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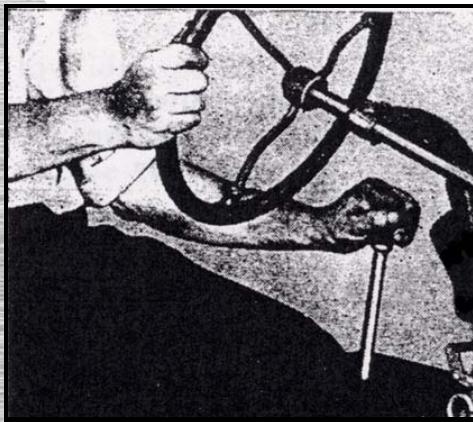
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International **Harvester**

Operator Manual

B-414
Gas & Diesel



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IH-O-B414

Operator's Manual

NOTES

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Operator's Manual



INTERNATIONAL

B-414

GAS & DIESEL

INTERNATIONAL HARVESTER COMPANY

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INTRODUCTION

Assembled in this manual are operation, lubrication, and maintenance instructions for the International B-414 and B-414 Diesel Tractors. This material has been prepared in detail in the hope that it will help you to better understand the correct care and efficient operation of your tractor.

Your International Harvester dealer has factory-trained servicemen, modern tools, and IH service parts to assure you of satisfactory tractor operation. To get the most out of your tractor, and to assure economical operation and top performance, your tractor should be inspected periodically by your International Harvester dealer's serviceman.

Depending upon your use of the tractor, these inspections should be performed as needed, or at least once a year, at which time a tune-up or other necessary service work should be performed. Proper pre-season maintenance will assure you of minimum lost time when your tractor is most needed.

Dealers are kept informed on the latest methods of servicing tractors. They carry stocks of IH parts, and are backed in every case by the full facilities of a nearby International Harvester district office and parts depot.

Throughout this manual the use of the terms LEFT, RIGHT, 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 in the driver's seat. Reference to FRONT indicates the radiator end of the tractor; to REAR the hitch end. See Illust. 4.

The illustrations in this manual are numbered to correspond with the pages on which they appear; for example, Illust. 4 is on page 4.

In order to provide a tractor equipped as nearly as possible to suit each customer's needs, a variety of extra equipment and accessories is available. Refer to page 56.

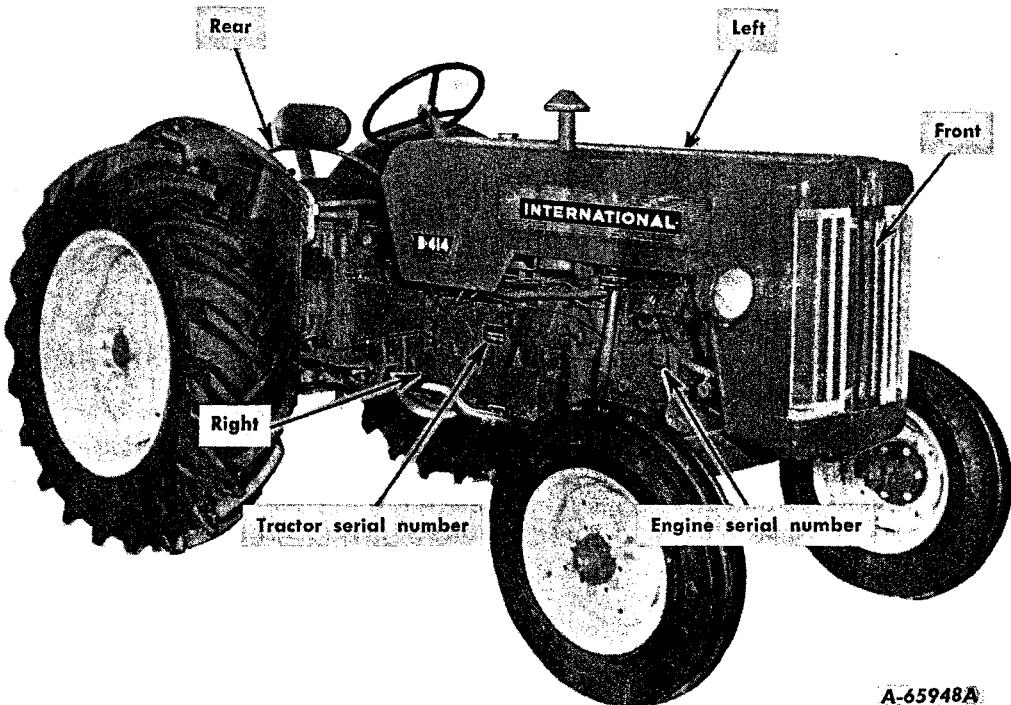
Where operating and maintaining instruction on these items is required, it is included in the instructions for operating or maintaining the tractor. Disregard the instructions for equipment not on your tractor.

When in need of parts, always specify the tractor and engine serial numbers including prefix and suffix letters. For ready reference, we suggest that you write these serial numbers in the spaces provided on the Delivery Report. The tractor serial number is stamped on a name plate attached to the right side of the clutch housing. See Illust. 4.

On gasoline engines, the engine serial number is stamped on the right side of the engine below and to the right of the fuel pump. This serial number is preceded by the prefix BC144, which indicates that it is a carbureted engine with a 144-cubic-inch piston displacement. See Illust. 4.

On diesel engines, the engine serial number is stamped on the right side of the engine below and to the right of the primary pump. This serial number is preceded by the prefix BD154, which indicates it is a diesel engine with a 154-cubic-inch piston displacement. See Illust. 4.

INTRODUCTION



Illust. 4
Serial numbers and terms of location shown
on the International B-414 Diesel Tractor.

INSTRUMENTS AND CONTROLS

BRAKE PEDALS

These pedals are used to stop the tractor, to hold the tractor in a stationary position, or to assist in making sharp turns as outlined below:

To stop the tractor, depress both pedals at the same time. Before driving the tractor in high gear, always latch the pedals together.

To hold the tractor in a stationary position, latch the pedals together, depress and lock them in this depressed position by using the hand brake lever.

To assist in making a sharp turn, operate the pedals individually, depressing the pedal on the side toward which the turn is to be made.

The brake pedal latch (Illust. 5) is used to latch both brake pedals together, causing the brakes to operate simultaneously.



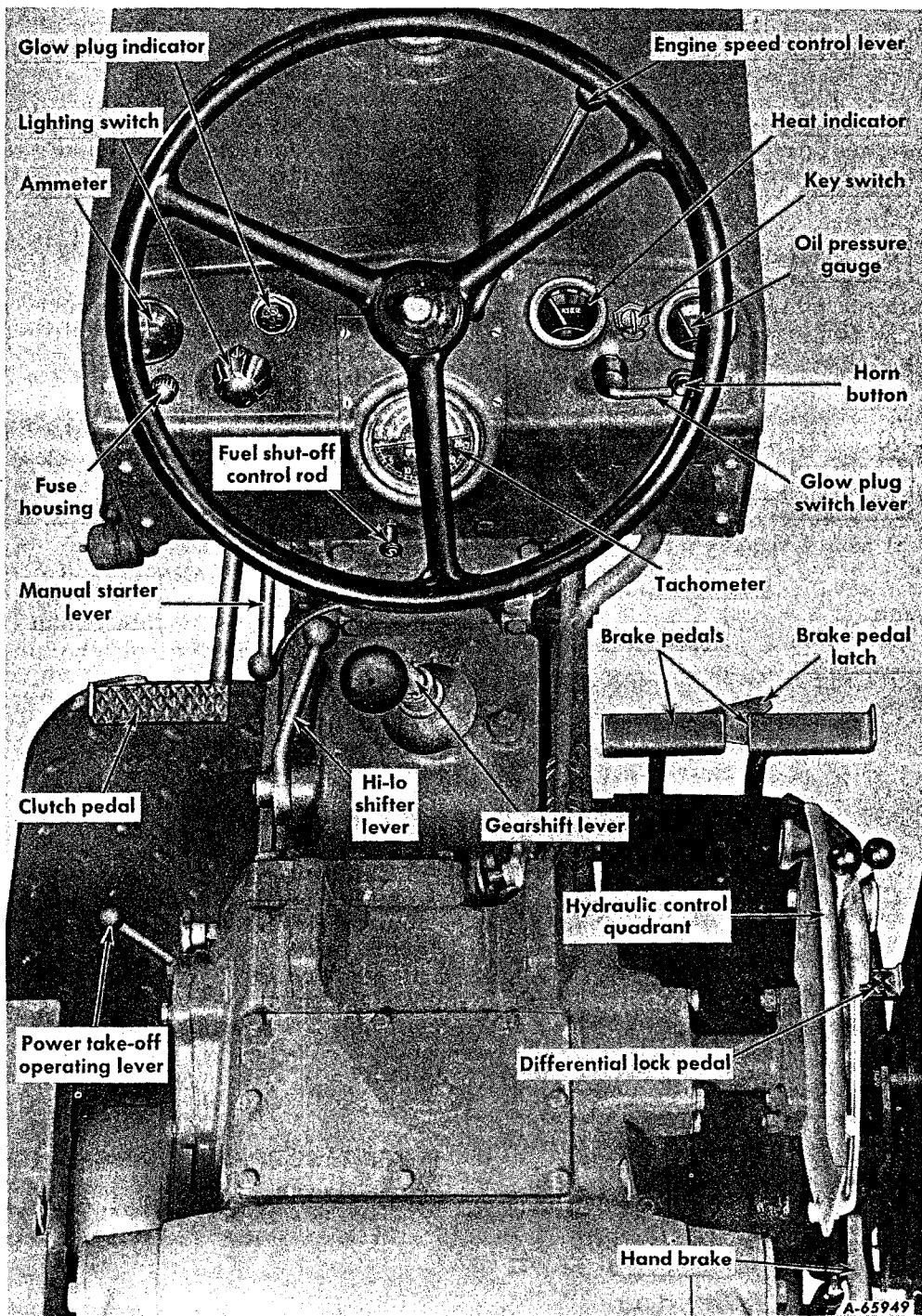
Caution! Always latch the brake pedals together when driving the tractor in the two highest gears (H-3 and H-4). To latch the pedals together, engage the latch (in the left pedal) (Illust. 5) in the slot in the right pedal. When the brake pedals are not latched together, the latch should rest in the slot in the left brake pedal.

The hand brake lever (Illust. 5) is used to lock the brake pedals in the depressed position; this keeps the tractor from moving.

ACCELERATOR PEDAL

The accelerator pedal (if so equipped) is used when making frequent changes of tractor speeds. Pressing the pedal down with the foot increases the speed of the engine. The engine speed control lever should be retarded when the accelerator pedal is to be used.

INSTRUMENTS AND CONTROLS



Illust. 5
Instruments and controls on the diesel engine tractor.

INSTRUMENTS AND CONTROLS

CLUTCH PEDAL

The clutch pedal disengages the engine from the transmission, when it is depressed part way down. It also disengages the power take-off when it is depressed all the way down.

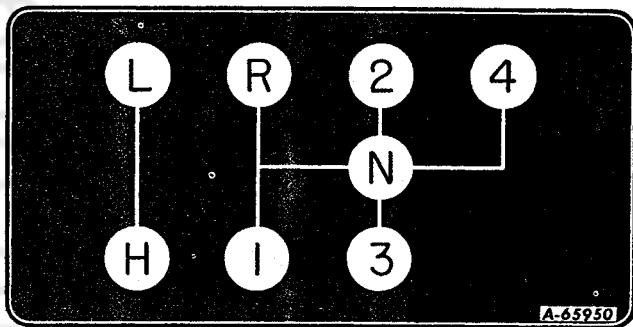
This enables the operator to shift gears or stop the tractor without disengaging the power take-off.

Note: When the tractor has a forward and reverse drive, depressing the clutch pedal disengages both the power take-off and the transmission. A single-stage heavy-duty clutch is used in tractors with forward and reverse drive.

DIFFERENTIAL LOCK PEDAL

This pedal engages a differential lock which locks the two rear wheels together to overcome individual wheel slippage on icy or slippery surfaces.

GEARSHIFT LEVER



Illust. 6
Gearshift positions.

This lever is used to select the various gear ratios in the transmission. There are eight forward speeds and two reverse speeds. See Illust. 6.

HI-LO SHIFTER LEVER

The tractor has eight forward and two reverse speeds by means of two speed ranges in each gearshift position.

When the Hi-lo shifter lever is moved to the "L" (forward) position, the tractor will operate in the low speed range and when the lever is moved to the "H" (rear) position, the tractor will operate in the high speed range. Refer to specifications on page 52.

FORWARD AND REVERSE DRIVE LEVER

This lever allows the operator to reverse the tractor direction of travel without shifting the transmission gears. The forward and reverse drive provides approximately 25% faster speed in reverse than in the forward gear in either the high or low speed range. Refer to "Specifications" for ground speeds.

ENGINE SPEED CONTROL LEVER

This lever controls the speed of the engine and, when set in a given position, will maintain a uniform engine speed even though the engine load may vary.

When the lever is set at the top point, the engine speed is fully retarded. When the lever is at the lowest point, the engine speed is fully advanced.

Minimum idle speed (hand throttle) for the gasoline engine is approximately 500 r.p.m. and for the diesel engine is 550 r.p.m. with the engine speed control lever fully retarded. Never operate the engine at more than the regular governed speed. Excessive speeds are harmful. For engine speeds, see "Specifications".

LIGHTING SWITCH

The switch has five positions: "OFF" position; 2nd position for red taillight; 3rd position for dim headlights and red taillight, 4th position for bright headlights and red taillight; 5th position for bright headlights. The red taillight should always be used when traveling on the highway at night or during times of poor visibility.

POWER TAKE-OFF OPERATING LEVER

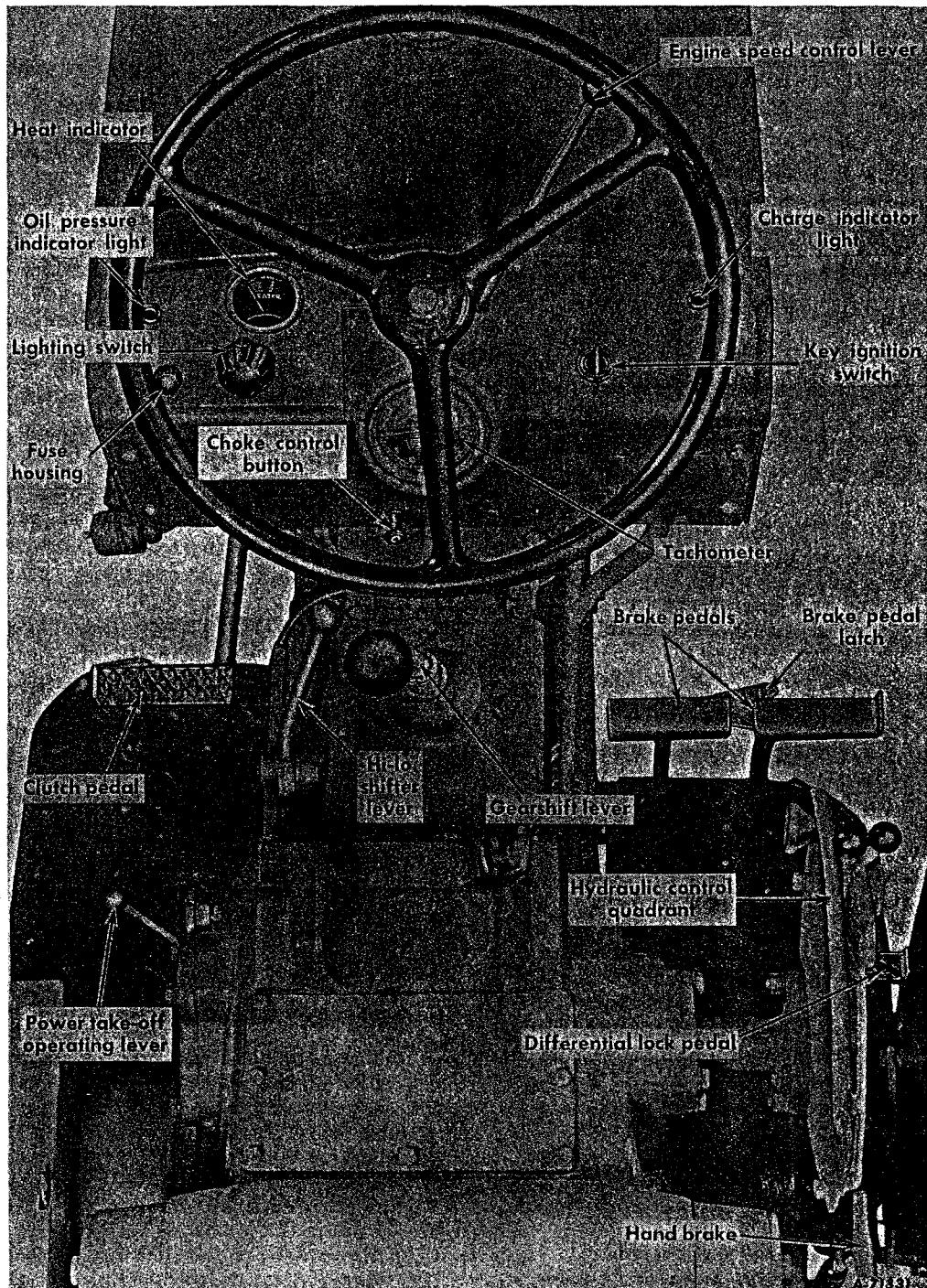
The same operating lever is used to engage or disengage the power take-off or belt pulley.

TACHOMETER

This instrument (Illust. 5) records engine hours of operation, shows normal tractor speeds in miles per hour in most forward gears, and indicates engine r.p.m. which provides a means of setting the exact engine speed specified for power take-off operations.

Continued on page 8.

INSTRUMENTS AND CONTROLS



Illust. 7
Instruments and controls on the gasoline engine tractor.

INSTRUMENTS AND CONTROLS

TACHOMETER - Continued

A mark on the lower half of the dial indicates the recommended power take-off shaft speed.

Refer to the tables in "Specifications" for normal tractor speeds according to tire sizes. Refer to "Power Take-Off Specifications" for power take-off shaft speeds.

HEAT INDICATOR

This instrument (Illust. 5) indicates the relative temperature range of the liquid in the cooling system for best engine performance. The indicator pointer should be in the center of the "RUN" range.

HYDRAULIC SYSTEM CONTROL LEVERS

These levers, on the hydraulic system control quadrant, operate the hydraulic system. They are used to raise, partially raise, or lower equipment to the desired position.

CHOKE CONTROL BUTTON (Gasoline engine)

The choke-control button (Illust. 7) makes it possible to regulate the carburetor choke from the driver's seat. Pulling out on the choke button closes the carburetor choke for starting the engine; pushing it back in opens the choke.

KEY IGNITION SWITCH (Gasoline engine)

Turning the key 30 degrees clockwise switches on the ignition. Turning the key 30 degrees further clockwise against the spring pressure, completes the electrical circuit between the battery and the cranking motor solenoid and causes the cranking motor pinion to engage the flywheel ring gear, thereby cranking the engine.

OIL PRESSURE INDICATOR LIGHT (Gasoline engine)

This light will be on when the ignition switch is first turned on, before the engine is started, and up to the speed required for normal oil pressure. After the oil pressure builds up to normal, the light will go out. Should the light not go out or come on again during engine operation, stop the engine immediately and investigate the cause of oil pressure failure.

If you are unable to find the cause, consult your International Harvester dealer before operating the engine.

CHARGE INDICATOR LIGHT (Gasoline engine)

This light will light up as soon as the ignition is switched on and will remain on when the engine is not running or the generator is not charging.

Note: When the engine is not operating or the engine has stalled and the operator leaves the tractor, the key must be turned to the "off" position to prevent battery discharge.

FUEL SHUT-OFF CONTROL ROD (Diesel engine)

The fuel shut-off control rod (Illust. 5) is used when starting or stopping the engine. Push the rod in when starting the engine. Pull the rod out when stopping the engine.

KEY SWITCH (Diesel engine)

A key-type lock ignition switch is on the right side of the instrument panel. See Illust. 5. Turn the key clockwise to a horizontal position before attempting to start the engine. The key cannot be removed when in this position.

GLOW PLUG INDICATOR (Diesel engine)

This indicates the correct operating of the glow plug circuit. When the required temperature for starting is reached, the indicator will glow red.

GLOW PLUG SWITCH LEVER (Diesel engine)

Pressing this lever into the operating position energizes the glow plugs to bring them up to igniting temperature. The glow plug indicator indicates whether the glow plug system is working.

MANUAL STARTER LEVER (Diesel engine)

Pushing this lever down causes the cranking motor pinion to engage the flywheel ring gear and completes the electrical circuit between the battery and the cranking motor solenoid.

OIL PRESSURE GAUGE (Diesel engine)

This gauge (on the instrument panel) indicates whether lubricating oil is circulating through the engine. The indicator needle should be in the white area when the engine is running at speeds approximately 100 r.p.m. above slow idle speed. If it is not, stop the engine immediately and investigate the cause of oil pressure failure. If you are unable to find the cause, consult your International Harvester dealer before operating the engine.

AMMETER (Diesel engine)

This instrument (Illust. 5) indicates whether the generator is charging or the battery is discharging. If it shows discharge continuously, investigate the cause to avoid completely discharging the battery and possible damage to the generator.

BEFORE STARTING A NEW TRACTOR

LUBRICATION

Tractors shipped to destinations in the United States of America, Canada and Mexico have the crankcase and air cleaner filled with run-in oil. This oil should be used in the diesel engine for the first 25 hours of operation and in the gasoline engine for the first 50 hours of operation at all temperatures. If it is necessary to add oil during the run-in period, use type MS oil of the proper viscosity for the prevailing temperature. The oil filter element also must be changed after the first 25 hours of diesel engine operation or after the first 50 hours of gasoline engine operation. Refer to the "Lubrication Guide" for further information.

Lubricate the entire tractor, following the "Lubrication Guide".

Check the oil levels of the engine crankcase, air cleaner, transmission, belt pulley housing, and all gear cases to see that they are filled to the correct levels with oil of the proper viscosity for the prevailing temperature. See the "Lubrication Guide".

PNEUMATIC TIRES

Before moving the tractor, check the air pressure in the pneumatic tires and inflate or deflate the front and rear tires to the correct operating pressures.

Keep the front tires inflated to 20 pounds per square inch and the rear tires inflated to 12 pounds per square inch. But if the tractor is used mainly on the highway, the pressure should be increased to 28 pounds per square inch for the front tires and 16 pounds per square inch for the rear tires.

