

Operator's Manual



TD-14A

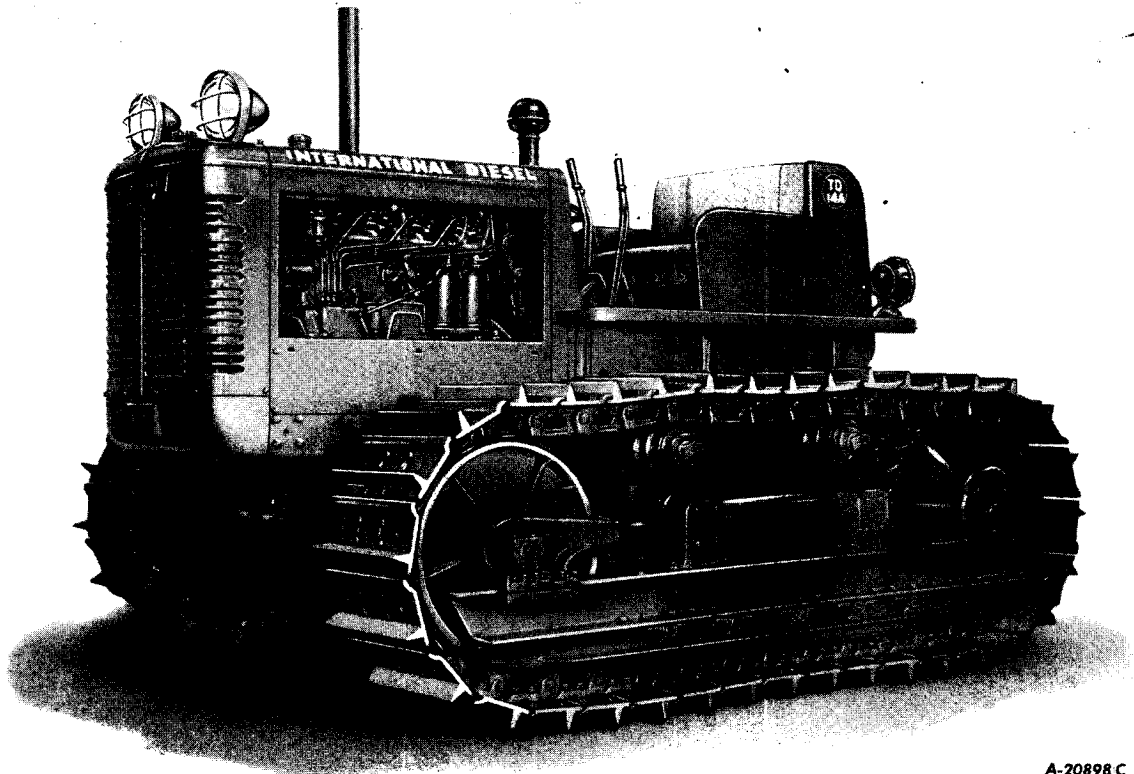
Crawler Tractor

INTERNATIONAL HARVESTER COMPANY

180 North Michigan Ave.

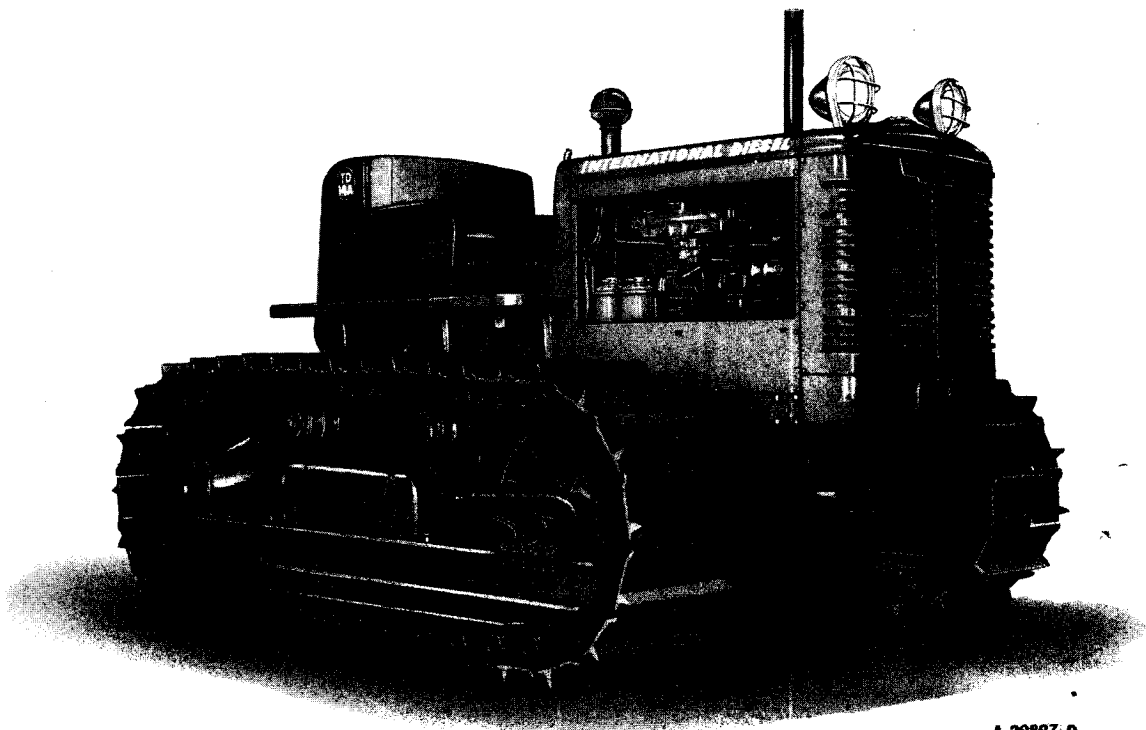
Chicago 1, Illinois, U. S. A.

It is the policy of International Harvester Company to improve its products whenever it is possible and practical to do so. We reserve the right to make changes or add improvements at any time, without incurring any obligation to make such changes on tractors sold previously.



A-20898 C

Left front view showing tractor equipped with starting and lighting, head light brush guards, crankcase guard and pull hook attachments.



A-20897 D

Right front view showing tractor equipped with starting and lighting, head light brush guards, crankcase guard and pull hook attachments.

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INTRODUCTION

Assembled in this book are operating and maintenance instructions for the TD-14A Crawler Tractor. This material has been prepared in detail with the hope that it will prove helpful to you in providing a better understanding of the correct care and efficient operation of the tractor.

Throughout this manual the use of the terms "left" and "right" and "front" and "rear" must be understood to avoid confusion when following instructions.

"Left" and "right" indicate the left and right sides of the tractor when facing forward from the operator's compartment.

The front of the tractor is the radiator end. The rear of the tractor is the fuel tank end.

If you should need information not given in this manual, or require the services of a trained mechanic, we recommend you use the facilities offered by the International Industrial

Power distributor or dealer in your locality. Distributors and dealers are kept informed on the latest methods of servicing tractors. They carry stocks of genuine IH parts, and are backed in every case by the full facilities of a nearby International Harvester District Office or parts depot.

When in need of parts, always specify the tractor and engine serial numbers. The serial number of the tractor is stamped on a name plate attached to the upper left corner of the dash in the operator's compartment. Serial number is preceded by the letters "TDF," *Illust. 1*. The serial number of the tractor engine is stamped on the left side of the engine crankcase. This serial number is preceded by the letters "TDFM," *Illust. 2*.

For ready reference, we suggest that you write these serial numbers in the spaces provided below.

Tractor Serial No. TDF - _____

Engine Serial No. TDFM - _____



Illust. 1
Tractor serial number.



Illust. 2
Engine serial number.

DESCRIPTION

MAIN COMPONENTS

The TD-14A Crawler Tractor is a full track-laying type tractor. The principal components of the tractor are the engine, engine clutch, transmission, steering clutches, sprocket drives and track assemblies.

Diesel Engine

Engine power is supplied by a full diesel, four-cylinder in-line engine. Features of the engine are: a five-bearing, Tocco-hardened crankshaft, replaceable cylinder sleeves, precision-type bearings, full pressure lubrication system, and a thermostat-controlled, centrifugal water pump cooling system.

Engine Clutch

The engine clutch is a heavy-duty, 15-inch, single-plate, hand-operated, over-center type. The release mechanism has an automatic clutch brake to facilitate fast shifting of gears.

Transmission

The transmission is the selective spur-gear type providing six forward speeds and two reverse speeds.

There are three forward and one reverse speeds in the low range, and three more forward and one reverse in the high range. Shifting from one range to the other is controlled by the Hi-Lo gearshift lever.

The gearshift lock provides positive holding of the sliding gears of the transmission and is ideal for operation under heavy load conditions and frequent gear shifting.

Steering Clutches and Brakes

Steering is accomplished through two multiple dry-disc, spring-loaded steering clutches by means of the two spring booster hand operated steering levers.

Steering brakes, operating on the steering clutch drums, make very sharp turns possible. The steering clutches transmit engine power from the bevel gear out to the sprocket drives. These clutches, with brakes, can be adjusted or replaced without disturbing adjacent units.

Sprocket Drives

The sprocket drives consist of sprocket drive gears and pinions which provide a fixed gear reduction and transmit power out to the tracks. Gears and sprockets are ball-bearing mounted on the stationary pivot shaft. Sprockets are reversible, making it possible to use both sides of the teeth.

Track Assemblies

Track assemblies consist of track chains and shoes driven by sprockets. The chains travel forward over two track idlers and around the front idlers. Five track rollers on the bottom of each track frame carry the weight of the vehicle. Sprockets and idlers are also mounted on the welded channel-iron track frames.

DESCRIPTION

SPECIFICATIONS

Capacities (U. S. Measure)

Fuel tank Approx. 45 gallons
 Gasoline tank 1-1/3 gallons
 Water cooling system 19 gallons
 Transmission 6 gallons
 Sprocket drive housings (each side). . . 6 pints
 Crankcase pan 16 quarts
 Injection pump 1/2 pint
 Air cleaner oil cup 4-1/2 pints

Engine (Diesel Type)

Cylinders 4
 Bore 4-3/4 inch
 Stroke 6-1/2 inch
 Fuel injection pump IH
 Carburetor (dual manifold starting) IH
 Magneto with impulse coupling. . . IH Type H-4
 Spark plug gap023 inch
 Valve clearance (engine hot)018 inch
 Valve clearance (engine cold)020 inch

Engine Speed

Full load 1,400±10 rpm
 High idle 1,555±30 rpm
 Low idle 500±50 rpm

Engine Clutch

Over-center type (with automatic clutch brake) 15 inch

Steering Clutch

Multiple dry-disc, spring-loaded type with manual release 15 inch

Brakes

External (contracting on steering clutch drums) 17 inch

Track

Tread (standard) 56 inches
 Tread (wide tread) 74 inches
 Ground contact length (normal). . 78-5/8 inches
 Track shoe width (standard) 16 inches

Transmission

Six speeds forward	{ Low	1.6 mph
	{ Second	2.0 mph
	{ Third	2.6 mph
	{ Fourth	3.4 mph
	{ Fifth	4.4 mph
Two speeds reverse	{ High	5.7 mph
	{ Low-reverse	1.6 mph
	{ High-reverse	3.4 mph

General Over-All Dimensions

Length (over-all) 134-1/8 inches
 Width (over-all)
 (standard tread) 74-1/8 inches
 Width (over-all) (wide tread) . . 92-1/8 inches
 Height (to top of air cleaner
 from ground line) 77-1/2 inches
 Drawbar lateral movement
 at pin 27-7/8 inches
 Drawbar height (from ground
 line) 13-11/16 inches

DIESEL FUEL SPECIFICATIONS

The best guide to follow when selecting fuel for use in the International diesel engine is the set of fuel specifications prepared and recommended by the builder.

Most refiners now market fuel oil designated as diesel fuel to distinguish it from burner fuel. Although similar to burner fuel, the diesel fuel is usually made from the straight run distillates, while the burner fuel may contain sufficient quantities of the lower ignition catalytic cracked distillates to make it unsatisfactory for use in the International diesel engine.

Some refiners are marketing one grade of fuel for both diesel and burner use. This fuel, when within the specifications shown below, can be safely used. However, maintaining the quality and suitability of these fuels for International diesel engines is definitely the responsibility of the supplier.

Diesel fuel for high-speed diesel engines is now obtainable in the U.S.A. in two grades, namely No. 1-D (light fuel) and No. 2-D (heavy fuel). No. 2-D fuel gives the most satisfactory performance in International diesel engines when the physical properties are within the limits of the specifications on the next page:

Continued on next page

DESCRIPTION

Gravity--Min.	30 API
Flash point--Min.	125° F. Min. or legal
Pour point	10° lower than minimum anticipated temperature
Cloud point	Preferably no more than 10° higher than pour point
Water and sediment	None
Carbon residue (10% residuum)	0.25% Max.
Ash (by weight)	0.02% Max.
Distillation	
Initial Boiling Point--Min.	325° F.
50% Boiling Point--Min.	475° F.
End Boiling Point--Min.	610° F.
End Boiling Point--Max.	725° F.
Sulphur by weight	0.5% Max.
Cetane number	40 Min.
Copper strip corrosion	3 hrs. at 212° F.
Color	3 NPA Max.

When No. 2-D fuel conforming to the above specifications is not available, the No. 1-D (light) fuel may be used. However, this lighter fuel has a lower heat content and lower viscosity. Its use may result in loss of power and/or increased fuel consumption and shortened injection pump life. However, No. 1-D fuel may be required in sub-zero weather in order for the pump to maintain an adequate flow of fuel.

Fuels lighter than kerosene will not give satisfactory performance in International diesel engines. Although some fuels meet the No. 2-D specifications, their composition may be such that unsatisfactory engine wear and excessive deposits may result unless high additive lubricating oil is used. Knowledge of the fuels in your area and the types of crankcase oils required for satisfactory performance with these fuels will avoid service problems. When in doubt, see your International Industrial Power distributor or dealer.

Water and sediment will tend to clog the filters. If water passes through them it will corrode the pump plungers and other highly finished parts in the pump and nozzles, thus greatly shortening their lives. The fuel must be free from water, sediment and residue.

Buy clean fuel and keep it clean. Store fuel in tanks equipped with hose and nozzle because the fuel is less likely to become contaminated. Do not use funnels, cans and drums because they are difficult to keep clean. Handle the fuel as little as possible. Always fill the engine fuel tank at the end of each day to reduce condensation. Drain the water trap daily. Following these rules will pay dividends.

TOOLS SHIPPED WITH TRACTOR

These tools may be ordered as a replacement kit under number 263 290 R91 (less bucket lubricator).

Steering clutch compressor angle tool with block

Socket wrench set carrying case

Oil can

Socket wrench handle extension

Socket wrench "T" handle with extension

Hex socket wrench (1-1/8 inch)

Hex socket wrench (1 inch)

Hex socket wrench (7/8 inch)

Hex socket wrench (13/16 inch)

Hex socket wrench (3/4 inch)

Hex socket wrench (5/8 inch)

Hex socket wrench (9/16 inch)

Stem handled socket wrench (1-1/32 inch)

Socket wrench "T" handle

Stem handled socket wrench handle)

Drawbar stop pin (cotter pin 1/4 x 2-1/4 inch)

Front idler adjuster wrench

Ball peen hammer (1-1/2 pound)

"S" wrench (3/4 x 7/8 inch)

Screwdriver (5-inch handle)

Hand lubricator (9 ounce size)

Water pump wrench

Combination slip joint pliers

Socket head plug wrench (1/2 x 3/4 inch)

Spark plug wrench handle

Breaker point and spark plug gauge

Spark plug wrench (31/32 inch)

Bucket lubricator (tank type--25 pounds)

Track roller lubricating plug wrench

OPERATION

BEFORE STARTING A NEW TRACTOR

1. Make a complete inspection of the tractor for any damage that may have occurred while in transport. Check to be sure that all component units are securely mounted to the engine.

2. Refer to the "LUBRICATION GUIDE" and completely lubricate the tractor, including the air cleaner.

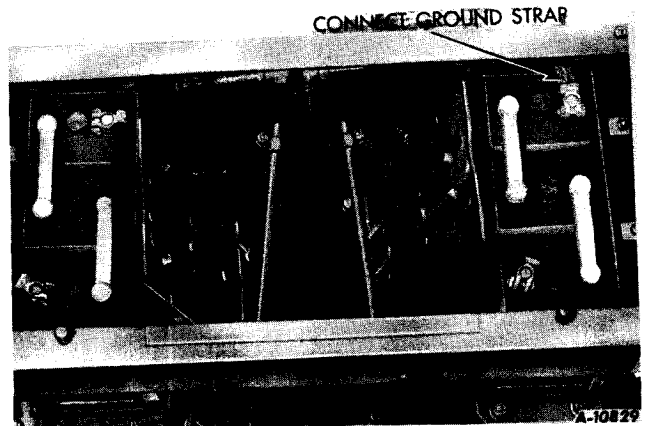
a. Tractors shipped to destinations in the United States, Canada and Mexico are filled with oil before leaving the factory. The lubricant in the crankcase, air cleaner and injection pump of diesel engines, when shipped from the factory, is for snipaway purposes and is not suitable for use in regular service. The original oil should be drained immediately from the crankcase, air cleaner and injection pump and replaced with the required amount of fresh oil having the physical properties and proper viscosity for the prevailing air temperatures and type of service.

b. All oil is drained from the crankcase and air cleaner of tractors shipped for export.

3. Check to be sure that the drain valve on the lower left side of the radiator is closed and that the drain valve on the left side of the crankcase is closed. Fill the cooling system with clean water (soft or rain water if possible) to a level slightly below the bottom of the radiator filler opening.

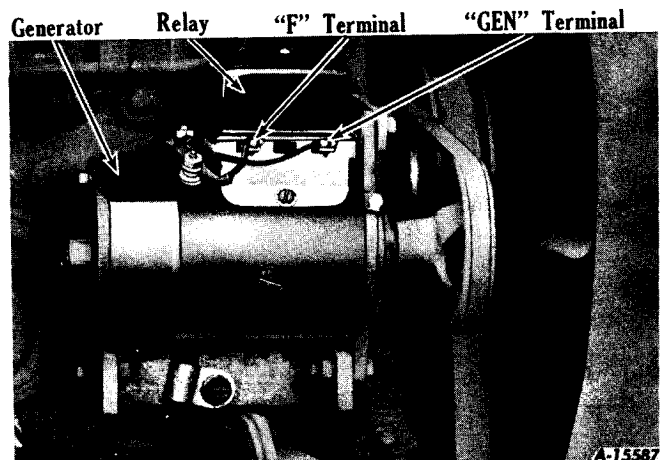
4. Check the tension of the fan belts. The tension is correct when the belt can be depressed by thumb pressure $\frac{3}{4}$ to 1 inch midway between two pulleys. If the belt tension is not correct, adjust it as outlined on page 43.

5. If the tractor is equipped with a starting attachment, be sure that the battery cable terminal is clean and bright; then connect the braided ground strap to the battery, *Illust. 3*. Connect the generator field cable to the "F" terminal on the generator, *Illust. 4*. Correctly polarize the generator to the battery by placing a jumper lead momentarily across the "BAT" and "GEN" terminals of the generator relay. Check to be sure that all electrical terminals are clean and securely fastened. Check the level and the specific gravity of electrolyte in the batteries.



Illust. 3
Battery and battery cables.

6. Check to be sure that the magneto is securely mounted in place and that it was not damaged or cracked in shipment. Check the spark plug cables to be sure that they are securely connected in the magneto distributor cap and at each spark plug.



Illust. 4
Generator and relay with cables
connected to terminals.

OPERATION

OPERATING CONTROLS AND INSTRUMENTS

The operator should be thoroughly familiar with the location and the use of all controls and instruments on the tractor before trying to operate it. Regardless of previous experience as a tractor operator, carefully read this section before attempting to operate the tractor.

Compression Release Lever

This is a short lever located in the upper left corner of the dash. See *Illust. 6*. Pulling down on this lever converts the engine from the diesel to the gasoline cycle for starting purposes. When placing the compression release lever in the gasoline position, be sure it latches securely. After the engine has operated on gasoline for about one minute (2 or 3 minutes for severe cold conditions), switch the engine to diesel operation by pushing the compression release lever all the way up. Leave the compression release lever in the diesel position (up position) after the engine has stopped.

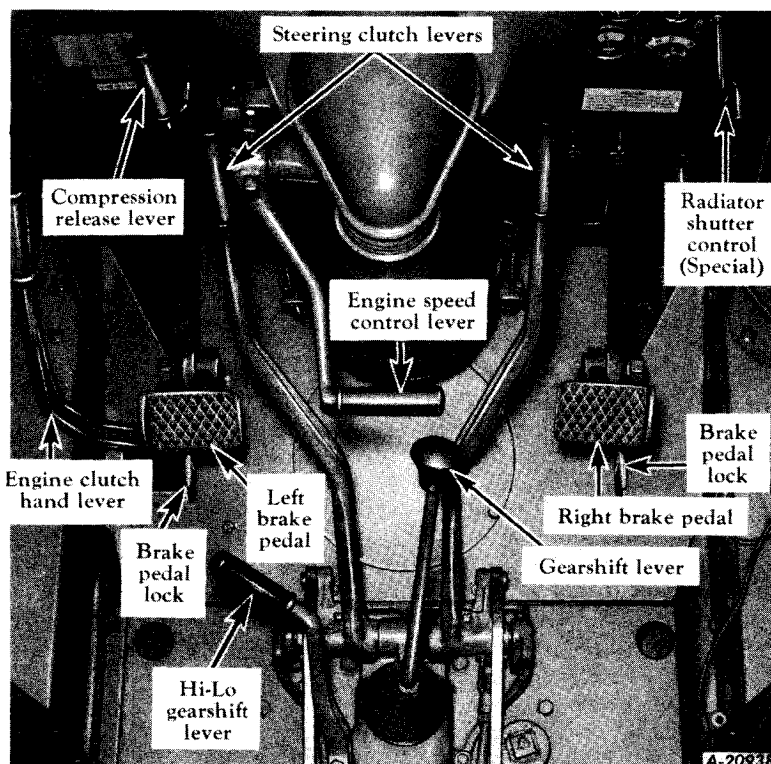
NOTE: For correct method of starting the engine on gasoline, refer to page 13. For changing to diesel operation, refer to page 14. For changing back to gasoline operation before stopping the engine, refer to page 17.

Fuel Pressure Indicator



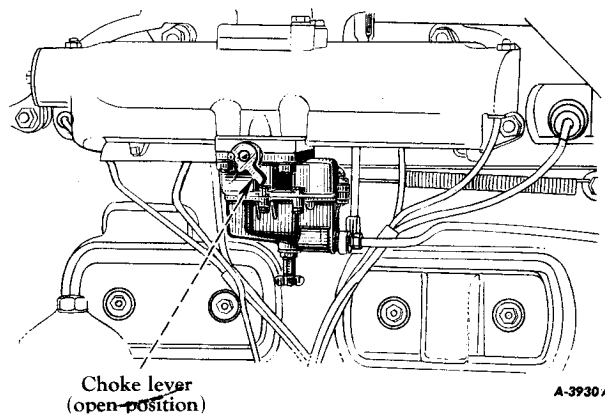
Illust. 5
Fuel pressure indicator.

This indicator, located on the injection pump, registers the pressure of the fuel from the primary pump through the final fuel filter to the injection pump. With the engine operating (either on gasoline or diesel cycle), the pointer of the indicator should be in the white or "Operating Range" area. If the pointer remains in the red or "Change Filter" area, the auxiliary or final fuel filter element needs replacement. Refer to pages 51 and 52.



Illust. 6
Instruments and controls.

Choke Lever



Illust. 7
Carburetor choke lever.

The choke lever assists in starting the engine when the engine is cold. Turning the choke lever clockwise shuts off the air to the carburetor, giving a rich mixture. After the first few revolutions of the engine, turn the choke lever counterclockwise to a point where the engine operates without missing. After the engine has operated a short time, turn the choke lever counterclockwise all the way.

OPERATION

Engine Speed Control Lever

This lever is located directly in front of the operator, just to the right of the compression release lever. *See Illust. 6.* It controls the engine speed on the diesel cycle and, when set in a given position, maintains a uniform engine speed under variable loads. Moving the lever upward increases the engine speed, and moving it downward decreases the engine speed.

Engine Clutch Hand Lever

This is the long lever extending up from the left side of the platform in the operator's compartment. *See Illust. 6.* It is used to engage or disengage the engine from the transmission. Pull the lever all the way back, or until a definite over-center action is felt, to engage the clutch, and push the lever all the way forward to disengage the clutch.

Gearshift Lever

This is the short lever extending at an angle from the gearshift housing in the operator's compartment. *See Illust. 6.* It is used to select the various gear ratios provided in the transmission. There are three forward speed positions and one reverse speed position. A total of six forward speeds and two reverse speeds is available by using the Hi-Lo gearshift lever.

The gearshift lock provides positive holding in engagement of the sliding gears on the transmission. It is ideal for operating under heavy load conditions and frequent gear shifting.

Hi-Lo Gearshift Lever

It is the short lever located directly to the left of the transmission gearshift lever. *See Illust. 6.* It controls the high and low speed range of the transmission. When the lever is in the down position (forward), the transmission gearshift lever can be used to select low speeds in reverse, first, second and third gear. When the lever is moved to the up position (backward), the tractor can be shifted to high speeds in reverse, fourth, fifth and sixth gears.

Steering Clutch Hand Levers

These are the two long hand levers located directly in front of the tractor seat on either side of the transmission gearshift lever. *See Illust. 6.* Pulling back on the left lever disengages the left steering clutch which cuts

off power going to the left track. All of the engine power is then applied on the right track, causing the tractor to turn to the left. Pulling back on the right lever causes the tractor to turn to the right. A minimum of effort is required to operate the spring booster, hand operated levers.

Steering Brake Pedals

These are located on either side of the operator's compartment, coming up through the platform. *See Illust. 6.* Normally, when pulling a load the use of the steering clutch levers will turn the tractor. Steering brakes are used to make sharp pivot turns. To make a sharp turn, pull all the way back on the steering clutch lever and press down the steering brake pedal on the side toward which the turn is to be made.

Steering Brake Locks

The locks are located underneath each steering brake pedal. *See Illust. 6.* To lock either brake, push down the pedal and raise the lock rod. This action engages a pawl in a ratchet on the pedal and locks the brake. To unlock the brakes, push down on the pedals and release the lock rods.

Oil Pressure Indicator

It is located in the upper right corner of the dash in the operator's compartment and it indicates the pressure of the oil circulating through the engine. *See Illust. 8.* The indicator needle must be in the white sector of the gauge when the engine is operating and oil pressure is normal. If the indicator needle remains in the red sector, stop the engine immediately and investigate the cause of oil pressure failure. If you are unable to find the cause, consult your International Industrial Power distributor or dealer before operating the engine.

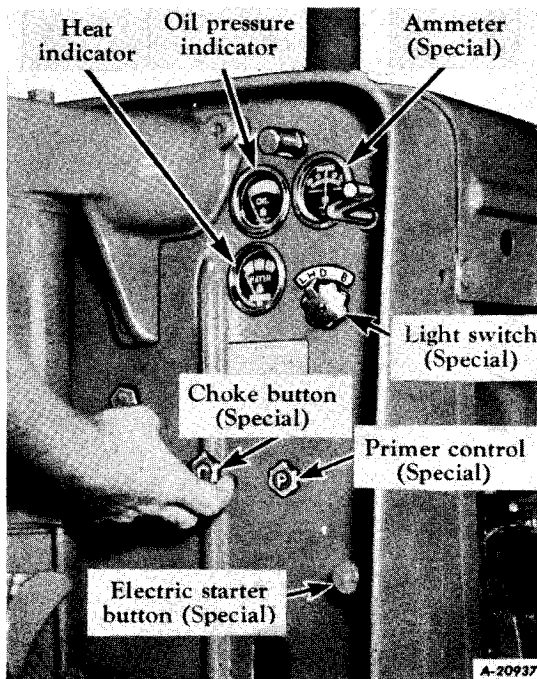
Ammeter

This instrument (part of the starting and lighting attachments) is located in the upper right corner of the dash, just to the left of the oil pressure gauge. *See Illust. 8.* The ammeter indicates whether the batteries are being charged or discharged. The gauge should show "charge" whenever the engine is operating at normal speed. If the ammeter shows a constant discharge while the engine is operating, the cause must be determined and repaired in order to avoid completely discharging the batteries.

OPERATION

Light Switch

The switch (part of the starting and lighting attachments) is located directly underneath the ammeter and oil pressure gauge. *See Illust. 8.* It also controls the generator charging rate. In its regular position at "L" it is set for low charging. Turn to the next position at the right, "H" for high charging rate, to the third position marked "D" for dim light, and to the last position marked "B" for bright light.



Illust. 8
Engine instruments and controls on dash.

Choke Button

This button (part of the starting and lighting attachment) is located in the right-hand portion of the dash in the operator's compartment. *See Illust. 8.* The choke aids in starting the engine when it is cold. Pulling out the choke rod restricts the flow of air to the carburetor, enriching the fuel mixture. After the first few revolutions of the engine, push the choke button in half way, or to a point where the engine runs without missing. As the engine gradually warms up, push the choke button all the way in.

Electric Starter Button

This button (part of the starting and lighting attachment) protrudes from the dash at a

point directly above the right-hand steering brake pedal. *See Illust. 8.* Depressing this button completes the electrical circuit between the battery and the cranking motor, and causes the cranking motor pinion to engage the flywheel ring gear, thereby cranking the engine. Stop pressing the button the moment the engine starts. Do not operate the cranking motor for more than 30 seconds at any one time. Allow the cranking motor to cool 2 or 3 minutes and repeat the starting operations.

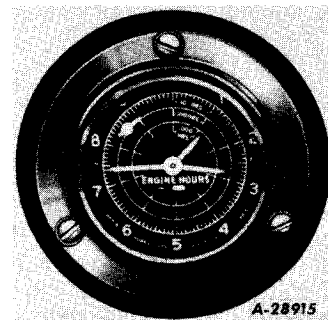
Primer Button (Special)

It is located directly to the right of the choke button. *See Illust. 8.* When starting the engine in cold weather, the engine should be primed. A few strokes of the primer button which sprays raw gasoline directly into the intake manifold, is usually sufficient. The number of strokes will depend upon the temperature.

Heat Indicator

The heat indicator (*Illust. 8*) is located in the upper right side of the dash. It indicates the temperature of the water circulating through the engine. If a radiator shutter is used, the shutter should be opened up just enough to maintain the operating temperature on the high side of the "RUN" range.

Electric Engine Hour Meter (Special)



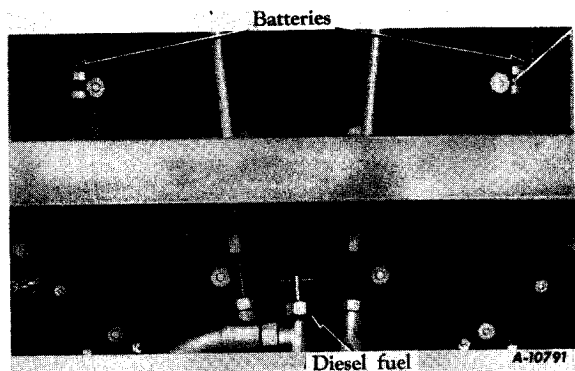
Illust. 9
Electric engine hour meter (special).

This electrically-operated attachment, which is on the dash, is available for use on tractors equipped with electric starting or lighting equipment. The meter indicates the actual hours of engine operation, enabling the operator to determine, without guesswork, lubrication, oil change and inspection periods. It also provides a means of computing specific job costs and of recording fuel and oil consumption. For the correct method of reading the meter, *see page 78.*

OPERATION

PREPARING THE TRACTOR FOR EACH DAY'S WORK

Fuel System



Illustr. 10
Diesel fuel shut-off valve.

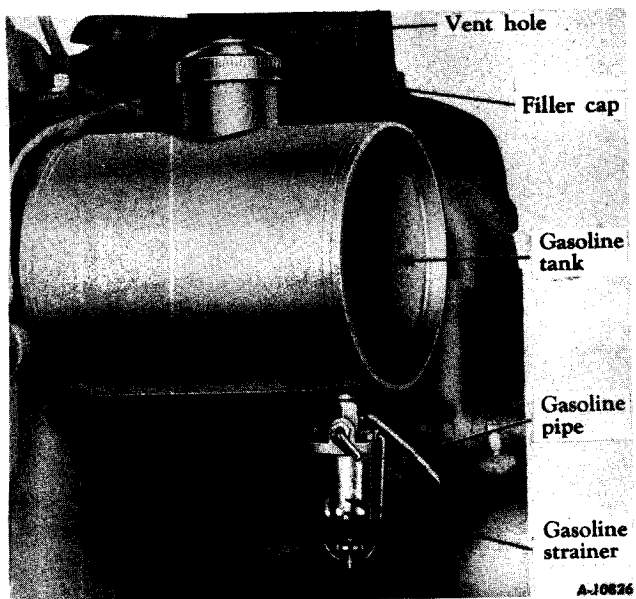
Fill the main fuel tank (capacity 45 gallons, U.S.) and the gasoline tank (capacity 1-1/3 gallons, U.S.) if necessary. For fuel specifications, refer to page 5. Strain the diesel fuel to be sure it is free from foreign substances. Do not use dirty fuel.

Lift the bottom seat cushion and check to see that the diesel fuel shut-off valve is in open position.

Check to see that the gasoline shut-off valve is open.

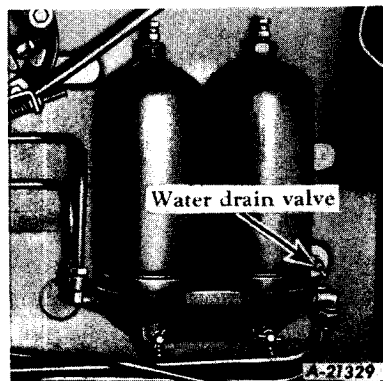
Exercise extreme care when filling fuel tanks from drums or similar containers. Do not take the last three inches of fuel as water may be in the bottom of the container. The remainder can be accumulated in several containers, poured into one container and allowed to settle. The fuel can be pumped out down to the last three inches.

Refer to "OPERATING PRECAUTIONS" on page 12 regarding safety measure to be followed when filling gasoline and fuel tanks. See Illustr. 14.



Illustr. 11
Gasoline tank and shut-off valve.

Cooling System



Illustr. 12
Crankcase drain valve.

1. Be sure that the drain valves on the left side of the crankcase and the lower left side of the radiator are closed. See Illustr. 12 and 13.

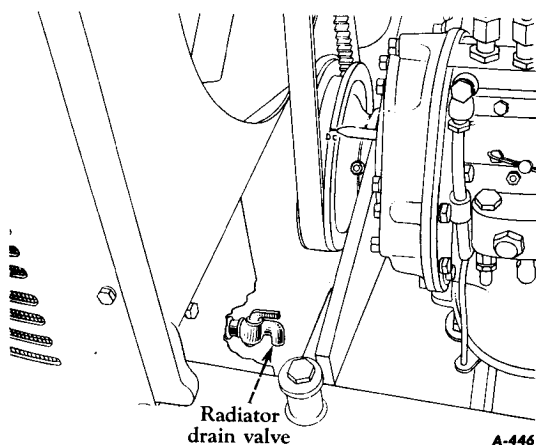
2. Remove the radiator filler cap and see if the water comes up to a level slightly below the bottom of the filler neck. Add water if necessary.

3. Replace the filler cap. The capacity of the cooling system is 19 U.S. gallons. For further information, refer to "COOLING SYSTEM" on page 42.

Continued on next page

OPERATION

NOTE: Be sure not to start the engine until the cooling system is filled with a coolant.



Illustr. 13
Radiator drain valve.

Lubrication

Be sure that the oil level in the crankcase is up to the "FULL" mark on the bayonet-type oil gauge. Refer to the "LUBRICATION GUIDE" for complete lubrication requirements.

OPERATING PRECAUTIONS

NOTE: Operate a new tractor with a light load for the first 30 to 36 hours at a governed speed from 1450 to 1500 rpm.

1. Do not attempt to start the engine by towing or coasting the tractor. To do so may cause serious damage to the engine and transmission.
2. Do not run the cranking motor (special attachment) for more than approximately 30 seconds at any one time. If the engine fails to start, allow the cranking motor to cool for 2 or 3 minutes and then repeat the starting operation.
3. If trouble is experienced in starting on gasoline in cold or damp weather, the spark plugs should be removed and wiped off, removing any condensation. At the same time, check the spark plug gap, which should be .023 inch. After drying the spark plugs, install them in the engine; then start the engine in the usual manner.

4. When cranking the engine by hand, stand in a position that will eliminate any possibility of being struck by the starting crank if there is a reversal of the direction of the engine. See *Illustr. 19*. Crank the engine by using quick upstrokes; do not spin it.

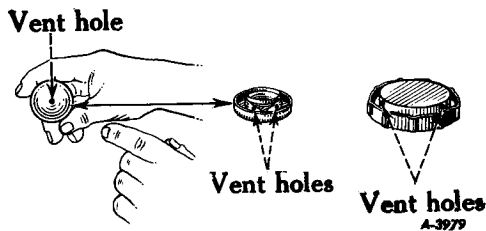
5. **CAUTION:** Never fill the gasoline tank when near an open flame, or when the engine is operating. Keep the funnel, used for pouring in the fuel, in contact with the metal of the tank. By so doing, you will avoid the possibility of an electric spark igniting the gas. Do not light matches near gasoline as the air within a radius of several feet is permeated with a highly explosive vapor. See *Illustr. 14*.



Illustr. 14
Correct method of
pouring gasoline into the tank.

6. Be sure that the vent holes in the caps for the fuel and gasoline tanks are kept open at all times to assure proper flow of the fuel. See *Illustr. 15*.
7. Do not pour cold water into the radiator if the engine is very hot, unless conditions make it absolutely necessary. Under such conditions, start the engine and let it idle while pouring the water slowly into the radiator.
8. Do not apply the steering brake until the steering clutch is fully released as excessive heating and rapid wear of steering brakes will result.
9. When pulling a load, it is not necessary to use the steering brakes except to make sharp turns; the load acts as a brake. Do not use the brakes unless it is necessary to do so in order to make the required turn.

OPERATION



Illust. 15
Air vent holes in the gasoline
and diesel fuel tank caps.

10. Do not ride the brake pedals as this will result in excessive wear on the brake linings.

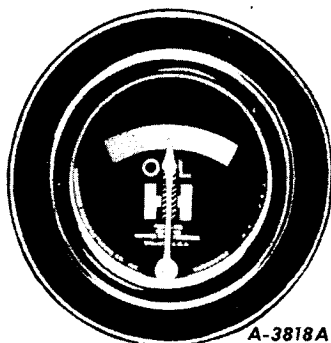
11. Improper use of the steering brakes when making turns will cause the tractor to jerk. Try to avoid this by using the steering control lever intermittently with only a slight pressure on the brake pedal when making any turn except a pivot turn. This method of turning gives you a more even turn and does not subject the tractor to sudden impacts.

12. The drawbar should be free to swing at all times unless it is absolutely necessary to hold it in one position.

13. Place the transmission gearshift lever into the desired speed position before putting the tractor into motion.

14. Do not operate the engine under load until it is thoroughly warmed up. Never operate the engine at more than the regular governed speed. Excessive speeds are harmful.

15. Immediately after engine starts, check the oil pressure indicator (*Illust. 16*) to see if it is registering pressure. If it is not, stop engine and inspect the oil system to find the cause of failure. If unable to find cause, be sure to consult your International



Illust. 16
Oil pressure indicator.

