350, 500B, 600B Series Tractors

Service Manual

9-92281

Reprinted

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SECTION XIV, L. P. FUEL SYSTEM

6. Hold High Pressure Valve closed and check distance between side of body casting and inside of Valve lever groove, Fig. B-172. This should be ½" as measured with Ensign Gage Number 8276, Fig. B-172. If necessary, hold lever so valve is off its seat and bend lever slightly.

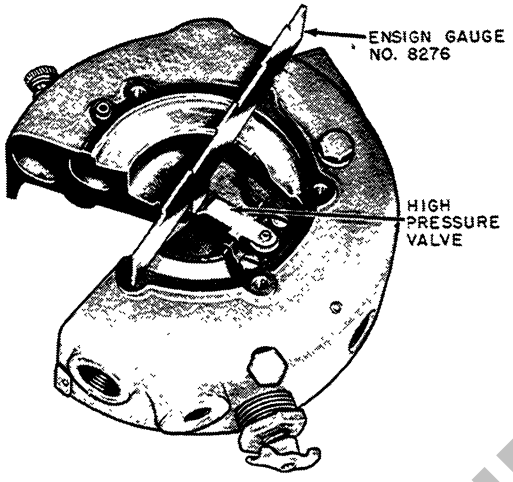


Fig. B-172 Setting High Pressure Valve

7. Carefully install the Pressure Regulator Diaphragm Assembly on the body. Be sure the lower leg of the Bracket on the diaphragm is slipped under the valve lever, Fig. B-173.

8. Align Passage "C" in body with mating passage in Pressure Regulator Cover and install the cover, Fig. B-173.

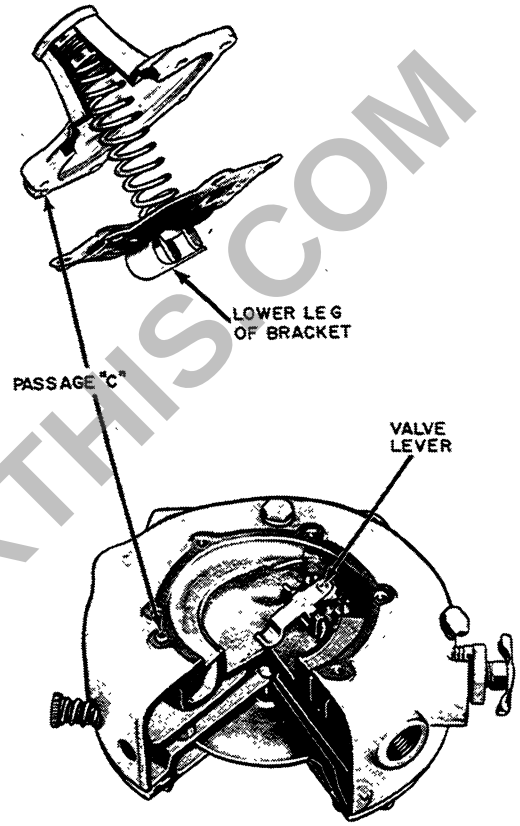


Fig. B-173

9. Insert Pressure Regulator Spring in cover (widest end up) and install the Spring Retainer, Fig. B-173.

CAUTION

Always Check regulator and lines for leakage when it has been necessary to disassemble regulator.

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SECTION XIV, L. P. FUEL SYSTEM

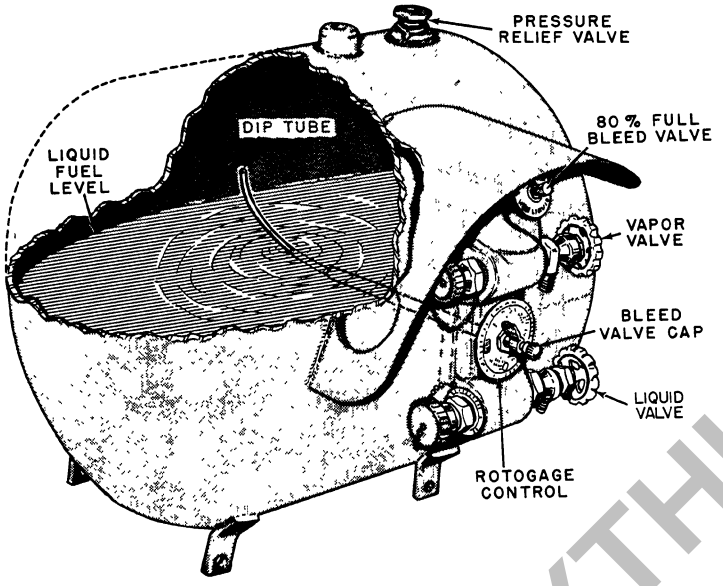


Fig. B-155

PRESSURE RELIEF VALVE

The pressure relief valve is a simple spring loaded valve provided in the top of the tank to avoid any extreme high pressures that might be built up in the tank. A valve spring is designed to allow the valve to open at 312 lbs. per sq. in. pressure.

Do Not Change the Relief Valve Setting

If the pressure relief valve develops a leak, the entire valve must be replaced. Install the new valve following the procedures outlined for installation and checking the liquid filler valve.

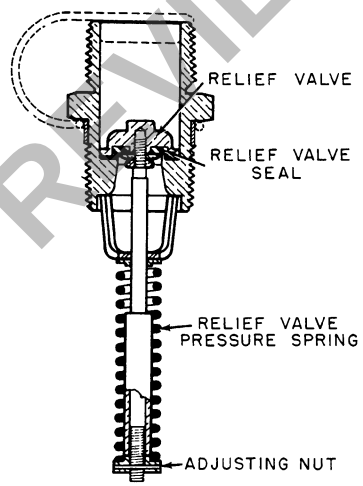


Fig. B-156 Pressure Relief Valve

ROTOGAGE

The rotogage provides a means of determining the liquid level in the fuel tank. This can be accomplished by moving the dial pointer from the 100% mark until the end of the hollow dip tube reaches the liquid level. Liquid vapor will then pass through the tube and exhaust out the valve in the outer end of the tube.

If the rotogage is damaged or worn so that it leaks, the entire gage must be replaced. Follow installation procedures outlined under "Liquid Filler Valves" and check for leaks as outlined in the same paragraph.