When operating with heavy front end loads, follow the tire manufacturer's recommendations for tire inflation. Contact your International Harvester dealer.

ENGINE COOLING SYSTEM

Tractors shipped to destinations in the United States and Canada have the cooling system filled with antifreeze solution. Check the coolant level in the radiator. When cold, the coolant level should be approximately 2-1/4 inches below the top of the filler neck.

If water is added, use only clean water; soft or rain water is recommended, as it does not contain alkali, which forms scale and eventually clogs the passages.

Never start or operate the engine without water or antifreeze in the cooling system.

For further information, see "COOLING SYSTEM" on pages 28 and 29. If the tractor is to be operated in freezing temperatures (+32°F. or lower), see "COLD WEATHER PRECAUTIONS" on page 41.

FUEL SYSTEM

Fill the fuel tank. For fuel tank capacity, see the "SPECIFICATIONS".

Use clean fuel and keep it clean. Store fuel in tanks equipped with hose and nozzle to prevent contamination of the fuel. The use of funnels, cans and drums is not recommended because they are difficult to keep clean.

Before attempting to use a fuel for which your tractor is not designed, see your International Harvester dealer or the nearest International Harvester Company district office for full details.

Gasoline Engine

International Harvester gasoline burning engines are specifically designed for use with regular grade gasoline having a 90 minimum octane rating (Research Method—approximately 84 Motor Method).

Operate the fuel pump hand primer lever (on the right side of the engine) to bring fuel to the carburetor.

Diesel Engine

Carefully strain the diesel fuel to be sure it is free from foreign substances. Do not use dirty fuel. See "DIESEL FUEL SPECIFICATIONS" on page 13.

Vent the fuel system before starting the engine for the first time. See "VENTING THE FUEL SYSTEM" on page 16.

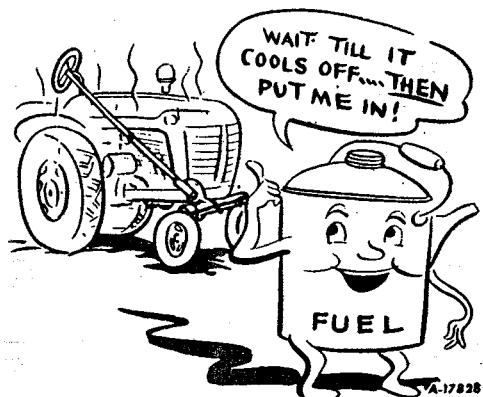
INSTRUMENTS AND CONTROLS

Thoroughly acquaint yourself with all instruments and controls as described on pages 4 to 8.

PREPARING A TRACTOR FOR EACH DAY'S WORK

- Air cleaner oil cup and filter Remove, clean and refill. See page 30.
Cooling system Check level of coolant in radiator. See page 28.
Lubrication points See "LUBRICATION GUIDE".

FUEL SYSTEM



Never refuel the tractor while the engine is running or extremely hot.

Fill the fuel tank, preferably at the end of each day's work. This will force out any moisture-laden air and prevent condensation.

The filler cap on the fuel tank is vented. These vents should be kept open at all times to assure proper flow of the fuels.



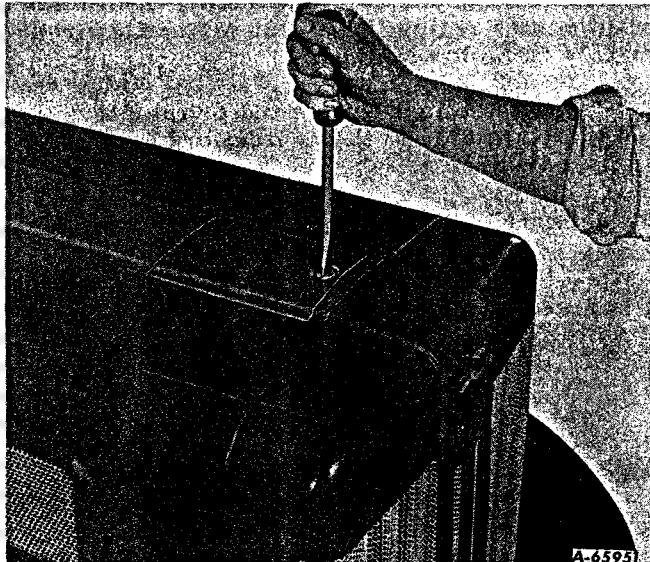
SAFETY FIRST! Never fill the fuel tank when the engine is running or "hot" or when near an open flame. Do not smoke or use an oil lantern when working around inflammable fuels. When refueling the tractor, keep the hose nozzle or the funnel and container in contact with the metal of the fuel tank to avoid the possibility of an electric spark igniting the fumes.

Before starting the diesel tractor for each day's work, open the diesel fuel tank water drain cock to drain off water and sediment. Close the drain cock as soon as clean fuel appears.

COOLING SYSTEM

Turn the retaining screw on the radiator cap access cover (see Illust. 10) and press down on the rear of the cover. Remove the radiator filler cap and check the coolant level. Fill the radiator to a level approximately 2-1/4 inches below the top of the filler neck.

AIR CLEANING SYSTEM



Illust. 10
Radiator cap access cover.



Illust. 10A
Air cleaner oil cup.

The air cleaner cap should be cleaned, and the oil in the air cleaner oil cup should be changed more frequently than every ten hours of operation if unusually dusty or dirty conditions are encountered.

OPERATING THE GASOLINE ENGINE

Before attempting to start or operate the tractor, be sure you review the instructions for the new tractor and thoroughly familiarize yourself with the instruments and controls.

This engine is designed to operate on gasoline with a 90 minimum octane rating (Research method).

FUEL SYSTEM

Be sure the shut-off valve on the fuel strainer under the fuel tank is open.

To prevent leakage or seepage when the valve is in its full open position, be sure to screw the needle stem (shut-off valve) out until the seat on the stem is tight against the stop.

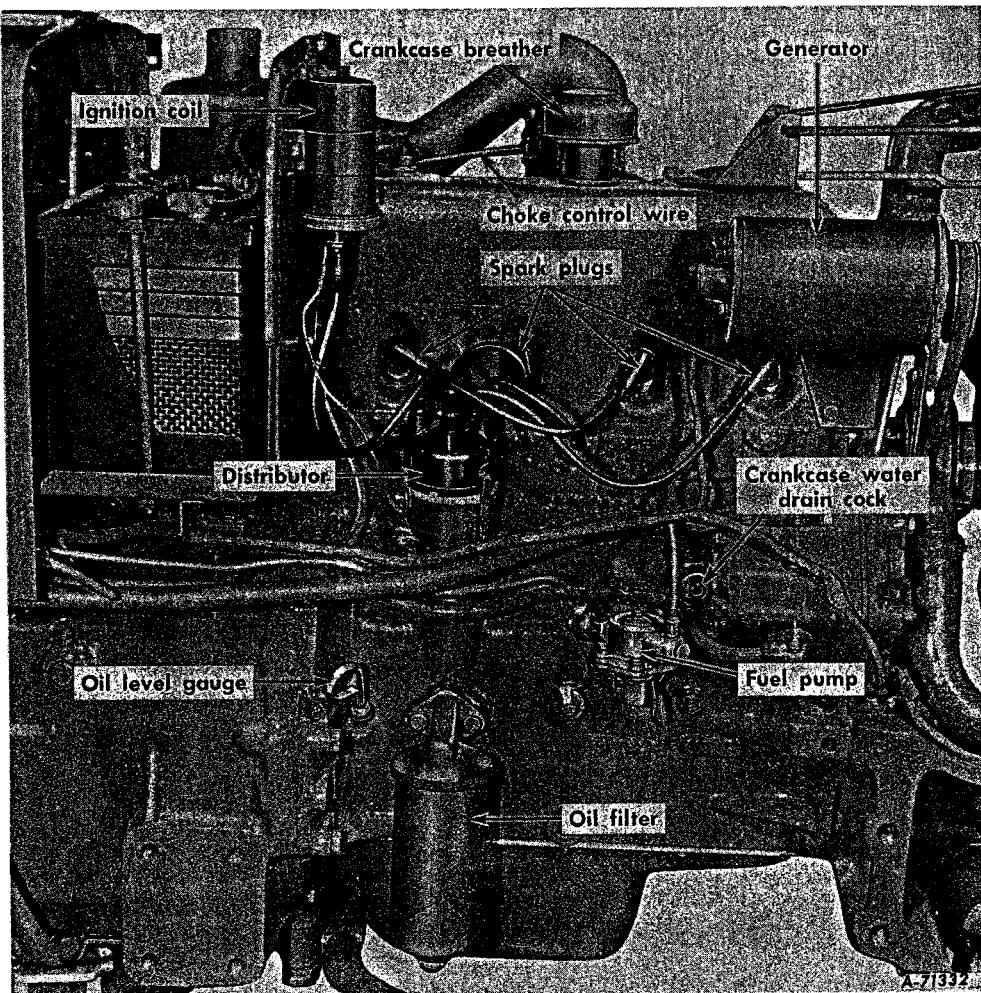
STARTING THE ENGINE

1. Put the gearshift lever in the neutral position. See Illust. 5.
2. Pull the choke control button out all the way.

Note: Avoid overchoking, as excessive use of the choke will flood the engine, making it

hard to start. The use of the choke for starting will vary, depending on temperature and altitude.

3. Advance the engine speed control lever to approximately the one-third open position.
4. Disengage the engine clutch by pressing the clutch pedal all the way down.
5. Turn the ignition switch key clockwise against the pressure of the spring. Hold it in this position to operate the cranking motor until the engine starts, then release the key. **Note:** Do not operate the cranking motor for more than 30 seconds at any one time. If the engine does not start within this time, release the key and wait a minute or two before trying again.



Illust. 11
Right side of gasoline engine.

OPERATING THE GASOLINE ENGINE

AFTER THE ENGINE STARTS

As soon as the engine starts, adjust the choke to a point where the engine operates without missing and, as the engine warms up, open the choke all the way by gradually pushing the choke rod all the way in. Do not use the choke control button to enrich the fuel mixture, except when starting the engine.

Immediately after the engine starts, check the oil pressure gauge (Illusts. 5 or 7) to make sure lubricating oil is circulating through the engine. 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 Harvester dealer before operating the engine.

STOPPING THE ENGINE

Retard the engine speed control lever by pushing it all the way up (Illust. 7). Allow the engine to cool slowly from full-load operation by slowly idling the engine for a short time. Then turn the key counterclockwise to the "OFF" position to stop the engine. It is advisable to close the fuel shut-off valves if the engine is to be stopped for any length of time.

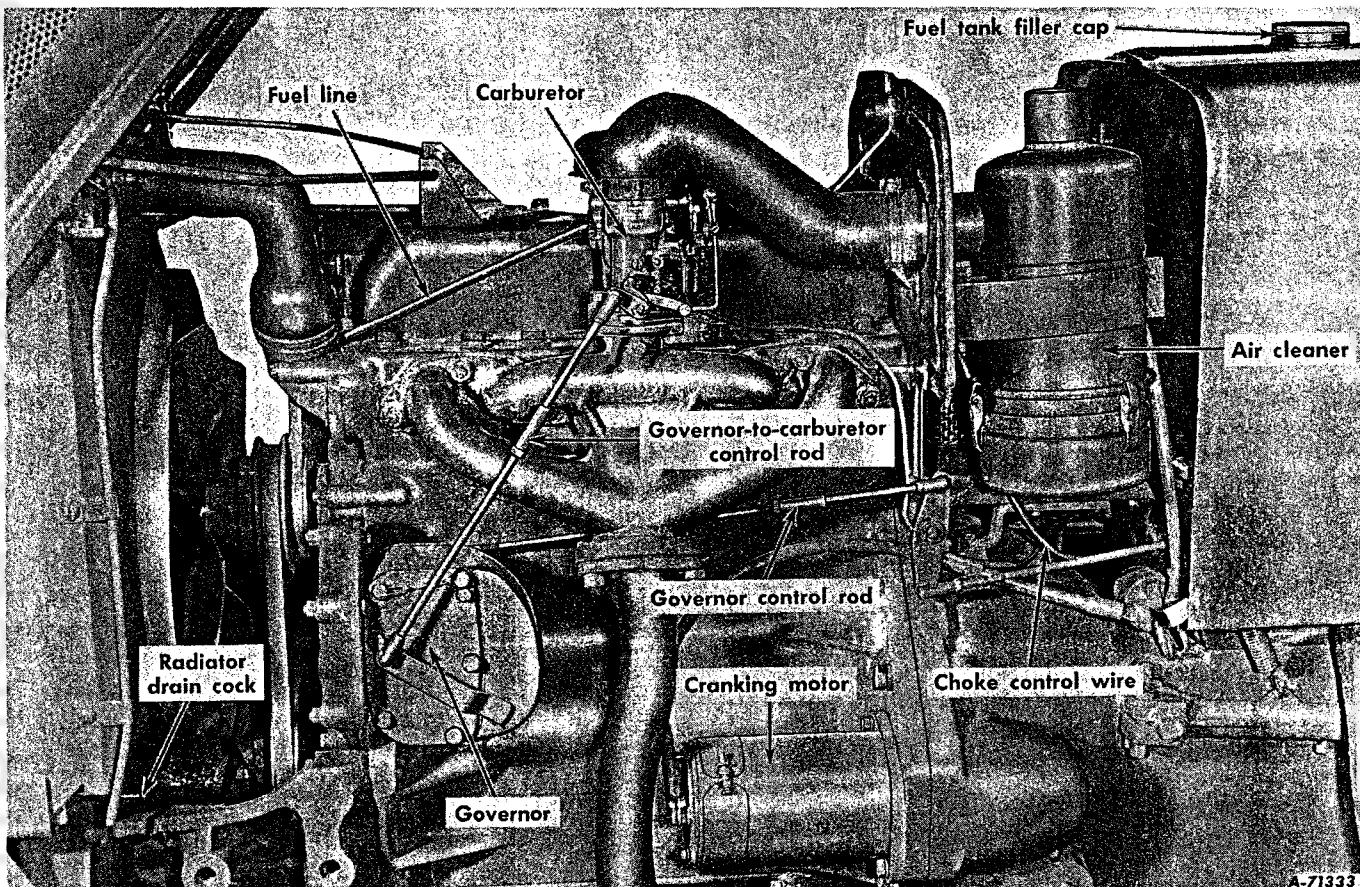


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When starting the engine in a barn or garage, keep the doors wide open because exhaust gases from internal-combustion engines contain poisonous carbon monoxide which is odorless, tasteless and colorless.

Note: Never operate the cranking motor while the engine is rotating.

6. Slowly release the clutch after the engine starts.



Illust. 12
Left side of the gasoline engine.

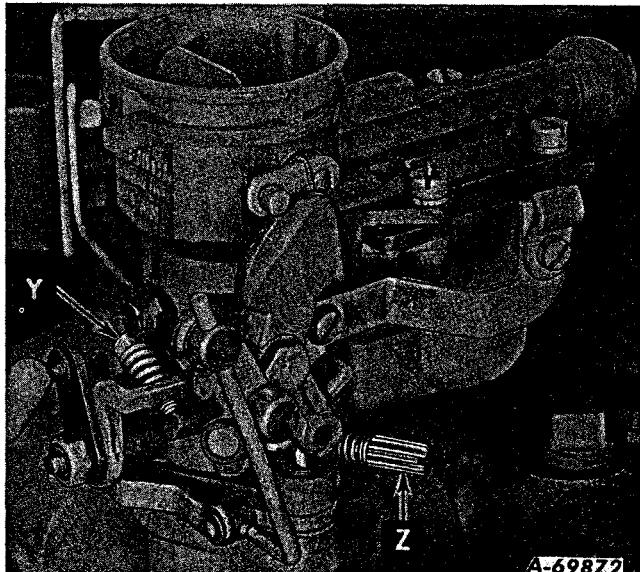
GASOLINE FUEL SYSTEM

CARBURETOR (Gasoline Engine)

The carburetor mixes gasoline and air together to form a combustible mixture. Always use a clean supply of fuel to minimize servicing.

To adjust the idling mixture proceed as follows:

1. Retard the engine speed control lever.
2. Adjust the throttle stop screw "Y" (See Illust. 13) to give a slight increase in engine speed.
3. Turn the idling mixture screw "Z" in or out to give the smoothest engine idling with the highest speed.
4. Readjust the throttle stop screw to give the required engine idling speed.



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Illust. 13
Carburetor adjustments.

DIESEL FUEL SPECIFICATIONS

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

Most refiners now market fuel oil designated as diesel fuel to distinguish it from burner fuel. Although similar to burner fuel, diesel fuel is usually made from the straight-run distillates, while 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 give the most satisfactory performance in International diesel engines when the physical properties are within the

limits of the following specifications:

Gravity	Min. 30 API
Flash point.....	Min. +125°F. or legal
Pour point	10° lower than min. anticipated temperature
Cloud point	Preferably no more than 10° higher than pour point
Water and sediment (by volume)	0.10%
Carbon residue (10% residuum)	0.25% max.
Ash (by weight)	0.02% max.

Distillation:

Initial boiling point min.....	+325°F.
50% boiling point min.....	+475°F.
90% boiling point min.....	+550°F.
90% boiling point max.	+675°F.
End boiling point max.	+725°F.
Sulphur by weight.....	0.5% max.
Cetane number (ignition quality).....	40 min.
Copper strip corrosion--3 hours	+212°F. No. 3 max.
Color	3 NPA max.
Viscosity, kinematic +100°F.	centistokes--min. 1.8
Viscosity, kinematic +100°F.	centistokes--max. 5.8

DIESEL FUEL SPECIFICATIONS

When No. 2-D fuel conforming to the above specifications is not available, 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

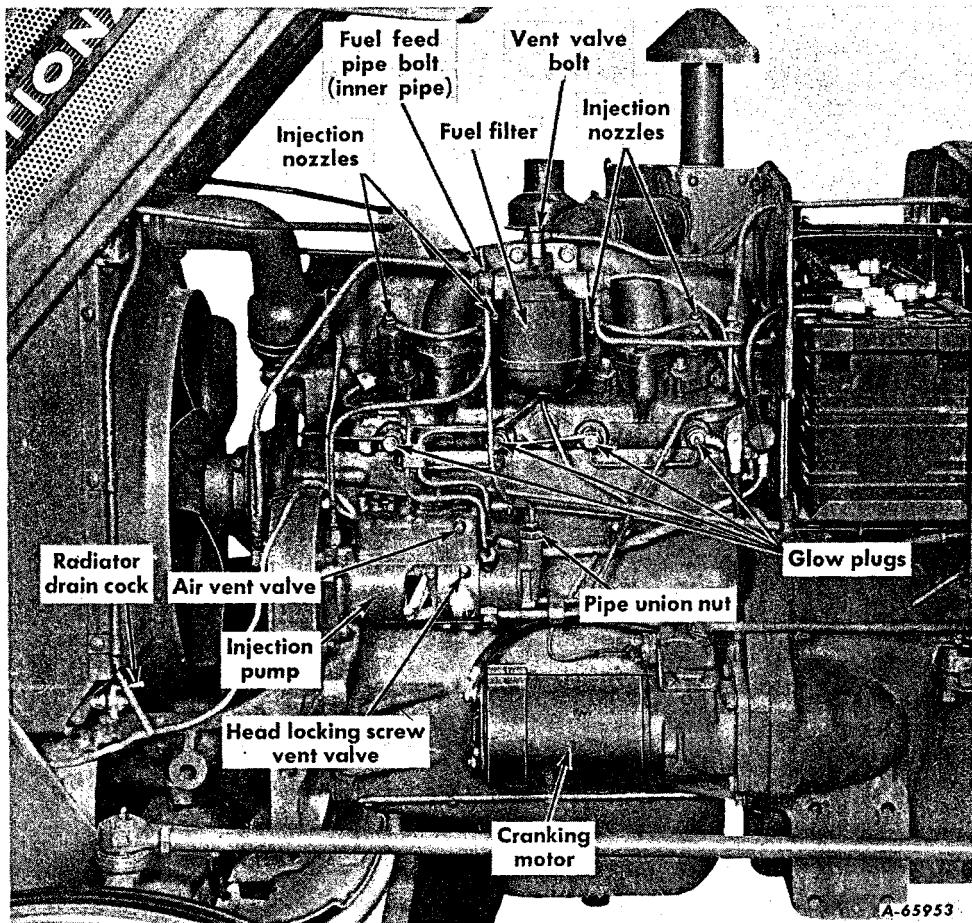
performance with these fuels will avoid service problems. When in doubt, see your International Harvester dealer.

Water and sediment will tend to clog the filter. If water passes through the filter, 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. To reduce the possibility of fuel contamination, store fuel in tanks equipped with hose and nozzle. 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. Following these rules will pay dividends.