Industrial Power distributor or dealer before operating the engine.

16. Be sure to replace the lubricating oil filter element and to clean the air cleaner at the regular specified intervals.

CAUTION: Because of fire hazards and insurance regulations, we do not recommend the use of gasoline for the cleaning of parts, especially not when service is performed inside of buildings. A less inflammable fluid than gasoline should be used, such as Stoddard solvent or kerosene.

OPERATING THE DIESEL ENGINE

Four steps are necessary in operating this diesel engine:

1. Starting the engine on gasoline.

2. Changing to diesel operation.

3. Changing the engine back to gasoline operation before stopping the engine. This facilitates the next starting.

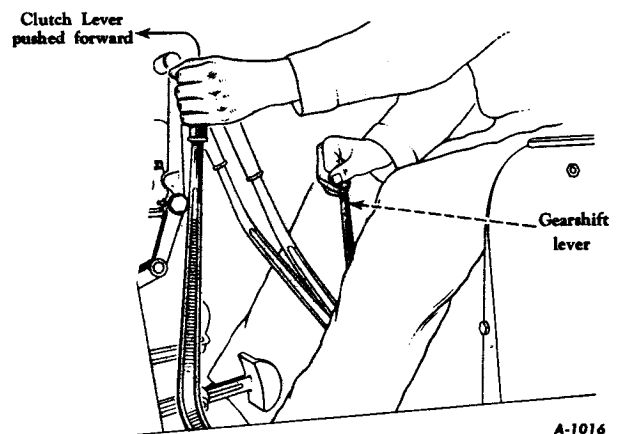
4. After stopping the engine on gasoline, push the compression release lever up into diesel position. This action permits the starting valves to cool on their seats.

The above steps are fully explained in the following pages.

Starting the Engine (Hand Cranking)

1. Open the shut-off valves underneath the gasoline and diesel fuel tanks, *Illusts. 10 and 11*. To prevent leakage and seepage from

Continued on next page

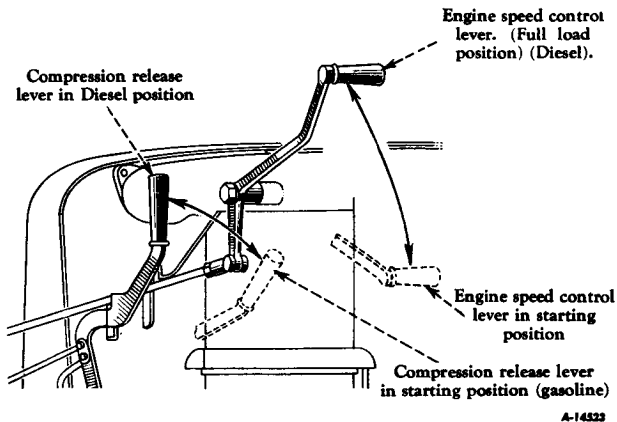


Illust. 17
Placing gearshift lever in neutral
and disengaging the engine clutch.

OPERATION

valves be sure to screw the needle stem (shut-off valve) out until the seat of the stem is tight against the stop.

2. Move the transmission gearshift lever into neutral position and disengage the engine clutch by pushing the clutch hand lever all the way forward. See *Illust. 17*.



Illust. 18
Engine controls.

3. Pull the compression release lever down into the starting position. See *Illust. 18*. Be sure that the lever is in the latched position.

4. Pull the engine speed control lever down into starting position, and leave it in this position until the engine is changed to diesel operation.

5. Set the choke lever approximately one-third open. See *Illust. 7*. (In cold weather, close it all the way.) If necessary in cold weather, give the primer button several strokes (if equipped with primer attachment).

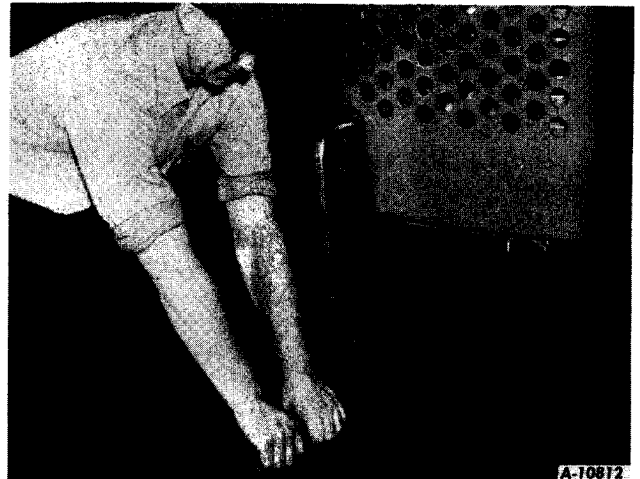
6. Crank the engine with quick, upward half-strokes until the engine starts. **CAUTION:** The operator should stand in a position that will eliminate any possibility of being struck by the starting crank if there is a reversal in the direction of engine rotation. See *Illust. 19*. Do not "spin" the crank.

7. As soon as the engine starts, regulate the choke lever on the side of the carburetor until the engine runs smoothly. As the engine warms up, open the choke all the way.

8. Place the crank in the clamp on the channel at the right side of the engine.

Starting the Engine (for Tractors Equipped with Electric Cranking Motor)

1. to 4. Follow the same procedure outlined in steps 1. to 4. for starting the engine by hand cranking.



Illust. 19
Correct position for operator
when cranking the engine.

5. Pull the choke button out part way. (In cold weather pull it out all the way.) If necessary in cold weather, give the primer button several strokes (if equipped with primer attachment).

6. Press the starter button. Release it the instant that the engine starts.

7. After the engine starts, push the choke button in to a point where the engine runs without missing and, as the engine warms up, gradually push the choke button all the way in.

Check the Oil Pressure

Check the engine oil pressure when the engine starts. If the indicator needle does not move into the white area of the gauge, stop the engine and inspect the oil system to find the cause of the failure.

Changing Engine to Diesel Operation

1. Allow the engine to operate on gasoline for about one minute (two or three minutes in cold weather) before switching over to diesel operation.

2. Move the compression release lever all the way up to the diesel position. See *Illust. 18*.

OPERATION

3. Immediately move the engine speed control lever upward enough to prevent the engine from stalling.

4. The engine will now run as a diesel unit, unless there is air in the fuel injection system. To vent air from the diesel system, refer to page 48.

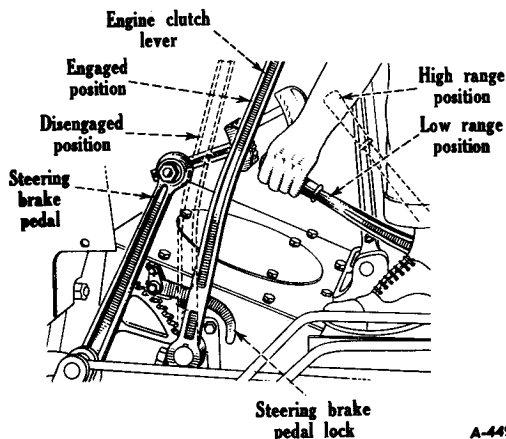
DRIVING THE TRACTOR

SAFETY FIRST: Before dismounting from the tractor, place the transmission gearshift lever in the neutral position.

Read and observe "OPERATING PRECAUTIONS" on pages 12 and 13.

After the tractor is in motion, take extreme care to prevent accidents and personal injuries.

Before attempting to drive the tractor, be thoroughly familiar with the location and function of all the instruments and controls. Refer to pages 8 to 10 for description of all the instruments and controls.



Illust. 20
Hi-Lo gearshift lever,
engine clutch lever, and steering
brake pedals in operator's compartment

Driving the Tractor

1. Set the engine speed control lever in the idling position (lever moved slightly upward).

2. Push the engine clutch lever all the way forward. See Illust. 20.

3. Select the high or low speed range with the Hi-Lo gearshift lever. Move the transmission gearshift lever to the desired speed position. See Illust. 21.

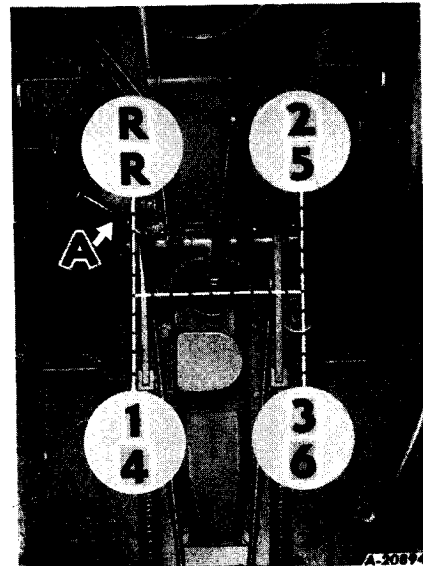
4. Advance the engine speed control lever to about half full-load engine speed.

5. Pull the engine clutch lever back gradually until full over-center engagement can be felt.

6. Pull back firmly on the clutch lever to lock the clutch in its engaged position. At the same time, advance the engine speed control lever.

7. If the engine labors under the selected speed with the engine speed control lever in the full-load speed position, stop the tractor and select a lower speed.

8. The full load speed is 1400 ± 10 rpm; high idle speed is 1555 ± 30 rpm; low idle speed is 500 ± 50 rpm.



Illust. 21
Transmission gearshift positions.
"A" shows the Hi-Lo gearshift lever.

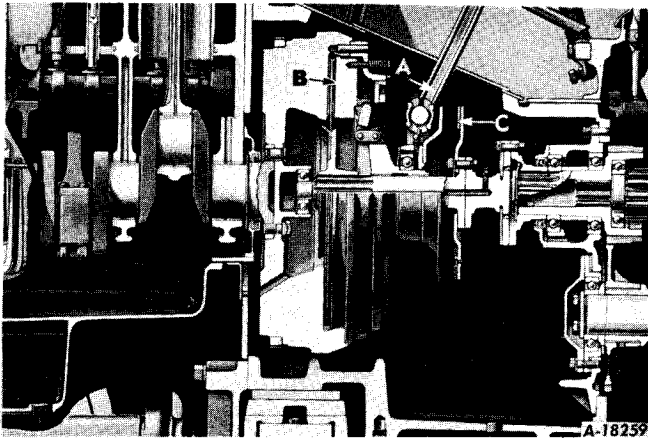
Shifting Gears

Always completely disengage the engine clutch when shifting gears. To disengage the engine clutch push the engine clutch hand lever all the way forward. This action disengages the clutch and applies the clutch brake in the same operation. To shift gears, apply forward pressure on the clutch hand lever and, at the same time, move the transmission gearshift lever to the correct position for the speed desired. See Illust. 21.

OPERATION

Engine Clutch Brake

The clutch brake (*see Illust. 22*) consists of a stationary disc that is actuated by the clutch release mechanism, and a disc with frictional facing that is attached to the clutch release bearing carrier. Forward pressure on the clutch hand lever forces the stationary disc into contact with the spinning friction disc and slows down the speed of the clutch shaft. This action in turn slows down the revolutions of the transmission gears and allows faster shifting. No adjustment of the clutch brake is necessary.



Illust. 22
Engine clutch assembly.

- A. Clutch lever
- B. Clutch disc
- C. Clutch brake

Hi-Lo Gearshift Lever

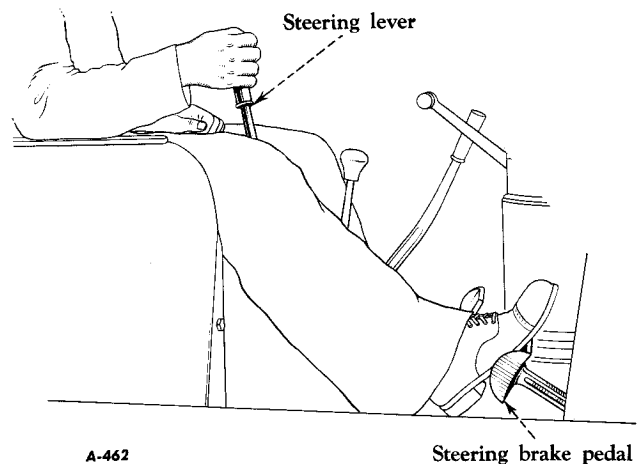
The high and low speed range of the transmission is controlled by the Hi-Lo gearshift lever. *See Illust. 20*. Moving this lever forward places the transmission in the low speed range, and moving it backward selects the high speed range.

When the Hi-Lo lever is in the "down" position (forward), the tractor can be shifted, by using the transmission gearshift lever, into low-reverse, first, second or third speeds. When the Hi-Lo lever is in the "up" position (backward), the tractor can be shifted to high-reverse, fourth, fifth or sixth speeds.

Steering the Tractor

The direction of travel of the tractor is controlled by two steering clutch levers.

1. Turn to the right or left by pulling back the steering clutch lever on the side toward which the turn is to be made.



Illust. 23
Turning tractor to the right.

2. To make a sharp turn, use the steering brake on the side toward which the turn is to be made. For example: To turn sharply to the right, pull back on the right steering clutch lever and then push down on the right steering brake pedal. *See Illust. 23*.

3. If pulling back on the steering clutch lever does not turn the tractor enough, and if pushing the steering brake all the way down turns the tractor too much, press down gently on the steering brake pedal until the desired turn is made.

Steering Downgrade

1. When going downgrade with the tractor pulling the load, steering should be done in the usual manner.

2. When going downgrade with the load pushing the tractor, the steering clutch operation is reversed. Disengage the right steering clutch to turn left, and disengage the left steering clutch to turn right. Do not apply the brakes.

Operating Over an Obstruction

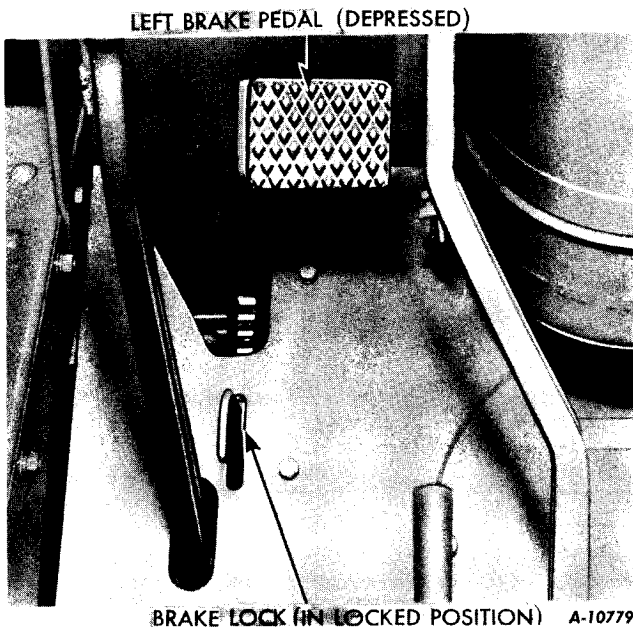
When driving over a log or ditch bank, use the steering clutches instead of the engine clutch to the tractor. Both steering clutches may be released slightly until the tractor moves forward at an angle, over and down. If the load is light, it might be necessary to use the brakes.

Steering Brake Locks

Each steering brake pedal has a locking device. To lock either brake, push the brake pedal down and lift up the ratchet pawl, *Illust. 24*. This engages the pawl in the ratchet and locks the brake pedal.

OPERATION

Do not use the brake pedals as footrests; this would cause undue wear on the brake parts.



Illustr. 24

Left brake pedal in locked position.

Stopping the Tractor

Push the engine clutch hand lever all the way forward to disengage the engine, and move the transmission gearshift lever into neutral position. If necessary, push down on both steering brake pedals to halt the tractor.

If the tractor is to be parked on a slope where there is a possibility of rolling, apply the brakes and lock them by raising the brake locks.

NOTE: If the tractor is to be parked on a slope during extremely cold weather, secure the tractor with blocks instead of locking the brakes. Condensation of moisture may cause the brake bands to freeze on the drums.

Stopping the Engine

1. Turn on the gasoline supply by opening the shut-off valve.
2. Place the engine speed control lever in the starting (shut-off) position and at the same time place the compression release lever in the gasoline (starting) position.
3. Allow the engine to operate on gasoline until the exhaust is clear; then stop the engine by placing the compression release lever in

the diesel position (do not move the engine speed control lever).

4. After the engine stops, leave the compression release lever in the diesel position to permit the starting valves to cool on their seats.

5. Close the gasoline shut-off valve.

Towing a Disabled Tractor

At times it may be necessary to tow the tractor. However, if the power train or the tracks are damaged, the tractor should be transported to avoid further damage. To tow a tractor:

1. Attach a towing cable to the front of the tractor or, in an emergency, to the drawbar.
2. Be sure that the steering brakes are released before towing the tractor.
3. Use the steering clutch hand levers to assist in steering the towed tractor.
4. Never tow the tractor when the tracks are damaged.

OPERATING IN COLD WEATHER

In order to start and operate the tractor with a minimum of difficulty in temperatures of 32°F. or lower, observe the following precautions:

Starting the Engine



Illustr. 25

Priming the engine when starting.

Continued on next page

OPERATION

During cold weather, and when the engine is cold, set the choke lever nearly closed and prime the engine with the primer button, if equipped with primer attachment. In zero weather, give the engine 6 to 8 primes.

In temperatures 10° to 20° F., give the engine 3 to 5 primes.

In temperatures 30° to 40° F., give the engine 1 to 3 primes.

Then crank the engine in the usual manner.

Fuel System

Use only a high-test, winter-grade gasoline for starting. Keep the supply in a closed container to prevent the more volatile portion of the gasoline from evaporating. Fill the gasoline tank and the diesel fuel tank at the end of each day's run to prevent moisture from collecting in the tanks.

Lubricating the Tractor

Lubricate the tractor completely with winter-grade lubricants as outlined in the "LUBRICATION GUIDE" on pages 24 and 25.

Cooling System

When the temperature is likely to be 32° F. or lower, there is danger of the water freezing in the cooling system. To prevent this, either drain the water from the cooling system at the end of each run, or use a recommended antifreeze solution.

IMPORTANT! Before filling the radiator in freezing weather, cover the entire radiator and start the engine; then put in the water **IMMEDIATELY**. This prevents the water from freezing during the warming up period.

NOTE: Never operate the engine without water or antifreeze solution in the cooling system. Do not start a cold engine and operate it dry while driving the tractor to the source of the coolant. This is most apt to cause cylinder head failure, overheat the piston rings and (in wet sleeve engines) destroy the rubber seal ring. Carry the water to the tractor.

The capacity of the cooling system is 19 U. S. gallons. If the tractor is equipped with a radiator shutter and heat indicator, close the shutter when starting; then regulate it as required to hold the needle of the heat indicator in the high side of the "RUN" range.

Using Antifreeze Solutions

The table below shows the amount of antifreeze solution required for various temperatures.

NOTE: Use only one type of antifreeze solution. Do not mix solutions, as this would make it difficult to determine the amount of protection given to the cooling system.

Never use any of the following as an antifreeze in the cooling system: Honey, salt, kerosene, diesel fuel, glucose or sugar, calcium chloride, or any alkaline solution.

Do not use alcohol as an antifreeze if other solutions are available, as denatured alcohol boils at 173° F. However, if it is necessary to use alcohol, the use of a low boiling point thermostat is recommended. See "SPECIAL ATTACHMENTS" section. Check the solution frequently to be sure that the cooling system is adequately protected against freezing.

Freezing Point (Fahrenheit)	Quarts of Antifreeze Required		
	Ethylene Glycol	Distilled Glycerine	Denatured Alcohol
10°	19	25	23
0°	25	30	28
-10°	30	36	33
-20°	34	40	38
-30°	38	45	43
-40°	41		49
-50°	44		55
-60°	47		59
-70°	49		

Servicing the Batteries (If Tractor is Equipped with Starting and Lighting Attachment)

The efficiency of batteries decreases sharply with lowering temperatures and it becomes practically nil at minus (-) 40° F. Do not attempt to start the engine, if the batteries have been chilled to -20° F., unless the batteries have been heated. Immersion in warm water to within an inch or two of the top of the battery case is a satisfactory means of warming a battery. Check the specific gravity of the battery electrolyte at frequent intervals, and keep the batteries as fully charged as possible.

Checking the Spark Plugs

If trouble is experienced in starting, remove the spark plugs and wipe them off to remove any condensation. Then check the spark plug gap, which should be .023 inch.

OPERATION

Freeing Tracks Frozen to the Ground

If the tractor is left out during cold weather and the tracks become frozen to the ground, do not attempt to jerk them free with the power of the engine. Start the tractor slowly and, if the tracks do not break free, pry them loose. If necessary use a blow torch, being careful about fire hazards. To prevent the tracks from freezing in the ground, park the tractor on planks.

Operating the Tractor in Water or Snow

When operating the tractor in deep water or thawing snow, lubricate the track rollers every 5 hours. This will flush out any water that may have been forced past the seals and into the lubricant. If operating the tractor in water that is deep enough to come above the bottom of the transmission case, inspect the lubricant in the transmission and drive gear sprocket housings frequently. If any water is present, drain these housings and refill with new oil.

NOTE: When operating the tractor in water, or under extremely dusty conditions, water or dust will enter the compartments through the holes in the drain plugs on the engine clutch and the steering clutch compartments. To prevent this, take out the drain plugs and replace them with solid plugs that have no holes. After each 60 hours, remove the plugs to allow any oil accumulation to drain out.

PREVENTIVE MAINTENANCE

Preventive maintenance is a systematic series of inspections performed periodically in order to maintain top efficiency in the performance of the tractor. The importance of preventive maintenance cannot be overemphasized, and it should be practiced by every tractor

owner to reduce costly breakdowns. Preventive maintenance inspections should be performed at the intervals outlined in the "PERIODIC INSPECTIONS." The prompt detection and correction of minor irregularities will help keep the tractor operating at peak efficiency at all times.

PERIODIC INSPECTIONS

To insure mechanical efficiency, it is necessary that the tractor be inspected systematically at the intervals outlined below.

After Every 10 Hours of Operation

Lubrication points	Refer to "LUBRICATION GUIDE."
Diesel fuel water trap	Drain off water and sediment. <i>Refer to page 50.</i>

After Every 60 Hours of Operation

Flexible rubber connection between air cleaner and intake pipe	Inspect for loose fit or damage.
Fan belt	Check tension; replace when necessary. <i>Refer to pages 43 and 44.</i>
Radiator fins	Clean spaces.
Steering clutch and engine clutch housing drain plugs	Remove plugs and drain oil accumulation. Refer to "Operating the Tractor in Water or Snow" above.
Tracks	Check slack. <i>Refer to page 64.</i>
Lubrication points	Refer to "LUBRICATION GUIDE."

OPERATING IN HOT WEATHER

Lubrication

Follow closely the lubrication instructions as outlined in the "LUBRICATION GUIDE."

Fuel System

Keep the gasoline tank and the diesel fuel tank full to prevent condensation of moisture in the tanks. Be sure that the vents in the fuel tank filler caps are open.

Batteries (If Tractor is Equipped with Starting and Lighting Attachment)

Inspect the batteries frequently to see that the water is at the correct level and that the specific gravity is correct.

Cooling System

To prevent overheating in hot weather, make the following checks:

1. Check the tension of the fan belts at frequent intervals.
2. Check the coolant level frequently, and be sure the radiator filler cap is on tight.
3. Clean and flush the internal parts of the cooling system frequently.
4. Keep the external parts of the radiator clean of bugs and dirt.

Continued on next page

PREVENTIVE MAINTENANCE

FOR TRACTORS EQUIPPED WITH STARTING AND LIGHTING ATTACHMENT

Battery liquid Check amount and specific gravity. *See page 83.*
Battery terminals Clean and grease. *Refer to page 82.*

After Every 120 Hours of Operation

Lubrication points Refer to "LUBRICATION GUIDE."
Carburetor and linkage Check for secure mounting and leaks. Check linkage
for operation and lubricate with a few drops of oil.
Tray (air cleaner) Remove and clean. *Refer to page 46.*

After Every 240 Hours of Operation

Gasoline strainer and sediment bowl Take apart and clean. *Refer to page 48.*
Spark plugs Remove and clean; check gap. *Refer to page 59.*
Engine crankcase Drain and change oil. Refer to "LUBRICATION GUIDE."
Magneto breaker points and chamber Clean chamber and check gap. *See pages 56 to 58.*
Magneto drive chamber and impulse
coupling Check; clean if necessary. *Refer to pages 56 and 57.*
Crankcase breather Remove and clean; replace element if necessary.

After Every 480 Hours of Operation

Fuel line screen at carburetor Remove and clean. *Refer to page 47.*
Cooling system Clean. *Refer to pages 42 and 43.*
Engine valves Check for clearance. *Refer to pages 44 and 45.*
Steering clutch hand levers Check for free movement at handles. *Refer to pages 61 and 62.*
Steering brake pedal Check for free movement at pedal pads. *Refer to page 62.*
Lubricating oil filters Replace filter elements. *Refer to page 41.*
Lubrication points Refer to "LUBRICATION GUIDE."
Diesel fuel water trap Remove and clean. *Refer to page 50.*

After Every 960 Hours of Operation

Air cleaner, complete Remove and clean. *Refer to pages 45 and 46.*

Periodic

Engine clutch Check to see that the clutch holds securely and does
not drag. *Refer to page 60.*
Fuel filters Replace elements when necessary. *See pages 51
and 52.*
Magneto distributor cap Remove and clean. *Refer to page 58.*
Primary pump filter screen Remove and clean. *Refer to page 52.*
* Generator commutator }
* Cranking motor commutator } Clean. *Refer to page 81.*
* Wiring Check for worn, cracked, or frayed insulation, broken
wires, loose or corroded connections.

* Part of Starting and Lighting Attachment.

PREVENTIVE MAINTENANCE

TRACTOR LUBRICATION

Thorough lubrication service performed at definite intervals and according to an established routine will aid greatly in prolonging the life of the tractor and in reducing operating expense. In the "LUBRICATION GUIDE" on the following pages the recommended intervals between lubrication periods are approximate, being based on average operating conditions. The type of work being done, load, ground and weather conditions are all factors to consider in frequency of lubrication. The life and performance of a machine depend on the care that it is given. Proper lubrication is probably the most important maintenance service for your tractor.

Oil Pump Screen

The gear type oil pump in the crankcase oil pan has a screen attached to the oil intake to stop large dirt particles from entering the lubrication system. This screen should be cleaned whenever the oil pan is removed. The oil intake floats on top of the oil in the oil pan and always draws the oil from the surface, thus preventing water or sediment from mixing with the oil.

Oil Filler Strainer Screen

At regular intervals, remove the oil filler strainer screen from the oil filler and clean the screen.

Crankcase Breather

The crankcase breather, located in the push rod chamber on the right side of the crankcase, has a double metal crimp element. Clean the element after every 240 hours of operation, or more when operating under unusual dust or dirt conditions. If necessary, replace with a new breather element.

Oil Filters

The engine is equipped with full flow type oil filters designed to remove all harmful foreign particles from the oil before it is distributed to the engine. To obtain full benefit from the filters the elements should be replaced with new ones every 480 hours.

The oil filters keep the oil free from harmful contamination for 480 hours of operation under normal operating conditions. However, it may be necessary to replace the filter element after shorter operating periods under severe operating conditions such as extreme dust conditions, low engine temperature, intermittent load operating with long stand-by periods, excessively heavy loads where high oil temperatures are the rule, or when diesel fuel with a high sulphur content is used.

Cleaning the old element is not satisfactory.

For the recommended oil to use for the prevailing temperature refer to "LUBRICATION GUIDE" on pages 24 and 25.

Oil Pressure Indicator

The oil pressure indicator shows the pressure of the oil circulating through the engine. Under all operating conditions the oil pressure of the engine should hold the indicator in the white section. If the indicator does not register, stop the engine at once and inspect the oil system to find the cause of failure. If unable to find the cause, consult your International Industrial Power distributor or dealer before operating the engine.

Always look at the oil pressure indicator immediately after starting the engine.

Oil Level Gauge

Do not operate the engine for any length of time with the crankcase oil below the "LOW" mark on the bayonet oil level gauge.

To check the oil level with the bayonet gauge, unscrew the wing nut, remove the gauge wipe it clean and insert it in the crankcase until the wing nut rests on top of the gauge sleeve threads. Do not screw the nut onto the sleeve. Remove the gauge again and read the oil level.

NOTE: The gauge has readings on both sides and can be used when the engine is running or when it is stopped. Be sure to use the correct side. If the engine has just been stopped, allow five to ten minutes for the oil to drain down into the oil pan before taking the reading; otherwise, the reading might not show the true amount of oil in the crankcase and more oil than necessary might be added.

PREVENTIVE MAINTENANCE

Keep Lubricants Clean

It is important that the lubricants, lubricators and containers be kept clean and free from foreign matter and that each lubrication point be wiped clean before the lubricator is applied.

Lubricant Specifications

MOTOR OIL

Motor oil (MO) (for use in crankcase, air cleaner, and injection pump) should be well refined petroleum oil free from water and sediment. It should also be free of fatty oils, acids, soaps, resins or other substances which might injure the surfaces or cause corrosion on any metals used in the engine.

Heavy duty type crankcase oils provide the most satisfactory engine lubrication and should be used in International diesel engines with present day diesel fuels. The quality of the base oil and the amount and type of additives used in these oils determine their suitability for use in high speed diesel engines under severe operating conditions and also determine the degree of their suitability for use with diesel fuels containing sulphur or other injurious products.

Heavy duty oils which meet the requirements of Military Specifications Mil-0-2104 Engine Oil are recommended as minimum performance level crankcase oils for use in International diesel engines. In general, the sulphur content of the fuel used in a diesel engine determines the minimum performance level of the crankcase oils.

Oils meeting the Mil-0-2104 requirements are expected to give acceptable results in International diesel engines under all conditions with diesel fuels having sulphur content not exceeding 0.4%.

When diesel fuels having sulphur content higher than 0.4% are used, higher additive

content in the crankcase oil may be required to reduce the objectionable engine deposits and wear caused by the combustion products from these fuels.

At present there are in most areas in the U.S.A. crankcase oils available which will give acceptable results in International diesel engines with fuels having sulphur content up to 1.0%. Most refiners produce and market one or more of these crankcase oils which have additive content considerably above that of the Mil-0-2104 qualified oils. These higher additive oils should be used where fuels with a sulphur content over 0.5% are used. Your fuel supplier should know the sulphur content of his fuel.

It has never been the policy of the International Harvester Company to publish approved lists of lubricants or to guarantee oil performance in service. The responsibility for the quality of the lubricant, its performance under conditions of operation, and its compatibility with the diesel fuels used must remain with the supplier or the lubricant. High speed diesel fuels and lubricants should be procured from a reliable source. When in doubt consult your International Industrial Power distributor or dealer.

No special procedure is required when heavy duty oils are used other than to have the engine thoroughly run-in.

UNIVERSAL GEAR LUBRICANT

Universal gear lubricant (UGL) (Mil-L-2105) for use in the transmission and sprocket drive housings should be high quality and of recognized manufacture for the protection of your tractor. SAE-80 is recommended in cold weather. For track rollers and idlers, use a good quality mineral oil free from solid materials, in various grades for different air temperatures.

CHASSIS LUBRICANT

Chassis lubricant (CL) is used as pressure gun grease at all temperatures.

Selecting the Proper Motor Oil

During cold weather the selection of crankcase lubricating oils should be based on the lowest anticipated temperature for the day to make starting easier. For hot weather operation the selection should be based on the highest anticipated temperature. Refer to "LUBRICATION GUIDE" on pages 24 and 25.

PREVENTIVE MAINTENANCE

CHANGES IN TEMPERATURE

It is not necessary to change crankcase oil during operation when the atmospheric temperature rises or falls into another temperature range as specified in the "LUBRICATION GUIDE" on the following pages. For example: SAE-20 can be used instead of SAE-10W in temperatures below 32° F. if no starting trouble is experienced; or the SAE-10W oil that is specified for use in temperatures 32° to 10° F. can be used in temperatures as high as 40° F.; or the SAE-10W oil that is recommended for use in temperatures below 10° F. can be used in temperatures as high as 32° F. and even up to 40° F., except when operating under continuously heavy loads.

THINNING THE CRANKCASE OIL

When using lighter grades of lubricating oils, there may be a tendency for the oil in the crankcase to gradually become thicker; in this case it is desirable in cold weather to add one quart of kerosene to the crankcase between specified oil changes to maintain easy cranking.

LUBRICATION WHEN SHIPPED

The lubricant in the crankcase, air cleaner, and injection pumps in diesel engines, when shipped from the factory, is for ship-away purposes and is not suitable for use in regulator service. The original oil should immediately be drained from the crankcase, air cleaner, and injection pump and should be replaced with the required amount of fresh oil having the physical properties and proper viscosity for the prevailing air temperatures and type of service.

CHANGE AFTER EVERY 240 HOURS

Change oil in the crankcase after every 240 hours of operation, or more often under abnormal operating conditions. Drain the crankcase while the oil is warm so it will drain freely and completely. Also see "Oil Filters" on page 21.

After changing oil, the engine should not be operated at high speed or under load until the new oil has had ample time to reach all bearings.

After changing to a lighter grade of oil the engine should be operated at least 5 to 10 minutes without load so that the lighter oil is worked into the bearings and onto the cylinder walls.

Chassis Lubricant when Shipped from Factory

All crawler tractors shipped from the factory between April 1st and October 1st are filled with SAE-90 in the transmission and sprocket drives and SAE-140 in the track rollers and track idlers.

All crawler tractors shipped from the factory between October 1st and April 1st are filled with SAE-80 in the transmission and sprocket drives, and SAE-90 in the track rollers and track idlers.

The oil in the transmission and sprocket drive housings should be changed at least once a year; however, do not operate the tractor more than 960 hours without changing.

Whenever the oil in the transmission and sprocket drive housings is changed, wash out the housings with kerosene before refilling with oil. First drain the old oil from these housings; then fill the housings to the proper level with kerosene. Operate the tractor in low gear for several minutes. Remove the drain plugs from these housings and allow time for complete drainage of the kerosene. Refill with universal gear lubricant.

In the track rollers and idlers use universal gear lubricant as specified in the "LUBRICATION GUIDE" on the following pages, depending upon the prevailing air temperature.

Draining Clutch Compartments

When operating the tractor in water, under very wet conditions or under extremely dusty conditions water or dust may enter the engine clutch or steering clutch compartments through the holes in the drain plugs. To avoid this replace the drain plugs with solid plugs. Remove the plugs after every 60 hours of operation to allow any oil accumulation to drain out.

Tractors Exported

When tractors are packed for export all oil is drained from the crankcase, air cleaner and fuel injection pump. Before starting to operate the tractor, give it complete lubrication service. Refer to the "LUBRICATION GUIDE" on the following pages.

LUBRICATION GUIDE

KEY

MO (Motor Oil)—According to anticipated air temperature. Oils which qualify under military specification Mil-O-2104 are recommended.
UGL (Universal gear lubricant)—According to anticipated air temperature. Extreme pressure gear lubricant (EP) types and universal gear lubricant (UGL) types which qualify under military specification Mil-L-2105 are recommended.
CL (Pressure-gun grease)—Use as chassis lubricant, all temperatures.
HT (High temperature melting point grease)—All temperatures.
MG (Magnetto grease)—All temperatures.

Points of lubrication are individually illustrated on the following pages. They are identified by Item Numbers corresponding with those listed along each side of the Lubrication Guide.

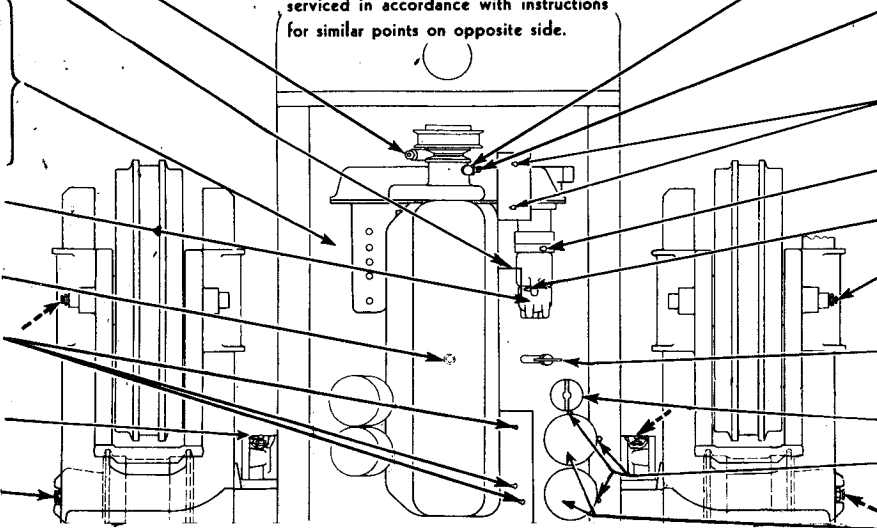
APPLICATION	KEY	CAPACITY	ANTICIPATED AIR TEMPERATURE					
			Above 90° F.	90° F. to 45° F.	45° F. to 32° F.	32° F. to 10° F.	10° F. to -10° F.	Below -10° F.
Crankcase	MO	16 quarts	*SAE-30	SAE-30	SAE-20	SAE-10W	SAE-10W	Blend 14 qt. SAE-10W and 2 qt. Kerosene
Air cleaner	MO	4½ pints	*SAE-30	SAE-30	SAE-20	SAE-10W	SAE-10W	SAE-10W
Fuel injection pump	MO	½ pint	*SAE-30	SAE-30	SAE-20	SAE-10W	SAE-10W	SAE-10W
Magnetto distributor bearing	MO		SAE-10W or light electric motor oil	SAE-10W or light electric motor oil	SAE-10W or light electric motor oil	SAE-10W or light electric motor oil	light electric motor oil	light electric motor oil
Magnetto impulse coupling	MO		SAE-10W or light electric motor oil	SAE-10W or light electric motor oil	SAE-10W or light electric motor oil	SAE-10W or light electric motor oil	light electric motor oil	KEROSENE
Generator	MO		SAE-20	SAE-20	SAE-20	SAE-20	SAE-10W	SAE-10W
Starting motor	MO		SAE-20	SAE-20	SAE-20	SAE-20	SAE-10W	SAE-10W
Transmission	UGL	6 gallons	Above 50° F. SAE-90		50° F. to 30° F. SAE-90		30° F. to -10° F. SAE-80	
Sprocket drive housing	UGL	6 pints	*SAE-140		SAE-90		SAE-80	
Track roller	UGL	½ pint	*SAE-140		SAE-90		SAE-80	
Track idler	UGL	3½ pints	*SAE-140		SAE-90		SAE-80	
Front idler	UGL	2 pints	*SAE-140		SAE-90		SAE-80	

Recommended Intervals of Time for Lubrication Service
10 hours of operation or daily service
60 hours of operation or weekly service
120 hours of operation or bi-weekly service
240 hours of operation or monthly service
480 hours of operation or bi-monthly service
960 hours of operation or seasonal service
NOTE: Intervals of time are based on normal operation. Reduce the intervals of time if unusually severe operating conditions are encountered.