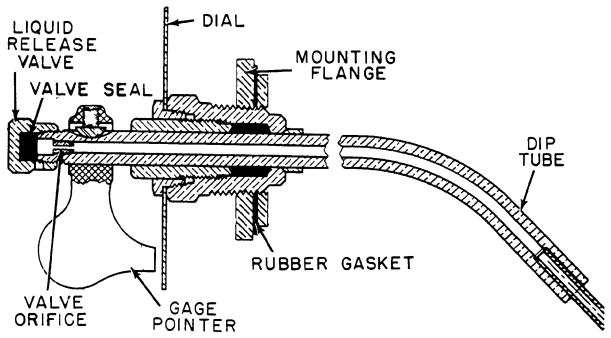


Fig. B-157 Rotogage

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SECTION XIV, L. P. FUEL SYSTEM

ENSIGN LIQUID FUEL FILTER

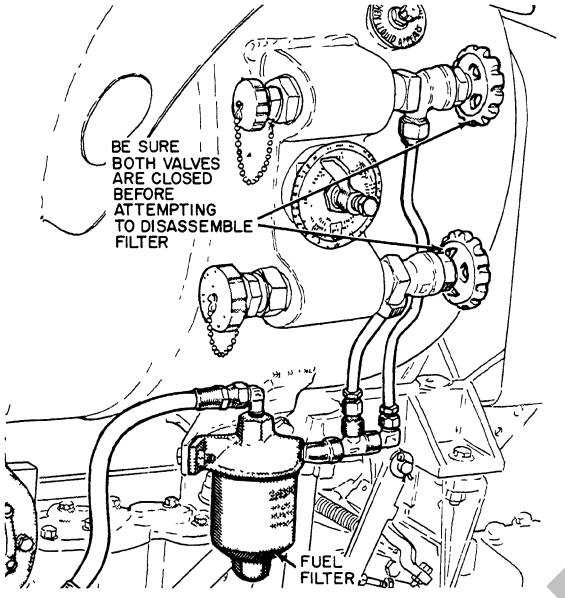


Fig. B-158 Fuel Filter and Tank Valves

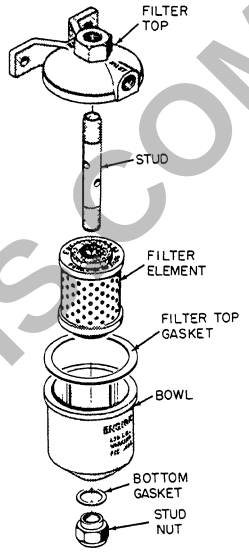


Fig. 159 Filter — Exploded

The LP-Gas Filter will work satisfactorily until it becomes clogged up sufficiently to restrict the flow of fuel.

A partially clogged filter element will cause a pressure drop across the element which will in turn cause the fuel to vaporize partially. If too much vaporization occurs, there will be insufficient fuel to operate the engine and the outside of the filter will become extremely cold.

The Ensign LP-Gas Filter is made of cast brass and is designed and tested for a working pressure of 250 pounds per square inch. It is provided to stop the passage of scale, rust or other foreign matter that may be carried by the liquid fuel as it flows from the tank. The filter catches and retains in its settling bowl all the solid particles coming through with the liquid fuel. Should the liquid fuel line between the tank and the regulator become clogged at any point other than the filter, frost will form on the line at the point where the obstruction occurs. If frost appears on any portion of the fuel regulator, it is an indication of insufficient coolant circulation.

The filter can easily be cleaned without removing it from the mounting bracket, Fig. B-158. To dis-assemble the filter, unscrew the stud nut and remove the bowl bottom, which allows the filter element to be extracted. The element is a fiber cartridge which should be replaced with a Genuine Case cartridge. (Use no substitutes). Always install new body and bowl bottom gaskets when this filter is reassembled; this will prevent leaks from occurring.

CAUTION: Always make sure the fuel tank valves are completely closed before attempting to clean the filter, regulator or fuel lines.

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SECTION XIII, GASOLINE FUEL SYSTEM

ZENITH 62 SERIES CARBURETOR

The Zenith 62 series carburetors are updraft of double venturi design. The fuel bowl hugs the center line of the carburetor and together with the duplex float makes it possible to maintain proper metering of air and fuel to the engine, without flooding, when operated on extreme angles. They are "sealed" and "balanced" carburetors in that all air for the fuel bowl and metering well venting and for idling must come through the air cleaner.

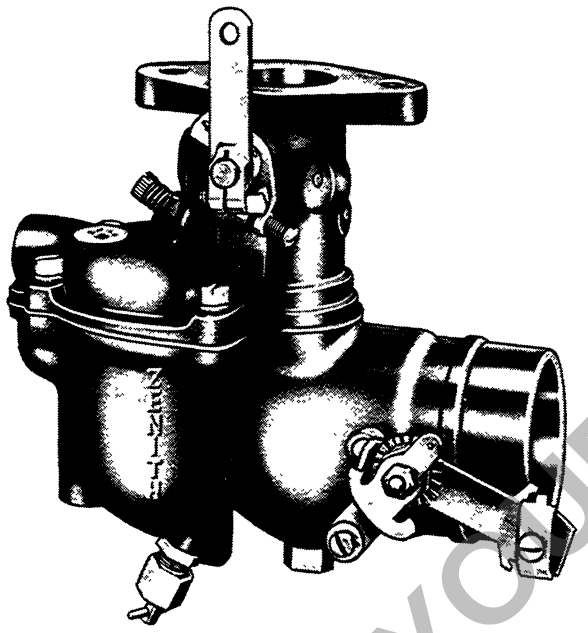


Fig. B-145

Figures B-146 and B-147 show the construction of this model carburetor.

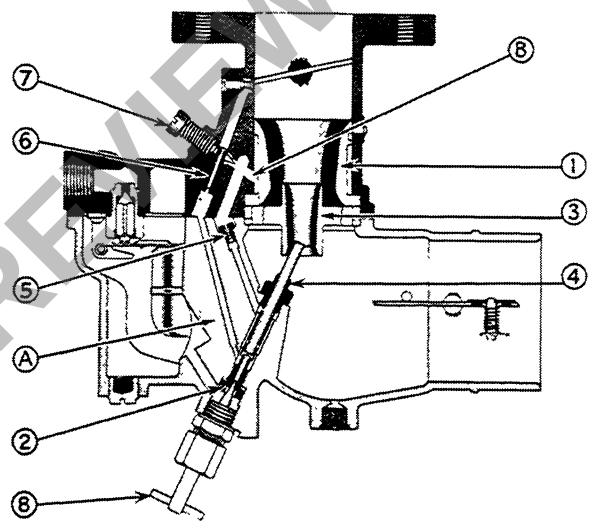


Fig. B-146

The removable Venturi (1) measures the volume of air which passes through the carburetor.

MAIN JET SYSTEM: The Main Jet (2), often referred to as the "high speed jet," exerts its principal influence at the higher engine speeds. Fuel from the bowl is metered through the Main Jet (2) and discharged into the air stream at the point of greatest suction, in the secondary Venturi (3) through the Main Discharge Jet (4).

The main jet (2) determines the maximum amount of fuel which may be obtained for high speed operations. The Main Jet Adjustment (8) reduces this amount if it is turned toward its seat. Ordinarily the main jet adjustment has no effect after it is two turns open.

