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5-3040B

DEPARTMENT OF THE ARMY
TECHNICAL MANUAL

TM5-3040B

DEPARTMENT OF THE AIR
FORCE TECHNICAL ORDER

TO 19-75AJ-139

TRACTOR CRAWLER TYPE

DIESEL-DRIVEN
(28,100 TO 38,000 LBS.
DRAWBAR PULL)

STANDARD CATERPILLAR

D-8, 78-INCH GAGE
(TRACTOR SERIAL NO.
2U14765 AND UP)

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DEPARTMENTS OF THE ARMY AND THE AIR FORCE
DECEMBER 1953

TECHNICAL MANUAL
No. 5-3040B
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DEPARTMENTS OF THE ARMY AND
THE AIR FORCE
WASHINGTON 25, D. C., 17 December 1953

**TRACTOR, CRAWLER TYPE, DIESEL DRIVEN (28,100 to
38,000 lbs. Drawbar Pull) STANDARD CATERPILLAR D-8,
78-INCH GAGE (Tractor Serial No. 2U14765 and up)**

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SUMMARY OF SAFETY PRECAUTIONS

Correct or report any mechanical deficiencies that may result in damage to the machine if operation is continued.

Always stop the engine before making repairs or adjustments on any part of the unit.

Avoid operating at excessive speed over rough roads, down steep grades, or where vision is limited.

Keep machine in gear and leave clutch engaged when traveling down-grade.

After starting the engine, allow it to warm up at fast idling speed before applying load.

Always return choke button to closed position after engine is warmed up.

Always engage clutches carefully. Sudden engagements cause undue strain on tractor.

Make sure that fuel and oil containers are clean.

Always provide a metallic contact between container and tank when adding gasoline.

Always run engine at idling speed for a few minutes before stopping.

Be sure brakes are in good working order.

CHAPTER I

INTRODUCTION

Section I. GENERAL

1. Scope

a. This manual is published for the use of the personnel to whom this tractor is issued. It contains information on the operation and organizational maintenance of the tractor as well as a description of the major units and their functions in relation to other components of the tractor. It applies only to the Caterpillar D-8 Tractor, serial No. 2U14765 and up.

b. Supply catalogs, technical manuals, and other publications applicable to the equipment covered by this manual are listed in appendix I. Appendix II lists the tools and other items issued with and carried on or with this equipment.

2. Records and Report Forms

Maintenance record forms listed and briefly described in the following subparagraphs will be used in the maintenance of this equipment.

a. DD Form 110, Vehicle and Equipment Operational Record. This form is used by equipment operators for reporting the accomplishment of daily preventive maintenance services, and for reporting any equipment deficiencies observed during operation.

b. Standard Form 91, Operator's Report of Motor Vehicle Accident. One copy of this form is kept with the equipment at all times. In case of an accident resulting in injury or property damage, Form 91, is filled out immediately (or as promptly thereafter as is practical) by the operator.

c. DA Form 464, Work Sheet for Preventive Maintenance and Technical Inspection of Engineer Equipment. This form is used by personnel of the using organization and higher echelons for reporting the results of preventive maintenance service and technical inspections.

d. DA Form 460, Preventive Maintenance Roster. This form is used for maintaining an operating time record on the items of equipment, and for scheduling lubrication and preventive maintenance services at proper intervals.

e. DA Form 478, Organizational Equipment File. Major repairs or rebuilding, replacement of major unit assemblies, and accomplishment of equipment modifications are recorded on this form.

f. DA Form 9-69, Spot-Check Inspection Report for all Full-Track and Tank-Like Wheeled Vehicles. This form may be used instead of DA Form 464 as a check list for applicable items to be inspected during spot-check inspection.

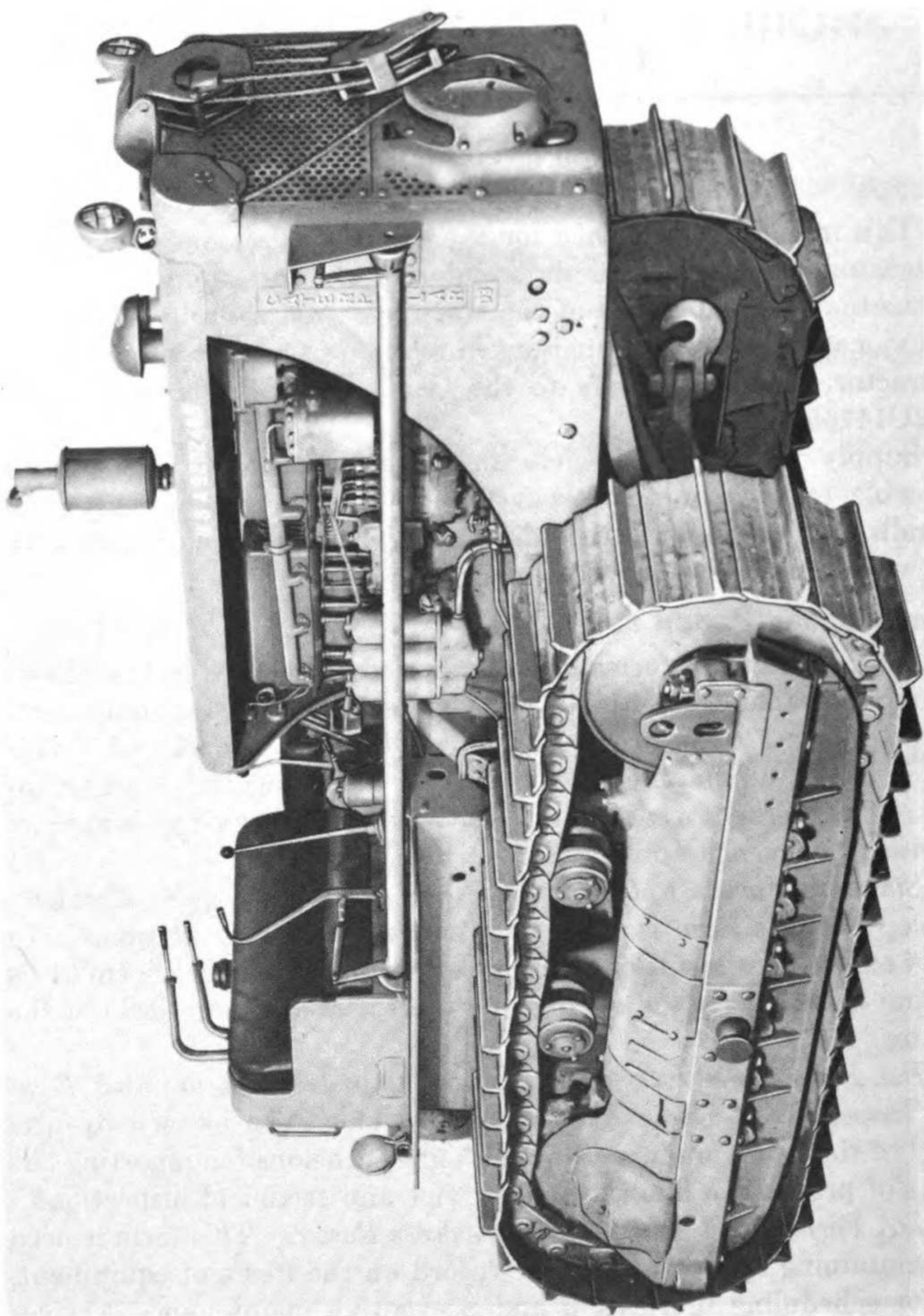


Figure 1. Three-quarter right front view of tractor.

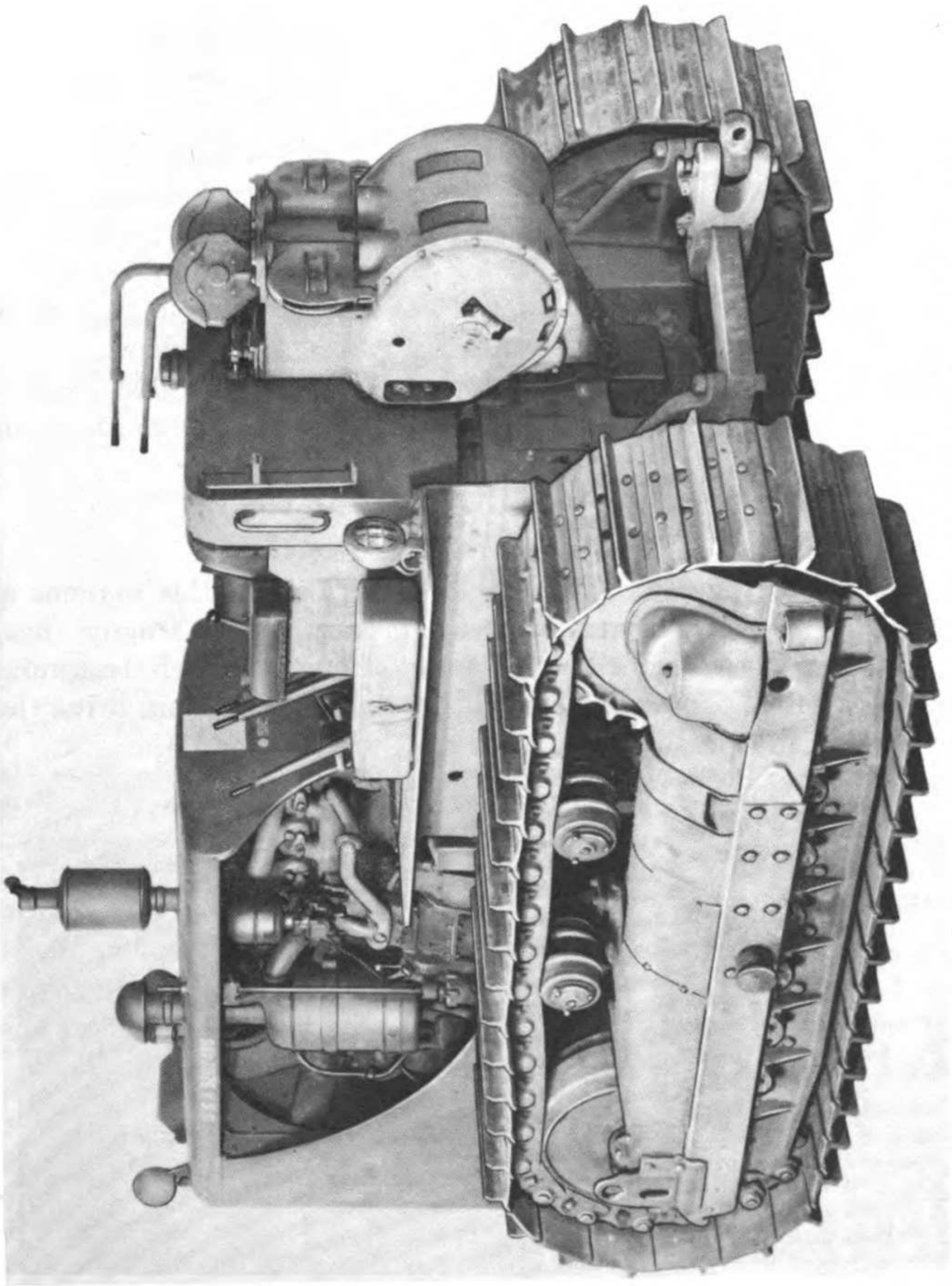


Figure 2. Three-quarter left rear view of tractor with rear power control unit.

g. DA Form 468, Unsatisfactory Equipment Report. This form is used for reporting manufacturing, design, or operational defects in the materiel, with a view to correcting such defects; it is also used for recommending modifications of the materiel. Form 468 is not used for reporting failures, isolated materiel defects, or malfunction of materiel resulting from fair wear and tear or accidental damage. Form 468 is not used to report issue of parts and equipment, or for reporting replacements and/or repairs.

h. DD Form 6, Report of Damaged or Improper Shipment. This form is to be used for reporting damages incurred in shipment.

i. DA Form 9-81, Exchange Part or Unit Identification Tag. This form is used to accomplish the direct exchange of unserviceable for serviceable parts.

j. DA Form 811, Work Request and Job Order. This form is used to request work done by higher echelon organizations.

k. DA Form 867, Status of Modification Work Order. This form is used to maintain records of all modification work performed on equipment.

Section II. DESCRIPTION AND DATA

3. Description

a. General Information. The tractor described in this manual is a Caterpillar, D-8, track crawler, rear sprocket driven tractor (figs. 1 and 2). It is self-propelled by a diesel engine which transmits power to two final drive sprocket wheels which engage and drive the tracks around the sprocket and front idler wheels (figs. 3).

- | | |
|-----------------------------|----------------------------|
| 1 Tractor weight | 5 Rear sprocket |
| 2 Tractor front lifting eye | 6 Tractor rear lifting eye |
| 3 Front idler wheel | 7 Drawbar |
| 4 Track carrier rollers | |

b. Diesel Engine (fig. 4). The engine which powers the D-8 tractor is a six-cylinder, four-stroke cycle, valve-in-head, Caterpillar diesel engine. The diesel engine is similar to the spark-ignition engine except that in the diesel engine, fuel is injected into the cylinders and is ignited by the heat of compression.

- | | |
|---------------------------|----------------------------------|
| 1 Lubricating oil filters | 7 Fuel filter housing |
| 2 Coolant manifold | 8 Injection pump housing filler. |
| 3 Crankcase breather | 9 Fuel filter |
| 4 Governor housing | 10 Hour meter |
| 5 Injection pump housing | 11 Oil filler |
| 6 Injection pump | |

c. Starting Engine. An independent 2-cylinder, 24-horsepower Caterpillar gasoline engine is used to start the diesel. The starting engine power is transmitted to the diesel engine flywheel through a pinion which is manually engaged with the flywheel ring gear. It will crank the diesel, with compression on, for as long as necessary and the pinion automatically releases when the diesel engine starts.

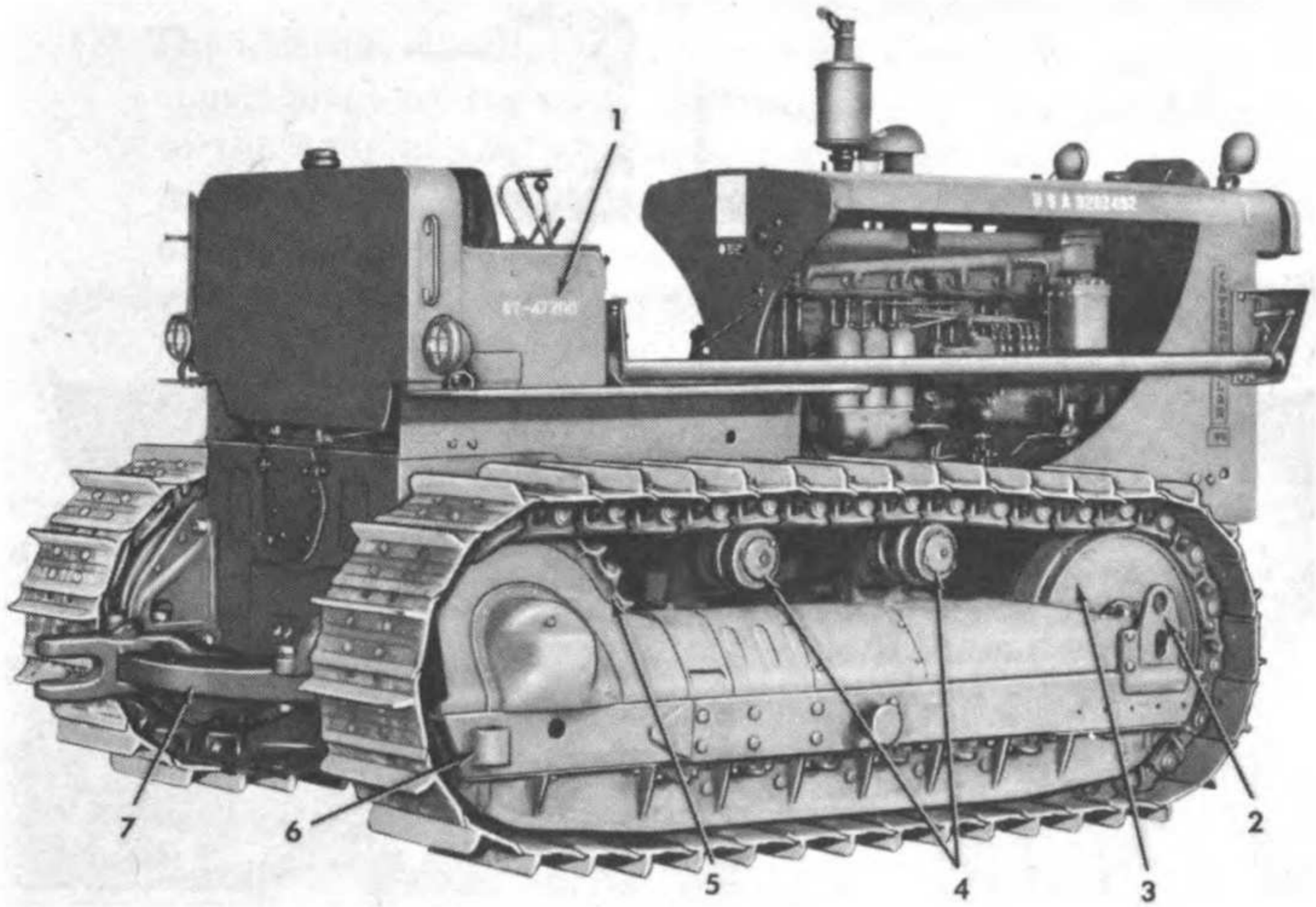


Figure 3. D-8 tractor nomenclature.

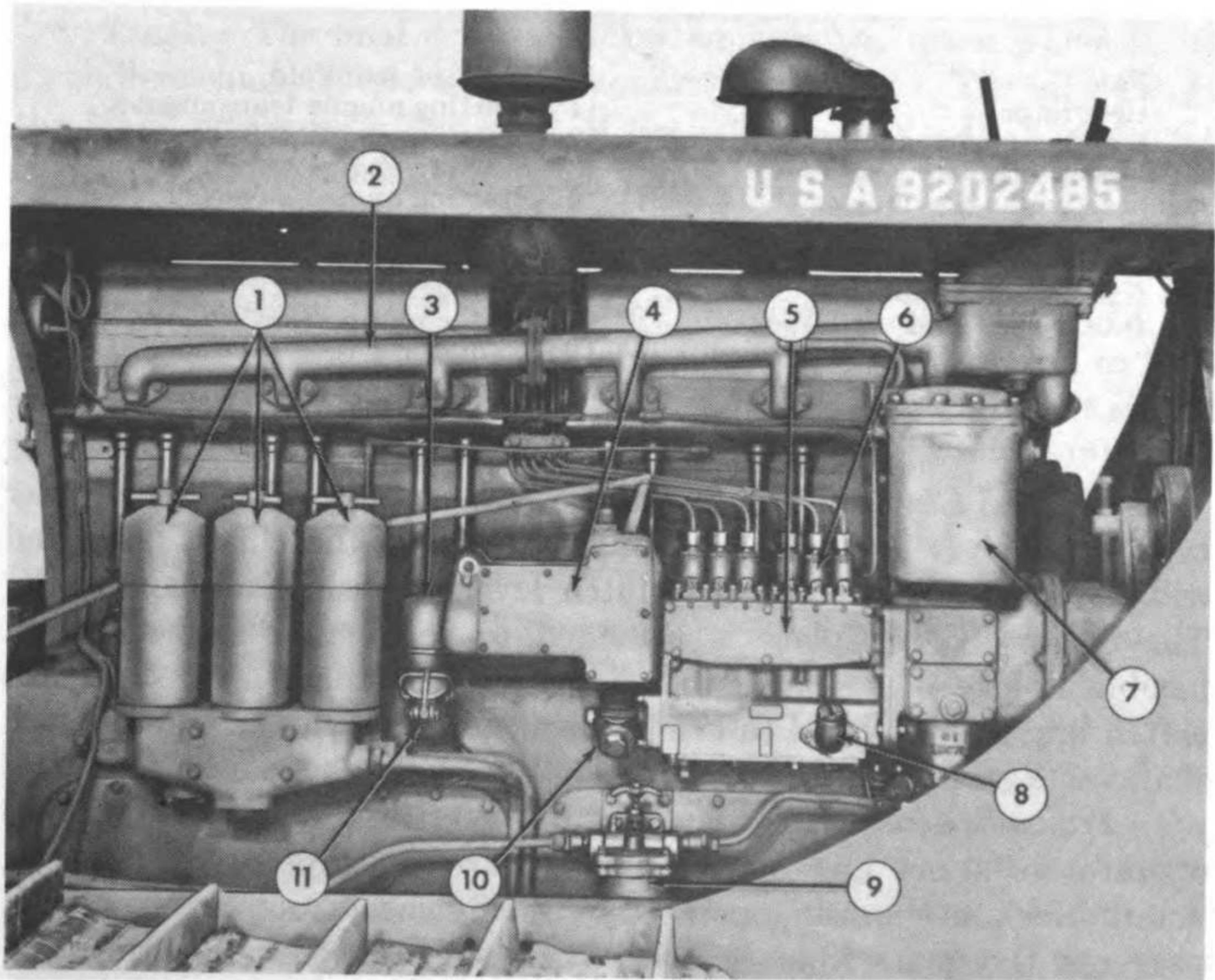
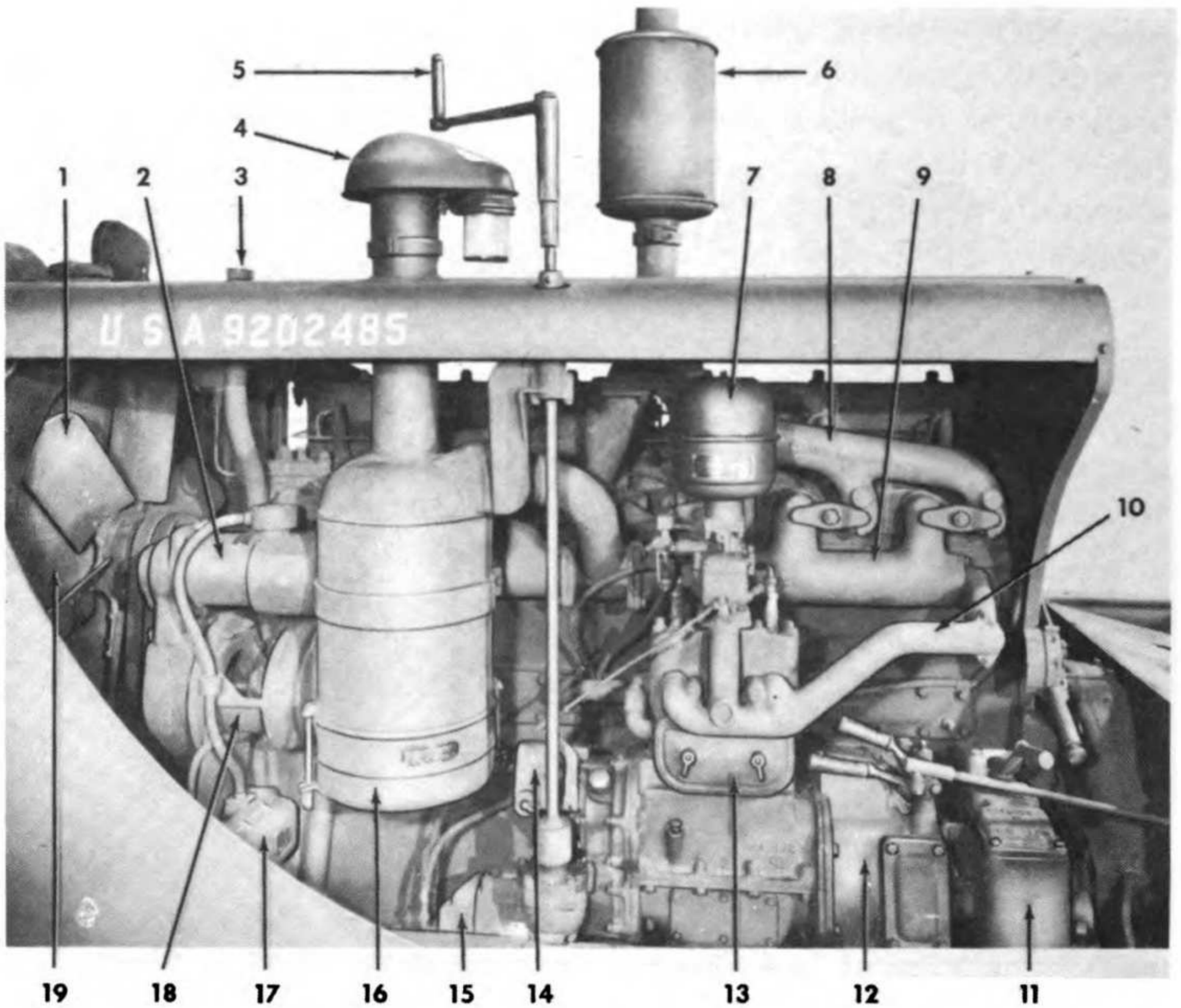


Figure 4. Diesel engine installed (right side).



- | | | | |
|---|-----------------------------|----|-------------------------------|
| 1 | Fan | 10 | Exhaust manifold |
| 2 | Generator | 11 | Starting engine transmission |
| 3 | Starting engine exhaust | 12 | Starting engine clutch |
| 4 | Pre-cleaner | 13 | Starting engine valve housing |
| 5 | Starting engine crank | 14 | Starting engine governor |
| 6 | Diesel muffler | 15 | Magneto |
| 7 | Starting engine air cleaner | 16 | Air cleaner |
| 8 | Exhaust manifold | 17 | Voltage regulator |
| 9 | Intake manifold | 18 | Water pump |
| | | 19 | Radiator |

Figure 5. Diesel engine installed (left side).

d. Flywheel Clutch. The flywheel clutch is a dry plate, over center type clutch. It is engaged by pulling back on the clutch lever and will remain engaged until the clutch lever is pushed forward again. The clutch driving plate is attached to the engine flywheel with flexible links. The driven disk is splined to the clutch shaft. A clutch brake is provided to bring the rotating clutch and transmission shafts to a stop when the clutch is disengaged.

e. Transmission. The transmission gearshift lever enables the operator to select any one of five forward or three reverse speeds. An interlock mechanism, operated by the flywheel clutch control lever, prevents the gears from being shifted while the clutch is engaged. Power is transmitted through gears from the upper shaft to the pinion shaft which drives the bevel gear.

f. Steering Clutches and Brakes.

- (1) The steering clutches are dry, multiple-disk clutches, held in engagement by springs. The steering clutches are attached to the ends of the bevel gear shaft. The outer drums are mounted on the final drive pinion. The brake bands operate on the outer drums.
- (2) Steering is accomplished by disengaging either clutch and applying the brake which stops one track and allows full power to go to the other track.

g. Final Drive Assembly. The final drive housings are bolted to the sides of the transmission and steering clutch case. The power is transmitted from the steering clutches through the final drive pinion, to the sprocket which is mounted on the final drive gear hub. Bellows type, self-aligning seals on each side of the sprocket seal the final drive gear case. The sprocket shaft, pressed into the transmission case, extends through the final drive gear hub and supports the outer bearing.

h. Track Roller Frame Assemblies. The tractor is supported on the track roller frame assemblies at the front by the equalizer spring and at the rear by the sprocket shafts. This construction allows the track roller frames to move up and down independently when the tractor is operated over rough ground. The track rollers, which are mounted on the track roller frames, support the entire weight of the tractor on the tracks.

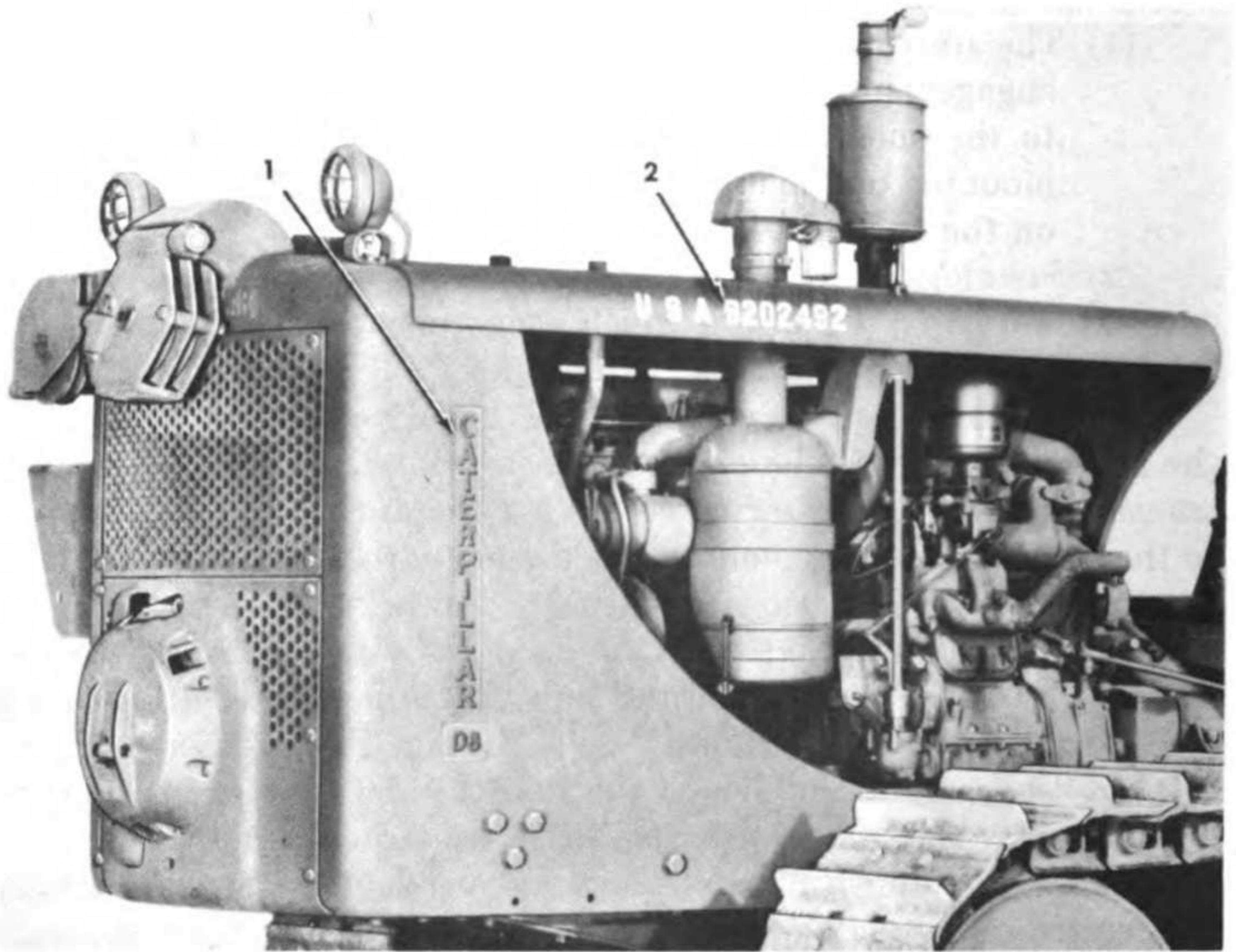
i. Track. The final drive sprocket engages the track which forms an endless chain around the sprocket and front idler. The idler guides the track into position in front of the track rollers. It is connected to the recoil spring by the track adjusting screw which determines the position of the idler on the track roller frame. The recoil spring bolt holds the recoil spring in compression which prevents the spring from ever pushing the idler ahead of the position determined by the adjusting screw and at the same time allows the recoil spring to form a cushion for the idler, letting it move back if a foreign object should get between the track and rollers or if the track should run into a solid object.

4. Identification

a. Nameplate (fig. 6). The manufacturer's name and model designation are stamped on plates attached to the radiator guard.

b. USA Registration Number (fig. 6). The Department of the Army (USA) registration number is stenciled on the right and left sides of the engine hood by the manufacturer.

c. Tractor Serial Number (fig. 7). The tractor serial number is stamped on two metal plates. One plate is attached on the left side of the diesel engine crankcase immediately above the starting engine transmission, and the other plate is attached on the steering clutch case at the rear of the tractor.



- 1 Manufacturer's nameplate
- 2 Registration number

Figure 6. Vehicle identification information.



Figure 7. Tractor serial number.

d. *Generator Serial Number* (fig. 8). The generator serial number is stamped on a plate which is attached to the generator housing. The plate also contains data pertinent to the operation and output of the generator.



Figure 8. Generator serial number.

e. *Voltage Regulator Serial Number* (fig. 9). The voltage regulator serial number is stamped on a plate which is attached to the voltage regulator housing.

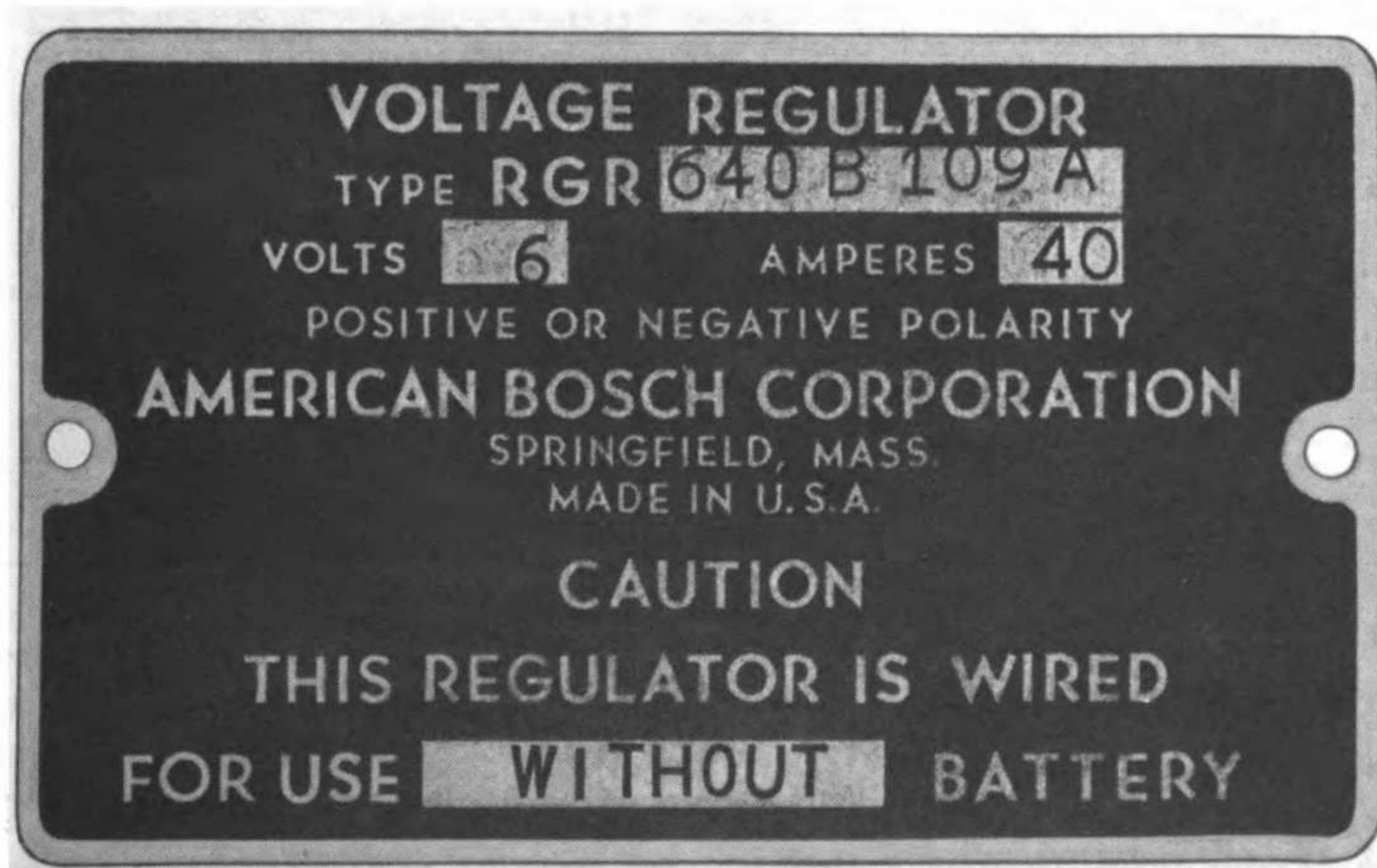


Figure 9. Voltage regulator serial number.

f. *Magneto Serial Number* (fig. 10). The magneto serial number is stamped on a plate which is attached to the magneto housing.



Figure 10. Magneto serial number.

g. *Data Plates* (fig. 11). Two data plates are attached to the left side of the tractor seat, and contain applicable identification and transportation information.



Figure 11. Vehicle data plates.

5. Differences in Models

a. This manual covers Caterpillar D-8 tractors bearing serial numbers 2U14765 and up.

b. Principal difference between these tractors and those built prior to this serial number is the transmission.

c. Tractors covered by this manual are equipped with a synchro-mesh transmission, with six speeds forward and three reverse. Earlier tractors were equipped with spur-gear type transmissions, with six speeds forward and two reverse. For information on these tractors see TM 5-3040.

6. Tabulated Data

a. Detailed Specifications.

(1) Diesel engine.

| | |
|--|-------------------------|
| Operating cycle | four-stroke |
| Cooling | liquid |
| Lubrication (separate transmission system) | pressure |
| Number of cylinders (in line) | 6 |
| Bore and stroke | 5 $\frac{3}{4}$ x 8 in. |
| Piston displacement | 1246 cu. in. |
| Firing order | 1-5-3-6-2-4 |
| Crankshaft speed (at maximum load) | 1000 rpm |
| Piston speed (at 1000 rpm) | 1333 fpm |
| Power rating | 79.35 hp |
| Weight (including starting engine) | 5650 lbs. |

(2) Starting engine.

| | |
|---------------------------------------|-------------------------|
| Operating cycle | four-stroke |
| Cooling (integral with diesel engine) | liquid |
| Ignition | magneto |
| Lubrication | splash system |
| Number of cylinders | 2 |
| Bore and stroke | 3 $\frac{5}{8}$ x 4 in. |
| Piston displacement | 82.56 cu. in. |
| Crankshaft speed | 2700 rpm |
| Power rating (at 2700 rpm) | 24 hp |
| Low idle speed | 800 rpm |
| High idle speed | 2850 rpm |
| Weight | 400 lb. |

(3) Accessories.

Generator (lighting), American Bosch 6 volt, 40 amp. Model GRB-640 B-207.

Magneto, starting engine, American Bosch Model 4-2 180° C-319.

Voltage regulator, American Bosch Model PGR 640 B-105A.

Carburetor, starting engine, Zenith Series 22.

Spark plug, starting engine, 18 mm, Champion 15A.

Fuel injection system, Caterpillar D-8.

Air cleaner, diesel engine, Donaldson Model A1247.

Air cleaner, starting engine, Donaldson Model B-654.

6. Tabulated Data—Continued

(4) *Tractor dimensions and weights.*

| | |
|---|--------------|
| Gage (center-to-center of tracks) | 78 in. |
| Ground contact area | 4389 sq. in. |
| Ground clearance | 10½ in. |
| Overall length w/front and rear power controls (length is same with or without rear control). | 194 in. |
| Overall length w/o front and rear power controls. | 188 in. |
| Overall width | 103¾ in. |
| These vary with different equalizer springs. { | |
| Overall height | 112 in. |
| Height without muffler and precleaner. | 95 in. |
| Gross weight (shipping weight) bare tractor. | 36,550 lb. |
| Shipping cubage (Bare D8 less muffler and precleaner, approximately). | 1075 |
| Approximate weight of auxiliary equipment: | |
| Front power control unit | 680 lb. |
| Rear power control unit | 1920 lb. |
| Straight blade bulldozer for front power control unit. | 5472 lb. |
| Straight blade bulldozer for rear power control unit. | 5610 lb. |
| Angling blade bulldozer for front power control unit. | 6010 lb. |
| Angling blade bulldozer for rear power control unit. | 6280 lb. |

b. Performance. The following data applies to the tractor when operated at sea level:

| | |
|---|------------|
| Drawbar horsepower | 130 |
| Belt horsepower | 148 |
| Drawbar pull through gear speed range: | |
| First | 28,700 lb. |
| Second | 21,700 lb. |
| Third | 16,650 lb. |
| Fourth | 11,900 lb. |
| Fifth | 8,600 lb. |
| Drawbar pull through gear speed range at maximum engine torque: | |
| First | 31,600 lb. |
| Second | 23,900 lb. |
| Third | 18,300 lb. |
| Fourth | 13,310 lb. |
| Fifth | 9,500 lb. |

Tractor speed through gear speed range forward:

| | |
|-------------|---------|
| First..... | 1.7 mph |
| Second..... | 2.3 mph |
| Third..... | 2.8 mph |
| Fourth..... | 3.7 mph |
| Fifth..... | 4.8 mph |

Tractor speed through gear speed range reverse:

| | |
|-------------|---------|
| First..... | 2.2 mph |
| Second..... | 3.0 mph |
| Third..... | 3.7 mph |

c. Capacities.

| | |
|------------------------------------|----------------------|
| Air cleaner, diesel engine..... | 5 qt. |
| Air cleaner, starting engine..... | $\frac{3}{4}$ qt. |
| Cooling system..... | 25 gal. |
| Crankcase, diesel engine..... | 34 qt. |
| Crankcase, starting engine..... | $2\frac{1}{4}$ qt. |
| Final drives (each)..... | 20 qt. |
| Fuel injection pump housing..... | $\frac{3}{4}$ qt. |
| Fuel tank, diesel engine..... | $68\frac{1}{2}$ gal. |
| Fuel tank, starting engine..... | $4\frac{1}{2}$ qt. |
| Transmission, starting engine..... | $\frac{3}{4}$ qt. |
| Transmission, diesel engine..... | 41 qt. |

CHAPTER II

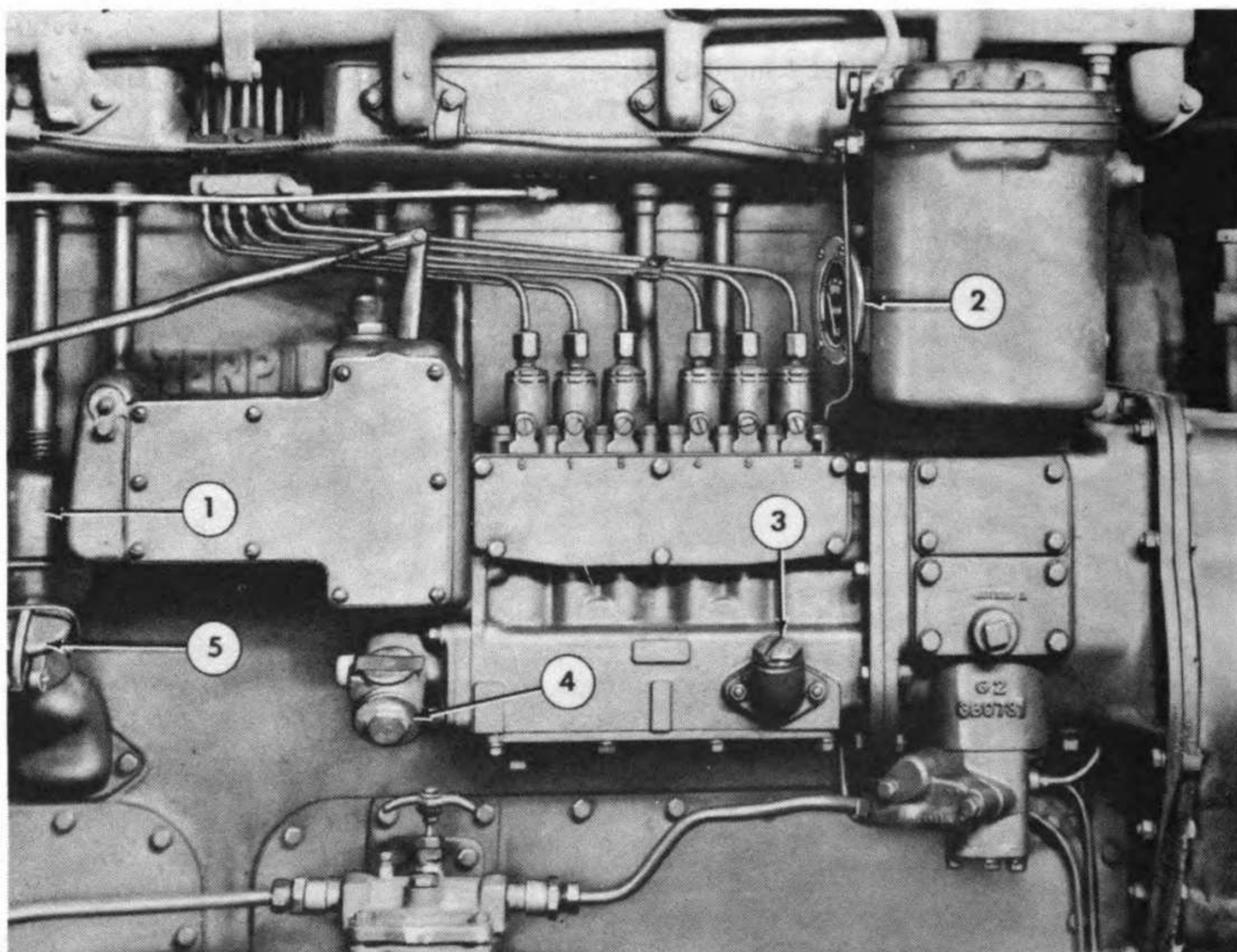
OPERATING INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF EQUIPMENT

7. New Equipment

a. General. New machines and attachments are processed to meet military requirements for domestic or oversea shipment. To prevent corrosion, all vulnerable openings in engines and gear compartments are sealed. Exposed moving parts and unpainted machined surfaces are covered with rust preventive compounds. This preparation makes definite services necessary before a machine can be operated.

b. Remove Tie-Down Devices. Remove all tie wires, steel strapping, tie rods, and blocking. Handle heavy parts carefully to avoid injury.



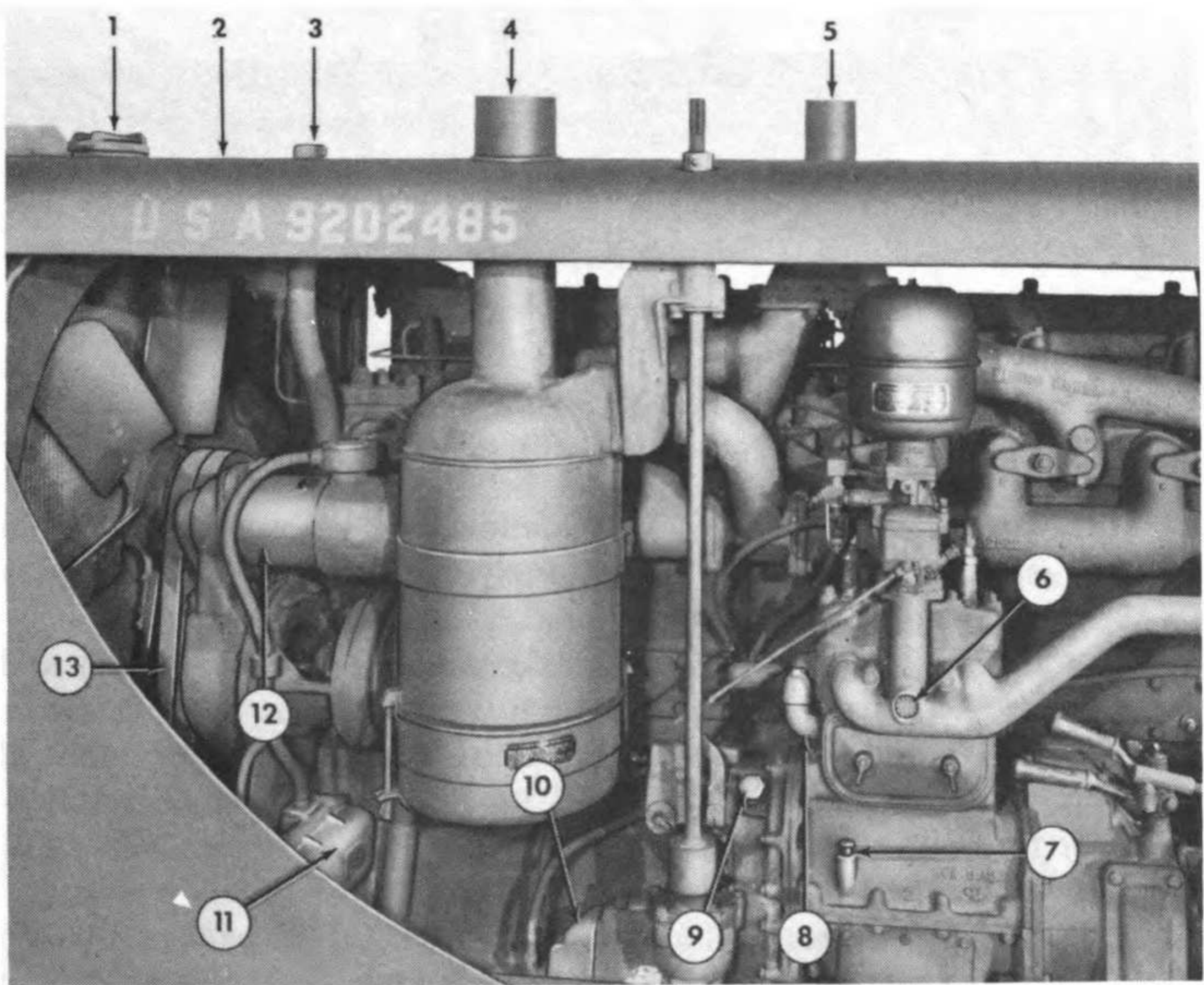
- | | |
|---------------------------------|--------------|
| 1 Crankcase breather | 4 Hour meter |
| 2 Fuel pressure gage | 5 Oil filler |
| 3 Injection pump housing filler | |

Figure 12. Corrosion preventive sealing—engine right side.

c. *Hoisting Vehicle.* Refer to paragraph 103b for hoisting instructions.

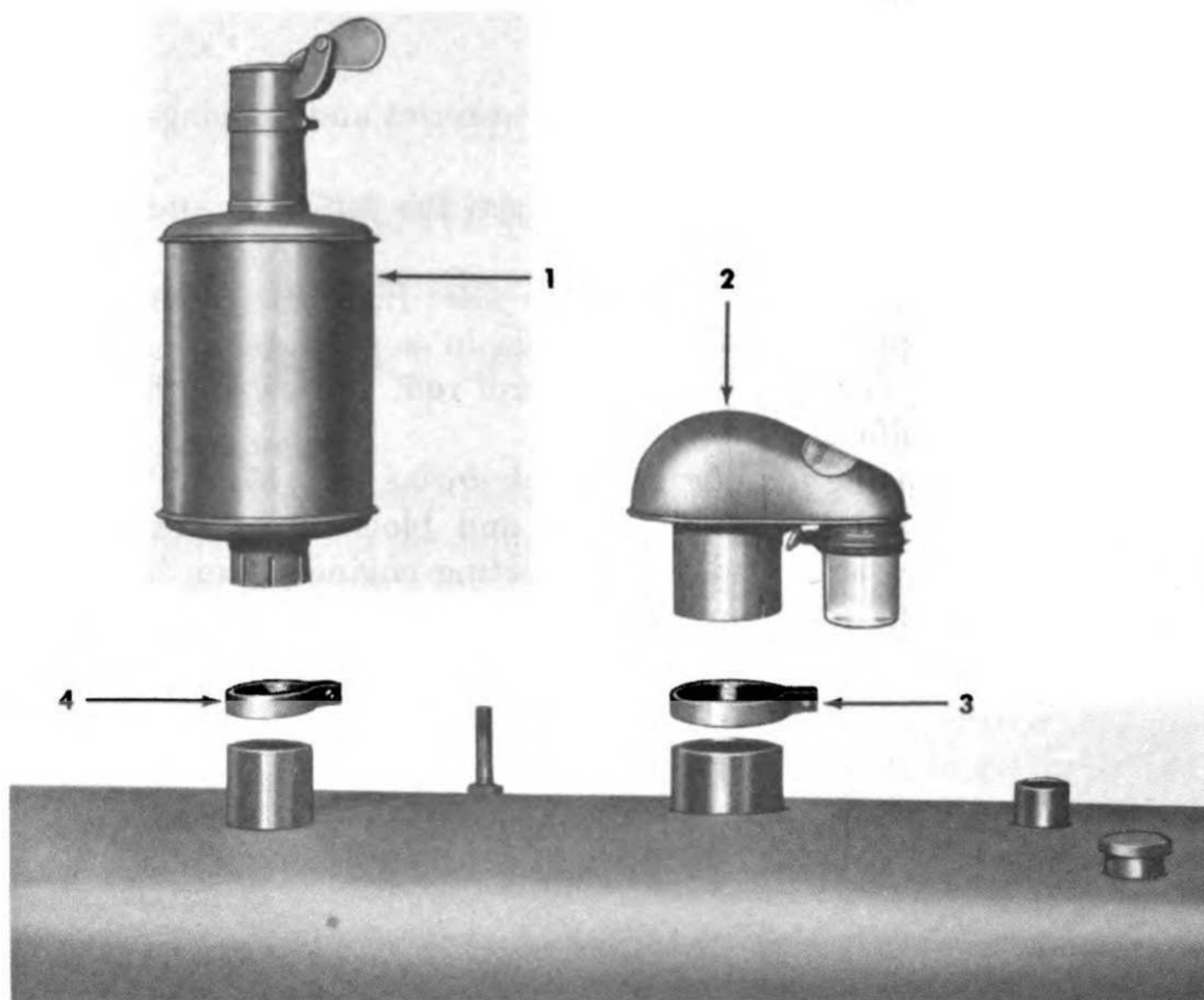
d. *Remove Seals.*

- (1) Remove the seals from the accessories and openings pointed out in figures 12 and 13.
- (2) Remove the paper from between the fan belts and the fan drive pulleys.
- (3) *Starting engine manifold drain filter* (fig. 13). The starting engine manifold drain filter is in a sack attached to the starting engine governor control rod. Screw the filter into the manifold.
- (4) *Diesel engine radiator and block drains* (fig. 15). The diesel engine radiator drain valve and block drain plug are in separate sacks tied to the starting engine pinion lever rod. Screw the plug into the block (1) and the drain valve into the radiator outlet pipe (2).



- | | |
|----------------------------------|----------------------|
| 1 Radiator cap | 8 Breather |
| 2 Gasoline tank filler | 9 Oil filler |
| 3 Starting engine exhaust | 10 Magneto |
| 4 Air cleaner inlet | 11 Voltage regulator |
| 5 Diesel exhaust | 12 Generator |
| 6 Manifold drain | 13 Fan belts |
| 7 Starting engine oil level gage | |

Figure 13. Corrosion preventive sealing—engine left side.



- | | |
|--------------|--------------------|
| 1 Muffler | 3 Precleaner clamp |
| 2 Precleaner | 4 Muffler clamp |

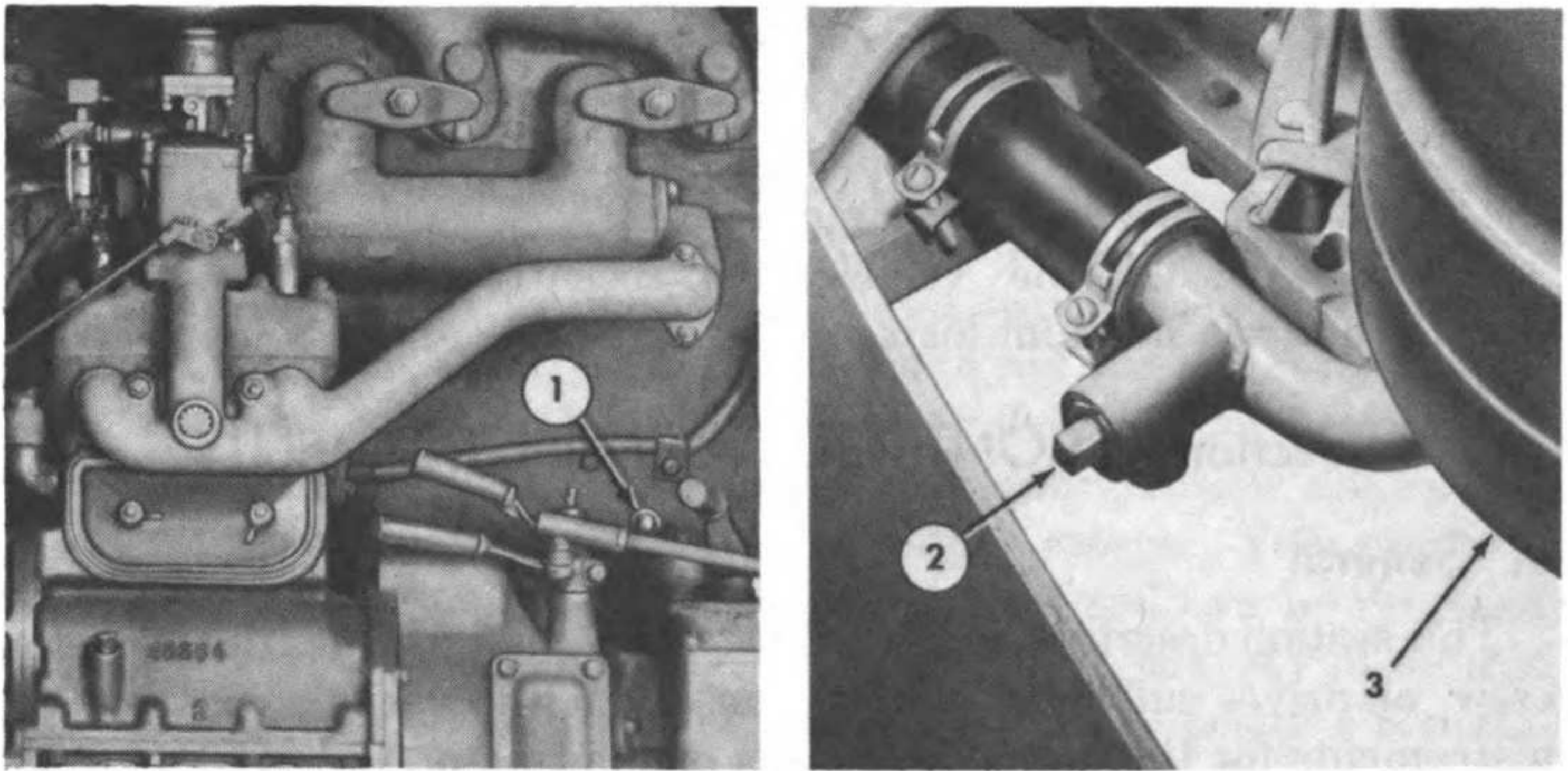
Figure 14. Muffler and precleaner installation.

(3) Corrosion preventive compounds can be removed with a steam cleaner. If a steam cleaner is not available, dry cleaning solvent can be used.

e. Inspection. Inspect the tractor for damage, missing parts, and for evidence of tampering. Report any damaged or missing parts. Check the tools and spare parts against the applicable Department of the Army Supply Manual, and check to be certain that all publications are present. Report any missing items.

f. Assembly.

(1) *Precleaner* (fig. 14). The precleaner (2) is packed on top of the starting engine transmission and the clamp is located around the gear shaft control lever. Slide the clamp (3) over the diesel engine air cleaner stack and press the precleaner down over the stack so that the glass trap jar is toward the rear of the vehicle. Raise the clamp, seat the precleaner, and secure it on the stack by tightening the clamp.



- 1 Block drain plug
- 2 Radiator drain plug
- 3 Air cleaner

Figure 15. Block and radiator drain plugs installed.

- (2) *Muffler* (fig. 14). The muffler (1) is packed at the front of the tractor on the left side. The clamp (4) is located around the gearshift control lever. Attach the muffler to the exhaust pipe, as in figure 14.
- (5) *Spark plug wires*. Attach the starting engine spark plug wires to the magneto and the spark plugs.
- (6) *Lights* (fig. 1). Attach two of the lights at the front end of the tractor at the top corners of the radiator guard. Attach the other two lights to the rear ends of the fenders. Be sure the paint is removed from the points of attachment, and connect the wires.
- (7) *Fan belts*. Adjust the tension on the fan belts in accordance with instructions in paragraph 73c.
- (8) *Supplementary instructions*. Consult the applicable technical manuals and bulletins for supplementary assembly instructions. These publications are listed in appendix I.

g. Lubrication. Lubricate the entire tractor in accordance with LO 5-3040-B.

h. Preparation for Operation. The radiator, fuel tanks, and air cleaners will be tagged with instructions for draining and filling.

8. Used Equipment

a. General. Perform applicable operations as outlined in paragraph 7, above.

b. Inspection. Give a used or reconditioned vehicle a thorough inspection as specified in paragraph 49. Check for loose nuts and cap screws, broken or missing parts. Check all adjustments. Try

the transmission in all speeds. Be sure the engine is firing on all cylinders.

c. Lubrication. Check the oil, water, and fuel supply and lubricate the vehicle as specified in paragraph 44.

d. Operation. If the vehicle has recently been reconditioned, operate under a medium load for the first 64 hours.

Section II. CONTROLS AND INSTRUMENTS

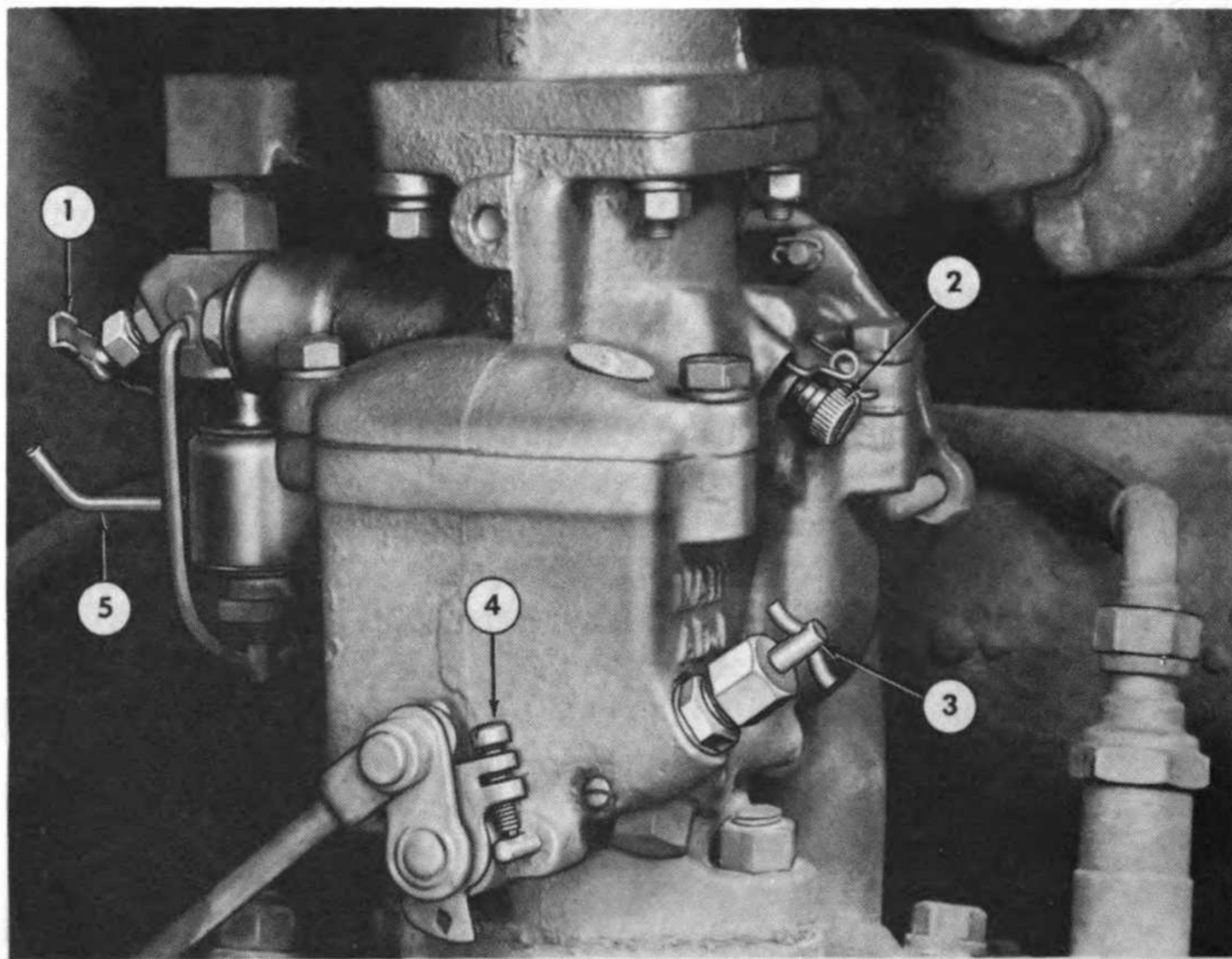
9. General

This section describes, locates, illustrates, and furnishes the operator, crew, or driver sufficient information about the various controls and instruments for the proper operation of the tractor.

10. Fuel Tank Valve

(fig. 16)

The starting engine fuel tank valve (1) is located on the carburetor just below and in front of the starting engine air cleaner. The valve shuts off fuel to the carburetor and is also used to drain the starting engine fuel tank.



- | | |
|------------------------------------|----------------------------|
| 1 Fuel inlet valve | 4 Idle speed control screw |
| 2 Idling speed jet adjusting screw | 5 Choke control rod |
| 3 High speed jet screw | |

Figure 16. Carburetor adjustments.

11. Choke Control Rod

(fig. 16)

The choke control rod is located on the starting engine carburetor adjacent to the fuel tank valve (1). The choke operates in a positive manner for three-fourths of the choke rod travel, at which position the valve is fully closed. Pulling the choke rod the last fourth of its travel trips the positive control and the valve is then held in the closed position by spring tension. The spring tension allows the choke to open automatically when the engine starts. This prevents flooding of the engine before the choke control rod can be returned to the "OFF" position. Pushing the choke rod all the way in returns the choke to the "OFF" position and reengages the positive control. For this reason, if it is necessary to choke the engine when starting, the choke control rod should always be pulled all of the way out.

12. Idling Latch

(fig. 17)

A pivoted latch (7) is mounted on the starting engine governor mounting flange. When dropped in front of the starting engine governor lever (8), the latch will hold the lever in the idling position. When raised, the latch will permit the lever to move into position for full governed speed. The latch also mounts a setscrew which can be adjusted to regulate idling speed.

13. Starting Engine Magneto Switch

(fig. 17)

The starting engine magneto switch is mounted on the side of the governor housing (6). It grounds the magneto when it is turned to the OFF position and stops the starting engine.

14. Compression Release Lever

(fig. 17)

The compression release lever (2) which is mounted on the quadrant on the instrument panel at the left rear of the diesel engine is connected through a cam and push rod arrangement, to the exhaust valve rocker arms. When the lever is moved to the HALF position, the compression is released on half of the cylinders. When the lever is moved to the START position, the compression is released on all cylinders. This control is used to reduce the initial effort required to start the diesel engine.

15. Starting Engine Clutch Lever

(fig. 17)

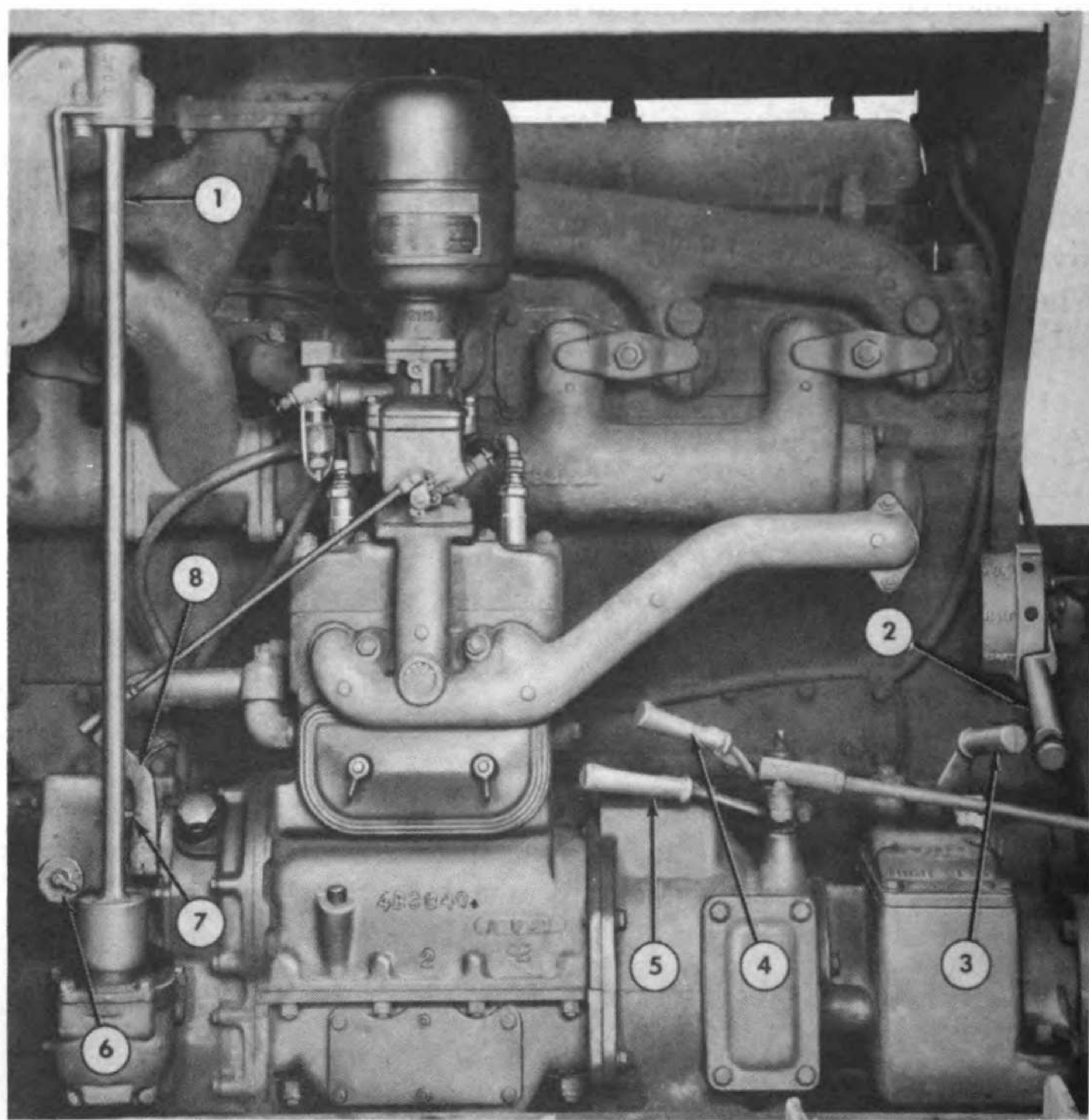
The starting engine clutch lever (5) is the lower of the two levers mounted on the starting engine clutch housing. The word CLUTCH

is cast into the handle of the lever. The lever engages the starting engine with the starter pinion when it is pulled outward and snapped over center. When the lever is pushed in towards the diesel engine block, it applies a brake to the starter pinion, enabling the operator to engage the starter pinion with the ring gear on the flywheel without clashing.

16. Starter Pinion Lever

(fig. 17)

The starter pinion lever (4) is the upper of two levers mounted on the starting engine clutch housing. The word PINION is cast into the handle of the lever. The lever engages the starter pinion with the ring gear on the Diesel engine flywheel.



- | | |
|-----------------------------|----------------------------------|
| 1 Starting crankshaft | 5 Starting engine clutch lever |
| 2 Compression release lever | 6 Starting engine magneto switch |
| 3 Transmission shift lever | 7 Idling latch |
| 4 Starter pinion lever | 8 Starting engine governor lever |

Figure 17. Starting engine controls.

17. Starting Engine Transmission Shift Lever

(fig. 17)

The starting engine transmission shift lever (3) is mounted on the starting engine transmission. This lever permits shifting the starting engine transmission into HIGH or LOW speed. During cold weather, or any time the oil drag in the Diesel engine slows down the starting engine so the normal cranking speed cannot be reached, the starting engine transmission can be shifted into the LOW speed position.

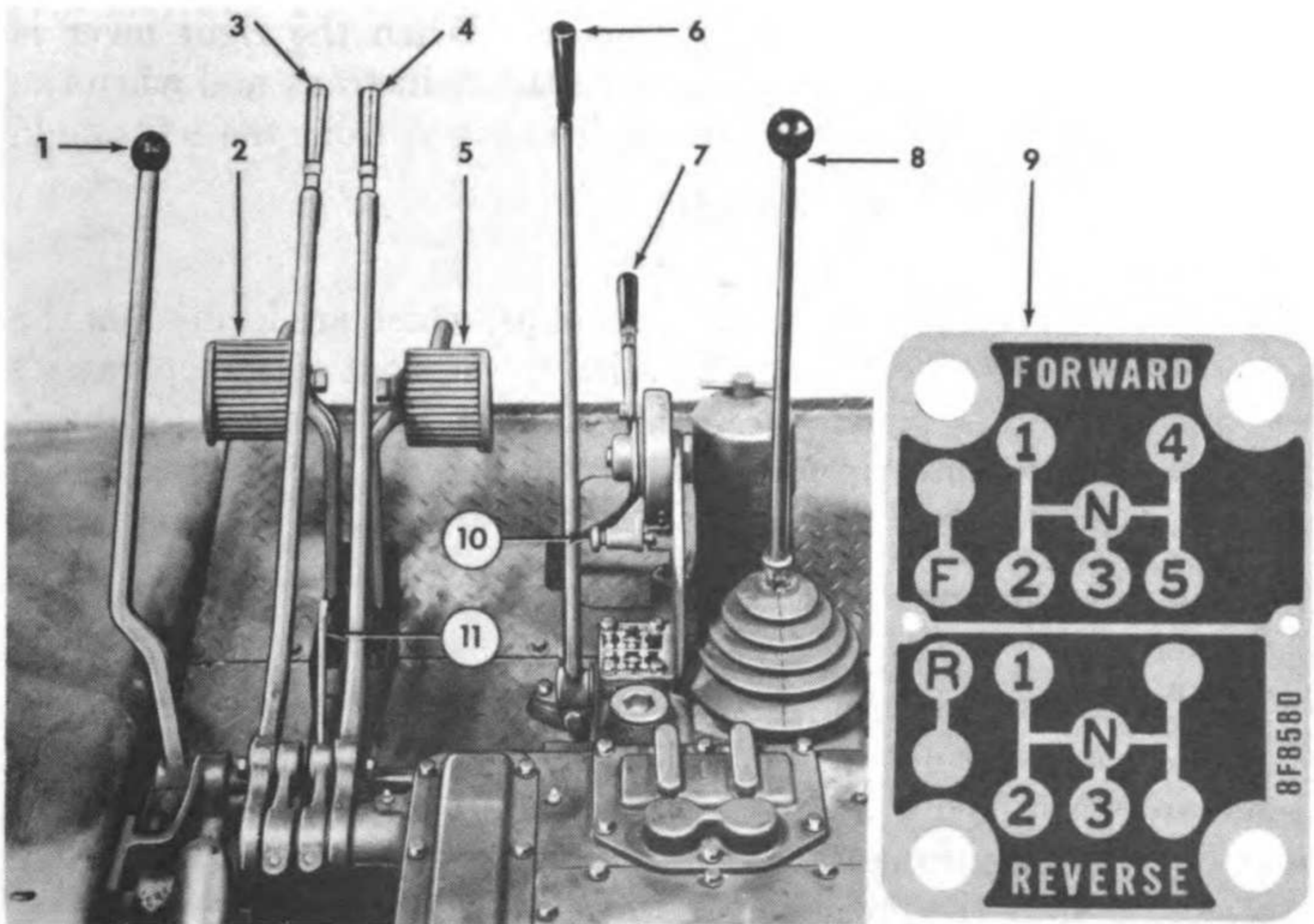
18. Starting Crank

The starting crank (5, fig. 5) is mounted on the starting engine starting crank shaft (1, fig. 17) which extends up from the starting gear housing and through the engine hood.

19. Throttle Control Lever

(fig. 18)

The throttle control lever (7) is located on the control pedestal, directly in front and to the right of the operator's seat. It is used to change the governed speed of the engine. When the lever is pulled back, the speed is increased. When the lever is pushed forward, the speed is decreased. When the plunger (10) on the bottom of the lever is pulled out and the lever pushed all the way forward, the engine will stop.



- 1 Flywheel clutch control lever
- 2 Steering clutch brake pedal
- 3 Steering clutch lever
- 4 Steering clutch lever
- 5 Steering clutch brake pedal

- 6 Forward-reverse selector lever
- 7 Throttle control lever
- 8 Gearshift control lever
- 9 Gearshift instruction plate
- 10 Throttle locking plunger
- 11 Brake locking lever

Figure 18. Operating controls.

20. Flywheel Clutch Control Lever

(fig. 18)

The flywheel clutch control lever (1) is mounted in front of the operator's seat, to the extreme left of the compartment. It engages and disengages the flywheel clutch. When the lever is pulled back, it snaps into engagement and remains engaged until it is pushed forward into the clutch released position. When the clutch control lever is pressed forward beyond the released position, it applies a brake to the upper transmission shaft which permits gear shifting without clashing the gears.

21. Gearshift Control Lever

(fig. 18)

The gearshift control lever (8) is mounted on the floor of the operator's compartment, just to the right of the throttle control lever. It is used to select the various speeds provided in the transmission. Five speeds forward and three speeds reverse are available (9).

22. Steering Clutch Levers

(fig. 18)

The steering clutch levers (3 and 4) are located on the floor of the operator's compartment, directly in front of the operator's seat. This enables the operator to steer the tractor. When the right lever is pulled back it disengages the power from the right track and when the left lever is pulled back the power is disengaged from the left track.

23. Steering Clutch Brake Pedals

(fig. 18)

The steering clutch brake pedals (2 and 5), which are located on the floor of the operator's compartment directly in front of the operator's seat, operate brakes which brake the right or left track as desired. These are an aid to steering or stopping the tractor and are worked in conjunction with the steering clutch levers.

24. Brake Pedal Locking Lever

(fig. 18)

The brake pedal locking lever (11), located on the floor of the operator's compartment between the clutch brake pedals, operates a ratchet and pawl device which locks the left brake pedal in the applied position. Pushing the lever all the way forward locks the left brake pedal, and pulling the lever all the way back releases it.

25. Forward-Reverse Selector Lever

(fig. 18)

The forward-reverse selector lever (6) is located on the floor of the operator's compartment, to the right of the steering clutch levers. This lever shifts the transmission from forward to reverse gears.

Pushing the lever forward engages the reverse gear train, and pulling the lever back engages the forward gear train. The lever has a neutral position which is halfway between the forward and reverse positions.

Note.—The forward-reverse selector lever does not affect the forward and reverse gear trains of the transmission when the gearshift control lever is in the fourth or fifth forward speed gear positions.

26. Lubricating Oil Pressure Gage

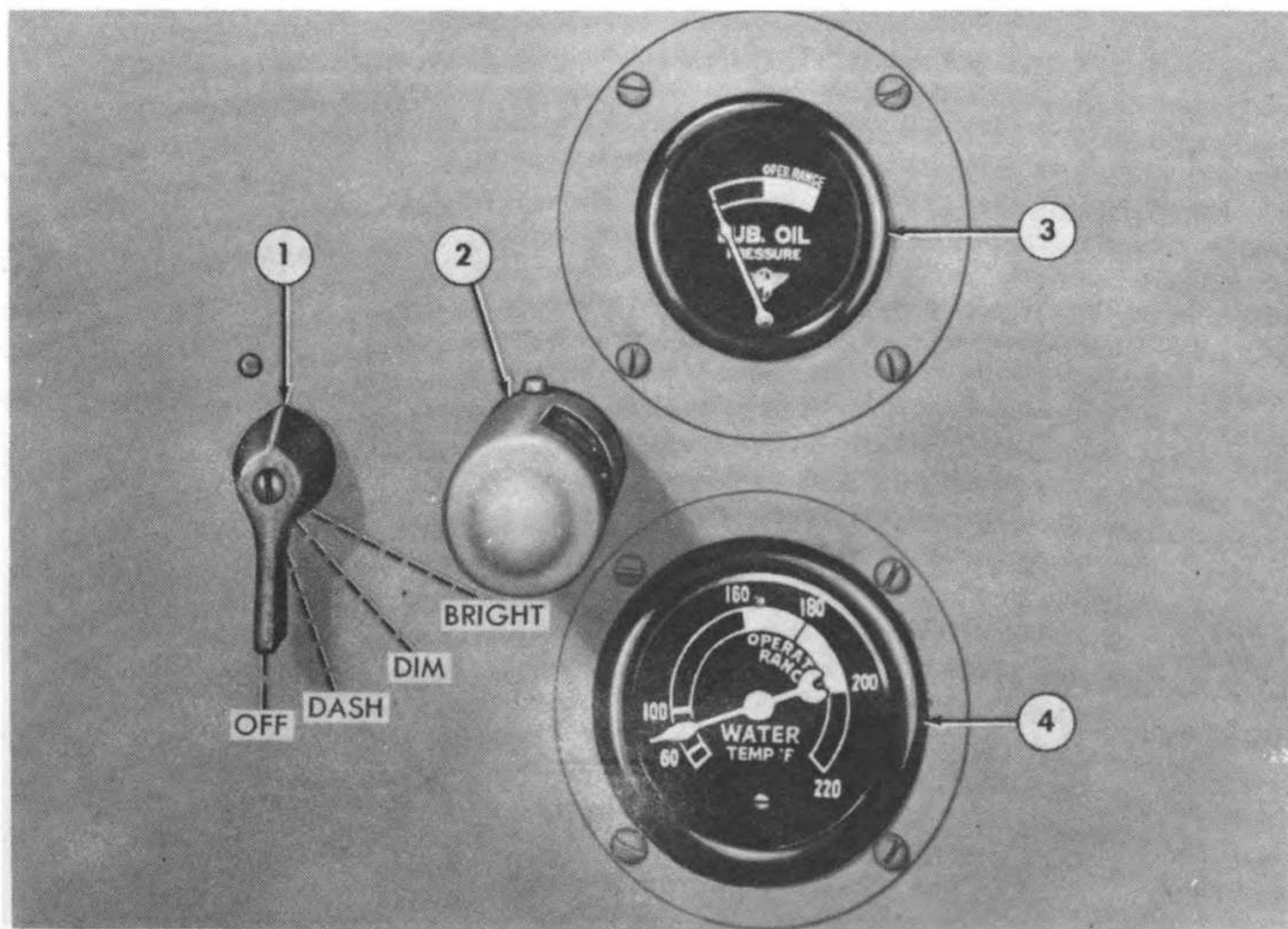
(fig. 19)

The lubricating oil pressure gage (3), located on the instrument panel in the operator's compartment, indicates the pressure of the diesel engine lubrication oil, and does not indicate the amount of oil in the crankcase. When the engine is operating, the oil pressure indicator should never fall below the operating "white" range on the gage.

27. Temperature Gage

(fig. 19)

The temperature gage (4), operated through a capillary tube connected to the engine thermal unit, indicates the temperatures of the coolant in the cooling system. The gage is located on the instrument panel in the operator's compartment. It is graduated from 60° to 220° F. The normal operating temperature of the engine is between 175° and 185° F.



1 Light switch
2 Instrument light

3 Lubricating oil pressure gage
4 Water temperature gage

Figure 19. Instrument panel.

28. Light Switch

(fig. 19)

The light switch (1) is located on the instrument panel in the operator's compartment, and is used to control the head and taillights of the tractor, and the instrument light (2). The four positions of the switch, OFF, DASH, DIM, and BR, are indicated on the instrument panel.

29. Fuel Pressure Gage

(fig. 20)

The fuel pressure gage, mounted near the top of the fuel filter housing on the right-hand side of the diesel engine, indicates the condition of the fuel filters. As the filters gradually become clogged, with the engine at normal operating speed, the fuel gage indicator will move back from the NORMAL (white) range to the CAUTION (green) range, and later to the OUT (red) range.

30. Hour Meter

(fig. 21)

The hour meter (2) is mounted on the rear of the fuel pump housing on the right-hand side of the engine. It records the total elapsed operating time of the diesel engine. A tachometer outlet (1) is provided on the hour meter housing.

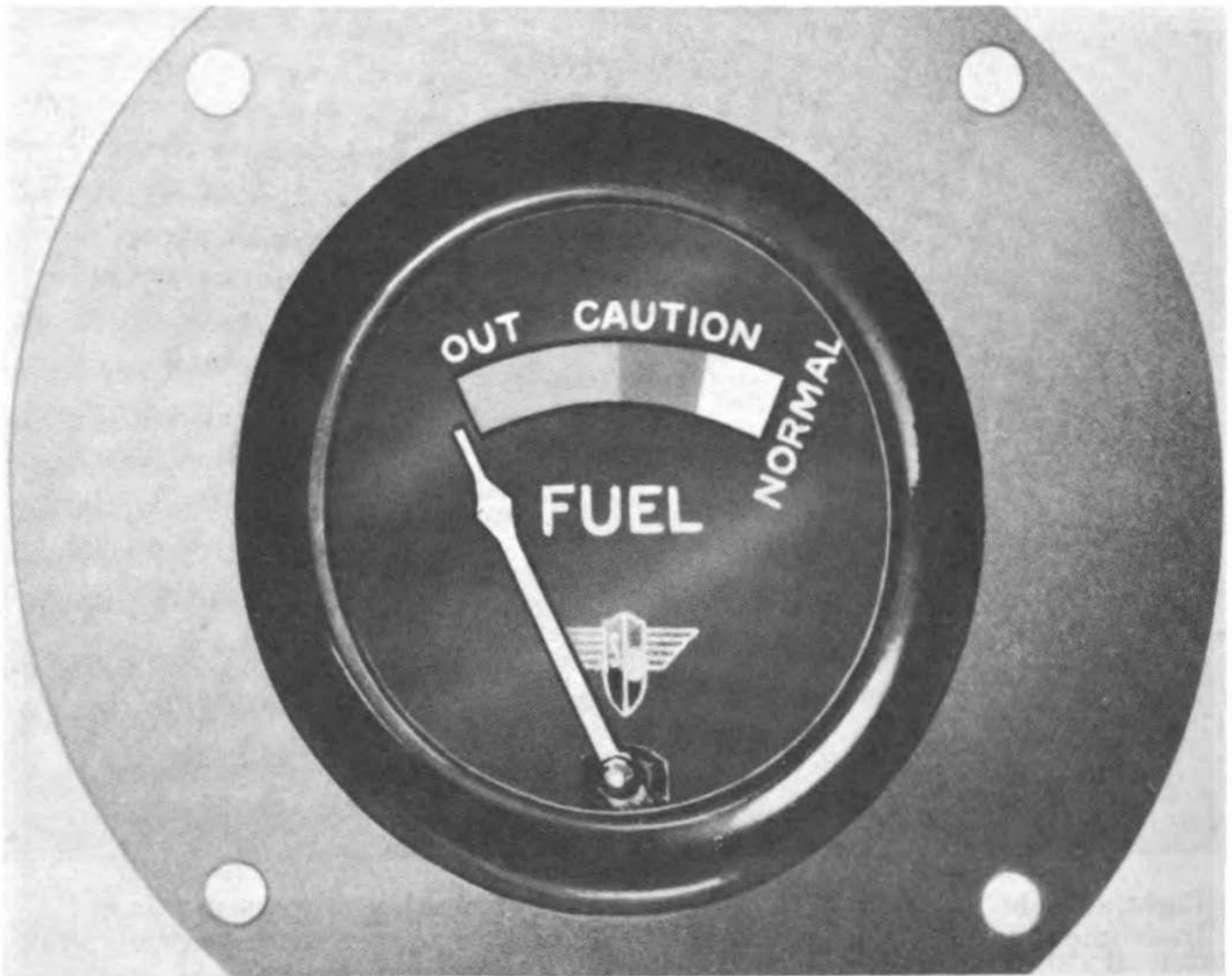


Figure 20. Fuel pressure gage.

