500 SERIES C
CRAWLER TRACTOR
(CHASSIS)

FORM
SM-500C

MARCH, 1976

(Replaces GSS-1418)

Due to a continuous program of research and development, some procedures, specifications and parts may be altered in a constant effort to improve machines.

Periodic revisions may be made to this publication and mailed automatically to distributors. It is recommended that customers contact their distributor for information on the latest revision.

PRINTED IN UNITED STATES OF AMERICA (0376)

General Contents

SPECIAL SERVICE TOOLS REQUIRED

SECTIONS 1 & 2	None Required
SECTION 3	
FES 50	Clutch service tool
SECTION 4	
	Pressure gauge (2), 0 to 100 psi capacity with 1/4 inch NPT male fitting. (Obtain locally.)
FES 123-5	Connector (2), 396 425 R91 (Order from parts depot)
FES 96-3	Connector (2)
9402 706	Connector (2), (Order from parts depot)
SECTION 5	
*OTC 915	Gear and pulley puller
SECTION 6	
FES 115-2	Thermomelt stik pencil
SECTION 7	
FES 50	Clutch service tool
SECTION 8	
*OTC 952	Puller attachment
FES 143-1	Aligning dowel - 3 required
SECTION 9	
FES 57-3	O-ring tool
*OTC 950	Puller
*OTC 530-7	Step plate
*OTC 620-11	Step plate
SECTION 10	None Required
SECTION 11	
FES 2-10	Connector - 2 required (9 410 204, order from parts depot)
FES 2-45	Connector - 2 required (573 206 R1, order from parts depot)
FES 2-50	Connector (394 981 R1, order from parts depot)
FES 2-51	Elbow (633 460 R91, order from parts depot)
FES 2-52	Hose assembly - 2 required (470 251 R91, order from parts depot)
FES 2-53	Union - 2 required (584 802 R1, order from parts depot)
FES 51D	Hydraulic Flo-Rater

FES 57-3	O-ring
FES 76	Hose assembly
FES 98-25	Tee
677 732 R91	Power beyond conversion kit (Order from parts depot)

SECTION 12

FES 118	Portable tachometer
3132 915 R91	Tachometer angle drive (Order from parts depot)

Refer to the Farm and Industrial Equipment Service Tool Manual GSS-1251 for "FES" tool ordering information.

*Purchase "OTC" tools locally, or order from:

Service Tools Inc.
1901 South Indiana Ave.
Chicago, Illinois 60616

STANDARD TORQUE DATA FOR NUTS AND BOLTS

Recommended torque, in foot pounds, for all Standard Application Nuts and Bolts, provided:

A. All thread surfaces are clean and lubricated with SAE-30 engine oil. (See NOTE.)
B. Joints are rigid, that is, no gaskets or compressible materials are used.
C. When reusing nuts or bolts use minimum torque values.

NOTE: Multiply the standard torque by:

.65 when finished jam nuts are used.
.70 when Molykote, white lead or similar mixtures are used as lubricants.
.75 when parkerized bolts or nuts are used.
.85 when cadmium plated bolts or nuts and zinc bolts w/waxed zinc nuts are used.
.90 when hardened surfaces are used under the nut or bolt head.

Bolt or Stud Diameter	Type 1 Studs Only		Type 1 Bolts 6" length or less		Type 1 Bolts longer than 6"		Type 5 (all lengths)		Type 8 (all lengths) Only when used† in cast (gray) iron		Type 8 (all lengths) All other applications	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
1/4	5	6	5	6	3	3	9	10	11	13	12	14
5/16	12	13	12	13	6	7	19	21	24	27	27	30
3/8	21	24	21	24	11	13	33	37	43	47	45	50
7/16	35	38	35	38	19	21	53	60	69	76	75	85
1/2	52	58	52	58	29	32	80	90	104	117	115	130
9/16	70	80	70	80	41	46	115	130	150	170	165	185
5/8	98	110	98	110	57	63	160	180	210	230	220	250
3/4	174	195	174	195	100	112	290	320	350	390	400	450
7/8	300	330	162	181	162	181	420	470	570	630	650	730
1	420	470	250	270	250	270	630	710	850	950	970	1090
1-1/8	600	660	350	380	350	380	850	950	1200	1350	1380	1550
1-1/4	840	940	490	540	490	540	1200	1350	1700	1900	1940	2180
1-3/8	1100	1230	640	710	640	710	1570	1760	2300	2500	2600	2800
1-1/2	1470	1640	850	940	850	940	2000	2300	3000	3300	3300	3700
1-3/4	2350	2450	1330	1490	1330	1490	3300	3700	4700	5200	5300	6000
2	3500	3900	2000	2200	2000	2200	5000	5500	7000	7800	8000	9000

† When bolt penetration is 1-1/2 times the diameter of the bolt.

BOLT TYPE IDENTIFICATION CHART

IH TYPE	S.A.E. GRADE	DESCRIPTION	BOLT HEAD MARKING *
1	Equivalent 1 or 2	WILL HAVE A IH STANDARD MONOGRAM IN THE CENTER OF THE HEAD Low or Medium Carbon Steel Not Heat Treated	
5	5	WILL HAVE A IH AND 3 RADIAL LINES Quenched and Tempered Medium Carbon Steel	
8	8	WILL HAVE A IH AND 6 RADIAL LINES Quenched and Tempered Special Carbon or Alloy Steel	

*The center marking identifies the bolt manufacturer. The IH monogram is currently used. Some bolts may still have an IH or a raised dot which previously identified IH bolts.

STANDARD TORQUE DATA
FOR HYDRAULIC TUBES AND FITTINGS

TUBE NUTS FOR 37° FLARED FITTINGS				
SIZE	TUBING O.D.	THREAD SIZE	TORQUE - FT. LBS.	
			MIN.	MAX.
4	1/4	7/16-20	10	20
5	5/16	1/2-20	15	25
6	3/8	9/16-18	25	35
8	1/2	3/4-16	40	55
10	5/8	7/8-14	55	75
12	3/4	1-1/16-12	75	95
14	7/8	1-3/16-12	95	115
16	1	1-5/16-12	115	145
20	1-1/4	1-5/8-12	150	180
24	1-1/2	1-7/8-12	200	250
32	2	2-1/2-12	300	350

O-RING BOSS PLUGS & SWIVEL NUTS JIC - 37° SEAT TORQUE - FT. LBS.	
MIN.	MAX.
6	10
10	15
15	20
25	30
35	40
60	70
70	80
80	90
95	115
120	140
250	300

Above torque figures are recommended for plain, cadmium or zinc plated fittings, dry or wet installations.

Swivel nuts either swaged or brazed.

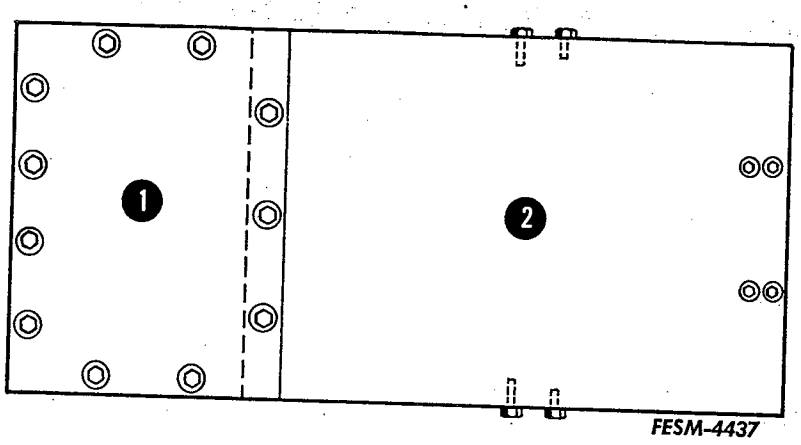
These torques are not recommended for tubes with wall thickness of .035 or less.

Section 1

ENGINE REMOVAL AND INSTALLATION

CONTENTS

REMOVAL



1. Crankcase guard
2. Transmission guard

1. Remove the capscrews securing the crankcase guard to the tractor frame and transmission guard, allowing it to drop onto the frame brackets. Then remove the crankcase guard from the front of the tractor.

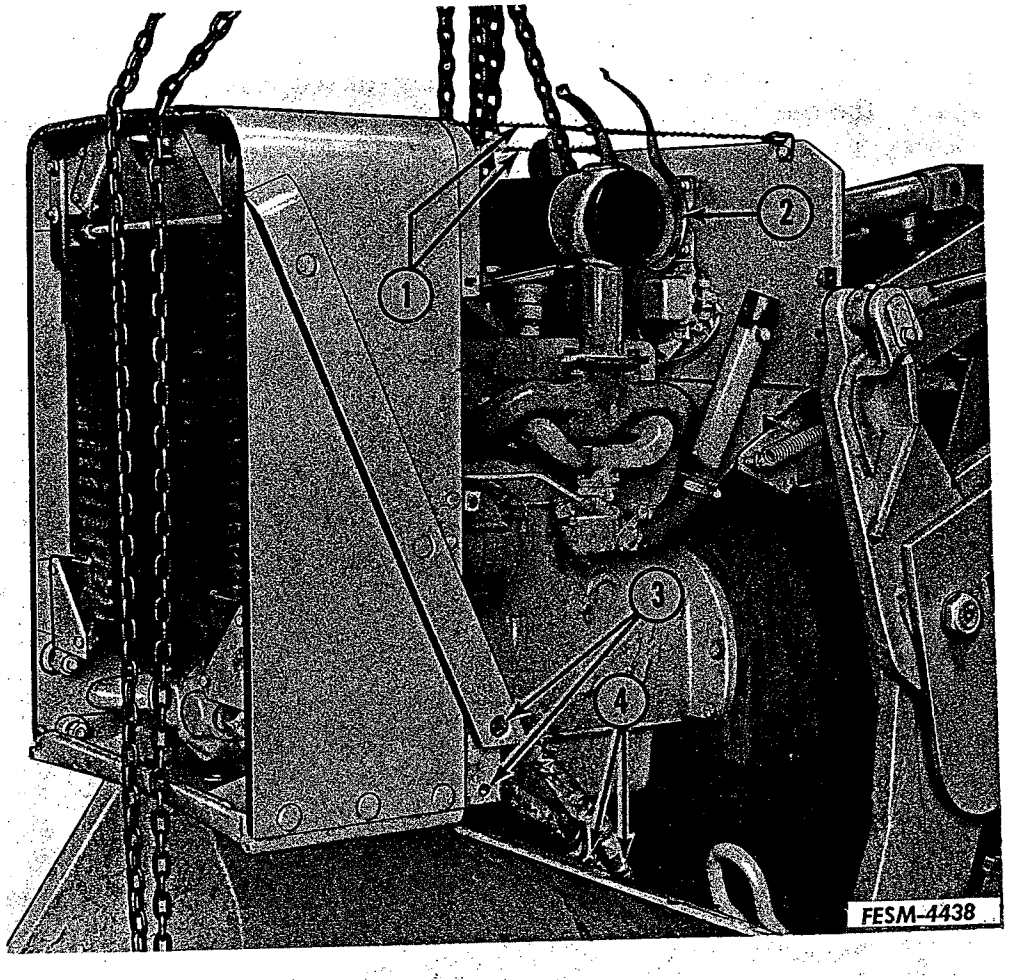
NOTE: If the capscrew heads are worn making removal with a wrench impossible, weld short capscrews to the worn heads to aid removal.

2. Remove the capscrews securing the rear of the transmission guard to the tractor. Then, using a floor jack to support the guard, remove the side bolts, and remove the transmission guard from the rear.

3. Steam clean the tractor and guards.

4. Remove the grill guard. Then remove the engine hood with air intake and exhaust pipes.

5. Drain the transmission cases and the hydraulic reservoir.



1. Battery support wire
2. Air cleaner removed
3. Front mounting bolts removed
4. Power shift reverser oil cooler lines

6. Remove the complete air cleaner assembly.

7. Wire the battery support to the radiator housing to support the weight of the batteries.

NOTE: Use a double strand of wire. Twist the strands with a punch to hold the support firmly.

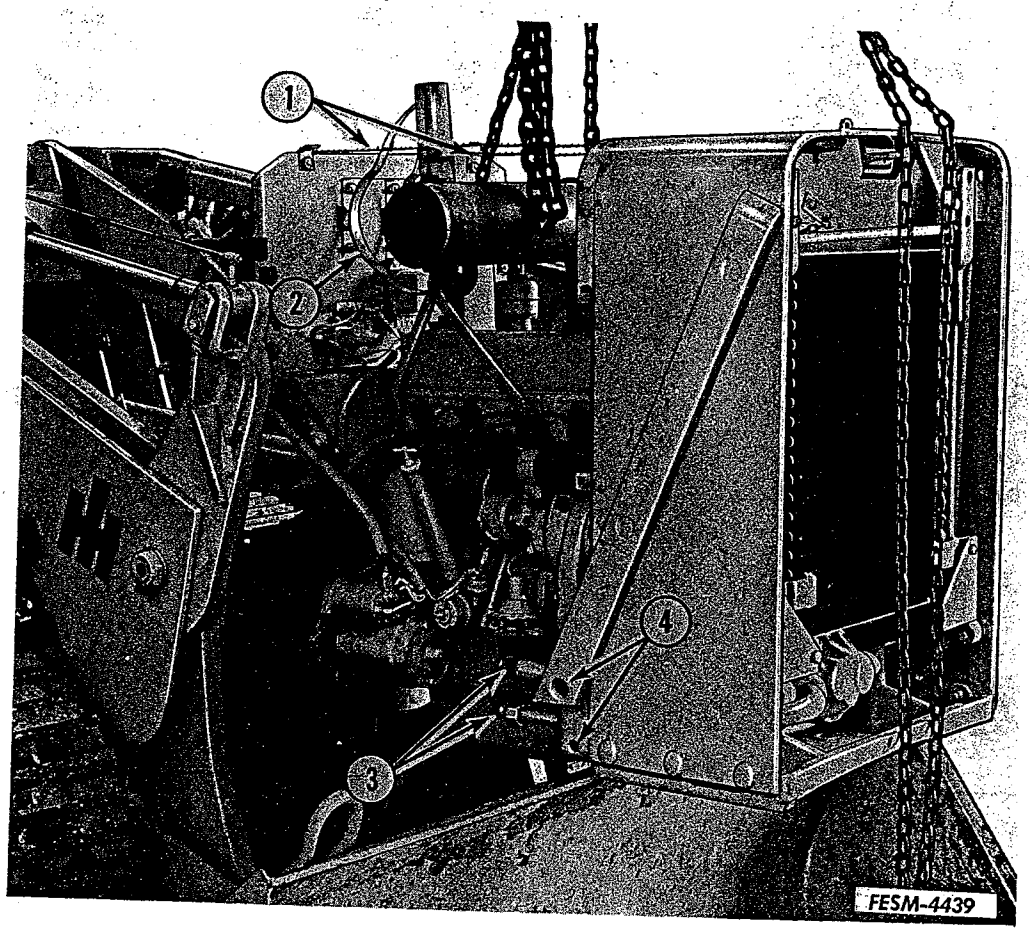
8. Disconnect the transmission and equipment hydraulic cooler hoses and drain the coolers, if so equipped.

9. Disconnect the oil cooler lines on the left side of the engine, if so equipped. Cap the open lines.

NOTE: There are three oil cooler lines on the left side of tractors equipped with an equipment hydraulic cooler.

10. Remove the decelerator or power control pedal mounting bracket if so equipped. Remove the deck plates.

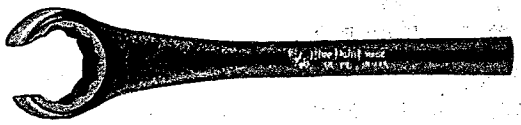
11. Disconnect the power control linkage at the valve if so equipped, and wire the pedal assembly out of the way.



1. Battery support wire
2. Air cleaner removed
3. Hydraulic pump lines
4. Front mounting bolts removed

12. Loosen the suction line hose clamps on the right side of the engine and transmission. Move the hose rearward to gain access to the pressure line(s).

13. Disconnect the hydraulic pump pressure line and the equipment hydraulic cooler line, if so equipped. Seal the open lines.



FESM-4440

NOTE: To simplify disconnecting and connecting the high pressure line(s), use a Snap-On RX-30 (1-5/16 inch) tube wrench or equivalent.

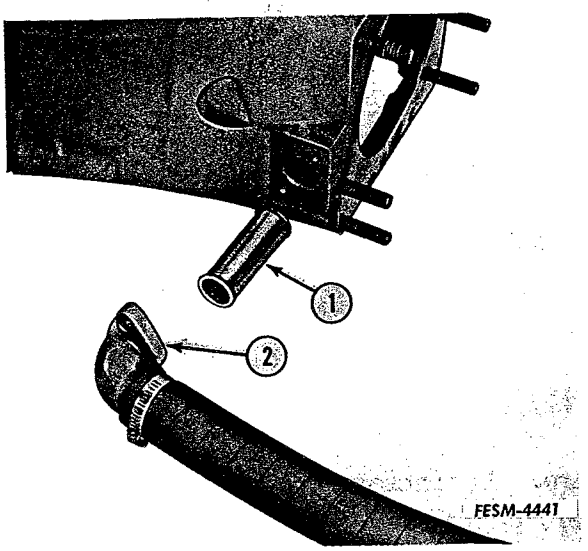
14. Disconnect electrical wiring as required.

15. Disconnect the fuel lines and engine controls as required.

16. Seal the open lines.

17. Remove the flywheel housing dust cover.

18. Remove the reverser charge pump suction line elbow and cross-over tube from the flywheel housing. (Power shift models only.)



FESM-4441

1. Cross-over tube
2. Elbow

19. Support the engine with a chain as follows:

a. Diesel engine — use the shackles provided.

b. Gasoline engine — use the valve cover studs.

Remove the four bolts holding the front bolster to the frame.

NOTE: Early model machines use a carriage type bolt in the lower holes securing the front bolster to the frame. Removal and replacement of these carriage bolts will be simplified if they are cut off and replaced with 5/8 x 2 inch capscrews with 21/32 x 1-1/2 inch 16 gauge flat washers. Refer to the parts catalog for ordering information.

20. Remove the stud nuts and the two capscrews on the bottom (inside the flywheel housing), holding the flywheel housing to the reverser or gear drive housing.

21. Support the rear of the engine with a rolling floor jack. Use a wooden block between the jack and the flywheel housing, and adjust the chain so that the jack will partially support the rear of the engine.

IMPORTANT: The engine assembly must be separated from the power shift reverser or gear drive housing in a horizontal position. If the rear of the engine drops down during removal, damage to the transmission drive shaft or the reverser drive shaft and torque converter extension drive tangs may result.

22. TRACTORS EQUIPPED WITH TORQUE CONVERTER:

a. Remove the capscrews which secure flex plate to the flywheel. Pry the flex plate to the rear to insure that the torque converter pilot shaft is not stuck to the flywheel.

b. Support the torque converter and move the engine forward 6 to 12 inches. Remove the torque converter drain, and set aside on the flexplate, with the drive tangs facing upward.

23. Move the engine forward, and out of the chassis. Block it in an upright position.

IMPORTANT: Do not support the engine assembly on the oil pan.

NOTE: Refer to the following manuals for engine service:

GSS-1377-H, D-155 Diesel Engine and Fuel System.

GSS-1295-J, C-146 Gasoline Engine.

INSTALLATION

Reverse the removal procedure. On tractors equipped with torque converter, pay particular attention to the following steps:

Tractors Equipped with Torque Converter

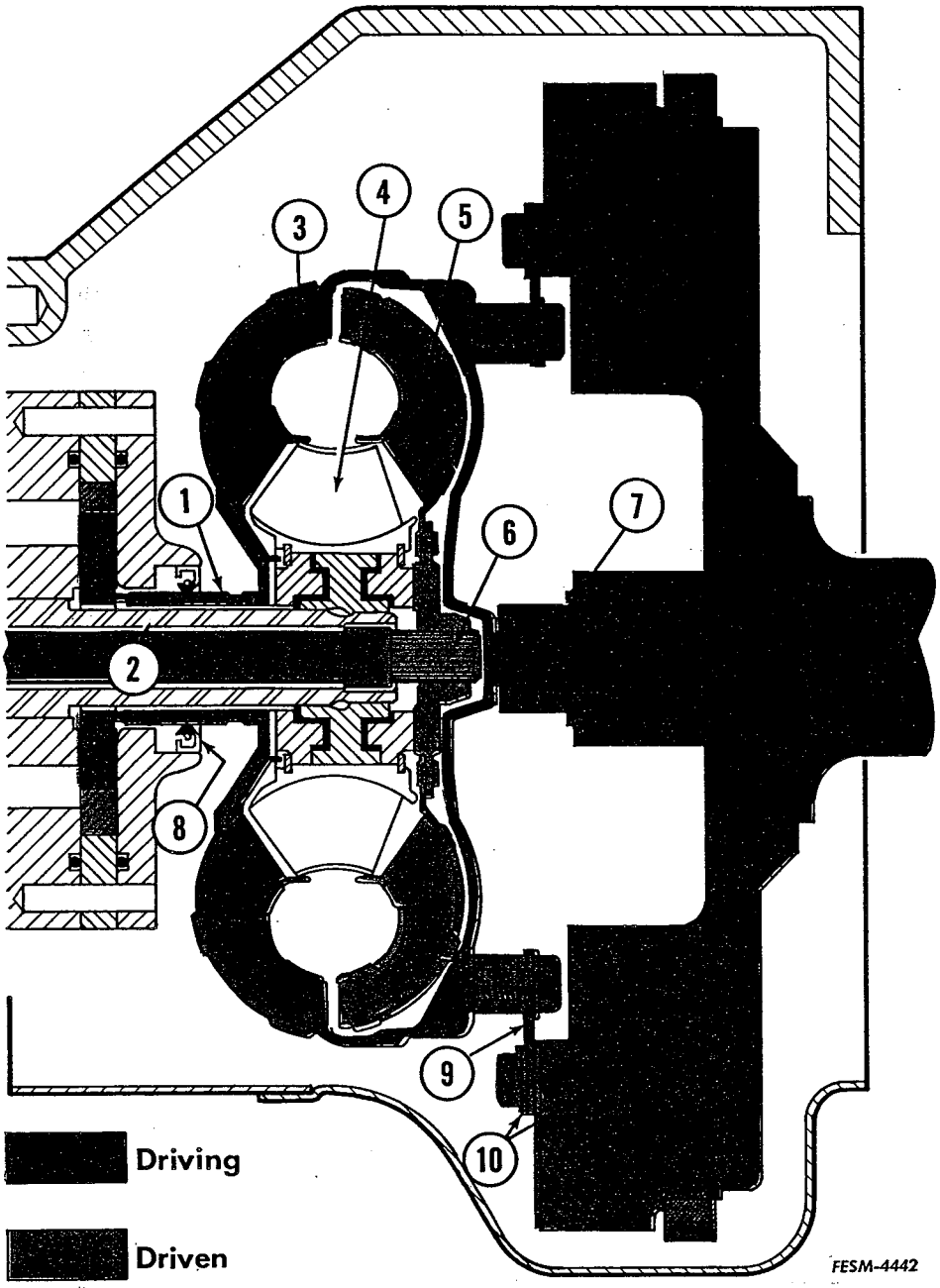
1. Inspect the charge pump seal for leakage. If pump leakage is evident, refer to Section 4, and replace the seal and bushing as necessary.

2. Inspect the flex plate for distortion, cracks and elongated holes. Replace the flex plate if necessary. Install the special convex washers on each side of the flex plate, convex side toward the plate using IH Plasti-Gasket, and coat the pilot shaft with IH Never Seeze.

NOTE: Gluing the washers will prevent loss and aid torque converter installation.

3. As the engine is being moved into position, install the torque converter in the flywheel housing on the reverser drive shaft, and engage the converter drive tangs in the charge pump. Align the torque converter pilot shaft with the pilot bore in the flywheel and secure the flywheel housing to the reverser.

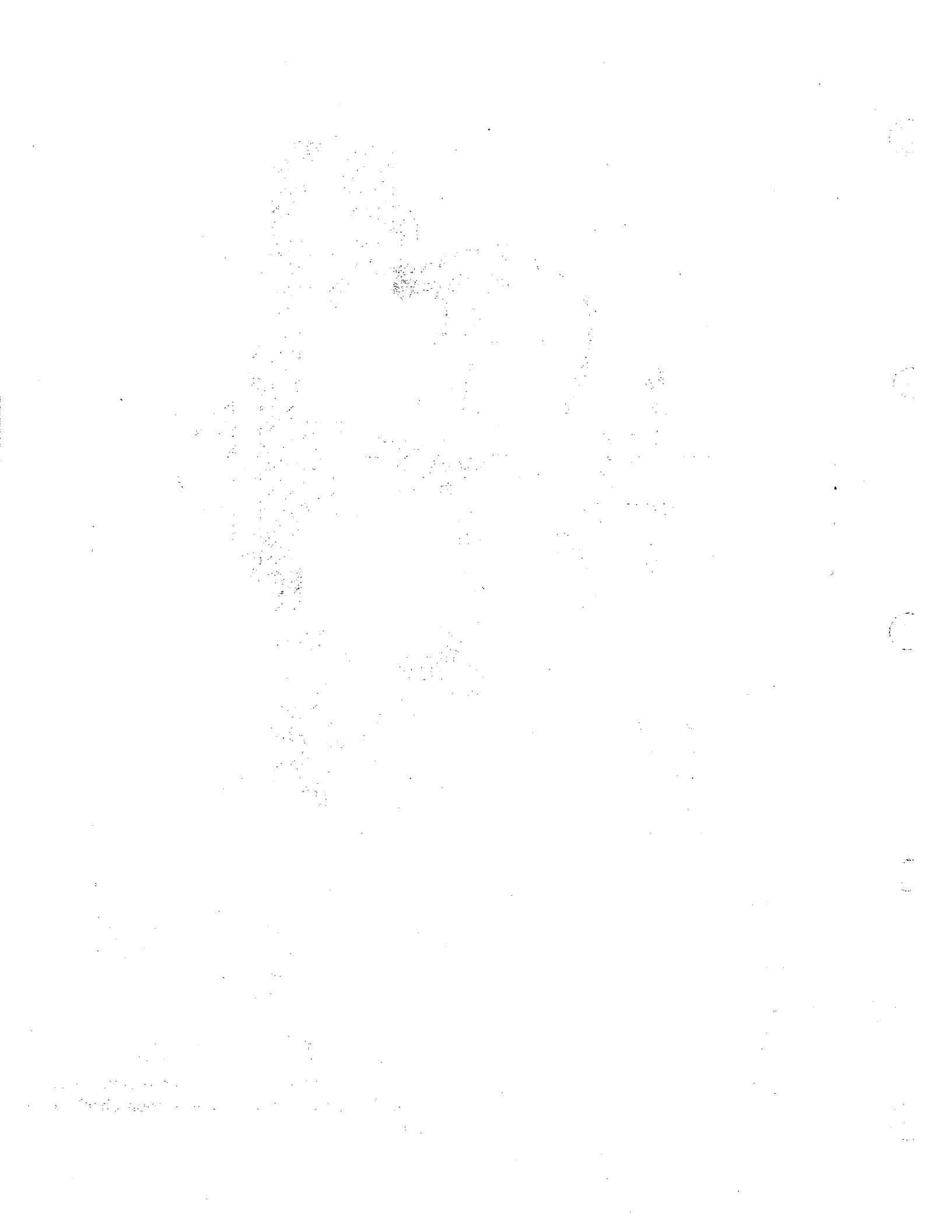
IMPORTANT: Do not use the flywheel housing studs to draw the housings together, as damage to the torque converter and charge pump may occur. If difficulty is encountered, check torque converter pilot shaft alignment to the bore in the flywheel.

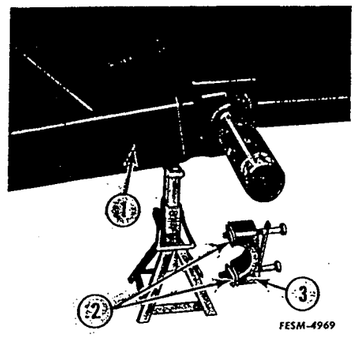


1. Charge pump drive tangs
2. Stator support tube
3. Impeller
4. Stator
5. Turbine
6. Reverser drive shaft
7. Converter pilot shaft
8. Charge pump seal
9. Flex plate
10. Convex washers

4. Torque to mounting studs to 220 ft. lbs. and the two mounting bolts to 170 ft. lbs. Then rotate the converter to insure that it is free to turn, and bolt the flex plate to the flywheel. Torque the capscrews to 85 ft. lbs.

IMPORTANT: Do not install the flex plate to flywheel capscrews until after the flywheel housing is bolted to the reverser, and the torque converter has been checked for freedom of movement.

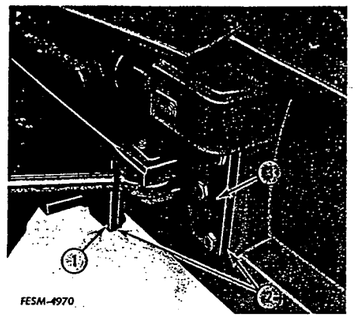




1. Bullgrader frame
2. Shims
3. Trunnion clamp (2)

Shims are used on the bullgrader frame trunnion clamps, the tilt pivot clamp bars, and the tilt clamp bars to adjust operating clearances.

As wear occurs, remove shims to reduce operating clearances.



1. Tilt pivot clamp (2)
2. Shims
3. Tilt clamp (2)

LOADER TILT LEVER WEAR SHIMS

1. Disconnect the bucket cylinder and tilt link from the tilt lever.

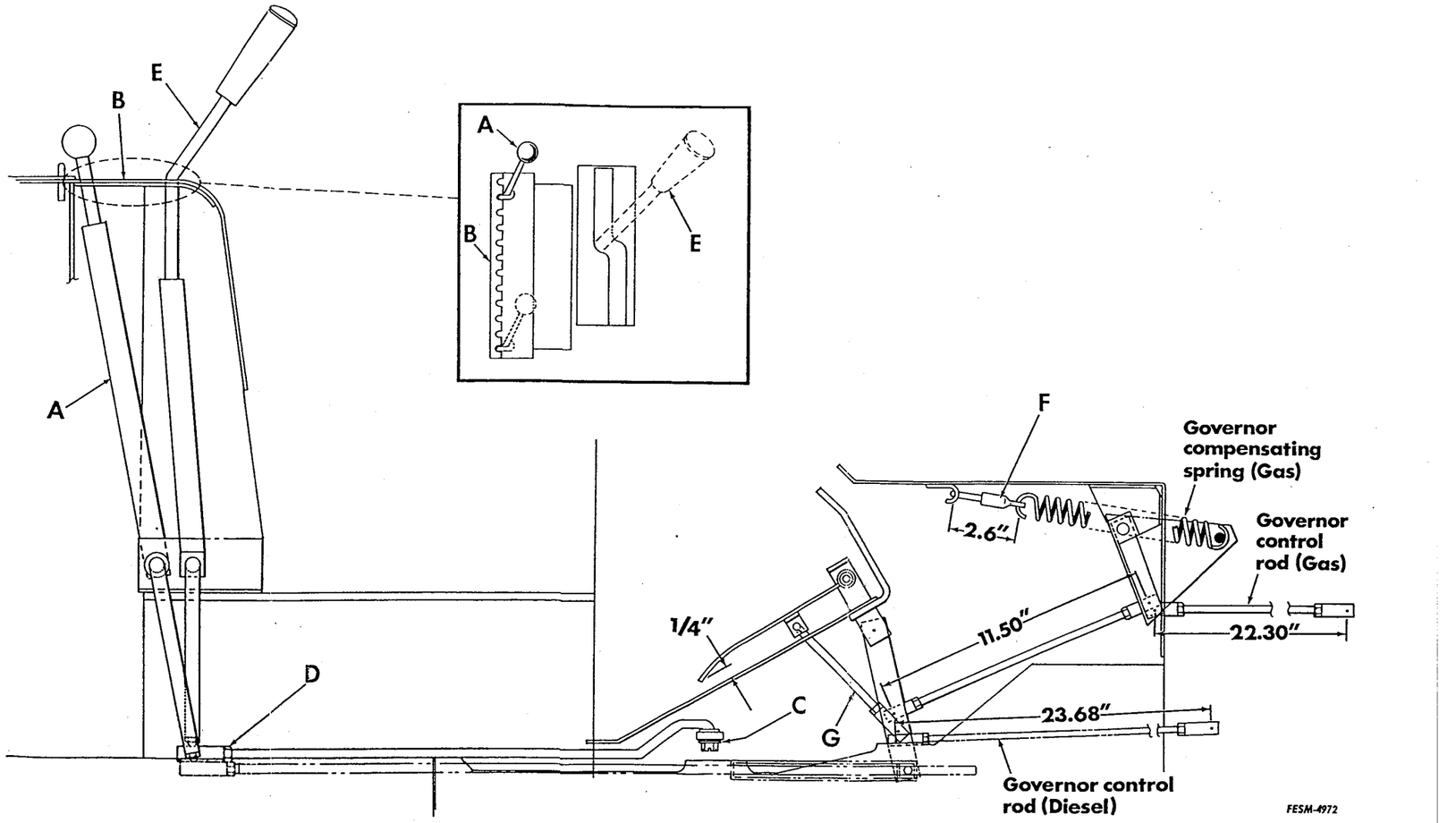
2. Measure lever endplay with a feeler gauge. Endplay must not exceed .030 inch.

3. Subtract shims from the pivot bolt as necessary. Then torque the pivot shaft nut to 40 ft. lbs. and recheck endplay.

IMPORTANT: The tilt arm must pivot freely. If binding occurs, replace the pivot bushing and pin as necessary.

4. Torque the pivot shaft nut to 300 ft. lbs.

THROTTLE, DECELERATOR, AND DIRECTIONAL CONTROL LINKAGE DIAGRAM (Fold-out No. 1)



Section 2

COOLING SYSTEM

CONTENTS

GENERAL DESCRIPTION

The cooling system dissipates heat generated during engine, power shift reverser, and hydraulic system operation.

The engine radiator and coolers are mounted in front of the engine, and are air cooled by air from the engine mounted fan.

Fan

The cooling system may be equipped with either a conventional suction fan or a blower fan. The suction fan pulls air through the radiator, discharging to the rear; whereas the blower fan pushes air through the radiator, discharging to the front.

The suction fan is preferred for cooling efficiency and power requirement. Less cool air drawn from the front of the tractor is required to equal the cooling effect of a blower fan, which draws heated air from the engine compartment.

The blower fan is preferred for operator comfort when operating a bullgrader or loader in loose dry materials. Dirt particles picked up by the fan blades are discharged away from the operator.

The blower fan is not available on tractors equipped with a backhoe. During backhoe operation, engine and hydraulic cooling is of primary importance. The suction fanprovides maximum cooling efficiency, and the operator's position eliminates discomfort.

Sand Screen

A sand screen is available for tractors equipped with the blower fan. The sand screen, which mounts on the back side of the radiator, reduces the sand blasting effect on the radiator fins, thereby maintaining radiator cooling efficiency.

Engine

The engine cooling system is a conventional pressurized system. Refer to service manual GSS-1333 Tractor Maintenance and Tune-up for information on cooling system components. Water pump and thermostat service are covered in the following manuals:

GSS-1377-H, D-155 Diesel Engine and Fuel System.

GSS-1295-J, C-146 Gasoline Engine.

Transmission

The transmission oil cooler, when used, is mounted in front of the radiator. It is mounted on hinges, so that it may be swung down for cleaning the radiator and cooler.

On tractors equipped with torque converter, the cooler receives return fluid from the torque converter, and discharges it to the reverser housing. Cooler pressure is limited by the reverser apply pressure regulator and the torque converter pressure relief valve.

On tractors equipped with the power shift reverser but without the torque converter, the cooler receives full charge pump flow and discharges it to the reverser control valve. Excessive cooler pressure is prevented by the cooler differential relief valve in the charge pump outlet manifold.

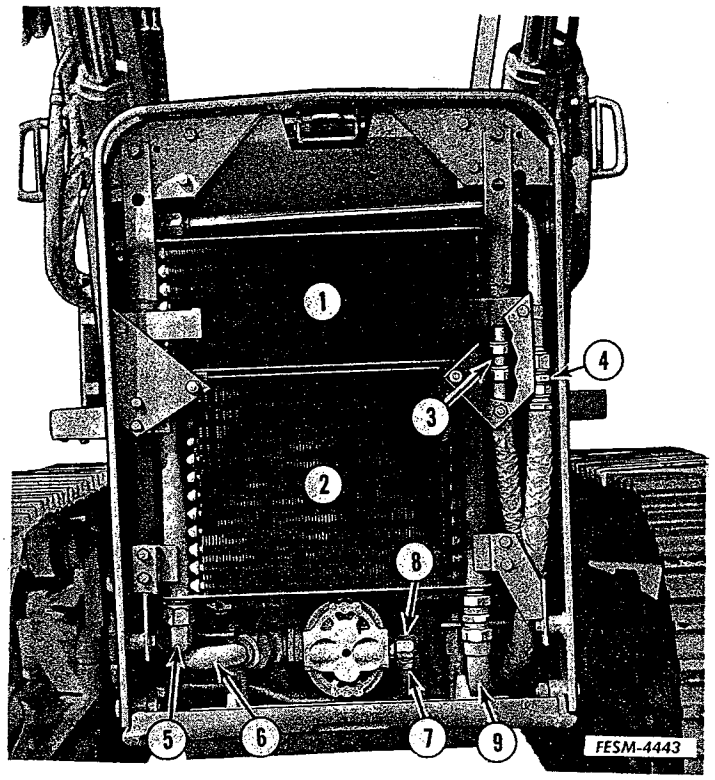
Hydraulic Equipment

The equipment hydraulic cooler is used only when a backhoe is mounted on the tractor. It may be mounted alone in front of the radiator, or below the power shift reverser transmission oil cooler, on tractors without torque converter.

The equipment hydraulic and torque converter transmission coolers cannot be mounted together on one tractor. Therefore, the backhoe is not mounted on a tractor equipped with torque converter.

The equipment hydraulic cooler receives all fluid returning from the backhoe control valves, and discharges it to the hydraulic reservoir.

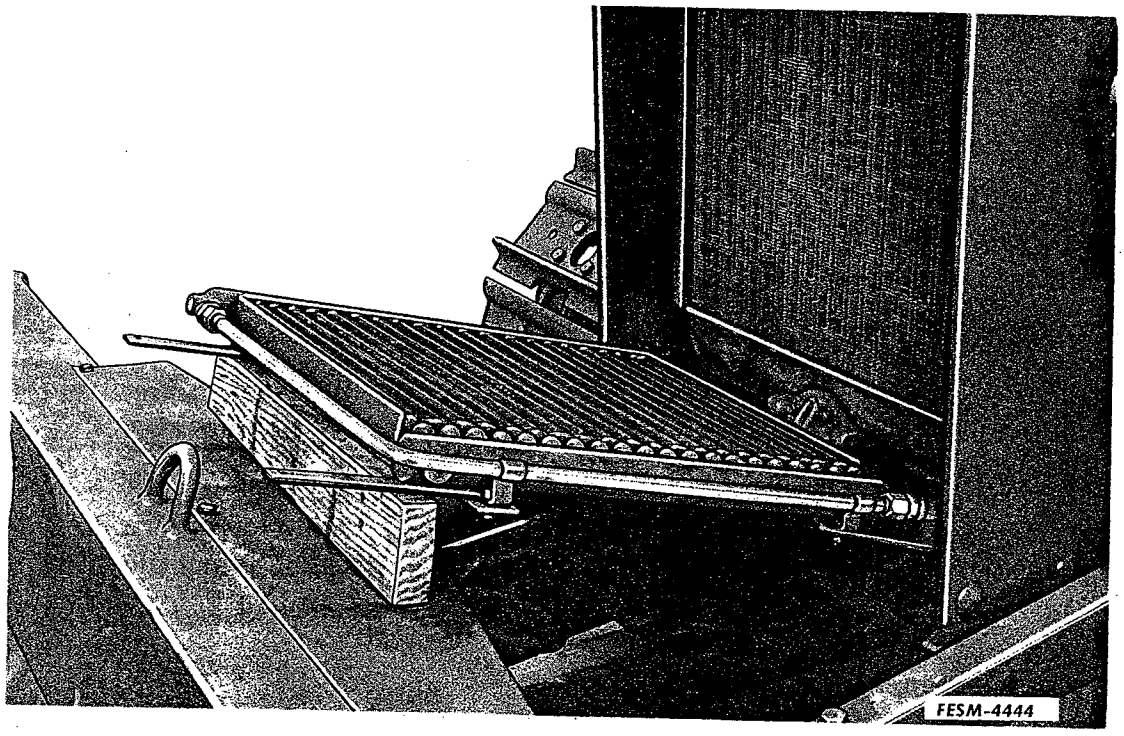
RADIATOR AND COOLER-REMOVAL AND INSTALLATION



Remove the radiator and coolers in the following sequence. Installation is the reverse of the removal procedure.

1. Transmission cooler
2. Equipment hydraulic cooler
3. Transmission cooler - in
4. Transmission cooler - out
5. Equipment cooler - out
6. Pump suction
7. 10 gpm pump - out
8. 17 gpm pump - out
9. Equipment cooler - in

Transmission Oil Cooler



1. Remove the radiator grill.

2. Remove the capscrews and restraining chain at the top of the transmission cooler.

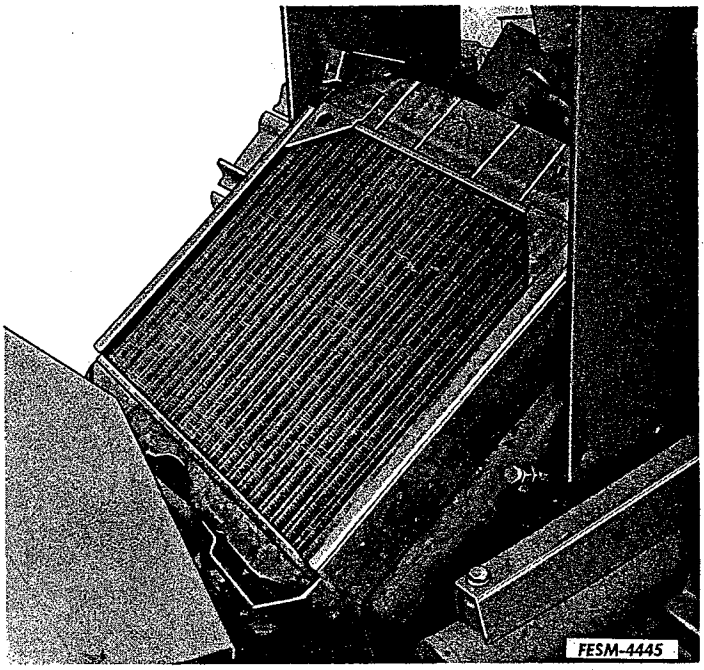
3. Fold the cooler down. Remove the cooler lines and seal the open lines.

4. Remove the transmission cooler hinge bolts and bushings. Remove the transmission cooler.

Equipment Hydraulic Cooler

Remove the cooler lines and seal them. Remove the mounting bolts, and remove the cooler.

Radiator



1. Drain the radiator and remove the hoses.

2. Remove the radiator mounting bolts. Work the bottom of the radiator up and out; and remove the radiator from the tractor.

RADIATOR AND COOLER-SERVICE PROCEDURE

Radiator and cooler service procedure is identical. It is recommended that service be performed by a qualified radiator repair specialist.

1. Inspect the assembly for sand blasting damage. If sand blasting has occurred, the radiator must be replaced.

2. RADIATOR ONLY: Remove the shrouding and sand screen, if so equipped. Remove debris from the radiator fins with compressed air, and boil the radiator out to rid the core of mineral deposits, rust and scale.

3. Plug the assembly, submerge in water, and check for leaks.

4. Repair or replace the damaged assembly.

5. Inspect the fan blades and shrouding for damage, and the water pump seal for leakage. Replace the fan if bent or worn as a result of sand blasting. Repair the shroud as necessary.

6. Replace the coolant hoses, engine thermostat, and radiator cap, if necessary.

7. Inspect the radiator side seals. Replace oil soaked and damaged seals. Use an automotive trim adhesive such as 3M Cement No. 1711 to glue the side seals to the radiator housing.

Section 3

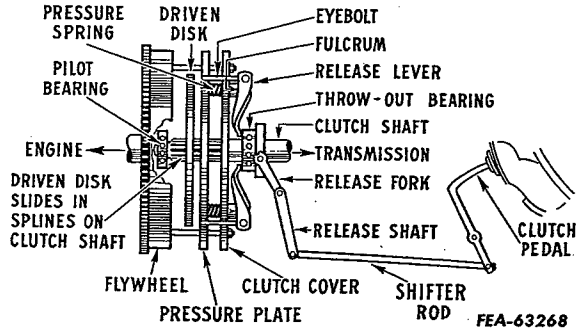
ENGINE CLUTCH

CONTENTS

SPECIFICATIONS

Manufacturer	Rockford clutch
Type	Single dry disc
Size - inches	11
Clutch pedal free travel - inches	1-1/8
Flywheel allowable wear (maximum) - inch	.040
Driven member	
Thickness (new) - inch	.351 to .367
Allowable wear (maximum) - inch	.125
Allowable warping (maximum) - inch	.040
Pressure plate allowable wear and warping (maximum) - inch	.020
Clutch springs	
Number	9
Color Code	Yellow
Free length - inches	2.156
Test length - inches	1-7/16
Test load - lbs.	155
Release levers	
Pivot block jam nut torque - ft. lbs.	40
Height adjustment - inches	1.645
With back plate to pressure plate dimension - inch	.355
Release lever adjustment using FES 50 clutch tool	
Gauge block and spacer	No. 21
Use with 3, 1 inch spacer blocks between the base plate and clutch pressure plate.	

GENERAL DESCRIPTION



Schematic view of a spring-loaded, single-plate clutch in the disengaged position.

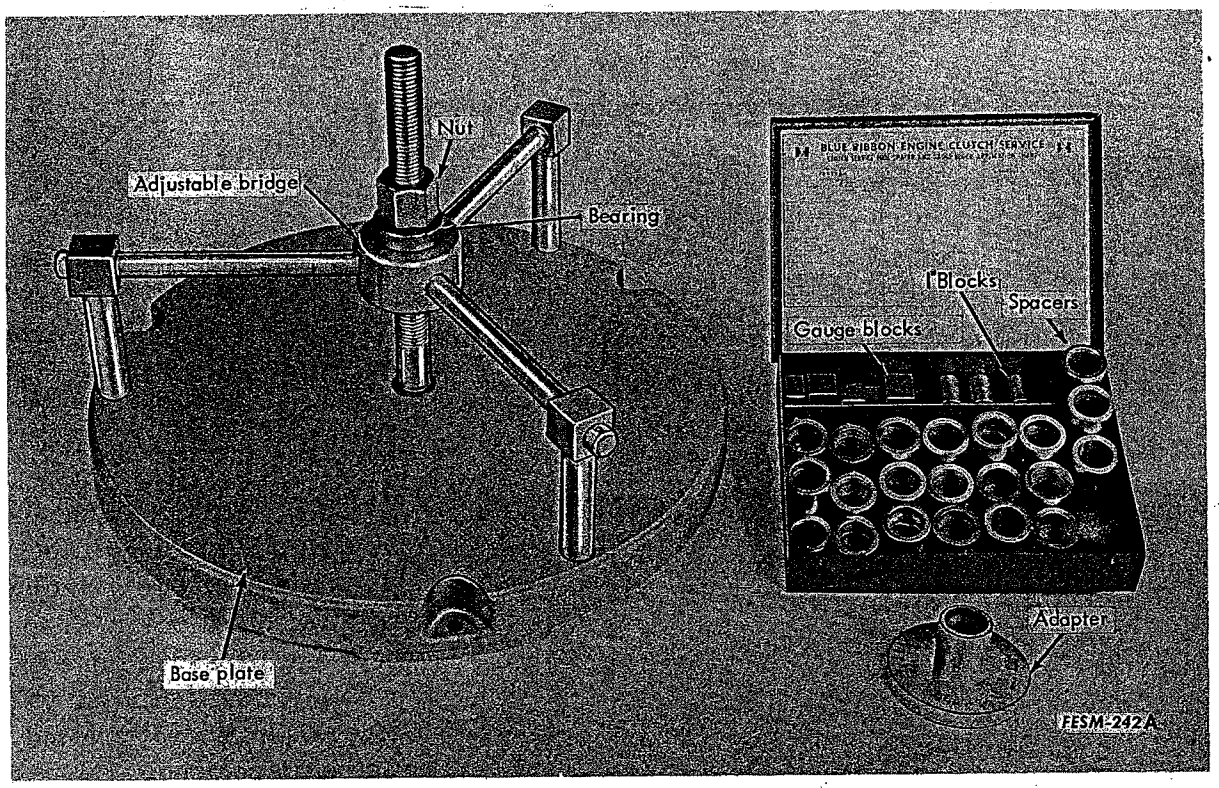
The engine clutch is a single dry disc spring loaded clutch. Refer to service manual GSS-1281-D for a complete discussion of clutch theory.

REMOVAL

1. Remove the tractor engine as outlined in section 1.

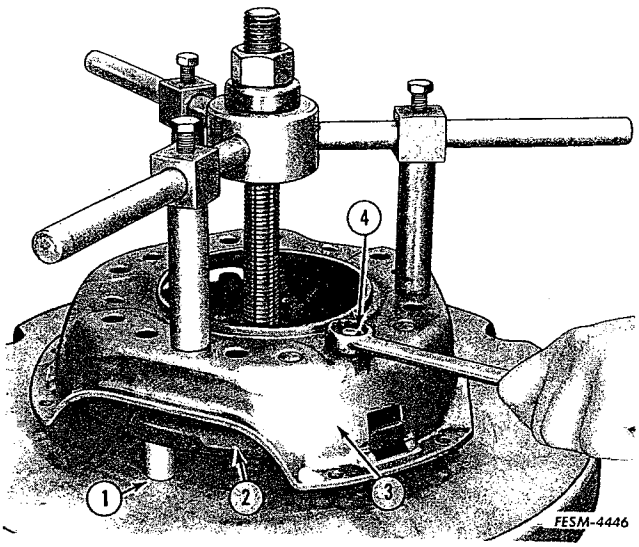
2. Remove the capscrews holding the clutch back plate to the engine flywheel; and remove the clutch assembly.

DISASSEMBLY



Clutch service tool (FES 50).

Clutch service tool FES 50 is recommended for servicing and adjusting the pressure plate assembly. Gauge blocks and spacers used with the clutch tool insure precision adjustment of the pressure plate assembly.



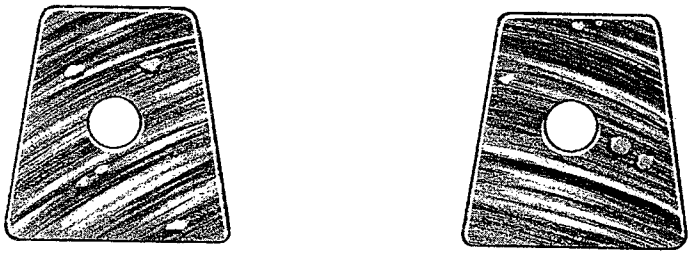
1. Place the pressure plate assembly on the clutch tool with the three 1 inch round blocks between the pressure plate and the tool base plate.

2. Install the adjustable bridge with the bearing and nut; and compress the clutch back plate.

3. Remove the pivot block jam nuts. Then remove the adjustable bridge and the clutch back plate.

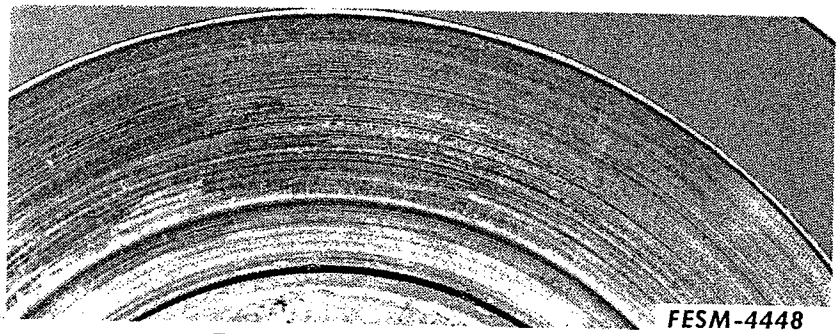
1. 1 inch round block (3)	3. Back plate
2. Pressure plate	4. Jam nut (3)

INSPECTION AND REPAIR



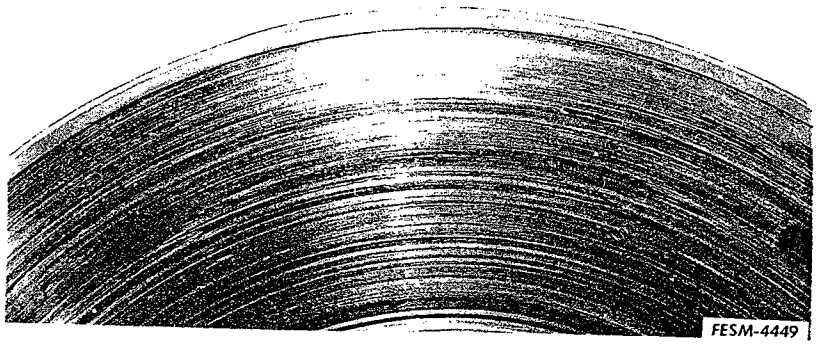
Driven member - normal wear pattern.

Thoroughly clean all parts in an evaporative solvent, and dry with compressed air. Remove rust with a wire brush.



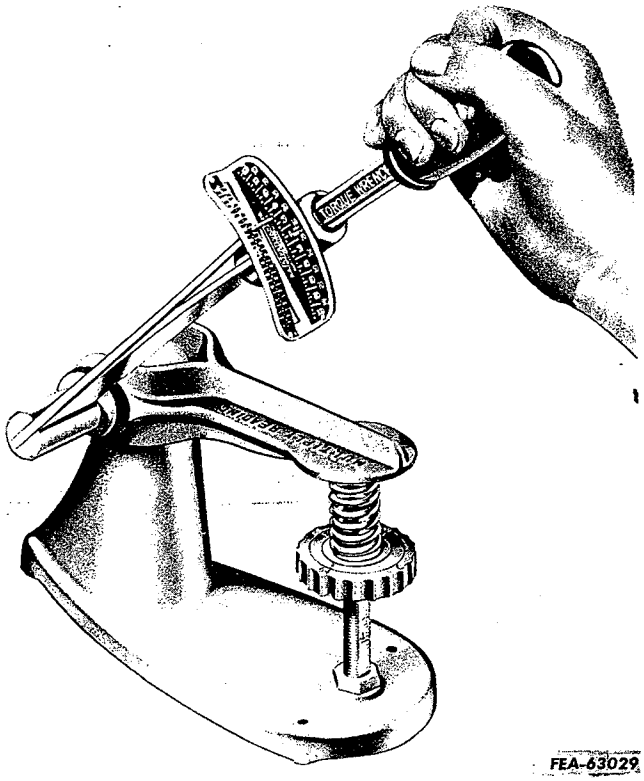
Flywheel - normal wear pattern.

NOTE: After a few hours of operation, the facing of the driven member will glaze to a dark blue black color. The flywheel and pressure plate will develop grooves similar to a phonograph record, and may also be discolored. These wear characteristics of the cera-metallic driven member are normal, and do not affect clutch action or service life.



Pressure plate - normal wear pattern.

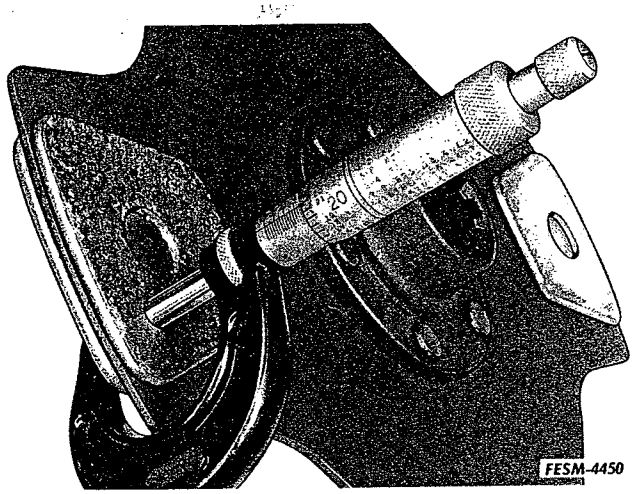
Clutch Springs



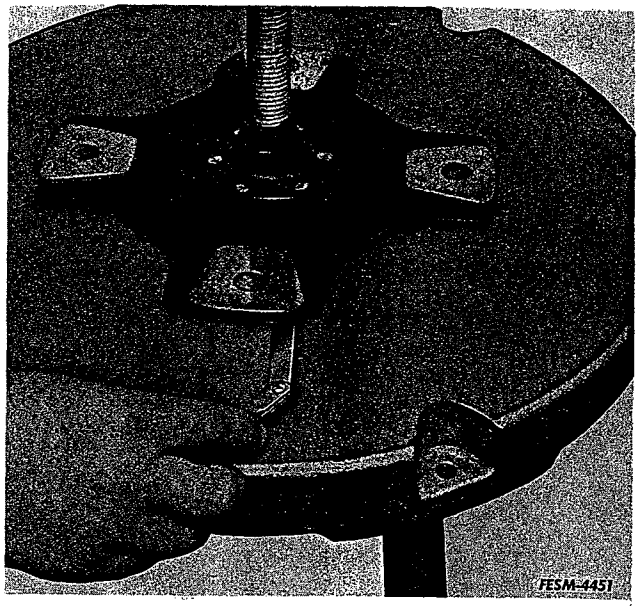
Testing clutch pressure springs.

Check clutch spring free length and tension at test length. Springs must measure a minimum of 2.156 inches, and must require 155 lbs. to compress to 1-7/16 inch. Replace clutch springs as a set of nine if necessary.

Driven Member



1. Measure the driven member disc pads with a micrometer. If any pad measures .226 inches or less, the driven member is worn out and must be replaced.



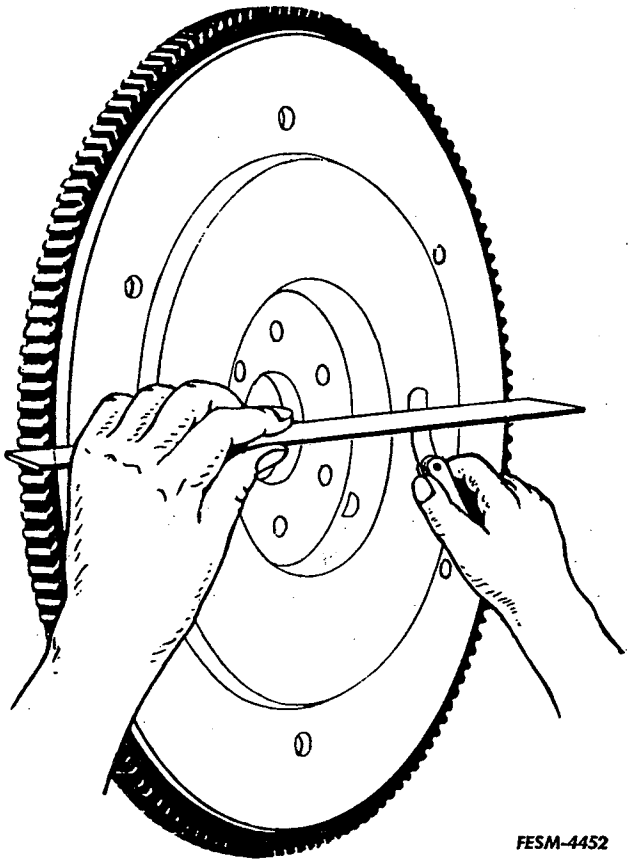
Checking flatness of the driven member.

2. Place the driven member on a flat surface and check for flatness. If a .040 inch feeler gauge can be inserted between any disc pad and the flat surface, replace the disc.

3. Inspect the driven member hub splines for damage, and the hub rivets for looseness. Replace if damaged.

Flywheel and Pressure Plate

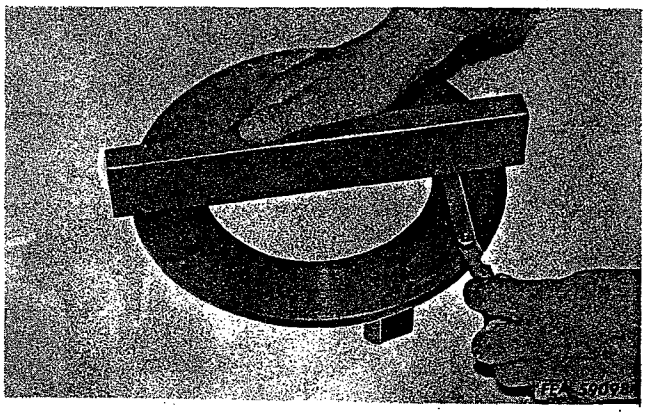
1. Inspect the flywheel and pressure plate for severe heat checking and deposits from the cerametallic friction pads. Resurface the flywheel or pressure plate if these conditions exist.



Measuring flywheel wear.

2. Measure flywheel wear with a straightedge and feeler gauge. Resurface the flywheel if a .040 inch feeler gauge can be inserted anywhere between the friction surface and the straight edge.

3. Measure pressure plate wear with a straight edge and feeler gauge. Resurface the pressure plate if a .020 inch feeler gauge can be inserted between the friction surface and the straight edge.



Measuring pressure plate wear.

Pilot Bearing

Inspect the transmission drive shaft pilot bearing. The pilot bearing must turn freely, be tight in the flywheel bore, and show no evidence of grease leakage. Replace if defective.

Throwout Bearing

Check the clutch throwout bearing. It must turn freely and not show evidence of stalling. If the bearing has stalled during operation, damage to the bearing and release levers will be evident. Replacement is recommended when the clutch is serviced.

Release Levers

Inspect the release levers and replace damaged parts.

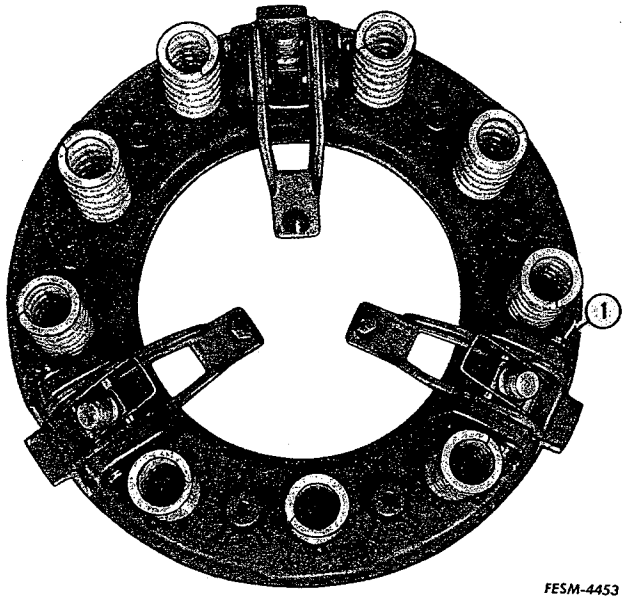
NOTE: The lever assemblies are loosely pinned in slotted holes. Replace parts only if damage is evident.

Control Linkage

1. Inspect the clutch release sleeve and bushing. The sleeve should operate freely on the bushing. Replace if worn or damaged.

2. Inspect the release fork and shaft. The fork should be tight on the shaft. Replace worn and damaged parts.

REASSEMBLY AND ADJUSTMENT



FESM-4453

1. Pin head (3)

1. Lubricate the lever assemblies with Lubriplate 220 grease or equivalent, and reassemble them to the pressure plate with the lever pin heads facing the direction of clutch rotation.

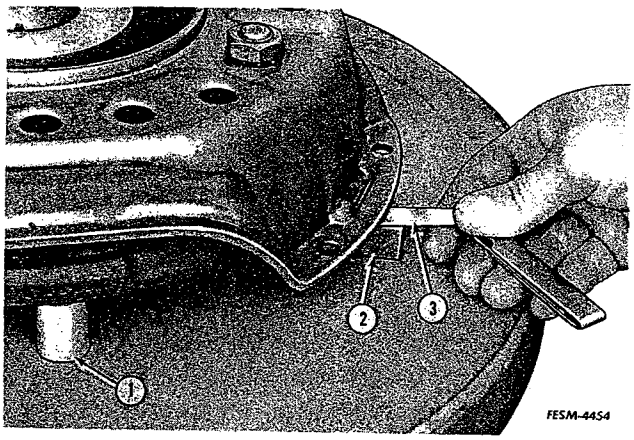
2. Place the pressure plate on the clutch tool with the three 1 inch round blocks between the pressure plate and the base plate.

3. Install the clutch springs and back plate.

4. Install the adjustable bridge and compress the assembly while positioning the pivot blocks.

5. Install the pivot block jam nuts, and torque to 40 ft. lbs.

6. Remove the adjustable bridge; and install the number 21 tubular spacer, adapter, bearing and nut. Tighten until the adapter is tight against the spacer.



FESM-4454

1. 1 inch round spacer block
2. No. 21 gauge block
3. .002 inch feeler gauge

7. Place the number 21 gauge block between the base plate and the flywheel mounting surface of the back plate. Adjust each release lever screw so that there is .002 inch clearance between the clutch back plate and the gauge block, below each release lever.

NOTE: Clutch lever adjustment specifications are listed on page 3-2 for use with other clutch fixtures.

8. Remove the adjustable bridge and remove the clutch assembly from the clutch tool.

CLUTCH ALIGNMENT

Necessity for Proper Engine Clutch Alignment

The clutch shaft, from the pilot bearing to the transmission, is in effect an extension of the crankshaft, and as such must be in alignment with the crankshaft.

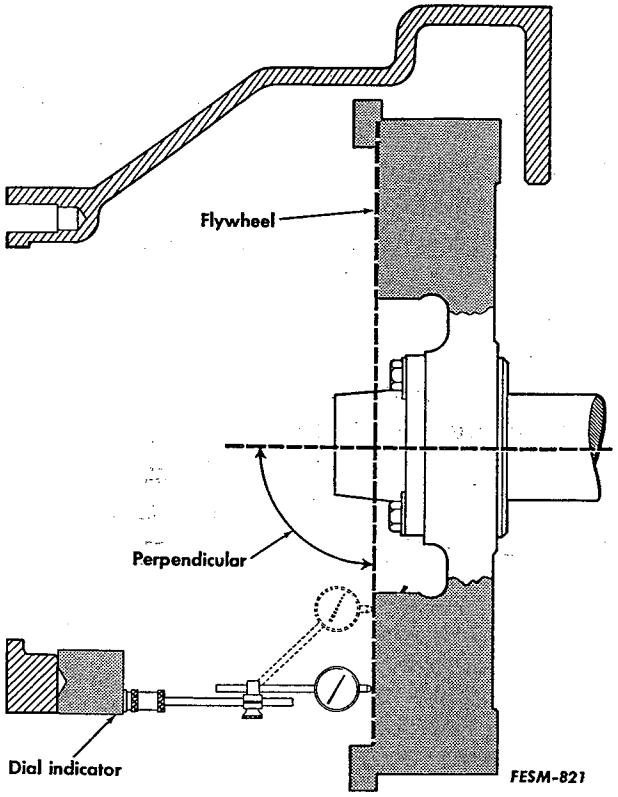
With all clutch parts thus assembled around a common axis it is obvious that to operate satisfactorily they must rotate concentrically and that anything which would cause parts to rotate eccentrically, would result in failure. Consequently, when adjusting or assembling clutches, the serviceman should be alert to evidences of misalignment and do whatever is necessary to correct that undesirable condition.

Evidence and Cause of Misalignment

The most common evidence of engine clutch misalignment is difficulty in shifting gears due to failure of the clutch to release fully.

Excessive wear of the pilot bearing, clutch shaft splines and disc hubs; and broken or distorted clutch discs are other signs of misalignment.

The most common cause of misalignment is carelessness during reassembly.



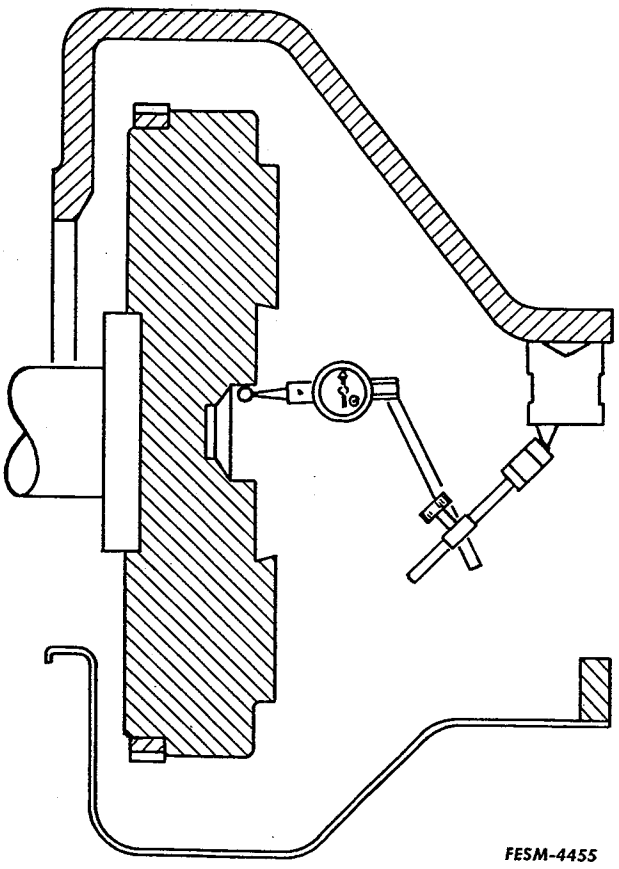
Checking flywheel perpendicularity.

If repeated clutch failure occurs, alignment should be checked.

Flywheel perpendicularity to crankshaft

IMPORTANT: Before checking the perpendicularity of the flywheel to the crankshaft make sure that the flywheel is securely bolted to the crankshaft.

Attach a dial indicator to the flywheel housing placing the point against the unworn friction surface of the flywheel as illustrated. Revolve the engine flywheel one revolution and note the variation on the dial. Variation should not exceed .006".



Checking pilot bore concentricity.

If variation is greater than .006 inch T.I.R., remove the flywheel; and clean the flywheel and the crankshaft flange. Install the flywheel on the crankshaft. Tighten the capscrews evenly, and recheck. Replace the flywheel to correct the T.I.R. measurement.

Concentricity of the pilot bearing bore

Remove the pilot bearing and attach a dial indicator to the flywheel housing. Place the contact point of the indicator against the pilot bearing bore as illustrated. Turn the flywheel; and note any variation. Permissible variation is .006" T.I.R.

If variation is greater than .006", install a new bushing.

INSTALLATION

Reverse the removal procedure with special emphasis on the following steps:

1. Lightly coat the transmission drive shaft splines with IH Never Seeze lubricant.

2. Install the clutch disc hub toward the clutch assembly.

3. Lubricate the throw out bearing until grease is forced out between the release sleeve and bushing. Refer to the operator's manual for lubrication specifications.

4. Adjust clutch pedal free travel to 1-1/8 inch.

Section 4

TORQUE CONVERTER, POWERSHIFT REVERSER, AND GEAR DRIVE HOUSING

CONTENTS

SPECIFICATIONS

TORQUE CONVERTER

Manufacturer	Borg Warner
Stall speed (wide open throttle)	2125-2225
Ratio (at stall)	2-1
Relief valve opening pressure - psi	80 max.
Maximum safe operating temperature - degrees F	250
Pilot shaft O.D. - inch	.7485-.7595
Pilot shaft bore in flywheel - inch	.7505-.7515
Charge pump drive tube O.D. to charge pump front cover bushing I.D. (clearance) - inch	.0015-.0045
Tube O.D. - inches	1.6845-1.6855
Bushing I.D. - inches	1.6870-1.6890
Alignment - clutch housing to flywheel	
Flywheel pilot bore run-out - inch	.005 max.
Flywheel to clutch housing bore run-out	See text
Flywheel to reverser housing mounting surface run-out	See text

POWER SHIFT REVERSER

	With Torque Converter	Without Torque Converter
Type	Manually selected, hydraulically applied clutches	
Number of internally splined bronze clutch discs	14	14
Number of externally splined steel clutch plates	12	12
Forward clutch gear assembly		
Rolling end play - inches	.001-.003	.001-.003
Distance from bearing cup seating shoulder to shim pack - inch	.578-.593	.578-.593
Clutch shaft		
Housing I.D. at seal ring location - inches	2.003-2.004	2.003-2.004
Pilot O.D. - inch	1.6245-1.6250	1.6245-1.6250
Rolling endplay - inch	.001-.003	.001-.003
Counter shaft rolling end play - inch	.003-.017	.003-.017
Charge pump		
Capacity (free flow) - gpm	20	15
Gear set thickness - inch	.4995-.5000	.3795-.3800
Gear housing thickness - inch	.5015-.5025	.3815-.3825
Gear clearance - inch	.008 max.	.008 max.
Front cover bushing I.D. to drive tube O.D. (clearance) - inch	.0015-.0045	------
Bushing I.D. - inches	1.6870-1.6890	------
Tube O.D. - inches	1.6845-1.6855	------
Inner gear bushing I.D. to stator support tube O.D. (clearance) - inch	.001-.004	------
Bushing I.D. - inches	1.251-1.253	------
Tube O.D. - inches	1.249-1.250	------
Reverser drive shaft bushing I.D. (in stator support tube) to shaft O.D. (clearance) - inch	.0015-.0045	------
Bushing I.D. - inch	.813-.815	------
Shaft O.D. - inch	.8105-.8115	------

POWER SHIFT REVERSER - Continued

	With Torque Converter	Without Torque Converter
Control Valve		
Directional control valve spool rolling torque - ft. lb.	10 max.	10 max.
Power control valve spool rolling torque - inch lb.	------	5 max.
Reverser drive shaft O.D. to bushing I.D. (clearance) - inch	.0015-.0045	------
Shaft O.D. - inch	.8105-.8115	------
Bushing I.D. - inch	.813-.815	------
Reverser drive shaft O.D. at charge pump rear seal - inch	.8075-.8145	------

GEAR DRIVE HOUSING

Transmission drive shaft and gear end play - inch	.001-.003
Drive shaft end play - inch	.005-.020

Control Valve Pressure Settings - Psi (Fluid Temperature 170°F Minimum)

Valve Description	Tractors with torque converter		Tractors without torque converter	
	High Idle	Low Idle	High Idle	Low Idle
Torque converter relief	80 max.	80 max.	-	-
Oil cooler relief	-	-	10	10
Apply pressure regulator	74-78	50	74-78	-
Lube pressure regulator	10-14	0	10-14	-

Spring Specifications

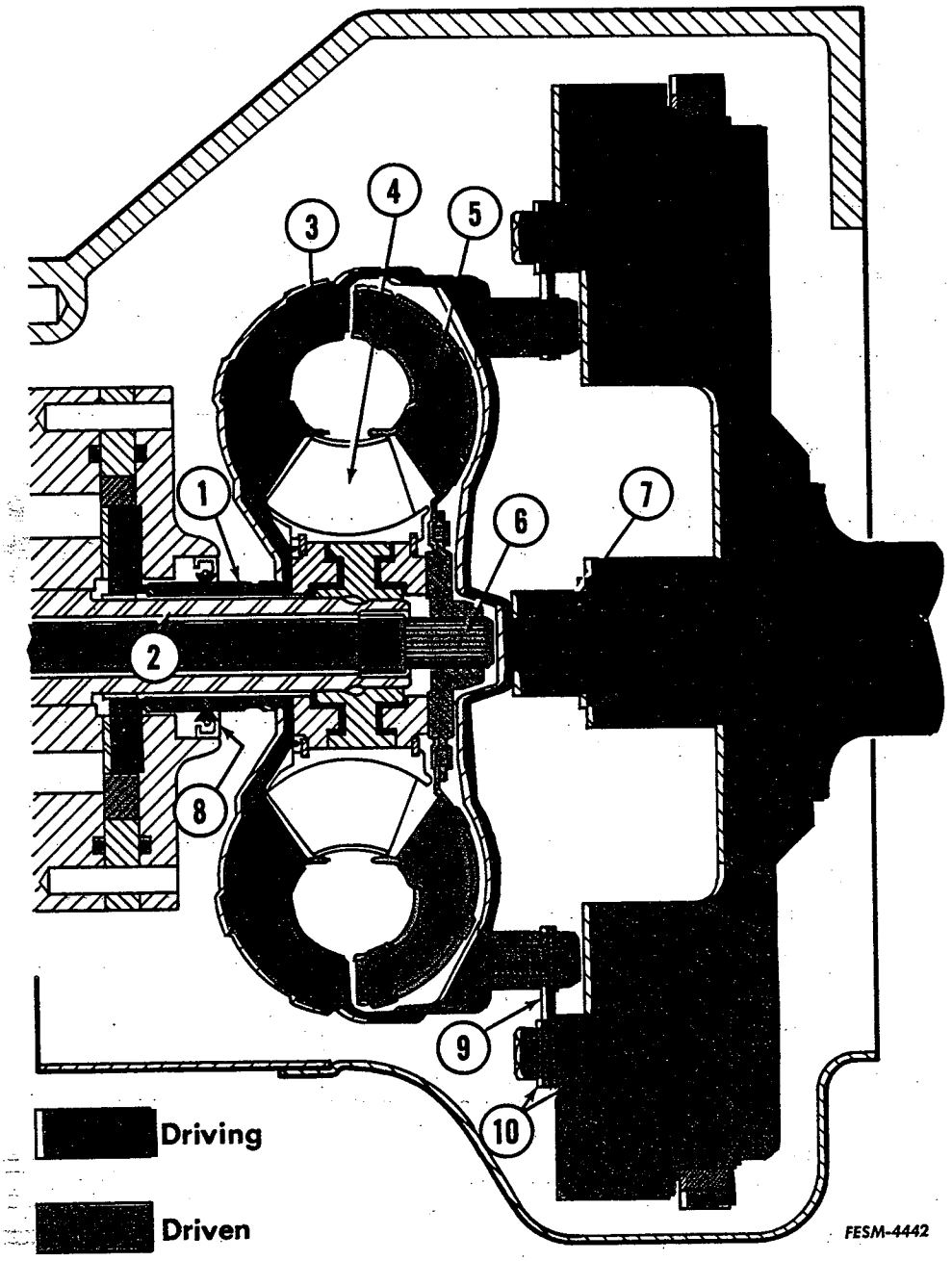
Spring Description	Free Length (inches)	Total Number of Coils	Test Length (inches)	Test Load (pounds)
Apply pressure regulator	4-1/8	15-3/4	2-3/32	48-1/2
Cooler relief valve Lube pressure regulator	3-53/64	22	1-3/16	10
Detent	1-7/16	20	1-3/64	22
Piston return	1-9/64	7-3/4	13/16	8

Special Torques - ft. lb.

Reverse idler shaft nut	450
Forward clutch gear shaft nut	80
Transmission drive gear shaft nut	80

TORQUE CONVERTER

General



Power flow.

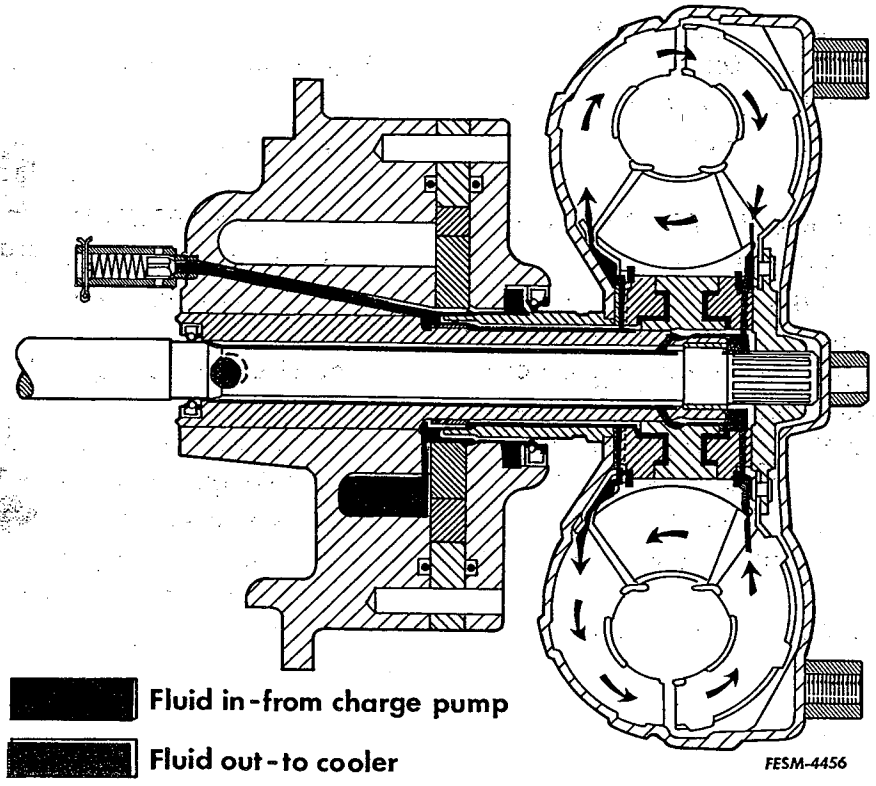
1. Charge pump drive tube	6. Reverser drive shaft
2. Stator support tube	7. Converter pilot shaft
3. Impeller	8. Charge pump seal
4. Stator	9. Flex plate
5. Turbine	10. Convex washers

Power Flow

The torque converter multiplies engine torque automatically as track load is increased, allowing the engine to operate continuously at its most efficient speed.

The converter consists basically of an IMPELLER, a TURBINE, and a STATOR enclosed in a housing filled with fluid.

The IMPELLER turns with the engine, forcing fluid at high velocity against the turbine blades. The TURBINE, forced to turn, powers the power shift reverser drive shaft to which it is attached. The STATOR, which is stationary, receives fluid from the turbine, and redirects it to the impeller where the cycle is repeated.



Fluid flow.

Fluid Flow

A portion of the reverser charge pump flow is circulated through the converter at apply pressure for cooling. Fluid enters the converter between the stator support tube and the charge pump drive tube at the impeller, and leaves the converter from the turbine between the reverser drive shaft and the stator support tube. Oil leaving the converter is circulated through the transmission cooler, and back to the reverser housing.

When track load is light, turbine speed approaches impeller speed. Torque multiplication is negligible and very little power is lost in the form of heat.

As track load increases the torque requirement, the converter multiplies engine torque with a corresponding speed decrease, and power loss in the form of heat.

Torque multiplication increases to a maximum of 2 to 1 as the turbine slows to a stop. When the converter is "stalled", all available engine horse power is converted to heat.

Fluid circulation through the converter to the oil cooler by the charge pump maintains converter temperature at a safe level during normal operation. A transmission temperature gauge is provided on the instrument panel to allow the operator to visually check converter temperature.

If the torque converter is over-loaded for extended periods of time, it will overheat. Operation at temperatures above 250 degrees Fahrenheit will permanently damage the torque converter, and can cause seal and bushing failure in the charge pump.

Stall Speed

Converter stall speed is an indicator of combined engine and torque converter performance. When the torque converter is stalled under load, engine speed should read from 2125 to 2225 rpm.

A variation from the specified stall speed indicates torque converter or engine inefficiency. Check high idle speed and fuel consumption to determine engine performance. Service the engine or torque converter as necessary to correct stall speed. DO NOT ADJUST ENGINE HORSEPOWER ON THE BASIS OF CONVERTER STALL SPEED. To do so may result in over fueling or under fueling the engine.

NOTE: The use of a P.T.O. driven dynamometer to check engine horsepower is of no value, as it is impossible to determine converter internal slippage.

If stall speed is low, check the following:

1. Air cleaner (replace)
2. Fuel filters (replace)
3. Injection nozzles - "coked"
4. Engine compression - low
5. Fuel consumption - low

If stall speed is high, check the following:

1. Apply pressure - low
2. Torque converter relief valve - stuck open
3. Charge pump suction - restricted
4. Flex plate - broken
5. Clutch slippage

Removal and Installation

Remove and install the tractor engine and torque converter as outlined in Section 1.

Overhaul

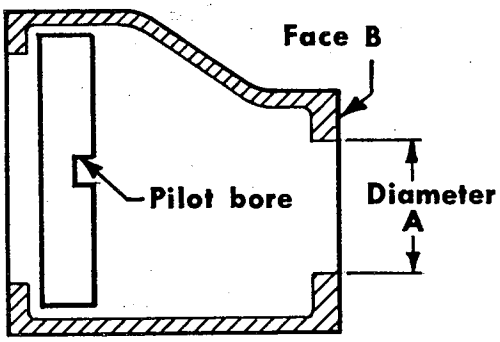
The torque converter is only serviced as a complete assembly.

If a mechanical failure of the torque converter has occurred, check torque converter alignment, condition of supporting parts such as seals, bushings, oil cooler, fan, belt etc., as well as operator technique.

Torque Converter Alignment

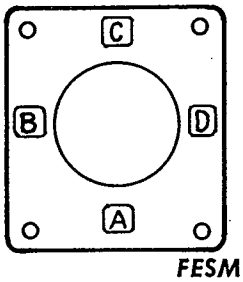
The transmission or reverser drive shaft is an extension of the engine crankshaft. Alignment of the crankshaft to the reverser drive shaft is critical and will effect the operation of the torque converter.

If a mechanical failure of the torque converter occurs; or if misalignment of the torque converter is suspected, remove the engine and check torque converter alignment as follows:



FESM-4457

Figure 1.



FESM-4458

Figure 2.

Bell Housing to Flywheel Alignment

1. Refer to figure 1. With a dial indicator mounted on the flywheel housing, measure the runout on the pilot bore (x) of the flywheel. Maximum runout is .005 inch T.I.R.

2. Refer to figure 1. With dial indicator mounted on the flywheel, indicate diameter "A" and face "B" for a complete rotation of the flywheel as follows:

a. Refer to figure 2. With indicator set at zero at location "A", record both the diameter and face runout readings when you reach "C".

b. Repeat by setting indicator at zero at location "B" and record readings when you reach "D". Be sure to note the sign of the runout (+ or -).

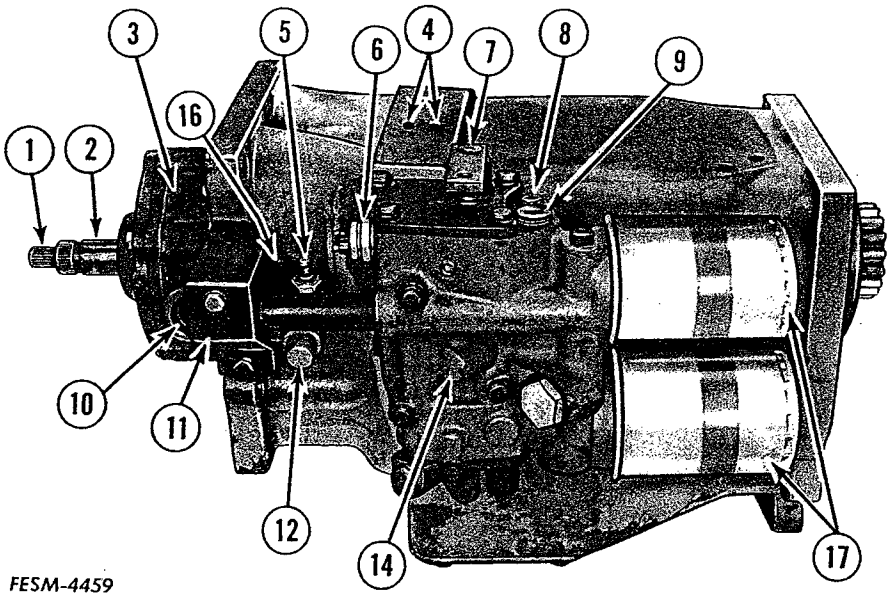
Alignment is acceptable if the algebraic difference of the face runout and one half the diameter runout at both locations "C" and "D" is equal to, or less than, .014 inch minus the runout determined in step 1.

EXAMPLE: Runout of the pilot diameter on the flywheel is measured to be .002 inch (item 1, above). Then with dial indicator mounted on the flywheel and zeroed at location "A", (step 2a) the diameter runout at "C" is +.004 inch and face runout is -.007 inch.

$$\frac{+.004}{2} - (-.007)^* = .009$$ which

is less than .014 - .002. The "A" through "C" phase of the assembly is acceptable.

*In an algebraic equation, to subtract a minus (-) number the sign (-) is changed to a plus (+) and the number is added.



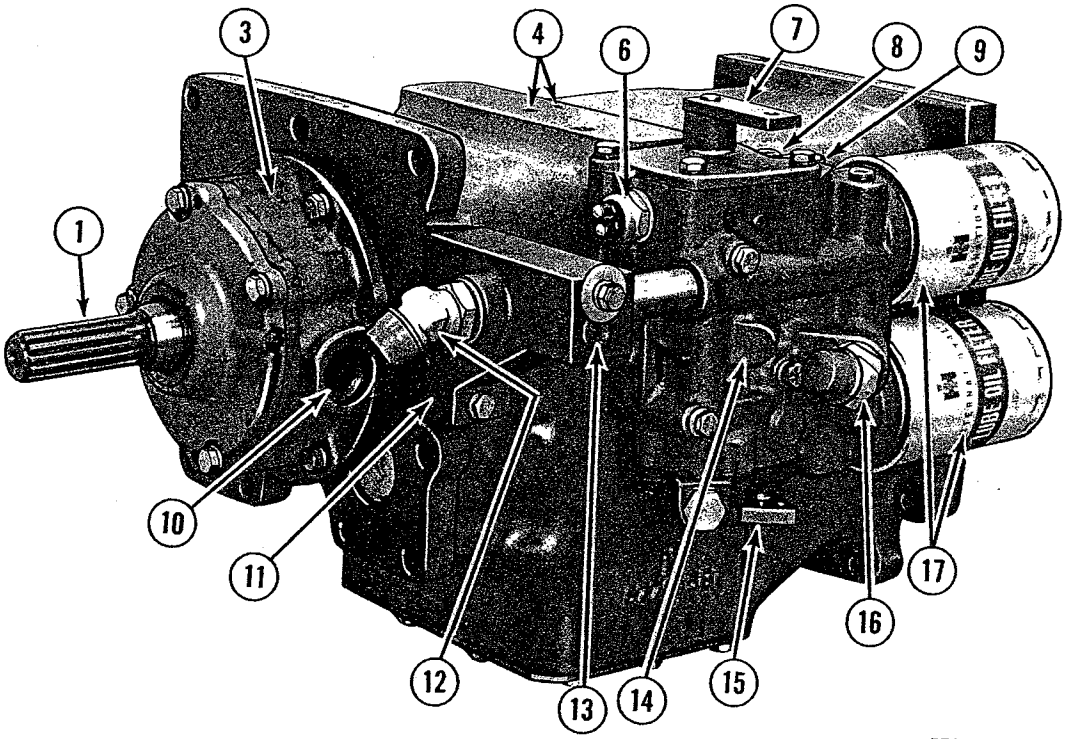
FESM-4459

Reverser used with torque converter.

1. Reverser drive shaft
2. Stator support tube*
3. Charge pump
4. Test ports
5. Fluid temperature sender *
6. Safety starting switch
7. Directional control valve lever
8. Lube pressure regulator
9. Apply pressure regulator
10. Charge pump suction port
11. Charge pump manifold
12. Fluid out to transmission cooler
13. Transmission cooler by-pass valve †
14. Control valve assembly
15. Power control valve lever †
16. Return from transmission cooler
17. Filters

* Tractors equipped with torque converter.

† Tractors without torque converter.



FESM-4460

Reverser used without torque converter.

POWER SHIFT REVERSER

General Description

(Foldouts 1 and 2)

The power shift reverser uses two hydraulically actuated clutches to change direction of machine travel.

The reverser may be used with or without a torque converter. In either case, a foot controlled pedal is provided, replacing the conventional engine clutch pedal in location and function.

The decelerator pedal, used on machines equipped with the torque converter, disconnects engine power from the tracks by reducing engine speed to a point where the torque converter stalls.

The power control pedal, used on machines without torque converter, disconnects engine power from the tracks by placing both power shift clutches in neutral.

Charge Pump (Foldouts 4 and 5)

The charge pump provides fluid under pressure for lubrication, cooling, and operation of the reverser clutches and torque converter. It is a geroter type pump, mounted on the front of the reverser. When the tractor is equipped with torque converter, the pump is driven by the torque converter housing drive tube. On machines without torque converter, the charge pump is driven by the reverser drive shaft. The pump draws fluid from the rear frame through a strainer and directs it under pressure to the reverser control valve and torque converter, if so equipped.

Transmission Cooler (Foldouts 4 and 5)

The transmission cooler, which is located ahead of the engine radiator, maintains transmission fluid temperature within normal operating range.

On tractors equipped with torque converter, the transmission cooler receives fluid from the torque converter and discharges it into the reverser housing. Cooler pressure is limited to 80 psi. by the torque converter safety relief valve, located on the back of the charge pump.

