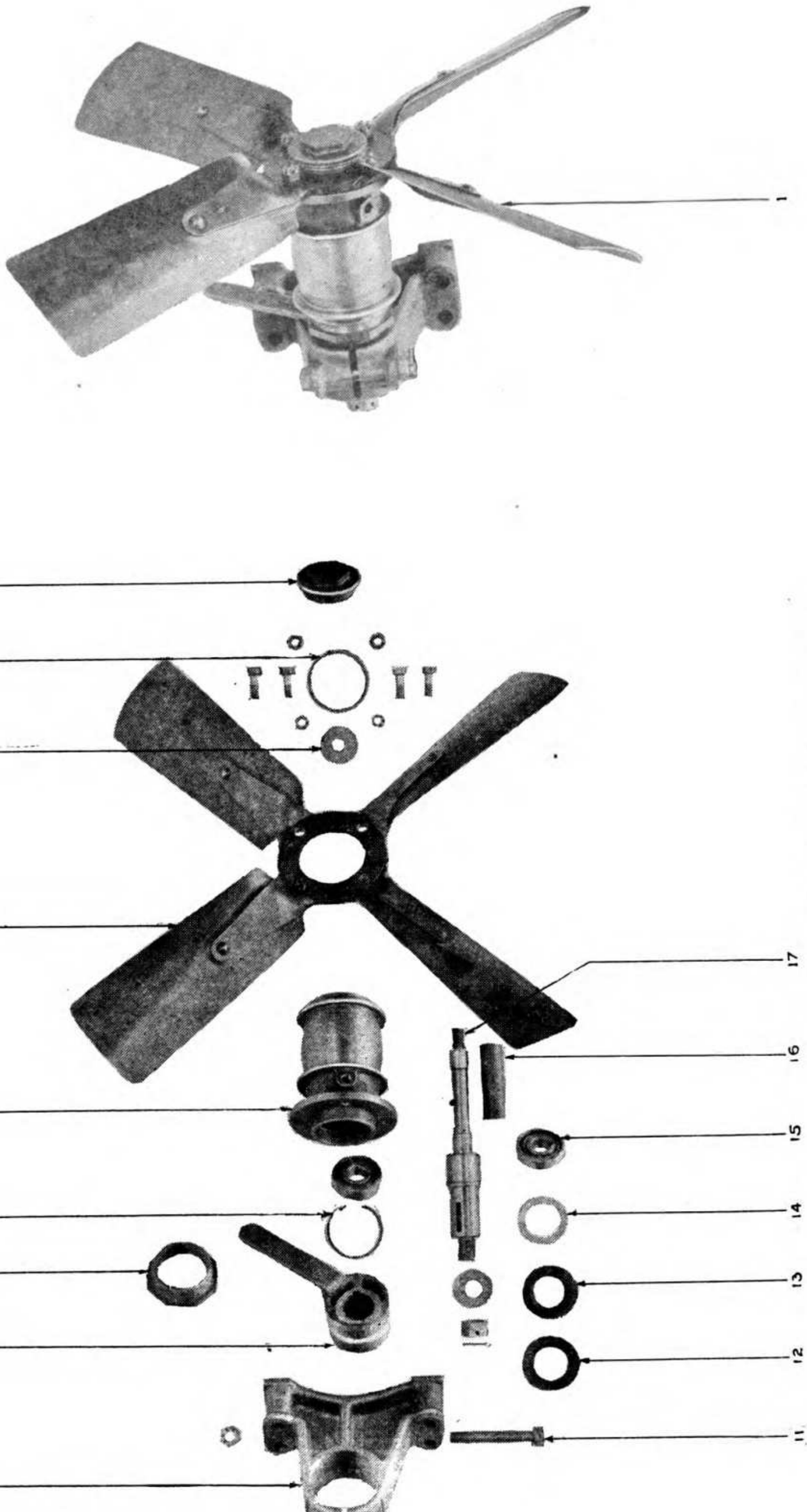
FAN HUB

The Fan Hub is made from cast iron and acts both as the Drive Pulley and the Fan Blade Carrier. Inside of it are the two annular ball bearings, upon which the Fan rotates. A ¼-inch pipe plug in the side of the Fan Hub is provided through which the Fan Hub may be filled with Ref. No. 6 cup grease for the purpose of lubricating the bearings. The front end of the Fan Hub is closed by a Fan Hub Cap, which is made oil tight by means of the Fan Cap Gasket. At the rear end of the Fan Hub there is a Fan Hub Washer of felt, which serves to retain the lubricant inside of the Fan Hub at this point. The Fan Hub is located in place upon the Fan Shaft by clamping the Back Fan Bearing between the Back Fan Bearing Retainer and the Fan Hub Packing Nut. The Front Fan Bearing merely floats and serves to support the Fan Hub but not to retain it in position. Both ball bearings used in the Fan are of the same size, namely: number 304 standard annular type bearings. The bearings are held in place upon the Fanshaft by means of a Fanshaft Washer and a 0.5 (½) inch S. A. E. castellated nut with a tubular steel Fan Hub Bearing Spacer, 3.125 (3⅛) inches long, 1 inch in outside diameter and with 0.095 (3/32) inch gauge walls.

FAN BRACKET

The Fanshaft is not fastened directly into the Fan Bracket but to the Fan Belt Adjusting Eccentric. The eccentric is provided with a 6-inch handle, which makes it convenient to operate and is clamped in place by splitting one side of the Fan Bracket Hole into which the eccentric fits and clamping with a 0.5 (½) inch bolt. By means of this eccentric, a 1-inch adjustment or variation between the fan belt

PLATE 35



COOLING FAN AND PARTS

PLATE 35

COOLING FAN AND PARTS

Ref. No.	Ord. No.	Name
1	.....	Fan and bracket assembled.
2	283B	Fan hub cap.
3	285A	Fan cap gasket.
4	284F	Fan shaft washer.
5	281A	Fan.
6	283A	Fan hub.
7	283C	Fan hub retaining ring.
8	283D	Fan hub packing nut.
9	282B	Fan belt adjusting eccentric.
10	282A	Fan bracket.
11	285G	S. A. E. bolt.
12	285B	Fan hub washer.
13	285C	Fan hub washer.
14	285D	Fan bearing washer.
15	285F	Fan bearing.
16	284D	Fan hub bearing spacer.
17	284A	Fan shaft.

pulley centers is obtained. Both the Fan Belt Adjusting Eccentric and the Fan Bracket are cast from malleable iron. The Fan Bracket is attached to the upper Crankcase by four 0.5 (½) inch bolts.

FAN BELT

The Fan Belt is made of 2.5 (2½) inches wide two-ply chrome tan leather. The developed length of the belt, not including the splice, is 41.125 (41⅛) inches. The splice should have a lap of 5 inches and the belt should be stitched ¼-inch in from either edge with 8 stitches per inch. The minimum center to center distance of the Fan Belt Pulleys is 12.625 (12⅝) inches. The radius of the Fan Hub Pulley is 1.625 (1⅝) inches and that of the Driving Pulley is 3.187 (3 3/16) inches.

REASONS FOR FAN BELT SLIPPAGE.

A fan will not run at proper speed if the belt is oiled or greasy, if the belt is too loose, or if the fan is too tight in the bearing.

WATER PUMP AND FAN DRIVE ASSEMBLY

The Water Pump and Fan Drive Assembly consists of the following important parts: Centrifugal Water Pump with shaft and coupling, the Main Drive Shaft which is located inside of the Crankcase, the Bushings for this Drive Shaft, the Pump and Magneto Drive Gear and the Fan Drive Pulley.

WATER PUMP

The Water Pump consists of three important parts: the Water Pump Body, the Water Pump Cover and the Water Pump Rotor. The Water Pump Body and Cover are held together by means of eight 0.25 (¼) x 0.625 (⅝) inch Round Fillister Head Screws. The Water Pump Body and Cover when assembled are held in place on the Engine

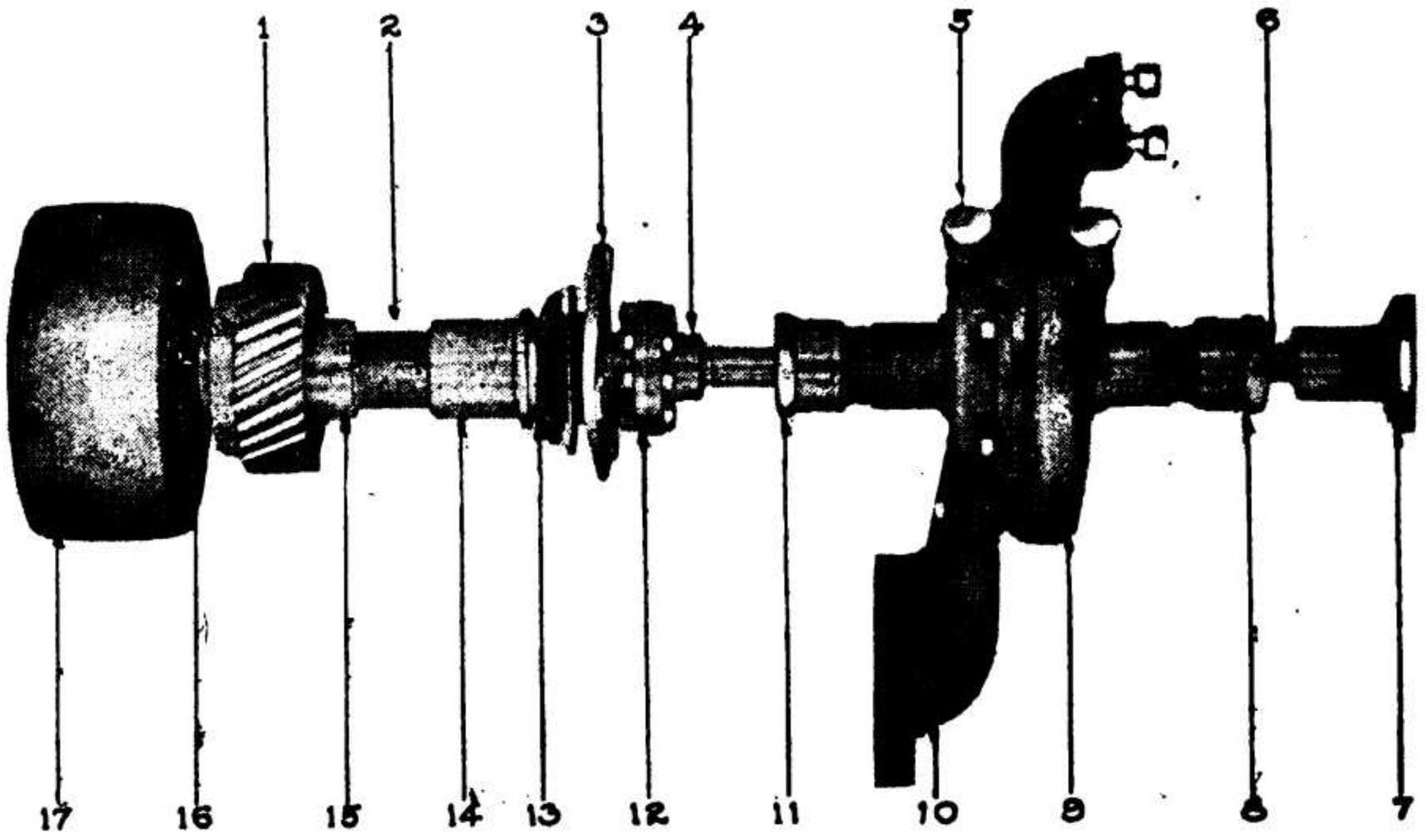


PLATE 36—WATER PUMP ASSEMBLY.

Ref. No.	Ord. No.	Name
1	364B	Pump and magneto gear.
2	362A	Water pump drive shaft.
3	363A	Pump shaft housing cover.
4	363C	Pump coupling flange—8 hole.
5	362E	Grease cup.
6	362B	Water pump shaft.
7	361A	Water pump rotor.
8	361F	Water pump packing nut, L. H.
9	360B	Water pump body.
10	360A	Water pump cover.
11	361E	Water pump packing nut, R. H.
12	363D	Pump coupling flange—10 hole.
13	365A	Drive shaft gland.
14	268C	Bushing, outer.
15	362F	Shaft bushing, outer.
16	364D	Drive shaft oil sling.
17	364A	Fan drive pulley.

Crankcase by two bearing-like supports. The Rotor is mounted upon a 0.749 (¾) inch bronze shaft, 14.125 (14⅛) inches long, the specification for which is S. A. E. Number 26. This is interchangeable with part number 1105-V on the Class "A" and "B" trucks.

The Rotor of the Water Pump is also of bronze and of the same specification. It is held in place by a Number 1 taper pin, 0.183 x 1.5 (1½) inches. The Water Pump Shaft is carried upon two cast iron Bushings, 0.75 (¾) inch inside diameter, 1.063 ($1\frac{1}{16}$) inch outside diameter and 1.5 (1½) inches long. Care must be taken, should these

Bushings be replaced, to see that the holes drilled through them to allow grease to be forced into the bearings register with the corresponding Grease Cup holes in the Water Pump Body and Cover. Two Grease Cups are provided for the purpose of lubricating these bearings and are conveniently placed on the top of the Water Pump Body and Cover.

To prevent water leakage around the Pump Shaft, Water Pump Packing is inserted in glands at either end of the Pump Assembly.

Water Pump Packing Nuts are required to keep the packing in the glands tight. The nuts are made from bronze and are not interchangeable; the one toward the rear end of the engine has a left hand thread, while the one at the front end of the Engine has a right hand thread.

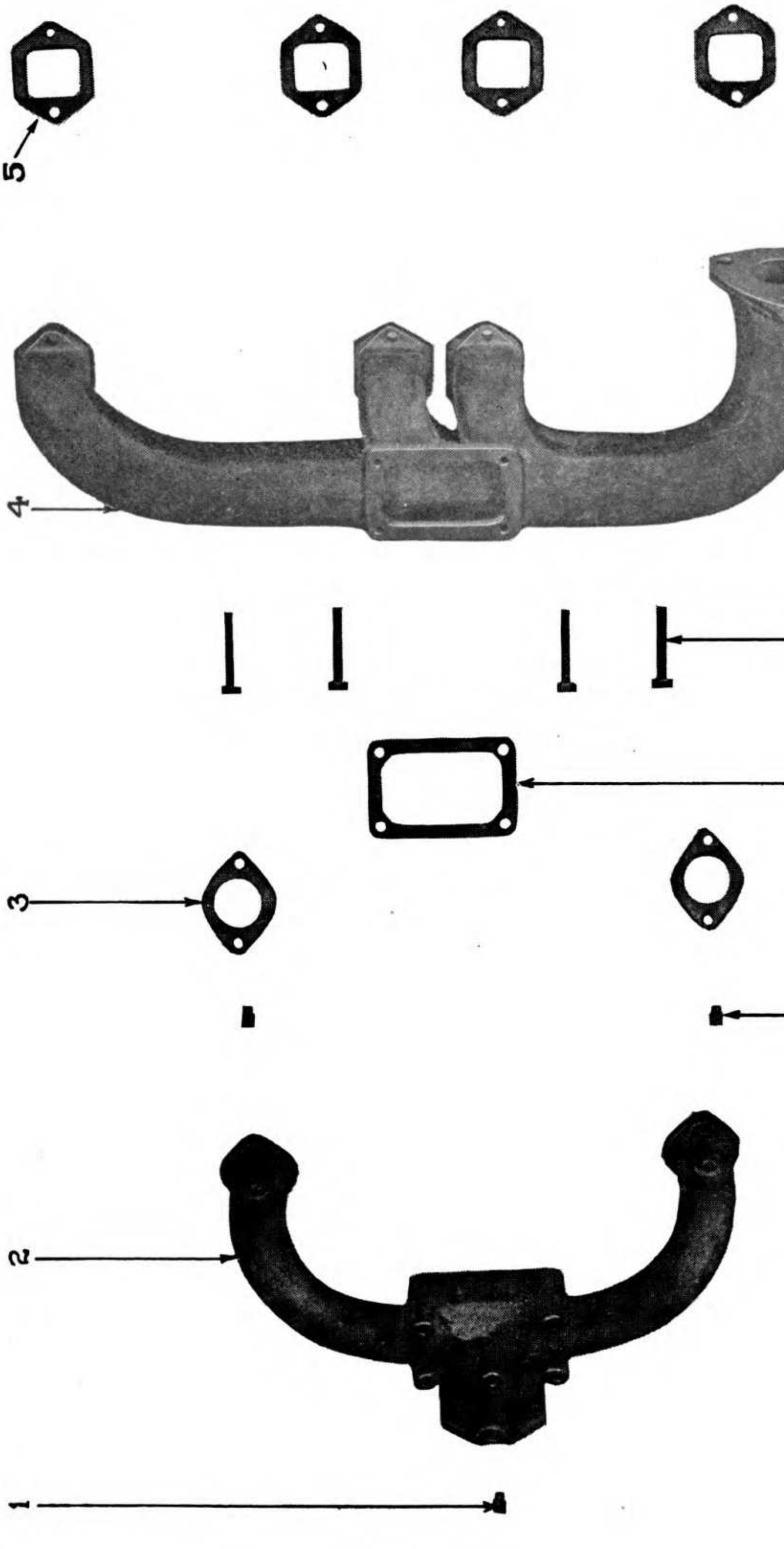
WATER PUMP COUPLING

A Flange Coupling is placed between the Water Pump Drive Shaft located in the Engine Crankcase and the Water Pump Shaft located outside of it. This Coupling is to facilitate the removal of the Water Pump when this is necessary, and to provide convenient means for timing the Magneto. This Coupling is made up in two parts, both the same size but having a different number of holes drilled in them. The Rear Pump Coupling Flange has eight 0.265 ($\frac{17}{64}$) inch drilled holes located on 2-inch diameter circle and equally spaced. The Front Pump Coupling Flange has ten holes of the same diameter and on the same diameter bolt circle. It is possible by the use of this coupling with the holes so spaced to readily adjust the timing of the Magneto, which is driven off of the rear end of the Water Pump Shaft. Two S. A. E. bolts 0.25 ($\frac{1}{4}$) inch and 0.875 ($\frac{7}{8}$) inch are used to transmit the drive.

WATER PUMP DRIVE SHAFT

The Water Pump Drive Shaft is carried upon two Bushings, located in the Crankcase, both of which are bronze, babbitt lined. The Bushing located at the front end of the Water Pump Drive Shaft is not interchangeable with the one located at the rear but is interchangeable with a similarly located Bushing used on the Governor Shaft found on the opposite side of the Engine. This Front Bushing is provided with a Thrust Flange 2.312 ($2\frac{5}{16}$) inches in diameter. The Front Bushing measures 1.5 ($1\frac{1}{2}$) inches inside diameter and 1.877 ($1\frac{7}{8}$) inches outside diameter and 1.812 ($1\frac{13}{16}$) inches overall length. The specifications of the bronze back and babbitt lining of these Bushings are respectively S. A. E. Number 27 and S. A. E. Number 24. The Rear Bushing for the Water Pump Drive Shaft is of slightly different size and is interchangeable with the Idler Bushings and a

PLATE 37



INTAKE AND EXHAUST MANIFOLDS

PLATE 37—INTAKE AND EXHAUST MANIFOLDS

Ref. No.	Ord. No.	Name
1	176F	Pipe plug.
2	394A	Intake manifold.
3	391E	Intake port gasket.
4	393A	Exhaust manifold.
5	391C	Exhaust port gasket.
6	13E	Pipe plug.
7	391A	Intake heater gasket.
8	394B	Bolt.

similarly placed bushing on the Governor Shaft. Its dimensions are as follows: Outside diameter of Flange 2.322 ($2\frac{5}{16}$) inches, inside diameter of Bushing 1.5 ($1\frac{1}{2}$) inches, outside diameter 1.877 ($1\frac{7}{8}$) inches and overall length of 1.812 ($1\frac{13}{16}$) inches. It differs from the Front Bushing on this Shaft in that the babbitt lining is not carried over the face of the Thrust Flange.

The Water Pump Drive Shaft is driven by means of a Pump and Magneto Gear located inside of the Timing Gear Housing.

This Gear is made from steel, has a 1.25 ($1\frac{1}{4}$) inch face, 3.971 ($3\frac{31}{32}$) inches outside diameter, 3.75 ($3\frac{3}{4}$) inches pitch diameter, 30 teeth, 9 diametral pitch and left hand helical angle of 27 degrees 15 minutes.

On an extension of the Water Pump Drive Shaft is keyed the Fan Drive Pulley. This Pulley is made from cast iron and is 6.375 ($6\frac{3}{8}$) inches in diameter and has a crowned face of 9 inches radius and 2.75 ($2\frac{3}{4}$) inches width. To facilitate its removal two 0.375 ($\frac{3}{8}$) inch tapped holes are provided in the Pulley into which puller screws may be inserted. A large Felt Pulley Washer 3.375 ($3\frac{3}{8}$) inches in diameter and 0.25 ($\frac{1}{4}$) inch thick is provided to keep oil from working out of the Timing Gear Cover through the Hole provided for the Fan Drive Pulley Shaft.

TO PACK WATER PUMP GLANDS

The water pump glands (packing boxes of the shaft) should be packed with a good grade of waterproof asbestos, or compounded packing. If asbestos loose twisted rope packing is available, untwist one strand, soak it thoroughly with cylinder oil, and cover with as much fine graphite as it will retain.

Always coil the packing around the shaft in the direction of rotation of the packing nut, so it will not tend to unwind when the packing nut is screwed on.

If only square or round braided packing of too large a size is available, cut off a piece of about the desired length, place it between the jaws of a bench vise, squeeze it out flat, and then cut off a strip of the desired width with a pair of thin snips or heavy scissors. The gland nuts should not be tightened any more than necessary to prevent leakage of water.

PLATE 38

MUFFLER ASSEMBLY AND PARTS

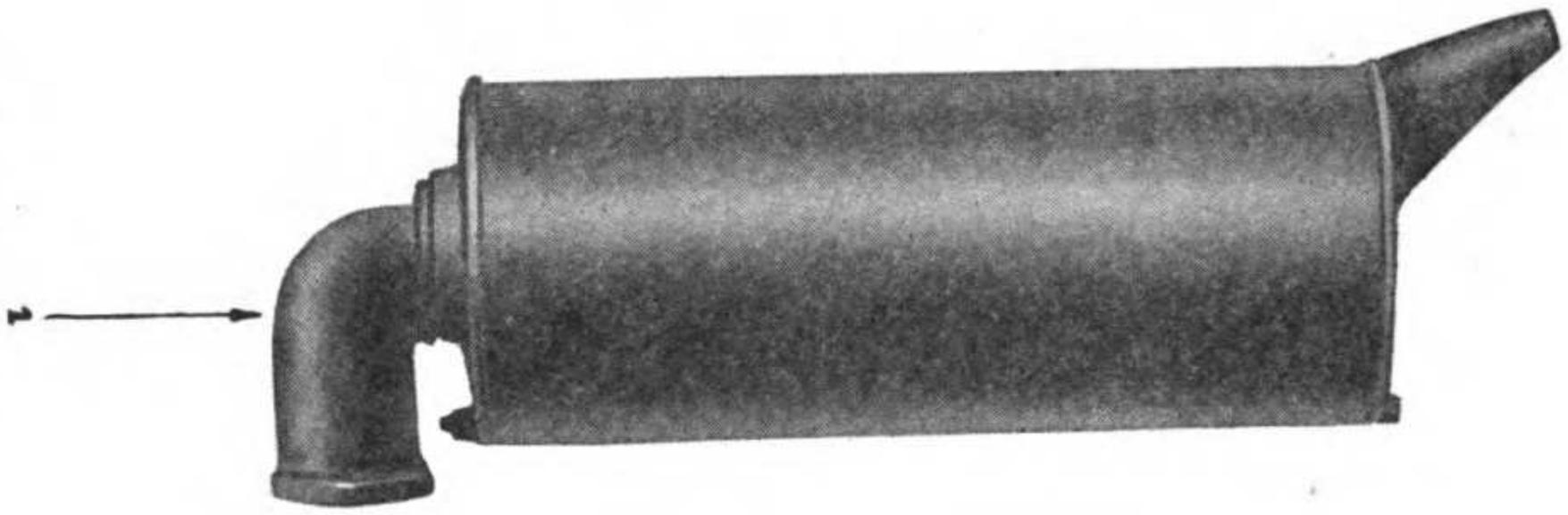


PLATE 38—MUFFLER AND PARTS.

Ref. No.	Ord. No.	Name
1	241A	Muffler assembled.
2		Flange.
3		Head piece.
4	241C	Exhaust pipe.
5		Tail piece.
6		Tee rods.
7		Tee rod nuts.
8		Inner sleeve.
9		Center sleeve.
10		Outer sleeve.

TO TEMPORARILY REMEDY DEFECTIVE WATER PUMP

In case of a damaged or inoperative pump the water pump rotor should be removed from the pump to prevent its obstructing the passage. The cooling system must be full to insure circulation (by thermo-syphon) under these conditions, which are produced by the water boiling. Necessarily this is a temporary arrangement, as water is lost rapidly.

TO THAW FROZEN PUMP

During cold weather, after an engine has been stopped for a sufficient time to permit any water in the cooling system to freeze, the engine should not be turned over with a crank until it is ascertained that no water has collected in the water pump, and frozen the pump rotor to the pump housing. The pump may be warmed with a gasoline blow torch, hot water or cloths soaked with gasoline may be applied to the pump and lighted to thaw the ice.

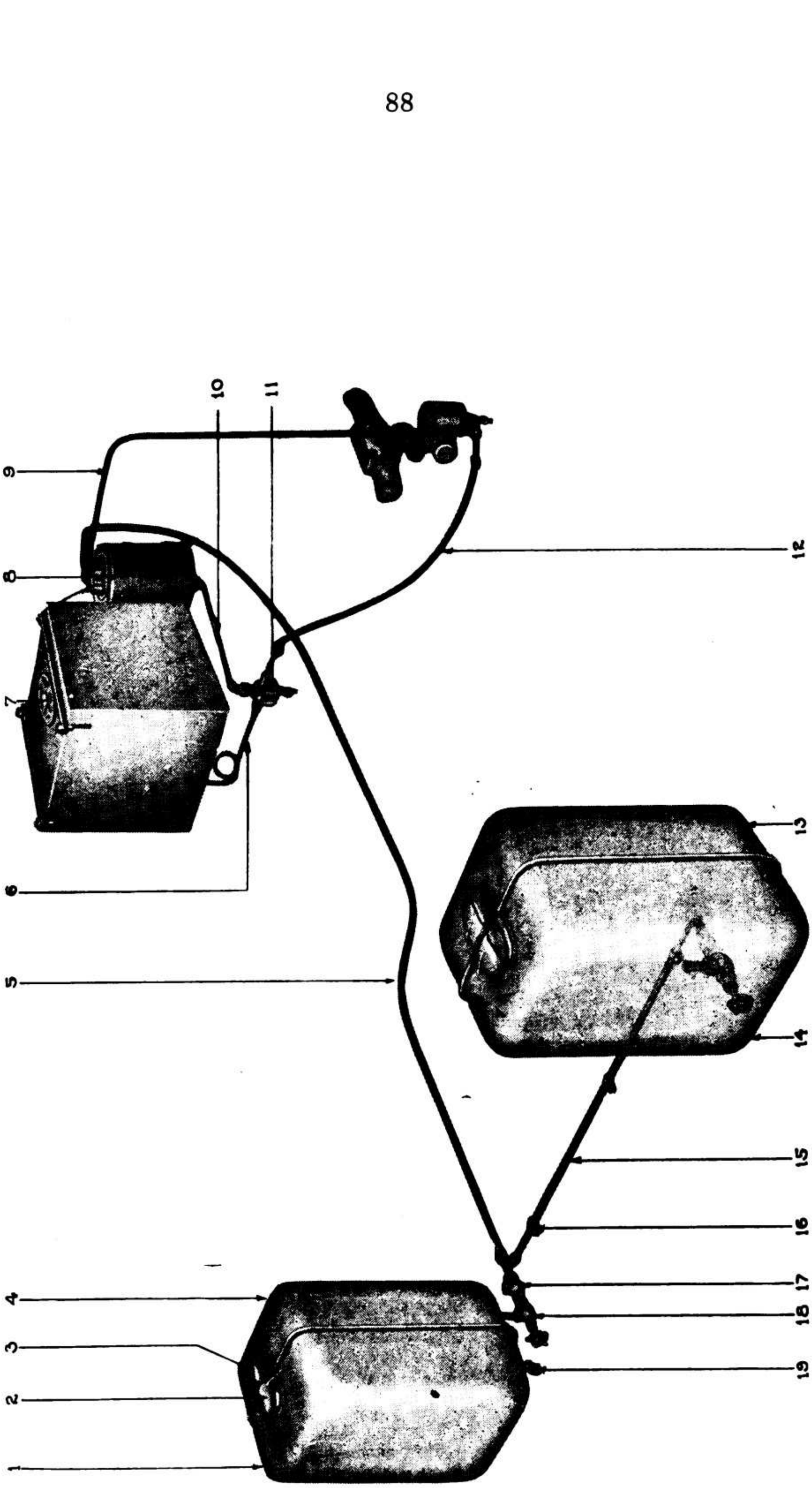
To avoid freezing in winter cover the lower portion of the radiator with cardboard to obstruct air flow. The lower portion is always colder than the top because the water, when it gets to the bottom, already has been cooled. The water, as it enters the top of the radiator is hot, having just come from around the cylinders.

MANIFOLD ASSEMBLY

There are four Manifold Assemblies on the Engine: the Water Outlet Manifold which is attached to the top of the Cylinders and the Water Inlet Manifold which is attached to the lower side of the Cylinder Water Jackets. In addition there are the two Manifolds, one for the Intake and one for the Exhaust, which are bolted together immediately above the Carbureter. The common point at which the intake and exhaust manifolds are bolted together serves as the "Hot Spot" in the Fuel Supply System and insures better vaporization and fuel economy.

The water outlet manifold and the flexible metallic Radiator Inlet Hose are sweated together and form a single assembly.

PLATE 39



FUEL SUPPLY SYSTEM

PLATE 39—FUEL SUPPLY SYSTEM.

Ref. No.	Ord. No.	Name
1	200B	Gasoline tank—right half.
2	201A	Filler cap.
3	202D	Filler cap bail.
4	200A	Gasoline tank—left half.
5	202F	Gas pipe hose outlet.
6	207E	Reserve supply pipe.
7	206F	Filler cap.
8	209A	Vacuum gasoline tank.
9	211A	Vacuum pipe.
10	202E	Gas pipe hose.
11	416C	3-way gasoline valve and strainer.
12	202G	Carbureter and gas pipe hose.
13	200B	Gasoline tank—right half.
14	200A	Gasoline tank—left half.
15	202G	Carbureter and gas pipe hose.
16	211D	Gasoline line clip.
17	204D	Horizontal check valve.
18	204B	Needle angle valve.
19	204G	Drip cock.

MUFFLER ASSEMBLY

The Muffler is mounted on the top of the armor and connected to the Exhaust Manifold by a 12-inch piece of 2.5 (2½) inch seamless steel tubing. The Muffler is very simple in construction, as the photograph of the part shows. It is held in place upon the armor by means of a heavy pressed steel bracket at the front end, and by a cast iron connecting piece at the rear.

FUEL SUPPLY SYSTEM

The Fuel Supply System may be divided into what might be called two independent sources of fuel, the Main Fuel System, which consists of two 12 U. S. gallon tanks located on each side of the Superstructure back of the driver's seat, from which fuel is drawn and delivered to the Carbureter by means of a Vacuum Tank, located under the armor and mounted between the two Cylinder Blocks. The other source of fuel supply is the Reserve or Auxiliary Tank, suspended from the armor plate which forms the cover of the Engine and which carries a supply of 10 U. S. gallons of gasoline.

MAIN FUEL TANKS

The Main Fuel Tanks are made up from two terne plate pressings with rolled flanges, soldered together, making each tank 19 inches high, 12.5 (12½) inches wide and 13 inches thick. A Filler Opening is provided in the top of each tank approximately 6 inches long and 2 inches wide. This is provided with a hinged cap that is held in place

by a Filler Cap Bail. A Filler strainer to prevent dirt being introduced into the Fuel System is provided and each Tank also has an independent Drip Cock by means of which it can be drained. In addition each tank is provided with a check valve between the Needle Angle Valve, which is used to shut it off, and the Main Feed Line from the Supply Tanks to the Vacuum Tank. The purpose of the Check Valve is obvious. If one of the other Fuel tanks were punctured accidentally or by bullets or the like, all of the fuel in both tanks would be lost.

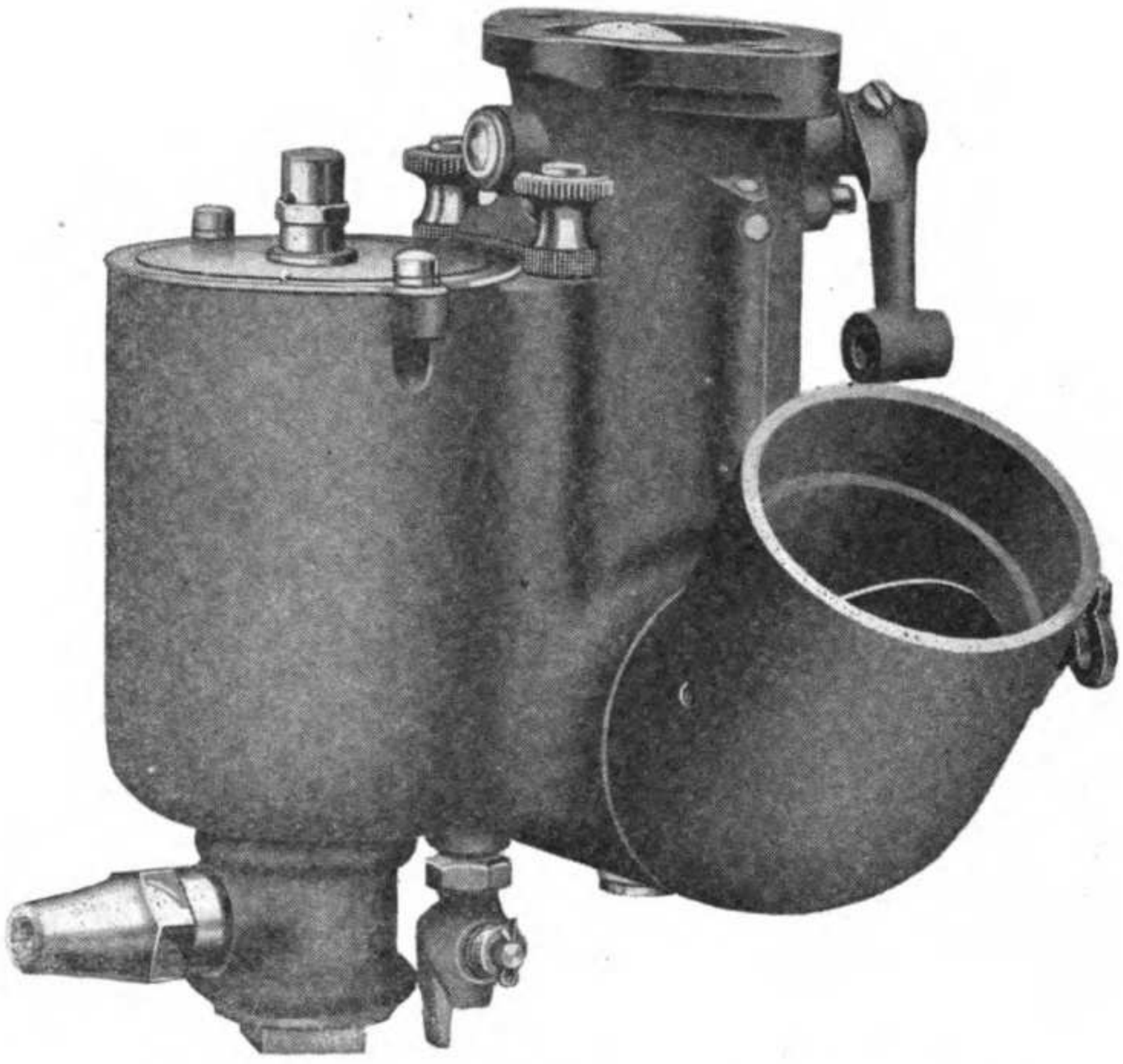


PLATE 40—SCHEBLER CARBURETER

By the introduction of the Check Valve only the fuel in the tank which is leaking will be lost. A line is used connecting the two rear tanks to a single pipe from a tee located under the Left Main Fuel Tank and goes from that point to the Vacuum Tank.

The Vacuum System draws the fuel from the Main Fuel Tanks at the rear into the Vacuum Gasoline Tank and from thence feeds it by gravity to the Carbureter.

CARBURETER

The Carburetion System is the means of supplying the Engine with an explosive mixture of gasoline and air. The System consists of a Carbureter, which receives gasoline from a Supply Tank and mixes it with air in the proper proportion, and a system of passages from the Carbureter to the Inlet Valves which direct the mixture into the Cylinders.

The Tractor is equipped with a Schebler Carbureter, Model A Special. The Carbureter is bolted to a flange on the lower end of the Intake Manifold.

The Carbureter converts the gasoline into vapor and mixes it with the proper amount of air to produce a gas that will explode rapidly in the Cylinders. This Carbureter is of the plain tube type, that is, all the air through the Carbureter passes the fuel nozzle, which is located in the center of a simple pipe or tube and no parts of the Carbureter are of automatic operation or move except the Float mechanism.

Referring to Plate 41, the action of the Carbureter is as follows:

All air enters the Carbureter at (1) and passes up through the Venturi Tube or Mixing Chamber, past the nozzle and Throttle Valve to the Intake Manifold. Fuel enters the Carbureter at (12), passes through the strainer (11) into the Float Bowl, where it is held at a constant level by means of a metal float (15), which actuates the Needle Valve (13) through the Float Arms.

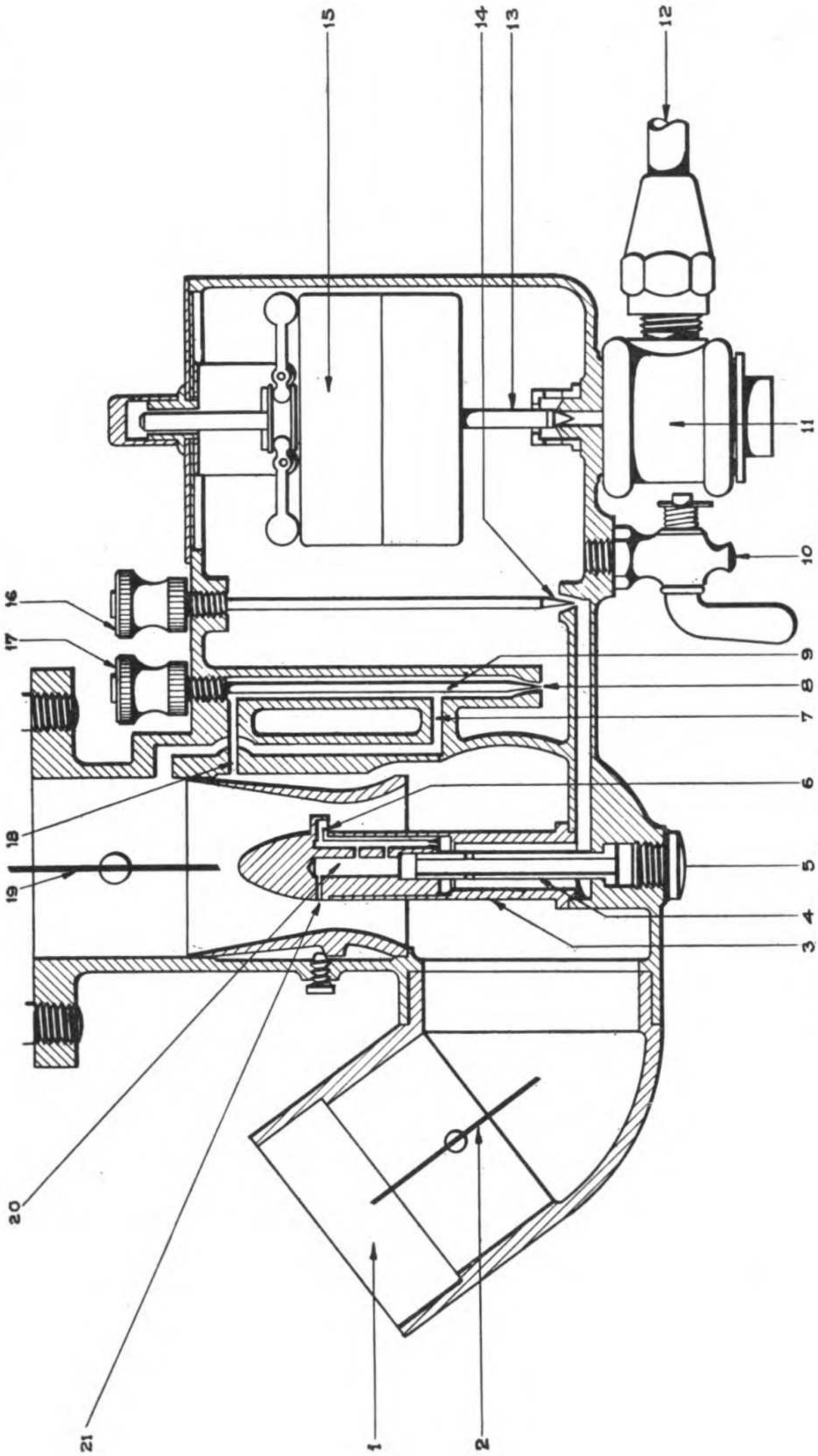
From the Float Bowl the fuel passes the Idling or Low Speed Adjusting Needle Valve (8) into the passages (7) and (9) until it reaches the same level as the fuel in the Float Chamber. It also runs through the Main Fuel Adjusting Needle Valve into the Main Nozzle (4) until the same level is reached.

The Engine is started with the Throttle Valve (19) nearly closed. The air at the Inlet (1) should be choked by means of the Valve (2) if the weather is cold enough to make this necessary. Fuel is drawn through the passage (7) together with some air from the small hole (18) and delivered to the edge of the Throttle Valve (19) where it is atomized and drawn into the manifold. (See diagram on Plate 42 showing Carbureter at choked position.)

As the Throttle is opened, more air is drawn past the Nozzle Housing (3) and tends to draw or suck fuel from the three holes (21), (only one of which is shown on diagram), while it drives into the holes (6) which face the incoming air. The air that drives into the holes (6) mixes with the fuel in the Main Nozzle and is drawn out the holes (21) together with the fuel. This atomized fuel is picked up by the inrushing air and is drawn through the Main Venturi Tube, past the Throttle Valve and into the Intake Manifold. This action of the air driving into the Nozzle controls the reserve of fuel stored there for acceleration purposes, as well as the fuel flow through the valve (14) thus maintaining the proper proportion of fuel to air constantly without the use of moving parts. (See Diagram on Plate 42 of Carbureter running under partial and full loads.)

The only care necessary to insure the proper operation of the Carbureter is to make certain that all connections are tight and that the choke valve is free to return to its normal open position after use.

PLATE 41



SECTIONAL DRAWING OF CARBURETER

PLATE 41
SCHEBLER CARBURETER, MODEL A

Ref. No.	Name
1	Air inlet.
2	Choke valve.
3	Main fuel nozzle housing.
4	Main fuel nozzle.
5	Main fuel nozzle drain plug.
6	Pitot tube vents (3)
7	Auxiliary fuel passage.
8	Idle adjusting needle valve.
9	Auxiliary fuel passage.
10	Carbureter drain cock.
11	Strainer.
12	Fuel supply pipe.
13	Float feed needle valve.
14	Main fuel adjusting needle valve.
15	Float.
16	Main needle valve adjusting head.
17	Idle needle valve adjusting head.
18	Auxiliary air passage.
19	Throttle valve.
20	Main fuel jet mixing chamber.
21	Main fuel jets (3).

Occasionally remove and clean the Strainer and drain the Float Bowl by means of the pet cock on the bottom to remove any water or sediment which may have collected in the bottom of the bowl.

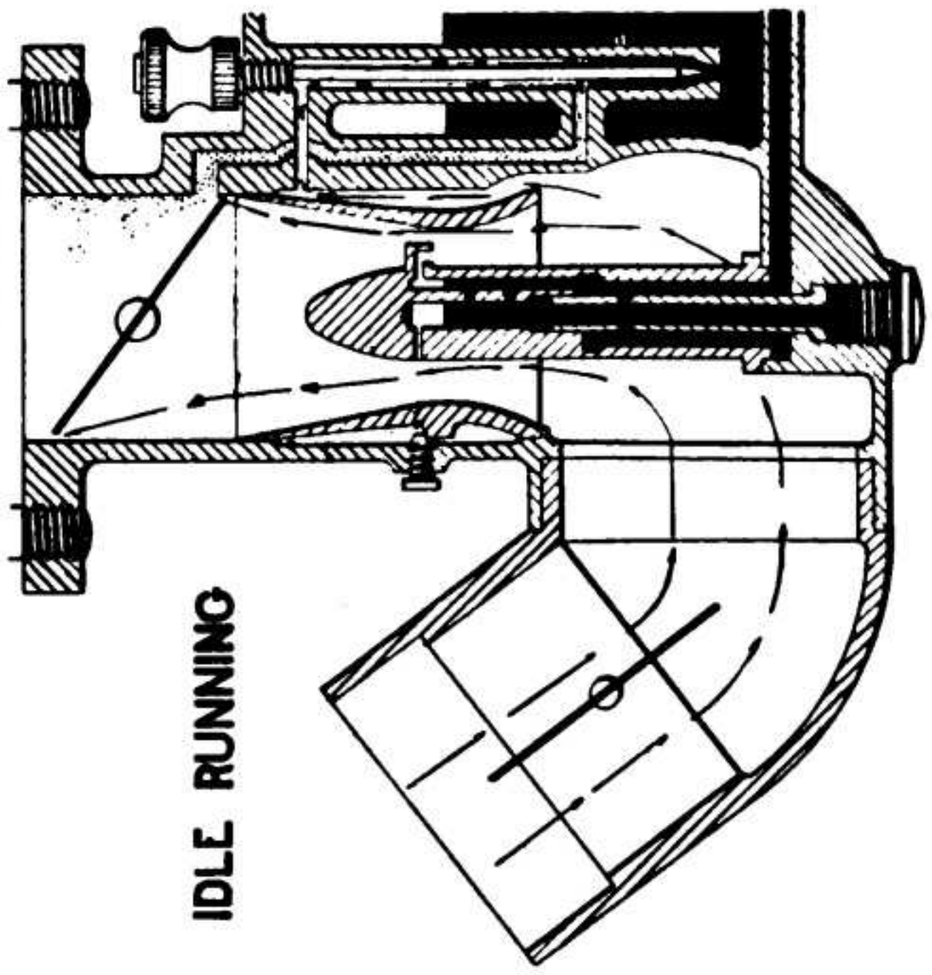
CARBURETER ADJUSTMENT

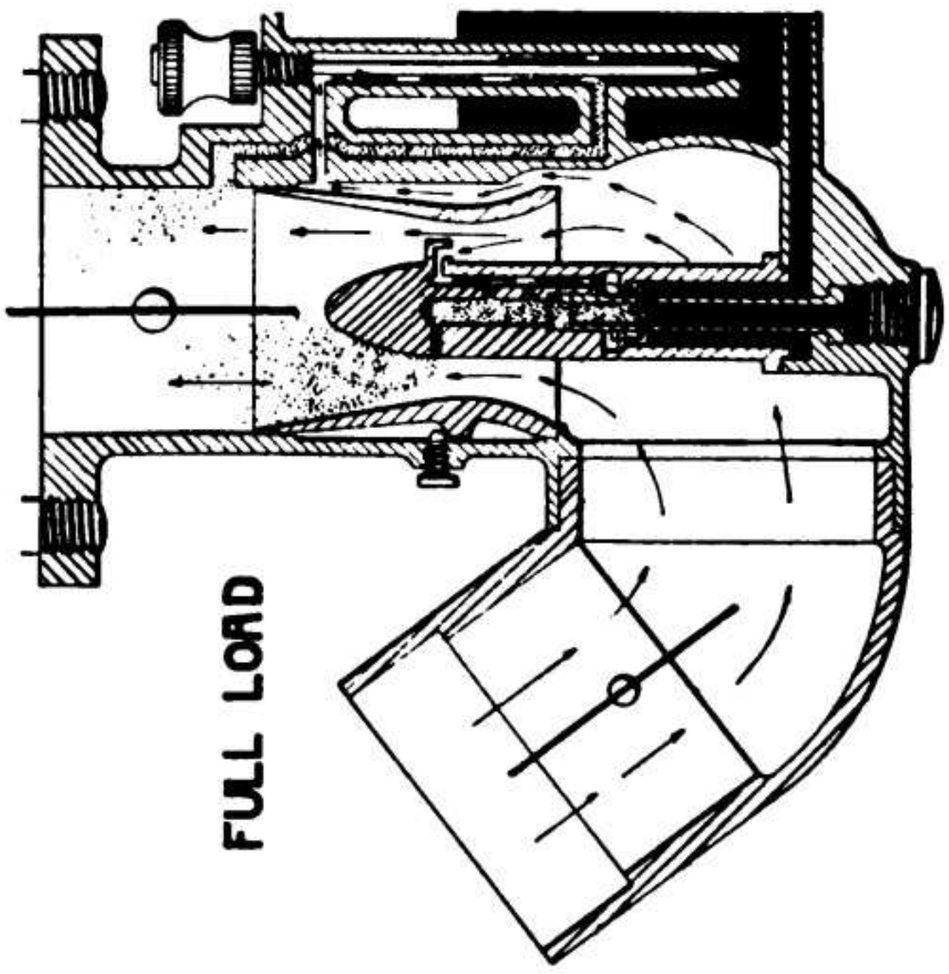
There are two adjustments on the Model "A" Special Carbureter, one is for the idling or slow speed and one for the main jet, and they are so marked on the dial on the tops of the Adjusting Heads. If these adjustments are once set, they should require no further attention except in extreme changes of temperature or when the Engine Valves require re-grinding. In the latter case, a slight enrichment of the Idle Adjusting Head should suffice.

Adjustments are made as follows:

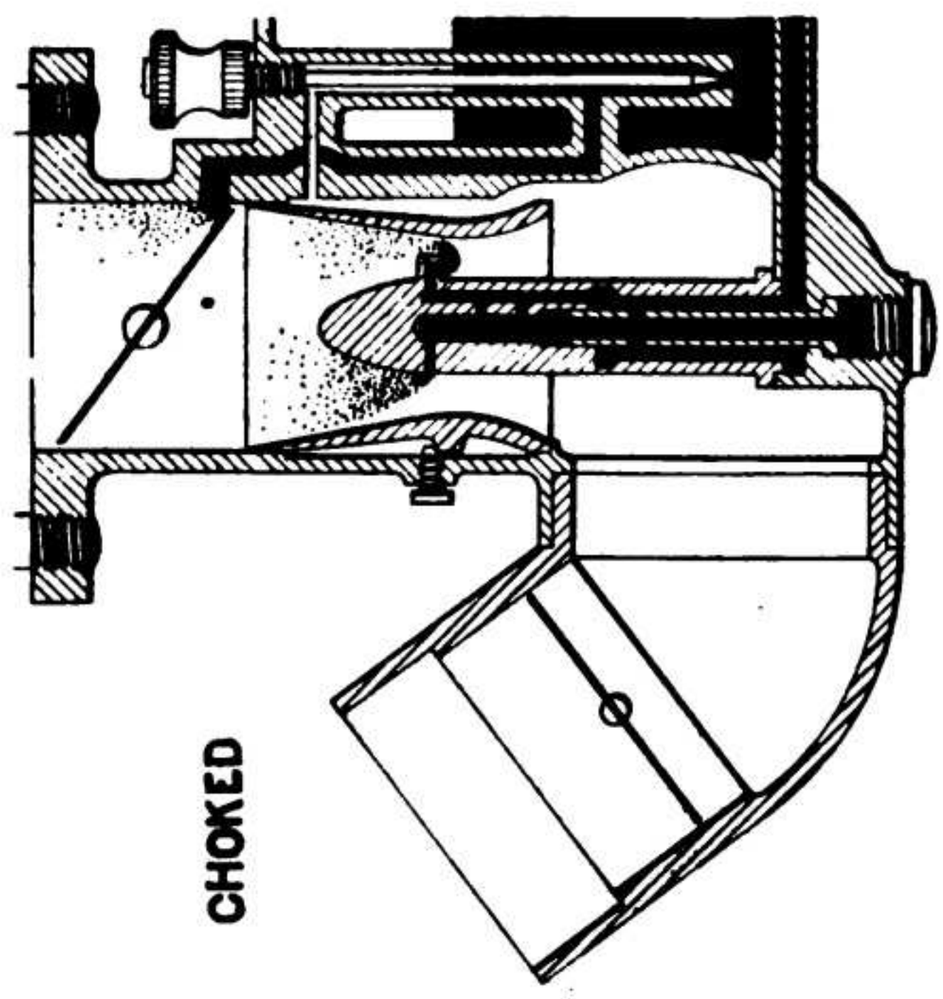
Screw out both Adjusting Needles several turns. Start the Engine with the Throttle slightly open. Slowly turn the Idle Adjusting Head (17) to the right or towards the "less gas" position as indicated by the dial until the Engine fires evenly. Adjust the Engine speed for running idle by means of the Throttle Lever Stop Screw on the Throttle Lever. Open the Throttle wide, allowing the Governor to regulate the Engine speed and with a retarded spark, turn the Main Gas Adjusting Head (16) toward the "less gas" direction until the Engine begins to back-fire. Turn the Adjusting Head in the "more gas" direction just sufficient to stop the Engine back-firing. These adjustments should produce a good clean powerful mixture.

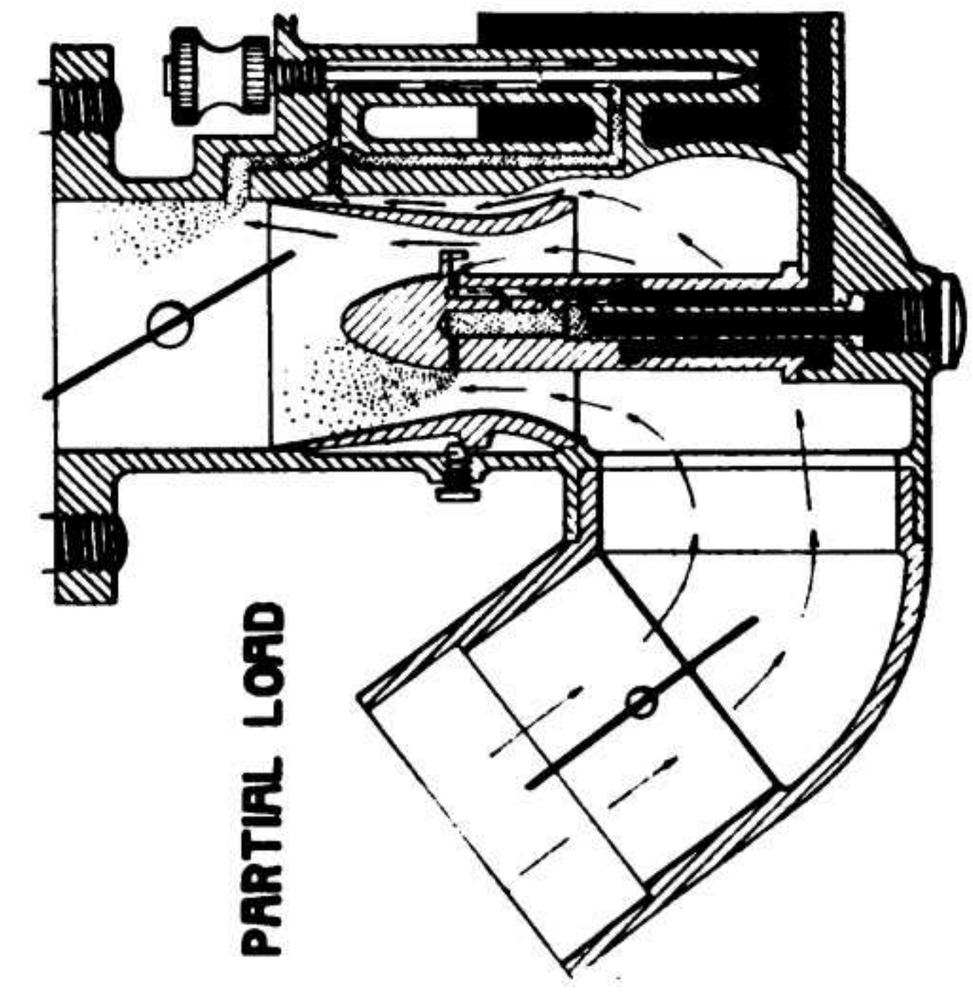
PLATE 42





CARBURETER OPERATING DIAGRAMS





For starting or warming up with the present day fuel, it is almost always necessary to use the air choke until proper operating temperature is obtained. The Engine will start readily with the choke closed one-half to three-quarters of the way. Under some conditions, as when the weather is very cold, it may be necessary to close the choke entirely, but this should be done only for an instant, as it cuts off all the air and delivers practically raw gasoline.

INTAKE MANIFOLD LEAKS

It is imperative that the Intake Manifold be air tight and care should be taken that there is no possibility of leakage around the gaskets where it is bolted to the Cylinders, or between the Carbureter and the manifold. Oil put on parts where leakage is suspicioned will be sucked in if there is a leak, and repairs should be made at once.

TO PREVENT WATER IN CARBURETER

The Drain Cock in the bottom of the Carbureter should be opened occasionally and the Carbureter drained so that any water or sediment will be cleaned out.

PREVENTION OF GASOLINE WASTE

If it becomes necessary to leave the Tractor standing on a steep grade for any length of time, shut off the gasoline at the Three-Way Valve on the Instrument Board, as the Carbureter Float may bind, due to the angle of the Tractor, and hold the Needle Valve open instead of allowing it to close as under ordinary circumstances. Under some conditions, this would allow gasoline to leak from the Carbureter unless turned off at the tank.

AUXILIARY OR RESERVE FUEL SYSTEM

The Reserve Gasoline Tank is made from terne plate, is 12 x 15.5 (15½) inches and 12 inches high. It is filled through a 4-inch opening located on top of and reached through a door in the armor plate. Like the Main Fuel Tanks, it is provided with an adequate gasoline strainer to prevent the introduction of dirt. Gasoline is fed from this tank directly to the Carbureter by gravity.

THREE-WAY VALVE

A Three-way Valve, already mentioned in connection with the Instrument Assembly, is located upon the Instrument Bracket at the rear end of the Engine. It controls the supply of fuel from the Main and Reserve Fuel Tanks. When turned in one direction, it feeds fuel from the Vacuum Gasoline Tank to the Carbureter. When in the opposite position, it feeds fuel from the Reserve Tank to the Carbureter. There is an intermediate position at which it shuts off fuel from both tanks.

FUEL PIPING

All of the Fuel Piping used on the Tractor is 0.375 (3/8) inch seamless copper tubing with 0.035 inch number 19 B. & S. gauge walls. In addition, all of the piping is covered by .075 (3/4) inch outside diameter and 0.375 (3/8) inch inside diameter rubber gas pipe hose. Adjacent to each union on the pipe lines the hose is cut off and a Hose Clamp applied. This makes it impossible for the Tractor to be held up, due to the breakage of a gas piping between the unions. This is put upon the pipes for emergencies and, in case a pipe breaks, the rubber tube should not be depended upon any longer than is necessary because the fuel will tend to rot out the hose at the point of breakage.

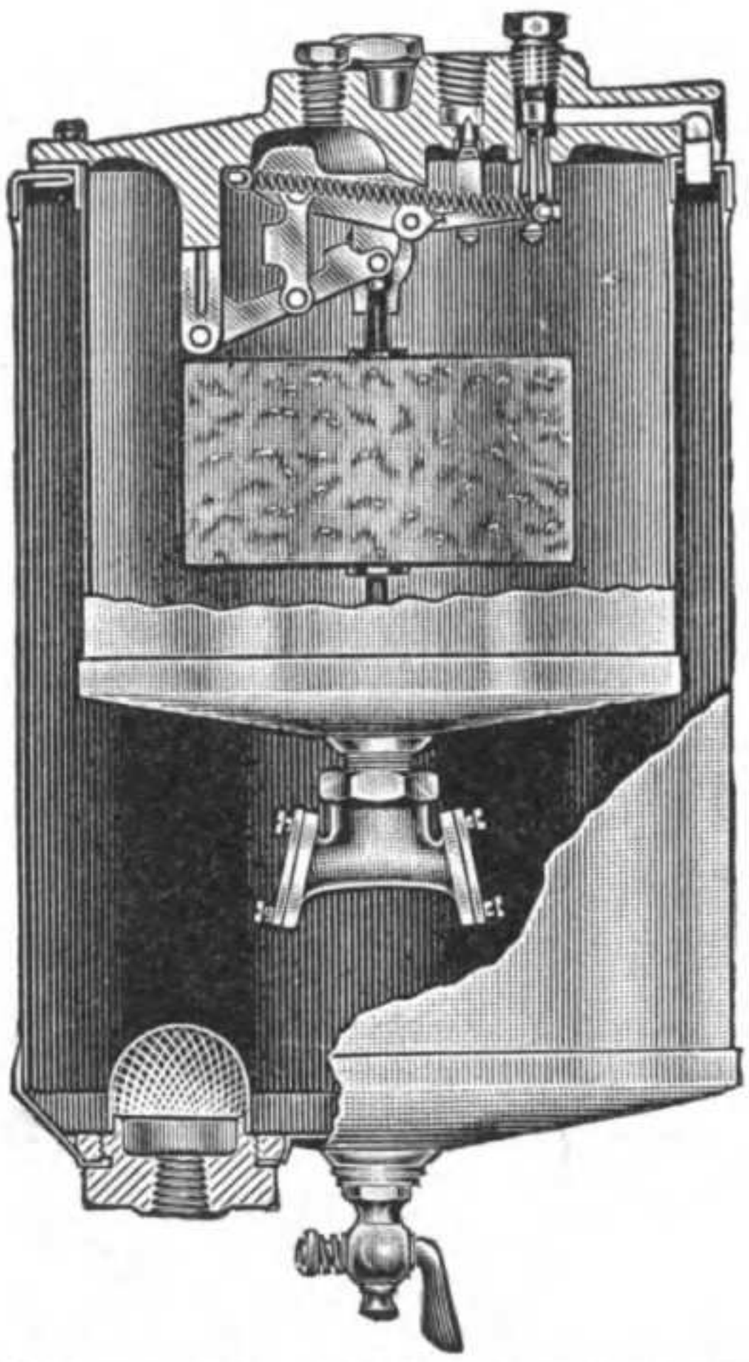


PLATE 43—VACUUM TANK

SOME DETAILS OF VACUUM TANK

The Stewart Model 146-A Vacuum Tank is built heavier and of greater capacity than the former models. It is designed especially for tractor work. The model used on the 5-Ton Artillery Tractor has 3.75 (3¾) pints capacity. It has a Venturi type air vent which insures rapid emptying of the inner chamber. The latter has a double flapper valve which also allows the inner chamber to empty twice as fast as when only one was used. The float is made of cork and carefully coated to prevent it absorbing gasoline. A strainer is provided in the bottom to stop and catch any sediment that may accumulate in the lower chamber. A pet cock in the bottom of the vacuum tank permits this sediment to

be withdrawn when necessary and also drains any water which may have been separated out in the lower chamber of the tank. It should be cleaned out every week at the same time that the carbureter is drained and its strainer cleaned.

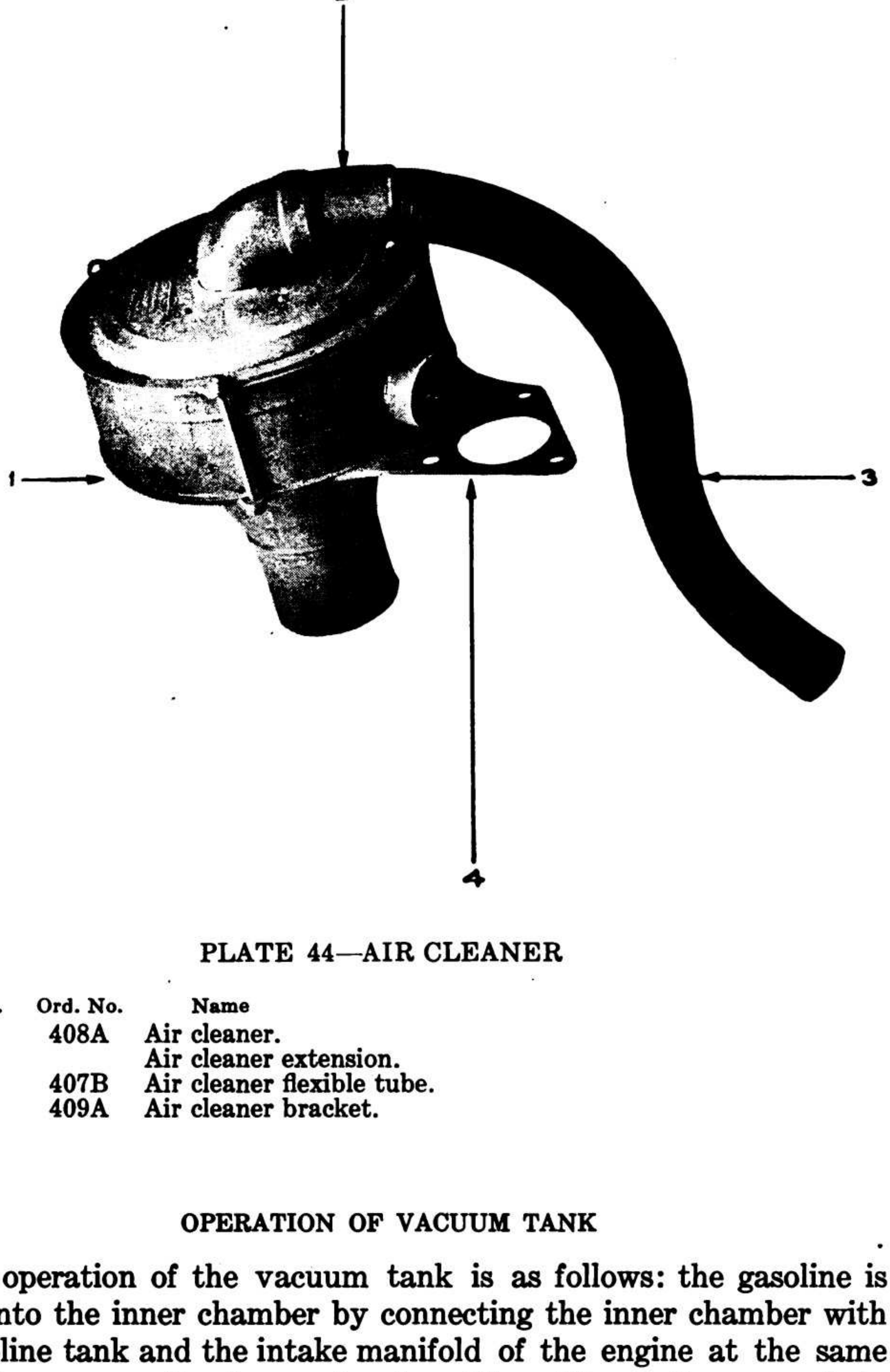


PLATE 44—AIR CLEANER

Ref. No.	Ord. No.	Name
1	408A	Air cleaner.
2		Air cleaner extension.
3	407B	Air cleaner flexible tube.
4	409A	Air cleaner bracket.

OPERATION OF VACUUM TANK

The operation of the vacuum tank is as follows: the gasoline is drawn into the inner chamber by connecting the inner chamber with the gasoline tank and the intake manifold of the engine at the same time. As soon as the inner chamber fills with gasoline enough to

raise the float, which is carried inside of it, it trips a valve connecting the inner chamber with the intake manifold and at the same time opens one which connects with the atmosphere. This allows the gasoline in the inner chamber to empty into the lower chamber and from there flow to the carbureter by gravity. A valve located between the lower chamber and the inner chamber prevents gasoline from being sucked up when it is being drawn into the inner chamber from the Main Fuel Tank.

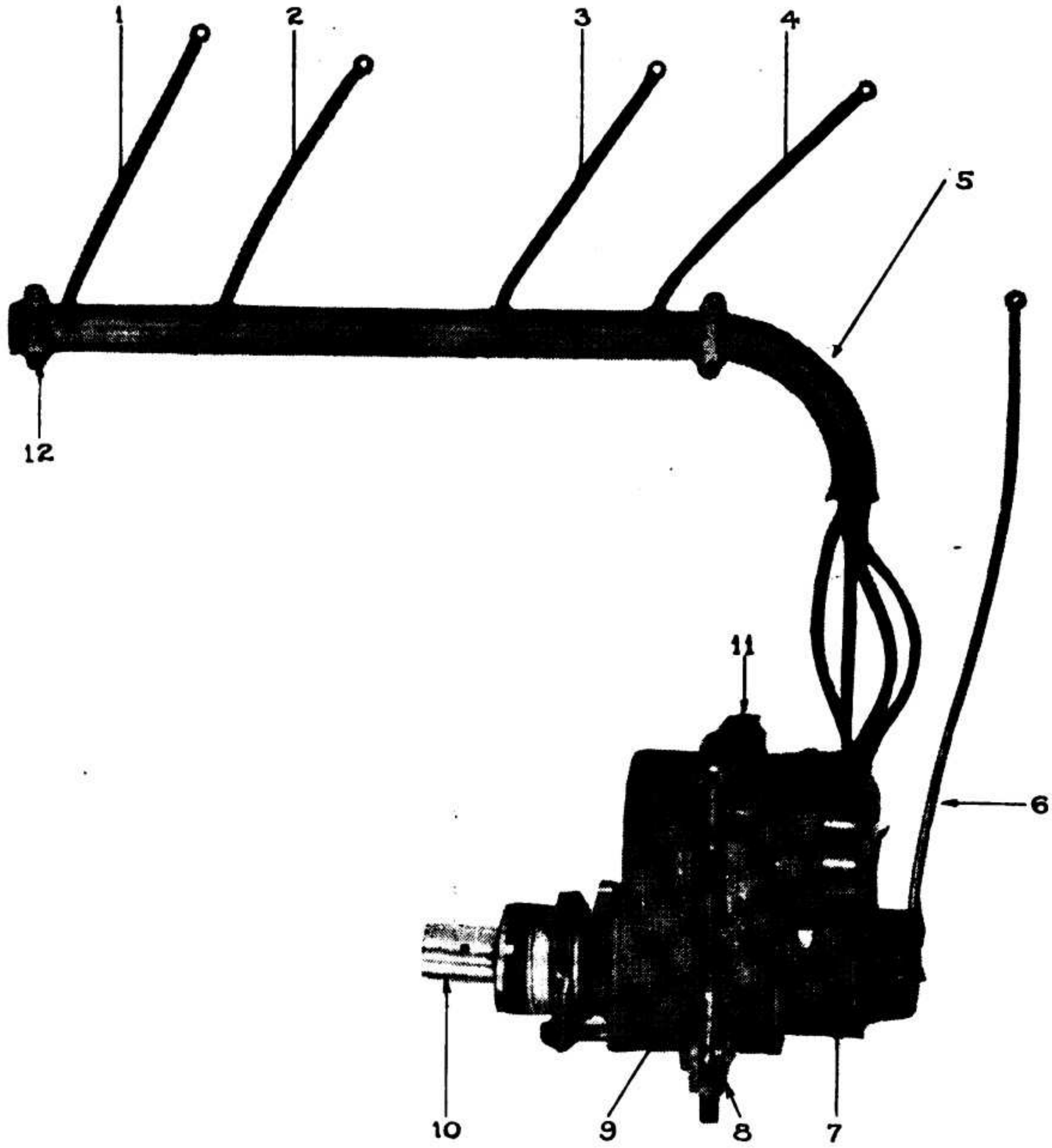


PLATE 45—MAGNETO AND CONNECTIONS

Ref. No.	Ord. No.	Name
1	354B	Ignition cable tube.
2	354C	Ignition cable tube.
3	354D	Ignition cable tube.
4	354E	Ignition cable tube.
5	354A	Ignition cable tube.
6	353A	Magneto ground wire.
7	423A	Magneto.
8	424C	Magneto strap yoke stud.
9	424E	Magneto strap tie bolt.
10	424A	Magneto coupling.
11	424B	Magneto strap clamp.
12	353B	Cable tube bracket, upper.
	353C	Cable tube bracket, lower.

IGNITION SYSTEM

The Ignition System used on the Five-ton Artillery Tractor is extremely simple, consisting of the G 4 II type Eisemann Magneto, the Ignition Switch, located on the Instrument Bracket, the High Tension Wires from the Magneto to the Spark Plugs, a tube in which these cables are carried, and the Spark Plugs.

MAGNETO

BRIEF DESCRIPTION OF OPERATION

A magneto is an alternating current generator which supplies current to cause a spark at the spark plug terminals, which spark fires the explosive mixture at the proper time.

The Magneto is mounted upon the left hand side of the Engine upon a bracket cast integral with the Crankcase. It is driven by the rear end of the Water Pump Shaft. A coupling of the Oldham type is enclosed between the end of the Water Pump Shaft and the Magneto so as to take care of any disalignment between the two assemblies.

The magneto used in this truck is an Eisemann straight high-tension magneto, that is, one which does not employ an outside coil for stepping up the voltage. Both primary and secondary windings are on the armature shaft and both windings have a grounded end. The armature shaft revolving in the magnetic field existing between the permanent magnets, causes a low voltage current to be produced in the primary winding. This winding is connected with the breaker or interrupter, so that the current flow of the primary may be broken or interrupted in order to induce a secondary current of high-voltage in the secondary winding. At the instant of interruption of the primary the secondary is induced and this is the current which flows to the distributor and thence through cables to the spark plugs.

When you throw the switch to "on" position no current passes through the switch. The primary current path after generation is through the primary winding, through the interrupter, and to ground, thus returning to its source of generation, which every current does if there is a path for it.

The secondary winding also is grounded at one end. The induced high-voltage current flows through the secondary winding to the distributor to the spark plugs in order, thence to ground, and the secondary winding being grounded the circuit is completed through the metal parts of the engine.

MAGNETO TIMING

As the spark occurs when the primary circuit is broken by the opening of the platinum contacts on the breaker mechanism, it is necessary that the magneto will be so timed that at full retard position of the timing

lever body the platinum contacts will open when the respective piston of the motor has reached its highest point on the compression stroke. Turn motor by hand until piston of No. 1 cylinder is on dead center (firing point), remove the distributor plate from the magneto and turn the armature shaft until the setting mark on the distributor disc is in line with the setting screw. With the armature in this position, the platinum contacts are just opening and the metal insert of the distributor disc is in connection with carbon for No. 1 cylinder. The driving medium must now be fixed to the armature shaft without disturbing the position of the latter, and the cables connected to the spark plugs.

MAGNETO MAINTENANCE

Aside from lubrication, as mentioned on page 000, there is little attention required. Eisemann Type G-4- II Edition should receive 20 drops of 3-in-1 or similar oil every two weeks, distributed as follows: One drop in the oil hole, one most convenient (on side of breaker box), 5 drops in the covered holes on each side of the distributor and 14 drops in the large covered hole at the driving end of the magneto.