To set this adjustment, retard the spark and open the throttle to approximately ¼ open. Turn the adjustment clockwise, shutting off the fuel until the engine speed decreases due to too lean mixture. Now open the adjustment until the engine speed decreases due to too much fuel. The adjustment should be set at a position half way between these two extremes.

COMPENSATING SYSTEM: The compensating system consists of the Main Discharge Jet (4) and the Well Vent (5). The flow of fuel from the Main Jet (2) is controlled by the size of the Well Vent (5) and the size of the Main Discharge Jet (4).

IDLING SYSTEM: The Idling system consists of the Idling Jet (6) and the Idle Adjusting Needle (7). The Idling Jet (6) receives its fuel from the Main Jet (2) through Channel (A). The fuel is metered through the Idling Jet (6) and is mixed with air which is admitted, from behind the Venturi (1), through channel (B). The Idle Adjusting Needle (7) controls the amount of air which is admitted to the Idling System. The Idling System functions only at Idling and Low Speeds. At these speeds, the Throttle Plate (10) is almost closed and there is a very strong suction past the edge of the Throttle Plate. This suction draws the mixture of fuel and air from the Idling Jet (6) which discharges into the air stream through the Priming Plug.

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SECTION XIV, L. P. FUEL SYSTEM

COMPONENTS AND PRINCIPALS OF OPERATION

The principles of operation, broken down into four stages for close examination, are shown on the flow diagram, Fig. B-149 in the following order:

1. *Primary or high pressure regulation.* LP-Gas is dropped from tank pressure (normally 20 to 175 pounds) down to a regulated 4 to 6 pounds.

2. *Application of heat to the rapidly expanded fuel.* This function is performed by the vaporizer, a chamber heated by the circulating engine coolant.

3. *Low pressure regulation.* The thoroughly vaporized and expanded LP-Gas must be dropped further in pressure from the initial 4 to 6 pounds to slightly below atmospheric pressure. This is accomplished by the low pressure valve and chamber of the low pressure regulator.

The low pressure regulator must instantly permit vaporized gas to flow to the carburetor and engine in metered volumes to conform automatically to every engine demand. It must also be capable of shutting off the fuel and sealing it tightly when the engine is stopped.

4. *Carburetion.* This last stage is a mixing function—mixing fuel and air — and a means for proportioning or measuring out gas and air for the right mixture strengths. Coordination between the low pressure regulator and the carburetor must be perfect throughout the entire range of engine speeds and loads, from fast acceleration to wide open throttle and back to idle. Flow characteristics of the carburetor and regulator must follow very closely the engine demand. This performance must be instant and without periods of erratic overrichness or lean flat-spot operation.

LP-GAS FUEL SUPPLY TANK
(Case Factory Installed Tanks Only)

Tank Liquid Capacity (80% Full) ..... 18.4 U. S. Gallons

The only service operations that can be performed on the tank are replacement of the various valves and the Roto Gage.

CAUTION: *Before the Roto Gage or any of the valves are removed, the tank must be completely emptied of fuel using the following procedure:*

RECOMMENDED METHOD OF EMPTYING LP-GAS FUEL TANK

The recommended method of emptying a tank which contains a substantial amount of liquid LPG is to burn the vapor instead of releasing it directly into the atmosphere.

The burning of the vapor is accomplished by hooking a hose line 20 feet or longer in length to the filler valve of the tank. Place the end of the hose down wind from the tractor or engine so there will be no possibility of damage to the unit.

Prior to attaching the hose line to the filler valve of the tank, place some burning waste at the end of the hose so the escaping vapor will be ignited immediately.

Burning the released vapor in this manner will eliminate any possibility of a dangerous accumulation forming in a low place.

Remember – LPG is heavier than air and will tend to accumulate in any available poorly ventilated low place.

CAUTION: *Always perform this operation in an open, well ventilated area where there is no danger of gas accumulating in a low place. Where an engine power unit is installed in an enclosure, attach a hose line 20 feet or longer in length to the filter drain valve. Locate the end of the hose downwind from the engine enclosure and place some burning waste at the end of the hose before opening the valve so escaping vapor will be ignited immediately.*

Accidents Are Caused and Don't Just Happen!

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SECTION XIV, L. P. FUEL SYSTEM

CARBURETOR PRINCIPLES OF OPERATION —Continued

Engine Operating
(High Idle)

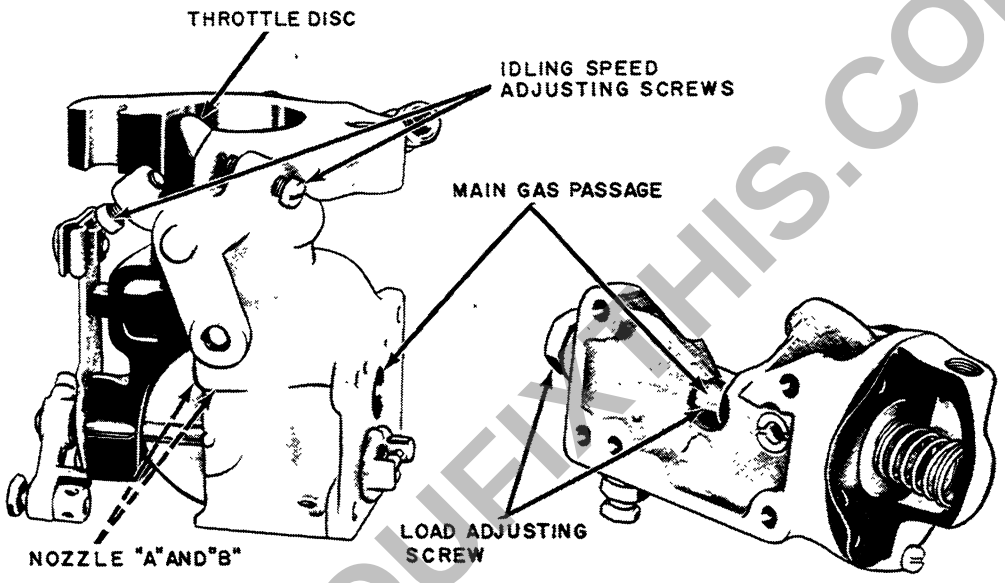


Fig. B-175

When the engine is operating at high idle, the carburetor functions as follows:

1. The gas is drawn from the Gas Outlet on the Regulating Unit and enters the carburetor Main Gas Passage at slightly below atmospheric pressure.

2. The gas then flows from the Main Gas Passage to the Venturi through Nozzles A and B. The gas flows through the Main Gas Passage into the nozzles is regulated by the Load Adjusting Screw, Fig. B-175.

