

Operator's Instructions

for

CATERPILLAR

Reg. U. S. Pat. Off.

DIESEL D2 TRACTOR

Serial Numbers

4U1-up

5U1-up

CATERPILLAR TRACTOR CO.

PEORIA

ILLINOIS

U. S. A.

FORM 10953-3

Avoid Accidents

Most accidents, whether they occur in the air, in industry, on the farm, at home, on the highways, or at sea, are caused by someone's failure to follow simple and fundamental safety rules or precautions. For this reason most accidents can be prevented by recognizing the real cause and doing something about it before the accident occurs.

Regardless of the care used in the design and construction of any type of equipment, there are many conditions that cannot be completely safe-guarded against without interfering with reasonable accessibility and efficient operation.

A careful operator is the best insurance against an accident.

The complete observance of one simple rule would prevent many thousands of serious injuries each year. That rule is: "Never attempt to clean, oil or adjust a machine while it is in motion."

Foreword

"Caterpillar" products are a combination of advanced engineering, skilled manufacturing, and the finest materials metallurgical science can select. Thousands of satisfying, economical working hours are built into each machine.

Whether or not the owner derives the maximum of service from his machine depends largely on the care exercised in its operation and maintenance. This book is written to give the operator essential information regarding the day-to-day operation, lubrication and adjustment of the machine. Careful adherence to these instructions will result in assured economy.

A great many "Caterpillar" owners depend upon their dealer for service other than the care and adjustments described in this book. This practice is recommended because "Caterpillar" dealers have stocks of genuine "Caterpillar" parts and are equipped with tools designed and built by "Caterpillar". Their servicemen are factory-trained and are kept closely informed by the factory regarding advanced methods of servicing "Caterpillar" products — thus, in all ways they are equipped to render the best of service.

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ATTACHMENT INSTRUCTIONS

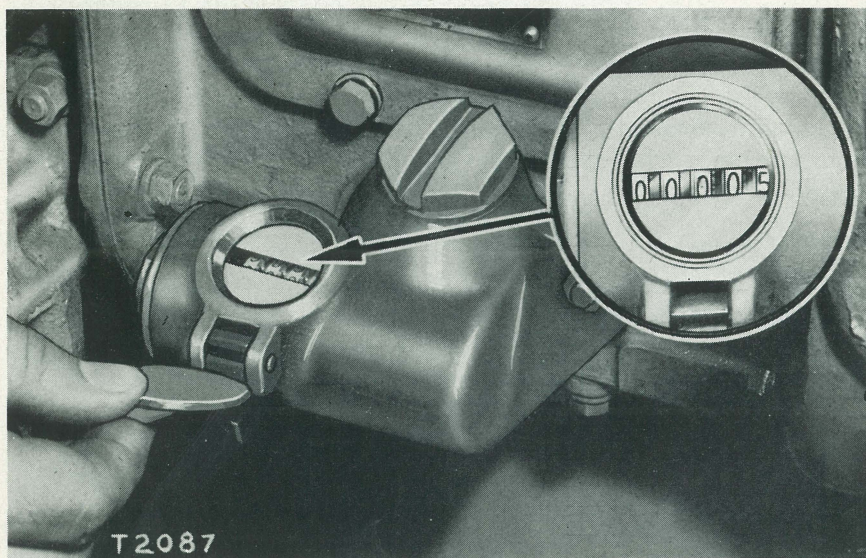
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Lubrication Instructions

GENERAL LUBRICATING INFORMATION

Careful attention to the following information on lubricants and their proper selection will add much to performance, economy and long life of your tractor. The lubrication chart specifies the lubricants to be used, the points to be serviced and the hourly intervals of servicing according to "Hour Meter" hours.

All time intervals in the lubrication chart and maintenance instructions are for "Hour Meter" hours, therefore, daily readings will tell when to service the tractor. The "Hour Meter" is located on the left of the engine near the bottom of the fuel injection pump housing. It does not keep pace with the clock but when the crankshaft turns as many revolutions as are made in an hour at normal operating speed, the dial advances one number.



COVER ON HOUR METER RAISED TO OBSERVE DIAL READING

Drain oil, check oil levels and refill compartments with the tractor level. It is best to drain oil when it is warm, after the tractor has run for some time. Then, most of the sediment will be in suspension, and therefore, will readily drain.

Use the brush supplied in the tool equipment when removing dirt from fittings and cleaning around air cleaners, breathers, and inspection covers. Lubricate all miscellaneous points, not equipped with fittings, with crankcase lubricating oil every 60 hours.

Naturally, any precautions taken during cold weather to house the tractor, cover it with a tarpaulin, or warm it before starting, will cause more rapid oil distribution and contribute to quicker starting. The engine should always be allowed to idle at not less than half engine speed for

several minutes after starting to assure adequate lubrication before operating at normal load.

All oil companies have adopted the S.A.E. (Society of Automotive Engineers) viscosity number system which classifies crankcase lubricating oils and transmission oils in terms of viscosity or fluidity. The oils with the lower numbers are lighter, and flow more readily than do the oils with higher numbers. The S.A.E. number refers only to the viscosity of the oil, and has reference to no other characteristic or property.

The following topic recommends the types, viscosities and grades of lubricants best suited for use in your tractor for various operating temperatures.

LUBRICANTS

Crankcase Lubricating Oil: (Abbreviated CO).

At temperatures above freezing, S.A.E. No. 30 oil should be used in all compartments. At temperatures below freezing S.A.E. No. 10 oil should be used to provide better circulation and to make cranking easier.

In sub-zero operation, it is advisable to dilute the oils with kerosene so they will be fluid enough to insure free circulation. However, evaporation in the engine crankcase under steady operation makes it necessary to add kerosene to maintain proper fluidity. This should be done before stopping; then operate the engine for a few minutes to mix the kerosene and oil.

NOTE

Detergent type oils that are recommended for use in "Caterpillar" Diesel Engines will, within a short period of operation, become much darker in color. This should not be any cause for concern. The darkening of the oil is due to minute particles of carbon, resulting from the combustion process, being held in suspension in the oil. This ability to hold carbon particles in suspension is one of the primary functions of a detergent type lubricant. Otherwise, these particles would settle out, eventually leading to objectionable deposits in the engine. When the oil darkens therefore, it is an indication that it is keeping the engine clean and insuring satisfactory lubrication performance.

(CO) U. S. Army Specifications 2-104B Oils: The crankcase lubricating oils which will provide most satisfactory service in "Caterpillar" Diesel Engines under most conditions are those which conform to U. S. Army Specification 2-104B. These oils have been developed specifically for use in Diesel engines and other heavy duty service. All of these oils are marketed domestically and some are marketed in export territories. Your oil dealer having products qualified by Ordnance Department as conforming to this specification can provide you with such information.

(CO) Straight Mineral or U. S. Army Specification 2-104B Oils: In compartments other than the Diesel engine crankcase where crankcase lubricating oil is recommended, (such as starting engine crankcase, Diesel and starting engine air cleaners, fuel injection pump housing) use either

straight mineral crankcase lubricating oil or an oil conforming to U. S. Army Specifications 2-104B, whichever is most convenient and economical.

(CO) Superior Lubricants (Series 2): Lubricating oils known as Superior Lubricants (Series 2) for "Caterpillar" Diesel Engines should be used in the crankcase for most satisfactory service when operating on fuels of sulphur content higher than 0.5 per cent. See the topic, FUELS and consult your "Caterpillar" dealer for brand names of Superior Lubricants (Series 2) lubricating oils.

When the sulphur content of the fuel is greater than 1. per cent, it may be necessary to reduce oil change periods. When the sulphur content of the fuel is 1.5 per cent or higher, reduce oil change periods to 120 hours.

Ball And Roller Bearing Lubricant: (Abbreviated BR).

(BR) This lubricant is a mixture of mineral oil and metallic soaps. Use No. 2 grade for most temperatures. For extremely low temperatures use No. 0 or No. 1 grade.

This grease can be applied to all bearing points — plain bushings, ball bearings and roller bearings — where equipped with hydraulic pressure fittings or when bearings are hand packed.

Use only a high grade Ball and Roller Bearing Grease of short fiber. This grease must be satisfactory in anti-friction bearings at speeds up to 3000 RPM at a maximum temperature of 300° F. It is a grease with sufficient adhesive qualities to cling to the bearings in all extremes of high and low operating temperatures. Greases of this kind have been classified by grades by the N.L.G.I. (National Lubricating Grease Institute) designated in order of "worked" penetration or consistency.

Track Roller Lubricant: (Abbreviated RL).

(RL) This is a stringy, tacky lubricant of a semi-fluid consistency at the prevailing atmospheric temperature. This lubricant developed for track rollers is recommended for use at points provided with button head fittings. It can be handled readily in the standard volume compressor.

In sub-zero weather, crankcase lubricating oils may be used when track roller lubricant is too heavy to be handled in the compressor.

Transmission Oil: (Abbreviated TO).

(TO) Use a straight mineral transmission oil that will flow and will not channel at existing operating temperatures. For temperatures above freezing use S.A.E. No. 90 oil. When operating continuously in extremely hot temperature use S.A.E. No. 140 oil. Below freezing, an oil of lower viscosity S.A.E. No. 80, will be required. In extremely cold weather the oil should be diluted with sufficient kerosene to provide fluidity.

◆
CAUTION

Under no circumstances should the track be lubricated. The stiffness noted between the links of a new track is not caused by a lack of clearance between the track pins and bushings, and it will disappear as the track wears in.

LUBRICATION CHART

CATERPILLAR

REG. U. S. PAT. OFF.

DIESEL D2 TRACTOR

The folded page is arranged to serve two purposes:

First, it is a complete outline of all the information required to lubricate the tractor.

Second, the illustration and identification of points of lubrication can be used with the detailed illustrations and information on the pages following the chart as a reference for lubricating and service information.

Key To Lubricants

CO Crankcase Lubricating Oil. TO Transmission Oil.
BR Ball and Roller Bearing Lubricants. RL Track Roller Lubricant.

Lubrication Points Charted Under Hourly Intervals By Lubricants

INTERVALS	Every 5 HRS.	Every 10 HRS.	Every 20 HRS.	Every 60 HRS.	Every 120 HRS.	Every 240 HRS.	Every 480 HRS.	Every 900 HRS.
LUBRICANTS								
CO	*14	1-6-10		12-14	6-7-8-10-12	6-7-8-10-12-14		
BR			2-16			5-9		
RL	**11-13 15		11-15	#13	13			
TO			4		3-17		†3	3-17

Identification Of Points Of Lubrication And Lubricants To Apply

- 1 STEERING CLUTCH RELEASE BEARING CO

2 SHAFT BEARINGS FOR STEERING CLUTCH AND FLYWHEEL CLUTCH CONTROLS BR

3 FINAL DRIVE TO

4 FLYWHEEL CLUTCH SHIFT COLLAR TO

5 FLYWHEEL CLUTCH PILOT BEARING BR

6 STARTING ENGINE CRANKCASE . . CO

7 STARTING ENGINE CLUTCH . . . CO
- 8 FUEL INJECTION PUMP HOUSING CO

9 FAN BEARINGS BR

10 DIESEL ENGINE CRANKCASE LUBRICATING OIL SYSTEM . . . CO

11 FRONT IDLERS RL

12 STARTING ENGINE AIR CLEANER . CO

13 TRACK ROLLERS RL

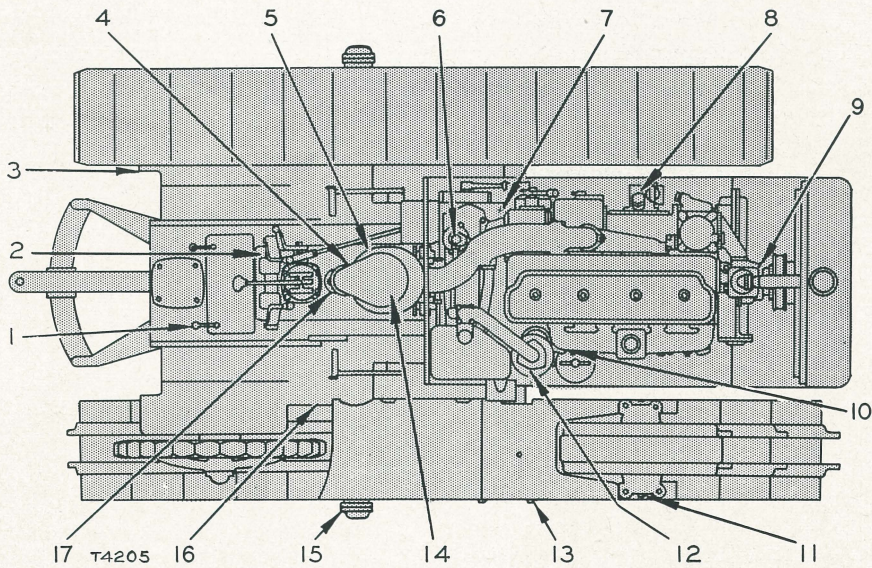
14 DIESEL ENGINE AIR CLEANER . CO

15 TRACK ROLLER FRAME BEARINGS . RL

16 BRAKE PEDAL SHAFT BEARINGS . BR

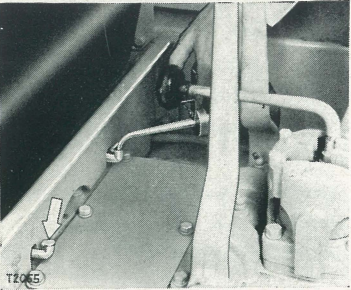
17 TRANSMISSION TO

Location Of Points Of Lubrication

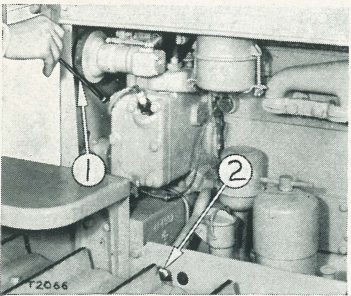


*Only when operating in extremely dusty conditions. **Only when operating in deep mud and water.
†Only when operating in extremely dusty conditions or deep mud and water.
‡Only on tractors before 4U2389 and 5U3860.

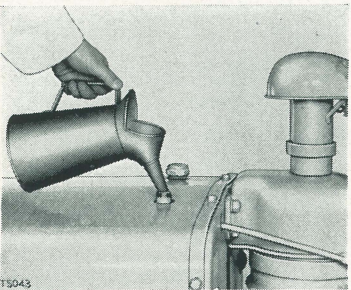
CO CRANKCASE LUBRICATING OIL



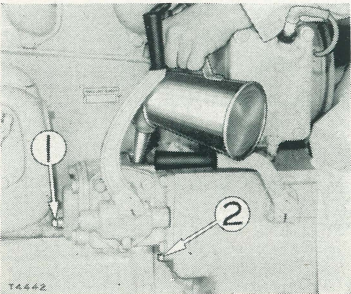
1 STEERING CLUTCH RELEASE BEARINGS
Fill two oil cups, one for each bearing, every 10 hours.



6 STARTING ENGINE CRANKCASE
Check oil level at full mark (1) on gauge every 10 hours. Every 120 to 240 hours, drain (2) and wash. See Topic, "Crankcase Lubricating Oil System".



6 STARTING ENGINE CRANKCASE
Refill crankcase every 120 to 240 hours.



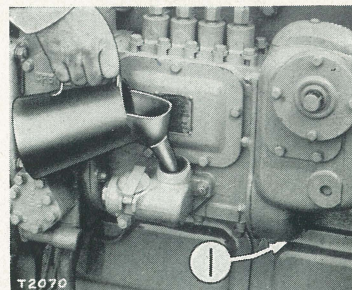
7 STARTING ENGINE CLUTCH
Check oil level by removing plug (1) every 120 hours. Keep lubricant to level plug opening. Drain (2), wash and refill housing every 240 hours. See Topic, "Starting Engine Clutch."

CO CRANKCASE LUBRICATING OIL

8

FUEL INJECTION PUMP HOUSING

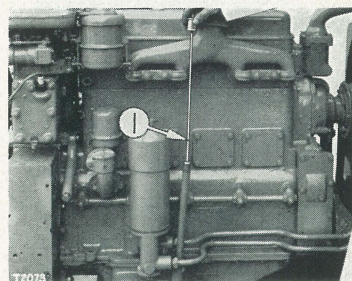
Check level every 120 hours. Keep filled to top of filler opening. Drain (1) and refill every 240 hours.



10

DIESEL ENGINE CRANKCASE

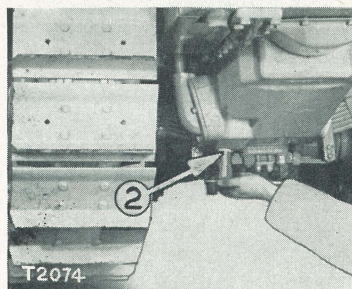
Check oil level with engine running, every 10 hours. Oil should be up to full mark (1) on gauge. See the topic, Crankcase Lubricating Oil—also see Note A.



10

DIESEL ENGINE CRANKCASE

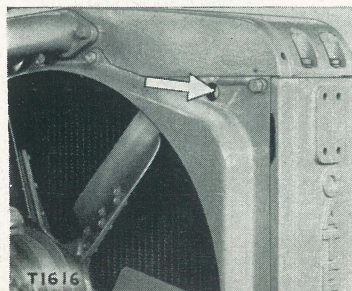
Drain crankcase at (2) every 120 to 240 hours, depending on dust conditions and/or sulphur content of the fuel, while the engine is hot. See topic, "Crankcase Lubricating Oil System."



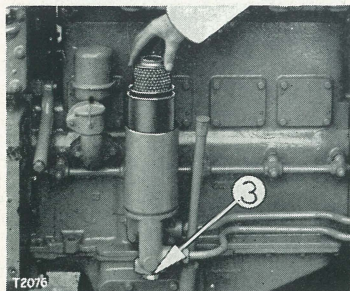
10

DIESEL ENGINE CRANKCASE

Open oil cooler vent valve so the oil will drain more rapidly from the oil cooler each time the crankcase is drained.



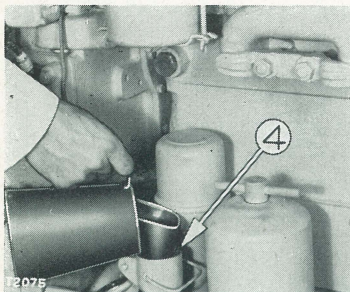
CO CRANKCASE LUBRICATING OIL



DIESEL ENGINE CRANKCASE LUBRICATING OIL FILTER

10

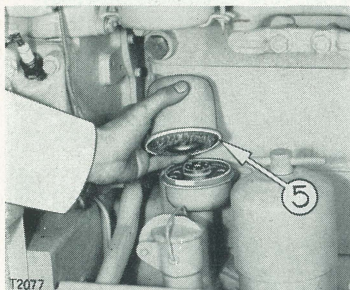
At each oil change period, wash metallic strainer element and replace inner filter element with new element as instructed in the topic, "Crankcase Lubricating Oil System".



DIESEL ENGINE CRANKCASE

10

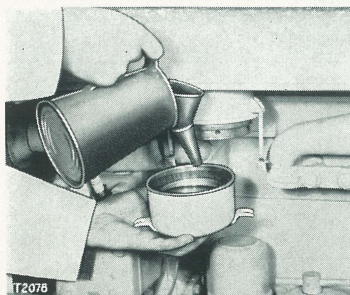
After draining crankcase refill at (4) and start the Diesel engine. Run engine for two minutes then add oil to bring level to full mark on gauge.



DIESEL ENGINE CRANKCASE BREATHER

10

Wash breather element (5) each time crankcase oil is drained. Pour $\frac{1}{4}$ pint (0.12 liter) oil through element and replace.



STARTING ENGINE AIR CLEANER

12

Wash and refill cup every 60 to 120 hours to oil level mark. Wash filter section every 240 hours. See topic, "Air Cleaners".

