



Blue Ribbon Service

SUPPLEMENT TO
GSS-1369

HYDROSTATIC TRANSMISSION

INTERNATIONAL[®] CUB CADET[®] TRACTOR

Models 105, 123 and 125

INTERNATIONAL HARVESTER COMPANY

401 NORTH MICHIGAN AVE. CHICAGO, ILLINOIS 60611, U.S.A.

FOREWORD

The instructions and special tools shown in this Blue Ribbon Service Manual are for use by International Harvester Dealers and their factory trained servicemen.

The specifications as listed in this manual are current as of the printing date. Due to changes and improvements in our products, dealers are periodically issued service bulletins to keep this manual up-to-date. We suggest you refer to the most recent information when performing service work on this equipment.

International Harvester Factory Trained servicemen are best qualified to service I.H. equipment.

NOTE

Service and adjustment of the Hydrostatic Transmission is covered in this manual. Removal and Installation is covered in GSS-1369.

LIBRARY FILING INFORMATION

1. File this Supplement in Book 13 with GSS-1369.
2. Enter the following information in the Service Manual Index.

In the following sections, after form number GSS-1369, add "And Supplement":

Tractor Transmission
Tractor Brakes

PRINCIPLES OF HYDROSTATICS

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SPECIFICATIONS

CONTENTS

Pressure

Charge pump (developing pressure at rated speed) - p.s.i. 70-120

Tolerances

Slipper thickness (minimum - inch) (pump and motor)121

All slippers in block assembly must be within .002 inch thickness of each other.

Spring Specifications

Spring Description	Free Length (inches)	Test Length (inches)	Test Load (pounds)
Motor and pump block assemblies	1-3/64-1-1/16	19/32	63-75
Charge pump relief valve	1.057	.525	7.0-7.6

Special Torques (foot pounds)

Charge pump cap screws 52

Center section-to-transmission case cap screws 35

Motor swash plate (fixed) hexagon socket head cap screws 67

LIBRARY FILING INFORMATION

1. File this Supplement in Book 13 with GSS-1309

2. Enter the following information in the Service Manual

Tractor Transmission
Tractor Brakes

PRINCIPLES OF HYDROSTATICS

This hydrostatic drive can be defined as an energy transfer system composed of a variable displacement pump and a fixed displacement motor for the transmission of power by fluid under pressure and in a contained vessel. The pump converts mechanical energy into hydraulic energy, and the motor converts hydraulic energy into mechanical energy.

A simple hydrostatic drive is shown in Illust. 1. A 10 lb. force on "pump" piston (A) creates 10 psi pressure on the fluid connecting the "pump" and "motor". Since the fluid under pressure exerts 10 psi equally and in all directions, the "motor" piston (B) moves up with a force of 40 lbs. since its area is 4 square inches. If the "pump" piston (A) is moved 1 inch, the "motor" piston (B) will only move 1/4 inch since its area is four times the area of the pump piston.

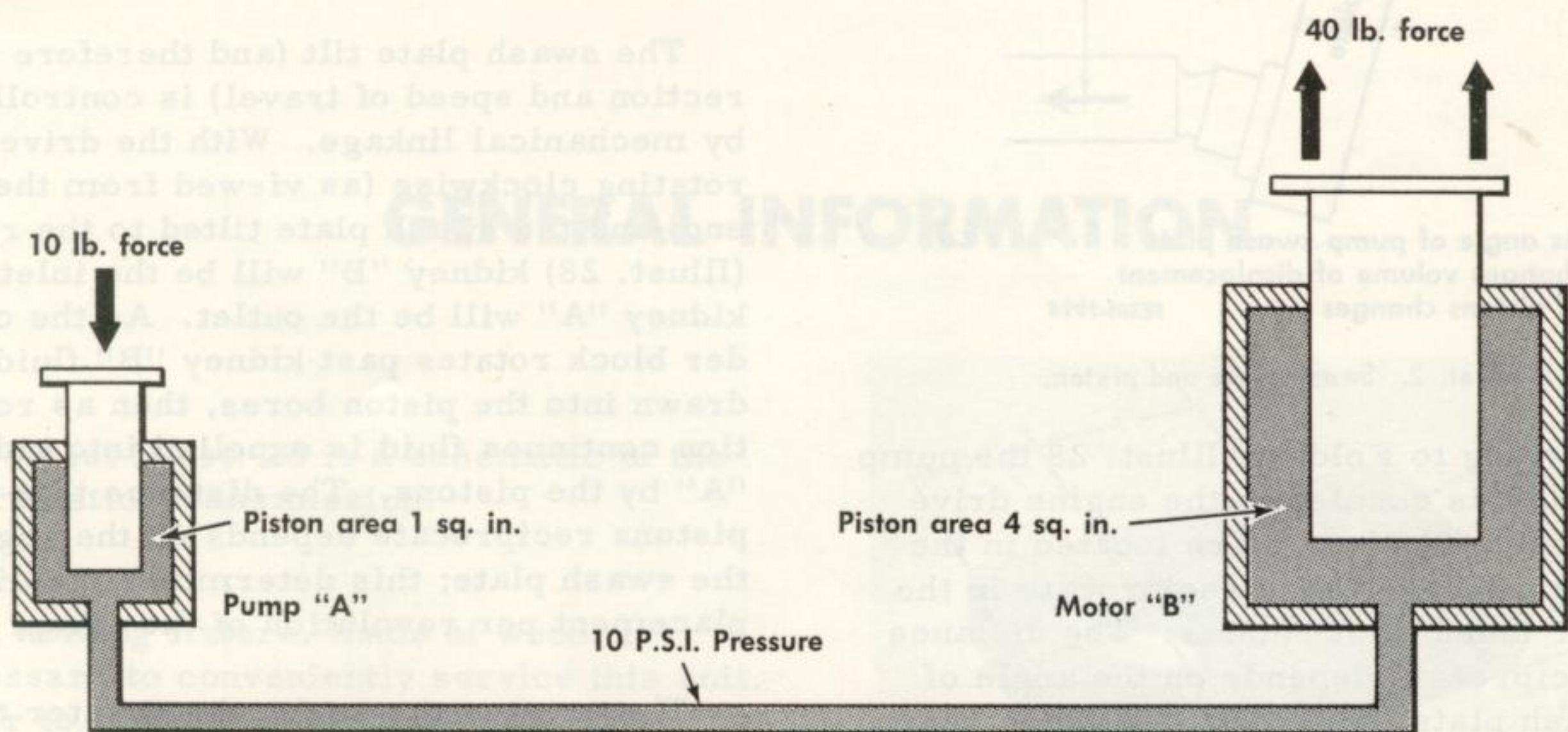
This illustrates the basic principles in their simplest form. Modern hydrostatic

transmissions consist of multiple piston pumps and multiple piston motors arranged in a manner so as to continuously perform the transfer of energy shown in Illust. 1.

The piston pump is designed with a rotating shaft which imparts a reciprocating motion to its pistons, pumping fluid in a continuous stream to a motor which accepts the fluid under pressure in its pistons, which in turn imparts a rotating motion to the motor shaft. This arrangement is still based on the basic principles shown in Illust. 1.

In a hydrostatic drive, there are only three basic items to control, these three items are:

1. Rate of fluid flow.
2. Direction of fluid flow.
3. Fluid pressure.



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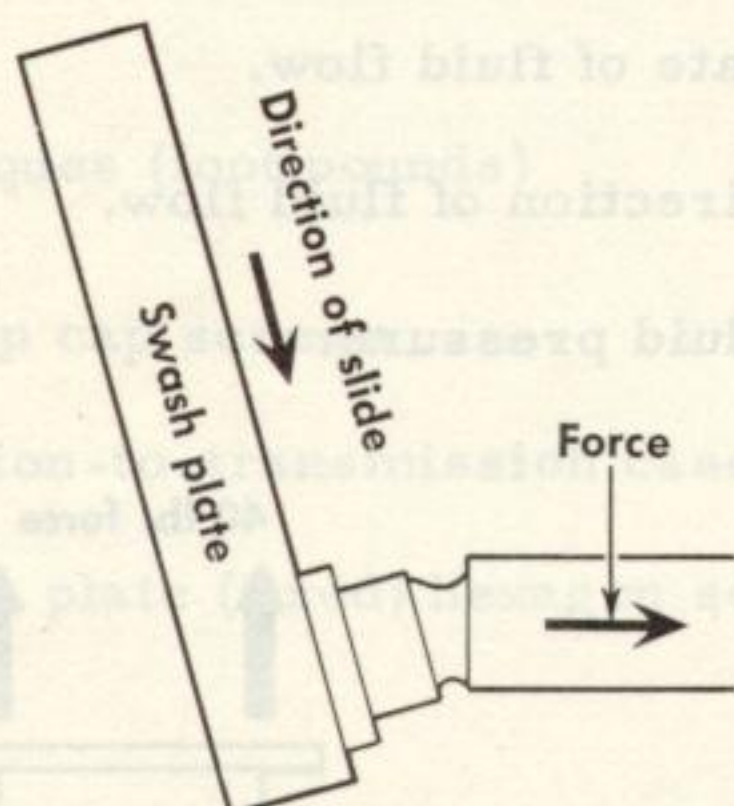
Illust. 1. Simple hydrostatic transmission.

Since infinite control of these three basic items is possible, it therefore follows that a hydrostatic drive is infinitely controllable. Infinite control over the rate of fluid flow results in control of the output speed. Infinite control over the direction of fluid flow results in control of the direction of the output shaft. Control over the fluid pressure results in control of the magnitude of force applied to the output shaft. Therefore, infinite control over the speed, direction and magnitude of force of the output shaft is obtainable.

The pump displacement is varied to change its output and the motor displacement is fixed as to the volume of fluid it will accept. Varying either pump or motor capability changes motor speed and mechanical ratio.

HOW IT WORKS

Variable Displacement Pump and Fixed Motor



As angle of pump swash plate changes volume of displacement of pistons changes FESM-1914

Illust. 2. Swash plate and piston.

Referring to Foldout, Illust. 28 the pump drive shaft is coupled to the engine drive shaft. Nine (9) pistons are located in the cylinder block and they reciprocate in the cylinder block as it rotates. The distance they reciprocate depends on the angle of the swash plate, Illust. 2. The drive shaft and cylinder block assembly are the only parts that rotate. The pump cylinder block always rotates the same direction as the engine.

The swash plate is mounted on trunions supported by needle bearings mounted in the transmission case. The swash plate does not rotate but merely tilts back and forth from a vertical plane. The vertical plane is a "zero output" position as the pistons are not reciprocating. The drive shaft drives through a center hole in the swash plate and does not touch it. The center section which has the hydraulic porting, referred to as kidneys, allowing fluid to flow between the pump and motor is bolted to the transmission case.

"Kidneys" which are open passages from the pump to the motor through the center section are the only connection between them. See Foldout, Illust. 28.

By reversing the tilt of the pump swash plate the flow through the inlet and outlet kidneys can be reversed. The pump swash plate can be tilted 15 degrees from the vertical position for forward and 7 degrees for reverse.

The output shaft rotation depends on the pump swash plate tilting position from the vertical. With the swash plate in the vertical position, no reciprocating motion will be imparted to the pistons, therefore, there will be no flow of fluid from the pump to the motor.

The swash plate tilt (and therefore direction and speed of travel) is controlled by mechanical linkage. With the drive shaft rotating clockwise (as viewed from the drive end) and the swash plate tilted to the rear (Illust. 28) kidney "B" will be the inlet and kidney "A" will be the outlet. As the cylinder block rotates past kidney "B" fluid is drawn into the piston bores, then as rotation continues fluid is expelled into kidney "A" by the pistons. The distance that the pistons reciprocate depends on the angle of the swash plate; this determines the displacement per revolution of the pump.

The greater the angle, the greater the displacement; therefore, the more flow of fluid from the pump. Now it can be seen as the swash plate angle is varied so it will vary the flow from the pump.

When the pump swash plate is tilted to the front, the flow reverses on kidney "B" then becomes the inlet and kidney "A" becomes the outlet--now the flow of fluid has been reversed while the drive shaft continues to rotate in the same direction.