MAGNETO MOUNTING

The Magneto is held in place upon the Magneto Bracket by means of a Magneto Strap Clamp, a light steel forging that goes over the top of the Magneto and is held down by two 0.375 (3/8) inch Magneto Strap Tie Bolts. The base of the Magneto is accurately located on its bracket by two steel 0.375 (3/8) inch Dowel Pins that are screwed onto the base of the Magneto.

TO CLEAN BREAKER POINTS

The platinum contacts of the breaker mechanism should be occasionally cleaned with gasoline, and for obvious reasons, thoroughly dried before starting the engine. The distributor disc and collect or ring should likewise be cleaned once or twice in four months with a cloth moistened with gasoline.

WHEN TO REPLACE IGNITION CABLES

In order to obtain the best results, the cables should be at once replaced if they show signs of cracking or wearing. After a year of normal service, it is advisable to carry in reserve a few carbons for the distributor plate, as well as a contact spring and an adjustable contact screw.

IMPULSE STARTER

This device, mounted on the armature shaft outside of the magneto proper, is simply a means of giving the armature a quick, fast turn. The

impulse starter contains a spring whose stored up energy is released by tripping by means of a dog, a ratchet to which the spring is attached. The Eisemann impulse starter eliminates the necessity for an auxiliary ignition system, as this device causes the magneto to produce a hot, fat spark, regardless of how slow the magneto is cranked.

The Impulse Starter used on this model of Magneto does not have to be set prior to starting, it is *entirely automatic* in action, being withdrawn at 180 Revolutions per Minute. In this respect it is distinctive from the Impulse Starters, found on most of the truck and tractor Engines, used by the Ordnance Department.

IGNITION TROUBLES AND HOW TO REMEDY THEM

If the engine misfires or refuses to start, and the ignition is inspected, it should be found out first whether the trouble lies in the magneto or in the spark plugs. The latter should be examined first, as they are the most frequent cause of trouble.

If the missing is in one cylinder only, or in different cylinders, the the corresponding spark plug should be examined to see that the gap is not too large. This gap between the electrodes should be approximately 1/32 inch. Also the spark plug may be short-circuited through carbon or oil, or the insulation may be cracked. Cleaning with gasoline or replacing is the remedy for carbonized or oily plugs.

The wiring should be carefully examined and checked in accordance with the firing order of the engine. If cables are cracked, or worn, they should be replaced. All connections must be kept clean and tight.

Clean breaker contact with gasoline until the contact surface appears quite white, or if pitted, use a fine file—but very carefully—so that the surfaces remain square to each other. For this purpose a manicure file may be used, or a special magneto file. The correct gap of the contact points is 0.010 inch (.25 m/m) and in no case should it be more than 0.012 inch (.3 m/m). As these contacts wear away in time, they should be regulated by giving the adjustable screw a forward turn, care being taken to securely tighten the lock nut. This can be accomplished without removing the timing lever or make-and-break mechanism.

If the platinum contact riveted to the contact arm, or that of the adjustable screw should be worn down entirely, it would necessitate a change of either or both. When the adjustable screw is replaced or adjusted, care must be taken that the lock nut is securely tightened in place.

If, after following these instructions, the engine still refuses to start, the magneto should then be tested by removing the distributor plate and resting a screw driver on the gear casing, holding same about 1/8 inch

from the collector ring. Then if, upon rotating the armature, a spark jumps across the .125-inch gap, it shows that the trouble does not lie in the magneto, but in some other part of the engine, possibly the carbureter.

But if a spark does not jump across the .125-inch gap previously mentioned, the magneto is at fault. See page 30 for further information on ignition troubles.

A re-magnetization of the magnets will only be necessary if these have been taken away from the apparatus and allowed to remain a long time without both ends of the magnets being connected with a piece of soft iron—a so-called keeper. The same thing occurs if the armature is taken out of the pole pieces without a conducting rod of iron being laid across both poles. This piece must remain on the poles until the armature is again placed between the pole pieces. Often the magnets, after being taken down, are put back in the wrong position and in this way the magnetic power is neutralized. To prevent this mistake all magnets are marked—the north pole being designated by the letter "N" stamped in the magnet. When replacing magnets care should be taken to place the same poles on the same side.

CONDENSER

The condenser is constructed of two insulated series or layers of tinfoil, connected in parallel across the platinum breaker points; each series consists of about 250 sheets of tinfoil insulated from each other, and alternating with the layers of the other series, the whole acting as a reservoir for the primary current.

The action of the condenser results in intensifying the secondary current nearly 25 times and preventing an arc at the platinum breaker points when they are separated. An arc at the points acts as an electrical cushion to the interrupted flow of electricity, and thus the magneto would give a much weakened spark.

WHEN CONDENSER IS PUNCTURED

When a condenser becomes punctured (insulation between layers destroyed) the engine will only operate if the spark plug points are very close together, and will show very little strength.

TO TEST FOR SHORT CIRCUIT

To test the ignition switch and wiring for a short circuit, simply remove the breaker box and cap ground wire, and if a spark can then be secured, difficulty will be in the part removed.

TO CLEAN DISTRIBUTOR

The distributor may be cleaned of carbon and dirt, with several drops of lubricating oil rubbed on, either with a finger or a bit of waste or cloth. This will loosen the carbon, after which the distributor may be wiped clean with a small piece of waste.

TO TIME DISTRIBUTING FINGER

If the distributor wheel has been removed, it should be replaced with care. The distributing finger should be so timed that regardless of the amount of breaker box advance, or retard, the spark will always occur while the finger is under a carbon brush. This may be set by advancing the breaker box half its full travel and rotating armature shaft in the direction of rotation (anti-clockwise) until the platinum breaker points just begin to separate. The distributor wheel should then be replaced so that the center of the distributor finger comes directly under the center of a carbon brush.

BREAKER ADJUSTMENT

The correct opening of the circuit breaker points is from .010 inch to .012 inch. If they are set too close excessive arcing will occur and the points will burn, and cause weak spark at high speeds. If set too wide, result will be burning of points and weak or no spark at high engine speeds in which case low tension winding does not have time to "build up," thus decreasing strength of spark.

TO INSTALL NEW BREAKER POINTS

When the platinum points have been worn down by service, or excessive filing, and new ones must be installed, if it is possible to secure them already mounted, such should always be done.

If unmounted points only can be secured for replacement, they are usually supplied with a small, round teat. 063 (1/16) inch diameter on the back of point. To mount point, drill a .063 (1/16) inch diameter hole, .094 (3/32) inch deep in the mounting, and solder point on (sweat on), filing off any excess solder. If soldering equipment is not at hand, the point may be mounted temporarily by squeezing teat out of round with a pair of pliers and forcing into hole.

The point should be soldered in at the first opportunity, as it may work loose and cause trouble, which is very difficult to find. After the points have been mounted they should be adjusted with a maximum break of .012 inch and the points must bear evenly all over on their face (i. e., in contact with each other), being filed, if necessary, to secure square contact.

If a platinum point cannot be obtained, a nickel or silver point produced from a coin will make it possible to run, but the engine will show very little power.

IGNITION CABLE ASSEMBLY

The Ignition Cable Assembly includes the Ignition Cable Tube, the High Tension, or Spark Plug, Wires, the Magneto Ground Wire and the Brackets, which support the Ignition Cable Tube.

IGNITION CABLE TUBE

The Ignition Cable Tube is a 1.125 (1⅛) inch steel tube with 0.035 inch Number 20 Birmingham gauge wall, black enameled. Its developing length is 21.75 (21¾) inches. The front end of the Ignition Cable Tube is closed by a hard black fibre plug, which is held in place by a

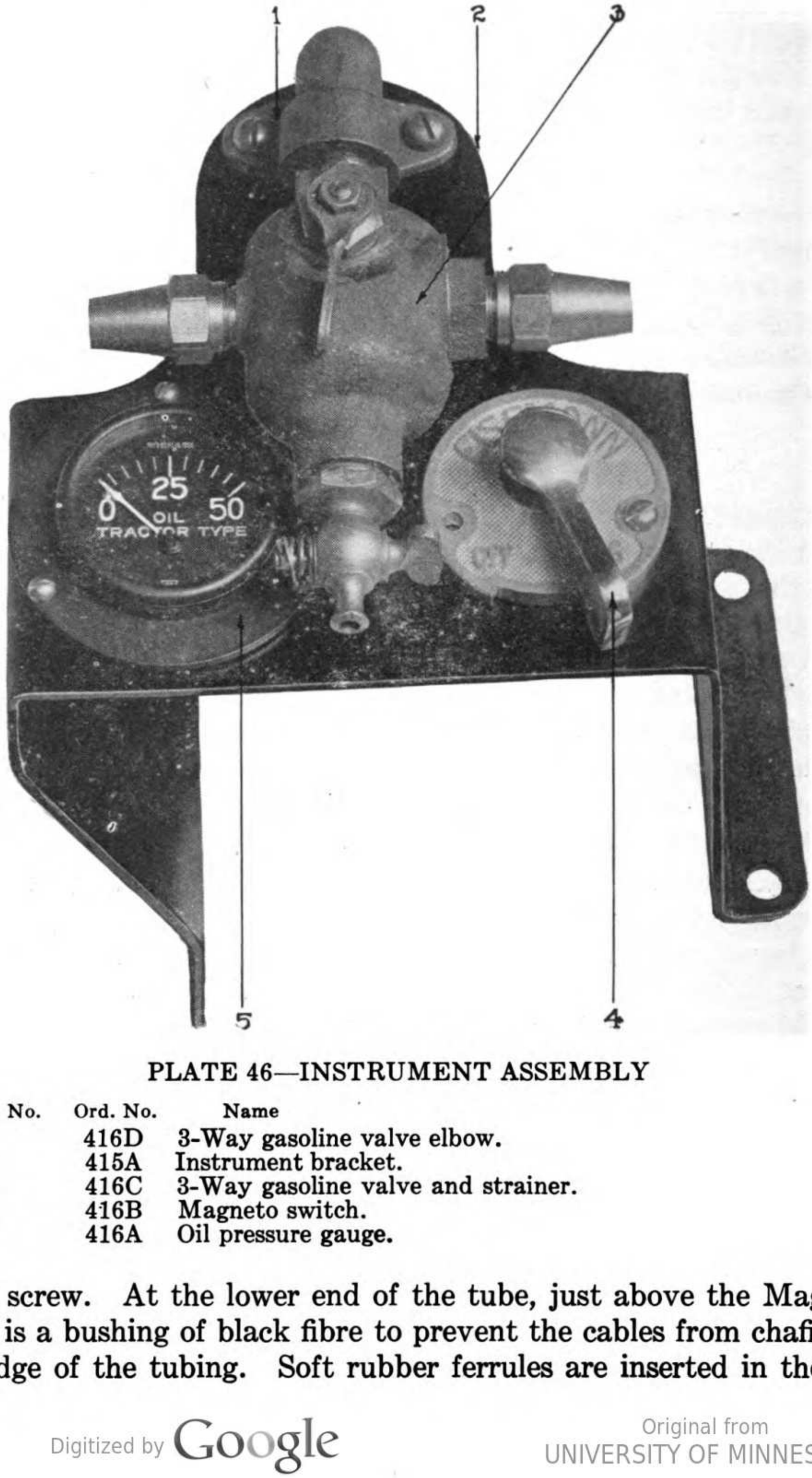


PLATE 46—INSTRUMENT ASSEMBLY

Ref. No.	Ord. No.	Name
1	416D	3-Way gasoline valve elbow.
2	415A	Instrument bracket.
3	416C	3-Way gasoline valve and strainer.
4	416B	Magneto switch.
5	416A	Oil pressure gauge.

wood screw. At the lower end of the tube, just above the Magneto, there is a bushing of black fibre to prevent the cables from chafing on the edge of the tubing. Soft rubber ferrules are inserted in the four

holes through which the Cables emerge to the Spark Plugs. The Cable Tube is held in place by two forged steel brackets attached to the cylinder wall. These are split and held together by two brass 0.164 ($\frac{3}{16}$) inch round head A. S. M. E. machine screws. Removing these permits the entire Cable Assembly to be taken off of the Engine.

INSTRUMENT ASSEMBLY

The Instrument Assembly is located on a bracket attached to the rear end of the Engine and projects through the dash armor of the Tractor. It consists of three units, the Eisemann Magneto Switch, the Lubricating Oil Pressure Gauge and the Three-way Gasoline Valve and Strainer.

Ignition Switch—The first of these controls the Ignition of the Engine and by the use of it, the Engine may be started or stopped.

The Oil Pressure Gauge indicates at all times the pressure on the Main Oil Line. It registers from zero to 50 pounds. When the lubricating oil is cold it is likely to show more than 25 pounds pressure. When the lubricating oil has heated up and is thin, it should show *at least 25 pounds pressure.*

The Three-way Valve permits the fuel to be drawn either from the Reserve Gasoline Supply of 10 U. S. gallons or from the Vacuum Tank. In starting the Tractor after it has been out of use for a considerable period, always use the Reserve Tank, during which process the Vacuum Tank is filled up with fuel from the rear or main tanks.

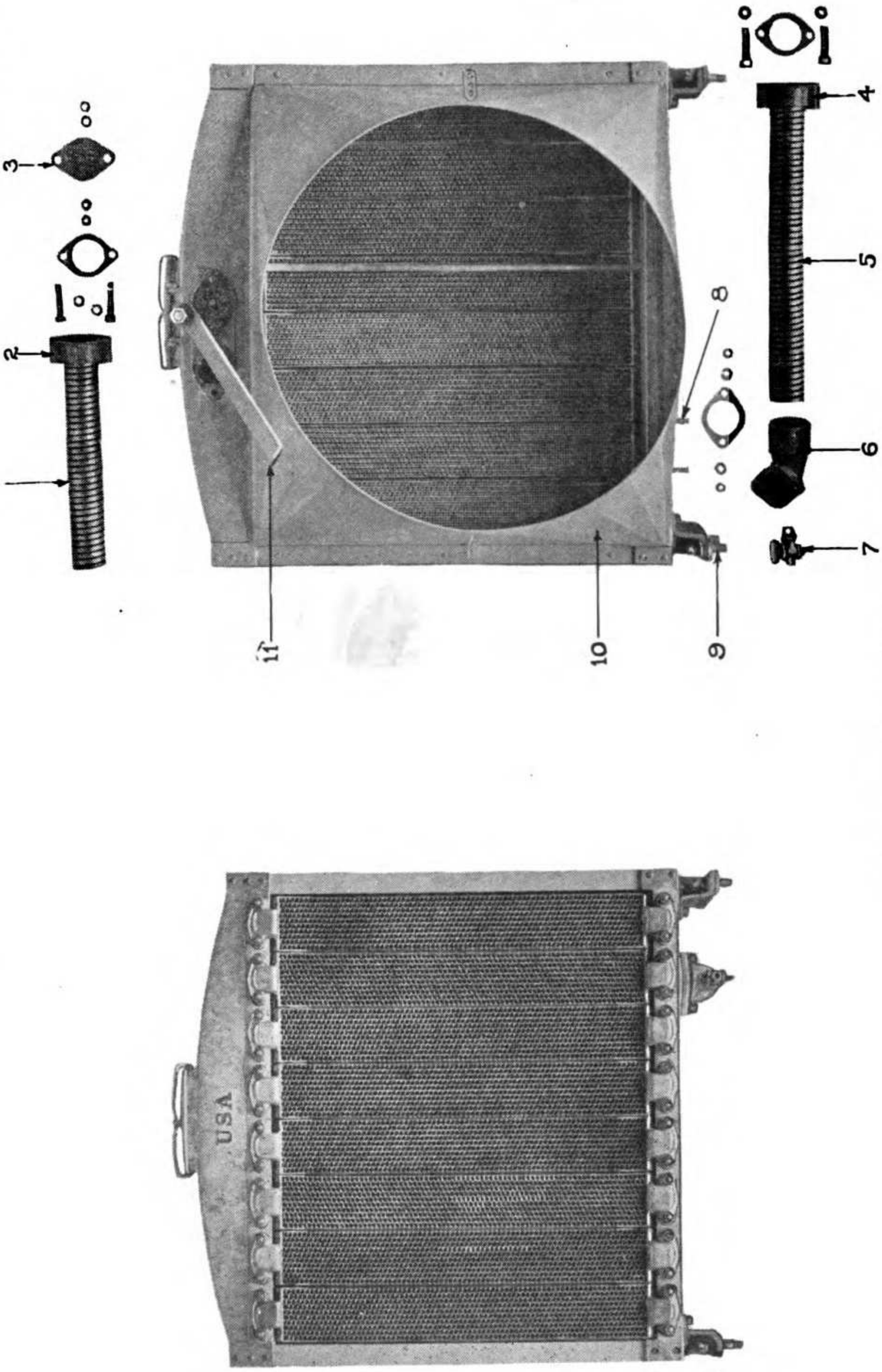
COOLING SYSTEM

The Cooling System on the Five-ton Artillery Tractor consists of the Radiator and Shroud, the centrifugal Water Pump and the Air Circulating Fan, together with the necessary Water Intake and Outlet Manifolds. The construction of the Water Pump, the Cooling Fan and the Water Inlet and Outlet Manifolds has already been described in the preceding paragraphs.

RADIATOR AND SHROUD

The Radiator is made with eight detachable cooling sections. These sections are held in place on the Upper and Lower Water Headers by flanged couplings and two studs and nuts at each end. Gaskets are placed between these to prevent leakage of water around the coupling or flange joint. In case of accident to any one of the headers, it should not be removed, but instead a blind Gasket should be placed over the top and bottom flanges and the sections screwed back in place. If the section is removed, it will permit the Cooling Fan to draw all the air through the opening made by its removal, thereby reducing the cooling ability of the remaining sections. By leaving the injured section in place, the Radiator may be maintained at almost its original efficiency.

PLATE 47



RADIATOR AND PARTS

PLATE 47—RADIATOR AND PARTS

Ref. No.	Ord. No.	Name
1	245C	Radiator inlet hose.
2	245E	Hose flange.
3	245D	Radiator inlet cover.
4	245E	Hose flange.
5	245B	Radiator outlet hose.
6	245A	Radiator outlet flange.
7	246F	Short shank drain cock.
8	246E	Stud.
9	246C	Stud.
10	244A	Radiator and shroud.
11	246B	Radiator brace.

To insure the proper distribution of the air over the entire surface of the Radiator, a deep Shroud is provided which surrounds the Cooling Fan.

The Radiator is provided with a Flange Water Inlet 1.937 (1 15/16) inches inside diameter at the top and an Outlet at the bottom of the same dimensions. The Water Inlet at the top and Outlet at the bottom have the same sized flanges and are readily detachable. The Upper Coupling is held in place by two 0.437 (7/16) inch S. A. E. cap screws. The Water Outlet at the bottom is held in place by two 0.437 (7/16) inch studs and nuts. The lower section is provided with a a Short Shank Drain Cock, which projects out in front of the Radiator and may be readily reached when it is desired to drain the Radiator and the Cooling System.

Flexible metallic hose is used for both the Radiator Outlet and the Radiator Inlet. The Radiator Inlet Hose is regularly sweated to the Water Outlet Manifold on the top of the Engine. The hose attached to the Radiator Outlet at the bottom is provided with a flange, which is coupled to the Inlet of the Water Pump by two 0.437 (7/16) inch cap screws, and is regularly part of the Radiator Assembly.

The Radiator is supported upon the Main Frame by two angular brackets attached to the bottom of the Radiator. Four 0.625 (5/8) inch studs in the Frame and castellated nuts are provided to hold it in place, together with a flat strap iron brace attached to it and to the Engine Cylinder at the top. Between the Radiator support and the Main Frame four circular washers of rubber and fabric are used.

CARE IN FREEZING WEATHER

During freezing weather, the cooling system should be drained of all water where a fresh supply is available, or the Engine and Radiator properly protected with blankets, etc.

IF RADIATOR TUBE BREAKS

If any of the radiator tubes are broken in the radiator while in the field, they might be soldered. For quick repairs before it is possible to solder the tubes, slip heavy paper, cardboard or any other like substance, between the end piece or the gasket flange of the cooling unit and the upper and lower water headers of the radiator. *Do not take out a section of the radiator and try to plug up the holes in the headers thus left exposed.* It is impossible to satisfactorily cool the engine when this is done, as the fan tends to draw all the air through the opening left by the removed radiator section.

TO CLEAN COOLING SYSTEM

The circulating system may be cleaned by uncoupling the hose connections and thoroughly flushing the radiator and cylinder jackets with water under pressure. The cylinder jackets may be cleaned by removing the upper manifold and scraping or dissolving the sediment or by pouring hot washing soda solution (saturated) into the cooling system.

CARE OF COOLING SYSTEM

When filling the radiator, use clean water as free from impurities as possible, and fill to a depth of about three inches above the top of the ribs.

Do not pour cold water into the radiator when the system is nearly dry and the engine is hot.

Empty the radiator occasionally through the drain cocks on the pump and radiator, flushing out to remove sediment.

The fan draws air through the radiator. Keep the spaces free from mud and dirt.

SOLDERING

TO PREPARE RADIATOR PARTS FOR SOLDERING

If a tube becomes broken it may be soldered. Before soldering copper, the parts must be cleaned until bright, with a wire scratch brush scraper, file or emery cloth, then they must be coated with a soldering flux to remove all grease and foreign material.

Soldering flux is sometimes referred to as "cut acid," since a very satisfactory flux can be prepared by dissolving zinc (from an old dry battery, if necessary) in muriatic acid, until all gasing ceases. If extra strength

muriatic acid is used in making cut acid, it should be diluted with about an equal volume of water before adding the zinc. If the gasing does not occur at once, heating the acid will assist the action.

In this connection, always pour acid into water, but never pour water into acid, as, if the acid is very strong, a rapid boiling may throw acid out.

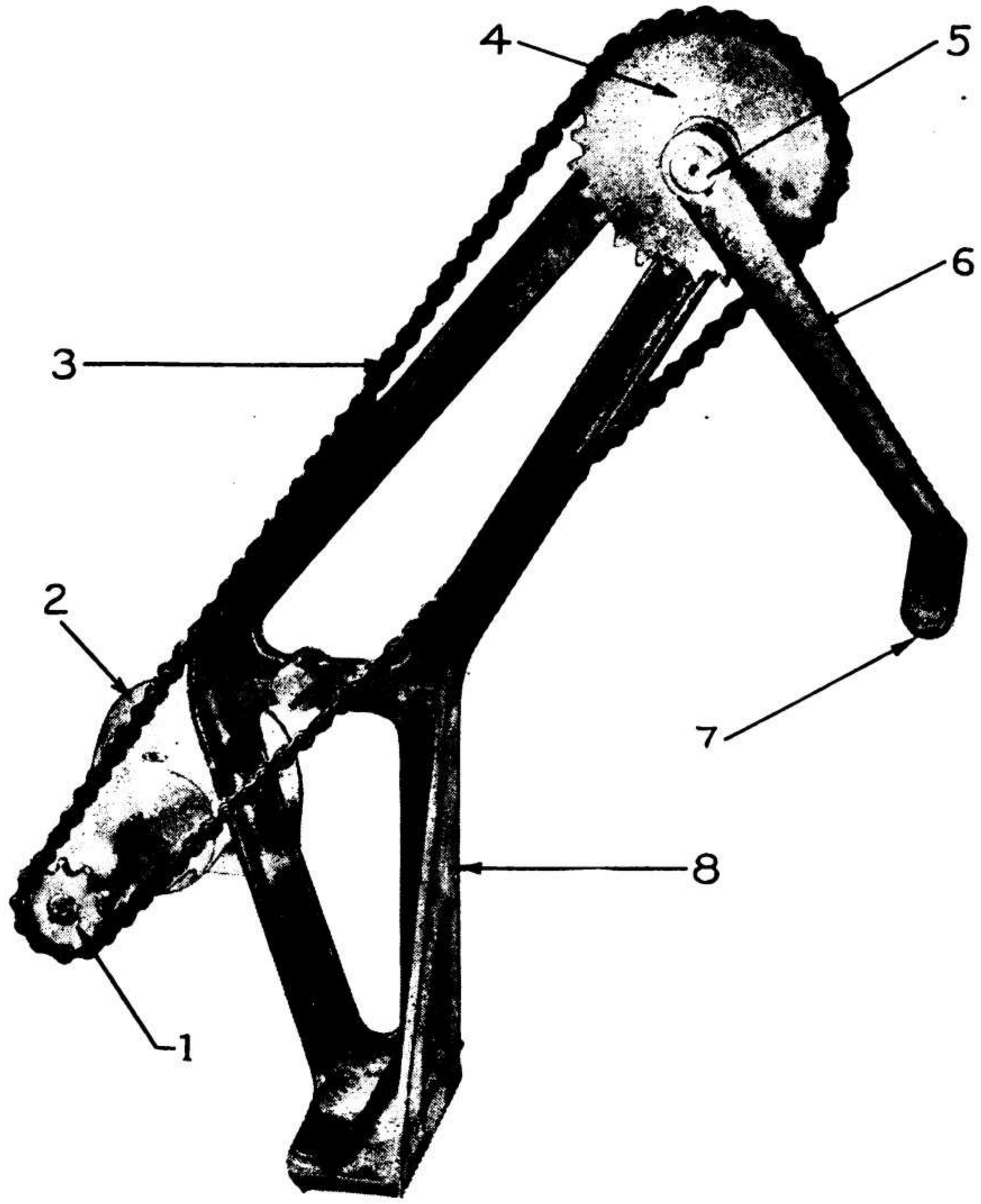


PLATE 48—HAND STARTER

Ref. No.	Ord. No.	Name
1	181A	Eclipse-Bendix starting drive.
2	183A	Eccentric.
3	183B	Eccentric bushing.
4	183C	Starting crank shaft.
5	183D	Starting crank pin.
6	182A	Starting crank bracket.
7	184A	Starting crank.
8	184B	Starting crank handle.
9	184C	Starting crank handle shaft.
10	182B	Bolt, S. A. E., 5 x 3.75.
11	183E	Starting crank bracket brace.
12	182C	Bolt, S. A. E., .5 x 3.25.
13	184F	Roller chain.
14	184D	Starting crank shaft sprocket.

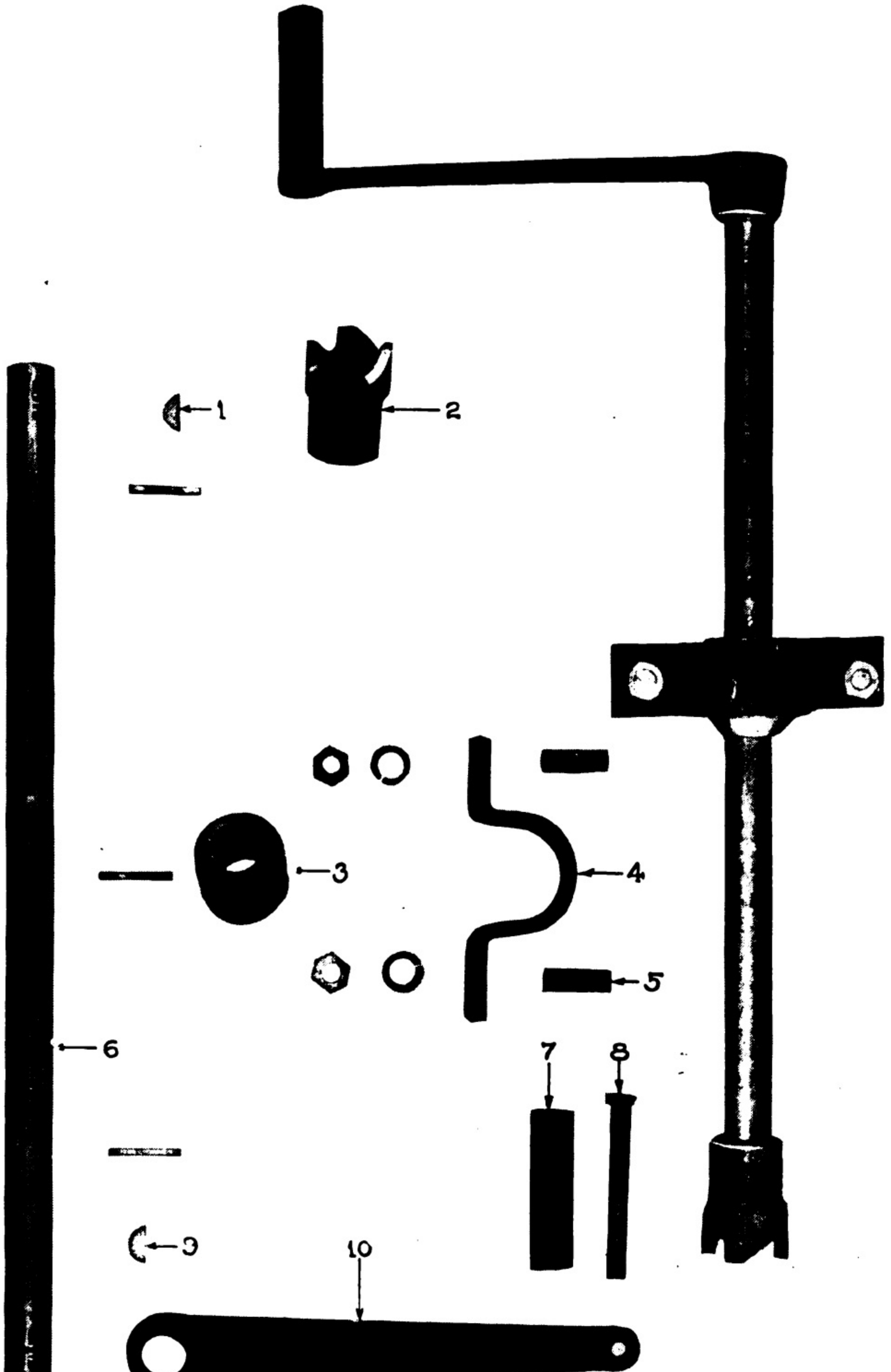


PLATE 49—FRONT STARTING CRANK AND PARTS

PLATE 49—FRONT STARTING CRANK AND PARTS

Ref. No.	Ord. No.	Name
1	249F	Key.
2	249C	Front starting crank jaw.
3	249D	Starting crank shaft bearing.
4	249E	Starting crank bracket.
5	246D	Stud.
6	249B	Front starting crank shaft.
7	184B	Starting crank handle.
8	184C	Starting crank handle shaft.
9	249F	Key.
10	249A	Front starting crank.

SOLDERING TIN

Clean, bright tin can be soldered by using powdered resin for a flux, or tallow.

SOLDERING IRONS AND STEELS

Cast iron, malleable iron, steel and black iron, or sheet iron, should be scraped bright, then cleaned with sulphuric acid before applying the cut acid. This being done, solder as for copper. In the case of cast iron the parts being soldered must be heated.

The essentials of good soldering are sufficient heat, cleanliness of the parts to be soldered and of the soldering copper, or "iron," as it is usually called, and purity of flux or "cut acid."

The soldering iron should be filed bright, then tinned with solder, after being cleaned with salamoniac. If salamoniac is unavailable "cut acid" will work fairly well.

Always have the soldering iron hot enough to heat the work, but never permit it to get red hot, since that will cause the solder to attack the copper, producing "hard solder" which only melts at near a red heat, and is useless for soldering purposes. In case an iron is "burnt," file it freely.

The best solder for most jobs is known as "half and half," being composed of equal parts of tin and lead.

STARTING DEVICES

There are two Starting Devices on the Engine, one the Front Starting Crank which is used only in an emergency and the regular or Hand Starting Mechanism which is provided at the rear and conveniently located near the driver's seat.

FRONT STARTING CRANK

The Front Starting Crank is composed of a cold rolled steel, Front Starting Crank Shaft, a Drop Forged Starting Crank, a Starting Crankshaft Bearing which is pinned onto the Starting Crankshaft, the Front Starting Crank Jaw which engages with the Starting Crank Pin located on the front end of the Crankshaft, and the Starting Crank Handle and Shaft attached to the Starting Crank forging.

HAND STARTER

The Hand Starter at the rear, which is mounted upon the platform of the Tractor, and adjacent to the driver's seat, is of slightly more complicated design but infinitely more convenient to operate. It consists of a Starting Crank Bracket of malleable iron which is attached to the Tractor Frame, a Starting Crank Handle and Crank mounted at the top of the Starting Crank Plate, a Roller chain running over a sprocket, called the Starting Crankshaft Sprocket, a small sprocket attached to the Bendix Starter Shaft and the Bendix Drive located in the right rear Engine arm.

OPERATION OF STARTER

The Bendix Starter Mechanism, located in the Engine arm is similar in every respect to that found on the end of an electric starting motor. When the Starting Crank Handle is rotating rapidly, the Bendix Starter Pinion is thrown into engagement with the Gear cut upon the Flywheel periphery, thus connecting the Starting Crank Handle with the Engine Crankshaft together automatically. As soon as the engine starts up the Bendix Pinion is automatically thrown out of engagement and the Starting Crank thereby disengaged from the Engine. The Bendix Starting Drive is a complete unit in itself and is inserted from the front side of the Engine arm. It is held in place by three cap screws, 0.375 (3/8) inch. The size of the mounted flange for this Starting Drive is the same as that used on the Number 3, S. A. E. electric starting motor flange. The Bendix Starting Pinion has 12 teeth, of 7 diametral pitch and 20 degree Fellows stub tooth form.

CRANK CHAIN ADJUSTMENT

The Starting Crank Chain will stretch in use, and a 0.75 (3/4) inch adjustment is provided by an eccentric located in the Starting Crank

Bracket. This is clamped in place when the proper tension on the Chain has been obtained. The Starting Crankshaft is mounted upon a bronze bushing, which is pressed into the eccentric. The Roller Chain has 0.625 (5/8) inch pitch, 0.4 (2/5) inch diameter rollers, 48 links and is 0.25 (1/4) inch wide. The Starting Crankshaft Sprocket has 28 teeth and pitch diameter of 5.582 (5 19/32) inches, while the small sprocket on the Bendix Drive has 11 teeth.

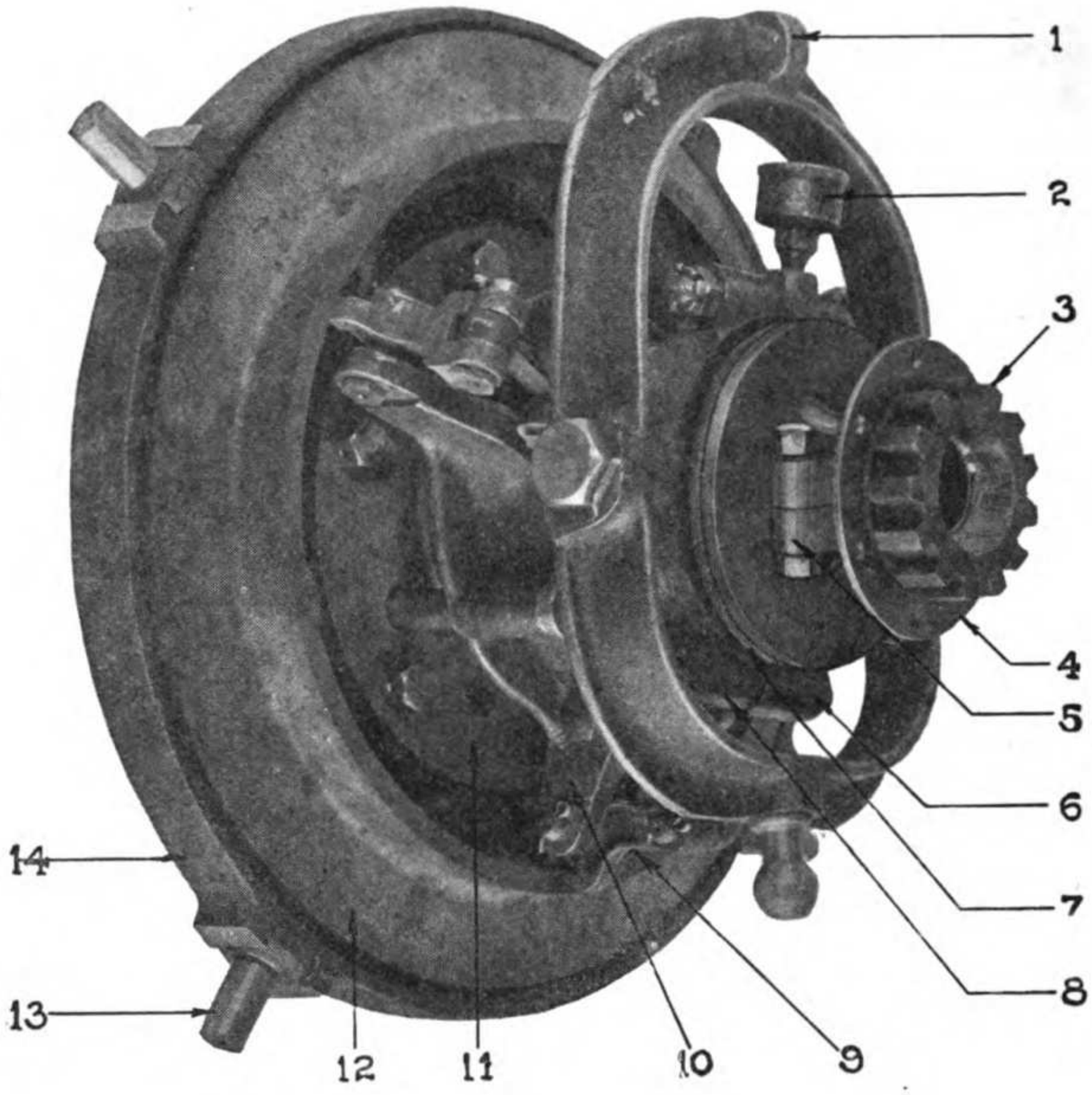


PLATE 50—MASTER CLUTCH

Ref. No.	Ord. No.	Name
1	163A	Shifter fork.
2	102C	Grease cup.
3	162B	Coupling, male half .
4	164B	Coupling dust washer.
5	161A	Master clutch brake disc.
6	163B	Shifter yoke—left.
7	161B	Brake disc.
8	163C	Shifter yoke—right.
9	165C	Clutch dog.
10	162A	Dog holder.
11	159D	Inner disc hub.
12	159C	Outer disc.
13	160B	Allen safety set screw.
14	159B	Center disc.

CHAPTER III

MASTER CLUTCH

Just as in all types of automotive vehicles, there is a Master Clutch placed between the Engine and the Transmission System. The type of plate clutch used is clamped or engaged by means of toggle joints which relieve the crankshaft of any thrust whether the Master Clutch is engaged or disengaged. Unlike the usual truck, automobile or tractor control, the Master Clutch is positively engaged or disengaged by a hand lever conveniently placed near the driver's hand.

MASTER CLUTCH ASSEMBLY

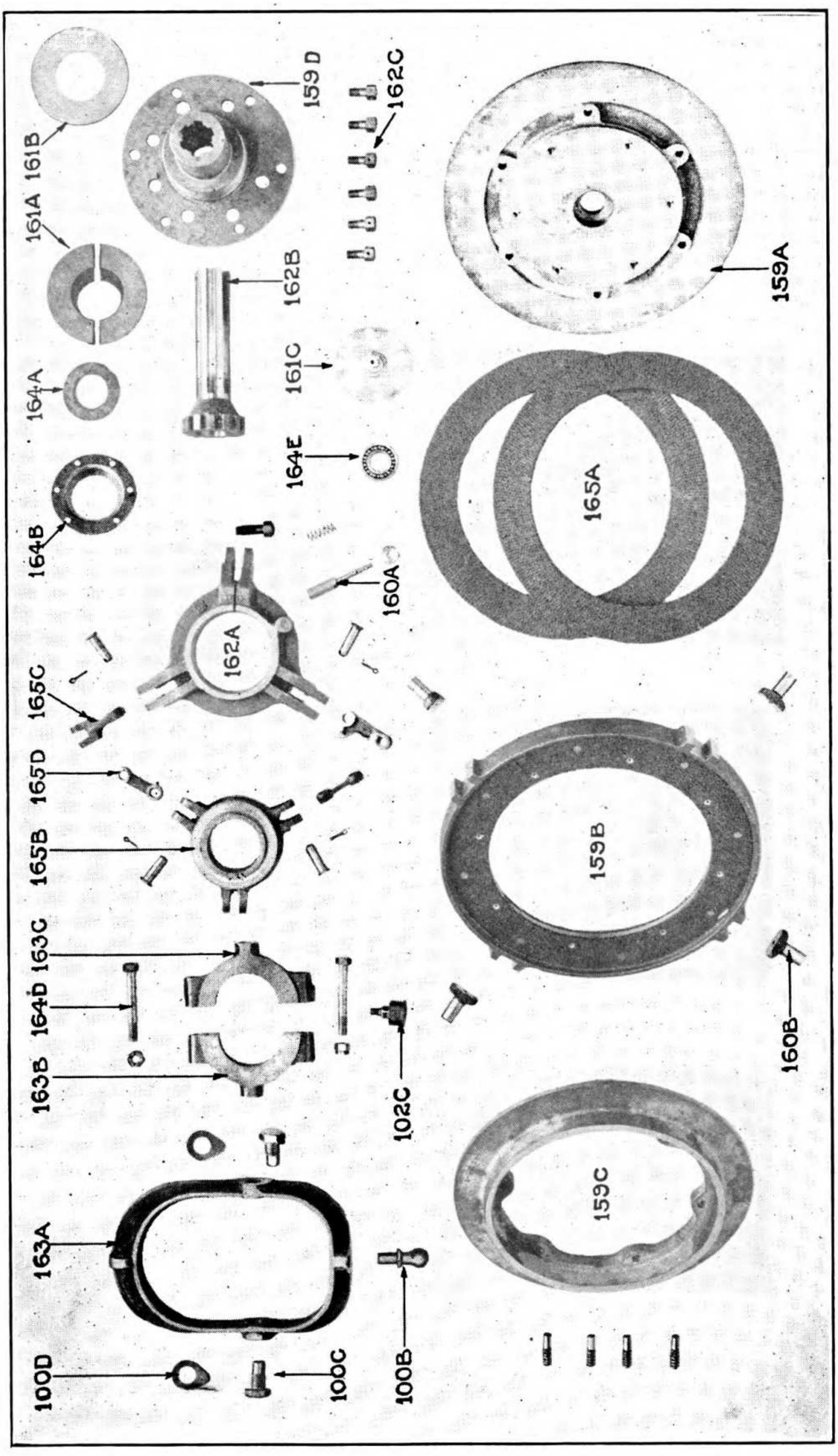
The Master Clutch is of the multiple plate type, that is, it has a large driving plate attached to and driven by the Flywheel, which is clamped between two concentric driven rings, attached to the Master Clutch Inner Disc Hub thru which the power is transmitted from the Engine Flywheel to the Transmission. These plates are known as the Master Clutch Inner Disc and the Master Clutch Outer Disc, the former being inside of the Flywheel or toward the front of the Tractor, and the latter being toward the rear. The Master Clutch Center Disc is driven thru four Keyways parallel to the axis of the Clutch which engaged with four Flywheel Pins that are inserted in the rim of the Engine Flywheel. Between the Inner and Outer Clutch Discs and the Master Clutch Center Disc there are two Master Clutch Friction Discs made from asbestos fabric and riveted to the Master Clutch Center Disc. These provide a wearing surface which may be replaced as the conditions demand. The Clutch is engaged by three Clutch Dogs or Bell Cranks, which are operated by a similar number of Master Clutch Links attached to the Master Clutch Shaft.

The action of the Crank Links and Crank Dogs is that of a toggle joint so that, when the Clutch is engaged, there is no tendency for it to release, and vice versa. The fulcrum pins upon which the Master Clutch Dogs are carried are mounted on arms attached to the Master Clutch Dog Holder, a cylindrical piece that is screwed on to the Master Clutch Inner Disc Hub.

ADJUSTMENT OF CLUTCH

This Master Clutch Dog Holder may be rotated so as to bring the Master Clutch Dogs closer to the Master Clutch Outer Disc and thereby compensate for wear on the Master Clutch Friction Discs. The Master Clutch Dog Holder is prevented from rotating with regard to the Master Clutch Inner Disc Hub by means of a stop pin (also called Clutch Adjusting Plunger) carried in the Master Clutch Dog Holder and kept in engagement by a spring. This may be readily disengaged

PLATE 51



MASTER CLUTCH PARTS

PLATE 51

MASTER CLUTCH PARTS

Ref. No.	Ord. No.	Name
1	100D	Lock washer.
2	163A	Shifter fork.
3	163B	Shifter yoke, left half.
4	164D	Yoke bolt.
5	163C	Shifter yoke, right half.
6	165B	Clutch shifter.
7	165D	Clutch link.
8	165C	Clutch dog.
9	164B	Coupling dust washer.
10	164A	Coupling felt washer.
11	161A	Clutch brake disc.
12	161B	Clutch brake facing.
13	100C	Clutch fork screw.
14	100B	Clutch fork ball end.
15	102C	Grease cup.
16	162A	Dog holder.
17	160A	Stop pin.
18	164E	Clutch bearing.
19	161C	Bearing flange.
20	162B	Coupling, male half.
21	159D	Clutch inner disc hub.
22	162C	Inner disc hub cap screws.
23	159C	Clutch outer disc.
24	159B	Clutch center disc.
25	165A	Clutch friction disc.
26	160B	Flywheel pin.
27	159A	Clutch inner disc.

by means of the Stop Pin Knob and the Master Clutch Dog Holder rotating clock wise when looking toward the Radiator of the Tractor. In order to tighten the Clutch there are eight Stop Pin Holes in the Master Clutch Inner Disc Hub, and as there are eight threads per inch on the Master Clutch Inner Disc Hub, the Master Clutch Dog Holder may thus be advanced as little as 1/64 inch at each adjustment if desired. The Master Clutch Shifter is so designed that the Master Clutch Links will always have the same toggle action, no matter what the Clutch adjustment may be.

SUPPORT OF CLUTCH

The Master Clutch is supported at the Flywheel Center by a number 1205 S. K. F. radial ball bearing and at the rear end by the male portion of the Transmission Coupling. The latter is a 6-splined shaft 1.743 (1¾) inches diameter over the tops of the splines and 1.485 (1½) inches in diameter at the bottom. This splined shaft, which slides inside of the Master Clutch Inner Disc Hub, is a steel forging with the rear end upset so as to provide the male coupling gear blank as an integral part. This gear is 3.25 (3¼) inches outside diameter, has the same pitch diameter and 0.75 (¾) inch in face, with 13 teeth, 4 diametral pitch of 20 degree involute Fellows stub tooth form. The S. K. F. number 1205 bearing is not supported directly in the Flywheel, but is mounted upon the Clutch Bearing Flange, which is fastened to the Flywheel by six 0.375 (⅜) inch cap screws. The Master Clutch Inner Disc is mounted directly upon this bearing and the Master Clutch Inner Disc Hub, when bolted to the Master Clutch Inner Disc, clamps the outer race of the bearing and thereby positively retains and holds the Clutch Assembly in its proper relation to the Flywheel.

CLUTCH OPERATING MECHANISM

The Clutch is engaged and disengaged by means of a linkage composed of the following parts: the Clutch Shifter Yoke, made in both right and left pieces that are not interchangeable, the Master Clutch Shifter Fork, the Master Clutch Shifter Fork Ball End. The Master Clutch Shifter Fork is fulcrumed in a socket, into which the Clutch Fork Ball goes, that is mounted on the Main Frame. On either side of the Shifter Fork are the Clutch Shifter Fork Screws, which go into the 0.687 (11/16) inch diameter trunnion holes of the Shifter Yoke. The two halves of the Shifter Yoke, right and left, are held together by two 0.5 (½) inch bolts. When assembled, the Shifter Yoke is mounted upon a collar turned integral with the Master Clutch Shifter. The upper end of the Master Clutch Shifter Fork is attached to the Clutch Hand Lever by means of a link with an adjusting turn buckle in it.

CLUTCH BRAKE

The Master Clutch is prevented from rotating when disengaged by the Master Clutch Brake Disc, which is formed in two pieces bolted together with 0.375 (⅜) inch bolts and faced with 0.25 (¼) inch thick hard fibre Master Clutch Brake Disc, 5.25 (5¼) inches in diameter.

CLUTCH DISC DIMENSIONS

The Master Clutch Friction Discs are made from asbestos fabric and are 0.125 (⅛) inch thick. They are 15.25 (15¼) inches outside diameter and 11.25 (11¼) inches inside diameter. These discs are riveted by means of sixteen 0.1875 (3/16) inch copper rivets to the Master Clutch Center Disc. The Master Clutch Inner and Outer Discs are 15.25 (15¼) inches in diameter and are both made from cast iron. The Outer Disc is driven from the Inner Disc by six steel pins 0.5 (½) inch in diameter, that are riveted on to the Clutch Inner Disc. The Flywheel Pins, four of which transmit the power of the Engine from the Flywheel to the Master Clutch Center Disc, are 0.987 (63/64) inch wide and 1.625 (1⅝) inches long. These have 1/64 inch clearance in the Master Clutch Center Disc Keyways.

TO REMOVE MASTER CLUTCH

The Master Clutch may be removed without disturbing the Transmission Unit but cannot be removed without the sliding forward of the engine in the frame. This should not be forgotten as any attempt to withdraw the Clutch Male Coupling without raising the engine rear end and movement of the engine forward will result in a bent Clutch Shaft and serious operating trouble when reassembled. Otherwise the removal of the Master Clutch presents no unusual difficulties.

The next step is to cut the wire which locks the six screws that hold the Clutch Hub to the Clutch Front Disk. This permits the removal of the entire clutch engaging mechanism. Then the castellated nut that holds the clutch onto the rear end of the crankshaft is taken off and the Front Clutch Disk pulled off together with the Ball Bearing at the center of the Clutch.

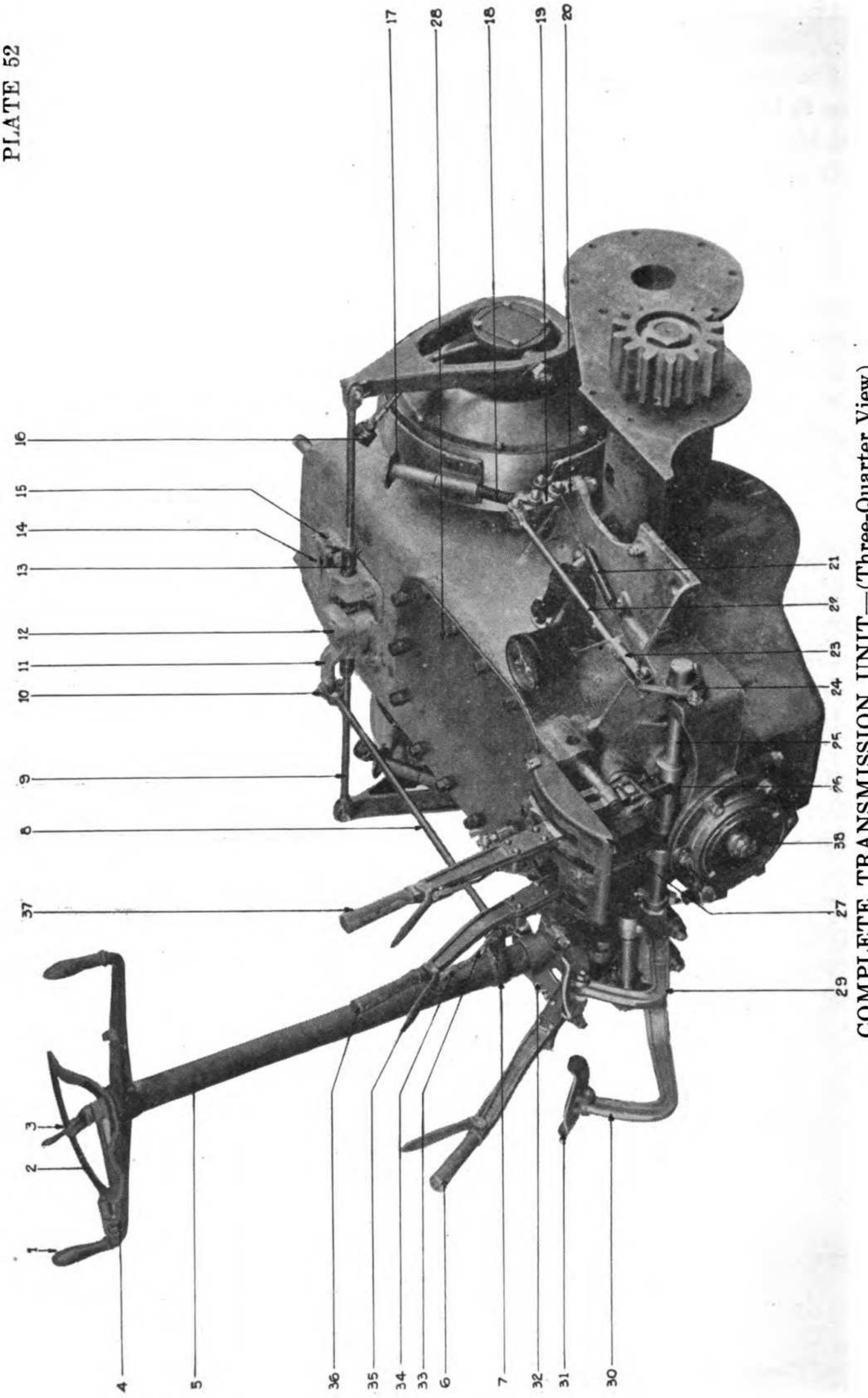
TO REPLACE FRICTION DISK

To replace the friction disks it is not necessary to remove the Front Clutch Plate or the Clutch Hub from the Master Clutch Assembly. It is only necessary to take off the Clutch engaging mechanism which consists of the Shifter Ring and the Adjustment Ring after which the Rear Clutch Plate may be withdrawn and the Clutch Driving Disk removed. The Friction Disks are riveted to this and therefore may be easily replaced.

TO ADJUST MASTER CLUTCH BRAKE

The Master Clutch Brake is adjusted by changing the length of the link which connects the Master Clutch Yoke with the Master Clutch Operating Lever mounted upon the Transmission Unit. The shorter this link is the tighter the Master Clutch Brake will be. The adjustment is accomplished by removing the clevis pin turning the link or rod and replacing after adjusting.

PLATE 52



COMPLETE TRANSMISSION UNIT—(Three-Quarter View)

PLATE 52—COMPLETE TRANSMISSION UNIT

Ref. No.	Ord. No.	Name
1	70A	Steering clutch hand lever.
2	72A	Spark throttle quadrant.
3	70C	Spark control hand lever.
4	70B	Throttle control hand lever.
5	69C	Steering tube.
6	62A	Brake hand lever.
7	71B	Steering tube lever.
8	71A	Steering control drag link.
9	73A	Clutch brake rod.
10	71F	S. A. E. clevis pin.
11	66D	Bell crank.
12	66E	Bell crank stud.
13	65D	Steering control push rod end.
14	66A	Breather cap.
15	65A	Breather bracket.
16	102C	Grease cup.
17	81E	Brake band adjustment nut.
18	73D	Clutch brake adjusting rod.
19	73B	Brake multiple lever.
20	73C	Brake toggle support.
21	81A	Brake foot pedal spring.
22	73A	Clutch brake rod.
23	74B	Adjustable yoke end.
24	68D	Left hand brake lever.
25	68A	Brake shaft.
26	64G	Change gear hand lever.
27	77A	Selector plate.
28	57A	Transmission case cover.
29	67A	Brake foot pedal, left.
30	67B	Brake foot pedal, right.
31	68C	Pedal pad.
32	74E	Brake lever ratchet.
33	74H	Hand lever grip rod.
34	74A	Adjustable yoke ends.
35	63B	Lever grips.
36	62C	Master clutch hand lever.
37	63A	Gear shift hand lever.

CHAPTER IV

TRANSMISSION SYSTEM

CHAPTER CONTENTS

TRANSMISSION

The Transmission System is similar so far as the gear change is concerned to the conventional one on automotive units. Back of the transmission the system is distinctly different. In the gear shift three speeds forward and reverse are provided but the intermediate speed is direct instead of the high, the latter being a stepped-up speed for running the Tractor light. The low speed is used when the load to be pulled is exceptionally heavy or the going is bad.

The major portion of the final drive system is found in the Transmission Unit. It is like a combined rear axle and transmission system used on some types of automobiles. The final set of reduction gears are outside of the transmission unit but are enclosed in a case to protect them from the dirt and to permit them to run in oil.

That portion of the reduction gearing found inside of the Transmission Unit includes the Bevel Gears, which transmit the power from the gear shift to the Steering Clutch Shaft, the Intermediate Pinion and Intermediate Gear. On the shaft which carries the latter is mounted the Intermediate Shaft Pinion which meshes with the Drive Sprocket

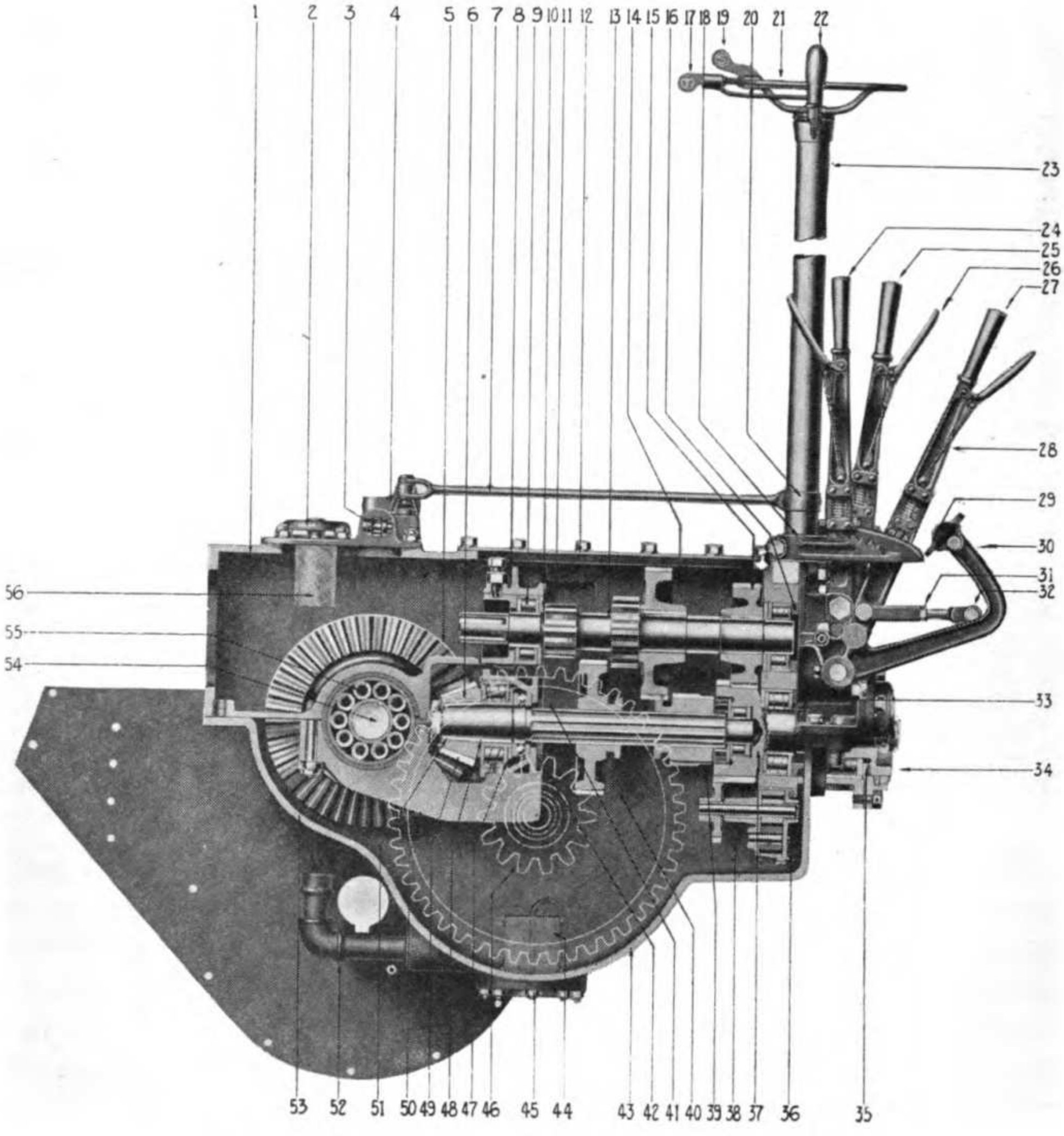
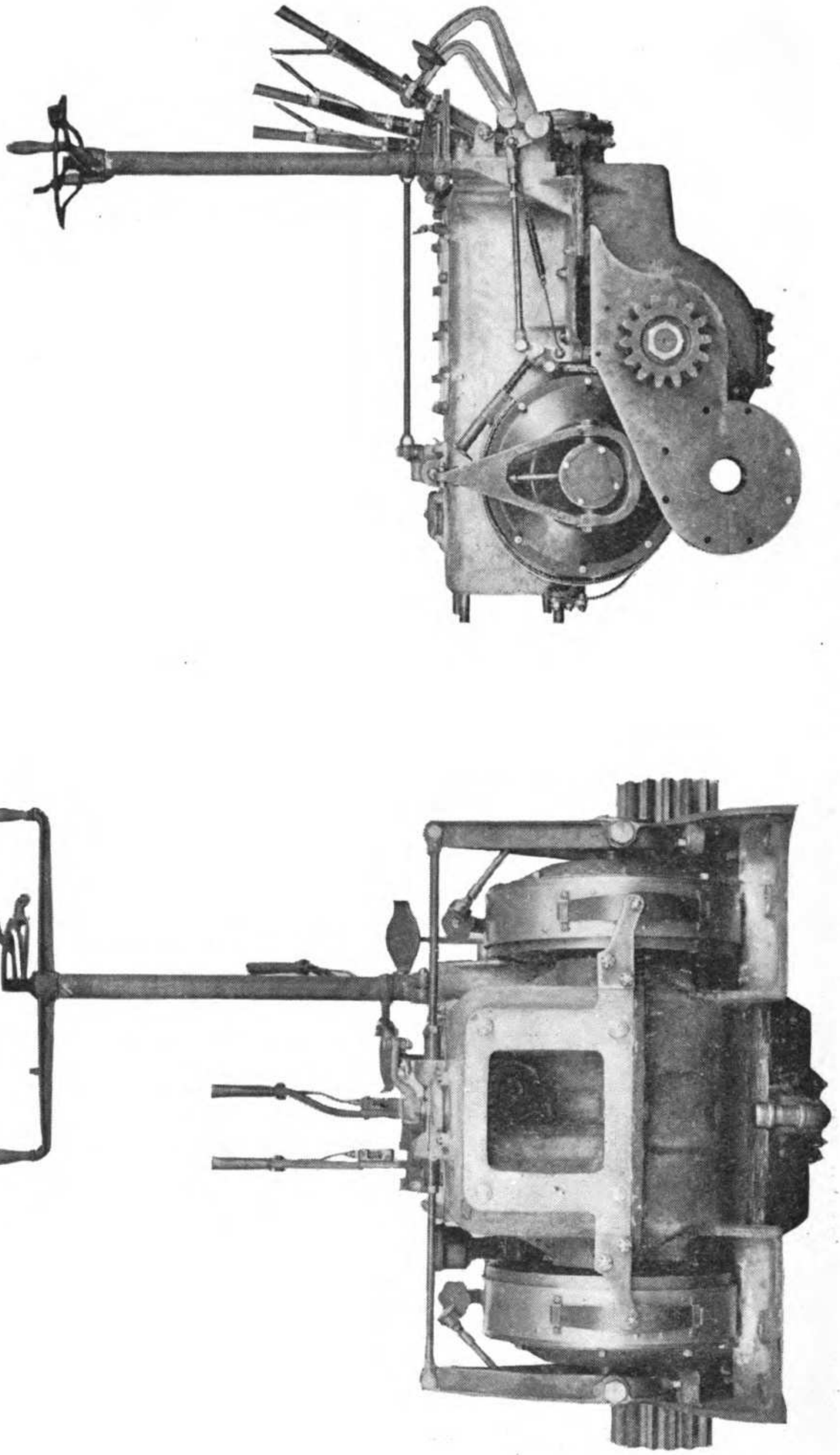


PLATE 53—SECTION OF TRANSMISSION

PLATE 53—SECTION OF TRANSMISSION

Ref. No.	Ord. No.	Name
1	41A	Upper transmission case.
2	66A	Breather cap.
3	65A	Breather bracket.
4	66D	Bell crank.
5	51A	Steering clutch shaft bevel gear.
6	48A	Bevel pinion.
7	71A	Steering control drag link.
8	46F	Countershaft bearing lock screw.
9	46E	Countershaft bearing retainer ring.
10	52G	Countershaft bearing.
11	46A	Countershaft bearing cap.
12	57A	Transmission case cover.
13	45A	Countershaft.
14	45B	High speed driving gear.
15	45C	Countershaft driving gear.
16	52G	Countershaft bearing.
17	70B	Throttle control hand lever.
18	74E	Brake lever ratchet.
19	70C	Spark control hand lever.
20	71B	Steering tube lever.
21	72A	Spark throttle quadrant.
22	70A	Steering clutch hand lever.
23	69C	Steering tube.
24	62A	Brake hand lever.
25	63A	Gear shift hand lever.
26	63B	Lever grips.
27	62C	Master clutch hand lever.
28	74H	Hand lever grip rod.
29	77A	Selector plate.
30	67B	Brake foot pedal, right.
31	74B	Adjustable yoke end.
32	74C	Master clutch operating rod.
33	28A	Roller bearing.
34	53B	Coupling, female half.
35	28A	Roller bearing.
36	FF56A	Oil pump, complete.
37	60E	Bevel pinion shaft bearing.
38	54E	Oil pump drive spur gear.
39	48C	Pinion shaft gear.
40	48B	Driven gear.
41	78A	Bevel pinion bearing sleeve.
42	60A	Bevel pinion shaft thrust bearing.
43	26A	Intermediate shaft spur gear.
44	30B	Oil suction pipe.
45	80A	Oil sump.
46	26B	Intermediate shaft drive pinion.
47	60C	Bevel pinion and clutch shaft bearing.
48	47C	Pinion shaft.
49	48A	Bevel pinion.
50	49A	Gear and pinion bearing cap.
51	47D	Pinion shaft nut.
52		Oil stand pipe.
53	23A	Lower transmission case.
54	50A	Steering clutch shaft.
55	51B	Bearing housing.
56	65E	Oil filler screen.

PLATE 54



RIGHT SIDE AND REAR VIEW OF TRANSMISSION

Gear carried in a steel case outside of the Transmission Unit. The latter gear is mounted on the same shaft as the Drive Sprocket and drives the latter. The Sprocket in turn drives the Track which propels the vehicle.

TRANSMISSION UNIT

The Transmission Unit on the Five-ton Artillery Tractor is a single unit connecting up the Engine and the Track Drive Sprockets. It is made in two parts, the Upper and Lower, and houses the Change Speed Gears, the Steering Clutch Assembly and the Intermediate Reduction Gears. On the outside of the Transmission Unit are carried the Steering Gear and the pedals and levers necessary to control the Tractor. The Transmission is mounted on the rear end of the Main Frame.

POWER DIAGRAM

The power from the Engine is transmitted through the Master Clutch and the Male Clutch Coupling to the Female Coupling attached to the Main Drive Pinion in the Transmission Unit. From the Main Drive Pinion power is transmitted in one of four ways to the Bevel Pinion mounted on the rear end of the Pinion Shaft (sometimes called the Splined Shaft). The four ways in which the power is transmitted to this shaft are known as the different speeds of the Gear Box and are High, Direct, Low and Reverse. The path of power through these gears in their various positions is clearly shown in Plate 3. From the Bevel Pinion the train of power is through the Steering Clutch Shaft Bevel Gear, then through the Steering Clutch Shaft to the Steering Clutches mounted on either end of this shaft but outside of the Transmission Case. From the Steering Clutches the power is returned through the Steering Clutch Housing, which is mounted in the form of a sleeve over the Steering Clutch Shaft to the Intermediate Pinion. The Intermediate Pinion drives the Intermediate Gear and through the Intermediate Shaft the Intermediate Shaft Pinion which meshes with the Drive Sprocket Gear, the latter two being located outside of the Transmission Unit.

TRANSMISSION CASE

The Transmission Case is made up of two parts, the Upper, which carries the Gear Box and the Steering Clutch Assembly, and the Lower, which acts as an oil reservoir and housing for the Intermediate Gears. In addition, the Upper Half carries the Steering Gear, the Control Pedals and Levers. The Transmission is split along the center line and the Main Drive Pinion and the Steering Clutch Shaft centers. Therefore, the Intermediate Gears are located below the parting line in the Lower Transmission Case. The Transmission Shafts and the Steering Clutch Assembly are held in place in the Upper Transmission Case by Bearing Caps so that the Upper Transmission Case may be removed if necessary without dropping out the shafts mentioned.

PLATE 55

LEFT SIDE AND FRONT VIEW OF TRANSMISSION

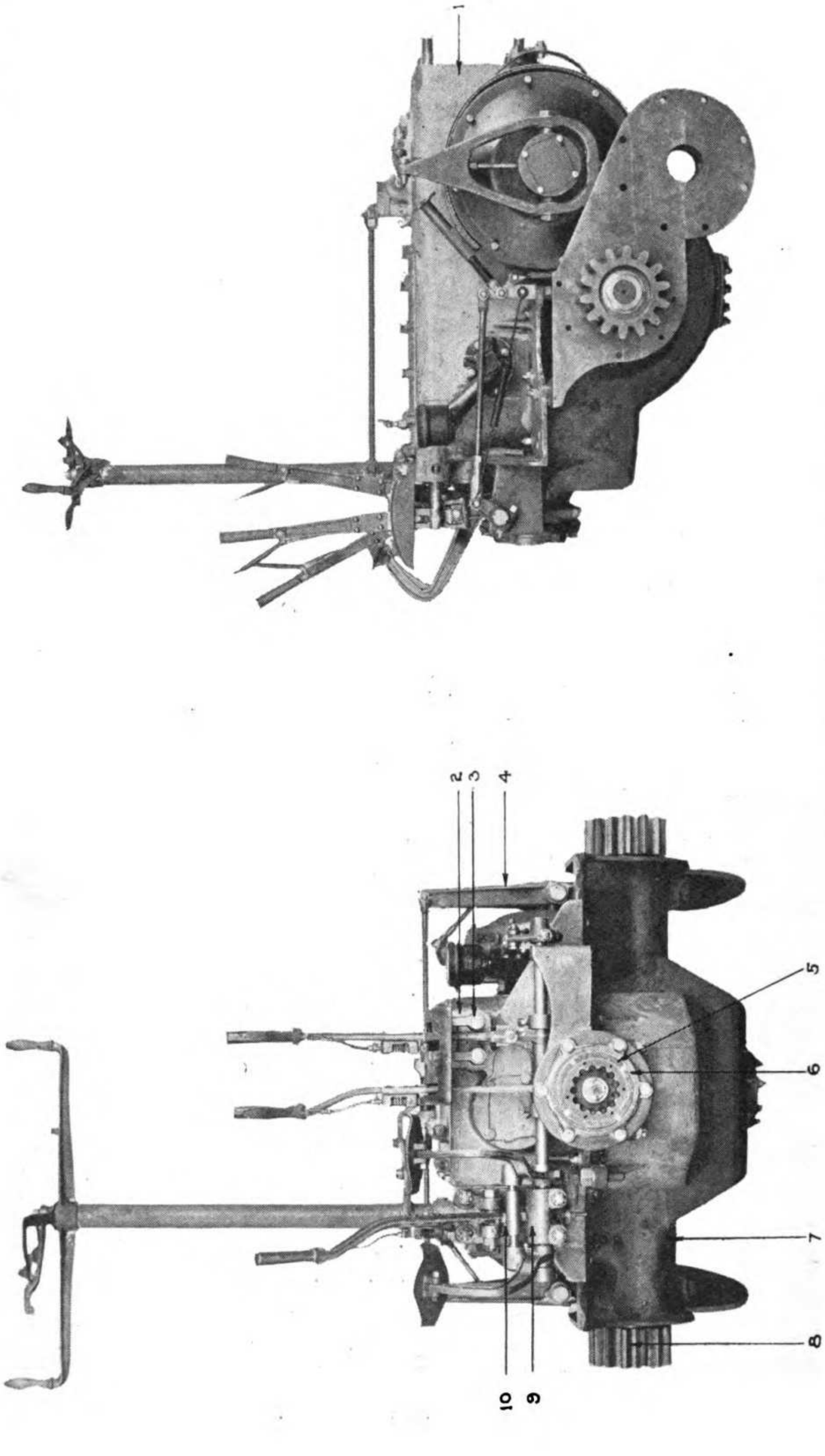


PLATE 55
LEFT SIDE AND FRONT VIEW OF TRANSMISSION

Ref. No.	Ord. No.	Name
1	41A	Upper transmission case.
2	59C	Shifter rod end.
3	59A	Shifter rod.
4	100A	Steering clutch shifter fork.
5	55B	Packing ring.
6	55A	Packing cap.
7	23A	Transmission case, lower.
8	26B	Intermediate shaft drive pinion.
9	69A	Steering column cap.
10	68G	Brake pedal equalizer.

CHANGE SPEED GEARS

The Change Speed Gears are mounted upon three shafts, all of which rotate upon Hyatt High Duty roller bearings.

The Main Drive Pinion and its shaft are forged integral. The Main Drive Pinion is also provided with an internal gear into which the forward end of the Pinion Shaft Gear slides when in its most forward position. When thus engaged, the Main Drive Pinion and the Pinion Shaft are locked together. This is called Direct Drive and in this Gear Box is the Intermediate Speed.

For High, Low, and Reverse the power from the Main Drive Pinion is first transmitted through the Countershaft Drive Gear to the Countershaft and thence through the proper gear to one of the gears mounted upon the Pinion Shaft. There are four gears on the Countershaft, starting from the front of the Gear Box they are designated as follows: the Countershaft Driving Gear, which is constantly in mesh with the Main Drive Pinion; and the High Speed, Low and Reverse Driving Gears. The Countershaft and the High Speed Driving Gears are pressed and keyed upon the Countershaft but the Low and Reverse Gears cut integral with the Countershaft forging. The Pinion Shaft Gear and the Driven Gear are both movable axially upon the Pinion Shaft which is splined. By the relative movement of these slidably mounted gears, it is possible to obtain the variations in the gear reduction between the Engine and the Track Drive Sprockets.