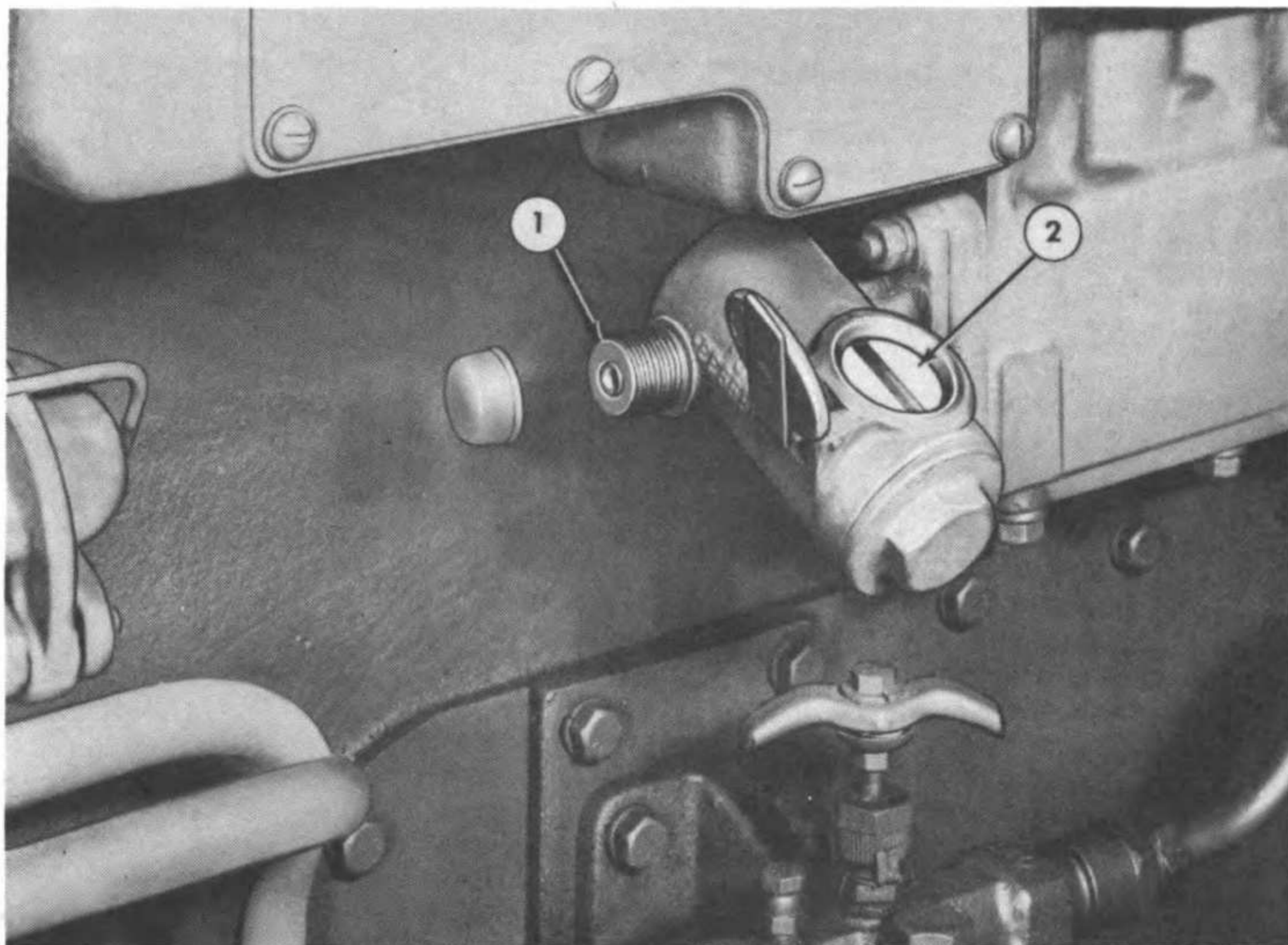


Figure 21. Hour meter installed.

Section III. OPERATION UNDER USUAL CONDITIONS

31. General

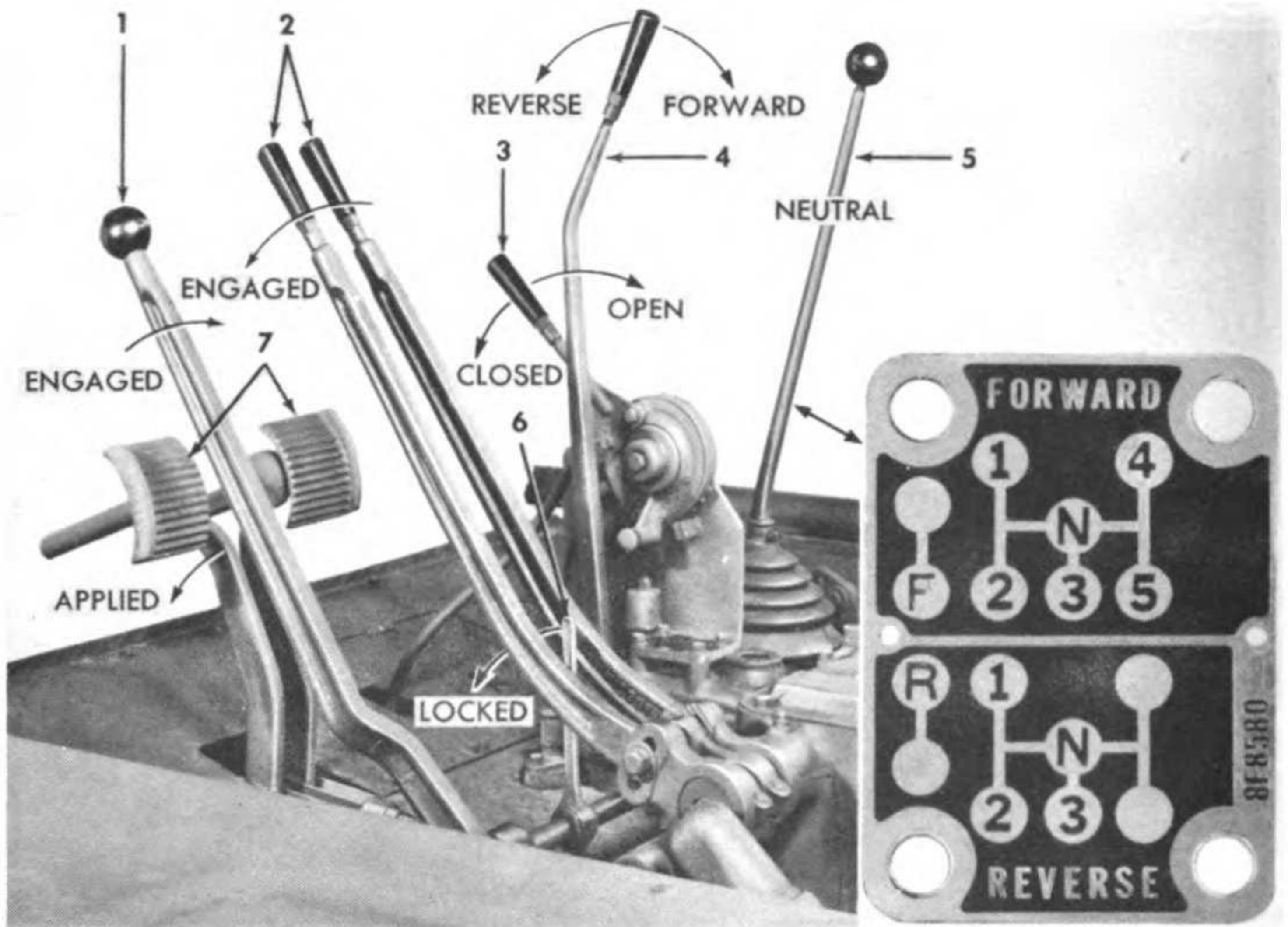
a. The instructions in this section are published for the information and guidance of the personnel responsible for the operation of this tractor.

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

32. Starting and Stopping

a. *Preparations for Starting.*

- (1) Service the tractor in accordance with paragraph 49c.
- (2) Place the gear shift lever (5, fig. 22) in neutral (N) position.
- (3) Lock the throttle lever (3) in the extreme forward, or closed position.
- (4) Disengage the flywheel clutch control lever (1) by pushing it forward.
- (5) Place forward-reverse selector lever (4) in the neutral position.
- (6) Move the compression release lever to the START position (fig. 23).



- | | |
|----------------------------------|--------------------------------|
| 1 Flywheel clutch control lever | 5 Gear shift control lever |
| 2 Steering clutch levers | 6 Brake locking lever |
| 3 Throttle lever | 7 Steering clutch brake pedals |
| 4 Forward-reverse selector lever | |

Figure 22. Operation of tractor controls.

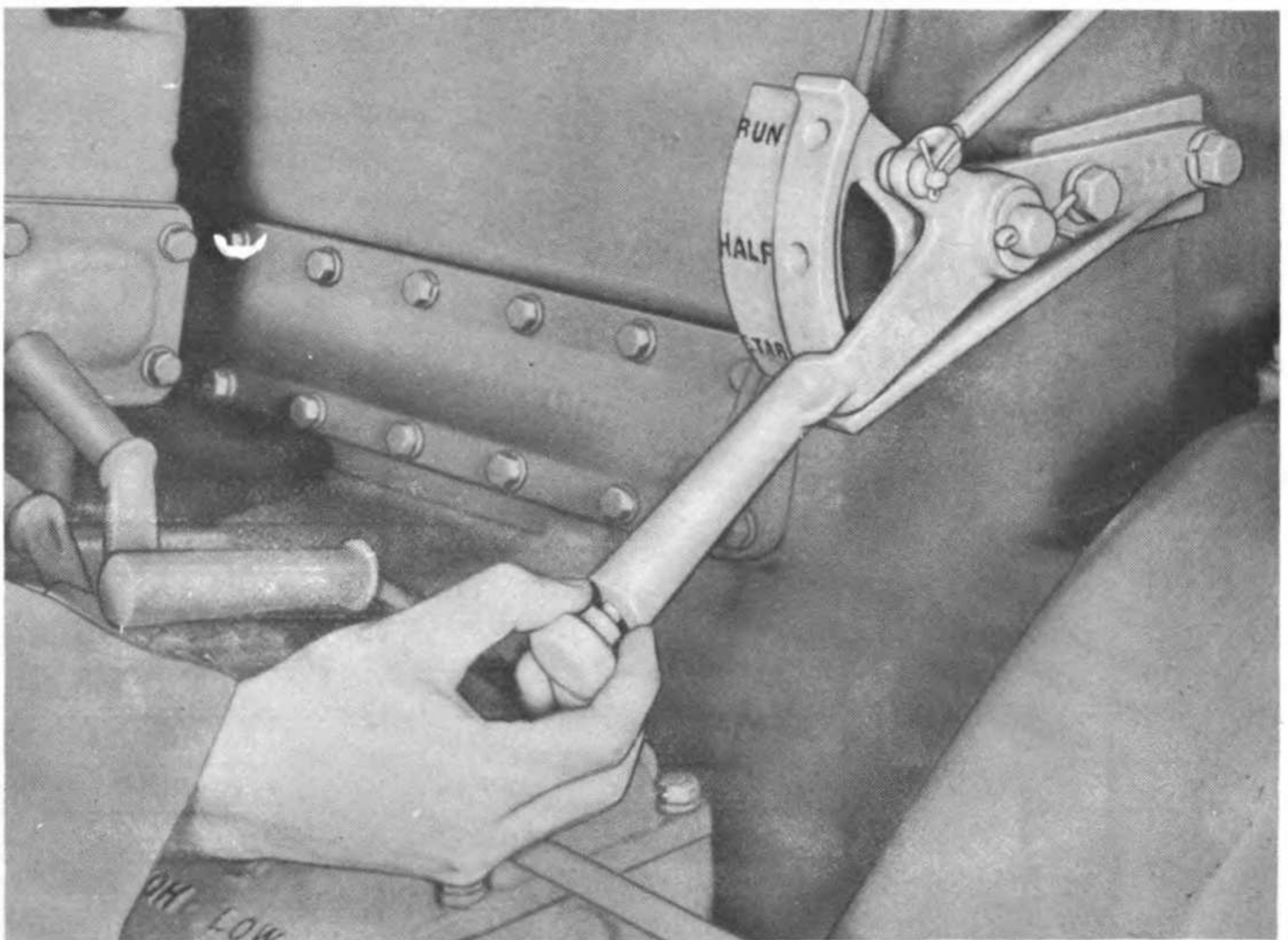


Figure 23. Compression release lever in START position.

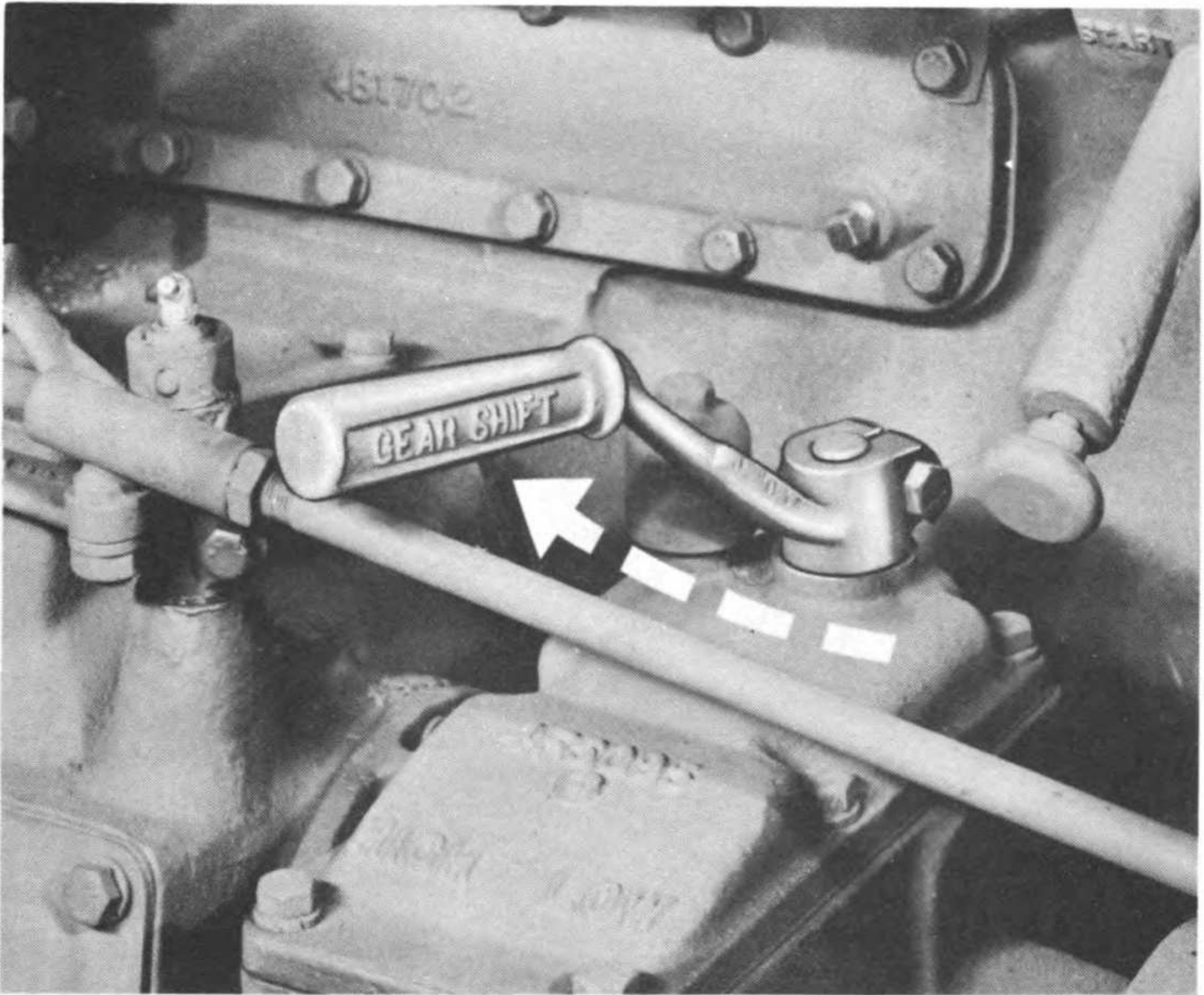


Figure 24. Transmission shift lever in *START* position.

- (7) Shift the starting engine transmission into *HIGH* (fig. 24). Use *LOW* speed for cold weather starting as directed in paragraph 36f(1).
- (8) Disengage the starting engine clutch by pushing the lever in toward the diesel engine block (fig. 25).

b. Starting the Starting Engine.

- (1) Open the starting engine fuel inlet valve (1, fig. 26).
- (2) Pull out the starting engine choke control rod (2, fig. 26). It is not necessary to choke an engine that is already warm.
- (3) Latch the starting engine throttle lever in the idling position by dropping the idling latch (3) in front of the lever.
- (4) Turn the starting engine magneto switch (4, fig. 26) to *ON* position.
- (5) Install the crank (1, fig. 27) on the starting-crank shaft (2) where it projects through the hood.

Caution: Do not attempt, in any manner, to spin or push the crank. Pull the crank through the compression strokes.

Note.—If the engine will not start, refer to the troubleshooting guide in paragraph 53.

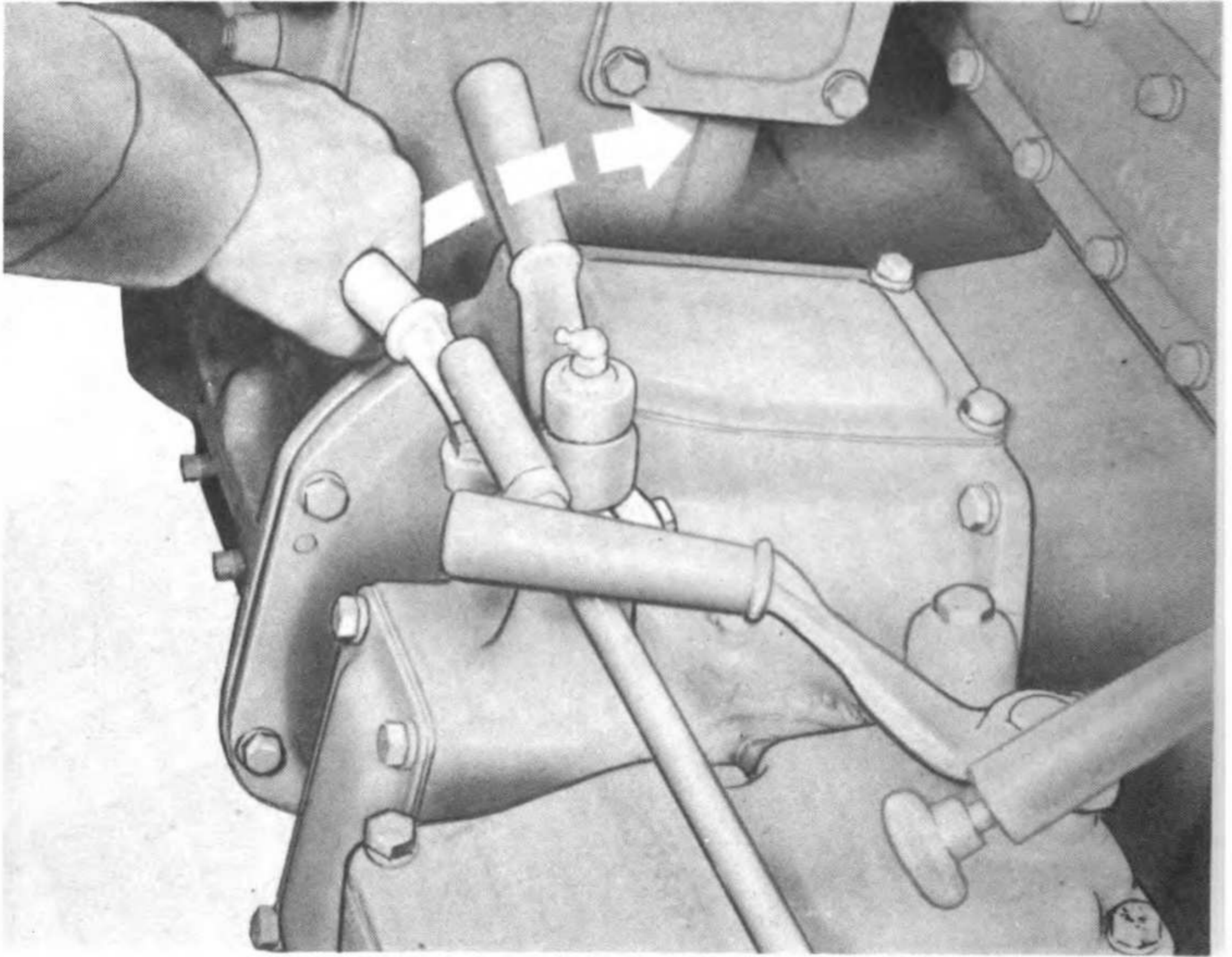


Figure 25. Disengaging starting engine clutch.

(6) *Engine warmup.*

(a) Remove the crank.

(b) Push in the choke control rod (2, fig. 26).

Note.—Temperature will vary the length of time it is necessary to have the choke on. Actual experience in starting will determine this interval.

(c) Permit the starting engine to warm up at idling speed before using it to start the diesel engine.

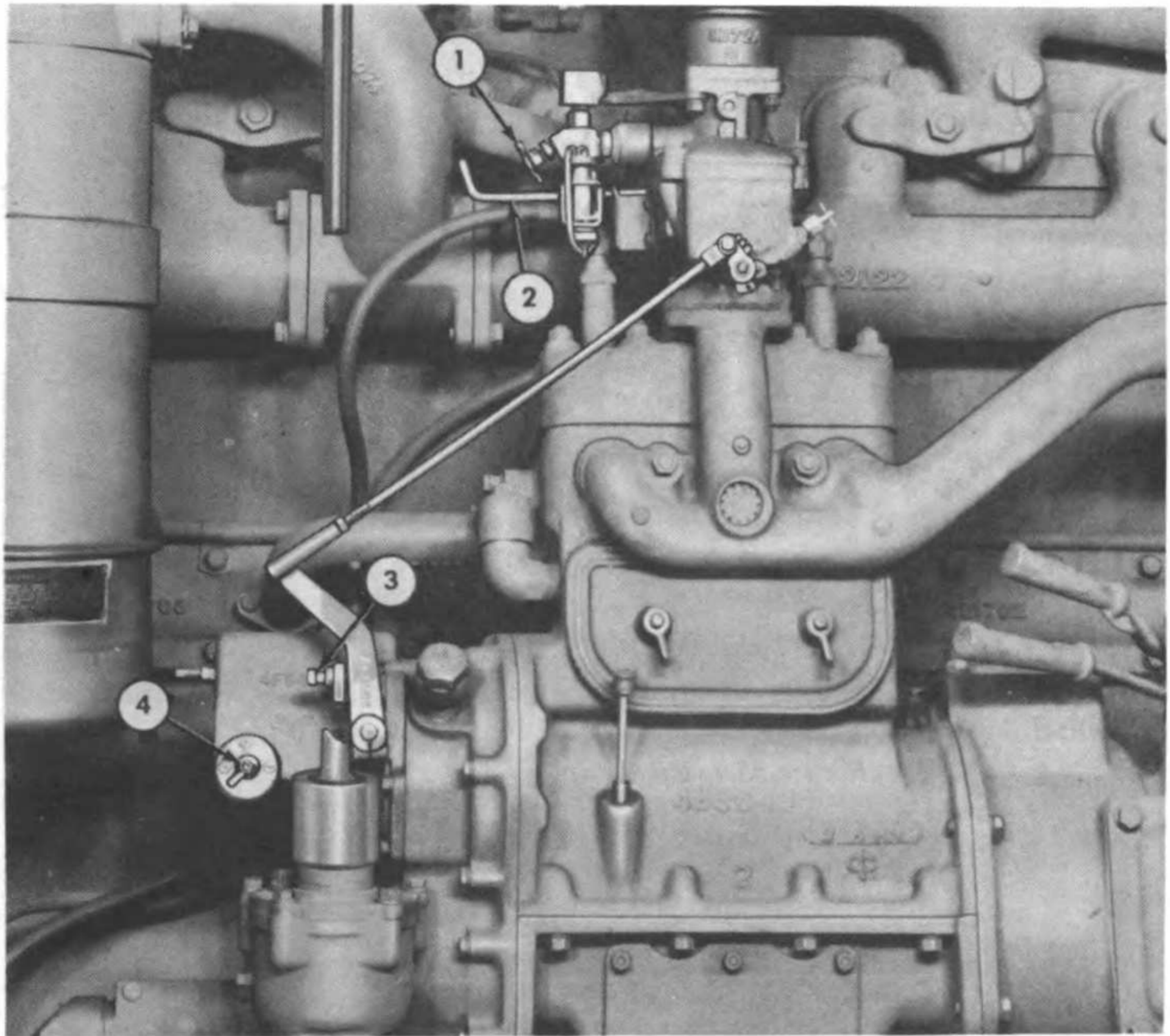
c. *Starting the Diesel Engine.*

(1) With the starting engine running at idling speed, apply the starting engine clutch brake to stop the starter pinion from rotating by pushing the flywheel clutch control lever (1, fig. 28) all the way forward and holding it there.

Caution: Do not attempt to engage the starter pinion before first applying the starting clutch brake.

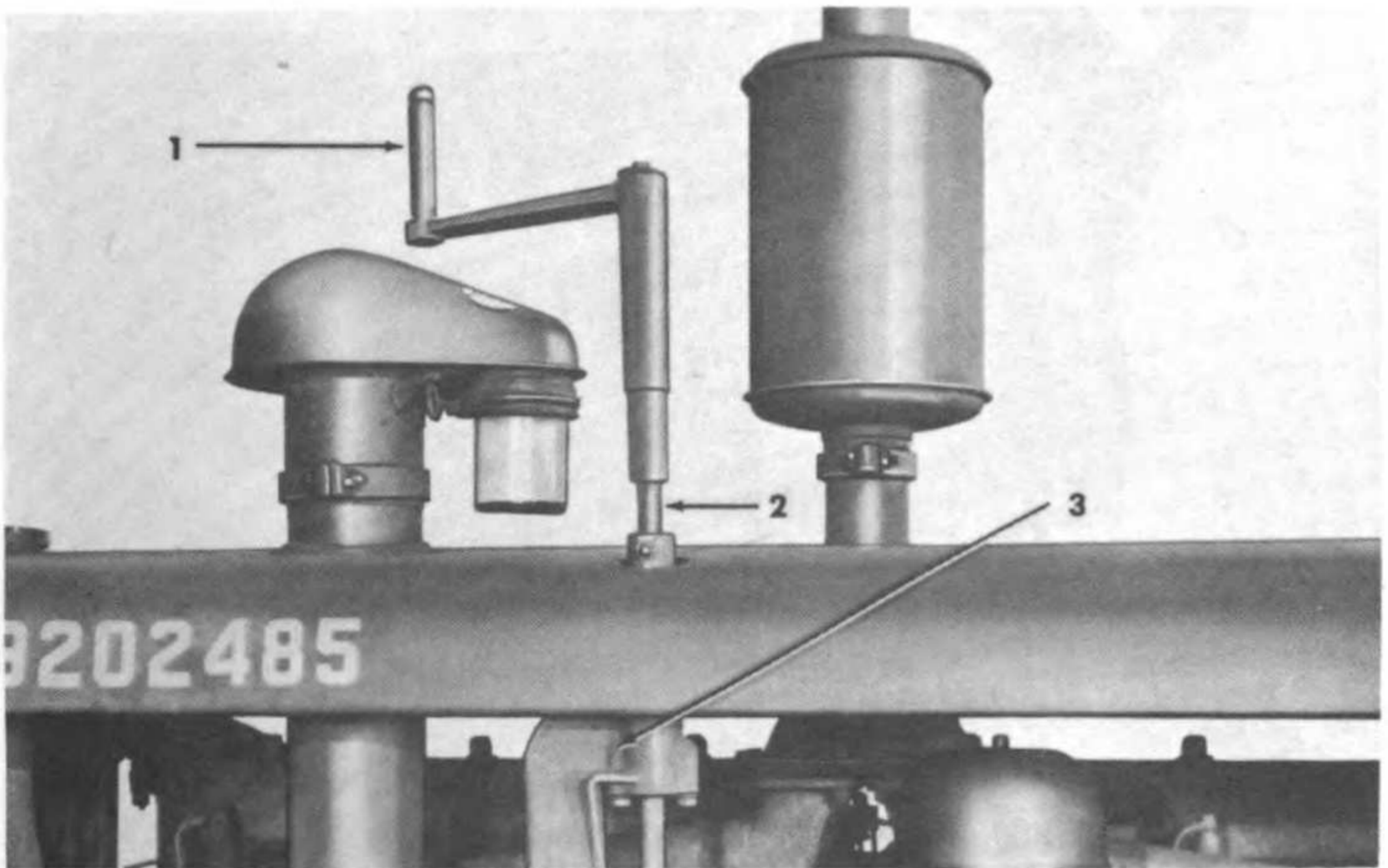
(2) Engage the starter pinion with the flywheel ring gear by pulling back on the starter pinion lever (2, fig. 28). Release the clutch brake.

(3) Raise the idling latch (3, fig. 26) to let the starting engine run at full governed speed.



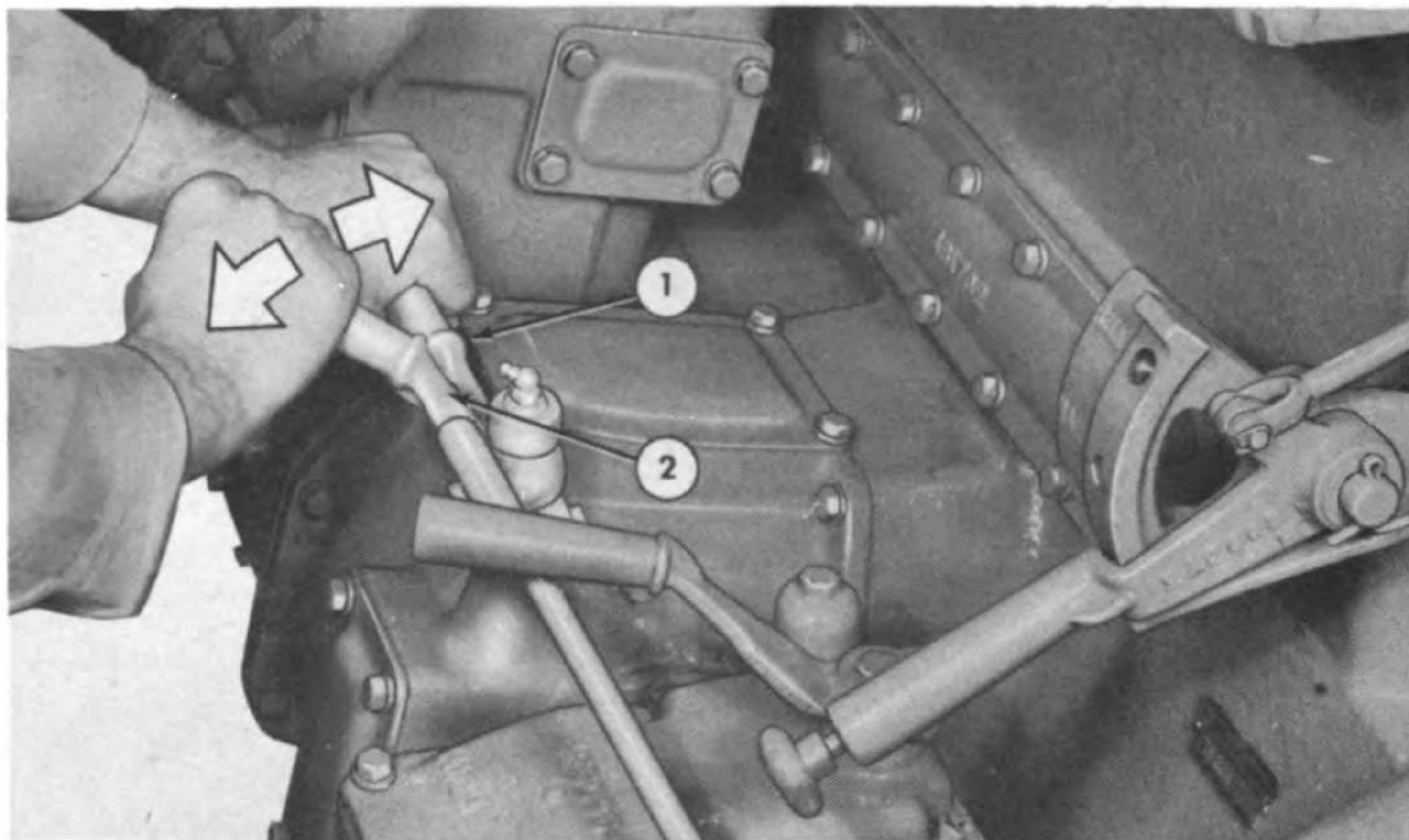
- | | |
|---------------------|----------------------------------|
| 1 Fuel inlet valve | 3 Idle latch and adjusting screw |
| 2 Choke control rod | 4 Magneto switch |

Figure 26. Starting engine controls in START position.



- | | |
|------------------------------|----------------------|
| 1 Starting engine crank | 3 Crankshaft bracket |
| 2 Starting engine crankshaft | |

Figure 27. Starting crank installed.



1 Clutch lever

2 Pinion lever

Figure 28. Engaging the starter pinion.

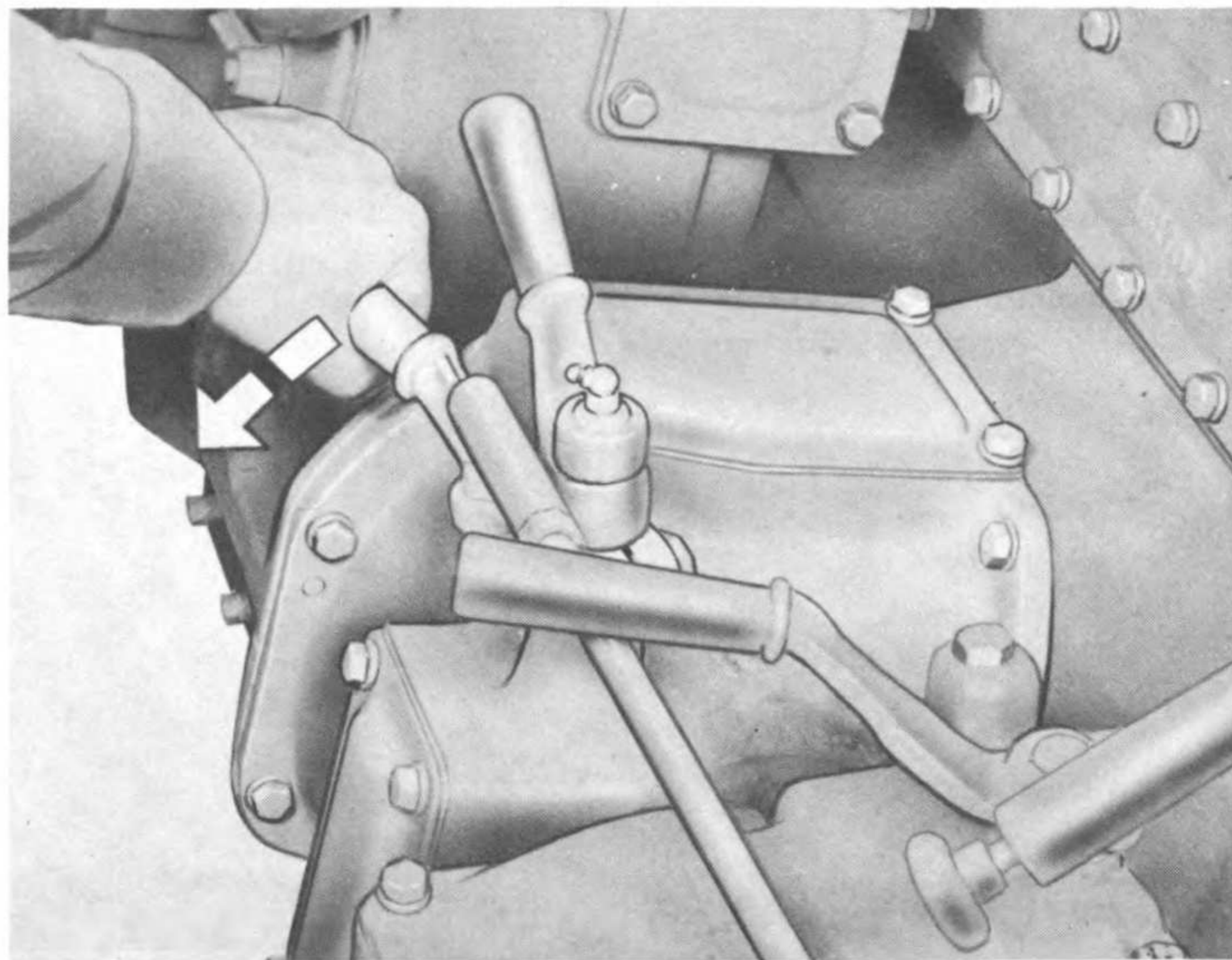


Figure 29. Engaging the starting engine clutch.

- (4) Engage the starting engine clutch by pulling the lever (1, fig. 28) out until it snaps over center (fig. 29). If the starting engine slows to the stalling point, when the clutch is engaged, disengage the clutch and let the engine pick up speed again.

- (5) Move the compression release lever to the RUN position (fig. 30) as soon as the starting engine will turn the diesel engine at normal cranking speed.
- (6) After the starting engine has cranked the diesel engine against compression until it is sufficiently warm and the lubricating oil pressure gage (3, fig. 19), is registering in the OPERATING RANGE, unlock the throttle control lever by pulling out on the knob, and pull the lever back about halfway (fig. 31).
- (7) When the diesel engine begins to fire, the starter pinion disengages automatically, but it is necessary to disengage the starting engine clutch by pushing the clutch control lever in toward the engine (fig. 25). Shut down the starting engine as follows:
 - (a) Latch the starting engine throttle in the idling position by dropping the idling latch (3, fig. 26) in front of the throttle lever.
 - (b) Close the starting engine fuel tank valve (1, fig. 26), allowing the engine to burn all the fuel in the carburetor before it comes to a stop.
 - (c) Turn the starting engine magneto switch (4, fig. 26) to OFF.
 - (d) Allow the diesel engine to idle 5 minutes with the throttle control in half engine speed position before applying the load.

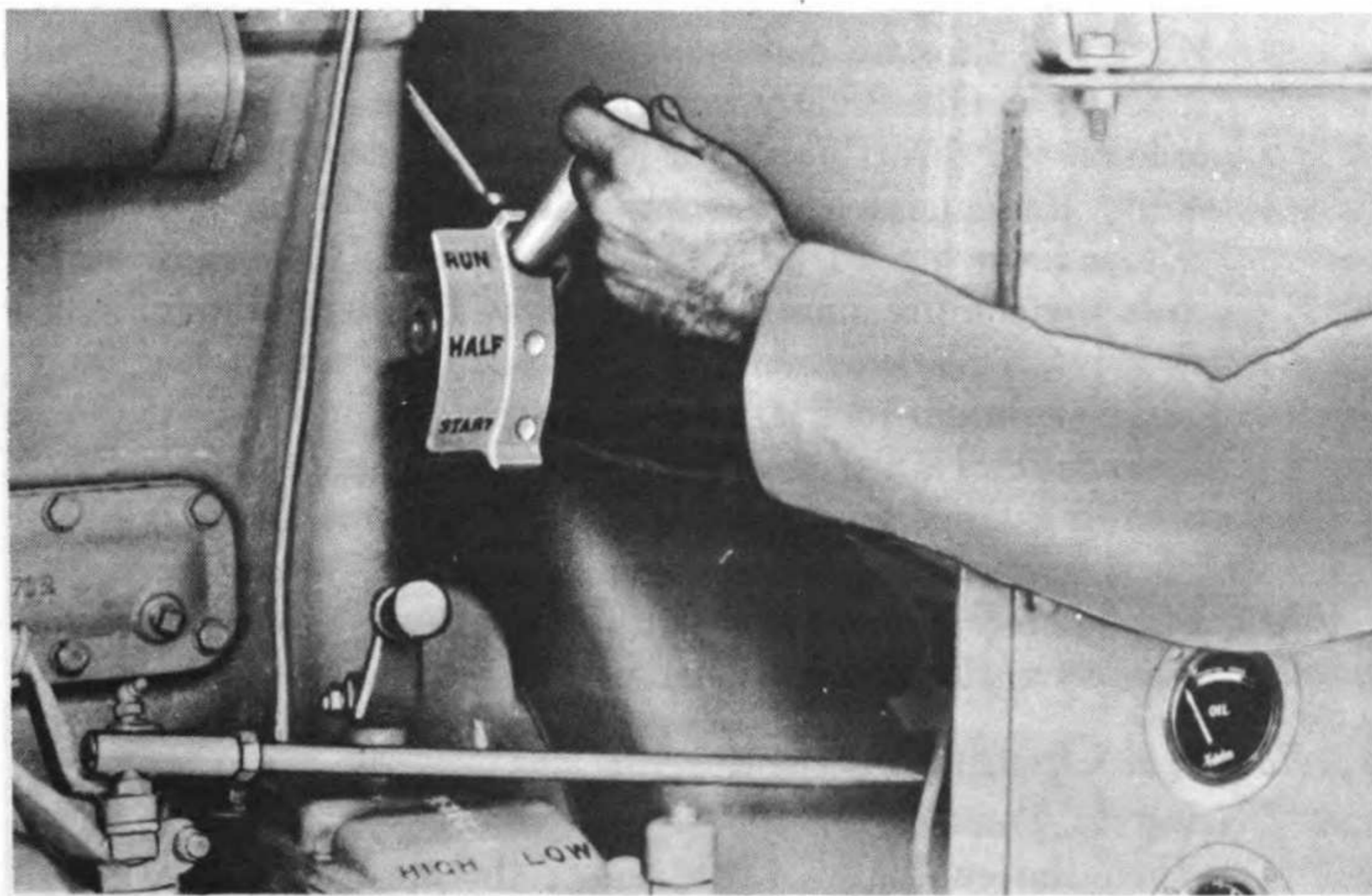


Figure 30. Compression release lever in RUN position.

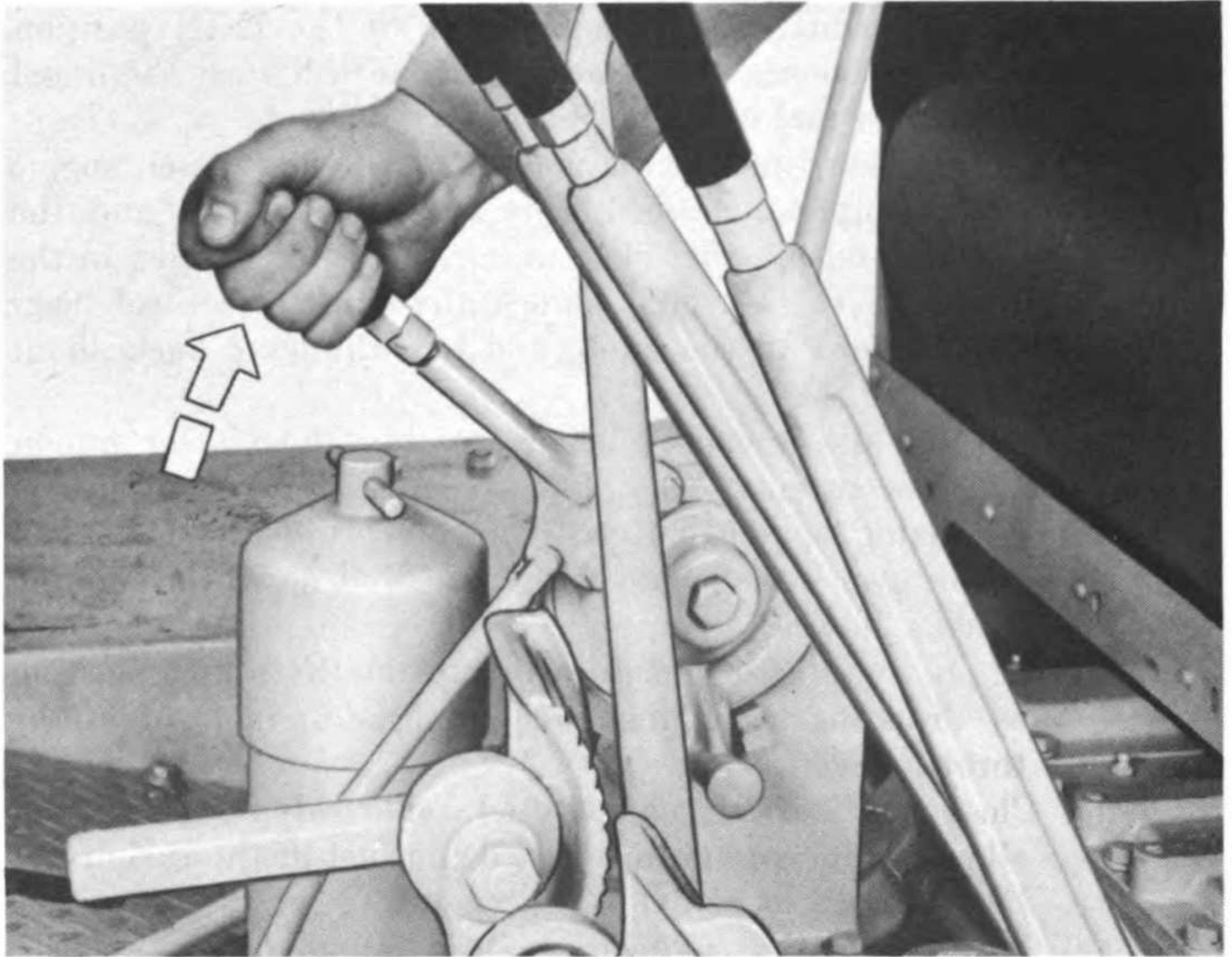


Figure 31. Position of throttle control lever for starting.

Note.—If the engine does not start, refer to the troubleshooting guide, paragraph 54. Cold weather starting directions are given in paragraph 36.

d. Stopping the Diesel Engine.

- (1) Allow the engine to idle 5 minutes with the throttle half open before stopping.
- (2) Move the throttle control lever (3, fig. 22) to the extreme forward or **CLOSED** position and drop the plunger into the hole on the throttle control bracket.
- (3) While the engine is slowing down, shift the compression release lever (fig. 23) to **START** position. After engine stops, shift the compression release lever to **RUN** position (fig. 30) so valves will be closed.
- (4) Leave the main fuel tank valve open.
- (5) If the tractor must stand without shelter, cover the exhaust pipe to exclude rain or snow. If the temperature is below freezing, or if freezing weather is expected before the engine will be started again, drain the cooling system or protect it with an antifreeze solution, see paragraph 36.

33. General Operation Details

a. Driving the Tractor (fig. 22).

- (1) When the engine is warm, move the throttle control lever (3) to the low idling position.

- (2) Disengage the flywheel clutch by pressing the clutch control lever (1) forward. To permit shifting gears without clashing, continue to press forward on the clutch lever until the clutch stops rotating.
- (3) Carefully move the gear shift control lever (5) into the desired speed.
- (4) Move the forward-reverse selector lever (4) into the desired position.

Note.—The forward-reverse selector lever controls the direction of travel. Shifting from forward to reverse or reverse to forward, in any of the first three speeds, is accomplished without moving the gear shift control lever. Disengage the flywheel clutch and move the selector lever to either the forward or reverse position. The tractor will move forward in fourth or fifth gear with the forward reverse selector lever in either forward or neutral position. Always shift gears completely into mesh.

- (5) Pull the throttle control lever (3) back. Carefully engage the flywheel clutch lever (1) until the slack is taken up between the tractor and the load. Then pull the clutch lever back firmly until it snaps over center.
- (6) The forward-reverse selector lever is used when moving forward and backward for short distances in operations where low gear ratios are necessary. For example, when bulldozing to remove boulders or other obstructions.

b. Steering the Tractor (fig. 22).

- (1) Pull the steering clutch lever (2) all the way back on the side toward which the turn is to be made.
- (2) Apply the brake, on the same side, by pressing down on the brake pedal (7) hard enough to turn at the desired angle.
- (3) Both the brake and the steering clutch controls should be handled smoothly so the turn will be made evenly and not as a series of jerks. Just before the turn is completed, release the brake, then engage the steering clutch by releasing the control lever smoothly.
- (4) The brake must be in the fully released position during normal operation of the tractor. Keep the feet off the pedals except when it is necessary to apply the brakes. With a load behind the tractor it is seldom necessary to use the brakes in steering except for sharp turns, since the load acts as a brake. To hold the tractor on slopes, lock the left brake in position by pushing forward on the left brake pedal and then engaging the brake pedal lock lever (6).

c. Stopping the Tractor (fig. 22).

- (1) Disengage the flywheel clutch lever (1).
- (2) Move the throttle control (3) to the idling position.
- (3) Shift the gear shift control lever (5) into neutral position.

- (4) Shift the forward-reverse selector lever (4) into neutral position.
- (5) Engage the flywheel clutch. Do not allow the tractor to idle with the flywheel clutch disengaged.

34. Specific Operation

a. Towing. The tractor is equipped with a drawbar to which chains or cables may be attached to perform towing operations or any tasks which require pulling force.

b. Bulldozing. When equipped with a bulldozer blade and necessary controls the tractor may be used for excavating, leveling, clearing, or any other operation requiring a pushing force. For further information on bulldozing operations see TM 5-1586.

c. Operating Over an Obstruction. The fact that the steering clutches are controlled by separate levers may be used to advantage in running over an obstruction such as a log or a ditch bank. Both of the clutches may be released slightly until the tractor balances on top of the obstruction. Then one clutch may be engaged gradually so that the tractor moves forward at an angle, over and down. If the tractor is being operated without a load, it may be necessary to use the brakes.

d. Steering Downgrade. When going downgrade with the tractor pulling the load, steer in the usual manner. If the load is pushing the tractor, the operation of the steering clutches is reversed. For example, to turn to the right under these conditions, release the steering clutch on the left, but do not apply the brake. This allows the left track to travel faster, while the right track is held back by the engine which acts as a brake.

35. Moving to a New Location

a. If it is not feasible to drive the tractor to a new work site, drive tractor onto a platform trailer or truck by means of a ramp.

b. If necessary, remove exhaust extension and precleaner to protect from damage.

c. Place the tractor squarely on the truck or trailer bed, and make sure that the tracks have solid footing for their full length.

d. Secure tractor to truck or trailer bed as described in paragraph 107 *a* (11).

Section IV. OPERATION UNDER UNUSUAL CONDITIONS

36. Cold Weather Operation

a. General. Low temperatures make additional preparation and maintenance necessary to assure starting and prevent damage to the tractor.

b. Protection of Cooling System.

- (1) Ethylene glycol is prescribed for use as an antifreeze solution. The following table gives the quantity required to protect the cooling system of this tractor at the indicated temperatures.

| <i>Temperature</i> (°F.) | <i>Quarts</i> <i>Ethylene</i> <i>Glycol</i> | <i>Temperature</i> (°F.) | <i>Quarts</i> <i>Ethylene</i> <i>Glycol</i> | <i>Temperature</i> (°F.) | <i>Quarts</i> <i>Ethylene</i> <i>Glycol</i> |
|-----------------------------|---|-----------------------------|---|-----------------------------|---|
| 10 | 28 | -20 | 49 | -50 | 63 |
| 0 | 35 | -30 | 56 | -60 | 70 |
| -10 | 42 | -40 | 63 | | |

- (2) The following precautions should be taken before installing the antifreeze compound:

- (a) Flush the cooling system thoroughly. If necessary, remove scale as described in paragraph 71.
- (b) Check the cooling system for leaks. Replace hoses and pump packing if they show signs of deterioration.
- (c) Inspect the fan belt. Adjust or replace if necessary, see paragraph 73.

c. Lubrication. Lubrication at temperatures below -10° F. is covered in the lubrication order, LO 5-3040-B, and details are given in paragraph 46.

d. Fuel System.

- (1) In sub-zero weather, use grade X Diesel fuel.
- (2) The following precautions should be taken to avoid the formation of ice in the fuel system:
 - (a) Always keep the fuel tanks as full as possible. This will reduce the condensation of water from the free air space above the fuel.
 - (b) Use caution when handling fuel to prevent the entrance of snow or ice.
 - (c) Open the fuel tank drain cock and remove the filter housing drain plug regularly to drain off accumulated water.

e. Starting the Starting Engine. The following instructions are intended to supplement the starting procedure covered in paragraph 32b.

- (1) Fill the fuel tank with gasoline.
- (2) Before every start, see that there is no ice on the spark plugs, wiring or magneto.
- (3) Sometimes moisture will collect on the starting engine spark plugs. Remove and dry the plugs by pouring gasoline over the electrodes and igniting it.
- (4) Pouring a small amount of gasoline on spark plug electrodes before they are replaced is more effective in promoting combustion than priming the cylinders with raw gasoline.

f. Starting the Diesel Engine. The following instructions are intended to supplement the starting procedure covered in paragraph 32c.

- (1) The starting engine transmission provides a LOW speed (fig. 32) to start to crank the cold diesel engine. Be sure the starting engine clutch is disengaged and the diesel engine flywheel has stopped turning before the transmission is shifted into HIGH. Shift the transmission into HIGH to start the diesel.
- (2) When the oil "drag" of the diesel engine prevents the starting engine from turning the diesel engine fast enough to start it, move the compression release lever to the HALF position (fig. 33). When the lever is in this position, the compression is released on half of the cylinders and allows faster cranking. Move the compression release lever to RUN (fig. 30) as soon as the starting engine can turn the diesel engine with the lever in that position.

37. Hot Weather Operation

a. Cooling System.

- (1) In extremely high temperatures, the water in the cooling system should be checked more frequently than under normal conditions.
- (2) Inspect the fan belt adjustment at frequent intervals (par. 73).
- (3) Keep trash out of the fins in the oil cooler and water radiator cores.

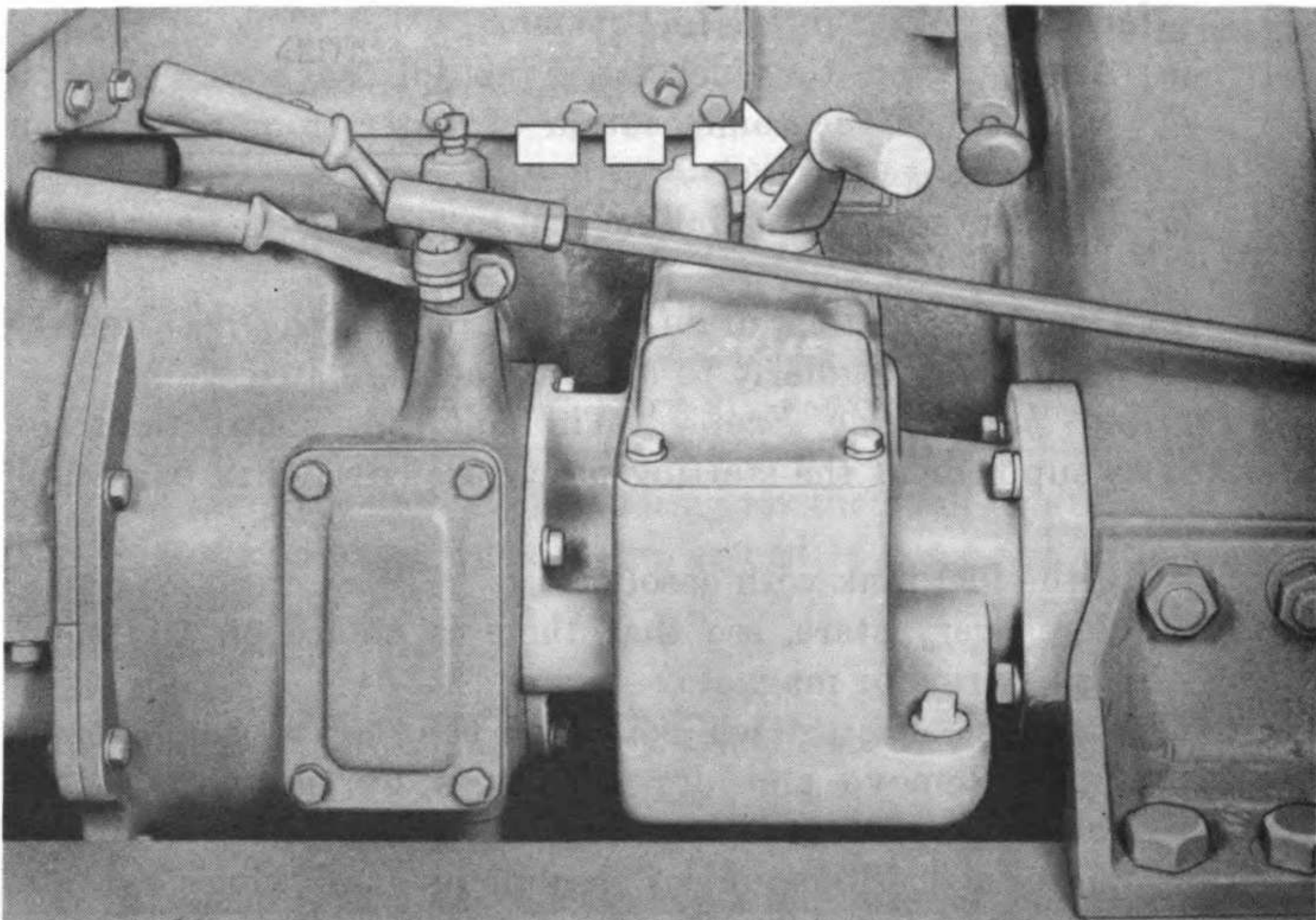


Figure 32. Transmission shift lever positioned for cold weather starting.

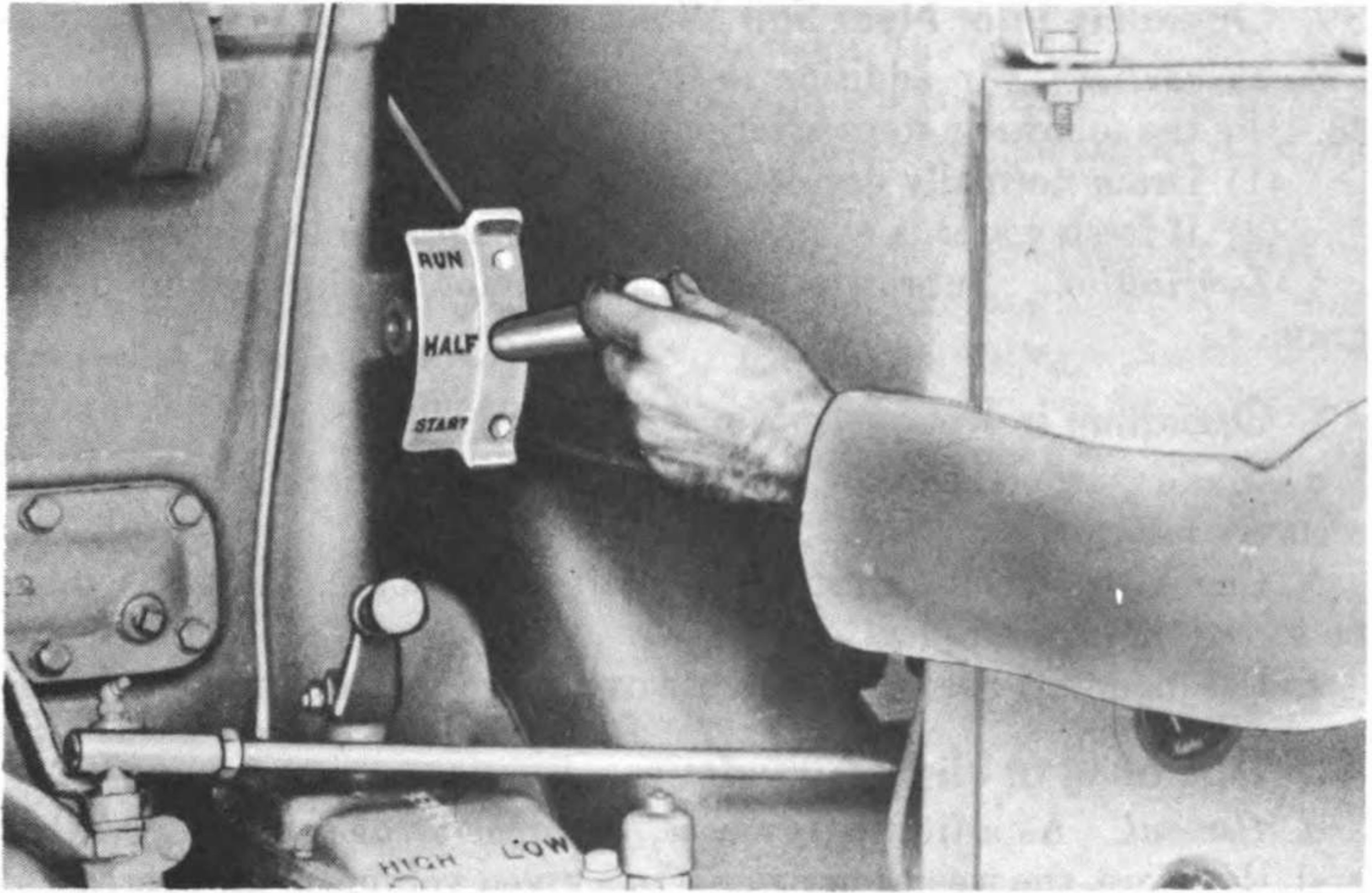


Figure 33. Compression release in "Half" position.

- (4) Use only clean water. Do not use water that contains alkali or other substances which may cause scale formation.
- (5) If the engine overheats, have the water temperature regulator and water pump checked.

b. Lubrication. Special attention should be given to lubrication. Consult the lubrication order (fig. 35) and the instructions in paragraph 46.

38. Operation in Deep Mud or Water

a. Lubrication. Special attention should be given to lubrication. Consult the lubrication order (fig. 35) and the instructions in paragraph 46.

b. Fan. If there is danger of dropping into deep water, remove the fan belt to prevent the fan from pulling into the radiator.

c. Freeing Mired Tractor. When a tractor mires down in deep mud, there are several ways to get out without the aid of another tractor:

- (1) *Winch.* If the tractor is equipped with a winch, it may be possible to run the winch line out and anchor it to a tree or rock. When the line is anchored, the tractor can winch itself out.
- (2) *Timber.* If a timber of any size is available, lay it in front of the tracks, at the front or rear of the tractor, so that it will be caught by the track shoes as the track revolves. The tractor will pull itself out.

39. Operating in or Near Salt Water

a. *Precautions.* In addition to the precautions listed in paragraph 38, take the following steps after operation:

- (1) Drain normally dry compartments.
- (2) If fresh water is available, flush the entire tractor.

b. *Lubrication.* Lubricate the entire tractor as directed in paragraph 45.

40. Operating in Rough Terrain

a. Make sure crankcase and radiator guards are in place and securely fastened.

b. Check the track adjustment. If it is too loose, the track may be forced off of the rollers.

c. Use moderate speed and operate over large obstructions with care.

41. Operating at High Altitudes

a. *General.* As altitude increases, the density of the air decreases and, therefore, the weight of oxygen in a given volume of air decreases. The volume of fuel that can be burned and the horsepower developed within the cylinders likewise will decrease.

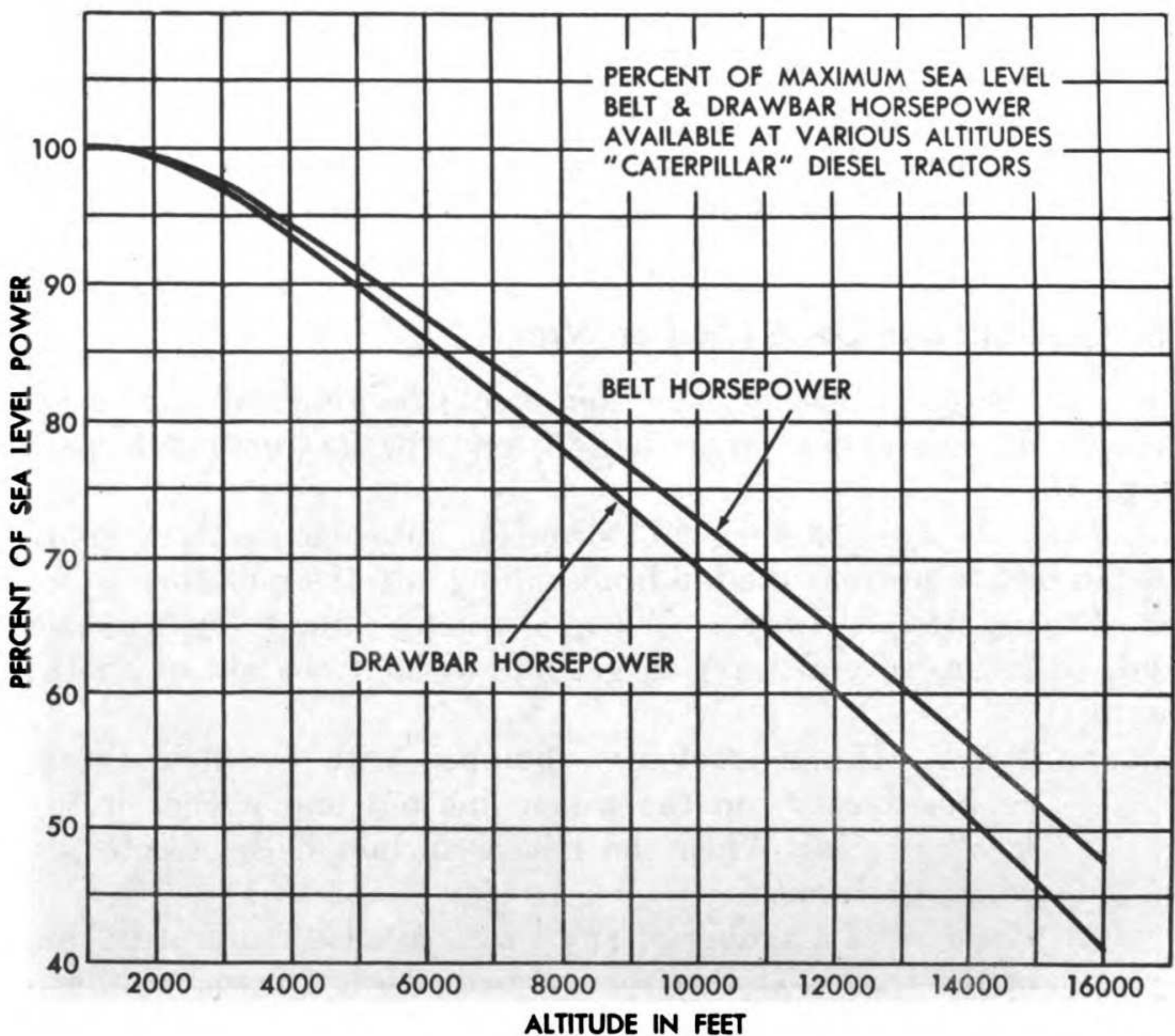


Figure 34. Altitude horsepower loss curve.

b. Graph. The power consumed between the engine and the drawbar will vary slightly with the speed and tractive conditions, but the accompanying graph (fig. 34) may be considered sufficiently accurate for estimating purposes.

c. Calculation. To obtain the pounds pull available at various altitudes, multiply the pounds pull given for sea level conditions (refer to tabulated data) (par. 6*b*) by the percentage shown in the graph for drawbar horsepower (fig. 34). *Example:* Sea level drawbar pull, first speed 28,700 lbs. At 12,000 feet, altitude drawbar pull=60 percent of sea level drawbar pull. $28,700 \times 0.60 =$ drawbar pull of 17,220 lbs.

CHAPTER III

MAINTENANCE INSTRUCTIONS

Section I. SPECIAL ORGANIZATIONAL TOOLS AND EQUIPMENT

42. Special Tools and Equipment

A list of special organizational tools, parts, and equipment supplied with or issued with the tractor is included in a Department of the Army supply manual.

43. Initial Issue Tools

Initial issue tools are listed in appendix II.

Section II. LUBRICATION AND PAINTING

44. General Lubrication Information

a. Lubrication Order 5-3040-B prescribes first and second echelon lubrication maintenance for the Caterpillar D-8 Tractor.

b. A lubrication order is published for each item of equipment. The lubrication order shown in figure 35 is a reproduction of the approved lubrication order for this tractor. For the current LO 5-3040 refer to SR 310-20-4.

c. Lubrication orders prescribe approved first and second echelon lubrication instructions for mechanical equipment issued by the technical services. The instructions contained therein are mandatory.

45. Detailed Lubrication Information

a. *General.* Lubrication is a highly essential part of preventive maintenance, determining to a great extent the serviceability of parts and assemblies. Lubrication instructions for this vehicle are consolidated in LO 5-3040-B (fig. 35) which specifies the points to be lubricated, the periods of lubrication, and the lubricant to be used. The circled reference numbers in the reproduction of LO 5-3040-B are keyed to detailed illustrations of the lubrication points. Paragraphs following give detailed instructions for some of the more complex lubrication operations.

LUBRICATION ORDER **LO 5-3040-B**

(Supersedes LO 5-3040, 4 Mar 1952)

TRACTOR, CRAWLER TYPE, DIESEL DRIVEN, 28,100 TO 38,000 LBS DRAWBAR PULL, SERIAL NUMBERS 2U1 AND UP, CATERPILLAR MODEL D-8

Reference: TM 5-3040-B TB 5-3068-1

Intervals given are maximums for normal 8-hour day operation. For abnormal conditions or activities, intervals should be shortened to compensate.

Clean fittings before lubricating.

Clean parts with SOLVENT, Dry Cleaning, or with OIL, fuel, Diesel. Dry before lubricating.

Relubricate after washing or farding.

Drain crank and gear cases only when hot after operation; replenish and check level when cool.

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

- KEY -

| LUBRICANT | CAPACITY | EXPECTED TEMPERATURE | | | INTERVALS |
|--|----------|----------------------|---------------------|---------------|--|
| | | Above +32°F | +32°F to -10°F | Below -10°F | |
| OE -Oil, Engine, Heavy Duty | | | | | |
| Diesel Crank-case | 34 qts | OE 30 or 9250 | OE 10 or 9110 | See Note 1 | D-Daily 2D-2 Day W-Weekly 2W-2 Week M-Monthly 2M-2 Month Q-Quarterly |
| Starting Engine Crank-case | 2 qts | | | | |
| Diesel Air Cleaner | 5 qts | OE 30 or 9250 | OE 10 or 9110 | OHA | |
| Starting Engine Air Cleaner | ¼ qt | | | | |
| Fuel Injection Pump Housing | ¼ qt | | | | |
| Other Points | | | | | |
| GO -LUBRICANT, Gear, Universal | | | | | |
| Transmission (before 2U5307) | 38 qts | GO 90 | GO 75 | GOS | |
| Transmission (after 2U5307) | 41 qts | | | | |
| Final Drives (each) | 20 qts | | | | |
| Starting Engine Transmission | ¼ qt | | | | |
| GAA -GREASE, Automotive and Artillery | | | | | |
| OHA -OIL, Hydraulic, Aircraft, Petroleum Base | | | | | |
| GOS -LUBRICANT, Gear, Universal, Subzero | | | | | |

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Figure 35. Lubrication order.

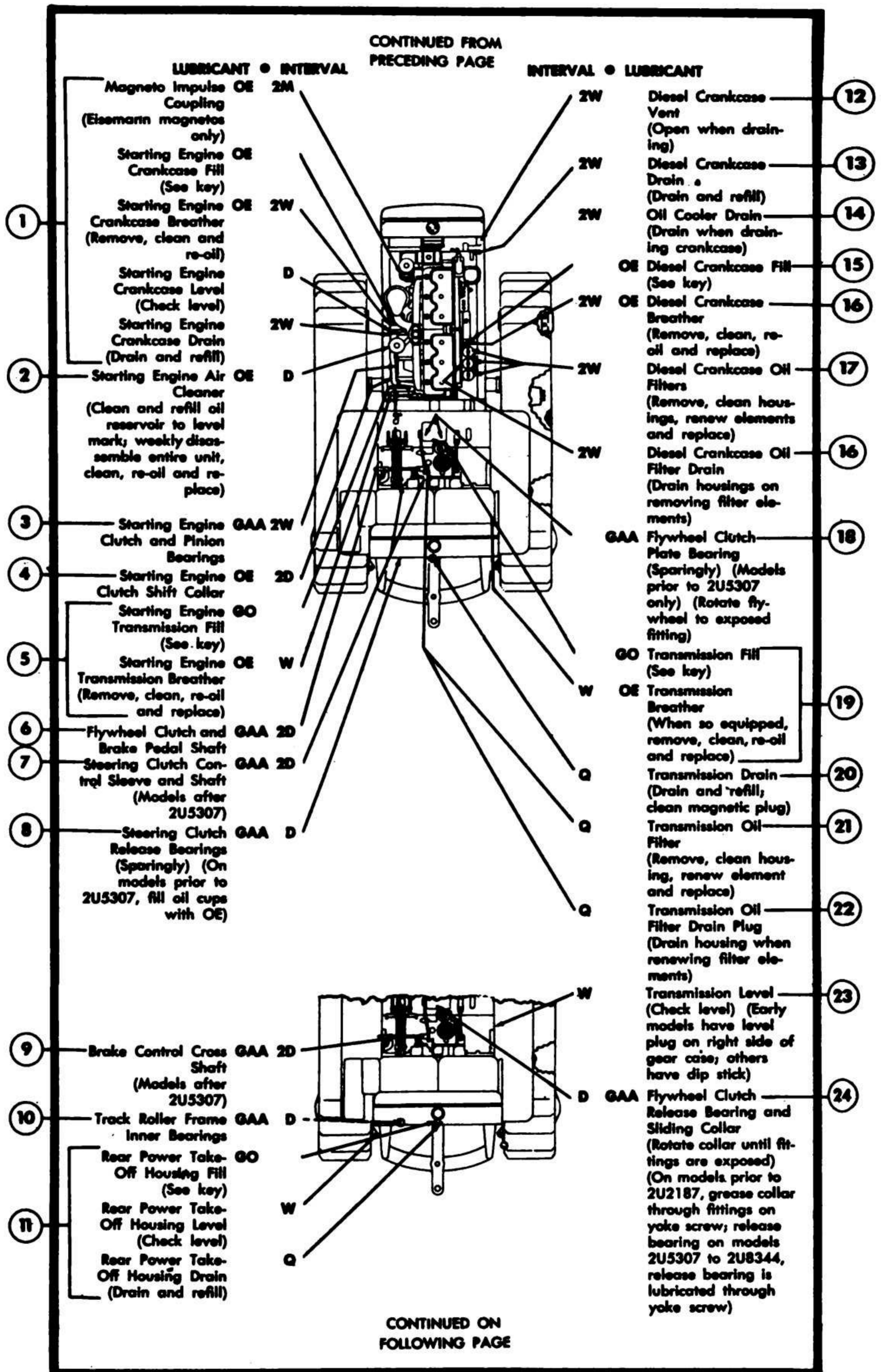
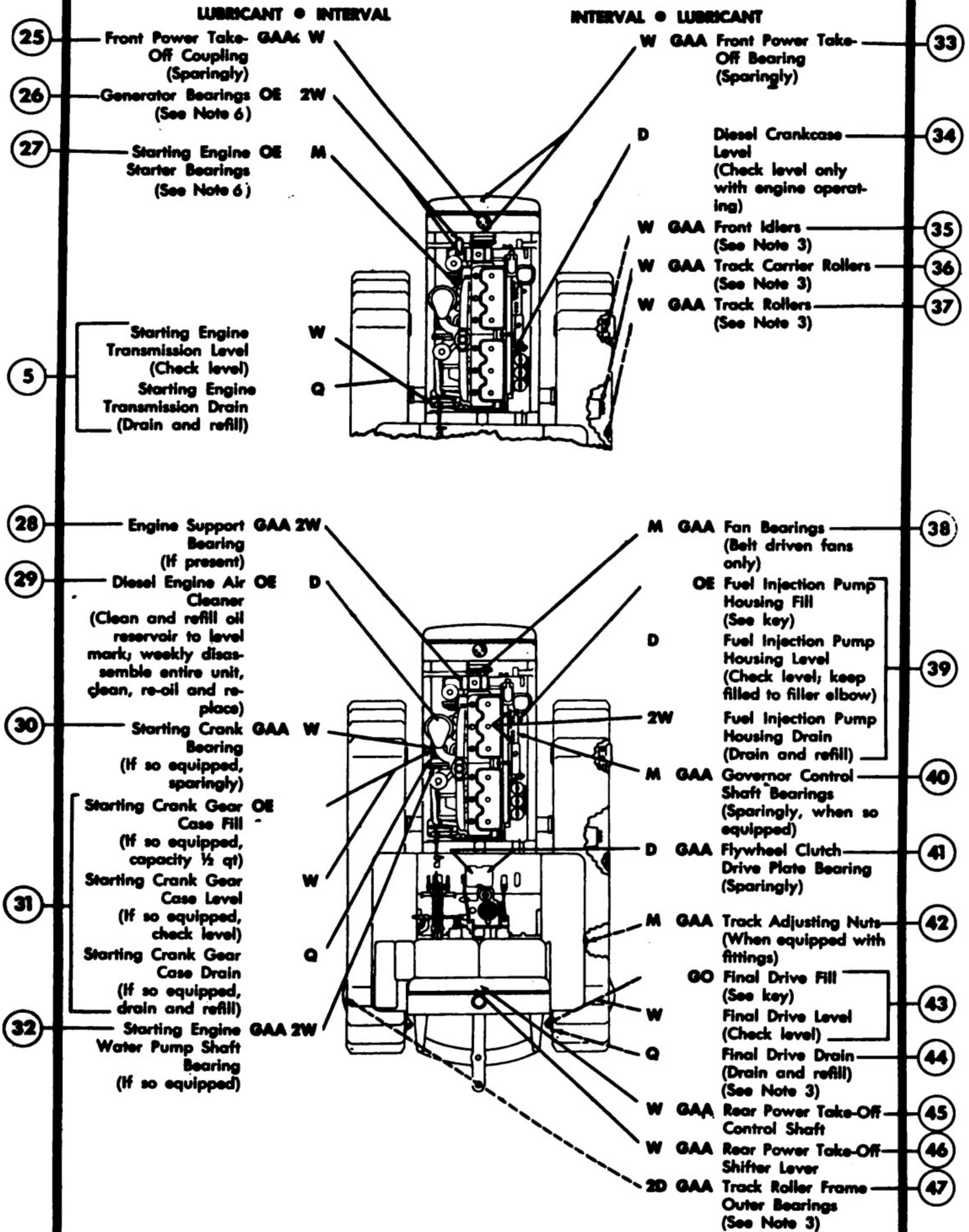


Figure 35. Lubrication order—Continued.

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Figure 35. Lubrication order—Continued.

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NOTES:

1. **COLD WEATHER** (When winterization kit is not available) Every 3 days, drain Diesel and starting engine crankcases and refill to "Full" marks with OE 10. Add 11 qts of gasoline to Diesel crankcase, ½ qt to starting engine crankcase, and run both engines 5 minutes to mix. Mark the new levels on the oil gages for future reference. **CAUTION:** Every ½ day check levels and fill to "Full" marks with OE 10. If engines are to be shut down for ½ day or more, add 11 qts of gasoline to Diesel crankcase, ½ qt gasoline to starting engine crankcase, to reach new level mark and run both engines 5 minutes to mix. **NOTE:** OIL, fuel, Diesel may be used as a temporary diluent only when sufficient gasoline is not available.

WARNING: Diluent used is inflammable; do not service equipment near heater or open flame.

2. **FOR OPERATION OF EQUIPMENT IN PROTRACTED COLD TEMPERATURES BELOW -10°F.** Clean parts with SOLVENT, Dry Cleaning, and drain all oil housings. Relubricate with lubricants indicated in the key for below -10°F.

3. **MUD AND DEEP WATER OPERATION**—When operating tractor with tracks partially or completely submerged in mud or water, track rollers, track carrier rollers, front idlers and track roller frame idlers should be lubricated twice daily.

4. **OIL CAN POINTS**—Weekly clean and coat hand crank lever bearings, throttle and governor linkages, clutch lever shaft bearings, yoke bearings, pins, springs, yokes, clevises and exposed threaded surfaces with OE.

5. **FINAL DRIVES**—Lubricant in final drives should be changed immediately signs of water or dirt are seen in the oil; leakage of oil from the final drives in excess of 1 qt weekly should be reported to higher authority.

6. **STARTER AND GENERATOR BEARINGS**—Lubricate sparingly. When equipped with Life-Seal bearings or oil impregnated bushings, no lubrication required; **CAUTION:** When so equipped, do not use solvents in cleaning. Wipe with an oil dampened cloth only.

Copy of this Lubrication Order will remain with the equipment at all times; instructions contained herein are mandatory and supersede all conflicting lubrication instructions dated prior to the date of this Lubrication Order.

BY ORDER OF THE SECRETARY OF THE ARMY:

OFFICIAL:

WM. E. BERGIN
Major General, USA
The Adjutant General

M. B. RIDGWAY
Chief of Staff
United States Army

Figure 35. Lubrication order—Continued.

b. Air Cleaners.

(1) *Starting engine air cleaner.*

- (a) *Air cleaner cup.* To change the oil in the air cleaner cup, unscrew the wing nut on top of the air cleaner and remove the filter section. Clean out the cup and refill with clean oil up to the oil level bead.
- (b) *Filter.* The filter section can be cleaned by shaking it in a pan of dry-cleaning solvent. Be sure there is a gasket between the air cleaner and its mounting, as the connection must be airtight.

(2) *Diesel engine air cleaner.*

- (a) *General.* The air cleaner does its work efficiently as long as the oil in the cup is thin enough to spray into the screen section and wash the dirt collected there back into the cup. When the oil becomes thickened with dust it is unable to do this. However, even in cold weather, the oil should not be too thin. Very thin oil can carry over in the intake manifold and carry dirt with it.
- (b) *Precleaner.* The precleaner prevents the larger particles of dust from entering the air cleaner. It will function only when the glass jar is in place. Inspect the jar regularly and empty it when it is about half full of dust. The jar is removed by unscrewing the clamp that holds it in place. Inspect the fins in the precleaner regularly, and clean when dirty.
- (c) *Air cleaner inlet pipe.* At the same time the oil in the cup is being changed, inspect the inlet pipe with the oil cup removed. Clean off any dirt that has collected on the walls of the pipe.
- (d) *Air cleaner screens.* Six of the air cleaner screens can be removed for servicing. To remove the first screen, unscrew two wing nuts that hold it in place. The other screens will come off of the air inlet pipe one at a time. If one of the screens is clean there is no reason for removing any above it. To wash the screens, shake them in a pan of diesel fuel or dry-cleaning solvent. When replacing the screens, arrange them in pairs with the cross arms facing each other. Be sure to tighten the wing nuts holding the screens to prevent them from vibrating and eventually disintegrating.

c. Breathers.

- (1) *General.* To insure a clean supply of air entering the crank-cases, replaceable crimped copper filter elements are used. The elements can be removed for cleaning and should be washed in diesel fuel or dry-cleaning solvent. Before replacing the elements, soak the crimped copper with lubricating oil.

- (2) *Starting engine crankcase breather* (fig. 35). The breather (8) can be unscrewed from the starting engine as a unit and then disassembled. The filter cover is held in place by a nut tightened on a stud. Remove the nut and take off the cover. The filter element can then be removed for cleaning.
- (3) *Diesel engine crankcase breather* (fig. 35). The breather (1) is mounted on the crankcase oil filler assembly. The filter element fits in the cap assembly and can be removed by unscrewing the cap and prying the element out of the cap. After the cap has been removed, the skirt assembly can be lifted off of the oil filler assembly and cleaned.

d. Oil Filters (Diesel Engine). Three filters on the same base, located on the right side of the engine, filter the oil as it passes through. Each filter has a replaceable filter element which consists of layers of a corrugated fibrous material in a perforated metal case. Oil enters through the perforations in the metal case, is filtered and discharged through the core or center of the element. The filter element should be replaced at every oil change. The elements are removed by unscrewing the cover holddown wing screws and removing the covers.

e. Oil Filter (Transmission).

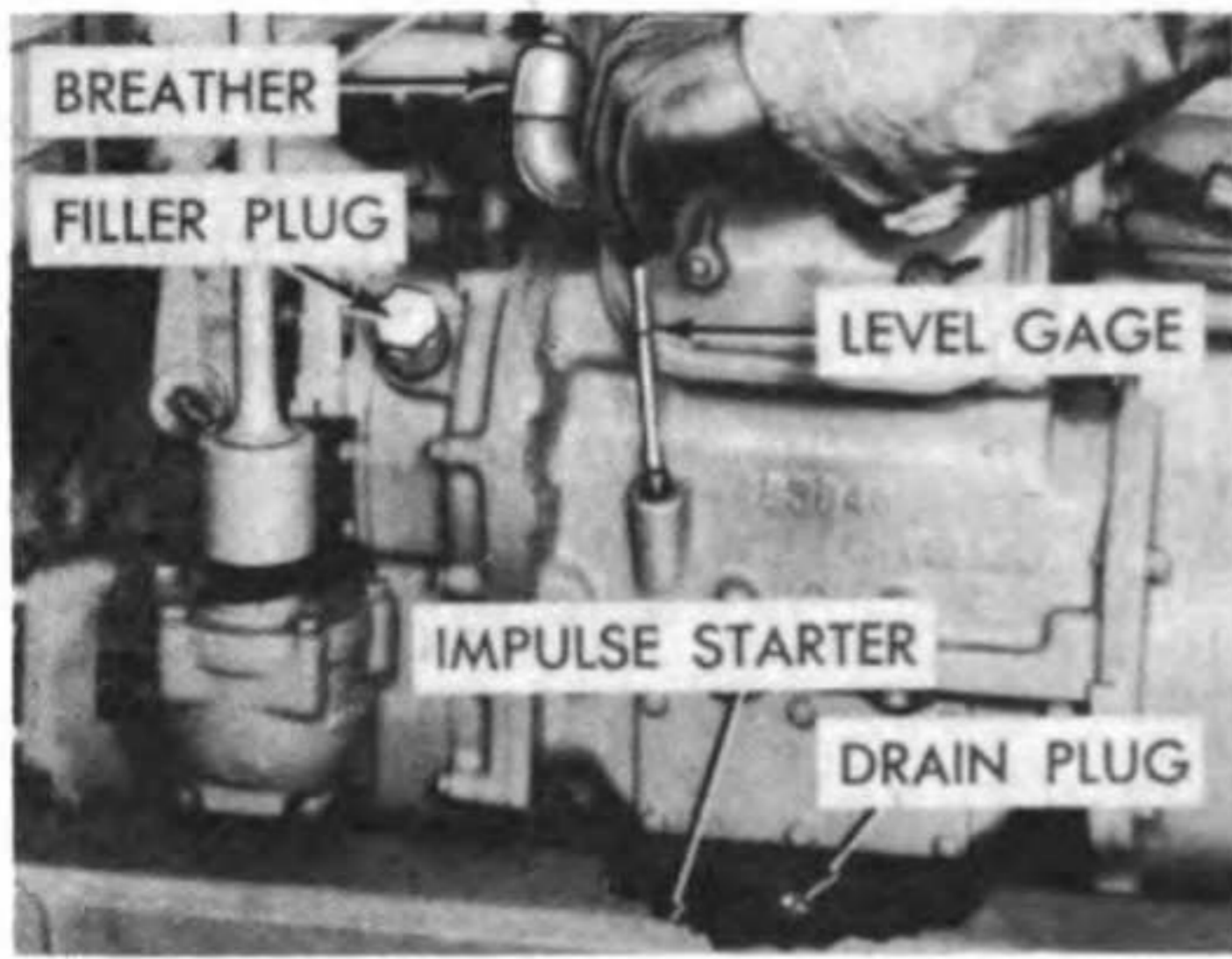
- (1) *Description.* The transmission oil filter housing is located just forward of the gear shift control lever in the operator's compartment. It contains an inner element, which is identical to those contained in the diesel fuel filter housing, and an outer, metallic, strainer element.
- (2) *Removal.* Remove the clamp nut from the top of the filter, lift off the top and lift out the inner and outer elements.
- (3) *Maintenance.*
 - (a) Periodically check the transmission oil filter element. If there is sludge or foreign matter evident on the metallic strainer element, it should be washed off with a non-inflammable cleaning fluid. If brushing is necessary, brush parallel to the windings. When heavy sludging of the metallic strainer element is observed, it is advisable to replace the inner bypass filter element with a new element.
 - (b) Service the transmission oil filter completely each time the transmission oil is drained. Drain the filter housing by removing the plug.

f. Compartments Containing Lubricant. Mud, dust, or water should be prevented from entering all compartments containing lubricant. Excessive leakage of oil from a compartment indicates seals or gaskets are defective and should be replaced to prevent the entrance of dirt and water. If dirt is detected in a compartment, the oil must be changed immediately and the mechanism disassembled and cleaned at the first opportunity.