NOTE A: After the first thirty (30) hours operation of a new Diesel engine, drain and refill the crankcase with either U. S. Army Specification 2-104B oil or, when high sulphur content fuel is being burned in the engine, Superior Lubricants (Series 2) should be used. It is not essential to change the oil filter inner element at this time unless the engine is operating in very dusty conditions.

CO CRANKCASE LUBRICATING OIL

14

DIESEL ENGINE AIR CLEANER CUP

Wash oil cup and refill to circular mark, every 5 to 60 hours, depending on amount of dust.

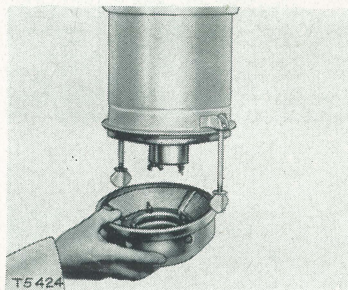


14

DIESEL ENGINE AIR CLEANER SCREENS

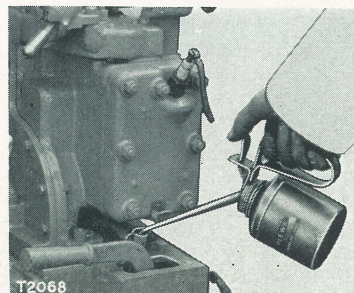
Remove and disassemble the tray assembly and wash the screens every 60 to 240 hours, depending upon dust. See topic, "Air Cleaners".

On earlier models, wash the removable element every 60 to 240 hours.

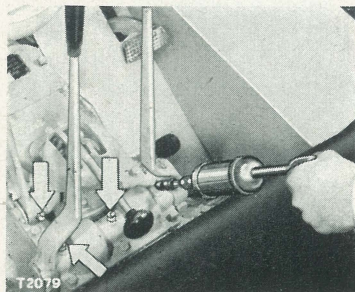


STARTER PINION

Earlier engines are equipped with oil cups. Experience with later engines without oil cups shows that lubrication is not essential at this point. Where cup is provided no lubrication is required and can be removed and a plug installed in its place.



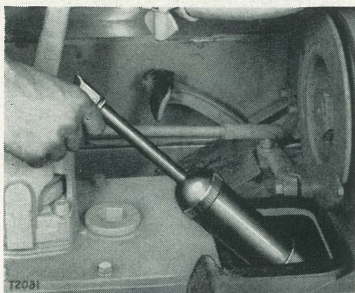
BR BALL AND ROLLER BEARING LUBRICANT



2

STEERING AND FLYWHEEL CLUTCH CONTROL LEVER SHAFTS

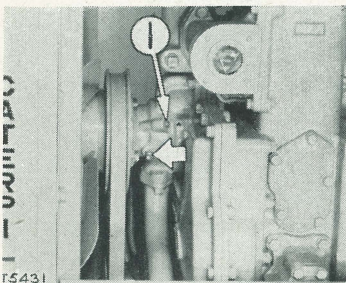
Lubricate four bearings every 20 hours, one fitting for each bearing.



5

FLYWHEEL CLUTCH PILOT BEARING

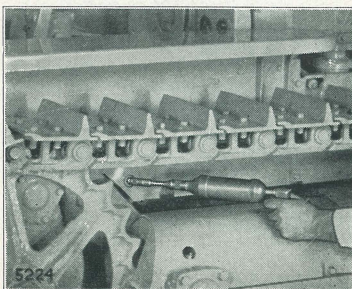
Lubricate bearing every 240 hours. Remove inspection cover, turn flywheel until fitting appears and apply two or three shots of grease.



9

FAN BEARINGS

Lubricate every 240 hours. Lubricate until grease appears at relief valve (1). Wipe off excess grease.



16

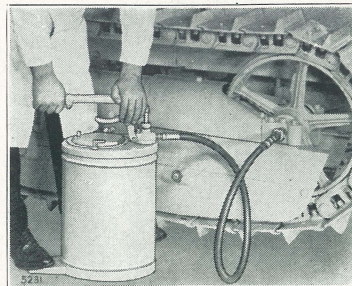
BRAKE PEDAL SHAFT BEARINGS

Lubricate bearings every 20 hours. One fitting on each side of tractor.

RL TRACK ROLLER LUBRICANT

FRONT IDLERS

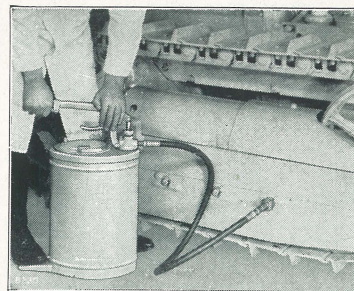
- 11** Lubricate through fitting on both sides of tractor every 20 hours. If operating in deep mud or water, lubricate every 5 hours.



TRACK ROLLERS

- 13** On tractors 4U2389 and 5U3860 up, lubricate each roller on both sides of tractor every 120 hours. On tractors before 4U2389 and 5U3860 lubricate each roller on both sides of tractor every 60 to 120 hours (depending on operating conditions). If operating in deep mud or water with all tractors, lubricate every 5 hours.

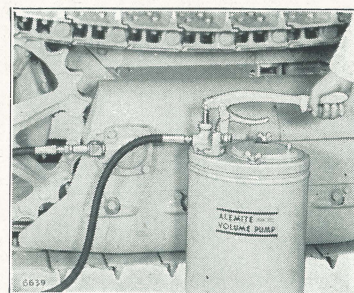
Apply lubricant until noticeable resistance is felt on the compressor handle.



TRACK ROLLER FRAME BEARINGS

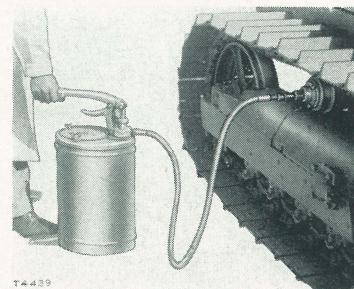
- 15** Lubricate two bearings every 20 hours, one fitting on each side of the tractor. If operating in deep mud or water lubricate every 5 hours.

Lubricate non-oscillating bar pivot pin every 120 hours if so equipped. See Lubrication of Attachments.

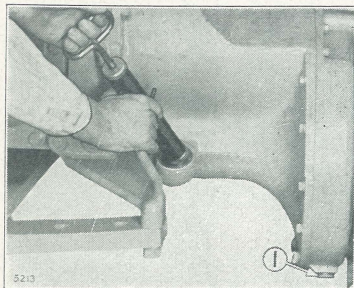


TRACK CARRIER ROLLERS

If so equipped lubricate rollers on both sides of tractor every 120 hours. If operating in deep mud or water, lubricate every 5 hours.



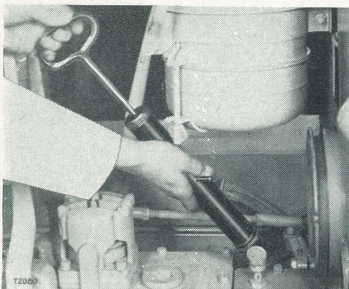
TO TRANSMISSION OIL



3

FINAL DRIVE

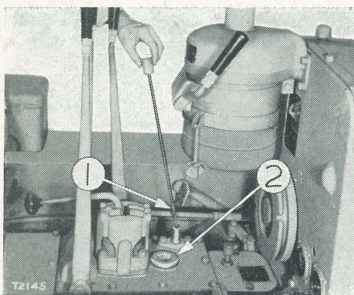
Check oil level by removing two filler plugs, one for each side, every 120 hours. Keep lubricant to level of filler opening. Drain compartment at (1), wash and refill it every 900 hours (480 hours when operating in either extremely dusty conditions or deep mud and water). See topic, "Washing Gear Compartments".



4

FLYWHEEL CLUTCH SHIFT COLLAR

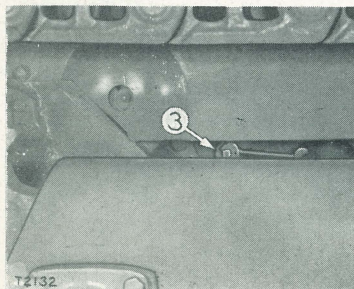
Fill oil cup with lubricant every 20 hours, with engine stopped.



17

TRANSMISSION

Check oil level every 120 hours. Keep oil level up to full mark (1) on gauge. If equipment mounted on the tractor interferes in checking the oil level with the gauge, keep the oil level to the plug (3) on the right side of the transmission case. Refill or replenish with oil at (2).

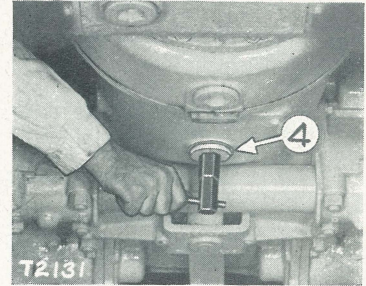


TO TRANSMISSION OIL

TRANSMISSION

17

Drain the transmission case (4) every 900 hours. Wash and refill to level plug on the right side of the transmission case or to level mark on gauge. Openings connect the transmission and bevel gear compartments. The oil will maintain the same level in both compartments. See topic, "Washing Gear Compartments".



Lubrication of Attachments

(For further attachment information see page 65.)

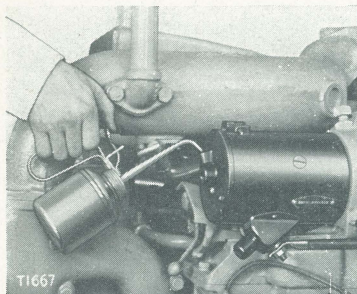
The following list of identifying letters, names of attachments requiring lubrication, and type of lubricant required will help in lubrication of attachments.

A. STARTING ENGINE ELECTRIC STARTER	CO
B. FLYWHEEL CLUTCH PILOT BEARING	BR
C. GENERATOR	CO
D. BELT PULLEY DRIVE GEAR CASE	TO
E. REAR POWER TAKE-OFF GEAR CASE	TO
F. FRONT POWER TAKE-OFF BEARING AND COUPLING	BR
G. NON-OSCILLATING BAR PIVOT PIN AND TRACK ADJUSTING SCREW	BR

Identification Of Points Of Lubrication and Lubricants To Apply

INTERVALS	Every 5 HRS.	Every 60 HRS.	Every 120 HRS.	Every 240 HRS.	Every 900 HRS.
LUBRICANTS					
CO			A-C		
BR	G	F	F-G	B-G	
TO			D-E		D-E

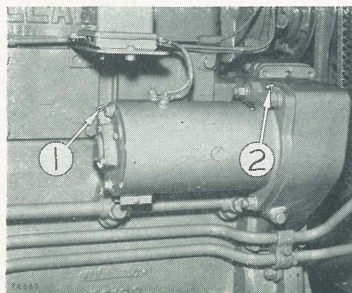
CO CRANKCASE LUBRICATING OIL



A

STARTING ENGINE ELECTRIC STARTER

Lubricate bearing with two or three drops of oil every 120 hours.



C

GENERATOR

Lubricate rear bearing (1), front bearing (2), when equipped with oil cups, with two or three drops of oil every 120 hours.

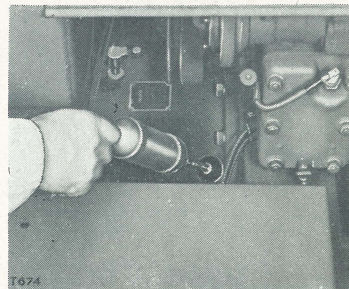
Some generators have bearings packed with ball and roller bearing grease making lubrication necessary only when the generator is disassembled for cleaning or servicing.

BR BALL AND ROLLER BEARING LUBRICANT

B

REAR SEAT MODEL FLYWHEEL CLUTCH PILOT BEARING

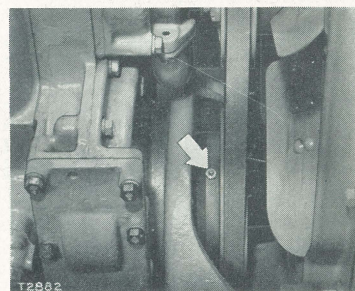
Every 240 hours, remove plug on Flywheel Clutch Housing, turn flywheel until fitting is visible, lubricate with two or three shots and replace plug.



F

FRONT POWER TAKE-OFF COUPLING

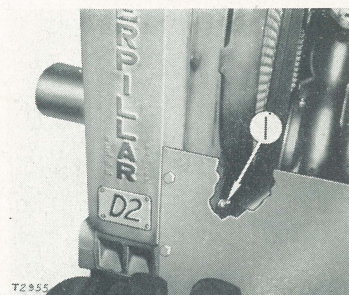
Lubricate sparingly every 120 hours. Excessive grease applied in the coupling may work out on to fan belt and pulley causing excessive wear.



F

FRONT POWER TAKE-OFF BEARING

Lubricate bearing through fitting (1) every 60 hours. Do not overlubricate. Excess grease may work out on belts resulting in excessive wear.

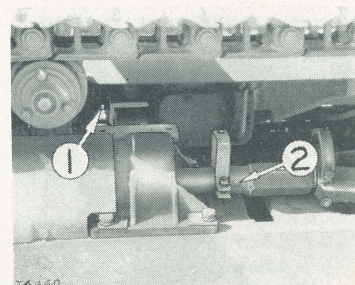


G

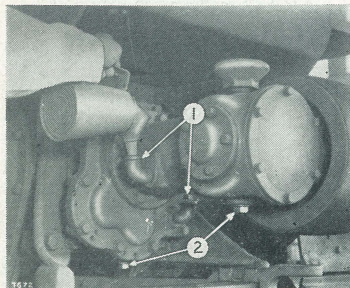
NON OSCILLATING BAR PIVOT PIN AND TRACK ADJUSTING SCREW

Lubricate pin every 120 hours from the right side of the tractor at (1). When operating in deep mud and water, lubricate every 5 hours.

Remove the track adjusting screw guard and lubricate screw at (2) every 240 hours.



TO TRANSMISSION OIL

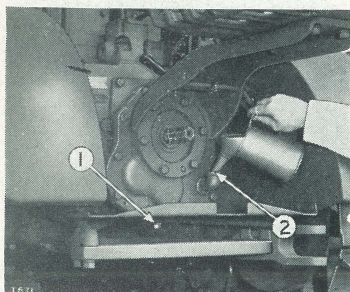


BELT PULLEY DRIVE

D

Every 120 hours, check Belt Pulley Drive oil level at filler elbow (1). Overfilling will cause overheating.

Every 900 hours drain (2) wash and refill to top of filler elbow (1). Periodically remove breather and wash.



REAR POWER TAKE-OFF

E

Check oil level at filler opening every 120 hours and bring level to plug opening. Over filling will cause overheating.

Drain housing by removing plug (1) every 900 hours, wash housing and refill to top of filler opening (2).

Operation Instructions

(Information on attachments for this tractor begins on page 65)

PREPARING THE TRACTOR FOR USE

New Tractor Initial Service: The first duty of anyone charged with the care and operation of a tractor is to give it a detailed inspection, and to lubricate all parts as directed in the LUBRICATION INSTRUCTIONS section of this book.

Fill the Diesel fuel tank, taking care no dirt, water, or other foreign substances are admitted with the fuel. Give particular attention to the details of fuel handling as outlined under the topic, CARE OF THE FUEL SUPPLY. Fill the starting engine fuel tank with gasoline.

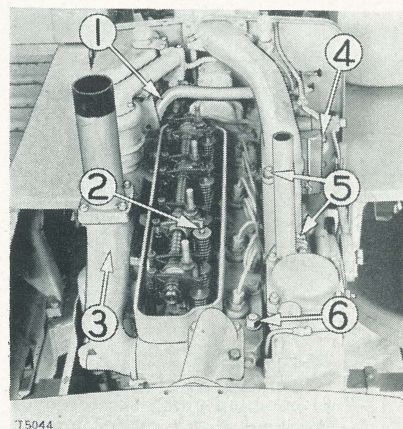
Fill the cooling system with clean soft water, or with the correct anti-freeze solution if temperatures below freezing are likely to be encountered. See the topic, COOLING SYSTEM.

During the initial operation of the tractor, the capscrews of the track roller end collars, the track shoe bolts, the inlet manifold stud nuts and the equalizer spring clips should be checked and tightened if necessary. Since these parts are subjected to continued stress, periodic checks should be made.

New Tractor Recheck: After the first thirty days of operation, tighten the Diesel engine cylinder head stud nuts (6), the Diesel engine inlet (5) and exhaust (3) manifolds, the starting engine cylinder heads (4), and the starting engine manifold assembly (1). When the Diesel engine cyl-

POINTS TO BE SERVICED AT RECHECK PERIOD

- 1—Starting engine manifold assembly.
- 2—Valve clearance adjustment.
- 3—Diesel engine exhaust manifold.
- 4—Starting engine cylinder heads.
- 5—Diesel engine inlet manifold.
- 6—Diesel engine cylinder head stud nut.



inder head stud nuts are tightened, the cylinder head gasket is squeezed together and the valve clearances are changed. After the cylinder head stud nuts are tightened, adjust the valve clearances at (2) as described in the topic, VALVE CLEARANCE ADJUSTMENT.

New Operator's Responsibility: The operator who is given the responsibility of care and operation of a tractor already in service, should first, check it for necessary lubrication, fuel supply and coolant in the radiator.

Second, the tractor should have any necessary adjustments made to obtain satisfactory performance.

Third, if the tractor has been stored with oil in the cylinders, comply with the starting procedure under the topic, STORAGE.

STARTING THE ENGINES

Starting Engine

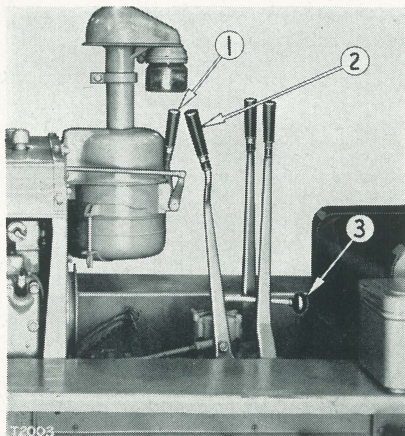
Before attempting to start the starting engine check the Diesel engine and tractor controls as well as the starting engine controls to see that they are in the correct position for starting. **Be sure to check the crankcase oil level in the Diesel engine and starting engine to make certain the oil is up to the full mark on the gauge.**

Position Controls for Starting:

Disengage the flywheel clutch (lever (2) pushed forward).

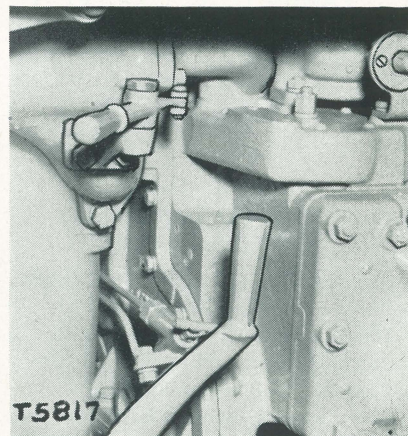
Shift the speed selector lever (3) to the neutral position.

Push the fuel injection pump control lever (1) forward as far as possible so the injection pumps are closed.



**TRACTOR CONTROLS IN
START POSITION**

- 1—Fuel injection pump control lever.
- 2—Flywheel clutch control lever.
- 3—Speed selector lever.



**COMPRESSION RELEASE LEVER
IN START POSITION**

Move the compression release lever to the START position.

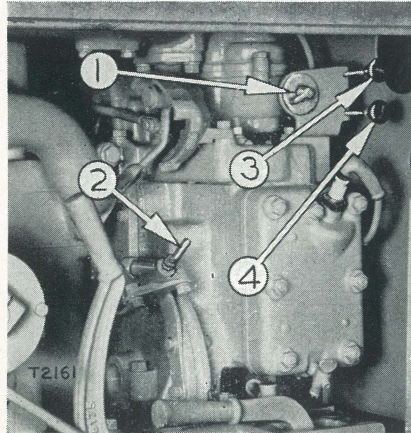
Disengage the starting engine clutch by pulling the lever back toward the starting engine.