BEVEL GEARS

The Bevel Gears in the Transmission serve not only to change the direction of the Drive Shafts from longitude to transverse, but also to give additional reduction in the Transmission System. The Bevel Pinion is mounted upon the rear end of the Pinion Shaft. The thrust

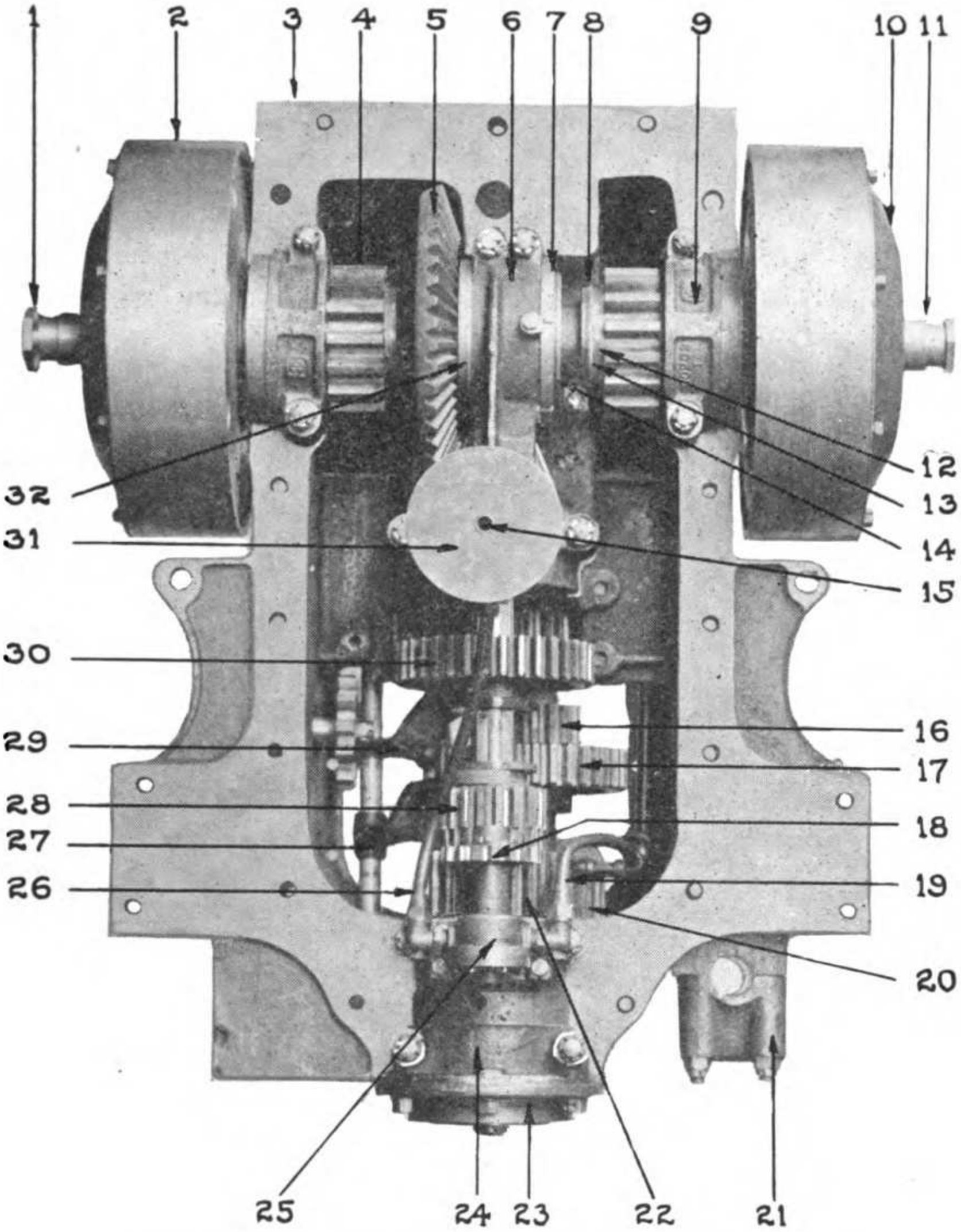


PLATE 56—BOTTOM VIEW OF TRANSMISSION

from this gear is taken by a Bevel Pinion Shaft Thrust Bearing, which is carried in a Bevel Pinion Bearing Sleeve. The thrust in the Steering Clutch Shaft Bevel Gear is taken by bronze Thrust Washers, located on either side of the Steering Clutch Shaft inside of the Transmission Housing.

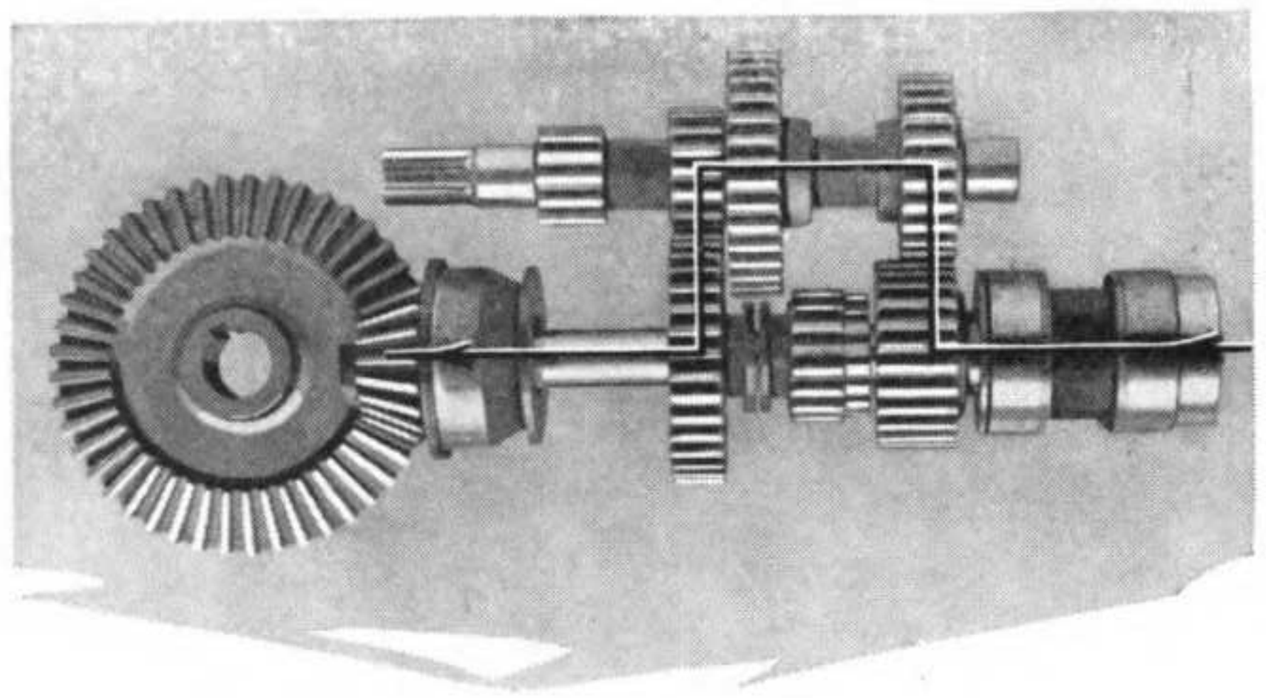
PLATE 56
BOTTOM VIEW OF UPPER TRANSMISSION CASE

Ref. No.	Ord No.	Name
1	96D	Pressure ring screw.
2	93B	Steering clutch housing.
3	41A	Upper transmission case.
4	99B	Intermediate pinion.
5	51A	Steering clutch shaft bevel gear.
6	49A	Gear and pinion bearing cap.
7	51C	Bearing housing adjusting nut.
8	50E	Thrust collar.
9	56A	Clutch quill bearing cap.
10	94B	Clutch housing dust guard.
11	94A	Steering clutch pressure ring.
12	52C	Thrust washer.
13	52B	Thrust washer.
14	52F	Ball bearing cage.
15	80B	Oil suction pipe.
16	45A	Countershaft.
17	45B	High speed driving gear.
18	54A	Coupling bearing cap.
19	80A	Oil discharge pipe.
20	45C	Countershaft driving gear.
21	69A	Steering column cap.
22	53A	Main drive pinion.
23	55A	Packing cap.
24	54A	Coupling bearing cap.
25	FF56A	Oil pump complete.
26	80B	Oil suction pipe.
27	58A	Direct and high shifter fork.
28	48C	Pinion shaft gear.
29	58B	Reverse and low shifter fork.
30	48B	Driven gear.
31	80G	Oil sump cover.
32	51B	Bearing housing.

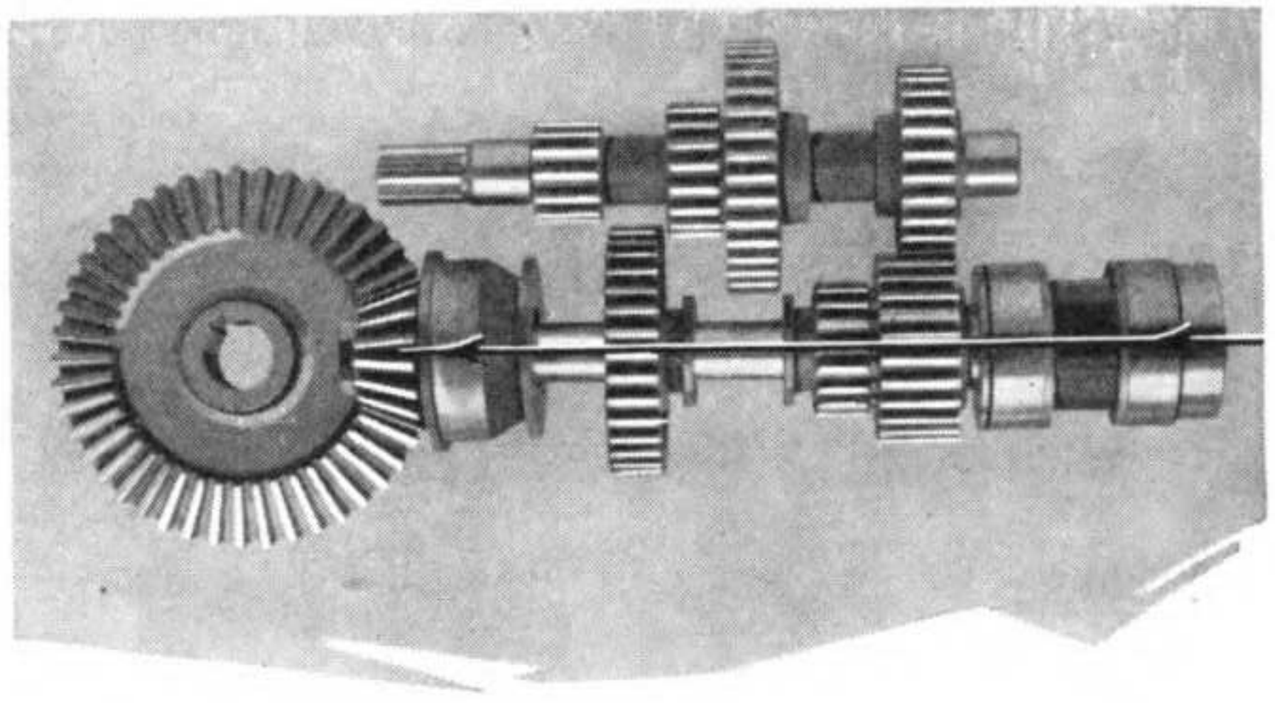
GEAR DIMENSIONS

The Main Drive Pinion, has external and internal gear teeth and is made from a steel drop forging S. A. E. specification number 2320 with heat treatment "G". The Outside Gear, which meshes with the Countershaft Drive Gear, has an outside diameter of 5.484 (5½) inches, pitch diameter of 5.2 (5 1/5) inches, 26 teeth of 5 pitch with 20 degrees involute Fellows stub tooth form and 1.5 (1½) inch face. The Internal Gear is 0.812 (13/16) inch face and has 18 teeth.

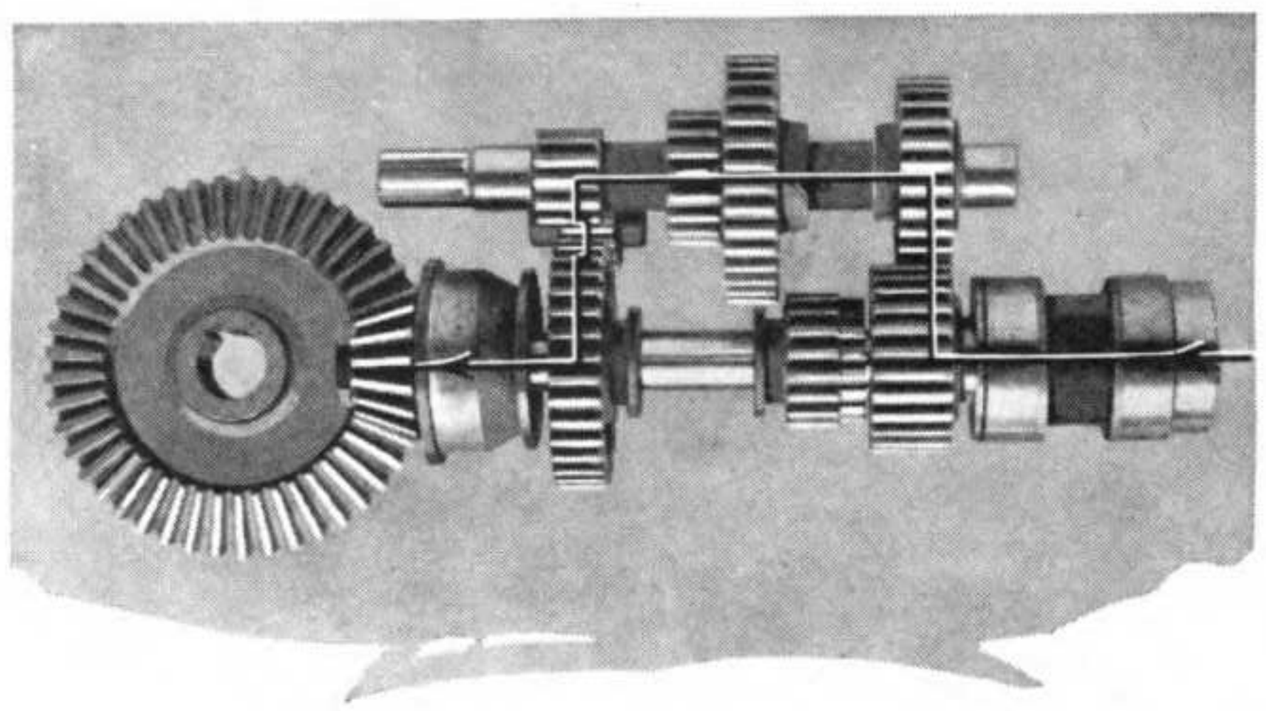
The Pinion Shaft Gear is made from the same material and has the same heat treatment as the Main Drive Pinion. Its outside diameter is 3.884 (3⅞) inches and pitch diameter 3.6 (3⅝) inches. The effective face of the gear measures 1.5 (1½) inches and it has 18 teeth, 5 pitch, 20 degrees involute Fellows stub tooth form. The Driven Gear has the same material specifications and gear tooth form and pitch. It has 1.5 (1½) inches face, 7.281 (7 17/64) inches outside diameter, 7 inches pitch diameter and 35 teeth. This gear is also slidably mounted upon the splined or Pinion Shaft.



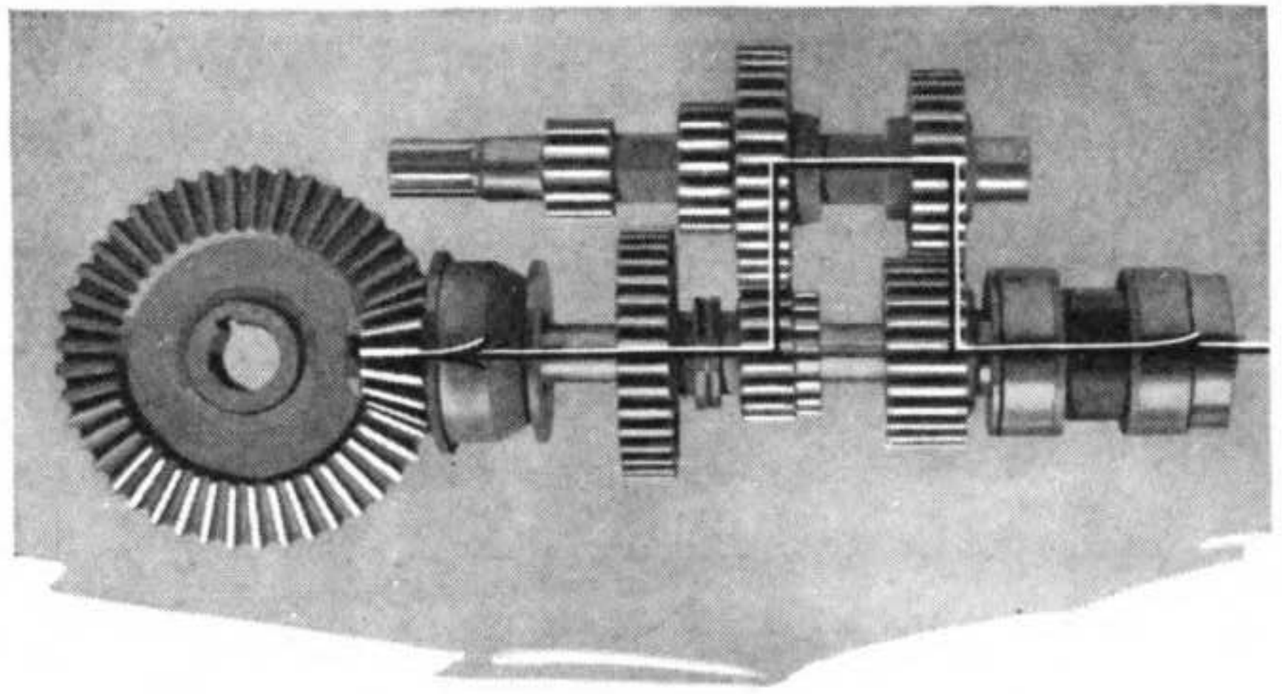
LOW



DIRECT



REVERSE



HIGH

DIAGRAM OF GEAR SHIFT POSITIONS

COUNTERSHAFT

The Countershaft, the Countershaft Driving Gear and the High Speed Driving Gear are all made from steel drop forgings S. A. E. specification number 2320 with heat treatment "G." All the gears have 5 pitch, 20 degrees involute Fellows stub teeth and 1.5 (1½) inches face. The Countershaft has the Low and Reverse Gears cut integral with it. The shaft itself is 2 inches in diameter. The outside diameter of the Reverse Gear is 2.885 (2⅞) inches and pitch diameter 2.6 (2⅝) inches. While the Reverse Gear has an actual face of 1.875 (1⅞) inches, only 1.5 (1½) inches of it are effective because the Reverse Idler Gear has this width. The Reverse Idler Gear has an outside diameter of 4.284 (4 17/64) inches and pitch diameter of 4 inches. The Reverse Gear has 13 and the Idler 20 teeth.

The Low Speed Gear has 3.884 (3⅞) inches outside diameter and 3.6 (3⅝) inches pitch diameter and 18 teeth. The High Speed Driving Gear has 7.284 (7 17/64) inches outside diameter, 7 inches pitch diameter and 35 teeth. The Countershaft Driving Gear has 5.684 (5 11/32) inches outside diameter, 5.4 (5 7/16) inches pitch diameter and 27 teeth.

The Bevel Pinion has 2 inches face, 17 teeth of 4 pitch, 20 degrees involute Fellows stub tooth form. It is made from S. A. E. specification number 2320 steel with heat treatment "G". Its outside diameter is 4.624 (4⅝) inches and pitch diameter 4.25 (4¼) inches. The angle between the axis and the pitch cone is 20 degrees 42 minutes and that to the outside diameter cone 22 degrees 36 minutes.

STEERING CLUTCH SHAFT ASSEMBLY

The Steering Clutch Shaft Assembly includes part of the Transmission Assembly and part of the Steering Clutch, and the two can be more clearly described by considering them jointly. The Steering Clutch Shaft is 30.25 (30¼) inches long with a maximum diameter of 2 inches. At the center the Steering Clutch Shaft Bevel Gear is pressed and keyed. Here a Hyatt High Duty Roller Bearing is provided for supporting the shaft. There is also a ball thrust bearing called the Steering Clutch Shaft Thrust Bearing, employed at this point to prevent any endwise motion of the Steering Clutch Shaft when either one of the Steering Clutches are disengaged. When either one of the Steering Clutches are disengaged, there is an end thrust on the shaft in the direction of the Clutch which has been disengaged.

STEERING CLUTCH

The Steering Clutches are supported by both the Steering Clutch Shaft, upon which they are mounted, and by the Steering Clutch Quill Bearing, a Hyatt Roller, which is mounted upon the quill or sleeve like extension of the Steering Clutch Housing. This bearing is located between the Steering Clutch Housing and the Intermediate Pinion.

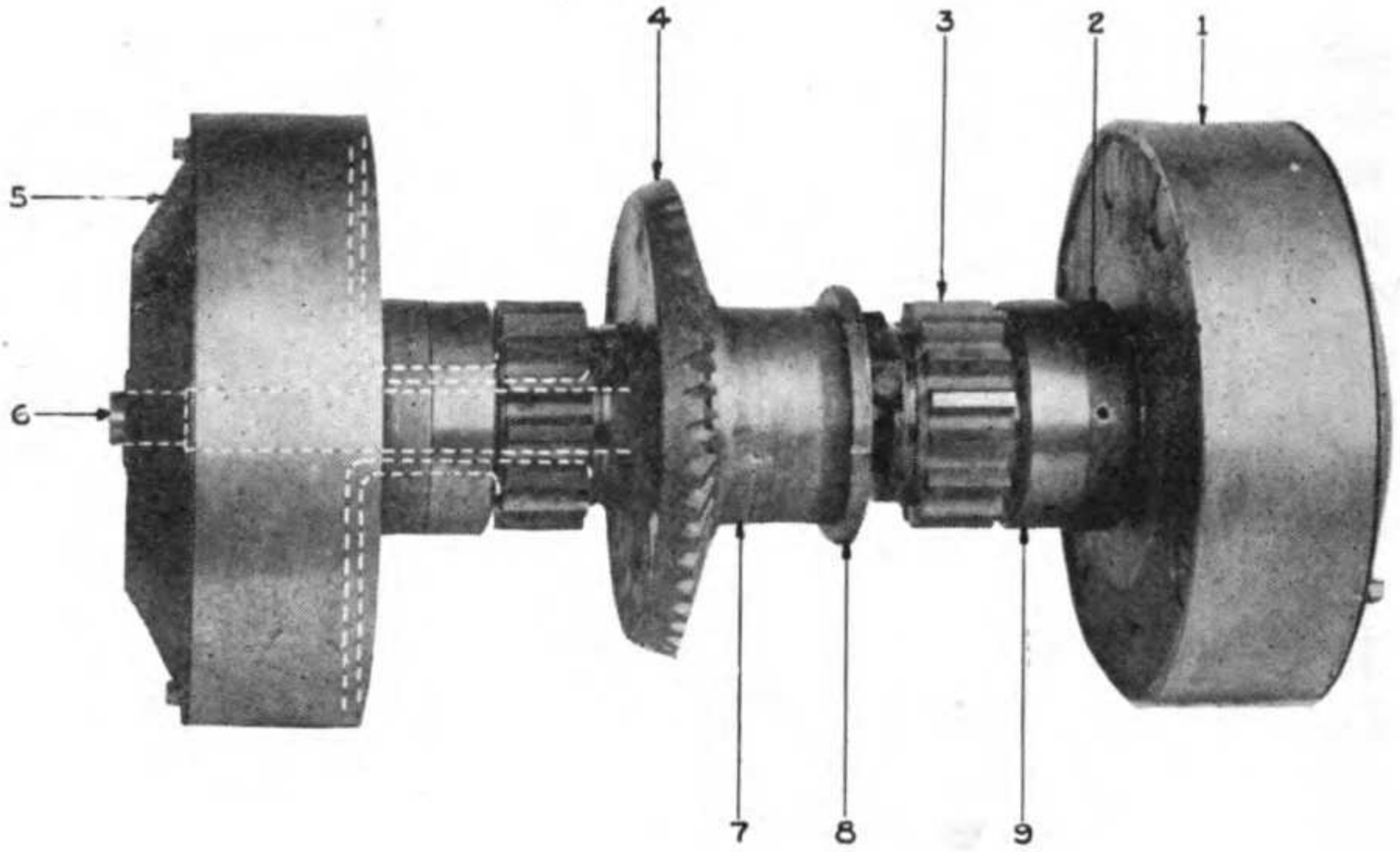


PLATE 58—STEERING CLUTCH SHAFT ASSEMBLY

Ref. No.	Ord. No.	Name
1	93B	Steering clutch housing.
2	101A	Clutch quill bearing oil retainer.
3	99B	Intermediate pinion.
4	51A	Steering clutch shaft bevel gear.
5	94B	Clutch housing dust guard.
6	50A	Steering clutch shaft.
7	51B	Bearing housing.
8	51C	Bearing housing adjustable nut.
9	102A	Clutch quill bearing.

The two Steering Clutches are interchangeable so that a description of one will suffice. The Steering Clutch is of the dry plate multiple disc type, in which there are 5 asbestos fabric faced Driven Discs and 6 hardened steel Driving Discs that engage with the former.

These Discs are clamped together between the Steering Clutch Retainer, which is attached directly to the outer end of the Steering Clutch Shaft, and the Steering Clutch Pressure Ring, which is telescoped over the Steering Clutch Retainer Hub and drawn up against the discs by means of 8 helical springs. In order to protect the springs and discs of the Steering Clutch from dirt and water, the open end of the Steering Clutch Housing is covered by the Clutch Housing Dust Guard. The

power is transmitted from the Driven Clutch Discs to the Steering Clutch Housing by means of 8 keys riveted onto the inside of the Clutch Housing. On the outer end of the Steering Clutch Pressure Ring is mounted a Steering Clutch Shifter Ring Bearing, which is a number 209-3 Fafnir double row annular ball bearing. This is carried inside of a dust proof Steering Clutch Shifting Ring, the latter being trunnioned in the Steering Clutch Shifter Fork. Nominally there is no end thrust or radial load on this bearing but when the Clutch is disengaged, it has to take the combined end thrust of the 8 Steering Clutch Springs.

STEERING CLUTCH PARTS

The Steering Clutch Retainer is a malleable iron casting, drum shaped, on which are carried eight keys 0.498 (½) inch thick and 0.75 (¾) inch wide, which drive the 6 steel Clutch Driving Discs. The same size of keys are used on the inside of the Steering Clutch Housing to receive the drive from the Clutch Driven Discs. The dimensions of the Steering Clutch Friction Discs, which are made from asbestos fabric and held upon either side of the 5 Clutch Driven Discs by 16 0.218 (7/32) inch rivets, are as follows: thickness 0.125 (⅛) inch, outside diameter 12.75 (12 ¾) inches, inside diameter 9.812 (9 13/16) inches.

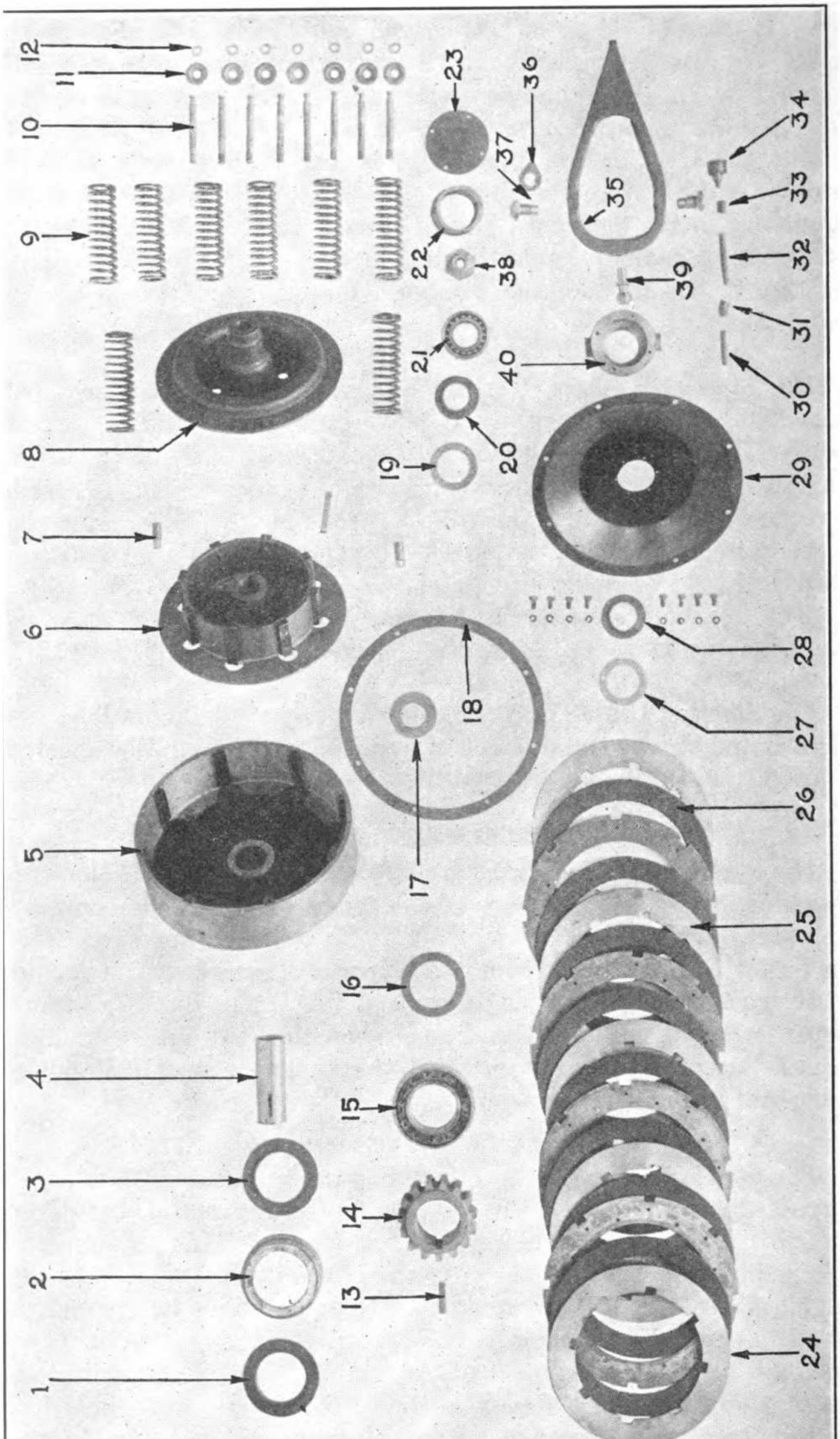
The Steering Clutch Springs, 8 in number, are 8 inches long when released and show a compression of from 105 to 125 pounds when closed to 3.562 (3 9/16) inches.

STEERING CLUTCH BRAKES

The Steering Clutch Brakes are located on both sides of the Upper Transmission Case. They are of the band type and are prevented from dragging by means of a support at the rear end and by the Operating Belt Crank at the front. A Clutch Brake Spring is included between the Brake Multiple Lever and the Brake Band in order to keep the Brakes clear of the drums when they are released. Brake Band Adjustment Nuts are provided to take up the wear and maintain a constant braking action.

ADJUSTMENT OF STEERING CLUTCHES

The only provision for the adjustment of the Steering Clutches is in the rods that connect up the Bell Crank mounted upon top of the Transmission Case with the Steering Clutch Yokes. This adjustment is obtained by disconnecting the yoke end of the Brake Rod as it is called and turning the rod until there is sufficient clearance for the clutches and then connecting the rod yoke with the top of the Steering Clutch Yoke again. The adjustment of the Clutch Plates is automatic until the friction discs have become so badly worn that they have to be replaced. The adjustment mentioned above is only necessary to insure proper steering action.



STEERING CLUTCH PARTS

PLATE 59—STEERING CLUTCH PARTS

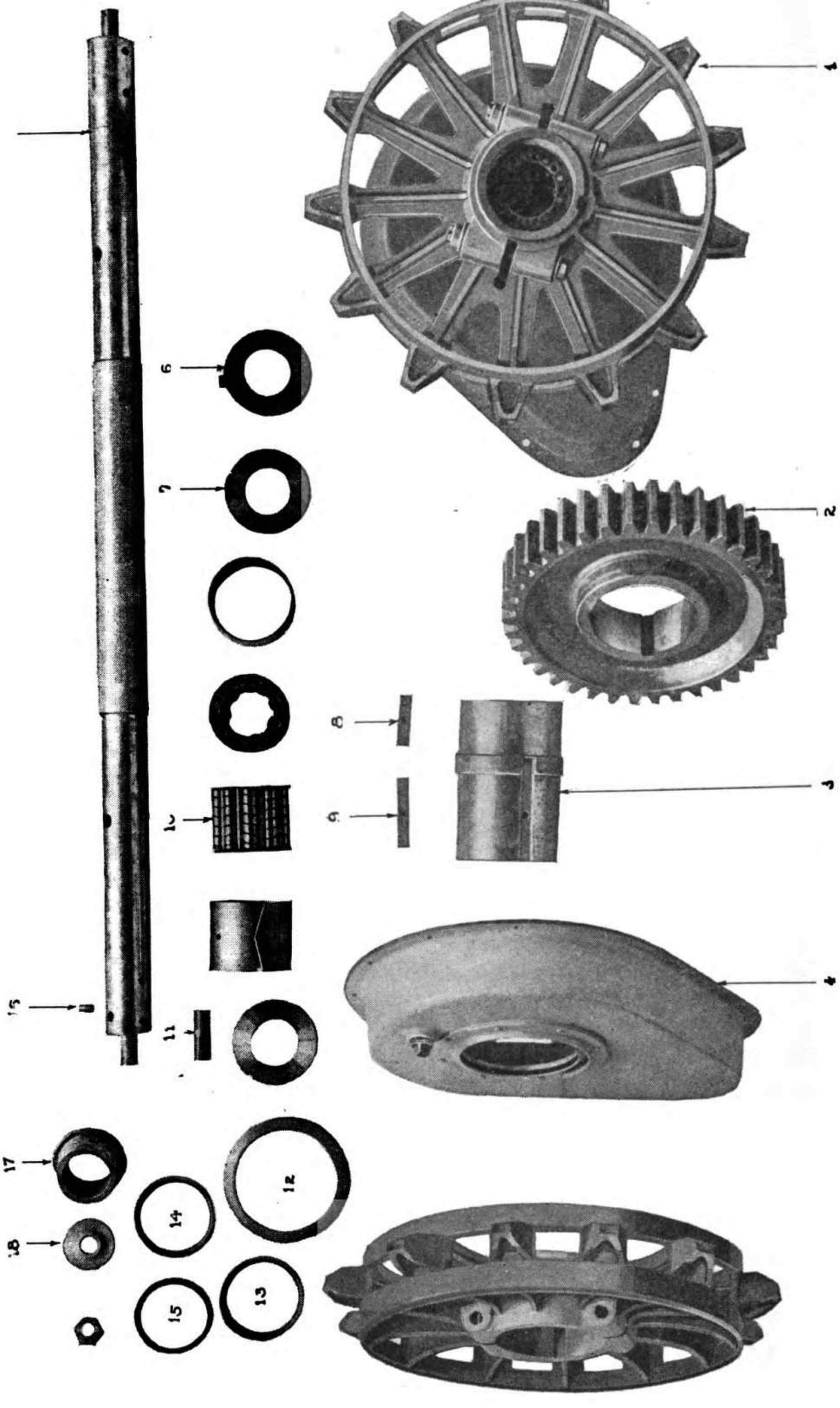
Ref. No.	Ord. No.	Name
1	101B	Clutch quill bearing retaining washer.
2	101A	Clutch quill bearing oil retainer.
3	101C	Steering clutch quill oil retainer washer.
4	98E	Steering clutch housing bushing.
5	93B	Steering clutch housing.
6	93A	Steering clutch retainer.
7	98C	Retainer dowel.
8	94A	Steering clutch pressure ring.
9	96C	Steering clutch spring.
10	97C	Steering clutch spring stud.
11	97D	Steering clutch spring retainer.
12	97E	Clutch spring retainer stop.
13	99C	Intermediate pinion key.
14	99B	Intermediate pinion.
15	102A	Clutch quill bearing.
16	101B	Clutch quill bearing retainer washer.
17	97A	Clutch housing thrust washer.
18	99A	Dust guard gasket.
19	97B	Dust washer retainer.
20	97F	Shifter ring dust washer.
21	102B	Shifting ring bearing.
22	97G	Shifting ring spacer.
23	98F	Shifter ring cover plate.
24	95B	Steering clutch driving disc.
25	95A	Steering clutch driven disc.
26	96A	Steering friction disc.
27	97B	Dust washer retainer.
28	97F	Shifter ring dust washer.
29	94B	Clutch housing dust guard.
30	103B	Pipe nipple.
31	103D	Plain elbow.
32	103A	Pipe nipple.
33	103C	Plain coupling.
34	102C	Grease cup.
35	100A	Steering clutch shifter fork.
36	100D	Lock washer.
37	100C	Clutch fork screw.
38	96D	Pressure ring screw.
39	100B	Clutch fork ball end.
40	96B	Steering clutch shifter ring.

When the Steering Clutch Friction Discs have to be replaced it is first necessary to remove the Upper Transmission Case as it is impossible to get into the Steering Clutch Housings in any other manner. After the Upper Transmission Case has been removed it is possible to get into the Steering Clutch Housing very easily. All that it is necessary to do is remove the Steering Clutch Yoke, Cover Plate, and the eight springs which engage the multiple disc clutch. Then the plates may easily be removed and the friction discs that are worn, removed and new ones riveted in their place.

TRANSMISSION GEARS

The Steering Clutch Shaft Bevel Gear is made from the same material and treated in the same manner as the Bevel Pinion, but has 45 teeth, 11.25 (11¼) inches pitch diameter. The Intermediate Pinion, which is mounted upon the inside end of the Steering Clutch Housing, is made from the same material as the Transmission Gear and treated in the same manner. It has 5.5 (5½) inches outside diameter, 5 inches pitch diameter, 15 teeth 3–4 pitch, 20 degrees involute Fellows stub tooth form and 2.125 (2⅛) inches face. It meshes with the Intermediate Shaft Spur Gear, which also is carried inside of the Transmission Case, and has the following dimensions: Outside diameter 16.166 (16 3/16) inches; pitch diameter 15.666 (15 2/3) inches width 2 inches and 47, 3–4 pitch 20 degrees involute Fellows stub teeth. The gear is made from a rolled steel blank of S. A. E. specification

PLATE 60



DRIVE SPROCKET AND GEAR PARTS

PLATE 60

DRIVING SPROCKET AND GEAR PARTS

Ref. No.	Ord. No.	Name
1	108A 116A	Track sprocket.
2	109A	Sprocket sleeve drive gear.
3	114A	Track sprocket sleeve.
4	113A	Gear case.
5	111A	Track sprocket shaft.
6	111C	Thrust washer.
7	114C	Drive sprocket thrust washer.
8	114G	Sprocket drive gear key.
9	114F	Sprocket key.
10	114B	Roller bearing.
11	111B	Stud.
12	110C	Dust ring.
13	110E	Dust washer retainer.
14	110F	Dust washer retainer.
15	110D	Dust washer.
16	115E	Set screw.
17	115C	Thrust collar.
18	111D	Rear thrust washer.

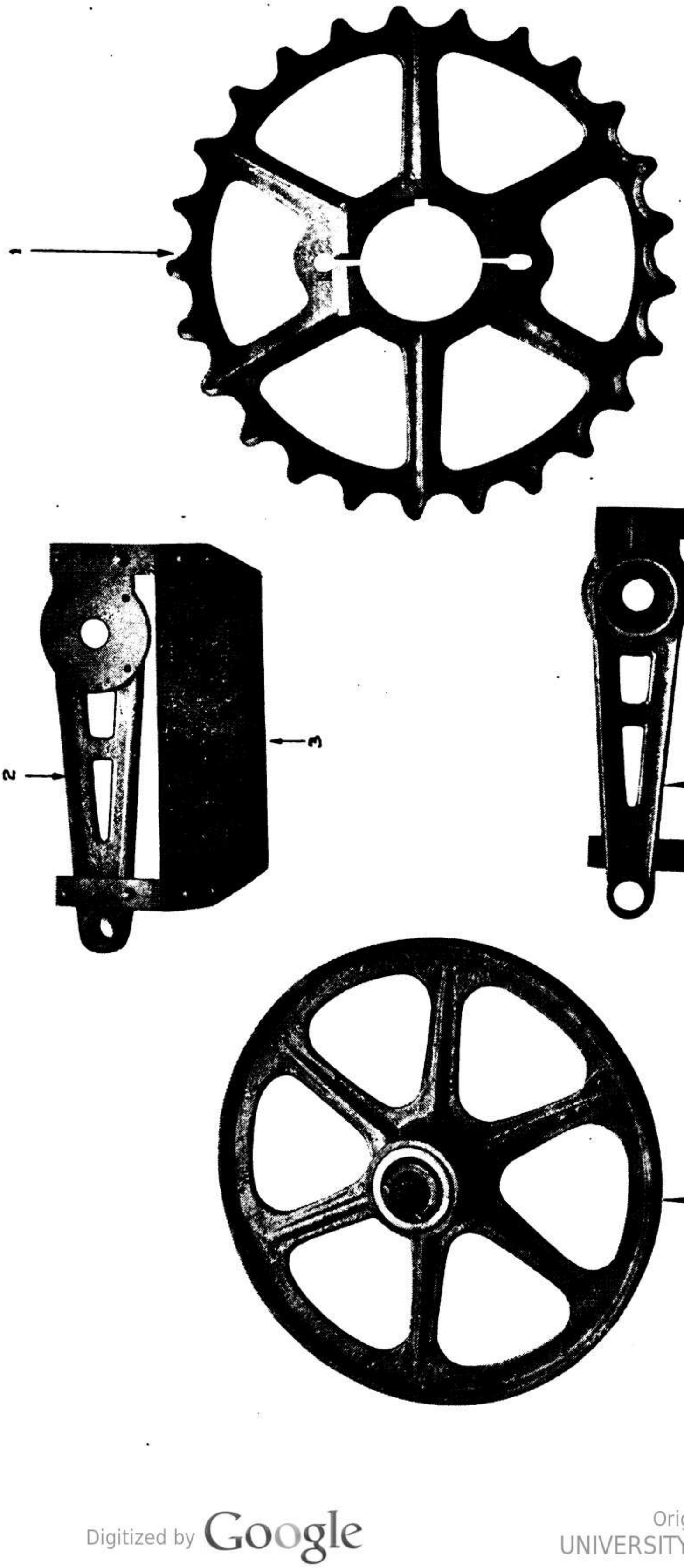
number 1020 steel with heat treatment "A". The Intermediate Shaft is 2.5 (2½) inches in diameter and 17.687 (17 11/16) inches overall. On the inside end of the Intermediate Shaft the Intermediate Gear is mounted. On the outside end of it is carried the Intermediate Shaft Drive Pinion, which is made from S. A. E. specification number 2320 steel with heat treatment "A". This has an outside diameter of 6.4 (6 7/16) inches, a pitch diameter of 5.6 (5 5/8) inches, and 14 teeth 2.5 (2½) diametral pitch, 14 degrees 30 minutes involute form.

GEAR RATIOS

The reduction through the Transmission are as follows, 0.535 to 1 on High. This ratio shows that the Transmission gives a step-up or raises the speed of the Pinion Shaft above that of the Engine. The Intermediate Speed is direct drive and in this case the Pinion Shaft is driven at the same speed as the Main Drive Pinion or the Engine. In Low Gear the reduction is 2.02, which indicates that the Pinion Shaft in this case runs at about half the speed of the Engine. When in Reverse Gear, there is a still greater reduction between the Engine and the Pinion Shaft, it being 2.8 to 1.

From the Gear Box back there are three main reductions to the Drive Sprockets, the first of these being that in the Bevel Gears where there is a reduction of 2.65 to 1. The next step is through the Intermediate Gears where the reduction is 3.125 to 1 and in the final one through the outside Intermediate Shaft Drive Pinion and Drive Sprocket Gear, the reduction is 2.71 to 1. Hence the total reduction between the Gear Box and the Drive Sprocket Gear is 22.5 to 1.

PLATE 61



INITIAL DESIGN DRIVE SPROCKET AND GEAR

PLATE 61
INITIAL DESIGN
DRIVE SPROCKET AND GEAR

Ref. No.	Ord. No.	Name
1	108A	Track sprocket.
2	112A	Rear thrust rod and guard, R. H.
3	112B	Rear thrust rod guard.
4	128A	Blank sprocket.
5	112A	Rear thrust rod and guard, L. H.
6	112E	Thrust rod guard support.

The ratio of the Engine Revolutions to those of the Drive Sprocket are as follows on each of the Change Speed Gears: On High or the stepped-up speed 12 to 1, on Intermediate or Direct Drive 22.5 (22½) to 1, on Low 45.5 (45½) to 1 and on Reverse 60.6 (60 3/5) to 1.

TRANSMISSION LUBRICATION

The Transmission Lubricating System is similar in a number of ways to that of the Engine. The Transmission Case is of such dimensions that it would be impossible to carry a deep enough supply of lubricant to insure that the Change Speed Gears would receive an adequate supply. For this reason a limited amount of lubricating oil is carried in the bottom of the Transmission Case and an oil pump is used to circulate it and distribute it over the face of the Change Speed Gears. This Oil Pump is of the rotary gear type and is mounted on the Main Drive Pinion Bearing Cap. A suction pipe on this pump goes to the bottom of the Transmission Case and oil is delivered at the top onto each of the Countershaft Gears and also the Bevel Pinion. On top of the Transmission Case, there is a pet cock, which communicates with the Lubricating Oil System. By means of this cock it is possible to determine whether the Lubricating Oil Pump is operating or not. The Oil Pump is driven by a Spur Gear that meshes with the Main Drive Pinion so that it is positively rotated.

Transmission Lubricating Oil is introduced through an opening protected by a hinged cover on the top of the Upper Transmission Case.

At the back of the Tractor and in the Lower Transmission Case there is an iron pipe, a stand pipe, closed by a threaded cap. If this cap is removed before introducing fresh lubricant, the proper oil level in the Transmission Case can be ascertained when filling, as it will be seen to overflow out of this stand pipe when the proper level has been obtained.

An Oil Screen is provided in the bottom of the case to keep dirt and sediment out of the Lubricating Oil System. This screen is carried in a housing, which is readily removable from the bottom of the Transmission Case when it is desired to clean the screen or filter.

DRIVE SPROCKET AND GEARS

The design of the Drive Sprocket and Gears and also what is called the Blank Sprocket, which is mounted on the Front Roller Frame, was changed after the first production, therefore, it will be necessary to describe both of the Track Sprockets used. Not only were the Sprockets changed but the Rear Thrust Rod used in the first production was removed and a Spring Radius Rod was applied to the Front Roller Frame Assembly.

The parts which remained were the Track Sprocket Shaft, on which the Track Sprocket is mounted, the Sprocket Sleeve Drive Gear, the Gear Case, the Roller Bearing and the method of fastening the entire assembly on the Track Sprocket Shaft.

The Track Sprocket used on the initial production drove the Track Link Spacers and, on account of the design of the teeth, also supported the Track Link Shoes. The newer design of the Track Sprocket drives the Track in the same manner as before but is provided with a broad flange on either side, upon which the inside ground surface of the Track Link Shoes rests, thereby relieving the teeth of the Sprocket from any load save that of driving. The first Sprocket was provided with 26 teeth and 6 spokes and the new Sprocket has 13 teeth and an equal number of spokes. The pitch diameter of the Sprocket is 24.25 (24¼) inches and the outside diameter is 25 inches. The pitch of the Track Sprockets is 6.031 (6 1/32) inches. The Drive or Thrust between the Main Frame of the Tractor and the Track is taken by the Rear Thrust Rod, which is in the form of an arm 14.625 (14⅝) inches long center to center. It is mounted on the outside end of the Track Sprocket Shaft and attached to the rear end of the Rear Roller Frame. As mentioned above this design was only used on the initial production and has been replaced by the Spring Radius Rod shown on page 151.

CHAPTER V

SUPPORTING ASSEMBLIES

CHAPTER CONTENTS

The Supporting Assemblies consist of the Main Frame with its accessories, the Equalizing Bar and the Roller Frames.

MAIN FRAME ASSEMBLY

The Main Frame Assembly consists of the Main Frame, the Spring Brackets that carry the two rear Track Supporting Rollers, the Master Clutch Shifter Fork Bracket, the Equalizing Bar Pin, the Engine Brackets and the Engine Trunnion Support, together with the necessary studs and nuts.

MAIN FRAME

The Main Frame is a steel casting, approximately 104.5 (104½) inches long and 35.5 (35½) inches wide. It is made up with five cross members cast integral; one at the front, to which the Front Pintle is attached; the second and third between which the Equalizing Bar is carried, about one third of the distance back; the fourth about two-thirds of the way back and upon which the front end of the Transmission Unit rests; the fifth at the rear end of the Frame tying the sides together at this point. The walls of the Frame vary from 0.625 (⅝) inch to 0.5 (½) inch in thickness. The maximum vertical depth of the Frame near the center is 8.312 (8 5/16) inches. It has a drop at the back of 9.625 (9⅝) inches to provide a clearance for the back end of the Transmission and gears. The shape of the Casting is that of a channel steel frame.

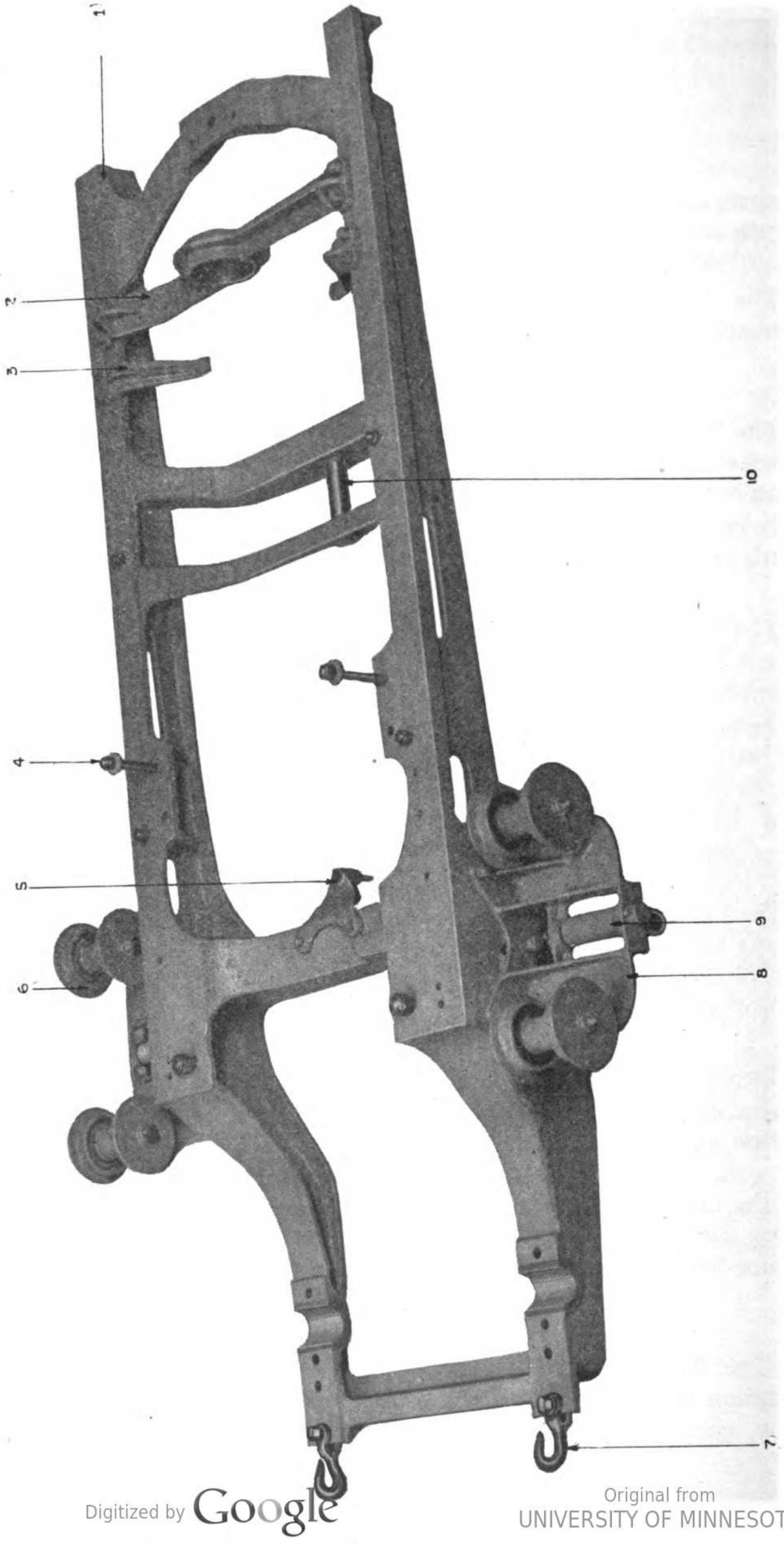
SPRING BRACKETS

Two cast steel Spring Brackets are mounted on either side of the Frame opposite the fourth cross member. They are bolted to the Frame and practically form a permanent part of it. They not only serve to carry the two rear Track Support Rollers but also are cut out on the underside to receive the two Tractor Support Springs and also carry the Roller Frame Sliding Link, which prevents the Rear Roller Frame from dropping off in passing over bad holes.

ENGINE TRUNNION SUPPORT

The front end of the Engine is supported by a cast steel front trunnion support, that slips over a 5-inch trunnion 2.5 (2½) inches wide, cast integral with the Timing Gear Cover Plate. The two

PLATE 62



MAIN FRAME ASSEMBLY

PLATE 62—MAIN FRAME ASSEMBLY

Ref. No.	Ord. No.	Name
1	9A	Main frame.
2	14C	Engine front trunnion support.
3	14A	Engine bracket, front
4	10A	Bolt, S. A. E., drilled.
5	15A	Master clutch shifter fork bracket.
6	13A	Track roller.
7	16A	Rear towing hook.
8	11A	Spring bracket.
9	11B	Roller frame sliding link.
10	15H	Equalizing bar pin.

Engine Brackets located on either side of the Frame immediately behind the Engine Trunnion Support are provided so that the front end of the Engine will not drop down when the Engine Trunnion Support is removed. This is necessary when the Timing Gears of the Engine have to be examined.

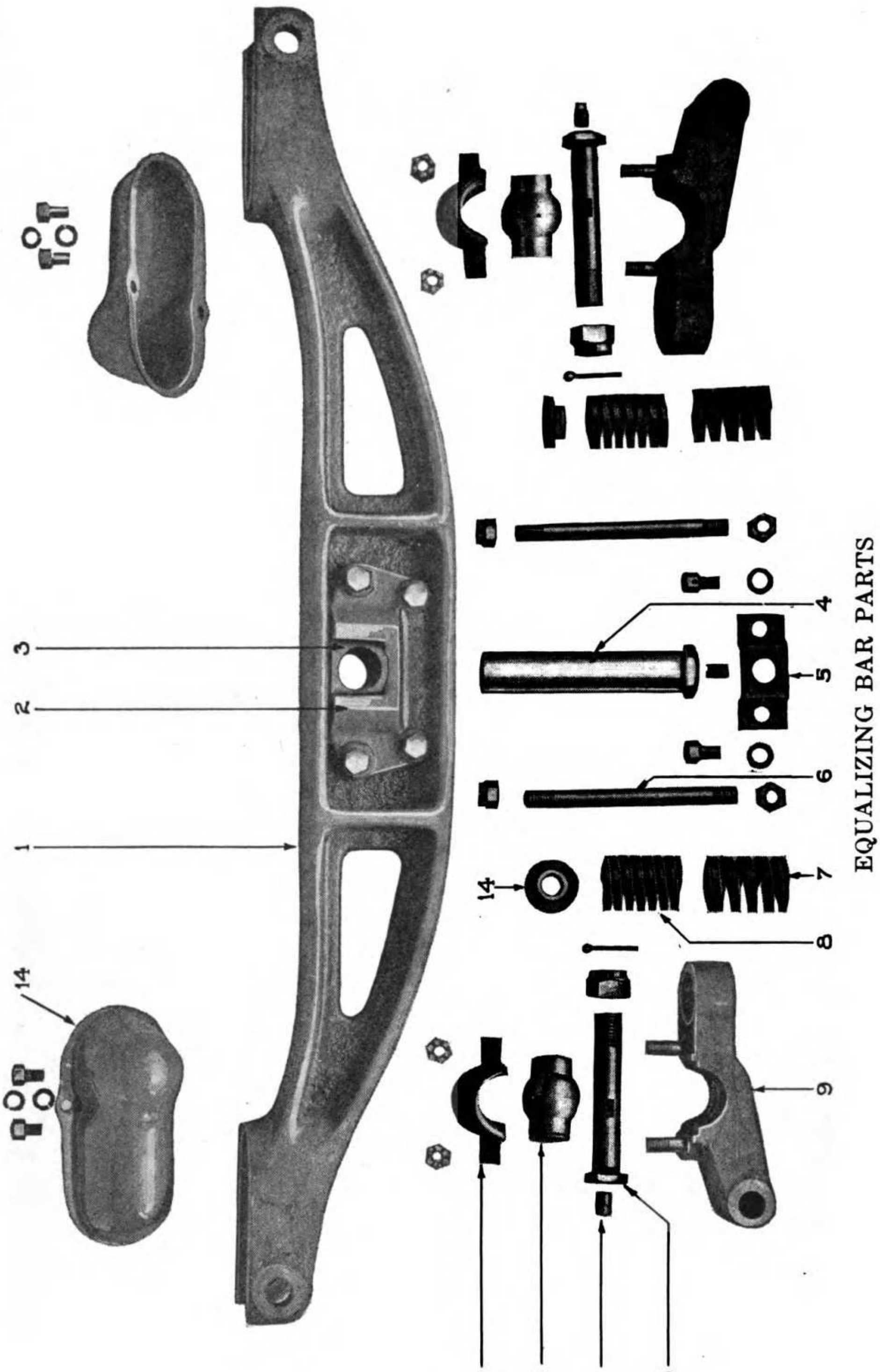
EQUALIZING BAR PIN

The Equalizing Bar Pin is a hardened and ground steel pin inserted between the second and the third cross members and upon which the Equalizing Bar Ball turns. It is 1.683 ($1\frac{11}{16}$) inches in diameter and has a length over the Hex. head of 8.375 ($8\frac{3}{8}$) inches. It is held in place by an Equalizing Bar Pin Fork, a "U" shaped piece of 0.187 ($\frac{3}{16}$) inch by 2 inch wrought iron bar. It fits over the flats of the Hex. head on the Equalizing Bar Pin and is held in place by two 0.625 ($\frac{5}{8}$) inch cap screws. A hole is provided in the center of it, through which grease may be forced into the channels drilled in the Equalizing Bar Pin for the purpose of lubricating it and also the Equalizing Bar Ball.

EQUALIZING BAR ASSEMBLY

The Equalizing Bar Assembly consists of the Equalizing Bar, the Equalizing Bar Block and Retainer, the Spring Bracket, the Support and Recoil Springs, the Spring Bracket Cap and Equalizing Bar Covers.

PLATE 63



EQUALIZING BAR PARTS

PLATE 63

EQUALIZING BAR PARTS

Ref. No.	Ord. No.	Name
1	141A	Equalizing bar.
2	144A	Pivot block retainer.
3	144B	Equalizing bar pivot block.
4	15H	Equalizing bar pin.
5	15E	Equalizing bar pin fork.
6	143B	Spring bracket stud.
7	143D	Support spring.
8	143E	Recoil spring.
9	142A	Spring bracket.
10	143C	Equalizing bar end pin.
11	15K	Pipe plug.
12	143A	Equalizing bar end ball.
13	142B	Spring bracket cap.
14	144C	Equalizing bar end cover.

EQUALIZING BAR

The Equalizing Bar is a steel casting 51.375 (51 3/8) inches overall. It carries a trunnion, or pivot, at the center and the Spring Brackets, at its outer ends, which are forked. It is of I-beam section, 6 inches high and 4 inches wide with wall thickness of 0.625 (5/8) inches.

It is placed transversely of the Tractor Frame and supports the front end of the Tractor Main Frame, while resting at its outer ends upon the Front Roller Frames of the running gear.

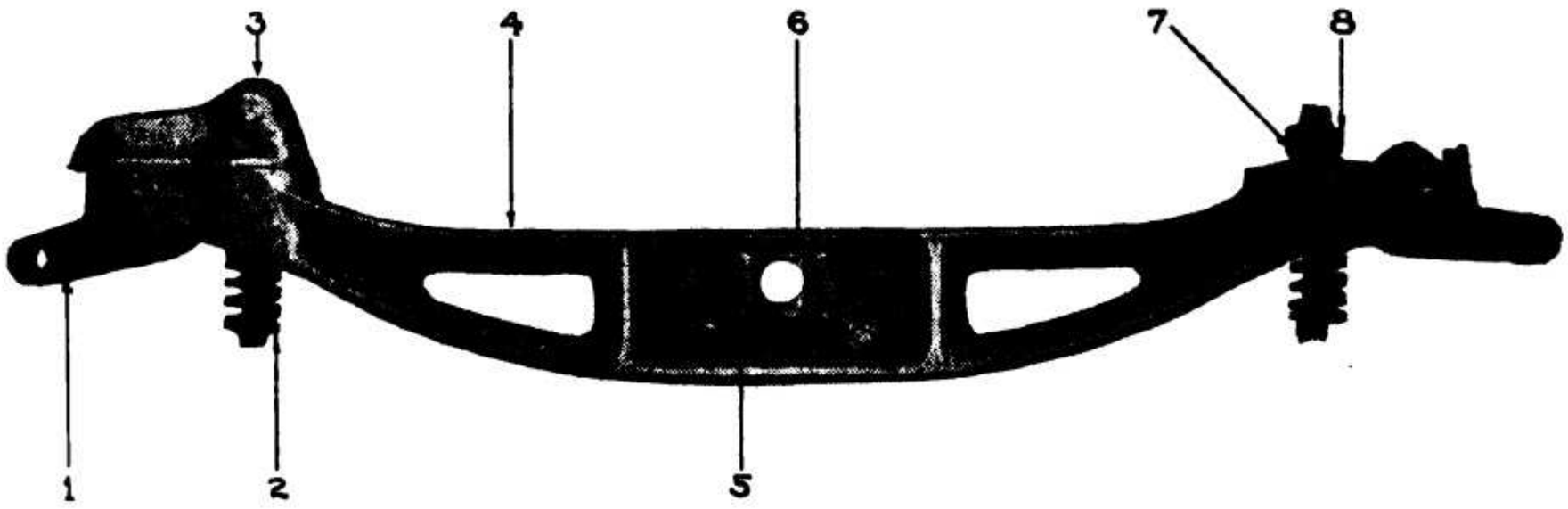


PLATE 64—EQUALIZING BAR ASSEMBLY

Ref. No.	Ord. No.	Name
1	142A	Spring bracket.
2	143D	Support spring.
3	144C	Equalizing bar end cover.
4	141A	Equalizing bar.
5	144A	Pivot block retainer.
6	144B	Equalizing bar pivot block.
7	143E	Recoil spring.
8	FF56D	Recoil spring washer.

SPRING SUSPENSION

The Equalizing Bar ends carry the Spring Brackets, which are pivoted on the outside end and carried between the two springs in the inside end. The lower spring supports the weight of the Tractor and is,

therefore, called the Support Spring. Above the Spring Bracket is placed a lighter spring called the Recoil Spring which resists any tendency to lift the Front Roller Frame in going over rough ground.

TRACK SUPPORTING ROLLERS

The Track Supporting Rollers are interchangeable both in the rear and front. The Front Track Support Rollers are part of the Front Roller Frame Assembly. The latter rollers are interchangeable, but are carried on the Front Roller Frame Assembly, having a different Roller Track Bracket.

The Track Rollers are 5 inches in diameter where they support the Track and have a 0.625 (5/8) inch flange on the outside. They are of cast iron and are machined so that they telescope in the Roller Track Bracket so as to prevent, as far as possible, any tendency of dirt, water

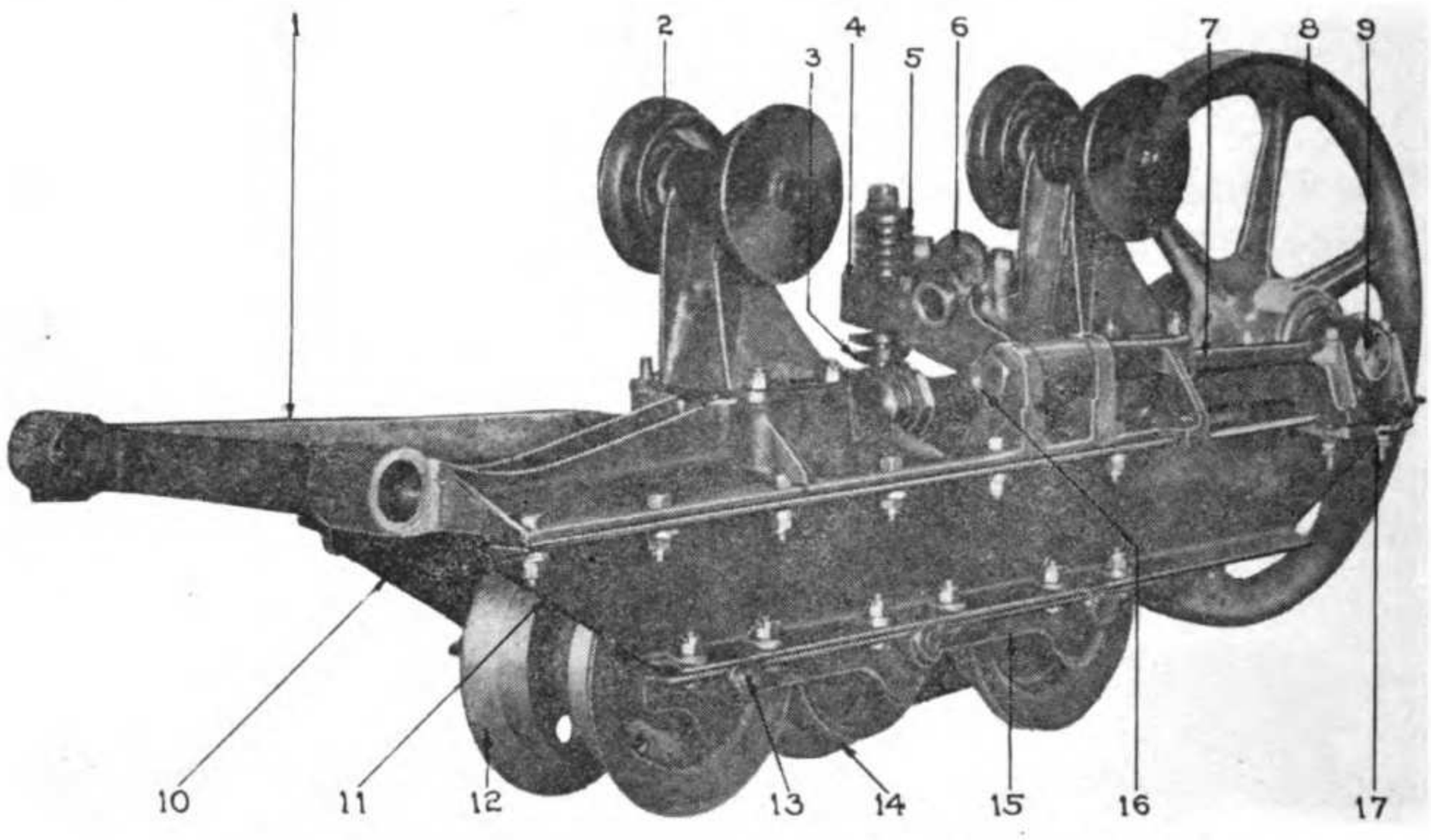


PLATE 65—FRONT ROLLER FRAME ASSEMBLY

Ref. No.	Ord. No.	Name
1	124A	Roller frame, right.
	124B	Roller frame, left.
2	13A	Track roller.
3	143D	Support spring.
4	142A	Spring bracket.
5	143E	Recoil spring.
6	142B	Spring bracket clamp.
7	134A	Blank sprocket fork.
8	128A	Blank sprocket.
9	128B	Sprocket shaft.
10	125B	Channel, front left.
11	125A	Channel, front right.
12	126C	Truck wheel.
13	126A	Truck wheel gudgeon.
14	126B	Truck wheel.
15	125E	Truck wheel gudgeon bracket.
16	133F	Spring bracket bolt.
17	128D	Sprocket fork clamp.

or mud to work into the two Hyatt roller bearings upon which the Track Roller Shaft runs.

The Track Roller Shaft is made from hardened steel, S. A. E. specification number 1035, with heat treatment H and is 1 inch in diameter by 7½ inches long. To the ends of the Track Roller Shaft are keyed with number 9 Whitney keys to each of the Track Rollers, and the whole Assembly is clamped together by means of 0.875 (7/8) inch 14 U. S. S. castellated nuts. The two Hyatt roller bearings used with the Track Support Roller Assembly are 1.5 (1½) inches long and 1.937 (1 15/16) inches in diameter.

ROLLER FRAMES

In order to allow the track to conform to inequalities in the ground the Truck Rollers are not all jointed together on a single frame, but are mounted on two frames that are comparatively independent. This design gives the necessary articulation in covering rough ground. The

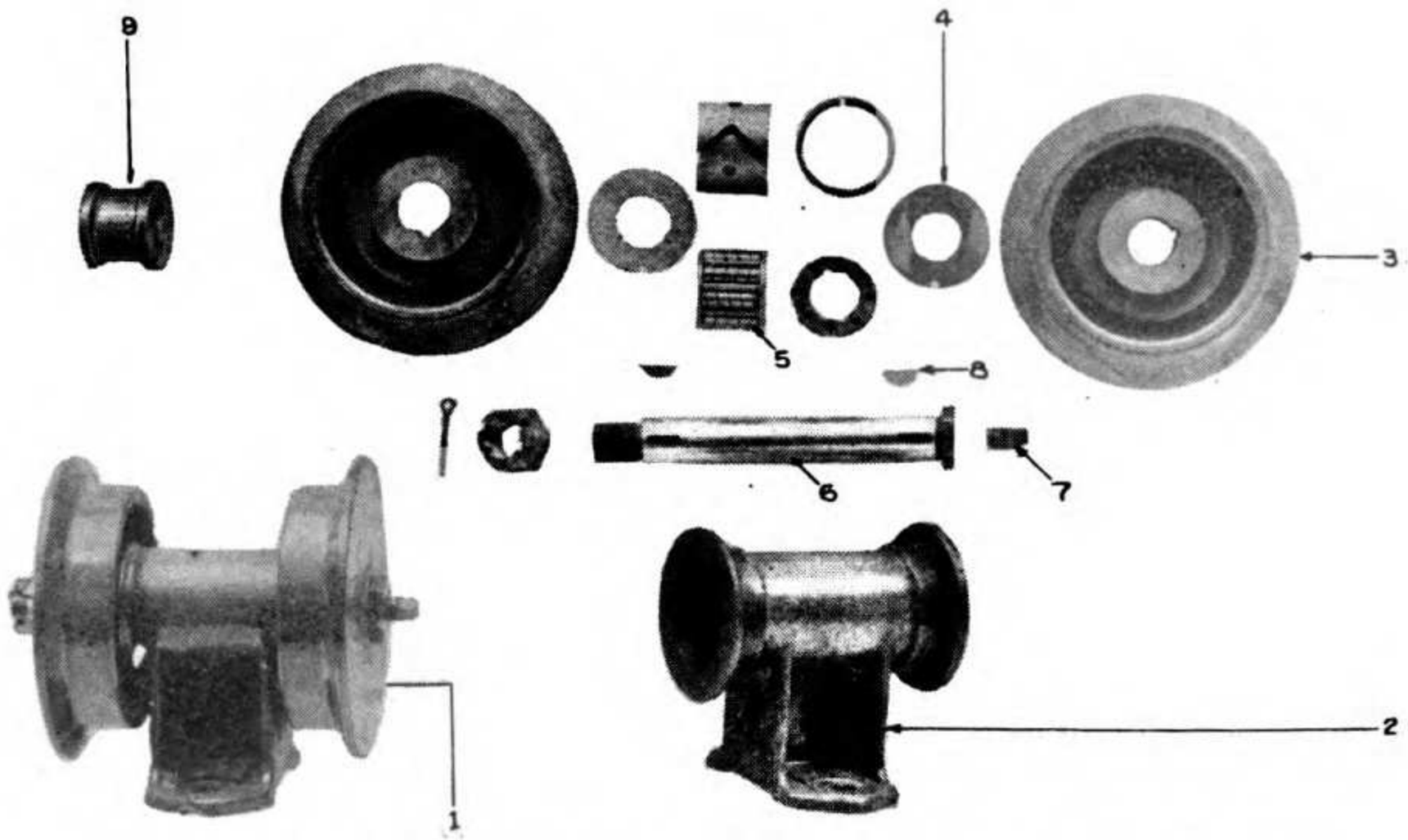


PLATE 66—TRACK SUPPORTING ROLLER AND PARTS

Ref. No.	Ord. No.	Name
1	....	Assembly.
2	12A	Roller track bracket, rear.
3	13A	Track roller.
4	12C	Track roller thrust washer.
5	13C	Track roller bearing.
6	13B	Track roller shaft.
7	13E	Pipe plug.
8	13F	Key.
9	13D	Track roller bearing spacer.

drive or thrust is transmitted from the Roller Frame to the Main Frame by means of a Spring Radius Rod located between the Front and the Rear Roller Frames. Springs are placed between the Rear Roller Frame and the Main Frame while at the front the Main Frame is supported by an Equalizer Bar placed transversely of the Main Frame to which it is pivoted at the center and the ends of which are attached

to the Right and Left Front Roller Frames. This mounting of the Main Frame gives a three-point suspension allowing both of the Tracks to follow the contour of the ground without straining the Main Frame or disaligning any of its component parts.

Thus there are four Roller Frame Assemblies, two on each side, a Front Roller Frame Assembly and Rear Roller Frame. The Roller Frames on each side are not interchangeable, and have to be carefully designated Right and Left.

FRONT ROLLER FRAME

The Front Roller Frame supports the front end of the Tractor through the medium of the Equalizer Bar which is fastened through a link to the top of the Front Roller Frame Assembly. This Roller Frame not only carries the three Truck Wheels upon which the weight of the front end of the tractor is carried but also carries two Front Roller Track Brackets that carry two Track Supporting Rollers of the same dimensions as those mounted on the Frame Bracket at the rear end of the frame. The brackets, however, are not interchangeable. The Front Roller Frame also carries the Blank Sprocket which is not rigidly fixed to the front end of the frame but is carried in a Blank Sprocket Fork which is attached to the frame and allows for the adjustment of the tension of the Track as the Track Pins and Links wear.

FRONT ROLLER FRAME CONSTRUCTION

The Front Roller Frame is made up of the Front Roller Frame, a triangular steel casting which is mounted upon two channel steel frame members, the Blank Sprocket Fork which is on top of the channels at the front end, the two Truck Wheel Gudgeon Brackets which are mounted on the bottom of the Channels and support the Gudgeon Pins upon which the Truck Rollers are carried. When the Truck Rollers which are located between the two channels are in place the Gudgeon Pins serve to tie the bottom edges of the channels together and make a rigid Front Roller Frame.