3. Air enters the carburetor from the air cleaner through the Air Horn and is mixed with the gas in the Venturi.

   The air fuel mixture then passes Throttle Disc and enters the intake manifold. The Throttle Disc controls the volume of combustible mixture that enters the engine and thereby controls the engine speed and power.

The Idle Fuel Adjusting Screw

The Idle Fuel Adjustment Screw located on the Regulating Unit provides a means of controlling the quantity of fuel to the carburetor by varying the amount of suction.

The Idling Speed Adjusting Screw

The Idling Speed Adjusting Screws on the carburetor Throttle Valve Shaft, Fig. B-175 provide a means of controlling the engine idling speed by varying the quantity of air fuel mixture that can enter the engine.

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SECTION III, CYLINDER HEAD ASSEMBLY

6. Remove cylinder head gasket and note impression made by cylinder sleeves. When sleeves are in proper position (see page B-72) and cylinder head stud nuts are properly tightened (page B-29), a sharp impression will be made on the gasket as shown in Fig. B-12.

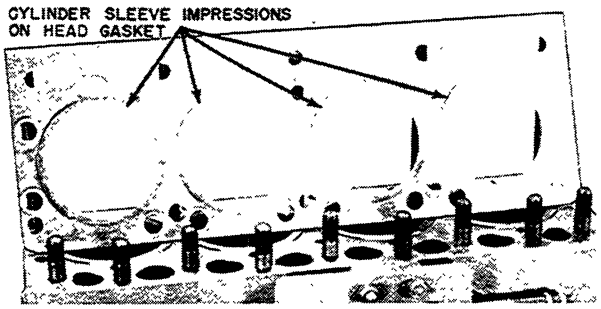


Fig. B-12 Head Gasket Condition

CLEANING CYLINDER HEAD

1. Remove dirt and carbon from the cylinder head by scraping and brushing. Blow out cooling passages with an air hose.

CHECKING COMPRESSION

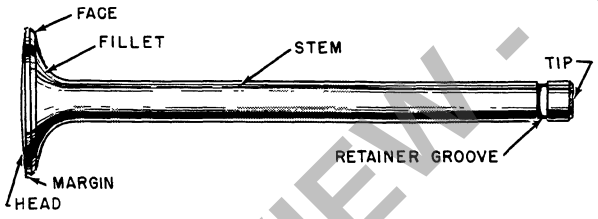


Fig. B-13 Valve Nomenclature

One of the sources of lack of power is lack of compression in one or more of the cylinders. An engine with poor compression is inefficient and should not be kept in service. If compression is poor, it is because of compression leaks past the valves or rings.

1. Remove cables from spark plugs and remove plugs from cylinder head.

2. Move throttle and choke valve to full open position.

3. Install compression gage into front spark plug port and operate starter until maximum reading on gage is reached. Repeat this operation on the three remaining cylinders. Fig. B-14.

Compression pressure depends on starting speed, engine temperature, and compression ratio. If the readings indicated on the compression gage fall within the pressure range listed on the compression pressure chart and do not vary more than 5 lbs. between cylinders, compression pressure can be considered normal.

COMPRESSION PRESSURE CHART

164 Cu. In. Engine

Gasoline	140-150 lbs.
L. P. G.	155-165 lbs.

5. If pressure in any cylinder is weak, pour approximately one tablespoon of oil into spark plug hole while piston is down. Wait a few minutes for oil to run down over piston rings to prevent oil from getting on valve and repeat test. The oil seals the rings so a low reading on first test, which remains low on second test, indicates leaky valves. A higher reading on second test, indicates leaky rings. An extremely low compression reading on two adjacent cylinders indicatets a leaking or blown cylinder head gasket. A gasket which has blown out between cylinders will cause erratic explosions. Replace with a new gasket.

6. A higher than normal reading may indicate excessive carbon deposits on walls of combustion chamber. Remove head and clean.

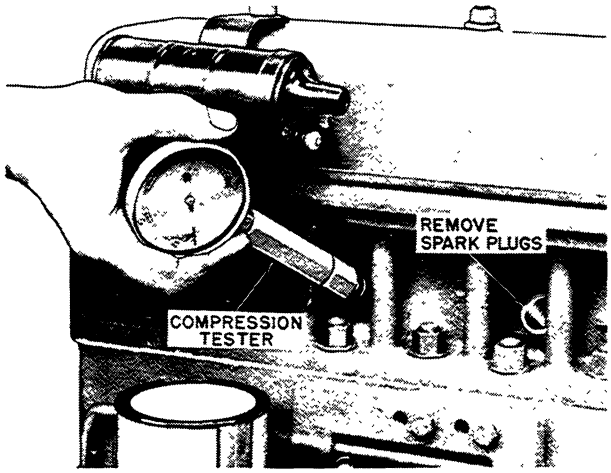


Fig. B-14 Testing Compression

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SECTION XI, PISTON AND ROD ASSEMBLIES

REMOVING

Remove bearing cap on connecting rod and slide piston and connecting rod out of cylinder sleeve through top of block.

Remove carbon and ridge at top of cylinder sleeve with a ridge reamer before attempting to remove piston.

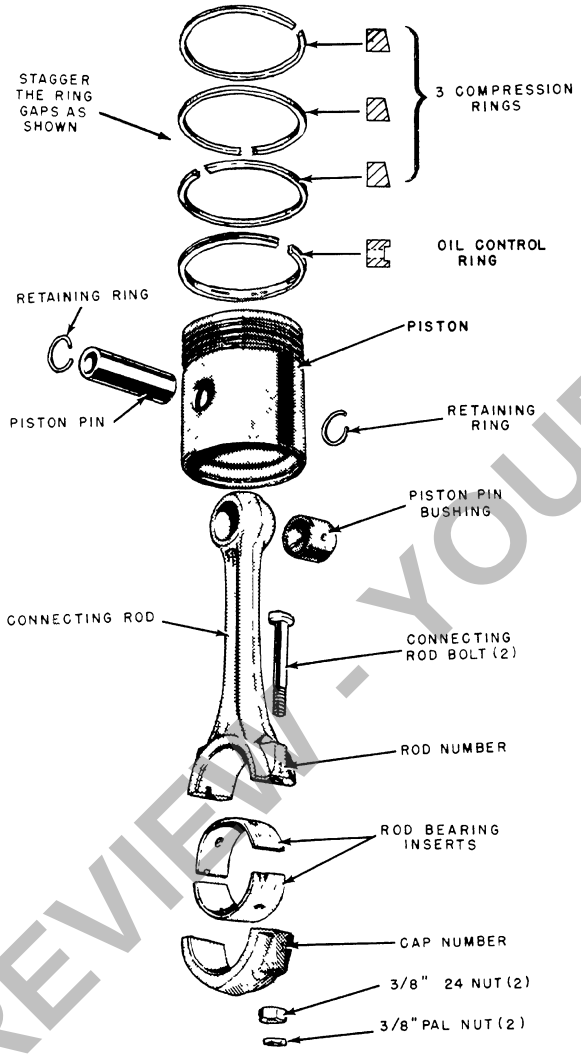


Fig. B-119 Piston and Rod Assembly

INSPECTING PISTONS

1. Remove rings from piston.
2. Check piston for worn ring grooves, cracks or being out-of-round.
3. Clean ring grooves thoroughly.
4. If necessary, use a drill to clean oil return holes in ring groove.