- Item No. Point of Lubrication Lubricant Hours
- 18 Front Engine Support CL 60
Apply two or three strokes of the lubricator, or sufficient grease to flush out the old grease or dirt.
- 39 Ignition Cut-out Switch MG 960
Remove manifold end cover, apply trace of grease to contact points.
- FUEL INJECTION PUMP
Oil Filler MO 10
Oil Level Valve MO 10
Open oil level valve. If no oil appears, add oil at filler to bring it up to the level of the valve.
- 29 Oil Drain Plug MO
Drain the pump housing and refill to the level valve each time the crankcase oil is drained. (See Note 2 below)
- Magnetto Breaker Arm Rubbing Block MG 480
Pack a small quantity of grease back of the breaker arm rubbing block and in recess in breaker post.
- 31 Crankcase Oil Drain Plug MO
With engine hot, remove plug and drain all oil from crankcase. Refill with new oil. (See Note 2 below)
- 33 Cranking Motor (Special) MO 240
To reach the three oil cups, remove the engine side sheet and the cranking motor shield. Apply eight to ten drops of oil to each cup.
- 11 Track Frame Guide Rollers CL 10
(One on each side.) Apply two or three strokes of lubricator, or sufficient grease to flush out old grease and dirt.
- 25 Track Rollers UGL 120
(Five on each side.) Remove the pipe plug. Fill with lubricator until oil runs out of vent hole. (See Note 7.)

*See Note 8.

All points indicated by short-shaft, dotted arrows are points that are on both sides of the tractor and must be serviced in accordance with instructions for similar points on opposite side.



- Hours Lubricant Point of Lubrication Item No.
- 10 CL Water Pump Shaft
Remove the cap on the fitting. Apply not more than two strokes of the lubricator. Over-lubrication will force lubricant into the cooling system and may cause clogging of the system.
- 60 CL Fan Hub Bearing 14
Apply one or two strokes of the lubricator. Do not overlubricate. If lubricant appears out of fan hub while using the lubricator, stop the application.
- 120 MO Generator (Special) 28
Apply 8 to 10 drops of oil to each of two oil cups.
- 60 MO Magnetto Impulse Coupling 15
Oil liberally.
- 480 MO Magnetto Distributor Bearing 36
Apply several drops of oil to fill oil cup.
- 120 UGL Front Idlers 27
(One on each side.) Remove pipe plug in the outer end of the shaft. If no oil appears, fill with lubricator. (See Note 7.)
- 10 MO Crankcase Oil Level Bayonet Gauge 9
Check oil level with gauge. Add oil to bring oil level to "FULL" mark on gauge. (See Note 2.)
- 10 MO Crankcase Oil Filler 9
- 240 Lubricating Oil Filter Drain Plugs 34
Drain the filter base and filter cases whenever the crankcase oil is drained. (See Note 1.)
- 480 Lubricating Oil Filter Elements 35
Change the filter elements to coincide with every other filter drain and crankcase oil change. (See Note 1.)

Item No.	Point of Lubrication	Lubricant	Hours	Lubricant	Point of Lubrication	Item No.
26	Track Idlers	UGL 120		10	MO Air Cleaner	8
	(Two on each side.) Remove the pipe plug. If no oil appears, fill with the lubricator until there is a noticeably increased load on the lever. (See Note 7.) Plug opening must be above the horizontal position when checking or lubricating.					Clean the oil cup and refill it to the oil level bead.
19	Steering Brake Pedal Shafts . . . CL	60		60	CL Engine Clutch Camshaft Bearings . . 21	
	(One on each side.) Apply two or three strokes of lubricator to each fitting.					Remove the round plate on the clutch compartment cover, crank the engine until each of three fittings is opposite the opening, and apply one or two strokes of the lubricator to each fitting.
16	Engine Clutch Compartment Drain Plug	60		60	CL Engine Clutch Release Sleeve . . 24	
	Drain the clutch compartment. (See Note 3.)					Remove the round plate on the clutch compartment cover and apply three or four strokes of the lubricator.
6	Steering Clutch Levers CL	10		60	HT Engine Clutch Release Bearing . . 22	
	Apply two or three strokes of lubricator to each fitting.					Remove the round plate on the clutch compartment cover and apply three or four strokes of the lubricator.
12	Gear Shifter Lockshaft Bracket . . . CL	10		60	HT Engine Clutch Pilot Bearing . . . 20	
	Use two or three strokes of lubricator.					Remove the round plate on the clutch compartment cover and apply five or six strokes of the lubricator.
13	Gear Shifter Lock Cam Housing . CL	10		240	UGL Transmission Oil Filler and Level Gauge	32
	(Three fittings.) Remove seat and tool box. Apply two or three strokes of lubricator to each fitting.					Check oil level with gauge. Add oil to bring oil level to "FULL" mark on gauge. (See Note 4.)
	Steering Clutch Release Bearings CL			960	Transmission Drain Plug	137
	Remove seat and tool box to reach fittings. Apply two or three strokes of lubricator to each fitting.					Remove plug and drain oil immediately after operation. Replace the plug and refill. (See Note 4.)
	Steering Clutch Release Fork			60	Steering Clutch Compartment	17
	Lower Bearings CL	40			Drain Plugs	
	Remove seat and tool box to reach fittings. Apply two or three strokes of lubricator to each fitting.					(One on each side.) Drain the clutch compartment. (See Note 3.)
	Track Frame Pivots CL	10		10	CL Steering Clutch Release Fork	5
	Apply two or three strokes of lubricator. (One on each side.)					Upper Bearings
1	Track Frame Diagonal Braces . . . CL	10		60	CL Steering Clutch Pilot Bearings . . 23	
	Apply two or three strokes of lubricator to each fitting.					(One on each side.) Apply ten to twenty strokes of the lubricator to each fitting. (See Note 6.)
30	Sprocket Drive Level and Filler Plugs	UGL 240		960	Sprocket Drive Drain Plugs . . . 38	
	(One on each side.) Check and, if necessary, add lubricant. (See Note 5.)					(One on each side.) (See Note 5.)

NOTE 1—Under normal operating conditions, change the crankcase lubricating oil every 240 hours and the oil filter elements after every 480 hours of operation. However, it may be necessary to change the oil after shorter working periods under severe operating conditions such as extremely dusty conditions, low engine temperatures, intermittent operation, excessively heavy loads with high oil temperatures, or when diesel fuel with high sulphur content is used. Change the lubricating oil in the fuel injection pump whenever the crankcase oil is changed.

(a) To drain the oil completely from the crankcase and filters:
 (1) With the engine hot, remove the crankcase drain plug, the filter base drain plug and the filter case drain plugs.
 (b) After replacing the plugs, add one quart of oil to each case. The amount of oil added (2 quarts) should be deducted from the amount specified for the crankcase.

NOTE 2—The crankcase oil level bayonet gauge has readings on both sides, showing the crankcase oil level when the engine is operating and when it is stopped. Be sure to use the correct side. For an accurate check with the engine stopped, wait for the oil to drain into the crankcase pan. To use the gauge:

1. Unscrew the wing nut, remove the gauge and wipe it clean.
2. Insert the gauge until the wing nut rests on the top of the gauge sleeve threads. Do not screw the nut onto the sleeve.
3. Remove the gauge and check the oil level.

NOTE 3—When operating where water may come up to the level of the drain plug holes, install solid pipe plugs. When solid plugs are used, remove them after every 60 hours of operation to drain the compartments of excessive lubricant which may have collected.

NOTE 4—After every 240 hours of operation, check oil level and add lubricant to level of "FULL" mark on bayonet gauge. The oil in the transmission case should be changed at least once a year. However, do not operate the tractor more than 960 hours without changing the oil in the transmission case. If the oil has been changed to SAE-80 for below-zero operation, then change to SAE-90 before hot weather. Check the oil level preferably after the tractor has been idle for several hours. (Capacity 6 U. S. gallons). The correct method of checking the transmission oil level with a bayonet gauge is:

- (1) Unscrew and remove the gauge, and wipe it clean.
- (2) Reinsert the gauge until the bottom of the threaded plug rests free on top of the threaded ring in the transmission case.
- (3) Remove the gauge and check the oil level.

NOTE 5—After every 240 hours of operation, remove level plug and, if lubricant is low, fill to level and install the plug. The oil in the sprocket drive housings should be changed at least once a year. However, do not operate the tractor more than 960 hours without changing the oil. If the oil in the sprocket drive housings has been changed to SAE-80 for below-zero operation, then change to SAE-90 before hot weather. (Capacity 6 U. S. pints each side.)

NOTE 6—To reach the lubrication fittings, remove the two round plates at the rear of the main frame (one on each side). Move the tractor as necessary to line up the fittings with the access holes. Never use a fluid lubricant as it may get on the clutch facings.

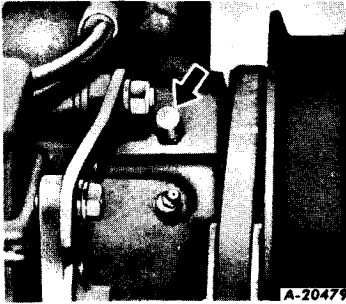
NOTE 7—Lubricate more frequently if the seals are worn or when the tractor is being operated in water or under excessively dusty conditions.

NOTE 8—SAE-40 may be used instead of SAE-30 and SAE-250 may be used instead of SAE-140 where prevailing temperatures exceed 90° sufficiently to make it desirable.

ALWAYS USE CLEAN CONTAINERS. KEEP LUBRICATORS CLEAN. WIPE DIRT FROM FITTINGS BEFORE APPLYING LUBRICATORS.

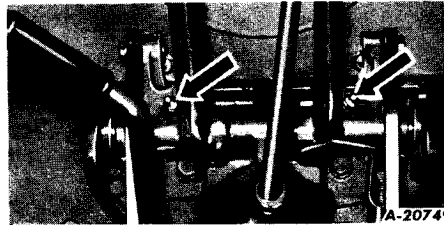
PREVENTIVE MAINTENANCE

Service After Every 10 Hours of Operation



A-20479

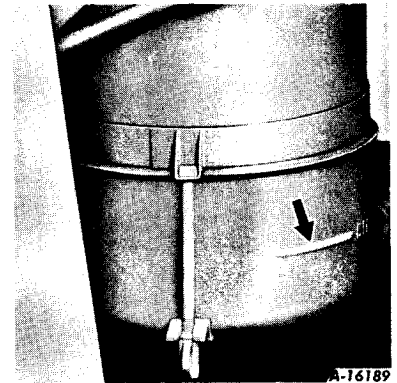
Item 1 - Water pump shaft.
Remove the cap on the fitting. Apply not more than 2 strokes of the lubricator. Overlubrication will force lubricant into the cooling system and cause clogging.



A-20749

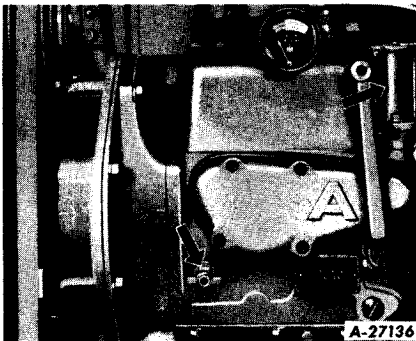
Item 6 - Steering clutch levers.

Apply 2 or 3 strokes of lubricator to each fitting.



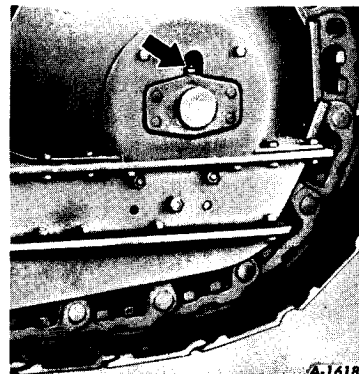
A-16189

Item 8 - Air cleaner.
Clean and refill the oil cup to the level bead. (Capacity 4-1/2 U.S. pints.)



A-27136

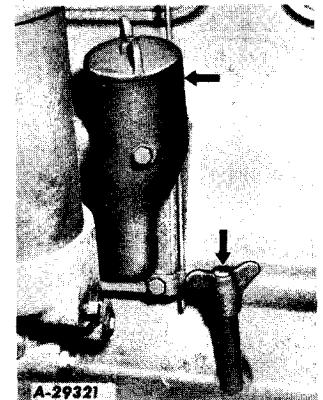
Item 2 - Injection pump oil level valve and filler.
Open oil level valve. If no oil appears, add oil at filler to bring it up to level of valve.



A-16181

Item 7 - Track frame pivots.

(One on each side.) Apply 2 or 3 strokes of lubricator to each fitting.



A-29321

Item 9 - Crankcase oil filler and level gauge.
Check oil level with gauge. Add oil to bring oil level to "FULL" mark on gauge.

Item 3 - Steering clutch release bearings (No. 1 arrows).

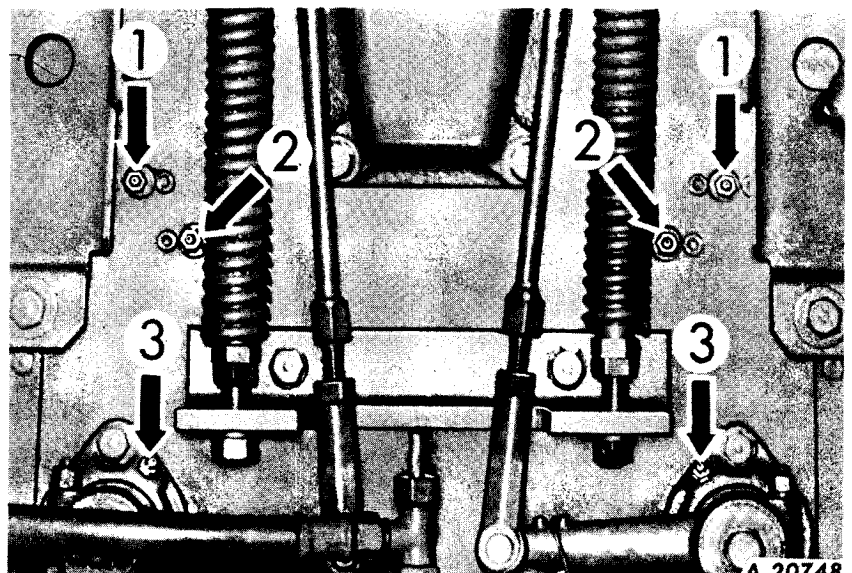
Remove seat and tool box to reach fittings. Apply 2 or 3 strokes of lubricator to each fitting.

Item 4 - Steering clutch release fork lower bearings (No. 2 arrows).

Remove seat and tool box to reach fittings. Apply 2 or 3 strokes of lubricator to each fitting.

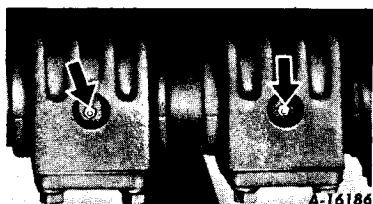
Item 5 - Steering clutch release fork upper bearings (No. 3 arrows).

Remove seat and tool box to reach fittings. Apply 2 or 3 strokes of lubricator to each fitting.



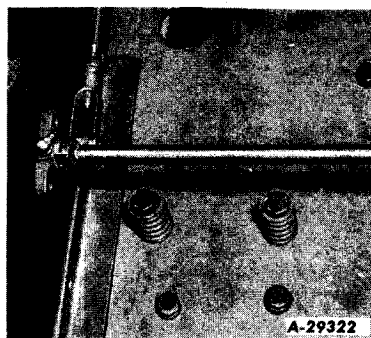
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PREVENTIVE MAINTENANCE



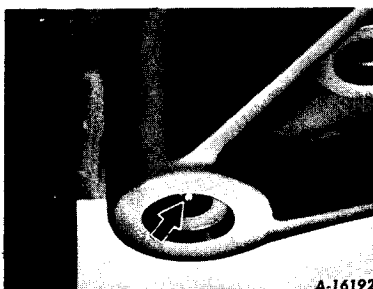
Item 10 - Track frame diagonal braces.

Apply 2 or 3 strokes of lubricator to each fitting.



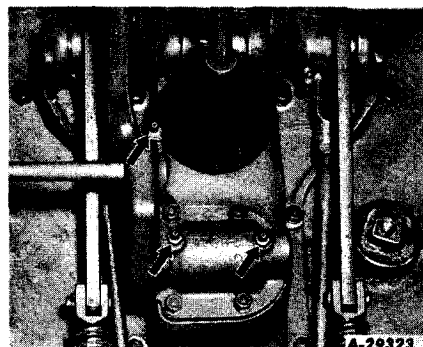
Item 12 - Gear shifter lockshaft bracket.

Apply 2 or 3 strokes of lubricator.



Item 11 - Track frame guide rollers.

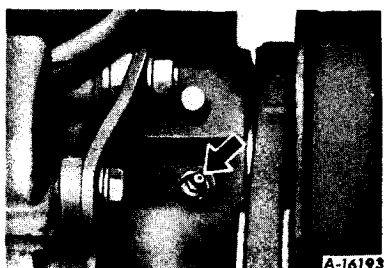
(One on each side.) Apply 2 or 3 strokes of lubricator, or sufficient grease to flush out old grease and dirt.



Item 13 - Gear shifter lock cam housing.

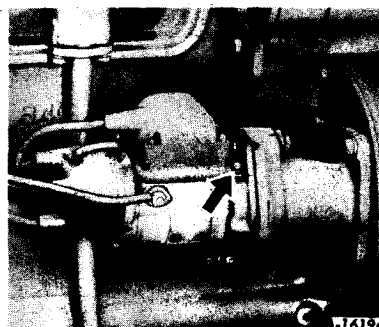
Remove seat and tool box. Apply 2 or 3 strokes of the lubricator to each fitting.

Service After Every 60 Hours of Operation



Item 14 - Fan hub bearing.

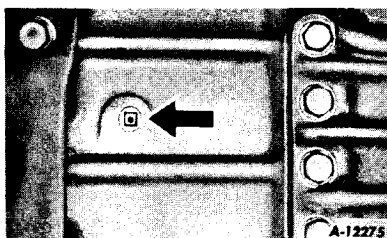
Apply 1 or 2 strokes of lubricator. Do not overlubricate. If lubricant appears out of fan hub while using the lubricator, stop the application.



Item 15 - Magneto impulse coupling.

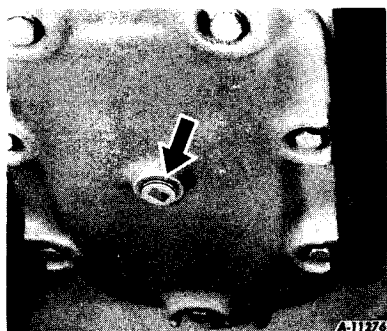
Oil liberally with oil as specified in the lubrication guide.

PREVENTIVE MAINTENANCE



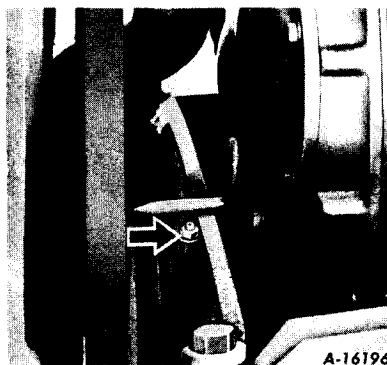
Item 16 - Engine clutch compartment drain plug.

If a solid pipe plug was used while operating where water might enter the drain hole, remove plug and drain the clutch compartment of excess lubricant which may have collected.

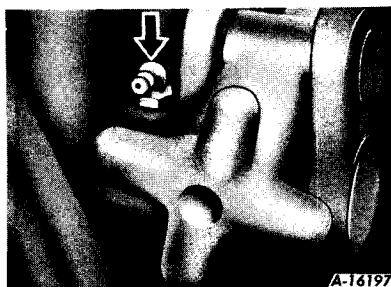


Item 17 - Steering clutch compartment drain plugs.

If solid pipe plugs were used while operating where water might enter the drain holes, remove plugs and drain the clutch compartments of excess lubricant which may have collected.

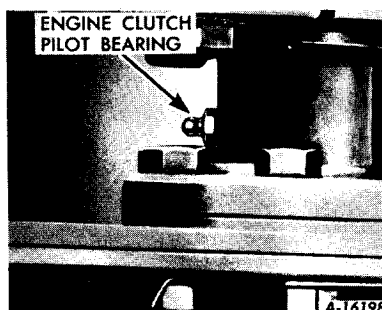


Item 18 - Front engine support.
Apply 2 or 3 strokes of the lubricator or sufficient grease to flush out old grease and dirt.



Item 19 - Steering brake pedal shafts.

(One on each side.) Apply 2 or 3 strokes of lubricator to each fitting.



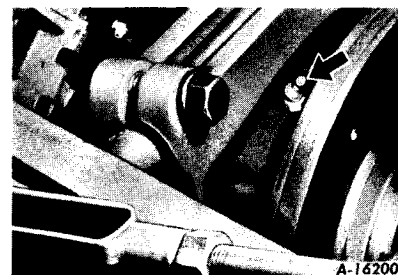
Item 20 - Engine clutch pilot bearing.

Remove the round plate on the clutch compartment cover and apply 5 or 6 strokes of the lubricator to the fitting.



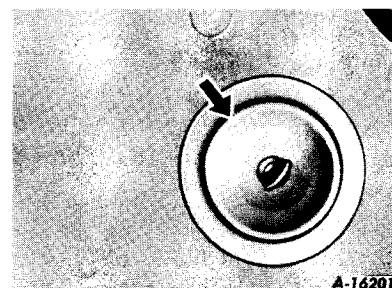
Item 21 - Engine clutch camshafts.

Remove the round plate on the clutch compartment cover. Apply 1 or 2 strokes of the lubricator to each of 3 fittings. Crank the engine until each camshaft fitting is opposite the opening.



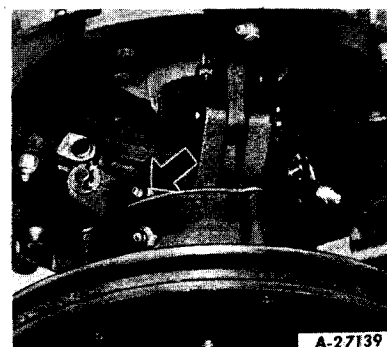
Item 22 - Engine clutch release bearing.

Remove round plate on clutch compartment cover and apply 3 or 4 strokes of lubricator to the fitting.



Item 23 - Steering clutch pilot bearings.

(One on each side.) Remove round plate, move tractor to line up fitting with the hole, and apply 10 to 20 strokes of lubricator to each fitting.

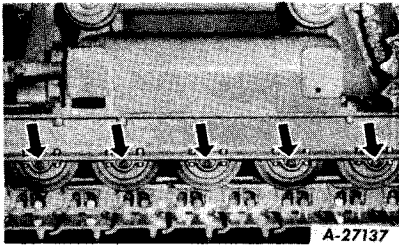


Item 24 - Engine clutch release sleeve.

Remove the round plate on the clutch compartment cover. Apply 3 or 4 strokes of the lubricator to the fitting.

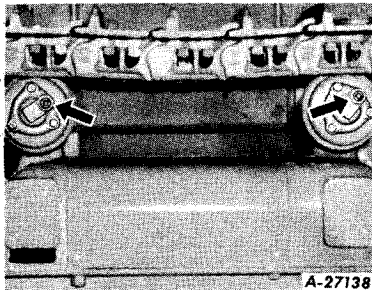
PREVENTIVE MAINTENANCE

Service After Every 120 Hours of Operation



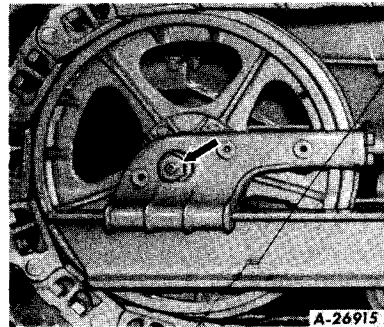
Item 25 - Track rollers.

Remove the pipe plug. Fill with the lubricator until oil runs out vent hole. Lubricate more frequently if the seals are worn, or when the tractor is being operated in water or under excessively dusty conditions.



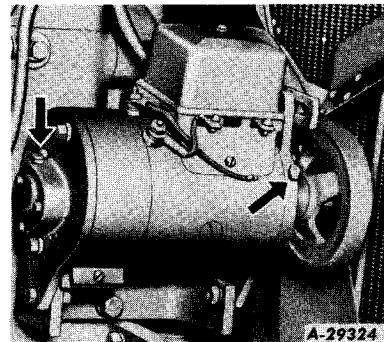
Item 26 - Track idlers.

Remove the pipe plug; if no oil appears, fill with the lubricator until there is a noticeably increased load on the lever. Plug opening must be in the horizontal position when checking or lubricating. Lubricate more frequently if the seals are worn or when the tractor is being operated in water or under excessively dusty conditions.



Item 27 - Front idlers.

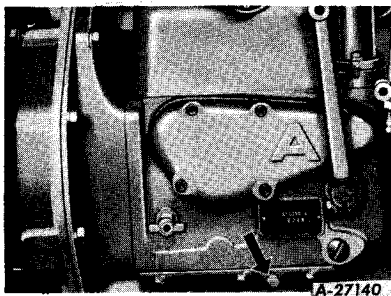
Remove the pipe plug in the outer end of shaft; if no oil appears, fill with lubricator. Lubricate more frequently if the seals are worn or when the tractor is being operated in water or under excessively dusty conditions.



Item 28 - Generator (special).

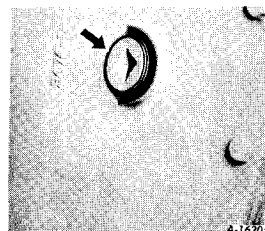
Apply 8 to 10 drops of oil to each of two oil cups.

Service After Every 240 Hours of Operation



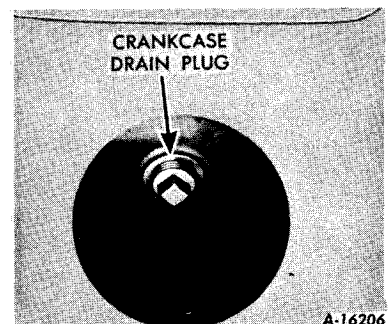
Item 29 - Injection pump lubricating oil drain plug.

Drain pump housing and refill to level cock each time oil in crankcase is drained. (Capacity 1/2 U.S. pint.)



Item 30 - Sprocket drive level and filler plugs.

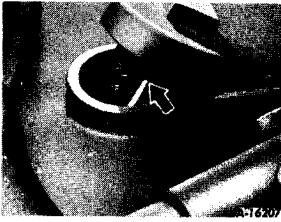
(One on each side.) Remove the plugs, check the lubricant level and, if the lubricant is low, fill it to the level of the plug. Replace the plugs.



Item 31 - Crankcase drain plug.

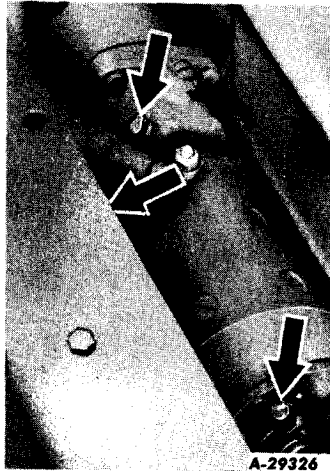
Remove plug and drain all oil from crankcase (engine should be hot). Refill with new oil.

PREVENTIVE MAINTENANCE



Item 32 - Transmission oil filler and level gauge.

Check oil level as shown in Lubrication Guide. If necessary, add oil.



Item 33 - Cranking motor (special).
To reach the 3 oil cups, remove the engine side sheet and the cranking motor shield. Apply 8 to 10 drops of oil to each cup.

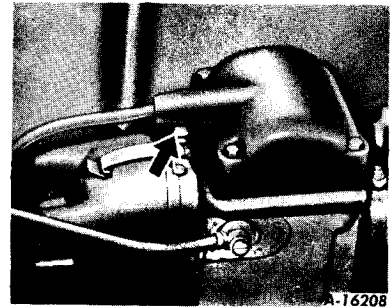


Item 34 - Lubricating oil filter drain plugs.
Drain the filter base and filter cases whenever the crankcase oil is drained. Drain the oil while the engine is hot. After replacing the plugs, add 1 quart of oil to each case. The 2 quarts added should be deducted from the total amount required for the crankcase.

Service After Every 480 Hours of Operation



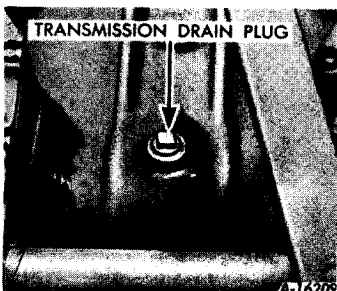
Item 35 - Lubricating oil filter elements.
Change the filter elements to coincide with every other filter drain and crankcase oil change. After replacing the elements and the plugs, add 1 quart of oil to each case. The 2 quarts added should be deducted from the total amount required for the crankcase.



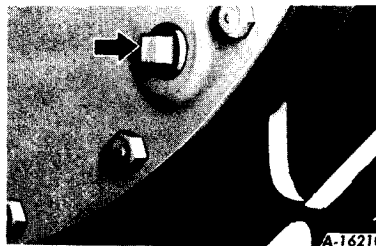
Item 36 - Magneto distributor bearing.

Fill the oil cup with the grade of oil specified in the "Lubrication Guide."

Service After Every 960 Hours of Operation



Item 37 - Transmission drain plug.
Remove plug and drain oil immediately after operation. Replace the plug and refill.



Item 38 - Sprocket drive drain plugs.
(One on each side.) Remove plug and drain oil immediately after operation. Replace plug and refill.



Item 39 - Ignition cut-out switch.
Remove cover and apply traces of grease to contact points.

PREVENTIVE MAINTENANCE
CHECKING MECHANICAL PROBLEMS

PROBLEM	PROBABLE CAUSE	PROBABLE REMEDY
ENGINE WILL NOT TURN	<p>A. Cranking motor inoperative (if used).</p> <p>(1) Batteries faulty.</p> <p>(2) Cables and terminals faulty.</p> <p>(3) Starting switch defective.</p> <p>(4) Cranking motor defective.</p> <p>(5) Cranking motor commutator dirty or worn.</p> <p>B. Engine oil too heavy for operation in extreme low temperature.</p> <p>C. Internal seizure.</p>	<p>A.</p> <p>(1) Recharge or replace batteries if necessary.</p> <p>(2) Inspect ground cable and "battery-to-starter-switch" cable for any faults which may cause shorting, or inspect for incorrect connections. Replace cables if necessary.</p> <p>(3) Replace starting switch.</p> <p>(4) *</p> <p>(5) Clean commutator. <i>See page 81.</i> If worn, or out of round, repair. *</p> <p>B. Use grade of oil specified in "LUBRICATION GUIDE." <i>See page 24.</i></p> <p>C. Attempt to turn engine with spark plugs removed, clutch disengaged, and compression release lever in starting position. If engine does not turn easily, internal damage is indicated. *</p>
	<p>A. Gasoline fuel system faulty.</p> <p>(1) No gasoline in tank.</p> <p>(2) Gasoline shut-off valve closed.</p> <p>(3) Gasoline strainer screen clogged.</p> <p>(4) Water in gasoline.</p> <p>(5) No gasoline at carburetor.</p> <p>B. Battery low in charge and does not turn engine fast enough.</p> <p>C. Ignition system faulty.</p> <p>(1) Ignition circuit broken.</p> <p>(2) Wet or fouled spark plugs.</p>	<p>A.</p> <p>(1) Fill small tank with gasoline.</p> <p>(2) Open gasoline shut-off valve.</p> <p>(3) Clean gasoline strainer. <i>See page 48.</i></p> <p>(4) Drain gasoline tank, strainer, and carburetor.</p> <p>(5) Clean fuel line from gasoline tank to carburetor. Check vent holes in gasoline tank filler cap.</p> <p>B. Charge battery.</p> <p>C.</p> <p>(1) Check cables from distributor cap to spark plugs for correct wiring or loose connections.</p> <p>(2) Remove spark plugs, wipe off moisture and dry plugs. Remove carbon. Check gap, which must be .023 inch.</p>

Continued on next page

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PREVENTIVE MAINTENANCE

PROBLEM	PROBABLE CAUSE	PROBABLE REMEDY
ENGINE TURNS BUT WILL NOT START	(3) Cracked or broken spark plug insulators.	(3) Replace.
	(4) Magneto grounding switch inoperative.	(4) Disconnect grounding switch cable from magneto. Attempt to start engine. If engine starts, switch in manifold or cable is inoperative and should be inspected.
	(5) No spark from magneto.	(5) Remove distributor block from magneto and turn engine to see if distributor rotor turns. (a) If distributor rotor does not turn, remove magneto as described on page 58.* (b) If rotor turns but engine does not start, remove a spark plug cable from spark plug. Hold cable terminal 1/4 inch from cylinder head and turn engine. If spark appears, plugs may be fouled or need replacement. If no spark appears, check breaker points in magneto. See pages 56 to 58.
	D. Carburetor choked too much.	D. Open the choke. Wait a few minutes before attempting again to start engine.
	E. Compression release lever in diesel position.	E. Pull compression release lever into gasoline (starting) position.
	F. Air intake restricted or exhaust system clogged.	F. Service air cleaner and clean exhaust system.
ENGINE WILL NOT OPERATE AS A DIESEL ENGINE	A. Injection pump does not deliver fuel.	A.
	(1) Fuel tank empty, or tank shut-off valve closed.	(1) Fill fuel tank or open shut-off valve.
	(2) Fuel supply system air-bound.	(2) Vent the fuel system. See page 48.
	(3) Diesel fuel filters or strainers clogged.	(3) Disassemble, clean, and if necessary replace fuel filters. See pages 51 and 52.
	(4) Fuel tubing clogged or injection nozzles inoperative.	(4) *
	B. Compression release mechanism not functioning.	B.
	(1) Starting valves warped.	(1) *
	(2) Starting control linkage out of adjustment.	(2) Check linkage for broken parts, missing cotters and pins. Adjust. *

*Consult your International Industrial Power distributor or dealer.

PREVENTIVE MAINTENANCE

PROBLEM	PROBABLE CAUSE	PROBABLE REMEDY
ENGINE WILL NOT OPERATE AS A DIESEL ENGINE	<p>(3) Butterfly valves in manifold not functioning.</p> <p>C. Faulty timing of injection pump.</p> <p>D. Water in diesel fuel.</p> <p>E. Controls not in correct position.</p>	<p>(3) Remove manifold end covers, and operate compression release lever to see if butterfly valves are functioning.</p> <p>C. Retime pump to engine. <i>See page 55.</i></p> <p>D. Drain entire diesel fuel system including water trap and filters. Refill with diesel fuel, and vent system.</p> <p>E. Set controls as outlined in "OPERATION" section on pages 14 and 15.</p>
MISSING AND BACKFIRING (Gasoline Cycle)	<p>A. Water in the gasoline.</p> <p>B. Air leaks around intake manifold.</p> <p>C. Improper firing order.</p> <p>D. Magneto not correctly timed to engine.</p> <p>E. Starting valves not properly seated.</p>	<p>A. Drain gasoline tank, strainer and carburetor.</p> <p>B. Tighten manifold stud nuts.</p> <p>C. Check spark plug cables for correct installation at spark plugs and magneto.</p> <p>D. Check and adjust timing. <i>See pages 58 and 59.</i></p> <p>E. *</p>
ENGINE DOES NOT IDLE PROPERLY (Diesel Cycle)	<p>A. Injection pump control lever shaft sticky, sluggish, or stuck.</p> <p>B. Injection pump plunger spring broken, or plunger stuck.</p> <p>C. Injection pump plunger and bushing worn.</p> <p>D. Surging at any idle speed.</p> <p>E. Injection nozzles faulty.</p>	<p>A.)</p> <p>B.)</p> <p>C.)</p> <p>D.)</p> <p>E. Remove, and repair or replace. *</p> <p><i>Remove injection pump and have it tested. * See pages 54 and 55.</i></p>
LOSS OF OIL PRESSURE	<p>A. Low oil level.</p> <p>B. Oil pressure indicator or line defective.</p> <p>C. Main or connecting rod bearings worn.</p> <p>D. Dirt in regulating valve, or regulating valve spring broken.</p> <p>E. Oil pump worn.</p> <p>F. Camshaft bearings worn excessively.</p>	<p>A. Add sufficient oil to bring up to specified mark on level gauge.</p> <p>B. Replace. *</p> <p>C. Replace. *</p> <p>D. Clean, or replace spring. *</p> <p>E. Remove, and repair or replace. *</p> <p>F. Install new bearings. *</p>

Continued on next page

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PREVENTIVE MAINTENANCE

PROBLEM	PROBABLE CAUSE	PROBABLE REMEDY
LOSS OF OIL PRESSURE	G. Oil diluted or not as specified.	G. Change oil regularly using correct grade.
	H. Oil leaks.	H. See "A" of "EXCESSIVE LUBRICATING OIL CONSUMPTION."
	I. Clogged oil filter.	I. Change filter element.
LACK OF COMPRESSION	A. Improper valve clearance.	A. Adjust valve clearance. <i>See page 44.</i>
	B. Valves sticking.	B. Clean valve guides and stems. Grind valves if necessary. *
	C. Valves warped.	C. Replace.*
	D. Broken valve spring.	D. Replace.*
	E. Worn cylinder head gasket.	E. Replace.*
	F. Worn pistons, sleeves, piston rings, and sticking piston rings.	F. Replace.*
	G. Starting valves warped.	G. Replace.*
ENGINE DOES NOT DEVELOP FULL POWER, AND UNEVEN OPERATION	A. Injection nozzle valves dirty or sticking.	A. Remove, and clean or replace. *
	B. Insufficient air to engine. (1) Air leaks around intake manifold.	B. Service the air cleaner. <i>See page 45.</i> (1) Tighten manifold stud nuts or install new gasket.
	C. Injection pump not operating properly, or not properly timed.	C. *
	D. Poor fuel.	D. Use good grade diesel fuel.
	E. Faulty valve action.	E. Adjust valve clearance. <i>See page 44.</i> If valves are burned or warped, replace. *
	F. Worn piston rings and pins, or sleeves.	F. *
	G. Exhaust restricted.	G. Remove restriction.
	H. Intermittent fuel delivery.	H. Follow steps under "A," "C," "D," and "E" of "ENGINE WILL NOT OPERATE AS A DIESEL ENGINE."
	I. Lack of engine compression.	I. See "LACK OF COMPRESSION" above.
SMOKY EXHAUST	A. Poor fuel.	A. Use good grade diesel fuel.
	B. Injection pump not properly timed.	B. Retime pump to engine. <i>See pages 55 and 56.</i>
	C. Injection nozzles not functioning properly.	C. Opening pressure not correct, or nozzle leaks. *
	D. Engine overloaded.	D. Reduce load.