46. Lubrication Under Unusual Conditions

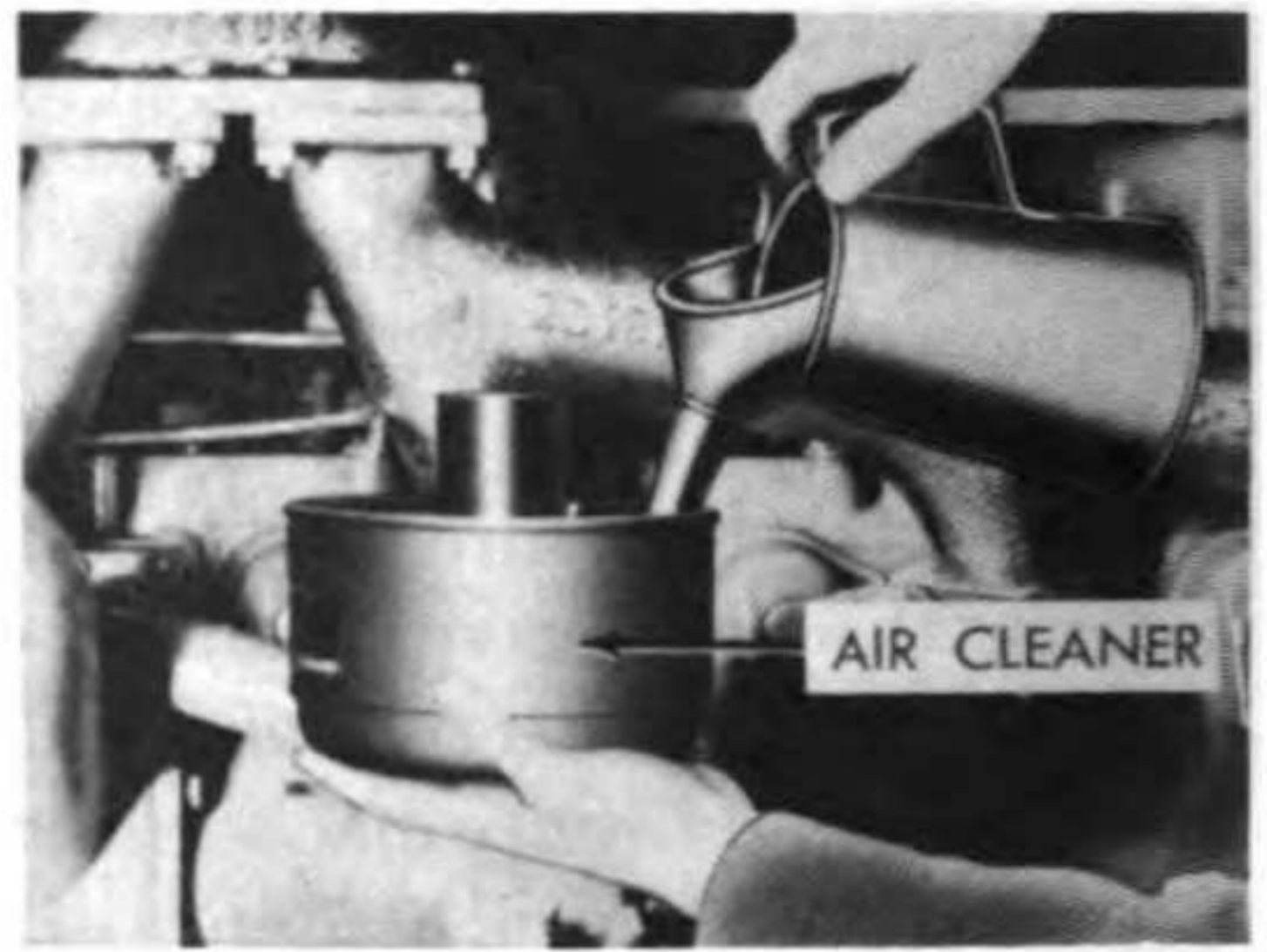
a. Unusual Conditions. Reduce service intervals specified on the lubrication order to compensate for abnormal operation and extreme conditions, such as high or low temperatures, prolonged periods of high speed operation, continued operation in sand or dust, immersion in water, or exposure to moisture, any one of which may quickly destroy the protective qualities of the lubricant. Intervals may be extended during inactive periods.

b. Changing Grades of Lubricants. Lubricants are prescribed in the "Key" (fig. 35) in accordance with three temperature ranges: above $+32^{\circ}$ F.; from $+32^{\circ}$ to -10° F., and below -10° F. Sluggish starting is an indication of lubricants thickening, and is the signal to change grades prescribed for the next lower temperature range. Ordinarily, it will be necessary to change grades of lubricants only when air temperatures are consistently in the next higher or lower range.



Ref. 1: Check oil level gage daily. Every quarter oil impulse starter on earlier engines equipped with Eisemann Magnetos.

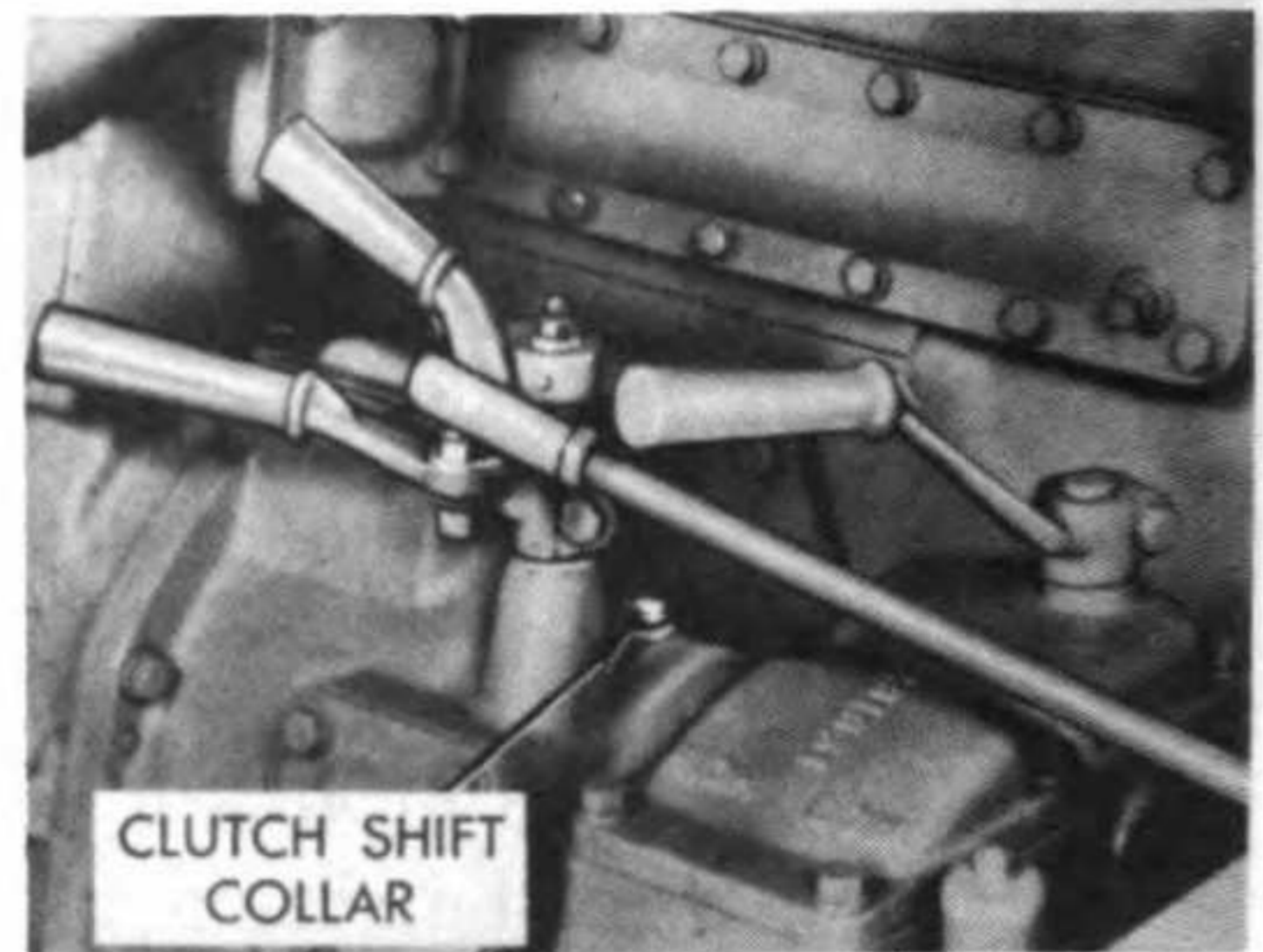
See key for draining crankcase. Drain crankcase, wash and refill to correct oil level. At every oil change, wash and oil breather.



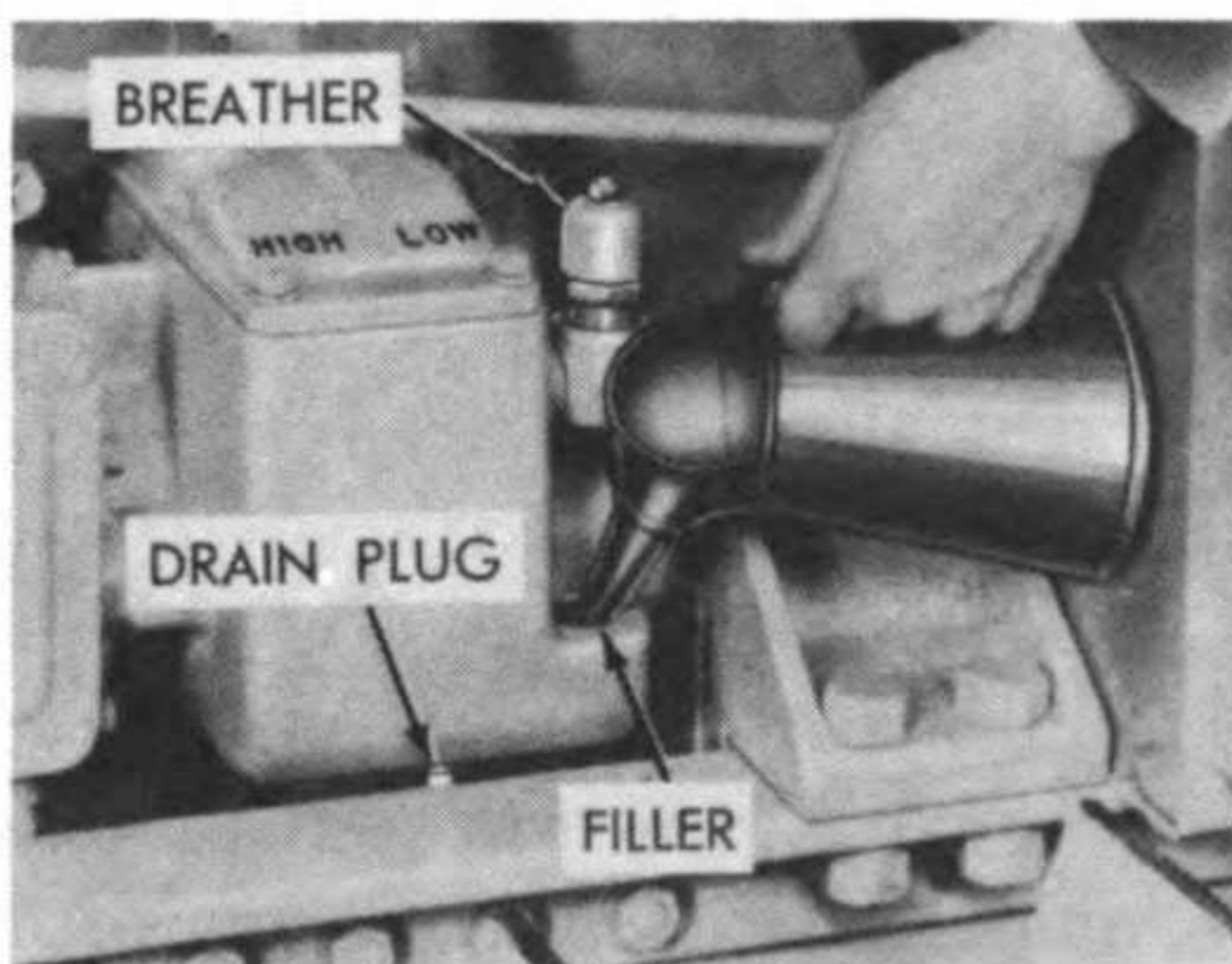
Ref. 2: Wash oil cup and refill to circular mark weekly. Monthly, remove and clean filter section



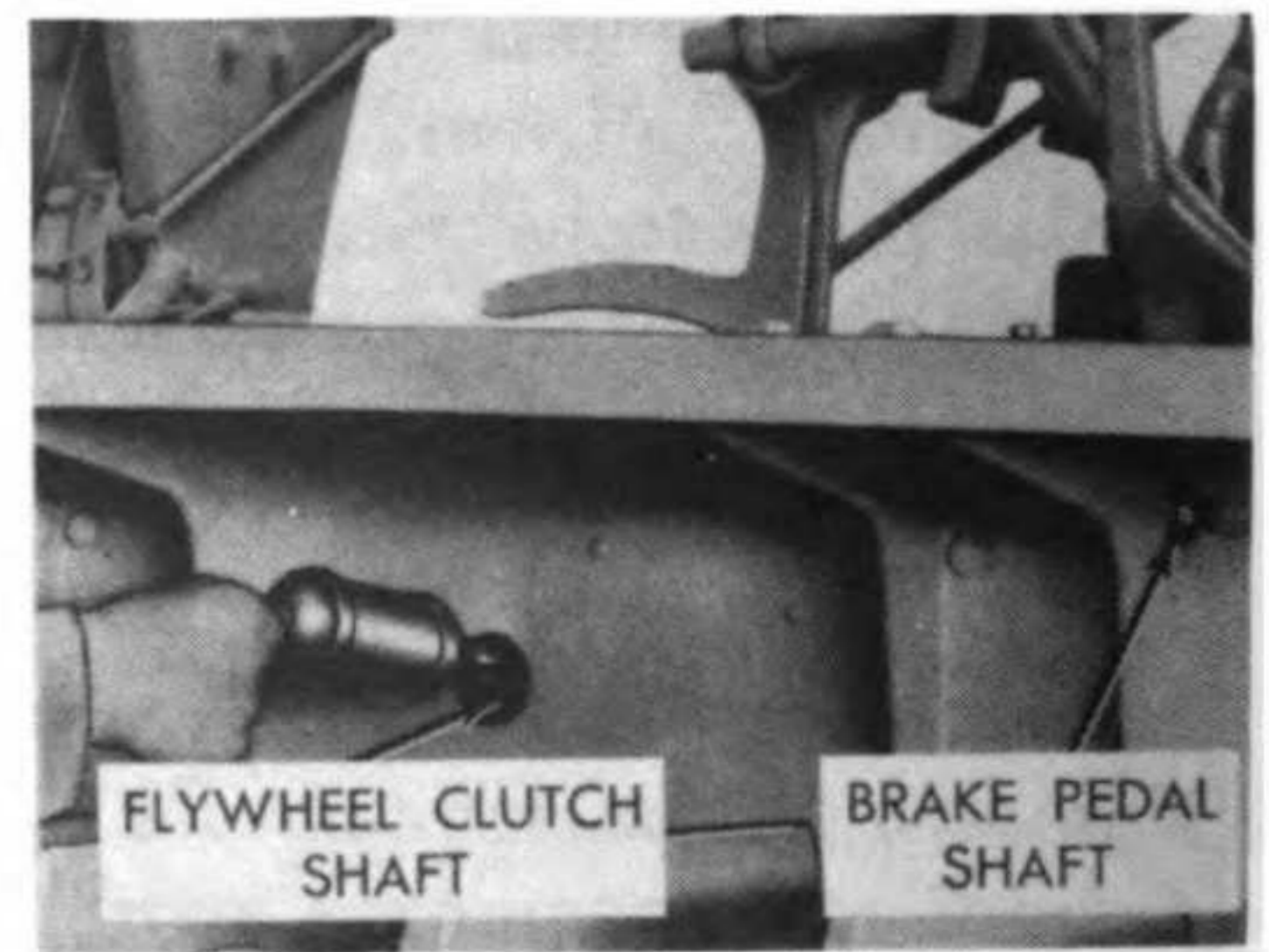
Ref. 3: Lubricate every 2 weeks.



Ref. 4: Fill oil cup every 2 days.

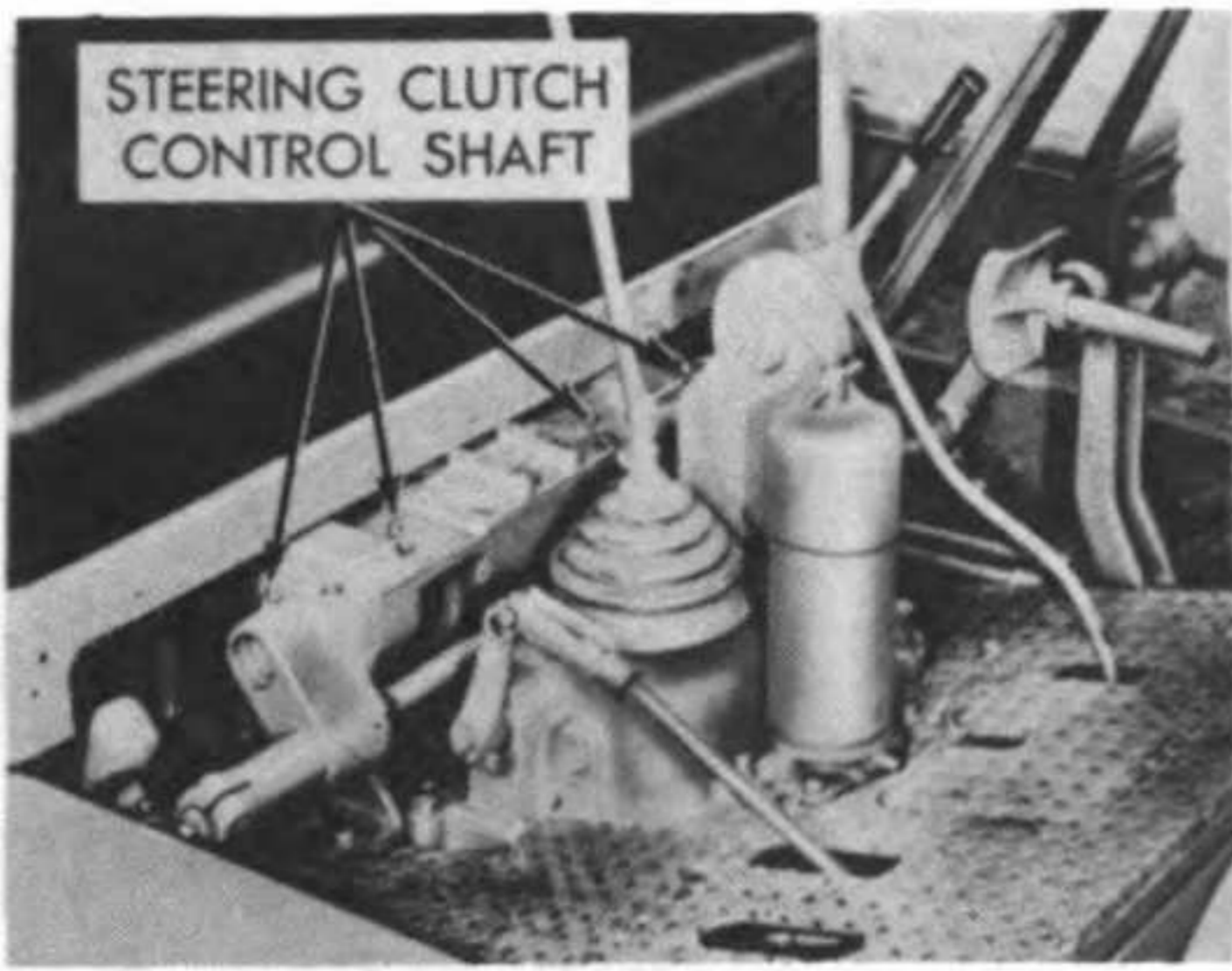


Ref. 5: Check transmission oil level weekly. Fill to filler opening, remove breather, disassemble and wash. Drain, wash, and refill starting engine transmission quarterly.

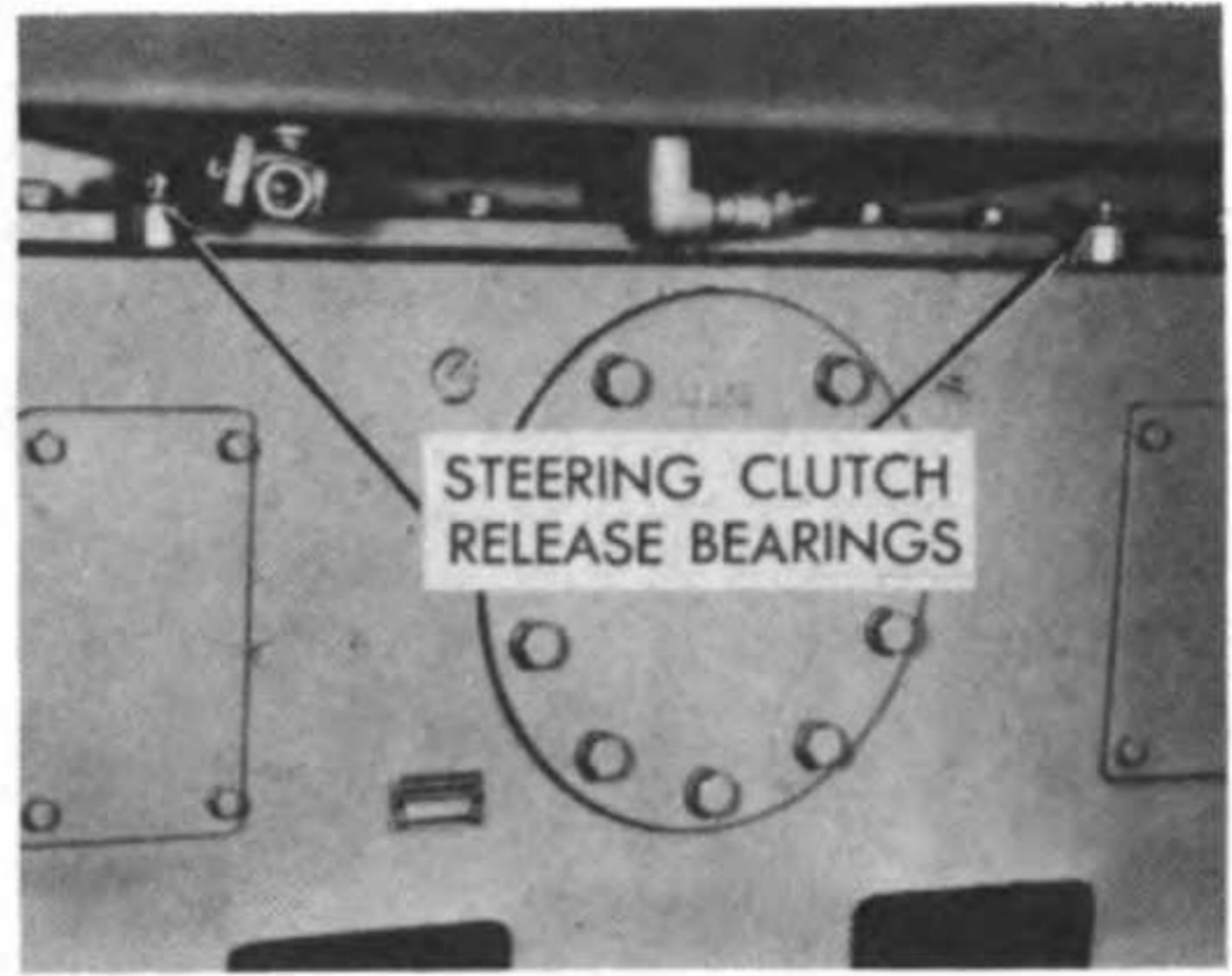


Ref. 6: Lubricate brake pedal shaft bearings and flywheel clutch shaft bearings every 2 days.

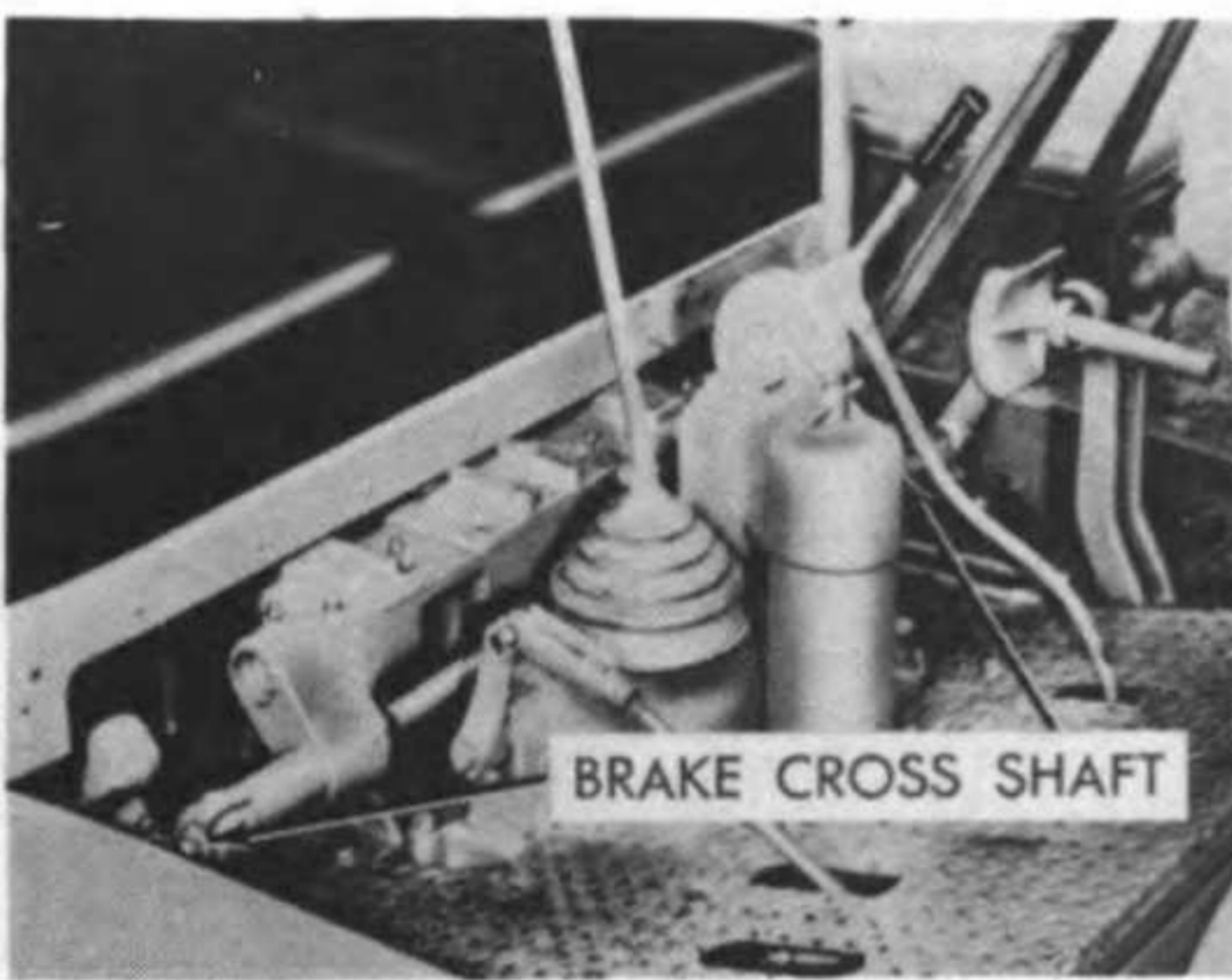
Figure 35. Lubrication order—Continued.



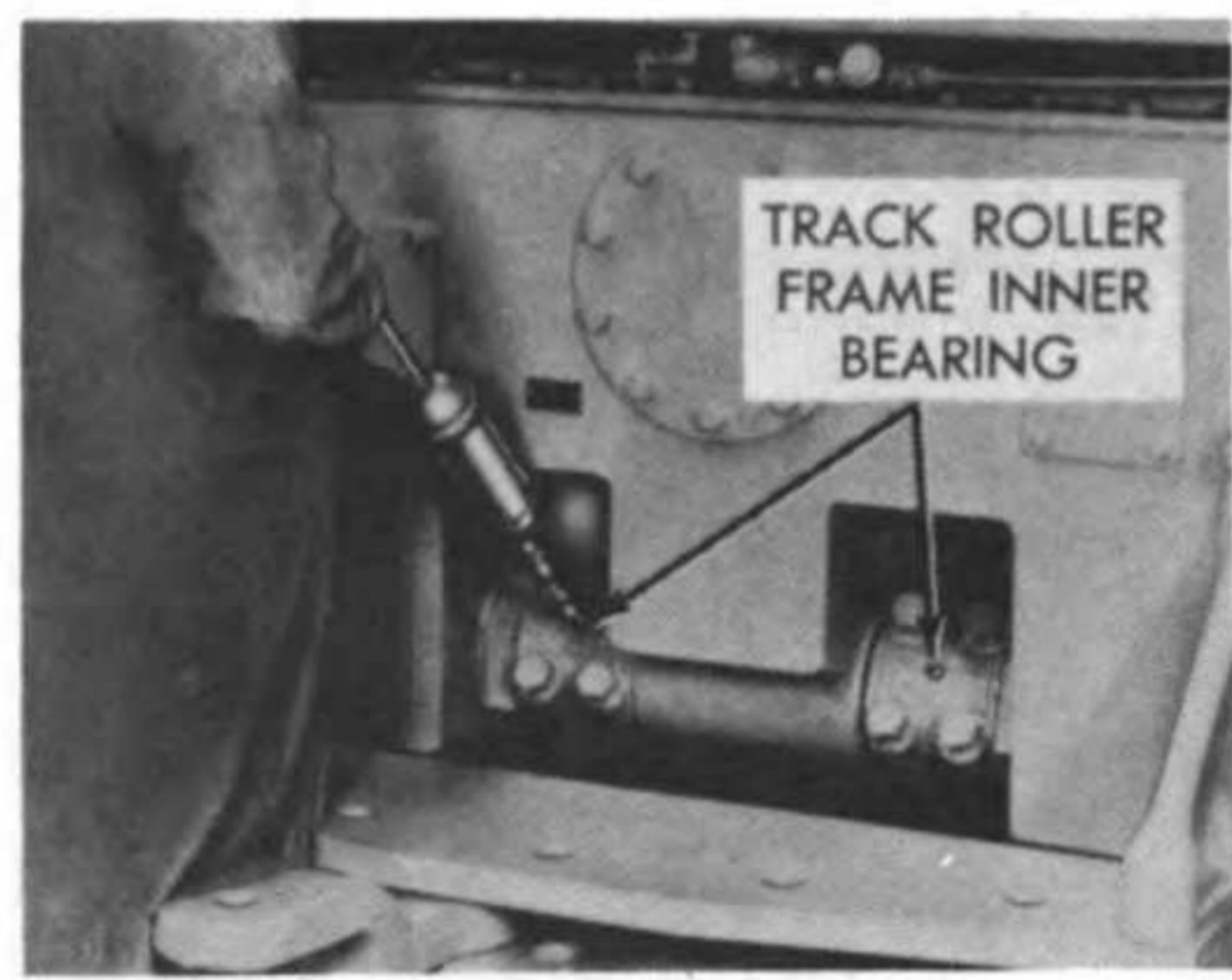
Ref. 7: Lubricate bearings through fittings every 2 days.



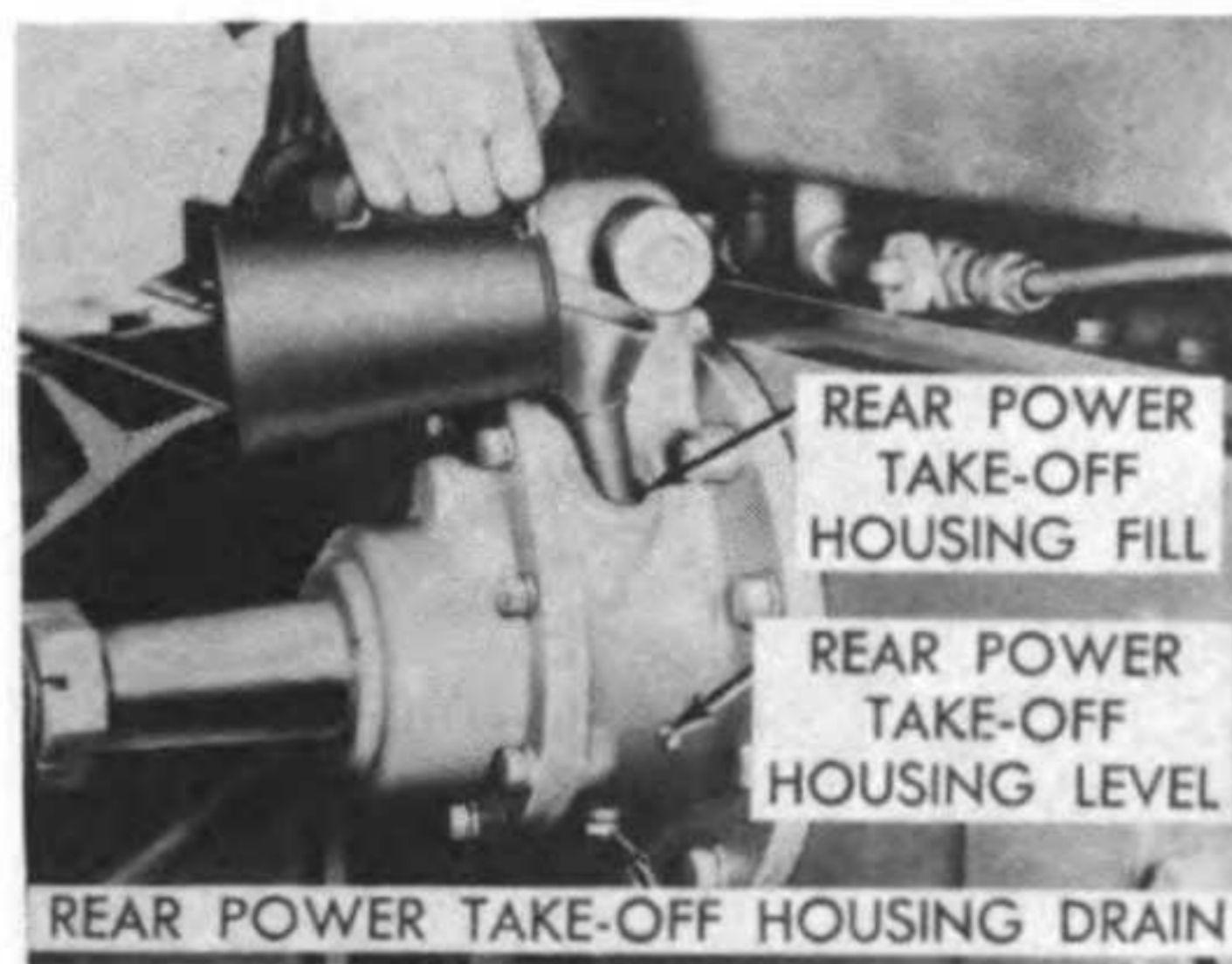
Ref. 8: Lubricate each bearing sparingly through fittings on top rear of transmission case daily.



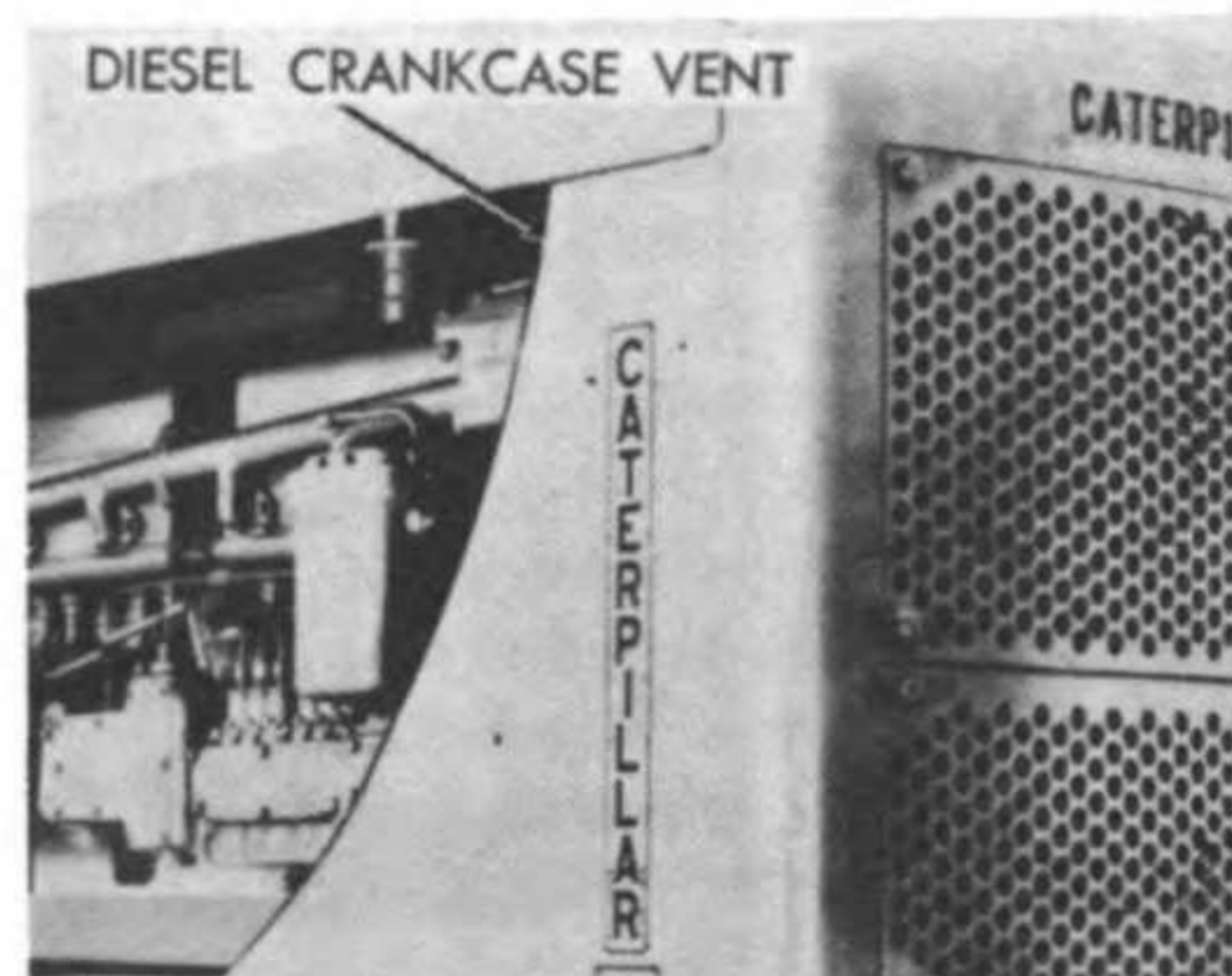
Ref. 9: Lubricate both ends of shaft, through fittings, every 2 days.



Ref. 10: Lubricate two bearings daily, one fitting for each bearing. If operating in deep mud or water, lubricate every one-half day.

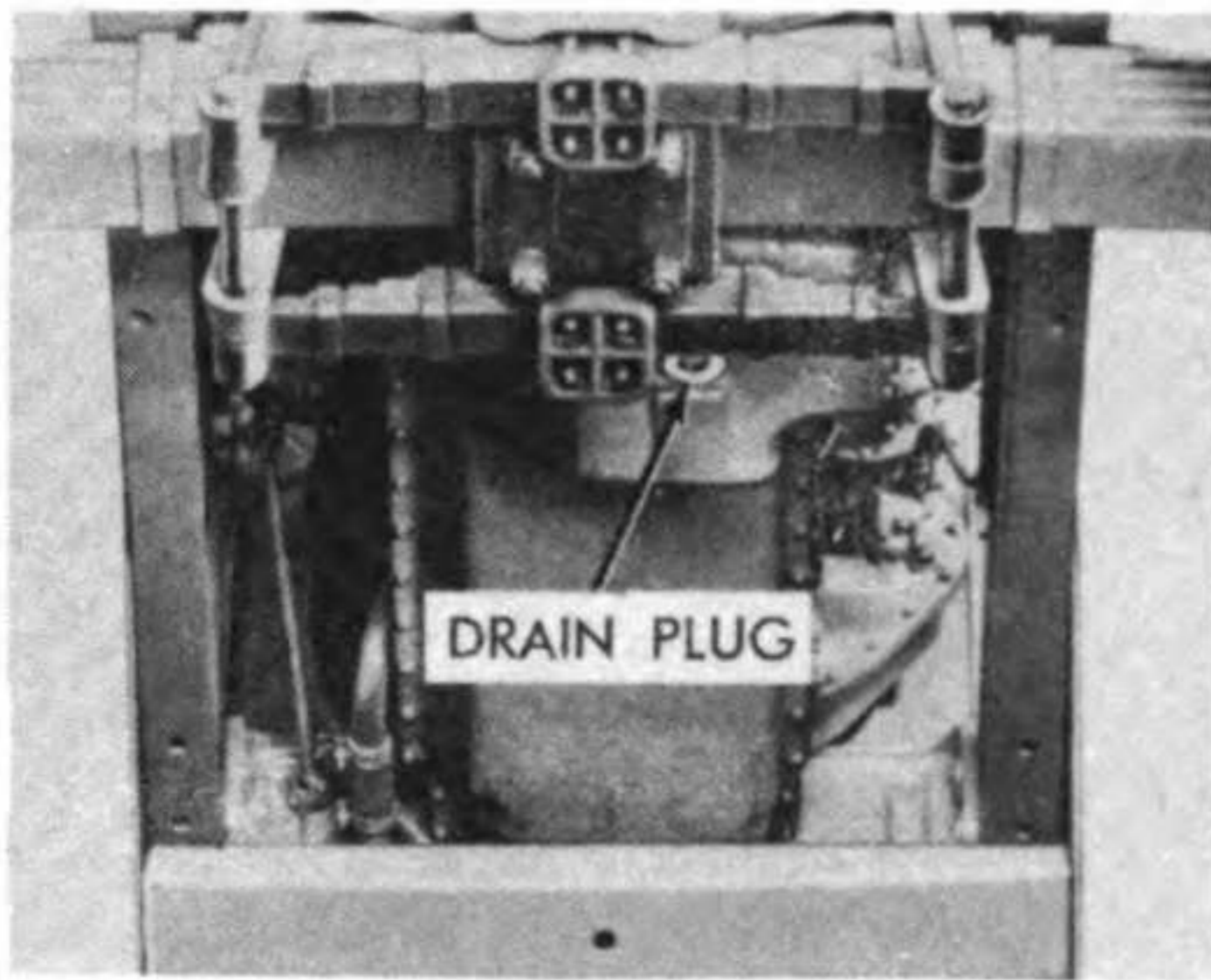


Ref. 11: Check level once a week and maintain level at filler. Drain and refill quarterly.

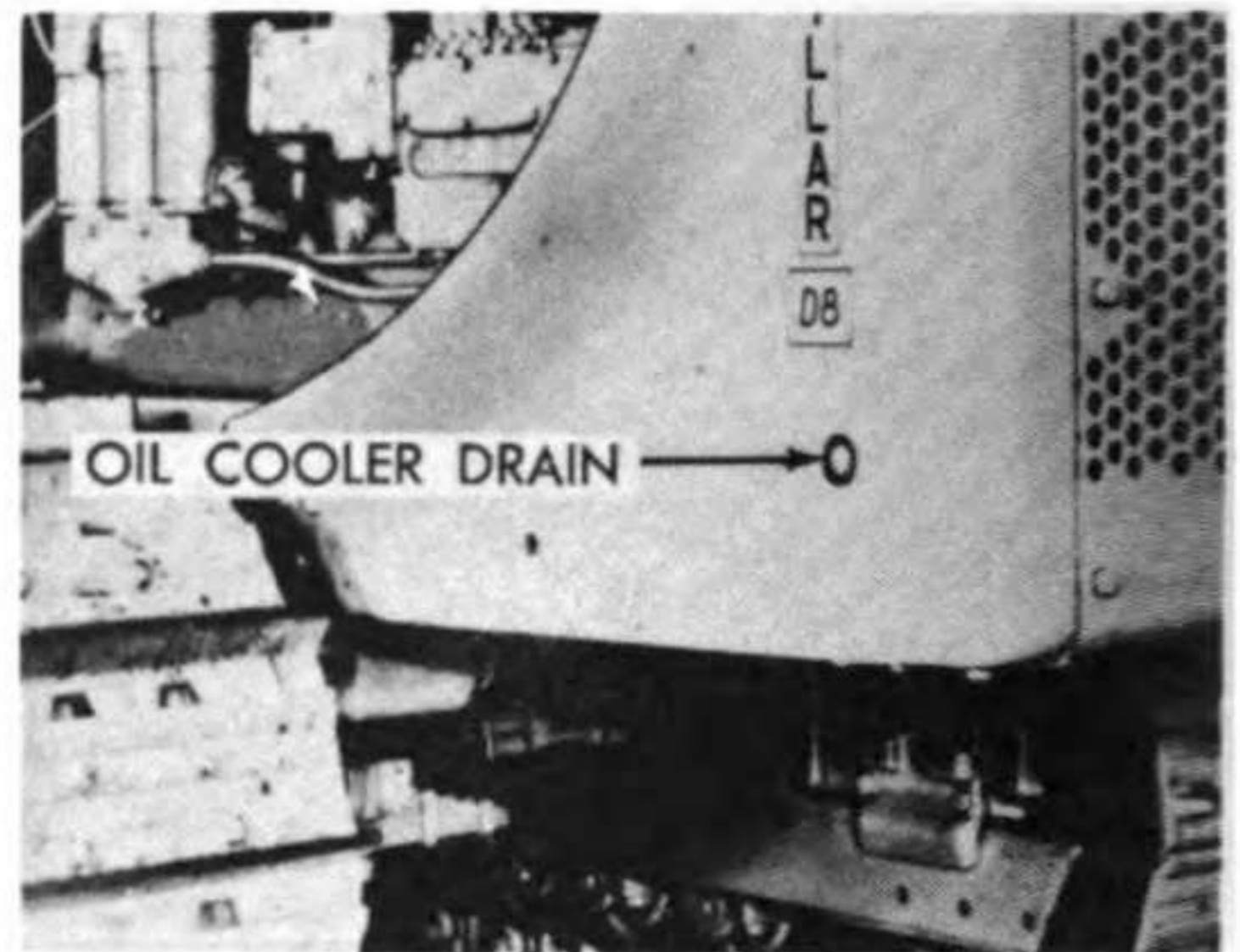


Ref. 12: Open vent when draining crankcase.

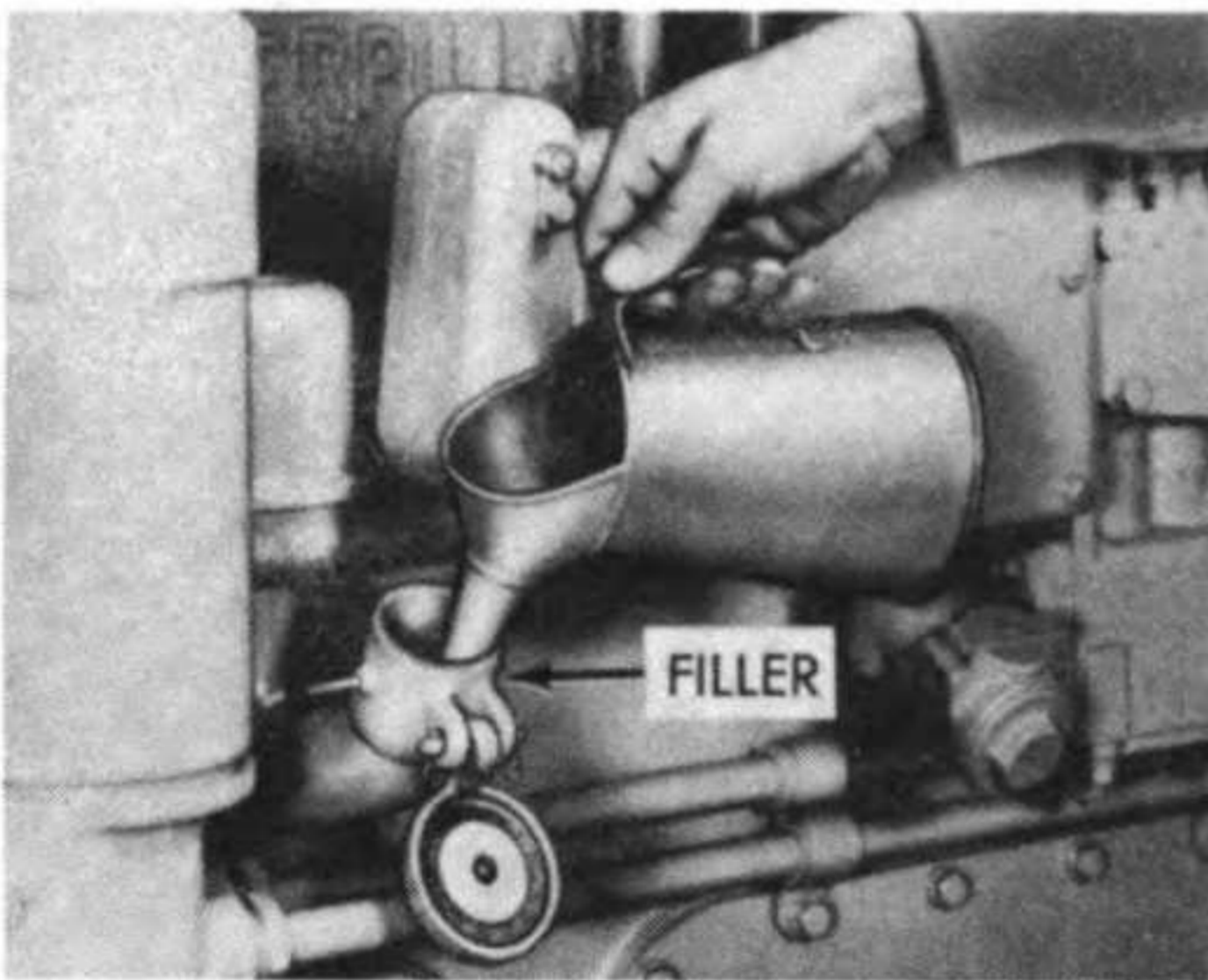
Figure 35. Lubrication order—Continued.



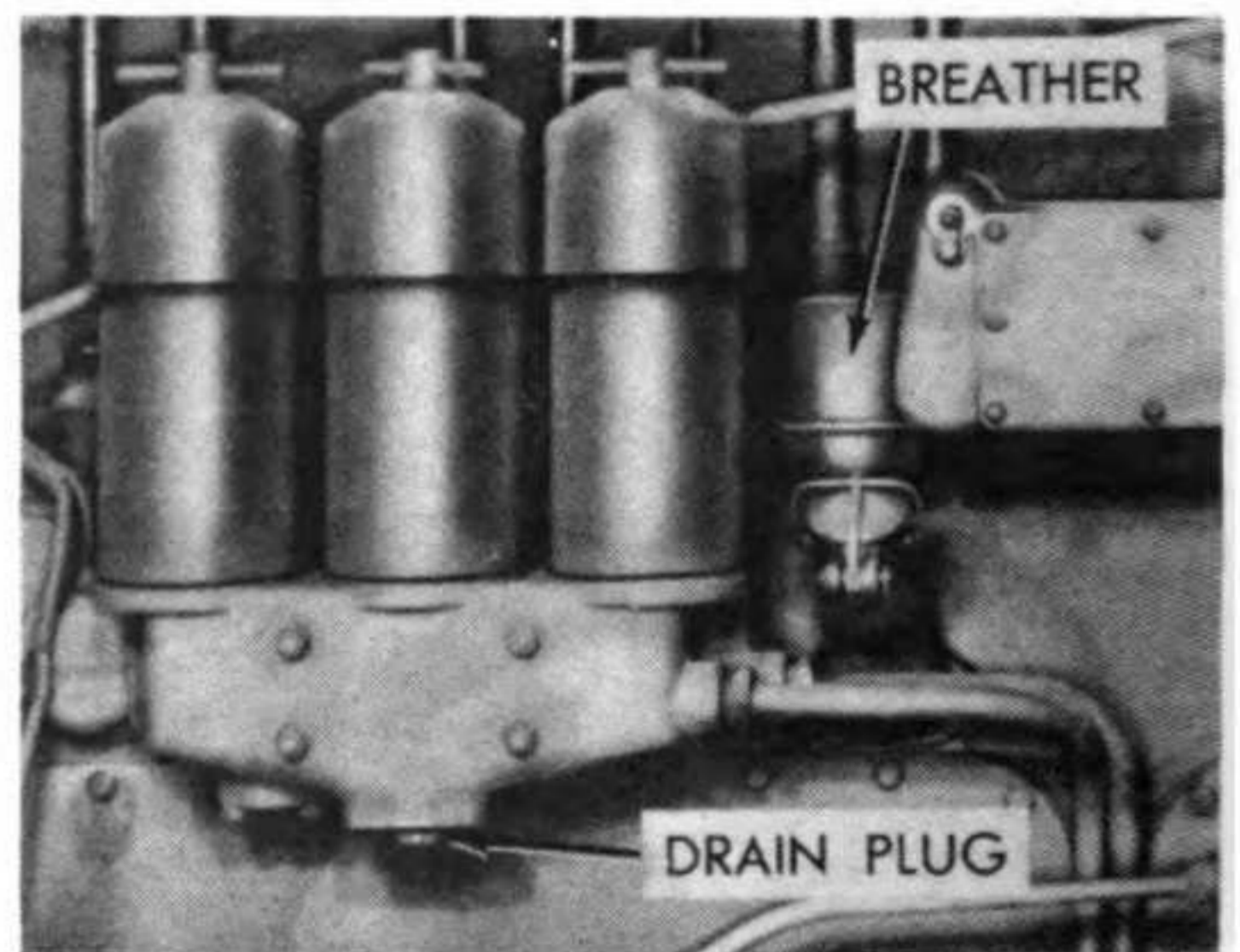
Ref. 13: Drain and refill the crankcase every 2 weeks.



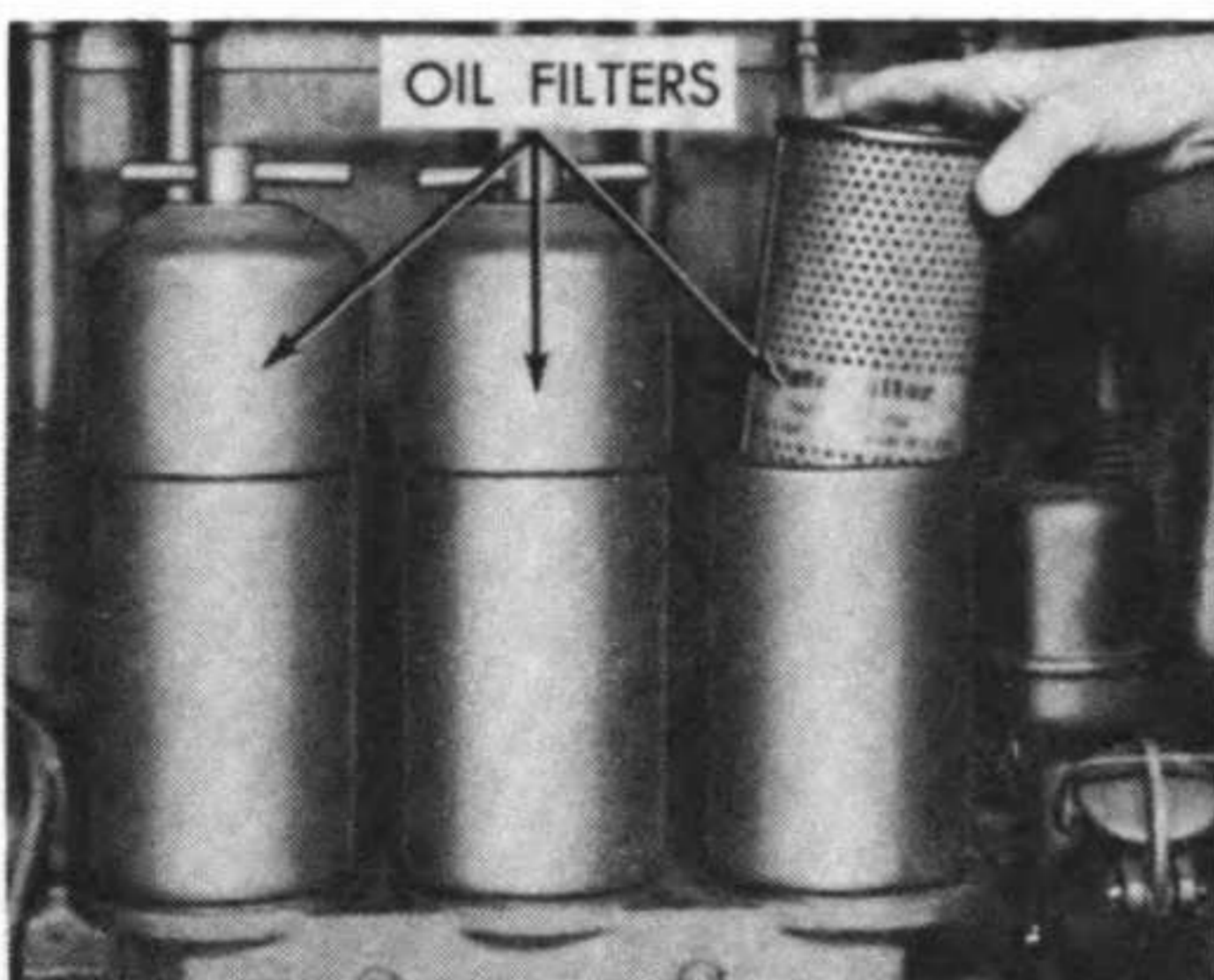
Ref. 14: Drain every 2 weeks when draining crankcase and refill.



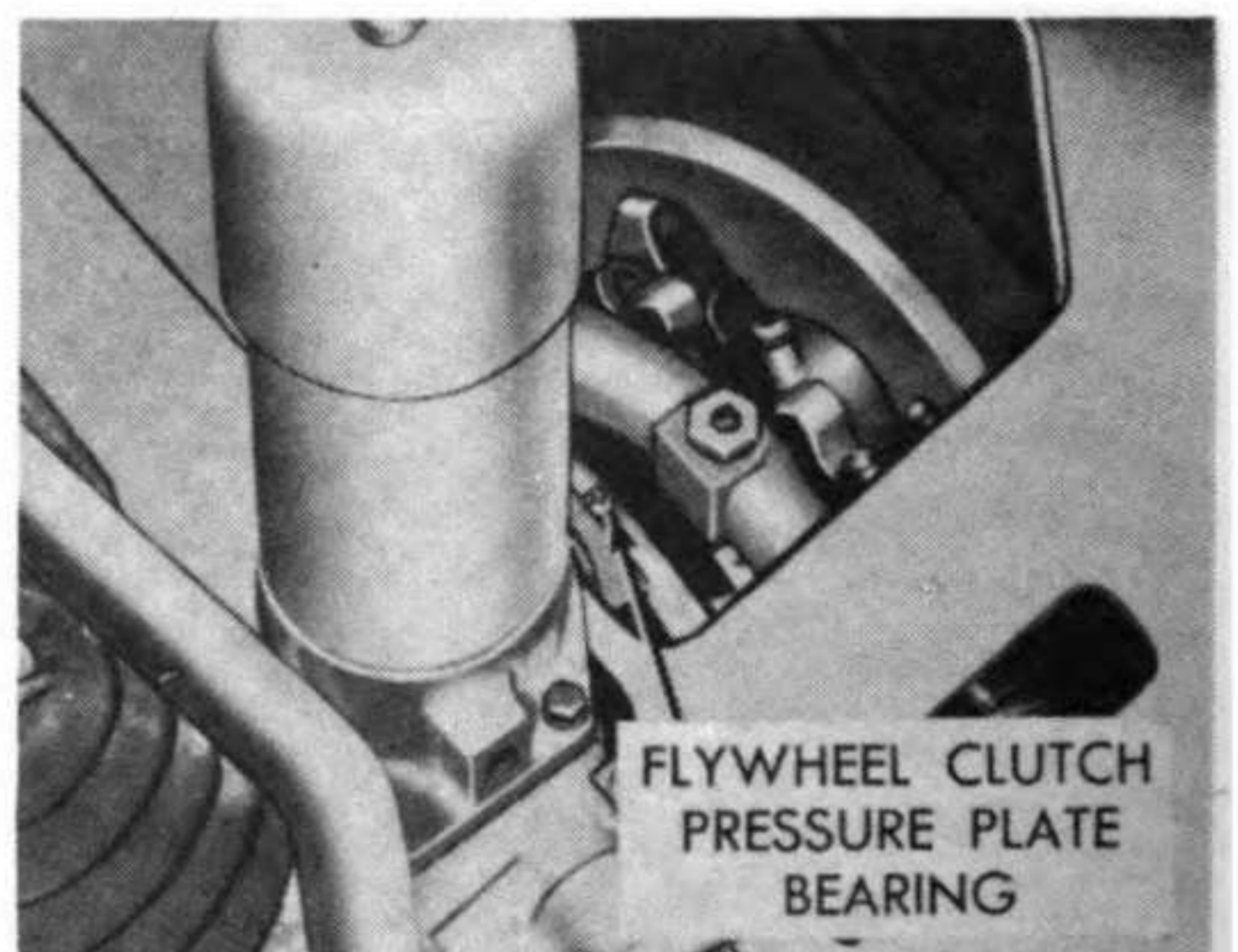
Ref. 15: After draining crankcase, refill at filler and start the diesel engine. Run engine for 2 minutes, then add oil to bring level to full mark on gage.



Ref. 16: Wash breather element each time crankcase is drained. Remove oil filter drain plug and drain oil filters at each crankcase oil change.

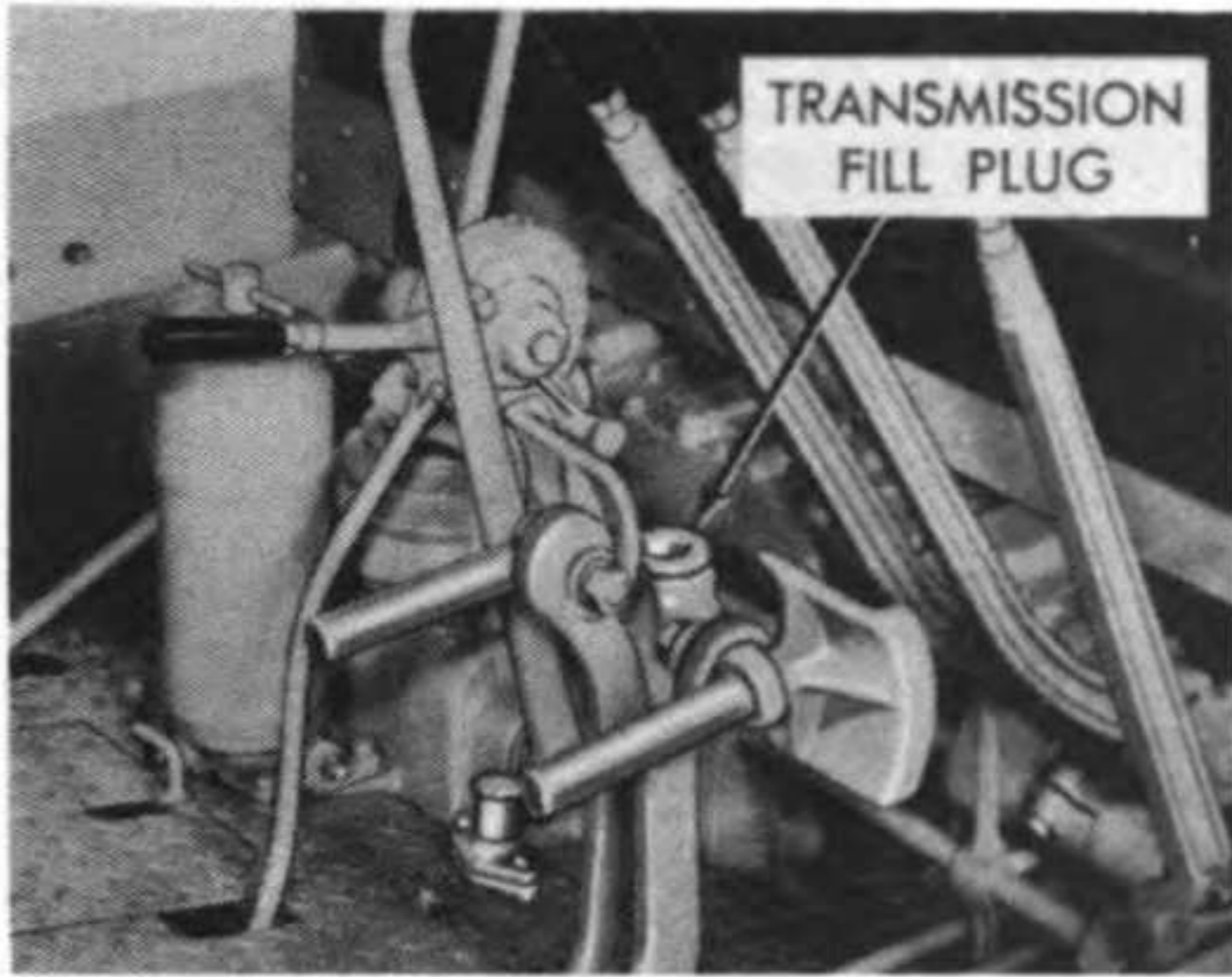


Ref. 17: At each oil change period, wash metallic strainer elements and replace inner filter elements with new elements.

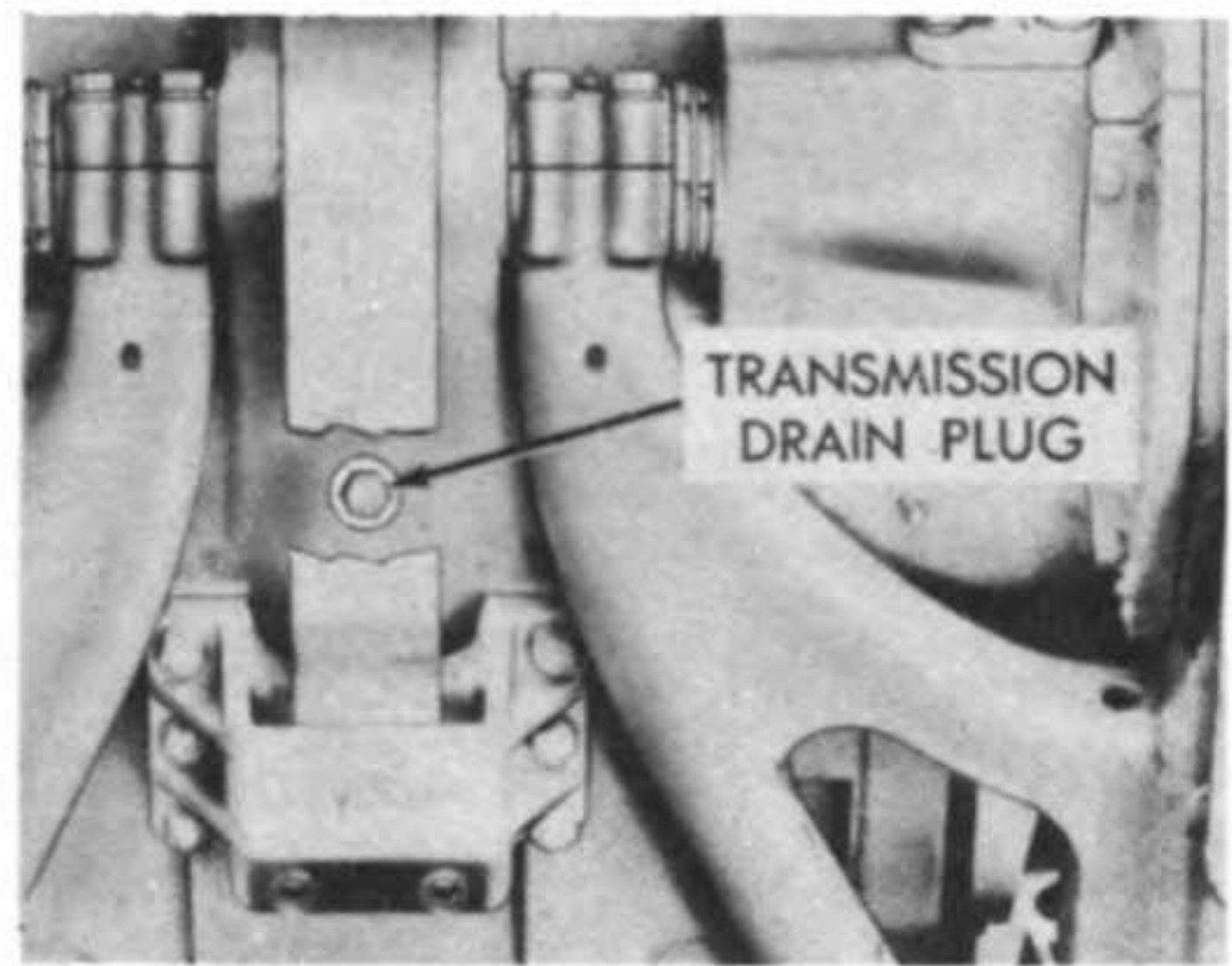


Ref. 18: Lubricate bearing sparingly. Rotate flywheel until fitting appears.

Figure 35. Lubrication order—Continued.



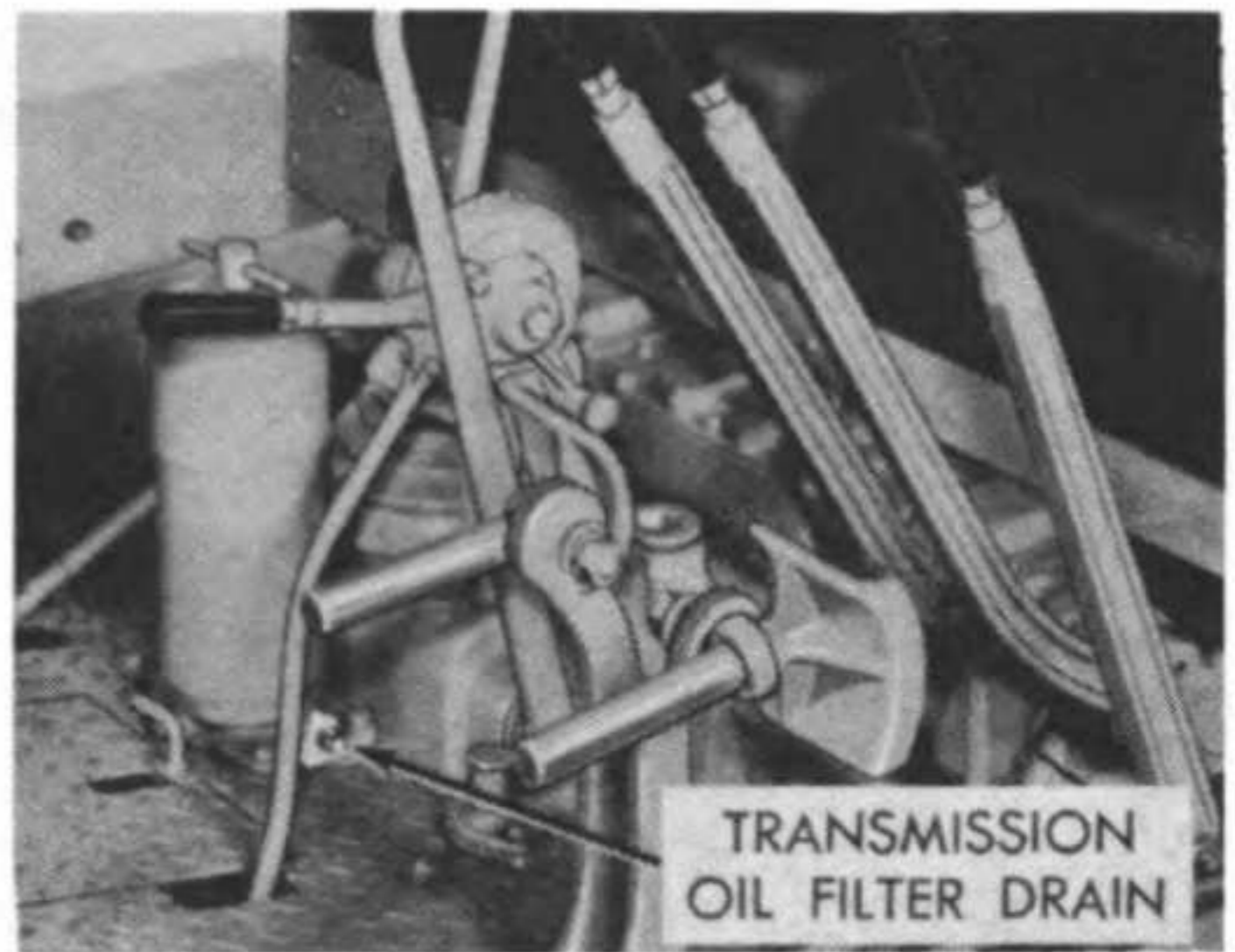
Ref. 19: Fill housing to full mark on gage, start the diesel engine and run for 3 minutes with the flywheel clutch engaged. This will fill the filter, oil passages and bearings with lubricant. If transmission is equipped with breather, remove, clean, re-oil, and replace breather.



Ref. 20: Drain the transmission quarterly. Wash compartment at each drain period. Clean magnet plug.



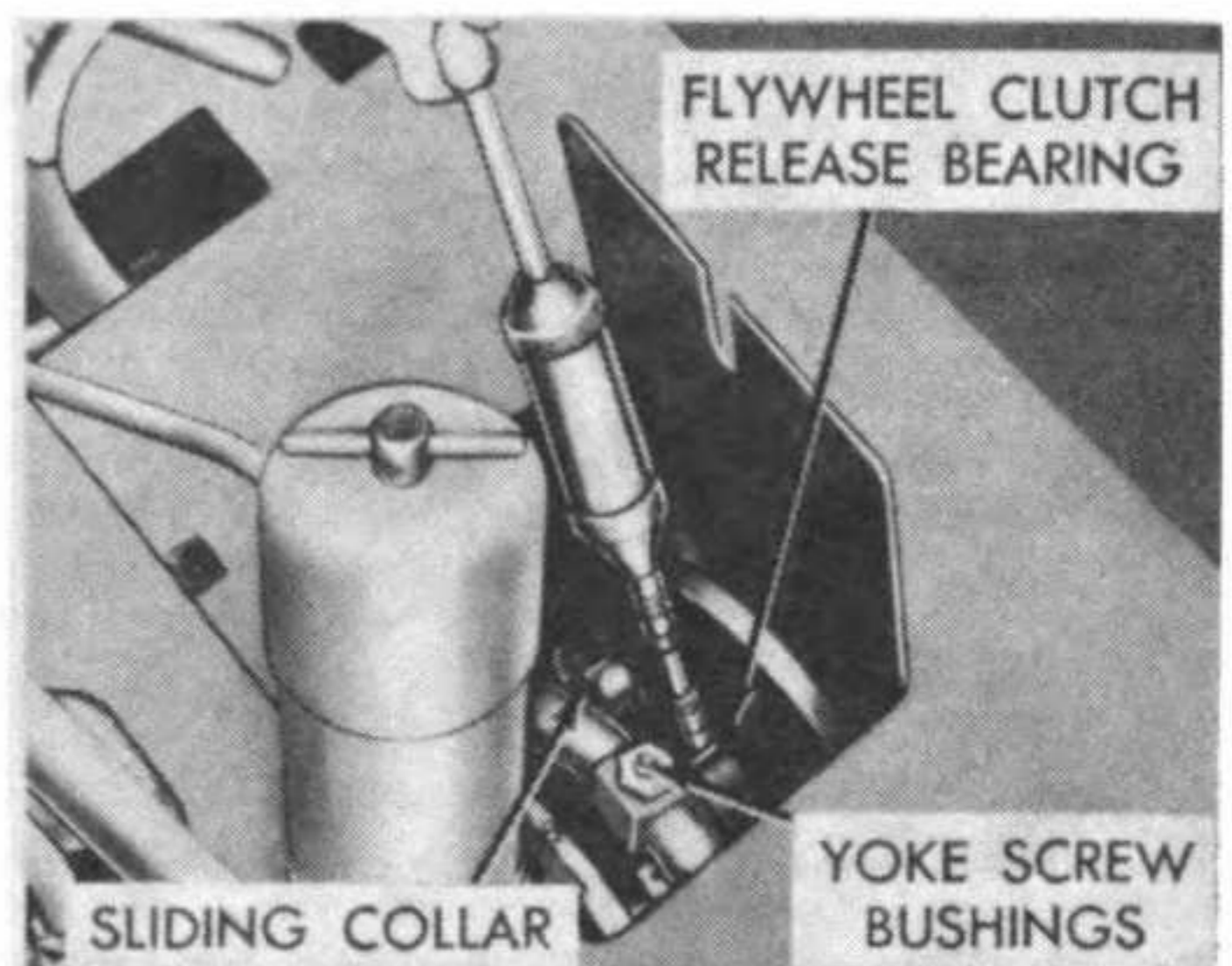
Ref. 21: Check the oil filter element weekly. If there is sludge evident on the metallic strainer element, it should be washed off with a non-flammable cleaning fluid. If brushing is necessary, brush parallel to the windings. When heavy sludging of the element is observed, it is advisable to replace the inner bypass filter element with a new element.



Ref. 22: Drain the transmission oil filter completely each time the transmission oil is drained.

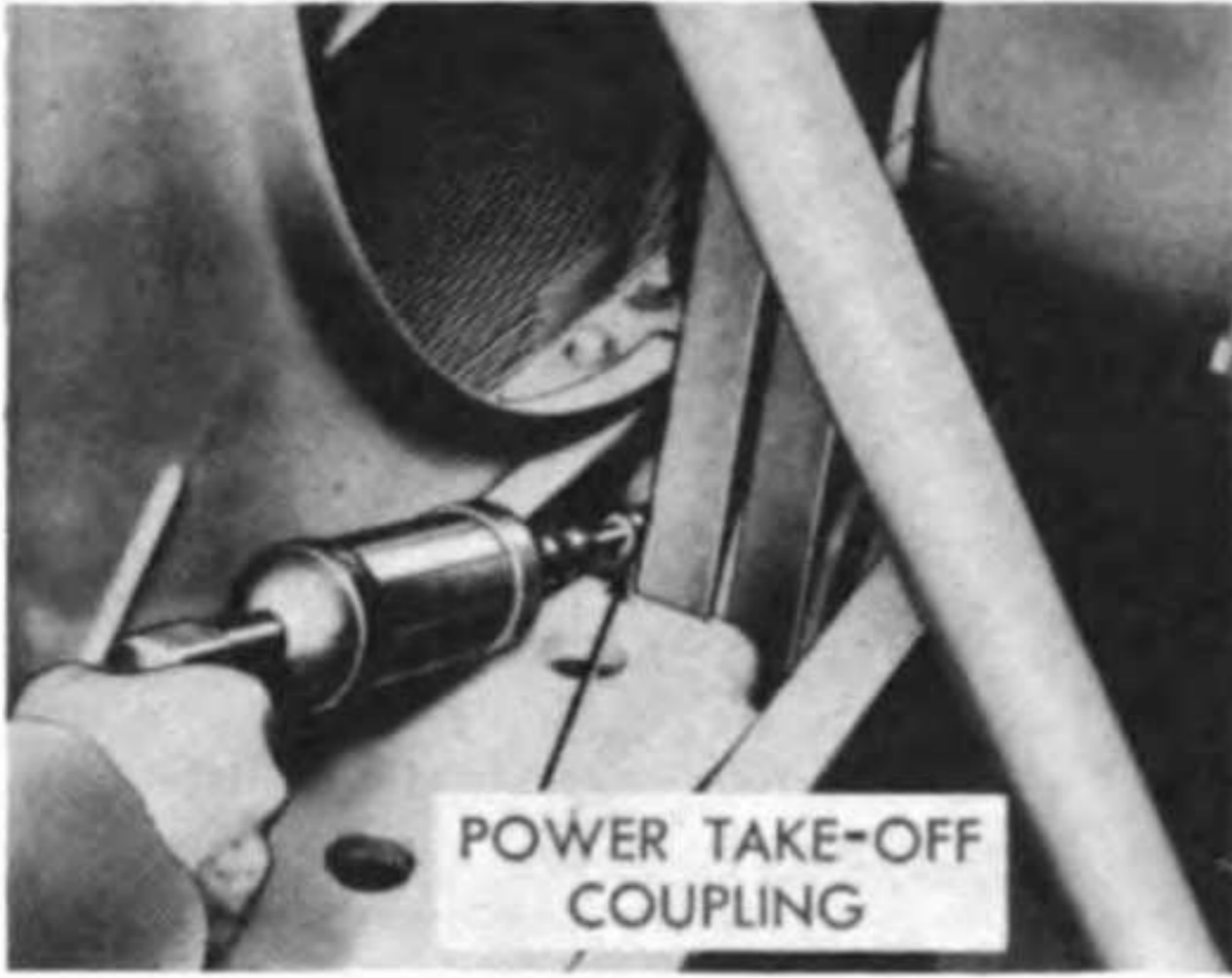


Ref. 23: Check transmission oil level every week. Oil should be up to level mark on gage.

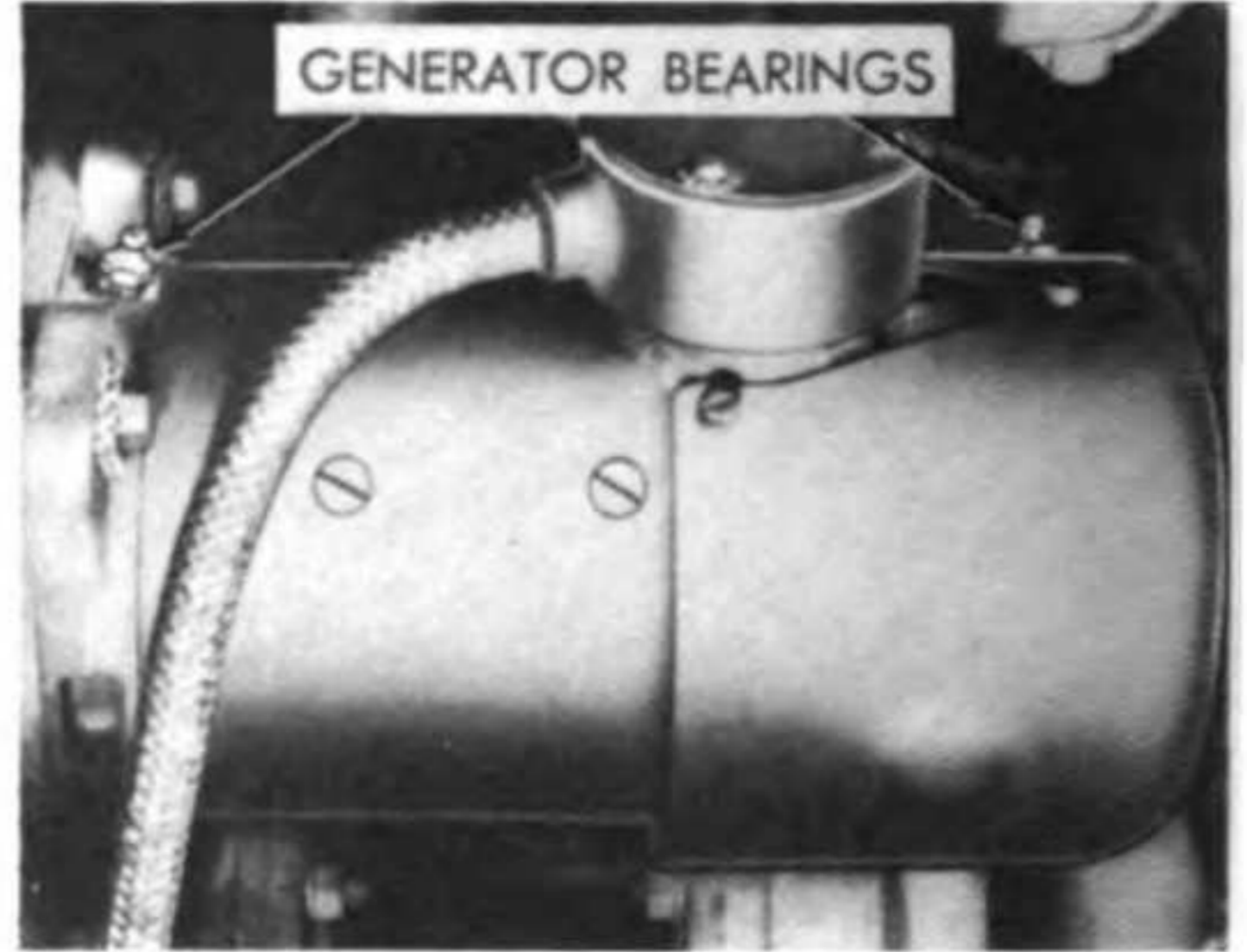


Ref. 24: Lubricate sliding collar, release bearing and yoke screw bushings through fittings. To reach fittings, turn collar until fittings appear.

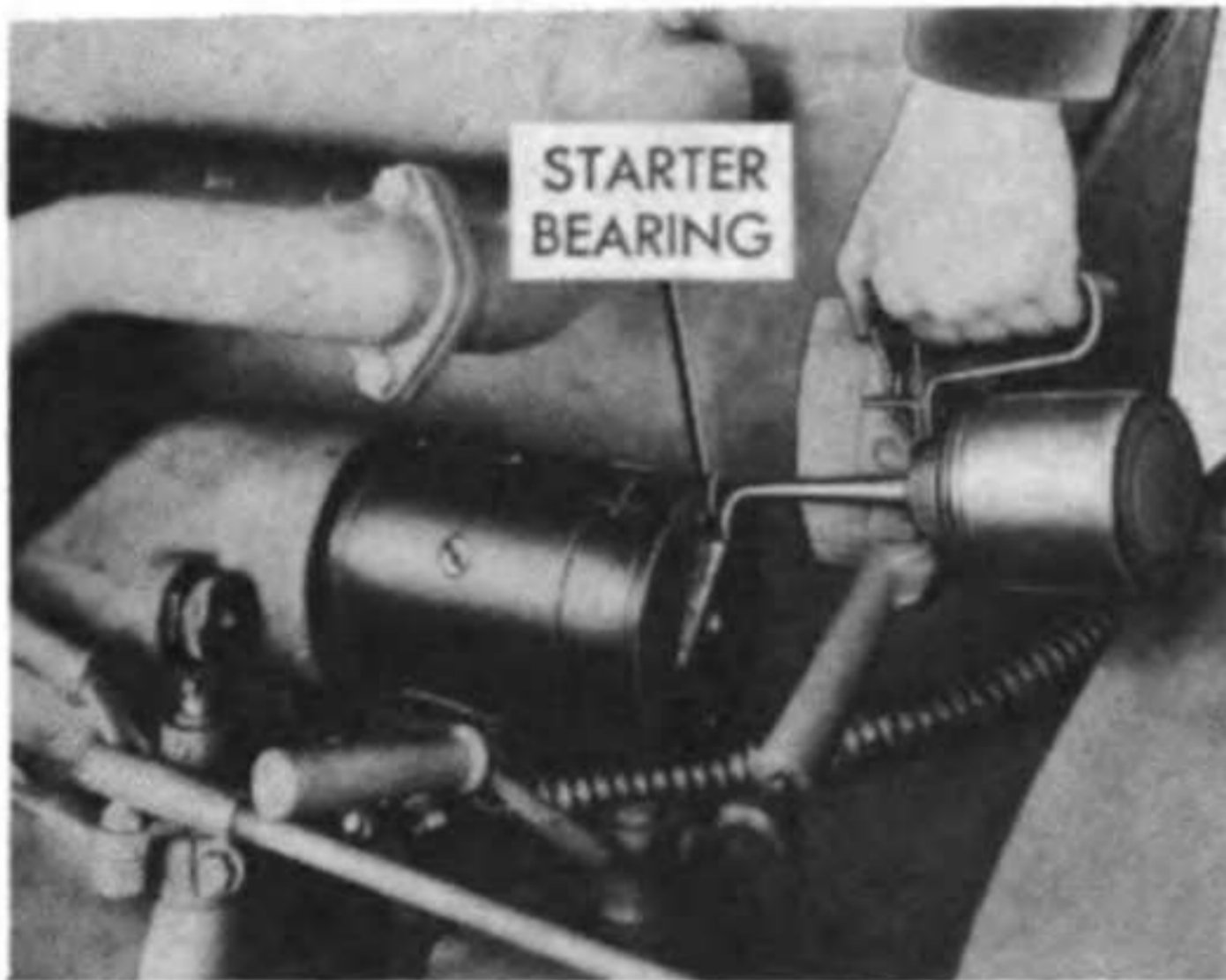
Figure 35. Lubrication order—Continued.



