T 280 - 7953

Operator's Manual

INTERNATIONAL HARVESTER

INTERNATIONAL®
TD-9
Crawler Tractor

INTERNATIONAL HARVESTER COMPANY
401 North Michigan Ave. Chicago, Illinois 60611, U.S.A.

TO THE OWNER

The purpose of this manual is to assist you in realizing the benefits you anticipated when you purchased this International Harvester product. Many people have contributed to the design and production of this product and its delivery to you. They have an interest in its successful performance and have provided this manual to give you the benefit of the experience they have gained through years of field testing and normal usage of this and similar products.

The way you operate and the care you give this product will have much to do with its successful performance. This manual has been carefully prepared and the information arranged and illustrated to make it as easy as possible for you to find the information you wish. It will pay you to read the entire manual carefully before operating and keep it handy for future reference. Your authorized International Construction Equipment Distributor or Dealer will be glad to answer any further questions you may have on the operation or care of this product.

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 products sold previously.

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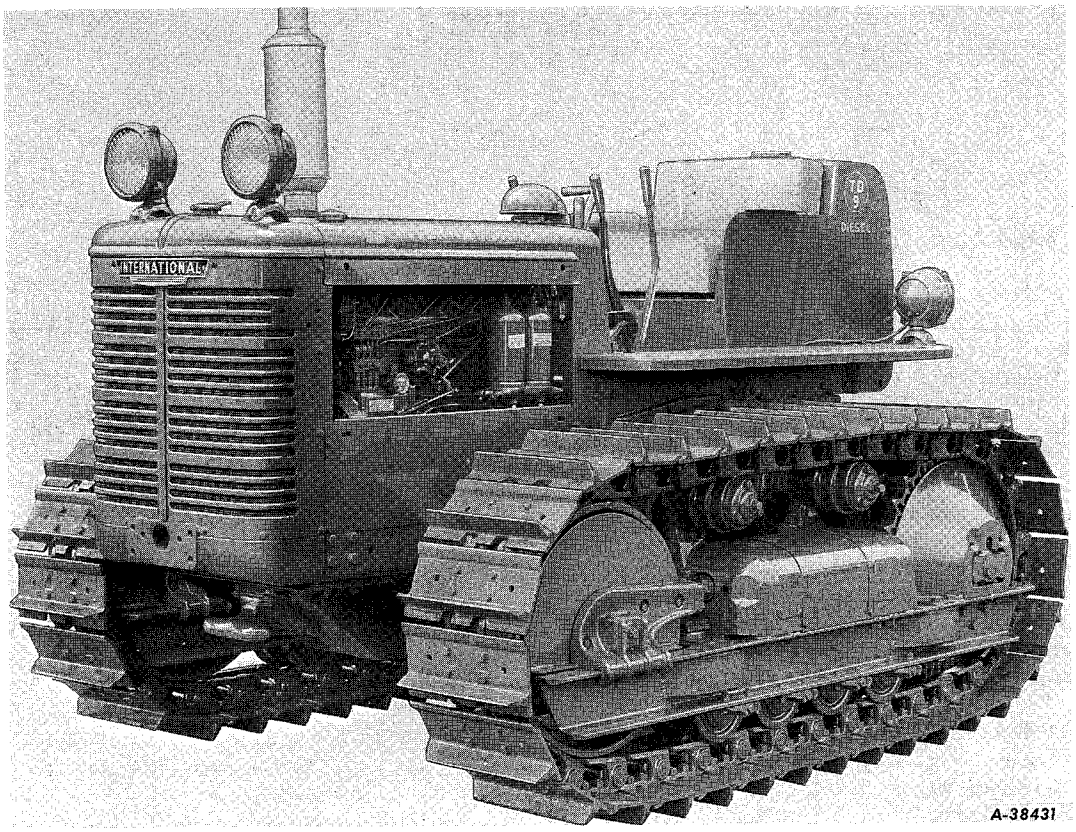
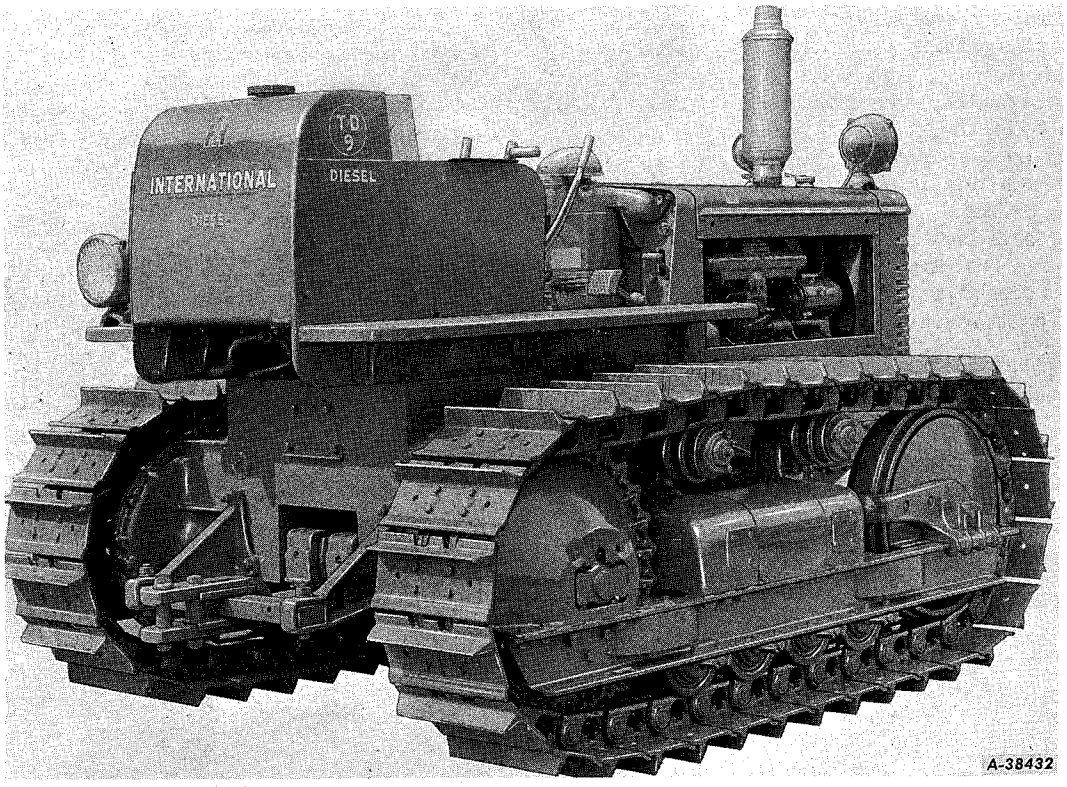
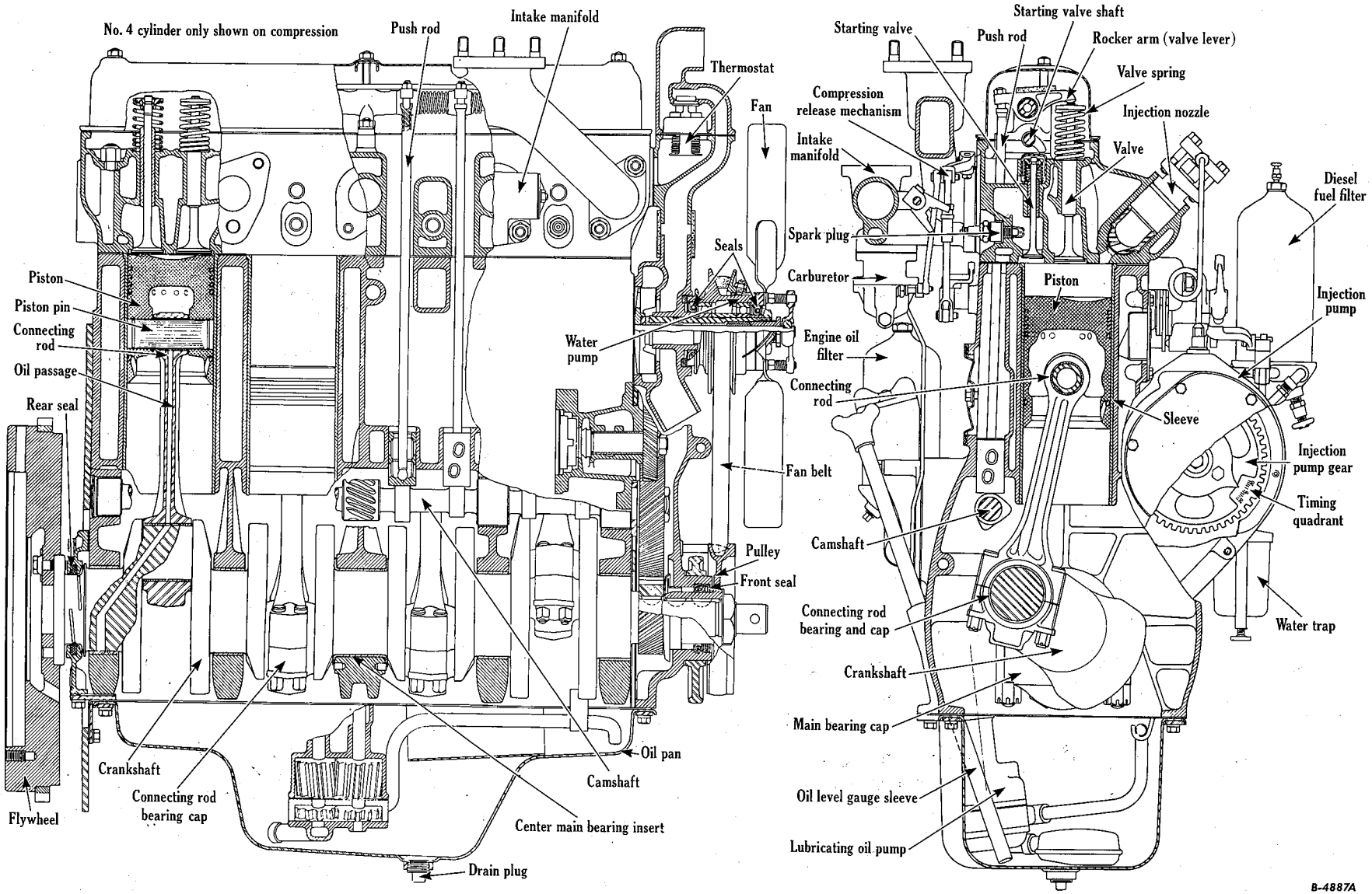


Left front view of TD-9 Crawler Tractor.



Right rear view of TD-9 Crawler Tractor.



Engine cross section (with counterbalanced crankshaft).

INTRODUCTION

Assembled in this book are the operating and maintenance instructions for the TD-9 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. Properly adjusted, operated and maintained, it will respond to every reasonable demand and give you reliable service for years to come.

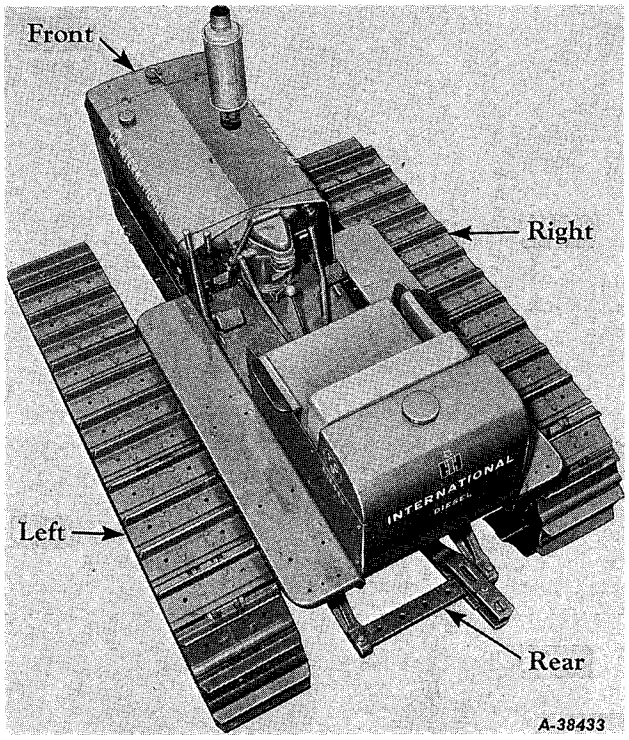
Throughout this manual the use of the terms "left" and "right," and "front" and "rear," must be understood to avoid confusion when following instructions.

"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.

The illustrations in this manual are numbered to correspond with the pages on which they appear. For example: *Illusts. 4, 4A and 4B are on page 4.*

If you should need information not given in this manual, or require the services of a trained mechanic, see 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 Parts Depot.

When in need of parts, always specify the tractor and engine serial numbers. The tractor serial number is stamped on a name plate attached to the upper left corner of the dash in the operator's compartment *(Illust. 4)*. The serial number is preceded by the letters "TDCB." The engine serial number is stamped on the left side of the engine crankcase *(Illust. 4B)*. This serial number is preceded by the letters "TDCBM."

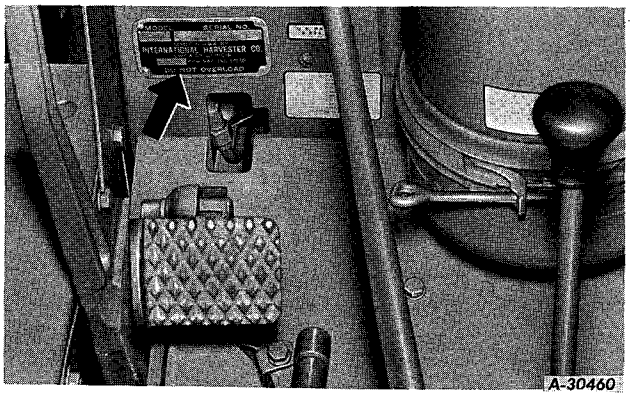


Illust. 4A

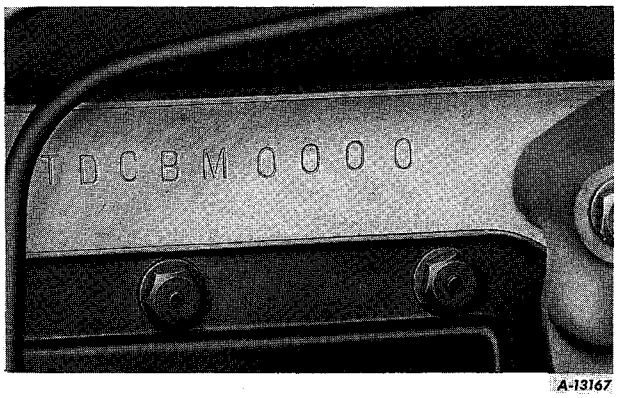
For ready reference, we suggest that you write these serial numbers in the spaces provided below.

Tractor Serial No. TDCB_____

Engine Serial No. TDCBM_____



Illust. 4
Tractor serial number.



Illust. 4B
Engine serial number.

DESCRIPTION

The TD-9 Crawler Tractor is a full track-laying type tractor, powered by a diesel engine. The principal components of your 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 counterbalanced 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, 13-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 five forward and one reverse speeds.

Steering Clutches and Brakes

Steering is accomplished through two multiple dry-disc, spring-loaded steering clutches. 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 top track idlers and around the front idler. Four 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.

SPECIFICATIONS AND CAPACITIES

Capacities (U. S. Measure)

Fuel tank	31 gallons
Gasoline tank	2/3 gallon
Water cooling system	13 gallons
Transmission	5-1/2 gallons
Sprocket drive housings (each side)	3 pints
Crankcase pan	11 quarts
Injection pump	1/2 pint
Air cleaner oil cup	3-3/4 pints

Engine (Diesel Type)

Cylinders	4
Bore	4.4 inches
Stroke	5.5 inches
Fuel injection pump	IH
Carburetor (dual manifold starting)	IH
Battery ignition unit	IH
Spark plug gap	.023 inch
Valve clearance (engine hot)	.017 inch
Valve clearance (engine cold)	.019 inch

Engine Speed

Full load	1400±10 r.p.m.
High idle	1555±30 r.p.m.
Low operating	900 r.p.m.
Low idle	500±50 r.p.m.

Engine Clutch

Over-center type (hand-controlled) . . 13 inches

Steering Clutches

Multiple dry-disc spring-loaded type with manual release . . . . 14-1/8 inches

Steering Brakes

External (contracting on steering clutch drums) . . . . . 15-3/4 inches

Track

Tread (standard)	44 inches
Tread (wide)	60 inches
Ground contact length (regular track frame)	63-1/16 inches
Ground contact length (extended track frame)	72-15/16 inches
Track shoe width (regular)	13 inches

Continued on next page

Transmission

Five forward and one reverse speeds (at rated engine r.p.m.)	
Low	1.5 m.p.h.
Second	2.2 m.p.h.
Third	3.0 m.p.h.
Fourth	3.9 m.p.h.
High	5.3 m.p.h.
Reverse	1.7 m.p.h.

General Over-All Dimensions

Length (over-all) (regular track frame)	114 inches
Length (over-all) (extended track frame)	115-1/8 inches
Width (over-all) (standard tread)	59 inches
Width (over-all) (wide tread)	75 inches
Height to top of air cleaner (from ground line)	63-3/4 inches
Height to top of exhaust pipe extension (from ground line)	79 inches
Drawbar height (from ground line)	13-13/16 inches
Drawbar lateral movement at pin	19-1/2 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 use in both diesel and burner applications. 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 following specifications:

Gravity - minimum	30 API
Flash point - minimum	125°F. minimum 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% maximum
Ash (by weight)	0.02% maximum
Distillation	
Initial boiling point - minimum	325°F.
50% boiling point - minimum	475°F.
End boiling point - minimum	610°F.
End boiling point - maximum	725°F.
Sulphur (by weight)	0.5% maximum
Cetane number	40 minimum
Copper strip corrosion	3 hours at 212°F.
Color	3 NPA maximum

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 THE TRACTOR

The general service tools shipped with the tractor are listed below. Replacement kits can be purchased from the International Industrial Power distributor or dealer in your locality under attachment No. 263 289 R92.

Spark plug wrench, 7/8 inch.
Spark plug wrench handle.
Front idler adjuster wrench.
Water pump wrench.
Socket head plug wrench.
Pressure oil can.
Grease gun (hand-type, 15 ounce).

OPERATING CONTROLS AND INSTRUMENTS

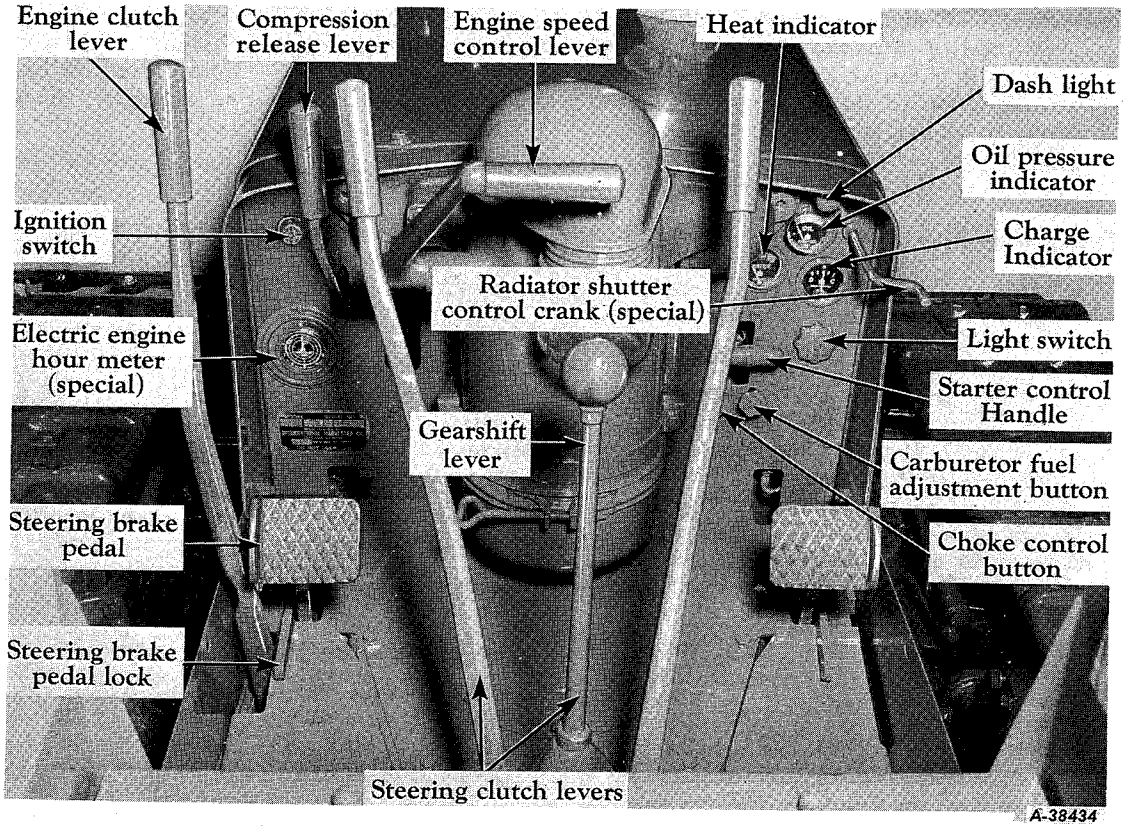
The operator should be thoroughly familiar with the location and the use of all controls and instruments on the tractor before trying to operate it. Regardless of previous experience as a tractor operator, carefully read this section before attempting to operate the tractor.

Starter Control Handle

Pulling the starter control handle *(Illust. 7)* completes the electrical circuit between the batteries and the cranking motor and causes the cranking motor pinion to engage the flywheel ring gear, thereby cranking the engine. Release the handle the moment the engine starts. CAUTION: Do not operate the cranking motor for more than 30 seconds at any one time. Allow the cranking motor to cool two or three minutes and repeat the cranking operation.

Choke Control Button

The choke control button *(Illust. 7)* is located in the right-hand portion of the dash, in the operator's compartment. The choke aids in starting the engine when it is cold. Pulling out the choke button 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 to where the engine runs without missing. As the engine warms up, push the choke button all the way in. Do not operate the engine with the choke button out after the engine is warmed up.



Illust. 7
Operating controls and instruments.

Charge Indicator

This instrument indicates if batteries are being charged by the generator. The charge indicator *(Illust. 7)* should show charge whenever the engine is operating at a speed faster than low idle speed. When the batteries receive a capacity charge, the pointer will return to zero. The voltage regulator changes the rate of charge from the generator, depending upon battery condition. If it indicates discharge continuously while the engine is operating at faster than low idle speed, the cause should be investigated to avoid completely discharging the batteries and possible damage to the generator.

Light Switch

The light switch *(Illust. 7)* has three positions: "Off," "Bright Head and Rear Light," and "Bright Head Light Only."

Fuel Oil Pressure Indicator

This indicator *(Illust. 62)*, located on the injection pump, registers the pressure of the fuel oil from the primary pump through the final fuel filter to the injection pump. With the engine operating (either gasoline or diesel cycle) the pointer of the indicator should be in the white area or "OPERATING RANGE" area. If the pointer remains in the red or "CHANGE FILTER" area, the auxiliary or final filter element needs replacement.

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. 7.* 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.

Heat Indicator

The heat indicator is located on the 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 in the "RUN" range.

Illust. 8
Heat indicator.

Compression Release Lever

This is a short lever located in the upper left corner of the dash. *See Illust. 7.* 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 (two or three 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 16.*

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. 7.* 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.

NOTE: For the 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 16.*

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. 7.* 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

The gearshift lever *(Illust. 7)* is the short lever extending at an angle from the gearshift housing in the operator's compartment. It is used to select the various gear ratios provided in the transmission. There are five forward speed positions and one reverse *(see Illust. 14)*.

Steering Clutch Hand Levers

The steering clutch levers *(Illust. 7)* are the two long levers located directly in front of the tractor seat (one on each side) of the transmission gearshift lever. Pulling back on the left lever disengages the left steering clutch, which cuts off the 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.

Steering Brake Pedals

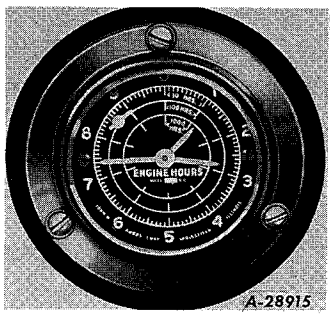
These are located (one on each side) of the operator's compartment, coming up through the platform. Normally, when pulling a load, the use of the steering clutch levers will turn the tractor. Steering brakes are used to make sharp pivot turns. To make a sharp turn, pull all the way back on the steering clutch lever and press down the steering brake pedal on the side toward which the turn is to be made. Never apply the brake pedal until the steering clutch is fully released. Do not use the brake unless it is necessary to make a sharp turn.

Steering Brake Locks

The locks are located underneath each steering brake pedal. *See Illust. 7.* 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.

Electric Engine Hour Meter (Special)

This electrically operated attachment, which is on the dash *(Illusts. 7 and 9)*, indicates the actual hours of engine operation, enabling the operator to determine, without guesswork, the specified lubricaion,oil change and inspection periods. It also provides a



Illust. 9
Electric engine hour meter (special).

means of computing specific job costs and of recording fuel and oil consumption. For the correct method of reading the meter, *see page 81.*

Radiator Shutter Control Crank (Special)

This control crank *(Illust. 7)* is used to open and close the radiator shutter, to control the engine temperature. Turn the crank counterclockwise to close the shutter.

Ignition Switch

This switch is a push-pull type ignition switch with two positions, "off" and "on." Pulling the button out is the "on" position and competes the ignition circuit.

Carburetor Fuel Adjustment Button

This button *(Illust. 7)* marked "P," located in the right hand portion of the dash, regulates the amount of gasoline passing through the adjustable fuel jet in the carburetor to facilitate cold weather starting. Turning this button to the left (counterclockwise) gradually opens the fuel jet to admit more fuel until the stop pin is reached. At this point, slightly past 1/2 turn, the fuel jet is fully open. To close the fuel jet, turn the button to the right (clockwise) from the stop pin until some resistance is felt. When the fuel jet is completely closed, the letter "P" on the button should be in an upright position.

NOTE: Do not use force on the button marked "P" to close the fuel jet, as this will cause undue wear on the jet valve and valve seat in the carburetor.

OPERATION

BEFORE STARTING A NEW TRACTOR

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

NOTE: Operate a new tractor with a light load the first 30 to 36 hours at the regular governed speed.

Lubrication

Refer to the "LUBRICATION GUIDE" on pages 24 and 25 and lubricate the entire tractor.

The lubricant in the crankcase, air cleaner and injection pump in diesel engines, when shipped from the factory to destinations in the United States, Canada and Mexico, can be used for the first 50 hours of operation. This oil should then be drained from the crankcase, air cleaner and injection pump, and replaced with the required amount of fresh oil having the physical properties and proper viscosity grade for the prevailing air temperature and type of service. Engines packed for export shipment have all oil drained from the crankcase, air cleaner and filter.

Check the oil levels of the engine crankcase, air cleaner, injection pump, transmission case, and sprocket drive gear cases to be sure that they are filled to the correct levels with the proper grades of oil for the prevailing temperature. Refer to specifications of lubricants *on page 22.*

Remove the spark plugs and put about one teaspoonful of crankcase oil into each cylinder. Replace the spark plugs and crank the engine by hand to distribute the oil over the cylinder walls. This assures positive lubrication of the cylinders and pistons immediately after starting and eliminates the possibility of scoring.

The lubrication procedure above is necessary only in starting a new tractor or one that has been idle for a long time. For procedure in starting a tractor that has been removed from storage *refer to page 73.*

All crawler tractors shipped from the factory between April 1st and October 1st are shipped with SAE-90 in the transmission and sprocket drive housings and SAE-140 in the track rollers and idlers. All crawler tractors shipped from the factory between October 1st and April 1st are shipped with SAE-80 in the transmission and sprocket drive housings, and SAE-90 in the track rollers and idlers.

Cooling System

Check to see that the drain valve on the lower left side of the radiator *(Illust. 12A)* is closed and that the drain valve on the left side of the crankcase is also closed *(refer to Illust. 12)*. Remove the vent plug in the thermostat housing. Fill the cooling system with clean water (soft or rain water if possible). When water appears from the vent, replace the plug and fill to a level approximately 1-1/4 inches below the bottom of the radiator filler neck.

NOTE: In normal temperatures (above 32°F.) the engine should not be started until the cooling system has been filled with water.

If the tractor is to be used in freezing temperatures, refer to "OPERATING IN COLD WEATHER" on pages 17 and 18.

Check the tension of the fan and generator belts. *See Illust. 43.* If the tension is not correct, adjust *as outlined on page 43.*

For further information, refer to "COOLING SYSTEM" on pages 42 to 44.

Fuel System

Check to see that you have an adequate supply of fuel in both the gasoline and diesel fuel tanks; also that the fuel tank shut-off valves are open. *Refer to Illusts. 11 and 11B.* Be sure all fuel used is of dependable quality, clean and free from water. For further information, refer to "FUEL SYSTEM" on pages 59 to 66.

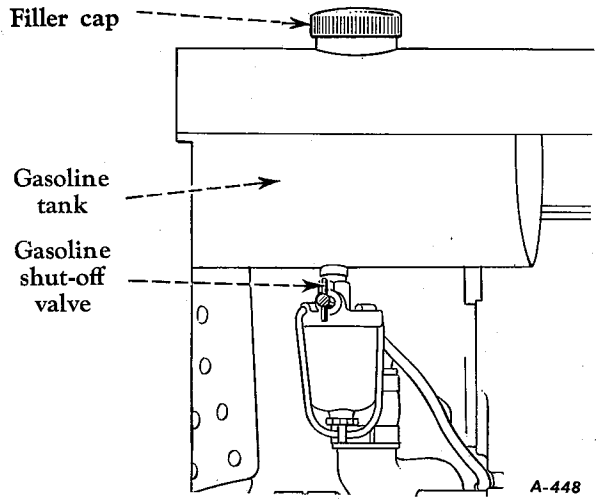
Electrical System

Be sure the battery cable terminal is clean and bright, then connect the braided ground strap to the battery. Connect the generator field cable to the "F" terminal on the generator. Correctly polarize the generator to the battery by placing a jumper lead momentarily across the "BAT" terminal of the regulator and the "A" terminal of the generator. Check to see that all electrical terminals are clean and securely fastened.

Check the level and specific gravity of the electrolyte in the batteries *(refer to pages 56 and 57)*. Batteries shipped dry should be serviced as specified on the instruction tag attached to the battery.

Check to see that the distributor is securely mounted in place and was not damaged or cracked in shipment. Check the spark plug cables to make sure they are securely connected in the distributor cap and to each spark plug.

PREPARING THE TRACTOR FOR EACH DAY'S WORK



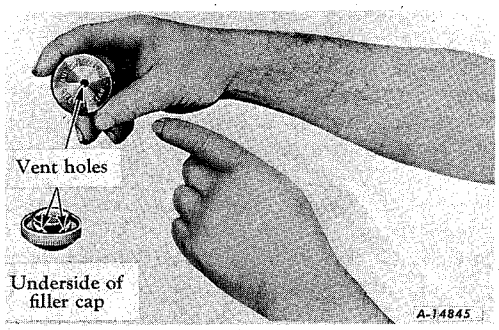
Illust. 11
Gasoline tank and shut-off valve.

Fuel System

Fill the gasoline tank with a good grade of clean gasoline (capacity is approximately 2/3 U. S. gallon). *See Illust. 11.* Be sure the gasoline shut-off valve is open.

SAFETY FIRST: Never fill the gasoline tank when near an open flame or when the engine is operating. When pouring in the gasoline keep the funnel and container in contact with the metal of the gasoline tank to avoid the possibility of an electric spark igniting the gas. Never light matches near gasoline as the air within several feet is permeated with a highly explosive vapor.

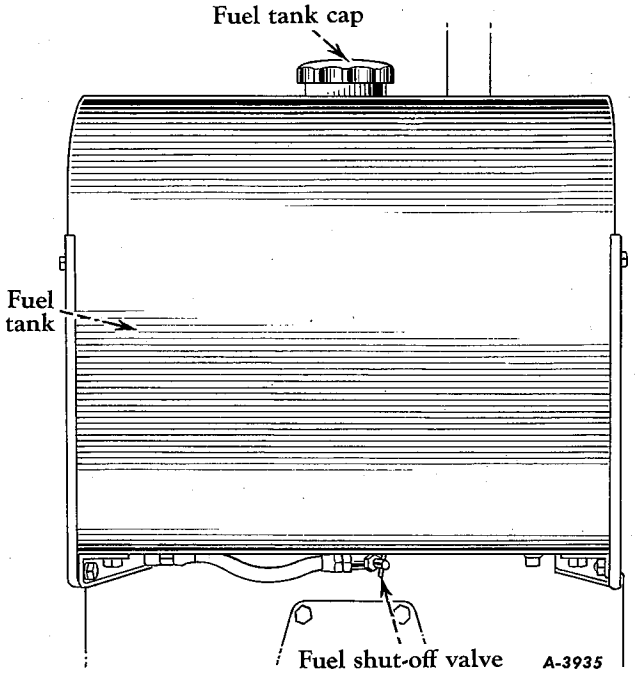
Check the fuel in the diesel fuel tank (capacity 31 gallons U. S.) and if necessary add fuel *(Illust. 11B)*. For correct fuel specifications *refer to page 6.*



Illust. 11A
Vent holes in gasoline tank cap.