The motor used is an axial piston fixed displacement motor of the same design as the pump. A splined output shaft is splined to the cylinder block and is driven by it. As fluid under pressure is introduced from the pump, force is exerted against the pistons in the motor cylinder block. Since the swash plate of the motor is inclined, the pistons slide on the incline and rotate the motor cylinder block. See Illust. 2. As the

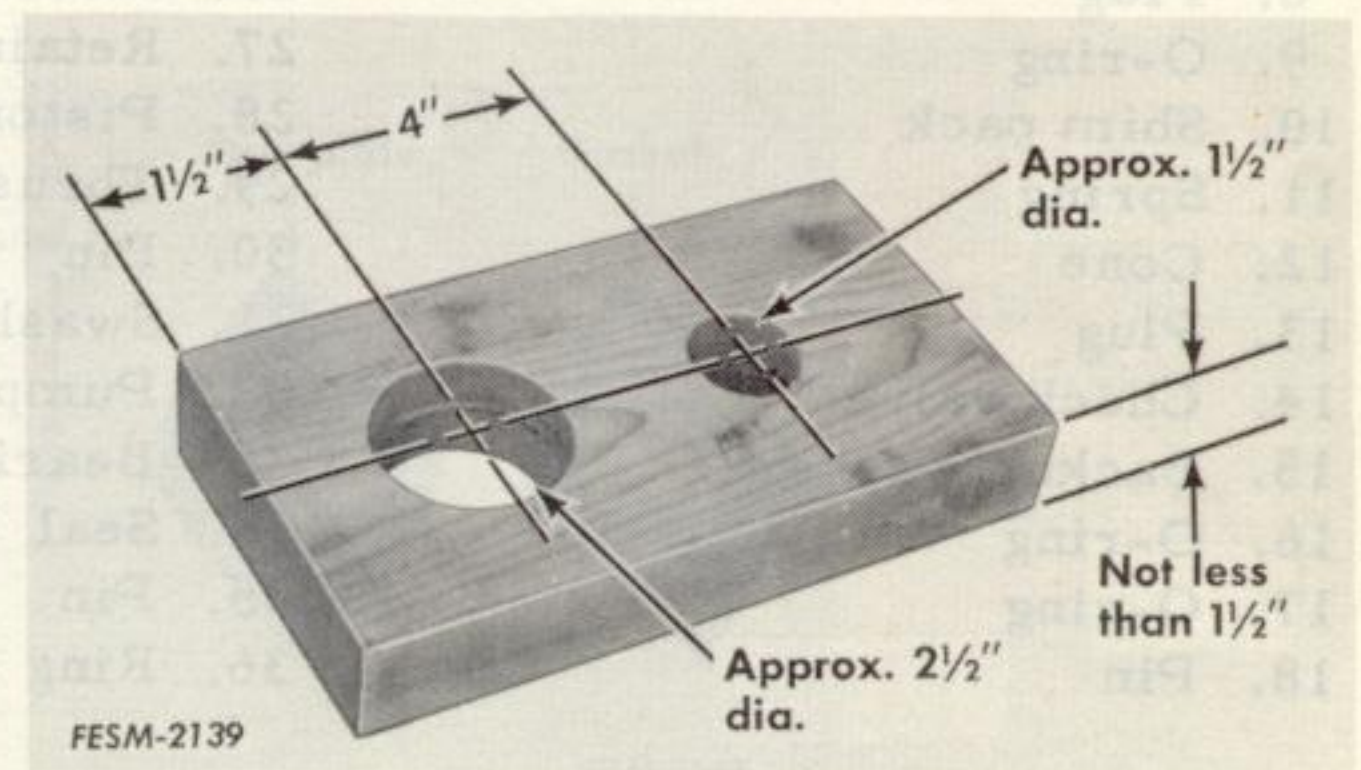
cylinder continues to rotate clockwise fluid is expelled. When the swash plate angle is moved beyond vertical, fluid under pressure is introduced by the pump into the opposite kidney and the motor cylinder block and output shaft will rotate in the opposite direction. There is a very little flow of high pressure fluid. The charge pump furnishes fluid to make up for leakage and to furnish circulation for cooling.

The pump is carried on ball bearings and the motor is carried on tapered roller bearings. The only connection between the two is the hydraulic porting in the center section referred to above as kidneys.

GENERAL INFORMATION

Foldout Illust. 28 is a schematic of the Hydrostatic Transmission.

A holding fixture, made of wood, is necessary to conveniently service this unit. Refer to Illust. 3 for dimensions.



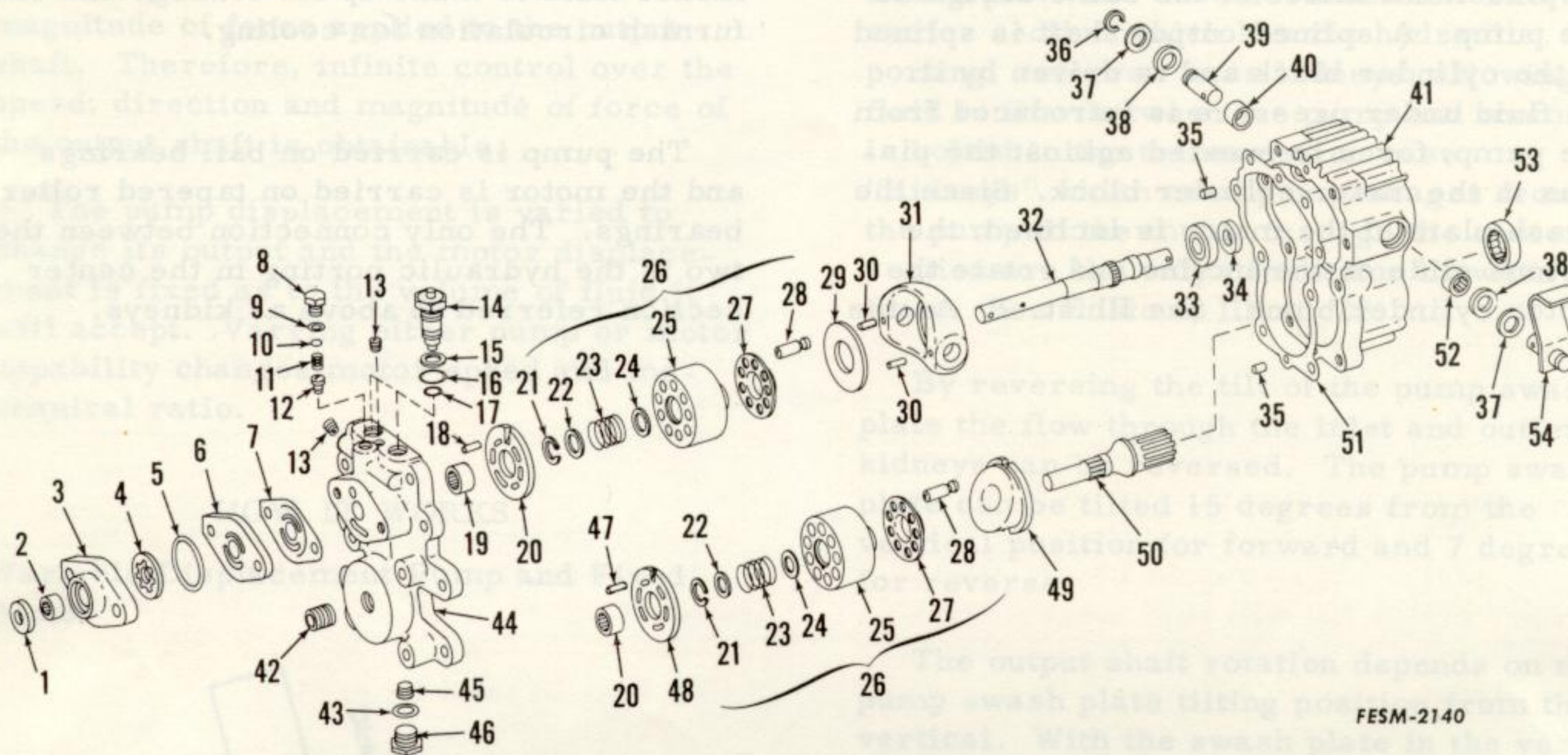
Illust. 3. Holding fixture.

Refer to Illust. 4 for additional reference to the parts described during service procedures in this manual.

Many of the component parts have highly polished machined surfaces. Extreme

care must be taken to prevent damage during disassembly and reassembly.

Coat hands with clean Hy-Tran before handling the polished surfaces of the parts in order to minimize rust formation.



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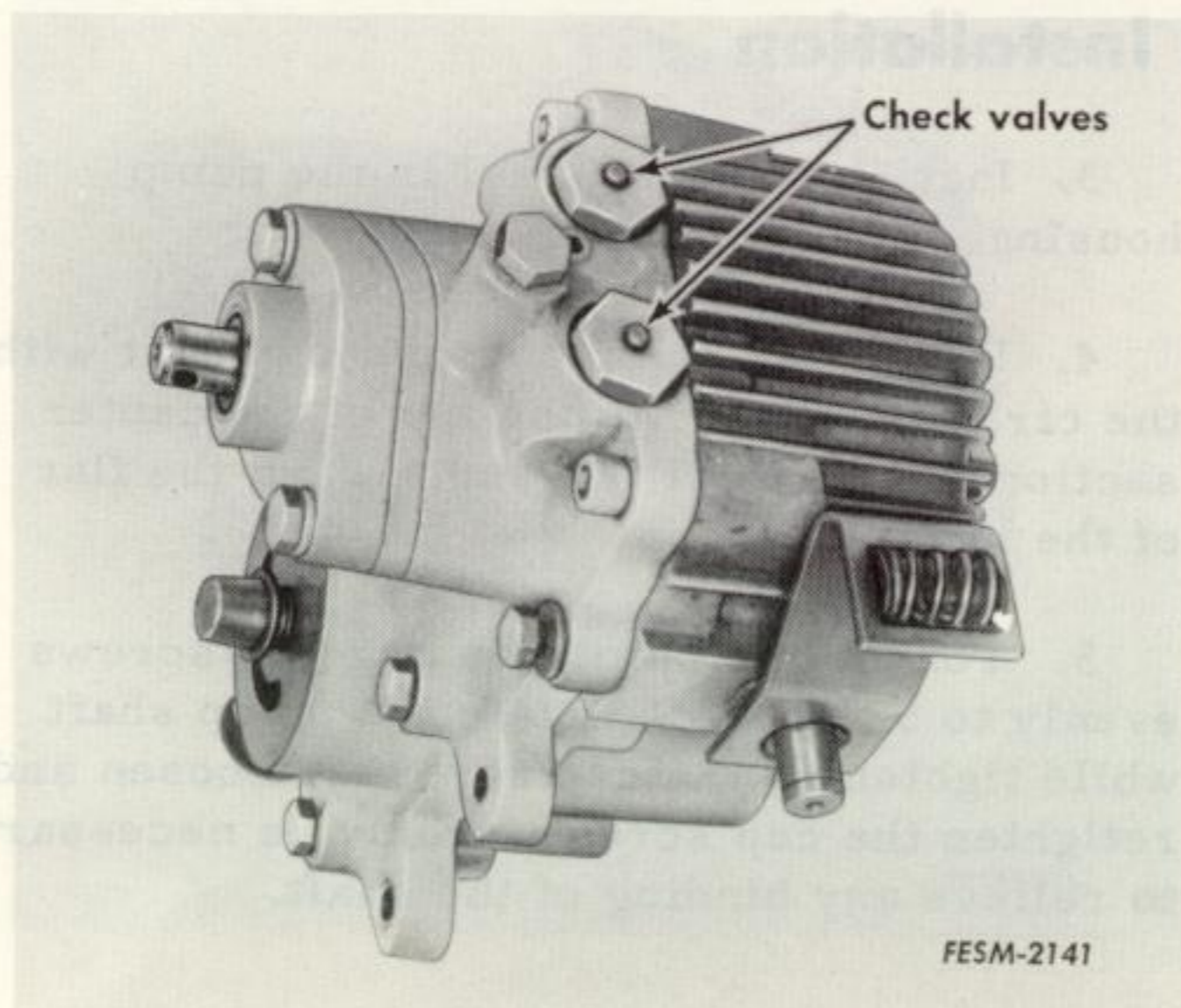
Illust. 4. Exploded view of the hydrostatic transmission.

- | | | |
|------------------------|------------------------|----------------------------|
| 1. Seal | 19. Bearing | 37. Washer |
| 2. Needle bearing | 20. Plate | 38. Seal |
| 3. Charge pump housing | 21. Snap ring | 39. Shaft |
| 4. Rotor assembly | 22. Washer | 40. Bushing |
| 5. O-ring | 23. Spring | 41. Housing |
| 6. Port plate | 24. Washer | 42. Fitting |
| 7. Gasket | 25. Block | 43. O-ring |
| 8. Plug | 26. Motor and pump kit | 44. Center section housing |
| 9. O-ring | 27. Retainer | 45. Plug |
| 10. Shim pack | 28. Piston | 46. Plug |
| 11. Spring | 29. Thrust plate | 47. Pin |
| 12. Cone | 30. Pin | 48. Valve plate |
| 13. Plug | 31. Swash plate | 49. Swash plate |
| 14. Check valve | 32. Pump shaft | 50. Motor shaft |
| 15. Backup washer | 33. Bearing | 51. Gasket |
| 16. O-ring | 34. Seal | 52. Needle bearing |
| 17. O-ring | 35. Pin | 53. Roller bearing |
| 18. Pin | 36. Ring | 54. Shaft assembly |

CHARGE PUMP SERVICE

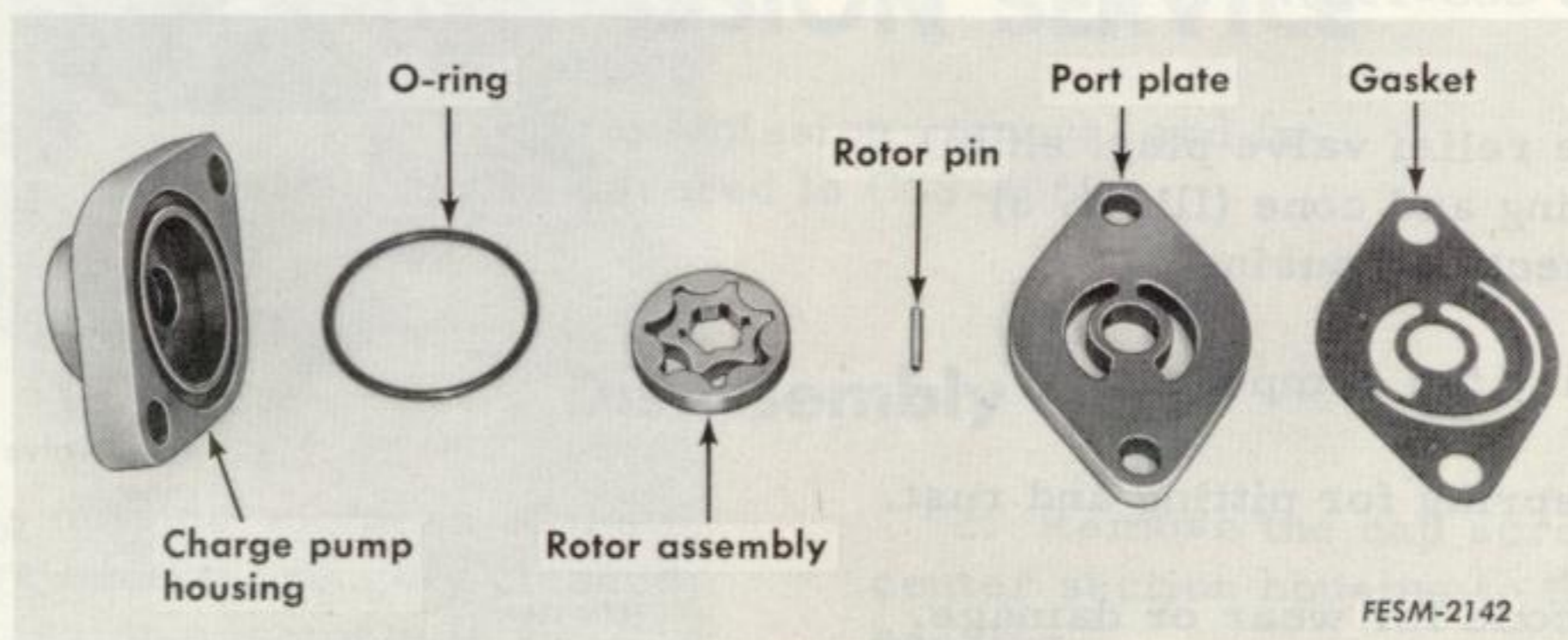
Removal and Disassembly

1. Thoroughly clean and deburr the outside of the transmission before attempting any disassembly. Remove paint from shaft surfaces.