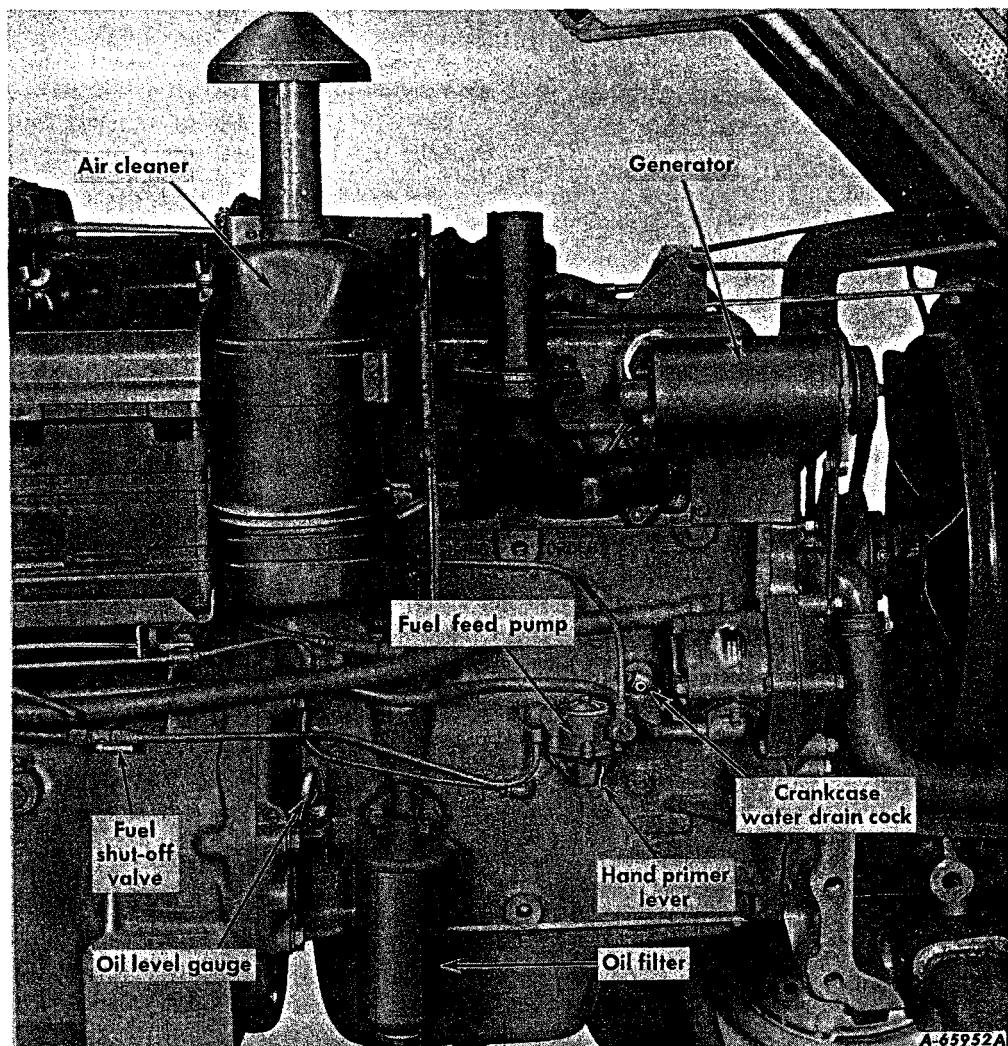
OPERATING THE DIESEL ENGINE

Before attempting to start or operate the tractor, be sure you review the instructions for the new tractor and thoroughly familiarize yourself with the instruments and controls.



Illust. 14
Left side of diesel engine.

OPERATING THE DIESEL ENGINE



Illust. 15
Right side of the diesel engine.

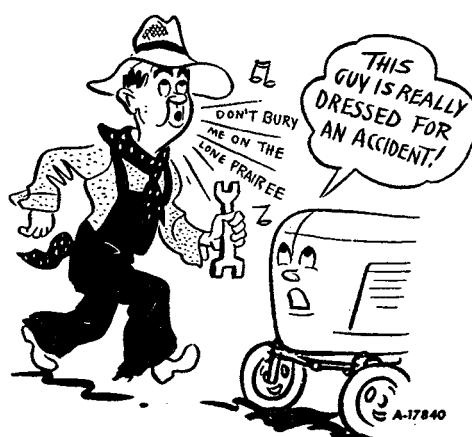
FUEL SYSTEM

When filling the fuel tank, carefully strain the diesel fuel to be sure it is free from foreign substances. Do not use dirty fuel. See "Diesel Fuel Specifications" on page 13.

Be sure the shut-off valve on the right side of the tractor under the fuel tank is open.

All air must be eliminated from the fuel lines before the engine will start and operate properly. All plugs and fuel line connections must be thoroughly tight to prevent leakage and to prevent air from entering the fuel system.

Note: To prevent possible damage to the fuel injection pump and to facilitate starting, before attempting to start the engine, vent the fuel system according to the following instructions.



Loose or "floppy" clothing should not be worn by the operator because of the danger of it wrapping on or getting into the moving parts.

OPERATING THE DIESEL ENGINE

VENTING THE FUEL SYSTEM

Follow the instructions given below, to be sure that only fuel which has passed through the filter element can reach the interior of the pump.

Set the engine speed control lever to approximately the half-open position.

Push the fuel shut-off rod in all the way.

Loosen the air vent valve on the side of the injection pump. See Illust. 15.

Loosen the vent valve on the head locking screw.

At the filter end of the return pipe to the tank, on top of the filter cover, unscrew the vent valve bolt two or three turns.

Operate the hand primer lever on the right side of the engine until the fuel is free of air bubbles and flows in a solid stream from each venting point, then tighten the screws in the following order: vent valve bolt, head locking screw vent valve, and air vent valve on the injection pump.

Loosen the union at the injection nozzle end of one of the high pressure pipes. Crank the engine until the fuel flows free of air bubbles. Tighten the connection, then repeat this procedure for the remaining three connections.

The engine is now ready for use.

VENTING AFTER CHANGING THE FILTER ELEMENT

Loosen the vent valve bolt on the filter cover. Operate the primer until the fuel flows free of air bubbles from the vent.

Tighten the vent valve bolt.

Loosen the bolt at the filter end of the filter to injection pump feed pipe (the inner pipe connection). Operate the hand primer until fuel, free of air bubbles, flows from around the threads.

Tighten the feed pipe bolt. The pump and filter are now filled and primed and ready for operation.

STARTING THE ENGINE

Move the gearshift lever to the "neutral" position.

Set the engine speed control lever to approximately the half open position.

Be sure the fuel shut-off control rod is fully in.

Disengage the clutch by pressing the pedal all the way down.

Push the glow plug switch lever down into the operating position and hold it there for about 20-25 seconds until the glow plug indicator glows a dull red.

While still holding the glow plug switch lever in the operating position, push down on the manual starter lever until the engine fires evenly. Release the glow plug switch lever.

Move the engine speed control lever to idle the engine at approximately 800 r.p.m.

Note: To protect the batteries, it is preferable to lengthen the glow plug heating time rather than use the cranking motor too long.

For restarting a warmed-up engine, the glow plug switch lever need be held in position for only a few seconds, or if the engine is very warm, not at all.

AFTER THE ENGINE STARTS

Immediately after the engine starts, check the oil pressure gauge (Illust. 5) to make sure lubricating oil is circulating through the engine. 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 Harvester dealer before operating the engine.

Inspect the engine to see that it is running evenly and note whether the exhaust smoke shows evidence of poor combustion. Uneven running is generally due to air in the lines or faulty nozzles. Black exhaust smoke can generally be traced to poor or excessive fuel, or wrong injection pump timing to the engine. Blue smoke indicates heavy oil consumption. White smoke indicates "misfiring" cylinders. For possible remedies, see "Trouble Shooting".

STOPPING THE ENGINE

Retard the engine speed by pushing the control lever all the way up. Allow the engine to cool slowly from full-load operation by slowly idling the engine for a short time. Then pull the fuel shut-off control rod out all the way and turn the key switch counterclockwise to the "OFF" position.

DIESEL FUEL SYSTEM

The diesel fuel system consists of a fuel tank with a built-in water trap and a water drain plug, a fuel filter, a fuel feed pump, an injection pump assembly complete with governor, a nozzle holder and nozzle assembly for each cylinder and high pressure steel tubings connecting the pump discharge outlets to the nozzles.

The fuel feed pump, on the right side of the engine, draws the fuel from the supply tank and pumps it to the filter. The fuel injection pump draws the fuel from the filter, places it under the high pressure required for mechanical atomization, meters it with great accuracy, distributes it in proper sequence to the various cylinders, makes the individual injections with fine precision in timing, and produces, uniformly through the nozzles, the correct pattern of spray for the combustion chamber.

Careless or too frequent removal of elements of the fuel injection system for "inspection" or "cleaning" is generally far more harmful than beneficial, because of the danger that dirt will enter the exposed connections and because of the possibility of mishandling the equipment through lack of knowledge of its design and construction. Various of its components are made with the utmost precision and are easily damaged when removed.

FUEL STORAGE

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

conditions require the use of drums for fuel storage, use a pump to draw the fuel from the drums, rather than from a faucet, as water and foreign material 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.

If drums are used for storage of diesel fuel, place them under cover, or in a horizontal (laid-down) position if left exposed to rain. Do not disturb the drums after the fuel settles.

Do not use the last three inches of fuel in the supply tank or drum; collect it in a container and allow it to settle. In this manner the sediment and foreign material can be separated from the fuel and disposed of with no loss of fuel.

FUEL TANK AND WATER DRAIN COCK

The fuel tank has a built-in water trap and a water drain cock at the bottom of the tank at the right side of tractor. Water and foreign materials which settles to the bottom of the tank should be drained off daily from the fuel before it enters the fuel filter and fuel injection pump. Open the drain cock before starting the tractor for each day's work and allow water and sediment to drain from the tank until diesel fuel appears, then close the drain cock.

FUEL FILTER

The life of the filter element depends on the amount of impurities it is called upon to remove from the fuel. Therefore, clean fuel and a well cared for water trap will not only increase the life of the fuel filter but make it more efficient. The element cannot be cleaned and should be removed only when replacement is necessary.

If impaired engine operation indicates the filter has become clogged, replace the filter immediately. This condition will be indicated by loss of power and engine missing at full load.

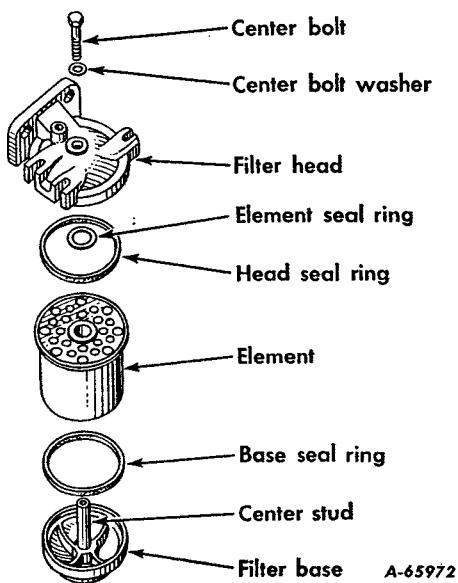
Removing and Replacing the Element

Clean the outside of the fuel filter case and top thoroughly; this is to insure no foreign matter enters the assembly when the case is removed.

Close the fuel shut-off cock at the bottom left corner of the fuel tank.

Remove the center bolt and remove the filter base and element. Clean the base and replace the element. Be sure the seal rings are in good condition. Assemble the base with element to the filter head and tighten the center bolt securely.

Cleanliness while installing a new element cannot be over-emphasized. Care should be taken to prevent dirt, water, etc. from getting onto the new element. For venting after installation, see page 16.



Illust. 17

Diesel fuel filter.

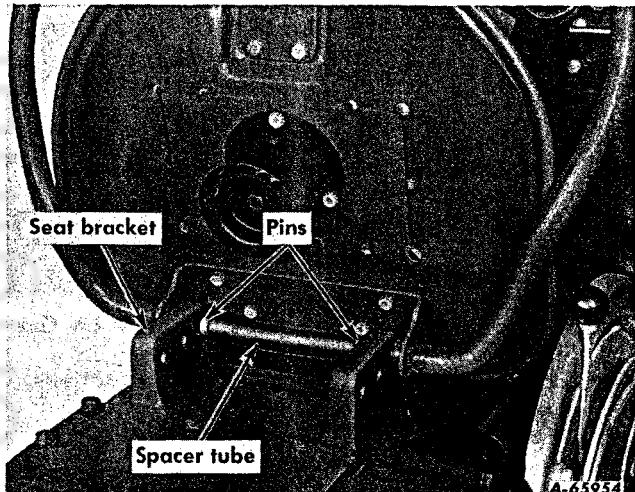
DRIVING THE TRACTOR

ADJUSTING THE SEAT

The foam rubber seat has a rubber cushioned backrest mounted on a spring cushion. It is directly supported by a rubber shock absorber and pivots on seat support tubing pinned to the seat bracket.

Three sets of holes are provided in the seat bracket for adjusting the seat forward and rearward.

To adjust the seat, remove the spacer tube, pull the pins, move the seat support tube to the desired set of holes, reinstall the pins and spacer tube.



Illust. 18
Adjusting the seat.

STARTING THE TRACTOR

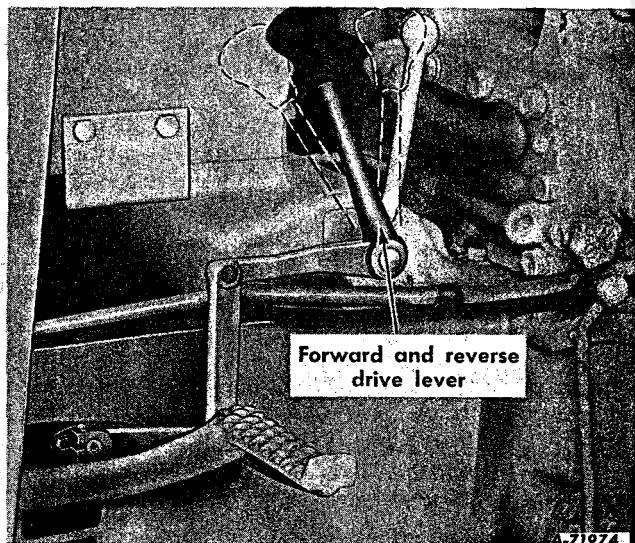
Never operate an engine immediately under full load. Do not overload the engine at any time.

With the engine running and the clutch in the disengaged position, select the desired gear and speed range by moving the gearshift lever and the hi-lo shifter lever to their appropriate positions (see Illust. 6). Release the parking brake. Slowly release the clutch and the tractor will start in motion.

Note: Allow the engine to warm up to operating temperature and operate it at less than full load during the run-in period (first 25 hours of operation for diesel engines or first 50 hours of operation for gasoline engines.)

FORWARD AND REVERSE DRIVE

When the tractor has a forward and reverse drive, the operator can reverse the tractor direction of travel in any selected gear, in either the high or low speed range, without shifting the transmission gears.



Illust. 18A
Forward and reverse drive lever
positions.

 Caution! The tractor will travel approximately 25% faster in the reverse drive than in forward gear, therefore, a certain amount of caution should be taken when changing the direction of travel from forward to reverse; particularly in the higher speed ranges.

To operate the forward and reverse drive, set the gearshift lever and the hi-lo shifter lever in the desired gear and speed range positions. Disengage the clutch and move the forward and reverse drive lever all the way forward for forward travel or all the way rearward for reverse travel. Slowly release the clutch to start the tractor in motion. Move the lever to the center for neutral position. Refer to "Ground Speeds" on page 56.

STEERING THE TRACTOR

Steering is in the conventional manner, but assistance in making sharp turns can be gained by applying the brake on the side towards which the turn is to be made.

DRIVING THE TRACTOR

The brake pedals can be latched together to cause the brakes to operate simultaneously. See Illust. 5.

Caution! Always latch the brake pedals together when travelling in the two highest speeds (H3 and H4). Sharp turns at these speeds are dangerous.

STOPPING THE TRACTOR

Apply the brakes until the tractor stops moving, and at the same time, disengage the clutch. Move the gearshift lever into "neutral" and release the clutch pedal. Apply the parking brake.

TOWING THE TRACTOR

When towing the tractor to transport it from one place to another, the transmission gearshift lever must be in the fourth speed gear position and the Hi-Lo shifter lever in the neutral (center) position. The ground speed should not exceed fifteen miles per hour.

Do not tow this tractor with a rigid towbar. A driver must steer the tractor. The towing device must be attached to the front bolster and not to the axle.

DIFFERENTIAL LOCK

The differential lock provides a very important operating advantage and it takes only a brief period for the operator to familiarize himself with its use. Its purpose is to overcome completely the one-wheel slip encountered

under bad field conditions, especially when plowing or when hauling heavy trailers on slippery surfaces.

A pedal, operated by heel pressure, is on the right side of the platform. Depressing this pedal engages the differential lock which, in effect, connects the shafts which carry the drive to the rear wheels, making them a solid shaft. This makes it impossible for the rear wheels to turn at different speeds. The condition where one wheel spins, digging itself in to the soil while the other stands virtually idle, is thus overcome.

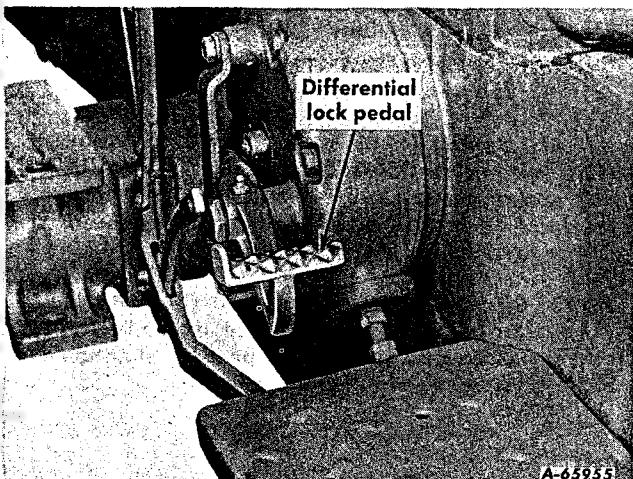
Also the condition where one wheel is turning (and slipping) fractionally faster than the other is easily overcome, saving fuel, brake wear and tire abuse.

Engagement normally takes place while the tractor is still in motion. A spring-loaded safety device has been incorporated to prevent too-forceful engagement. If one wheel is spinning too rapidly for the differential lock to engage, a clicking noise will be heard. If this continues for more than a few seconds, depress the engine clutch pedal momentarily and the differential lock will come into operation immediately.

Should the differential lock be hard to disengage, a quick pressure on the correct brake (when plowing) or momentarily depressing the clutch, will relieve the torque on the shafts and allow the spring-loaded collar, which joins them, to disengage. The end of the lock control shaft will then be seen to emerge from the right brake housing, near the pad of the differential lock pedal.

While the effect of the differential lock is most noticeable and effective when ground conditions are at their worst, use of the differential lock need not be limited to such conditions. It will be found that the more general use of the differential lock will make an appreciable improvement in traction and allow more economic working of the tractor by increasing the speed of field work even when wheel slip is not particularly apparent. Continual engagement of the differential lock is not harmful to the wearing parts.

When plowing, the tractor can follow a gently curving furrow without undue strain on the locking mechanism or the gears and shafts. However, the differential lock must be disengaged before attempting turns, particularly at the headland and in other confined spaces.



Illust. 19
Differential lock pedal.

HITCHING TO THE SWINGING DRAWBAR

The tractor, when so equipped, exerts its pulling power on trailing-type equipment by means of the swinging drawbar, which is adjustable up and down to accommodate different hitches. Correct hitching will save both the tractor and the equipment from undue strain and wear. Incorrect hitching tends to make the tractor difficult to steer and may result in unsatisfactory work by the equipment being pulled.

The tractor exerts its pulling power along a vertical line extending upward from a point on the ground midway between the drive wheel tracks and slightly ahead of the rear axle. This point is referred to as the center of pull. The height of load application depends upon the vertical location of the drawbar rear attaching point. Trailing-type equipment has what is called a center of resistance or a theoretical point, the location of which is determined by test, from which a pull must be applied to move it along. A line connecting the center of equipment resistance with the drawbar rear attaching point is known as the line of pull.

Whenever possible, the tractor tread should be adjusted and the tractor operated so the center of pull is straight ahead of the center of resistance, in the direction of travel. When this is not possible or advisable, the swinging drawbar should be pinned to one side just enough so an extension of the line of pull passes through the vertical line extending upward from the center of pull, or within a few inches of this line. This drawbar position is determined by trial and will result in the side force being exerted on the drive wheels, rather than being transferred through the tractor chassis to the front wheels where steering may become difficult.

When pulling trailing-type equipment which does not require close positioning, the drawbar tongue may be left free to swing, making

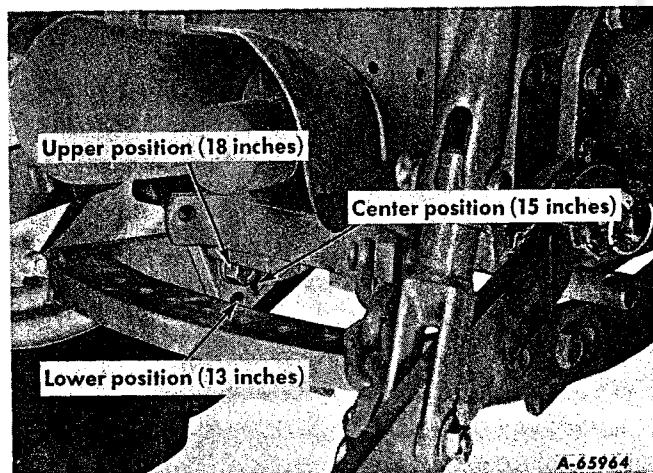
steering under load easier both on the straight-away and when turning.



Caution! Lock the drawbar in the center position when towing loaded wagons or heavy equipment downhill or on the highway.

DRAWBAR HEIGHT ADJUSTMENT

Three drawbar heights are available by using the three holes in the drawbar frame support plates (see Illust. 20).



Illust. 20
Swinging drawbar height adjustment.

For the majority of work, it will be found that the upper position is the most suitable, but for many power take-off driven machines the middle or lower positions may be found to offer a better working drawbar height.

Note: All distances given are the height of the top of the drawbar from the ground level when measured on a tractor having standard tires (13.6-28 rear, 6:00-16 front).

HYDRAULIC SYSTEM

Operation

The hydraulic system uses a pump which is driven directly from the engine and is thus able to operate the Three-Point Hitch or any remote cylinder independently of the clutch or power take-off.

The hydraulic fluid reservoir under the tractor seat contains the hydraulic fluid for operating the hitch and remote cylinders.

Features of the hydraulic system include: position control, draft control, flow control, and remote control.

By use of one or the other of the two control levers in the quadrant, on the right side of the operator's seat, the operator can quickly and accurately select the required working position.

When transporting equipment, move the position control lever back to the maximum lift position, and the draft control lever and slide toward the front of the quadrant. The isolating valve must be fully open.

All of the controls for these features can be quickly and easily reached while sitting in the operator's seat.

 Caution! When parking the tractor, always lower the equipment to the ground, whether or not the engine is stopped.

POSITION CONTROL

The position control lever controls the lifting and lowering of the Three-Point Hitch. Move the lever forward to lower and rearward to lift the hitch. By means of an internal follow-up linkage, the lift arms automatically follow the hand lever movement or are positioned according to the position of the hand lever in its quadrant.

The setting of the position control lever on the quadrant will determine the lowest position the equipment will go. Setting the knurled stop against the lever enables the operator to readily return the equipment to the same working position each time it is raised.

