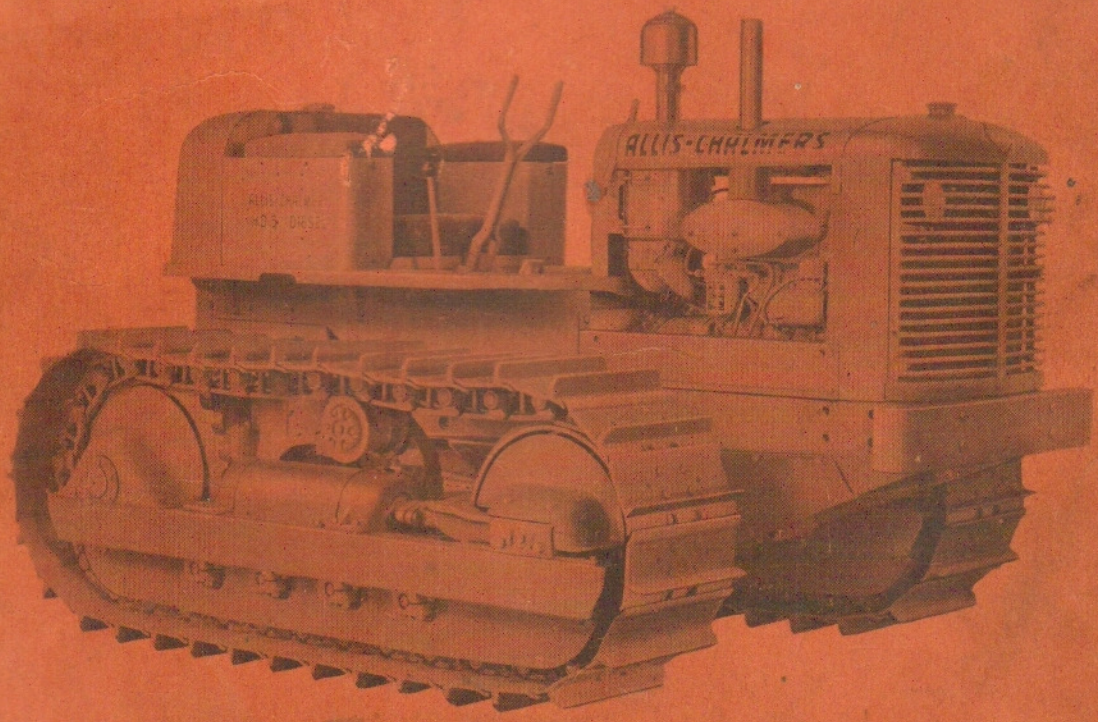
OPERATORS MANUAL
FOR
MODEL
HD 5 TRACTOR



THIS MANUAL SHOULD BE KEPT WITH THE TRACTOR

ALLIS-CHALMERS MFG. CO.
TRACTOR DIVISION
MILWAUKEE, WISCONSIN, U. S. A.

LITHO. IN U. S. A.

FORM T-225C

HD5

S/N TS 5562

FOREWORD

This book is written for the purpose of giving the operator essential information regarding the day-to-day care, lubrication, and adjustment of the tractor. Economical operation will be assured if these instructions are followed.

The instructions given in this book cover the operation of the "Allis-Chalmers" HD5 Tractor. A close adherence to these instructions will result in many hours of trouble-free operation and a longer operating life for the unit.

Many owners of "Allis-Chalmers" equipment employ the Dealer's Service Department for all work other than routine care and adjustments. This practice is encouraged as our dealers are dept well informed by the factory regarding advanced methods of servicing "Allis-Chalmers" products and are equipped to render satisfactory service.

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GENERAL INFORMATION

The Model HD5 Tractor is a track-type tractor powered with a 2 cylinder, 2 cycle diesel engine. Power from the engine is transmitted through a single plate, over-center type clutch, and a universal joint drive shaft assembly to the transmission. The final drive gears and track drive sprockets are driven by two multiple-disc steering clutches, one on each end of the bevel gear cross shaft.

At full governed engine speed (under load) of 1800 R.P.M., the transmission provides 5 forward speeds, ranging from 1.46 M.P.H. to 5.47 M.P.H., and a reverse speed of 1.99 M.P.H. Mechanical self-energizing brakes insure easy and positive control of the tractor at all times.

The standard tractor is equipped with electric starter and head lights, full width crankcase guard and positive seal truck wheels, track idlers, and track support rollers.

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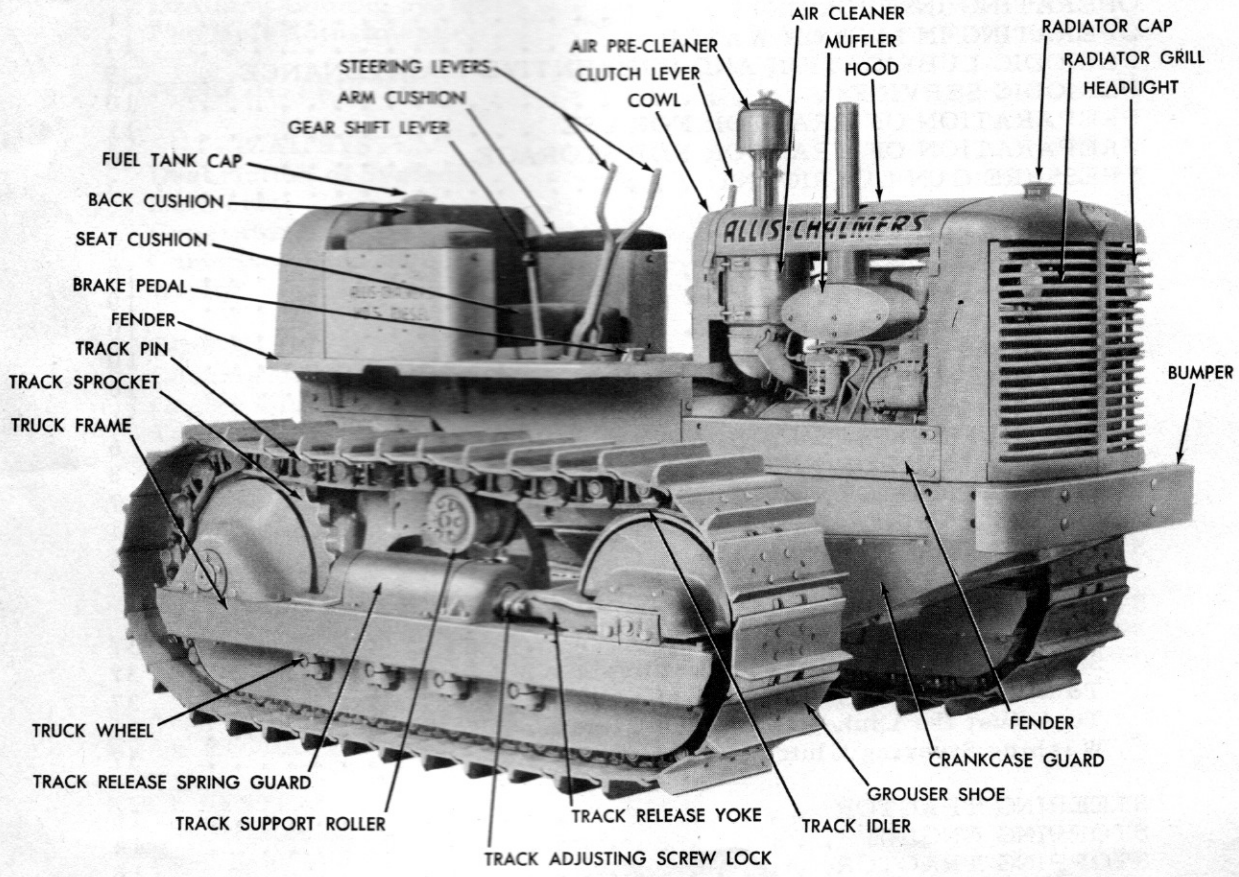


HD-5 TRACTOR
FIG. 1

GENERAL SPECIFICATIONS (STANDARD TRACTOR)

GENERAL:

Weight (44" tread)	10,500 lb.
(60" tread)	11,250 lb.
Overall Length	10 ft. 4-7/8 in.
Overall Width (44" tread)	5 ft. 2-3/4 in.
(60" tread)	6 ft. 6-3/4 in.
Overall Height (Including air pre-cleaner and exhaust pipe)	6 ft. 1-1/8 in.
(Air pre-cleaner and exhaust pipe removed)	5 ft. 3/8 in.
Tread Width - center-to-center of tracks	
Narrow tread	44 in.
Wide tread	60 in.
Turning Radius	
(44" tread)	5 ft. 10-3/4 in.
(60" tread)	6 ft. 10-7/8 in.
Length of Track on ground	5 ft. 4-1/4 in.
Track Shoe Width (Standard)	13 in.
Ground Contact Area	1670-1/2 sq. in.
Ground Pressure	
(44" tread)	6.28 lbs. sq. in.
(60" tread)	6.73 lbs. sq. in.
Ground Clearance	11-1/4 in.
Drawbar Height	13-15/16 in.
Lateral Movement of Drawbar	21 in.

MAXIMUM SPEEDS:

1st Gear	1.46 M.P.H.
2nd Gear	2.44 M.P.H.
3rd Gear	3.30 M.P.H.
4th Gear	3.96 M.P.H.
5 th Gear	5.47 M.P.H.
Reverse	1.99 M.P.H.

ENGINE:

Make	General Motors
Type	2-Cycle Diesel
Number of Cylinders	2
Bore and Stroke	4-1/4 x 5 in.
Piston Displacement	142 cu. in.
Full Governed Speed (Under Load)	1800 R.P.M.
Maximum Net Torque	164.8 ft. lb. @1000 R.P.M.
Fuel Used	Nos. 1 & 2 Diesel
Fuel Injection System	Unit Injectors
Lubrication	Forced Feed

CAPACITIES:

(U.S. Standard Measure)

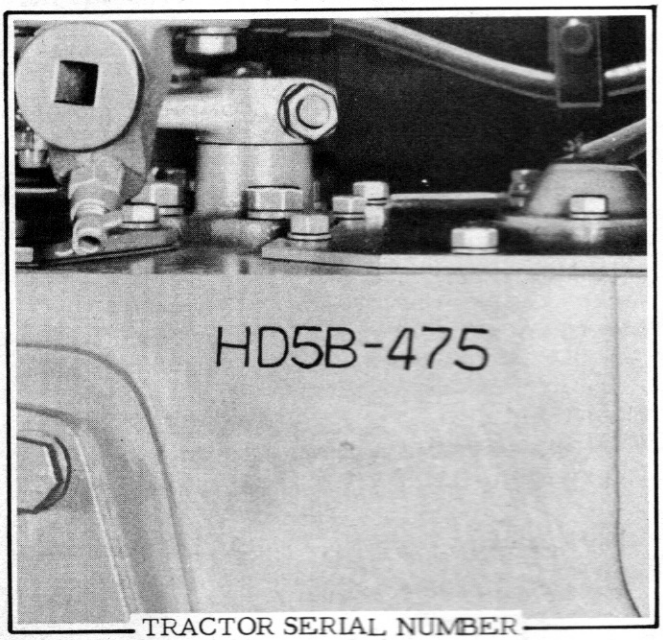
	APPROX. CAP.
Fuel Tank	37 gal.
Cooling System	3-3/4 gal.
Engine Crankcase	2 gal.
Transmission	5 gal.
Final Drives (each)	3 gal.
Air Cleaner	2-1/4 qts.

The Allis-Chalmers Manufacturing Company reserves the right to make changes in the above specifications or to add improvements at any time without notice or obligation.

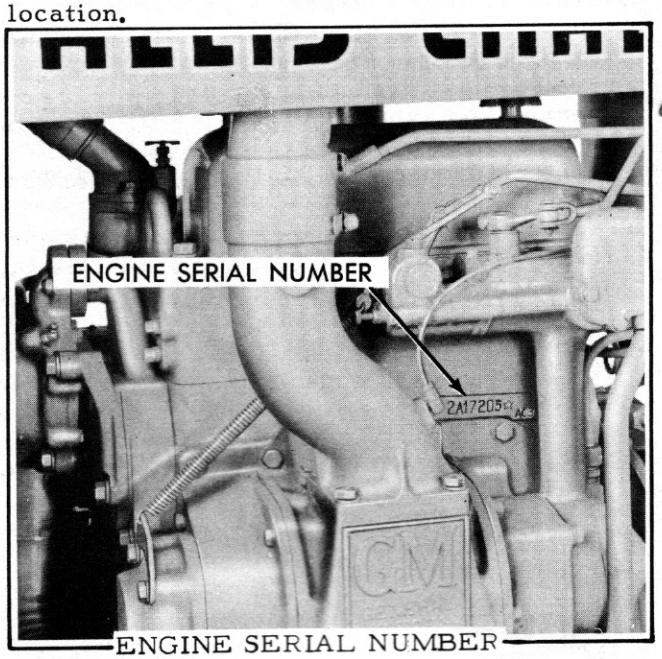
TRACTOR AND ENGINE SERIAL NUMBERS

On all parts orders and in all correspondence relative to the tractor, it is necessary that both the tractor and the engine serial numbers be given. This will properly identify the particular machine and will insure obtaining the correct replacement parts for it.

The tractor serial number is stamped in the rear face of the steering clutch housing near the upper right corner and on a plate attached to the cowl. The engine serial number may be stamped on a plate attached to the left side of the cylinder block below the governor control housing or it may be stamped in the cylinder block at the same relative location.



TRACTOR SERIAL NUMBER
FIG. 2



ENGINE SERIAL NUMBER
FIG. 3

SPECIFICATIONS OF LUBRICANTS

A. ENGINE CRANKCASE LUBRICANT:

USE NON-CORROSIVE DIESEL ENGINE LUBRICATING OIL CONTAINING ADDITIVES WHICH WILL PREVENT SLUDGE OR GUM DEPOSITS. UNDER NO CIRCUMSTANCES SHOULD A CORROSIVE DIESEL ENGINE LUBRICATING OIL EVER BE USED.

Use oil with the following viscosity:

Atmospheric Temperature	Viscosity
Above 32°F.	Use SAE 30
0°F. to 32°F.	Use SAE 20W
0°F. and below	Use SAE 10W

Manufacturers of lubricants recognize the importance of the qualities required for use in our equipment and they are cooperating fully to insure the use of only those oils which fulfill these requirements. The oil distributor and oil manufacturer are to be held responsible for the results obtained from their products.

The outstanding lubricating requirements for efficient operation of the engine are: The maintaining of piston rings in a clean, free condition; absence of hard carbon and "varnish" deposits on or within engine parts; the prevention of bearing corrosion and the promotion of general cleanliness within the engine.

Proper operation and maintenance of the engine is necessary to obtain the desired results from the lubricating oil. Operating and maintenance factors can be effectively controlled by the engine user.

B. TRANSMISSION AND FINAL DRIVE LUBRICANT:

Lubricate these assemblies with a good grade of motor oil purchased from a reputable oil company.

Use oil with the following viscosity:

Atmospheric Temperature	Viscosity
Above 32°F.	Use SAE 50
32°F. and below	Use SAE 30

C. TRUCK WHEEL, TRACK IDLER, AND TRACK SUPPORT ROLLER LUBRICANT:

Lubricate these assemblies with a grease that has been tested and approved by the Allis-Chalmers Manufacturing Company.

The type of grease used for lubricating these assemblies was selected because of its good pumpability and cold temperature characteristics and because of its having a minimum effect on the synthetic rubber seal boots. It is also an extremely stable grease and will not deteriorate excessively with long use.

A revised list of tested greases is issued every six months and new greases which have been tested and approved during each period are added to the list. Ask your nearest "Allis-Chalmers" authorized dealer for the latest list.

D. PRESSURE GUN LUBRICANT:

Use a ball and roller bearing lubricant with a minimum melting point of 300°F. This lubricant should be in a viscosity range so as to insure easy handling in the pressure gun at prevailing air temperatures. The ball and roller bearing lubricant must be water proof.

SPECIFICATIONS OF FUEL OIL

Use No. 1 Diesel Fuel Oil purchased from a reputable oil company. In warm weather, No. 2 Diesel Fuel Oil may be used. This fuel must be within the classification limits as established by the American Society for Testing Material-Tentative Diesel Fuel Oil Specifications (ASTM-D 975).

For longer engine life and better performance, fuel oil requirements must comply with four basic qualifications:

1. Physical cleanliness.
2. Absence of chemical contamination.
3. Proper burning characteristics.
4. Cold starting ability.

Physical cleanliness means freedom from water, dirt, and other incombustible ingredients. Since all present day high-speed engine fuels are completely distilled, they leave the refinery in clean condition. Transport and subsequent storage account for the addition of most foreign matter found in the fuel.

Of the chemical contamination, the most objectionable are free sulphur and gum, which, even in relatively small quantities are largely responsible for harmful internal engine deposits. The fuel must also be free from alkali and mineral acids.

Proper burning characteristics are dependent upon ignition quality and volatility.

All fuels meeting the requirements of the No. 1-D and the lighter types of fuel in the No. 2-D grade of the ASTM D-975 Diesel Fuel Oil Specifications are satisfactory. The volatile grade (ASTM No. 1-D) is recommended for all types of service where frequent speed and load changes occur, while fuels in the heavier grade (ASTM No. 2-D) may be used with sustained high loads. However, prolonged use of fuel oils combining low ignition quality (less than 45 Cetane Number) with high boiling temperatures (more than 675° F. end point) should be avoided, particularly in cold weather.

CAUTION: The sulphur content of Diesel fuel oil should be as low as possible. For normal temperature conditions, the fuel oil should contain less than 0.5% sulphur. For cold weather operation, fuel oils with less than 0.3% sulphur are preferable.

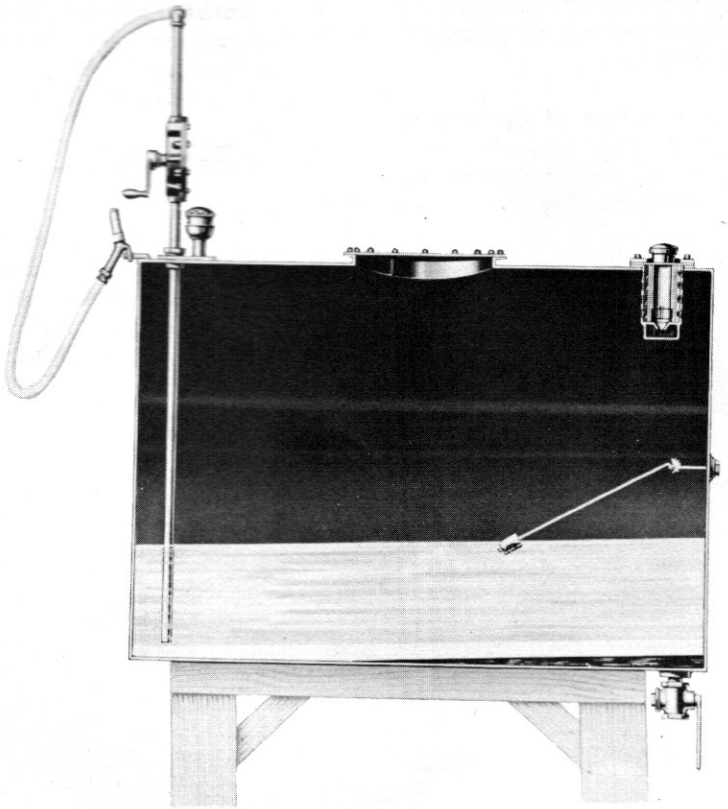


FIG. 4 FUEL STORAGE TANK

FUEL STORAGE

The importance of proper storage of fuel cannot be too strongly stressed. Storage tanks, drums, or service tanks must be free from rust, scale, sediment or any other foreign matter which will contaminate the fuel. Contaminated fuel will clog the filters and eventually damage the fuel pump and injectors.

A portable storage tank provides the best method for storing fuel on the job. In a tank, the sediment and water can easily be drained and the fuel can be pumped into the tractor fuel tank with a minimum of handling. Consult your nearest "Allis-Chalmers" Dealer for details about this type of storage tank. Since condensation will occur in the tank, it is very important that a sediment sump be provided in the bottom of the storage tank where the water and settlings can be drained daily.

Fuel should be allowed to settle at least 48 hours in the storage container before it is put in the fuel tank of the tractor. It is advisable to use a pump and draw the fuel from the tank or barrel rather than from the bottom of the container by means of a faucet or through the bung hole.

Where conditions are such that drums must be used to supply fuel, it is advisable to have enough drums to allow sufficient time for the fuel to settle. The fuel should be used only to within about three inches from the bottom of the drums. The fuel thus left in a number of drums can be collected into one drum and used after the usual time allowed for settling. In this manner, the sediment and foreign matter will be disposed of and no fuel will be wasted. Whenever drums are used for storage, they should be covered or placed under shelter so that the fuel will not become contaminated by water which will enter through the filler plugs when it rains, even though the plugs are tight.

The fuel tank of the tractor should be filled at the end of the day's run rather than in the morning. This will reduce the water content, as a full tank is less subject to condensation. The fuel tank is provided with a drain elbow and drain cock. Sediment will settle into this elbow and can be drained.

PERIODIC LUBRICATION AND PREVENTIVE MAINTENANCE

Lubrication is an essential part of preventive maintenance, controlling to a great extent the useful life of the tractor. Different lubricants are needed and some units in the tractor require more frequent lubrication than others. Therefore, it is important that the instructions regarding types of lubricants and the frequency of their application, as given on the following pages, be explicitly followed. Periodic lubrication of the moving parts reduces to a minimum the possibility of mechanical failures.

To prevent minor irregularities from developing into serious conditions that might involve shutdown and major repair, several other services are recommended for the same intervals as the periodic lubrication. The purpose of these services or inspections, which require only a few minutes, is to assure the uninterrupted operation of the tractor by revealing the need for adjustment caused by normal wear. The need for some minor adjustment, if neglected, could result in failure and shut-down.

Refer to the lubrication and service chart and supplementary illustrations for location of the various units to be serviced. Instructions on lubrication and service intervals are given on the chart.