Illust. 5. Hydrostatic transmission.

2. Remove the cap screws securing the charge pump housing to the center section housing (Illust. 5). Carefully remove the pump housing. The rotor assembly may stick to the housing. Do not drop the assembly.



Illust. 6. Exploded view of charge pump.



Illust. 7. Removing the lip seal.

3. Remove the rotor assembly (if it was not removed in step 2). Because of the polished surface, be sure to protect the assembly against nicks, scratches and rust.

4. Remove the pump port plate. **NOTE THE POSITION OF THE PORT PLATE GASKET.** The new gasket must be installed with the circular groove to the top of the center section housing with the flat end toward the flat of the housing (Illust.6).

5. Using a screwdriver, pry the lip seal out of the pump housing (Illust. 7).

6. To replace the needle bearing, press the bearing out of the pump housing.

Inspection and Repair

The rotor assembly is serviced as a unit. The charge pump housing, port plate, gasket, O-ring, lip seal and rotor pin are all serviced separately.

Inspect all parts for excessive wear or damage.

Use a new lip seal, O-ring and port plate gasket.

Reassembly and Installation

Reassembly and installation of the charge pump to the center section housing is the exact reverse of removal and disassembly with particular attention paid to the following:

1. Thoroughly lubricate all parts in clean Hy-Tran.

2. If removed, install the new needle bearing in the pump housing. Be sure the bearing is "bottomed" in the bore.

3. Install a new oil seal in the pump housing. Install a new O-ring.

4. Install the pump port plate gasket with the circular groove to the top of the center section housing and flat end toward the flat of the housing.

5. Torque the pump housing cap screws evenly to 52 ft. lbs. Rotate the pump shaft while tightening the cap screws. Loosen and retighten the cap screws evenly as necessary to relieve any binding of the shaft.

CHARGE PUMP RELIEF VALVE SERVICE

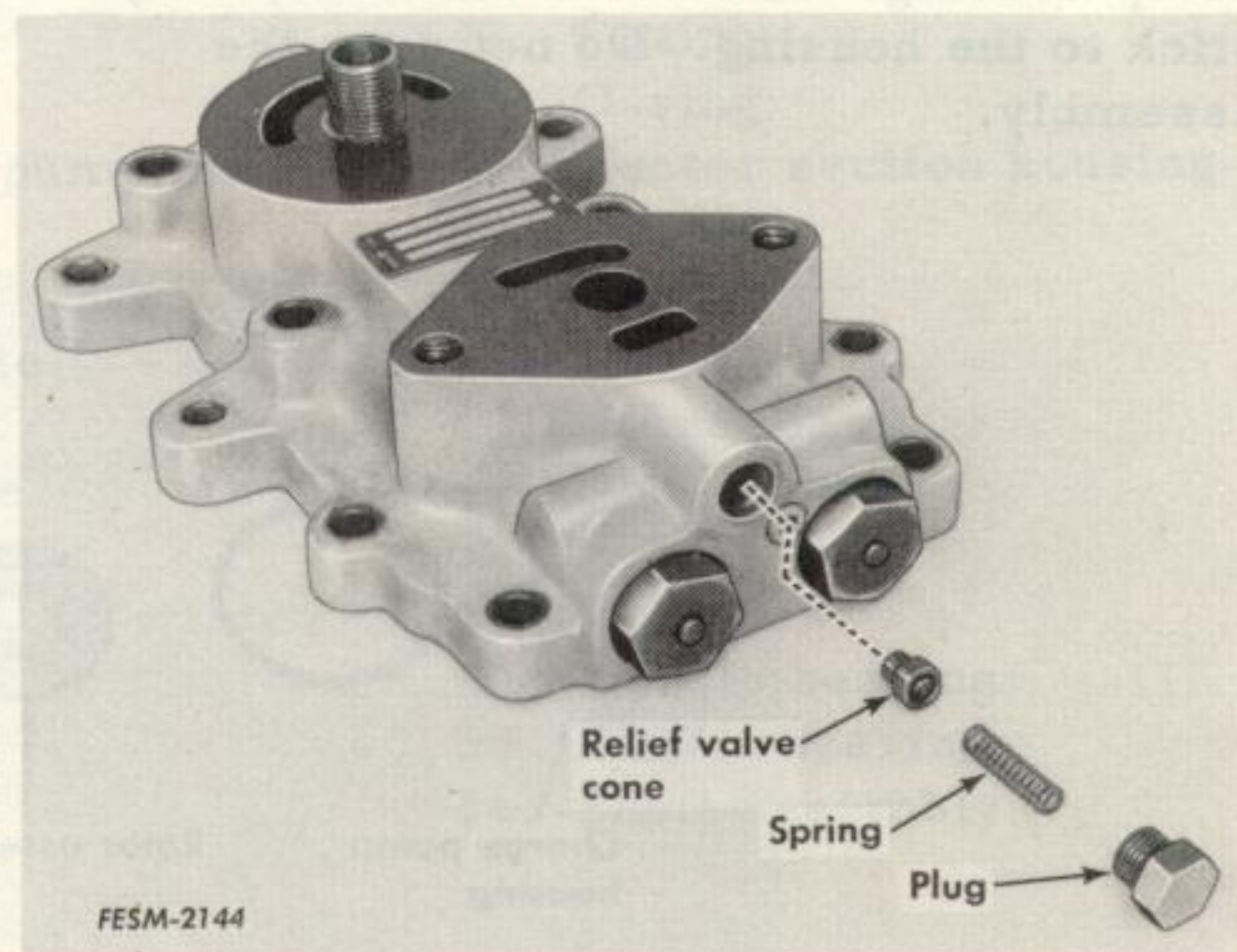
NOTE: The charge pump can be serviced without removing the transmission from the tractor. However, the tractor must be split. Refer to GSS-1369.

1. Remove the relief valve plug, shim pack (if any), spring and cone (Illust. 8) from the center section housing.

2. Wash and dry the components.

3. Check the spring for pitting and rust.

4. Check the cone for wear or damage. Check the valve seat in the center section housing for dirt, nicks and scratches.

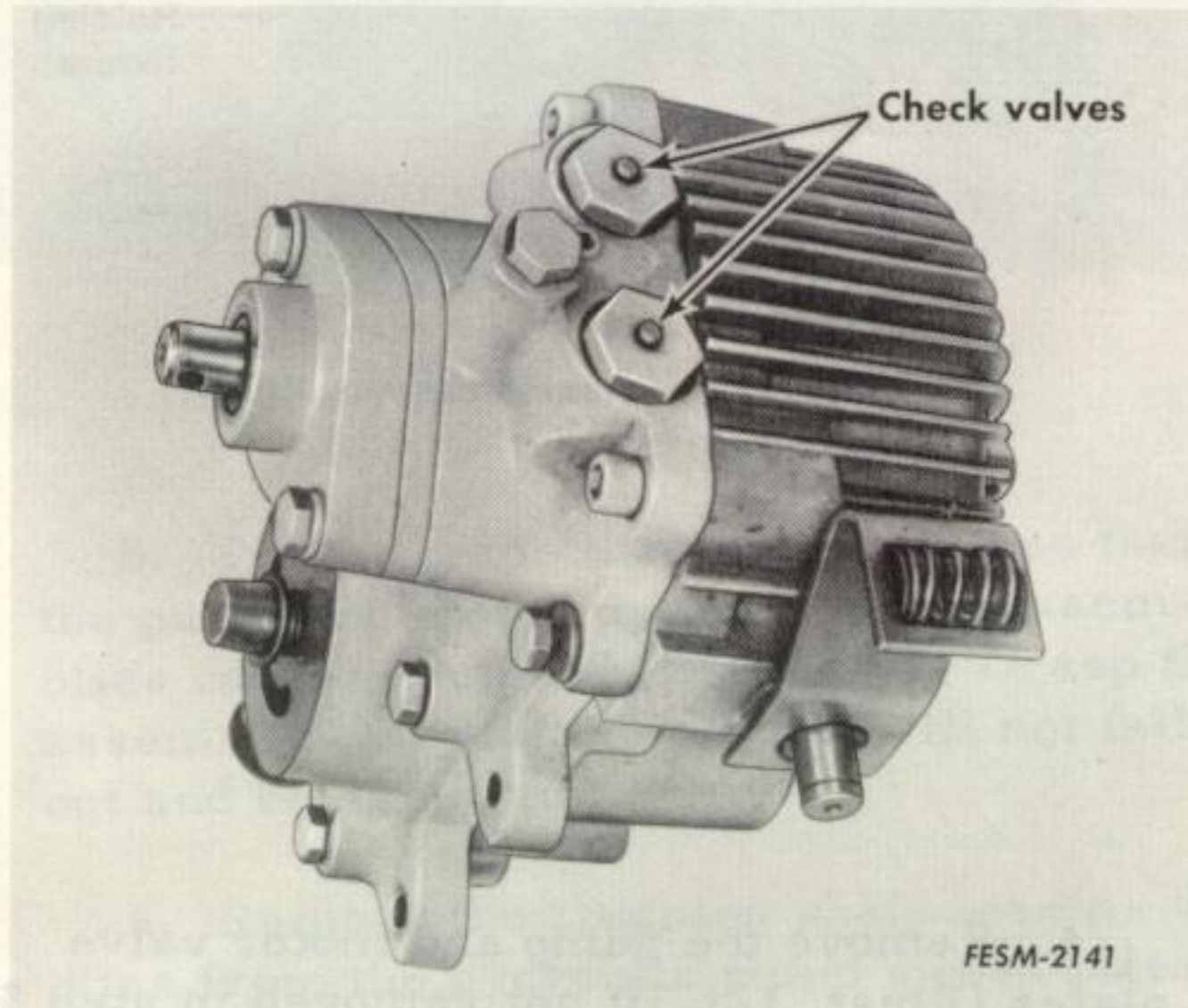


Illust. 8. Relief valve removed.

5. Install the relief valve in the reverse order of removal. Be sure to use a new O-ring on the plug.

6. Recouple the tractor and check the operation of the relief valve. Refer to "Trouble Shooting" on page 20.

CHECK VALVE SERVICE



Illust. 9. Center section housing check valves.

NOTE: The check valves can be serviced without removing the transmission from the tractor. However, the tractor must be split. Refer to GSS-1369.

The check valves are serviced as an assembly only. Servicing of the valve is limited to replacement only, except for external O-rings and back-up washer.

Remove the check valves from the center housing section.

Thoroughly wash the valves in clean solvent and air dry.

Check the valves for dirt, corrosion and free plunger movement. Replace any valve in doubtful condition.

Replace all O-rings and back-up washers.

Thoroughly lubricate the valves in clean Hy-Tran and install them in the center housing section. Apply IH 251 HEP grease to the external ends of the valve spools.

NOTE: The valves are identical therefore they are interchangeable.