Check clearance of piston in sleeve by using feeler strips of .003" thick (½" wide) shim stock. When used with a clamp type scale at several positions around the piston, a 5 to 10 lb. pull indicates the proper clearance.

INSTALLING RINGS

1. Attach piston to rod before installing rings.
2. Use a ring expander similar to that shown in Fig. B-120 to install or remove rings.

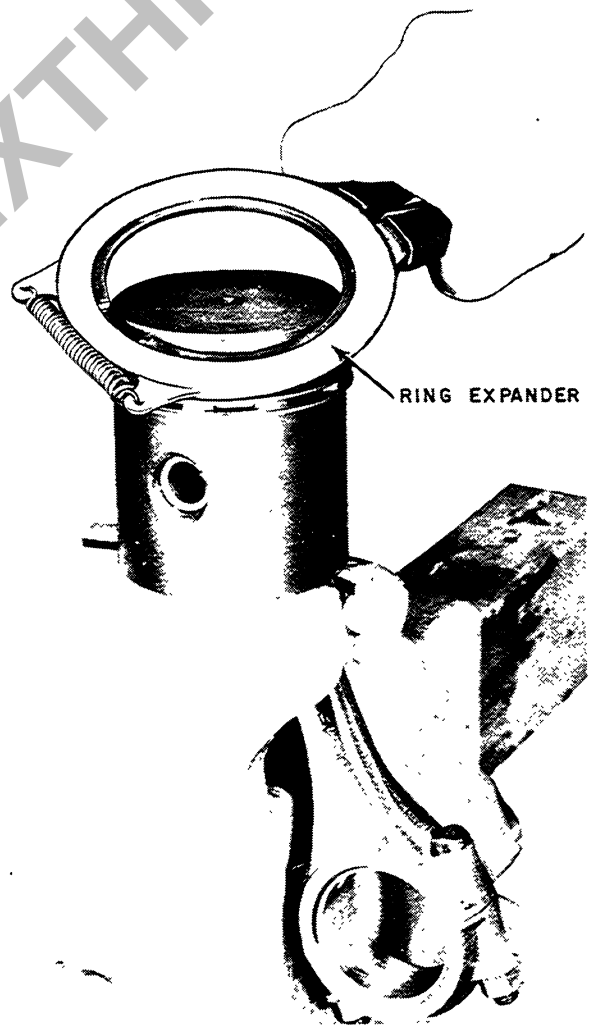


Fig. B-120 Installing Rings on Piston

3. Install oil ring first and then compression rings in order.

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SECTION XIV, L. P. FUEL SYSTEM

PRINCIPLES OF OPERATION — Continued

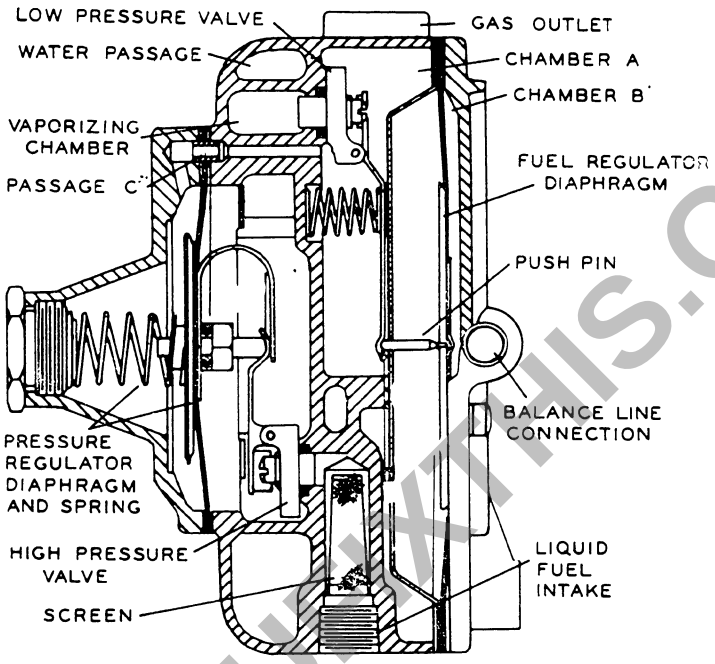


Fig. B-163 Model W Regulator (Engine Operating)

When engine is started, suction from the carburetor is applied at the *Gas Outlet* and is communicated to *Chamber "A"* and to the inner surface of the *Fuel Regulator Diaphragm.*

An increase in pressure is applied to *Chamber "B"* and to the outer surface of the diaphragm by way of the *Balance Line* from the air intake side of carburetor.

With suction reducing the pressure at inner surface, and the pressure increased at the outer surface, the *Fuel Regulator Diaphragm* is forced inward. The diaphragm, in turn, forces the *Push Pin* to move the *Low Pressure Valve Lever* and thus opens the valve so fuel can flow into *Chamber "A"* out *Gas Outlet* and to the carburetor.

When the *Low Pressure Valve* opens, the flow of fuel past the valve reduces the pressure against the inner surface of the *Pressure Regulator Diaphragm.* The diaphragm spring then forces the diaphragm inward and opens the *High Pressure Valve.*

After the engine has started, suction from *Chamber "A"* is also communicated to the outer surface of the *Pressure Regulator Diaphragm* thru *Passage "C".* This allows the fuel pressure exerted on the inner surface of the diaphragm to force the diaphragm outward and thus partly close the *High Pressure Valve.* In this way, fuel is accurately regulated to meet the engine's demand.

The *Balance Line* from the air intake side of the carburetor serves to compensate for any air entrance loss that might occur due to a plugged air cleaner or similar condition. Any decrease in the amount of air flowing into the intake side of carburetor will decrease the pressure on the outer surface of the *Fuel Regulator Diaphragm* by way of the *Balance Line.* The *Low Pressure Valve* will not be opened as far and the fuel flow to the carburetor will be reduced, thus maintaining a constant mixture in the carburetor.

The *Compensator assembly* in the back plate serves to control pulsation in the fuel regulator diaphragm, particularly when the engine is operating at lower speeds.