ROUTINE SERVICE

For added convenience, listed below are the lubrication points, adjustments, service items and inspections to be made at each of the intervals (10-75-200-1000 hours) shown on the Lubrication and Service Chart. Reference figures given below are on this chart:

10-HOUR SERVICE
(Shown in RED on chart)

INSPECT:

- Crankcase Oil Level (Fig. A)
- Air Cleaner - Oil Cup (Fig. C)
- Air Pre-Cleaner (Fig. B)
- Radiator (Fig. A)

SERVICE:

- Fuel Filters
  - First Stage (Fig. E)
  - Second Stage (Fig. A)
- Fuel Tank Drain Elbow (Fig. D)

75-HOUR SERVICE
(Shown in GREEN on chart)

INSPECT:

- Final Drives (Fig. J)
- Transmission (Figs. H & I)

SERVICE:

- Engine Crankcase - Change Oil (Fig. A)
- Lubricating Oil Filter - Replace Element (Fig. E)
- Batteries - Test (Fig. G)

LUBRICATE:

- Engine Clutch (Fig. K)
- Engine Clutch Camshafts (Fig. K)

200-HOUR SERVICE
(Shown in BLUE on chart)

LUBRICATE:

- Starter (Fig. F)
- Generator (Fig. A)
- Fan (Fig. E)
- Clutch Shaft Rear Bearing (Fig. H)
- Brake Pedal Levers (Fig. H)

1000-HOUR SERVICE
(Shown in BROWN on chart)

LUBRICATE:

- Truck Wheels (Fig. L)
- Track Idlers (Fig. N)
- Track Support Rollers (Fig. M)
- Transmission (Fig. I)
- Final Drives (Fig. J)
- Drive Shaft Universal Joints (Fig. H)

PERIODIC SERVICE
(Shown in BLACK on chart)

- Fuel Filters - Replace Element
  - First Stage (Fig. E)
  - Second Stage (Fig. A)
- Engine Clutch - Adjust
- Steering Clutch Linkage - Adjust
- Brakes - Adjust
- Tracks - Adjust
- Radiator Drain Cock (Fig. 0)

PREPARATION OF TRACTOR FOR USE

Make a complete inspection of the tractor to be sure that no parts have been lost or damaged while in transit or storage.

Fill the fuel tank with the correct grade of fuel oil. Refer to "Specifications of Fuel Oil". Use care to prevent the entrance of dirt or foreign matter while filling the tank.

Check the oil levels in the engine crankcase, transmission, and final drive compartments and lubricate all points where fittings are provided for use of a pressure gun, (refer to lubrication chart). Be sure the truck wheels, track idlers, and track support rollers are completely filled with grease (refer to "Truck Wheel, Track Idler, and Track Support Roller Lubricant").

Remove the oil cup from the air cleaner to make sure the oil in the cup is at the prescribed level. Refer to "Air Cleaner". See that the air pre-cleaner is properly installed.

Fill the cooling system with clean water which is free from lime or alkali.
IMPORTANT: Open the vent valve in the top of the thermostat housing, while filling the system to allow air trapped in the cylinder block to escape. Close the valve after the system has been filled. Turn the valve out to open it; turn it in to close it.

Operate the tractor with a light load for the first 60 hours. The most efficient engine operation is obtained with temperature held within a range of 160° to 185° F. Operating the engine with temperature below this range will result in incomplete combustion of fuel and higher fuel consumption with less power, and will cause harmful gummy deposits within the engine. Maintaining the correct engine temperature depends mostly on proper functioning of the thermostat. If the engine temperature remains consistently below normal, the thermostat should be removed and inspected. If the thermostat is corroded and stuck or if the bellows of the unit leaks, install a new unit.

When operating in cold weather, provide a cover for the radiator and for the sides of the engine compartment if the thermostat proves inadequate to maintain the normal operating temperature of 160° to 185°F.

Inspect the entire tractor after the first 10 hours of operation. Tighten all loose bolts and check the adjustment of the engine clutch, steering clutch linkage, brakes, and tracks. Tighten all the track shoe bolts, by tightening these bolts at this time and again at the end of 60 hours, the possibility of their becoming loose and enlarging the bolt holes will be minimized. Check the engine for proper adjustment of valves, for timing and equalizing of injectors, and make any other adjustments that may be necessary as explained in pertinent sections of this book.

OPERATING CONTROLS AND INSTRUMENTS

The operator of the tractor must familiarize himself with the various controls and instruments provided for its operation. Although many of these controls are similar to those of other tractors, there are important differences, and it is not wise, regardless of previous experience, to operate the tractor before fully understanding the purpose of each control and instrument.

A. OPERATING CONTROLS

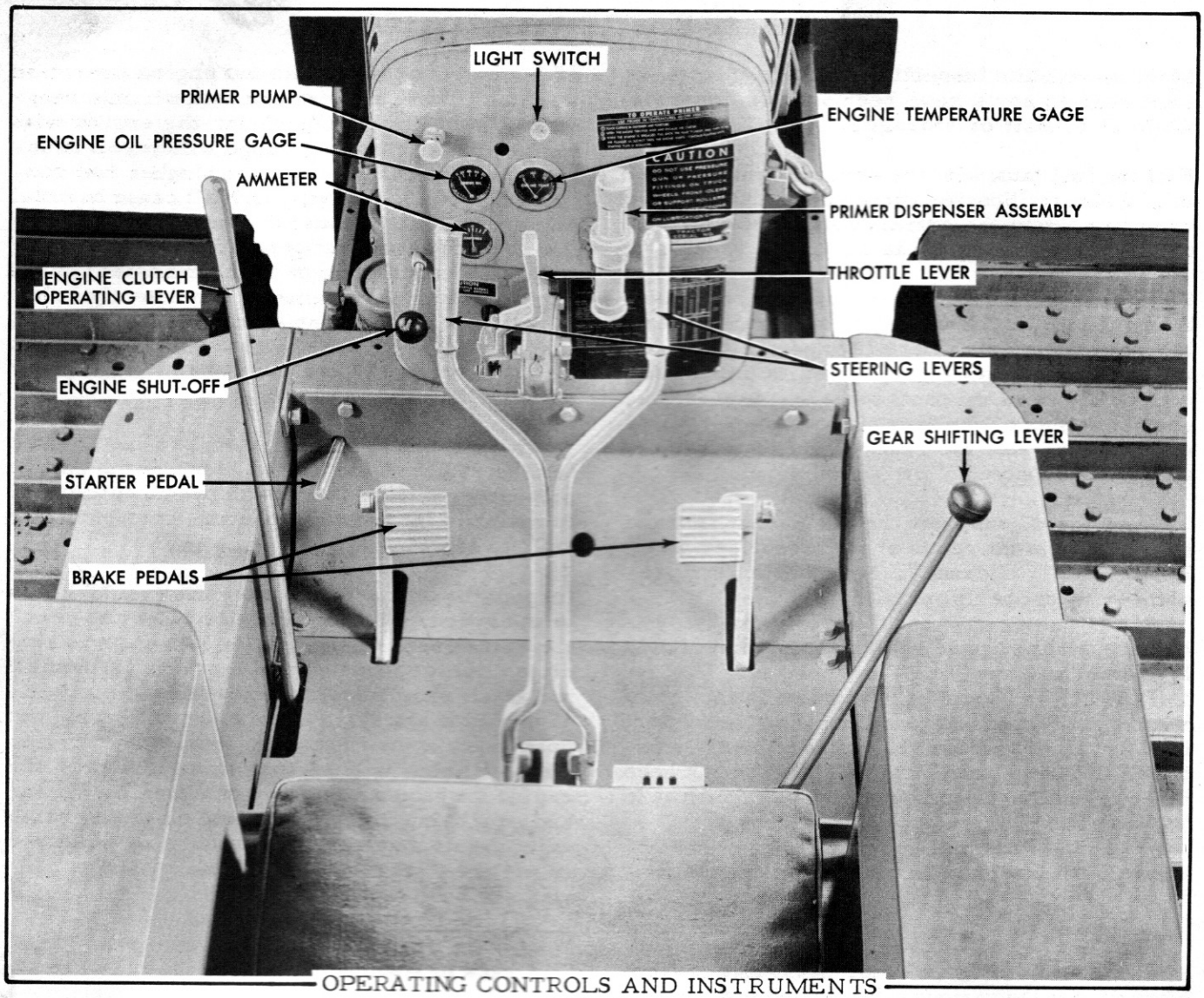
1. ENGINE SHUT-OFF

The engine shut-off controls the governor fuel shut-off lever and the air valve in the blower air inlet elbow. Push the shut-off knob all the way in against the dash when the engine is to be started; pull it all the way back to stop the engine.

2. STARTER PEDAL

Push on the starter pedal to engage the starter pinion with the flywheel ring gear and to operate the starter switch. Each time the starter pedal is depressed it must be allowed to return to its original position (all the way out) and the starter given time to cease spinning before it can again be used; otherwise, starter will run but will not turn engine.

NOTE: If the engine does not start within a half minute allow the starter to cool for two minutes before it is used again. Refer to "Starting Engine".



OPERATING CONTROLS AND INSTRUMENTS
FIG. 5

3. THROTTLE

The throttle lever is connected to the variable speed control lever on the governor. The engine will run at idling speed with the lever all the way forward. Pull the lever back to increase the engine speed.

4. ENGINE CLUTCH OPERATING LEVER

The clutch operating lever controls the engine clutch which transmits the power from the engine to the transmission. Push the lever forward to disengage the clutch; pull it back to engage the clutch.

The clutch operating lever also operates a shifting shaft locking device in the transmission. When the lever is pulled back and the clutch is engaged, the shifting shafts are locked at the same time in the position to which they have been moved by the gear shifting lever. The clutch must be disengaged before the gear shifting lever can be moved to shift the gears back into neutral or into another gear.

5. GEAR SHIFTING LEVER

The gear shifting lever is used to select the proper transmission gear ratio for the desired power or speed. The position to to which the lever must be moved for each of the 5 forward speeds and for reverse is indicated on the leverarm guide at the bottom of the lever.

6. STEERING LEVERS

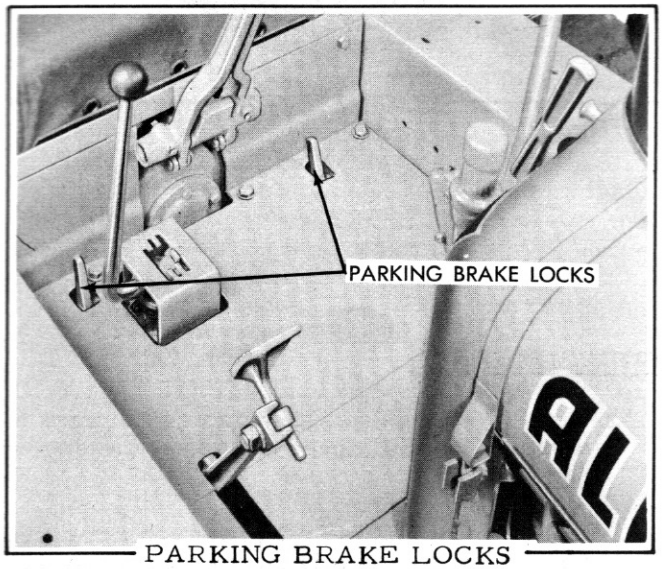
The steering levers control the two steering clutches which connect the transmission with the final drive gears and track drive sprockets. These levers are used to steer the tractor by disengaging the left or right steering clutch. Pull the right hand lever back to make a right turn; pull the left hand

lever back to make a left turn (refer to "Driving Instructions").

7. BRAKE PEDALS

The brakes are used to retard the speed, or facilitate turning the tractor. To turn the tractor to the right, press on the right brake pedal; to turn to the left, press on the left brake pedal with the corresponding steering clutch fully disengaged.

CAUTION: Never use the brakes to turn the tractor without first pulling the steering clutch lever back as far as possible on the side toward which the turn is to be made.



PARKING BRAKE LOCKS
FIG. 6

8. PARKING BRAKE LOCKS

The parking brake locks provide a means of holding the brakes in applied position. Apply the brakes and engage the locks by moving the lock levers forward. Release the locks by pressing down on the pedals and moving the lock levers back.

9. COLD WEATHER ENGINE PRIMER DISPENSER

The dispenser, located on the cowl (to the right of the instrument panel,) is used to hold and to puncture a capsule containing starting fluid used for cold weather starting.

10. COLD WEATHER ENGINE PRIMER PUMP

The primer pump, mounted in the left side of the cowl, is used to force the starting fluid through a small nozzle into the air inlet elbow of the blower. Refer to "Starting Engine" for full instructions on the use of the Cold Weather Engine Primer.

11. LIGHT SWITCH

Pull the switch out to turn on the lights.

B. OPERATING INSTRUMENTS

1. ENGINE TEMPERATURE GAGE

This gage registers the engine temperature, which should be maintained between 160° and 185° F. at all times.

2. ENGINE OIL PRESSURE GAGE

This gage indicates the pressure at which the oil is circulated through the engine. At full throttle, this pressure should be between 25 and 35 pounds at normal engine operating temperature.

CAUTION: If no pressure registers on the gage, the engine must be stopped immediately and the cause determined.

3. AMMETER

The ammeter registers the charging rate of the generator. When the batteries are in a discharged condition, the ammeter should register from 4 to 8 amperes until the batteries approach a charged condition. When the batteries are fully charged, the ammeter will register nearly zero through the action of the generator regulator except for a short time after the starter has been used.

4. INSTRUCTIONS FOR READING ENGINE HOUR METER

The hour meter is installed on tractors as special equipment.

All hands move clockwise. The small indicator (upper left) visibly turns when meter is recording.

The meter records up to 10,000 hours and repeats. The four figures of the hours of operation are read from the three hands as follows:

1 9 5 5

Use number passed on thousand hour (inner) track here.

Use number passed on hundred hour (middle) track here.

Use number passed on ten hour (outer) track here.

Use number of marks passed beyond last figure on ten hour track here.

HOUR METER
FIG. 7

STARTING AND STOPPING ENGINE

A. STARTING ENGINE

1. Before starting the engine, check the fuel supply, crankcase oil level, and the level of the water or anti-freeze solution in the cooling system. If repairs have been made since the last operating period, be sure all nuts and bolts affected by the repairs have been securely tightened and the parts have been properly adjusted.

2. Push the engine clutch operating lever forward and place the gear shifting lever in its neutral position.

3. Push the engine shut-off knob all the way in, (against stop).

4. Pull the throttle lever all the way back, (wide open).

5. Press forward on the starter pedal. If the starter spins but does not turn the engine, pull the pedal back to its original position (all the way back) and wait until the starter stops spinning before pressing on the pedal again.
   CAUTION: If the engine does not start within 30 seconds, allow the starter to cool for 2 minutes before using it again.

6. As soon as the engine begins to run, close the throttle enough to slow the engine down to about 3/4 of full speed and allow the engine to warm up.

7. Observe the engine oil pressure indicated on the gage. At full governed speed and with the engine heated to normal operating temperature (160° to 185° F.), the oil pressure should be between 25 and 35 pounds. If the oil is cold, no pressure may register for about 15 seconds after the engine starts, but if the pressure does not then rise to normal or above, the engine must be stopped immediately and the cause determined.

8. In cold weather, when it is necessary to use a starting aid in starting the engine, proceed as stated above in the first four (4) operations, then proceed as follows:

   a. Unscrew the upper chamber of the engine primer dispenser.

   b. Place a capsule of fluid, small or large, depending upon the air temperature and the requirements established by trial, in the lower chamber or body of the dispenser. In extremely low temperatures, one large and one small capsule may be necessary.

   c. Pull the plunger to the top of the upper chamber and screw chamber tightly onto body.

d. Push plunger to bottom, thus puncturing capsule and releasing fluid so it can be picked up by primer pump.

e. Push engine shut-off knob all the way in (operating position) and pull throttle wide open.

f. Depress starter pedal to crank engine, and at the same time use primer pump to pump fluid into the air system until engine starts and runs normally on regular fuel. Use capsule only of size required to start engine and after engine has started, continue pumping slowly until all fluid in the dispenser has been injected into engine.

g. While the engine is warming up, unscrew the upper chamber and remove the empty capsule. Replace the upper chamber.

CAUTION: The starting fluid contained in the capsule is essentially ethyl ether, highly inflammable and should be treated with the same caution as high octane gasoline. Gelatine capsules dissolve in water and soften at high temperatures. Therefore, the following precautions must be taken:

1. Avoid breathing large quantities of the fumes from the fluid.
2. Avoid cutting of hand by barbs on puncturing plunger.
3. Avoid proximity of fluid and capsules to open flames, sparks, or hot surfaces.
4. Avoid contact of capsules with water.
5. Avoid subjection of capsules to high temperature (above approximately 120° F.).

Obtain capsules from your nearest "Allis-Chalmers" Dealer. Capsules are packed, 12 of the 17 cc or 24 of the 7cc, in a can for safe storage and easy handling. Obtain the size and quantity most suitable for your needs according to prevailing air temperatures.

B. STOPPING ENGINE

Close the throttle and allow the engine to idle for a few minutes so that the engine temperature will level off, then pull the engine shut-off knob all the way out to stop the engine. Cover the exhaust pipe at the end of each day's operation to prevent rain from entering while the tractor is idle.

IMPORTANT: ALWAYS SLOW THE ENGINE TO IDLING SPEED BEFORE PULLING THE SHUT-OFF KNOB TO STOP THE ENGINE.

AVOID UNNECESSARY ENGINE IDLING

Prolonged engine idling causes the engine temperature to fall below the specified operating range of 160° to 185°F. Operating with the temperature below this range is detrimental to the engine, causing incomplete combustion of fuel, which in turn causes crankcase dilution and lacquer or gummy deposits to form on valves, pistons, rings, etc. It also causes rapid accumulation of sludge within the engine.

Since starting the engine is accomplished with no more effort than starting the average automobile engine, there should be no reason for prolonged engine idling. Stop the engine, as you would your automobile engine, when prolonged idling periods would otherwise occur.

DRIVING INSTRUCTIONS

A. STARTING TRACTOR

Start the engine and allow it to warm up. Then close the throttle to slow the engine down to idling speed. If the engine clutch has been engaged, disengage it and push forward on the clutch operating lever to force the clutch brake facing against the clutch brake disc on the clutch shaft and to stop the rotation of the transmission gears. Move the gear shifting lever into the required position for the desired speed or power. Open the throttle about halfway and pull back steadily on the clutch operating lever until all slack is taken up between the tractor and the load, then snap the lever back quickly to fully engage the clutch. After the clutch is engaged, open the throttle to meet the operating requirements. Engagement of the clutch with the engine running at half throttle and picking up the load in the above manner will prevent excessive slippage of the clutch, thus prolonging clutch life, and will also prevent "shock loading" the tractor.

To shift to a higher gear after the tractor is in motion, close the throttle and disengage the clutch. At the same time, shift to the higher gear, then engage the clutch again and open the throttle. The gear shift lever has six positions other than neutral, providing five forward speed ranges and one reverse. Refer to the gear shifting diagram for the position to which the lever must be moved to obtain the desired speed range.

GEAR	GEAR SHIFT LEVER
First	Left & Forward
Second	Center & Forward
Third	Right & Forward
Fourth	Center & Back
Fifth	Right & Back
Reverse	Left & Back

Satisfactory and efficient operation depends largely on the operator's judgment in selecting the proper gear ratio and speed for the various loads or operation. Always work the tractor in the gear that will permit the engine to operate at full speed. This will not only insure the most power from the engine but will also allow the engine to operate at its highest efficiency.

DO NOT SLIP THE ENGINE CLUTCH IN AN EFFORT TO PULL AN OVERLOAD; SHIFT TO A LOWER GEAR.

The engine clutch should engage with a definite over-center "snap" and should require an appreciable pull on the lever for its engagement. If this "snap" is not evident, or if the clutch slips when picking up the load, adjustment must be made immediately. Refer to "Engine Clutch Adjustment".

B. STEERING TRACTOR

Steer the tractor by disengaging the steering clutch on the side of the tractor toward which the turn is to be made. This is done by means of the steering levers located directly in front of the operator. To make a right turn, pull back the right hand steering lever; to make a left turn, pull back the left hand steering lever. With the left steering clutch disengaged, the power is removed from the left track and the track will slow down or stop. Since the power is still being delivered to the right track, it will keep turning and cause the tractor to turn to the left. Pulling back the right hand steering lever causes the tractor to turn to the right in the same manner.

If a short turn is to be made, press down the brake pedal on the side toward which the turn is to be made after the steering lever has been pulled back; this will stop and hold the track stationary.

Always pull the steering lever all the way back when turning. When the tractor has turned as desired, return the lever immediately to its forward position. Disengage and engage the steering clutches smoothly and completely to avoid excessive wear on the clutch friction discs.

When steering the tractor down steep grades with the load pushing the tractor, the use of the steering levers is opposite to that when pulling a load. In this case, the left hand steering lever is used to make a right turn and the right hand lever to make a left turn. Disengaging either clutch will allow the track on that side to travel faster since the braking power of the engine is released from it, while the clutch remaining engaged will act as a brake for the opposite track.

During operation, observe the amount of free travel of the steering levers (the distance the levers move before pressure is felt and disengagement of clutch begins.) This free travel which insures complete engagement of the steering clutches, should be from 1 to 3 inches, measured at the tops of the levers. When the free travel of either lever becomes less than 1 inch, the release linkage requires adjustment. Refer to "Steering Clutch Linkage Adjustment".

C. STOPPING TRACTOR

To stop the tractor, close the throttle and dis-

engage the engine clutch by pushing the clutch lever forward, then press down on the brake pedals to apply the brakes. If the tractor is parked on a grade where there is a possibility of its rolling, lock the brakes in applied position by moving the pedal lock levers forward while the pedals are held down, then remove the feet from the pedals. The locks are released by pressing down on the pedals and moving the lock levers back. DO NOT "RIDE" THE BRAKE PEDALS WHILE OPERATING TRACTOR.

IMPORTANT: ALWAYS SHUT-OFF THE ENGINE WHEN STOPPING even if the tractor is to remain idle only a few minutes. This will not only save fuel and unnecessary wear on the engine but will also avoid operating the engine below normal temperature. If it is necessary to keep the engine running, it should be run with the throttle opened far enough to maintain the normal engine oil and fuel pressure and with the engine clutch engaged.

While operating the tractor, observe the action of the brakes. Each pedal must have from 1-3/4 to 2 inches of free travel and the brake must engage fully before the pedal arm strikes the floor plate at the front end of the slot in which it moves. If the brakes are in proper adjustment, yet fail to hold, this condition may be due to oil on the brake linings and the brakes will require washing. Refer to "Brakes" for instructions on adjusting the brakes and to "Washing Steering Clutches" for instructions on washing the brakes and steering clutches.