Open the starting engine fuel valve by unscrewing the fuel valve control (2).

Pull out the starting engine choke control (3).

Pull out the starting engine throttle control (4).

Turn ON the ignition switch (1).



STARTING ENGINE CONTROLS

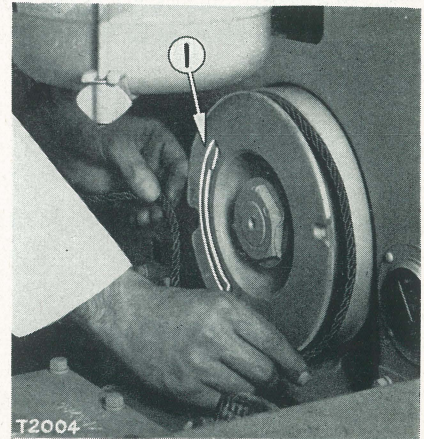
- 1—Ignition switch. 2—Fuel valve control. 3—Choke control.
4—Throttle control.



Place the knotted end of the starting rope with the knot to the outside, in one of the two notches on the starting engine flywheel flange and wind the rope around the groove in such a manner that pulling the rope will turn the flywheel in the direction indicated by the arrow (1) on the flywheel.

PLACING STARTING ROPE ON FLYWHEEL

- 1—Arrow indicating direction flywheel turns.

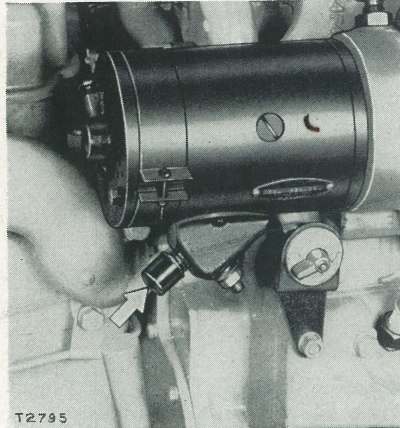


Grasp the starting rope handle with the right hand and spin the flywheel with a quick pull on the rope. Temperature and altitude will vary the length of time it is necessary to have the choke ON. Actual experience in starting will determine this interval. Push in the choke control rod when the engine will run with the choke OFF.

When the engine starts keep the speed low until the crankcase lubricating oil has a chance to warm up and better lubricate the engine.

Helpful suggestions for starting the starting engine in cold weather are in the topic, OPERATING IN COLD WEATHER.

Operating Starting Engine Electric Starter: To start the starting engine with electric starter, place the Diesel and starting engine controls in the same position as described in the preceding topic. Then crank the engine with the electric starter by pushing the starter button.



STARTING ENGINE ELECTRIC
STARTER BUTTON

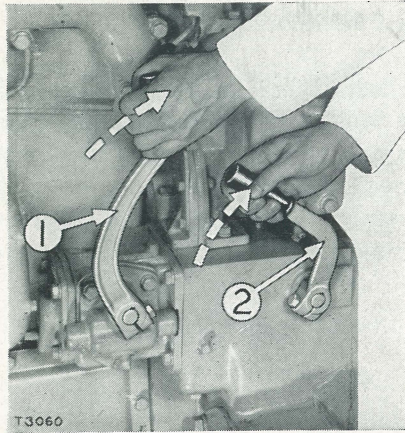


Diesel Engine

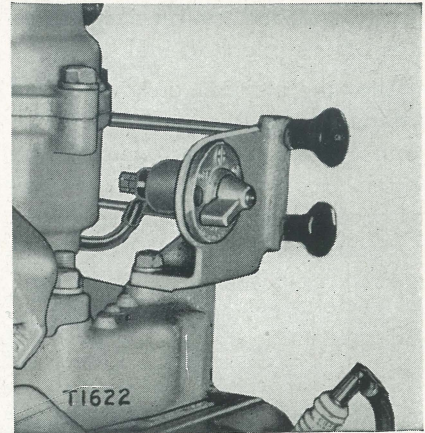
The following four steps should be carefully followed to prevent damage to the starter pinion or flywheel ring gear.

1. Check to see that the starting engine clutch and flywheel clutch are disengaged.
2. Check to see that the starting engine is running at idle speed.
3. Apply the starting engine clutch brake to stop the starter pinion from rotating by pulling the clutch control lever (1) all the way back and holding it there.
4. Engage the starter pinion with the flywheel ring gear by pulling up on the starter pinion control lever (2), then release the clutch brake and partially engage the clutch to be sure of full engagement of the starter pinion.

Push the throttle control in to let the starting engine run at full governed speed. Engage the starting engine clutch by pushing the lever forward until it snaps over center. If the engine slows to the stalling point when the clutch is engaged, as it might in cold weather, disengage the clutch and let the engine pick up speed again.

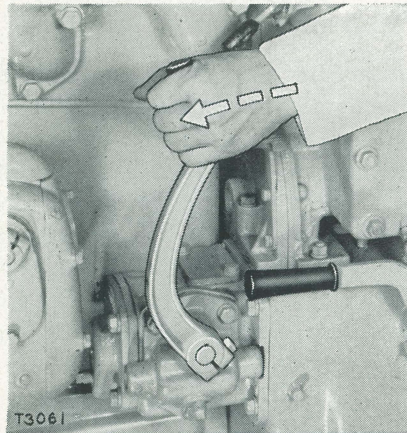


ENGAGING STARTER PINION
1—Clutch control lever. 2—Pinion control lever.

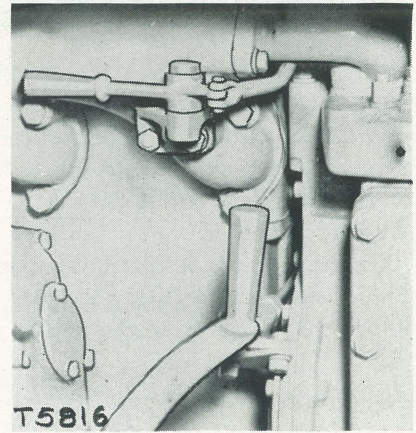


**STARTING ENGINE THROTTLE AND
CHOKE CONTROL POSITIONS FOR
FULL GOVERNED SPEED**

Move the compression release lever to the RUN position as soon as the starting engine is cranking the Diesel engine at normal cranking speed. The heat generated when the starting engine is cranking the Diesel engine against compression, and the circulation of the starting engine exhaust through the tube in the Diesel engine air inlet pipe warms the cylinders, pistons, and combustion chambers to the starting temperature.



**ENGAGING STARTING ENGINE
CLUTCH**

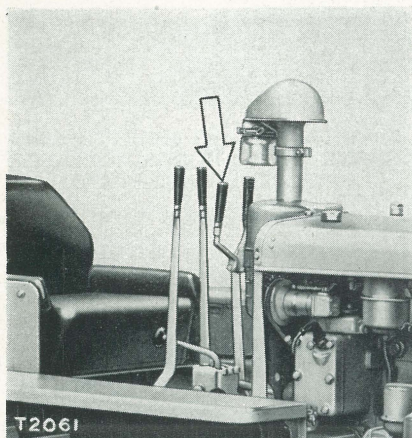


**COMPRESSION RELEASE
LEVER IN RUN POSITION**

Allow the starting engine to crank the Diesel engine against compression for a few minutes to add heat to the Diesel engine before starting it. Actual experience will determine the length of time necessary to crank the Diesel engine to warm it sufficiently to assure easy starting. Altitude and temperature cause a variation in the length of time required to warm the engine before starting. In cold weather the cylinders and pre-combustion chambers must absorb more heat before reaching starting temperature than in warm weather. Even in warm weather some heat

must be added by turning the engine against compression a few minutes before injecting fuel.

After the starting engine has cranked the Diesel engine against compression until the Diesel is sufficiently warm, **move the injection pump control lever to approximately half engine speed position.** If the Diesel engine does not start after it has turned several revolutions, move the injection pump control lever to the extreme forward position so the injection pumps are shut off, and let the starting engine turn the Diesel engine against compression a little longer.



**FUEL INJECTION PUMP
CONTROL LEVER IN
START POSITION**



If the Diesel engine is thoroughly heated but does not start, make an inspection to see that everything is correctly set for starting. If smoke has been coming from the Diesel engine exhaust, fuel has been reaching the cylinder. If no smoke has been evident when the fuel injection pump control lever was in the RUN position, check the fuel supply. If the Diesel fuel tank is empty or the fuel tank valve is closed, it will be necessary to prime the system as outlined under the topic, PRIMING THE FUEL SYSTEM. In case there may be water or dirt in the fuel system, or if the fuel injection equipment is suspected, see the topic, FUEL INJECTION EQUIPMENT.

When the Diesel engine begins to run, the starter pinion automatically disengages, but it is necessary to disengage the starting engine clutch by pulling back on the control lever.

Stop the starting engine by closing the starting engine fuel valve, allowing the engine to burn all the fuel in the carburetor. Then turn off the ignition switch.

Check the lubricating oil pressure gauge to see that it is registering pressure. When the engine is warm and running at normal engine speed the gauge should register in the "Operating Range."

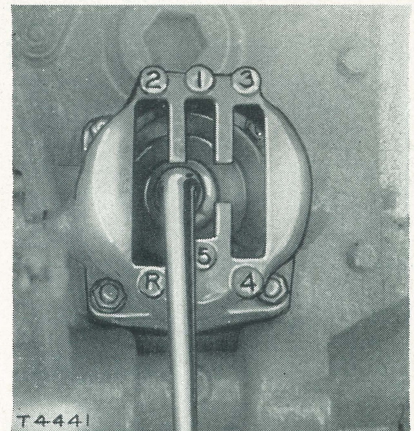
Allow the Diesel engine to idle 5 minutes with the fuel injection pump control lever at half engine speed position before applying the load.

LUBRICATING OIL
PRESSURE GAUGE

DRIVING THE TRACTOR

When the engine has been running long enough to warm up, move the injection pump control lever to the low idle speed position. Disengage the flywheel clutch by pressing the clutch control lever forward as far as it will go. This applies the clutch brake. Continue to press forward on the lever until the clutch stops turning. Carefully move the speed selector lever into position for the speed desired.

Speed selector lever positions are illustrated here or refer to the positions cast at the ends of the slots in the plate around the speed selector lever.

SPEED SELECTION
POSITIONS

The clutch lever controls the locking mechanism that holds the sliding transmission gears in position, so the gears cannot be shifted into or out of mesh with the clutch engaged. Always shift gears completely into mesh.

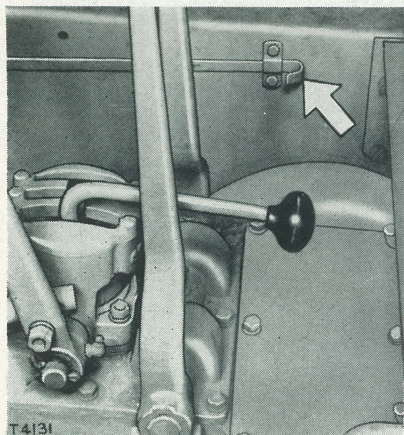
Carefully engage the flywheel clutch until the slack is taken up between the tractor and the load. When the tractor begins to move the load, pull the clutch lever all the way back so the engaging mechanism will snap over center and remain fully engaged. Never move a load with the flywheel clutch only partially engaged as this causes heating and rapid unnecessary wear on the clutch plates.

STEERING THE TRACTOR

The tractor is steered by hand levers that operate the steering clutches and by pedals that control the steering clutch brakes. Release the steering clutch on the side toward which the turn is to be made by pulling back on that steering clutch lever. Apply the brake on the same side by pressing down on the pedal just hard enough to turn at the desired angle. Both controls should be handled smoothly so the turn will be made evenly, and not as a series of jerks. Just before the turn is completed, release the brake. Then engage the steering clutch by releasing the control lever quickly but gently.

When the tractor is pulling a load, it is seldom necessary to use the brakes except for sharp turns, since the load acts as a brake. The brakes may also be used to hold the tractor back when going down grade. The right pedal may be locked in position to hold the tractor on slopes or when doing stationary work, by first depressing the pedal and then pulling back on the lock control rod on the inside of the right fender.

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



BRAKE LOCK CONTROL ROD



The pedals must be in the fully released position during the normal operation of the tractor. **Keep the feet off the pedals except when it is necessary to use the brakes.**

OPERATING OVER AN OBSTRUCTION

The fact that the steering clutches are controlled by separate levers may be used to advantage in running over an obstruction, such as a log or a ditch bank. Both of the clutches may be released slightly until

the tractor balances on top of the obstruction. Then one clutch may be engaged gradually so the tractor moves forward at an angle, over and down. If the tractor is being operated without a load it may be necessary to use the brakes.

OPERATING IN DEEP MUD OR WATER

If the tractor must be operated for any length of time in deep mud or water, certain precautions are necessary. See that the plugs are in place under the steering clutch compartments. Lubricate the track rollers, the front idlers and track roller frame bearings every 5 hours. Inspect the oil in the final drives frequently for mud and water and drain, wash and refill as soon as the oil shows the presence of mud or water. The presence of mud in the final drives or the excessive leakage of oil indicates the seals should be repaired. See the topic, LUBRICATION CHART.

STOPPING THE TRACTOR

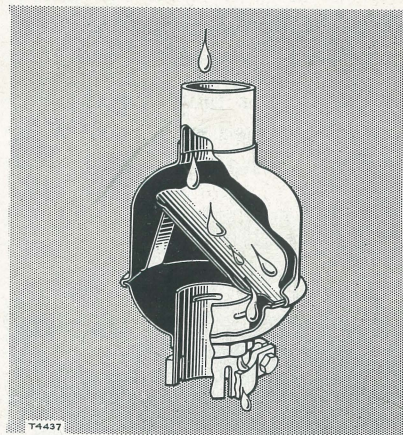
To stop the tractor when it is desired to allow the engine to continue to run, disengage the flywheel clutch and move the fuel injection pump control lever to the idling position. Shift the transmission gears into neutral and engage the flywheel clutch. Do not allow the tractor to idle with the flywheel clutch disengaged.

STOPPING DIESEL ENGINE

After the normal load is removed from the engine allow it to idle five minutes with the injection pump control lever in half engine speed position before stopping.

Move the injection pump control lever to the extreme forward position. Leave the Diesel fuel tank valve open.

RAIN TRAP FOR EXHAUST PIPES



If the tractor must stand without shelter, cover the exhaust pipes to exclude rain or snow. A rain trap for this purpose may be obtained from your "Caterpillar" dealer. If the temperature is below freezing, or if freezing weather is expected before the engine will be started again, drain the cooling system or protect it with an anti-freeze solution. See the topic, COOLING SYSTEM.

DAILY CARE

A daily check of the tractor should be made to see if there are any loose nuts, bolts, capscrews, or parts worn to such an extent that they are no longer serviceable. The capscrews of the track roller end collars, the track shoe bolts, the inlet manifold stud nuts, and the equalizer spring clip nuts are typical of points which should be checked frequently and kept tight since these parts are subjected to continued pounding. Particular attention should also be given to keeping the gasketed joints of the final drive cases tight to prevent leakage and possible damage to parts through excessive movement. If corrective steps are taken immediately upon discovery of loose or worn parts, fewer forced stops and more economical operation will result.

Check the cooling system each day, and if necessary, add water or anti-freeze solution.

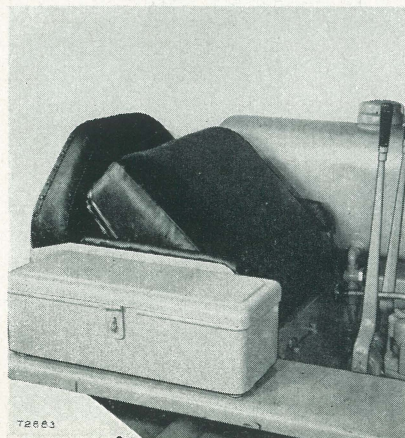
Fill the Diesel fuel tank at the end of the day's run. See the topic, CARE OF THE DIESEL FUEL TANK for other periodic care.

When the Diesel engine is operating continuously the starting engine should be run for a few minutes each day to dissipate condensation and renew the oil film on the bearing surfaces and cylinder walls.

Dirt should not be allowed to accumulate on the tractor. A few minutes spent daily in keeping it clean are well repaid in improved appearance, and greater ease and safety in operation and maintenance.

The "Hour Meter" which is located on the left side of engine near the bottom of the fuel injection pump housing, should be read daily. From the daily readings, the lubricating time of all parts as directed under the topic, LUBRICATION CHART, can be determined. The "Hour Meter" readings should also be used in determining maintenance service periods.

If the tractor must stand without shelter the operators seat cushion should be tipped as shown. When this is done the water proof covering prevents moisture entering the padding under the covering. If the cushion



**SEAT CUSHION TIPPED
TO PROTECT PADDING**



is turned bottom side up in rainy weather the padding under the water proof covering may become damp. This moisture with accumulated dirt and heat will shorten the life of the cushion.

OPERATING IN COLD WEATHER

If the starting engine and the Diesel engine are both in good mechanical condition, and the precautions necessary for cold weather operation are taken, ordinary cold weather will not cause difficulty in starting or loss of efficiency.

Lubricants: As the atmospheric temperatures become lower, where warm housing facilities are not available, lubricants of lower viscosity should be used. See the topic, LUBRICANTS.

Coolant: When the temperature is below freezing, sufficient anti-freeze solution should be used in the cooling system to prevent freezing. See the topic, COOLING SYSTEM.

The liquid in the cooling system may be warmed to make starting easier and quicker. When warming anti-freeze solutions, keep away from flames, as some of these solutions may be inflammable. Avoid getting the solution hot, and even a warm solution should be poured very slowly into a cold cooling system to prevent damage by sudden expansion.

Fuel: Fuel must be "free flowing" enough to flow readily through the fuel lines at the lowest temperature at which the tractor will be started and operated. For additional information on this subject, see the topic, FUELS.

Starting The Starting Engine: If the tractor has been standing without shelter in extremely cold weather, the suggestions that follow will materially assist starting as well as protect the engine against damage.

It is very important to keep low viscosity crankcase lubricating oil up to the full mark on the gauges, in both the Diesel engine and starting engine to provide proper lubrication when starting. Refer to the topic, LUBRICANTS.

Crank the starting engine several revolutions with the ignition switch off, and the starting engine clutch disengaged. This will better distribute oil to the bearings and cylinder walls.

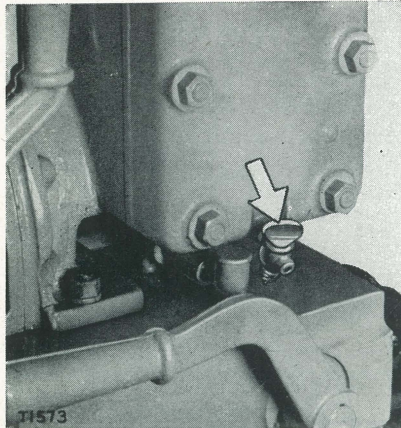
Sometimes moisture, or fuel which has not vaporized, collects on the starting engine spark plugs. They may be dried out by removing them and pouring gasoline over the electrodes. Ignite the gasoline and allow it to burn. **Use care to prevent fire.**

Pouring a small amount of gasoline on the electrodes before they are replaced in the engine is more effective in promoting combustion than priming the cylinders with gasoline. A small amount of gasoline in the

cylinders will remove the film of oil from the cylinder walls and interfere with compression.

If the starting engine is flooded, open the drain cock on each cylinder head and spin the flywheel until the cylinders are cleared of excess fuel.

Sometimes the starting engine can be started more quickly by pushing in the throttle control. **When the engine starts pull out the throttle to the idling position to keep the engine speed low until the crankcase lubricating oil has a chance to warm up and better lubricate the engine.**



CYLINDER HEAD
DRAIN COCK



STORAGE

Lubricate all points mentioned in the lubrication chart if the tractor is to be stored or left standing for any length of time. This will protect against rusting.