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PREVENTIVE MAINTENANCE

PROBLEM	PROBABLE CAUSE	PROBABLE REMEDY
SMOKY EXHAUST	<p>E. Incorrect injection pump governor adjustment.</p> <p>F. Worn or sticking oil control rings or worn cylinder sleeves.</p> <p>G. Incorrect lubricant.</p>	<p>E. *</p> <p>F. Replace. *</p> <p>G. Use correct grade of lubricant as specified in "LUBRICATION GUIDE."</p>
ENGINE OVERHEATS	<p>A. Insufficient water in the cooling system.</p> <p>(1) Radiator cap loose. (2) Loose hose connections. (3) Water pump leaks.</p> <p>B. Fan belt slipping.</p> <p>C. Cooling system clogged.</p> <p>D. Dirt and trash on outside of radiator core.</p> <p>E. Thermostat inoperative.</p> <p>F. Lack of lubricating oil.</p> <p>G. Engine overloaded.</p> <p>H. Water pump defective</p> <p>I. Clogged lubricating oil filter.</p>	<p>A. Check level of water in radiator and add water if necessary. Check for leaks. NOTE: Do not pour cold water in an overheated engine or possible cracking of the cylinder head may result. See page 42.</p> <p>(1) Tighten radiator cap. (2) Tighten hose connections. (3) Service packing gland. See page 44.</p> <p>B. Check belt tension and adjust. See page 43.</p> <p>C. Flush out radiator and engine. See pages 42 and 43.</p> <p>D. Clean all dirt and trash from between the radiator tube fins with air or water pressure.</p> <p>E. Remove and replace if necessary. See page 44.</p> <p>F. Add sufficient oil to bring up to specified mark on level gauge.</p> <p>G. Reduce load.</p> <p>H. Repair or replace. *</p> <p>I. Replace filter element.</p>
EXCESSIVE LUBRICATING OIL CONSUMPTION	<p>A. Oil leaks.</p> <p>B. Worn valve guides, worn piston rings, sleeves, pistons, and clogged oil control rings.</p> <p>C. Improper lubricant.</p>	<p>A. Check and service where necessary - at valve lever housing, valve cover, side plates, dust seal at rear of oil pan, crankcase front cover, oil seals at front and rear of crankshaft, oil pan oil filter and oil pressure indicator tube.</p> <p>B. Excessive smoke coming from the breather pipe on the side of the crankcase or a smoky exhaust indicates that an excessive amount of oil is being used. *</p> <p>C. Use only the lubricant specified in the "LUBRICATION GUIDE" on pages 24 and 25.</p>

Continued on next page

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PREVENTIVE MAINTENANCE

PROBLEM	PROBABLE CAUSE	PROBABLE REMEDY
EXCESSIVE LUBRICATING OIL CONSUMPTION	<p>D. Overheated engine.</p> <p>E. Excessive amount of oil in crankcase.</p>	<p>D. Refer to "ENGINE OVERHEATS."</p> <p>E. Check oil level and drain any excess oil.</p>
ENGINE NOISES	<p>A. Loose piston pin. The pin at fault can be found by short-circuiting spark plugs on gasoline cycle until the noise stops.</p> <p>B. Piston slap.</p> <p>C. Worn or loose connecting rod bearings. The bearings at fault can be found by short-circuiting spark plugs on gasoline cycle until the noise stops.</p> <p>D. Incorrect valve clearance.</p> <p>E.</p> <p>(1) Leaky injection nozzle valve.</p> <p>(2) Poor fuel and water in the fuel.</p> <p>(3) Faulty injection pump timing.</p> <p>(4) Incorrect engine temperature.</p>	<p>A. Replace pin. *</p> <p>B. Replace piston and sleeve. *</p> <p>C. Replace bearings. *</p> <p>D. Adjust valve clearance. <i>See page 44.</i></p> <p>E.</p> <p>(1) Replace nozzle valve. *</p> <p>(2) Drain entire diesel system and refill with a good grade of clean diesel fuel. Remove and clean the water trap.</p> <p>(3) Retime pump to engine. <i>See pages 55 and 56.</i></p> <p>(4) Keep temperature in work range of heat indicator.</p>
ENGINE CLUTCH SLIPS OR DRAGS	<p>A. Clutch not properly adjusted.</p> <p>B. Dirt or oil in clutch assembly.</p> <p>C. Clutch inoperative.</p>	<p>A. Adjust clutch for definite over-center engagement. <i>See page 60.</i></p> <p>B. Remove clutch and clean.</p> <p>C. *</p>

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PREVENTIVE MAINTENANCE

PROBLEM	PROBABLE CAUSE	PROBABLE REMEDY
ROLLERS OR IDLERS WILL NOT TURN	<p>A. Insufficient lubricant.</p> <p>B. Bushing or internal seizure.</p> <p>C. Mud packed between rollers and idlers.</p>	<p>A. Follow specifications in "LUBRICATION GUIDE" on pages 24 and 25.</p> <p>B. *</p> <p>C. Thoroughly clean entire track assembly.</p>
GEARS HARD TO SHIFT	<p>A. Oil in transmission too heavy.</p> <p>B. Burred gears.</p> <p>C. Gear shifter forks out of alignment or damaged.</p> <p>D. Worn shifting controls.</p> <p>E. Damaged transmission parts.</p>	<p>A. Drain and fill with specified lubricant.</p> <p>B. *</p> <p>C. *</p> <p>D. *</p> <p>E. *</p>
TRANSMISSION GEARS WILL NOT SHIFT	<p>A. Gear shift lever or lever forks faulty.</p> <p>B. Sliding gears stuck on spline shaft.</p> <p>C. Engine clutch drags.</p>	<p>A. *</p> <p>B. *</p> <p>C. Refer to "ENGINE CLUTCH SLIPS OR DRAGS."</p>
TRANSMISSION GEARS SLIP OUT OF MESH	<p>A. Gears not fully engaged.</p> <p>B. Gears damaged.</p>	<p>A. Push or pull gearshift lever as far as it will go. If shift lever movement is correct, shift fork assembly is at fault. *</p> <p>B. *</p>
ENGINE OPERATES BUT TRACTOR WILL NOT MOVE	<p>A. Steering brakes locked.</p> <p>B. Engine clutch not correctly adjusted.</p> <p>C. Transmission faulty.</p> <p>D. Steering clutches slip.</p>	<p>A. Release steering brake pedal from the latching pawls.</p> <p>B. Adjust clutch for definite over-center engagement. <i>See page 60.</i></p> <p>C. *</p> <p>D. Adjust steering clutches. <i>See page 61.</i></p>
TRACTOR WILL NOT TURN	<p>A. Steering clutch does not disengage.</p> <p>(1) Steering clutch hand lever not correctly used.</p> <p>(2) Steering clutch is not correctly adjusted.</p> <p>(3) Steering clutches faulty.</p>	<p>A.</p> <p>(1) Pull steering clutch hand lever all the way back.</p> <p>(2) Adjust steering clutches and controls. <i>See page 61.</i></p> <p>(3) *</p>

Continued on next page

*Consult your International Industrial Power distributor or dealer.

PREVENTIVE MAINTENANCE

PROBLEM	PROBABLE CAUSE	PROBABLE REMEDY
TRACTOR WILL NOT MAKE SHORT (PIVOT) TURN	<p>A. Steering clutch does not disengage.</p> <p>B. Steering brakes will not hold.</p> <p>(1) Steering brakes not correctly adjusted.</p> <p>(2) Steering brakes worn or faulty.</p>	<p>A. See preceding paragraph.</p> <p>B.</p> <p>(1) Adjust steering brakes and controls. <i>See page 62.</i></p> <p>(2) Replace steering brake. *</p>
TRACK CHAIN COMES OFF DURING OPERATION	<p>A. Rocks in track assembly.</p> <p>B. Track chain loose.</p> <p>C. Track spring broken, front idler worn or misaligned.</p>	<p>A. Clean rocks and dirt from track.</p> <p>B. Adjust track chain tension. <i>See page 64.</i></p> <p>C. *</p>
TRACTOR CREEPS TO ONE SIDE	<p>A. Track loose on one side.</p> <p>B. Track shoes loose.</p>	<p>A. Adjust track tension.</p> <p>B. Tighten cap screws properly.</p>
TRACK CHAIN LOOSE	<p>A. Track not properly adjusted.</p> <p>B. Sprocket worn.</p> <p>C. Track links or bushings worn.</p>	<p>A. Adjust track tension.</p> <p>B. *</p> <p>C. *</p>
EXCESSIVE TRACK WEAR	<p>A. Damaged sprocket.</p> <p>B. Front idler misaligned.</p> <p>C. Improper track tension.</p> <p>D. Track rollers do not turn.</p> <p>E. Track idler does not turn.</p>	<p>A. *</p> <p>B. *</p> <p>C. Adjust track tension.</p> <p>D. } See "ROLLERS OR IDLERS WILL NOT TURN."</p> <p>E. }</p>
TRACTOR LOSES POWER	<p>A. Track chains too tight.</p>	<p>A. Adjust track chain tension. Tight track chains will cause tractor to lose up to 75 per cent of horsepower</p>

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PREVENTIVE MAINTENANCE

PROBLEM	PROBABLE CAUSE	PROBABLE REMEDY
AMMETER SHOWS NO CHARGE WITH ENGINE OPERATING	<p>A. Connections loose or corroded.</p> <p>B. Ammeter inoperative.</p> <p>C. Generator inoperative.</p> <p>D. Relay inoperative.</p>	<p>A. Clean and tighten connections.</p> <p>B. Turn on bright lights; if ammeter shows no discharge ammeter probably is inoperative. *</p> <p>C. Place jumper lead from "GEN" terminal on relay to upper radiator tank; if no flash, generator is inoperative. *</p> <p>D. *</p>
AMMETER SHOWS NO CHARGE UNTIL HIGH SPEED	A. Relay adjusted to operate at too high closing voltage.	A. *
AMMETER SHOWS EXCESSIVE CHARGE	<p>A. Generator third brush not correctly adjusted.</p> <p>B. Battery run down.</p> <p>C. Battery faulty.</p> <p>D. Generator field grounded.</p> <p>E. Defective voltage control unit.</p> <p>F. Shorted generator field.</p>	<p>A. Adjust third brush. See page 81.</p> <p>B. Recharge battery.</p> <p>C. Replace battery.</p> <p>D. Check for external ground and correct.</p> <p>E. Replace. *</p> <p>F. Replace generator. *</p>
AMMETER SHOWS DISCHARGE WITH ENGINE OPERATING	<p>A. Generator belt loose.</p> <p>B. Short circuits.</p> <p>C. Generator inoperative.</p> <p>D. Relay inoperative.</p>	<p>A. Tighten belt.</p> <p>B. *</p> <p>C. Place jumper lead from "GEN" terminal on relay to upper radiator tank; if no flash, generator is inoperative. *</p> <p>D. *</p>
AMMETER POINTER FLUCTUATES RAPIDLY	<p>A. Shorted or loose connections.</p> <p>B. Generator defective.</p> <p>C. Generator drive belt loose.</p> <p>D. Low idling speed.</p>	<p>A. Check for shorted circuits and tighten connections.</p> <p>B. *</p> <p>C. Adjust belt. Replace if necessary.</p> <p>D. Adjust idling speed. *</p>
AMMETER SHOWS HEAVY DISCHARGE WITH ENGINE NOT OPERATING	A. Relay contacts stuck.	A. Disconnect cable from "BAT" terminal on relay; if ammeter returns to zero, relay contacts are stuck. *

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MAINTENANCE

The mechanical efficiency of the tractor is dependent upon the ability of each component unit to operate effectively. The following pages cover each of the major systems or assemblies of the tractor, including procedures for unit removal, servicing and installation.

Consult your International Industrial Power distributor or dealer before attempting to service any units not covered in this book.

LUBRICATING OIL SYSTEM

Circulation of oil in the full-pressure engine lubrication system is maintained by a gear-type pump located in the sump of the oil pan. Positive lubrication of the working parts of the engine is assured under all operating conditions, whether on level ground or on slopes. Rifle-drilled passages in the crankcase and engine block eliminate external pipes. The crankshaft and connecting rods, as well as the passages to the timing gears, are rifle-drilled. Filters, through which the lubricating oil is pumped, keep the oil clean.

The oil pump has two sets of gears. The main set of gears takes oil from the sump and delivers it under pressure to all working parts. The auxiliary set of gears transfers oil from the front or rear of the oil pan to the sump, when the tractor is operating at an extreme angle of tilt. The oil pump forms a compact assembly in the oil sump and is driven by one shaft from a spiral gear on the camshaft. A bayonet-type oil-level gauge, located on the right side of the crankcase, measures the oil level in the crankcase. A gauge on the dash in front of the operator indicates the oil pressure. A plunger-type pressure relief valve, located in the filter base, maintains the oil pressure at 38 to 46 pounds.

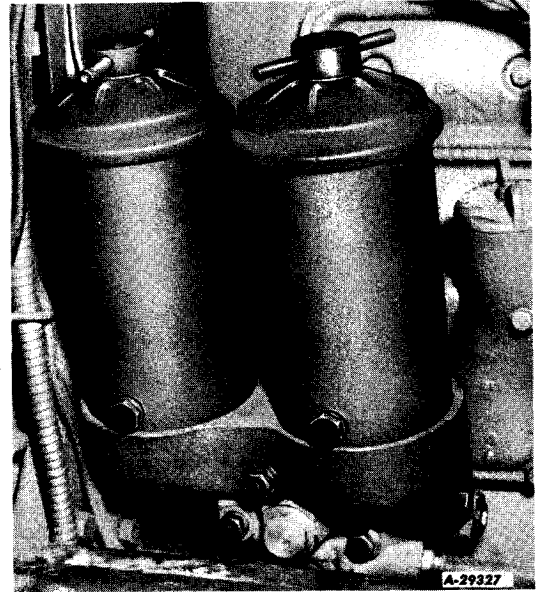
The oil in the tractor engine is kept clean in three ways: first, by effective sealing; second, by the floating type oil screen; third, by filters through which the oil circulates under pressure. The floating-type oil screen is hinged to the pump and floats near the surface of the oil in the sump. Consequently, it draws only the cleanest oil, as the impurities and sediment in the oil settle to the bottom of the oil pan.

FULL-FLOW OIL FILTERS

The life of your engine depends upon clean oil being circulated to all bearings. Minute particles of abrasive matter eventually accumu-

late in the crankcase, and lubricating oil undergoes changes which produce sludge, acids, gums and other harmful by-products. The purpose of the oil filters is to separate and remove the dirt and other foreign substances from the oil, to prevent these injurious materials from being circulated to the engine. Keeping dirt and oil impurities away from precision-made engine parts will guard against undue wear, operating troubles and upkeep expense.

The full-flow lubricating oil system of this engine includes a "no-drain-back" feature which eliminates the necessity of pumping the oil up into the filters when starting the engine.

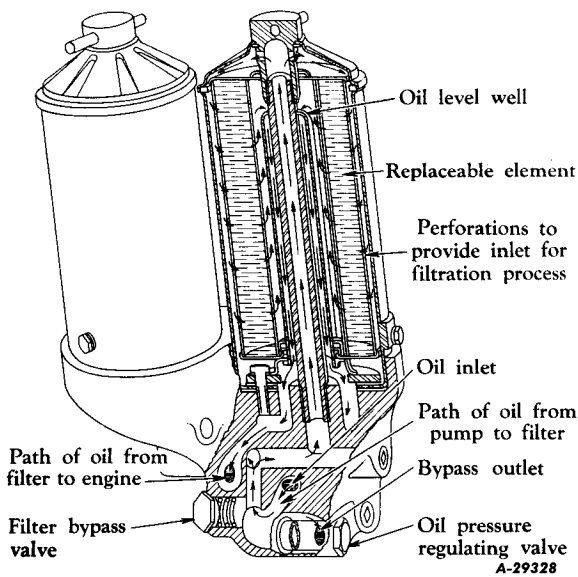


Illust. 26
Full-flow oil filters.

The filter cases are permanently bolted to the filter base, with removable covers at the tops. This prevents dirt from entering the filter cases while changing the elements.

These oil filters keep the circulating oil free from harmful contamination for 480 hours of operation under normal operating conditions, at which time the filter elements must be replaced. It may be necessary to replace the filter elements after shorter operating periods under severe operating conditions such as extremely dusty conditions, low engine temperatures, intermittent operation, excessively heavy loads with high oil temperatures, or when diesel fuel with high sulphur content is used. For the recommended oil to use for the prevailing temperature refer to "LUBRICATION GUIDE" on pages 24 and 25.

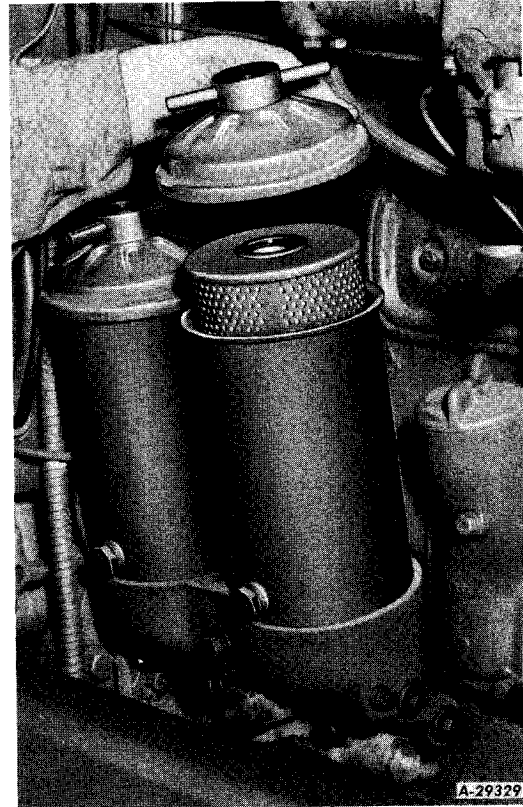
MAINTENANCE



Illustr. 27
Cross section view of filter.

Changing the Filter Elements

1. Stop the engine.
2. Remove the filter case drain plugs (1 for each case) and allow the cases to drain completely.
3. Clean off the filter case covers to prevent dirt from falling into the cases.
4. Unscrew and remove the case covers.
5. Remove the old elements.
6. Clean the inside of the filter cases with a rag dampened in kerosene.
7. Install the new filter elements. **NOTE:** Grease or otherwise lubricate the rubber seals at each end of the elements before assembling. Use a slight twisting motion when installing the filter elements, in order not to damage the sealing rings.
8. Install the drain plugs in the filter cases.
9. Fill the filter cases. (One quart of oil for each filter case.) The adding of oil to each filter case speeds up lubrication to the bearings, oil pump drive gears and other vital engine parts, thus eliminating the time required by the pump to fill the filter cases.
10. Install the case covers, making sure the gaskets are in place.



Illustr. 28
Lifting cover to change element.

11. Start the engine and see that the oil pressure indicator is registering pressure.

NOTE: The above procedure is only necessary when making the filter element change. If the crankcase oil is to be drained at the same time as a filter element change period, the following should be added to the above procedure:

12. Remove the filter base drain plug and allow the base to drain completely.
13. Install the drain plug in filter base.
14. Fill the crankcase with 14 quarts of oil (grade of oil specified in "LUBRICATION GUIDE" for the prevailing temperature).

NOTE: To avoid delay, always carry extra elements on hand for replacement at the proper time. **CLEANING THE OLD ELEMENTS IS NOT SATISFACTORY.**

MAINTENANCE

COOLING SYSTEM

The closed cooling system automatically maintains the most desirable engine temperature under all normal conditions of operation. This type of system permits the tractor to be operated at extreme angles without loss of water through the overflow pipe. The valve is designed to open at approximately 7 pounds pressure. The radiator cap is designed to hold this pressure and should be securely fastened at all times. A positive centrifugal pump circulates coolant in a closed system between the crankcase, cylinder heads and radiator.

Temperature of the coolant is controlled by a thermostat of the by-pass type. When the engine is cold, the coolant circulates within a closed cycle (*broken arrows in Illust. 29*) starting from the water pump, then through the crankcase, cylinder head and the thermostat assembly. At the thermostat, the coolant is by-passed back into the water pump. This circulation permits the engine to warm up to normal operating temperature, and the operation of the water pump prevents formation of steam pockets.

The temperature of the coolant controls the degree of opening of the thermostat. When efficient operating temperature has been reached, the thermostat opens to its fullest extent, the thermostat by-pass closes, and no

coolant is by-passed through the water pump. The flow of the coolant (*solid black arrows in Illust. 29*) then runs from the cylinder head, past the thermostat, into the upper radiator; then from the lower radiator into the water pump and back through the crankcase and cylinder head. The capacity of the entire cooling system is 19 gallons (U.S. measure).

Maintenance of Cooling System

Before the tractor is operated, preventive maintenance procedures must be performed on the cooling system in order to maintain its original efficiency. The water used should be clean and free from alkaline substances. Treatment of the water with rust inhibitor compounds will greatly reduce rusting of the iron in the cooling system. Rust inhibitor compounds are inexpensive and simple to use and should be added to the water in the proportions recommended by their manufacturers.

Thoroughly clean the cooling system, fill it nearly full with clean water, and add the recommended amount of rust inhibitor. Operate the engine until it reaches the temperature that permits the thermostat to open and the coolant mixture to establish complete circulation throughout the entire system.

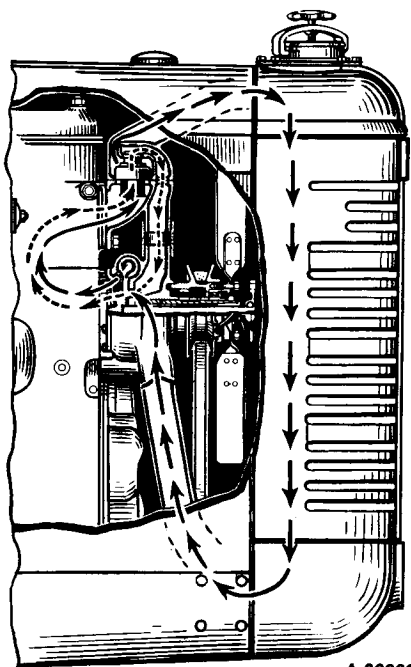
It is recommended that the cooling system be cleaned at least twice a year. Clean the system before antifreeze solution is added to the coolant, and again after it has been removed. After the danger of freezing temperatures has passed, clean the system and refill with water and rust inhibitor.

The presence of rust in the radiator or in the cooling solution is an indication that the inhibitor solution has weakened. If this happens, drain the solution, flush out the system and refill.

Filling the Cooling System

The capacity of the cooling system is 19 U.S. gallons. Fill the system as follows:

1. Close the crankcase and radiator drain cocks. See *Illusts. 12 and 13*.
2. Pour water (soft or rain water, if available) into the radiator.
3. Fill the radiator to a level slightly below the bottom of the filler neck.
4. Unless conditions make it absolutely necessary, do not pour cold water into the radiator if the engine is very hot. Under such conditions, start the engine and let it idle. Then slowly pour the water into the radiator.



Illust. 29

Diagram of circulation in cooling system - broken line arrows show path of water during engine warm up.

MAINTENANCE

5. If the tractor is to be operated in freezing temperatures (32° F. or lower), refer to "OPERATING IN COLD WEATHER" on pages 17 to 19.

Cleaning Out Dirt and Sludge

1. Drain the cooling system by opening the radiator drain valve and the crankcase drain valve. Allow the system to drain, and then close the drain valves. *See Illusts. 12 and 13.*

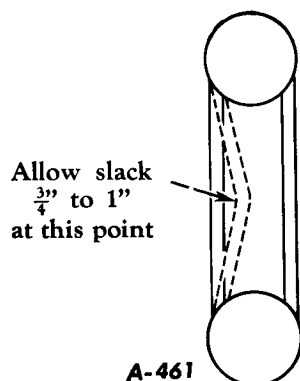
2. Fill the cooling system with a solution of 6 to 7 pounds of ordinary washing soda mixed with 19 gallons (U.S.) of water.

3. Leave the radiator filler cap off and operate the engine until the water is hot. Stop the engine; then drain the system and flush it with clean water.

Cleaning the Radiator Core

Engine overheating often is caused by bent or clogged radiator fins. Blow insects and dirt from the radiator core air passages, using air or water under pressure. Apply the air or water hose to the rear of the radiator. When straightening bent fins, be careful not to injure the tubes or to break the bond between the fins and tubes.

Checking Fan Belt Tension



Illust. 30
Correct belt tension.

Check the tension of the fan belt after every 60 hours of operation to assure maintenance of the correct tension. The tension is correct when the belt can be depressed without effort by the thumb, approximately three-quarters to one inch midway between the two pulleys. *See Illust. 30.* If the belt is too tight or too loose, adjust it.

Adjusting the Fan Belt

The tension of the fan belt can be adjusted by changing the width of the groove in the fan pulley as follows:

1. Loosen the set screw "2" (*Illust. 31*); then screw the pulley flange "1" in toward the belt to tighten the belt, and out to loosen it.

2. Retighten the set screw "2" after the

correct tension has been obtained.

After a new belt has been in use approximately 60 hours, check the tension and adjust again if necessary.

The belt should at no time contact the bottom of the pulley groove as this will wear it out rapidly. Adjust the pulley for a narrower groove, if this is possible without increasing the tension more than allowable. Having V-belts tighter than the tension specified will result in rapid wear.

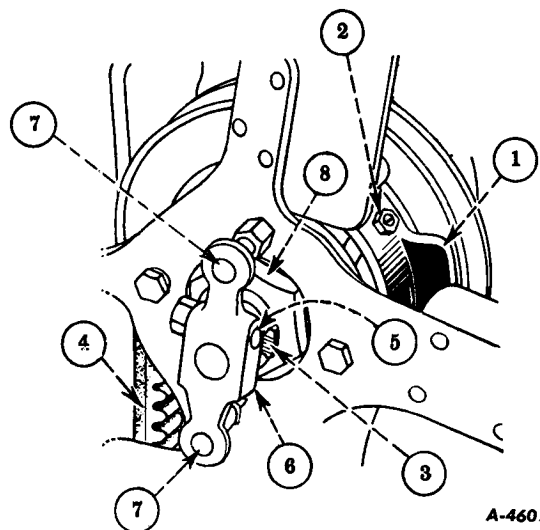
Removing the Fan Belt

1. Loosen the screw "2" in the flange on the fan pulley and unscrew the flange as far as possible. *See Illust. 31.*

2. Start the belt over the outer flange of the lower pulley and pry it out with a light bar or rod.

3. Slowly crank the engine at the same time and the belt will work off the pulley.

4. After the belt is off the pulley, remove the starting crank. The belt can now be worked over the top of the fan blades.



Illust. 31
Fan and water pump adjustment.

1. Fan pulley flange.
2. Set screw in pulley flange.
3. Water pump packing nut.
4. Fan belt.
5. Driver pin.
6. Driver.
7. Stud.
8. Packing gland.

MAINTENANCE

Replacing the Fan Belt

The fan belt should be replaced when it becomes soaked with grease, or when it is so badly worn that it does not drive the fan at the proper speed.

When replacing the belt, reverse the procedure outlined under "Removing the Fan Belt," except that the belt can be started on the lower pulley by hand and, by cranking the engine slowly, the belt will find the correct position.

Replacing Pressure Valve

When pressure valve fails to open it should be replaced as no adjustments are provided. To replace valve, drain a portion of water from the radiator, remove pressure valve drain nut, take out valve and replace with a new valve, replace nut and refill radiator.

Water Pump Packing

Due to wear after considerable service, the pump packing may leak. If this occurs, tighten the packing nut "3" just enough to stop the leaking. See *Illust. 31*.

To install new packing, remove the driver pin "5" and the driver "6." Unscrew and remove the packing nut "3." Place the water pump packing around shaft and reassemble the packing nut, driver and the driver pin.

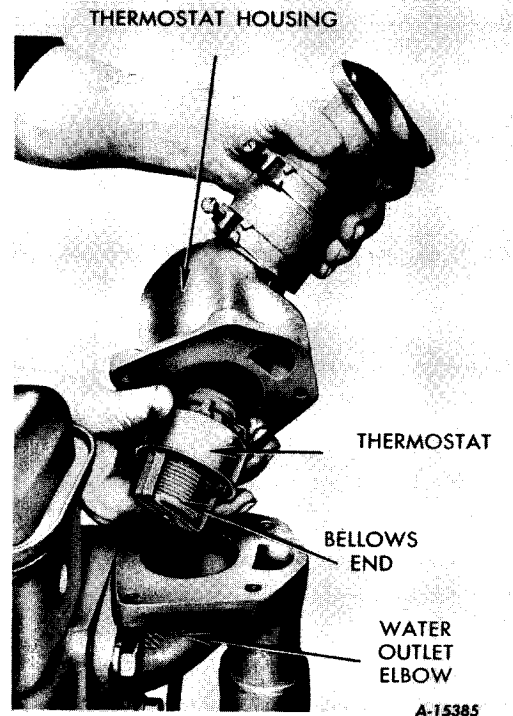
Removing the Thermostat

The thermostat can be removed in the following manner:

1. Drain the cooling system.
2. Remove the cap screws that secure the radiator inlet pipe to the rear of the radiator. See *Illust. 32*.
3. Remove the cap screws that secure the thermostat housing to the water outlet elbow.
4. Lift the thermostat housing off the water outlet elbow.
5. Remove the thermostat from the housing.

No attempt should be made to repair a defective thermostat. It can be tested for operation by putting it into a pan of water, then heating the water and, by using a thermometer, noting if the thermostat opens at the correct temperature and closes when the water cools.

To install the thermostat, reverse the removal procedure.



A-15385

Illust. 32
Removing the thermostat.

VALVE CLEARANCE ADJUSTMENT

Check the valves for clearance after every 480 hours of operation, and adjust the clearance if necessary. A clearance of .018-inch is necessary between the end of the valve levers and the valve stems when the valves are closed and the engine is hot; set to .020 with engine cold.

1. Attach a jumper wire between the magneto terminal "C" and the coil cover mounting bolt "B." This will ground the magneto and prevent accidental starting. See *Illust. 51*.
2. Set the compression release lever in the low compression position (gasoline operation).
3. Remove the valve housing.
4. Remove the spark plug from the No. 1 cylinder (the cylinder next to the radiator).
5. Place your thumb over the spark plug opening and slowly crank the engine until an outward pressure can be felt. Pressure indicates that the No. 1 piston is moving toward the upper dead center of the compression stroke.

MAINTENANCE

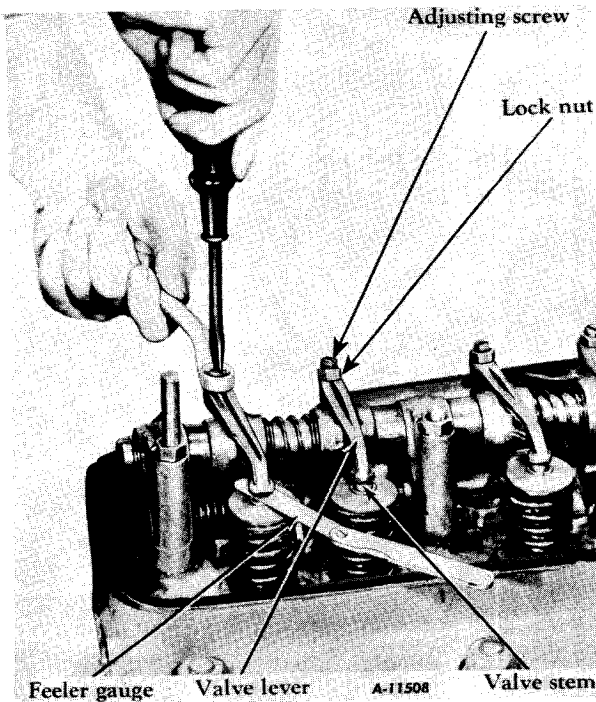
AIR CLEANER

All air entering the tractor engine is drawn through an oil-bath type air cleaner. Its purpose is to provide the engine with clean, filtered air. The air enters at the top of the air cleaner through the intake cap which is fitted with a heavy screen to prevent the entry of large particles of dirt, leaves, etc. Air then passes down through a tube in the center of the air cleaner to an oil cup at the bottom of the cleaner where it passes through an oil bath. From there, the air, along with particles of oil, rises in mist form into screen elements. These screens catch the oil which has surrounded the dust particles.

Cleaning the Oil Cup

Clean and refill the oil cup every day, or after every 10 hours of operation (more frequently when operating under dusty conditions). Refill the oil cup to the oil level bead with the grade of oil specified in the "LUBRICATION GUIDE." The oil cup capacity is 4-1/2 pints (U.S.).

Before removing or installing the oil cup, clean or wipe the oil or grit from the top bead of the oil cup.



Illust. 33
Adjusting valve clearance
with a feeler gauge.

6. Continue cranking slowly until the notch marked "DC" on the fan drive pulley is in line with the timing pointer in the front crankcase cover. See Illust. 54. Both the valves are now closed on compression stroke of the No. 1 cylinder.

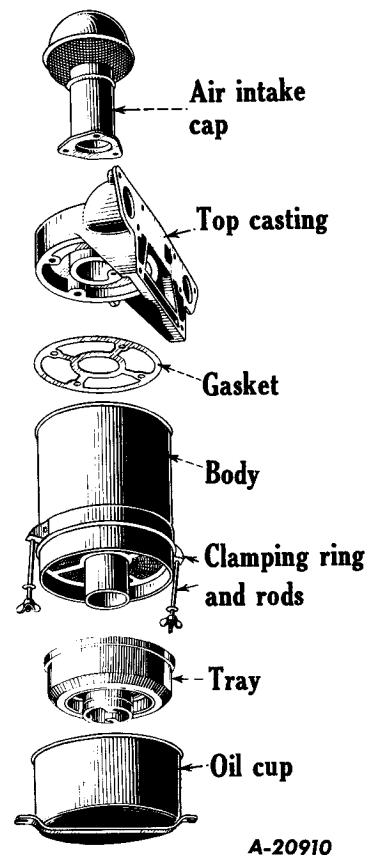
7. Loosen the lock nut and adjust the screw in the valve lever so the gauge slips snugly between the end of the valve lever and the valve stem. See Illust. 33. Tighten the lock nut and recheck clearance.

8. Crank the engine half of a revolution at a time and check the clearance of the valves for each cylinder. Adjust the clearance if necessary. Do this on each set of cylinder valves in succession according to the firing order of the engine, which is 1, 3, 4, 2.

9. Install the valve housing. Check to be sure that the valve housing gasket makes an oil tight seal with the cylinder head. Replace the gasket with a new one if necessary.

10. Remove the jumper wire between magneto terminal and the coil cover mounting bolt.

NOTE: Be accurate - use a feeler gauge when checking the valve clearance.



Illust. 34
Air cleaner taken apart
for cleaning.

MAINTENANCE

Cleaning the Tray Assembly

The air cleaner is provided with a removable tray held in place by a clamp. The tray should be removed and cleaned every 120 hours or more frequently if conditions warrant cleaning. Clean the tray with diesel fuel, dry cleaning solvent or kerosene.

Air Intake Cap

The dome of the air intake cap serves as a rain shield and the screen prevents chaff and other coarse dirt from getting into the air cleaner. Keep this screen clean from all chaff, oil, dust or paint. Clogged holes in the screen will reduce the power of the engine by restricting the flow of air.

Washing the Air Cleaner

After every 960 hours of operation or oftener if operating under extremely dusty conditions, remove the air cleaner from the tractor and disassemble it. See *Illust. 34*. Wash the parts thoroughly in diesel fuel, dry cleaning solvent or kerosene. Be sure to clean out the air intake pipe, and thoroughly clean the inside of the main body.

After the parts have been cleaned thoroughly, install the air cleaner body on the tractor. Be sure that all joints are air-tight; then replace the air intake cap. Fill the oil cup to the proper level with the specified grade of oil and install it on the air cleaner. Be sure that it is held securely in place by the cup clamps.

General Precautions

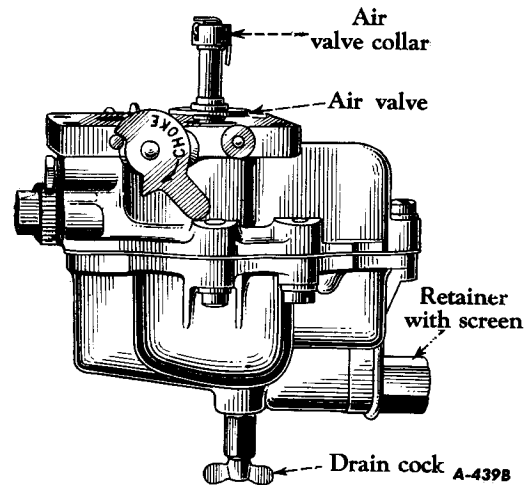
As an added precaution against dirt getting into the engine, frequently inspect the flexible rubber hose connections between the intake manifold and the air cleaner. If they show any sign of deterioration, replace them.

To eliminate strain on the rubber hose connections, be sure that the pipes line up.

All the joints between the air cleaner and the intake manifold, and between the manifold and the cylinders of the engine, should be tight. All the gaskets must be in good condition and the bolts should be drawn up tight.

GASOLINE STARTING SYSTEM

The diesel engine of the tractor is started on gasoline the same as a conventional spark-ignition engine. After a quick cylinder warm-up the engine is switched to diesel operation



Illust. 35
Starting carburetor.

and is ready for full-load speed within a few minutes. Gasoline starting is possible because the cylinder head includes an auxiliary combustion chamber, with spark plugs, which is connected to the regular combustion chamber by a starting valve. When the valve is opened for starting the engine, the compression ratio is the same as in a gasoline engine.

For operation on gasoline, an auxiliary gasoline tank (1-1/3 gallons) is provided and mounted to the rear of the radiator (left side) under the hood. During gasoline (starting) operation, the gasoline flows from this tank into a combination strainer and water trap that is mounted directly under the gasoline tank. From the strainer, gasoline flows by gravity through tubing to the starting carburetor, where it is mixed with incoming air and delivered through a dual intake manifold to the cylinders.

Starting Carburetor

The diesel dual manifold starting carburetor is used only when starting the engine. The gasoline level is controlled by a conventional float and float valve mechanism when starting and operating on gasoline. The float valve is locked into its seat, shutting off the gasoline supply to the fuel bowl, when the engine is changed over to operate on the diesel cycle.

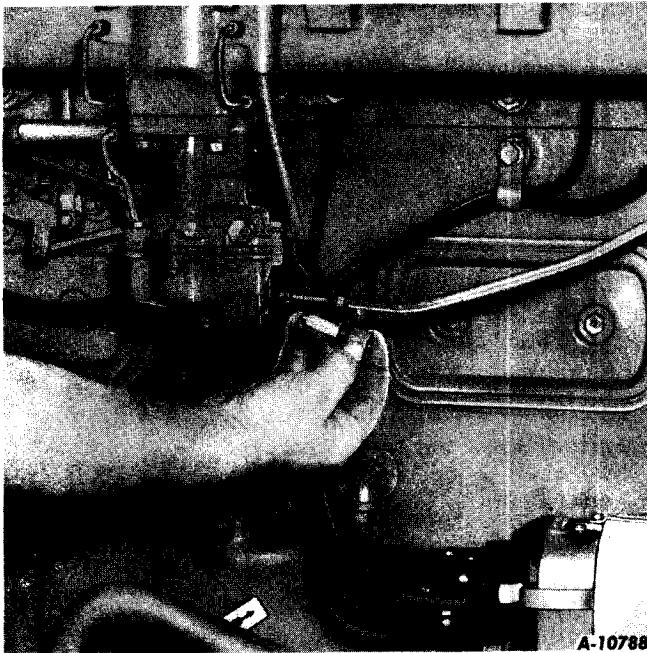
The float valve is protected against dirt and foreign material by a strainer. This strainer should be removed occasionally and cleaned. See *Illust. 36*.

NOTE: Periodically, check the screw which fastens the fuel bowl to the fuel bowl cover; also be sure that the cover screws are kept tight to prevent any leakage of air past the fuel bowl cover gasket.

MAINTENANCE

Cleaning the Strainer

1. Close the gasoline shut-off valve at the gasoline tank.
2. Disconnect the gasoline pipe at the carburetor.
3. Unscrew the strainer fitting from the carburetor; wash it in kerosene and reassemble it. *See Illust. 36.*
4. Open the gasoline shut-off valve.