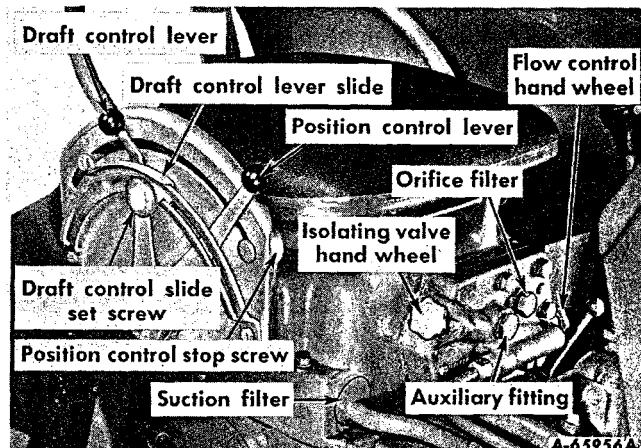
Note: The maximum limit of lift of the hitch is preset in the factory by means of the hex head bolt which is toward the rear of the quadrant. This bolt is the permanent stop (see Illust. 21) and must not be changed. If the lever is moved past the stop, the system will be placed on high pressure with possible damage to the hydraulic pump. Further rearward movement of the lever will cause the hitch to drop.

Operation

Move the draft control lever to the farthest forward position. Adjust the position control lever stop to the position which will maintain the correct working position of the equipment. Return the lever to this position at the start of each round.

DRAFT CONTROL

Draft control is achieved by use of the fact that all ground-working equipment imposes a load on the top link of the three-point hitch.



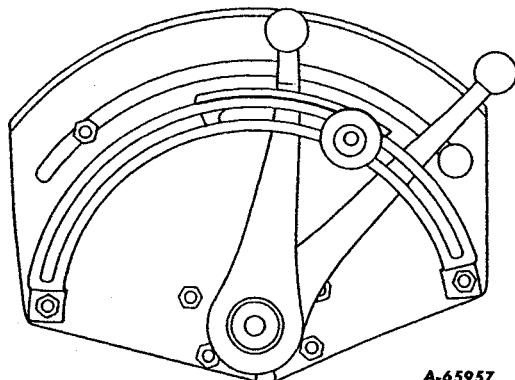
Illust. 21
Hydraulic control lever.

The deeper the equipment operates, the greater the load. As the draft load varies due to soil conditions or contour operation, so the top link load varies. This variation is transferred through the internal mechanism into hydraulic valve movement.

An increase in top link load will automatically change the valve to the "raise" position and, correspondingly, a decrease in the top link load will automatically change the valve to the "lower" position.

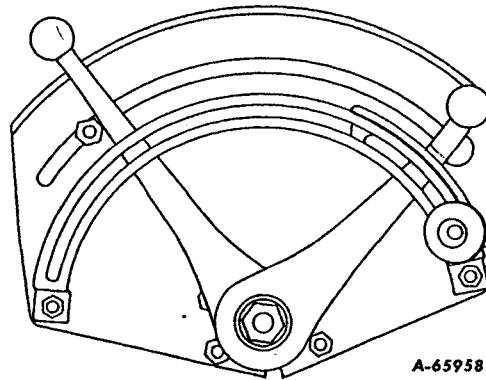
A setting of the draft control lever will be found which corresponds with a particular top link load and any variation in this load will adjust the valve to "raise" or "lower" and thus maintain an approximately uniform working position of the equipment and more uniform loading of the tractor engine.

HYDRAULIC SYSTEM



A-65957

Illust. 22
Controls set for draft control operation.



A-65958

Illust. 22A
Controls set for transporting.

Operation

Lower the equipment into the working position by moving the knurled stop and position control lever fully forward. Set the draft control lever (see Illusts. 21 and 22) for the required working depth. The slide (see Illust. 21) should then be set so the draft control lever is in approximately the center of the slide. Under extreme operating conditions, the operator may find it necessary to move the draft control lever forward or rearward within the range of the slide to maintain the selected working depth.

Smoother draft control operation will result with the use of the differential lock when conditions permit.

To raise the equipment out of the ground, move the position control lever rearward to the permanent stop.

Note: Do not use the draft control lever to raise or lower the equipment.

FLOW CONTROL

This control (see Illust. 21) enables the operator to change the rate of flow, from the hydraulic pump to the hitch cylinder, from full flow to approximately half flow rate.

To get the slow delivery rate, the knob should be pushed in and given a quarter-turn counterclockwise. To get the fast delivery rate, the knob should be pushed in and given a quarter-turn clockwise.

The slow delivery rate generally should be used when operating under draft control. The fast delivery rate will generally be used, with out-of-ground equipment such as loaders, etc.

OPERATING REMOTE CONTROL CYLINDERS Using Three-Point Hitch Controls

The auxiliary fitting (see Illust. 21) is used for connecting the hose for a remote control cylinder when the position control lever on the hitch valve is used to control it.

Move the draft control lever fully forward and lock the slide.

Raise the lower links until the ends are approximately six inches from the highest position.

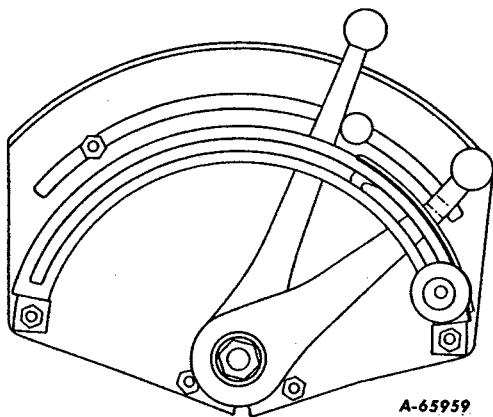
Move the knurled stop up against the position control lever.

Then close the isolating valve. This valve (see Illust. 21) must be closed (screwed clockwise) only when operating remote control cylinders connected to the auxiliary fitting.

Note: This isolating valve must always be fully opened or fully closed.

The position control lever against the knurled stop is the "hold" position for the cylinder. See Illust. 24.

HYDRAULIC SYSTEM



Illust. 23
Controls set for position control operation.

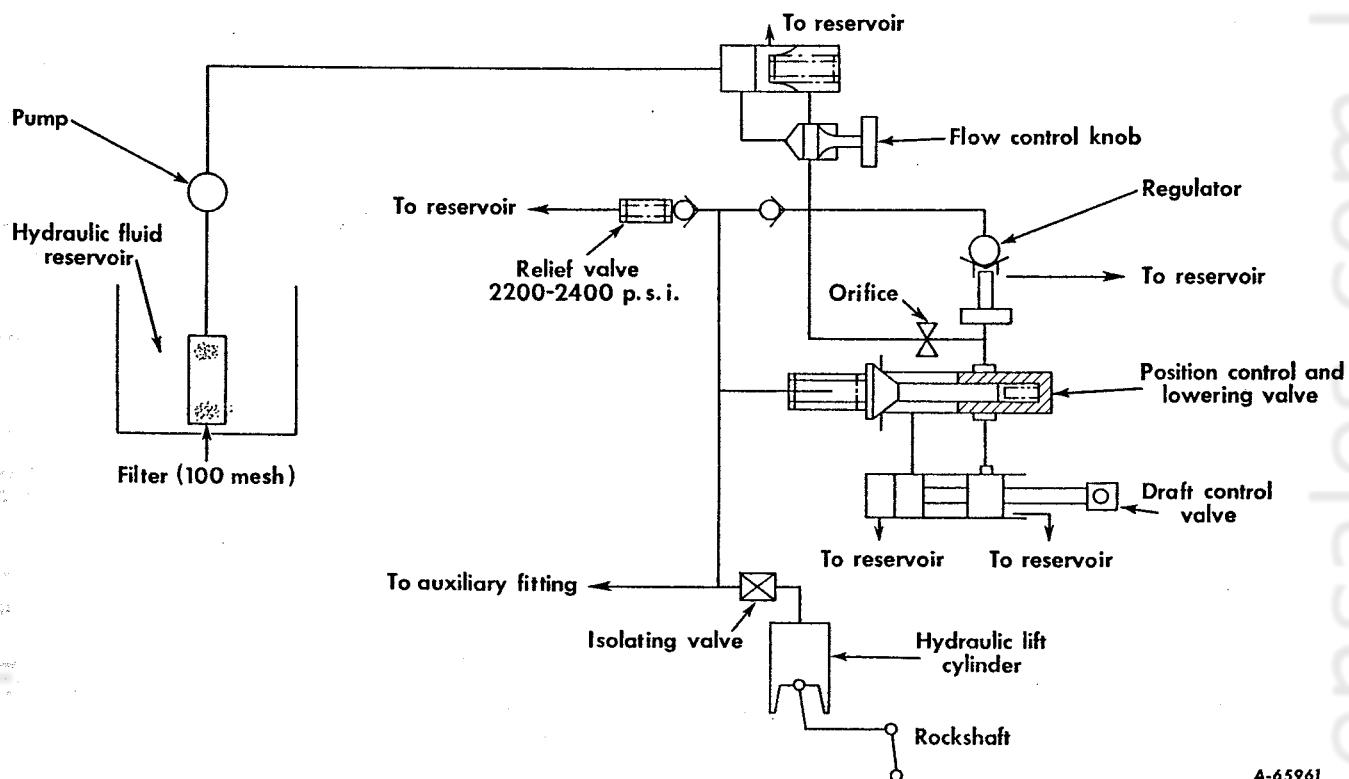
Note: Do not use the permanent stop (maximum lift position) for this purpose.

To retract the cylinder piston and lower the equipment, move the position control lever around the stop a short distance. When the equipment has lowered to the desired position, return the lever to the "hold" position by moving the lever around and against the stop.

Note: Be sure the lever is against the stop and not partly beyond it into the "raise" portion of the quadrant.

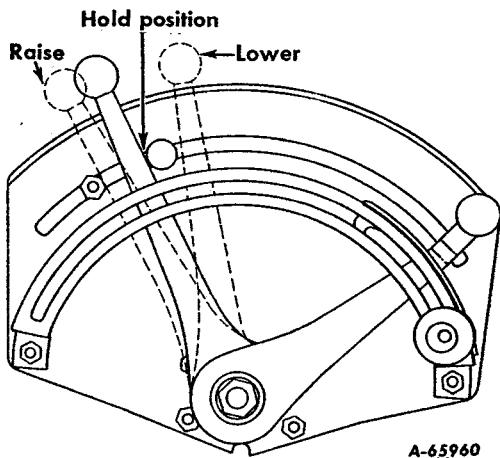
To extend the cylinder piston and raise the equipment, move the position control lever toward the "raise" position until the equipment has reached the desired height. Then, immediately return the lever to the stop.

Note: It is important that the lever be returned to the stop at once to prevent overheating the system and overloading the engine.



Illust. 23A
Flow control diagram.

HYDRAULIC SYSTEM



Illust. 24

Controls set for operating remote control cylinders.

AUXILIARY VALVE

One or two auxiliary valves are available for remote cylinder operation. They are mounted on the left side of the hydraulic housing.

To operate the auxiliary valve, move the lever forward to lower and rearward to raise the equipment. The lever will automatically return to "hold" when released.

If an auxiliary valve is used, the instructions given for using the position and draft control levers for operating the remote control cylinder do not apply.

MAINTENANCE

After every 1000 hours, the hydraulic system should be drained and refilled as follows:

Clean all the dirt from around the filler plug and suction filter. Loosen the hose clamps and push the hose forward on the suction pipe. Grip the filter stub pipe as near to the filter body as possible and twist it in a counterclockwise direction until the stub pipe is clear of the main pipe.

Allow the fluid to drain from the filter stub pipe into a suitable container.

Note: Do not run the tractor engine without hydraulic fluid in the reservoir, as damage to the pump will result.

CLEANING THE FILTERS

The hydraulic system has two filters to prevent entry of dirt into the hydraulic system. These are the suction filter and orifice filter on the hydraulic draft control.

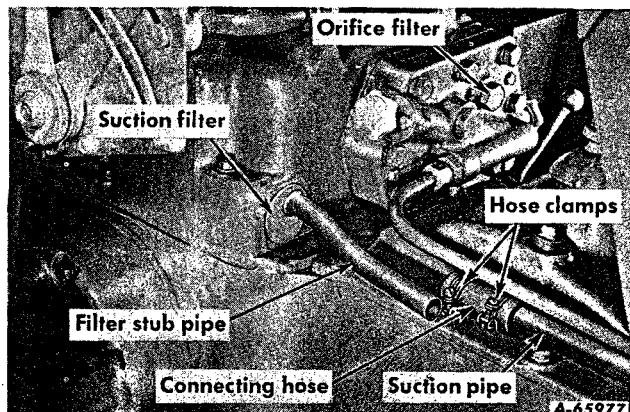
Clean the suction filter every time the fluid is changed in the reservoir. After draining the fluid, remove the filter by pulling on the stub pipe. See Illust. 24A.

Clean the filter carefully with clean diesel fuel or kerosene and a soft brush. Dry the filter by shaking it.

Every 1000 hours, remove the hex. head plug and clean or replace the orifice filter.

REFILLING THE HYDRAULIC SYSTEM

Remove the hydraulic filler plug (see Illust. 52) and refill the reservoir with the proper fluid. See the Lubrication Table.



Illust. 24A
Draining the hydraulic system.

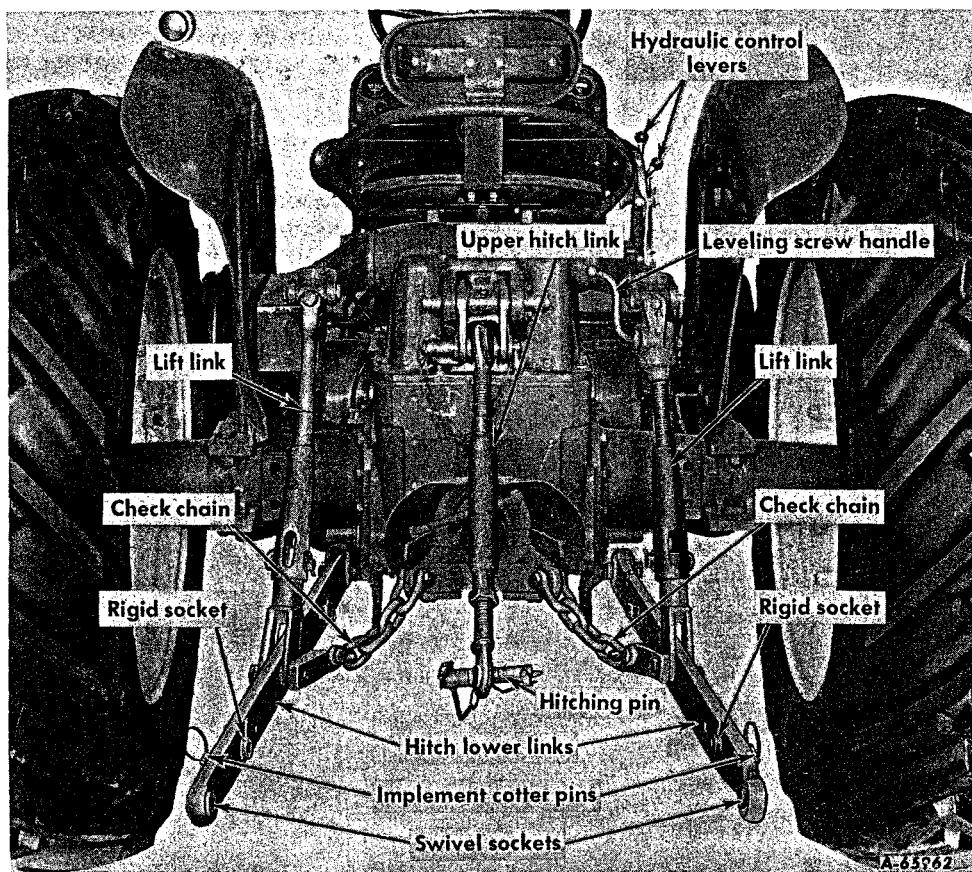
Run the engine and move the position control lever fully forward and fully rearward ten or twelve times to expel air from the pipes and also allow more fluid to be added to the reservoir to fill the entire system to its correct capacity.

Take care that only clean fluid is used in the system to prevent any dirt getting in the system.

Slow, jerky and noisy operation is caused by a shortage of hydraulic fluid in the reservoir or by a clogged suction filter. If these symptoms occur, add fluid to the reservoir. Should these symptoms persist, remove the suction filter and clean it. Then drain the fluid and refill with clean fluid.

These symptoms may occur on first starting the tractor in freezing weather, but will disappear once the fluid warms up.

OPERATING THE THREE-POINT HITCH



Illust. 25
Three-Point hitch.

The Three-Point Hitch used with the hydraulic draft control is the Category I type with inside check chains. It is designed to accommodate Category I equipment.

Hitching equipment to tractors with Three-Point Hitch is relatively simple, but it requires a little thought and practice to do the job quickly and without loss of motion. New hitches and equipment often need to be "broken-in" to work best. Easier action is obtained when the paint wears away.

Be sure the use of the draft control and position control levers is understood. Spend a little time observing the action of the hitch when it is moved by these levers.

Set the position control lever (see Illust. 21) as required to put the hitch lower links at the same height as the equipment hitching pins.

The equipment and the tractor should rest on reasonably level ground.

Back the tractor in straight until the swivel sockets in the ends of the hitch lower links are in line with the equipment hitching pins. Put the swivel socket onto the left equipment pin. Then, by adjusting the leveling screw handle, the right socket can be placed onto the equipment pin. Remove the implement cotter pins from their storage clips and insert them in the ends of the equipment hitching pins.

Remove the hitching pin from the upper hitch link. Adjust the hitch upper link so the swivel socket lines up between the hitching pin holes in the mast. Put the hitching pin through the mast holes and the swivel socket in the hitch upper link. Secure the pin with implement cotters.

OPERATING THE THREE-POINT HITCH

THREE-POINT HITCH DRAWBAR

This drawbar can be mounted in the normal position in the swivel socket ends of the lower links or in the specially provided rigid sockets in the links (see Illust. 26). In either case, the drawbar struts must be used.

Caution! The drawbar struts must always be in place when the drawbar is used in either of the above positions for pulling trailing-type equipment. In addition, the position control lever stop and draft control lever slide must be used to lock the levers in the fully forward positions.

Mounting the drawbar in the rigid sockets, when the struts are adjusted to their shortest position, will provide the standard hitch di-

mension of 14 inches from the drawbar to the end of the power take-off shaft.

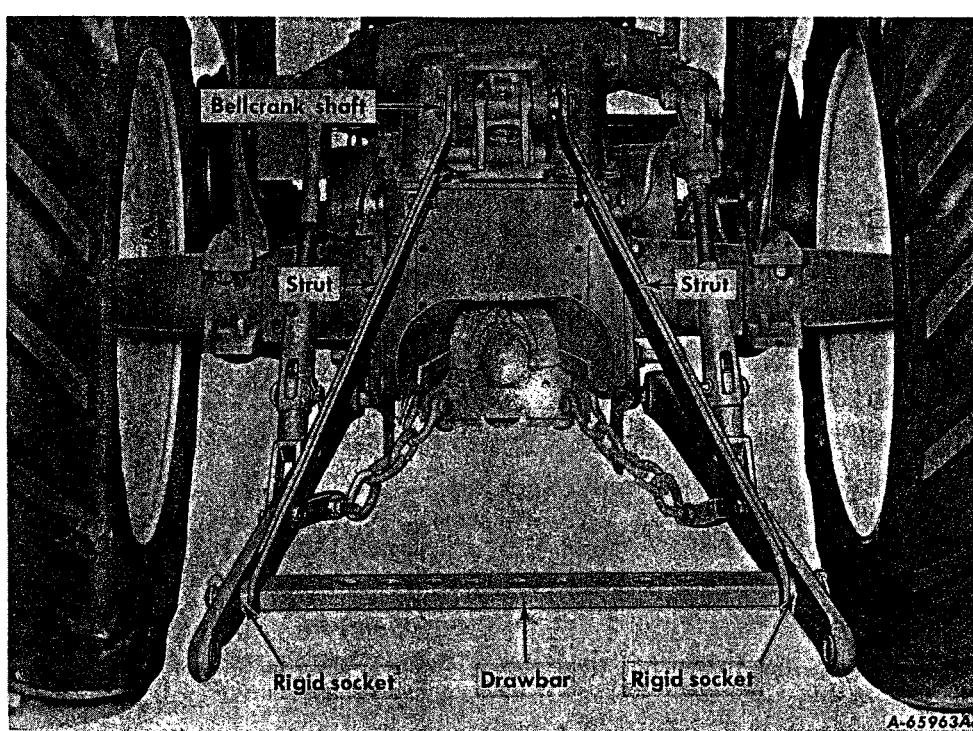
The drawbar is correctly leveled when the radial groove cut in the thread of the lift rod and leveling rod align with the top face of the turnbuckle.

LOWER LINK HITCH POINTS

The tractor has two pin positions to which the lower links can be attached. Normally the lower pin positions (see Illust. 25) are used.

ADJUSTABLE CHECK LINK

Adjustable check links are available as an attachment to prevent equipment sidesway. They can be attached to either or both of the lower links at one end and attached to a bracket on the rear axle carrier at the other.



Illust. 26
Three-Point hitch drawbar.

OPERATING THE BELT PULLEY

The belt pulley housing is bolted to the rear of the tractor transmission case, the belt pulley drive is then in splined engagement with the power take-off shaft. The pulley housing may be attached to the tractor with the pulley either to the left or to the right; however, having the pulley on the left is preferred.

When operating the belt pulley, the tractor gearshift lever must be in the neutral position.

When the pulley housing has been bolted to the transmission case, fill the housing up to the level of the plug on the side of the housing with the same viscosity oil used in the trans-

mission case. (Refer to the LUBRICATION GUIDE).

When operating the belt pulley, with the front of the tractor higher than the rear, it is important that the correct oil level be maintained in the transmission. Check and, if necessary, add oil up to the level of the transmission oil level plug.

Note: Static electricity, generated by belt work, can be discharged harmlessly from tractors with pneumatic tires by attaching a chain to the tractor and letting it touch the ground.