REAR ROLLER FRAME

The Rear Roller Frame is designed very much in the same manner as the Front Roller Frame except that the weight of the Tractor Frame is transmitted to the Rear Roller Frame through four springs, there being two inner and two outer springs, the pairs being concentric with one another. The Rear Roller Frame is kept from falling off or dropping too low when going over rough ground by the Link Pin which passes through the slotted end of a Link, attached to the bottom of the Main Frame Bracket.

The construction of the Rear Roller Frame is very much the same as that of the Front one. It consists of the Rear Roller Frame Casting

which is bolted to the tops of the two frame channels and the two Truck Wheel Gudgeon Brackets which are bolted to the bottom of the channels. The same Truck Wheels are used on both right and left and rear and front roller frames. The Gudgeon Brackets are also interchangeable.

The Front and Rear Roller Frames are joined together by a sort of hinge located at the rear end of the Front Roller Frame and the front end of the Rear Roller Frame. This hinge has what is called the Roller Frame Shaft, a shaft which is 1.937 (1 15/16) inches in diameter and 56.125 (56 1/8) inches long that not only holds the right Front and Rear Roller Frames together but the Left Roller Frames as well. This permits a certain articulation of the frames as they roll over rough ground but does not give too great flexibility. It also tends to keep the tracks more nearly parallel to the Drive Sprockets.

SPECIFICATIONS OF THE ROLLER FRAME PARTS

There are two kinds of Roller Truck Wheels, one with outside flanges just like the Track Supporting Rollers and one with a central flange. In the assembly of the Roller Frames there are three Truck Rollers

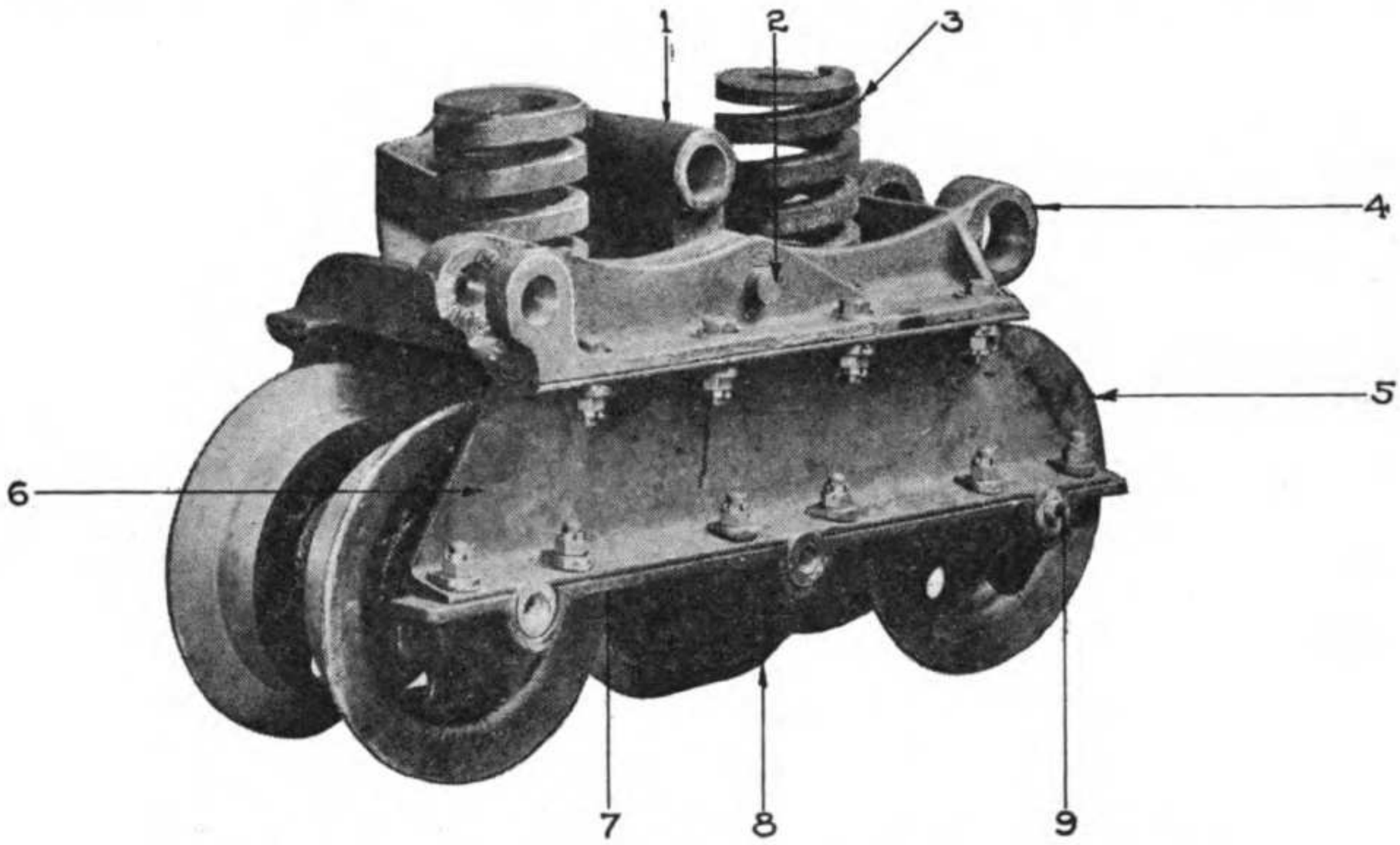


PLATE 67—REAR ROLLER FRAME ASSEMBLY

Ref. No.	Ord. No.	Name
1	11B	Roller frame sliding link.
2	11C	Sliding link pin.
3	130B	Roller frame spring, outer.
4	123A	Roller frame casting—rear right.
	123B	Roller frame casting—rear left.
	136A	To replace 123A.
	136B	To replace 123B.
5	126C	Truck wheel.
6	125C	Channel, rear right.
	125D	Channel, rear left.
7	125E	Truck wheel gudgeon bracket.
8	126B	Truck wheel.
9	126A	Truck wheel gudgeon.

used, two with outside flanges and one with inside flanges. The latter is located in the center of the Frame between the other two Rollers. The dimensions of these rollers are as follows: The diameter of the Roller Outside Flange Truck is 7.5 (7½) inches and the outside diameter over the flanges is 9.75 (9¾) inches. The over all width of this Truck Roller is 6.437 (6 7/16) inches over the flanges. The Truck Roller with the inside flanges is 7.5 (7½) inches diameter on its working surfaces and 9.25 (9¼) inches over the flange diameter. Its width is 5.125 (5⅛) inches. All the Truck Rollers are made from cast steel annealed. They are mounted upon the Hardened Gudgeon Pins which are inserted in the Hyatt Roller Bearings. The latter are 2.75 (2¾) inches outside diameter, 1.437 (1 7/16) inches inside diameter and 5 inches long. They are protected from the dirt and mud by special pressed steel and leather packing washers. The Gudgeon Pins are hollow and means of lubricating the roller bearings inside of the Truck Rollers is thus provided.

The Roller Frames are made up as mentioned above from channel steel. These are standard 6.5 pound roller channels of 5 inches height and 1.75 (1¾) inches width. The channels are not interchangeable on account of the difference in the drilling and the way in which they are cut. Hence care should be observed in ordering the repair parts and in assembling them that the proper channels are used. The Front Roller Frame channels are 50 inches long and the Rear Roller Frame channels 24.25 (24¼) inches.

The Blank Sprocket is carried on a cast steel yoke called the Blank Sprocket Fork. This is mounted upon the top of the Front Roller Frame channels to which it is clamped by four 0.624 (⅝) inch bolts. It is adjusted by a rod located between the Front Roller Frame casting and the Fork casting. This rod is threaded on the rear end and has a a square milled on its front end which engages with a square cored hole in the Blank Sprocket Fork. The square prevents it turning while the operator adjusts the position of the Blank Sprocket Fork. It is adjusted by a nut at the rear end abutting against the Front Roller Frame casting. The latter is prevented from loosening by a check nut also mounted upon the Adjusting Shaft. This adjustment is provided to take care of changes in the length of the Track due to wear. The adjusting piece is 1.5 (1½) inches in diameter and 14 inches long. It is provided with standard U. S. Threads.

The springs which are used between the Rear Roller Frame and the Main Frame Bracket are made from square spring steel. The Outer Spring is made from 0.75 (¾) inch square steel and is 5 inches long when free and has a pressure of from 1450 to 1550 pounds when compressed to 4.5 (4½) inches. It is 4 inches outside diameter. The Inner Spring is 2.25 (2¼) inches outside diameter and has a free length of

5 inches and a pressure of 1750 to 1850 pounds when compressed to 4.5 (4½) inches.

The Roller Frame Brackets are attached to the channels which form the main portion of the frame by 0.5 (½) inch bolts. The Front Roller Frame has 12 bolts and the Rear Roller Frame 8 bolts for this purpose.

The Blank Sprocket is carried upon a Hyatt Roller Bearing of the following Dimensions: outside diameter, 3.937 (3 15/16) inches; inside diameter, 1.937 (1 15/16) inches and length 6 inches.

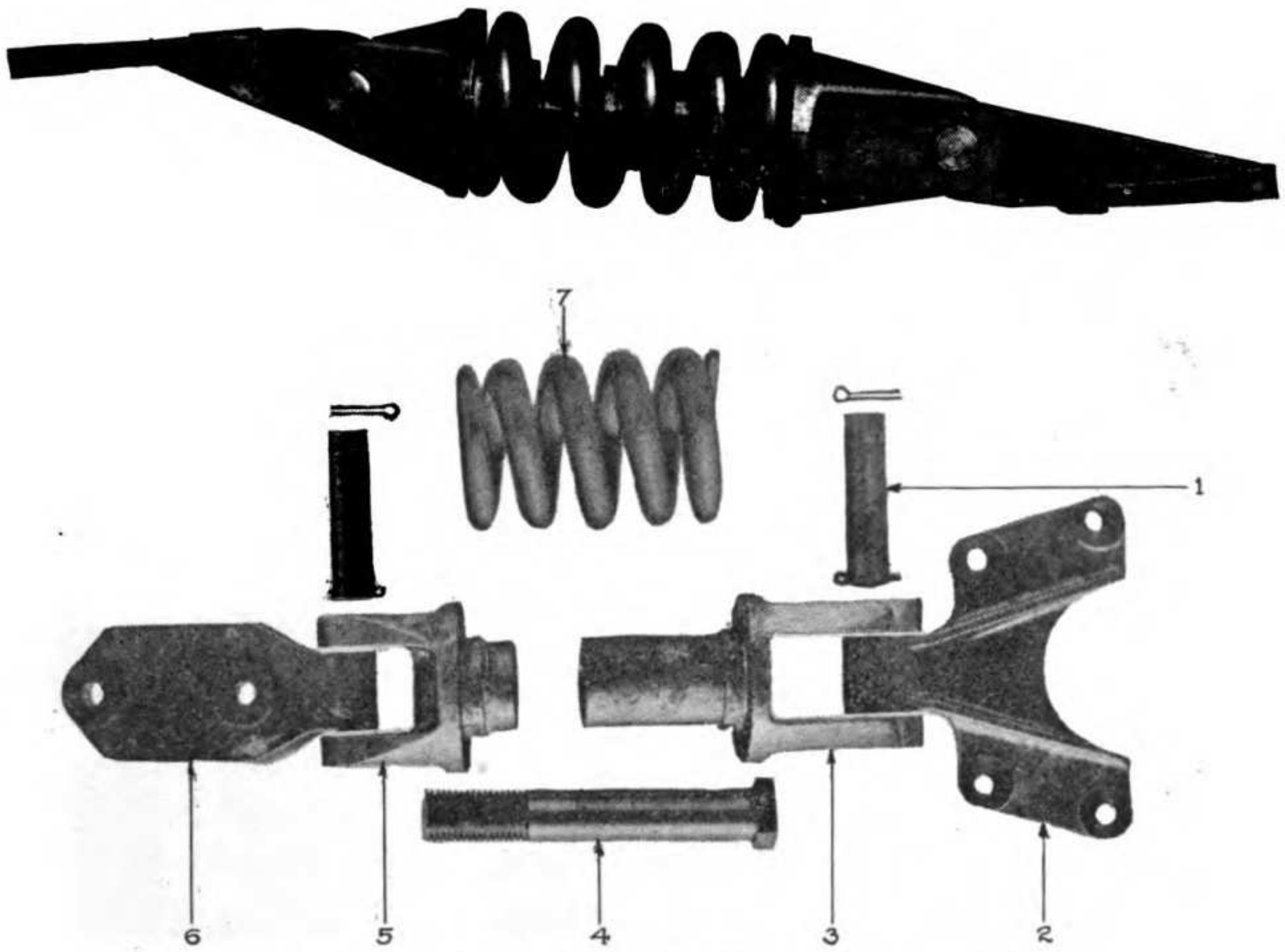


PLATE 68—SPRING RADIUS ROD PARTS

Ref. No.	Ord. No.	Name
1	138C	Radius rod hinge pin.
2	138A	Radius rod front bracket.
3	137A	Radius rod bearing.
4	137C	Radius rod bolt.
5	137B	Radius rod end cap.
6	17A	Radius rod rear bracket.
7	138D	Radius rod spring.

SPRING RADIUS ROD

After the initial production of the 5-ton Artillery Tractor the radius rod provided between the Drive Sprocket Shaft and the Rear Roller Frame was replaced by the Spring Radius Rod which is now standard construction. This radius rod is attached to the top of the Front Roller Frame Casting and to the Main Frame Bracket. It provides a flexible drive between the Truck Frames and Rollers and the Main Frame. This flexibility was necessary to prevent any damage being done to the Track if it were running in gravelly ground.

PLATE 69

TRACK PARTS

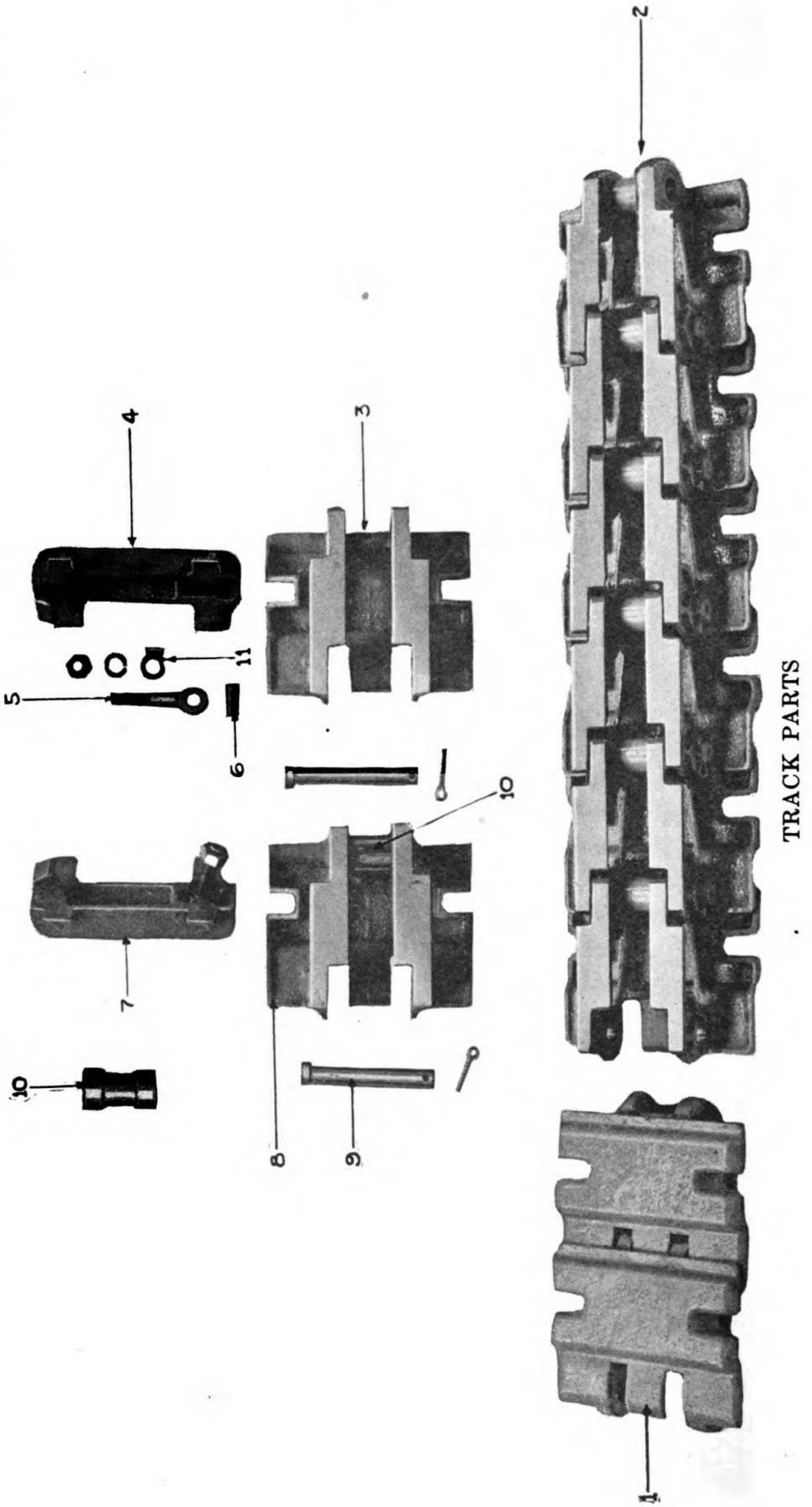


PLATE 69—TRACK PARTS

Ref. No.	Ord. No.	Name
1	. . .	Track assembly, under side.
2	. . .	Track assembly, showing roller tread.
3	150A	Track link shoe, 9-inch.
	150B	Track link shoe, 11-inch.
4	152A	Grouser, 9-inch.
	152B	Grouser, 11-inch.
5	151C	Grouser eyebolt, 9-inch.
	153A	Grouser eyebolt, 11-inch.
6	151D	Grouser pin.
7	. . .	Grouser with eyebolt assembly, 9-inch.
8	150A	Track link shoe, 9-inch.
	150B	Track link shoe, 11-inch.
9	151A	Track pin.
10	151B	Track link.
11	151E	Grouser eyebolt washer.

CHAPTER VI

TRACK ASSEMBLY

Each Track Assembly is composed of 39 Links, on each of which are Track Link Shoes. Each Track Assembly is made up of the following parts: the Track Link Shoes, which correspond to the links in a chain; the Track Link Spacer Block, which is pressed into the Track Link Shoes and with which the Tractor Drive Sprocket teeth engage; the Track Pin and the 0.312 ($\frac{5}{16}$) inch split pin, which holds the latter in place, and the Grousers, which are attached to the Track Link Shoes when it is necessary for the Tractor to secure traction on soft ground.

TRACK LINK SHOES

The Track Link Shoes are made from cast steel and are made up in two widths, 9 and 11 inches. It is very important to note, when ordering new Tractor Links or Grousers for replacement purposes, that the width of the Link or Grouser required be specified. The distance from center to center of the Track Pins, which is the circular pitch of the Track, measures 6 inches. At one end of each link the Track Link Space Block is pressed into it. These Track Link Spacing Blocks are made from steel and are 1.593 (1 19/32) inches outside diameter where the Track Drive Sprocket engages with them. The inside diameter is 1.01 (1) inch. The Track Pins pass through the Track Link Space Block and the enclosing arms of the adjacent

link, thereby tying the two together. The inner face of the Track Link Shoes is rough ground and forms a surface approximately 7.25 (7¼) inches long and 3 inches wide, upon which the Truck Wheels of the Tractor ride and upon which the Track Link Shoes are supported when passing over the Track Supporting Rollers.

TRACK PIN

The Track Pins are made from hardened and ground steel, are 0.999 (1) inch in diameter and 5.875 (5⅞) inches long overall. They are provided with a flattened off head at one end so as to prevent their rotating with respect to the Track Link Shoes. They are held in place by means of a 0.312 ($\frac{5}{16}$) inch split pin at the opposite end.

GROUSERS

The Grousers which are attached to the face of the Track Link Shoes form a projection 2.5 (2½) inches high, running the entire width of each Track Link Shoe when they are applied. They prevent slipping when climbing severe grades or when operating in very soft ground. They are held in place by a 0.625 (⅝) inch Eye-bolt Grouser pin and nut, to each Track Link Shoe. These Grousers are made from cast steel. When they are not in use, provision is made for carrying them under the driver's seat in the Superstructure of the Tractor.

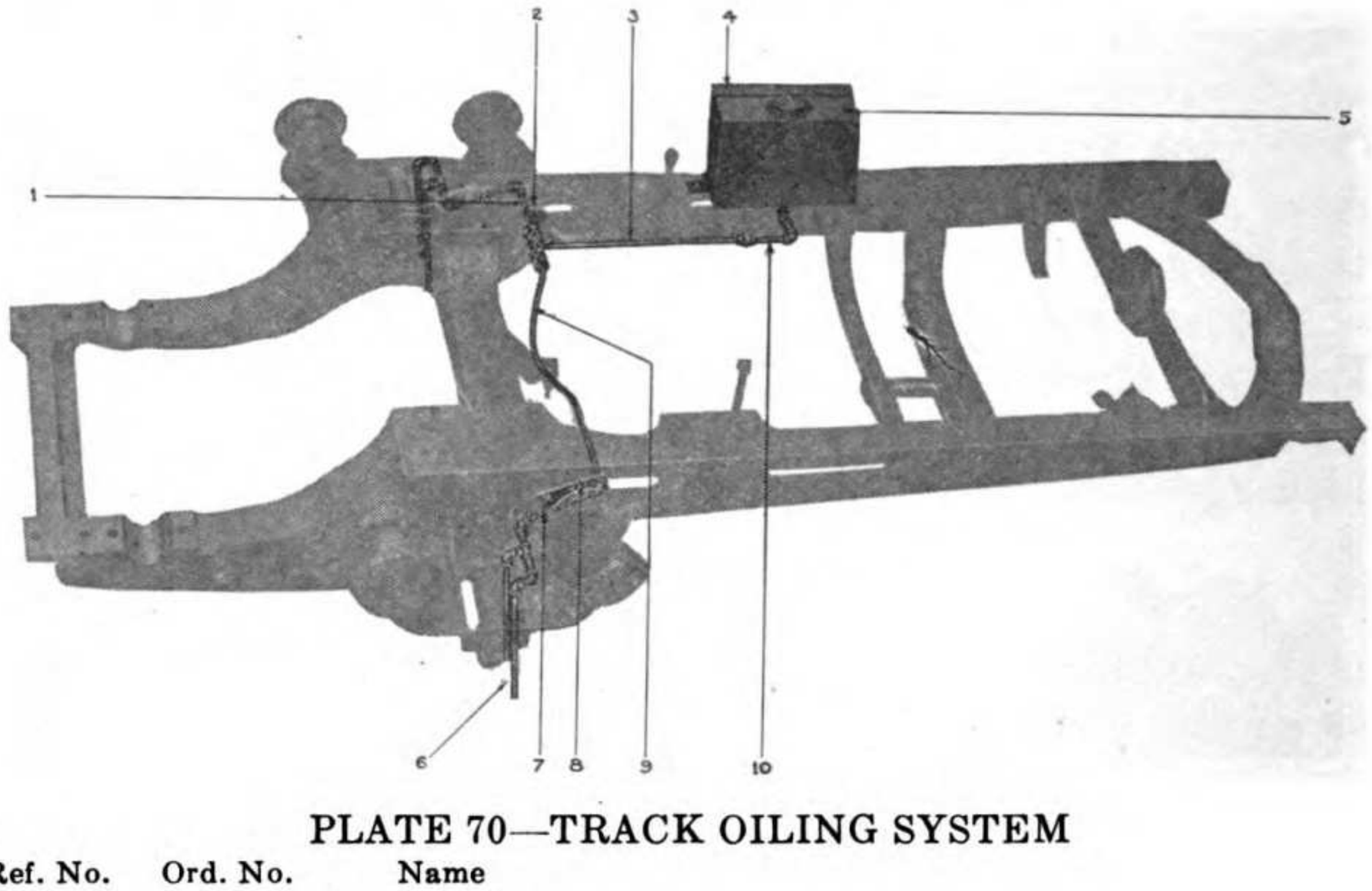


PLATE 70—TRACK OILING SYSTEM

Ref. No.	Ord. No.	Name
1	219B	Pipe nipple.
2	220E	Globe valve.
3	220D	Oil pipe.
4	218A	Track oil tank strap.
5	217A	Track oil tank.
6	220B	Oil pipe.
7	219E	Pipe nipple.
8	218C	Oil pipe hanger.
9	219C	Oil pipe.
10	219A	Pipe nipple.

TRACK OILING SYSTEM

The Track Oiling System consists of black iron pipes of suitable length attached to the Main Frame of the Tractor, two Globe Valves are located under the heel plate of the Superstructure for the purpose of regulating the amount of oil going to the Tracks, and a Track Oil Tank mounted on the left hand side of the Main Frame. Suitable pipe unions are used in this assembly so that it may be removed when necessary.

TRACK OIL TANK

The Track Oil Tank is made from galvanized iron, is 10 inches high, 12 inches long and 5 inches wide. It contains full 3.25 U. S. gallons.

OIL PIPES

The Track Oil Piping is of 0.375 (3/8) inch standard black pipe. The two Globe Valves are standard 0.375 (3/8) inch size and have brass bodies. The track oil is brought down to a tee located between the two Globe Valves. Each Globe Valve controls the pipe to one of the Tracks so that either or both of the Tracks may be lubricated at will.

CHAPTER VII

CONTROLLING SYSTEM

STEERING CLUTCHES AND OPERATION

See Plate 3

Since the Tractor is not provided with any guiding wheels, other means have been provided to direct it. These are the Steering Clutches. They are mounted upon the ends of the Steering Clutch Shaft and outside of the Transmission Unit although assembled as a part of the latter. Up to the Steering Clutch Shaft the power of the engine is transmitted equally to both tracks but back of this the drive may be connected or disconnected at the will of the driver. This is accomplished by turning the steering gear which operates the Steering Clutches mounted upon the ends of the Steering Clutch Shaft. The Steering Clutches are normally engaged so that when the tractor is traveling straight ahead or back the power is equally divided between the two Tracks. To change the direction of the Tractor the Steering Clutch on the side towards which the Tractor is to be turned is disengaged by moving the Steering Gear. The Power being transmitted to the Track on the opposite side causes the tractor to turn about the non-driven Track. To increase the speed of turning a brake is applied to the outside of the Steering Clutch Housing on the side which is not being driven, thus causing the Tractor to pivot about the Track which is thus stopped. The independent application of each brake is obtained by the use of brake pedals while the application of both brakes, simultaneously, is accomplished by means of a hand operated brake lever. The latter has a ratchet to hold the Tractor when on a grade.

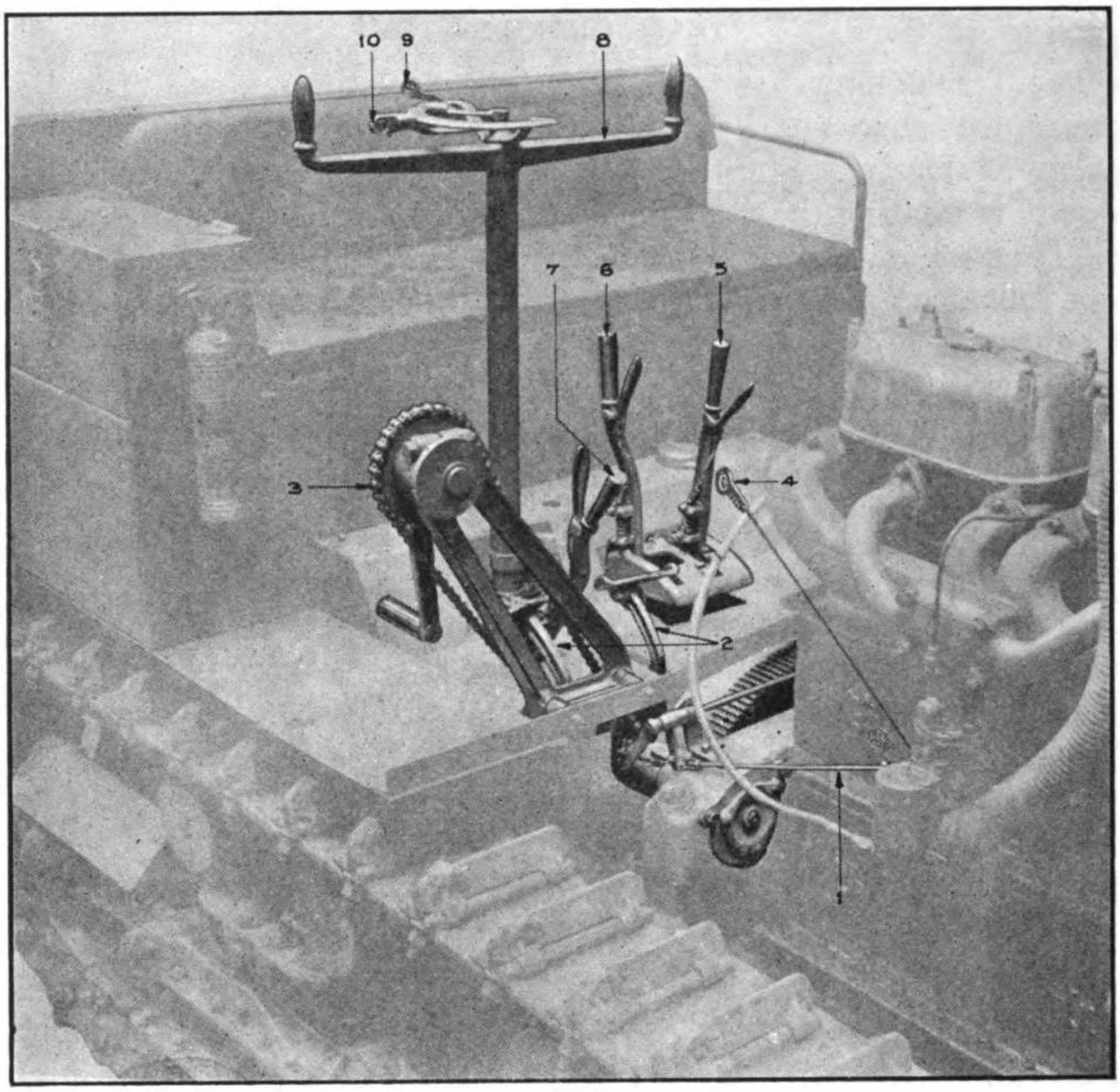


PLATE 71—5-TON ARTILLERY TRACTOR CONTROLS

Ref. No.	Ord. No.	Name
1	403F	Carbureter control rod, front.
2	67B	Brake foot pedals, right.
	67A	Brake foot pedals, left.
3	184F	Hand starter.
4	409E	Carbureter choke handle.
5	63A	Gear shift hand lever.
6	62C	Master clutch hand lever.
7	62A	Brake hand lever.
8	70A	Steering clutch hand lever.
9	70C	Spark control hand lever.
10	70B	Throttle control hand lever.

THE CONTROLS

The control of the 5-Ton Artillery Tractor is unlike that of the military trucks, in that there are no pedals provided to operate the Clutch. The Controls consist of the Steering Gear and the two Brake-Pedals which operate brakes on the outside of the Steering Clutches for the purpose of guiding the Tractor. There are also provided the Master Clutch Lever, by means of which the Master Clutch is positively engaged or disengaged; the Change Speed Lever, by which any of

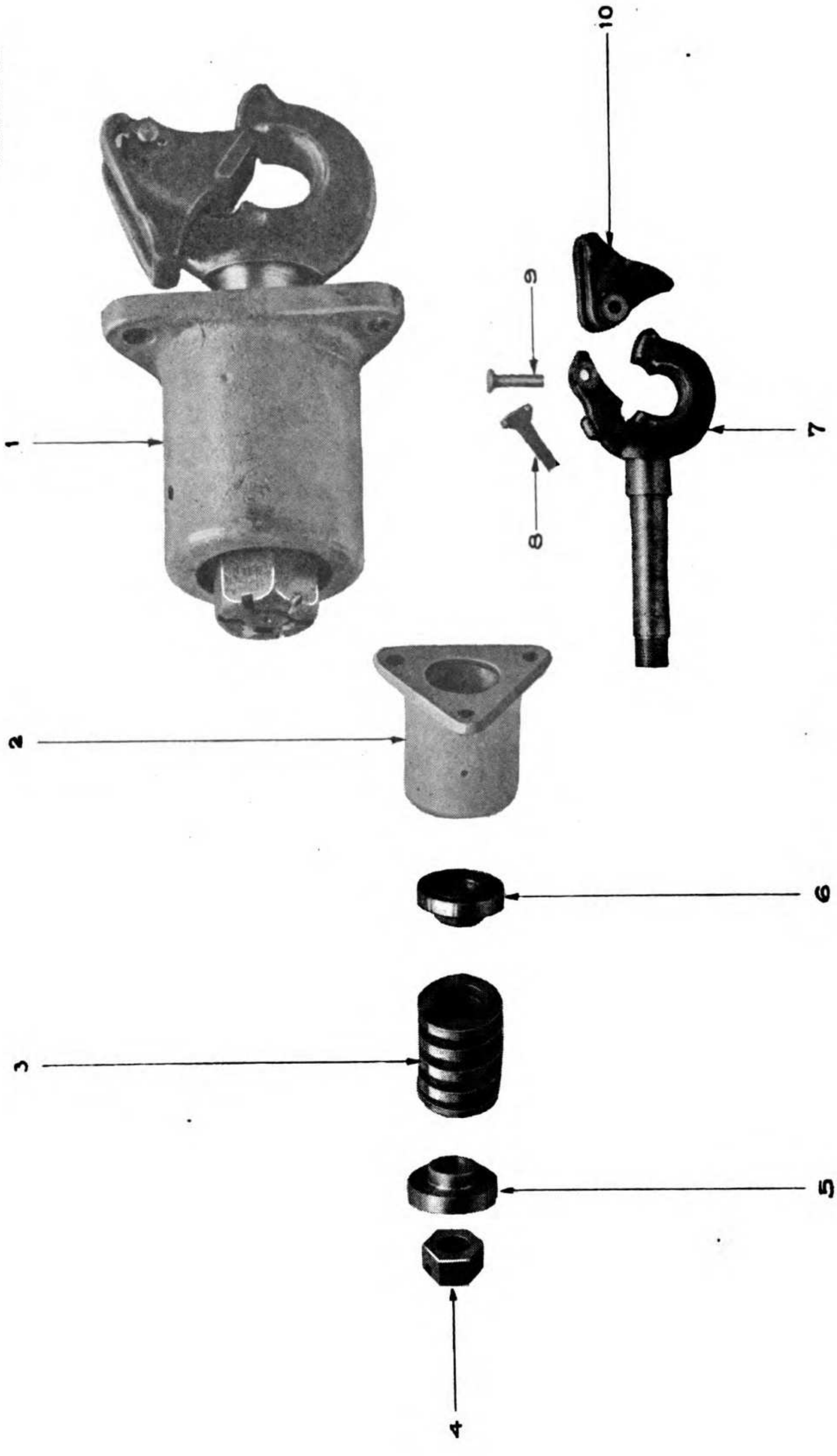
the four gear ratios may be obtained, and the Brake Lever that applies both of the Steering Clutch Brakes when it is desired to hold the tractor.

The Steering Gear is in the form of a two armed lever attached to the Steering Tube Lever that connects with the Steering Control Drag Link, the latter running fore and aft of the Tractor. This in turn operates a Bell Crank located on the back end of the Transmission Unit and through the same operates either one of the two Clutch Brake Rods that are attached to their respective Steering Clutch Yokes. These are hardly Clutch Brake Rods since they operate the Clutch and not the Brake, but since they are interchangeable with the Clutch Brake Rods found on the sides of the Transmission they carry this nomenclature. As will be noticed, the Steering Control Push Rod Ends to which the Clutch Brake Rods on top of the Transmission Case are attached, have no connection. Hence when either one of the Steering Clutches is being operated, the other remains unaffected.

Spark and Throttle Levers are mounted upon the stationary quadrant above the Steering Gear.

The Master Clutch Hand Lever is provided with a Lever Catch and Hand Lever Plunger, which locks the Clutch in engagement or releases it. A similar latch is provided on the Hand Brake Lever and on the Gear Shift Hand Lever. Hence all levers are locked in place at their proper positions. When the Hand Brake Lever is operated, it applies the Brakes to both of the Steering Clutch Housings and thereby positively holds the Tractor stationary in whatever position it may be. A Ratchet is provided for the Hand Brake Lever so that it may be latched tight whether the Brakes are new or old.

PLATE 72



FRONT PINTLE ASSEMBLY AND PARTS

PLATE 72—FRONT PINTLE AND PARTS

Ref. No.	Ord. No.	Name
1		Front pintle assembly.
2	171A	Pintle housing.
3	FF37C	Pintle spring.
4		Pintle nut.
5-6	FF37B	Pintle guide rings.
7	FF37	Pintle
8	AB19C	Pintle latch spring.
9	AB19D	Pintle latch pin.
10	AB19B1	Pintle latch.

CHAPTER VIII

PINTLE ASSEMBLIES

CHAPTER CONTENTS

PINTLE ASSEMBLIES

Two Pintle Assemblies are used on every Five-ton Artillery Tractor Model 1917. These have standard Ordnance Pintle dimensions. Two Pintles are used on the Tractor. The Pintle Pin construction is uniform in size and design but the Front and Rear Pintle Housings differ from each other.

FRONT PINTLE

The Front Pintle is supported upon the front end of the Main Frame. It is mounted on the back of the front cross member and projects through a hole in the same. The Front Pintle Housing is held in place by three 0.875 (7/8) inch bolts.

The Front and Rear Pintle Springs and Front and Rear Pintle Guide Rings are interchangeable.

PLATE 72

REAR PINTLE AND PARTS

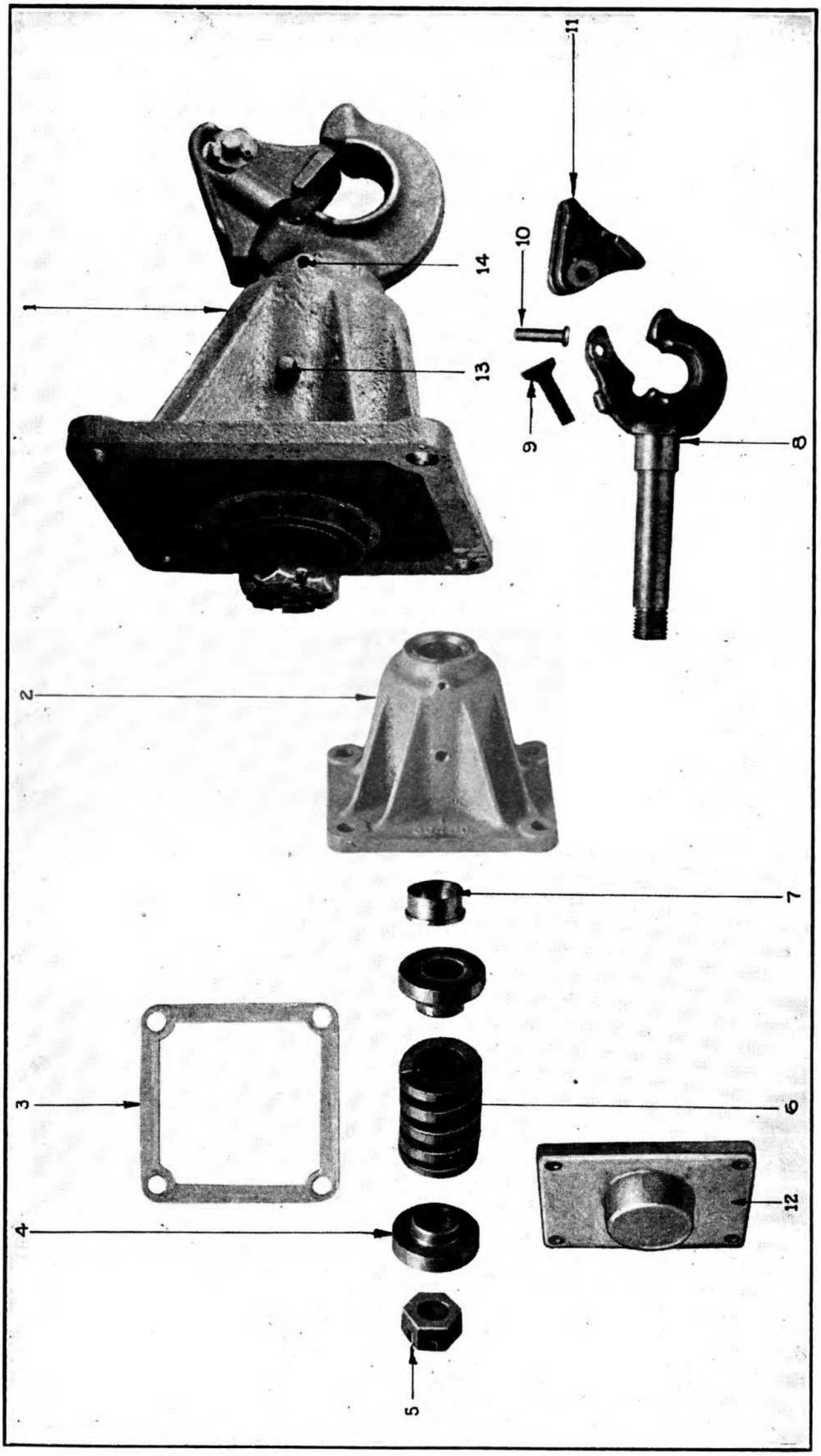


PLATE 72—REAR PINTLE AND PARTS

Ref No.	Ord. No.	Name
1	...	Pintle assembly.
2	176A	Rear pintle housing.
3	176C	Pintle plate gasket.
4	FF37B	Pintle guide ring.
5	...	Crown nut, 1¼-inch.
6	FF37C	Pintle spring.
7	176D	Rear pintle housing bushing.
8	FF37	Pintle.
9	AB19C	Pintle latch spring.
10	AB19D	Pintle latch pin.
11	AB19B1	Pintle latch.

REAR PINTLE ASSEMBLY

In addition to having different Pintle Housings, the Rear Pintle Assembly also has a special Pintle Housing Bushing and what is called a Pintle Plate. The latter is bolted between the Transmission Unit, to which the Rear Pintle is attached, and the Rear Pintle Housing by four 0.875 (⅜) inch studs and nuts.

TOWING ATTACHMENTS

Ordnance Pintles are supplied at either end of the Tractor to which the Lunettes of Ordnance Carriages may be fastened. The Front Pintle is attached to the Main Frame and the Rear to the Transmission Unit. In addition there are Towing Hooks attached to the rear end of the Main frame to which Carriages not provided with Lunettes may be fastened.

CHAPTER IX.

SUPERSTRUCTURE

CHAPTER CONTENTS

SUPERSTRUCTURE

The superstructure consists of two units, the Seat Assembly and the Armor. The latter is over the engine and is provided with two doors in the top through which the gasoline tank and radiator may be filled,

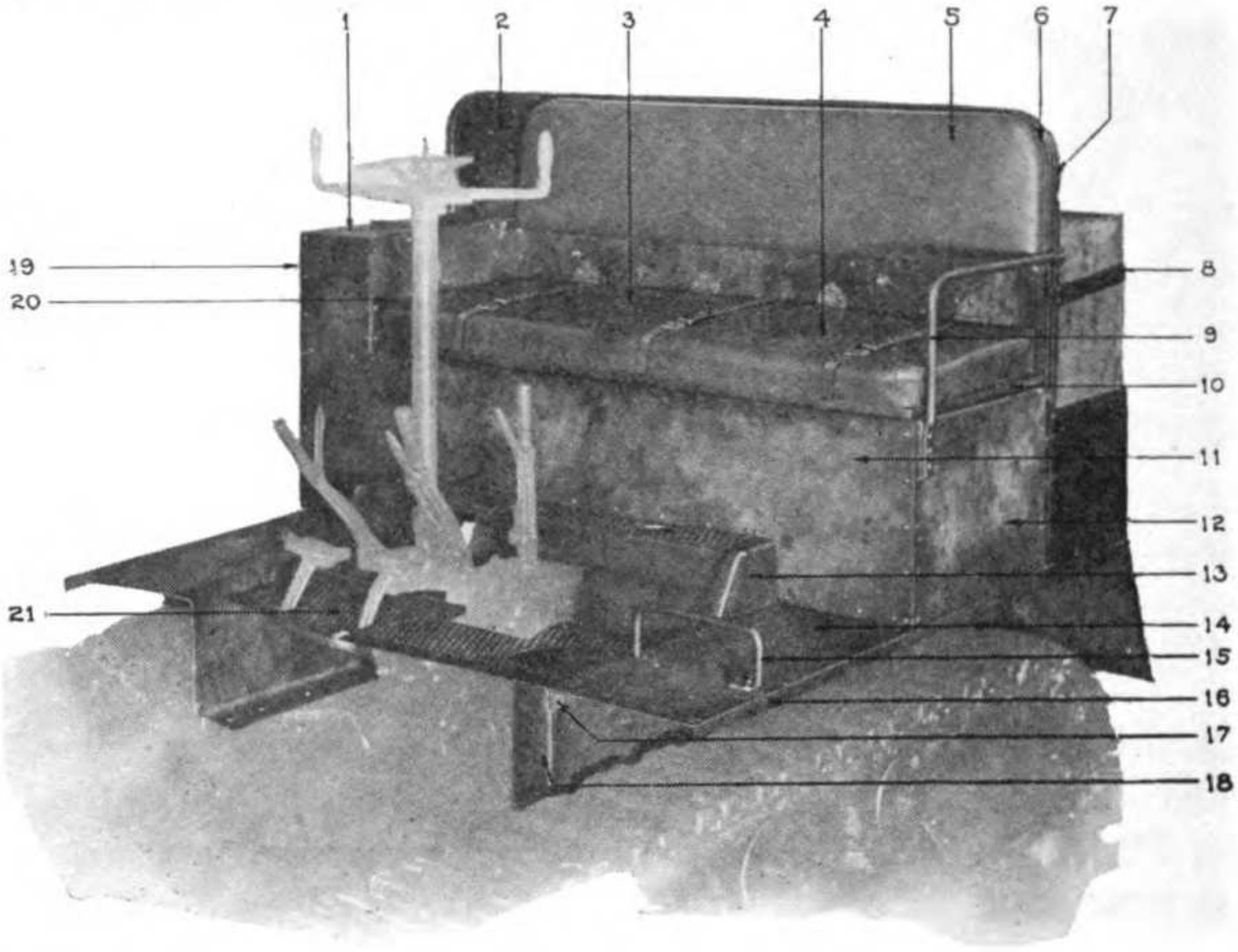


PLATE 74—SUPERSTRUCTURE AND PARTS

Ref. No.	Ord. No.	Name
1	234C	Tool box cover.
2	228A	Seat plate, back.
3	235L	Cushion spring.
4	235B	Hair felt.
5	236H	Lazy back form.
6	233A	Seat back rail, front.
7	232A	Seat back rail, rear.
8	233B	Gasoline tank strap.
9	231A	Arm rest.
10	235A	Seat.
11	227A	Seat plate, front.
12	227B	Seat and tool box side plate, left.
13	193A	Platform, rear plate.
14	191A	Fender toe plate, left.
15	194C	Fender toe grip.
16	194B	Fender support, right.
17	191D	Fender angle, left.
18	190B	Fender splash plate, L. H.
19	227C	Seat and tool box side plate, right.
20	234B	Tool box side, right.
21	193C	Platform, front plate.

also in both sides through which the engine may be reached, while in front there are three doors, a large one and two small ones, which are closed to protect the radiator when in action but are locked back when the Tractor is not in an exposed position. The Seat and Fenders are combined in a sort of body. The seat is hinged to give access to the box below in which the Grousers and Water Bucket and Special Wrenches are placed. There is also a tool box on the right-hand side of the seat in which special tools are carried and another back of the seat in which the standard tools are placed. At the rear of the seat are also located the two Main Gasoline Tanks which have a capacity of 24 U. S. Gallons.

ARMOR PLATE

The Armor Plate on the 5-Ton Artillery Tractor Model 1917 is mounted directly upon the Main Frame of the Tractor and secured to it by means of eight 0.625 (5/8) inch studs and nuts. The Armor entirely surrounds the Engine and Radiator, protecting the same from flying shrapnel and bullets. It is made from 0.25 (1/4) inch armor plate and is designed to stand a bullet having a muzzle velocity of 2700 yards at 20 yards distance.

ARMOR CONSTRUCTION

The Armor Plate is made up in flat pieces cut to the proper shape to form the various doors and sides of the Armor surrounding the Engine and joined together by means of angle irons of the proper shape and size. Two doors, both of which are interchangeable and providing 8 inch square openings, are located on the top of the Armor. One of these is at the front and provides access to the Radiator Filler Cap. The other at the rear left hand side of the top Armor Plate gives access to the Auxiliary Fuel Tank Filler Opening. On either side of the Armor there are double doors, the Upper one of which is hinged at the top, the Lower one hinged to the bottom. The Upper and Lower doors on the same side are not interchangeable, but both Lower doors are. At the rear of the Armor there is a dash board also of Armor Plate, on which there is an 8 by 9.5 (9½) inch opening closed like the opening in the top of the Armor by a steel door hinged at the bottom. Through this door the Magneto Switch, Oil Gauge and Three-way Valve may be reached. The opening between the Toe Boards on the Platform and Fender and the Dash Board on the Dash Armor is closed by a hinged Toe Board attached to the bottom half of the latter.

At the front end of the Tractor, doors are provided to allow the free circulation of air through the Radiator when the Tractor is not operating in a danger zone. When it is, these doors are closed and provision is made to allow a free circulation of air through the Radiator without exposing it to damage from the shrapnel or bullets.

DOOR SHIELD

The Door Shield, as the Armor Plate in front of the Radiator is called, is hinged at the top and overlaps the two Front Doors, which are hinged at the outer side. A space of 2 inches is allowed between the two front doors and the Door Shield, which folds down over them, thus permitting a fairly free circulation of air into the front end of the Armor and thence through the Radiator without exposing the Radiator to direct fire.

BAFFLE PLATES

Two Baffle Plates are located beneath the Door Shield to protect the lower portion of the Radiator and to permit a free circulation of air into the lower front end of the Armor.

COMPONENT PARTS OF ARMOR

There are eight doors, three plates on each side of the Armor, a large Top Plate, the Dash Board Plate, two Baffle Plates and three Front Plates on the forward end of the Armor. In addition there is a light plate hinged to the bottom end of the Dash Board which forms the Toe Board. The doors on the sides are carried upon three hinges each, the Door Shield, the two Front Doors, the two Top Doors, the Dash Board Door and the Toe Boards are supported by two hinges each. A Filler Plate is provided over the joint between each of the side doors to prevent lead spattering into the Engine should a bullet strike near the joint between them. All of the other doors overlap the Armor Plate, thus providing the same protection.

EQUIPMENT CARRIED ON ARMOR

The Equipment carried on the Armor consists of the two oil Lamps and their Brackets located on each side; two Hatchets and a Name Plate mounted on the Dash Board; a Shovel and a Pickaxe located on the top Armor Plate and a Bracket for a Searchlight.

Provision is made for supporting the doors when lowered or raised by latches or similar devices. The lower Side Doors are supported by brackets mounted on the side of the Armor Plate when in this position. The entire Armor Plate is bolted together with 0.375 (3/8) by 1 inch bolts so that any injured section may be readily replaced and the entire Armor disassembled or assembled for shipment to or from the Field.

CHAPTER X

EQUIPMENT

EQUIPMENT FOR 5-TON ARTILLERY TRACTOR, MODEL 1917

Drawing	Piece Mark	Item	No. Per Tractor
31-35-1		Armor, inclosing engine, radiator and fuel tank, complete set	1
15-5-51	U51D1	Axe	1
15-5-50		Buckets, canvas, water	2
Holt No.	60808	**Bracket for steering clutch spring tool	1
76-15-75		Box, Motor Vehicle Tool, model, 1918	1
		Book, ordnance handbook on artillery tractor, 5-ton	1
14-4-17		*Batteries, extra, for flashlight, tungsten, American Eveready Co. No. 793	2
		*Bulb, extra for flashlight, Mazda, American Eveready Co., No. 1197	1
		*Breaker assembly, magneto	1
15-21-8	MC8B1	Can, safety, 1 gallon	1
15-21-12		*Chain, towing, 15 feet long	1
		*Chisel, cold, ½″ x 6″	1
15-5-127	U127B	*Chisel, cold, ¾″ x 8″	1
		*Chisel, cold, ⅜″ x 6″	1
		*Chisel, cold, ⅜″ x 6″, diamond point	1
38-9-17		*Cover, canvas, for ordnance hand books	1
		*Drift, copper, ⅜″ x 4″	1
		*Drift, copper, ⅝″ x 6″	1
15-5-111	U111G	*Drift, solid, 3/16″ point, 5.6″ long	1
15-21-8	MC8A1	Extinguisher, fire, Pyrene, quart size, filled, complete including bracket	1
		*File, flat bastard, double cut, 10″ long	1
		*File, half round bastard, 10″ long	1
		*File, square bastard, 5/16″ double cut, 10″ long	1
		*File, ⅜″ round bastard, 10″ long	1
15-5-174	C	*File, three cornered, ⅝″ taper, single cut, second cut	1
		*Files, magneto, "Disston's"	2
14-4-17		*Flashlight, American Eveready, No. 1991 without rubber hood	1
		*Gauge, thickness or feeler, Starrett No. 72	1
15-5-404		*Gun, grease and oil, with two nozzles	1
		*Gaskets, spark plug	12
15-5-51	U51B1	Hatchet	2
		*Hammer, ball pein, 12 ounce, standard handle	1
		*Hammer, ball pein, 24 ounce, standard handle, "Maydole" or equal	1
15-5-180	U180C	*Hammer, soft babbitt	1
Holt No.	60828	Handle, ratchet socket wrench, "Mossberg"	1
Holt No.	60829	Handle, offset socket wrench, "Mossberg"	1
		*Jack screw "Vulcan," size 1¼″ x 10″, 10 ton capacity with bar	1
Holt No.	60830	Joint, universal, "Mossberg"	1
15-5-8		Lantern, complete	1
15-21-10	MC10A	Lamp, side, right	1
15-21-10	MC10B	Lamp, side, left	1

*Carried in Motor Vehicle Tool box.
**One furnished with every 10 tractors.

EQUIPMENT FOR 5-TON ARTILLERY TRACTOR, MODEL 1917 (cont'd)

Drawing	Piece Mark	Item	No. Per Tractor
15-21-15	MC15B	Lamp, tail	1
15-5-51	U52C2	Mattock, pick	1
15-5-46	U46J	*Oilers, dome type	2
		Oil, medium, gasoline engine, gallon	1
		*Puller and spreader, cotter pin, 3/8" x 6 1/2" long. "Bay State"	1
Holt No. 60811		**Pin for socket wrench	1
		*Pins, cotter, box of assorted	1
		*Pliers, pair of 8" combination gas	1
		*Pliers, pair of 6" round nose	1
15-5-234		*Pliers, pair of 8" side cutting	1
15-5-384		*Pinch-bar, 27" long	1
		*Punch, center, 4 1/2" long, "Bay State"	1
		*Plugs, spark	4
15-5-106	U106A-C	Pads, lantern bracket, complete	2
38-7-16		Paulin, 12 feet x 12 feet	1
		*Rule, folding steel, 12" long, "Starrett" No. 450 M. & E	1
15-21-7		Straps, 12" long, style AV, 7 holes (Axe Handle, 1) (Hatchet handle 1)	3
15-21-7		Strap, 22.75" long, style AV, 7 holes (for water bucket)	1
15-5-8	U8D	Straps, lantern	2
15-21-7		Strap, 15" long, style AV, 7 holes (short handled shovel)	1
15-21-7		Strap, 15" long, style AVS, 7 holes (for pick mattock)	1
15-21-7		Strap, cushion, 52" long, style DV, 10 holes	3
15-5-51	U51C	Shovel, short handled	1
Holt No. 60809		**Screw for steering clutch spring tool	1
Holt No. 60810		**Socket for steering clutch spring tool	1
Holt No. 60832		Socket, square, "Mossberg"	1
Holt No. 60834		Socket, hexagonal "Mossberg"	1
Holt No. 60835		Socket, hexagonal "Mossberg"	1
Holt No. 60836		Socket, hexagonal "Mossberg"	1
Holt No. 60837		Socket, hexagonal "Mossberg"	1
Holt No. 60838		Socket, hexagonal "Mossberg"	1
		*Shackles, standard, round pin, drop froged steel, Anchor style, size 5/8"	2
		*Scrapers, set of 3, carbon	1
15-5-100	U100E	*Screw driver	1
		*Screw driver, all steel, 9" long, "Channon"	1
		*Screw driver, offset, 6" long, straight handle, "Channon"	1
15-5-53	U53A,B	*Sledge, model 1907	1
		*Tape, friction, 3/4", 1/2 lb. rolls	2
Holt No. 60831		Tube, long extension, "Mossberg"	1
		*Wrench, monkey, 6" long, steel handle, "Trimo"	1
		*Wrench, monkey, 15" long, steel handle, "Trimo"	1
		*Wrench, pipe, 6" long, steel handle, "Trimo"	1
		*Wrench, pipe, 10" long, steel handle, "Trimo"	1
		*Wrench, adjustable "S," 6" Wescott pattern	1
		*Wrench, adjustable "S," 10" Wescott pattern	1
		*Wrench, spark plug	1
		*Wrench, magneto	1
		*Wrench, double end, 5/16" and 3/8" milled openings, Williams' No. 721, semi-finished	1

*Carried in Motor Vehicle Tool Box.
**One furnished with every 10 tractors.

EQUIPMENT FOR 5-TON ARTILLERY TRACTOR, MODEL 1917 (cont'd)

Drawing	Piece Mark	Item	No. Per Tractor
		*Wrenches, double end, $\frac{13}{32}$" and $\frac{1}{2}$" milled openings, Williams' No. 23 semi-finished	2
		*Wrenches, double end, $\frac{7}{16}$" and $\frac{9}{16}$" milled openings, Williams' No. 725 A., semi-finished	2
		*Wrenches, double end, $\frac{19}{32}$" and $\frac{11}{16}$" milled openings, Williams' No. 27, semi-finished	2
		*Wrench, double end $\frac{5}{8}$" and $\frac{3}{4}$" milled openings, Williams' No. 729, semi-finished	1
		*Wrench, double end $\frac{13}{16}$" and $\frac{7}{8}$" milled openings, Williams' No. 731B, semi-finished	1
		*Wrench, double end $\frac{25}{32}$" and $\frac{31}{32}$" milled openings, Williams' No. 32, semi-finished	1
		*Wrench, double end $\frac{15}{16}$" and 1" milled openings, Williams' No. 33C, semi-finished	1
		*Wrench, double end $1\frac{1}{8}$" and $1\frac{1}{4}$" milled openings, Williams' No. 737, semi-finished	1
		*Wrench, double end $1\frac{1}{16}$" and $1\frac{7}{16}$" milled openings, Williams' No. 38, semi-finished	1
Holt No. 60812		**Wrench, Spanner	1
Holt No. 60813		**Wrench, Spanner	1
Holt No. 60814		**Wrench, socket	1
Holt No. 60815		Wrench for cylinder head stud nut	1
Holt No. 60816		Wrench, spanner	1
Holt No. 60818		Wrench for cylinder base stud nut	1
Holt No. 60820		**Wrench, socket	1
Holt No. 60822		Wrench for thrust rod nut	1
		*Washers, lock, S. A. E. heavy:	
		$\frac{1}{4}$", $\frac{5}{64}$" x $\frac{5}{64}$" Stock	10
		$\frac{5}{16}$", $\frac{1}{8}$" x $\frac{1}{8}$" Stock	10
		$\frac{3}{8}$", $\frac{1}{8}$" x $\frac{1}{8}$" Stock	10
		$\frac{7}{16}$", $\frac{1}{8}$" x $\frac{1}{8}$" Stock	10
		$\frac{1}{2}$", $\frac{1}{8}$" x $\frac{1}{8}$" Stock	10
		$\frac{9}{16}$", $\frac{1}{8}$" x $\frac{1}{8}$" Stock	10
		$\frac{5}{8}$", $\frac{1}{8}$" x $\frac{1}{8}$" Stock	10
		*Waste, white cotton, pound	1
		*Wire, copper, No. 16, B. & S., spool	1
		*Wire, soft steel, No. 16, B. & S., spool	1

*Carried in Motor Vehicle Tool Box.
**One furnished with every 10 tractors.

CHAPTER XI

NOMENCLATURE

5-TON ARTILLERY TRACTOR, MODEL 1917

The Nomenclature of Parts is arranged in the following order: Engine Group, Master Clutch, Transmission System. Supporting Assemblies, Track Assemblies, Pintle Assemblies, and Superstructure.

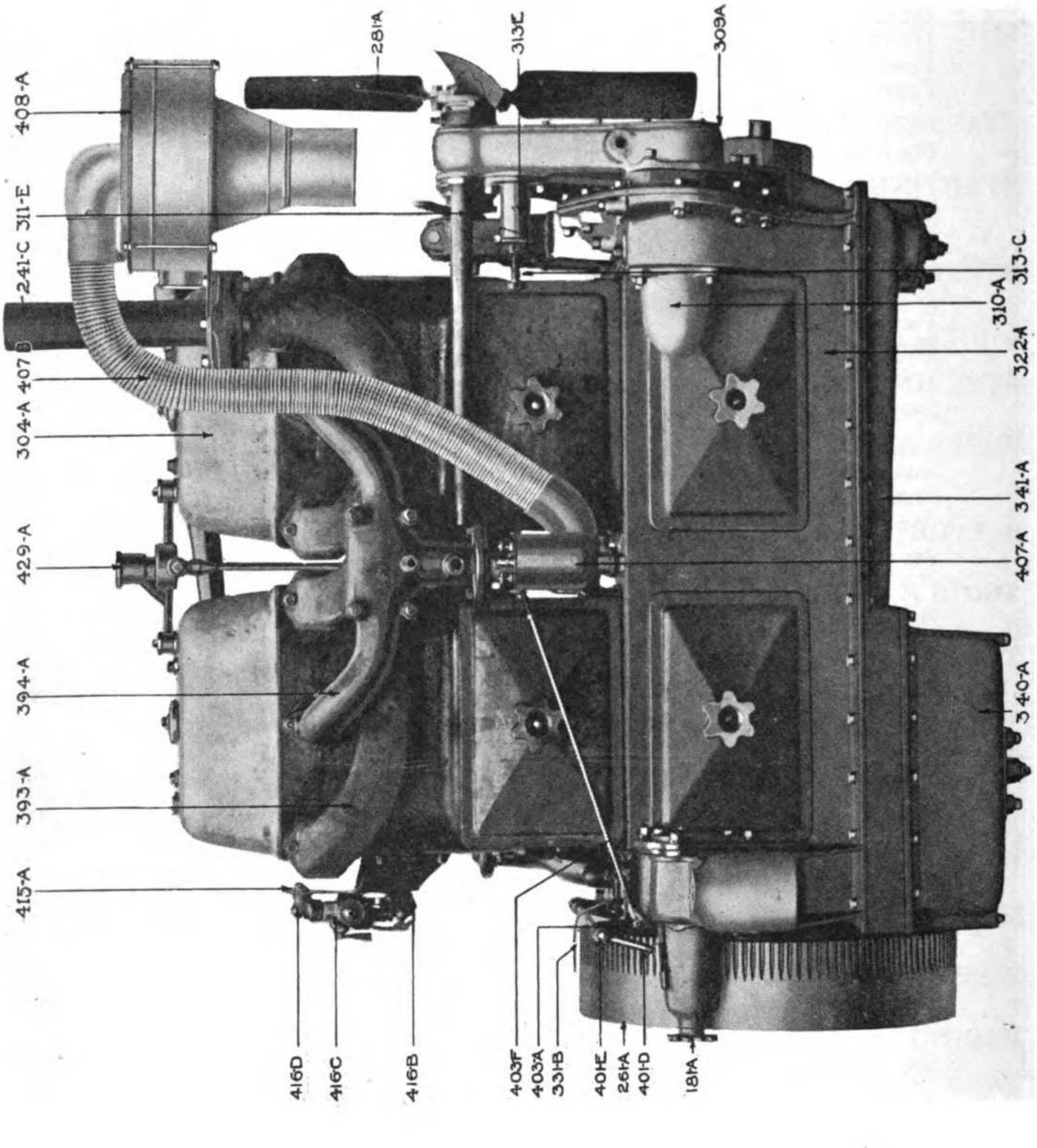
The entire Equipment List is given in Chapter X and is not repeated in this chapter.

The Property Classification of all parts included in the Nomenclature, that is in Chapter XI is CLASS IV—DIVISION 10.

For easier reference the following index to the Nomenclature of Parts is given.

NOMENCLATURE INDEX

PLATE 75



RIGHT SIDE VIEW OF ENGINE

NOMENCLATURE OF PARTS—Continued

Part No.	No. Per Tractor	Property Classification—Class IV, Division 10	
		Name of Part	Location
		***Engine*—ENGINE CYLINDER**	
		See illustrations on pages 34, 36, 38, 40, 42, 45, 172, 173, 174, 175, 176, 179	
300B	8	Auxiliary valve spring	Inside main valve spring
298E	8	Bolt .312 ($\frac{5}{16}$) x 1.5 (1 $\frac{1}{2}$)	Rocker arm bracket to cylinder head
291A	2	Cylinder	
294B	2	Cylinder base gasket	Between cylinder base and crank case
301C	8	Cylinder block core plug	Through cylinder walls
292A	2	Cylinder head	Top of cylinder
303A	2	Cylinder head cover	Bolted to cylinder head*
304A	2	Cylinder head cover	Bolted to cylinder head
300D	2	Cylinder head cover breather cap	Top cylinder head cover
302H	4	Cylinder head cover stud	Cylinder head cover to rocker arm bracket
	4	.375 ($\frac{3}{8}$) Washer S. A. E	
	4	.375 ($\frac{3}{8}$)—24 Nuts S. A. E	

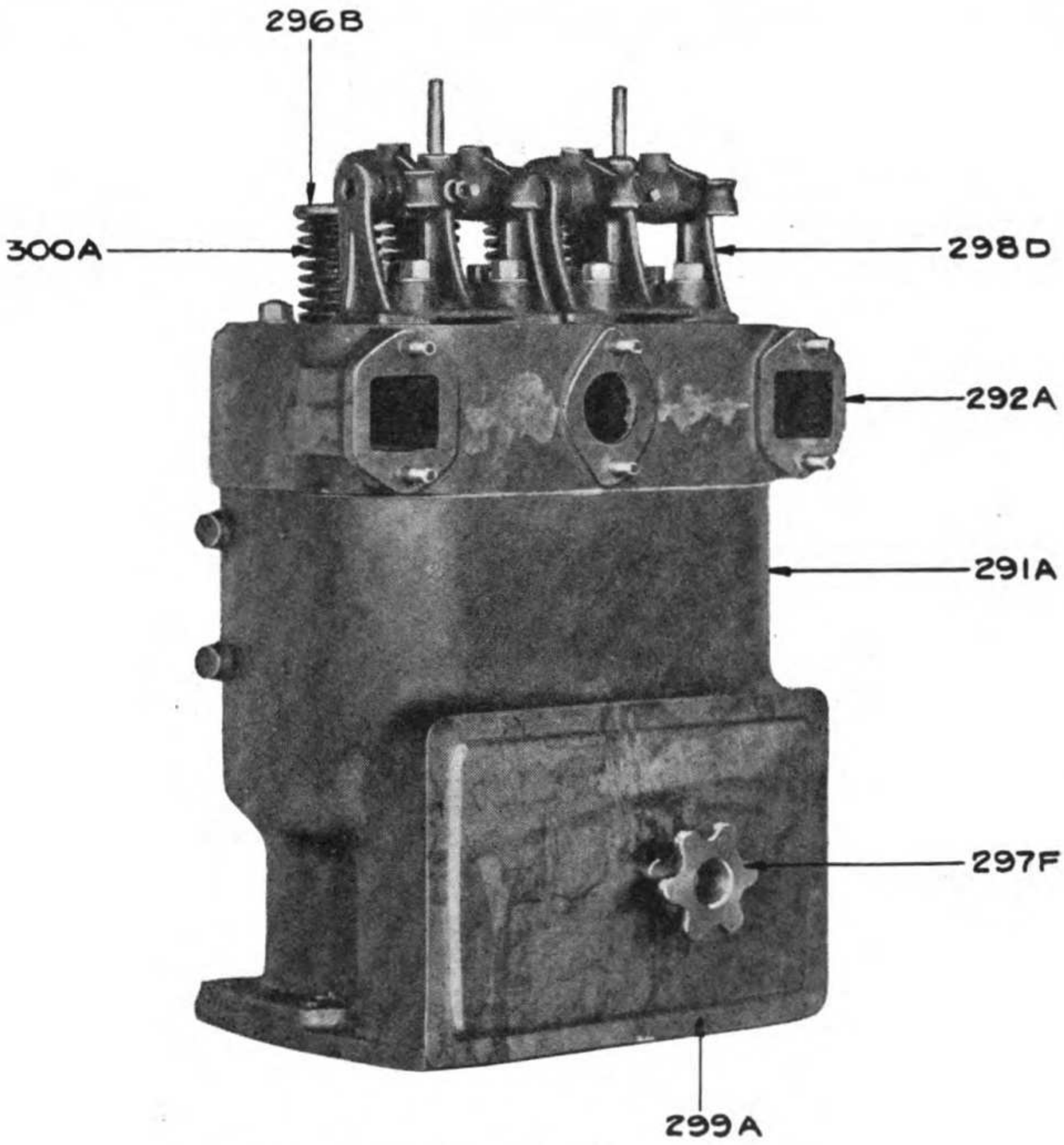
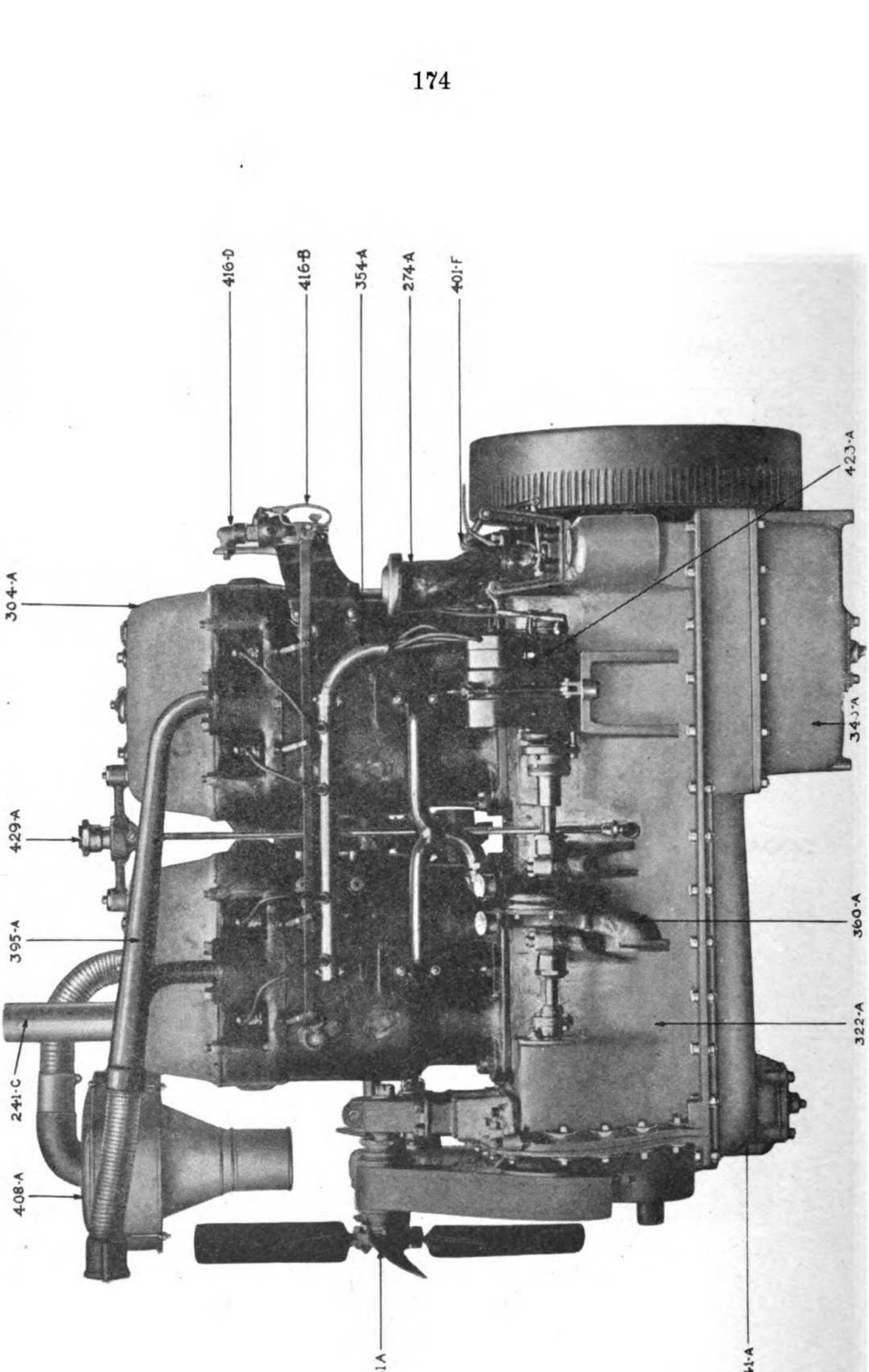


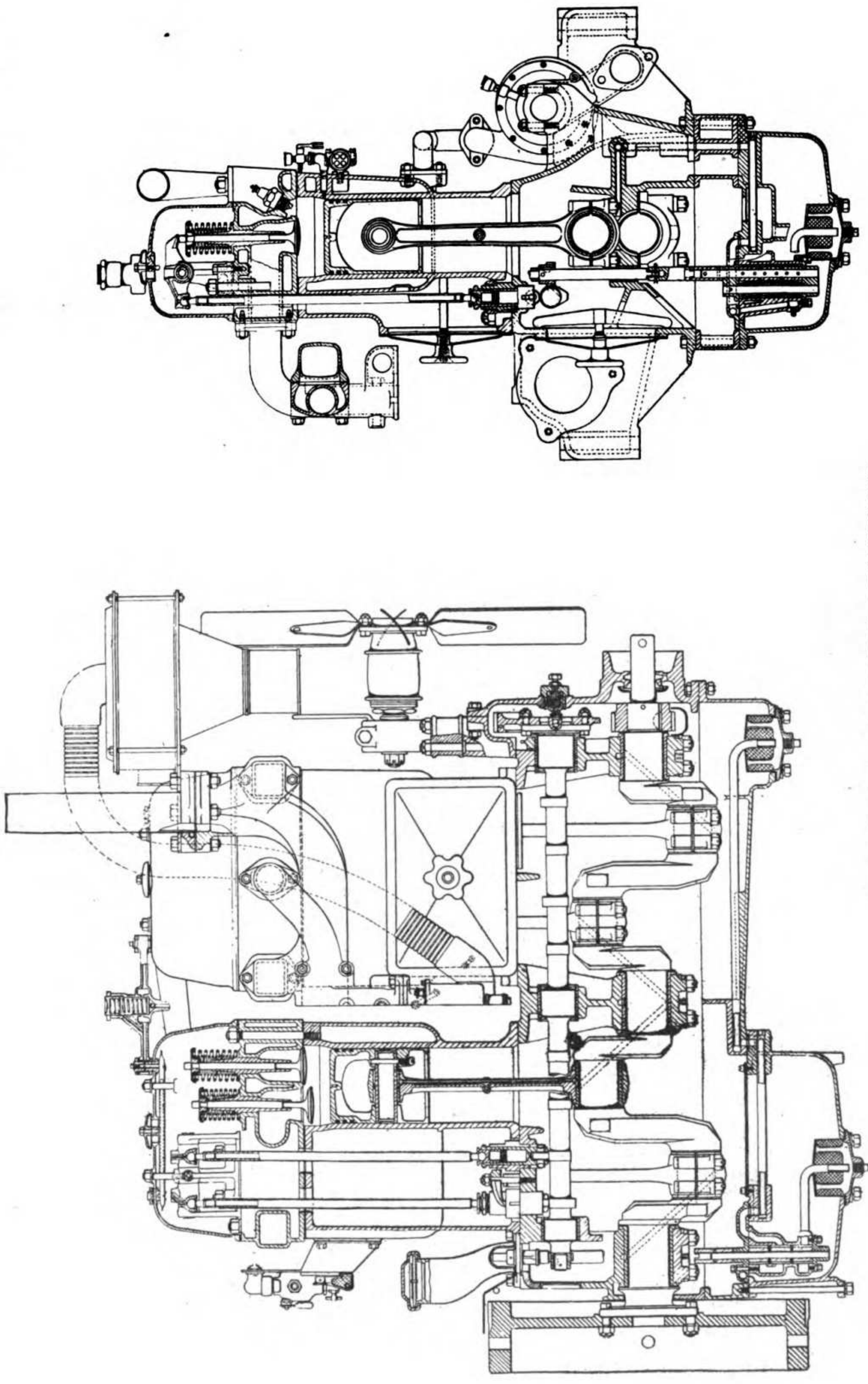
PLATE 76—CYLINDER ASSEMBLY

PLATE 77



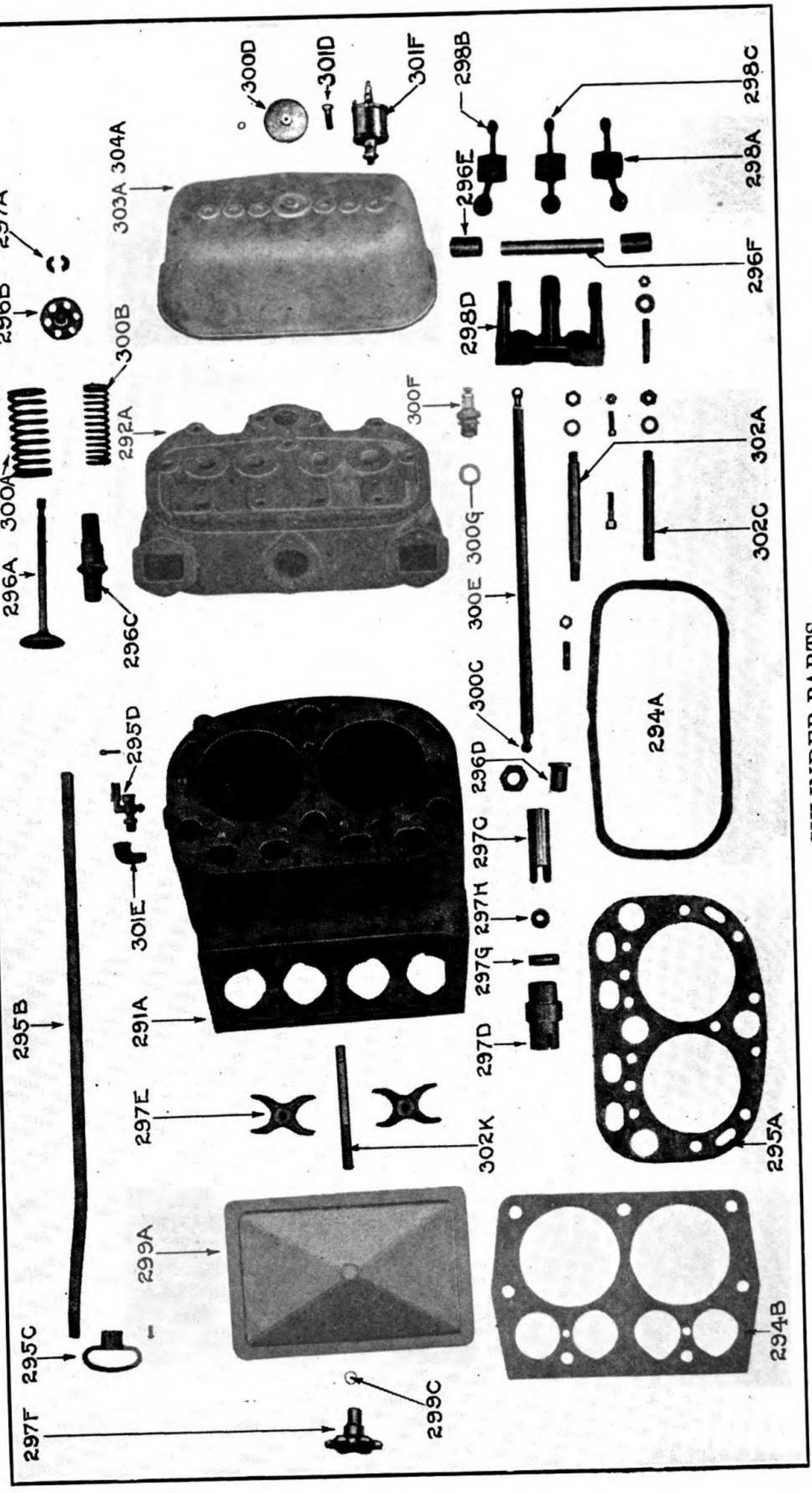
LEFT SIDE VIEW OF ENGINE

PLATE 78



SECTIONAL DRAWING OF ENGINE

PLATE 79



CYLINDER PARTS

NOMENCLATURE OF PARTS—Continued

Part No.	No. Per Tractor	Property Classification—Class IV, Division 10	
		Name of Part	Location

Engine—ENGINE CYLINDER (*Continued*)

See illustrations on pages 34, 36, 38, 40, 42, 45, 172, 173, 174, 175, 176, 179

294A	2	Cylinder head gasket	Between cylinder head and cover
295A	2	Cylinder head gasket	Between cylinder and cylinder head
302A	8	Cylinder head stud	Through cylinder head to cylinder
	8	.5 (½)—20 Nuts S. A. E	
302B	8	Cylinder head stud	Through cylinder head to cylinder
302C	6	Cylinder head stud	Through cylinder head to cylinder
	6	.5 (½)—20 Nuts S. A. E	
295B	1	Gang hand lever*	On priming cups
295C	1	Gang lever handle*	On gang hand lever
	2	.187 (3/16) x .5 (½) B. H. rivets*	
	4	.125 (⅛) x .75 (¾) Split pins*	
302F	4	Inlet manifold stud	Through manifold to cylinder
300A	8	Main valve spring	Around valve guide
302D	12	Manifold stud	Through manifold to cylinder
295D	4	Priming cups	Attached to cylinder walls
	4	.125 (⅛) x .75 (¾) Split pins	
298A	2	Rocker arm, right	On rocker arm shaft
298B	2	Rocker arm, left	On rocker arm shaft
298C	4	Rocker arm, straight	On rocker arm shaft
298D	4	Rocker arm bracket	Bolted to cylinder head
296E	8	Rocker arm bushing	In rocker arm
296F	4	Rocker arm shaft	Through rocker arm bracket
301D	2	Screw hexagon head cap	Through breather cap
	2	.25 (¼) Lock washers	
301B	4	Screw, set dog point	Through rocker arm bracket
	4	.25 (¼)—28 Nuts	
301F	8	Sight feed oiler	On top of cylinder head cover*
300F	4	Spark plug	Through side of cylinders
300G	4	Spark plug gasket	Between spark plugs and cylinders
301E	4	Street elbow	On priming cups
302E	12	Tobin bronze nuts .375 (⅜)—24 S. A. E.	With manifold studs 302D
302G	14	Tobin bronze nuts .375 (⅜)—28 S. A. E.	With inlet manifold studs 302F
296A	8	Valve	In cylinder head
297F	2	Valve cover nut	With valve cover stud
299C	2	Valve cover nut retainer	On valve cover stud
299A	2	Valve cover plate	Bolted to lower side cylinder
299B	2	Valve cover plate gasket	Between valve cover plate and cyl.
302K	2	Valve cover stud	Fastens cover plate to cylinder
296C	8	Valve guide	In cylinder head
300E	8	Valve push rod	In side of cylinder case
300C	16	Valve push rod end	Ends of push rod
296B	8	Valve spring seat	Top of valve spring
297A	8	Valve spring seat block	Top of valve stem
297C	8	Valve tappet	In cylinder base
296D	8	Valve tappet adjusting screw	Bottom of push rod
297D	8	Valve tappet guide	In cylinder base
297E	4	Valve tappet guide crab	Holds valve tappet in position
297B	8	Valve tappet lock nut	With valve tappet adjusting screw.
297H	8	Valve tappet roller	Bottom of valve tappet
297G	8	Valve tappet roller pin	Through valve tappet roller
301A	20	Washer	With cylinder head studs

NOTE. Parts marked * were only used on initial production. Also see note on rocker arm oiling system.