When the engine stops, suction ceases entirely and the *Low Pressure Valve closes.* This, in turn, causes a pressure build up against the inner surface of the *Pressure Regulator Diaphragm* which closes the *High Pressure Valve.*

NOTE: *When the engine is not to be used for a prolonged period of time, it is advisable to close the Liquid Valve on the supply tank and allow the engine to use up the fuel in the regulator and lines. If this is done, there will be no fuel trapped in the Vaporizing Chamber and the area surrounding the High Pressure Valve. The valve will be open and all pressure will be relieved from the Pressure Regulator Diaphragm and Spring.*

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SECTION V, BELT PULLEY

REMOVING THE BELT PULLEY

To remove belt pulley from shaft, unscrew nut and take off lockwasher, attach T-134 puller as shown in Fig. D-30, with three cap screws screwed into pulley hub. Tighten cap screws evenly until pulley can be removed.

A sheet metal cap to cover pulley shaft is furnished, and should be used at all times when the pulley is removed. Secure the shaft cover cap in place with lockwasher and pulley shaft nut.

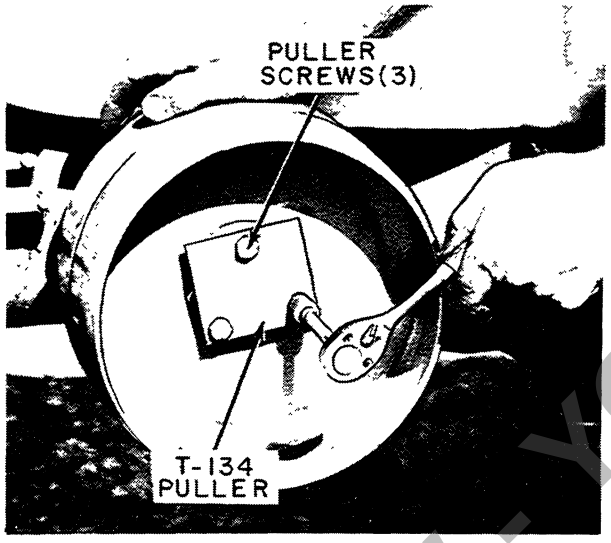


Fig. D-30 Pulling Belt Pulley

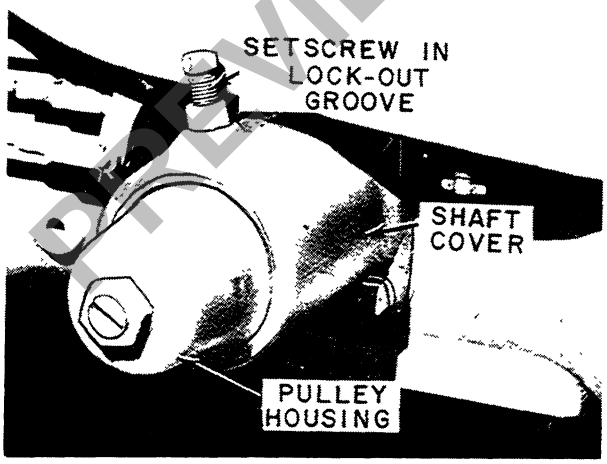


Fig. D-31 Sheet Metal Cap

SERVICING BELT PULLEY

Installing Outer Oil Seal

The belt pulley on these tractors will have one outer oil seal. If seepage should develop at this point, proceed as follows:

1. Drain oil from torque tube.
2. Remove pulley as illustrated in Fig. D-30.
3. Remove oil seal and place T-110 oil seal installation sleeve over the end of belt pulley shaft, and slide new seal over sleeve as shown in Fig. D-32.
4. Move seal on shaft until it is flush with sleeve as shown in Fig. D-32.

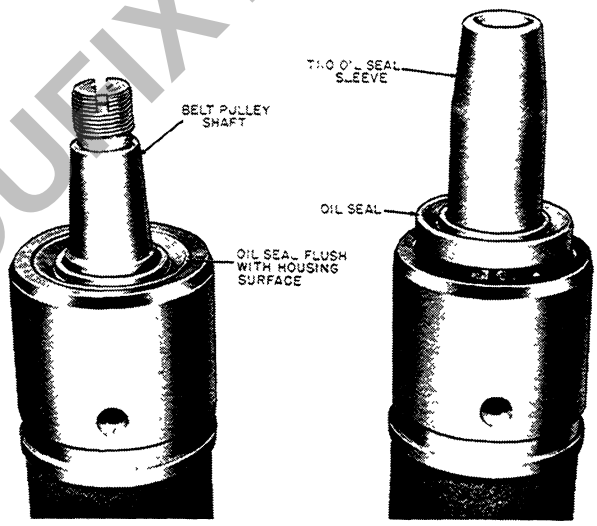


Fig. D-32 Installing Belt Pulley Oil Seal

SERVICING SHAFT AND BEARINGS

To service the belt pulley shaft or bearings, it will be necessary to remove the belt pulley and sleeve from the housing. This may be done by removing the sleeve set screw and moving the sleeve outward in the direction of the bevel gear.

To remove the belt pulley shaft, remove the peen from the locknut on the beveled gear end of the shaft and remove the nut.

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SECTION IX, TRIPL RANGE CONTROL COVER