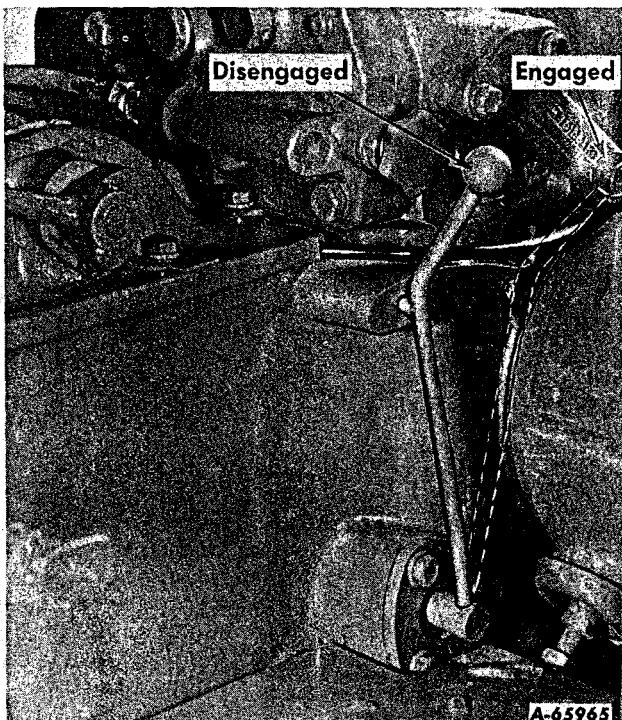
OPERATING THE POWER TAKE-OFF

The tractor may have either a transmission-driven heavy-duty single-stage clutch power take-off or a constant-running power take-off with a two-stage clutch. Each type has a 1-3/8 inch standard spline power take-off shaft operating at a speed of 545 r.p.m. The power take-off is disengaged when the operating lever is in the forward position and is engaged by pulling the operating lever to the rearward position.

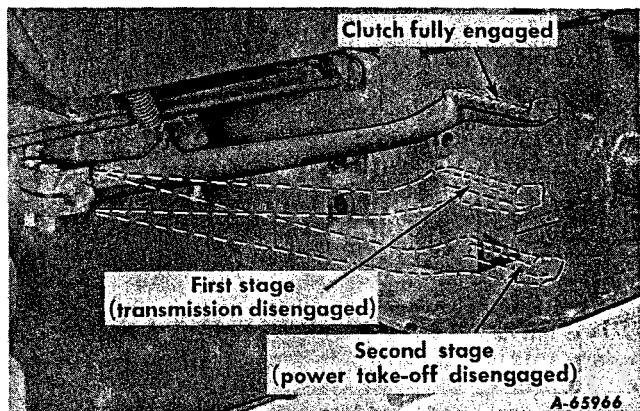
The heavy-duty single-stage clutch power take-off (not constant-running) is used on tractors with forward and reverse drive.

The constant-running power take-off with the two-stage clutch is used on tractors with a standard (8-speed) transmission and is operated by a two-stage clutch pedal action. See Illust. 27A.

Great advantages are gained in using this type of power take-off, especially when baling or combining in heavily-bunched windrows or crops.



Illust. 27
Power take-off operating lever.



Illust. 27A
Two-stage clutch pedal.

In the case of baling, where a thick patch of material is encountered which overloads the baler, the clutch pedal is depressed through the first stage, thus stopping the tractor while power to the baler is uninterrupted, allowing it to cope with the extra material, without further forward movement. When the material has been cleared, the clutch pedal is released and normal baling continued. A further advantage is that when it is necessary to change gears due to uneven material, full power take-off speed and thus correct plunger speed of the baler is maintained throughout the operation.

In the same way when using a power-driven combine, correct and uniform cylinder speed is maintained (giving maximum separation of the grain) during gear shifting or other momentary stops.

OPERATION

Move the engine speed control lever to the low idle position.

Press the clutch pedal all the way down (full travel). Engage the power take-off by moving the lever to the rearward position. See Illust. 27.

Move the gearshift lever to the desired speed.

Move the engine speed control lever to obtain the required power. Release the clutch pedal through both stages.

COOLING SYSTEM

A belt-driven water pump is used to circulate the water through the engine block, cylinder head, and radiator. Circulation is controlled by a thermostat which prevents the water from flowing through the radiator until the engine has reached operating temperature. With the thermostat closed, water circulates only through the engine block.

FILLING THE COOLING SYSTEM

1. Close the drain plugs.
2. Fill the radiator to a level approximately 2-1/4 inches below the top of the filler neck. Filling the radiator to this level will allow for expansion of the coolant under normal operating conditions. Use clean water; soft or rain water is recommended, as it does not contain alkali, which forms scale and eventually clogs passages.

Fill the radiator slowly. This permits air to escape from the cylinder head, allowing the cooling system to be filled to its maximum capacity.

Before replacing the filler cap, be sure to remove any chaff or 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 gasket surface must be in good condition. The cap must be properly tightened to the stop, and 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. When draining the radiator, always remove the filler cap to permit complete drainage.

If the valve is faulty, replace it with a new radiator cap of the same type.

Do not attempt to repair or replace any of the regulating valve parts.

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 precautions.

Turn the radiator cap 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 as above.

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



CLEANING THE COOLING SYSTEM

Twice a year or more often, depending upon the mineral content of the water used, the cooling system should be drained and thoroughly flushed. This is particularly important before using an antifreeze solution.

Drain the cooling system by opening the drain cock on the right side of the engine (Illusts. 11 or 15) and the radiator drain (Illusts. 12 or 14). Allow the system to drain; then close the drain cocks.

If the engine is to be operated in freezing temperatures, refer to "Cold Weather Precautions" on page 41.

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.

The practice of flushing the system by forcing water from a hose in the radiator filler neck, without the use of cleaning solutions, may be only a waste of time. Iron corrosion is greater than that of any other cooling system metal, which accounts for the large quantities of rust found in neglected water jackets. Heavy rust deposits in the water jacket hold in heat and create local hot spots, especially around the exhaust valve seats. Under these conditions, the metal may get so hot that the valves will stick or burn, or the cylinder block or head may be damaged by heat cracking.

Unless the cooling water is treated with a corrosive preventive, rust and scale will eventually clog the passages in the radiator and water jacket. This condition is aggravated in some localities by the formation of insoluble salts from the water used.

IH Cooling System Cleaner dissolves rust, scale, and sludge and retards future corrosion when used according to the directions on the container.

Note: Do not use chemical mixtures to stop radiator leaks except as a temporary measure in an emergency. Instead, have the radiator repaired.

If the radiator is clogged with insoluble salt formations, take it to a reputable concern specializing in the removal of such formations. Reliable radiator service stations are familiar with local conditions and are equipped to apply the proper treatment.

In localities where alkaline, acid, or saline waters are the only kind available, the addition of IH Radiator Rust Preventive will tend to minimize the corrosive action of such water.

COOLING SYSTEM

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

After draining the antifreeze, IH Radiator Rust Preventive should be added to the cooling water to protect the cooling system during warm weather operation. This inhibitor solution should be drained and discarded in the fall when danger of freezing again makes necessary the use of an antifreeze.

RADIATOR CORE

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

FAN BELT TENSION

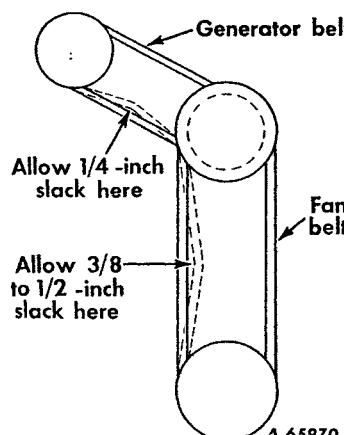
The slack of the fan belt should be checked after the first twenty-five hours and every fifty hours of operation thereafter, to maintain the correct tension. The tension is correct when the belt can be depressed without effort by your thumb approximately $\frac{3}{8}$ inch midway between the fan and generator pulleys. See Illust. 29. If the slack is more than $\frac{1}{2}$ inch, adjust the belt.

Adjusting the Fan Belt

Loosen the set screw.
Screw the pulley flange in to tighten the belt and out to loosen it.

Retighten the set screw after the correct tension has been obtained. See Illust. 29.

The belt should never contact the bottom of the pulley groove as this causes the belt to wear rapidly.



Illust. 29
Correct belt tension.

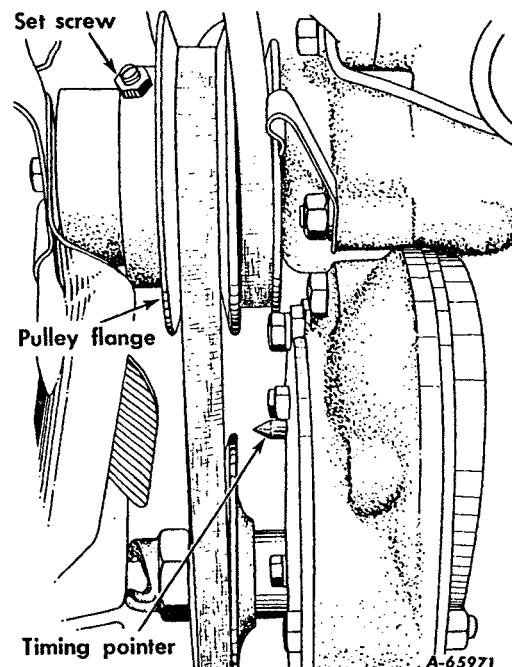
Removing and Replacing the Fan Belt

Loosen the set screw (see Illust. 29A) in the flange of the fan pulley and unscrew the flange as far as possible. Start the belt over the outer flange of the crankshaft pulley and pry it out with a light bar or rod. Slowly turn the engine over at the same time and the belt will work off the pulley. Withdraw the belt between the pulley and the fan blades. Work the belt over the fan blades.

To replace the fan belt, reverse the procedure outlined above except that the belt can be started over the crankshaft pulley by hand instead of using a metal bar.

By slowly turning the engine, the belt will find its correct position.

After a new belt has been in use for 25 hours, check the tension and adjust it if necessary.



Illust. 29A
Fan belt tension.

GENERATOR BELT TENSION

The slack of the generator belt should be checked after the first twenty-five hours and every fifty hours of operation thereafter, to maintain the correct tension. The tension is correct when the belt can be depressed $\frac{1}{4}$ inch midway between the pulleys. See Illust. 29.

Adjusting the Generator Belt

Loosen the generator mounting bolts and the generator brace bolt.

Move the generator away from the engine until the tension on the belt is correct. Retighten the bolts.

COOLING SYSTEM

Removing and Replacing the Generator Belt

Remove the generator brace bolt and loosen the generator mounting bolts. Move generator towards the engine and remove the belt from the generator pulley.

Remove the fan belt from the crankshaft pulley as previously described. Slip the generator belt through the fan belt and out over the fan.

To replace the belt, reverse the procedure outlined above and adjust the generator belt tension as previously instructed.

Check for correct tension when the belt has been in use for 25 hours.

WATER PUMP

The water pump is in front of the crankcase and is driven by the fan belt from the crank-shaft pulley. The inlet of the water pump is connected to the lower radiator connection and the outlet flow from the pump is through the integral passages cast in the crankcase.

No lubrication of the pump is required as the bearings are of the permanently sealed type and are packed with special lubricant for the life of the bearing.

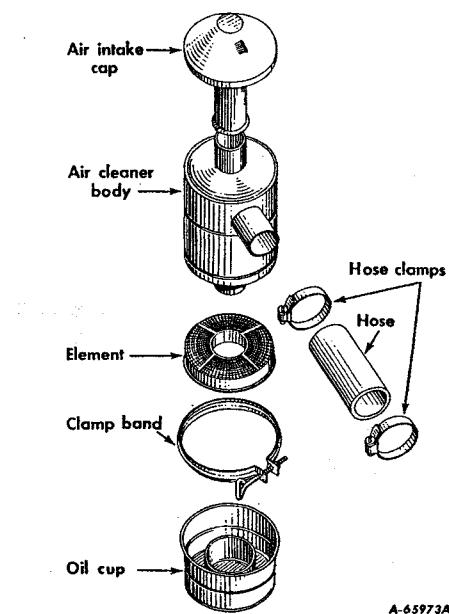
The water pump requires no attention other than bearing replacement when they show excessive looseness or if a water leak develops which indicates that a damaged or badly worn seal needs replacement.

AIR CLEANING SYSTEM

AIR CLEANER

Clean air for combustion is assured by an oil-type air cleaner. A heavy screen in the air cleaner body prevents large particles from entering the air cleaner. The air then passes to the oil cup where it goes through a bath of oil. As the air rises to the intake manifold, it passes through a series of oil-bathed screens and the fine dust is removed. As the oil from the screen works back down, it carries the dirt with it and settles in the oil cup. Never allow dirt to build up in the cup more than 1/2 inch deep.

Oil Cup Service



Illust. 30
Exploded view of the air cleaner.

Clean and refill the oil cup every day, or every 10 hours of operation (more frequently when operating under dusty conditions). Refill the oil cup to the oil level bead with the same grade of oil used in the engine crankcase. For the oil cup capacity, refer to page 51.

Do not remove the oil cup while the engine is operating. Before replacing the oil cup, clean or wipe oil or grit from the top bead of the oil cup.

Washing the Air Cleaner

After every 50 hours of operation - particularly if operating the tractor in an atmosphere heavily laden with dust, chaff or lint - remove the entire air cleaner from the tractor, dis-assemble it (see Illust. 30) and wash the parts thoroughly in kerosene or other solvent. Be sure to clean out the air intake pipe.

After all parts have been thoroughly cleaned, replace the air cleaner body on the tractor. Make sure all joints are airtight. Replace the air intake cap. Fill the oil cup to the proper level with the specified grade of oil and replace it on the air cleaner. Be sure it is held securely in place by the oil cup bail or clamp.

General Precautions

As an added precaution against dirt entering the engine, frequently inspect the flexible rubber hose connections between the manifold and the air cleaner. If they show any sign of deterioration, replace them. To eliminate strain on the rubber hose connections, be sure the pipes line up. All joints between the air cleaner, manifold, and cylinders of the engine should be tight. All gaskets must be in good condition and the bolts should be drawn up tight.

CRANKCASE BREather CAP

The crankcase breather and oil filler cap is on the top of the valve housing. See Illust. 11. Tip the hood forward, then remove the breather cap and clean it after every 250 hours of operation. Under severe dust conditions, clean it more frequently.

To clean, wash the breather and oil filler cap in kerosene or other solvent, dip it in engine lubricating oil, and replace it after wiping off the excess oil.

ELECTRICAL SYSTEM

The electrical system of the gasoline engine tractor consists of a generator voltage regulator, cranking motor, lights, lighting switch, electrical instruments, distributor, coil, resistor and a twelve volt battery.

The electrical system of the diesel engine tractor consists of a generator, voltage regulator, cranking motor, lights, lighting switch, electrical instruments and two six volt batteries.

IGNITION SYSTEM (Gasoline Engine)

For maximum operating efficiency and to prevent costly breakdowns on the job, it is recommended that the ignition system be checked periodically. Remove, clean, and adjust the spark plugs. Clean and adjust the distributor breaker points. Check all spark plug cables for breaks and shorts.

Coil

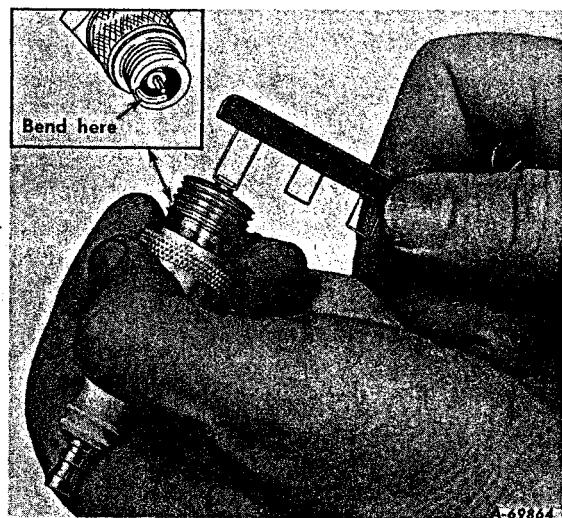
This unit changes the low tension voltage of the battery into a high tension voltage sufficient to cause a spark to jump across the spark plug gap. Keep the leads clean and tight.

Spark Plug Cables

Replace the cables when they become hard, cracked, shorted, or rotted. If the spark plug cables are removed, note the position of each in the distributor cap.

The cable terminals must fit snugly in the distributor and coil sockets. Use rubber nipples to cover these connections. Be sure each cable is secured to a sparkplug terminal.

Spark Plugs



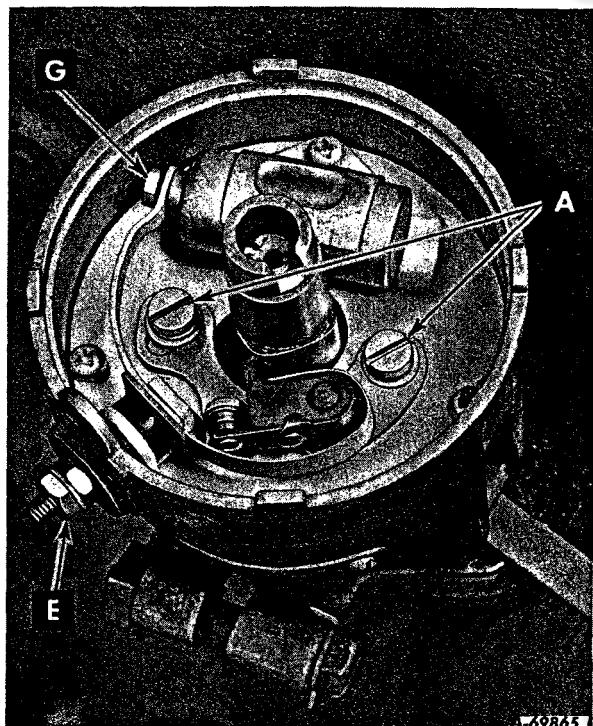
Illust. 31
Checking spark plug gap.

Blow all the dirt from the base of the spark plugs, using compressed air. To prevent cracking the porcelain, use a spark plug wrench, and remove the plugs. Clean dirty plugs using the sandblasting method. Using a .025 inch diameter round wire-type gauge, regap the electrodes. Always bend only the

outer (grounded) electrode to obtain necessary clearance. Replace the plugs, using gaskets that are in good condition, and tighten to 25-ft. lbs. of torque.

See your International Harvester 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.

Checking and Cleaning Breaker Points



Illust. 31A
Breaker point adjustment.

Periodically inspect the breaker points for pitting and wear. Check the gap when the points are at their widest opening. The correct gap is .014 inch.

Remove the distributor cap, clean and wipe it thoroughly. If the cap is cracked, replace it with a new cap. See your International Harvester dealer.

Remove the rotor and cover plate. If the breaker points are worn or pitted excessively, replace them. If they are found to be slightly pitted or burned, use a recommended fine file and dress both contacts to a smooth flat surface. Never use emery cloth or sandpaper.

Crank the engine until a cam lobe holds the points at the maximum gap. Loosen the two screws on the adjustable contact, insert a .014 inch feeler gauge and adjust the points until the gauge is a snug fit. Tighten the screws.

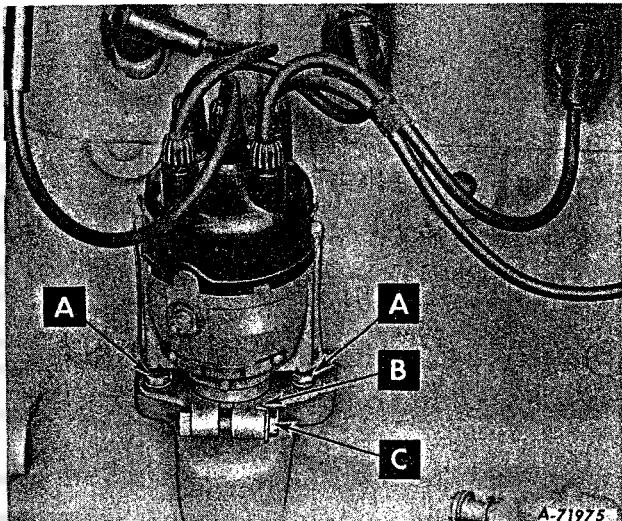
ELECTRICAL SYSTEM

TIMING THE DISTRIBUTOR TO THE ENGINE (ENGINE NOT RUNNING)

Note: Before checking or adjusting the timing, inspect the distributor breaker points and, if necessary, dress or replace them with new ones, and adjust the gap to .014 inch as previously instructed.

The engine firing order is 1-3-4-2. The crankshaft drive pulley rotates clockwise as viewed from the front of the tractor. The distributor shaft rotates counter-clockwise as viewed from the top.

The ignition timing for this engine requires the spark to occur when the piston is at top dead center (TDC) on the compression stroke.



Illust. 32
Distributor mounting.

To set the ignition timing with the engine not running, proceed as follows:

Remove the No. 1 spark plug, place your thumb over the opening and slowly crank the engine by hand until an outward pressure is felt. Continue turning slowly until the TDC notch on the rear flange of the crankshaft pulley is in line with the timing pointer on the crankcase front cover. This places the No. 1 piston at top dead center on the compression stroke.

Loosen the distributor mounting bolts "A", (Illust. 32) bend up the tab on lock washer "B", and loosen clamp bolt "C".

Turn the ignition switch key to the "ON" position.

Hold the No. 1 spark plug cable terminal approximately 1/8 inch from a clean point on the crankcase. Then rotate the distributor body to the left or right as required until a spark jumps between the No. 1 spark plug cable terminal and the crankcase.

Tighten the distributor mounting bolts "A", and the clamp bolt "C" securely, and bend the tab on lock washer "B" to lock in position.

Turn the ignition switch key to the "OFF" position.

Install the No. 1 spark plug and reconnect the cable.

The engine is now timed to fire at top dead center. Slight advance or retard may be required to obtain the most favorable timing judged on smoothness of running and power requirements.

A slight amount of advance or retard can be obtained by just loosening the distributor mounting bolts "A" since the holes in the mounting plate are slotted.

TIMING WITH A TIMING LIGHT (ENGINE RUNNING)

The ignition timing can be adjusted with greater speed and accuracy by using an ignition timing light.

As the crankshaft drive pulley is marked only with the TDC notch, which is for timing when the engine is not running, two additional marks must be added to the rear flange of the pulley before a timing light can be used.

The first mark is to be 6 degrees (approximately 11/32 inch) before the TDC notch and the second mark 17 degrees (approximately 31/32 inch) before the TDC notch.

Standing at the right side of the engine with the TDC notch in the pulley at the timing pointer, the two marks must be added above the notch (towards the top of the pulley) since the pulley rotation is in a clockwise direction. These marks will be more visible if white lead or chalk is added.

When the timing light is directed at the timing pointer and 6 degree mark should line up with the pointer when the engine is operating at 500 r.p.m. and the 17 degree mark should line up with the pointer when the engine is operating at 1000 r.p.m.

ELECTRICAL SYSTEM

Replacing Breaker Points and Condenser

Remove the distributor cap, rotor and cover plate. Remove the two screws "A" (Illust. 31A) which retain the adjustable side of the breaker points. Remove the retaining nut "G" (Illust. 31A) from the condenser. Loosen the retaining nut "E" (Illust. 31) from the terminal post and loosen the terminal post. Both contact breaker points can now be removed.