On tractors without torque converter, the cooler receives charge pump flow and discharges it to the reverser control valve. The cooler bypass valve, located in the charge pump outlet manifold, protects the charge pump and cooler from excessive fluid pressure resulting from possible restriction in the cooler. The cooler bypass valve opens whenever the pressure differential across the cooler exceeds 10 psi., as in cold weather when the fluid is cold and viscous. Bypassed fluid is diverted into the reverser control valve.

Control Valve (Foldouts 4 and 5)

The reverser control valve, mounted on the left side of the transmission, receives fluid from the charge pump. It directs and regulates pressure of the charge pump flow to the hydraulic clutches.

Filters (Foldouts 4 and 5)

Fluid enters the control valve through two full flow replaceable filters. A bypass valve is built into each filter to limit charge pump pressure in the event of filter restriction.

Apply Pressure Regulator Valve (Foldouts 4 and 5)

The apply pressure regulator valve limits charge pump and clutch apply pressure to 76 $\pm$2 psi. when the fluid is at operating temperature. Bypassed fluid enters the lubrication circuit.

Lube Pressure Regulator Valve (Foldouts 4 and 5)

The lube pressure regulator valve limits lubrication circuit pressure to 12 $\pm$2 psi. for lubrication of the clutches and clutch shaft bearings. Bypassed fluid is discharged to the reverser housing.

Directional Control Valve (Foldouts 4 and 5)

The directional control valve directs charge pump fluid to the hydraulic clutches for engagement and lubrication. When in the forward or reverse position, the directional control valve supplies fluid at apply pressure to one clutch, and fluid at lube pressure to the other clutch. When in neutral, the directional control valve supplies fluid at lube pressure to both clutches.

Power Control Valve (Foldouts 4 and 5)

The power control valve used on machines without torque converter allows the operator to disengage either clutch. When the power control pedal is depressed: (1) The power control valve blocks fluid at apply pressure from the directional control valve. (2) It directs fluid at lube pressure to the hydraulic clutch that was engaged. (3) This in turn causes the clutch to disengage.

All circuits will remain on lube pressure until the Power Control pedal is released.

Clutch Shaft (Foldouts 4 and 5)

Two passages in the clutch shaft carry fluid from the control valve to the hydraulic clutches and bearings. The inner passage supplies fluid to the forward apply piston, and lubricates the forward drive clutch and the rear drive shaft bearing. The outer passage supplies fluid to the reverse apply piston, and lubricates the reverse drive clutch and reverse gear needle bearing.

Apply Pistons (Foldouts 4 and 5)

The forward and reverse apply pistons move together as an assembly on the clutch shaft to engage one clutch or the other and at the same time disengage the opposite clutch. A separator plate fastened to the clutch shaft separates the forward and reverse pressure chambers.

Accelerator Pistons (Foldout 6)

Each piston assembly (one forward and one reverse) has within the basic assembly an accelerator piston. The accelerator pistons serve three (3) purposes:

1. They operate the disc valves to permit fluid transfer from one pressure chamber to the other.

2. They take up the neutral slack.

3. They meter fluid to the apply piston pressure chambers through their modulating orifices.

Disc Valves (Foldout 6)

The disc valves, mounted on the separator plate, permit rapid one way fluid transfer through the separator plate holes from one apply piston pressure chamber to the other. They are controlled by the accelerator pistons, and are connected by three dowel pins extending through the separator plate.

Clutch Operation (Foldout 6)

Reverse

In operation these series of events occur:

1. On initial selection of the reverse clutch pack, fluid under apply pressure enters the accelerator piston cavity at port "A". (See foldout 6)

2. Fluid forces the accelerator piston to the left holding the reverse disc valve and reinforcing disc tightly against the separator plate.

3. The disc valve in turn forces 3 dowel pins (located in the separator plate) to move the reinforcing disc and disc valve in the forward piston cavity away from the separator plate.

4. Pressure build up in the accelerator piston cavity is at this same time forcing the main apply piston to the right as shown by the arrow to take up any clearance between the apply piston head and the clutch pack assembly.

5. Inasmuch as the forward and reverse pistons move across the separator plate in unison, the fluid on the disengaged side of the separator plate is transferred through a series of vents drilled into the separator plate, into the forward pressure chamber by bending the forward disc valve due to the fluid flow.

This sequence of events reduces the necessity of moving large volumes of fluid to fill the apply cavity; and as such only a small fluid supply will provide the pressure rise required.

6. The force available in the chamber A is of insufficient magnitude to lock up the clutch pack assembly. It only provides force to take up the clearance (provided in neutral) and start to compress the centering springs.

7. Fluid at apply pressure is metered out of chamber A as the pressure rises on completion of the events in items 1 through 6 above via the modulating orifice into chamber B.

Chamber B has sufficient area when multiplied by the apply pressure to force the apply piston to the right.

The apply pressure rises until the force overcomes the opposing energy stored in the bellville washers and centering springs. When the bellville washers are forced into a vertical position the pressure in chamber B has risen to its maximum.

The reverse clutch gear transmits power through the reverse idler and counter shaft to the forward clutch gear. The forward clutch gear is splined to the output shaft.

Forward

Forward clutch operation is identical to reverse clutch operation as far as the clutches are concerned. The forward clutch gear assembly connects the clutch shaft to the rear gear, which is splined to the output shaft.

Neutral or Power Control Pedal Depressed

When the power control pedal is depressed or the directional control valve is placed in the neutral position, both clutches receive fluid at lube pressure. Both disc valves are open allowing fluid pressure to equalize in the pressure chambers. The centering springs then center the apply pistons in the neutral position.

Shift Speed

Speed of shifting is predetermined by the design characteristics of the clutch assembly.

Correct clutch operation is dependent on the proper fluid, operating pressures, and operating temperature.

Service Procedures

General

IMPORTANT: Do not begin any any procedure that will prevent operation of the tractor until pressures and other characteristics that are definitely not a part of the operational design have been recorded. Record this information for reference during the overhaul.

Control Valve and Charge Pump Outlet Manifold

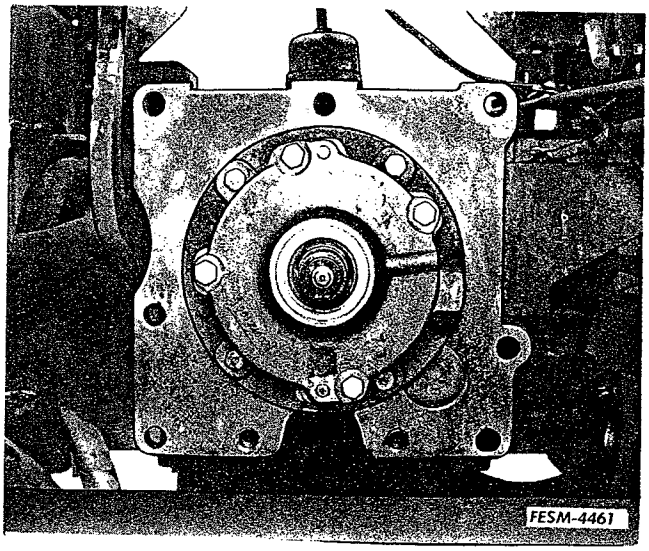
The control valve and charge pump outlet manifold may be removed from the power shift reverser without removing the engine or reverser housing. Both assemblies can be removed as a unit from below the operator's compartment deck plates. Refer to "Disassembly" for removal. If internal service of the power shift reverser is required, remove the control valve and manifold after the power shift reverser is removed.

Charge Pump

The charge pump may be removed from the power shift reverser without removing the reverser housing. Removal of the reverser control valve and charge pump manifold must precede charge pump removal. Refer to "Disassembly" for removal.

If internal service of the power shift reverser is required, remove the charge pump after the power shift reverser is removed.

Removal

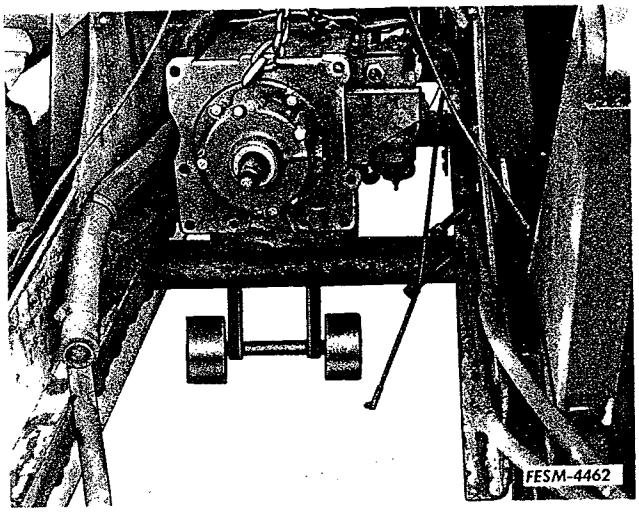


Engine and battery support removed.

1. Remove the engine. (Refer to Section 1 - "Engine Removal and Installation".)

2. Remove the batteries and battery support.

3. Disconnect the control linkage and electrical and hydraulic lines from the reverser housing; and drain the remaining hydraulic fluid.



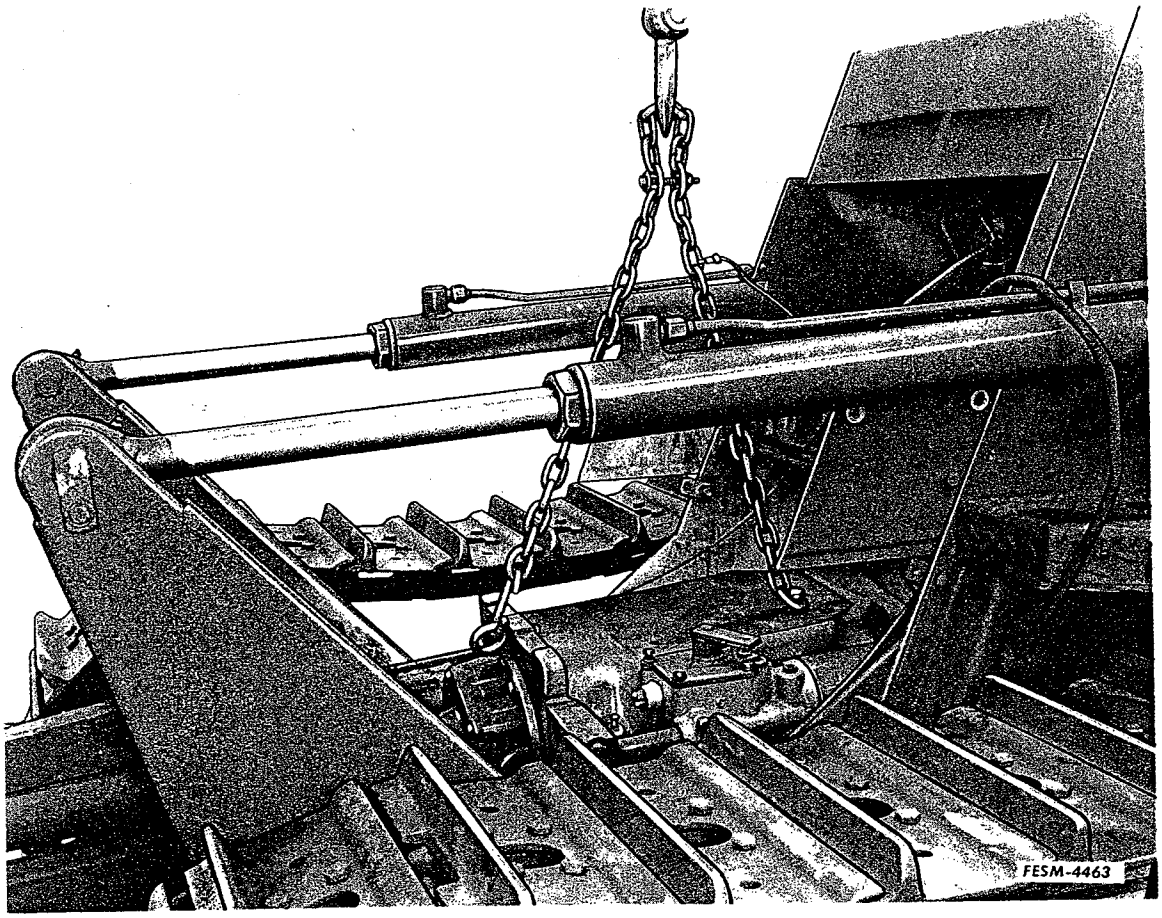
Front of reverser supported on gauge bar.

4. Support the rear of the housing with a rolling floor jack, and the front with a chain hoist. Then disconnect the reverser from the rear frame.

5. Move the reverser forward and lower the front so that it is supported on the gauge bar. Then reposition the chain and remove the reverser from the chassis.

IMPORTANT: Be careful not to lose the transmission input shaft pilot bearing.

6. Thoroughly clean the exterior of the reverser housing to prevent contamination during disassembly.



Removing reverser from chassis.

Control Valve and Charge Pump Outlet Manifold Removal

If the reverser housing has already been removed, start with step 6.

1. Drain the transmission oil cooler.

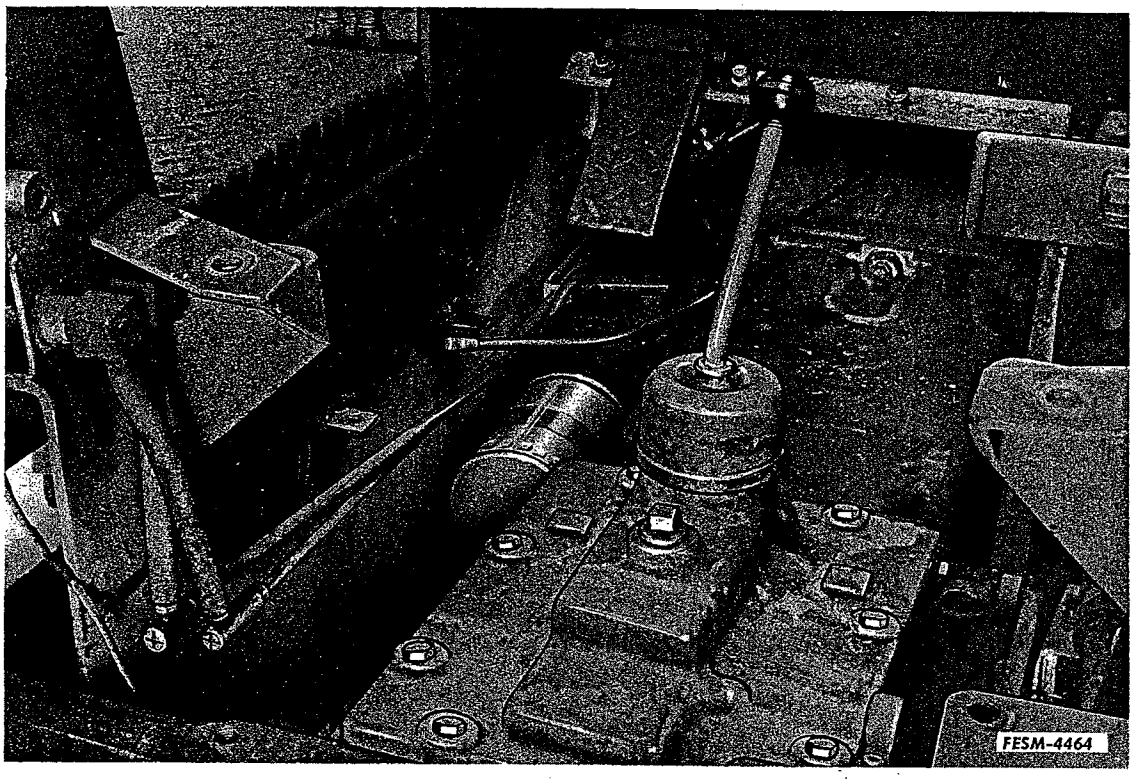
2. Remove the decelerator or power control pedal, and remove the forward deck plate.

3. Remove the oil cooler lines from the manifold, and cap the connections.

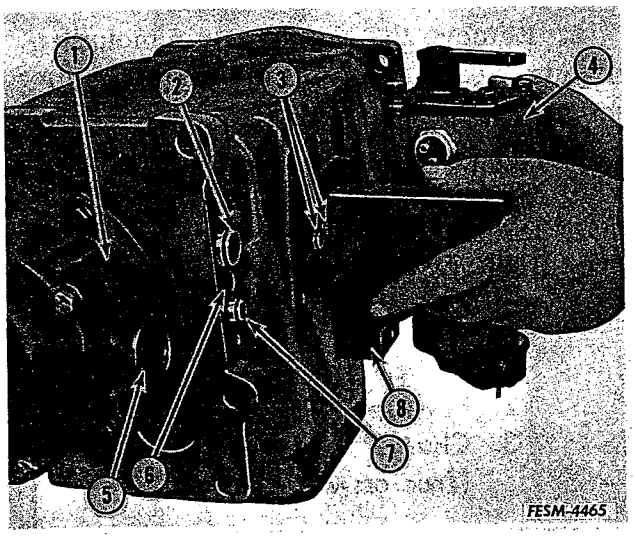
4. Remove the control valve linkage from the valve and tie it out of the way.

5. Thoroughly clean the exterior of control valve assembly and surrounding area to prevent contamination of the valve assembly and reverser fluid passages.

6. Remove and discard the hydraulic filters.

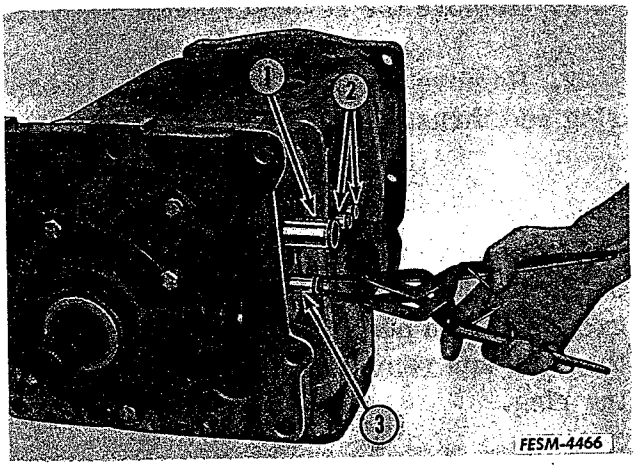


Plates removed.



7. Remove the capscrews securing the control valve and charge pump outlet manifold to the reverser. Then remove the valve and manifold as an assembly.

1. Charge pump
2. Charge pump pressure tube
3. Control valve to clutch tubes
4. Control valve assembly
5. Charge pump suction port
6. Oil cooler return to housing port (T.C. only)
7. Torque converter to oil cooler tube (T.C. only)
8. Charge pump manifold



1. Charge pump pressure tube
2. Control valve to clutch tubes
3. Torque converter to oil cooler tube (T.C. only)

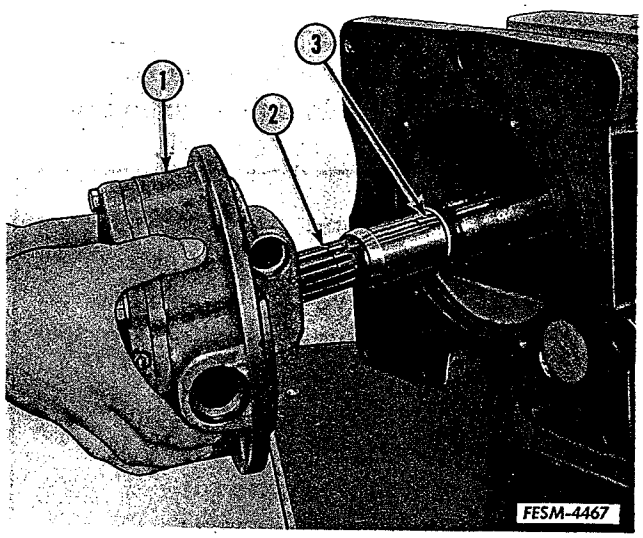
8. Remove the connecting tubes from the reverser housing using internally expanding snap ring pliers.

NOTE: There are two tubes connecting the valve to the clutches and one tube connecting the charge pump to the manifold. On tractors equipped with torque converter, there is an additional tube connecting the manifold to the reverser housing (T.C. to cooler).

Charge Pump Removal

1. Remove the engine, reverser control valve, and charge pump outlet manifold.

IMPORTANT: The charge pump pressure tube connecting the pump to the outlet manifold must be removed before the charge pump can be removed.



2. Remove the charge pump mounting screws. Then remove the charge pump assembly.

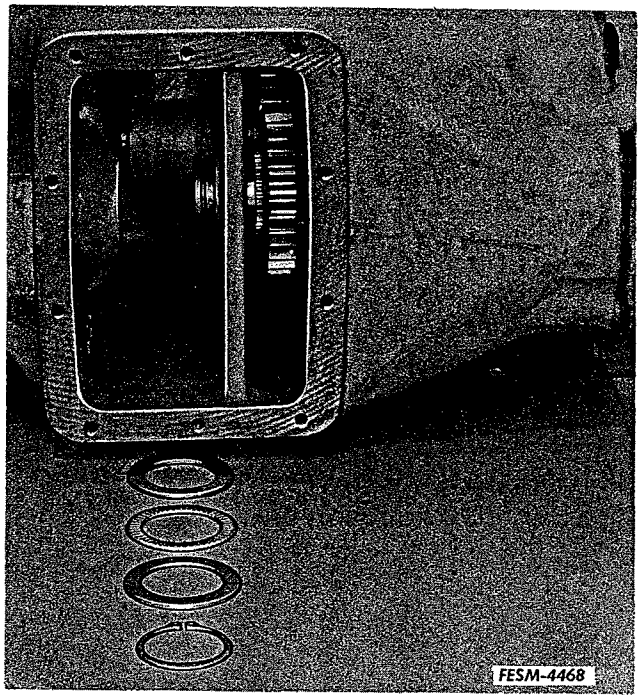
3. TRACTORS WITHOUT TORQUE CONVERTER: Remove the woodruff key from the reverser drive shaft.

1. Charge pump
2. Reverser drive shaft
3. Charge pump drive key (Tractors without T.C.)

Countershaft Removal

1. Remove the reverser bottom cover.

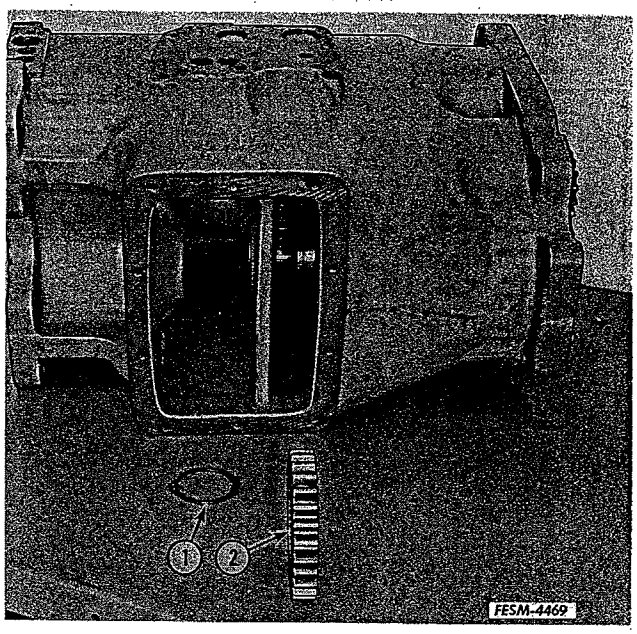
2. Remove the countershaft front snap ring and thrust bearing assembly.



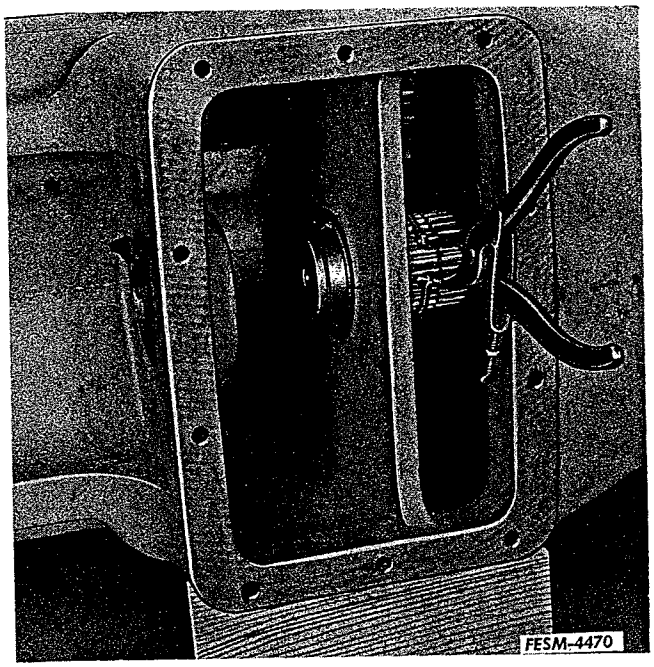
Countershaft front snap ring and thrust bearing assembly removed.

3. Remove the retaining ring, in front of the front countershaft gear from its groove. Then push the countershaft to the rear and remove the gear and retaining ring.

1. Retaining ring
2. Front countershaft gear



Front countershaft gear and retaining ring removed.



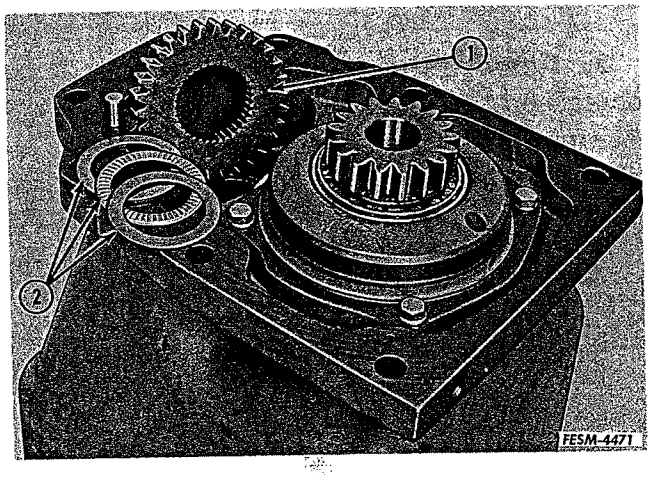
Removing retaining ring.

4. Remove the retaining ring in back of the front gear. Then push the shaft out the rear of the housing, and remove the rear gear and thrust bearing assembly.

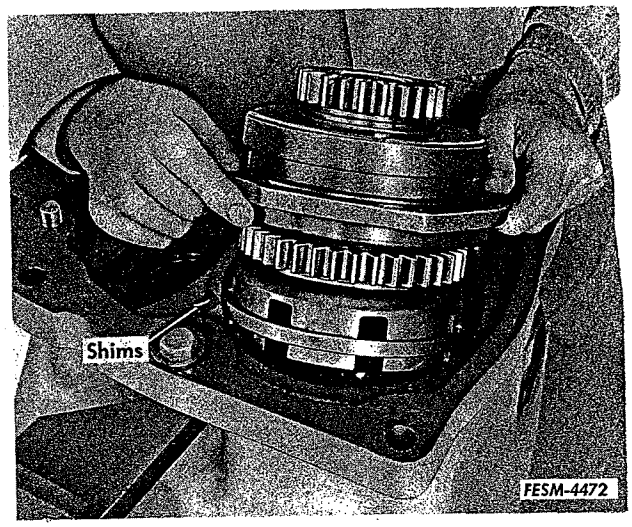
Forward Clutch Gear Assembly Removal

Remove the capscrews securing the transmission input shaft bearing housing to the rear of the reverser. Then, remove the bearing housing and forward clutch gear assembly.

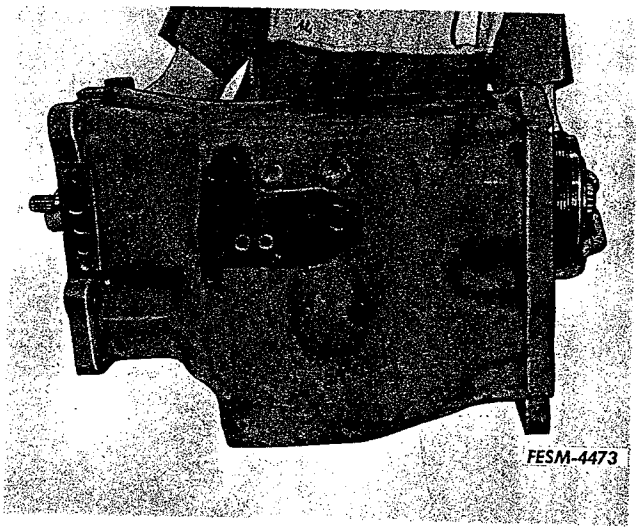
IMPORTANT: Note the number and position of shims removed for use in reassembly.



1. Rear countershaft gear
2. Thrust bearing assembly



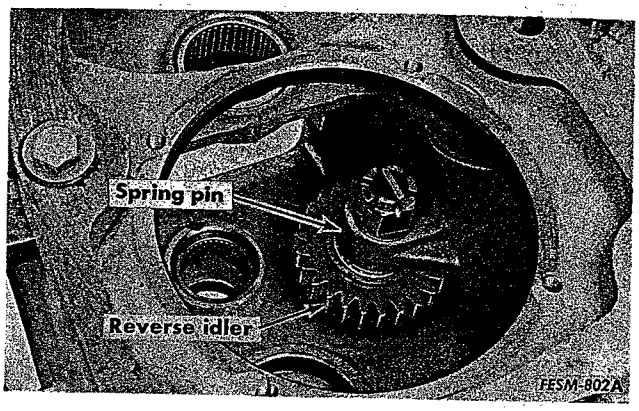
Removing the forward clutch gear assembly.



Removing the clutch shaft assembly.

Clutch Shaft Removal

Support the drive shaft and clutch shaft assembly as shown. Then remove the complete assembly from the rear of the reverser housing.



Reverse Idler Removal

1. Remove the cotter pin and nut from the idler shaft.

2. Remove the allen screw plug located on the left side of the reverser housing. Then drive the spring pin out from the inside of the housing.

3. Remove the shaft, gear, and bearing assembly.

General

Components may be serviced in any order following their removal from the reverser housing as outlined in Disassembly.

Cleanliness cannot be over emphasized. Following disassembly, clean all parts in an evaporative solvent and dry with compressed air.

*Coat all parts of each component with IH Hy-Tran® fluid prior to reassembly, to lubricate the parts and prevent corrosion.

Use petroleum jelly to aid assembly, prevent damage to O-rings and bearing surfaces, and lubricate bearings.

*Hy-Tran has a high degree of retention (will not drain off) and as such is definitely preferable in all instances especially where a time lag between assembly and actual use may occur. The use of other lubricants is not recommended.

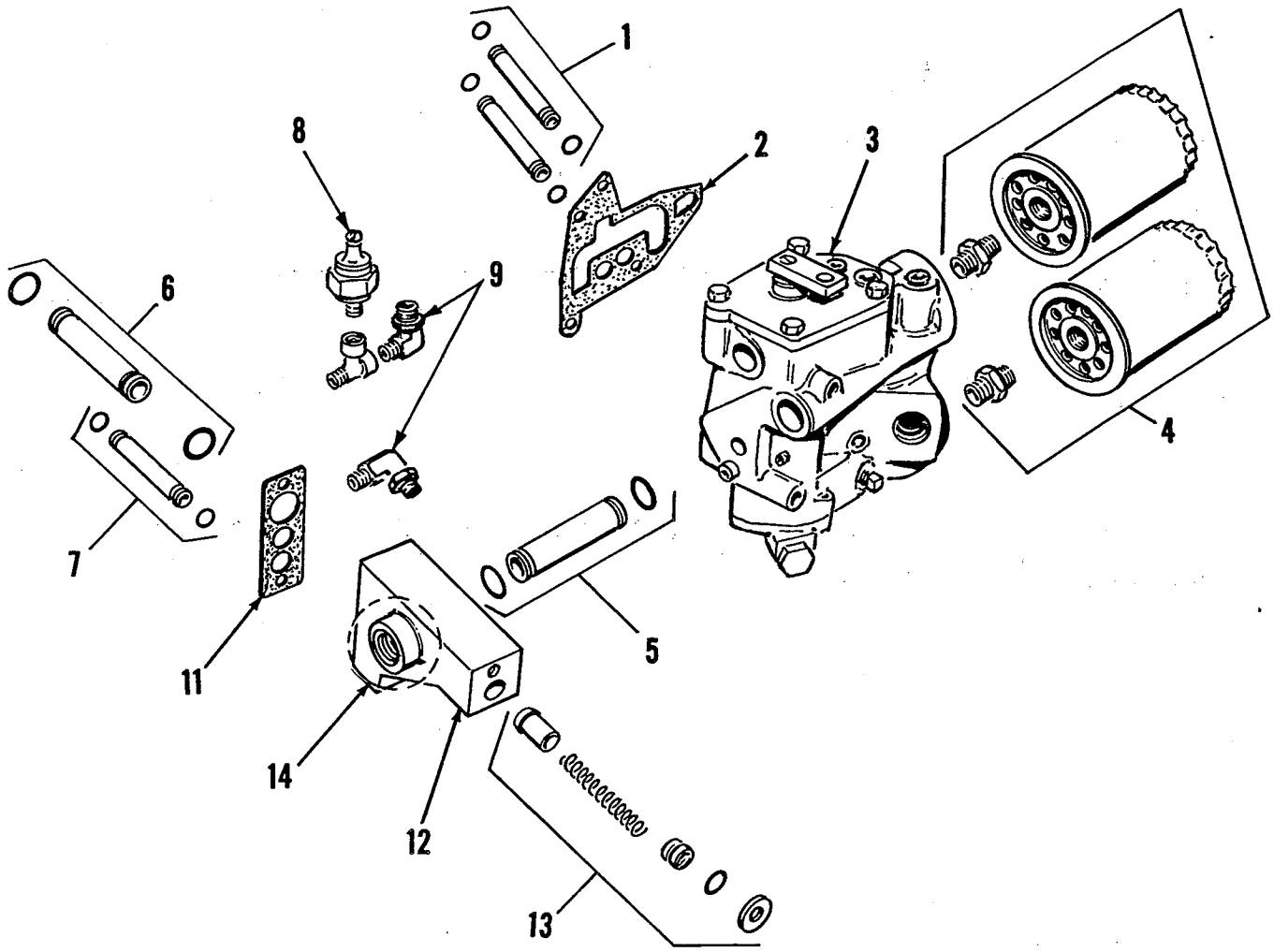
Control Valve and Charge Pump Outlet Manifold

Disassembly

1. Remove the charge pump outlet manifold and connecting tube from the control valve.

2. Remove the control valve connecting tube from the manifold.

3. TRACTORS WITHOUT TORQUE CONVERTER: Remove the cooler bypass valve assembly and plug by pushing the plunger in with a wooden dowel, from the rear side.



FESM-4474

1. Valve to clutch tubes and O-rings
2. Gasket
3. Control valve assembly
4. Filters and connectors
5. Manifold to valve tube and O-rings
6. Pump pressure to manifold tube and O-rings

*7. Torque converter to oil cooler tube and O-rings

*8. Torque converter temperature sender

*9. Torque converter to oil cooler fitting

*10. Oil cooler return to manifold fitting.

11. Gasket
12. Pump outlet manifold

†13. Oil cooler by-pass valve assembly

†14. Manifold to oil cooler port

* Tractors equipped with torque converter

† Tractors without torque converter

4. Remove the power control valve or cover from the bottom of the valve assembly.

5. Remove the safety starting switch.

6. Remove the top cover; and mark the detent disc and spool for reference during reassembly.

7. Drive the roll pin out of the detent disc using a pin punch inserted through the access hole in the valve housing. Then, remove the detent disc, ball, bushing, and spring.

8. Push the spool and thrust bearing assembly out the bottom of the housing.

9. Remove the plugs from the pressure regulator valves, and remove the shims, springs, and plungers.

10. Remove the relay arm roll pin. Then remove the relay arm, bar, and washer.

11. MACHINES WITHOUT TORQUE CONVERTER: Remove the power control arm block roll pin. Then remove the arm block and power control spool. Remove the roll pin over the check ball. Invert to spill out the check ball.

Inspection, Repair, and Reassembly

1. Inspect the control valve parts for wear, scoring, or other damage. Replace damaged parts.

2. It is advisable to check the springs for free length and tension at test length especially if the reverser assembly registered low pressure prior to tear down.

Spring	Free Length (Inches)	Test Length (Inches)	Test Load (Lbs.)
Apply Pressure Regulator	4-1/8	2-3/32	48-1/2
Lube Pressure Regulator	3-53/64	1-3/4	22
Detent	1-7/16	1-3/64	22

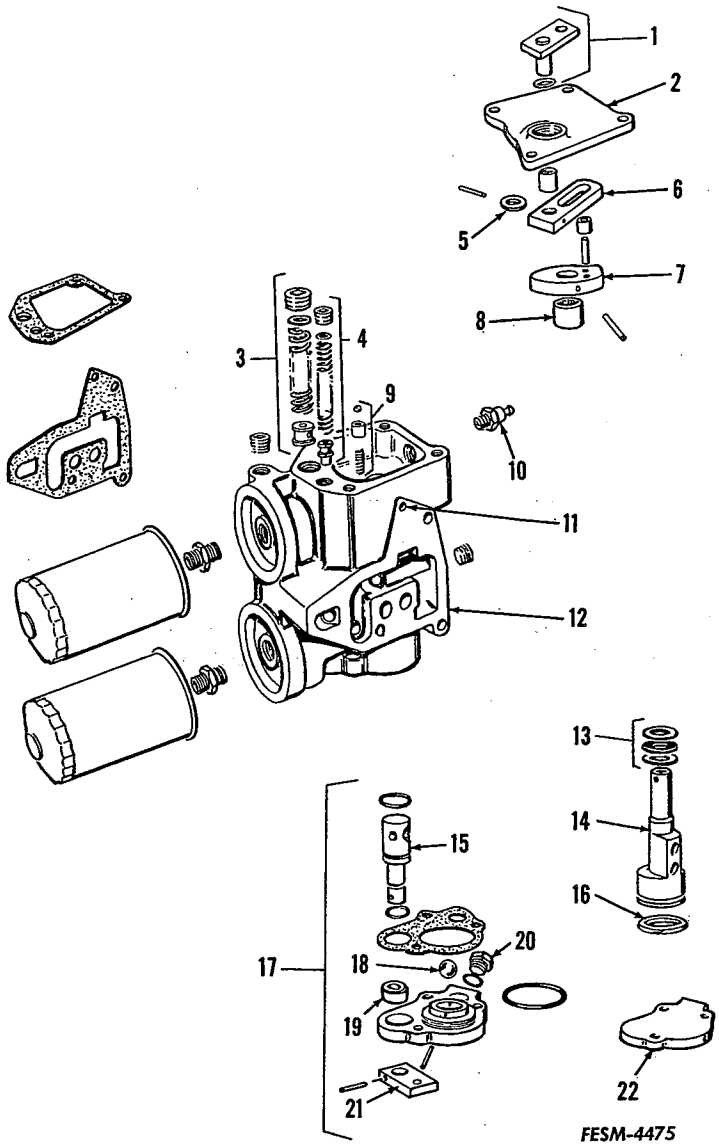
3. Install the seal ring and thrust bearing assembly on the control valve spool. Then lubricate the assembly with petroleum jelly; and install it in the valve body.

4. Check the spool for freedom of movement. Replace the needle bearing if the spool does not move freely.

5. Install the detent spring, bushing and ball. Then install the detent disc, aligning the reference marks punched during disassembly; and install the roll pin through the access hole in the valve body.

6. MACHINES WITHOUT TORQUE CONVERTER:

a. Inspect the power control valve spool and bushing for wear, scoring or other damage. Replace worn or damaged parts.



1. Relay arm and seal
2. Top cover
3. Apply pressure regulator
4. Lube pressure regulator
5. Spacer washer
6. Relay bar
7. Detent disc
8. Needle bearing
9. Detent assembly
10. Safety starting switch
11. Access hole to drive roll pin
12. Valve body
13. Thrust bearing assembly
14. Directional control valve spool
*15. Power control valve spool
16. Seal ring
*17. Power control valve assembly
*18. Ball
*19. Bushing
*20. Plug
*21. Power control arm block
**22. Bottom cover

* Tractors equipped without torque converter only.

** Tractors equipped with torque converter only.

b. Inspect the ball and seat in the bottom cover; and replace damaged parts. Install the ball, pin, and plug with a new O-ring.

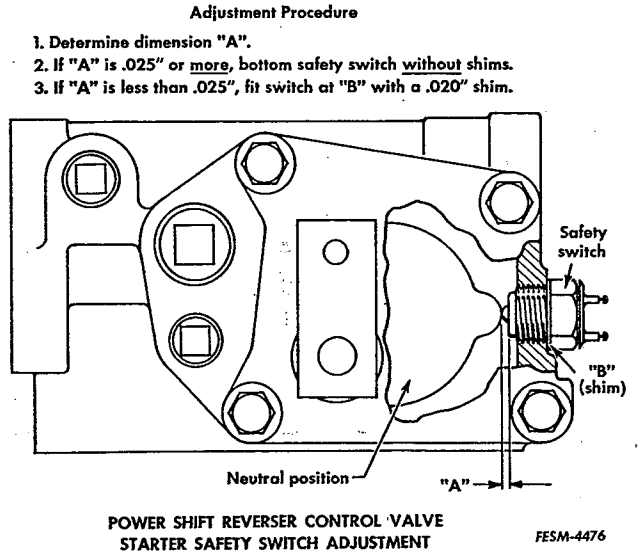
c. Install the power control valve spool in the bottom cover with a new O-ring.

d. Install the arm block and roll pin.

e. Check the rolling torque of the power control spool with an ignition point spring scale hooked in the arm of the block. Rolling torque should not exceed 5 inch lb. Polish the spool with crocus cloth, or replace if necessary.

7. Install the bottom cover or power control valve assembly on the valve body with a new gasket. Torque the capscrews to 20 ft. lbs. Recheck power control valve rolling torque.

8. Install the safety starting switch. Then, with the directional control valve spool in the neutral position, measure "A", the distance the ball protrudes from the switch capsule, If the measurement is less than .025 inch, shim the capsule at "B" with a .020" shim. Refer to the parts catalog for ordering information.



Power shift reverser control valve starter safety switch adjustment.

9. Inspect the relay arm, pin and bushings for wear. Replace damaged parts.

10. Replace the top cover seal, and install the relay arm and bar assembly with the spacer washer and spring pin.

11. Install the top cover on the valve body with a new gasket. Torque the capscrews to 35 ft. lbs.

12. Measure the effort required to move the directional control valve assembly as follows:

a. Slide a length of pipe over the arm. Then attach a spring scale to the pipe, 12 inches from the arm shaft.

b. Measure the effort required to rotate the spool with the spring scale. The arm should require 10 lb. pull, scale reading to rotate the shaft through the detent positions. If greater effort is required, the problem must be found and corrected, or possible shearing of the roll pins can occur.

13. Inspect the pressure regulator valve plungers and their bores for freedom of movement. Replace damaged parts. Slight scoring is permissible.

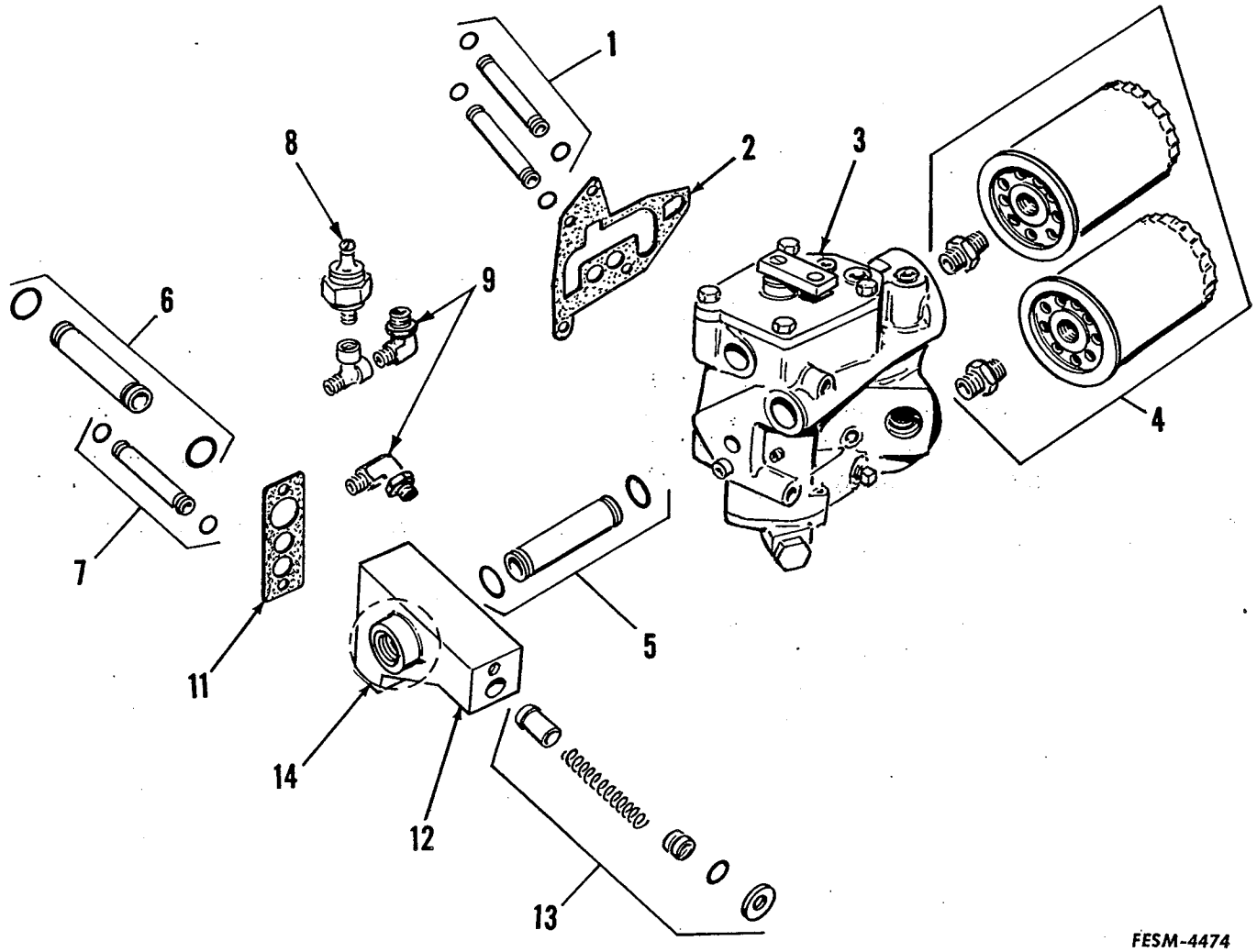
14. Install the regulator plungers, springs, shims and plugs.

15. MACHINES WITHOUT TORQUE CONVERTER:

a. Inspect the oil cooler relief valve assembly for freedom of movement. Slight scoring is permissible. Replace worn and damaged parts.

b. Check the cooler relief spring free length and tension at test length. The spring should measure 3-53/64 inch, and tension should measure 10 lbs. at 1-3/16 inches.

c. Install a new O-ring on the plug, and install the valve assembly.

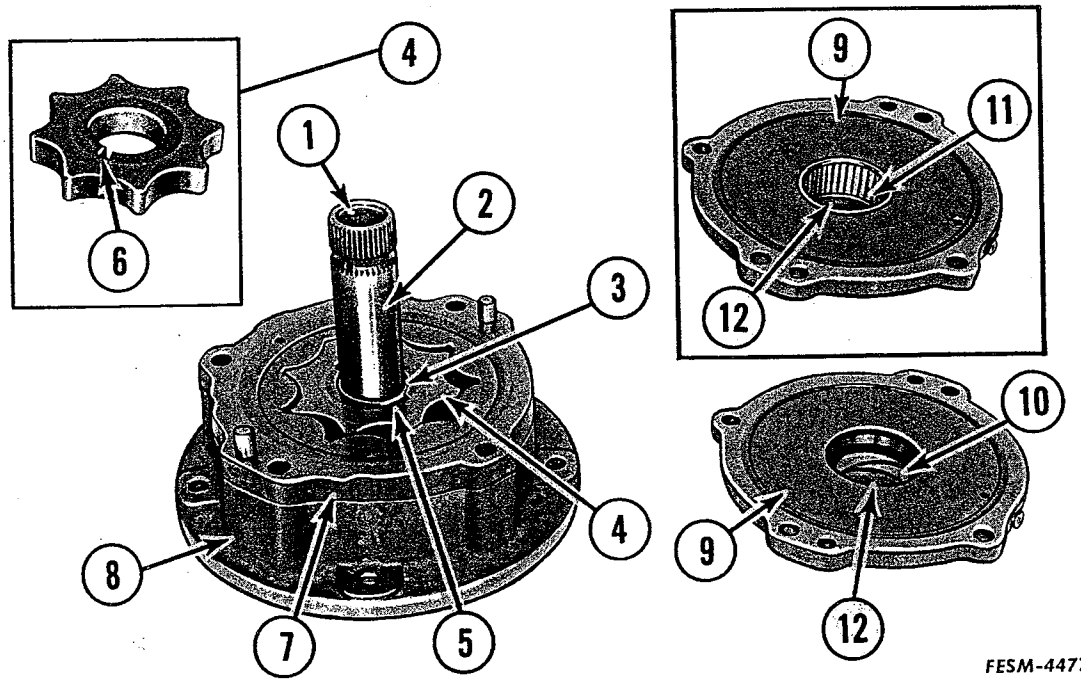


FESM-4474

1. Valve to clutch tubes and O-rings
2. Gasket
3. Control valve assembly
4. Filters and connectors
5. Manifold to valve tube and O-rings
6. Pump pressure to manifold tube and O-rings
* 7. Torque converter to oil cooler tube
* 8. Torque converter temperature sender
* 9. Torque converter to oil cooler fitting
*10. Oil cooler to manifold fitting
11. Gasket
12. Manifold, pump outlet
† 13. Oil cooler bypass valve assembly
† 14. Manifold to oil cooler port

*Machines equipped with torque converter

†Machines without torque converter



FESM-4477

* 1. Drive shaft bushing
* 2. Stator support tube
* 3. Inner gear bushing
4. Inner gear
* 5. Driving slot
† 6. Key slot, for woodruff key
7. Gear housing
8. Pump housing
9. Front cover
*10. Front cover bushing
†11. Front cover bearing
12. Front cover seal

* Machines equipped with torque converter

† Machines without torque converter

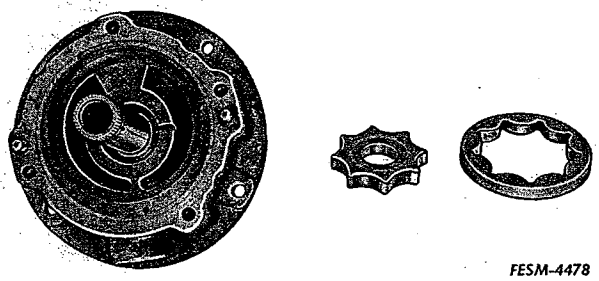
Charge Pump

Disassembly

1. Remove the charge pump front cover. Remove the gears and gear housing by tapping the pump housing on a wooden block.

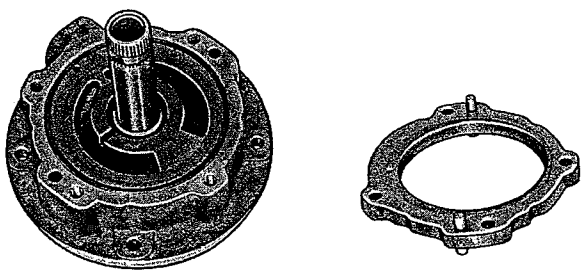
2. TRACTORS EQUIPPED WITH TORQUE CONVERTER: Remove the torque converter relief valve for cleaning, especially if any type of malfunction or failure has occurred.

NOTE: Unless a fixture is available for checking the pressure setting, replacement is recommended.



FESM-4478

Gears removed (torque converter model illustrated)



FESM-4479

Gear housing removed (torque converter model illustrated)

Inspection, Repair, and Reassembly

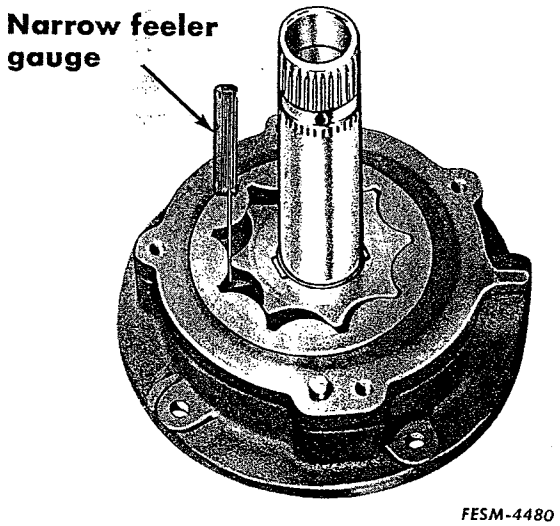
Inspect the pump gears, gear housing, pump housing, and front cover, for scoring or other visible wear. Replace worn parts. Always replace the charge pump seal regardless of the number of operating hours (due to difficult location).

NOTE: The stator support tube on machines equipped with torque converter is an integral part of the charge pump housing and is not serviced separately.

Machines Equipped with Torque Converter

1. Measure the inner gear bushing I.D. and the stator support tube O.D. with micrometers. The measured difference, which is the operating clearance, must not exceed .1618 inch.

2. Measure the drive shaft bushing I.D. and the drive shaft O.D. with micrometers. The measured difference, which is the operating clearance, must not exceed .004 inch.



Measuring gear clearance

3. Measure the front cover bushing I.D. and the charge pump drive tube O.D. with micrometers. The measured difference, which is the operating clearance, must not exceed .045 inch.

NOTE: Replacement of the smooth cover bushing, used on early model tractors, is recommended.

4. Inspect the inner gear slots and the converter extension tangs for visible wear.

IMPORTANT: Rapid and abnormal wear of the reverser drive shaft, stator support tube, converter drive tube extension, and bushings, indicate torque converter misalignment. Refer to Torque Converter Alignment for corrective procedure.

5. Install the gears and gear housing on the pump housing. Then measure gear clearance with a feeler gauge. Clearance must not exceed .008 inch.

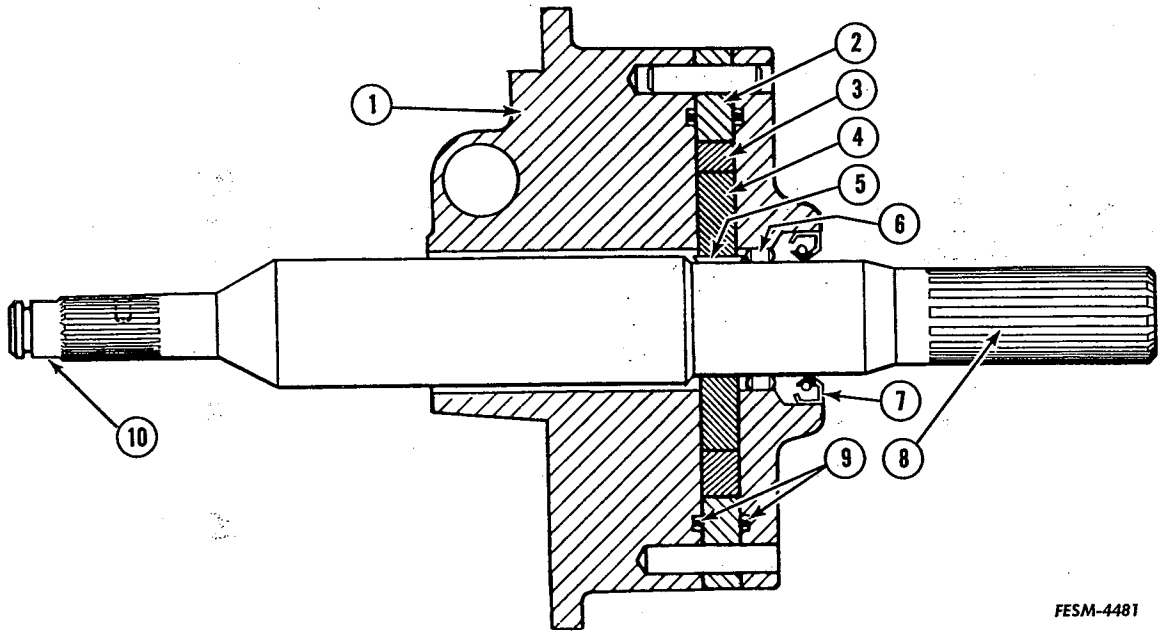
6. Replace worn parts.

7. Replace the charge pump rear and cover seals; and the torque converter relief valve, if it was removed.

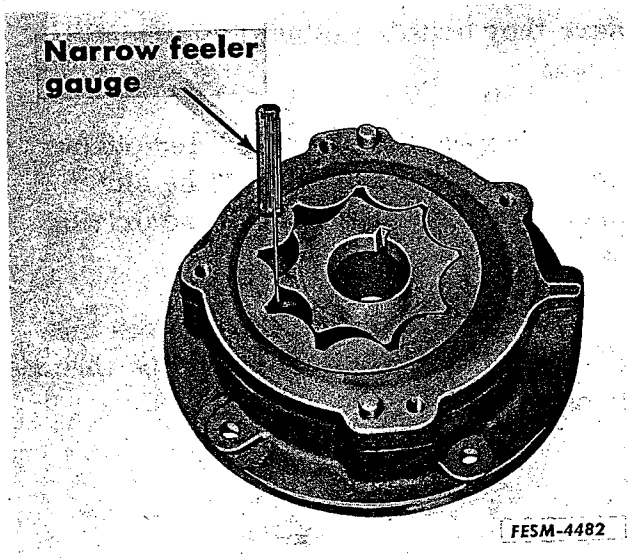
IMPORTANT: Be careful not to distort the seal case in the front cover. The seal is to be pressed in flush with the outer edge of its bore. However, it is permissible to position the seal within the bore to take advantage of a smoother portion of the extension shaft.

8. Install the front cover, and torque the capscrews to 35 ft. lbs.

Tractors without Torque Converter



1. Pump housing	5. Drive key	8. Reverser drive shaft
2. Gear housing	6. Needle bearing assembly	9. O-ring seals
3. Outer gear	7. Cover seal	10. O-ring
4. Inner gear		



Measuring gear clearance

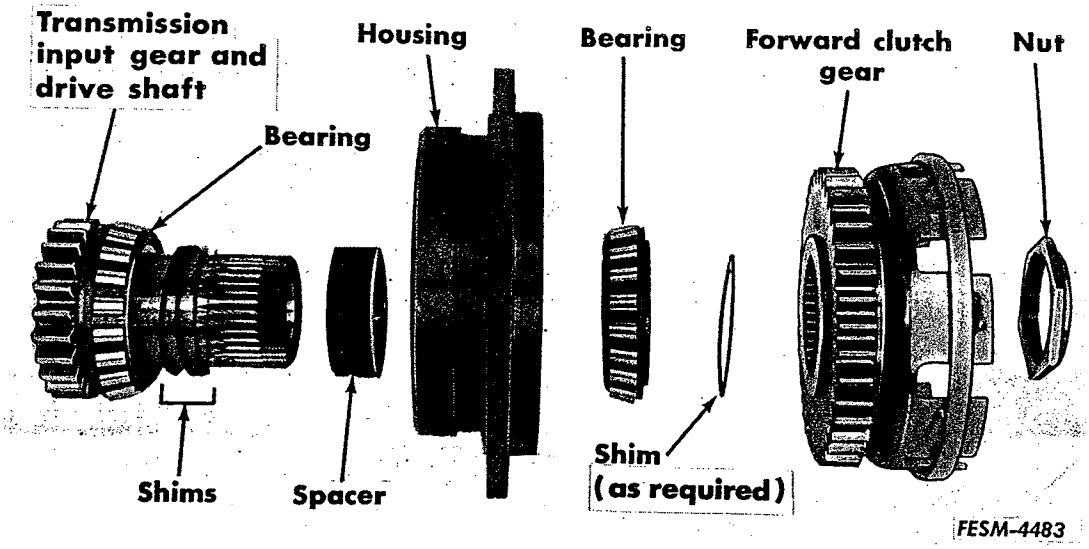
1. Inspect the inner gear key slot, key, and reverser drive shaft key pocket, for visible wear or damage.

2. Install the gears and gear housing on the pump housing. Then measure gear clearance with a feeler gauge. Clearance must not exceed .008 inch.

3. Inspect the front cover bearing and reverser drive shaft for wear or damage.

4. Replace worn and damaged parts; and always replace the front cover seal.

NOTE: Do not reassemble the pump at this time. The charge pump must be disassembled prior to installation in order to locate the inner gear on the reverser drive shaft and key. Refer to "Charge Pump Installation" in "Reassembly".



Forward Clutch Gear Assembly

Disassembly

1. Position the assembly on the transmission input gear. Unstake the nut located inside the forward clutch gear drum.

2. Lock the transmission input gear in a brass jawed vise. Remove the nut.

3. Remove the forward clutch gear.

NOTE: There may be a shim between the bearing and gear.

4. Position the housing in a press so that the transmission input gear is clear. Press the transmission input gear and shaft out of the housing. Note the location and number of shims, and the spacer that separate the two bearing cones.

Inspection and Repair

1. If it is necessary to replace the bearing next to the gear, use a split puller to secure the cone; and press the shaft through the bearing. Use a suitable tube that will slip over the shaft and mate with the inner cone of the bearing when pressing it on the shaft.

2. When replacing bearing cups be sure they bottom against the retainer rings.

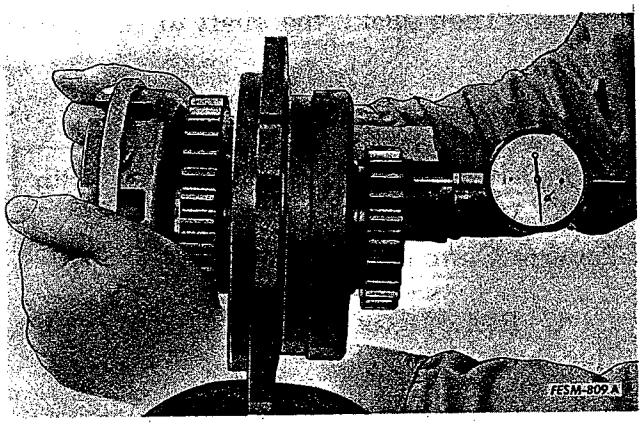
3. Inspect the gear teeth for pitting and excessive wear. Check the clutch drum for excessive wear at the driving area.

4. Inspect the shaft thread area and the nut. Use a file to clean up the threads if required.

Reassembly

This procedure is the exact reverse of disassembly except as follows:

1. Using the original shims, torque the drum retainer nut to 80 ft. lbs. DO NOT STAKE THE NUT AT THIS TIME.



Checking rolling end play

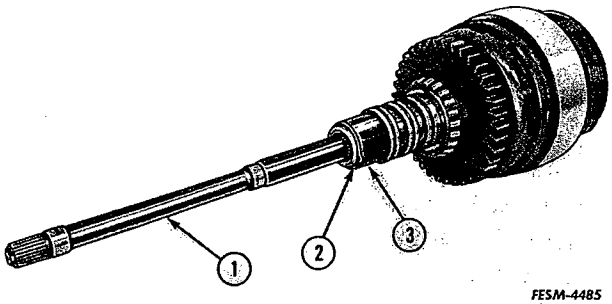
2. Locate the assembly in a vise and attach dial indicator as shown.

3. Rotate the drum assembly as far as possible in each direction while continuously pushing the assembly ahead. Set the dial indicator at zero.

4. Rotate again as in step 3 but pull the drum instead of pushing it. Dial movement indicates rolling end play.

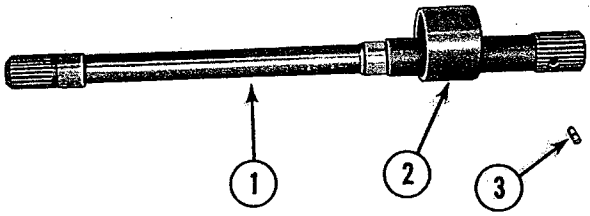
5. The rolling end play must be from .001 to .003 inch. Disassemble the assembly and add or subtract shims as required to provide the specified end play.

6. Torque the nut to 80 ft. lbs. Secure the nut by staking with a suitable punch.



FESM-4485

1. Drive shaft
2. Retaining ring
3. Spacer



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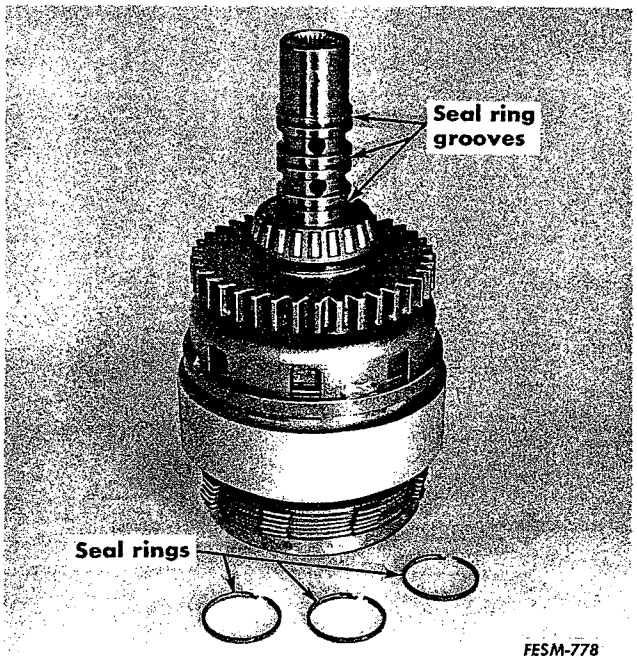


FESM-778

Clutch Shaft Assembly

DISASSEMBLY

Reverser Drive Shaft Removal

Remove the retaining ring and spacer from the front end of the clutch shaft. Then, remove the dowel pin and drive shaft.

NOTE: To remove the dowel pin, turn the shaft so that the pin hole faces downward. Then shake the shaft to remove the pin.

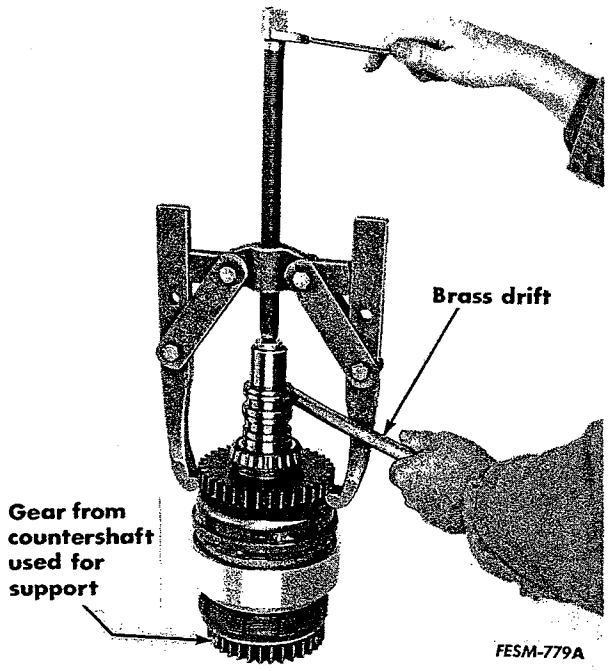
1. Drive shaft 2. Spacer 3. Pin

Reverse Clutch Gear Assembly Removal

1. Remove the three seal rings from the shaft.

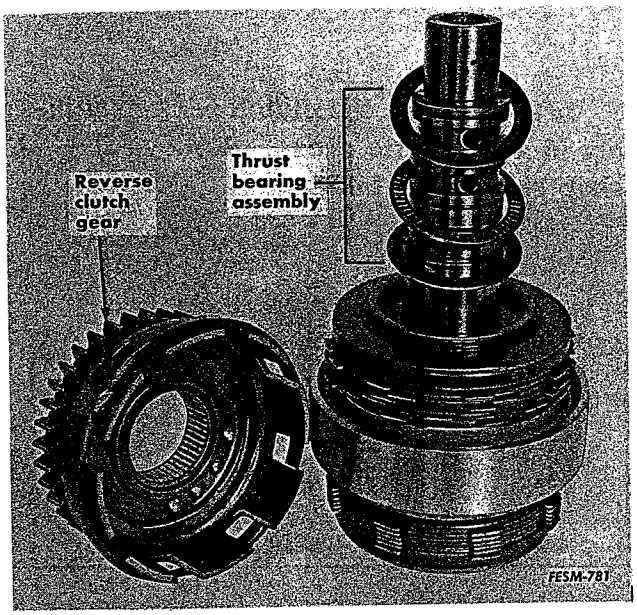
2. Support the assembly to protect the small bearing cone.

Remove the reverse clutch gear and bearings with a puller, using a step plate to protect the shaft. Then remove the inner thrust bearing assembly.

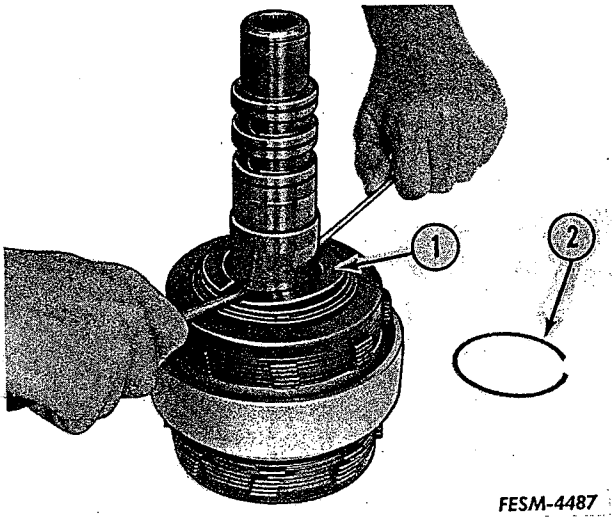


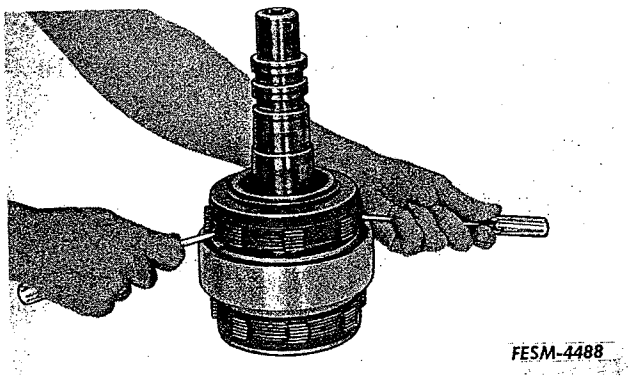
FESM-779A

Removing the reverse clutch gear assembly



Reverse clutch gear removed.





Separating the pack from the piston.

1. Clutch pack assembly
2. Snap ring
3. Split retaining washer

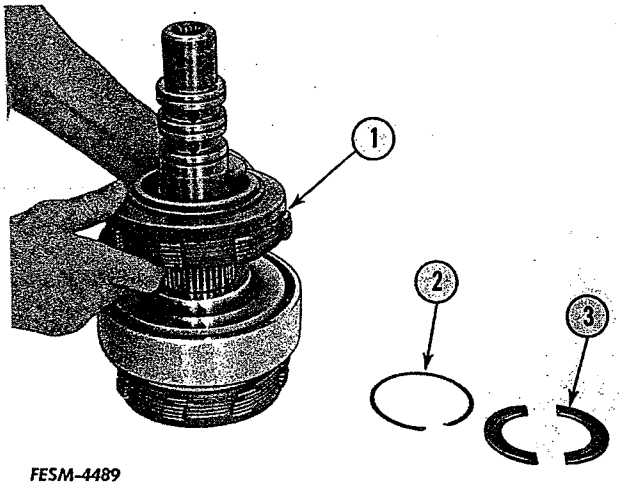
Clutch Pack Assembly Removal

1. Remove the clutch hub snap ring. Then compress the clutch with two screwdrivers, and work out the split retaining washers.

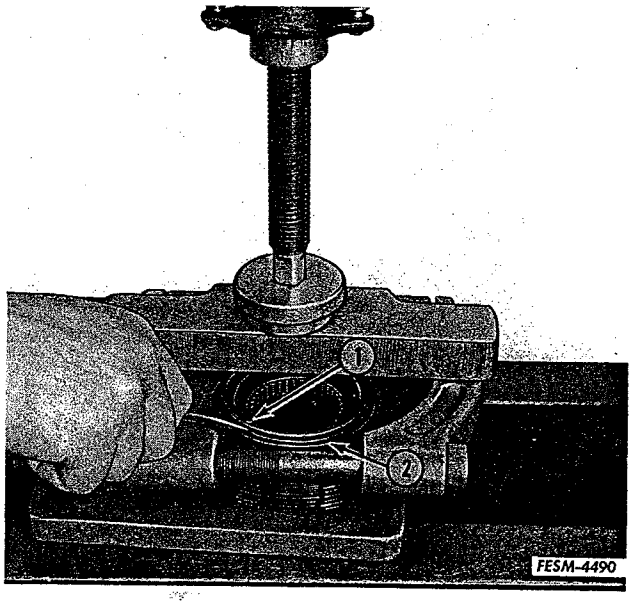
1. Split retaining washer
2. Snap ring

2. Remove the clutch pack assembly from the shaft, using two screwdrivers to separate the pack from the apply piston.

NOTE: If the clutch packs do not require service, proceed to apply piston removal.

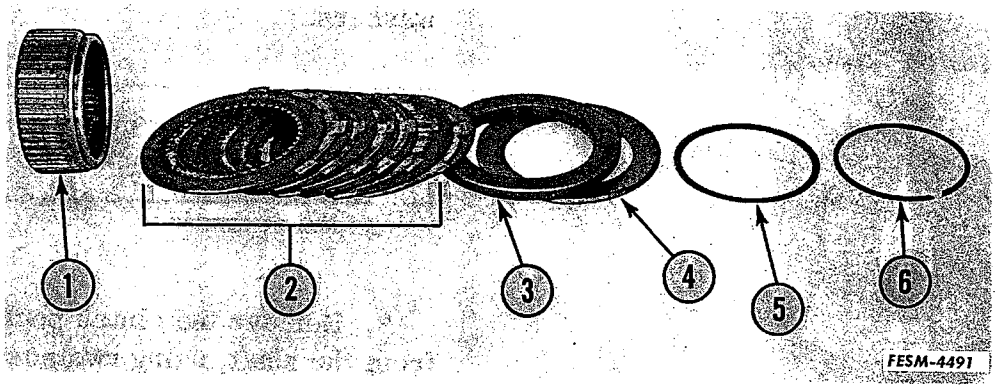


Removing the reverse clutch pack.



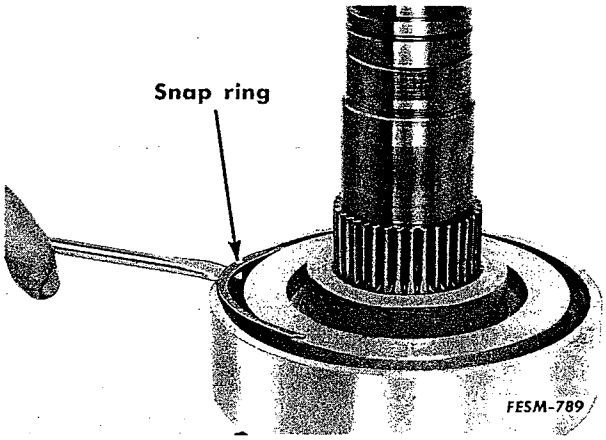
3. Compress the clutch pack assembly in a hydraulic press. Remove the snap ring and retainer.

1. Snap ring
2. Retainer

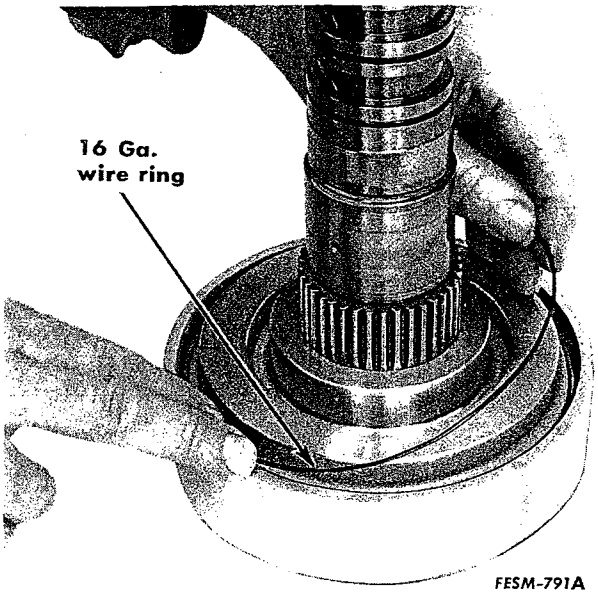


1. Hub
2. Discs and plates
3. Backing plate
4. Belleville washer
5. Snap ring retainer
6. Snap ring

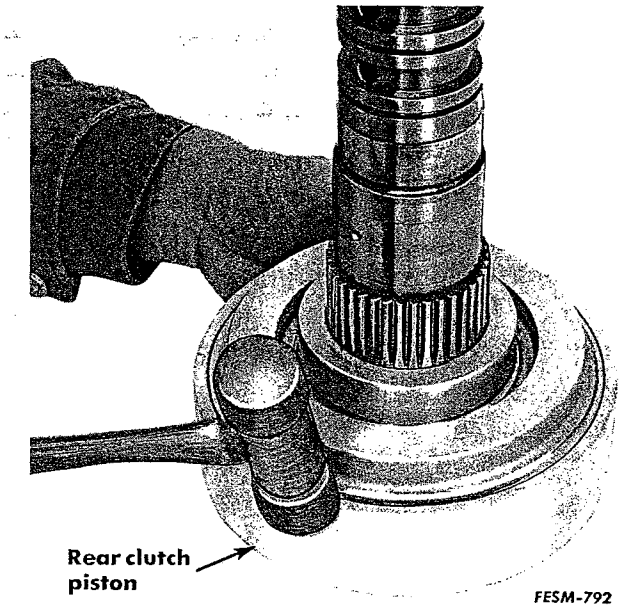
4. Remove the clutch pack assembly from the press. Remove the belleville washer, retainer, springs, discs and plates.



Removing the snap ring.



Installing the wire ring.



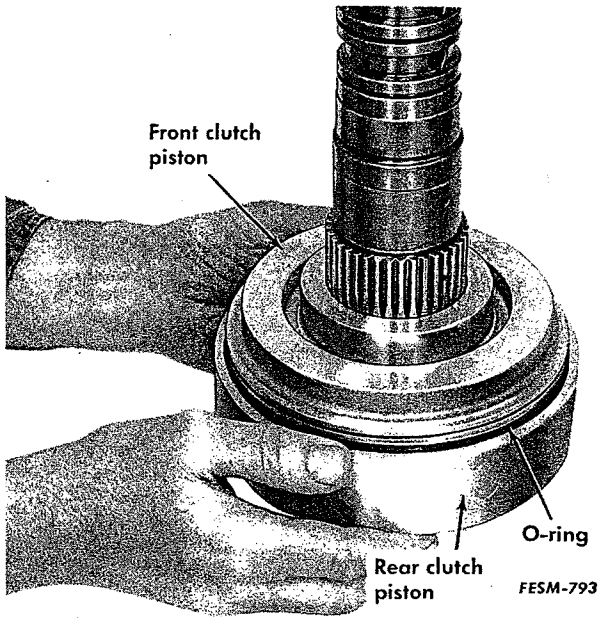
Separating the pistons.

Pack Assembly Removal

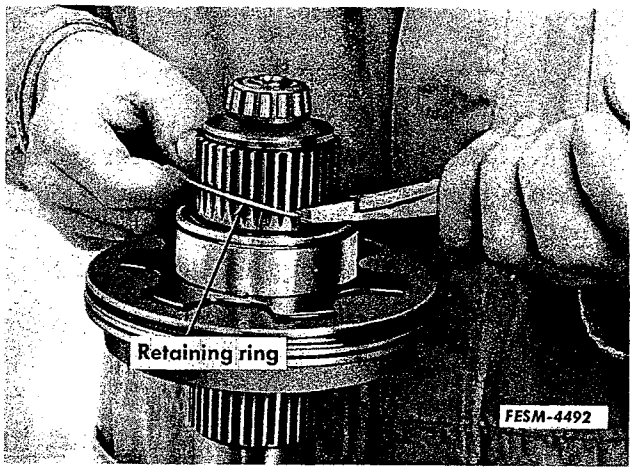
1. Remove the apply piston snap ring. Then form a piece of 16 gauge wire, 18 inches long around the outside of the piston, to form a ring; and install the wire ring in the snap ring groove.

IMPORTANT: The wire ring must fit smoothly and evenly in the groove, without irregularities or overlapping. The wire ring will prevent the piston seal and separator plate O-ring from lodging in the snap ring groove, preventing disassembly.

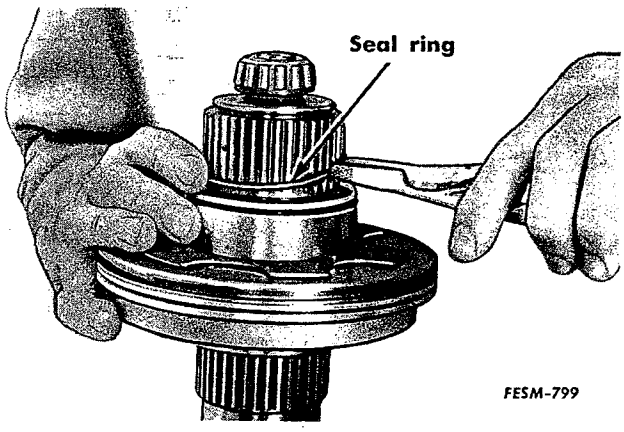
2. Separate the clutch pistons by carefully tapping on the outer edge of the rear piston with a plastic hammer. Remove the apply pistons from the shaft.



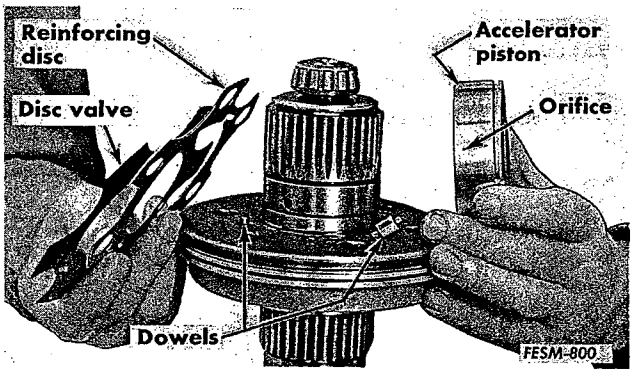
Removing the rear piston.



Removing the retaining ring.



Removing the seal ring.



Removing the accelerator piston and disc valve assembly.

Accelerator Pistons and Disc Valves - Removal

1. Support the shaft in a vise with brass jaws, and remove one accelerator piston retaining ring.

NOTE: Use Proto No. 251 snap ring pliers or equivalent of the parallel jaw design.

2. Unhook and remove the accelerator piston to shaft seal ring. Then remove the piston, disc valve assembly, and three dowel pins from the separator plate.

3. Turn the shaft over in the vise, and remove the opposite assembly.

INSPECTION, REPAIR AND REASSEMBLY

1. Inspect the clutch shaft sealing ring lands splines, and bearing surfaces, for burrs, scoring or wear which will hinder operation. Remove minor imperfections with crocus cloth.

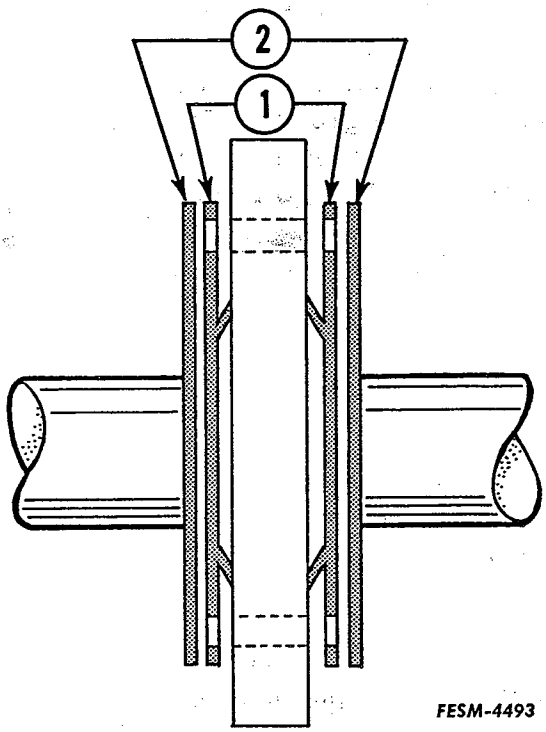
2. Check sealing ring fit on the clutch shaft. Rings should be free to turn in the grooves.

3. Replace the shaft if worn or damaged.

NOTE: Lightly coat all parts with petroleum jelly as they are reassembled.

Accelerator Pistons and Disc Valves

1. Inspect the disc valves and reinforcing discs for flatness. Replace bent or warped discs which would cause fluid leakage.



1. Reinforcing disc
2. Disc valve

2. Check the separator plate snap rings to be sure that they are in place, anchoring the separator plate to the shaft.

3. Support the clutch shaft in a vise with brass jaws. Place one disc valve assembly in position on the separator plate.

IMPORTANT: The reinforcing disc goes between the separator plate and the disc valve with the tangs pointing toward the separator plate.

4. Visually inspect the accelerator piston modulator orifice to make sure that it is not obstructed. Install the piston and retaining ring.

5. Install new seal rings on the accelerator piston and shaft.

6. Turn the shaft assembly over in the vise, and install the three dowels into the separator plate and discs.

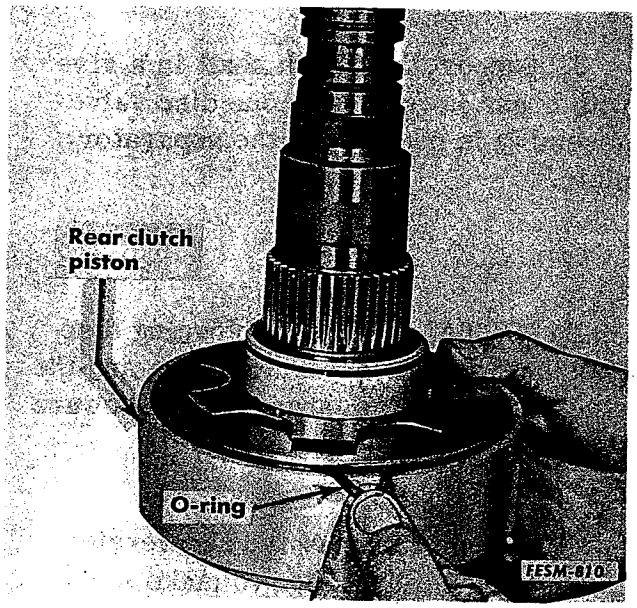
7. Install the other accelerator piston and disc valve assembly.

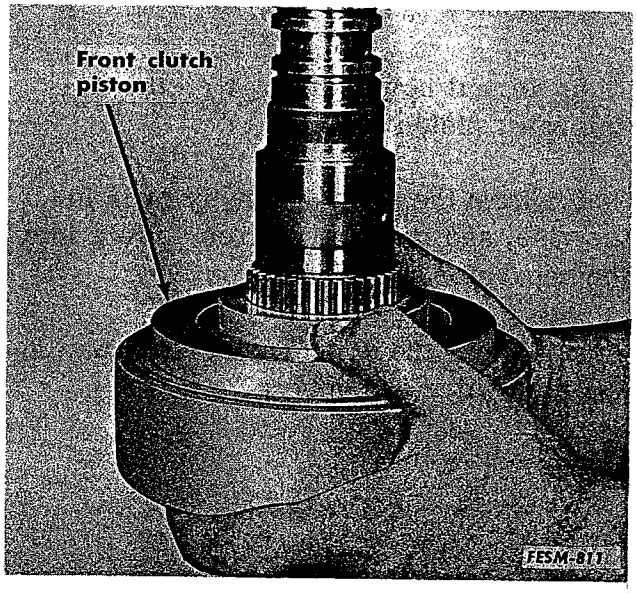
Apply Pistons

1. Install the separator plate O-ring.

NOTE: The O-ring will appear too large, but is purposely so designed to promote proper sealing.

2. Locate the 16 gauge wire ring used in disassembly into the rear piston snap ring groove.





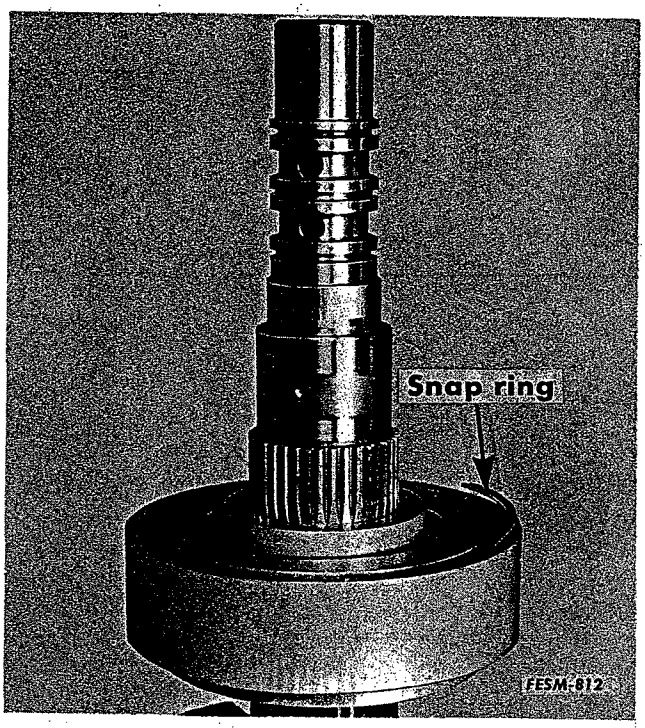
Installing the apply pistons

IMPORTANT: The wire ring will prevent damage to the separator plate O-ring, and shearing or wedging of the piston seal, which would prevent reassembly.

3. Coat all parts lightly with petroleum jelly. Insert the clutch shaft through the rear piston. Support the shaft in a vise with brass jaws, and work the piston over the separator plate while working the O-ring into the groove. Use no force other than that generated by squeezing the parts together by hand.

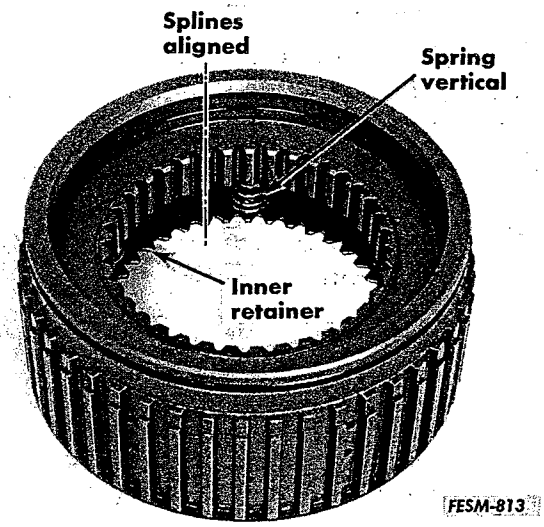
4. Gently install the front piston into the rear piston. Be careful not to damage the seal ring.

5. Remove the 16 gauge wire then install the apply piston snap ring.

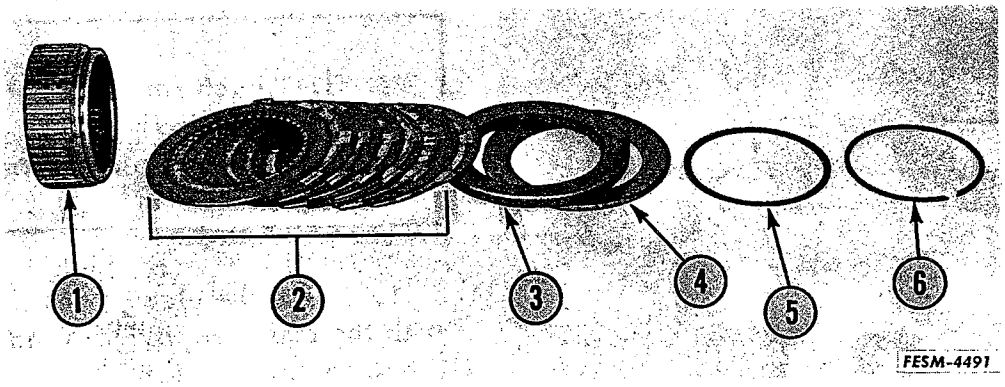


Clutch Pack Assemblies

If the clutch packs were not disassembled, proceed to step 8.



Hub assembly.