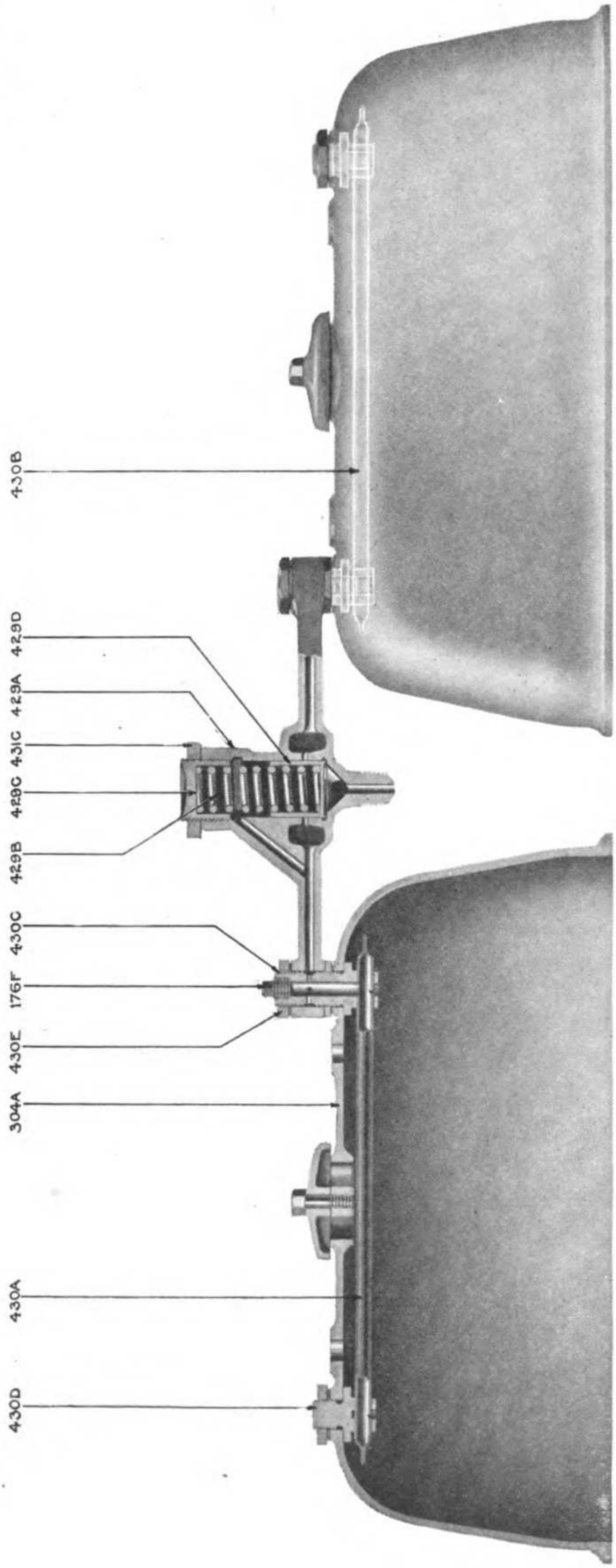
Engine—ROCKER ARM OILING SYSTEM

See illustration on page 178

431C	1	Adjusting lock nut 1¼"—12	On relief valve
204E	1	Elbow, flared tube S. A. E	On relief valve pipe
430F	6	Gasket	In oil pipe stud lock nut
430C	2	Oil pipe stud	In valve cover top
430E	6	Oil pipe stud lock nut	In valve cover top
429C	1	Oil relief adj. plug	In oil relief body

NOTE. This oiling system not used on first production of 5-Ton Artillery Tractor, Model 1917. For first production see Oiling System, page 189.

PLATE 80



ROCKER ARM COVERS AND OILING SYSTEM

NOMENCLATURE OF PARTS—Continued

Part No.	No. Per Tractor	Property Classification—Class IV, Division 10	
		Name of Part	Location

Engine—ROCKER ARM OILING SYSTEM

429D	1	Oil relief plunger	In oil relief body
429B	1	Oil relief spring	In oil relief body
431A	1	Oil pressure relief valve pipe	
431B	1	Pipe bushing	On relief valve
176F	1	Pipe plug	
13E	2	Pipe plug	
430B	2	Pipe support stud	In valve cover top
207F	2	S. A. E. Union nut	
430A	1	Valve cover feed pipe, right	In valve cover
430B	1	Valve cover feed pipe, left	In valve cover
429A	1	Valve cover oil relief body	Cylinder head cover

NOTE. This oiling system not used on first production of 5-Ton Artillery Tractor, Model 1917. For first production see Oiling System, page 189

Engine—CRANK SHAFT

See illustration on page 182

260A	1	Crank shaft	In upper crank case
262A	1	Crank shaft gear	Front end of crank shaft
262C	1	Crank shaft gear pin	Pins gear to shaft
262B	1	Crank shaft oil sling	Front end of crank shaft
261A	1	Flywheel	On rear end of crank shaft
262F	6	Flywheel bolt	Flywheel to crank shaft flange
	6	.5 (½)—20 Castle nut	
262G	1	Key, Whitney No. 18	Keys crank shaft gear to shaft
262D	1	Starting crank pin	Front end of crank shaft
262E	1	Starting pin lockscrew	Front end of crank shaft

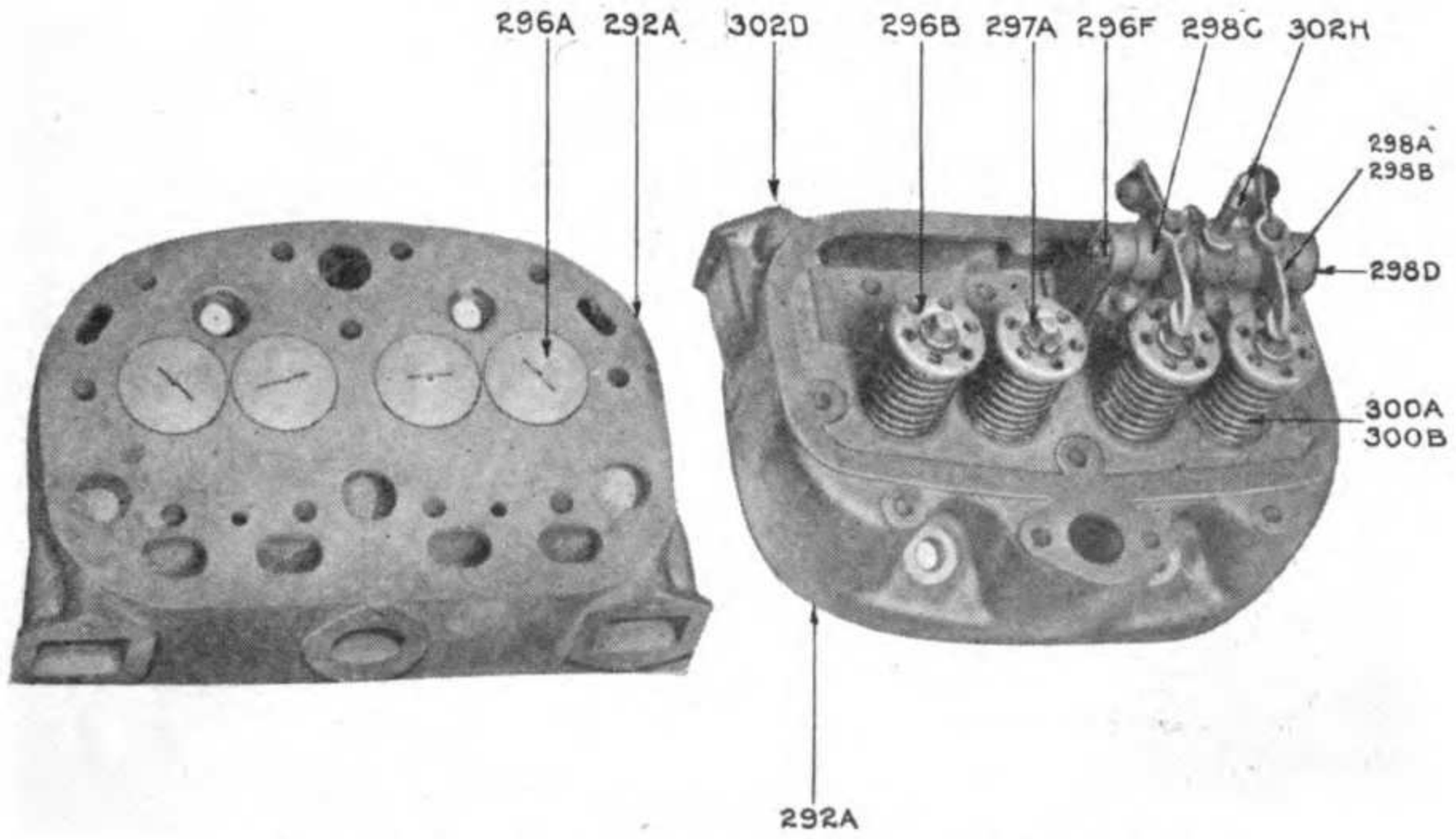
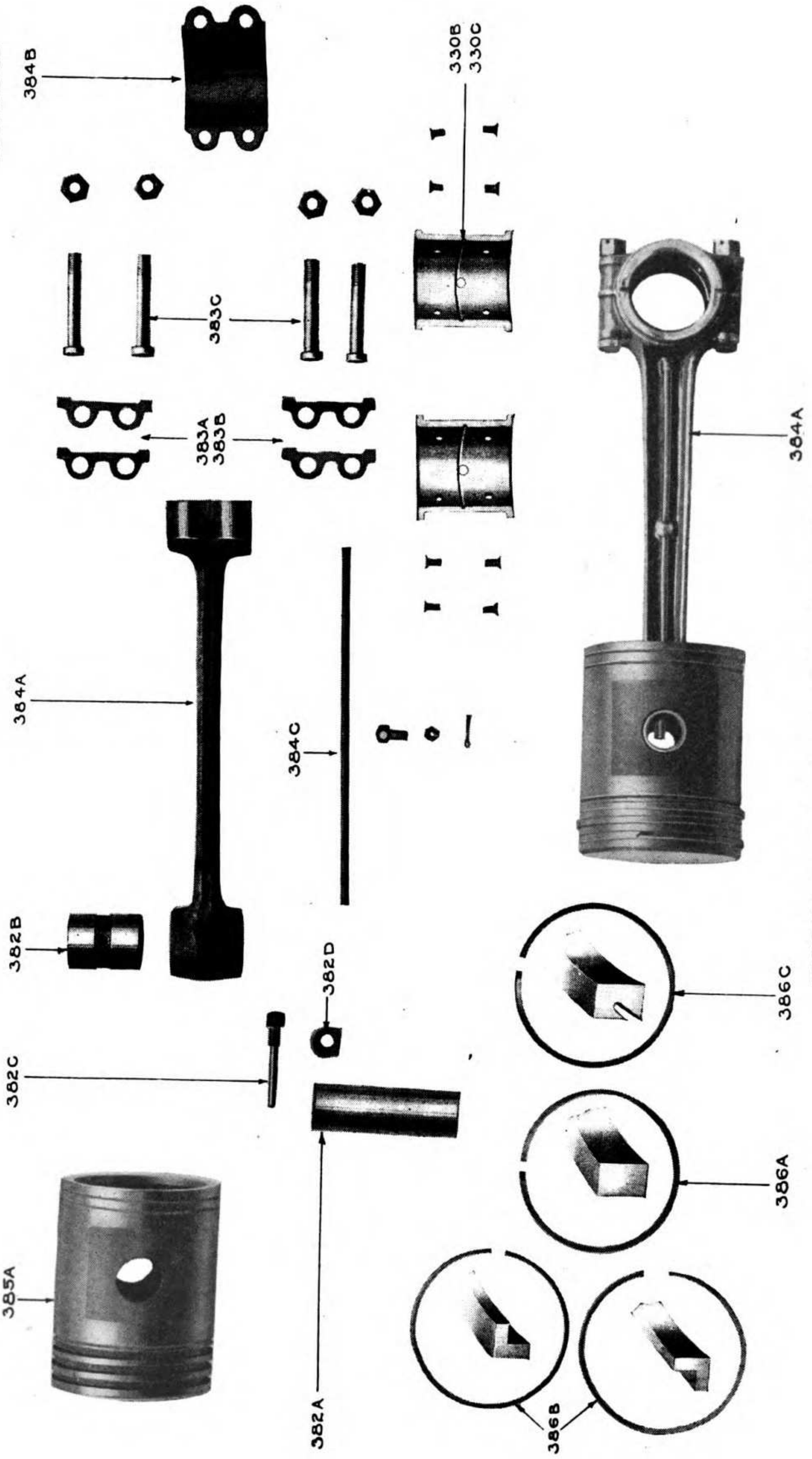


PLATE 81—CYLINDER HEAD ASSEMBLY

PLATE 82



PISTON AND CONNECTING ROD PARTS

NOMENCLATURE OF PARTS—Continued

Part No.	No. Per Tractor	Property Classification—Class IV, Division 10	
		Name of Part	Location

Engine—PISTON AND CONNECTING ROD

See illustration on page 180

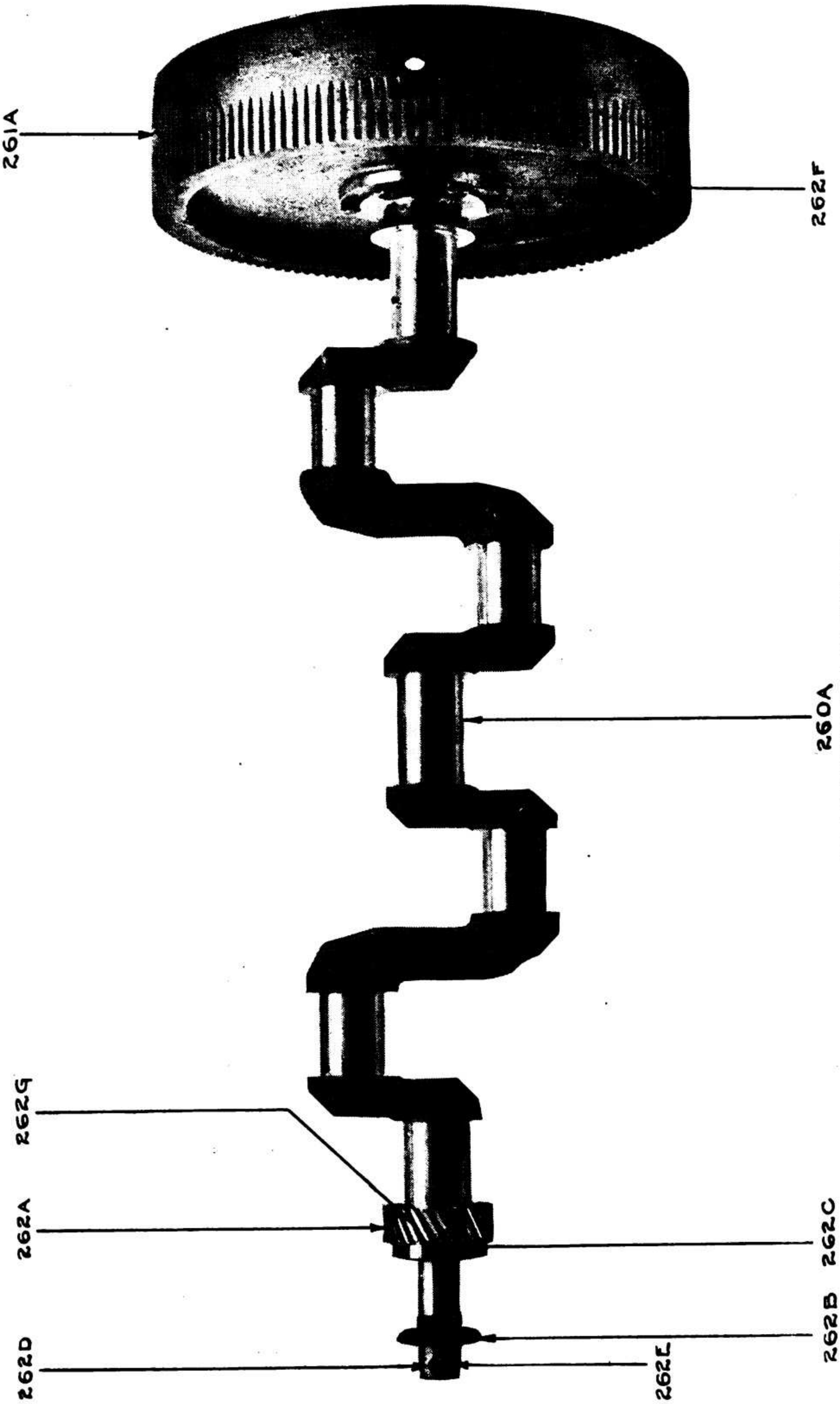
331D	32	Bearing lock screw	Lower end of connecting rod
384A	4	Connecting rod	Crank shaft to piston
383C	16	Connecting rod bolt	Connecting rod to conn. rod cap
384B	4	Connecting rod cap	Lower end of connecting rod
384C	4	Connecting rod oil tube	In connecting rod
384D	4	Connecting rod oil tube clip	Holds oil tube to connecting rod
	4	.25 (¼)—28 Castle nut S. A. E.	
383A	8	Connecting rod shim	Between connecting rod and connecting cap
383B	8	Connecting rod shim	Between connecting rod and connecting cap
330B	8	Crank shaft bushing	Lower end connecting rod
330C	8	Crank shaft bushing	Lower end connecting rod
330G	16	Nut, .5 (½)—20	Used with connecting rod bolt
	16	.093 Split pins	
176F	4	Pipe plug	To top of connecting rod
385A	4	Piston	
382A	4	Piston pin	Connects piston and connecting rod
382B	4	Piston pin bushing	In connecting rod
382D	4	Piston pin lock	Locks piston pin lock screw
382C	4	Piston pin lock screw	Pins piston pin to piston
386B	4	Piston ring, leak proof	Upper piston ring
386C	4	Piston ring, oil	Lower piston ring
386A	4	Piston ring, plain	Center piston ring

Engine—UPPER CRANK CASE

See illustrations on pages 172, 174, 183

331D	24	Paring lock screw	In main bearing
326B	16	Bolts .375 (⅜) x 1.875 (1⅞) S. A. E	Gear case cover to crank case
333E	8	Cam shaft bearing dowel pin	Through cam shaft bearing
328B	1	Cam shaft bushing, inner	In crank case
328D	1	Cam shaft bushing, inner	In crank case
328F	1	Cam shaft bushing, inner	In crank case
328A	1	Cam shaft bushing, outer	Retainer for bearing
328C	1	Cam shaft bushing, outer	In crank case
328E	1	Cam shaft bushing, outer	In crank case
329A	2	Center and rear bearing cap	In crank case
329D	4	Center and rear bearing shim	On center and rear bearing
332B	2	Crank case hand hold clamp	Right side crank case
299A	2	Crank case hand hold cover	Inside crank case
299B	2	Crank case hand hold cover gasket	Between cover and crank case
331A	1	Crank case main oil pipe	Oil line to rear bearing
332A	1	Crank case, upper	On main frame
330B	10	Crank shaft bushing	In front bearing
330C	10	Crank shaft bushing	In front bearing
329B	4	Crank shaft bushing, inner	Bearing for crank shaft
329C	4	Crank shaft bushing, outer	Retainer for bearing
330D	2	Crank shaft bearing shim	In upper crank case
331C	1	Crank shaft washer	Front end of crank case
333F	4	Cylinder hold down stud	Cylinder to crank case
333B	2	Fan bracket stud front	Fan bracket crank case
	2	.5 (½)—20 Castle nut S. A. E	
333A	2	Fan bracket stud, rear	Fan bracket crank case
	2	.5 (½)—20 Castle nut S. A. E	
328K	1	Filler block gasket	Between filler block and crank case
328L	2	Filler block screw	In filler block

PLATE 83



CRANKSHAFT ASSEMBLY

NOMENCLATURE OF PARTS—Continued

Engine—UPPER CRANK CASE—*Continued*

See illustrations on pages 172, 174, 183

Part No.	No. Per Tractor	Property Classification—Class IV, Division 10	
		Name of Part	Location
334C	2	Fillister head screw	Oil tray to crank case
	2	.25 (¼) x .375 (⅜) Lock washer	
331B	1	Fly wheel pointer	Rear end of crank case
330A	1	Front bearing cap	Front end of crank case
330F	2	Front crank shaft bearing shim	Front bearing
330E	2	Front main bearing stud	Through front bearing cap
326A	1	Gear case cover	Front end of crank case
327A	1	Gear case top cover	Front end of crank case
332A	1	Gear case cover gasket	Between gear case and crank case
332C	2	Hand hole cover clutch stud	Hand hole cover to crank case
329E	10	Main bearing bolt	Main crank shaft bearing
329G	12	Main bearing bolt washer	Main bearing bolt
329F	4	Main bearing shim, center and rear	Center and rear bearings
330G	14	Nut	On main bearing bolt
334B	2	Oil tray support	Holds oil tray
113E	2	Pipe plug	
328H	1	Rear bearing filler block	Rear bearing
328G	1	Rear cam bearing plug	Rear end of crank case
332F	4	Screw hexagon head cap .375 (⅜) x 1.5 (1½)	Gear case top cover to crank case
	4	.375 (⅜) Lock washer	
334A	1	Timing gear oil tray	Bottom of crank case
297F	.2	Valve cover nut	On hand hole cover clamp stud
299C	2	Valve cover nut retainer	Used with valve cover nut
332E	10	Valve tappet guide pin	Through valve tappet guide
332D	4	Valve tappet guide stud	Valve tappet guide to crank case
	4	.375 (⅜)—24 Castle nut S. A. E.	
333C	2	Water pump bracket tap	On crank case
333D	4	Water pump bracket stud	Bracket cap to crank case
	4	.374 (⅜)—24 Castle nuts	

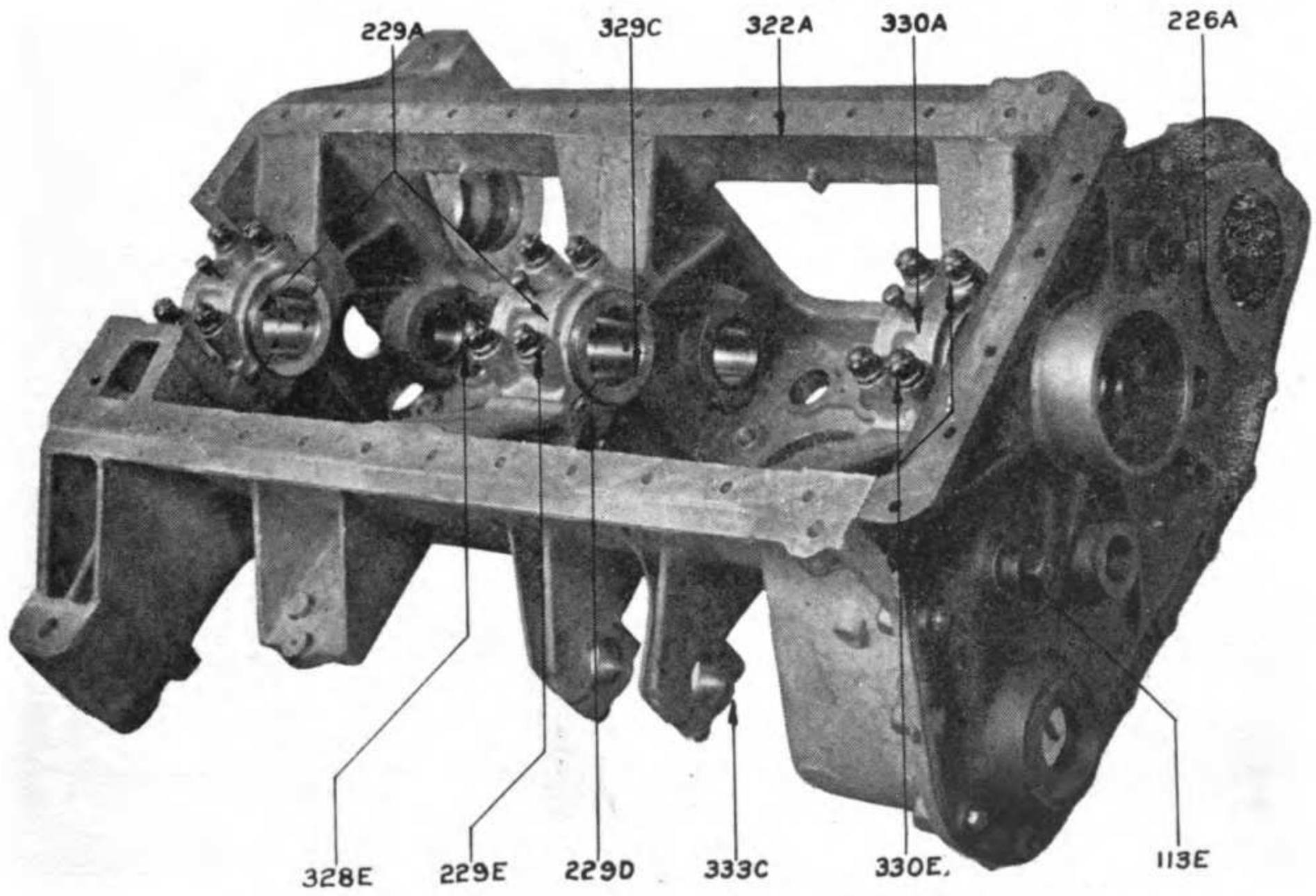
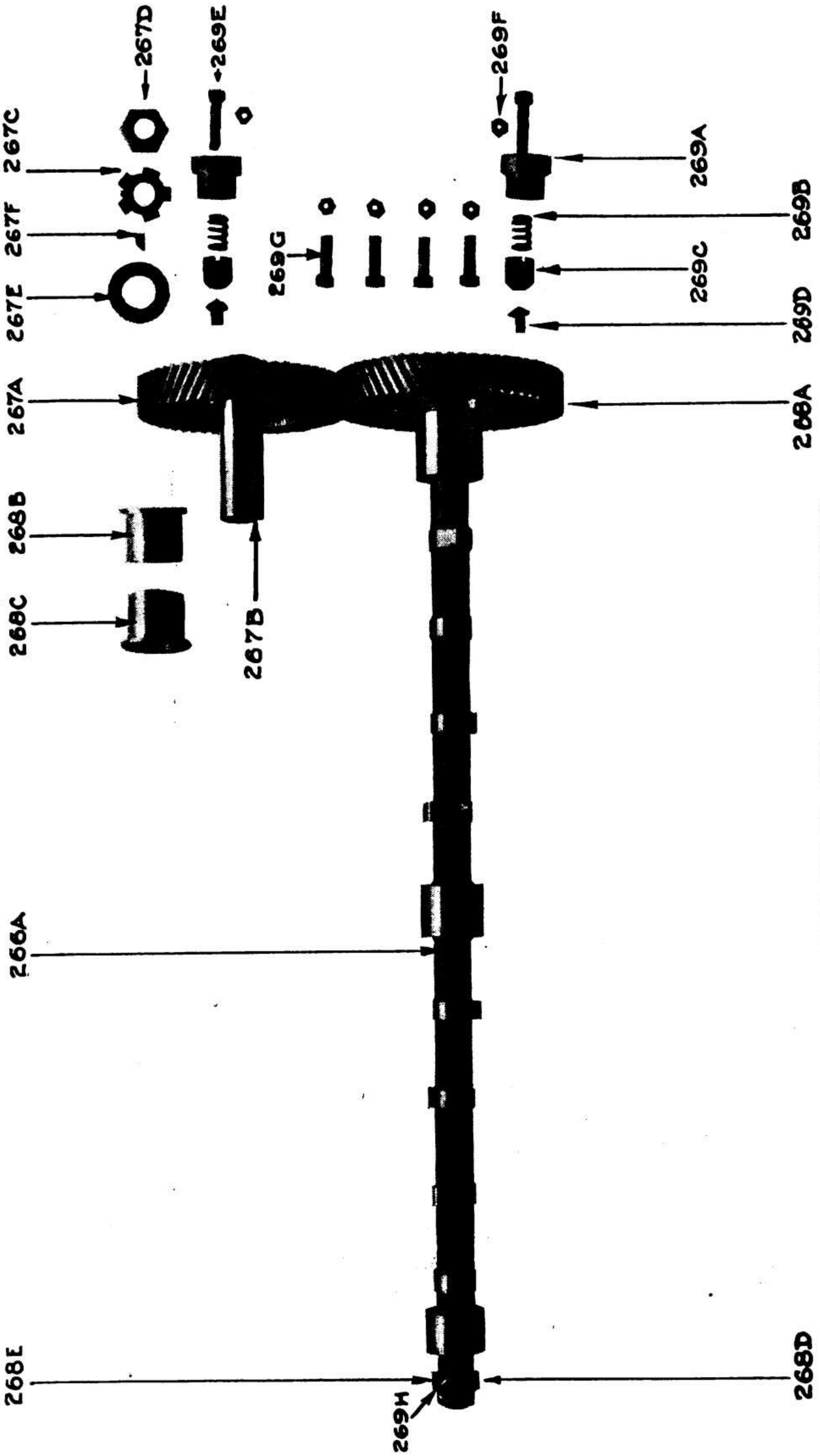


PLATE 84—UPPER CRANK CASE ASSEMBLY

PLATE 85



CAM SHAFT AND IDLER ASSEMBLY

NOMENCLATURE OF PARTS—Continued

Engine—BREATHER BODY

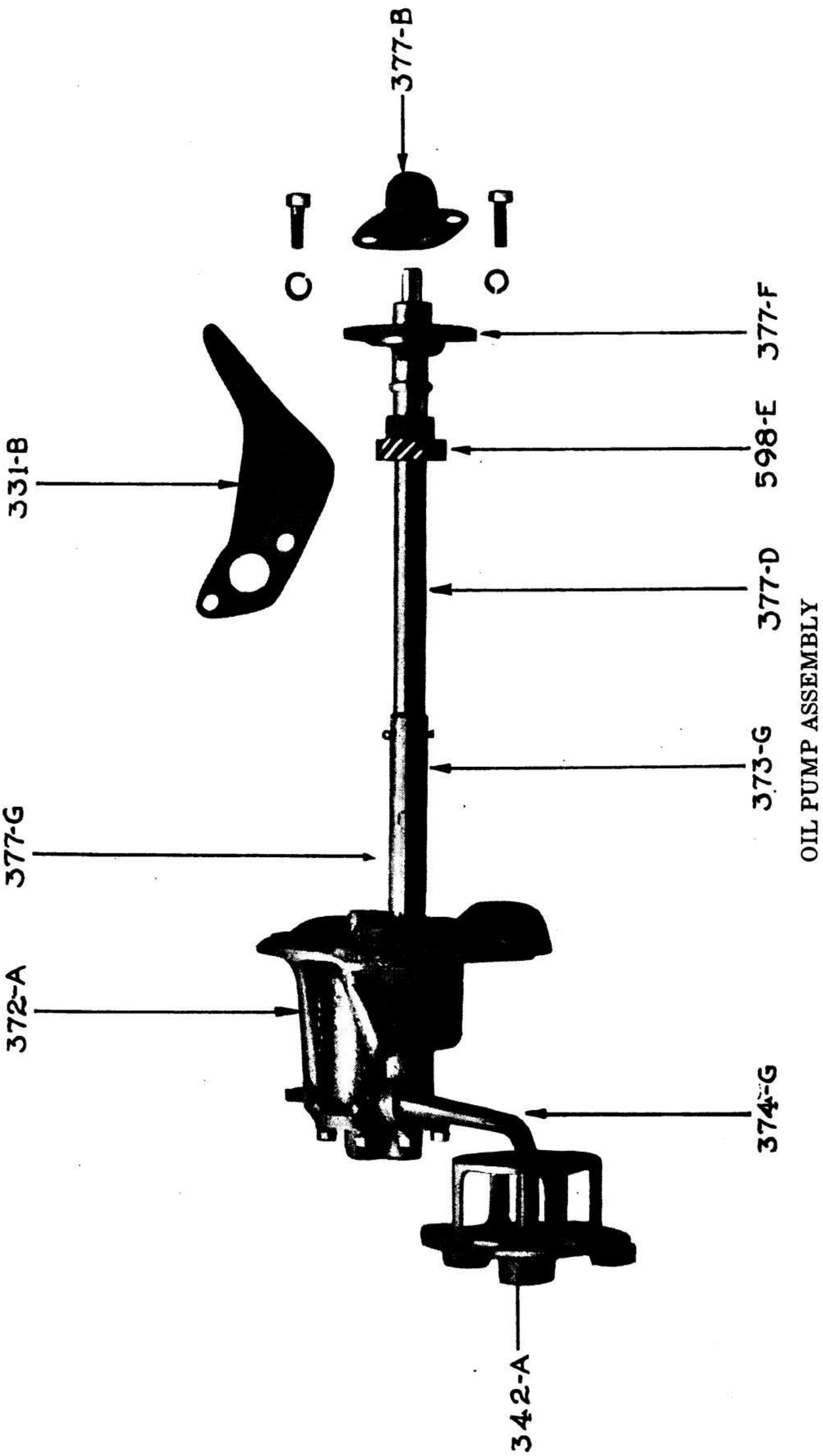
Part No.	No. Per Tractor	Property Classification—Class IV, Division 10	
		Name of Part	Location
274A	1	Breather body	On upper crank case
274B	1	Breather cover	On breather body
274C	1	Breather cover pin	Hinges cover to body
274D	1	Breather cover spring	On breather body
274E	1	Breather gasket	Between breather body and upper crank case
275A	2	Breather leather reinforcement	Inside breather cap
275D	1	Breather screen, lower	Inside breather body
275C	1	Breather screen, upper	Inside breather body
275B	1	Breather valve	Inside breather cap
276F	1	Oil gauge blade	Inside oil gauge tube
276B	1	Oil gauge handle	Top of oil gauge tube
276C	1	Oil gauge handle pin	Pins handle to blade
276A	1	Oil gauge tube	Through upper and lower crank case
276C	1	Oil gauge tube lock nut	Locks oil tube in crank case
276D	1	Oil gauge tube washer	Between lock nut and handle
275E	3	Screw (A. S. M. E.) No. 10—32 x .875 (7/8)	Breather spring to body

Engine—CAM SHAFT

See illustration on page 184

269G	4	Bolt S. A. E. drilled .375 (3/8) x 1.5 (1 1/2)	Gear to cam shaft
	4	.375 (3/8)—24 Castle nuts	
268B	2	Bushing, inner	Bearing for idler gear shaft
268C	2	Bushing, outer	Retainer for inner bushing
266A	1	Cam shaft	Upper crank case
268A	1	Cam shaft gear	Front end of cam shaft
269F	2	Check nuts S. A. E. .375 (3/8)—24	Locks plunger stop screw
267A	1	Idler gear	Meshes with cam shaft gear
267F	1	Idler gear key	Keys idler gear to shaft
267B	1	Idler gear shaft	
267D	1	Idler gear shaft nut	Front end of idler gear shaft
267E	1	Idler gear thrust washer	Between idler gear and bushing
269H	1	Key	Keys oil pump driver gear to shaft
268D	1	Oil pump drive gear pin	Pins drive gear to shaft
268E	1	Oil pump gear, driver	Rear end of cam shaft
269E	2	Plunger stop screw	Through plunger housing
267C	1	Shaft nut lock washer	Front end of idler gear shaft
269D	2	Thrust plug	Front ends of idler gear and cam shafts
269C	2	Thrust plunger	In plunger housing
269A	2	Thrust plunger housing	In gear case cover
269B	2	Thrust plunger spring	Inside of plunger housing

PLATE 86



OIL PUMP ASSEMBLY

NOMENCLATURE OF PARTS—Continued

Part No.	No. Per Tractor	Property Classification—Class IV, Division 10	
		Name of Part	Location

Engine—LOWER CRANK CASE

See illustrations on pages 172, 174, 187

340B	1	Bolt, .375 (3/8) x 6.625 (6 5/8) S. A. E.	Lower oil pan to crank case
341B	10	Bolt, .375 (3/8) x 4.25 (4 1/4) S. A. E.	Oil pan to upper and lower crank case
341C	20	Bolt, .375 (3/8) x 1.5 (1 1/2) S. A. E.	Oil pan to upper and lower crank case
341D	2	Bolt, .375 (3/8) x 9.375 (9 3/8)	Upper and lower crank case
	32	.375 (3/8) Lock washers	
	30	.375 (3/8)—24 Plain nut S. A. E.	
344C	1	Crank case oil screen	In oil screen frame
345F	5	Crank case washer	End of oil pipe
343A	1	Engine oil pan gasket (left)	Between oil pan and crank case
343B	1	Engine oil pan gasket (right)	Between oil pan and crank case
340A	1	Lower oil pan	Bottom of crank case
346A	1	Lower oil pan gasket	Between lower oil pan and crank case
345B	1	Lower oil pan pipe	Cast in lower oil pan
345C	1	Lower oil pan pipe	Cast in lower oil pan
345D	1	Lower oil pan pipe	Cast in lower oil pan
346B	1	Oil pan partition pipe	Between lower oil pan and crank case
346C	1	Oil pan partition plate gasket	Between oil partition plate and oil pan
346D	14	Oil pan partition plate washer	Used with 340C
345E	2	Oil pipe plug	End of oil pipe
342C	1	Oil pump screen	In oil screen body
342A	1	Oil screen body	Bolted to upper pan
344A	1	Oil screen frame	Bolted to lower pan
344B	1	Oil screen gasket	Between oil screen frame and lower oil pan
342B	1	Oil strainer gasket	Between upper oil pan and oil screen body

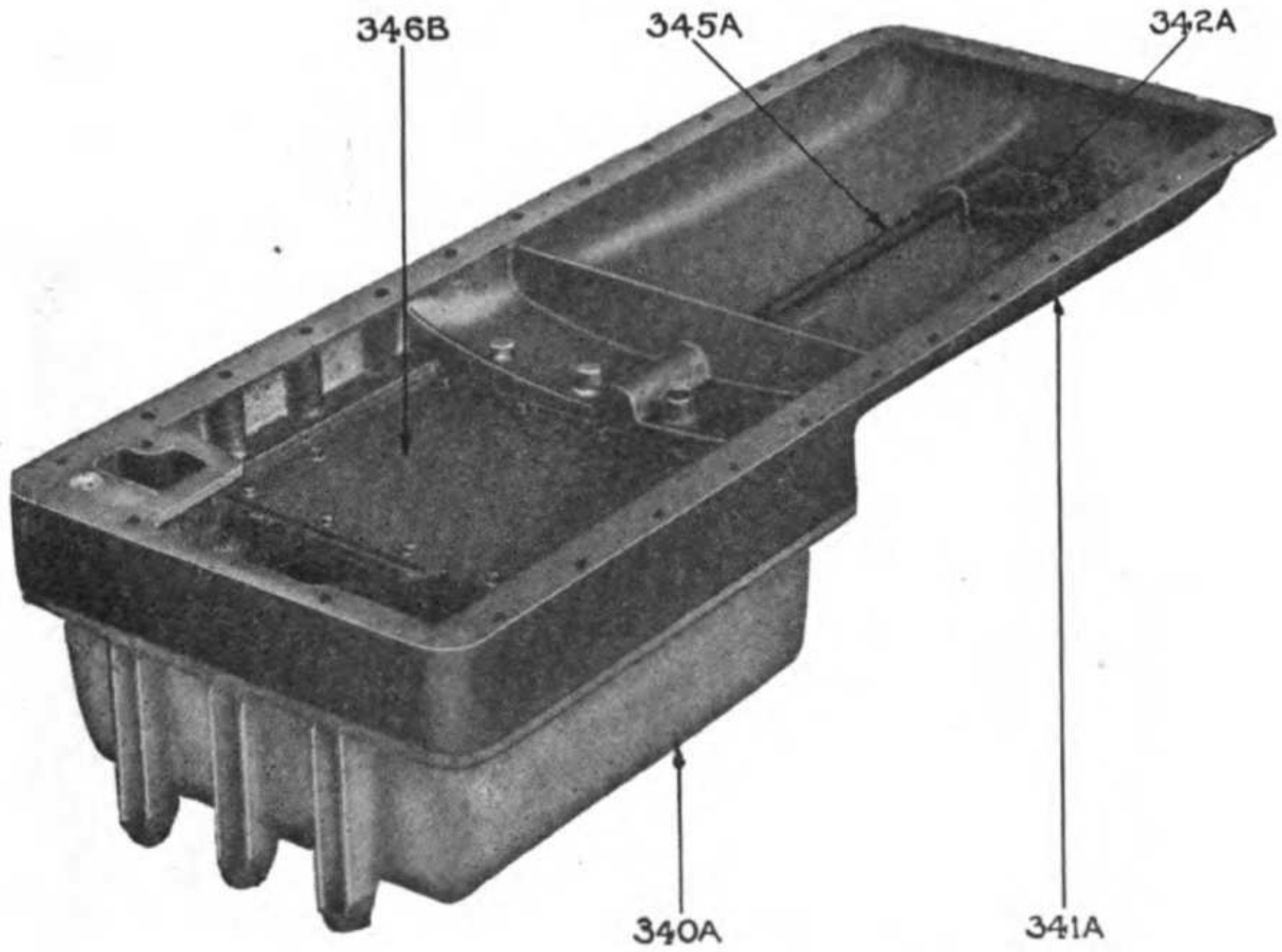
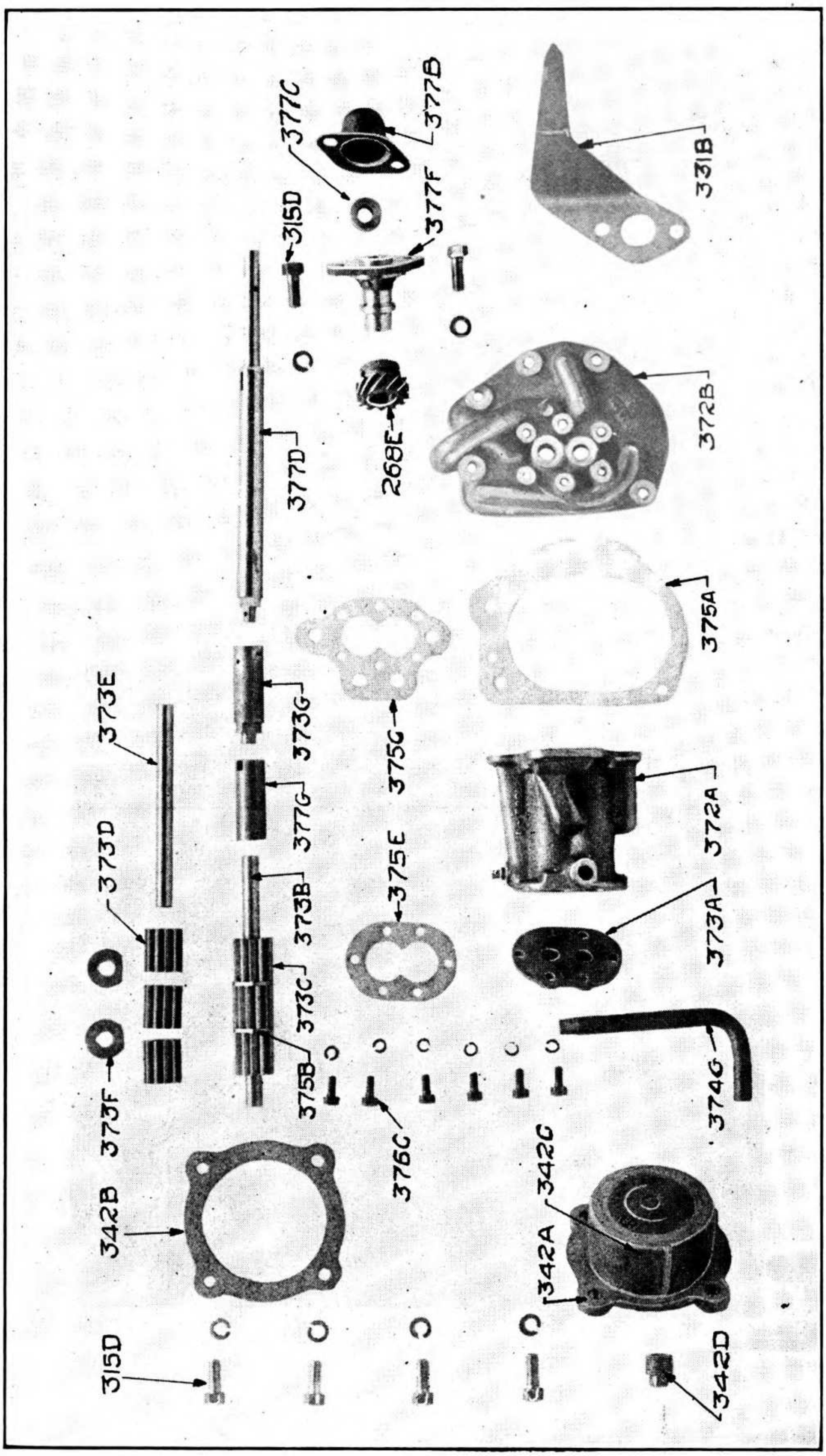


PLATE 87—LOWER CRANK CASE

PLATE 88

OIL PUMP PARTS



NOMENCLATURE OF PARTS—Continued

Part No.	No. Per Tractor	Property Classification—Class IV, Division 10	
		Name of Part	Location

Engine—LOWER CRANK CASE—*Continued*

See illustrations on pages 172, 174, 187

342D	2	Pipe plug	Bottom of lower oil pan
344D	6	Screw, ASME machine No. 8—32 x .5 (½)	Screen frame to oil pan
	6	.187 (3/16) Lock washer	
340C	14	Screw, round fillister head	Oil partition plate to oil pan
315D	4	Screw, hexagon head cap	Oil screen body to upper flange
341A	1	Upper oil pan	Bottom of crank case
345A	1	Upper oil pan pipe	Cast in upper oil pan

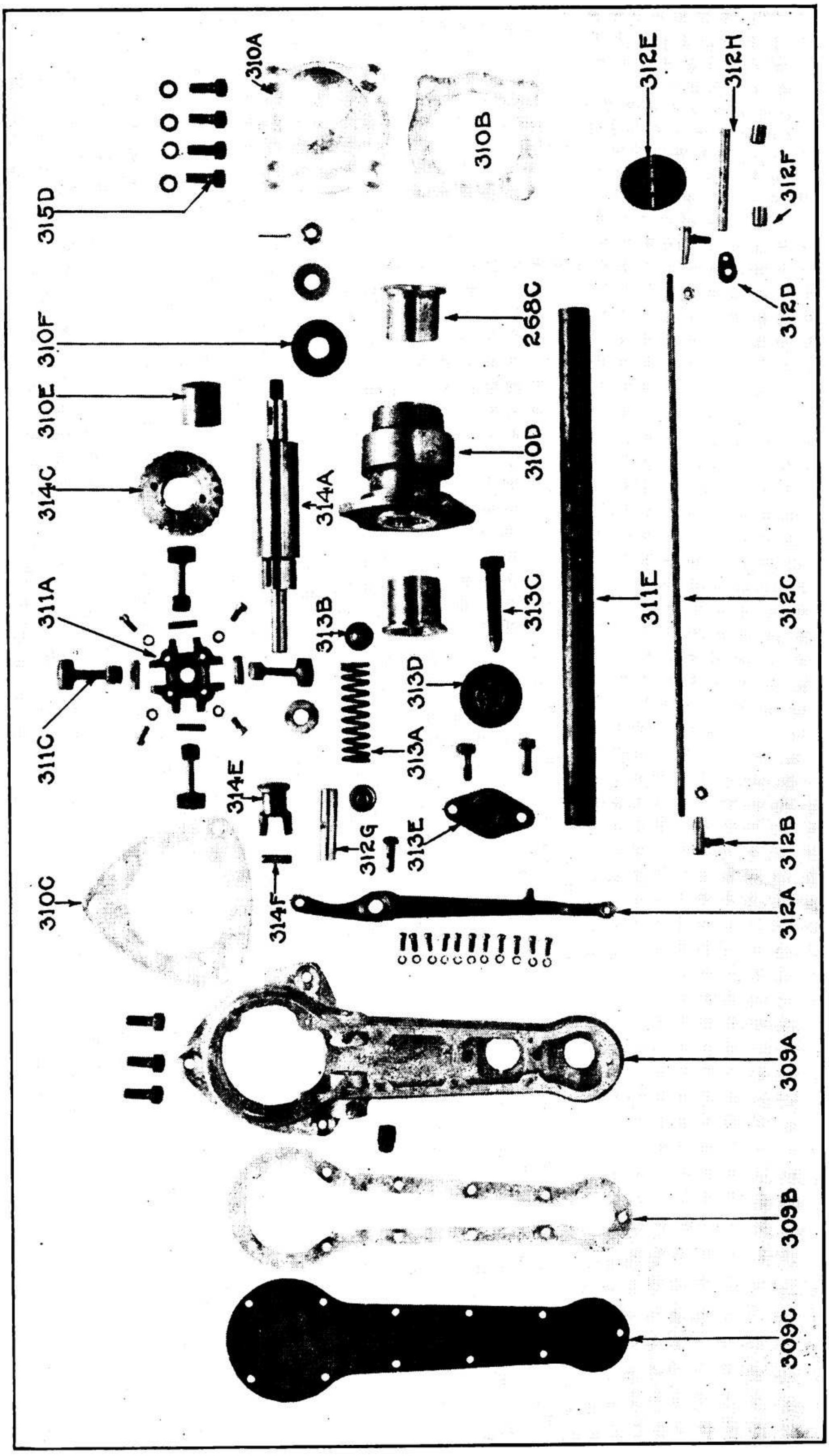
Engine—OILING SYSTEM

See illustrations on pages 70, 72, 76, 186, 187, 188

376D	1	Ball	In oil relief valve body*
377H	1	Drive shaft bearing oil pipe	Main oil lead to drive shaft bearing
377E	1	Drive shaft bushing, lower	Drive shaft, supported by crank case
377C	1	Drive shaft collar	Pin to end of drive shaft
	1	Taper pin .162x1	
377B	1	Drive shaft cover	Bolted to drive shaft bracket
377A	1	Drive shaft cover gasket	Between drive shaft bracket and crank case
373B	1	Drive shaft, lower	In oil pump body
208B	1	Flared tube union nut	In oil pump line
376E	1	Gear feeder plug	To replace 374D
374A	1	Gear oil feeder	Fastened to oil relief valve body
374F	1	Gear oil feeder plug	End gear oil feeder
269H	1	Key	Used with pump drive gear (driven)
372A	1	Oil pump body	In lower oil pan
373G	1	Oil pump coupling shaft	Couples U. & L. drive shaft
	1	Split pin .125x1.25	
373A	1	Oil pump cover, lower	Screwed to oil pump body
372B	1	Oil pump cover, upper	Screwed to oil pump body
268E	1	Oil pump drive gear driven	Mounted on upper pump drive shaft
377F	1	Oil pump drive shaft bracket	Top of crank case
377D	1	Oil pump drive shaft, upper	Geared to cam shaft
373D	3	Oil pump gear driven	On idler shaft gear
373C	3	Oil pump gear driver	On drive shaft
373E	1	Oil pump idler shaft	In oil pump body
375E	1	Oil pump lower cover gasket	Between lower cover and pump body
342C	1	Oil pump screen	In oil screen body
377G	1	Oil pump shaft collar	Pinned to lower oil pump shaft
373F	2	Oil pump spacing collar	Between idler pump gears
375B	2	Oil pump spacing collar	Between pump driven gears
374G	1	Oil pump suction pipe	Oil screen body to oil pump
375A	1	Oil pump upper cover gasket	Between upper cover and lower oil pan
375D	1	Oil pump upper cover nipple	Screwed to upper cover
375C	1	Oil pump upper gasket	Between upper body and pump body
374C	1	Oil relief adjusting lock	End of oil relief valve body*
374E	1	Oil relief valve adjusting plug	End of oil relief valve body*
374D	1	Oil relief valve body	In front of crank case*
	1	.625 (5/8) Lock washers	
374B	1	Oil relief valve spring	In oil relief valve body*
342A	1	Oil screen body	Bottom of lower oil pan
342B	1	Oil strainer gasket	Between oil strainer cover and oil pan
373H	9	Pin	Holds shaft collar to lower shaft
176F	1	Pipe plug	Through side of pump body
342D	1	Pipe plug	Through oil strainer cover
268D	1	Pump drive gear pin	Holds pump drive gear to shaft
376A	2	Screw hex. head cap .25 (¼) x 1.25 (1¼)	Through upper cover to pump body
	2	.25 (¼) Lock washers	
376B	5	Screw hex. head cap .312 (5/16) x 1	Bolts upper cover to oil pan
	5	.312 (5/16) Lock washers	
376C	10	Screw hex. head cap .25 (¼) x .625 (⅝)	Through lower cover to pump body
	10	.25 (¼) Lock washers	
315D	2	Screw hex. head cap .375 (⅜) x 1	Through shaft cover bracket and crank case
	2	.375 (⅜) Lock washers	
315D	4	Screw hex. head cap .375 (⅜) x 1	Through oil strainer cover
208A	1	Tube union and male pipe end	In oil pump line

NOTE. Parts marked * were only used on initial production. See note on Rocker Arm Oiling System.

PLATE 89



GOVERNOR PARTS

NOMENCLATURE OF PARTS—Continued

Engine—GOVERNOR

See illustrations on pages 190, 191, 192

Part No.	No. Per Tractor	Property Classification—Class IV, Division 10	
		Name of Part	Location
313D	1	Adjusting screw lock nut	On adjusting spring cage
312C	2	Ball joint	On governor lever
	1	.25 (¼)—28 Nuts S. A. E	
312K	1	Bolts S. A. E. .312 (5/16) x 1	Through governor lever
	1	.312 (5/16) Lock washer	
268B	1	Bushing, inner	Bearing for generator drive shaft
268C	1	Bushing, outer	Retainer for inner bushing
310E	1	Drive shaft spacer	End of generator shaft
314C	1	Generator gear	On generator drive shaft
310C	1	Generator gasket	Between lever housing and crank case
310A	1	Generator shaft cover	Covers end of generator shaft
310B	1	Generator shaft cover gasket	Between generator cover and crank case
313C	1	Governor adjusting screw	Through gov. adjusting spring case
313E	1	Governor adjusting spring case	Bolted to lever housing
314A	1	Governor and generator drive shaft	In upper crank case
	1	.5 (½) Plain washers	
	1	.5 (½)—20 Castle nuts S. A. E	
312A	1	Governor lever	Inside governor housing
309B	1	Governor lever cover gasket	Between lever housing and cover
309A	1	Governor lever housing	Enclosing governor lever
309C	1	Governor lever housing cover	Outside lever housing
314F	1	Governor lever pin	Pins gov. lever to shifting collar
312G	1	Governor lever spindle	Through governor lever
312C	1	Governor rod	Between governor lever and throttle
	2	.25 (¼)—28 nuts S. A. E	
311E	1	Governor rod tube	Encases governor rod
311F	1	Governor tube lock nut	Locks governor tube to housing
314E	1	Governor shifting collar	End of drive shaft
311A	1	Governor spider	Bolted to generator gear
311B	4	Governor spider pin	Through governor spider
311C	4	Governor weight	Attach to governor spider

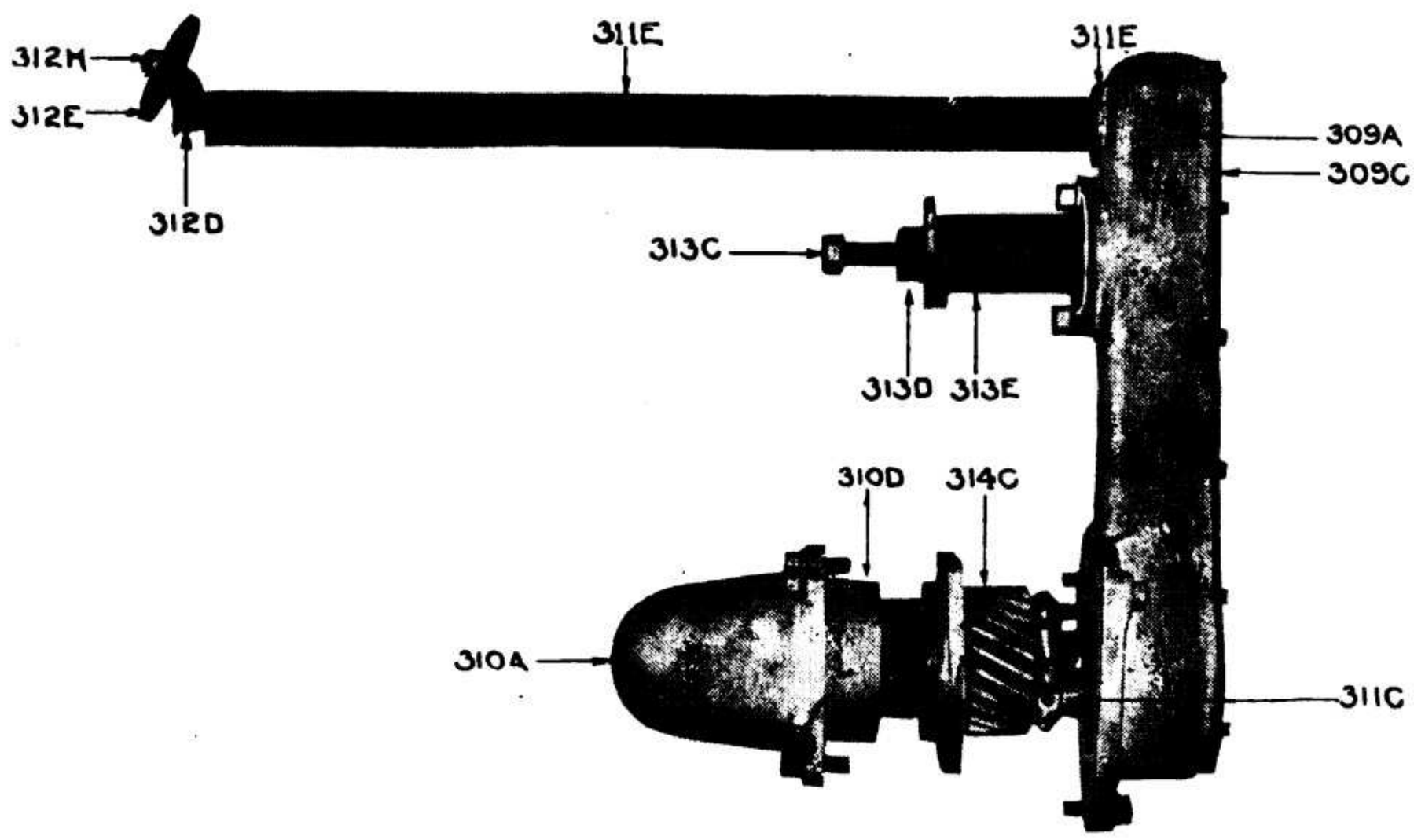


PLATE 90—GOVERNOR ASSEMBLY

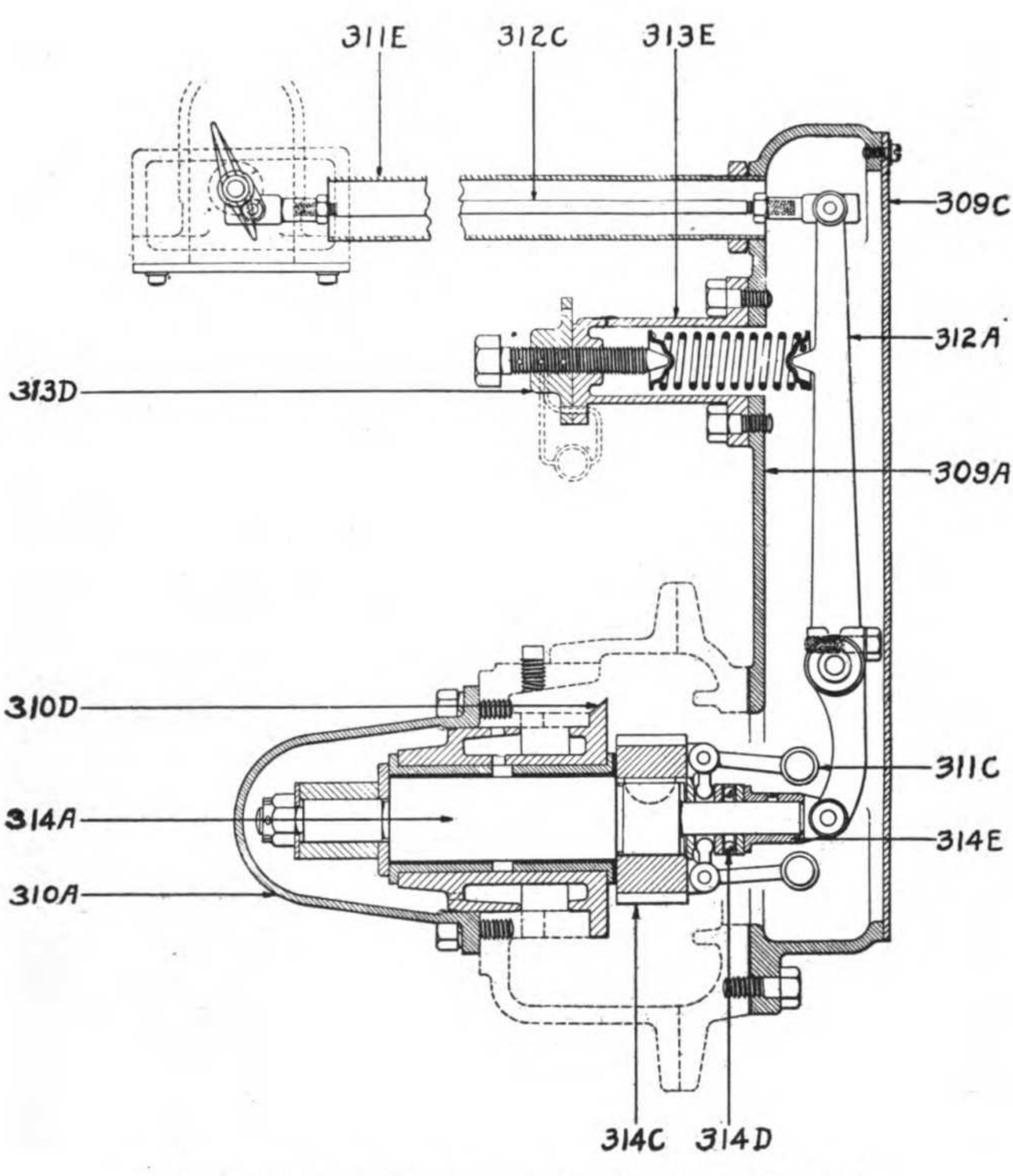


PLATE 91—SECTIONAL DRAWING OF GOVERNOR

NOMENCLATURE OF PARTS—Continued

Part No.	No. Per Tractor	Property Classification—Class IV, Division 10	
		Name of Part	Location

Engine—GOVERNOR—*Continued*

See illustrations on pages 190, 191, 192

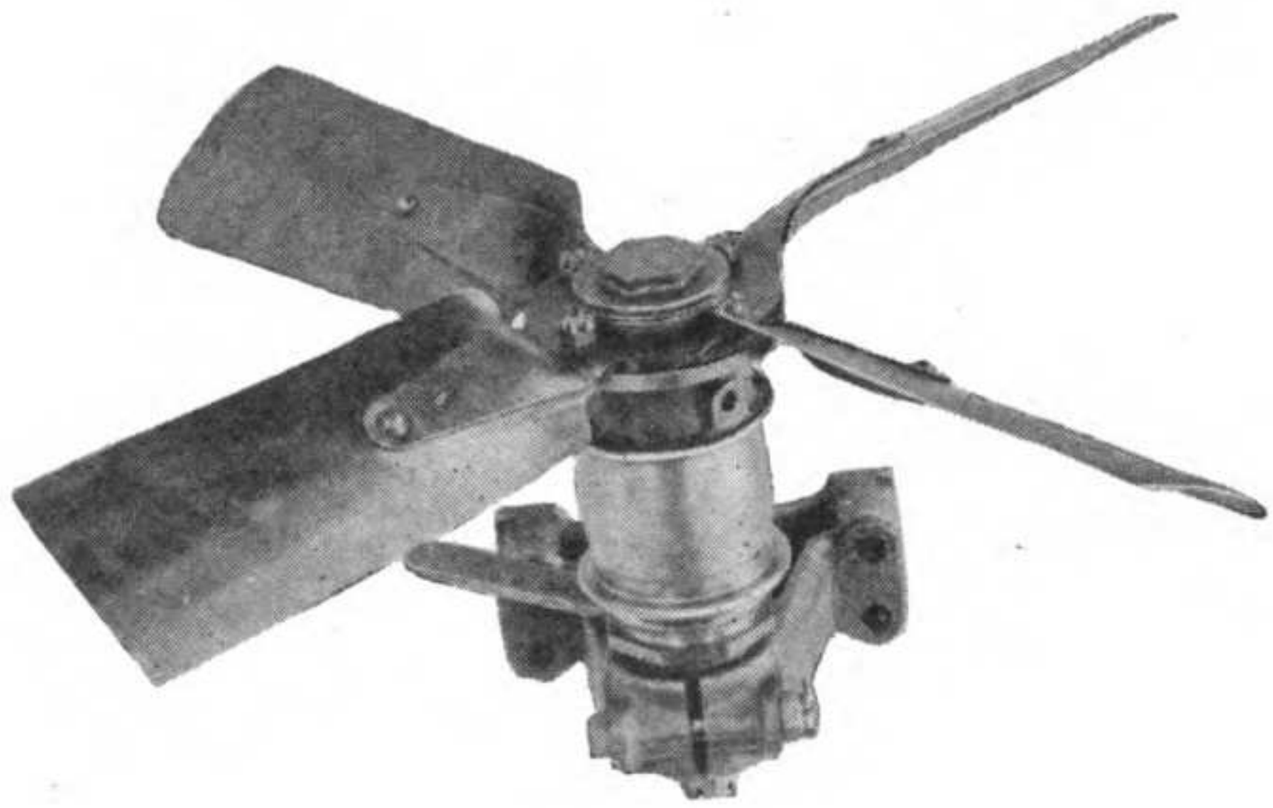
313A	1	Governor spring	In governor adjusting spring cage
318B	2	Governor spring seat	Side of governor lever
314D	1	Governor thrust bearing	Outside governor spider
312E	1	Governor throttle valve	On throttle spindle
314B	1	Key	Keys generator gear to shaft
315K	1	Pipe plug	In upper crank case
315A	3	Screw (ASME machine) No. 8—32 x .375 (3/8)	Butterfly valve to spindle
315B	15	Screw (ASME machine) No. 10—32 x .5 (1/2)	Governor
	15	.187 (3/16) Lock washers	
315C	2	Screw, hex. head cap .375 (3/8) x .75 (3/4)	Spring cage to housing
	2	.375 (3/8) Lock washer	
315D	11	Screw, hex. head cap .375 (3/8) x 1	Shaft cover to crank case
	11	.375 (3/8) Lock washers	
314G		Screw, hex. head cap	
310D	1	Shaft bearing cage	Fastens to crank case
362G	1	Shaft bushing, inner	In crank case
362F	1	Shaft bushing, outer	In crank case
312D	1	Throttle lever	End of governor rod
311D	1	Throttle lever cover	Around throttle lever
312H	1	Throttle spindle	Through butterfly valve
312F	2	Throttle spindle bushing	Ends of throttle spindle
310F	1	Thrust washer	Between spacer and generator shaft