See that the vent holes in the fuel and gasoline tank filler cap *(Illust. 11A)* are kept open at all times to assure proper flow of the fuel.

Lift the bottom seat cushion and make sure the fuel shut-off valve is in the open position *(Illust. 11B)*.



Illust. 11B
Diesel fuel tank and shut-off valve.

Carefully strain the gasoline and the diesel fuel to be sure they are free from foreign substances. Do not use dirty fuel.

Fill the main fuel tank immediately after operating the tractor or at the end of the day's work. Never allow the fuel to get lower than two inches above the bottom of the fuel tank.

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

Cooling System

Be sure that the radiator drain valve on the lower left side of the radiator *(Illust. 12A)* and the crankcase water drain valve on the left side of the crankcase *(Illust. 12)* are closed.

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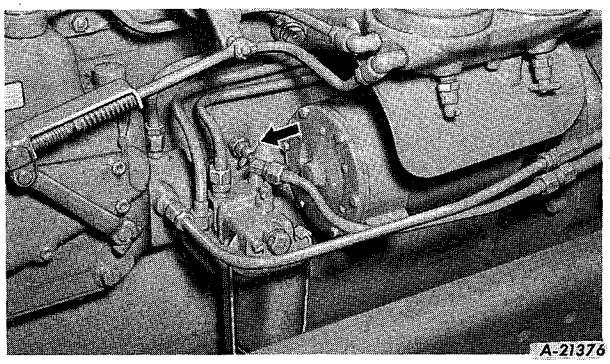
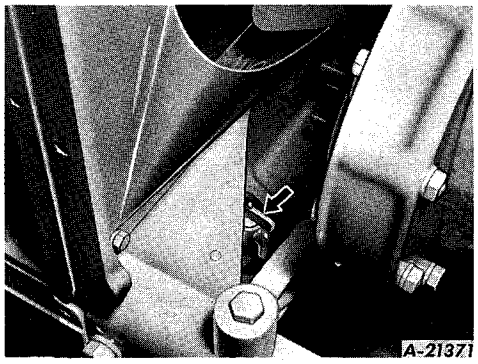


Illust. 12
Crankcase water drain valve



Illust. 12A
Radiator drain valve.

Remove the radiator cap and check to see that the water is up to a level about 1-1/4 inches below the bottom of the filler neck. Filling the cooling system to this level will allow for expansion of the water under normal operating conditions. Replace the radiator cap. For further information, refer to "COOLING SYSTEM" on pages 42 to 44.

Lubrication

Check for any leakage from the lubricant compartments. Be sure the oil in the crankcase is up to the full level mark on the gauge. For complete lubrication requirements, refer to the "LUBRICATION GUIDE" on pages 24 and 25.

OPERATING PRECAUTIONS

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.

Never operate the cranking motor more than 30 seconds at a time; allow the cranking motor to cool two or three minutes and repeat the starting operations.

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, replace them in the engine, then start the engine in the usual manner.

CAUTION: When cranking the engine by hand, the operator should 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. Crank the engine by using quick upstrokes; do not spin it.

Illust. 12B
Oil pressure indicator.

Immediately after the engine starts, check the oil pressure indicator *(Illust. 12B)* to see if it is registering pressure. If it is not, stop the engine and inspect the oil system to find the cause of failure. If you are unable to find the cause, consult your International Industrial Power distributor or dealer before operating the engine.

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

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

When putting the tractor in motion, always engage the engine clutch gradually so the engine will start the tractor without jerking. This is particularly necessary when going up a steep hill, climbing out of a ditch, or if the tractor is hitched to a heavy load.

Do not apply the steering brake until the steering clutch is fully released (pulled all the way back), or excessive heating and rapid wear of the steering brakes will result.

When pulling a load, it is not necessary to use the steering brakes except to make sharp turns; the load itself acts as a brake. Do not

use the brakes unless it is necessary to do so in order to make the required turn.

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

Improper use of the steering brakes when making turns will cause the tractor to jerk. Try to avoid this by using the steering clutch 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.

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

Always completely disengage the engine clutch when shifting gears. Disengage the engine clutch by pushing the engine clutch lever all the way forward. Pushing the clutch lever forward not only disengages the clutch but it also applies the clutch brake. Hold the clutch lever forward and carefully move the gearshift lever to the speed desired.

If the tractor is equipped with a power take-off, stop the power take-off before dismounting from the tractor.

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 slowly pouring the water into the radiator.

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

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 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 the 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

1. Open the shut-off valves underneath the gasoline and diesel fuel tanks. *See Illusts. 11 and 11B.* To prevent leakage and seepage from the 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 the neutral position and disengage the engine clutch by pushing the clutch lever all the way forward *(Illust. 15)*.

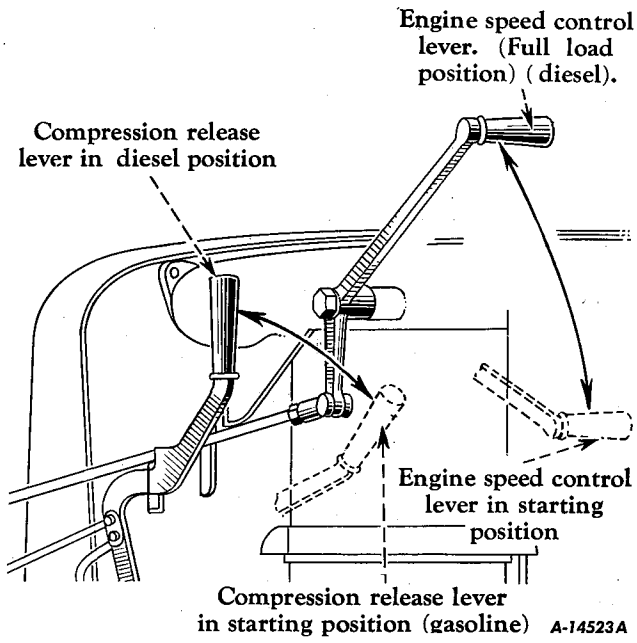
3. Pull the compression release lever down into the starting position (gasoline) *(Illust. 13)*. Be sure that the lever is in the latched position.

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

5. Pull the choke control button out part way. (In cold weather, open fuel adjustment rod button counterclockwise to stop pin, approximately 1/2 turn left. Pull the choke button out all the way.)

6. Pull the ignition switch button out to the "on" position.

Continued on next page



Illust. 13
Engine controls.

7. Pull out the starter control handle.
NOTE: Do not operate the cranking motor more than 30 seconds at a time because it will overheat and may burn out. Allow the cranking motor to cool for a few minutes and repeat the operation.

8. 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 control button all the way in. (In cold weather, adjust the fuel adjustment rod button to keep the engine running at maximum speed.)

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.

Starting the Engine (Hand Cranking)

1 to 6. Follow the regular procedure as outlined in the preceding steps 1 to 6 for "Starting the Engine."

7. 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. Do not "spin" the crank.

8. As soon as the engine starts, regulate the choke control button until the engine runs smoothly. As the engine warms up, open the choke all the way.

Check the oil pressure indicator to see if it is registering pressure. If not, stop the engine immediately and determine the cause of oil pressure failure.

NOTE: If trouble is experienced in starting the engine, refer to "OPERATING PRECAUTIONS" on pages 12 and 13; also refer to "OPERATING IN COLD WEATHER" on pages 17 and 18, and "CHECKING MECHANICAL PROBLEMS" on pages 32 to 41.

Changing the Engine to Diesel Operation

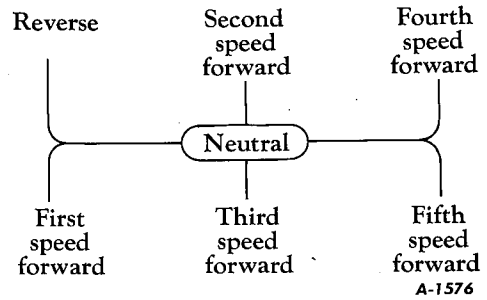
1. Allow the engine to operate on gasoline for about one minute (two or three minutes in cold weather) before switching over to diesel operation.

2. Move the compression release lever all the way up into the diesel position, then after a short pause to allow for combustion of the gasoline remaining in the cylinders, move the engine speed control lever upward enough to prevent the engine from stalling *(Illust. 13)*.

3. The engine will now run as a diesel unit, unless there is air in the fuel injection system. To vent air from the system, *refer to page 59*.

4. The engine may start noisily when diesel operation begins, but the noise will decrease as the engine warms up.

NOTE: The carburetor and distributor are cut out and the auxiliary combustion chamber is closed, isolating the spark plugs, when the compression release lever is put in the diesel position.



Illust. 14
Transmission gearshift positions.

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 operating controls and instruments. For description of the controls and instruments, *refer to pages 7 to 9*.

Starting to Drive

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

2. Disengage the engine clutch by pushing the clutch lever all the way forward.

3. Move the transmission gearshift lever to the desired speed position *(Illust. 14)*.

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. Pull back firmly on the clutch lever to

lock the clutch in its engage position. At the same time, advance the engine speed control lever.

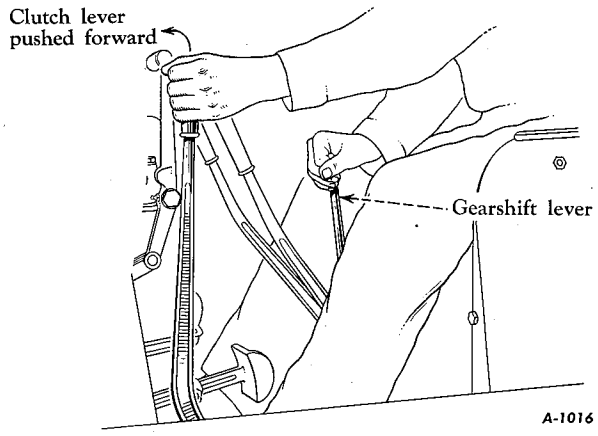
NOTE: When starting the tractor, always engage the engine clutch gradually so the engine will pick up the load slowly. This is particularly necessary when the tractor is going up a steep hill, climbing out of ditches, or when it is hitched to a heavy or difficult load. When using a long chain to hitch the tractor to the load, drive the tractor forward slowly until all the slack is taken out of the chain.

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

Shifting Gears

Always completely disengage the engine clutch when shifting gears. To disengage the engine clutch, push the engine clutch 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 engine clutch lever and at the same time move the transmission gearshift lever to the correct position for the speed desired *(Illusts. 14 and 15)*.

The clutch brake 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 engine clutch 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 permits faster shifting. No adjustment of the clutch brake is necessary.



Illust. 15
Disengaging engine clutch to shift gears.

Regulating the Engine Speed

The engine speed control lever enables you to adjust the speed of the engine to the load that is to be handled. After you have selected the desired engine speed, the governor will automatically maintain this engine speed under variable loads. Retarding the engine speed control lever will decrease the load which the tractor can handle.

The rated or maximum full-load speed is 1400 ± 10 r.p.m.; high idle speed is 1555 ± 30 r.p.m.; low operating speed is 900 r.p.m.; and low idle speed is 500 ± 50 r.p.m.

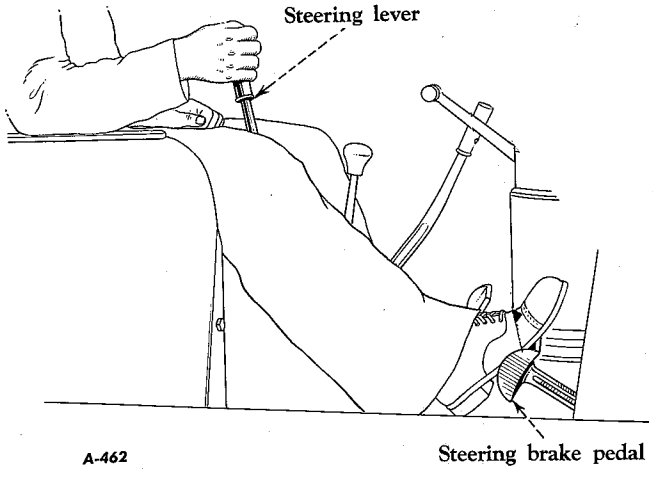
Steering the Tractor

The direction of travel is controlled by the two steering clutch levers. *See Illust. 15A.*

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

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 all the way on the right steering clutch lever and then push down on the right steering brake pedal.

If pulling all the way 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.



Illust. 15A
Turning the tractor to the right.

Steering Downgrade

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

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

Operating Over an Obstruction

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

Stopping the Tractor

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

Steering Brake Locks

Each steering brake pedal has a locking lever device. To lock either brake, push the steering brake pedal down and lift up the steering brake pedal lock *(Illust. 7)*. This engages the pawl in the ratchet and locks the brake pedal.

Do not use the brake pedals as foot rests; this causes undue wear on the brake parts.

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.

CAUTION: 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. Reduce engine speed to low idle for a short period of time.

2. Change to gasoline cycle by placing the engine speed control lever in the starting (diesel shut-off) position, and at the same time, move the compression release lever (down) all the way to the gasoline starting position.

3. Allow the engine to operate on the gasoline cycle until the exhaust is clear; then stop the engine by placing the compression release lever in the diesel operating position (do not move the engine speed control lever). See Note 1.

4. After the engine stops, leave the compression release lever in the diesel position to permit the starting valves to cool on their seats to prevent warping. See Note 1.

5. Turn off the ignition switch. See Note 2.

6. Close the gasoline shut-off valve. See Note 2.

CAUTION: Starting valves are subject to warpage if the operator does not follow the above procedures when stopping the engine.

NOTE 1: The reasons for using the compression release lever to stop the engine instead of shutting off the ignition switch are to retain enough gasoline in the fuel filter bowl to facilitate the next starting, and also to take the precaution that the compression release lever will be in the right position to allow the starting valves to cool on their seats after the engine stops.

NOTE 2: Steps 5 and 6 are recommended when the engine is to remain idle for a long period, or as a precaution when the operator leaves the tractor unattended.

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.

Attach a towing cable to the front of the tractor or, in an emergency, to the drawbar.

Be sure that the brake locks are released before towing the tractor.

Use the steering clutch levers to assist in steering the towed tractor.

Never tow the tractor with the engine clutch engaged, or when the tracks are damaged.

NOTE: Do not attempt to start the engine by towing the tractor.

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

Refer to the instructions in "Starting the Engine" on page 13, for starting the engine in cold weather.

Fuel System

Use only a high test, winter grade gasoline for starting. Keep the supply in a closed container so the more volatile portion does not evaporate.

Fill the gasoline and diesel fuel tanks at the end of the day's run to prevent moisture from collecting in the tanks.

Lubrication

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.

If the tractor is equipped with a radiator shutter and a heat indicator, close the shutter when starting; then regulate it, as required, to hold the needle of the heat indicator in the "RUN" range.

To drain the cooling system, open the radiator drain valve on the lower left side of the radiator *(Illust. 12A)* and open the water drain valve in the left side of the crankcase *(Illust. 12)*. Be sure that the drain valves are not clogged and that the water drains out completely.

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: Even though the engine is started before the water is added, NEVER run the engine more than a few seconds without water or antifreeze solution. If the engine needs coolant, carry the water to the tractor; do not drive the tractor to the source of the water. Operating a cold engine without coolant will cause cylinder head failure and overheat the piston rings.

Antifreeze Solutions

Before filling the cooling system with antifreeze, drain and clean the system. Refill and check the radiator, water pump, and all gaskets and hose connections, for leaks. If any are found, make repairs before filling the system.

The following table shows the amount of antifreeze required for various temperatures (the capacity of the cooling system is approximately 13 U. S. gallons).

Freezing Point (Fahrenheit)	Quarts of Antifreeze Required		
	Ethylene Glycol	Distilled Glycerine	Denatured Alcohol
10°	13	17	16
0°	18	21	20
-10°	21	25	23
-20°	24	28	26
-30°	26	31	30
-40°	28	. . .	34
-50°	30	. . .	37
-60°	32	. . .	40
-70°	33	. . .	. . .

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 attachment is recommended. Check the solution frequently to be sure that the cooling system is adequately protected against freezing.

Batteries

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.

Spark Plugs

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

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; if the tracks do not break free, pry them loose. If necessary, use a blow torch, being careful about fire hazards. To prevent the tractor from freezing to the ground, park the tractor on planks.

Operating in Water or Snow

When operating the tractor in deep water or thawing snow, lubricate the track rollers every five hours. This will flush out any water that may have been forced past the seals 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 sprocket drive 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 is very likely to enter through the holes in the engine clutch and the steering clutch compartments *(refer to items 10 and 11 in the Lubrication Guide)*. To prevent this, put in solid pipe plugs that have no holes. Every 60 hours of operation remove the plugs to allow any oil accumulation to drain out.

OPERATING IN HOT WEATHER

Lubrication

Follow closely the lubrication instructions as outlined in the "LUBRICATION GUIDE" on pages 24 and 25.

Fuel System

Keep the gasoline and 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

Inspect and check the batteries frequently to see that the water is at the correct level and that the specific gravity is correct. *Refer to pages 56 and 57.*

Cooling System

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

Check the tension of the fan belt frequently.

Check the coolant level frequently, and be sure the radiator filler cap is on tight.

Clean and flush the internal parts of the cooling system frequently.

Keep the external parts of the radiator clean of bugs and dirt.

PREVENTIVE MAINTENANCE

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

Preventive maintenance inspections should be performed at the intervals given and as outlined in "Periodic Inspections" below, and on the following page. The prompt detection and correction of minor irregularities will help keep the tractor operating at peak efficiency at all times.

PERIODIC INSPECTIONS

To assure mechanical efficiency, the tractor should be systematically inspected at the intervals outlined below:

Point of Inspection	Remarks
After Every 10 Hours of Operation	
Diesel fuel water trap	Drain off water and sediment. *Refer to pages 59 and 60.*
Lubrication points	Refer to "LUBRICATION GUIDE."
After Every 60 Hours of Operation	
Fan belt	Check tension; replace when necessary. *Refer to page 43.*
Radiator and connections	Inspect for leaks and loose connections; if anti-freeze is used, check its value. *Refer to page 17.*
Radiator core	Clean spaces. *Refer to page 43.*
Flexible rubber connections between air cleaner and intake pipe	Inspect for loose fit or damage.
Engine clutch and steering clutch housing drain plugs	Remove plugs and drain oil accumulation. Refer to "LUBRICATION GUIDE."
Tracks	Check slack. *Refer to pages 70 and 71.*
Battery liquid	Check amount and specific gravity. *Refer to pages 56 and 57..*
Battery terminals	Clean. *Refer to page 56.*
Lubrication points	Refer to "LUBRICATION GUIDE."
After Every 120 Hours of Operation	
Air cleaner tray assembly	Remove and clean. *Refer to page 45.*
Lubrication points	Refer to "LUBRICATION GUIDE."
After Every 240 Hours of Operation	
Engine crankcase	Drain and change oil. Refer to "LUBRICATION GUIDE."
Crankcase breather	Remove and clean; replace element if necessary.

Continued on next page

Point of Inspection	Remarks
After Every 240 Hours of Operation - Continued	
Gasoline strainer and sediment bowl	Take apart and clean. *Refer to pages 58 and 59.*
Spark plugs	Remove and clean; check gap. *Refer to page 51.*
Distributor breaker points and chamber	Clean chamber and check gap. *Refer to page 48.*
After Every 480 Hours of Operation	
Diesel fuel water trap	Remove and clean. *Refer to pages 59 and 60.*
Gasoline fuel line strainer (at carburetor)	Remove and clean. *Refer to page 58.*
Cooling system	Clean. *Refer to page 42.*
Engine valves	Check clearance. *Refer to page 47.*
Steering clutch levers	Check for free movement at handles. *Refer to page 68.*
Steering brake pedals	Check for free movement at pedal pads. *Refer to page 68.*
Lubricating oil filter	Replace filter element. *Refer to pages 46 and 47.*
Lubrication points	Refer to "LUBRICATION GUIDE."
Lubricating oil filter retaining bolt metering hole	Clean.
After Every 960 Hours of Operation	
Air cleaner, complete	Remove and clean. *Refer to pages 45 and 46.*
Generator commutator	Clean. *Refer to page 53.*
Cranking motor commutator	Clean. *Refer to page 53.*
Lubrication points	Refer to "LUBRICATION GUIDE."
Periodic	
Auxiliary and final fuel filters	Replace elements if necessary. *Refer to detailed instructions on pages 62 and 63.*
Primary pump filter screen	Remove screen and clean. *Refer to page 63.*
Carburetor and linkage	Check carburetor for secure mounting and leaks; check linkage for operation, and lubricate according to the "LUBRICATION GUIDE."
Wiring	Check for worn, cracked, or frayed insulation, broken wires, loose or corroded connections.
Engine clutch	Check to see that clutch holds securely and does not drag. Refer to pages 66 and 67.

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 pages 24 and 25 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 preventive maintenance service for your tractor.

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.

The oil in the tractor engine is kept clean in three ways: first, by effective sealing; second, by the floating type oil pump screen; third, by the filter through which the oil circulates under pressure.

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 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 frequently when operating under unusual dust or dirt conditions. If necessary, replace with a new breather element.

Oil Filter

Under normal operating conditions, the oil filter keeps the oil free from harmful contamination for 240 hours of operation, at which time the crankcase oil should be changed.

The filter element should be replaced after every 480 hours of operation. 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 operation 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 the "LUBRICATION GUIDE" on pages 24 and 25.

Oil Pressure Indicator

The oil pressure indicator *(Illust. 12B)* 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 you are 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.

Crankcase Oil Level Gauge

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

To check the oil level with the 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.

Continued on next page

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.

CAUTION: Before checking the crankcase oil level with the engine running, loosen the oil filler cap to vent the crankcase, thus providing a balanced pressure when checking the oil level.

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 pressure-gun or lubricator is applied.

Lubricant Specifications

MOTOR OIL

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

Heavy duty is the term used for motor oil possessing oxidation stabilizing, anti-corrosive and anti-sludging properties necessary to make it generally suitable for high speed diesel engines. This is additive type oil. The term heavy duty as used here does not pertain to the viscosity rating or "weight" of the oil.

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-L-2104A 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-L-2104A 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 available, in most areas in the U. S. A., crankcase oils 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-L-2104A 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 of 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, also for the track rollers and idlers, should be a good quality mineral oil free from solid materials, in various grades for different air temperatures. Lubricants of high quality and recognized manufacture are recommended for the protection of your tractor.

CHASSIS LUBRICANT

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

Engine Lubrication

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.

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 pages 24 and 25. For example: SAE-20 can be used instead of SAE-10W if no starting trouble is experienced; or SAE-10W can be used in temperatures as high as 50°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 pump of a diesel engine, when shipped from the factory, can be used for the first 50 hours of operation. This oil should then be drained from the crankcase, air cleaner and injection pump, and replaced with the required amount of fresh oil having the physical properties and proper viscosity grade for the prevailing air temperature and type of service.

When the tractors are packed for export all the oil is drained from the lubricant compartments. Before starting, give complete lubrication service. Refer to "LUBRICATION GUIDE" on the following pages.

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 refer to "Oil Filter" 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 five to ten 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 pages 24 and 25, 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.

LUBRICATION GUIDE

KEY

MO (Motor Oil)—According to anticipated air temperature. Oils which qualify under military specification Mil-L-2104A 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 (Magneto grease)—All temperatures.

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.
Crankcase	MO	11 quarts	*SAE-30	SAE-30	SAE-20	Blend 10 qts. SAE-10W and 1 qt. Kerosene	Blend 9 qts. SAE-10W and 2 qts. Kerosene
Air cleaner	MO	3¾ pints	*SAE-30	SAE-30	SAE-20	SAE-10W	SAE-10W
Fuel injection pump	MO	½ pint	*SAE-30	SAE-30	SAE-20	SAE-10W	SAE-10W
Generator	MO		SAE-20	SAE-20	SAE-20	SAE-20	SAE-10W
			Above +50°F.		+50°F. to +20°F.		+20°F. to −10°F.
Transmission	UGL	22 quarts	SAE-90		SAE-90		SAE-80
Sprocket drive housing	UGL	3 pints	*SAE-140		SAE-90		SAE-80
Track roller	UGL	½ pint	*SAE-140		SAE-90		SAE-80
Track idler	UGL	2 pints	*SAE-140		SAE-90		SAE-80
Front idler	UGL	½ pint	*SAE-140		SAE-90		SAE-80

*NOTE—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.

Lubrication Point Illustrations

For convenience in finding lubrication points, each item on this guide is individually illustrated on the pages following. Note "item numbers" along sides of guide.

Always use clean containers. Keep lubricators clean. Wipe dirt from fittings before applying lubricators.

Recommended Intervals of Time for Lubrication Service

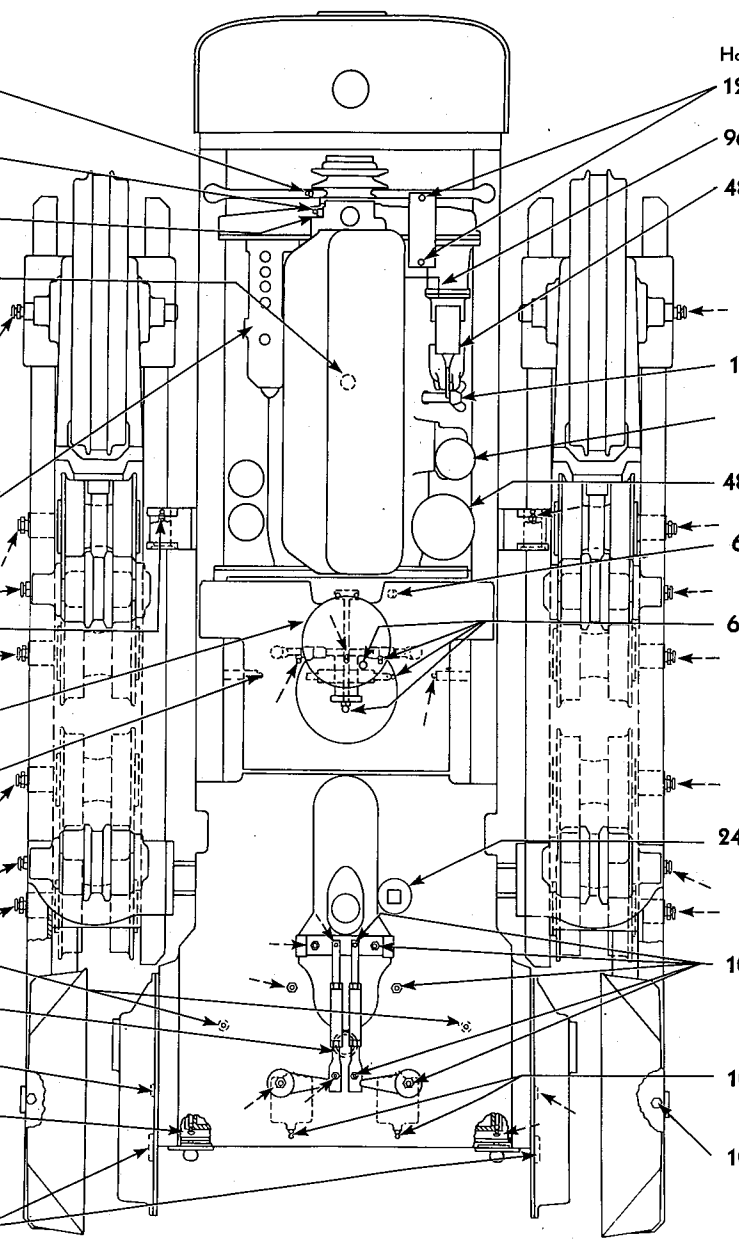
10 hours of operation or daily service
60 hours of operation or weekly service
120 hours of operation or bi-weekly service
240 hours of operation or monthly service
480 hours of operation or bi-monthly service
960 hours of operation or seasonal service

Note — Intervals of time between lubrication services are based on average operating conditions. Under unusually severe conditions of operation reduce the interval of time between services.

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

Occasionally apply a few drops of motor oil to the engine speed control, compression release, and other engine control linkage.

A-30462A

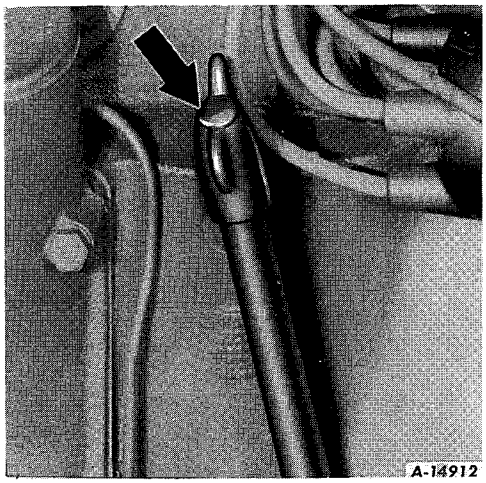


Item No.	Point of Lubrication	Lubricant	Hours
12	Front Engine Support	CL	60
5	Water Pump Shaft	CL	10
13	Fan Hub Bearing	CL	60
22	Crankcase Oil Drain Plug		240
16	Front Idlers	UGL	120
3	FUEL INJECTION PUMP		
	Oil Filler	MO	
	Oil Level Valve		10
20	Oil Drain Plug		240
6	Track Frame Guide Rollers	CL	10
4	Air Cleaner	MO	10
24	Steering Brake Pedal Shaft	CL	240
19	Track Rollers	UGL	120
18	Track Idlers	UGL	120
11	Steering Clutch Compartment Drain Plugs		60
27	Transmission Drain Plug		960
28	Sprocket Drive Drain Plugs		960
15	Steering Clutch Pilot Bearings	CL	60
23	Sprocket Drive Level and Filler Plugs	UGL	240

Hours	Lubricant	Point of Lubrication	Item No.
120	MO	Generator	17
960	MG	Ignition Cut-Out Switch	29
480	CL	Distributor Lubrication Fittings	25
		Magneto (Tractors so equipped) For lubrication instructions, refer to "Magneto" in the Special Attachments.	
10		Crankcase Oil Level Gauge	1
	MO	Crankcase Oil Filler	2
480		Lubricating Oil Filter	26
60		Engine Clutch Compartment Drain Plug	10
60		Engine Clutch Lubrication Points.	14
	CL	A—Engine Clutch Camshaft Bearings	
	CL	B—Engine Clutch Release Sleeve	
	HT	C—Engine Clutch Release Bearing	
	HT	D—Engine Clutch Pilot Bearing	
240	UGL	Transmission Oil Level Gauge and Filler	21
10	CL	Steering Clutch Lubrication Points	7
10	CL	Track Frame Diagonal Braces	9
10	CL	Track Frame Pivots	8

B-7192A

Service After Every 10 Hours of Operation



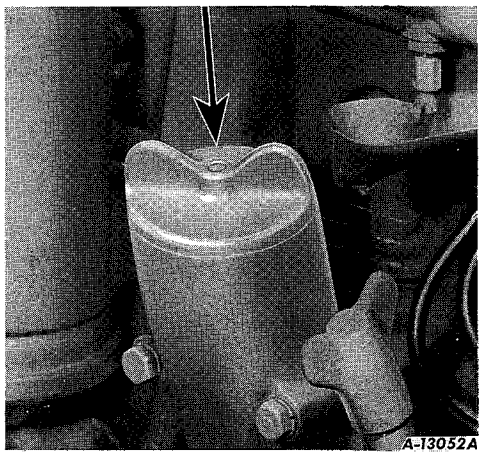
Item 1 - Crankcase oil level gauge.

This gauge has readings on both sides, showing the crankcase oil level when the engine is operating and when stopped. Be sure to use the correct side. For 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.

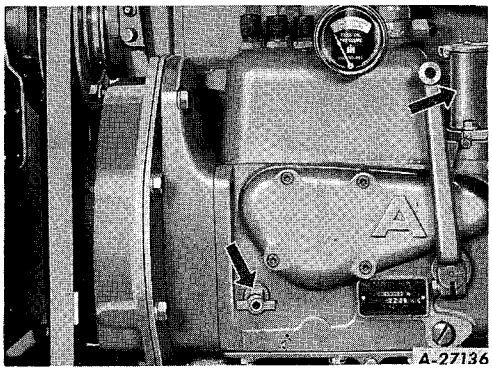
2. Insert the gauge until the wing nut rests on the top of the gauge sleeve threads. Do not screw the nut onto the sleeve.

3. Remove the gauge and check the oil level.



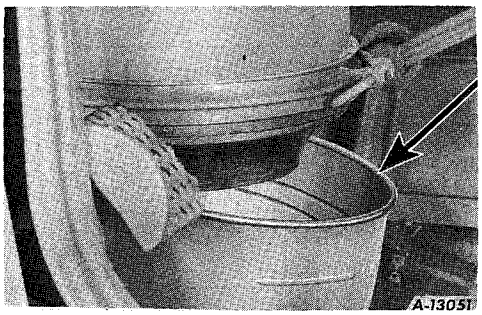
Item 2 - Crankcase oil filler.