1. Hub
2. Discs and plates
3. Backing plate
4. Belleville washer
5. Snap ring retainer
6. Snap ring

1. Replace worn, warped or burned discs and plates.

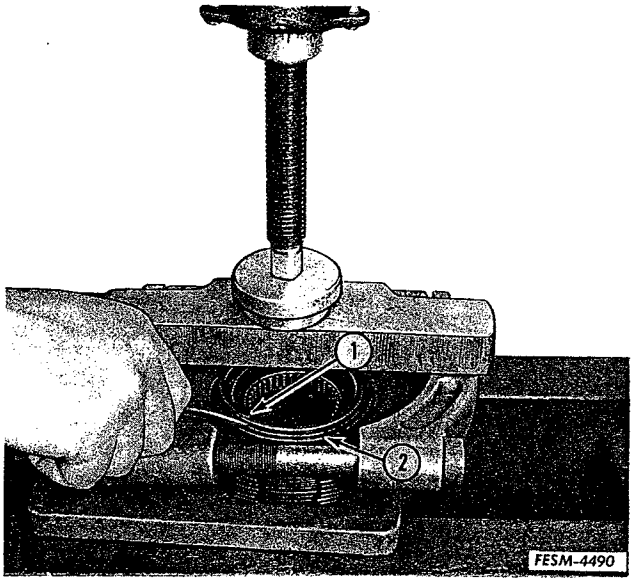
2. Soak the clutch plates in Hy-Tran fluid. New plates must be soaked for one hour. Used plates must be soaked for 20 minutes.

3. Inspect the piston return springs for free length, and tension at test length. Free length should measure 1-9/64 inches, and test load should be 8 lbs. at 13/16 inches.

4. Install the springs and retainer in the hub. The splines must be aligned, and the springs vertical.

5. Install the seven clutch discs and six plates, starting and ending with a bronze disc.

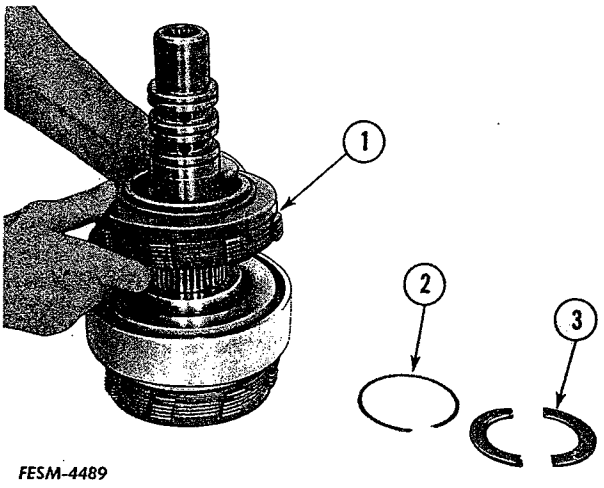
6. Position the backing plate with the relieved side toward the assembly. Position the bellville washer with the concave side toward the assembly.



Installing the snap ring.

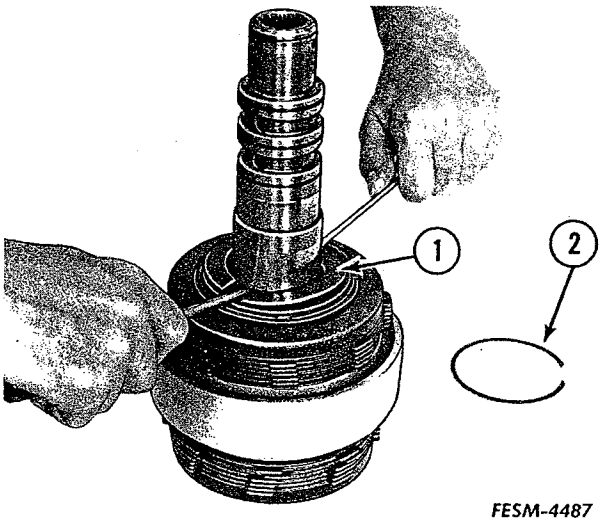
7. Compress the Belleville washer and clutch plates in a press, and install the snap ring and retainer.

1. Snap ring
2. Retainer

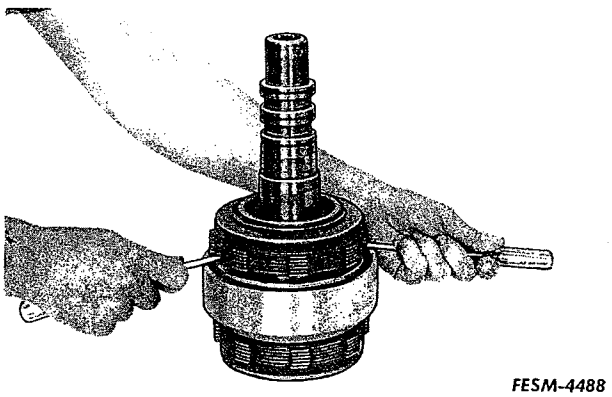


8. Install one clutch pack assembly and the split retaining washer, using two screwdrivers to compress the pack.

1. Clutch pack assembly
2. Snap ring
3. Split retaining washer



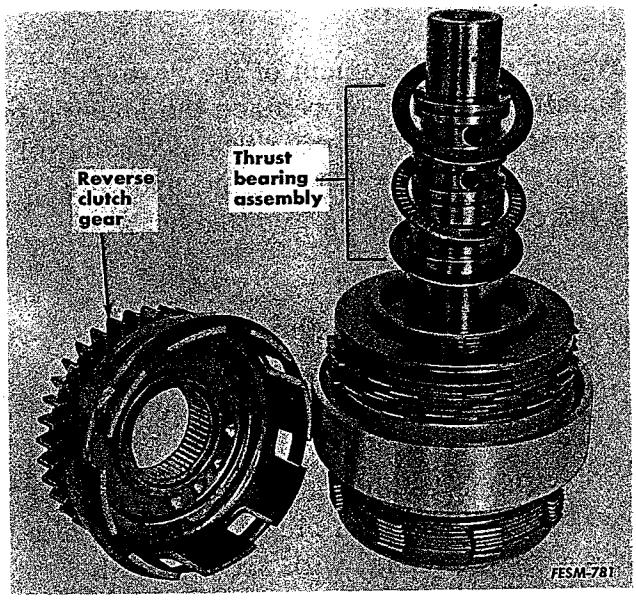
9. Raise the clutch pack assembly with the two screwdrivers, and install the snap ring.



Raising the clutch pack to install the snap ring.

1. Split retaining washer
2. Snap ring

10. Install the other clutch pack assembly.

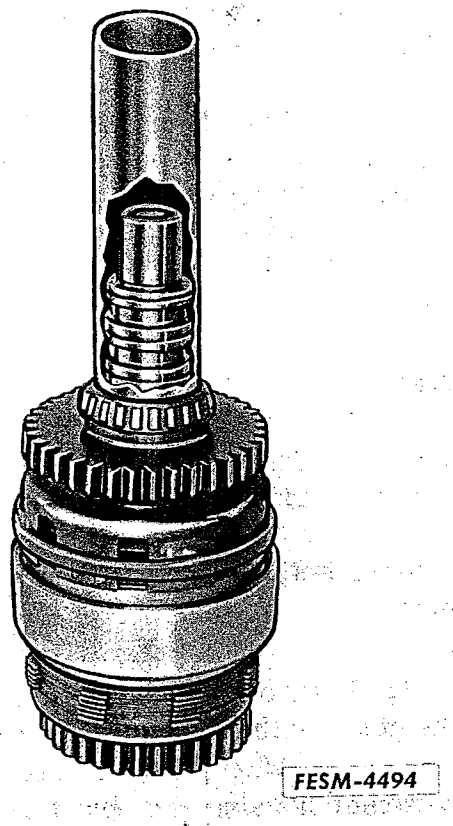


Reverse Clutch Gear Assembly

1. Inspect the clutch gear bearings for wear or damage, and replace if necessary.

2. Install the clutch gear with thrust and needle bearings, on the clutch shaft; and press on the tapered roller bearing.

3. Install the three hook type sealing rings.



Tube positioned for roller bearing installation.

Inspection And Repair

1. Clean all parts in an evaporative solvent, and dry with compressed air.

2. Inspect the housing for cracks, stripped bolt holes, and other damage which will impair reverser operation.

3. Inspect bearing bores for roughness and damage. Inspect the needle bearings; and replace if necessary.

4. Inspect fluid passages for blockage and foreign material.

5. Inspect the clutch shaft bore in the housing for scoring or other damage where the clutch shaft seal rings contact the housing. Remove minor scoring with crocus cloth to prevent fluid leakage.

NOTE: Damage other than surface scoring is caused by excessive rolling end play of the clutch shaft; and will require repair or replacement of the reverser housing. Repair or replace the housing to correct defects. Repair would consist of boring out the damaged area, adding a sleeve, and reboring to standard size.

6. Replace all seals and gaskets.

7. Replace worn and damaged parts.

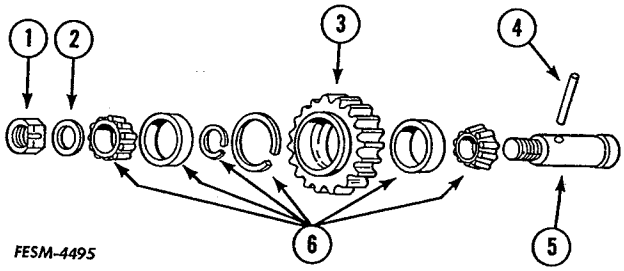
8. Remove burrs, sharp edges and scratches from seal ring grooves, shafts, and working parts, with crocus cloth.

9. Coat all internal parts of the reverser with IH Hy-Tran fluid during reassembly, to lubricate the parts and prevent corrosion.

10. Use petroleum jelly to aid assembly, and prevent damage to O-rings and bearing surfaces, and to lubricate bearings.

Reassembly

Reverse Idler Installation



1. Nut
2. Washer
3. Reverser idler gear
4. Roll pin
5. Shaft
6. Bearing assembly

Idler bearing cones, races, spacer, and retaining rings, are replaced as an assembly. The spacer is matched to the bearing set, and will determine idler end play.

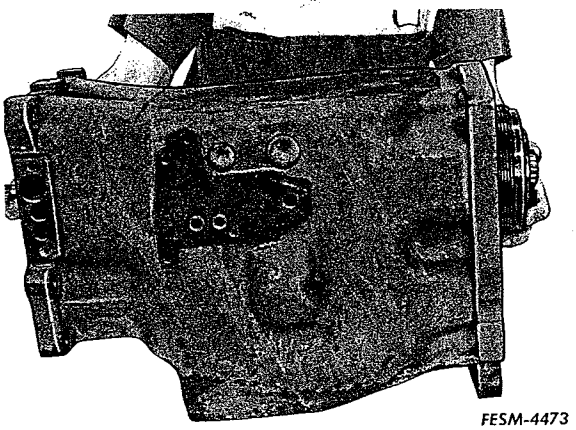
1. Position the bearing assembly in the gear, with the spacer between the cones. Position the gear assembly in the reverser housing and insert the idler shaft through the assembly.

2. Align the hole in the shaft with the hole in the reverser housing. Install the roll pin through the hole provided, with a pin punch.

3. Install the Allen screw plug, behind the roll pin, and the nut and washer, on the shaft.

4. Torque the nut to 450 ft. lbs. using a crows foot or open end socket. Install the cotter pin through the nut. It is permissible to back-off the nut to permit insertion of the cotter pin.

Clutch Shaft Installation



Installing the clutch shaft.

1. Insert the reverser drive shaft in the clutch shaft to aid clutch shaft installation.

2. Install the clutch shaft assembly in the housing.

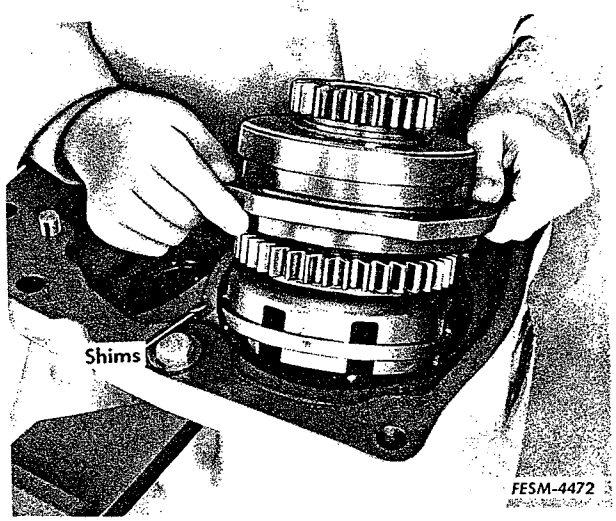
3. Remove the reverser drive shaft from the clutch shaft.

Forward Clutch Gear Installation

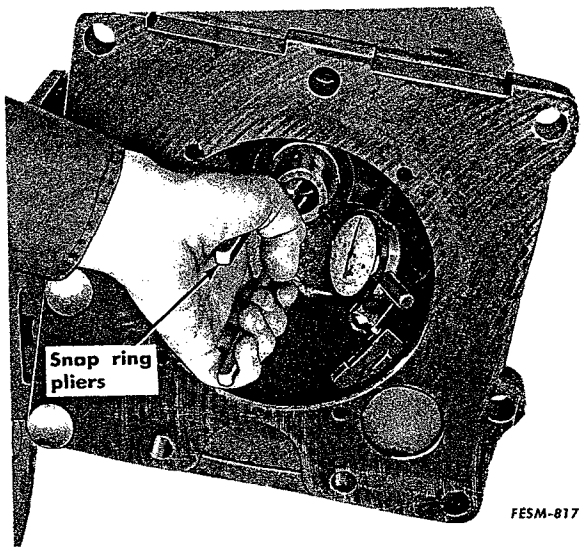
1. Install the forward clutch gear assembly with original shims, rotating the input shaft gear by hand while pushing the assembly toward the center of the housing. Tighten the capscrews to 35 ft. lbs.

2. Locate a magnetic base dial indicator as shown in the illustration.

3. Using internal snap ring pliers as illustrated, rotate the clutch shaft while pulling outward.



Installing the forward clutch gear.



Checking clutch shaft end play.

4. Set the dial indicator at zero, then continue to rotate the shaft assembly while pushing inward. Determine by several tries, the rolling end clearance in the clutch shaft. It must fall in the .001 to .003 inch range.

5. Remove or install shims between the reverser housing and the forward clutch gear assembly, as necessary to obtain .001 to .003 inch clutch shaft rolling end play.

6. Torque the capscrews to 35 ft. lbs.

Reverser Drive Shaft Installation

1. Inspect the splines and dowel pin hole for damage. Replace the shaft if damaged.

2. Install a new O-ring on the shaft; and install the shaft, dowel pin, sleeve, and retaining ring.

Shimming the Forward Clutch Gear

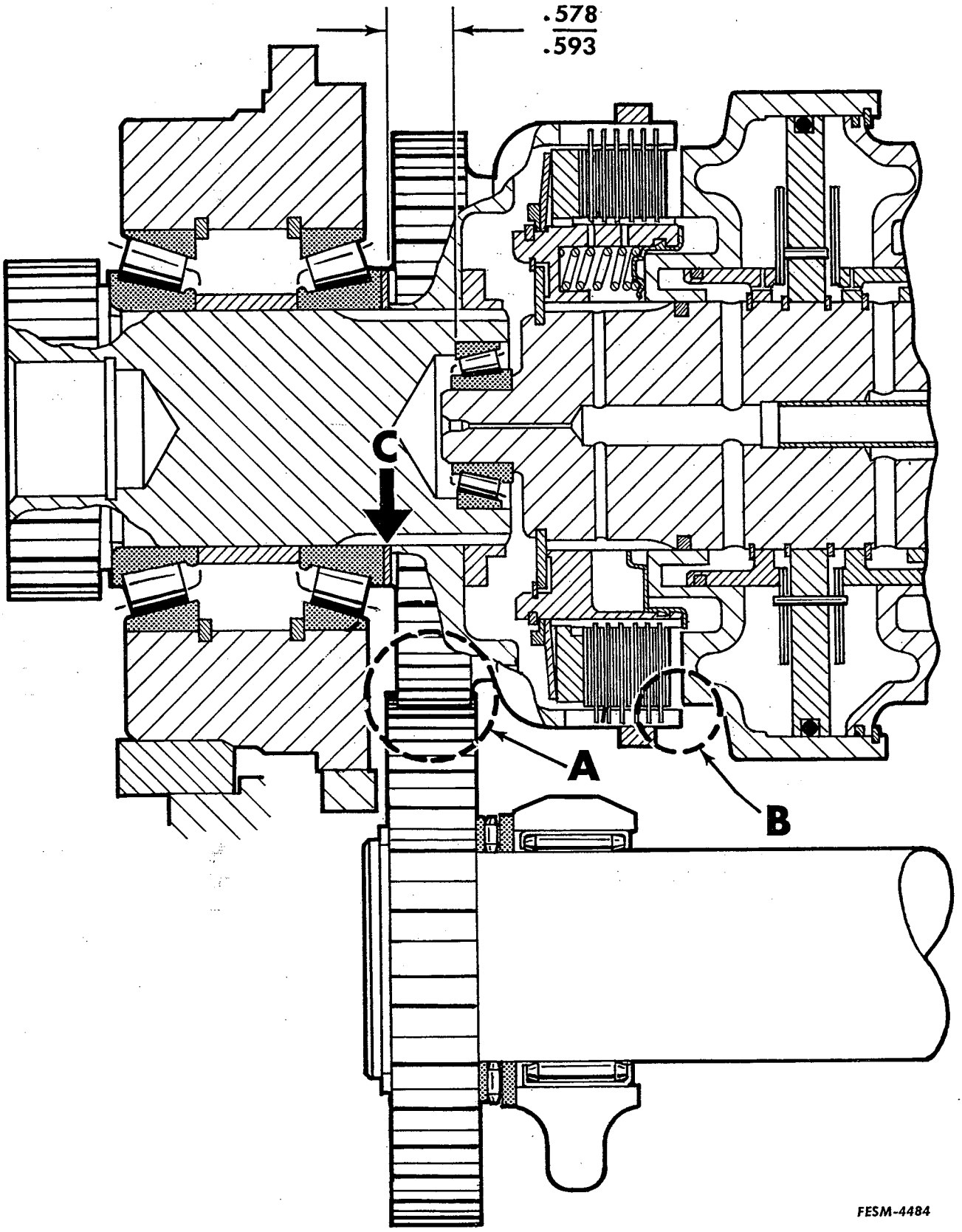
In all but remote instances, the forward clutch gear will be correctly located by using the original shim(s) located between the bearing cone and the forward clutch gear and drum.

1. Visually observe the location of the forward clutch gear where it engages the rear countershaft drive gear.

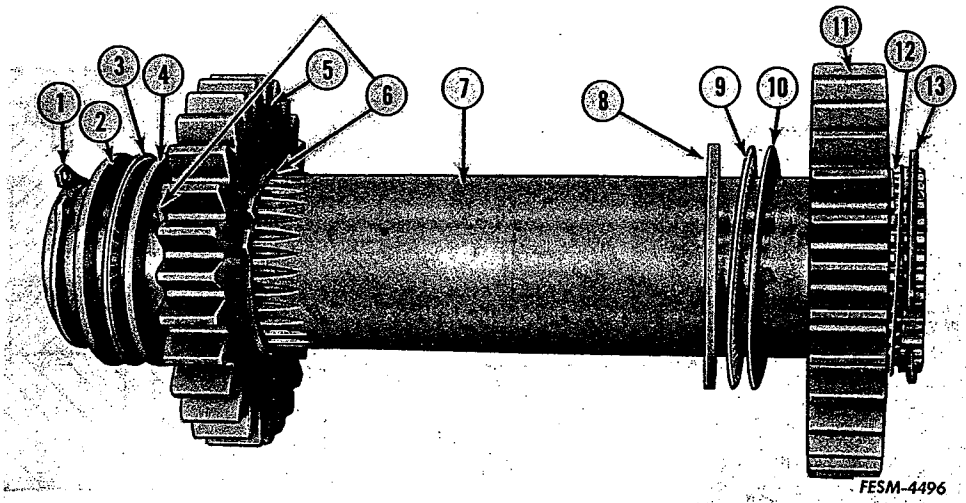
2. Add or subtract shims at "C" to locate the gear in the same wear area at "A" that it had previously operated in. In the event that new gears are used, adjust the shims to permit full engagement of the teeth in area "A". Also determine that no interference exists at "B".

NOTE: Service shops having suitable equipment can determine the required shim pack by measuring the distance between the bearing cup seating shoulder and the top of the shim pack. (Refer to the illustration) this distance must measure from .578 to .593 inch.

3. Tighten the drum retainer nut to 80 ft. lbs.; and stake the nut to lock it in place.



Forward clutch gear shims.

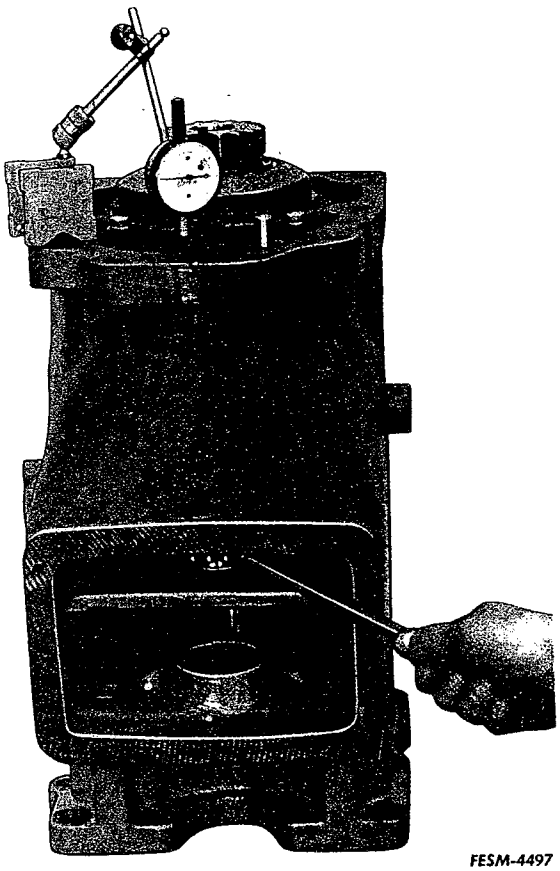


1. Retaining ring
2. Bearing race
3. Thrust bearing
4. Bearing race
5. Front gear
6. Retaining ring (2)
7. Shaft
8. Bearing thick race
9. Thrust bearing
10. Bearing thin race
11. Rear gear
12. Shim (as req'd)
13. Retaining ring

Countershaft Installation

1. Inspect the countershaft and needle bearings for damage; and replace if necessary.

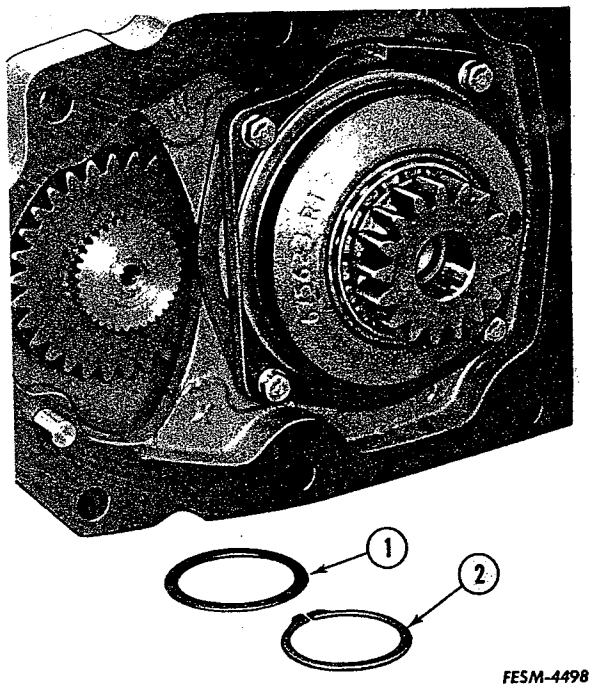
2. Install the shaft assembly in the housing with the rear thrust bearing thick race (8) toward the needle bearing in the housing.



FESM-4497

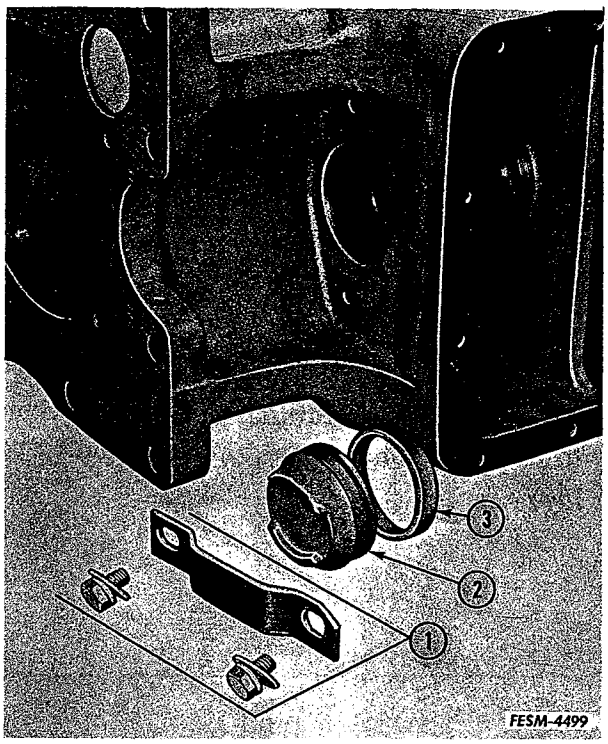
Measuring countershaft end play.

3. Measure countershaft end play with a dial indicator. Add or subtract shims under the rear retaining ring as required to obtain from .003 to .017 inch shaft end play.



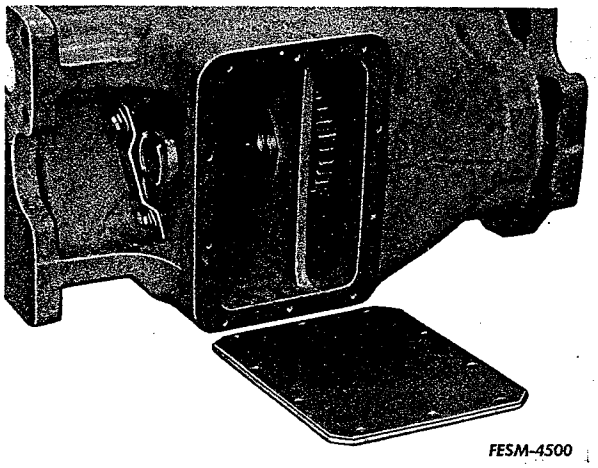
FESM-4498

1. Shim
2. Retaining ring



4. Install the countershaft access plug, spacer, and retainer, or on later models the welch type plug, if removed from the housing.

1. Retainer
2. Plug
3. Spacer



Bottom cover removed.

5. Install the reverser bottom cover with a new gasket lightly coated with IH gasket maker. Torque the capscrews to 20 ft. lbs.

Charge Pump Installation

Tractors Equipped with Torque Converter

1. Install the charge pump with a new gasket, and torque the capscrews to 35 ft. lbs.

2. Position the torque converter on the reverser drive shaft. Engage the charge pump drive tube in the charge pump, and check for freedom of movement.

IMPORTANT: When properly positioned, the turbine will engage the reverser drive shaft, the stator will engage the stator support tube, and the drive tangs will engage the charge pump, in that order. If the torque converter cannot be turned freely, the problem must be corrected.

3. Remove the torque converter, and set it aside.

Tractors without Torque Converter

The charge pump must be disassembled prior to installation, in order to locate the inner gear on the reverser drive shaft and key.

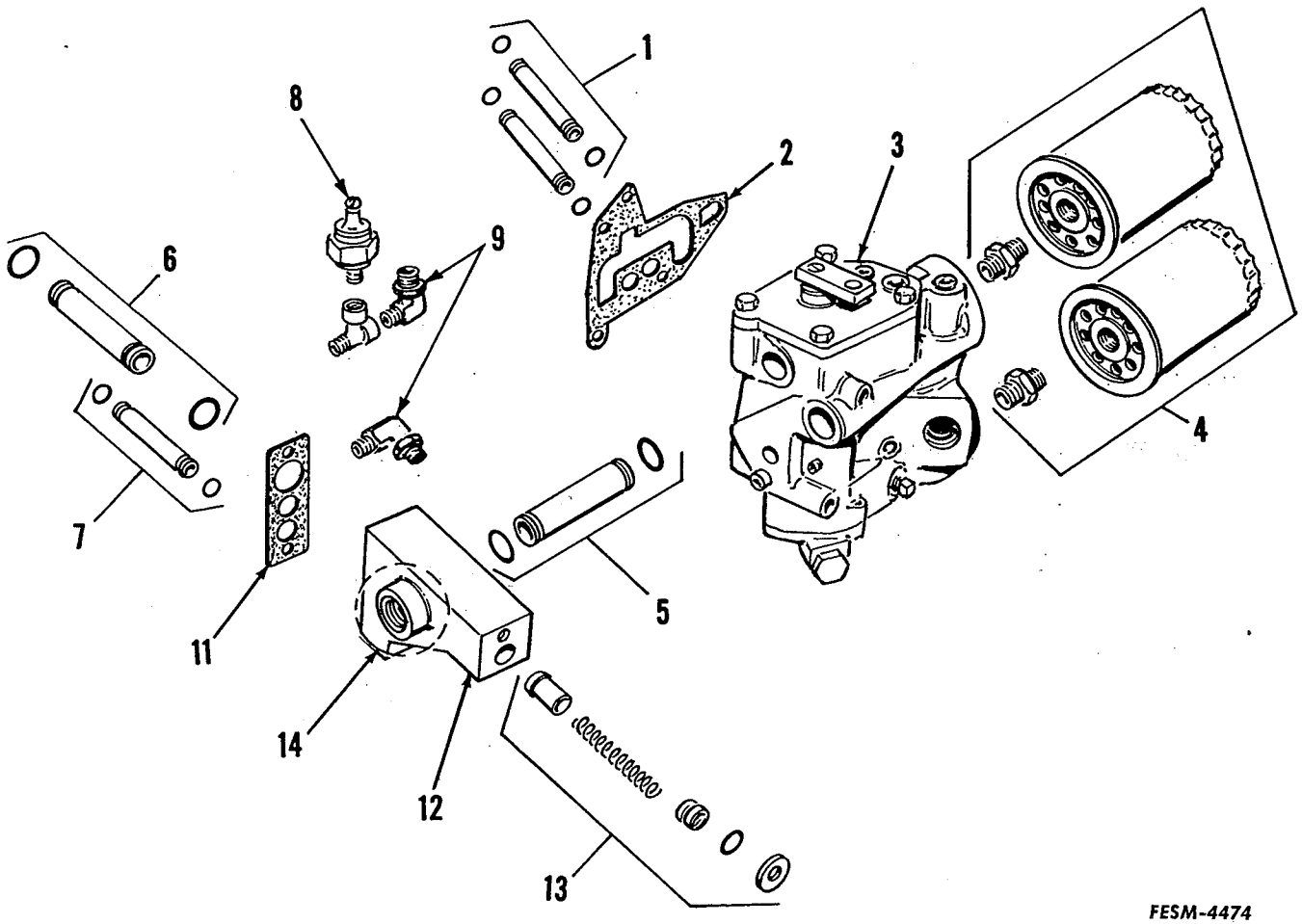
1. Remove the charge pump front cover if installed. Remove the gears by tapping the housing on a wooden block.

2. Install the pump housing on the reverser housing with a new gasket, and torque the capscrews to 35 ft. lbs.

3. Install the key in the reverser drive shaft. Install the pump gears.

4. Install the gear housing with new O-rings. Use petroleum jelly to hold the rings in position. Install the front cover with a new seal, and torque the capscrews to 35 ft. lbs.

5. Check the reverser drive shaft for freedom of movement. If it does not turn freely, the problem must be corrected, before proceeding.



FESM-4474

1. Valve to clutch tubes and O-rings
2. Gasket
3. Control valve assembly
4. Filters and connectors
5. Manifold to valve tube and O-rings
6. Pump pressure to manifold tube and O-rings
*7. Torque converter to oil cooler tube
*8. Torque converter temperature sender
*9. Torque converter to oil cooler fitting
*10. Oil cooler return to manifold fitting
11. Gasket
12. Pump outlet manifold
†13. Oil cooler by-pass valve assembly
†14. Manifold to oil cooler port

*Tractors equipped with torque converter

†Tractors without torque converter

Control Valve and Charge Pump Outlet Manifold Installation

1. Inspect the connecting tubes and the bores for roughness and sharp edges which would hinder installation or damage O-rings. Remove roughness and sharp edges. Install the tubes in the reverser housing with new O-rings, liberally coated with petroleum jelly.

IMPORTANT: If the tubes require greater than finger pressure to install, the problem must be corrected, or damage to the O-rings will occur.

2. Install the control valve and charge pump outlet manifold as a unit with new gaskets; and torque the capscrews to 35 ft. lbs.

3. Install new hydraulic filters.

4. If the power shift reverser was removed from the tractor, proceed to installation. If the reverser was not removed:

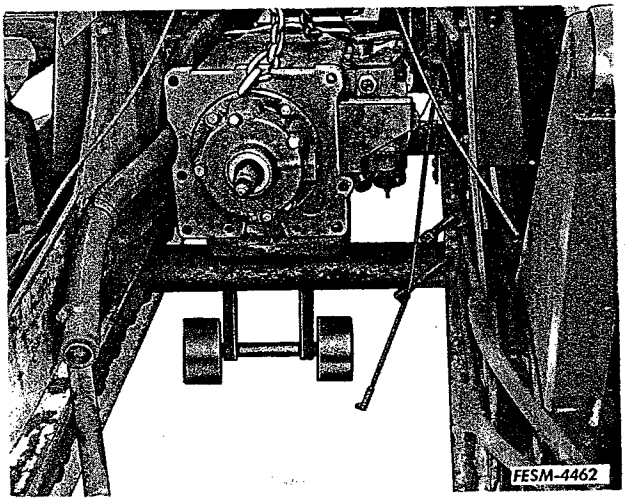
a. Reconnect control valve linkage, and the oil cooler lines.

b. Replace the deck plates and power control or decelerator pedal. Service the transmission and rear frame with Hy-Tran.

Installation

1. Coat the transmission input shaft pilot bearing with petroleum jelly; and install it in the gear shaft bore.

2. Position a new gasket on the front of the rear frame using IH Gasket Maker or an equivalent sealer on both sides of the gasket.



Front of reverser supported on gauge bar.

3. Support the reverser housing with a chain hoist; and position the housing in the chassis with the front of the housing supported on the gauge bar. Support the rear of the housing with a rolling floor jack.

4. Reposition the chain to support the front of the reverser housing. Move the housing into position on the rear frame.

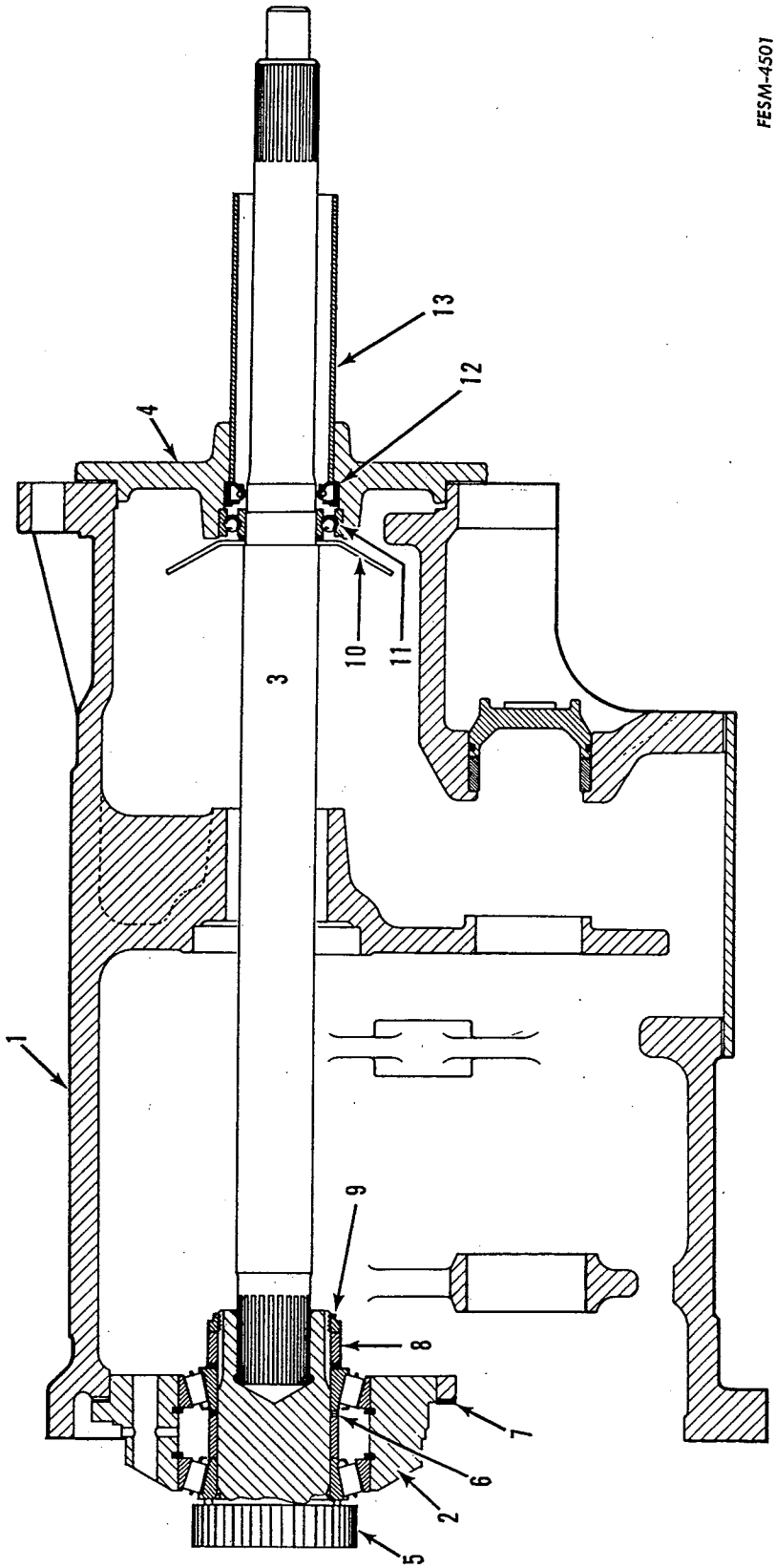
5. Install the nuts securing the reverser to the rear frame studs, and torque them to 220 ft. lbs. Remove the chain hoist.

6. Connect the control linkage, electrical and hydraulic lines.

7. Install the battery support and batteries.

8. Install the engine, and refer to section 10 for adjustments.

GEAR DRIVE HOUSING



1. Gear drive housing
2. Rear bearing housing
3. Drive shaft
4. Clutch throw-out support assembly
5. Transmission input gear
6. Bearing preload shims
7. Drive shaft end, play shims
8. Spacer
9. Retaining nut
10. Flinger
11. Drive shaft support bearing
12. Seal
13. Throw-out support bushing

General
(Foldout 3)

The gear drive housing is used in place of the power shift reverser on machines equipped with a standard transmission and engine clutch.

The clutch throwout support and drive shaft assembly may be serviced without removal of the gear drive housing. However, the housing must be removed to adjust drive shaft end play.

Rear bearing housing service requires removal of the gear drive housing.

Removal

Refer to the power shift reverser removal procedure.

Disassembly

1. Remove the clutch throwout support and drive shaft.

2. Remove the rear bearing housing.

3. Unstake and remove the retaining nut from the gear shaft, and press the shaft through the bearing housing.

IMPORTANT: Note the number and location of shims for use during reassembly.

Inspection, Repair and Reassembly

1. Inspect the transmission input shaft with gear, transmission drive shaft, and the pilot bearing, for wear or damage. Inspect the drive shaft splines and seal locating area for wear.

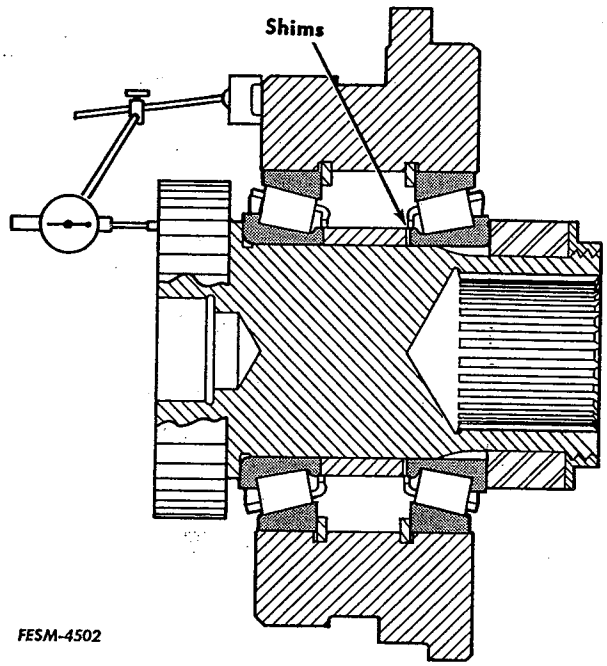
2. Inspect the clutch throwout support bushing and bearing for wear or damage, and replace the seal.

3. Replace worn or damaged parts.

4. Inspect the drive shaft support bearing for wear or damage. Replace if necessary.

5. Install the drive shaft, and clutch throwout support with a new gasket. Torque the capscrews to 35 ft. lbs.

6. Install the transmission input gear shaft with bearings and shims in the bearing housing and torque the retaining nut to 80 ft. lbs.



Measuring gear shaft rolling end play.

7. Mount a dial indicator on the bearing housing and measure gear shaft rolling end play. Add or subtract shims as necessary to obtain the specified end play of .001 to .003 inch.

8. Torque the retaining nut to 80 ft. lbs. Then stake the nut to the gear shaft.

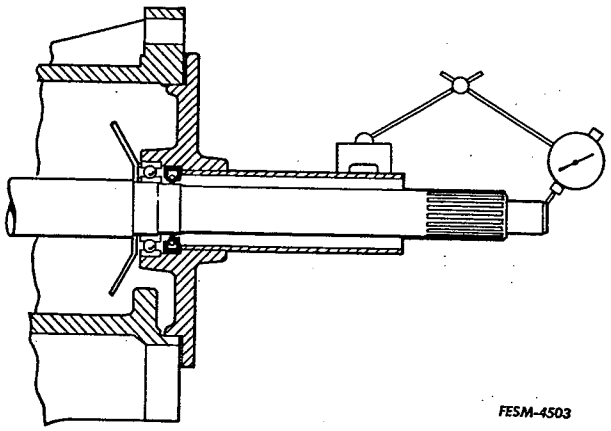
9. Install the bearing housing assembly with shims on the reverser housing. Torque the capscrews to 35 ft. lbs.

10. Mount a dial indicator on the clutch throwout support bushing; and measure drive shaft end play. Add or subtract shims between the housings as necessary to obtain the specified drive shaft end play of .005 to .020 inch.

11. Torque the capscrews to 35 ft. lbs.

Installation

Refer to the power shift reverser installation procedure.

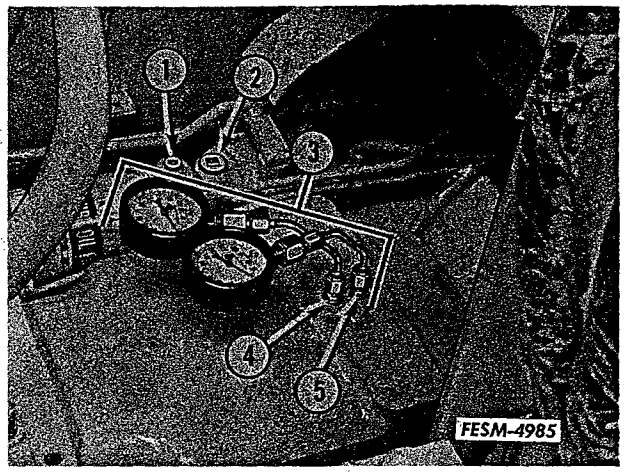


Checking drive shaft end play.

TEST AND ADJUSTMENTS

NOTE: Refer to Section 12 for control linkage adjustments.

Reverser Operating Pressures



1. Lube pressure regulator
2. Apply pressure regulator
3. Pressure gauge, 0 to 100 psi capacity with 1/4 inch NPT male fitting (2); FES 123-5 connector (2) IH part number 396 424 R91; FES 96-3 connector (2); connector (2) IH part number 9 402 706.
4. Reverse clutch test port
5. Forward clutch test port

Two test ports are provided in the top of the reverser housing to check clutch operating pressures.

1. Remove the operator's compartment deck plates; and install gauges in the test ports as illustrated.

2. Operate the tractor to bring the fluid up to operating temperature (at least 170°F).

3. Check clutch pressure with the engine running at high idle, and the gear transmission in neutral. Compare test results with the specifications listed below:

Control Valve Lever Position	Forward Clutch Pressure (psi)	Reverse Clutch Pressure (psi)
Neutral	10-14 *	10-14 *
Forward	74-78**	10-14 *
Reverse	10-14 *	74-78**
Power control pedal depressed †	10-14 *	10-14 *

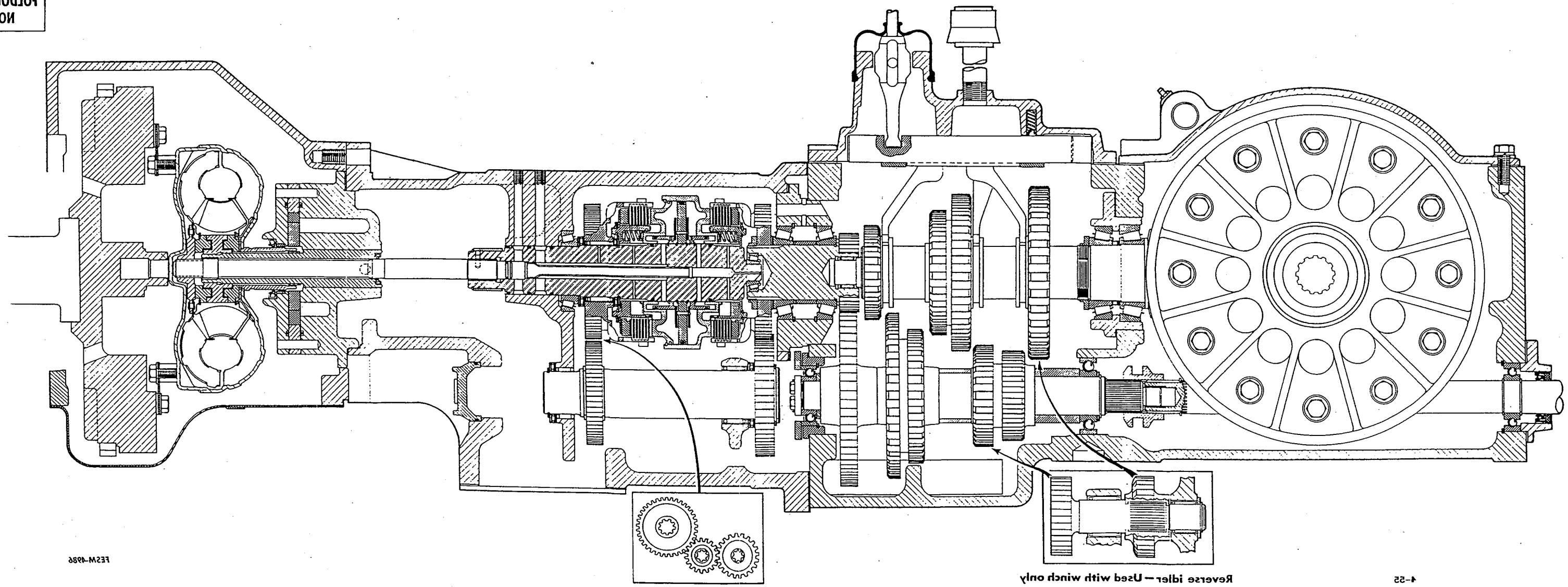
* Lube pressure
** Apply pressure
† Tractors without torque converter only. Pressure must remain constant in forward, neutral, and reverse.

4. If operating pressures do not meet specifications, disconnect the control valve linkage. Repeat the test, operating the control valve levers by hand.

5. Apply and lube pressures must remain constant regardless of control valve position. If the pressures are consistently low or high, remove the regulator valve plugs; and add or remove shims as necessary to correct operating pressures.

IMPORTANT: Correct lube pressure before apply pressure. Apply pressure will be affected by a change in lube pressure.

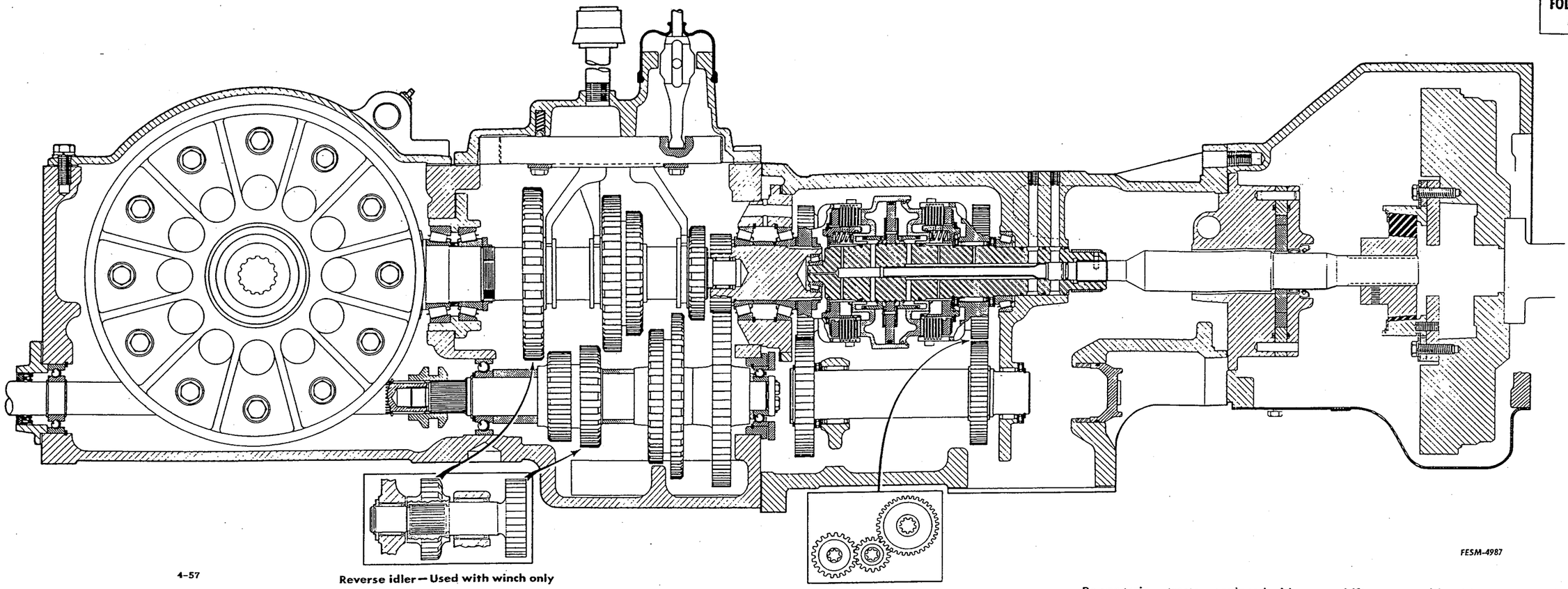
FOLDOUT
NO. 1



FES4-4958

Power train — tractors equipped with power shift reverser and torque converter.

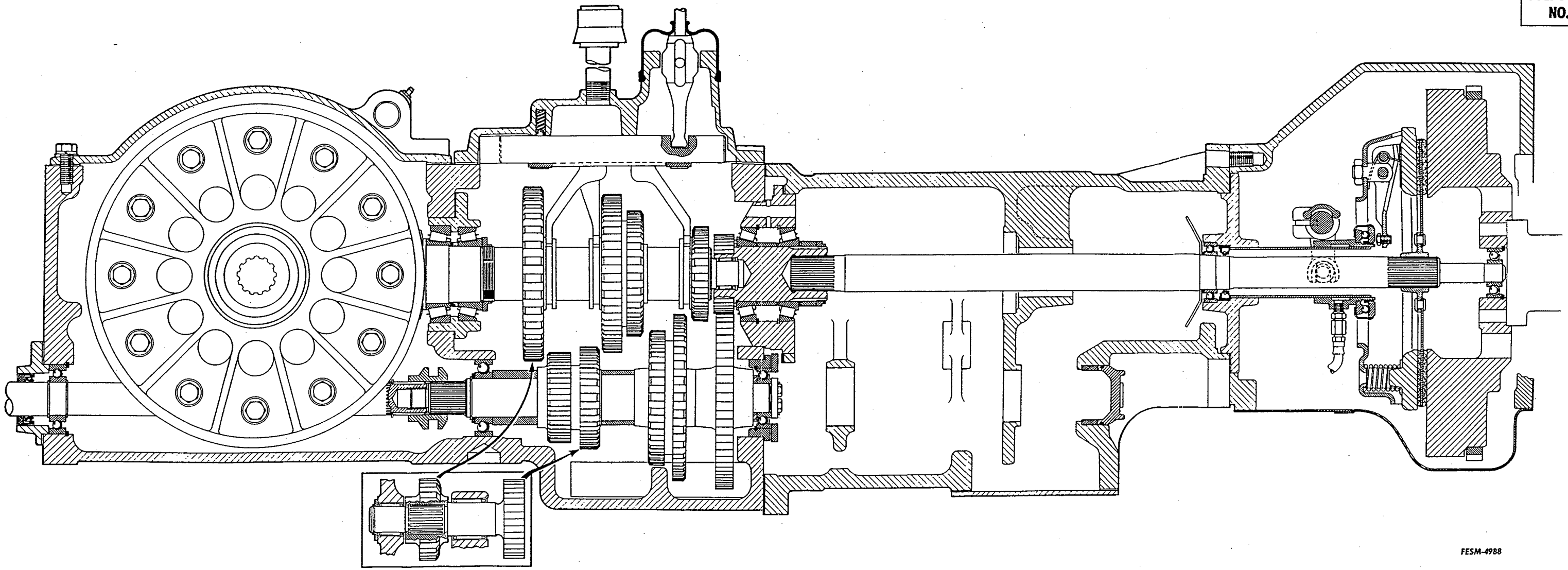
FOLDOUT NO. 2



FESM-4987

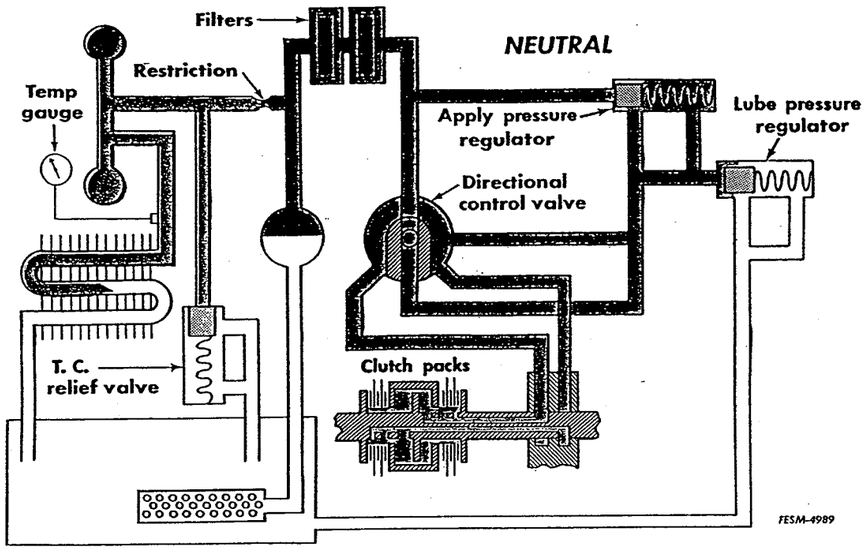
Reverse idler — Used with winch only

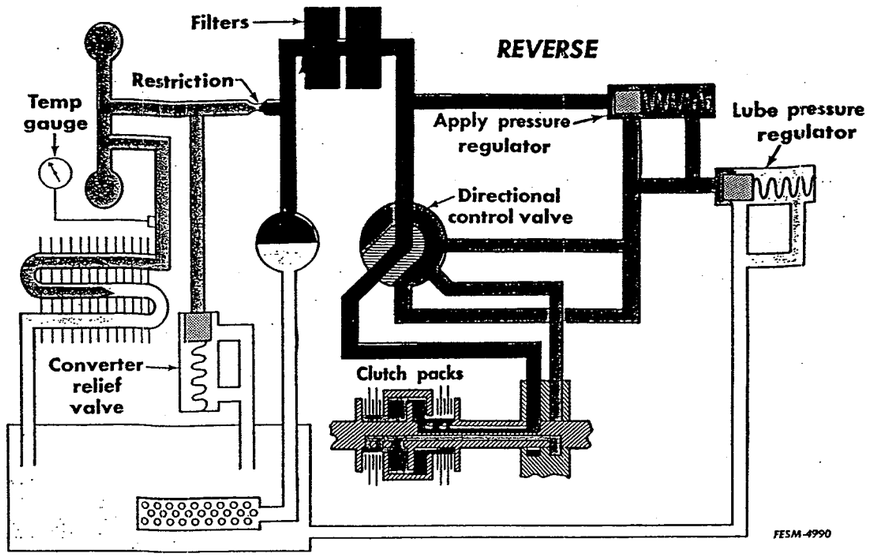
Power train — tractors equipped with power shift reverser, without torque converter.

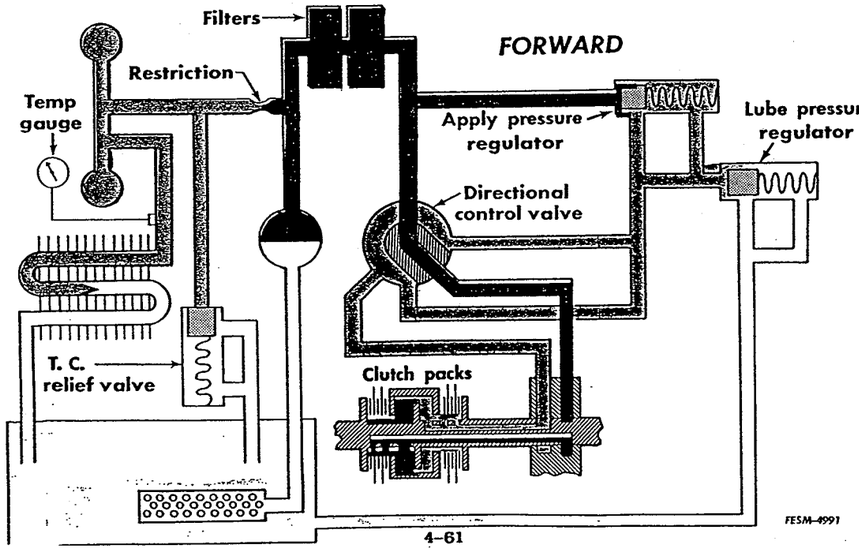


FESM-4988

Power train — standard gear drive tractor.







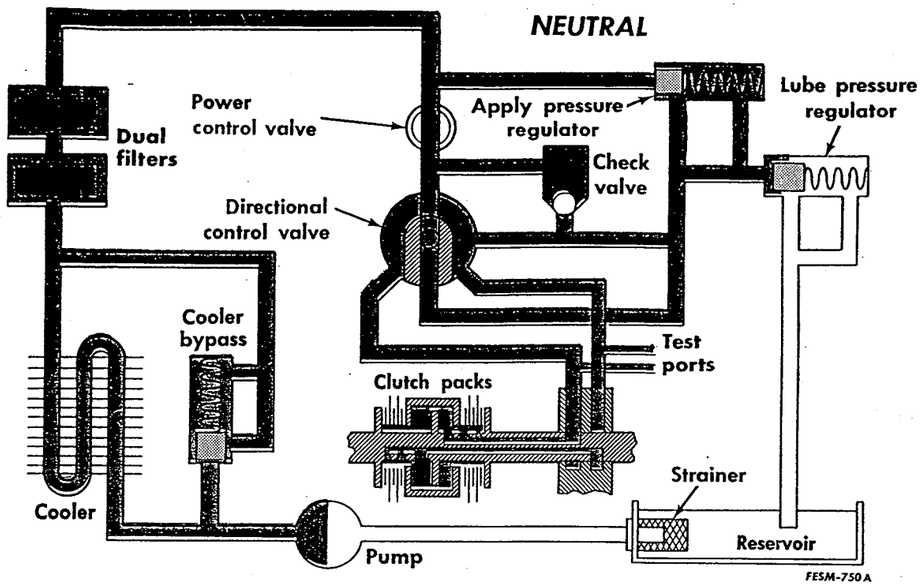
Hydraulic circuits — power shift reverser with torque converter.

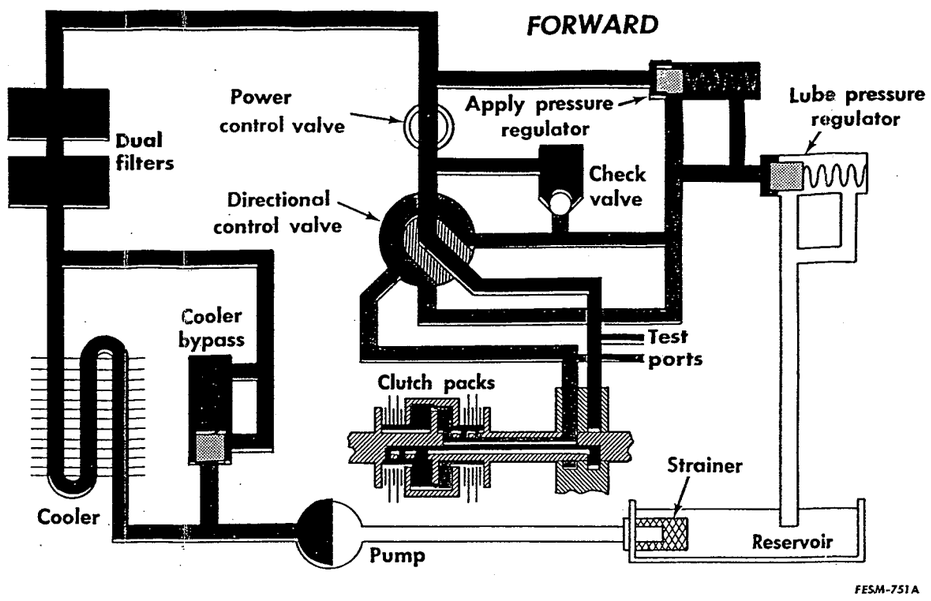
APPLY PRESSURE

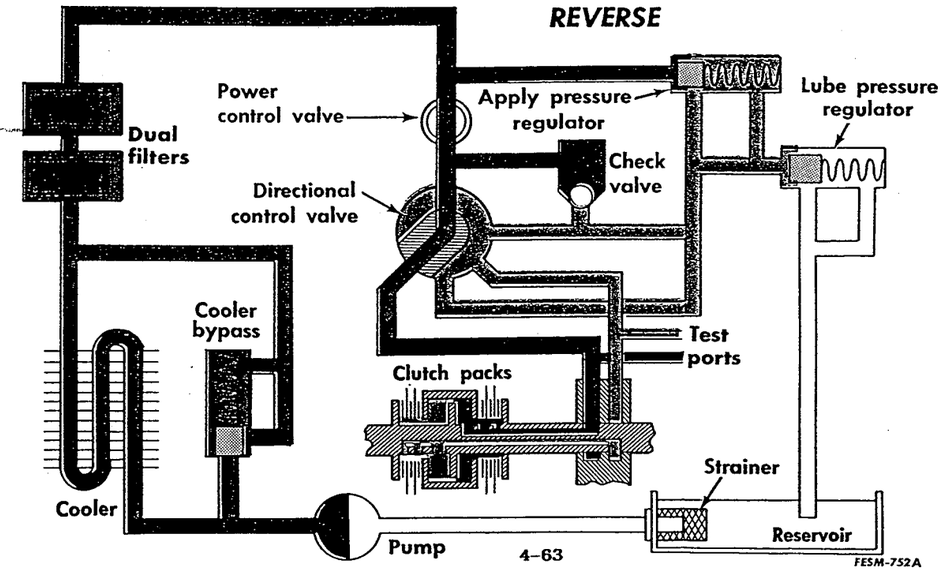
CONVERTER PRESSURE

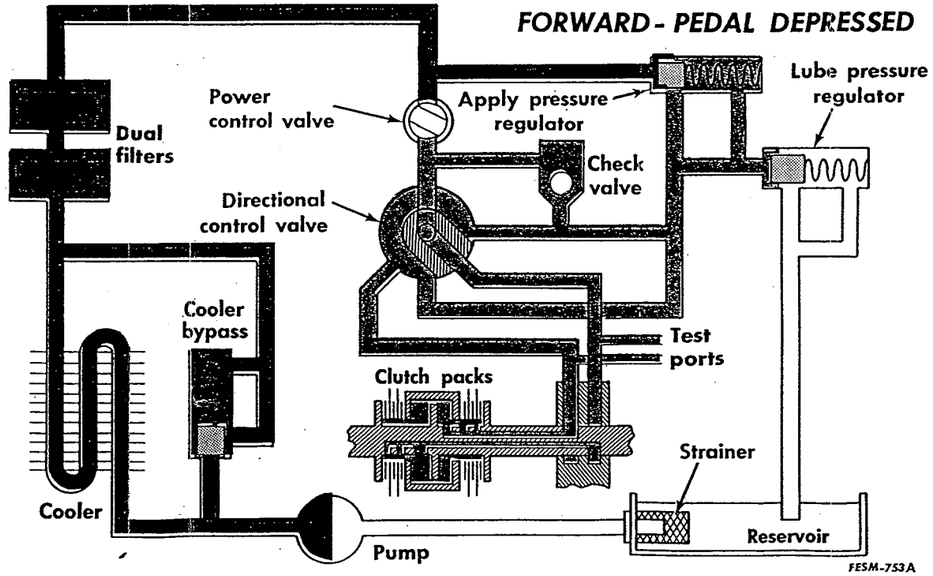
LUBE PRESSURE

SUCTION AND RETURN







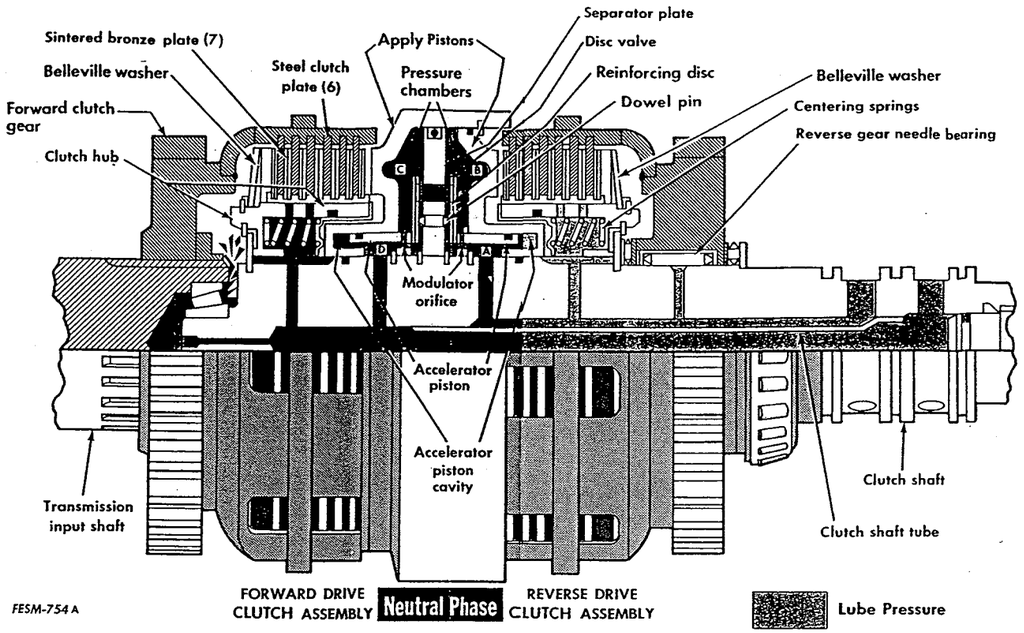


Hydraulic circuits — power shift reverser without torque converter.

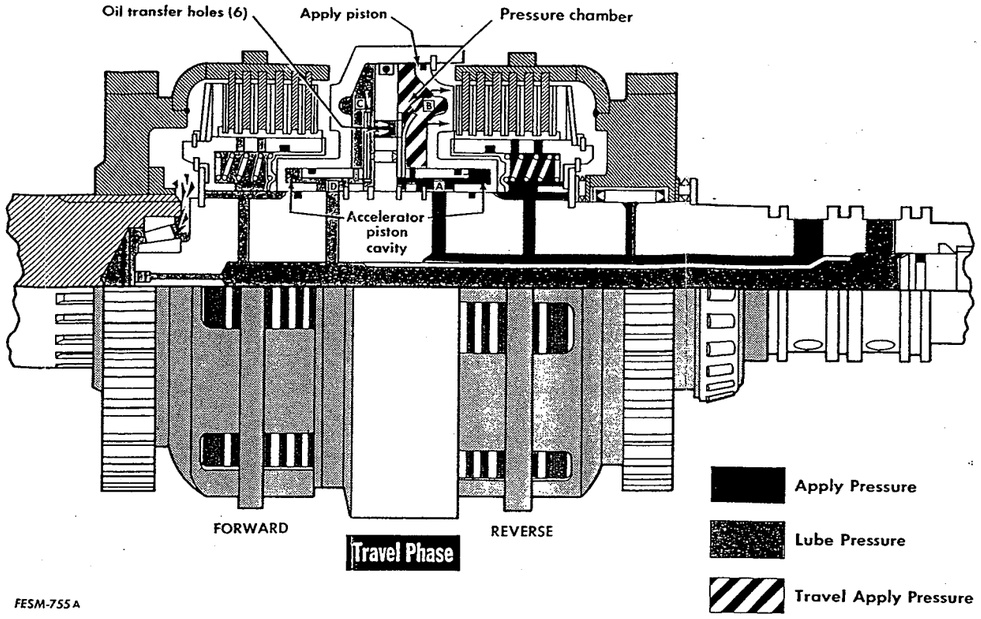
LUBE PRESSURE

APPLY PRESSURE

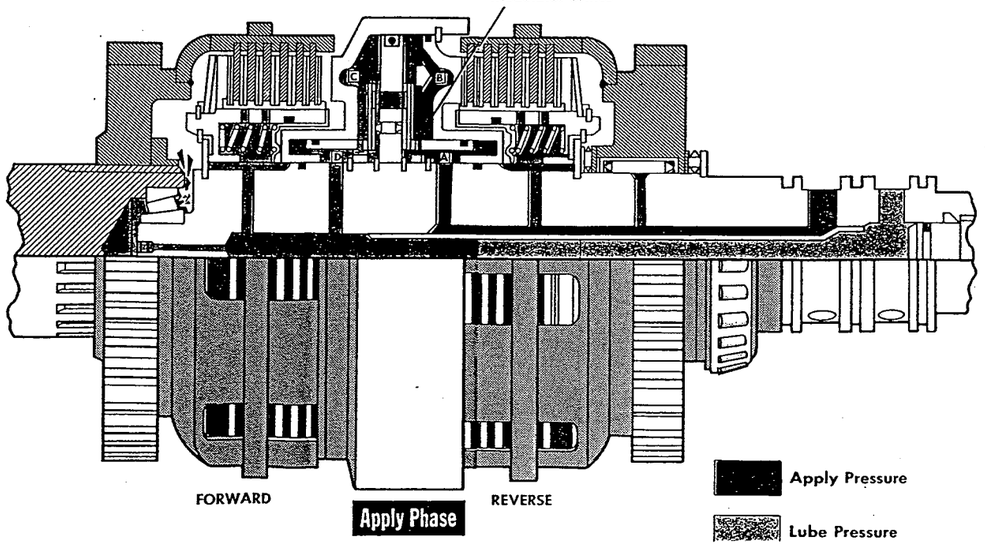
SUCTION AND RETURN



FESM-754 A



FESM-755 A



Hydraulic circuits — power shift reverser clutch shaft.

Section 5

TRANSMISSION AND BEVEL GEAR

CONTENTS

SPECIFICATIONS

Bevel gear carrier bearing preload (measured as rolling torque) with seals installed - in. lbs. 22

Spline shaft rear bearing preload (measured with spring scale and string wrapped around shaft splines) - lbs. . . . . 6 to 8

Pinion cone center dimension from pinion face to bevel gear hub . . . . . See text

Backlash - bevel gear to pinion measured on bevel gear perimeter . . . . . See text

Bevel gear pilot shaft O.D. (inch - new) . . . . . .739 to .741

Sprocket drive pinion shaft pilot bushing I.D. (inch - new) . . . . . .742 to .744

Bevel gear pilot shaft and bushing maximum clearance allowed - inch 020

Special torques

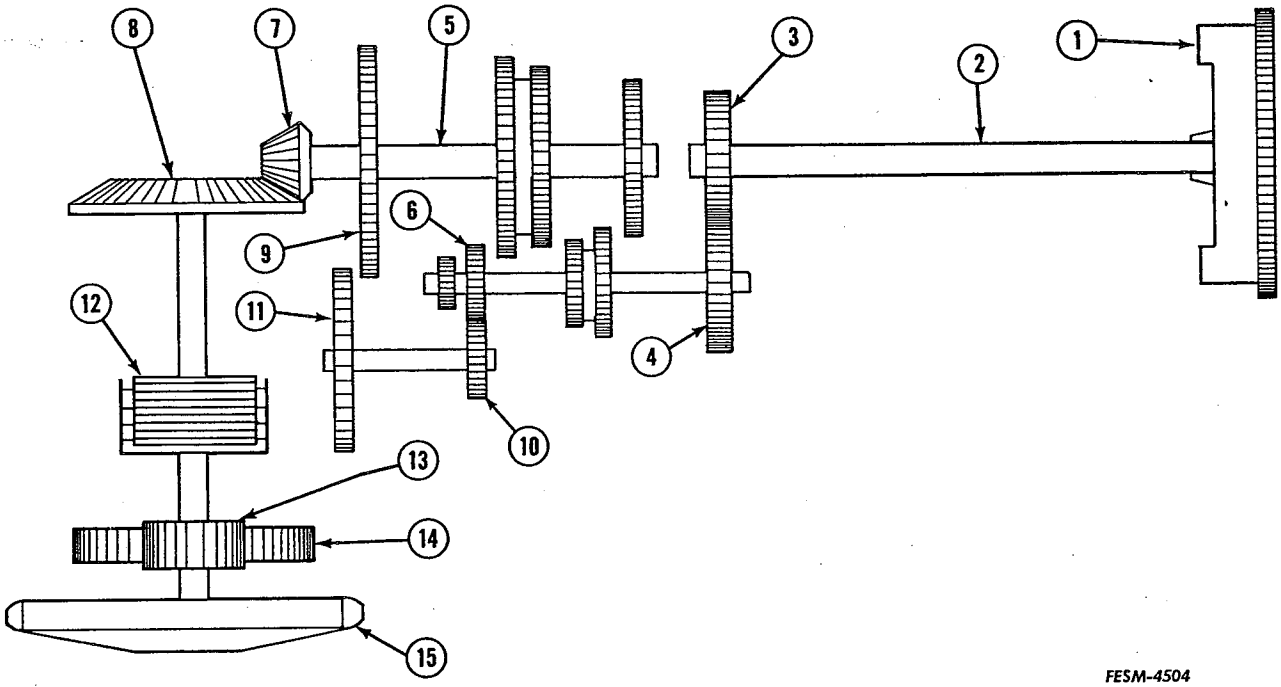
Bevel gear to hub capscrews (ft. lb.) 120

Transmission spline shaft bearing retainer nut (ft. lb.) 70

POWER FLOW DESCRIPTION

This tractor has three power train options as follows:

Standard Gear Drive (4 by 1)

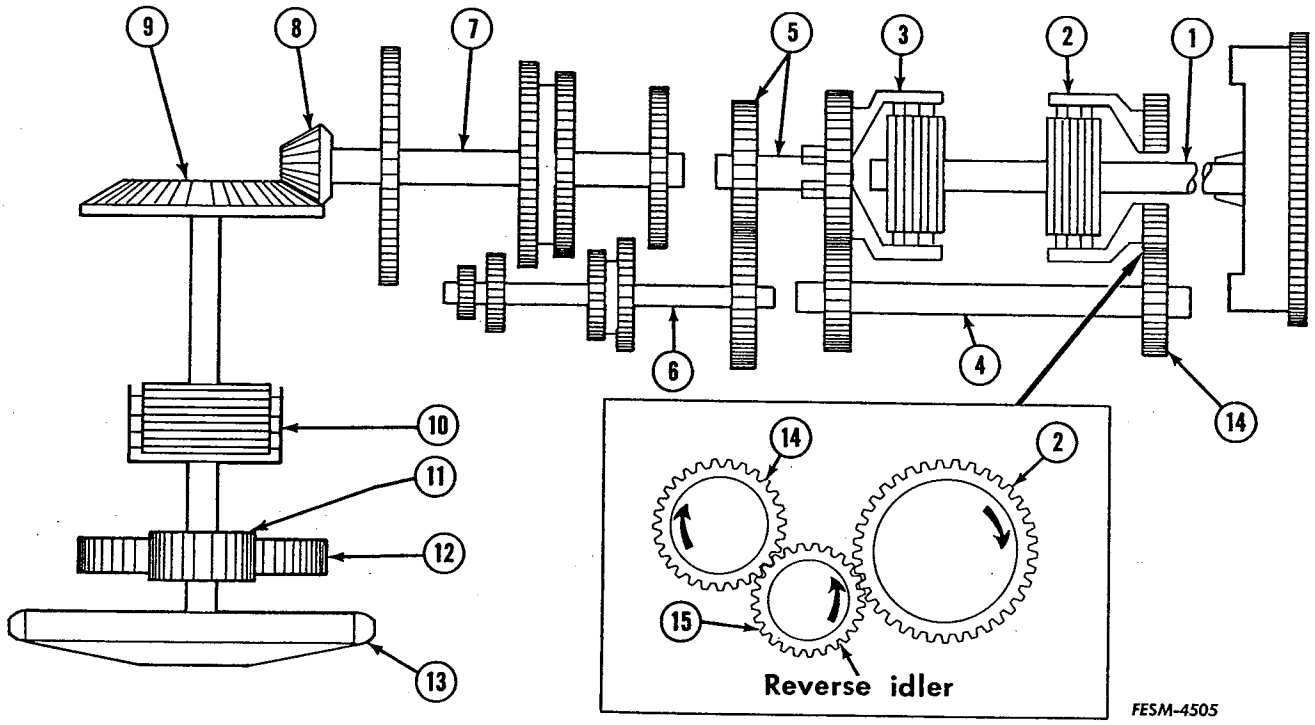


FESM-4504

The flywheel (1) transmits power from a standard friction clutch into a drive line (2) connected directly with a constant mesh gear (3). The constant mesh gear drives the countershaft by gear (4). Gears are then selected by the operator (4 speeds forward - 1 reverse) to drive the spline or pinion shaft (5). The pinion (7), connected directly (integral) with the spline shaft, turns the bevel gear (8), delivering power to the steering clutch (12), the sprocket drive pinion (13), the bullgear (14) and finally the sprocket (15).

Reverse is accomplished by sliding gear (9) into mesh with idler gear (11). The rotation of gears (10) and (11) is reversed thereby. The 2nd speed countershaft gear (6) is constantly meshed with the reverse idler gear (10). All shafts are mounted on needle, roller or tapered bearings.

Power Shift Reverser without Torque Converter (4 by 4)



The flywheel is directly coupled to the reverser drive shaft (1) which is directly connected to two hydraulically actuated clutches (2 and 3) which make up the power shift transmission.

The power shift selector valve can be positioned either in forward, neutral or reverse. In forward drive the rear clutch pack (3) is engaged and the front clutch pack (2) is disengaged. This drives the transmission input shaft and gear (5).

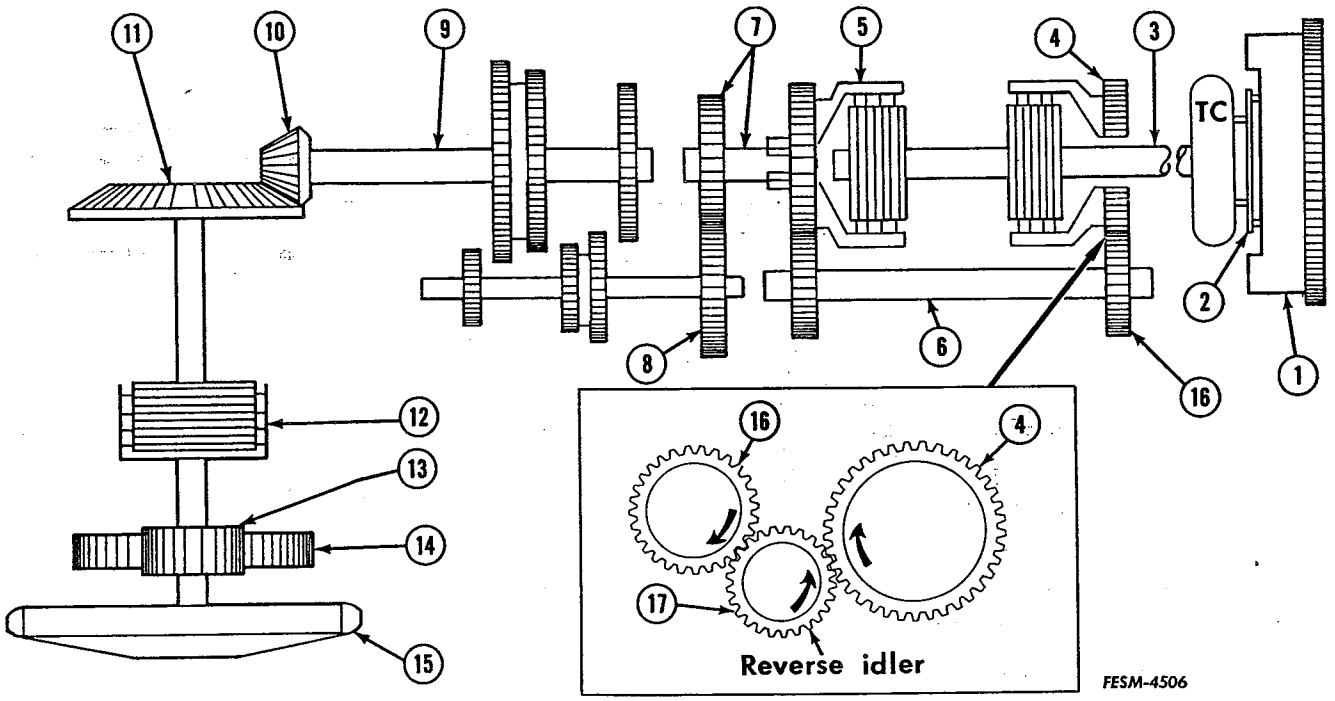
The transmission input shaft drives the countershaft and gears (6). A gear on the countershaft (6) drives the appropriate gear on the spline shaft (7) after selection by the operator. The spline shaft (7) with integral pinion (8) drives the bevel gear (9). The bevel gear (9) drives the steering clutch (10) which is in turn directly connected to the sprocket drive pinion (11) and through it the sprocket drive gear (12) which is directly connected to the rear drive sprocket (13).

In reverse drive the front clutch pack (2) is engaged and the rear clutch pack (3) is disengaged. This drives through the reverse idler (15) and the reverse drive (14), to the reverse countershaft assembly (4) to the transmission input shaft (5) via the drum (3) which spins over the disengaged discs. At this time the power flow is by the same means as described in forward motion only in reverse direction.

If the selector valve position is in neutral, both clutch packs (2 and 3) are disengaged.

All shafts in this power train are mounted in either ball, needle or tapered roller bearings. A cross section of the power train with power shift reverser is shown in Section 4, Foldout 2.

Power Shift Reverser with Torque Converter (3 by 3)



In this application the engine flywheel (1) drives by the flex plate (2) the torque converter. The torque converter output shaft is connected directly with the power shift reverser clutch shaft.

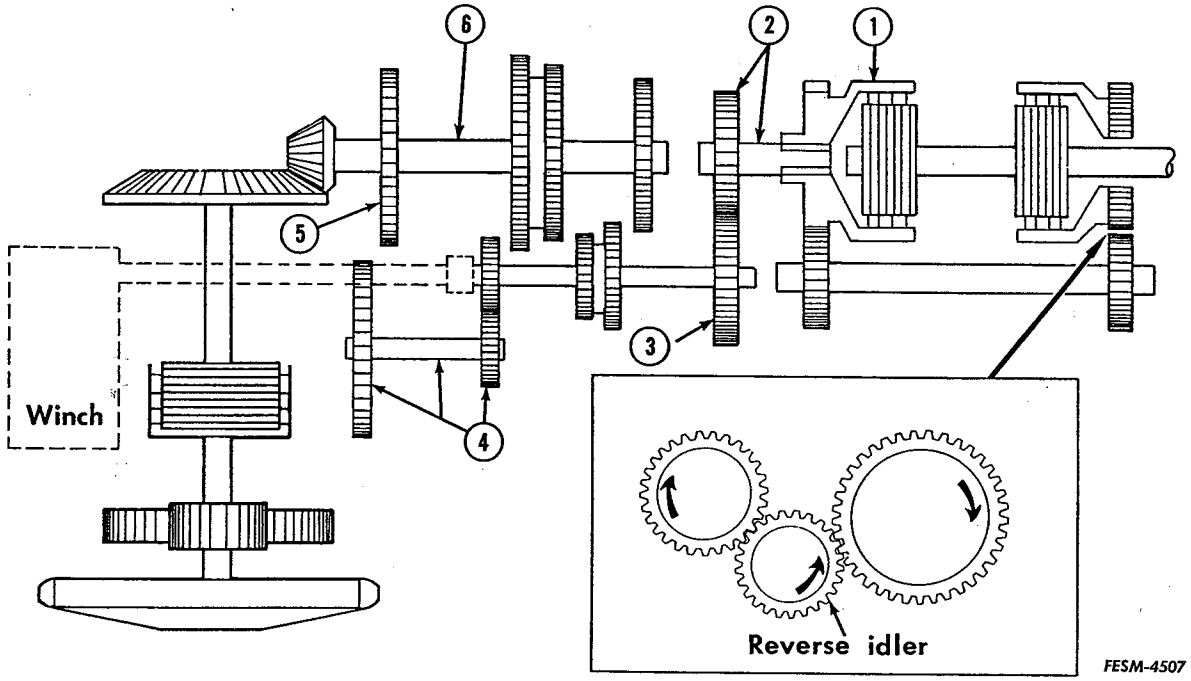
In forward drive the clutch pack assembly (5) is engaged connecting shaft (3) to shaft and gear (7). Gear (7) turns the countershaft by turning gear (8) which is splined directly to the countershaft.

The operator can select one of three (3) available speeds in his range transmission.

A gear on the countershaft drives the appropriate gear on the spline shaft (9) after selection by the operator. The spline shaft (9) with integral pinion (10) drives the bevel gear (11). The bevel gear (11) drives the steering clutch (12) which is in turn directly connected to the sprocket drive pinion, (13) and through it the sprocket drive gear (14) which is directly connected to the rear drive sprocket (15).

Shifting the power shift reverser into reverse results in disconnection of the clutch pack at (5) and engagement of the reverse pack at (4). Gear (4) drives gear (17) and then gear (16) reversing the direction of shaft (6) and the input to the main range transmission (7). Gear (7) now revolves gear (8) and the rotation of the countershaft is reversed, as is the rotation of shaft (9). Now the entire train, pinion shaft (9), pinion (10), bevel gear (11), clutch packs, bullgear and sprocket (12, 13, 14 and 15) are also reversed.

Winch Operation — Tractors with Power Shift Reverser



The winch is inoperable when the power shift reverser is operated in reverse, because rotation of the range transmission is reversed, turning the winch drive shaft in the wrong direction (counterclockwise).

A reverse gear arrangement (4) is available as a factory installed option only, to provide emergency winch power when the tractor is driven rearward.

The power shift selector valve is placed in the forward drive position. Clutch pack (1) drives the input gear and shaft (2). Gear (2) drives the countershaft (3) and the winch drive shaft (dotted lines) in a clockwise direction (viewed from the rear) providing winch power.

The range transmission gear shift is placed in the reverse gear position. Gear (5) meshes with the reverse gear arrangement (4), reversing rotation of the spline shaft (6), driving the tractor rearward.

IMPORTANT: The range transmission reverse gear arrangement is provided for emergency use only. Extensive use will cause premature failure.

SERVICE PROCEDURES

General

Rear Frame Removal

Rear frame removal is recommended only for replacement or extensive repair to the housing. Transmission and bevel gear service does not ordinarily require rear frame removal.

Transmission Cover and Gear Shift Service

Transmission cover and gear shift service requires removal of the operator's compartment deck plates, and steering levers. Refer to "Disassembly".

Transmission and Bevel Gear Pinion Service

Transmission service requires a rear section split.

The bevel gear pinion is an integral part of the transmission spline shaft.

Service of the bearings and shaft requires partial disassembly of the transmission.

Refer to "Rear Section Split" and "Disassembly".

Bevel Gear and Pinion Replacement

The bevel gear and pinion are a matched set, and are not serviced separately.

The pinion is an integral part of the transmission spline shaft. Service of the bearings and shaft requires partial disassembly of the transmission.

Bevel gear replacement requires removal of the steering clutches.

Refer to "Rear Section Split" and "Disassembly".

Bevel Gear, Shaft, and Carrier Bearing Service

Bevel gear, bevel gear carrier bearings, and bevel gear shaft service requires removal of the steering clutches

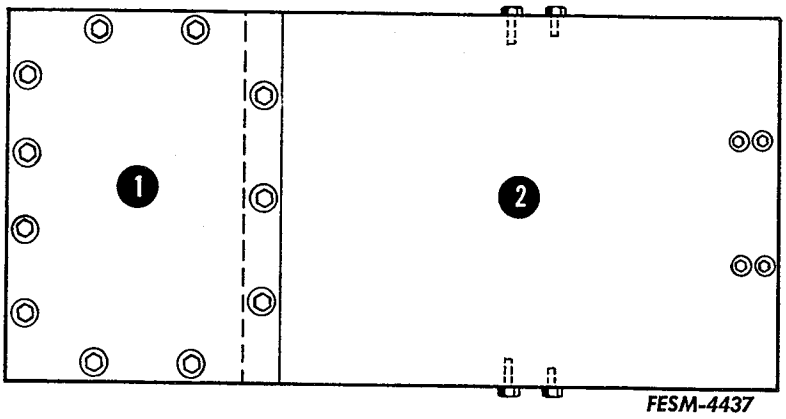
Refer to Section 7 "Steering Clutches and Brakes". Then refer to "Disassembly" in this section.

Sprocket Drive Pinion and Bevel Gear Oil Seal Replacement

Seal replacement requires removal of the steering clutch on the side of the seal to be replaced.

Refer to Section 7, "Steering Clutches and Brakes", for procedure.

Rear Section Split



1. Crankcase guard
2. Transmission guard

1. Remove the bolts securing the crankcase guard to the tractor frame and transmission guard, allowing the guard to drop onto the frame brackets. Then remove the crankcase guard from the front of the tractor.

NOTE: If the bolts are worn so that removal with a wrench is impossible, weld short bolts to the worn bolts to aid removal.

2. Remove the bolts securing the rear of the transmission guard to the tractor. Then, using a floor jack to support the guard, remove the side bolts, and remove the transmission guard.

3. Steam clean the tractor and guards.

4. Drain the transmission, rear frame, and the hydraulic fluid reservoir.

5. Remove the grill guard and engine hood assembly.

6. Disconnect the battery cables.

7. Remove the complete air cleaner assembly.

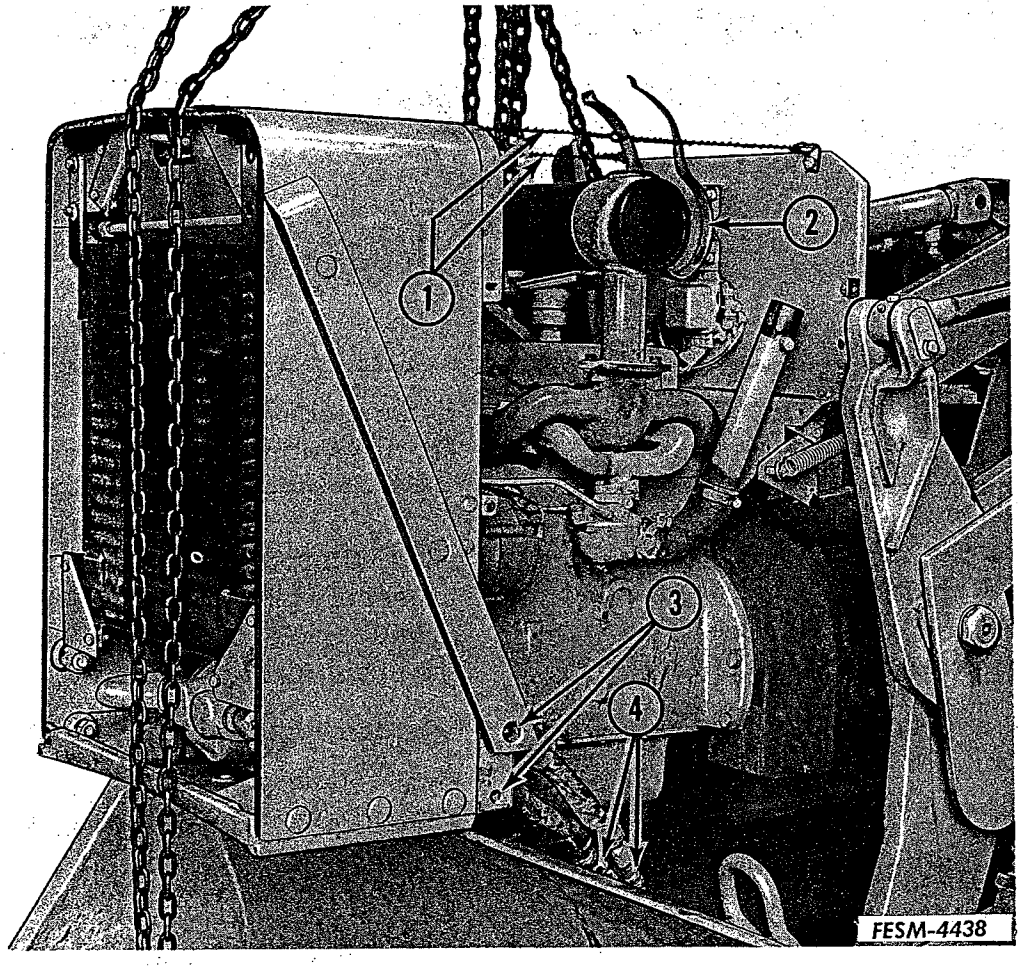
8. Wire the battery support to the radiator housing, to support the weight of the batteries.