Engine—FAN

See illustrations on pages 194, 195

283F	4	Bolt S. A. E. drilled .375 (3/8) x 1	Fan to hub
	4	.375 (3/8)—24 Castle nuts	
285G	1	Bolt S. A. E. drilled .5 (1/2) x 3.437 (3 7/16)	On fan bracket
	1	.5 (1/2)—20 Castle nuts	
281A	1	Fan	Front end of engine
285F	1	Fan bearing	On fan shaft, in hub
285E	1	Fan bearing retainer	In fan hub
285D	1	Fan bearing washer	Between packing nut and bearing
282C	1	Fan belt	
282B	1	Fan belt adjusting eccentric	On fan bracket
282A	1	Fan bracket	Front end of crankcase
285A	1	Fan cap gasket	Between hub and cap
283A	1	Fan hub	On fan shaft
284D	1	Fan hub bearing spacer	Between fan hub bearings
283B	1	Fan hub cap	End of fan hub
283C	1	Fan hub packing nut	Rear end of fan hub
283D	1	Fan hub retaining ring	In packing nut
285B	1	Fan hub washer	In packing nut
285C	1	Fan hub washer	In packing nut
284A	1	Fan shaft	In adjusting eccentric
284C	1	Fan shaft nut, rear	On fan shaft
284F	1	Fan shaft washer	Between nut and front bearing
284E	1	Fan shaft washer, rear	Between nut and eccentric
284B	1	Key	Keys shaft to eccentric
283E	2	Lock ring	Rear end of fan hub
176F	1	Pipe plug	In fan hub

PLATE 92



FAN ASSEMBLY AND PARTS

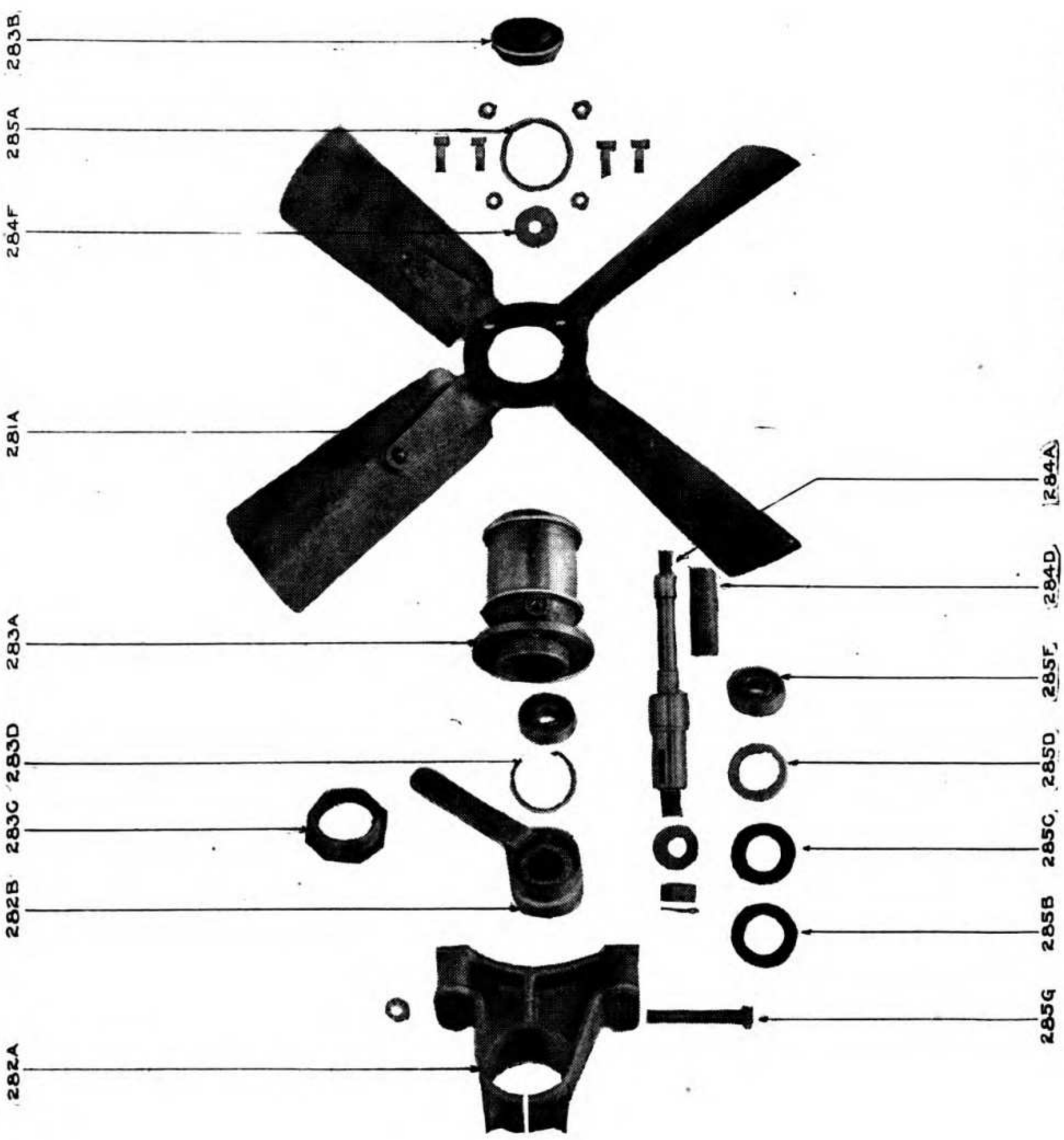
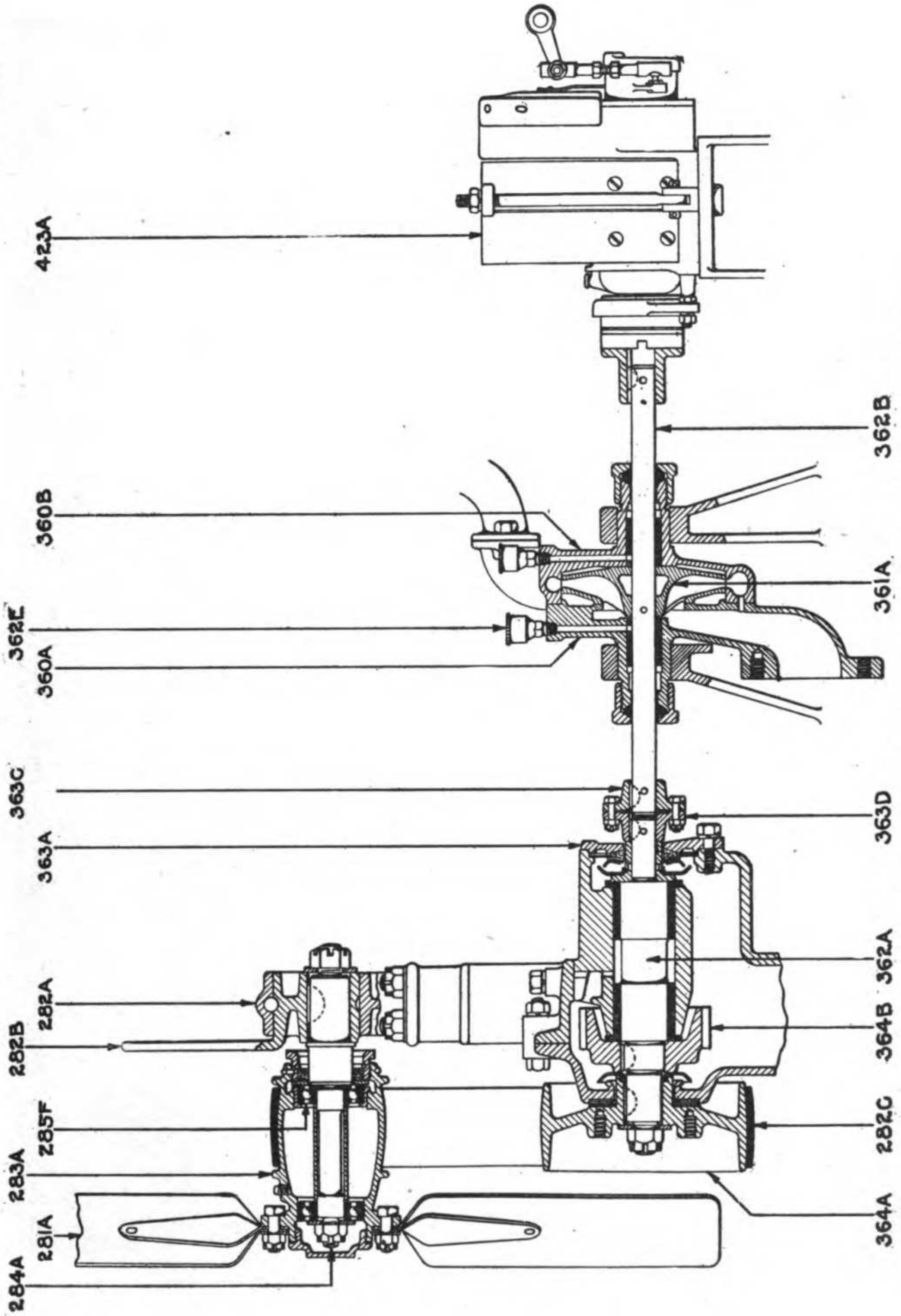
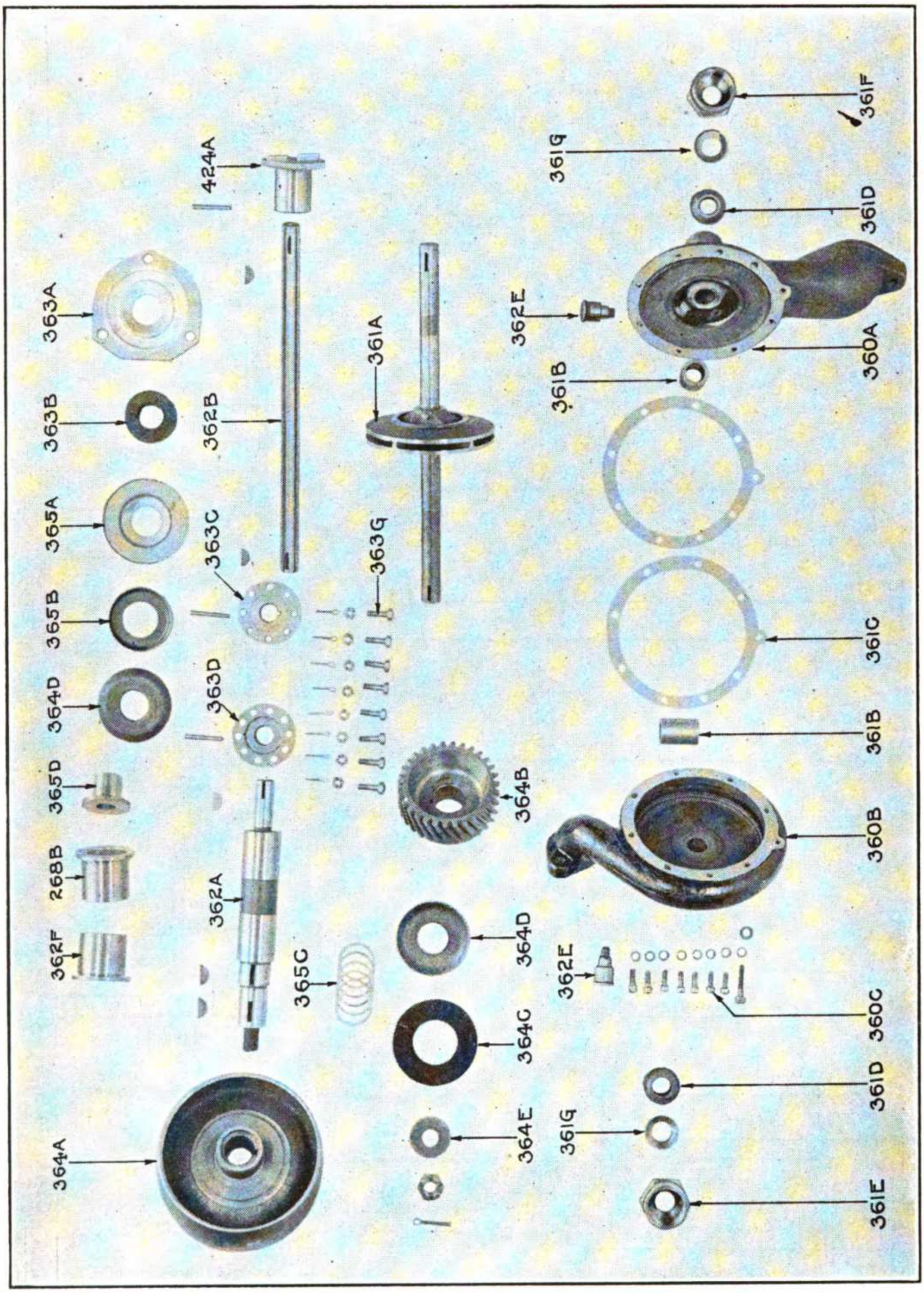


PLATE 93



SECTIONAL DRAWING FAN—WATER PUMP AND MAGNETO

PLATE 94



WATER PUMP PARTS

NOMENCLATURE OF PARTS—Continued

Part No.	No. Per Tractor	Property Classification—Class IV, Division 10	
		Name of Part	Location
		***Engine*—WATER PUMP**	
		See illustrations on pages 196, 197	
363G	2	Bolt S. A. E. drilled .25 (¼) x .875 (⅞)	Bolts coupling flanges
	2	.25 (¼)—28 Castle nut S. A. E.	
365A	1	Drive shaft gland	Around thrust collar
365B	1	Drive shaft oil retainer	Around thrust collar
364D	2	Drive shaft oil sling	On drive shaft
363B	1	Drive shaft packing	Around drive shaft thrust collar
365C	8	Drive shaft shim	Between shaft bushing and pump gear
365D	1	Drive shaft thrust collar	Pinned to water pump shaft
363F	1	Drive shaft thrust collar pin	Fastens thrust collar to shaft
364A	1	Fan driving pulley	Front end of pump drive shaft
362E	2	Grease cup	On water pump body
362C	3	Key	On water pump and drive shaft
362D	2	Key	On drive shaft
364C	1	Pulley felt washer	Around fan drive pulley hub
364E	1	Pulley washer	In front fan pulley
364B	1	Pump and magneto gear	Front end water pump drive shaft
363C	1	Pump coupling flange, 8 hole	Couples water pump and drive shaft
	1	Taper pin .183x1.5	
363D	1	Pump coupling flange, 10 hole	Couples water pump and drive shaft
	1	Taper pin .183x1.5	
361B	2	Pump shaft bushing	Both sides of water pipe rotor
363A	1	Pump shaft housing cover	On pump shaft housing
363E	1	Pump shaft housing gasket	Between shaft housing and crank case
360C	8	Screw R. F. H. steel .25 (¼) x .625 (⅝)	Bolts water pump body to cover
	8	Lock washers	
362G	1	Shaft bushing, inner	On water pump drive shaft
362F	2	Shaft bushing, outer	On water pump drive shaft
360B	1	Water pump body	Bolted to water pump cover
360A	1	Water pump cover	Bolted to upper crank case
361C	1	Water pump cover gasket	Between cover and body
362A	1	Water pump drive shaft	Geared to cam shaft
	1	.625 (⅝)—18 Castle nut	
361D	2	Water pump packing	With water pump packing nut
361F	1	Water pump packing nut, L. H.	Screwed on body end
361E	1	Water pump packing nut, R. H.	Screwed on cover end
361A	1	Water pump rotor	Mounted on water pump shaft
	1	Taper pin .183 x 1.5	
362B	1	Water pump shaft	Coupled to water pump drive shaft
	1	Taper pin .183 x 1.5	
361G	2	Water pump steel gland	Inside packing nut

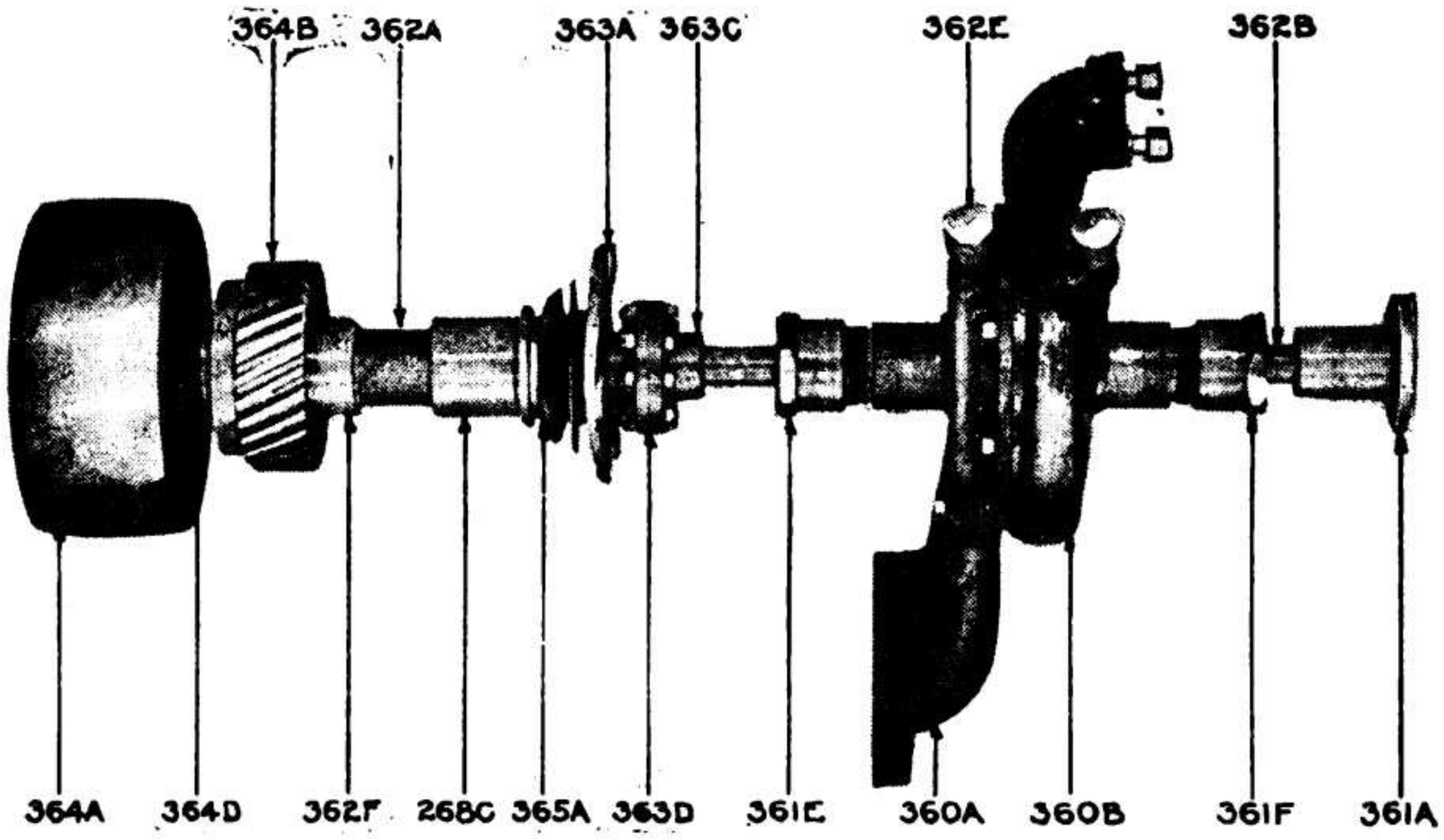
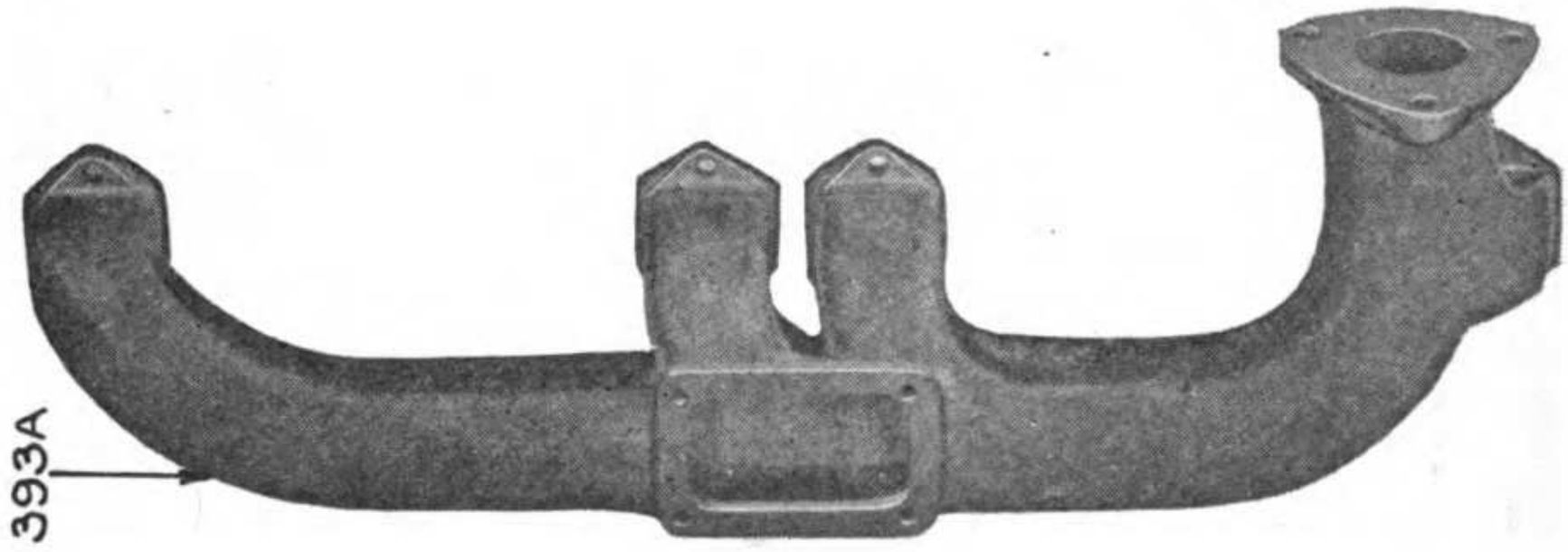


PLATE 95—WATER PUMP ASSEMBLY

PLATE 96

INTAKE AND EXHAUST MANIFOLDS



NOMENCLATURE OF PARTS—Continued

Engine—MANIFOLDS

See illustration on page 198

Part No.	No. Per Tractor	Property Classification—Class IV, Division 10	
		Name of Part	Location
392E	3	Bolt, .5 (½) x 2.25 (2¼) S. A. E.	Packing flange to manifold flange
394B	4	Bolts, .375 (⅜) x .275	Intake heater to manifold
393A	1	Exhaust manifold	Side of cylinder head
391D	1	Exhaust manifold gasket	On manifold flange
392D	1	Exhaust pipe piping flange	On exhaust manifold flange
391C	4	Exhaust port gasket	Between exhaust port and cylinder
396B	1	Inlet manifold flange	End of inlet manifold
396C	2	Inlet manifold flange	Manifold cylinder
391A	1	Intake heater gasket	Between intake heater and manifold
394A	1	Intake manifold	Side of cylinder head
391E	2	Intake port gasket	Between intake port and cylinder
392B	2	Intake water pipe gasket	Water inlet flange
392F	3	Tobin bronze nuts, .5 (½)—2) S. A. E.	Packing flange to manifold flange
392C	2	Outlet water flange	Top of cylinder head
176F	1	Pipe plug	Through intake heater
13E	2	Pipe plug	Top of intake manifold
396F	1	Water inlet manifold	Side of cylinders
391B	2	Water outlet gasket	Between water pipe and cyl. head
395A	1	Water outlet manifold	Connects radiator and water jacket
392G	1	Water outlet pipe thimble	At end of water outlet pipe
392A	1	Water pump tee gasket	On water pump inlet flange

Engine—MUFFLER

See illustration on page 200

241E	2	Bolts S. A. E	Muffler flange to armor
	2	.5 (½)—20 S. A. E. nuts	
	2	.5 (½) Lock washers	
241C	1	Exhaust pipe	
241B	2	Muffler bracket	On armor and end of muffler
241A	1	Muffler and flange	On end of exhaust pipe
241D	2	Screw hex. cap .5 (½) x 1	Through bracket to muffler
	2	.5 (½) Lock washers	

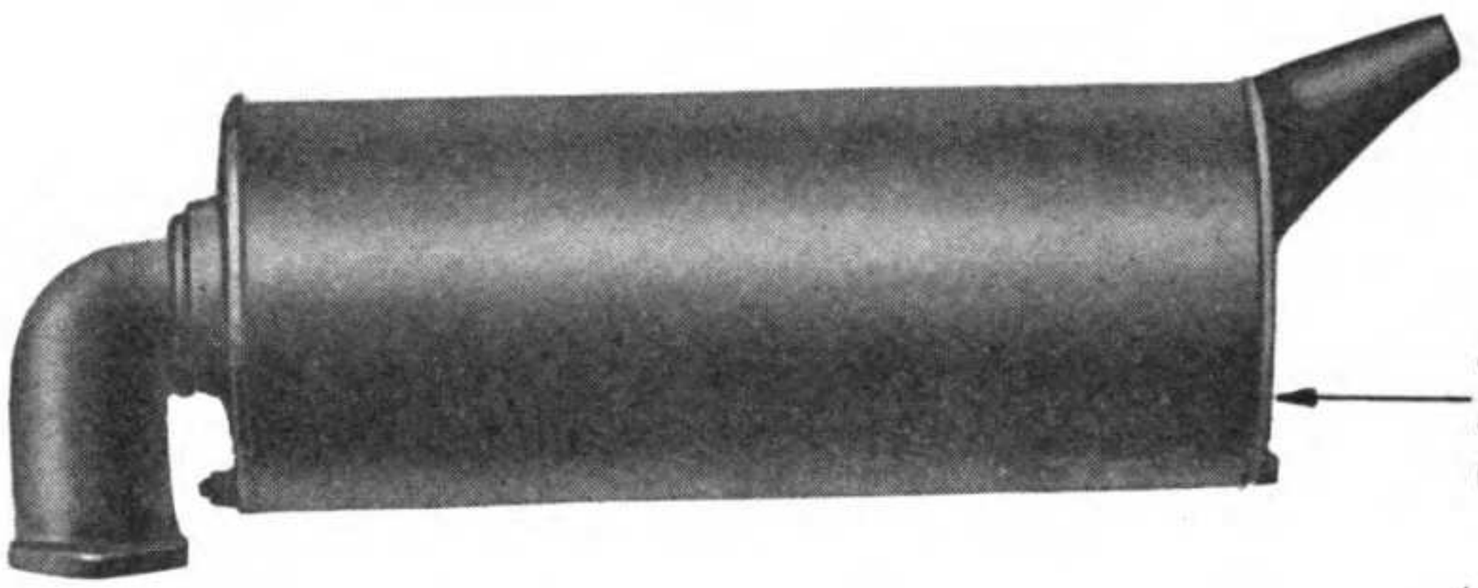
Engine—CARBURETER

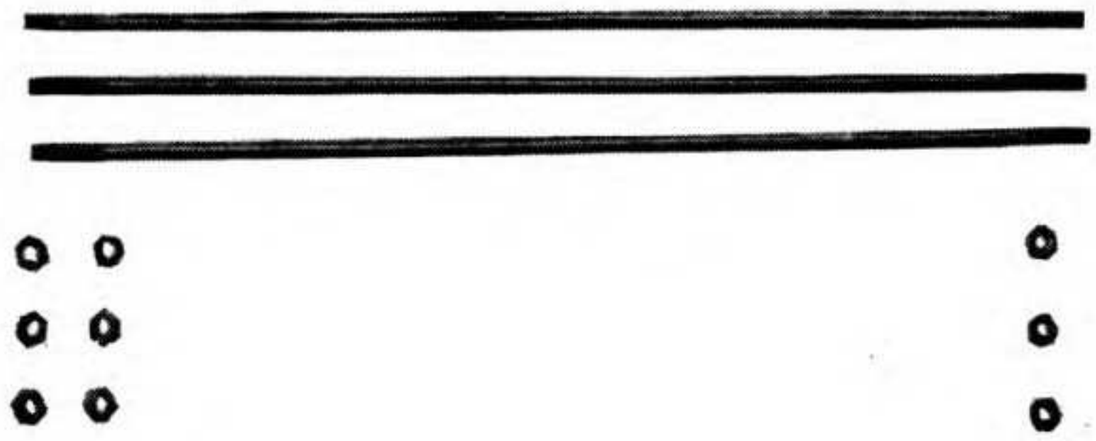
See illustration on page 202

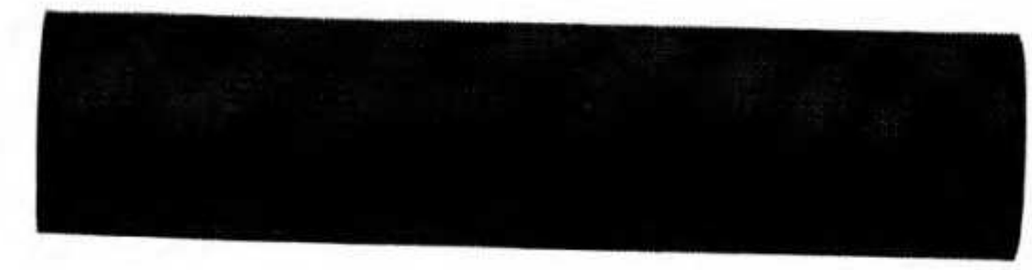
408A	1	Air cleaner	Bolted to exhaust manifold flange
409A	1	Air cleaner bracket	Bolted to exhaust manifold flange
409C	1	Air cleaner clamp ring	Top of air cleaner
409B	3	Air cleaner clamp stud	Air cleaner clamp to brackets
	6	.25 (¼)—28 Nuts	
407B	1	Air cleaner flexible tube	Between carbureter and air cleaner
407A	1	Carbureter assembly	Bolted to intake manifold
409E	1	Carbureter choke handle	End of choke wire
409B	1	Carbureter choke wire	Connected to carbureter air valve

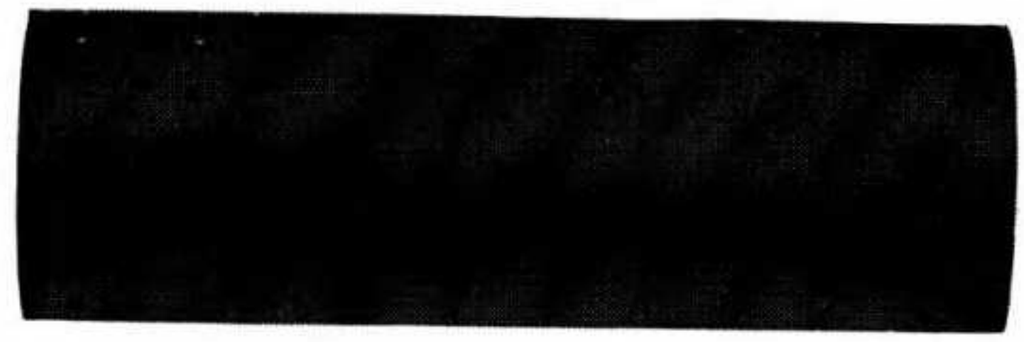
PLATE 97

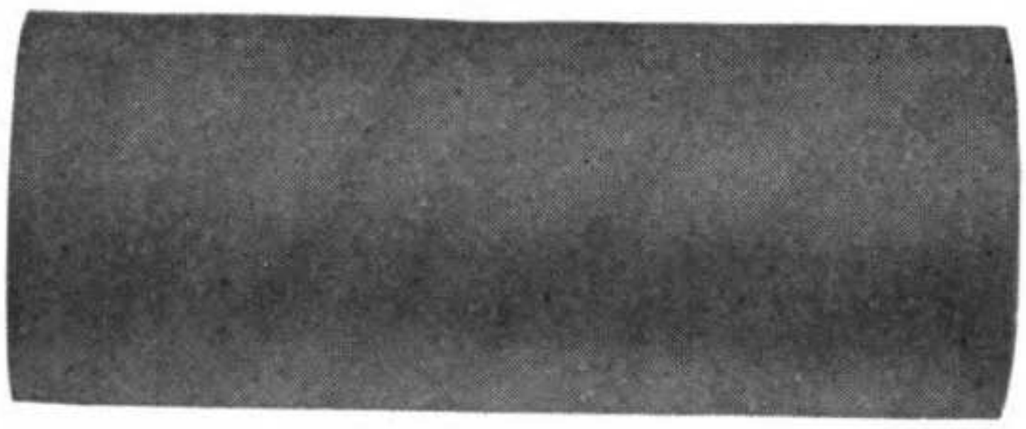
MUFFLER AND EXHAUST PARTS











NOMENCLATURE OF PARTS—Continued

Part No.	No. Per Tractor	Property Classification—Class IV, Division 10	
		Name of Part	Location

Engine—IGNITION

See illustrations on pages 204, 205

353C	2	Cable tube bracket, lower	Bolted to cylinder
353B	2	Cable tube bracket, upper	Bolted to lower cable tube bracket
354A	1	Ignition cable tube	Side of cylinder
354B	1	Ignition cable tube	To cylinder No. 1
354C	1	Ignition cable tube	To cylinder No. 2
354D	1	Ignition cable tube	To cylinder No. 3
354E	1	Ignition cable tube	To cylinder No. 4
353E	4	Igniton cable tube ferrule	Around ignition cable
353F	1	Ignition cable tube front cap	Front end of cable tube
353D	1	Ignition cable tube rear bushing	Rear end of cable tube
353A	1	Magneto ground wire	Switch to magneto
353H	1	Screw, round head, wood, .125 (⅛) x .5 (½)	Through cable tube inner cap
353G	4	Screw, A. S. M. E. machine No. 8—32 x .875 (⅞)	Upper to lower cable tube bracket.
Holt 61991	1	Switch ground wire	Switch to motor

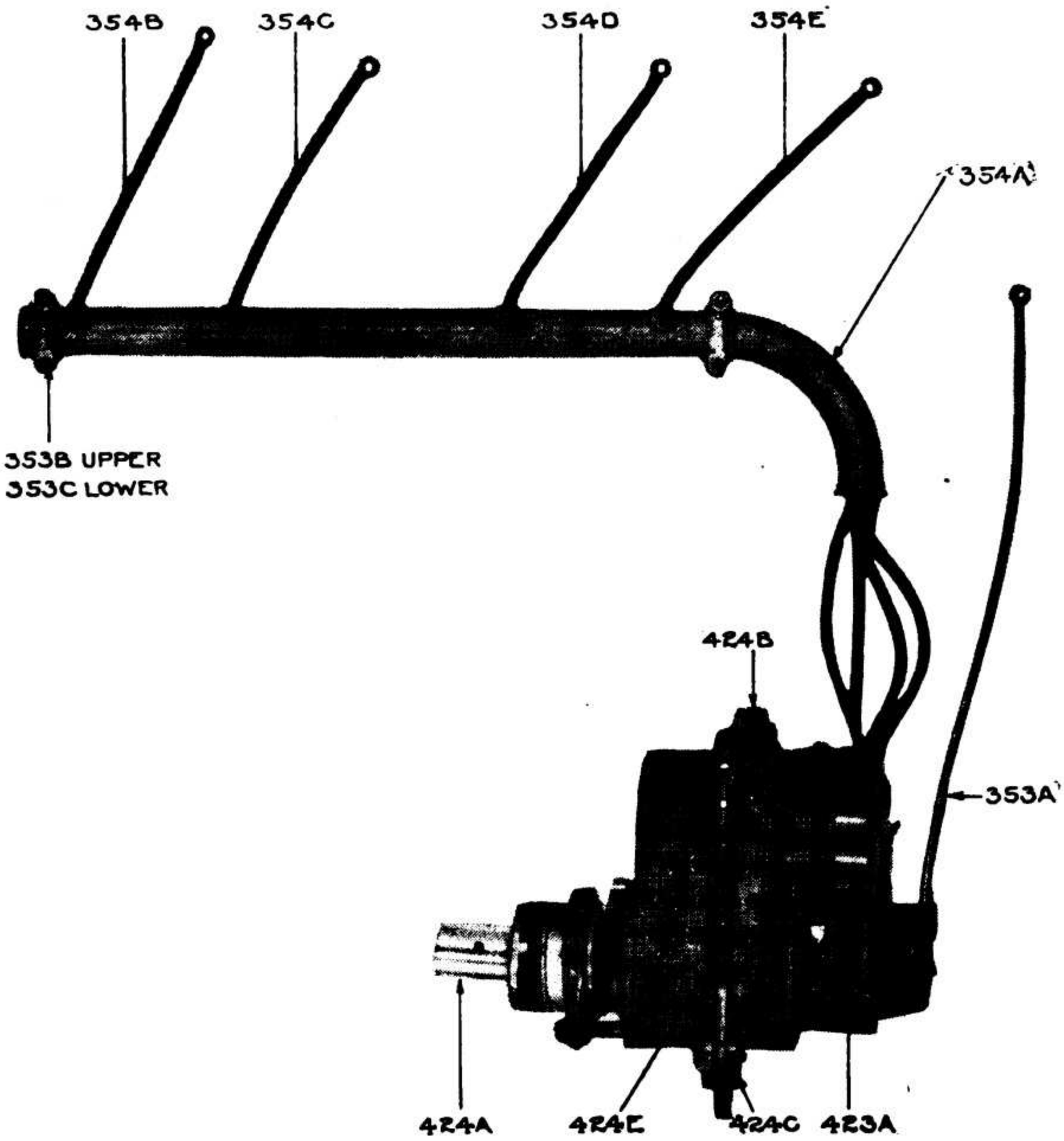


PLATE 100—IGNITION SYSTEM

NOMENCLATURE OF PARTS—Continued

Part No.	No. Per Tractor	Property Classification—Class IV, Division 10	
		Name of Part	Location
		***Engine*—MAGNETO**	
		See illustration on page 204	
423A	1	Magneto	Bolts to pad on side of crank case
424A	1	Magneto coupling	Couples to water pump shaft
424F	2	Magneto dowel	Pins bottom of magneto to pad
424G	2	Magneto strap bolt nut	End of magneto strap tie bolt
	2	.375 (⅜)—24 Lock washers	
424B	1	Magneto strap clamp	Over top of magneto
424D	2	Magneto strap pin	Through magneto strap yoke stud
424E	2	Magneto strap tie bolt	Bolts strap clamp to yoke
424C	2	Magneto strap yoke stud	Holds magneto strap clamp to pad

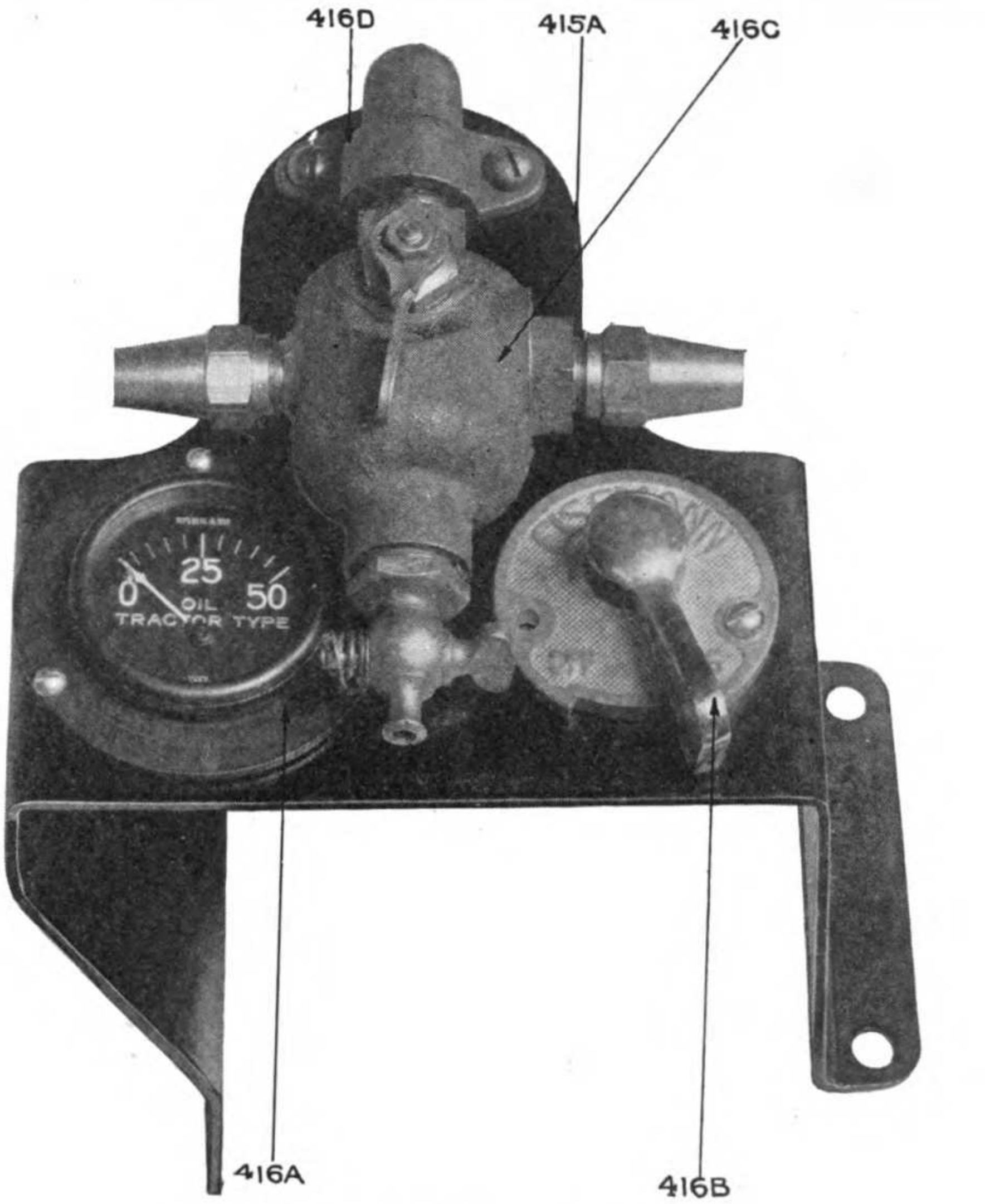
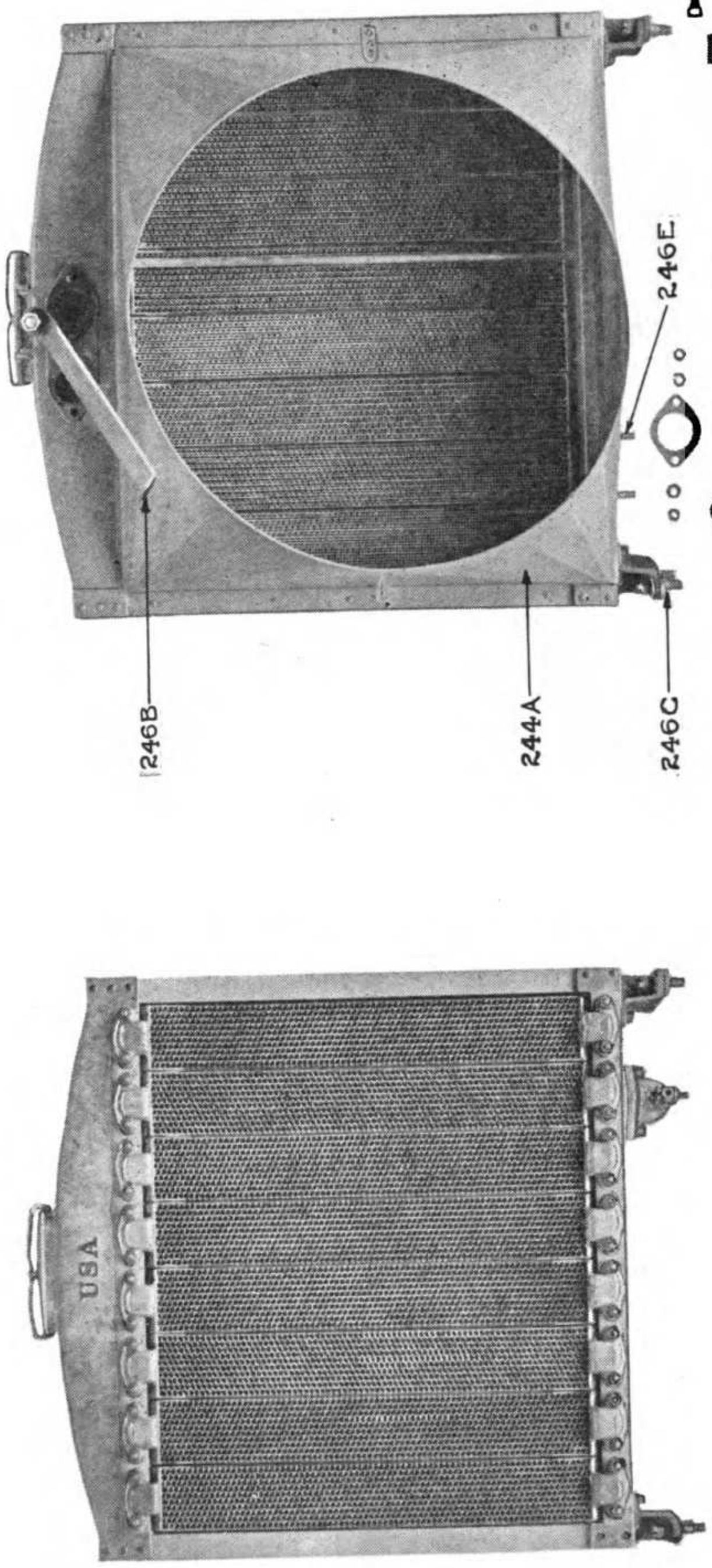


PLATE 101—INSTRUMENT ASSEMBLY

RADIATOR AND PARTS



NOMENCLATURE OF PARTS—Continued

Part No.	No. Per Tractor	Property Classification—Class IV, Division 10	
		Name of Part	Location

Engine—INSTRUMENTS

See illustration on page 205

418B	2	Bolt and nut, round head, stove .25 (¼) x .5 (½)	3 Way valve to bracket
	2	.25 (¼) Lock washers	
418C	2	Bolt and nut, round head, stove .187 ($\frac{3}{16}$) x .5 (½)	Magneto switch to bracket
	2	.187 ($\frac{3}{16}$) Lock washers	
418D	3	Bolt and nut, round head, stove .156 ($\frac{5}{32}$) x .5 (½)	Pressure gauge to bracket
	3	.187 ($\frac{3}{16}$) Lock washers	
415A	1	Instrument bracket	On cylinder
416B	1	Magneto switch	On instrument bracket
416A	1	Oil pressure gauge	On instrument bracket
417A	1	Oil pressure pipe	Leads to oil pressure gauge
98G	4	Screw, hex. head cap	Through instrument bracket
	4	.312 ($\frac{5}{16}$) Lock washer	
416C	1	3-Way gasoline valve and strainer	On instrument bracket
416B	1	3-Way gasoline valve elbow	On instrument bracket
417B	2	Tube flange	On oil pressure pipe
418A	1	Tube union	End of pressure pipe
417C	1	Tube union nut	On tube flange

Engine—COOLING SYSTEM

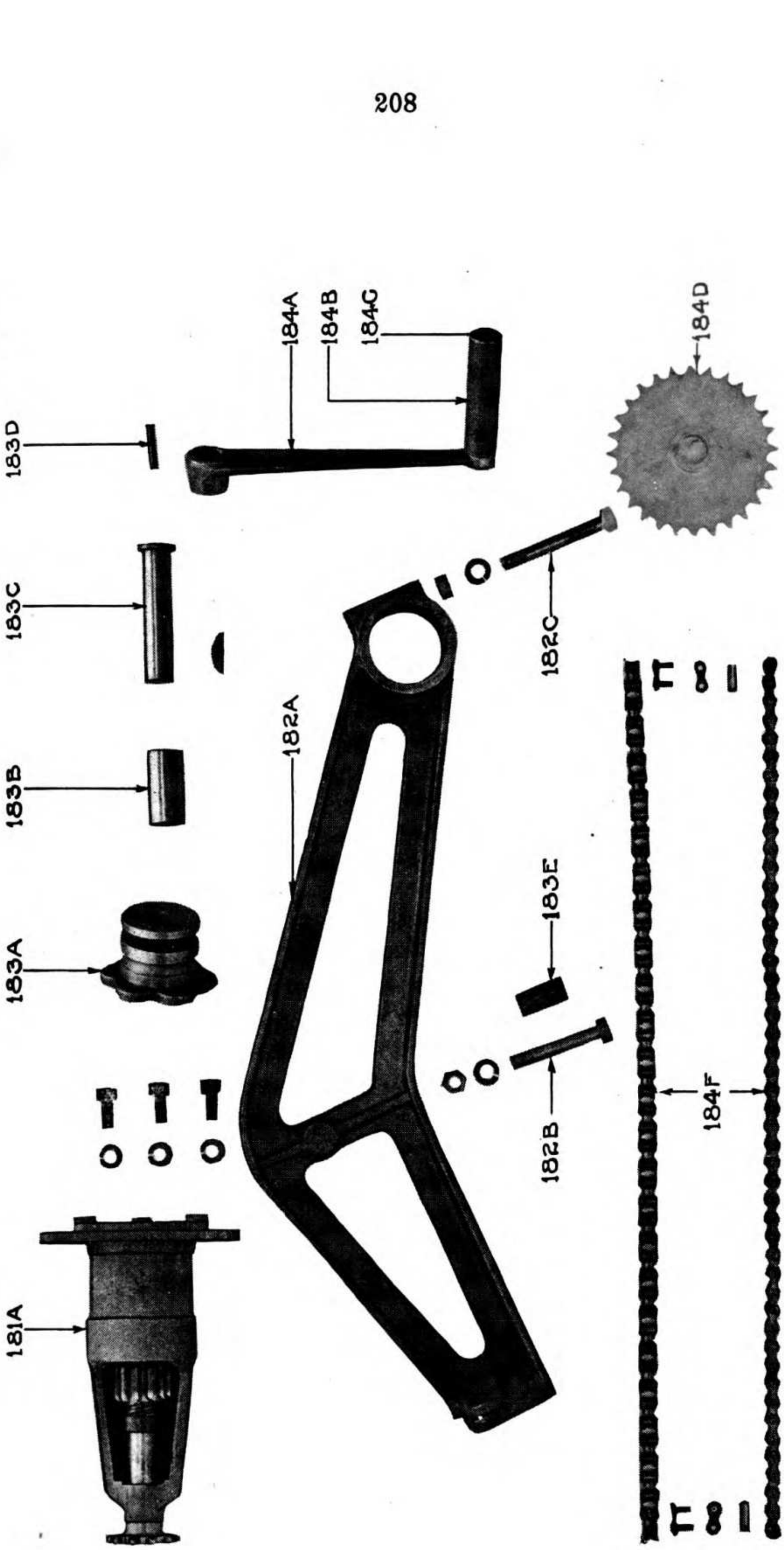
See illustration on page 206

245G	4	Bolt hex. head	On flange gaskets
	4	Lock washers	
245E	1	Hose flange	On inlet base
245F	4	Inlet and outlet flange gasket	On top, back of radiator
246B	1	Radiator brace	On top and rear of radiator
244A	1	Radiator and shroud	On front of main frame
245C	1	Radiator inlet hose	On top of radiator
245D	1	Radiator inlet cover	On top of radiator
245A	1	Radiator outlet flange	On bottom of radiator
245B	1	Radiator outlet hose	Hose to radiator outlet
246A	4	Radiator support washer	On main frame
246F	1	Short shank drain cock	Under outlet flange
246C	4	Stud	On main frame
	4	.625 (⅝)—18 Castle nuts	
246D	1	Stud	Through radiator brace
	1	.625 (⅝) —18 S. A. E. nuts	
246E	4	Stud	Bottom of radiator
	4	.437 ($\frac{7}{16}$)—20 S. A. E. nuts	
	4	.437 ($\frac{7}{16}$) Lock washer	

Engine—SPARK AND THROTTLE CONTROL

312B	7	Ball joints	On magneto control rod
	7	.25 (¼)—28 Nut S. A. E	
402D	1	Bolt .25 (¼) x .75 (¾)	Throttle control lever
	1	.25 (¼) Lock washer	
402D	1	Bolt, .25 (¼) x .75 (¾)	Throttle control lever
	1	.25 (¼) Lock washer	
403C	2	Bolts, .312 ($\frac{5}{16}$) x 1.25 (1¼)	Through carbureter control bracket
298E	2	Bolts, .312 ($\frac{5}{16}$) x 1.5 (1½)	In spark control bracket

PLATE 103



HAND STARTER PARTS

NOMENCLATURE OF PARTS—Continued

Part No.	No. Per Tractor	Property Classification—Class IV, Division 10	
		Name of Part	Location

Engine—SPARK AND THROTTLE CONTROL—*Continued*

403B	1	Carbureter control bracket	Support spark control shaft
403A	1	Carbureter control lever	Bottom of spark control shaft
403G	1	Carbureter control rod collar	Pin to carbureter control rod
	1	.062 ($\frac{1}{16}$) x .75 ($\frac{3}{4}$) split pin	
403F	1	Carbureter control rod, front	Carbureter
	2	.25 ($\frac{1}{4}$)—28 Nuts, S. A. E	
402A	1	Carbureter lever connection	End of carbureter control rod
	1	.062 ($\frac{1}{16}$) x .75 ($\frac{3}{4}$) split pin	
402B	1	Carbureter rod compression spring	End of carbureter control rod
402F	1	Magneto control rod	Leads to magneto point
373H	3	Pin	Used on spark control shaft
403D	1	Rear carbureter control rod	Connects to throttle control lever
401D	2	Spark and carbureter control lever	Pin to control shaft
401F	1	Spark control connecting rod	Connects control lever and shaft
401A	1	Spark control bracket	Front of crank case
402C	1	Spark control lever	Join to throttle control lever
401C	1	Spark control lever	Fastens to control bracket
401G	1	Spark control lever bolt	Control lever to bracket
402G	1	Spark control rod	End of spark control shaft
401E	1	Spark control shaft	Supported by control bracket
403E	1	Spark control shaft collar	Pinned to spark control shaft
402H	2	Steering post ball joint	On throttle control lever
402E	1	Throttle control lever	Lower end to throttle tube

Engine—HAND STARTER

See illustrations on pages 48, 208

181B	3	Bolt .437 ($\frac{7}{16}$) x 1	On E. B. starting drive
	3	.437 ($\frac{7}{16}$) Lock washer	
182B	1	Bolt S. A. E. .5 ($\frac{1}{2}$) x 3.75 ($3\frac{3}{4}$)	Center of crank bracket
182C	1	Bolt S. A. E. .5 ($\frac{1}{2}$) x 3.25 ($3\frac{1}{4}$)	Top of crank bracket
	2	.5 ($\frac{1}{2}$) Lock washers	
	2	.5 ($\frac{1}{2}$)—20 Nuts S. A. E	
183A	1	Eccentric	On starting crank bracket
183B	1	Eccentric bushing	In starting crank bracket
181A	1	Eclipse bendix starting drive	Right rear motor support
184E	1	Key	On crank shaft
184F	1	Roller chain	Around shaft sprocket
184A	1	Starting crank	
182A	1	Starting crank bracket	On main frame
183E	1	Starting crank bracket brace	Center of bracket
184B	2	Starting crank handle	
184C	2	Starting crank handle shaft	Riveted to crank
183D	1	Starting crank pin	Through crank and shaft
183C	1	Starting crank shaft	Through crank bracket
184D	1	Starting crank shaft sprocket	

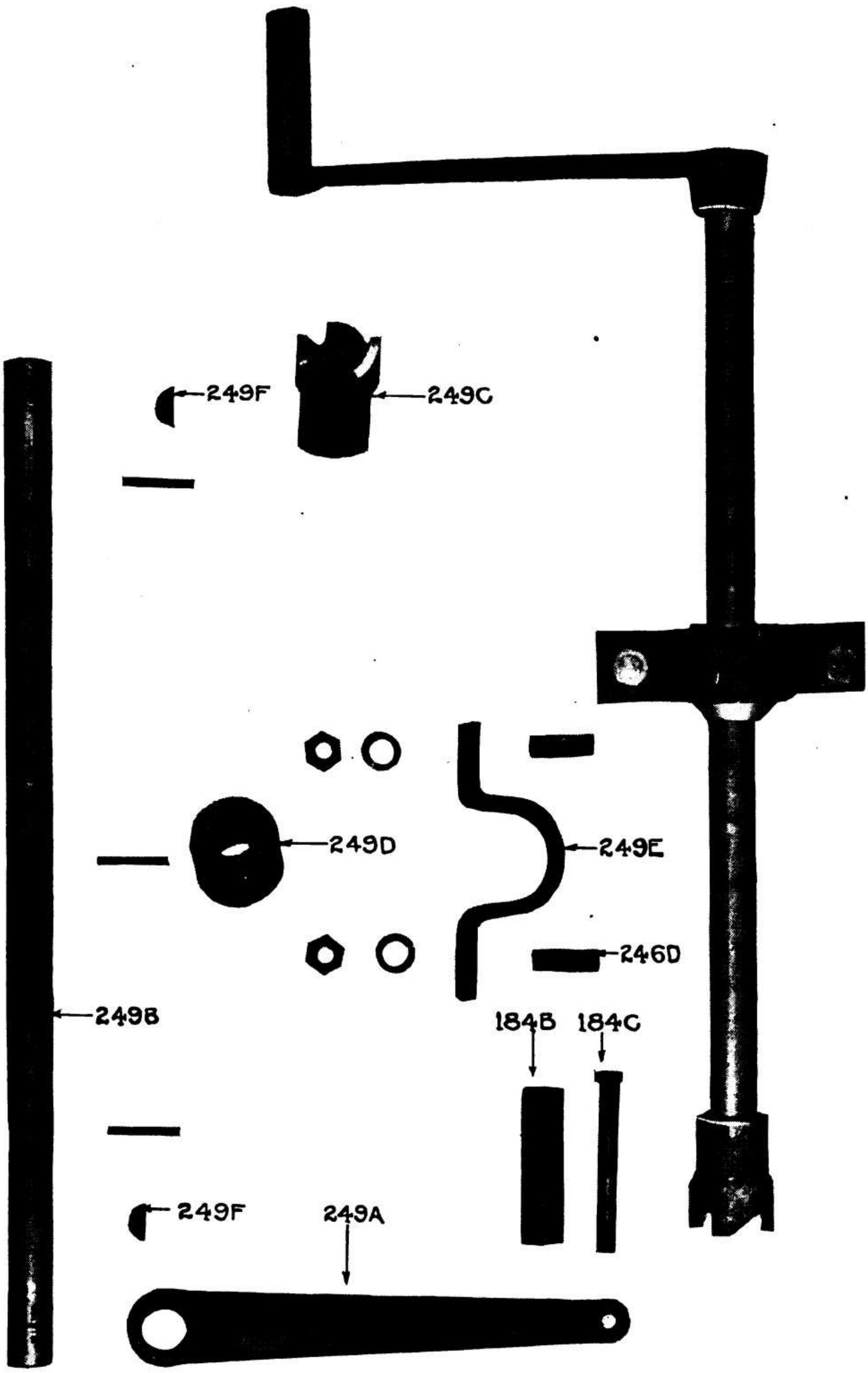


PLATE 104—FRONT STARTING CRANK AND PARTS

NOMENCLATURE OF PARTS—Continued

Part No.	No. Per Tractor	Property Classification—Class IV, Division 10	
		Name of Part	Location

Engine—FRONT STARTING CRANK

See illustration on page 210

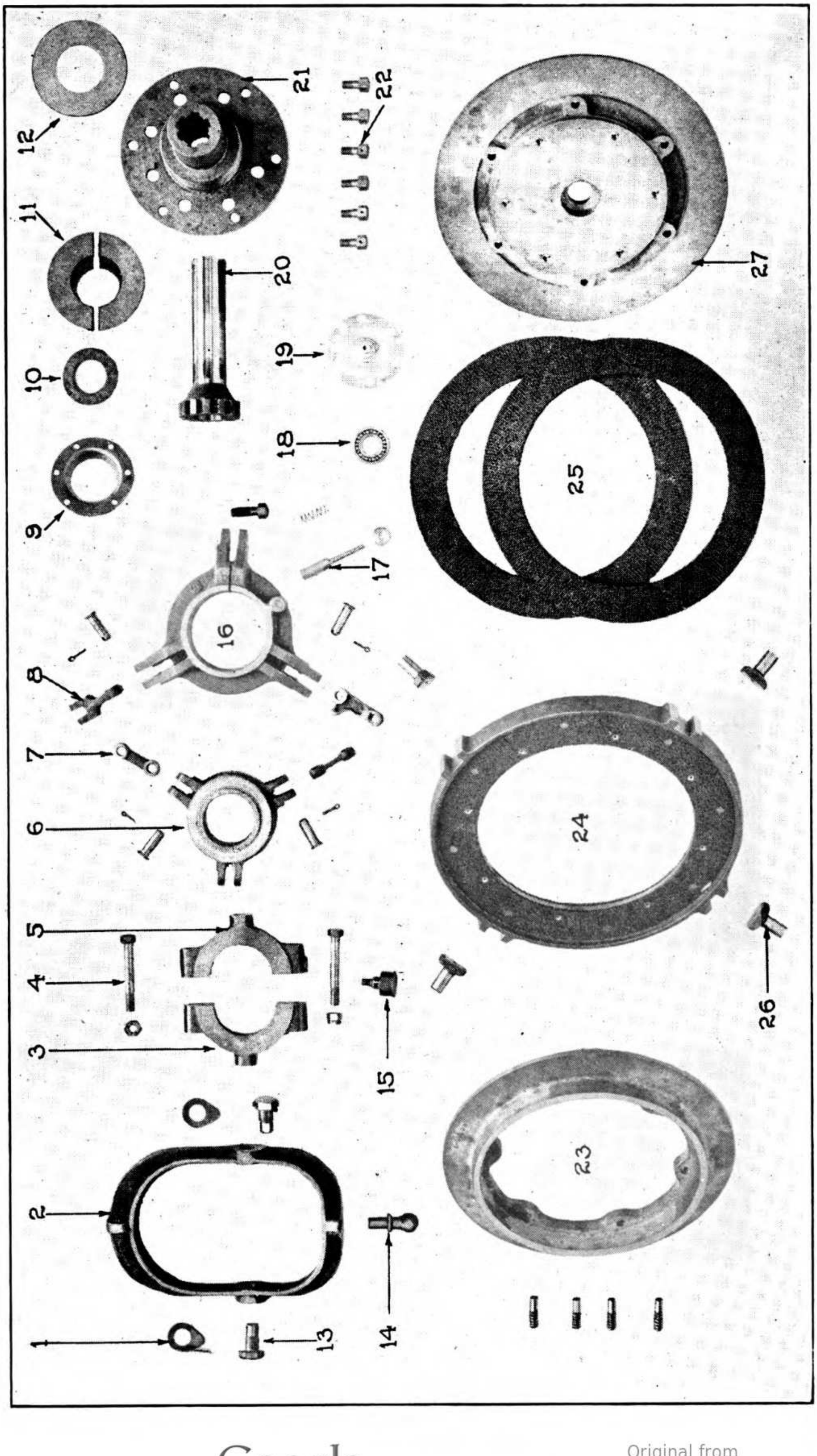
249A	1	Front starting crank	Front end of starting crank shaft
249C	1	Front starting crank jaw	End of starting crank shaft
249B	1	Front starting crank shaft	Front end of crank shaft
	3	.208x1.875 taper pins	
249F	2	Key	Ends of starting crank shaft
249E	1	Starting crank bracket	On main frame
184B	1	Starting crank handle	
184C	1	Starting crank handle shaft	
249D	1	Starting crank shaft bearing	In starting crank bracket
246D	2	Stud	Bracket to main frame
	2	.625 (5/8)—18 S. A. E. nuts	
	2	.625 (5/8) Lock washers	

Master Clutch—MASTER CLUTCH

See illustrations on pages 114, 212, 213

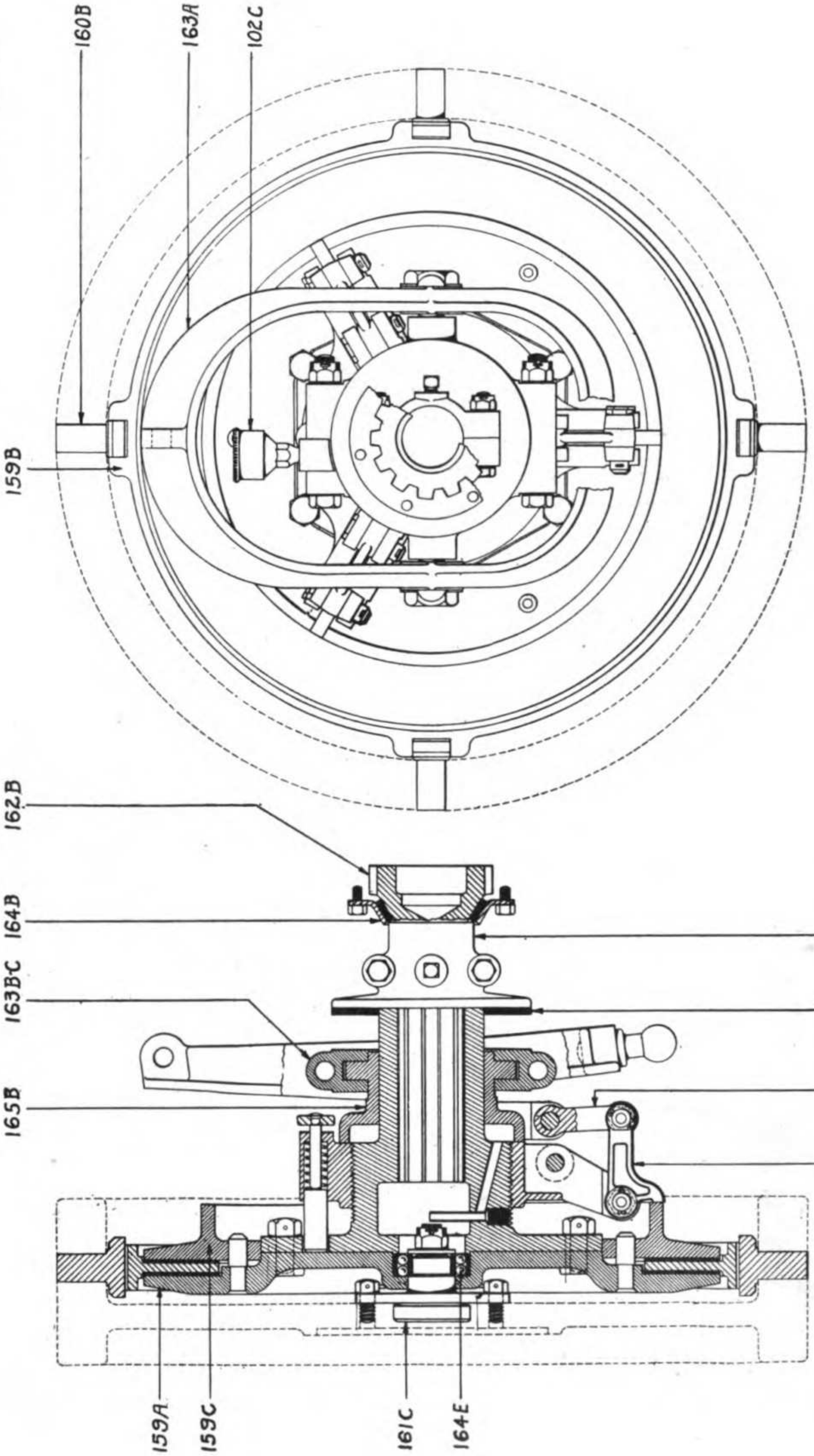
160D	1	Allen safety set screw	Inner disc hub
161C	1	Bearing flange	Back of flywheel
161G	1	Bearing washer	Against ball bearing
164C	2	Bolt S. A. E. drilled .375 (3/8) x 2	On brake disc
	2	.375 (3/8)—24 Castle nuts	
164D	2	Bolt S. A. E. drilled .5 (1/2) x 3.75 (3 3/4)	On shifter yoke
	2	.5 (1/2)—20 Castle nuts	
161B	1	Brake disc	On face of clutch brake
159B	1	Center disc	
FF56E	1	Clutch adj. plunger knob	On clutch adj. plunger
164E	1	Clutch bearing	Center of outer disc
165C	3	Clutch dog	On clutch shifter
161F	3	Clutch dog pin	Through M. clutch dog holder
165D	3	Clutch link	On clutch shifter
161E	6	Clutch link pin	On clutch links
165B	1	Clutch shifter	On inner disc hub
164B	1	Coupling dust washer	Around coupling, male half
164A	1	Coupling felt washer	Around coupling, male half
162B	1	Coupling, male half	Between clutch and transmission
162A	1	Dog holder	Around inner hub
161D	6	Drive pin	Connects outer and inner discs
160B	4	Flywheel pin	Through flywheel rim
165A	2	Friction disc	On center disc
159A	1	Inner disc	
159D	1	Inner disc hub	
160F	1	Lock wire	Through inner disc bolts
161A	2	Master clutch brake disc	Between clutch and transmission
160C	1	Oil tube	Inner disc hub
159C	1	Outer disc	
164G	2	Oval point set screw	Through brake disc
FF56B	1	Plunger spring	On master clutch adj. plunger
164H	16	Rivets, tubular	Master clutch disc
160E	6	Screw, hexagon head cap .375 (3/8) x .75 (3/4)	On flywheel
162C	6	Screw, hexagon head cap .5 (1/2) x 1	Outer disc to inner disc hub
164F	1	Screw, hexagon head cap .5 (1/2) x 1.5 (1 1/2)	
163A	1	Shifter fork	
163B	1	Shifter yoke (left)	On shifter fork
163C	1	Shifter yoke (right)	On shifter fork
160A	1	Stop pin	Dog holder to disc hub

PLATE 105



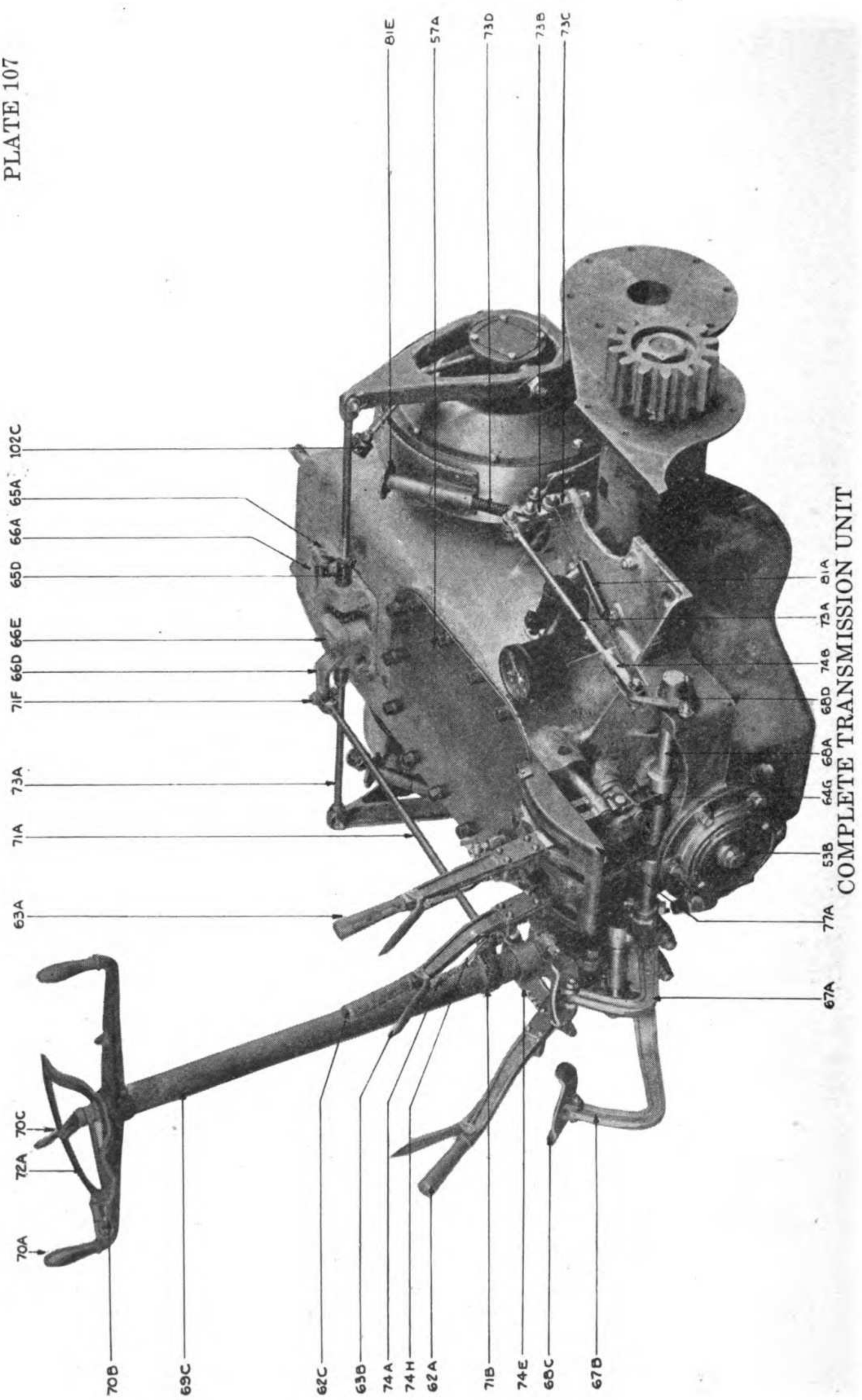
MASTER CLUTCH AND GEAR PARTS

PLATE 106



SECTIONAL DRAWING OF MASTER CLUTCH

PLATE 107



NOMENCLATURE OF PARTS—Continued

Part No.	No. Per Tractor	Property Classification—Class IV, Division 10	
		Name of Part	Location