Unscrew the cap. Fill the crankcase to the "FULL" mark on the crankcase oil level gauge.



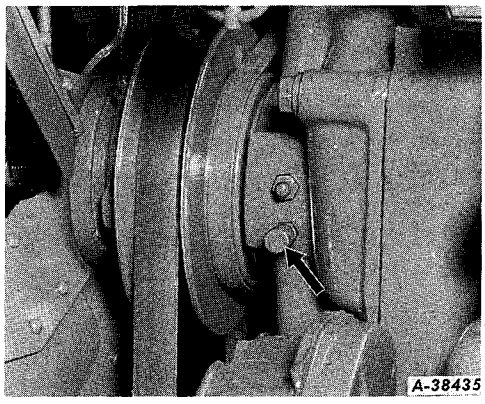
Item 3 - Fuel injection pump.

Check the oil level by opening the oil level valve. If oil does not appear, add oil through the filler to bring the oil level to the opening of the valve.



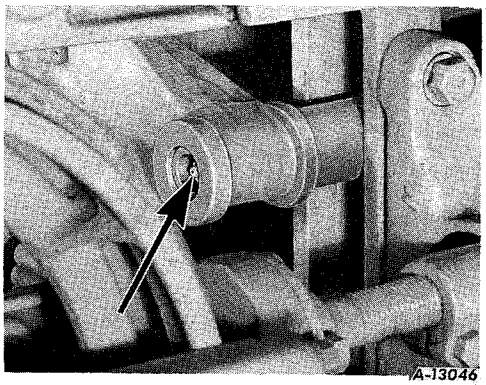
Item 4 - Air cleaner.

Clean the oil cup and refill it to the oil level bead.



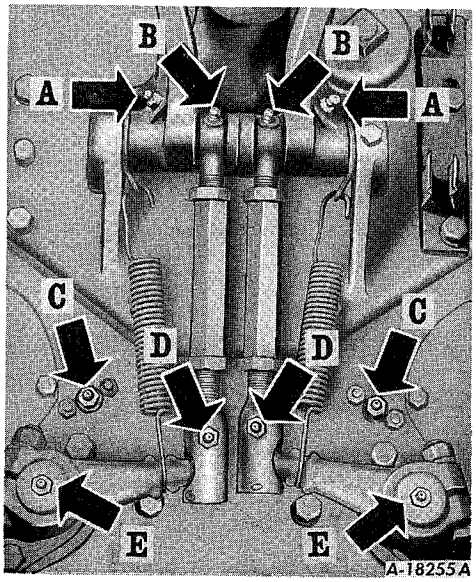
Item 5 - Water pump shaft.

Remove the cap. Use the hand lubricator sparingly. Overlubrication will force the lubricant into the cooling system, which may cause clogging. At temperatures of 10°F. or lower, use military specification grease Mil-G-10924 ammendment No. 2, GAA-2 is recommended.



Item 6 - Track frame guide rollers.

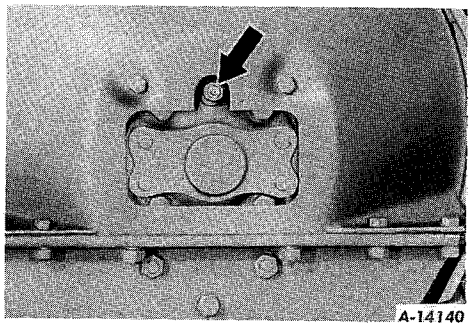
(One on each side.) Apply two or three strokes of the hand lubricator, or sufficient lubricant to force the old grease and dirt out of each fitting.



Item 7 - Steering clutch lubrication points.

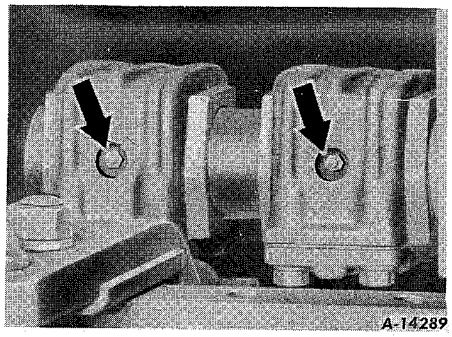
Apply two or three strokes of the hand lubricator or sufficient lubricant to force the old grease and dirt out of each fitting.

A - Steering clutch levers.
B - Steering clutch turnbuckle eyes.
*C - Steering clutch release bearings.
*D - Steering clutch turnbuckle sockets.
*E - Steering clutch release shaft bushings.
*NOTE: Remove the seat and tool box to reach these fittings.



Item 8 - Track frame pivots.

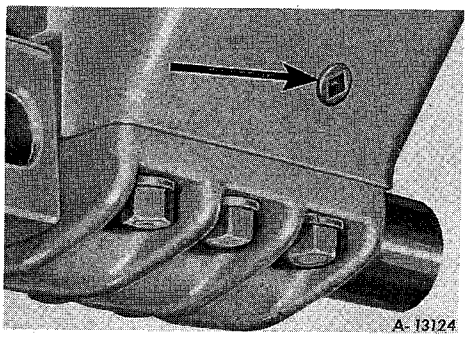
(One on each side.) Apply two or three strokes of the hand lubricator or sufficient lubricant to force the old grease and dirt out of each fitting.



Item 9 - Track frame diagonal braces.

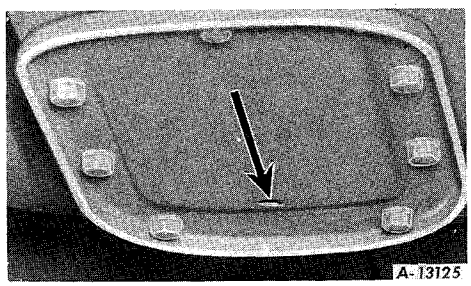
Apply two or three strokes of the hand lubricator to each fitting.

Service After Every 60 Hours of Operation



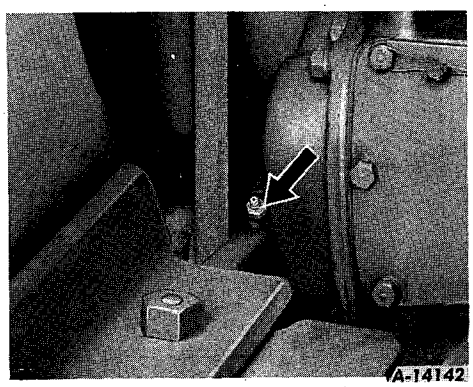
Item 10 - Engine clutch compartment drain plug.

When operating where water is likely to enter the drain hole, a solid plug should be installed. If so equipped, the solid plug should be removed to drain the compartment of any excess lubricant.



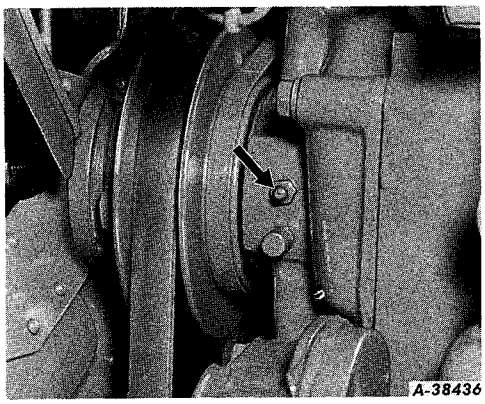
Item 11 - Steering clutch compartment drain plugs.

(One on each side.) When operating where water is likely to enter the drain holes, solid plugs should be installed. If so equipped, the solid plugs should be removed to drain the compartments of any excess lubricant.



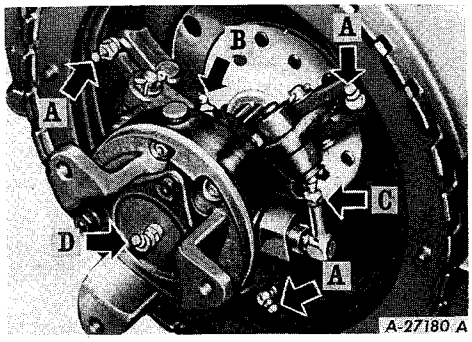
Item 12 - Front engine support.

Apply two or three strokes of the hand lubricator or sufficient lubricant to force out the old grease and dirt.



Item 13 - Fan hub bearing.

Apply one or two strokes of the hand lubricator. If the lubricant comes out of the fan hub while using the lubricator, stop the application.



Item 14 - Engine clutch lubrication points.

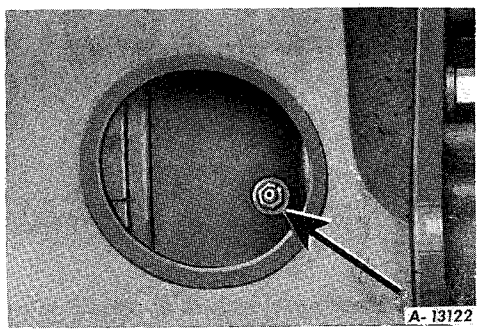
Remove the round plate on the clutch compartment cover. Use the hand lubricator on the fittings as follows:

A. Engine clutch camshaft bearings.
Crank the engine to reach each fitting and apply one or two strokes of the lubricator.

B. Engine clutch release sleeve.
Apply three or four strokes of the lubricator.

C. Engine clutch release bearing.
Apply three or four strokes of the lubricator.

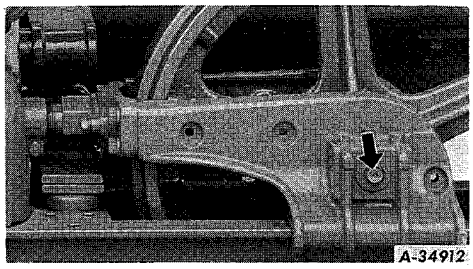
D. Engine clutch pilot bearing.
Apply five or six strokes of the lubricator.



Item 15 - Steering clutch pilot bearings.

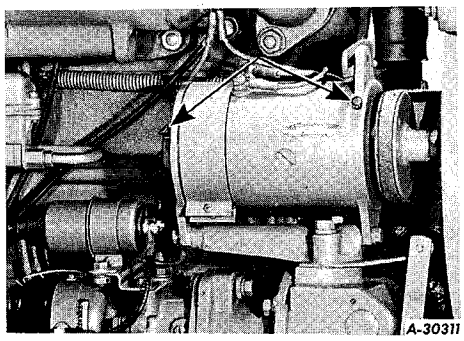
To reach the lubrication fittings, remove the two round plates at the rear of the main frame (one on each side). Move the tractor as necessary to line up the fittings with the access holes. Apply 10 to 20 strokes of the hand lubricator to each fitting. Never use a fluid lubricant as it may get on the clutch facings.

Service After Every 120 Hours of Operation



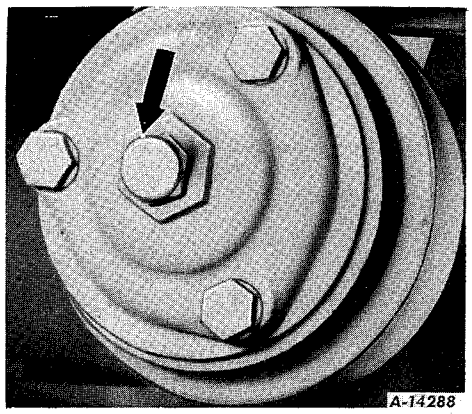
Item 16 - Front idlers.

(One on each side.) Use the tank lubricator. Add lubricant until resistance is felt on the lever. Lubricate more frequently if the seals are worn or when the tractor is being operated in water or under excessively dusty conditions.



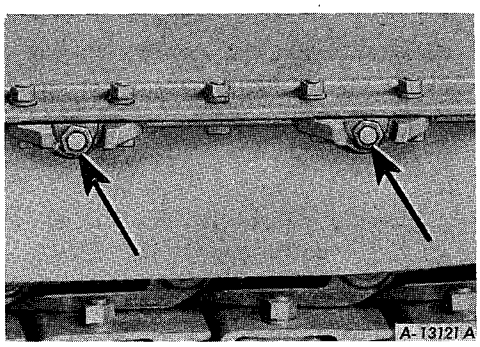
Item 17 - Generator.

Apply eight to ten drops of oil to each oil cup.



Item 18 - Track idlers.

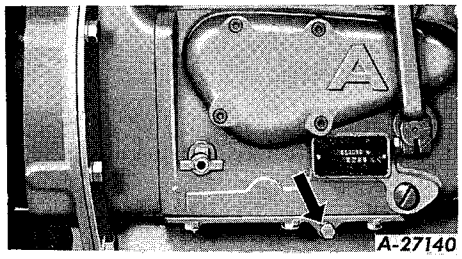
(Two on each side.) Use the tank lubricator. Add lubricant until resistance is felt on the lever. Lubricate more frequently if the seals are worn or when the tractor is being operated in water or under excessively dusty conditions.



Item 19 - Track rollers.

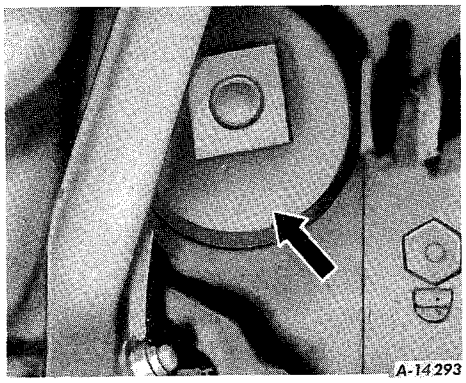
(Four on each side.) Use the tank lubricator. Add lubricant until resistance is felt on the lever. Lubricate more frequently if the seals are worn or when the tractor is being operated in water or under excessively dusty conditions.

Service After Every 240 Hours of Operation



Item 20 - Fuel injection pump oil drain plug.

Remove the drain plug and drain the pump each time the crankcase oil is changed. Refill at filler until oil appears at level valve.



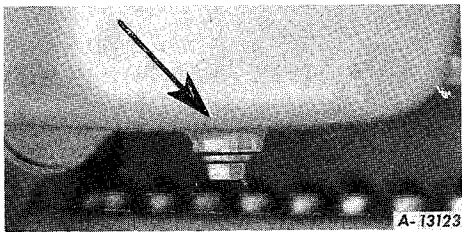
Item 21 - Transmission oil level gauge and filler.

It is advisable to check the oil level after the tractor has stood idle for several hours. To check the oil level:

1. Unscrew and remove the gauge and wipe it clean.

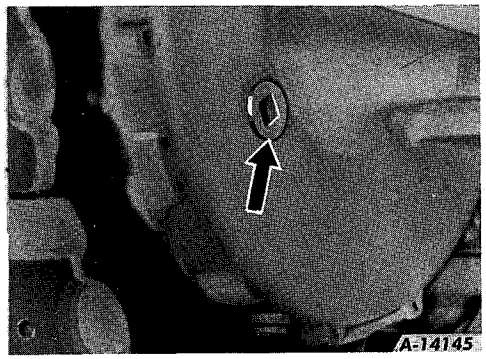
2. Insert the gauge until the bottom of the plug rests on the top of the threaded ring in the transmission case. Do not screw the plug into the threads.

3. Remove the gauge and check the oil level. If necessary, add oil to bring the oil level to the "FULL" mark on the gauge.



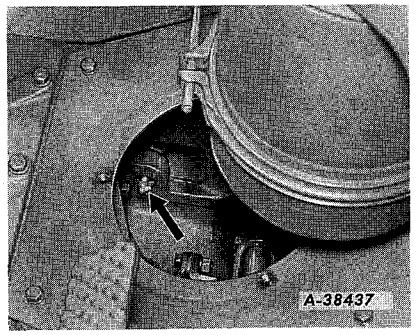
Item 22 - Crankcase oil drain plug.

Drain the oil while the engine is hot. 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. If the crankcase guard attachment is used, remove the cover in the guard to reach the plug.



Item 23 - Sprocket drive level and filler plugs.

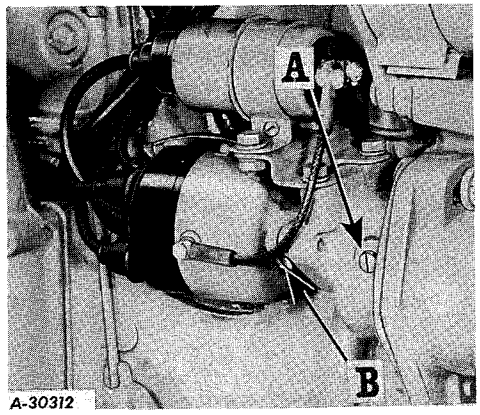
(One on each side.) Remove the plugs, check the lubricant level, and if the lubricant is low, fill it to the level of the plug. Replace the plugs.



Item 24 - Steering brake pedal shaft.

(One on each side.) Apply six strokes of the lubricator to each fitting. Remove the round plate on the clutch compartment cover to reach the fittings.

Service After Every 480 Hours of Operation

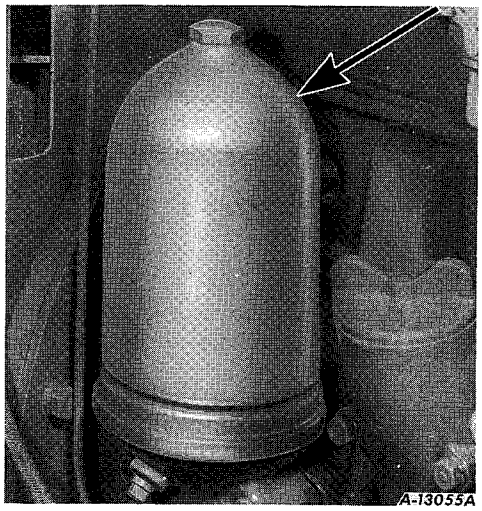


Item 25 - Distributor lubrication fittings.

Remove the plugs and install fittings.

A. Distributor drive housing. Apply two or three strokes of the hand lubricator. Do not over-lubricate.

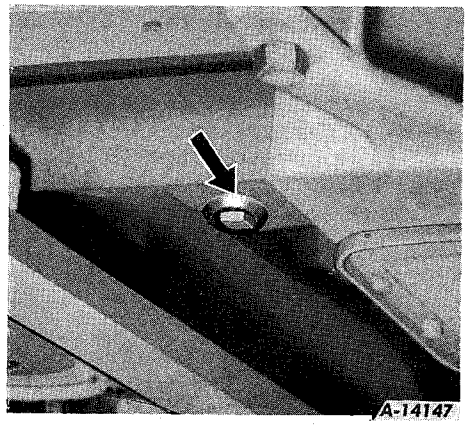
B. Distributor rotor shaft. Apply the hand lubricator until a small quantity of lubricant comes out of the relief hole opposite the plug.



Item 26 - Lubricating oil filter.

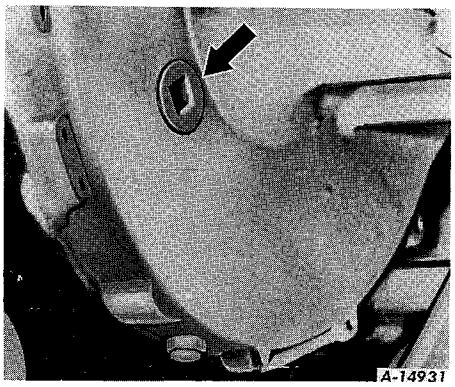
Drain the filter and change the element to coincide with every other oil change. Drain the oil while the engine is hot. It may be necessary to change the filter element after shorter working periods under severe operating conditions such as extremely dusty conditions, low engine temperatures, intermittent operation, excessively heavy loads with high oil temperatures, or when diesel fuel with high sulphur content is used.

Service After Every 960 Hours of Operation



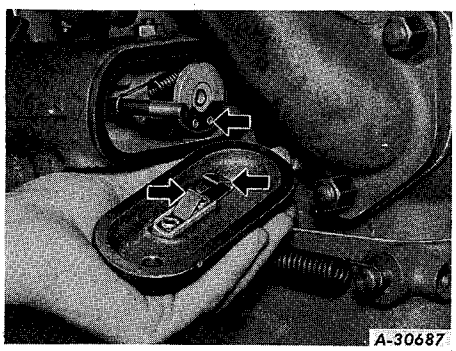
Item 27 - Transmission drain plug.

To drain oil, remove drain plug immediately after operation. Replace plug and refill at filler. Oil should be changed at least once a year even if 960 hours has not been reached. If the oil has been changed to SAE-80 for cold weather, change to the proper grade before hot weather.



Item 28 - Sprocket drive drain plugs.

(One on each side.) To drain oil, remove drain plugs immediately after operation. Replace plugs and refill at fillers. Oil should be changed at least once a year even if 960 hours has not been reached. If the oil has been changed to SAE-80 for cold weather, change to the proper grade before hot weather.



Item 29 - Ignition cut-out switch.

Remove the manifold end cover. Apply a trace of grease to the contact points.

CHECKING MECHANICAL PROBLEMS

PROBLEM	PROBABLE CAUSE	PROBABLE REMEDY
ENGINE WILL NOT TURN	A. Cranking motor inoperative.	A.
	1. Batteries faulty.	1. Recharge or replace batteries if necessary.
	2. Cables and terminals faulty.	2. Inspect ground cable and battery-to-starter switch cable for any faults which may cause shorting, or incorrect connections. Replace cables if necessary.
	3. Starting switch defective.	3. Replace starting switch.
	4. Cranking motor defective.	4. *
	5. Cranking motor commutator dirty or worn.	5. Clean commutator. *See page 53.* If worn or out-of-round, repair.*
	B. Engine oil too heavy for operation in extreme low temperature.	B. Use grade of oil specified in "LUBRICATION GUIDE" on pages 24 and 25.
	C. Internal seizure.	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.*
ENGINE TURNS BUT WILL NOT START	A. Gasoline fuel system faulty.	A.
	1. No gasoline in tank.	1. Fill small tank with gasoline.
	2. Gasoline shut-off valve closed.	2. Open gasoline shut-off valve.
	3. Gasoline strainer screen clogged.	3. Clean gasoline strainer. *See pages 58 and 59.*
	4. Water in gasoline.	4. Drain gasoline tank, strainer, and carburetor.
	5. No gasoline at carburetor.	5. Clean fuel line from gasoline tank to carburetor. Check vent holes in gasoline tank filler cap.
	B. Batteries low in charge and do not turn engine fast enough.	B. Charge batteries.

Continued on next page

* Consult your International Industrial Power distributor or dealer.

PROBLEM	PROBABLE CAUSE	PROBABLE REMEDY
ENGINE TURNS BUT WILL NOT START - Continued	C. Ignition system faulty.	C.
	1. Ignition circuit broken.	1. Check cables from distributor cap to spark plugs for correct wiring or loose connections.
	2. Wet or fouled spark plugs.	2. Remove spark plugs, wipe off moisture and dry plugs. Remove carbon. Check gap, which must be .023 inch.
	3. Cracked or broken spark plug insulators.	3. Replace.
	4. Ignition cut-out switch in manifold inoperative.	4. Disconnect the coil to cut-out switch cable from manifold, and reconnect to the other terminal on manifold cover. Turn on the ignition switch and attempt to start engine. If engine starts, the switch in manifold is inoperative and should be inspected.
	5. Ignition switch faulty.	5. With the ignition switch pulled out, the charge indicator should show discharge when the starter control handle is engaged. If it does not, the switch is probably defective. Place a jumper wire across the ignition switch wires. Engage the starter control handle; if engine starts, the ignition switch needs to be replaced.
	6. No spark from distributor.	6. Remove distributor cap and turn engine to see if distributor rotor turns. a. If distributor rotor does not turn, remove battery ignition unit *as described on page 48.* 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 distributor. *See page 48.*

Continued on next page

* Consult your International Industrial Power distributor or dealer.

PROBLEM	PROBABLE CAUSE	PROBABLE REMEDY
ENGINE TURNS BUT WILL NOT START - Continued	D. Carburetor choked too much.	D. Push the choke button in to open the choke. In warm weather, or if the engine is warm, check to see that the carburetor fuel adjustment knob "P" is in the closed position. Wait a few minutes before attempting to start the engine again.
	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 pages 59 and 60.*
	3. Diesel fuel filters or strainers clogged.	3. Disassemble and clean. *See pages 62 and 63.*
	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.*
	3. Butterfly valves in manifold not functioning.	3. Remove manifold end covers, and operate compression release lever to see if butterfly valves are functioning.
	C. Faulty timing of injection pump.	C. Retime pump to engine. *See page 66.*
	D. Water in diesel fuel.	D. Drain entire diesel fuel system including water trap and filters. Refill with diesel fuel, and vent system.
	E. Controls not in correct position.	E. Set controls as outlined in "OPERATING CONTROLS AND INSTRUMENTS."

* Consult your International Industrial Power distributor or dealer.

PROBLEM	PROBABLE CAUSE	PROBABLE REMEDY
MISSING AND BACKFIRING (Gasoline cycle)	A. Water in gasoline.	A. Drain gasoline tank, strainer and carburetor. Refill with clean gasoline.
	B. Air leaks around intake manifold.	B. Tighten manifold stud nuts.
	C. Firing order not correct.	C. Check spark plug cables for correct installation at spark plugs and distributor.
	D. Distributor not correctly timed to engine.	D. Check and adjust timing. *See page 50.*
	E. Starting valves not properly seated.	E. *
ENGINE DOES NOT IDLE PROPERLY (Diesel cycle)	A. Injection pump control lever shaft sticky, sluggish, or stuck.	A. Remove injection pump and have it tested. *See pages 65 and 66.**
	B. Injection pump plunger spring broken, or plunger stuck.	B.
	C. Injection pump plunger and bushing worn.	C.
	D. Surging at any idle speed.	D.
	E. Injection nozzles faulty.	E. Remove, and repair or replace.*
LOSS OF OIL PRESSURE	A. Low oil level.	A. Add sufficient oil to bring up to specified mark on level gauge.
	B. Oil pressure indicator or line defective.	B. Replace.*
	C. Main or connecting rod bearings worn.	C. Replace.*
	D. Dirt in regulating valve, or regulating valve spring broken.	D. Clean, or replace spring.*
	E. Oil pump worn.	E. Remove, and repair or replace.*
	F. Camshaft bearings worn excessively.	F. Install new bearings.*
	G. Oil diluted or not as specified.	G. Change oil regularly using correct grade.

Continued on next page

* Consult your International Industrial Power distributor or dealer.

PROBLEM	PROBABLE CAUSE	PROBABLE REMEDY
LOSS OF OIL PRESSURE - Continued	H. Oil leaks.	H. Check and service where necessary - at 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.
	I. Clogged oil filter.	I. Change filter element.
LACK OF COMPRESSION	A. Valve clearance not correct.	A. Adjust valve clearance. *See page 47.*
	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.	B. Service the air cleaner. *See pages 45 and 46.*
	C. Air leaks around intake manifold.	C. Tighten manifold stud nuts or install new gasket.
	D. Injection pump not operating properly, or not correctly timed.	D. *
	E. Poor fuel.	E. Use good grade diesel fuel.
	F. Faulty valve action.	F. Adjust valve clearance. *See page 47.* If valves are burned or warped, replace.*
	G. Worn piston rings and pins, or sleeves.	G. *
	H. Exhaust restricted.	H. Remove restriction.
	I. Intermittent fuel delivery.	I. Follow steps under "B," "C," "D" and "E" of "ENGINE WILL NOT OPERATE AS A DIESEL ENGINE."
	J. Lack of engine compression.	J. See "LACK OF COMPRESSION" above.

* Consult your International Industrial Power distributor or dealer.

PROBLEM	PROBABLE CAUSE	PROBABLE REMEDY
SMOKY EXHAUST	A. Poor fuel.	A. Use good grade diesel fuel.
	B. Injection pump not correctly timed.	B. Retime pump to engine. *See page 66.*
	C. Injection nozzles not functioning properly.	C. Opening pressure not correct, or nozzle leaks.*
	D. Engine overloaded.	D. Reduce load.
	E. Improper injection pump governor adjustment.	E. *
	F. Worn or sticking oil control rings, or worn cylinder sleeves.	F. Replace.*
	G. Improper lubricant.	G. Use grade of lubricant specified in "LUBRICATION GUIDE" on pages 24 and 25.
	H. Dirty air cleaner.	H. Service the air cleaner. *See pages 45 and 46.*
	I. Clogged crankcase breather.	I. Service the breather. *See page 21.*
ENGINE OVERHEATS	A. Insufficient water in the cooling system.	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 pages 42 and 43.*
	1. Radiator cap loose. 2. Loose hose connections. 3. Water pump leaks.	1. Tighten radiator cap. 2. Tighten hose connections. 3. Service packing gland. *See page 44.*
	B. Fan belt slipping.	B. Check belt tension and adjust. *See page 43.*
	C. Cooling system clogged.	C. Flush out radiator and engine. *See page 43.*
	D. Dirt and trash on outside of radiator core.	D. Clean all dirt and trash from between the radiator tube fins with air or water pressure.
	E. Thermostat inoperative.	E. Remove and replace if necessary. *See page 44.*
	F. Lack of lubricating oil.	F. Add sufficient oil to bring up to specified mark on level gauge.
	G. Engine overloaded.	G. Reduce load.
	H. Water pump defective.	H. Repair or replace.*
	I. Clogged lubricating oil filter.	I. Replace filter element.

* Consult your International Industrial Power distributor or dealer.

PROBLEM	PROBABLE CAUSE	PROBABLE REMEDY
EXCESSIVE LUBRICATING OIL CONSUMPTION	A. Oil leaks.	A. Check and service where necessary - at 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.
	B. Worn valve guides; worn piston rings, sleeves, pistons; and clogged oil control rings.	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.*
	C. Improper lubricant.	C. Use only the lubricant specified in "LUBRICATION GUIDE" on pages 24 and 25.
	D. Overheated engine.	D. See "ENGINE OVERHEATS" above.
	E. Excessive oil poured into crankcase, because gauge was read from wrong side, or too soon after stopping the engine.	E. Read gauge correctly and carefully. See "LUBRICATION GUIDE" on pages 24 and 25.
	F. Clogged crankcase breather.	F. Service the breather. *See page 21.*
ENGINE NOISES		
A. Sharp rap at idling speed.	A. Loose piston pin. The pin at fault can be found by short-circuiting spark plugs on gasoline cycle until the noise stops.	A. Replace pin.*
B. Flat slap when advancing engine speed under load.	B. Piston slap.	B. Replace piston and sleeve.*
C. Metallic knock when idling and retarding engine speed, but disappears under load.	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.	C. Replace bearings.*
D. Constant rapid clicking.	D. Incorrect valve clearance.	D. Adjust valve clearance. *See page 47.*
E. Combustion knock in one or two cylinders.	E.	E.
	1. Leaky injection nozzle valve.	1. Replace nozzle valve.*
	2. Poor fuel, and water in the fuel.	2. Drain entire diesel system and refill with a good grade of clean diesel fuel. Remove and clean the water trap.
	3. Faulty injection pump timing.	3. Retime pump to engine. *See page 66.*
	4. Improper engine temperature.	4. Keep temperature in work range of heat indicator.

*Consult your International Industrial Power distributor or dealer.

PROBLEM	PROBABLE CAUSE	PROBABLE REMEDY
ENGINE CLUTCH SLIPS OR DRAGS	A. Clutch not properly adjusted.	A. Adjust clutch for definite over-center engagement. *See pages 66 and 67.*
	B. Dirt or oil in clutch assembly.	B. Remove clutch and clean.
	C. Clutch inoperative.	C. *
ROLLERS OR IDLERS WILL NOT TURN	A. Insufficient lubricant.	A. Follow specifications of "LUBRICATION GUIDE" on pages 24 and 25.
	B. Bushing or internal seizure.	B. *
	C. Mud packed between rollers and idlers.	C. Thoroughly clean entire track assembly.
GEARS HARD TO SHIFT	A. Oil in transmission too heavy.	A. Drain and fill with specified lubricant.
	B. Burred gears.	B. *
	C. Gear shifter forks out of alignment or damaged.	C. *
	D. Worn shifting controls.	D. *
	E. Damaged transmission parts.	E. *
TRANSMISSION GEARS WILL NOT SHIFT	A. Gearshift lever or lever forks faulty.	A. *
	B. Sliding gears stuck on spline shaft.	B. *
	C. Engine clutch drags.	C. See "ENGINE CLUTCH SLIPS OR DRAGS."
TRANSMISSION GEARS SLIP OUT OF MESH	A. Gears not fully engaged.	A. Push or pull gearshift lever as far as it will go. If shift lever movement is correct, shifter fork assembly is at fault.
	B. Gears damaged.	B. *
ENGINE OPERATES BUT TRACTOR WILL NOT MOVE	A. Steering brakes locked.	A. Release steering brake pedals from latching pawls.
	B. Engine clutch not properly adjusted.	B. Adjust clutch for definite over-center engagement. *See pages 66 and 67.*
	C. Transmission faulty.	C. *
	D. Steering clutches slip.	D. Adjust steering clutches. *See page 68.*

*Consult your International Industrial Power distributor or dealer.