9. Drain the transmission hydraulic coolers if so equipped.

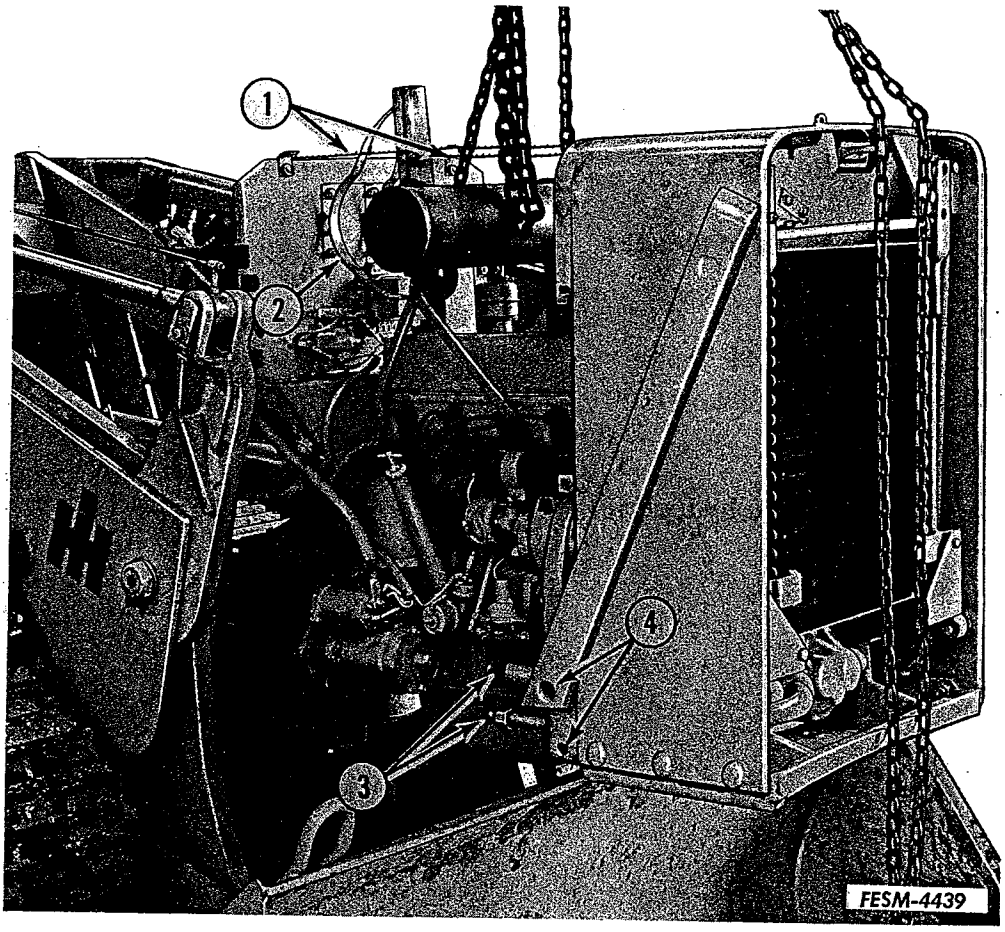
10. Disconnect the transmission and hydraulic cooler line(s) on the left side of the engine, if so equipped. Seal the open lines.

11. Remove the decelerator or power control pedal mounting brackets if so equipped; and remove the deck plates.

12. Disconnect the power control linkage at the valve, if so equipped; and wire the pedal assembly out of the way.



1. Battery support wire
2. Air cleaner removed
3. Front mounting bolts removed
4. Transmission cooler lines



1. Battery support wire	3. Hydraulic pump lines
2. Air cleaner removed	4. Front mounting bolts removed

13. Loosen the suction line hose clamps on the right side of the engine and transmission. Move the hose rearward to gain access to the pressure line(s).

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Snap-On RX-30 tube wrench.

14. Disconnect the hydraulic pump pressure line(s) and the equipment hydraulic cooler line, if so equipped. Seal the open lines.

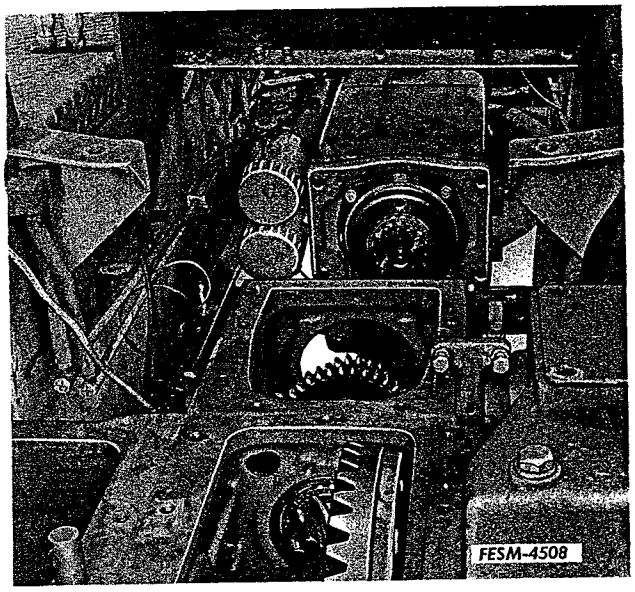
NOTE: To simplify disconnecting and connecting the high pressure line(s), use a Snap-on RX-30 tube wrench or equivalent.

15. Disconnect electrical wiring as required.

16. Disconnect the fuel lines and engine controls as required; and seal the open lines.

17. Disconnect the reverser charge pump suction hose at the flywheel housing (power shift models only).

18. Support the engine with a chain, and remove the four bolts holding the front bolster to the frame.



Rear section split completed.

NOTE: Early model tractors use carriage bolts to secure the front bolster to the frame. Removal and replacement of these carriage bolts will be simplified if they are cut off and replaced with 5/8 x 2 inch capscrews with 21/32 x 1-1/2 inch 16 gauge flat washers. Refer to the parts catalog for ordering information.

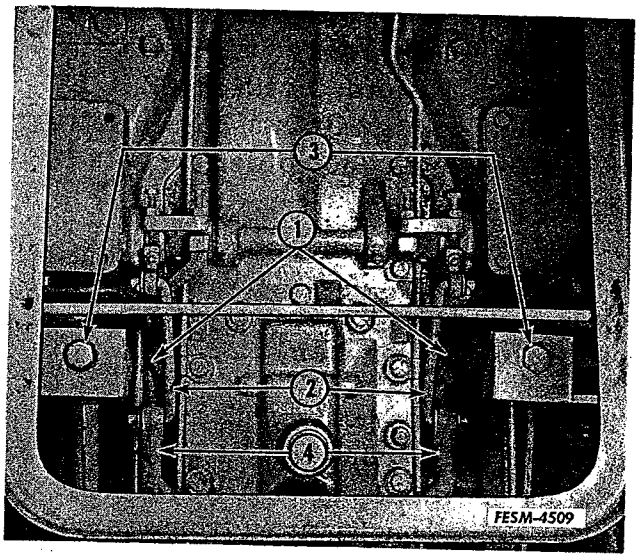
19. Remove the nuts securing the power shift reverser or gear drive housing to the rear frame.

20. Support the power shift reverser or gear drive housing with a rolling floor jack, and move the engine and reverser or gear drive housing away from the transmission.

21. Lower the assembly so that the reverser housing is supported on the gauge bar; and securely block the engine under the front bolster.

Disassembly

Transmission Cover and Gear Shift Removal



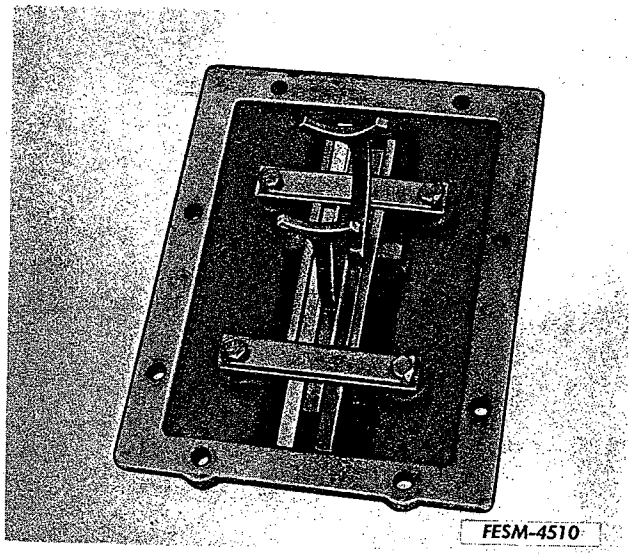
1. Pivot bolts
2. Steering rods
3. Assist spring adjusting bolts
4. Steering levers

1. Remove the deck plates and rear sheet from the operator's compartment.

CAUTION: Remove the tension from the steering assist springs before disconnecting the steering rods.

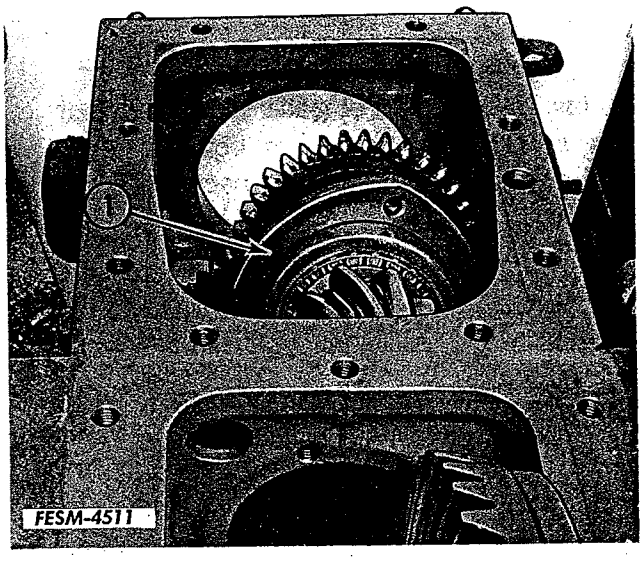
2. Remove the tension from the steering assist springs. Disconnect the steering rods.

3. Remove the steering lever pivot bolts; and remove the steering levers.



Transmission top cover removed.

4. Remove the transmission top cover and gear shift assembly.



1. Retainer

Spline Shaft

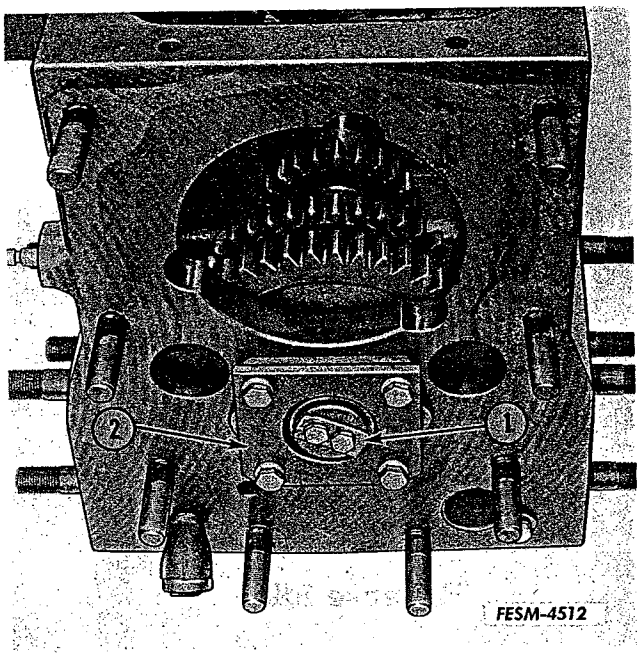
Remove the capscrews from the rear bearing retainer, and work the shaft assembly with bearing retainer, shims, and gears forward. Then tip the rear end of the shaft up, and remove the assembly from the housing.

P.T.O. Shaft

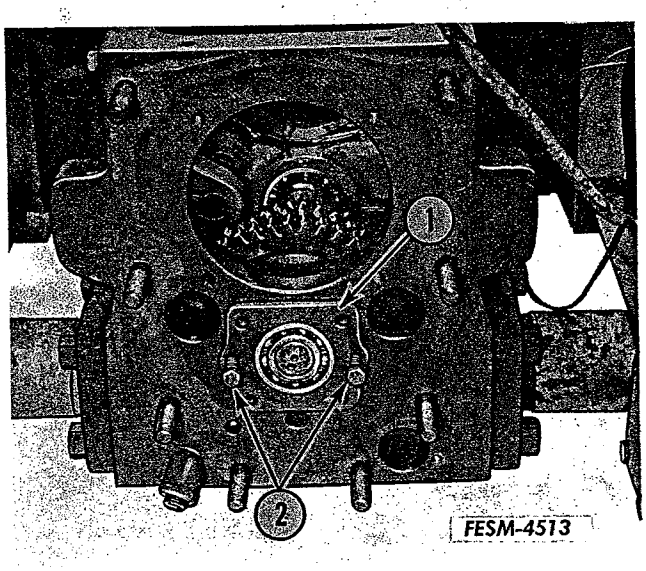
Remove the seal retainer, P.T.O. shaft, and shifter spool, if so equipped. Refer to "Power Take Off and Speed Reducer" - "Removal" for procedure.

Counter Shaft

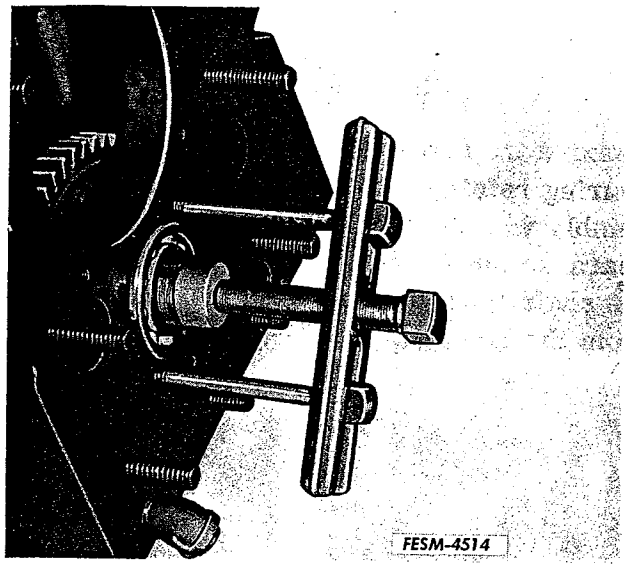
1. Remove the counter shaft lock plate and washer, and the bearing cage retainer block. Then, remove the bearing retainer using the capscrews removed as jackscrews, to aid removal.



1. Lock plate
2. Retainer block

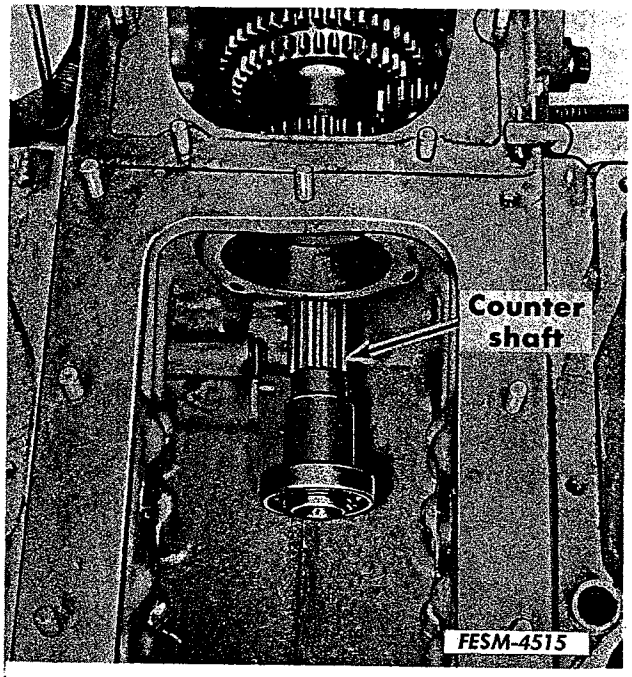


1. Retainer
2. Jack screws



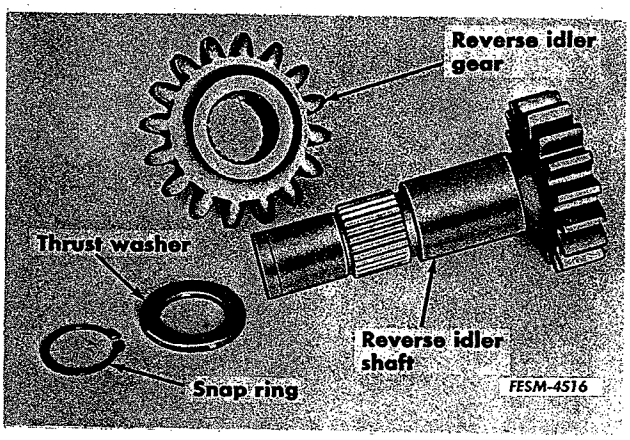
Pressing the counter shaft.

2. Press the counter shaft and rear bearing into the bevel gear compartment using an OTC 915 puller or equivalent; and remove the gears and spacers from the shaft.



Removing the counter shaft.

3. Move the counter shaft into the rear pto bearing bore. Then tilt the forward end up, and remove the shaft through the spline shaft bearing bore.



Reverse idler assembly.

Reverse Idler

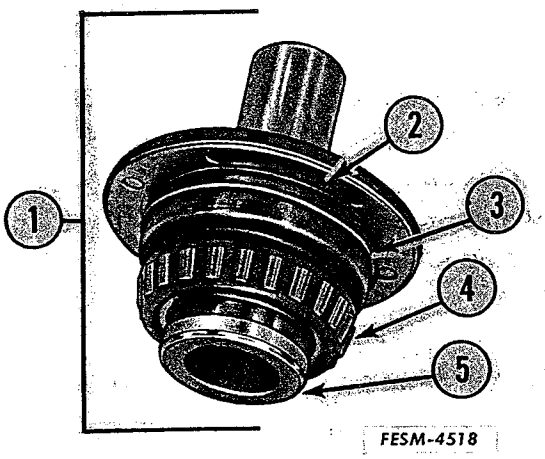
Remove the snap ring and thrust washer from the reverse idler shaft. Then remove the shaft and gear.

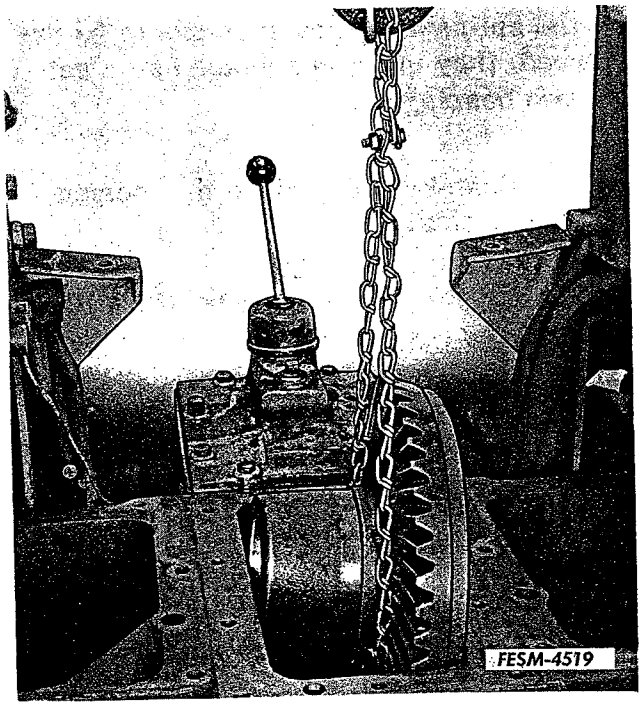
NOTE: The reverse idler is available only as a factory installed option. If a reverse idler is desired for field installation, the rear frame must be replaced.

Bevel Gear Removal

1. Drain the rear frame.

2. Remove the final drive pinion shafts, bevel gear shaft, and steering clutches.





Removing the bevel gear.

Refer to Section 7 "Steering Clutches and Brakes" – "Removal", for procedure.

3. Remove the bevel gear top cover, and support the bevel gear with a chain.

4. Remove the bevel gear bearing retainer(s) using the capscrews removed as jackscrews in the holes provided to aid removal. Then wire the shims to the retainers, and mark the retainers to indicate the side from which they were removed.

1. Retainer assembly
2. Shims
3. O-ring
4. Bearing
5. Sleeve

5. Remove the bevel gear. If the transmission spline shaft was not removed, place the transmission in neutral to allow the pinion shaft to rotate during bevel gear removal.

Inspection and Repair

General

1. Remove any obstruction that may be present in the steering clutch housing drain holes.

NOTE: Plugs must be removed except when operating the tractor in water.

2. Clean all parts and the housing interiors with an evaporative solvent. Remove rust from shaft splines with a wire brush. Dry with compressed air.

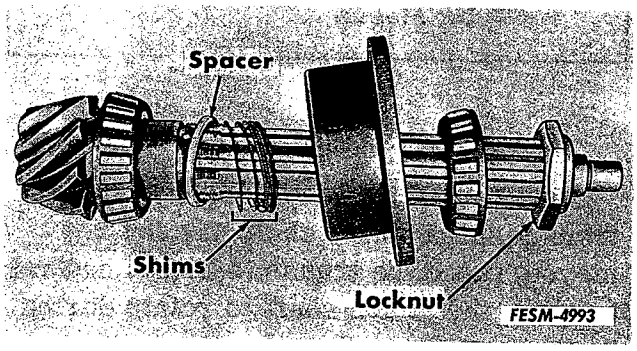
3. Replace damaged parts.

4. Tighten the capscrews securing the steering clutch housings to the rear frame to 170 ft. lbs.

5. Coat all internal parts of the rear frame with IH Hy-Tran fluid during reassembly, to lubricate the parts and prevent corrosion.

6. Use petroleum jelly to aid reassembly and prevent damage to O-rings and bearing surfaces.

Transmission Spline Shaft and Bearing Replacement



The transmission spline shaft (bevel gear pinion) and bevel gear are a matched set. They are replaced as an assembly.

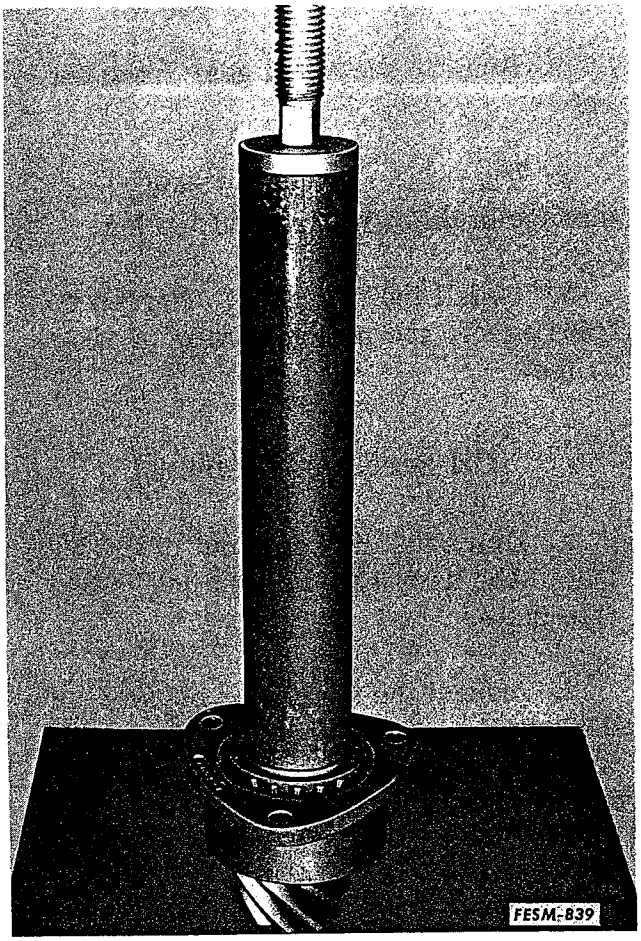
If the spline shaft bearings are to be replaced, they must be replaced as a set of two bearings.

1. Unstake and remove the locknut from the shaft.

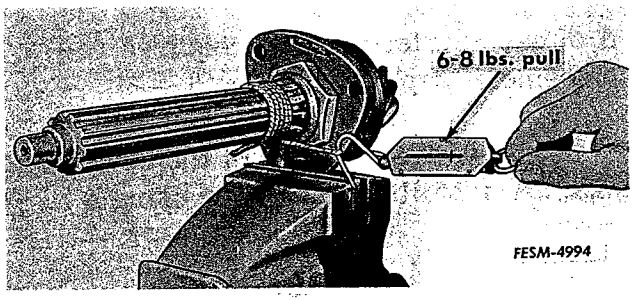
2. Support the bearing retainer in a press; and press the shaft through the front bearing.

3. Remove the shaft rear bearing using a bearing puller attachment.

4. Drive the bearing cups out of the retainer; and install the new cups using a press and step plate.



Installing the bearings.



Measuring spline shaft rolling torque.

5. Assemble the new bearings and retainer on the shaft with the original shims and spacer. Press against the front bearing inner race with a length of tubing to seat the bearings.

6. Install the locknut on the shaft; and torque to 70 ft. lbs.

IMPORTANT: Do not adjust bearing preload on used bearings.

7. Support the bearing retainer in a vise. Wrap a string around the shaft splines; and measure rolling torque with a spring scale.

8. Add or subtract shims as necessary to obtain a rolling torque reading of 6 to 8 lbs. Stake the locknut in place.

Bevel Gear Assembly

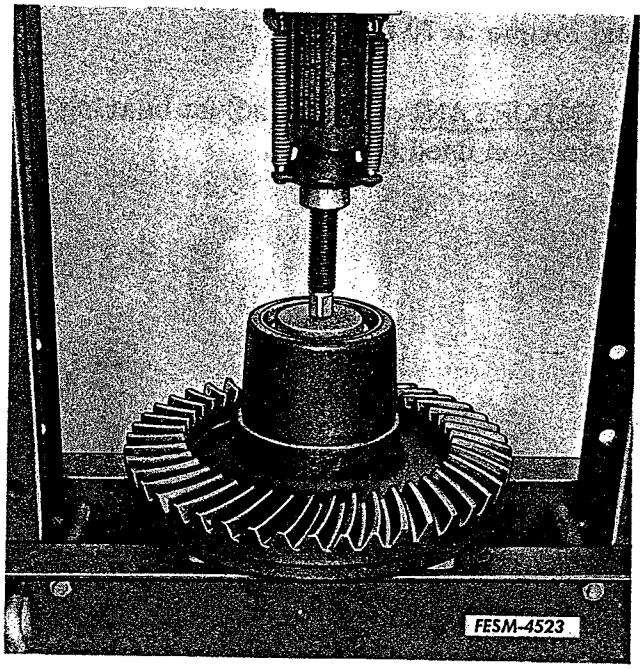
Shaft

1. Coat the bevel gear shaft with IH Never Seeze; and check for freedom of movement in the hub and steering clutches.

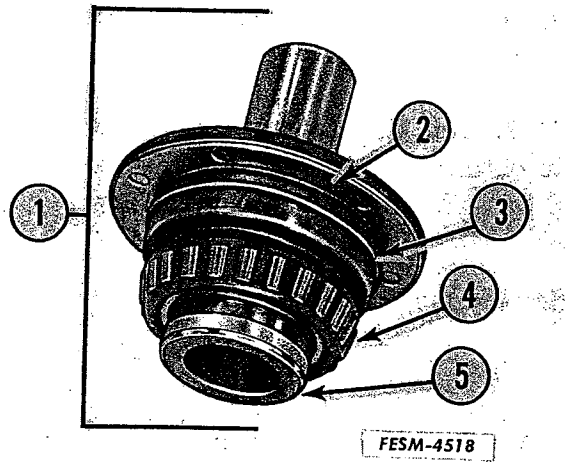
2. Check bevel gear shaft fit in the sprocket drive pinion shaft pilot bores. The shaft must fit freely, but clearance must not exceed .020 inch. Replace the bushing and shaft as necessary to restore operating clearance.

Gear Replacement

The bevel gear and pinion (transmission spline shaft) are a matched set. They are replaced as an assembly.



Installing the seals.



1. Bearing retainer assembly
2. Shims
3. O-ring
4. Carrier bearing
5. Sleeve

1. Remove the bevel gear from the hub.

2. Thoroughly clean the mounting surface of the new gear and the hub.

3. Install the new gear. Tighten the bolts evenly and progressively to 120 ft. lbs.

Oil Seal Replacement

1. Drive the old seals out of the hub. Install the new seals using a press and step plate.

2. Inspect the seal wear sleeves on the bearing retainers. If they are worn or damaged, heat the sleeve to expand them for removal and installation.

Bearing Replacement

If either carrier bearing requires replacement, replace them both.

1. Drive the cups out of the bevel gear hub; and install the new cups using a press.

2. Use a bearing puller to remove each bearing from its carrier.

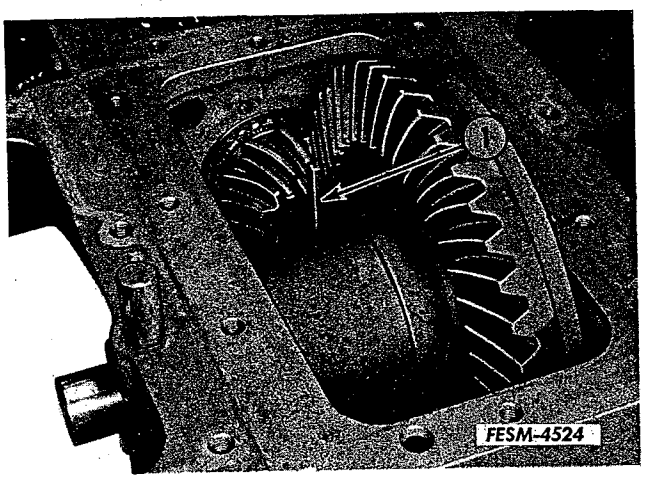
3. Install the new bearings using a piece of tubing to press against the inner races of the bearings.

4. Position the bevel gear assembly in the rear frame. Install the bearing retainers with O-rings and original shims. Tighten the retainer cap screws to 35 ft. lbs.

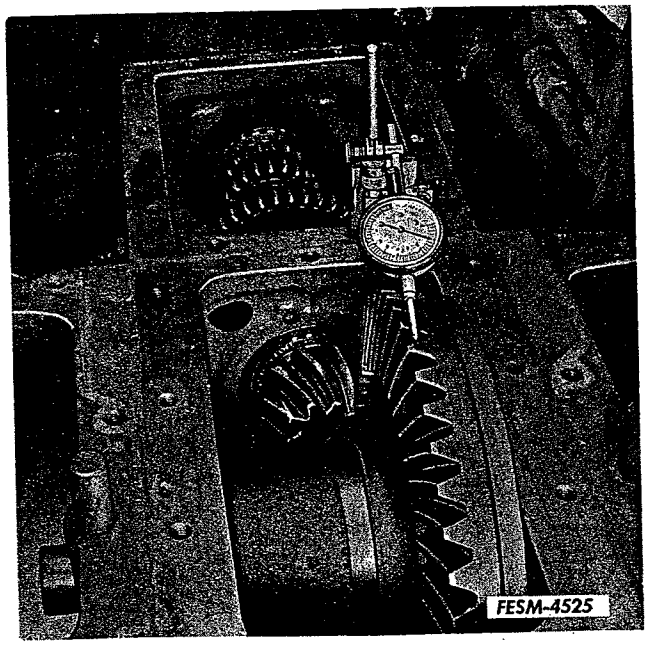
5. Install a cap screw in one end of the bevel gear shaft, and install the shaft in the gear assembly.

6. Check rolling torque of the bevel gear assembly using an in. lb. torque wrench to turn the bevel gear shaft.

7. Add or subtract shims from one bearing retainer as necessary to obtain a rolling torque of 22 in. lbs.



1. Parallel blocks



IMPORTANT: 22 in. lbs. rolling torque is specified with bevel gear oil seals installed, and the pinion removed.

Bevel Gear and Pinion Adjustments

Pinion Cone Center

The pinion cone center adjustment must be checked after installing a new transmission spline shaft, or spline shaft bearings

1. Install the spline shaft assembly in the transmission housing without gears, using the original shims. Torque the capscrews to 85 ft. lbs.

2. Subtract 2.7828 inches from the measurement figure etched into the face of the pinion. The resulting figure is the distance from the face of the pinion to the machined surface of the bevel gear hub when the pinion is properly installed.

3. Force the pinion forward, and measure the distance from the face of the pinion to the machined surface on the bevel gear hub, using parallel blocks. Add or subtract shims under the spline shaft rear bearing retainer as necessary to obtain the proper distance obtained in step 2 above.

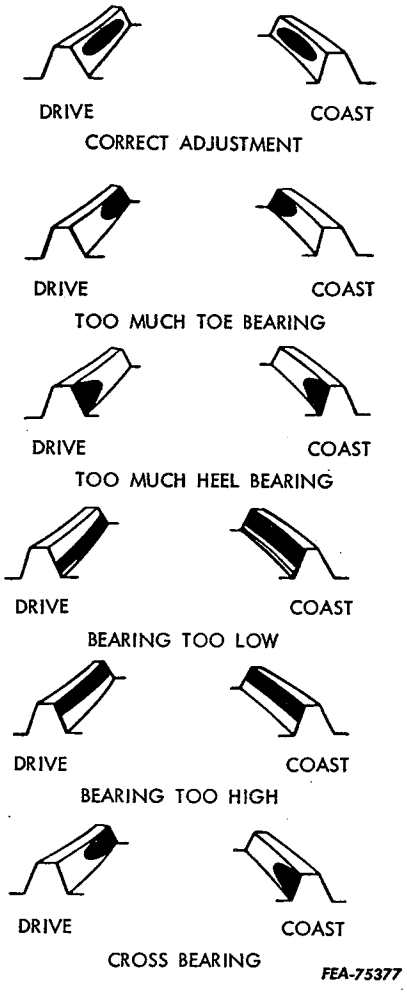
Backlash

Bevel gear to pinion backlash must be checked when a new gear set or bevel gear carrier bearings are replaced.

Check bevel gear backlash using a dial indicator as illustrated.

Transfer shims from one carrier bearing retainer to the other as necessary to obtain the specified backlash etched into the perimeter of the bevel gear.

IMPORTANT: Do not add or remove shims, as bearing preload will be affected.



Tooth Contact Picture Check

After the pinion cone center and backlash adjustments have been performed, it is a good policy to check tooth contact picture, to insure the proper relationship between the bevel gear and pinion.

Correct Adjustment - Properly matched gears.

Too Much Toe Bearing - Insufficient backlash.

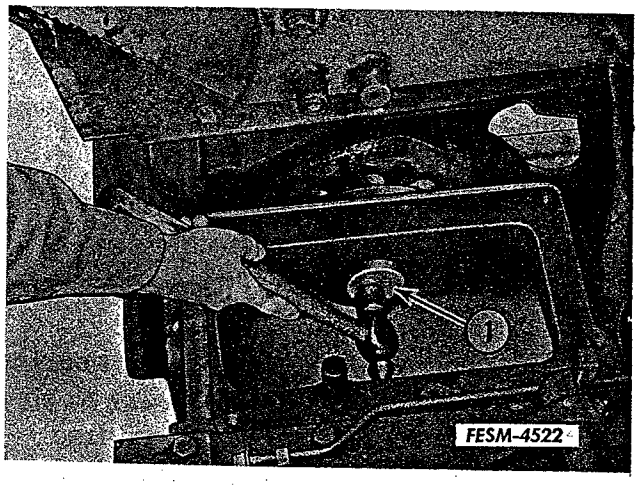
Too Much Heel Bearing - Too much backlash.

Bearing Too Low - Pinion too deep, move pinion out and readjust backlash.

Bearing Too High - Pinion too shallow, move pinion in and readjust backlash.

Cross Bearing - Mounting points on case are not in line, usually due to bearing failure or distorted case.

IMPORTANT: When used gears are installed, tooth contact should match the existing wear pattern. If backlash is corrected on used gears, noisy operation and rapid wear will result.



1. Step plate

Sprocket Drive Pinion Seal Replacement

1. Pry the seals out of the steering clutch housings.

IMPORTANT: Be careful not to damage the needle bearings.

2. Clean the seal bore. Coat the outer edge of each seal with IH Plasti-Gasket. Drive the seals into place using a step plate.

Reassembly

Bevel Gear Installation

1. Position the bevel gear in the rear frame. Then install the bearing retainers with bearings, new seals, and shim packs. Torque the capscrews to 35 ft. lbs.

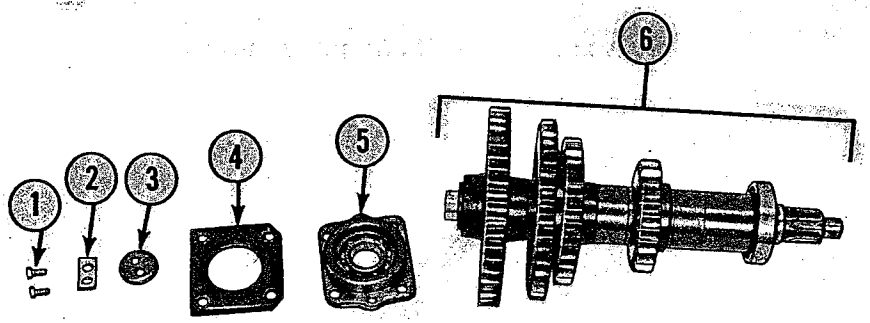
2. Install the bevel gear shaft in the bevel gear using a slide hammer.

3. Install the steering clutches, and final drive pinions. Refer to Section 7 "Steering Clutches and Brakes".

Transmission

Reverse the disassembly procedure paying particular attention to the following steps.

Counter Shaft



FESM-4526

1. Capscrews
2. Lock plate
3. Retainer washer
4. Cage retainer block
5. Bearing cage with bearing
6. Countershaft assembly

1. Position the counter shaft gears and spacers in the housing. Then insert the shaft with rear bearing and spacer through the gears.

2. While a helper centers the front end of the counter shaft in the front bearing bore, drive the counter shaft forward with a brass drift.

3. Install the front bearing, bearing cage, and retainer block. Torque the capscrews to 35 ft. lbs. Then drive the counter shaft forward until the front spacer seats on the bearing.

4. Install the counter shaft lock plate and washer; and torque the capscrews to 20 ft. lbs.

Spline Shaft

Install the spline shaft with gears, bearings, retainer, and shims. Torque the capscrews to 55 ft. lbs.

Transmission Cover and Gear Shift Installation

Install the transmission cover and gear shift assembly after the engine and reverser or gear drive housing is installed.

Rear Section Recoupling

Reverse the splitting procedure.

Section 6

POWER TAKE-OFF AND SPEED REDUCER

CONTENTS

SPECIFICATIONS

Speed Reducer

Low Speed Shaft O.D. - inches	1.813
Low Speed Gear I.D. - inches	1.811

GENERAL DESCRIPTION

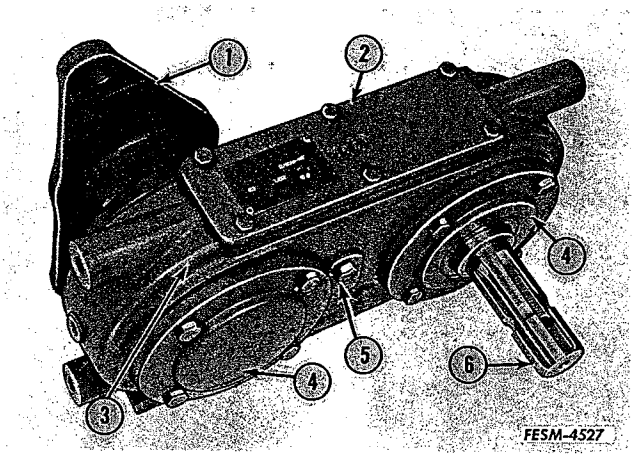
Power Take-off

The power take-off attachment is driven by the transmission counter shaft at a rated speed of 1000 rpm.

On tractors equipped with the power shift reverser, pto direction of rotation is reversed with tractor direction of travel.

The pto shaft is engaged by a hand operated lever which moves the pto shaft mounted shifter coupler into engagement with the transmission counter shaft.

Speed Reducer



The speed reducer gearbox attachment reduces pto shaft rated speed to 540 rpm. It is mounted on the rear of the tractor, and is lubricated by fluid from the rear frame.

1. Adapter housing
2. Top cover
3. Housing
4. Shaft retainer (4)
5. Idler gear pin
6. Low speed shaft

REMOVAL AND DISASSEMBLY

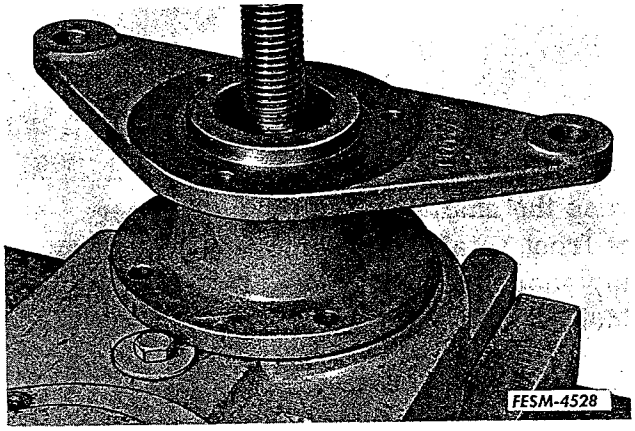
1. Clean the speed reducer gear box and the area surrounding the power take-off output shaft.

2. Drive the rear of the tractor onto blocks to raise the rear sprockets 8 inches or more; or drain the rear frame and speed reducer gear box.

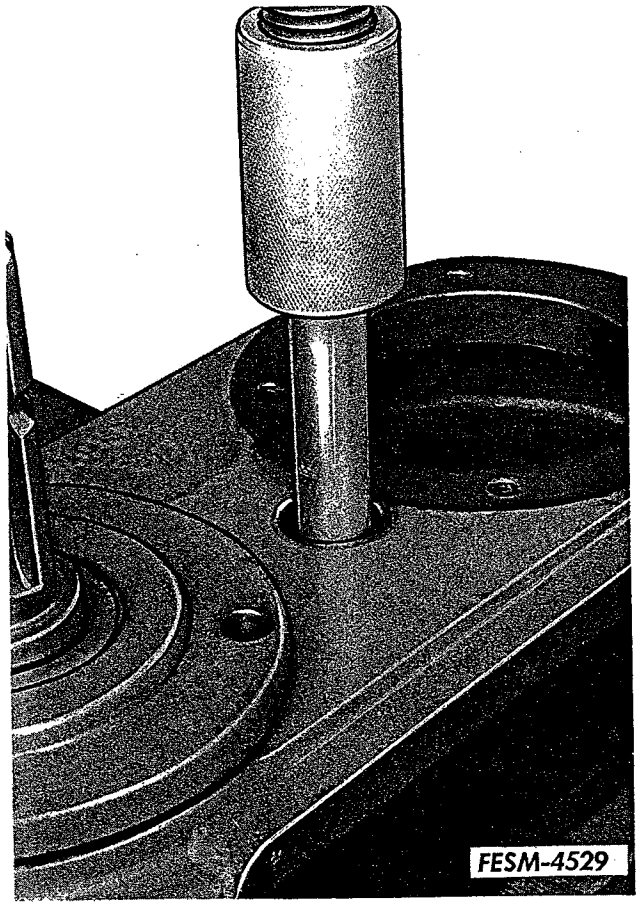
Speed Reducer

1. Remove the speed reducer with adapter from the rear frame. Cover the opening in the rear frame.

NOTE: If the speed reducer does not require service, proceed to pto removal and disassembly.



Removing the high speed gear shaft and rear retainer.



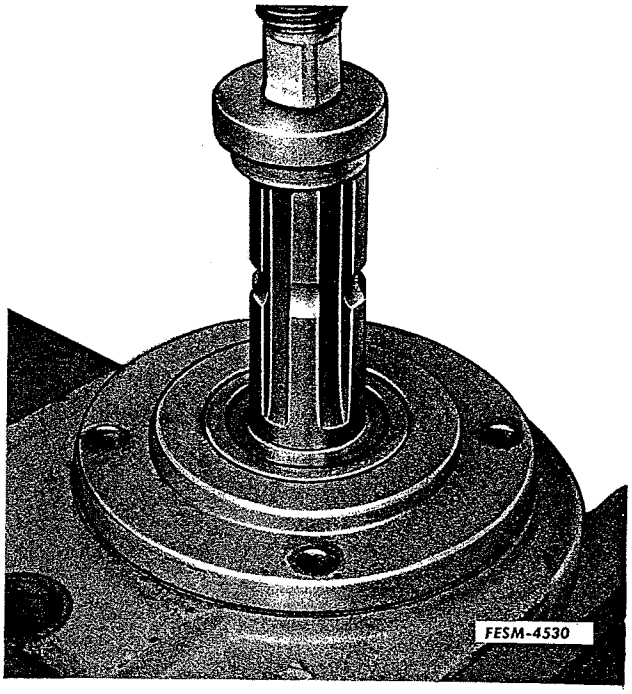
Removing the idler pin.

2. Remove the top cover, shield, and support bracket.

3. Remove the capscrews from the shaft retainers and adapter housing.

4. Press the high speed gear shaft and rear retainer out of the housing. Then remove the adapter housing.

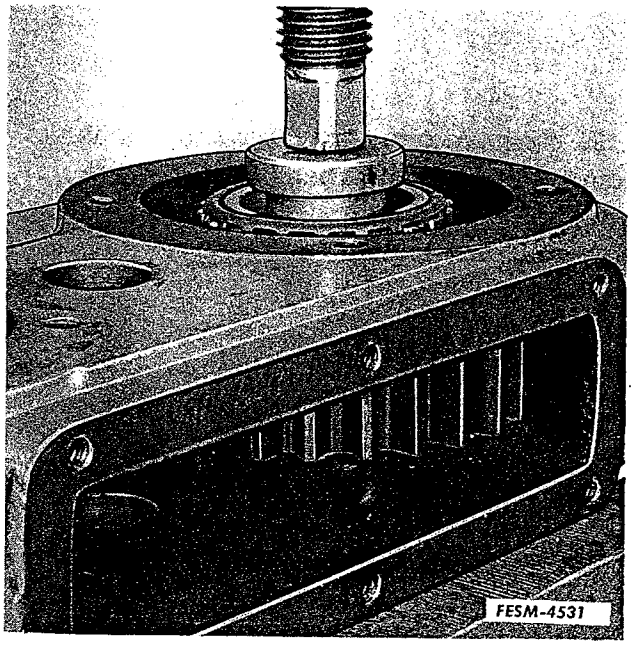
5. Remove one capscrew and washer from the idler pin. Then press the pin out of the gear box; and remove the idler gear and bearing assembly.



Pressing on the low speed shaft to remove the front retainer.

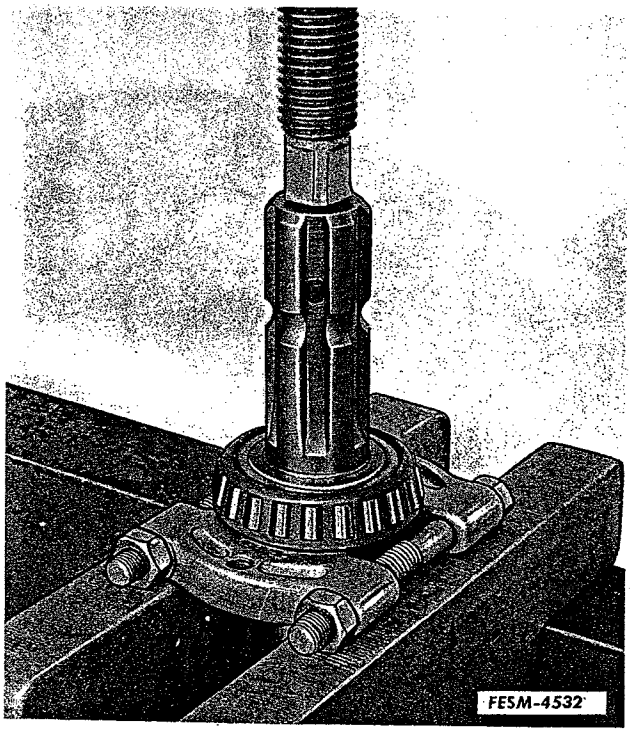
6. Remove the low speed shaft front retainer by pressing on the shaft. Then turn the assembly over; and press the shaft and rear retainer out of the housing and gear.

IMPORTANT: Do not continue to press the shaft through the gear after the front retainer is removed. The gear may score the shaft where the oil seal rides.



Removing the low speed shaft and rear retainer.

7. Press the low speed shaft out of the bearing.

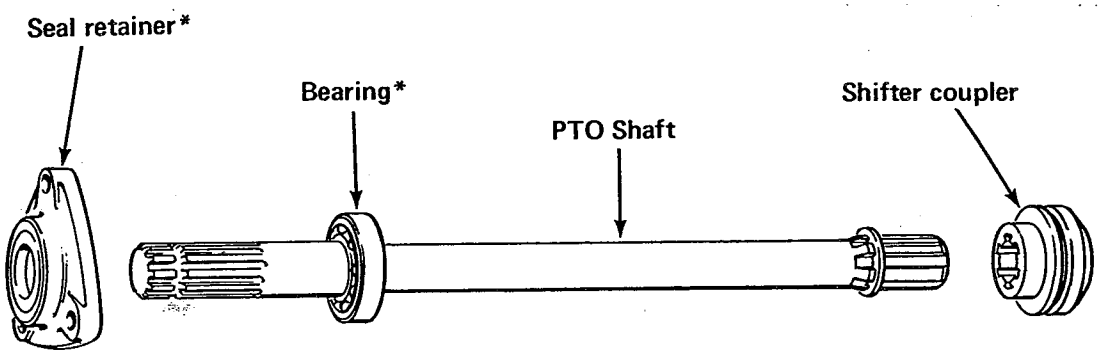


Removing the low speed shaft rear bearing.

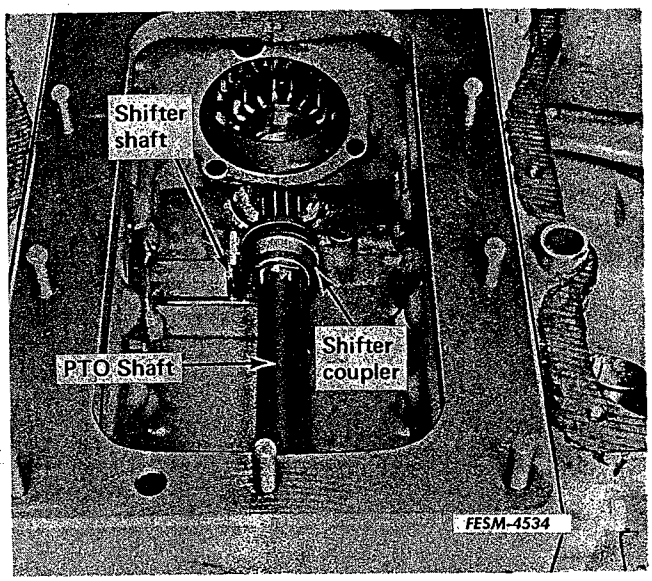
Power Take-off

1. Engage the power take-off control lever to prevent the shifter coupler from dropping during shaft removal.

2. Remove the capscrews from the seal retainer, and remove the shaft with retainer from the rear frame.



*Not used with speed reducer.



3. If the shifter coupler is to be removed, have an assistant disengage the pto lever while you remove the disengaged coupler.

4. If the shifter control linkage is to be removed, disconnect the shifter shaft outer arm. Then push the shifter shaft into the rear frame.

5. If the shifter shaft seal is to be replaced, remove the shifter bracket, and remove the seal.

INSPECTION AND REPAIR

1. Clean the parts in an evaporative solvent and dry with compressed air.

2. Replace all gaskets, and O-rings.

NOTE: Speed reducer shaft retainer gaskets are used as shims to determine bearing preloads.

3. Replace worn and damaged parts.

4. Remove burrs with a file, and polish the shafts where the seals ride with emery cloth.

5. Coat all parts with IH Hy-Tran fluid during reassembly.

6. Use petroleum jelly to aid assembly and prevent damage to O-rings.

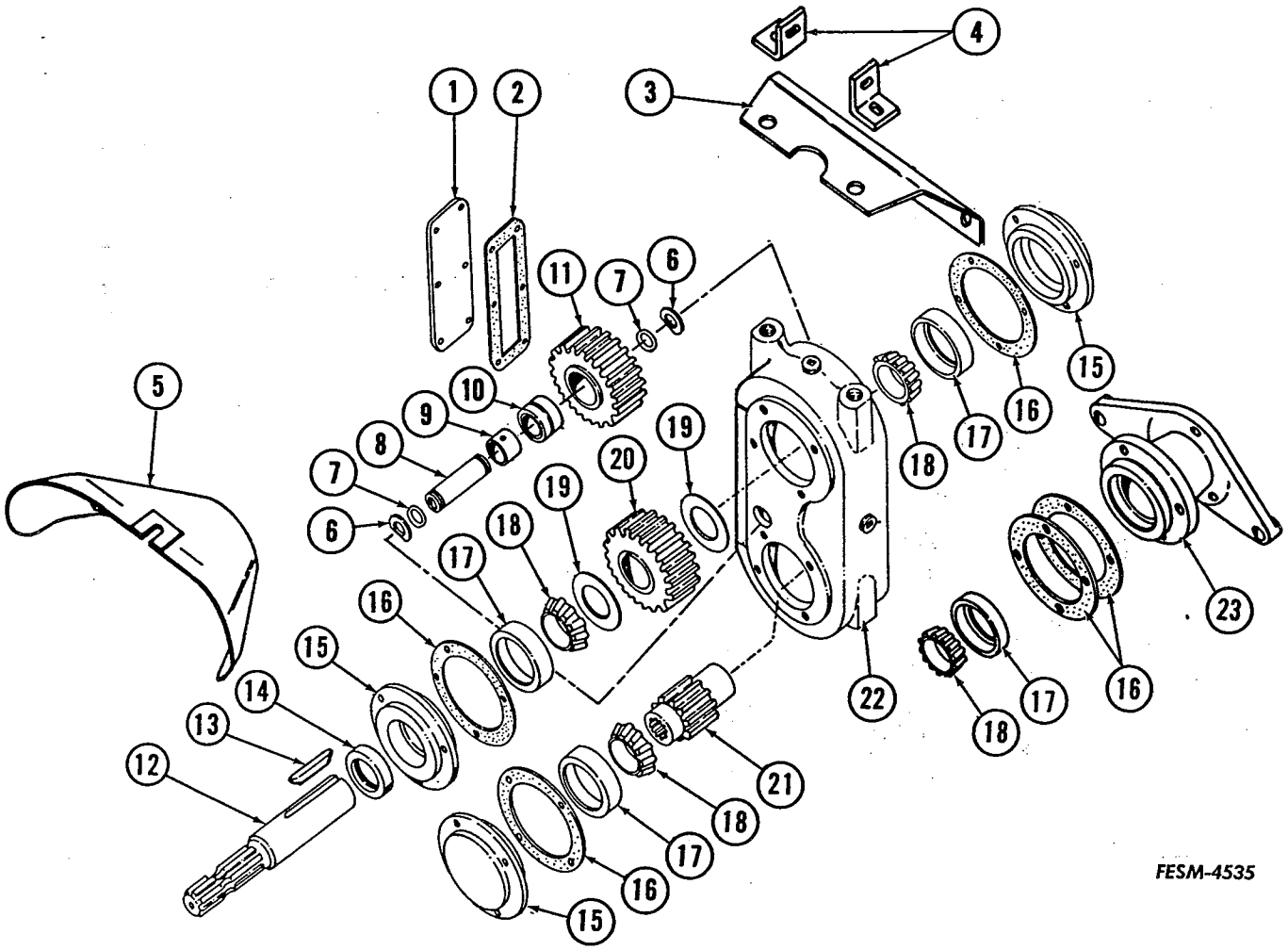
REASSEMBLY AND INSTALLATION

Power Take-off

1. Install the shifter shaft bracket with a new seal and gasket. Then install the shifter shaft outer arm.

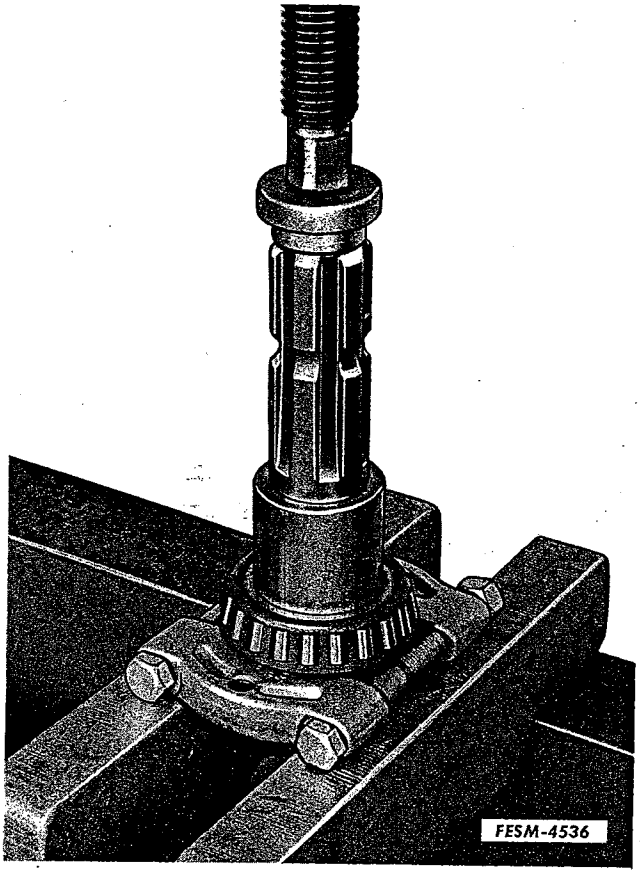
2. Install the shifter coupler; and engage the control lever to hold it in position.

3. Install the pto shaft assembly, engaging the shaft splines. Torque the retainer capscrews to 20 ft. lbs.



1. Cover
2. Gasket
3. Support
4. Support angle (2)
5. Shield
6. Washer (2)
7. O-ring (2)
8. Idler pin
9. Bearing race
10. Needle bearing
11. Idler gear
12. Low speed shaft
13. Key
14. Seal
15. Shaft retainer (2)
16. Shim gasket (as required)
17. Bearing cup (4)
18. Bearing cone (4)
19. Washer (2)
20. Low speed gear
21. High speed gear
22. Speed reducer housing
23. Adapter housing

Speed Reducer



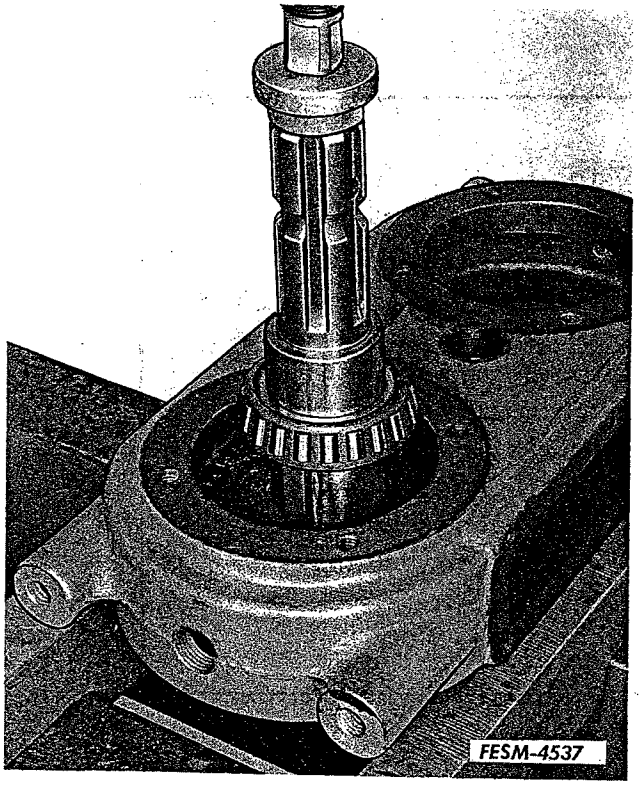
Installing the low speed shaft rear bearing.

1. Press the low speed shaft into the rear bearing from the front end, until it just clears the shaft keyway. Install the spacer, washer, and key.

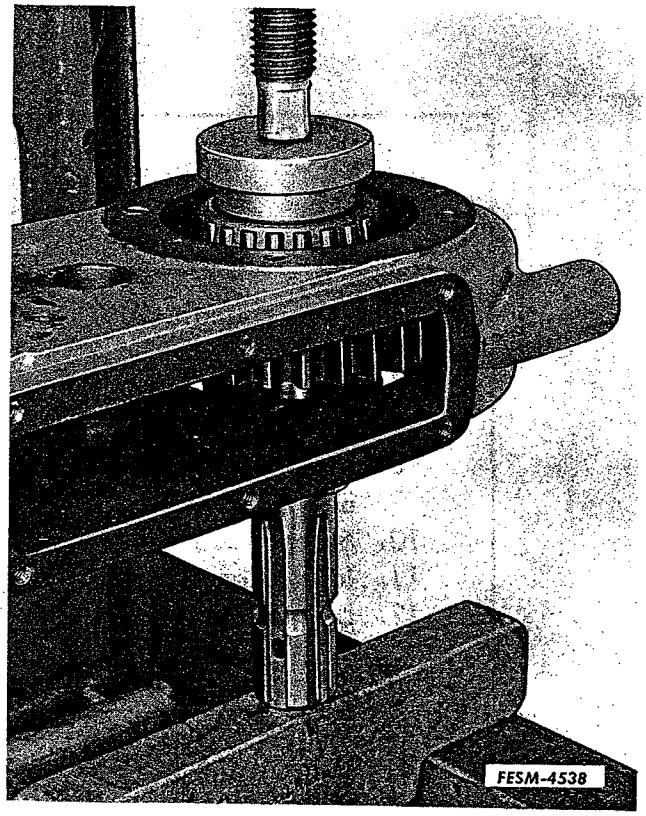
IMPORTANT: The low speed gear is a .003 inch interference fit to the shaft; and must be heated to expand the gear prior to installation.

2. Heat the gear evenly to 550°F. Use an FES 115-2 Thermo-melt Stiks pencil to indicate when the gear reaches 550°.

3. Position the low speed gear in the housing; and press the shaft through the gear until the front bearing can be started on the shaft. Then install the washer; and press the bearing and gear together onto the shaft until the shaft is flush with the front bearing inner cone.



Installing the low speed gear.

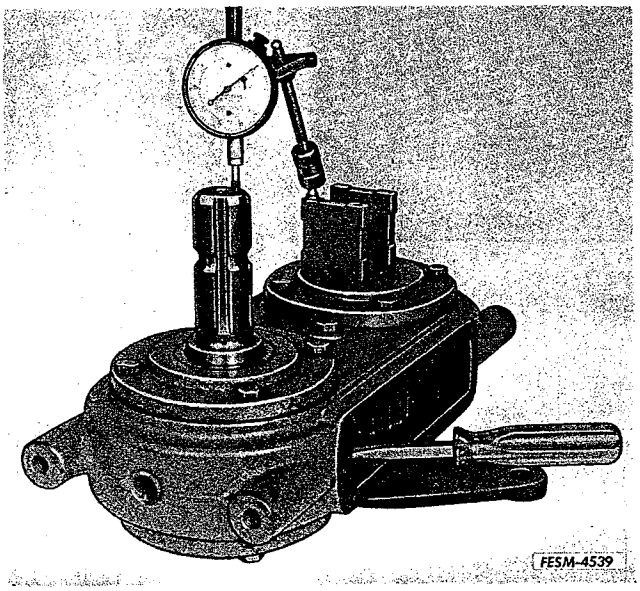


Installing the low speed shaft front bearing.

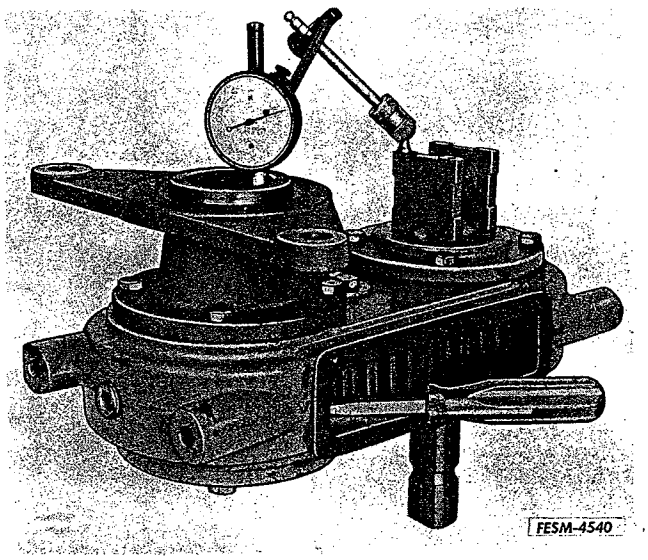
4. Position the idler gear with bearing assembly in the housing; and install the pin with new O-rings. Tighten the capscrews to 35 ft. lbs.

5. Press the bearings onto the high speed gear shaft, flush with the gear.

6. Install the bearing cups in the shaft retainers and adapter housing.



Checking low speed shaft end play.



Checking high speed shaft end play.

Install a new seal in the output shaft rear retainer.

7. Install the retainers and adapter housing with new gasket packs equal in thickness to the packs removed. Use IH Gasket Maker to seal the capscrews; and tighten them to 35 ft. lbs.

8. Check shaft end play with a dial indicator. Add or subtract gaskets evenly as necessary to obtain an end play of .000 to .005 inch for both shafts.

IMPORTANT: Check the shafts for freedom of movement. Do not preload the bearings. Gasket packs must measure within .005 inch on each shaft.

9. Install the cover with a new gasket. Tighten the capscrews to 10 ft. lbs.

10. Install the shield and support bracket. Then install the speed reducer on the tractor rear frame. Tighten the 5/8 inch capscrews to 150 ft. lbs., and the 5/16 inch capscrews to 20 ft. lbs.

Section 7

STEERING CLUTCHES AND BRAKES

CONTENTS

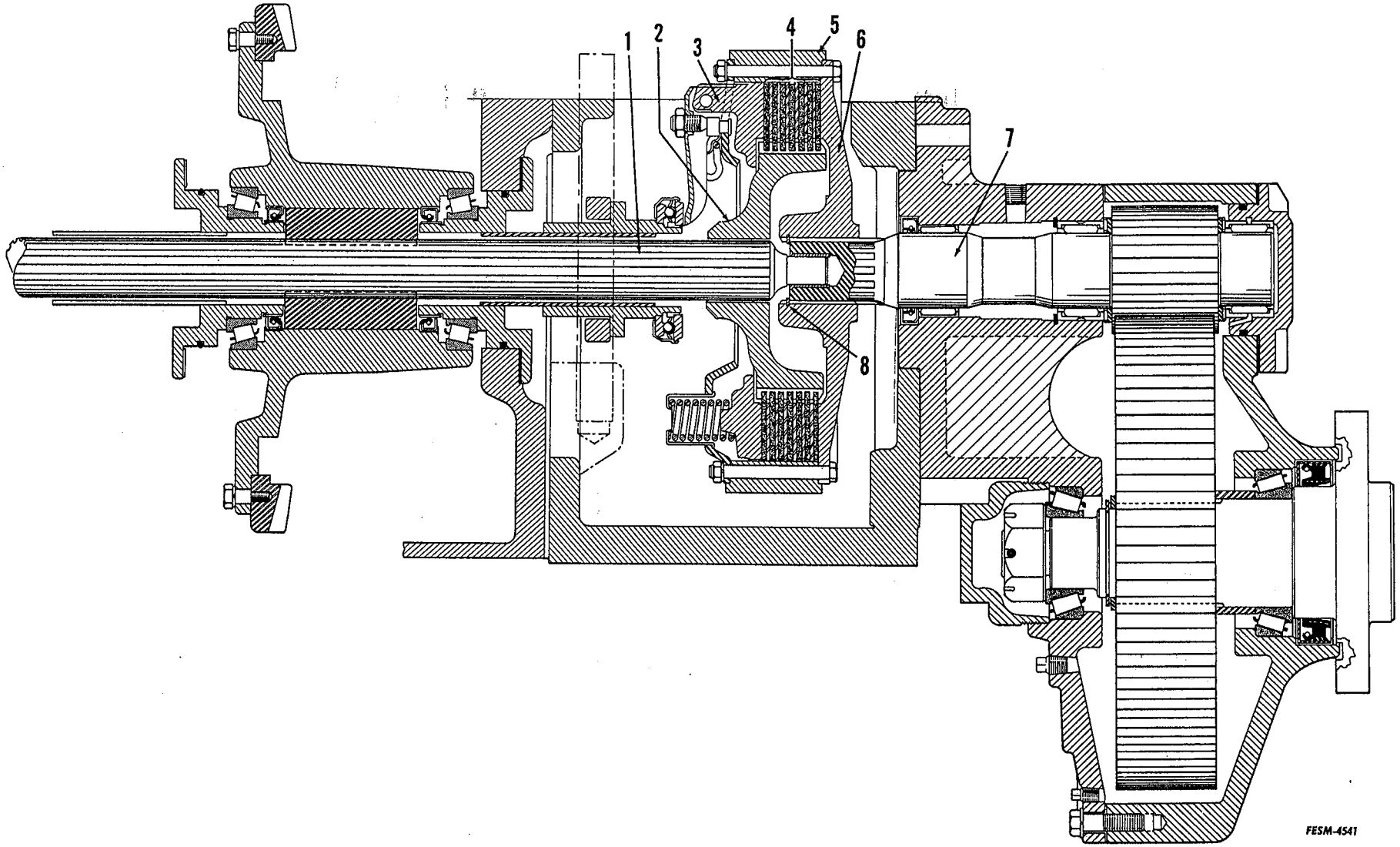
SPECIFICATIONS

Manufacturer	Rockford clutch
Type	Multiple-dry disc
Size (diameter in inches)	10
Steering lever free travel (measured at lever tips) - inches	1 - 1-1/4
Brake cross shaft arms free travel - inch	1/4
Steering and brake actuating lever clearances - inch	3/8
Base plate allowable wear and distortion - inch	.006
Clutch disc	
Number	7
Type	Organic
Thickness (average new) - inch	.145-.151
Clutch plates	
Number	6
Thickness (average new) - inch	.093
Allowable taper (I.D. to O.D.) - inch	.001-.003
Pressure plate allowable wear and distortion - inch	.006
Clutch springs	
Number	9
Color code	Light blue
Free length - inches	2.750
Test length - inches	1-13/16
Test load at test length - lb.	166 min.
Clutch adjustment	
Release lever to pressure plate dimension - inch.	2.149-2.179
With back plate to pressure plate dimension - inch	.851
Release lever adjustment using FES 50 clutch tool - use gauge block and spacer	No. 3
Release lever to base plate dimension (assembled) - inches.	4.750-4.785
Release lever to brake drum outer edge (assembled) - inches	1.365-1.485

Bevel gear shaft pilot - O.D. (new) - inch	.739-.741
Sprocket drive pinion shaft pilot bushing - I.D. (new) - inch	.742-.744
Bevel gear pilot shaft and bushing clearance (allowable wear) - inch	.020 max.

Brake test specifications

Brakes will stall tractor - gear number	
Standard gear drive	2
Power shift without torque converter	2
Power shift with torque converter	3



1. Bevel gear shaft	3. Pressure plate assembly	5. Drum	7. Sprocket drive pinion shaft
2. Clutch hub	4. Discs (7) and plates (6)	6. Base plate	8. Snap ring

GENERAL DESCRIPTION

The steering clutches, mounted on the ends of the bevel gear shaft, control power flow to each sprocket drive pinion shaft. The clutches are dry, multiple disc type, and are spring loaded.

The clutch discs are driven by the bevel gear shaft and clutch hub. When the clutch is engaged, the discs and plates rotate as an assembly transferring power to the sprocket drive pinion shaft through the clutch drum and base plate.

The brake bands are wrapped around the steering clutch drums and are used to retard or stop rotation of the base plate and sprocket drive pinion shaft to which the drum is attached. Each steering lever controls one clutch brake assembly. As the lever is moved to the rear, the clutch is released, then the brake is applied, retarding or stopping the track. There is a neutral position between clutch release and brake apply.

The foot operated brake pedal actuates both brake bands simultaneously. The steering clutches are not released when the foot pedal is depressed.

PRELIMINARY INSPECTION

If, on inspecting the clutches, it is found that free play is non-existent, a check of the holding ability of the steering clutch assemblies should be made. A lack of free play signifies a partially or perhaps completely loaded release system which could result in continuous clutch slippage.

Check the steering clutch assemblies as follows:

1. Adjust the linkage to give the desired free play. Refer to Section 12, "Adjustments."

2. Lodge the blade or bucket against some immovable object (tree, rock, etc).

3. Release both clutches, then engage both. Both tracks should drive, engine die, or torque converter stall.

4. Release both clutches and engage each one separately. Each clutch should hold. The track should spin the engine, engine die, or the converter stall. If either clutch fails to hold, servicing is required.

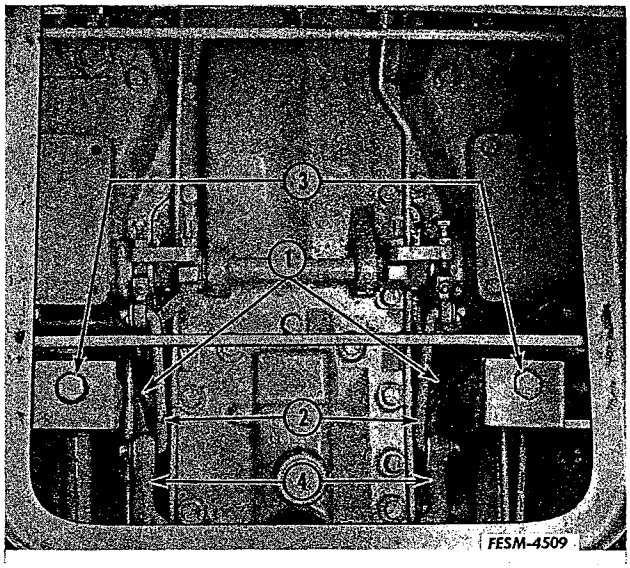
NOTE: It is possible that step three will be satisfactory and step four will result in a slipping clutch. Reason: All power (100% available) is divided equally between the two clutches in step three. In step four, all power must be absorbed by one clutch.

REMOVAL

Clutch assemblies may be removed individually, or together. The clutch must be removed to remove the brake band. The following procedure is for removal of one assembly.

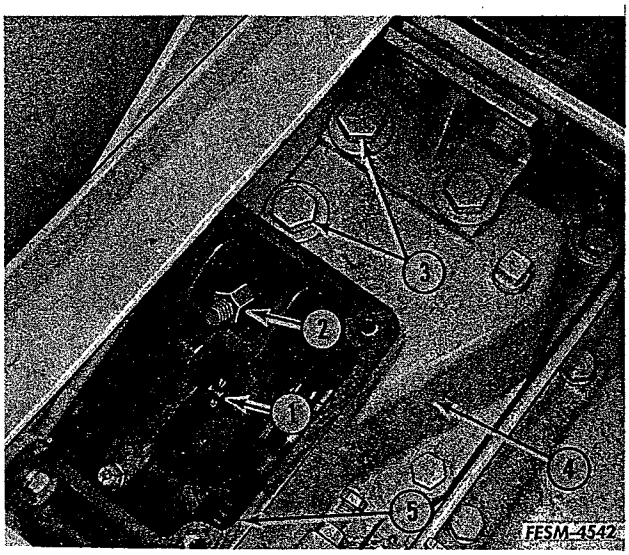
1. Raise the tractor to position the tracks so that the cut-out holes in the drive sprockets are aligned with the sprocket drive pinion shaft covers. Block the tractor so that it cannot move.

2. Remove the operator's seat, seat support and shield. Remove the fuel tank lower mounting bracket, and filler strip on the outside of the clutch cover on the side being serviced.



3. CAUTION: Remove the tension from the steering assist spring and disconnect the steering rod.

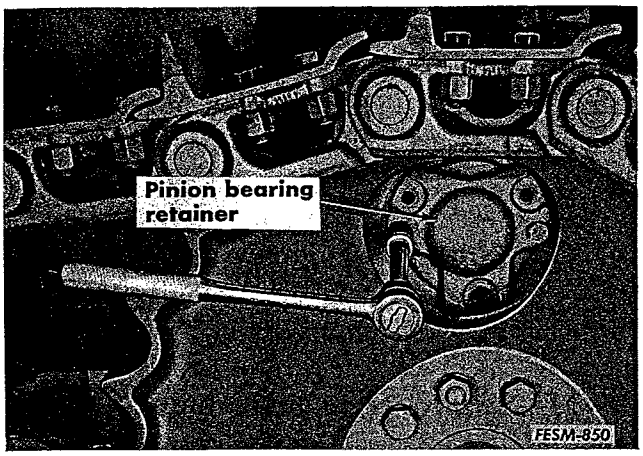
1. Pivot bolts
2. Steering rods
3. Assist spring adjusting bolts
4. Steering levers



4. Remove the clutch cover inspection plate. Remove the brake band clevis pin. Tighten the brake band adjusting nut to secure the band to the brake drum.

5. Remove the bolts securing the brake band anchor bracket to the cover.

1. Band clevis
2. Band adjuster nut
3. Brake anchor capscrews
4. Clutch housing cover
5. Inspection plate cover, removed

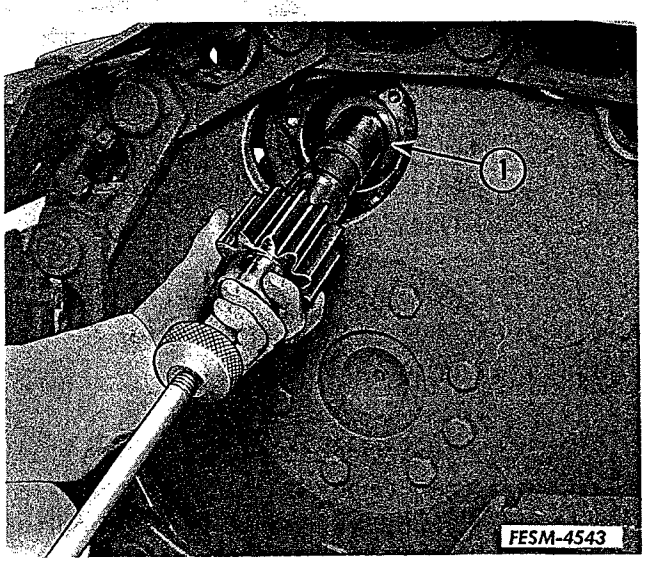


Removing the retainer.

6. If the R.H. assembly is being removed, disconnect the upper R.H. fuel tank support, and jack the fender up to allow cover removal.

7. Tilt and raise the cover while holding the link. Then remove the steering adjustable link. Remove the cover.

8. Remove the sprocket drive pinion shaft retainers, L.H. and R.H., using the capscrews removed as jack screws.



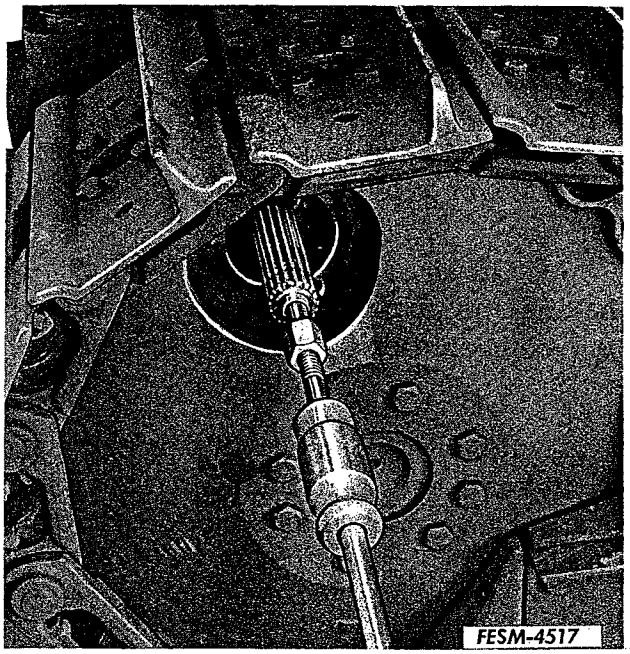
Removing the pinion shaft.

1. Thrust bearing

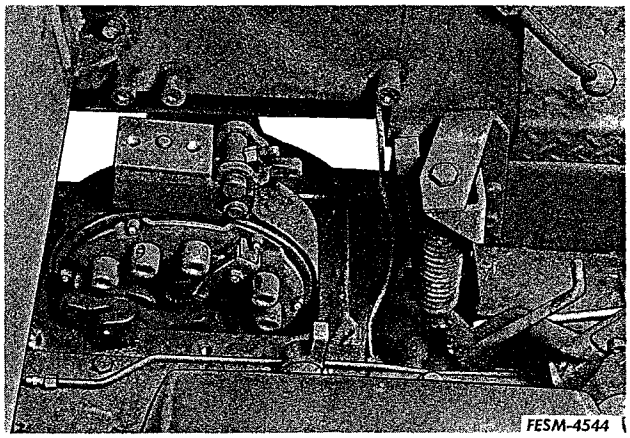
IMPORTANT: When removing the pinion shafts be careful not to drop the inner thrust bearing assemblies in the sprocket drive housings.

9. Start removal of the pinion shaft using a slide hammer. As the shaft moves out, it must be carefully tilted down as shown in the illustration. Both L.H. and R.H. shafts must be removed.

10. Support the steering clutch assembly being removed so that it does not drop.



Removing the bevel gear shaft.



Bevel gear shaft removed from the clutch assembly.

IMPORTANT: When removing the bevel gear shaft from the steering clutch, pull the shaft only far enough to allow clutch removal. If difficulty is encountered, use penetrating oil to aid shaft removal.

11. Pull the bevel gear shaft out of the steering clutch from the opposite side, using a slide hammer.

12. Remove the steering clutch assembly.

NOTE: If both clutches have been removed, remove the bevel gear shaft.

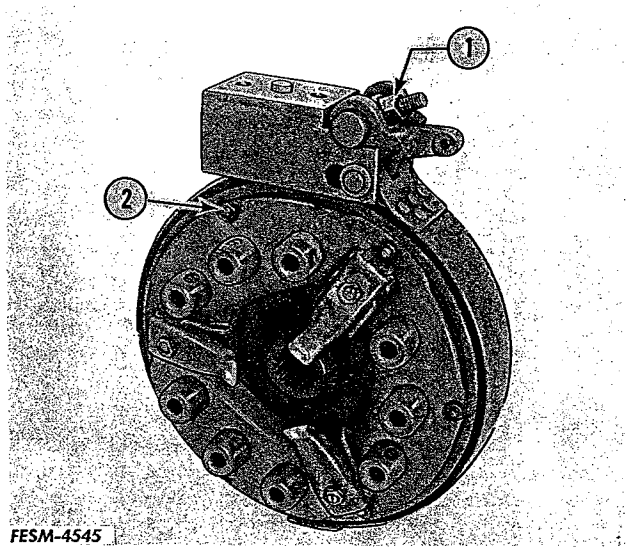
13. Remove the clutch release vertical shaft, fork, bearing, and sleeve.

14. If the bevel gear assembly requires service, refer to Section 5, "Transmission and Bevel Gear".

15. If the sprocket drive assembly requires service, refer to Section 8 "Sprocket Drives".

16. If the bevel gear or sprocket drive oil seals require replacement, proceed to "Inspection and Repair" in this section.

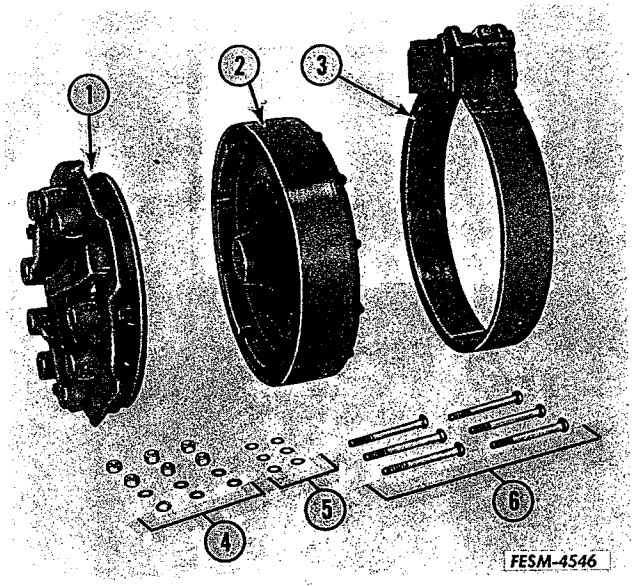
DISASSEMBLY



1. Loosen the brake band adjusting nut. Then slide the brake band from the clutch drum assembly.

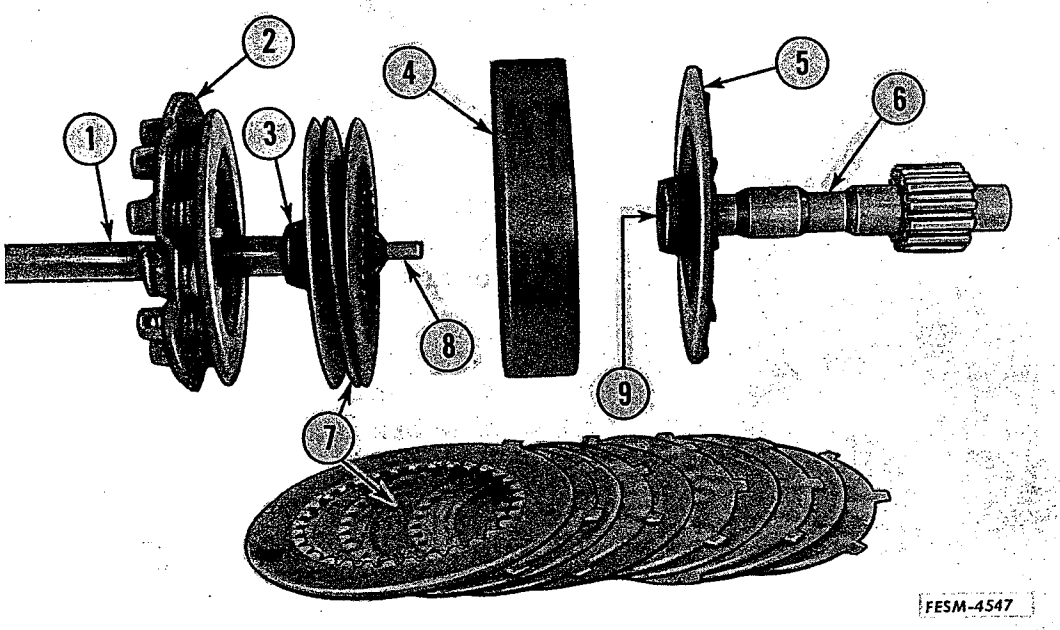
2. Lay the clutch assembly on the base plate, and remove the nuts from the "through" bolts.

1. Brake band adjusting nut
2. Through bolt nut (6)



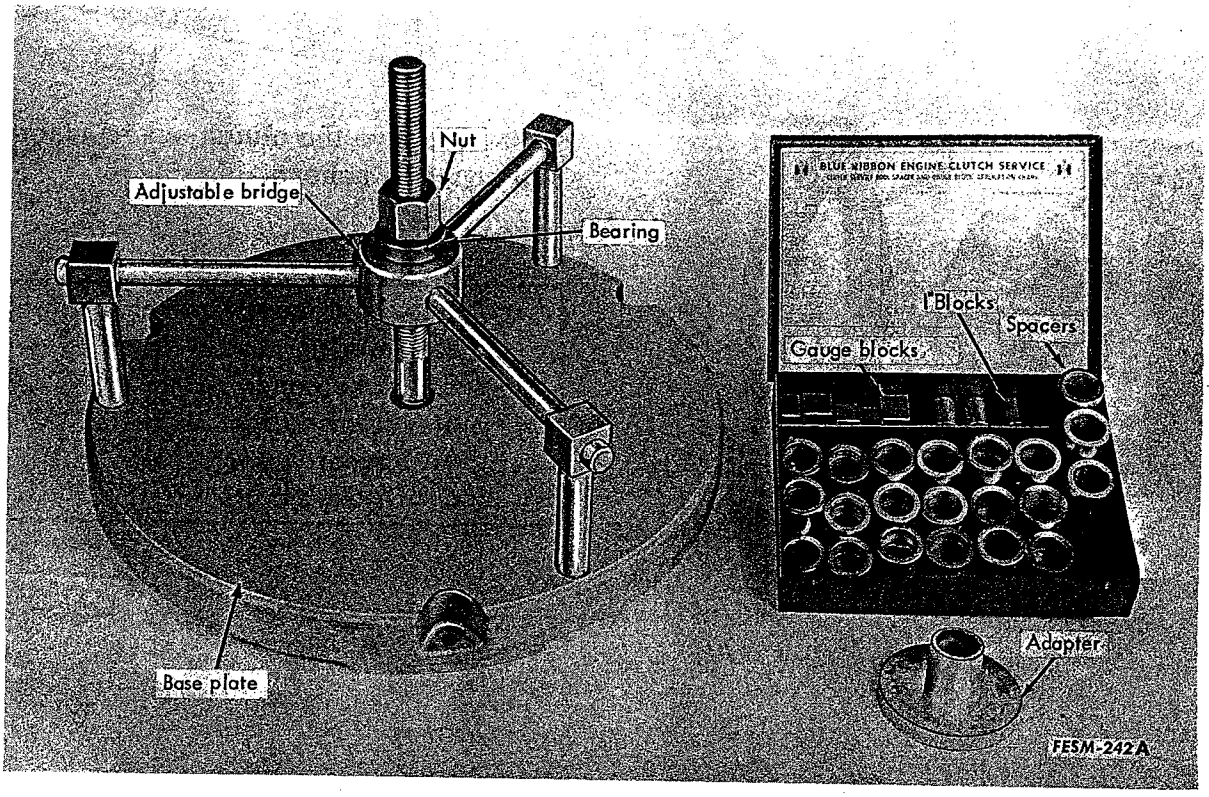
3. Remove the clutch cover assembly and spacer washers.

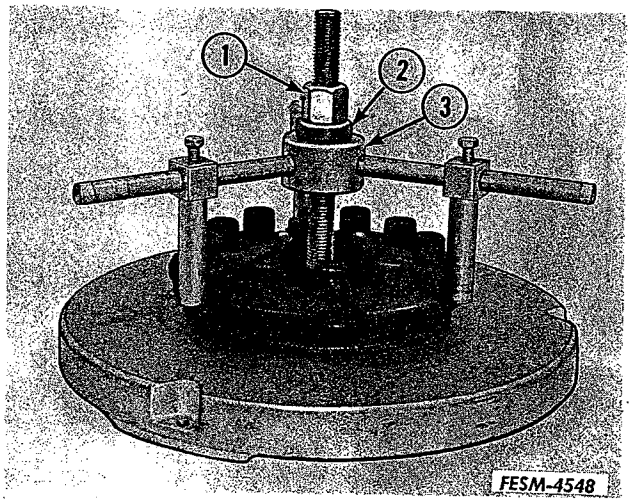
1. Clutch cover assembly
2. Steering clutch drum
3. Brake band
4. Nuts and lock washers
5. Spacer washers
6. Through bolts



1. Bevel gear shaft
2. Clutch cover assembly
3. Clutch hub
4. Drum
5. Base plate
6. Sprocket drive pinion shaft
7. Discs (7) and plates (6)
8. Shaft pilot
9. Pilot bore

4. Remove the hub and discs from the drum, and separate the drum from the base plate. If the clutch cover assembly does not require service, proceed to Inspection and Repair.