Clean and wipe the cam lobes and flats and the top of the plate. Apply a light coating of International Harvester High Temperature grease (21372-D) on the cam lobes and flats. Fill the recess in the breaker post, and pack a small quantity in back of the breaker arm rubbing block. Apply 4 or 5 drops of engine oil to the hole in the distributor shaft. See Illust. 31A.

Install the new breaker points, making sure the contacts are in alignment. To align the contacts, use an alignment tool or long nose pliers and bend the stationary contact only. Do not bend the movable arm to align the contacts. Install the new condenser. Crank the engine until a cam lobe holds the points at the maximum gap. Loosen the two screws on the adjustable contact, insert a .014 inch feeler gauge and adjust the points until the gauge is a snug fit. Tighten the screws. Replace the cover plate, rotor and distributor cap.

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 generator "D" terminal and the single wire terminal of the ammeter. 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.

Note: Never place a jumper lead between or accidentally bridge the "A" and the "F" terminals on the regulator, as this will damage the regulator.

FUSE

A cartridge-type fuse is in the fuse housing to the left of the lighting switch. If a short circuit occurs in the lighting 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. See "Specifications" on page 55. 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, unscrew the fuse housing knob on the instrument panel (see Illust. 5) pull out the old fuse, and replace it with a new one.

STORAGE BATTERY

Cleaning and Servicing the Battery

Occasionally remove the battery cable and ground strap, brighten the terminal contact surfaces with wire wool, and reassemble. Apply a light coat of vaseline or chassis lubricant. Be sure the terminals are clamped tightly and that the batteries are fastened securely in place. Replace unserviceable cables. Keep the vent holes in the battery filler caps open.

Check the battery at least once a month for water level. 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.

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.

Acid or electrolyte should never be added except by a skilled battery man. 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 batteries. 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

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 batteries once every two weeks to maintain the correct specific gravity. The specific gravity of a fully charged battery is 1.255 to 1.270 corrected to +80°F. (liquid temperature).

ELECTRICAL SYSTEM

Specific Gravity - Continued

A specific gravity reading of at least 1.230 corrected to +80°F. should be maintained. Never allow the battery to fall below 1.230.

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.

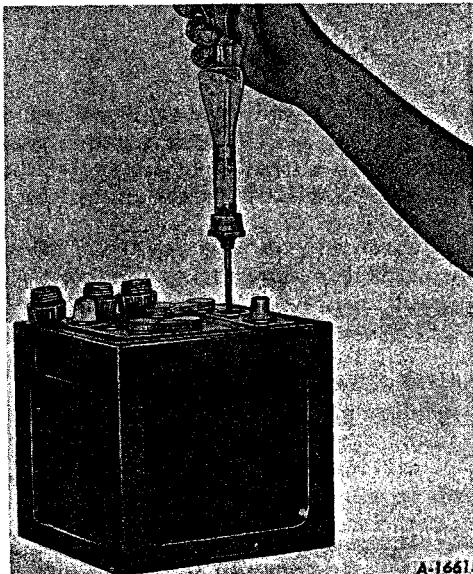
Example No. 1

Hydrometer reading	1.270
Electrolyte temperature	+20°F.
Subtract .024 Sp. Gr.....	(.004x6)
Corrected Sp. Gr. is	1.246

Example No. 2

Hydrometer reading	1.255
Electrolyte temperature	+100°F.
Add .008 Sp. Gr.....	(.004x2)
Corrected Sp. Gr. is	1.263

Use an accurate hydrometer when testing for specific gravity. Readings should not be taken immediately after adding water. All cells should show approximately the same specific gravity reading. Wide variations indicate something is wrong.



Illust. 34

Taking a hydrometer reading of electrolyte in the battery.

Cold Weather Operation

It is especially important to keep the battery close to 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 electrolyte, or damage to the battery will result from the water freezing.

A battery three-fourths charged is in no danger of damage from freezing. Therefore keep the battery better than three-fourths charged, especially during winter weather.

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
1.265	-80°F.
1.220	-30°F.
1.210	-20°F.
1.180	-10°F.
1.160	-0°F.
1.140	+10°F.
1.100	+20°F.
1.000	+30°F.

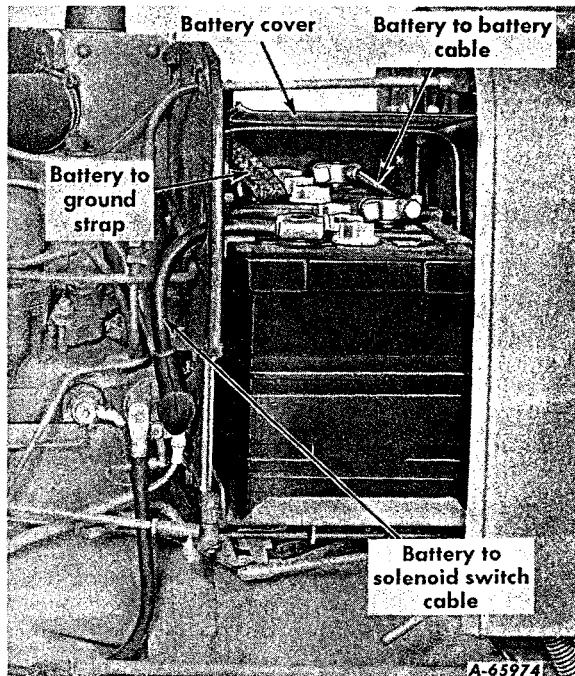
The temperatures shown indicate the approximate points at which the first ice crystals begin to appear in the solution. The solution does not freeze solid until a lower temperature is reached.

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.

Ground Cable or Strap

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

Note: Before working on any part of the electrical system, disconnect the battery ground strap (see Illust. 34A). Do not reconnect it until all electrical work has been completed. This will prevent shorting and causing damage to any of the electrical units.



Illust. 34A
Battery cable and strap on a diesel engine.

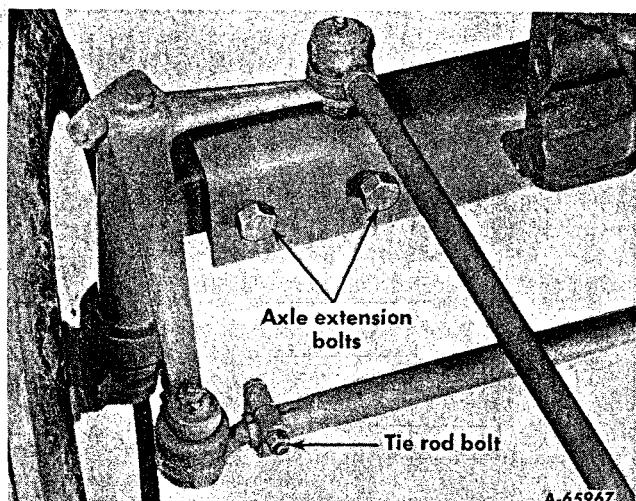
WHEEL TREADS, WEIGHTS, AND TIRES

FRONT AXLE ADJUSTMENTS

Adjustment of the front axle extensions allows variation of the tread in 4-inch spacing from 48 inches to 76 inches. To get the 72-inch setting, the front axle extensions must be set at 64 inches with the concave side of the wheel discs facing out. The 76-inch setting is achieved by facing the wheel discs with the concave side facing out with the extensions set at 68 inches.

The axle can be adjusted in 4-inch spacings as required.

There are six adjustment grooves in the tie rod. The grooves are four inches apart to give a total adjustment of 20 inches to correspond with the axle extension settings. Whenever the axle extension settings are changed, the tie rod must be reset.



Illust. 35
Front axle adjustment.

To adjust the tread width, proceed as follows:

Jack up the front of the tractor so the wheels are clear of the ground.

Remove the two axle extension bolts (see Illust. 35) on each side of the axle.

Loosen the two tie rod bolts.

Adjust the axle and tie rod to the required tread.

Note: Each time the axle is adjusted, the tie rod must be adjusted accordingly, otherwise the geometry of the steering mechanism will be incorrect. This does not apply when the wheels are reversed to get the 72- and 76-inch settings.

Retighten the tie rod bolts and replace the axle extension retaining bolts. Securely tighten the nuts.

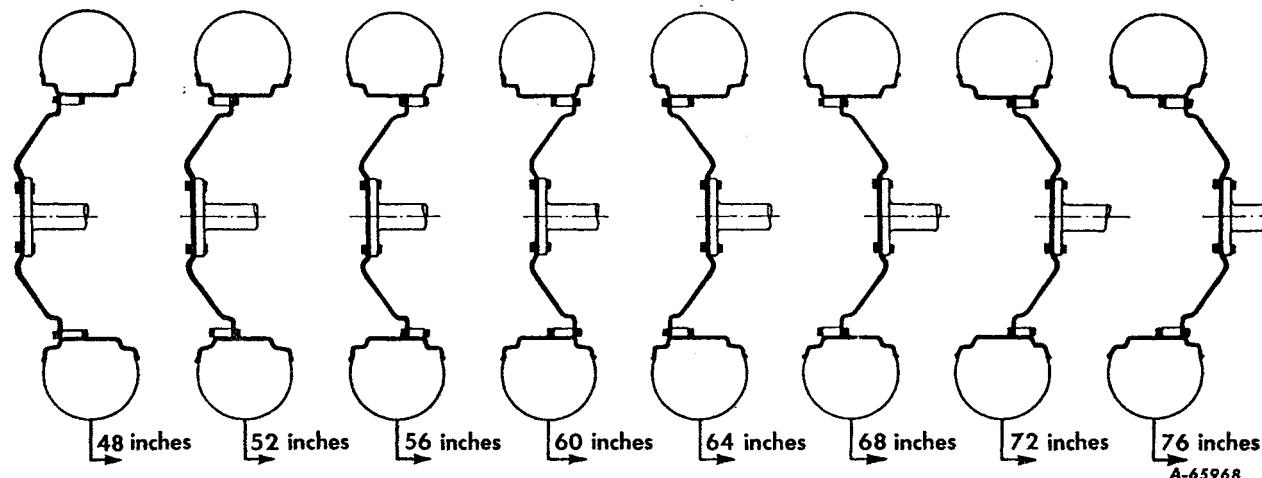
Adjusting the Toe-In

Note: The toe-in is adjusted at the factory and it is not necessary to readjust it regardless of any wheel tread setting made in the field, if the operator follows the preceding instructions.

If the tie rod setting has been changed incorrectly, then it will be necessary to adjust the toe-in as follows:

Before measuring and adjusting the toe-in be sure the front wheels are in the straight-ahead position and the tractor is on level ground.

After adjusting the front wheel tread, and with all bolts tightened, the front wheels should have $1/4$ inch to $3/8$ inch toe-in. Measure the distance between the outer edges of the wheel rims at the same height as the hub caps. Mark the points measured and turn the wheel one-



Illust. 35A
Rear wheel tread adjustment.

WHEEL TREADS, WEIGHTS, AND TIRES

half revolution so the marked points are at the rear. Measure the distance between these same two marks in their new position. This distance must be $1\frac{1}{4}$ inch to $3\frac{1}{8}$ inch greater than at the front.

To adjust the toe-in, shorten or extend the tie rod by removing the left tie rod bolt (see Illust. 35) and screwing the rod clockwise or counterclockwise.

Note: When the toe-in adjustments have been made, jack up the tractor and tilt the axle to its maximum position. While in this position, turn the wheels to the extreme left position. The welded stop on the steering knuckle pivot pin sleeve should rest against the stop on the steering knuckle.



SAFETY FIRST! Be sure the jack is firmly and squarely placed, so that it will not slip and is strong enough to support the weight of the tractor. Also, lock the brakes to keep the tractor from rolling back when the front end is elevated.

ADJUSTING THE REAR WHEEL TREAD

The tread of the rear wheels is adjusted from 48 inches to 76 inches by assembling the rims in different positions as shown in Illust. 35A. Tread changes from a setting of 48 inches to 52 inches, 64 inches or 68 inches can be made without changing the wheels to the opposite side of the tractor, while treads of 56 inches, 60 inches, or 72 inches require reversing the wheels to the opposite side of the tractor.

Note: When the wheels are to be reversed from either the concave in or the concave out position, mount the wheels so the tire tread will rotate in the correct direction as shown by the arrow on the tire.

FRONT WHEEL WEIGHTS

The front wheel weights weigh approximately 50 pounds each, and either one or two can be attached to each front wheel. To increase steerability, front wheel weights are recommended for use as a front end counterbalance whenever heavy loads are superimposed on the drawbar, or when heavy equipment is to be mounted on the rear end of the tractor.

The first set of front wheel weights includes a set of two weights and eight $1\frac{1}{2}$ NC x $2\frac{1}{2}$ -inch bolts, nuts, lock washers, and plain washers for attaching the weights to the front wheels.

If additional weight is desired, a second set of weights can be attached to the wheels by using eight $1\frac{1}{2}$ NC x $3\frac{1}{2}$ -inch bolts, nuts, lock washers, and plain washers.

In attaching the second weights to the first weights, it will be necessary to remove the shorter bolts and use the longer bolts.

REAR WHEEL WEIGHTS

These weights can be attached to each drive wheel to reduce slippage and increase drawbar pull. The increase in drawbar pull, with the proportionate reduction in slippage, varies with the type of soil.

The rear wheel weights weigh approximately 135 pounds each and either one, two or three weights can be attached to each rear wheel to reduce slippage and tire wear and increase the traction of rubber-tired tractors.

The first set of rear wheel weights includes a set of two weights, six tapered washers, and six $\frac{5}{8}$ x $3\frac{1}{2}$ -inch bolts, nuts, and lock washers for attaching the weights to the wheel. Provision is made for attaching a second and third set to the first one.

Mount the first weight either on the convex or concave side of the rear wheel, using the outer holes of the weights, and using the tapered washers furnished.

Assemble the first weights to the wheels using $\frac{5}{8}$ x $3\frac{1}{2}$ -inch bolts, lock washers, and hex. nuts in the three alternate holes.

Assemble the second weights to the first weight using $\frac{5}{8}$ x $3\frac{1}{2}$ -inch bolts, lock washers, and hex. nuts in the three open notches.

A third set of weights, if used, can be assembled to the second weights in the same way.

WHEEL TREADS, WEIGHTS, AND TIRES

PNEUMATIC TIRES

Observe the following instructions and recommendations in order to secure maximum life and efficient service from the pneumatic tires.

Inflation

Keep the pneumatic tires properly inflated. Underinflation will damage the tire cord body and may cause the tire to slip on the rim and tear out the tube valve stem. Overinflation results in excessive slippage, causing rapid tire wear.

Check the air pressure once a week with an accurate, low-pressure gauge having one-pound graduations. Do not allow the air pressure to drop below the recommendations.

Always see that the tire valve caps are in place and are screwed tightly. The caps prevent the loss of air through the valve core, and also prevent loose soil, mud, gravel, snow, and ice from entering and damaging the valve core and air chamber in the tires.

The tires can be inflated with a pressure pump, hand pump, or spark plug pump. Spark plug pumps can be purchased from International Harvester dealers.

Operating Pressure for Low-Pressure Tractor Tires



Caution! Upon receiving your tractor, immediately adjust the air pressure in tires as indicated below.

Keep the front tires inflated to 20 pounds per square inch and the rear tires inflated to 12 pounds per square inch. But if the tractor is used mainly on the highway, the pressure should be increased to 28 pounds per square inch for the front tires and 16 pounds per square inch for the rear tires.

The rear wheel tire loads may be increased up to 20% with no increase in inflation when used on tractors with mounted implements and operated at speeds not exceeding 10 miles per hour. Tire loads should be calculated to include FULL hoppers or tanks.

Shipping Tractors Equipped with Pneumatic Tires

When tractors are transported on a carrier, such as a railroad car or trailer, inflation pressures should be as follows to make possible rigid blocking and to prevent bouncing.

Rear tires may be inflated up to 30 pounds pressure. Front tire inflations should not exceed maximum pressures shown above. These higher pressures must be reduced to operating inflation BEFORE the tractor is removed from the carrier.

Towing the Tractor

When towing the tractor to transport it from one place to another, the ground speed should not exceed fifteen miles per hour.

Mounting Tires on the Rims

After mounting a new or old tire on the rim, inflate it to thirty pounds pressure to seat the tire bead on the rim flange and to prevent the tire from creeping and shearing off the valve. Then deflate or inflate the tire to the correct operating pressure.

Traction and Weights

The tractor should not be operated with the tires improperly inflated. To insure the maximum hours of service, watch the tread lugs; if they wear down too fast, immediately add more weight to cut down slippage. Check for high air pressure. Consult your International Harvester dealer for information.

Wheel Weights

The drawbar pull of a tractor can be increased by adding cast-iron weights to the driving wheels, and by the use of liquid in the tire tubes.

The amount of the increase in drawbar pull by the addition of certain definite weights varies with the type of soil. When very heavy weight is required, both liquid and cast-iron weights can be used.

Overloading

Do not overload the tractor tires by mounting implements on the tractor which exceed the load capacity of the size of the tires on the tractor.

Care of Tires

Avoid stumps, stones, deep ruts and other hazards. Cuts in tires should be repaired immediately because neglect decreases tire life.

Keep the tires free from oil and grease as both destroy rubber.

After using the tractor for spraying (insect control work), use water to remove any chemicals that may be on the tires.

Tire Chains

In wet grass or ground conditions, use lug-type chains. The flexing of the tire and the creeping of chains will break the mud loose as the wheel rotates.

Note: There is a possibility of the tire slipping within the chain; to prevent this, the use of spring-type chain fasteners is recommended.

BRAKES

The tractor is equipped with mechanical, disc-type brakes. The brakes are controlled by foot pedals which can be operated individually, or simultaneously when latched together.



Caution! Always latch the brake pedals together when traveling in high gear.

Check the brakes for free movement and equal pressure after every 150 hours of operation until the proper interval is determined according to usage. Check the free movement thereafter, as required, to maintain equal pressure and efficient braking.

The brakes should not drag before they take hold. The pedals should have a free movement of $\frac{3}{4}$ inch, the measurement to be taken at the pedal pad, or just enough movement so that when a slight pressure is applied on the brake pedals, the brake lock can be dropped into the first notch in the rack on the hand brake.

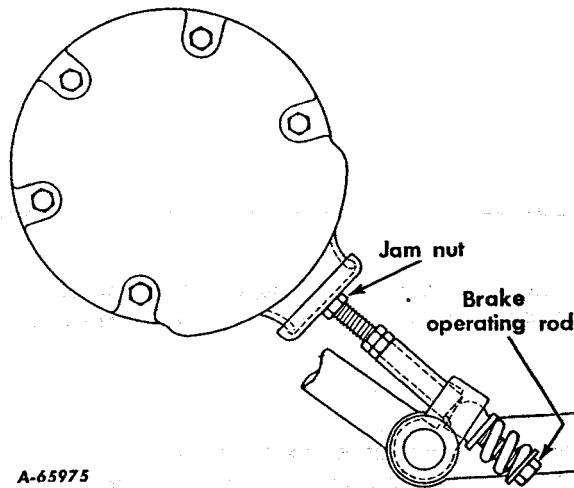
When the brakes wear, free travel increases and the brakes should be readjusted before the free travel reaches $1\frac{3}{4}$ inches.

BRAKE ADJUSTMENT

Adjust the free pedal travel of the right brake pedal first, as follows:

Loosen jam nut (Illust. 38); then turn brake operating rod until the correct free pedal travel is obtained. Then adjust the free pedal travel of the left brake pedal in the same manner by adjusting the brake operating rod at the left brake housing.

It is very important to have the brakes equalized. To have equalized brakes, both pedals must have the same amount of free movement.



Illust. 38
Brake pedal adjustment.

Test the brakes separately on left and right turns at slow speed.

Lock the brake pedals together and operate the tractor on level, hard ground at governed speed in 4th gear in the low speed range. Check for equal action of the brakes. Readjust them if necessary. Lengthen the linkage on the side toward which the tractor "pulls" to correct the action.

Note: Unequal braking action is indicated by the tractor pulling to one side when the brakes are applied. If there is no side pull in 4th gear in the low speed range, continue the tests as follows:

Operate the tractor in 4th gear in the high speed range and check for any tendency to pull to one side when the brakes are applied. Re-adjust the brake linkage as necessary.

When the correct adjustment has been made lock the rod by tightening the jam nut on the right and left operating rods. See Illust. 38.

Clutch

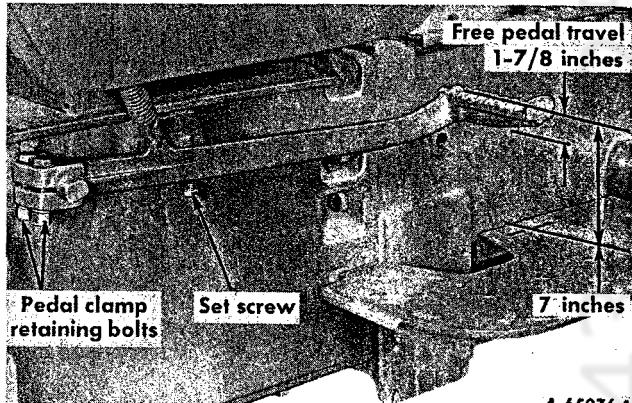
ADJUSTING THE CLUTCH PEDAL

The clutch pedal should be adjusted to give a measurement of 7 inches between the top of the pedal pad and the foot plate. Adjust the set screw until the required measurement is obtained (see Illust. 39).

Note: Do not adjust the pedal free travel by means of the set screw.

Check the clutch for free pedal movement after every 150 hours of operation until the proper interval is determined according to usage.

With the clutch fully engaged, the pedal should have a free movement of 1-7/8 inches. The correct free movement is obtained by loosening the pedal clamp retaining bolts, turning the pedal and clamp assembly on the clutch release shaft until there is correct free movement of the pedal, then tightening the bolts. These dimensions apply to either the single or dual-stage clutch.



Illust. 39
Clutch pedal adjustment.