OPERATING IN MUD OR WATER

The engine clutch and steering clutch compartments are dry compartments provided with drain holes to allow drainage of any oil that might leak into them. These drain holes should be left open (plugs removed) during normal operation. When operating in mud, water, or extremely dusty or sandy conditions, the plugs furnished with the tractor should be installed to prevent the entrance of dirt or water. The drain holes in the bottom of the steering clutch compartments are located a few inches to the right and left of the transmission drain plug; the engine clutch compartment drain hole is located at the bottom of the front side of the flywheel housing.

Remove the drain plugs daily to drain any water or oil that might have accumulated, thus preventing it from getting on the brake linings or clutch facings. If the tractor remains idle at night, it is good practice to remove the plugs at the end of the day and install them again before starting the tractor the next day.

Inspect the oil in the final drive housings frequently and drain, flush, and refill the housings as often as the oil shows the presence of any mud or water.

COLD WEATHER OPERATION

When atmospheric temperature drops to the freezing point or below, the engine crankcase and other oil compartments must be drained and refilled with oil of lighter viscosity (refer to "Specifications of Lubricants"). The air cleaner will also require the use of lighter oil (refer to "Air Cleaner Service"). The cooling system must be checked for leaks and filled with an anti-freeze solution to protect it from freezing (refer to "Cooling System"). All leaking hoses and gaskets should be replaced, all leaks corrected, and all connections tightened to prevent loss of the anti-freeze solution.

Test and prepare the "Cold Weather Engine Primer" for use as soon as lowering atmospheric temperature indicates aid in engine starting will be required. Provide a cover for the radiator and for the sides of the engine compartment if the thermostat proves inadequate to maintain operating temperature of 160° to 185° F. If the engine is operated below this temperature range, sludge will build up in the engine, engine efficiency will drop and conditions may develop to cause damage to engine parts.

Dependable starting of a diesel engine, by any means, can be obtained only with adequate cranking speed. For this reason, it is necessary that the batteries, starter, cables, generator and generator regulator be inspected and put in first-class condition at the onset of cold weather (refer to "Electrical System").

If the tractor is to be operated in arctic temperatures, consult your nearest authorized dealer or write the factory for information regarding the availability of special cold weather equipment.

CAUTION: If mud or snow collects on the tracks during the operating period and is allowed to freeze solid while the tractor is idle, or if the tracks freeze solidly to the ground, apply heat to loosen the frozen material or tracks. Serious damage could be caused by an attempt to break the tractor loose under engine power or by moving the tractor with large frozen lumps of material in the tracks.

A. DESCRIPTION OF SYSTEM

The cooling system includes the water pump, radiator, oil cooler, thermostat, cooling fan, and water passages in the cylinder block and head. The pump draws the water from the bottom of the radiator and circulates it through the oil cooler housing and the water passages in the engine. The water is discharged from the cylinder head and passes through the thermostat housing and upper radiator hose to the upper part of the radiator. The water is cooled as it passes from the top to bottom of the radiator by air drawn through the radiator core by the cooling fan.

B. GENERAL MAINTENANCE

Keep the cooling system filled with clean water which is free from lime or alkali. The use of water containing lime will result in lime deposits in the cylinder head and block, causing hot spots in the engine and eventually restricting the water passages. Alkali in the water will cause a corrosive action detrimental to the engine.

In winter weather use an ethylene gylcol anti-freeze solution in the system to protect it against damage from freezing. This type of anti-freeze has a much higher boiling point than water. After any addition of water or anti-freeze compound, test the solution after the added quantity has become thoroughly mixed to make sure it will withstand the prevailing or anticipated temperature. A mixture of 60% of ethylene glycol and 40% water will provide maximum protection; the use of more than 60% of ethylene glycol in the solution will raise the freezing point and provide less protection against freezing.

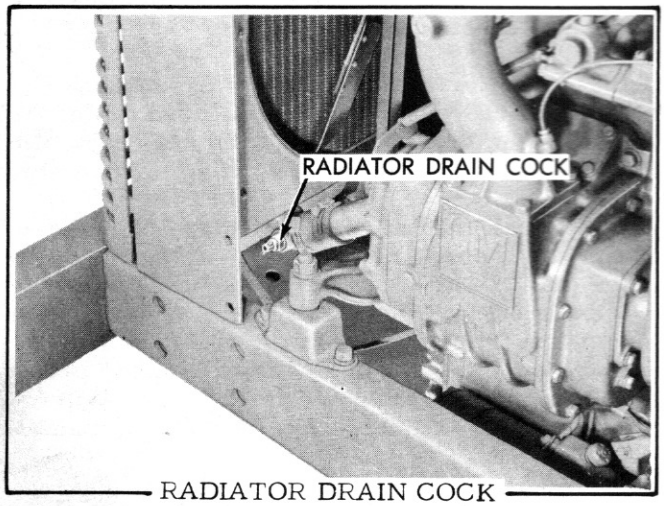
Keep the radiator air passages free from leaves, trash, and other material which will restrict the flow of air through the radiator. All leaks in the cooling system must be corrected as soon as they are evident and the fan belts must be kept in proper adjustment. The most efficient engine operation is obtained with the temperature held within a range of 160° to 185° F. Operating the engine with the temperature below this range will result in incomplete combustion of fuel, higher fuel consumption with less power, and will cause harmful deposits within the engine.

Maintaining the normal engine temperature (160° to 185° F.) depends mostly on proper functioning of the thermostat. If the engine temperature remains consistently below normal, the thermostat should be removed and inspected. If the thermostat is corroded and stuck, or if the bellows of the unit leaks, install a new unit.

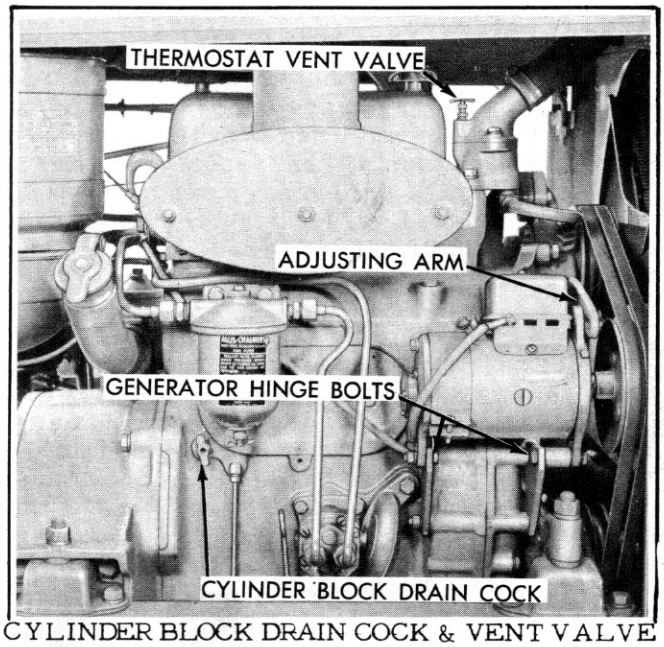
C. FILLING COOLING SYSTEM

Close the drain cocks, one in the right side of the cylinder block and the other at the bottom of the radiator, then fill the cooling system through the radiator.

IMPORTANT: The vent valve in the thermostat housing must be opened when filling the system to allow the air trapped in the engine by the closed thermostat to escape. Close the vent valve after the system is filled. If the valve is left open, it will prevent proper engine warm-up and regulation of the engine temperature by the thermostat. Since the valve opens and closes inside the thermostat housing, the only way to tell whether the valve is open or closed is to turn the handle. The valve is opened by turning the handle out and closed by turning it in.



RADIATOR DRAIN COCK
FIG. 8



CYLINDER BLOCK DRAIN COCK & VENT VALVE
FIG. 9

D. DRAINING COOLING SYSTEM

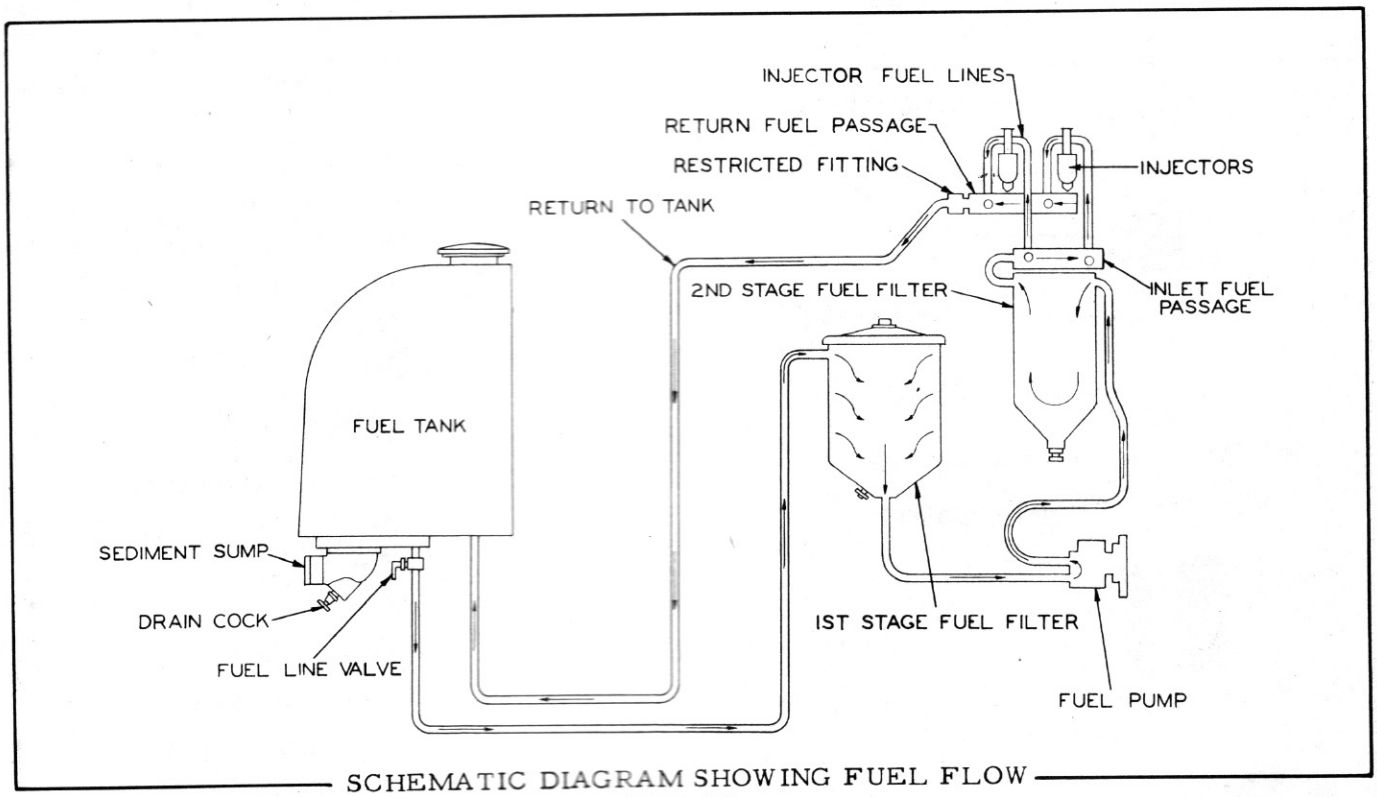
Drain the cooling system by opening the cylinder block and radiator drain cocks. Also open the vent valve in the thermostat housing to allow drainage of the water trapped above the thermostat.

E. FAN BELT ADJUSTMENT

The fan belts are correctly adjusted when the straight (left) side of the belts can be pressed inward approximately 1 inch at a point halfway between the crankshaft and fan pulleys.

To adjust the belts, loosen the cpascrew in the adjusting arm at the front of the generator (refer to Fig. 9), then move the generator in or out until the correct tension on the belts is obtained. Tighten the capscrew and the generator hinge bolts.

FUEL SYSTEM



SCHEMATIC DIAGRAM SHOWING FUEL FLOW
FIG. 10

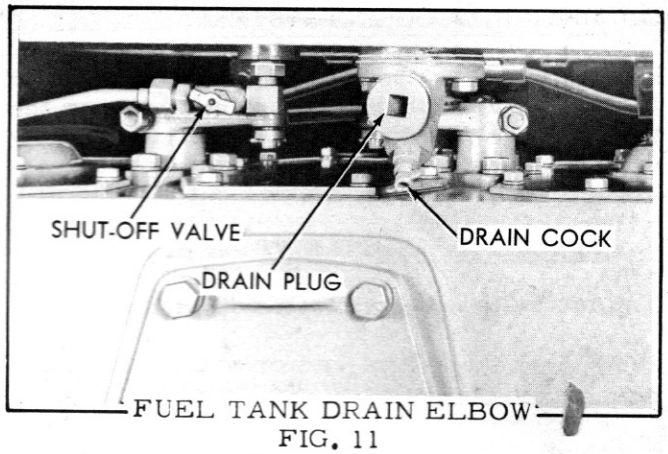
A. DESCRIPTION OF SYSTEM

The engine fuel system consists of the fuel tank, first stage fuel filter, fuel pump, second stage fuel filter, injectors, and fuel lines. The fuel is drawn from the bottom of the tank and through the first stage filter by the fuel pump. The pump then circulates the fuel under pressure through the second stage fuel filter and into the inlet fuel passage in the cylinder head and through the injectors. As the fuel enters each injector, it passes through a small porous metal filter in the injector body.

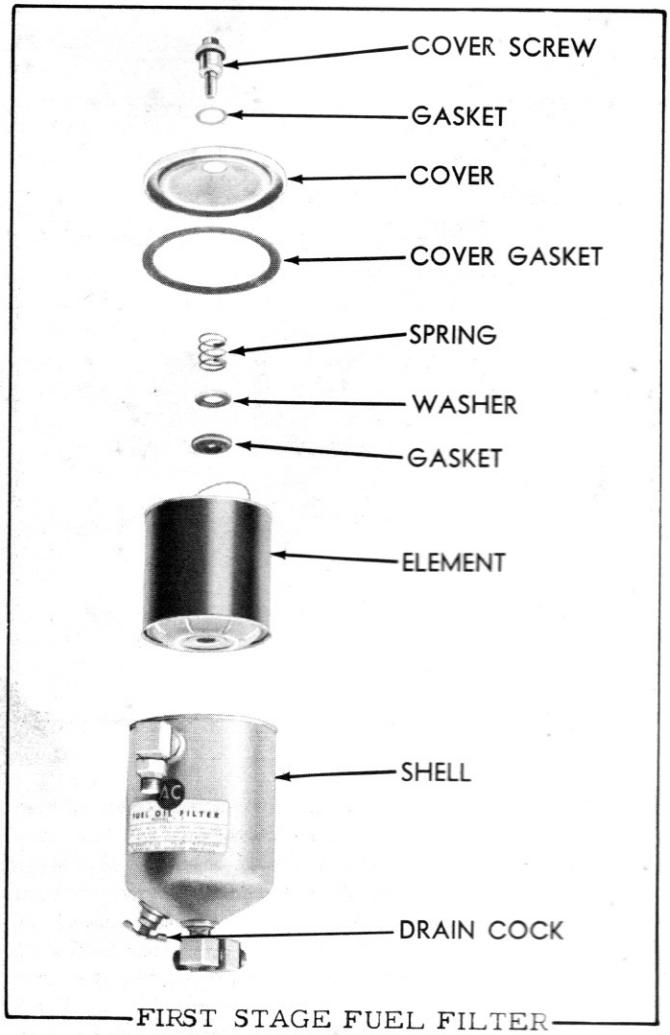
The amount of fuel required for operation of the engine is injected into the cylinders by the injectors. Surplus fuel leaving each injector through a second porous metal filter, enters the return fuel passage and returns to the fuel tank. A pressure of 25 to 45 pounds is maintained within the system by a restricted fitting in the return line. The continuous circulation of the fuel through the injectors helps to cool them and eliminates the possibility of air pockets in the fuel supply system.

B. FUEL TANK AND DRAIN ELBOW

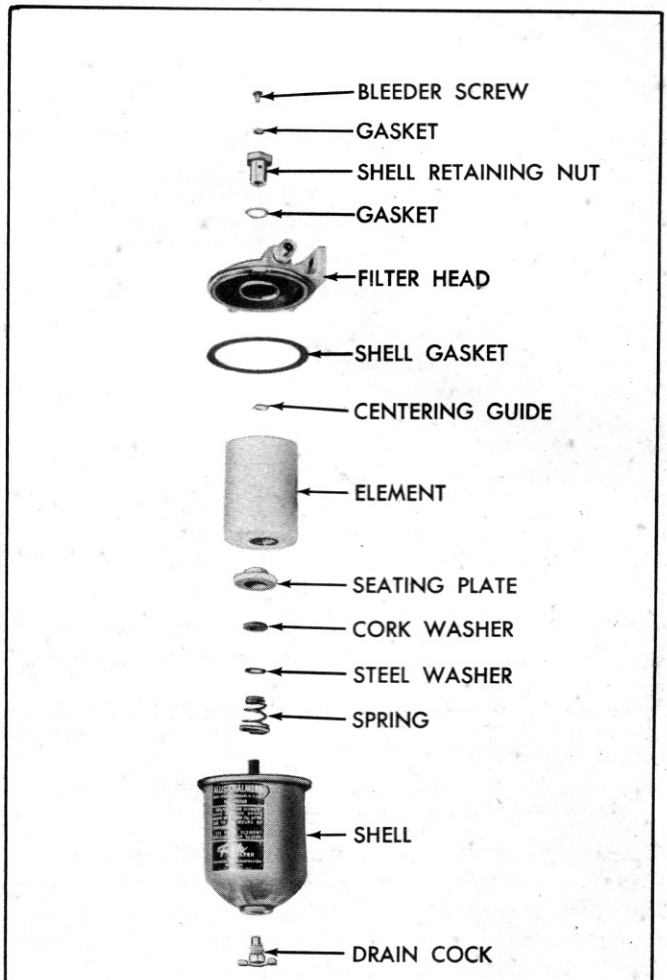
The drain elbow in the bottom of the fuel tank provides a means of flushing the tank and also acts as a sediment sump. Open the drain cock on this elbow before the engine is started at the beginning of the day's operation in warm weather or shortly after the end of the day's operation in freezing weather and allow the water or sediment to drain. Close the drain cock when clean fuel runs out. Drain the tank when an accumulation of rust and scale is evident. To drain the fuel tank, remove the plug in the end of the elbow. Flush the tank thoroughly after draining.



FUEL TANK DRAIN ELBOW
FIG. 11



FIRST STAGE FUEL FILTER
FIG. 12



SECOND STAGE FUEL FILTER
FIG. 13

C. FIRST STAGE FUEL FILTER

DESCRIPTION

This filter, mounted at the left side of the engine, contains a replaceable element. Dirt and sediment in the fuel is collected by this filter and prevented from passing on to the fuel pump. A drain cock in the bottom of the filter shell allows drainage of the sediment collected.

SERVICE

Open the filter drain cock, before the engine is started at the beginning of the day's operation in warm weather or shortly after the end of the day's operation in freezing weather, and allow the water or sediment to drain. Close the drain cock when clean fuel runs out. Remove and discard the old element and install a new one after every 300 to 500 hours of operation (more often if

conditions warrant), or when the filter becomes clogged. A clogged filter is usually indicated by irregular engine performance.

To change the element, close the fuel tank shut-off valve, remove the filter cover, drain the filter, lift out the spring and element, and wash the inside of the filter shell. Place a new element, cork gasket, and steel washer in position and re-install the cover, using the new cover gasket furnished with the new element. Start the engine and check to be sure that the filter does not leak.

D. SECOND STAGE FUEL FILTER

DESCRIPTION

This filter, mounted on the right side of the engine, contains a replaceable element. Any small particles of dirt, which may have passed through the first stage filter, are caught by this filter and prevented from reaching the injectors. A drain cock in the bottom of the filter shell, allows for drainage of the sediment collected.

SERVICE

Open the filter drain cock, before the engine is started at the beginning of the day's operation in warm weather or shortly after the end of the day's operation in freezing weather, and allow the water or sediment to drain. Close the drain cock when clean fuel runs out. Remove and discard the old element and install a new one after every 300 to 500 hours of operation (more often if conditions warrant), or when the filter becomes clogged. A clogged filter is usually indicated by irregular engine performance.

To change the element, drain the filter and remove the shell from the filter head. Remove and discard the old element, small steel washer, cork washer, and shell gasket. Wash the shell thoroughly. Install a new element kit.
NOTE: The spring is installed below the element. Re-install the shell, using the new shell gasket, steel washer, cork washer, and element furnished with the kit. Start the engine and check to be sure that the filter does not leak.

E. HEAVY DUTY FILTER

On tractors equipped with Heavy Duty Filters, service as follows:

Remove the drain plug in the bottom of the filter housing, before the engine is started at the beginning of the day's operation in warm weather or shortly after the end of the day's operation in freezing weather, and allow the water or sediment to drain. Replace the drain plug when clean fuel runs out. Remove and discard the old element and install a new one after every 300 to 500 hours of operation or when the fuel pressure drops below 20 to 25 pounds per square inch.

F. TO CHANGE THE HEAVY DUTY FUEL FILTER ELEMENT.

1. Close the fuel shut-off valve at bottom of fuel tank.

2. Remove drain plug from bottom of filter housing and allow fuel to drain from filter. Then, remove lid capscrews and and lift lid from housing.

3. Unscrew T-handle hold-down assembly from center tube and remove element from filter housing by lifting with pull-out bail.

4. Clean the filter housing thoroughly and replace drain plug.

5. Install a new "Dieselpak" element and top gasket in the filter housing. To assure leak-proof sealing, examine the seats on each end of the filter element to see that they are in good condition and clean.

6. Replace the T-handle hold-down assembly and tighten firmly. Fill the filter housing with clean fuel oil.

7. Replace the lid on the filter housing and tighten the lid capscrews evenly and securely.

8. Fill the fuel tank so that there will be sufficient fuel in the tank to fill the filter by gravity, then open the fuel shut-off valve at the fuel tank and remove the vent plug from the top of the filter housing. Allow the filter to fill by gravity. Install the vent plug when fuel emerges from the vent plug opening.

9. Start the engine and check for leaks at the filter lid, vent plug, and drain plug.

CAUTION: Use only "Dieselpak" element in the Heavy Duty Filter.

G. CHECKING FUEL SUPPLY SYSTEM

Uneven running of the engine, excessive vibration, stalling when idling, and loss of power are indications of an insufficient supply of fuel to the injectors. To determine the cause for any of the above conditions, check for the following:

(1) Air being drawn into the system on the suction side of the pump.