A-10788

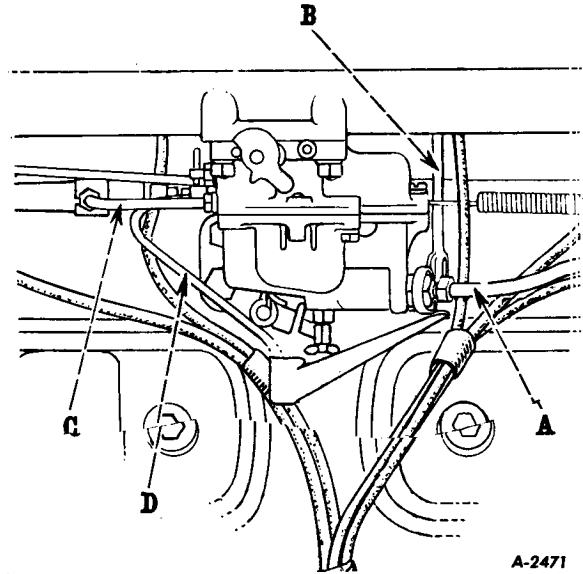
Illust. 36
Removing the carburetor strainer for cleaning.

Adjusting the Carburetor

The speed of the engine, when operating on gasoline, is controlled by the amount of opening of the air valve. The maximum valve opening is set by the adjustment of the air valve collar. This opening should be $\frac{9}{64}$ -inch.

The choke lever regulates the air for starting.

NOTE: The present day grade of gasoline has a tendency to form gum. It is necessary, therefore, that the gasoline tank and the fuel bowl be completely drained of fuel when the



A-2471

Illust. 37
Carburetor and connections.

engine is to be out of service for more than 2 weeks.

These gum deposits can be completely dissolved with a mixture of one part of alcohol and one part of benzol, or with acetone.

Removing the Carburetor

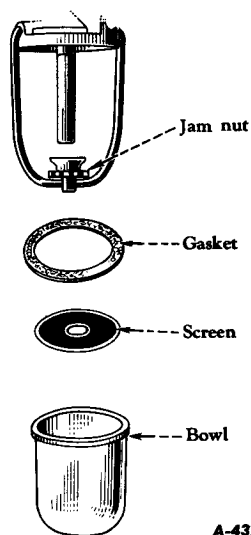
1. Shut off the gasoline supply at the gasoline tank.
2. Disconnect the gasoline supply pipe "A" at the carburetor. *See Illust. 37.*
3. Remove the pin holding the yoke to shut-off rod "B".
4. Disconnect primer tube "C" at the carburetor.
5. Remove the clip on drip tube "D" by taking out the cap screw holding the clip to the oil filler.
6. Remove 4 nuts and lock washers holding the carburetor to the manifold, and lift off the carburetor complete with drain trough and drip tube.

Installing the Carburetor

1. Install the carburetor on the engine in the reverse order of removal.
2. Turn on the gasoline supply at the gasoline tank.

MAINTENANCE

Cleaning the Gasoline Strainer and Sediment Bowl



Illust. 38
Gasoline strainer and glass bowl removed for cleaning.

The gasoline strainer, located under the gasoline tank, should be cleaned after every 240 hours of operation when the tractor is in use. To clean the strainer, close the gasoline shut-off valve and take the strainer apart by loosening the lower jam nut and disassembling the strainer. Clean the screen if necessary.

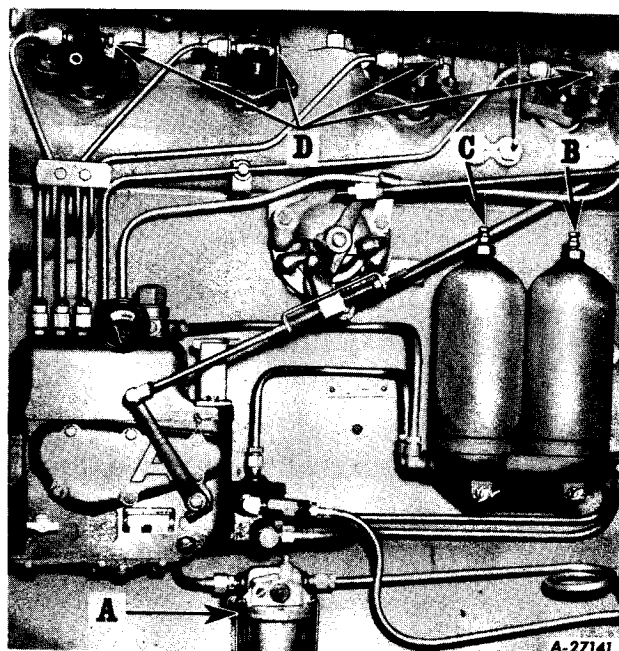
When reassembling the strainer, be sure that the cork gasket between the bowl and the main body is in good condition and that it does not leak.

DIESEL FUEL SYSTEM

The diesel fuel system consists of a fuel tank, an IH single-plunge injection pump with primary pump and governor unit, two fuel filters, a water trap, fuel lines, injection nozzles and the necessary piping and connections. Diesel fuel passes through the system as follows:

The fuel is drawn from the tank, through the water trap and auxiliary fuel filter by the primary pump which is mounted on the injection pump. From there it is drawn through the final fuel filter and then to the injection pump where it is metered in exact quantities as required by governor setting and load demands.

The fuel is then delivered under high pressure from the injection pump to the injection nozzles and is distributed to the correct cylinder at the correct time in accordance



Illust. 39
Water trap, auxiliary filter, final fuel filter and injection nozzles.

with the firing order of the engine. All fuel delivered to the injection pump in excess of that used by the engine is returned through a separate pipe to the fuel tank. Thus, fuel is being recirculated continually through the fuel system.

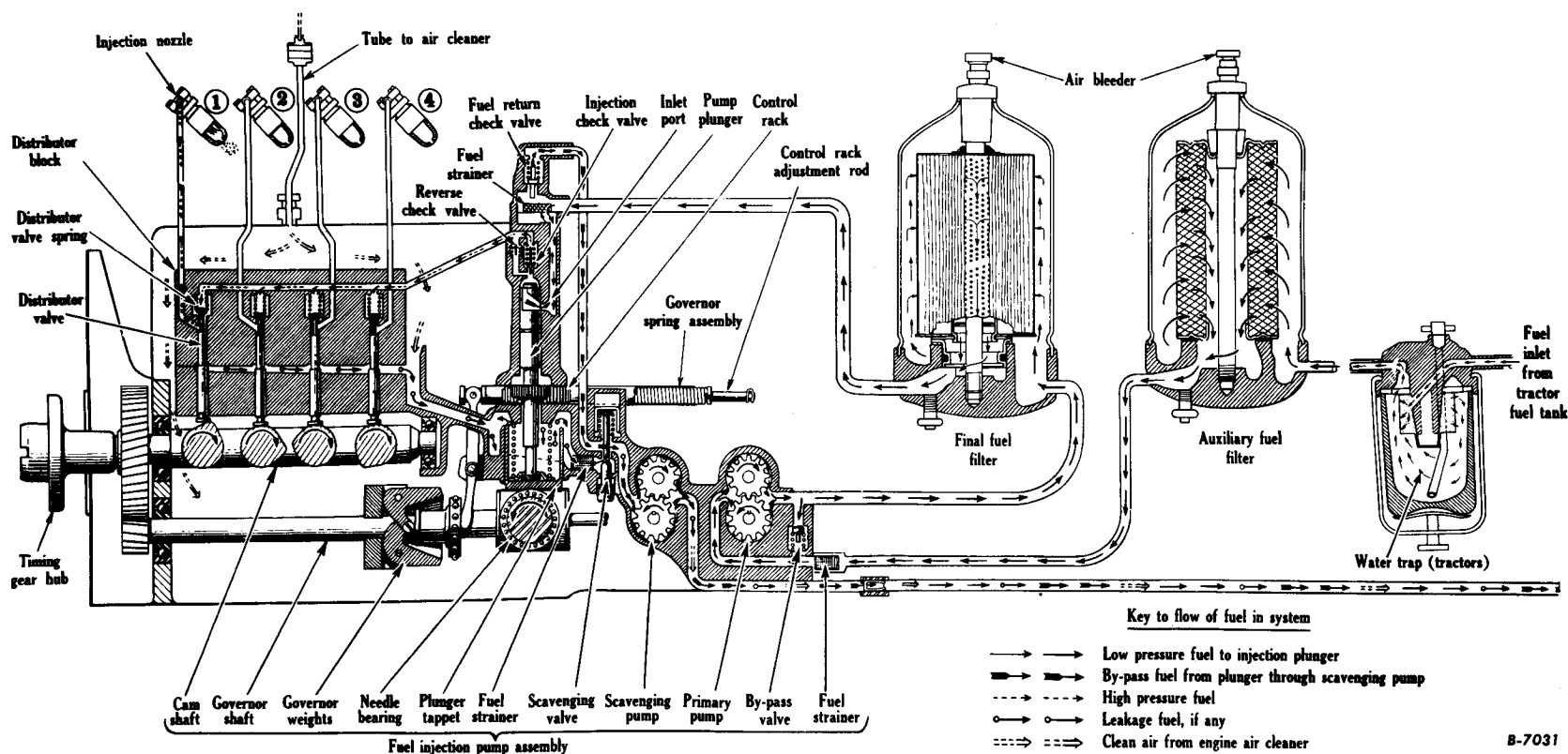
Venting Air from Diesel Fuel System

The engine will fail to run on the diesel cycle if there is any air in the fuel system. To remove air, it is necessary to vent the fuel system by opening the vent valves successively on the water trap, fuel filter and injection nozzles.

With the engine stopped and the fuel tank shut-off valve open, open the vent screw "A" on the water trap. See Illust. 39. Close when fuel starts to flow; then vent the air bleeder "B," on the auxiliary fuel filter, and close when fuel starts to flow.

Start and operate the engine on the gasoline cycle, then advance the engine speed control lever slightly. Open air bleeder "C," on the final fuel filter, and close when fuel starts to flow. Open each nozzle vent screw "D" individually and close when fuel flows.

Pull the engine speed control lever to the shut-off position. The fuel system should now be completely vented of air.



Illust. 40
Schematic diagram of diesel fuel system.

B-7031

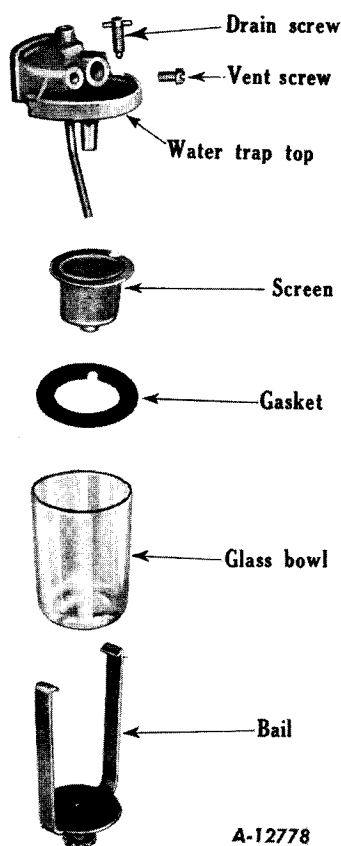
MAINTENANCE

Draining and Cleaning the Water Trap

Proper servicing of the diesel fuel water trap is of vital importance. If the fuel filter becomes waterlogged because the water trap is not drained frequently, the fuel will not flow freely.

The diesel fuel water trap is located in the fuel line. Drain it after every 10 hours of operation, or more frequently if an excessive amount of water is found, by opening the drain valve on the top of the trap.

The diesel fuel water trap in the fuel line should be taken apart and cleaned after every 480 hours of operation. See *Illust. 41*.



Illust. 41
Fuel strainer and water trap.

1. Close the fuel shut-off valve at the tank.
2. Loosen the thumb nut under the bowl; remove the bail and the bowl.
3. Loosen the gasket and pull the screen off the tube. Wash screen and bowl in kerosene.
4. Reassemble the screen and the gasket;

the gasket must be in good condition and in its proper place.

5. Reassemble the bowl and bail and tighten the thumb nut.

6. After draining or cleaning the water trap, vent the air from the fuel system.

NOTE: If there is not sufficient clearance to remove the bowl as described above, it may be necessary to remove the entire water trap from the bracket before disassembling it.

Importance of Clean Fuel

The life of any injection pump is, to a large extent, dependent on the cleanliness of the fuel put into the tank. Dirt that is allowed to pass through the pump acts as an abrasive on the closely fitted moving parts, causing rapid wear and shortening the normal life of the pump. Water that is allowed to pass through the pump may cause corrosion and subsequent scoring of parts.

The first consideration should be given to the fuel that is put into the tank. It should be as free of dirt and water as possible. The life of the filters depends on the amount of dirt and water that must be removed from the fuel.

The diesel fuel water trap, located on the injection pump side of the engine, should be drained after every 10 hours of operation, or more frequently if indications of excessive water are found in the bottom of the glass bowl. Proper servicing of the water trap is of vital importance. If the fuel filters become waterlogged, fuel flow will be restricted.

Fuel Filter Elements

The life of the filter elements depends upon the amount of dirt, water and sediment that they must remove.

Fuel filter elements cannot be cleaned and should not be disturbed except when it becomes necessary to replace them.

It is important that precautions be taken to keep the fuel clean and free from water during storage and in handling. This will lengthen the life of the filter elements.

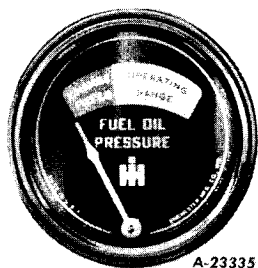
Loss of power or engine missing may indicate that the fuel filters have become restricted.

The need for frequent venting of the final fuel filter indicates either air leakage into the fuel lines, or that the auxiliary filter has become clogged, restricting fuel flow to the engine.

MAINTENANCE

When to Replace Filter Elements

1. When fuel pressure indicator located on the fuel inlet fitting of the injection pump (see *Illust. 42*) shows the indicator in the red or "Change Filter" area with the engine operating (either on gasoline or diesel cycle) it means that one or both of the fuel filter elements must be replaced, or that the fuel system is clogged at some point. It may also be accompanied by loss of power or misfiring of the engine.



Illust. 42
Fuel pressure indicator.

2. Before replacing the filter elements, service the water trap. (Refer to "Draining and Cleaning the Water Trap" on page 50.)

3. If the indicator hand remains in the red area after servicing the water trap, replace the auxiliary fuel filter element and clean the screen in the filter base.

4. Clean the primary pump filter screen. Refer to page 52.

5. If the indicator hand remains in the red area after replacing the auxiliary fuel filter element and after cleaning the primary pump filter screen, replace the final fuel filter element.

NOTE: It is advisable to check the auxiliary fuel filter at the drain cock for traces of water every day or more frequently under severe conditions. If water is found, it indicates that more frequent servicing of the water trap is necessary to obtain full service from the auxiliary fuel filter element.

Precautions When Replacing Filter Elements

1. Cleanliness cannot be overemphasized. In handling new elements, care should be exercised to prevent dirt, water, etc., getting on the elements. Keep new elements in original packages until ready to install.

2. Before loosening the case studs, clean the outside of the cases thoroughly with kerosene or diesel fuel to prevent dirt or foreign

material from entering the base when the cases are removed.

Removing and Installing Auxiliary Fuel Filter Elements

1. Clean the outside of the case and base thoroughly with diesel fuel or kerosene to prevent dirt or foreign materials from entering the filter base when the case is removed.

2. Close the fuel tank shut-off valve, and then open the bleeder and drain cock and allow the fuel to drain.

3. Unscrew the case stud "A" and lift both the case and stud from the filter base. See *Illust. 43*.

4. Remove the old element and top and bottom plates "C" and "E".

5. Rinse the inside of the case "B" thoroughly with diesel fuel to remove all dirt or foreign substance.

6. Inspect the filter base carefully; if dirt is found in the base on the clean side of the filter element, remove and wash thoroughly with two changes of clean diesel fuel or kerosene. Inspect the filter base gasket and replace with a new gasket if necessary.

7. Install the plates "C" and "E" on the new filter element "D".

IMPORTANT! Be certain that the plates slide into the wire coils inside of the element and that the top plate has the face stamped "Top" on the top.

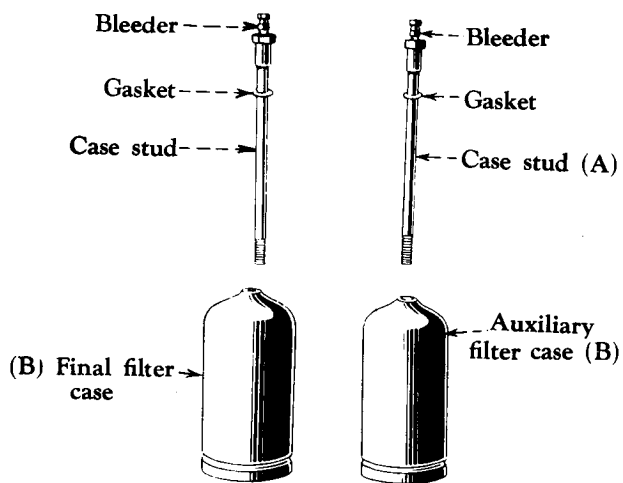
8. Place gasket "F" on the bottom plate "E" and install the element on the base.

9. Inspect case gasket "G" and replace with a new gasket if necessary. Install the case and case stud marked "AUX" and draw the case down tight.

10. Open the fuel tank shut-off valve and vent the auxiliary filter of all air before starting the engine. The fuel level in the fuel tank must be above the top of the bleeder to remove all the air. It is advisable to check the auxiliary fuel filter at the drain cock for traces of water every day or more frequently under severe conditions. If water is found, it clearly indicates that more frequent servicing of the water trap is essential to obtain the required life of the auxiliary fuel filter element.

Continued on next page

MAINTENANCE



4. Remove the old element 'H'.

5. Place the new filter element 'H' in the base. (The end with large pilot must be down.) Insert the new element carefully using a slight twisting motion to prevent damage to the seal ring on the bottom pilot.

6. Install the case 'B' (making sure the gasket is in good condition) and insert the stud 'A' through the filter element and into the filter base. (When inserting the stud marked 'FIN' through the element turn the threaded portion of the seal ring into the top of the filter element to prevent damage.) Draw the case down tight by tightening the case stud.

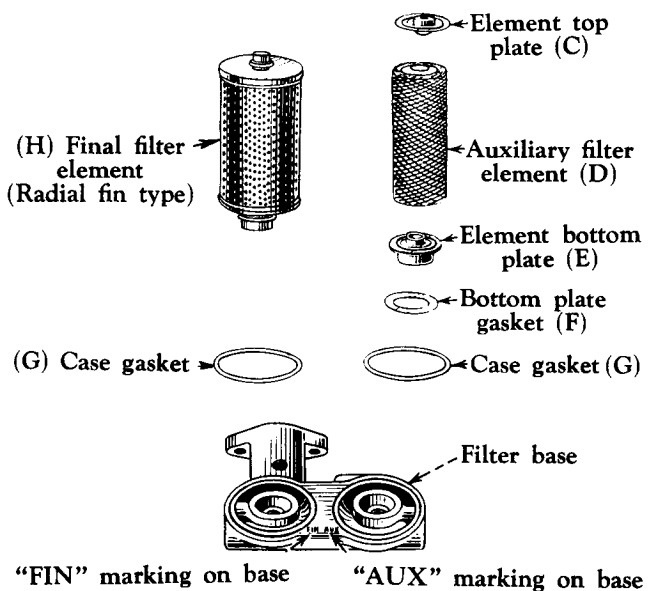
The final filter is located on the left and the auxiliary filter is located on the right as viewed from the filter side of the engine.

Fuel Injection Pump and Governor

The fuel injection pump and governor are combined in a mechanism of very fine precision construction and adjustment, and will function for long periods of time under hard operating conditions if properly cared for in the matter of lubrication and servicing.

The governor is sealed at the factory and operates in a bath of oil. Its function is to maintain the engine speed selected by the operator and automatically proportion the fuel to the load.

DO NOT ATTEMPT TO ADJUST THE FUEL INJECTION PUMP OR THE GOVERNOR. In case of unsatisfactory operation of the engine, due to possible trouble in the injection pump, first check over the instructions on the preceding pages for servicing the various units of the whole fuel system. After servicing the other parts of the fuel system, without overcoming the trouble, it may be necessary to replace the fuel injection pump, or refer to your International Industrial Power distributor or dealer.



"FIN" marking on base "AUX" marking on base
A-21355B

Illust. 43

Fuel filters taken apart for element replacement.

Removing and Installing Final Fuel Filter (Radial Fin Type)

1. Clean the outside of the case and base thoroughly with diesel fuel or kerosene to prevent dirt or foreign material from entering the filter base when the case is removed.

2. Open the bleeder and the drain cock and allow the fuel to drain.

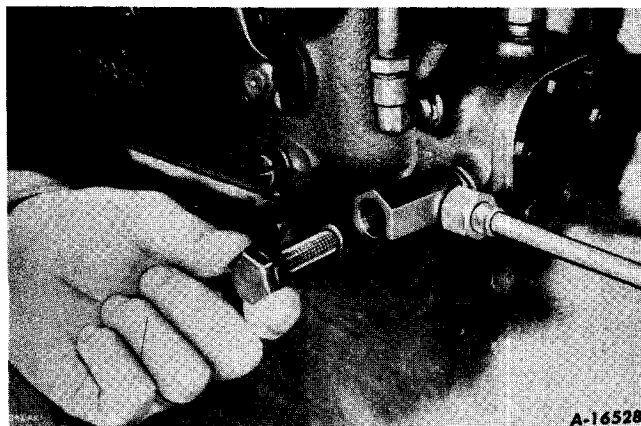
3. Unscrew the case stud 'A' and lift the filter case 'B' and stud from filter base.

Primary Pump Filter Screen

The primary pump filter screen (see Illust. 44) should be cleaned whenever the fuel filter element is changed. Remove the nut and filter screen assembly from the primary pump filter body and wash in kerosene or clean diesel fuel. Precautions should be taken that no dirt or foreign material enters the filter body upon removal or replacement of the filter screen.

NOTE: When installing the primary pump filter screen apply a coat of special sealer that will not harden or dissolve when in contact with fuel or lubricating oil, such as Tite-Seal No. 2 or Perma-Tex No. 2 Sealer. **CAUTION:** Put the sealer on the threads only.

MAINTENANCE



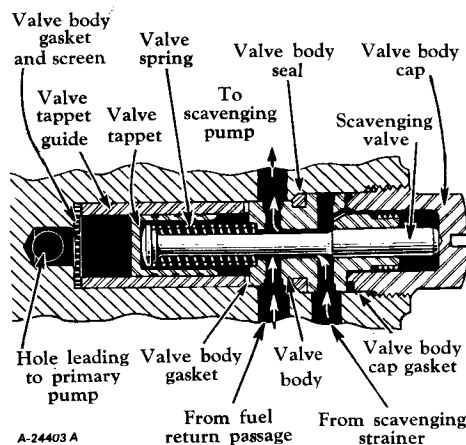
Illustr. 44

Removing primary pump filter screen.

Scavenging Valve

Faulty operation of the scavenging valve is indicated by an excessive amount of thinned out lubricating oil in the sump of the injection pump. If either the scavenging valve or the valve tappet is stuck in the open position, removal of the valve cap will show the end of the scavenging valve extending beyond the threaded end of the valve body. The valve body and valve tappet with valve tappet guide will have to be removed to determine whether the scavenging valve or the valve tappet is stuck in the closed position. In either case, these parts must be removed, cleaned and reinstalled.

It is not necessary to remove the injection pump from the engine to make repairs on the scavenging valve, but be sure all exterior parts of the pump are thoroughly cleaned before proceeding.



Illustr. 45

Cross-section view of scavenging valve assembly.

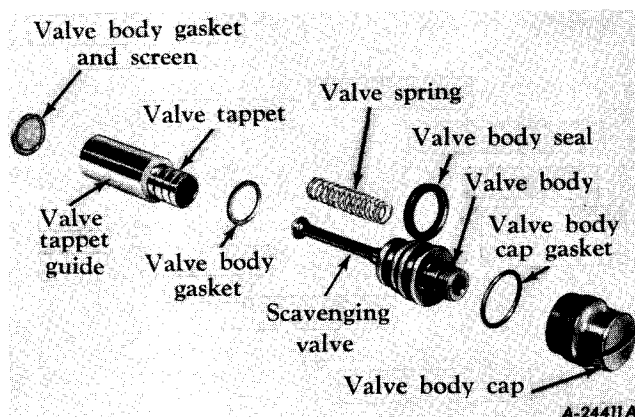
REMOVING THE SCAVENGING VALVE

Use a wide bit screw driver to remove the scavenging valve cap. See Illustr. 45. Remove the scavenging valve body by using a 1/8" pipe coupling that catches 1 or 1-1/2 threads of the body. Use a 1/4" brass rod to withdraw the valve tappet and valve tappet guide. The valve screen can be removed by using a thin metal scale.

Thoroughly clean all parts of the valve in a dry cleaning solvent.

INSTALLING THE SCAVENGING VALVE

The scavenging valve parts must be kept clean and should be reinstalled as shown in Illustr. 46 and according to the following instructions:



Illustr. 46

Exploded view of scavenging valve assembly.

1. The valve body seal is not usable a second time, as it is damaged by removal. Replace it with a new seal. The valve body seal must be installed on the valve body with the flat surface facing out and the beveled surface facing in.

2. Install the valve body gasket and screen in a vertical position in the injection pump housing.

3. Lubricate the valve tappet and valve tappet guide with engine crankcase lubricating oil or diesel fuel oil. Assemble the valve tappet into the valve tappet guide and install them in the injection pump housing.

4. Install the valve body gasket in the injection pump housing against the outer end of the valve tappet guide.

Continued on next page

MAINTENANCE

5. Lubricate the valve spring, scavenging valve and the valve body with valve body seal (use a new seal). Assemble the valve spring and valve body onto the scavenging valve and install them in the pump housing, using a rotating motion to avoid damaging or turning the edges of the valve body seal.

6. Install the valve body cap gasket (rubber ring) in the pump housing and screw in the valve body cap. Tighten the cap with hand pressure only on a wide bit screwdriver. Do not use a wrench on the screwdriver because the valve assembly will be distorted.

SCAVENGING PUMP CHECK VALVE

This valve serves to keep the scavenging pump primed at all times, and it also serves to prevent self-draining of the fuel lines.

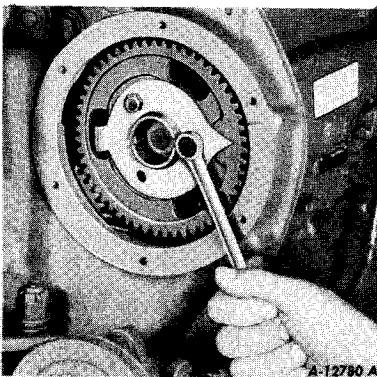
Removing the Fuel Injection Pump

1. **KEEP ALL PARTS CLEAN.** Before disconnecting any fuel pipes from the pump, first thoroughly clean the pump and connections with kerosene or diesel fuel. When the pipes have been disconnected, the discharge fittings and all open connections should be covered to prevent dirt from entering the fuel system.

2. Close the fuel shut-off valve. Drain the fuel from the diesel fuel filter. Drain the lubricating oil from the injection pump housing.

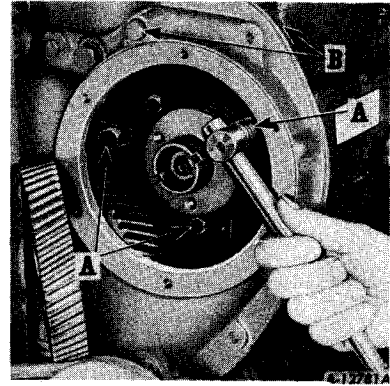
3. Set the compression release lever in the gasoline (starting) position.

4. Attach a jumper wire between magneto terminal "C" and the coil cover mounting bolt "B." This will ground the magneto



Illust. 47

Cap screws which secure timing indicator and gear to hub.



Illust. 48

Cap screws which secure the pump to the crankcase front cover.

and prevent accidental starting. See Illust. 51.

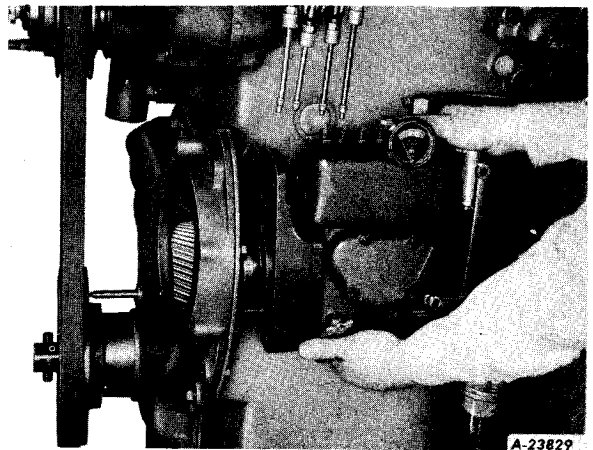
5. Disconnect all fuel pipes attached to the injection pump. Install caps on the discharge fittings and cover open connections with tape.

CAUTION: Be sure to disconnect the fuel injection pipes at both ends before removing the pump to prevent grooving of the pipe collar.

6. Disconnect the engine speed control rod.

7. Remove the cap screws which secure the pump gear cover to the crankcase front cover; then lift off the pump gear cover.

8. Crank the engine until the chamfered tooth "D" (Illust. 50) on the injection pump gear



Illust. 49

Removing the complete IH pump assembly from the crankcase front cover.

MAINTENANCE

lines up with the "DC" mark on the crankcase front cover. **CAUTION:** Do not crank the engine after the injection pump has been removed or it will be necessary to retime the pump to the engine.

9. Remove the 3 cap screws (Illustr. 47) which secure the timing indicator and pump gear to the gear hub; then lift off the timing indicator and the gear.

10. Remove 3 cap screws "A" (Illustr. 48) securing the pump to the crankcase front cover.

11. Remove the 2 cap screws "B" (Illustr. 48) which secure the pump mounting flange to the crankcase front cover; then lift off the complete pump assembly. See Illustr. 49.

Installing the Fuel Injection Pump

1. If the timing has been disturbed while the injection pump has been removed, crank the engine until the No. 1 cylinder is at top dead center of the compression stroke. This position can be determined by removing the No. 1 spark plug, placing your thumb over the opening and cranking the engine slowly until an outward pressure can be felt. Continue cranking slowly until the notch marked "DC" on the front flange of the fan drive pulley is in line with the timing pointer on the crankcase front cover.

2. Assemble a new gasket to the pump mounting flange. Lift the pump into place against the crankcase front cover, inserting the pump gear hub into the pump gear, and lining up the notch in the gear hub "B" (Illustr. 50) with the notch on the front face of the gear.

3. Secure the top of the pump mounting flange to the crankcase front cover with 2 cap screws.

4. Assemble the injection pump gear on the gear hub (with the No. 1 cylinder at top dead center of the compression stroke) so that the chamfered tooth on the gear lines up with the "DC" mark on the crankcase front cover "E" (Illustr. 50). Do not attempt under any conditions to retime the engine by matching the "K" marks on the injection pump gear "C" (Illustr. 50) and the idler gear.

5. Assemble the timing indicator "F" (Illustr. 50) to the gear hub "B" (Illustr. 50) setting the indicator at "0". Insert and tighten three cap screws which secure the indicator and the gear to the gear hub.

6. Use a hand crank to turn the engine, and align 3 large holes in the pump gear with the cap screw holes behind the gear. Insert and tighten 3 cap screws which secure the pump to the crankcase front cover. It is important to insert the short cap screw in the lower hole.

7. Assemble the gear cover with a new gasket and secure it to the crankcase front cover with cap screws.

8. Connect the engine speed control rod.

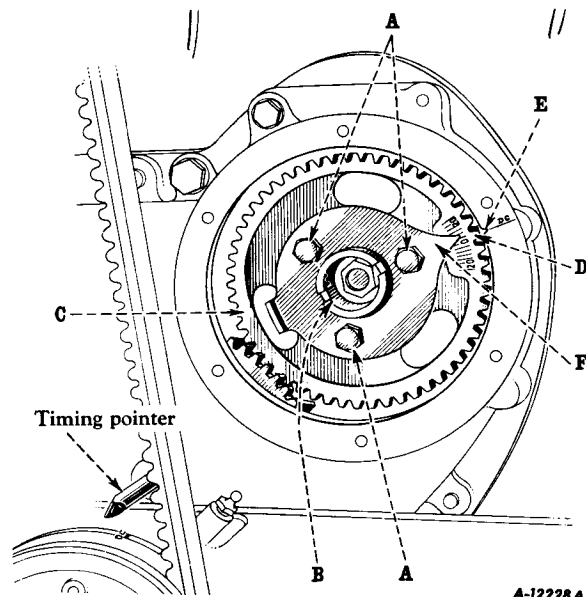
9. Connect the fuel pipes. Be sure all connections are clean and tight.

10. Add lubricant as specified in the "LUBRICATION GUIDE."

11. Remove the jumper wire from the coil cover mounting bolt to the magneto terminal. Set the compression release lever in the gasoline (starting) position.

12. Start the engine on gasoline, and vent the air from the entire fuel system.

13. Convert the engine to the diesel cycle and note the engine operation. If the engine operates roughly, check and adjust the timing.



Illustr. 50
Timing the fuel injection pump to the engine.

Timing the Fuel Injection Pump

The timing of the fuel injection pump can be adjusted by slots in the pump driving gear where it is bolted to the gear hub, the hub being keyed to the pump shaft.

Continued on next page

MAINTENANCE

The adjustment is normally set with the timing indicator "F" (*Illust. 50*) on the center mark of the graduations of the pump gear. To be sure of the best operating conditions the indicator can be tried on either side of the center mark and set at the best operating position.

To change the location of the indicator, loosen the cap screws "A" (*Illust. 50*) which hold the indicator and gear hub to the gear. Turn the gear hub until the indicator is at the desired position; then tighten the cap screws.

To advance the time of fuel injection, turn the gear hub clockwise. To retard the fuel injection, turn the hub counterclockwise. The correct adjustment has been obtained when the engine speed is maximum for a fixed load and engine operation is smooth with a clean exhaust.

Venting Air from the Fuel System

If the fuel filter has been drained, if the fuel pipes have been disconnected, or if air has entered the system for any reason, it will be necessary to vent the system before the engine will operate properly on the diesel cycle. To remove the air, it is necessary to vent the system as described on page 48.

Storage of Diesel Fuel

A permanent storage tank is the best means of storing diesel fuel. The sediment and water from the fuel can easily be drained from the storage tank through a trap provided for this purpose. The fuel can be pumped from the storage tank into the tractor with a minimum of handling.

If conditions require the use of drums for fuel storage, they should be placed under cover. If the drums are left exposed to the elements, place the drums on their sides. It is best to draw the fuel from the drums with a pump, rather than from a faucet, as the water and foreign matter from the fuel settles to the bottom of the drum. The suction pipe of the pump should be at least three inches from the bottom of the drum or storage tank. It is advisable not to disturb the drums after the fuel has settled.

The last three inches of fuel in the storage tank or drums should not be used. Collect such fuel into one container and allow it to settle again. In this manner, the sediment and water can be separated from the fuel, and disposed of with no loss of fuel.

IGNITION SYSTEM

The ignition system is used only for starting the engine on the gasoline cycle. The ignition system consists of a cut-out switch and cable, located in the lower front end of the intake manifold assembly, a high-tension magneto mounted on the right side of the engine, and a spark plug and cable for each cylinder.

Magneto

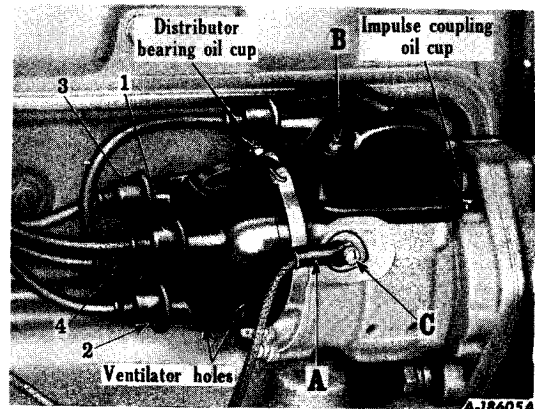
The magneto is mounted to a bracket on the right side of the crankcase. An impulse coupling on the drive end of the magneto provides a hot spark to facilitate easy starting at hand-cranking speed. The breaker point and distributor assembly are built into the rear of the magneto. The magneto is permanently engaged; when the engine is switched over to diesel operation, a cut-out switch automatically grounds the magneto.

LUBRICATING THE MAGNETO

Every week, or after every 60 hours of operation, oil the impulse coupling liberally with a light electric motor oil or SAE-10W. Use kerosene when the temperature is below 10° F.

After every 480 hours of operation, fill the distributor bearing oil cup with a light electric motor oil or SAE-10W. Do not oil more often as excessive oil might work into the breaker point chamber and cause rapid point wear.

GREASING THE BREAKER MECHANISM AND CHECKING THE BREAKER POINTS



Illust. 51
Counterclockwise rotation (viewed from the distributor end).

MAINTENANCE

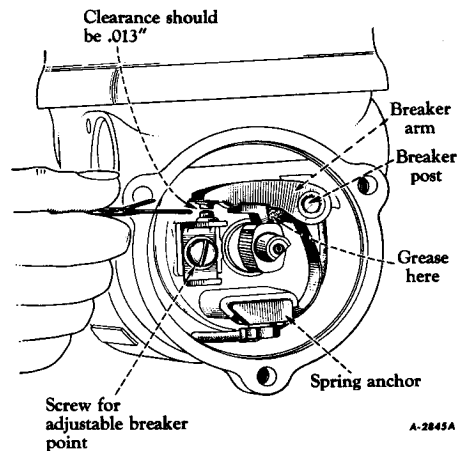
The magneto requires very little attention other than properly lubricating the oil cups as specified on page 56.

It is important, however, to keep the breaker arm chamber clean, as oil on the breaker points will cause rapid point wear. Overlubrication of the distributor bearing oil cup (Illustr. 51) might cause a dirty breaker point chamber.

After every 240 hours of operation, inspect the breaker point chamber to be sure that it is clean. See that the points are in good condition and have the proper clearance. If the chamber is clean, no attention is necessary other than checking the clearance of the points; if the chamber is dirty, clean all parts thoroughly. After cleaning, dress the points, check the point clearance, and grease the breaker arm as outlined below.

To reach the breaker mechanism, remove the distributor cap and crank the engine slowly until metal strip on the distributor rotor points toward the No. 1 terminal on distributor cap and the impulse coupling just trips. Remove the distributor rotor. Take off the distributor body by removing the 3 screws "A" (Illustr. 53). Do not crank the engine while the distributor body is removed or it might be necessary to retune the magneto to the engine.

Pry the breaker arm and anchor from the chamber and clean all parts. Inspect the



Illustr. 52
Magneto breaker mechanism.

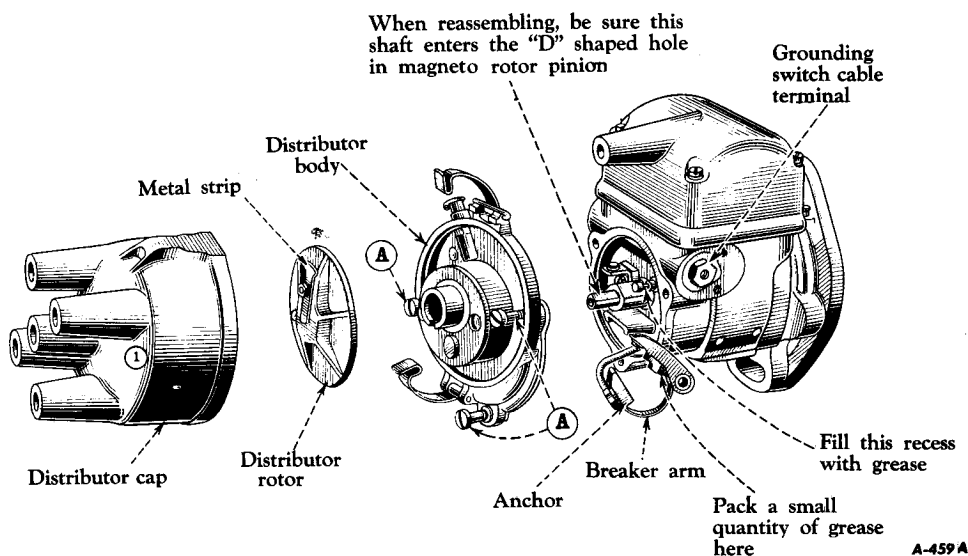
breaker points and, if necessary, dress them with a sharp fine file. If the points are worn excessively, replace both points.