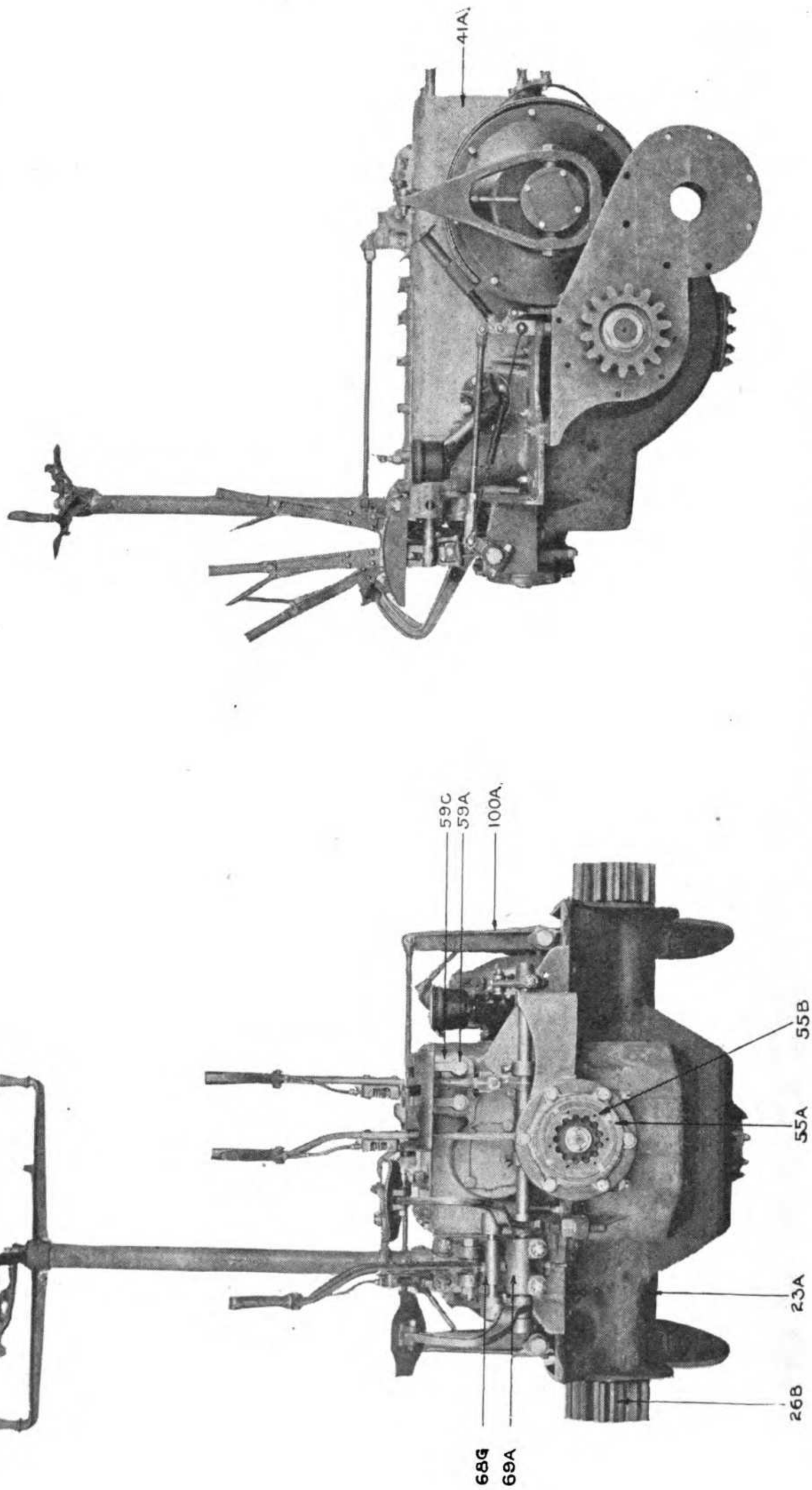
Transmission System—UPPER TRANSMISSION

See illustrations on pages 122, 124, 130, 214, 216, 217

74A	3	Adjusting yoke end S. A. E.	On hand lever grip rod
74B	3	Adjusting yoke end S. A. E.	On M. clutch operating rod
52D	1	Ball bearing adapter	Center of steering clutch shaft
52F	1	Ball bearing cage	With clutch shaft thrust bearing
56C	4	Bearing cap stud	Through clutch quill bearing caps
	4	.625 (⅝)—18 Castle nut	
51B	1	Bearing housing	Encasing clutch shaft bearing
51C	1	Bearing housing adjusting nut	Around bearing housing
51D	6	Bearing housing shim	Between bearing housing and transmission case
49C	6	Bearing sleeve shim	On bevel pinion bearing sleeve
48A	1	Bevel pinion	Rear end pinion shaft
60C	2	Bevel pinion and clutch shaft bearing	Center steering clutch shaft
80C	1	Bevel pinion oil lead	From main oil lead to bevel pinion
78A	1	Bevel pinion bearing sleeve	In pinion bearing cap
60E	1	Bevel pinion shaft bearing	Front end pinion shaft
60A	1	Bevel pinion shaft thrust bearing	In pinion bearing sleeve
66D	1	Bell crank	On steering control drag link
66F	1	Bell crank stud	Through bell crank to breather bracket
61F	1	Bolt S. A. E. .375 (⅜) x 3.093 (3 1/32)	Through lock key
	1	.375 (⅜)—24 Castle nut S. A. E.	
61G	10	Bolt S. A. E. drilled .5 (½) x 2	Connecting upper and lower trans.
	10	.5 (½)—20 Castle nuts S. A. E.	
62B	1	Bolt S. A. E. drilled .75 (¾) x 3.75 (3¾)	Through brake lever to collar cap.
	21	.75 (¾)—16 Castle nut S. A. E.	
68H	2	Bolt S. A. E.	Through brake pedal
	2	.75 Nut S. A. E.	
74D	3	Bolt S. A. E. drilled .5 (½) x 2.25 (2¼)	Through brake lever ratchet
	3	.5 (½)—20 Castle nut	
76C	4	Bolt S. A. E. drilled .375 (⅜) x 1	Through support arm to trans. case
	4	.375 (⅜)—24 Castle nut	
	2	.375 (⅜) Plain washers	
14D	4	Bolt S. A. E. drilled .75 (¾) x 2.25 (2¼)	Through upper and lower trans
	4	.75 (¾)—16 Castle nut	
113B	1	Bolt S. A. E. drilled .375 (⅜) x 1.375 (1⅜)	
	1	.375 (⅜)—24 Castle nut	
113B	1	Bolt S. A. E. drilled .375 (⅜) x 1.375 (1⅜)	Through oil suction pipe clamp
75D	2	Brake band clevis	Holding brake band to multiple lever
75C	4	Brake band clip	Outside brake band
81D	2	Brake band end	End of brake band
81E	2	Brake band hand adjusting nut	End of clutch band adjusting rod
67A	1	Brake foot pedal, left	
67B	1	Brake foot pedal, right	
81A	2	Brake foot pedal spring	Brake pedal to toggle support
62A	1	Brake hand lever	Right hand lever
64E	1	Brake hand lever plunger	On brake hand lever
74E	1	Brake lever ratchet	On steering column cap
68G	1	Brake pedal equalizer	Between brake pedals
73B	2	Brake multiple lever	To brake toggle support
68A	1	Brake shaft	In transmission case
68B	3	Brake shaft collar	On brake shaft
68F	1	Brake shaft spacer	On brake shaft
73C	2	Brake toggle support	On side of transmission case
	2	.75 (¾)—16 Castle nut	
65A	1	Breather bracket	Rear top transmission case
65C	1	Breather bracket gasket	Between breather bracket and transmission case
66A	1	Breather cap	Top of breather
66C	1	Breather cap pin	Used with breather cap
66B	1	Breather cap spring	Used with breather cap
46C	2	Cap bearing stud long	Through counter shaft bearing cap to transmission case
	2	.625 (⅝)—18 Castle nut	
46B	5	Cap bearing stud short	Through counter shaft bearing cap to transmission case
	5	.625 (⅝)—18 Castle nut	

PLATE 108

FRONT AND LEFT SIDE VIEWS OF TRANSMISSION UNIT



NOMENCLATURE OF PARTS—Continued

Part No.	No. Per Tractor	Property Classification—Class IV, Division 10	
		Name of Part	Location
		***Transmission System*—UPPER TRANSMISSION—(*Continued*)**	
		See illustrations on pages 122, 124, 130, 214, 216, 217	
64G	1	Change gear hand lever pivot block	On brake shaft
64H	1	Change gear lever shifter pin	On shifter rod end
71F	12	Clevis pin S. A. E.	Used in upper transmission and steering apparatus
74G	3	Clevis pin	On hand lever grip rod
81B	4	Clevis pin	Through brake toggle support
73D	2	Clutch brake adjusting rod	End clutch brake rod
	2	.5 (½)—20 Nut S. A. E	
76B	2	Clutch brake band support arm	Rear end transmission case
73A	4	Clutch brake rod	Brake hand lever to adjusting yoke
	4	.5 (½)—20 S. A. E. Nut	
81C	2	Clutch brake spring	On clutch brake adjusting rod
56A	2	Clutch quill bearing cap	On steering clutch shaft
45A	1	Counter shaft	Over main drive shaft
52G	2	Counter shaft bearing	Both ends of counter shaft
46A	1	Counter shaft bearing cap	Rear bearing counter shaft
46F	1	Counter shaft bearing lock screw	Through bearing cap to retainer ring
	1	.625 (⅝)—18 Plain nut	
46E	1	Counter shaft bearing retainer ring	With counter shaft bearing
45C	1	Counter shaft driving gear	Front end counter shaft
57F	1	Counter shaft front bearing cap	End counter shaft
54A	1	Coupling bearing cap	Front of transmission case
55C	1	Coupling bearing cap packing	Used with packing ring
53C	1	Coupling bearing spacer	Between pinion roller bearings
54F	6	Coupling bearing cap stud	Steering column cap,
	6	.625 (⅝)—18 Castle nut	

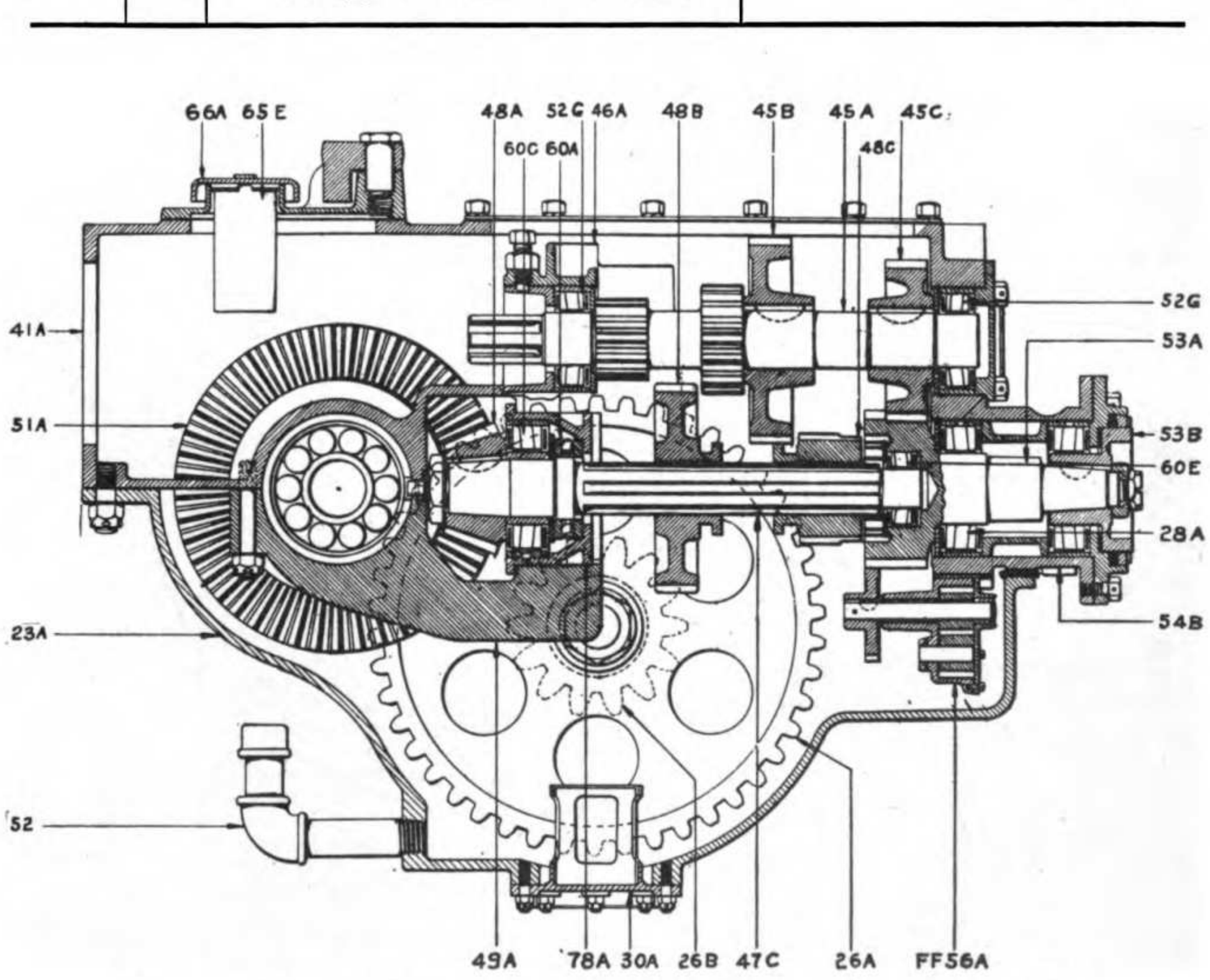


PLATE 109—SECTIONAL DRAWING OF TRANSMISSION

NOMENCLATURE OF PARTS—Continued

Transmission System—UPPER TRANSMISSION—*Continued*

See illustrations on pages 122, 124, 130, 214, 216, 217

Part No.	No. Per Tractor	Property Classification—Class IV, Division 10	
		Name of Part	Location
53B	1	Coupling, female half	Front end drive pinion
58A	1	Direct and high shifter fork	On shifter rod shaft
56B	4	Dowel pin	Clutch quill bearing cap
48B	1	Driven gear	Center pinion shaft
78E	1	Elbow drilled	On oil line
53G	1	Equalizing ring	End main drive pinion
53F	1	Equalizing ring nut	End main drive pinion
52A	1	Filler spacer	On thrust collar steering clutch shaft
79A	3	Flared tube union nut	On oil line
57E	1	Front bearing cap gasket	Between bearing cap and trans. case
49A	1	Gear and pinion bearing cap	Bolted to transmission case
63A	1	Gear shift hand lever	Left lever
64B	1	Gear shift lever pin	On gear shift hand lever
74K	3	Grip rod nut	On hand lever grip rods
74H	3	Hand lever grip rod	On hand lever
64F	2	Hand lever plunger	Master clutch lever
63C	3	Hand lever plunger guide	On hand levers
64D	3	Hand lever plunger springs	On hand levers
69D	1	Hand spark rod	Center steering column
69E	1	Hand throttle tube	Center steering column
45B	1	High speed driving gear	Center counter shaft
52E	2	Holding screw	Through bearing housing to clutch shaft bearing
59F	1	Interlock spring	On shifter rod interlock
27B	1	Key	On steering clutch shaft bevel gear
50C	4	Key	With counter and pinion shaft gears
68E	2	Key	On brake shaft
68D	1	Left hand brake lever	On brake shaft
63B	3	Lever grips	On hand levers
64C	3	Lever grip pin	On hand levers
50D	1	Lock key	Side of steering clutch shaft
52H	1	Lock screw	Bearing housing to ball bearing cage
50F	2	Lock washer	End steering clutch shaft
FF56C	1	Lockwasher	Bearing housing adjusting nut
57D	1	Lock wire	Through counter shaft front bearing cap screws
62C	1	Master clutch hand lever	Center lever
74C	2	Master clutch operating rod	From hand lever to master clutch
	2	.5 (½)—20 Nut S. A. E	
53A	1	Main drive pinion	Front end of transmission case
80E	1	Main oil lead	Under transmission case cover
80H	2	Main oil lead clamp	Top transmission case cover
	2	.375 (⅜)—24 Castle nuts	
80A	1	Oil discharge pipe	Lower end oil line
65E	1	Oil filler springs	
79A	1	Oil line inspection cap	Under pet cock
79H	1	Oil line packing washer	Below inspection cap
54E	1	Oil line drive spur gear	On oil pump shaft
54C	1	Oil line screw wire	With cap screw 54B
54D	1	Oil line shim	Between oil pump and coupling bearing cap
FF56A	1	Oil pump complete	On front transmission bearing cap
80B	1	Oil suction pipe	Right side transmission case
78C	1	Oil suction pipe clamp	Holding oil suction pipe to trans.case
80G	1	Oil sump cover	Over oil sump
55A	1	Packing cap	Front end main drive pinion
78B	1	Packing cap gasket	Between packing cap and trans. case
55D	1	Packing cap screw wire	Through packing cap nuts
55B	1	Packing ring	Front end main drive pinion
79K	1	Packing washer	On oil line
68C	2	Pedal pad	Top of brake pedal
79E	1	Pet cock	On oil line over transmission case
47C	1	Pinion shaft	On line with main drive shaft
48C	1	Pinion shaft gear	Front end pinion shaft
47E	1	Pinion shaft lock washer	Rear end pinion shaft
47D	1	Pinion shaft nut	On pinion shaft
79C	2	Pipe bushing	On oil discharge pipe
79F	1	Pipe cap	End of oil line
80F	2	Pipe nipple	Under inspection cap

NOMENCLATURE OF PARTS—Continued

Part No.	No. Per Tractor	Property Classification—Class IV, Division 10	
		Name of Part	Location

Transmission System—UPPER TRANSMISSION—*Continued*

See illustrations on pages 122, 124, 130, 214, 216, 217

64A	2	Pivot block spring	Gear shift hand lever
	1	.375 (3/8) x 1.625 (1 5/8) B. H. rivet	
53D	1	Retainer	With bevel pinion shaft bearing ring
58B	1	Reverse and low shifter fork	On shifter rod shaft
80D	1	Reverse drive gear oil lead	From main oil lead to reverse gear
60D	1	Reverse idler bearing	On reverse gear shaft
47A	1	Reverse idler gear	On reverse idler gear shaft
47B	1	Reverse idler gear shaft	In reverse idler bearing
74F	3	Rivet pin	On lever grips
75G	16	Rivets .187 (3/16) x .375 (3/8) F. H	On brake band end
75F	34	Rivets tubular	On outside brake band
75E	8	Rivets .187 (3/16) x .25 (1/4) W. B. Norway iron	On brake band support springs
28A	2	Roller bearing	On main drive pinion
28D	1	Roller bearing washer	With pinion roller bearing
46D	3	Roller bearing washer	On counter shaft bearing
63E	1	Set screw, cup point	On gear shift hand lever
68K	3	Set screw, cup point	Through brake shaft collar
162C	10	Screw hex. head cap .5 (1/2) x 1	In front bearing cap
315D	3	Screw hex. head cap .375 (3/8) x 1	In speedometer bracket
	3	.375 (3/8) Lock washers	
78F	1	Screw hex. head cap slotted .375 (3/8) x 1	In speedometer bracket
	1	.375 (3/8) Lock washer	
49B	1	Screw hex. head cap .312 (5/16) x .75 (3/4)	On adjusting lock washer
	1	.312 (5/16) Lock washer	
54B	4	Screw hex. head cap drilled .375 (3/8) x .75 (3/4)	Through oil pump to coupling bearing cap
57C	14	Screw hex. head cap .5 (1/2) x .75 (3/4)	Through transmission case cover
	14	.5 (1/2) Lock washers	
115E	1	Screw, set	Through reverse idler cap bearing
77A	1	Selector plate	Top transmission case
59A	2	Shifter rod	In left of transmission case
59C	2	Shifter rod ends	Front end shifter rod
59B	2	Shifter rod end pin	On shifter rod shaft
59E	2	Shifter rod interlock	Front end of shifter rods
59D	2	Shifter fork lock pin	On shifter fork
	2	.5 (1/2)—20 Plain nuts	
78D	1	Side outlet elbow	On oil line
71E	2	Spark and throttle plunger	Inside spark and throttle lever
72A	1	Spark and throttle quadrant	Top steering column
71D	2	Spark and throttle spring	Inside spark and throttle lever
70C	1	Spark control hand lever	Top steering column
63D	8	Spring washer	In plunger guide
51A	1	Steering clutch shaft bevel gear	Center steering clutch shaft
75A	2	Steering clutch brake band	Outside steering clutch
75B	2	Steering clutch brake band lining	Inside brake band
70A	1	Steering clutch hand lever	Top of steering column
50A	1	Steering clutch shaft	Rear transmission case
50B	2	Steering clutch shaft nut	Outer end steering clutch shaft
60B	1	Steering clutch shaft thrust bearing	Center steering clutch shaft
69B	1	Steering column	
71C	1	Steering column bushing	Foot of steering column
69A	1	Steering column cap	Lower end of steering column
71A	1	Steering control brake link	Connected to steering column
65D	2	Steering control push rod ends	On end clutch brake rod
69C	1	Steering tube	Encasing steering column
71B	1	Steering tube lever	Bolted to steering column
65B	10	Stud	On breather bracket
32F	2	Stud	Through selector plate
	2	.5 (1/2)—20 Castle nuts S. A. E	
49D	4	Stud	Through pinion bearing cap to transmission case
	2	.625 (5/8)—18 Castle nuts S. A. E	
61D	3	Stud	Rear transmission case
	3	.75 (3/4)—16 Castle nuts S. A. E	
61E	2	Stud	Through steering column cap
	2	.625 (5/8)—18 Castle nuts S. A. E	
76A	2	Support springs	Holding brake band to support arm
70B	1	Throttle control hand lever	Top of steering column

NOMENCLATURE OF PARTS—Continued

Part No.	No. Per Tractor	Property Classification—Class IV, Division 10	
		Name of Part	Location
		Transmission System*—UPPER TRANSMISSION—*Continued	
		See illustrations on pages 122, 124, 130, 214, 216, 217	
61A	1	Thrust button	Rear end pinion shaft
61C	1	Thrust button pin	Rear end pinion shaft
61B	1	Thrust button shim	Rear end pinion shaft
50E	1	Thrust collar	With steering clutch shaft thrust bearing
52B	1	Thrust washer	On thrust collar steering clutch shaft
52C	2	Thrust washer	On steering clutch shaft bevel gear and thrust collar
53E	1	Thrust washer	On coupling, female half
57A	1	Transmission case cover	Top transmission case
57B	1	Transmission case cover gasket	Between transmission case and cover
79B	1	Tube union and male pipe end	On oil line
79D	2	Tube union elbow and male pipe end	On oil discharge pipe
41A	1	Upper transmission case	Above rear of main frame
		***Transmission System*—STEERING CLUTCH**	
		(See illustration on page 218, 221, 222)	
100B	2	Clutch fork ball end	Lower end shifter fork
100C	4	Clutch fork screw	Through clutch shifter ring
94B	2	Clutch housing dust guard	Bolted to housing
	12	.125 (1/8) x .437 (7/16) Rivets csk	
97A	2	Clutch housing thrust washer	Between steering clutch housing and retainer
102A	2	Clutch quill bearing	Mounted on clutch housing hub
101A	2	Clutch quill bearing oil retainer	Around clutch housing hub
	16	.125 (1/8) x .625 (5/8) B. H. rivets	
101B	2	Clutch quill bearing retaining washer	With clutch quill bearing

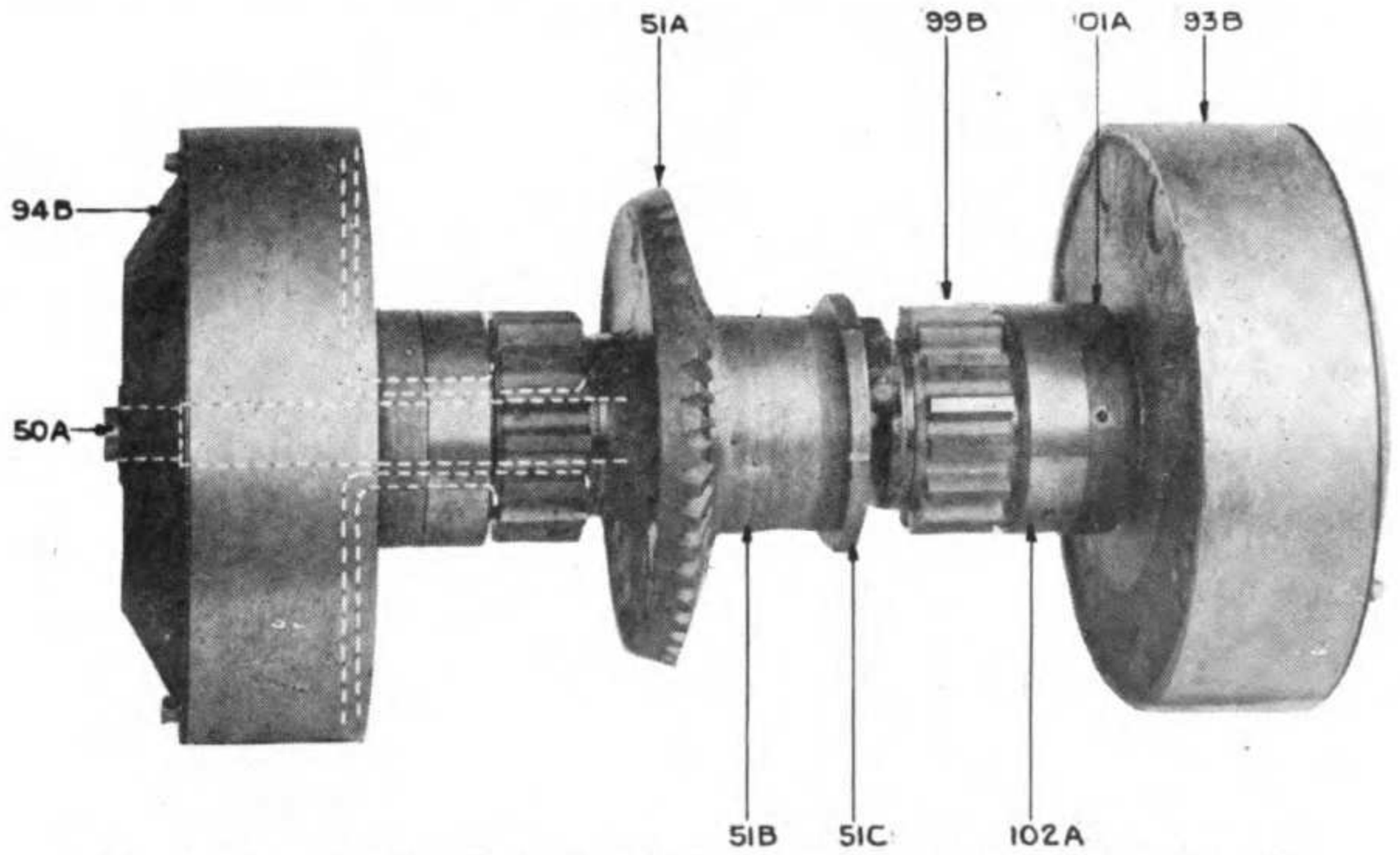
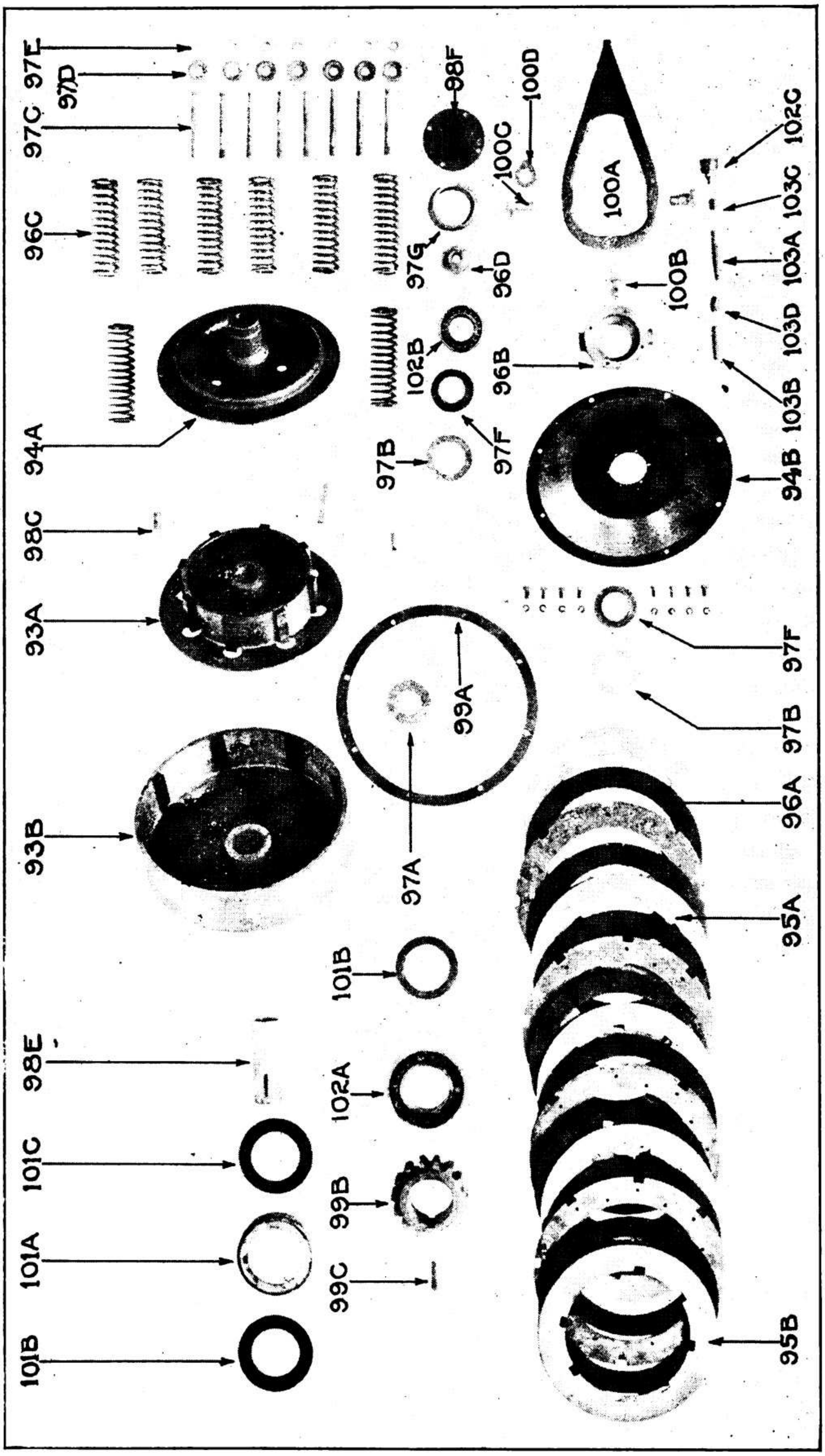


PLATE 111—STEERING CLUTCH SHAFT ASSEMBLY

PLATE 112



STEERING CLUTCH PARTS

NOMENCLATURE OF PARTS—Continued

Part No.	No. Per Tractor	Property Classification—Class IV, Division 10	
		Name of Part	Location
		Transmission System*—STEERING CLUTCH—*Continued	
		See illustrations on pages 218, 221, 222	
97E	32	Clutch spring retainer stop	End of clutch spring studs
98A	16	Disc key	Riveted to retainer
98B	16	Disc key	Riveted to steering clutch housing
99A	2	Dust guard gasket	Between dust guard and clutch housing
97B	4	Dust washer retainer	Inside shifting ring
	12	.125 (⅛) x .25 (¼) Rivets csk	
102C	2	Grease cup	For clutch shift ring
99C	2	Intermediate pinion key	End intermediate pinion
99B	2	Intermediate pinion	On end of clutch housing
100D	4	Lock washer	Used with clutch fork screw
99E	2	Lock wire	Through cover plate cap screws
101D	2	Oil retainer clamp washer	On oil retainer
103A	2	Pipe nipple	On shifting ring oiler
103B	2	Pipe nipple	On shifting ring oiler
103C	2	Plain coupling	On shifting ring oiler
103D	2	Plain elbow	Shifting ring oiler
96D	2	Pressure ring screw	End of steering clutch shaft
98C	4	Retainer dowel	Through retainer and pressure ring
98D	2	Retainer key	For retainer shaft way
103E	160	Rivet, tubular	Through friction and driven discs
102E	2	Screw, headless set	Through pressure ring screw
98D	16	Screw, hex. head cap .312 ($\frac{5}{16}$) x .5 (½)	Through dust guard to housing
	16	.312 ($\frac{5}{16}$) Lock washers	
99D	8	Screw, hex. head cap .25 (¼) x .5 (½)	Through shifter ring cover plate
98F	2	Shifter ring cover plate	Bolted to shifter ring
97F	4	Shifter ring dust washer	Inside clutch shifting ring
97G	2	Shifting ring spacer	Inside clutch shifting ring
102B	2	Shifting ring bearing	On clutch shifting ring
95A	10	Steering clutch driven disc	Between steering clutch retainer and pressure ring
95B	12	Steering clutch driving disc	In steering clutch retainer
96A	20	Steering clutch friction disc	In steering clutch retainer
93B	2	Steering clutch housing	
	32	.125 (⅛) x 1 Rivets csk	
98E	2	Steering clutch housing bushing	Between housing and steering clutch shaft
94A	2	Steering clutch pressure ring	Inside steering clutch housing
101C	4	Steering clutch quill oil retainer washer	Riveted to oil retainer
93A	2	Steering clutch retainer	Within steering clutch housing
	32	.25 (¼) x 1 B. H. rivets	
100A	2	Steering clutch shifter fork	End of steering clutch
96B	2	Steering clutch shifting ring	End of steering clutch shaft
96C	16	Steering clutch spring	Bolted to steering clutch retainer
97D	16	Steering clutch spring retainer	End of steering clutch spring
97C	16	Steering clutch spring stud	On retainer
102B	16	Welch plug	On outer clutch housing
		***Transmission System*—LOWER TRANSMISSION**	
		See illustration on page 224	
31C	16	Bolt S. A. E. drilled .5 (½) x 1.156 ($1\frac{5}{32}$)	On track sprocket shaft cap
	16	.5 (½)—20 Castle nuts	
32D	2	Clutch quill bearing packing	Between U. and L. Trans. case
32C	1	Coupling bearing cap packing	Between U. and L. Trans. case
31F	1	Ell	On oil sump
29A	2	Gear case plate	Rear transmission case
27A	2	Intermediate shaft	In intermediate shaft bearings
26B	2	Intermediate shaft drive pinion	End intermediate shaft
27C	4	Intermediate shaft lock washer	At ends of intermediate shaft
27D	4	Intermediate shaft nut	At ends of intermediate shaft
28E	4	Intermediate shaft space packing	With intermediate shaft spacer
28C	2	Intermediate shaft spacer	Between roller bearings
26A	2	Intermediate shaft spur gear	On intermediate shaft
26C	4	Intermediate shaft thrust washer	On intermediate shaft outside end

NOMENCLATURE OF PARTS—Continued

Part No.	No. Per Tractor	Property Classification—Class IV, Division 10	
		Name of Part	Location
		Transmission System*—LOWER TRANSMISSION—*Continued	
		See illustration on page 224	
27B	4	Key	End intermediate shaft
30E	1	Lock wire	On oil sump studs
31E	1	Oil level horizontal nipple	On oil sump
31D	1	Oil level vertical nipple	On oil sump
30A	1	Oil sump	Bottom transmission case
30B	1	Oil sump gasket	Between oil sump and Trans. case
30C	1	Oil sump screen	In oil sump
28B	2	Outer intermediate bearing	In transmission case
31G	1	Pipe cap	In oil sump
28A	2	Roller bearing	In transmission case
28D	2	Roller bearing washer	Used with bearing 28A
32G	1	Oval point set screw	Front transmission case
	1	.75 (¾)—16 Nut	
30D	8	Stud	Oil sump to transmission case
	8	.375 (⅜)—24 Castle nut S. A. E.	

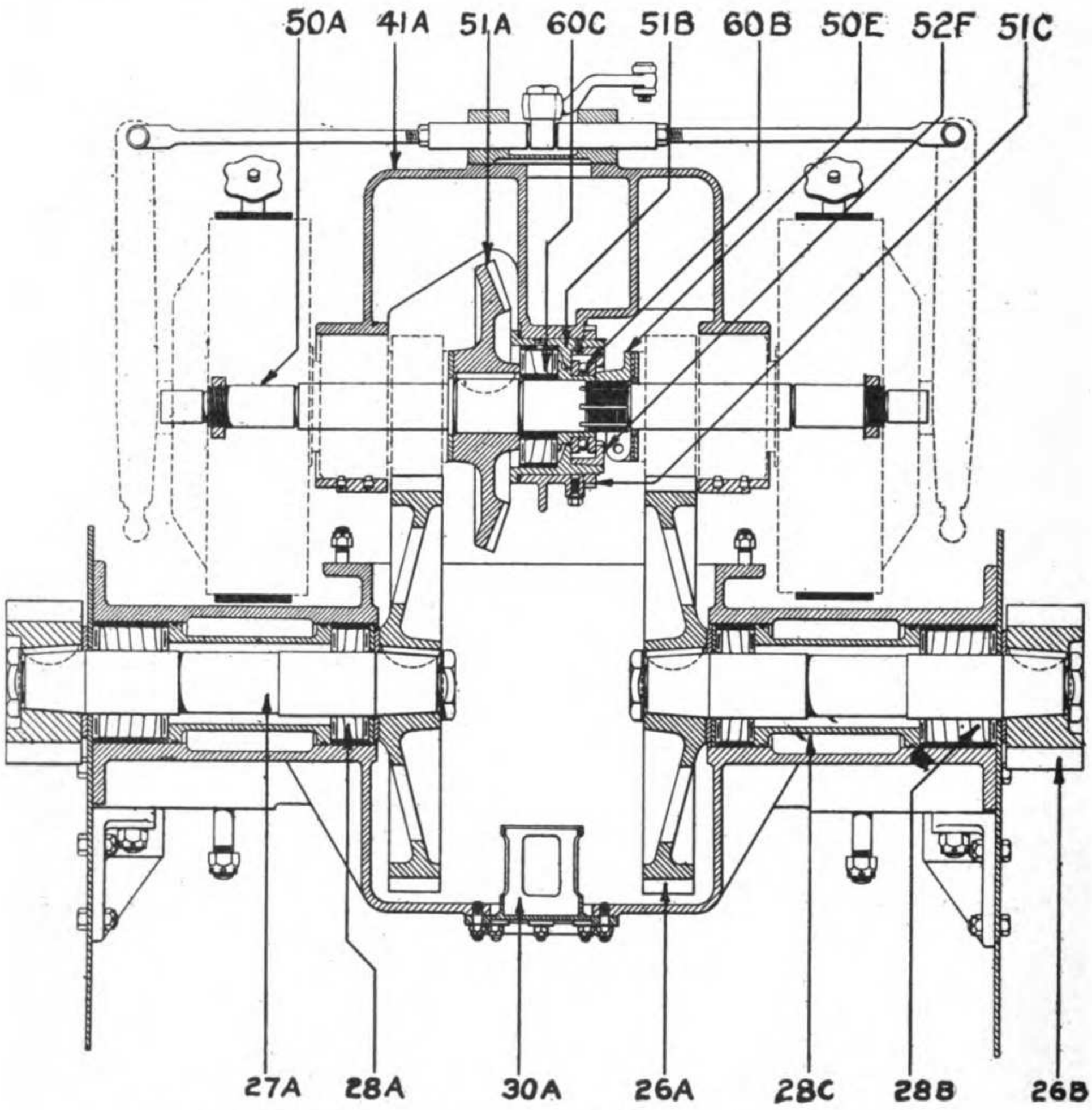


PLATE 113—SECTION COMPLETE TRANSMISSION

NOMENCLATURE OF PARTS—Continued

Part No.	No. Per Tractor	Property Classification—Class IV, Division 10	
		Name of Part	Location

Transmission System—LOWER TRANSMISSION—*Continued*

See illustration on page 224

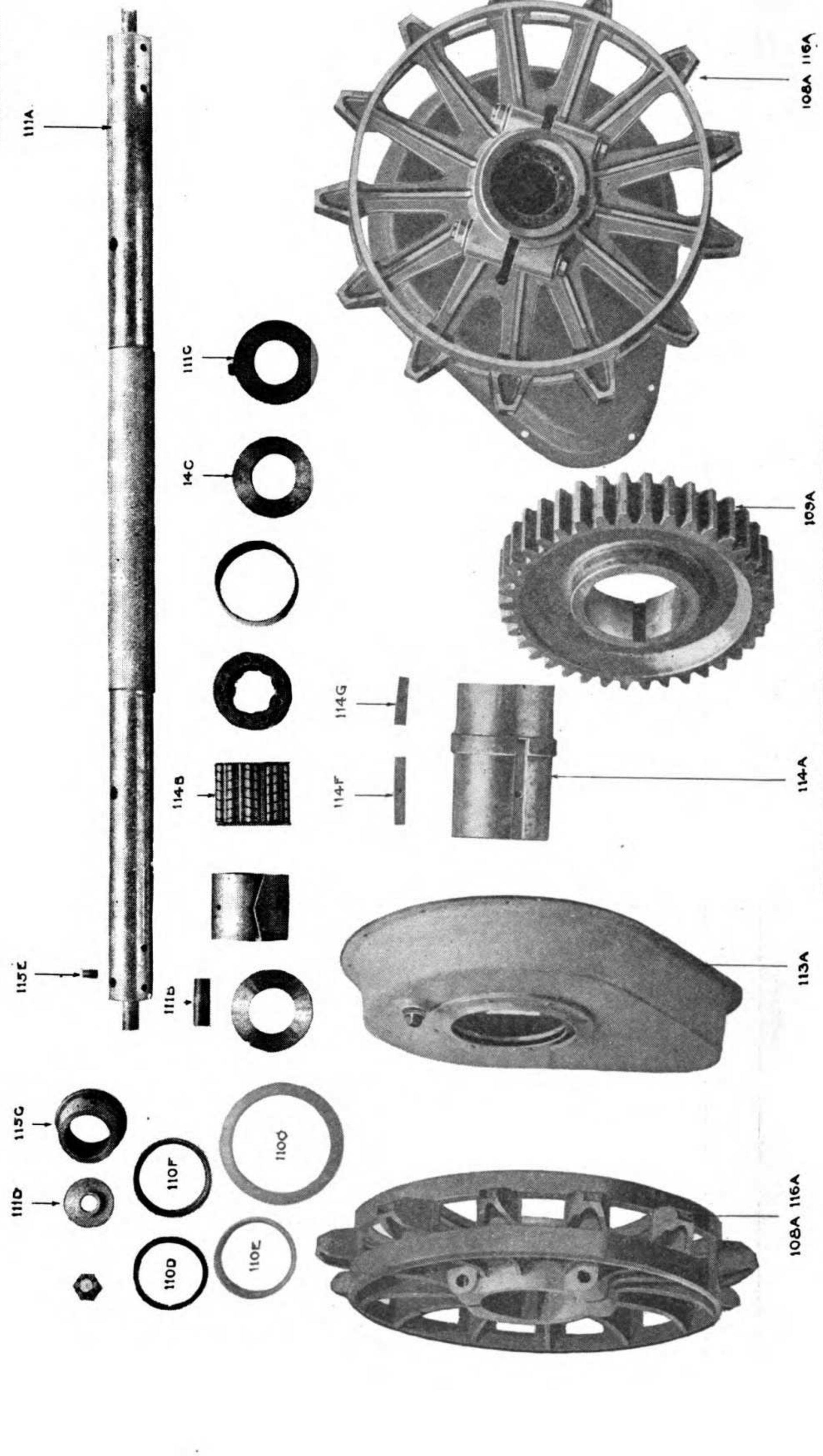
31B	4	Stud	Through track sprocket shaft cap
	4	.75 (¾)—16 Castle nut S. A. E.	
32E	4	Stud	Transmission case to main frame
	4	.75 (¾)—16 Castle nut S. A. E.	
32F	2	Stud	Through upper and lower transmission cases
	2	.5 (½)—20 Castle nut S. A. E.	
31A	2	Track sprocket shaft cap	Bolted to gear case plate
32H	2	Transmission case dowel pin	In track sprocket shaft
32A	2	Transmission case gasket, front	Between upper and lower trans. case
32B	1	Transmission case gasket, rear	Between upper and lower trans. case
23A	1	Transmission case, lower	Below rear of main frame

Transmission System—DRIVE SPROCKET AND GEAR

See illustrations on pages 226, 227, 228

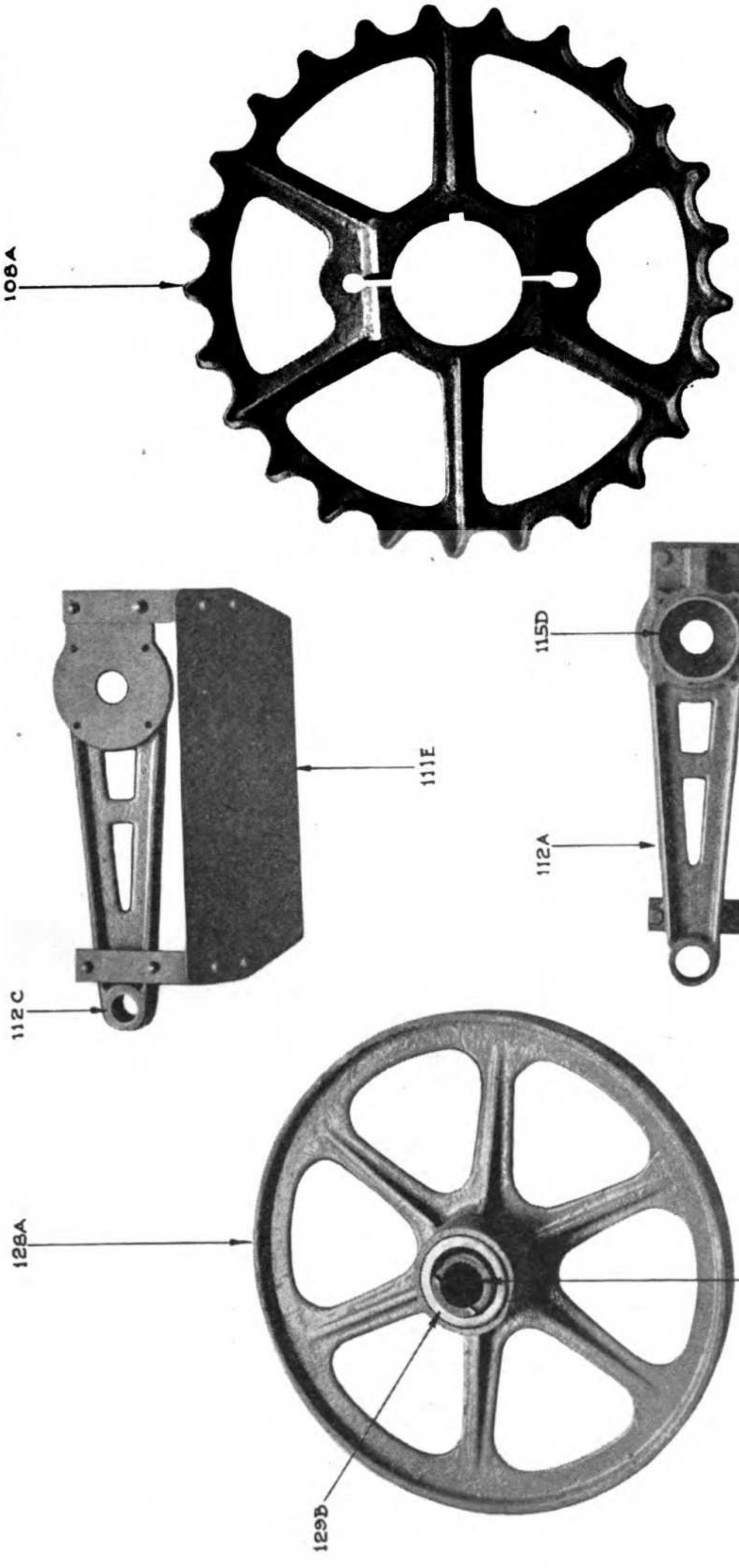
113B	8	Bolt S. A. E. drilled .375 (⅜) x 1.375 (1⅜)	Through outer rim gear case
	8	.375 (⅜)—24 Castle nut S. A. E.	
113C	22	Bolt S. A. E. drilled .375 (⅜) x .875 (⅞)	Through outer rim gear case
	22	.375 (⅜)—24 Castle nut	
115A	8	Bolt S. A. E. drilled .625 (⅝) x 6.5 (6½)	Through thrust rod
	8	.625 (⅝)—18 Castle nut S. A. E.	
114D	4	Dowel pin	Through sprocket sleeve
114E	4	Dowel pin	Through sprocket wheel and sleeve
114C	4	Drive sprocket thrust washer	End of roller bearing
110B	2	Dust deflector	Riveted to gear case
110C	2	Dust ring	Used on oil ring
110D	2	Dust washer	On thrust collar
110E	2	Dust washer retainer	On thrust collar
110F	2	Dust washer retainer	On thrust collar
118A	2	Gear case	Housing for sprocket sleeve drive gear
	4	.25 (¼) x .75 (¾) B. H. rivets	
	16	.25 (¼) x .625 (⅝) B. H. rivets	
113D	2	Gear case pipe flange	On gear case plate
110A	2	Oil ring	Riveted to gear case
113E	2	Pipe plug	In pipe flange
13E	2	Pipe plug	In thrust rod
112A	2	Rear thrust rod	Over end of thrust collar. To be replaced by radius rod. (See roller frame.)
112C	2	Rear thrust rod bushing	Front end thrust rod. To be replaced by radius rod. (See roller frame.)
115D	2	Rear thrust rod bushing	Between thrust rod collar and thrust rod
112D	2	Rear thrust rod dust cap	Enclosing end of sprocket shaft
111E	2	Rear thrust rod guard	Riveted to thrust rod dust cap
112B	2	Rear thrust rod guard	Riveted to thrust rod dust cap. To be replaced by radius rod. (See roller frame.)
112E	4	Rear thrust rod guard support	Bolted to dust cap. To be replaced by radius rod. (See roller frame.)
	8	.375 (⅜) x 1.25 (1¼) B. H. rivets	
	8	.375 (⅜) x .875 (⅞) B. H. rivets	
111D	2	Rear thrust washer	Used with thrust collar
114B	4	Roller bearing	On track sprocket shaft
315C	4	Screw hex. head cap	Through rear thrust rod dust cap
	4	.375 (⅜) Lock washers	
115E	2	Screw, set .625 (⅝) x .5 (½)	Through thrust collar to shaft
114G	2	Sprocket drive gear key	Through sprocket drive gear and sleeve

PLATE 114



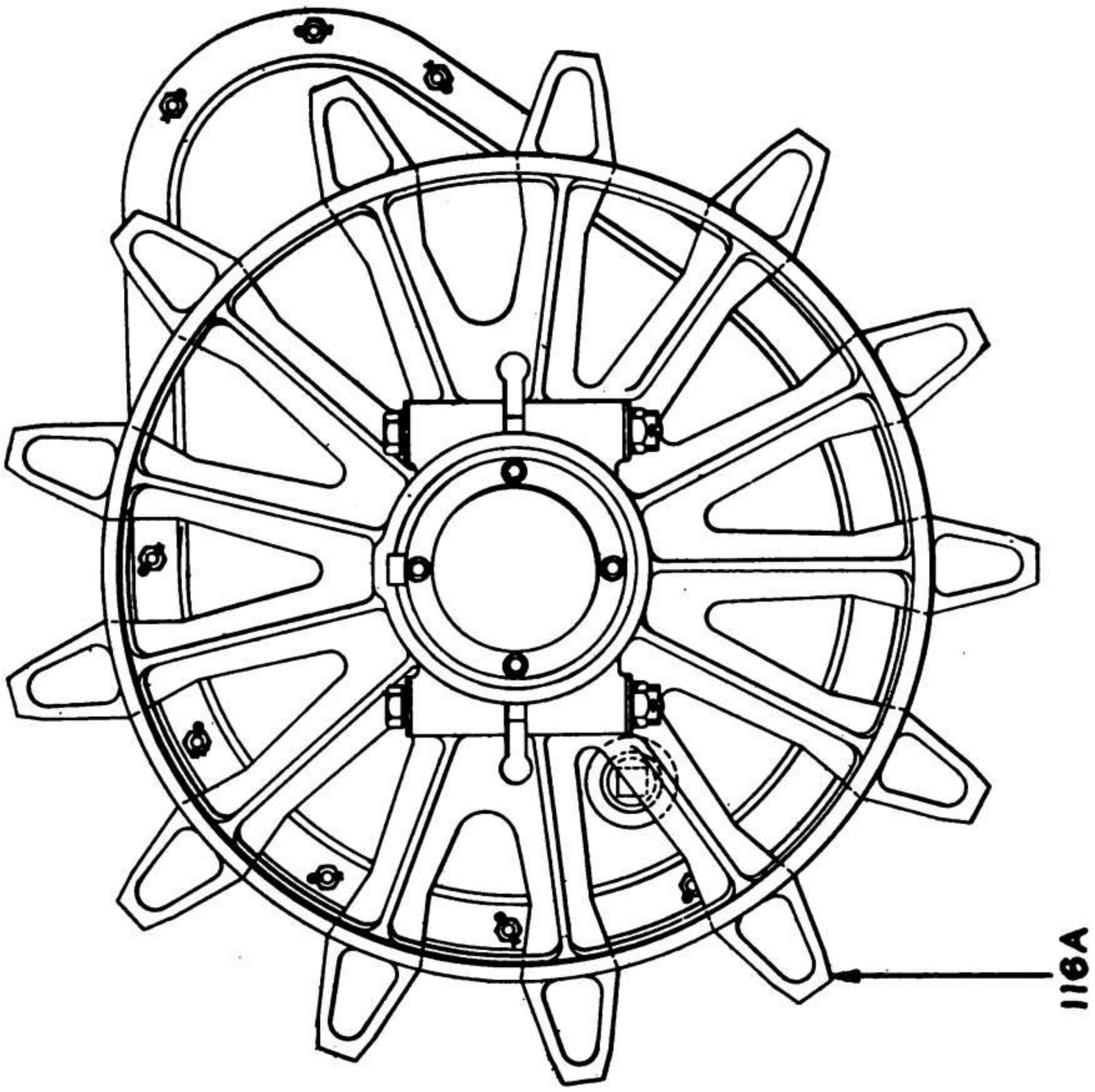
DRIVE SPROCKET AND GEAR PARTS

PLATE 115

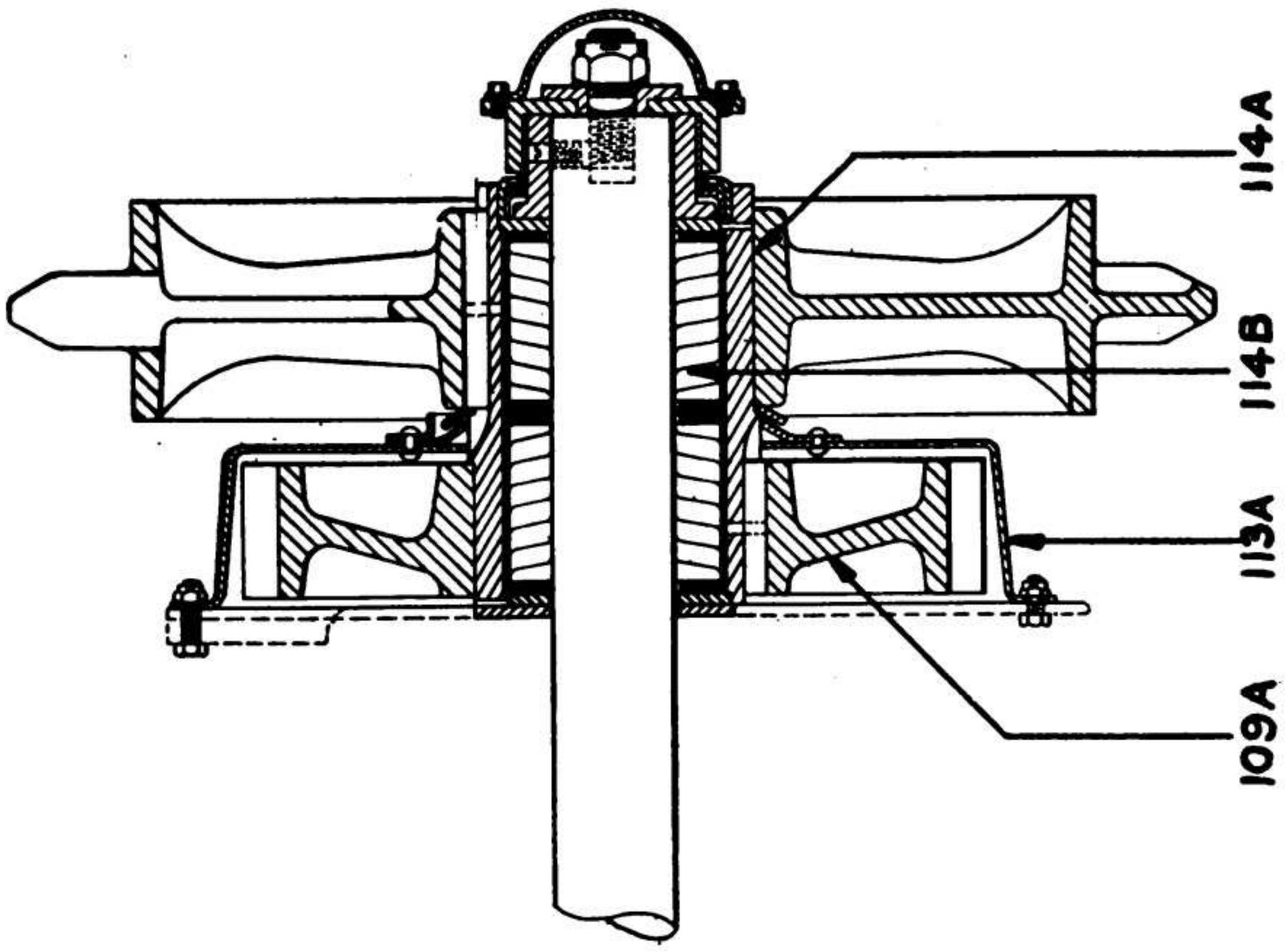


FIRST DRIVE SPROCKET RADIUS ROD AND BLANK SPROCKET

PLATE 116



SECTIONAL DRAWING OF DRIVE SPROCKET AND GEAR



NOMENCLATURE OF PARTS—Continued

Part No.	No. Per Tractor	Property Classification—Class IV, Division 10	
		Name of Part	Location
		Transmission System*—DRIVE SPROCKET AND GEAR—*Continued	
114F	2	Sprocket key	In sprocket wheel
109A	2	Sprocket sleeve drive gear	On track sprocket sleeve
111B	2	Stud	End of sprocket shaft
	2	1 (1.—14) Castle nut S. A. E	
115C	2	Thrust collar	End of sprocket shaft
111C	2	Thrust washer	End track sprocket sleeve
108A	2	Track sprocket	Mounted on track sprocket shaft
116A	2	Track sprocket	To replace 108A
111A	1	Track sprocket shaft	Supports main frame, rear
114A	2	Track sprocket sleeve	Enclosing sprocket roller bearings
115B	16	Washer	Used with 115A

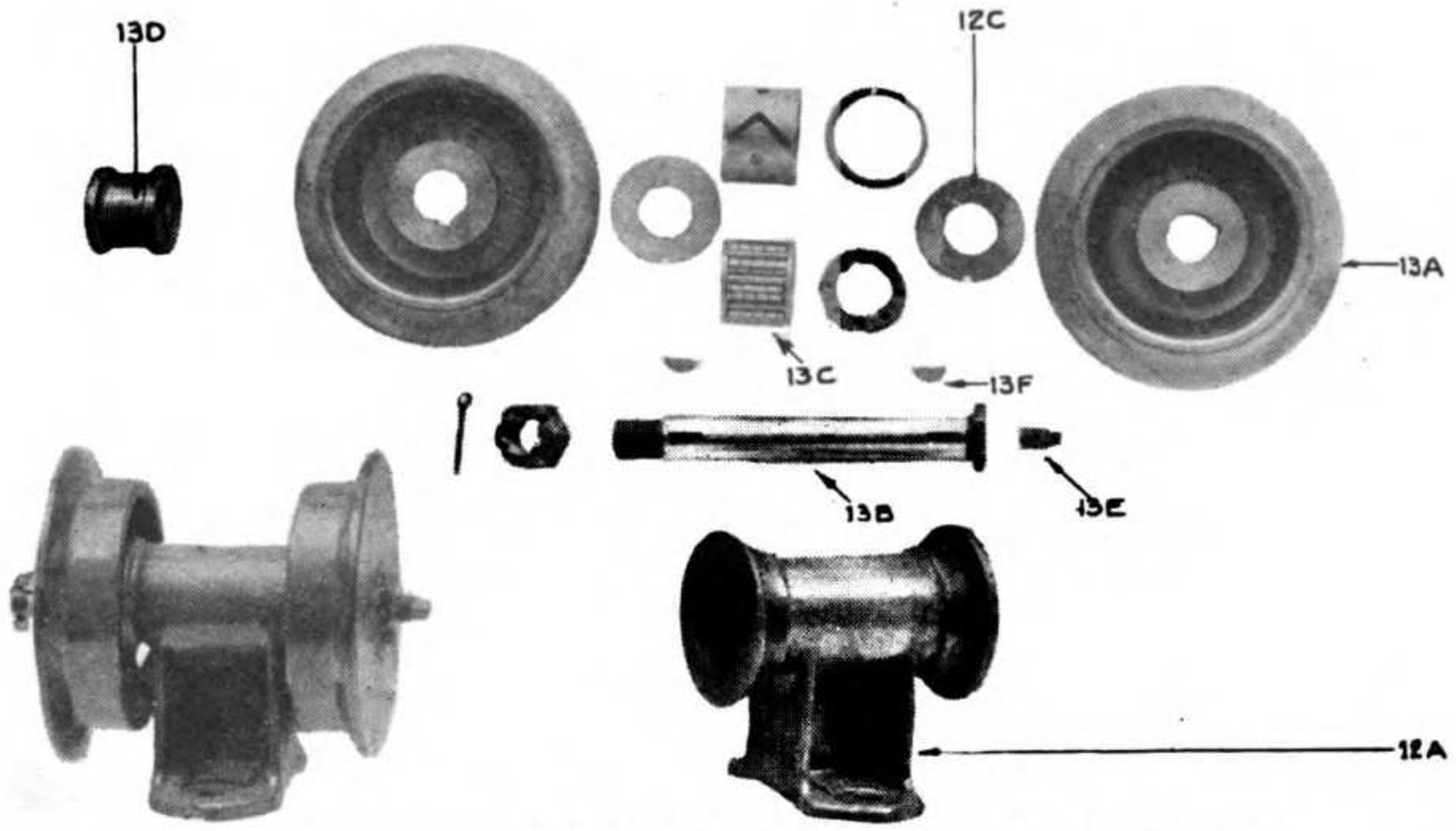
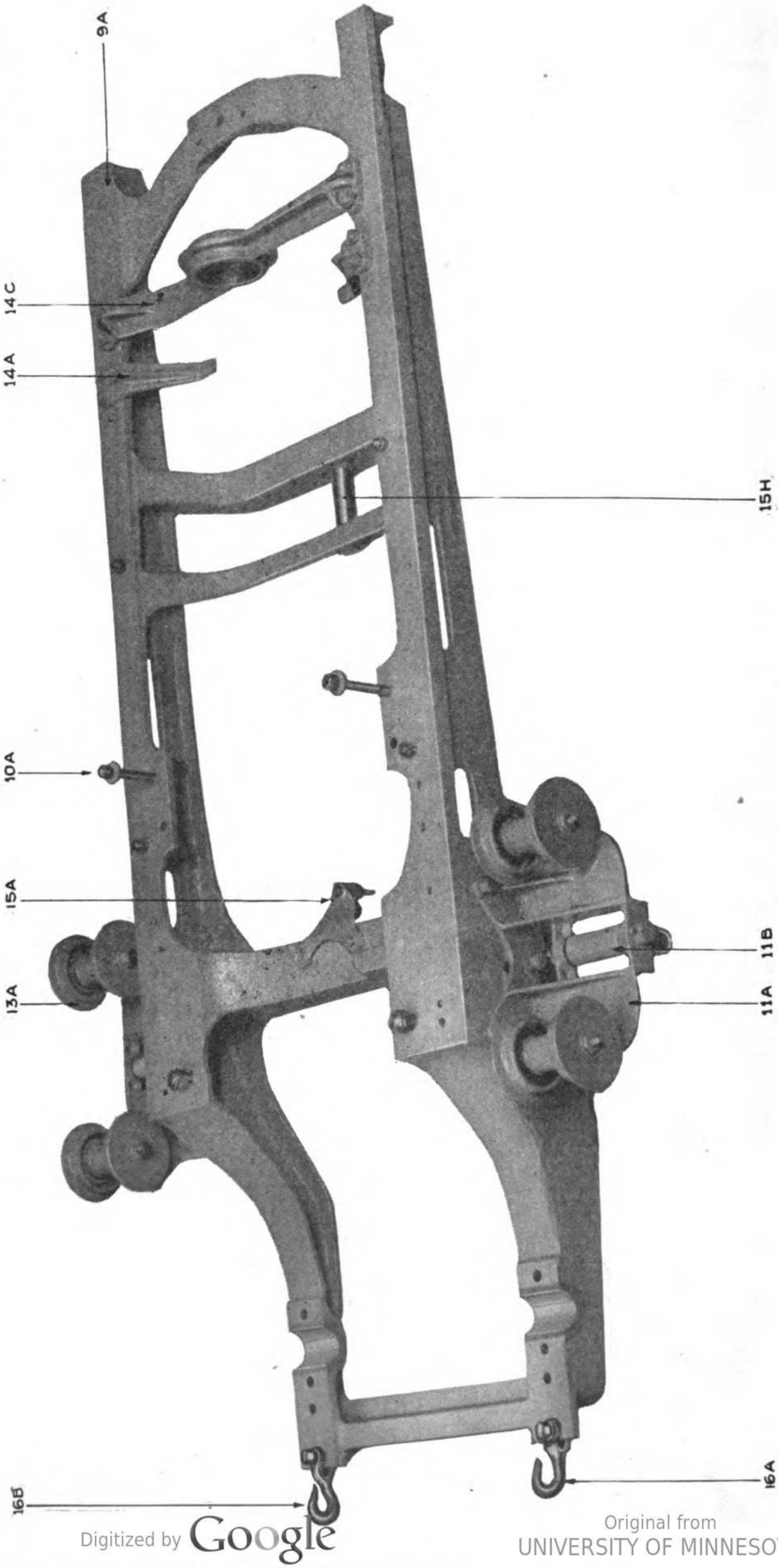


PLATE 117—TRACK SUPPORTING ROLLERS

PLATE 118



MAIN FRAME ASSEMBLY

NOMENCLATURE OF PARTS—Continued

Part No.	No. Per Tractor	Property Classification—Class IV, Division 10	
		Name of Part	Location

Supporting Assemblies—MAIN FRAME

See illustration on page 230

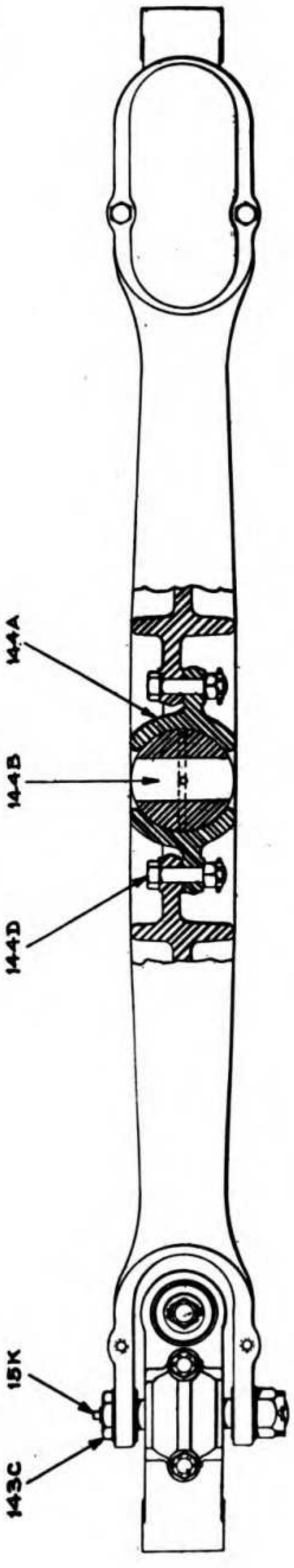
10C	4	Armor stud	Armor plate to main frame
10A	2	Bolt S. A. E. drilled, .75 (¾) x 6.75 (6¾)	Engine to Engine support
	2	.75—16 Castle nuts	
10B	2	Bolt S. A. E. drilled, 1 x 2.75 (2¾)	Fastens upper transmission to frame
	2	1.0—14 Castle nuts	
14D	4	Bolt S. A. E. drilled, .75 (¾) x 2.75 (2¾)	Front trunnion support to frame
	4	.75 (¾)—16 Castle nuts	
16C	2	Bolt S. A. E. drilled .75 (¾) x 3.5 (3½)	Towing hooks to frame
	2	.75 (¾)—16 Castle nuts	
61G	2	Bolt S. A. E. drilled .5 (½) x 2	Clutch shifter fork bracket to frame
	2	.5 (½)—20 Castle nuts	
15D	1	Check nut (½)—20	Master clutch shifter fork bracket
14C	1	Engine front trunnion support	Front of Engine bracket
15H	1	Equalizing bar pin	Equalizing bar cross frame
15E	1	Equalizing bar pin fork	End equalizing bar pin
13F	8	Key, Whitney No. 9	Keys track roller to shaft
15G	1	Lock wire	Thru cap screws 15F
9A	1	Main frame	
15A	1	Master clutch shifter fork bracket	Middle center cross frame
14A	2	Engine bracket, front	Right and left front main frame
14B	4	Engine bracket stud	Engine bracket to frame
	4	.625 (⅝)—18 Castle Nuts	
43zb	1	Name plate (Maxwell)	Front end main frame
43ac	1	Name plate (Reo)	Front end main frame
13E	4	Pipe plug	End track roller shaft 13B
15K	1	Pipe plug	End equalizing bar pin
16B	1	Rear towing hook L. H	Rear side of frame
16A	1	Rear towing hook R. H	Rear side of frame
11B	2	Roller frame sliding link	Spring bracket to rear roller truck
12A	4	Roller track bracket, rear	Supports rear track roller
15F	2	Screw, h. h. cap	Pin fork to cross frame
	2	.625 (⅝) Lock washer	
15C	1	Screw, set .5 (½) x 2″	M. C. Shifter fork bracket
11C	2	Slide link pin	Through sliding link
11A	2	Spring bracket	For upper rear track rollers
11D	14	Spring bracket stud	Spring bracket 11A to frame
	14	.75 (¾)—16 Castle nuts	
12B	8	Track bracket dowel pin	Holds thrust washer to bracket
12D	8	Track bracket stud	Roller bracket to spring bracket
	8	.5 (½)—20 Castle nuts S. A. E	
13A	8	Track roller	On track roller shaft
13C	8	Track roller bearing	In rear track roller bracket
13D	4	Track roller bearing spacer	On track roller shaft
13B	4	Track roller shaft	In track roller bearings
	4	.875 (⅞)—14 Castle nuts, S. A. E	
12C	8	Track roller thrust washer	Outer end roller shaft

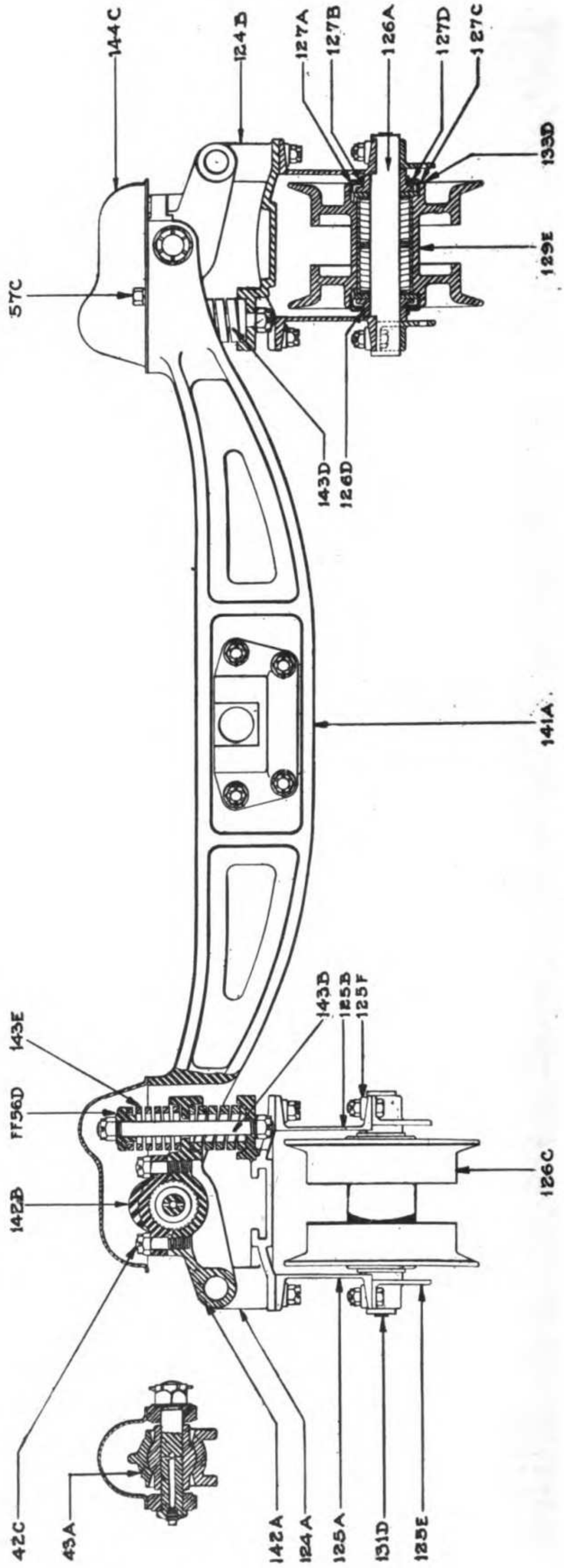
Supporting Assemblies—EQUALIZING BAR

See illustrations on pages 145, 232, 233

142C	4	Bracket cap stud	Spring bracket cap to bracket
	4	.625 (⅝)—18 Castle nuts	
141A	1	Equalizing bar	Main frame, front center
143A	2	Equalizing bar end ball	Inside spring bracket
143C	2	Equalizing bar end pin	End of equalizing bar
	2	1.125 (1⅛)—12 Castle nuts	
144C	2	Equalizing bar end cover	On equalizing bar
144B	1	Equalizing bar pivot block	Center of equalizing bar
15K	2	Pipe plug	Equalizing bar end pin
144A	1	Pivot block retainer	Center of equalizing bar
143E	2	Recoil spring	In spring
FF56D	2	Recoil spring washer	On top of spring
57C	4	Screw hexagon head cap	Equalizing bar end cover
	4	.5 (½) Lock washer	