(2) Clogged fuel filter elements.

(3) Partially clogged fuel lines.

(4) Clogged injector fuel filters.

(5) Inoperative fuel pump.

To check the flow of fuel through the system, disconnect the fuel return line at any point between the fuel return passage in the cylinder head and the fuel tank. With the engine operating at full throttle, (engine clutch engaged), the system will be functioning properly when a full stream of fuel with considerable force can be observed returning to the fuel tank through the fuel return line. If only a small stream is observed returning to the tank, all the causes listed above must be checked and eliminated in turn.

1. CHECK FOR CLOGGED FUEL FILTER ELEMENTS AND ADMISSION OF AIR INTO SYSTEM

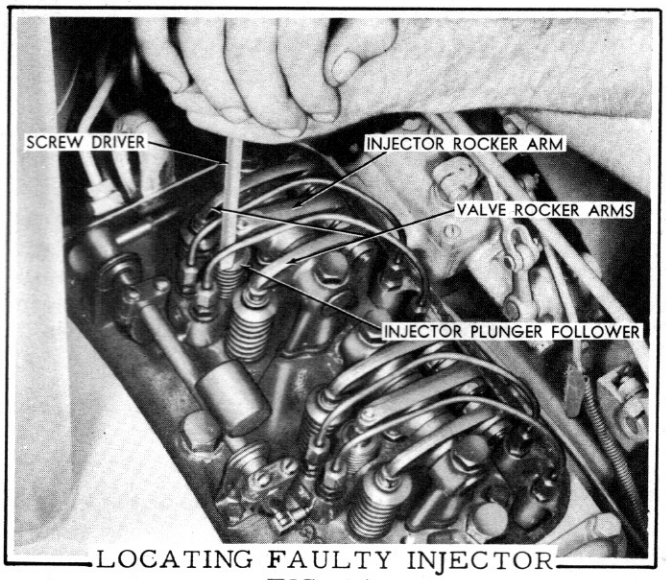
To check for air being admitted into the system, loosen the bleeding screw on top of the second stage filter and start the engine. If air is entering into the fuel system, foam or bubbles will be observed in the fuel that emerges from the loosened screw. Correct this condition by inspecting and tightening all the fuel line and filter connections. Start the engine and test for smooth operation and full flow of fuel.

If the fuel lines or filters are clogged, clean the first stage or second stage filter, or both, install new elements, and disconnect and blow out the fuel lines. This should eliminate the difficulty. Check for a full flow of fuel after the engine is again started.

2. CHECK FOR CLOGGED INJECTOR FILTERS

If the engine still runs "ragged" with a suitable fuel return, the injector filters for one of the cylinders may be partially clogged. Locate the faulty injector as follows:

Run the engine at idling speed and cut out each injector in turn by holding the injector follower down with a screwdriver or a small block of wood while the engine is running.



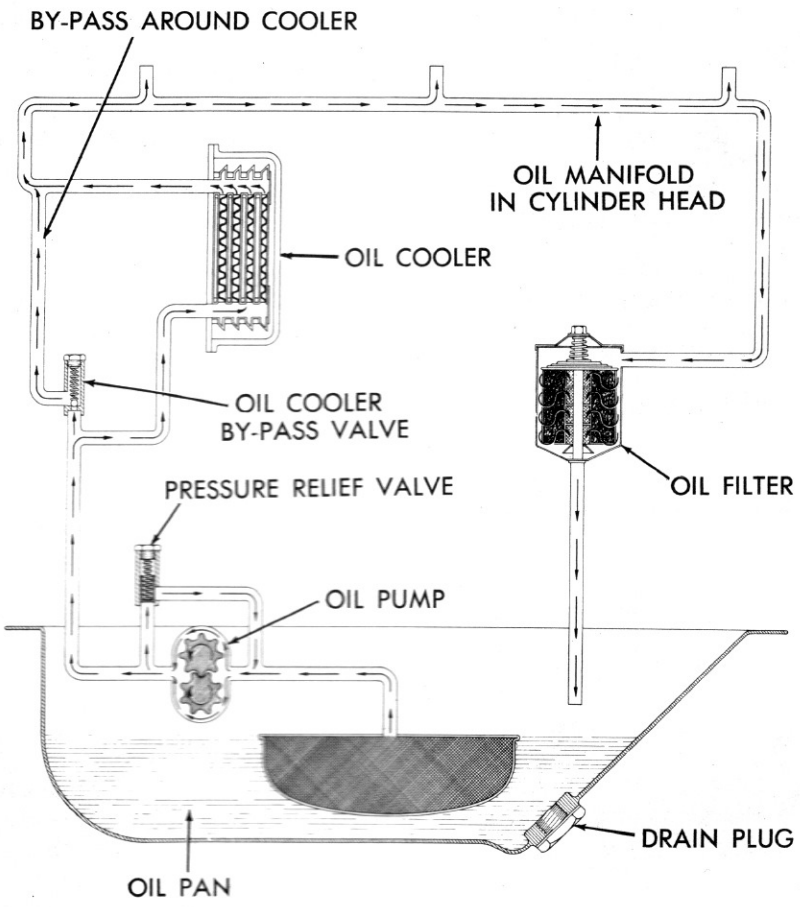
LOCATING FAULTY INJECTOR
FIG. 14

CAUTION: Do not allow screwdriver to slip off the follower as damage to the valve assemblies may result.

A decrease in engine speed with the follower held down will indicate that the injector for that cylinder is functioning properly. If the engine speed does not decrease, the injector is inoperative and should be removed for further inspection. To determine whether or not the injectors are obtaining sufficient fuel, stop the engine and remove the fuel feed line that connects the injector to the return fuel passage. Hold a finger over the injector fuel outlet and crank the engine with the starter. If fuel gushes from the injector while the starter is cranking the engine, an ample fuel supply is indicated.

3. CHECK FOR INOPERATIVE PUMP

If all the possible causes for insufficient supply of fuel, as explained in the above paragraphs, have been eliminated, the fuel pump will be considered inoperative, and must be removed and repaired or replaced.



SCHEMATIC DIAGRAM SHOWING OIL FLOW
FIG. 15

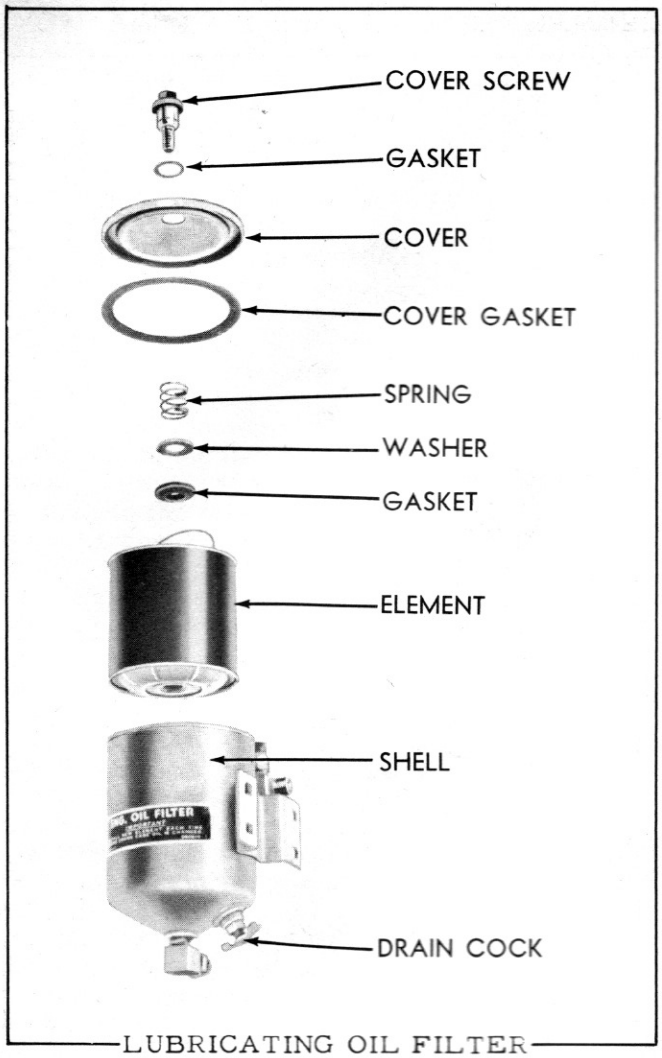
A. DESCRIPTION OF SYSTEM

The engine lubrication system, shown schematically, includes the gear driven oil pump, oil cooler, oil filter, and oil by-pass valve.

A spring-loaded plunger and spring type pressure relief valve, located in the pump, limits the pump discharge pressure to provide 25 to 40 pounds per square inch, indicated by the pressure gage, with the engine operating at full throttle and at normal operating temperature.

The oil discharged from the pump passes through the oil passages in the cylinder block and through the oil cooler, then into the cylinder head main oil gallery and vertical passages leading to the various engine bearings and operating parts. Should the oil cooler core become clogged, the oil by-passes the unit through the by-pass valve located in the semi-circular housing on the right side of the cylinder block.

A lubricating oil filter with a replaceable element is introduced directly into the lubricating system. A portion of the oil delivered by the pump passes through this filter where impurities in the oil are removed. The oil then returns to the crankcase.



LUBRICATING OIL FILTER
FIG. 16

B. LUBRICATING OIL FILTER

The lubricating oil filter, mounted on the left side of the engine, has a replaceable element consisting of filtering material contained within a perforated metal cylinder. A drain cock in the bottom of the filter shell allows draining of the filter for replacement of the element. A new element must be installed each time the oil in the crankcase is changed.

To change the element, remove the filter cover, drain the filter, lift out the spring and element, and wash the inside of the filter shell. Place a new element, element gasket and washer in position and re-install the cover, using the new cover gasket furnished with the new element. Start the engine and check to be sure that oil does not leak from the filter.

C. HEAVY DUTY FILTER

On tractors equipped with Heavy Duty Filters, the elements must be changed at each oil change. To change the element, proceed as follows:

1. Remove drain plug from bottom of filter housing and allow oil to drain from filter. Then, remove the lid capscrews and lift lid from housing.

2. Unscrew T-handle hold-down assembly from center tube and remove element from filter housing by lifting with pull-out bail.

3. Clean filter housing thoroughly and replace drain plug.

4. Install a new "Dieselpak" element and top gasket in filter housing. To assure leak proof sealing, examine the seats on each end of the filter element to see that they are in good condition and clean.

5. Replace T-handle hold-down assembly and tighten firmly.

6. Replace lid on filter housing and tighten the lid capscrews evenly.

7. Fill crankcase to proper level with prescribed lubricating oil and have approximately an additional 2 gallons on hand.

8. Remove vent plug from top of filter housing.

9. Start engine and keep it at low idle. As soon as engine starts, slowly add 1-1/2 gallons of crankcase lubricant to the crankcase.

10. Run engine until oil emerges from vent plug then install vent plug securely. Check for leaks around filter top, drain plug, and vent plug.

11. Check oil level and fill crankcase to "full" on bayonet gage.

CAUTION: Use only "Dieselpak" elements in the Heavy Duty Filter.

D. OIL COOLER

The oil cooler, located at the front of the engine, consists of a corrosion-resistant cooling core contained in a cast iron housing. The lubricating oil pump circulates oil through the cooling core and the water pump circulates coolant through the cooler housing around the outside of the plates of the core, thereby controlling the oil temperature in accordance with the engine cooling liquid at all times.

The oil cooler plates are lined with small fins which dissipate heat from the oil to the cooling water. If proper lubricating oil maintenance procedure is followed, the cooler will function efficiently for an indefinite period. However, if oil is allowed to become laden with impurities,

they will deposit in the cooler core; consequently causing restriction or clogging of the oil passages in the cooler core. Clogging of the cooler is usually indicated by a drop in oil pressure. If this occurs, the core must be cleaned or a new one installed to avoid excessive heating of the oil.

IT IS ABSOLUTELY NECESSARY THAT THE OIL COOLER UNIT BE KEPT CLEAN FOR PROPER OIL COOLING.

E. CLEANING OIL COOLER

Cleaning the oil cooler requires the use of special solvents. The following solvents have been found effective when used according to the manufacturer's direction:

Excellow Floor Cleaning Compound.
Turco Cleaning Compound.
No. 70 Stripper.
Mixture of 3 parts Oakite No. 7 and 5 parts fuel oil.
Bendix Cleaning Compound.

To use the last named solvent, merely submerse the core in the solution for a sufficient length of time to allow the chemical action of the solvent to dissolve or loosen the sludge or other foreign matter from the cooler.

Flush the core thoroughly with live steam or spirits after cleaning, regardless of type of cleaner used.

Cement gaskets to both sides of flange of cooler core and coat both sides of gaskets with cement when the element and housing are again installed after cleaning.

NOTE: If the core of the oil cooler is badly clogged, a new core must be installed.

ELECTRICAL SYSTEM

A. DESCRIPTION

The electrical system, which includes the starter, generator, generator regulator, batteries, headlights, and wiring, is 12-volt through-out. Current is supplied by two 6-volt wet cell storage batteries carried in compartments at the ends of the seat.

Electrical energy drained from the batteries through the operation of the electrical equipment is replaced by the generator. The output of the generator is controlled by the generator regulator to prevent overcharging of the batteries.

B. BATTERIES

Check the level of the electrolyte in the batteries every 75 hours of operation or as often as operating conditions prove it necessary. Maintain the level of the solution 3/8" above the plates by the addition of clean distilled water. Keep the battery and cable terminals tight and clean. If corrosion occurs, clean the battery posts and terminals with a strong soda solution and coat the terminals lightly with vaseline before connecting them again. The vaseline will prevent further corrosion.

When air temperature is below the freezing point, special attention should be given to hydrometer readings of the batteries. The electrolyte in full charged batteries will have a hydrometer reading of 1.280 to 1.300 specific gravity when the electrolyte temperature is 77° F. Specific gravity readings without correction for temperature are practically meaningless. For each 30 degrees that the temperature of the electrolyte is above 77°F., add 10 points to the hydrometer reading and for each 30 degrees below 77° F., subtract 10 points to get the true specific gravity. For example, if the hydrometer reading is 1.250 and the electrolyte temperature is 17° F. (60 degrees below 77° F.) 1.250 minus 20 points equals 1.230 - the true specific gravity.

If the corrected readings are below 1.240, the batteries are not receiving sufficient charge. This might indicate that the generator or regulator requires attention. If these units prove satisfactory, inspect the system for short circuits, loose connections, or corroded connections.

In zero weather there is danger of batteries freezing if the specific gravity is below 1.175. Batteries with a specific gravity of 1.225 will freeze at 35° below zero F.

During freezing weather, any addition of water to the cells should be made after the engine is started at the beginning of an operating period to make certain that the water and electrolyte solution will be thoroughly mixed; otherwise it may freeze. The filler caps must be kept tight at all times and the tops of the batteries kept clean and dry.

C. GENERATOR, GENERATOR REGULATOR, AND STARTER

The generator and regulator are set to charge the batteries at the rate of 4 to 8 amperes. Under normal conditions the ammeter should indicate this rate of charge for a short time after the starting of the engine or until the generator replaces the energy drained from the batteries during cranking; then it will show little or no charge. This is sufficient to keep the batteries fully charged under normal conditions.

It is important that the generator be maintained in good condition so that the batteries will be kept charged and provide the necessary cranking speed for starting the engine. This is especially important in cold weather when battery efficiency drops in proportion to the drop in temperature. Any authorized United Motors Service Station is equipped to test or rebuild the generator, regulator, or starter when these units require service.

D. WIRING

Heavy cables connect the batteries and the starter; wires assembled in harnesses connect the remaining electrical units. A 20-ampere fuse, introduced in the wire leading to the headlights and located at the instrument panel, prevents burning out the lights in the event of a short-circuit. An additional fuse is provided at the rear of the tractor for protection of special lighting equipment.

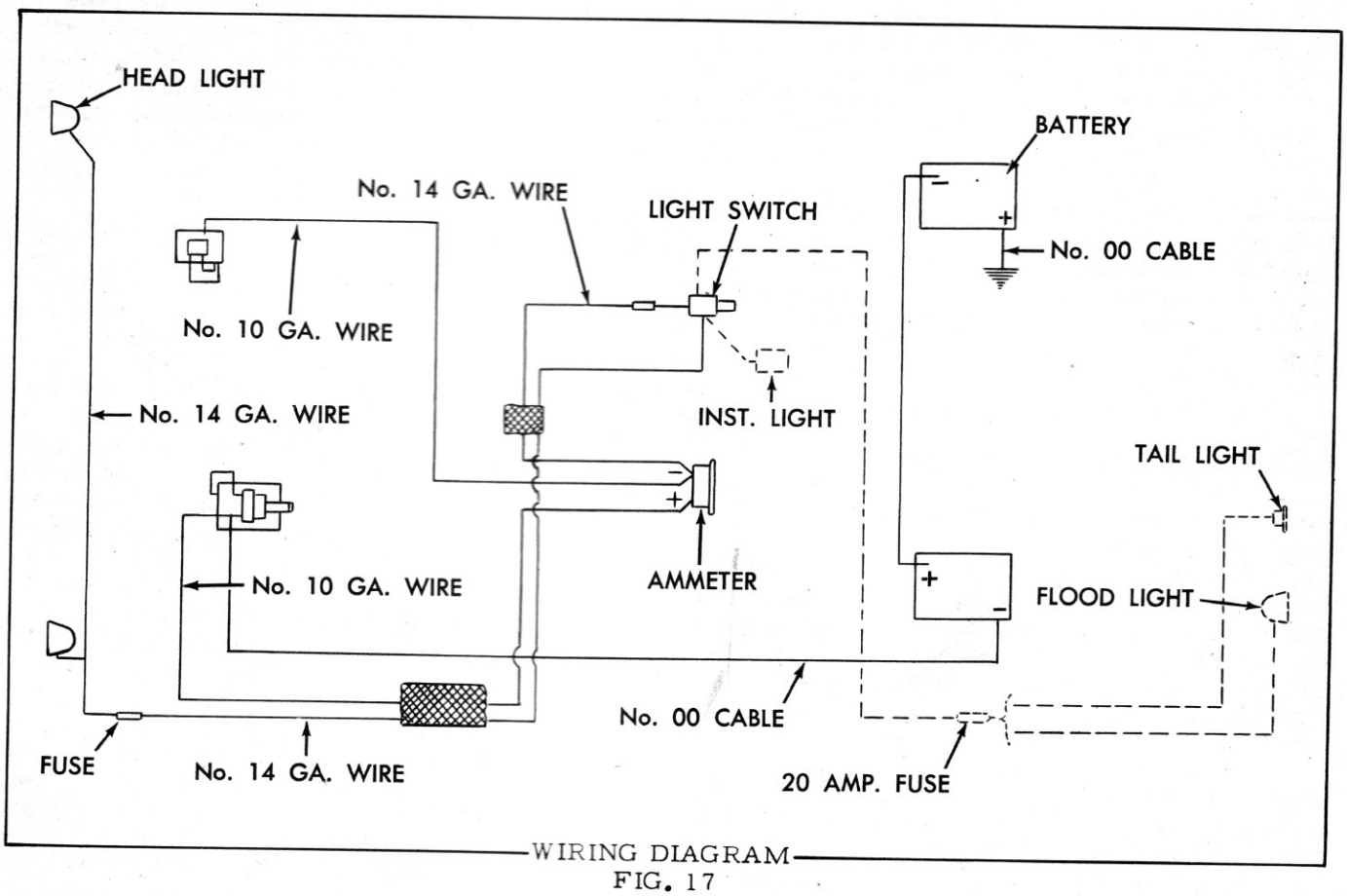
Inspect the wiring frequently to detect any loose connections or frayed insulation. Tighten the connections and wrap any frayed spots on wires with friction tape to prevent short circuits.

E. GENERATOR BELT ADJUSTMENT

The generator belts are correctly adjusted when the left side of the belts can be pressed inward approximately 1 inch at a point half way between the fan and crankshaft pulleys.

TO ADJUST GENERATOR BELTS

Loosen the capscrew in the adjusting arm at the front end of the generator and loosen the generator hinge bolts, then move the generator in or out until the correct tension of the belts is obtained. Tighten the adjusting arm capscrew and the generator hinge bolts. Refer to Fig. 9.



WIRING DIAGRAM
FIG. 17

A. OPERATION

The purpose of the air cleaner and air pre-cleaner is to remove dust and other foreign matter from the air used by the engine. The life of the engine depends largely on their efficiency, as fast wear on cylinder liners, pistons, and rings will result if the air cleaner is not kept in good condition and properly serviced.

Air for the engine enters through the pre-cleaner mounted on the top of the air cleaner extension pipe. The pre-cleaner is of the centrifugal type with fins that impart a swirling motion to the air thus causing heavy particles of dirt in the air to be thrown to the outside of the bowl and deposited therein. Approximately 85% of the dirt in the air is thus removed.

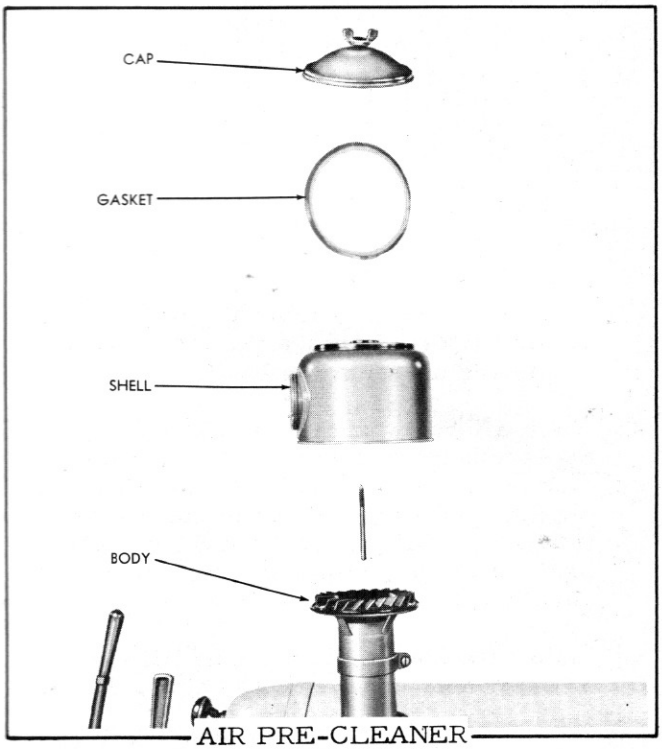
After passing through the pre-cleaner the air enters the air cleaner, through the air cleaner inlet pipe that extends through the center of the air cleaner body. An oil cup filled to a specified level with engine oil is suspended on the lower end of the air cleaner body. As the air is drawn through the cleaner, a portion of this oil is whipped up onto screen mats in the main body of the cleaner. Dust still remaining in the air collects on these oily mats as the air passes through them. The oil, dripping back into the cup carries this dust with it to deposit it in the cup. Thus, only clean air enters the blower for delivery to the cylinders. A broken hose, loose hose clamp, damaged blower gasket, or leak of any kind that allows air to enter cylinders without first passing through the air cleaner will defeat the purpose of the cleaner. Therefore, extreme care should be taken to prevent leaks.