Diesel Engine: If the tractor is to be stored or left standing for a long period of time, the lubricating oil may drain away from the cylinder walls and piston rings. This lack of lubricant permits the rings and liners to rust. It also permits unnecessary wear caused by metal-to-metal contact between the pistons, rings and liners when the engine is started before fresh oil has reached these surfaces. The lack of lubricant may not cause any noticeable change in engine operation after it has been started but it does contribute to shorter engine life.

On the Diesel engine the film should be renewed by running the engine once a week until it is thoroughly warm. This will circulate the oil and prevent rusting from condensation. If it is not convenient to start the engine, remove the injection valves once a month and pour $\frac{1}{8}$ pint (0.06 liter) of crankcase lubricating oil into each cylinder. Then turn the engine several revolutions with the compression release lever in the START position and the injection pump control lever in the CLOSED position. Replace the injection valves. Thereafter, turn the engine once a

week between monthly oiling intervals to distribute the oil on the cylinder walls and pistons.

CAUTION

If rusting in the Diesel engine has been guarded against by pouring oil into the cylinders rather than by running the engine, the following precaution should be observed before starting.

Move the compression release lever to the START position to release the compression, then turn the engine to dissipate oil that may have accumulated in the cylinders.

If excess oil is not removed, compressing it in the small space between the piston and cylinder head will cause damage to the engine.

Starting Engine: The oil film should be renewed in the starting engine by running the engine once a week until it is thoroughly warm. If it is not convenient to start the engine, remove the spark plugs once a month and pour $\frac{1}{8}$ pint (0.06 liter) of oil into each cylinder. Then spin the fly-wheel several revolutions and replace the spark plugs. Thereafter, turn the engine once a week between monthly oiling intervals to distribute the oil on the cylinder walls and pistons.

Final Drive: Allowing the tractor to stand idle for lengthy periods may permit the gasket on the final drive seals to become lightly stuck to the washer on which it operates. When this occurs the gaskets may be damaged when the tractor is operated, causing the seals to leak. For this reason, the tractor should be driven backward and forward, at a time when starting the engine to renew the oil film on the cylinder walls and piston rings, to prevent this condition occurring.

Cooling System: If the temperature will be below freezing, the cooling system should be drained if the cooling system has not been serviced as indicated in the topic, COOLING SYSTEM.



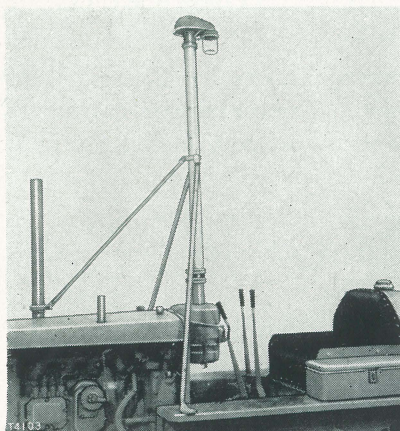
Maintenance Instructions

The foregoing paragraphs have been devoted to instructions which are necessary for day-to-day operation of the tractor. The following topics give detailed instructions regarding the care and adjustment of the various parts.

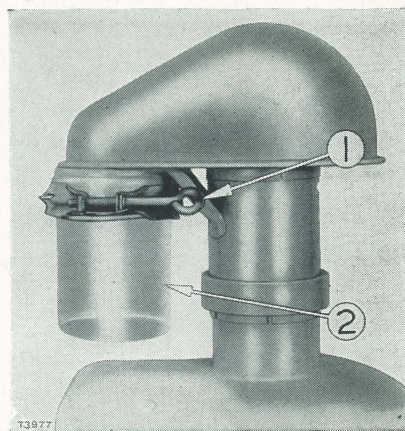
AIR CLEANERS

The air cleaners do their work efficiently only as long as the oil in the cups is thin enough to flow freely, so it will spray into the filter sections and wash back the dirt collecting there. For this reason, the air cleaners should be inspected frequently and serviced as often as necessary.

Where dust conditions are severe, dust and abrasives may be carried in a heavy cloud rising to the height of the pre-cleaner. If the pre-cleaner is neglected the oil in the air cleaner cup will become thick and allow dust to enter the engine, thus contributing to shorter engine life. In these conditions an air inlet pipe extension which is available from your "Cat-epillar" dealer will put the pre-cleaner up where the air is cleaner, reducing engine wear and the frequency of air-cleaner maintenance.



AIR INLET PIPE
EXTENSION



PRE-CLEANER
1—Screw clamp. 2—Jar.

Pre-Cleaner Care: The pre-cleaner plays a very important part in air cleaning for the Diesel engine. For this reason, always install the jar (2) correctly and replace a broken jar immediately. Remove and empty the jar before it becomes three fourths full by loosening the screw clamp (1) that holds it in place. Inspect the fins in the pre-cleaner regularly and when they are dirty remove the entire pre-cleaner and wash it in water.

Diesel Engine Air Cleaner: The air cleaner on a Diesel engine will clean and pass a greater volume of air in a day's run than the air cleaner on a spark ignition engine doing the same work under like conditions. Each Diesel cylinder draws in a full charge of air on every inlet stroke, regardless of the engine speed or the amount of work the engine is doing; whereas the total volume of air taken in by a spark ignition engine is regulated by the position of the throttle in the carburetor and changes with varying loads.

The interval between the oil changes and cleaning will vary with the weather and the working conditions. During the dry, dusty months and on jobs where dust conditions are severe, it may be necessary to service the Diesel engine air cleaner as often as every 5 hours. In damp weather, and on jobs where there is little or no dust, this operation may be necessary only once every 60 hours. However, dependence should not be placed in visible detection of dust, or lack of dust, in the air as a basis for servicing the air cleaner. The high efficiency of the pre-cleaner prevents the large particles of dust from entering the air cleaner, but it does not exclude the finer ones. For this reason, the oil in the air cleaner may become saturated with dust due to its fineness, much more rapidly than in instances where dust is more apparent.

The fine particles of dust become suspended in the oil, lowering its cleaning efficiency, without leaving any noticeable sediment in the cup. Consequently, the oil in the air cleaner should be changed when, because of the fine dust particles, it becomes thicker than normal.

Inspect The Oil In The Diesel And Starting Engine Air Cleaner Cups: Unscrew the wing nuts and take off the oil cup. The air cleaner cup should be washed and refilled when the oil shows evidence of being murky or cloudy.

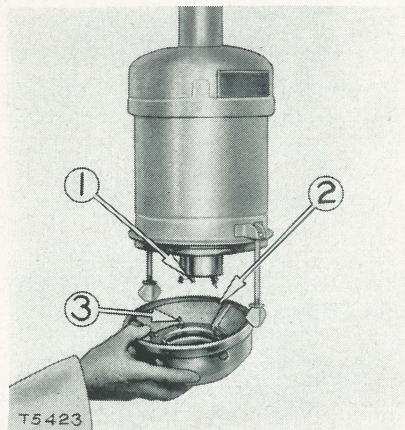
Inspect the inside of the air inlet pipe as well as the removable tray assembly or element each time the oil cup is removed. Clean or wash them if necessary.

When refilling the oil cup, care should be taken to see that both the inner and outer cups are filled only to the oil level bead.

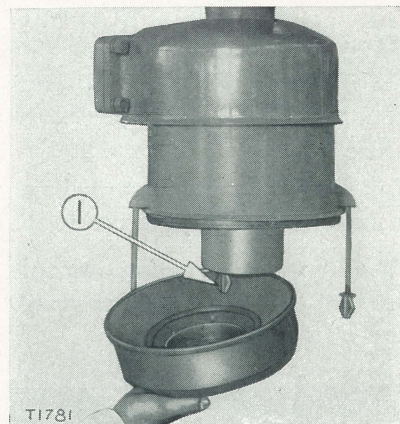
Never attempt to change the oil in the air cleaner cup when the engine is running. This will cause dirty oil to be held in the filter section by in-take action. The dirty oil held in the filter section will contaminate the fresh oil and also cause an abnormally high oil level.

Wash Air Cleaner Screens or Element: Every 60 to 240 hours, depending upon dust conditions, remove the tray assembly (2) by unscrewing the two wing nuts (1) holding it in place, turning the tray assembly slightly and slipping it off the air inlet pipe. Disassemble the tray assembly by loosening the three thumb screws (3) and lifting out the six screens. Wash them with a brush in a pan of kerosene or some non-inflammable cleaning fluid.

Place the screens in the tray, positioning them so the three dowels line up with the notches in the screen, and tighten the thumb screws. Install the tray assembly to the air inlet pipe. Refill the oil cup to the oil level mark and replace it. Make sure all connections are tight. On earlier tractors, wash the removable element every 60 to 240 hours. To remove the element, unscrew wing nut (1).



**REMOVING AIR CLEANER
SCREENS (LATER TRACTORS)**
1—Wing nuts. 2—Tray assembly.
3—Thumb screws.

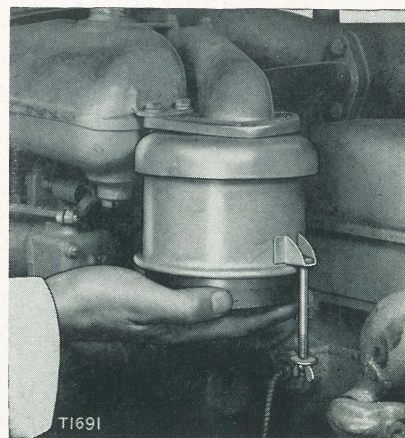


**REMOVING AIR CLEANER
ELEMENT (EARLIER TRACTORS)**

Wash The Entire Air Cleaner: At least once a year — more often in dusty conditions — the entire air cleaner should be removed from its support in order to thoroughly clean the upper filter section in the cleaner body. Remove the oil cup and removable element and immerse the entire cleaner in kerosene or some non-inflammable cleaning fluid. Wash the oil cup and removable element as outlined in the preceding topics. Reassemble the air cleaner making certain all connections are air tight.

Wash Starting Engine Air Cleaner: Every 240 hours unscrew the wing

REMOVING STARTING ENGINE AIR CLEANER



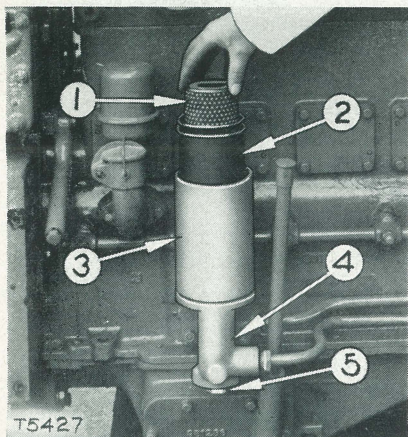
nuts and remove the oil cup. Remove the cleaner body by taking out the capscrews at the top of the cleaner. Wash the filter by shaking it in a pan of kerosene or some non-inflammable cleaning fluid. Wash and refill the oil cup and assemble the air cleaner. Be sure the gasket between the air cleaner and the cleaner pipe is in place and all connections are air tight.

CRANKCASE LUBRICATING OIL SYSTEM

Crankcase Lubricating Oil Filter: While the oil is draining from the crankcase and oil cooler, remove the drain plug (5) from the oil filter base. Then loosen the clamp bolt and remove the cover and clamp bolt as a unit.

Lift out the inner element (1) and metallic strainer element (2). Remove the inner element and discard it.

Wash the cover, metallic strainer element, housing (3) and sludge compartment (4) with kerosene or some non-inflammable cleaning fluid and allow it to drain.



CRANKCASE LUBRICATING OIL
FILTER

1—Inner element. 2—Metallic strainer element. 3—Housing. 4—Sludge compartment. 5—Drain plug.



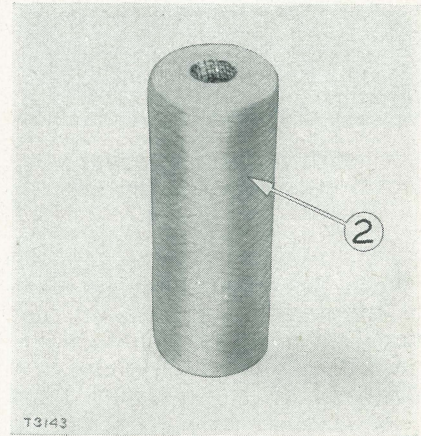
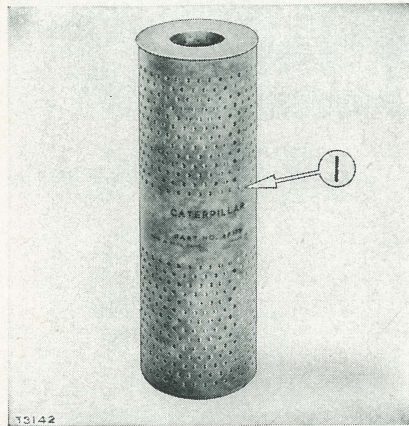
Wash the metallic element (2) by shaking it in some non-inflammable cleaning fluid. If the sludge must be brushed off, use the brush supplied in the tool equipment and stroke parallel to the winding. Eventually, gums and lacquers may clog the metallic strainer element, even though it appears clean on the outside. The element openings between the windings and the internal condition of an element can be checked by comparing it with a new one. Plug the holes in the bottom of both an old and new metallic strainer elements and immerse them to the top rim in Diesel fuel. Compare the rate at which the fuel rises inside of each element. Discard the used one if it is not at least three-fourths full by the time the new one is completely filled.

Reinstall the metallic strainer element, and install a new inner element. Replace the cover, tighten the clamp bolt, and replace the drain plug.

Servicing the crankcase lubricating oil filter as described should be performed each time the crankcase is drained.

Crankcase Lubricating Oil Filter Inner Element: The two types of "Caterpillar" inner elements are illustrated. Either the type with perforated cover (1) or the absorbent yarn type (2) may be supplied with the engine or by your "Caterpillar" dealer.

The filter housing is designed to accommodate either element. They are self-sealing at the ends and both elements function with equal efficiency.



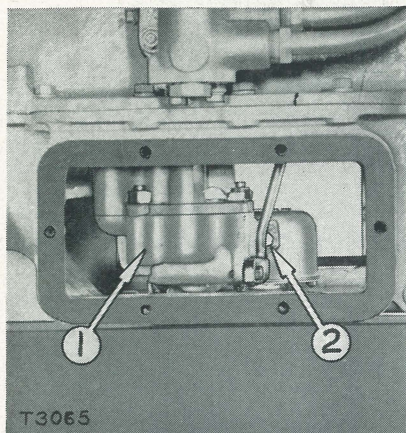
LUBRICATING OIL FILTER INNER ELEMENT
1—Perforated cover type. 2—Absorbent yarn type.

Wash The Diesel Engine Crankcase: Wash or flush out the crankcase occasionally to remove the foreign particles that accumulate there. At a time when it is necessary to change the crankcase lubricating oil, drain the crankcase, oil filter housing and oil cooler while the engine is hot. Replace the drain plugs and pour two gallons (7.6 liters or 1.6 Imp. Gal.) of flushing oil into the crankcase. Run the engine for three minutes, noting that the lubricating oil pressure gauge shows pressure. Then drain the flushing oil from the crankcase, filter compartment and oil cooler.

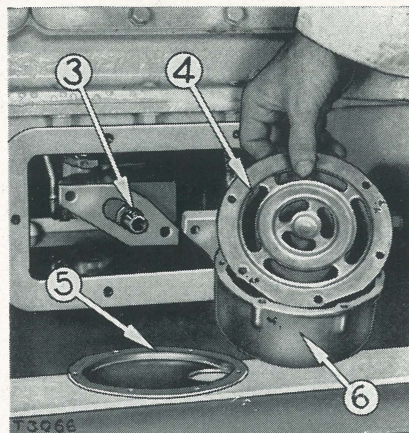
NOTE

Flushing oil may be used again if foreign matter is allowed to settle and then removed.

If sludge is noticeable when draining the crankcase, the oil pump suction bell screen should be removed and cleaned. The suction bell can be removed after removing both side plates from the oil pan. Remove the capscrews (2) which hold the bell to the pump case (1). The bell (6) can now be removed from the crankcase pan through the left opening. Remove the capscrews which hold the cover (5) and screen (4) in position on the bell and wash the screen in some kerosene or non-inflammable cleaning fluid. When installing the bell be sure the spring (3) and gasket are in their correct position between the pump case and bell.



SUCTION BELL REMOVAL
1—Pump case. 2—Capscrews.



**REMOVING SUCTION
BELL SCREEN FOR CLEANING**
3—Spring. 4—Screen. 5—Cover.
6—Bell.

Wash the Starting Engine Crankcase: Remove the drain plug while the engine is warm. Replace the plug and refill the crankcase with 1 quart (1 liter) or 0.20 Imp. Gal. of flushing oil. Run the engine 3 minutes and drain. Refill with fresh oil of the correct viscosity. See the LUBRICATION INSTRUCTIONS section of this book.

FUELS

As a source of power the Diesel engine has two outstanding advantages over the gasoline engine. The first is its lower rate of fuel consumption—and second its ability to use cheaper fuels. Customers should always buy the **lowest priced fuel giving satisfactory operation.**

Your "Caterpillar" dealer is familiar with fuels that are giving good results in "Caterpillar" Diesel Engines in his territory. If necessary, consult him for his recommendations. He will be glad to advise you.

Because of the lack of world-wide standardization of Diesel fuel classifications, it is not possible to make specific recommendations for export territories. For best results see your "Caterpillar" dealer for brand names of satisfactory fuels in your particular area.

In the United States and Canada Diesel fuels are available under two general classifications. One is "premium" fuel and the other is "domestic furnace oil".

"Caterpillar" Diesel engines are designed to operate on the less expensive domestic furnace oils. For a number of years, No. 3 domestic furnace oil as classified by the American Society For Testing Materials, was recommended. A change in furnace oil specifications eliminates the No. 3 grade which is now described as No. 2 grade. Fuels falling within this general class are widely available, give satisfactory results and cost considerably less than "premium" fuels.

During recent years because of the tremendous demand for petroleum products, there has been appreciable variation in the composition of

fuels furnished under the domestic furnace oil classification. Some of these fuels, while not affecting ease of starting, rate of fuel consumption and horsepower output, have increased the wear rate of piston rings and cylinder liners many times, or ring sticking may become a factor in controlling engine life. Usually this has been due to the higher sulphur content of the fuel.

When fuels of sulphur content higher than 0.5 per cent must be burned certain precautions should be observed. Engine cooling water temperatures should not be below 170° F. Lubricating oils, known as Superior Lubricants (Series 2) for "Caterpillar" Diesel Engines which are very effective in reducing the detrimental effects of high sulphur fuels, should be used in the Diesel engine crankcase. See topic, CRANKCASE LUBRICATING OIL.

In subzero (-18° C.) weather, where warm storage is not provided, fuels with unusually low pour points may be required. It is necessary that it be fluid enough to flow from the Diesel fuel tank to the engine transfer pump at the lowest temperature at which the engine must start and operate.

CARE OF THE FUEL SUPPLY

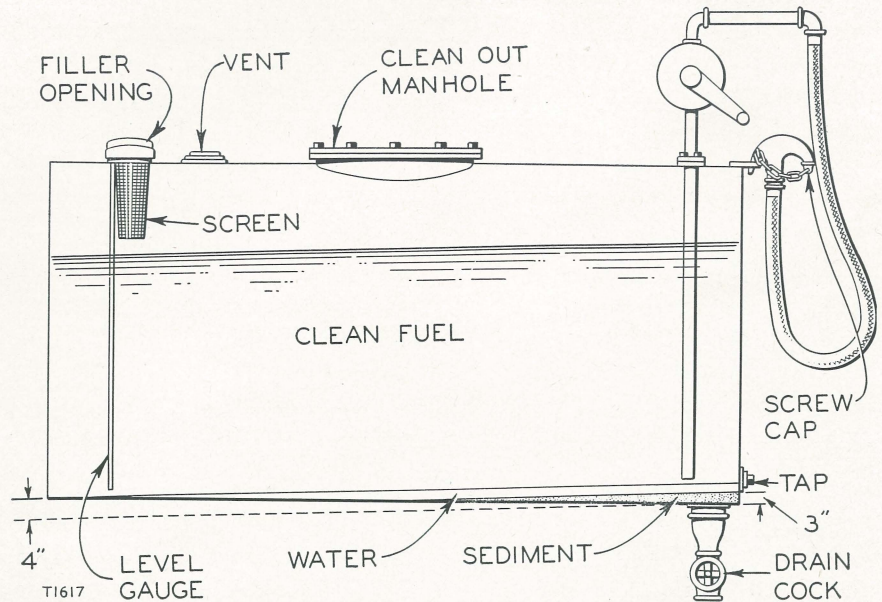
Keep The Fuel Clean: Too much emphasis cannot be placed on the importance of using only clean Diesel fuel. In selecting a fuel, it should be pointed out that distillates are especially desirable because, in refining, they are heated to a vaporous state and condensed in another container; thus, all the sediment and residue remain in the still.