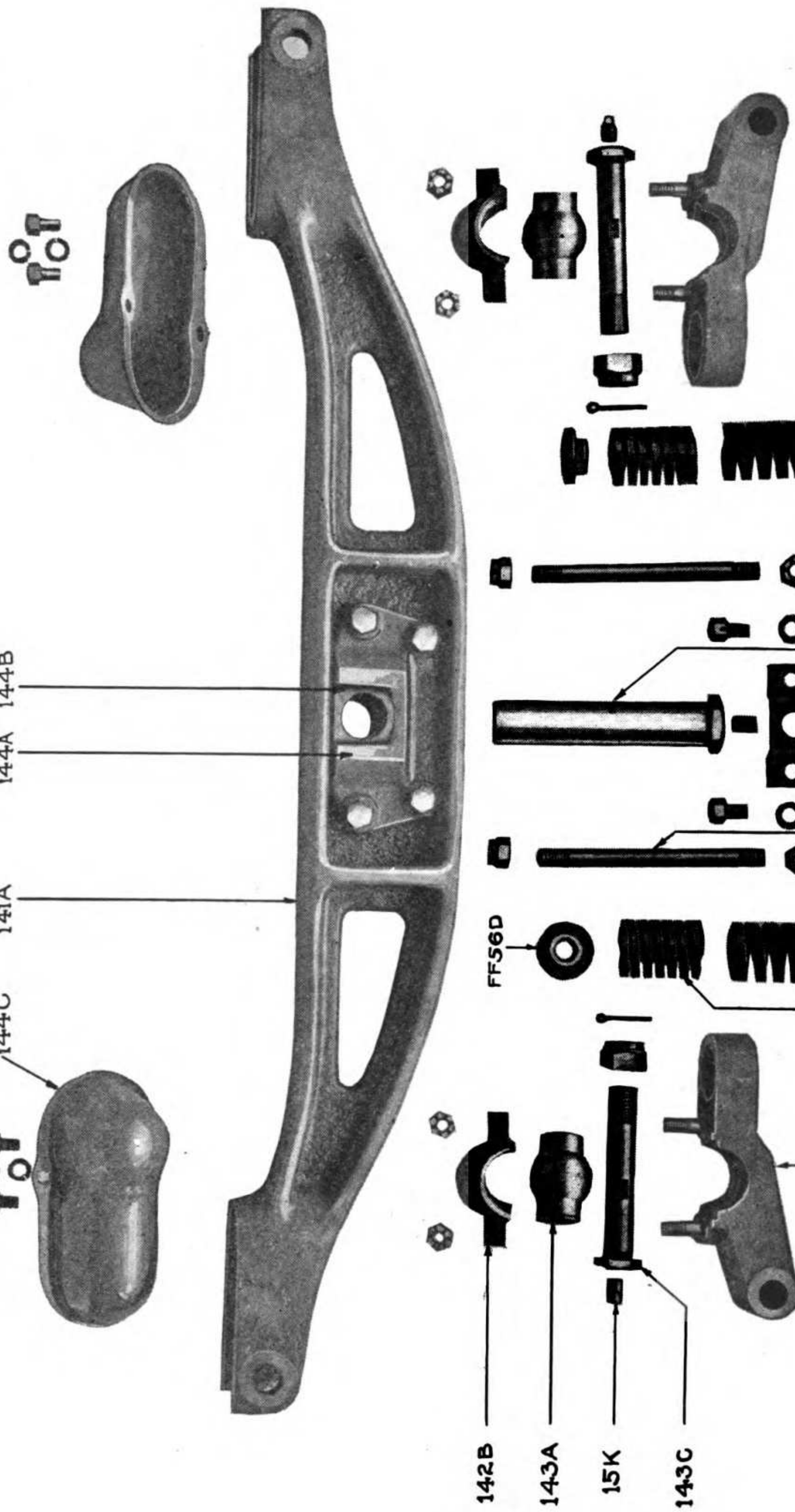
PLATE 119





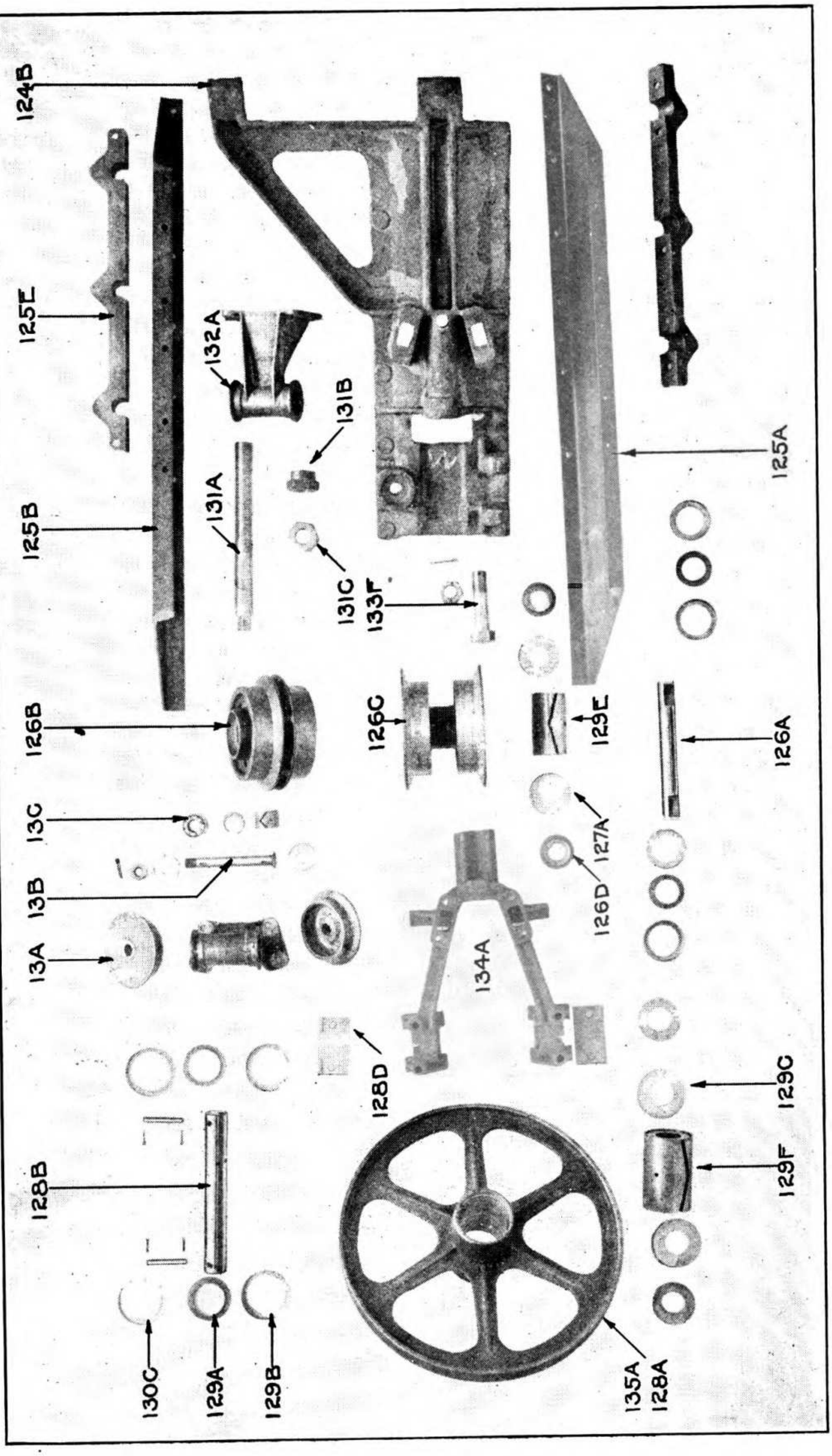
EQUALIZING BAR DRAWING

PLATE 120



EQUALIZING BAR PARTS

PLATE 121



FRONT ROLLER FRAME PARTS

NOMENCLATURE OF PARTS—Continued

Part No.	No. Per Tractor	Property Classification—Class IV, Division 10	
		Name of Part	Location
		Supporting Assemblies*—EQUALIZING BAR—*Continued	
		See illustrations on pages 145, 232, 233	
142A	2	Spring bracket	End of equalizing bar
142B	2	Spring bracket cap	On spring bracket
143B	2	Spring bracket stud	Spring bracket to equalizing bar
	2	.75 (¾)—16 Castle nuts	
144D	4	Stud bolt, S. A. E.	Pivot block retainer to bar
143D	2	Support spring	Between spring bracket and frame
		***Supporting Assemblies*—ROLLER FRAME (front and rear)**	
		See illustrations on pages 234, 235, 236, 237, 239	
13D	4	Bearing spacer	For track roller bearings
128A	2	Blank sprocket	On front of roller frame
135A	2	Blank sprocket	To replace 128A
		Note: See dwg. No. 121 for 133A.	
129F	2	Blank sprocket bearing	Inside blank sprocket
134A	2	Blank sprocket fork	
129D	4	Blank sprocket thrust collar	End of roller bearing blank sprocket
129C	4	Blank sprocket thrust washer	End of roller bearing blank sprocket
127G	48	Bolt S. A. E. drilled .5 (½) x 1.5 (1½)	On channels and gudgeon brackets
	48	.5 (½)—20 Castle nuts	
131E	40	Bolt S. A. E. drilled .5 (½) x 1.75 (1¾)	Front and rear roller frames
	40	.5 (½)—20 Castle nuts	
133A	2	Bolt S. A. E. drilled 1.25 (1¼) x 5	Rear roller frames
	2	1.25 (1¼)—12 Castle nuts	
133B	8	Bolt S. A. E. drilled .5 (½) x 5	On front end sprocket fork
	8	.5 (½)—20 Plain nuts	
133F	2	Bolt S. A. E. drilled 1.125 (1⅛) x 6.5 (6½)	Top of roller frame
	2	1.125 (1⅛)—12 Castle nuts	

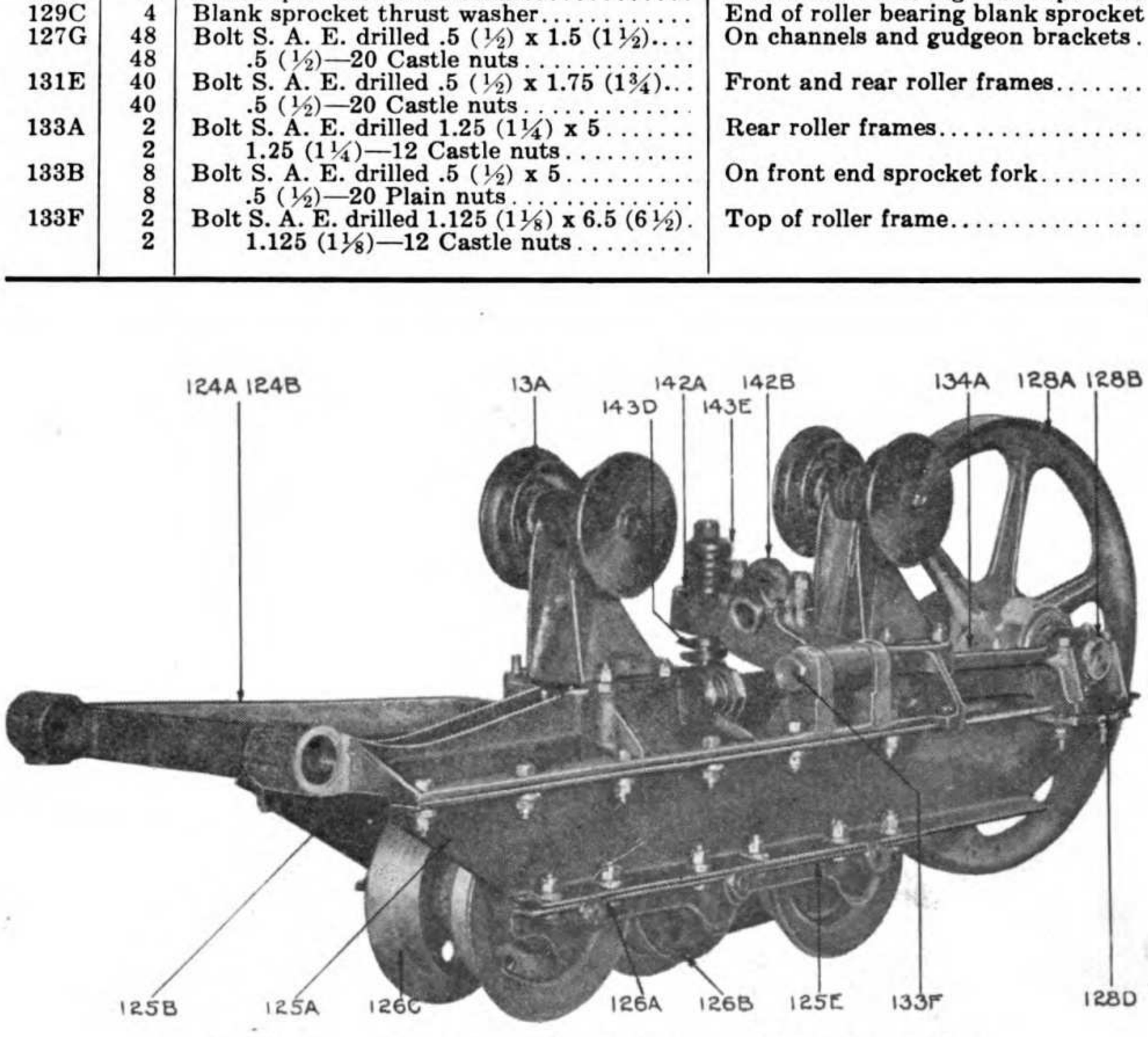
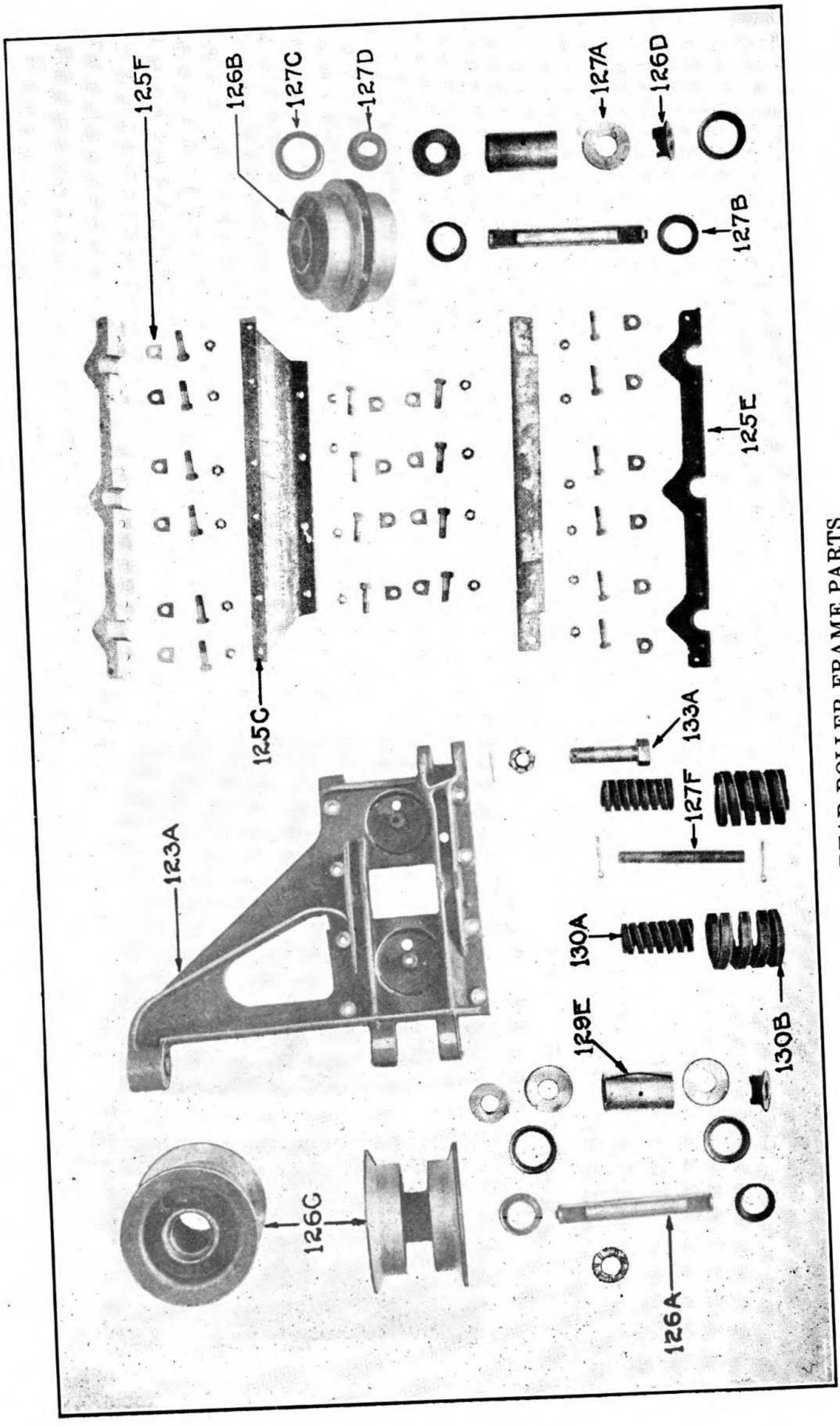


PLATE 122—FRONT ROLLER FRAME ASSEMBLY

PLATE 123



REAR ROLLER FRAME PARTS

NOMENCLATURE OF PARTS—Continued

Part No.	No. Per Tractor	Property Classification—Class IV, Division 10	
		Name of Part	Location
		Supporting Assemblies*—ROLLER FRAME—*Continued	
		See illustrations on pages 234, 235, 236, 237, 239	
125B	2	Channel, front left	Front left side roller frame
125A	2	Channel, front right	Front right side roller frame
125D	2	Channel, rear left	Rear left side roller frame
125C	2	Channel, rear right	Rear right side roller frame
125F	88	Channel washer	On front and rear channels
133E	8	Check nut S. A. E	Front end sprocket fork
127D	24	Dust washer	Around thrust collar
131C	4	Dust washer	Around blank sprocket thrust collar
129A	4	Dust washer retainer	Around blank sprocket thrust collar
29B	4	Dust washer retainer	Around blank sprocket thrust collar
131D	14	Pipe plug	End of sprocket shaft
13E	4	Pipe plug	End of track roller shaft
137A	2	Radius rod bearing	On ends of radius rod
137C	2	Radius rod bolt	In radius rod ends
137B	2	Radius rod end cap	On ends of radius rod
138A	2	Radius rod front bracket	On rear of front roller frame
138C	4	Radius rod hinge pin	On radius rod
138B	12	Radius rod holding stud	On roller frame
138D	2	Radius rod spring	On radius rod
124B	1	Roller frame, front left	
124A	1	Roller frame, front right	
123B	1	Roller frame casting, rear left	
123A	1	Roller frame casting, rear right	
136A	1	Roller frame casting, rear right	To replace 123A
136B	1	Roller frame casting, rear left	To replace 123B
127E	1	Roller frame shaft	Connecting roller frames
130A	4	Roller frame spring, inner	Rear roller frame top
130B	4	Roller frame spring, outer	Rear roller frame top
132A	4	Roller track bracket, front	On top of roller frames
127F	2	Sliding link, lower pin	Upper center rear roller frame
128D	4	Sprocket fork clamp	Holding blank sprocket to bearing
128B	2	Sprocket shaft	Through blank sprocket
128C	4	Sprocket shaft pin	Through ends of sprocket shaft
131A	2	Thrust rod	Rear of blank sprocket fork
131C	2	Thrust rod jam nut	Rear end thrust rod
131B	2	Thrust rod nut	Rear end thrust rod

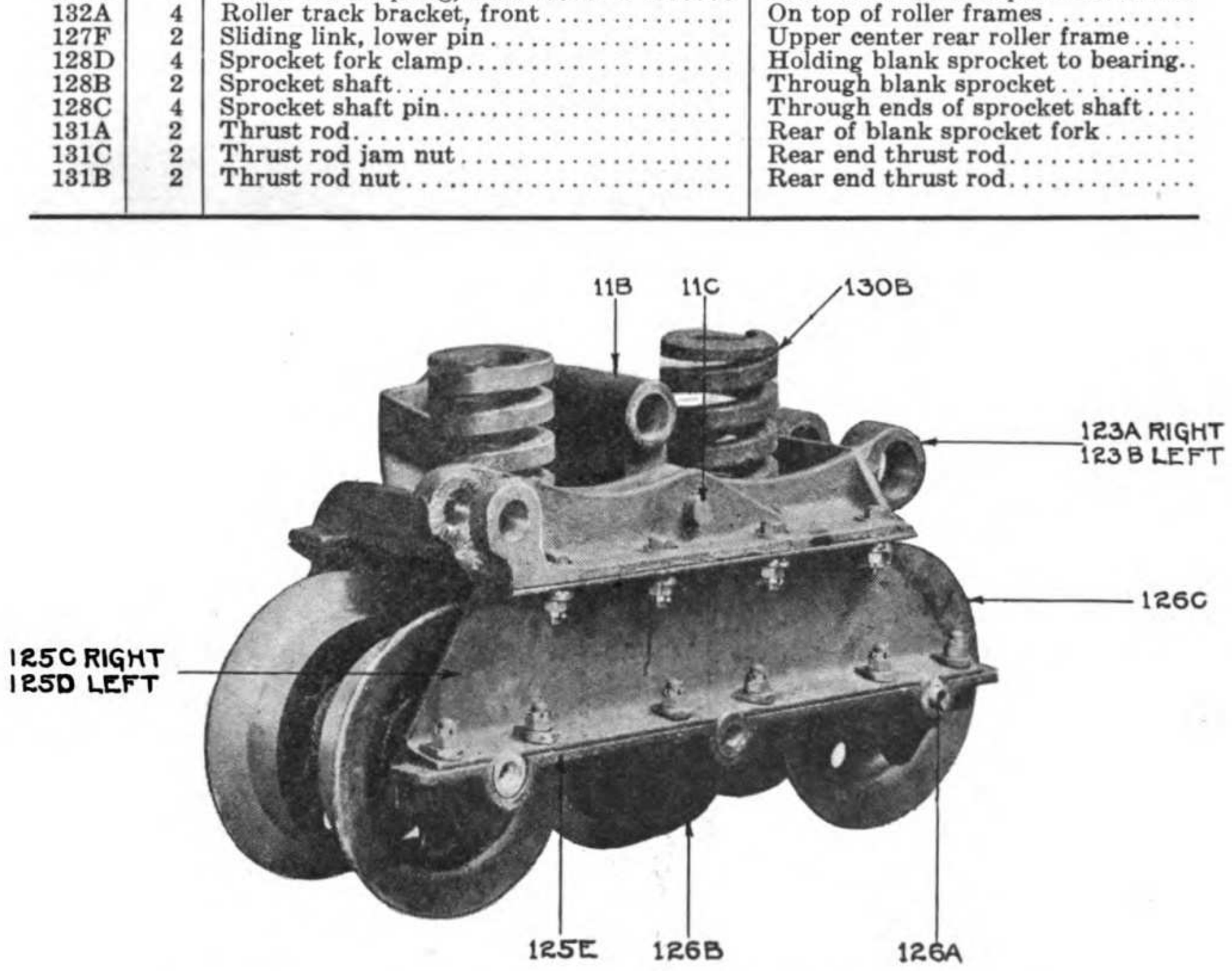
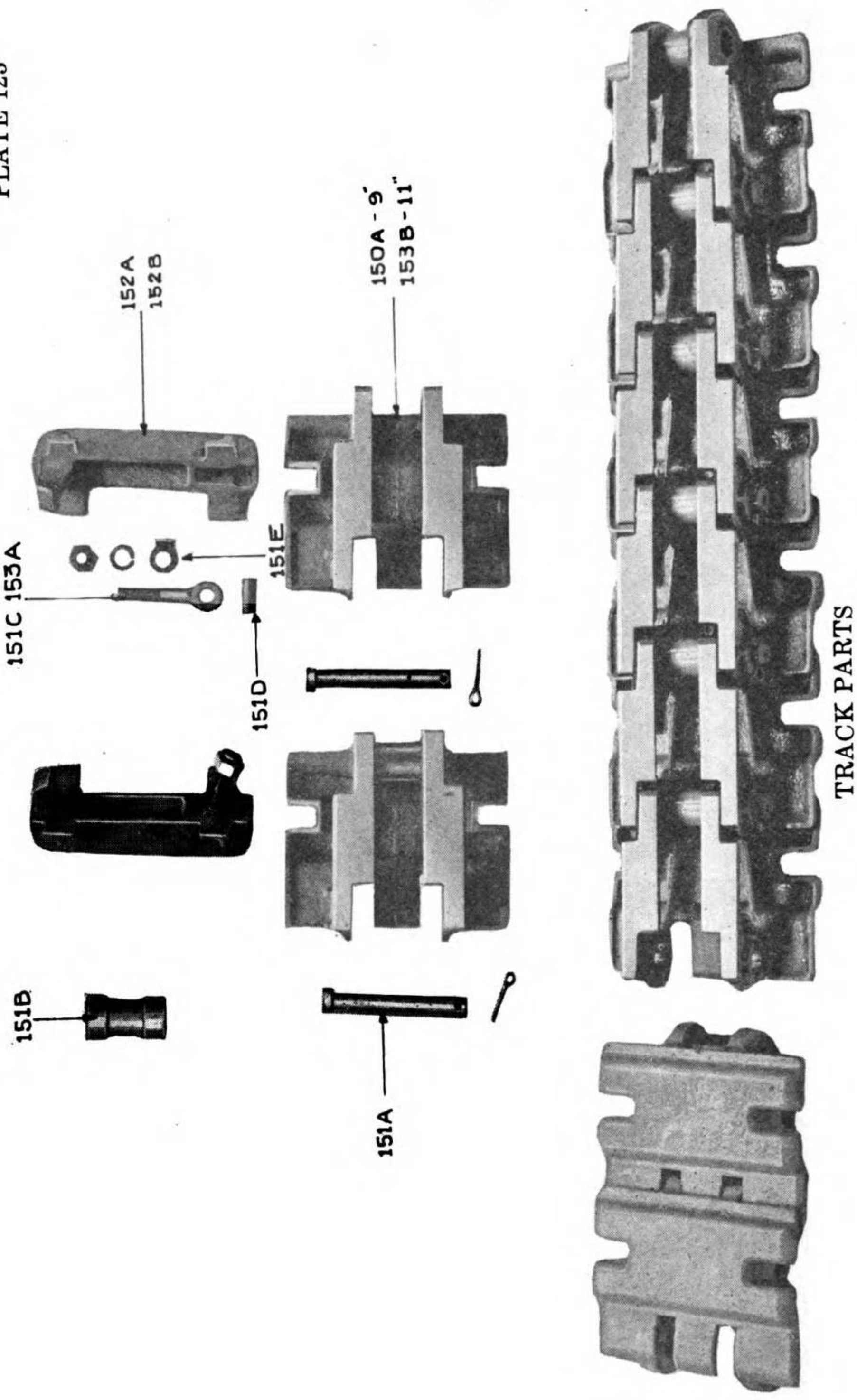


PLATE 124—REAR ROLLER FRAME ASSEMBLY

PLATE 125



TRACK PARTS

NOMENCLATURE OF PARTS—Continued

Part No.	No. Per Tractor	Property Classification—Class IV, Division 10	
		Name of Part	Location
		Supporting Assemblies*—ROLLER FRAME—*Continued	
		See illustrations on pages 234, 235, 236, 237, 239	
12C	8	Thrust washer	End of roller bearing
133D	28	Thrust washer dowel pin	Through blank sprocket hub
12B	8	Track bracket dowel pin	
13A	4	Track roller	On roller track bracket
13C	8	Track roller bearing	
13B	4	Track roller shaft	Through track rollers
	4	.875 (7/8)—14 Castle nuts	
126B	4	Truck wheel	Truck wheel center
126C	8	Truck wheel	Front and rear of trucks
129E	12	Truck wheel bearing	Inside truck wheels
127B	24	Truck wheel dust washer retainer	Around truck thrust collar
127C	24	Truck wheel dust washer retainer	Around truck thrust collar
126A	12	Truck wheel gudgeon	Through truck wheels
125E	8	Truck wheel gudgeon bracket	Under front and rear channels
126D	24	Truck wheel thrust collar	Inside of channels on gudgeon
127A	24	Truck wheel thrust washer	On ends of truck wheel
		***Track Assemblies*—TRACK LINKS**	
		See illustration on page 238	
152A	78	Grouser (9″)	Outside face of track
152B	78	Grouser (11″)	To replace 152A
151C	78	Grouser eye bolt	Grouser to track link shoe
	78	.625 (5/8) Lock washers	
	78	.625 (5/8)—18 Nuts	
153A	78	Grouser eye bolt	Grouser to track link shoe to replace 151C
	78	.625 (5/8) Lock washers	
	78	.625 (5/8)—18 Nuts	
		NOTE: Different grousers to be used on separate shipments	
151E	78	Grouser eye bolt washer	On grouser eye bolt
151D	78	Grouser pin	Through grouser eye bolt
150A	78	Track link shoe (9″)	
153B	78	Track link shoe (11″)	To replace 150A
151B	78	Track link space block	On track pin
151A	78	Track pin	

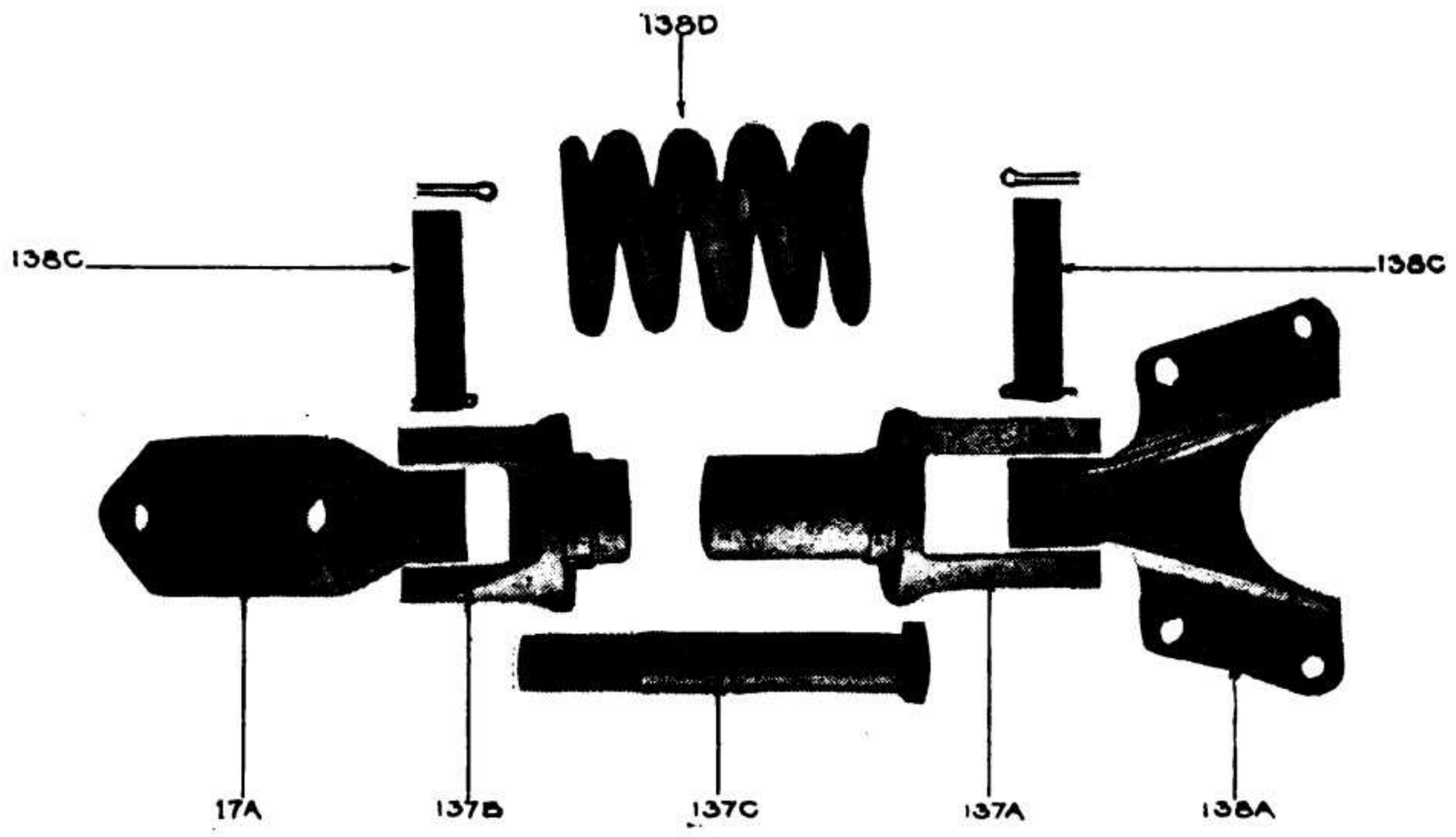
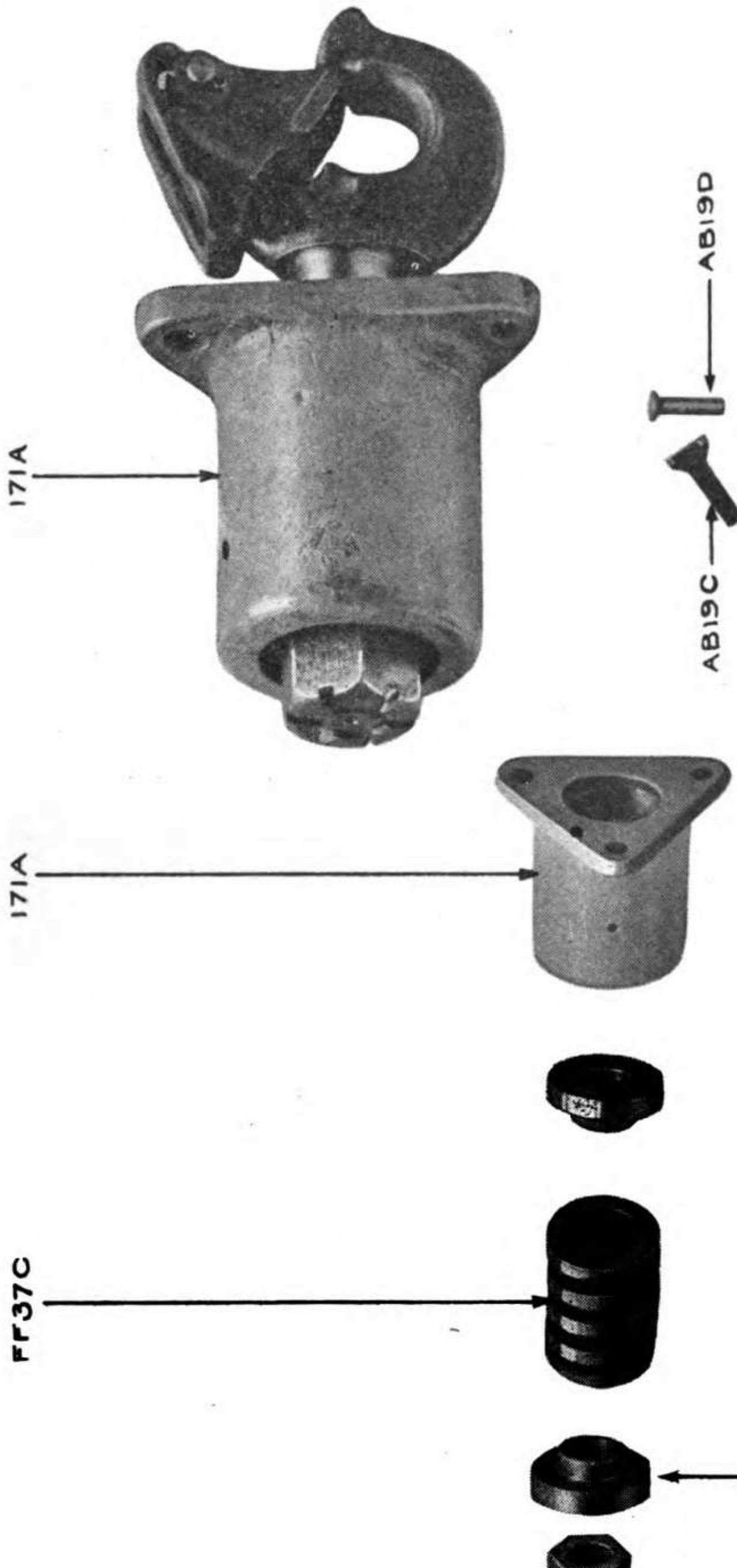


PLATE 126—SPRING RADIUS ROD PARTS

PLATE 127



FRONT PINTLE PARTS

NOMENCLATURE OF PARTS—Continued

Part No.	No. Per Tractor	Property Classification—Class IV, Division 10	
		Name of Part	Location

Track Assemblies—TRACK OILING SYSTEM

See illustration on page 241

218G	2	Bolts .5 (½) x .175 (½) S. A. E	Through pipe clips
	2	.5 (½)—20 S. A. E. Nuts	
	2	.5 (½) Lock washers	
218B	10	Ell	
220E	2	Globe valve	
220D	1	Oil pipe	
220B	4	Oil pipe	
219C	1	Oil pipe	
218B	2	Oil pipe clip	Between street ell and T
218C	2	Oil pipe hanger	
217B	1	Pipe flange	Bottom of tank
219A	3	Pipe nipple	Oil pipe line
219B	1	Pipe nipple	Oil pipe line
219E	2	Pipe nipple	
220A	3	Pipe nipple	
220C	5	Pipe nipple	
220F	1	Pipe union	
217E	6	Rivets, tinners .187 (3/16) x .375 (3/8)	Through filler flange
217F	4	Rivets, tinners .165 x .328 (21/64)	Through pipe flange
190E	2	Screw, cap .625 (5/8) x 1.25 (1¼)	
	2	.625 (5/8) Lock washer	
218E	2	Street ell	
219D	3	Tee	
217A	1	Track oil tank	Left side of armor plate
217C	1	Track oil tank filler cap	Top of tank
217B	1	Track oil tank filler flange	Top of tank
218A	1	Track oil tank strap	Around oil tank
218F	1	Track oil tank strap webbing	Under strap

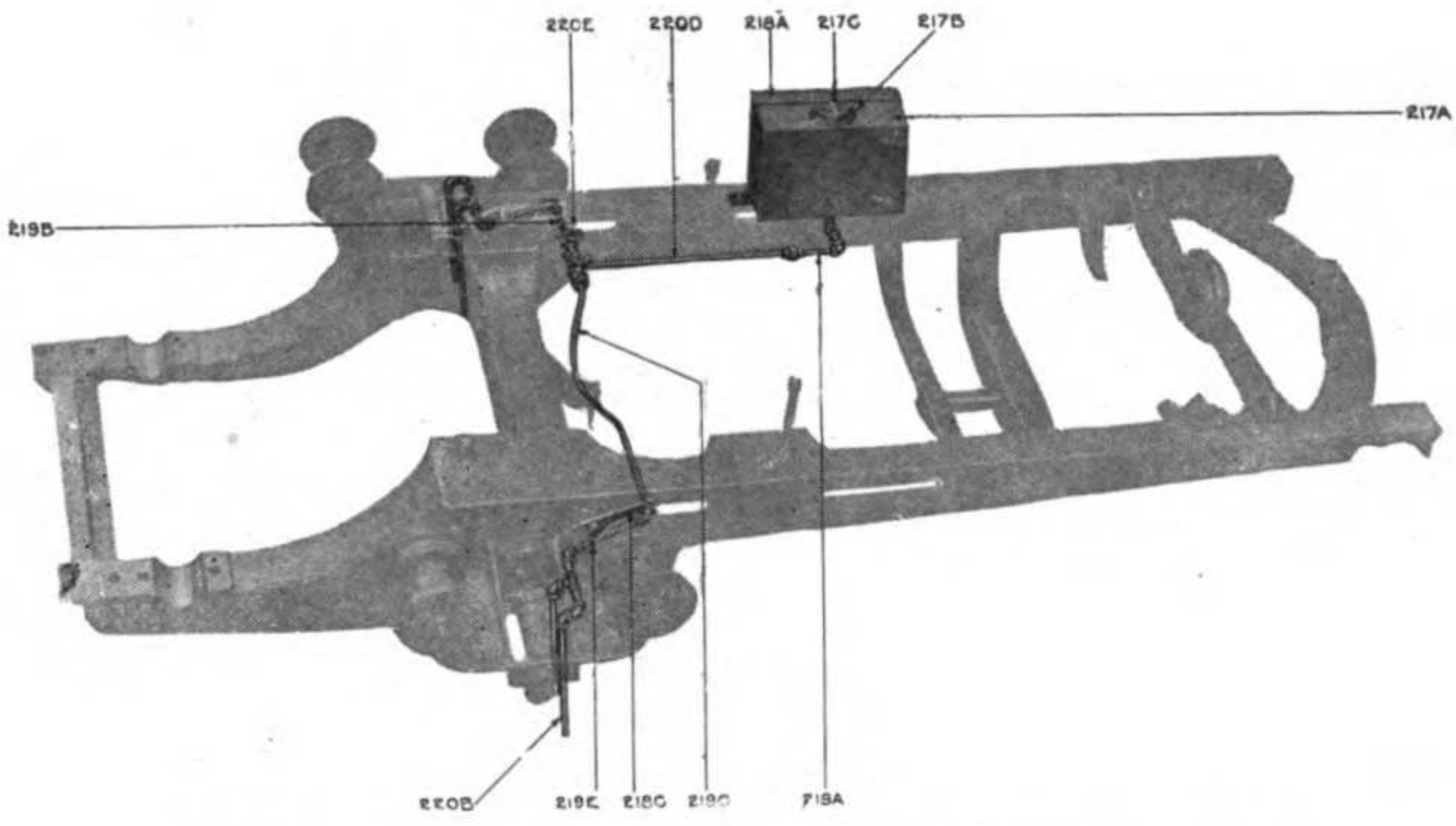
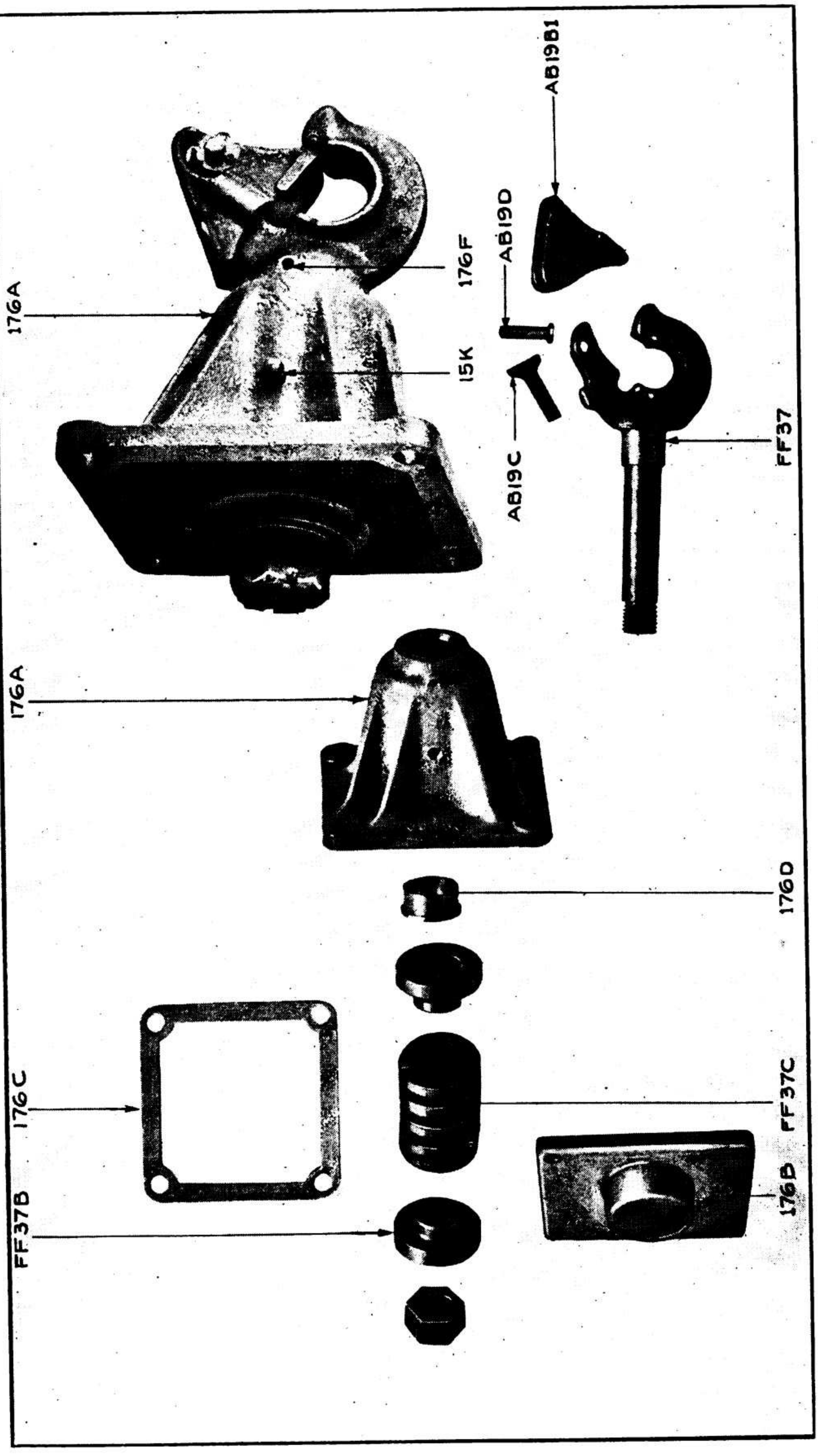


PLATE 128—DIAGRAM OF TRACK OILING SYSTEM

PLATE 129



REAR PINTLE PARTS

NOMENCLATURE OF PARTS—Continued

Part No.	No. Per Tractor	Property Classification—Class IV, Division 10	
		Name of Part	Location
		Pintle Assemblies—FRONT PINTLE	
		See illustration on page 240	
171B	3	Bolt S. A. E. drilled .875 (⅞) x 2.75 (2¾)	Through pintle housing
	3	.875 (⅞)—14 Castle nuts	
171A	1	Front pintle housing	Front end of main frame
FF37	1	Pintle	
		Note: Pintle consists of the following	
		1.625 (1⅝)—5½ Crown nut	
FF37B	2	Pintle guide ring	On pintle shank
AB19B1	1	Pintle latch	
AB19D	1	Pintle latch pin	
AB19C	1	Pintle latch spring	
FF37C	1	Pintle spring	
		Pintle Assemblies—REAR PINTLE	
		See illustration on page 242	
176B	1	Pintle plate	On upper transmission case
176C	1	Pintle plate gasket	Between plate and housing
176F	1	Pipe plug	In housing
15K	1	Pipe plug	In housing
FF37	1	Pintle	
176A	1	Rear pintle housing	Rear end of upper transmission case.
176D	1	Rear pintle housing bushing	Front end of housing
176E	1	Rear pintle stud	Housing to transmission
		Note: Pintle consists of the following:	
		1.625 (1⅝)—5½ Crown nut	
FF37B	2	Pintle guide ring	
AB19B1	1	Pintle latch	
AB19D	1	Pintle latch pin	
AB19C	1	Pintle latch spring	
FF37C	1	Pintle spring	
		Superstructure—OPERATOR'S SEAT AND TOOL BOX	
		See illustration on page 244	
231A	1	Arm rest	On left of seat
231D	1	Arm rest reinforcing plate	Between arm rest and side plate
236C	1	Blue glazed wadding	
230G	13	Bolts S. A. E.	Through filler plate to seat frame
232D	3	Bolts S. A. E. .375 (⅜) x 1	Through tail light bracket
229D	8	Bolt and nut, R. H. S. (.562 (9/16) x .75 (¾)	Through seat frame
	8	.25 (¼) Lock washer	
235F	1	Cordwelt	
236A	1	Curled hair	
235N	6	Cushion reinforcing pad	
235L	1	Cushion spring	
235K	1	Duck enameled	
230E	2	Frame angle filler plate	Bolted to seat frame
230D	1	Frame shoe, left	Riveted to front of seat frame
230C	1	Frame shoe, right	Riveted to front of seat frame
226A	1	Gas tank and tool box plate rear	Rear plate of seat body
228B	2	Gas tank guide	Riveted to seat plate back
226C	2	Gas tank guide, rear	Riveted to gas tank plate
226B	4	Gas tank support	Riveted to seat and gas tank plates
	16	.25 (¼) x .5 (½) B. H. rivets	
235B	1	Hair felt	
G83J	4	Hinge	On seat back
GB3K	4	Hinge pin	
236H	1	Lazy back form	
236G	40	Nails No. 200	
235C	1	Olive drab leather	

NOMENCLATURE OF PARTS—Continued

Part No.	No. Per Tractor	Property Classification—Class IV, Division 10	
		Name of Part	Location
		Superstructure*—OPERATOR'S SEAT AND TOOL BOX *—Continued	
		See illustration on page 244	
236D	1	O. D. leather No. 1 mach. buffed	
236E	1	O. D. binding	
227D	1	Patent license plate	On seat side plate
235E	1	Rag board	
235A	1	Seat	
	12	.25 (¼) x .75 (¾) Csk. rivets	
227B	1	Seat and tool box side plate. L. H	Side of seat frame
	6	.25 (¼) x .5 (½) B. H. rivets	
227C	1	Seat and tool box side plate, R. H	Side of seat frame
233A	1	Seat back rail, front	On front of seat back plate
	21	.25 (¼) x .625 (⅝) B. H. rivets	
	12	.25 (¼) x .5 (½) B. H. rivets	
230F	2	Seat bottom filler	Bet. seat frame and bottom plate
229A	1	Seat bottom plate	On bottom of seat frame
231C	1	Seat corner angle	On seat and tool box side plate
	10	.25 (¼) x .5 (½) B. H. rivets	
230B	1	Seat frame, left	On left side of main frame
230A	1	Seat frame, right	On right side of main frame
228C	4	Seat hinge filler block	On seat plate back
	12	.25 (¼) x .75 (¾) Csk. rivets	
228A	1	Seat plate, back	On back of seat frame
227A	1	Seat plate, front	Front of seat body
	12	.187 ($\frac{3}{16}$) x .375 (⅜) B. H. rivets	
	2	.25 (¼) x .5 (½) B. H. rivets	
232A	1	Seat rail, rear	On top of seat back
	4	.25 (¼) x .625 (⅝) B. H. rivets	
	10	.25 (¼) x .5 (½) B. H. rivets	
229B	4	Seat support, lower	On seat bottom plate and seat frame
	32	.25 (¼) x .5(½) B. H. rivets	

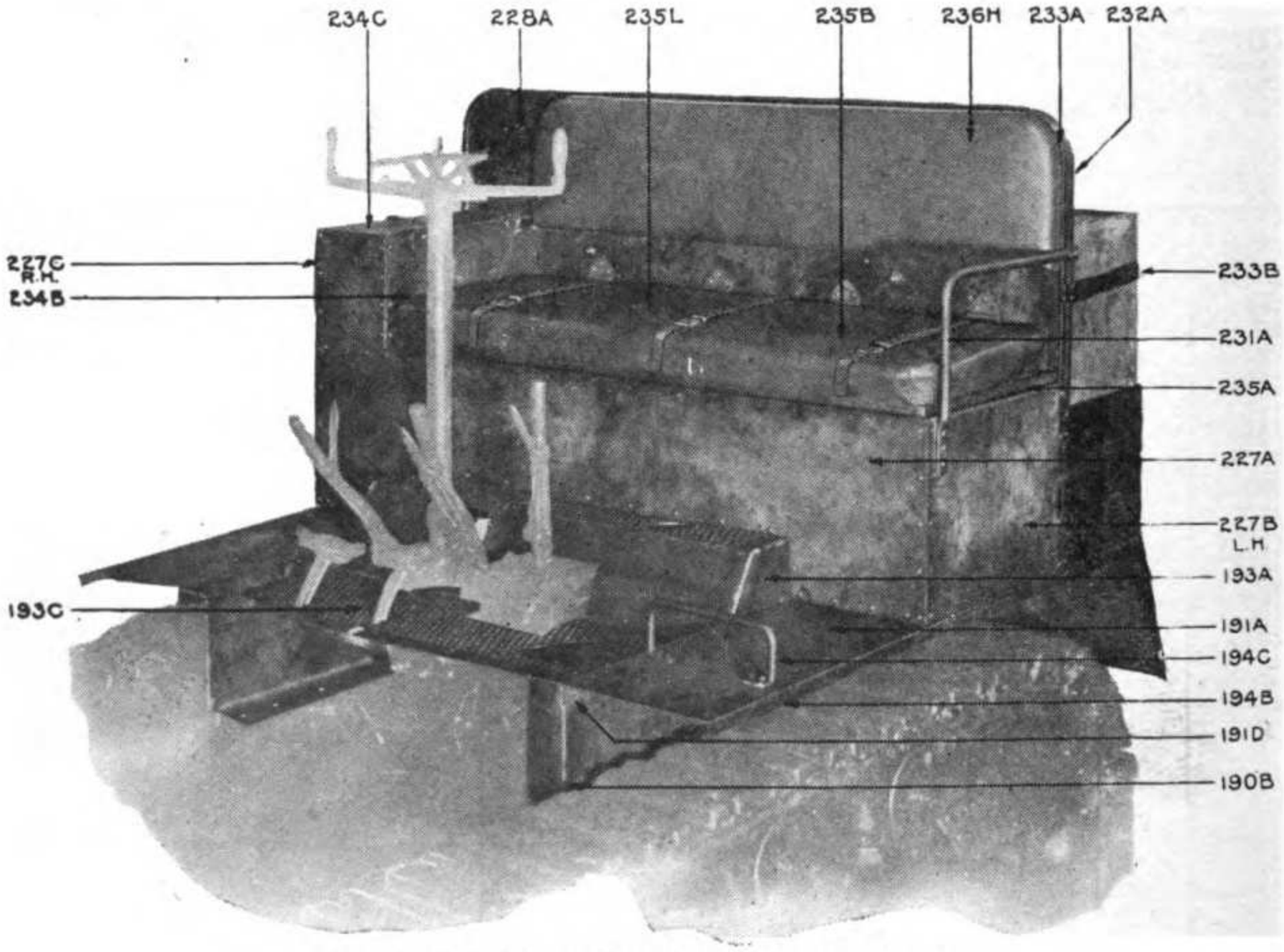
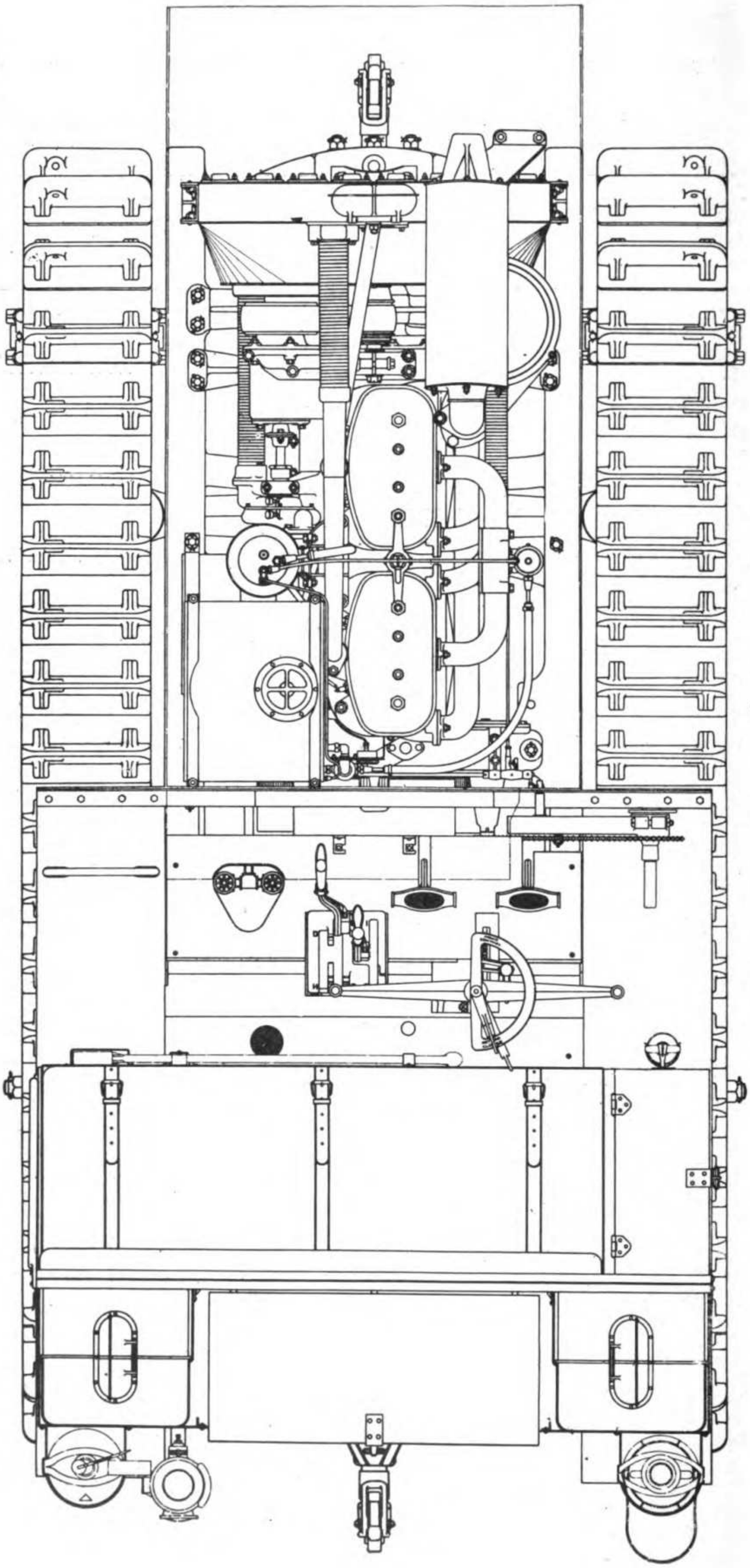


PLATE 130—SUPERSTRUCTURE

NOMENCLATURE OF PARTS—Continued

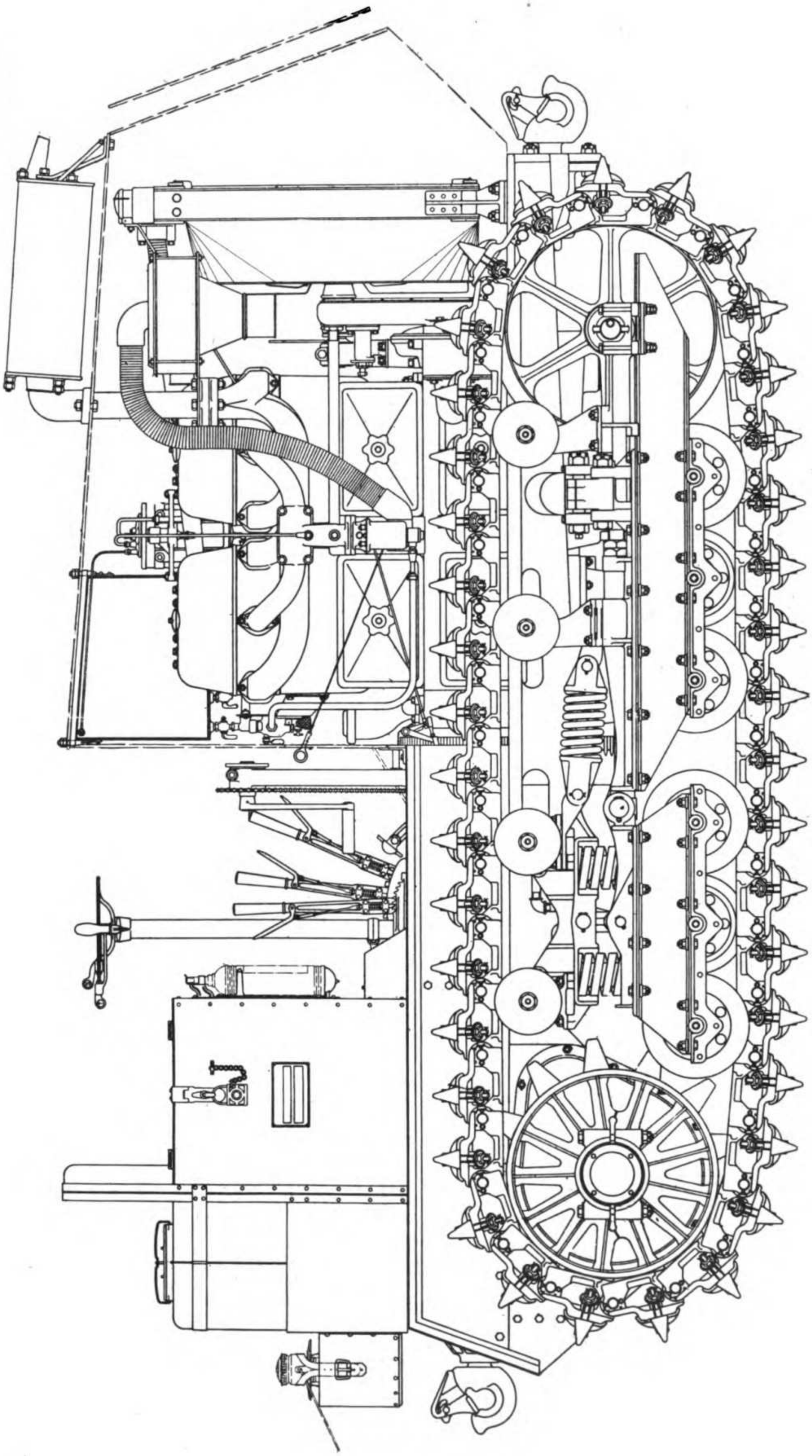
Part No.	No. Per Tractor	Property Classification—Class IV, Division 10	
		Name of Part	Location
		Superstructure*—OPERATOR'S SEAT AND TOOL BOX—*Continued	
		See illustration on page 244	
229C	2	Seat support, upper	On seat bottom plate and seat frame
	38	.25 (¼) x .5 (½) B. H. rivets	
228D	15	Screws, No. 10, wood	Back of seat to seat plate
235M	6	Strap loop	On seat back
	12	.187 ($\frac{3}{16}$) x .375 (⅜) B. H. rivets	
236F	1	Tacks	
232C	1	Tail light bracket	On gas tank and tool box plate
233B	2	Tank strap band	Rear of seat back plate
	6	.187 ($\frac{3}{16}$) x .375 (⅜) B. H. rivets	
232B	2	Tank strap band webbing	Rear of seat back
207C	2	Tank strap end	
235G	1	Thread cord	
235H	1	Thread G-2-5	
234A	1	Tool box bottom	
231B	1	Tool box corner angle	On seat back plate
	16	.25 (¼) x .5 (½) B. H. rivets	
234C	1	Tool box cover	
234F	2	Tool box hinge, female	
	6	.25 (¼) x .5 (½) B. H. rivets	
234D	2	Tool box hinge, male	
	6	.25 (¼) x .5 (½) B. H. rivets	
234E	2	Tool box hinge pin	
234B	1	Tool box side, L. H	
226D	2	Tool box support	On gas tank plate
	20	.25 (¼) x .5 (½) B. H. rivets	
234G	4	Tool box support	On seat plate back
	32	.25 (¼) x .5 (½) B. H. rivets	
236B	1	Unbleached muslin	
235D	1	Wagon duck	
		***Superstructure*—PLATFORM AND FENDER**	
190F	12	Bolt S. A. E. .375 (⅜) x .75 (¾)	Through fender splash plate
	12	.375 (⅜) Nuts S. A. E	
	12	.375 (⅜) Lock washers	
191E	4	Bolt S. A. E. .375 (⅜) x 1	Through fender splash plate and angle
	4	.375 (⅜) Lock washers	
	4	.375 (⅜)—24 Nuts S. A. E	
194G	8	Bolt S. A. E. .25 (¼) x .875 (⅞)	Through fender support angle
	8	.25 (¼) Lock washers	
	8	.25 (¼)—28 S. A. E. Nuts	
194E	2	Bolt R. H. S. with nuts .375 (⅜) x .75 (¾)	Connects platform and flywheel guard bracket
191D	1	Fender angle, left	Connects splash plate to toe plate
191C	1	Fender angle, right	Connects splash plate to toe plate
190B	1	Fender splash plate, L. H	
190A	1	Fender splash plate, R. H	
194D	1	Fender support angle	Across front of fender
194A	1	Fender support, left	On outer edge of toe plate
194B	1	Fender support, right	On outer edge of toe plate
194C	1	Fender toe grip	On right fender
191A	1	Fender toe plate, left	
191B	1	Fender toe plate, right	
192A	1	Flywheel guard	Over flywheel
192B	2	Flywheel guard bracket	On platform front plate
	4	.187 ($\frac{3}{16}$) B. H. rivets	
190C	2	Platform angle	Connects fender to platform
198A	1	Platform, rear plate	Rear of platform
198C	1	Platform, front plate	On front of platform
194F	4	Screw hex. head cap .312 ($\frac{5}{16}$) x .875 (⅞)	Through fender toe grip
	4	.312 ($\frac{5}{16}$) Lock washers	
	4	.312 ($\frac{5}{16}$)—24 Nuts	
190E	2	Screw hex. head cap .625 (⅝) x 1.25 (1¼)	Through platform
	2	.625 (⅝) Lock washers	
193D	4	Screw R. H. steel .25 (¼) x .75 (¾)	Through platform angle
	4	.25 (¼) Lock washers	
193D	2	Screw R. H. steel .25 (¼) x .75 (¾)	Through platform rear plate
	2	.25 (¼) Lock washers	
198B	1	Speedometer screen guard	

PLATE 131



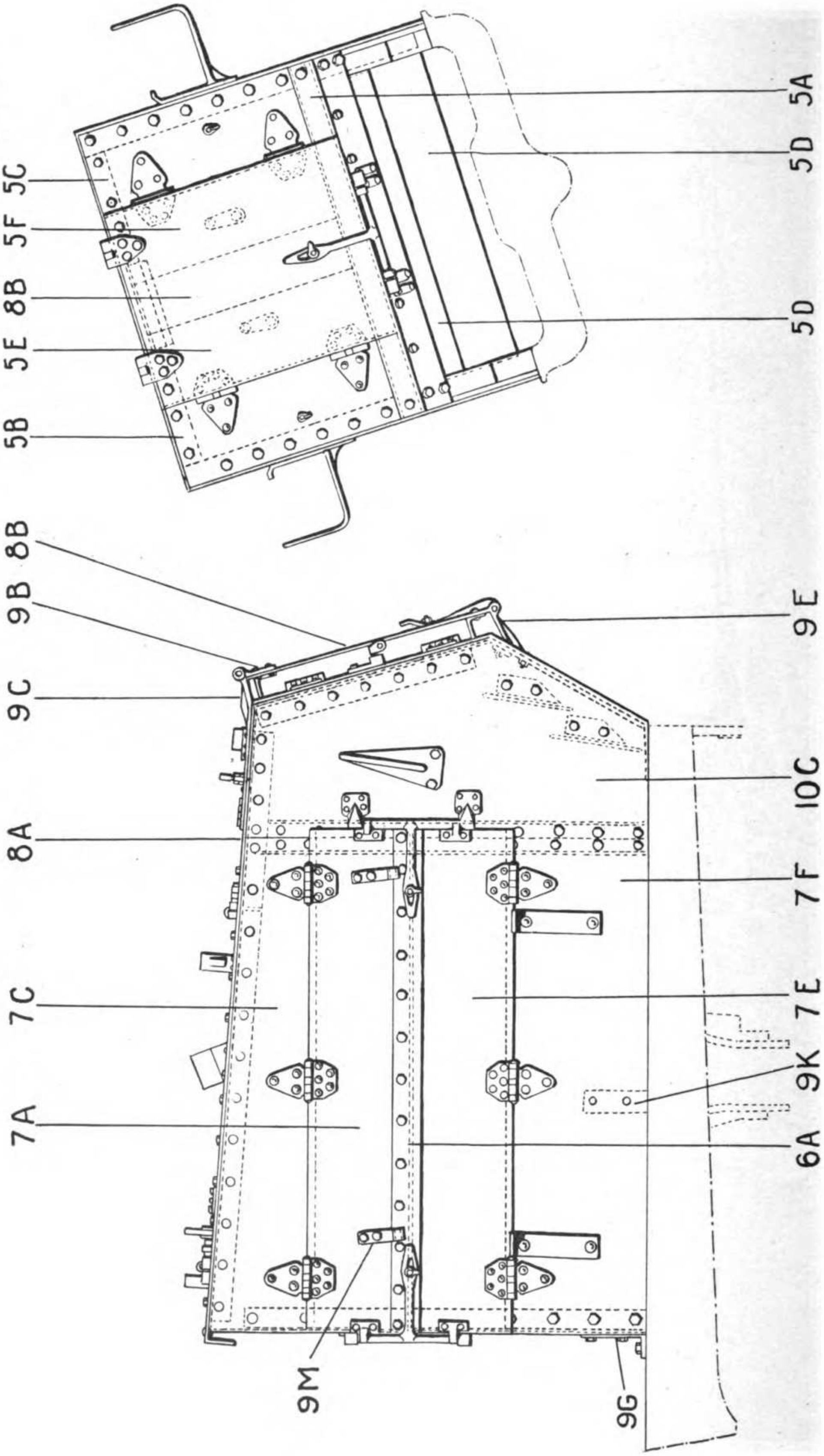
TOP VIEW OF 5-TON ARTILLERY TRACTOR

PLATE 132



SIDE VIEW OF TRACTOR

PLATE 133



ARMOR

NOMENCLATURE OF PARTS—Continued

Part No.	No. Per Tractor	Property Classification—Class IV, Division 11	
		Name of Part	Location
		***Superstructure*—ARMOR**	
5A	1	Front plate, lower	Front of armor
5B	1	Front plate, right	Front of armor
5C	1	Front plate, left	Front of armor
5D	2	Baffle plate	Bottom, front of armor
5E	1	Door, front, right	Front of armor
5F	1	Door, front, left	Front of armor
5G	32	0.375 (⅜) x 1 bolts	Front of armor
	32	0.375 (⅜) nuts	Front of armor
5H	4	0.5 (½) x 1.562 (1 5/16) bolts	Front of armor
	4	0.5 (½) nuts	Front of armor
5K	1	Foot board	Rear of armor
6A	2	Side door lap	Side of armor
6B	1	Side channel, right	Side of armor
6C	1	Side channel, left	Side of armor
6D	2	Front door filler	Front of armor
6E	2	Door shield angle bearing	Front of armor
6F	2	Side door filler	Side of armor
6G	2	Front support	Front of armor
6H	1	Top stiffener angle	Top of armor
7A	1	Side door, upper, right	Side of armor
7B	1	Side door, upper, left	Side of armor
7C	1	Side plate, upper, right	Side of armor
7D	1	Side plate, upper, left	Side of armor
7E	2	Side door, lower	Side of armor
7F	1	Side plate, lower, right	Side of armor
7G	1	Side plate, lower, left	Side of armor
5G	12	.375 (⅜) x 1 bolts	Side of armor
	16	.375 (⅜) nuts	Side of armor
7H	4	.375 (⅜) x 1 countersunk screws	Side of armor
8A	1	Top plate	Top of armor
8B	1	Door shield	Front of armor
8C	2	.375 (⅜) x 1.25 (1¼) bolts	Top of armor
	23	.375 (⅜) nuts	Top of armor
5G	18	.375 (⅜) x 1 bolts	Top of armor
7H	3	.375 (⅜) x 1 countersunk screws	Top of armor
9A	2	Wing nut slot cover	Front armor plate
9B	2	Door shield hinge, female	On door shield
9C	2	Door shield hinge, male	Top of armor
9D	2	Wing nut slot cover pin	Front armor plate
9E	2	Lock bar hinge, lower	Front of armor
9F	5	Wing nut pin, side	Side of armor
9G	1	Rear support, right	Rear of armor
9H	1	Rear support, left	Rear of armor
9K	2	Side support	Side of armor
9L	2	Wing nut pin, front	Front of armor
9N	2	Shot bolt eye, side	Side of armor
10A	1	Rear plate	Rear of armor
10B	1	Side plate forward, right	Side of armor
10C	1	Side plate forward, left	Side of armor
10D	1	Rear door	Rear of armor
7H	1	.375 (⅜) countersunk screw	Rear of armor
5G	11	.375 (⅜) x 1 bolts	Rear of armor
	12	.375 (⅜) nuts	Rear of armor
11A	1	Side angle, upper, left	Side of armor
11B	1	Front angle, upper	Front of armor
11C	1	Side angle, upper, right	Side of armor
11D	1	Front angle, lower	Front of armor
11E	1	Ventilator shield	Front of armor
11F	1	Door shield, upper angle	Front of armor
11G	2	Side angle, front	Front of armor
11H	1	Side angle, rear, right	Side of armor
11K	1	Side angle, rear, left	Side of armor
11L	1	Door shield, lower angle	Rear of armor

GENERAL INDEX

A

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G

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I

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N

O

P

T

U

V

W

DECIMAL EQUIVALENTS OF AN *INCH* FOR EACH 1/64 INCH

1/32ds.	1/64ths.	Decimal	Fraction.	1/32ds.	1/64ths.	Decimal.	Fraction.
	1	.015625			33	.515625	
1	2	.03125		17	34	.53125	
	3	.046875			35	.546875	
2	4	.0625	1-16	18	36	.5625	9-16
	5	.078125			37	.578125	
3	6	.09375		19	38	.59375	
	7	.109375			39	.609375	
4	8	.125	1-8	20	40	.625	5-8
	9	.140625			41	.640625	
5	10	.15625		21	42	.65625	
	11	.171875			43	.671875	
6	12	.1875	3-16	22	44	.6875	11-16
	13	.203125			45	.703125	
7	14	.21875		23	46	.71875	
	15	.234375			47	.734375	
8	16	.25	1-4	24	48	.75	3-4
	17	.265625			49	.765625	
9	18	.28125		25	50	.78125	
	19	.296875			51	.796875	
10	20	.3125	5-16	26	52	.8125	13-16
	21	.328125			53	.828125	
11	22	.34375		27	54	.84375	
	23	.359375			55	.859375	
12	24	.375	3-8	28	56	.875	7-8
	25	.390625			57	.890625	
13	26	.40625		29	58	.90625	
	27	.421875			59	.921875	
14	28	.4375	7-16	30	60	.9375	15-16
	29	.453125			61	.953125	
15	30	.46875		31	62	.96875	
	31	.484375			63	.984375	
16	32	.5	1-2	32	64	1.	1