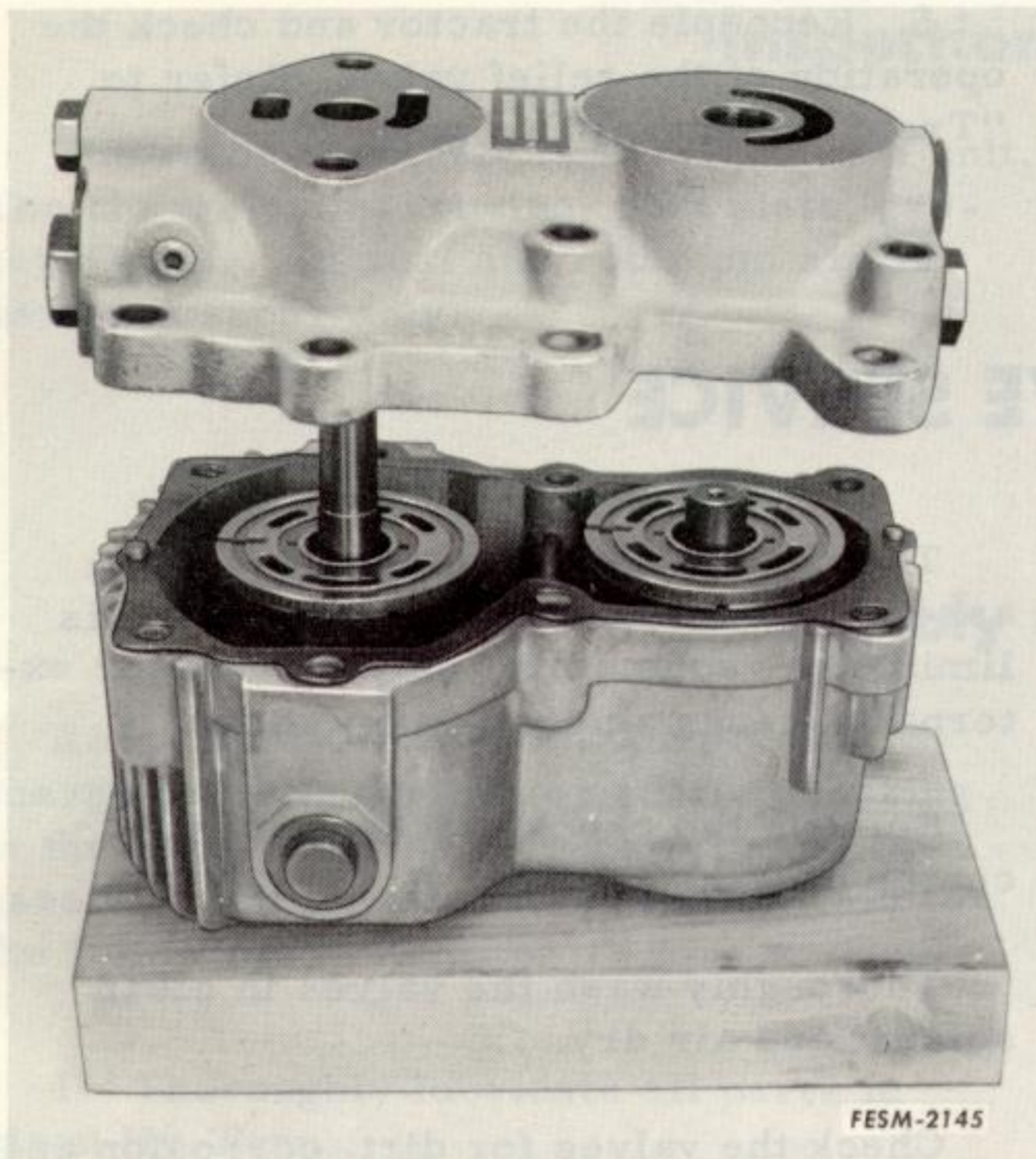
TRANSMISSION SERVICE

NOTE: Transmission removal and installation is covered in GSS-1369.

Disassembly

1. Be sure the outside surfaces of the transmission have been thoroughly cleaned. Place the transmission assembly in the holding fixture.

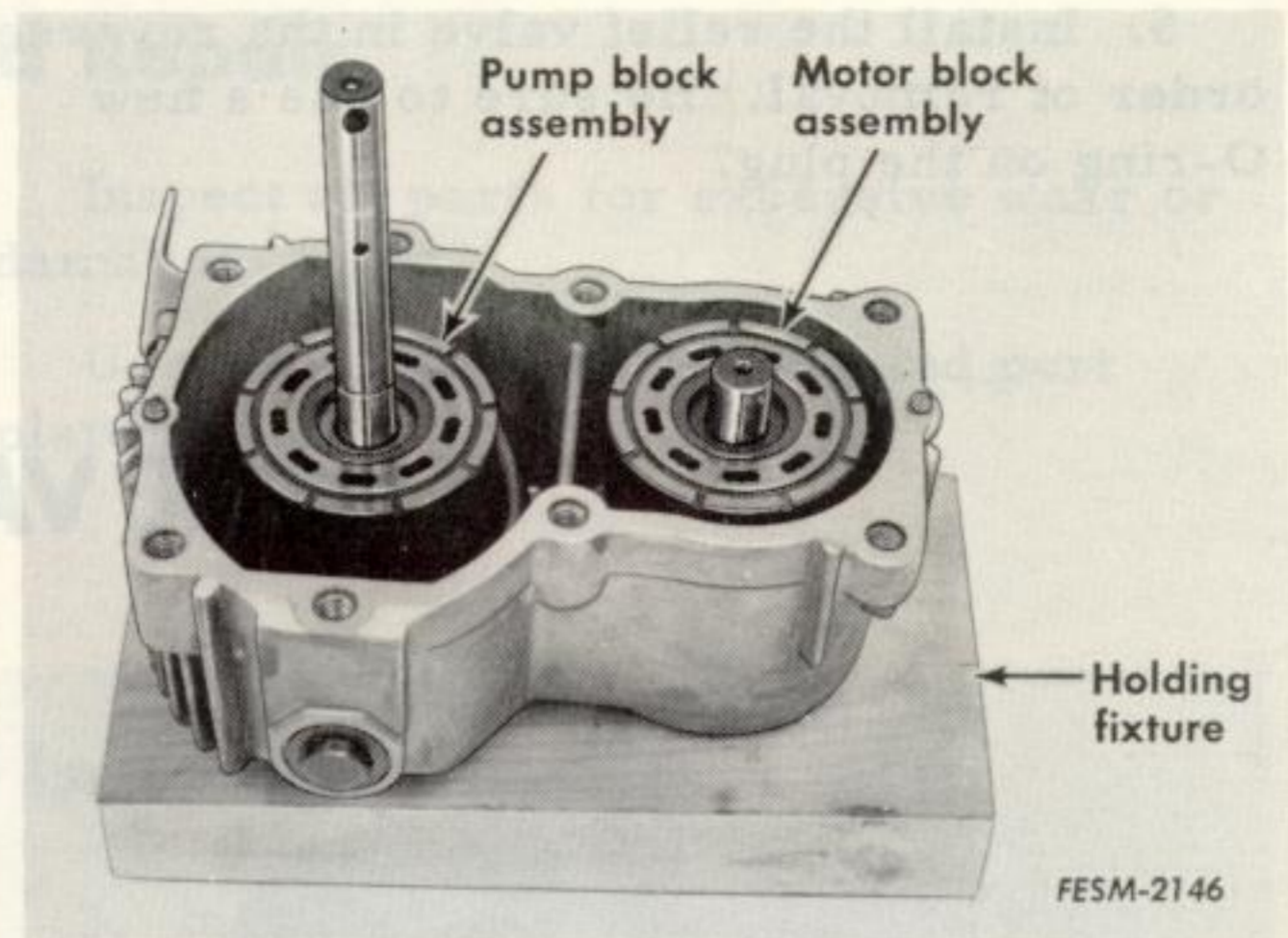
2. Remove the cap screws securing the center section housing to the transmission housing.



Illust. 10. Removing the center section.

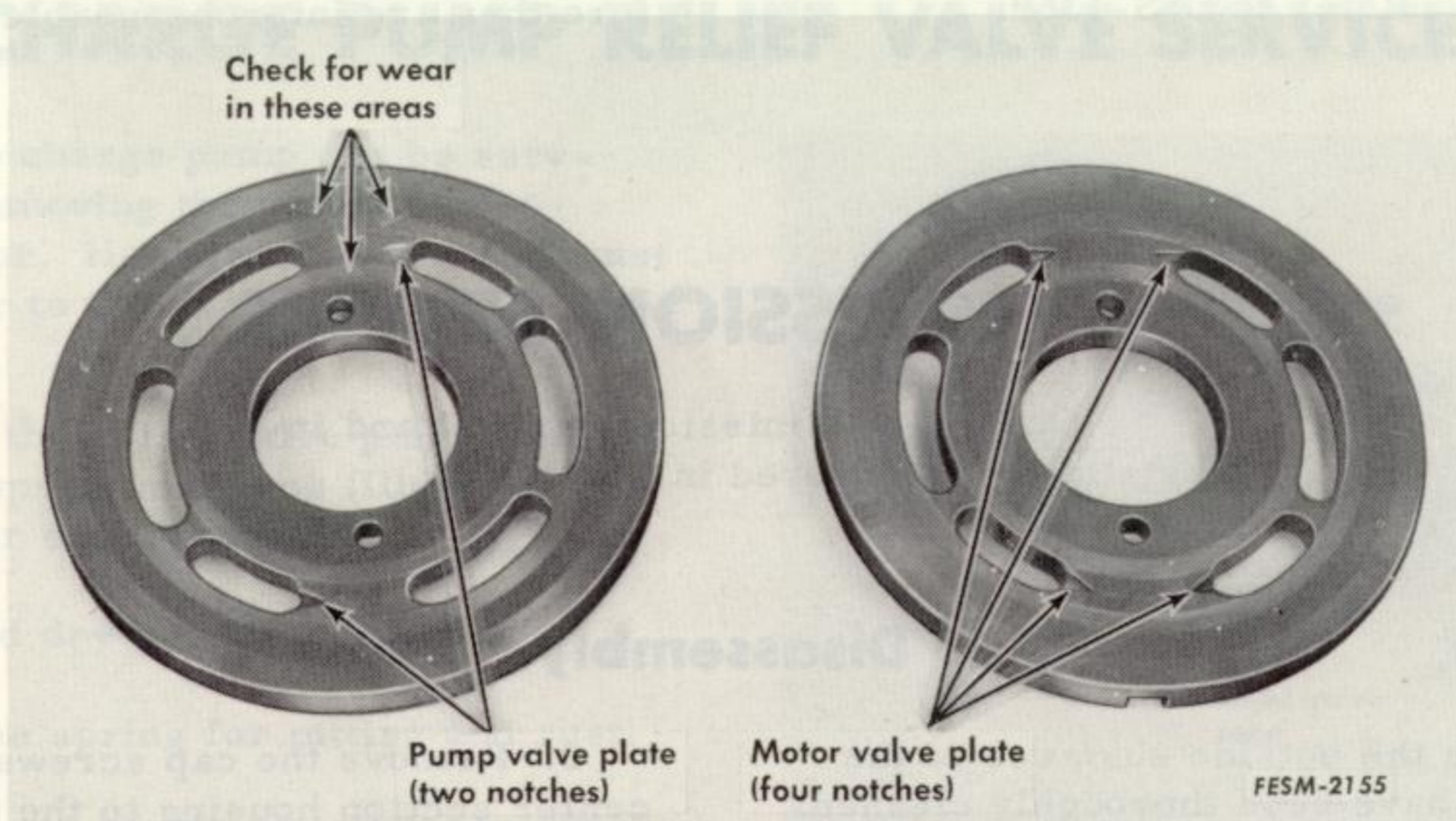
3. Lift the center section housing from the transmission housing (Illust. 10).

IMPORTANT: The valve plates may stick to the center section housing surface. Be extremely careful not to drop them.



Illust. 11. Transmission case assembly.

4. Remove the pump and motor valve plates (Illust. 12), (if not removed in step 3 above) noting the location of each plate. The valve plate with two notches is used on the pump assembly and the plate with four notches on the motor assembly. Remove the valve plate pins.



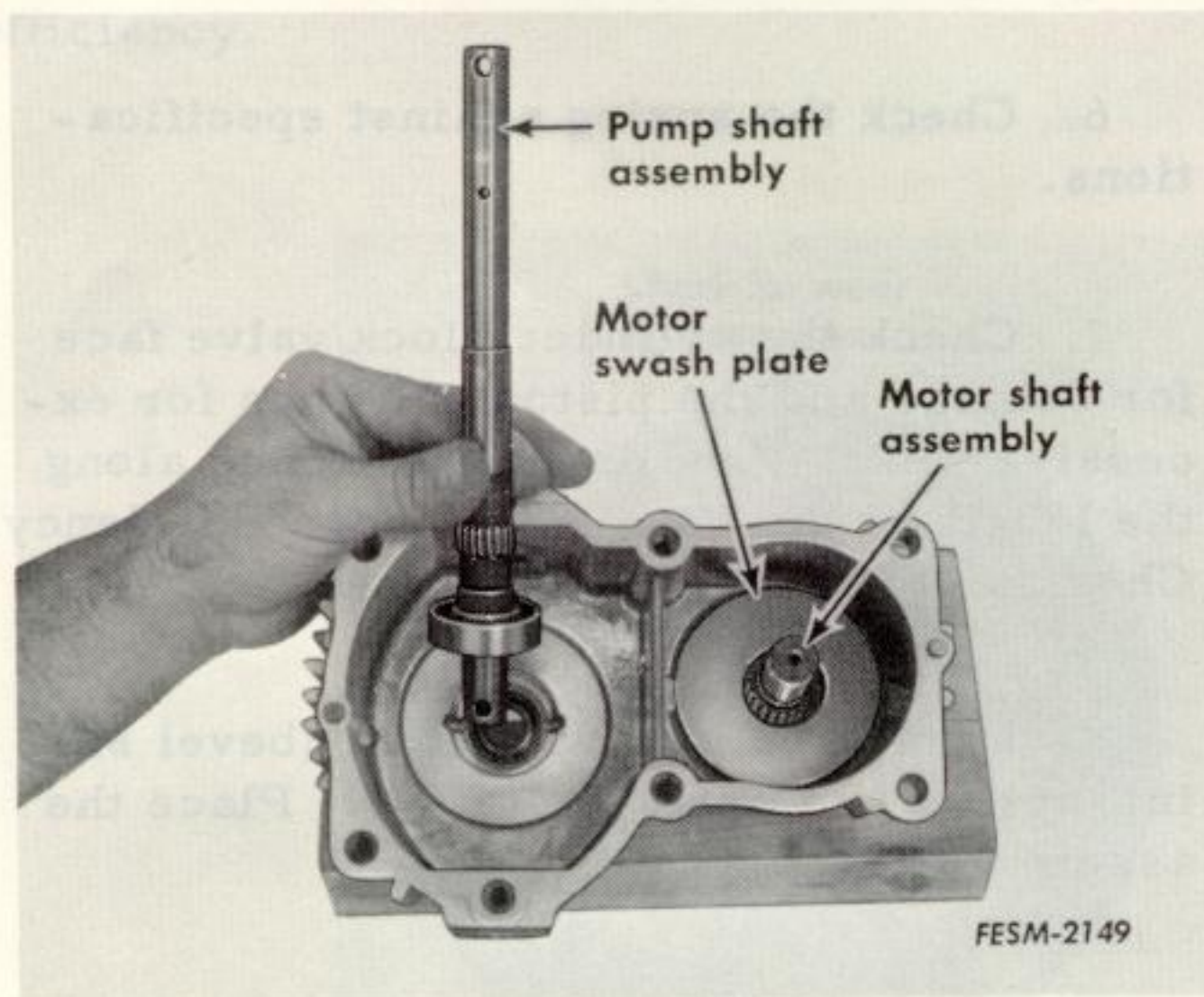
Illust. 12. Pump and motor valve plates.