It is important to buy clean fuel, and keep it clean. The best fuel can be rendered unsatisfactory by inadequate storage facilities or careless handling. The clearance between the fuel injection pump plunger and the barrel is very small, actually less than .0001 inch (0.00254 Mm.) which makes it evident that the invisible particles of dirt which might pass through the filters can damage these finely finished parts.

Effort should be constantly expended to prevent contamination of the fuel. An important step is to reduce the number of times the fuel must be handled. When the fuel can be delivered by the distributor to storage tanks and then pumped from the storage tank to the Diesel fuel tank, the handling is reduced to a minimum.

The illustration of a fuel storage tank is a typical, satisfactory installation. Since natural settling is an effective method of cleaning Diesel fuel, the fuel should be allowed to stand at least 24 hours in the storage tank after it has been filled before fuel is transferred to the Diesel fuel tank. Be sure to drain all water and sediment that has settled to the bottom of the tank before the tank is refilled. Occasionally, drain all of the fuel and clean the tank thoroughly.

The use of cans, funnels, and drums should be discouraged, since it is practically impossible to keep this equipment absolutely clean. If drums must be used, they should be allowed to stand for at least 24 hours before



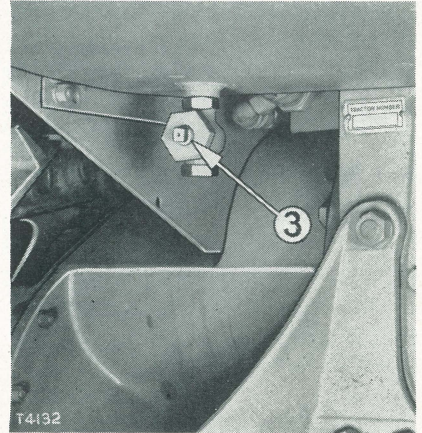
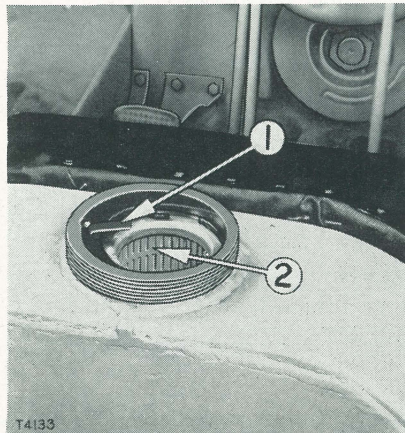
RECOMMENDED FUEL STORAGE TANK

drawing off fuel. A pump installation similar to that shown with the storage tank should be used. The drum should stand on end and the inlet for the pump be kept several inches above the bottom to prevent stirring up the sediment that settles to the bottom.

Whatever method is used, see that only clean fuel enters the Diesel fuel tank.

CARE OF THE DIESEL FUEL TANK

Diesel Fuel Tank: The fuel level in the Diesel fuel tank may be checked with the plunger gauge (1) in the filler opening.

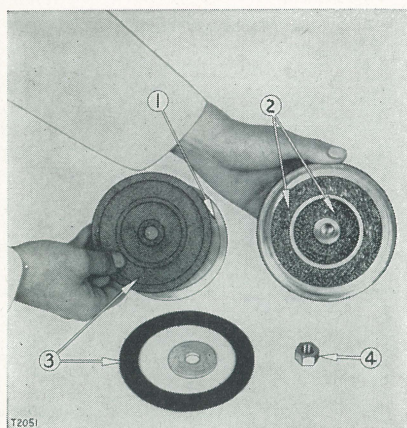


DIESEL FUEL TANK

1—Plunger gauge. 2—Strainer. 3—Drain cock.

Fill the Diesel fuel tank at the end of the day, because the incoming fuel will drive out the moisture-laden air and prevent condensation. Every 120 hours before starting the engine, open the drain cock (3) under the Diesel fuel tank and drain off any sediment or water which may have accumulated. The strainer (2) in the Diesel fuel tank filler opening should be removed and cleaned regularly. Remove the snap ring and lift out the strainer.

Diesel Fuel Tank Filler Cap: The Diesel fuel tank filler cap elements (2) should be washed every 60 to 240 hours depending upon the amount of dust in the air. To do this, remove the nut (4) from the stud and take out the baffle plate (1) and gaskets (3). Wash the cap and elements in kerosene or some non-inflammable cleaning fluid. After the cap is washed pour a small amount of crankcase lubricating oil on the filter elements.



FUEL TANK FILLER CAP

1—Plate. 2—Elements. 3—Gaskets. 4—Nut.

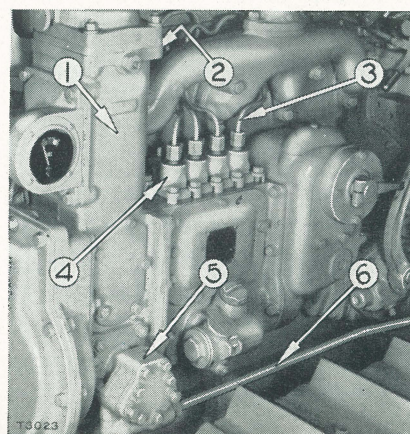


FUEL SYSTEM

The fuel flows from the Diesel fuel tank through the fuel line (6) to the fuel transfer pump (5). The fuel transfer pump supplies the fuel under

FUEL SYSTEM

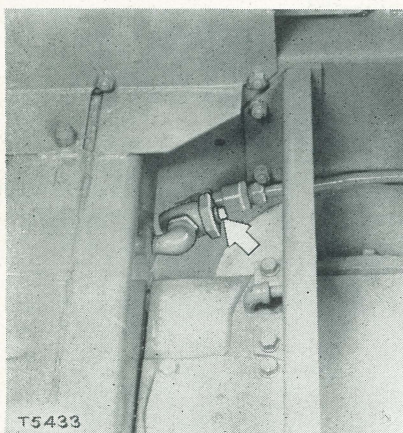
1—Fuel filter housing. 2—Fuel injection valve. 3—Fuel injection line. 4—Fuel injection pump. 5—Fuel transfer pump. 6—Fuel line from Diesel fuel tank.



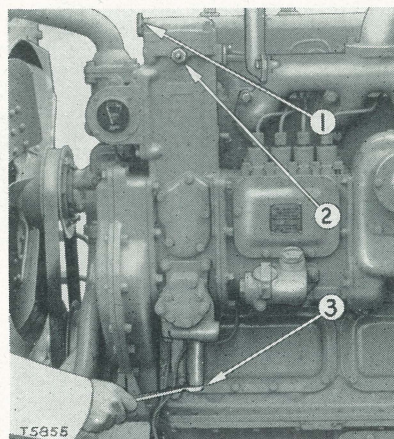
pressure to the fuel filter housing (1), the filters remove the dirt and other foreign particles. From here the fuel is supplied to the fuel pump manifold for the individual fuel injection pumps (4). The fuel injection pumps meter and force the fuel through the fuel injection lines (3) and the fuel injection valves (2) in the cylinder head, into the pre-combustion chamber where it is ignited and passed into the main combustion chamber or cylinder.

CARE OF THE FUEL FILTER

Draining Fuel Filter Housing: Every 60 hours, drain the filter housing of sediment and water which settles to the bottom of the compartment. Close the Diesel fuel tank valve, remove the filter housing drain plug (3) and open the lower vent (2) and then the upper vent (1) in the housing. Replace the drain plug, and prime the system. See the topic, PRIMING THE FUEL SYSTEM.



DIESEL FUEL TANK VALVE



DRAINING FUEL FILTER HOUSING

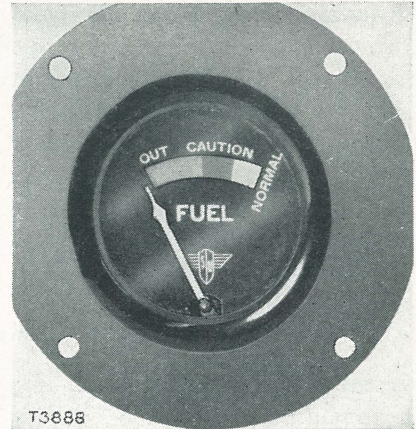
1—Upper vent. 2—Lower vent.
3—Drain plug.

Fuel Filter Elements: When the absorbent filter elements have collected enough contamination to interfere with free flow of fuel, they must be replaced with new elements. These elements will continue to absorb particles until fuel will no longer flow through them at a rate to maintain maximum engine performance. They will not discharge their burden into the clean fuel; this is prevented by the fine grade filter paper at the core.

Because these filter elements absorb and hold contaminants, they cannot be washed or otherwise restored.

As the filters gradually become clogged with foreign material, the position of the fuel gauge indicator will work back from the original position in the NORMAL (white) range, to the CAUTION (green) range, and later into the OUT (red) range. When the indicator shows in the OUT (red) range the filters should be changed and all new filter elements installed — never only one.

FUEL PRESSURE GAUGE

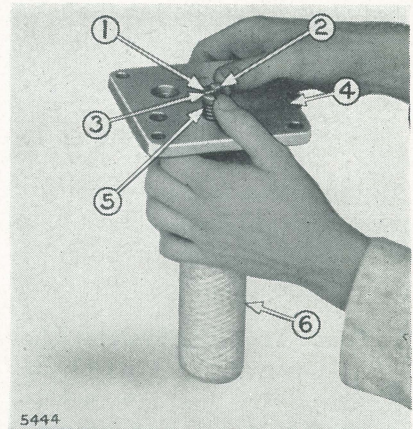


Removing Used Filter Elements: Remove the engine hood. Thoroughly clean the top of the filter cover and around the edges of the gasket joint between the filter body and cover, to guard against loose dirt dropping into the filter housing when the cover is removed. Close the Diesel fuel tank valve, remove the filter housing drain plug, open the lower and then the upper filter housing vents.

Remove the cover, and lift the assembly of filter element plate and all filter elements out of the housing.



REMOVING FUEL FILTER ASSEMBLY



REMOVING FILTER ELEMENT
1—Retainer. 2—Retainer rod. 3—Pin.
4—Filter element plate. 5—Spring.
6—Filter element.

To remove the used filter elements, set the assembly on a flat surface and compress each spring (5) until the retainer (1) will permit removal of the pin (3). Lift off the filter element plate (4) and remove the used elements (6) from the retainer rods (2).

Attaching New Filter Elements To Filter Element Plate: Thoroughly wash the plate, retainer rods, retainers, pins, and springs in clean kerosene, Diesel fuel or a non-inflammable cleaning fluid. Make sure that the hands are clean before attempting to install the new parts. Place the retainer rods into each new filter element and attach to the plate individually by compressing the spring and inserting the pin so it is held securely in the counterbore of the retainer. Grasp each element at the bottom end and give it approximately a half turn under light pressure to seat the ends of the element against the plate and against the disc on the bottom of the retainer rod. Keep the elements parallel and square with the plate while performing this operation.

Installing Filter Elements In Housing: Before installing the elements in the housing, flush out the housing with clean fuel and replace the drain plug. Install the new plate gaskets supplied with each set of elements.

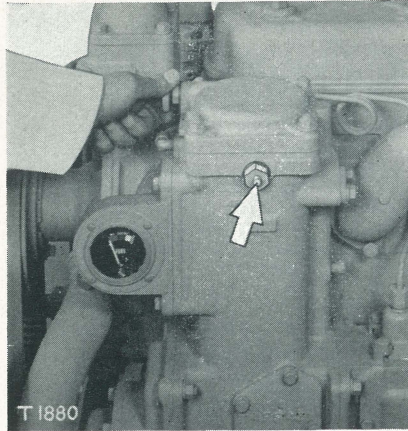
Exercise extreme care to see that the top side of the retainer plate, retainer assembly, and the inside of the housing cover are clean. These parts are on the clean side of the elements and if dirt is not completely removed, it will find its way into the fuel injection equipment. Replace the cover. Open the Diesel fuel tank valve and follow the instructions for PRIMING THE FUEL SYSTEM.

Keep New Filter Elements On Hand: An extra set of filter elements should be kept on hand for replacement. Always keep the elements wrapped in their original cartons to insure against dust and dirt accumulation which will shorten the life of the elements if it gets on the outside or may cause damage to the fuel injection equipment if it gets on the inside.

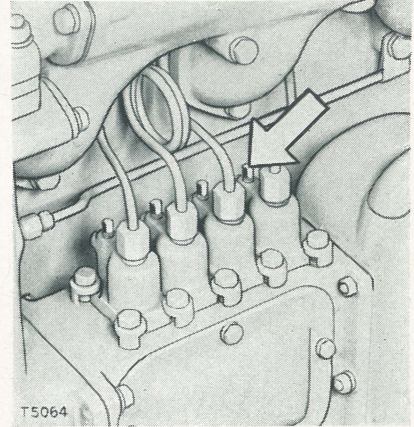
PRIMING THE FUEL SYSTEM

Any time the fuel flow is broken and air is allowed to get into the fuel system, the fuel system must be primed. If air is left in the lines, the fuel system may become air bound, resulting in inability to start the Diesel engine or the misfiring of one or more cylinders.

To Prime The Fuel System: Check to see that the Diesel fuel tank valve is open. Open the fuel filter vent valves and the vents on the fuel injection pumps. The fuel injection pump control lever should be in the extreme forward position, so the pumps are shut off. Then, start the starting engine, engage the starter pinion, and the starting engine clutch. Allow the starting engine to crank the Diesel engine at starting engine idle speed, with the compression release lever in the START position. This will allow the fuel transfer pump to force the air and fuel through the fuel filters and the fuel pump vents. When the flow of fuel through the vents becomes continuous and contains no air bubbles, close the vents. Open and close the vents several times in succession to be sure all of the air is bled from the system.



OPENING FUEL FILTER
VENTS



FUEL INJECTION PUMP
VENTS

FUEL INJECTION EQUIPMENT

When improper fuel injection is affecting the Diesel engine operation, a systematic check should be made to determine the cause. The most likely cause is dirt or water in the fuel. Drain the sediment from the Diesel fuel tank and drain the fuel filter housing. Check the fuel pressure gauge as mentioned in the topic, CARE OF THE FUEL FILTER. Replace the filters if necessary. Then prime the fuel system until clean fuel passes through the vent valves on the fuel injection pumps. If the fuel system is air bound, priming the system will overcome the difficulty.

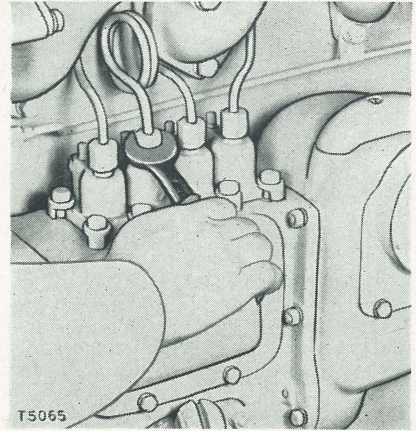
When the engine is running irregularly, and smoking, a fuel injection valve may not be spraying the fuel properly.

As the clearance between the plunger and the barrel of a fuel injection pump increases, due to wear, fuel leakage occurs. When the leakage increases to the point where insufficient fuel is injected into the cylinder, a loss of power is noticeable. With the loss of power, hard starting is also encountered.

Fuel Injection Valves

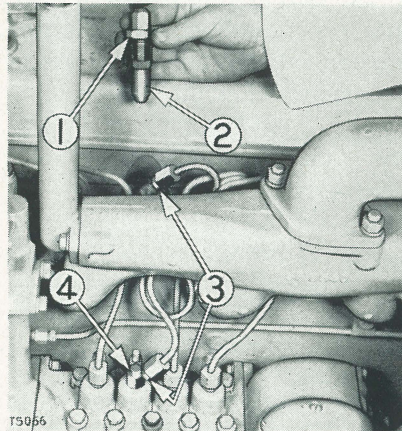
Testing Fuel Injection Valves: Whenever an engine performs in such a manner that a fuel injection valve is suspected of causing trouble, test all fuel injection valves. To test the injection valves, loosen the fuel injection line nuts at the fuel injection pumps, one at a time, while the engine is running. When a nut is loosened and the exhaust smoking is completely or partially eliminated and the irregularity in running is not affected, this identifies the defective valve and a new one should be installed in that cylinder.

LOOSENING FUEL INJECTION LINE NUT TO TEST VALVE



Removing Fuel Injection Valves: Before removing a valve clean the dirt from around the valve and connections with the brush supplied in the tool equipment.

Disconnect the fuel injection line from the injection valve and pump. Install the plug (3) and cover (4). Remove the valve retainer nut (1) and lift out the nozzle assembly (2) and body as a unit.



REMOVING FUEL INJECTION VALVE

1—Retainer nut. 2—Fuel injection
valve nozzle assembly. 3—Plug.
4—Cover.



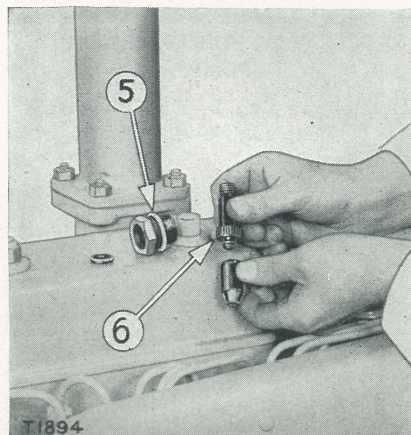
Installing Fuel Injection Valves: Screw the valve body (6) into the fuel injection valve nozzle assembly (2) only finger tight. The threads of the body and nozzle assembly are made to fit loosely. The clearance between the threads provides a passage for fuel to enter the nozzle assembly from the body.

Insert the nozzle assembly and valve body into the pre-combustion chamber opening, install the large seal (5) and then the retainer nut. The retainer nut should be drawn down only tight enough to prevent

leaks between the nozzle assembly and the nozzle assembly seats. The smaller seal should be placed on top of the retainer nut before connecting the fuel injection line to the valve.

INSTALLING FUEL INJECTION VALVE

5—Large seal. 6—Injection valve body.



Fuel Injection Pumps

Testing Fuel Injection Pumps: It is not usual for one pump on an engine to require replacement unless all the pumps are worn. Worn fuel injection pumps will result in loss of power and hard starting. When loss of power and hard starting is accompanied with a clear exhaust, good compression and no blow-by gases from the crankcase breather, it indicates worn injection pumps. These pumps can be checked by your "Caterpillar" dealer.

Removing Fuel Injection Pumps: Every precaution should be taken to prevent dirt from getting into the fuel injection pumps or housing. Use the brush supplied in the tool equipment to clean the top of the housing and around the inspection plate before removing. When fuel injection pumps are removed the pump plungers must not be taken from the barrels because dust or dirt will scratch these finely finished parts.