Ref. 25: Lubricate sparingly every week. Excessive lubricant applied in the coupling may work out onto the fan belt and pulley causing slippage.



Ref. 26: Lubricate sparingly every 2 weeks. When equipped with Life-Seal bearings or oil-impregnated bushings, no lubrication required.



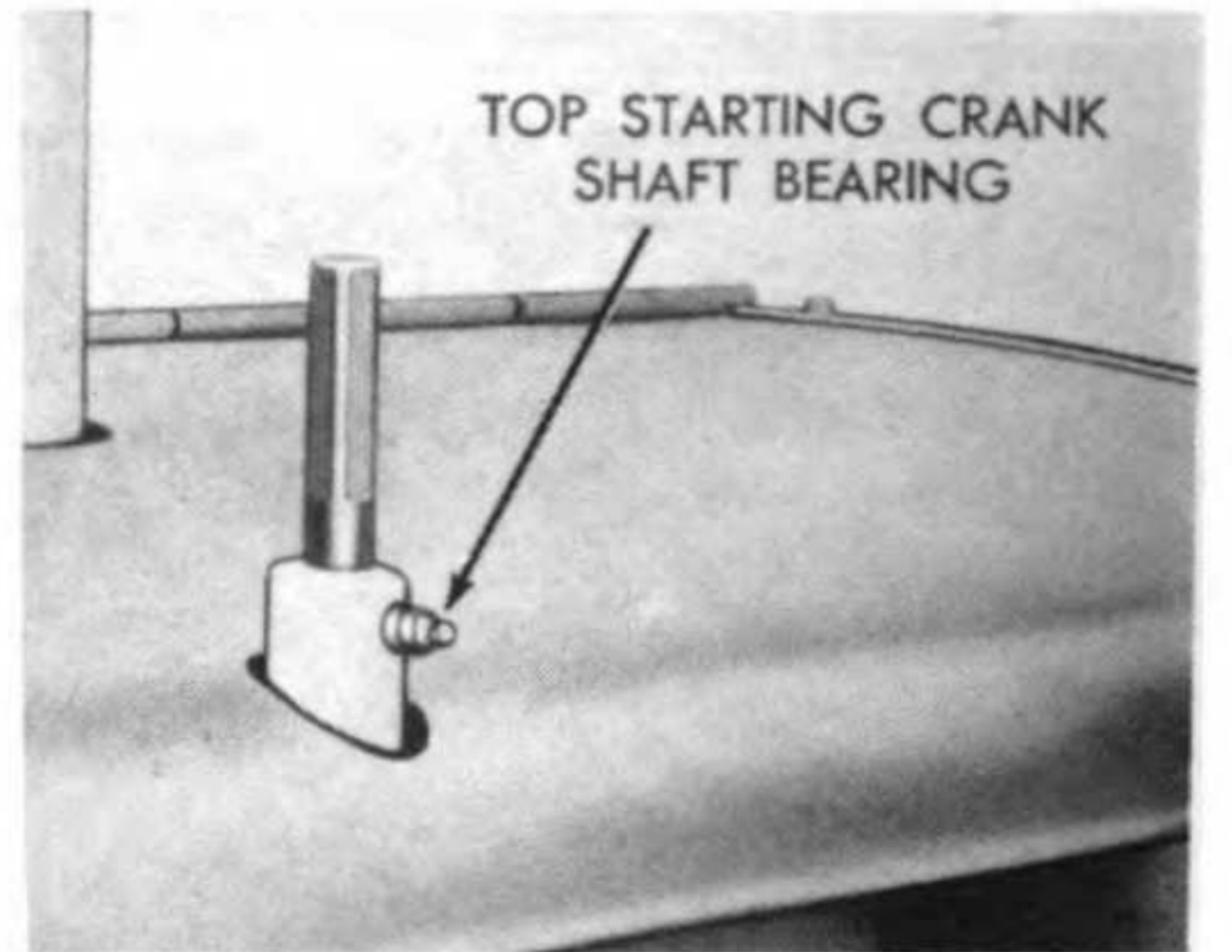
Ref. 27: Lubricate bearings with two or three drops of oil every month unless equipped with Life-Seal bearings or oil-impregnated bushings, in which case no lubrication is required.



Ref. 28: Lubricate bearings every 2 weeks. The engine front support on tractors after 2U4919 requires no lubrication.

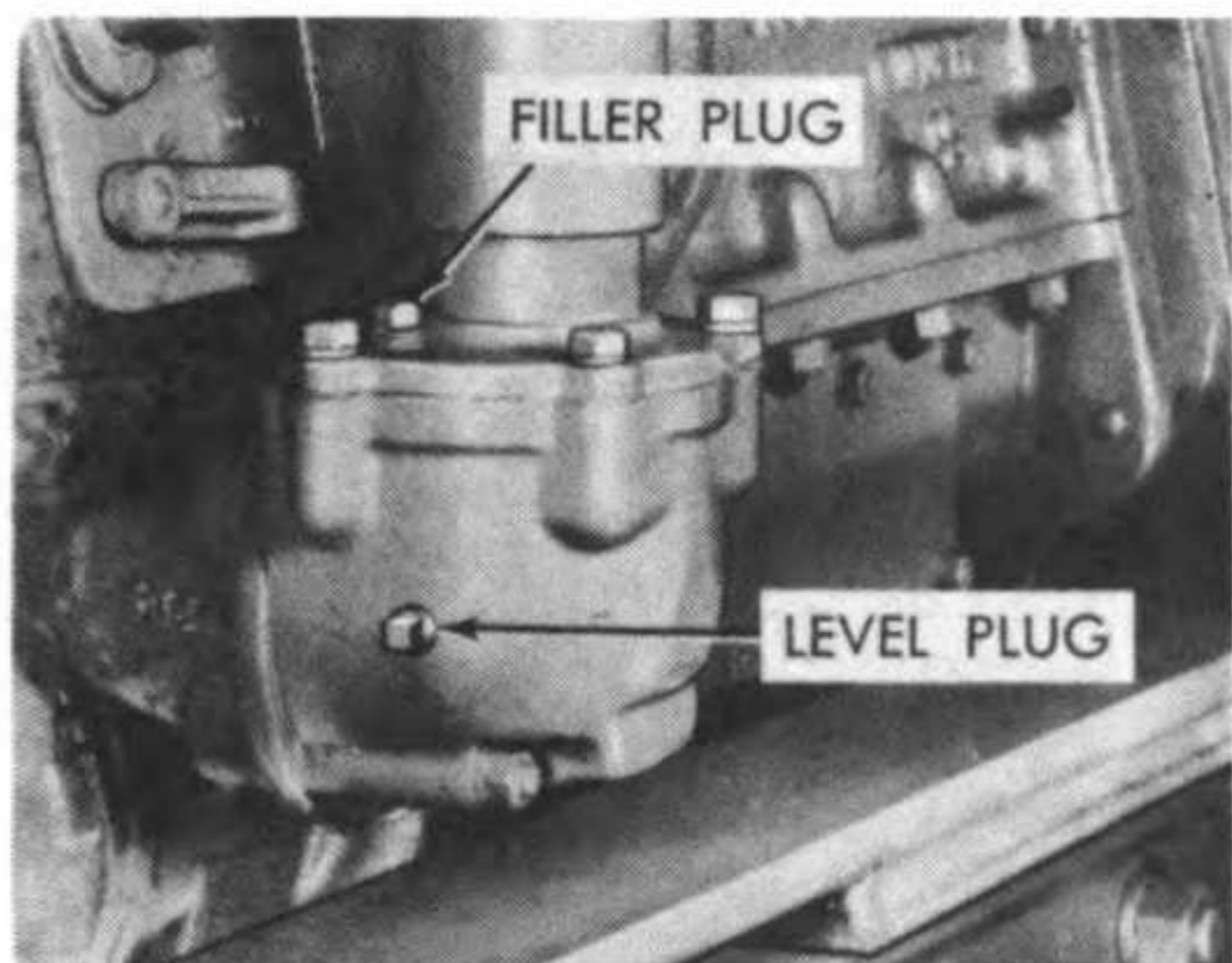


Ref. 29: Clean and refill oil reservoir to level mark daily. Every week remove, disassemble, and clean.

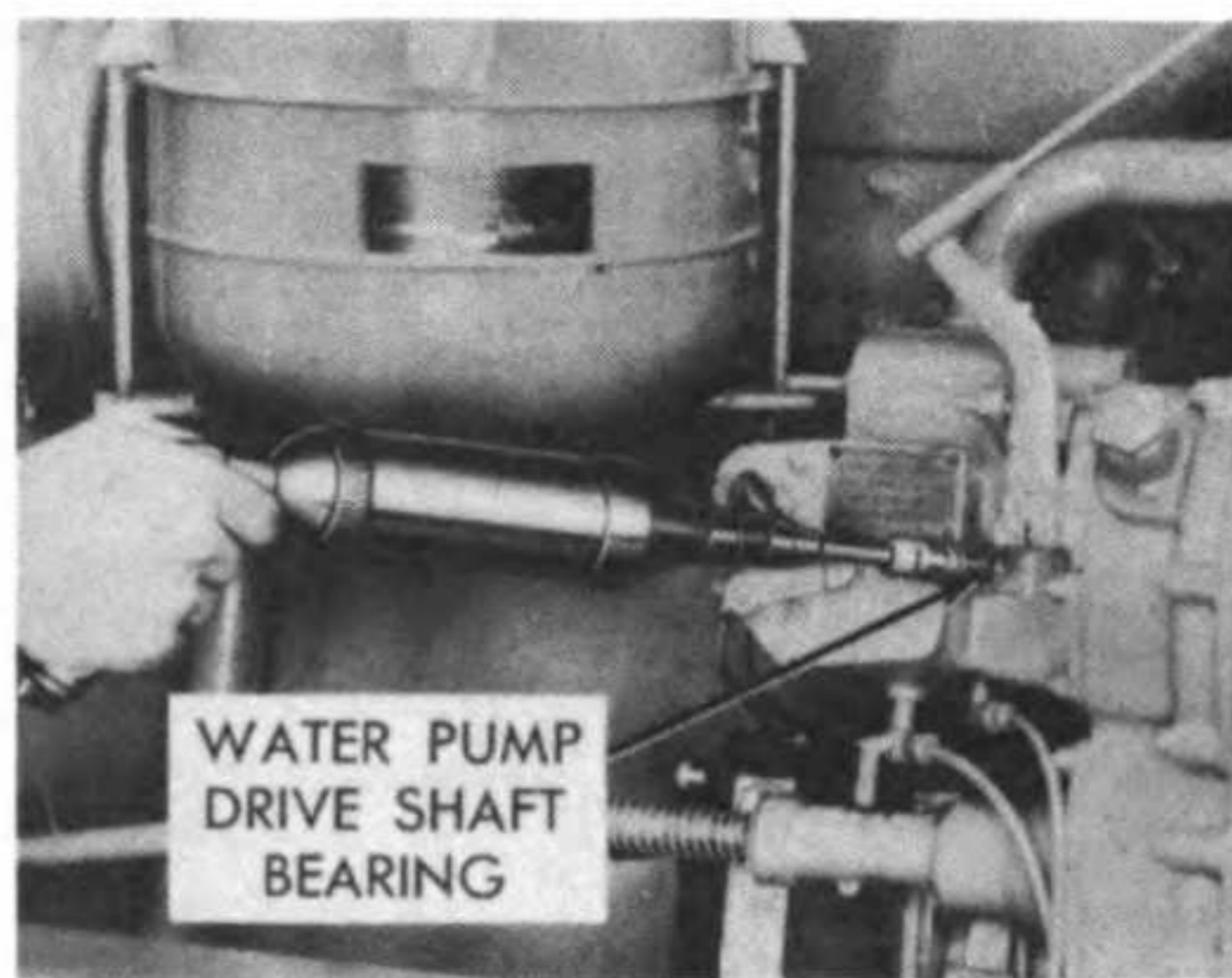


Ref. 30: On tractors effective with 2U9662 lubricate sparingly every week. Top starting crank on tractors before 2U9662 is special equipment.

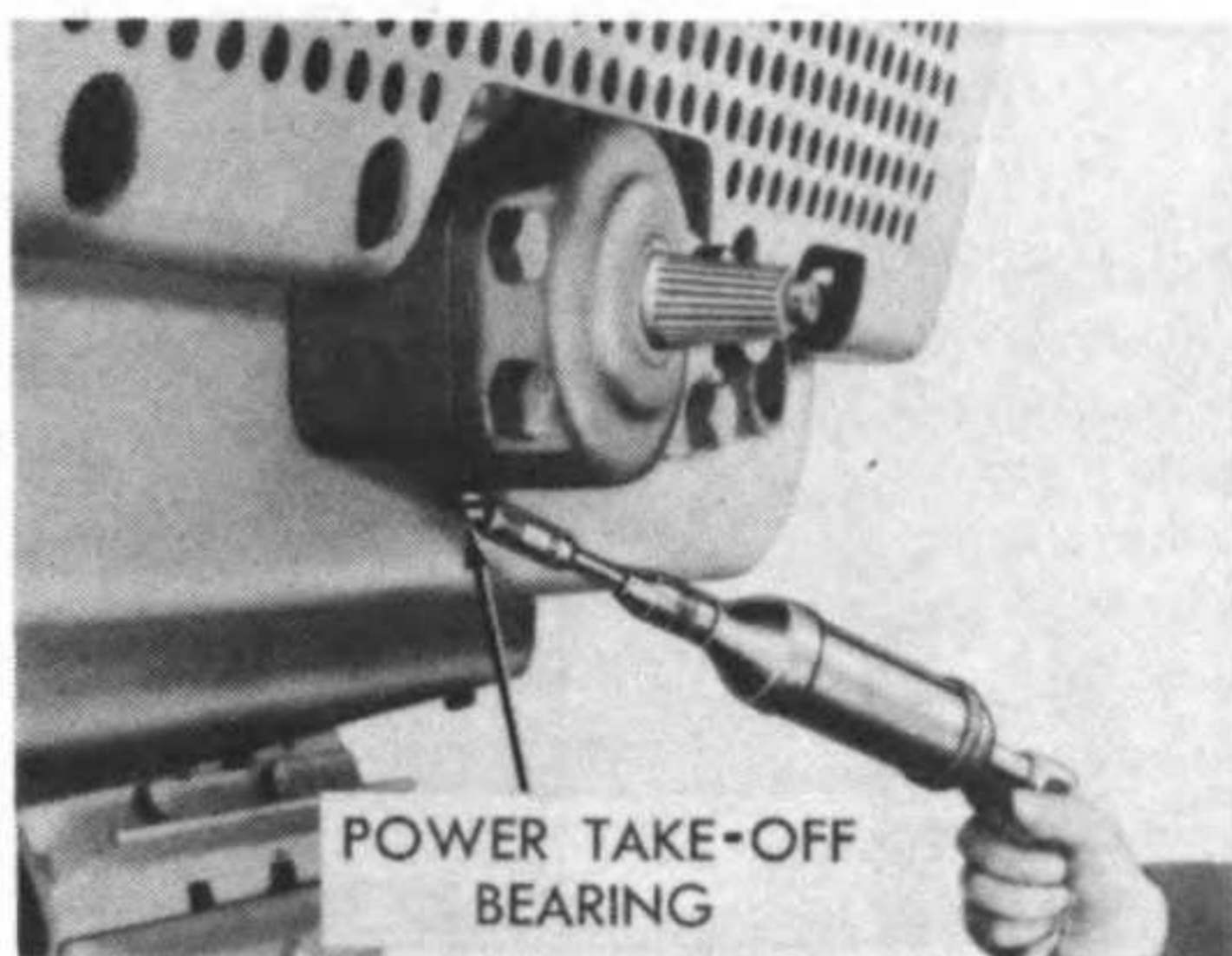
Figure 35. Lubrication order—Continued.



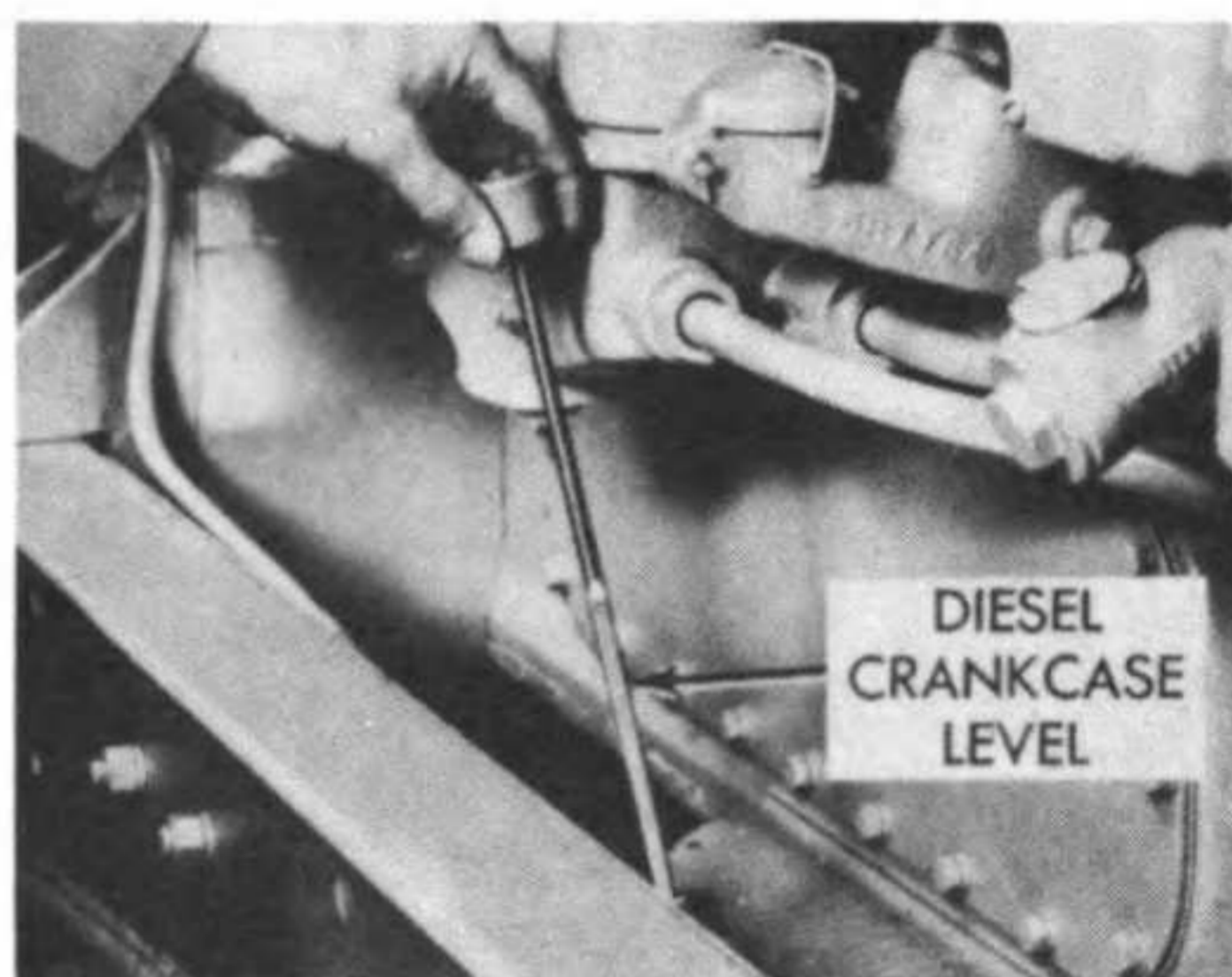
Ref. 31: On tractors effective with 2U9662 check lubricant level at level plug opening every week. Keep level to plug opening by adding lubricant through filler. Drain and refill quarterly. The top starting crank on tractors before 2U9662 is special equipment.



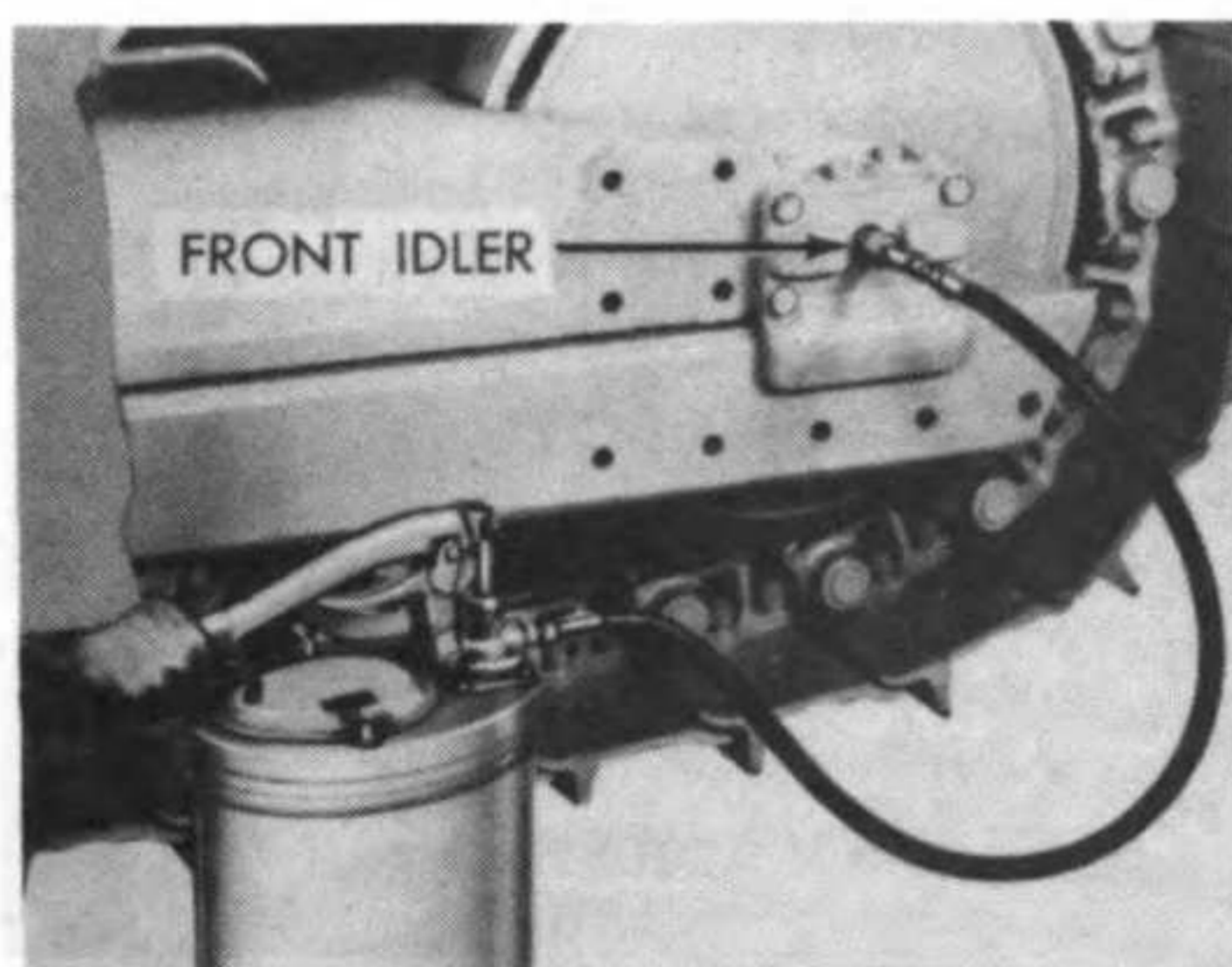
Ref. 32: Lubricate bearing every 2 weeks.



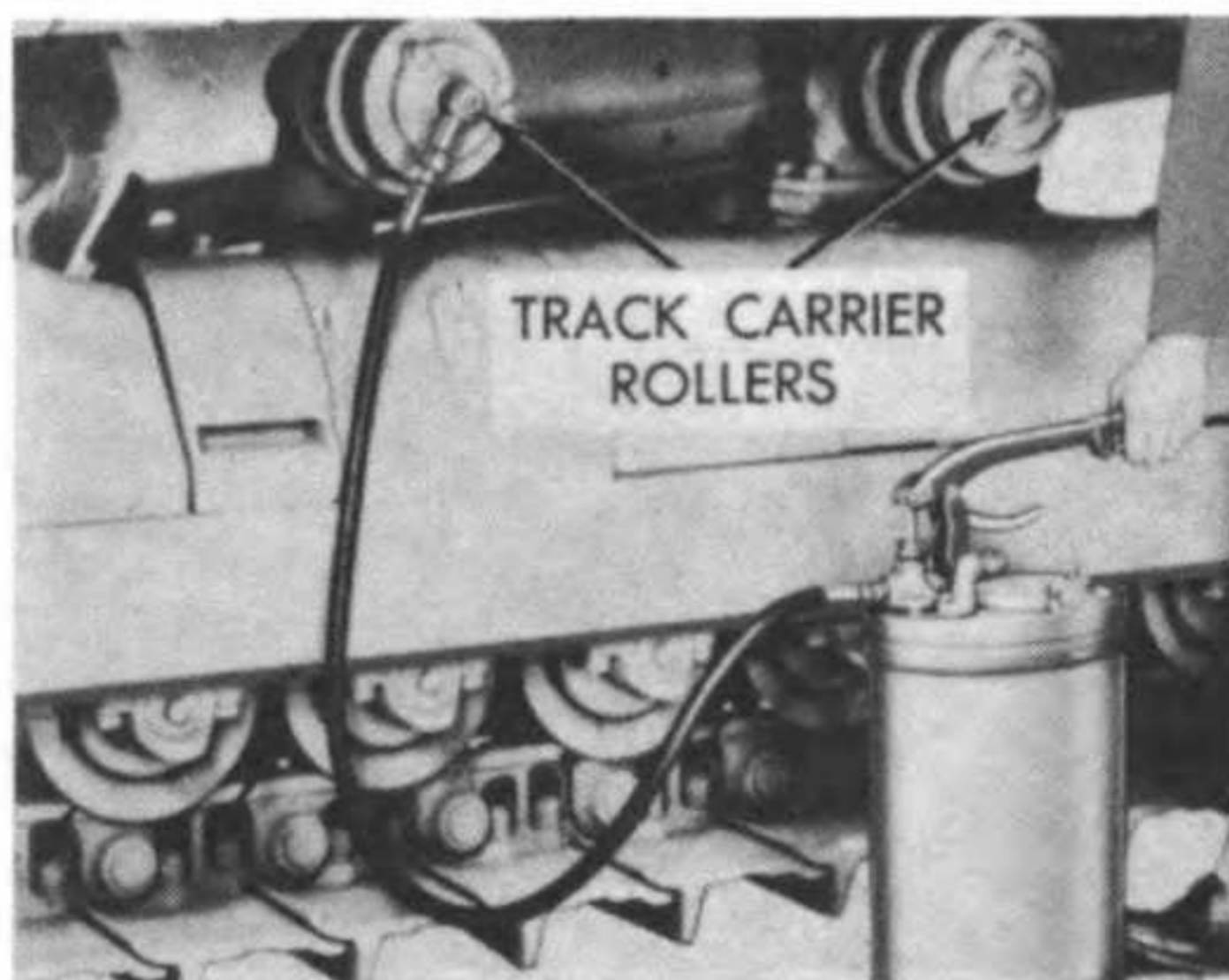
Ref. 33: Lubricate weekly. Do not over lubricate. Excess lubricant may work out on belts resulting in slippage.



Ref. 34: Check oil level daily and with engine running. Oil should be up to full mark on gage.

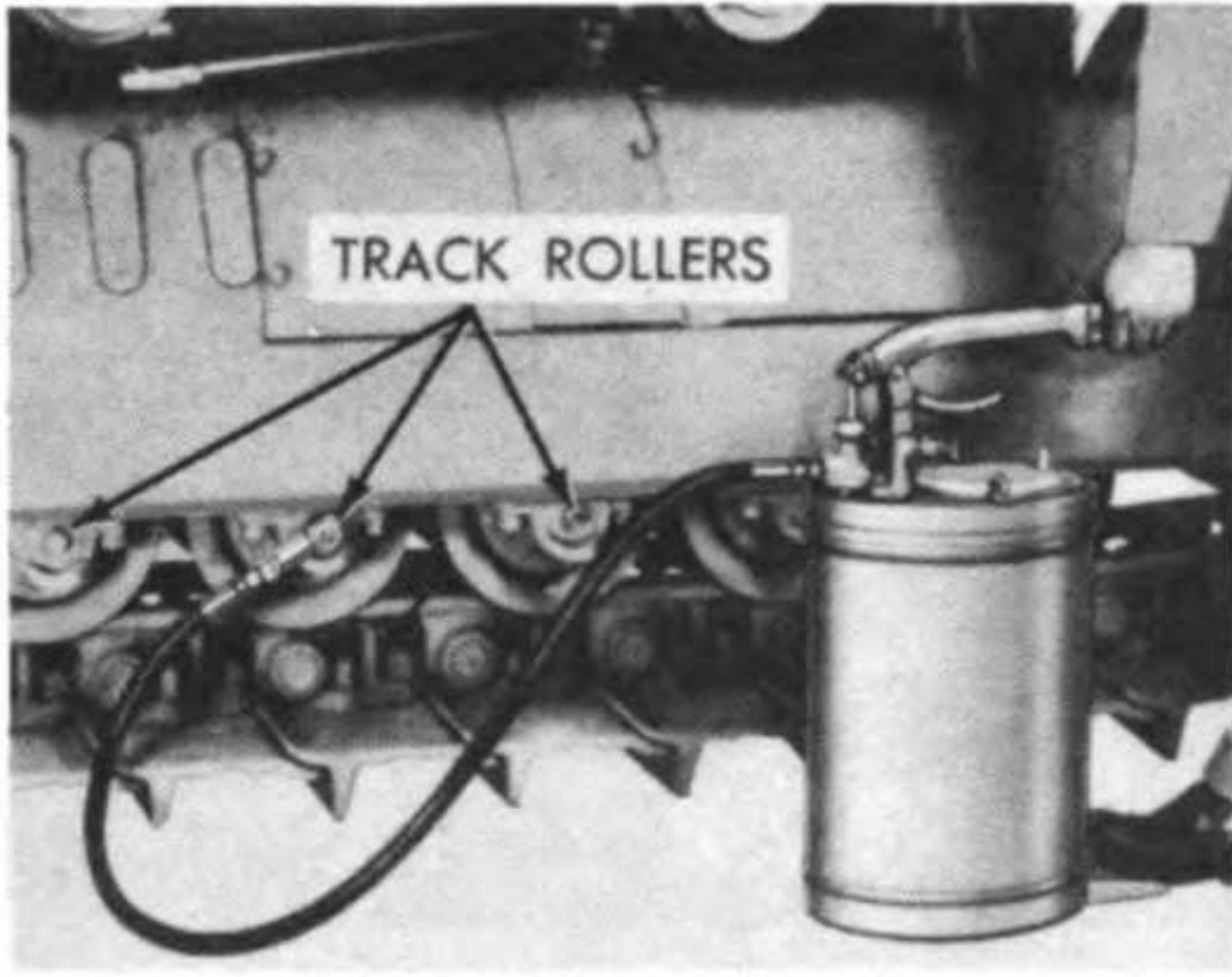


Ref. 35: Lubricate through fittings on both sides of tractor every week. If operating in deep mud or water, lubricate every one-half day.

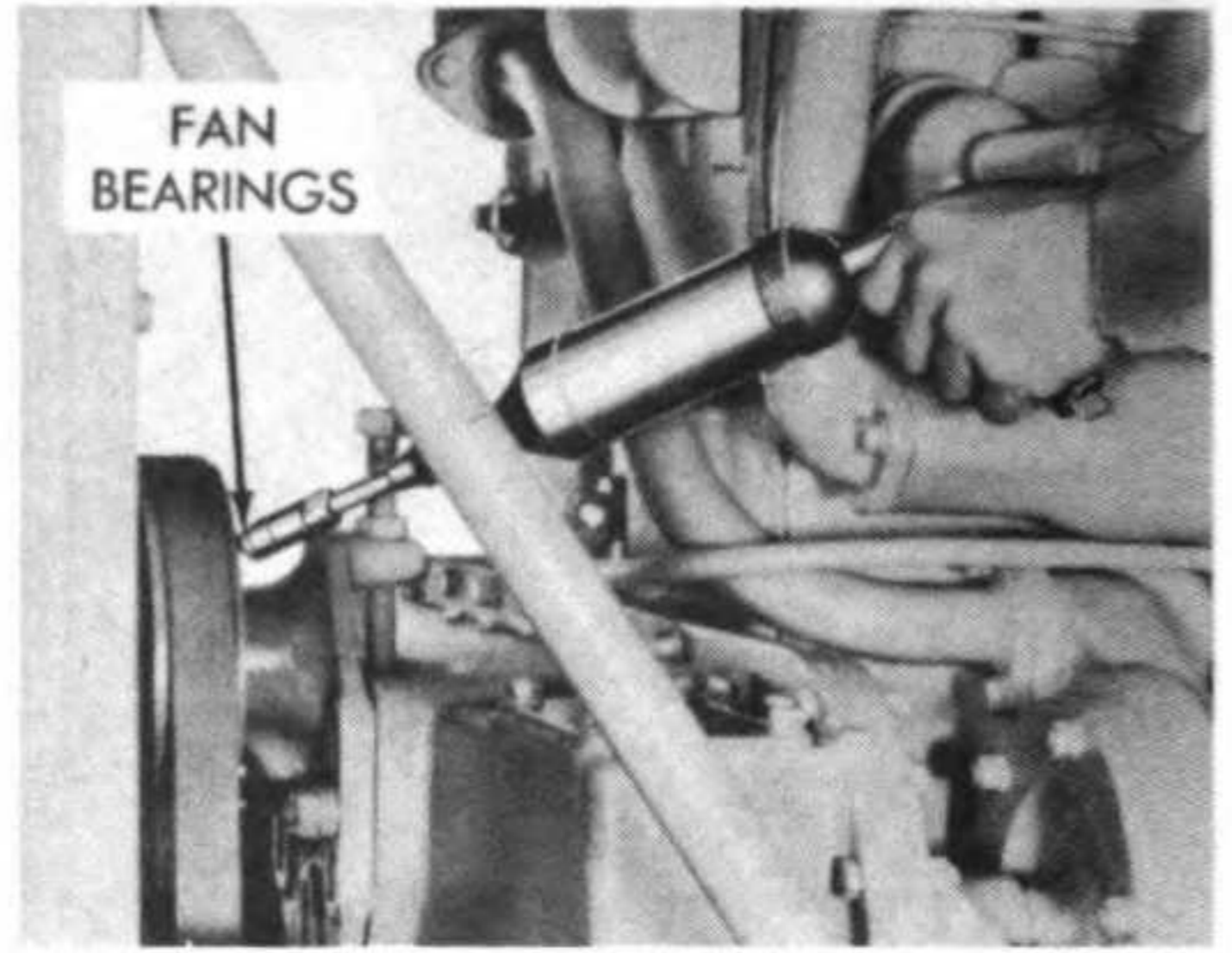


Ref. 36: Lubricate rollers on both sides of tractor every week. If operating in deep mud or water lubricate every one-half day.

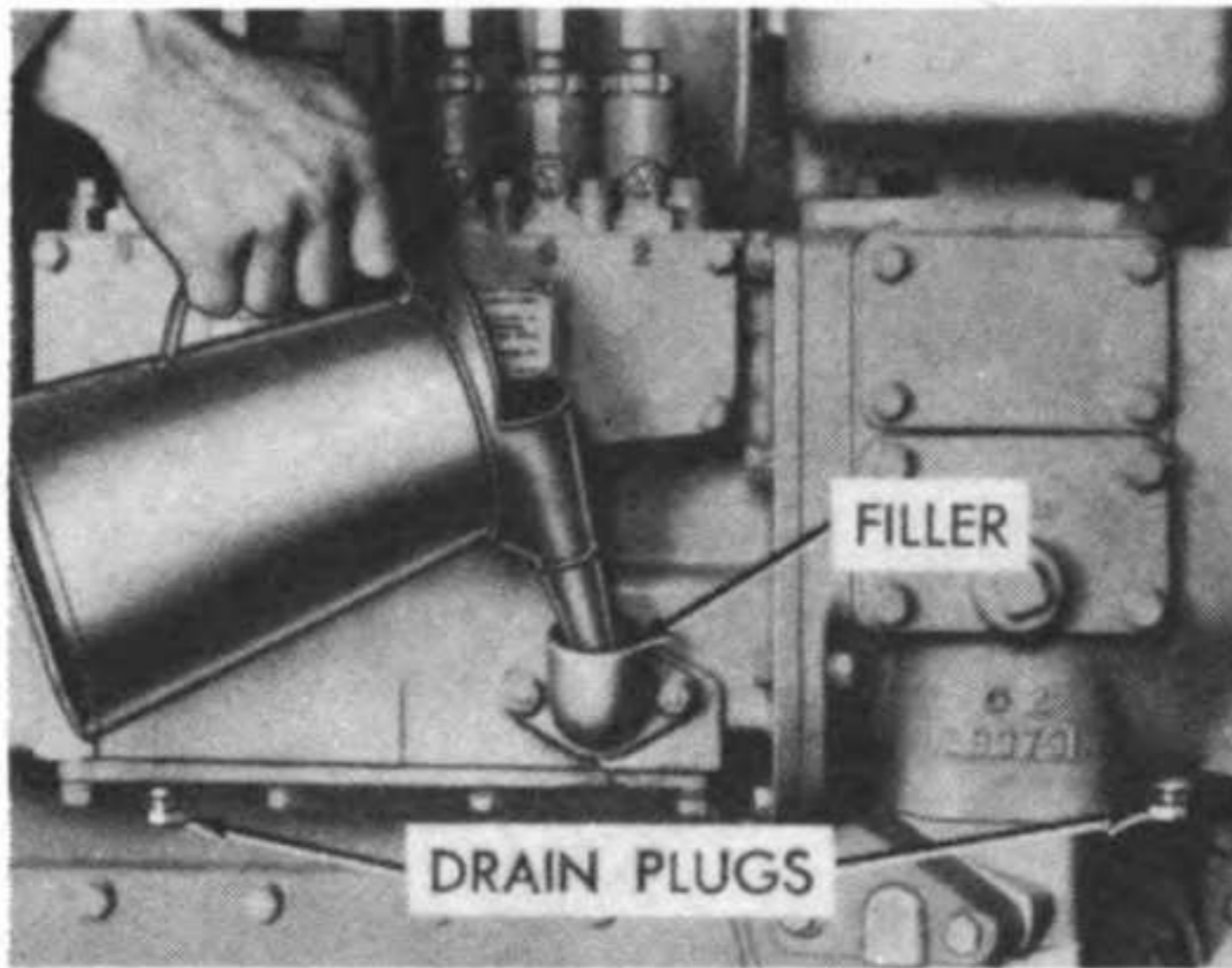
Figure 35. Lubrication order—Continued.



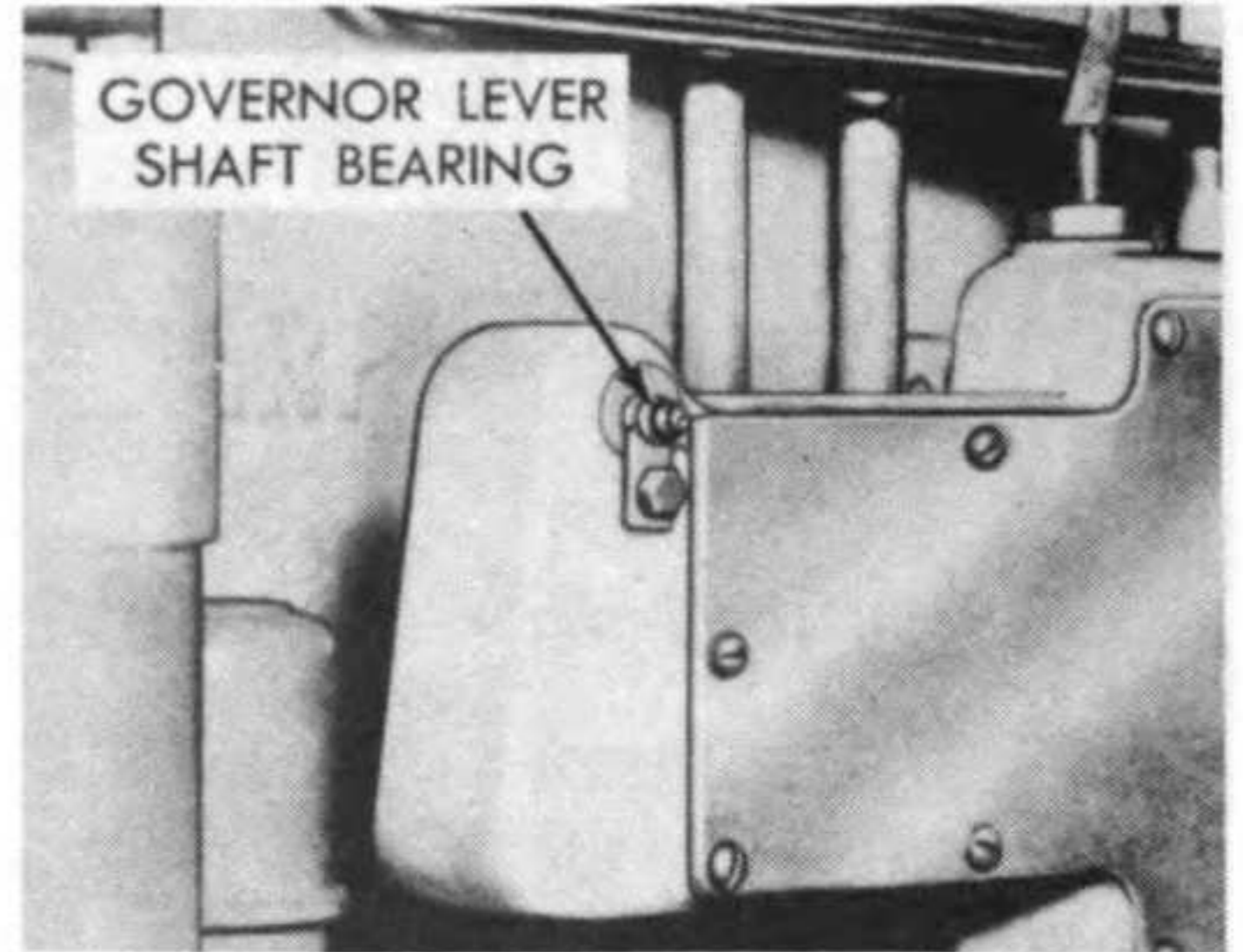
Ref. 37: Lubricate each roller on both sides of tractor every week. If operating in deep mud or water, lubricate every one-half day.



Ref. 38: Lubricate monthly. No lubricant required on early models with gear-driven fan.



Ref. 39: Check level daily and maintain level to filler elbow. Drain and refill every 2 weeks.



Ref. 40: Effective with 2U5434, lubricate the slide bar link lever shaft bearings sparingly once a month.



Ref. 41: Lubricate bearings sparingly every day. Turn clutch shaft until fitting appears.

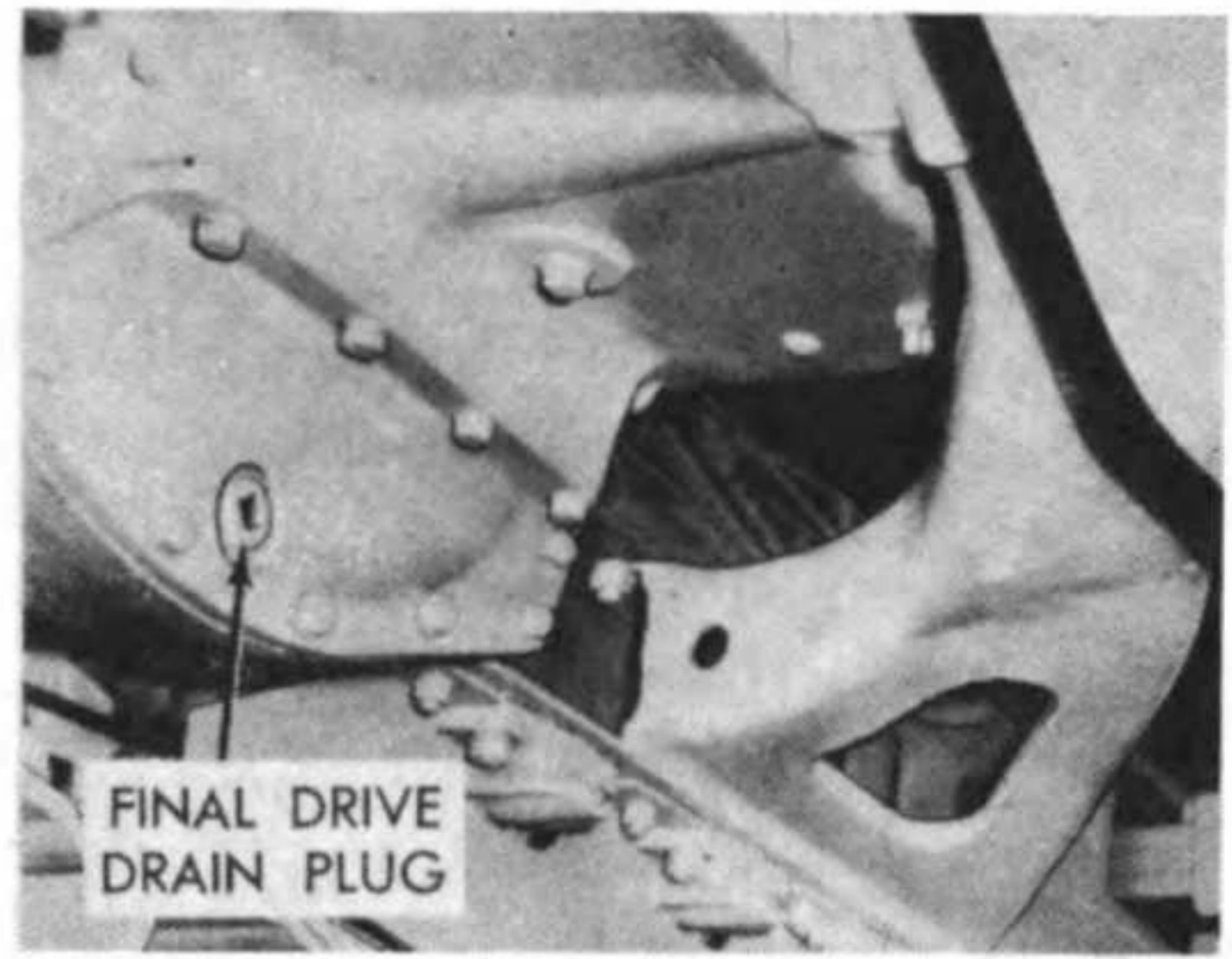


Ref. 42: When equipped with fittings, lubricate monthly. Remove plates on both sides of tractor to make fittings accessible.

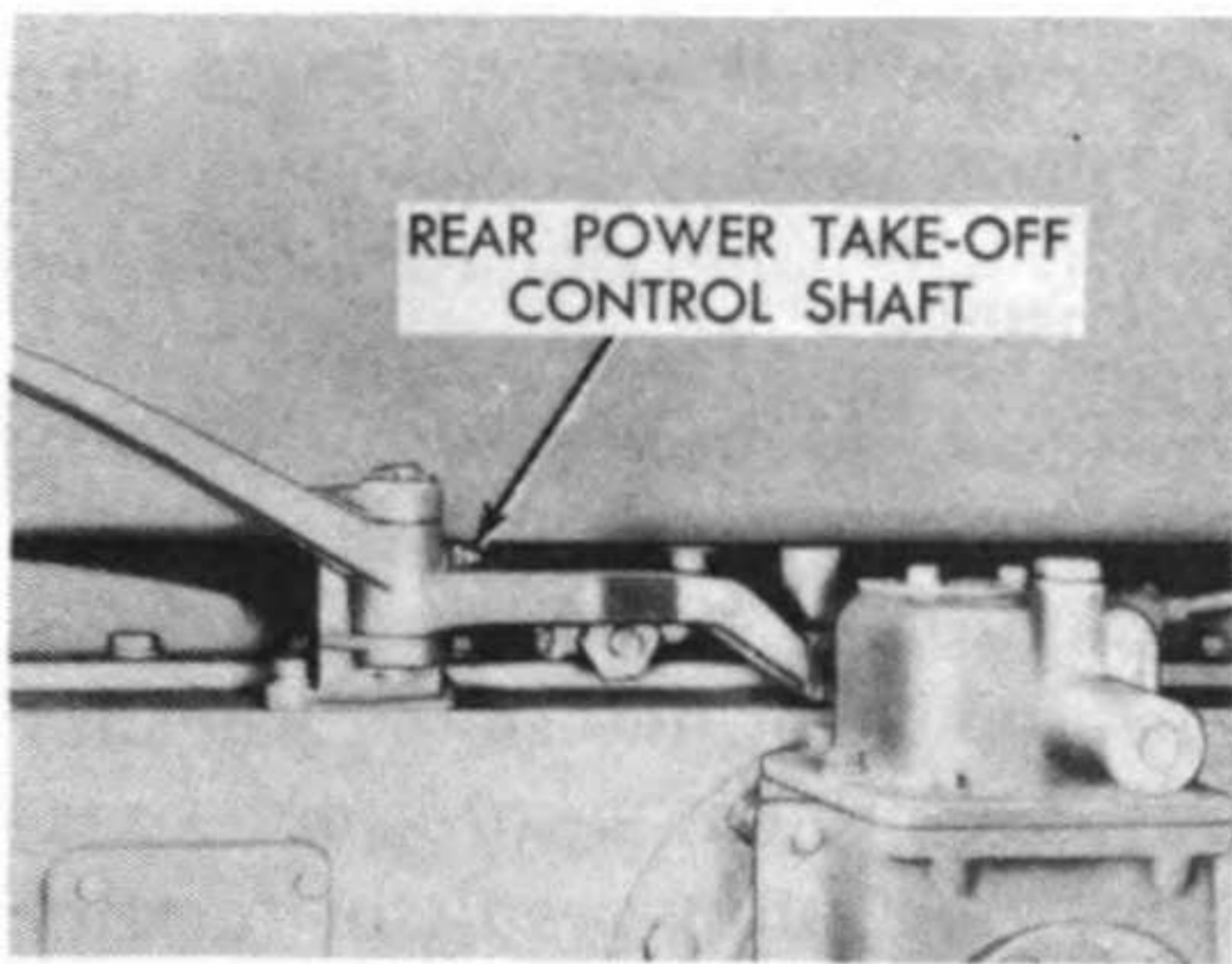
Figure 35. Lubrication order—Continued.



Ref. 43: Check oil level by removing two filler plugs, one for each side, every week. Keep lubricant to level of filler openings.



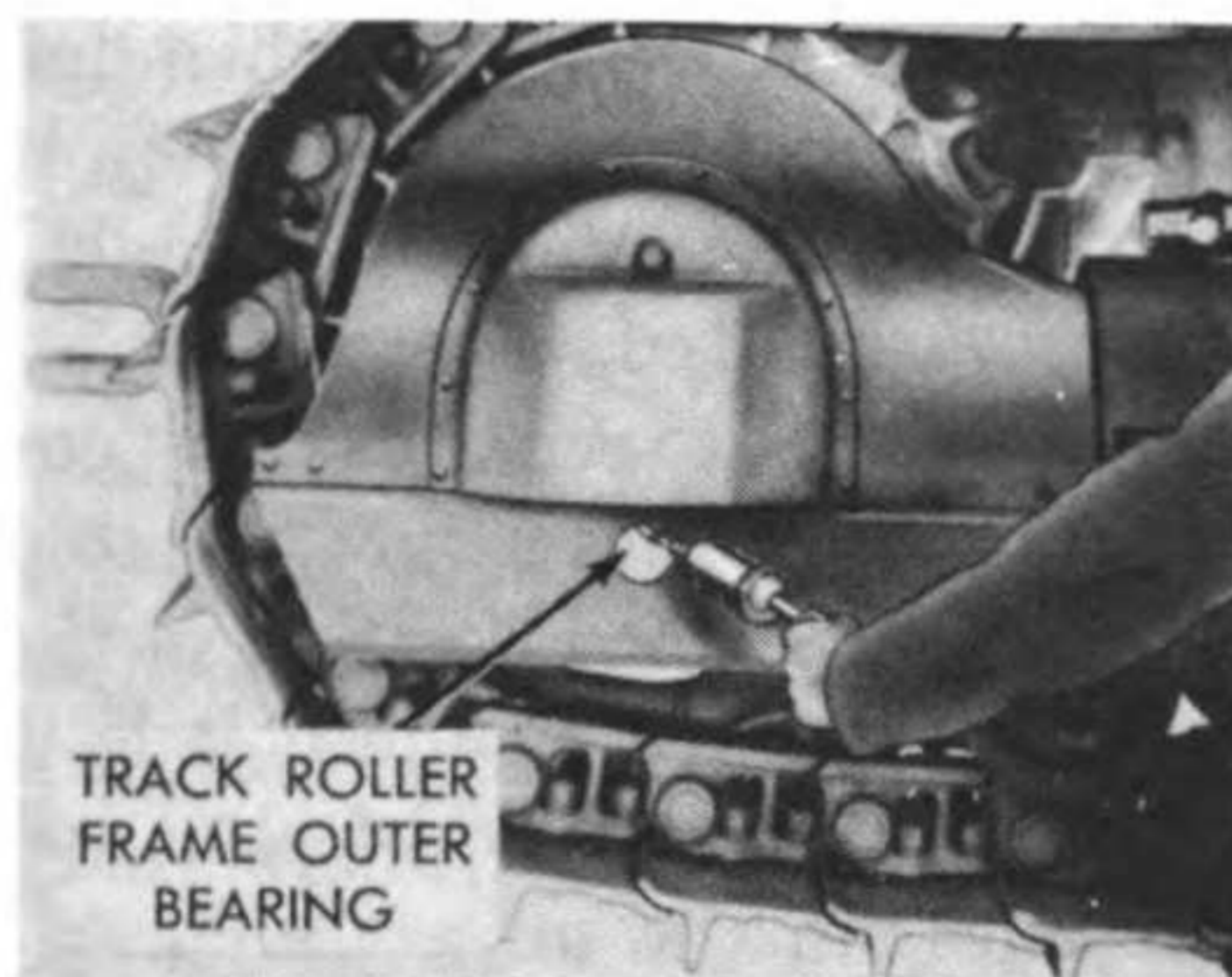
Ref. 44: Drain compartment, wash and refill quarterly.



Ref. 45: Lubricate bearing weekly.



Ref. 46: Lubricate bearing weekly.



Ref. 47: Every two days lubricate two bearings, one fitting on each side of the tractor. When operating in deep mud or water, lubricate every one-half day.

Figure 35. Lubrication order—Continued.

47. Painting

a. The tractor should be repainted whenever the existing paint shows signs of wearing off, cracking, peeling or deteriorating in any way.

b. Before starting to paint make sure that all machined surfaces, lubrication fittings, breather caps and vents, identification plates, wires and other electrical parts are protected with masking tape.

c. Paint all exposed surfaces of chassis, hood, radiator guard, gas tank, instrument panel and external controls.

d. Additional information on painting is contained in TM 9-2851.

Section III. PREVENTIVE MAINTENANCE SERVICES

48. General Information

The operator of this tractor and the organizational maintenance personnel must perform their preventive maintenance services regularly to make sure the tractor operates well and to lessen the chances of mechanical failure.

49. Operator, Driver, or Crew Maintenance

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

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

b. Reporting Deficiencies. Operator will report all deficiencies on DD Form 110.

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

- (1) *Fuel.* Check fuel supply. See that fuel tanks are full. Check reserve supply of fuel and replenish if necessary. Check fuel filters, clean and drain if necessary (par. 78).
- (2) *Oil.* Check oil level in engine crankcase. See that oil is at proper level. Check reserve supply of lubricants and replenish if necessary.
- (3) *Water.* Check radiator to see that coolant is up to proper level. Add coolant if necessary. When filling cold radiator containing antifreeze, allow room for expansion.
- (4) *Tampering and damage.* Check for tampering or damage that may have occurred since unit was last operated.
- (5) *Fire extinguisher.* See that extinguisher is in good condition, fully charged, and securely mounted.
- (6) *Accessories.* See that accessories are properly mounted and in good operating condition, and that all connections are tight.
- (7) *Leaks, general.* Check entire unit for leaks, paying particular attention to fuel and coolant lines and connections, and for signs of leaks under machine. Correct or report any leaks. Check affected levels and refill as necessary.
- (8) *Engine warmup (starting and diesel engines).* Before cranking the starting engine, see that clutch is disengaged. After engine is started, let it warm up at fast idling speed. Place tractor gear-selector lever in neutral position and disengage master clutch. Place forward-and-reverse lever in neutral position. After starting engine has warmed up, start diesel engine and let it run at half-throttle for 5 minutes and at full governed speed for an additional 5 minutes before applying load (par. 32). Engage master clutch and disengage starting-engine as soon as diesel engine is started.
- (9) *Choke (starting engine).* Use choke when starting cold engine. As soon as engine starts, adjust choke so engine runs normally. When engine is thoroughly warm, see that choke is fully open. Refer to paragraph 36.
- (10) *Instruments.* Check all gages for proper operation. At normal operating speed and temperature, gages should read as follows: engine oil pressure, in OPERATING range; fuel pressure, in NORMAL range; coolant temperature, 175° to 185° F.

- (11) *Lamps.* Check lamps and switches for condition, secure mounting, and proper operation.
- (12) *Tracks.* Check tracks and sprockets for obstructions which may prevent them from turning freely. Use caution when starting tractor if there is any indication that tracks are frozen to the ground or that dirt is frozen on tracks or sprockets.
- (13) *Lubrication.* Lubricate as indicated in lubrication order 5-3040-B.
- (14) *Tools and equipment.* See that tools and equipment assigned to the tractor are serviceable, clean, and properly stowed or mounted.
- (15) *Engine operation.* Check engine for normal operation. If any unusual sounds or other deficiencies are noticed, see that the unsatisfactory conditions are corrected.
- (16) *Steering linkage.* Inspect the steering levers and steering linkage for loose or bent parts. Apply both steering levers and observe whether they meet resistance after moving through approximately 3 inches of free movement. Check to see that the steering clutch brake pedals operate and that the pedal locking device holds properly. Check for broken support screens.
- (17) *Towing connections.* See that the drawbar is in good condition. Be sure mountings and locking devices are secure; report any damage or deficiency that may have occurred.
- (18) *Operator's publications.* Operator must have the required operator's permit in his possession. See that Standard Form 91 (Operator's Report of Motor Vehicle Accident), LO 5-3040-B, and this technical manual are on the equipment. See that all forms, manuals, and other publications are legible and safely stowed.
- (19) *Visual inspection.* Make a general check of entire unit for cracks, breaks, and loose or missing bolts and nuts. Before beginning operation see that parking brake is in released position. Remove all dirt, grease, oil, and other debris from engine.

d. During-Operation Services. The operator is responsible for correcting or reporting unusual sounds and odors, deficiencies in performance, or other signs of abnormal operation.

- (1) *Instruments (gages).* Check all gage readings frequently. If oil-pressure indicator shows an unusual drop or no pressure, or if coolant temperature gage shows overheating, stop engine immediately and report the irregularity to proper authority. Do not operate until failure is corrected.

- (2) *Abnormal operation and noises.* Check for any abnormal noise, paying particular attention to the gear cases. If any abnormal noise is heard, stop machine immediately. Check for any abnormal operation, such as brakes grabbing, falling to hold, or not releasing properly. If brakes seem to drag for a few seconds after being applied normally, apply brakes several times while backing the unit. If clutch slips, stop operation and report deficiency to the proper authority.
- (3) *Clutches.* Check master and steering clutches for improper operation, such as grabbing, chattering, slipping, and failing to release fully. Check operation of master clutch brake. If transmission gears cannot be shifted without clashing, it indicates that clutch brake is not holding or that master clutch is not fully releasing.
- (4) *Running gear.* Check for any unusual noise from tracks, sprockets, rollers, and idlers. Correct or report any deficiencies.
- (5) *Transmission.* Check for unusual gear noise during operation. See whether transmission gear-selector lever operates freely and stays in selected position. Report any deficiencies.
- (6) *Engine.* Check engine for unusual noise, lack of power, and response to controls.

e. At-Halt Services. During halts, even for short periods, the operator should make a general check of the equipment and correct or report all deficiencies. In addition he should perform the following specific duties:

- (1) *Fuel.* Check fuel supply. Add fuel if necessary.
- (2) *Oil.* Check oil level in engine crankcase. Add oil if necessary.
- (3) *Water.* Check coolant level in radiator. Add coolant if necessary. If engine overheats because of lack of coolant, either allow it to cool before filling radiator, or run engine at fast idling speed and slowly fill radiator.
- (4) *Shutdown precautions.* When the tractor is stopped but the engine is to be left running, move throttle-control to idling position and transmission gears to neutral position. Engage master clutch. Always allow engine to idle a few minutes at half throttle before stopping. To stop engine, move throttle lever to STOP position and compression-release lever to START position. Leave the main fuel-tank valve open. After the engine stops, shift compression-release lever to RUN position so valves will be closed.
- (5) *Lubrication.* Lubricate as indicated in lubrication order 5-3040-B.
- (6) *Temperatures.* Check idlers and upper- and lower-track rollers for excessive heat which may indicate insufficient lubrication.

- (7) *Accessories and belts.* See that fan, water pump, and generator are securely mounted and that all their drive belts are in correct adjustment and not damaged.
- (8) *Air cleaner.* If operating under extremely dusty conditions, inspect the air cleaner and service as required.
- (9) *Leaks, general.* Check entire unit for leaks, paying particular attention to fuel, oil, and water lines and connections. Correct or report all leaks.
- (10) *Visual inspection.* Make a general check of the unit for bent, cracked, or broken parts and loose or missing bolts and nuts. Check for any signs of overheated clutch, brakes, and bearings. If operating under extremely dusty conditions inspect the air cleaner and service in accordance with lubrication order 5-3040-B.

f. After-Operation Services. To make sure that the machine is ready to operate at any time, the following services must be performed by the operator or crew immediately after each operating period of 8 hours or less. Correct any deficiency or report the condition to the proper authority.

- (1) *Shutdown precautions.* Move machine to an area where there is the least danger of its being damaged. Park it on firm ground; use planking or other suitable material if necessary. Set parking brake after stopping engine.
- (2) *Fuel, oil, and water.* Fill fuel tank with clean fuel. Check oil level in transmission, final drive system, and power-control gear case. Add oil if necessary. Check radiator. Proper coolant level is at or near overflow when engine is hot. Change coolant if it is contaminated with rust or dirt. If coolant is oily report the condition to the proper authority. If coolant contains antifreeze, check the freezing point. If antifreeze is added, mix the solution thoroughly by running engine.
- (3) *Engine operation.* Correct or report unusual noises, insecure mountings, or performance irregularities noted during operation.
- (4) *Instruments.* Check all instruments to see that they are securely mounted, properly connected, and in good condition.
- (5) *Lamps and reflectors.* See that lamps are clean, securely mounted, and in good operating condition.
- (6) *Electrical wiring.* Check all wiring for breaks, for loose or corroded connections, and for worn, cracked, frayed, or oil-soaked insulation.
- (7) *Air cleaners.* Check oil and fill bowl to proper level. If oil is dirty, clean and refill bowl as specified in lubrication order 5-3040-B. Clean precleaner jar. Reassemble cleaner and see that all connections are tight.

- (8) *Fuel filter (starting engine)*. Remove and clean sediment bowl if it contains water or dirt. See that gasket is in good condition before replacing bowl. Check fuel line screen.
- (9) *Fire extinguisher*. See that extinguisher is in good condition, fully charged, and securely mounted.
- (10) *Clean equipment*. Remove all dirt and excess oil or grease from exterior of tractor and from operator's compartment. If freezing temperature is expected, insure that frozen material does not interfere with the movement of any part of the machine.
- (11) *Tools and equipment*. See that all tools and equipment assigned to the engine are serviceable, clean, and properly stowed or mounted.
- (12) *Lights*. Check to see if lights operate properly. Check condition and mounting of all lamps. See that the lamps are clean.
- (13) *Lubrication*. Refer to lubrication order.
- (14) *Visual inspection*. Check for leaks, excessively worn or damaged parts, and loose or missing bolts, nuts, and pins. See that the battery is securely mounted and that connections and caps are clean and tight. Check for fuel and oil leaks, and for worn or defective fan belt.
- (15) *Protection*. Cover exhaust pipes if tractor is stored outdoors. See that tool-compartment lid is closed and fastened.

50. Maintenance and Safety Precautions

- a. Correct or report any mechanical deficiencies that may result in damage to the machine if operation is continued.
- b. Always stop the engine before making repairs or adjustments on any part of the unit.
- c. Avoid operating at excessive speed over rough roads, down steep grades, or where vision is limited.
- d. Keep machine in gear and leave clutch engaged when traveling downgrade.
- e. After starting the engine, allow it to warm up at fast idling speed before applying load.
- f. Always return choke button to closed position after engine is warmed up.
- g. Always engage clutches carefully. Sudden engagements cause undue strain on tractor.
- h. Make sure that fuel and oil containers are clean.
- i. Always provide a metallic contact between container and tank when adding gasoline.
- j. Always run engine at idling speed for a few minutes before stopping.
- k. Be sure brakes are in good working order.

51. Organizational Maintenance

a. Organizational preventive maintenance services are performed by organizational maintenance personnel, with the assistance of the operator, at monthly and weekly intervals. The weekly interval will cover about 60 hours of use and the monthly interval will be equivalent to 4 weeks of use. The technical inspection column is provided for the information and guidance of personnel performing technical inspections, and constitutes the minimum inspection requirements for the equipment.

b. The preventive maintenance services to be performed at these regular intervals are listed and described below. The numbers appearing in the columns opposite each service refer to a corresponding number appearing on "Work Sheet for Engineer Equipment, Form 464" and indicate that a report of the service should be made at that particular number on Form 464. These numbers appear in either second, third, or both columns as an indication of the interval at which the service is to be performed.

| Techni- cal in- spection | Service | | |
|--------------------------------|---------|--------|--|
| | Monthly | Weekly | |
| 1 | 1 | 1 | <i>Before-operation services.</i> Check and perform services listed in the daily before-operation services (par. 49c). |
| 2 | 2 | 2 | <i>Lubrication.</i> Inspect entire unit for missing or damaged lubrication fittings and grease cups and for indications of insufficient lubrication. |
| | 2 | 2 | Lubricate if necessary. Refer to Lubrication Order 5-3040-B. Replace missing or damaged fittings. |
| 3 | 3 | 3 | <i>Tools and equipment.</i> Inspect condition of all tools and equipment assigned to the unit. Check condition of tool boxes or compartments. |
| | 3 | 3 | See that all tools and equipment assigned to the unit are clean, serviceable, and properly stowed or mounted. See that tool boxes or compartments are in good condition and that they close and fasten properly. |
| 4 | 4 | 4 | <i>Fire extinguisher.</i> Check condition of fire extinguisher and inspect for full charge, proper working order, and secure mounting. The amount of charge in the carbon tetrachloride type can be determined by shaking the extinguisher and judging by sound and weight whether it is full. The carbon dioxide type must be weighed to determine the state of charge. Empty and full weights are stamped on the valve body. |
| | 4 | 4 | See that any deficiencies are corrected or reported. |
| 5 | 5 | 5 | <i>Publications.</i> See that this technical manual, LO 5-3040-B, and Standard Form 91 are with the machine. |
| 6 | 6 | 6 | <i>Appearance.</i> Inspect the general appearance of the unit, paying special attention to cleanness, legibility of identification markings, and condition of paint. |

| Technical Inspection | Service | | |
|----------------------|---------|--------|---|
| | Monthly | Weekly | |
| 7 | 7 | 7 | <i>Modification.</i> See if all available modification work orders applying to this unit have been completed and are recorded on DA Form 478 (MWO and Major Unit Replacement Record and Organizational Equipment File). |
| 11 | 11 | 11 | <i>Cylinder head, manifold, and gaskets.</i> Inspect cylinder head, manifold, and exhaust pipe for leaks, loose mounting bolts, and defective gaskets. |
| | 11 | 11 | Tighten loose manifold- and exhaust-pipe mounting bolts and nuts. Replace any defective gaskets. On new or reconditioned engines, check all cylinder-head bolts for tightness at the first weekly servicing. The correct torque-wrench pull is 167 foot-pounds for $\frac{7}{8}$ -inch bolts and 58 foot-pounds for $\frac{5}{8}$ -inch bolts. |
| 12 | 12 | 12 | <i>Valve mechanism.</i> Check valve adjustment if excessive tappet noise or loss of power is noticed. Correct hot-valve clearance is 0.012 inch for both intake and exhaust valves. |
| | 12 | 12 | Adjust valve-tappet clearance if necessary (par. 69). Be sure that valve-cover gasket is in good condition and that cover fits securely (par. 69). |
| 14 | 14 | 14 | <i>Crankcase and breather.</i> Inspect crankcase for leaks. Check condition of breather. Check oil level. Inspect suction bell and screen. |
| | 14 | 14 | Correct or report any oil leaks. Change oil and clean breather if necessary. Refer to lubrication order 5-3040-B. |
| 15 | 15 | 15 | <i>Oil filter.</i> Inspect oil-filter assembly and connection for leaks while engine is running. |
| | 15 | 15 | Service oil filter as specified in lubrication order. After servicing filter, check it carefully for leaks while engine is running. |
| 16 | 16 | 16 | <i>Radiator and oil cooler.</i> Inspect radiator and oil cooler for leaks, obstructions in core air passages, and loose mounting bolts. Check all cooling-system hose for leaks, excessive deterioration, and loose connections. |
| | 16 | 16 | Check operating temperature and condition of coolant. If coolant temperature is not within the normal range during operation, thermostat may be defective. If coolant contains antifreeze check its freezing point. Flush and refill radiator if coolant is contaminated with rust or dirt. If coolant is oily, check for cause, and correct or report deficiency. See that core air passages are clean. Replace any damaged or defective cooling-system hose, lines, and gaskets. See that all mounting bolts and connections are tight. Protect coolant from freezing and record its freezing point on DA Form 464. |
| 17 | 17 | 17 | <i>Water pump, fan, and shroud.</i> Inspect the pump for leaks and for loose mounting and assembly bolts. Check condition and mounting of fan blades and fan shroud. |

| Techni- cal in- spection | Service | | |
|--------------------------------|---------|--------|---|
| | Monthly | Weekly | |
| | 17 | 17 | Tighten or replace loose or missing bolts and cap screws. If pump leaks, tighten packing nut only enough to stop leaks; repack if necessary (par. 72d). |
| 18 | 18 | 18 | <i>Belts and pulleys.</i> Inspect for excessively worn, cracked, or frayed belt. Check belt tension and condition and alinement of pulleys. The belt is adjusted properly when it can be deflected 1 to 1½ inches from its normal position without undue pressure, at a point midway between pulleys. |
| | 18 | 18 | Adjust tension of belt if necessary. Replace belt if it is frayed or badly worn (par. 73). A new belt should not be installed on a worn pulley. |
| 19 | 19 | 19 | <i>Oil pump.</i> Check oil pump for leaks, cracks, loose or missing bolts and nuts, and any unusual noise. |
| | 19 | 19 | Replace loose or missing bolts and nuts. Stop engine if unusual noises are detected and report condition to proper authority. |
| 20 | 20 | 20 | <i>Governor and linkage.</i> Check governor adjustment. If engine surges when running at top speed without a load, the governor needs adjustment. |
| | 20 | 20 | Adjust governor bumper screw if necessary. |
| 26 | 26 | 26 | <i>Air cleaner.</i> Inspect air cleaner for secure mounting and tight connections. Check condition and level of oil in bowl. |
| | 26 | 26 | Remove and wash filter section in fuel oil or solvent. Refill bowl to proper level with correct lubricant. Reassemble and see that all connections are tight. |
| 28 | 28 | 28 | <i>Cylinder head, manifold, and gaskets.</i> Inspect for cracks, leaks, and loose mounting bolts. |
| | 28 | 28 | On new or reconditioned engines, tighten bolts on cylinder head at the first weekly service. Correct any other deficiencies. |
| 29 | 29 | 29 | <i>Crankcase and breather.</i> Inspect crankcase or leaks; check oil level. Check condition and mounting of breather. |
| | 29 | 29 | Drain crankcase and refill with correct lubricant at interval specified in lubrication order 5-3040-B. Perform this service while engine is warm. Remove and wash crankcase breather at each oil change. Correct or report any leaks. |
| 30 | 30 | 30 | <i>Valves.</i> Check valve adjustment if there is any indication of loss of power or excessive tappet noise. Correct clearance is 0.008 inch. |
| | 30 | 30 | Adjust valve clearance if necessary. See that valve cover gasket is in good condition and that cover fits securely (par. 69). |
| 31 | 31 | ----- | <i>Ignition system.</i> Inspect spark plugs for serviceability and proper adjustment. Correct point gap is 0.025 inch. Check condition and adjustment of magneto breaker points. Correct gap is 0.020 inch. |

| Techni- cal in- spection | Service | | |
|--------------------------------|---------|--------|---|
| | Monthly | Weekly | |
| | 31 | ----- | Clean spark plugs and adjust point gap. See that plugs and gaskets are in good condition before reinstalling. Adjust magneto breaker points if necessary. Replace points if badly burned or pitted (par. 42f(5)). See that wiring is clean and in good condition. |
| 32 | 32 | 32 | <i>Carburetor and governor.</i> Inspect carburetor and governor for secure mounting. Check all lines and connections for leaks. Check condition of fuel in filter sediment bowl. |
| | 32 | 32 | Tighten any loose mounting bolts and correct any leaks. Clean fuel-filter sediment bowl if it contains water or dirt (par. 76a). See that governor linkage operates freely and is in good condition. |
| 33 | 33 | 33 | <i>Clutch, transmission, and starter pinion.</i> Check clutch for proper operation and adjustment. Clutch should engage smoothly with a distinct snap and a reasonably firm lever action. Check transmission housing for correct oil level. Check starter pinion for proper operation. Pinion should move freely, should stay engaged while diesel engine is being cranked, and should release promptly when engine starts. |
| | 33 | 33 | Adjust clutch if necessary (par. 90). Adjust starter pinion latch springs if necessary. Make sure latch springs are not adjusted too tightly because over-speeding and damage to the starting engine may result if pinion does not release promptly as soon as diesel engine starts. |
| 40 | 40 | 40 | <i>Filter (diesel fuel).</i> Inspect filter housing, lines, and connections for leaks while engine is running. Check for proper fuel pressure. |
| | 40 | 40 | Drain water and sediment from filter housing. If fuel pressure indicator drops below the NORMAL range with engine running at normal operating speed, new absorbent filter elements are installed (par. 78b). After draining filter housing or installing new filter elements, fuel system must be primed (par. 79). |
| 41 | 41 | 41 | <i>Air cleaner.</i> Inspect air cleaner for secure mounting and tight connections. Check precleaner dust-collector jar for excessive accumulation of dust. |
| | 41 | 41 | Remove and clean oil bowl and screens and dust-collector jar as specified in Lubrication Order 5-3040-B. See that all connections are tight after reassembling. |
| 42 | 42 | 42 | <i>Nozzles, injector (pump).</i> Inspect injector-pump housing, lines, and connections for leaks. Check housing for proper oil level. See if engine runs irregularly, if exhaust shows an excessive amount of smoke, or if engine starts hard. |
| | 42 | 42 | Correct any leaks. Drain injector-pump housing and refill with correct lubricant at interval specified in lubrication order. If engine runs irregularly or if exhaust shows an excessive amount of smoke, clean or renew injection valves as necessary. (par. 80). |

| Techni- cal in- spection | Service | | |
|--------------------------------|---------|--------|---|
| | Monthly | Weekly | |
| 43 | 43 | 43 | <i>Fuel tank, cap, and gaskets.</i> Check fuel tank for loose bolts and leaks. See that cap fits securely and that gaskets are in good condition. |
| | 43 | 43 | Tighten any loose mounting bolts and correct any leaks. Open drain cock in bottom of fuel tank and drain out any water or sediment that may have accumulated. Remove strainer and filler-cap element, and wash in fuel oil or solvent. Reassemble and reoil element. See that filler-cap gasket is in good condition and that cap fits securely (par. 76). Be sure that fuel-tank vent is open. |
| 44 | 44 | 44 | <i>Fuel lines.</i> Check for collapsed, leaking, or damaged fuel lines and for loose connections. |
| | 44 | 44 | Tighten any loose connections and replace damaged fuel lines. |
| 48 | 48 | 48 | <i>Generator.</i> Check generator for secure mounting. Inspect commutator and brushes for wear and oil deposits. |
| | 48 | 48 | Replace brushes if badly worn (par. 85c(1)). Clean commutator if necessary (par. 85c (2)). |
| 50 | 50 | 50 | <i>Wiring and switches.</i> Check all wiring for breaks, for loose or corroded connections, and for worn, cracked, frayed, or oil-soaked insulation. See that switches are in good operating condition and securely mounted. Correct any deficiencies. |
| 52 | 52 | 52 | <i>Lights.</i> See that all lights are securely mounted and in good operating condition. |
| 57 | 57 | 57 | <i>Gages.</i> Inspect temperature, oil- and fuel-pressure gages on control panel for cracked or broken glass, insecure mounting, and defective operation. |
| | 57 | 57 | See that gages are securely mounted. Replace damaged or defective gages. |
| 58 | 58 | 58 | <i>Meters.</i> Inspect hour meter for broken glass and loose mounting screws. Check meters for proper operation. |
| | 58 | 58 | Tighten or replace loose or missing mounting screws. Replace damaged or defective meters. |
| 62 | 62 | 62 | <i>Levers, pedals, and linkage.</i> Inspect all levers and pedals for loose or missing mounting bolts and screws, for defective operation, and worn bushings. Check pedal and lever linkage for excessively worn or missing connecting pins and locking pins. |
| | 62 | 62 | Tighten or replace any loose or missing bolts, screws, and pins. |
| 80 | 80 | 80 | <i>Frame.</i> Inspect frame for cracks, breaks, loose bolts, and misalignment. Check frame, including engine hood, and panels for loose or missing mounting bolts. |
| | 80 | 80 | Tighten or replace loose or missing bolts. See that any cracks, breaks, and bent parts are repaired. |
| 83 | 83 | 83 | <i>Springs.</i> Check springs for broken or shifted leaves and loose U-bolts. Check auxiliary springs for excessively worn shackle pins and bushings. |
| | 83 | 83 | Correct or report any deficiencies. |

| Techni- cal in- spection | Service | | |
|--------------------------------|---------|--------|--|
| | Monthly | Weekly | |
| 87 | 87 | 87 | <i>Track assembly.</i> Inspect track for excessively worn links, pins, and bushings and for loose or missing track-shoe bolts. Check for missing plugs on the master pins. |
| | 87 | 87 | Tighten or replace any loose or missing track-shoe bolts. Report excessively worn links, pins, and bushings. Replace missing plugs. |
| 88 | 88 | 88 | <i>Idlers and rollers.</i> Inspect idlers and rollers for good condition, secure mounting, and proper lubrication. |
| | 88 | 88 | Report excessively worn or damaged idlers and rollers. Tighten any loose mounting bolts. Lubricate as specified in Lubrication Order 5-3040-B. |
| 89 | 89 | 89 | <i>Track tension.</i> Check track for proper tension. Adjustment is correct when track can be raised from 1½ to 4 inches above the rear carrier rollers. |
| | 89 | 89 | Adjust track if necessary. See that adjusting-screw clamp bolts are tightened after adjustment is made. |
| 90 | 90 | 90 | <i>Frames and guards.</i> Inspect frame for cracks, breaks, broken welds, and loose or missing mounting bolts and nuts. |
| | 90 | 90 | Repair all breaks and cracks. Tighten or replace all loose or missing bolts and nuts. See that guards and shields are in good condition and secure. |
| 93 | 93 | 93 | <i>Transmission and bevel gears.</i> Check transmission and bevel gears for any unusual noise during operation. See whether gear-selector lever operates freely in all positions. Check for correct oil level. |
| | 93 | 93 | Correct or report any deficiencies. Fill case to proper level with lubricant specified in Lubrication Order 5-3040-B. |
| 94 | 94 | 94 | <i>Drive sprockets and chains.</i> Inspect sprockets for excessive wear and damage. Check for chipped or broken sprockets. |
| | 94 | 94 | Repair or report all deficiencies. |
| 95 | 95 | 95 | <i>Master clutch.</i> Inspect clutch for proper operation and adjustment. Clutch should engage with a distinct snap and a reasonably hard lever pull. Inspect clutch facings for excessive wear. |
| | 95 | 95 | Adjust clutch if necessary (par. 90). See that drive-plate links are in good condition and that all connecting pins, bolts, and locks are in place and secure. Report to proper authority if clutch facings show excessive wear. Remove clutch-housing drain plug and drain out any accumulation of oil. |
| 96 | 96 | 96 | <i>Steering clutches.</i> Check clutches for proper operation and adjustment. Clutch-release should have 3 inches of free movement at top of levers. |

| Technical In- spection | Service | | |
|---------------------------|---------|--------|---|
| | Monthly | Weekly | |
| | 96 | 96 | Adjust clutches if free movement of levers is less than 3 inches (par. 96). Before making adjustment, check for obstructions between lever and bumper block. See that all control linkage is in good condition and properly adjusted and that all pins, nuts, and locks are in place and secure. Remove drain plugs in clutch compartment and drain any oil or water that may have accumulated (par. 95). |
| 101 | 101 | 101 | <i>Steering brakes.</i> Inspect brakes for proper operation and adjustment. Brakes should hold securely when pedal is depressed three-fourths of the way to the floor plate. Check condition of lining. |
| | 101 | 101 | Adjust brakes if necessary (par. 99). See that brakes are relined before lining is worn down to the rivets. |
| 107 | 107 | 107 | <i>Final drive.</i> Inspect final-drive-gear cases for loose mounting bolts and leaks around oil seals and gaskets. Check condition and level of oil. See whether final-drive-gear hub-bearing adjusting-nut lock is in place and secure. Check for any looseness of sprockets. Check outer-frame bearing assembly for secure mounting to track-roller frame. |
| | 107 | 107 | Tighten any loose mounting bolts. If any in-and-out movement of sprocket can be detected, or if excessive leaks are noticed, report deficiencies to proper authority. If signs of water or mud appear in lubricant, drain, flush, and refill with lubricant specified in Lubrication Order 5-3040-B. |

Section IV. TROUBLESHOOTING

52. Use of Troubleshooting Section

This section provides information useful in diagnosing and correcting unsatisfactory operation or failure of the tractor or any of its components. Each trouble symptom stated is followed by a list of probable causes of the trouble. The possible remedy recommended is described opposite the probable cause.

Note.—All references in this section to TM 5-3040C pertain to operations that are the responsibility of field and depot maintenance personnel.