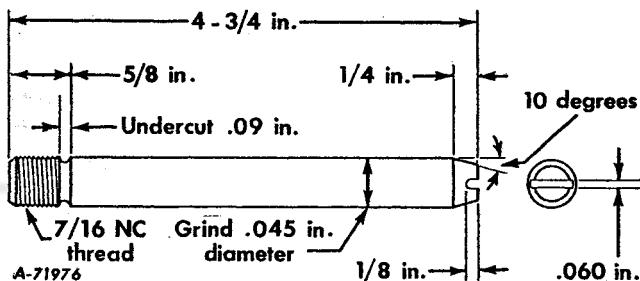
MINOR ENGINE SERVICE OPERATIONS

CYLINDER HEAD GASKET

1. Apply a light coating of lubricant to the cylinder head when installing a new gasket. (All gaskets used in reassembly must be new.) If the gasket is copper-faced asbestos, the upper face is marked TOP to prevent incorrect assembly.

2. Screw two guide studs (made to the dimensions shown in Illust. 39A) into the cylinder head. These studs hold the gasket in position and insure correct alignment of the cylinder head.

3. Install the cylinder head on the guide studs and screw in the cap screws. Remove the guide studs and replace them with cap screws.



Illust. 39A
Cylinder head guide stud.

4. Assemble the center valve lever shaft bracket in position and secure it with the long cap screw.

5. Tighten down the cap screws progressively in accordance with the sequence shown in Illust. 39B or 40 to from 75 to 80 foot-pounds torque. Do not screw one cap screw down perfectly tight and then go to the next as you will not obtain an even pressure on the gasket in this manner.

6. Remove the cap screw from the center valve lever shaft bracket and remove the bracket.

7. Reinstall the valve push rods in their original locations.

15	○	9	○	1	○	8	○	16
○	11	○	3	○	6	○	14	○

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Illust. 39B
Diesel engine cylinder head cap screw tightening sequence.

Minor Engine Service Operations

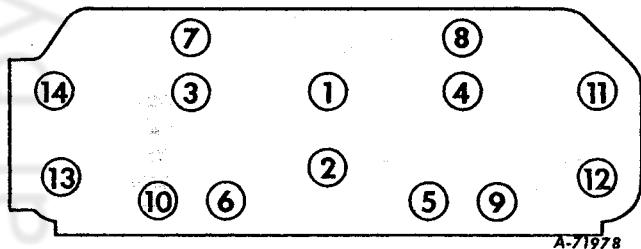
CYLINDER HEAD GASKET

8. Loosen the lock nuts on each valve lever and back off the adjusting screw.

9. Install the valve levers on the studs, maintaining an inward pressure. Secure them with the nuts.

10. Reinstall the long cap screws through the center bracket and torque them to the correct figure.

11. Using a new gasket, assemble the thermostat housing to the cylinder head.



Illust. 40
Gasoline engine cylinder head
cap screw tightening sequence.

Note: Be sure to adjust the valve tappet clearance after the last tightening of the cylinder head cap screws.

After 25 hours of operation, retighten the cylinder head cap screws to the proper torque and readjust the valve tappet clearance as instructed below.

CRANKSHAFT BEARINGS, PISTONS AND RINGS

We cannot impress too strongly the necessity of having your International Harvester dealer do the work of replacing the connecting-rod bearings, crankshaft bearings, pistons and rings, and reconditioning the valves.

VALVE CLEARANCE ADJUSTMENT

Check the valve clearance after the first 25 hours, and after the first 200 hours of operation, then every 480 hours of operation thereafter. Adjust the clearance, if necessary. A clearance of .020 inch, measured when the valves are closed and the engine is warm, is necessary between the end of the valve levers and the valve stems.

Adjusting the Clearance

1. Remove the valve housing.

2. Crank the engine until the No. 1 cylinder is at the top dead center of the compression

stroke. Watch the intake valve of the No. 1 cylinder (the second valve from the front of the engine) while the engine is slowly cranked by hand. Continue cranking slowly until the TDC mark on the engine flywheel is in line with the pointer. Both valves are now closed on the compression stroke of the No. 1 cylinder.

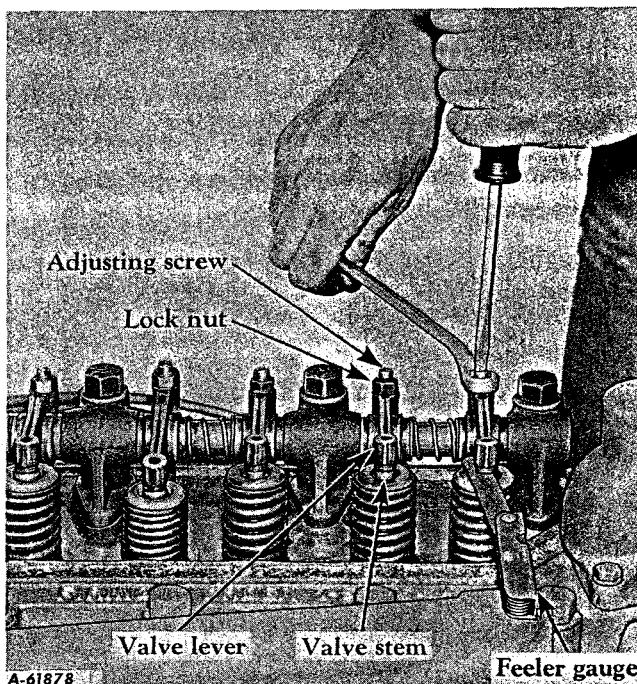
3. Loosen the lock nut and adjust the screw in the valve lever so the gauge slips snugly between the end of the valve lever and the valve stem. See Illust. 40A.

4. Tighten the lock nut and recheck the clearance.

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

6. Replace the valve housing. Check to see that the valve housing gasket makes an oiltight seal with the cylinder head. Use a new gasket if necessary.

Note: Be accurate - use a feeler gauge for checking the valve clearance.



Illust. 40A
Gauging the valve levers with a feeler gauge.

COLD WEATHER PRECAUTIONS

When operating the tractor in temperatures of +32°F. or lower, observe the following precautions:

LUBRICATION

Be sure to use lubricant of the correct viscosity in the engine crankcase and air cleaner as specified in the "Lubrication Table".

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, drain the water from the cooling system at the end of each run or use IH permanent type antifreeze.

DRAINING AND REFILLING THE COOLING SYSTEM

If an antifreeze is not to be used:

1. Drain the cooling system by opening the crankcase drain cock on the right side of the engine and the radiator drain on the lower left side of the radiator. See Illusts. 11 and 12 or 14 and 15.

2. See that the drain is not clogged and that the water drains completely. Then close the drain cocks.

Note: Before filling the cooling system in freezing weather, close the radiator curtain (if so equipped) or cover the front of the radiator. Have sufficient water available at the tractor to fill the cooling system (warm water is preferable). Start the engine, then put the water in immediately. This keeps the water from freezing during warm-up. Maintain the operating temperature of the engine by regulating the radiator shutter or uncovering the front of the radiator as much as necessary.

If an antifreeze is to be used:

1. Inspect the hose connections. They must be in good condition both inside and out. Then tighten all water connections.

2. Inspect the water pump for leaks.

3. Inspect the fan belt and adjust it, if necessary, to the proper tension as described on page 29. If the belt is worn, or oil-soaked, install a new one.

4. Drain the cooling system as described above. Clean it as described on page 29.

5. Check to be sure that the radiator drain plug and the crankcase plug on the right side of the engine is tightly closed. Then fill the cooling system, using either of the following procedures:

a. Make a solution of the required amount of IH permanent-type antifreeze with the necessary amount of clean water (use soft or rain water if possible) as instructed on the container, to fill the cooling system. Slowly fill the cooling system to a level approximately 2-1/4 inches below the top of the filler neck. See "Specifications" on page 54 for the cooling system capacity. Because the thermostat is closed, only part of the solution can be put in. Start the engine, and run it until the operating temperature is reached, to permit the thermostat to open. Then check the level of the solution and add solution as necessary to bring it up to the proper level.

b. Put the required amount of IH permanent-type antifreeze into the cooling system. Add sufficient clean water (use soft or rain water if possible) to a level approximately 2-1/4 inches below the top of the filler neck. Start the engine and run it until the operating temperature is reached to permit the thermostat to open and allow the antifreeze and water to mix thoroughly. After the engine is warm, check the coolant level in the radiator, and, if necessary, add water to bring it up to the proper level.

6. Check the cooling system for leaks, paying special attention to the hose connections.

The use of alcohol as an antifreeze is not recommended because denatured alcohol boils at +173°F. However, if it is necessary to use alcohol, check the solution frequently to make certain you have adequate protection for the prevailing temperature.

Note: Use only one type of antifreeze solution. Do not mix solutions, as it will be difficult to determine the exact amount of protection.

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

STORING THE TRACTOR

STORAGE

When your tractor is not to be used for some time, it should be stored in a dry and protected place. Leaving your tractor outdoors, exposed to the elements, materially shortens its life.

Follow the procedure outlined below when your tractor is placed in storage, and repeat the lubrication instructions every six months thereafter. We also recommend that caution is practiced when starting an engine that has been in storage.

1. Wash or clean and completely lubricate the tractor. See the "Lubrication Guide".

2. Store the tractor so the tires are protected from light. Before storing the tractor, clean the tires thoroughly. Jack up the tractor so the load is off the tires, when it is to be out of service for a long period. If not jacked up, inflate the tires at regular intervals.

3. Run the engine long enough to thoroughly warm the oil in the crankcase before draining the oil. Remove the oil filter element. (If any evidence of rust is found on the retaining bolt, clean thoroughly.) Replace the oil filter element with a new one and flush out any sludge from the filter base as instructed on page 50. Refill the crankcase with new oil.

Diesel engine only

4. Drain all fuel from the fuel tank. Partially fill the fuel tank with a mixture of one-half pure white kerosene and one-half SAE-10W oil, enough to run the engine 10 to 15 minutes.

5. Start the engine and run it at a speed of 1,000 to 1,200 r.p.m. until the engine stops from lack of fuel.

6. Remove the nozzle bodies. Spray about one ounce of SAE-50 oil through each precombustion chamber throat into each cylinder, then crank the engine two or three revolutions. Clean the gasket seats and install new gaskets, when reinstalling the nozzle bodies.

Gasoline engine only

7. After the engine has cooled off, remove the spark plugs and pour one tablespoonful of SAE-50 lubricating oil of good quality into each cylinder. Crank the engine two or three times to distribute the oil over the cylinder walls. Then replace the spark plugs.

Note: Gum will eventually form in the fuel tanks, lines and carburetor if the unit is not used. Gum in carburetor jets and passages affects engine starting. Gum can be dissolved with acetone or a 50-50 mixture of alcohol and benzol.

Gasoline and diesel engines

8. Drain and flush the cooling system.

9. Clean and remove the valve housing cover, then slush the valves, rocker arms, and push rods with SAE-50 oil. (If any evidence of rust is found, remove it before lubricating.) Use a paint brush to coat the inside of the valve housing cover with SAE-50 lubricating oil. Replace the valve housing cover. The engine must not be run after the slushing operation.

10. Plug up the ends of the breather pipe and exhaust pipe.

11. Remove the batteries and place them on a rack or bench in a cool, dry place above freezing (+32°F.). Check the batteries at least once a month for water level and specific gravity. See "Electrical System" on pages 33 and 34.

12. Block the clutch pedal with a wood block so that the clutch is disengaged. This will prevent the clutch facing from sticking to the flywheel or clutch pressure plate.

REMOVING FROM STORAGE

1. Remove the valve housing cover and slush the valves and valve operating mechanism with a mixture of one-half kerosene and one-half SAE-10W engine oil.

Omit steps 2, 3, and 4 if performed before tractor was stored.

2. Drain the crankcase and flush out with kerosene or flushing oil and fill with the specified lubricating oil. See the "Lubrication Guide".

3. Be sure the lubricating oil filter has a new element before starting the engine.

4. Clean the air cleaner and refill the oil cup.

5. Remove the crankcase breather pipe plug and the exhaust pipe plug.

6. Fill the water cooling system. Be sure the cooling system has a rust inhibitor added to the coolant.

STORING THE TRACTOR

7. Install fully charged batteries and be sure the proper connections are made.

8. Fill the fuel tank.

9. Vent all air from the fuel system as described on page 16.


Caution! Keep the doors wide open or move the machine outside the storage room immediately to avoid danger from exhaust gas. Do not accelerate the engine rapidly, or operate it at high speed immediately after starting.

Gasoline engine only

10. Remove the spark plugs and pour a mixture of one-half gasoline and one-half light lubricating oil into each cylinder; one ounce (two tablespoonsfuls) per cylinder is enough.

11. Crank the engine rapidly until 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 valves and pistons.

12. Install the spark plugs after cleaning and setting the gaps.

13. Start the engine and let it run slowly; observe if any valves are sticking. If so, pour a small quantity of diesel fuel, or kerosene on the valve stems until loose.

14. Install the valve housing cover.

Gasoline engine only

15. After the engine has been run long enough to clean the excess oil out of the cylinders, the spark plugs should be removed and checked for oil fouling. If fouled, clean and reinstall them in the engine.

16. Remove the block from the clutch pedal.

17. Before driving the tractor, inflate the tires to the correct operating pressures.

TROUBLE SHOOTING

Mechanical Problems and their Probable Cause

If any trouble is experienced, make sure of the cause before attempting to make any adjustments. When making an adjustment, keep in mind the previous setting in case the adjustment doesn't solve the problem.

Possible Cause

Using wrong fuel

Fuel lines clogged.....

Water in cylinders

Defective battery or cranking motor

Lack of compression

Flywheel ring gear teeth broken

Lubricating oil or wrong viscosity.....

Gears engaged

Internal seizure

Air intake restricted or exhaust system

clogged.....

Fuel pump inoperative

Possible Remedy

HARD TO START

Drain fuel tank and fuel system, refill with correct fuel.

Check fuel lines.

Check cylinder head gasket or look for clogged drain hole in exhaust manifold.

Check and service. *

Adjust valve clearance and check cylinder head gasket. *

*

Drain and refill with proper lubricant (refer to "LUBRICATION TABLE").

Put gearshift lever in the neutral position. Turn engine over with nozzle bodies removed and engine clutch disengaged. If the engine does not turn easily, internal damage is indicated. *

Service air cleaner. Clean the exhaust system. Check diaphragm for leaks, replace if necessary.

*See your International Harvester dealer.

TROUBLE SHOOTING

Possible Cause	Possible Remedy
	Diesel engine only
Water in fuel	Drain tank, water trap and filter (use new fuel).
Defective glow plug or indicator resistor.....	Check and service. *
	Gasoline engine only
Faulty coil or condenser	Test and replace.
Short or loose connection in ignition circuit	Inspect and tighten cables and connections. Replace where necessary.
Distributor points dirty, worn or out of adjustment	Clean or if badly worn or pitted, replace. Adjust gap to .014 inch.
Spark plugs faulty	Clean plugs and adjust gap to .024 to .026 inch. If badly worn fit new plugs.
Incorrect air and fuel mixture.....	Clean and adjust the carburetor.*
Carburetor needle valve stuck	Service needle valve.*
Blocked jets in the carburetor	Remove and clean jets.*

ENGINE OPERATES IRREGULARLY OR KNOCKS

Poor grade fuel or water in fuel	Drain and use a good grade of clean fuel. *
Engine overheating	Check the cooling system and fan belt.
Engine valves at fault.....	Check valve clearance.
Engine smokes	Engine overloaded. Reduce load. Check fuel delivery and lubricant use. Check governor adjustment. *
Excessive carbon in engine	*
Loose piston pin or bearings	*
Broken rings or loose pistons	*
Worn connecting rod and main bearings	*
Air leakage at the intake manifold, loose air cleaner connections and/or loose air line unions	Check gaskets for leaks, nuts and unions for tightness and examine all connections and be sure that they are correctly seated.
Air intake restricted	Service the air cleaner.

Diesel engine only

Injection pump governor out of adjustment	*
Injection pump governor linkage worn or sticking	Check linkage. *
Injection nozzles dirty or stuck	Remove the defective nozzles, clean or replace. * Use clean fuel.
Injection nozzles leaking	With the engine operating, loosen connections, one at a time. If knocking lessens with connection open, it indicates that the valve leaks. Replace. *
Combustion knocks	Replace nozzles or valves. *

*See your International Harvester dealer.

TROUBLE SHOOTING

Possible Cause	Possible Remedy
ENGINE OPERATES IRREGULARLY OR KNOCKS - Continued	
Gasoline engine only	
Spark plugs defective	Remove, clean and reset the gap (.024 - .026 inch).
Tracking on plug leads or distributor cap	Check if oil or water is present on the plug leads or cap. Dry out. Replace if necessary.
Loose high tension cable	Check leads, tighten connections.
Incorrect carburetor adjustment	Remove, clean and re-adjust.*
Distributor out of time	Check timing and reset.*
Excessive wear in distributor	Replace defective parts.*
LACK OF POWER	
Engine overheated	See "Engine Overheats".
Governor not working properly.....	Check control linkage for wear.*
Poor compression	Service valves and piston rings.*
Poor fuel.....	Use correct fuel.*
Fuel pipes obstructed	Clean.
Fuel tank air vent closed	Open air vent in the cap.
Exhaust pipe clogged	Clean out.
Air cleaner clogged	Clean air cleaner.
Too-high-viscosity oil in the crankcase or air cleaner	Refer to "LUBRICATION TABLE".
Clutch slipping or oil on facings.....	Adjust free travel of pedal and check crankcase, rear oil seal; replace the facings.*
Brakes drag	Adjust brakes.
Diesel engine only	
Incorrect timing of injection pump	*
Fuel filter partly clogged	Replace filter element.
Injection nozzle valves, dirty or stuck	Remove defective valves, clean or replace. Use clean fuel.
Gasoline engine only	
Incorrect air and fuel mixture	Adjust carburetor.
Sticking choke control.....	Check that the choke is fully open when the dash control is pushed in.
Incorrect distributor gap	Adjust gap to .014 inch.
Ignition out of time.....	Check timing and reset.*
Spark plugs defective	Remove, clean and reset gap. Replace if necessary.
ENGINE WILL NOT IDLE CORRECTLY	
Gasoline engine only	
Spark plugs defective	Remove, clean and reset the gaps (.024 - .026 inch). Replace if worn.
Distributor out of time.....	Check timing and reset.*
Incorrect carburetor adjustment	Remove, clean and re-adjust.
Air leaks at carburetor	Replace gasket.
Excessive wear on throttle shaft.....	Replace housing and shaft.*
Excessive wear in distributor	Replace defective parts.

*See your International Harvester dealer.

TROUBLE SHOOTING

Possible Cause	Possible Remedy
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ENGINE OVERHEATS

Cooling system clogged or limed	Clean system.
Water pump leaks	*
Thermostat left out or not functioning	*
Fan belt slipping	Adjust or replace the belt.
Insufficient water in the cooling system	Add coolant. Note: Do not pour cold water in an overheated engine or possible cracking of the cylinder head may result.
Radiator cores clogged	Remove all chaff or dirt from the radiator grille, clean with forced air or water.
Heat indicator defective	*

Diesel engine only

Injection pump defective	*
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Gasoline engine only

Distributor too far advanced or retarded	Check timing and correct.*
Weak fuel mixture	Adjust the carburetor.*
Air leaks at the carburetor	Replace carburetor gasket.

NO LUBRICATING OIL PRESSURE, TOO HIGH OR TOO LOW

Wrong viscosity, diluted or insufficient oil	Refer to "LUBRICATION TABLE".
Broken, loose or plugged oil lines	Replace, clean and tighten.*
Low oil level in the crankcase	Add oil and check for oil leakage, also refer to "Lubrication Guide" and "General Engine Lubrication".
Defective or dirty oil pressure regulating valve.....	*
Oil pump strainer clogged or pump not working	*
Worn bearings	*
Clogged oil filter	Change filter element.
Defective oil pressure indicator	Replace.

LUBRICATING OIL DILUTION OR USES TOO MUCH OIL

Incorrect viscosity oil	Refer to "LUBRICATION TABLE".
Leaks in oil lines, filter, crankcase sump plug or gasket	Check and tighten.*
Worn piston oil rings or cylinders	*
Loose connecting rod bearings	*
Engine overheating	Refer to sections "Lack of Power" and "Engine Overheats."
Engine speed too high.....	*
Crankcase breather clogged	Clean breather in kerosene and dip in oil.

*See your International Harvester dealer.

TROUBLE SHOOTING

Possible Cause	Possible Remedy
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USING TOO MUCH FUEL

Fuel leaks	Tighten or replace fuel lines.
Engine overloaded	Select gear most suited to the work and operate at maximum engine r.p.m.
Engine not operating at proper temperature ...	Check cooling system and thermostat.
Air cleaner clogged	Service the air cleaner.
Incorrect grade of fuel	Check with fuel supplier.
Diesel engine only	
Fuel injection nozzle not operating properly	Clean nozzles or replace.*

ELECTRICAL

Loose wiring or improper connections	Check wiring to see that all connections are clean and tight.
Battery defective, low charge or loose connections	Recharge, clean and tighten cable lugs or replace with new, check ground cable.
Cranking motor inoperative	Check commutator and brushes.
Generator inoperative.....	Check commutator and brushes.
Voltage regulator or generator relay	*
Ammeter inoperative	Replace ammeter.*
Ammeter shows discharge.....	Check battery and generator, check drive belt and wiring.
Lights fail	Check battery ground cable. Turn switch, replace lamps, replace fuse, recharge battery, check wiring and generator.*
Lights burn dim	Recharge battery, tighten cable terminals, check lamps, clean contacts.

BRAKES

Do not hold or slipping	Adjust brakes or install new linings. * Linings oiled up; check bull pinion shaft oil seal.
Drag or uneven	Adjust brakes.
Return spring broken	Replace.
Will not release	Hand brake left on - release.

TRANSMISSION

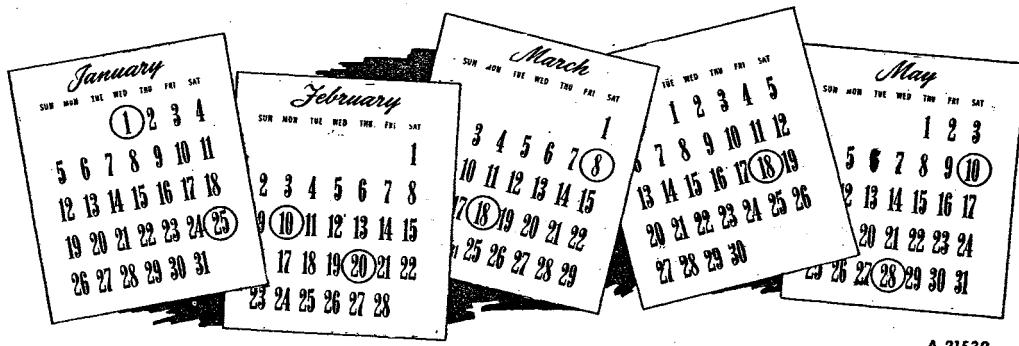
Hard to shift gears	Use correct viscosity lubricant.
Shifter fork or lever defective	Replace.*
Engine clutch drags	Refer to "Lack of Power"
Gears slipping out of mesh	*
Excessively noisy	Check oil level, use proper viscosity lubricant.*
Damaged parts	*
Differential lock will not disengage	Cam plate badly worn - replace.*

REAR WHEELS

Do not turn	Release brake lock. Transmission, differential or clutch faulty. Refer to "Transmission" above.*
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*See your International Harvester dealer.