PROBLEM	PROBABLE CAUSE	PROBABLE REMEDY
TRACTOR WILL NOT TURN	A. Steering clutch does not disengage. 1. Steering clutch lever not properly used. 2. Steering clutch not properly adjusted. 3. Steering clutch faulty.	A. 1. Pull steering clutch lever all the way back. 2. Adjust steering clutch and controls. *See page 68.* 3. *
TRACTOR WILL NOT MAKE SHORT (PIVOT) TURN	A. Steering clutch does not disengage. B. Steering brake will not hold. 1. Steering brake not properly adjusted. 2. Steering brake worn or faulty.	A. See paragraph above. B. 1. Adjust steering brake and controls. *See pages 68 and 69.* 2. Replace steering brake.*
TRACK CHAIN COMES OFF DURING OPERATION	A. Rocks in track assembly. B. Track chain loose. C. Track spring broken, front idler worn or misaligned.	A. Clean rocks and dirt from tracks. B. Adjust track chain tension. *See pages 70 and 71.* C. *
TRACTOR CREEPS TO ONE SIDE	A. Track loose on one side. B. Track shoes loose.	A. Adjust track tension. B. Tighten cap screws properly.
TRACK CHAIN LOOSE	A. Track not properly adjusted. B. Sprocket worn. C. Track links or bushings worn.	A. Adjust track tension. B. * C. *
EXCESSIVE TRACK WEAR	A. Damaged sprocket. B. Front idler misaligned. C. Improper track tension. D. Track rollers do not turn. E. Track idler does not turn.	A. * B. * C. Adjust track tension. D. } See "ROLLERS OR IDLERS WILL NOT TURN." E. }
TRACTOR LOSES POWER	A. Track chains too tight.	A. Adjust track chain tension. Tight track chains may cause tractor to lose up to 75 percent of power.

*Consult your International Industrial Power distributor or dealer.

PROBLEM	PROBABLE CAUSE	PROBABLE REMEDY
CHARGE INDICATOR SHOWS NO CHARGE WITH ENGINE OPERATING	A. Connections loose or corroded.	A. Clean and tighten connections.
	B. Charge indicator inoperative.	B. Turn on bright lights; if charge indicator shows no discharge, charge indicator probably is inoperative.*
	C. Generator inoperative.	C. Place jumper lead from "GEN" terminal on regulator to upper water tank of the radiator; if no flash, generator is inoperative.*
	D. Regulator inoperative.	D. *
CHARGE INDICATOR SHOWS NO CHARGE UNTIL HIGH SPEED	A. Regulator adjusted to operate at too high closing voltage.	A. *
CHARGE INDICATOR SHOWS EXCESSIVE CHARGE	A. Batteries run down.	A. Recharge batteries.
	B. Batteries faulty.	B. Replace batteries.
	C. Generator field grounded.	C. Check for external ground and correct.
	D. Defective voltage regulator.	D. Replace.*
	E. Shorted generator field.	E. Replace generator.*
CHARGE INDICATOR SHOWS DISCHARGE WITH ENGINE OPERATING	A. Generator belt loose.	A. Tighten belt.
	B. Short circuits.	B. *
	C. Generator inoperative.	C. Place jumper lead from "GEN" terminal on regulator to upper water tank of the radiator; if no flash, generator is inoperative.*
	D. Regulator inoperative.	D. *
CHARGE INDICATOR POINTER FLUCTUATES RAPIDLY	A. Shorted circuits or loose connections.	A. Check for shorted circuits and tighten connections.
	B. Generator defective.	B. *
	C. Generator drive belt loose.	C. Adjust belt. Replace if necessary.
	D. Low idling speed.	D. Adjust idling speed.
CHARGE INDICATOR SHOWS HEAVY DISCHARGE WITH ENGINE NOT OPERATING	A. Regulator contacts stuck.	A. Disconnect cable from "BAT" terminal on regulator; if charge indicator returns to zero, regulator contacts are stuck.*

*Consult your International Industrial Power distributor or dealer.

MAINTENANCE

COOLING SYSTEM

The cooling system operates under four pounds pressure which is controlled by means of a regulating valve built into the radiator cap. Always use clean water (soft or rain water if possible).

The system automatically maintains the most desirable engine temperature under all normal conditions of operation. A positive centrifugal pump circulates the coolant through the engine block, cylinder head, and radiator.

When the engine is cold, a thermostat of the by-pass type prevents the circulation of the coolant to the radiator and allows the coolant to circulate only through the cylinder head and around the cylinders of the engine until the engine has reached an efficient operating temperature. When this temperature has been reached the thermostat is wide open and the by-pass is closed, allowing the coolant to circulate through the engine block, cylinder head, and radiator.

Rust Prevention

One of the most common causes of engine overheating is a rust-clogged cooling system. Rust interferes with circulation and cooling which causes overheating.

In localities where alkaline, acid, or saline waters are the only kind available, the addition of a rust preventive or "inhibitor" will tend to minimize the corrosive action of such water.

For rust prevention during winter use of the engine, a fresh filling of an antifreeze containing an effective corrosion preventive should be used. In the spring, drain and discard the old antifreeze solution as the rust preventive or "inhibitor" may be exhausted from contamination and continued use.

After draining the antifreeze, a rust preventive should be added to the cooling water to protect the cooling system during warm weather operations. This inhibitor solution should be drained and discarded in the fall when danger from frost again makes necessary the use of an antifreeze.

Filling the Cooling System

The water capacity of the cooling system is approximately 13 U. S. gallons.

1. Be sure the crankcase drain valve on the left side of the engine and the radiator drain plug are closed.

2. Remove radiator filler cap "A" *(Illust. 43)* and fill the radiator to approximately 1-1/4 inches below the bottom of filler neck "C."

Before replacing the filler cap, be sure to remove any dirt particles which may be on the gasket surface or cap, and tighten the cap clockwise to the stop.

NOTE: A pressure-cooled system will not operate properly unless the cooling system is tight. The filler cap must be properly tightened to the stop. The gasket surface of the cap must be in good condition. The system must not have loose connections or leaks. Unless these instructions are followed, pressure will not be maintained, and loss of water and consequent overheating will result.

Draining the Cooling System

1. Open the crankcase drain valve on the left side of the engine, and remove the radiator drain plug.

2. See that the drains are not clogged and that the water drains completely. Then replace the plug and close the drain valve.

Cleaning Out Dirt and Sludge

1. Drain the cooling system. Then replace the radiator drain plug and close the crankcase drain plug.

When draining the radiator, remove the filler cap to permit complete draining.

2. Fill the cooling system with a solution of 4 to 5 pounds of ordinary washing soda mixed with 13 U. S. gallons of water (cooling system capacity).

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

4. Refill the cooling system *as instructed above.*

Adding Water to the Cooling System

CAUTION: If the water in the cooling system is hot and water is to be added, observe the following:

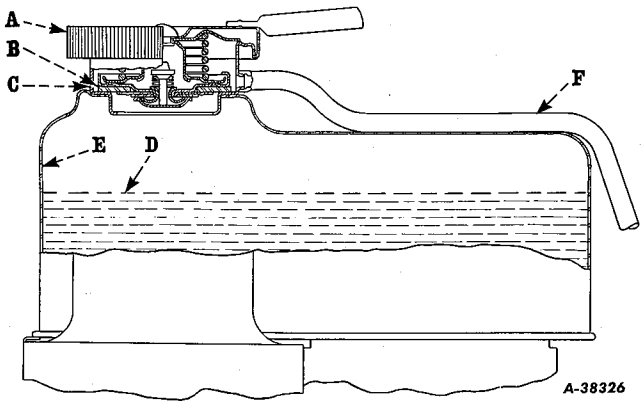
Turn radiator cap "A" *(Illust. 43)* slowly counterclockwise to the safety stop to allow the pressure or any steam to escape; then press down on the cap and continue to turn until the cap is free to be removed.

Allow the engine to cool, and fill the radiator slowly to approximately 1-1/4 inches below the bottom of filler neck "C." Due to expansion when the system becomes hot, any excess water will be discharged through overflow pipe "F."

NOTE: Do not pour cold water into the radiator if the engine is very hot unless conditions make it absolutely necessary; in which case, start the engine and let it idle; then slowly pour the water into the radiator.

Before replacing the filler cap, be sure to remove any dirt particles which may be on the gasket surface or cap, and tighten the cap clockwise to the stop.

Do not attempt to repair or replace any of the regulating valve parts. If the valve is faulty, replace it with a new radiator cap of the same type.



Illust. 43
Water-level in pressure-cooled radiator.

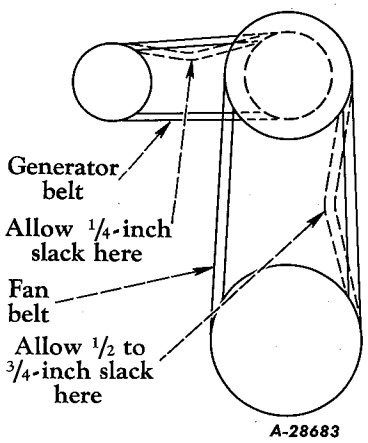
"A" Radiator cap.
"B" Filler cap gasket.
"C" Filler neck.
"D" Water level.
"E" Upper water tank.
"F" Overflow pipe.

Radiator Fins

Overheating is often caused by bent or clogged radiator fins. If the spaces between the fins become clogged, clean them with an air or water hose. When straightening bent fins be careful not to injure the tubes or break the bond between the fins and tubes.

Fan Belt Tension

The slack of the fan belt should be checked frequently to assure correct tension. The tension is correct when the belt can be depressed without effort by the thumb, approximately 1/2 to 3/4 inch, midway between the two pulleys *(Illust. 43A)*. Before checking for the 1/2 to 3/4 inch dimension, rotate top of the fan pulley



Illust. 43A
Correct belt tension.

toward side of belt to be checked for tension. This will remove slack from the opposite side of the belt. If the slack is more than 3/4 inch, or less than 1/2 inch, adjust the belt as described below.

Adjusting the Fan Belt

The tension of the fan belt can be adjusted by changing the width of the groove in the fan pulley. To adjust, loosen the lock nut and set screw (2) *(Illust. 44)*, then screw the pulley flange (1) in toward the belt to tighten the belt, and out to loosen it. Retighten the lock nut and set screw (2) after the correct tension has been obtained.

After each change in belt tension, rotate the crankshaft pulley to reseat the belt correctly in the pulley groove before checking for the 1/2 to 3/4 inch dimension.

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 would wear it out rapidly. Adjust the pulley for a narrower groove, if this is possible without increasing the tension more than allowable. Having a V-belt tighter than the tension specified will result in rapid wear.

Removing the Fan Belt

1. Disconnect the ignition switch cable "C" *(Illust. 49B)* from the negative terminal on the ignition coil. (This is done to eliminate any possibility of accidentally starting the engine.)

2. Loosen the lock nut and set screw (2) *(Illust. 44)* in the flange (1) on the fan pulley.

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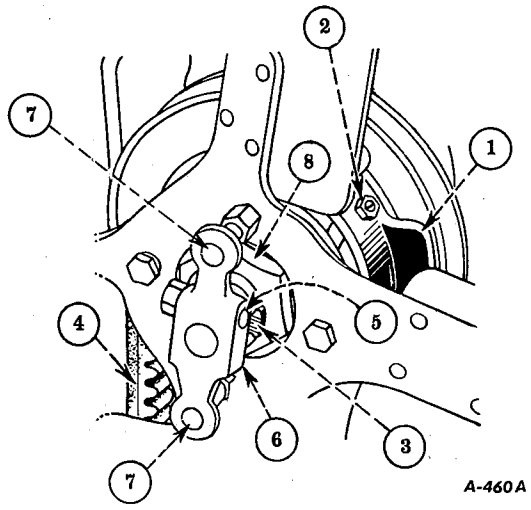


Illust. 44
Fan and water pump adjustment points.

1. Fan pulley flange.
2. Lock nut and set screw in pulley flange.
3. Water pump packing gland.
4. Fan belt.
5. Driver pin.
6. Driver.
7. Stud.
8. Fan hub nut.

3. Unscrew the flange as far as possible.

4. Start the belt over the outer flange of the lower pulley by prying out with a light bar or rod.

5. Crank the engine slowly and the belt will work off the pulley.

6. Remove the crank.

7. Work the belt over the top of the fan blades.

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. Reverse the procedure for removing the belt after first disconnecting the ignition switch cable from the negative terminal on the ignition coil (to avoid accidental starting). The belt can be started on the lower pulley by hand, and slow cranking will run it into position.

Water Pump Packing

If the pump packing leaks, tighten the packing gland (3) *(Illust. 44)* just enough to stop the leaking. If tightening the packing gland does not stop the leaking, install new packing, as follows:

1. Remove the driver pin (5) and the driver (6).

2. Unscrew and remove the packing gland (3).

3 Remove the old packing and place the new packing around the shaft.

4. Reassemble the packing gland, the driver, and the driver pin. Tighten the packing gland just enough to prevent leaking.

Removing the Thermostat *(See Illust. 44A.)*

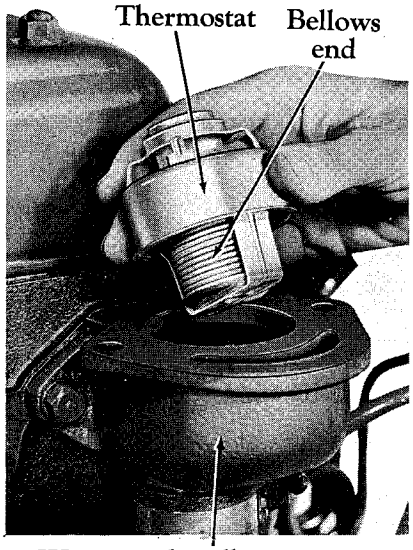
1. Drain the water from the cooling system.

2. Loosen both radiator inlet hose clamps and slide the hose toward the thermostat housing.

3. Remove two cap screws holding the thermostat housing to the cylinder head water outlet elbow, and remove the housing.

4. Remove the thermostat.

To install the thermostat, reverse the procedure. Replace the old gasket with a new gasket, if necessary. Then refill the cooling system.



Illust. 44A
Removing the thermostat.

AIR CLEANING SYSTEM

All air entering the 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). Do not allow dirt or sludge to build up in the oil cup more than 1/2 inch deep. Refill the oil cup to the oil level bead with the grade of oil specified in the "LUBRICATION GUIDE." The oil cup capacity is 3-3/4 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, oil cup retaining clamp, and the surface under the clamp.

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.

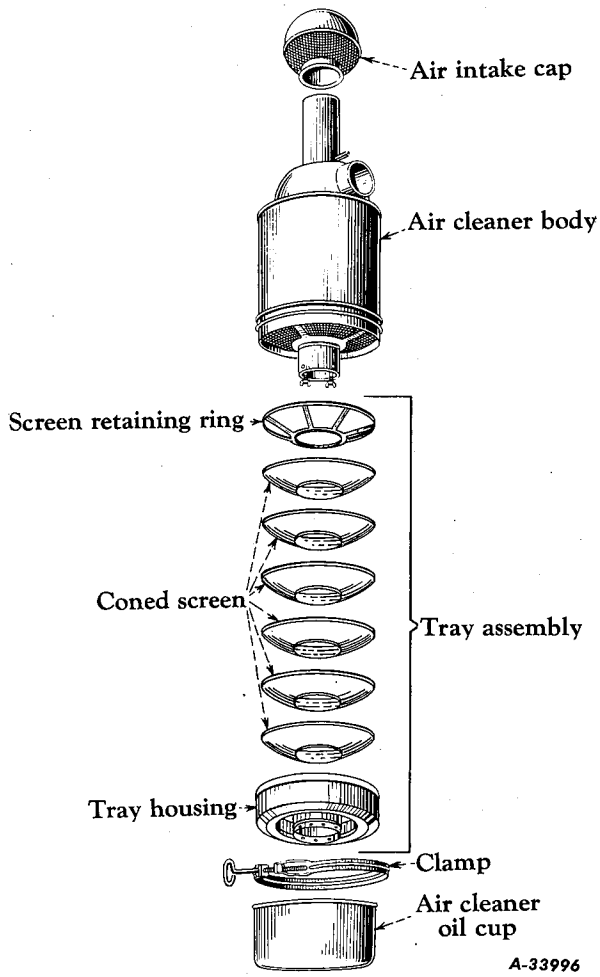
Cleaning the Tray Assembly

The air cleaner is provided with a removable tray held in place by two wing nuts which, when loosened, will allow the tray to be turned (right or left) to release the tray locks for dropping the tray. For cleaning, take out the four wing bolts and screen retaining ring to remove the six screens, nested within the tray. The tray should be removed and cleaned every 120 hours or more frequently if conditions warrant. Clean the tray with diesel fuel, dry cleaning solvent or kerosene.

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 *as shown in Illust. 45.* 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 airtight; 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 it is held securely in place by the cup clamp.



Illust. 45
Air cleaner taken apart for cleaning.

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.

Continued on next page

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

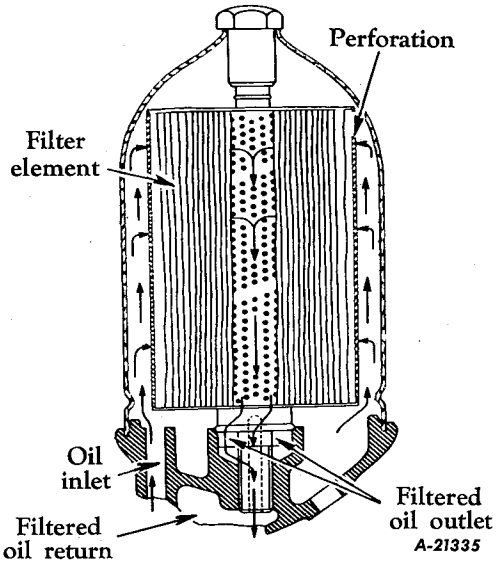
All joints between the air cleaner and the intake manifold, and between the manifold and the cylinders of the engine, should be tight. All of the gaskets must be in a good condition and the bolts should be drawn up tight.

LUBRICATING OIL FILTER

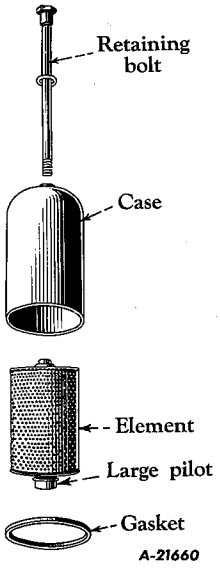
The life of your engine depends upon clean oil being circulated to all bearings. Minute particles of abrasive matter eventually accumulate in the crankcase, and lubricating oil undergoes changes which produce sludge, acids, gums, varnish, and other harmful by-products.

The purpose of the oil filter 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 the precision-made engine parts will safeguard the engine against undue wear, and the operating troubles and upkeep expense which are a natural result of that condition.

This oil filter keeps the circulating oil free from harmful contamination for 480 hours of operation under normal operating conditions, at which time the crankcase oil should be changed and the filter element replaced. It may be necessary to change oil and replace the filter element 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. Refer to "LUBRICATION GUIDE" on pages 24 and 25 for the recommended oil to use for the prevailing temperature.



Illust. 46
Cutaway view of filter.



Illust. 46A
Filter disassembled.

Changing the Filter Element

1. Stop the engine.

2. Open the oil filter base drain and allow the filter to drain completely.

3. Clean off the filter case to prevent dirt from dropping into the base.

4. Unscrew and remove the retaining bolt.

5. Lift up and remove the case.

6. Remove the old element.

NOTE: If some special equipment on the tractor prevents the lifting of the case over the element, remove the case and the element together.

7. Wipe out the base and the case with a cloth dampened with kerosene.

8. See that the case gasket is in position. Replace the drain plug in the filter base and install the new filter element (the large pilot must be down). Inspect the small metering hole at the threaded end of the retaining bolt and make sure that the hole is not plugged. A plugged metering hole will impair or stop oil flow through the filter element.

9. Replace the case and carefully insert the retaining bolt and draw up tight. IMPORTANT: Do not drive or force the retaining bolt through the oil seal, but carefully screw the bolt through the seal and into the base threads.

10. Check the oil level in the crankcase to see that the new oil is up to the proper level. Refer to the "LUBRICATION GUIDE" on pages 24 and 25. Start the engine and see that the oil pressure indicator is registering pressure, and inspect the filter for oil leaks.

NOTE: To avoid delay, always carry extra elements on hand for replacement at the proper time. Cleaning the old element is not satisfactory.

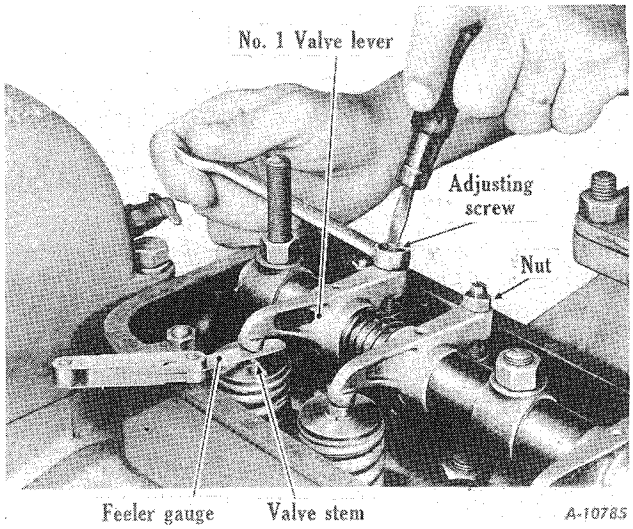
VALVE CLEARANCE ADJUSTMENT

Check valve clearance after every 480 hours of operation, and adjust the clearance if necessary. A clearance of 0.017 inch is necessary between the valve levers and the valve stems when the valves are closed and the engine is hot; set to 0.019 inch when the engine is cold.

1. Before checking the valve clearance, cut out the distributor by disconnecting the ignition switch cable "C" *(Illust. 49B)* from the negative terminal on the ignition coil. This will prevent accidental starting.

2. Set the compression release lever in the gasoline starting position. *See Illust. 13.*

3. Remove the valve cover.



Illust. 47
Gauging valve levers with a feeler gauge.

4. Remove the spark plug from the No. 1 cylinder (the cylinder next to the radiator). Place your thumb over the spark plug opening, and slowly crank the engine until an outward pressure can be felt. Pressure indicates the No. 1 piston is moving toward top dead center of the compression stroke. Continue cranking slowly until the notch marked "DC" *(Illust. 66)* on the fan drive pulley is in line with the timing pointer on the crankcase front cover. Both valves are now closed on the compression stroke of No. 1 cylinder.

5. Loosen the adjusting screw lock nut on the valve lever (on both of the No. 1 cylinder intake and exhaust valves). Insert the feeler gauge between the valve lever and valve stem. Turn the adjusting screw in or out, as necessary, to hold the feeler gauge snugly. When the correct clearance is secured, hold the adjusting screw in place with a screwdriver and tighten the lock nut. Make this adjustment on both valves of the No. 1 cylinder before moving to the next cylinder. Recheck the clearance of both valves.

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

7. Install the valve cover. Check to see that the valve cover gasket makes an oiltight seal with the cylinder head. Use a new gasket if necessary.

8. Connect the ignition switch cable "C" *(Illust. 49B)* to the negative terminal on the ignition coil, from which it was removed.

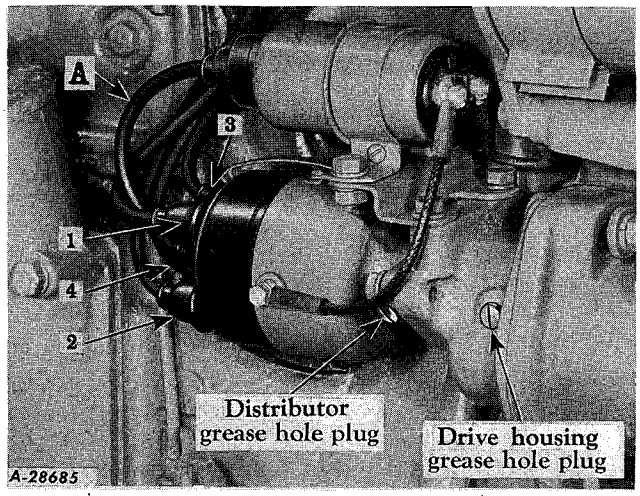
IMPORTANT: Be accurate; use a feeler gauge for checking the valve clearance.

IGNITION SYSTEM

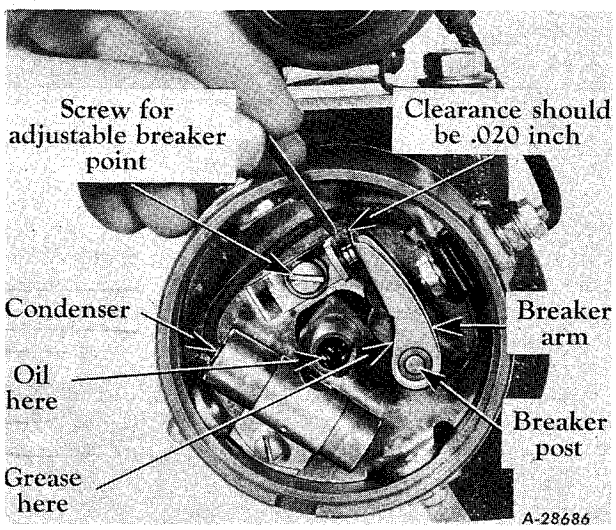
Lubricating the Battery Ignition Unit

Every six months or after every 480 hours of operation, whichever occurs first, remove the grease plugs *(Illust. 48)* and insert lubrication fittings. Apply lubricator grease (chassis lubricant) to the distributor fitting until a small quantity comes out of the relief hole opposite the plug. Apply several strokes of the lubricator to the fitting on the drive housing.

Remove the distributor cap and the distributor rotor and apply one or two drops of light engine oil to the felt in the hole at the end of the breaker cam. *See Illusts. 48A and 49.*



Illust. 48
Distributor wiring and lubrication.



Illust. 48A
Adjusting the breaker points.

Greasing the Breaker Mechanism and Checking the Points

It is important that the breaker chamber be kept clean because oil on the breaker points will cause rapid burning. Remove the distributor cap, distributor rotor, and the breaker cover for breaker chamber inspection. *See Illust. 49.* Care should be taken, when removing the breaker cover, to prevent dirt from entering the breaker chamber. Be sure the chamber is clean and the breaker points are in good condition and have the proper opening.

Never use emery cloth or sandpaper to clean the points. If the points are worn excessively, replace both points.

Fill the recess in the breaker post with grease and pack a small quantity of magneto grease in back of the breaker arm rubbing block. *See Illusts. 48A and 49.* See your International Industrial Power distributor or dealer for the proper grease to use.

Check the condition of the breaker points for build-up or lip formation. If present, the points must be dressed before the point opening can be checked or set. Check the opening between the breaker points with a feeler gauge *(Illust. 48A)*. The point opening should be .020 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. Then move the point toward or away from the point on the breaker arm until the gauge slips snugly into the opening. After the adjustment has been made, tighten the screw.

Distributor Cap

Whenever the distributor cap is removed, examine the inside. If any dust, moisture or oil deposits are present, thoroughly clean and wipe dry. To assure long life of the distributor, care must be taken to keep the three small ventilator holes in the distributor cap open at all times. Also see that the distributor rotor is kept clean.

If the terminal nipples are removed, be sure the distributor cap terminals and coil terminal are clean and dry. The distributor is equipped with these nipples to prevent any external electrical leakage when the tractor is operating under adverse conditions.

Ignition Coil

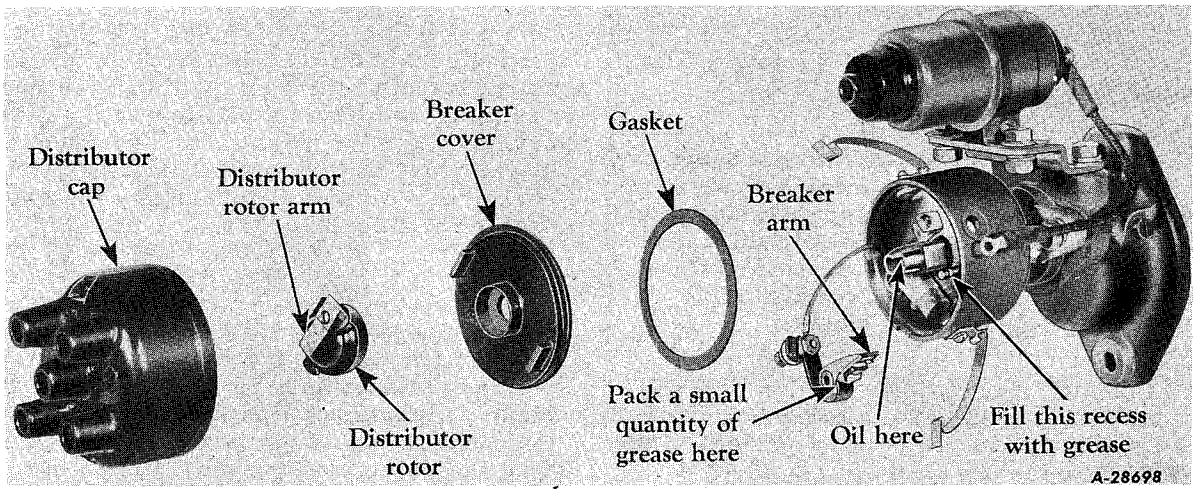
The ignition coil does not require special service other than to keep all terminals and connections clean and tight.

Ignition Cut-out Switch

Once a year or after every 960 hours of operation, whichever comes first, apply a trace of IH magneto grease to the contact points of the ignition cut-out switch in the front end cover of the intake manifold. To reach the switch, remove the stud nut and cap screw and remove the end cover.

Removing the Battery Ignition Unit

If it is necessary to remove the battery ignition unit for any reason, proceed as follows:



Illust. 49
Distributor partially disassembled for servicing.

1. Disconnect the ignition switch cable "C" *(Illust. 49B)* from the negative terminal on the ignition coil.

2. Pull the secondary cable "A" *(Illust. 50)* out of the center socket on the distributor cap and remove the cap.

3. Crank the engine slowly until the distributor rotor arm is in the No. 1 firing position. *See Illust. 49B.*

4. Remove the two cap screws "B" *(Illust. 50)* and the mounting clip from the distributor drive housing flange and remove the complete unit.

Installing the Battery Ignition Unit

1. Before installing the distributor it will be necessary to crank the engine until No. 1 piston (next to radiator) is on the top dead center of the compression stroke. The compression stroke can be determined by removing the No. 1 spark plug, placing your thumb over the opening, and cranking the engine until an outward pressure is felt. Continue cranking slowly until the "DC" mark on the fan drive pulley is in line with the pointer on the crankcase front cover. The No. 1 piston is now at top dead center.

2. Place the battery ignition unit in one hand and, with the fingers of the other hand, turn the drive lugs in a counterclockwise direction until the rotor arm is approximately in

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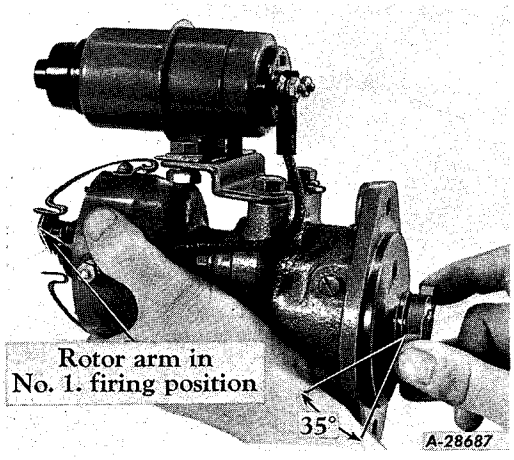
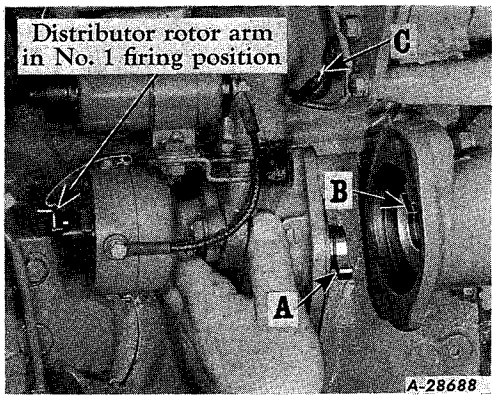


Illust. 49A
Adjusting the distributor rotor and drive shaft lugs for timing the distributor.



Illust. 49B
Assembling the battery ignition unit.

the No. 1 firing position. *See Illust. 49A.* Then continue to turn slowly and lightly until a slight resistance is felt.

3. Pull out the drive shaft to disengage the gears; then turn the shaft counterclockwise so the drive shaft lugs "A" are approximately 35° past horizontal or approximately in the same position as drive shaft slots "B." *See Illust. 49B.* Engage the gears and press the drive shaft in with the palm of the hand.

4. Assemble the battery ignition unit and gasket and fasten with the mounting bolts and washers, using the mounting clip in front of the lock washer on the top bolt. Assemble the distributor cap.