Illust. 13. Block assembly removed.

5. Tip the transmission housing so that the pump and motor cylinder block assemblies can be removed (Illust. 13). Grasp the assemblies so that the pistons will not fall out and be damaged.

6. Remove the trunnion shaft assemblies from the hydraulic pump swash plate by driving on the spring pins sufficiently to remove the shaft assemblies. Remove the swash plate.



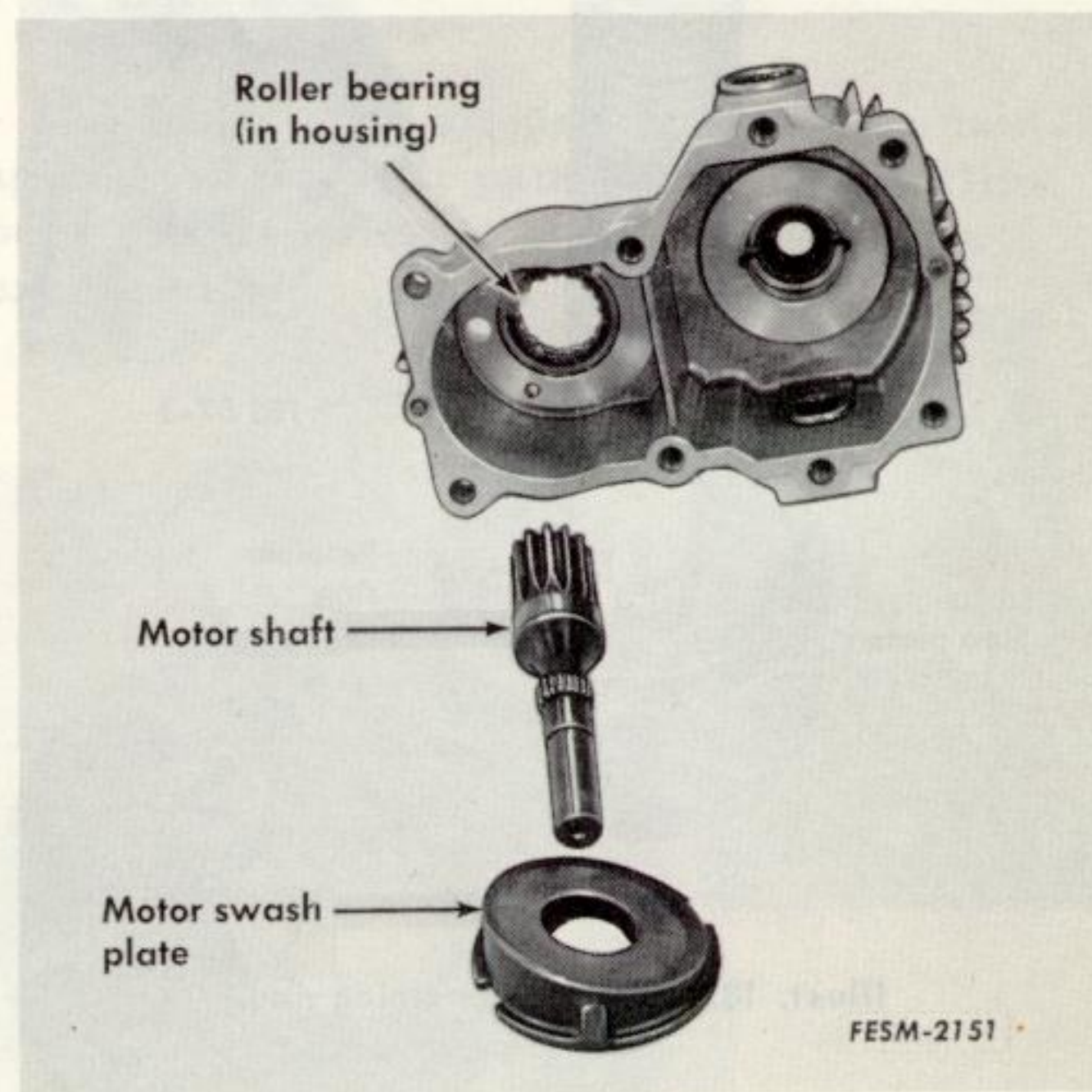
Illust. 14. Removing the pump shaft assembly.

7. Remove the pump shaft assembly (Illust. 14).



Illust. 15. Removing the hydraulic motor swash plate cap screws.

8. Remove the socket head cap screws securing the hydraulic motor swash plate (Illust. 15).

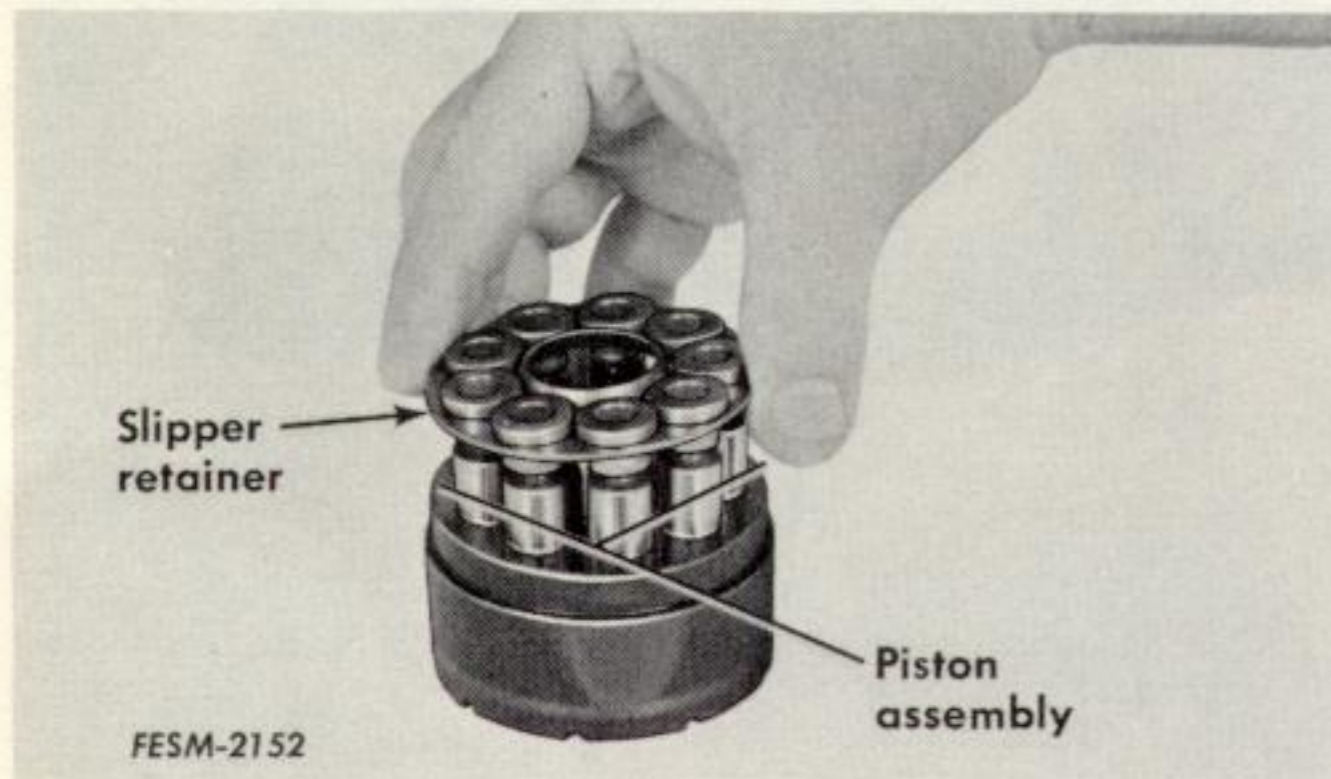


Illust. 16. Transmission motor shaft and swash plate removed.

9. Remove the transmission motor shaft and swash plate from the housing (Illust. 16).

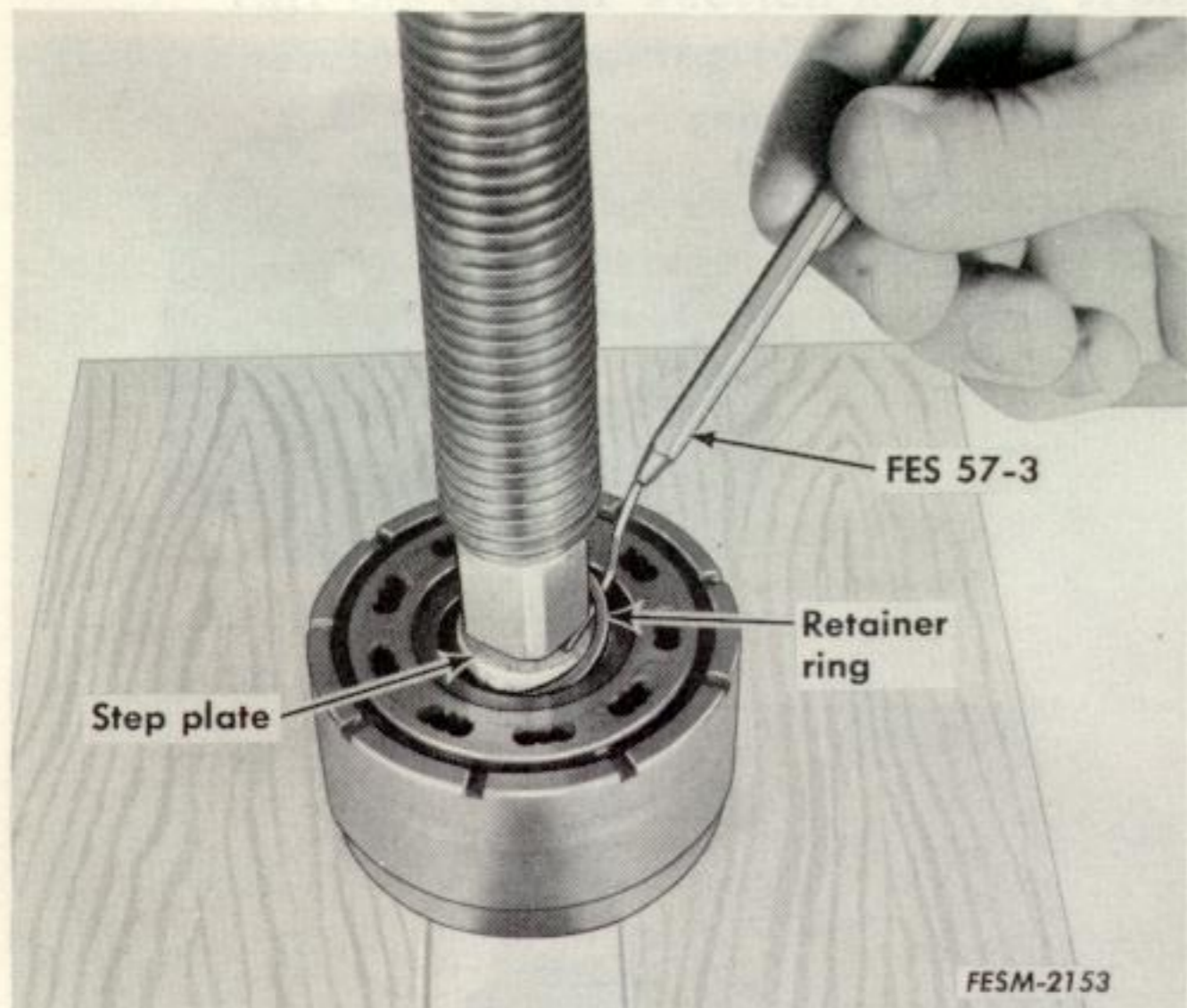
Inspection and Repair

Thoroughly clean all parts and dry with compressed air.



Illust. 17. Removing pistons and slipper retainer.