PERIODIC INSPECTION



A-21539

To keep your tractor performing efficiently, it is advisable to systematically inspect the following points at intervals as outlined below.

After Every 10 Hours of Operation

- | | |
|---|--|
| Air cleaner oil cup and filter | Remove, clean, and refill. See page 30. |
| Cooling system | Check level of coolant in radiator. See page 28. |
| Diesel fuel tank water drain cock | Drain until clean fuel appears. See page 17. |
| Lubrication points..... | See "Lubrication Guide". |

After the First 25 Hours of Operation

- | | |
|--|---------------------------|
| Fan belt | Check slack. See page 29. |
| Generator belt | Check slack. See page 29. |
| Valve clearance | Check. See page 40. |
| Crankcase oil (diesel engine) | Replace. See page 53. |
| Crankcase oil filter element (diesel engine) ... | Replace. See page 50. |

After the First 50 Hours of Operation

- | | |
|--|-----------------------|
| Crankcase oil (gasoline engine) | Replace. See page 53. |
| Crankcase oil filter element (gasoline engine) | Replace. See page 50. |

After Every 50 Hours of Operation

- | | |
|-----------------------------|--------------------------------|
| Fan belt | Check tension. See page 29. |
| Generator belt | Check tension. See page 29. |
| Air cleaner, complete | Remove and clean. See page 30. |

After Every 100 Hours of Operation

- | | |
|------------------------------------|--------------------------------------|
| Crankcase oil filter element | Change. See page 50. |
| Storage battery | Check specific gravity. See page 33. |

After Every 150 Hours of Operation

- | | |
|--------------|---------------------|
| Brakes | Check. See page 38. |
| Clutch | Check. See page 39. |

After the First 200 Hours of Operation

- | | |
|---|---------------------|
| Engine valve clearance adjustment | Check. See page 40. |
|---|---------------------|

PERIODIC INSPECTIONS

After Every 250 Hours of Operation

Crankcase breather and oil filler cap Remove and clean. See page 30.

After Every 500 Hours or 6 Months of Operation

Cooling system Clean. See page 28.
Valve clearance adjustment Check. See page 40.

After Every 1000 Hours of Operation

Front wheel bearings Repack. See page 50.
Hydraulic system and filters Drain and refill. See page 24.

LUBRICATION

The life of any tractor depends upon the care it is given. Proper lubrication is a very important part of that care.

CRANKCASE OIL (Diesel engine)

Heavy-duty engine crankcase oils provide the most satisfactory engine lubrication and should be used in diesel engines with present-day diesel fuels. "Series 3" lubricating oils are recommended for use in these engines.

CRANKCASE OIL (Gasoline engine)

The three types of crankcase oils marketed have been classified by the American Petroleum Institute (API) as "For Service ML", "For Service MM", and "For Service MS". Either single or multi-viscosity oils designed "For Service MS" are recommended for this engine.

TO AID STARTING

To facilitate starting, the selection of crankcase lubricating oils should be based on the lowest anticipated temperature for the day. It is not necessary to change the crankcase oil every time the temperature rises or falls into another temperature range during some part of the 24-hour day.

LUBRICATION FITTING GREASE

Use pressure-gun grease (chassis lubricant) for lubrication fittings on which the hand lubricator is applied.

Note: Keep your supply of lubricating oil and grease absolutely clean and free from dust. Always use clean containers. Keep the lubricator clean and wipe dirt from the fittings before applying the lubricator.

OIL FILTER

The life of your engine depends upon clean oil being circulated to all bearings.

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. This filter will keep the circulating oil free of harmful materials. Under normal operating conditions, replace the filter element every 100 hours of operation.

Note: To avoid delays, we recommend that you carry extra filter elements on hand so that replacement can be made at the proper time.

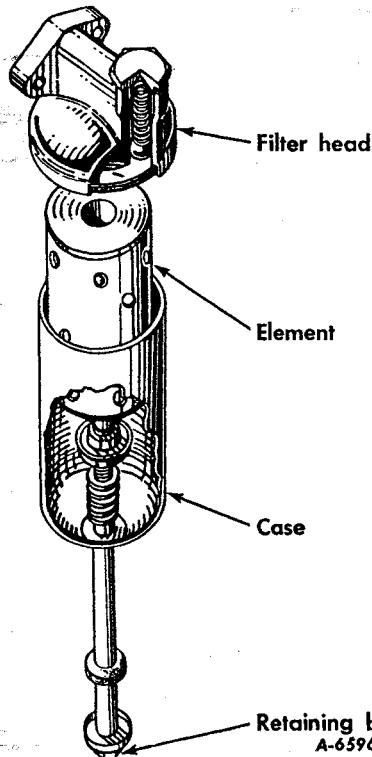
LUBRICATION

Changing the Filter Element

Do not change the element while the engine is running.

Clean off all dirt from the oil filter head and case. Unscrew the retaining bolt until it is possible to withdraw the bolt and case from the filter head. Remove the old element.

Wipe out the filter head and case with a cloth dampened with kerosene, diesel fuel, or other solvent.



Illust. 50
Oil filter.

Note: Be sure the rubber seals in the filter head and on the retaining bolt are in good condition and in the proper position. See Illust. 50.

Install the new filter element as follows:

Insert the retaining bolt as far as possible into the case. Place the element on the retaining bolt and into the case. Slide the bolt and case into the filter head and tighten the retaining bolt securely.

Drain and refill the crankcase oil pan with new oil as instructed in the "Lubrication Guide".

Start the engine and check the oil pressure indicator to see whether lubricating oil is circulating through the engine; then inspect the filter for oil leaks.

REPACKING THE FRONT WHEEL BEARINGS

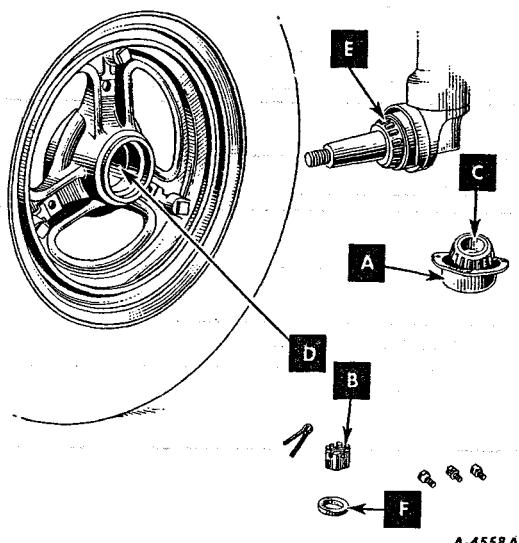
After every 1000 hours of operation, or at least once a year, whichever occurs first, remove, clean, and repack the front wheel bearings. Proceed as follows:

Raise the front end of the tractor until the wheel clears the ground. Remove the hub cap "A", the cotter pin, the nut "B" and the washer "F". Remove the bearing "C" and place it in the hub cap "A" or in a clean container; then remove the wheel. Remove the grease retainer and clean the inside of the hub "D". Remove the old grease from the bearings and grease retainers, clean them with kerosene and repack them with fiber grease.

It is advisable to leave the bearing "E" on the axle and clean it with a brush and kerosene. Repack the rollers with new grease before reassembling the bearings.

Reassemble the wheel and tighten nut "B" until the wheel binds slightly, rotating the wheel at the same time. Back the nut off one castellation from the cotter pin hole; replace the cotter pin and hub cap.

Be sure to keep all parts clean.

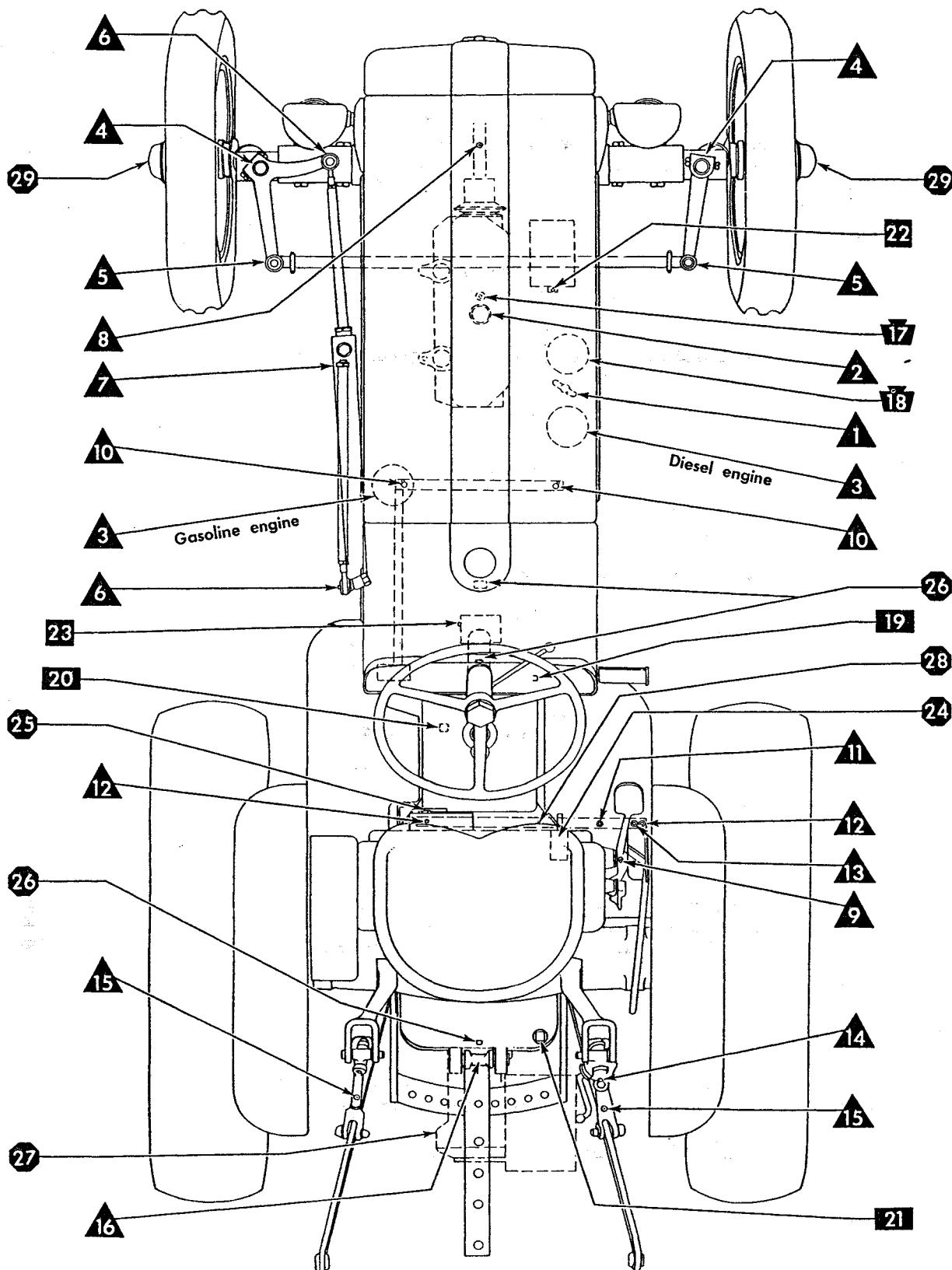


Illust. 50A
Wheel removed for repacking bearings.

LUBRICATION
Lubrication Table

Point of Lubrication	Capacity	Lubricant				
GASOLINE ENGINE		Anticipated Air Temperature				
		Above +90°F.	+90°F. to +32°F.	+32°F. to +10°F.	+10°F. to -10°F.	Below -10°F.
Engine crankcase	5 qts.	SAE-30	SAE-20	SAE-10W	4-1/2 qts. SAE-10W with 1 pt. kerosene	4 qts. SAE-10W with 1 qt. kerosene
Air cleaner oil cup	1-1/4 pts.	SAE-30	SAE-20	SAE-10W	SAE-10W	SAE-10W
Distributor Distributor.....	xxx	Chassis lubricant				
Cam hole felt (in distributor).	xxx	Light engine oil				
Generator	xxx	SAE-20 engine oil				
Point of Lubrication	Capacity	Lubricant				
DIESEL ENGINE		Anticipated Air Temperature				
		Above +45°F.	+45°F. to +10°F.	+10°F. to -10°F.	Below -10°F.	
Engine crankcase	5 qts.	SAE-30	SAE-10W	4-1/2 qts. SAE-10W with 1 pt. kerosene	4 qts. SAE-10W with 1 qt. kerosene	
Air cleaner oil cup	1-1/4 pts.	SAE-30	SAE-10W	SAE-10W	SAE-10W	SAE-10W
Generator	xxx	SAE-20 engine oil				
Point of Lubrication	Capacity	Lubricant				
CHASSIS						
Transmission	5 gal.	SAE-80				
Belt pulley	1-1/4 pts.					
Steering gear housing	1-3/4 pts.					
Hydraulic system	3 gal.	IH Hy-Tran Fluid				
Lubrication fittings	xxx	Use chassis lubricant (pressure gun grease) for fittings on which the hand lubricator is applied.				

LUBRICATION Lubrication Guide



B-12499A

Illust. 52
Lubrication guide.

LUBRICATION

Daily or After 10 Hours of Operation

- 1 - Oil level gauge.
- 2 - Oil filter.

Check the oil (with the engine stopped) and add sufficient new oil to bring it to the "FULL" mark on the bayonet gauge. Do not check the oil level while the engine is operating or operate the engine if the oil level is below the "LOW" mark on the bayonet gauge.

- 3 - Air cleaner.

Clean and refill the oil cup to the oil level head with the same viscosity oil as used in the engine crankcase.

- 4 - Steering knuckle pivot (2).
- 5 - Tie rod (2).

- 6 - Drag link (2).
- 7 - Hydraulic cylinder.
- 8 - Front axle pivot.
- 9 - Differential lock pedal.
- 10 - Clutch pedal shaft (2).
- 11 - Brake pedal shaft.
- 12 - Brake pedal.
- 13 - Hand brake lever.
- 14 - Three-point hitch leveling screw.
- 15 - Three-point hitch lower link housing (one on each lower link).
- 16 - Top link bearing.

Use chassis lubricant (pressure-gun grease) and apply two or three strokes of the lubricator or sufficient grease to flush out the old grease and dirt.

After Every 100 Hours of Operation

- 17 - Crankcase oil pan drain plug.

Remove the plug and drain all the oil from the crankcase while the engine is warm; then refill with new oil to the "FULL" mark on the oil level gauge. Refer to the Lubrication Table.

- 19 - Transmission oil level plug.
- 20 - Transmission oil filler plug.

Remove the oil level plug and the filler plug. Keep the lubricant up to plug opening in the right side of the transmission case. Use approved lubricant according to the Lubrication Table.

After Every 250 Hours of Operation

- 21 - Hydraulic lift housing filler plug.

Remove the plug and check the oil level. Add lubricant up to the bottom of filler plug opening. Refer to the Lubrication Table.

- Distributor (gasoline engine)

Refer to page 33.

After Every Six Months or 500 Hours of Operation

- 22 - Generator.

Remove the rubber plug and squirt a few drops of SAE-20 oil through the hole at the end of the generator shaft and on the felt pad inside.

- 23 - Steering gear housing.

Remove the oil filler plug and add oil up to level of the filler plug hole.

Periodic

- 24 - Suction filter.
- 25 - Orifice filter.

Remove and clean these filters every 1000 hours as instructed on page 23.

- 27 - Belt pulley.

Check the oil level. Use approved lubricant (see Lubrication Table) and keep the lubricant up to the level plug.

- 26 - Oil drain plugs (2).

After every 1000 hours, remove the two drain plugs and allow all the oil to drain out. Replace the drain plugs and remove the filler plug and lever plug. Refill with approved lubricant up to the level opening and replace the filler plug and level plug.

- 28 - Hydraulic system.

Drain the fluid after every 1000 as instructed on page 23.

- 29 - Front wheels.

After every 1000 hours, or at least once a year, which ever is sooner, remove, clean, and repack the front wheel bearings with fiber grease. See page 47.

SPECIFICATIONS

Capacities (U.S. Measure - Approximate)

Cooling system	9-1/2 qt.
Fuel tank	12-3/4 gal.
Crankcase pan	5 qt.
Transmission and differential case	Approx. 5 gal.
Steering gear housing	1-3/4 pt.
Belt pulley drive unit	1-1/4 pt.
Air cleaner oil cup	1-1/4 pt.
Hydraulic system reservoir	3 gal.

Gasoline engine

Make and model	IH, BC-144
Cylinders	4
Bore	3-3/8 in.
Stroke	4 in.
Engine speeds	
Minimum speed (governed)	Approx. 500 r.p.m.
Maximum idle speed (no load)	Approx. 2200 r.p.m.
Maximum (full load)	2000 r.p.m.
Valve clearance (engine hot)020 in.
Spark plug gap024 to .026 in.
Distributor	
Breaker point gap014 in.
Spark advance (at 500 r.p.m.)	6° before TDC
Spark advance (at 1000 r.p.m.)	17° before TDC

Diesel engine

Make and model	IH, BD-154
Cylinders	4
Bore	3-1/2 in.
Stroke	4
Engine speeds	
Minimum speed (governed)	Approx. 550 r.p.m.
Maximum idle speed (no load)	Approx. 2200 r.p.m.
Maximum (full load)	2,000 r.p.m.
Valve clearance (engine hot)020 in.
Injection pump, C.A.V.	Model DPA
Injection nozzles	C.A.V. pintle
Injection pump timing retard, start of injection, engine stopped	16° before TDC

Power Take-Off

Shaft speeds	
Maximum (full load) (2,000 engine r.p.m.)	545 r.p.m.
Low idle (no load)	150 r.p.m.
Fast idle (no load)	600 r.p.m.

Belt Pulley

Pulley speeds	
Maximum (full load) (2,000 engine r.p.m.)	1286 r.p.m.
Low idle (no load)	354 r.p.m.
Fast idle (no load)	1414 r.p.m.
Belt speed (at full load engine speed)	3198 ft. per. min.
Pulley diameter	9-1/2 in.
Pulley face	6-3/8 in.

SPECIFICATIONS

Electrical System

System voltage	12-volt-positive ground
Battery size (diesel engine)	2-6 volt (IH-115R2)
Battery size (gasoline engine)	1-12 volt (11HS-50)
Generator, Lucas	17 amp.
Generator regulator, Lucas	2 unit
Cranking motor, Lucas	Positive engagement (manual)
Light switch.....	4 position
Lamps	12-16 volt
Fuse (cartridge-type)	25 amp.

Clutch

Two-stage, dry-disc, spring loaded	11 in. (engine) 9 in. (PTO)
Single-stage, dry-disc, spring-loaded, heavy-duty (with forward and reverse drive).....	11 in.

Brakes

Foot brake, mechanical-disc type, operated either
individually or interlocked
Parking brake hand lever lock for foot brakes

Wheels and Tread

Front wheels, pneumatic tire size	6.00-16
Rear wheels, pneumatic tire size.....	13.6-28
Tread, front	48 to 76 in.
Tread, rear	
Concave turned in	48 to 60 in.
Concave turned out	64 to 76 in.
Wheelbase.....	76-1/2 in.

General Dimensions

Length over-all	115 in.
Width over-all	
Minimum (to outside edge of rear axle)	64 in.
Maximum (to outside edge of rear tires)	90 in.
Height over-all (to top of steering wheel)	61 in.
Ground clearance for crops under front axle.....	18-3/4 in.
Ground clearance for crops under frame	16-3/4 in.
Ground clearance for crops under rear axle	20-3/4 in.
Swinging drawbar height above ground (adjustable).....	13, 15, 18 in.
Drawbar lateral adjustment each side of center hole:	
Straight drawbar (for Three-Point Hitch)	8-1/2 in.
Swinging drawbar lateral swing each side of center	10 in.
Minimum turning radius (wheels in minimum tread):	
With brake applied	10 ft. 5 in.
Without brake applied	12 ft.

SPECIFICATIONS

Ground Speeds

Tractor speeds in miles per hour.
Based on 13.6-28 tires and 2000 r.p.m. engine speed.

Gear	Miles Per Hour	Miles per hour for tractors with fast reverser	
		Forward	Reverse
L1	1.5	1.5	1.9
L2	2.5	2.5	3.2
L3	3.6	3.6	4.5
L4	5.3	5.3	6.7
H1	4.3	4.3	5.4
H2	7.3	7.3	9.2
H3	10.4	10.4	13.2
H4	15.5	15.5	19.6
Low reverse	2.2	-	-
High reverse	6.5	-	-

EXTRA EQUIPMENT AND ACCESSORIES

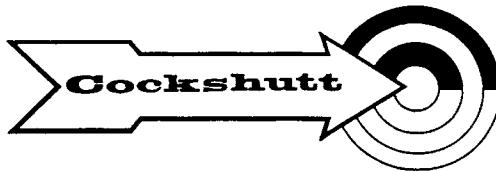
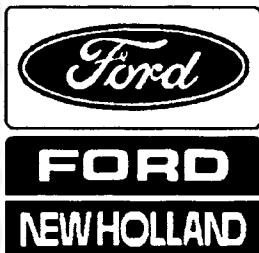
The tractor is used for so many different types of work and is called on to operate under so many different conditions that a considerable variety of equipment is necessary to adapt it to the varied requirements of the user.

When you purchased your tractor, you probably had it completely equipped for your particular needs at that time. However, later you may wish to obtain some of the equipment or accessories listed below. These items can be purchased from and installed by your International Harvester dealer.

Types of Equipment	Types of Equipment
Accelerator pedal	Power take-off
Adjustable check link	Three-Point Hitch drawbar with vertical stabilizers
Drawbar, swinging	Vertical exhaust muffler
Front axle stay rod	Weights, front end
Hydraulic power steering	Weights, front wheel
Hydraulic remote control	Weights, rear wheel
Power-adjusted rear wheels and rims	

NOTES

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