53. Starting Engine

a. Starting Engine Will Not Start.

| <i>Probable cause</i> | <i>Possible remedy</i> |
|--|---|
| Lack of gasoline in tank..... | Fill tank. |
| Water in gasoline or gasoline of improper quality. | Drain and refill with proper gasoline. |
| Gasoline not reaching carburetor: | |
| Gasoline shut off at tank..... | Turn valve ON at fitting on carburetor. |
| Clogged vent in filler cap..... | Remove dirt from hole in cap. |
| Dirt or ice in sediment bowl..... | Remove and clean. |
| Clogged filter within sediment bowl.. | Remove and wash (par. 64). |
| Clogged gasoline line..... | Remove and clean. |
| Clogged screen at carburetor inlet... | Remove and wash (par. 64). |
| Flooded engine..... | Turn gasoline off at tank, push choke in, turn switch off, and crank with governor control in high speed position, four or five revolutions, then turn switch on and start (par. 32). Report to proper authority. |
| Improper use of choke. | |
| Float and valve in carburetor not functioning. | |
| Dirty starting engine air cleaner..... | Service air cleaner (par. 64). |
| Broken or corroded spark plug wires..... | Repair or replace. |
| Defective spark plugs..... | Clean, adjust, or replace (par. 63c). |
| <i>Test:</i> Remove plugs, ground them to engine while cranking. | |
| Grounded switch: | Replace (par. 63c). |
| <i>Test:</i> Remove wire from switch and try to start engine. If engine starts, switch is defective. | |
| Wet ignition system..... | Dry off system. |
| Faulty magneto..... | Repair or replace (par. 63). |
| <i>Test:</i> Remove wire from spark plug, hold it one-eighth inch from metal of spark plug, crank and check spark. | |
| Lack of compression: | |
| Oil washed from cylinder walls by flooded engine. | Remove spark plugs and put oil in cylinder (par. 63c). |
| Worn or broken piston rings..... | Report to proper authority. |

b. Starting Engine Backfires:

| <i>Probable cause</i> | <i>Possible remedy</i> |
|--------------------------------|-----------------------------|
| Crossed spark plug wires..... | Attach in correct position. |
| Magneto timing off..... | Time magneto (par. 63). |
| Cracked distributor plate..... | Replace plate. |

c. Starter Pinion Will Not Stay Engaged:

| <i>Probable cause</i> | <i>Possible remedy</i> |
|---|---|
| Diesel engine not sufficiently warm..... | Let starting engine crank diesel a longer period of time. |
| Diesel engine throttle open or throttle rod bent. | Close throttle or straighten rod. |
| Starting engine running too fast..... | Report to proper authority. |
| Improper adjustment of latches..... | Adjust (par. 67b). |
| Worn or broken latches..... | Report to proper authority. |

d. Starter Pinion Will Not Release:

| <i>Probable cause</i> | <i>Possible remedy</i> |
|---------------------------------------|---|
| Dirt, gum, and corrosion in mechanism | Clean and wash with diesel fuel or dry-cleaning solvent. |
| Diesel engine running too slow | Open throttle one-half way back when starting diesel (par. 11). |
| Improper adjustment of latches | Adjust (par. 67b). |
| Broken release spring | Report to proper authority. |

e. Starting Engine Clutch Slips:

| <i>Probable cause</i> | <i>Possible remedy</i> |
|-----------------------|--|
| Improper adjustment | Adjust (par. 66). |
| Oil on clutch facings | Drain compartment and flush with cleaning solvent. |
| Facings worn out | Report to proper authority. |

f. Starting Engine Has Not Enough Power to Rotate Diesel:

| <i>Probable cause</i> | <i>Possible remedy</i> |
|---|---------------------------------|
| Transmission and flywheel clutch engaged | Disengage flywheel clutch. |
| Oil in diesel engine crankcase too stiff | Use proper grade (LO 5-3040-B). |
| Starting engine in poor mechanical condition. | Report to proper authority. |

54. Diesel Engine

a. Diesel Engine Will Not Start:

| <i>Probable cause</i> | <i>Possible remedy</i> |
|---|---|
| Diesel engine not sufficiently warm | Let starting engine crank diesel a longer period of time. |
| Lack of fuel in tank | Fill tank. |
| Fuel line shut off at tank | Open valve under tank and prime system (par. 79). |
| Fuel system air locked | Prime system (par. 79). |
| Clogged or mashed main fuel line | Clean, repair or replace and prime fuel system. |
| Slide bar sticking in shutoff position | Remove plate from side of fuel pump housing; remove dirt and corrosion to free slide bar. |
| Fuel transfer pump failure | Clean bypass valve (par. 77). Replace pump (par. 77). |
| Clogged air cleaner or blocked manifold | Service air cleaner. Check manifold. |
| Poor compression | Report to proper authority. |
| Badly worn injection pumps | Check and replace if necessary (par. 81). |
| Starting engine transmission, in low gear | Shift to high gear. |

b. Diesel Engine Knocks Excessively:

| <i>Probable cause</i> | <i>Possible remedy</i> |
|---------------------------------------|--|
| Poor grade of fuel | Improve quality of fuel. |
| Faulty injection valve | Test and replace if necessary (par. 80). |
| Clogged air cleaner | Service air cleaner. |
| Loose connecting rod bearings | Report to proper authority. |
| Loose main bearings | Report to proper authority. |
| Piston hitting exhaust or inlet valve | Adjust valves (par. 69). |

c. Diesel Engine Smokes:

| <i>Probable cause</i> | <i>Possible remedy</i> |
|---|--|
| Clogged air cleaner..... | Service air cleaner. |
| Faulty injection valves..... | Test and replace if necessary (par. 80). |
| Altitude..... | None (par. 41). |
| Oil entering combustion chamber from crankcase. | Report to proper authority. |
| Poor grade of fuel..... | Improve quality of fuel. |

d. Diesel Engine Misses:

| <i>Probable cause</i> | <i>Possible remedy</i> |
|---|--|
| Air in fuel system..... | Prime system (par. 79). |
| Faulty injection valves..... | Test and replace if necessary (par. 80). |
| Clogged fuel filters..... Symptom: A low fuel pressure gage reading. | Check and replace (par. 78). |
| Defective transfer pump: Dirt under bypass valve..... | Remove, clean, or replace (par. 77). |
| Worn pump gears (gradual drop in pressure.) | Replace fuel transfer pump (par. 77). |
| Water in fuel..... | Drain and refill with clean fuel and prime system (par. 79). |
| Defective inlet or exhaust valves: Improper adjustment..... | Adjust (par. 69). |
| Improper adjustment of compression release push rods. | Make adjustment (par. 69). |
| Broken valve spring..... | Report to proper authority. |
| Burnt or sticking valves..... | Report to proper authority. |

e. Lack of Power:

| <i>Probable cause</i> | <i>Possible remedy</i> |
|---|---|
| Clogged or tight tracks..... | Clean and loosen tracks, if necessary. |
| Clogged air cleaner..... | Service air cleaner. |
| Worn injection pumps..... | Check and replace if necessary (par. 69). |
| Poor compression: Worn piston rings..... | Report to proper authority. |
| Improper adjustment of exhaust or inlet valves. | Adjust valves (par. 81). |
| Altitude..... | None (par. 41). |

f. Diesel Engine Overheats:

| <i>Probable cause</i> | <i>Possible remedy</i> |
|---|-------------------------------|
| Insufficient coolant..... | Check and fill. |
| Dirt and trash on air cooler and between radiator fins. | Clean out the dirt and trash. |
| Loose or broken fan belt..... | Adjust or replace (par. 73) |
| Failure of water temperature regulator to open. | Report to proper authority. |
| Excessive scale or sediment deposits in system. | Clean and refill (par. 71). |
| Water pump impeller loose on shaft..... | Report to proper authority. |

g. Low or No Oil Pressure:

| <i>Probable cause</i> | <i>Possible remedy</i> |
|---|--------------------------------|
| Low or no oil in crankcase..... | Check and fill to full mark. |
| Clogged oil filters..... | Service oil filters (par. 83). |
| Defective oil gage..... | Check and replace. |
| Clogged or broken line to gage..... | Clean, repair, or replace. |
| Oil pump failure..... | Report to proper authority. |
| Leak in oil cooler lines or connections.... | Repair or replace. |
| Loose connecting rod or main bearings... | Report to proper authority. |

55. Flywheel Clutch

a. Flywheel Clutch Slips.

| <i>Probable cause</i> | <i>Possible remedy</i> |
|----------------------------|---------------------------------|
| Improper adjustment..... | Adjust (par. 90). |
| Glazed clutch facings..... | Report to proper authority. |
| Oil on facings..... | Wash with dry-cleaning solvent. |
| Facings worn out..... | Report to proper authority. |

b. Flywheel Clutch Will Not Stay Engaged:

| <i>Probable cause</i> | <i>Possible remedy</i> |
|---|--|
| Improper adjustment..... | Adjust (par. 90). |
| Dirt between release collar and adjusting collar which prevents "snap over center." | Clean and wash with dry-cleaning solvent or diesel fuel. |
| Worn clutch links, pins, cams, and linkage.. | Report to proper authority. |
| Worn release collar..... | Report to proper authority. |

c. Flywheel Clutch Will Not Disengage:

| <i>Probable cause</i> | <i>Possible remedy</i> |
|--|-----------------------------|
| No clearance between driving plate and pressure or driven plate. | Report to proper authority. |
| Broken facing or rivets to let facing wedge between plates. | Report to proper authority. |
| Center plate bearing seized to clutch shaft.. | Report to proper authority. |

d. Flywheel Clutch Hard to Engage:

| <i>Probable cause</i> | <i>Possible remedy</i> |
|---|--|
| Dirt between sliding collar and clutch shaft. | Engage and disengage clutch several times while applying dry-cleaning solvent. |
| Improper adjustment..... | Adjust (par. 90). |

56. Transmission

a. Transmission Will Not Stay Engaged:

| <i>Probable cause</i> | <i>Possible remedy</i> |
|-------------------------------------|-----------------------------|
| Gears partially engaged..... | Fully engage gears. |
| Sticking shifter fork on shaft..... | Report to proper authority. |
| Faulty interlock mechanism..... | Report to proper authority. |

b. Transmission Will Not Engage Any or All Gears:

| <i>Probable cause</i> | <i>Possible remedy</i> |
|--------------------------------------|-----------------------------|
| Gearshift mechanism out of line..... | Report to proper authority |
| Bent or broken shifter fork..... | Report to proper authority. |

c. Transmission Becomes Locked:

| <i>Probable cause</i> | <i>Possible remedy</i> |
|--------------------------------------|-----------------------------|
| Gearshift mechanism out of line..... | Report to proper authority. |
| Broken transmission parts..... | Report to proper authority. |

57. Steering Clutches

a. Steering Clutches Hard to Disengage:

| <i>Probable cause</i> | <i>Possible remedy</i> |
|---------------------------|-----------------------------|
| Improper adjustment..... | Adjust (par. 96). |
| Broken or worn parts..... | Report to proper authority. |

b. Steering Clutches Slip:

| <i>Probable cause</i> | <i>Possible remedy</i> |
|--------------------------|------------------------------|
| Improper adjustment..... | Adjust (par. 96). |
| Oil on facings..... | Drain compartment (par. 95). |
| Facings worn out..... | Report to proper authority. |

c. Steering Clutches Will Not Disengage:

| <i>Probable cause</i> | <i>Possible remedy</i> |
|--------------------------------------|-----------------------------|
| Loose equalizer bar clamp nut..... | Tighten clamp nut. |
| Improper adjustment..... | Adjust (par. 96). |
| Worn or damaged release bearing..... | Report to proper authority. |

58. Steering Clutch Brakes

a. Brake Will Not Engage:

| <i>Probable cause</i> | <i>Possible remedy</i> |
|--------------------------|------------------------|
| Pins out of linkage..... | Put pins in place. |

b. Brake Pedal Will Not Return:

| <i>Probable cause</i> | <i>Possible remedy</i> |
|---|-----------------------------|
| Locking device locked..... | Put lock in "OFF" position. |
| Brake return spring disconnected..... | Connect spring. |
| Brake return spring weak or broken..... | Replace spring. |

c. Brake Slips:

| <i>Probable cause</i> | <i>Possible remedy</i> |
|--------------------------------------|--|
| Improper adjustment..... | Adjust (par. 99). |
| Steering clutch not disengaging..... | Check steering clutch, adjust or repair (par. 99). |
| Oil on brake lining..... | Drain compartment (par. 98). |

59. Final Drive

a. Oil leak Around Sprocket Hub.

| <i>Probable cause</i> | <i>Possible remedy</i> |
|--|-----------------------------|
| Outer bellows seal failure..... | Report to proper authority. |
| <i>Symptom:</i> Oil leak on outside of sprocket. | |
| Inner bellows seal failure..... | Report to proper authority. |
| <i>Symptom:</i> Oil leak on inside of sprocket. | |
| Improper adjustment of sprocket bearings on bearing failure. | Report to proper authority. |
| Sprung sprocket shaft..... | Report to proper authority. |

b. Wear on Side of Sprocket Teeth:

| <i>Probable cause</i> | <i>Possible remedy</i> |
|--|-----------------------------|
| Track roller frame out of alinement with sprocket. | Report to proper authority. |
| Badly worn track rollers..... | Report to proper authority. |
| Track coming off rollers..... | Adjust track (par. 101). |

60. Tracks

a. Tracks Become Too Tight:

| <i>Probable cause</i> | <i>Possible remedy</i> |
|--|---|
| Mud, sand or snow packed in track..... | Clean and loosen track if necessary (par. 101). |
| Recoil spring bolt broken..... | Report to proper authority. |

b. Tracks Come Off:

| <i>Probable cause</i> | <i>Possible remedy</i> |
|--|------------------------------|
| Tracks too loose..... | Adjust (par. 101). |
| Badly worn track rollers..... | Report to proper authority. |
| Front idler out of alinement..... | Report to proper authority. |
| Working on side hills in rocks and limbs.. | Install track roller guards. |

61. Track and Carrier Rollers

a. Rollers Leak Grease at End Collar:

| <i>Probable cause</i> | <i>Possible remedy</i> |
|----------------------------|-----------------------------|
| Seals worn or damaged..... | Report to proper authority. |

b. Flat Spots on Rollers:

| <i>Probable cause</i> | <i>Possible remedy</i> |
|---|---|
| Mud and trash packed around rollers preventing them from turning. | Dig mud and trash from between the rollers after operation. |

Section V. STARTING ENGINE

62. Description

The starting engine (fig. 36) is a two-cylinder, four-stroke cycle gasoline engine mounted on the left side of the diesel engine cylinder block. The cooling systems are interconnected and the starting engine exhaust gases pass through a tube in the diesel engine inlet manifold. This arrangement conditions the diesel engine for starting. The starting engine transmits its power through a plate type clutch and a two-speed transmission to a pinion which is engaged with the diesel engine flywheel ring gear by means of a hand lever.

63. Ignition System

a. Description. Starting engine ignition is provided by a two-pole brush type magneto which is mounted on the starting engine timing gear cover (8, fig. 36). The magneto is fully shielded and fungus-proofed; timing is fixed and rotation is counterclockwise.

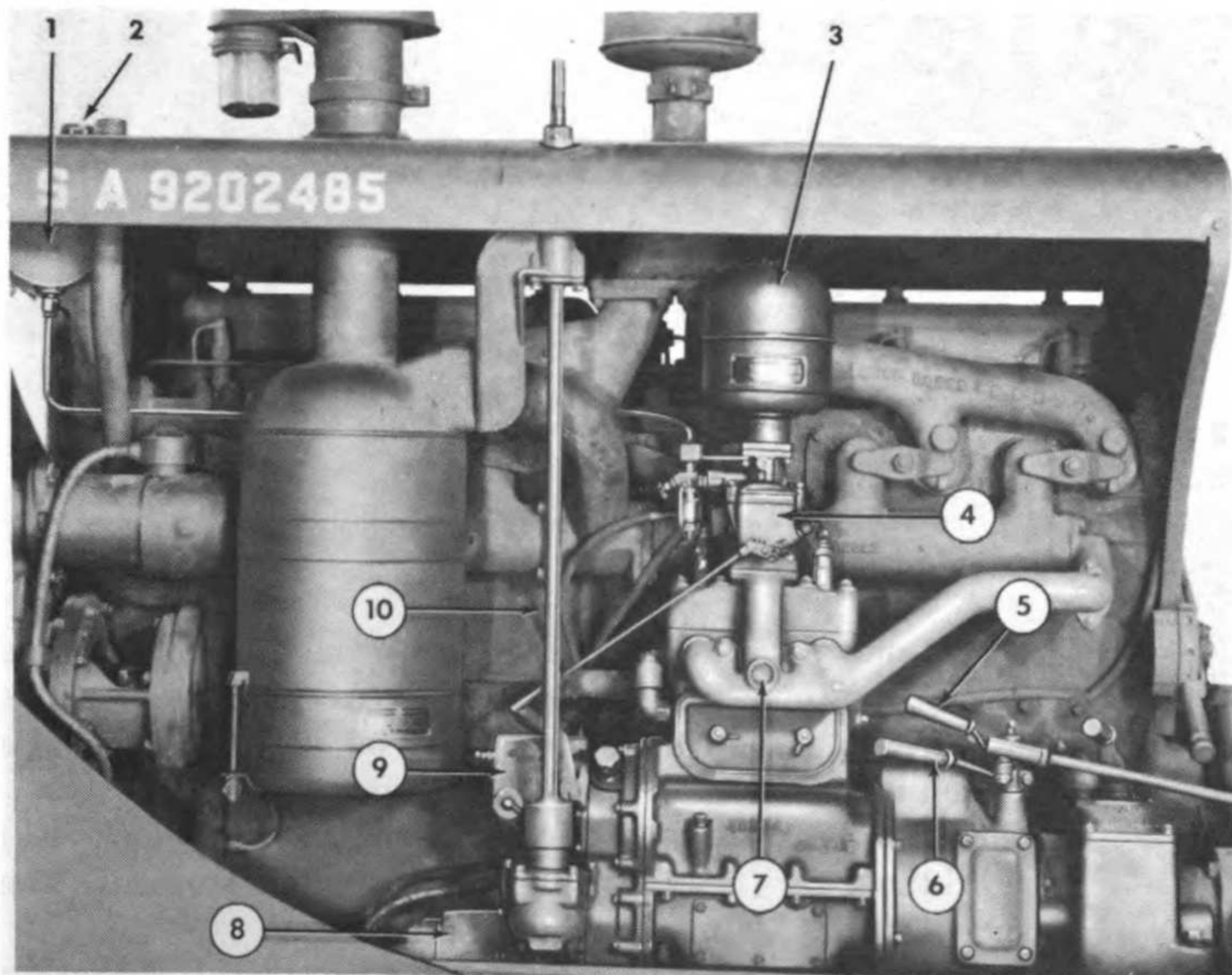
b. Magneto.

(1) *Removal* (fig. 37).

- (a) Disconnect the cable connections (1) on the end of the magneto.
- (b) Disconnect the magneto switch connecting cable (4) from the magneto.
- (c) Remove the two cap screws (5) and lift off the magneto.

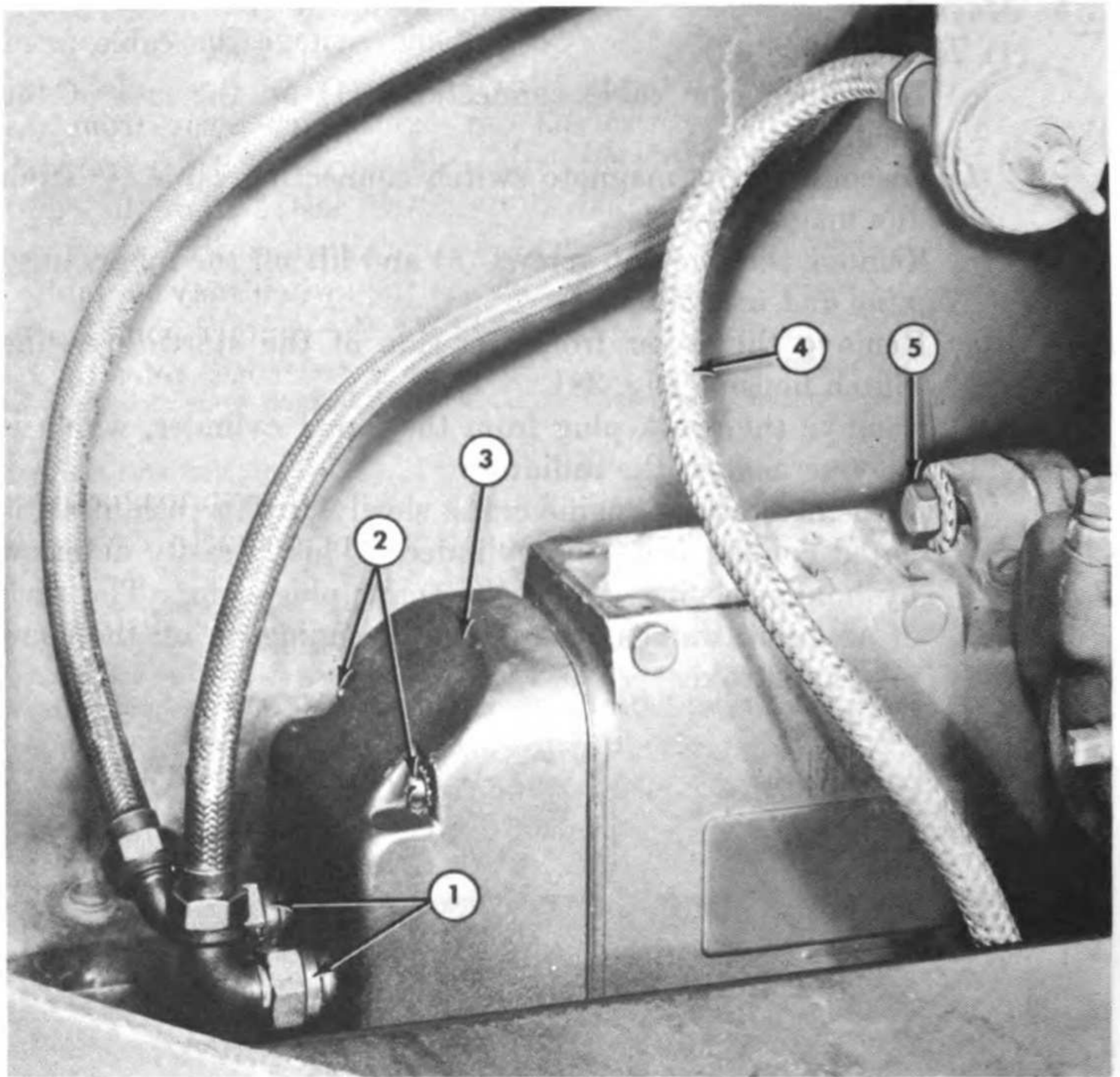
(2) *Timing and installation.*

- (a) Remove the cover from the side of the starting engine clutch housing (fig. 38).
- (b) Remove the spark plug from the No. 1 cylinder, which is the one nearest the radiator.
- (c) Turn the starting engine crank slowly until a rush of air is noted coming from the cylinder. This is easily detected by holding a finger over the spark plug hole. The rush of air indicates that the piston is coming up on the compression stroke.



- | | |
|-------------------|------------------------|
| 1 Gasoline tank | 6 Clutch lever |
| 2 Gas filler neck | 7 Manifold drain |
| 3 Air cleaner | 8 Magneto |
| 4 Carburetor | 9 Governor |
| 5 Pinion lever | 10 Starting crankshaft |

Figure 36. Starting engine installed.



1 Cable connections
2 Screw

3 Cover
4 Switch cable
5 Cap screw

Figure 37. Magneto removal points.

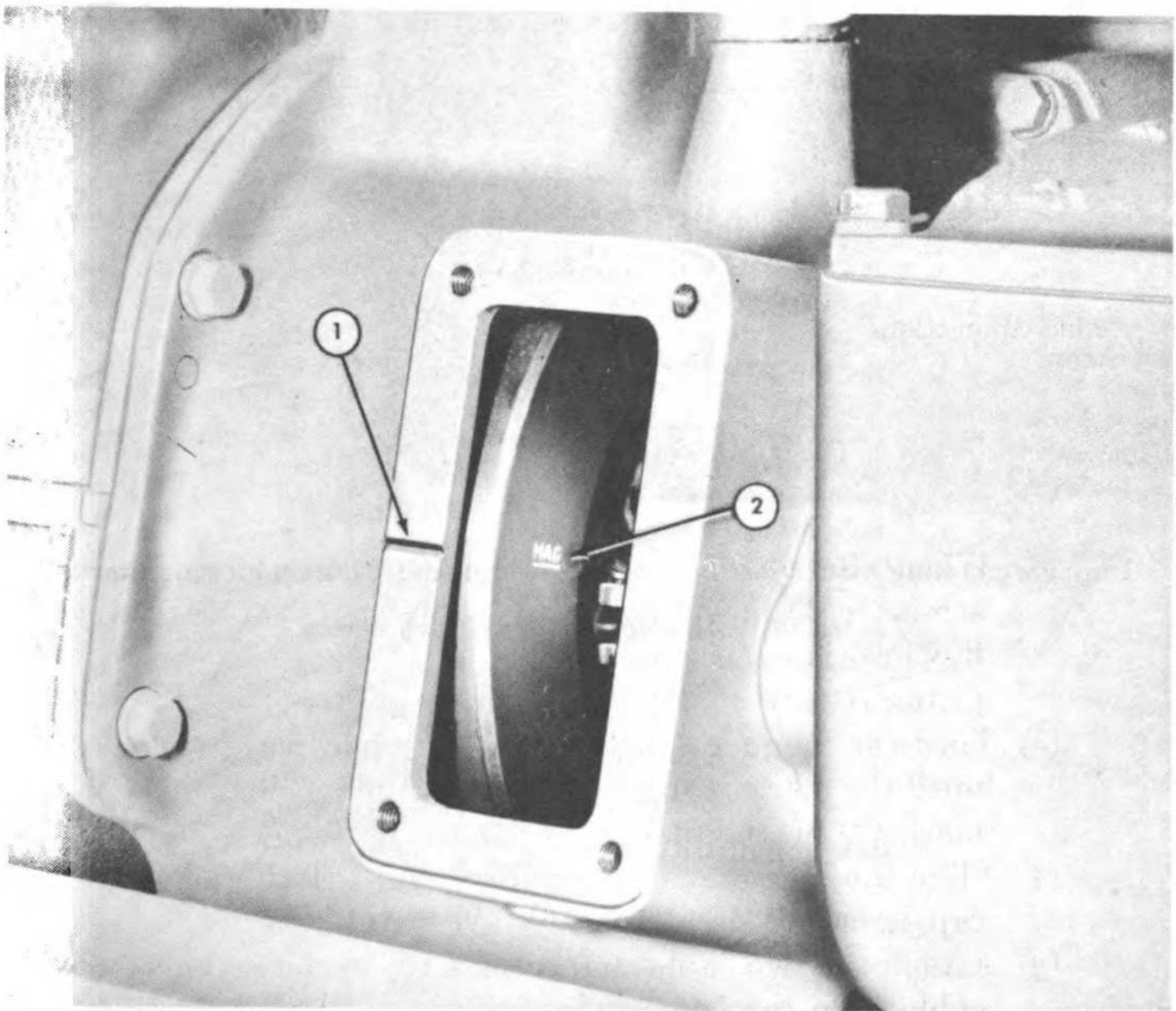
- (d) When the piston starts to come up on the compression stroke, continue turning until the MAG mark (2) on the flywheel is even with the mark (1) on the housing. The piston is now at the correct firing point.
- (e) Turn the magneto impulse coupling backwards (clockwise) until the mark (1, fig. 39) on the coupling lines up with the mark (2) on the mounting flange pilot ring.
- (f) Slide the magneto into position and install the mounting cap screws (5, fig. 37).
- (g) Attach the two cable connections (1) to the magneto. The cable from the No. 1 cylinder goes on the left-hand terminal, or the terminal nearest the diesel engine.
- (h) Connect the cable (4) from the magneto switch to the terminal on the underside of the magneto.

(3) *Testing magneto.*

- (a) Turn the magneto switch on and remove the cable from a spark plug.
- (b) Hold the cable terminal one-eighth inch away from the metal part of the plug while the engine is being cranked.
- (c) Crank the engine and, if no spark passes from the cable to the plug body, disconnect the magneto switch wire from the magneto and try again, as the switch may be faulty.
- (d) If the magneto fails to fire, check the contact point opening. If the contact point opening is correct, refer to the proper authority.

(4) *Checking magneto point opening.*

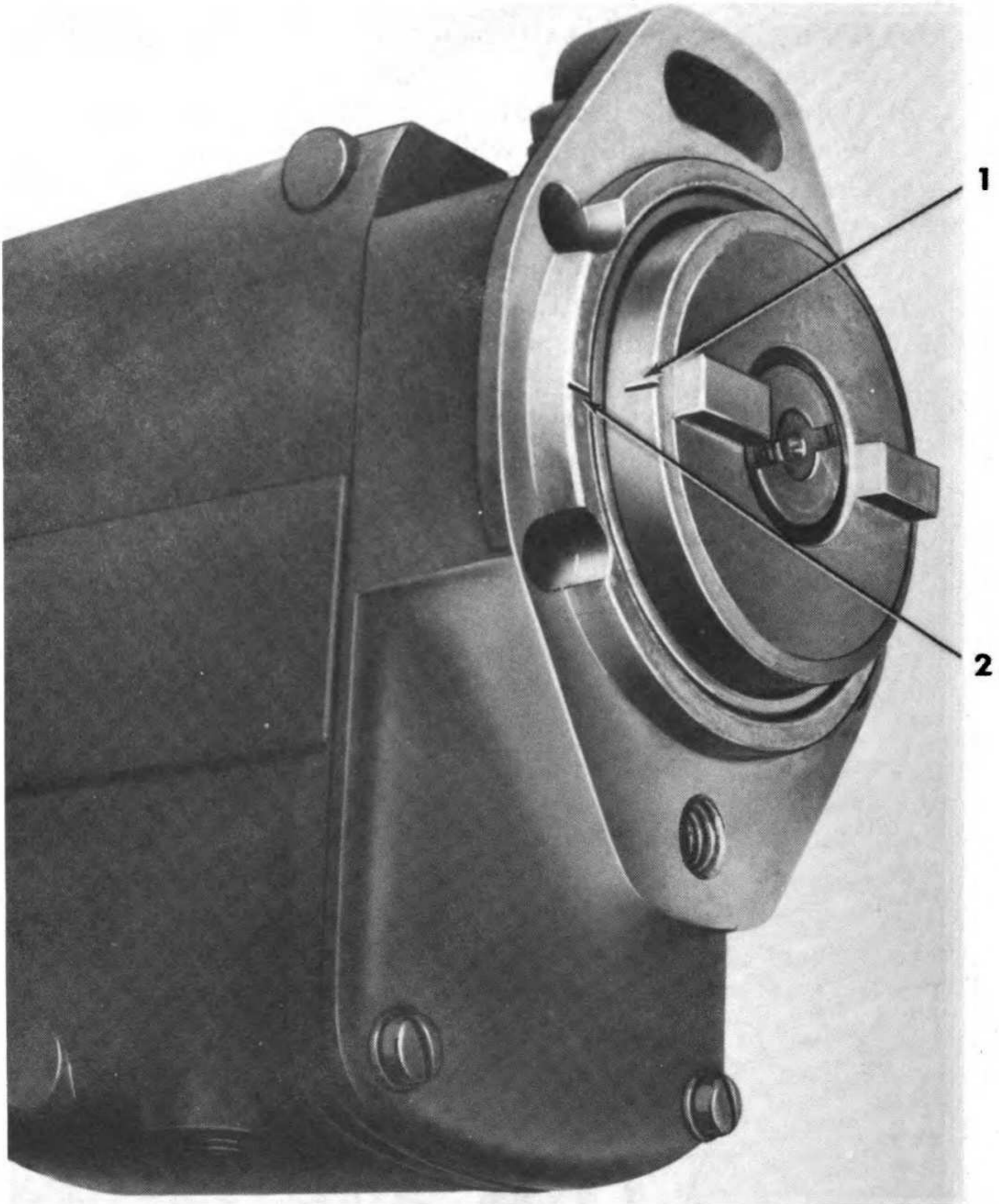
- (a) Disconnect cable connections (1, fig. 37) from magneto.
- (b) Remove the screws (2) which secure magneto cover (3) and remove cover.
- (c) Remove the studs (1, fig. 40) and remove distributor plate (2).
- (d) Lift out the distributor rotor (fig. 41).
- (e) Crank the engine until the bumper block (1, fig. 42) is on the highest elevation of the cam (2).



1 Housing mark

2 Flywheel mark

Figure 38. Timing magneto to engine.



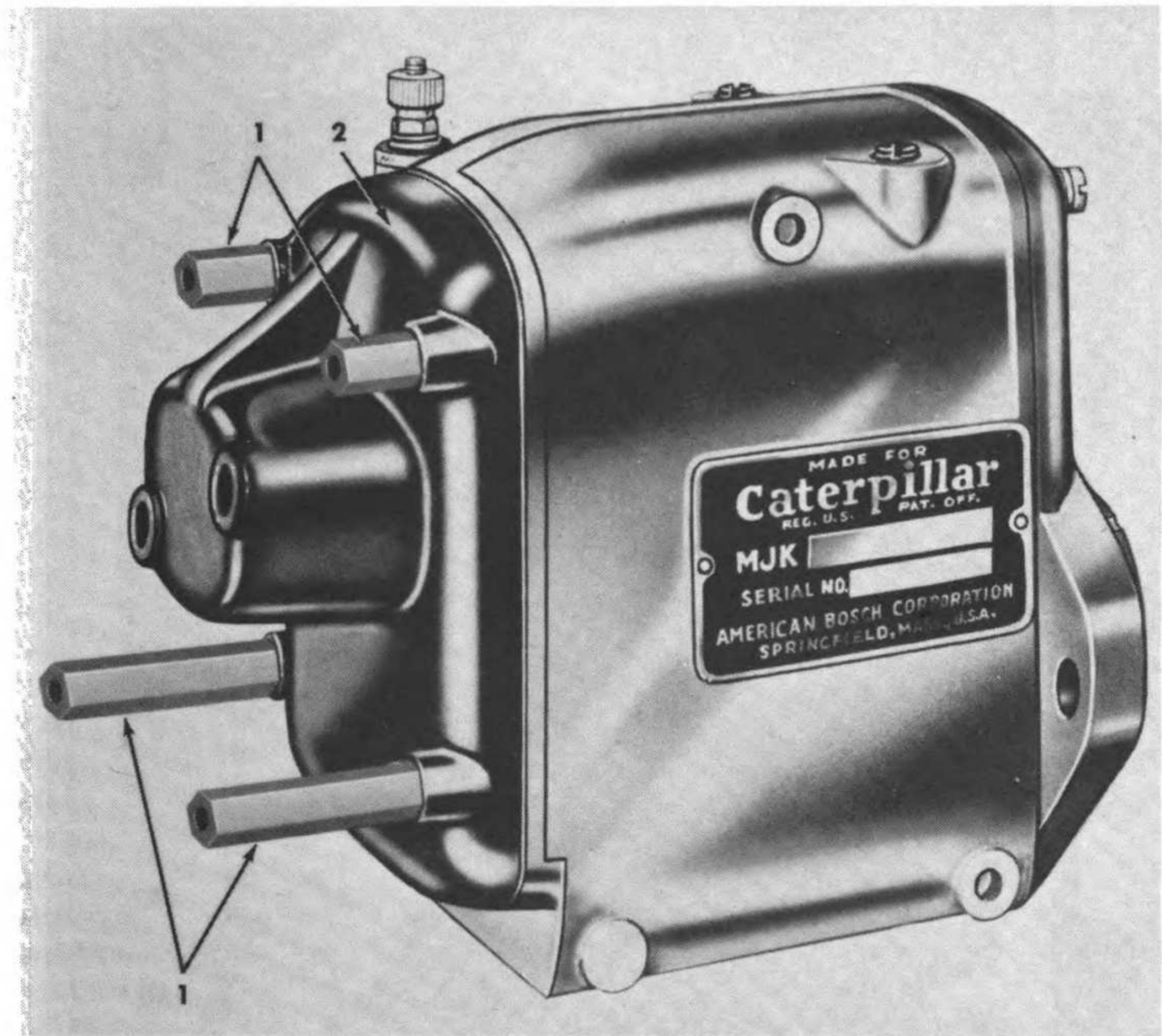
1 Impulse coupling mark

2 Mounting flange pilot ring mark

Figure 39. Alining magneto timing marks.

- (f) Check the clearance, which should be 0.020 inch, with a thickness gage as shown in figure 43.
- (5) *Adjusting contact point opening.*
- (a) Loosen the screw (3, fig. 42) that anchors the contact point bracket (5).
 - (b) Move the bracket by turning the eccentric adjusting screw (4) with a screw driver as shown in figure 44.
 - (c) Tighten the bracket screw (3, fig. 42) and recheck the point gap.

c. *Adjusting Spark Plug Gap.* The spark plug gap should be 0.025 inch. Measure the gap with a thickness gage (fig. 45), and adjust by bending the side electrode.



1 Studs

2 Distributor plate

Figure 40. Distributor plate removal.

64. Starting Engine Fuel System

a. Description. The starting engine fuel system is a simple gravity-feed system. A one-gallon gasoline tank (1, fig. 36) is mounted under the engine hood forward of the diesel engine. A single line carries the fuel through a sediment bowl and directly into the carburetor.

b. Fuel Tank.

(1) *Removal.*

- (a) Loosen clamping bolts in clamps (3 and 4, fig. 14) and remove muffler (1) and precleaner (2).
- (b) Remove the cap screws which secure the hood to the dash panel.
- (c) Unfasten the hood releasing latches (1, fig. 46) which secure the hood (2) to the radiator brackets, and lift off the hood.

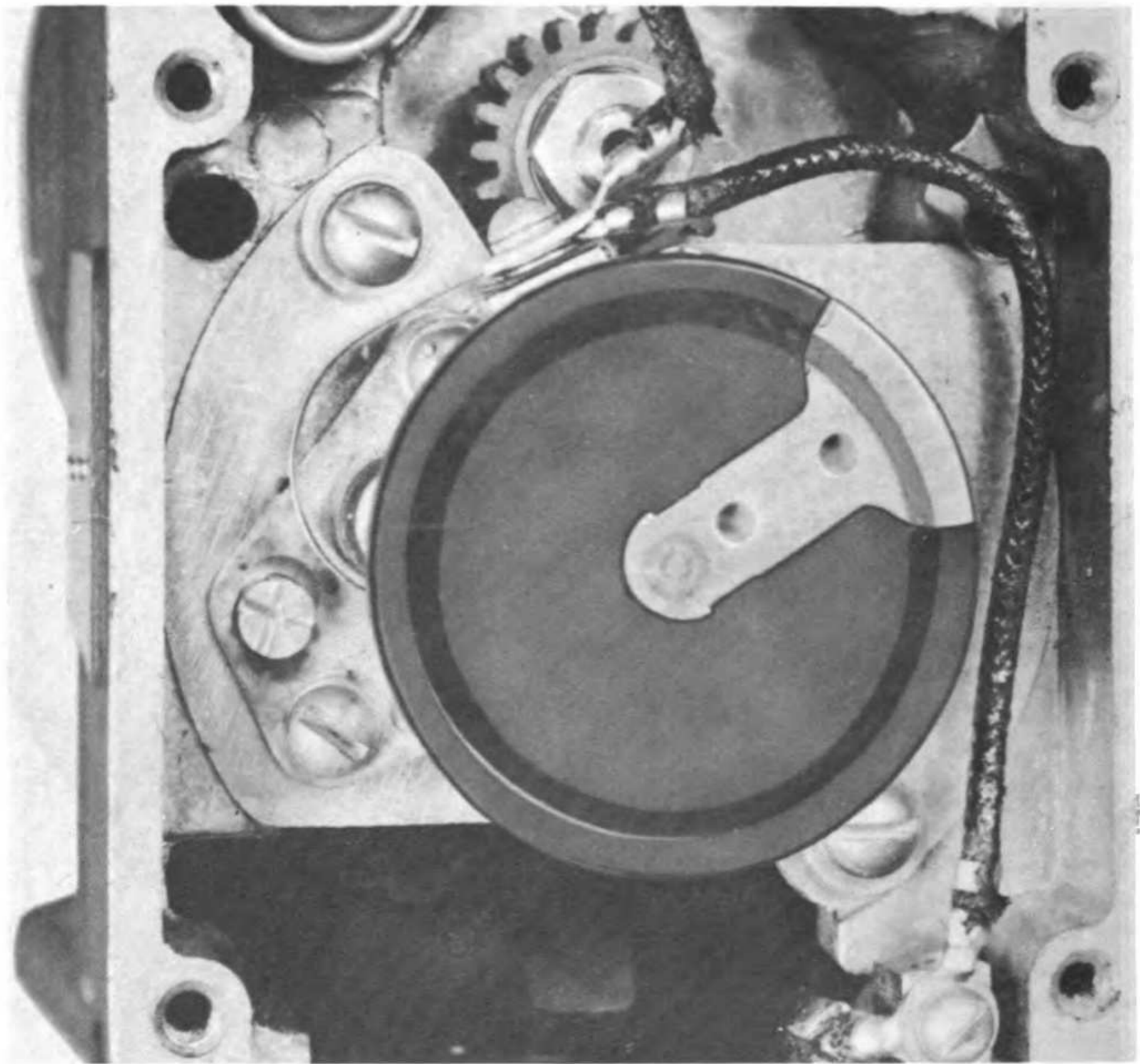
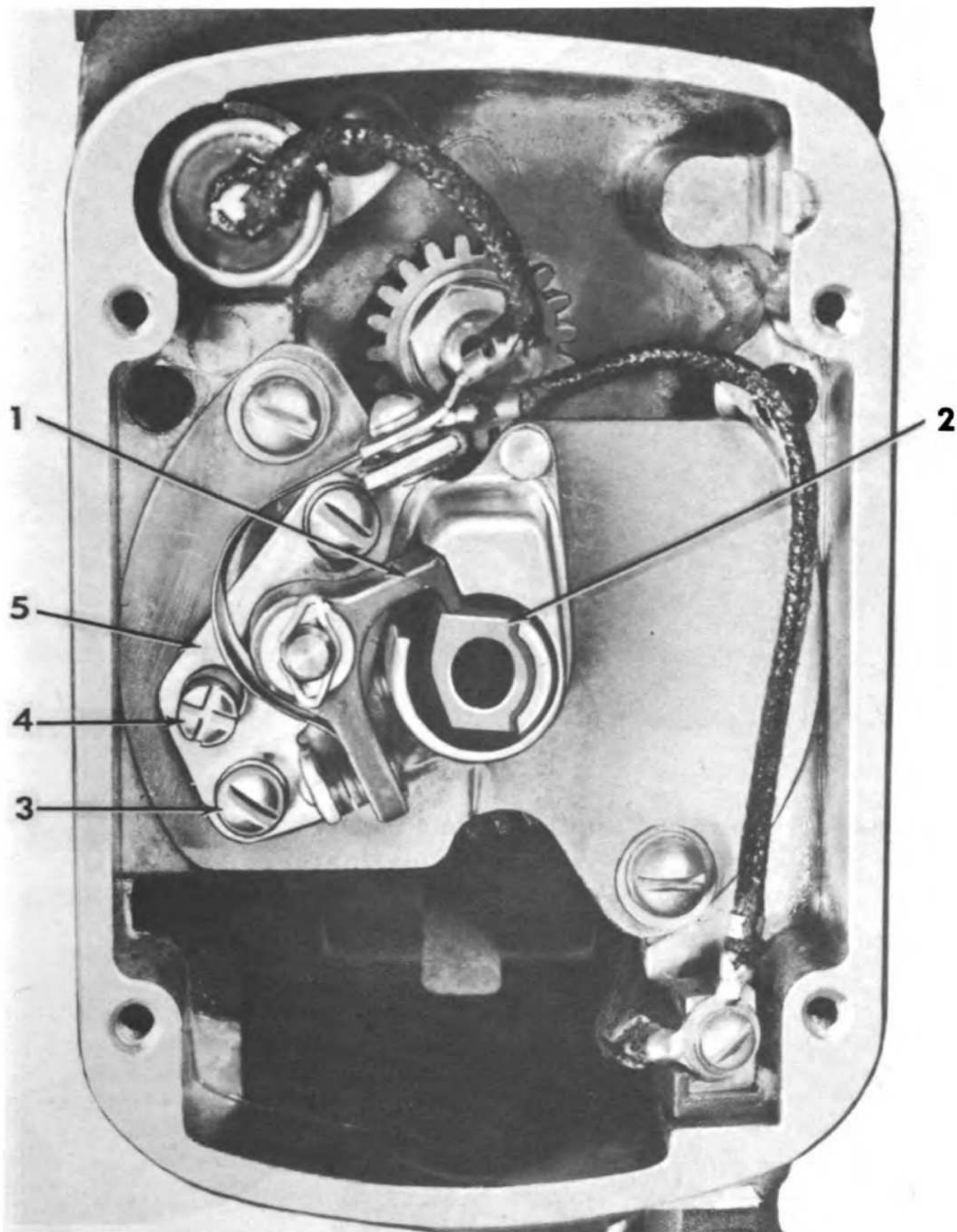


Figure 41. Distributor rotor installed.



- | | | | |
|---|---------------|---|-----------------------|
| 1 | Bumper block | 4 | Adjusting screw |
| 2 | Cam | 5 | Contact point bracket |
| 3 | Bracket screw | | |

Figure 42. Magneto distributor plate and rotor removed.



Figure 43. Checking contact point opening.

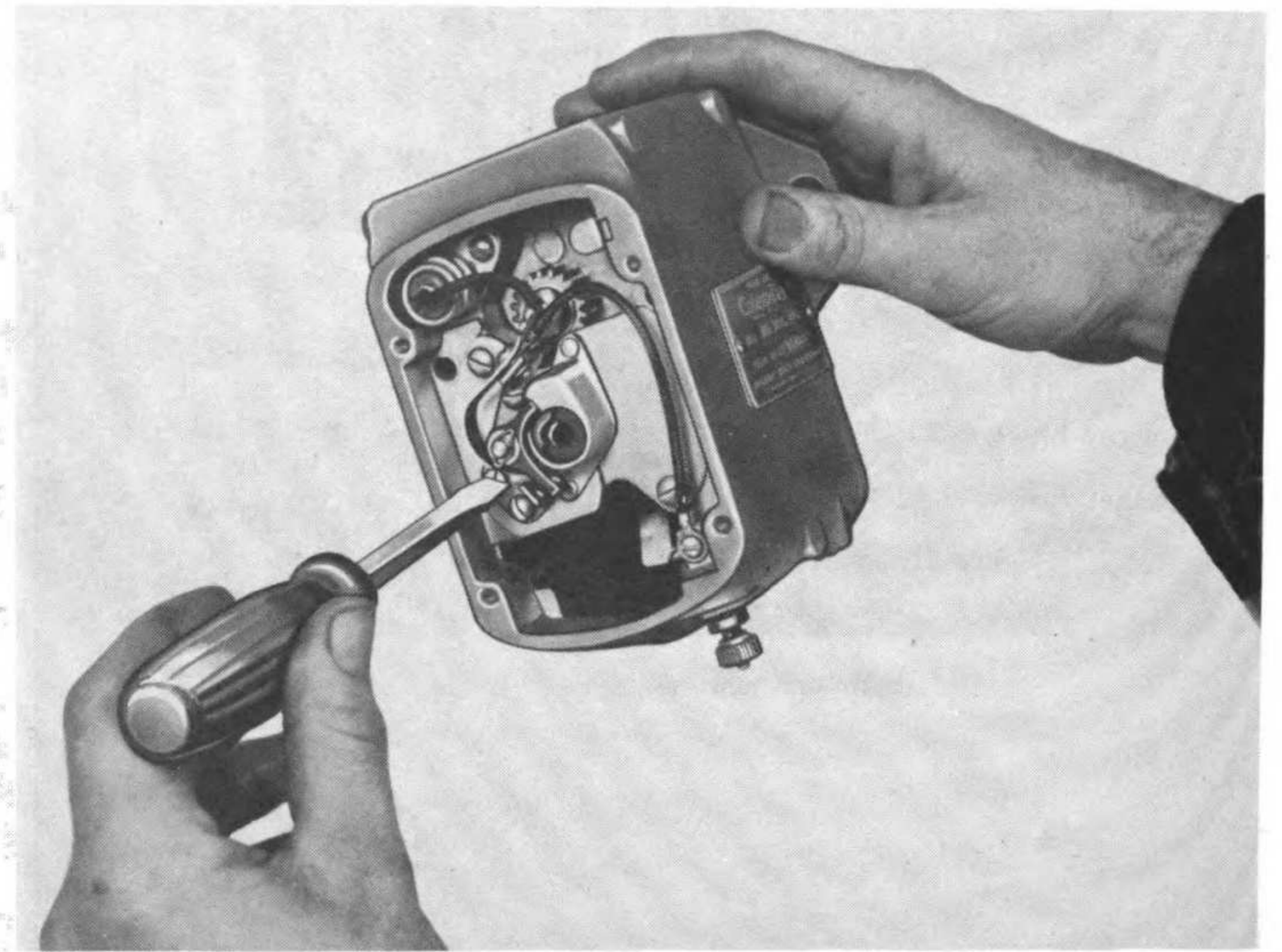


Figure 44. Adjusting magneto contact point gap.

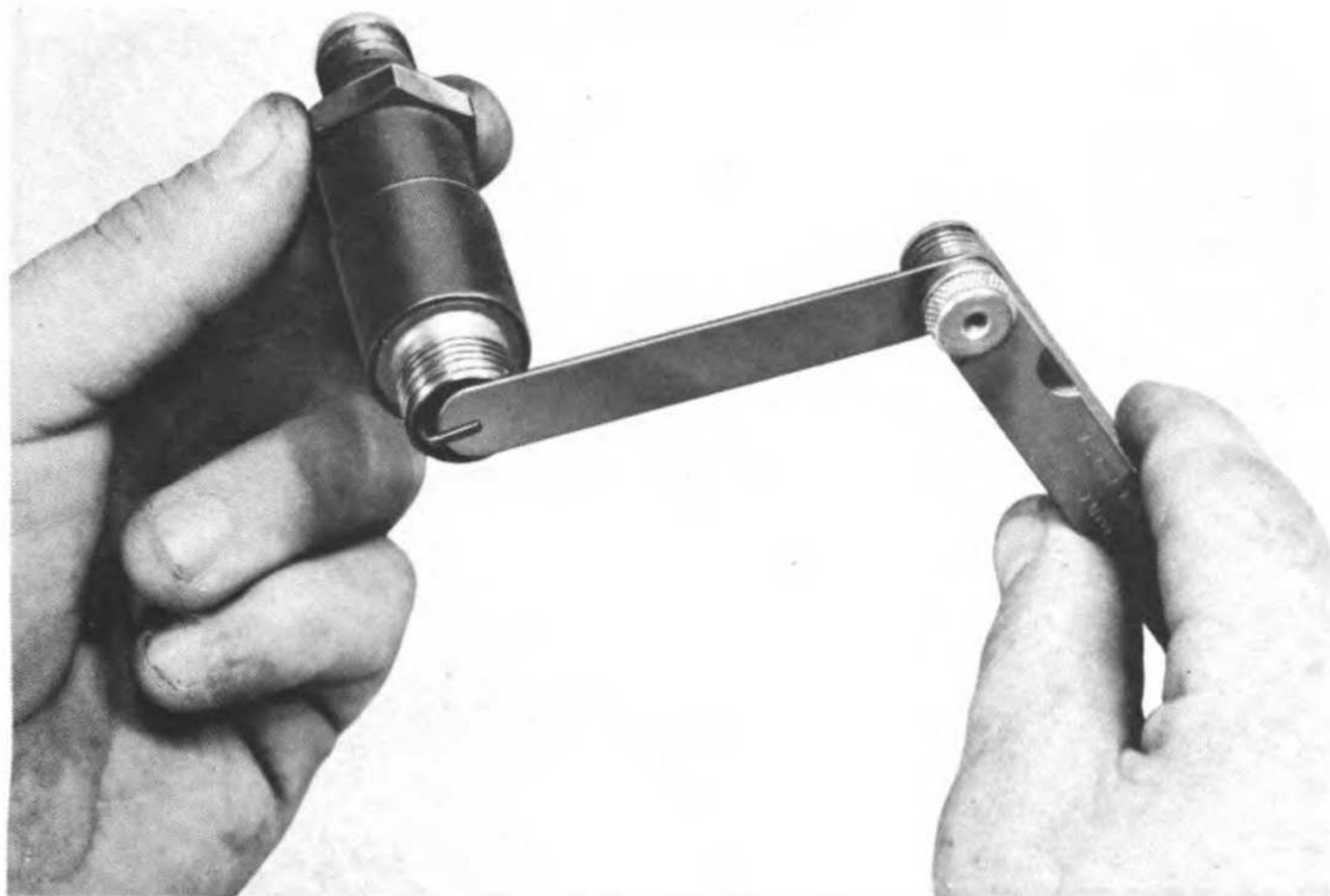


Figure 45. Measuring spark plug gap.

(d) Disconnect fuel line at fuel tank, and drain the tank.

(e) Loosen two tank support straps and lift tank from vehicle.

(2) *Installation.*

(a) Place the fuel tank in position on the support brackets, with the line connection to the left and down.

(b) Replace and tighten two support straps.

(c) Connect the fuel line at the bottom of the tank.

(d) Replace the hood and secure to dash panel with cap screws and to radiator brackets with latches.

(e) Install muffler and precleaner and secure with clamps (3 and 4, fig. 14).

c. *Carburetor.*

(1) *Removal.*

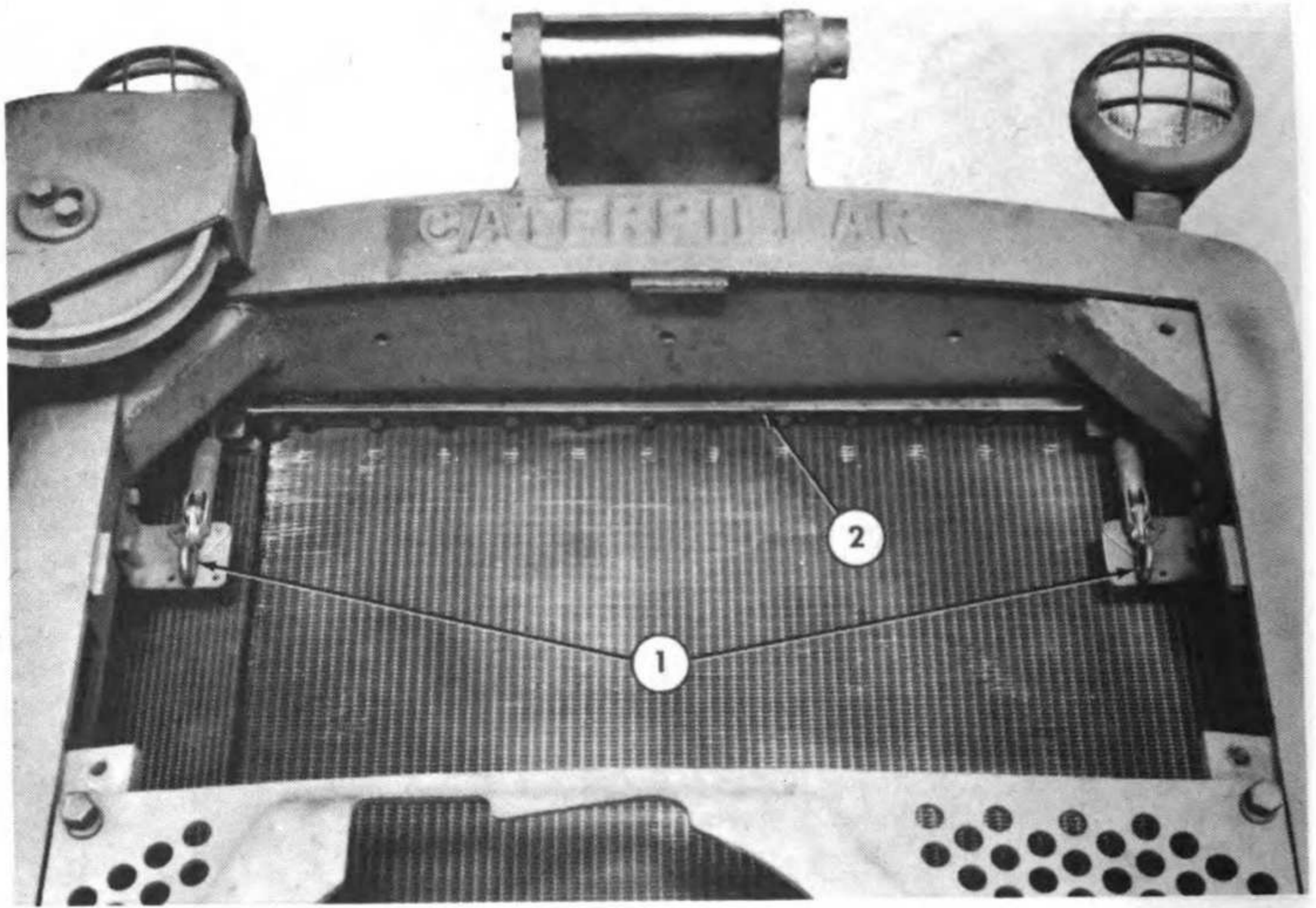
(a) Loosen the thumbscrew on top of the starting engine air cleaner (1, fig. 47) and lift the air cleaner from the adapter (2).

(b) The adapter is bolted to the carburetor by four mounting bolts. Remove bolts and lift off adapter.

(c) Remove the cotter pin, and the clevis pin connecting the throttle control rod (2, fig. 48) to the carburetor.

(d) Close the fuel shutoff valve (4).

(e) Remove the single bolt connecting the screen body assembly (1) to the carburetor, and pull the screen body assembly away from the carburetor.



1 Hood latches

2 Hood

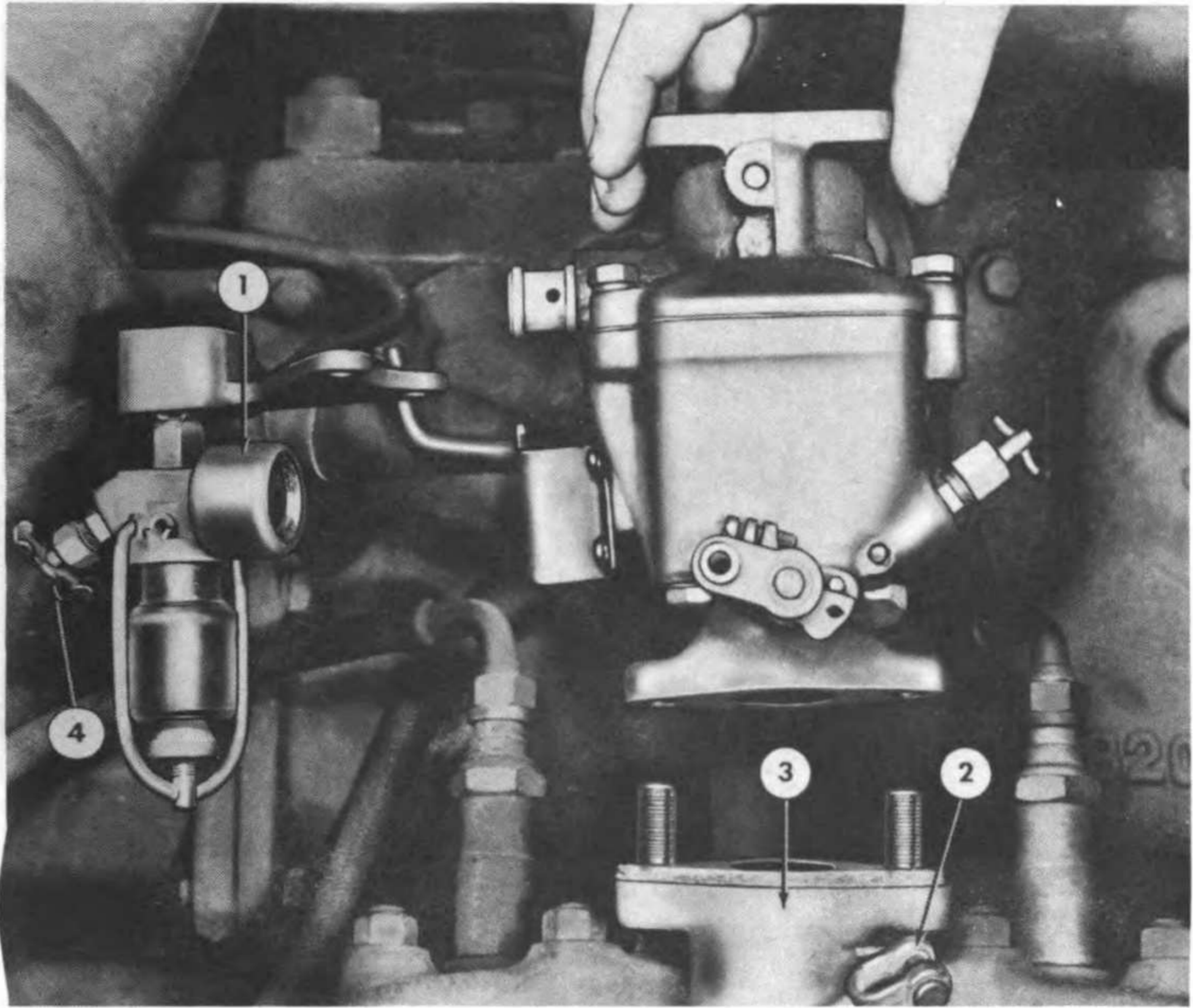
Figure 46. Hood releasing latches.



1 Air cleaner

2 Adapter

Figure 47. Removing starting engine air cleaner.



1 Screen body
2 Throttle rod

3 Intake manifold
4 Fuel shutoff valve

Figure 48. Removing carburetor.

(f) Remove four nuts fastening the carburetor to the intake manifold (3) and lift the carburetor off of the mounting studs.

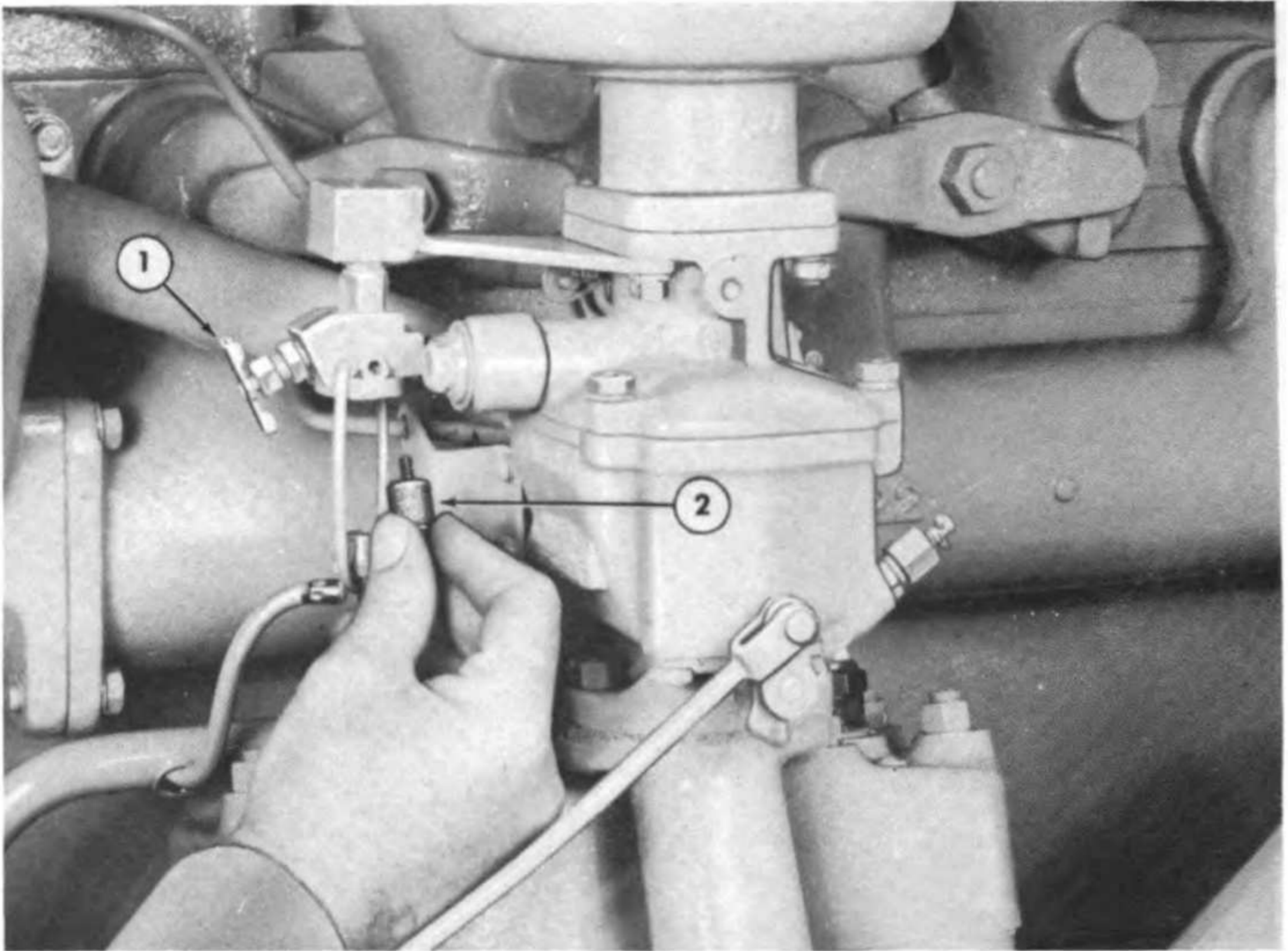
(2) *Maintenance.*

(a) *Clean the sediment bowl and filter (fig. 49).*

1. Close the fuel shutoff valve (1) on the screen body assembly, and remove the bolt by unscrewing the nut that clamps it to the body of the valve.
2. Unscrew the edge-type filter (2) and clean it in diesel fuel or dry-cleaning solvent.
3. Screw the filter back in place, being careful not to damage it.
4. See that gasket is clean and replace the bowl. Tighten the screw with the fingers until there are no leaks when the fuel shutoff valve is opened.

(b) *Clean the fuel line screen (fig. 50).*

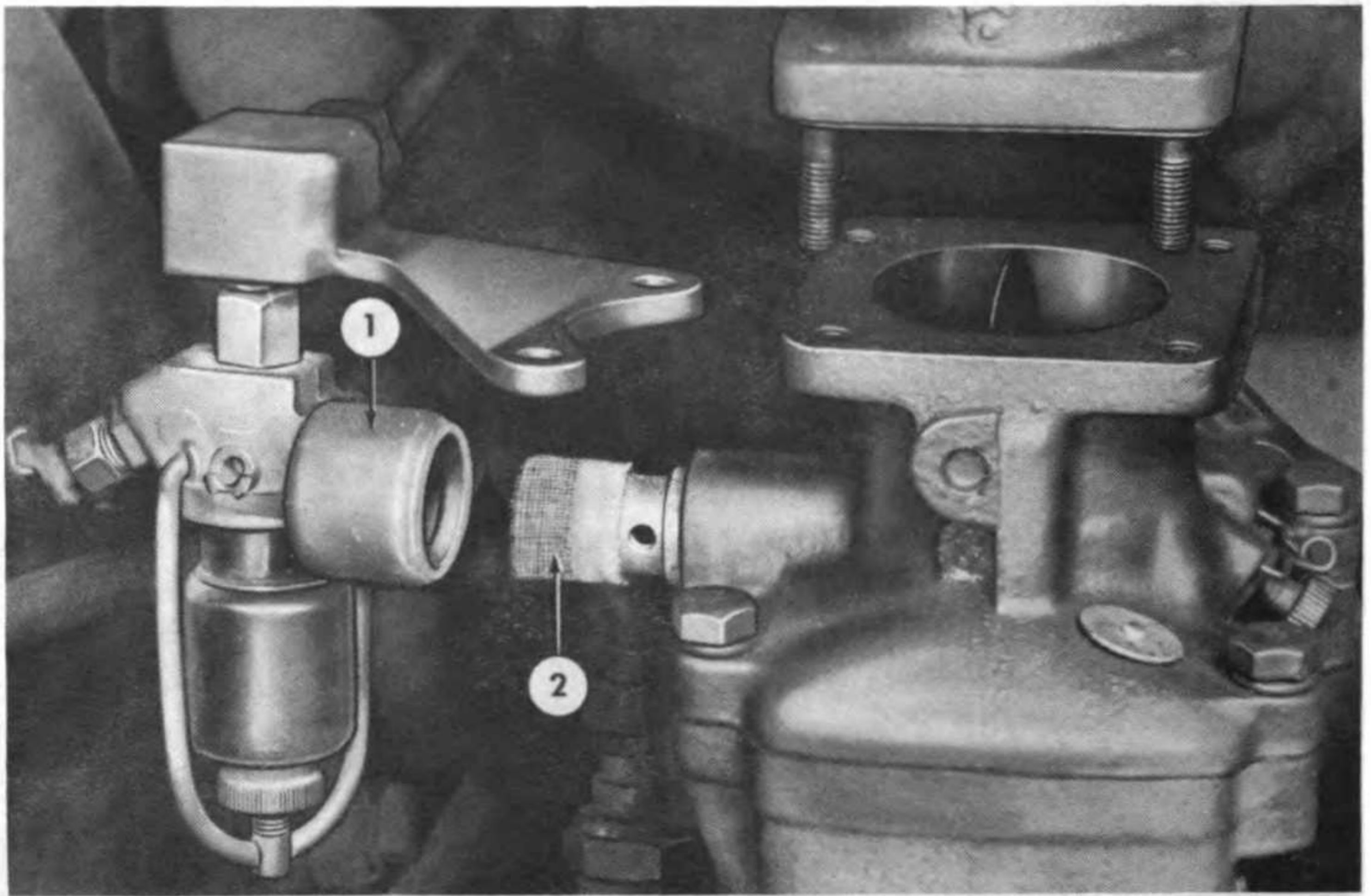
1. *General.* The fuel line screen should be removed and cleaned whenever the sediment bowl is serviced.
2. Remove air cleaner and adapter (c. (1) (a) above).



1 Fuel shutoff valve

2 Filter

Figure 49. Starting engine sediment bowl filter.



1 Fuel line screen body

2 Filter screen

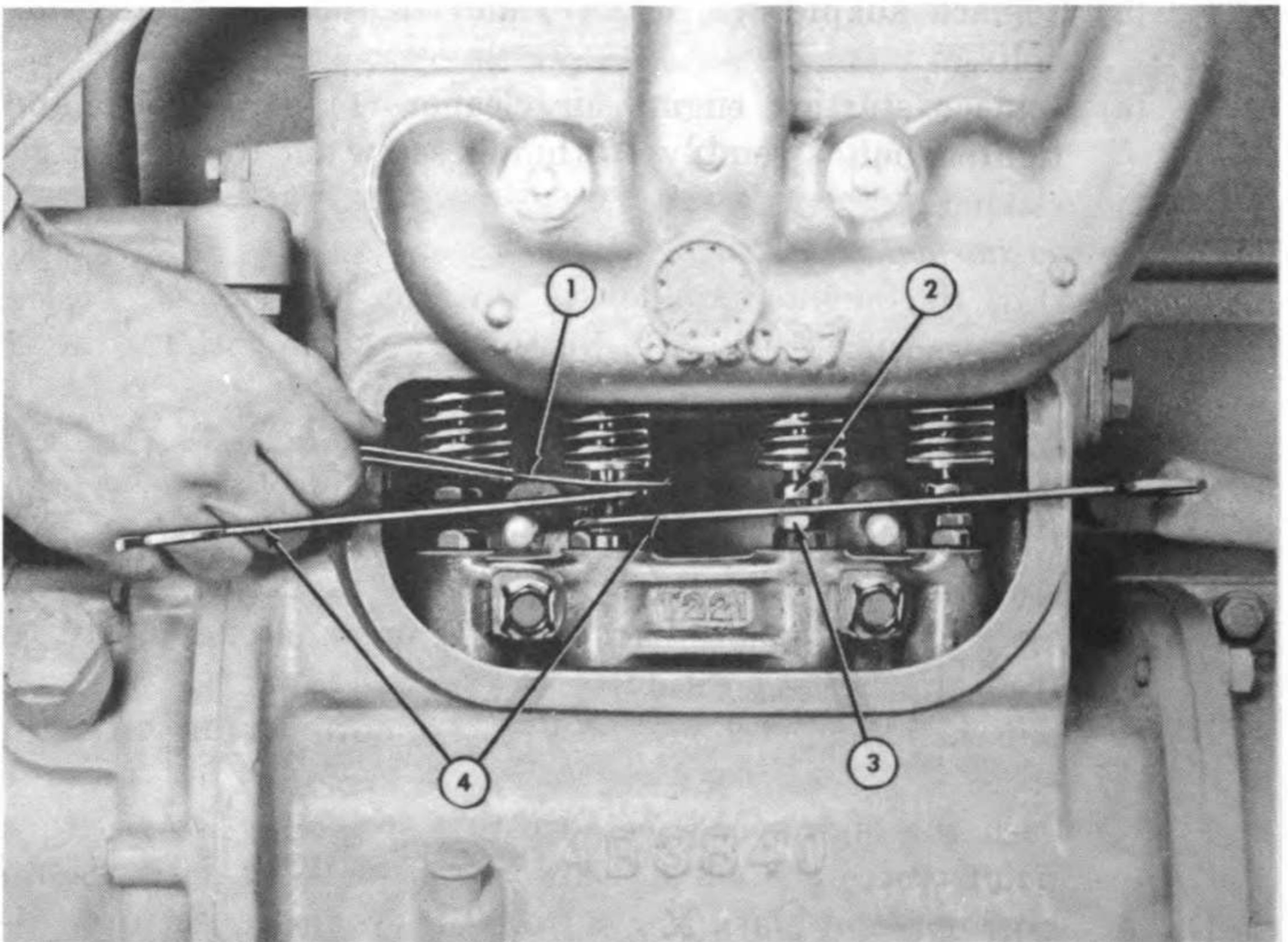
Figure 50. Removing fuel line screen.

3. Close the fuel shutoff valve (1) and remove the single bolt through the screen body assembly. Slide the assembly away from the carburetor.
 4. Slide the screen (2) off of the stud and wash the screen in dry-cleaning solvent.
 5. Replace the screen. Slide the fuel screen body assembly (1) over the screen and stud, and secure them with the bolt.
 6. Replace adapter and air cleaner (c(3)(d) and (e) below).
 - (c) *Manifold drain filter.* The manifold drain filter (7, fig. 36) should be removed from the starting engine manifold for inspection. Remove the snap ring and lift out the element. Replace it if it has deteriorated.
- (3) *Installation.*
- (a) Place the carburetor in position on the mounting studs on top of the intake manifold (3, fig. 48). The fuel connection must be toward the front of the diesel engine.
 - (b) Replace the single bolt connecting the screen body assembly to the carburetor.
 - (c) Place the throttle control rod in position on the carburetor and secure with clevis pin and cotter pin.
 - (d) Replace adapter (2, fig. 47) and tighten four mounting bolts.
 - (e) Replace starting engine air cleaner (1) on adapter and tighten bolt assembly at thumb screw on top of the air cleaner.
- (4) *Adjustments.*
- (a) Start the engine and allow it to warm up.
 - (b) Lock the throttle lever in the idling position with the idling latch (7, fig. 17).
 - (c) Turn the idling jet adjusting screw (2, fig. 16) until the engine idles evenly without emitting black smoke from the exhaust. An approximate setting may be made before starting the engine, by turning the idling jet screw gently against the seat and backing it off one and one-half turns from the closed position.
 - (d) Lift the idling latch and let the engine run at full governed speed.
 - (e) Turn the high speed jet adjusting screw (3, fig. 16) to a point where the engine runs evenly without surging and does not emit black smoke from the exhaust. An approximate setting may be made before starting the engine, by turning the high speed jet adjusting screw gently against its seat and backing it off one and three-eighths turns from the closed position.

- (f) Adjust the idling speed adjusting screw on the carburetor end of the throttle rod (4, fig. 16) to obtain an engine speed of about 800 rpm.
- (g) Adjust the idling latch screw (7, fig. 17) so the idle speed adjusting screw is held against the stop when the latch is engaged.

65. Starting Engine Valve Clearance Adjustment

- a. Run the engine until it reaches normal operating temperature.
- b. Remove two wing nuts and lift off the valve cover.
- c. Crank the engine until the valve to be adjusted closes, and the valve lifter is in its lowest position. Both inlet and exhaust valves of one cylinder are closed when the piston in that cylinder is on the compression stroke.
- d. Hold the adjusting screw (2, fig. 51) and loosen the lock nut (3) with $\frac{1}{16}$ -inch tappet wrenches (4).
- e. Turn the adjusting screw with a $\frac{1}{16}$ -inch tappet wrench until there is a slight drag on an 0.008-inch thickness gage (1) between the end of the valve stem and the head of the adjusting screw.
- f. Tighten the lock nut and recheck the adjustment.
- g. Place the valve cover in position and secure with two wing nuts.



1 Thickness gage
2 Adjusting screw

3 Lock nut
4 Wrench

Figure 51. Starting engine valve adjustment.

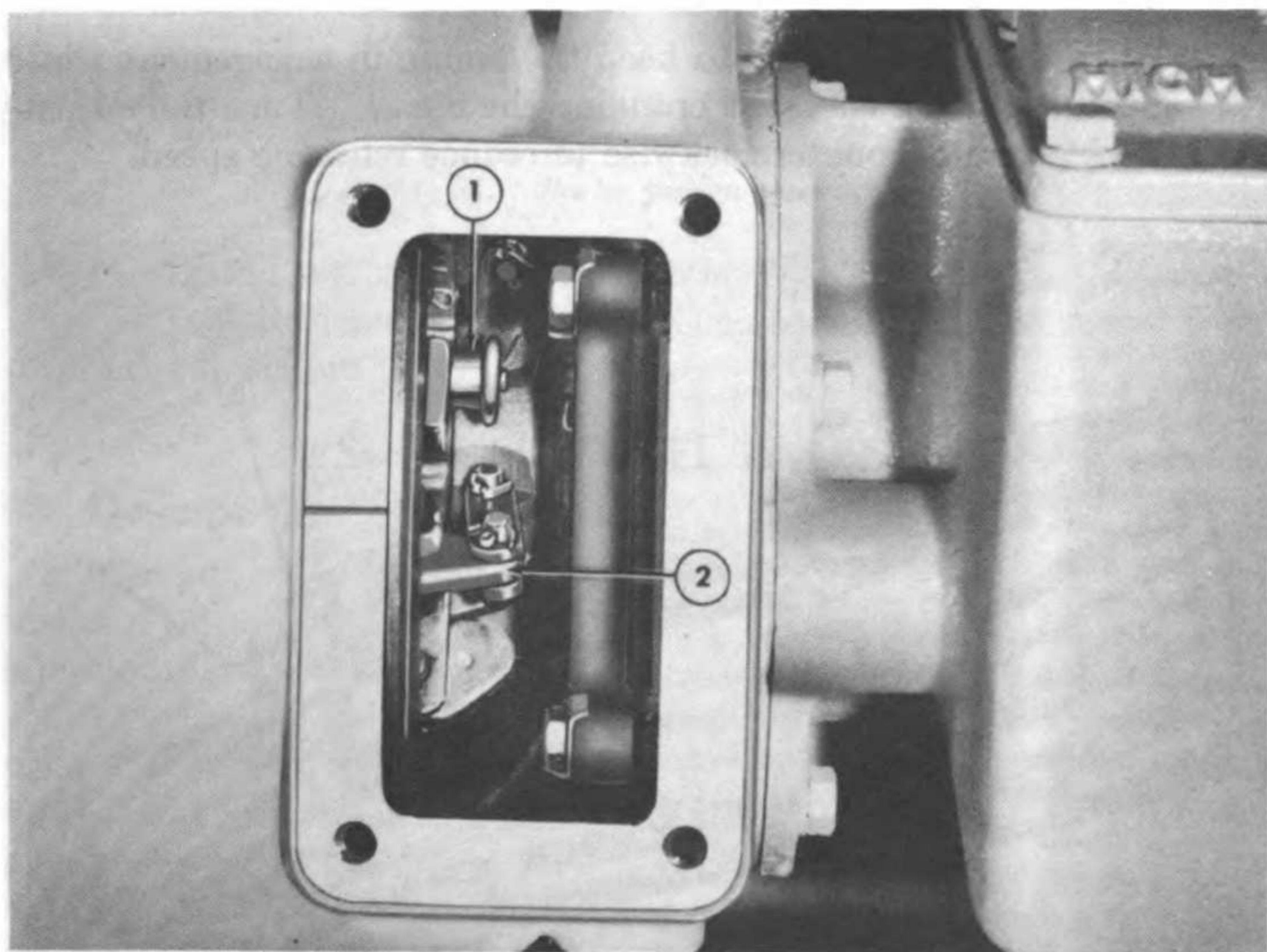
66. Starting Engine Clutch

a. General. Check the clutch frequently and adjust when necessary. If oil is noticed in the housing, remove the plug under the clutch housing (12, fig. 5) and drain.

b. Checking Adjustment. Pull the clutch lever to the engaged position (fig. 29). The lever should go into this position with a distinct snap, and should require a reasonably hard pull.

c. Adjusting Procedure (fig. 52).

- (1) Remove four cap screws and lift the inspection plate from the side of the clutch housing.
- (2) Turn the adjustment collar (2) until the lock pin (1) is accessible.
- (3) Pull out on the spring loaded lock pin.
- (4) Turn the collar in a clockwise direction until the lock pin drops into the next hole.
- (5) Test the adjustment by engaging the clutch. If one hole gives a slightly loose adjustment and the next gives too tight an adjustment, use the loose adjustment.



1 Adjustment collar

2 Lock pin

Figure 52. Starting engine clutch adjustment.

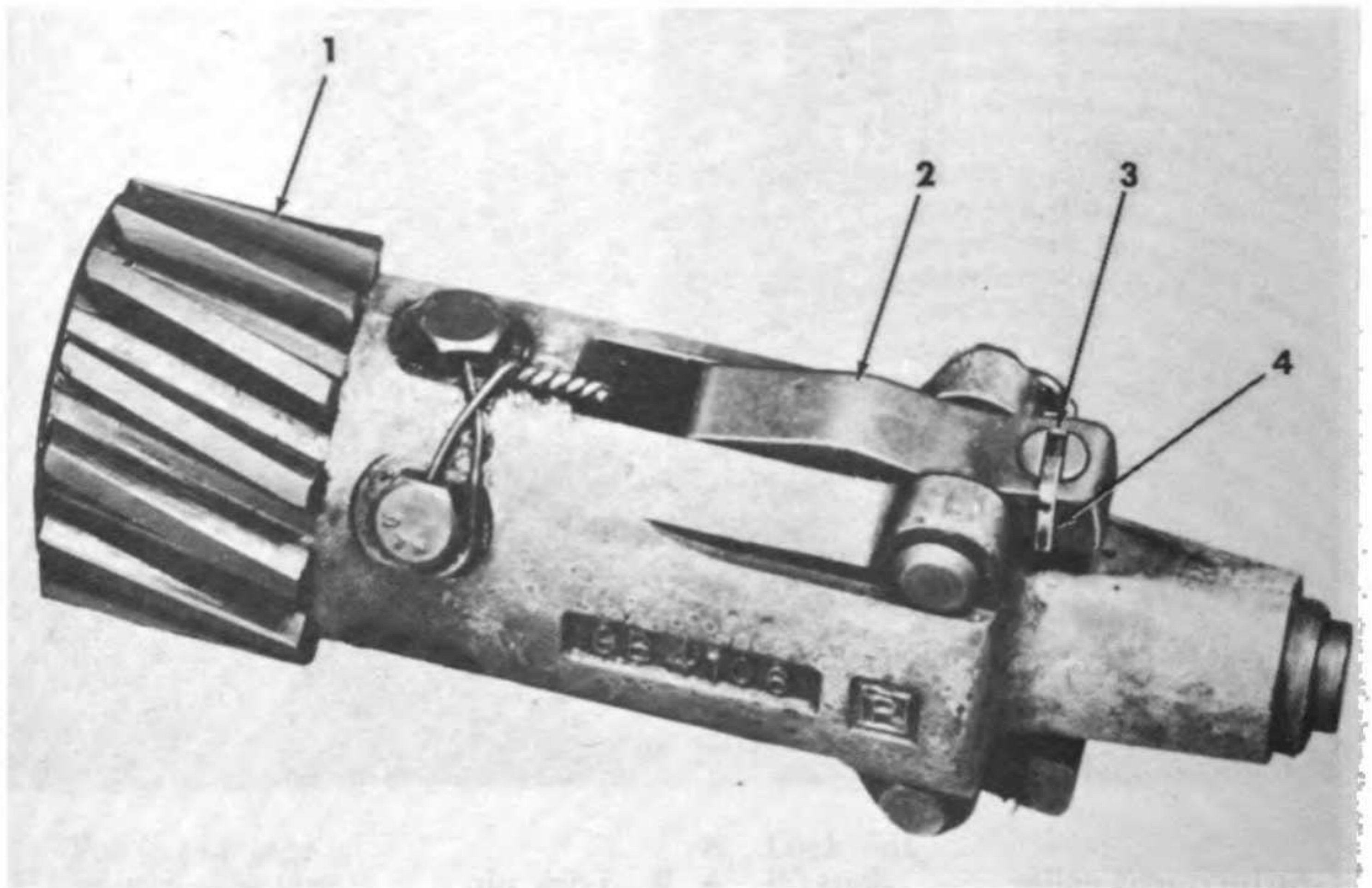
67. Starter Pinion

a. *Description* (fig. 53). The starting engine power is transmitted to the diesel engine flywheel through a pinion (1) which is manually engaged with the flywheel ring gear. The pinion is held in engagement by latches (2) which release by the increased centrifugal force when the diesel engine starts. When the latches release, a spring pushes the pinion out of engagement with the ring gear. Releasing speed may be adjusted by means of the adjusting screw (3) on each latch.

b. *Latch Spring Adjustment.*

Caution: Before latch spring adjustment, all other possible causes of improper starter pinion operation should be eliminated (see par. 53c). If the releasing speed is set too high, the starting engine may be damaged by overspeeding when the diesel engine starts.

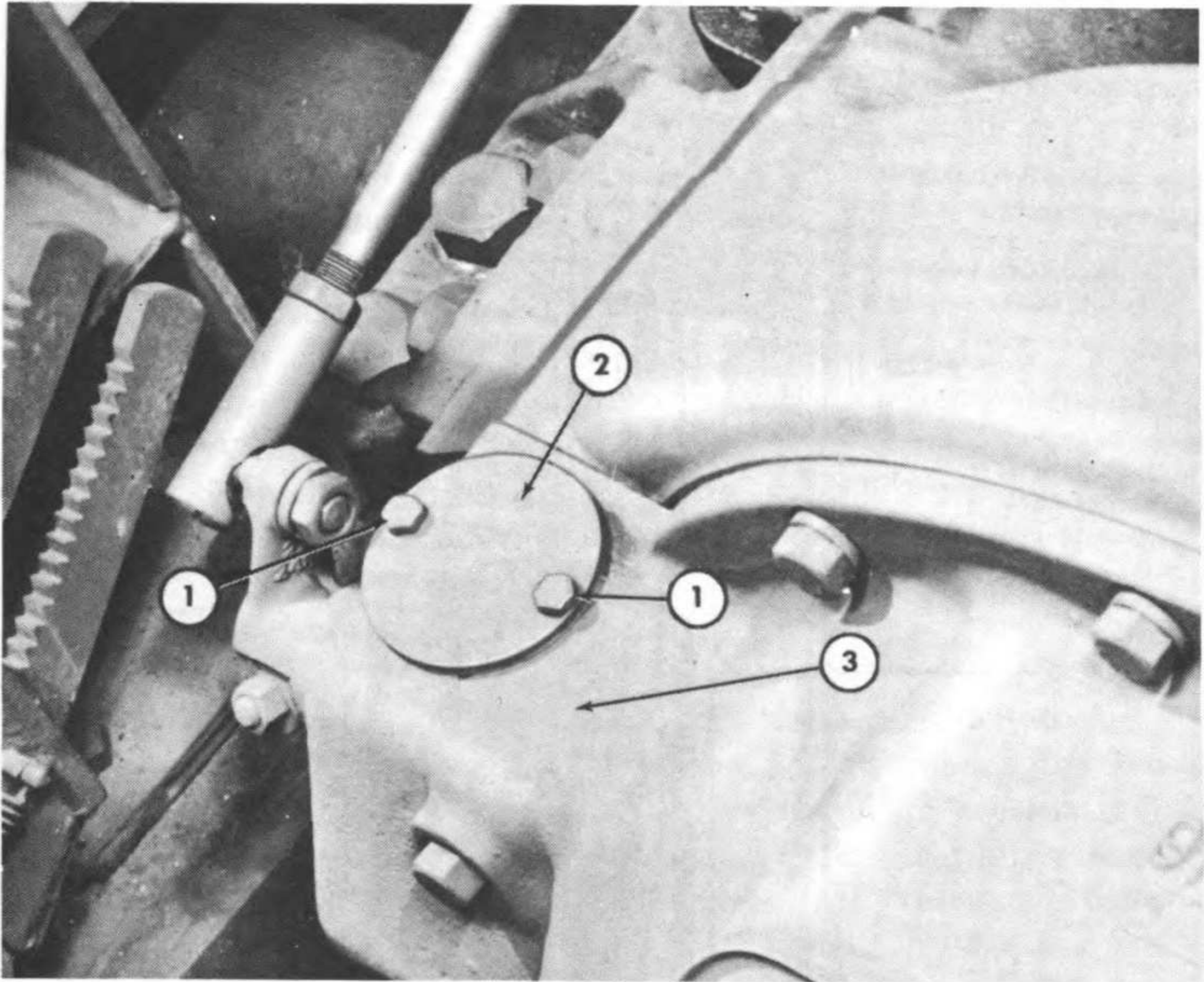
- (1) Remove the two cap screws (1, fig. 54) which secure the access cover (2) to housing (3) and remove cover.
- (2) Remove the cotter pin (4, fig. 53) from each latch and turn adjusting screws (3) clockwise to increase releasing speed. One-half turn on each screw will increase releasing speed 100 to 150 rpm.
- (3) Tighten just enough to keep the pinion in engagement while the starting engine is cranking the diesel. Turn the adjusting screws counterclockwise to reduce releasing speed.



1 Pinion
2 Latch

3 Adjusting screw
4 Cotter pin

Figure 53. Start pinion and latch assembly.



1 Cap screw
2 Access cover

3 Housing

Figure 54. Starter pinion access cover.

- (4) Install cotter pins (4) in each latch to secure adjusting screw.
- (5) Install access cover (2, fig. 54) on housing (3) and secure with cap screws (1).

Section VI. DIESEL ENGINE

68. Description

a. General. The engine in the D-8 tractor is a six-cylinder, four-stroke cycle, valve-in-head type (figs. 4 and 5). Individual fuel injection pumps and injection valves are used for each cylinder.

b. Operation. During the inlet stroke the inlet valve opens, the piston moves down, and only air enters the cylinder. On the compression stroke, the inlet and exhaust valves are closed and when the piston moves up the air is compressed until it reaches a temperature of over 1,000° F. Near the end of the compression stroke and during the beginning of the power stroke, fuel is injected into the hot compressed air and spontaneously ignited. The expansion of the burning fuel forces the piston down, producing the power stroke. When the piston moves up again on the exhaust stroke, the exhaust valve is opened, the burned gases are forced out of the cylinder, and the cycle starts over again.