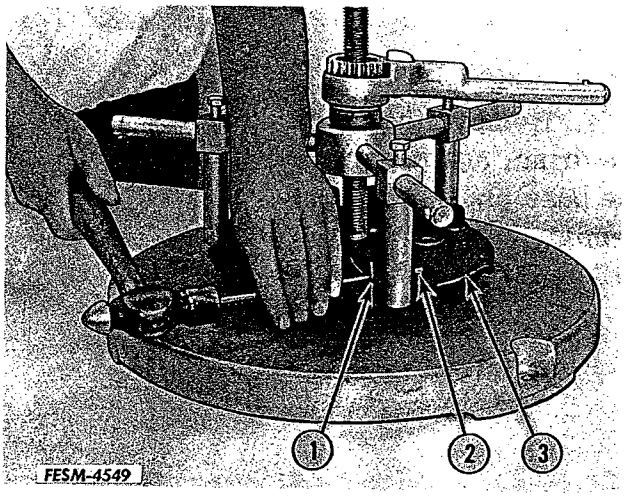




NOTE: Clutch service tool FES-50 is recommended for servicing and adjusting the clutch cover assembly. Gauge blocks and spacers used with the clutch tool insure precision adjustment of the clutch cover assembly.

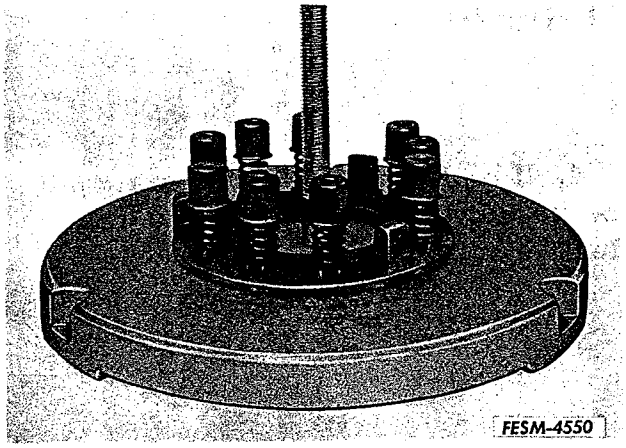
5. Place the clutch cover assembly on the clutch tool, and install the adjustable bridge, bearing and nut.

1. Nut
2. Bearing
3. Bridge



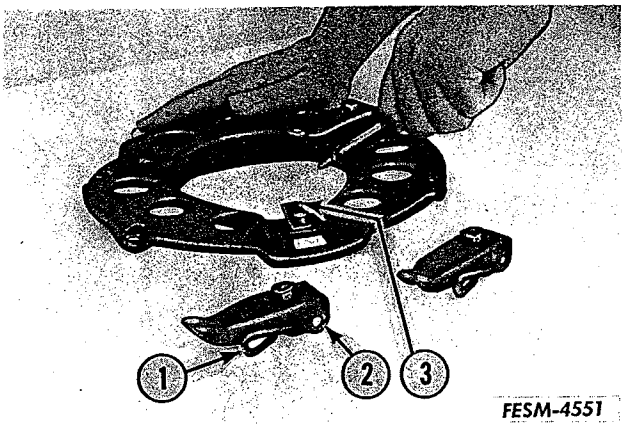
6. Compress the backplate. Then remove the release lever pins.

1. Release lever (3)
2. Pin (3)
3. Back plate



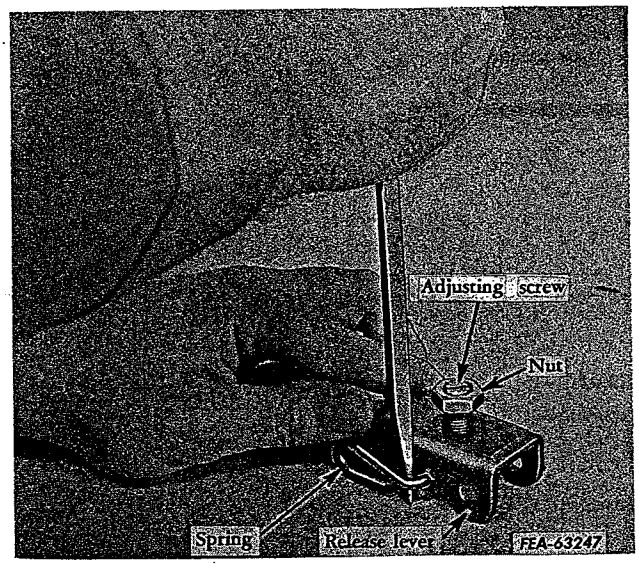
Bridge and back plate removed.

7. Remove the bridge. Then remove the backplate.



8. Using a screw driver inserted through the lever springs, pry the levers toward the center of the back plate to remove them from the spring clips.

1. Lever spring (3)
2. Lever (3)
3. Spring clip (3)



Removing the lever springs.

9. Remove the lever springs if necessary, using a screw driver to pry the springs out of the levers.

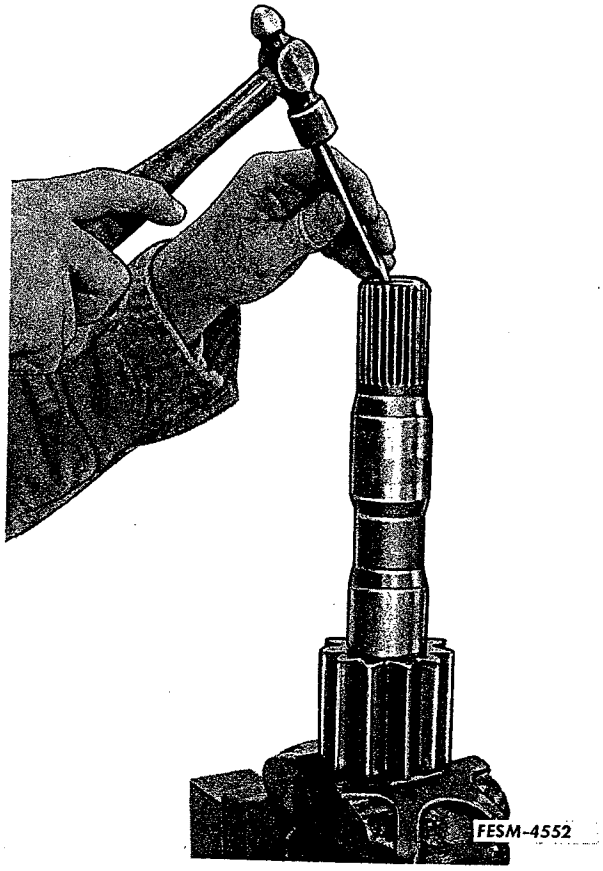
INSPECTION AND REPAIR

General

1. Clean the steering clutch housing and all parts in an evaporative solvent and dry with compressed air. Remove rust from shaft splines with a wire brush. Clean out the clutch drain hole. Run a tap through the threaded hole.

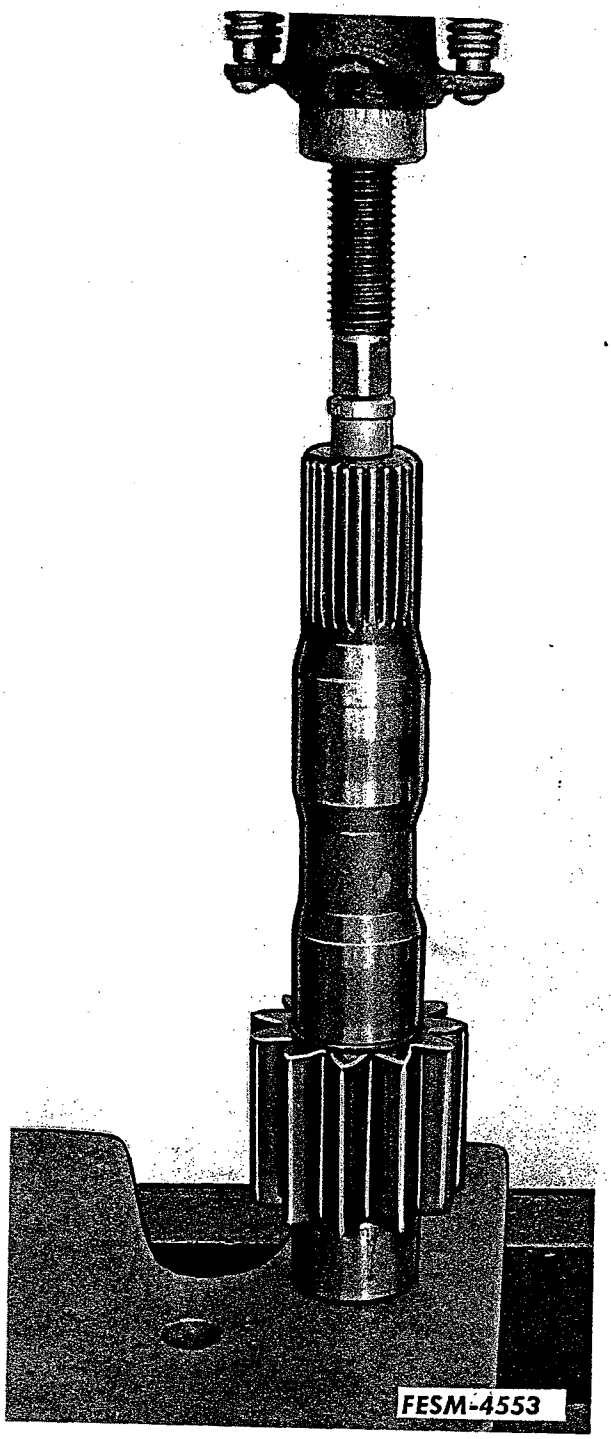
2. Inspect the bevel gear and sprocket drive pinion shaft splines for burrs. Remove burrs with a file. Polish the seal and bearing surfaces with crocus cloth.

3. Inspect the bevel gear shaft pilot and the pinion shaft pilot bushing. The shafts must fit freely, but clearance must not exceed .020 inch.



Removing the bushing.

4. If replacement is necessary, split the bushing with a sharp cape chisel. Remove and press in a new bushing.



Installing the bushing.

Sprocket Pinion Shaft Oil Seal Replacement

Installing the seal.

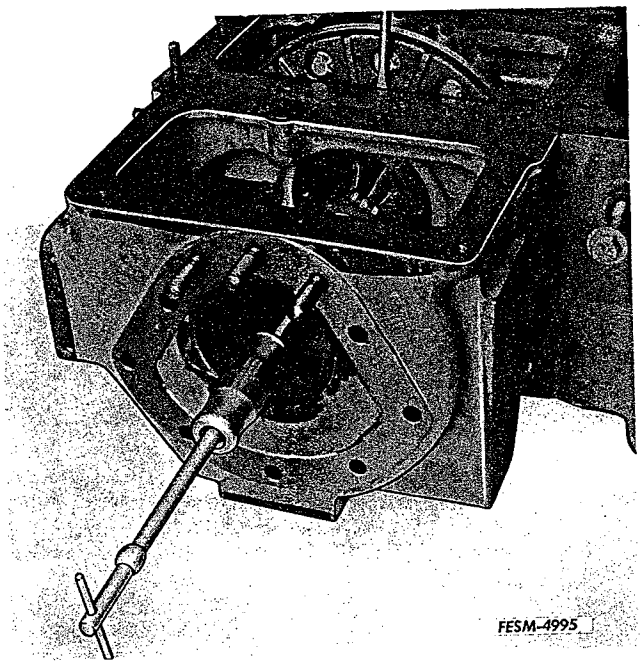
1. Pry the seal out of the steering clutch housing using a screw driver.

2. Clean the seal bore in the housing. Be careful not to damage the needle bearing behind the seal.

3. Coat the seal bore with IH Plasti-Gasket. Drive the seal into the bore, using a step plate to protect the seal.

1. Step plate

Bevel Gear Oil Seal Replacement



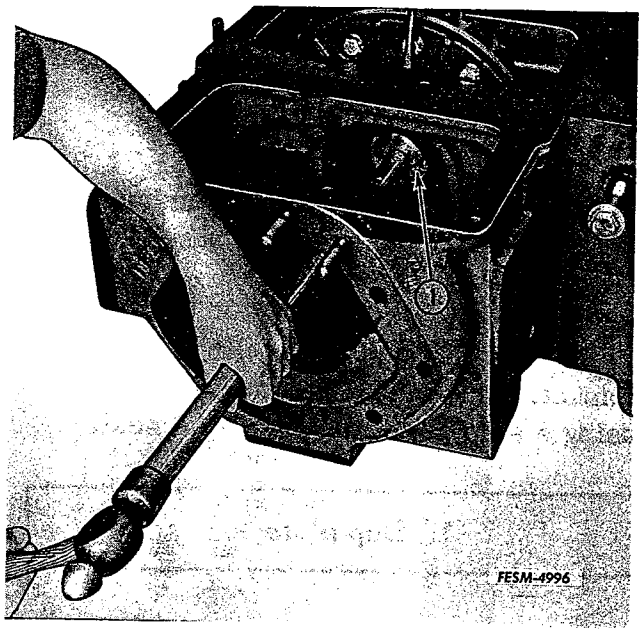
Removing the seal.

1. Remove the bevel gear cover; and drain the rear frame.

2. Block the bevel gear to support the assembly when the carrier bearing is removed.

3. Remove the bevel gear bearing retainer using the capscrews removed as jack screws in the holes provided.

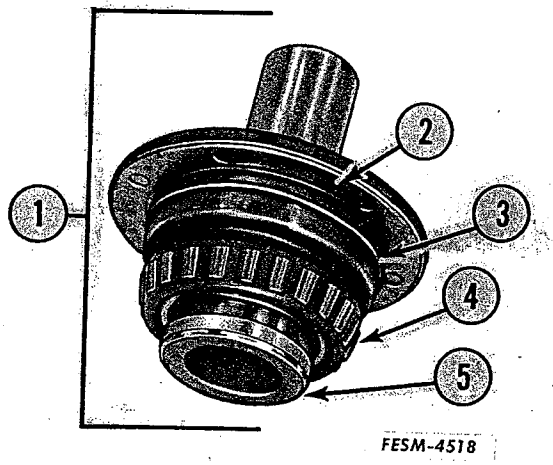
4. Remove the bevel gear oil seal,using a slide hammer inserted through the sprocket drive pinion shaft bore.



Installing the seal.

5. Drive a new seal into the bevel gear hub,using a step plate to protect the seal.

1. Step plate



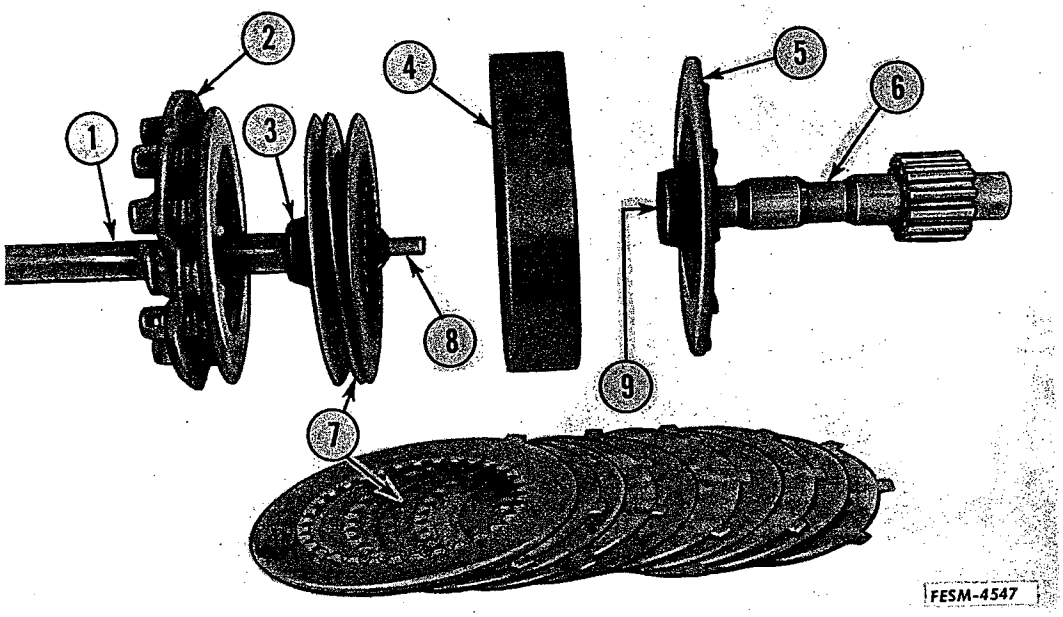
1. Retainer assembly
2. Shims
3. O-ring
4. Bearing
5. Wear sleeve

6. Inspect the seal wear sleeve on the bearing retainer. If it is worn or damaged, heat the sleeve to expand it for removal and installation.

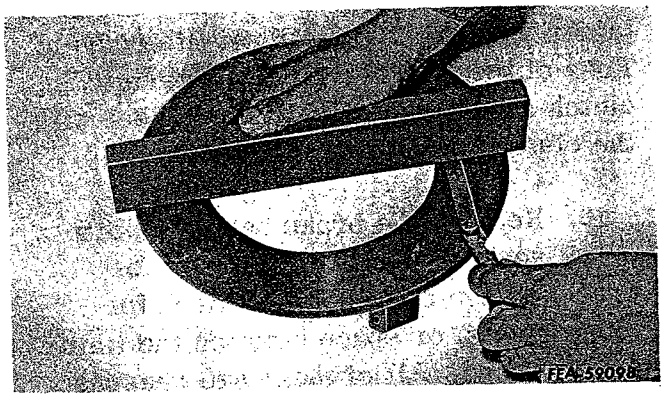
7. Install the bearing retainer with shims, and a new O-ring seal. Tighten the capscrews to 35 ft. lbs.

8. Remove the blocks supporting the bevel gear assembly. Replace the cover, and Hy-Tran fluid.

Clutch Brake Assembly



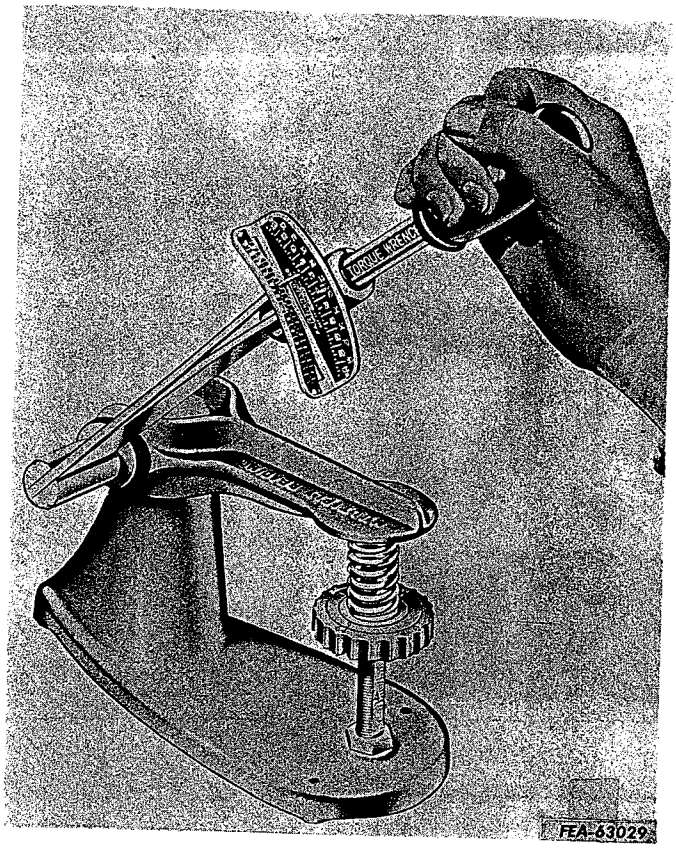
1. Bevel gear shaft
2. Pressure plate assembly
3. Clutch hub
4. Drum
5. Base plate
6. Sprocket drive pinion shaft
7. Discs (7), plates (6)
8. Shaft pilot
9. Pilot bore



Checking the pressure plate for wear and distortion.

1. Check the pressure plate and base plate for distortion and wear using a straight edge and feeler gauge. Replace parts which are .006 inch out of flat.

2. Replace the pressure plate and base plate if severe heat checking is evident.



Checking spring tension.

3. Inspect the release lever pin holes and tips where they contact the release bearing for wear. Replace weak lever springs and worn adjusting screws.

NOTE: Replace worn levers, lever springs and adjusting screws in sets of three.

4. Inspect the back plate for bending, and the drive lug slots for wear. Replace worn adjusting screw seats and bent or broken lever spring clips.

5. Check pressure spring free length and tension at test length. Springs must measure a minimum of 2.750 inches and must require 166 lbs. to compress to 1-13/16 inches. Replace springs as a set of nine.

6. Inspect the hub splines for wear or damage, and the snap ring, to be sure it is firmly seated in the groove.

7. Replace worn, glazed, and oil soaked discs, and discs which are warped or have worn splines.

8. Replace worn and warped plates.

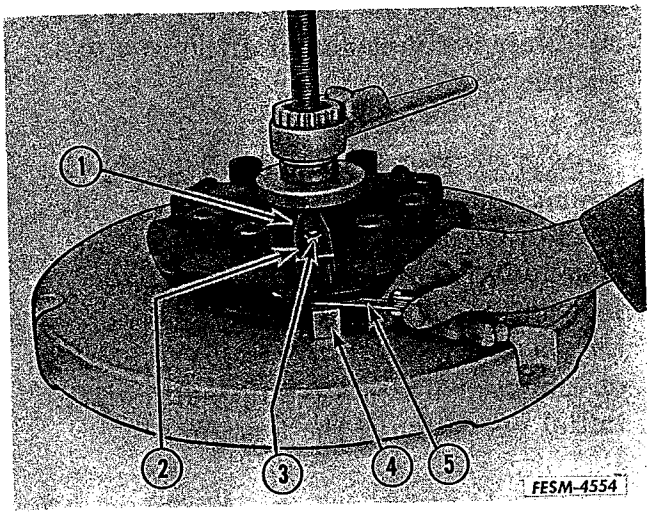
9. Insert the sprocket drive pinion shaft into the clutch back plate. The retainer ring in the plate must fit securely. Loss of the retainer ring will permit the clutch assembly to float into contact with the clutch housing.

10. Replace the brake bands if worn or oil soaked. Check the linings for cracks at the rivet holes. Check for loose rivets, or space between the lining and the band. All of these are reasons for replacement.

11. If the linings are glazed, remove the glaze with sandpaper.

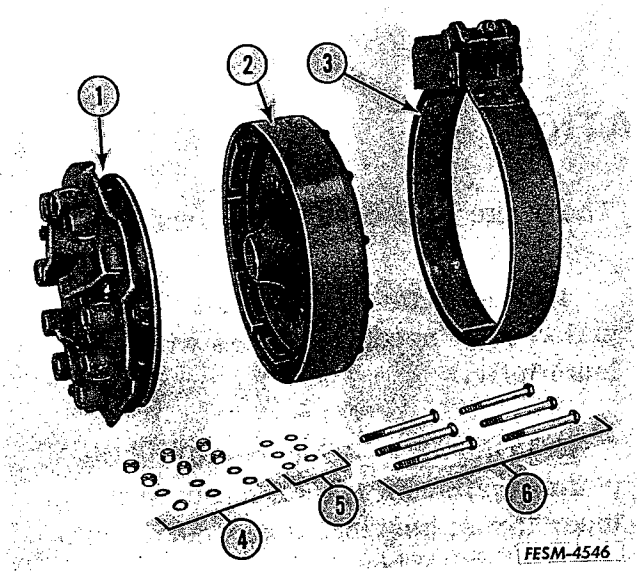
REASSEMBLY

Reverse the disassembly procedure paying particular attention to the following steps.



1. Install the assembled clutch cover assembly on the clutch tool with the number 3 tubular spacer. Then compress the back plate and adjust each lever adjusting screw to obtain a clearance of .002 inch measured with a feeler gauge between the black plate and number 3 gauge block below each lever.

1. Tubular spacer
2. Lever
3. Adjusting screw
4. Gauge block
5. Feeler gauge



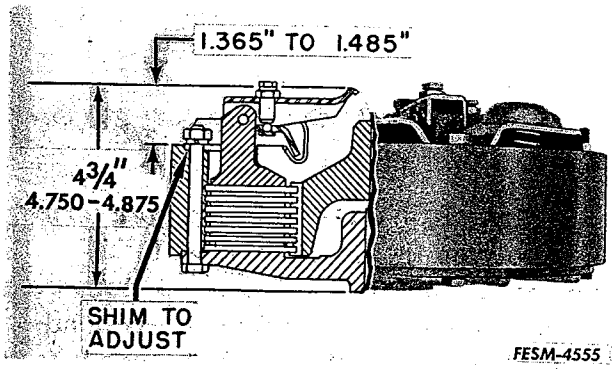
2. Insert the "through" bolts through the base plate and drum. Then rest the assembly on the base plate.

3. Install one disc and position the hub into the assembly.

4. Install the remaining 6 discs and 6 plates, starting with a plate and ending with a disc.

5. Install the cover assembly without spacer washers.

1. Clutch cover assembly
2. Steering clutch drum
3. Brake band
4. Nuts and lock washers
5. Spacer washers
6. Through bolts



Positioning the cover assembly.

6. Measure the overall length of the clutch assembly from the outside of the base plate to the lever tips. Add spacer washers evenly to each bolt as necessary, between the clutch cover and drum to obtain a dimension of 4.750 to 4.875 inches.

NOTE: Under no circumstances readjust the clutch levers to correct uneven lever height. If the clutch cover assembly is properly adjusted, (see inspection and repair) unevenness of the fingers is due to variation in plates or discs, and will correct itself during initial operation of the tractor.

INSTALLATION

The following procedure outlines installation of one clutch brake assembly.

1. Lightly coat the bevel gear shaft splines with IH Never-Seeze. Install the bevel gear shaft.

2. Lightly coat the release sleeve with IH Never-Seeze. Install the clutch release vertical shaft with fork, bearing, and sleeve. Insure the lower bearing pocket is full of lubriant.

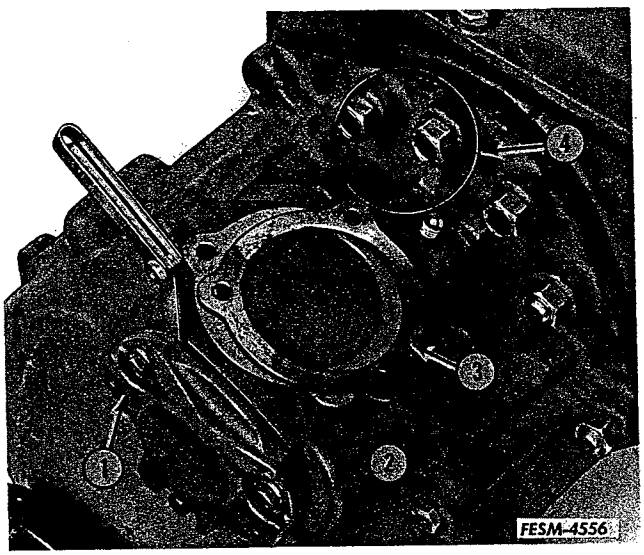
NOTE: Release bearing replacement is recommended when the clutch is serviced.

3. Position the clutch brake assembly in the housing on the bevel gear shaft. The brake band should be fairly snug.

4. Lubricate the sprocket drive pinion shaft needle bearings with petroleum jelly.

IMPORTANT: When installing the pinion shafts, be careful not to drop the inner thrust bearings and washers into the final drive housings.

5. Install the pinion shafts with thrust bearings and washers into the clutch back plates. Use a 1/8 inch rod inserted through the gear teeth to position the inner thrust bearings and washers in a vertical position.



1. Retainer
2. Housing
3. Shims
4. O-ring

6. Slide the clutch assembly outward until the snap ring is bottomed in the clutch back plate.

7. Install the sprocket drive pinion retainers without shims and O-rings. The thrust bearings and races must be in position. Tighten the capscrews until the thrust bearings are lightly seated.

8. Measure the clearance between each retainer and sprocket drive housing with a feeler gauge to determine the shim pack required. The required shim pack will equal the clearance plus .020 inch.

9. Install each bearing retainer with a new O-ring and the shim pack. Lubricate the needle bearing before installation. Apply Loctite to the capscrews and torque to 35 ft. lbs.

10. Liberally coat both sides of the steering cover gasket with IH Gasket Maker and install it on the steering clutch housing.

11. Position the steering clutch cover on the steering clutch housing and connect the steering rod. Move the cover as required to install the adjustable steering link and loosely start the cover capscrews into the housing.

12. Install the brake anchor bolts. Push the cover toward the center line of the tractor while tightening the capscrews. Torque the capscrews to 85 ft. lbs.

13. Connect the brake link and insert the cotter pin.

14. Install the fuel tank brackets, filler strip and operators seat assembly. Fill the transmission and rear frame to the specified level with clean IH Hy-Tran.

15. For adjustments, refer to Section 12.

Section 8

SPROCKET DRIVES

CONTENTS

SPECIFICATIONS

Pinion shaft	
Pilot bushing clearance to bevel gear shaft (allowable wear) - inch	.020 max.
Pilot bushing I.D. (new) - inch	.742-.744
Bevel gear pilot shaft O.D. (new) - inch	.739-.741
End play - inch	.020
Sprocket drive shaft	
Rolling end play - inch	.005-.0015

GENERAL DESCRIPTION

Each sprocket drive is a bull gear and pinion type speed reducer, which transmits power from one steering clutch to its drive sprocket.

The pinion shaft is splined into the clutch base plate. The sprocket is bolted to the sprocket driveshaft. Power is transmitted from the steering clutch through the pinion and bull gear to the sprocket drive shaft. The sprocket drive shaft drives the sprocket.

Each sprocket drive housing holds one quart (U.S. measure) of multi-purpose gear lube, for lubrication of the gears and bearings. Refer to the operators manual for lube specifications and maintenance instructions.

SERVICE PROCEDURES

General

Pinion Shaft and Bevel Gear Oil Seal Replacement

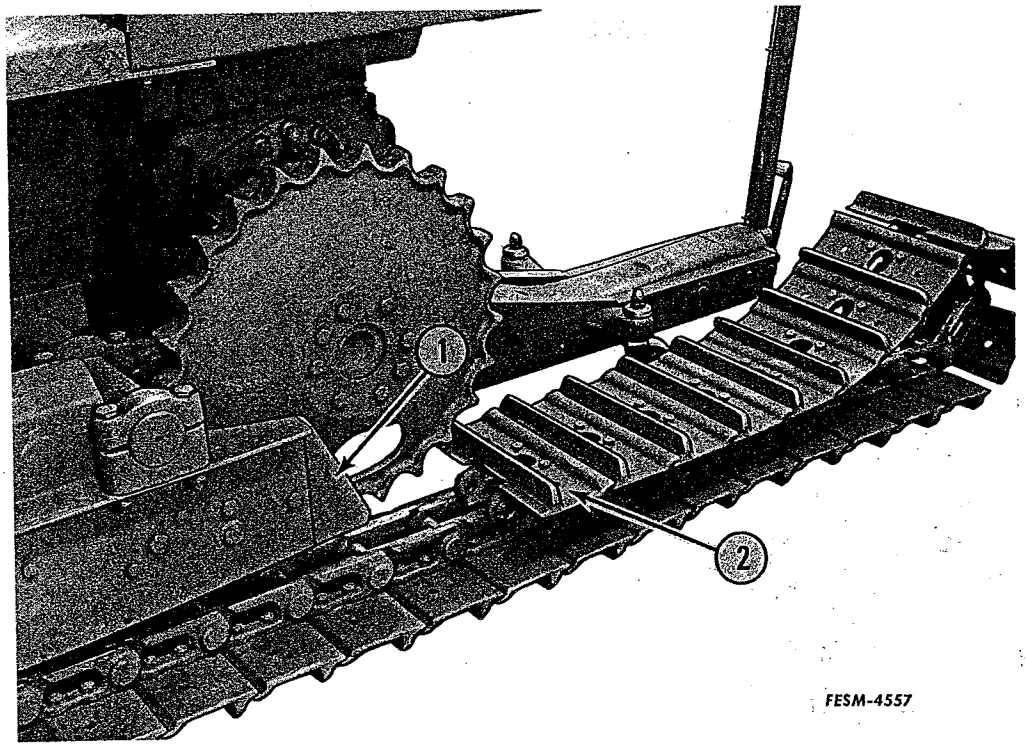
Replacement requires removal of the steering clutch on the side of the seal to be replaced. Refer to Section 7 "Steering Clutches and Brakes" for procedure.

Overhaul

Overhaul requires removal of the steering clutch, track, and housing on the side of the drive assembly requiring service. Refer to Section 7 "Steering Clutches and Brakes" for clutch removal. Refer to Section 9 "Track and Track Frame" for track removal.

Removal

1. Remove the steering clutches on the side of the housing to be removed. Refer to Section 7 "Steering Clutches and Brakes" for procedure.



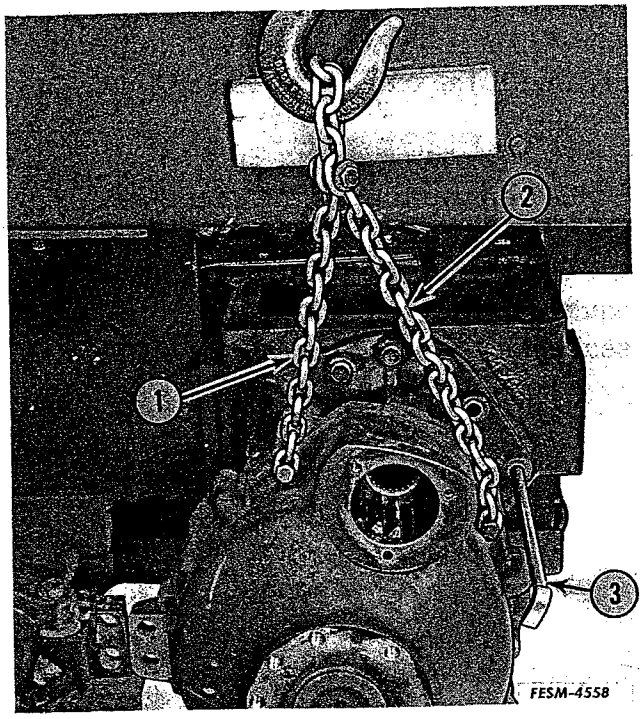
1. Outer rock deflector
2. Track removed

2. Remove the track from the sprocket of the sprocket drive to be removed. Then remove the inner and outer rock deflectors. Refer to Section 9 "Track and Track Frame" for procedure.

3. Drain the sprocket drive housing and remove the sprocket.

4. Support the sprocket drive housing with a chain. Refer to the illustration for location and chain length required to balance the assembly.

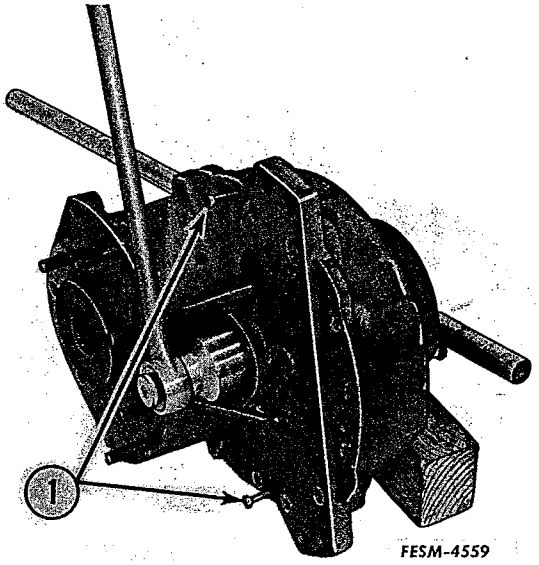
5. Remove the capscrews securing the sprocket drive housing to the tractor at the rear frame, the track frame, and inside the steering clutch housing. Remove the assembly.



1. Chain 14 inch
2. Chain 18-1/2 inch
3. Pry bar used as aligning dowel

Disassembly

1. Thoroughly steam clean the sprocket drive housing.



1. Jack screws

2. Block the housing securely and remove the sprocket drive shaft cap and the spring pin locking the nut. Then remove the nut, using a pipe or bar and two capscrews installed into the sprocket mounting flange to prevent the shaft from turning.

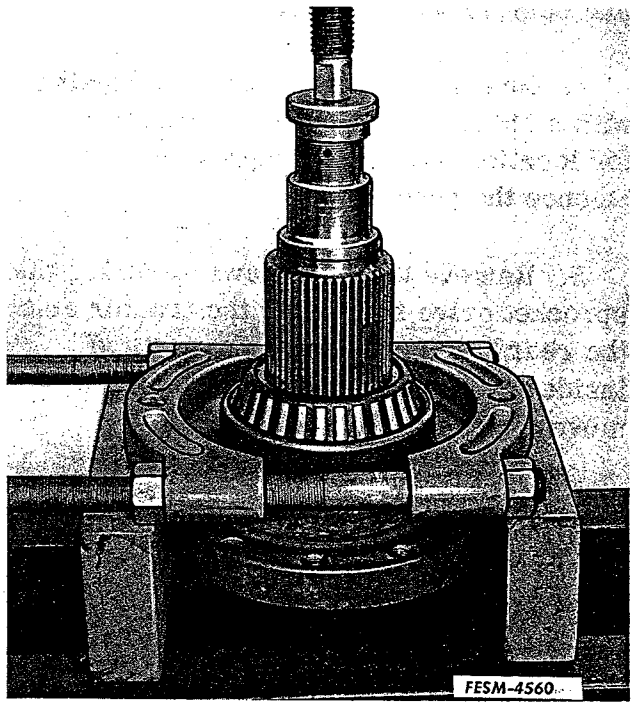
3. Remove the capscrews holding the housing halves together. Then drive the dowel pins from the inner half into the outer half.

4. Separate the housing halves, using jackscrews in the holes provided. Drive against the track frame mounting surface with a brass mallet to aid separation.

IMPORTANT: Do not allow the inner bearing to drop as the housing halves are separated. Damage to the bearing may result.

5. Support the outer housing half on blocks, with the sprocket flange facing down. Remove the snap ring and spacer washer from the shaft. Then drive the shaft through the bull gear with a brass drift until the outer seal clears the housing.

6. Remove the shaft. Then press the shaft through the outer bearing and seal, using an OTC 952 pulling attachment, or equivalent, to support the bearing and seal.



Removing the outer bearing and seal.

Inspection and Repair

1. Clean all parts in an evaporative solvent, and dry with compressed air.

2. Inspect the pinion shaft for damaged or worn teeth, splines, and bearing surfaces.

3. Inspect the bearing surface of the bevel gear shaft, and the pinion shaft pilot bushing. The shafts must fit freely, but clearance must not exceed .020 inch.

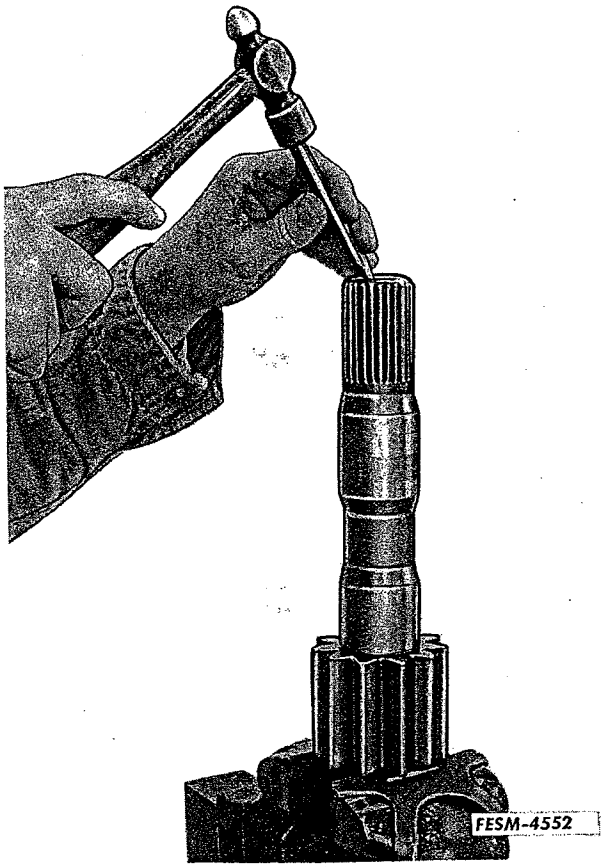
4. If replacement is necessary, split the pilot bushing with a sharp cape chisel, and remove it. Then press a new bushing into place.

5. Inspect the bull gear for wear, and damaged teeth and splines.

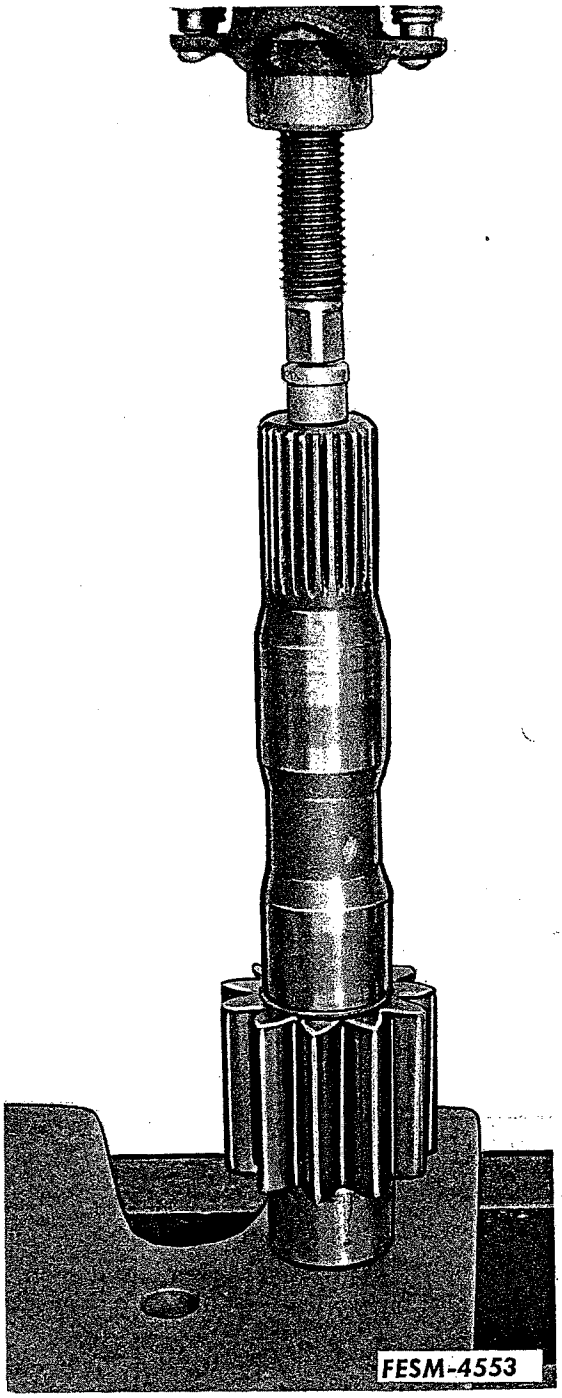
6. If the sprocket drive shaft is to be reused, check for damaged splines. Check for damaged threads by installing the nut. Replace the shaft or repair damaged threads with a thread chaser.

7. Inspect the housing for cracks, damaged bores, and pulled threads.

8. Replace used seals, O-rings, and gaskets. Repair or replace damaged parts.

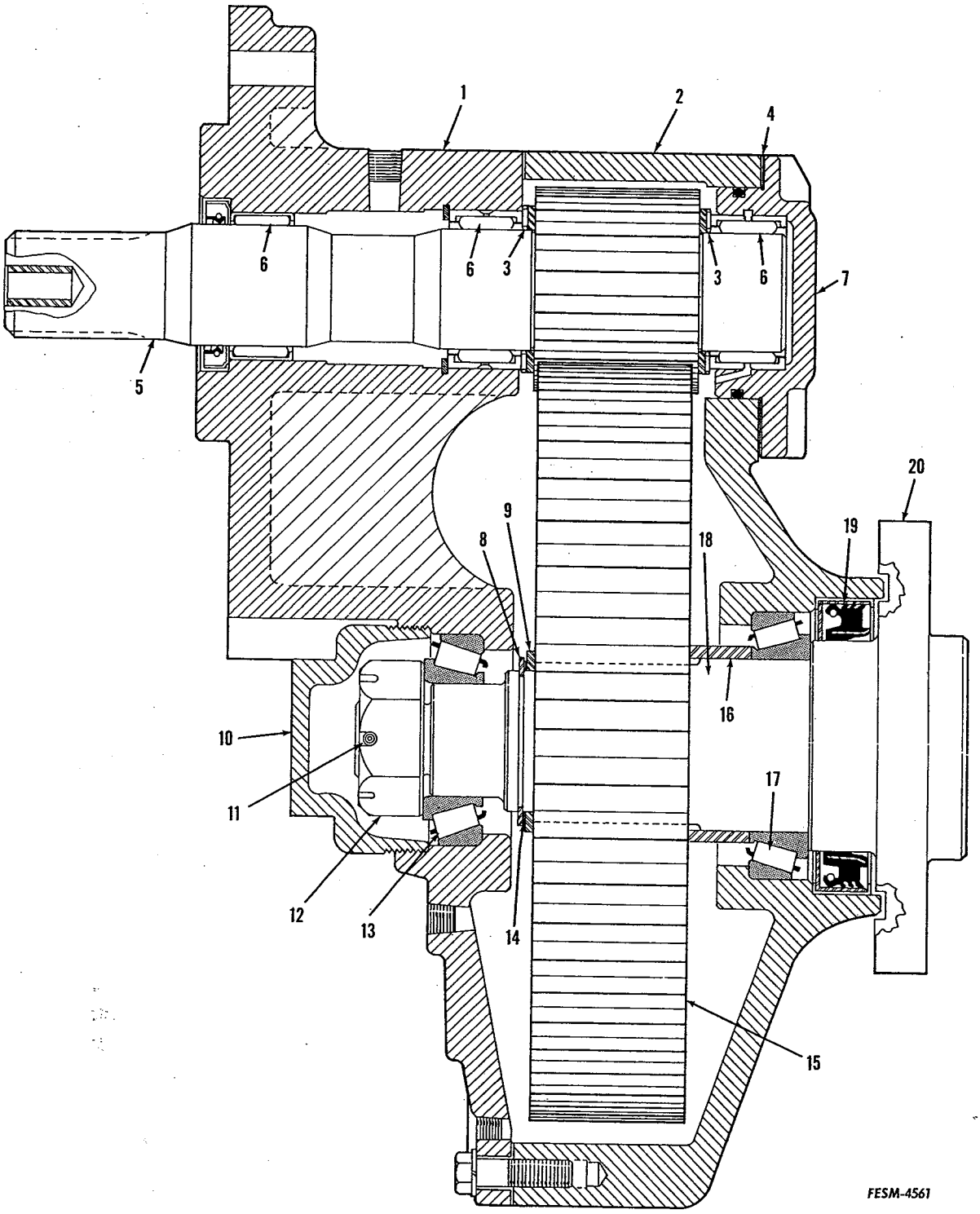


Removing the pilot bushing.

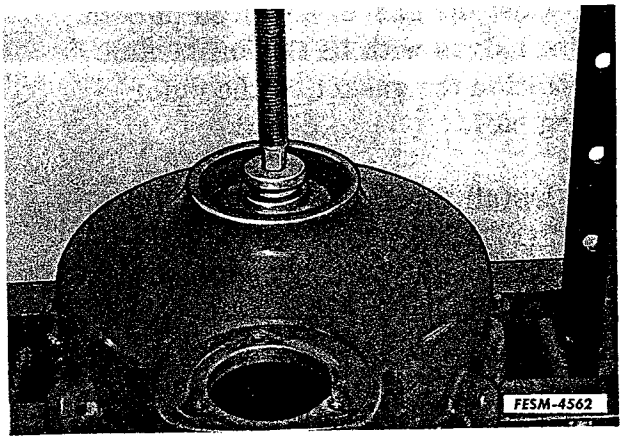


Installing the pilot bushing.

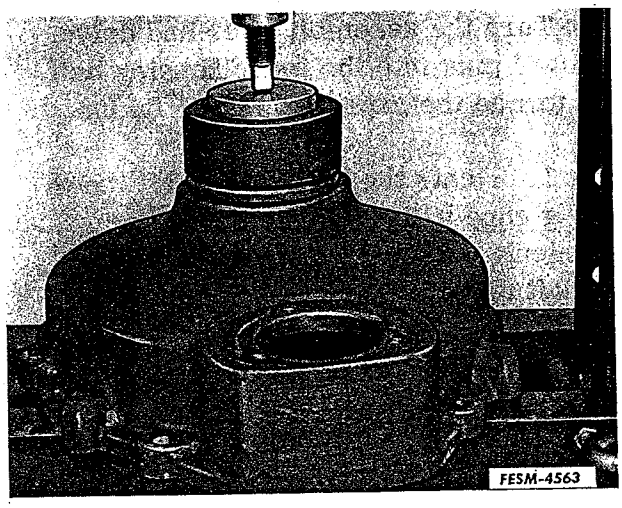
Reassembly



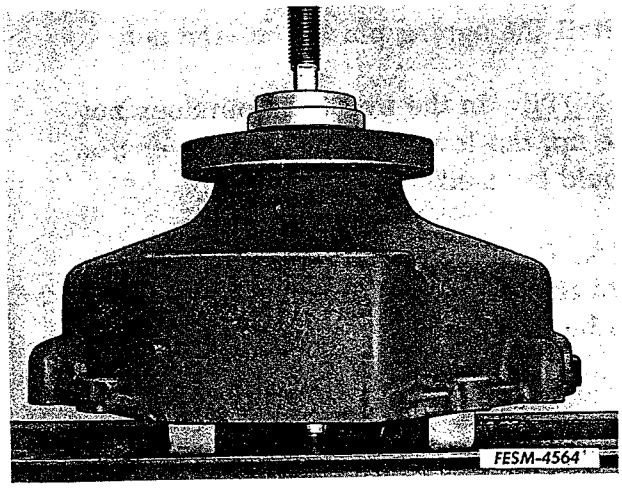
1. Inner housing half
2. Outer housing half
3. Thrust bearing assembly (2)
4. Shims (as required)
5. Pinion shaft with gear
6. Needle bearing (3)
7. Pinion retainer
8. Snap ring
9. Spacer washer
10. Cap
11. Spring pin
12. Nut
13. Bull gear inner bearing
14. Shims (as required)
15. Bull gear
16. Spacer
17. Bull gear outer bearing
18. Sprocket drive shaft
19. Oil seal
20. Sprocket flange



Installing the outer bearing.



Installing the seal.



Installing the shaft.

1. If necessary, remove the bull gear outer bearing cup, and press a new cup into position.

2. Lubricate the bull gear outer bearing with Lubriplate 5555 or equivalent, and install it in the bearing cup.

3. Press a new seal into the outer housing.

IMPORTANT: The "oil side" indicated on the seal must face the bearing. Center the seal carefully to prevent "canting" during installation.

4. Place the bull gear with spacer on blocks in the press. Then place the outer housing half with bearing and seal on top of the spacer.

IMPORTANT: The housing must not contact the blocks supporting the bull gear.

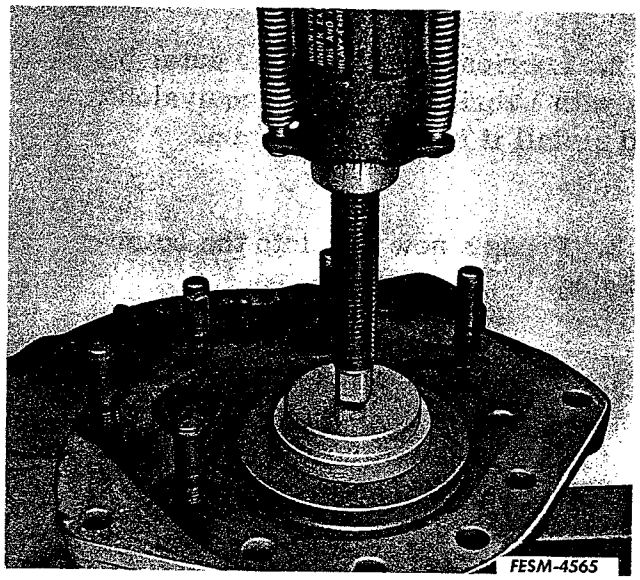
5. Install the sprocket drive shaft, and press the shaft through the bull gear to position the outer bearing and sprocket drive shaft seal.

6. Remove the outer housing half with shaft from the press, leaving the bull gear on the press. Place the housing with shaft on the sprocket flange. Then install the spacer*, bull gear, washer, and snap ring, using shims as required between the snap ring and washer, to prevent bull gear end play.

*IMPORTANT: Position the outer spacer with the chamfered edge toward the gear.

7. Install the pinion shaft bearings and sprocket drive shaft inner bearing cup in the inner housing half if removed.

8. Remove the pinion shaft oil seal in the inner housing half. Coat the seal bore with IH Plasti-Gasket; and install a new seal.



Installing the pinion shaft oil seal.

9. Coat the gasket surfaces of both housing halves with IH Gasket Maker, and position the gasket on the outer housing half.

10. Install three 1/2 inch aligning dowels (FES 143-1) spaced equally, in the outer housing half. Then install the inner housing half.

11. Remove the aligning dowels. Install the capscrews but do not tighten them.

12. Turn the assembly over and drive the dowel pins into the inner housing half. Then torque the capscrews to 85 ft. lbs.

13. Lubricate the bull gear shaft inner bearing cone with Lubriplate 5555 or equivalent. Then press the bearing onto the shaft until the nut can be started.

14. Install the nut and tighten to seat the bearing.

15. Check shaft rolling endplay with a dial indicator. Adjust the nut to obtain .0005 to .0015 inch rolling endplay. Then install the spring pin to lock the nut.

NOTE: In the event the pin does not line up, the lower (.005 inch) dimension should be used.

16. Coat the sprocket drive shaft cap with IH Gasket Maker, and install it on the housing.

Installation

Reverse the removal procedure, paying particular attention to the following steps:

1. Before installing the steering clutches, install the drain plug in the sprocket drive housing; and fill the housing to the proper level with lubricant as specified in the operator's manual.

2. Refer to Section 7, "Steering Clutches and Brakes" for steering clutch installation.

Section 9

TRACK AND TRACK FRAMES

CONTENTS

SPECIFICATIONS

Track Chain

Track chain sag - inches	1-1/4-1-1/2
Track link pin diameter - inches	1.121-1.125
Track master pin diameter - inches	1.1095-1.1110
Track link bushing I.D. - inches	1.130-1.139
Track link bushing O.D. - inches	1.675-1.679
Master bushing - inches	
I.D.	1.130-1.139
O.D.	1.675-1.679
Master bushing spacer - inches	
I.D.	1.130-1.139
O.D.	1.614-1.624
Track pitch length (dist. between pin centers) - inches	6.000
*Maximum permissible pitch length - inches	6.100
*Maximum permissible track pin wear - inch	1/16
*Maximum permissible track pin bushing wear - inches	
I.D.	1/16
O.D.	1/8
Side clearance between links - inch	.030
Track link height - inches	3
Maximum permissible track link wear - inch	1/4
Track shoe grouser height (std. shoe) - inches	2
Maximum permissible grouser wear (std. shoe) - inch	7/8

Track Frame

Recoil spring	
Free length	Non-Serviceable
Test length	Non-Serviceable
Test load	Non-Serviceable
Number of coils	Non-Serviceable
Hydraulic Track Adjuster	
Filler check valve - psi	2500
†Pressure relief valve release pressure - psi	6000-6200
Cylinder bore - inches	2.000-2.002
Piston O.D. - inches	1.997-1.999
Adjuster to front idler support bracket capscrew torque	Standard

* Pitch increase (caused by track pin and bushing wear) of 1/8 inch is permissible for all applications. However, on less severe operations, wear of 3/16 inch is allowed. The type of operation and soil in which the unit is running determine which wear figure is acceptable. When in doubt, use 1/8 inch as the limit.

†Must not leak at pressures less than 6000 psi.

Track Roller with E/F Seals

Shaft diameter - inches	1.981-1.982
Thrust washer thickness - inch	.185-.220
Minimum thrust washer thickness permissible - inch	.165
Width of roller body (distance between thrust washer mating surfaces) - inches	4.110-4.120
Body bore diameter - inches	2.125-2.127
Bushing I.D. (assembled) - inches	1.985-1.987
Body flange height - inch	7/16
Maximum permissible flange height - inch	11/16
Rolling diameter (dia. at point of contact with track chain) - inches	6-7/8
Maximum permissible wear of roller diameter - inch	1/2
Roller end play - inch	.010-.020

Track Roller with D/F Seals

Shaft diameter - inches	1.981-1.982
Roller preload (see text)	1 to 3 lbs. pull on scale
Bearing cup bore I.D. - inches	2.561-2.562
Body bore shoulder dimension (bearing cup recess to bearing cup recess) - inches	3.095-3.100
Maximum permissible flange height - inch	11/16
Rolling diameter (dia. at point of contact with track chain) - inches	6-7/8
Maximum permissible wear of rolling diameter - inches	1/2
Shim sizes for preload - inch (use as required)	.002, .005, .010, .020, .030

Top Idler (E/F Seals Only)

Body bore diameter - inches	2.125-2.127
Shaft diameter - inches	1.981-1.982
Thrust plate thickness - inch	.185-.220
Body flange height - inch	7/16
Maximum permissible flange height - inch	11/16
Diameter (at point of contact with track chain) - inches	6-7/8
Maximum permissible wear of idler diameter - inch	1/2
Locking device-idler shaft bolt	IH Loctite thread sealant Type B

Front Idler with E/F Seals

Shaft diameter - inches	1.981-1.982
Bushing I.D. (assembled) - inches	1.985-1.987
Front idler running clearance - inch	.003-.006
Thrust washer thickness - inch	.185-.220
Guide rib height - inch	11/16
Maximum permissible flange height - inch	7/8
Roller diameter (dia. at point of contact with track chain) - inches	20-1/2
Maximum permissible wear of idler diameter - inch	1/2
Front idler preload (see text) (use point scale; start wheel by hand)	14-15 ounces pull on scale

Front Idler with D/F Seals

Shaft diameter - inches	1.981-1.982
Bearing preload	See text
Guide rib height - inch	11/16
Maximum permissible flange height - inch	7/8
Rolling diameter (dia. at point of contact with track chain - inches	20-1/2
Maximum permissible wear of rolling diameter - inch	1/2
Sizes of shims for preload - inch (use as required)	.002, .005, 010, .020, .030

Special Torques (Lubricated with SAE-30) - ft. lbs.

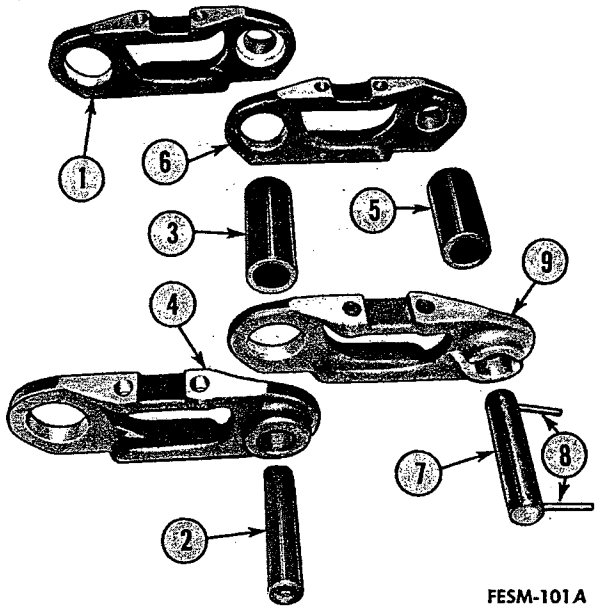
Track shoe bolts	90
Front idler shaft capscrews	280-320
Gauge bar mounting pad capscrews	290
Front idler - top idler - track roller - thrust plate capscrews	26-30
Top idler shaft mounting bolt (with Loctite - Do not use oil)	280-320
Roller shaft capscrews	280-320

Lubricants for Rollers and Idlers

D/F Seals	SAE 30 (EO) - Series 3
EF Seals (500 hr. rollers)	Lubriplate 5555
(100 hr. rollers)	MGL per Operator's Manual

Track Adjuster Fluid ..... Use roller lubricant

TRACK CHAIN ASSEMBLY



FESM-101A

1. Regular link (left)	4. Regular link (right)	7. Master link pin
2. Regular link pin	5. Master link bushing	8. Roll pins
3. Regular link bushing	6. Master link (left)	9. Master link (right)

General

The track chain consists of drop-forged, heat-treated steel links which are held together by bushings and pins to form a continuous interlocking type chain as shown in the illustration. The pins locate the outer ends of the links, and the bushings the inner ends of the links. The outer links are recessed to pocket the bushings. This recessing feature adds to chain life by adding bearing area plus protecting the bushing from easy entrance of dirt into the area surrounding the pin.

The bushings and pins are a press fit in the links, with the pins pivoting inside the bushings. The left and right track chains are interchangeable. The track chains are easily removed. Each track chain has a master pin which can be identified by a roll pin. The track shoes are attached to the track links,and they are held in place with special heat-treated capscrews and nuts.

The track links ride on the track rollers, front idler, and top idler. It usually becomes necessary to replace the pins and bushings before the links wear out; and it is a matter of judgment then whether the links are good enough to justify a new set of pins and bushings.

On a new track chain, the track shoe bolts must be checked after each day's operation until it becomes evident that the bolts have become permanently set. Track shoe bolt torque is 90 ft. lbs. Strike the heads of the bolts several heavy blows during torquing. The special bolts are heat-treated to withstand strain. Do not attempt to use common bolts in the track shoes.

Only wear on the outside of the bushings is visible. Wear on the pins and interior of the bushings is indicated by track chain "stretch" (forward adjustment of the front idler). The amount of wear can be determined by measuring the pitch length of the track (distance between centers of pins) under tension and comparing it with the new pitch length of 6.000 inches and the maximum allowable pitch length of 6.100 inches.

Sprocket wear must be considered in conjunction with track chain wear. Wear of pins and bushings increases the pitch length of the track chain. The results are, that the pitch lengths of the sprocket and track chain become more and more out-of-phase; and the bushings ride higher on the sprocket. The track chains should never be allowed to reach this point, as severe wear of the sprocket tooth tips will occur.

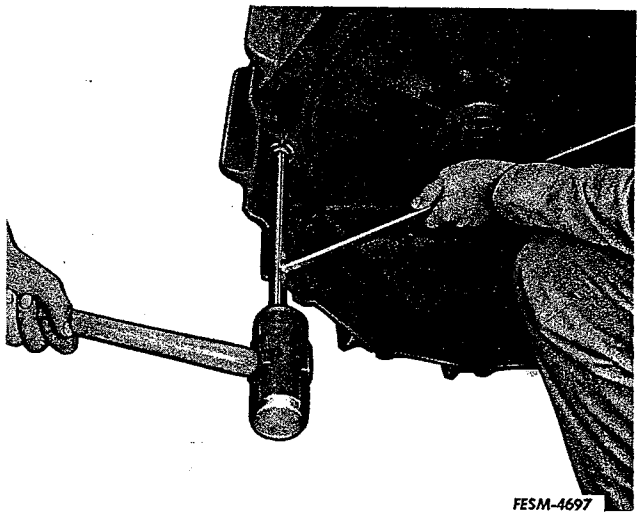
Whenever new or rebuilt track chains are installed, the sprockets should also be replaced, or interchanged side for side, to present the least worn side of the teeth to the bushings. Links should never be removed to bring a "stretched" track chain within the adjustable range. Pins and bushing may be turned. Refer to "Track Chain" - "Repair."

A track chain worn enough to take up the length of one link will be so far out of phase that the increased wear on the sprocket will more than offset the saving obtained by the small addition to the life of the track chain.

Servicemen are cautioned to pay heed to the possibility of a chain minus a link by noting (a) total number of links in the chain, and (b) track bushings should ride in sprocket tooth pockets. If a link is removed from a worn chain, the bushings will ride close to top of the sprocket teeth.

Continued shearing of the track master pin locks is the result of an excessively loose master pin.

Removal

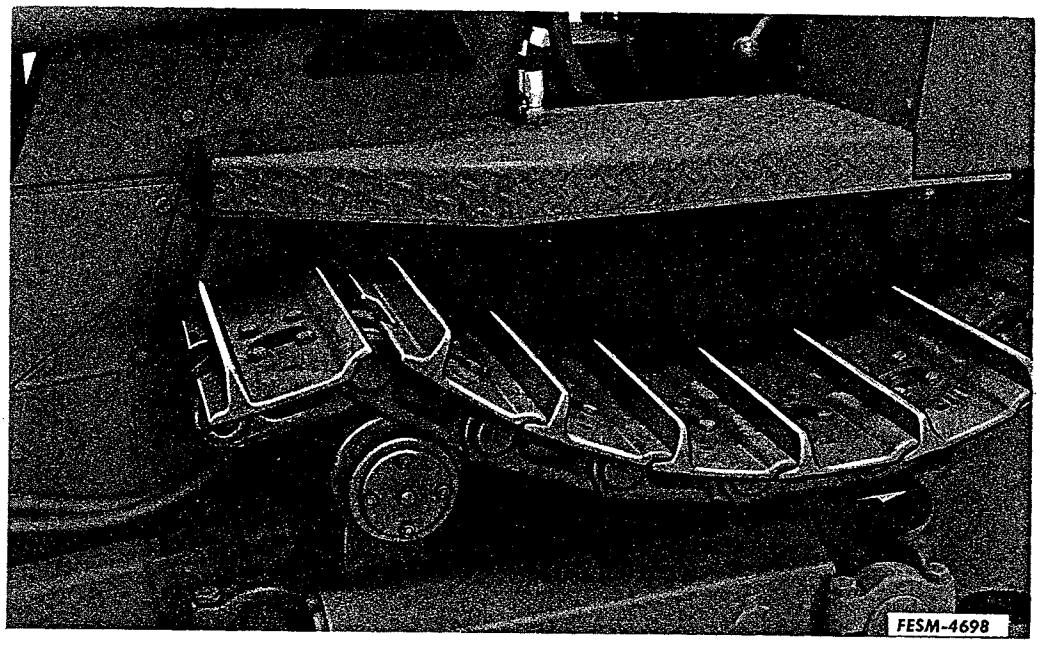


Removing the master pin.

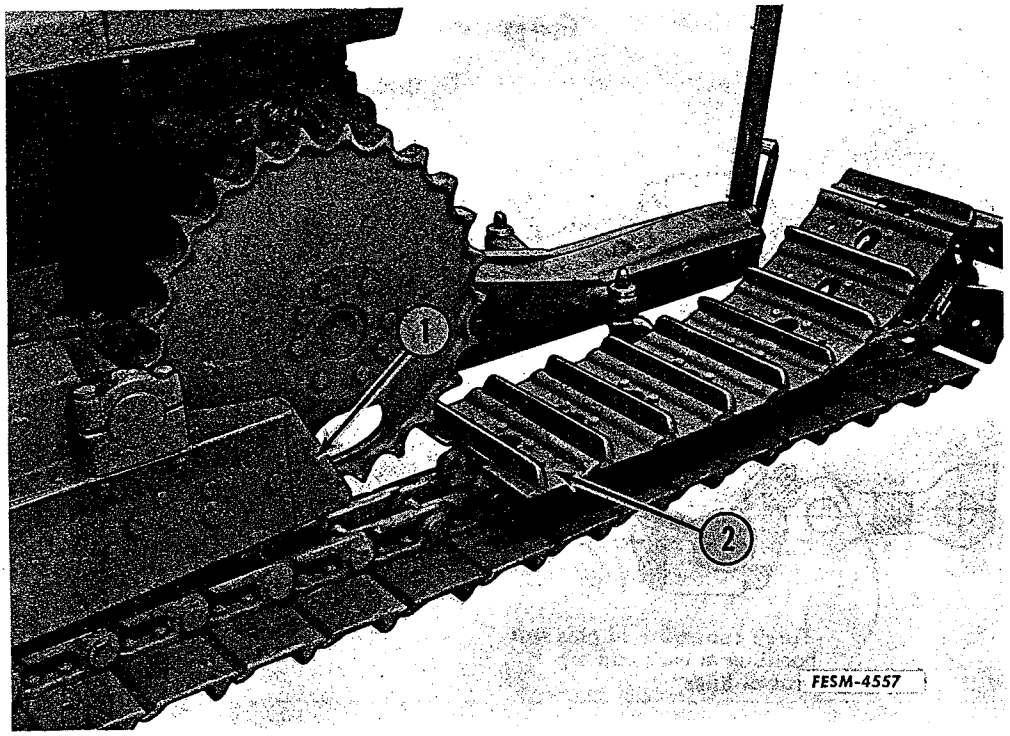
1. Drive the tractor forward on level ground until the master link pin (identified by a roll pin) is in front of the front idler.

2. Loosen the track chain tension.

3. Remove the roll pin from the master link pin and using a heavy track pin-driver and sledge, drive out the master link pin. If the pin resists removal, back up the sledge blows with a heavy steel bar on the master link opposite the side being driven.



Removing the track assembly (L.H.).

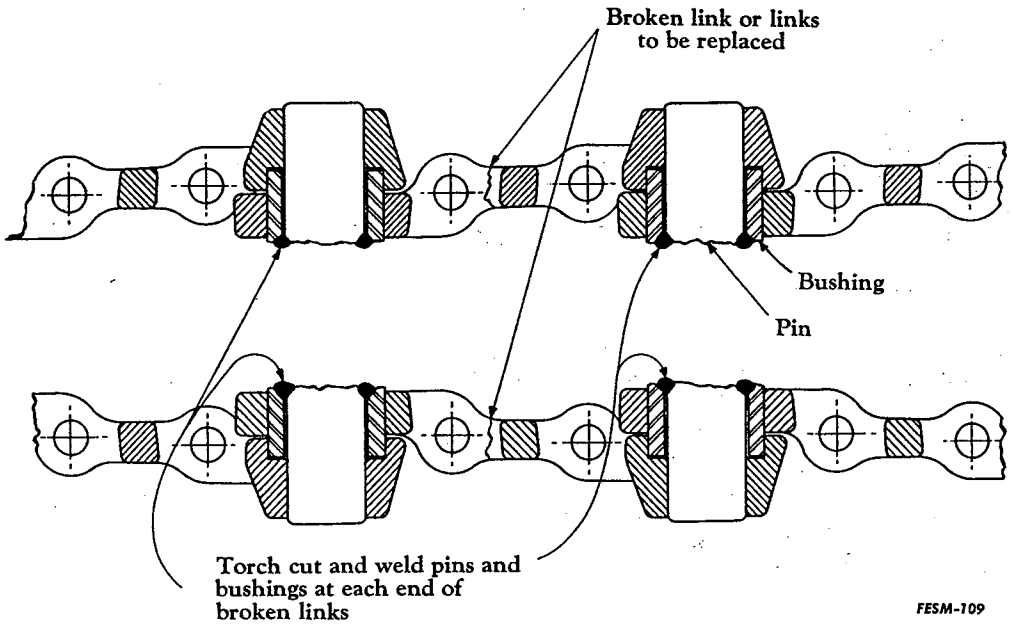


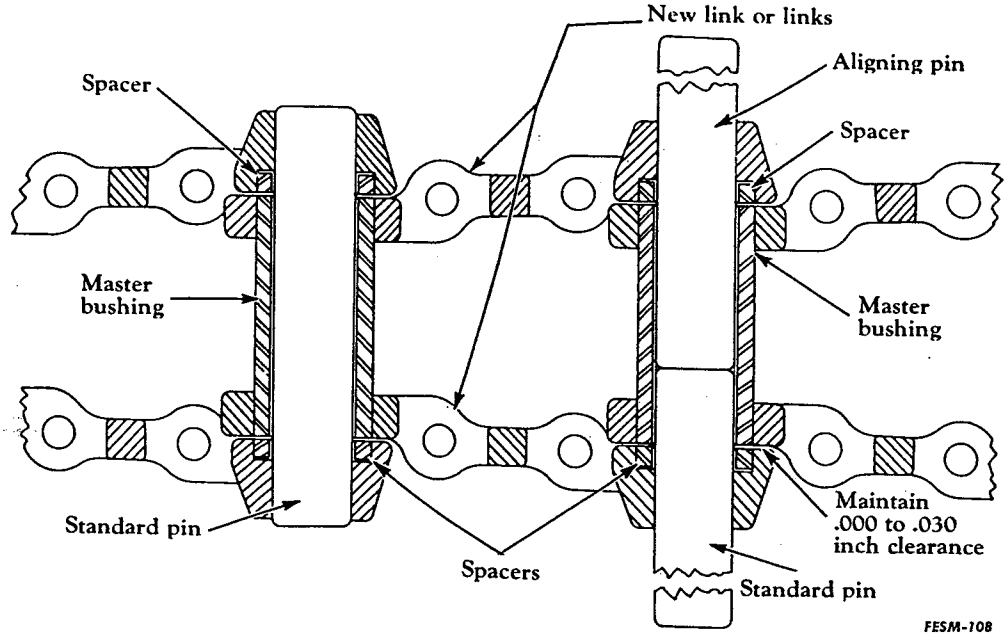
1. Outer rock deflector (LH)
2. Track removed

4. Jack the tractor up until the rollers are clear of the chain. With the tractor engine running, and the transmission in reverse, engage the steering clutch on the side of the track being removed; and feed the track off the rear sprocket.

5. Jack the tractor chassis up and drag the track assembly out from under the track frame, or leave it in position under the frame as dictated by the job being performed.

Repair





To repair or replace worn track pins, bushings, or links, a hydraulic track chain press will be necessary. The 500C Crawler requires a press of 30 tons minimum capacity. Refer to the manufacturer's instructions for chain press operation.

IMPORTANT: When assembling the track chain, be sure that the track shoe attaching holes align with the links.

Link Replacement

1. To replace an individual link that is damaged, remove the track chain from the tractor. After the track chain is free and extended flat, remove three or four of the track shoes adjacent to the damaged link. Cut the pins and bushings off the damaged link with a torch.

The cuts should be made as close to the inside faces of the inner links as possible, to provide sufficient clearance between the links for removal of the remaining pin and bushing sections.

IMPORTANT: Be careful not to damage the inner faces of the links when cutting the bushings and pins.

2. The pieces of the pins and bushings remaining in the links must now be securely welded together at the cuts. It is important that the welds be strong enough to carry the bushing out with the pin. Press each of the pin and bushing assemblies (welded) out of the links. Remove and replace the damaged link or links.

3. Place the master bushing spacers into the counterbores of the links.

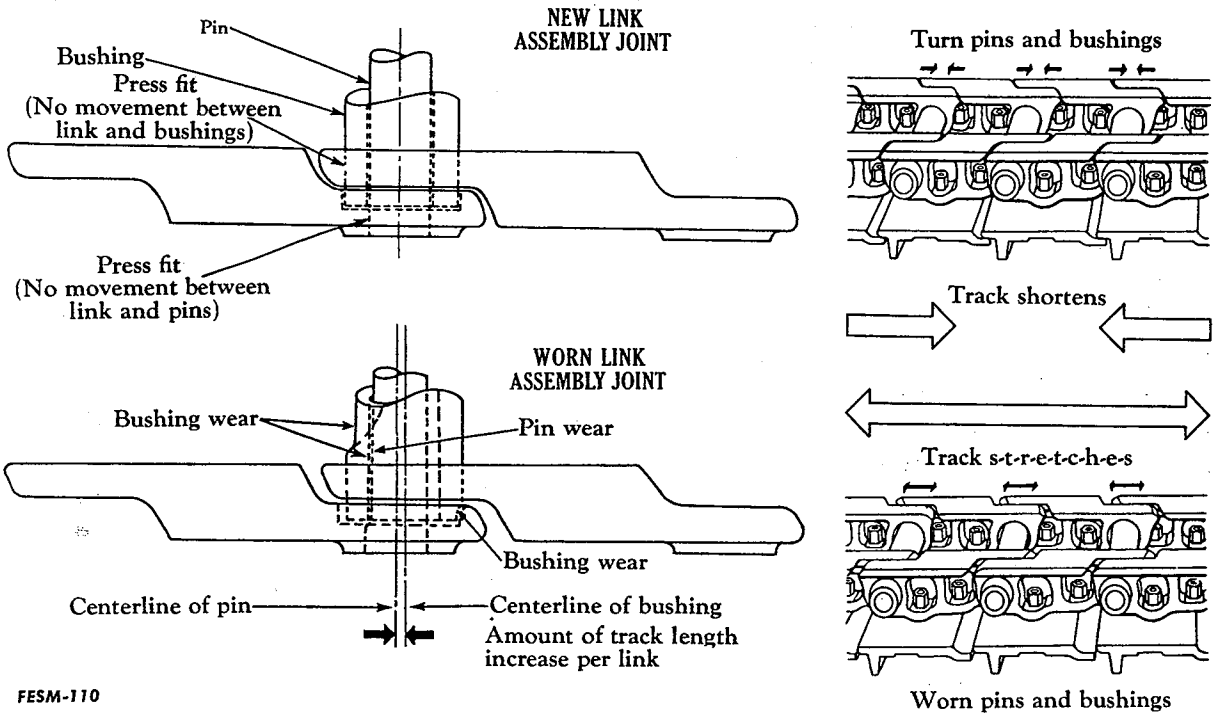
4. Assemble the track link using a master bushing. Install the link on the chain using an aligning pin to hold link alignment while the new pins are pressed into position.

NOTE: An aligning pin can be made from a track pin which has been ground down to a slightly smaller diameter than a regular pin. It is used to align the track links prior to inserting a new pin.

Chain Section Replacement

1. To replace a damaged section of track chain, remove the track shoes and cut out the damaged section with a cutting torch. Remove the end links as outlined in "Link Replacement". Rebuild the section onto the track chain by pressing on individual standard links, link pins, and bushings, with a hydraulic track press. When joining track chain sections together, master links, master link bushings, special spacers, and a master link pin, can be used in the coupling link as outlined in "Link Replacement".

"Turning" the Pins and Bushings



As internal and external wear on track pins and bushings develops, the tracks actually become longer, and the separation between the parting edges of the links becomes greater. This gradual wear produces "stretch" in the track chain assembly; and requires that the idler be adjusted forward to maintain the proper track chain tension.

Improperly adjusted track chains, either too tight or too loose, affect the rate of wear on all track parts. Wear rate is unpredictable and dependent on terrain, climatic conditions, abrasiveness of soil and distances traveled. Improper selection of track shoes or lack of suitable guards also promotes wear.

The use of cutaway sprockets increases the bushing (external) wear rate.

The pins and bushings should be turned prior to reaching the maximum forward position of the front idler adjustment.

If the bushings are permitted to wear too thin where they contact the sprocket teeth, they will be susceptible to breakage on turning. A "turned" pin and bushing will provide approximately half the original service life received.

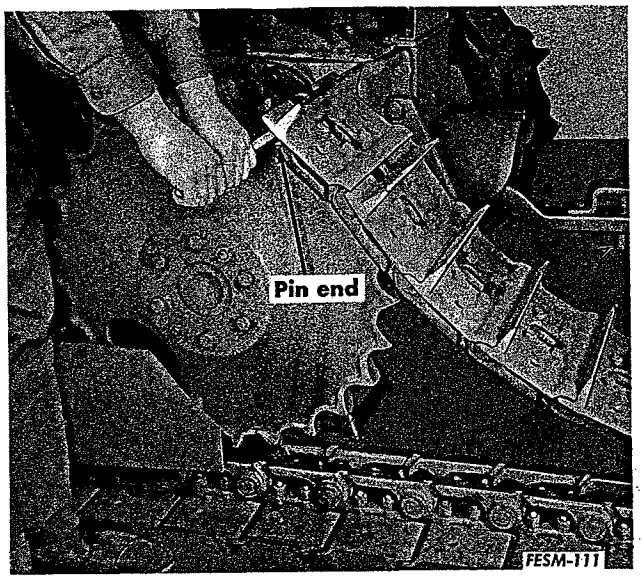
It may not be economic to merely turn pins and bushings due to cost of labor involved. In these instances new pins and bushings would be installed.

1. Remove the row of bolts from the track chain on the pin press adapter side. Leave all bolts intact on the ram side, but check the bolts for looseness.

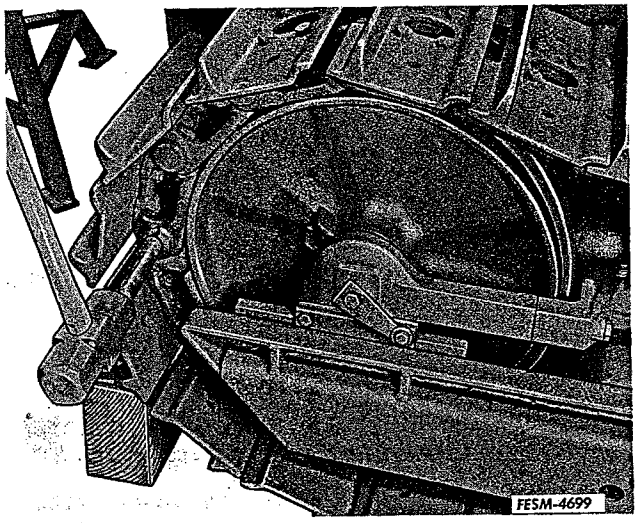
2. Press out all the track pins and bushings; turn the bushings 180 degrees (one-half turn); and then reinstall them. Turn the pins one-half turn, and then reinstall them.

3. Install the track shoe bolts and nut and torque them to 90 ft. lbs.

Installation



Installing the track chain assembly.



Installing the master pin.

1. Slide the track chain under track frame if removed. The pin end should be in the forward position.

IMPORTANT: If the track chain is reversed, severe wear on the sprocket teeth and track link bushings will result.

2. Position the track assembly under the tractor so that the sprocket is slightly ahead of the rear end of the track chain.

3. Place a bar through the master link bushing hole. Pull the track chain up around the sprocket and forward, passing over the top and front idler.

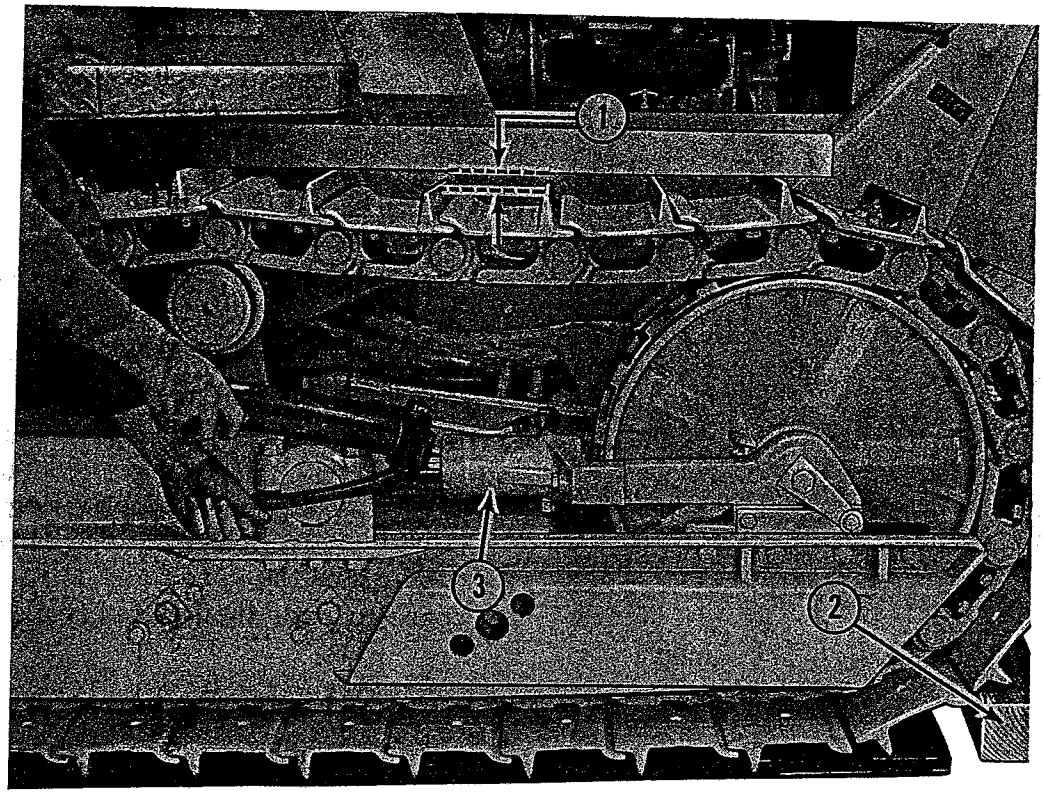
NOTE: Engine power may be used to turn the sprocket.

4. Position a block (8 to 10 inches high) under the grouser of the shoe on the second from last link of the chain.

5. Apply just enough power in the forward range by slipping the steering clutch to take the slack out of the bottom part of the track chain. Then block the chain assembly at the rear of the sprocket. Install the master pin and secure it with a roll pin. Be sure that the roll pin hole in the master pin has not collapsed due to difficult removal. Resize if necessary with a twist drill. If the tractor has inside front mounted equipment, it may be necessary to turn the master pin to the rear sprocket by moving the tractor forward, to install roll pin.

6. Adjust track chain tension. Refer to the adjustment procedure following.

Adjustment



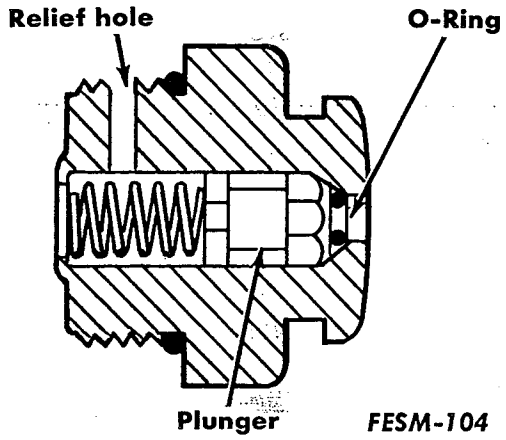
FESM-4696

1. 1-1/4 to 1-1/2 inches
2. Chain wedged against block
3. Hydraulic adjuster

1. Place a wooden block, approximately one foot (1 ft.) in height under the foremost track shoe grouser lug. Drive the tractor slowly forward until the track chain just starts to climb the block; then apply and lock the brakes to remove the slack from the bottom of the track chain. Jump on the top of the track chain between the front idler and the track top idler.

2. Place a long straight edge or board on top of the track chain so each end of the straight edge rests on the track chain over the track top and front idlers. Measure the clearance between the bottom of the straight edge and the top of the grouser nearest to the midway point between the idlers. This clearance should be 1-1/4" to 1-1/2". If the clearance is more or less than this measurement, the track chain tension should be adjusted.

3. To increase track chain tension, position a grease gun on the high pressure fitting which is located on the upper-side of the hydraulic track adjuster cylinder; and force in sufficient lubricant to correct chain tension. If the track chain is too tight, loosen the fitting slightly. This will allow the fluid to escape through the relief hole in the threaded portion of the fitting.



Adjuster high pressure fitting.

IMPORTANT: Only a high pressure fitting with straight threads should be used in this track adjuster cylinder. Do not use a fitting from a roller or idler, as it will destroy the threads in the adjuster cylinder. The tractor should be moved forward and backward a few times to determine final adjustment.

TRACK FRAME

General

The track frames house and support the front idlers, rollers, top idlers and recoil spring assemblies; and serve as an attachment point for operating accessories.

The track chain assemblies move around the track frames propelled by the sprockets.

The frames are attached to the chassis by gauge bars: one transverse bar at the front, and two stub bars at the rear (one on each side).

The directional alignment of the track frames is determined by their location on the gauge bars.

Top Idlers

The top idlers support the lengths of track chain that run between the front idlers and the drive sprockets.

The top idlers remove and stabilize the whip that exists when the tractor is in reverse, and prevent excessive sprocket tooth wear.

Top idlers, due to their location, have a habit of stalling during certain types of operation, and if not loosened (by cleaning the surrounding area) will develop flat spots. If the flat is severe, the idler will stall repeatedly at this location.

Front Idlers

The front idlers are rotating guides for the track chains which provide stability to the front end of the tractor. Being spring cushioned, they take up shock at this point. The springs have a preset tension.

The ends of the front idler shafts are fastened to the idler carrying brackets. Two lock bolts position and prevent each shaft from turning.

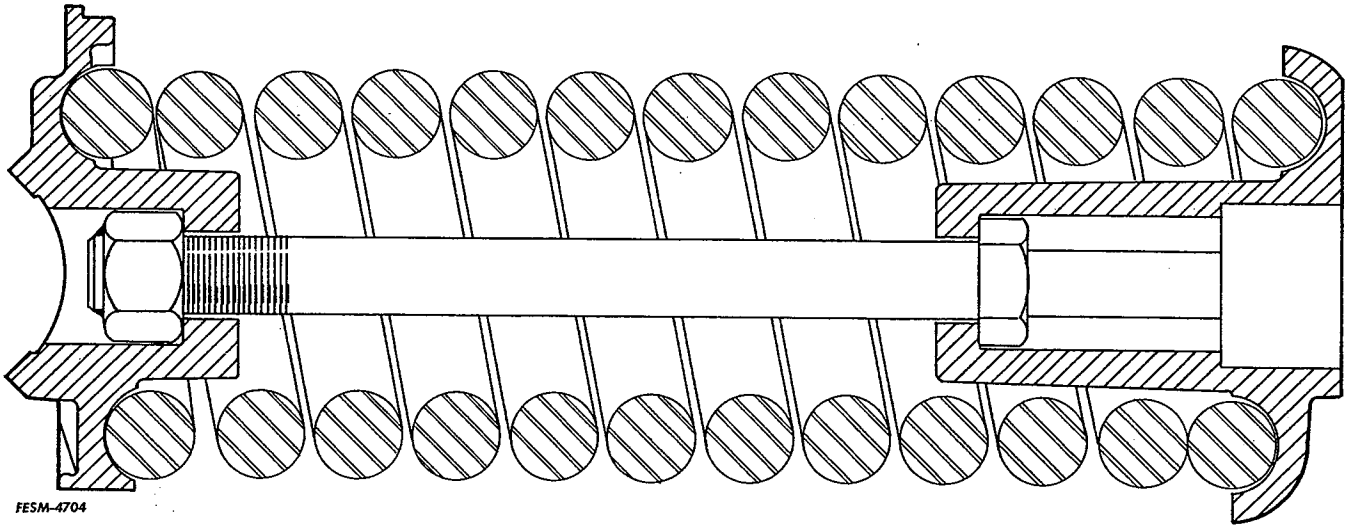
The brackets supporting the front idlers are mounted on runners welded to the track frames. Shims are used for taking up wear between brackets and the runners.

Track Chain Adjusters

The chain adjuster is a simple hydraulic cylinder. It is sealed with O-rings and is adjusted for length by means of a hand grease gun.

The lubricant is the same as that used in the rollers or chassis.

Track Recoil Springs



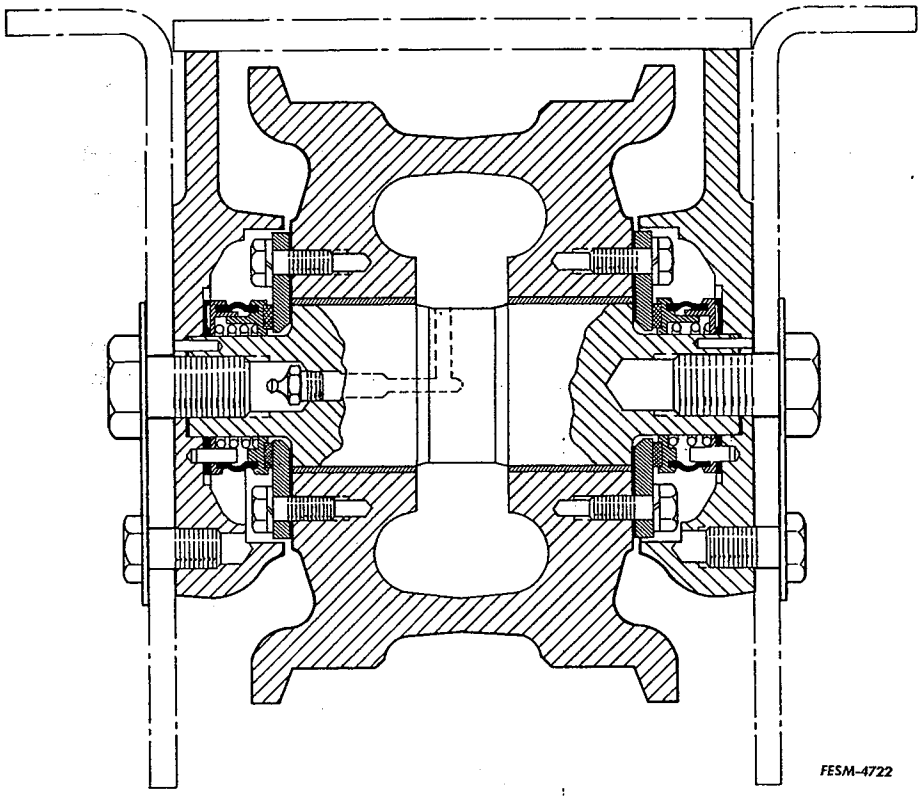
Each recoil spring is an assembly consisting of a spring with end caps held together by a long bolt which compresses the spring to a pre-determined length.