5. Connect the ignition switch cable "C" *(Illust. 49B)* to the negative terminal on the ignition coil.

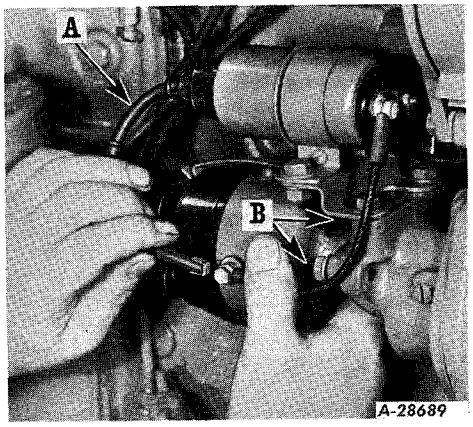
Timing the Distributor to the Engine

The timing operation must be performed while the engine is on the gasoline cycle.

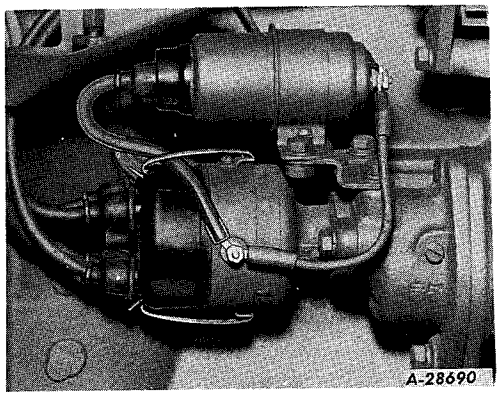
Loosen the distributor mounting bolts "B" *(Illust. 50)*. Set the engine on the top dead center of the firing stroke of the No. 1 cylinder. The secondary cable should be assembled properly in the coil terminal. Pull out the ignition switch and note if the charge indicator shows discharge. If the charge indicator shows discharge, the points are closed and retarding the distributor is not necessary. If the charge indicator does not show discharge, retard the distributor by turning the body about 30° in the same direction as the cam rotation. Pull the secondary cable "A" *(Illust. 50)* out of the center socket on the distributor cap and hold the free end of the cable within 1/16 inch to 1/8 inch from the distributor primary terminal, *as shown in Illust. 50.* Advance the distributor, by turning the distributor body slowly in a direction opposite to the cam rotation, until a spark occurs.

Place the secondary cable under the distributor cap spring and place the terminal within 1/16 inch to 1/8 inch of the distributor primary terminal *as shown in Illust. 50.* Make a final check by cranking the engine until the "DC" notch on the fan drive pulley is in line with the pointer on the front crankcase cover *(see Illust. 66)* and continuing until the spark just occurs at the gap between the secondary cable and the primary terminal. The timing mark should just be in line or slightly past the timing pointer (never time before top dead center). If necessary, make the required adjustment to have the spark occur as specified. Retighten the distributor mounting bolts. Assemble the spark plug cables in proper sequence, using the rubber nipples provided. Assemble the secondary cable in the distributor cap. *See Illust. 48.*

Attach the spark plug cables to the spark plugs and to the terminal sockets of the distributor cap in the following order: The No. 1 cylinder spark plug cable to the socket marked (1) *(Illust. 51A)*. Then, going around the distributor cap in a counterclockwise direction, attach the cable from the No. 3 spark plug to the next or second socket, the cable from the No. 4 spark plug to the next or third socket, and the cable from the No. 2 spark plugs to the fourth or last socket. *See Illust. 51A.*



Illust. 50
Advancing the distributor while holding the secondary cable 1/16" to 1/8" from the primary terminal.

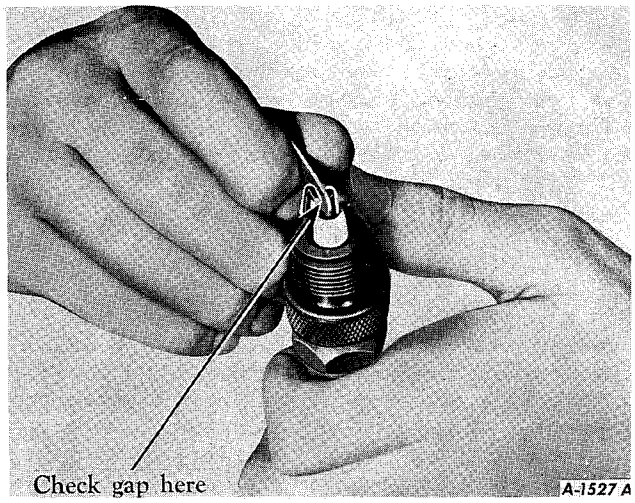


Illust. 50A
Showing the secondary cable held under the distributor cap spring for final check of timing.

Spark Plugs

CAUTION: Remove all dirt from the base of the spark plug before removing the spark plug.

Remove the spark plugs after every 240 hours of operation for cleaning and checking the gaps between the electrodes. A gap of .023 inch should be maintained. 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 of the ends, the engine will misfire and will be hard to start.



Illust. 51
Checking the spark plug gap (set gap .023 inch).

Cleaning the Spark Plugs

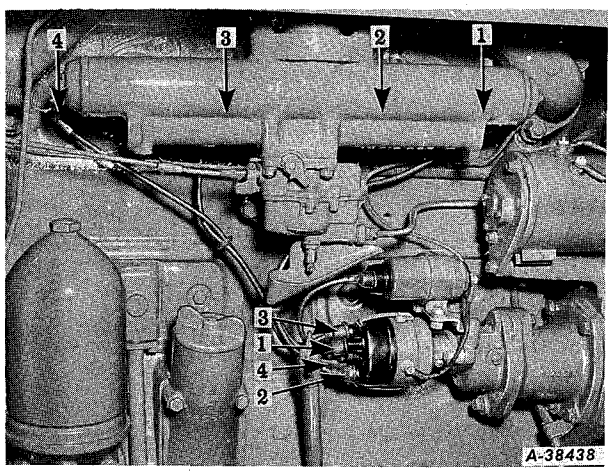
Sandblasting is the recommended method for cleaning spark plugs. Never scrape or clean the insulator with anything that will scratch the porcelain. Scratched porcelain allows carbon and dirt to accumulate much faster.

Always use a spark plug wrench when removing or replacing the spark plugs. This helps to prevent cracking the porcelain.

When replacing spark plugs, be sure the gaskets are in good condition and screw the plugs in tight.

Replace defective plugs with new plugs.

See your International Industrial Power distributor or dealer for various makes of replacement plugs for normal or special service. These plugs have been tested and recommended as best suited for this engine.



Illust. 51A
Spark plug wiring. Engine firing order is 1, 3, 4, 2.

Spark Plug Cables

If the spark plug cables are removed for any reason, note the position of each cable on the distributor. *See Illusts. 48 and 51A.*

Keep a minimum clearance of 1/4 inch 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 cylinder head, the heat of the engine will soon cause the rubber to become soft, ruining the cable.

ELECTRICAL SYSTEM

The electrical system of the tractor is a 12-volt system and consists of a generator, voltage regulator, cranking motor, lights, light switch, battery ignition unit, and two 6-volt batteries. The system is single wire type with ground return to the battery. The cables are contained in a harness of nonmetallic, oilproof and waterproof woven braid.

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.

Continued on next page.

Tractors with electrical equipment 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 cable disconnected or broken. To operate the generator without the battery, remove the connection from the "F" terminal on the generator frame.

Do not paint the instruments or electrical connections.

Polarizing the Generator

If the generator or the regulator has been removed or the leads disconnected, the generator should be repolarized. After the leads have been reconnected, but before the engine is started, proceed as follows:

After making certain that the grounded battery terminal is the positive (+) one, momentarily connect a jumper lead between the "BAT" terminal of the regulator and the "A" terminal of the generator. This allows a momentary surge of current to flow through the generator, which correctly polarizes it. Reversed polarity may result in vibration, arcing and burning of the relay contact points.

IMPORTANT: Do not touch the jumper lead to the "F" terminal on the generator as this will damage the regulator.

Generator and Regulator

The generator supplies current to keep the batteries in a charged condition, and to replace the energy consumed by the cranking motor and lights. The generator is sealed to prevent the entrance of dirt and moisture. It is hinge-mounted on the right side of the engine crankcase and is driven by a V-belt from the fan pulley. The generator, as received from the factory, has a fixed third brush which is set to give the maximum generator output.

The generator charging rate is controlled by a voltage regulator which controls the generator output, thereby maintaining a satisfactory charging rate, and prevents the batteries from overcharging under varying temperatures and operating conditions. It should not require adjustment or attention. If the regulator fails to operate correctly, replace it with a new one or see your International Industrial Power distributor or dealer.

CAUTION: Do not at any time place a jumper lead between or accidentally bridge the battery terminal and the field terminal on the regulator. Serious damage to the regulator may result.

Generator Lubrication

After every 120 hours of operation, put 8 to 10 drops of SAE-20 oil in each of the two cups on the generator. Do not lubricate excessively since excessive lubrication may cause oil and grease to gum on the commutator and result in a reduction of the generator output. Never oil the commutator.

Generator Belt Tension

Check the slack of the generator belt to assure maintenance of the correct tension. The belt should never be loose enough to allow slippage and should not be so tight as to cause excessive side-thrust on the generator bearing. Allow approximately 1/4 inch slack. *See Illust. 43A.*

Adjusting the Generator Belt

Adjust the generator belt tension by loosening the generator brace bolt and generator mounting bolts and moving the generator toward or away from the engine. Tighten the generator brace bolt and mounting bolts after the tension is taken up. (The tension is correct when the belt can be depressed without effort by the thumb, approximately 1/4 inch, midway between the two pulleys.) *See Illust. 43A.*

Removing the Generator Belt

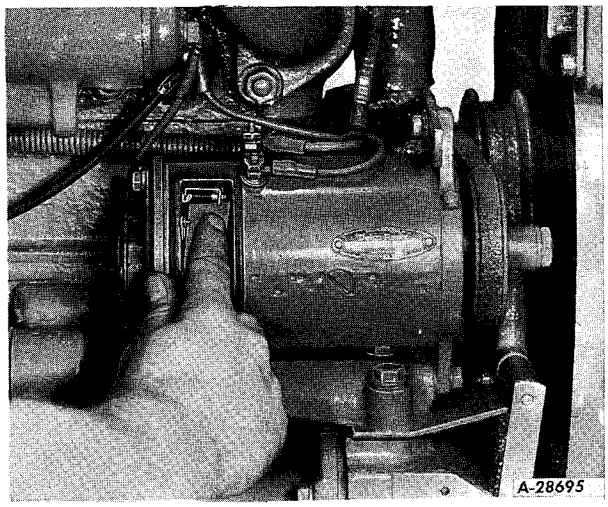
Remove the generator brace bolt and loosen the generator mounting bolts. Then move the generator in toward the engine and remove the belt from the generator pulley.

Remove the fan belt as follows: Loosen the lock nut and set screw in the flange on the fan pulley and unscrew the flange as far as possible. Start the fan belt over the outer flange of the lower pulley and pry it out with a light bar or rod. At the same time, slowly hand crank the engine and the belt will work off the pulley. Then slip the generator belt through the fan belt and over the fan.

Replacing the Generator Belt

Replace the generator belt when it becomes soaked with grease or badly worn. When replacing the belt, reverse the procedure outlined above for removing the belt. Adjust the fan belt *as described on page 43,* and the generator belt as above.

Cleaning the Generator Commutator



Illust. 53
Cleaning the generator commutator.

If the commutator is dirty or slightly grooved, it can be polished by placing a piece of No. 00 sandpaper on the commutator while the armature is slowly revolving. *See Illust. 53.* Never use emery or carborundum cloth. Blow all dust from the commutator after the polishing operation is finished.

If the commutator is badly worn, rough or out-of-round, it is advisable to take the unit to your International Industrial Power distributor or dealer and have the commutator reconditioned.

Cranking Motor

The cranking motor is mounted on the left side of the clutch housing.

At regular intervals, remove the cranking motor cover band and inspect the commutator.

To clean the commutator, pull out the cable from the center socket on the distributor cap. Remove the cranking motor cover band. Pull the starter control handle and, with the cranking motor operating, insert a piece of No. 00 sandpaper over the commutator to clean off dirt and discoloration. Never use emery or carborundum cloth. Always blow all dust from the commutator compartment after cleaning.

Cranking Motor Lubrication

The cranking motor has oilless type bushings and it requires no lubrication.

Removing the Cranking Motor

Disconnect the ground cable from the battery; remove the cable from the terminal on the cranking motor. Remove the three cap screws which hold the cranking motor to the clutch housing and remove the complete cranking motor.

To install the cranking motor, reverse the removal procedure.

Light Switch

The light switch has three positions: "Off," "Bright Head and Rear Light," and "Bright Head Light Only."

The Fuse

A cartridge type SFE-20 fuse is located back of the light switch. If a short circuit occurs in the light circuit, the fuse will burn out and break the circuit, preventing damage to the electrical system.

It is important to use the same capacity fuse for replacement. If the lights fail, check the fuse. If the fuse continually burns out, check the electrical wiring for short circuits.

To install a new fuse, remove the fuse from the mounting clips back of the light switch and replace with a new one.

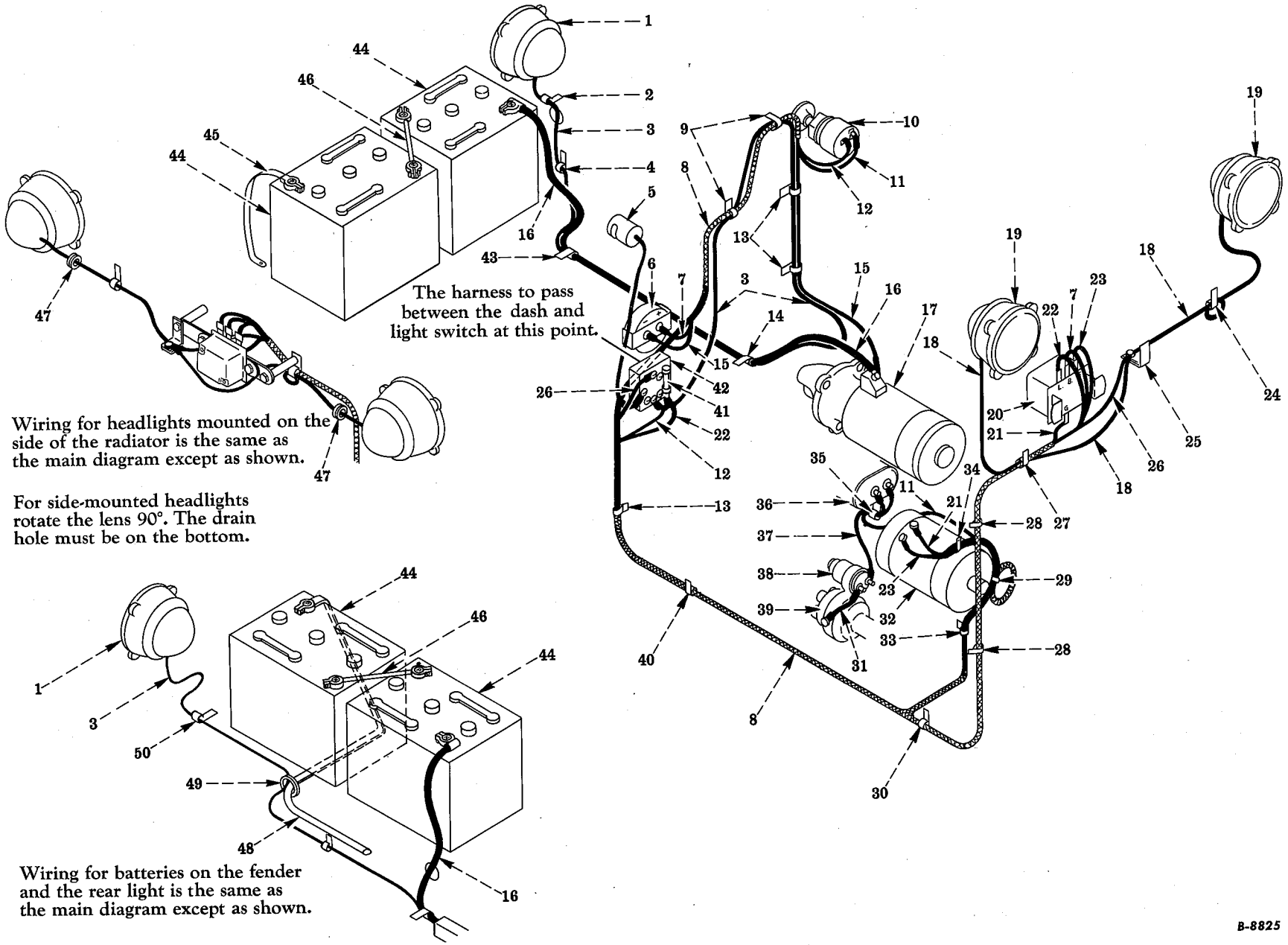
Storage Batteries

Electrical energy, obtained through chemical action, is stored in the battery to be used for starting the engine and for furnishing electric lighting. It is not the source of electricity but only a storage reservoir for use when the generator is not running. In starting, for instance, the battery supplies the energy; but as soon as the engine starts, the generator output begins to replace the electricity taken from the battery.

You will receive maximum satisfactory service from your batteries by closely following a few simple precautions and service operations.

A registration card is furnished with the battery. The purchaser of a new battery should take the card to the nearest authorized battery service station for registration.

Complete instructions for moist, uncharged batteries (used for export) are included with the battery.



Illust. 54 - Wiring diagram for starting and lighting.

Index to Reference Numbers shown in illustration on opposite page.

Ref. No.	Description
1	Rear light.
2	Cable clip for 1/2" bolt (on fender mounting carriage bolt in rear bracket).
3	Cable - light switch to rear light.
4	Cable clip for 3/8" bolt (on fender mounting bolt, second from fuel tank).
5	Dash light.
6	Charge indicator.
7	Cable - charge indicator to "BAT" terminal on regulator (green).
8	Cable harness.
9	Cable clip (dash).
10	Ignition switch.
11	Cable - ignition switch to manifold switch (yellow).
12	Cable - ignition switch to light switch (yellow w/ black tracer).
13	Cable clip for 1/4" bolt (on dash).
14	Cable clip for 1/2" bolt (on engine clutch cover, second bolt from rear; form the clip in assembly to fit cable and bend it to hold cable rigidly against main frame).
15	Cable - charge indicator to starting switch (black).
16	Cable - battery to starting switch.
17	Cranking motor.
18	Cable - right and left head light to junction block.
19	Head light.
20	Cable - "A" terminal on generator to "GEN" terminal on regulator (red w/black tracer).
21	Cable - "A" terminal on generator to "GEN" terminal on regulator (red w/black tracer).
22	Cable - light switch to "L" terminal on regulator (blue).
23	Cable - "F" terminal on generator to "F" terminal on regulator (black w/red tracer).
24	Cable clip for 3/8" bolt (on lower bolt of gas tank).
25	Junction block (mounted on relay bracket stud).
26	Cable - light switch to junction block (black).
27	Cable clip for 5/16" bolt (under relay mounting stud).
28	Cable clip for 5/16" bolt (on fan shroud).
29	Cable clamp (short).
30	Cable clip for 3/8" bolt (on side angle).
31	Cable - ignition coil to distributor.
32	Generator.
33	Cable clip for 3/8" bolt (on crankcase).
34	Cable clip for 5/16" bolt (generator brace bolt).
35	Cable clip for 1/2" bolt (on intake manifold, front).
36	Intake manifold.
37	Cable - negative terminal of coil to manifold switch.
38	Ignition coil.
39	Distributor.
40	Cable clip for 3/8" bolt (on side angle).
41	Fuse.
42	Light switch.
43	Cable clip for 1/2" bolt (on shifter fork housing cover bolt).
44	Batteries.
45	Cable - battery to ground (ground strap to main frame cover).
46	Cable - battery to battery.
47	Grommet in radiator grille.
48	Battery to ground cable.
49	Grommet (in left seat side sheet).
50	Cable clip.

Cleaning and Servicing the Batteries

Battery cable terminals must be kept clean and tight. Use hot water for cleaning the top of the batteries. Brighten the terminal contact surface with wire wool and reassemble. Be sure the terminals are clamped tightly and that the batteries are fastened securely in the battery box. Replace unserviceable cables. Keep the vent holes in the battery filler caps open.

Liquid Level

The electrolyte (acid and water) in each cell should be at star level at all times to prevent battery failure. When the electrolyte is below this level, pure, distilled water should be added. If your battery is equipped with automatic liquid leveling devices, follow the directions furnished with the battery or consult your International Industrial Power distributor or dealer. Never use hydrant water or any water which has been in a metal container. Keep pure, distilled water on hand in a glass jar for battery use only. Use a clean syringe when adding water and be careful not to allow dirt or corrosive salts to enter the cells.

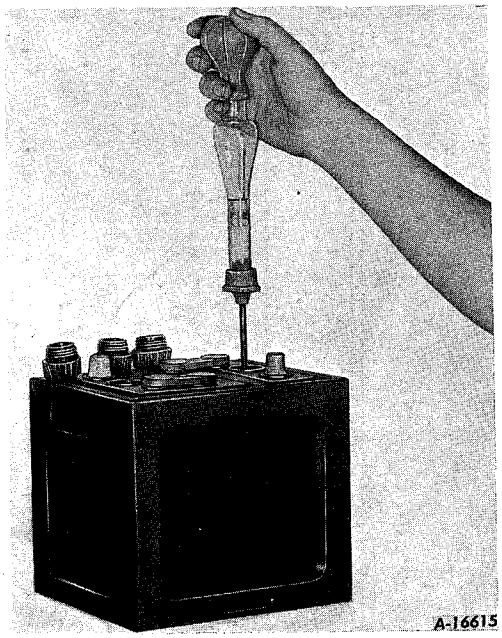
Acid or electrolyte should never be added except by a skilled batteryman. Under no circumstances add any special battery "dopes," solutions or powders.

CAUTION: Electric storage batteries give off highly inflammable hydrogen gas when charging and continue to do so for some time after receiving a steady charge. Do not under any circumstances allow an electric spark or an open flame near the battery. Do not lay tools across battery terminals as this may result in a spark or short circuit which may cause an explosion. Be careful to avoid spilling any electrolyte on hands or clothing.

Specific Gravity of Electrolyte

The specific gravity of the electrolyte indicates the relative condition of the battery charge and warns when it may be necessary to recharge the battery.

Inspect the battery once every two weeks to maintain the correct specific gravity. The specific gravity of a fully charged battery is 1.275 to 1.300 corrected to +80°F. (liquid temperature). A specific gravity reading of at least 1.250 corrected to +80°F. should be maintained. Never allow the battery to fall below 1.240.



Illust. 56
Taking hydrometer reading of electrolyte.

The specific gravity reading will vary with the temperature of the electrolyte. For readings taken at any temperature other than +80°F., a temperature correction must be applied. This is done by adding .004 specific gravity for every 10° above +80°F., and by subtracting .004 specific gravity for every 10° below +80°F.

Example No. 1

Hydrometer reading	1.270
Electrolyte temperature	+20°F.
Subtract .024 Sp. Gr.	(.004 x 6)
Corrected Sp. Gr. is	1.246

Example No. 2

Hydrometer reading	1.255
Electrolyte temperature	+100°F.
Add .008 Sp. Gr.	(.004 x 2)
Corrected Sp. Gr. is	1.263

Use an accurate hydrometer when testing for specific gravity. Reading should not be taken immediately after adding water.

All cells should show approximately the same specific gravity reading. Wide variations indicate something wrong. For service, see your International Industrial Power distributor or dealer, or authorized battery service station.

Battery Voltage

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

Cold Weather Precautions

It is especially important to keep the battery at full charge for cold weather operation. Add water to the battery in freezing temperatures only when the tractor is to operate for several hours, to thoroughly mix the water and the electrolyte, or damage to the battery will result from the water freezing.

The electrolyte of a battery in various stages of charge will start to freeze at temperatures indicated below:

Specific Gravity (Corrected to +80°F.)	Freezing Temperature Degrees Fahrenheit
1.250 - 3/4 charge .	62°F. below zero
1.200	16°F. below zero
1.150	5°F. above zero
1.100	19°F. above zero

The above temperatures indicate the approximate points at which the first ice crystals begin to appear in the solution. The solution does not freeze solid until a lower temperature is reached. A battery three-fourths charged is in no danger of freezing. Therefore, keep the battery better than three-fourths charged, especially during winter weather.

If your tractor is not to be operated for some time during the winter months, it is advisable to remove the battery and store it in a cool, dry place above freezing (+32°F.). Place the battery on a rack or bench.

Check the battery at least once a month for water level and specific gravity. If the battery shows need of charging it should be given immediate attention. Keeping the battery fully charged not only adds to its life but makes it available for instant use when needed.

When replacing a battery, make certain that the ground cable is connected to the positive (+) terminal on the battery.

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

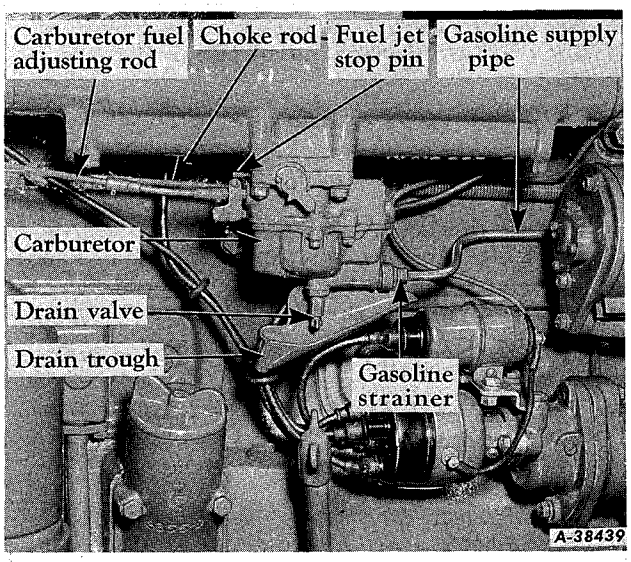
GASOLINE STARTING SYSTEM

Description

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

For operation on gasoline, an auxiliary gasoline tank (2/3 gal.) is provided. It is 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 sediment bowl that is mounted directly under the gasoline tank. From the strainer, the 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.

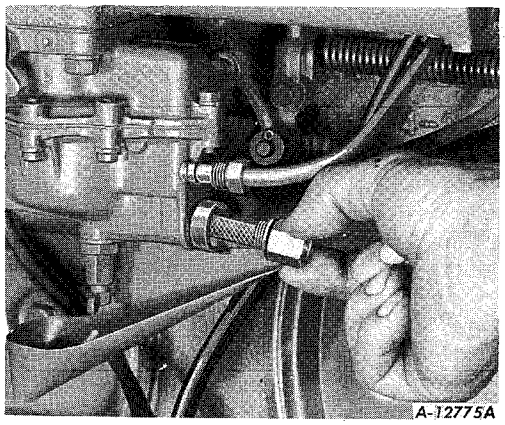
Carburetor



Illust. 57
Starting carburetor.

The carburetor is used only when starting the engine. The gasoline level is controlled by a float valve mechanism. The float valve is locked into its seat, shutting off the flow of gasoline to the fuel bowl, when the engine is changed over to operate on diesel fuel.

Cleaning the Carburetor Strainer Screen



Illust. 58
Removing carburetor strainer.

The float valve is protected against dirt and foreign material by a strainer located in the gasoline inlet fitting. This strainer should be removed occasionally and cleaned as follows:

1. Close the gasoline shut-off valve at the gasoline tank.

2. Disconnect the gasoline supply pipe at the carburetor.

3. Unscrew the strainer fitting from the carburetor; wash it in kerosene and reassemble it.

4. Open the gasoline shut-off valve.

Care of the Carburetor

Periodically, check the screw fastening the fuel bowl to the fuel bowl cover, and see that the cover screws are kept tight to prevent any leakage of air past the fuel bowl cover gasket.

Present day grade 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 engine is to be out of service for more than two weeks.

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

The fuel level in the carburetor should be not less than 13/32 inch or greater than 7/16 inch from the top of the bowl. The top of the float, when properly adjusted, will be approximately 9/32 inch from the top of the bowl.

The starting choke regulates the air for starting.

Removing the Carburetor

The carburetor has two external adjustments. One, the choke control button which regulates the air and gasoline mixture when starting. The second adjustment is the carburetor fuel adjustment button which allows more gasoline to enter the carburetor for cold weather starting. In case of possible internal trouble the carburetor should be removed as explained below and taken to your International Industrial Power Distributor or dealer for servicing.

1. Close the gasoline shut-off valve at the gasoline tank.

2. Open the drain valve and drain all gasoline from the carburetor. After draining, remove the drain valve, which frees the rear end of the drain trough.

3. Disconnect the gasoline supply pipe at the carburetor.

4. Disconnect the fuel adjustment rod at the carburetor.

5. With the compression release lever in the starting position, disconnect the carburetor control link from the carburetor locking lever and shaft.

6. Remove the four stud nuts which secure the carburetor to the intake manifold and remove the carburetor, complete with drain trough.

Installing the Carburetor

1. Install the carburetor on the engine by reversing the order of removal, using a new gasket.

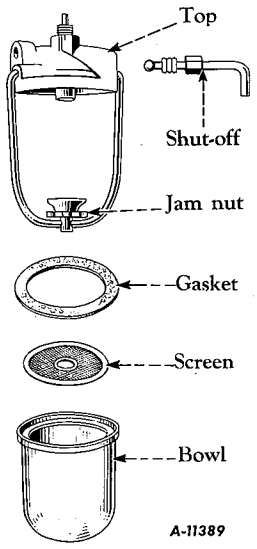
2. Turn on the gasoline supply at the gasoline tank.

Cleaning the Gasoline Strainer and Sediment Bowl

The gasoline strainer under the gasoline tank acts as a combination water trap and sediment bowl. It should be cleaned after every 240 hours of operation.

1. Close the shut-off valve.

2. Loosen the jam nut below the glass bowl and swing the bail aside. The wire screen should come away with the bowl, but if it sticks to the cork gasket, it can be removed with the fingers.



Illust. 59
Gasoline strainer and sediment bowl disassembled.

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

Servicing Internal Parts

In case of possible internal trouble, the carburetor should be removed and taken to your International Industrial Power Distributor or dealer for servicing.

DIESEL FUEL SYSTEM

Description

The diesel fuel system includes: the fuel tank; water trap; auxiliary fuel filter; final fuel filter; single plunger injection pump with combination primary and scavenging pumps and built-in governor; injection nozzles and necessary piping and connections.

Fuel passes through the system *(Illust. 61)* as follows:

The fuel flows from the fuel tank by gravity into the water trap. From here it is drawn through the auxiliary filter (equipped with replaceable filter element) by the primary pump located on the injection pump.

From the auxiliary filter the fuel enters the primary pump through a replaceable close mesh strainer, and is forced under pressure through the final filter. Excess fuel from the primary pump is released by a by-pass valve for recirculation through the primary pump.

From the radial fin type final filter the fuel passes through a fine mesh strainer into a reservoir above the plunger in the injection pump. The fuel is then forced by the plunger through the distributor valves and fuel lines to the injection nozzles and into the combustion chambers of the engine.

Diesel Fuel Storage and Care

Diesel fuel should be free from sediment and water. If sediment is allowed to reach the injection pump it will act as an abrasive on the closely fitted moving parts, causing rapid wear, and shortening the normal life of the pump. If water is allowed to pass through the pump it will cause corrosion and subsequent scoring of parts.

A storage tank provides the best method of storing diesel fuel on the job. By the use of a storage tank the sediment and water can easily be drained off through a trap, and the fuel can be pumped into the tractor with a minimum of handling.

When conditions require the use of drums for fuel storage, it is advisable to use a pump to draw the fuel from the drum, rather than a faucet, as the water and foreign materials settle to the bottom of the drum. The suction pipe of the pump should be at least three inches from the bottom of the storage tank or drum.

Whenever drums are used for storage of diesel fuel, they should be placed under cover, or in a horizontal (laid down) position if left exposed to rain. It is advisable not to disturb the drums after the fuel settles.

The last three inches in each drum or tank should not be used but should be collected into one container and allowed to settle. In this manner the sediment and foreign materials can be separated from the fuel and disposed of with no loss of fuel.

Venting Air from Fuel System

The engine will not operate satisfactorily on the diesel cycle if there is any air in the fuel injection system, due to "air lock." Loss of power, or missing of the engine, is frequently caused by air in the fuel system, which may happen from a variety of causes, such as: changing the fuel filter elements; removing and replacing fuel lines or connections; allowing the fuel in the tank to run low; or operating the engine a short time with the fuel tank valve closed.

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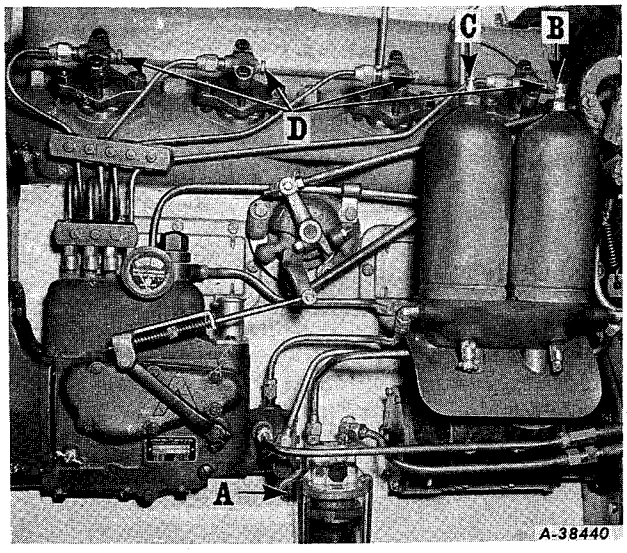


Illust. 60
Water trap, auxiliary filter, final fuel filter and injection nozzles.