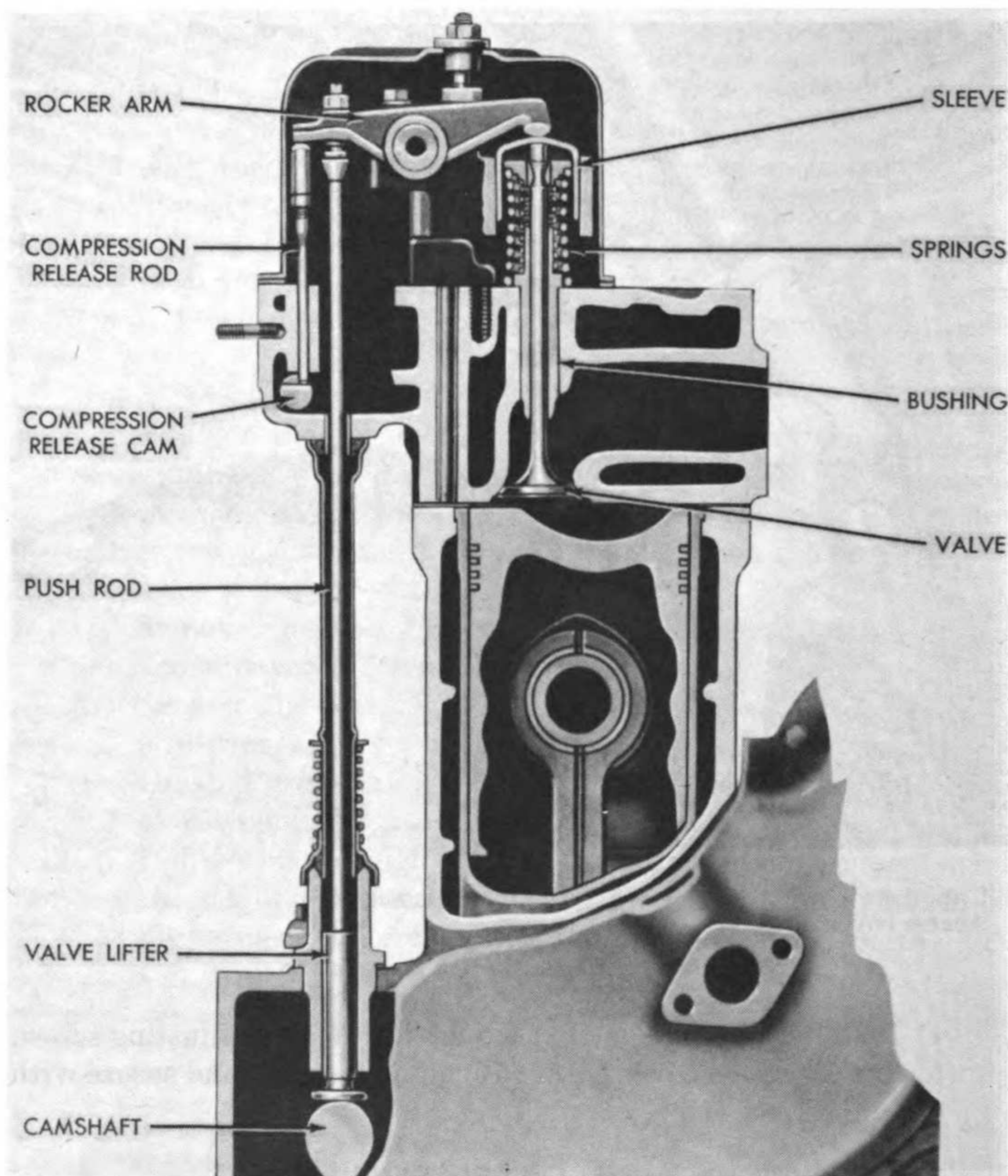


Figure 55. Valves and valve mechanism.

69. Valves and Valve Mechanism

a. Description (fig. 55). The inlet and exhaust valves are located in the cylinder heads. The valves are operated by a gear-driven camshaft, through a lifter, push rod, and rocker arm arrangement. The valve stems operate in replaceable bushings. Sleeves are provided to eliminate side thrust from the valve stems. Compression release for starting is accomplished by a cam and push rods manually controlled, which act on the exhaust rocker arms to hold the exhaust valves open.

b. Adjustment.

(1) *General.*

(a) The valve clearance adjustment is correct on both inlet and exhaust valves when there is 0.012-inch clearance between the valve rocker arm and the valve sleeve, with

the engine hot, the valves closed, and the compression release lever in the RUN position (fig. 30). If the adjustment is not completed while the engine is still warm, start the engine and allow it to warm up again. At the end of the day's operation, while the engine is at normal operating temperature, is the most desirable time for making valve clearance adjustments.

- (b) The compression release adjustment should be checked and made at the same time the valve clearance adjustment is checked and made. There must be .025-inch to .030-inch between each compression release push rod and the exhaust rocker arm, with the valves closed and the compression release in the RUN position.

(2) *Valve clearance adjustment.*

- (a) Remove the hood (par. 41b(1)(b)).
- (b) Remove the six nuts and lock washers which secure the two valve covers to studs on top of the engine block.
- (c) The valves being checked must be entirely closed before the valve and compression release clearances can be checked or adjusted. To close both valves on each of the cylinders listed under "A" (fig. 56) rotate the crank-

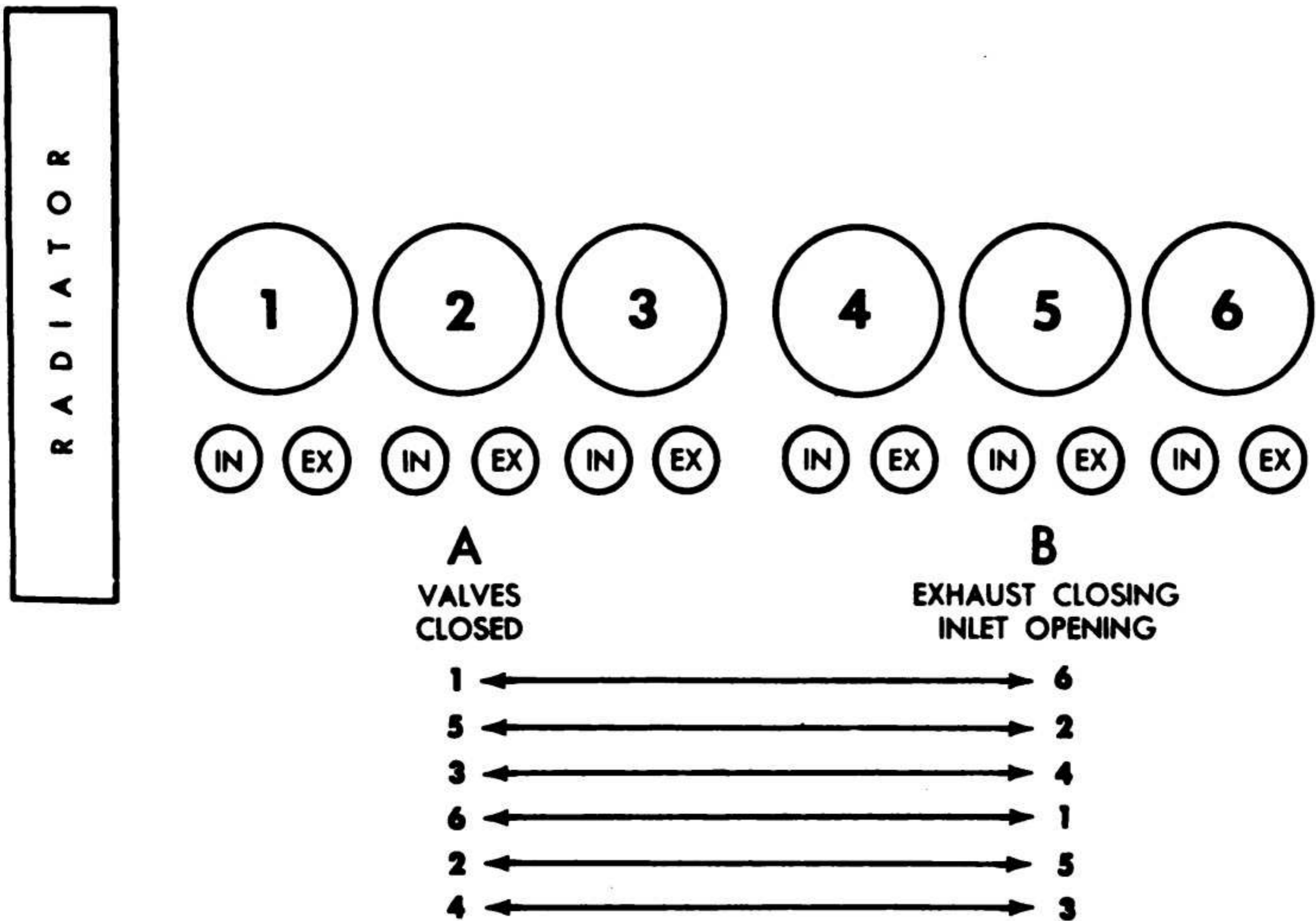


Figure 56. Valve closing procedure.

shaft in the direction of normal rotation, until the exhaust valve is about to close the inlet valve starts to open on the cylinders listed opposite under "B". If the valves are adjusted in the firing order, they can all be adjusted in two revolutions of the crankshaft.

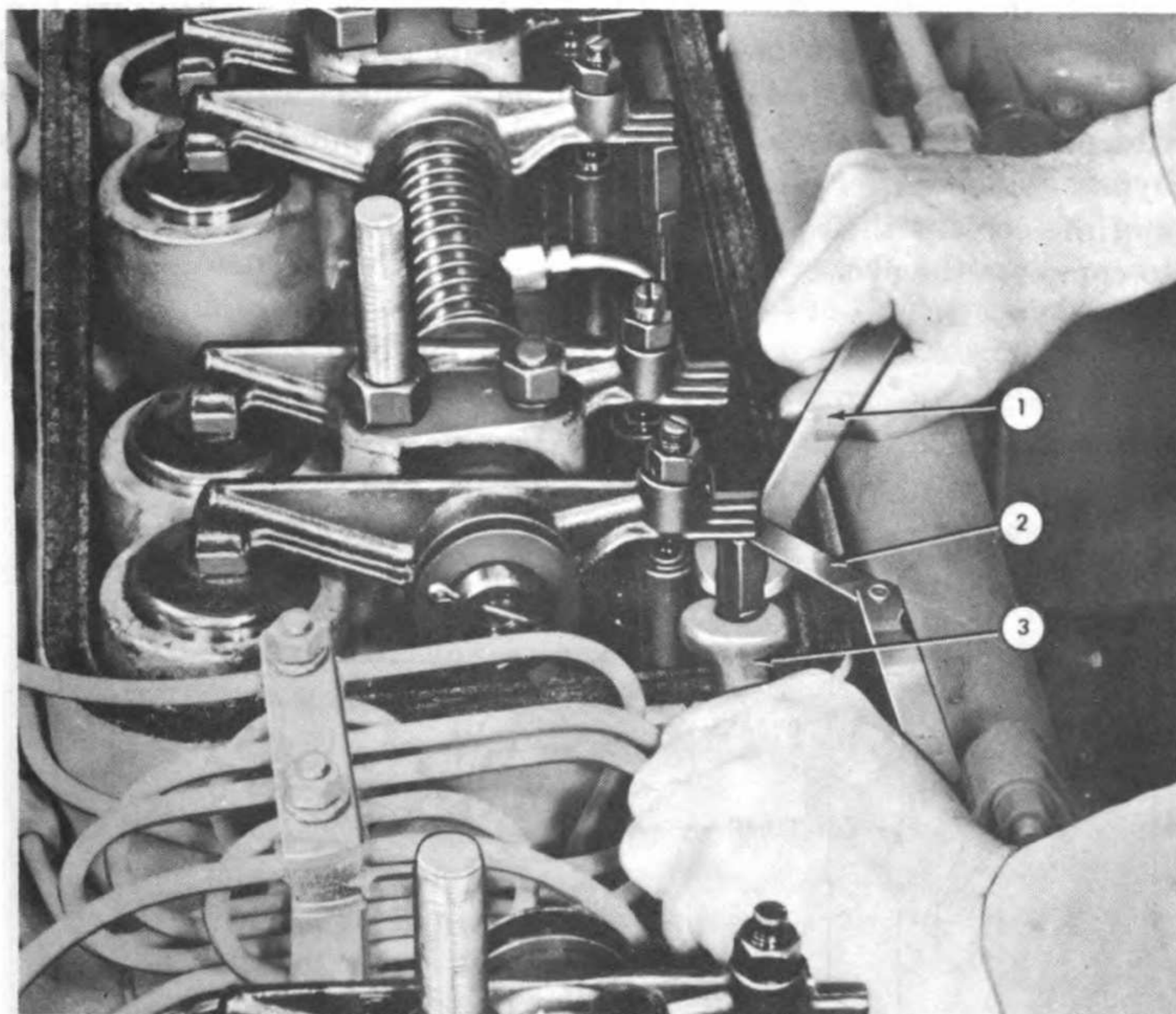
- (d) Move the compression release lever to the START position to make it easier to turn the crankshaft, but place the lever in the RUN position before the valve clearances are checked.



- 1 Screwdriver
- 2 Wrench
- 3 Thickness gage

Figure 57. Valve adjustment.

- (e) Loosen valve clearance adjusting screw lock nut with wrench (2, fig. 57) and turn the adjusting screw with a screwdriver (1) until a slight drag is obtained on a 0.012-inch thickness gage (3) when it is passed between the top of the valve sleeve and the valve rocker.
- (f) Tighten the lock nut and recheck the clearance.
- (3) *Compression release adjustment.*
 - (a) Loosen the compression release rod lock nut with wrenches (1, fig. 58) and turn the adjusting nut until a slight drag is obtained on a 0.025-inch thickness gage (2) when it is passed between the end of the push rod and the projection on the exhaust valve rocker arm.
 - (b) Hold the adjusting nut and tighten the lock nut. Recheck adjustment.
 - (c) Install valve covers on studs on top of engine block and secure with lock washers and nuts.



1 Wrench

2 Thickness gage

Figure 58. Compression release adjustment.

Section VII. COOLING SYSTEM

70. Description

a. The cooling system (fig. 59) consists of the following major units: Water pump, water manifolds, water temperature regulators, sealed pressure overflow valve, radiator, fan, and connecting pipes and hoses. Capacity of the system is 28 gallons.

b. The gear-driven centrifugal water pump circulates the coolant through both the starting engine and the diesel engine. This aids in starting the diesel engine since the starting engine heat warms the coolant in the entire system. The coolant is forced by the pump to the cylinder block, through directional tubes into the cylinder head where the flow is directed against the pre-combustion chambers and valves. From the cylinder heads, the coolant passes through an external return manifold. A tube from the manifold circulates some of the coolant through a jacket around the fuel filter housing and warms the fuel for cold weather operation.

c. Two water temperature regulators are mounted in the forward end of the manifold and serve to limit the flow of coolant to the radiator during the warm-up period, in order to quickly reach proper engine temperature. When the engine is cold, the regulators are closed and the coolant is bypassed to the water pump by means of a bypass tube. After the engine is warmed up, the regulators open and the coolant then passes through the radiator and into the pump to complete the cycle.

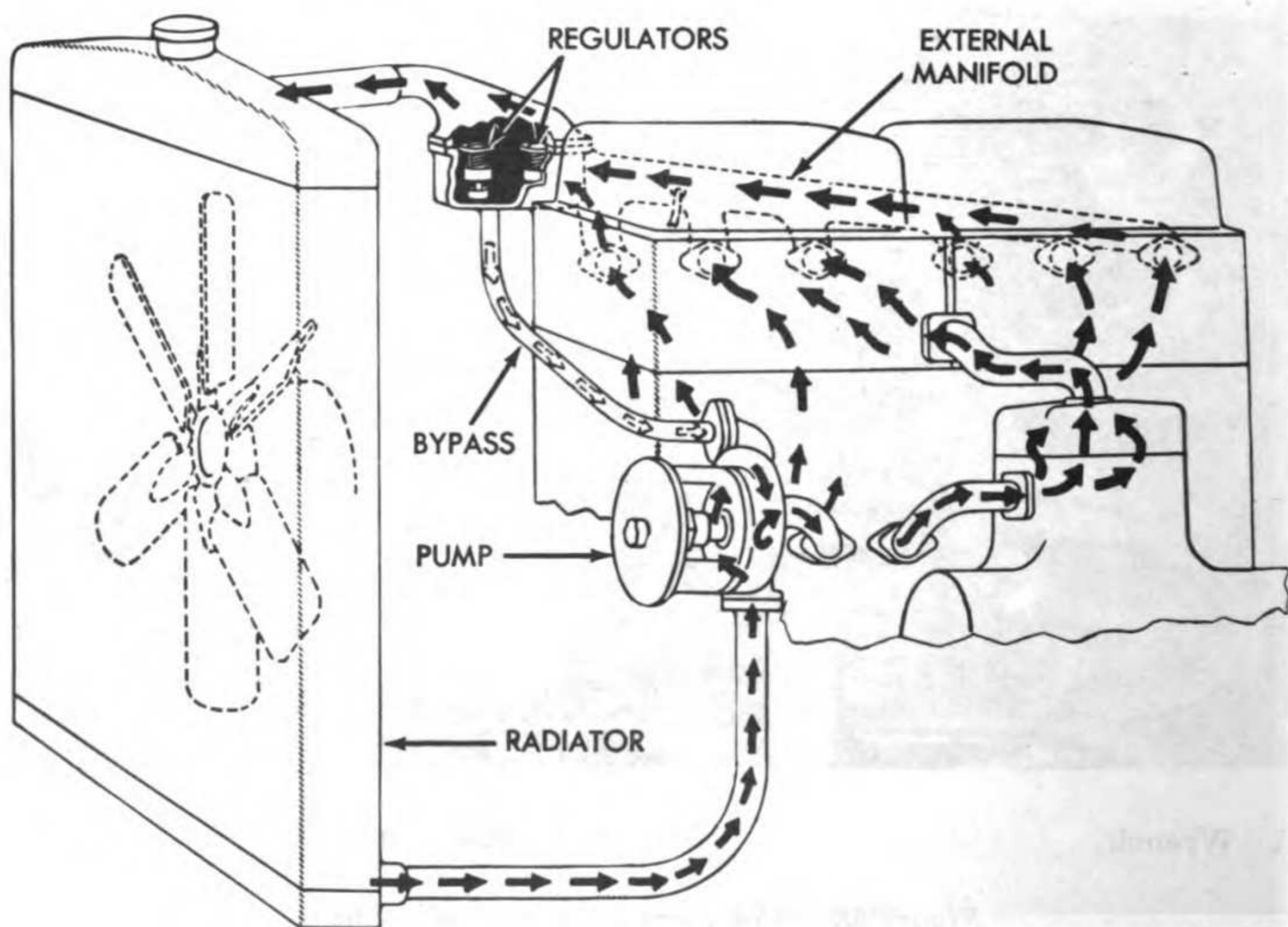


Figure 59. Cooling system.

d. A sealed pressure overflow unit (fig. 65) serves to keep the coolant from running out of the overflow pipe when the tractor is operating at extreme angles and also prevents, in some measure, the loss of antifreeze by evaporation. The fan is driven by two V-belts from a pulley on the crankshaft (fig. 64).

71. Radiator and Water Jacket Maintenance

a. General. General maintenance of the radiator and water jacket involves several points. Keep sufficient clean cooling liquid in the system. Clean, flush, and refill the system whenever inspection reveals an unusual accumulation of lime, rust, or scale. Always clean seasonally, as well as before and after using antifreeze solution. Clean the leaves and debris from between the radiator core and guard.

b. Draining the System.

- (1) Open the drain valve located in the radiator outlet fitting (fig. 15).
- (2) Remove the pipe plug located in the cover at the left rear corner of the diesel engine block (fig. 15).

c. Cleaning and Flushing.

(1) *Cleaning.* It is recommended that the cooling system be cleaned at least twice a year; before the antifreeze compound (ethylene-glycol type) is put into the system, and again after it is removed.

- (a) Run the engine until the temperature is within the operating range. Stop the engine and remove the radiator cap. Drain the radiator and the engine.
- (b) Allow the engine to cool. Close the drains; pour water slowly into the radiator until the system is approximately half full; then start the engine and set at idling speed. Add the cleaning compound in the proportion of one container of cleaner to every four gallons of cooling system capacity. Then complete filling the system with water.

Note.—Never mix the water and the cleaning compound before putting them into the system.

- (c) Place a clean drain pan in position to collect the overflow, using the overflow to maintain the level in the radiator, if necessary.
- (d) Replace the radiator cap and run the engine at fast idling speed, covering the radiator, if necessary, until the coolant reaches a temperature above 180° F., but not over 200° F. Do not drive the tractor. Constantly check the level in the radiator.
- (e) Stop the engine after it has run for thirty minutes at a temperature of at least 180° F., but not over 200° F. Remove the radiator cap and drain the system completely.

(2) *Neutralizing.*

- (a) Allow the engine to cool. Close the drains; pour water slowly into the radiator until the system is approximately half full; then start the engine and set at idling speed. Add the neutralizer compound in the proportion of one container of neutralizer to every four gallons of cooling system capacity. Then fill the system with water.
- (b) With the radiator covered, let the engine idle for at least five minutes at the normal temperature; then stop the engine.
- (c) Drain the system completely by removing the radiator cap and opening all the drains.

(3) *Flushing.*

- (a) Allow the engine to cool. Close the drains. Pour water slowly into the radiator until the system is approximately half full; then run the engine at idling speed and fill the system completely.
- (b) Run the engine, keeping the radiator covered, if necessary, until the coolant is heated to the normal operating temperature.
- (c) Drain system by removing the radiator cap and opening all the drains. Repeat the flushing operation until the drain water is clear.
- (d) Allow the engine to cool and then clean all sediment from the radiator cap, drains, and the overflow pipe. Blow insects and dirt from the radiator core air passages with compressed air, blowing from the rear. Use water to soften obstructions, if necessary.

d. Filling the System. After completing the flushing operation, make certain that the engine has been allowed to cool again. Close the drain cocks. Pour water slowly into the radiator until the system is approximately half full; then run the engine at idling speed, and fill the system completely.

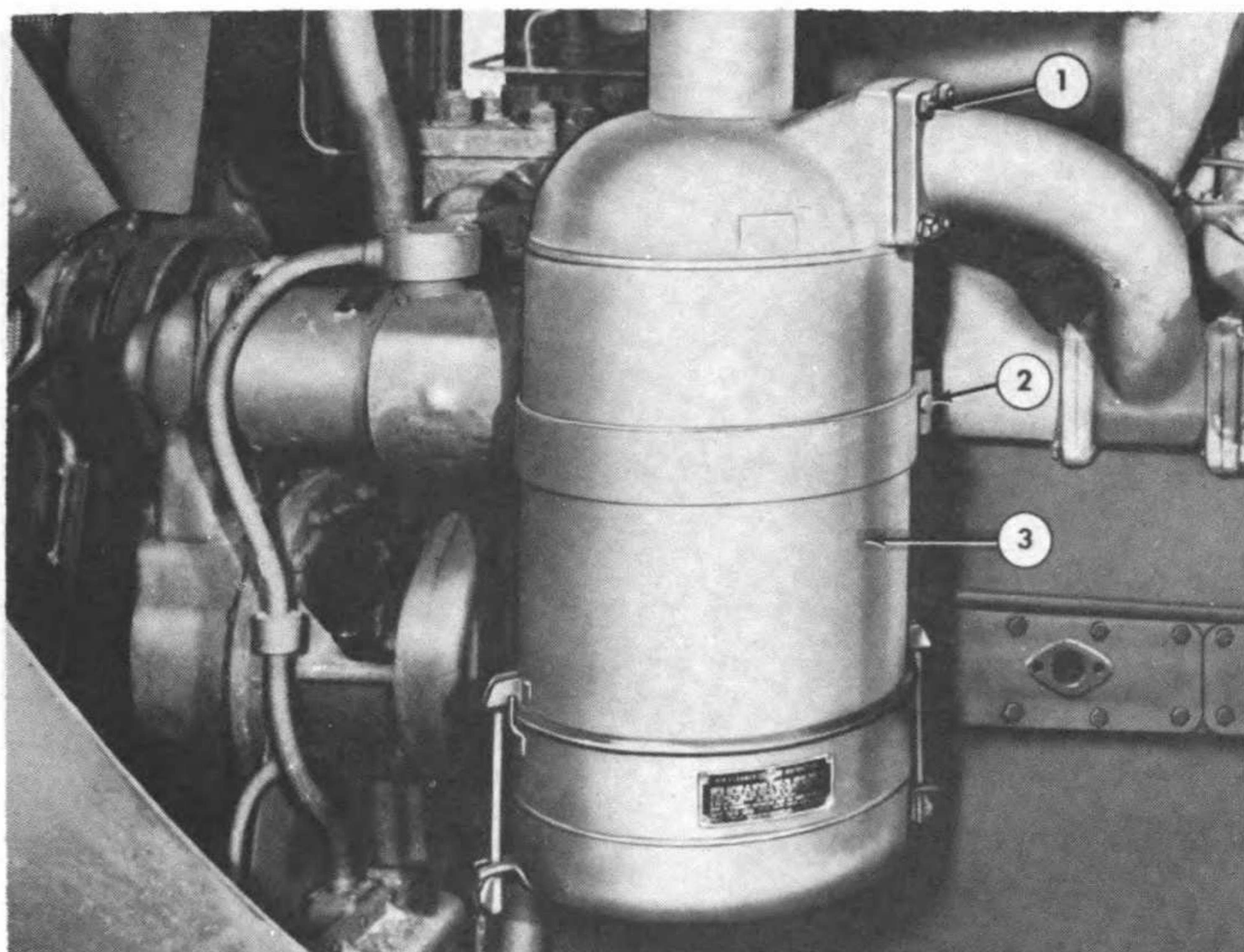
e. Examining for Leaks. Stop the engine when the cooling system is completely full. Examine the entire cooling system for leaks. This is important because the cleaning solution uncovers leaks which already exist but are plugged with rust or corrosion. Leaks that cannot be corrected by the using organization should be reported to higher authority.

72. Water Pump

a. General. The gear driven, centrifugal type water pump is mounted at the rear of the timing gear housing. It circulates the coolant through both the starting engine and diesel engine.

b. Removal.

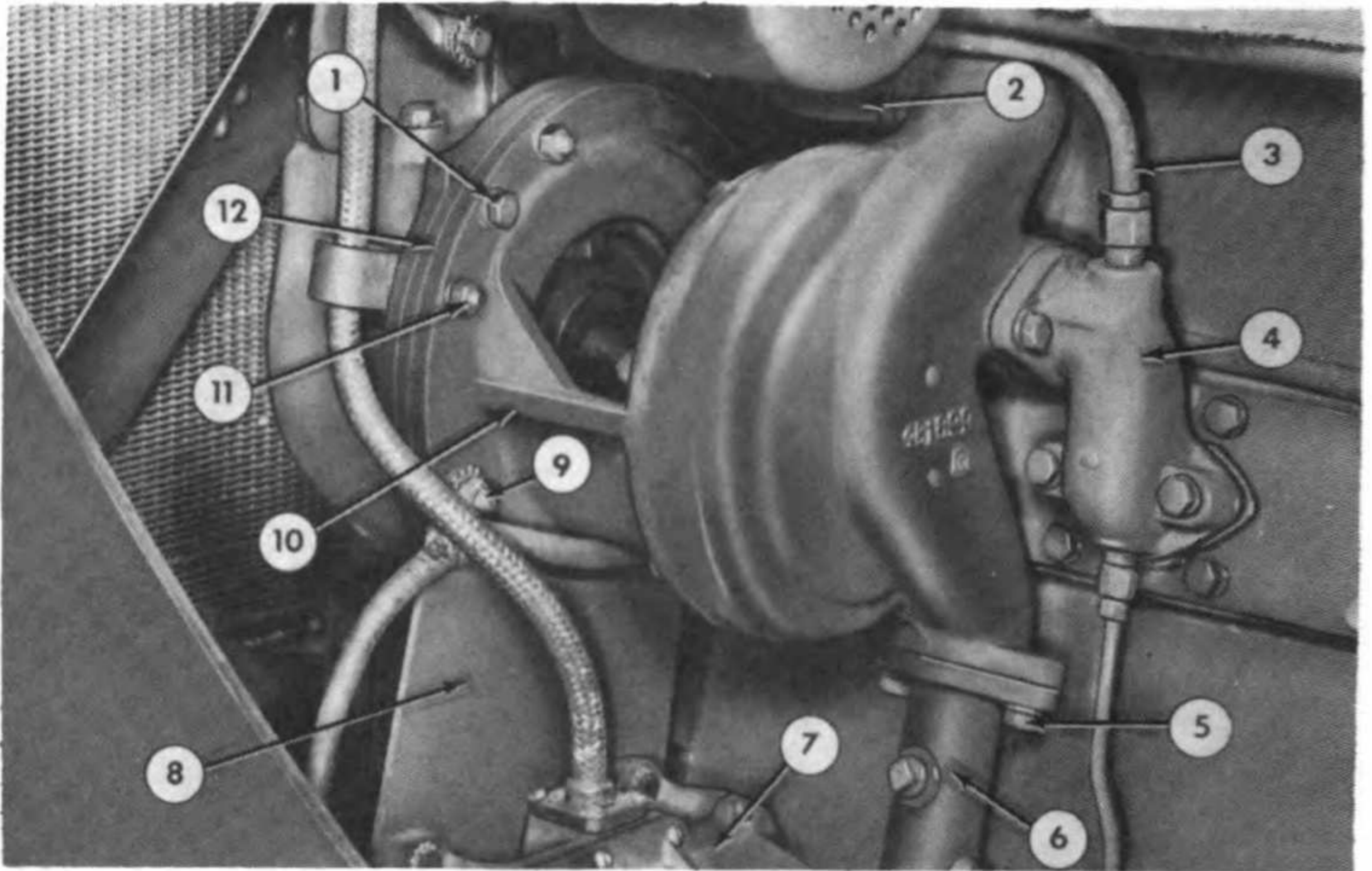
- (1) Remove pre-cleaner (par. 64b(1)(a)).



1 Nut 2 Cap screw 3 Air cleaner

Figure 60. Air cleaner removal points.

- (2) Remove nuts and lock washers (1, fig. 60). Remove cap screw (2) and remove air cleaner (3).
- (3) Drain the cooling system (par. 71*b*).
- (4) Remove the cap screws connecting the regulator bypass tube (2, fig. 61) to the water pump.
- (5) Remove the cap screws (5) from the pump inlet line (6).
- (6) Disconnect the tube (3) from the elbow (4).
- (7) Remove cap screws from elbow (4) and remove elbow.
- (8) Remove the nuts (11) and all the cap screws around the pump mounting flange except (1) and the one directly opposite it. These two cap screws hold the bearing assembly (12) to the bracket assembly (1) and do not extend into the timing gear housing.
- (9) Remove the three cap screws (9) in the voltage regulator mounting bracket (8). Swing the voltage regulator (7) with bracket to one side.
- (10) Slide the water pump back until the drive gear is out of the timing gear housing and lift pump from housing.



- | | |
|------------------------------|------------------------------|
| 1 Bearing retainer cap screw | 7 Voltage regulator |
| 2 Bypass tube | 8 Voltage regulator bracket |
| 3 Tube (to fuel filter) | 9 Cap screw |
| 4 Elbow | 10 Bracket assembly |
| 5 Cap screw | 11 Mounting flange cap screw |
| 6 Inlet line | 12 Bearing |

Figure 61. Water pump removal points.

c. Installation.

Note.—When installing the water pump, use new gaskets and start all the nuts and cap screws before tightening any of them.

- (1) Slide the water pump back into the timing gear housing until the drive gear meshes with the timing gear.
- (2) Lift the voltage regulator mounting bracket (8, fig. 61) into position and replace three supporting cap screws (9) and nuts, but do not tighten.
- (3) Replace all cap screws and nuts around the pump mounting flange, but do not tighten.
- (4) Install the elbow (4) on water pump and cylinder block and secure with cap screws.
- (5) Connect the tube (3) to elbow (4).
- (6) Install cap screws (5) in pump inlet line (2).
- (7) Install the cap screws which connect the temperature regulator bypass tube (2) to water pump.
- (8) Tighten all mounting flange cap screws securely.
- (9) Install air cleaner (3) (fig. 60) and secure with nuts and lock washers (1) and cap screws (2).
- (10) Install pre-cleaner (par. 64b(2)(e)).
- (11) Fill the cooling system (par. 71d) before operation.

d. Packing Nut Adjustment (fig. 62). Adjust the packing nut, using wrench 4A 334. Tighten the nut until the leak is stopped; then loosen it one-sixth turn to relieve the packing pressure on the shaft. Do not overtighten the packing nut. Too tight an adjustment prevents the coolant from wetting and lubricating the pump packing and shaft, and results in scoring the shaft. Install new packing if the pump still leaks when properly adjusted.

73. Fan Belts

a. General. The engine is equipped with two fan belts. When frayed or worn, replace both belts even if one is in good condition.

b. Removal (fig. 63).

- (1) Loosen the nut (3) holding the fan bracket to the timing gear housing.
- (2) Loosen the lock nut (2) and back off the adjusting screw (1) until the belts are loose enough to be removed from the lower pulley.
- (3) Remove the belts by sliding them up between the fan and radiator.

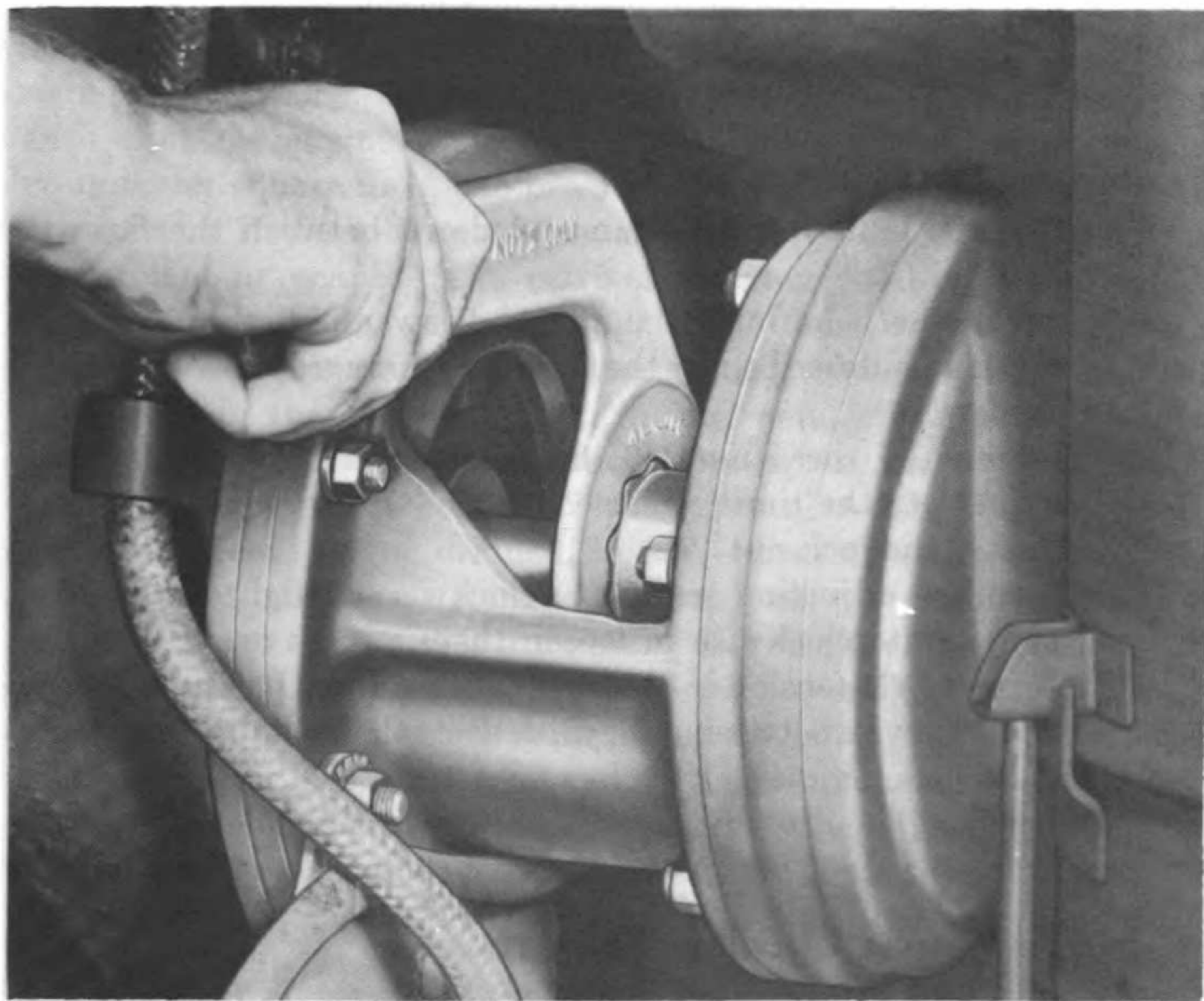
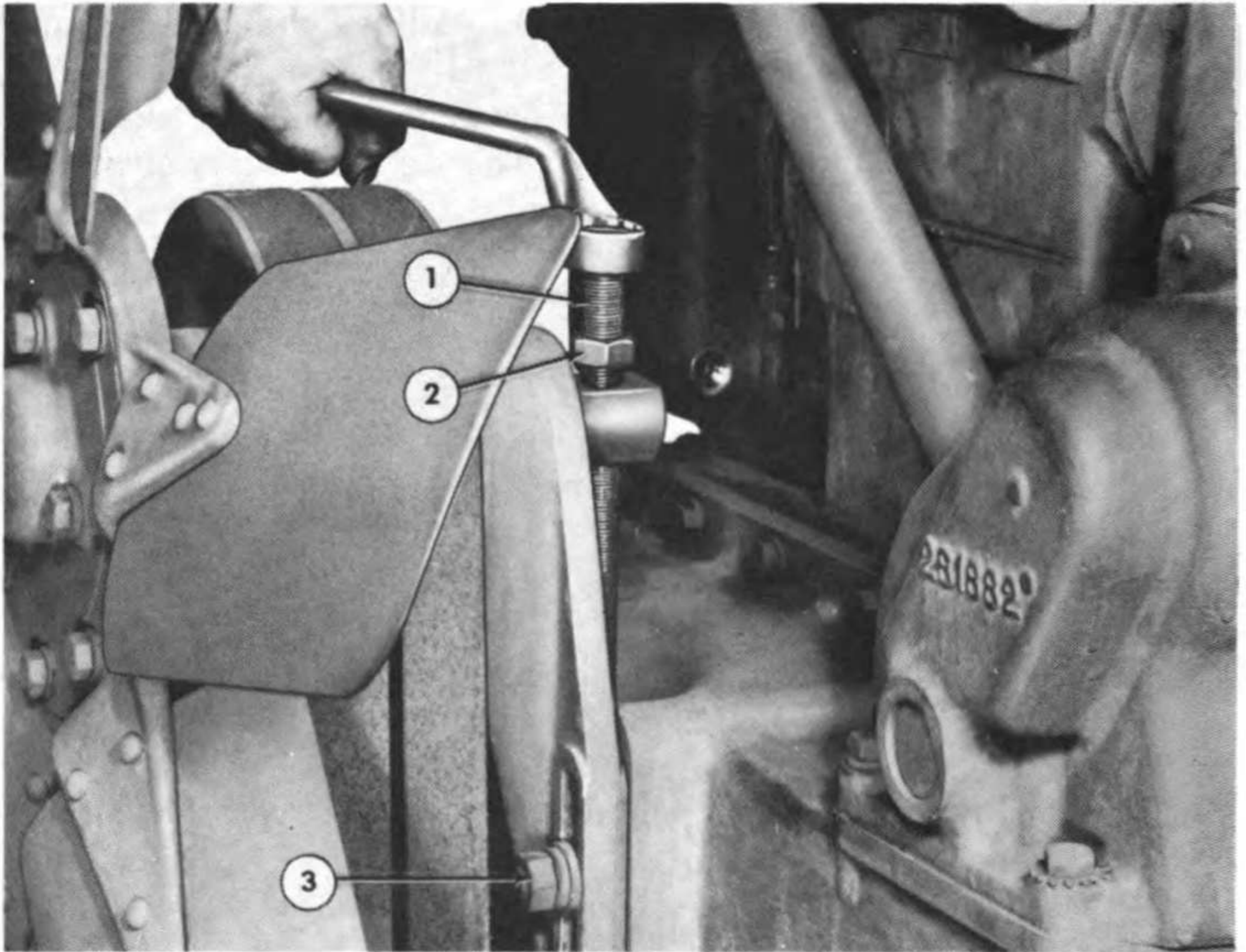


Figure 62. Water pump packing nut adjustment.



1 Adjusting screw
2 Lock nut

3 Bracket mounting nut

Figure 63. Fan belt replacement.

c. Installation (fig. 63).

- (1) Pass the belts over the fan and down between the fan and radiator.
- (2) Install the belts on the upper and lower pulleys and adjust tension as described in the following paragraph.

d. Adjustment.

- (1) Loosen the three nuts (3, fig. 63) which hold the fan hub bracket to the timing gear cover.
- (2) Loosen the lock nut (2).
- (3) Turn the adjusting screw (1) clockwise to tighten the belts and counterclockwise to loosen them.
- (4) Correct belt tension is obtained when a light pressure on the belt, midway between pulleys, deflects the belt approximately 1½ inches (fig. 64).
- (5) Tighten the adjusting screw lock nut (2, fig. 63) and the fan bracket nuts (3) after the correct belt tension is obtained.

74. Sealed Pressure Overflow Valve

a. Description (fig. 65). The sealed pressure overflow valve is located in the radiator top tank, and serves two purposes; to prevent the loss of coolant when the tractor operates at extreme angles, and

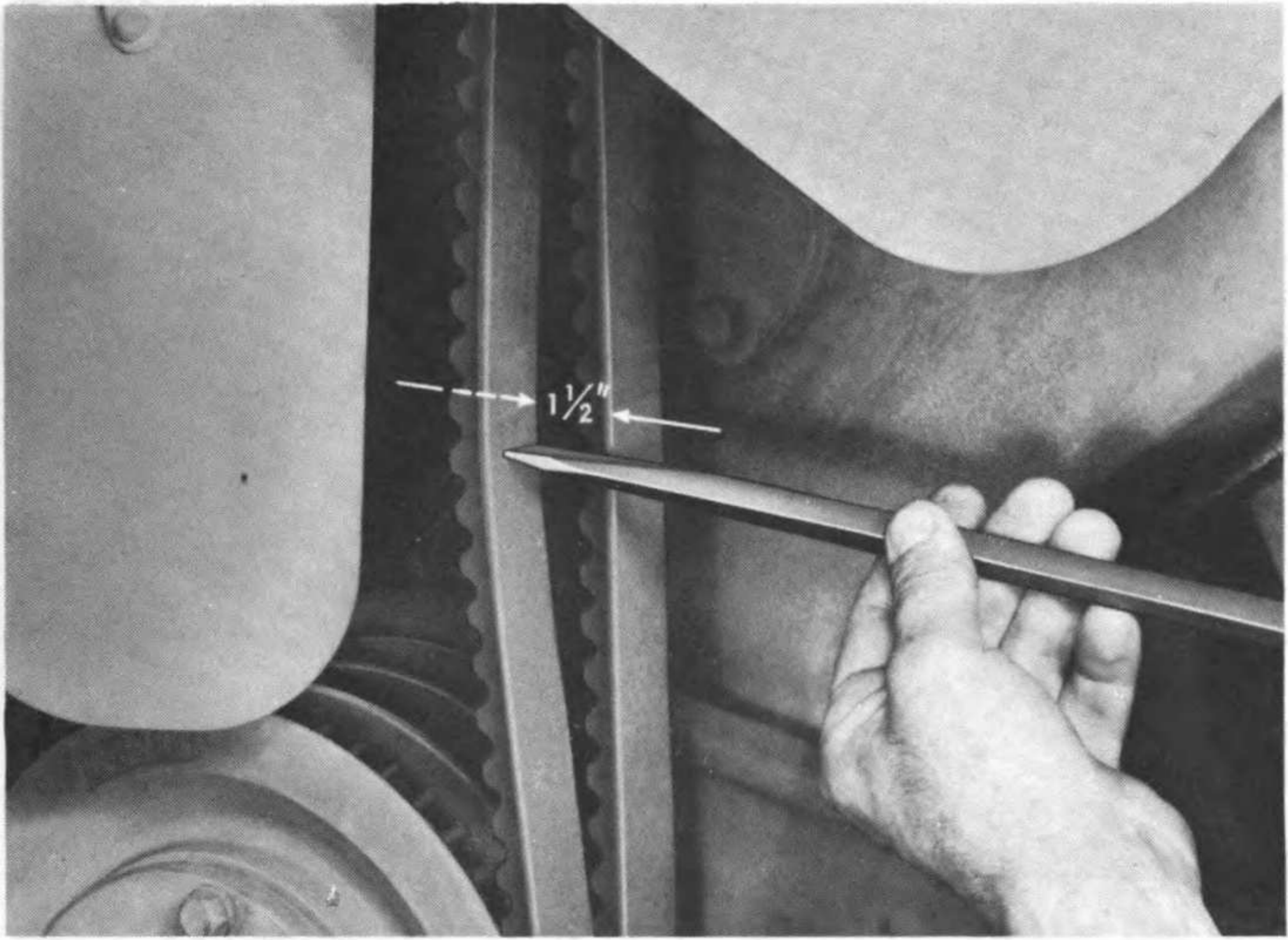


Figure 64. Checking fan belt tension.

to reduce the loss of coolant and antifreeze by evaporation. It operates in the following manner: Due to expansion of the coolant by rising temperatures, a pressure will be built up in the cooling system each time the engine is started. When the pressure rises above six pounds per square inch, the pressure relief valve opens to relieve the pressure or, if the cooling system has been over-filled, allows some of the coolant to escape. The valve closes when the temperature of the coolant levels off and remains closed until there is a further increase in pressure. When the temperature of the coolant falls, a vacuum will result in the cooling system. The vacuum release valve opens when the vacuum reaches one pound per square inch, and lets in air through the overflow tube. This valve also functions when the cooling system is being drained, to prevent an air-lock.

b. Removal (fig. 65). Remove four cap screws securing the cover on the valve in the radiator top tank. Lift off the cover and the valve.

c. Cleaning and Inspection. Inspect the gaskets and seals for damage, and clean the unit by brushing the parts thoroughly until all foreign matter has been removed. Check operation of the spring-loaded valves and be sure that no dirt has lodged in the valve seats.

d. Installation (fig. 65). Place the valve in position in the valve housing with a gasket on either side. Replace the valve cover and secure with cap screws.



Figure 65. Removing sealed pressure overflow valve.

Section VIII. FUEL SYSTEM

75. Description

a. General. The fuel system (fig. 66) is divided into two sections which are designated as the supply or low pressure side, and the injection or high pressure side. The supply side consists of the fuel tank, transfer pump, fuel filters, fuel pressure gage, and connecting lines. The injection side is made up of the fuel injection pumps, fuel injection valves, and connecting lines.

b. Supply Side. On the supply side of the fuel system, the fuel flows by gravity from the main fuel tank through the Purolator-type fuel filter to the transfer pump. The transfer pump forces the fuel through the fuel filter elements into the upper chamber of the fuel filter housing and down into the individual fuel injection pumps. The fuel pressure gage is connected so as to register pressure on the fuel between the filters and the injection pumps, and serves to indicate the condition of the fuel filter elements and the transfer pump.

c. Injection Side. On the injection side of the fuel system, the injection pumps deliver the fuel to the injection valves. The injection valves atomize the fuel delivered to the cylinders. Overflow from the injection valves is carried by a drain tube to the suction side of the transfer pump.

d. Care of Fuel.

- (1) Too much emphasis cannot be placed on the importance of using only clean fuel. The best fuel can be rendered unsatisfactory by inadequate storage facilities or careless handling. Dirty fuel will result in rapid clogging of the filters, excessive wear on the fuel transfer pump, and premature wear on the fuel injection pumps and valves. Water in the fuel also will cause difficulty in the form of unsatisfactory engine performance and rusting of the finely finished parts in the injection equipment. The following suggestions will help assure a clean fuel supply:
- (2) Where possible use a large storage tank. Allow the dirt and water to settle for at least 32 hours before using the fuel, then draw from the top, preferably with a pump. Periodically drain water and sediment from the bottom.
- (3) Avoid the use of open cans and funnels. If cans must be used, select clean cans with tight caps.
- (4) Before removing the fuel tank cap, clean the dust and dirt from the cap and surrounding area. If a pump is used on a storage tank, wipe off the nozzle before filling the fuel tank or, if cans are used, wipe off the cap and top of the can.

76. Fuel Tank

The diesel fuel tank has a capacity of 69 gallons and is located directly behind the seat cushion in the operator's compartment. The filler opening is located in the top of the tank (fig. 66). A fuel strainer in the filler opening and an air filter in the cap are provided to aid in keeping dirt out of the fuel. The main fuel line projects up from the bottom of the tank several inches to prevent water and sediment in the bottom of the tank from going directly to the transfer pump. A sediment drain cock is provided to drain off this sediment and water.

77. Fuel Transfer Pump

a. Description. The fuel transfer pump is under the rear end of the accessory shaft. This pump forces fuel through the fuel filter elements (fig. 66) to the injection pumps. An adapter mounted on the side of the transfer pump contains a spring-loaded plunger which opens to bypass fuel not required by the fuel injection pumps, or when the fuel filters become clogged.

b. Pump Adapter.

(1) *Removal* (fig. 67).

- (a) Close the fuel shutoff valve in the main fuel line under the fuel tank.
- (b) Disconnect the main fuel line (1) from the adapter (3).
- (c) Take out the two cap screws holding the adapter to the transfer pump body (2) and remove the adapter.

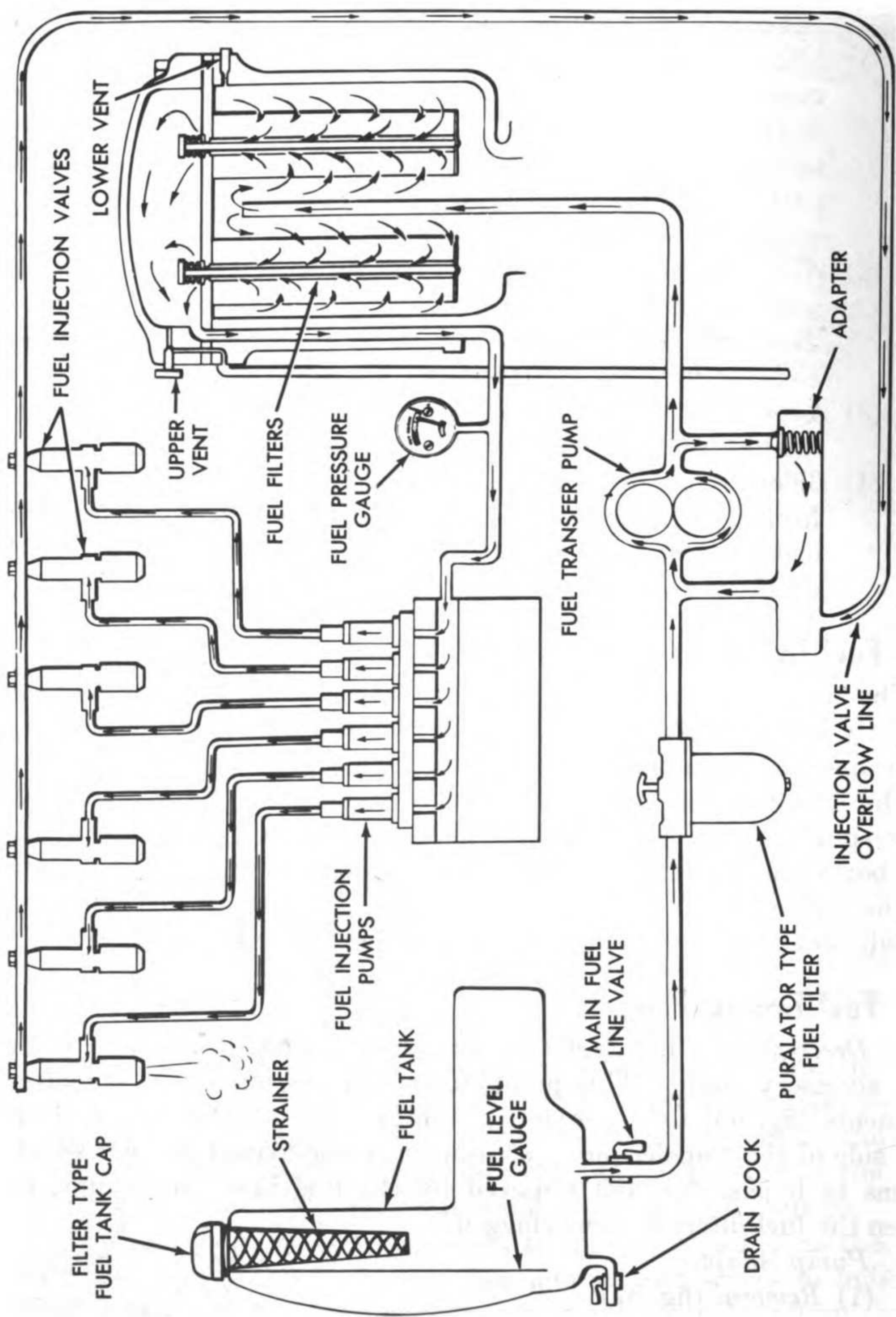
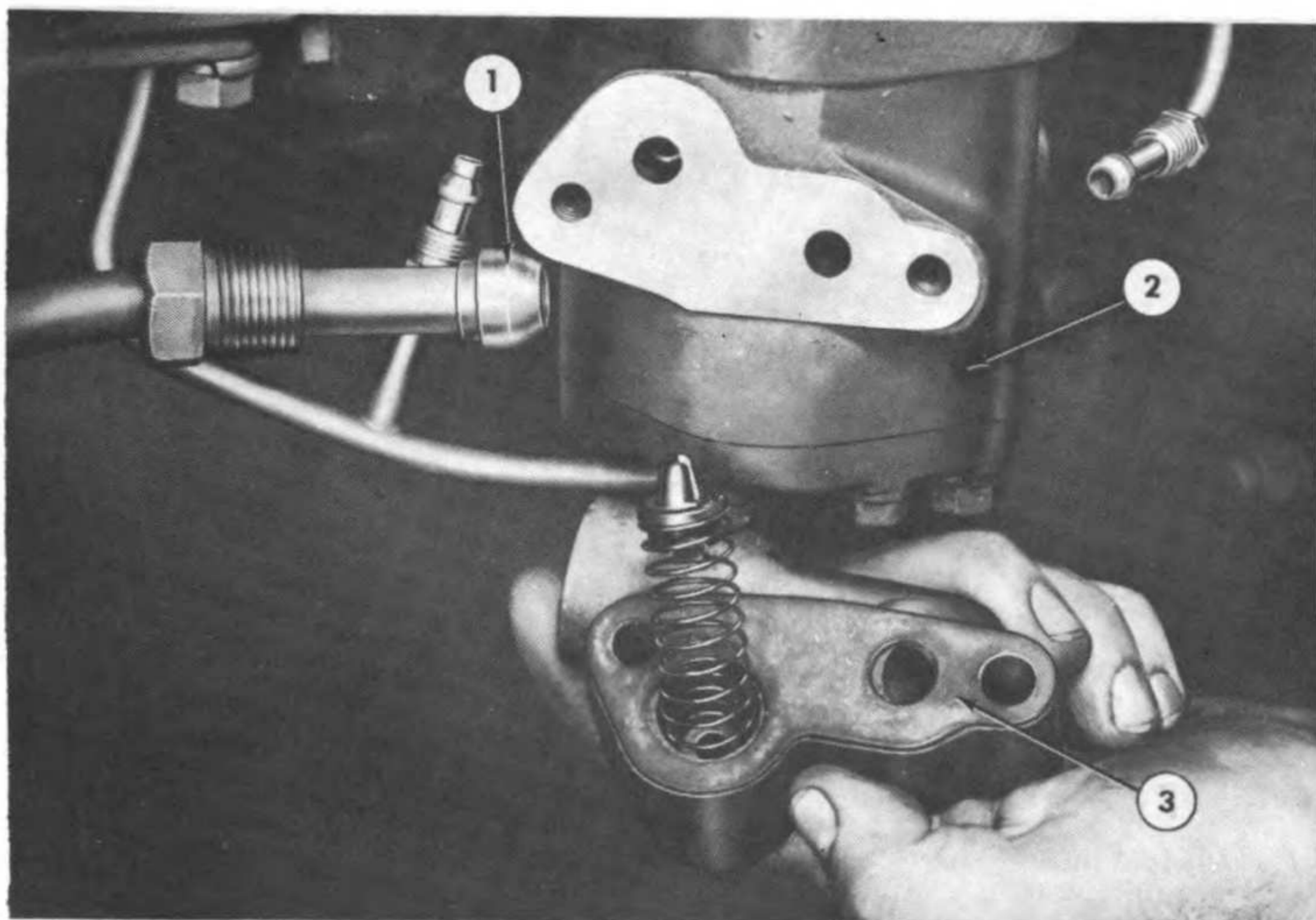


Figure 66. Schematic drawing of fuel system.



1 Main fuel line 2 Transfer pump body 3 Adapter

Figure 67. Removing fuel transfer pump adapter.

(2) *Cleaning.* Clean the plunger and seat with diesel fuel or dry-cleaning solvent.

(3) *Installation.*

(a) Place the adapter in position on the transfer pump housing and secure with the two cap screws.

(b) Connect the main fuel line and turn on fuel.

c. *Pump.*

(1) *Removal* (fig. 68).

(a) Close the fuel shutoff valve in the main fuel line under the fuel tank.

(b) Remove the two bolts holding the fuel line clips to the frame of the tractor.

(c) Disconnect the main fuel (1) line from the adapter (3).

(d) Disconnect the two drain lines (2 and 5) from the transfer pump body.

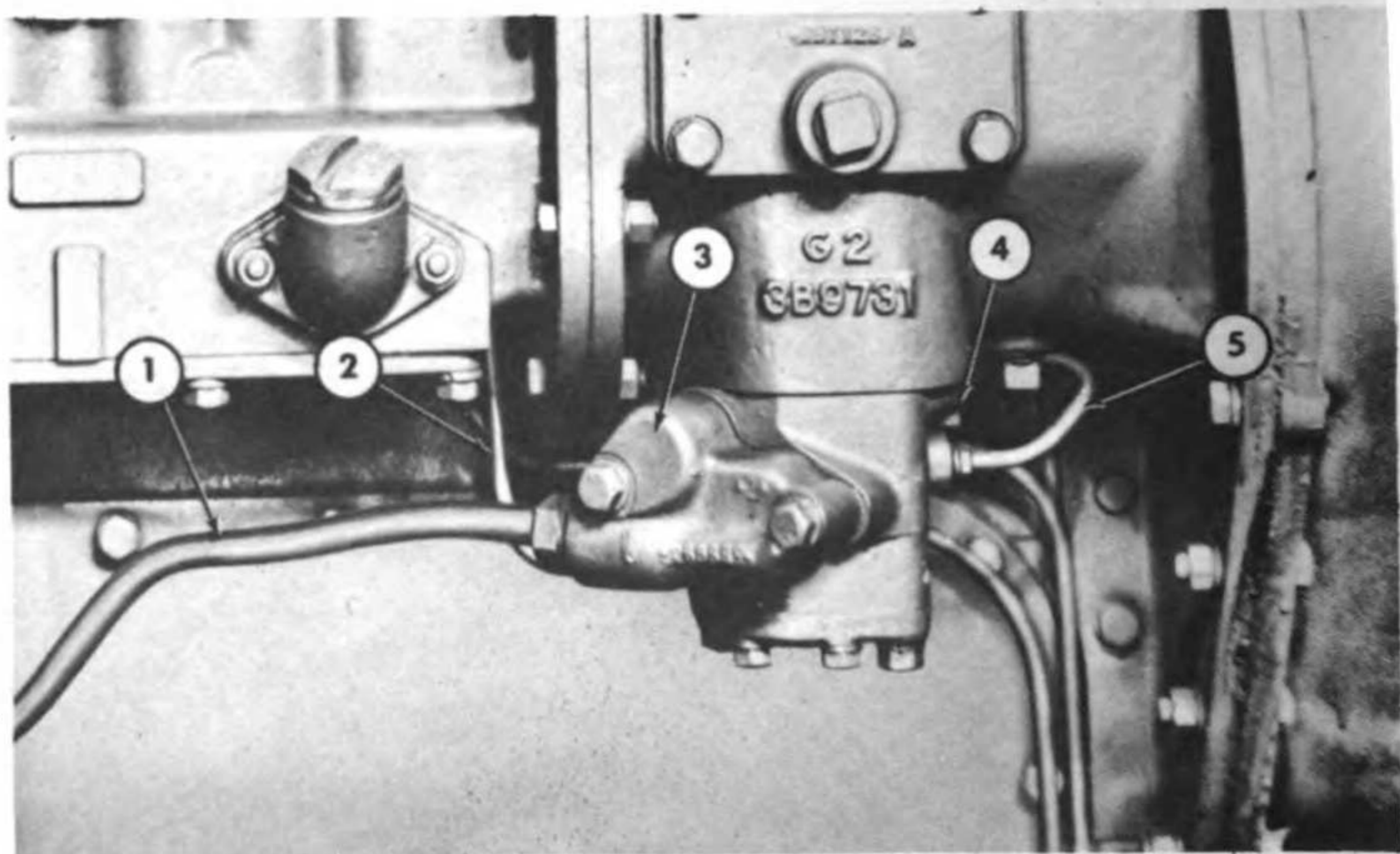
(e) Remove the four cap screws (4) holding the transfer pump to the accessory drive shaft housing and remove the pump.

(2) *Installation* (fig. 68).

(a) Be sure the rubber seal, metal ferrule, and gasket are in good condition and in place as the pump is installed.

(b) Place the pump in position on the accessory drive shaft housing and secure with four cap screws (4).

(c) Connect the two drain lines (2 and 5) to the transfer pump body.



- | | |
|------------------|--------------|
| 1 Main fuel line | 4 Cap screw |
| 2 Drain line | 5 Drain line |
| 3 Adapter | |

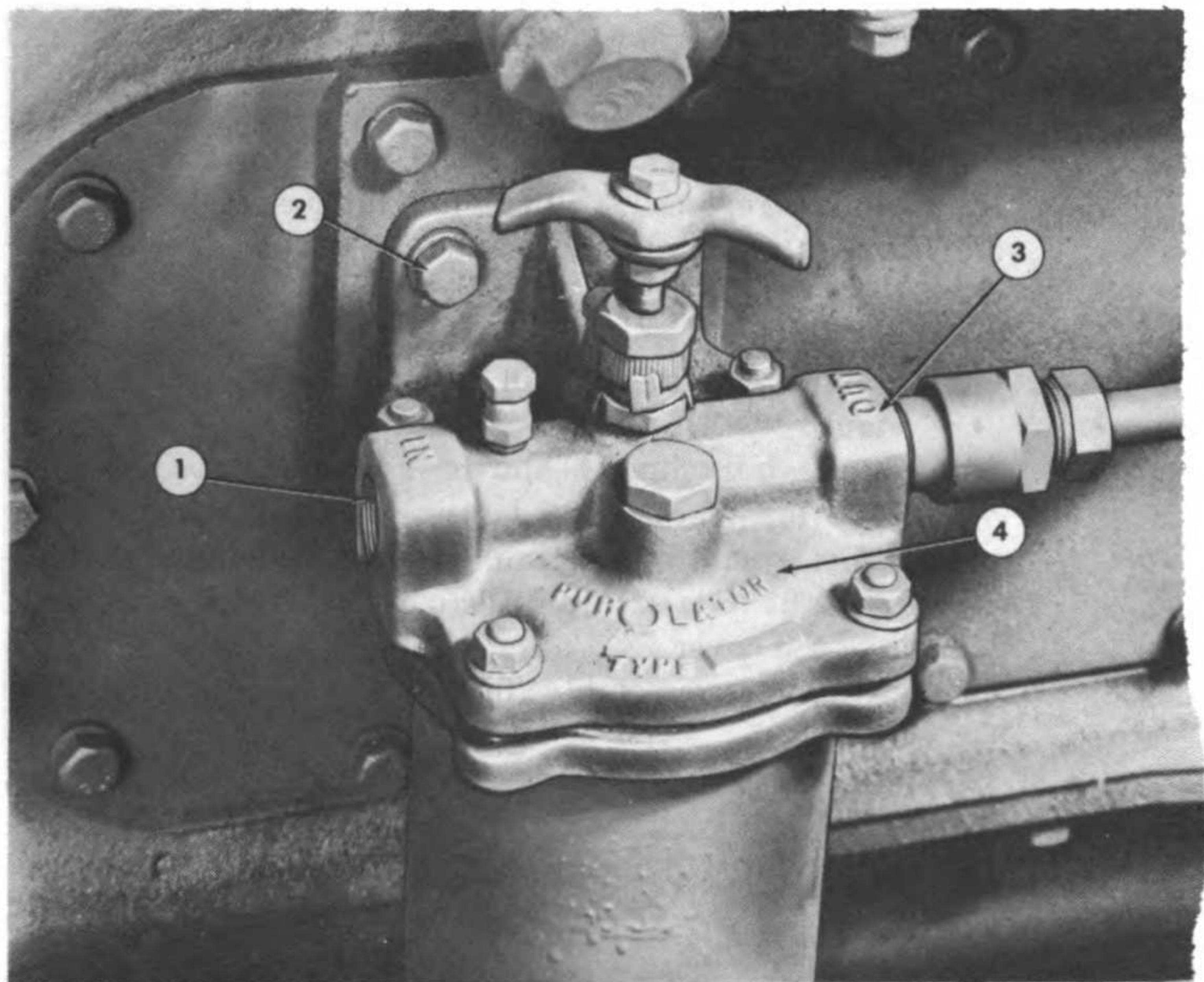
Figure 68. Removing fuel transfer pump.

- (d) Connect the main fuel line (1) to the adapter (3).
- (e) Replace two bolts securing the fuel-line clips to the frame of the tractor.
- (f) Open the fuel shutoff valve in the main fuel line under the fuel tank.

78. Fuel Filters

a. Fuel Line Filter.

- (1) *Description.* A fuel filter (fig. 69) is located in the main fuel line between the fuel tank and the fuel transfer pump on the right-hand side of the engine. It consists of a metal filter element and a rotating filter scraper which removes sludge deposited on the element. The scraper is manually operated by a handle on top of the unit.
- (2) *Removal* (fig. 69).
 - (a) Close the fuel shutoff valve in the main fuel line under the fuel tank.
 - (b) Disconnect the main fuel line at the inlet port (1) and outlet port (3) on the filter (4).
 - (c) Remove two cap screws (2) securing the filter mounting flange to the engine and lift off the filter.



- | | |
|--------------------------|---------------|
| 1 Inlet port | 3 Outlet port |
| 2 Filter mounting flange | 4 Filter |

Figure 69. Purolator-type fuel filter installed.

(3) *Cleaning.* Turn the handle of the Purolator filter one full turn at least once in every 24 hours. Then after giving the dirt and sludge time to settle to the bottom of the case, open the drain on the bottom of the filter and drain off fuel until it runs clean.

(4) *Installation* (fig. 69).

(a) Place the filter in position on the engine so that the IN port (1) is on the fuel tank side of the main fuel line and secure with two cap screws (2).

(b) Connect the main fuel lines to the inlet port (1) and outlet port (3) and open the fuel shutoff valve under the fuel tank.

b. Main Fuel Filters.

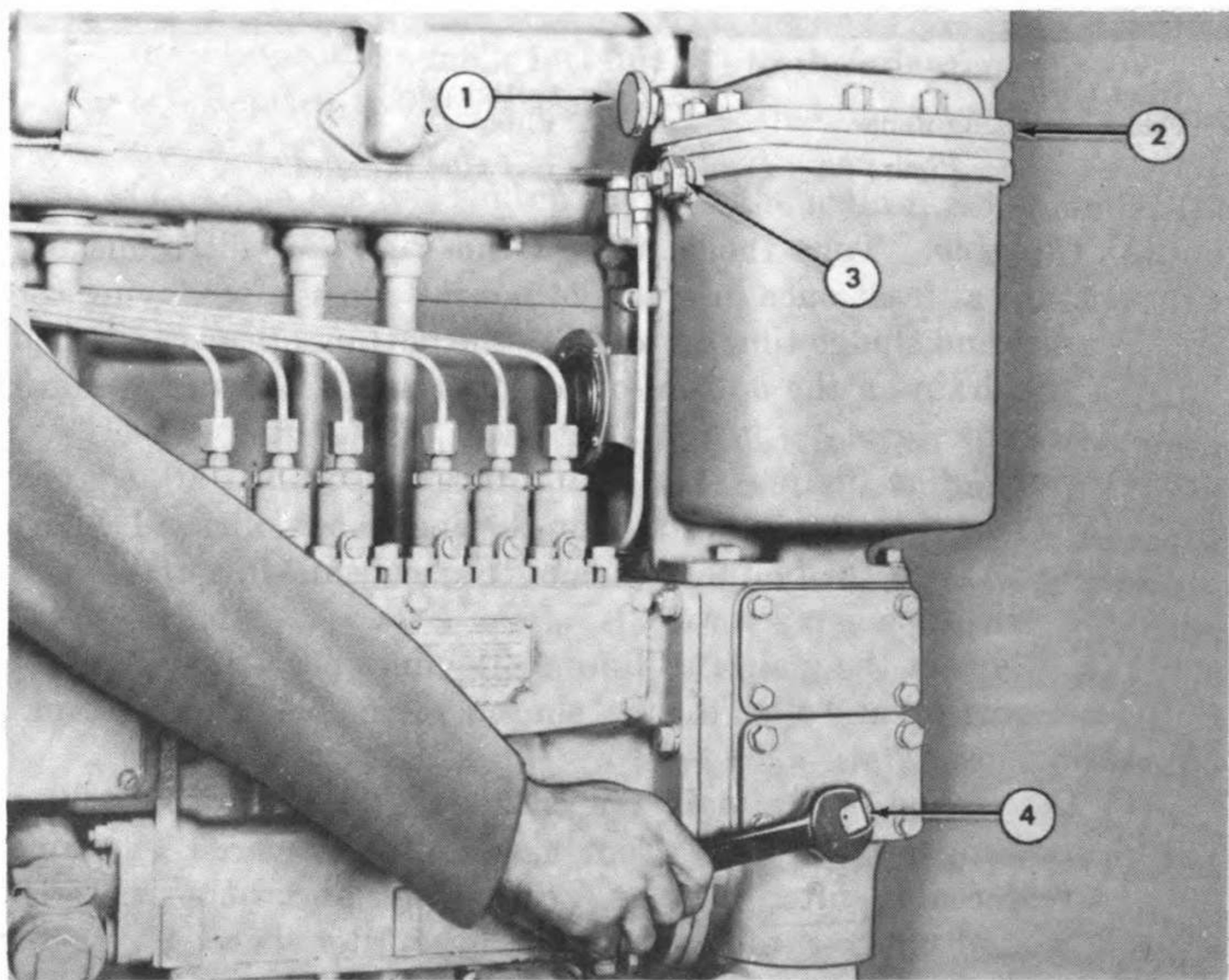
(1) *Description.* The main fuel filters are located in fuel filter housing on the right front side of the engine. The nine replaceable filter elements consist of absorbent material wound upon an inner sleeve. As the filters become clogged with foreign material, the position the fuel gage indicator will work back from the original position in the NORMAL (white range) to the OUT (red range) when the engine is running.

(2) *Filter element replacement.*

(a) *General.* When the absorbent filters have collected enough contamination to cause the fuel pressure gage indicator to register in the OUT range when the engine is running, they must be replaced. Since these filter elements absorb and hold contaminants, they cannot be washed or otherwise restored.

(b) *Removal (fig. 70).*

1. Close the fuel shutoff valve in the main fuel line under the fuel tank.
2. Remove the drain plug (4) and drain the fuel filter housing.
3. Clean the top of the filter housing cover (2) to prevent loose dirt from dropping into the filter housing.
4. Remove eight nuts securing the cover to the housing and remove the cover.
5. Lift out the filter assembly (fig. 71) and place it on a flat, clean surface.
6. Compress each spring (3) and remove the retaining pins (2, fig. 72).
7. Lift off the plate (5) and remove the elements (4) from the rods (6).



1 Upper vent valve
2 Cover

3 Lower vent valve
4 Drain plug

Figure 70. Draining fuel filter housing.

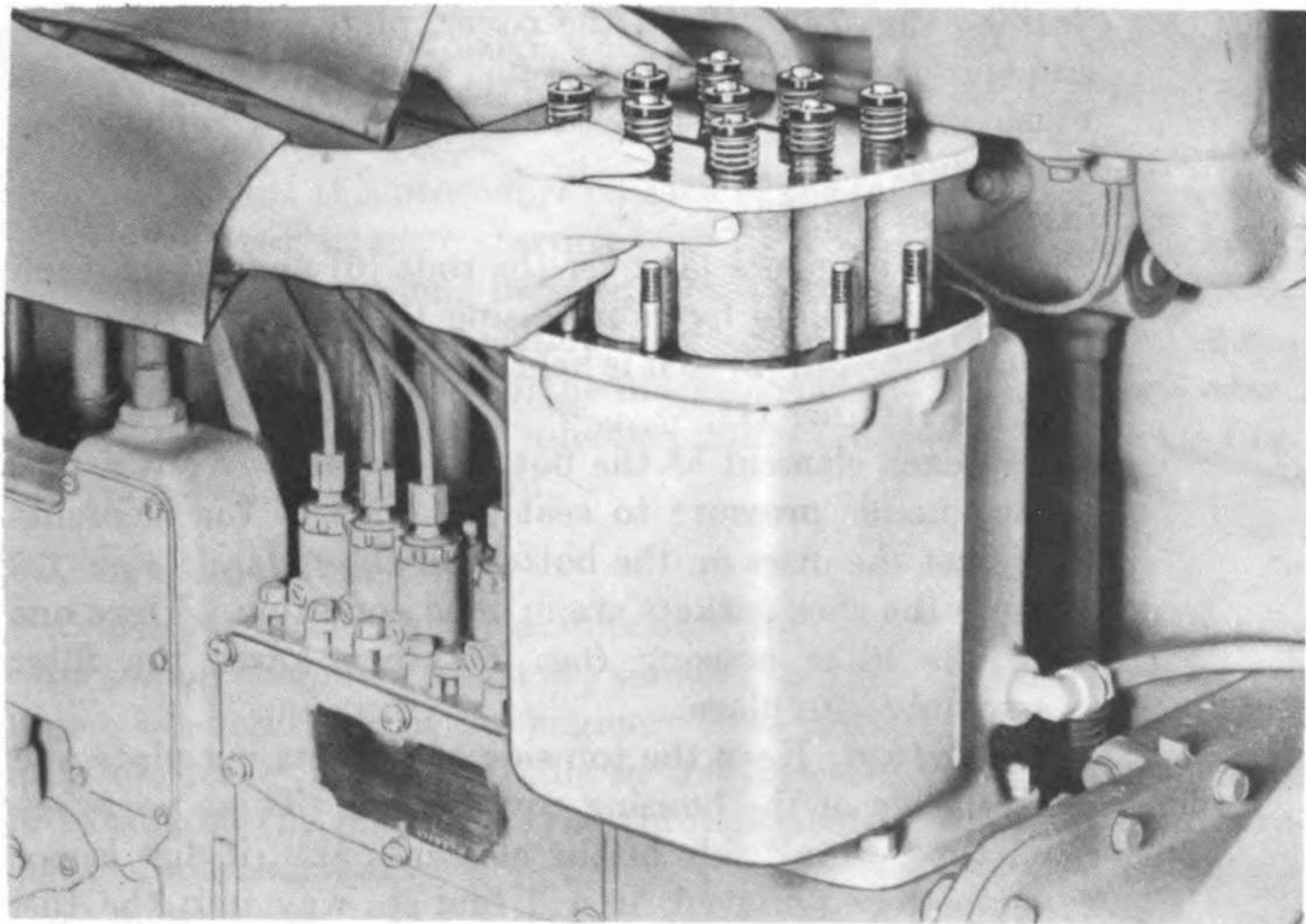
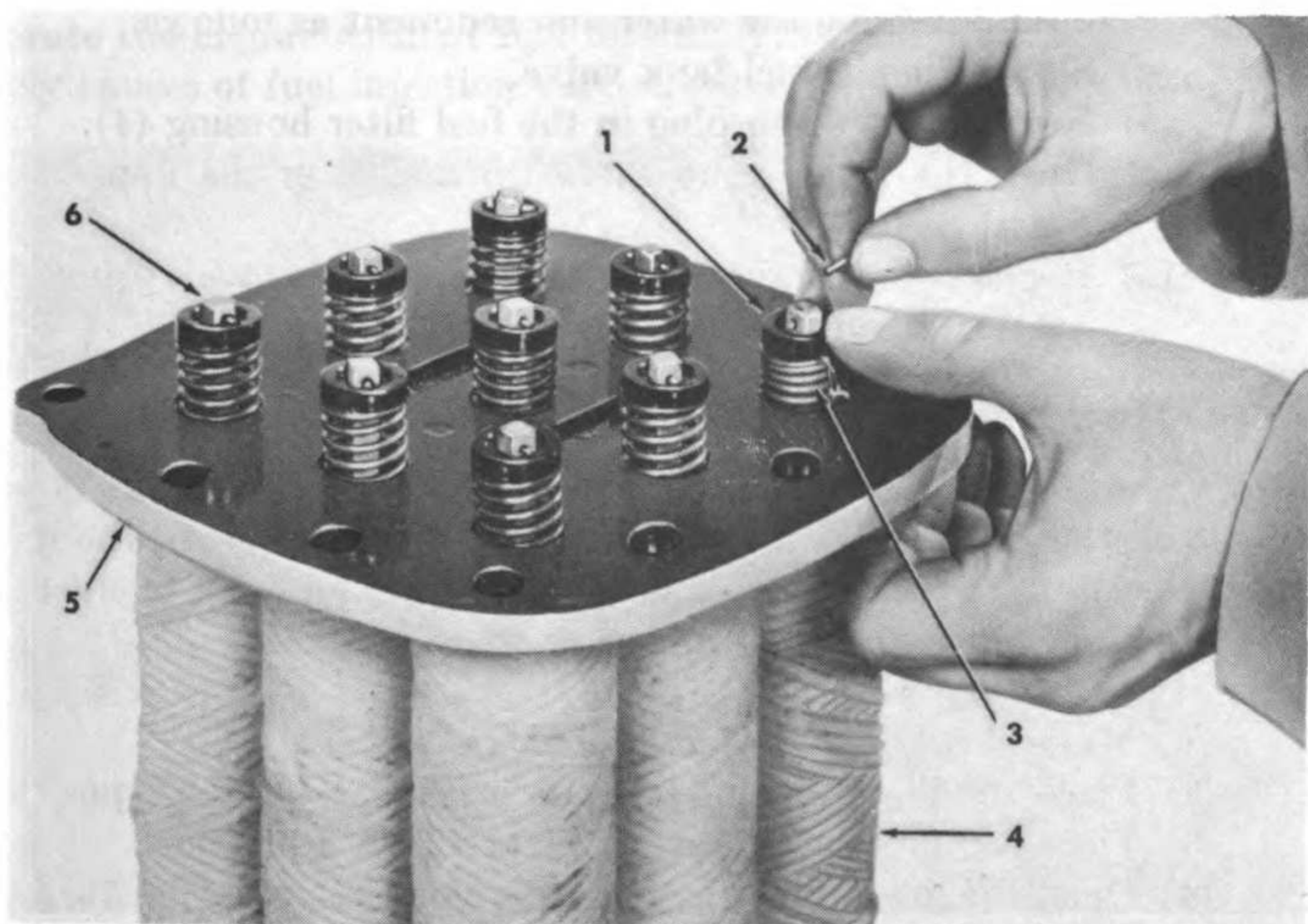


Figure 71. Removing fuel filter assembly.



- | | |
|------------|------------------|
| 1 Retainer | 4 Filter element |
| 2 Pin | 5 Plate |
| 3 Spring | 6 Rod |

Figure 72. Filter element replacement.

(c) *Cleaning* (fig. 72). Wash the cover, plate, retainers, pins, and springs carefully in diesel fuel or dry-cleaning solvent. Flush out the housing with diesel fuel and replace the drain plug.

(d) *Installation* (fig. 72).

1. Place new elements (4) over the rods (6) and attach each rod to the plate by compressing the spring (3) and inserting the pin (2) so it is held securely in the counterbore of the retainer (1).

2. Grasp each element at the bottom end and give it a half turn under pressure to seat the ends of the elements against the discs on the bottom of the rods.

3. Be sure the cork gaskets are in good condition. Place one on the filter housing (fig. 71) then lower the filter assembly into place.

Caution: Keep the top side of the retainer plate and the inside of the housing cover clean. These parts are on the "clean" side of the elements and, if dirt is not completely removed, it will find its way into the fuel injection equipment.

4. Place another gasket on the top of the plate. Replace the cover, secure with eight nuts, and turn on the fuel.

5. Prime the fuel system as directed in paragraph 79.

(3) *Maintenance*. Drain the fuel filter housing (fig. 70) every 64 hours to remove the water and sediment as follows:

(a) Shut off main fuel tank valve.

(b) Remove the drain plug in the fuel filter housing (4).

(c) Open the lower vent valve (3) and then the upper vent valve (1).

(d) Replace the drain plug, close the vents, and prime the system as outlined in paragraph 79.

79. Priming the Fuel System

a. *Purpose*. Anytime the fuel system is opened and air is allowed to get in, the fuel system must be primed. If air is left in the lines, the fuel system will become airbound, resulting in inability to start the diesel engine, or the misfiring of one or more cylinders.

b. *Priming Procedure*.

(1) Make sure the main fuel line valve is open.

(2) Place the diesel engine throttle in the SHUT OFF position.

(3) Place compression release lever in START position.

(4) Open the lower fuel filter housing vent valve (3, fig. 70).

(5) Start the starting engine and crank the diesel engine at full cranking speed.

(6) Observe the flow of fuel from the vent until it is a steady stream without air bubbles.

- (7) Close the vent valve when no more air bubbles are observed.
- (8) Repeat the above procedure with the upper fuel filter vent valve (1).
- (9) Repeat this procedure on each of the fuel injection pump vent valves, in turn, starting with the one nearest the filter housing. Use a long-handled socket wrench as shown in figure 73.
- (10) Start the diesel engine to determine if all the air is out of the system. If the engine misses, repeat the priming procedure on each of the fuel injection pump vents, with the engine running at idling speed.

80. Fuel Injection Valves

a. Description. The fuel injection valves are screwed into pre-combustion chambers which are screwed into the cylinder head on the upper left-hand side of the engine. Fuel pressure, developed by the injection pump, raises a needle in the injection valve against spring pressure and the fuel is sprayed through a single orifice into the pre-combustion chamber.

b. Adjustments. The injection valves have no operating adjustments. When the valve is assembled at the factory, precise adjustments are made, and these adjustments should not be altered during the life of the injection valve.

Caution: To protect fuel injection valves, drain the sediment and water from the fuel tank and filter housing regularly, and never operate the engine without fuel filters. Dirt and water are the most likely causes of fuel injection valve trouble.

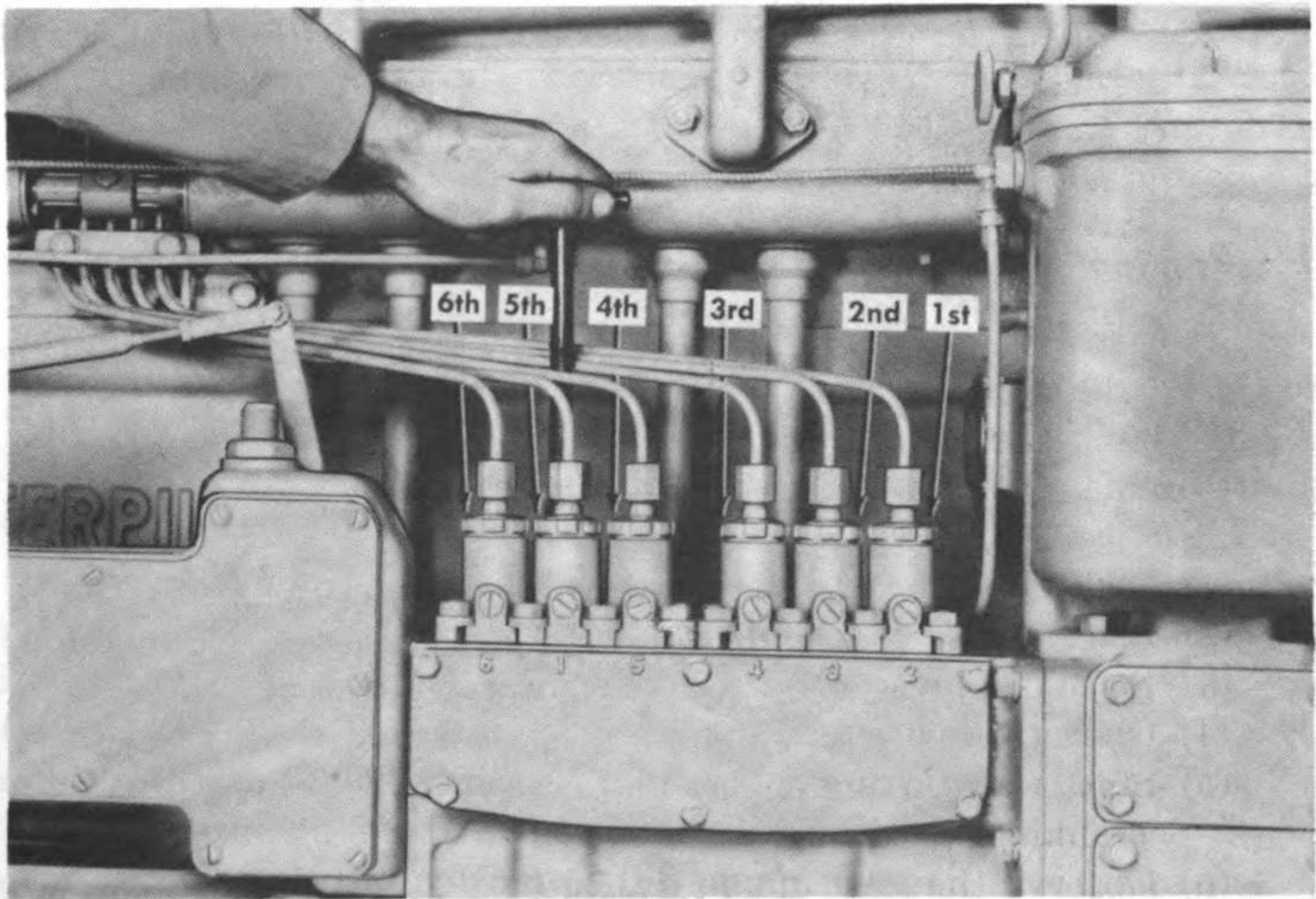


Figure 73. Fuel injection pump vent valves.

c. Checking and Replacement Procedure.

(1) *General.* Before removing a fuel injection valve for testing on an engine that is missing, rapping, or puffing black smoke, make the following check to determine which cylinder is causing the difficulty:

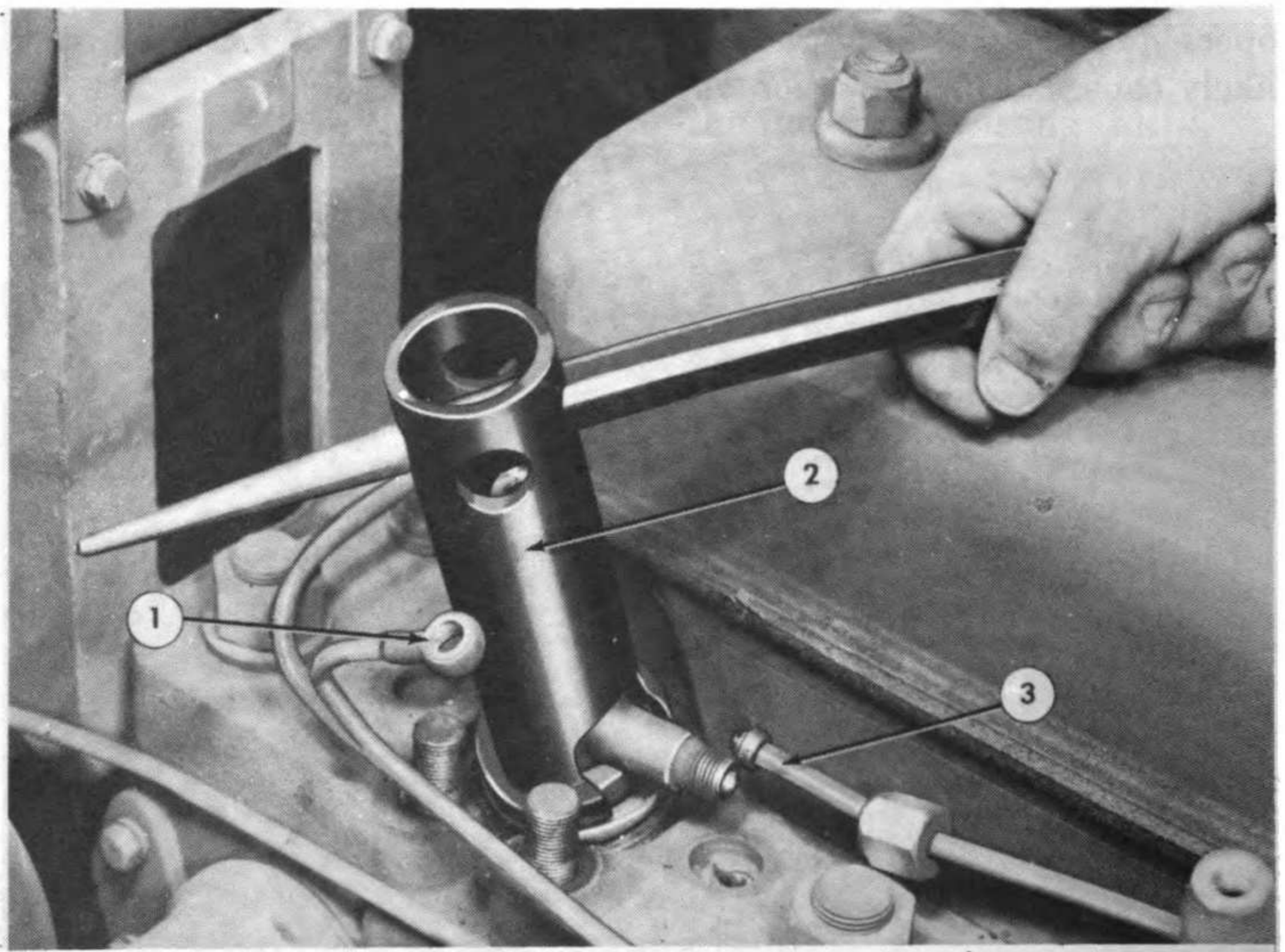
- (a) Run the engine at a speed which makes the defect most pronounced.
- (b) Loosen the fuel line nut on one fuel injection pump at a time to "cut out" the cylinder. When one is found that makes no difference in the irregular operation of the engine, stop the engine and remove and test this valve.