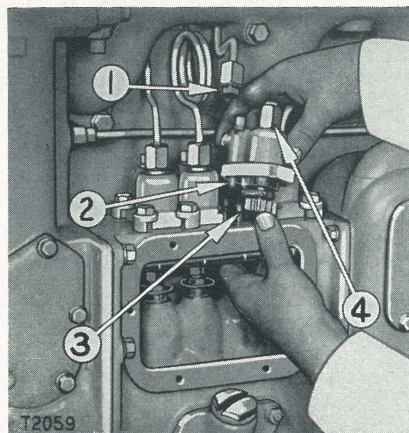
After cleaning the top of the housing, and around the inspection plate, remove the fuel injection lines from the pumps and immediately cap and plug the openings with covers (4) and plugs (1) provided in the tool equipment. Remove the inspection plate.

Remove the capscrews and clamps holding the fuel injection pump to the housing and lift the pump straight up only enough to clear the dowel pins. Then insert a finger through the inspection hole, hold the plunger from dropping out and shift the pump to one side so the end of the pump plunger will free itself from the slot in the lifter. Place the ferrule cap seal (3) and plug (2) furnished in the tool equipment over the fuel outlet of the fuel housing and in the inlet of the pump to keep out dirt.

Should the plunger accidentally be removed from the pump barrel, take every precaution to avoid nicking or scratching it since the slightest

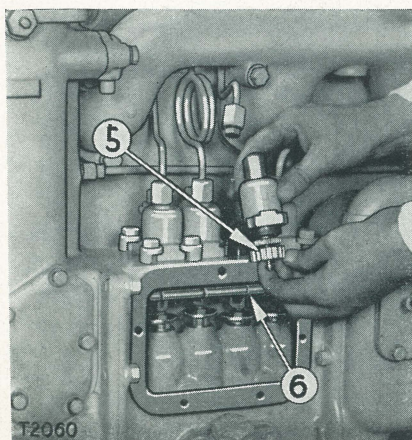
REMOVING FUEL INJECTION PUMP

1—Fuel line plug. 2—Plug. 3—Ferrule cap seal. 4—Cover.



rough spot will cause undue wear in the barrel and shorten the life of the pump. The plunger should be rinsed in clean fuel before putting it back in the barrel. Be sure the plunger is replaced in the barrel from which it was withdrawn. **Each fuel injection pump assembly (plunger and barrel) is machined as a unit and finished to such exact limits that it must be used, removed, and replaced as a unit.**

Installing Fuel Injection Pumps: Lower the pump and plunger into the housing, taking care that the pump plunger does not slide out of the pump. Line up the marked tooth (5) of the injection pump plunger gear with the mark (6) on the rack as the plunger is lowered into place. Slide the end of the plunger into the slot in the lifter. Remove the ferrule cap seal and plug from the fuel passage and lower the pump onto the dowel pins. Fasten the pump in place.



INSTALLING FUEL INJECTION PUMP

5—Marked gear tooth.
6—Mark on rack.



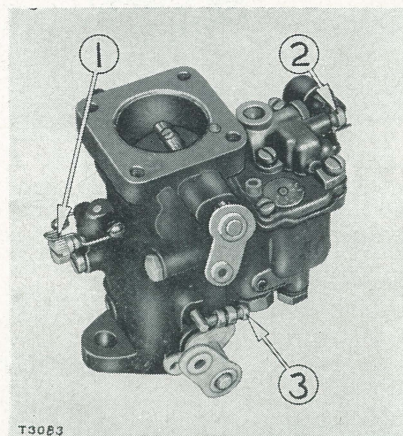
STARTING ENGINE FUEL SYSTEM

Keeping the starting engine fuel tank filled will prevent condensation in the tank. Periodically drain any water which may have accumulated in the starting engine fuel tank by loosening the plug in the bottom of the tank.

Carburetor Adjustment: To obtain an approximate carburetor adjustment, turn the adjusting screws in gently as far as possible. Then back

CARBURETOR ADJUSTMENT

- 1—Idling speed adjusting screw.
- 2—High speed adjusting screw.
- 3—Idling speed control screw.

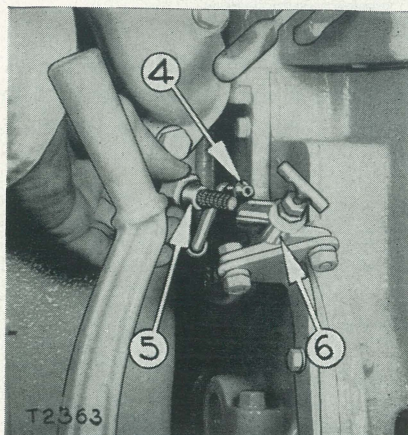


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off the high speed screw (2) one turn from the open position and the idling speed adjusting screw (1) one half turn from the closed position.

A more accurate adjustment can be obtained while the engine is running by turning the high speed screw (2) in to make the mixture richer or out to make it leaner. Adjust this screw to a point that will give the greatest amount of power with a clear exhaust. Turn the idling speed adjusting screw (1) until the engine will idle regularly at slow speed without emitting black smoke from the exhaust. Turn this screw in to make the mixture richer or out to make it leaner. Turn the idling speed control screw (3) to the left (out) to decrease idling speed or to the right (in) to increase the speed.

Starting Engine Fuel Filter Screen: The filter screen (5) in the starting engine fuel shut off valve collects sediment that may be in the fuel. This collected sediment can be removed by turning off the valve, removing the fuel line (4) from the filter screen nut and the screen nut from the body (6). Wash the screen in kerosene or non-inflammable cleaning fluid. The body can be washed out with the screen removed by opening the valve long enough to allow gasoline from the tank to remove the



REMOVING STARTING ENGINE FUEL FILTER SCREEN

- 4—Fuel line. 5—Filter screen.
6—Filter body.



loose sediment. If water is noticed on the screen or in the fuel line loosen the plug on the bottom of the fuel tank to drain any water that has accumulated.

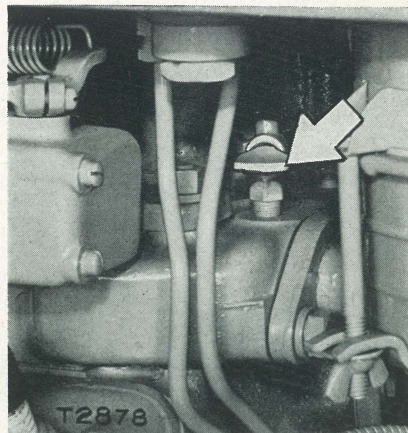
COOLING SYSTEM

Coolants: Water used in the cooling system should be soft, or as free as possible from scale forming minerals. If it is impossible to obtain soft water it is advisable to treat the available water with "Caterpillar" Rust Inhibitor. The use of this rust inhibitor in the cooling system will prevent the formation of rust. It will also retard, and in some cases completely eliminate mineral deposits within the engine. Most commercial anti-freeze solutions contain rust inhibitors, therefore, it is not necessary to use rust inhibitors with those anti-freeze solutions which do contain inhibitors. Your "Caterpillar" dealer stocks "Caterpillar" Rust Inhibitor in convenient one quart cans. Directions for its use are printed on each can.

When the temperature is below freezing sufficient anti-freeze should be used in the cooling system to prevent freezing. Various anti-freeze mixtures such as ethylene glycol (Prestone, G.M., Permaguard, Zerex, etc.) denatured ethyl alcohol, methanol (synthetic wood or methyl alcohol) and glycerine are all suitable for use. Alcohol can be used successfully but, because it readily evaporates at the normal operating temperature of the Diesel engine the solution should be tested frequently — even daily — and kept up to correct strength. This loss by evaporation is objectionable **but the temperature regulator should not be removed.** Doing so might make the solution run cooler and save the alcohol, but it is not desirable for good performance. It is essential, therefore, that the coolant be tested frequently to assure adequate protection.

Filling: Fill the starting and Diesel engine cooling system by pouring the coolant into the radiator filler opening. A vent cock located on top of the starting engine water manifold should be opened when filling the cooling system. This venting allows all air to escape from the system and assures complete filling. The vent cock should be closed as soon as the cooling system is full.

STARTING ENGINE WATER
MANIFOLD VENT COCK



Cleaning The Radiator: Dirt in between the tubes of the radiator and oil cooler may cause excessively high operating temperature. This dirt may be easily removed by removing the four capscrews which hold the radiator screen in place. Then wash, brush or blow the dirt out with whichever method is available and most effective.

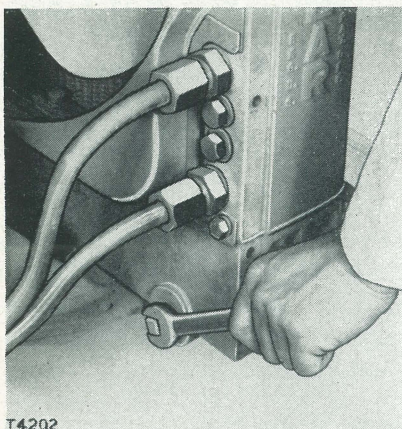
Draining: Open the radiator drain valve on the right rear side of the radiator bottom tank and remove the plug or open the drain cock in the right side at the rear of the engine block. This will drain the entire cooling system, of the Diesel and starting engines, if the tractor is level.

Cleaning The Cooling System: The cooling system should be drained occasionally to remove dirt and sediment which accumulates. The draining should be done at the end of the day's run, when the foreign material is in suspension and will easily drain with the liquid.

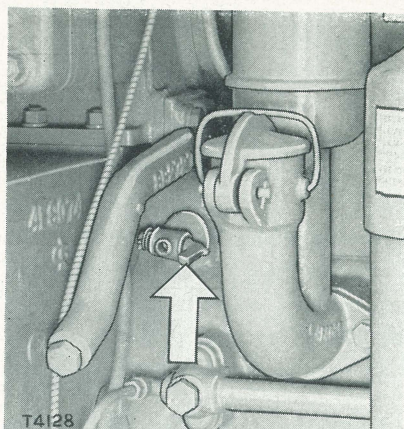
The cooling system should be washed out occasionally. To do this, run the engine until the liquid in the cooling system is at operating temperature, and the loose foreign material is stirred up. Then stop the engine, and drain as quickly as possible before the sediment has time to settle. Close the drain and pour in kerosene equal to about one-tenth the capacity of the cooling system and fill the remainder with a solution of one-half pound (226.8 grams) of washing soda to each gallon (3.8 liters or .8 Imp. Gal.) of water. Run the engine for about one-half hour, and again drain and flush the system with clean water.

In more obstinate cases, if the above treatment does not prove effective, an acid solution may be used; but acid must be used with extreme care, and only after other means have proven ineffective. Immediately after the system has been washed with the soda solution described, fill the cooling system with a solution of five parts hydrochloric (commercial muriatic) acid, one part formaldehyde and forty-eight parts water and allow it to remain in the system for a few hours at operating temperature. The formaldehyde should first be mixed with the water, then the acid added to the solution. Drain immediately after stopping the engine and thoroughly flush the system with clean water to which has been added a handful of washing soda, which acts as a neutralizing agent.

After using the acid treatment, the cooling system should be drained and flushed with clean water the second time at the end of the day's run.



**OPENING RADIATOR
DRAIN VALVE**



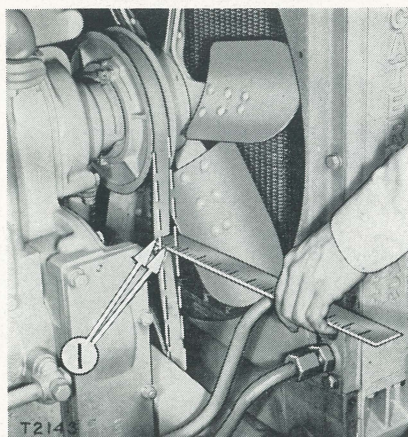
**DRAIN COCK
CYLINDER BLOCK**

CAUTION

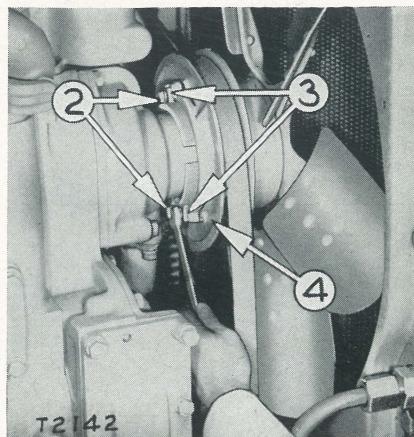
The acid solution is also a solvent of the metals of which radiators are made, therefore, great care must be exercised to avoid continuing the operation beyond the point where the scale is dissolved. It is highly important that no trace of the acid be left in the cooling system.

FAN BELT ADJUSTMENT

To adjust the fan belt, remove the locks (3) holding the adjustable rim of the pulley in position on the hub of the fan by taking out the fastening capscrews (2). Screwing the rim (4) toward the radiator will tighten the belt. Be sure the locks are lined up with the slots in the hub before the capscrews are tightened. The adjustment is correct when the belt can be easily pushed inward a distance of approximately 1 inch (2.5 Cm.) as

**CHECKING FAN BELT TENSION**

1—Allow 1 inch (2.5 Cm.) slack at this point. 2—Capscrews. 3—Locks.
4—Adjusting rim.

**FAN BELT ADJUSTMENT**

shown at (1). If the fan belt is operated too loose, it will slap against the pulleys, causing unnecessary wear to the belt and possibly slipping to the extent that the engine will overheat. If the belt is too tight, unnecessary stresses are placed upon the fan bearing and belt, which might shorten the life of both.

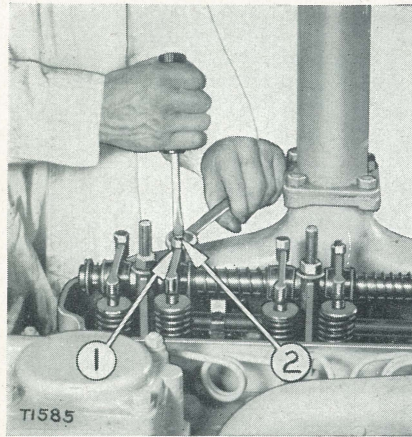
VALVE CLEARANCE ADJUSTMENT

The initial valve clearance adjustment should be made at the time the cylinder head stud nuts are tightened after the first thirty days of operation. Thereafter, the clearances should be checked and adjusted if necessary after every 240 hour operating interval.

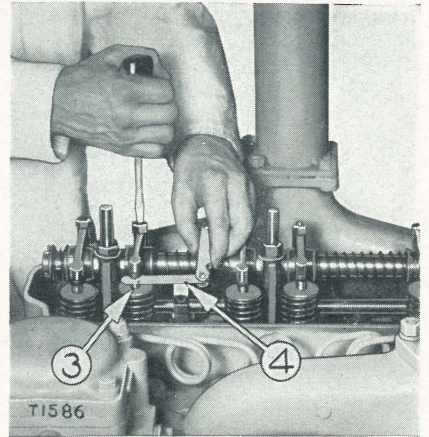
The valve clearance adjustment should be made while the engine is hot, either while the engine is running or before it has been stopped twenty minutes after having run long enough to thoroughly warm up. If the adjustment with the engine stopped is not completed during the twenty minute interval, start the engine and allow it to warm up. The valve clearance adjustment must be made or the clearances checked with the compression release lever in the RUN position.

To Adjust: Loosen the valve adjusting screw lock nut (1), turn the adjusting screw (2) to allow a thickness gauge (4) to pass between the top of the valve stem (3) and the end of the valve rocker at the correct clearance. Set this clearance at .010 inch (0.25 Mm.) for exhaust and inlet valves. Tighten the adjusting screw lock nut and check the adjustment.

If the adjustment is made with the engine stopped, turn the engine until the valve closes and the push rod is at its lowest point.

**LOOSENING LOCK NUT**

1—Lock nut. 2—Adjusting screw.

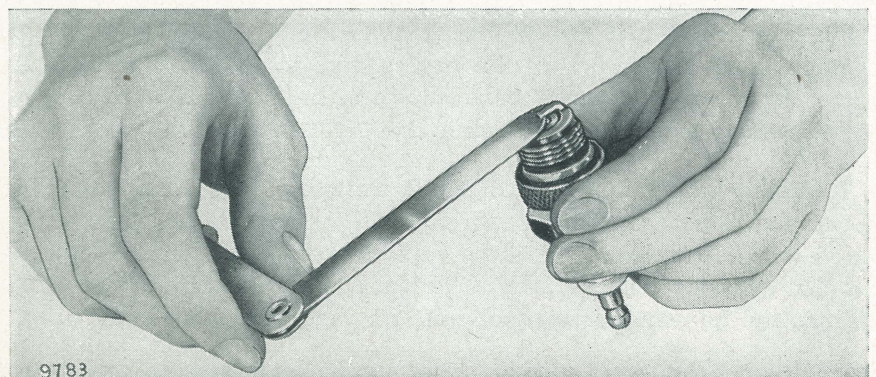
**ADJUSTING VALVE CLEARANCE**

3—Valve stem. 4—Thickness gauge.

The compression release clearance is not adjustable but it should be checked when the valve clearances are checked. The normal clearance between the inlet valve rocker arm button and flat of the compression release shaft is about .125 inch (approximately .3 Cm.). If the clearance does not check see your "Caterpillar" dealer.

SPARK PLUG ADJUSTMENT

The spark plugs should be examined often enough so the gap may be kept at approximately .025 inch (0.64 Mm.). Measure this gap with a thickness gauge. To adjust the gap, bend the outer electrode.

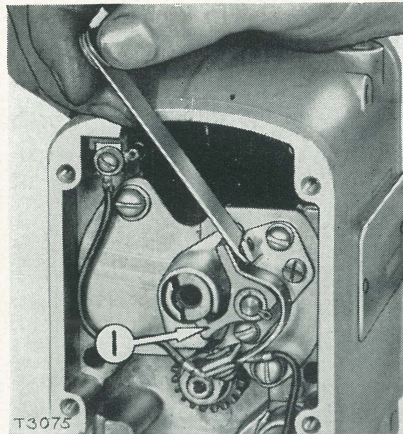
**STARTING ENGINE SPARK PLUG ADJUSTMENT**

STARTING ENGINE MAGNETO

Do Not Lubricate The Magneto At Any Point: The bearings are packed with a ball and roller bearing lubricant when assembled, and this should be replaced only when the magneto is taken to your "Caterpillar" dealer for checking or reconditioning.

Checking Contact Point Opening: Every 1,200 hours check the contact point opening.

To check, first remove the distributor plate and pull out the distributor rotor, then turn the engine flywheel until the contact point bumper block (1) is on the highest elevation of the cam. Check the clearance with a thickness gauge. This clearance should be .014 to .018 inch (.35 to .45 Mm.).

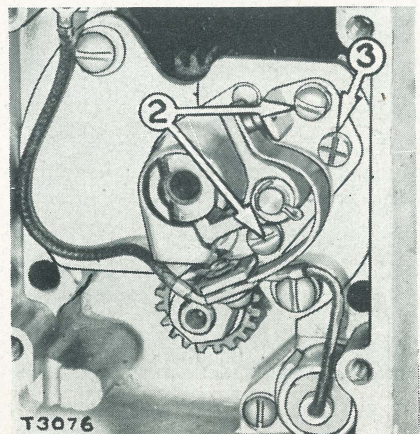


CHECKING CONTACT POINT OPENING

1—Bumper block.



Adjusting Contact Point Opening: Loosen the screws (2) which hold the adjustable contact point bracket and move the bracket by inserting a screw driver in the eccentric slotted-head screw (3) and turn until the correct point opening is obtained. Then tighten the fastening screws and recheck the adjustment.