If air has entered the fuel system in any way, it will be necessary to vent the system before the engine will operate on the diesel cycle. Remove the air by venting the water trap, fuel filters, and injection nozzles, as follows:

1. Before the engine is started and with the fuel tank valve open, open the water trap vent screw "A" *(Illust. 60)* and the auxiliary fuel filter bleeder "B." These vents should remain open until fuel flows free from air. IMPORTANT: The level of the fuel in the tank must be above the top of the auxiliary filter when the air is being vented.

2. Close the vents when the fuel flows free from air.

3. Start the engine (in gasoline position), then open the final filter bleeder "C." Close the bleeder "C" when fuel starts to flow.

4. Advance the engine speed control lever slightly while operating on gasoline and open each nozzle vent "D" individually until the fuel flows free from air, then close the vent.

Draining and Cleaning Diesel Fuel Water Trap and Strainer

Proper servicing of the water trap is of vital importance because, if the fuel filters become waterlogged, the fuel flow will be restricted. The trap is located on the left side of the engine. The water should be drained from the trap every ten hours of operation, or sooner if conditions require it. This may be done by opening the drain screw valve on the water trap top *(Illust. 60A)*.

The trap should be taken apart and cleaned after every 480 hours of operation. To do this:

1. Close the fuel shut-off valve under the fuel tank.

2. Remove the trap by loosening the bolt holding the top to the bracket which is mounted on the engine crankcase.

3. Loosen the thumb nut under the bowl. Remove the bail strap and the bowl.

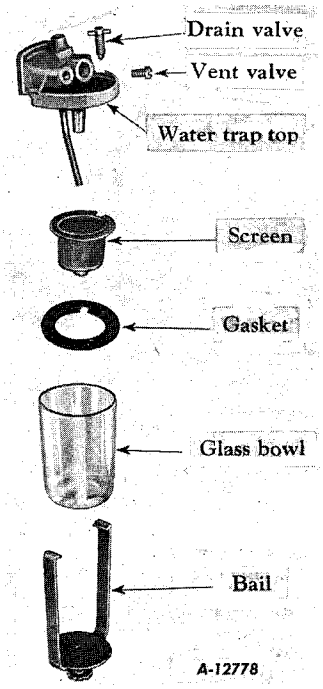
4. Loosen the gasket and pull the screen off the tube. Wash the top, screen, gasket, and glass bowl in kerosene to remove all dirt and sediment.

5. Reassemble the screen and gasket, which must be in good condition and in its proper place.

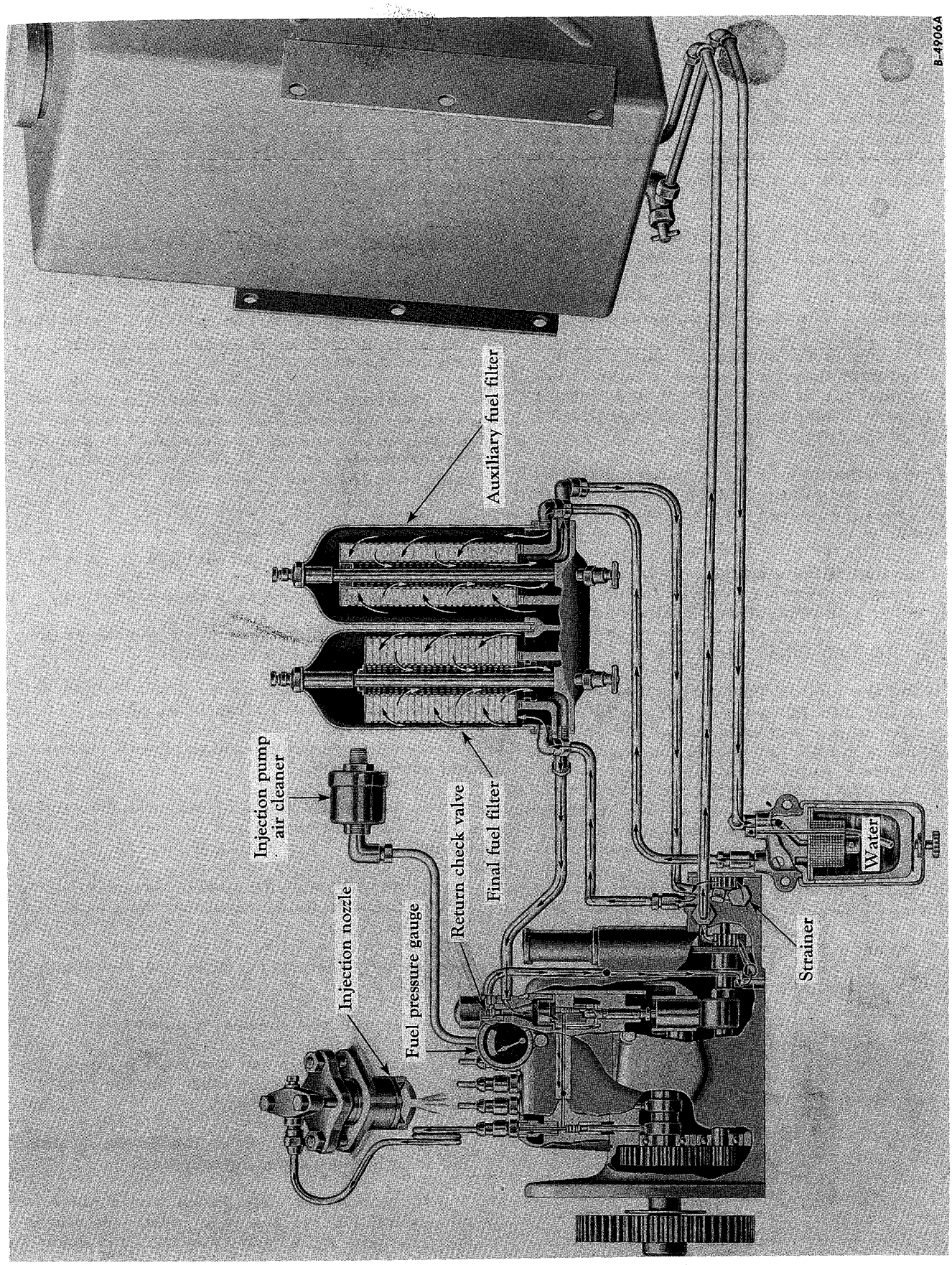
6. Reassemble the glass bowl and strap and tighten the thumb nut by hand.

7. Then assemble the entire trap and gasket (replace the gasket if necessary) to the bracket.

8. After complete assembly, open the fuel shut-off valve under the fuel tank and vent the system of air as described above.



Illust. 60A
Diesel fuel water trap and strainer.



Illust. 61 – Schematic drawing of diesel fuel system.

Auxiliary and Final Fuel Filters

Filter cases are plainly marked "Final Filter" and "Auxiliary Filter" and the base is correspondingly marked "FIN" and "AUX." The final filter is located on the left side, and the auxiliary filter is located on the right side when looking toward the filter side of the engine.

The auxiliary and final filters are proviced with replaceable filter elements. The life of the filter elements depends upon the amount of dirt, water and sediment that they must remove. These 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.

The normal life of the auxiliary filter element is approximately 1,000 hours of operation if the diesel fuel water trap has been properly serviced.

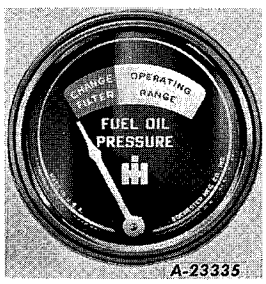
The final filter element will last indefinitely if proper service is given to the auxiliary filter and to the diesel fuel water trap.

When to Replace Filter Elements

When the fuel oil pressure indicator located on the injection pump *(Illust. 62)* shows the pointer of the indicator in the red or "CHANGE FILTER" area with the engine running (either on gasoline or diesel cycle), it means that one or both of the fuel filters need replacement, or that the fuel system is clogged at some point. It may also be accompanied by loss of power or misfiring of the engine.

Before replacing filter elements, service the air and water trap. *See pages 59 and 60.*

If the indicator pointer remains in the red area after servicing the air and water trap, replace the auxiliary fuel filter element.



Illust. 62
Fuel oil pressure indicator.

Clean the primary pump filter screen. *See page 63.*

If the indicator pointer 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. *See page 63.*

Precautions When Replacing Filter Elements

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

Before loosening the filter retaining bolt clean the outside of the case and base thoroughly with kerosene or diesel fuel to prevent dirt or foreign material from entering the base when the case is removed.

Removing and Replacing the Auxiliary Fuel Filter Element

1. Close the fuel tank shut-off valve.

2. Open the air vent valve and the drain valve and allow the fuel to drain.

3. Unscrew the retaining bolt and lift both the case and bolt from the filter base.

4. Remove the old element with the top and bottom plates.

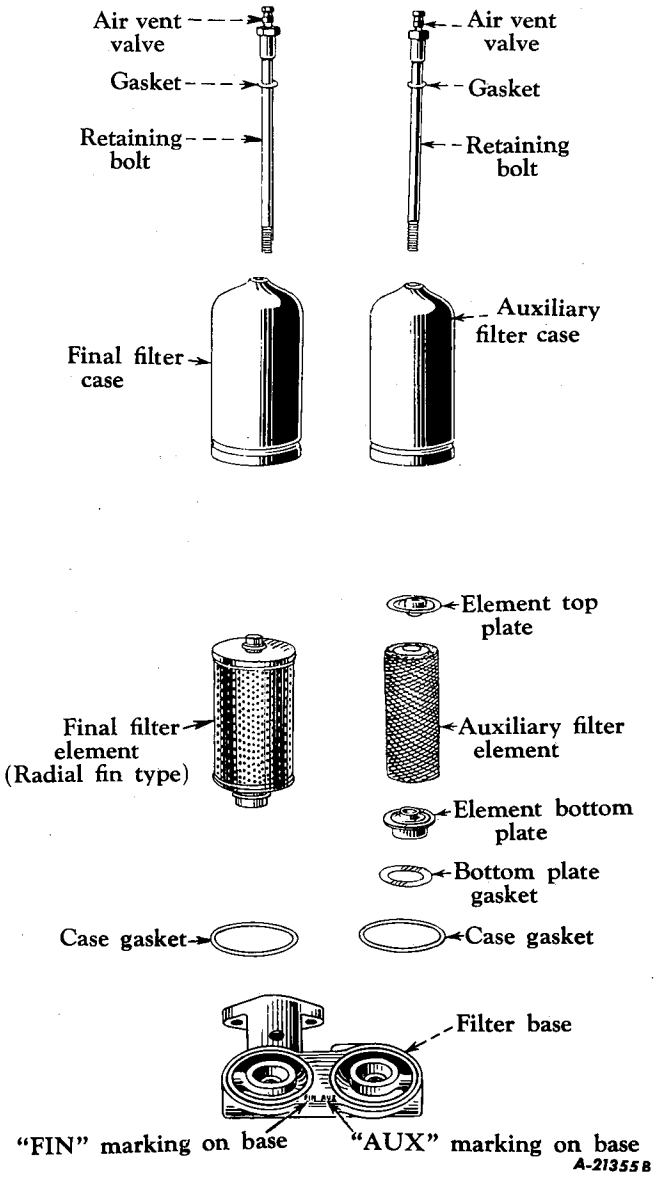
5. Rinse the inside of the case thoroughly with diesel fuel to remove all dirt or foreign substances.

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 kerosene or diesel fuel. Inspect the filter base gasket and replace if necessary.

7. Install the element top and bottom plates on the new filter element. Be sure that the plates slide into the wire coil inside of the element and that the top plate has the face stamped "TOP" on the top.

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

9. Inspect the case gasket and replace if necessary. Install the case and the retaining bolt marked "AUX" and draw the case down tight.



Illust. 63
Auxiliary and final fuel filters disassembled.

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 valve for traces of water every day, or more frequently under severe conditions. If water is found, it indicates more frequent servicing of the diesel fuel water trap is necessary to obtain full service from the auxiliary fuel filter element.

Removing and Replacing the Final Fuel Filter Element

1. Close the fuel tank shut-off valve.

2. Open the air vent valve and the drain valve and allow the fuel to drain.

3. Unscrew retaining bolt and lift both the filter case and bolt from the filter base.

4. Remove the old element.

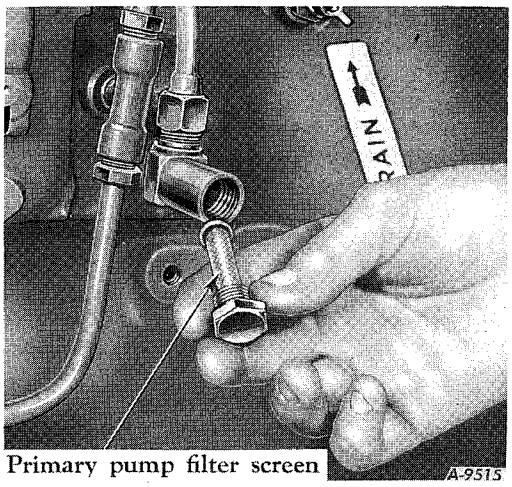
5. Place the new filter element in the base. (The end with the large pilot must be down.) Insert the new element carefully using a slight twisting motion to prevent damage to the seal ring on the bottom pilot.

6. Put on the case and insert the bolt marked "FIN" through the filter element and into the filter base. (When inserting the bolt through the element turn the threaded portion of the bolt through the seal ring in the top of the filter element to prevent damage.) Draw the case down tight by tightening the retaining bolt.

7. In some installations, because of insufficient clearance, it will be necessary to remove the filter element and case together.

8. Open the fuel tank shut-off valve.

Primary Pump Filter Screen



Illust. 63A
Removing primary pump filter screen.

The primary pump filter screen located in the primary pump inlet fitting should be cleaned whenever the auxiliary filter element is changed. Remove the nut and filter screen assembly from the primary pump filter body and wash in kerosene or in 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.

Fuel Injection Pump and Governor

The fuel injection pump is 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 a part of the fuel injection pump and is fully enclosed and sealed at the factory. It operates in a bath of oil and its function is to maintain the engine speed selected by the operator and to 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 tractor, due to possible trouble in the injection pump, first check over the instructions *on pages 59 to 66* 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 remove and replace the fuel injection pump *(see pages 65 and 66)* or refer to your International Industrial Power Distributor or dealer.

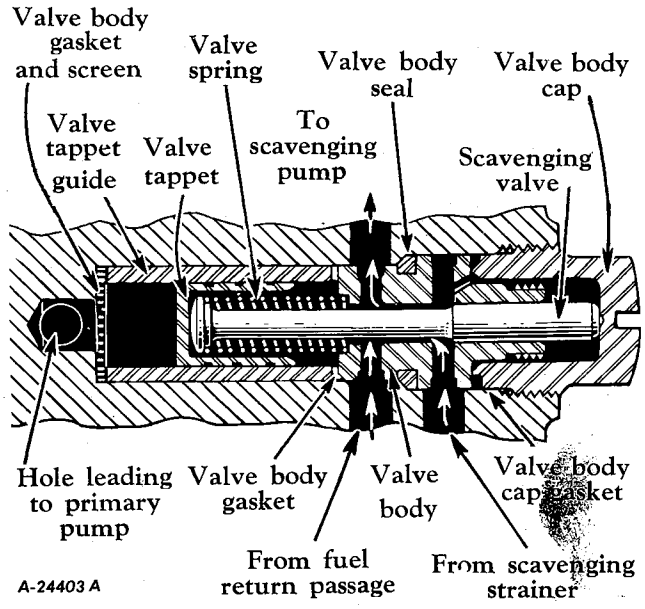
Scavenging Valve

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 scavengine 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.

Removing the Scavenging Valve

Use a wide bit screwdriver to remove the scavenging valve cap. *See Illust. 64.* Remove the scavenging valve body by using a 1/8 inch pipe coupling that catches 1 or 1-1/2 threads of the body. Use a 1/4 inch 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 dry-cleaning solvent.



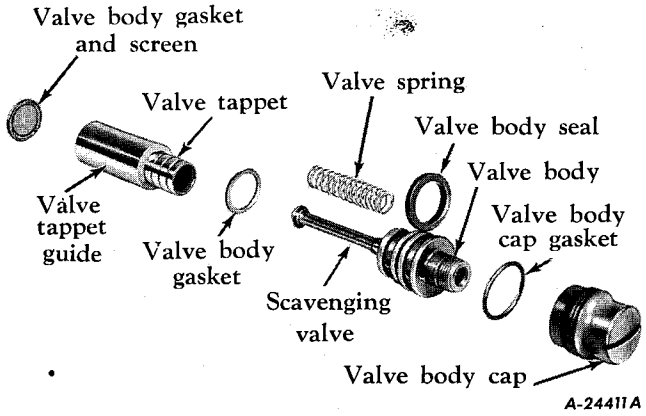
Illust. 64
Cross section of scavenging valve assembly.

Installing the Scavenging Valve

The scavenging valve parts must be kept clean and should be reinstalled *as shown in Illust. 64A*, and according to the following instructions.

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.



Illust. 64A
Exploded view of scavenging valve assembly.

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.

5. Lubricate the valve spring, the scavenging valve, and valve body, and the 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.

Removing the Fuel Injection Pump

In case it becomes necessary to remove the complete fuel injection pump from the engine, follow these instructions:

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

2. Put the compression release lever in the gasoline (starting) position.

3. Disconnect the ignition switch cable "C" *(Illust. 49B)* from the negative terminal on the ignition coil.

4. Disconnect the engine speed control rod.

5. Drain the diesel fuel from the fuel filters and the lubricating oil from the injection pump housing.

6. Thoroughly clean the injection pump and the fuel line connectors with a brush and diesel fuel. Disconnect all fuel pipes. (Use two wrenches - one on the pump fittings, the other on the nut on the fuel pipe.) Cap all fittings and tape the ends of all fuel lines to keep dirt from entering the system.

NOTE: Keep all parts clean.

7. Take out the five cap screws which secure the pump gear cover to the crankcase front cover and remove the pump gear cover.

8. Take out the three cap screws "A" *(Illust. 66)* which secure the timing indicator "B" and pump gear "C" to the gear hub "D" and remove the timing indicator.

9. Take out the three cap screws "E," reached through the elongated holes in the injection pump gear *(see Illust. 66)* which secure the front mounting flange to the crankcase front plate. (Turn the engine with the hand crank until the cap screws are centered in the elongated holes.)

10. Take out the two cap screws "F" which secure the pump mounting flange to the crankcase front cover and lift off the complete pump assembly.

Installing the Fuel Injection Pump

When the fuel injection pump is to be reinstalled on the engine, follow these instructions:

1. If the timing was disturbed while the injection pump was removed, support the injection pump drive gear in the crankcase front cover, with a wire through the hub hole and over the top of the housing so the gear will not bind in the housing, and crank the engine until the No. 1 cylinder is at the top dead center of the compression stroke. This position can be determined by removing the No. 1 spark plug and placing your thumb over the opening and slowly cranking the engine until an outward pressure is felt. Continue slowly cranking 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. Then remove the wire holding the pump drive gear.

2. Assemble a new gasket to the pump mounting flange. Lift the pump into place against the crankcase front cover and insert the pump gear hub into the pump gear.

3. Secure the top of the pump mounting flange to the crankcase front cover with the two cap screws. *See "F" in Illust. 66.*

4. Use a hand crank to turn the engine to align the three elongated holes in the pump gear with the three cap screw holes behind the gear. Insert and tighten the three cap screws which secure the injection pump to the crankcase front cover. It is important to put the short cap screw in the lower hole.

5. Line up the notch in the gear hub with the notch on the front face of the gear. Assemble the timing indicator to the gear hub, setting the indicator at "O." Insert and tighten the three cap screws which secure the indicator and the gear to the gear hub.

Continued on next page

6. Assemble the gear cover with a new gasket and loosely secure it to the crankcase front cover with the cap screws to prevent the entrance of dirt. Do not tighten the cap screws because it may be necessary to remove the cover to time the injection pump.

7. Connect the engine speed control rod.

8. Connect the fuel pipes. (Use two wrenches.) Be sure all connections are clean and tight.

CAUTION: When reassembling the pipe nuts on the fuel lines to the injection pump, turn the nut with a wrench until you can feel the nut solidly contact the sleeve. From that point apply 1/6 to 1/3 turn with the wrench.

9. Add lubricant as specified in the "LUBRICATION GUIDE" on pages 24 and 25.

10. Attach the ignition switch cable "C" *(Illust. 49B)* to the negative terminal on the ignition coil. Set the compression release lever in the gasoline (starting) position.

11. Start the engine on gasoline and vent the air from the entire fuel system. *See pages 59 and 60.*

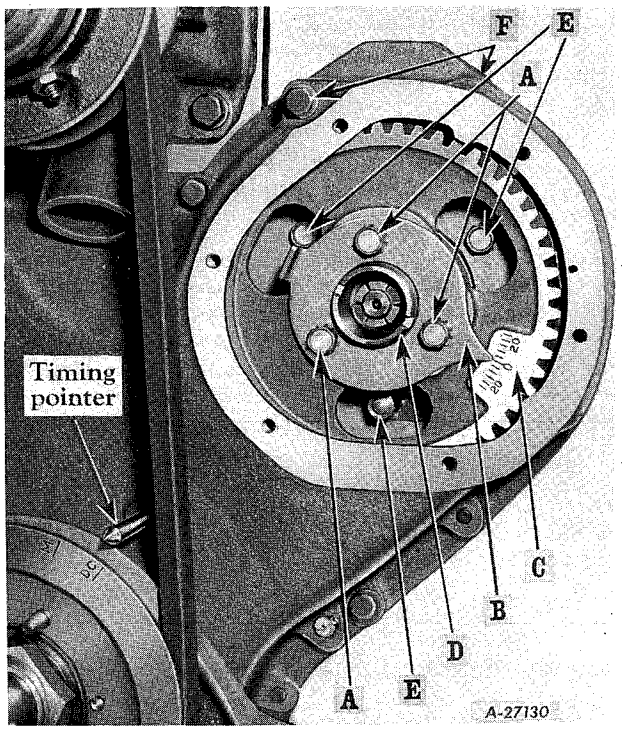
12. Convert to diesel cycle and note the engine operation. If it is not smooth, stop the engine, remove the cover, and check and adjust the timing as described below. If the operation is satisfactory, stop the engine and tighten the five cap screws in the drive gear cover. *See step 6 above.*

Timing the Fuel Injection Pump

The injection pump is fitted with a timing adjustment. This adjustment must be made when the engine is not operating. The correct adjustment has been obtained when the engine speed is maximum for a fixed load, and the engine operation is smooth, with a clean exhaust.

It is necessary to take out the six cap screws which hold the pump gear cover in place and remove the cover to make the injection pump timing adjustment.

The timing adjustment is normally set with the indicator "B" at the graduation center mark "O" on the pump gear "C." *See Illust. 66.* It may be advanced or retarded by loosening the cap screws "A" and turning the gear hub "D" clockwise to advance the timing or counterclockwise to retard the timing of the injection pump. To be sure of the best timing adjustment, the engine should be operated with the indicator on either side of the center mark and set in the position giving the most efficient operation.



Illust. 66
Injection pump timing.

Be sure to tighten securely the cap screws "A" which hold the indicator and pump gear to the gear hub.

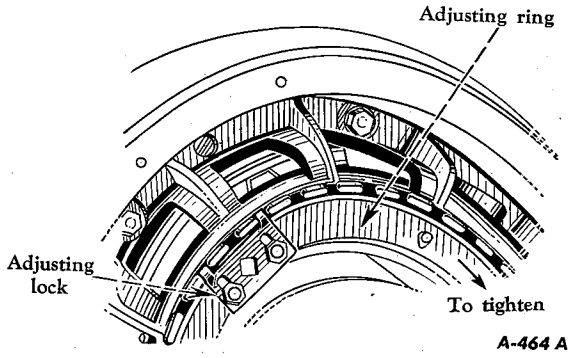
Inspect the pump gear cover gasket and replace the gasket if necessary. Install the cover and the six cap screws holding it.

ENGINE CLUTCH

This is a hand-operated, 13-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.

Operation

1. The clutch is fully engaged when the engine clutch lever is pulled back all the way to a point where the full over-center cam engagement is definitely felt.



Illust. 67
Adjustment features of the over-center clutch.

2. The clutch should be adjusted when there is a noticeable clutch slippage while the tractor is operating under load.

Maintenance

This clutch is designed so that it requires a minimum of attention. It is very important, however, that the lubrication instructions outlined in the "LUBRICATION GUIDE" be closely followed.

When operating the tractor in water, under very wet or under extremely dusty conditions, water or dust may enter through the hole in the drain plug of the engine clutch compartment. To avoid this, replace the drain plug with a solid plug. The solid plug should be removed after every 60 hours of operation, to drain any excessive lubricant that may have collected.

Adjusting the Engine Clutch

1. Remove the round clutch inspection cover, which is located on the floor plate ahead of the steering clutch levers.

2. Slowly crank the engine until the adjustment ring lock is accessible at the injection cover opening. Loosen the nut on the adjusting ring lock and disengage the lock from the notch in the back plate.

3. With the clutch lever in disengaged position, turn the adjusting ring in a clockwise direction, moving it one notch, or possibly two notches at the most, at any one time. Engage the ring lock in the lock plate. Pull the clutch lever back to the engaged position as a check to determine if over-center engagement is felt.

4. If the adjustment has been made as outlined, and the cams are so tight that the full over-center engagement is not definitely felt, the adjusting ring should be backed off one notch (in counterclockwise direction).

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

The clutch is correctly adjusted when a considerable (not excessive) pressure can be felt when the clutch lever is pulled back to the engaged position and a definite over-center cam engagement can be felt. If little or no pressure on the end of the clutch lever is required to engage the clutch, then further adjustment is necessary.

5. After the clutch has been correctly adjusted, be sure to tighten the nut on the adjusting ring lock; then replace the cover plate.

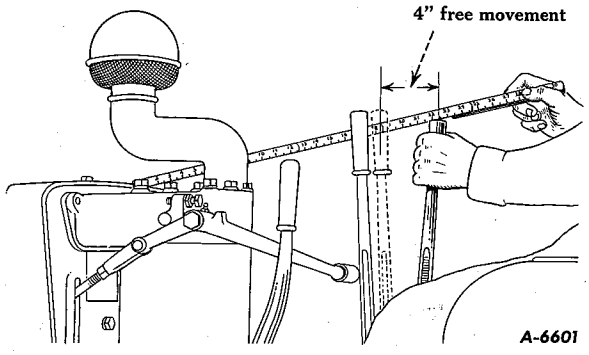
STEERING CLUTCHES

Description

There are two 14-1/8 inch, multiple dry-disc, spring-loaded type steering clutches in the tractor. They are located in separate dry compartments, one on each side of the drive bevel gear compartment, at the rear of the main frame. The two steering clutch levers, directly in front of the operator, control the steering clutches.

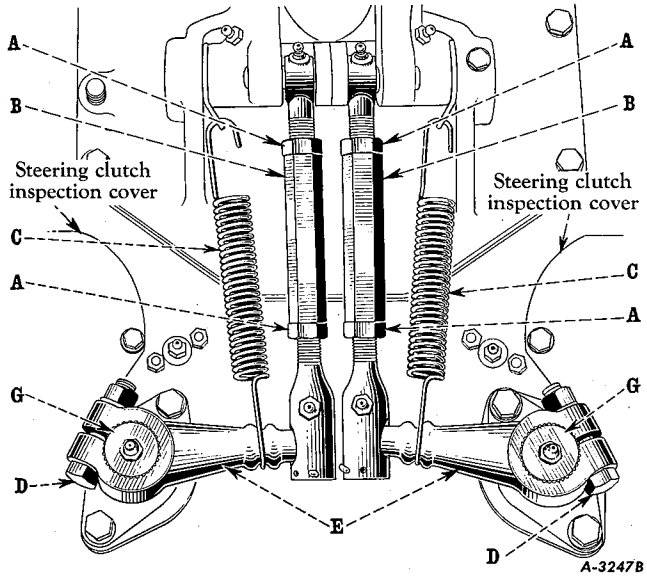
The steering clutch levers must have two inches minimum to four inches maximum free travel before meeting resistance for normal operation. Measure this free travel *as shown in Illust. 67A.*

If the steering clutches slip, or if the free travel of the levers is incorrect, adjustment is necessary.



Illust. 67A
Measuring free movement of steering clutch levers.

Adjusting the Steering Clutches



Illust. 68
Steering clutch adjustment.

Loosen the lock nuts "A" *(Illust. 68)* and turn turnbuckle "B" several turns to shorten the linkage. Then tighten the lock nuts "A" against the turnbuckle "B."

Check to see if the free movement of the clutch lever is between two and four inches.

When adjustment can no longer be made by means of shortening the operating linkage, proceed as follows: Remove the release springs "C." Loosen the lock nuts "A" and turn the turnbuckle "B" to lengthen the linkage as much as possible. Remove the release lever cap screw "D" and pry the release lever "E" off the splined release shaft "G." Turn the right-hand release lever counterclockwise (the left-hand release lever clockwise) slightly, and replace the release lever "E" on the splined shaft "G." Replace the spring "C" and shorten the linkage until the free movement of four inches is obtained.

When the desired free movement of the lever is obtained, replace and tighten the release lever cap screw "D" and tighten the lock nuts "A" against the turnbuckle.

Subsequent intermediate adjustments can be made by shortening the linkage as described.

STEERING BRAKES

Description

There are two steering brakes on the tractor, one surrounding each steering clutch drum. The brakes are 15-3/4 inch contracting bands, actuated by pedals located (one on each side) of the operator's compartment. The steering brake pedals should have approximately three inches of free movement before meeting resistance, measured at the pedal pad *(see Illust. 69)*. If the free movement becomes less than two inches, adjustment is necessary.

Adjusting the Steering Brakes *(See Illust. 69.)*

1. Remove the foot rest and jam a screwdriver or similar sized object between the adjuster "B" and the main frame. Loosen the two cap screws "A" which hold the brake pedal to the pedal shaft and adjuster. Two holes are provided in each main frame side channel to permit access to these cap screws.

2. With the cap screws loosened sufficiently shove the adjuster downward several notches (the adjuster is notched on the inside and contacts a notched adjuster lock "J").

3. While holding the adjuster "B" in this new position, pull the brake pedal "L" up and rearward as far as possible (complete disengaged position) and continue holding the adjuster while another man on the outside of the tractor tightens the forward cap screw.

4. Again measure the free travel of the brake pedal. If more adjustment is needed repeat the above procedure and shove the adjuster downward a few more notches; then tighten both cap screws.

When adjustment can no longer be made in this manner, proceed as follows:

1. Loosen the two cap screws "A."

2. Pull the adjuster "B" up as far as possible.

3. Remove the steering clutch inspection cover from the top of the main frame cover.

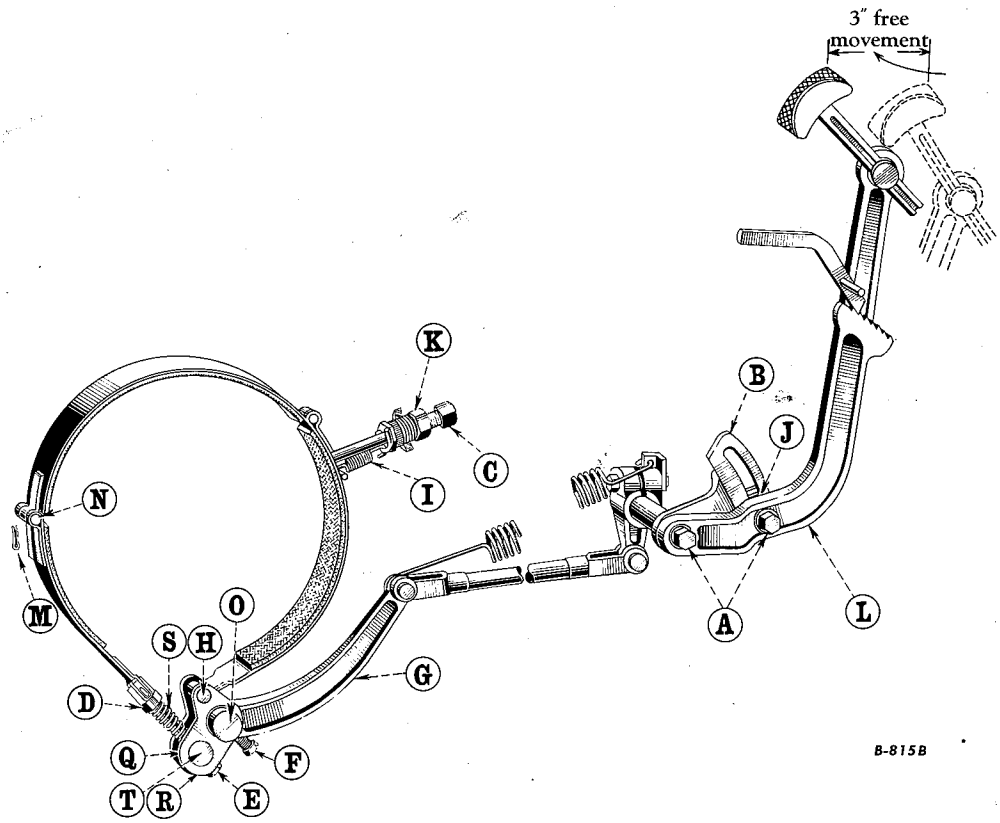
4. Loosen the jam nut "K" and turn the set screw "C" until there is a clearance of 1/64 inch between the lining and the steering clutch drum at that point; then tighten the nut "K."