Fill the recess in breaker post with grease, and pack a small quantity of grease in back of the breaker arm rubbing block. See Illustr. 52 and 53.

Assemble the breaker arm, leaving the spring anchor projecting 1/8 to 3/16 inch above the top of slot so it is pushed into place by the distributor body. Be sure the points line up after breaker arm has been pushed into place.

Check the gap between the breaker points, using the gauge furnished with the tractor.

Continued on next page



Illustr. 53
Magneto distributor assembly.

MAINTENANCE

See *Illust. 52*. The point opening should be .013 inch when the rubbing block is on the high part of the cam. If the gap is not correct, adjust it by loosening the screw holding the adjustable point (*Illust. 52*) and moving the point up or down until the gauge slips snugly into the opening. After the proper adjustment has been made, tighten the screw.

Line up the distributor rotor key with the keyway in the spindle (*Illust. 53*) and press the rotor loosely on the spindle. With the engine on top dead center of the No. 1 firing stroke, turn the distributor rotor until the metal strip on rotor points to the No. 1 terminal on the distributor cap. Place the distributor body on the magneto and be sure that the rotor shaft enters the "D" shaped hole in the magneto-rotor pinion. Remove the distributor rotor to tighten the 3 screws "A" (*Illust. 53*). Install the distributor rotor and distributor cap.

GREASING THE ROTOR BEARINGS AND THE DISTRIBUTOR GEAR CASE

After every 1920 hours of operation, or at least every 2 years, clean the magneto rotor bearings, distributor gear case, distributor gear, and distributor gear chamber and repack with IH magneto grease. We recommend that this be done by an International Industrial Power distributor or dealer.

DISTRIBUTOR CAP

Both the inside and outside of the distributor cap should be kept free of dust, moisture and oil deposits. Every 3 or 4 months, remove the distributor cap and examine the inside. If any of the above conditions are present, thoroughly clean the inside and outside and wipe dry. To assure long life of the distributor, care must also be taken to keep the 2 small ventilator holes (*Illust. 51*) open at all times. The distributor rotor also must be kept clean.

REMOVING THE MAGNETO

1. Take off the switch cable "A" by removing the fillister-head screw and lock washer attaching the cable to the magneto terminal "C." See *Illust. 51*.

2. Pull the spark plug cables from the sockets in the distributor end of the magneto.

3. Remove the cap screws and washers holding the magneto to the bracket, and take off the magneto assembly.

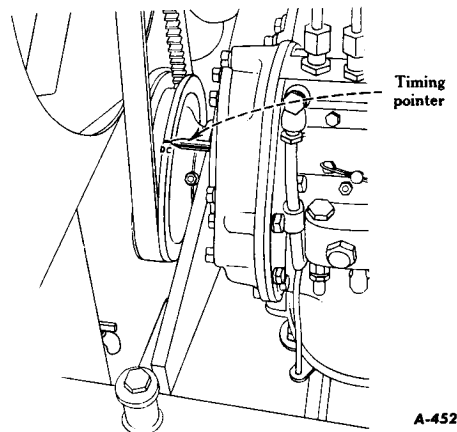
INSTALLING THE MAGNETO AND TIMING IT TO THE ENGINE

If the magneto has been removed, the following instructions must be closely followed when installing the magneto on the engine:

1. Attach a jumper wire between magneto terminal "C" and coil cover mounting bolt "B." This will ground the magneto and prevent accidental starting. See *Illust. 51*.

2. Set the compression release lever in low compression position (gasoline operation).

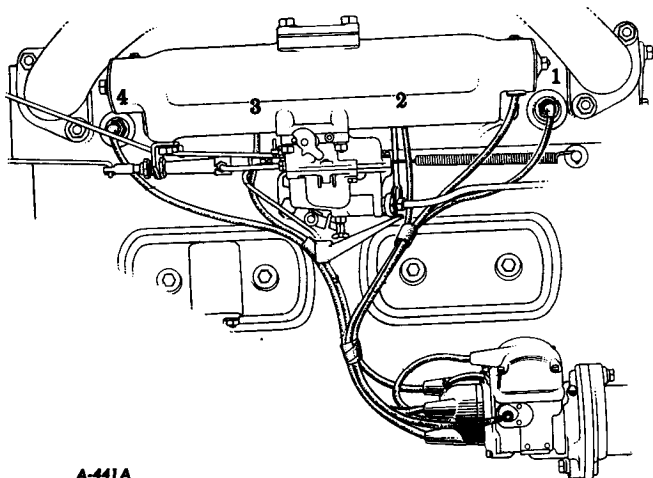
3. Crank the engine until the No. 1 piston (the piston next to the radiator) is on the upper dead center of the compression stroke. The compression stroke can be determined as follows: Remove the No. 1 spark plug. Place your thumb over the opening and crank the engine until an outward pressure is felt. Continue cranking slowly until the notch marked "DC" on the fan drive pulley is in line with the pointer on the front crankcase cover. See *Illust. 54*.



Illust. 54
Timing pointer and "DC" mark.

4. Remove the distributor cap and turn the magneto coupling in a clockwise direction (as viewed from the coupling end) until the metal strip on the distributor rotor points toward the No. 1 terminal on the distributor cap.

MAINTENANCE



A-441A

Illust. 55

IH-4 magneto wiring chart.

The engine firing order is 1, 3, 4, 2.

5. Assemble the magneto on the engine. Make sure the lugs on the impulse coupling engage in the slots on the magneto drive coupling. (Assemble the magneto so the top is as far away from the crankcase as possible.)

6. Insert the magneto mounting bolts loosely in the magneto flange, just enough to hold the magneto in place. Then crank the engine one complete revolution to the next top dead center. Now push the upper part of the magneto toward the engine until the impulse coupling just trips.

7. Tighten the mounting bolts securely. Attach the spark plug cables to the magneto. Start by connecting the No. 1 cylinder spark plug to the socket marked "1" on the distributor cap; connect the No. 3 socket with the No. 3 cylinder; next with the No. 4 cylinder, and next with the No. 2 cylinder. See *Illusts. 51 and 55*.

8. Remove the jumper wire from magneto terminal and connect the ignition switch cable to the terminal and reconnect the jumper wire.

9. To check the timing, crank the engine slowly until the top dead center of the No. 1 cylinder is reached, at which time the impulse coupling should just trip.

10. The magneto is now correctly wired and timed.

11. Remove the jumper wire from the coil cover mounting bolt to the magneto terminal.



Illust. 56

Checking the gap between points.
Gap should be .023 inch.

Spark Plugs

Remove the spark plugs after every 240 hours of operation, or oftener if necessary, for cleaning and checking gaps between electrodes. A gap of .023 inch should be maintained. A gauge of this thickness is furnished. When making this adjustment, always bend the outer electrode. Never bend the center electrode as it may damage the insulator. If the gap between the electrodes is too great, due to improper setting or burning off the ends, the engine will misfire and be hard to start.

CLEANING THE SPARK PLUGS

Sand blasting is the recommended method of cleaning spark plugs.

Never scrape or clean the insulator with anything which will scratch the porcelain. Scratched porcelain allows carbon and dirt to accumulate much faster.

Spark Plug Cables

If spark plug cables are removed for any reason, note the position of each cable on the magneto so they can be installed correctly. (*Illusts. 51 and 55* show the correct wiring.)

There should be 1/4-inch minimum clearance between the spark plug cables and the cylinder head. By maintaining this clearance, shorting-out the spark plug will be prevented and the cable will be away from the extreme heat of the cylinder head. If the cable touches the head, heat soon causes the rubber to become soft and ruins the cable.

MAINTENANCE

OVER-CENTER ENGINE CLUTCH

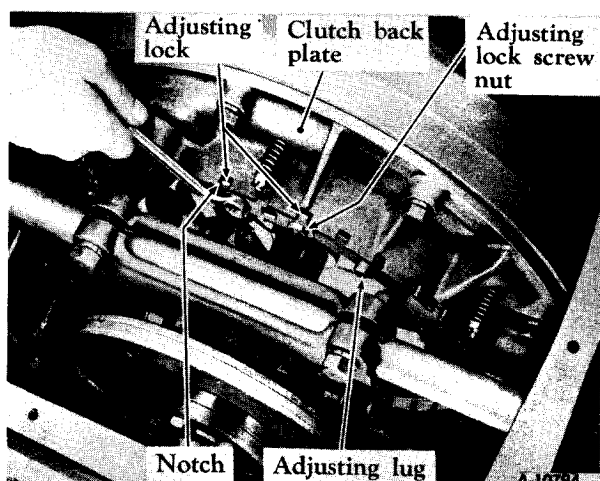
This is a hand-operated, 15-inch, single-plate, over-center clutch with ball-bearing release. The clutch has two rollers in each release cam to prevent wear and binding. The release mechanism has an automatic clutch brake which facilitates the shifting of transmission gears. No adjustment of the clutch brake is necessary.

Maintenance

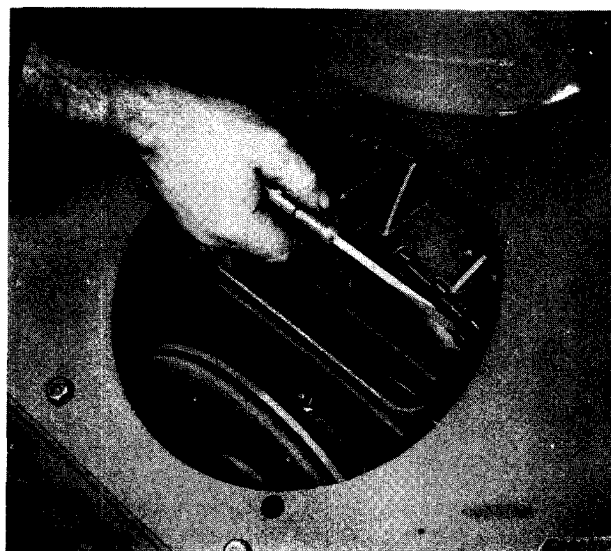
The over-center clutch requires a minimum of attention. It is important, however, that the instructions for lubrication given in the "LUBRICATION GUIDE" be followed.

Operating and Adjusting Clutch

1. Remove the clutch inspection cover.
2. With the clutch disengaged and the clutch brake engaged, slowly crank the engine until the adjusting ring lock appears.
3. Disengage the lock and rotate the adjusting ring until the hand lever pull at the handle is 60 to 65 pounds. The transmission shift lock mechanism, if used, should be disconnected from the clutch hand lever during adjustment.
4. Engage the adjusting ring lock and tighten the lock bolts.



Illustr. 57
Adjusting the engine clutch.



Illustr. 58
Turning the engine clutch
adjusting ring clockwise.

5. Start the engine and check to see that the driven member is free with the clutch disengaged.
6. Reassemble the transmission shift lock mechanism to the clutch hand lever.
7. Replace the clutch inspection cover.

For satisfactory operation of the clutch, do not have the clutch adjusted so tightly that this full over-center engagement cannot be secured easily.

If little or no pressure is required on the end of the hand lever to engage the clutch, then further adjustment, as outlined above, is necessary.

The correct adjustment has been made when a considerable (not excessive) pressure is necessary when pulling the clutch hand lever to the engaged position so that a definite over-center cam engagement can be felt.

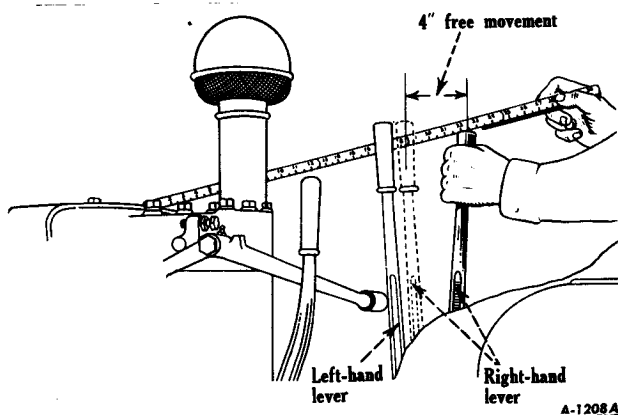
If the adjustment has been made as described above, and the cams are so tight that you do not get the full over-center engagement, the adjusting ring should be backed off one notch (in a counterclockwise direction).

MAINTENANCE

STEERING CLUTCHES

There are two 15-inch, multiple dry-disc, spring-loaded steering clutches in the tractor. They are located in separate compartments, one on each side of the drive bevel gear compartment at the rear of the main frame. The two steering clutch hand levers, directly in front of the operator, control the steering clutches.

The steering clutch hand levers must have 2 inches minimum to 4 inches maximum free travel before meeting resistance for normal operation. Measure this free travel as shown in *Illust. 59*.



Illust. 59
Measuring the free movement of the steering clutch levers.

Adjusting the Steering Clutch

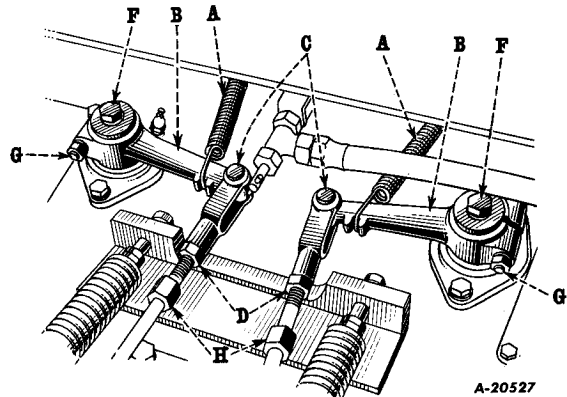
If the clutches slip, or if the free travel of the hand levers is incorrect, adjustment is necessary. To make the adjustment, proceed as follows:

1. Loosen the yoke lock nuts "D" (*Illust. 60*) and turn the rods "H" counterclockwise (facing toward front of tractor) to shorten the rods, or clockwise to lengthen the rods. Then tighten the lock nuts "D" against the rods.

2. Check to see if the free movement of the hand lever is within the minimum and maximum limits. See *Illust. 59*.

3. When adjustment can no longer be made by means of lengthening the operating rod, proceed as follows: loosen the yoke lock nuts "D," remove the release lever return springs "A" and the operating rod yoke pins "C"; then remove the steering clutch release lever cap screws "F." Loosen the cap screws "G" and pry the release levers "B" off the splined release shafts. Turn the right-hand release lever clockwise and the left-hand release lever counterclockwise slightly. Install

the levers on the splined release shafts and reassemble the yoke pins "C." Then adjust the operating rods "H" until a free movement of from 2 to 4 inches has been obtained.



Illust. 60
Adjustment points for steering clutches.

4. When the desired free movement of the hand lever has been obtained, install and tighten the release lever cap screws "F" and tighten the cap screws "G." Reassemble the release lever return springs "A."

5. Subsequent intermediate adjustments can be made by lengthening the rod linkage as described above.

Lubricating the Steering Clutch

Follow the lubrication instructions in the "LUBRICATION GUIDE." If operating the tractor in water or under extremely dusty conditions, refer to Note 4 in the "LUBRICATION GUIDE."

Adjusting Hand Lever Booster

Correct adjustment is obtained when the steering clutch hand levers can be pulled back with the minimum of effort and return to the fully engaged position when released. If the hand levers do not return to the fully engaged position when released, the booster spring tension is too great. If the levers remain in a partially disengaged position undue wear of steering clutch discs will result.

For best results we suggest the following procedure:

1. Loosen the spring adjusting bolt lock-nut "A" (*Illust. 61*).

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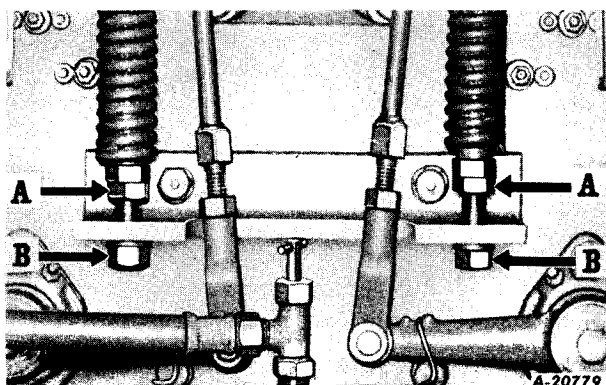
MAINTENANCE

2. Tighten the spring adjusting bolt "B" until the steering clutch hand lever remains in a partially disengaged position when pulled back and released.

3. Back off the spring adjusting bolt a turn at a time and manipulate the hand lever until it returns to the fully engaged position when released.

4. Tighten the locknut "A."

Repeat this procedure for the other lever.



Illust. 61
Clutch hand lever booster adjustment.

Lubrication

Lubrication and operation are the same as the regular steering clutch hand levers shown in the "LUBRICATION GUIDE" on pages 24 and 25.

STEERING BRAKES

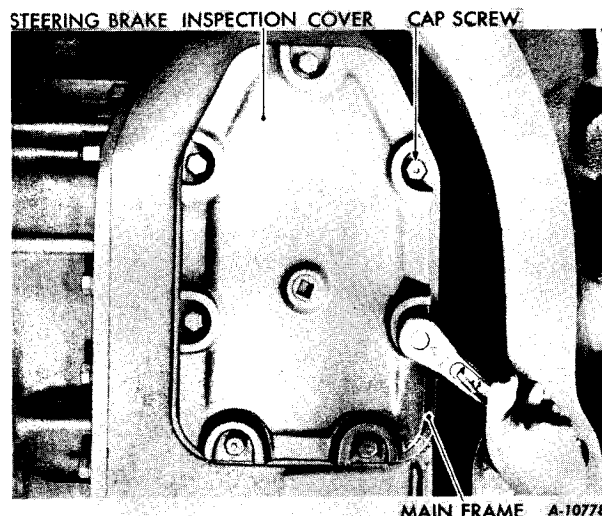
There are two steering brakes on the tractor, one surrounding each steering clutch drum. The brakes are 17-inch contracting bands, actuated by pedals located on either side of the operator's compartment. The steering brake pedals should have approximately 3 inches of free movement (before meeting resistance), measured at the pedal pad (Illust. 63). If the free movement becomes less than 2 inches, adjustment is necessary.

Adjusting the Steering Brakes

Turn the brake rod adjusting knobs "A" (Illust. 63) on each side of the tractor (located under the dash and just above the engine frame side channels) clockwise until the desired pedal travel has been obtained.

When adjustment can no longer be made with the knobs "A," turn the knobs counter-clockwise until about 1 inch of the threads on the linkage rods is covered. Then remove

the brake inspection covers located under the rear section of the main frame on each side of the tractor. See Illust. 62.



Illust. 62
Removing steering brake inspection cover.

Adjust the brake band set screw "E" (Illusts. 63 and 64) to give 1/64-inch clearance between the steering clutch drum and the lining at that point, and lock the set screw. The set screw is accessible from the outside of the tractor.

Loosen the jam nut "B" and turn the steering brake band adjusting bolt "C" until 1/64-inch clearance has been obtained between the steering clutch drum and the brake lining at all points.

Lock the jam nut "B," install the covers, and adjust the knobs "A" to give 3 inches free pedal movement.

Subsequent intermediate adjustments can be made with the adjustment knobs "A."

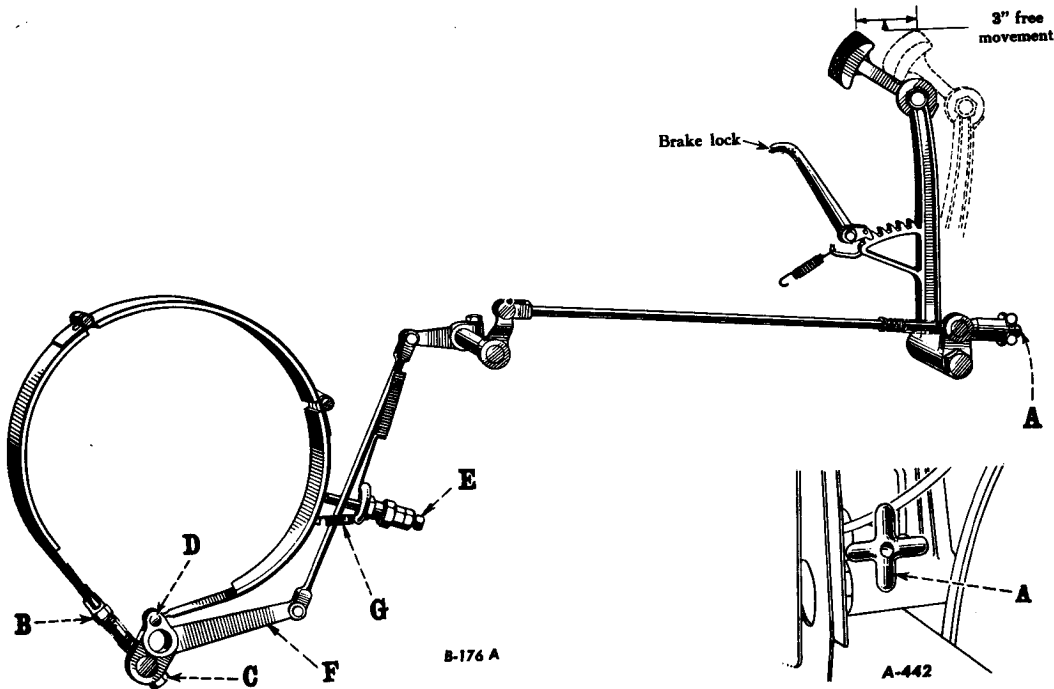
Renewing the Brake Lining

The brake bands should be relined before the lining is worn to a point where retaining rivets will score the clutch drums. Squealing and slipping brakes generally indicate when such condition exists.

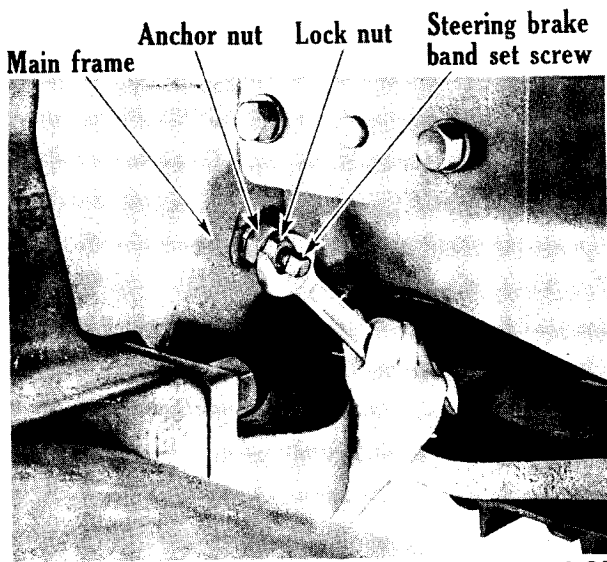
1. Release the tension on the brake rod adjusting knob "A" (Illust. 63).

2. Remove the covers from the bottom of the rear main frame.

MAINTENANCE

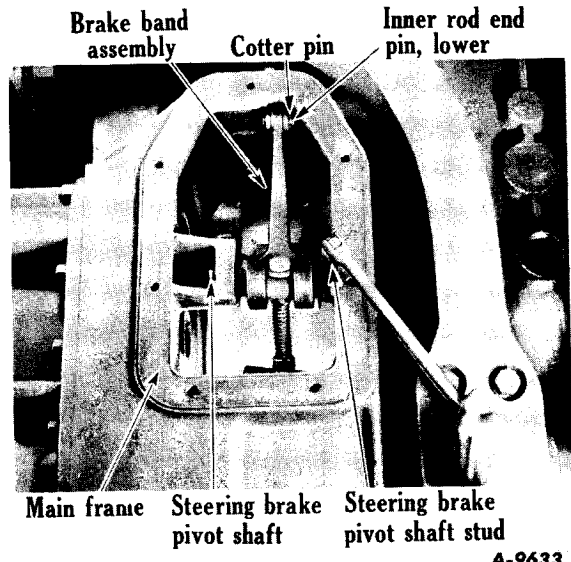


Illustr. 63
Steering brake adjusting points.



A-9632

Illustr. 64
Adjusting the steering brake band set screw.



A-9633

Illustr. 65
Removing the steering brake pivot shaft stud.

3. Remove the pivot shaft stud from the brake band pivot shaft (Illustr. 65) and slide the shaft far enough into the main frame to remove it from the pivot arm "F."

4. Back up the adjusting set screw "E" and unhook the spring "G" from the brake band.

5. Remove the brake band adjusting bolt

"C" the pin "D" and pull the brake band from the drum and out through the inspection cover opening.

6. Reline the bands and install them by reversing the above procedure. Then adjust as described above for the free movement of the pedals.

MAINTENANCE

TRACK ASSEMBLIES

If the track chain is too loose, it may have a tendency to climb the sprocket when the tractor is being backed.

If the track adjustment is either too tight or too loose, it causes undue wear on the track links, pins, bushings and bearings, and also on the front idler bearings.

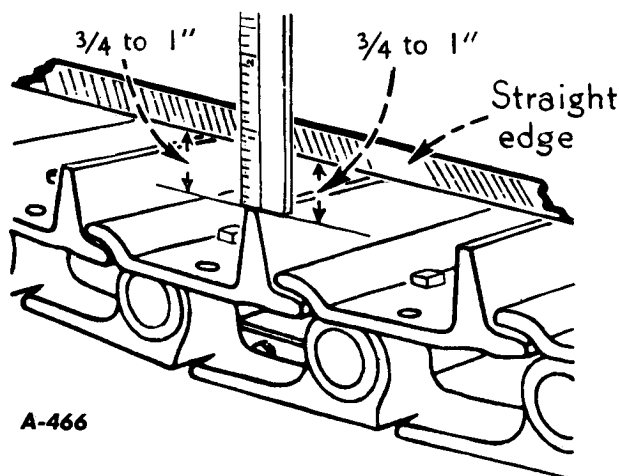
The two heavy coil springs in each track frame are properly set at the factory and they require no adjustments. Their purpose is to allow the front idlers to recoil under shock but they exert no tension on the track when in normal operating position.

On a new tractor, check the track shoe bolts after every 8 hours of operation until it becomes evident that a "set" has taken place. Always tighten the two front bolts first. The evidence of a "set" having taken place can be determined when the bolts retain a tightness of 200 to 220 foot-pounds. The bolts used for attaching the track shoes to the tracks are heat-treated alloy bolts and they will stand considerable tightening strain. Common bolts should not be used.

While tightening the bolts, it is well to strike the head of each bolt several sharp hammer blows, and then retighten. As a safety measure, use goggles to protect your eyes while striking the bolts.

Checking Slack in Track Chain

To check the slack in the track chain, the chain must be tight everywhere except on the top, between the front idler and the sprocket. This tightening of the track can be accomplished by placing a wooden block, approximately 1 foot in height, under the foremost track shoe lug; then, with the engine running, put the tractor in low gear and engage the clutch just

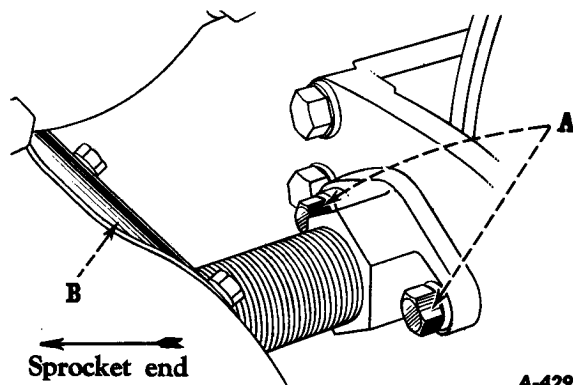


Illustr. 66
Checking the track chain tension.

enough so the sprocket drive tightens the chain along the ground and around the sprocket. After locking the brake and stopping the engine, stand on top of the track chain. Your weight will pull the chain tight around the front idler. All the slack should now be in the top part of the track chain.

Using a string or a straight edge align the tips of the track shoe cleats across each of the three spans between the top idlers and sprocket and front idler. The sag of the chain under the straight edge of each span should be approximately three-quarters to one inch. See Illustr. 66.

Adjusting the Track Chain



Illustr. 67
Track chain adjustment points.

If adjustment is necessary, remove the small cover plate "B" (Illustr. 67) at the front of the equalizer spring housing, and loosen the track spring adjuster lock bolt just inside the housing. Remove the 2 cap screws "A" at the front of the track spring adjuster. Turn the adjuster clockwise (as viewed from rear sprocket end); this pushes the front idler forward, tightening track chain. Turn the adjuster counterclockwise to loosen the track chain.

After the correct adjustment has been obtained, install the cap screws "A," tighten the lock bolt, and install the cover plate "B."

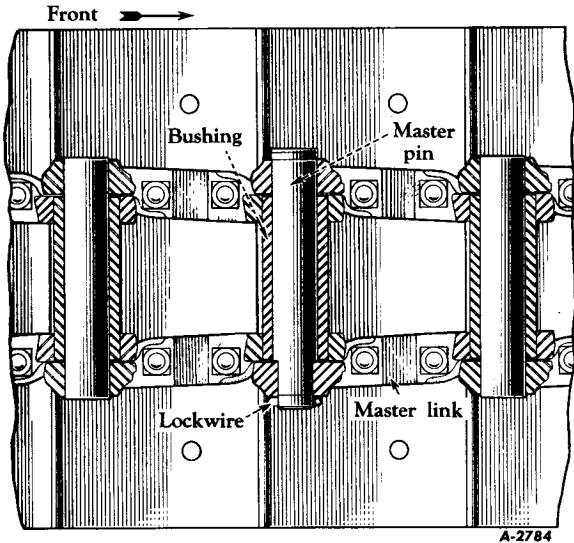
After the track chain has been thoroughly broken in, it is well to check the slack and adjust it again if necessary.

Removing the Track

To remove the entire track from the tractor, drive the tractor forward until the track link master pin (Illustr. 68) is in front of the front idler. The tractor should be level when removing the track chain. Loosen the tension in the track chain by turning the adjuster counterclockwise as described above.

Remove the track link master pin by removing the master pin lock wire and driving

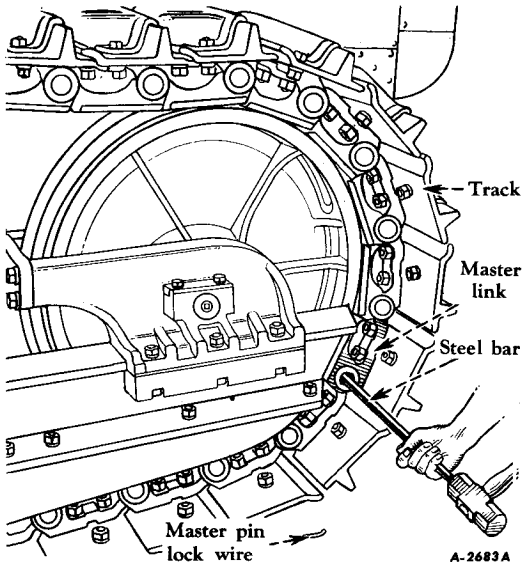
MAINTENANCE



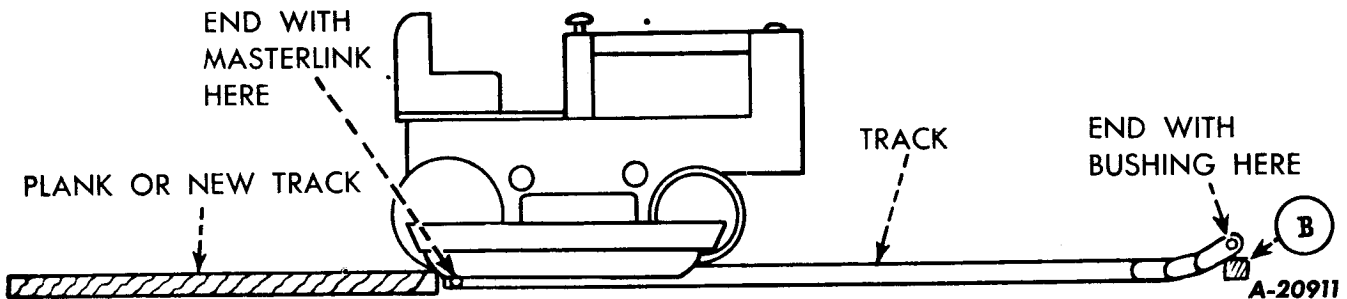
Illustr. 68
Track link master pin assembly.

out the master pin. Run the tractor backward until it is at the end of the track.

Place a plank flush against the rear of the



Illustr. 69
Removing track link master pin.



Illustr. 70 - Installing the track.

track when the track is flat on the ground as shown in Illustr. 70. The plank should be approximately the same thickness as the track, narrow enough to fit between the track frame shields, and long enough so the entire tractor can rest on the plank. Back the tractor off the track and onto the plank.

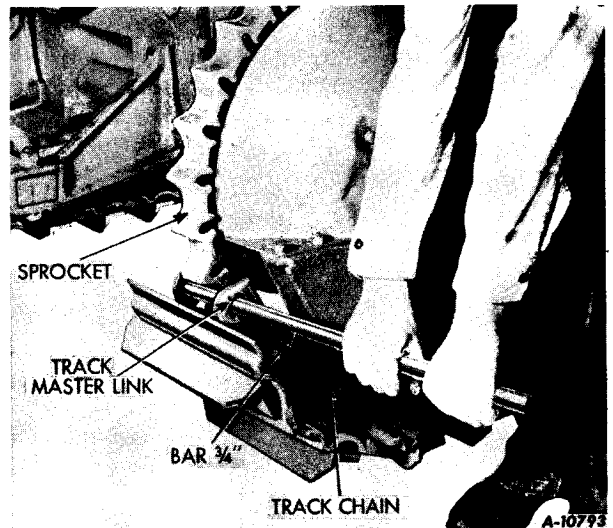
NOTE: If it is desired to replace the old track with a new one, remove the old track and place the new track flush against rear of the old track when the track is flat on the ground.

Installing the Track

When installing the track, place the track flush against the plank. The end with the bushing should be in the position shown in Illustr. 70. Run the tractor forward onto the track until the sprocket is slightly ahead of the rear end of the track. Put a crowbar through the master pin hole (Illustr. 71) and pull track up around the sprocket and forward over the track idlers and front idlers as the tractor is driven forward.

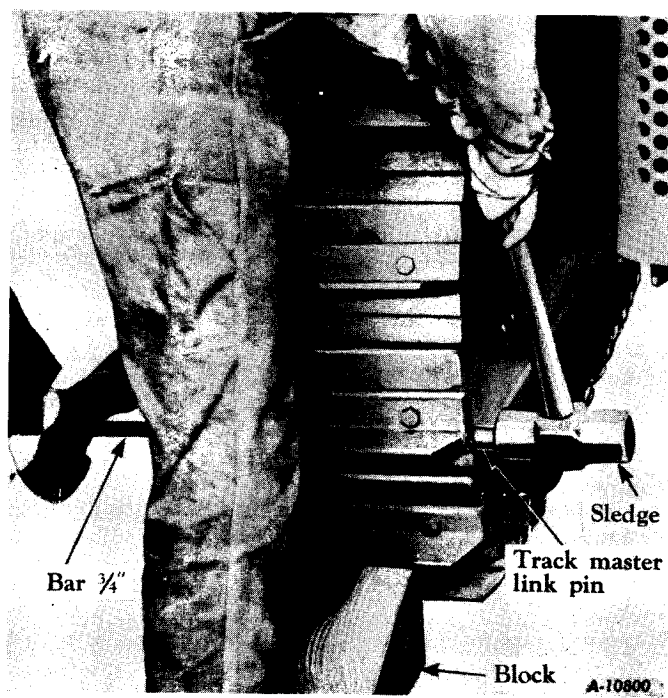
CAUTION: Drive the tractor forward in low speed with the engine speed control lever in the idle position, and ride the brakes so the tractor does not go too fast.

Continued on next page



Illustr. 71
Installing the track.

MAINTENANCE



Illust. 72
Installing the track.

Place a block (about 8 to 10 inches high) under the cleat of the shoe on the last link of the track at "B" (Illust. 70) to hold the track against the idler. Engage the engine clutch and apply just enough power in forward speed to take the slack out of the bottom part of the track. Then install the master pin and the lockwire. Adjust the tension in the track chain as described on page 64.

Track Roller Lubrication

It is important that the track rollers have the proper lubrication. For further information, refer to the "LUBRICATION GUIDE."

STORING THE TRACTOR

Follow the procedure outlined below whenever the tractor is placed in storage for 30 days or more. The lubrication precautions should be repeated every 6 months thereafter. We also recommend that caution be exercised in starting an engine that has been in storage. See page 67.

Wash or clean and completely lubricate the tractor. Refer to the "LUBRICATION GUIDE."

Drain the lubrication oil from the diesel injection pump and governor and refill with new oil as specified in the "LUBRICATION GUIDE."

Perform the following operations:

1. Drain the fuel tanks, water trap and the fuel filters.

2. Disconnect the fuel return pipe at the injection pump; then connect a suitable tubing to allow excess fuel to drain into a container.

3. Pour 4 gallons of high quality, recommended flushing oil into the fuel tank.

NOTE: In emergencies a flushing oil mixture of one-half kerosene and one-half good grade of light lubricating oil may be used.

4. Open air bleed vents on fuel filters; when oil appears close the air bleed vents.

5. Start engine and operate on gasoline cycle with governor control lever partly open. Open each nozzle air vent successively and bleed; close vents when oil appears. After bleeding all 4 nozzles, switch to diesel cycle and operate for 10 minutes as follows:

- a. Operate for 5 minutes and shut down.

- b. Start the engine and run on diesel cycle for 1 minute, and shut down.

- c. Start the engine again and run on diesel cycle for the remaining 4 minutes and shut down.

6. Reconnect fuel line.

NOTE: The engine must not be operated after the flushing operation.

Drain the water from the cooling system.

Oil magneto impulse coupling liberally with the grade of oil specified in the "LUBRICATION GUIDE."

Remove spark plugs and put the compression release lever in the gasoline (starting) position. Pour 1 tablespoonful of SAE-50 lubricating oil of good grade through the spark plug opening in each cylinder. Put the compression release lever in the diesel position.

Remove valve housing cover and spray oil over the rocker arm and starting valve assembly. Replace cover.

Cover the exhaust pipe and crankcase breather pipe to prevent moisture from entering interior of motor. Remove the air cleaner and cover the pipe.

Remove the oil filter elements. (If any evidence of rust is found on the center stud, clean thoroughly.) Replace the filter elements with new ones and drain out any sludge from the filter base.

Drain the carburetor gasoline strainer bowl and gasoline and diesel fuel tanks.