The recoil springs absorb rearward motion of the front idlers.

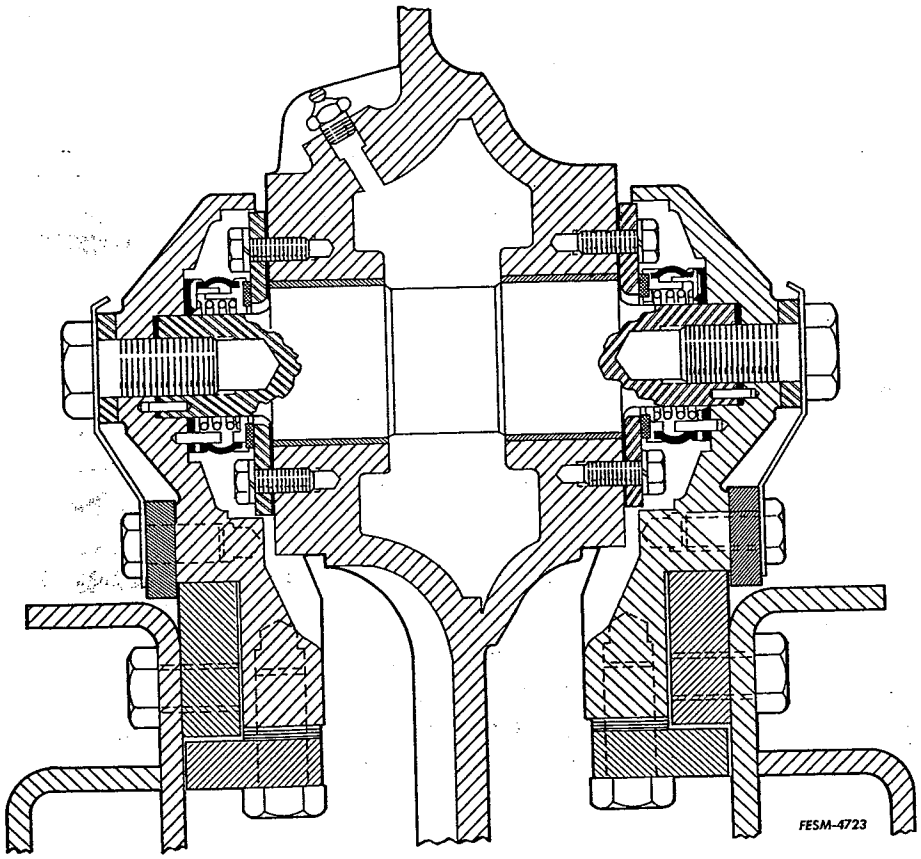
This feature would be vital in the event that either chain suddenly became over tensioned, such as entire tractor weight being imposed on the chain eliminating all free play (droop). If the chain assembly becomes clogged with a build up of mud, clay, snow, etc., the recoil mechanism reduces the shock to the final drive assembly.

Rollers and Idlers with E/F Seals

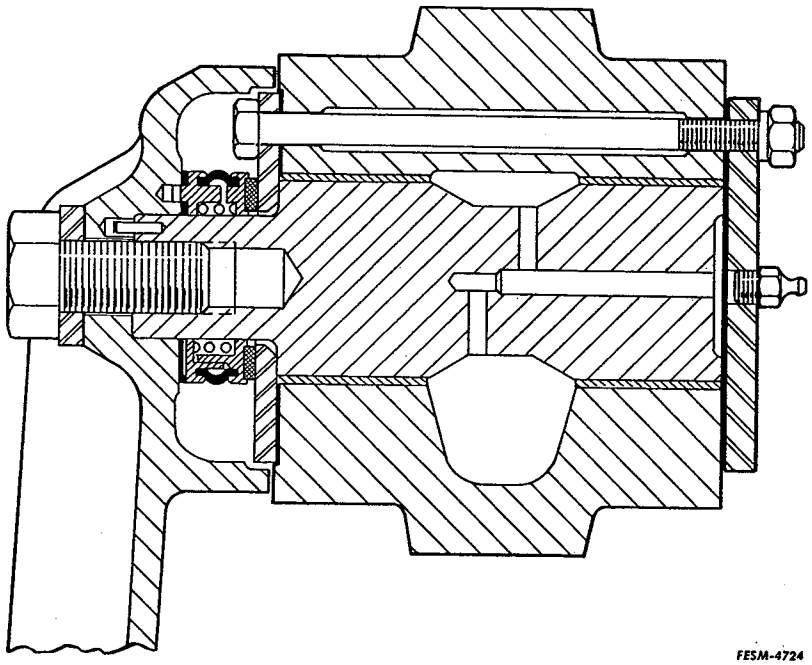
The basic design and location of the parts making up the front and top idlers, and rollers equipped with E/F seals, is shown in the following three illustrations.



Cross-section view of track roller with E/F seal.



Cross-section view of front idler with E/F seals.

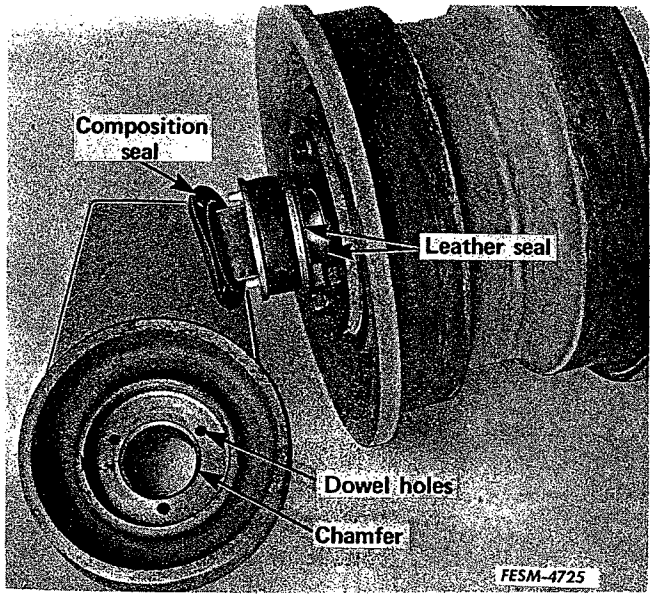


Cross-section view of top idler (E/F seals only).

Rollers and idlers with E/F seals are fitted with bronze bushings which run on steel shafts. These bushings are replaceable. The replacement bushings are precision type, and require no reaming when properly pressed into place.

Side thrust is carried by the thrust plates. End play is controlled by shim gaskets installed between the shell and the thrust plates.

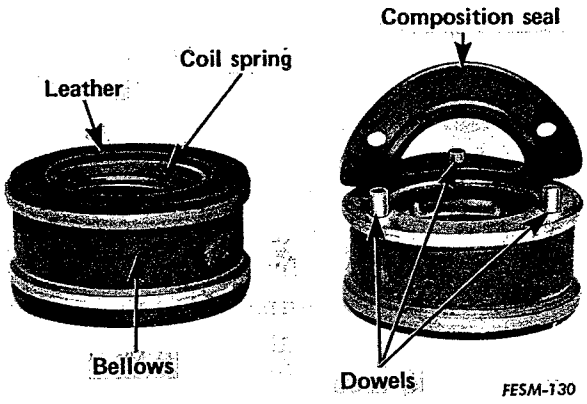
Lubrication is provided by external means through a lube fitting. The shell is made so that a reserve of lubricant is provided. The lubricant is sealed in with an E/F seal.



Track roller with E/F seals.

Each seal assembly has two sealing surfaces. One is leather. It is held against a thrust plate under spring pressure. This leather seal is the only part of the seal assembly that contacts a rotating part. With lubricant constantly present, and the relatively slow movement of the thrust plate across this surface, these seals have an excellent service life.

The second sealing surface does not move or rotate, so once properly installed there is little possibility of failure. This composition seal acts as a gasket between the seal assembly and the outer cap in which the seal is located.



E/F seal assembly.

Between the two sealing surfaces is a coil spring which applies pressure to load both. The spring is covered and sealed by a rubber like bellows. This bellows keeps the lubricant in, and dirt out, without interferring with the action of the spring; and also serves as a relief valve if the pressure during lubrication becomes excessive. The small holes in the bellows portion serve this purpose.

A small amount of seepage at the roller and idler seals is always visible, as the seal face must be continuously lubricated.

The operator in the field will note that seals will leak during lubrication. Leakage at the time of lubricating is natural and desirable. Inasmuch as "old" lubricant plus any contaminants will be forced out and carried away, the excess lubricant in this area presents a barrier to the entrance of mud or water. It should be kept in mind that in some cases an operator may be able to force lubrication in faster than it can escape, particularly in cold weather. This could lead to a premature failure. For this reason only a hand gun should be used.

The back-up washer side of each seal has three dowels. These dowels must be properly located in the holes provided in the roller mounting bracket. The back-up washer must be installed with the ribs contacting the seal, and the flat smooth side out against the locating surface. Each shaft bracket has a chamfer. Seal housings on front and top idlers are similarly relieved. This chamfer improves the unloading characteristics of the knife edge, reducing the possibility of imposing excessive pressure on the seals when lubricating.

There are two general types of lubricants used with the E/F seals. The one selected determines the "lube cycle" of the rollers or idlers:

a. Rollers and idlers lubed with Lubriplate 5555 will provide sufficient protection under ideal conditions for 500 operating hours. When working in mud, sand, wet inclement weather, etc. the lube interval MUST be reduced accordingly.

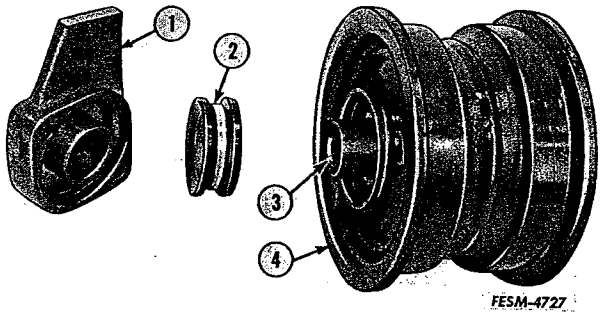
Lubriplate 5555 provides more than adequate protection for temperatures from -65°F. to above 90°F.

All model 500C crawlers are lubed at the works with 5555. However, they are filled with a quantity only sufficient for shipment. ALL ROLLERS and IDLERS MUST BE FILLED PRIOR TO TRACTOR OPERATION. The average tractor requires 28 lbs. of grease for this predelivery filling.

It is possible to switch from 5555 to other lubes, but the reverse is not recommended.

b. Rollers and idlers lubed with MGL can and will operate 100 operational hours under ideal conditions. Under other conditions of operation the lube cycle must be reduced accordingly.

"100 hour" rollers are lubed in accordance with the ambient temperatures as specified in the operators manual, with SAE #10W-30, 20W-40, SAE-90, SAE-140, or SAE-250 Mineral Gear Oil (EP). All idlers and rollers are to be filled prior to delivery.

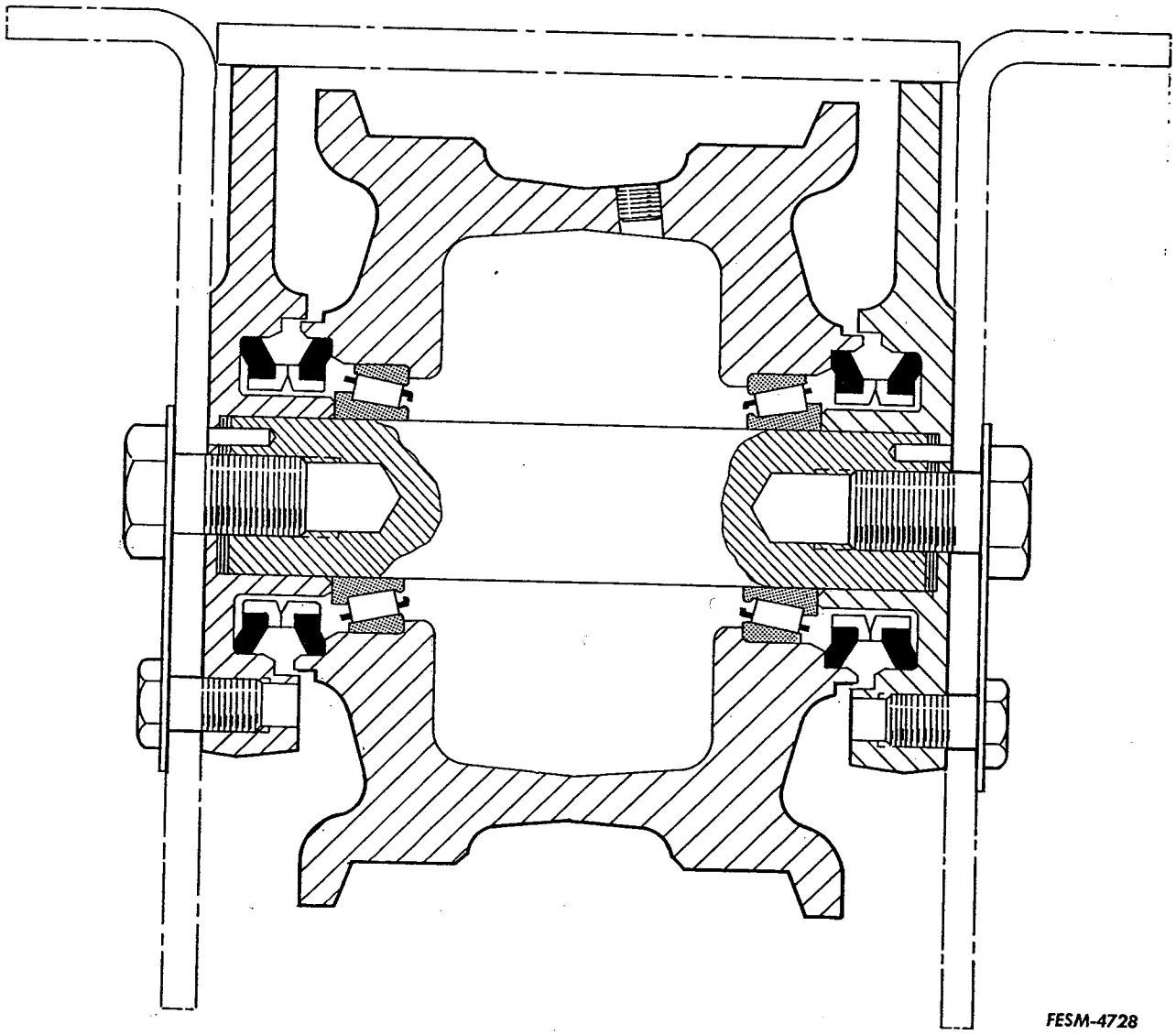


1. Support bracket
2. D/F seal assembly
3. Roller shaft
4. Roller shell

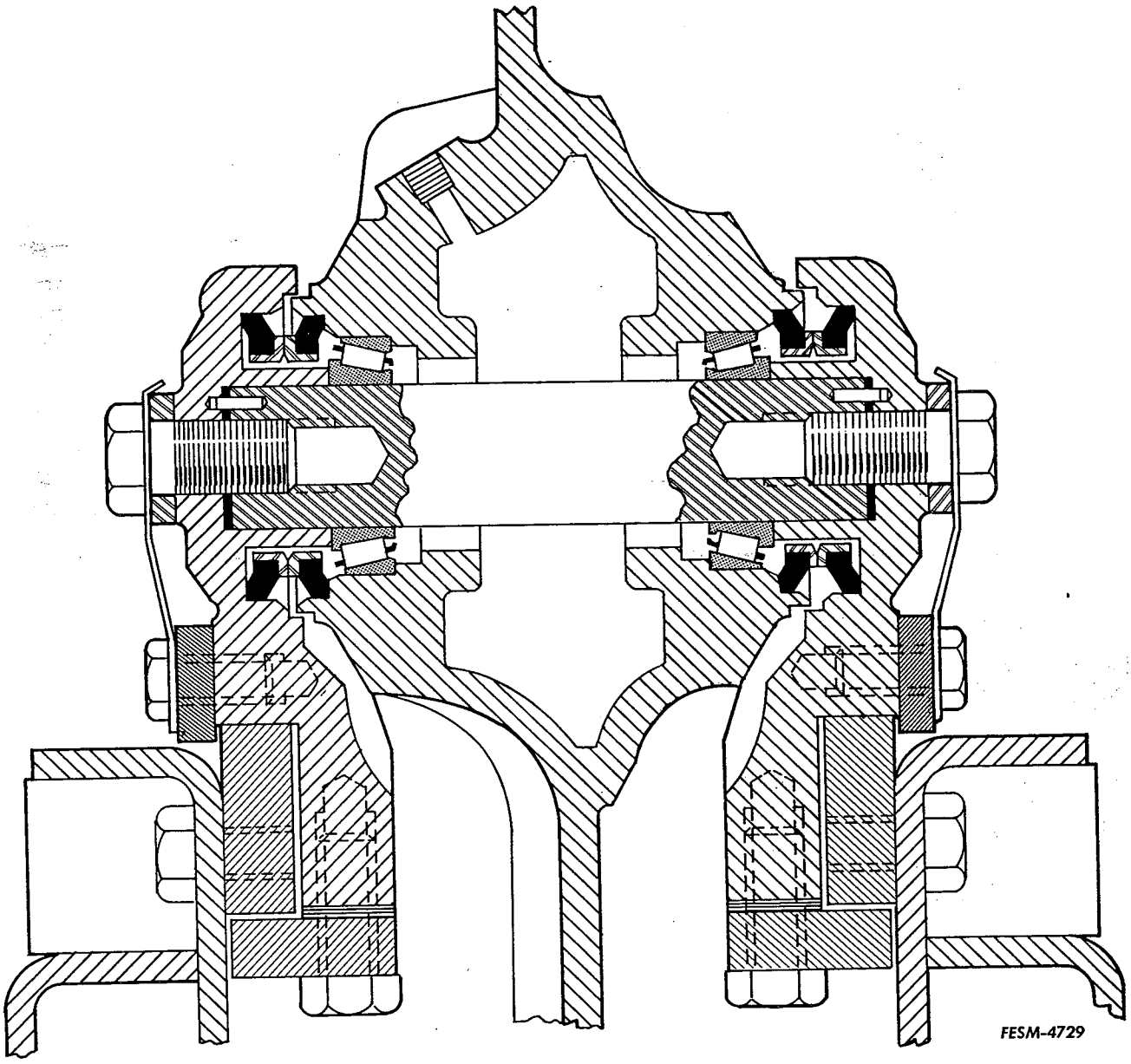
Rollers and Front Idlers with D/F Seals

The roller shells and brackets are so designed to hold and locate the rubber washers which in turn hold and position the metal faced seals. Actually the rubber washers serve the function of retaining, locating, and providing suitable pressure to maintain the metal faces in positive contact. The front idler is similar.

The reader will by referring to these illustrations for the roller, and for the front idler, more clearly understand the positioning and function of the rubber washers.



Cross-section view of track roller with D/F seals.



Cross-section view of front idler with D/F seals.

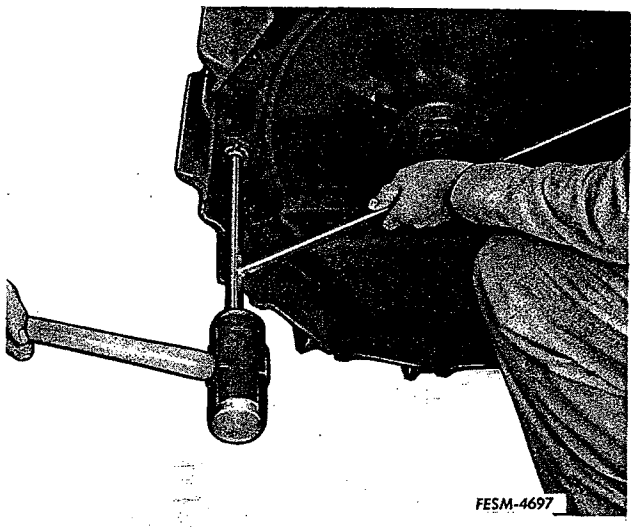
The inner washer at each end is known as the rotor washer, and its companion half of the metal seal is known as the rotor seal. The outer washer at each end, and its companion metal seal, is the stator seal and washer.

The rotor washer is provided with a lip to center the seal and provide added interference to resist slipping of the rubber.

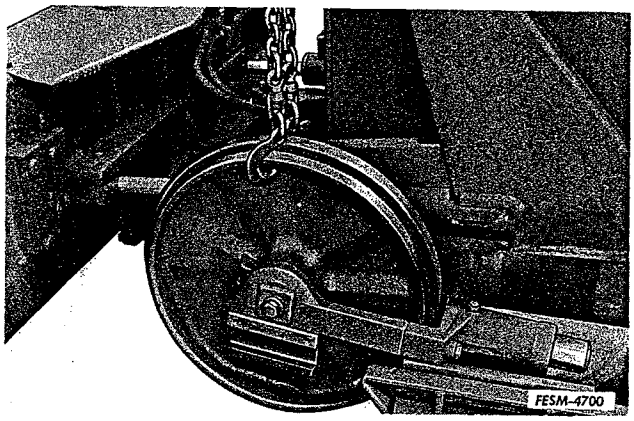
The D/F (Dual Function) metal faced seal is designed to keep the lube oil in and external contaminants out.

Rollers and idlers with D/F seals are factory filled with SAE 30 Series oil and service is required only on overhaul.

Removal



Removing the master pin.

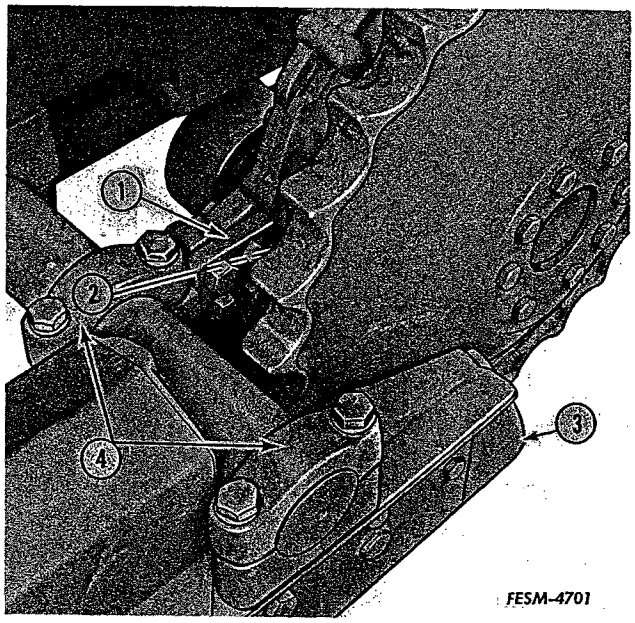


Removing the front idler.

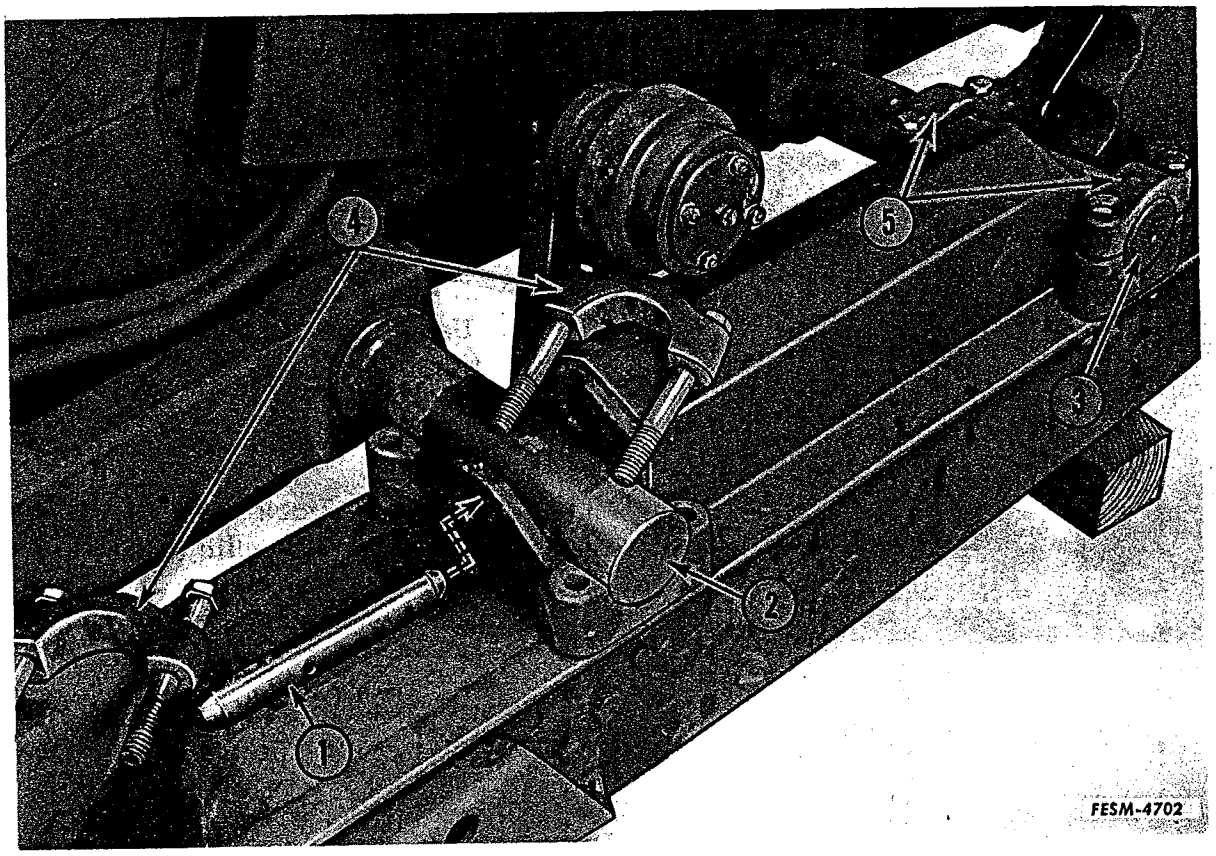
1. Disconnect the chain at the front idler. Then remove the front idler. Refer to "Front idler removal" and "Track chain removal."

2. Remove the inside stone deflector at the rear sprocket.

3. Remove the final drive stop bar.



1. Final drive stop bar
2. Inside stone deflector
3. Outside stone deflector
4. Gauge bar clamps



1. Track adjuster bar
2. Front gauge bar
3. Rear gauge bar (LH)
4. Front gauge bar clamps (2)
5. Rear gauge bar clamps (2)

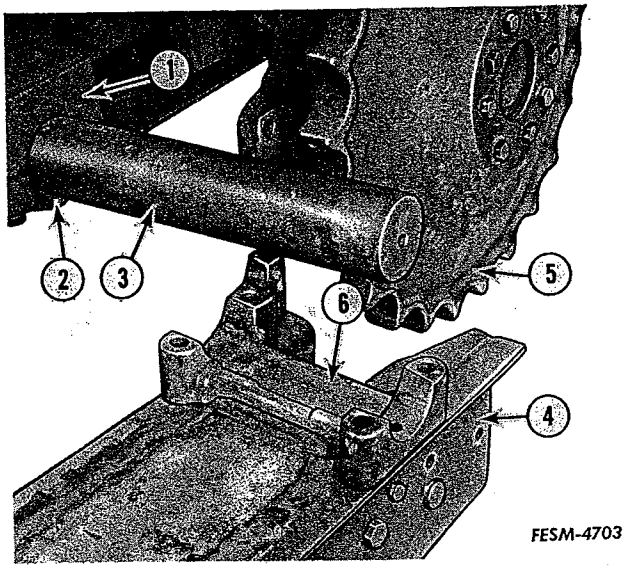
4. Work the track adjuster bar out of the recoil spring pocket and the front gauge bar.

NOTE: If bar resists removal, apply penetrating oil while working the bar back and forth.

5. Remove the gauge bar clamps.

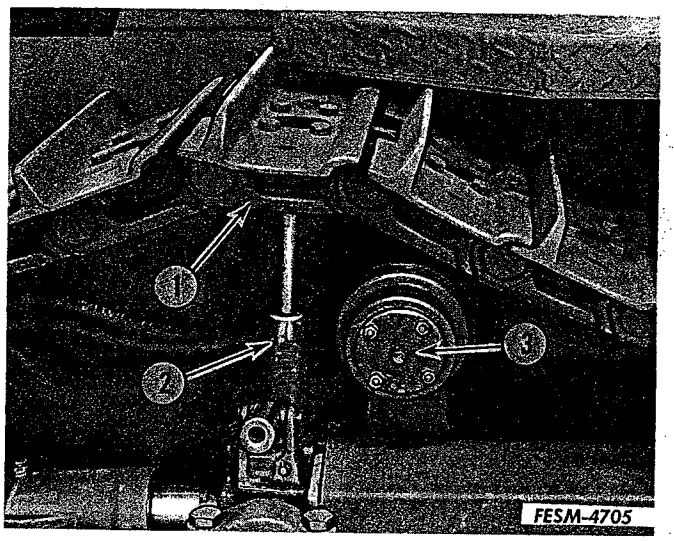
6. Jack the tractor chassis to clear the gauge bars from the track frame pads.

7. Slide the frame clear of the sprocket.



1. Chassis frame pad
2. Clamp
3. Rear gauge bar (LH)
4. Track frame
5. Sprocket
6. Track frame pad

Disassembly



Top Idler Removal

1. Release the track chain tension by moving the front idler back.

2. Using a hydraulic jack, raise the chain to clear the idler.

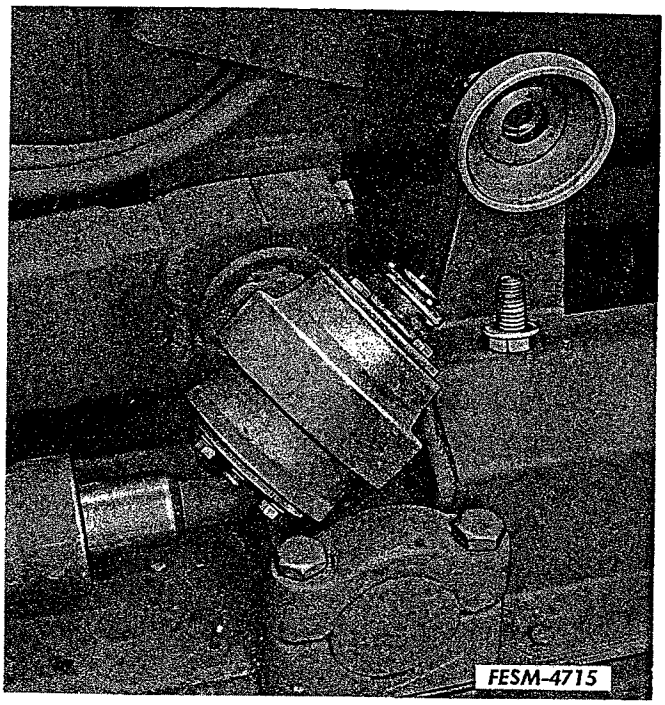
1. Track chain
2. Hydraulic jack
3. Top idler

3. Remove the capscrew from the end of the idler shaft (chassis side of chain).

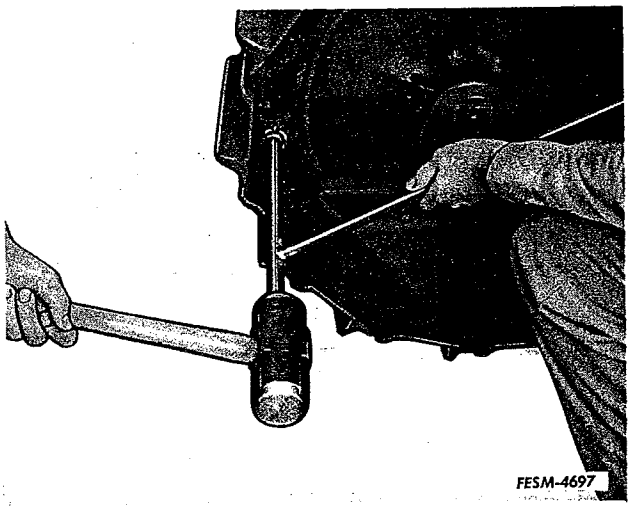
NOTE: This capscrew is secured with Loc-Tite and may require heating to aid removal.

If a prying action while turning the bolt does not loosen it, remove with an acetylene cutting torch.

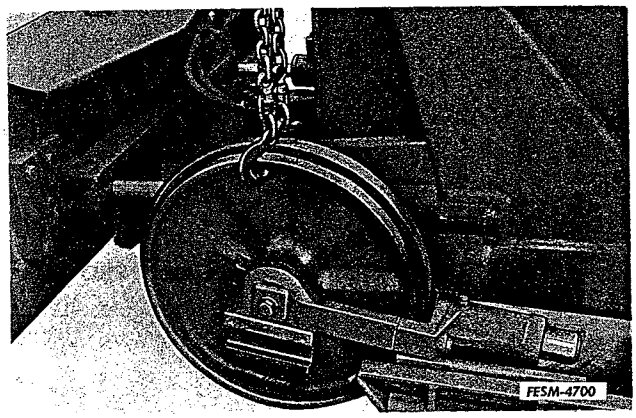
4. If the idler resists removal after the capscrew has been removed, reinstall the capscrew several turns; and strike the capscrew sharply with a hammer while pulling on the shaft. Be careful not to drop the seal assembly.



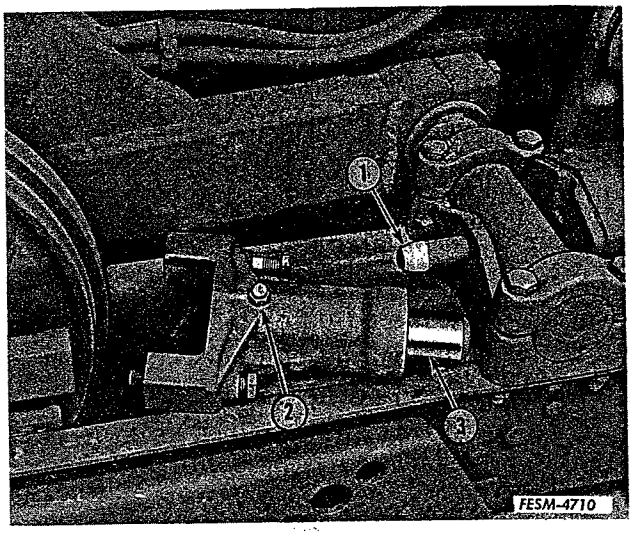
Top idler removed.



Removing the master pin.



Removing the front idler.



1. Adjuster bar
2. Lube fitting
3. Piston

Front Idler Removal

1. Split the track chain. Refer to "Track chain" – "Removal."

2. Using a large pry bar, move the idler forward.

3. Loosen the inside and outside idler shaft lock straps and capscrews.

4. Move the idler off of the slides as shown in the illustration.

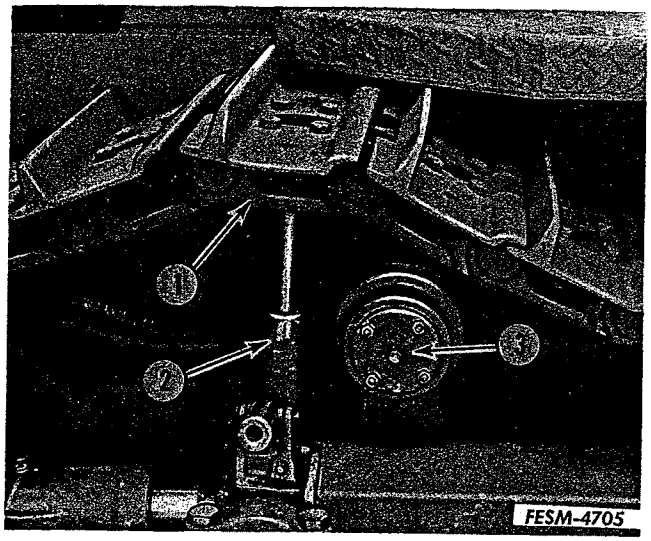
Track Chain Adjuster Removal

1. Remove the track chain, refer to "Track Chain"– "Removal."

2. Slide the front idler forward so that the adjuster may be disengaged from the track adjuster bar, which fits into the counterbore of the piston, and through the front gauge bar.

3. Remove the two bolts which hold the adjuster to the front idler support brackets; and remove the adjuster.

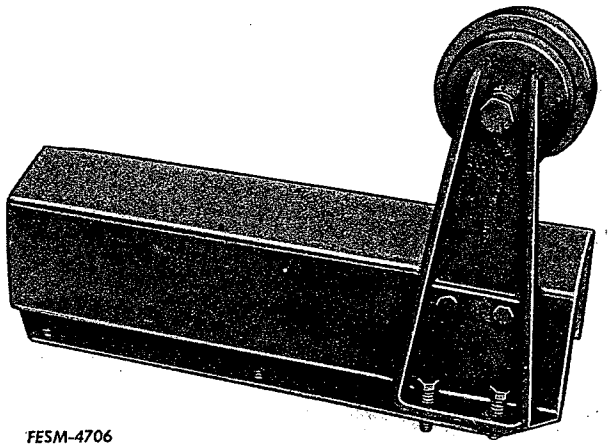
4. The track adjusting bar is chrome plated, and provided with two lube fittings where it passes through the gauge bar mounting pad. To remove this bar, use a liberal amount of IH penetrating oil while working the pin back and forth to loosen and remove it.



Track Recoil Spring Removal

1. Release the tension on the track chain. Install a hydraulic jack, as shown in the illustration, and raise the track to clear the top idler. The hydraulic adjuster should be completely collapsed.

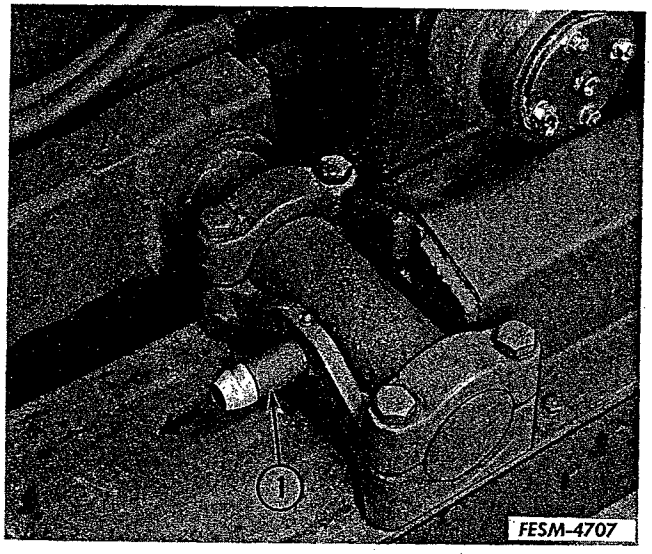
1. Track chain
2. Hydraulic jack
3. Top idler



Spring cover with idler and support removed.

2. Remove the spring cover, idler support, and idler, as an assembly.

NOTE: If the complete unit defies removal, the idler support can be removed from the spring cover. Then lift the cover off.

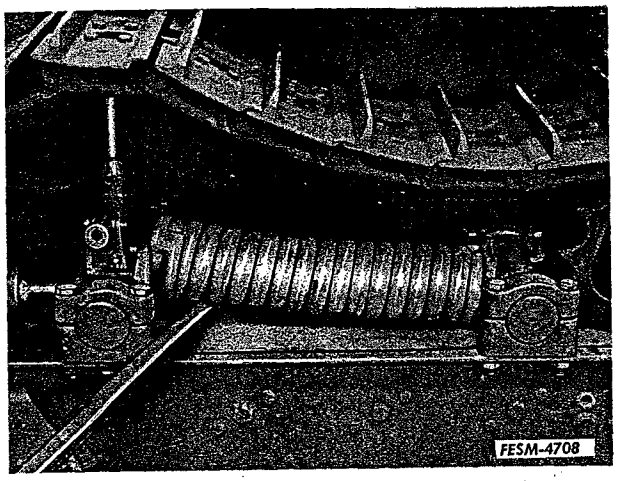


1. Adjuster bar

3. Move the front idler manually to the end of its slide. Use a bar then add blocks behind the idler. The idler adjuster must be clear of the adjuster rod.

4. Work the adjuster bar forward to clear the spring end cap recess. Drive against the end of the bar to loosen. Continued oiling and tapping, using a revolving action, will free the bar.

NOTE: Failure to provide daily lubrication to the lube fitting on the front gauge bar can hinder movement of the adjuster bar. If this has occurred, apply a liberal quantity of penetrating oil.



Removing the recoil spring.

5. Lift the spring up and out of the front cap with a heavy pry bar.

NOTE: If the spring binds while being pried up, thoroughly clean and dislodge any debris until it is free.

CAUTION: Do not attempt to disassemble the recoil spring assembly.

Roller Removal

Track rollers can be removed with the track frame left in position or with the track frame removed.

Track Frame Installed

1. If all rollers (one or both sides) are to be removed, split the track chain as described under "Removal", in the "Track Chain" portion of this section.

2. Jack the tractor clear of the chain by approximately 1/2 inch.

3. Remove the roller shaft and bracket bolts; and lower the rollers onto the chain. Do not jack tractor high enough to permit the brackets and seals to spill out.

4. Jack the tractor high enough to clear the roller shaft. Install the roller shaft capscrews in both ends of the roller shaft.

5. Jack the tractor high enough to clear the rollers. Remove the rollers.

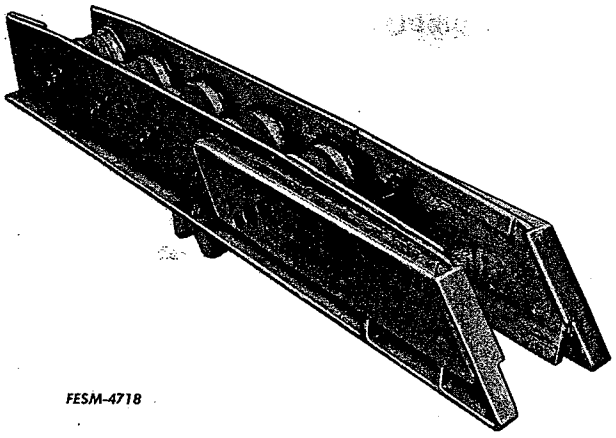
NOTE: If tractor height is a limiting factor, the chain can be removed following step 2 and pushing the chain to the center of the tractor a distance sufficient to clear the roller flanges.

Track Frame Removed

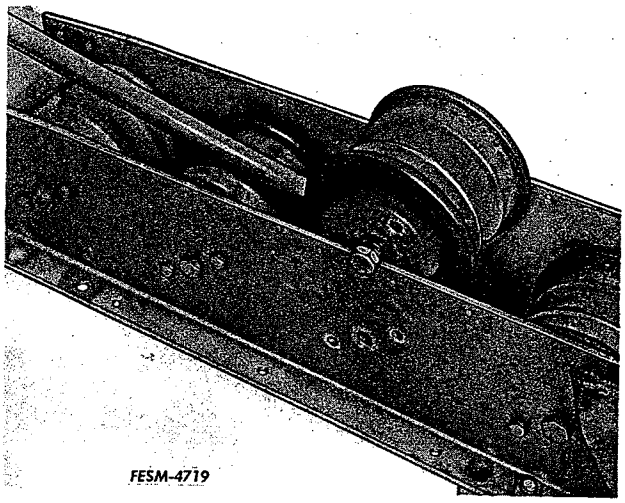
1. Remove the roller shaft and bracket mounting capscrews.

2. Using a pry bar, lift the roller and reinstall the roller shaft capscrews in each end of the shaft.

3. Remove the roller.



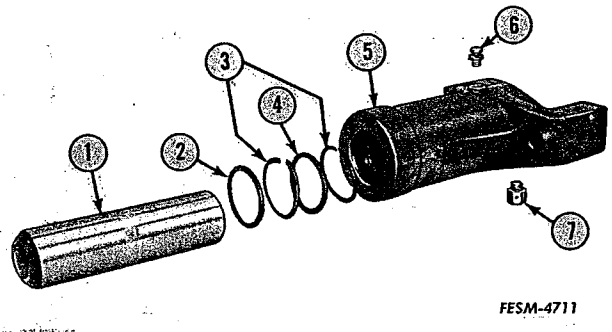
Track frame removed.



Removing a roller.

Track Chain Adjuster

Disassembly



1. Adjuster piston
2. Wiper
3. Back-up washers
4. O-ring
5. Track adjuster yoke (cylinder)
6. Button type lube fitting
7. Relief valve

1. Remove the lube fitting from the yoke to allow air to get in while the piston is being pulled out.

NOTE: If the piston will not come out, place the lube fitting back in and force the piston out using a grease gun.

2. Sealing media consists of an O-ring with a back-up washer on each side. A wiper ring prevents dirt from reaching the O-ring seal. Remove these parts from the cylinder using an O-ring tool FES 57-3.

Inspection, Repair, and Reassembly

1. Replace the O-ring and wiper ring.

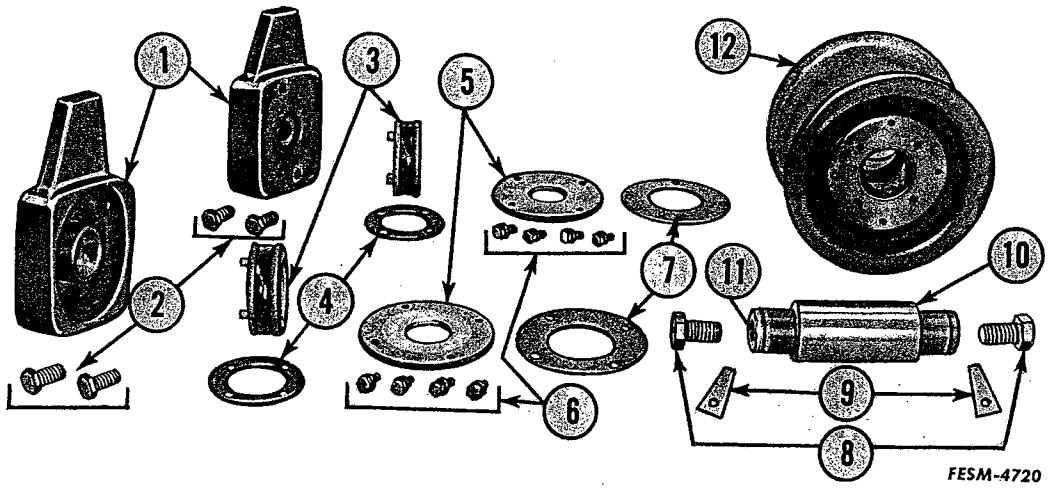
2. Use a "swiss" file and emery cloth to clean up small nicks. Scuffs or indentations on the piston will cause failure of O-ring.

3. Polish the track adjusting bar; and clean the passages thoroughly to lube and relief fittings.

4. Install the two back-up washers, new O-ring, and wiper ring.

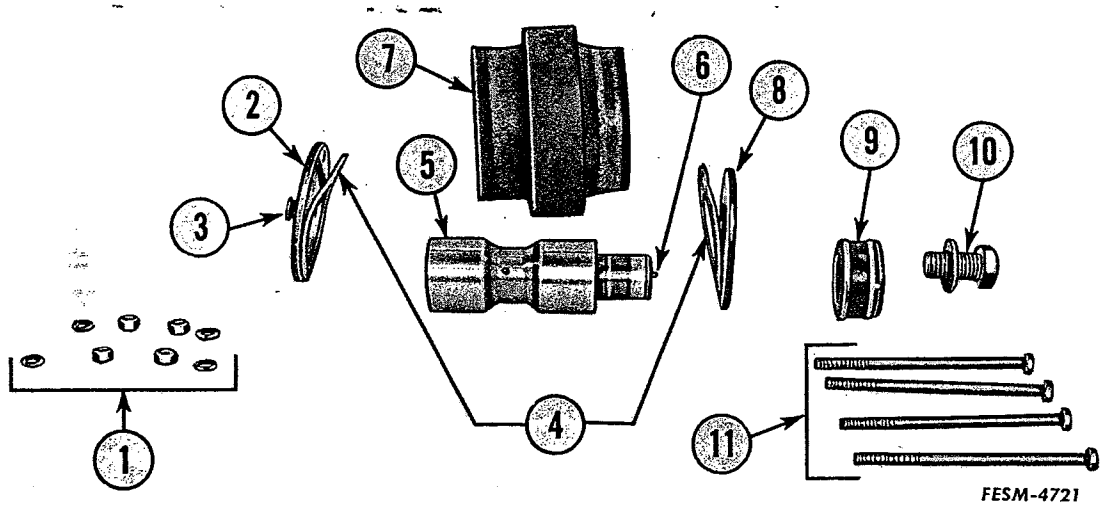
IMPORTANT: When assembling the adjuster, make sure that all internal parts are lubricated with a light oil. Also make sure the wiper ring has the tapered or lip edge out.

Rollers and Idlers with E/F Seals



Track roller with E/F seals.

1. Roller shaft support brackets
2. Roller shaft support capscrews
3. Roller seals
4. Seal gaskets
5. Thrust plates
6. Thrust plate capscrews
7. Shim gaskets
8. Roller shaft capscrews
9. Roller shaft locks
10. Roller shaft
11. Lube fitting
12. Roller shell



Top idler (E/F seals only).

1. Thrust plate nuts and washers
2. Outer thrust plate
3. Lube fitting
4. Shim gaskets
5. Idler shaft
6. Roll pin
7. Top idler shell with bushings
8. Inner thrust plate
9. E/F seal assembly
10. Shaft retaining capscrew and spacer
11. Thrust plate retainer bolts

The E/F or leather faced seal for rollers and idlers is identical in design; however the front idler seal is larger. Top idlers are available with E/F seals only.

Disassembly

1. Remove the shaft support bracket(s).

2. Remove the E/F seals.

3. Remove the four capscrews and washers from the thrust plates, the old thrust plate gaskets and the shaft itself.

Inspection and Repair

NOTE: E/F type seals will always show some signs of seepage. DO NOT confuse this with leakage. Seepage is beneficial in keeping the leather seal surface clean, soft, and the mating surfaces lubricated.

1. Clean the shell internal surfaces with steam or soap and hot water; and dry the shell thoroughly. Do not deemphasize this cleaning procedure in any manner.

2. Thoroughly scrape or wire brush the bracket mounting area to insure positive metal to metal contact of the bracket and frame.

3. Inspect the bores in the support brackets. Remove all signs of rust or corrosion from the shaft bores and seal surfaces.

4. The shaft capscrew threads should be buffed clean, and a tap run through the shaft threads to insure cleanliness.

5. Check for wear or galling at the ends of the shaft and the thrust plates where they contact. If signs of galling exist, polish the surfaces with emery cloth, or replace the part if necessary.

6. Check the shell for damage to the threaded holes.

7. Check the shell outer-circumference for flat spots in the chain contact area, and excessive wear to the rolling radius. Replace if there are any well defined flat spots, or the O.D. of the shell is worn beyond tolerance.

NOTE: The shells can be resurfaced if suitable equipment is available, using a continuous electric welding process.

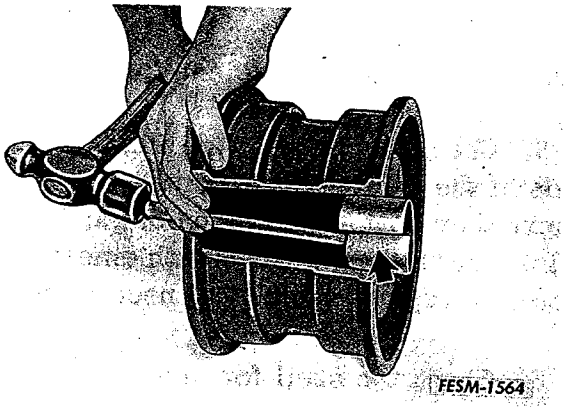
The economics of rebuilding small rollers and idlers is doubtful; and in the majority of instances a new roller or idler will provide a more economical approach. The front idlers however can be reworked, and usually at a saving.

8. If the shell has been reworked by rebuilding its surface, determine that the bushing bores have not become distorted.

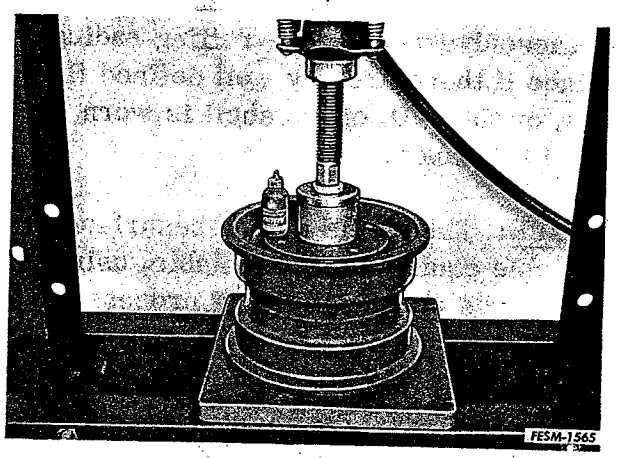
9. Inspect the bushings for excessive wear or looseness in the bore.

10. Check the wearing surfaces of the shafts and bushings.

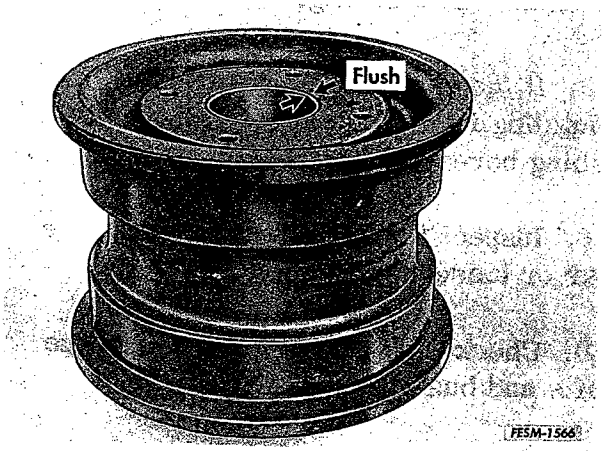
11. Compare the shaft O.D. and bushing I.D. with the specifications.



Removing the bushings.



Installing the bushing.



Bushing installed.

IMPORTANT: This illustration shows the only satisfactory method of removing the pressed in bushings. Any other method can result in damage to the thrust plate mounting surface. This could increase end play, and result in failure due to the hammering effect.

12. The bushing is formed bronze on steel and has a seam. Use a chisel, as shown to collapse the bushing in the seam; then drive the bushing out far enough so that a pair of pliers can be used to complete removal.

13. Coat the bushing back as well as the shell surface with IH Loctite (Part No. 999 568 R91); and press the bushing into position.

IMPORTANT: The bushing is correctly positioned when it is exactly flush with the thrust plate mounting surface.

If the roller bushings have been replaced, the roller shaft must move completely through the roller with no more than hand pressure.

Reassembly

NOTE: The seals are, as a rule, replaced on reassembly. Used seals are satisfactory if the bellows are intact, free of cracks and tears, dowel pins intact, and the leather seal face free of indentations or embedded particles.

1. Coat all moving parts with Lubriplate 5555 during reassembly.

2. The thrust plates must have the chamfered edge on the center bore facing towards the center of the shell.

3. Gaskets may be added or deleted behind all thrust plates to arrive at the proper end clearance of .010 to .020 inch. It is important that the shafts turn freely in the bushings when the end plates are torqued to 23 to 27 ft. lbs.

NOTE: When installing the seals, a little heavy grease on the sealing surface will help hold them in place.

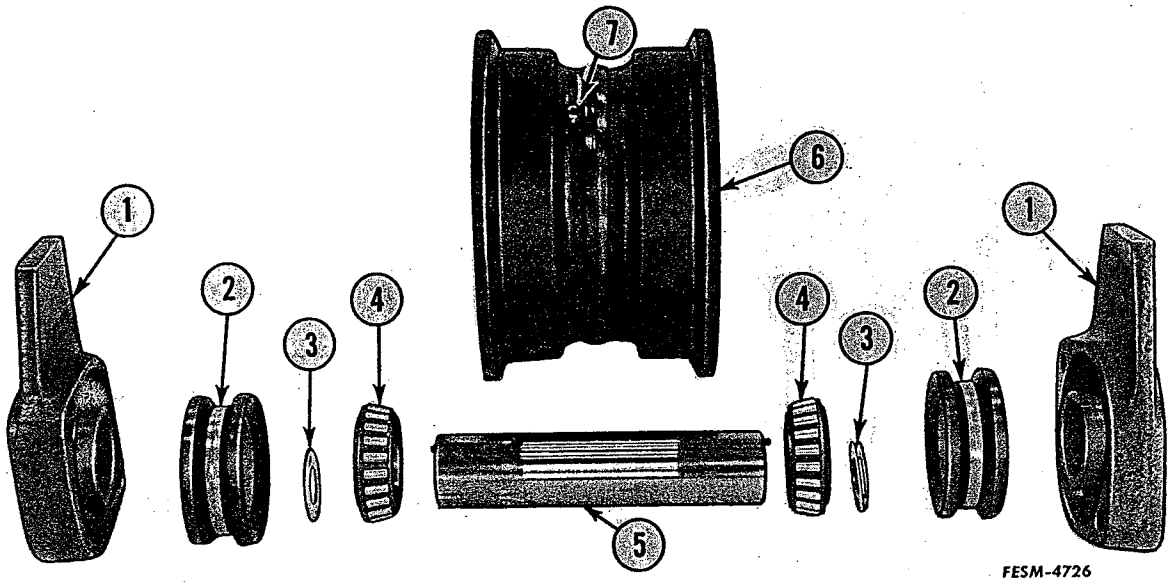
4. If the assembly is to be stored for use at a later date:

a. Tighten the roller support brackets hand tight only.

b. Pump at least 10 strokes of Lubriplate 5555 into the roller via the lube fitting to fill the lube passages.

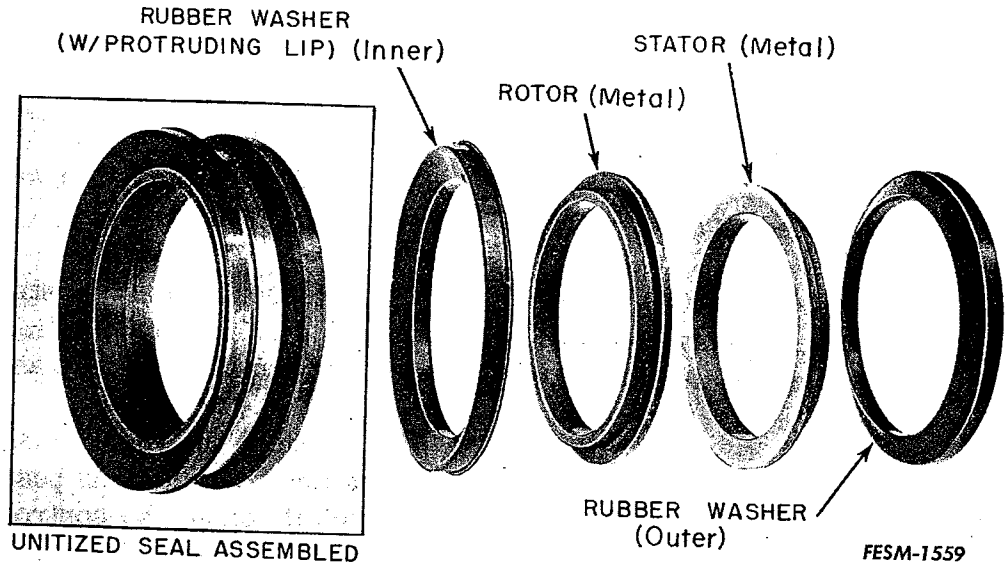
c. Store the roller in a location with as low a humidity as possible. If the humidity cannot be controlled, wrap in waterproof paper, and store in an air tight container.

Rollers and Front Idlers with D/F Seals



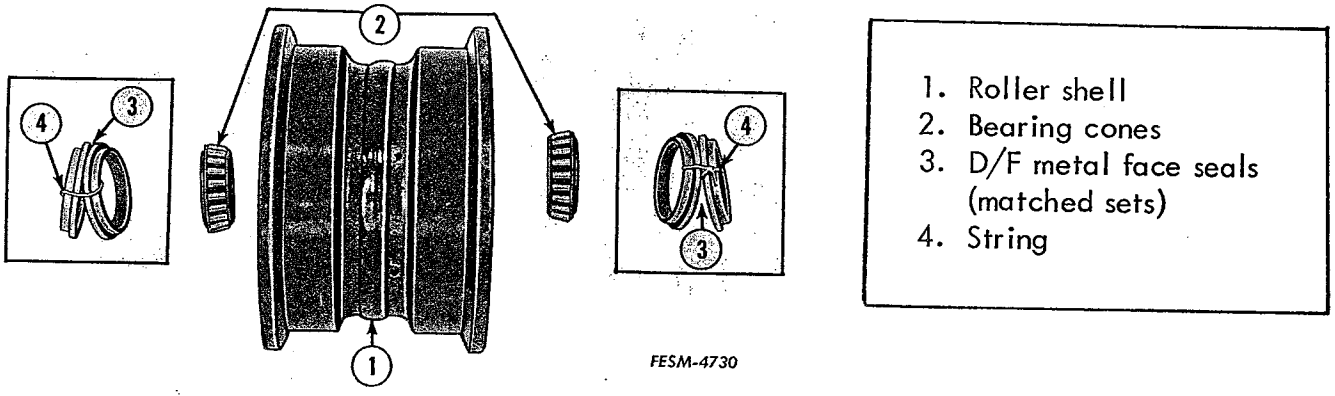
This illustration shows the parts that make up one roller with D/F seals. All of these parts are serviceable.

1. Shaft support bracket (2)
2. D/F seal assembly (2)
3. Shims (as required)
4. Roller bearing cone (2)
5. Roller shaft
6. Roller shell w/bearing cups
7. Filler plug



Each D/F seal assembly consists of four (4) specific parts, supplied as a matched set only.

Disassembly



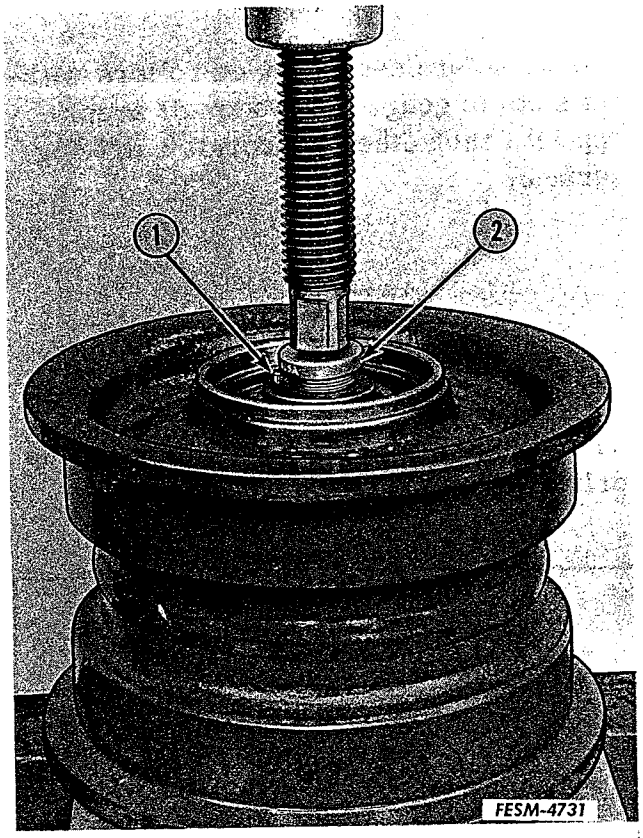
1. Remove the shaft capscrews.

2. Remove the shaft support brackets. If a bracket resists removal, rock it back and forth to loosen while pulling outward.

IMPORTANT: The metal seal rings as removed must remain as a set. Altering a set by intermixing the metal seal rings on any one or more rollers or idlers renders each of these mixed sets unserviceable. Each set of the metal seal rings can be shifted from one roller or idler to another without affecting their performance.

As the metal seal rings are removed, they should be tied together to prevent an inadvertent mix up.

The bearing cones should not be switched from side to side; they should be returned to the exact location from which they were removed. Failure to do so may alter the wear pattern and reduce service life.



1. Roll pin
2. Step plate

3. Remove the metal seal rings and tie them together with a piece of string as pairs from the side removed.

4. Press the shaft out of the shell. The step plate must clear the small roll pin. Be sure to support the shaft and lower bearing assembly as the top bearing clears the shaft.

NOTE: It is not necessary to remove the opposite bearing from the shaft unless it or the shaft is damaged.

Inspection and Repair

1. Clean the shell internal surfaces with steam, or soap and hot water.

Dry the shell thoroughly. Do not deemphasize this cleaning procedure in any manner.

2. Inspect the shell for excessive wear. Check the filler plug threads and threaded hole. Clean-up as necessary. Check to be sure that the bearing cups are not loose in the shell.

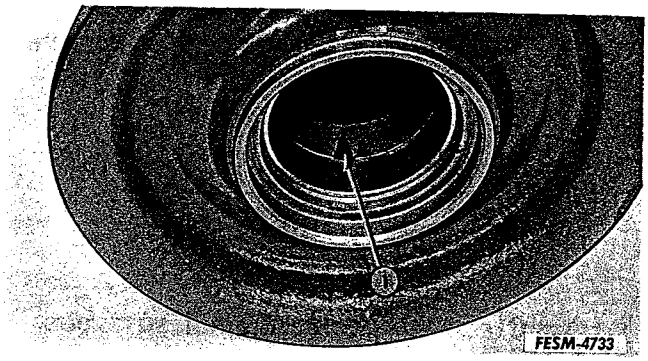
NOTE: The rollers and idlers can be resurfaced if suitable equipment is available, using a continuous electric welding process.

The current economies of rebuilding small rollers and idlers are doubtful; and in the majority of instances new parts will provide a more economical approach.

3. Inspect the bearings. Damage to either the cup or cone will require replacement of both parts. Damage is caused by loss of lubricant, incorrect lubricant, loss of bearing preload, and entrance of contaminants.

4. If the cups are to be replaced, use a punch to drive the old cups out of the shell in the slots provided.

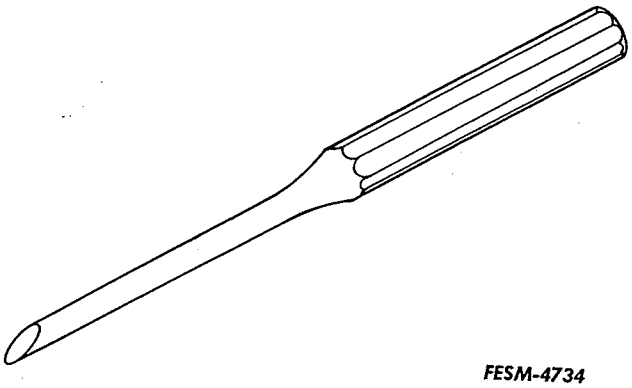
NOTE: Early model rollers and idlers did not have a relief ground into the cup seat area behind the cup.



It is therefore necessary on rollers without slots to gouge out two small areas opposite each other to provide a driving surface.

This illustration shows a roller with cup driving slots that were cut locally.

1. Driving slot



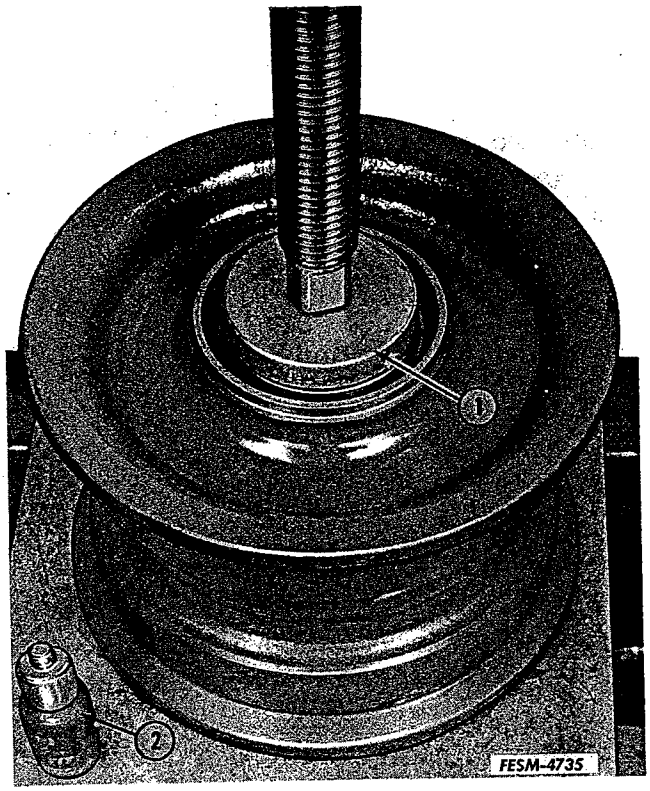
FESM-4734

Use a chisel shaped as shown in this illustration.

Working from the front face of the roller and going towards the center use the chisel to cut the relief on rollers not so equipped.

After driving out the cup, smooth up the relief area using a rotary file.

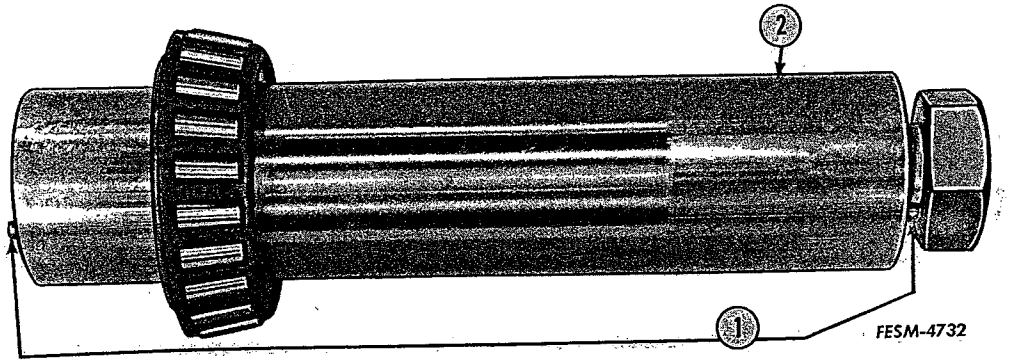
5. If any doubt exists as to the fit of the cups, clean the cup and bore with Loc-Quick Cleaner; and coat the cup O.D. as well as the receiving bore, with Loc-Tite Bearing Mount prior to installation.



6. Press the cups into position using a press and a OTC-620-11 step plate.

1. Step plate OTC-620-11
2. Loc-Tite bearing mount

NOTE: Due to the interference fit of the cup, installation will be aided by tapping the step plate with a small hammer to keep the cup and step plate square.



1. Roll pins
2. Roller shaft

7. Inspect the shaft for damage due to a "spun" bearing (undersize at bearing location). Check for pulled or crossed threads. Be sure that the small roll pins in each end are intact and protrude sufficiently.

8. Clean up any rough or abrasive areas on the shaft with emery cloth.

NOTE: Abrasion of the shaft as a result of pushing the bearing on or off the shaft does not effect the shaft as long as the bearing is tight.

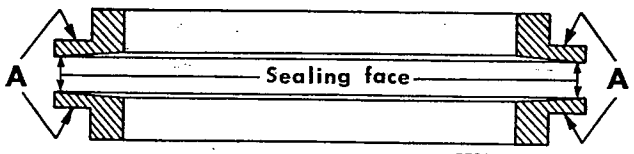
9. Inspect the brackets for cracks, loose shaft in bore, and a worn shaft roll pin locating hole. (Hole can be enlarged to next size to take larger roll pin.)

10. Do not attempt to salvage the following parts. They are to be discarded on each teardown:

a. Rubber washers

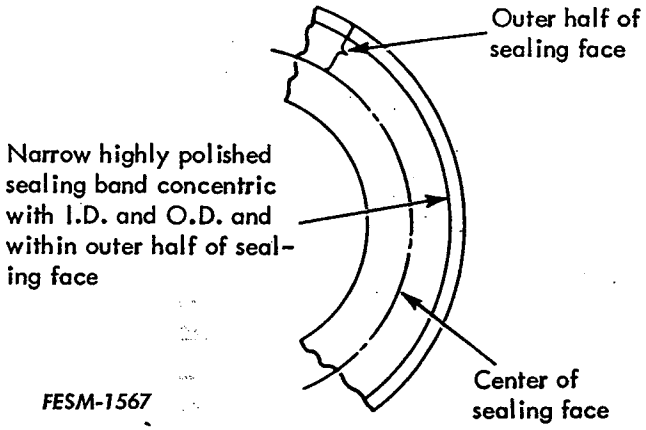
b. Reunitization bands

c. Shims



FESM-1570

11. Remove corrosion or other foreign material existing on surface described as "A" in the illustration. Use a pocket knife, scraper and/or any stiff bristled brush to facilitate this operation. DO NOT TOUCH OR SCRATCH THE SEALING BAND. If it is corroded, nicked or otherwise damaged, discard the set.



FESM-1567

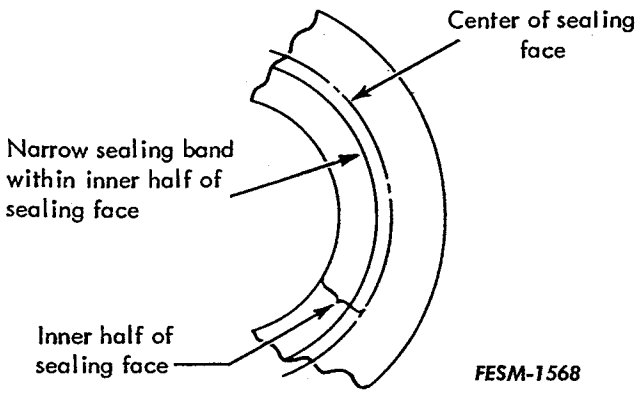
Acceptable wear pattern.

12. Wash the metal rings in a non-flammable solvent to remove all traces of oil or grease.

13. Inspect the metal seal rings for:

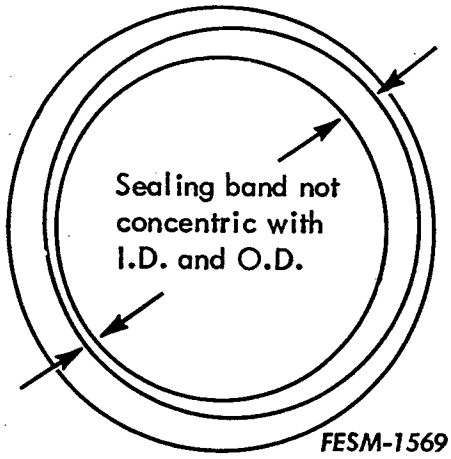
a. The narrow, highly polished sealing band must be within the outer half of the sealing face.

b. The narrow band must be uniform and concentric with the ID and OD.



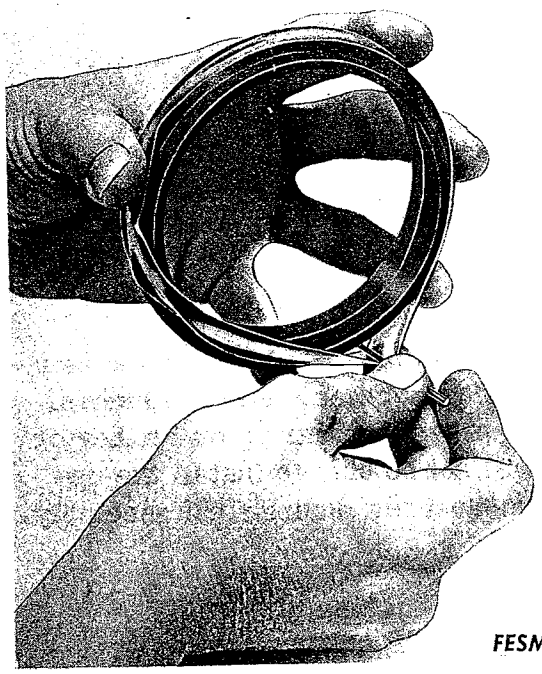
FESM-1568

To be discarded.

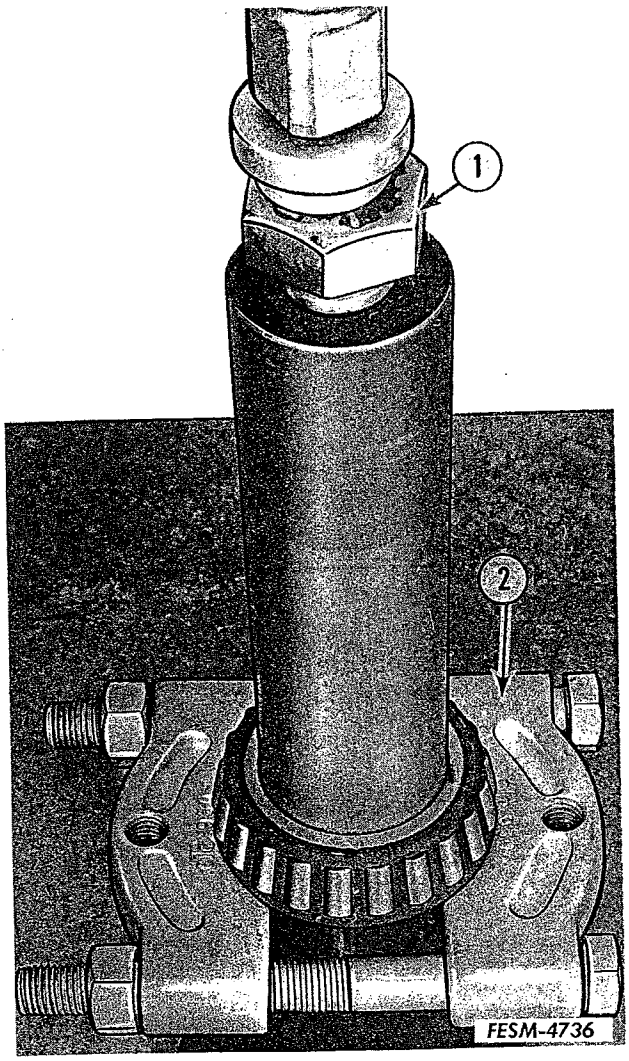


FESM-1569

To be discarded.



Installing the band.



Reassembly

IMPORTANT: You must have a seal overhaul package for each set of metal seal rings.

1. Apply a thin coat of Series 3 Grade 30 oil to one seal face only.

2. Rotor and stator are now "wrapped" with the special unitization band (found in overhaul package) as follows:

a. Soak the unitization band in lukewarm water until it is pliable. (Approximately 5 minutes.)

b. Slide the faces of the two metal sealing rings together.

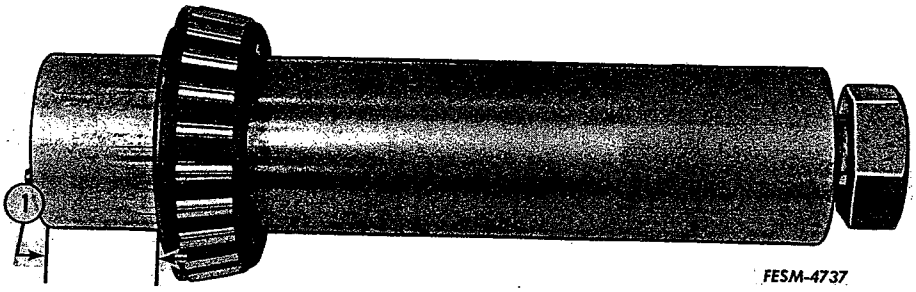
c. Hold the rings in one hand.

Carefully, using a small dowel (similar to a cotton swab stick, approximately 1/8" dia.) thread the plastic into position. When dry, it will hold the rotor and stator halves together.

3. Lay the D/F rotor and stator assembly aside and prepare the next assembly. When all seals are wrapped in this fashion, the first will be dry and ready for installation on the roller. On individual jobs the unitization band must dry for at least 30 minutes.

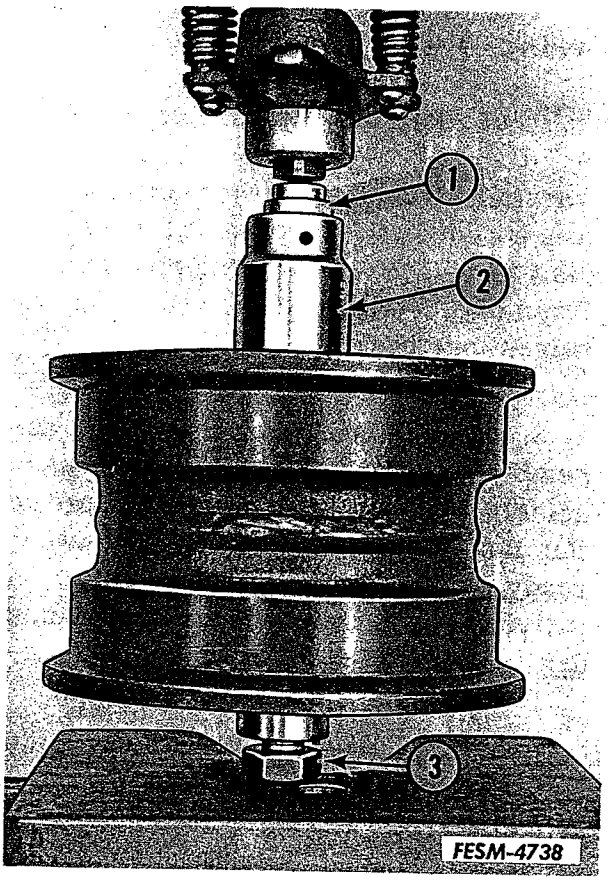
4. Using a press and OTC-950 puller attachment, start the bearing cone on the shaft.

1. Roller shaft bolt
2. OTC-950 puller attachment



1. 1-1/8 inches

5. Press the shaft through the bearing cone approximately 1-1/8 inches. Do not press the bearing on further or you will not be able to install the opposite capscrew during final assembly.



6. Place the roller shell and shaft on the press. Using one of the roller mounting capscrews as a support to protect the roll pin, start the bearing using an OTC 530-7 step plate. Tap the step plate with a hammer to maintain alignment if the bearing tilts. Use a 1-1/2 inch socket to aid installation.

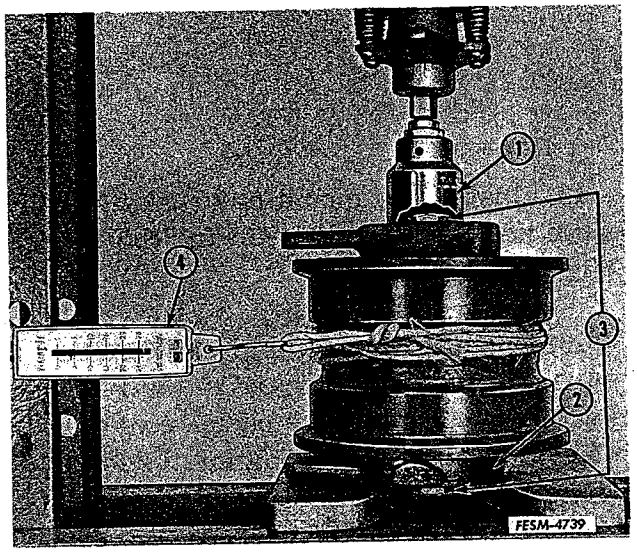
7. While pressing the bearing into place, check for free play by rocking the roller shell. Continue to press until approximately 1/32 to 1/16 inch end play is obtained.

1. Step plate, OTC 530-7
2. 1-1/2 inch socket
3. Roller mounting capscrew

8. Remove the assembly from the press.

Add at least .035" shims of equal thickness on each end of the shaft in the bracket support recess.

NOTE: The greater the shim pack the less pre-load will exist.



1. Socket
2. Shaft support bracket
3. Shaft capscrews
4. Spring scale

9. Assemble the mounting support brackets less the seal assemblies on the shaft.

Install the shaft capscrews finger tight.

10. Position the assembly in the press so that force will be applied to the mounting support brackets as shown in the illustration.

11. Apply 12 tons force to the assembly; or torque the shaft capscrews to 320 ft. lbs.

12. Using a cord and spring scale, check the rolling torque (bearing preload) that exists.

13. Remove shims of equal thickness from each side to obtain 1 to 3 lbs. on the scale as the assembly turns.

NOTE: In the event too many shims were removed causing the preload to rise above 1 to 3 lbs. , proceed as follows:

a. Remove the roller support brackets and shims.

b. Move the roller shaft down, as in disassembly, to spread the bearing cone distance.

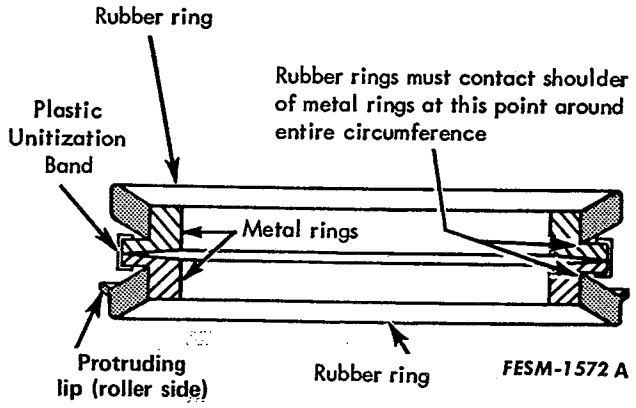
c. Add shims as required and repeat steps 8 through 12.

14. When the correct preload is obtained, remove the roller from the press, and balance out the shim packs if they are uneven.

15. Carefully wire or otherwise identify the shim packs as to proper location.

NOTE: The total shim pack thickness will vary from .010 to .063 inch.

16. Mount the assembly in a vise vertically. The front idler is best handled by blocking on the floor.



D/F seal assembly.

17. Assemble the unitized D/F seals into the assembly with new rubber rings.

IMPORTANT: The washers with the protruding lips must be placed into the roller cavities. This will center the seals during reassembly, and hold them securely in position.

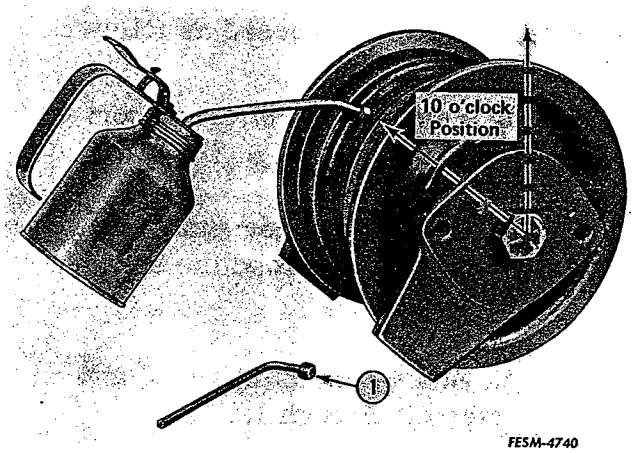
The rubber washers and their receiving bores must be dry and free of lubricant.

18. Install the mounting brackets with shim packs, carefully working the rubber rings into position.

19. Install the shaft capscrews. Be sure that the roll pins are in their receiving bores. Tighten the capscrews only enough to prevent dislocating the seal assemblies.

20. Turn the roller or idler until the filler plug is in the 10 or 2 o'clock position. Fill with SAE No. 30, Series 3 oil. Install the filler plug.

21. If the assembly is being overhauled for use at a later date, store the assembly in a room or location with minimum humidity. If humidity is high, wrap and package the assembly in an air tight carton.

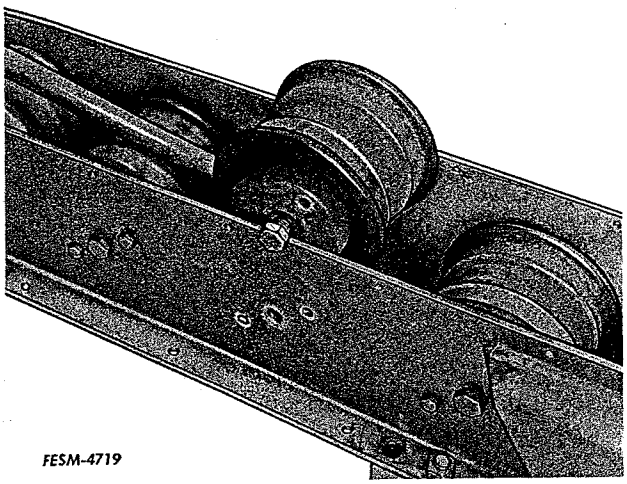


1. Filler plug

Roller Installation

Installing the rollers in the track frame is the reverse of removing.

IMPORTANT: Rollers with D/F seals must be filled with lubricant on the bench prior to installation. Refer to "Rollers and Idlers with D/F Seals" — "Reassembly".



Installing the rollers.

1. Work the roller, with the roller shaft brackets and capscrews into position, in the frame. This will hold the brackets in position after the capscrews are removed.

2. Remove the shaft capscrews. Position the roller so that the elongated portion of the roller support brackets are toward the top of the frame. Install the roller shaft capscrews and the four (4) bracket bolts.

3. Tighten the small capscrews by hand. Then torque the roller shaft capscrews to 280-320 ft. lbs.

NOTE: If the lock plates are installed just prior to reaching minimum torque the attaching point can be readily located within the range given as the torque is increased.

4. Torque the small capscrews to 55 ft. lbs.

5. Rollers with E/F seals: Refer to the operator's manual for lubrication instructions.

Recoil Spring Installation

1. Strike the spring sharply with a hammer to dislodge debris. Finish cleaning with a wire hand brush.

2. Thoroughly clean the spring mounting area.

3. Clean and polish the track adjuster bar and its receiving bore. Check to see that the grease fitting to this area is open by use of a grease gun.

4. Coat the adjuster bar with IH Never-Seeze and locate it to clear the recoil spring.

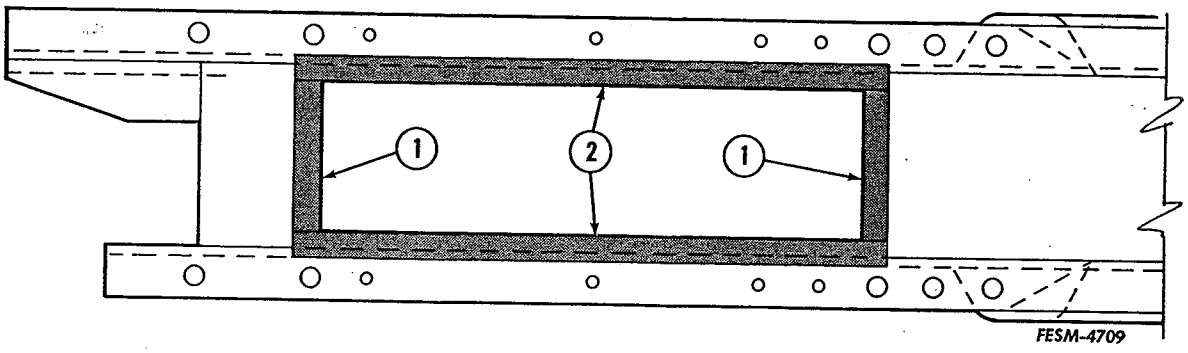
5. Install the rear of the spring into position then locate the front end.

6. Move the track adjuster bar into the coil spring cap recess. It may be necessary to pry the spring front cap downward at the same time the pin is moved into the recess.

7. If the cover seals are damaged, deteriorated or otherwise, indicate leakage is occurring, install new seals as follows:

a. Activate the adhesive on the rear face of the seals by lightly coating with IH Lacquer Thinner.

b. Carefully position the seals as shown in the illustration.



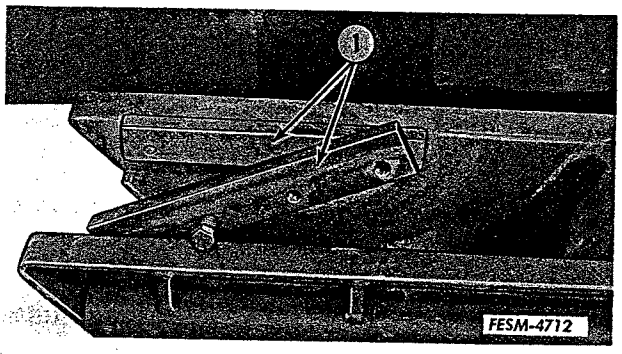
1. End seal strips (2)
2. Side seal strips (2)

c. Lay on a 1/8" bead of sealant such as Dow Corning Corp Silastic RTV 732 white sealant under the cover ends.

8. Install the cover and idler assembly.

Track Chain Adjuster Installation

Reverse the removal procedure.