Periodic inspection of the above parts and of the air cleaner body for dents, cracks, loosened solder connections, etc., should be made frequently. If any of the above mentioned conditions are found, they must be corrected immediately.

B. AIR PRE-CLEANER SERVICE

Empty the pre-cleaner whenever the dirt level reaches halfway up on the inspection glass. Remove and clean as follows:

1. Unscrew the wing nut to remove the cap from the shell.
2. Lift the shell from the pre-cleaner body. Clean the dirt out of the shell and wipe the inside of the shell with a dry cloth. Be sure the fins in the cleaner body are not bent, damaged, or clogged with leaves or other material.
3. Wipe the dust off the cap gasket and reassemble the pre-cleaner. Install a new gasket if the old one is not in good condition. Tighten the wing nut with the fingers. DO NOT USE A WRENCH.

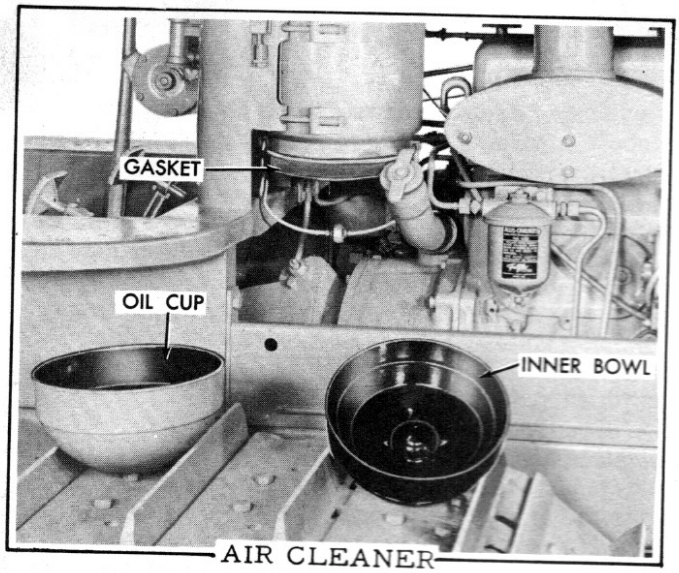


AIR PRE-CLEANER
FIG. 18

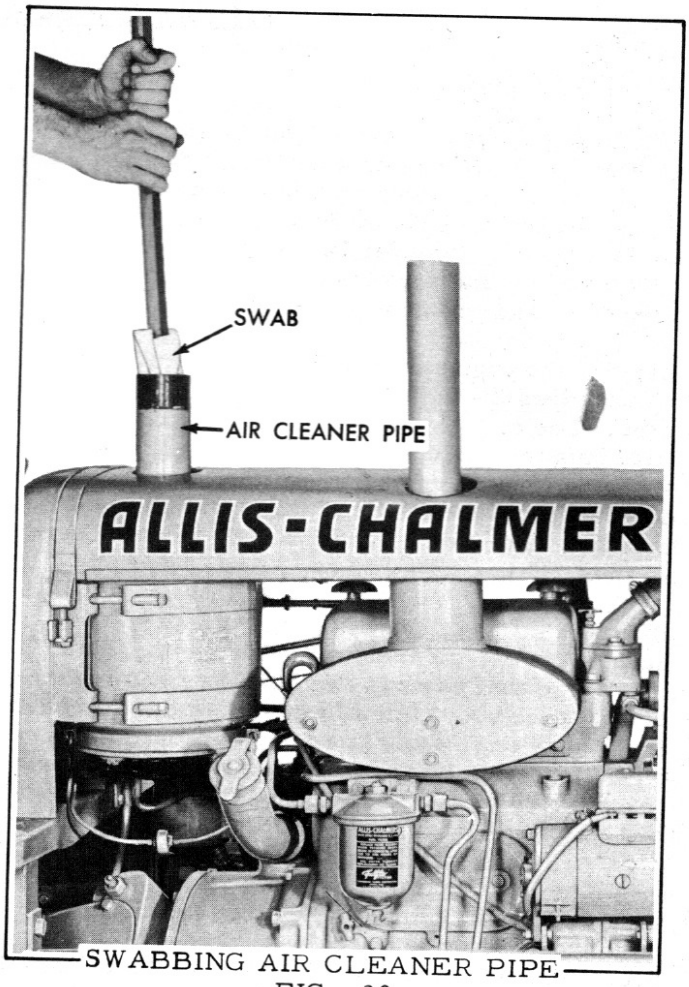
C. AIR CLEANER SERVICE

Remove the oil cup daily (more often if operating in extremely dusty conditions) to check the oil level in the cup and to determine the condition of the oil. Empty and wash the cup whenever the oil becomes discolored, indicating a quantity of dirt has collected, then refill with clean oil. Keep the cup filled to the "full" mark on inner bowl. Use same viscosity of oil as is used in the engine at prevailing temperatures.

NOTE: SOME DIESEL LUBRICATING OILS MAY FOAM WHEN USED IN THE AIR CLEANER. DO NOT USE AN OIL THAT FOAMS AS IT REDUCES AIR CLEANER EFFICIENCY AND IN SOME CASES WILL ALLOW THE OIL TO BE PULLED OVER INTO THE ENGINE, CAUSING SERIOUS DAMAGE.



AIR CLEANER
FIG. 19



SWABBING AIR CLEANER PIPE
FIG. 20

TO SERVICE CLEANER

1. Remove the oil cup from the bottom of the cleaner body. Remove the inner bowl and empty the oil from the bowl.

2. Wash all parts of the cup thoroughly with clean solvent or fuel oil. Remove the pre-cleaner assembly from the top of the air cleaner and swab out the inside of the air-intake pipe that extends from the pre-cleaner to the oil cup. Re-install the pre-cleaner assembly.

3. Install the bowl in the cup and fill to the top of the center cone with clean oil. Replace the cup on the bottom of the cleaner body. See that the gasket above the cup makes a tight seal.

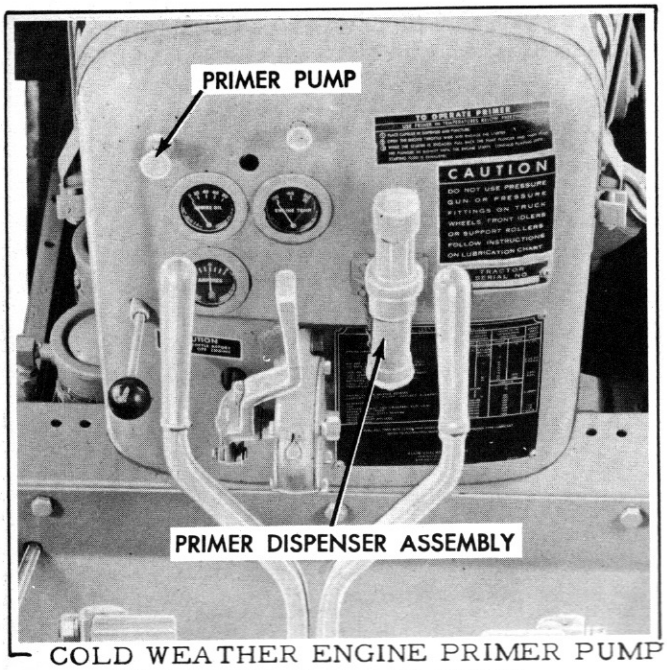
COLD WEATHER ENGINE PRIMER

PURPOSE

In warm weather, sufficient heat is generated by the compression of the air in the cylinders to ignite the fuel and start the engine within a very short cranking period. However, in cold weather the "drag" caused by cold oil between the pistons and cylinder walls, and in the bearings, reduces the cranking speed of the engine. A large part of the heat generated by compression of the air is absorbed by the pistons and cylinder walls. This heat loss and the reduced cranking speed may result in the temperature of the air in the cylinders being too low to ignite the fuel. A starting aid must then be used in starting the engine.

A. DESCRIPTION

The cold weather engine primer consists of a dispenser assembly, which holds and punctures a capsule containing ethyl ether fluid, a primer pump to force the fluid through a small nozzle into the air inlet elbow near the engine blower, a primer elbow assembly, and the necessary lines to complete the system. The dispenser is located on the cowl (to the right of the instrument panel) and the primer pump is mounted in the left side of the instrument panel. The vaporized starting fluid is forced through the primer elbow assembly into the air inlet elbow, where it is picked up by the engine blower and is blown into the cylinders. Since the fluid is highly combustible, it is easily ignited by compression in the cylinders. The engine will start quickly at low ambient temperatures with the aid of the primer if the starter will crank the engine even at a very low cranking speed. The starting fluid capsules, available in 7 c.c. and 17 c.c. sizes, can be obtained from "Allis-Chalmers" Dealers. Refer to "Starting and Stopping Engine" for full instructions on the use of the Cold Weather Engine Primer.



COLD WEATHER ENGINE PRIMER PUMP AND DISPENSER LOCATION
FIG. 21

B. COLD WEATHER ENGINE PRIMER TROUBLE SHOOTING

If the engine is cranked with the throttle wide open and does not start after two or three strokes of the primer pump, it is advisable to stop cranking and inspect the primer system for possible causes of failure:

1. PRIMER ELBOW ASSEMBLY CLOGGED

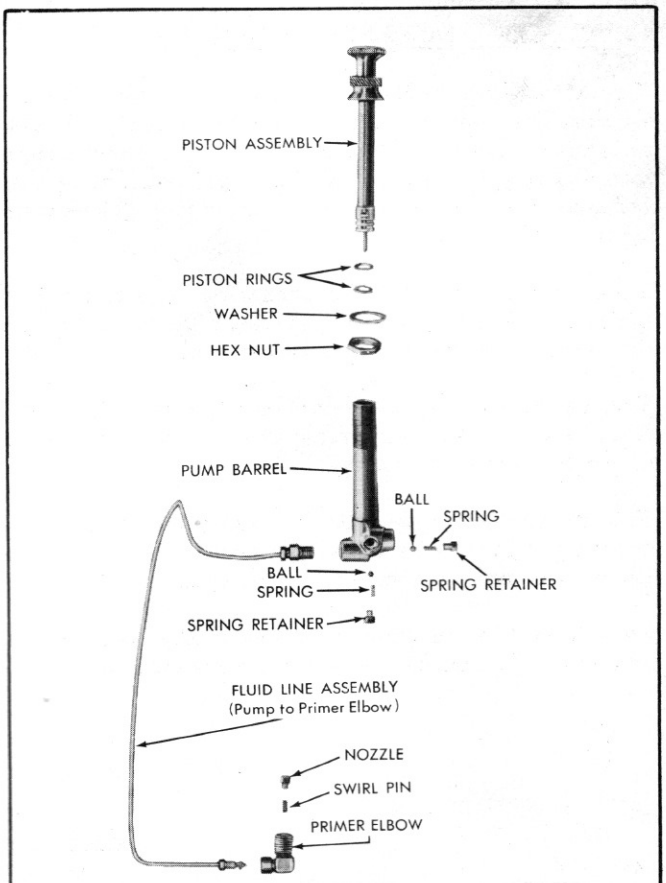
This condition will usually be indicated by excessive resistance on the primer pump. A partially clogged primer elbow assembly will prevent the delivery of sufficient starting fluid to the air inlet system. To clean the primer elbow assembly, remove the assembly from the air inlet elbow and remove the small nozzle from the primer elbow assembly. Remove and clean the nozzle swirl pin and open the hole in the end of the nozzle, if clogged.

CAUTION: Do not enlarge the hole in the end of the nozzle.

After cleaning, re-assemble the primer elbow assembly and install the assembly in the air inlet elbow.

2. INOPERATIVE PRIMER PUMP

Failure of the primer pump to function properly may be due to worn or damaged packing rings, a clogged dispenser filter screen, clogged fluid lines, or "frozen" or worn check valve balls. The packing rings on the plunger are made of a special rubber composition and must be replaced by duplicate parts if worn or damaged.



PRIMER PUMP & PRIMER ELBOW DETAILS
FIG. 22

To replace the packing rings, remove the knurled nut (under knob) from the pump barrel and withdraw the piston assembly from the barrel. Remove the packing rings from the grooves of the piston assembly and install new rings. Lubricate the rings and piston with light engine oil and install the piston assembly in the pump.

3. BALL CHECK VALVES

The two spring loaded ball check valves, located on the inlet and outlet openings of the pump, are provided to close the pump openings at the proper time. When the pump piston is pulled out (suction stroke, drawing fluid from dispenser) the ball check valve at the inlet port opens, allowing the fluid to be drawn from the dispenser. When the pump piston is pushed in (delivery stroke, supplying fluid to the primer elbow assembly), the ball check valve at the outlet port opens, allowing the pump to force the fluid to the primer elbow assembly. Worn or "frozen" ball check valves or broken springs will prevent the pump from operating properly. When this occurs, remove the spring retainers, springs, and balls from the inlet and outlet ports of the pump. Inspect the balls, ball seats, and springs for wear or damage. Clean the pump body and all its components thoroughly and re-assemble, using new parts where necessary.

4. CLOGGED DISPENSER STRAINER

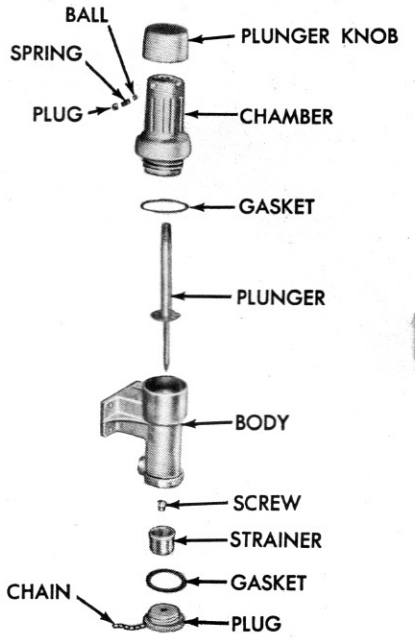
The strainer is bolted to the strainer plug, screwed into the bottom of the dispenser body. If the gelatine capsules are not removed soon after puncturing, the gelatine will melt and plug the strainer screen in the bottom of the dispenser body.

To clean the dispenser strainer, unscrew the strainer plug from the dispenser body and wash the strainer and plug in hot water.

The strainer may be removed for replacement if necessary by removing the retaining screw from the strainer plug.

The dispenser body may be washed without removing it from the cowl by removing the upper chamber, the connector, and strainer plug.

Re-assemble the dispenser assembly by a direct reversal of the disassembly procedure.



PRIMER DISPENSER DETAILS
FIG. 23

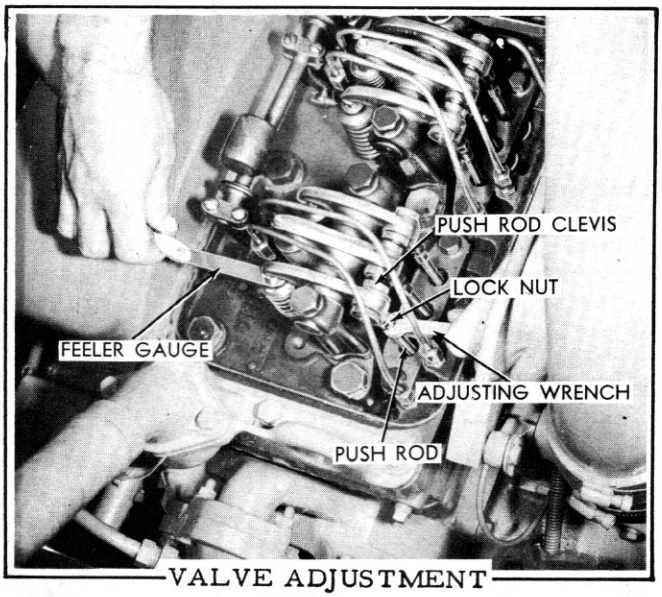
VALVE ADJUSTMENT

A. GENERAL

The correct clearance between the ends of the valve stems and the rocker arms is very important in a Diesel Engine because of the high compression pressures developed. Insufficient valve clearance will cause loss of compression, misfiring, and will eventually burn the valves and valve seats.

Too much clearance will result in faulty engine operation and rapid wear on valve operating mechanism. The proper valve lash is .009" with the engine at operating temperature.

After any mechanical work has been done which would disturb the valve setting, the valves may be set "cold" to .012" clearance so that the engine may be run and allowed to warm up to operating temperature in preparation to the final correct valve adjustment.



VALVE ADJUSTMENT
FIG. 24

B. TO ADJUST VALVES

1. Remove engine hood and rocker arm cover.

2. Crank the engine with the starter until the injector rocker arm for one cylinder is down and injector plunger is at the bottom of its stroke; the valves for that cylinder will then be closed and the valve rocker arms will be raised off the valve stems.

3. Check clearance between valve stems and rocker arms. When adjusted properly a .009" thickness gage should pass between them with a slight drag when the engine is at normal operating temperature. With the engine at ambient

temperature, the .012" feeler ribbon furnished with the tool kit may be used and the valves adjusted to .012" clearance - cold. Adjust each valve by loosening the lock nut and turning the push rod into the push rod clevis to increase the clearance or out of the push rod clevis to decrease the clearance. When proper clearance is obtained, tighten the lock nut. Re-check the clearance to be sure it was not changed by tightening the lock nut.

4. Crank the engine with the starter and repeat above operation on valves for the other cylinder. Replace rocker arm cover and hood.

CAUTION: If for any reason a push rod was disconnected from a rocker arm, be sure, when it is reinstalled, that the upper end of the push rod if flush with inside of the clevis yoke before engine is turned. If is not, it is possible that the valve will be opened too far and the piston will strike the valve and damage valve or piston.

INJECTOR TIMING

A. GENERAL

Timing of each injector consists of properly locating the top of the plunger follower in relation to the injector body so that the fuel will be injected into the cylinder at the proper time. This is done with the injector installed in the engine.

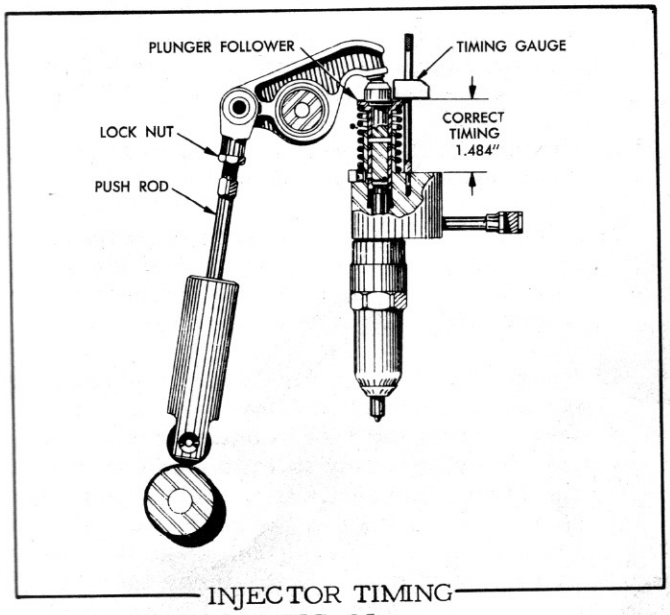
B. TO TIME INJECTOR

1. Remove the engine hood and rocker arm cover.

2. Rotate the engine with the starter until the the two valve rocker arms for the same cylinder are down and the valves are fully opened. Remove the rear fuel lines from each injector to provide room for a timing gage. Close the fuel openings on the injectors and in the cylinder head with shiping caps to prevent dirt from entering the system.

3. Place the timing gage in the hole in the injector body; be sure that the shoulder at the bottom end of the gage rests on the injector body and is not held up by the copper washer under the fuel connector or by dirt in the hole. Turn the gage so that the extended head (flat portion) of gage is toward the injector follower.

4. Loosen push rod lock nut and turn the push rod into the push rod clevis to raise the follower or out of the push rod clevis to lower the follower until the proper timing is obtained. When the injector is properly timed, the bottom (flat part) of the gage head will just pass over the top of the injector follower guide. The timing gage must be held perpendicular to the top surface of injector body while performing this adjustment.



INJECTOR TIMING
FIG. 25

5. Tighten the lock nut and re-check to be sure timing was not changed by tightening the lock nut. Replace rocker arm cover and hood.

INJECTOR EQUALIZING

A. GENERAL

Equalizing of the injectors consists of adjusting the injector rack control levers so that an equal amount of fuel is delivered to each cylinder. The most fuel is injected into the cylinders when the injector racks are moved all the way in, none is injected when the racks are moved all the way out. The engine will run unevenly or detonate (knock), if the injectors are not equalized.

B. TO EQUALIZE THE INJECTOR

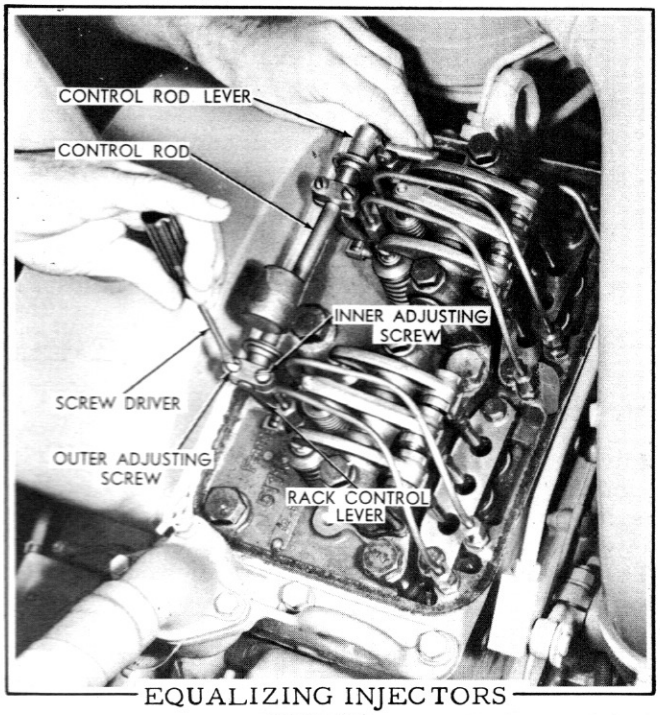
1. Remove the engine hood and the rocker arm cover. Check the valve lash which should be .009" with the engine hot, also see that the injectors are properly timed (refer to "Valve Adjustment" and "Injector Timing").