ADJUSTING CONTACT POINT OPENING

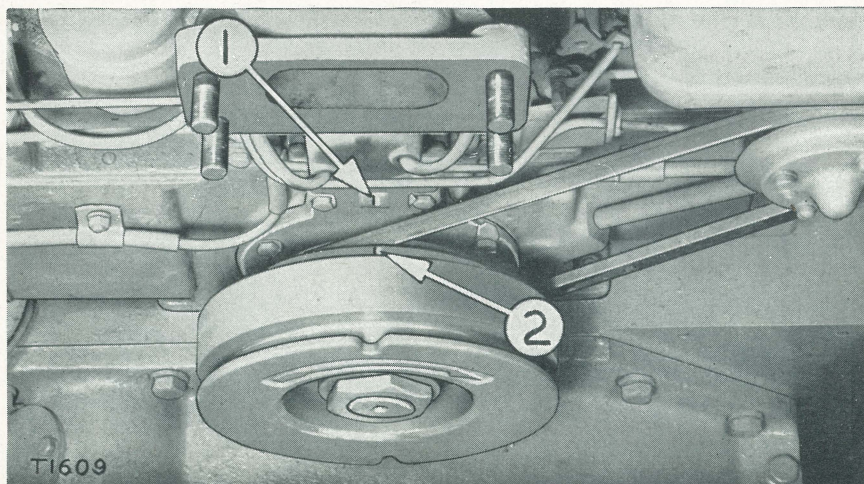
2—Bracket fastening screw.
3—Eccentric slotted-head screw.



Testing: A magneto may be tested when coupled to the engine by turning the switch, ON, removing the cable from a spark plug, and holding the terminal $\frac{1}{8}$ inch (3.17 Mm.) away from the metal base of the plug while turning the engine flywheel. If no spark passes from the terminal to the metal base, disconnect the magneto switch wire from the magneto where it is connected to the terminal on the top of the magneto housing and test again. If a spark passes from the terminal to the base with the switch wire removed, the cable running from the magneto to the switch has become grounded or the switch requires replacement. If, with the switch wire off, the magneto still does not fire, remove the magneto as instructed in the next paragraph and take it to your "Caterpillar" dealer for testing.

To Remove The Magneto For Testing: Take off the engine hood, the throttle and choke control rods. Remove the spark plug cables from the distributor plate and the wire from the switch. Remove the crankcase breather pipe assembly by removing the capscrews holding it to the carburetor adapter and crankcase breather body. Remove the two stud nuts holding the magneto to the engine manifold assembly, and lift off the magneto.

To Time The Magneto To The Engine: Check the adjustment of the contact points. Then open the cylinder head drain cock of No. 1 (rear or left) cylinder and turn the engine flywheel slowly until a rush of air is noted coming from the cylinder. This indicates that the piston is coming up on the compression stroke. Continue to turn the flywheel slowly until the mark (MAG) (2) is even with the mark (1) on the starting engine crankcase cover.

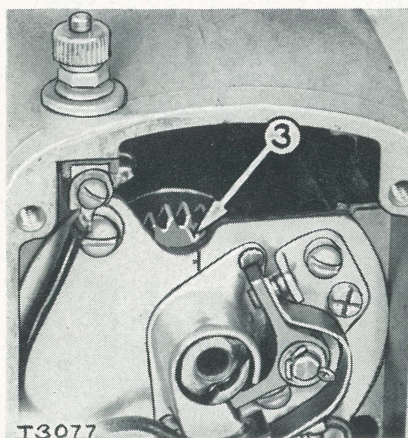


STARTING ENGINE FLYWHEEL AND CRANKCASE COVER TIMING MARKS

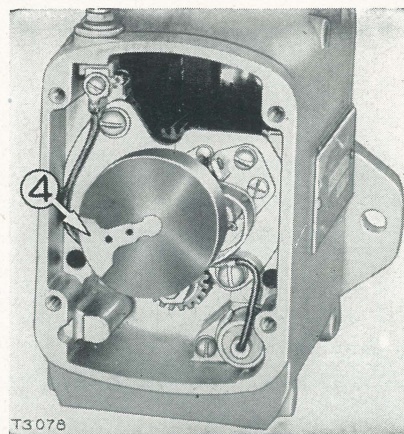
1—Mark on cover. 2—"MAG" mark on flywheel.

The crank of No. 1 cylinder is now 20° ahead of top center on the compression stroke, which is the correct firing point. With the magneto off the engine, remove the distributor plate and rotor from the magneto. Rotate the magneto drive gear until the "A" mark (3) on the distributor gear is showing. In this position the distributor rotor contact (4) will be in line with the conductor for No. 1 cylinder spark plug wire. The contact points should be barely separated.

Install the magneto on the engine and replace the distributor rotor and cover.



TIMING MARKS
3—"A" mark on distributor gear.



**ROTOR POSITION TO TIME
MAGNETO TO ENGINE**
4—Rotor contact.

Checking Timing With Magneto In Place: Locate the firing point of No. 1 cylinder as described in the topic, TO TIME MAGNETO TO THE ENGINE. Remove the cover from the magneto. The "A" mark on the distributor gear should be in position as shown. If the magneto timing is not correct, remove the two stud nuts securing the magneto to the top cover. Pull the magneto away from the cover sufficiently to disengage the magneto drive gear from the engine camshaft gear. Turn the magneto gear until the "A" mark on the distributor gear is in the position as described in the topic, TO TIME MAGNETO TO THE ENGINE, and push the magneto into place.

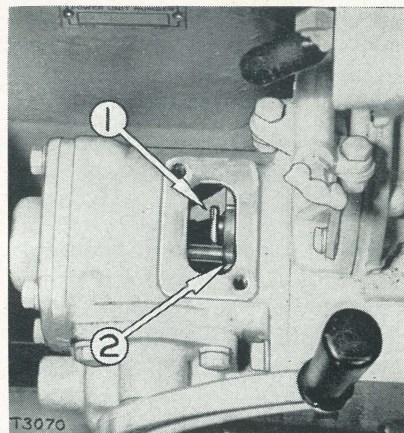
STARTING ENGINE CLUTCH

To Test the Adjustment: Push the clutch lever to the engaged position. The lever should go into position with a distinct snap, and should require a reasonably hard push.

To Adjust: Remove the oil filler plate or plug. Insert a short screw driver in this opening and turn the clutch adjusting collar (2) until the lock pin (1) can be reached. Engage the starter pinion. Pry out the lock pin, and tighten by turning the collar away from the Diesel engine until

STARTING ENGINE CLUTCH ADJUSTMENT

1—Lock pin. 2—Adjusting collar.



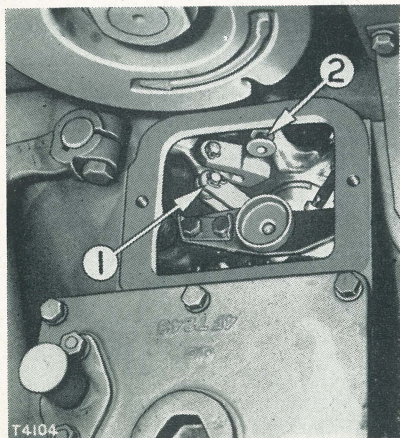
the lock pin drops into the next hole. Test the adjustment by engaging the clutch. If one hole gives a slightly loose adjustment and the next gives too tight an adjustment, use the looser adjustment.

To Wash: Every 240 hours, remove the drain plug while the oil is warm. Refill to the proper level with kerosene or some non-inflammable cleaning fluid and run the engine 3 minutes, engaging and disengaging the clutch. Remove the drain plug and let the housing drain thoroughly. Then fill with fresh oil.

FLYWHEEL CLUTCH

To Test The Adjustment: Pull out the clutch lever to the engaged position. For a desirable adjustment the lever should go into position with a distinct snap, requiring a reasonably hard pull.

To Adjust: Remove the inspection plate on top of the transmission case cover. Reach through this opening and turn the clutch adjusting collar (1) until the lock pin (2) can be reached. Engage the transmission gears.



FLYWHEEL CLUTCH ADJUSTMENT

1—Adjusting collar. 2—Lock pin.

Pull out the lock pin, and tighten by turning the collar to the right or clockwise until the lock pin drops in the next hole. Test the adjustment by engaging the clutch. If one hole gives a slightly loose adjustment and the next gives too tight an adjustment, use the looser adjustment. Replace the inspection cover.

Draining The Flywheel Clutch Housing: The clutch plates are designed to operate dry. The drain plug on the bottom of the flywheel housing, should be removed every 60 hours to drain any lubricant that may have seeped into the compartment from the engine, transmission, or clutch bearings. Lubricants from these points should not be allowed to accumulate in the housing. Any accumulation which will not drain from the housing should be washed out as instructed in the next paragraph.

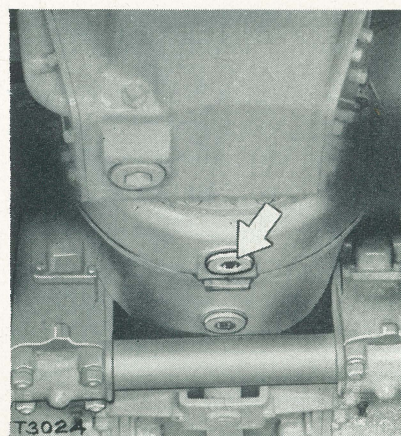
Washing The Flywheel Clutch Housing: Remove the flywheel housing drain plug and the cover from the housing every 900 hours and wash or flush the clutch housing with a non-inflammable cleaning fluid when the engine is stopped. The cleaning fluid should be forced on the housing inside surfaces, not on the clutch, with a flush type grease gun and allowed to drain with the accumulations from the housing.

Wash The Flywheel Clutch Links: If difficult operation of the clutch is encountered it may be that the clutch engaging linkage has become dirty. This dirt can be removed by washing the linkage with some non-inflammable cleaning fluid. When washing, care must be taken not to get greases or oils on the clutch plates. After washing the linkage the clutch release bearings, sliding collar and yoke screws should be lubricated as instructed in the LUBRICATION CHART.

STEERING CLUTCHES AND BRAKES

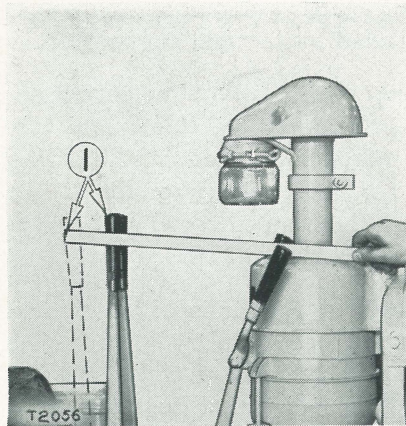
The steering clutches should be kept in proper adjustment to insure full engagement of the clutches when the levers are in the forward posi-

FLYWHEEL CLUTCH HOUSING
DRAIN PLUG



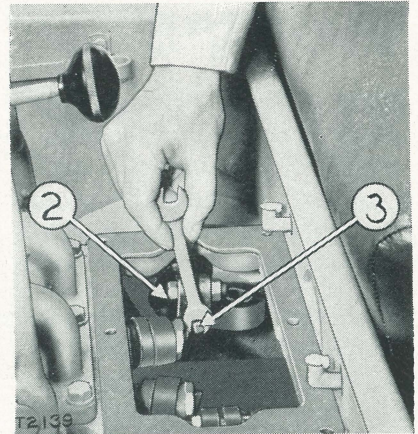
tion. Obstructions such as rocks, sticks and the like should be removed which hinder the control levers traveling to the extreme forward position. If the tractor is operated with improper steering clutch adjustment or with obstructions to the control levers the release bearings may become damaged.

Steering Clutch Adjustment: When the steering clutch levers have 3 inches (7.6 Cm.) free movement at (1), the clutch adjustment is correct. This free movement reduces as the clutch facings wear and adjustment becomes necessary.



CHECKING STEERING CLUTCH CONTROL LEVER FREE MOVEMENT

1—There should be at least 3 inches (7.6 Cm.) free motion at this point.



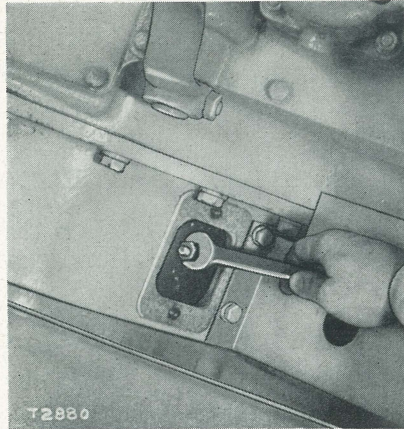
STEERING CLUTCH CONTROL LEVER ADJUSTMENT

2—Clamp bolt. 3—Adjusting screw.

To Adjust: Remove the inspection plate on the transmission top cover just below the operator's seat cushion. Loosen the clamp bolt (2) which holds the adjusting screw (3). Turn the adjusting screw OUT, or toward the center of the tractor to increase the free movement, until the correct adjustment is obtained. Tighten the clamp bolt. Make the same adjustment to the other clutch and replace the plate.

Steering Clutch Brake Adjustment: Keep the brakes adjusted just tight enough so the tractor will turn correctly when the steering clutch is released and the brake pedal is depressed 3 to 4 inches (7.62 to 10.16 Cm.). The band should be entirely free from the drum when the pedal is in the released position.

To Adjust: Remove the small cover at the lower end of the foot plate. To adjust the brakes, turn the adjusting nut in a clockwise direction to tighten the brakes. A spring, mounted on the tang of the brake band, engages the adjusting nut at each 1/6 turn, and keeps it from jarring out of adjustment. The adjusting nut should be turned sufficiently each time to allow the spring to seat firmly on the nut.

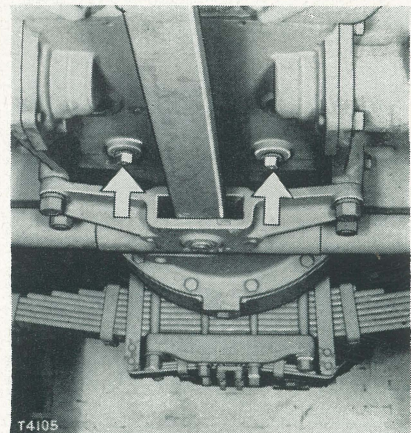


STEERING CLUTCH BRAKE ADJUSTMENT



Loosen the lock nut on the support screw on the under side of the transmission case below the brake drum. Apply the brake to draw the brake band tightly around the drum. Turn the support screw up tight against the band and then back off $1\frac{1}{2}$ turns and tighten the lock nut. This screw supports the brake band and maintains the correct clearance between the lining and the drum. The band should be entirely free from the drum when the pedal is in the released position.

Draining Steering Clutch Compartment: The steering clutches are designed to operate dry. Oil is used only to lubricate the release bearings. **This oil, and any seepage from the adjoining compartments should be drained every sixty hours of operation by removing the plugs in the**

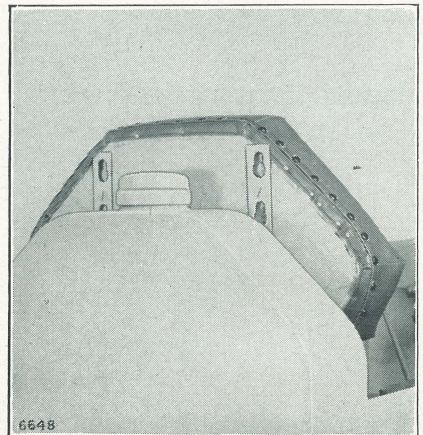
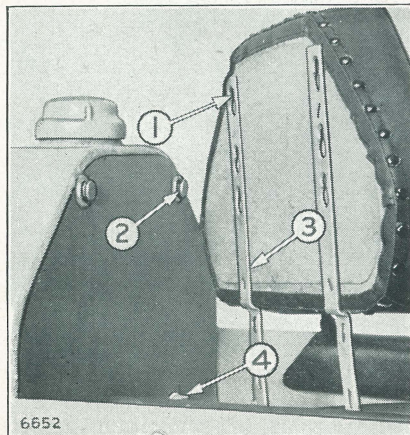
STEERING CLUTCH COMPARTMENT
DRAIN PLUG

bottom of the case. Failure to observe proper draining periods may result in the clutches slipping or difficulty in steering the tractor. The drain plugs should be replaced to keep out dirt and moisture during operation.

Washing The Steering Clutch Brakes: If the steering clutch compartments have not been drained at the proper interval or lubricant has accumulated on the steering clutch brakes sufficiently to cause slippage or difficult steering, some improvement in operation will result by washing the brakes. To do this, drain the compartments then remove the brake band inspection covers. Pour enough non-inflammable cleaning fluid into each compartment so that the bottom of each steering clutch brake drum will dip in the fluid. Operate the tractor back and forth for five minutes without releasing the steering clutches. This will prevent the oil and dirt on the outside of the clutches and the inside of the cases from being washed in between the clutch discs. Drain the clutch compartment and repeat the operation of washing, this time applying the brakes occasionally. Drain the clutch compartments, replace the drain plugs and lubricate the steering clutch release bearings.

SEAT BACK CUSHION ADJUSTMENT

The seat back cushion may be adjusted to three different heights for the operator's comfort. To do this, remove the seat cushion; then remove the capscrews from the lugs (4) holding the lower end of the fastener strips (3) in place. Then lift the seat back cushion off the buttons (2) located near the top of the fuel tank. Relocate the seat back cushion in the position desired by placing the cushion over the buttons. Make certain that the button heads are fastened securely in the adjusting holes (1), then replace the capscrews holding the lower end of the fastener strips in place.

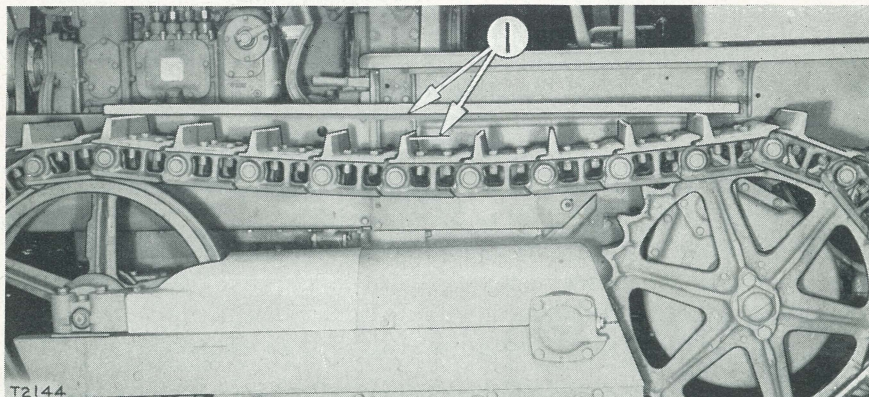


ADJUSTING SEAT BACK CUSHION

1—Adjusting holes. 2—Button. 3—Fastener strips. 4—Lugs.

TRACK ADJUSTMENT

The track adjustment is correct when the track has $1\frac{1}{2}$ to 2 inches (3.8 to 5.1 Cm.) sag measured as shown at (1), a point half way between sprocket and front idler centers.

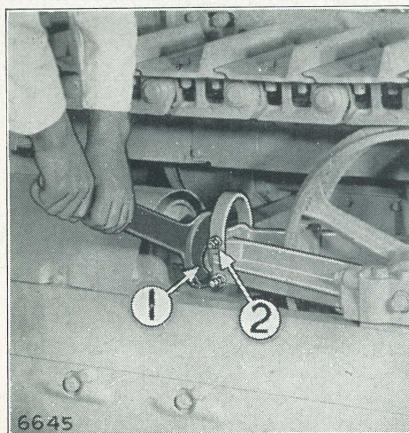


CHECKING TRACK ADJUSTMENT

1—It should be possible to raise track $1\frac{1}{2}$ to 2 inches (3.8 to 5.1 Cm.) at this point.

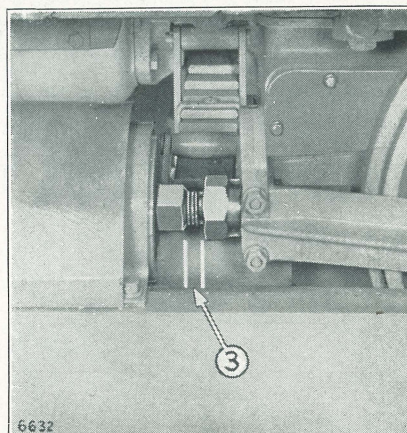
To Adjust: Remove the track adjusting bolt front guard and loosen the clamp bolts (2) that hold the front idler yoke on the track adjusting nut (1). Turn the nut until the track is at the correct adjustment.