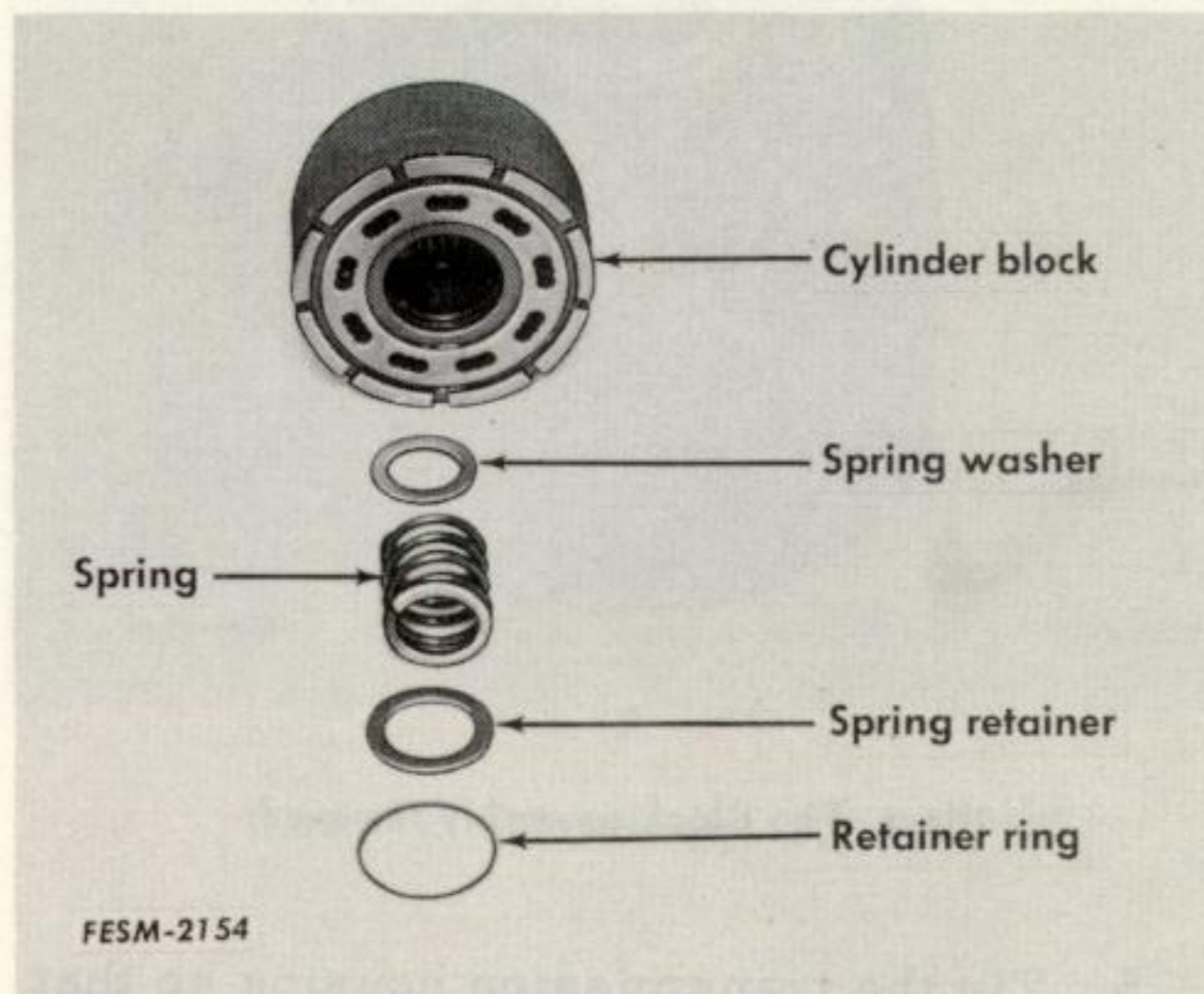
1. Remove piston and slipper assembly (Illust. 17).



Illust. 18. Removing retaining ring.

2. Place the cylinder block assembly in a press on wood blocks (Illust. 18).

3. Press on the spring retainer, using a step plate to compress the cylinder block spring (Illust. 18). Remove the retaining ring.



Illust. 19. Cylinder block disassembled.

4. Carefully release the press. Remove the spring retainer, spring and spring seat (Illust. 19). Remove the cylinder block from the press.

5. Thoroughly clean all parts and blow dry with compressed air.

6. Check the spring against specifications.

7. Check the cylinder block valve face for damage and the piston bushings for excessive wear. Any linear scratches along the length of the bore will reduce efficiency. Check piston fit in the bushings.

8. Install the spring washer (bevel side in), spring and spring retainer. Place the assembly in a press.

9. Compress the spring, using a step plate. Install the retaining ring.

10. Release the press and wrap the assembly in clean paper or lint free cloth before setting aside.

11. Remove the pistons from the slipper retainer. Thoroughly clean the pistons and blow dry with compressed air. Be certain center oil passage is open.

12. Carefully inspect each piston for scoring, wear or scratches.

13. Check the slippers for severe scratches or embedded material. Slippers may be lapped, but do not remove more than .005 inch. All slippers must be within .002 inch thickness of each other. Refer to the Specifications on page 4.

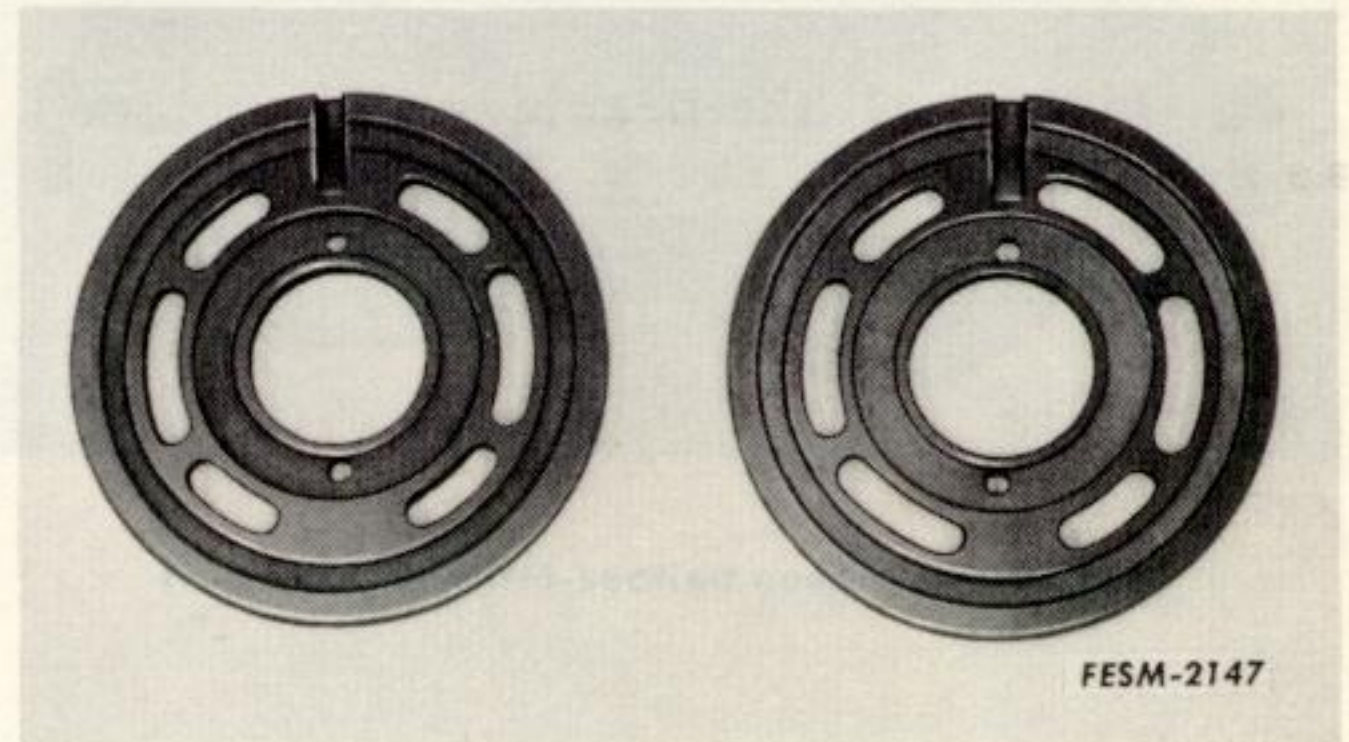
14. Replace any pistons that are badly worn or scored.

15. Wrap the pistons in clean paper or lint free cloth or reinstall in the cylinder block and wrap the assembly.

16. Thoroughly clean the valve plate and blow dry with compressed air.

17. Inspect the valve plate for scratches, excessive wear or erosion (Illust. 20). A worn or scored valve plate reduces pump efficiency.

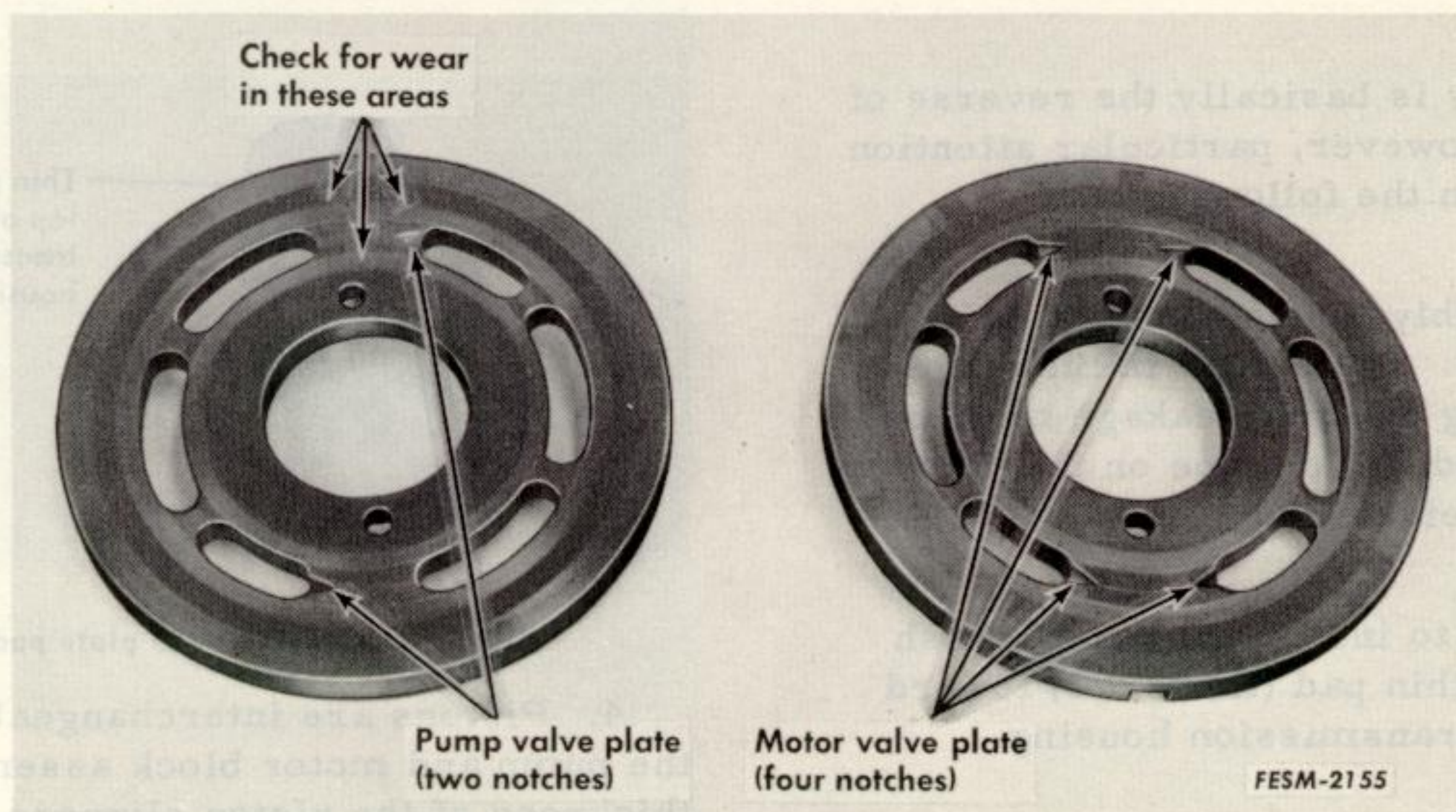
NOTE: To check the plate for wear, run your finger nail or a sharp pencil across the face of the plate. If wear is felt, replace the plate.



Illust. 21. Valve plate grooves.

18. Inspect the pin slot and grooves of the valve plate (Illust. 21). Clean out any foreign matter and deburr the surface as necessary.