MAINTENANCE

STARTING DIESEL ENGINES THAT HAVE BEEN IN STORAGE

1. Remove the covers from the crankcase breather exhaust pipes and air cleaner pipes.
2. Remove the spark plugs and put the compression release lever in the gasoline (starting) position. Pour a mixture of one-half gasoline and one-half light lubricating oil into each cylinder (2 tablespoonfuls per cylinder is enough).
3. Remove the valve housing cover and flush the valves and valve operating mechanism with the same mixture.
4. Crank the engine rapidly until the excess oil has been blown out of the spark plug holes. (This operation will loosen any tight piston rings and wash the old gummy oil from valves and pistons.)
5. Flush out the magneto impulse coupling with the same grade of oil used for lubrication, and lubricate the magneto as specified in the "LUBRICATION GUIDE."

6. Flush out the crankcase with kerosene and fill it with the proper grade of lubricating oil specified in the "LUBRICATION GUIDE."

7. Drain the oil from the injection pump and refill to proper level with specified lubricating oil. Refer to the "LUBRICATION GUIDE."

8. Before starting the engine, be sure the filters have new elements.

9. Set the spark plug gaps .023 inch and install.

10. Fill the water cooling system.

11. Fill the fuel tanks, and open the gasoline and diesel fuel shut-off valves.

12. Start the engine and let it operate slowly. Observe if any valves are sticking. If so, pour a small quantity of diesel fuel, dry-cleaning solvent, or kerosene on valve stem until loose.

13. Assemble the valve housing cover.

14. Do not accelerate the engine rapidly or operate at high speed immediately after starting.

SPECIAL ATTACHMENTS

Although International Crawler Tractors are designed and equipped to meet a wide range of uses, there are special jobs or particular conditions where special attachments contribute further to low cost and to satisfactory performance.

on the various attachments available for use with the TD-14A Crawler Tractor. You are urged to read and study the information given on the care and operation of these attachments.

The following pages contain information

Instructions on how to assemble and install special attachments are contained in a separate pamphlet.

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Head light brush guard	77	Track shoes (special)	75
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SPECIAL ATTACHMENTS

RADIATOR GUARD AND FRONT BUMPER

Front Bumper

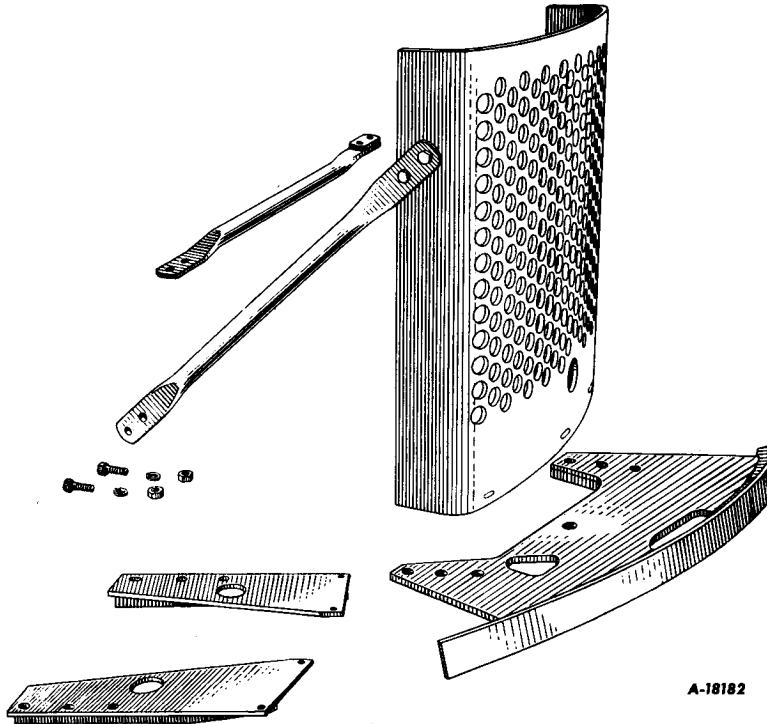
Radiator Guard

Radiator Guard and Front Bumper

International tractors are built to withstand all obstacles ordinarily encountered. However, in forest work, mining, land clearing,

Such protection has the effect of speeding up the work - finishing the job in less time than would be possible if the operator were proceeding cautiously to avoid obstacles. This attachment, therefore, not only prolongs the life of the tractor and saves upkeep expense, but also saves labor cost and increases output.

The bumper is frequently used to push heavy objects, move railroad cars, heavy



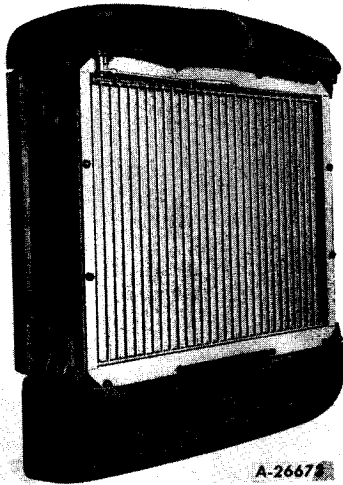
Illustr. 73
Radiator guard and front bumper attachments.

brush-breaker plowing, and certain earth moving jobs the front end of the tractor gets an unusual amount of rough treatment. The radiator guard and front bumper attachment are designed especially for these conditions, and will prevent damage from trees, stumps, boulders, and other objects.

pieces of equipment, stalled machines, etc. Ordinarily, the bumper rather than the radiator guard should bear the brunt of the load. Depending upon the type of work, however, it is possible to use the radiator guard without the bumper, or the bumper without the radiator guard.

SPECIAL ATTACHMENTS

RADIATOR SHUTTER



Illustr. 74
Radiator shutter.

A radiator shutter enables the operator to maintain a more even operating temperature without it being necessary for him to leave the seat. It is useful in cold weather starting and operation. Temperature registers on a heat indicator gauge that is installed on the dash. By using the control rod, the radiator shutter can be opened wide, closed tight (for starting) or set in any intermediate position.



Illustr. 75
Heat indicator.

Operation

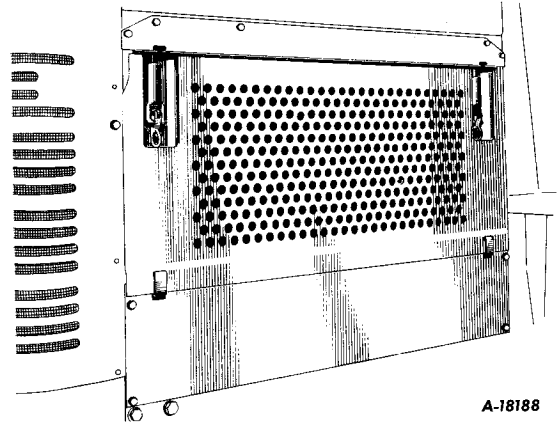
For warming a cold engine quickly, close the shutter completely by turning the control handle all the way to the left counterclockwise.

When the heat indicator begins to show "HOT" open the shutter just enough to maintain the operating temperature on the high side of the "RUN" range on the heat indicator.

Adjustment of the shutter will vary according to the tractor load, atmospheric temperature, and length of the idling period.

IMPORTANT! In freezing weather always close the shutter before starting the engine.

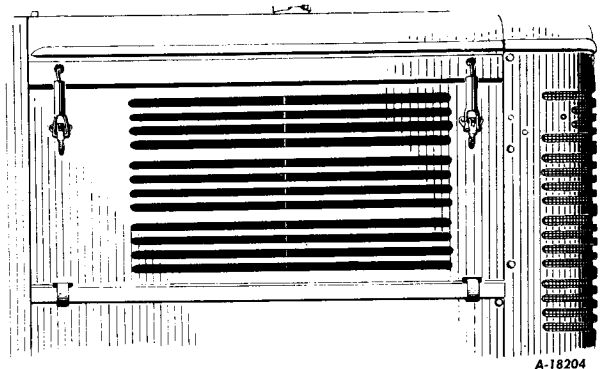
FOREST SHIELDS



Illustr. 76
Forest shield (left side).

The forest shield attachment protects the engine from being struck by large branches, thus saving such parts as fuel line piping, magneto, injection pump, carburetor, etc. from possible damage.

HOOD SIDE DOORS



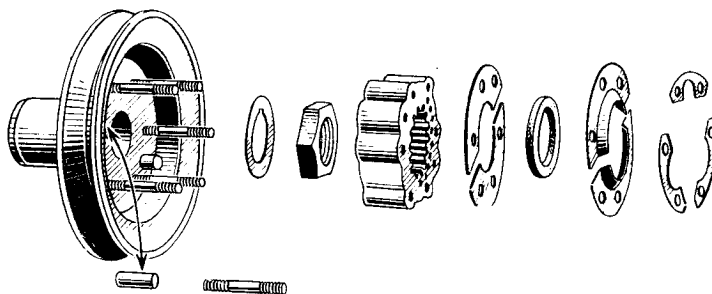
Illustr. 77
Hood side door (right side).

The hood side door attachment protects the engine parts, and prevents flying leaves, branches, dirt, etc. from entering the engine compartment.

When operating in cold weather, this added protection against snow and icy winter winds will help keep your engine dry and warm.

SPECIAL ATTACHMENTS

FRONT POWER TAKE-OFF COUPLING



A-18184 A

Illustr. 78

This attachment enables the power of the engine to be transmitted through the front of the tractor when this arrangement is required.

REAR POWER TAKE-OFF

Operation

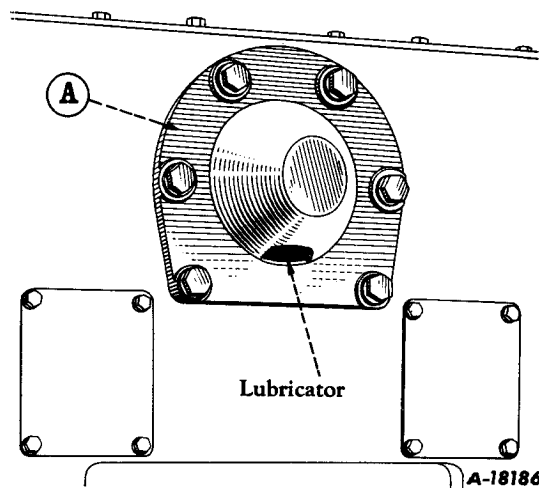
The power shaft is started and stopped by the use of the engine clutch. Always engage the clutch gradually.

CAUTION - SAFETY FIRST! Stop the power take-off before dismounting from the tractor.

To stop the power take-off, disengage the engine clutch.

If the power take-off is not to be used, stop the engine and put on the power shaft end cover. See "A," Illustr. 80.

Never remove or install the cover while the shaft is in motion.

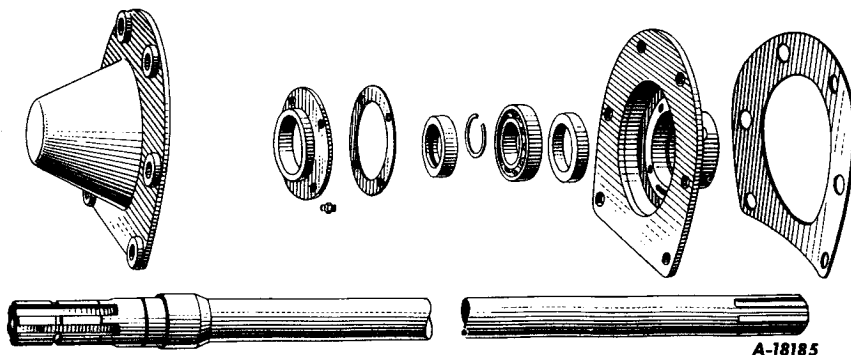


Illustr. 80

Rear power take-off shaft end cover.

Lubrication

Lubricate the bearing through fitting (Illustr. 80) once a week or oftener. Give several strokes of the lubricator. Use pressure gun grease (chassis lubricant).



Illustr. 79

Rear power take-off disassembled.

SPECIAL ATTACHMENTS

REDUCED SPEED REAR POWER TAKE-OFF

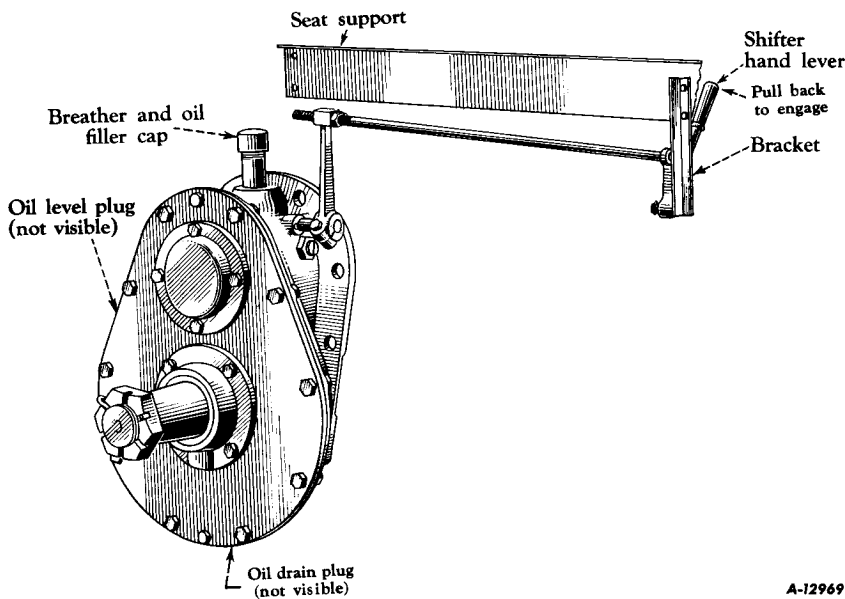
(This attachment is available in the following speeds: 350 rpm, 716 rpm, 933 rpm)

Lubrication

Use the same grade of lubricant specified for the transmission. Refer to the "LUBRICATION GUIDE."

then remove the level plug and drain to the level of the plug hole.

The gear compartment should always be drained and refilled at least once a season; however, never operate the power take-off more than 960 hours without changing the lubricant. If the lubricant has been thinned with kerosene for below-zero operation, do not neglect to change the lubricant before the



A-12969

Illustr. 81
Reduced speed rear power take-off.

Remove the filler cap and level plug from the gear compartment, and fill the compartment with lubricant to the level of the level plug hole. The refill capacity is approximately 2 to 2-1/2 pints, depending on the type of attachment. (Approximately 3/4 pint more is required when the attachment is first installed.) Then install the filler cap and level plug. Start the engine and operate the power take-off for a few minutes; recheck the level, and add more lubricant if necessary. The level should be checked occasionally.

For continued operation in temperatures below zero, add 1/3 pint of kerosene into the gear compartment. Start the engine and operate the power take-off until the mixture of lubricant and kerosene is thoroughly warmed;

weather becomes warm. To drain the lubricant, remove the drain plug from the bottom of the housing.

Operation

Always disengage the engine clutch before moving the power take-off shifter lever. Move the lever backward to engage the power take-off, and forward to disengage. Always engage the engine clutch gradually.

SAFETY FIRST! Always place the power take-off shifter lever in the disengaged position before dismounting from the tractor.

SPECIAL ATTACHMENTS

BELT PULLEY

(Includes Power Take-Off)

BELT PULLEY

(For Tractors Already Equipped with Power Take-Off)

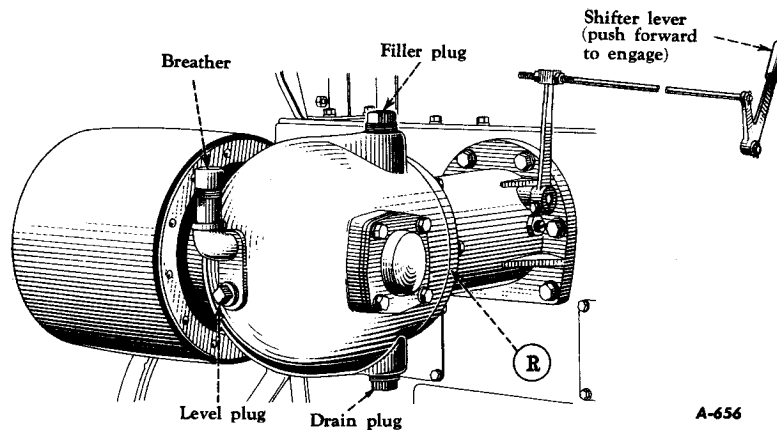
Lubrication

Use the type of lubricant specified for the transmission. Refer to the "LUBRICATION GUIDE."

Operation

The belt pulley operates at a speed of 875 rpm, and the belt speed is 2691 feet per minute when an 11-3/4 inch diameter pulley is used.

To engage the belt pulley, disengage the engine clutch and move the belt pulley shifter lever (*Illust. 82*) forward into the engaged position; then gradually engage the engine clutch.



Illust. 82

Belt attachment assembled on tractor (left-hand assembly).

Remove the filler and level plug from the belt pulley compartment and fill with lubricant to level plug hole (capacity approximately 5 quarts). Then replace the filler and level plugs. Start the engine and operate the belt pulley for a few minutes; recheck the oil level, and add more lubricant if necessary. The level should be checked occasionally.

For continued operation in temperatures below zero, add 3/4 quart of kerosene to the belt pulley compartment. Start the engine and operate the belt pulley until the mixture of lubricant and kerosene is thoroughly warmed; then remove the level plug and drain to the level of the plug hole.

The belt pulley compartment should always be drained and refilled at least once a season. However, never operate the belt pulley more than 960 hours without changing the lubricant. If the lubricant has been thinned with kerosene for below zero operation, do not neglect to change the lubricant before the weather becomes warm.

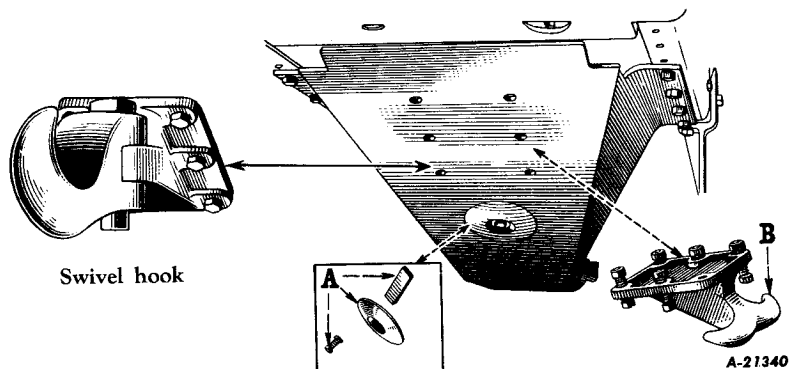
Never attempt to use the belt pulley shifter lever while the engine clutch is engaged and the engine is operating.

The belt pulley can be mounted on the rear frame for either left or right hand drive. (*Illust. 82* shows a belt pulley mounted for left hand drive.) To change the rotation of the pulley, reverse the assembly as follows:

1. Drain the lubricant.
2. Disconnect the housing at "R" (*see Illust. 82*) by removing 8 cap screws.
3. Reverse the housing and assemble it on the right side; then secure it with 8 cap screws.
4. Be sure to replace all the original shims between the housings or the gears will not mesh properly.
5. Switch the positions of the breather and the level plug. *See Illust. 82.*
6. Refill with lubricant to the proper level.

SPECIAL ATTACHMENTS

CRANKCASE GUARD FRONT PULL HOOK (For Tractors Equipped with Crankcase Guard)



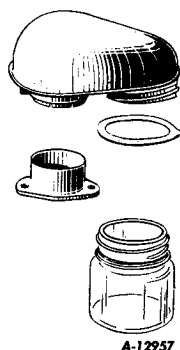
Illustr. 83

Crankcase guard and pull hook on tractor.
Also showing crankcase oil drain plug cover "A."

The crankcase guard protects the crankcase oil pan. We recommend its use for operating conditions where stumps, logs, boulders, or other obstructions are a constant threat.

The front pull hook "B," used with the crankcase guard, can bring into play the pulling power of the tractor reverse speed. The operator remains in position and can keep the job in full view. This attachment is also used for hitching tractors in tandem to pull extra heavy loads, and as an anchor for a tractor equipped with a winch.

PRE-CLEANER (COLLECTOR TYPE)

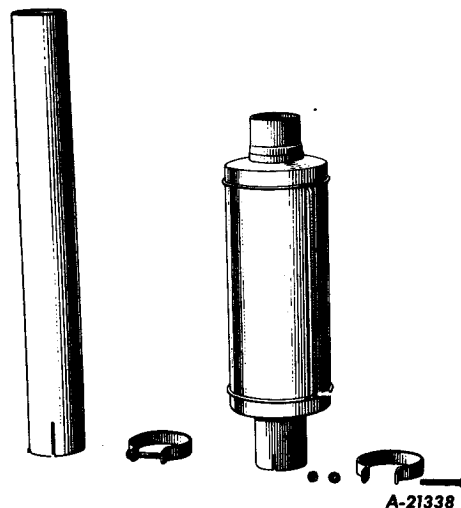


Illustr. 84

Cleaning

Remove and clean out the jar frequently, at least before it becomes 3/4 full. Remove the pre-cleaner and inspect the fins regularly. When the fins become oily or dirty, wash the entire pre-cleaner in kerosene. Replace the gasket and tighten the jar securely.

EXHAUST MUFFLER EXHAUST EXTENSION

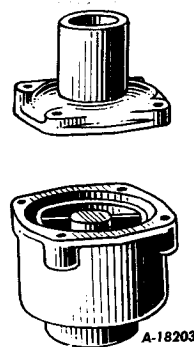


Illustr. 85

Exhaust extension,
clamp and muffler.

Often an exhaust muffler is required where the roar of an open exhaust may be disturbing and objectionable.

SPARK ARRESTER

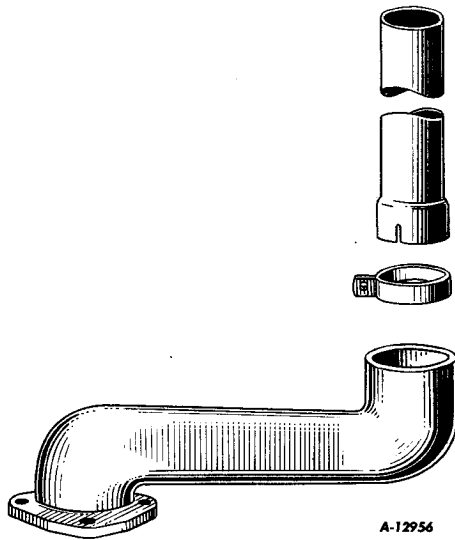


Illustr. 86

The spark arrester is valuable insurance against fire hazards. Its use is advisable when operating near dry underbrush, inflammable material, in forests, oil fields, grain fields, or any place where there is the possibility of fire from an exhaust spark. The spark arrester throws the exhaust gases into a cyclonic motion which causes any sparks or hot carbon particles in the exhaust to become smothered.

SPECIAL ATTACHMENTS

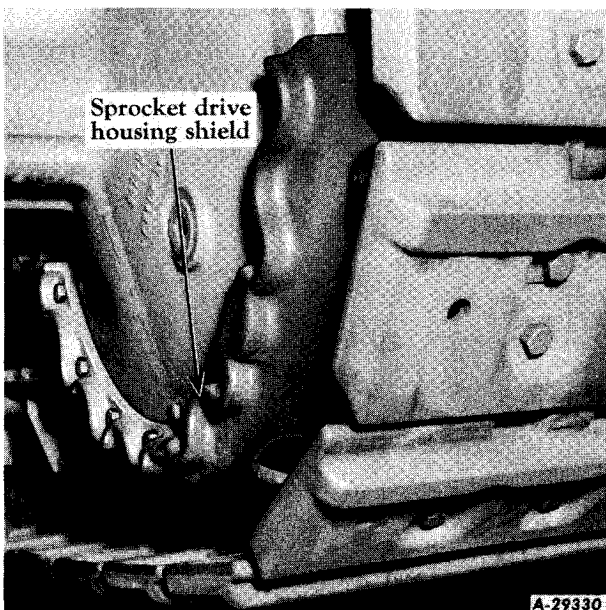
AIR PIPE EXTENSION



Illustr. 87

The regular air intake cap is located high enough above the ground to take care of most conditions but in some localities heavy clouds of dust rise up to the height of the tractor's "breather" pipe and an air pipe extension is advisable. Using the air pipe extension will pay big dividends in longer tractor life and better performance. It extends the air screen above the dust, assuring a fresher and cleaner supply of air for the engine.

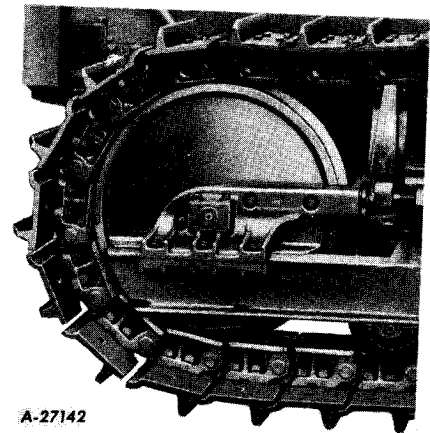
SPROCKET DRIVE HOUSING SHIELD



Illustr. 88

The sprocket drive housing shield is recommended where rocks, stones, branches, etc. are likely to be encountered.

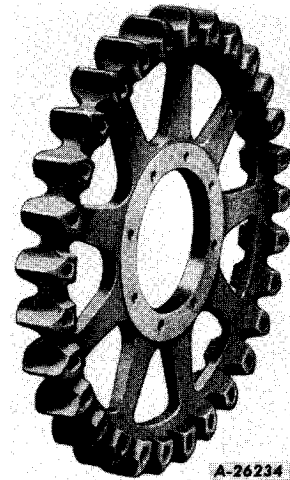
FRONT IDLER SHIELD



Illustr. 89

The front idler shield attachment is recommended for use when the tractor is operated under conditions where stones or other objects might get between the spokes of the front idler.

CUTAWAY SPROCKET



Illustr. 90

When the tractor is operated under adverse conditions, such as snow, mud or sand, the possibility of an accumulation forming around the sprocket teeth and track links is naturally increased. The special sprocket with cutaway teeth is designed to cut down this condition to a minimum.

SPECIAL ATTACHMENTS

TRACK SHOES AND GROUSERS

International crawler tractors are regularly supplied with grouser track shoes of a size, design, and material to give the best results in a majority of cases. Certain requirements, however, call for special shoes; consequently, a large variety of sizes and types are available.

Other shoes which are available include nonoverlapping grouser track shoes, street plates, staggered lug detachable ice grousers, and rubber shoes. These types of shoes are illustrated on this page.

Regular Shoe

Square-corner grouser

Shoe widths: 16", 18", 20", 22", 24".

For all general operating conditions. The 20, 22 and 24-inch width shoes can be used on wide-tread tractors only.

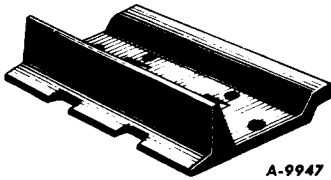


Fig. A

Regular Shoe

Clipped-corner grouser

Shoe widths: 16", 18", 20", 22", 24".

These shoes have the same general characteristics as square-corner shoes. See Fig. A. They are less likely to damage pavement or smooth surfaces when making turns. Also they pull out of the ground easier and retard the tractor less when operating under adverse soil conditions. The 20, 22 and 24-inch width shoes can be used on wide-tread tractors only.

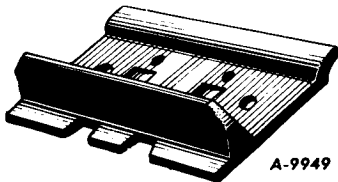


Fig. B

Snow and Ice Shoe

Staggered-lug grouser

Shoe widths: 16", 18".

Attachment consists of shoes (Figs. C and D) which are useful for continued service in ice and snow. The non-overlap edge and cut-out hole prevents wet snow from packing in the track chain. These shoes, when alternately assembled to the track, reduce damage to road surfaces.

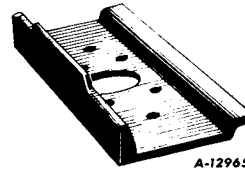


Fig. C
(center lug)

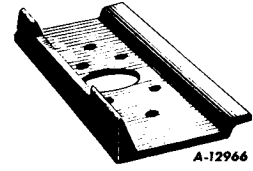


Fig. D
(end lug)

Overlapping Flat Shoe

Shoe widths: 16", 18".

The track shoe in Fig. E may be used alone where ground or floor conditions necessitate flat or non-lug type of shoes. The track shoe in Fig. F is especially recommended for crawler tractors with front end shovels.

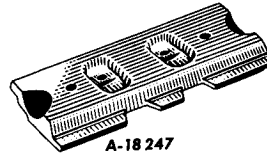


Fig. E

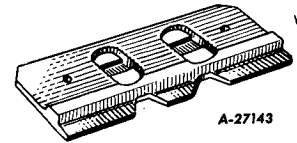


Fig. F

Street Plate

Shoe width: 13-1/2"

These street plates fit over the shoe and prevent damage to hard surfaced roads. Will fit on shoes shown in Figs. A, B, C and D only.

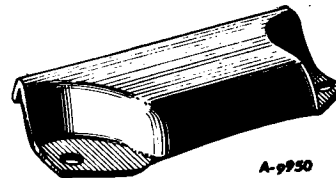


Fig. G

Rubber Shoes

Shoe width: 15"

These rubber shoes are adaptable where regular shoes are apt to damage floors or roadways.

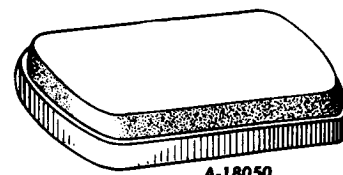
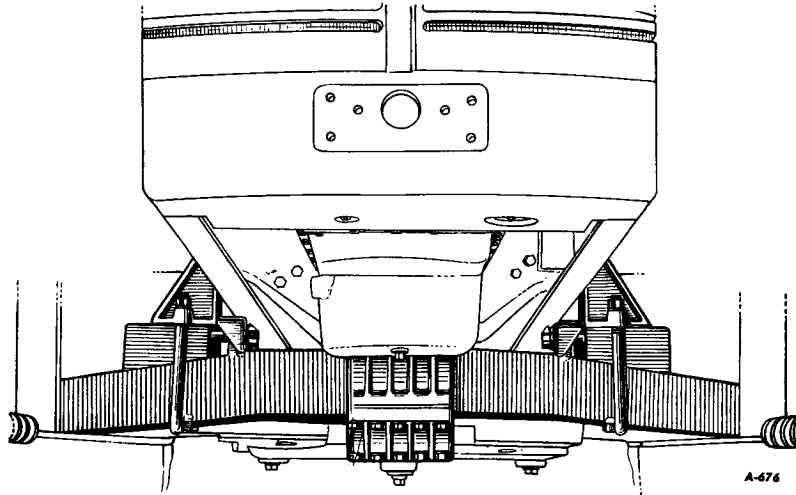


Fig. H

SPECIAL ATTACHMENTS

RIGID TRACK FRAME

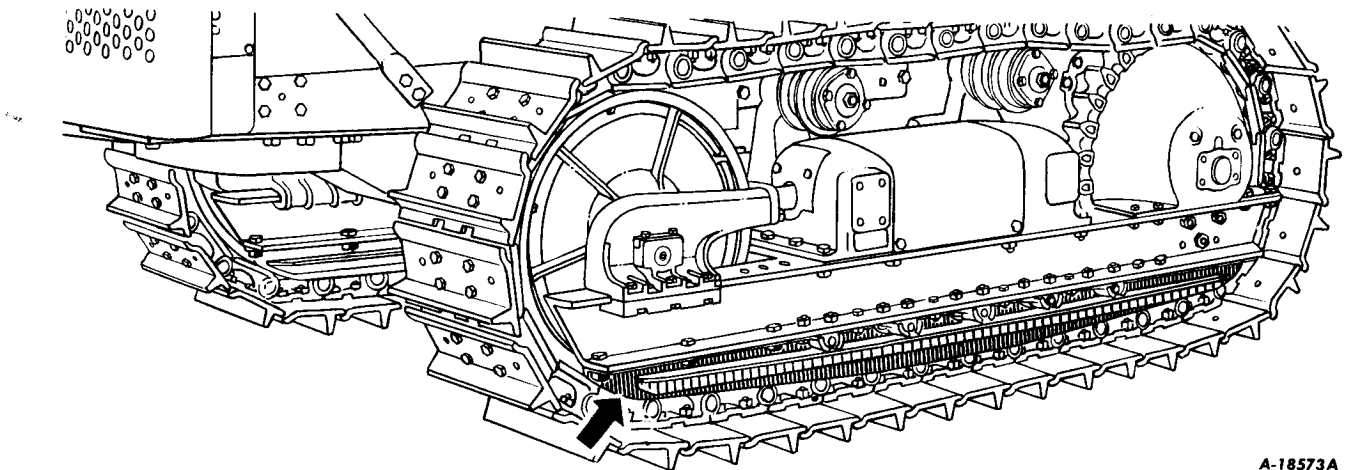


Illustr. 91

The rigid frame is recommended for use on tractors equipped with superimposed allied equipment mounted to the frame. It replaces

the equalizer spring and provides rigid non-oscillating track frame construction.

HEAVY DUTY TRACK ROLLER SHIELD



Illustr. 92

The heavy duty track roller shields will stop rocks, mud, lumber, etc. from entering the track rollers. They are built to withstand severe punishment.

bronze friction surfaces, are a superior type for use under certain conditions.

BI-METALLIC STEERING CLUTCH FRICTION DISC

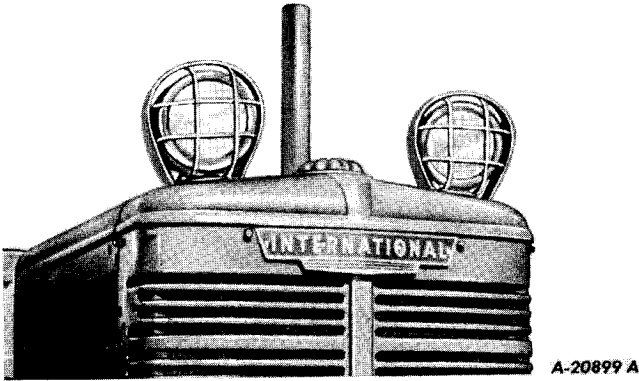
The bi-metallic steering clutch friction discs, composed of steel splined centers with

BI-METALLIC ENGINE CLUTCH DRIVEN MEMBER

The bi-metallic engine clutch driven member is a superior type driven member which is composed of steel splined centers with bronze friction surfaces.

SPECIAL ATTACHMENTS

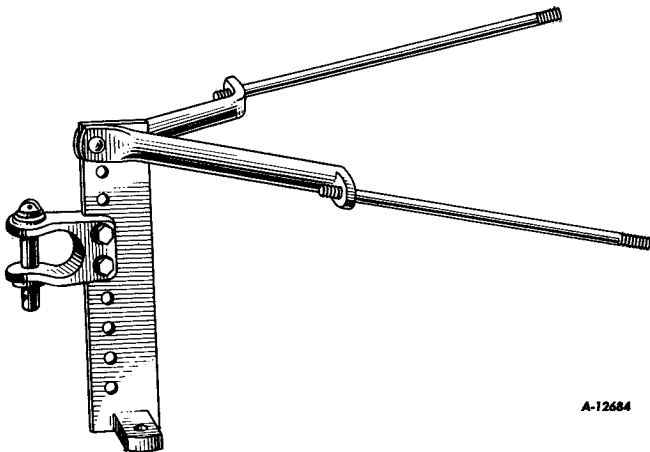
HEAD LIGHT BRUSH GUARD



Illustr. 93

This attachment will protect the head lamps against injury from low hanging branches, etc.

HIGH-HITCH DRAWBAR



Illustr. 94

The high-hitch drawbar enables the operator of the tractor to draw or pull objects which have to be attached at a certain height. This drawbar is adjustable up and down to accommodate different hitching heights of the equipment being pulled.

NOTE: The belt pulley attachment must be removed to use the high-hitch drawbar attachment. The power take-off attachment can not be used when the high-hitch drawbar attachment is applied.

BLOWER FAN

This attachment reverses the air flow through the radiator, thus preventing chaff or foreign particles from clogging the radiator and grille.

INCREASED THIRD AND SIXTH SPEED TRANSMISSION

This attachment provides a higher third gear speed for agricultural purposes. The third gear speed is increased from 2.6 to 2.8 miles per hour, and the sixth gear speed is increased from 5.6 to 6.2 miles per hour.

STARTING PRIMER

Description

When starting in cold weather the engine needs to be primed. A few strokes of the primer button, which sprays raw gasoline directly into the intake manifold, are usually sufficient. The number of strokes will depend on operating temperature.

Operation

During cold weather and when the engine is cold, set the choke valve lever nearly closed and prime the engine with the primer button.

In zero weather, give the engine 6 to 8 primes. In temperatures 10° to 20° F., give the engine 3 to 5 primes. In temperatures 30° to 40° F., give the engine 1 to 3 primes.

LOW BOILING POINT HEAT INDICATOR

This attachment (recommended when alcohol is used as an antifreeze) consists of a thermostat which has an opening range of 130° to 155° F. and a properly calibrated heat indicator for use with low boiling point antifreeze solutions. The original thermostat and heat indicator must be reinstalled when the temperature rises and antifreeze solutions are no longer necessary.

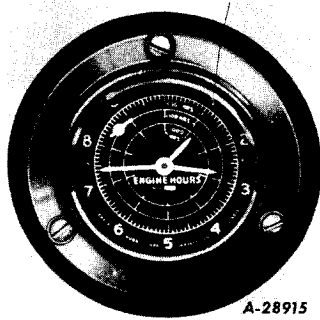
HYDRAULIC REMOTE CONTROL

The hydraulic remote control attachment, incorporating a remote cylinder mounted on the implement, makes it possible to raise, lower, and adjust implements hydraulically and to control their movement from the tractor seat. This attachment has a reservoir, safety valve, and pump as separate units. The pump is driven directly from the engine, permitting the use of the hydraulic system any time the engine is running regardless of whether the clutch is engaged or disengaged.

This system, in which only IH Touch Control fluid should be used, is a sealed system comprising the following principal parts: a hydraulic pump, a safety valve, a reservoir, a control valve, an automatic breakaway coupling, and a hydraulic cylinder. Use sealer on all pipe fittings.

SPECIAL ATTACHMENTS

ENGINE HOUR METER



Illustr. 95

This electrically-operated attachment, which is on the dash, is available for use on tractors equipped with electric starting or lighting equipment. The meter indicates the actual hours of engine operation, enabling the operator to determine, without guesswork, lubrication, oil change and inspection periods. It also provides a means of computing specific job costs and of recording fuel and oil consumption.

When the hour meter is operating, the small indicator located at the upper left of the dial makes one revolution per minute. The hour meter indicates up to 10,000 hours - automatically starting again at zero.

Instructions for Reading the Hour Meter

1. When the short hand has passed figure 1, but has not reached figure 2, on the inner, or 10,000 hour track, it will indicate 1,000 hours

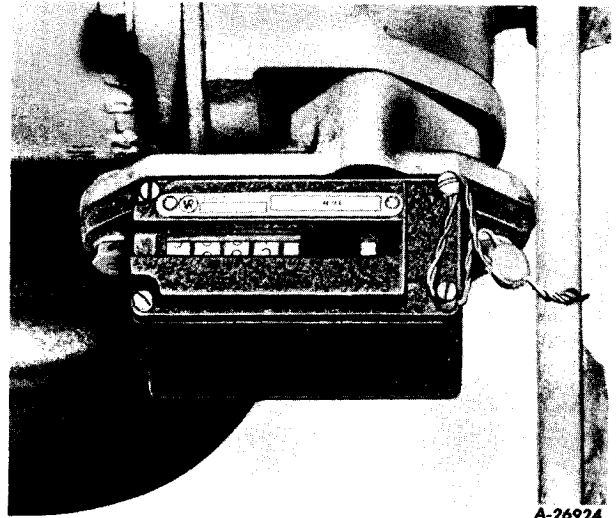
2. When the center hand is pointing between 2 and 3 on the middle, or 1,000 hour track, it will indicate 200 hours

3. When the long hand is pointing between 7 and 8 on the outer, or 100 hour track, it will indicate 70 hours

4. The outer track has ten graduations between any two figures. Each graduation is equal to 1 hour. Again reading the longest hand, it will be noted that it is 4 graduations past the figure 7. The last figure will, therefore, be 4 hours

Total 1,274 hours

SERVICE METER



A-26924

Illustr. 96
Right front side of engine.