(2) *Removal.*

- (a) Clean all dust and dirt from the valve and adjacent areas.
- (b) Disconnect the drain tube (1, fig. 74) from the top of the injection valve and install a suitable dirt seal.

Note.—A box of assorted rubber and metal caps, plugs and seals (fig. 75) is included in the tool box in each vehicle.

- (c) Disconnect the fuel inlet line (3, fig. 74) and cover the opening in the injection valve with a suitable cap. Cover the fuel line opening with a suitable plug.
- (d) Unscrew and remove the fuel injection valve, using the valve wrench (2) included in the tool kit.



1 Drain tube

2 Wrench

3 Inlet line

Figure 74. Removing fuel injection valve.

(3) *Testing a fuel injection valve.*

- (a) Turn the valve upside down in the pre-combustion chamber from which it was removed and reconnect the fuel line (fig. 76).
- (b) Disconnect the fuel injection valve overflow line from the line leading to the transfer pump and plug the transfer pump line. This is necessary to prevent an air-lock in the fuel system while the injection valves are being tested.
- (c) If only one valve is being tested, loosen the fuel line nut above each pump except the one that supplies the valve being tested. This will prevent fuel being injected into the other cylinders.
- (d) Start the starting engine and, with the compression release lever in the "START" position, engage the starter pinion and clutch. Allow the starting engine to operate at low idle speed.
- (e) Pull the diesel throttle all the way back so that the valves will spray their full amount.
- (f) Watch the spray that comes from the injection valve nozzle. If the discharge is in the form of a fine mist, it indicates that the valve is in good condition. If the spray exhibits any of the abnormal characteristics illustrated in figure 77, the fuel injection valve should be replaced.

(4) *Injection valve installation.*

- (a) Replace injection valve in the pre-combustion chamber and tighten only enough to prevent leaks between the valve and valve seat. Excessive tightening might cause distortion of the injection valve.
- (b) Remove the plug from the fuel line opening, and the cap from the opening in the injection valve and connect the line to the valve.
- (c) There is a copper washer above and below the drain tube connection on each valve. Connect the drain tube, with the copper washer in place, and tighten the screw moderately. This connection must be airtight or the system will become air-locked.

81. Fuel Injection Pumps

a. Description. Each pump measures the amount of fuel to be injected into its particular cylinder and produces the pressure for injection. The injection pump plunger is lifted by a cam and always makes a full stroke. The amount of fuel pumped during any one stroke is varied by turning the plunger in the barrel. The plunger is turned by the governor action through a rack which meshes with a gear segment on the bottom of the pump plunger.

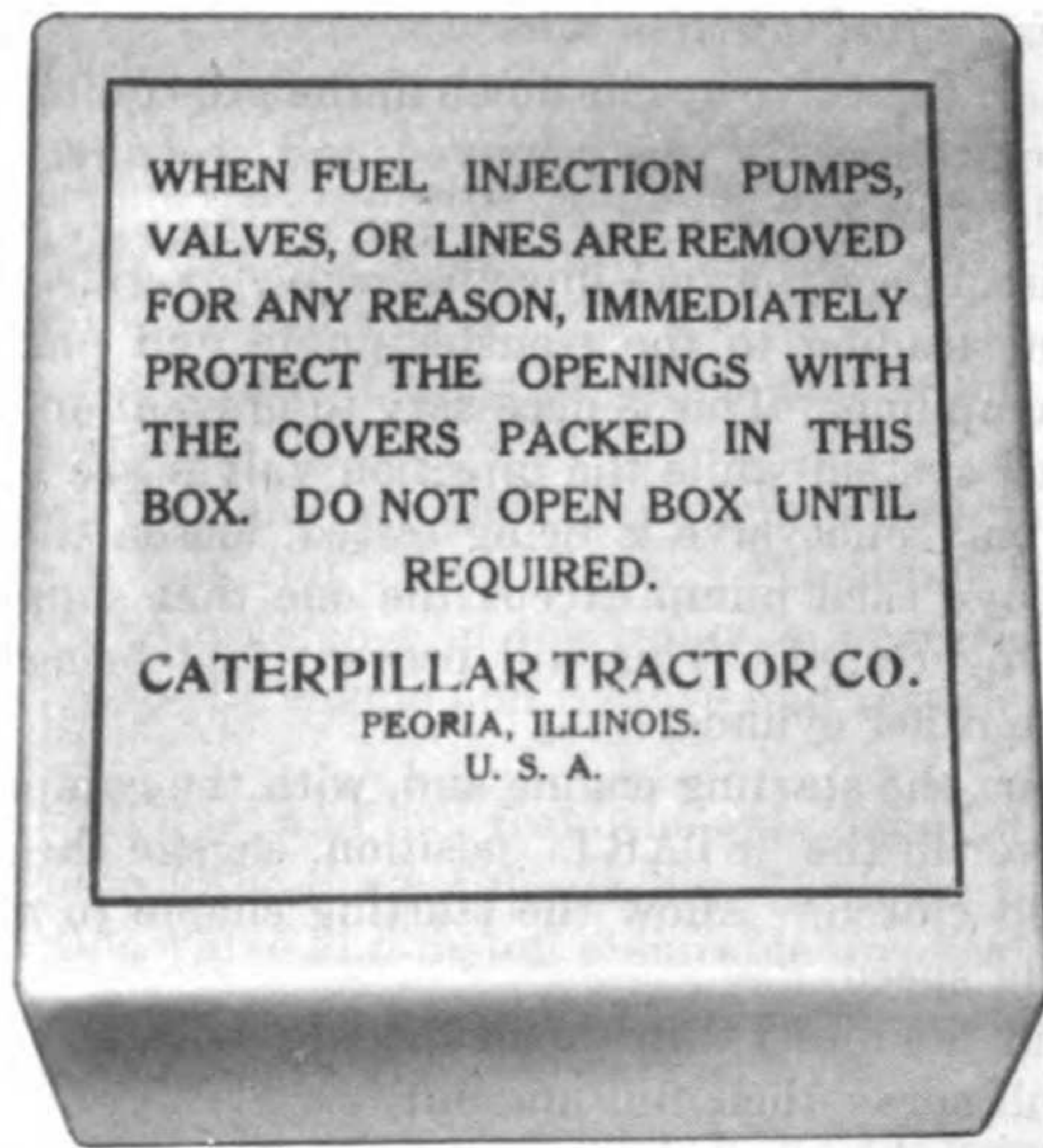


Figure 75. Fuel injection system dust covers.

b. Maintenance. The life of the fuel injection pumps depends on the precautions taken to keep the fuel supply clean. Dirt and water in the fuel contributes to premature pump failure.

c. Adjustment. All fuel pumps are interchangeable between cylinders on a particular engine and also between engines having the same cylinder bore, whether they are six or four cylinder. Each pump is adjusted when assembled at the factory and stays permanently in adjustment. They can be replaced individually without skilled setting.

d. Testing. Worn fuel injection pumps will result in loss of power and hard starting. These same conditions may be present if the piston rings and cylinder liners are badly worn. However, in the case of worn piston rings and liners, the hard starting and loss of power will be accompanied by poor compression, a smoky exhaust, and excessive blow-by gases from the crankcase breather.

e. Removal.

- (1) Clean the top of the housing and around the inspection plate on the side.
- (2) Disconnect the lines at the tops of the pumps and cap the openings in the pumps and lines with suitable caps (3, fig. 78) and plugs (4).
- (3) Remove the inspection plate by taking out the six cap screws holding it. Note that one cap screw is longer than the others. Be sure it is replaced in the proper location.
- (4) Remove the fork (6) that fastens the rack (5) to the slide bar.
- (5) Remove the two cap screws (2) and plates (1) that hold the rack (5) in place and pull the rack out of the housing.
- (6) Remove the cap screws and clamps that hold the fuel injection pump to the housing and lift the pump straight up only enough to clear the dowel pins (2, fig. 79).

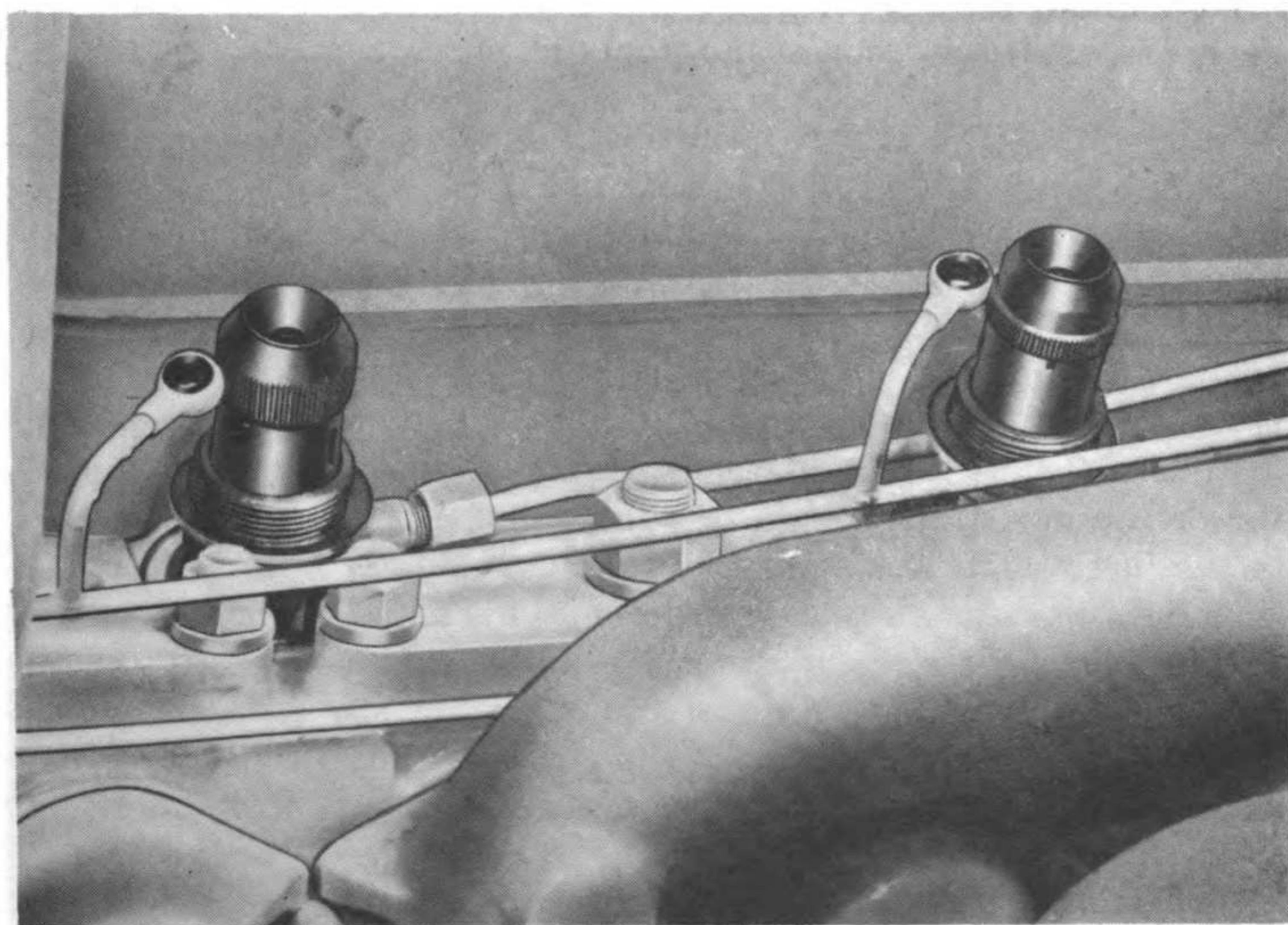


Figure 76. Checking injection valve spray characteristics.

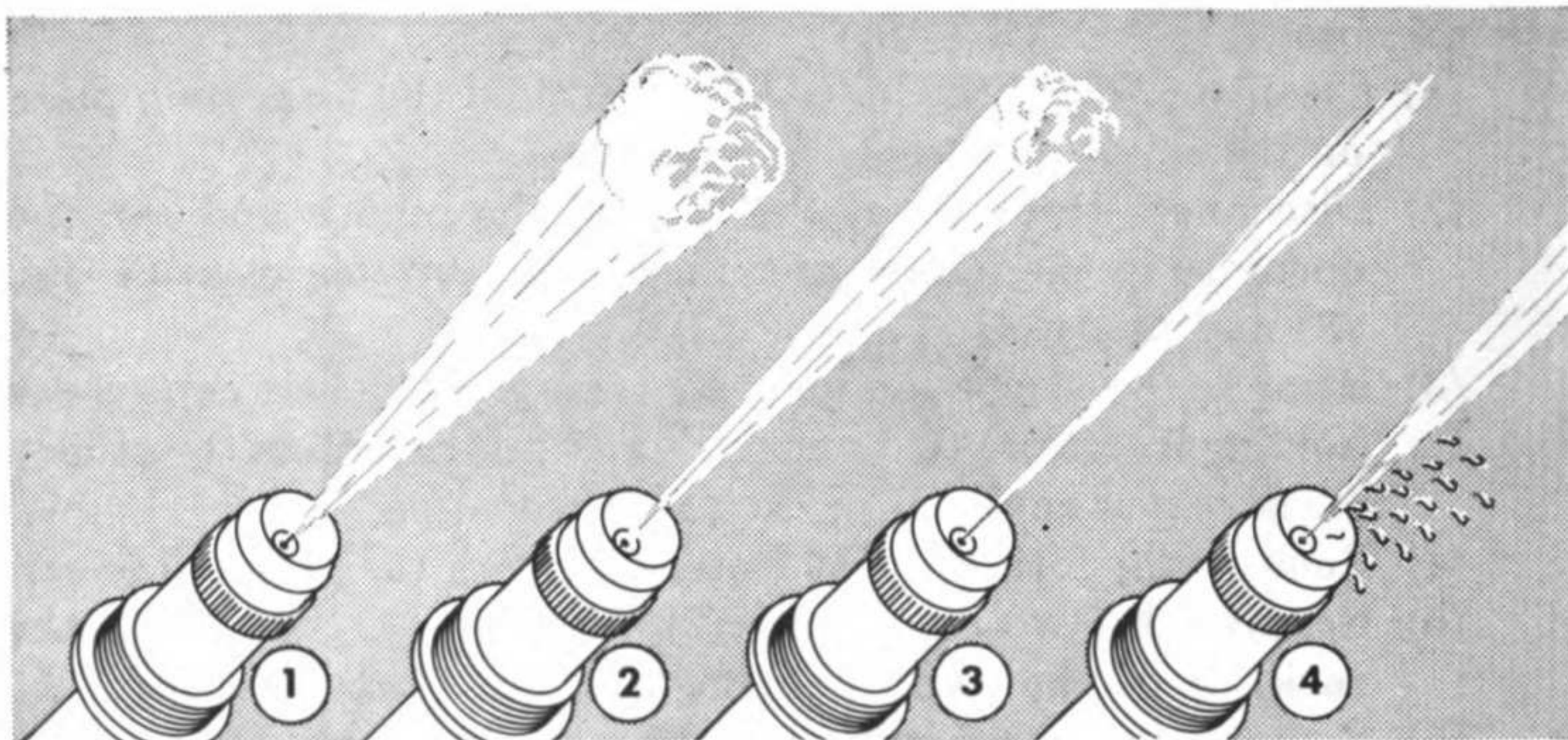
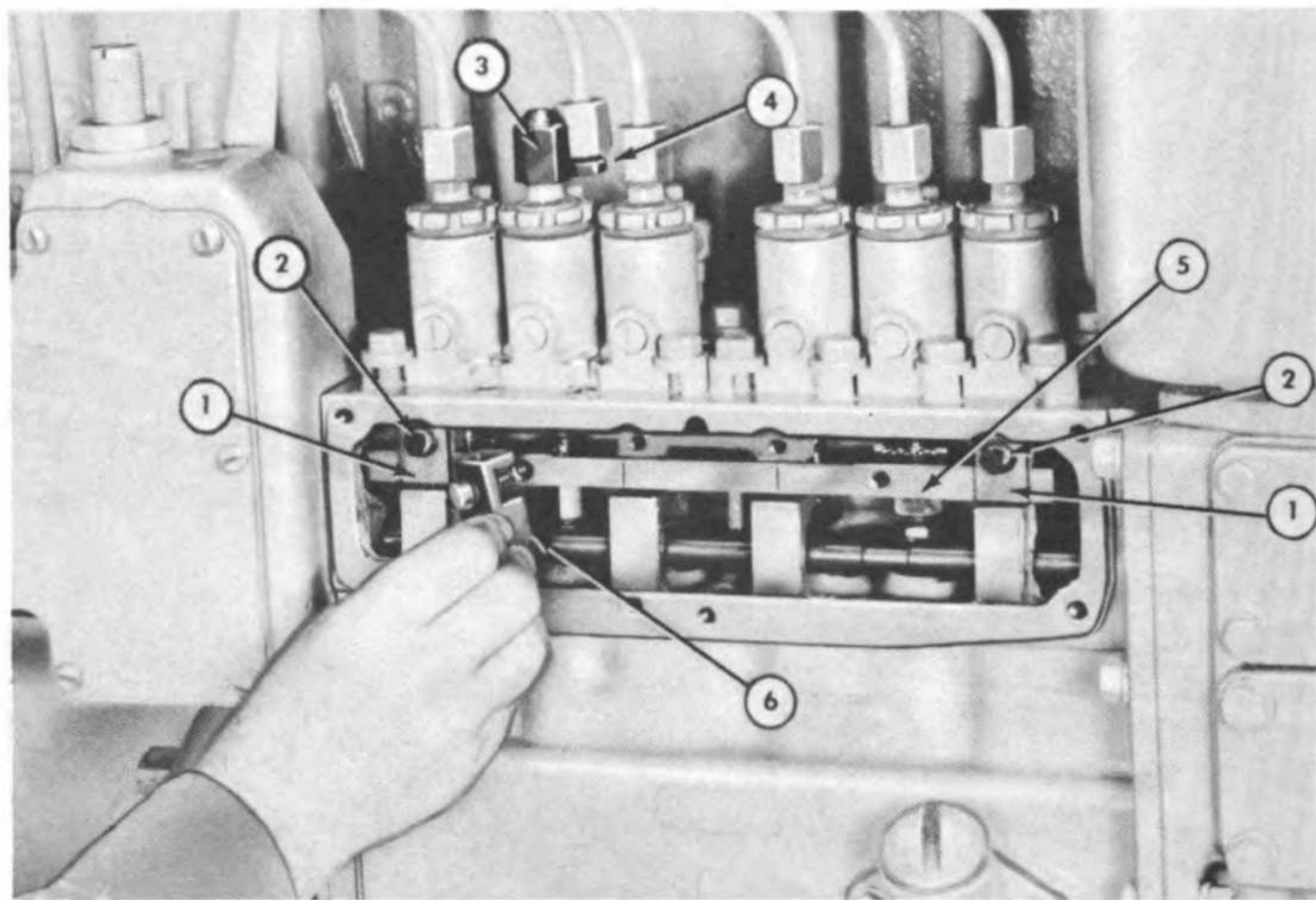


Figure 77. Injection valve spray characteristics.

- 1 Correct spray—Fine even spray in the form of a cone.
- 2 Incorrect spray—Fuel spray emitted on one side.
- 3 Incorrect spray—Fuel discharged in a solid stream or jet.
- 4 Incorrect spray—Uneven cutoff and dribble.



- | | |
|-------------|--------|
| 1 Plate | 4 Plug |
| 2 Cap screw | 5 Rack |
| 3 Cap | 6 Fork |

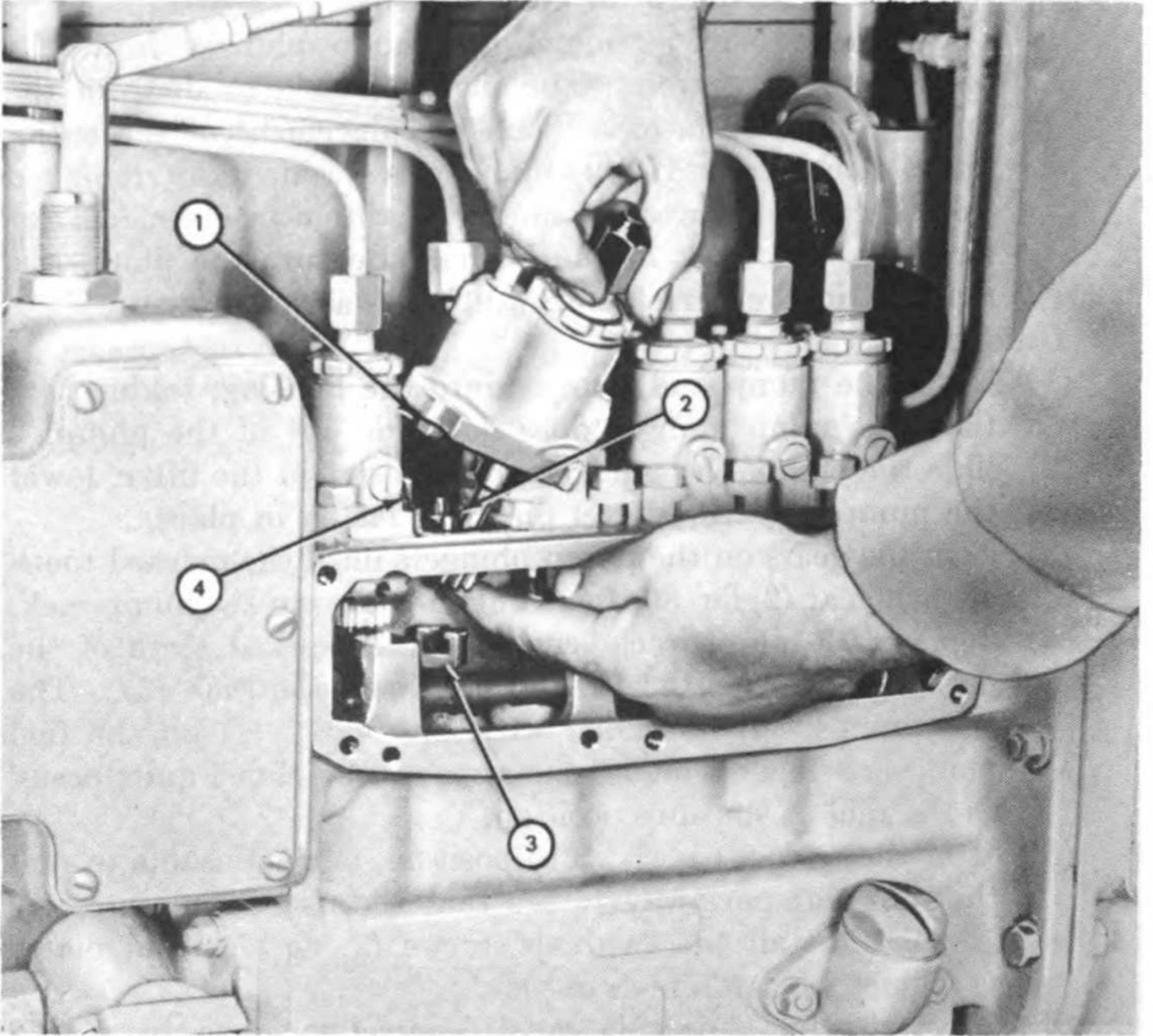
Figure 78. Removing rack fork and rack.

- (7) Insert a finger through the inspection hole to hold the plunger from dropping out and shift the pump to one side so the end of the pump plunger will free itself from the slot (3) in the lifter.
- (8) Place a ferrule cap seal (4) and plug (1) furnished in the tool equipment over the fuel outlet of the fuel housing and in the inlet of the pump to keep out dirt.

Caution: Never remove the pump plunger from the barrel for any reason. The slightest nick, or dirt, on the finely ground surfaces will make replacement of the entire pump necessary. If the plunger is accidentally removed from the pump barrel, it should be rinsed in clean fuel before it is put back in the barrel. Be sure the plunger is replaced in the barrel from which it was withdrawn.

f. Installation.

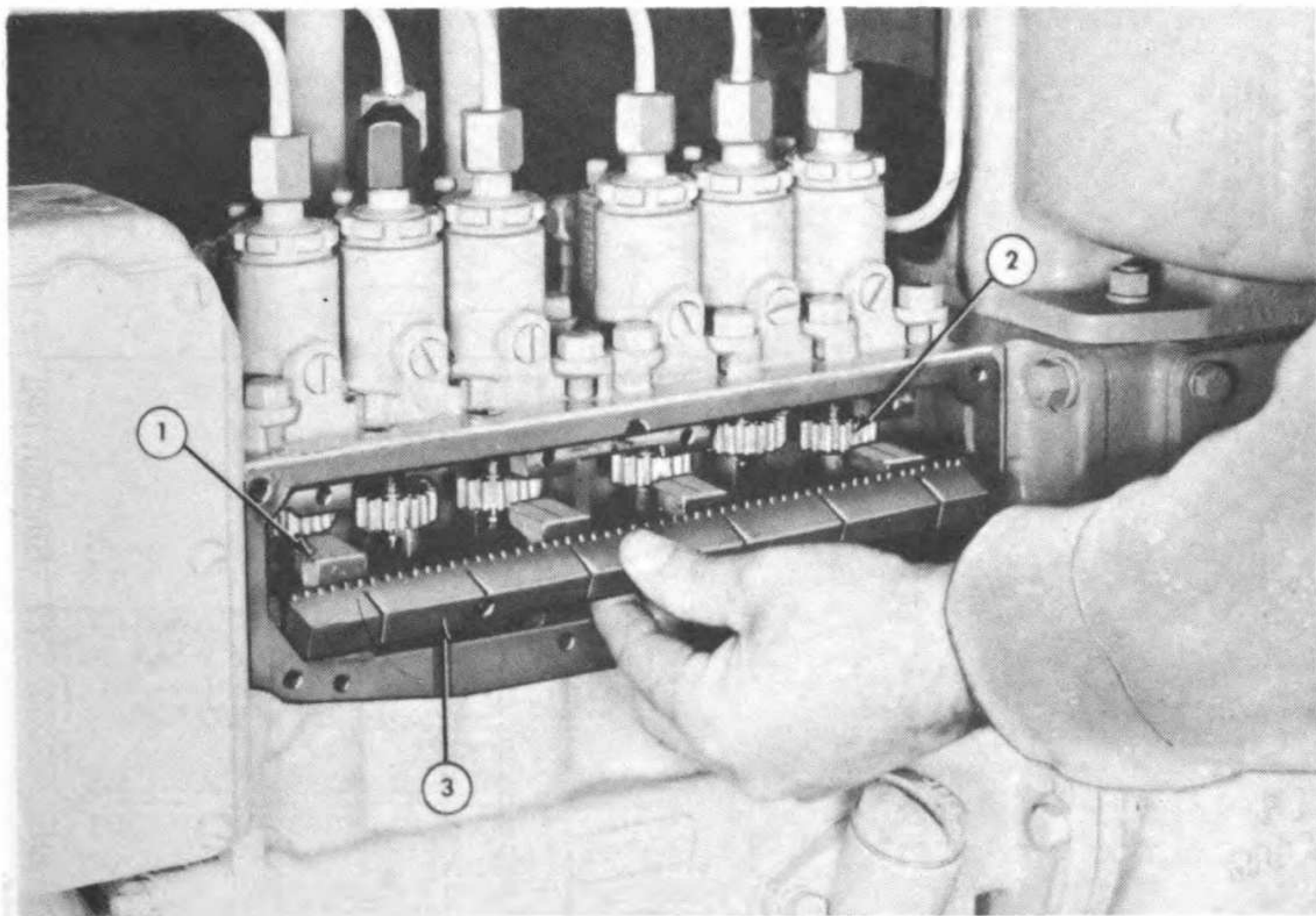
- (1) Lower the pump and plunger into the housing, taking care that the pump plunger does not slide out of the pump.
- (2) Slide the end of the plunger into the slot in the lifter, lower the pump onto the dowel pins and fasten in place.
- (3) Turn the gears on the pump plungers until the marked tooth of each gear (2, fig. 80) faces outward toward the pump rack.
- (4) Replace the pump rack, engaging the marked teeth of the pump plunger gears with the marks on the rack (3). The end pumps can be alined with the marks (1) on the fuel pump housing. The other pumps can be alined quite easily as the rack is slid into position.
- (5) After the rack (3) is slid into position, it is advisable to pull the rack out part way to see that the marks are correctly alined. Install the two cap screws (2, fig. 78) and plates (1) which hold the rack in place.
- (6) Move the fuel injection pump control lever to the FAST position and replace the fork that fastens the rack to the slide bar.
- (7) Replace the inspection cover, remove caps and plugs, and connect the fuel lines.
- (8) Prime the fuel system as detailed in paragraph 79.



1 Plug
2 Stud

3 Slot
4 Seal

Figure 79. Removing fuel injection pump.



1 End pump
2 Marked tooth

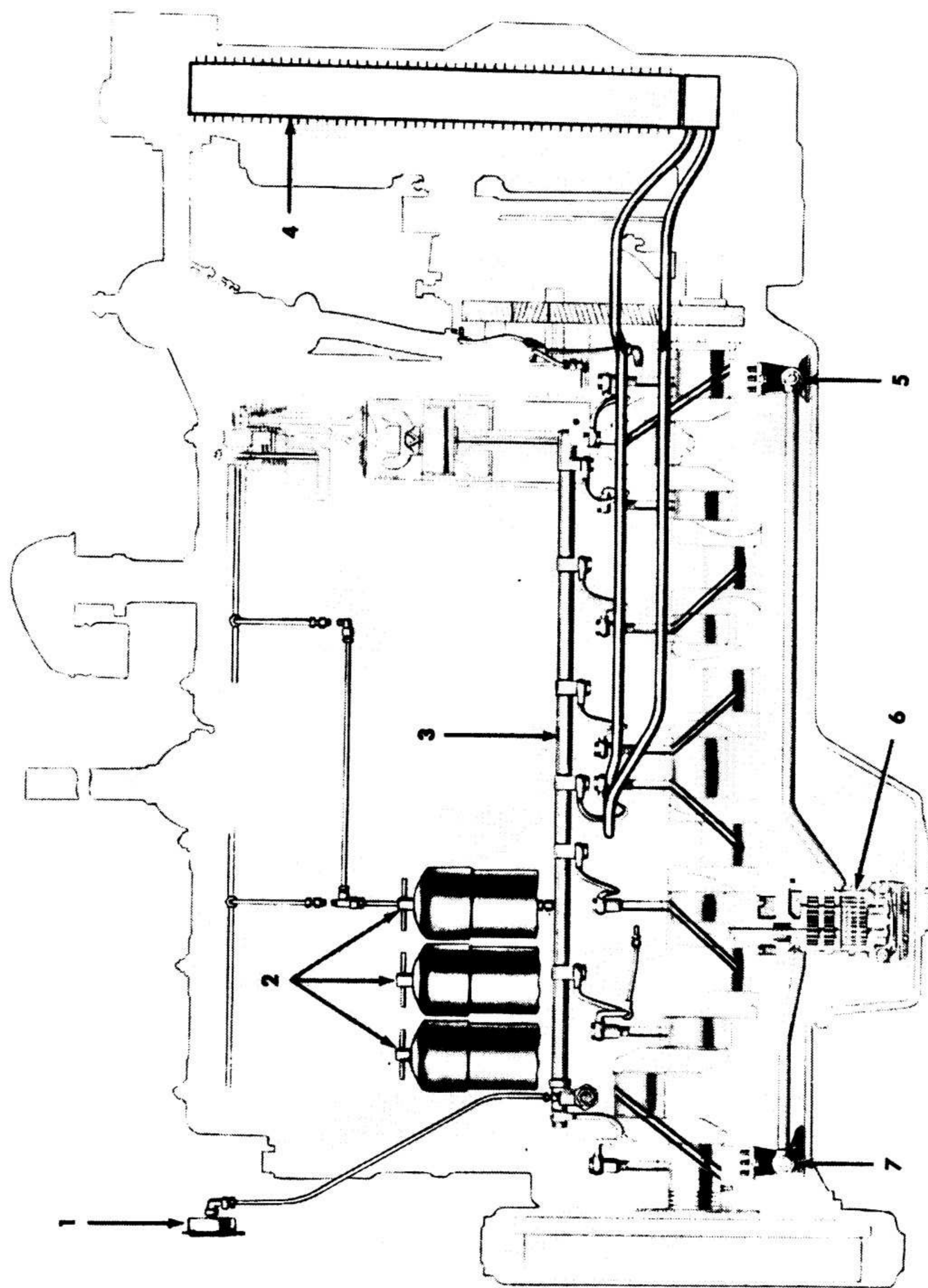
3 Rack

Figure 80. Installing pump rack.

Section IX. LUBRICATING SYSTEM

82. Description

The D-8 tractor engine is provided with a full-pressure lubricating system (fig. 81), consisting of an oil pump (6), filters (2), oil cooler (4), and pressure gage (1). The oil pump assembly contains two auxiliary pump sections connected to screened suction bells (5) and (7) located at the front end and rear end of the oil pan. On steep uphill or downhill operations, these pump sections return accumulated oil from the low end of the oil pan to the center sump in which is located the pressure pump suction bell. The pressure pump circulates the oil under pressure to all working parts of the engine. The oil pump forces oil through passages in the oil filter base to the oil cooler, mounted beside and to the right of the radiator, and then to the filters. After passing through the filters, the oil goes into the oil manifold (3) and is distributed to the main bearings, connecting rod bearings, piston pins, and valve rocker assembly. In the event that the oil cooler or oil filters become clogged, the oil is bypassed through valves to the bearings (fig. 82).



- 1 Pressure gage
- 2 Oil filters
- 3 Oil manifold
- 4 Oil cooler
- 5 Suction bell
- 6 Oil pump
- 7 Suction bell

Figure 81. Schematic drawing of lubricating oil system.

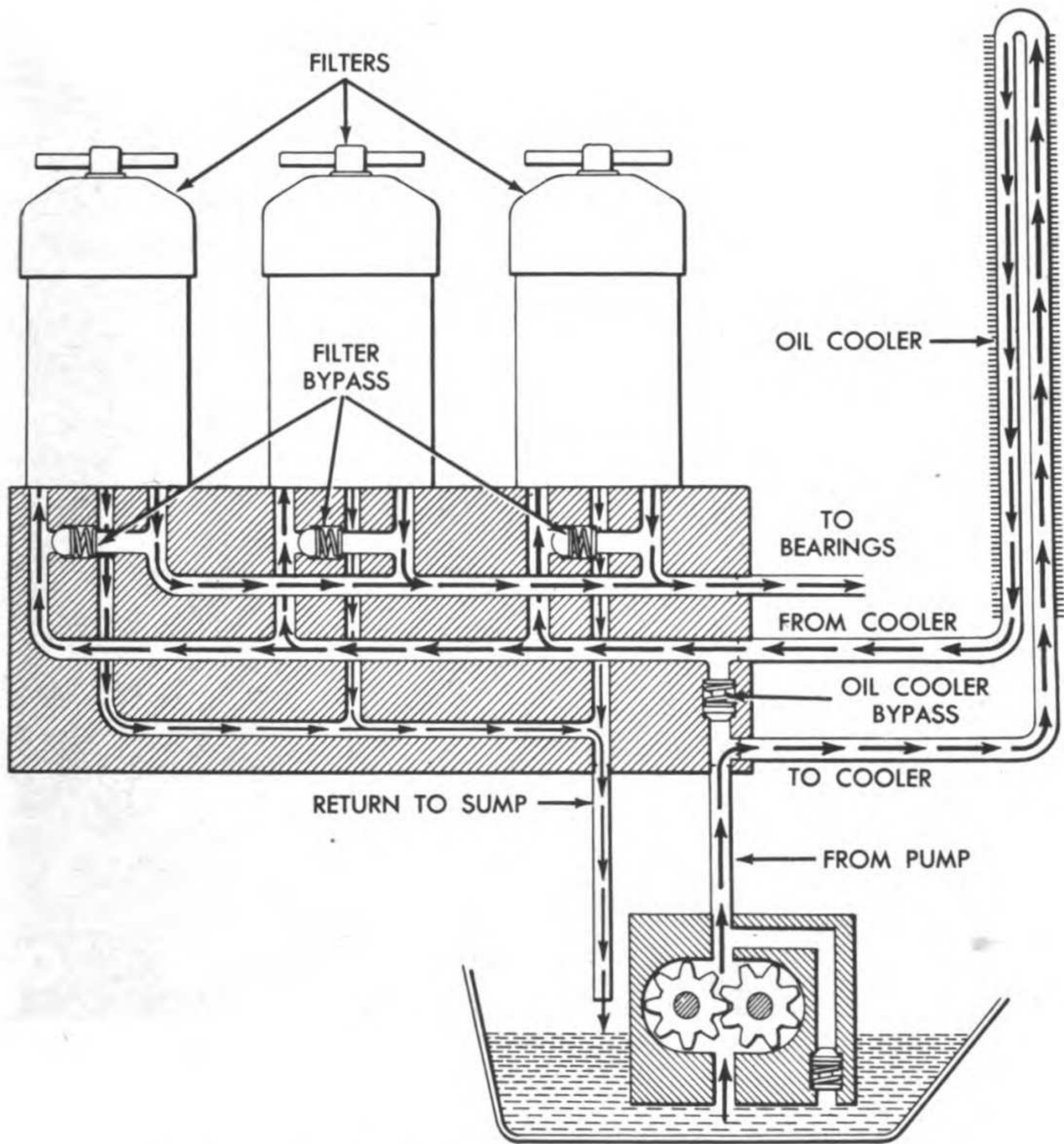


Figure 82. Cross section—lubricating oil filter system.

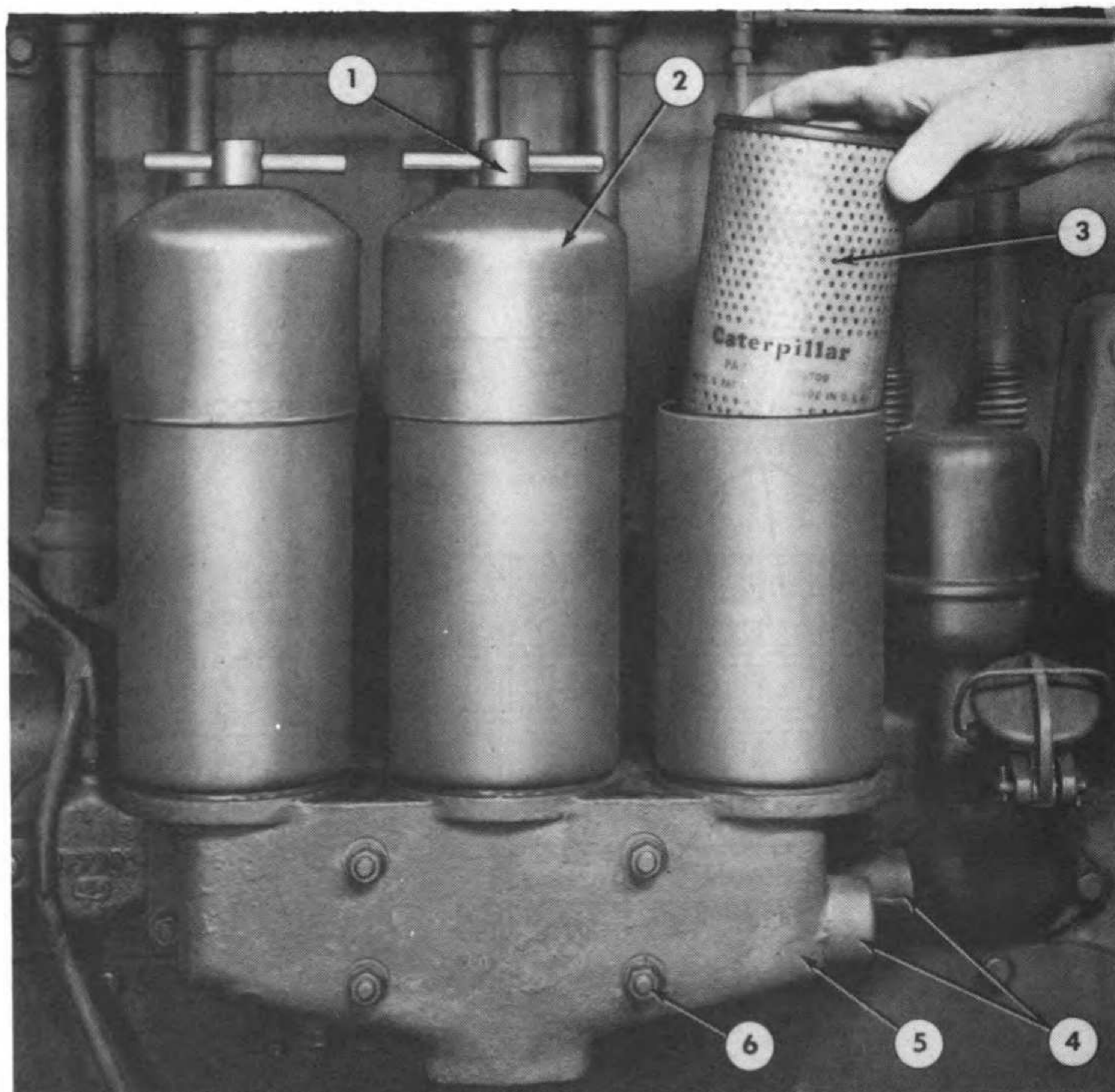
83. Oil Filters

a. Replace Filter Element (fig. 83).

- (1) Unscrew the hold down wing screw (1) and remove filter cover (2)
- (2) Lift element (3) from filter housing.
- (3) Install new element in filter housing and replace filter cover (2).
- (4) Secure filter cover to housing by tightening wing screw (1).

b. Remove Oil Filters (fig. 83).

- (1) Drain filters by removing drain plug at bottom of filter base (5).
- (2) Disconnect oil lines at the two ports (4).
- (3) Remove the four nuts (6) and lock washers which secure filter base (5) and lift off the base with filters.



- | | | |
|---------|------------------|---------------|
| 1 Screw | 3 Element | 5 Filter base |
| 2 Cover | 4 Oil line parts | 6 Nut |

Figure 83. Removing filter element.

c. Install Oil Filters (fig. 83).

- (1) Install the filters with base (5) on the mounting studs.
- (2) Install lock washers and nuts (6) on studs and tighten securely.
- (3) Connect oil lines at the two ports (4).

Section X. RADIO SUPPRESSION

84. General

Radio interference suppression is the elimination or minimizing of electrical disturbances which interfere with radio reception or disclose the location of the vehicle to sensitive electrical detectors. Suppression in the D-8 tractor is accomplished by the use of shielded ignition wiring, ground straps, toothed lock washers, and capacitors in those circuits which might cause interference.

85. Checking for Radio Suppression

a. Preliminary Instructions.

- (1) Move the tractor to a location that has been found to be comparatively free of radio interference from high tension lines, other vehicles, or machinery.
- (2) Place either a portable radio or a radio equipped vehicle within five feet of the tractor. Check the noise level in the radio before starting the tractor. If noise level is too high to detect any increase or difference in sound, move to a new location or wait until conditions are more favorable before beginning the test.

b. Checking Suppression.

- (1) Check existing noise level in the radio.
- (2) Start the starting engine and listen for any change in the noise level.
- (3) A steady clicking sound indicates ignition interference from the magneto spark plugs, or spark plug leads. Tighten all connectors and mounting bolts and be sure that magneto ground wire is securely tightened. Adjust breaker points and recheck. It may be necessary to replace spark plugs and/or magneto.
- (4) Start diesel engine and stop starting engine.
- (5) Recheck radio noise level. A whining sound that varies in pitch with engine speed indicates generating system interference. Clean and tighten ground and all wiring connections. If noise still persists change positive brush capacitor. If condition is not corrected, check commutator and brush condition. If necessary, change generator.
- (6) If an irregular clicking noise is heard, check generator regulator point condition and adjustment. Correct as necessary.

Section XI. ELECTRICAL SYSTEM

86. General

The electrical system (fig. 84) of the D-8 tractor consists of a generator, voltage regulator, head and tail lamps, and a control switch. The generator is regulated automatically to provide the amount of current required to operate the lights, within the capacity of the generator. The entire system is bonded to provide radio interference suppression.

87. Generator

a. *Description.* The generator is a shunt-wound, gear-driven-type, rated at 40 amperes. Output is automatically regulated by the generator voltage regulator.

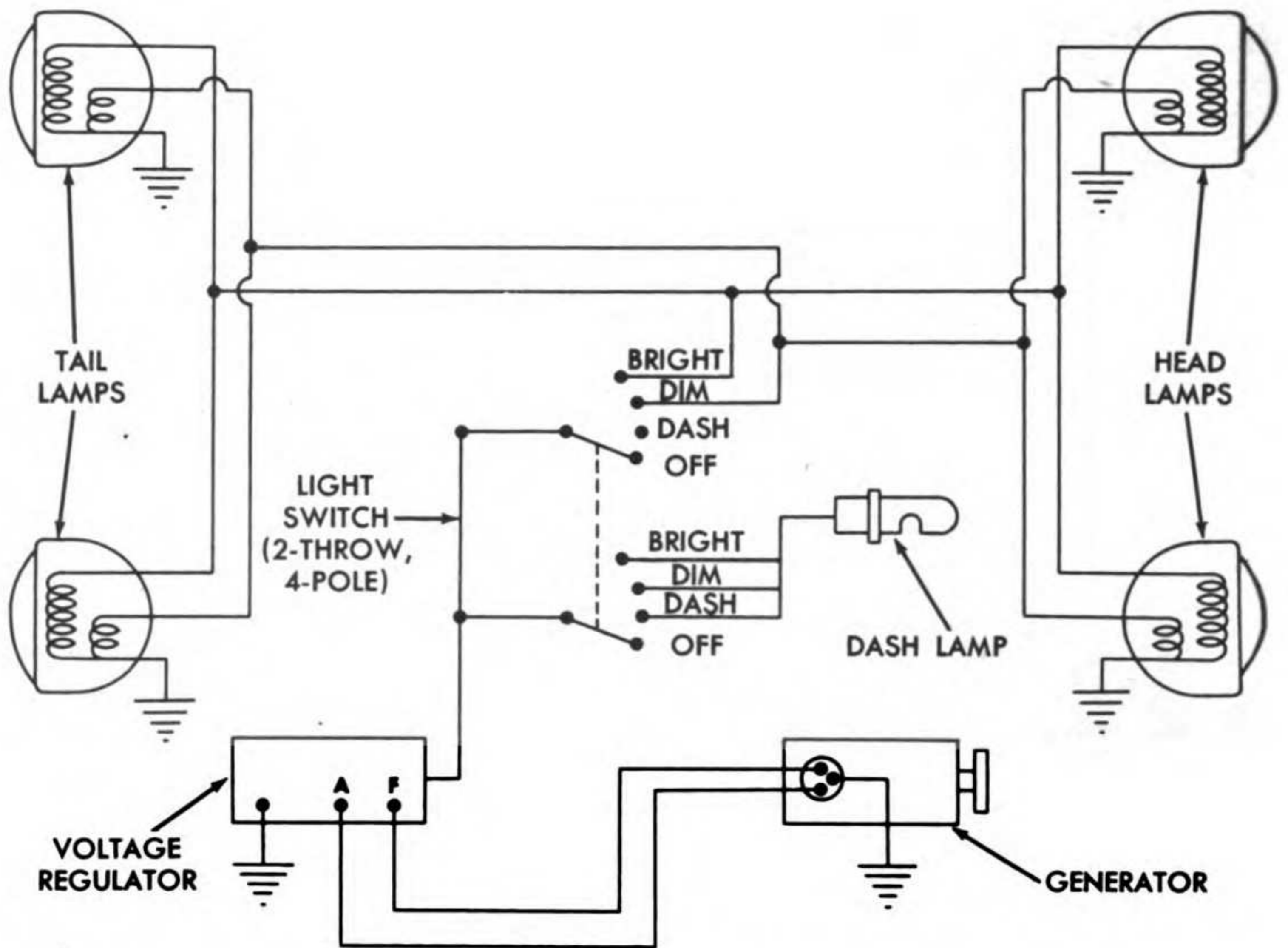


Figure 84. Electrical system wiring diagram.

b. *Removal* (fig. 85). The generator (2), voltage regulator (5), and connecting cable (10) are removed as a unit.

- (1) Remove the cap screw (8) attaching the cable clamp (9) to the water pump (4).
- (2) Remove three cap screws (7) supporting the voltage regulator mounting bracket (6) to the water pump.
- (3) Remove three cap screws (1) supporting the generator on the timing gear housing, and lift out the generator, shielded cable, and voltage regulator.

c. *Maintenance*.

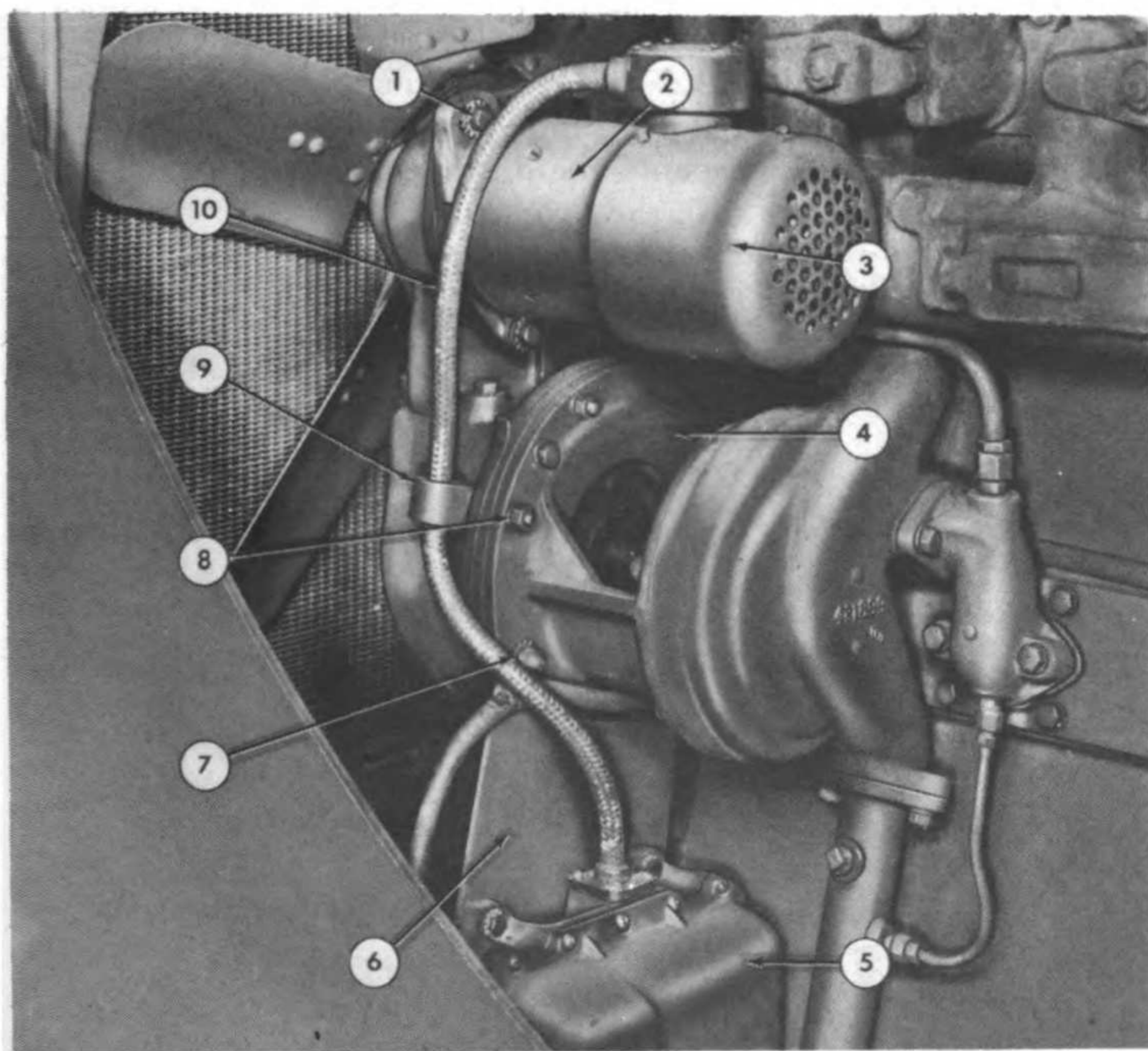
- (1) *Cleaning*. Every 1,000 hours the commutator end plate should be removed and the commutator checked. Remove eight fastening screws and remove the commutator end plate from the generator frame (fig. 86). If the commutator is glazed or darkened, polish with 2/0 sandpaper. Never use emery cloth. Clean out all traces of sand particles from the commutator, brushes, and brush holders.
- (2) *Brush replacement*. Brushes should be inspected and replaced if badly worn. New brushes are shipped rough-ground to insure partial fit. However, all brushes must be run-in at no load at least six to twenty-four hours to provide a minimum of 80 percent contact area.

Caution: Do not attempt to improve brush fit by using sandpaper or other abrasive material.

(3) *General reconditioning.* Every 4,000 hours, the generator should be removed and sent to a higher echelon for reconditioning and lubrication.

d. *Installation* (fig. 85). The generator (2), voltage regulator (5), and connecting cable (10) are installed as a unit as follows:

- (1) Place the generator (2) in position on the timing gear housing and replace three cap screws (1) through the mounting flange.
- (2) Lift the voltage regulator into position and replace three cap screws (7) supporting the voltage regulator mounting bracket (6) at the water pump (4).
- (3) Replace the cable clamp (9) on the water pump and secure with cap screw (8).



- | | | | |
|---|-------------------|----|----------------------------|
| 1 | Mounting screw | 6 | Regulator mounting bracket |
| 2 | Generator | 7 | Mounting bracket screw |
| 3 | Fan shroud | 8 | Clamp retaining screw |
| 4 | Water pump | 9 | Cable clamp |
| 5 | Voltage regulator | 10 | Cable |

Figure 85. Generator and voltage regulator installed.

88. Voltage Regulator

The regulator is properly adjusted at the factory and should not be changed except in case of failure when both the regulator and generator should be taken to a shop equipped with necessary tools and trained personnel, where the output of the generator can be checked and the regulator adjusted accordingly.

89. Lamps

a. Bulb Removal. (fig. 87).

- (1) Remove four screws holding the lens and guard assembly (1) on the lamp body (2) and lift off the assembly.
- (2) Press bulb in toward receptacle, turn it a quarter-turn counterclockwise and lift out.

b. Maintenance. Replace defective bulbs with bulbs of identical size and power. Keep the reflectors clean and polished. Replace broken or cracked lenses, and keep lenses clean.

c. Bulb Replacement.

- (1) Press the bulb firmly into the receptacle and give it a quarter-turn clockwise to lock it in position.
- (2) Replace the lens and guard assembly (1) on lamp body (2) and secure with the four screws.

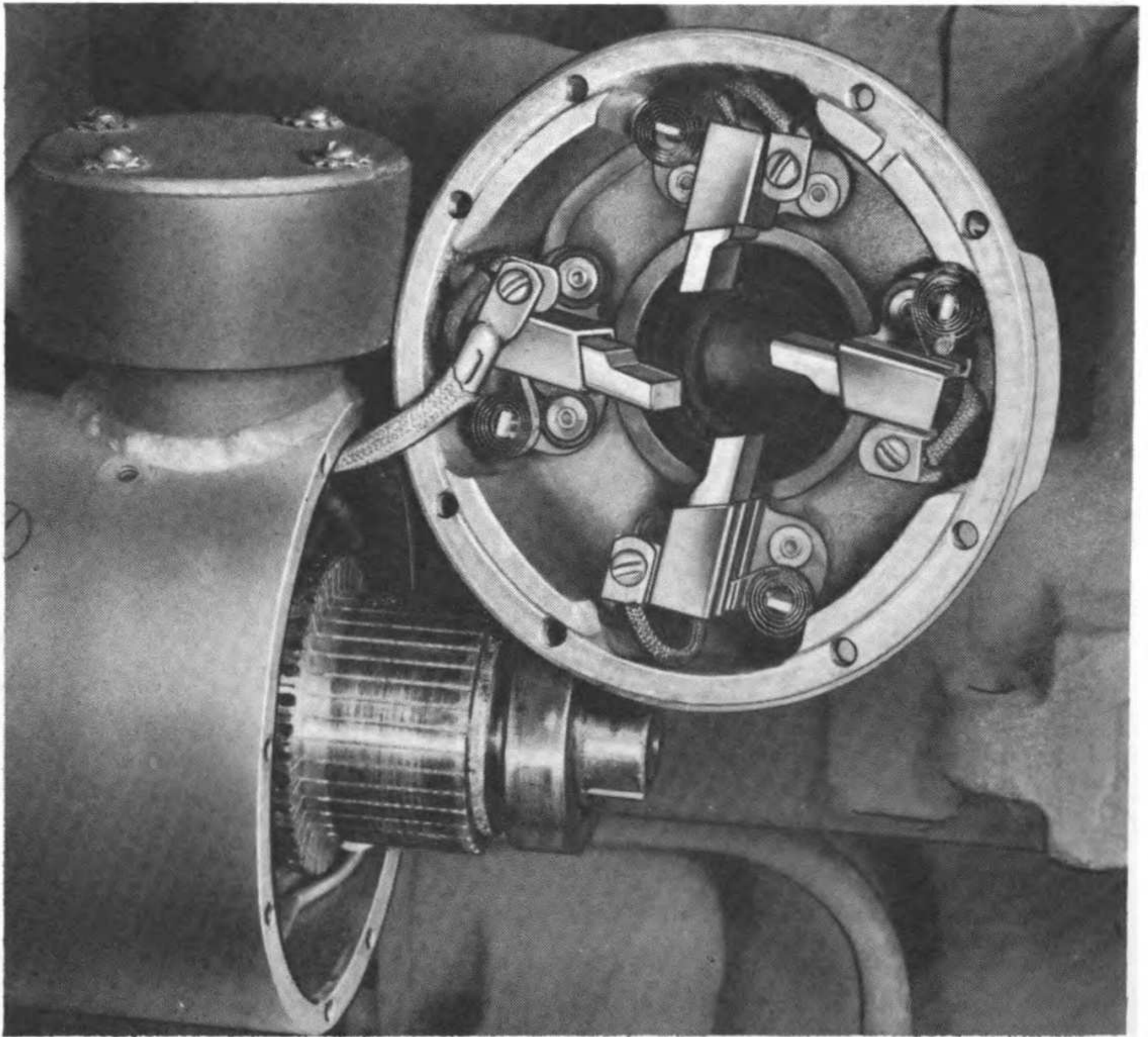
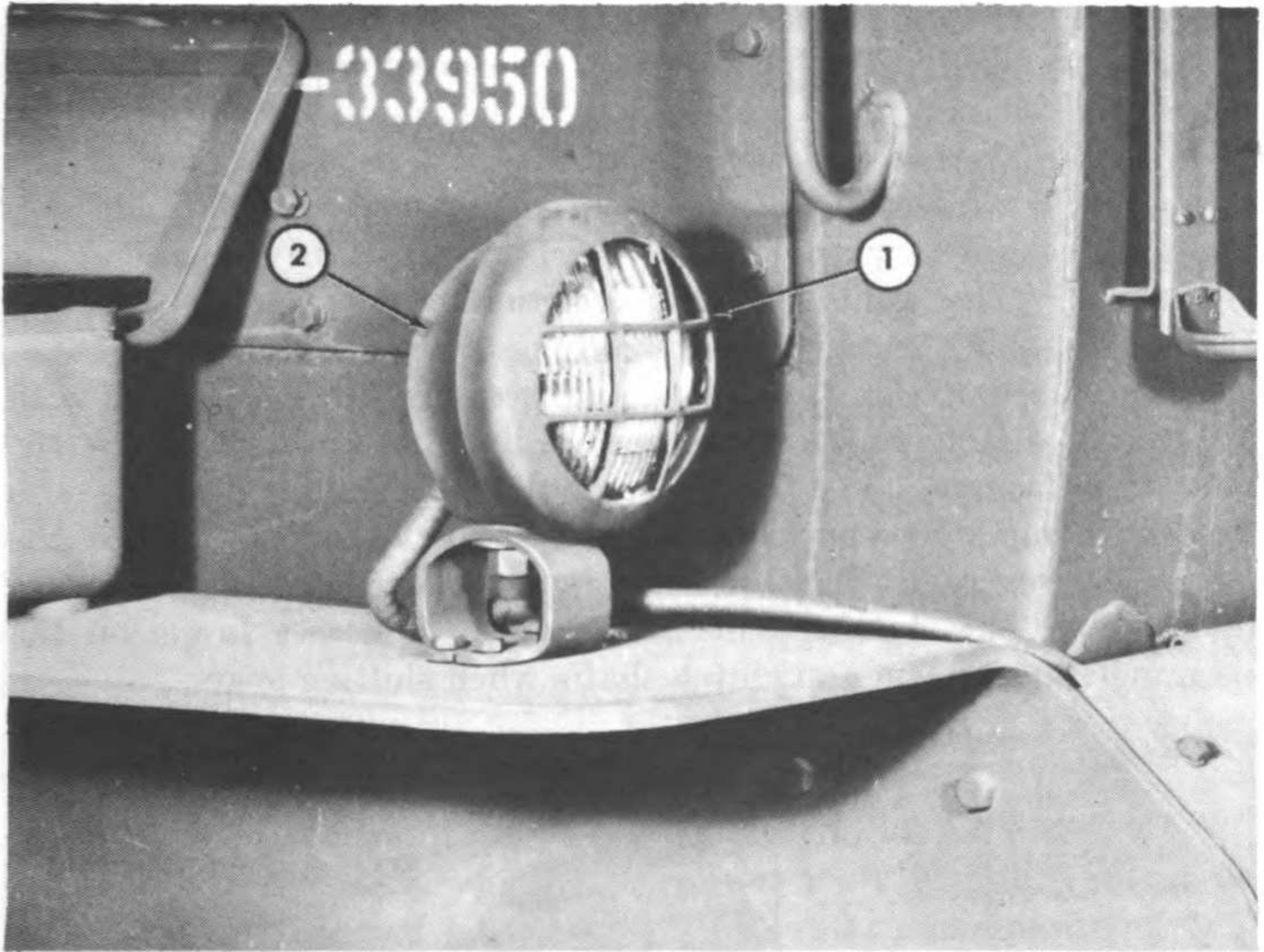


Figure 86. Generator brush replacement.



1 Lens and guard assembly

2 Lamp body

Figure 87. Lamp assembly.

Section XII. FLYWHEEL CLUTCH

90. Description

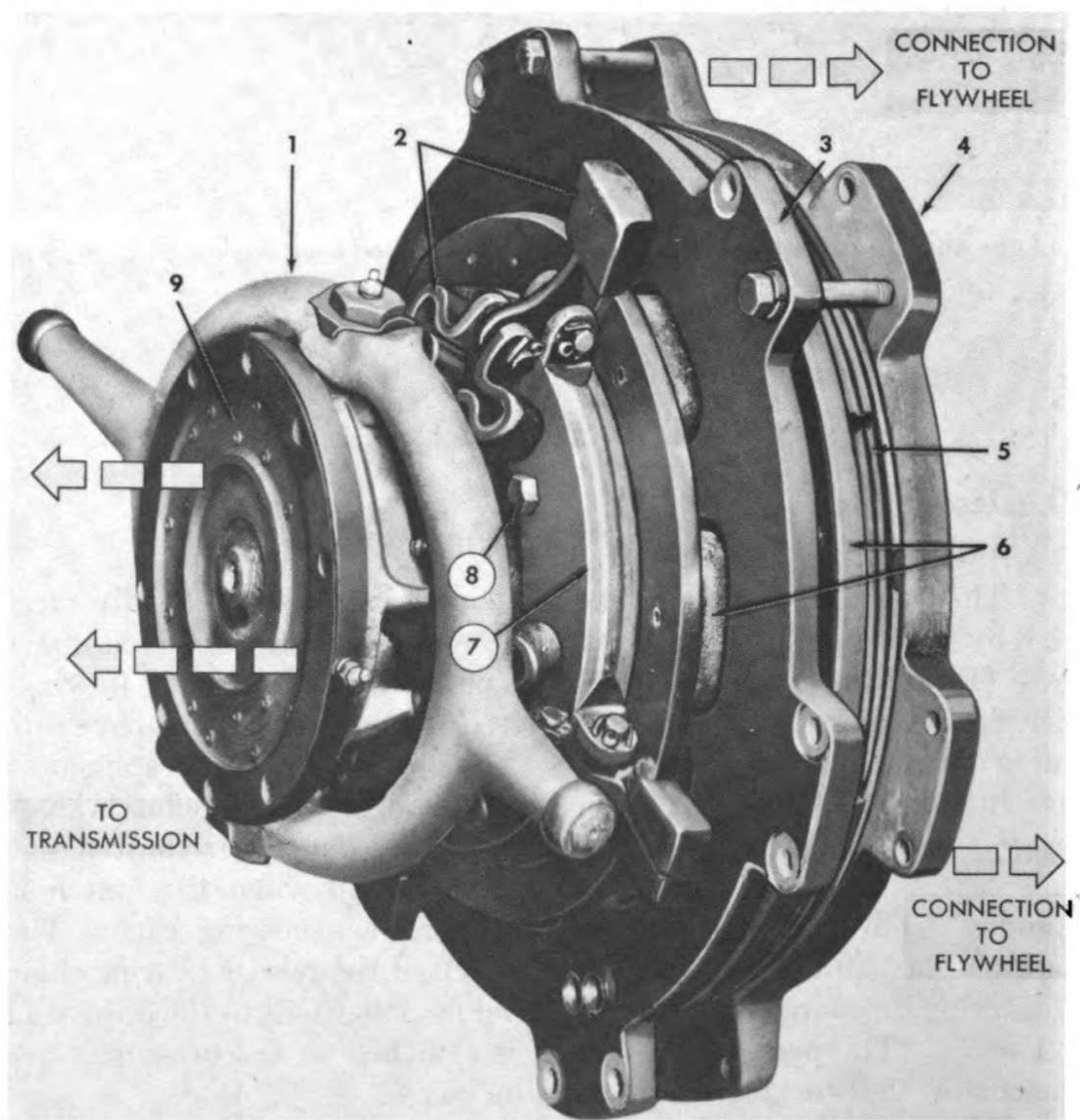
(fig. 88)

a. The flywheel clutch is of the dry, single-plate-type partially actuated by four toggle spring links and weighted cams (2). The drive plate (4) and drive hub (3) are attached to the diesel engine flywheel with flexible links. The pressure plate (6) is splined to the drive hub and is one of the driving members. The driven plate (5) is splined to the clutch shaft (9) which is forged integrally with the clutch shaft flange. The flange is bolted to the transmission upper shaft flange and imparts engine torque to the transmission when the clutch is engaged. The yoke is attached to the release bearing cage. The sliding collar (throwout collar) lies in front of the release bearing cage. The spring links are attached to the sliding collar and to the adjusting collar (7). The pressure plate ring is attached to the pressure plate and makes the working surface for the cams.

b. When the clutch control lever is pushed forward to engage the clutch, the yoke (1), bearing cage, and sliding collar move forward on the clutch shaft. The spring links raise the cam levers and bring the cams into contact with the pressure plate ring. It should be under-

stood that the spring links are under tension when the yoke moves forward. Since the clutch is rotating, the centrifugal force, generated in each cam weight, snaps it over center of its fulcrum on the adjusting collar in the characteristic manner of a toggle, as the tension on the spring link is released. This action drives the pressure plate forcibly against the stationary driven disk, which in turn is driven against the drive plate. The result is a clamping action by the pressure plate and drive plate upon the driven disk which rests between them.

c. The faces of the drive plate and pressure plate are lined with metallic-type facings; the driven disk is lined on both sides with the same type facings. The front face of the clutch shaft flange is also lined with metallic-type facings which contact the rear face of the release bearing cage when the clutch control lever is pushed forward to disengage the clutch. This arrangement acts as a brake on the spinning transmission and clutch shafts when shifting gears.



- | | | |
|--------------------------|------------------|--------------------|
| 1 Yoke | 4 Drive plate | 7 Adjusting collar |
| 2 Cam and lever assembly | 5 Driven plate | 8 Cap screws |
| 3 Drive hub | 6 Pressure plate | 9 Clutch shaft |

Figure 88. Flywheel clutch.

91. Maintenance

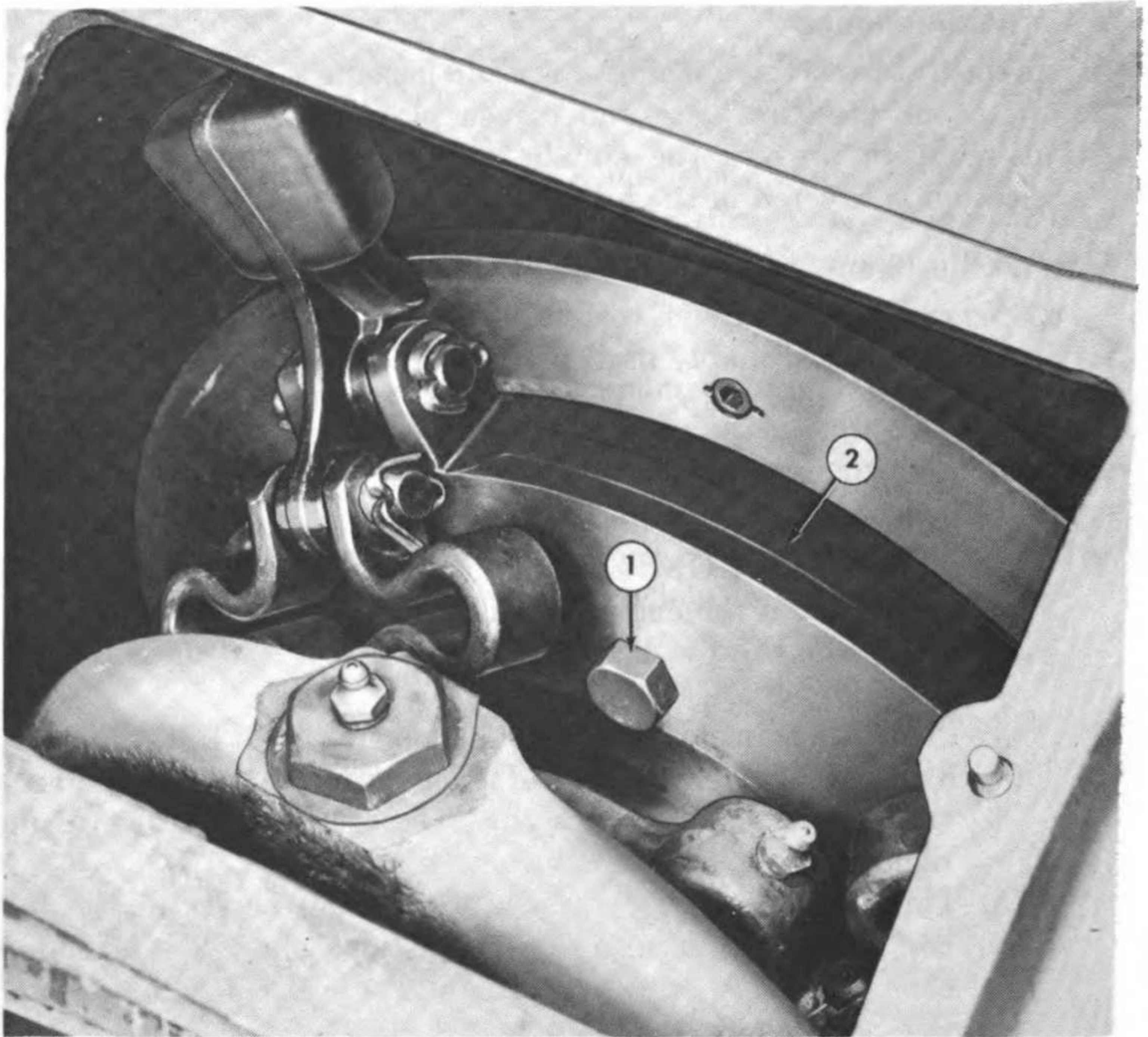
As the flywheel clutch facings wear and become thinner, the distance between the pressure plate and driven plate must be decreased by adjustment to prevent the clutch from slipping. Flywheel clutch lubrication is covered in the lubrication order.

92. Adjustment

a. General. The clutch is correctly adjusted when the clutch control lever requires a reasonably hard pull (55 to 65 lb.) and the clutch engages with a distinct snap. The flywheel clutch adjustment must be made with the engine stopped and the clutch disengaged.

b. Procedure (fig. 89).

- (1) Stop the engine by pushing the throttle control lever forward in the "SHUT OFF" position. Never attempt to adjust the clutch when the engine is running.
- (2) Disengage the flywheel clutch by pushing the clutch control lever forward.
- (3) Place the transmission control lever in "NEUTRAL".
- (4) Raise the hinged section of floor plate just forward of the transmission oil filter in the operator's compartment, and remove the cover from the clutch housing.
- (5) Turn the entire spider assembly to gain access to the four cap screws (1) securing the adjusting collar (2) and loosen each of the cap screws a turn or two. It is not necessary to remove the cap screws.
- (6) Engage the transmission gears to prevent the clutch shaft from turning.
- (7) Turn the adjusting collar a few degrees in a clockwise direction to tighten.
- (8) Disengage the transmission so that the entire assembly can again be turned without altering the adjustment, and tighten the four cap screws.
- (9) Check the adjustment by pulling the clutch control lever and repeat the above procedure until the desired clutch snap is obtained (55- to 65-pound pull).
- (10) Replace the housing cover and the access plate on the floor of the cab.



- 1 Cap screws
- 2 Adjusting collar

Figure 89. Flywheel clutch adjustment.

Section XIII. TRANSMISSION

93. Description

a. The transmission is of the constant mesh-type and provides five forward and three reverse speeds for operation of the tractor under a range of load conditions. The basic elements of the transmission consist of three splined shafts arranged so that all gears in any given gear train are in constant mesh to avoid gear clashing and prevent gear wear. The upper shaft is the power input shaft and is bolted to the clutch shaft at the flange. The pinion shaft is the power output shaft whose bevel pinion gear meshes with the steering clutch shaft ring gear and thus, through the final drives and sprockets, drives the tracks. The countershaft provides an axis for mounting the speed ratio gears necessary for the range of gear speeds required of the tractor.

b. All gears on the upper shaft turn freely on bearings on the shaft. Rotation is imparted to any gear by the sliding collar whose internal teeth mesh with the teeth on the gear hub and with teeth on the

coupling gear. The coupling gear has three rows of teeth. The coupling gear is splined directly to the shaft and rotates with it. Each sliding collar on the upper shaft serves to connect the rotating shaft with either of two gears.

c. When shifted to a given gear, the sliding collar meshes across the teeth on the gear hub and the teeth on the gear, thus connecting the freely rotating gear with the coupling gear, which is splined to the shaft, and imparted rotation to the gear. When the sliding collar is directly over the coupling gear it is in the neutral position and does not connect either gear to the shaft.

d. The upper shaft holds the forward and reverse gears (shifted by a separate control lever) and the fourth and fifth speed gears. The countershaft holds the first, second and third gears. The reverse gears are arranged in trains which mesh only with the first three speed ratio gears. It should be understood that due to the arrangement of trains, the position of the forward and reverse gear control lever does not affect the fourth and fifth speed ratio gears. The sliding collars are shifted by the forward-reverse control lever and the gear shift control lever. An interlock mechanism prevents shifting into conflicting gear trains.

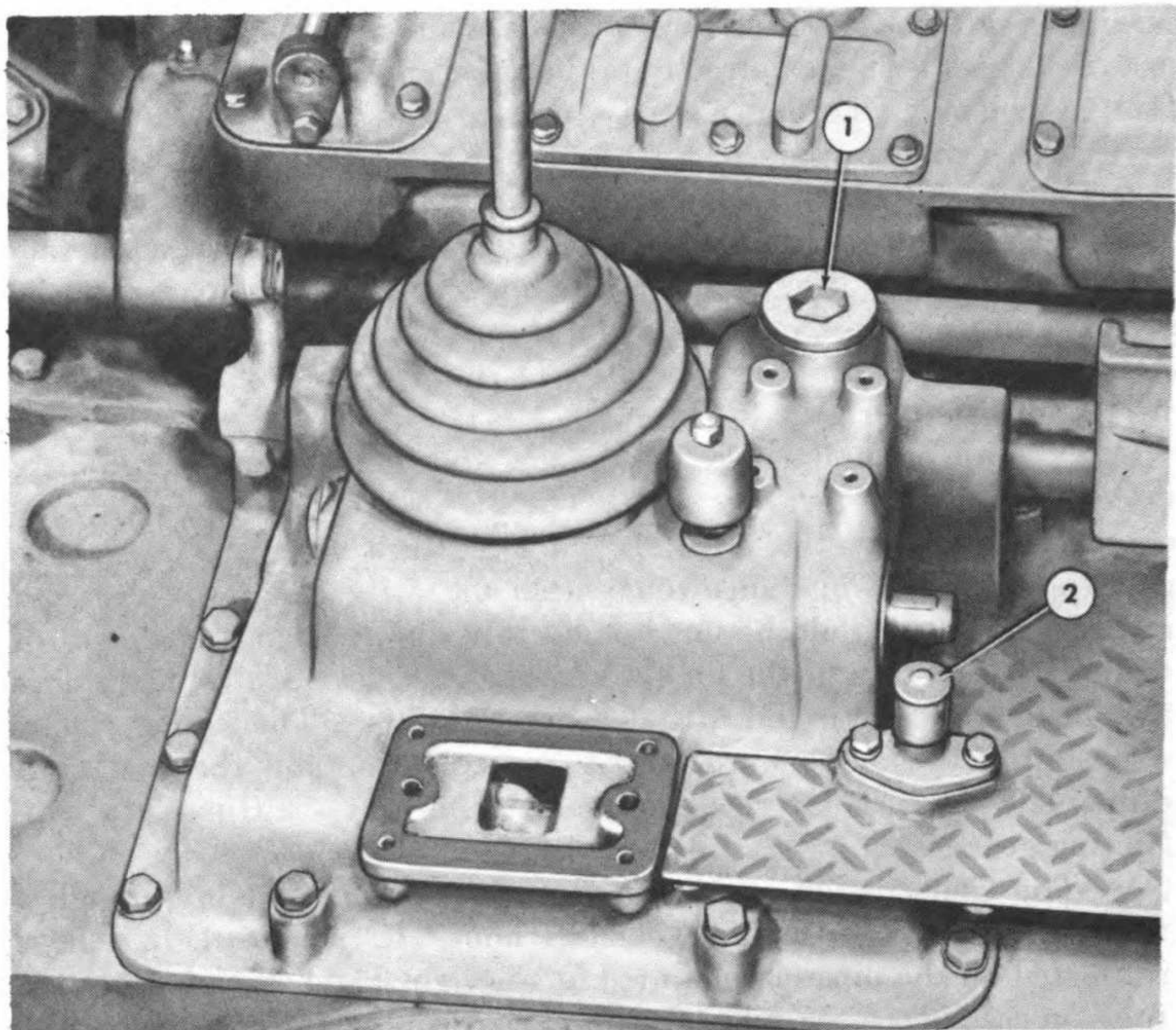
e. The transmission is lubricated with lubricant put in through a filler hole in the top of the gearshift housing (1, fig. 90), to a level indicated on the dipstick mounted at the right-hand side of the transmission case (2). The oil in the bevel gear compartment adjusts itself to that level through an opening between the two compartments.

94. Gearshift Mechanism

The gear shift mechanism, consisting of a gearshift control lever, is attached to the gearshift case (fig. 90) which, in turn, is attached to the transmission case cover. The single control lever and the shifter forks accomplish the combination of various speeds by the positioning of three sets of sliding gears which operate on splined shafts. By moving the sliding gears into the desired positions, the various forward and reverse speeds are obtained.

95. Gearshift Interlock Mechanism

The gearshift interlock mechanism, attached to brackets below the support assembly, holds the shifter forks and transmission gears in position when the flywheel clutch is engaged. Tangs on the locking bars engage notches in the shifter forks as the gears are shifted into any desired speed. The center notch in each shifter fork is for its neutral position. The other notches locate the gears for forward and reverse speeds. As the clutch is engaged, the locking bars, and, hence, the shifter forks, are held positively by a lever that rotates into position under the forward ends of the locking bars. When the clutch is disengaged, motion of the clutch release lever is transmitted through



1 Filler plug

2 Level gage

Figure 90. Transmission gearshift case.

the interlock link and interlock levers to the locking mechanism at the front ends of the locking bars. This causes the locking lever to be rotated out of position so that the bars are held only by spring tension. When gears are shifted, the locking bars are pushed down against spring tension, thus allowing the shifter fork to slide on the shifter shafts.

Section XIV. STEERING CLUTCHES

96. Description

The steering clutches are located in separate compartments on each side of the bevel gear (fig. 91).. The clutches are of the dry, multiple-disk type, held in engagement by springs.

97. Maintenance

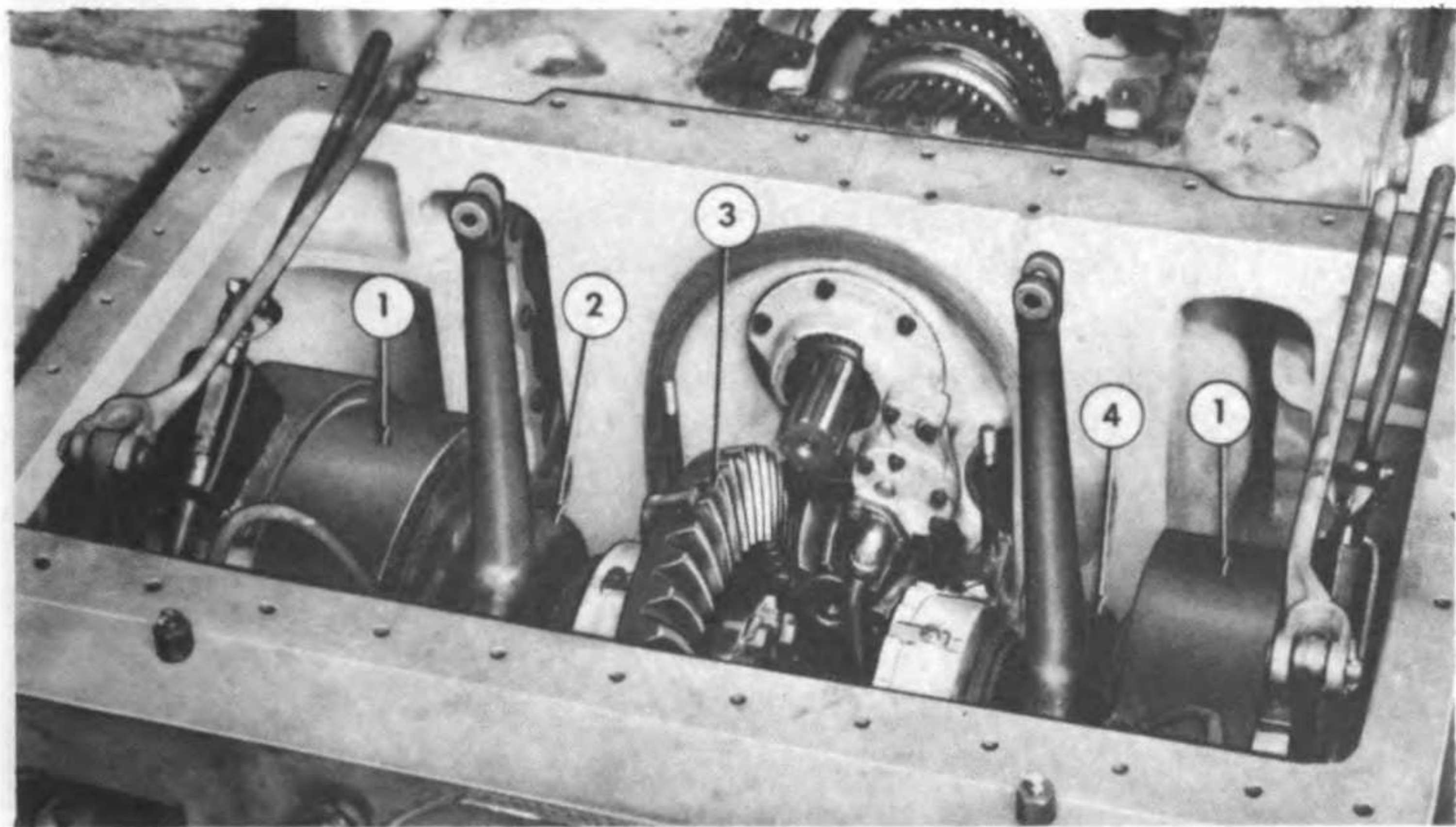
The steering clutches are designed to operate dry. Lubricant is used only to lubricate the release bearings. This lubricant and any seepage from adjoining compartments should be drained regularly by removing the plugs from the bottom of the case. Drain plugs must be kept in place while operating to prevent dirt and water from entering the compartments.

98. Adjustment

a. Clutch Adjustment. The adjustment on all tractors must be kept at a point that will allow 3 inches free motion at the top of the steering clutch levers (fig. 92). To adjust, lift off the seat cushion and remove the inspection plate over the crank adjusting screws (fig. 93). The steering clutch control levers should be in the fully forward position. Loosen the lock nut (4) on each adjusting screw and turn the adjusting nut (3) until it has a snug fit against the crank (7), then back off three turns and tighten the lock nut. The free lever movement may then be checked.

b. Lever Return Adjustment. If, at any time, either steering clutch lever is pulled back to release the clutch and fails to return all the way forward by itself, it will be necessary to do the following: Be sure the free motion at the top of the steering clutch levers is correct (fig. 92). take out the seat cushion and remove each clutch cover plate. Lubricate the spring guides inside the springs to eliminate binding. If the lever will not now return to the over-center position, loosen the lock nuts (2 and 6, fig. 93) at the back end of the booster spring (1), and turn the adjusting nut (3) slightly in a direction away from the engine until the lever snaps back over center to the forward position. Then give the adjusting nut an additional half turn and tighten the lock nut.

c. Cross Spring Tension Adjustment (fig. 93). After having made the proper booster spring and free lever movement adjustments, if it is found that the steering clutch lever fails to travel all the way forward, it will be necessary to adjust the cross spring tension. To do this, loosen the lock nut on the end of the cross spring adjusting screw



1 Brake band
2 Yoke

3 Bevel gear
4 Yoke

Figure 91. Bevel gear, steering clutches, and brakes.



Figure 92. Steering clutch control lever free movement.

(8) and turn the adjusting nut until satisfactory clutch lever return is obtained. The least amount of tension on the cross spring that will give proper lever return is desirable. Additional tension merely increases the resistance of the controls during operation.