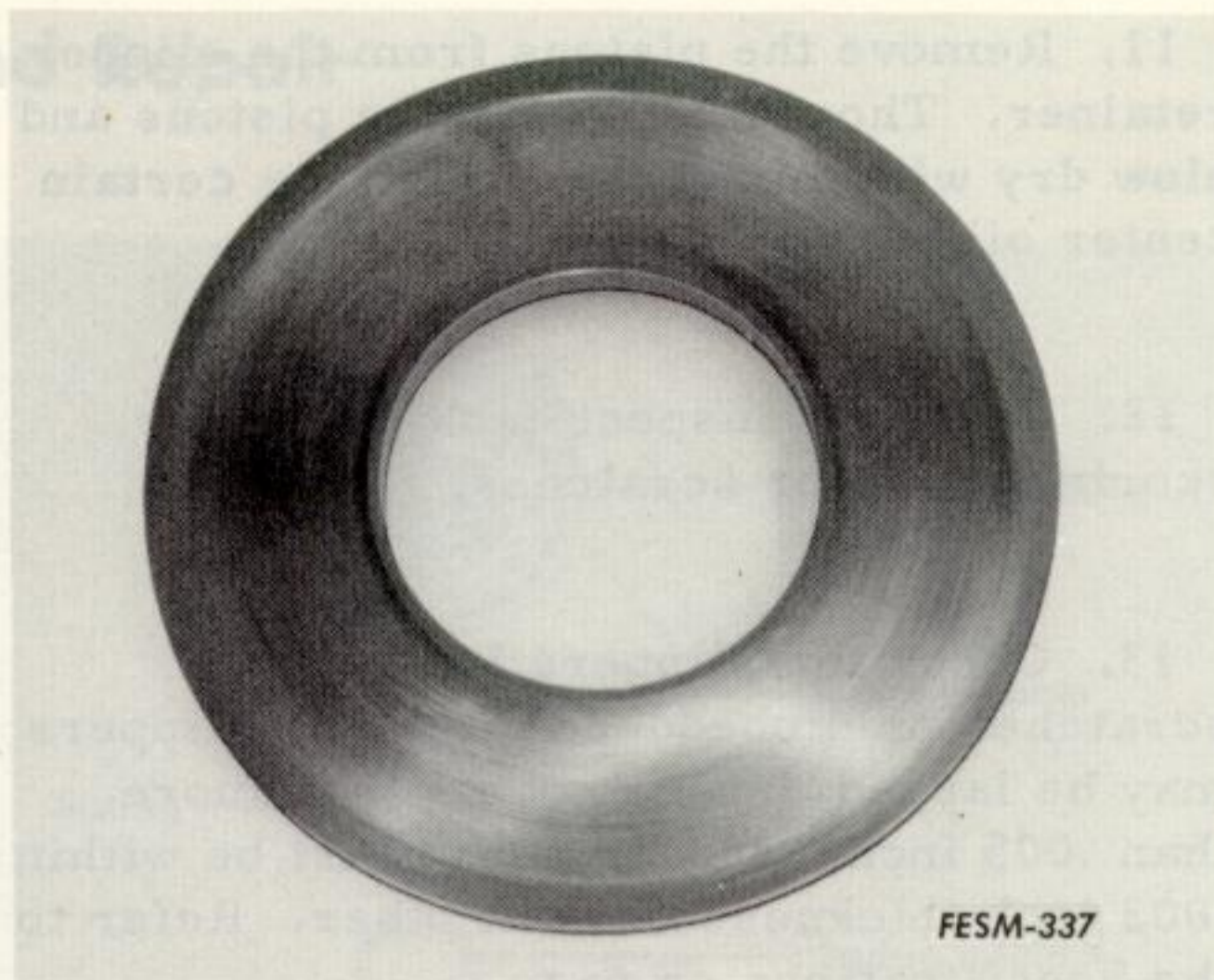
19. Inspect the slipper retainer for damage. A slight wear pattern where the slippers ride is normal. Replace if wear is excessive.



Illust. 20. Valve plate inspection.

20. Inspect the thrust plate (for the hydraulic pump swash plate) for wear, embedded material, or scoring (Illust. 22).

21. Inspect all the bearings and replace as necessary.



Illust. 22. Thrust plate inspection.

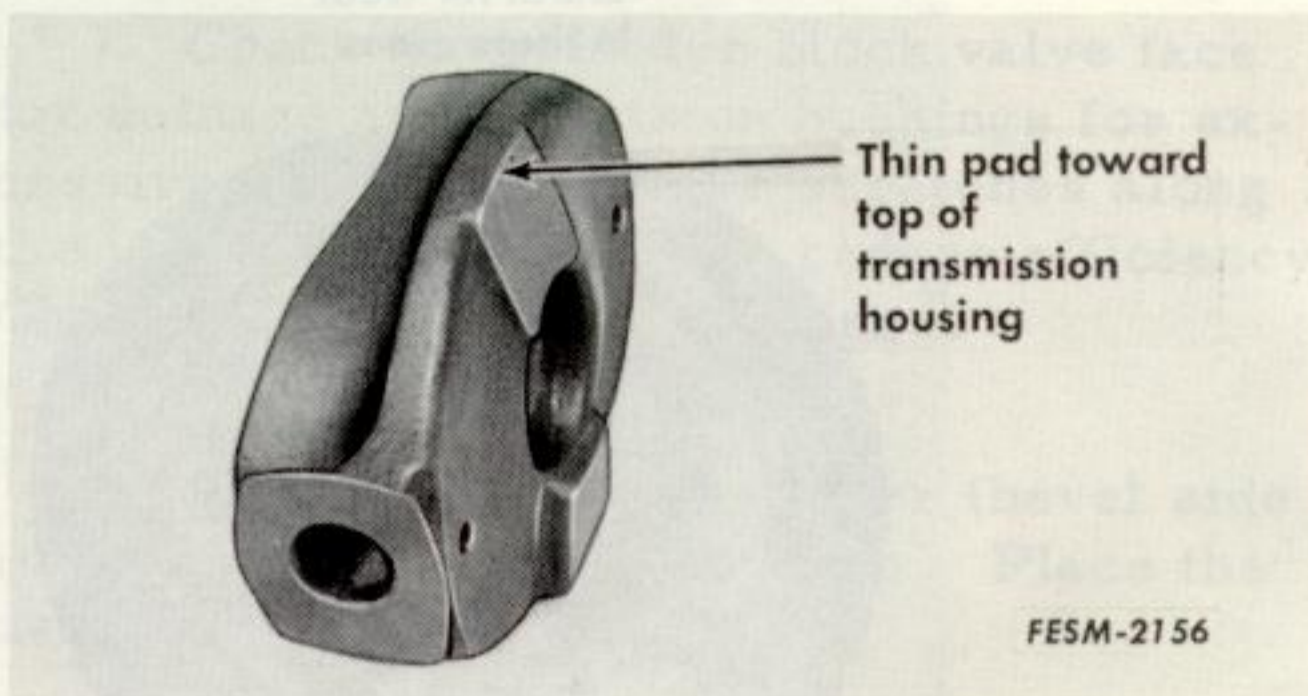
Reassembly

Reassembly is basically the reverse of disassembly however, particular attention should be given the following:

1. Thoroughly lubricate all parts in clean Hy-Tran. Pipe plugs in the center section housing showing leakage must be removed, doped (teflon tape on the threads is ideal) and reinstalled.

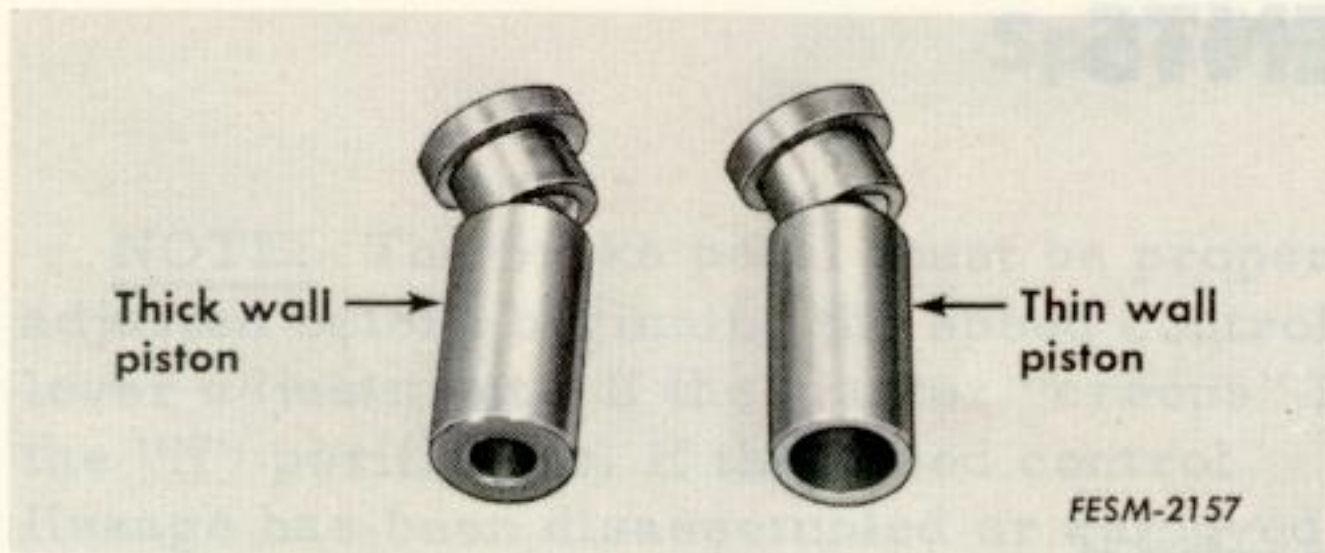
2. Be sure to install the pump swash plate with the thin pad (Illust. 23) toward the top of the transmission housing.

3. Use all new O-rings, seals and gaskets.



Illust. 23. Pump swash plate pads.

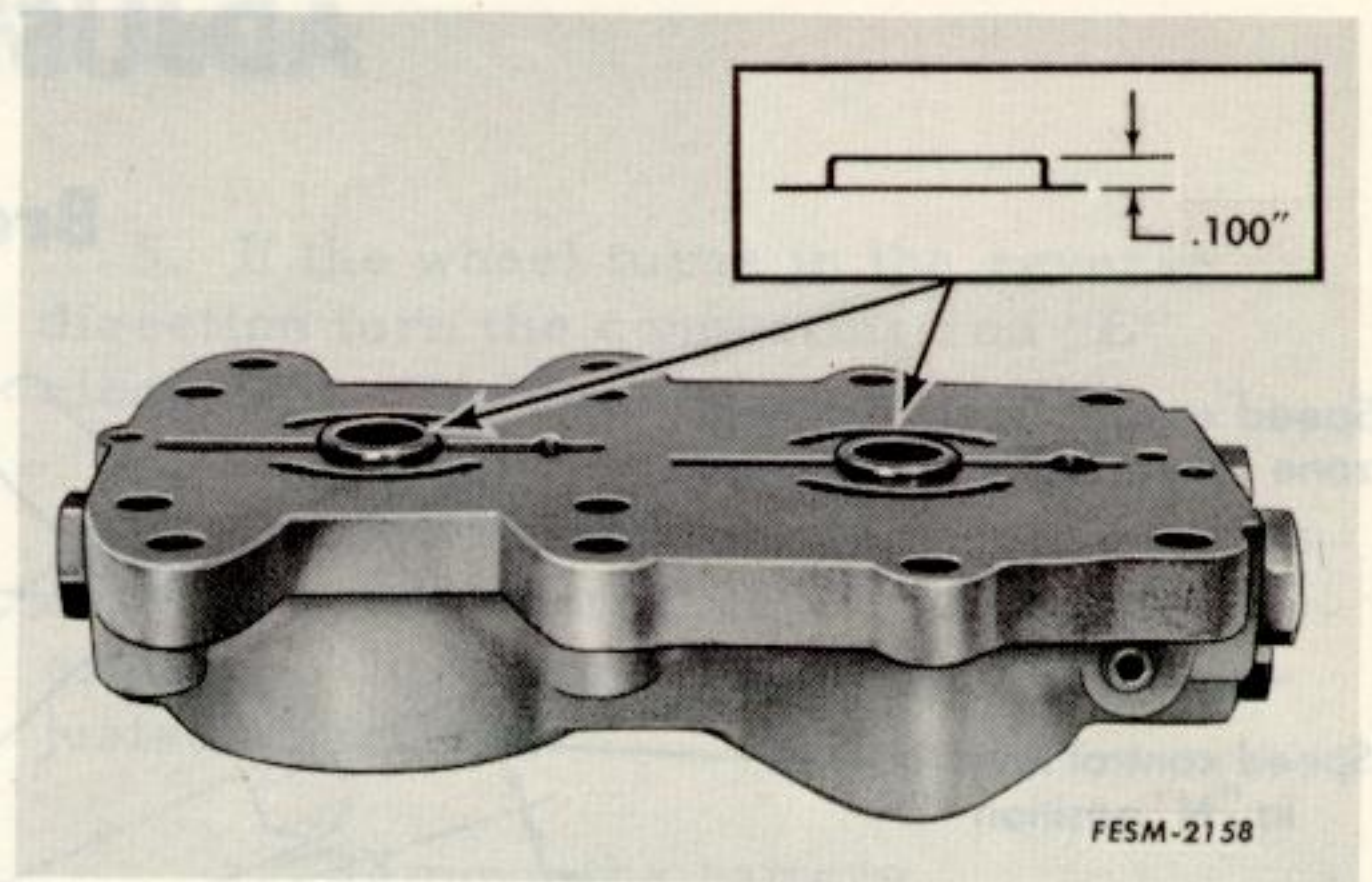
4. Pistons are interchangeable between the pump and motor block assemblies. The thickness of the piston slippers in the block assembly must not vary more than .002 inch of each other.



Illust. 24. Piston I.D.

Some units have thick wall pistons (Illust. 24). If it is necessary to replace one thick wall piston, the complete set (nine) in the block assembly must be replaced and then the remaining set (nine) of thick wall pistons must be used ONLY in pump block assembly.

The thin wall pistons (Illust. 24) can be serviced separately however all the slippers in a block assembly must be within .002 inch of each other.