12. Lock bolts with lock wire. Fig. E-72.

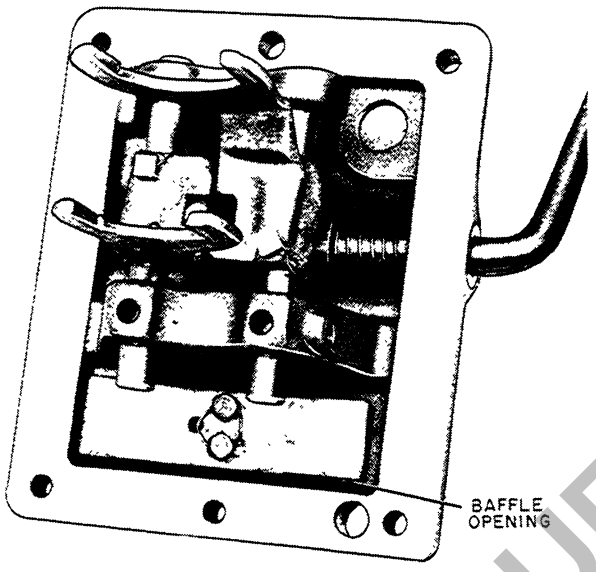


Fig. E-72 Control Cover Assembly

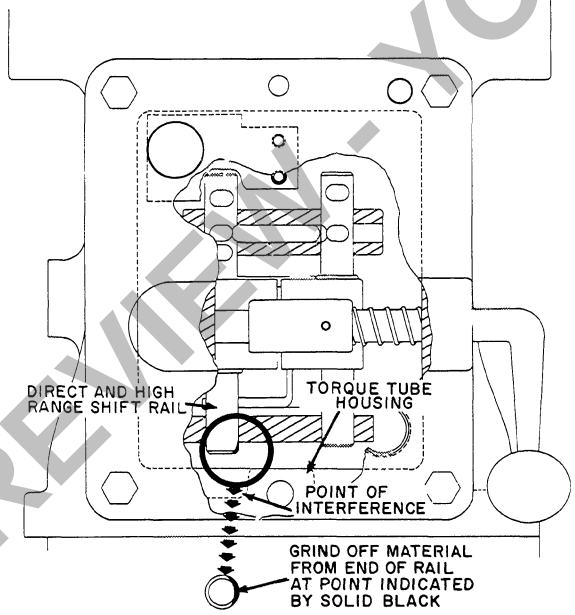


Fig. E-73 Shift Rail Interference

INSTALLING COVER

1. Position sliding gears on transmission mainshaft and move cover into position, making certain that forks have engaged the slots in the gears.
2. Before the cover is secured with bolts, it would be well to operate hand lever to make sure that both forks are engaging the gears.
3. Move the hand control lever into high range position to make certain that the mesh lock ball has fallen into the notch in the rail. Failure to lock in high range may be an indication that rail is striking the torque tube housing, Fig. E-73.
4. Tighten bolts to 35 ft. lbs. torque.

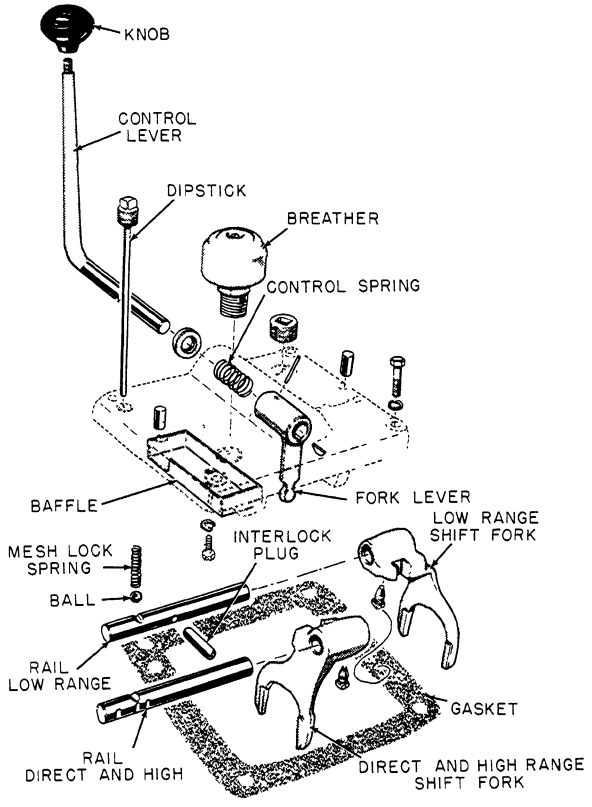


Fig. E-74 Tripl Range Control Cover

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SECTION VI, STEERING CAM AND HOUSING

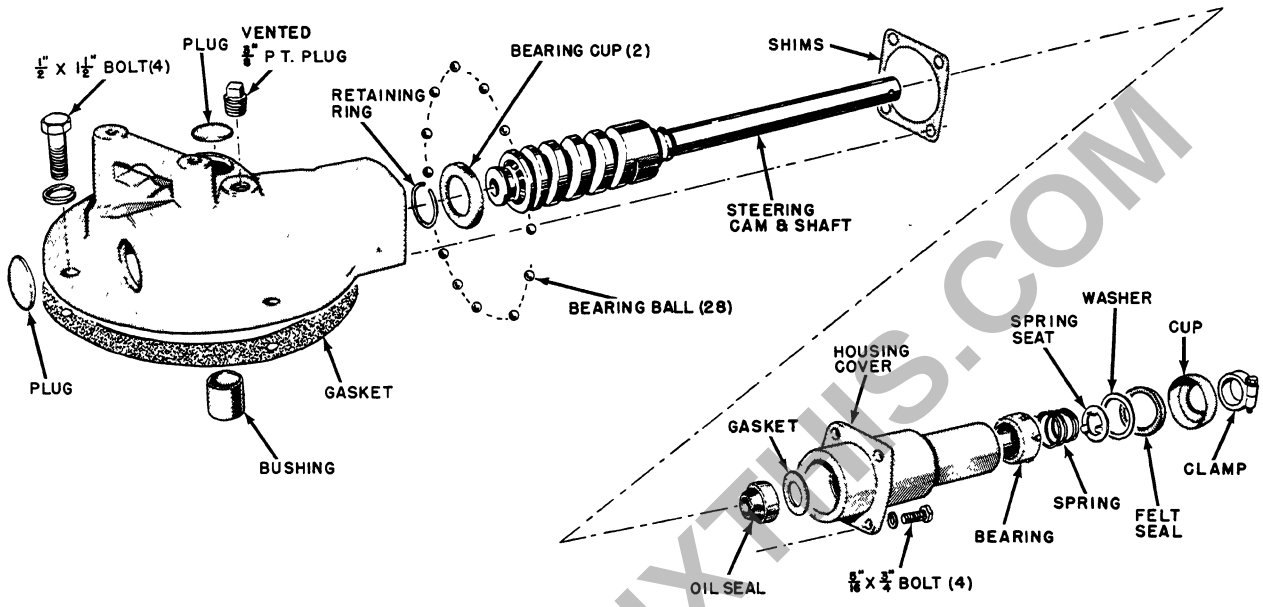


Fig. G-35 Cam and Lever Housing

REMOVING HOUSING

1. Drain lubricant from housing by removing plug. Fig. G-31.
2. Remove right and left hand grille doors and left hand side panel from tractor.
3. Remove air cleaner assembly from top of steering housing.
4. Drive out roll pin connecting lower steering shaft universal joint to steering cam shaft. Make certain sufficient support is provided to avoid springing the shaft.
5. Remove woodruff key from shaft.
6. Extract the bolts securing housing to support. Loosen the housing by inserting a pry bar through the crank hole in support casting and then prying straight up.
7. Housing can now be lifted up and out.

REMOVING CAMSHAFT BEARINGS

1. Extract the four bolts which secure the camshaft and cover to the steering housing.
2. Remove the woodruff key from the end of the shaft.

NOTE: *All burrs, nicks or rough spots must be removed from shaft to prevent damage to the oil seal in the cover housing.*

3. The retaining clamp can now be removed and camshaft can be pulled through cover housing.
4. Remove retaining rings, bearing cups and bearing balls from each end of steering cam.

INSTALLING CAMSHAFT BEARINGS

1. Coat the bearing cup with sufficient light grease to hold the bearing balls in place while the cup and balls are being positioned on the shaft.