Caution: In the engaged position, the steering clutch control levers should go all the way forward by themselves and the linkage should be free, permitting the three inches of free motion. If the levers remain in a partially "clutch released" position or have no free motion, failure of clutch release bearings will occur.

d. Steering Clutch Control Equalizer Bar Adjustment (fig. 94).

- (1) When the adjustment at the top of the release yoke on any tractor has been taken up, the position of the yoke can be changed to allow further adjustment. Loosen the clamp nut (4) on the underside of the case directly below the steering clutch shaft. This nut clamps the release yoke equalizer bar (2) in position. Slide the bar toward the outside of the

tractor by pulling in on the upper end of the yoke (1). Move the bar enough to allow full adjustment of the screw on the upper end of the release yoke. Then adjust the yoke at the top for the correct free motion of the steering clutch lever.

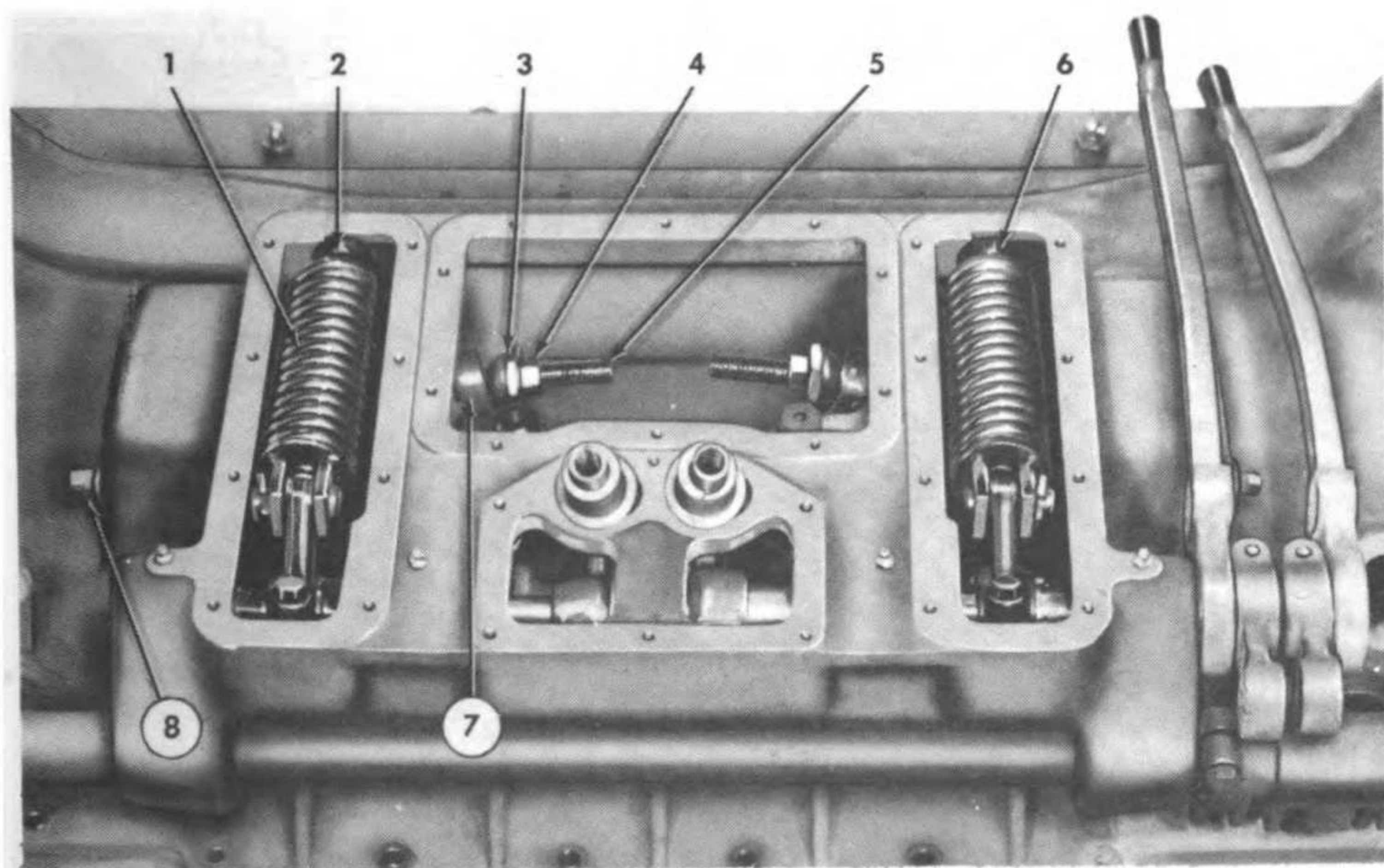
(2) As the limit of adjustment at the top and bottom of the release yoke is approached, consult the proper authority regarding further adjustment or relining the steering clutches.

e. *Steering Clutch Control Lever Position Adjustment* (fig. 95). The steering clutch levers are adjustable to several different positions. Loosen the cap screw that holds the lever to the bracket, move the lever to the desired position, and tighten the cap screw.

Section XV. STEERING CLUTCH BRAKES

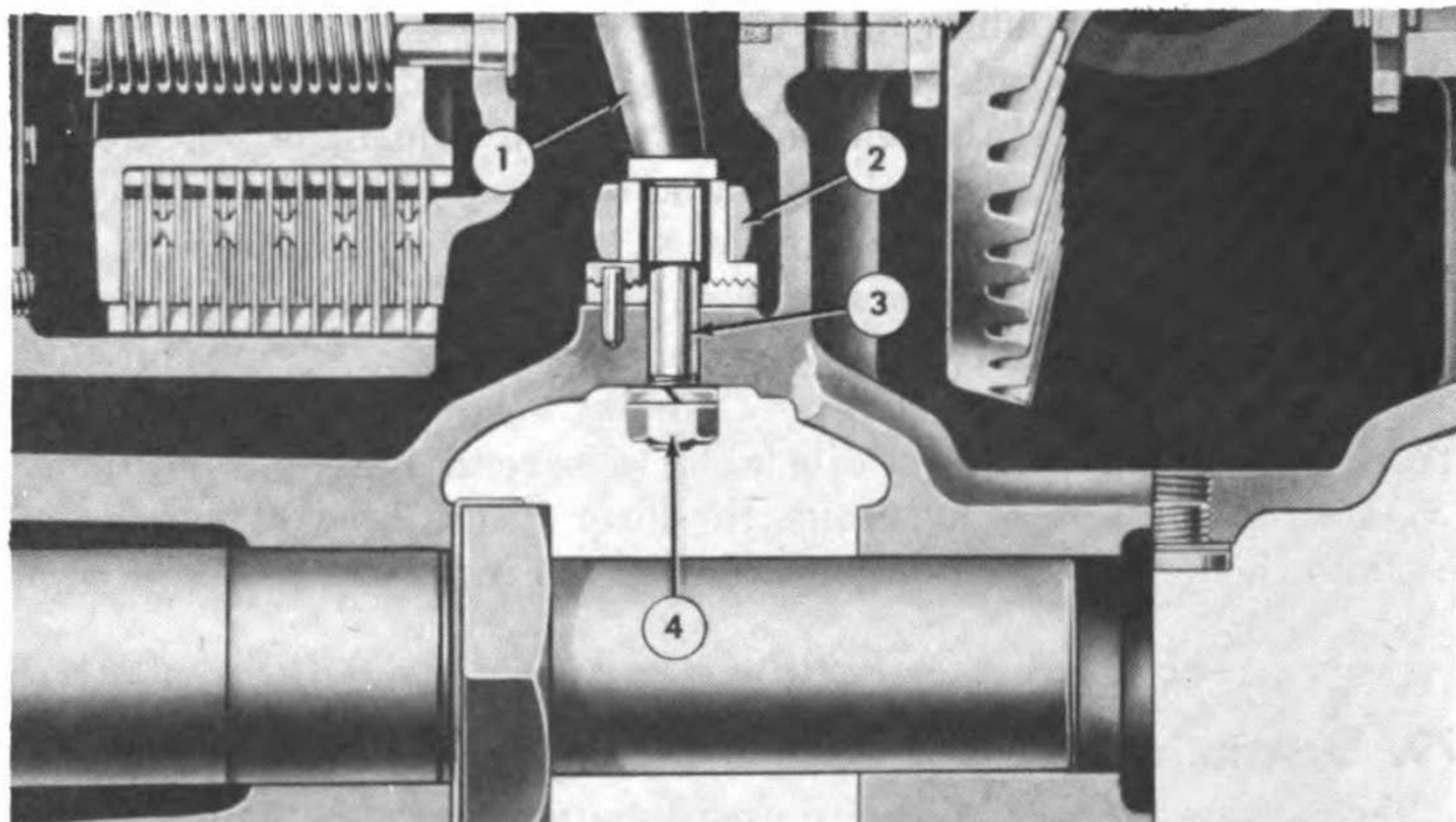
99. Description.

Two separate foot brakes are used to supplement the action of the steering clutches or to stop the tractor. Each pedal operates a self-energizing brake band on the steering clutch outer drum (fig. 96). The left-hand brake has a hand-operated lock to set the brake in a locked position to hold the tractor on slopes or when doing stationary work. A supporting screw located on the underside of the steering clutch case supports the brake and equalizes the clearance between the brake band and the brake drum when the brake is released.



- | | |
|------------------------|--------------------------------|
| 1 Spring | 5 Adjusting screw |
| 2 Spring adjusting nut | 6 Spring adjusting nut |
| 3 Adjusting nut | 7 Crank |
| 4 Lock nut | 8 Cross spring adjusting screw |

Figure 93. Steering clutch control adjustment.



- | | |
|-----------------------------|--------------|
| 1 Lower end of release yoke | 3 Clamp bolt |
| 2 Equalizer bar | 4 Clamp nut |

Figure 94. Steering clutch control equalizer bar adjustment.

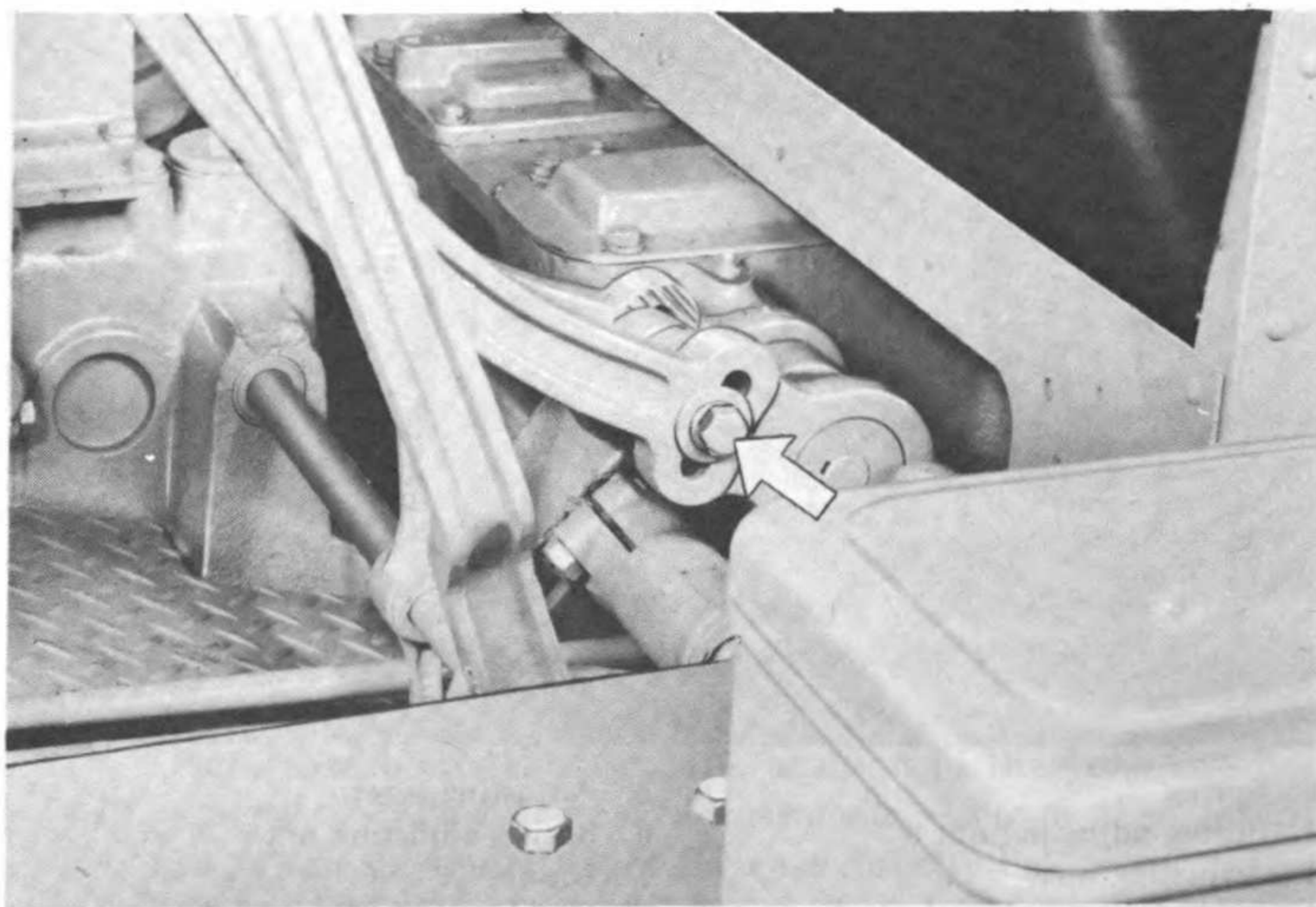
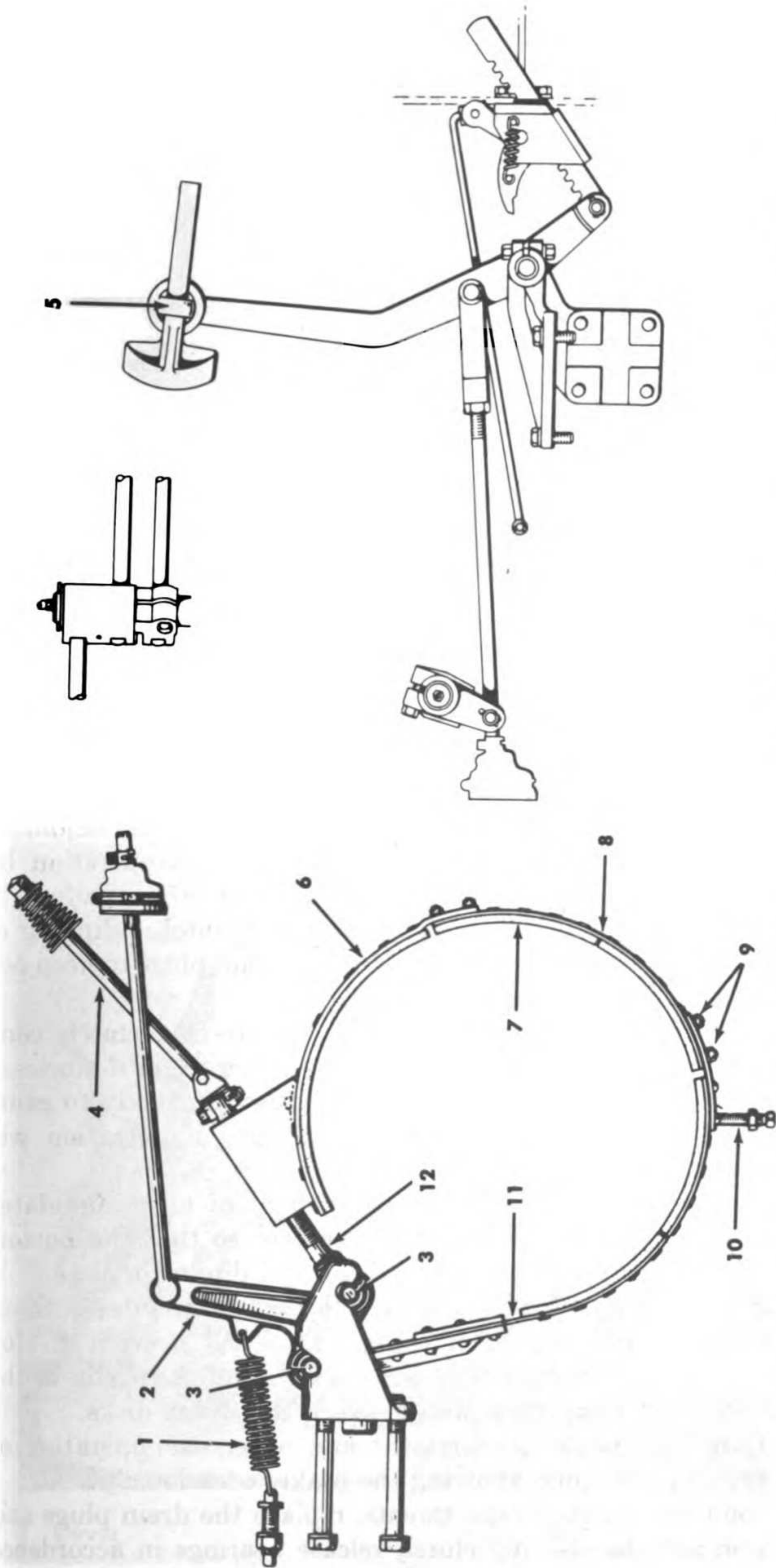


Figure 95. Steering clutch control lever adjustment.



- | | | | |
|---|--------------------|----|--------------------|
| 1 | Release spring | 7 | Brake lining |
| 2 | Lever | 8 | Band—lower section |
| 3 | Anchor pin | 9 | Bolts |
| 4 | Adjusting screw | 10 | Support screw |
| 5 | Eyebolt | 11 | Band—rear section |
| 6 | Band—upper section | 12 | Fork |

Figure 96. Schematic drawing of brake system.

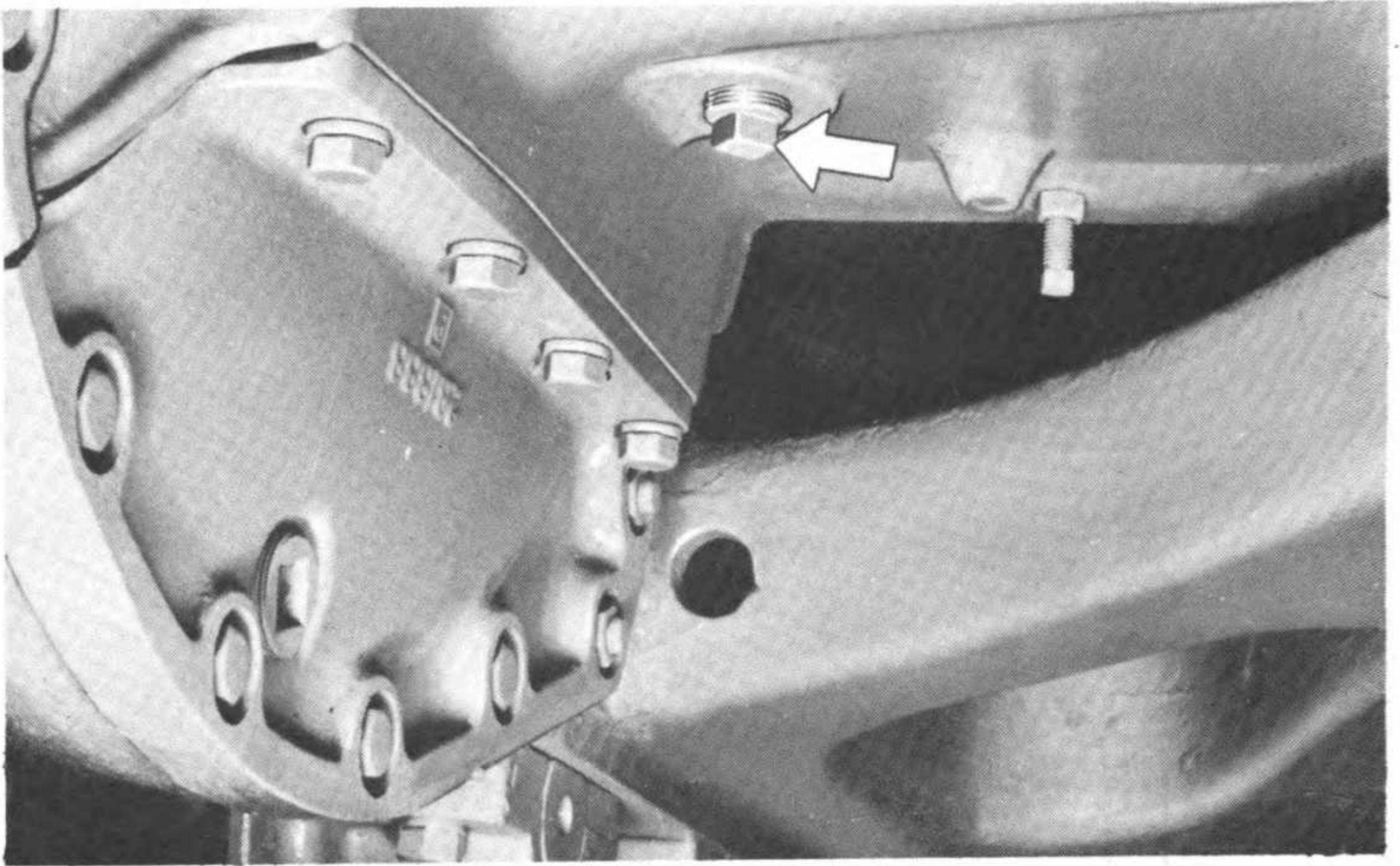


Figure 97. Steering clutch compartment drain plug.

100. Maintenance

a. Draining Steering Clutch Compartment. The steering clutches are designed to operate dry. Lubricant is used only to lubricate the release bearings. This lubricant, and any seepage from the adjoining compartments should be drained every sixty hours of operation by removing the plugs in the bottom of the case (fig. 97). Failure to observe proper draining periods may result in the clutches slipping or difficulty in steering the tractor. Replace the drain plugs to keep out dirt and moisture during operation.

b. Washing Steering Clutch Brakes. If the steering clutch compartments have not been drained at the proper interval, or if lubricant has accumulated on the steering clutch brakes sufficiently to cause slippage or difficult steering, some improvement in operation will result by washing the brakes, as follows:

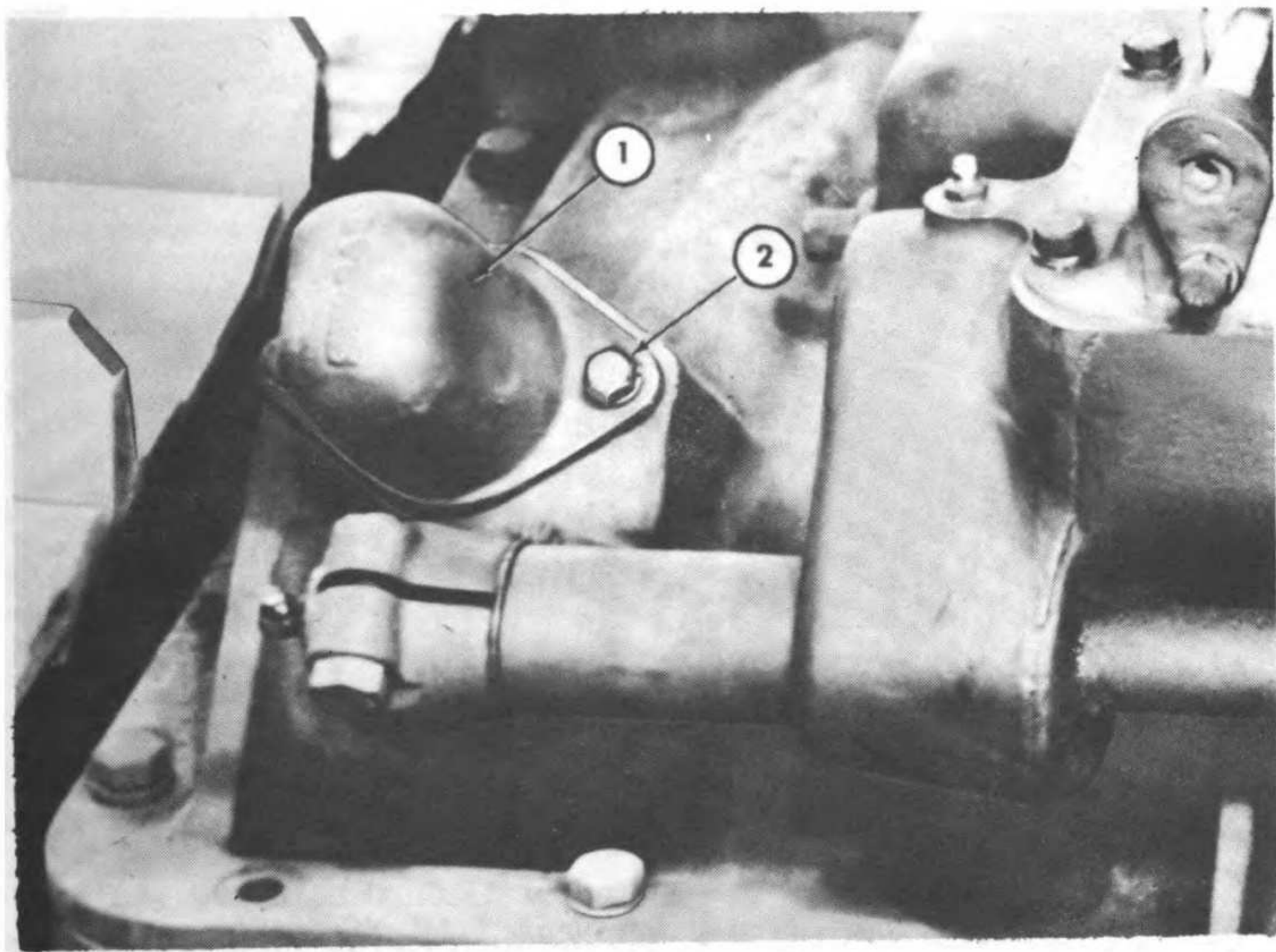
- (1) Drain the steering clutch compartment of all accumulated lubricant and fill with cleaning solvent so that the bottom of each steering clutch brake drum will dip in the fluid.
- (2) Operate the tractor back and forth for five minutes without releasing the steering clutches. This will prevent the oil and dirt on the outside of the clutches and the inside of the cases from being washed in between the clutch disks.
- (3) Drain the clutch compartment and repeat the operation of washing, this time applying the brakes occasionally.
- (4) Drain the clutch compartments, replace the drain plugs and lubricate the steering clutch release bearings in accordance with the lubrication order.

101. Adjustment

a. General. Keep the brakes adjusted just tight enough so the tractor will turn correctly when the steering clutch is released and the brake pedal is pressed down three-fourths of the way to the floor plate. The band should be entirely free from the drum when the pedal is released. Replace linings before they are worn down to the rivet heads, to prevent damage to the brake drums.

b. Procedure.

- (1) Remove the cap screws (2, fig. 98) which secure the cuplike covers (1) on top of each side of the transmission case cover.
- (2) Turn the head of the adjusting screw in a clockwise direction (one-half turn at a time) to tighten the brakes.
- (3) Loosen the lock nut on the support screw on the underside of the transmission case below the brake drum (fig. 96). Turn the support screw (10) up tight against the band and then back off $1\frac{1}{2}$ turns and tighten the lock nut.
- (4) Replace the covers.
- (5) The brake pedals are adjustable for length and angle. Loosen the nut on the eyebolt and move the pedal to the desired position. Then tighten the nut on the eyebolt (fig. 100).



1 Cover

2 Cap screw

Figure 98. Brake adjustment access covers.

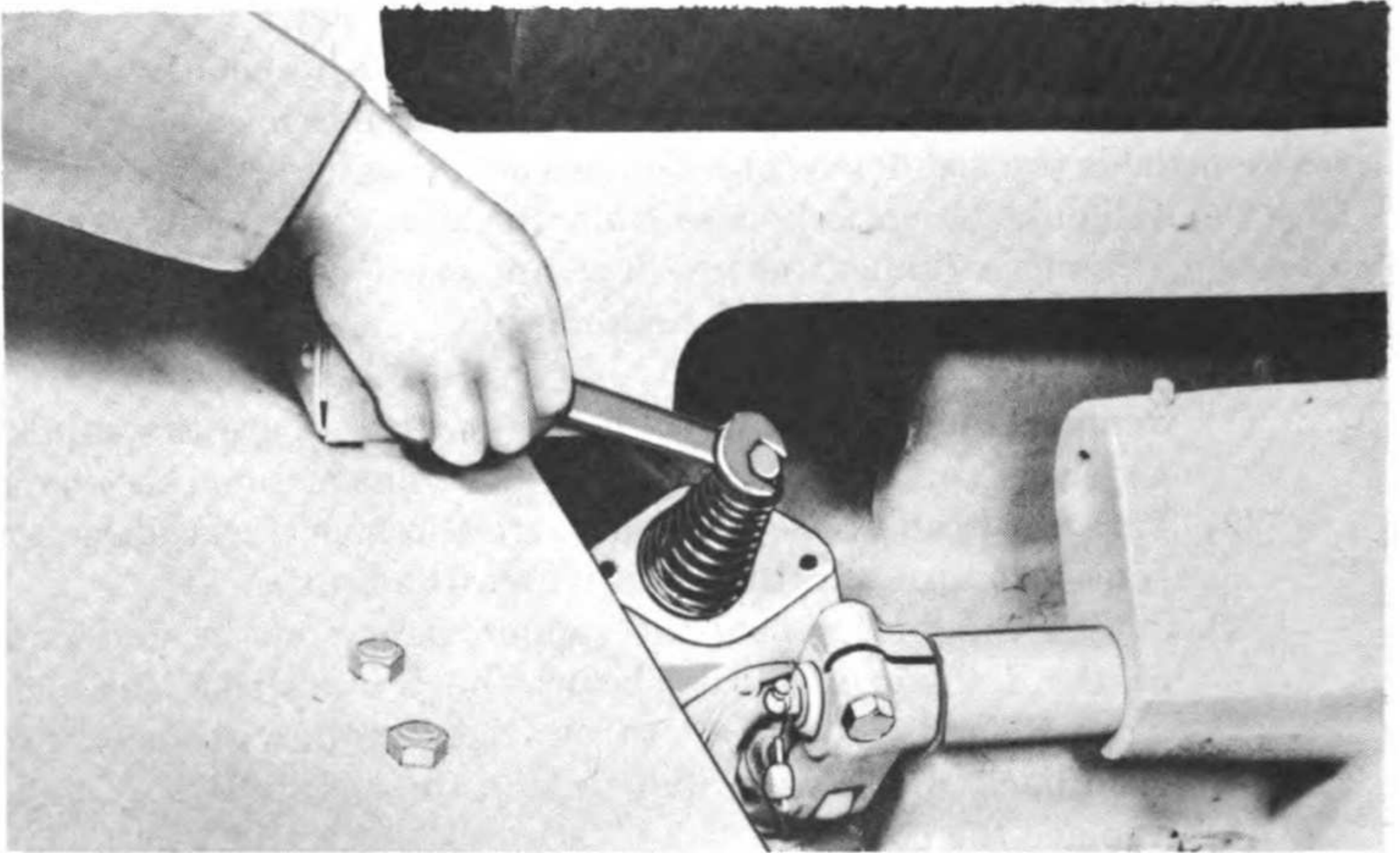


Figure 99. Steering clutch brake adjustment.

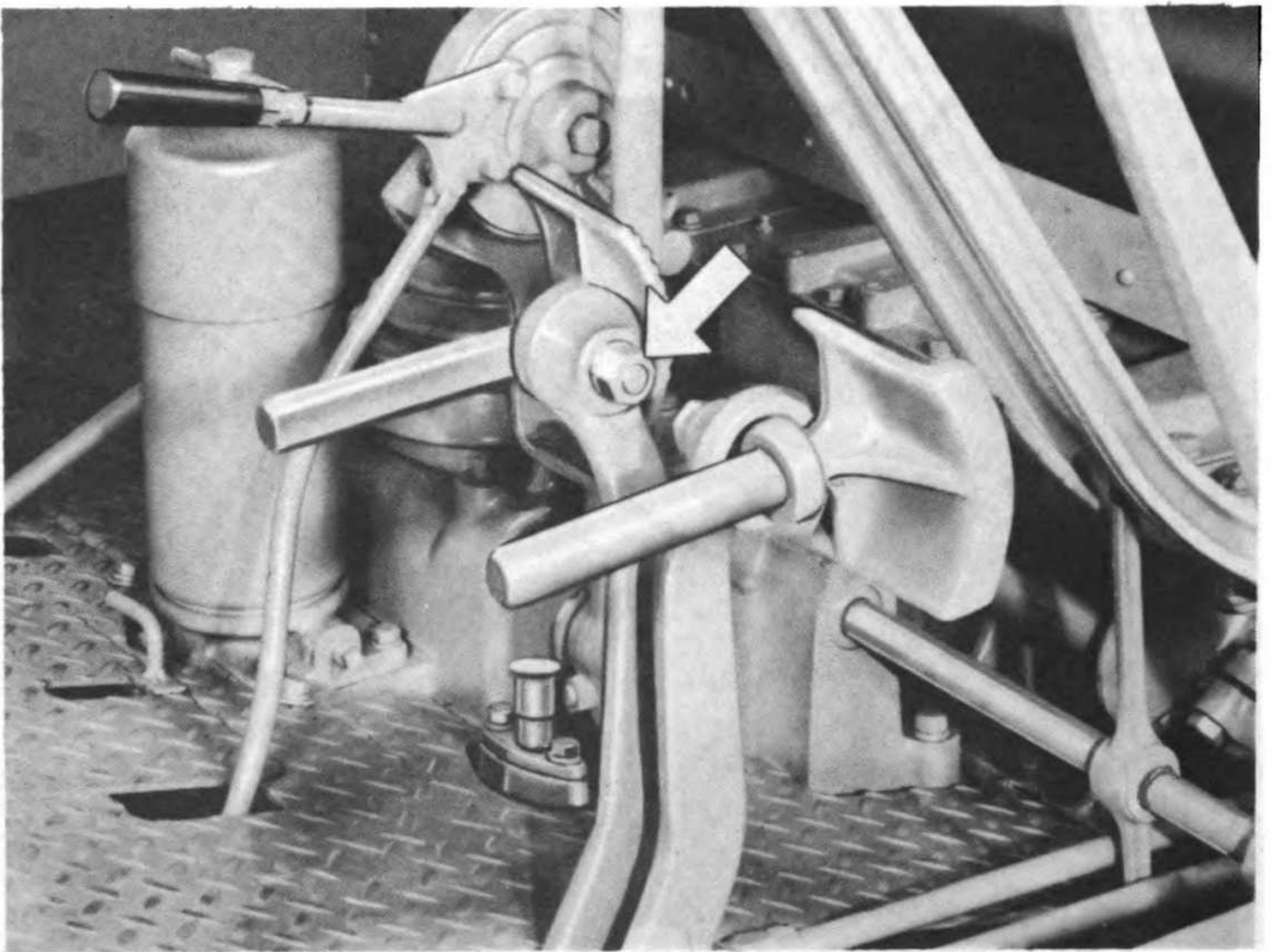
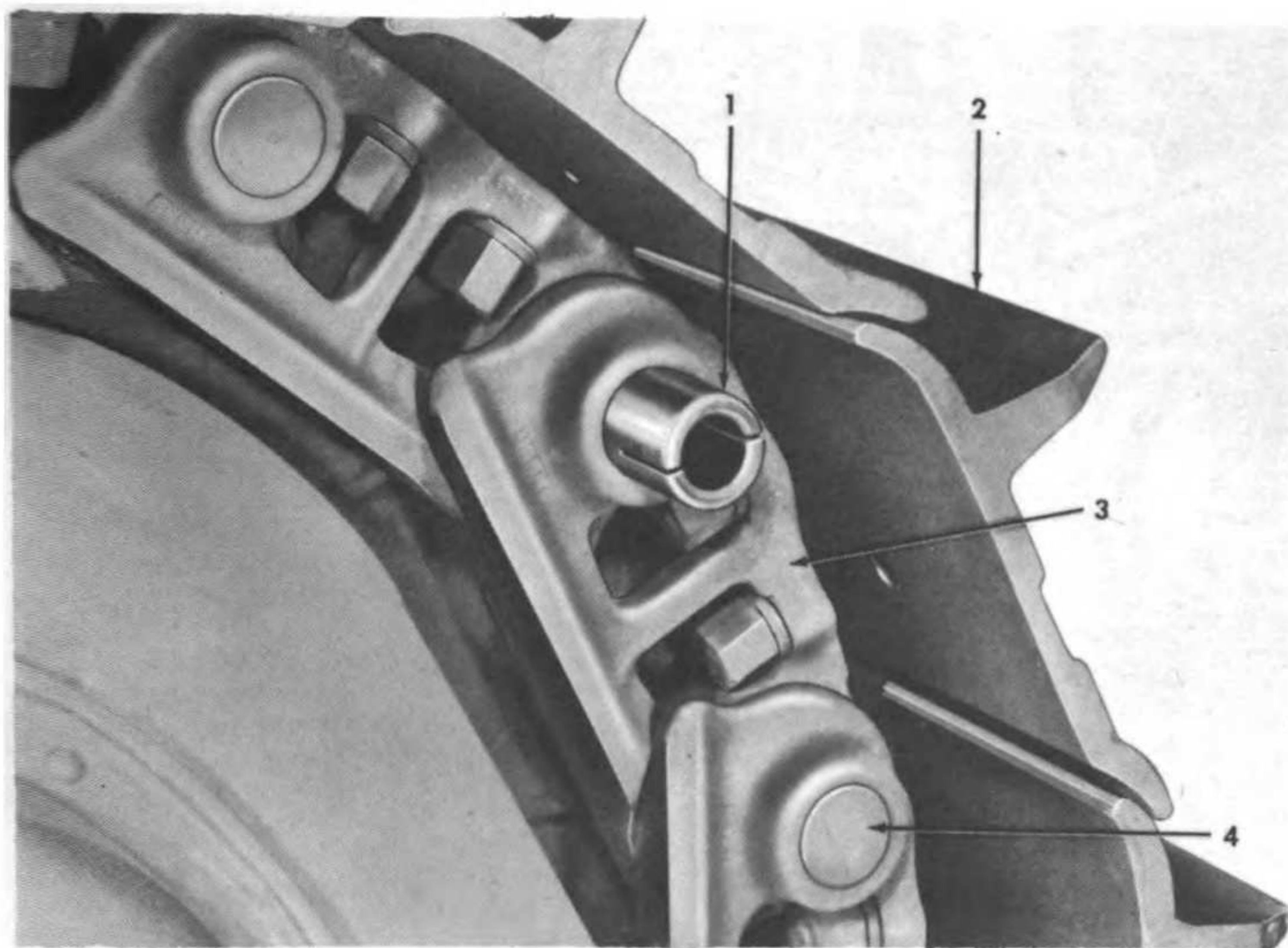


Figure 100. Steering clutch brake pedal adjustment.



- | | |
|---------------------------|--------|
| 1 Master pin | 3 Link |
| 2 Track shoe and bushings | 4 Pin |

Figure 101. Track linkage.

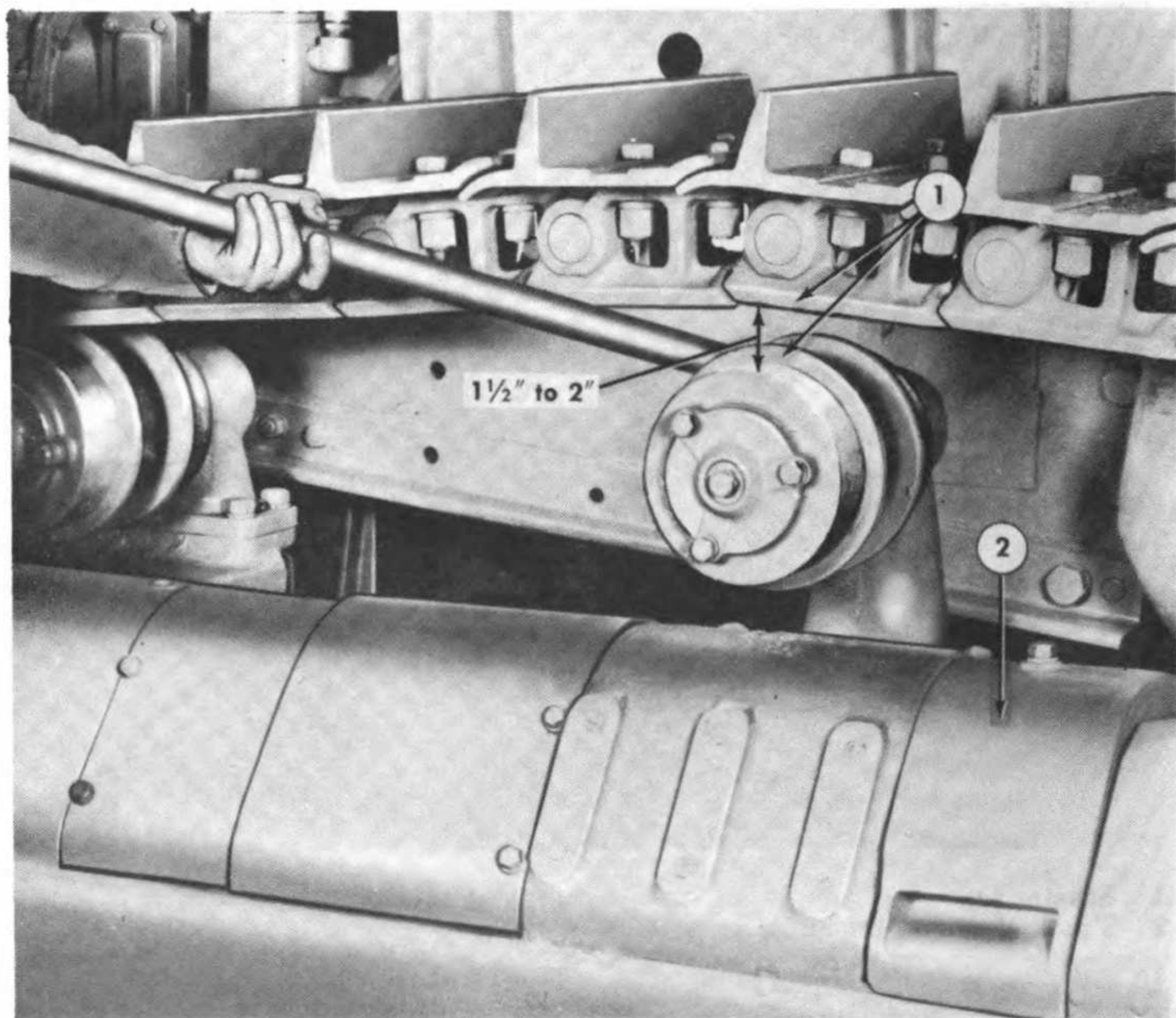
Section XVI. TRACKS

102. Description

The track assembly (fig. 101) consists of links (3), pins (1 and 4), bushings and shoes (2). Each link overlaps the preceding link and thus forms a continuous chain. Each link is counterbored in the overlapping portion to provide a tight joint, and reduce the entrance of abrasives. The bushings are alike except the master bushing, which is shorter for assembly purposes. With the master bushing, collars are inserted in the counterbored space. The pins are alike except the master pin, which is taper-reamed and split at each end. This construction permits a tapered plug to be driven into each end of the master pin to hold it in position in the links. The remaining pins and bushings are a press fit in the links. Each track shoe is attached securely to the links by four steel bolts and double length nuts.

103. Adjustment

a. General. The track adjustment is normally correct when the track may be raised from $1\frac{1}{2}$ to 2 inches above the track carrier roller with a bar. This adjustment should be the same on both tracks (fig. 102). When operating in loose material which may pick up and clog the tracks, loosen the track adjustment. Experience will show when it is necessary to change the adjustment from normal.



1 Track and carrier roller

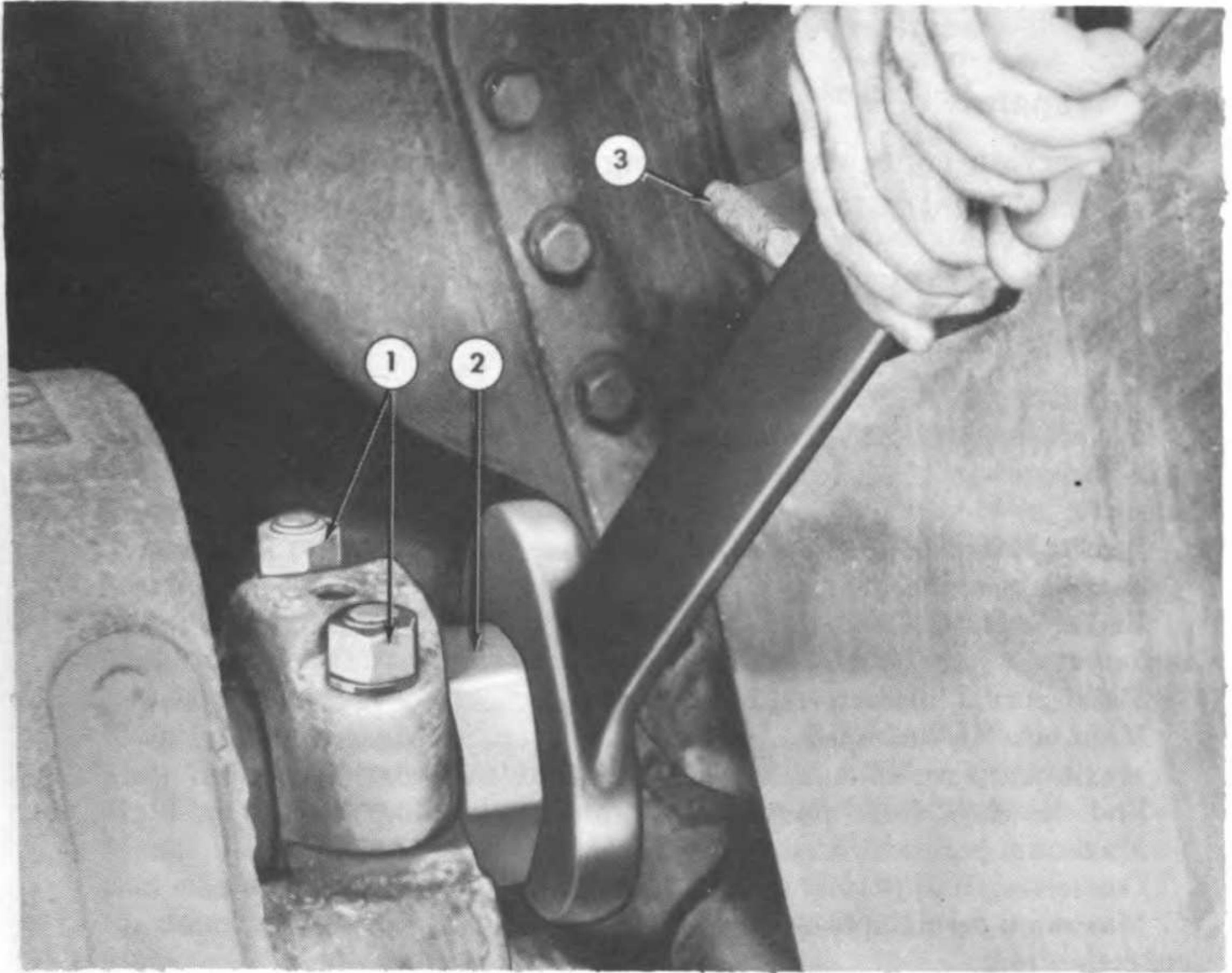
2 Adjusting screw guard

Figure 102. Checking track adjustment.

b. Adjusting Procedure.

- (1) Remove the track adjusting screw guard (2, fig. 102) which is the cover in the track roller frame just forward of the sprocket wheel.
- (2) Loosen the clamp nuts (1, fig. 103) that hold the cap on the large track adjustment nut (2).
- (3) Turn the adjusting nut until the track is at the correct adjustment.
- (4) Drive the tractor backward and forward to equalize the adjustment, then recheck the adjustment.
- (5) Tighten the clamp nuts and replace the track adjusting screw guard.

Note.—As continued track adjustment becomes necessary through service, the following precaution should be observed to prevent the adjusting bolt's being screwed out of the large adjusting nut, with subsequent damage to the threads: A maximum measurement of $5\frac{3}{4}$ inches (fig. 104) should not be exceeded between the adjacent faces of the track adjusting nut and the pilot that holds the recoil spring.



- 1 Clamp nuts
- 2 Adjusting nut

3 Sprocket

Figure 103. Adjusting track tension.

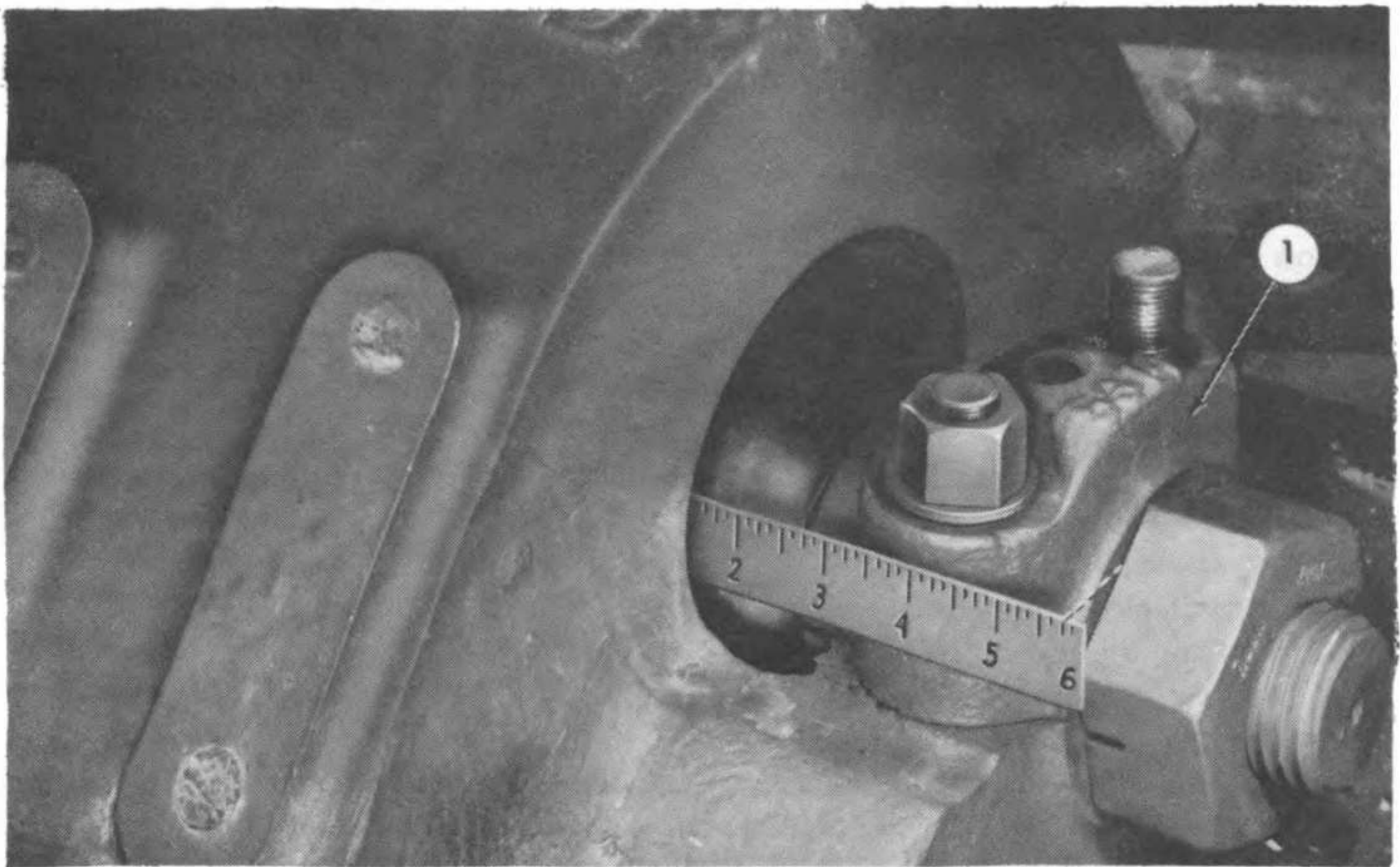


Figure 104. Track tension adjustment.

Section XVII. ENGINEERING DATA

104. General

This section contains engineering data, tolerances, clearances, and adjustments, and is to be used as a guide for maintenance personnel.

105. Engine Data

a. Starting Engine.

| | |
|---|---------------------------|
| Bore..... | 3 $\frac{5}{8}$ in. |
| Stroke..... | 4 in. |
| Brake horsepower..... | 24 at 2700 rpm. |
| Camshaft: | |
| Bearings, journal diameter, front and rear..... | 1.8705–1.8710 in. |
| Bearing clearance..... | 0.003–0.005 in. |
| End clearance..... | 0.005–0.015 in. |
| Crankshaft: | |
| Main journal, diameter..... | 2.1243–2.1250 in. |
| Main bearing clearance..... | 0.002–0.004 in. |
| Maximum permissible clearance..... | 0.009 in. |
| End clearance, front main bearing..... | 0.005–0.010 in. |
| Maximum permissible end clearance..... | 0.020 in. |
| Connecting rod, journal diameter..... | 1.999–2.000 in. |
| Maximum permissible out of roundness (journal)..... | 0.003 in. |
| Connecting rod: | |
| Connecting rod bearing clearance..... | 0.0025–0.0035 in. |
| Maximum permissible clearance..... | 0.009 in. |
| Cylinder bore: | |
| Diameter..... | 3.628–3.629 in. |
| Cylinder bore wear limit (out of round)..... | 0.003 in. |
| Cylinder bore wear limit (taper)..... | 0.008 in. |
| Piston pins: | |
| Clearance in rod bushing..... | 0.0008–0.0013 in. |
| Maximum permissible clearance between bushing and pin..... | 0.003 in. |
| Clearance in piston..... | 0.0004–0.001 in. |
| Maximum permissible clearance between piston and pin..... | 0.0025 in. |
| Piston rings: | |
| Compression ring gap..... | 0.010–0.020 in. |
| Oil ring gap..... | 0.010–0.018 in. |
| Compression ring groove clearance..... | 0.0015–0.003 in. |
| Oil ring groove clearance..... | 0.001–0.0025 in. |
| Maximum permissible groove clearance (new ring), compression and oil rings..... | 0.009 in. |
| Valves, exhaust and inlet: | |
| Tappett clearance (hot)..... | 0.008 in. |
| Face angle..... | 45°. |
| Bushing clearance..... | 0.002–0.004 in. |
| Valve timing: | |
| Exhaust opens..... | 40° before bottom center. |
| Exhaust closes..... | 5° after top center. |
| Inlet opens..... | 10° before top center. |
| Inlet closes..... | 35° after bottom center. |

| | |
|---|---|
| Valve spring | 31 pounds pressure when compressed to 2 inches. |
| Spark plug gap | 0.022 in. |
| <i>b. Diesel Engine.</i> | |
| Bore | 5¾ in. |
| Stroke | 8 in. |
| Firing order | 1-5-3-6-2-4. |
| Cylinder heads, tightness of cylinder head nuts after run-in: | |
| ⅝-in. nuts | 700 foot-pounds torque. |
| ¾-in. nuts | 2000 foot-pounds torque. |
| Camshaft: | |
| Bearing, journal diameter | 2.619-2.620 in. |
| Clearance | 0.0046-0.0066 in. |
| Maximum permissible clearance | 0.010 in. |
| End clearance | 0.003-0.007 in. |
| End clearance (thrust plate and washer) | 0.025 in. |
| Crankshaft: | |
| Main journal, diameter | 3.749-3.750 in. |
| Main bearing clearance (babbitt bearings) | 0.004-0.006 in. |
| Main bearing clearance (aluminum bearings) | 0.006-0.0085 in. |
| Maximum permissible clearance | 0.015 in. |
| End clearance (thrust plate and washer) | 0.010-0.017 in. |
| Maximum permissible end clearance | 0.025 in. |
| Main bearing stud nuts, torque wrench: | |
| ⅝-in. nuts | 58 foot-pounds. |
| ¾-in. nuts | 375 foot-pounds. |
| Connecting rod, journal diameter | 3.624-3.625 in. |
| Maximum permissible out of roundness | 0.007 in. |
| Connecting rod: | |
| Connecting rod bearing, clearance (babbitt bearings). | 0.0045-0.006 in. |
| Connecting rod bearing, clearance (aluminum bearings). | 0.006-0.0085 in. |
| Maximum permissible clearance | 0.015 in. |
| Connecting rod bolts, torque wrench | 125 foot-pounds. |
| Cylinder liner, maximum permissible liner wear (at top of ring travel). | 0.020 in. |
| Piston pins: | |
| Clearance in rod bushing | 0.001-0.0018 in. |
| Maximum permissible clearance in rod | 0.006 in. |
| Maximum permissible clearance in piston | 0.006 in. |
| Piston ring clearance in groove: | |
| Top ring | 0.0025-0.004 in. |
| 2nd and 3rd ring | 0.0025-0.004 in. |
| Oil control ring | 0.0015-0.0035 in. |
| Maximum permissible clearance | 0.012 in. |
| Valves: | |
| Tappett clearance (hot) | 0.012 in. |
| Exhaust valves: | |
| Stem clearance in bushing | 0.006-0.008 in. |
| Valve seat angle | 45°. |
| Maximum permissible clearance in bushing | 0.012 in. |

Valves—Continued

Inlet valves:

| | |
|--|-----------------|
| Stem clearance in bushing | 0.005–0.007 in. |
| Valve seat angle | 45°. |
| Maximum permissible clearance in bushing | 0.012 in. |

Valve timing:

| | |
|----------------|---------------------------|
| Exhaust opens | 50° before bottom center. |
| Exhaust closes | 22° after top center. |
| Inlet opens | 12° before top center. |
| Inlet closes | 30° after bottom center. |

To check valve timing: With valve clearances set 0.012'' hot, dial indicator mounted above valve stem, readings taken with valve 0.075'' off its seat:

| | |
|-----------------|-------------|
| Exhaust opening | 32° 4' BBC. |
| Exhaust closing | 2° 4' ATC. |
| Inlet opening | 5° 56' ATC. |
| Inlet closing | 10° 4' ABC. |

Valve spring:

| | |
|-------|--|
| Outer | 71–79 pounds pressure when compressed to $3\frac{1}{8}$ in. |
| Inner | 9–11 pounds pressure when compressed to $2\frac{13}{16}$ in. |

Rocker arm bushings: Clearance between shaft and bushings. 0.002–0.0035 in.

Oil pump: Clearance between gears and separator plates. 0.002–0.004 in.

Fuel injection pump timing 17½° B. T. C.

c. Power Transmission and Crawler Assemblies.

Flywheel clutch:

| | |
|--|-----------------|
| Clearance between shaft and sliding collar | 0.004–0.008 in. |
| Maximum permissible clearance | 0.030 in. |

Steering clutch:

| | |
|---|-----------------|
| Clearance between shaft and pressure plate bushing. | 0.007–0.009 in. |
| Maximum permissible clearance | 0.030 in. |

Clutch springs:

| | |
|-------|--|
| Outer | 230–270 pounds pressure when compressed to $6\frac{1}{4}$ in. |
| Inner | 166–194 pounds pressure when compressed to $6\frac{1}{16}$ in. |

Track roller frame:

| | |
|---|-----------------|
| Outer bearing clearance | 0.006–0.008 in. |
| Maximum permissible clearance outer bearing | 0.025 in. |
| Inner bearing clearance | 0.008–0.010 in. |
| Maximum permissible clearance inner bearing | 0.040 in. |

Track rollers:

| | |
|--|-----------------|
| Shaft clearance..... | 0.007–0.010 in. |
| Maximum permissible shaft clearance..... | 0.050 in. |
| End clearance..... | 0.010–0.028 in. |
| Maximum permissible end clearance..... | 0.050 in. |

Track carrier rollers:

| | |
|--|-----------------|
| Shaft clearance..... | 0.007–0.010 in. |
| Maximum permissible shaft clearance..... | 0.050 in. |
| End clearance..... | 0.010–0.028 in. |
| Maximum permissible end clearance..... | 0.100 in. |

Front idlers:

| | |
|--|-----------------|
| Shaft clearance..... | 0.006–0.010 in. |
| Maximum permissible shaft clearance..... | 0.050 in. |
| End clearance..... | 0.010–0.020 in. |

Tracks: Maximum measurement between adjacent faces of track adjusting nut and pilot (fig. 104). 5¼ in.

CHAPTER IV

SHIPMENT, LIMITED STORAGE, AND DEMOLITION TO PREVENT ENEMY USE

Section 1. STORAGE AND SHIPMENT

106. Limited Storage

a. Inspection. Inspect tractor thoroughly in accordance with instructions contained in paragraph 49.

b. Cleaning and Painting.

(1) *Cleaning.* Thoroughly clean the equipment and all components to insure that moisture, dirt, old preservatives and other foreign substances are completely removed. Make sure that all dirt and mud is removed from the tracks and track roller frame.

(2) *Painting.* Paint all areas where paint has deteriorated or has been removed during cleaning. Painting should be in accordance with instructions in paragraph 47.

c. Complete Lubrication. Lubricate the entire tractor in accordance with LO 5-3040-B.

d. Protection in Storage.

(1) If tractor is to be stored outside place planks under both tracks to prevent tracks from freezing to ground in freezing weather.

(2) Drain the oil and refill crankcase with clean oil.

(3) Cover the exhaust pipe to keep out rain or snow.

(4) Drain the starting engine gasoline tank and let the starting engine burn the gasoline out of the carburetor. This will prevent gum deposits in the system.

(5) Fill the diesel engine fuel tank with diesel fuel. This drives out all moisture-laden air and prevents condensation inside the tank.

(6) Check the storage battery with a hydrometer and recharge if the reading is 1.225 or lower. Clean the outside of the battery and cover all terminals with grease. If freezing weather is expected, remove the storage battery from tractor and store battery indoors.

(7) If temperature is below freezing or if freezing weather is expected before the tractor is used again, drain the cooling system, or protect it with antifreeze (see par. 36*a* and *b*).

107. Domestic Shipment

a. General. Prepare the equipment the same way as for limited storage (par. 102). The common means of shipping large tractors are by truck, trailer, or flat car. Regardless of the type of conveyance used, the following steps should be followed in preparing the tractor for shipment.

- (1) Lifting eyes (2 and 6, fig. 3) are provided near the front and rear on both sides of the tractor.
- (2) Place the tractor square on the truck bed or car floor and see that the tracks have solid footing for their full length.
- (3) Place the throttle control lever in "shut-off" position.
- (4) Place the compression release in "run" position.
- (5) Shift the transmission in first speed.
- (6) Engage the flywheel clutch.
- (7) Lock the brake pedal in the "applied" position.
- (8) Cover the exhaust pipe.
- (9) If the tractor is to be shipped by flatcar, place chocks as close together as possible in such a position as to prevent any forward or backward motion of the tractor. Fasten the chocks to the floor of the flatcar with spikes or some equally effective method (fig. 105).
- (10) Along the outside edge of both tracks, spike a 2 x 4-inch timber to the car floor to prevent side shift of the tractor.
- (11) When hauling by truck, the tractor must be chained or wired down to prevent it from slipping off as the truck travels over rough terrain. In front, on each side, a chain can be passed through the front idler across the top of the track and secured to the side of the truck bed. At the rear, on each side, chains can be attached between the drawbar plate and the side of the truck bed.
- (12) Drain the cooling system or protect it with antifreeze solution as directed in paragraph 36.
- (13) Large blocks or solid objects must not be placed under the tractor, as they may get under the crankcase and break it as the engine springs up and down on the equalizer spring.

b. Hoisting the Tractor.

- (1) *General.* If the tractor must be moved or loaded with a hoist or crane, the equipment necessary is an 18-ton hoist and two $\frac{7}{8}$ -inch wire cable slings 40 feet long. If a great number of tractors are to be moved in this fashion, four hoisting cable guards will prevent the sharp edges of the track shoes from damaging the cable.

(2) *Hoisting procedure.*

- (a) Place throttle control lever in the "shut-off" position.
- (b) Place the compression release in the "run" position.
- (c) Shift the transmission into "first" speed.
- (d) Engage the flywheel clutch.
- (e) Lock the brake pedal in the "applied" position.
- (f) Place one sling under each track at the front and the other sling under each track at the rear of the tractor in the angle between the grouser and the shoe of the first link angling up from the ground. As the cable tightens up, make sure the cable guards are in place (fig. 106).
- (g) Raise the tractor with a hoist or crane.

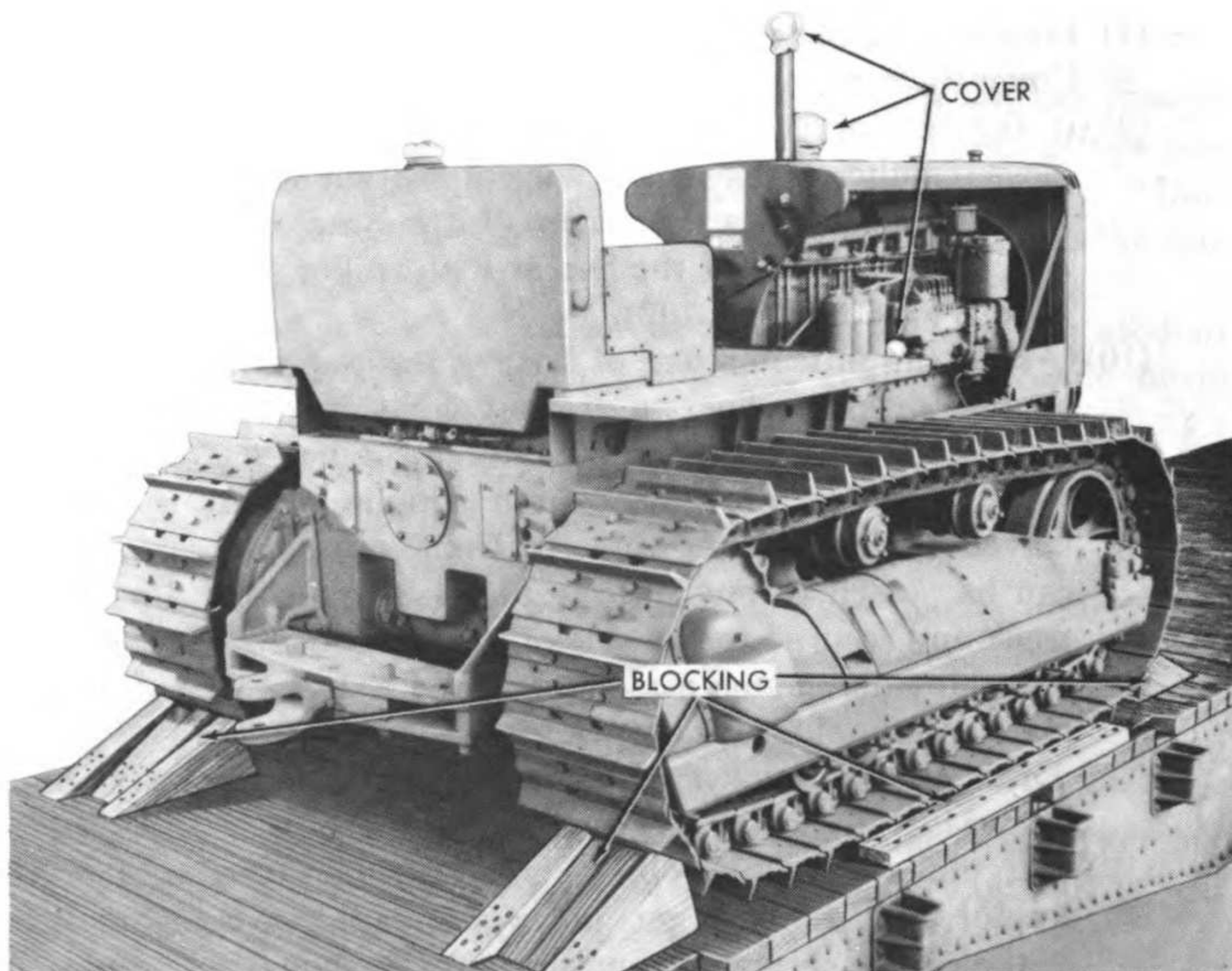


Figure 105. Blocking tractor on flatcar.

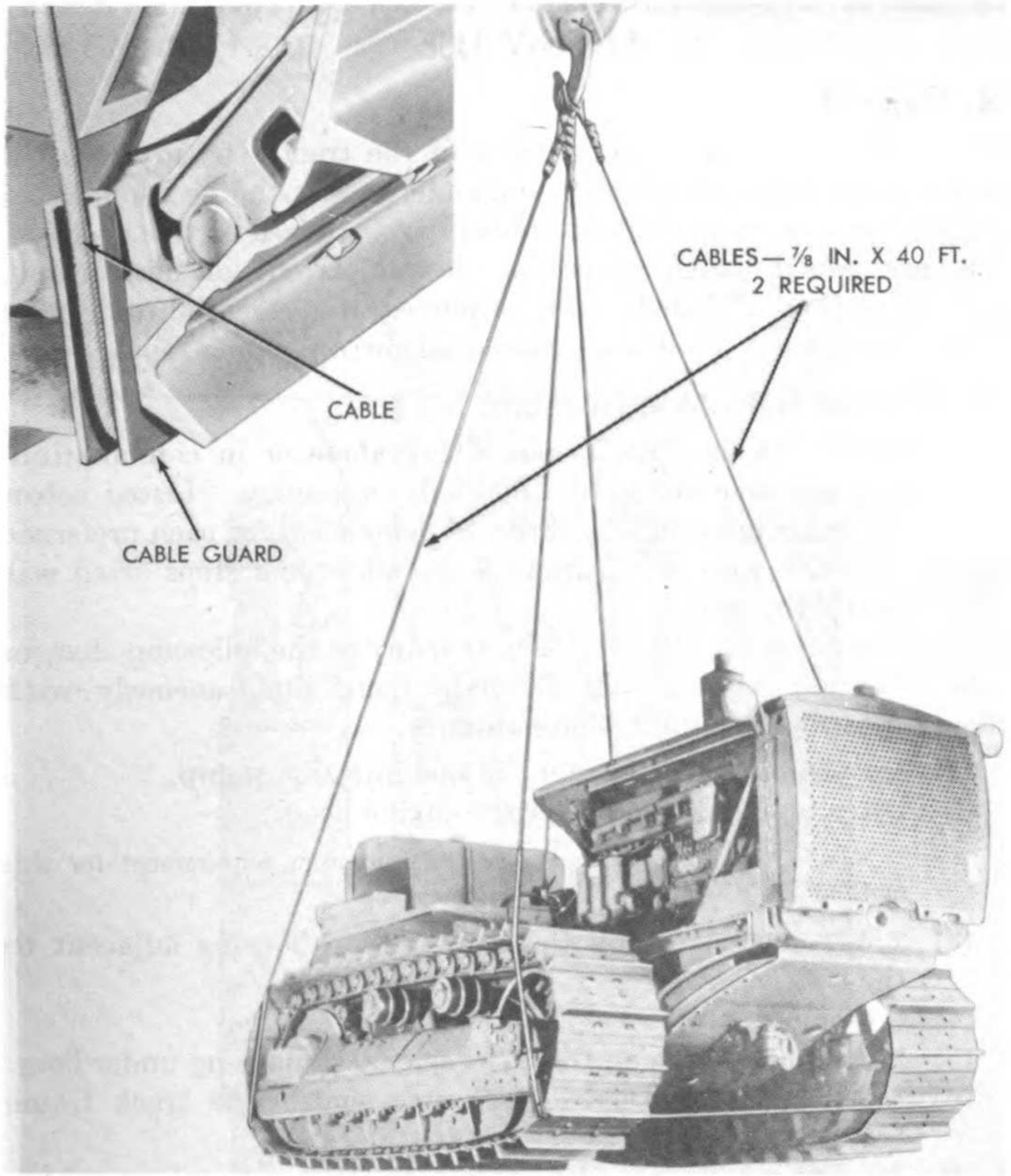


Figure 106. Hoisting tractor.

Section II. DEMOLITION OF TRACTOR TO PREVENT ENEMY USE

108. General

When capture or the abandonment of the tractor to an enemy is imminent, the responsible unit commander makes the decision either to destroy the unit or to render it inoperative. Based on this decision, orders are issued which cover the desired extent of destruction. Whatever method of demolition is employed, it is essential to destroy the same vital parts of all tractors and all corresponding repair parts.

109. Preferred Demolition Methods

Explosives or mechanical means, either alone or in combination, are the most effective demolition methods to employ. Listed below are the vital parts in order of priority of demolition for each preferred method. In each case, completion of the additional steps listed will further destroy the unit.

a. By Explosives (fig. 107). Place as many of the following charges as the situation permits and detonate them simultaneously with detonating cord and suitable detonators:

- (1) A 4-pound charge behind the fuel injection pump.
- (2) Three 2-pound charges on the engine head.

Note.—The above charges are the minimum requirement for this method.

- (3) A 6-pound charge on the transmission housing adjacent to the shifting lever.
- (4) A 4-pound charge behind the starting engine.
- (5) A 6-pound charge on the flywheel clutch housing under floor.
- (6) A 4-pound charge inside each open end of the track frame brace.

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

- (1) The fuel injection pump, water pump, starting engine, governor, and fuel lines.
- (2) The engine head, engine block and manifolds.

Note.—The above steps are the minimum requirement for this method.

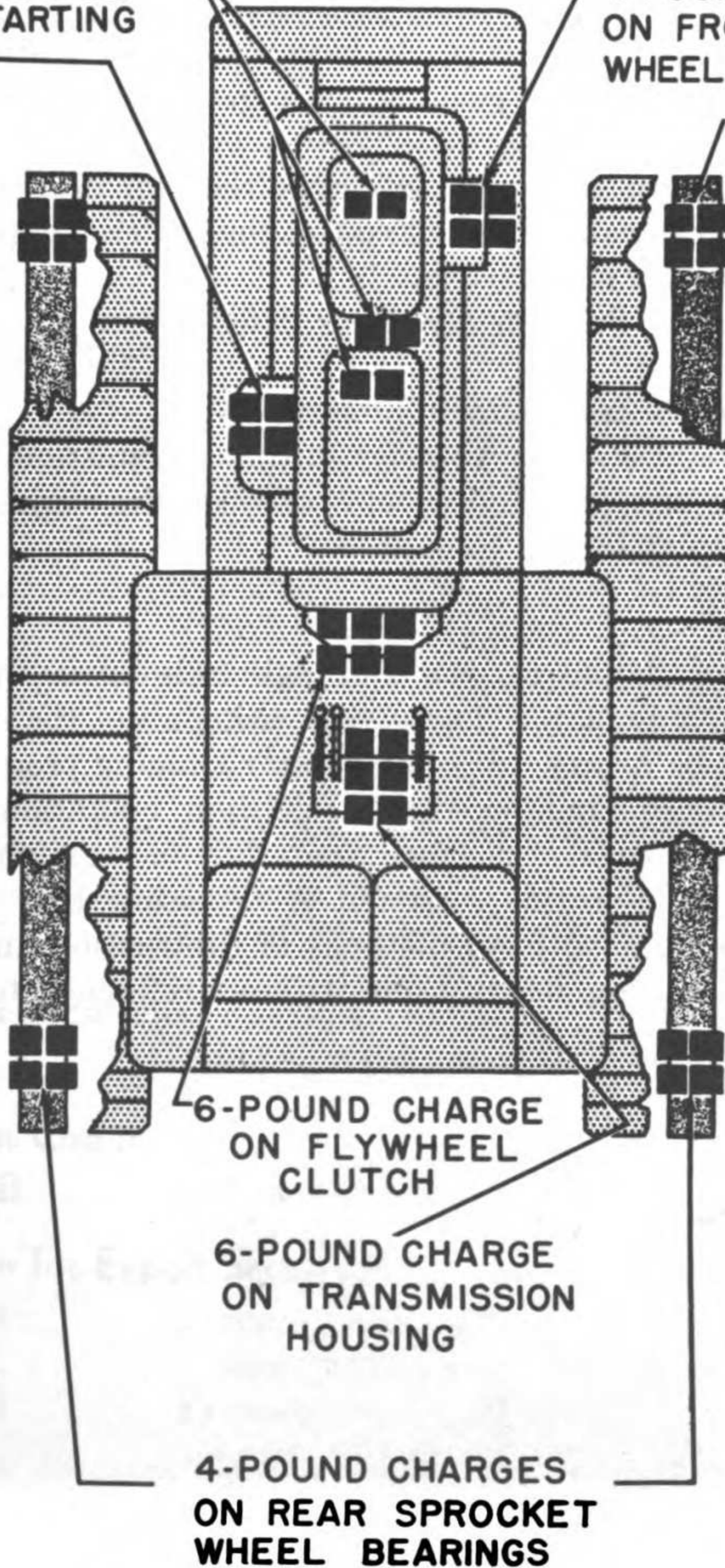
- (3) The control levers and transmission housing.
- (4) The final drive gear housings.
- (5) The radiator.

**2-POUND CHARGES
ON ENGINE HEAD**

**4-POUND CHARGE ON
FUEL INJECTION PUMP**

**4-POUND CHARGE
BEHIND STARTING
ENGINE**

**4-POUND CHARGE
ON FRONT IDLER
WHEEL BEARING**



**6-POUND CHARGE
ON FLYWHEEL
CLUTCH**

**6-POUND CHARGE
ON TRANSMISSION
HOUSING**

**4-POUND CHARGES
ON REAR SPROCKET
WHEEL BEARINGS**

Figure 107. Placement of charges.

110. Other Demolition Methods

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

a. By Weapons Fire. Fire on the tractor with the heaviest weapons available.

b. By Scattering and Concealment. Remove all easily accessible vital parts, such as the fuel injection pump and valves, control levers, tracks, and rollers, and scatter them through dense foliage, bury them in dirt or sand, or throw them in a lake, stream, well, or other body of water.

c. By Burning. Pack rags, clothing, or canvas under and around the unit. Saturate this packing with gasoline, oil, or diesel fuel, and ignite.

d. By Submersion. Totally submerge the unit in body of water to provide some water damage and concealment. Salt water will do the greatest damage to metal parts.

e. By Misuse. Perform the steps listed below to make the unit inoperative.

- (1) Drain the transmission housing.
- (2) Put sand or other abrasive in the transmission.
- (3) Drain lubricant and coolant and run the engine at full speed until engine fails to operate.

111. Training

All operators should receive thorough training in the destruction of the tractor. Simulated destruction, using all of the methods listed above, should be included in the operator training program. It must be emphasized in training that demolition operations are usually necessitated by critical situations, when the time available for destruction is limited. For this reason it is necessary that operators are thoroughly familiar with all methods of destruction and are able to carry out demolition instructions without reference to this or any other manual.

APPENDIX I

REFERENCES

1. Publications Indexes

Special Regulations in the 310-20 series and SR 110-1-1 should be consulted frequently for the latest changes or revisions of references given in this appendix and for new publications relating to material covered in this manual.

2. Auxiliary Equipment

- TM 5-1220..... Angledozer, Factor Mounting, Cable Operated, Le Tourneau, Model CK8.
- TM 5-9302..... Winch, Tractor Mounting, Single Drum, Reversible, Hoister, Model D-8 N.
- TM 5-9370..... Model FD8, Front Power Control Unit.
- TM 5-9957..... Power Control Unit, Cable Operating, Caterpillar Models 21, 24 and 25.
- TM 5-9958..... Power Control Unit, Hydraulic Operating, Caterpillar Model 46.

3. Dictionaries of Terms and Abbreviations

- SR 320-5-1..... Dictionary of U. S. Army Terms.
- SR 320-50-1..... List of Authorized Abbreviations.

4. General Publications

- TM 9-2851..... Painting Instructions for Field Use.

5. Lubrication Order

- LO 5-3040-B..... Lubrication Order.

6. Preparation for Export Shipment

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

7. Training Aids

- FM 21-8..... Military Training Aids.

APPENDIX II—INITIAL ISSUE ITEMS

| Federal supply class and item identification No. | Engineer stock No. | | Description | Allowances per item | Reference symbol | Source of supply |
|--|--------------------|-------------------|---|---------------------|------------------|--|
| | Code No. | Part No. | | | | |
| 191-0518 | GE | 78-8117. 000. 470 | COMPONENT ASSEMBLIES AND ACCESSORIES | | | |
| | | | TRACTOR: crawler-type; diesel driven; 24,100 to 32,000 pounds drawbar pull; ES 44-159; Caterpillar D8. (The following Initial Issue Items are applicable to all Sections.) | | NX | |
| | | | TOOL AND PUBLICATIONS SET | 1 | NX | |
| | | | BAR, jimmy: combination aligning and prying; 24 in. | 1 | NX | |
| | | | BAR, socket wrench, extension, drive, inches $\frac{3}{4}$, approx length inches 16, FS GGG-W-641. | 1 | --- | |
| | | | BRUSH, sash tool: FS H-B-491; oval; No. 5; $1\frac{1}{16}$ x $1\frac{1}{16}$ in. | 1 | NX | |
| | | | DEPARTMENT OF THE ARMY SUPPLY MANUAL ENG 7 & 8-3040. | 1 | (*) | Requisition additional copies as required from The Adjutant General (SR 310-90-1). |
| | | | GAGE, thick: US; 6 leaves; $3\frac{1}{2}$ in. long; 0.005, 0.006, 0.007, 0.008, 0.009, 0.010. | 1 | NX | |
| | | | GUN, lubricating: pressure-type; hand operated; Alemite No. 7584; 9 oz. | 1 | NX | |
| | | | GUN, lubricating: pump-type; hand operated; Alemite No. 6522; 35 lb; w/hose, No. 6542. | 1 | NX | |
| 239-0959 | GE | 41-3937. 060. 350 | | | | |
| | | | 41-4141. 009. 760 | | | |
| | | | 41-4142. 800. 200 | | | |

| | | | | | | |
|----------|----|-------------------|---|---|-------|--|
| | GE | 41-4144. 512. 200 | GUN, lubricating: suction-type; hand operated; No. 200058; Graco 12 oz; w/nozzle, No. 150161. | 1 | NX | |
| 187-1028 | GE | 41-4277. 200. 200 | HAMMER, machinist's: FS GGG-H-86; ball peen; class I; Type L; handled; 2 lb. | 1 | NX | |
| | GE | 41-4569. 070. 180 | HANDLE, socket wrench, sliding T, square drive, inches $\frac{3}{4}$ approx length inches 18, FS GGG-W-641. | 1 | ----- | |
| | | | LUBRICATION ORDER 5-3040 (28 June 1950). | 1 | (*) | Requisition additional copies as required from The Adjutant General (SR 310-90-1). |
| | GE | 99-1999. 000. 010 | MODIFICATION KIT, MWO ENG 1999-1, for Lubrication Order holder. | 1 | NX | |
| | GE | 13-5496. 005. 090 | OILER: steel; round; force feed; 1 pt cap; FS RR-O-376; Type II; 9 in. flexible spout. | 1 | NX | |
| | GE | 41-5976. 300. 060 | PLIERS, combination: slip joint; FS GGG-P-471; Type F; 6 in. | 1 | NX | |
| 189-2295 | GE | 41-7165. 080. 045 | SCREWDRIVER, common: plastic handle; 8 in. long x $\frac{7}{16}$ in. wide blade. | 1 | NX | |
| | | | TECHNICAL BULLETIN 5-3068-1 (30 April 1948). | 1 | (*) | Requisition additional copies as required from The Adjutant General (SR 310-90-1). |
| | | | TECHNICAL MANUAL 5-3040 | 2 | (*) | Requisition additional copies as required from The Adjutant General (SR 310-90-1). |
| | | | TECHNICAL MANUAL 5-3040A | 2 | (*) | Requisition additional copies as required from The Adjutant General (SR 310-90-1). |

| Federal supply class and item identification No. | Engineer stock No. | | Description | Allowances per item | Reference symbol | Source of supply |
|--|--------------------|-------------------|--|---------------------|------------------|------------------|
| | Code No. | Part No. | | | | |
| | | | TOOL AND PUBLICATIONS SET—Con. | | | |
| | GE | 41-9641. 875. 072 | WRENCH, drain plug: T-head; for sq countersunk plugs; $\frac{3}{4}$ x $\frac{13}{16}$ in.; Caterpillar Tractor Co. No. 1B5171 or equal. | 1 | NX | |
| | GE | 41-9652. 500. 150 | WRENCH, engineer's: FS GGG-W-636; 15-deg; double hd; Type IV; open end; spear hd; style 2; single; $\frac{5}{16}$ x $\frac{5}{8}$ in. nominal opening; $\frac{3}{8}$ in. approx length. | 1 | NX | |
| | GE | 41-9652. 500. 178 | WRENCH, engineer's: FS GGG-W-636; 15-deg; double hd; Type IV; open end; spear hd; style 2; single; $\frac{7}{16}$ x $\frac{1}{2}$ in. nominal opening; $\frac{5}{8}$ in. approx length. | 1 | NX | |
| | GE | 41-9652. 500. 221 | WRENCH, engineer's: FS GGG-W-636; 15-deg; double hd; Type IV; open end; spear hd; style 2; single; $\frac{9}{16}$ x $\frac{5}{8}$ in. nominal opening; $\frac{6}{8}$ in. approx length. | 1 | NX | |
| | GE | 41-9652. 500. 259 | WRENCH, engineer's: FS GGG-W-636; 15-deg; double hd; Type IV; open end; spear hd; style 2; single; $\frac{13}{16}$ x $\frac{7}{8}$ in. nominal opening; $\frac{9}{8}$ in. approx length. | 1 | NX | |
| | GE | 41-9652. 500. 310 | WRENCH, engineer's: FS GGG-W-636; 15-deg; double hd; Type IV; open end; spear hd; style 2; single; $\frac{15}{16}$ x 1 in. nominal opening; $1\frac{0}{8}$ in. approx length. | 1 | NX | |
| | GE | 41-9652. 500. 350 | WRENCH, engineer's: FS GGG-W-636; 15-deg; double hd; Type IV; open end; spear hd; style 2; single; $1\frac{1}{16}$ x $1\frac{1}{8}$ in. nominal opening; 12 in. long approx length. | 1 | NX | |

| | | | | |
|----|-------------------|---|---|-----|
| GE | 41-9652. 500. 398 | WRENCH, engineer's: FS GGG-W-636; 15-deg; double hd; Type IV; open end; spear hd; style 2; single; $1\frac{1}{4}$ x $1\frac{1}{16}$ in. nominal opening, 14 in. approx length. | 1 | NX |
| GE | 41-9652. 400. 750 | WRENCH, engineer's: 15-deg; double hd; open end; regular hd; heavy-duty; single; FS GGG-W-636; Type IV; style 1; class A; $1\frac{1}{16}$ x $\frac{3}{4}$ in. nominal opening; $8\frac{1}{16}$ in. approx length. | 1 | NX |
| GE | 41-9784. 140. 265 | WRENCH, special, caterpillar No. 4A62, fuel pump drive, 12 point opening, regular length $1\frac{1}{16}$ in. FS GGG-W-641. | 1 | --- |
| GE | 41-9771. 200. 055 | WRENCH, socket: T-handle type; w/pin handle; 6 point; single; $\frac{1}{16}$ in. nominal opening; $5\frac{3}{4}$ in. approx length. | 1 | NX |
| GE | 41-9783. 085. 095 | WRENCH, spark plug: pressed steel type; w/bar handle; double end; $2\frac{9}{32}$ x $3\frac{1}{32}$ in. opening. | 1 | NX |
| GE | 41-9783. 095. 115 | WRENCH, spark plug: pressed steel type; w/bar handle; double end; $3\frac{1}{32}$ x $1\frac{1}{32}$ in. opening. | 1 | NX |
| GE | 41-9892. 077. 300 | WRENCH, Socket, socket only, $\frac{3}{4}$ in. square vent screw. | 1 | --- |
| GE | 41-9784. 060. 050 | WRENCH, special: front idler adjusting nut; for Caterpillar D8; Caterpillar Part No. 1B7412. | 1 | NX |
| GE | 41-9834. 090. 090 | WRENCH, tappet check: one end straight; other end angle; double hd; open end; single; $\frac{1}{16}$ in. nominal opening; $\frac{1}{16}$ in. nominal angle end; 8 in. long. | 1 | NX |

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[AG 451.3 (16 Nov 53)]

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