The service meter records the number of hours the tractor is operating, provided the engine runs at full governed speed. This instrument is especially useful for determining the proper service periods.

HORIZONTAL READING SERVICE METER BRACKET

The horizontal reading service meter bracket attachment is to be used on tractors equipped with a vertical service meter. This attachment enables the operator to read the service meter without any inconvenience.

TOOL BOX (21-Inch)

This tool box, mounted for more accessibility on the left fender, has a large capacity. Provision is made for a lock but the lock is not part of the attachment.

SPECIAL ATTACHMENTS

ELECTRICAL ATTACHMENTS

Starting Attachment

Lighting Attachment

(Two Head Lights and One Rear Light)

Lighting Attachment

(Two Head Lights and One Tail Light)

Starting and Lighting Attachment

(Two Head Lights and One Rear Light)

Starting and Lighting Attachment

(Two Head Lights and One Tail Light)

NOTE: Lighting attachments are 6-volt systems; starting and combination starting and lighting attachments are 12-volt systems.

Advantages of Starting and Lighting Attachments

A starting attachment, a lighting attachment, or a starting and lighting attachment added to your tractor gives you extra conveniences, extra savings, and extra hours that your tractor can be used.

The starting attachment, in addition to being a convenience, saves many gallons of fuel ordinarily wasted when the engine is idled during "times out."

With a lighting attachment, you can work after sundown or 24 hours a day, if necessary, to make up time lost because of bad weather, to finish a job ahead of schedule, or to utilize hours that may change a loss to a profit.

The following pages give you information, which you are urged to read and study, on the care and operation of these attachments. When ordinary care is taken of your equipment, you should be assured of satisfactory service.

Precautions

Before working on any part of the electrical system, disconnect the battery ground cable. Do not reconnect the battery ground cable until all electrical work has been completed. This will avoid shorting and causing damage to any of the electrical units.

Be sure that all terminals are clean and securely fastened, and that there are no broken wires anywhere in the electrical circuit.

Tractors equipped with electrical attachments when shipped, have the battery ground cable disconnected at the battery end and, in addition, the connection at the "F" terminal on the generator frame is not completed. Before operating the tractor, connect the battery-to-ground cable and connect the generator.

IMPORTANT! The generator will burn out if operated with the battery cables or battery charging circuit cables disconnected or broken. To operate the generator without battery, remove connection from "F" terminal on generator frame.

Do not paint the instruments or electrical connections.

Description

When tractor is so equipped, the electrical system consists of either a 6-volt lighting attachment, a 12-volt starting attachment, or 12-volt starting and lighting attachment. These consist of a generator, generator cut-out relay, charging-rate switch and one battery for lighting attachment or two batteries (wired in series) for 12-volt starting, and starting and lighting attachments. Starting attachment includes a cranking motor.

Electrical systems are single wire type with a ground return to the batteries. The cables are contained in a non-metallic woven braid, oil and water proof harness.

Fan and Generator Pulley

This attachment must be used with all starting, lighting and combination starting and lighting attachments unless tractor is already so equipped.

Generator and Light Switch

The generator has an adjustable third brush for changing the charging rate. On the lighting, and starting and lighting attachments, a light switch with field resistance control is provided to regulate the charging rate of the generator from the instrument panel.

The generator field circuit is grounded through the light switch. Therefore, it is absolutely necessary at all times to make sure that there is a good electrical connection between the switch and the mounting panel.

Continued on next page

SPECIAL ATTACHMENTS

The light switch is used to control generator field resistance, and it has 4 positions; low charge, "L"; high charge, "H"; dim lights "D"; and bright lights "B."

When the lights are turned on either dim or bright, or to position "H," the field circuit is direct to the ground, giving a high charge or increased generator output.

During the daytime, when lights are not used, the switch should be put in the "L" position. This adds a resistance coil to the field circuit and reduces the output of the generator to approximately one-half its original charge rate. If the battery is low, the switch should be placed in the "H" position until the battery is fully charged.

The 6-volt generator, as received from the factory, will have the third brush set in a position to give an output of approximately 9

amperes when the switch is in the "H" position, and 4 to 5 amperes when the switch is in the "L" position.

The 12-volt generator, as received from the factory, will have the third brush set in a position to give an output of approximately 6 amperes when the switch is in the "H" position, and 2 to 3 amperes when the switch is in the "L" position.

To increase the generator output, remove the lead from the "F" terminal on the relay and ground it under the relay mounting screw. This will give an output of approximately 9 amperes for the 6-volt generator and approximately 6 amperes for the 12-volt generator.

It may be desired to reduce the charging rates mentioned above. This can be accomplished by adjusting the third brush. Refer to the paragraphs relating to third brush adjustment.

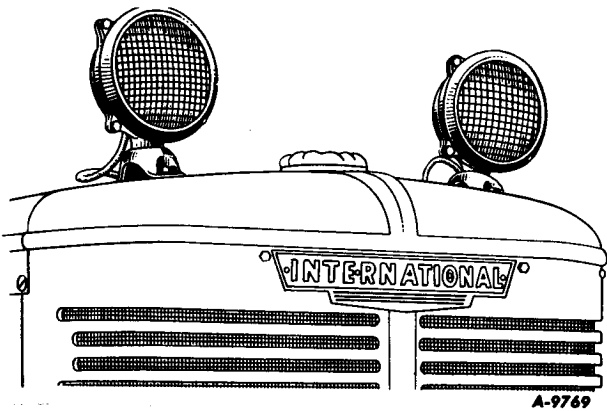


Fig. A - Location of head lights and cables on tractor.

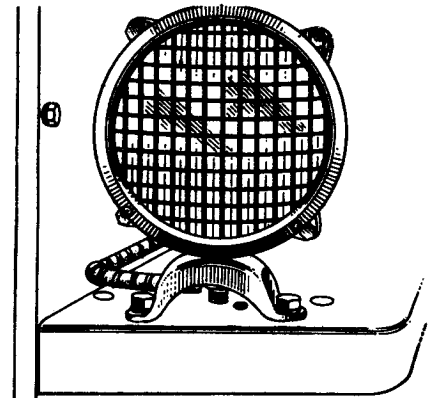


Fig. B - For attachment using rear light.

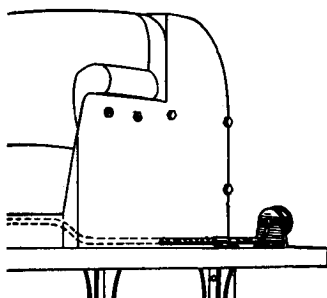


Fig. C - For attachment using tail light.

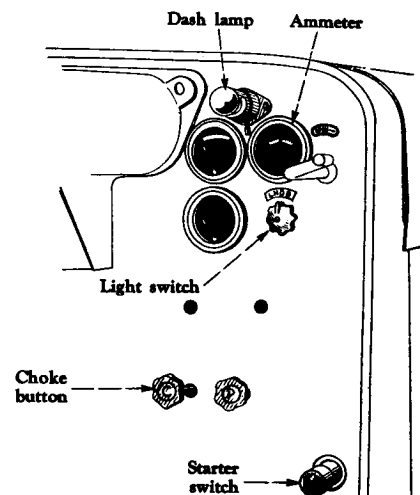


Fig. D - Instruments and switches.

SPECIAL ATTACHMENTS

The charging rates given are for average conditions only. The generator output may have to be varied to meet abnormal operating conditions in order to maintain a fully charged battery. To obtain the best life and performance of a battery, do not undercharge or overcharge it but maintain the correct specific gravity.

CLEANING GENERATOR AND CRANKING MOTOR COMMUTATORS

If the commutator of the cranking motor or of the generator is greasy, dirty or slightly burred, it can be polished with No. 00 sandpaper. Never use emery cloth. After the polishing operation all dust must be blown from the commutator. If a commutator is very rough or out of round refer to your International Industrial Power distributor or dealer.

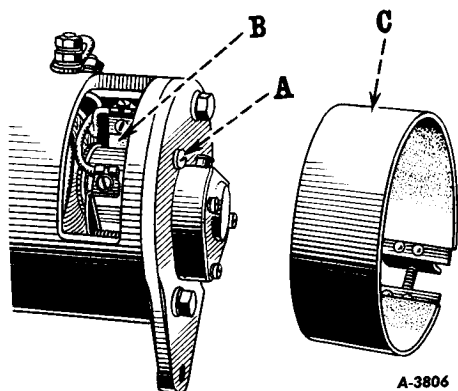
When polishing the generator commutator, remove the cover band and place the piece of sandpaper between a brush and the commutator while the armature is revolving.

When polishing the cranking motor commutator, first attach a jumper wire between magneto terminal "C" and coil cover mounting bolt "B." This will ground the magneto and prevent accidental starting. See *Illust. 51*. Then remove the commutator cover band. With the starting switch depressed and the cranking motor operating, place the piece of sandpaper over the commutator.

LUBRICATING GENERATOR (2 CUPS)

After 240 hours of operation, put in 8 to 10 drops of SAE-20 oil in each cup. Do not overlubricate since excessive oiling may cause oil and grease to gum on the commutator and cause a reduction of the generator output. Never oil the commutator.

ADJUSTING CHARGING RATE BY THIRD BRUSH



Illust. 98
Generator showing third brush.

1. Remove the cover band "C." See *Illust. 98*.

2. Loosen the round head screw "A" on the outside of the commutator end frame until the lock washer tension is released. Do not try to remove this screw.

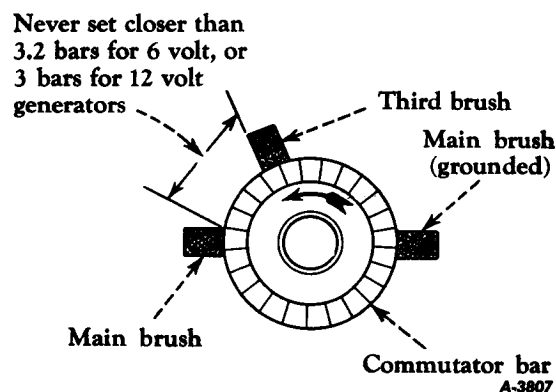
3. Change the charging rate by moving the third brush "B." This brush is the one mounted on a movable carrier. The other main brushes are mounted directly on the inside of the commutator end frame.

Increase the charging rate by moving the third brush in the direction of rotation of the armature and decrease it by moving the third brush in the opposite direction.

The maximum rate of charge for the 6-volt generator is 9 to 11 amperes when "hot" and 13 to 16 amperes when "cold." The maximum rate of charge for the 12-volt generator is 6 to 8 amperes when "hot" and 8 to 10 amperes when "cold," with the switch in the high charge position and no electrical load. Do not set beyond these limits.

Always check the maximum generator output when operating with a fully charged battery.

IMPORTANT! The third brush should never be set closer than 3.2 commutator bars from the main brush on 6-volt generators, or 3 commutator bars from the main brush on 12-volt generators. See *Illust. 99*.



Illust. 99
Commutator end (brush setting).

4. When the above adjustments have been completed be sure to tighten the round head screw "A" which locks the third brush carrier in place.

Continued on next page

SPECIAL ATTACHMENTS

5. Reassemble cover band "C," making sure that the joint is on the bottom of the generator and the opening in the generator is covered.

6. Unless you are familiar with electrical equipment, and know how to adjust it, the above adjustment should be done by your International Industrial Power distributor or dealer. He has the correct equipment and capable servicemen to make the adjustment.

CRANKING MOTOR LUBRICATION

Occasionally put a few drops of SAE-20 oil in the cranking motor oil cup. Whenever the cranking motor is removed from the engine, put 8 to 10 drops of SAE-20 oil in the oil cup on the Bendix drive end of the starting motor.

STORAGE BATTERIES

REGISTRATION CARD (NOT FOR EXPORT)

A registration card is furnished with the batteries. This card should be filled in and given to your International Industrial Power distributor or dealer for registration.

BATTERIES FOR EXPORT

Complete instructions are included with the batteries.

KEEP TERMINALS CLEAN

Battery cable terminals must be clean and tight. Use hot water for removing terminal corrosion and for cleaning the tops of the batteries. Brighten terminal contact surfaces with wire wool, apply a light coat of vaseline, and reassemble. Be sure terminals are clamped tightly and that the batteries are fastened securely in the battery box.

KEEP VENTS OPEN

Keep the vent holes open in the battery filler caps.

KEEP UP ELECTROLYTE LEVEL

The electrolyte in each cell should be 3/8 inch above the separators. Keep the electrolyte up to this level at all times to prevent battery failure. When the electrolyte falls below this level, pure distilled water should be added. Never use hydrant water or any water which has been in a metal receptacle.

Keep pure, distilled water in a glass jar on hand for battery use only. To put water in a cell use a clean syringe. When adding water to the batteries in temperature near the freezing point (32° F.) always operate the engine long enough to mix the water and the electrolyte or damage to the batteries from the water freezing will result.

KEEP BATTERIES FULLY CHARGED

The batteries must be maintained at full or nearly full charge to operate the cranking motor satisfactorily. The specific gravity of the electrolyte indicates the strength of the battery charge and its ability to crank the engine. The following table illustrates a typical range of specific gravity readings (at 80° F. or corrected to 80° F.) with respect to the condition of the battery charge:

1.280 sp. gr.	Fully charged
1.250 sp. gr.	75% charged
1.220 sp. gr.	50% charged
1.190 sp. gr.	25% charged
1.160 sp. gr.	Very little useful capacity
1.130 sp. gr.	Discharged

Specific gravity reading of at least 1.250 at 80° F., or corrected to 80° F., should be maintained (*see par. following*). If the specific gravity falls below this figure the generator charging rate should be increased (*see "ADJUSTING CHARGING RATE BY THIRD BRUSH" on page 81*) or the batteries should be recharged with standard auxiliary battery charger.

VARIATION OF ELECTROLYTE SPECIFIC GRAVITY WITH THE TEMPERATURE

The specific gravity reading of the electrolyte will vary with the temperature. For instance fully charged batteries reading 1.280 at 80° F. will read 1.268 at 110° F. or 1.312 at 0° F. When checking specific gravity to determine the condition of the battery charge or to adjust the charging rate of the generator, if the temperature is extremely high or low, the hydrometer reading at the actual electrolyte temperature should be corrected to standard reading at 80° F. by referring to the table following:

Read the thermometer in the electrolyte. Read the hydrometer. At the top of the table which follows find the column headed by the temperature nearest to the electrolyte temperature; find in that column the figure nearest the observed specific gravity reading and trace horizontally across to the 80° F. column. The figure in the 80° F. column is the true electrolyte specific gravity and should form the basis for any adjustment.

SPECIAL ATTACHMENTS

0°F	20°F	40°F	80°F	100°F	110°F	120°F
1.251	1.243	1.236	1.220	1.213	1.209	1.205
1.261	1.253	1.246	1.230	1.223	1.219	1.215
1.271	1.263	1.256	1.240	1.233	1.229	1.225
1.281	1.273	1.266	1.250	1.243	1.239	1.235
1.291	1.283	1.276	1.260	1.252	1.249	1.245
1.301	1.294	1.286	1.270	1.262	1.258	1.255
1.312	1.304	1.296	1.280	1.272	1.268	1.265

PRECAUTIONS FOR CHECKING AND MAINTAINING SPECIFIC GRAVITY OF BATTERIES

1. In order to maintain the correct specific gravity, inspect the batteries at least once a week. After approximately 40 hours of operation, check for water evaporation. If 2 ounces of water (average hydrometer full) has evaporated from each cell, it is an indication that the batteries are being over-charged. Do not neglect this warning. Have the International Industrial Power distributor or dealer adjust the electrical charging rate. Delay may seriously damage the batteries.

2. Specific gravity readings should not be made immediately after water has been put into the batteries; take readings either before the water is added or after the batteries have been on charge for some time.

3. All cells should show approximately the same specific gravity reading. Wide variation indicates something is wrong. See your International Industrial Power distributor or dealer.

4. The specific gravity reading of the electrolyte in a fully charged battery should not exceed the value specified by the manufacturer. If the specific gravity of a battery seems excessively high refer to your International Industrial Power distributor or dealer.

5. Acid or electrolyte should never be added except by a skilled battery man. Under no circumstances add any special battery "dopes," solutions or powders.

EFFECT OF LOW TEMPERATURES ON BATTERY PERFORMANCE

Battery capacity is greatly reduced by cold as cold has a decided numbing effect on the electro-chemical action in the batteries. The following comparison indicates the reduction in cranking power of fully charged batteries when the temperature of the

electrolyte drops from 80° F. to 32° F. and to 0° F.

80° F.	100%
32° F.	65%
0° F.	40%

Stiff engine oil in low temperatures adds to the load of starting. The following comparison indicates the increase in power necessary to crank an engine that is lubricated with SAE-20 oil when the temperature drops from 80° F. to 32° F. and to 0° F.

80° F.	100%
32° F.	165%
0° F.	250%

From the above charts, the combined effect of zero temperature in reducing battery capacity to 2/5 of its normal power, and the increase in cranking load due to stiff oil to 2-1/2 times the warm weather load, illustrates the importance of maintaining fully charged batteries in cold weather.

DANGER OF BATTERIES FREEZING WHEN NOT FULLY CHARGED

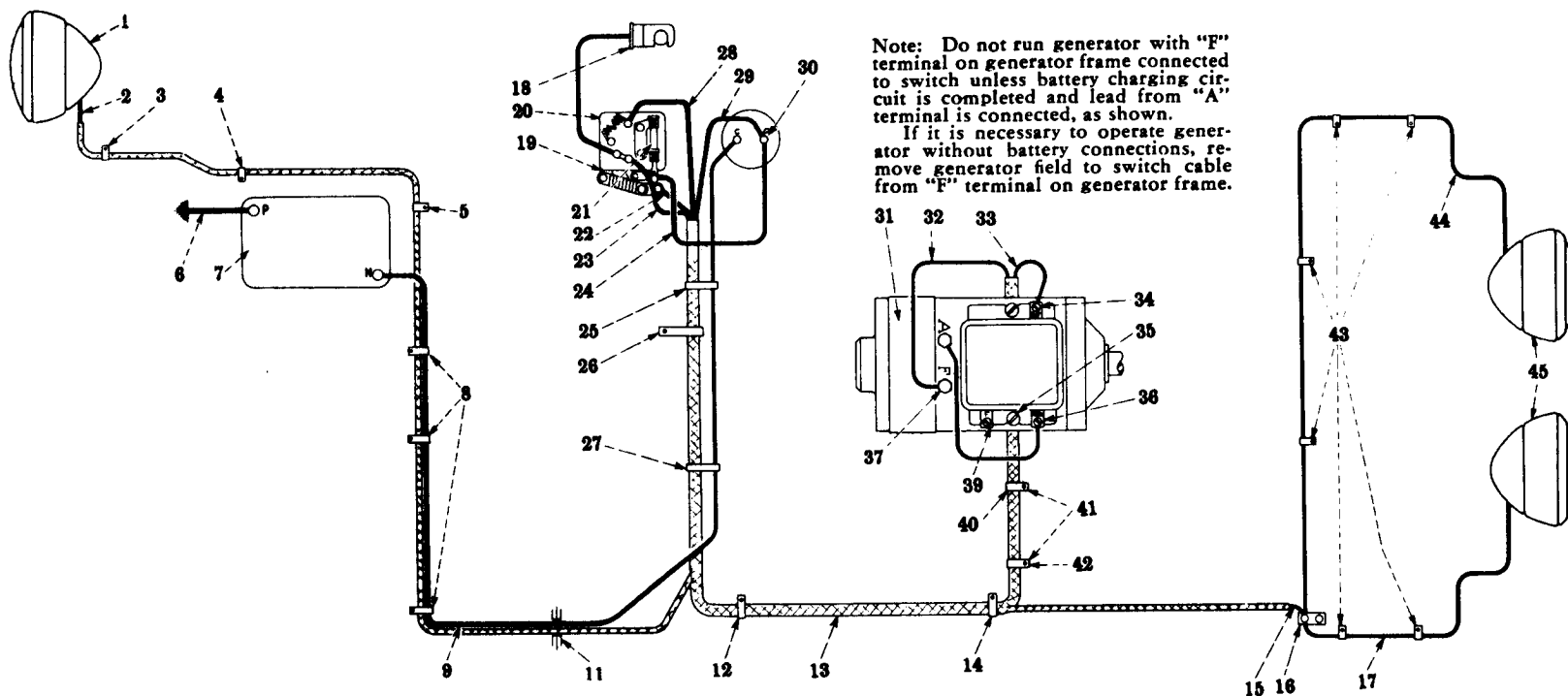
It is important to keep the batteries close to full charge in cold weather to avoid the danger of freezing. The electrolyte of a battery will start to freeze (first ice crystals begin to appear in the electrolyte although it does not freeze solid until a lower temperature is reached) approximately as indicated below (specific gravity readings corrected to 80° F.):

1.250 sp. gr.	Freezes at -60° F.
1.200 sp. gr.	Freezes at -15° F.
1.150 sp. gr.	Freezes at +5° F.
1.100 sp. gr.	Freezes at +20° F.

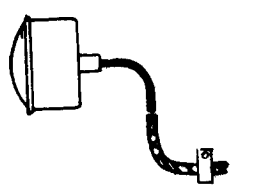
BATTERY VOLTAGE

With the batteries fully charged and on charge at the normal rate the average cell voltage at 80° F. ranges between 2.5 to 2.7 volts; at 100° F. it ranges between 2.4 and 2.6 volts.

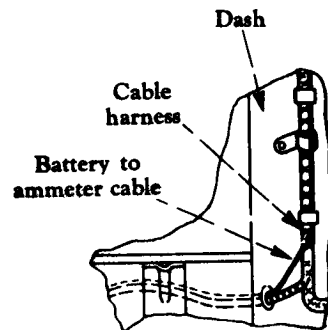
DELCO-REMY LIGHTING ATTACHMENT
WIRING DIAGRAM



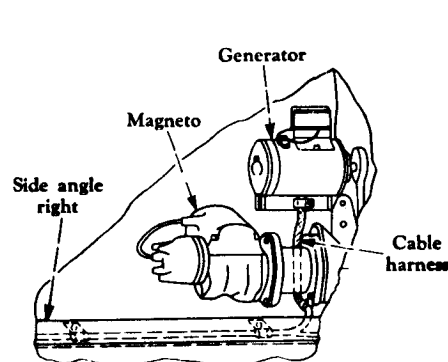
Illustr. 100
Wiring diagram for electric lighting attachments.



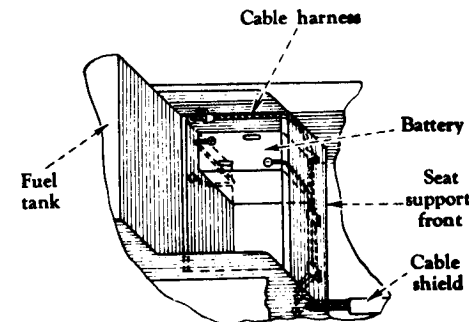
Illustr. 101
Connection when tail light is used. Cut off terminal from end of cable and use tail light plug.



Illustr. 102
Wiring at dash.



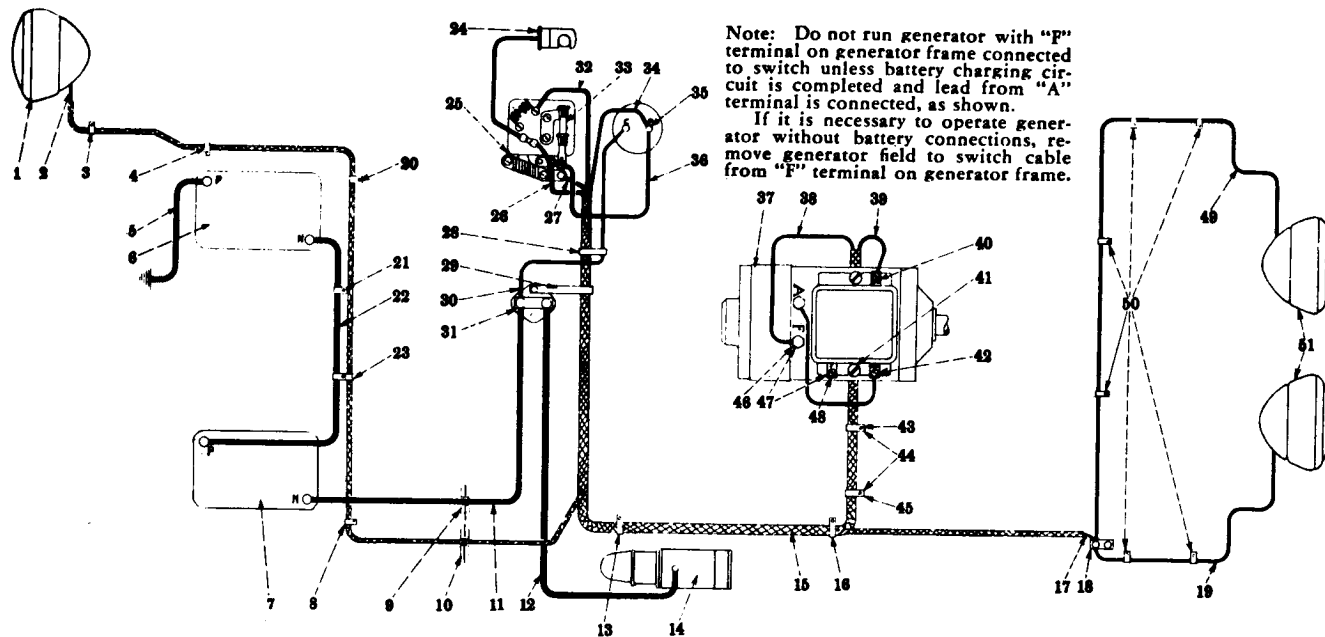
Illustr. 103
Wiring at generator.



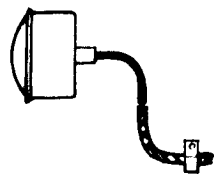
Illustr. 104
Battery box wiring.

Index to Reference Numbers shown in illustration on opposite page.

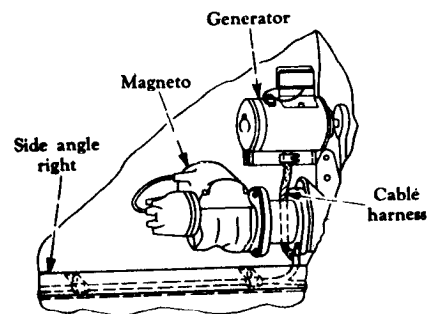
Ref. No.	Description	Ref. No.	Description
1	Rear light.	23	Cable - switch to rear light - black with white tracer.
2	Cable - switch to rear light - black with white tracer. When a tail light is used refer to <i>Illust. 101</i> .	24	Cable - ammeter to switch.
3	Clip - on fender mounting carriage bolt in bracket.	25	Clip.
4	Clip - on fender mounting bolt. See <i>Illust. 104</i> .	26	Clip - on dash (use 1/4" N.C. x 5/8" hex. head cap screw, nut and lock washer). See <i>Illust. 102</i> .
5	Clip - on seat support. See <i>Illust. 104</i> .	27	Clip.
6	Cable - battery to ground. Ground on gear shifter housing bolt, third from rear, right.	28	Cable - switch to junction block - black.
7	Battery.	29	Cable - generator to ammeter - natural with black and red cross tracers.
8	Clip - on seat support - front. See <i>Illust. 104</i> .	30	Ammeter.
9	Cable - battery to ammeter.	31	Generator.
11	Grommet - in dash. See <i>Illust. 102</i> .	32	Cable - generator to field to switch - natural with black tracer.
12	Clip - on side angle (use 3/8 N.C. x 1" cap screw, nut and lock washer). See <i>Illust. 103</i> .	33	Cable - generator to ammeter - natural with black and red cross tracers.
13	Cable harness complete.	34	"BAT" terminal on relay.
14	Clip - on side angle (use 3/8 N.C. x 1" cap screw, nut and lock washer).	35	Relay mounting screw.
15	Cable - switch to junction block - black.	36	"GEN" terminal on relay.
16	Junction block.	37	"F" terminal on frame of generator. Remove short lead connecting "F" terminal on frame of generator to "F" terminal on relay. Connect generator field to switch cable directly to "F" terminal on generator frame.
17	Cable - right head light to junction block.		"F" terminal on relay.
18	Dash light.	39	
19	A good electrical connection must be made between switch and switch mounting to complete generator field circuit.	40	Clip - on generator mounting bracket front bolt.
20	Light switch.	41	See <i>Illust. 103</i> .
21	Fuse.	42	Clip - on magneto bracket bolt.
22	Cable - generator to field to switch - natural with black tracer.	43	Clip - on fan shroud bolts.
		44	Cable - left head light to junction block.
		45	Head light mounted on top of radiator.

DELCO-REMY STARTING AND LIGHTING ATTACHMENT
WIRING DIAGRAM

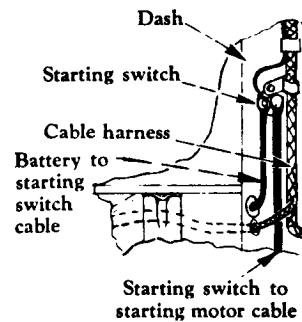
Illustr. 105
Wiring diagram for electric starting and lighting attachments.



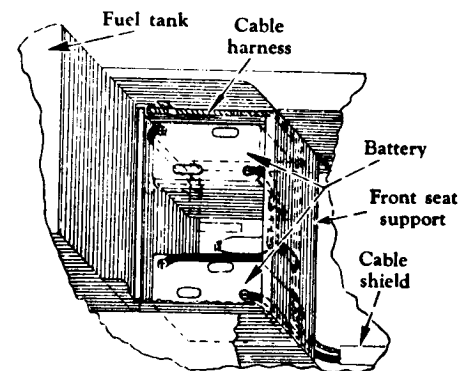
Illustr. 106
Connections when a light is used. Cut off terminal from end of cable and use taillight plug.



Illustr. 107
Wiring at dash.



Illustr. 108
Wiring at generator.



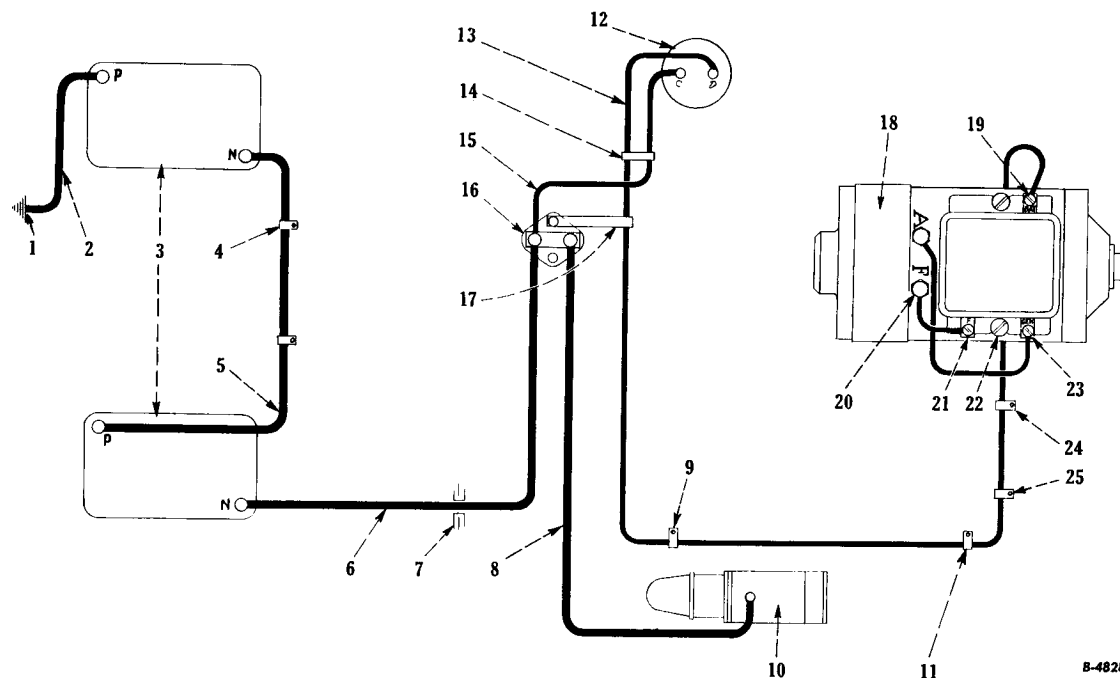
Illustr. 109
Battery box wiring.

Index to Reference Numbers shown in illustration on opposite page.

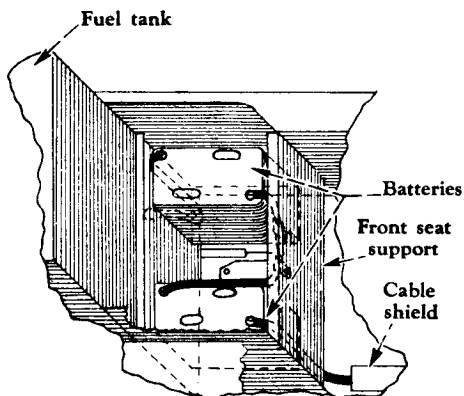
Ref. No.	Description	Ref. No.	Description
1	Rear light.	26	Cable - switch to rear light - black with white tracer.
2	Switch cable - switch to rear light - black with white tracer. If a tail light is used in place of the rear light, <i>see Illust. 106.</i>	27	Cable - generator field to switch - natural with black tracer.
3	Clip - on fender mounting carriage bolt in bracket.	28	Clip. <i>See Illust. 107.</i>
4	Clip - on fender mounting bolt. <i>See Illust. 109.</i>	29	Clip - on starting switch mounting bolt. <i>See Illust. 107.</i>
5	Cable - battery to ground. Ground cable on fuel tank mounting bolt - second from rear.	30	Cable - starting switch to ammeter.
6	Battery.	31	Starting switch.
7	Battery.	32	Cable - switch to junction block - black.
8	Clip - on seat support front. <i>See Illust. 109.</i>	33	Fuse.
9	Grommet - in dash. <i>See Illust. 107.</i>	34	Cable - generator to ammeter - natural with black and red cross tracers.
10	Grommet - in dash. <i>See Illust. 107.</i>	35	Ammeter.
11	Cable - battery to starting switch.	36	Cable - ammeter to switch.
12	Cable - starting switch to starting motor. <i>See Illust. 107.</i>	37	Generator.
13	Clip - on side angle - (use 3/8 N.C. x 1" cap screw, nut and lock washer). <i>See Illust. 108.</i>	38	Cable - generator field to switch - natural with black tracer.
14	Starting motor.	39	Cable - generator to ammeter - natural with black and red cross tracer.
15	Cable harness.	40	"BAT" terminal on relay.
16	Clip - on side angle - (use 3/8 N.C. x 1" hex. head cap screw, nut and lock washer). <i>See Illust. 108.</i>	41	Relay mounting screw.
17	Cable - switch to junction block - black.	42	"GEN" terminal on relay.
18	Junction block.	43	Clip - on generator mounting bracket front bolt.
19	Cable - right head light to junction block.	44	<i>See Illust. 108.</i>
20	Clip - on seat support front. <i>See Illust. 109.</i>	45	Clip - on magneto bracket bolt.
21	Clip - on seat support front - (use 3/8 N.C. x 3/4" cap screw, nut and lock washer). <i>See Illust. 109.</i>	46	"F" terminal on generator frame.
22	Cable - battery to battery.	47	Remove short lead connecting "F" terminal on frame to "F" terminal on relay. Connect generator field to switch cable directly to "F" terminal on generator frame.
23	Clip - on seat support front. <i>See Illust. 109.</i>	48	"F" terminal on relay.
24	Dash light.	49	Cable - left head light to junction block.
25	Light switch. A good electrical connection must be made between switch and switch mounting to complete generator field circuit.	50	Clip - on fan shroud bolts.
		51	Head light mounted on top of radiator.

DELCO-REMY STARTING ATTACHMENT
WIRING DIAGRAM

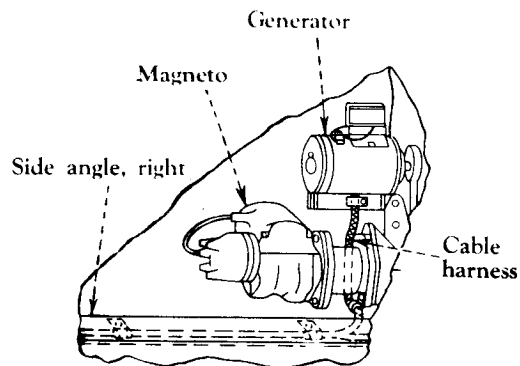
NOTE: Do not run generator unless battery charging circuit is completed and lead from "A" terminal is connected as shown. If it is necessary to operate generator without battery connections, remove connection from "F" terminal on generator



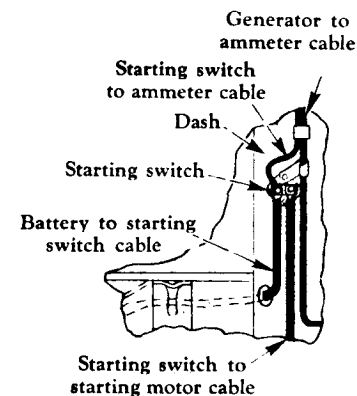
Illustr. 110
Wiring diagram for electric starting attachments.



Illustr. 111



Illustr. 112



Illustr. 113

Index to Reference Numbers shown in illustration on opposite page.

Ref. No.	Description	Ref. No.	Description
1	Ground on fuel tank mounting bolt - second from rear.	13	Cable - generator to ammeter.
2	Cable - battery to ground.	14	Clip. <i>See Illust. 113.</i>
3	Battery.	15	Cable - starting switch to ammeter. <i>See Illust. 113.</i>
4	Clip - on seat support front - (use 3/8" N.C. x 3/4" cap screw, nut and lock washer). <i>See Illust. 111.</i>	16	Starting switch.
5	Cable - battery to battery.	17	Clip on starting switch mounting bolt. <i>See Illust. 113.</i>
6	Cable - battery to starting switch.	18	Generator.
7	Grommet - in dash. <i>See Illust. 113.</i>	19	"BAT" terminal on relay.
8	Cable - starting switch to starting motor. <i>See Illust. 113.</i>	20	"F" terminal on generator frame.
9	Clip - on side angle - (use 3/8" N.C. x 1" hex. head cap screw, nut and lock washer). <i>See Illust. 112.</i>	21	"F" terminal on relay. To increase output of generator remove lead from "F" terminal on relay and ground it under relay mounting screw.
10	Starting motor.	22	Relay mounting screw.
11	Clip - on side angle - (use 3/8" N.C. x 1" hex. head cap screw, nut and lock washer). <i>See Illust. 112.</i>	23	"GEN" terminal on relay.
12	Ammeter.	24	Clip - generator mounting bracket front bolt. <i>See Illust. 112.</i>
		25	Clip - on magneto bracket bolt. <i>See Illust. 112.</i>

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