2. Disconnect the governor to injector control shaft link at the injector control shaft lever.

3. Adjust the injector lever screws on the front cylinder so that the upper half of the lever is straight (not cocked) with respect to the lower half. Tighten both screws.

4. Loosen the injector rack lever screws on the rear cylinder to allow 1/8" play at the lever. Hold the front control rack all the way in by pressing in on the lower end of the front control lever, then adjust and tighten the screws in the rear rack control lever so that the ball stud on the bottom of lever lightly contacts the inner face of the slot in the control rack. Tightening the inner screw moves the lever in; tightening the outer screw moves it out.

5. Push the engine shut-off knob all the way in against the dash (run position) and pull the throttle lever all the way back (wide (open).



EQUALIZING INJECTORS
FIG. 26

6. Hold the injector racks in by hand to the full fuel position and adjust the clevis on the injector control shaft end of the governor control link until the hole in the clevis slides freely over the pin on the rack lever.

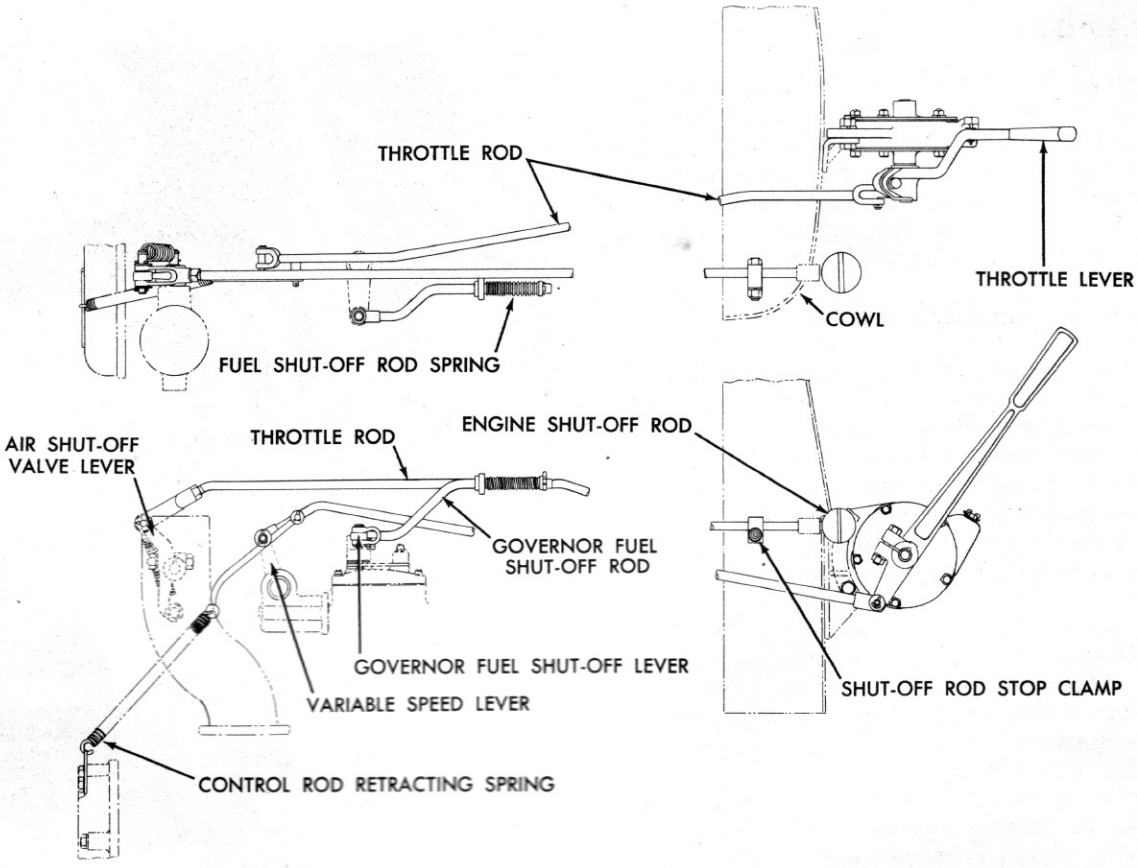
   CAUTION: Be careful not to compress the governor spring when adjusting the governor control shaft link.

NOTE: Use the procedure explained above when a rear injector is replaced. When a front injector is replaced, adjust the rack control lever by holding the rear control rack all the way in and adjust the front lever in the same manner.

ADJUSTMENT OF ENGINE CONTROLS

A. GENERAL

The engine shut-off control opens and closes the air valve in the blower air intake tube and moves the governor fuel shut-off lever to its opened and closed position. When the shut-off knob is pushed in (forward) as far as it will go (running position), the air valve and the fuel shut-off lever should move to their full open position; when the knob is pulled out, the air valve should close tightly and the fuel shut-off lever should move to its full closed position. Improper adjustment will result in loss of engine speed or power, failure of the engine to start with the knob pushed in, or failure to stop when the knob is pulled out.



ENGINE CONTROLS
FIG. 27

B. CHECK AND RE-ADJUST AS FOLLOWS:

If the shut-off control fails to operate as stated above, first be sure the linkage and levers are properly lubricated and the condition is not due to binding or broken springs.

1. EARLY MODELS - Push the engine shut-off control rod into running position (all the way in), and check to see if the locking ball in the air valve lever stop (at air intake tube) is centered in the hole in the shut-off valve lever. If not, adjust the rod linkage as necessary to center the locking ball in the hole.

2. LATE MODELS - Push the engine shut-off control rod into running position (all the way in), and check to see if the air shut-off valve shaft lever contacts the lever stop pin on the air intake tube. If not, adjust the rod linkage as necessary so that the lever contacts the stop pin with the control rod in the running position.

   Loosen the small stop clamp on the rear shut-off control rod, then pull the shut-off control rod to the "off" position (as far back as it will go). Push the control rod forward 1/16", then move the stop clamp on the control rod so that it contacts the rod guide boss, welded in cowl, and tighten the clamp securely. Locating the stop clamp in this position prevents the air valve from "bottoming" in the air intake tube when the control rod is in its "off" postion.

3. ADJUSTMENT OF GOVERNOR FUEL SHUT-OFF CONTROL - Push the engine shut-off control rod into running position (all the way in) and remove the pin connecting the governor fuel shut-off rod to the governor fuel shut-off lever. Hold the governor fuel shut-off in its forward position (as far as possible) and check to see if the hole in the fuel shut-off rod lines up with the hole in the fuel shut-off lever. If not, loosen the capscrew clamping the governor fuel shut-off lever to the shaft, and move the position of the lever on the shaft so that the holes line up when the lever is in its extreme forward position. Tighten the capscrew used to clamp the lever to the shaft and install the connecting pin.

GOVERNOR ADJUSTMENT

A. GENERAL

The governor is adjusted at the factory to provide the full governed speed (under load) of 1800 R.P.M. and an idling speed of 500 R.P.M. The governor very seldom gets out of working order. If the engine speed is irregular, check the fuel system and all other engine adjustments before changing the governor setting.

B. CHECKING ENGINE SPEED

Operate the engine until the normal operating temperature (160° to 185° F.) is indicated on the temperature gage. Hold a tachometer against the front end of the crankshaft. With the throttle all the way forward (idling position) and the engine clutch disengaged, the engine speed should be 500 R.P.M. With the throttle lever all the way back (wide open) the engine speed should be 1875 R.P.M.

NOTE: If equipment on the tractor prevents the use of a tachometer at the front end of the crankshaft, remove the small cover plate at the rear end of the generator and hold the tachometer against the rear end of the armature shaft. The generator runs at 1.55 times the engine speed. Therefore, generator speeds of 775 R.P.M. and 2905 R.P.M. will correspond with engine speeds of 500 R.P.M. and 1875 R.P.M.

CAUTION: Be sure that the fan belts are properly adjusted when checking the engine speed at the generator.

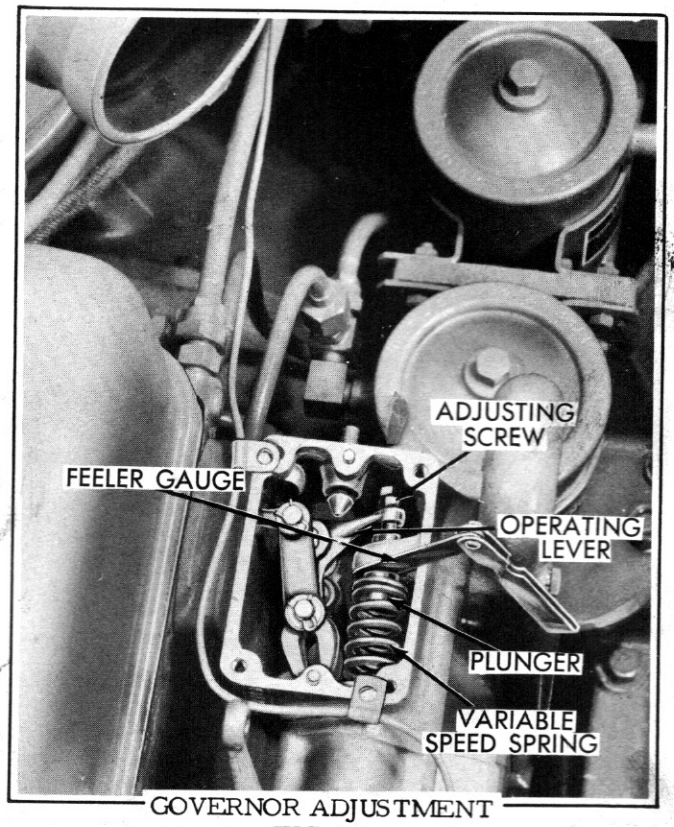
C. SPRING PLUNGER GAP ADJUSTMENT

A clearance of .006" must be maintained between the variable speed spring plunger and the guide. To make this adjustment, remove the control housing cover and pull the throttle lever half-way back. Loosen the lock nut on the gap adjusting screw and turn the screw in or out until a .006" gap is obtained between the spring plunger and the guide. Use a .006" feeler gage to measure this gap. Tighten the lock nut after the proper adjustment has been made and replace the cover.

D. HIGH IDLE SPEED ADJUSTMENT

NOTE: In most cases, the cause for the engine not reaching the proper high idle speed (1875 R.P.M.) will be found due to loose, or incorrectly adjusted throttle linkage and not due to the governor being out of adjustment. For this reason, before changing the adjustment of the governor, check the following:

1. Be sure that the governor fuel shut-off lever on the governor control housing moves to its extreme forward position (as far as it will go) when the engine shut-off control rod is pushed into running position.



GOVERNOR ADJUSTMENT
FIG. 28

2. Remove the pipe plug in the top of the governor variable speed spring housing, and check to be sure that the setscrew in the variable speed spring lever has not loosened, permitting the lever to turn on the shaft. Tighten the screw firmly so that the screw is drawn down tightly on the seat in the shaft. Replace the pipe plug. If the injectors have been properly timed and equalized and all adjustments and inspections listed above have been made and the engine still fails to attain its proper high idle speed of 1875 R.P.M. (2905 R.P.M. of generator), addition of adjusting washers between the variable speed spring and the spring retainer will be required.

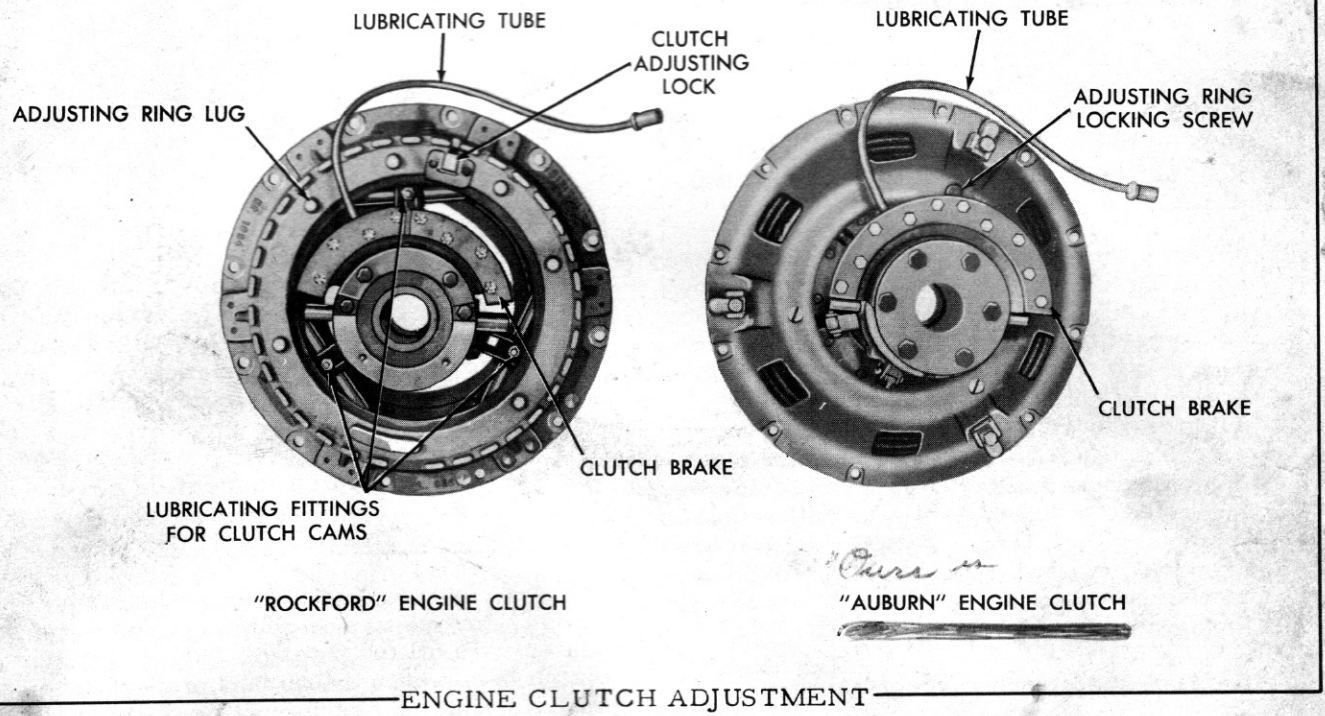
   The adjusting washers are installed by removing the variable speed spring housing from the governor control housing, lifting the spring from the spring retainer and inserting additional adjusting washers in the spring retainer. Each .010" thick washer will increase the high idle engine speed approximately 20 R.P.M.

   To decrease the high idle speed, remove the necessary amount of adjusting washers.

E. LOW IDLE SPEED ADJUSTMENT

With the throttle lever all the way forward (idling position), loosen the lock nut on the idle adjusting screw, then turn the screw in (clockwise) to increase the idling speed or out (counter-clockwise) to decrease the idling speed. When the correct speed is obtained, tighten the lock nut.

ENGINE CLUTCH



ENGINE CLUTCH ADJUSTMENT
FIG. 29

A. DESCRIPTION

The engine clutch is a single plate, dry clutch with an overcenter, cam-engaging action. A shifting sleeve and bearing mechanism, carried on the clutch shaft and connected by linkage to the clutch actuating levers, is operated by the clutch operating lever to engage and disengage the clutch. A cam adjustment between the pressure plate and actuating levers of the clutch provides a means of maintaining the necessary adjustment to compensate for normal wear on the clutch facings.

A clutch brake assembly, consisting of a stationary lined brake disc bolted to the rear of the clutch shifting sleeve yoke and a second plain brake disc bolted to the clutch shaft, is provided for stopping the rotation of the transmission gears when shifting. The clutch brake is applied by pressing forward on the clutch operating lever after disengaging the clutch.

NOTE: The tractor may be equipped with an "Auburn" or a "Rockford" Engine Clutch. A decal, attached to the clutch inspection cover (on the later model tractors), indicates the type of clutch used in the tractor.

B. ENGINE CLUTCH ADJUSTMENT

When the clutch is properly adjusted, approximately 50 pounds pull is required on the lever for its engagement. The clutch must engage with a distinct over-center snap. This adjustment, of 50 pounds pull, should be maintained to obtain maximum clutch life.

The correct method, for checking the pounds pull required on the operating lever to engage the clutch, is to use a spring scale and weigh the pull required. This pull should be checked from the bottom of the hand grip on the clutch operating lever.

IMPORTANT: SINCE MOST CLUTCH FAILURES ARE THE RESULT OF IMPROPER MAINTENANCE, IT IS VERY IMPORTANT THAT THE CLUTCH IS KEPT IN PROPER ADJUSTMENT AT

ALL TIMES AND THAT THE CLUTCH COMPONENTS ARE LUBRICATED AS RECOMMENDED. DO NOT SLIP THE CLUTCH EXCESSIVELY WHEN ENGAGING.

C. TO ADJUST THE "AUBURN" CLUTCH

1. Remove the clutch inspection cover from the upper right side of the clutch housing.

2. With the clutch disengaged, revolve the engine until the clutch adjusting ring locking screw can be reached through the inspection hole.

   NOTE: The adjusting ring locking screw is the one having a hex head.

3. Loosen the locking screw but DO NOT REMOVE IT. DO NOT LOOSEN THE TWO SLOTTED SCREWS.

4. Tighten the clutch by turning the notched adjusting ring clockwise with a large screwdriver or short pry bar until the proper adjustment is obtained. Moving the adjusting ring 2 or 3 notches is generally sufficient.

5. Tighten the adjusting ring locking screw securely. Attach a spring scale to the clutch operating lever (attach scale just below the lever hand grip) and weigh the pull required to engage the clutch. When the clutch is properly adjusted, a maximum of 50 pounds is required on the operating lever for its engagement.

6. Replace the clutch inspection cover.

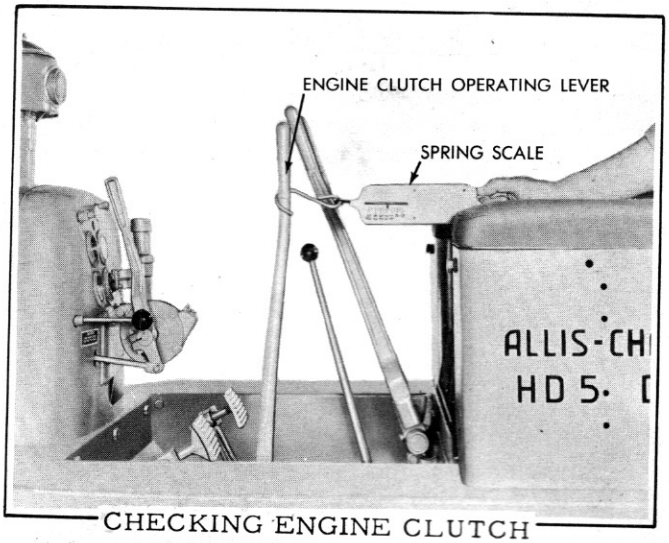
D. TO ADJUST THE "ROCKFORD" CLUTCH

1. Remove the clutch inspection cover from the upper right side of clutch housing.

2. With the clutch disengaged, revolve the engine until the clutch adjusting lock may be reached through the inspection hole. Disengage the adjusting lock from the slot in the clutch back plate.

3. Using a hammer and punch, or a suitable "bumping" bar, tap on the lugs of the adjusting ring to tighten or loosen the clutch. Turn the adjusting ring clockwise to tighten or counterclockwise to loosen. Moving the adjusting ring 2 or 3 notches is generally sufficient.

4. Lock the adjusting ring in place by engaging the adjusting lock into the nearest slot of the clutch back plate. Attach a spring scale to the clutch operating lever (attach scale just below hand grip) and weight the pull required to engage the clutch. When the clutch is properly adjusted, a maximum pull of 50 pounds is required on the operating lever for its engagement.



CHECKING ENGINE CLUTCH LEVER PULL
FIG. 30

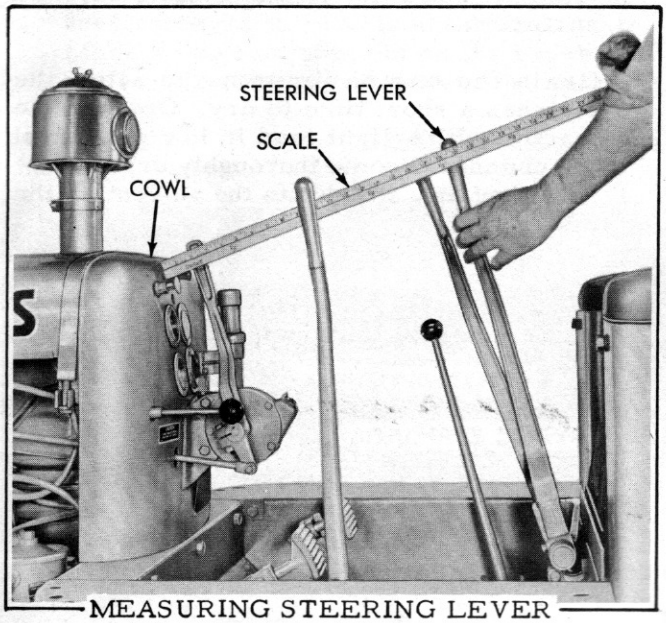
5. Replace the clutch inspection cover.

E. WASHING ENGINE CLUTCH

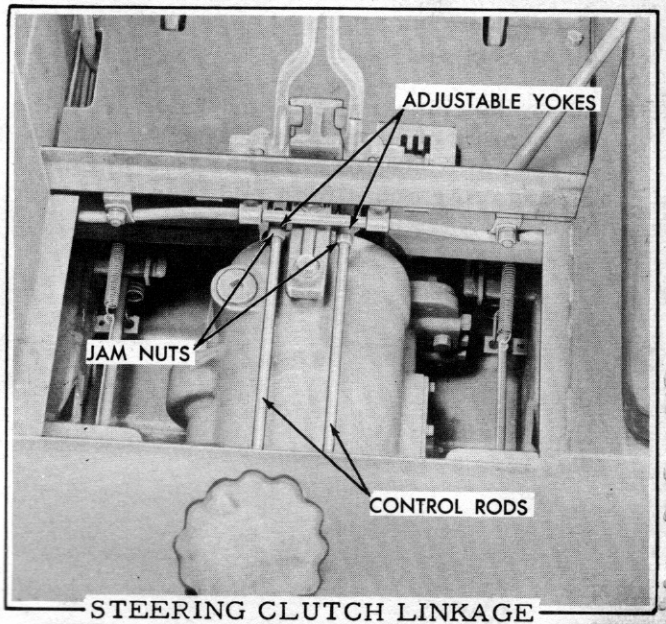
Oil leaks or over-lubrication of the clutch components may cause the clutch facings to become coated with oil or grease. This will cause the clutch to slip even though it is properly adjusted. In this event, the clutch must be washed.