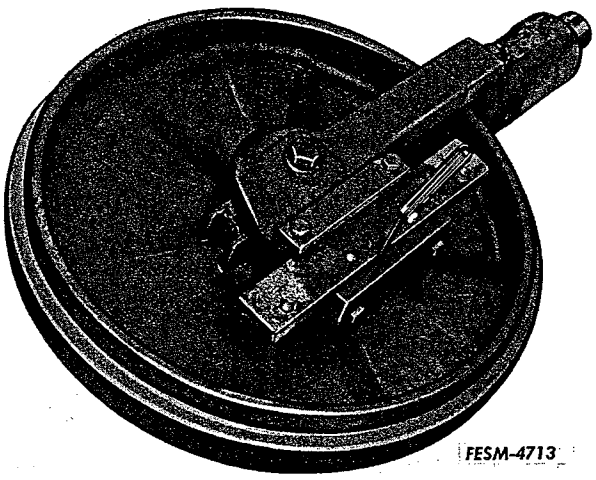


1. Idler runners

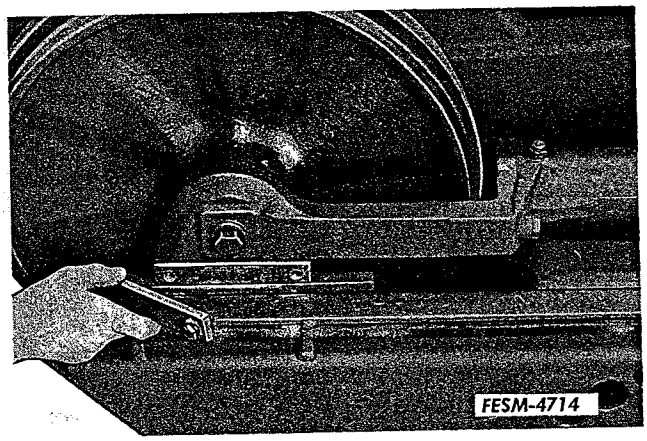
Front Idler Installation

1. If the front idler is satisfactory for installation, check the condition of the threaded holes in the idler shaft and the capscrews.

2. Check the idler runners on the track frame for excessive wear. Wear at this point is a natural result of operation and only the amount of wear is critical.



Checking idler runner vertical clearance.



Installing the side guide plates.

3. Remove the front idler guide runners from the frame and locate them in their respective front idler support brackets. Determine the vertical clearance; and by means of shims correct as required.

4. Install the runners on the frame.

5. Be sure that the lube fitting (on hub) has not been installed on the inside. Slide the front idler into position on the frame. Position the adjuster piston on the track adjuster bar.

NOTE: If the area the tractor is to be worked in has a high degree of moisture, coat the track adjuster bar with IH Never-Seeze.

6. Install the side guide plates.

7. Torque the hydraulic adjuster support bracket capscrews.

8. Torque the front idler shaft capscrews to 280-320 ft. lbs.

9. Torque the side and bottom guide plate capscrews.

10. Refer to the operator's manual for lubrication instructions.

IMPORTANT: After an initial run in period of approximately eight hours, check the mounting plate bolts and the idler shaft nuts for the proper torque and retighten if necessary.

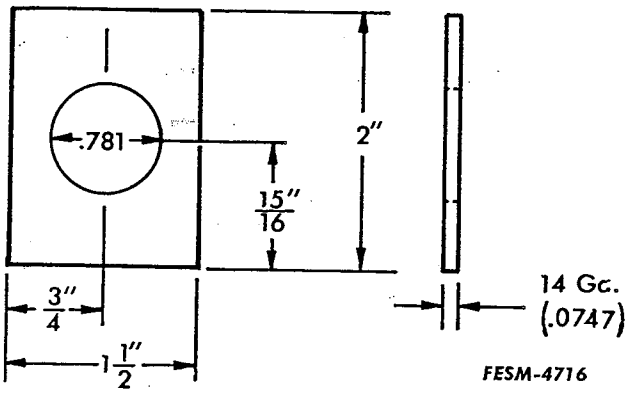
Top Idler Installation

1. Spray the idler capscrew and its receiving bore with "Loc-Quick Cleaner and Primer."

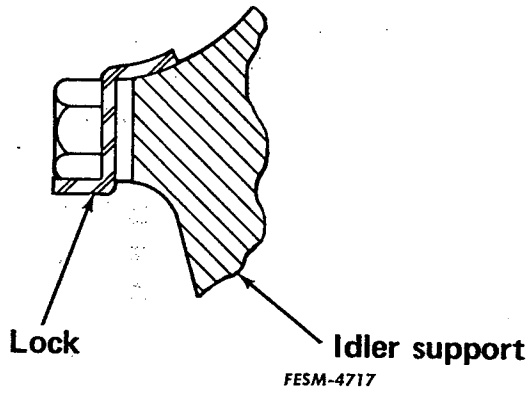
2. As soon as the cleaner dries, coat the threads with IH Loc-Tite.

3. Lightly brush the leather face with Lubriplate 5555.

NOTE: Early versions of the top idler used a locking capscrew (Nylock). The capscrew is to be installed with IH Loctite regardless of the type of capscrew used.



Lock plate dimensions.



Lock plate installed.

4. Insert the idler shaft and seal, being sure that the three seal case dowels are engaged, and that the small roll pin in the end of the roller shaft is in position in its receiving bore in the idler support.

5. Insert the capscrew with its spacer; and torque the capscrew to 280-320 ft. lbs.

NOTE: Where extremely cold weather prevails, the shaft may tend to revolve. (Idler resists turning.)

The top idler shaft can be locked if this occurs, by mechanical means as follows:

a. Manufacture a plate from 14 gauge steel as shown in the illustration.

b. Remove the top idler bolt and insert the lock plate. Torque the bolt to 280-320 ft. lbs. Crimp the lock plate to secure the bolt.

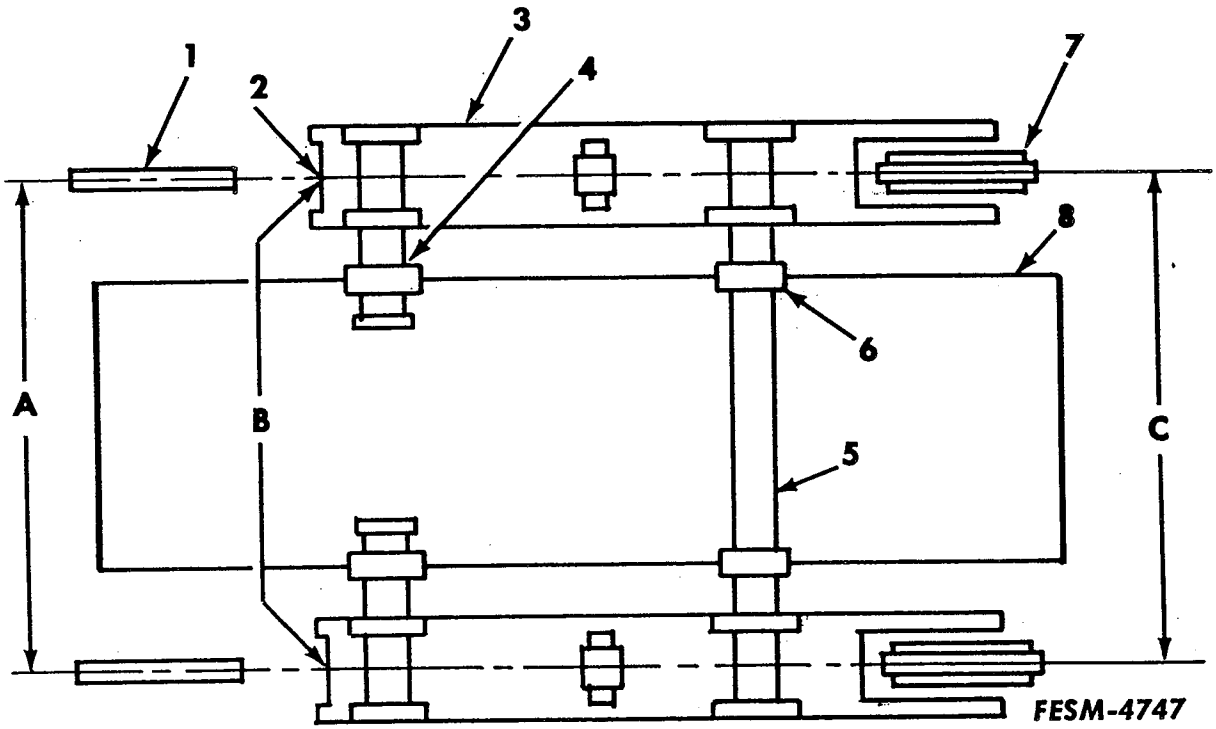
Installation

Installation is the reverse of the "Removal" procedure.

Be sure the gauge bar clamps and the pads are thoroughly clean both inside and out.

Torque the gauge bar clamp bolts to 290-320 ft. lbs.

Alignment



The design of this crawler is such that the track frames and chassis are mounted on gauge bars. This provides movement for adjustment.

If the track chains, front idlers or sprockets show an abnormal wear pattern, check track frame alignment.

If service has been performed on tracks or gauge bars, all parts must be returned to their original locations to maintain alignment. These positions will be identified by gauge bar, clamps, and mounting pad wear patterns.

Any major misalignment should in all probability necessitate a check of the front and rear gauge bars. It may not be necessary to remove them. Follow the instructions under "Gauge Bar Removal," to free the bars, rolling them in their mounts to determine any bends that could be present.

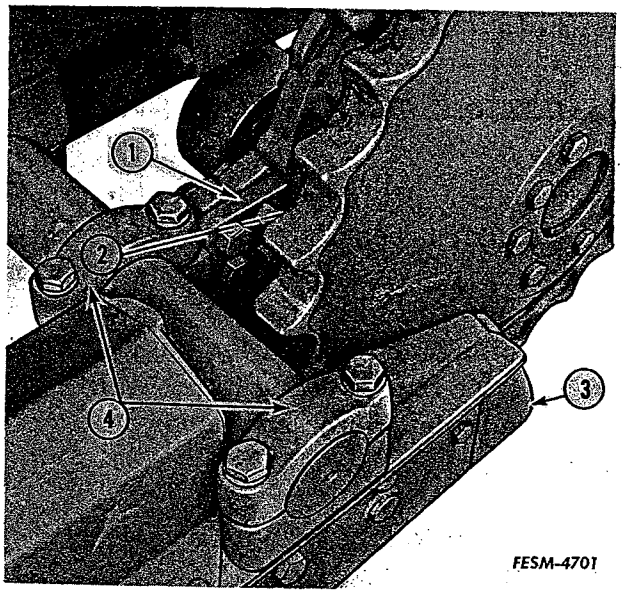
1. Position the tractor on a level area, preferably concrete.

2. All track frame gauge bar clamps and chassis clamps must be in position, however they should be loosened to permit movement of the frames or gauge bars. Remove the final drive stop bars.

3. Measure and determine dimensions "A" which is the exact centerline to centerline dimension of the drive sprockets.

4. The rear track roller (2) on each side must be centered exactly on the sprocket (1) centerline AND the rear roller (2) centerline to centerline dimension "B" must be equal to dimension "A". Proceed as follows:

a. Either build a template that fits the roller (2) and has a cut out for the sprocket (1) or, use a straight edge to determine the roller (2) is centered on the sprocket (1) centerline. If necessary to shift the frame(s) (3) on the rear gauge bar(s) (4) remove the final drive stop bar from both the frame and final drive. Use a heavy pry bar to accomplish sliding each frame (3) as necessary on its rear gauge bar (4). Reinstall the final drive stop block, adding shims as required to prevent distortion.



1. Final drive stop bar
2. Inside stone deflector
3. Outside stone deflector
4. Gauge bar clamps

b. Check the roller (2) centerline to centerline determining that dimension "B" is equal to "A".

5. Pry the front of the track frames either in or out to adjust the front idler (7) centerline "C" to the exact dimension of "A" and "B". This dimension must be within .06 inch of dimension "A". Torque up the front gauge bar (5) clamps at the track frame.

6. The chassis (8) must be centered on the front gauge bar (5).

a. Basic Tractor, 510 or 511 Bullgrader, or 75 Loader: Measure the distance from the front chassis mounting pad (6) to the extreme ends of the gauge bar (5). Adjust the chassis (8) so that this dimension is equal on both sides. Torque up the chassis clamps (6).

If the loader main frame is centered and interference occurs at the radiator guard rub bars, the loader boom is at fault and will have to be adjusted by heating and bending to gain the clearance required.

b. 512 Bullgrader: The 512 bullgrader equipped tractor is aligned in the exact same manner as the 510 or 511 with the following possible exceptions:

(1) If the rear frame dimension "B" resists adjustment due to interference of the "C" frame trunnion with the collar on the end of the rear gauge bar, it may be necessary to grind material from either the trunnion mounting base or clamp.

(2) In aligning the front idlers (7) it is possible that the track frames (3) could interfere with the "C" frame scuff plates. These would then have to be ground where the interference exists.

(3) To center the chassis (8), if required, it will be necessary to remove the two bolts L.H. and R.H. and the spacers located behind the torque resisting strap welded to the front gauge bar (5). In the event the chassis is shifted, add to or reduce the bushing width.

GAUGE BARS

General

The tractor frame, power train, and its payload, are mounted on and carried by the gauge bars.

Front Gauge Bars

The front gauge bar is a one piece steel bar located between the L.H. and R.H. track frames, which supports the chassis frame assembly. There are three variations of front gauge bars used depending on mounted equipment:

a. Basic Tractor or 75 Loader – a plain bar with a hole near each end, through which the front idler adjusting bar passes.

b. Model 510 and 511 Bullgrader – a bar which has, in addition to the items in a., a R.H. and L.H. collar welded to the bar to take the "C" frame side thrust.

c. Model 512 Bullgrader – a bar which has, in addition to the items in a., a torque restraining stap, radius rod bracket, and to each end of the bar a scuff plate, to take up side thrust from the "C" frame.

Rear Gauge Bars

The rear gauge bars carry the rear tractor frame, the rear of the track frames assemblies, and in the case of the 512 design, serve as the pivot point for the bullgrader "C" frame.

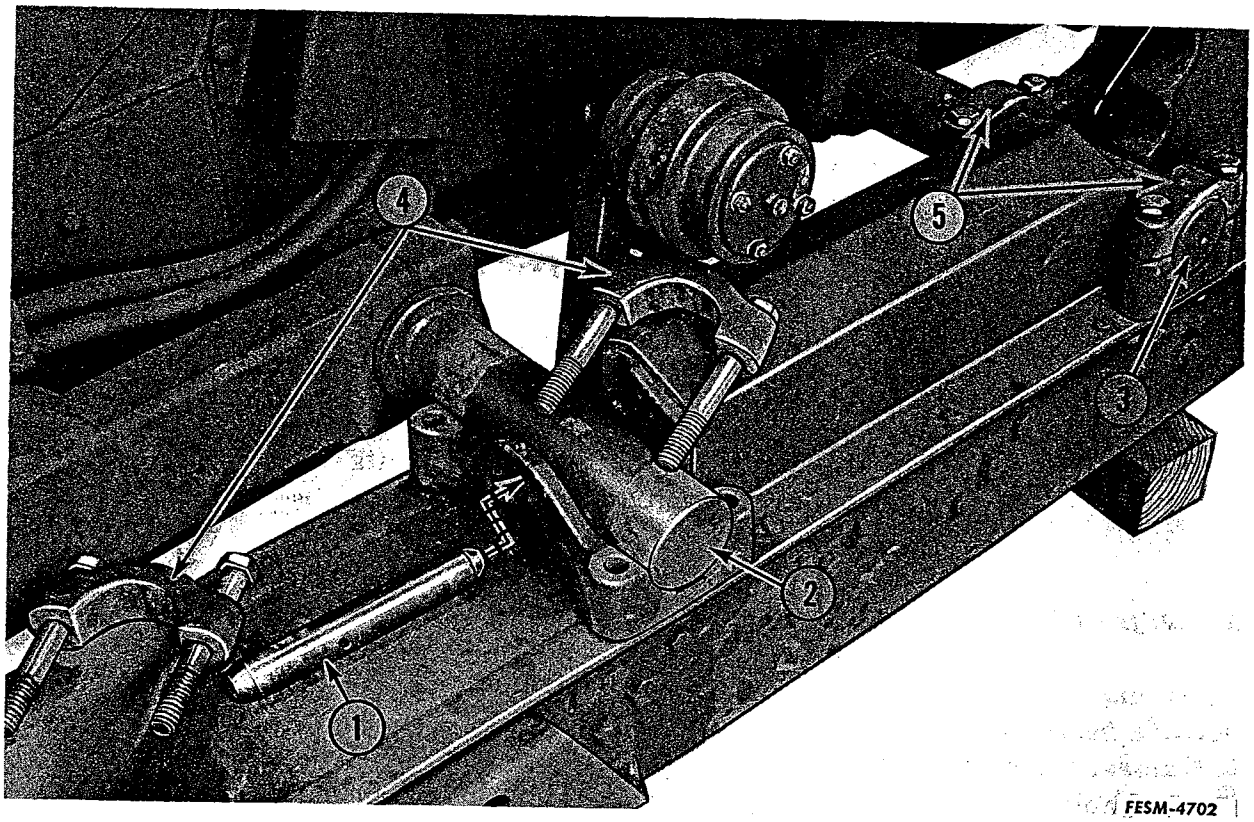
Each of the two rear gauge bars is fitted into a support plate, and held into this plate by means of a steel retaining ring.

The support plate is bolted to a machined surface on the rear tractor frame (chassis) by four studs and nuts. This configuration provides a certain degree of flexibility.

Front Gauge Bar

Removal

Tractors without Forward Mounted Equipment



1. Track adjuster bar
2. Front gauge bar
3. Rear gauge bar (LH)
4. Front gauge bar clamps (2)
5. Rear gauge bar clamps (2)

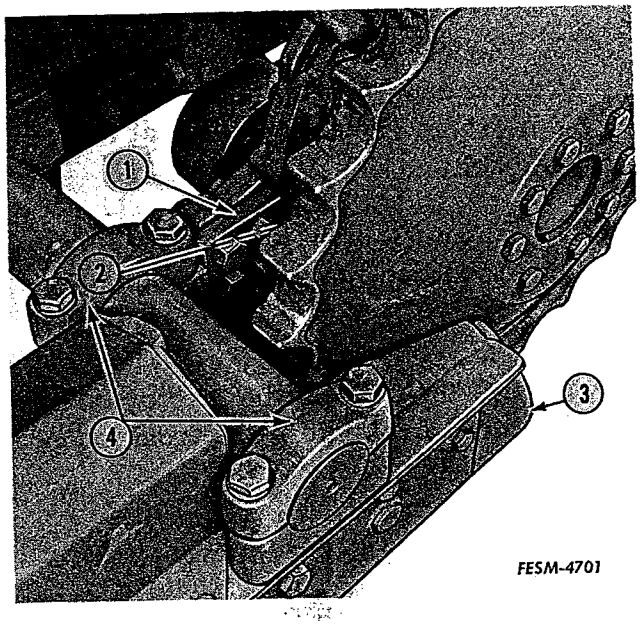
1. Remove the transmission guard. Refer to "Crankcase and Transmission Guards" – "Removal".

2. Collapse the idler hydraulic track chain adjuster; and split the track chains. Refer to "Track Chain" – "Removal".

3. Move the front idler forward as far as it will go on its slides; and block it in place.

4. Remove the track adjuster bar; and the track recoil spring.

5. Remove the front gauge bar clamps at the chassis and track frame.



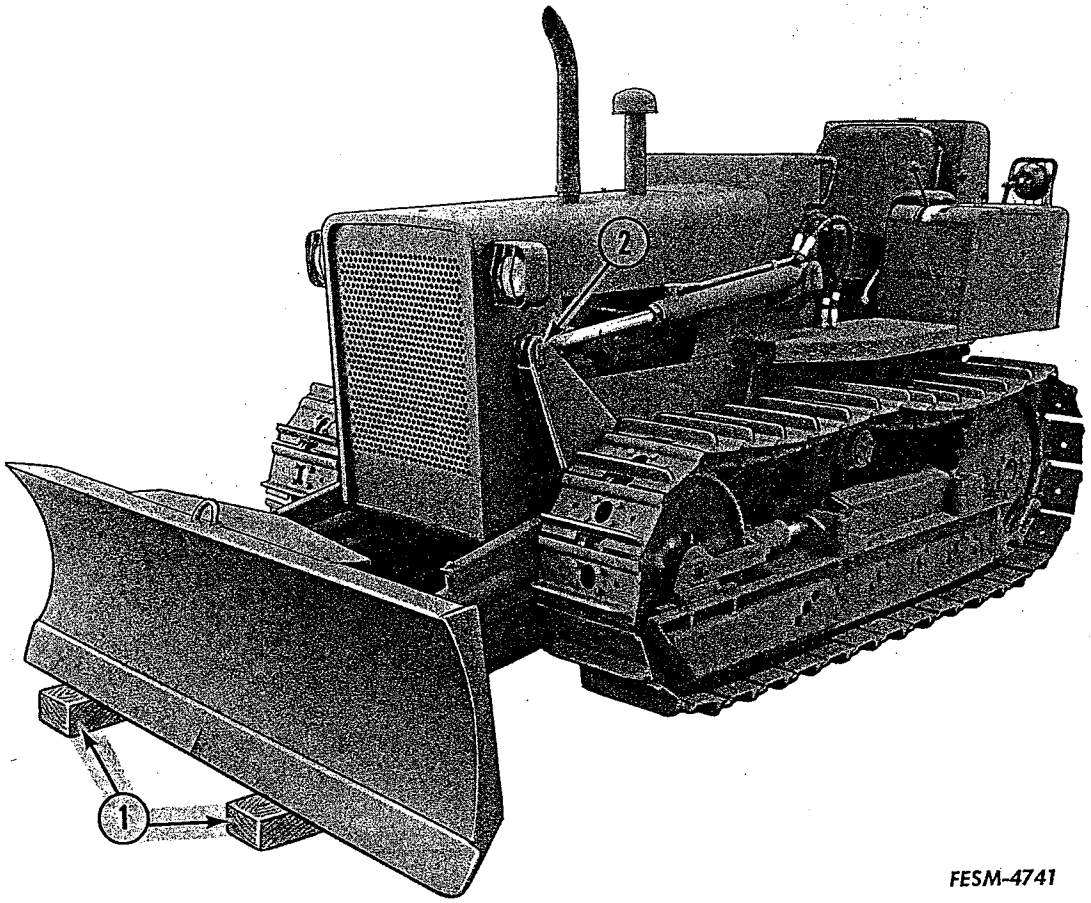
FESM-4701

6. Loosen the rear gauge bar clamps, and disconnect the final drive stop bar from the track frame.

7. Lift the front of the tractor chassis with a jack; and remove the front gauge bar.

1. Final drive stop bar
2. Inside stone deflector
3. Outside stone deflector
4. Gauge bar clamps

Tractors With 510 or 511 Bullgrader



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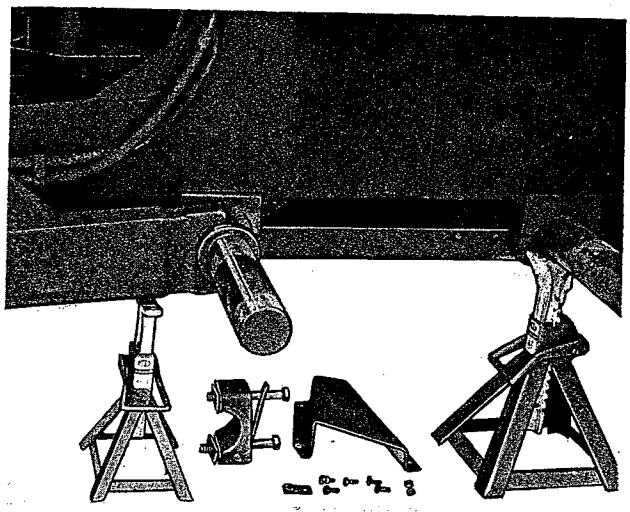
1. Wood blocks
2. Disconnect

1. Follow steps 1 through 6 under "Tractors without Forward Mounted Equipment."

2. Support the bullgrader blade and frame on blocks.



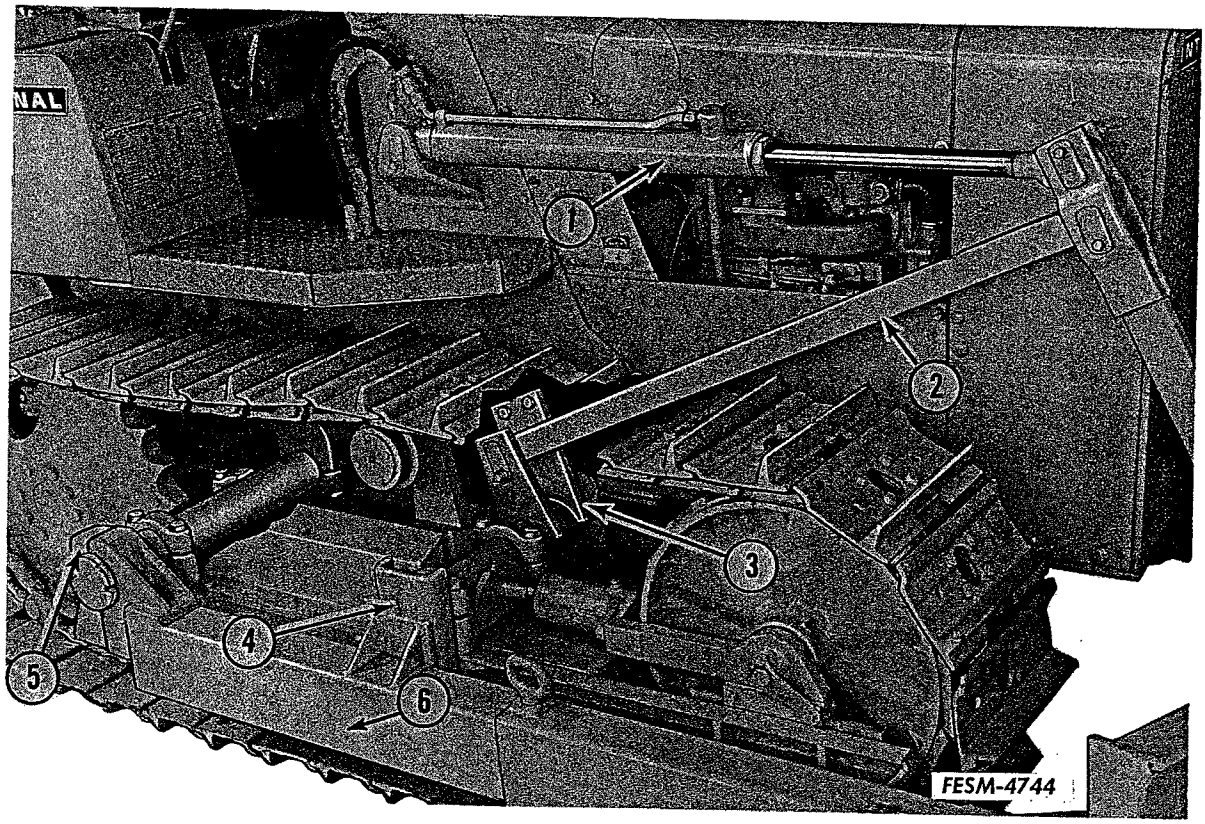
Trunnion clamp removed (L.H.).

3. Disconnect the lift cylinders at the piston rod ends; and remove the bull-grader frame trunnion clamps at the front gauge bar.

4. Carefully work the blade and frame assembly ahead just enough to clear the bar.

5. Lift the front of the tractor chassis with a jack; and remove the front gauge bar.

Tractors With 512 Bullgrader



1. Lift cylinder
2. Radius arm
3. Front gauge bar bracket
4. Scuff plate
5. C-frame trunnion clamp
6. C-frame

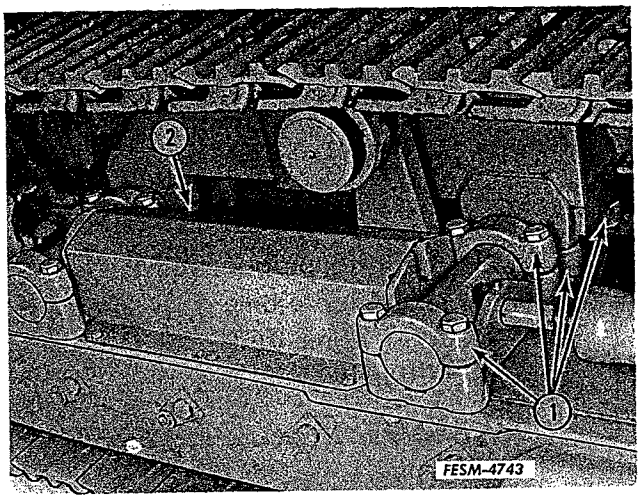
1. Support the bullgrader frame and blade on blocks.

2. Disconnect the lift cylinders at the rod ends; and the radius arms at the front gauge bar brackets.

3. Remove the bullgrader frame trunnion clamps from the rear gauge bars, and remove the bullgrader.

4. Follow steps 1 through 6 under "Tractors without Forward Mounted Equipment."

5. Use a floor jack or hoist to lift the "C" frame off the blocks that were installed in step 1. Lower the "C" frame to the floor. The "C" frame must clear the scuff plates on the ends of the front gauge bar.



1. Remove
2. Loosen

6. Roll the gauge bar until the cylinder lift radius rod bracket points forward and the scuff plates are horizontal.

7. Lift the front of the tractor chassis with a jack; and remove the front gauge bar.

Tractors With 75 Loader

1. Follow steps 1 through 6 under "Tractors without Forward Mounted Equipment."

2. Loosen the loader frame clamps at the rear gauge bar; and remove the front loader frame and gauge bar clamps.

3. Support the loader bucket on blocks; and raise the front of the tractor with a jack.

4. Remove the front gauge bar.

Installation

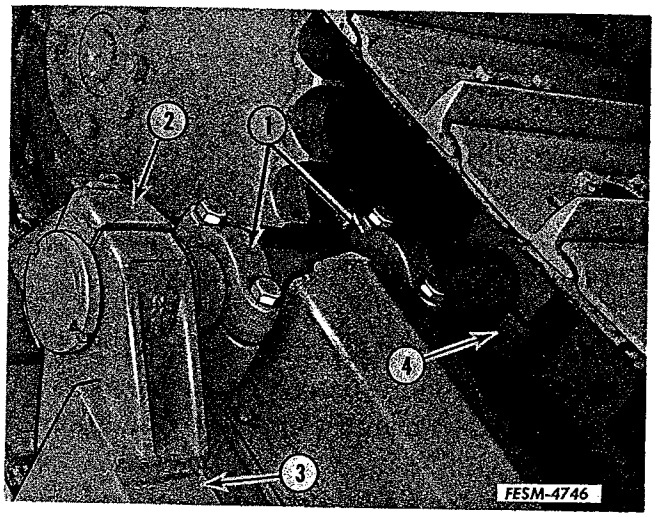
1. Thoroughly clean all mounting clamps and pads. Inspect for cracks and pulled threads on the clamp bolts.

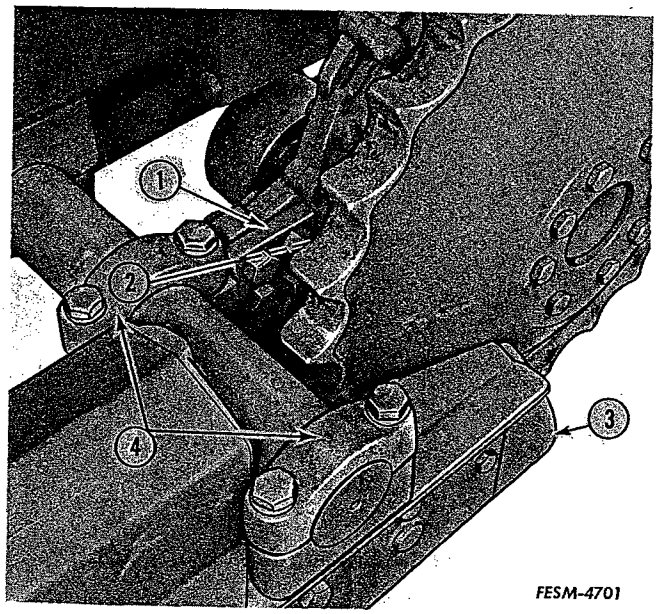
2. Reverse the removal procedure.

Rear Gauge Bars

Removal

1. Remove the transmission guard. Refer to "Crankcase and Transmission Guards" – "Removal".





2. 512 Bullgrader only: Support the bullgrader frame on blocks.

Remove the trunnion clamps at the rear gauge bars; and using a pry bar (and by moving the tractor to the rear) move the "C" frame away from the rear gauge bars.

3. Split the track chain on the side of the bar to be removed. Refer to "Track Chain" – "Removal".

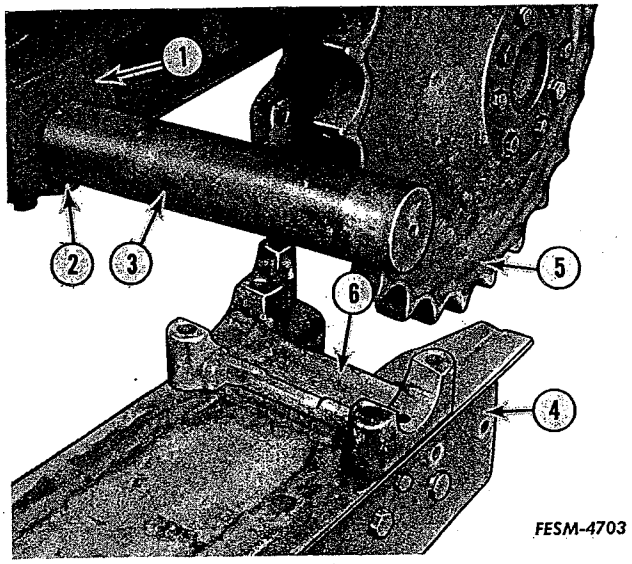
4. Remove the track adjuster bar, and the track recoil spring assembly.

5. Loosen the front gauge bar clamps at the track frame.

1. Rear gauge bar clamps
2. Trunnion clamp
3. "C" frame arm
4. Chassis clamp

6. Remove the clamps attaching the rear gauge bar to the track frame. Remove the final drive stop bar.

1. Final drive stop bar
2. Inside stone deflector
3. Outside stone deflector
4. Rear gauge bar clamps

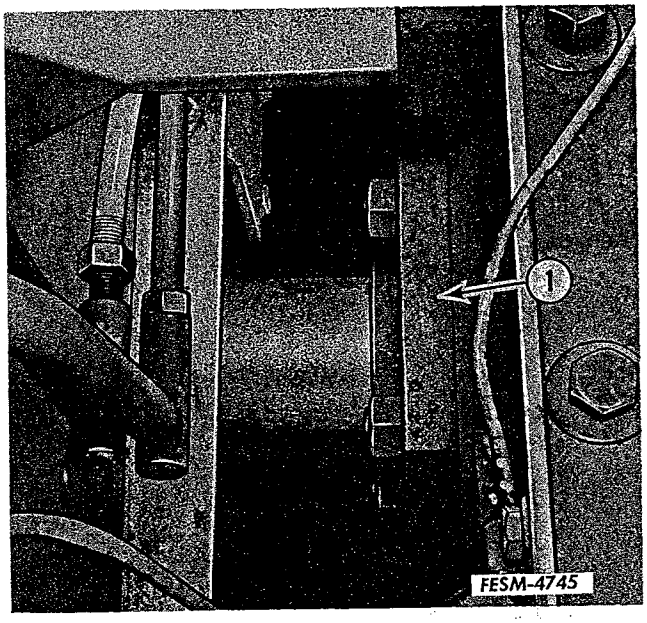


7. Remove the rear loader frame clamps.

8. Remove the clamps attaching the chassis to the rear gauge bars.

9. Using a floor jack raise the chassis enough to clear the gauge bars. Position a jack stand under the frame to support the chassis.

1. Chassis frame pad
2. Clamp
3. Rear gauge bar (LH)
4. Track frame
5. Sprocket
6. Track frame pad



10. Working through the area immediately below the operators compartment, remove the two uppermost nuts from the gauge bar bracket.

11. Remove the two lower nuts from the gauge bar bracket, from underneath the tractor.

12. Pull the gauge bar loose from the rear frame, and work it out of the area.

1. Gauge bar bracket (LH)

Installation

1. Tractors with 75 Loader: Be sure the trunnion mounting area is satisfactory.

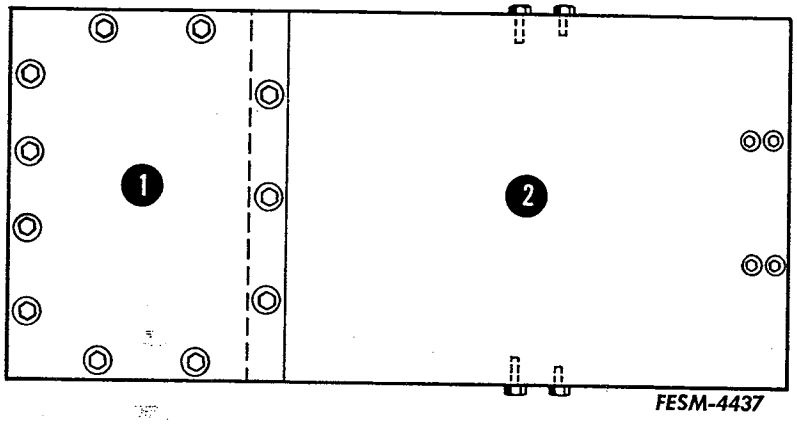
2. Check the condition of the rear gauge bar support plates and the attaching stud threads.

3. Check the bar retaining rings and grooves in the gauge bars.

4. Reverse the removal procedure.

CRANKCASE AND TRANSMISSION GUARDS

General



1. Crankcase guard
2. Transmission guard

Operational assignments of a crawler dictate that the underside of the crawler be protected. Transmission and crankcase guards are provided for this purpose.

Crankcase Guard

Removal

1. Thoroughly clean out the guard sections.

2. Remove all the capscrews except two opposites on the sides of the guard.

3. Position a rolling floor jack under the guard; and raise it up to support the guard. Then remove the two remaining capscrews.

4. Lower the jack until the guard "hangs-up" on the two installation hangers.

5. Move the guard forward and carry it out on the floor jack.

Installation

1. Slide the guard into the support hangers.

2. Use a jack to raise it into position. Align the holes with a punch.

3. Install the side capscrews loosely.

4. Remove the jack. Install the remaining capscrews finger tight. Tighten all the capscrews to standard torque.

NOTE: If the transmission guard was also removed, do not torque the crankcase guard capscrews until the transmission guard has been installed.

Transmission Guard

Removal

1. Remove the three (3) bolts attaching the crankcase guard to the transmission guard.

2. Remove one bolt from each side. (Can be reached from under track chain.) Remove one bolt from each rear corner of the guard.

3. Position a rolling floor jack under the center of the guard. Remove the remaining bolts.

4. Lower the guard and move it out from under the tractor.

Installation

1. Turn the guard over and check the crankcase drain access capscrews. Replace if necessary. If the heads are badly worn, arc weld a short bolt to each worn bolt; then remove.

2. The guard must be placed on a rolling floor jack so that the front is tilted upwards and worked under the crankcase guard.

3. Locate one bolt in each side (from under the tracks) and one at each rear corner, using a tapered punch to line up the holes.

4. Install all bolts finger tight. Tighten the bolts to standard torque. Remove the floor jack.

Section 10

ELECTRICAL

CONTENTS

Complete Overhaul and Testing information is covered in GSS-1052-C.

SPECIFICATIONS

Timing - Gasoline Engines

Ignition Timing (BTDC)

High idle $\pm$1 degree	20°
At 425 rpm (See Note)	2°

NOTE: Proper ignition timing at high idle is essential for best performance and engine life. Therefore, the distributor should be set to give the exact timing at high idle. Any variance that may exist then will occur at the low idle end of the advance curve.

DISTRIBUTOR

IH Part Number	Symbol Code	Rotation Viewing Drive End	Governor Spring Package Number	Point Opening (Inch)	Centrifugal Advance			
					Start		Maximum	
					Rpm	Degrees	Rpm	Degrees
405 814 R91	BC	C	380 626 R91	.020	425	2	2700	20

BATTERY*

IH Part Number	Prestolite Number	Capacity Ratings (Minimum)		
		Ampere Hours 20 Hour Rate	Starting Ability 150 Amps. @ 0°F.	
			Minutes Run	5 Second Voltage
—	2431X	61	5.5	9.5
—	4907X	155	6.4	9.5**
—	1258X	138	5.4	4.7

* Fully charged Specific Gravity - 1.255-1.270 @ 80°F.
** 30 Sec. Volts.

ALTERNATOR

Delco-Remy Number	Ground	Rotation Viewing Drive End	Field Current 80°F		Cold Output At Specified Voltage					Rated Hot Output (Amps)
			Amps	Volts	Volts	Amps	Approx. Rpm	Amps	Approx. Rpm	
1 100 805	N	Either	2.2-2.6	12	14	21	2000	30	5000	32

AC REGULATOR

(Double Contact Voltage Regulator Used with Alternator)

Delco-Remy Number	Ground	Voltage Regulator
		Voltage Setting *
1 119 513	N	13.8-14.8

* At 85°F ambient temp.

CRANKING-MOTOR

Delco-Remy Model Number	Rotation Viewing Drive End	No Load Test				
		Volts	Amps		Rpm	
			Min.	Max.	Min.	Max.
1 107 290	C	10.6	49 ①	76 ①	6200	9400
1 107 867	C	9	40 ①	140 ①	8000	13000

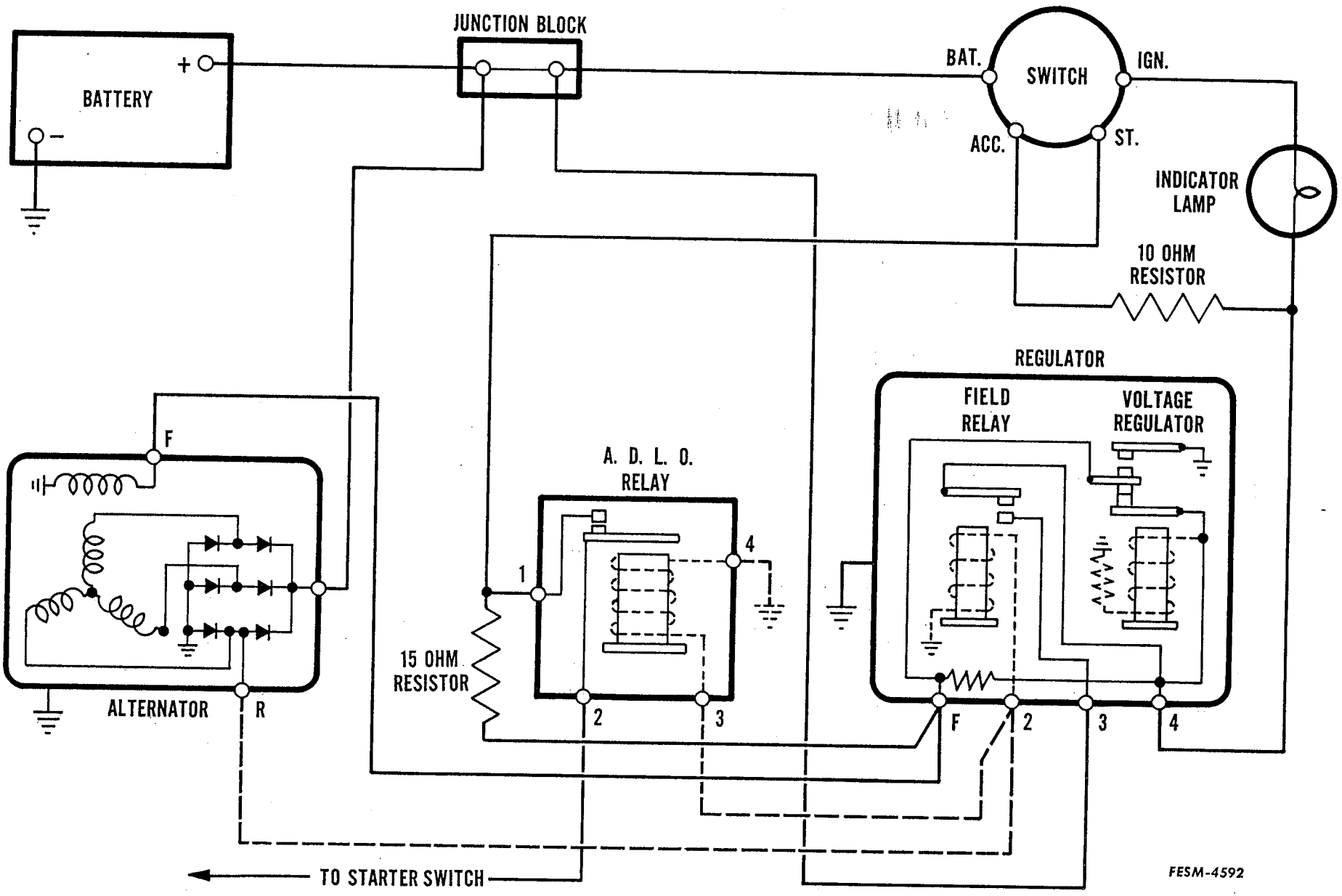
① Includes Solenoid.

CRANKING-MOTOR SWITCH

Delco-Remy Number	Type	Current Draw Pull-In Winding		Current Draw-Hold In Winding Only	
		Volts	Amps	Volts	Amps
1 114 356	Solenoid	5	13-15.5	10	14.5-16.5

A.D.L.O. (Automatic Disconnect Lock-Out Relay)

Delco-Remy Number	Point Opening	Opening Voltage
1 970 166	.017-.033	3.7-5.2


JUNCTION BLOCK
BATTERY
+
–
BAT.
SWITCH
IGN.
ACC.
ST.
INDICATOR LAMP
10 OHM RESISTOR
REGULATOR
FIELD RELAY
VOLTAGE REGULATOR
A. D. L. O. RELAY
F
ALTERNATOR
R
15 OHM RESISTOR
1
2
3
4
F
2
3
4
TO STARTER SWITCH
FESM-4592

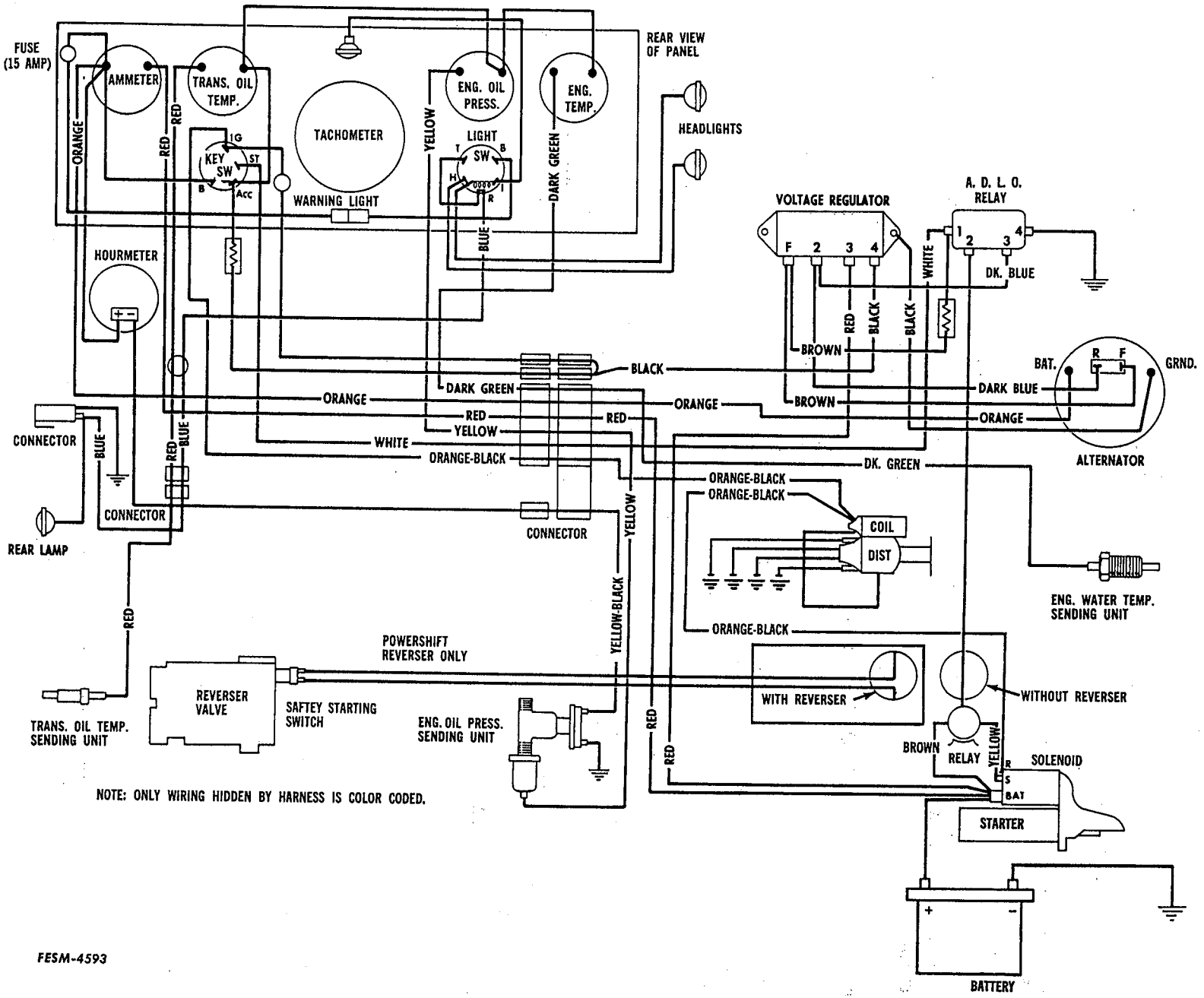
AUTOMATIC DISCONNECT LOCK OUT RELAY

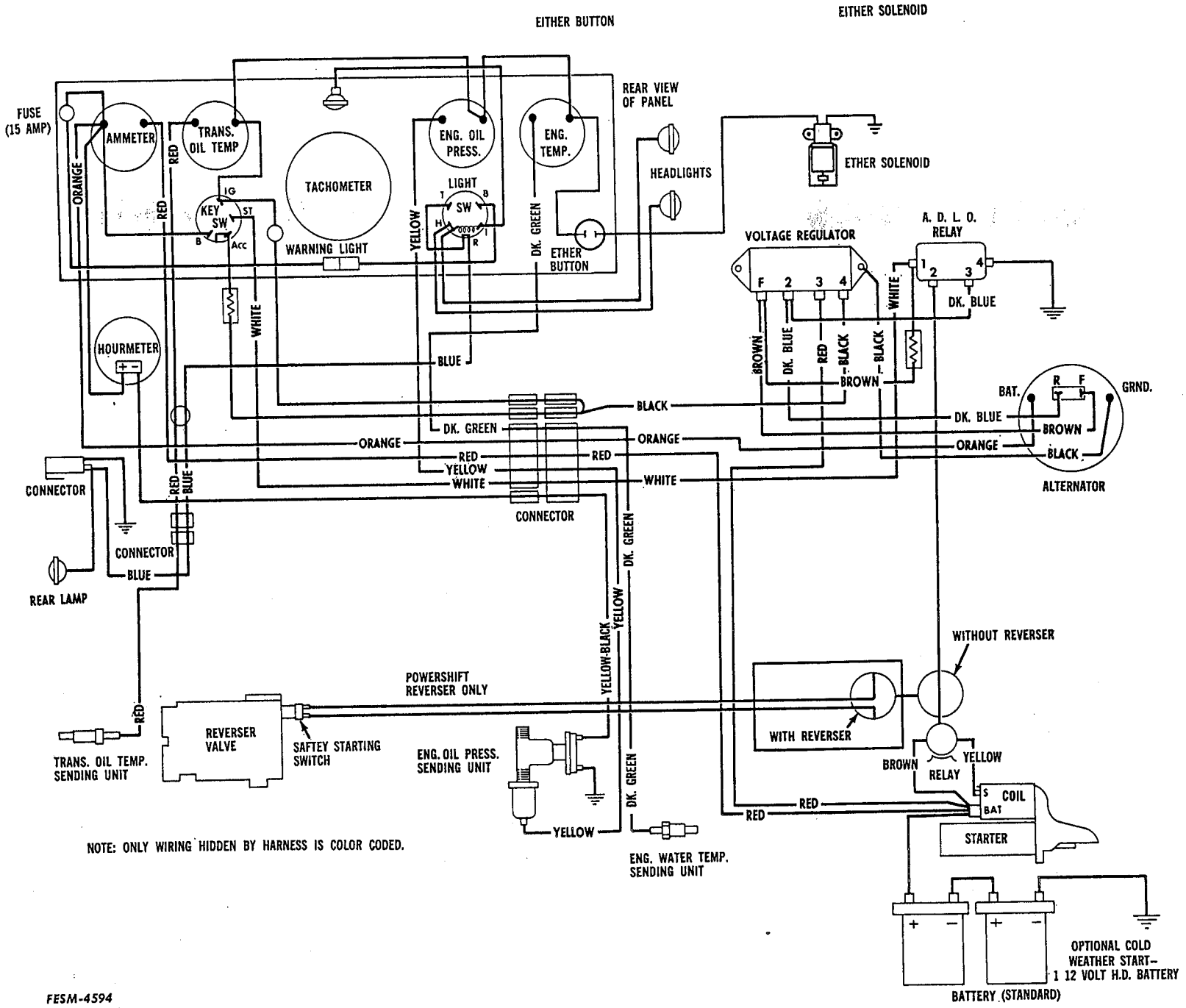
The charging system on the 500C Crawler Tractor is slightly different from that of other A.C. charging systems in that a relay has been added. This A.D.L.O. relay (automatic disconnect lock out) is wired into the circuit as shown in the diagram. The purpose of this relay and the 15 ohm resistor is to prevent the cranking motor from becoming engaged while the engine is running.

It can be seen from the diagram that the A.D.L.O. relay is composed of a set of points and a voltage coil to open the points. A wire from the ST. terminal of the switch to the No. 1 terminal on the relay permits current to flow across the points in the relay and on to the starter switch through the wire connected at terminal 2. A wire between terminal 2 of the voltage regulator and terminal 3 of the relay permits voltage to be impressed on the voltage coil in the relay. When this voltage reaches a high enough point (about 4 volts) the points in the relay separate and prevent current flow to the starter switch. Since the voltage coil in the relay is not grounded internally it is necessary to attach a ground wire to terminal 4 of the relay.

You will note in the diagram that the 15 ohm resistor is connected between the ST. terminal of the switch and the F terminal of the voltage regulator. The regular 10 ohm resistor is connected between the accessory terminal on the switch and the #4 terminal on the voltage regulator.

Since the accessory terminal is not energized in the start position of the switch the 10 ohm resistor is out of the circuit. The 15 ohm resistor replaces the 10 ohm resistor for starting and weakens the field in the alternator sufficiently to prevent the A.D.L.O. relay from stopping the cranking motor before the engine has started.


FUSE (15 AMP)
AMMETER
TRANS. OIL TEMP.
TACHOMETER
ENG. OIL PRESS.
ENG. TEMP.
REAR VIEW OF PANEL
HEADLIGHTS
LIGHT SW
KEY SW
IG
ST
B
Acc
WARNING LIGHT
HOURMETER
VOLTAGE REGULATOR
A. D. L. O. RELAY
DK. BLUE
BAT.
GRND.
ALTERNATOR
CONNECTOR
REAR LAMP
CONNECTOR
CONNECTOR
COIL
DIST
ENG. WATER TEMP. SENDING UNIT
POWERSHIFT REVERSER ONLY
REVERSER VALVE
SAFTEY STARTING SWITCH
TRANS. OIL TEMP. SENDING UNIT
ENG. OIL PRESS. SENDING UNIT
WITH REVERSER
WITHOUT REVERSER
RELAY
SOLENOID
STARTER
BATTERY
BLACK
DARK GREEN
ORANGE
RED
YELLOW
WHITE
ORANGE-BLACK
DK. GREEN
BROWN
DARK BLUE
YELLOW-BLACK
BLUE
NOTE: ONLY WIRING HIDDEN BY HARNESS IS COLOR CODED.
FESM-4593


EITHER BUTTON
EITHER SOLENOID
FUSE (15 AMP)
AMMETER
TRANS. OIL TEMP
TACHOMETER
ENG. OIL PRESS.
ENG. TEMP.
REAR VIEW OF PANEL
HEADLIGHTS
ETHER SOLENOID
LIGHT
KEY SW
WARNING LIGHT
ETHER BUTTON
VOLTAGE REGULATOR
A. D. L. O. RELAY
HOURMETER
ORANGE
RED
WHITE
YELLOW
BLUE
DK. GREEN
BLACK
BROWN
DK. BLUE
CONNECTOR
REAR LAMP
BAT.
GRND.
ALTERNATOR
YELLOW-BLACK
POWERSHIFT REVERSER ONLY
WITHOUT REVERSER
WITH REVERSER
REVERSER VALVE
SAFTEY STARTING SWITCH
TRANS. OIL TEMP. SENDING UNIT
ENG. OIL PRESS. SENDING UNIT
ENG. WATER TEMP. SENDING UNIT
RELAY
COIL
STARTER
OPTIONAL COLD WEATHER START– 1 12 VOLT H.D. BATTERY
BATTERY (STANDARD)
NOTE: ONLY WIRING HIDDEN BY HARNESS IS COLOR CODED.
FESM-4594

Section 11

HYDRAULICS AND HITCH

CONTENTS

SPECIFICATIONS

System type ..... Closed
Operating temperature (degrees fahrenheit) 120-180
Fluid ..... IH Hy-Tran
Reservoir
  Capacity (U.S. gallons) 5-3/8
  Pressure relief valve opening pressure (psi) 5-7
Filter
  Type ..... Paper cartridge
  Location ..... Reservoir
  Bypass valve opening pressure (psi differential) 10

Hydraulic Pump Flow

Flo-Rater Test (Fluid at 150° F. Set engine at no load RPM †. Then set pressure**)

Pump Size	†Engine RPM No Load	**Pressure PSI	Flow* GPM	Engine RPM at Test Load
17 GPM	2700	0	21.7	2700
	2700	1500	19.0	2650
	2500	0	19.0	2500
	2500	1500	17.5	2450
12 GPM	2700	0	15.5	2700
	2700	1500	13.5	2650
	2500	0	14.6	2700
	2500	1500	12.3	2450
27 GPM Dual Pump				
17 GPM	2750	0	19.0	2750
	2750	1500	18.5	2700
	2500	0	17.5	2500
	2500	1500	17.0	2450
10 GPM	2750	0	12.5	2750
	2750	1500	12.0	2660
	2500	0	11.5	2500
	2500	1500	11.0	2460

*5% error permitted.

Bench Test (Using IH Hy-Tran Fluid at 100°F)

Pump Size	Pump RPM	Pressure - PSI	Flow - GPM*
17 GPM	2750 2500	2000 2000	18.7 17.0
12 GPM	2750 2500	2000 2000	13.2 12.0
27 GPM Dual Pump			
17 GPM	2750 2500	2000 2000	18.7 17.9
10 GPM	2750 2500	2000 2000	11.0 11.3

*5% error permitted.

Control valves

- Manufacture ..... Gresen
- Model ..... CP
- Type ..... Sectional-open center
- System relief valve opening pressure (psi) 2000
- Circuit relief valve opening pressure (psi)
  - Gresen valve ..... Stamped on valve assembly
  - Drott single cylinder 2200

Control Valve Application

Cylinder	Valve	Port A	Port B
Bullgrader			
Lift	4-position 4-way	Check valve	Check valve
Tilt	3-position 4-way	Check valve	Check valve
Angle	3-position 4-way	3000 lb. circuit relief valve	3000 lb. circuit relief valve
Loader			
Lift	4-position 4-way	3000 lb. circuit relief valve	Anti-cavitation valve
Bucket	3-position 4-way	3000 lb. circuit relief valve	2500 lb. circuit relief valve
Drott 4 in 1 Bucket Clam			
Single Cylinder *			
Below S.N. 2093	3-position 4-way	2500 lb. circuit relief valve	Check valve
Above S.N. 2093	3-position 4-way	Check valve	2500 lb. circuit relief valve
Dual Cylinder			
Below S.N. 2048	3-position 4-way	2500 lb. circuit relief valve	Check valve
Above S.N. 2048	3-position 4-way	Check valve	2500 lb. circuit relief valve
Hitch *	4-position 3-way	Plug	Check valve
Remote Control - Factory Installation			
Alone	4-position 4-way	Check valve	Check valve
With Hitch	4-position 4-way	Check valve	Check valve
With Bullgrader	3-position 4-way	2500 lb. circuit relief valve	Check valve
With Loader	3-position 4-way	2500 lb. circuit relief valve	Check valve
Remote Control - Field Installation	As required	As required	As required

*Additional circuit relief valves are located in the hitch cylinder piston (thermo-relief) and early model Drott single cylinder.

Cylinder Specifications

Cylinder	Cylinder I.D.-Inches	Cylinder Stroke Inches
Bullgrader		
Lift	2.50	19.50
Tilt	3.00	5.10
Angle	3.00	13.50
Loader		
Lift	3.50	26.10
Bucket	2.50	17.45
Drott Clam		
Single Cylinder	3.50	9.70
Dual Cylinder	2.75	9.80

Spring Specifications

Spring	Free Length Inches	Test Length Inches	Test Load Lb.
Pump drive clutch	8.06	1.25	24.5
3 position-4 way valve spool	.733	7/16	40
4 position-4 way valve spool	2-11/16	1-3/16	50 $\pm$3
4 position-3 way valve spool	15/16	22/32	13-1/2
Hitch-Thermo relief valve	11/16	1/2	12-1/2
Hitch-depth control	9-5/16	9*	1540

* Length when installed.

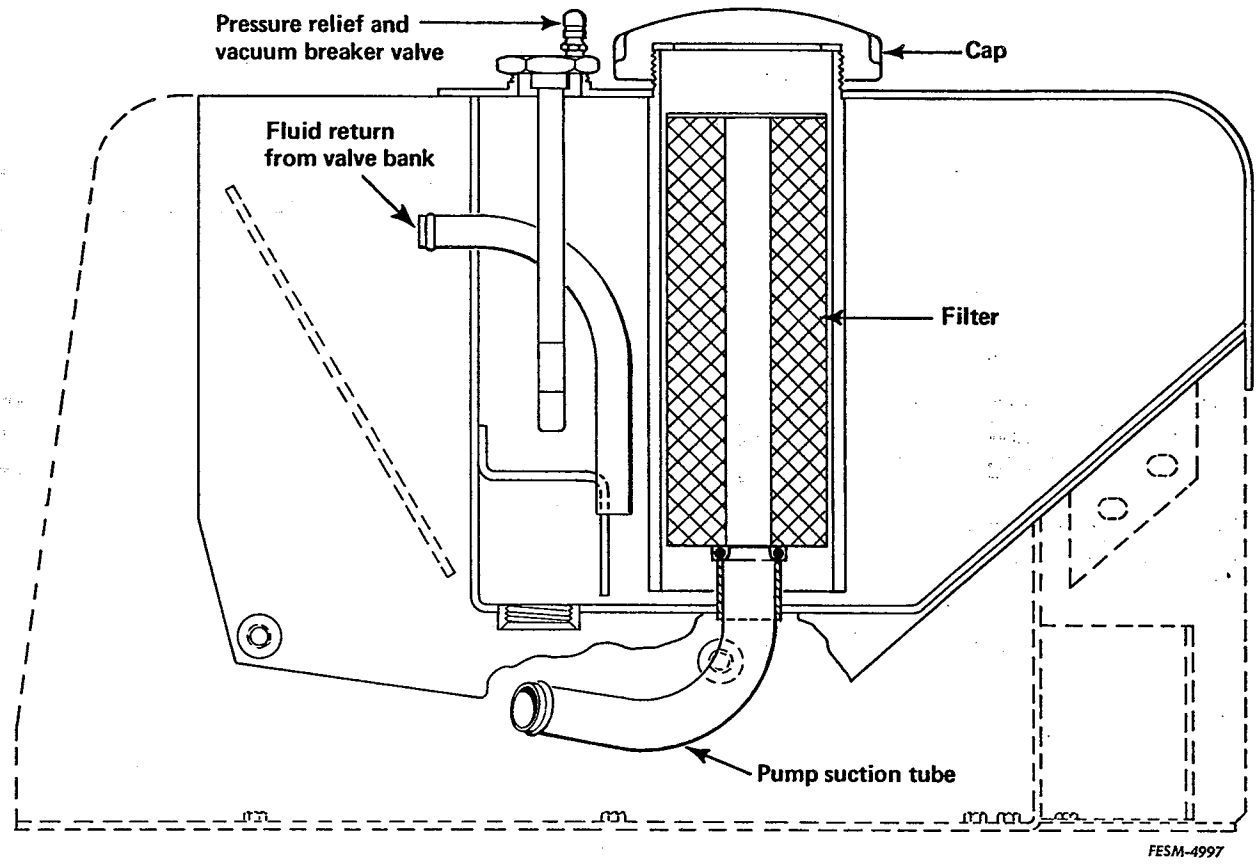
Special Torques

	Ft. lb.
System relief valve	30
Control valve port option assemblies	30
Valve bank studs	20
Cylinder piston rod nuts	
IH	
2-1/2 inch I.D. cylinder	380
3 inch I.D. cylinder	380
3-1/2 inch I.D. cylinder	475
Drott clam and grapple cylinders	782

GENERAL DESCRIPTION

The hydraulic system is a closed type, open center system, which supplies fluid under pressure to operate tractor mounted equipment.

Reservoir



The hydraulic fluid reservoir, located in the RH console, supplies fluid to the pump; and receives by-passed pump flow and fluid returned from mounted equipment cylinders.

The reservoir capacity is approximately 5 gallons. The reservoir houses the hydraulic filter. A combination pressure relief and vacuum breaker valve, mounted on the refill plug, maintains fluid pressure within the reservoir at 5 to 7 psi, to provide a positive return line pressure to the pump(s).

CAUTION: When checking fluid level or servicing the filter, remove the filler plug slowly, to allow air under pressure to escape from the reservoir.

Filter

A suction type paper filter element of the by-pass design is located under a special cap on top of the hydraulic fluid reservoir. Refer to the operator's manual for service procedure.

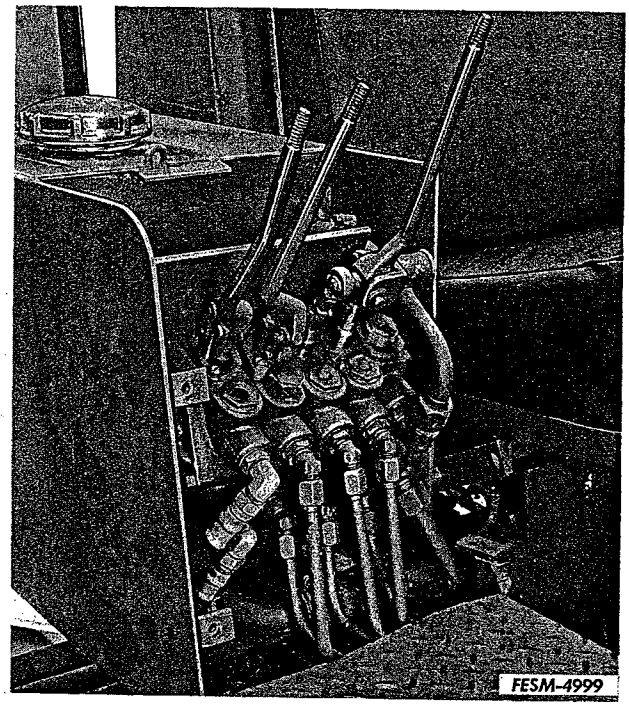
Pump

The hydraulic pump assembly is driven by the engine crankshaft. Three pump options are available:

1. 12 gpm - tractors with bullgraders
2. 17 gpm - tractors with loaders
3. 27 gpm - tractors with backhoes

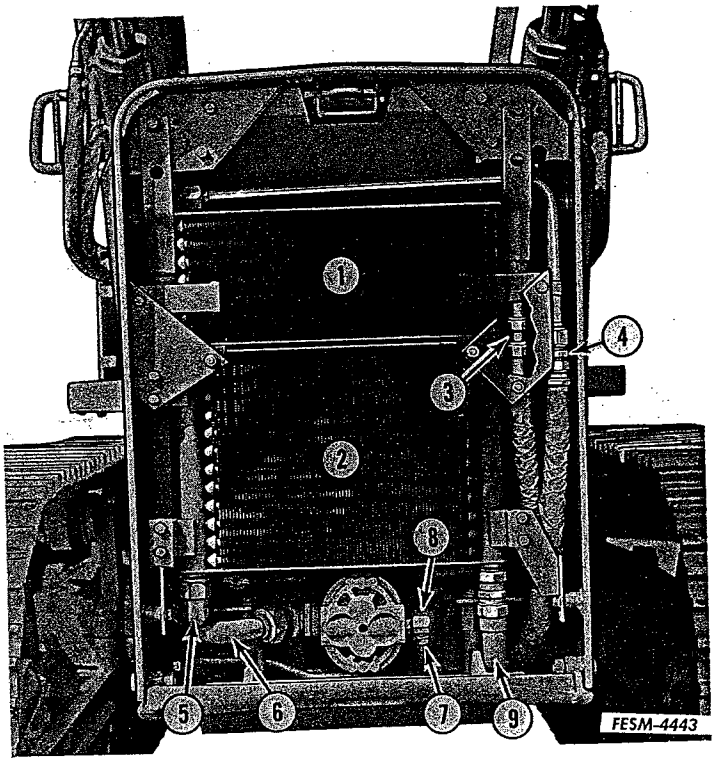
1. Pump
2. Clutch assembly

Valves



The control valves are open center design, and mounted in the RH console. Tractors equipped with a backhoe, use a power beyond feature.

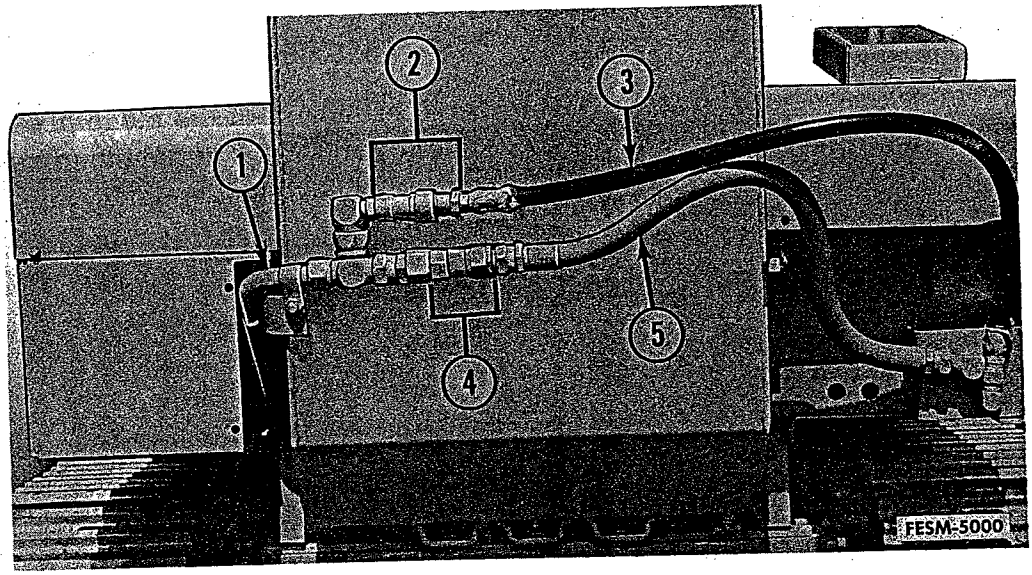
Oil Coolers



There are three cooler configurations all of the "oil to air" design.

1. Power shift cooler
2. Power shift w/torque converter cooler
3. Power shift and equipment coolers (two separate coolers)

1. Transmission cooler
2. Equipment hydraulic cooler
3. Transmission cooler-in
4. Transmission cooler-out
5. Equipment cooler-out
6. Pump suction
7. 10-gpm pump-out
8. 17-gpm pump-out
9. Equipment cooler-in

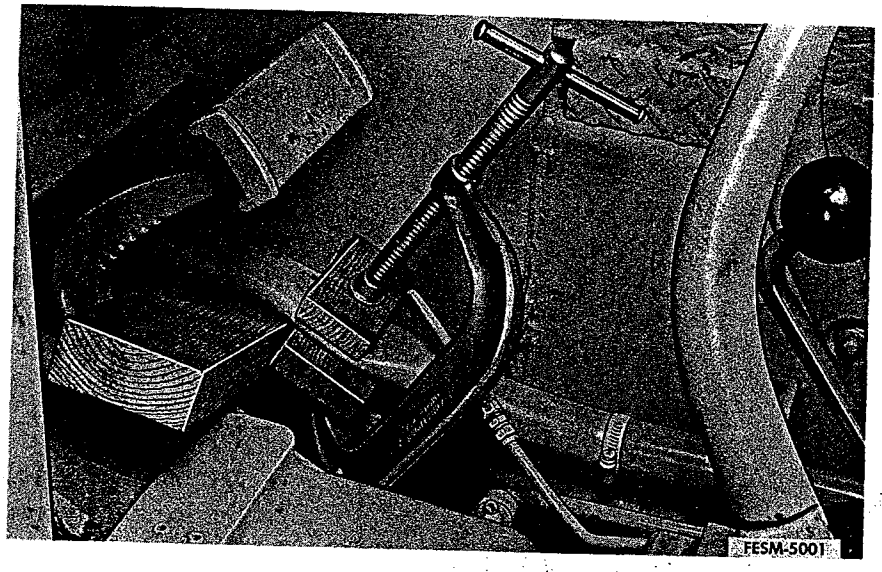


Backhoe hydraulic lines. Backhoe removed.

1. Return line - to oil cooler
2. Quick coupler
3. 10-gpm line
4. Quick coupler
5. 17-gpm line

PUMP

Removal



Suction hose clamped.

1. Raise the front of the tractor at least six inches; then lower the bullgrader or loader onto a block. Block the tracks.

2. Remove the deck plates from the operators compartment; and clamp the pump suction line to prevent fluid loss when the hydraulic suction line is disconnected.

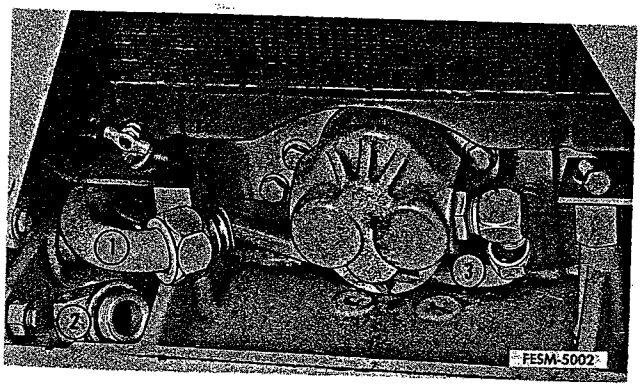
3. Remove the radiator grill assembly and the engine guard panels on each side of the engine.

4. Disconnect the pump suction line at the pump; and drain the line. Seal the connections.

5. Loosen the pump pressure line(s) but do not remove them.

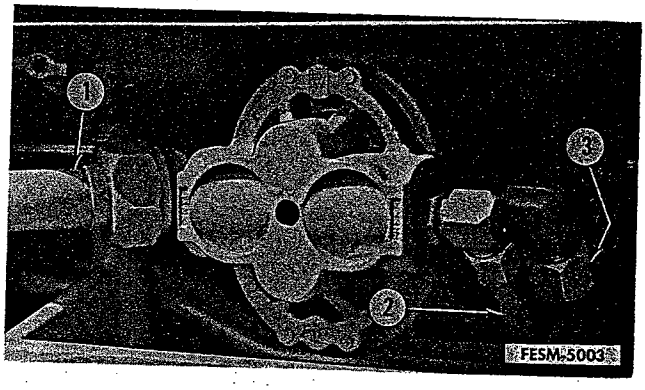
6. Remove the pump mounting bolts. Remove the pump suction port elbow if necessary to remove the bolts.

7. Disconnect the pump pressure line(s); and remove the pump assembly with shaft extension, spring, and clutch.



Single element pump.

1. Suction line
2. Suction port elbow removed
3. Pressure line



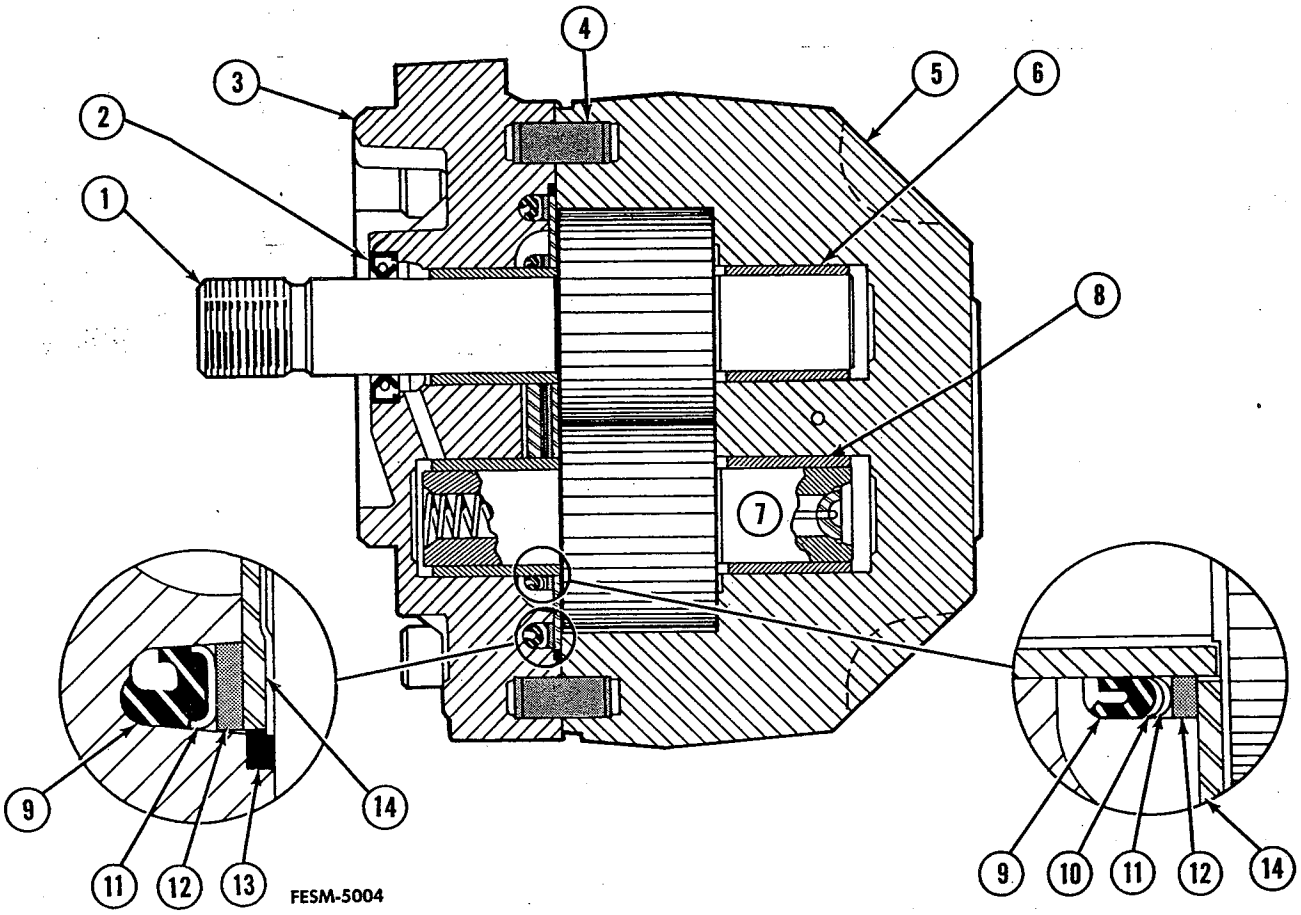
Tandem or dual element pump.

1. Suction line
2. Pressure line (10-gpm)
3. Pressure line (17-gpm)

Service

Hydraulic pump service is limited to replacement of seals and gaskets. Refer to the parts catalog for ordering information.

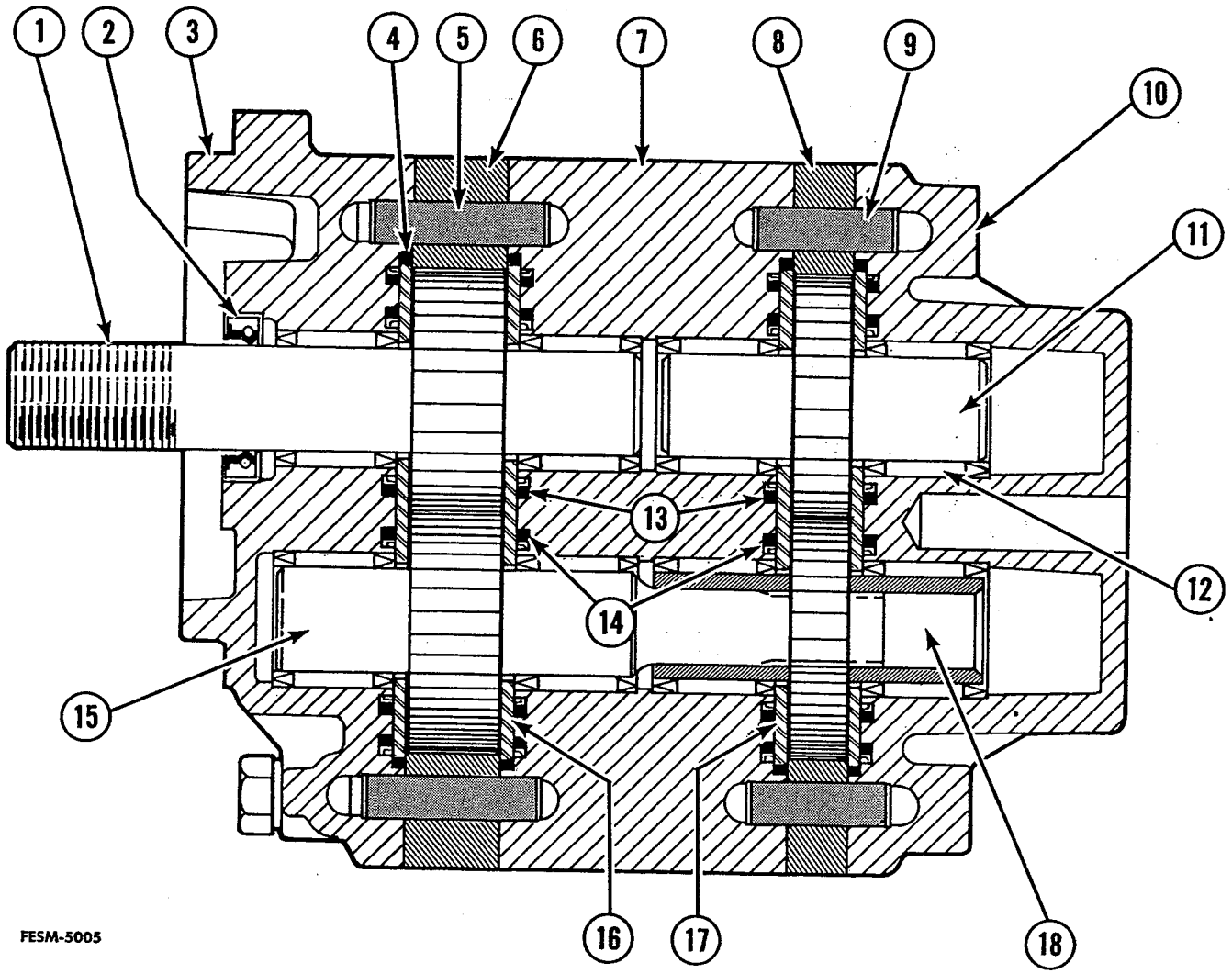
Pumps which fail the test procedure, or experience repeated failure of the pump shaft seal, should be replaced.



Single element pump.

1. Drive shaft and gear
2. Shaft seal *
3. Cover
4. Dowel pin (2)
5. Body
6. Bearing (2)
7. Driven shaft and gear
8. Bearing (2)
9. Sealing web *
10. Paper backing web *
11. Paper backing web *
12. Phenolic backing web *
13. O-ring *
14. Pressure plate *

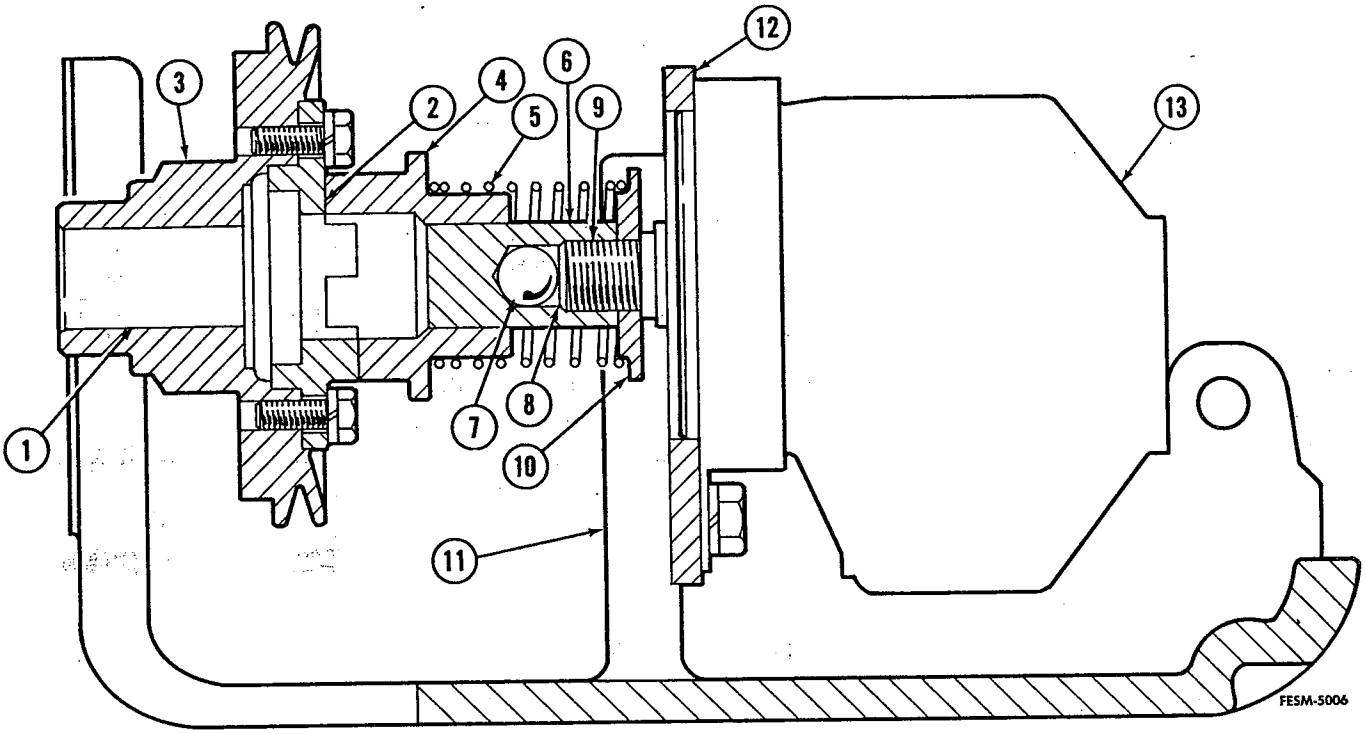
* Serviceable part



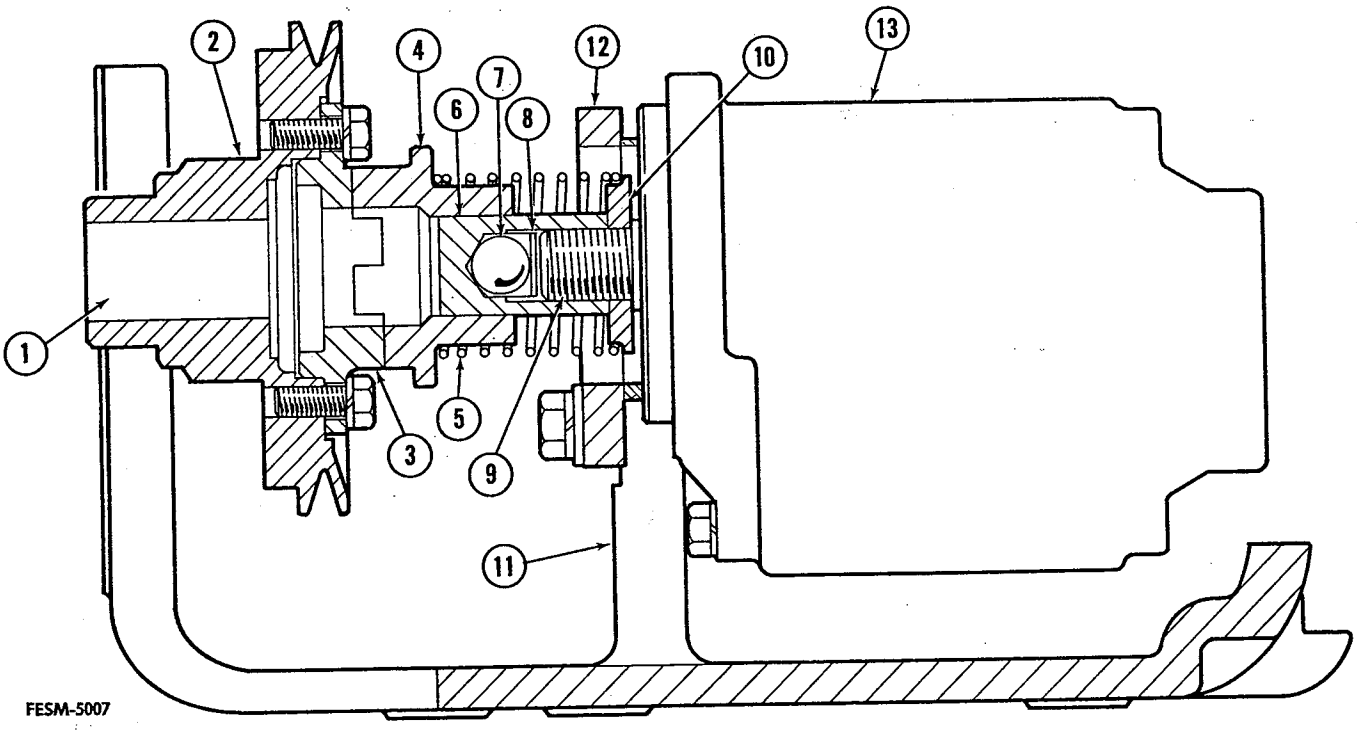
Tandem or dual element pump.

1. Drive shaft and gear (17-gpm)
2. Drive shaft seal *
3. Pump body
4. Sealing ring (4)*
5. Dowel pin (2)
6. Gear plate (17-gpm)
7. Bearing plate
8. Gear plate (10-gpm)
9. Dowel pin (2)
10. Cover
11. Idler shaft and gear
12. Needle bearing
13. Retaining seal (4)*
14. Back up ring (4)
15. Drive shaft and gear (17-gpm)
16. Wear plate (2)
17. Wear plate (2)
18. Drive gear (10-gpm)

*Pump is non-service with exception of seals.



Single element pump drive.



Tandem or dual element pump drive.

1. Crank shaft
2. Pulley
3. Clutch - front half
4. Clutch - rear half
5. Spring
6. Pump shaft extension
7. Spacer ball
8. Ball spacer
9. Pump drive shaft
10. Spring back up nut
11. Front bolster
12. Pump mounting bar
13. Pump assembly

1. Check the pump drive shaft extension for tightness on the shaft.

2. Inspect the extension and front clutch driving area for excessive wear.

3. Check the clutch spring free length and load at test length. The spring should measure 8.06 inches, and tension should measure 24.5 lbs. at 1.25 inches test length.

4. Check the front and rear clutch dogs for excessive wear.

5. Check pump mounting bar capscrew torque. Torque should measure 85 ft. lbs.

6. Replace worn and damaged pump drive parts.

7. If the hydraulic fluid is contaminated as a result of pump failure, remove the reservoir; and clean the interior using steam. Dry the reservoir with air.

Installation

Reverse the removal procedure, paying particular attention to the following steps:

1. Remove rust from the pump drive shaft extension and front clutch extension drive area. Then coat the surfaces with IH Never-Seeze.