NOTE: *Make certain 14 balls per bearing cup are used.*

2. Slide the camshaft into the cover housing carefully to avoid damage to the seal.
3. Install outer bearing, spring, spring seat, protective washer, felt seal, felt seal cup and retaining clamp in the order shown in Fig. G-35.

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SECTION II, SERVICE HINTS

OIL LEAKS IN GENERAL AREA OF CONTROL VALVE (Continued)
(Standard Drive Tractors)

	Possible Point of Leakage	Suggested Remedy	Page Reference
3.	Breather	3. Wash breather — check oil level	H- 3
4.	Gasket (adaptor base to Torque Tube)	4. Inspect surface of adaptor housing	H-33
5.	Detent spring plug	5. Check installation of copper gasket	H-32
6.	Control valve mounting bolt holes	6. Check for porous casting. Tighten bolts and re-torque	H-33
7.	Spool end cap	7. Replace gasket	H-34
8.	Interlock gasket	8. Replace gasket	H-25
9.	Filter cap	9. Inspect "O" ring and mounting bolt hole	H-19
10.	Shift button oil seal	10. Replace seal	H-16
11.	Gasket (Control to adaptor base)	11. Inspect machined surfaces of control. Use neoprene gasket to replace plastic gasket	H-33

OIL LEAKS IN GENERAL AREA OF CONTROL VALVE
(Case-O-Matic Drive Tractors)

1.	Oil seal in control body	1. Check for nicks or scratches on spool	1	H-32
2.	Control body gasket	2. Inspect surface of control	2	H-33
3.	Control Valve mounting bolt holes	3. Use Dyna-Seal washers	3	H-37
4.	Spool end cap	4. Replace gasket	4	H-37
5.	Interlock gasket	5. Replace gasket	5	H-25

NOTE: *Also refer to SECTION K covering Case-O-Matic Drive.*

LOSS OF OIL FROM HYDRAULIC RESERVOIR
(Case-O-Matic Drive Tractors)

1.	Control Valve	1. Eliminate Leakage	1	H-33
2.	Dual Range Housing	2. Check gasket and expansion plug	2	Group "E"

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SECTION VIII, PORTABLE CYLINDERS AND HOSE CONNECTIONS

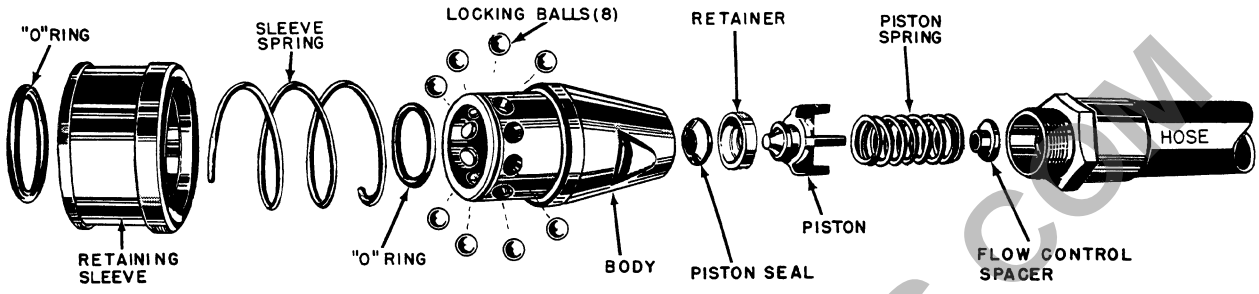


Fig. H-88 Locking Sleeve — Exploded

2. If socket was leaking oil when not connected to a portable cylinder, replace the piston seal. Fig. H-87.
3. If socket was leaking when connected to a cylinder, replace the "O" ring seal. Fig. H-87 and H-88. This "O" ring can be replaced without disassembling the socket. Make certain all rough surfaces in coupling plug have been removed before attempting to install a new "O" ring.
4. Reassemble all parts in reverse of order of removal. Fig. H-84.

DISASSEMBLING COUPLING PLUG

1. Secure the hose fitting and turn plug from hose.
2. Remove internal piston and related parts shown in Fig. H-90.

SERVICING AND ASSEMBLY OF COUPLING PLUG

1. Wash all parts thoroughly in cleaning solvent.
2. If coupling plug has been leaking when disconnected from socket, install new piston seal and piston "O" ring.
3. Reassemble parts in reverse order of removal.

FLOW CONTROL VALVE

The flow control valve, Fig. H-89 restricts the flow of oil between the cylinder and reservoir thereby preventing chattering or uneven drop which sometimes results when using a heavy implement with a fast drop.

The flow control valve will not limit the rate at which oil can be pumped to the ram.

Both coupling sockets should be equipped with the flow control valve so that the hoses can be reversed when coupling up and still control the flow of oil leaving the cylinder.

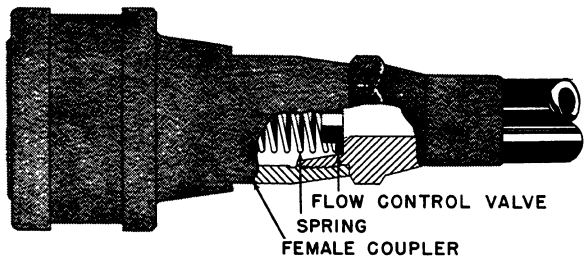


Fig. H-89 Flow Control Valve

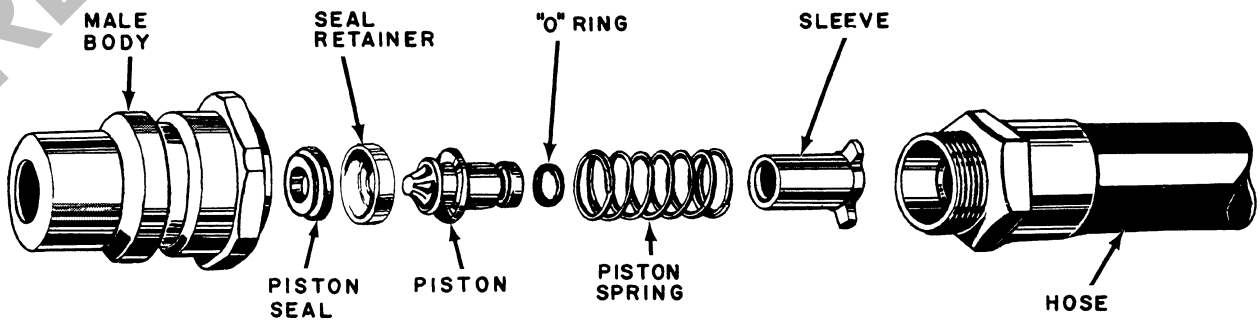


Fig. H-90 Coupling Plug — Exploded

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