Install the clutch housing drain plug in the front of the flywheel housing and remove the clutch inspection plate. Pour cleaning solvent into the housing until the level is 1-1/4 inches below the clutch shaft. Then install the inspection plate and run the engine at low idle speed for about 5 minutes with the clutch disengaged. Drain the solvent, and, if it is excessively dirty, refill the housing and repeat the process.

CAUTION: LUBRICATE THE CLUTCH SHIFTING BEARING THOROUGHLY AND IF THE TRACTOR IS EQUIPPED WITH A "ROCKFORD" ENGINE CLUTCH, LUBRICATE THE CLUTCH CAMS (3 POINTS) AFTER THE CLUTCH HAS BEEN WASHED AS THE LUBRICANT WILL BE WASHED OUT OF THESE COMPONENTS IN THE WASHING PROCESS. Operate the tractor with a light load in low gear for a short period until the clutch dries to prevent slippage due to the solvent on the clutch parts.



MEASURING STEERING LEVER FREE TRAVEL
FIG. 31



STEERING CLUTCH LINKAGE ADJUSTMENT
FIG. 32

A. DESCRIPTION

The two steering clutches are multiple disc clutches with 10 friction discs and 10 steel discs assembled alternately. Springs hold the steel and friction discs tightly together. Pulling back on the steering lever releases the clutch by forcing a throwout sleeve against a shifter plate in the clutch and compressing the springs, thereby allowing the steel discs and friction discs to separate.

B. STEERING CLUTCH LINKAGE ADJUSTMENT

The steering clutch linkage is properly adjusted when the steering levers each have 3" of free travel, measured at the tops of the levers. As the clutch discs wear, this free travel decreases. When the free travel has decreased to less than 1", an adjustment of the clutch linkage is required. Free travel of the levers is necessary to insure clearance between the clutch throwout sleeve and the throwout plate and for the proper full engagement of each clutch.

C. TO MEASURE THE FREE TRAVEL OF EITHER LEVER.

Place one end of a ruler or scale against the dash so that it projects horizontally past the top of the steering lever.

Holding the steering lever forward against the stop, measure the distance from the dash to the the top of the lever. Pull the lever back until pressure is felt, which is the point where disengagement of the clutch begins. Note the distance between the dash and the top of the lever. The difference between the two measurements is the free travel of the lever. If this distance is less than 1", an adjustment must be made.

D. TO ADJUST THE LINKAGE FOR EACH CLUTCH

Loosen the jam nut of the adjustable yoke on the front end of the control rod leading from the bottom end of the steering lever to the lever on the clutch throwout shaft.

Disconnect the rear end of the rod from the throwout lever, then lengthen the rod by turning it out of the yoke at the front. Adjust the length so that 3" of free travel at the top of the lever is obtained when the rod is re-connected.

Tighten the jam nut on the rod and install the cotter pin in the rear yoke pin.

E. WASHING STEERING CLUTCHES

Oil leaking into the steering clutch compartments may get on the clutch discs and cause the clutches to slip. If this occurs, wash the clutches in the following manner:

1. Install pipe plugs in the two drain holes in the bottom of the housing at each side of the drawbar.

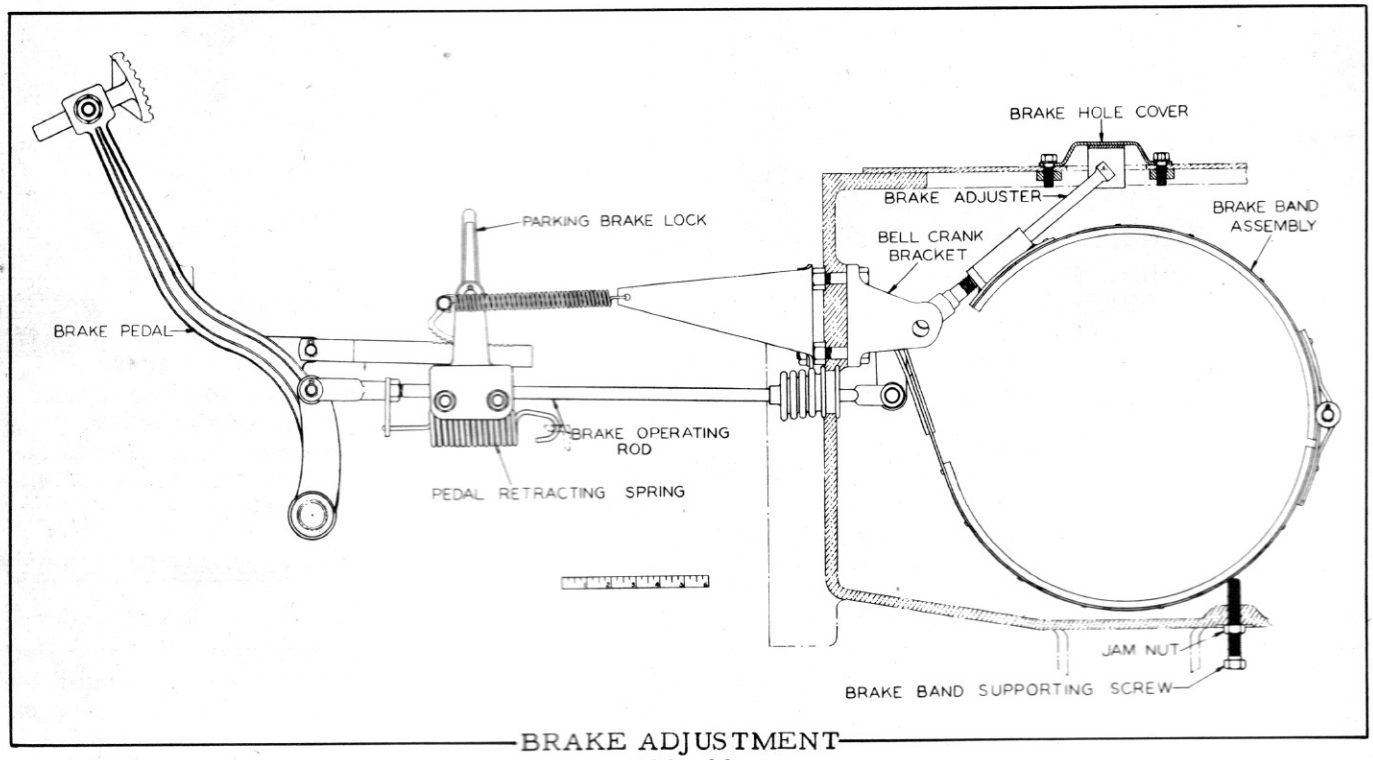
2. Remove the brake hole covers from the top of the housing and pour about three gallons of solvent into each compartment. Drive

the tractor back and forth in a straight line for five minutes, leaving the steering clutches engaged. The oil on the exterior of the clutches and brakes will be washed off in this operation.

3. Drain the compartments and refill with the same amount of solvent, then drive the tractor back and forth for another five minutes, disengaging one clutch and then the other continually during this period. Disengaging the clutches allows the clutch discs to separate so that the solvent can get between the discs to wash the oil from their friction surfaces.

4. Drain the compartments and allow the clutches a short time to dry. Operate the tractor with a light load in low gear until the clutches become thoroughly dry, otherwise they may slip due to the solvent on the discs.

BRAKES



BRAKE ADJUSTMENT
FIG. 33

A. GENERAL

The brakes are properly adjusted when the pedals have 1-3/4" to 2" of free travel and full brake application is accomplished before the pedals strike the floor plate at the forward end of the slots in which they operate. As the brake linings wear, the pedals will move farther forward and eventually will strike the floor plate before the brakes are fully applied. The brakes will then require adjustment. If the brakes are in proper adjustment, yet fail to hold, this condition may be due to oil on the linings and can be corrected by washing the brakes in the same manner as washing the steering clutches. Refer to "WASHING STEERING CLUTCHES" and follow the instructions given in Steps 1 and 2, then drain the compartments.

B. TO ADJUST EACH OF THE BRAKES

1. Remove the small oval brake hole cover from the top of the steering clutch housing.

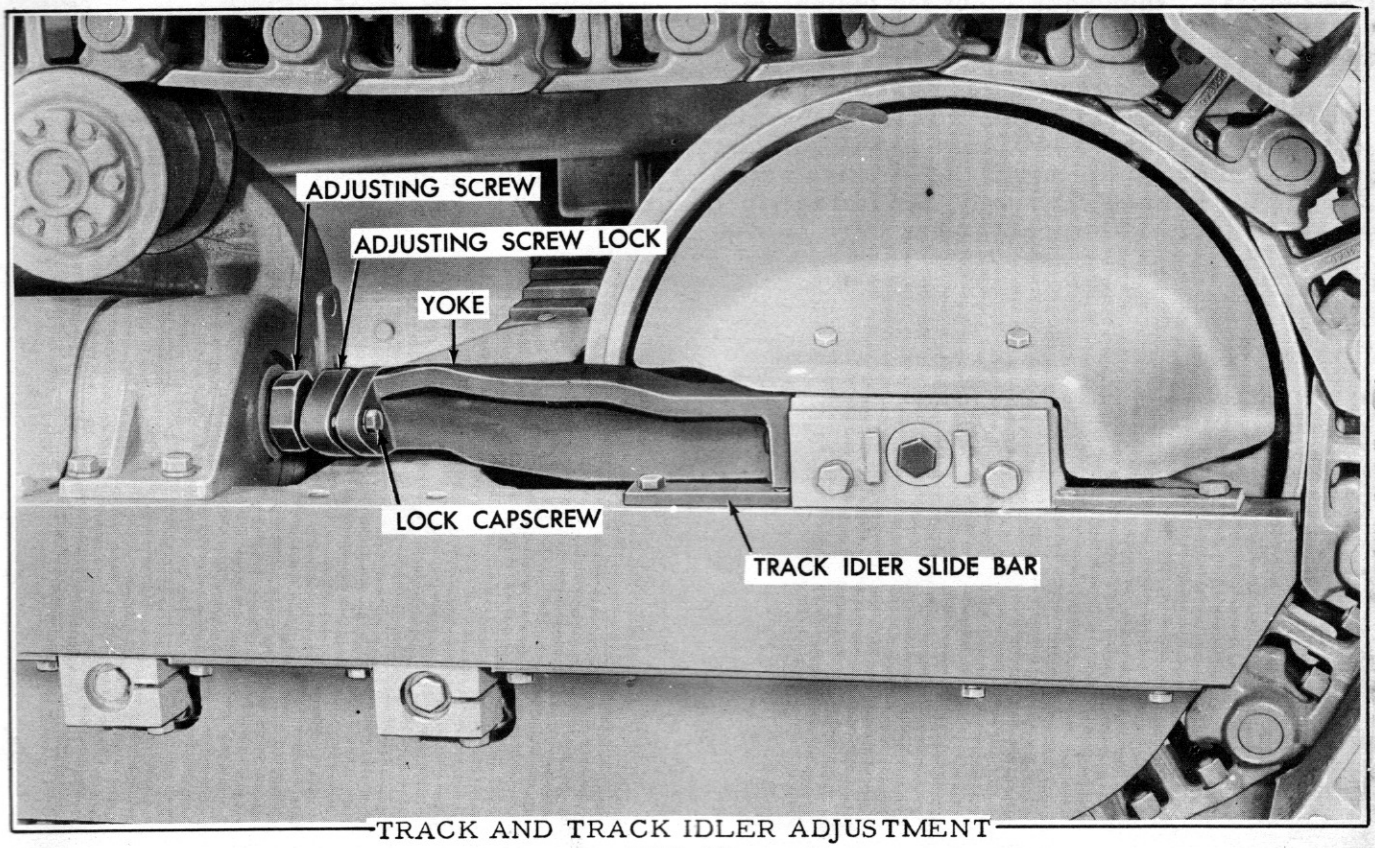
2. Refer to illustration of brake assembly. Turn the brake adjuster clockwise until the brake band is drawn tight around the drum, then turn the adjuster back about two turns.

3. Loosen the jam nut on the brake band supporting screw in the bottom of the housing. Turn the screw in until the brake band is forced against the drum, then back it out 1/2 turn to allow clearance between the band and the drum. Tighten the jam nut.

4. Drive the tractor back and forth and test the brake action. The pedals should have approximately 2" of free travel and the brakes should engage fully before the pedals reach the forward end of the slots in the floor plate. Make further adjustment on the brake adjuster, if necessary, to obtain the correct ...ee tra..el and pro e ... ...en. ...t. Repla... the cover.

NOTE: The head of the brake adjuster must be turned so the locking ears on the bottom of the cover will slip over the adjuster head when the cover is installed.

TRACK AND TRACK IDLER ADJUSTMENT



TRACK AND TRACK IDLER ADJUSTMENT
FIG. 34

The tracks are correctly adjusted when the upper part of the tracks can be pried up 1-1/2" to 2" above the support rollers with the use of a bar. Proper adjustment is important because rapid wear will occur on the tracks and other affected parts if the tracks are too tight or too loose.

To adjust each track, loosen the capscrew in the adjusting screw lock, then turn the adjusting screw out of the idler yoke to force the track idler ahead and tighten the track, or turn the screw into the yoke to loosen the track. Run the tractor forward and backward a few times, then check the adjustment of the track. When the correct adjustment of the track is obtained, tighten the capscrews in the lock.

Inspect the upper and lower track idler slide bars. If they are worn excessively they must be turned or replaced to renew the wearing surfaces. Add or remove shims between the lower slide bars and truck frames to provide a sliding fit between the track idler brackets and the slide bars.

If the track idler flange is wearing unevenly or cutting on one side, because it is not centered in the track rail assembly, adjust. Remove the track idler guiding plates and move sufficient shims from the side which shows no wear to the side which shows excessive wear. Reinstall the guiding plates.

PREPARATION OF TRACTOR FOR STORAGE

If the tractor is to be stored during the winter or slack season, make a complete inspection of the machine for loose, worn, or damaged parts and make the necessary repairs before it is stored.

Drain the engine crankcase and all other oil compartments and flush and refill them with new oil. To protect the fuel injection system, drain the fuel tank, then pour about ten gallons of a mixture of 40% mineral seal oil and 60% "Perfection" kerosene into the tank and run the engine for 15 minutes to circulate this mixture through the entire fuel system. This will leave the fuel system filled with the mixture and will prevent corrosion or gumming of the working parts. Major oil companies can supply this storage fuel mixture. After the tractor has been stored, finish filling the tank with regular diesel fuel oil to minimize condensation in the tank.

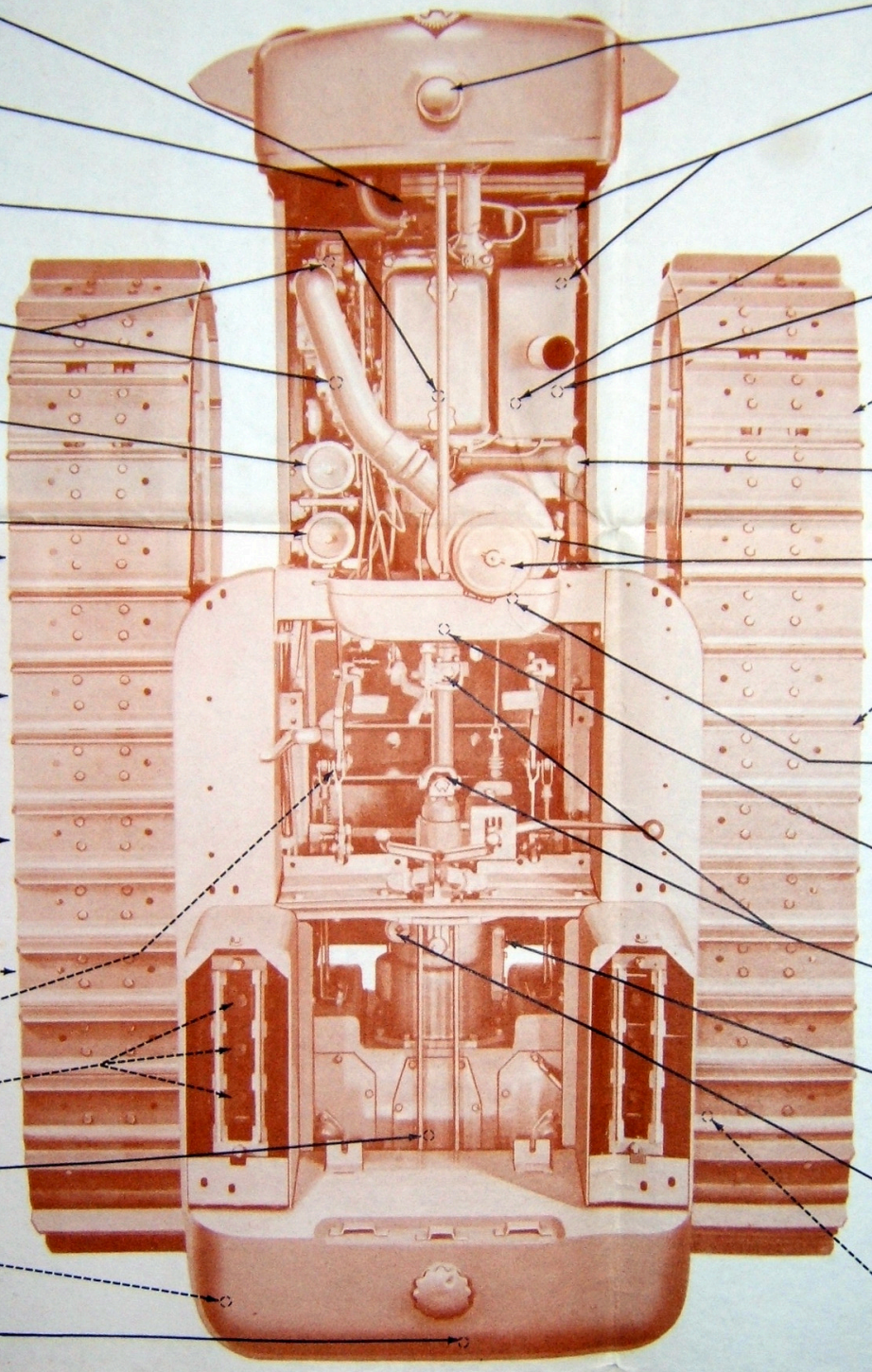
NOTE: This mixture of storage fuel and diesel fuel need not be drained when the tractor is again placed in service.

Remove the batteries, clean and store them in a cool, dry place. Test them once a month and recharge them if the specific gravity of the electrolyte falls below 1.250. The recharging is necessary to prevent their freezing in cold weather.

Drain the cooling system or fill it with an anti-freeze solution that will withstand the lowest anticipated temperature. Cover the exhaust pipe.

MODEL HD5 TRACTOR

LUBRICATION CHART



FAN
200 Hour Service
REFER TO FIG. E

RADIATOR DRAIN COCK
Periodic Service
REFER TO FIG. O

CRANKCASE DRAIN PLUG
75 Hour Service
REFER TO FIG. A

STARTER OIL CUPS
200 Hour Service
REFER TO FIG. F

LUBRICATING OIL FILTER
75 Hour Service
REFER TO FIG. E

FIRST STAGE FUEL FILTER
10 Hour Service
Periodic Service
REFER TO FIG. E

TRUCK WHEELS
1000 Hour Service
REFER TO FIG. L

BRAKE PEDAL LEVERS
200 Hour Service
REFER TO FIG. H

BATTERIES
75 Hour Service
REFER TO FIG. G

TRANSMISSION OIL DRAIN PLUG
1000 Hour Service
REFER TO FIG. I

FINAL DRIVE FILLER AND OIL LEVEL PLUGS
75 Hour Service
REFER TO FIG. J

FUEL TANK DRAIN ELBOW AND DRAIN COCK
10 Hour Service
REFER TO FIG. D

RADIATOR FILLER CAP
10 Hour Service
REFER TO FIG. A

GENERATOR OIL CUPS
200 Hour Service
REFER TO FIG. A

SECOND STAGE FUEL FILTER
10 Hour Service
Periodic Service
REFER TO FIG. A

CRANKCASE OIL LEVEL GAGE ROD
10 Hour Service
REFER TO FIG. A

TRACK IDLERS
1000 Hour Service
REFER TO FIG. N

CRANKCASE OIL FILLER TUBE
75 Hour Service
REFER TO FIG. A

AIR PRE-CLEANER AND AIR CLEANER
10 Hour Service
REFER TO FIGS. B & C

TRACK SUPPORT ROLLERS
1000 Hour Service
REFER TO FIG. M

ENGINE CLUTCH
75 Hour Service
REFER TO FIG. K
(See NOTE)

ENGINE CLUTCH SHAFT REAR BEARING
200 Hour Service
REFER TO FIG. H

DRIVE SHAFT UNIVERSAL JOINTS
1000 Hour Service
REFER TO FIG. H

TRANSMISSION OIL LEVEL PLUG
75 Hour Service
REFER TO FIG. H

TRANSMISSION OIL FILLER PLUG
75 Hour Service
1000 Hour Service
REFER TO FIG. I

FINAL DRIVE OIL DRAIN PLUGS
1000 Hour Service
REFER TO FIG. J

LEGEND

- 10 Hour Service
- 75 Hour Service
- 200 Hour Service
- 1000 Hour Service
- Periodic Service
- Lubricate dotted arrow points on both sides of the tractor.