When the adjustment has been made, drive the tractor backward and forward to equalize the adjustment. Then, recheck the adjustment. Tighten the clamp nuts and replace the cover.



ADJUSTING TRACK

1—Adjusting nut. 2—Adjusting nut clamp bolt.



LIMIT OF ADJUSTING TRACK

3—This measurement should not exceed $3\frac{1}{2}$ inches (9.0 Cm.).

As continued track adjustment becomes necessary through service, the following precaution should be observed to prevent the adjusting bolt being screwed out of the adjusting nut, with subsequent damage to the

threads: A maximum measurement of $3\frac{1}{2}$ inches (9.0 Cm.) should not be exceeded between the adjacent faces of the track adjusting nut and the nut that holds the recoil spring as shown at (3).

WASHING GEAR COMPARTMENTS

Washing The Transmission: Remove the drain plug from the transmission case after a run, when the oil is warm. This drains the speed change gear compartment and the bevel gear compartment. Replace the plug and fill to the proper level with kerosene or some non-inflammable cleaning fluid. Drive the tractor back and forth for 5 minutes, if it is convenient. If not, start the engine and put the gears in the highest speed. Tie back the steering clutch levers and engage the flywheel clutch. Allow the gears to run 5 minutes, disengage the clutch, and shift into neutral. Drain the cleaning fluid and refill with fresh lubricant to the correct level as instructed in the LUBRICATION INSTRUCTIONS section of this book.

Washing The Final Drive Cases: Remove the drain plugs from both cases after a run, when the oil is warm, and allow the old oil to drain. Replace the plugs and fill the cases to the proper level with kerosene or some non-inflammable cleaning fluid. Drive the tractor back and forth for 5 minutes. Drain the cleaning fluid and refill the final drives with fresh lubricant as instructed in the LUBRICATION INSTRUCTIONS section of this book.

Washing Belt Pulley Drive And Rear Power Take Off Housings: Remove the drain plug from the housing when the oil is warm, and allow the oil to drain. Replace the drain plug and fill the housing to the correct level with kerosene or some non-inflammable cleaning fluid. Operate the gears for five minutes to wash the housing. Drain the cleaning fluid and refill the housing to the proper level as instructed in the LUBRICATION INSTRUCTIONS section of this book.

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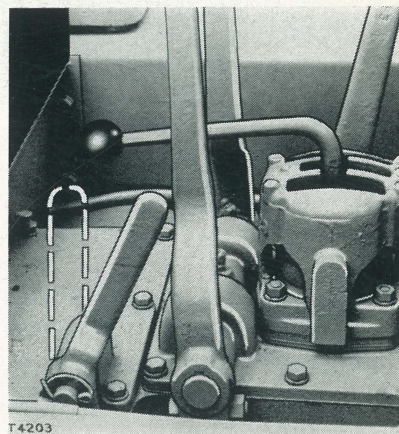
Attachment Instructions

Attachments are available from your "Caterpillar" dealer. Many of these attachments will add to operator comfort and convenience as well as increase the usefulness of your tractor.

REAR MOUNTED EQUIPMENT

The rear mounted equipment is driven with power from the tractor engine by means of the flywheel clutch and transmission.

BELT PULLEY DRIVE AND
POWER TAKE-OFF CONTROL

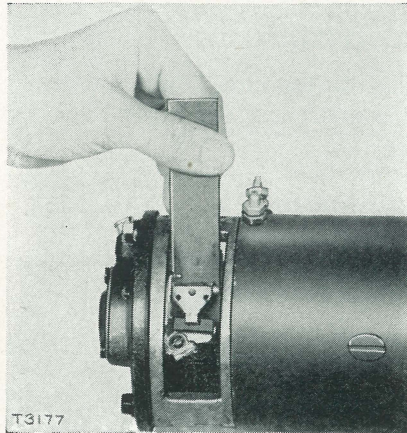


Belt Pulley Drive And Power Take-Off Operation: Disengage the flywheel clutch and shift the transmission into neutral. Push the power take-off control lever ahead to engage the sliding gear with the drive gear. Engage the flywheel clutch to deliver engine power through the transmission to the power take-off.

GENERATOR AND STARTING ENGINE ELECTRIC STARTER

Never operate a generator with an open circuit between it and the battery.

Cleaning Generator Or Electric Starter: Approximately every 1,200 hours, the inspection cover should be removed from the generator and starter and a check made of the commutator. If it is glazed or darkened, polish it with "00" sandpaper. To polish, hold the sandpaper on the commutator while the commutator is turning. The polishing should be done on the generator when the Diesel engine is running at low idle speed. It should be done on the starter by pressing the starter switch with the magneto switch turned off. Turn the sandpaper over to clean the contact surfaces of the brushes. The commutator should not be turning when the brushes are being cleaned. Make sure all trace of sand particles is removed from the commutator, brushes, and brush holders by blowing out with air or an equally effective method.



SANDING GENERATOR BRUSH



Brush Replacement: Brushes should be inspected and replaced if badly worn. When a new brush is installed, seat it properly with the contour of the commutator by using "00" sandpaper. Remove all sand particles and make certain the connections are all tight. A poor connection in the charging circuit will cause the generator to build up excessive voltage which may result in burned field or armature windings. A poor connection in the generator field will cause a low voltage.

General Reconditioning: Approximately every 4,000 hours, the generator and starter should be removed so that they may be completely disassembled, washed and have all parts replaced that show evidence of being unsatisfactory for reason of wear. It is suggested that this cleaning and reconditioning be entrusted to your "Caterpillar" dealer.

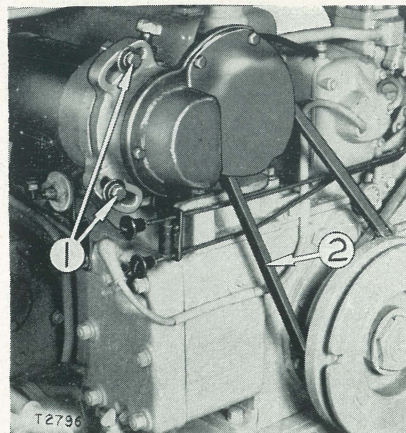
Starting Engine Starter Drive: If difficulty is experienced with the electric starter drive failing to engage with the belt pulley drive gear, dirt in the worm drive is probably responsible. To correct remove the starter from the mounting bracket, then take off the starter drive housing. Carefully clean the spiral grooves of the drive of any dirt or grease accumulations. Wash the spiral sleeve upon which the pinion operates. Also the springs, gear teeth and drive housing. This washing should be done with kerosene or some non-inflammable cleaning fluid.

Before installing the drive, lubricate the spiral sleeve and housing bushing with a few drops of light oil, then reassemble and install.

Starting Engine Starter Belt Adjustment: The starter belt should be maintained at the proper tension at all times. To adjust, remove the hood, loosen the capscrews (1) holding the starter belt drive gear housing in place, then push the starter belt pulley against the belt (2) as tight as possible by hand, and tighten the capscrews.

STARTING ENGINE STARTER BELT ADJUSTMENT

1—Capscrews. 2—Belt.



BATTERY CARE

Every 60 hours, or more often if continuous operation without the use of the battery is encountered, the following attention should be given to the battery to insure high efficiency and maximum operating life.

The battery should be tested with a hydrometer and kept within a margin of safety to a specific gravity of 1.275 to 1.300. A dangerously low point of charge is indicated by a hydrometer reading of 1.150 which will permit the battery to freeze. A specific gravity of 1.250 will permit the battery to withstand temperatures as low as -30° without freezing.

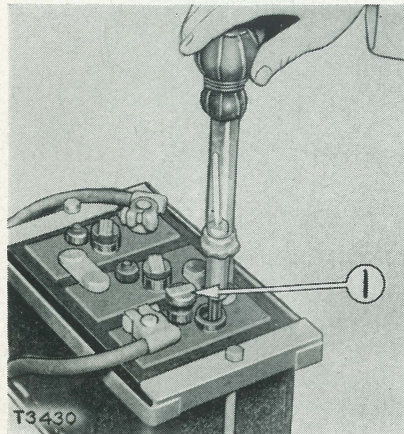
Water that escapes by evaporation should be replaced with distilled water or "approved water" (water free from impurities by analysis). The level should be maintained $\frac{3}{8}$ inch above the top of the separators or insulators. Do not overfill or underfill the cells of the battery as either has a detrimental effect on battery life.

If it is necessary to add water too frequently to the battery, it is probably being overcharged and checks should be made to find and correct the trouble. Loose ground connections or a poorly functioning voltage regulator will cause overcharging of the battery.

Most batteries are provided with filler plugs having special construction. These plugs, when removed for filling the battery, should be pressed on the raised portion of the vents. This prevents overfilling, as air entrapped in the top of the cells forces the excess water out through the filler openings. When the filler plugs are removed from the vents the entrapped air escapes, dropping the water to the proper level in the battery.

Always test a battery for degree of charge before adding water. Otherwise, before an accurate reading can be obtained, it will be necessary to operate the engine for a short period to charge the battery; thus allowing the water to mix with the electrolyte.

If when making weekly tests the battery shows evidence of becoming gradually discharged, it should be removed and completely recharged.



TESTING SPECIFIC GRAVITY OF ELECTROLYTE

1—Plugs should be placed on rubber vents to prevent overfilling.

Check to determine the reason for the battery becoming discharged. Inspect battery terminals and other points in the wiring. A loose connection or worn insulation may be the reason for the battery becoming discharged. Also check for an improperly functioning voltage regulator. Refer to the topic, **VOLTAGE REGULATOR**.

Keep the top of the battery clean and dry to prevent current losses and keep the terminals clean and tight. To clean corrosion from the battery terminals, scrub them with a weak solution of bicarbonate of soda (baking soda) and water. Dry the battery thoroughly, then coat the terminals with lubricant to prevent corrosion. Keep the battery securely fastened in its compartment at all times.

VOLTAGE REGULATOR

The voltage regulator is properly adjusted at the factory and should not be changed except in case of failure then both the regulator and generator should be taken to your "Caterpillar" dealer where the output of the generator can be checked and the regulator adjusted accordingly.

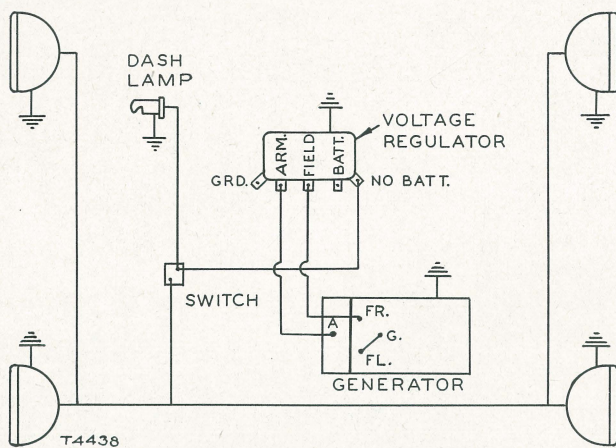
If the ammeter does not show a high charging rate, it is not an indication that the equipment is at fault unless the battery shows a low reading when checked with the hydrometer. The regulator permits a heavy flow of current from the generator to the battery only when the battery electrolyte has a low specific gravity. As the battery becomes charged, the ammeter reading decreases proportionately until at full charge practically no ammeter reading is evident.

If the hydrometer reading is low and no charge is evident on the ammeter, check the entire system for loose connections or broken wires.

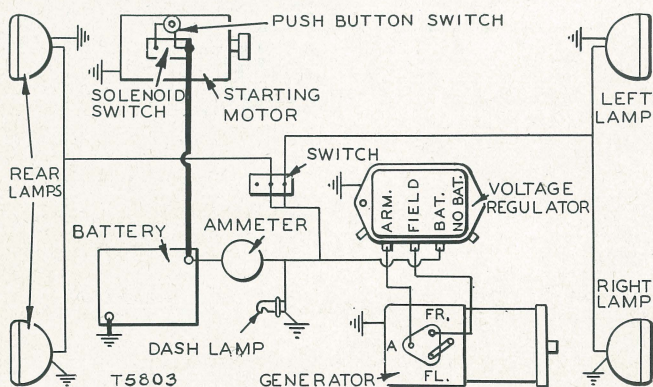
If all connections are satisfactory, check the generator for worn, broken or poorly seating brushes; also check the commutator to determine whether it is glazed or darkened. Refer to the topic, GENERATOR AND STARTING ENGINE ELECTRIC STARTER.

WIRING DIAGRAMS

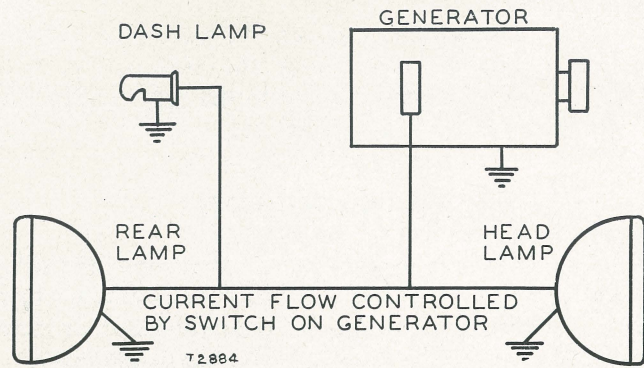
These diagrams, covering wiring arrangements for use with and without battery and cab, are furnished if it becomes necessary to disturb the electrical equipment for the purpose of reconditioning or parts replacement, reassembling may be accomplished without difficulty.



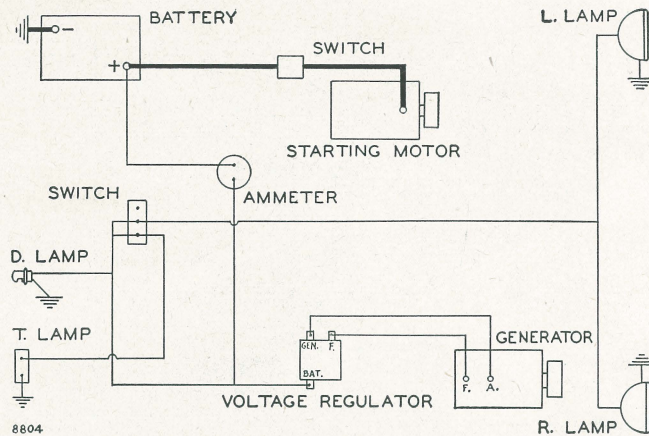
200 WATT GENERATOR—WITHOUT CAB; WITHOUT BATTERY



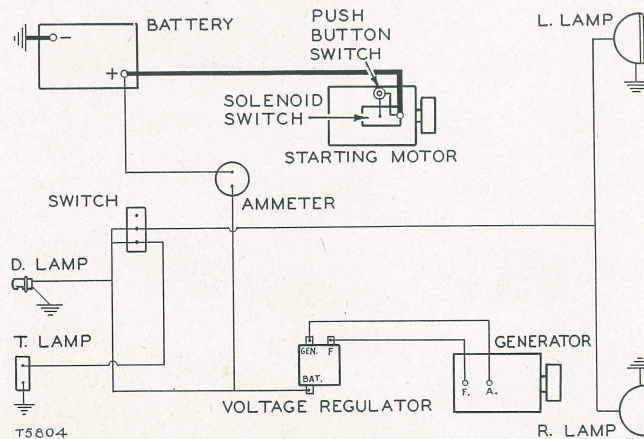
200 WATT GENERATOR — WITH BATTERY



130 WATT GENERATOR — WITHOUT CAB; WITHOUT BATTERY

175 OR 115 WATT GENERATOR — WITH BATTERY,
6 VOLT STARTING MOTOR AND CAB

Without cab use above diagram and move one head lamp to tail lamp location.
No tail lamp is used in the group.



LATER 115 WATT GENERATORS — WITH BATTERY, AND 6 VOLT STARTING MOTOR

LIGHTING SYSTEMS

Two types of lighting systems are available for use on this tractor. They are lighting systems with and without battery. In either type the generator armature revolves whenever the Diesel engine is in operation.

The lights of the lighting system with battery will light whether the engine is in operation or stopped. The switch to turn these lights on or off is mounted on the battery box. The lights of the lighting system without battery will light only when the Diesel engine is running. The switch for these lights is located on the generator where 130 watt generator is used, and is built in with the voltage regulator. Lighting systems with four sealed beam lamps without battery should use a 200 watt generator. In these systems the switch to turn the lights on is located on the dash.

The generators used with lighting systems without batteries are automatically regulated to provide the amount of current required to operate the lights within the capacity of the generator.

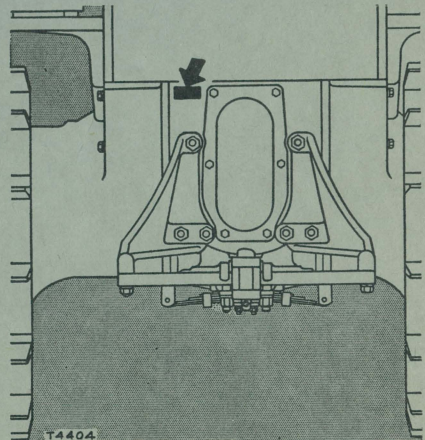
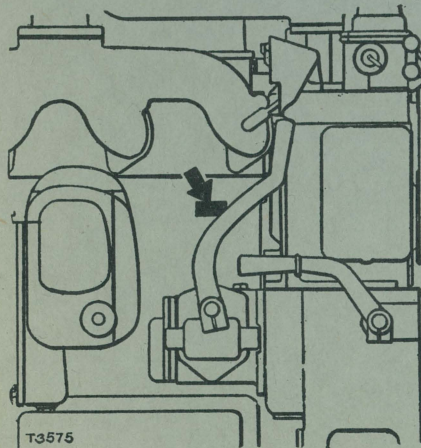
Generators are plainly marked and those of nominally 115 to 200 watt are commonly used for lighting systems only. If watt rating is not indicated on the generator name plate, multiply volts by ampere rating to determine the watt rating. Mazda bulbs consume approximately 1 watt per candle power. Sealed beam lamps consume 6 to 8 amperes per lamp. This being the case it is easy to add up the candle power or ampere load of the various bulbs in the circuit to determine if the lights used are within the capacity of the generator.

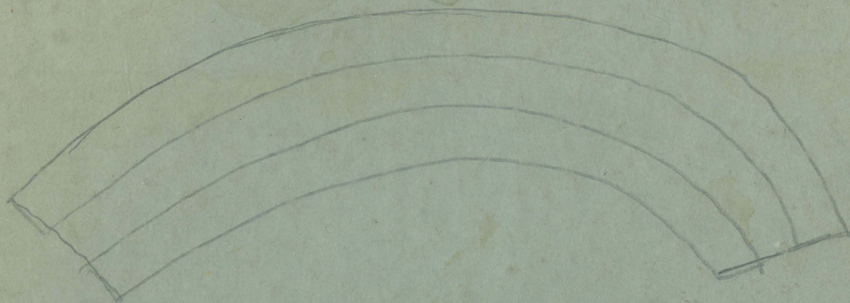
For this reason, the generator size should always be checked before deciding to add additional lights or to increase the light intensity by replacing standard bulbs with those of higher candle power.

Capacities

Crankcase, Diesel Engine	14 qt.
Crankcase, Starting Engine	1 qt.
Fuel Injection Pump Housing	$\frac{3}{4}$ qt.
Starting Engine Clutch Housing	$\frac{1}{2}$ qt.
Air Cleaner, Diesel Engine	2 qt.
Air Cleaner, Starting Engine	$\frac{1}{2}$ qt.
Fuel Tank, Diesel Engine	20 gal.
Fuel Tank, Starting Engine	$2\frac{1}{4}$ qt.
Final Drive (each)	$4\frac{1}{2}$ qt.
Transmission	8 qt.
Cooling System	$7\frac{1}{2}$ gal.

Location of Serial Number





CATERPILLAR TRACTOR CO.

PEORIA, ILLINOIS, U.S.A.

Diesel Engines . . Tractors . . Motor Graders
. Earthmoving Equipment

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