5. Remove the steering brake inspection cover from the bottom side of the main frame.

6. Loosen the lock nut "D" and turn the adjusting bolt "E" until the clearance between the brake band lining and the drum at that point is 1/64 inch.

7. Secure the adjusting bolt "E" by tightening the lock nut "D" against the rear section of the brake band.

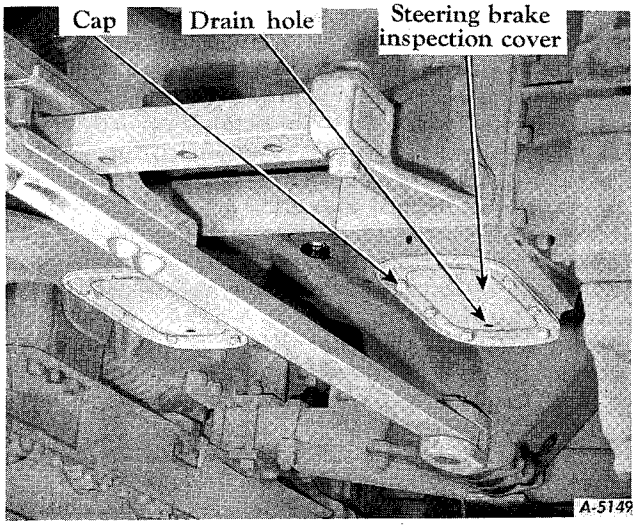
8. Replace the steering clutch and the steering brake inspection covers.



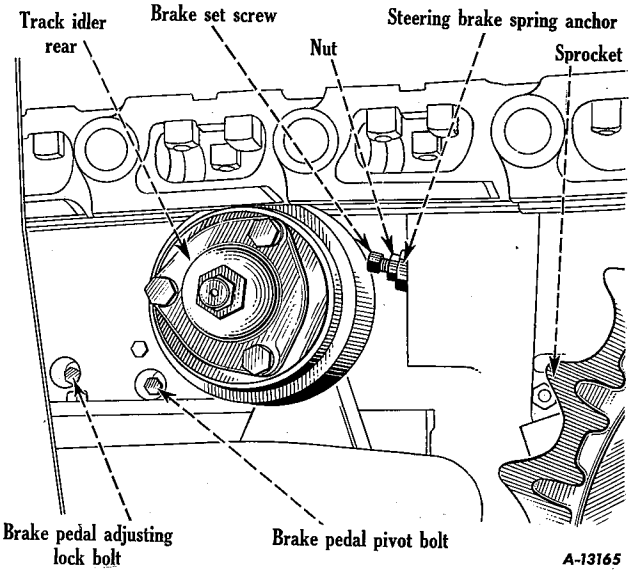
Illust. 69
Diagram of steering brakes and controls.

9. Adjust the brake pedal as described previously to give three inches free movement.

IMPORTANT: The brake band should be removed and relined before the lining is worn to the point where the rivets in the lining will score the clutch drum. Squealing brakes usually indicate the necessity for new linings.



Illust. 69A
Steering brake inspection covers.



Illust. 69B
External points for adjusting steering brakes.

Renewing the Brake Linings *(See Illust. 69.)*

1. Lift out the seat cushion and rear seat support. Then remove the steering clutch inspection cover.

2. Remove the foot rest. Loosen the nut "K" and remove the set screw "C."

3. Separate the rear and center sections of the brake band by removing the cotter pin "M" and pushing out the pin "N."

4. Remove the steering brake inspection cover from the bottom side of the main frame.

5. Take off the pipe plug in the lower outside of the main frame, in line with the pivot shaft "O." Remove the pivot shaft stud "F" and insert a short punch in the pipe plug hole and drive the pivot shaft so that it can be removed from the inside.

6. Loosen the lock nut "D," washer "Q," spacer "R," and spring "S" from the adjusting bolt. Remove the adjusting bolt adjusting pin "T."

7. With the pivot lever assembly pushed up out of the way, pull the rear and center sections of the brake band out through the steering brake inspection hole underneath the tractor.

8. Push the brake pedal all the way down and lock in this position with the brake pedal lock.

9. From underneath the tractor pull the pivot lever assembly down until the joint pin "H" can be worked out of the pivot lever "G" to the outside.

10. Disconnect the anchor spring "I" and lift the front section of the brake band out of the inspection hole at the top.

11. Reline the band and replace it by reversing the above procedure; then adjust the brakes as outlined above.

TRACK ASSEMBLIES

General

When backing the tractor, the track chain may have a tendency to climb the sprocket if it is too loose.

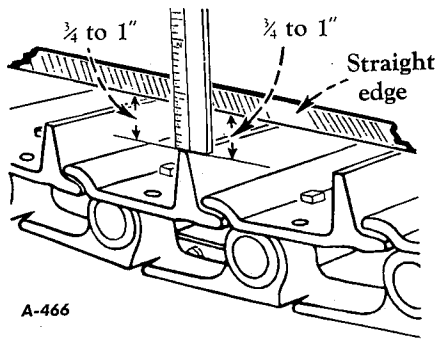
If the track adjustment is either too tight or too loose, it will cause undue wear on the track links, pins, bushings and bearings, and also on the front idler bearings.

When properly adjusted, the track chain spring takes care of the play in the track chain and there is no looseness or tension on the track when in the normal operating position.

On a new unit, check the track shoe bolts after every eight hours of operation until it becomes evident that a "set" has taken place. The evidence of a "set" having taken place can be determined when the bolts retain a tightness of 140 to 150 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. Ordinary bolts should not be used.

While tightening the bolts, strike the head of each bolt several sharp hammer blows and retighten. As a safety measure we recommend that you use goggles to protect your eyes while striking the bolts.

Checking Slack in the Track Chain

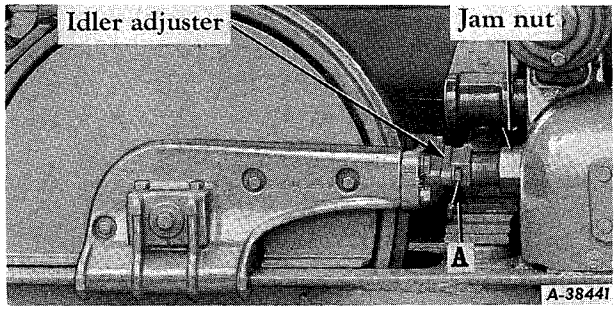


Illust. 70
Method of checking track chain tension.

In order to check the slack in the track chain, the chain must be tight everywhere except on the top, between the top idlers. This can be accomplished by placing a wooden block, approximately one foot in height, under the foremost track shoe lug; then, with the engine operating, put the tractor in low gear and engage the clutch just 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 between the top idlers. Your weight will pull the chain tight around the idlers. All slack should now be in the top part of the track chain between the top idlers.

Place a straightedge along the top of the track lugs, extending the full length of the chain *(see Illust. 70)*. The sag of the chain under the straightedge should be approximately three-fourths to one inch, measured at the center between the top idlers.

Adjusting the Track Chain



Illust. 71
Adjuster for changing track chain tension.

If it is necessary to adjust the track chain, remove the two cap screws "A" at the front of the track spring adjuster, and loosen the jam nut. Turn the idler adjuster clockwise (as viewed from the rear, the sprocket end). This pushes the front idler yoke forward, tightening the track chain. Turn the adjuster counterclockwise to loosen the track chain.

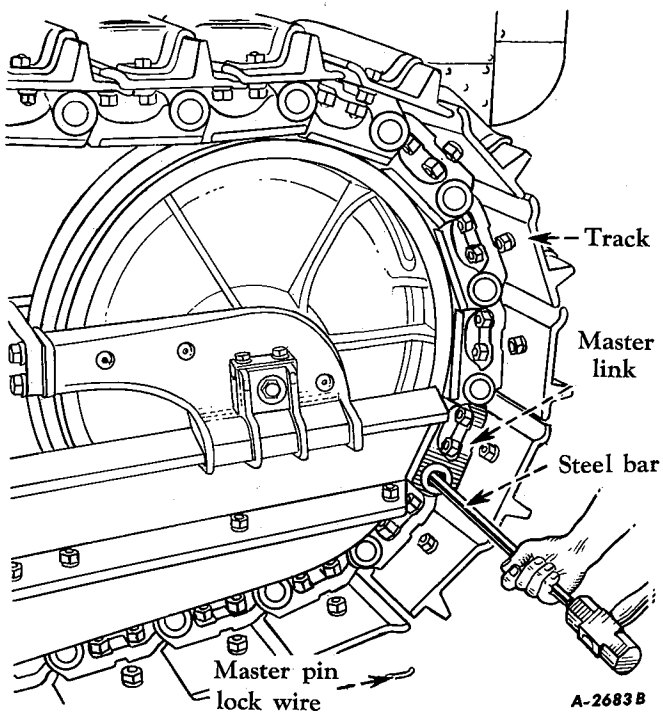
After the correct adjustment has been obtained, install the cap screws "A" and tighten the jam nut.

After a new track chain has been thoroughly broken in, check and adjust the amount of slack if necessary.

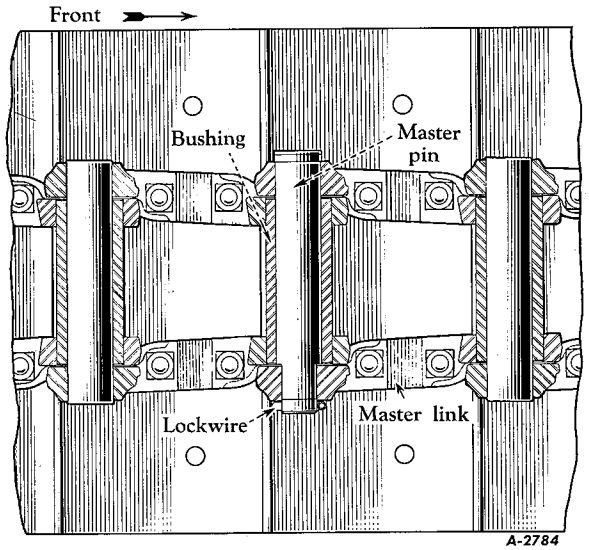
Removing the Track

To remove the entire track from the tractor, drive the tractor forward until the track link master pin *(Illust. 71A)* is in the 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 under "Adjusting the Track Chain" above.

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



Illust. 71B
Track link master pin removal.



Illust. 71A
Track link master pin assembly.

Back the tractor until it is at the end of the track. Plane a plank flush against the rear of the track. 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 you desire to replace the old track, remove the old track as described above and place the new track (instead of a plank) flush against the rear of the old track.

Installing the Track

When installing the track, the end with the bushing should be in the position *shown in Illust. 72.* Place the track flush against the plank and drive the tractor forward onto

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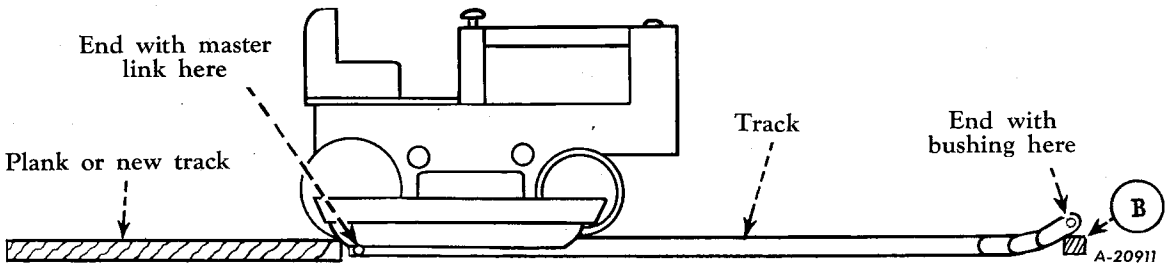
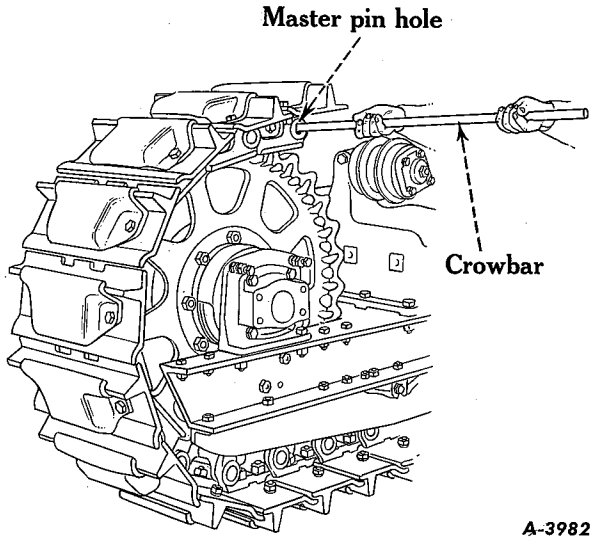
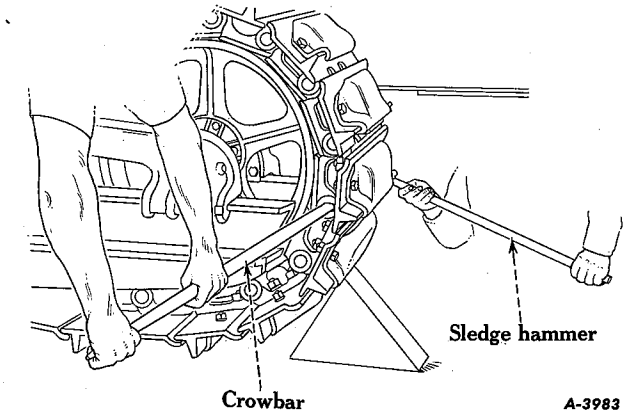


Illust. 72
Removing the track.



Illust. 72A
Installing the track.

the track until the sprocket is slightly ahead of the rear end of the track. Put the crowbar through the master pin hole *(Illust. 72A)* and pull the track up around the sprocket and forward over the track idlers and front idler as the tractor is driven forward.



Illust. 72B
Installing the track.

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

Place a block (about eight to ten inches high) under the cleat of the shoe on the last link of the track *(Illust. 72B)* to hold the track against the idler. Engage the engine clutch and apply just enough power in the forward speed to take the slack out of the bottom part of the track; then install the master pin and the lock wire. Adjust the tension in the track chain *as described on page 70.*

Track Roller Lubrication

It is important that the track rollers have the proper lubrication. Refer to the "LUBRICATION GUIDE" on pages 24 and 25.

STORING THE TRACTOR

When the tractor is not to be used for a period of time, it should be stored in a dry and protected place. Leaving equipment outdoors, exposed to the elements, will result in materially shortening its life.

The following procedure should be followed when the tractor is placed in storage for 30 days or more, and the lubrication precautions should be repeated every six months thereafter. We also recommend caution in starting an engine that has been in storage.

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

2. Drain the lubricating oil from the fuel injection pump and governor and refill with new oil as specified in the "LUBRICATION GUIDE."

3. Prepare the fuel injection pump and related parts as follows:

(a) Drain the diesel fuel tank. Clean the diesel fuel water trap, and reassemble. Drain the fuel filters.

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

(c) Pour four 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 a good grade of light lubricating oil may be used.

(d) Open the air bleed vents on the water trap and on the auxiliary fuel filter. When oil appears, close the air bleed vents.

(e) Open the air bleed vent on the final filter. Then start the engine and operate on gasoline with the engine speed control lever partly advanced. When oil appears, close the air bleed vent and switch the engine to the diesel cycle, and operate for ten minutes as follows:

1. Operate on the diesel cycle for five minutes and shut down.

2. Start the engine again and operate on the diesel cycle for one minute, and shut down.

3. Start the engine again and operate on the diesel cycle for the remaining four minutes, and shut down.

(f) Reconnect the fuel line.

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

4. Drain all water from the cooling system.

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

6. Remove the valve cover and spray SAE-50 lubricating oil over the rocker arm and starting valve assembly. Replace the cover.

7. Cover the exhaust pipe with a metal cap to prevent moisture from entering the manifold, and also cover the crankcase breather tube with a rag.

8. Remove the engine lubricating oil filter element. If any evidence of rust is found on the filter element retaining bolt, clean it thoroughly. Replace the filter element with a new one, and drain out any sludge from the filter base.

9. Drain the gasoline and the diesel fuel tanks.

STARTING ENGINES THAT HAVE BEEN IN STORAGE

1. 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 SAE-10W engine oil into each cylinder (two tablespoonfuls per cylinder is sufficient).

2. Remove the valve cover and flush the valves and valve operating mechanism with the same mixture.

3. 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 old, gummy oil from the valves and pistons.)

4. Flush out the crankcase with diesel fuel, dry-cleaning solvent, or kerosene, and fill it with the proper grade of lubricating oil as specified in the "LUBRICATION GUIDE."

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

6. Before starting the engine, be sure the lubricating oil filter has a new element installed.

7. Remove the coverings from the exhaust pipe, and from the crankcase breather.

8. Install the spark plugs.

9. Fill the cooling system.

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

11. Start the engine and let it run slowly. Observe if any of the valves are sticking. If they are, pour a small quantity of diesel fuel, dry-cleaning solvent, or kerosene, on the valve stems until the valves become loose.

12. Assemble the valve cover.

NOTE: Do not accelerate the engine rapidly or operate it 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.

The following pages contain information on the various attachments available for use with the TD-9 Crawler Tractor. You are urged to read and study the information given on the care and operation of these attachments.

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

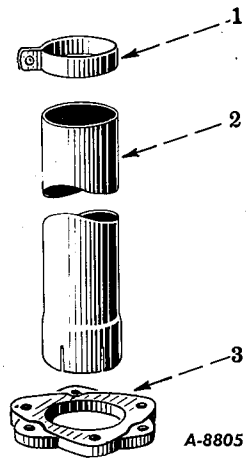
INDEX

BLOWER FAN
(Reverse Flow)

It is often advantageous to reverse the air flow through the radiator to prevent chaff or foreign particles from clogging the radiator and radiator grille.

AIR PIPE EXTENSION

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 "air cleaner pipe." Take advantage of the air pipe extension and it 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.



Illust. 74

1. Air pipe extension clamp.
2. Air pipe extension.
3. Air pipe adapter.

LOW-BOILING-POINT THERMOSTAT AND HEAT INDICATOR

This attachment consists of a thermostat which has an opening range of 135° to 155°F., and a properly calibrated heat indicator for use with low-boiling-point antifreeze solutions.

The original thermostat and heat indicator should be reinstalled when the temperature rises and antifreeze solutions are no longer necessary.

MAGNETO

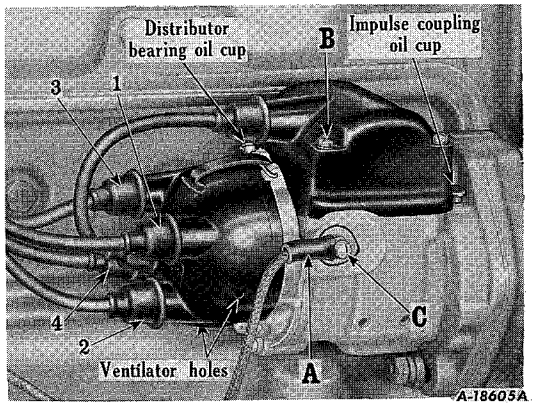
Description

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 the 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.

This high-tension magneto is designed and built in accordance with the latest magneto ignition practices. In order to obtain long magneto life, as well as trouble-free operation, closely follow the maintenance and lubrication instructions outlined below.

Lubricating the Magneto

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



Illust. 75
Counterclockwise rotation (viewed from the distributor end).

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

Greasing Breaker Mechanism and Checking Points

This magneto requires very little attention other than proper lubrication as specified above. 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 *(see Illust. 75)* 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; but 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 the metal strip on the distributor rotor points toward the No. 1 terminal on the distributor cap and the impulse coupling just trips. Remove the distributor rotor. Take off the distributor body by removing the three screws "A" *(see Illust. 76)*. Do not crank the engine while the distributor body is removed or it might be necessary to retime the magneto to the engine.

Pry the breaker arm and anchor from the chamber and clean all parts. Inspect the breaker points and, if necessary, dress them with a sharp fine file. If the points are worn excessively, replace both points.

After every 480 hours of operation, fill the recess in the breaker post with grease and pack a small quantity of grease in back of the breaker arm rubbing block *(see Illusts. 76 and 76A)*.

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

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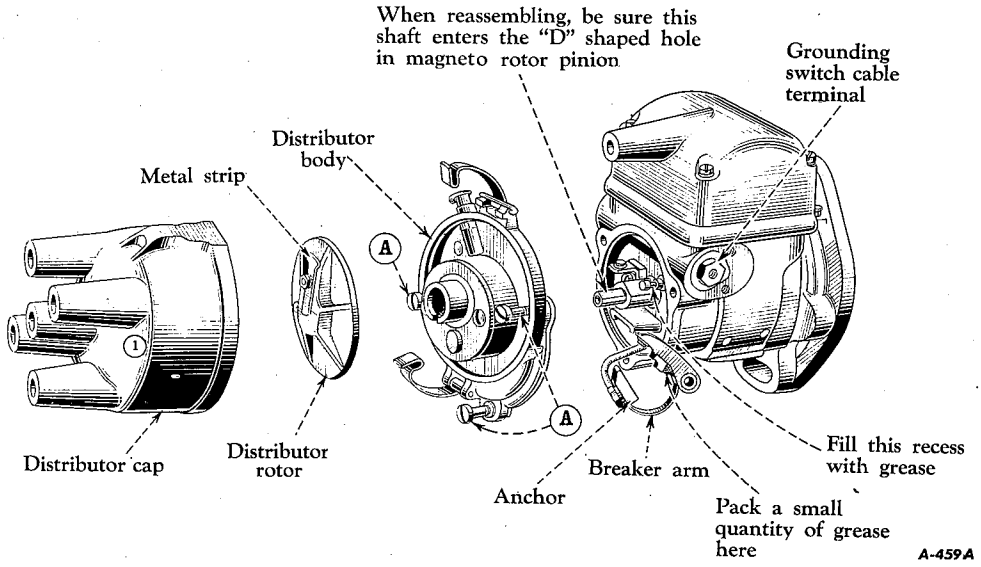


Illust. 76
Magneto, showing distributor assembly.

Check the gap between the breaker points, using the gauge furnished with the tractor *(see Illust. 76A)*. 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 *(see Illust. 76A)* 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.

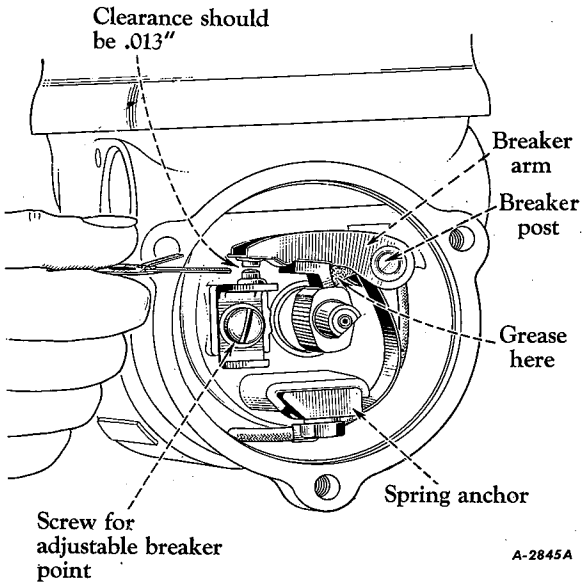
Line up the distributor rotor key with the keyway in the spindle *(see Illust. 76)* and press the rotor loosely on the spindle. With the engine on top dead center of the No. 1 firing stroke, turn the distributor rotor until the metal strip on the rotor points to the No. 1 terminal on the distributor cap. Place the distributor body on the magneto and be sure the rotor shaft enters the "D" shaped hole in the magneto rotor pinion. Remove the distributor rotor to tighten the three screws "A" *(see Illust. 76)*. Install the distributor rotor and distributor cap.

Greasing Rotor Bearing and Distributor Gear Chamber

After every 1,920 hours of operation, or at least every two 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

Whenever the distributor cap is removed, check the inside. The cap should be kept free of dust, moisture and oil deposits. 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 two small ventilator holes *(see Illust. 75)* open at all times. The distributor rotor also should be kept clean.



Illust. 76A
Magneto breaker mechanism.

Removing the Magneto

1. Take off the switch cable "A" *(Illust. 75)* by removing the fillister-head screw and lock washer attaching the cable to the magneto terminal "C" *(Illust. 75)*.

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 followed closely when installing the magneto on the engine:

1. Attach a jumper wire between the magneto terminal "C" *(Illust. 75)* and the coil cover mounting bolt "B." This will ground the magneto and prevent accidental starting.

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 top dead center of the compression stroke. The compression stroke can be determined by removing 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 mark "M" on the fan drive pulley is in line with the pointer on the crankcase front cover. *See Illust. 66.*

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.

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 into the magneto flange, just enough to hold the magneto in place. Then crank the engine one complete revolution until the "M" mark on the fan drive pulley is in line with the pointer. Now push the upper part of the magneto toward the engine until the impulse coupling just trips.

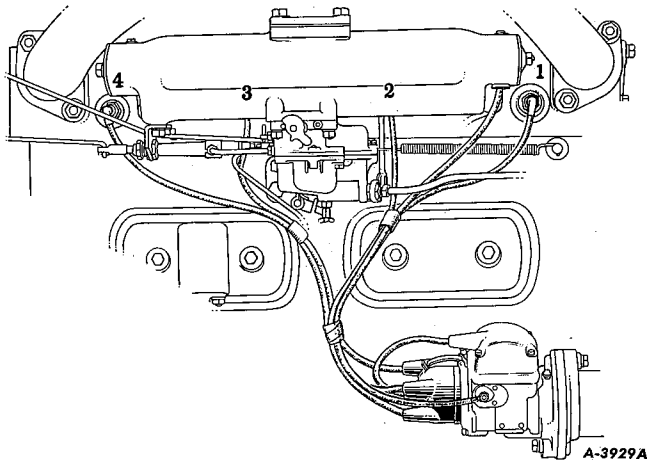
7. Tighten the mounting bolts securely. Attach the spark plug cables to the engine and magneto. Start by connecting the No. 1 cylinder spark plug to the socket marked "1" on the distributor block; then connect the No. 3 socket with the No. 3 cylinder; next the No. 4 cylinder, next the No. 2 cylinder *(see Illust. 75 and Wiring Chart, Illust. 77)*.

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

9. To check the timing, crank the engine slowly until the impulse coupling just trips. At this point the pointer on the crankcase front cover should be between the mark "M" on fan drive pulley and up to a point 9/16 inch beyond mark "M."

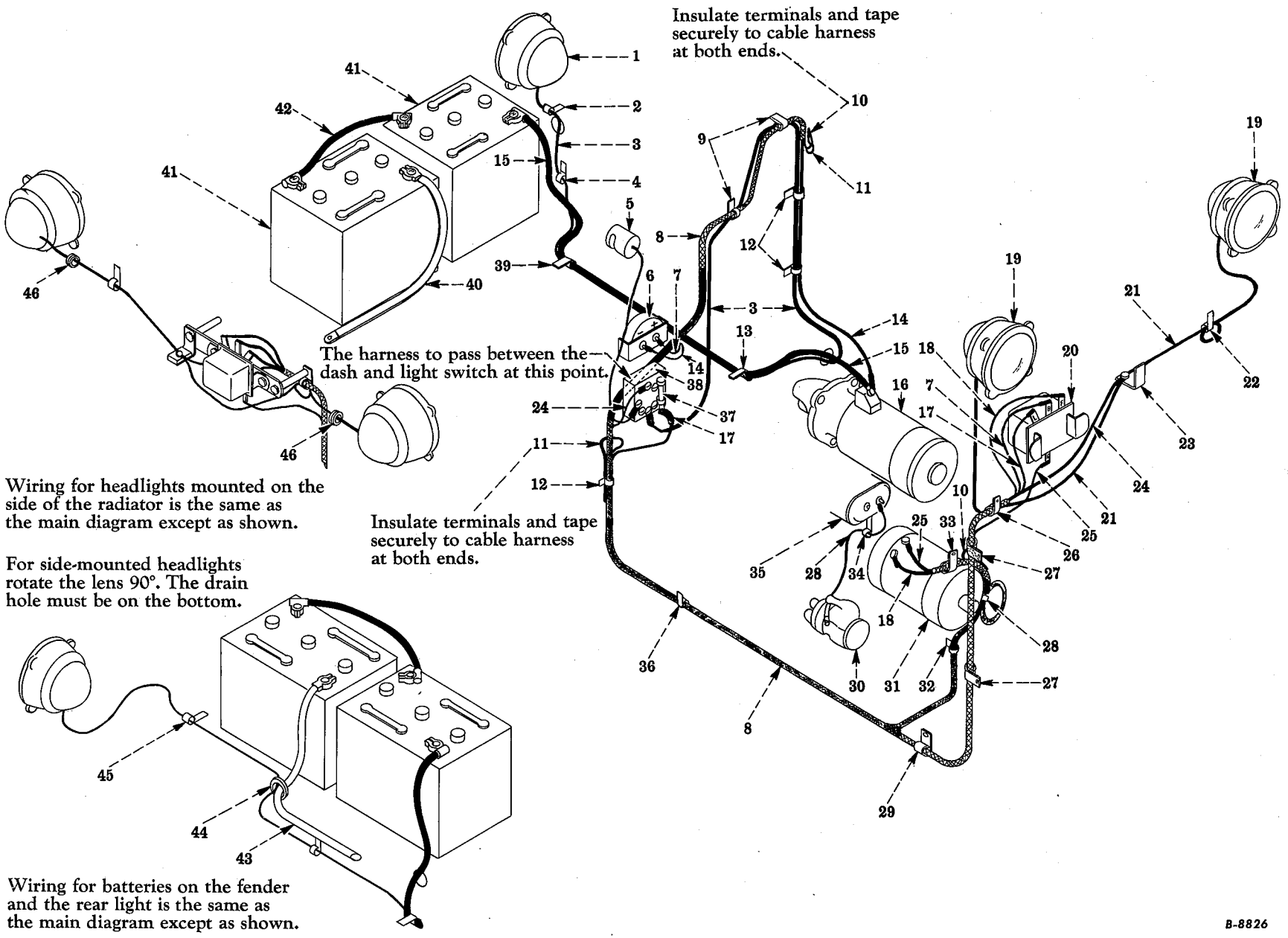
10. The magneto is now correctly wired and timed.

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



Illust. 77
H-4 magneto wiring chart.
Engine firing order is 1,3,4,2.

STARTING AND LIGHTING ATTACHMENT USED WITH MAGNETO IGNITION
(High or low seat)



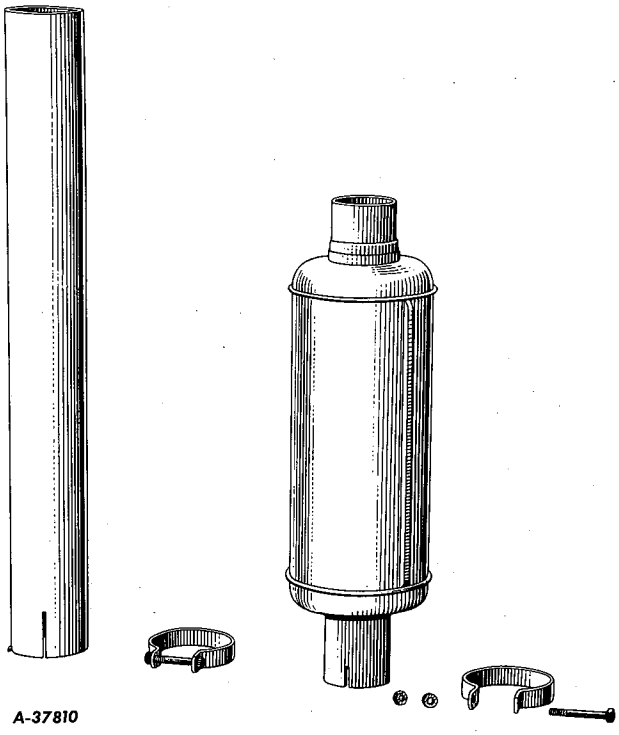
Illust. 78 - Wiring diagram.

Index to Reference Numbers shown in illustration on opposite page.