ALLIS-CHALMERS

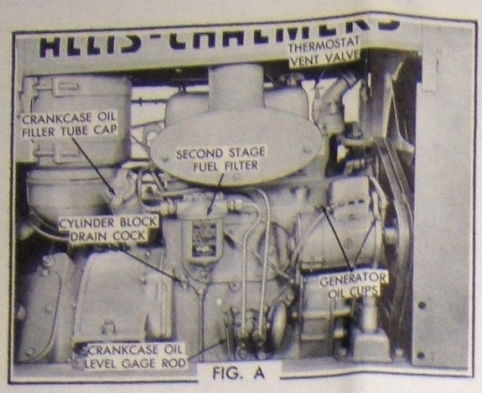


FIG. A

CRANKCASE OIL LEVEL GAGE ROD — 10 Hour Service. Check oil level and add oil if necessary to raise level to "FULL" mark on gage rod.

CRANKCASE OIL FILLER TUBE AND DRAIN PLUG — 75 Hour Service. Change oil. Operating conditions may necessitate this service at shorter intervals. Remove the small plate in the bottom of the crankcase guard to reach the drain plug. Remove the drain plug and allow the oil to drain, reinstall and tighten the drain plug, and reinstall the plate in the crankcase guard. Fill the crankcase with new oil to the "FULL" mark on the gage. Refer to the "Specifications of Lubricants" on this chart. Cap. 2 Gal.

RADIATOR FILLER CAP — 10 Hour Service. Check level of coolant and add if necessary. Keep the system filled with clean soft water or anti-freeze solution.

SECOND STAGE FUEL FILTER — 10 Hour Service. Open the filter drain cock before the engine is started at the beginning of an operating period and allow the water and sediment to drain. Close the drain cock when clean fuel runs out. In freezing weather, drain at the end of an operating period.

SECOND STAGE FUEL FILTER — Periodic Service. Install a new element every 300 to 500 hours of operation (more often if conditions warrant) or when the filter becomes clogged.

GENERATOR OIL CUPS — 200 Hour Service. Lubricate with 4 drops of light engine oil in each of the two oil cups.

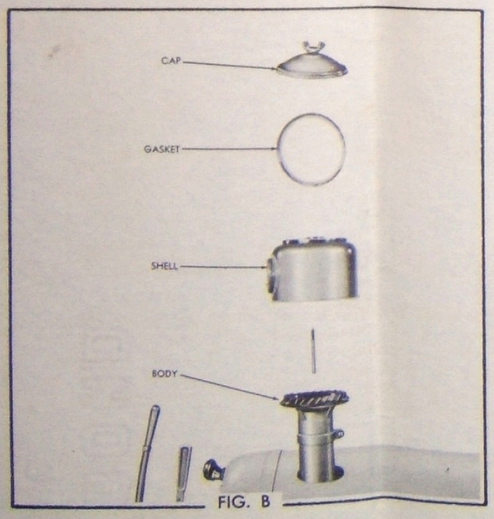


FIG. B

AIR PRE-CLEANER — 10 Hour Service. Empty the dirt from Shell when level reaches half-way up on the inspection glass. Remove the cap, lift the shell from the body, and clean the shell thoroughly. Reinstall the shell, gasket, and cap and tighten the wing nut. Make certain that the gasket is in good condition and properly installed.

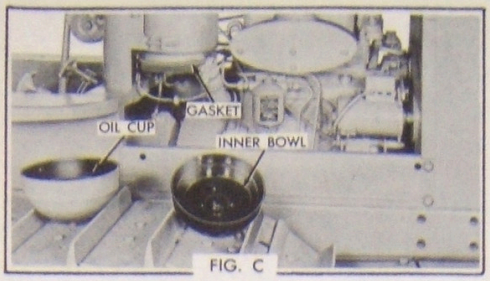


FIG. C

AIR CLEANER — 10 Hour Service. Remove the oil cup from bottom of cleaner and inspect condition and level of oil. If oil is discolored or there is a layer of dirt in cup and on the inner bowl, the oil must be changed. Empty the oil cup and wash and clean the cup and inner bowl thoroughly. Make certain that the oil cup gasket is in good condition and properly installed. Refill with the specified oil to the top of cone in the center of bowl and maintain the oil at this level. Cap. 2½ Qts.

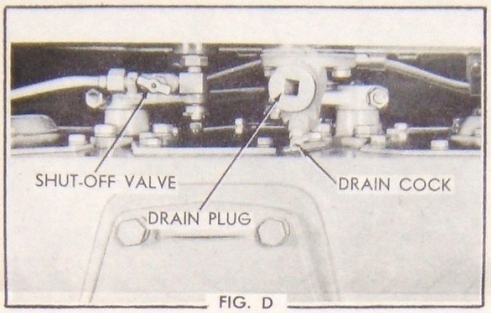


FIG. D

FUEL TANK DRAIN ELBOW AND DRAIN COCK — 10 Hour Service. Open the drain cock in the elbow before the engine is started at the beginning of an operating period and allow the water and sediment to drain. Close the drain cock when clean fuel runs out. In freezing weather, drain at the end of an operating period.

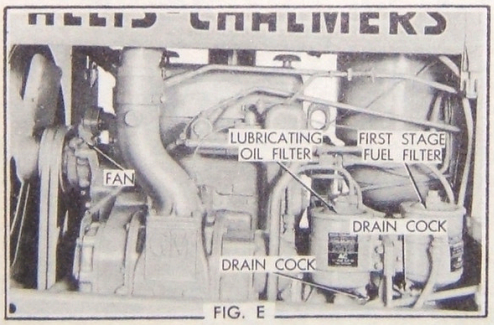


FIG. E

FIRST STAGE FUEL FILTER — 10 Hour Service. Open the filter drain cock before the engine is started at the beginning of an operating period and allow the water and sediment to drain. Close the drain cock when clean fuel runs out. In freezing weather, drain at the end of an operating period.

FIRST STAGE FUEL FILTER — Periodic Service. Install a new element every 300 to 500 hours of operation (more often if conditions warrant) or when the filter becomes clogged.

LUBRICATING OIL FILTER — 75 Hour Service. Drain filter shell, remove old element, clean shell, and install new element kit.

FAN — 200 Hour Service. 1 Lube Fitting. Lubricate with pressure gun lubricant. Refer to "Specifications of Lubricants."

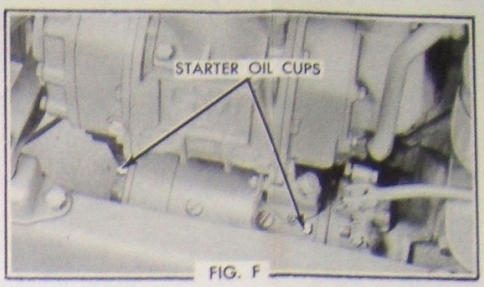


FIG. F

STARTER OIL CUPS — 200 Hour Service. If the starter is of the type containing the oil cups, lubricate with 4 drops of light engine oil in each of the two oil cups.

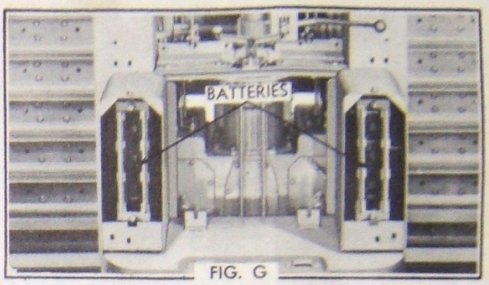


FIG. G

BATTERIES — 75 Hour Service. 3 Points each battery. Inspect electrolyte level and test with hydrometer. Add clean distilled water to keep level ⅜ inch above plates. Keep tops of batteries clean and terminals free from corrosion.

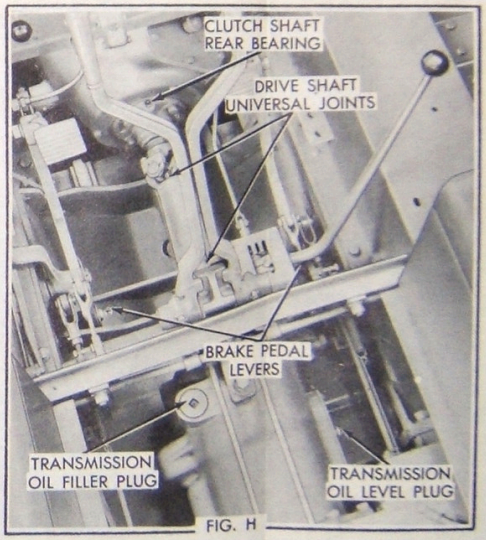


FIG. H

TRANSMISSION OIL LEVEL PLUG — 75 Hour Service. Check oil level and add oil if necessary to raise level even with level plug.

BRAKE PEDAL LEVERS — 200 Hour Service. 1 Lube fitting each side. Lubricate with pressure gun lubricant.

CLUTCH SHAFT REAR BEARING — 200 Hour Service. 1 Lube Fitting. Lubricate with pressure gun lubricant.

DRIVE SHAFT UNIVERSAL JOINTS — 1000 Hour Service. 2 Lube fittings. Remove the floor plates to reach the lube fittings. Lubricate with pressure gun lubricant.

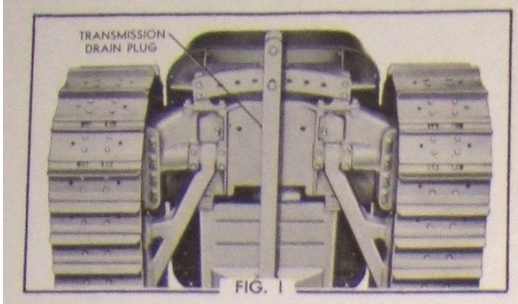


FIG. I

TRANSMISSION OIL FILLER PLUG (shown in Fig. H) — 75 and 1000 Hour Service **AND TRANSMISSION OIL DRAIN PLUG** — 1000 Hour Service. Change oil. Climatic or operating conditions may require this service at shorter intervals. Remove the drain plug and allow oil to drain. Reinstall and tighten drain plug. Fill the transmission through oil filler plug opening to level even with level plug shown in Fig. H. Use the specified lubricant for the prevailing air temperature. Cap. 5 Gal.

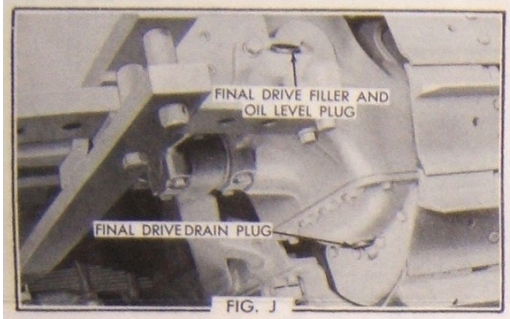


FIG. J

FINAL DRIVE FILLER AND OIL LEVEL PLUGS — 75 Hour Service. 1 Plug each side. Check oil level and add oil if necessary to raise level even with filler plug opening.

FINAL DRIVE OIL DRAIN PLUGS — 1000 Hour Service. 1 Plug each side. Change oil. Climatic or operating conditions may require this service at shorter intervals. Remove each drain plug and allow oil to drain. Reinstall and tighten each drain plug. Fill each final drive through oil filler plug opening to level even with opening. Use the specified lubricant for the prevailing air temperature. Cap. 3 Gal. each.

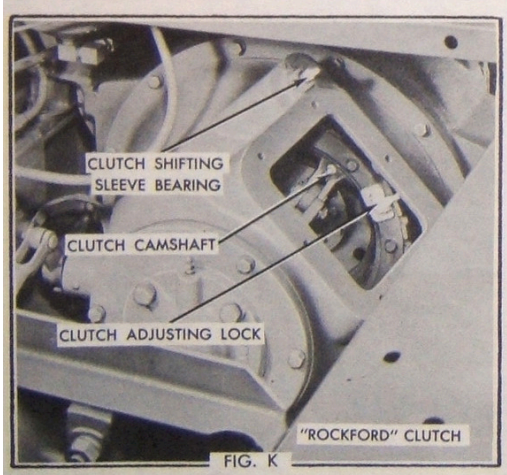


FIG. K

ENGINE CLUTCH — NOTE: The tractor may be equipped with either an "Auburn" or a "Rockford" Engine Clutch. Remove the clutch housing inspection cover. Refer to Fig. 29 in HD5 OPERATORS MANUAL, determine which type clutch is installed in the tractor. Later tractors have a "DECAL" on the inspection cover indicating the type clutch installed in the tractor.

ENGINE CLUTCH SHIFTING SLEEVE BEARING — 75 Hour Service. 1 Lube fitting (on either type clutch). Lubricate with pressure gun lubricant.

ENGINE CLUTCH CAMSHAFTS — 75 Hour Service ("Rockford" Clutch only). 3 Lube fittings. Remove the clutch housing inspection cover and front floor plate, then rotate engine clutch as necessary using engine starter to reach the three lube fittings. Lubricate with pressure gun lubricant. Do not allow excess grease to get on clutch disc. Lubricate more often if necessary for ease of operation.

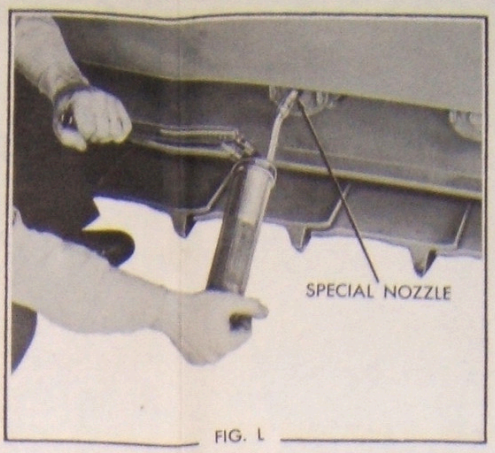


FIG. L

TRUCK WHEELS — 1000 Hour Service. 4 Truck wheels on each side on HD5A and HD5B models. The HD5G and HD5F models have 5 Truck wheels on each side. Lubricate with the specified truck wheel grease. A lubricator and special nozzle are included in the tool equipment shipped with each tractor. This lubricator and special nozzle MUST be used to inject grease into the truck wheel, track idlers, and track support rollers as the use of "high pressure" lubricating equipment will damage the seal boots which are a part of the positive seal assemblies. Pump the hand lubricator slowly when servicing.

Service each wheel as follows:

1. Wash the outer end of the wheel shaft and the special nozzle of the lubricator so that no dirt will enter with the grease.
2. Remove the plug and copper gasket from end of shaft.
3. Insert the special nozzle of the lubricator into the shaft as far as it will go and hold it in that position.
4. Pump grease into the wheel until clean grease is forced out the end of the shaft around the special nozzle. This will indicate that the wheel is full of clean grease.
5. Remove the special nozzle and install the shaft plug and gasket. Tighten the shaft plug securely.

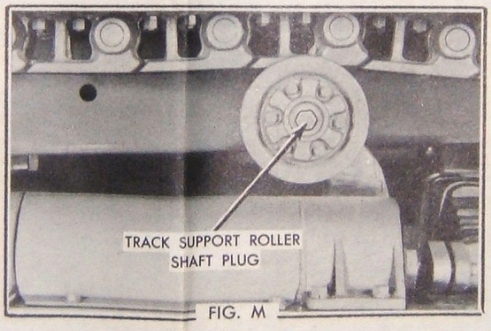


FIG. M

TRACK SUPPORT ROLLERS — 1000 Hour Service. 1 Roller each Side. Lubricate with the specified truck wheel grease. Use the same lubricator and special nozzle as used for lubricating the truck wheels. Refer to Figure L. Follow steps 1 through 5 under "Truck Wheels" and lubricate the track support rollers in the same manner.

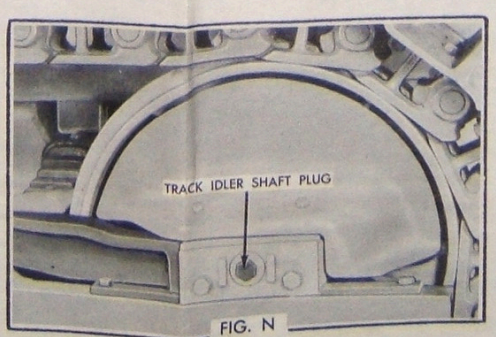


FIG. N

TRACK IDLERS — 1000 Hour Service. 1 Idler each side. Lubricate with the specified truck wheel grease. Use the same lubricator and special nozzle as used for lubricating the truck wheels. Refer to Figure L. Follow steps 1 through 5 under "Truck Wheels" and lubricate the track idlers in the same manner.

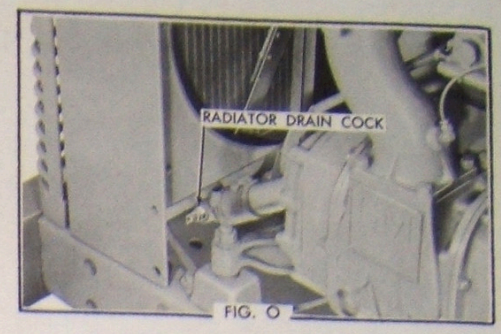


FIG. O

RADIATOR DRAIN COCK — Periodic Service. Drain and flush the cooling system periodically. To drain, turn the thermostat vent valve to the open position (up), open the radiator drain cock, and open the cylinder block drain cock (shown in Fig. A). Fill the system with clean soft water or anti-freeze solution.

To fill the system, close the radiator and the cylinder block drain cocks. Open the thermostat vent valve (turn up as far as it will go), then fill the system through the radiator. Close the thermostat vent valve (turn down as far as it will go).

PERIODIC SERVICES
(Not Shown on Chart)

ENGINE CLUTCH ADJUSTMENT — Check the pounds pull required on the clutch operating lever to engage the engine clutch. Keep the clutch adjusted so that a maximum pull of 50 pounds is required on the operating lever for its engagement.

STEERING CLUTCH ADJUSTMENT — Check the adjustment of each clutch. Keep the clutches adjusted so that each steering lever has 3" free travel when measured at the top of the lever. Readjustment MUST be made when the free travel has decreased to 1".

BRAKE ADJUSTMENT — Check the adjustment of each brake. Keep the brakes adjusted so that each brake pedal has 1¾" to 2" free travel before brake application begins.

TRACK ADJUSTMENT — Check the adjustment of each track. Keep the tracks adjusted so that the upper part of each track can be lifted 1½" to 2" above the support roller with the use of a pry bar.

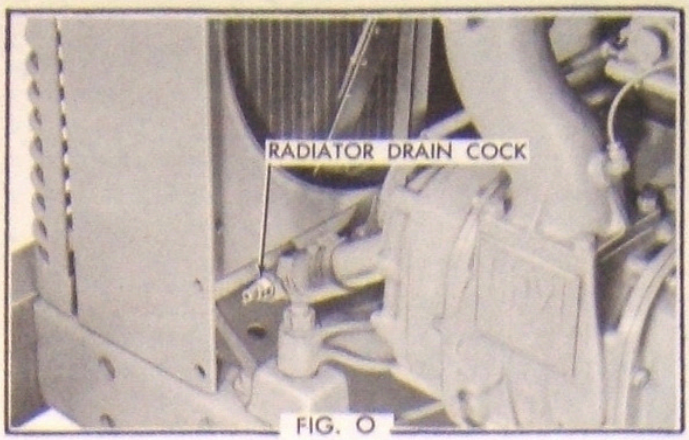


FIG. O

RADIATOR DRAIN COCK — Periodic Service. Drain and flush the cooling system periodically. To drain, turn the thermostat vent valve to the open position (up), open the radiator drain cock, and open the cylinder block drain cock (shown in Fig. A). Fill the system with clean soft water or anti-freeze solution.

To fill the system, close the radiator and the cylinder block drain cocks. Open the thermostat vent valve (turn up as far as it will go), then fill the system through the radiator. Close the thermostat vent valve (turn down as far as it will go).

PERIODIC SERVICES
(Not Shown on Chart)

ENGINE CLUTCH ADJUSTMENT — Check the pounds pull required on the clutch operating lever to engage the engine clutch. Keep the clutch adjusted so that a maximum pull of 50 pounds is required on the operating lever for its engagement.

STEERING CLUTCH ADJUSTMENT — Check the adjustment of each clutch. Keep the clutches adjusted so that each steering lever has 3" free travel when measured at the top of the lever. Readjustment MUST be made when the free travel has decreased to 1".

BRAKE ADJUSTMENT — Check the adjustment of each brake. Keep the brakes adjusted so that each brake pedal has 1¾" to 2" free travel before brake application begins.

TRACK ADJUSTMENT — Check the adjustment of each track. Keep the tracks adjusted so that the upper part of each track can be lifted 1½" to 2" above the support roller with the use of a pry bar.

SPECIFICATIONS OF LUBRICANTS

Engine Crankcase

USE NON-CORROSIVE DIESEL ENGINE LUBRICATING OIL CONTAINING ADDITIVES WHICH WILL PREVENT SLUDGE OR GUM DEPOSITS. UNDER NO CIRCUMSTANCES SHOULD A CORROSIVE DIESEL ENGINE LUBRICATING OIL EVER BE USED.

Use oil of the following viscosity:

Atmospheric Temperature	Viscosity
Above 32°F.	Use SAE 30
0°F. to 32°F.	Use SAE 20W
0°F. and below	Use SAE 10W

Engine Air Cleaner

Use the same viscosity oil as used in the engine crankcase for the prevailing air temperature.

NOTE: SOME DIESEL ENGINE LUBRICATING OILS MAY FOAM WHEN USED IN THE AIR CLEANER. DO NOT USE AN OIL THAT FOAMS AS IT REDUCES AIR CLEANER EFFICIENCY AND IN SOME CASES ALLOWS THE OIL TO BE PULLED OVER INTO THE ENGINE, CAUSING SERIOUS DAMAGE.

Transmission and Final Drive

Lubricate these assemblies with a good grade of engine oil purchased from a reputable oil company.

Use oil of the following viscosity:

Atmospheric Temperature	Viscosity
Above 32°F.	Use SAE 50
32°F. and below	Use SAE 30

Truck Wheels, Track Idlers, and Track Support Rollers

Lubricate these assemblies with a grease that has been tested and found satisfactory for use by the Allis-Chalmers Manufacturing Company.

A revised list of tested greases is issued every six months and greases which have been tested during each period are added to the list. Ask your nearest "Allis-Chalmers" authorized dealer for the latest list.

Pressure Gun Lubricant

Use a ball and roller bearing lubricant with a minimum melting point of 300°F. This lubricant should be in a viscosity range so as to insure easy handling in the pressure gun at prevailing air temperature. The ball and roller bearing lubricant must be water proof.

IMPORTANT: THOROUGHLY CLEAN ALL LUBRICATION FITTINGS, CAPS, FILLER AND LEVEL PLUGS AND THEIR SURROUNDING SURFACES BEFORE SERVICING. PREVENT DIRT FROM ENTERING WITH THE LUBRICANT.