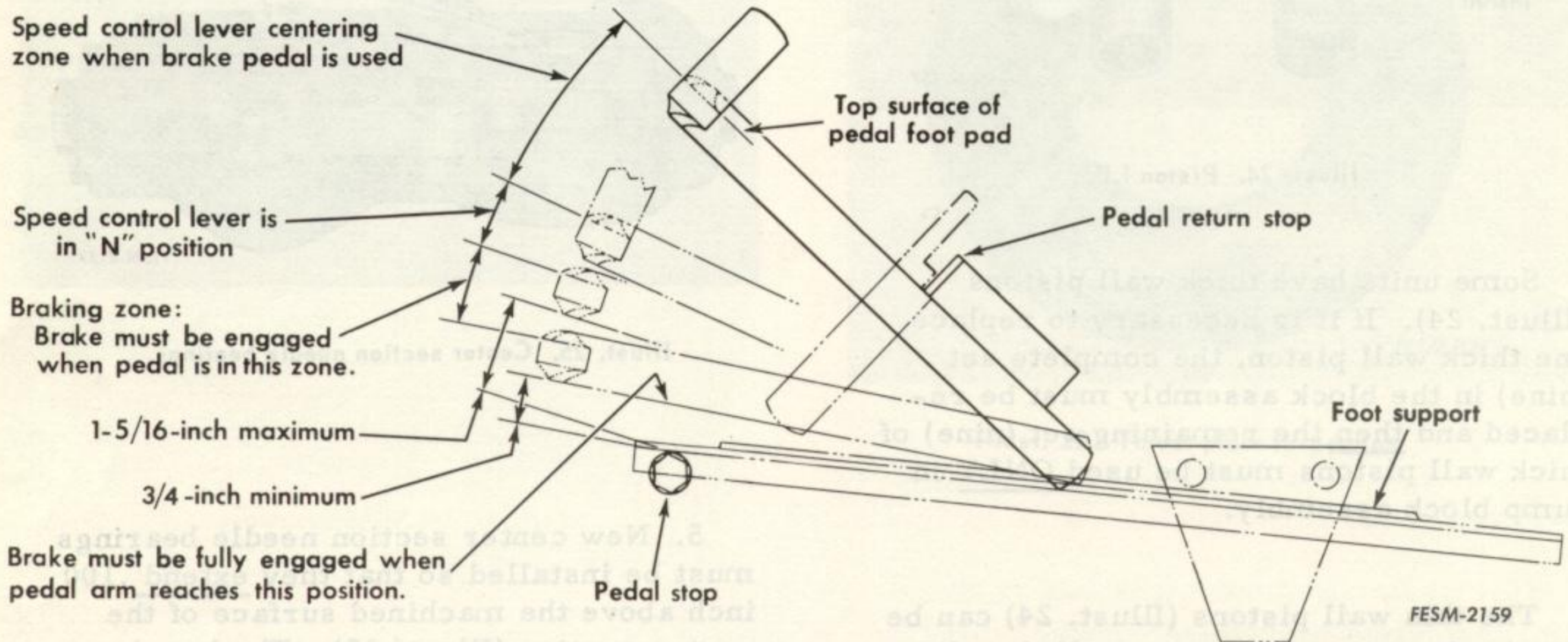


Illust. 25. Center section needle bearings.

5. New center section needle bearings must be installed so that they extend .100 inch above the machined surface of the center section (Illust. 25). The bearings "pilot" the valve plates when the unit is reassembled.

ADJUSTMENTS

Brake

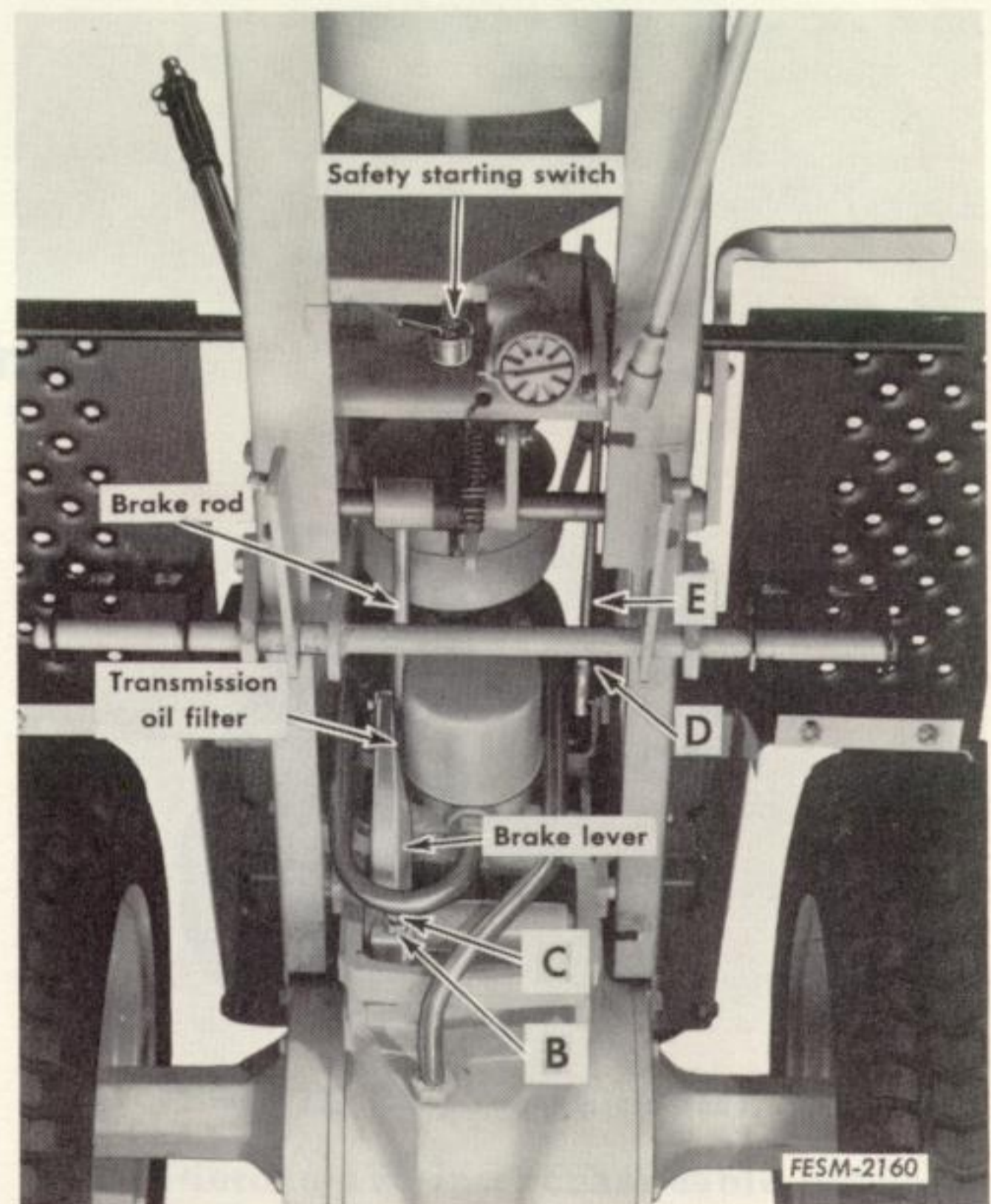


Illust. 26. Brake adjustments.

The brake should engage when the pedal arm is pressed down to within a maximum of 1-5/16 inches and a minimum of 3/4 inch distance above the top of the left foot support, which serves as the pedal stop. See Illust. 26.

It may be possible to push the pedal all the way down to the pedal stop, but this is of no concern as long as the brake is engaged when the pedal arm is at least 3/4 inch above the pedal stop.

To adjust the brake, loosen the jam nut "B" and turn the brake lever adjusting screw "C" (Illust. 27) in or out as required to get this measurement. The brake must not engage before the pedal arm is within the maximum distance of 1-5/16 inches above the pedal stop.



Illust. 27. Brake adjustments.

Speed Control Lever

NOTE: The brake pedal must be properly adjusted before beginning the speed control lever adjustment. If the tractor "creeps" in the "N" position or, if the speed control linkage has been disassembled or removed for any reason, the following adjustment must be made.

1. Block the tractor so the left rear wheel is off the ground.
2. Start the engine at half throttle or faster.
3. Move the speed control lever to the forward position. The rear wheel should rotate in the forward direction. Depress the brake pedal all the way down and release. The speed control lever should return to the "N" position and the rear wheel stop turning.
4. If the rear wheel turns in the forward direction, loosen jam nut "D" and turn the connecting rod "E" counterclockwise to lengthen it until the wheel stops turning. (See Illust. 27.)

5. If the wheel turns in the reverse direction turn the connecting rod "E" clockwise. Tighten the jam nut "D".

6. Proper friction adjustment is necessary on speed control lever for proper operation. The lever friction should be adjusted as follows:

- a. Remove the battery.
- b. Place a small wedge between the hand-control mounting bracket and the adjusting nut (foldout Illust. 28).
- c. Move the lever towards the "F" or forward position to tighten the nut.
- d. Remove the wedge.
- e. Check the friction adjustment with a fish scale. The reading should be 10 pounds when pulled in either direction from the offset in the lever.
- f. Replace the battery.

TROUBLE SHOOTING

If the tractor speed is erratic, that is, it will not creep but will suddenly accelerate, foreign material may be causing the check valves or the charge pump relief valve to stick open and close suddenly.

If the tractor will not move or moves slowly in both directions, a preliminary check of the power train can be made as follows:

1. Check the oil level. Check for suction line leak. Check for plugged oil filter.

2. Block the tractor so that the left rear wheel is off the ground and block the front wheels.

3. Remove the transmission case rear cover shield.

4. Depress both check valve spools (foldout Illust. 28) with the tow lever.

5. Start the engine and check the drive shaft rotation into the charge pump and out the rear of the transmission case for mechanical break down. "Work" the control lever to make sure there is no binding in the cam plate or linkage.

If the shaft does not turn, remove and overhaul the transmission. If the shaft is turning, continue with the following steps.

6. Check to see that both check valve spools have returned from the depressed position.

7. If neither valve spool returns "work" the speed control lever to make sure that no mechanical bind exists in the linkage, control cam and the control drive plate (foldout Illust. 28).

8. If both valve spools are still depressed, either the charge pump, the charge pump relief valve, or the check valves are at fault. Refer to pages 9, 10 and 11 for service of these components.

9. If only one valve spool returns, the tractor must be split and the defective check valve replaced.

NOTE: When the transmission has been removed from the tractor for service, check the condition of the final drive before reinstalling the transmission.

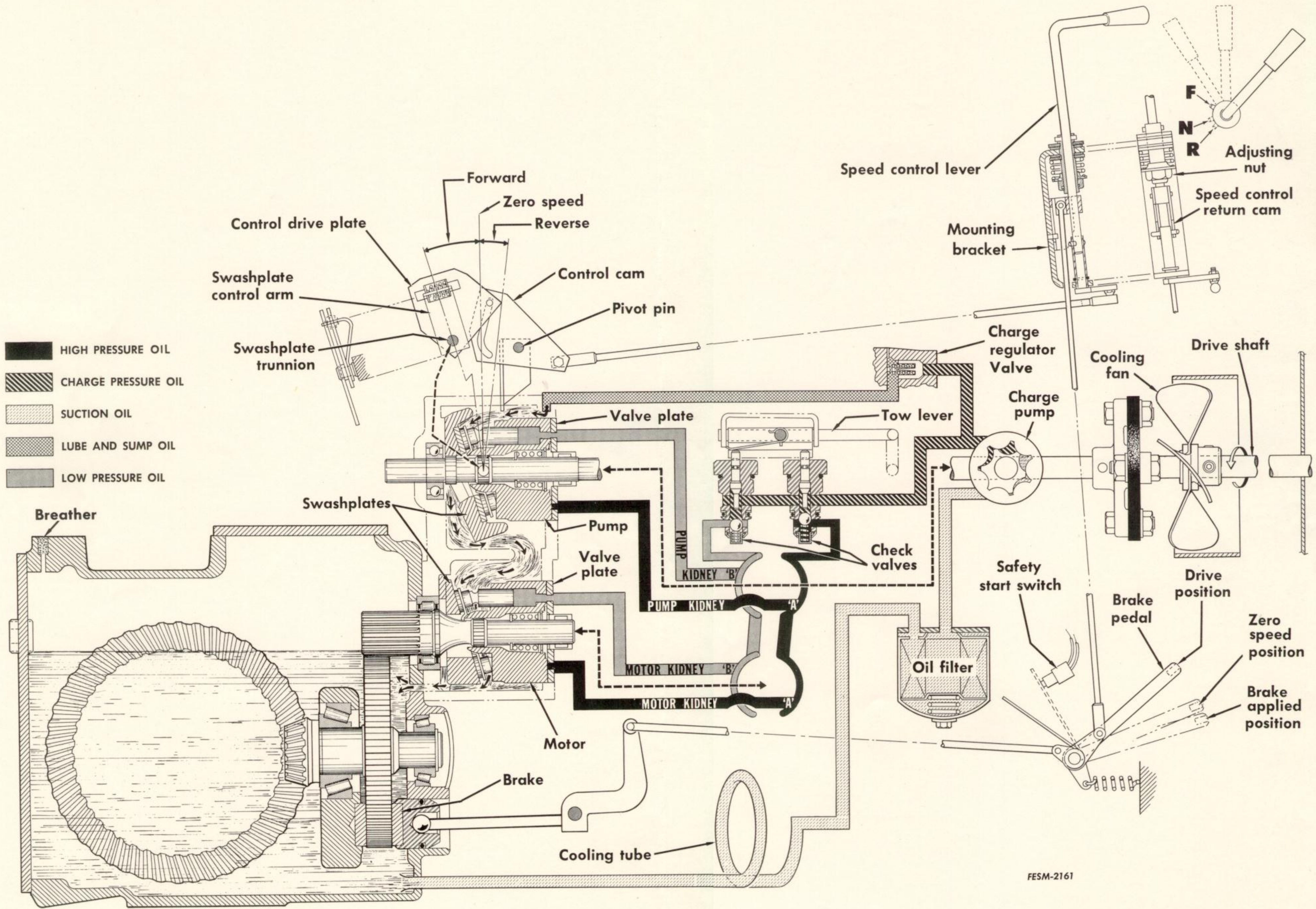


Illust. 28. Brake adjuster.

SERVICE BULLETIN RECORD

Important: Information in this manual section is subject to change or supplementing from time to time as a result of field experience and engineering modifications. As Service Bulletins are received, record them on this page for handy reference whenever this manual is to be used. . .Print entries in ink.

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Illust. 28. Schematic of hydrostatic transmission.

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