Ref. No.	Description
1	Rear light.
2	Cable clip for 1/2" bolt (on fender mounting carriage bolt in rear bracket).
3	Cable - light switch to rear light.
4	Cable clip for 3/8" bolt (on fender mounting bolt, second from fuel tank).
5	Dash light.
6	Charge indicator.
7	Cable-charge indicator to "bat"-terminal on regulator - green.
8	Cable harness.
9	Cable clip for 1/2" bolt (on air cleaner pipe flange).
10	Cable - ignition switch to manifold switch - yellow.
11	Cable - ignition switch to light switch - yellow with black tracer.
12	Cable clip for 1/4" bolt (on dash).
13	Cable clip for 1/2" bolt (on engine clutch cover second bolt from rear).
14	Cable - charge indicator to starting switch - red.
15	Cable - battery to starting switch.
16	Cranking motor.
17	Cable - light switch to "L" terminal on regulator - blue.
18	Cable - "F" terminal on generator to "F" terminal on regulator - black with red tracer.
19	Head light.
20	Voltage regulator.
21	Cable - right and left head light to junction block.
22	Cable clip for 3/8" bolt (on lower bolt of gas tank).
23	Junction block (mounted on relay bracket stud).
24	Cable - light switch to junction block - black.
25	Cable - "A" terminal on generator to "gen" terminal on regulator - red with black tracer.
26	Cable clip for 5/16" bolt (under relay mounting stud).
27	Cable clip for 5/16" bolt (on fan shroud bolt).
28	Magneto to manifold switch cable.
29	Cable clip for 3/8" bolt (on side angle).
30	Magneto.
31	Generator.
32	Cable clip for 3/8" bolt (on crankcase).
33	Cable clip for 5/16" bolt (generator brace bolt).
34	Cable clip for 1/2" bolt (on intake manifold, front).
35	Intake manifold.
36	Cable clip for 3/8" bolt (on side angle).
37	Fuse.
38	Light switch.
39	Cable clip for 1/2" bolt (on shifter fork housing cover corner bolt).
40	Cable-battery to ground (ground on fender to main frame angle, second bolt from front).
41	Batteries.
42	Cable - battery to battery.
43	Cable - battery to ground (ground on fender to main frame angle, second bolt from front).
44	Grommet in left seat side sheet.
45	Cable clip for 1/2" bolt (under inner rear battery support mounting bolt).
46	Grommet in radiator grille.

For operation and maintenance, see the standard electric starting and lighting and the magneto ignition attachment sections.

EXHAUST MUFFLER
EXHAUST EXTENSION



Illust. 80
Exhaust extension, clamp and muffler.

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

IGNITION SWITCH

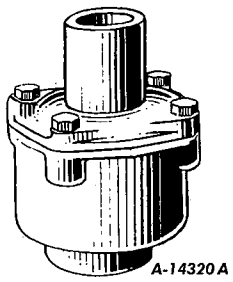
The ignition switch is a key-operated, closed-lock type switch. Turning the key to the right completes the ignition circuit. Turning the key to the vertical position shuts off the ignition. The cap protects the switch from rain, dust, and other corrosive materials.

SIDE OUTLET EXHAUST

For use in orchards or where an exhaust extension interferes with tractor operation.

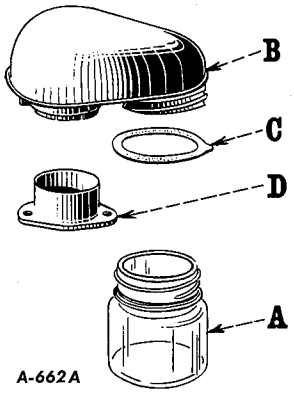
SPARK ARRESTER

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 be smothered.



Illust. 80A
Spark arrester.

AIR PRECLEANER



Illust. 80B

To Clean: Remove and clean out the jar frequently (at least before the jar "A" becomes 3/4 full). Remove the precleaner "B" and inspect the fins regularly. When the fins become oily or dirty, wash the entire precleaner in kerosene. Replace the gasket "C" and tighten the jar securely.

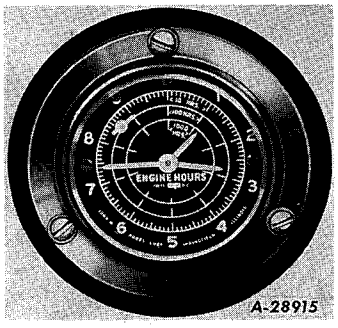
ODOMETER

With an odometer, an accurate check can be kept on the miles the tractor travels. It indicates the miles traveled forward and backward to the tenth of a mile. It makes possible an accurate computation of fuel consumption or any other operating cost per mile, or per job, and is especially useful in keeping tab on the miles of service performed by each machine on jobs where several tractors are used.

SERVICE METER

This service meter is used to show the time for service periods only. There are two kinds of service meters, clockwise and counterclockwise. The direction of rotation can be determined by viewing the service meter pad on the engine with the meter removed and noting the direction of rotation of the drive gear shaft.

ELECTRIC ENGINE HOUR METER



Illust. 81

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

Instructions for Reading the Meter

See Illusts. 7 and 81.

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

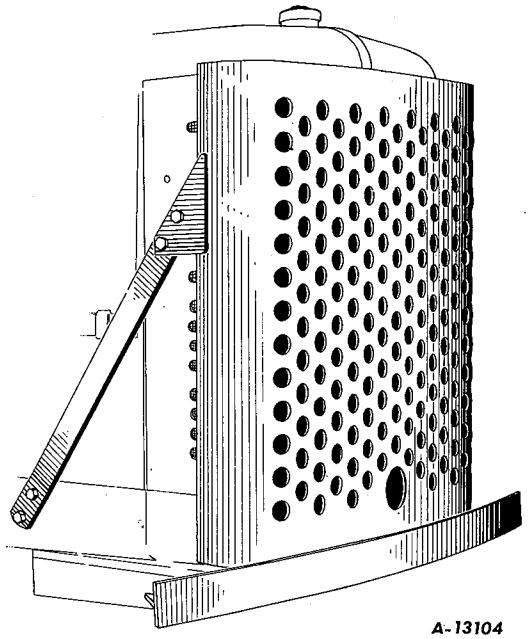
3. When the long hand is pointing between "7" and "8" on the outer (or 100 hour) track it will indicate. 70 hours

4. The outer track has ten graduations between any two figures. Each graduation is equal to 1 hour. Again reading the long 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

RADIATOR GUARD AND FRONT BUMPER

Radiator Guard
Front Bumper
Radiator Guard and Front Bumper



Illust. 81A
Radiator guard and front bumper assembled on tractor.

International tractors are built to operate in rough country and will stand the gaff of obstacles ordinarily encountered. However, in forest work, mining, land clearing, brush-breaker plowing, certain earth moving jobs, etc., the front end of the tractor frequently gets an unusual amount of rough treatment. The specially designed rugged radiator guard and front bumper add protection for the radiator against damage from trees, stumps, boulders and other objects.

Such protection has the effect of speeding up the work and finishing the job in less time than would be possible with the operator proceeding cautiously to avoid obstacles. Considered from this standpoint a radiator guard and front bumper not only prolong the life of the tractor and save upkeep expense, but they also save labor cost and increase output.

The bumper is frequently used to push heavy objects, such as railroad cars, heavy pieces of equipment, stalled machines, etc. In most work of this kind the bumper, rather than the radiator guard, should be depended upon to bear the brunt of the load. Depending on the type of work to be done, however, it is possible to use the radiator guard without the bumper, or the bumper without the radiator guard.

FUEL STRAINER

This strainer is inserted into the filler neck of the fuel tank to prevent dirt from entering, and eases the filtering load on the fuel filters. This strainer is easily removed for cleaning.

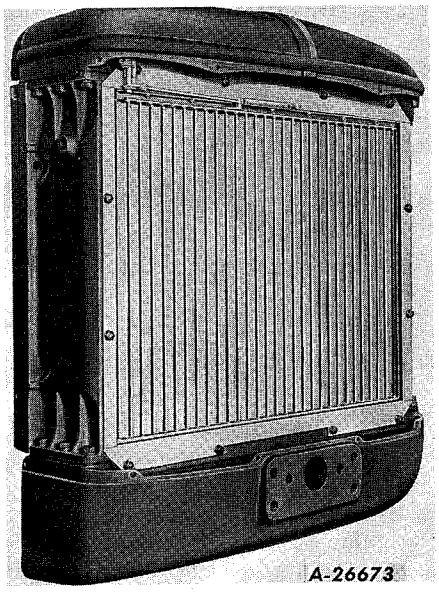
RADIATOR SHUTTER

A radiator shutter is useful for starting and operating in cold weather. The operator can easily maintain, from the seat, a more even operating temperature. This 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.

When Starting the Engine

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

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

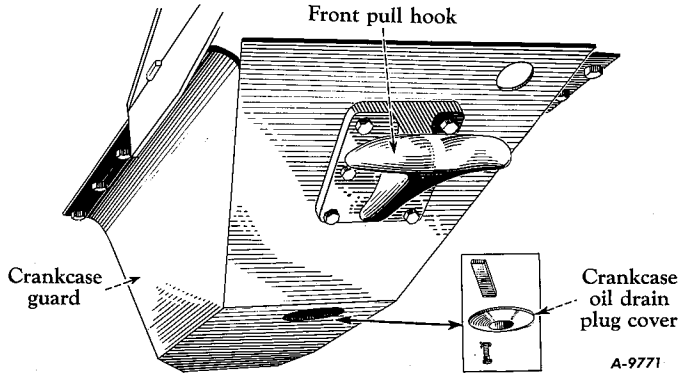


Illust. 82
Radiator shutter installed.

3. The adjustment of the shutter will vary according to the tractor load, long periods of idling, or the atmospheric temperature.

NOTE: Do not start the engine in freezing weather without closing the shutter first.

CRANKCASE GUARD (Used in modified industrial units)
CRANKCASE GUARD (For use with equalizer bar)
FRONT PULL HOOK (For tractors equipped with crankcase guard)



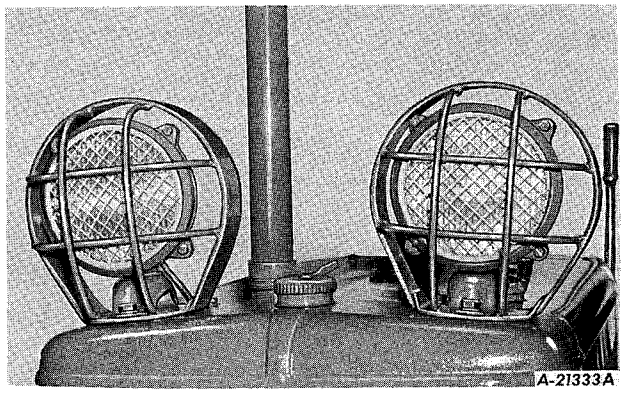
Illust. 82A - Crankcase guard and pull hook on tractor.

The crankcase guard is your answer to protection against damage to the crankcase oil pan. When operating under conditions where stumps, logs, large boulders or other obstructions are a constant threat, it is advisable to equip your tractor with this attachment.

By using the front pull hook in conjunction with the crankcase guard, the pulling power of

the tractor reverse speed can be brought into play while the operator remains in normal seated position with the job in full view before him. It is handy for hitching tractors in tandem to pull extra heavy loads, and is of practical value as an anchor for a tractor equipped with a winch.

HEAD LIGHT BRUSH GUARD



Illust. 83
Head light brush guards.

This attachment will protect the head lights of the tractor from injury by low hanging branches, etc.

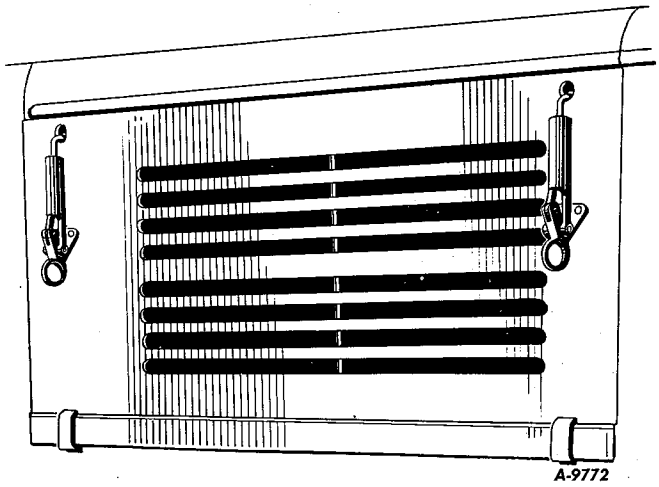
CHEVRON PRESSURE PRIMER

As an aid for quicker starting a cold engine during extreme cold weather, or arctic conditions, a pressure primer unit attachment is available for tractors equipped with electric starting. The pressure primer is connected to the air cleaner dome. When manually actuated, it discharges a highly flammable liquid into the air cleaner to be picked up by suction for even distribution to the cylinders on the gasoline starting cycle.

The pressure primer should not be used in conjunction with hand cranking.

HOOD SIDE DOOR

The hood side door attachment helps to protect the engine parts and to prevent flying leaves, branches, dirt, etc., from entering the engine compartment. Also, when operating in cold weather, this added protection against snow and icy winter winds helps to keep the engine dry and warm. Easily padlocked, when desired, to prevent tampering with the engine.



Illust. 83A
Hood side door on tractor.

TRACK SHOES

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, additional sizes and types are available, including staggered lug grouser snow and ice shoes, flat shoes, rubber shoes, and street plates.

Regular Shoe

Square corner grouser.
Shoe widths: 13, 14, 16, 18, and 20 inches.

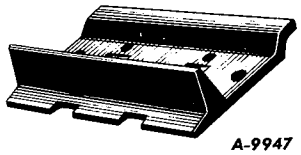


Fig. A

For all general operating conditions. The 16, 18 and 20 inch width shoes can be used on wide tread tractors only.

Regular Shoe

Clipped corner grouser.
Shoe widths: 13, 14, 16, 18, and 20 inches.

These shoes have the same general characteristics as square corner shoes. *See Fig. A.* They are less likely to damage pavement

Continued on next page

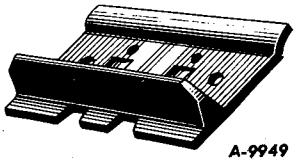


Fig. B

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 16, 18, and 20 inch width shoes can be used on wide tread tractors only.

Snow and Ice Shoe

Staggered lug grouser.
Shoe width: 16 inches.

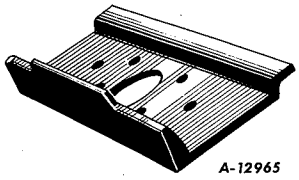


Fig. C
Center lug.

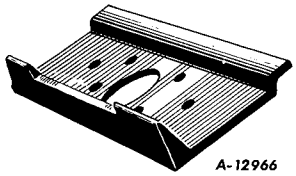


Fig. D
End lug.

The attachment consists of both center lug and end lug shoes, which are assembled alternately to the track, thus reducing damage to road surfaces. These shoes are useful for continued service in ice and snow, as the nonoverlap edge and cut-out hole prevent snow from packing in the track chain.

Overlapping Flat Shoe

Shoe width: 15 inches.

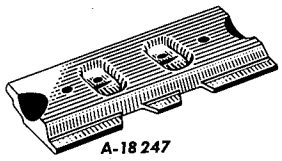


Fig. E

This track shoe may be used alone where maximum traction is required and ground or floor conditions necessitate minimum damage.

Overlapping Flat Shoe

Shoe width: 15 inches.

This track shoe is used with the extended track frame. It provides aggressive grouser

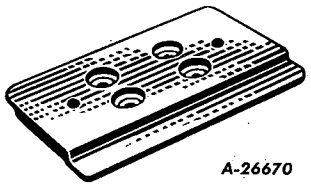


Fig. F

action, prevents slippage, and is especially recommended for use with front-end loaders.

Rubber Shoe

Shoe width: 12 inches.

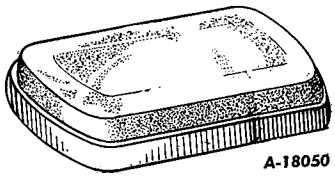


Fig. G

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

Street Plate

Plate width: 10-3/4 inches.

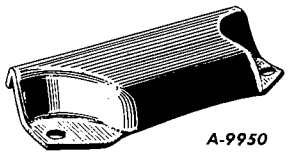
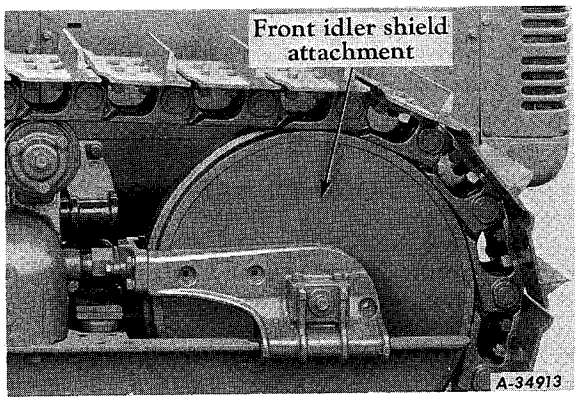


Fig. H

These plates fit over grouser lugs on shoes and prevent damage to hard surfaced roads.

FRONT IDLER SHIELD



Illust. 84

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.

CUT-AWAY SPROCKET

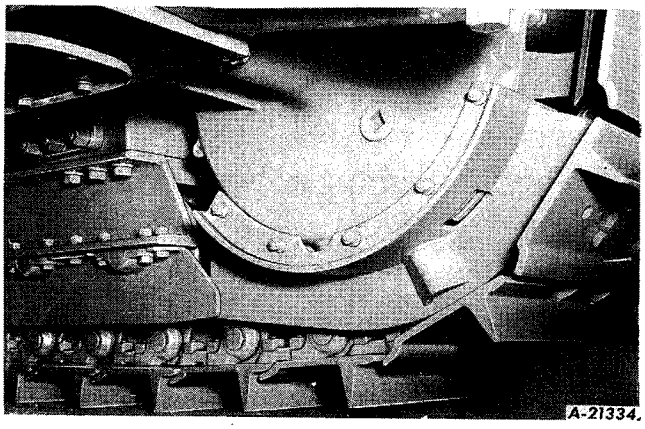
When your tractor is operated under adverse conditions, such as snow, mud or sand, the possibility of an accumulation forming around the sprocket teeth and track links is increased. The special sprocket with cut-away teeth is designed to cut down this condition to a minimum.

HEAVY DUTY TRACK ROLLER SHIELD

The heavy duty track roller shield will stop rocks, mud, lumber, etc., from entering the track rollers. It is made to take extremely heavy punishment.

FULL COVER SPROCKET HOUSING ROCKSHIELD

This attachment is recommended where rocks, stones, branches, etc., are encountered.



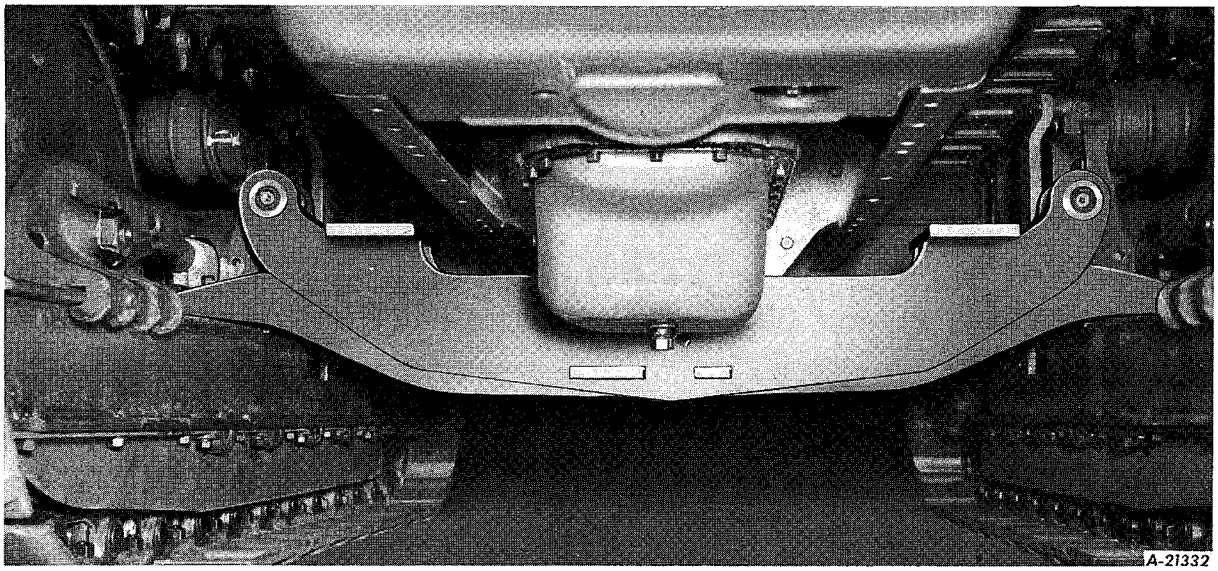
Illust. 85

RIGID EXTENDED TRACK FRAME

Used with large diameter front idler.

This attachment has one added track roller and two extra track shoes on each side. It is used in conjunction with large diameter front idler, for the purpose of carrying heavy superimposed loads, such as cranes, front-end loaders, pipe layers, etc.

EQUALIZER BAR



Illust. 85A
Equalizer spring.

This attachment is used to properly support the heavy loads imposed by front-end loaders, shovels, etc., and is designed to allow the tracks to oscillate. This attachment is not to be used without allied equipment mounted to it.

HEAVY EQUALIZER SPRING

This heavy duty equalizer spring is made available for commercial purposes. It will allow the track frames to oscillate.

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 the 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. This feature permits use of the hydraulic system any time the engine is running and regardless of whether the clutch is or is not engaged.

Use only IH Touch-Control fluid, which is especially refined for the purpose in this system.

HYDRAULIC HOSE EXTENSIONS

Five and eight foot hose extensions are available when extra hose length is required. The extensions consist of four hydraulic self-sealing couplings, two hoses and two pipe nipples.

TWO-SPEED REVERSE TRANSMISSION

This attachment substitutes a high reverse gear in place of the regular third speed forward gear. This arrangement will provide four forward and two reverse gears instead of the conventional five forward and one reverse gear regularly furnished. The speeds are then changed as follows:

	Regular	Two-Speed Reverse
First	1.5 m.p.h.	1.5 m.p.h.
Second	2.2 m.p.h.	2.2 m.p.h.
Third	3.0 m.p.h.	---
Fourth	3.9 m.p.h.	3.9 m.p.h.
Fifth	5.3 m.p.h.	5.3 m.p.h.
Reverse	1.7 m.p.h.	1.7 m.p.h.
Hi-reverse	---	3.5 m.p.h.

LOW SEAT

The low seat attachment, which seats the operator 4 inches lower than a regular seat, is to be used in orchards or where low hanging branches obscure the operator's vision.

TOOLS

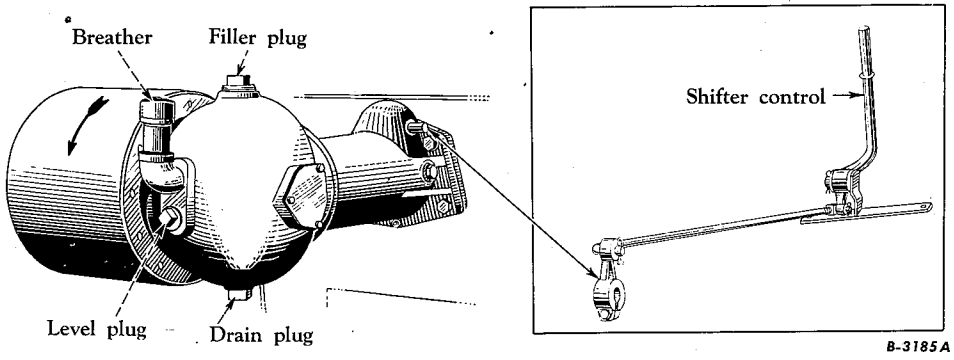
These tools may be ordered as an attachment under number 263 289 R92, or separately under their respective part number.

Socket wrench set in carrying case.
"S" wrench, 3/4 and 7/8 inch.
Spark plug wrench, 7/8 inch.
Spark plug wrench handle.
Front idler adjuster wrench.
Water pump wrench.
Combination slip joint pliers.
Screwdriver, 5 inch, wood handle.
Ball peen hammer, 1-1/2 pound.
Steering clutch compressor angle tool.
Pressure oil can.
Grease gun (hand-type, 15 ounce).

TOOL BOX
(21 Inch)

This large capacity tool box is mounted on the left fender for more accessibility. Provision is made for a lock.

BELT PULLEY AND POWER TAKE-OFF
BELT PULLEY (For Tractors Equipped With Power Take-off)



Illust. 86
Showing the belt pulley on the tractor.

Lubrication

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

Remove the filler and level plug from the belt pulley compartment and fill with lubricant to the level plug hole (capacity approximately 4-1/2 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 0°F., add 3/4 pint 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.

Operation

The pulley operates at a speed of 878 r.p.m., and the belt speed is 2528 feet per minute when a 11 inch diameter pulley is used.

To engage the belt pulley, disengage the engine clutch and move the belt pulley shifter control *(Illust. 86)* forward into the engaged position; then gradually engage the engine clutch.

IMPORTANT: Never attempt to use the belt pulley shifter control 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. 86* shows a belt pulley mounted for left hand drive.

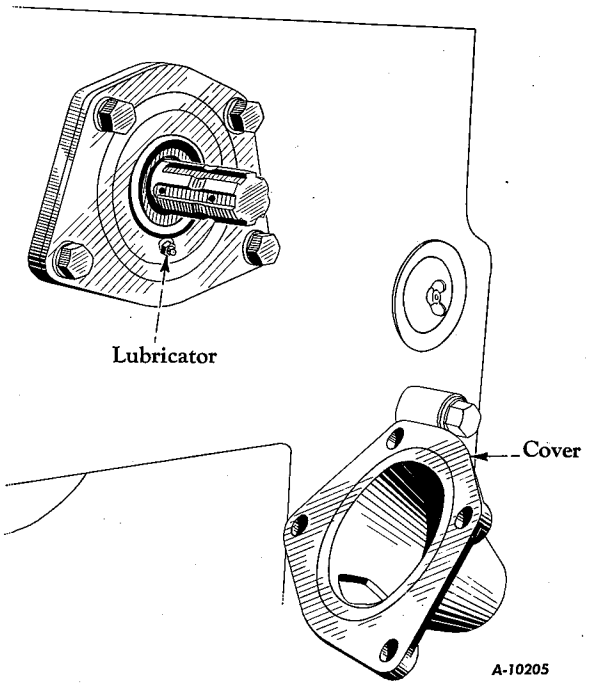
Optional Pulleys

On operations where the belt pulley attachment on your tractor is used as the motive power for different jobs, it may be advisable or beneficial to have different size pulleys on hand. The International Industrial Power distributor or dealer in your locality can furnish pulleys of the following sizes:

Diameter	Face	Belt Speed
11 inch*	8-1/2 inch	2528 ft. per min.
9-1/2 inch	8-1/2 inch	2184 ft. per min.
12-1/2 inch	8-1/2 inch	2873 ft. per min.
13-3/4 inch	8-1/2 inch	3160 ft. per min.
14-3/4 inch**	8-1/2 inch	3390 ft. per min.

* Regular pulley shipped with attachment.
**Use only with high seat.

REAR POWER TAKE-OFF



Illust. 87
Power take-off on tractor.

Power Take-off

The power take-off attachment extends the power of the engine to many types of operating equipment used in connection with the tractor.

Lubrication

Lubricate the bearing through the lubricator fitting after every 60 hours of operation. Apply several strokes of the hand lubricator. Use pressure-gun grease (chassis lubricant).

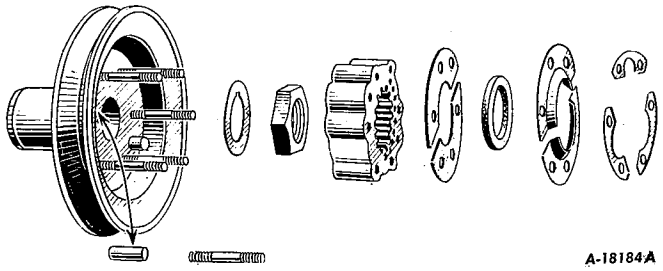
Operation

The power shaft is started and stopped by use of the engine clutch. Always engage the clutch gradually. The power shaft speed is 862 r.p.m.

Continued on next page

SAFETY FIRST: Stop the power take-off before dismounting from the tractor. If the power take-off is not to be used, stop the engine and put on the power shaft end cover. Never remove or replace the cover while the shaft is in motion.

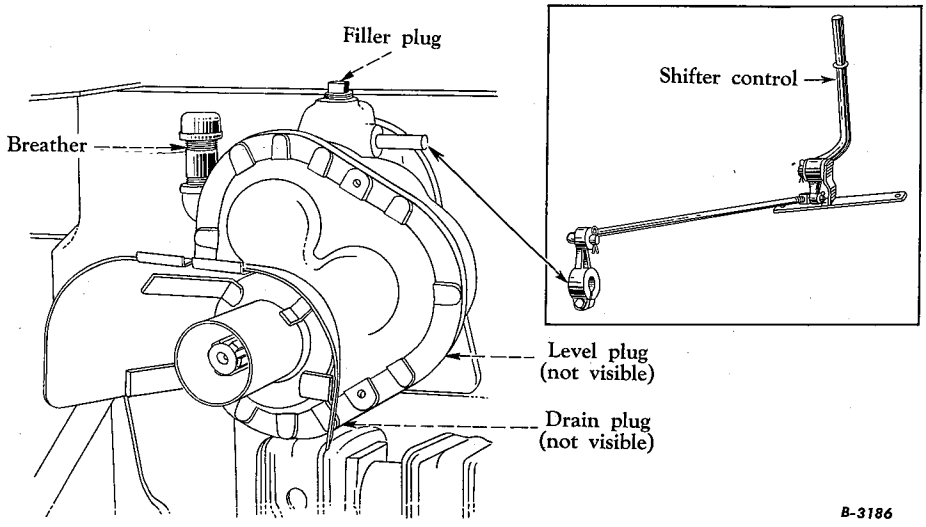
FRONT POWER TAKE-OFF COUPLING



Illust. 88 - Front power take-off coupling disassembled.

This attachment enables the power of the engine to be transmitted through the front of the tractor when such an arrangement is required. In cases of this type the owner is required to furnish the shaft through which the power is transmitted.

REDUCED SPEED REAR POWER TAKE-OFF (535 r.p.m.)



Illust. 88A - Reduced speed power take-off assembled on tractor.

Lubrication

Refer to the "LUBRICATION GUIDE" and use the same grade of lubricant as specified for the transmission.

Remove the filler and level plugs from the gear compartment, and fill the compartment with lubricant to the level of the level plug hole. The refill capacity is approximately 1-1/2 pints. Replace the filler plug 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.

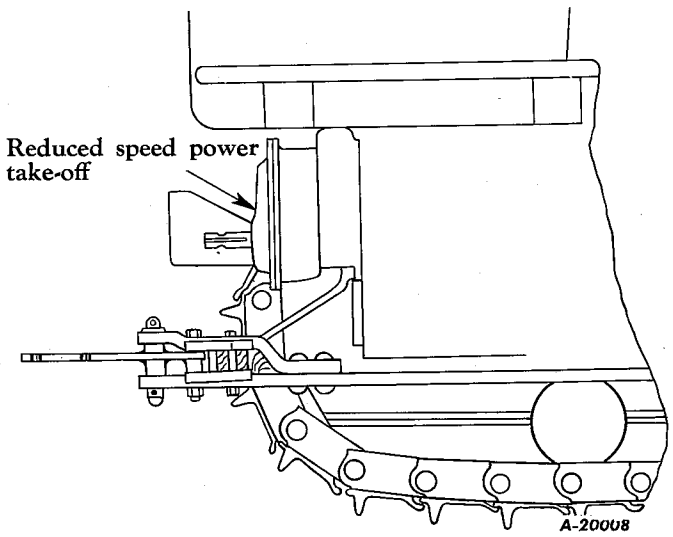
For continued operation in temperatures below 0°F., add 1/4 pint of kerosene into the gear compartment. Start the engine and operate the power take-off until the mixture of the lubricant and kerosene is thoroughly warmed; then remove the level plug and drain to the level of the plug hole.

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 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 control. Move the control *(Illust. 88A)* 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.



Illust. 89

DRAWBAR EXTENSION

This attachment is used when the tractor is equipped with reduced speed power take-off attachment, to provide a standardized drawbar for use with farm implements such as harvester threshers, corn pickers, etc.

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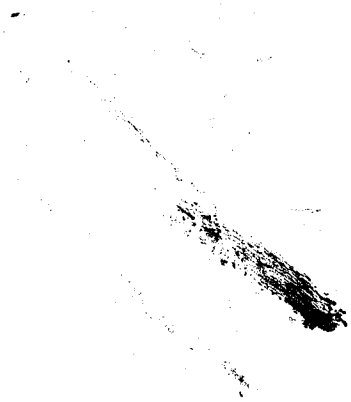
A Careful Operator

IS THE BEST INSURANCE

AGAINST AN ACCIDENT

—National Safety Council.



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