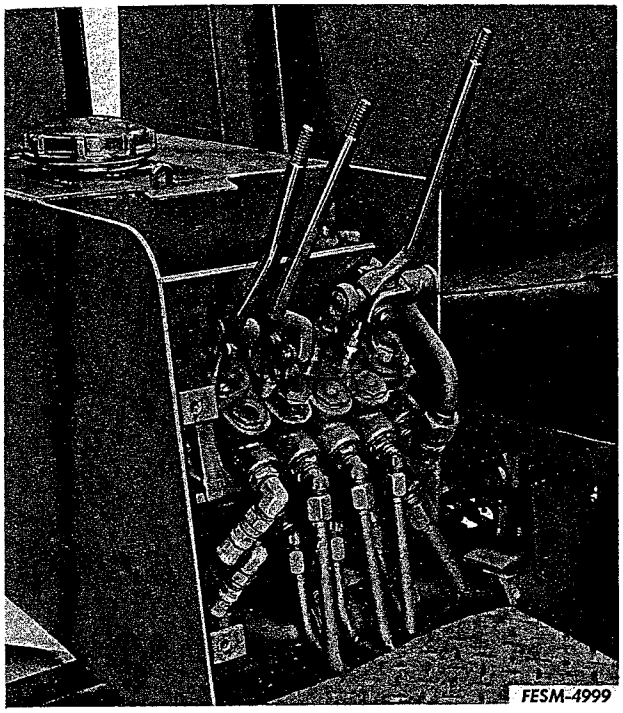
2. When the pump has been installed, and the fluid lines have been connected, fill the reservoir with approximately 5 gallons of IH Hy-Tran fluid. Then loosen the suction line at the pump, bleed air from the line, and retighten the suction line connection.

NOTE: It is recommended that the filter and fluid be replaced whenever the hydraulic system is serviced.

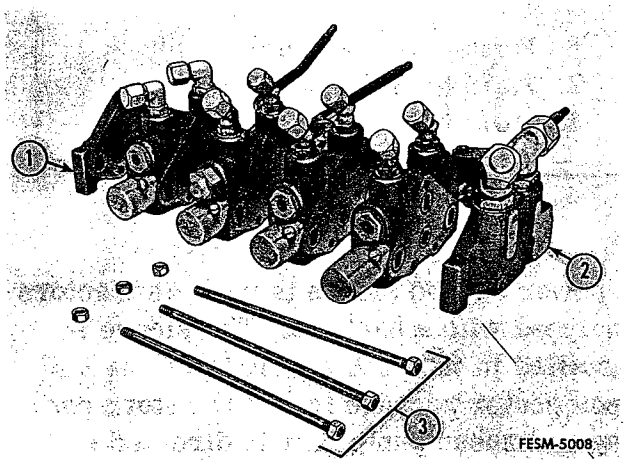
3. Check the fluid level in the reservoir. Add fluid if necessary.

CONTROL VALVES

General Description

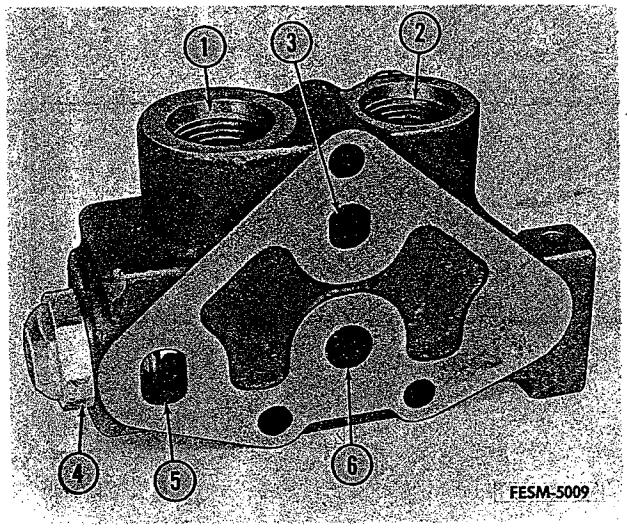


Open center type hydraulic valves, are mounted side by side between two end covers, forming a valve "bank" in the RH console.



One to four valves are used to satisfy the requirements of mounted equipment. O-ring seals are used between each valve assembly and end covers. Three valve bank studs retain the valve bank.

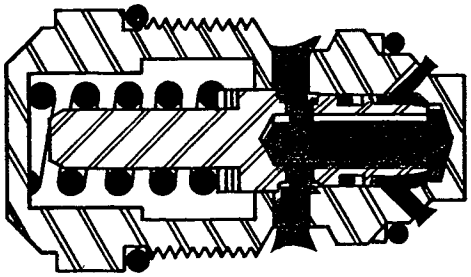
1. R.H. cover
2. L.H. cover
3. Studs



L.H. Cover

The left hand cover directs fluid from the pump to the open center and pressure passages in the valve bank, and directs fluid from the valve return passages to the reservoir.

1. Fluid out - to reservoir
2. Fluid in - from pump
3. Fluid to pressure passage
4. Main or system relief valve
5. Return passage
6. Open center passage



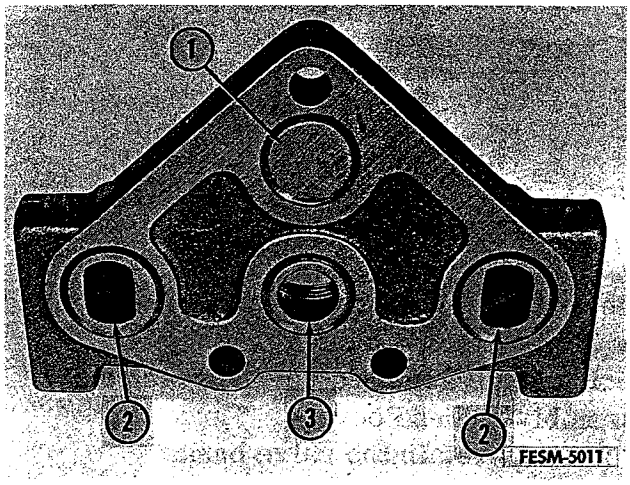
FESM-5010

Main or system relief valve.

The system relief valve limits pump pressure to 2000 psi.

Pump pressure

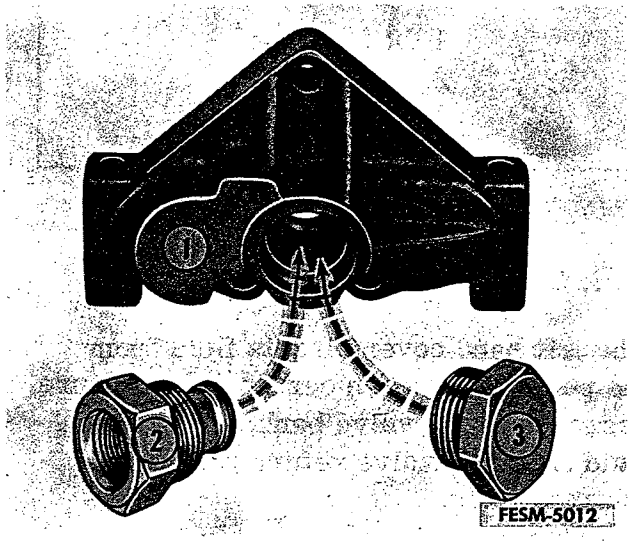
Return fluid



R.H. Cover

The right hand cover directs fluid from the open center passage in the valve bank to the return passage, and seals the pressure passage.

1. Pressure passage seal
2. Fluid to return passage
3. Fluid from open center passage

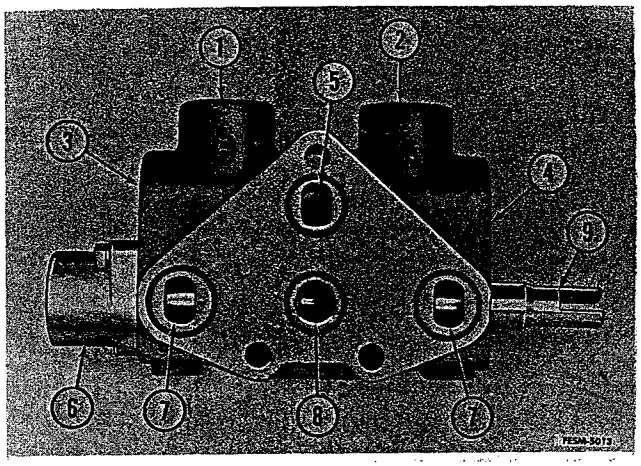


A power beyond sleeve is used on tractors equipped with a backhoe. The sleeve is installed in the R.H. cover, isolating the open center passage from the return passage. Unused pump flow is directed to the backhoe valves.

1. Sleeve
   or
2. Plug

Basic Control Valves

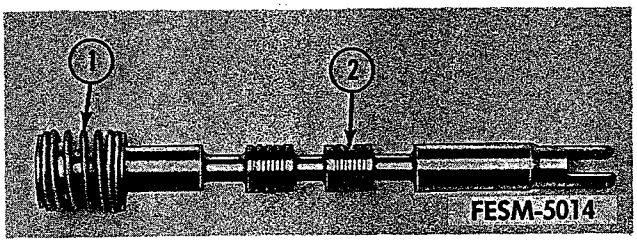
Three basic control valves are used. The basic valves vary only in spool design. Spools are not interchangeable and the body and spool are a matched set.



1. Cylinder port B
2. Cylinder port A
3. Valve port B
4. Valve port A
5. Pressure passage
6. Bonnett
7. Return passage (2)
8. Open center passage
9. Spool

3-position 4-way

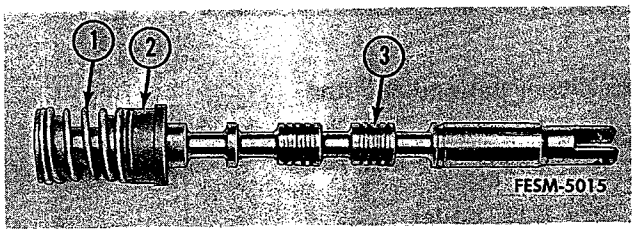
The 3-position 4-way valve is used to control double action cylinders when a float position is not desired. The standard centering spring is used to center the spool in the hold position.



1. Spool
2. Centering spring

4-position 4-way

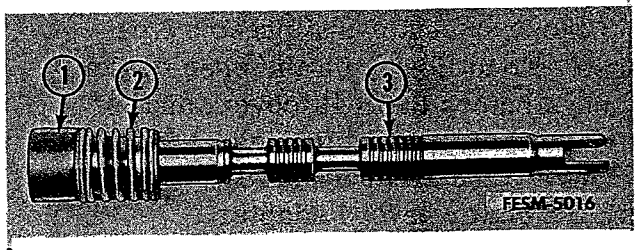
The 4-position 4-way valve is used to control double action cylinders when a float position is desired. A detent mechanism is used to allow the spool to be "locked" in the float position.



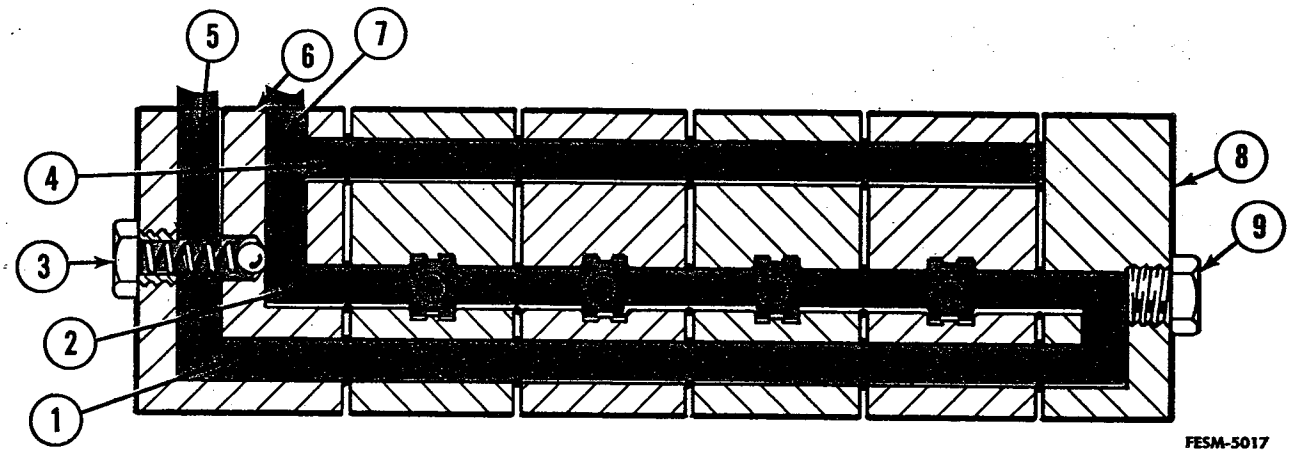
1. Centering spring
2. Detent mechanism
3. Spool

4-position 3-way

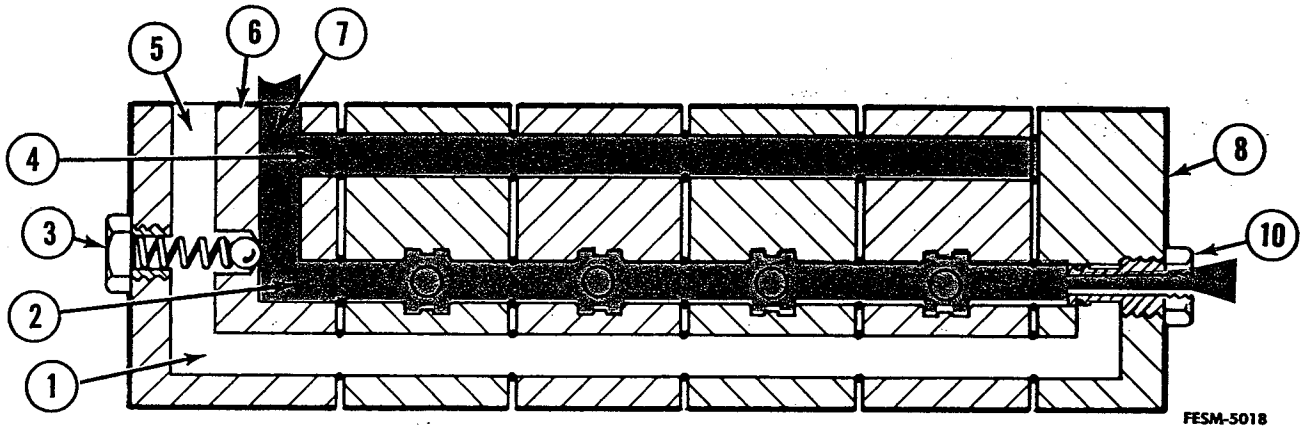
The 4-position 3-way valve is used to control single action cylinders. A detent mechanism is used to allow the spool to be "locked" in the lower or float position.



1. Detent mechanism
2. Centering spring
3. Spool



Free Flow — 4 Section valve bank without power beyond adapter



Free Flow — 4 Section valve bank with power beyond adapter

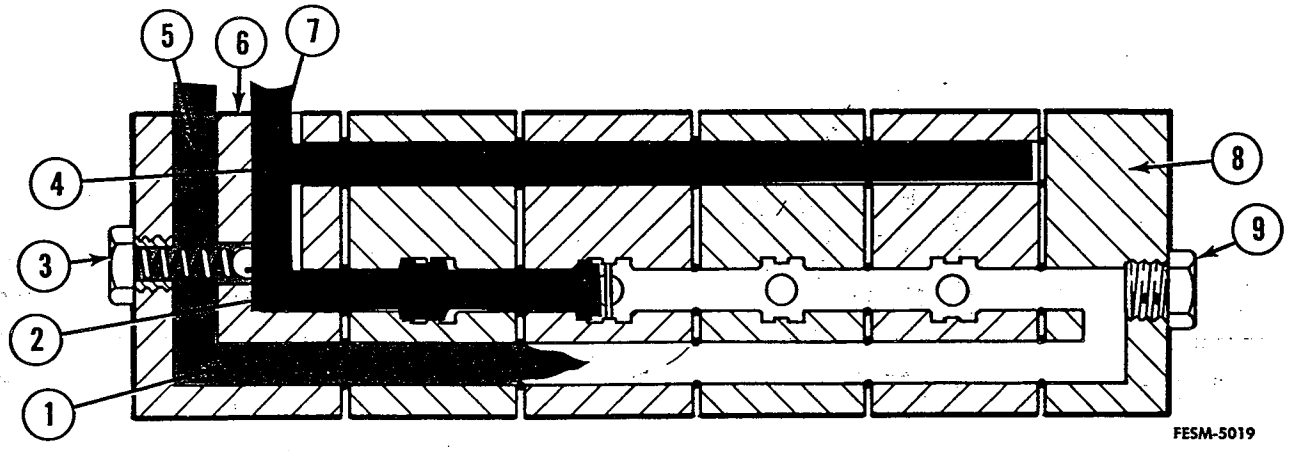
Low pressure

1. Return passage
2. Open center passage
3. Main or system relief valve
4. Pressure passage
5. Fluid out-to reservoir
6. L.H. cover
7. Fluid in-from pump
8. R.H. cover
9. Plug
10. Power beyond adapter

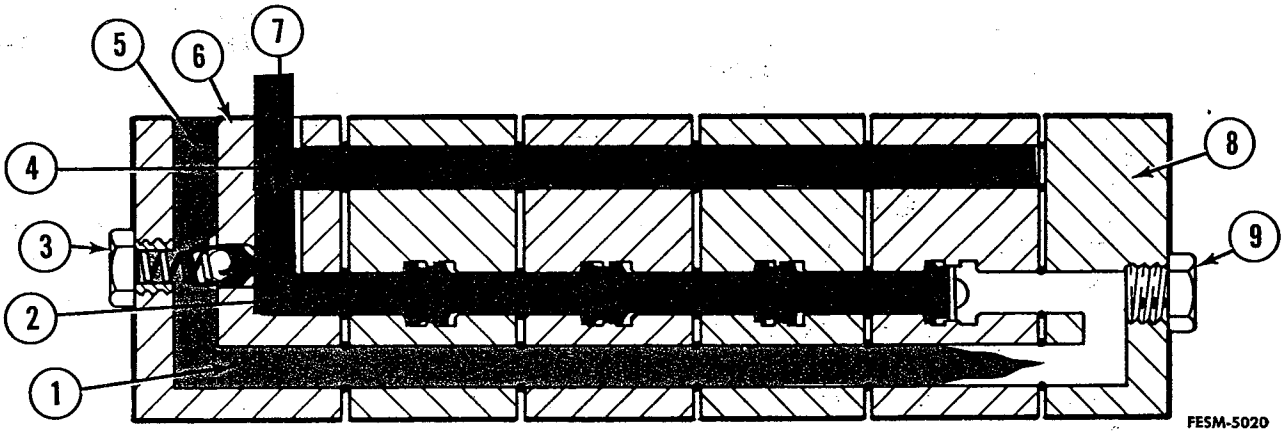
Open Center Fluid Flow

Free Flow

Pump flow enters the L.H. cover and is exposed to the main or system pressure relief valve. Pump flow is directed to both the open center and pressure passages. Fluid flow from the open center passage enters the R.H. cover, and is re-directed to the return passage or externally to the backhoe valves if equipped with the power beyond adapter.



Demand — 4 Section valve bank without power beyond adapter



Excessive Demand — 4 Section valve bank without power beyond adapter

Working pressure Low pressure

1. Return passage
2. Open center passage
3. Main or system relief valve
4. Pressure passage
5. Fluid out-to reservoir
6. L.H. cover
7. Fluid in-from pump
8. R.H. cover
9. Plug

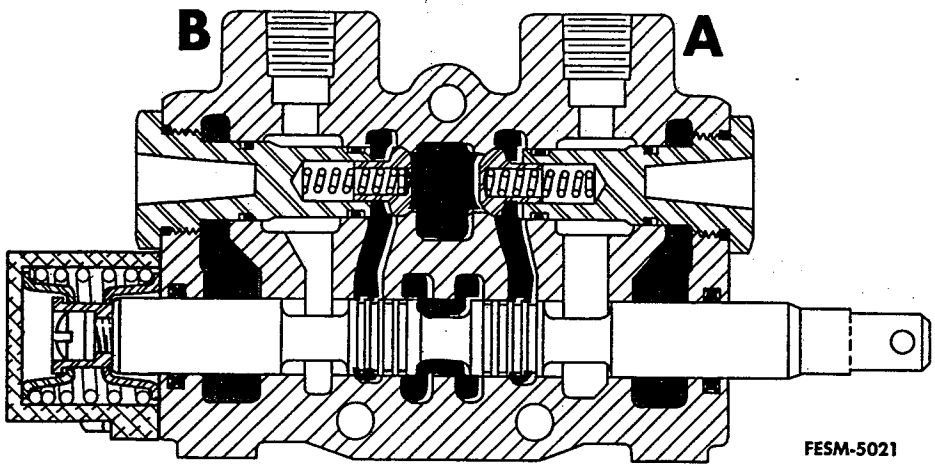
Demand

Fluid flowing through the open center passage is blocked by an actuated spool. Fluid now flows through the pressure passage to next spool being energized. Return fluid from the cylinder(s) being energized flows via the spool on demand into the return passage.

Excessive Demand

If system pressure exceeds 2000 psi the system pressure relief valve opens allowing pump flow to enter the return passage in the L.H. cover.

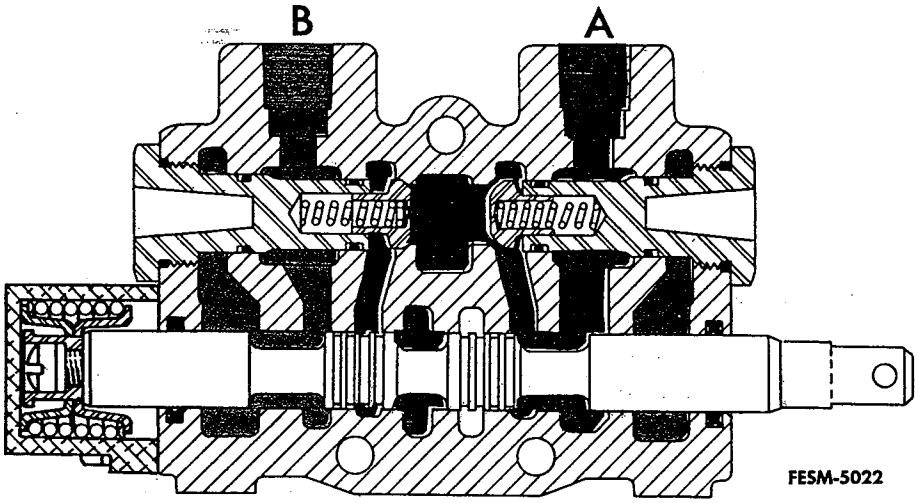
3-Position 4-Way Control Valve — Bullgrader tilt and angle; loader bucket, clam, grapple; remote control valve without float.



3-Position 4-Way Control Valve — Hold Position

Hold Position

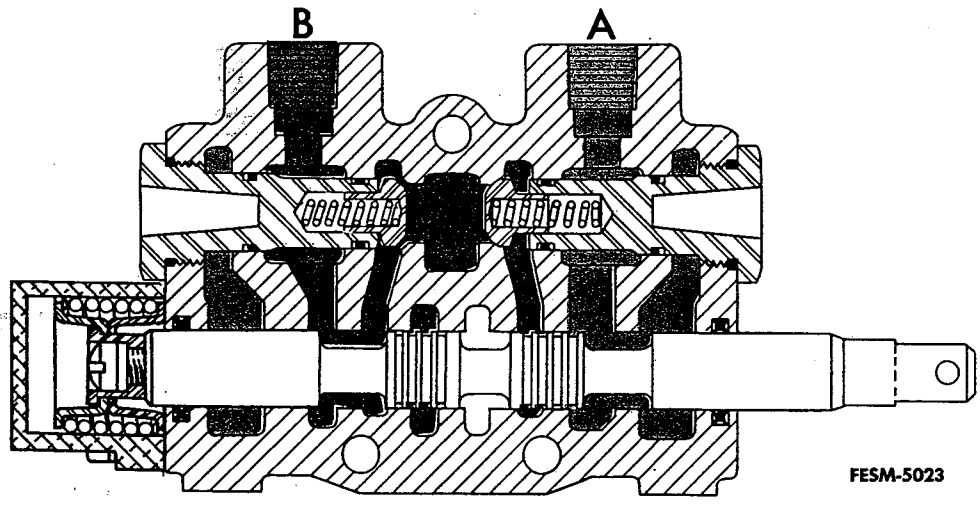
Fluid is directed to the pressure passage, and through the open center passage to power beyond or the return passage.



3-position 4-way valve — Port A position

Port A Position

Fluid flow is blocked in the open center passage. Fluid passes through the check valve at valve port A, past the spool, and out cylinder port A. Return fluid from cylinder port B passes around the check valve capsule in valve port B, past the spool to the return passage.



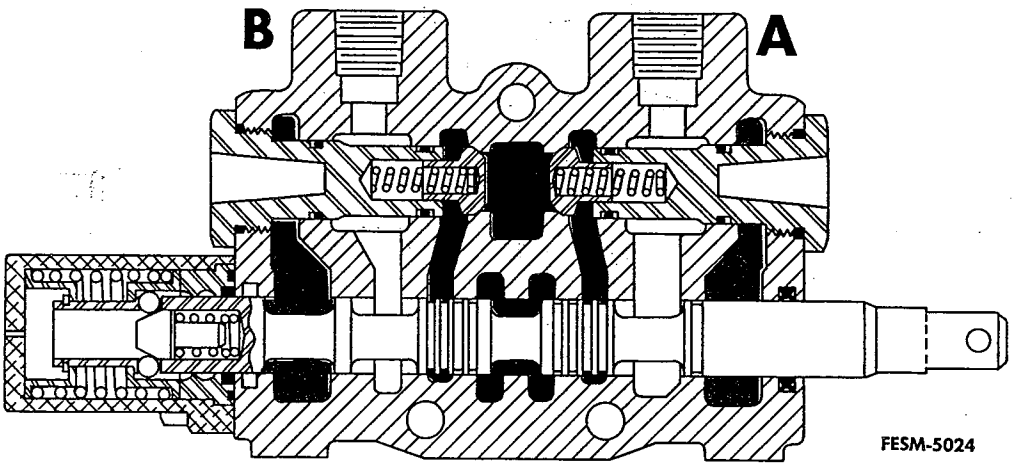
3-position 4-way valve — Port B position

Port B Position

Fluid flow is blocked in the open center passage. Fluid passes through the check valve at valve port B, past the spool, and out cylinder port B. Return fluid from cylinder port A passes around the check valve capsule in valve port A, past the spool to the return passage.

Pump pressure Return fluid

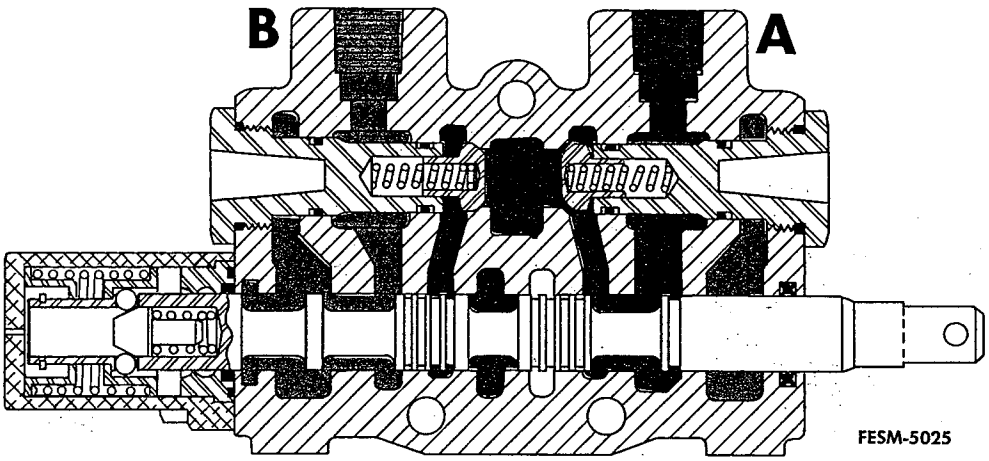
4-Position 4-Way Control Valve — Bullgrader and loader lift cylinders, and double acting remote control with float.



4-position 4-way control valve — hold position

Hold Position

Fluid flows from the pump to the pressure passage, and through the open center passage to power beyond or the return ports.

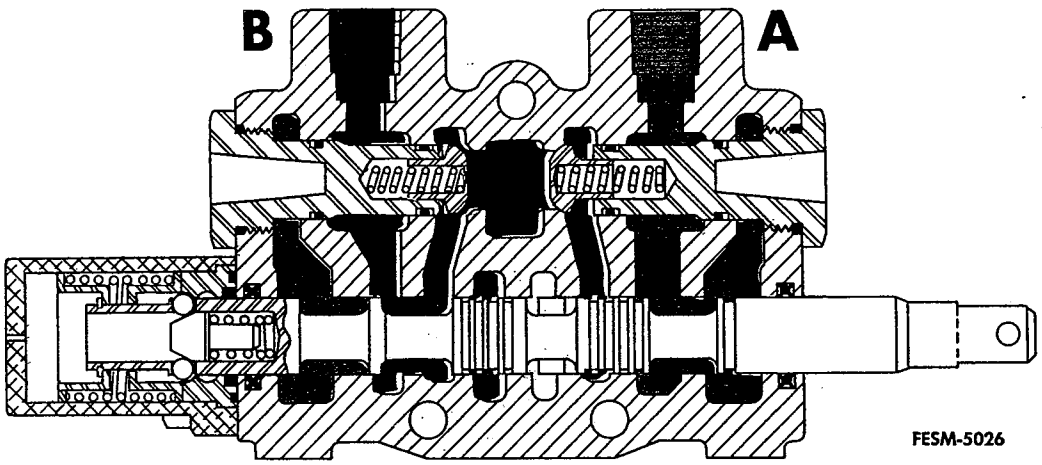


4-position 4-way control valve — Port A position

Port A Position

Fluid flow is blocked in the open center passage. Fluid passes through the check valve at valve port A, past the spool, and out cylinder port A. Return fluid from cylinder port B passes around the check valve capsule in valve port B, past the spool to the return passage.

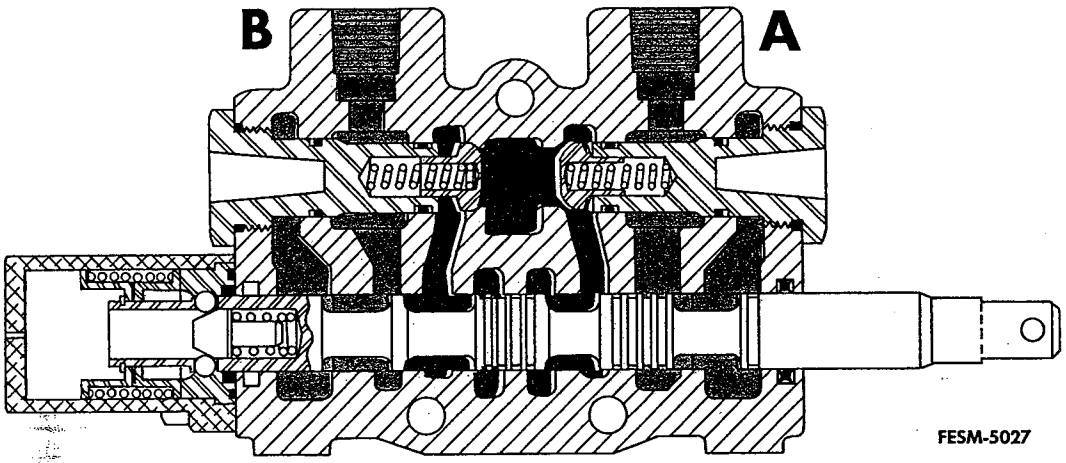
Pump pressure **Return fluid**



4-position 4-way control valve — Port B position

Port B Position

Fluid flow is blocked in the open center passage. Fluid passes through the check valve at valve port B, past the spool, and out cylinder port B. Return fluid from cylinder port A passes around the check valve capsule in valve port A, past the spool to the return passage.



4-position 4-way control valve — float position

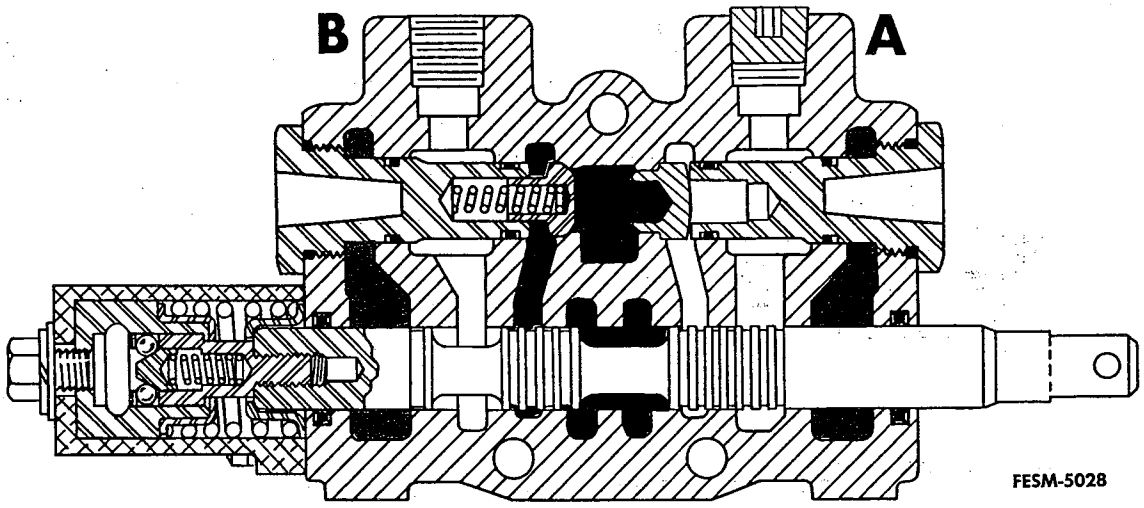
Float Position

Fluid flow is blocked in the open center passage. Fluid passes through the check valve at port A, past the spool, and out through the open center passage. Fluid passes back and forth as required from the cylinder ports, past the spool, to the return passages.

Pump pressure

Return fluid

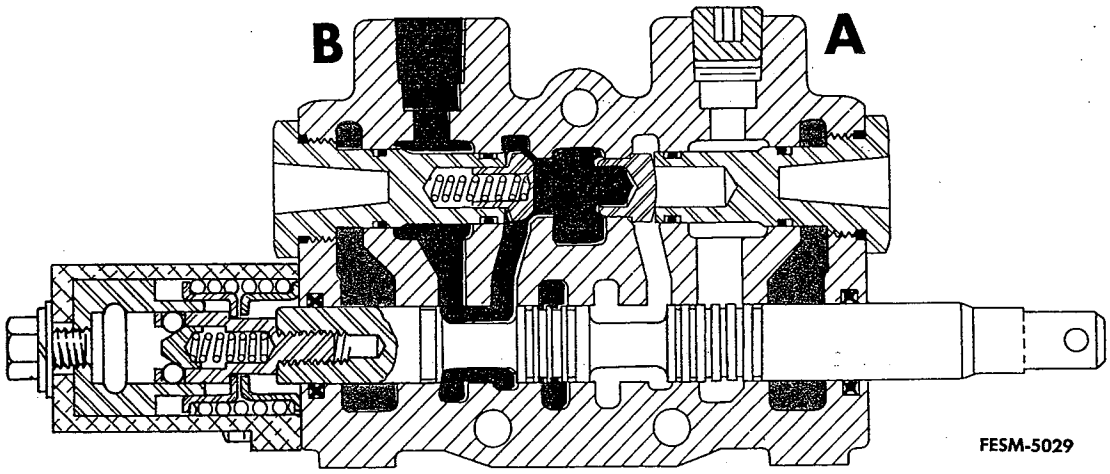
4-Position 3-Way Control Valve - Hitch



4-position 3-way control valve — hold position

Hold Position

Fluid flows from the pump to the pressure passage, and through the open center passage to power beyond or the return ports.



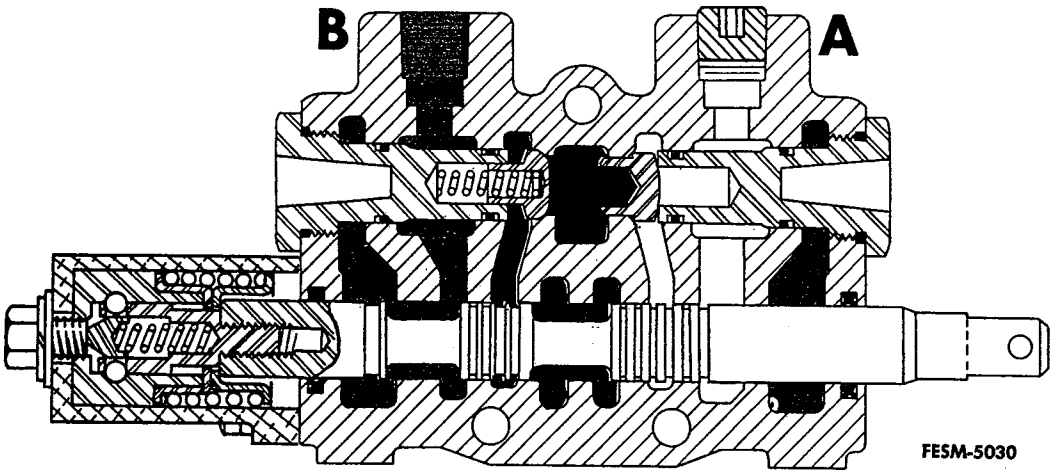
4-position 3-way control valve — raise position

Raise Position

Fluid flow is blocked in the open center passage. Fluid passes through the check valve at valve port B, past the spool, and out cylinder port B.

Pump pressure

Return fluid



4-position 3-way control valve — lower or float position

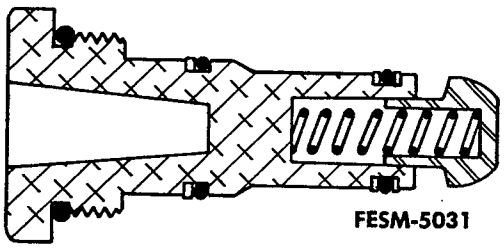
Lower and Float Position

Fluid flows from the pump to the pressure passage, and through the open center passage to power beyond or the return ports. Return fluid passes around the check valve capsule in valve port B, past the spool, to the return passage.

When the detent is engaged, the valve is in the float position. Fluid passes back and forth as required from cylinder port B, past the spool, to the return passage.

Pump pressure

Return fluid



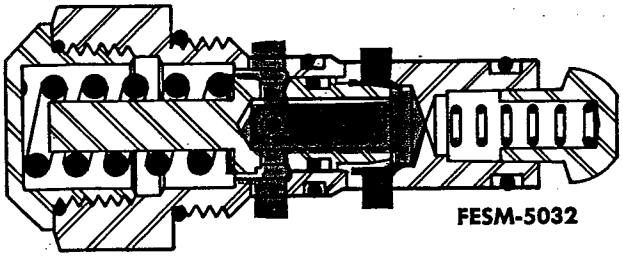
Check valve

Valve Port Options

Special valve capsule assemblies, located in the control valve - valve ports, provide for specific system requirements.

Check Valve

The check valve acts as a "drop check", permitting one way fluid flow from the pressure passage to its cylinder port. The check valve prevents reverse fluid flow (cylinder retraction) which would occur when fluid pressure is greater in the cylinder than the pressure chamber.



Circuit relief and check valve

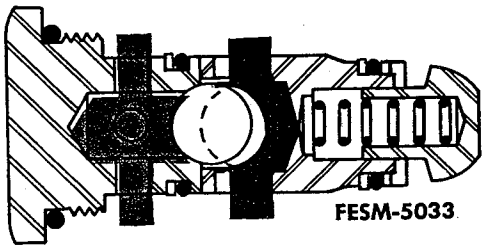
Circuit pressure

Return pressure

Circuit Relief and Check Valve

The circuit relief and check valve limits fluid pressure in its cylinder port, and the side of the cylinder to which the cylinder port is connected, when the spool is in the hold position. It also has the drop check valve feature.

Two valves are available, 2500 and 3000 psi. The circuit relief pressure setting is stamped on the cap of the assembly.



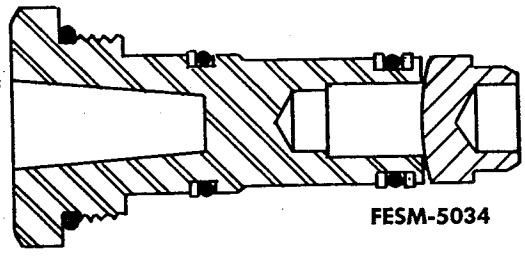
Anti-cavitation and check valve

System pressure

Return pressure

Anti-cavitation and Check Valve

The anti-cavitation and check valve allows fluid to flow from the return side of the cylinder to the pressure side. The rapid drop of the loader cylinder creates a "low pressure or partial vacuum on the pressure (red) side of the ball thereby permitting fluid to enter the pressure (red) side of the cylinder via the ball opened passage. It also has the "drop check valve" feature.



Plug

Plug

The plug is used in valve port A on 4-position 3-way valves. The plug seals the pressure passages from the spool, making cylinder port A inoperative. Port B is then used to direct fluid to and from the hitch single acting cylinder

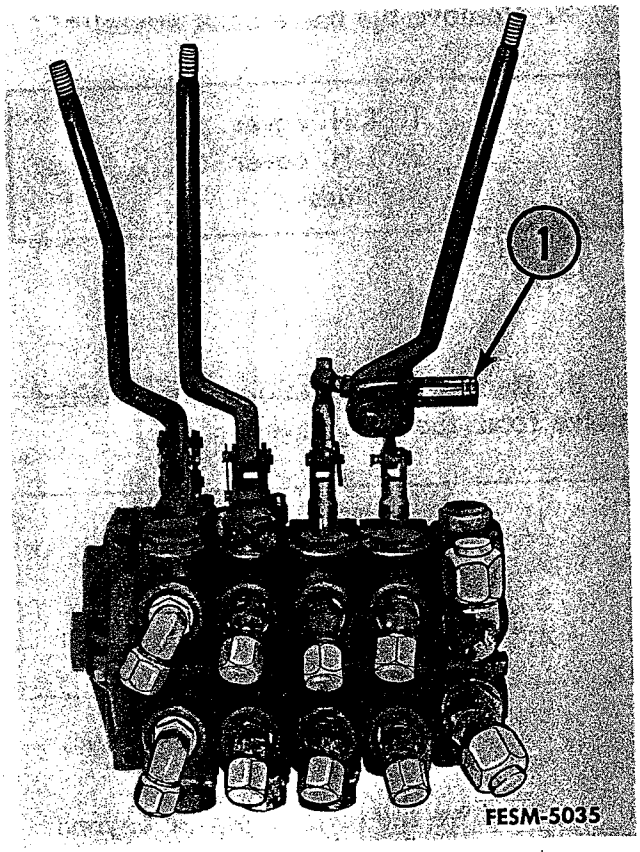
Control Valve Application

Cylinder	Valve	Port A	Port B
Bullgrader			
Lift	4-position 4-way	Check valve	Check valve
Tilt	3-position 4-way	Check valve	Check valve
Angle	3-position 4-way	3000 lb. circuit relief valve	3000 lb. circuit relief valve
Loader			
Lift	4-position 4-way	3000 lb. circuit relief valve	Anti-cavitation valve
Bucket	3-position 4-way	3000 lb. circuit relief valve	2500 lb. circuit relief valve
Drott 4 in 1 Bucket Clam			
Single Cylinder *			
Below S.N. 2093	3-position 4-way	2500 lb. circuit relief valve	Check valve
Above S.N. 2093	3-position 4-way	Check valve	2500 lb. circuit relief valve
Dual Cylinder			
Below S.N. 2048	3-position 4-way	2500 lb. circuit relief valve	Check valve
Above S.N. 2048	3-position 4-way	Check valve	2500 lb. circuit relief valve
Hitch *	4-position 3-way	Plug	Check valve
Remote Control - Factory Installation			
Alone	4-position 4-way	Check valve	Check valve
With Hitch	4-position 4-way	Check valve	Check valve
With Bullgrader	3-position 4-way	2500 lb. circuit relief valve	Check valve
With Loader	3-position 4-way	2500 lb. circuit relief valve	Check valve
Remote Control - Field Installation	As required	As required	As required

*Additional circuit relief valves are located in the hitch cylinder piston (thermo-relief) and early model Drott single cylinder.

Removal

1. CAUTION: Remove the hydraulic reservoir filler plug slowly to allow air under pressure to escape.



Valve bank removed

2. Remove the knobs from the valve control levers; and remove the valve cover assembly.

3. Thoroughly clean the exterior of the valve bank.

4. Remove the dual acting control lever yoke snap ring.

5. Loosen the return line hose. Then disconnect the return line from the L.H. cover, and twist the line in the hose so that the tube nut faces upward, to prevent syphoning the fluid from the reservoir.

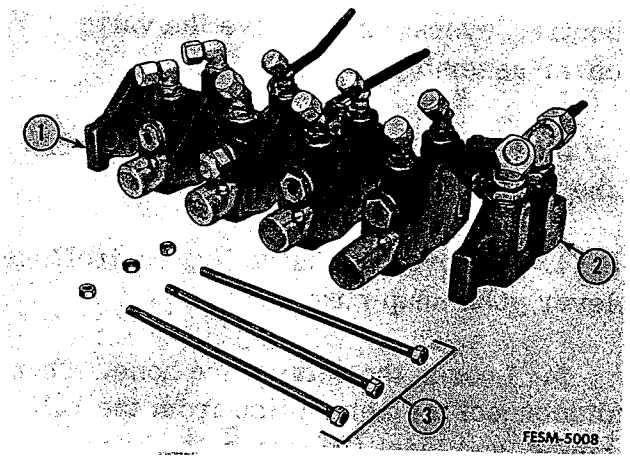
6. Disconnect all hydraulic lines at the valve bank.

7. Remove the three bolts holding the valve bank to the support plate, and remove the valve bank assembly.

1. Yoke snap ring removed

Disassembly

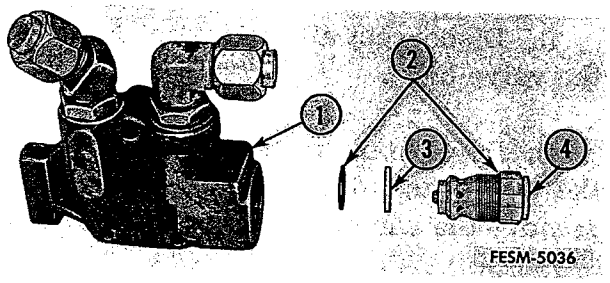
Valve Bank Assembly



1. Clean the assembly with an evaporative solvent, and dry with compressed air.

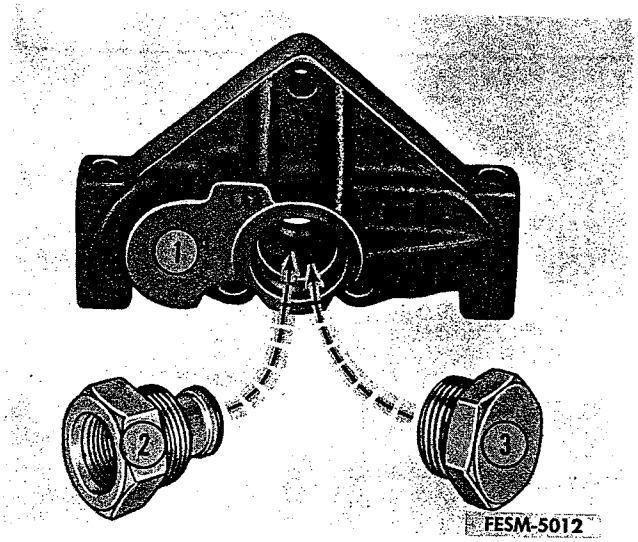
2. Remove the balve bank studs.

1. R.H. cover
2. L.H. cover
3. Studs



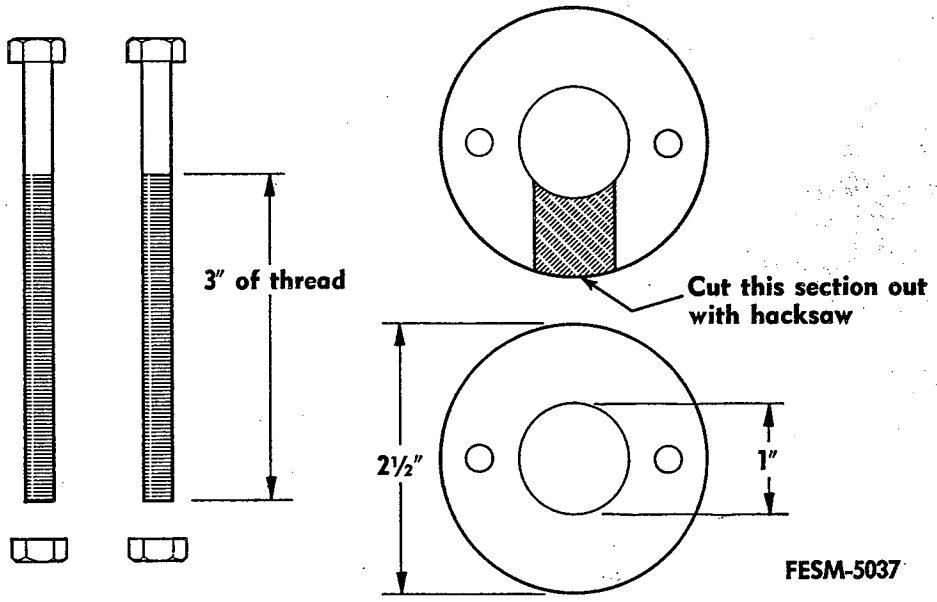
3. Remove the main or system relief valve from the L.H. cover.

1. L.H. cover
2. O-ring
3. Back-up ring
4. Main or system relief valve



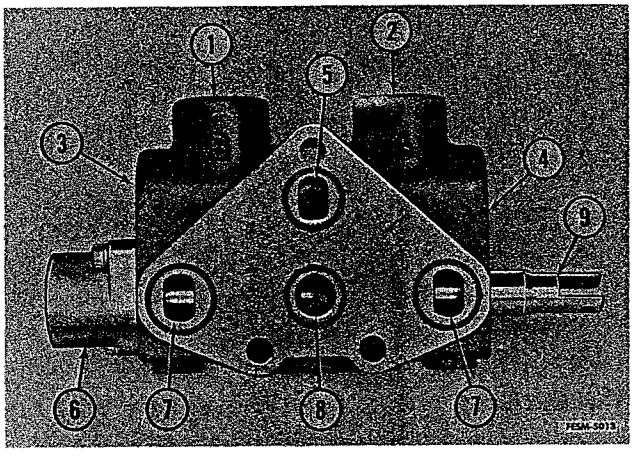
4. Remove the plug or power beyond sleeve from the R.H. cover.

1. Sleeve
   or
2. Plug



Spool Centering Spring Fixture

Make a fixture to compress spool centering springs as illustrated. Drill two holes in each washer for the bolts.



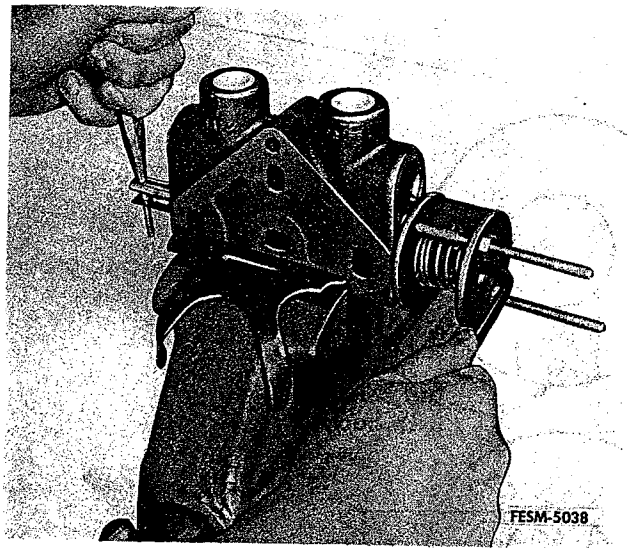
1. Cylinder port B
2. Cylinder port A
3. Valve port B
4. Valve port A
5. Pressure passage
6. Spool
7. Return passage (2)
8. Open center passage
9. Bonnet

3-position 4-way — Bullgrader tilt and angle; loader bucket, clam and grapple; and remote control without float.

1. Disconnect the control lever link from the spool; and remove the lever bracket if so equipped.

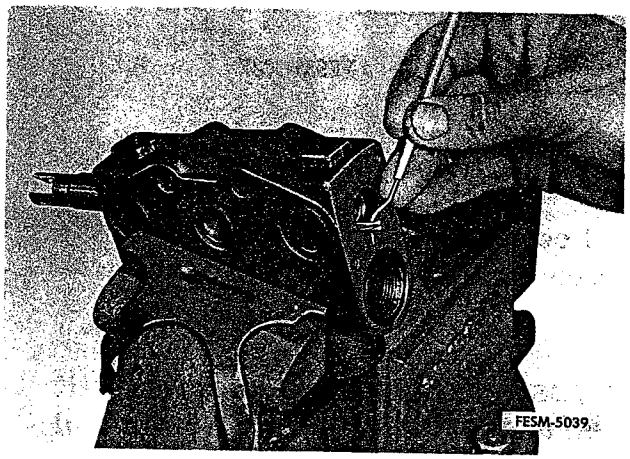
2. Remove rust and paint from the control lever end of the spool; and polish the surface with crocus cloth.

3. Remove the valve assemblies from valve ports A and B; and remove the bonnet.



4. Support the control valve in a vise, and install the spring fixture on the centering spring. Then remove the screw from the spool collar using a punch in the control lever link hole to prevent the spool from turning. Remove the centering spring assembly.

5. Carefully and slowly move the control lever end of the spool out of the valve body until the seal on the spring end can be removed. Remove the seal with an FES 57-3 O-ring tool. Then push the spool through the body removing it from the spring end. Remove the opposite spool seal ring.



Removing the spring end spool seal

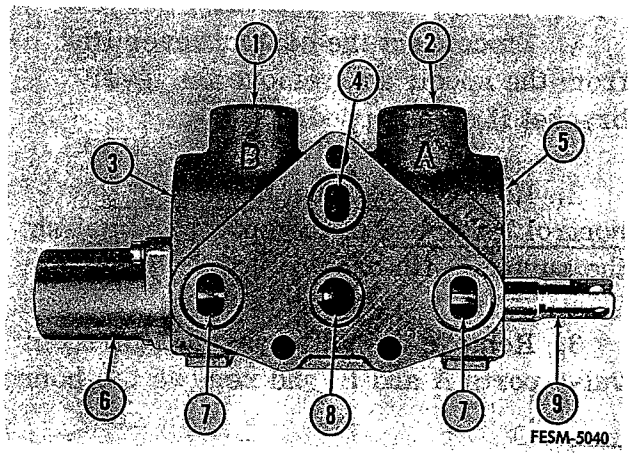
IMPORTANT: The control lever end of the spool must be free of paint and rust; and the spring end spool seal must be removed, before the spool. If the spool is moved too far when removing the spring end spool seal, it will hang up and lock on the opposite spool seal, making spool removal difficult or impossible.

4-position 4-way – Bullgrader and loader lift, and remote control with float.

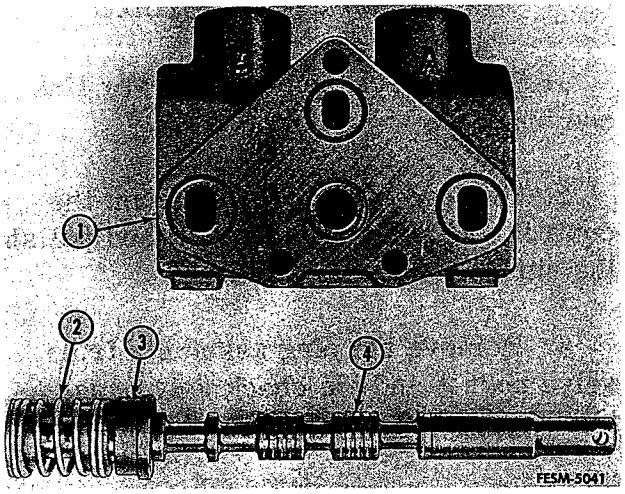
1. Disconnect the control lever link; and remove the lever bracket if so equipped.

2. Remove rust and paint from the control lever end of the spool; and polish the surface with crocus cloth.

3. Remove the valve assemblies from valve ports A and B; and remove the bonnet.



1. Cylinder port B
2. Cylinder port A
3. Valve port B
4. Pressure passage
5. Valve port A
6. Bonnet
7. Return passage (2)
8. Open center passage
9. Spool

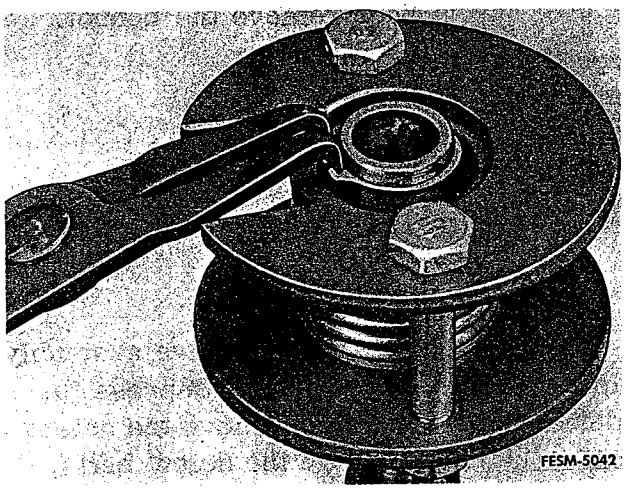


Spool removed

4. Remove the spool assembly.

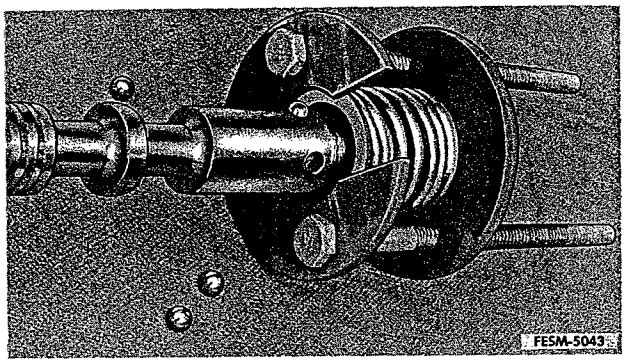
5. Remove the detent sleeve, O-ring, and seal. Then remove the spool seal from the lever end of the valve body.

1. Valve body
2. Centering spring
3. Detent sleeve
4. Spool



Removing the retaining ring

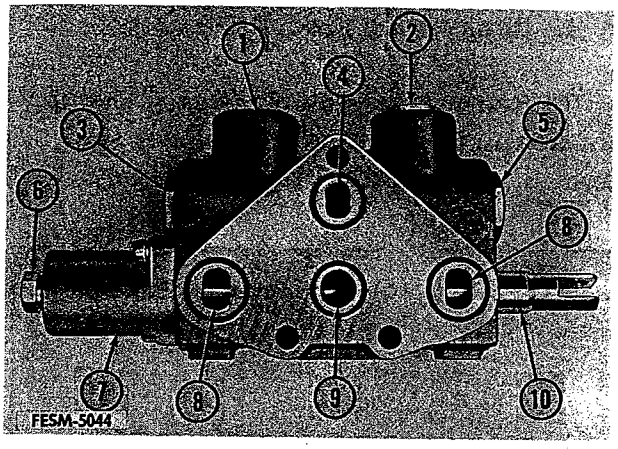
6. Support the spool in a vise with brass jaws. Then compress the spring with the fixture; and remove the spring retaining ring.



7. Hold the spring with fixture on the spool. Holding the assembly over a pan or rag, carefully remove the spring assembly. 4 balls will drop out of the spool.

8. Remove the ball guide and spring.

4-position 3-way – Hitch



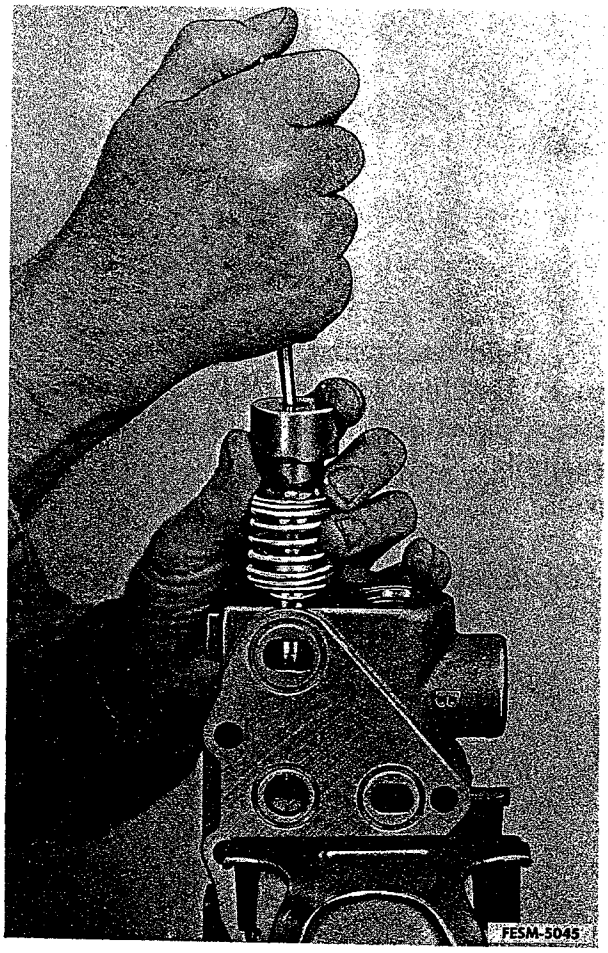
1. Cylinder port B
2. Cylinder port A (plugged)
3. Valve port B-check valve
4. Pressure passage
5. Valve port A-plug
6. Capscrew
7. Bonnet
8. Return passage (2)
9. Open center passage
10. Spool

1. Disconnect the control lever link and bracket.

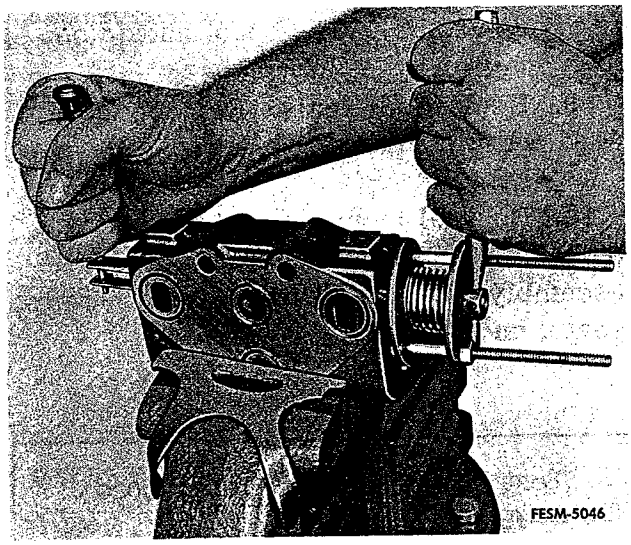
2. Remove rust and paint from the control lever end of the spool; and polish the surface with crocus cloth.

3. Remove the plug assembly from valve port A and the check valve assembly from valve port B.

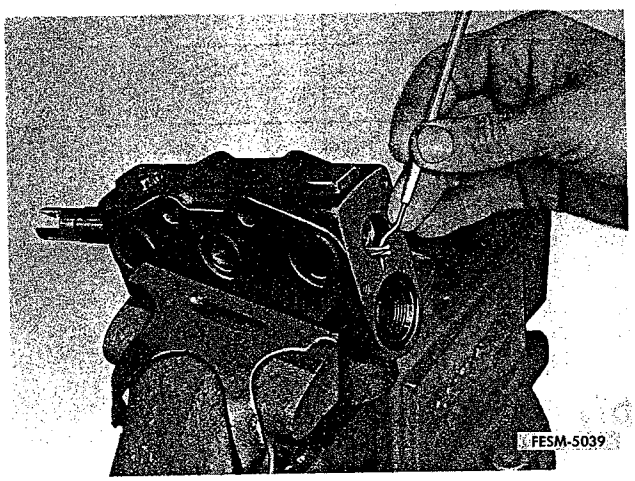
4. Remove the cap screws from the end of the bonnet. Then remove the bonnet.



5. Support the control valve assembly in a vise with brass jaws. Depress the detent ball guide, and remove the detent sleeve. Then remove the detent balls, guide and spring.



6. Install the spring fixture; and remove the detent holder, using one punch to loosen the detent holder and another to prevent the spool from turning. Then remove the spring assembly.



Removing the spring end spool seal

7. Move the control lever end of the spool out of the valve body until the seal on the spring end can be removed. Remove the seal with an FES 57-3 O-ring tool. Then remove the spool from the spring end; and remove the other spool seal.

IMPORTANT: The control lever end of the spool must be free of paint and rust; and the spring end spool seal must be removed, before the spool. If the spool is moved too far when removing the spring end spool seal, it will get caught on the opposite spool seal, making spool removal difficult.

Inspection and Repair

1. Clean all parts in an evaporative solvent, and dry with compressed air.

2. If the hydraulic fluid is contaminated as a result of pump failure, remove the reservoir, and clean the interior using steam. Dry the reservoir thoroughly before installation.

3. Inspect the spool and spool bore for scoring or other damage.

4. Inspect the valve port - valve assemblies for damage.

5. Check the control valve and surfaces of bodies for flatness, using a straight edge; and check O-ring grooves for damage.

6. Check the centering spring free length and tension at test length as specified in the table below.

7. Inspect the detent balls, sleeve, ball guide, and spring, for wear or damage.

8. Lubricate the spool with petroleum jelly and check for freedom of movement in the valve body. The spool should not bind.

9. Replace all seals. Replace damaged and worn parts.

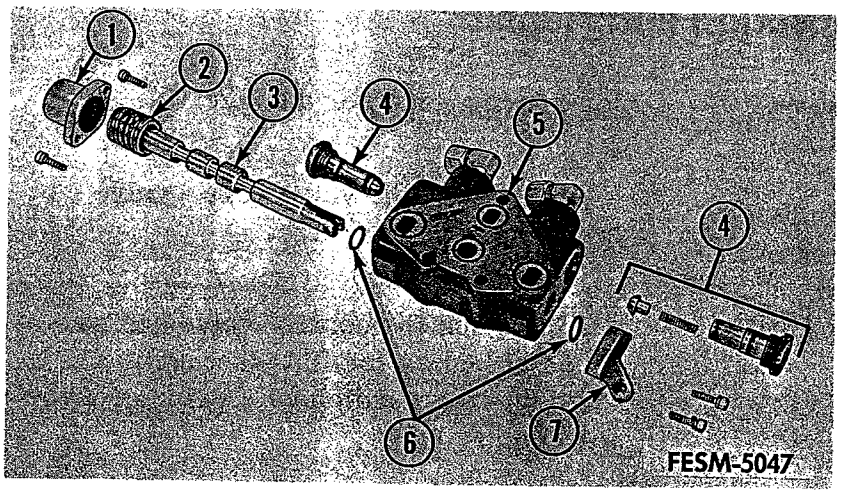
10. Coat all moving parts with petroleum jelly during reassembly to aid reassembly and prevent damage to O-rings, seals, and parts.

Centering Spring	Free Length Inches	Test Length Inches	Test Load Lb.
3-position 4-way	.733	7/16	40
4-position 4-way	2-11/16	1-3/16	50 ± 3
4-position 3-way	15/16	22/32	13-1/2

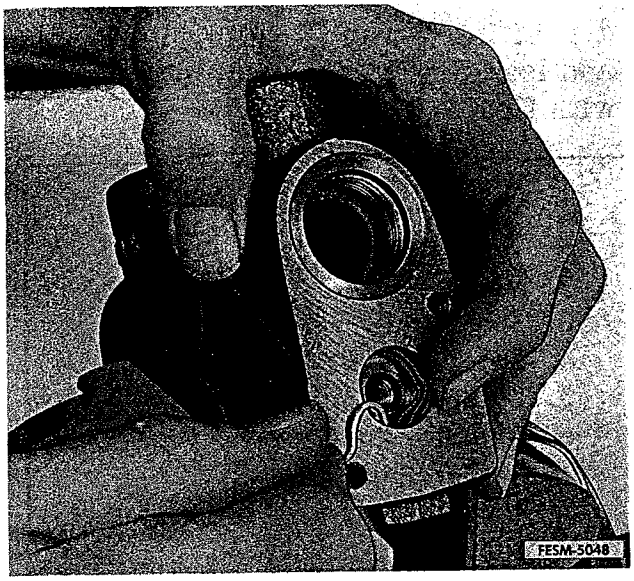
Reassembly

Control Valves

3-position 4-way – Bull grader tilt and angle; loader bucket, tilt, clam, and grapple; and remote control without float.



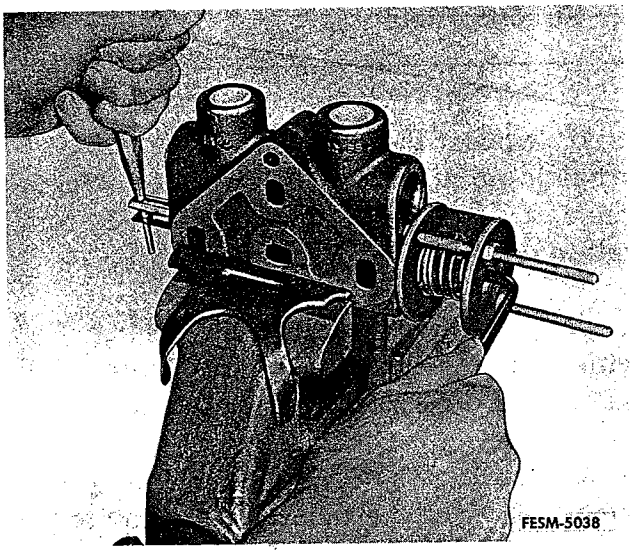
1. Bonnet
2. Centering spring assembly
3. Spool
4. Port option – check valve illustrated (2)
5. Valve body
6. Spool seal (2)
7. Control lever bracket



Installing the spring end spool seal

1. Install a new spool seal in the A end of the valve body. Then install the spool from the B or spring end until the spool seal on the spring end can be installed. Install the seal.

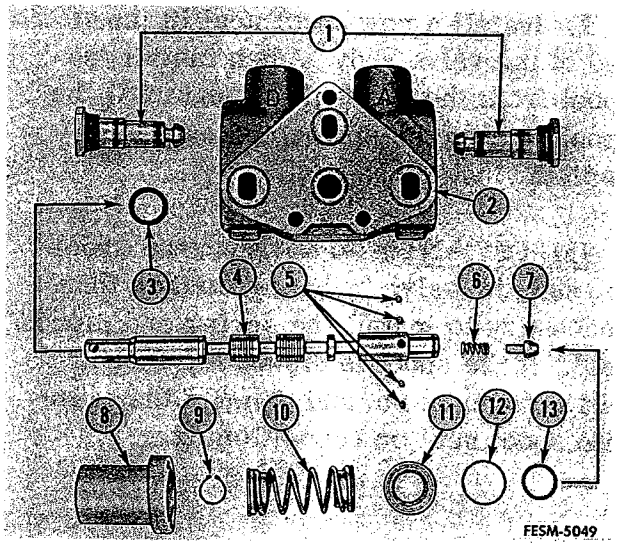
IMPORTANT: Do not push the spool through the valve body any further than necessary to install the spring end spool seal. If the spool is moved too far, it will get caught on, and damage the opposite spool seal on repositioning.



2. Push the spool through the seal. Compress the centering spring with stop collars in your spring fixture. Then install the spring assembly and collar on the spool. Use a punch in the control lever link hole to prevent the spool from turning.

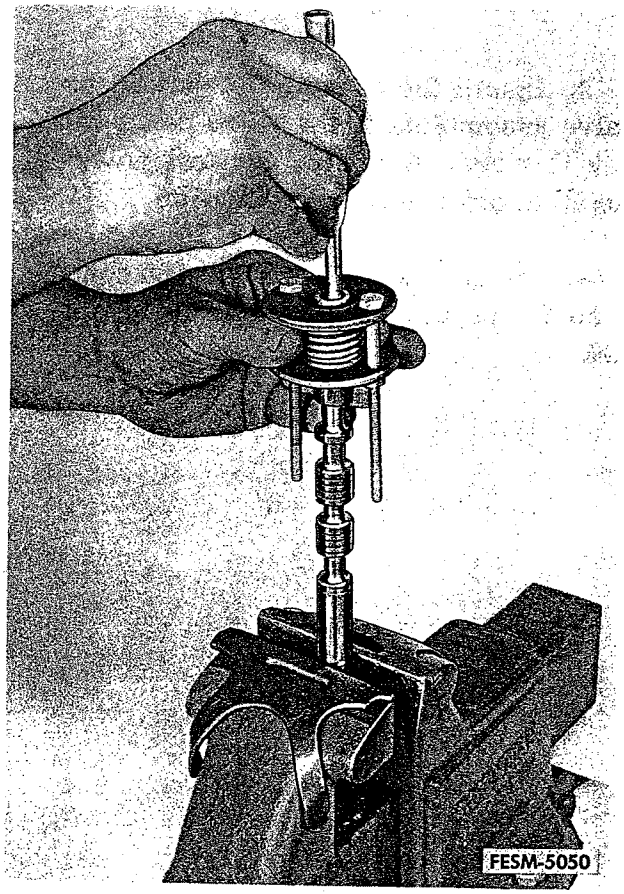
3. Install the bonnet; and install the valve assemblies in the valve ports with new O-rings. Refer to "Control Valve Application" for correct location.

4. Install the control lever bracket, if so equipped; and install the lever and link.



4-position 4-way – Bullgrader and loader lift, and remote control with float.

1. Valve port option (2) (check valve illustrated)
2. Valve body
3. Spool seal
4. Spool
5. Detent balls
6. Detent spring
7. Detent guide
8. Bonnett
9. Snap ring
10. Centering spring with stop collars
11. Detent sleeve
12. O-ring
13. Spool seal

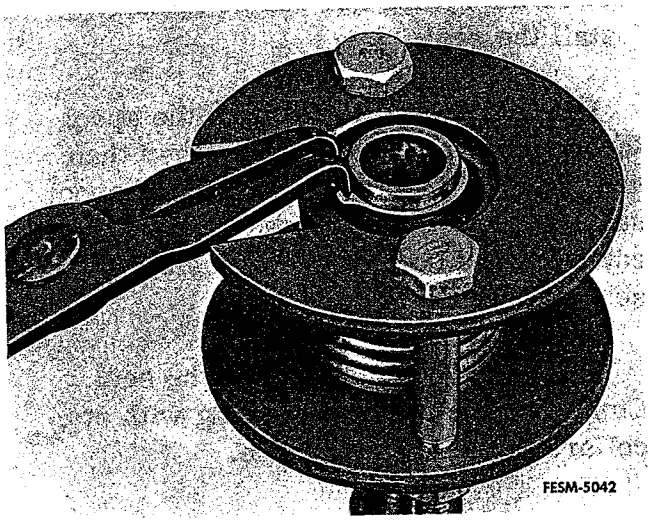


1. Support the spool in a vise with brass jaws; and install the detent spring, guide, and balls. Use petroleum jelly to retain the balls during reassembly.

2. Compress the centering spring with stop collars in the spring fixture; and position the assembly on the spool.

3. Depress the detent guide with a punch, allowing the inner stop collar to fall over the detent balls.

4. Install the spring retaining snap ring; and remove the spring fixture.



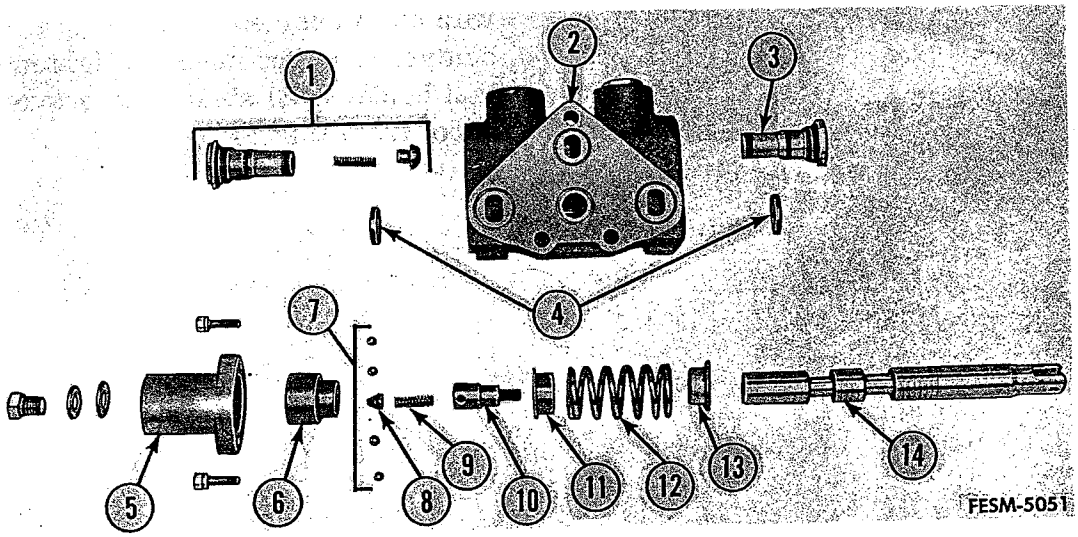
5. Install a new spool seal in the A end of the valve body. Then install the detent sleeve on the spool; and install the other spool seal and O-ring in the detent sleeve.

6. Install the spool in the body from the B end, and install the bonnet.

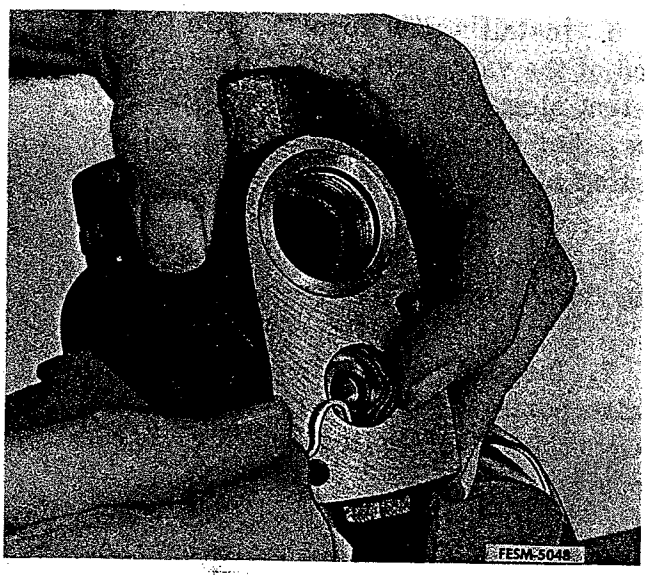
7. Install the valve assemblies in the valve ports with new O-rings. Refer to "Control Valve Application" for correct location.

8. Install the control lever bracket, if so equipped, and install the lever and link.

4-position 3-way – Hitch



1. Check valve assembly
2. Valve body
3. Plug assembly
4. Spool seal (2)
5. Bonnett
6. Detent sleeve
7. Detent balls
8. Detent guide
9. Detent spring
10. Detent holder
11. Stop collar (machined)
12. Centering spring
13. Stop collar (stamped)
14. Spool

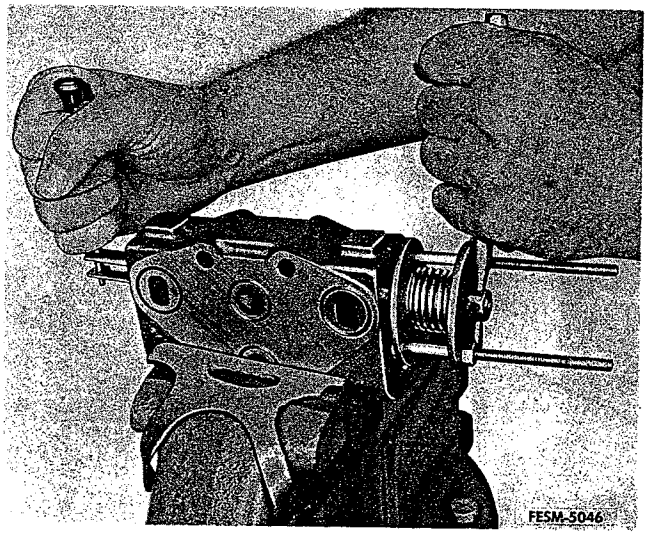


Installing the spring end spool seal

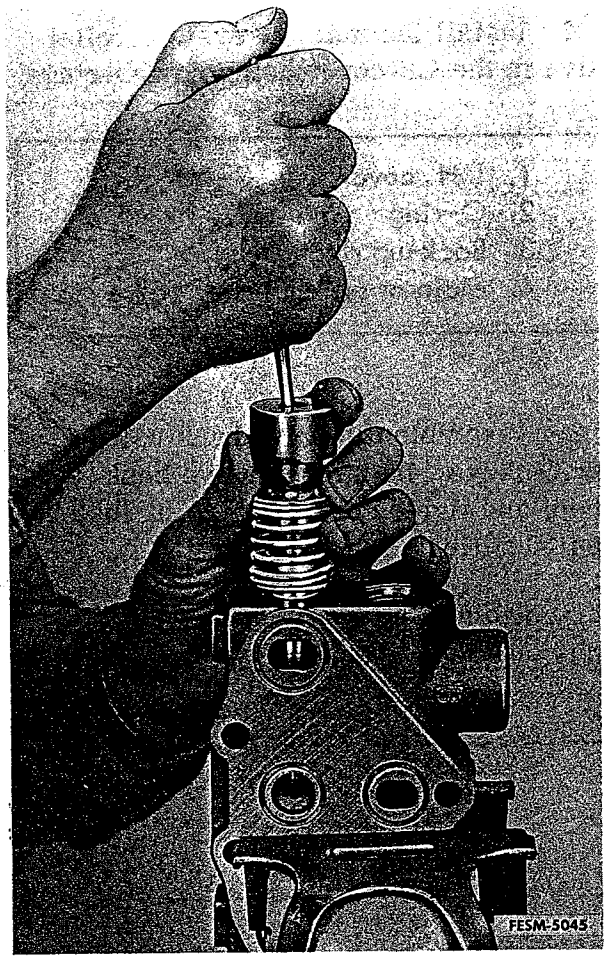
1. Install a new spool seal in the A end of the valve body. Then install the spool from the B or spring end until the spool seal on the spring end can be installed. Install the seal.

IMPORTANT: Do not push the spool through the valve body any further than necessary to install the spring and spool seal. If the spool is moved too far, it will catch on, and damage the opposite spool seal on repositioning.

2. Push the spool through the seal. Compress the centering spring with stop collars in the spring fixture.



3. Support the valve and spool assembly in a vise with brass jaws. Then install the centering spring and detent holder, with the machined collar next to the holder. Use one punch to tighten the detent holder, and another to prevent the spool from turning.



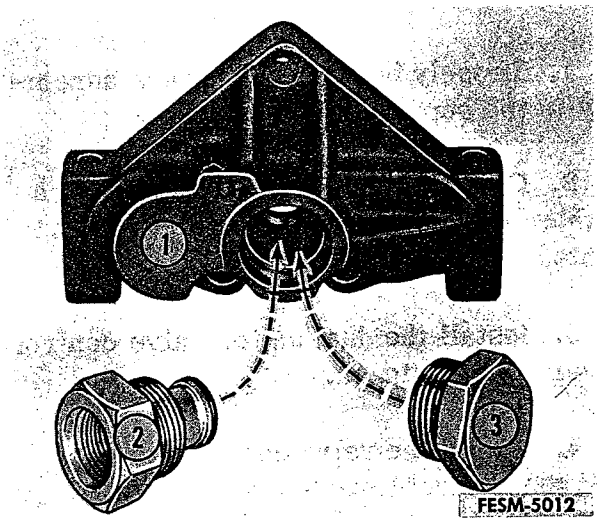
4. Remove the spring fixture; and install the detent spring, guide, and balls. Use petroleum jelly to prevent loss of the balls.

5. Position the detent sleeve on the detent holder; depress the detent guide with a punch; and work the sleeve over the balls.

6. Install the bonnet, and the cap screw which holds the detent sleeve to the bonnet.

7. Install the plug assembly in port A and the check valve assembly in port B with new O-rings.

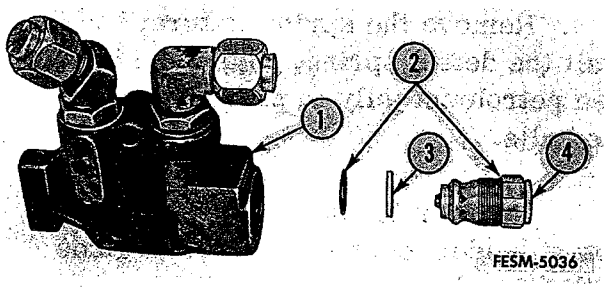
8. Install the control lever bracket; and connect the control lever link.



Valve Bank Assembly

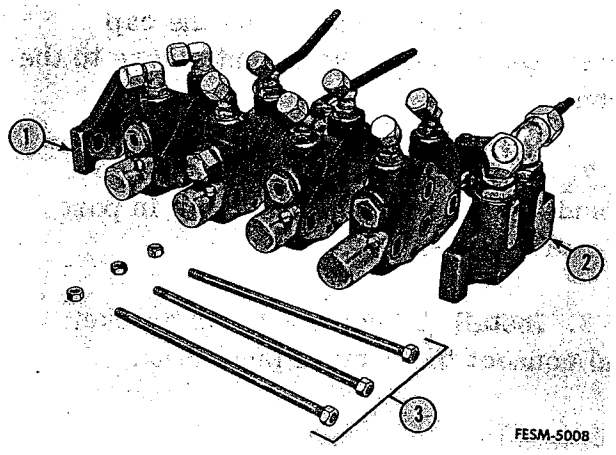
1. Install the plug or power beyond sleeve in the RH cover using new O-ring(s).

1. Sleeve
or
2. Plug



2. Install the main or system relief valve in the LH cover using new O-rings.

1. L.H. cover
2. O-ring
3. Back-up ring
4. Main or system relief valve

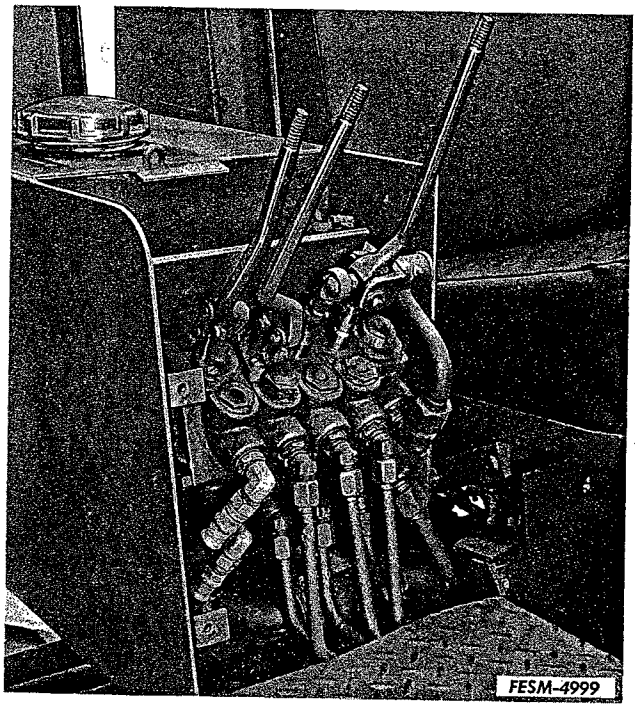


3. Assemble the valve bank using new O-rings. Install the valve bank studs; and tighten evenly to 10 ft. lbs, then 20 ft. lbs.

IMPORTANT: Failure to tighten the studs evenly will cause binding of spools.

1. R.H. cover
2. L.H. cover
3. Studs

Installation



1. Loosely bolt the valve bank assembly to the support plate.

2. Connect all hydraulic lines. Then tighten the bank assembly to the support plate.

3. Install the dual action valve control lever if so equipped.

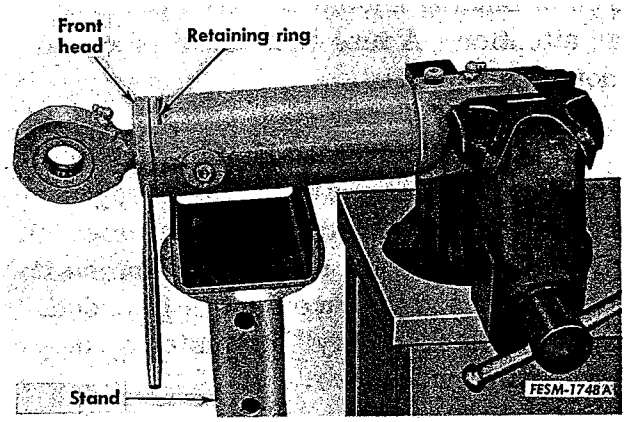
4. Install the valve cover assembly and the control lever knobs.

5. Check fluid level in the hydraulic reservoir. Add fluid if required.

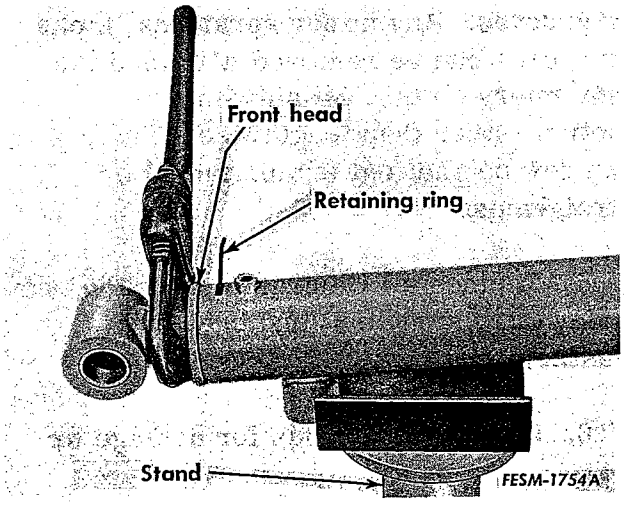
NOTE: It is recommended that the filter and fluid be replaced whenever the hydraulic system is serviced.

CYLINDER OVERHAUL

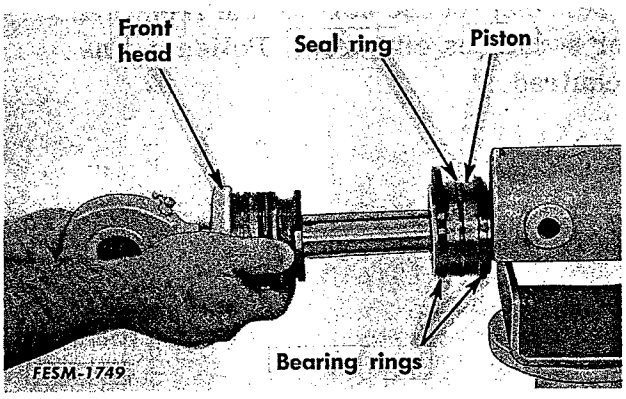
IH - Loader Lift and Bucket; and Bullgrader Lift, Tilt, and Angle Cylinders



Removing retaining ring. Bullgrader tilt and angle cylinders.



Removing front head retaining ring. Bullgrader lift and loader cylinders



Removing piston rod assembly. Bullgrader tilt and angle cylinders

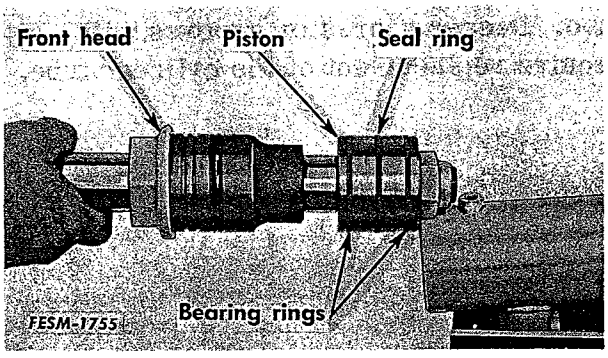
Disassembly

1. Drain the fluid from the cylinder.

2. Clamp the cylinder base in a vise. Support the rod end of the cylinder with a stand.

3. Rotate the front head to align the end of the retaining ring with the slot in the cylinder. Start the end of the retaining ring out of the slot with a small screwdriver. Rotate the front head to remove the retaining ring.

4. Remove the front head with a twisting motion. Pull the piston rod with front head and piston assembly carefully from the cylinder bore.



Removing piston rod assembly. Bullgrader lift and loader cylinders

5. Clamp the piston rod eye in a vise and support the piston end of the rod with a stand. Remove the piston lock nut.

6. Remove the piston and front head from the piston rod. Remove the O-ring from the piston rod.

7. Remove the wiper seal, O-ring, quad ring, and back-up washers from the front head. Use an FES 57-3 O-ring tool to remove seals and back-up washers.

8. Remove the bearing rings from the piston. The seal ring does not need to be removed unless it is damaged, which may occur during disassembly.

Inspection and Repair

1. Carefully check the cylinder bore for scratches or grooves. Very slight shallow scratches can be polished out with fine emery cloth and oil, to provide a smooth surface to the packing. Use a rotary motion when polishing. Never stroke the emery lengthwise through the tube. Deeper scores or grooves will require replacement of the cylinder tube.

2. Inspect the cylinder bore for roundness throughout its length. If a tight spot is noticed while removing the piston, the area of binding should be given particular attention. A tube that is out of round should be replaced.

3. Inspect the piston bearing and seal rings for excessive wear, frayed edges of imbedded particles of foreign material. DO NOT remove the piston seal unless it is damaged and replacement is intended. Refer to "Reassembly" for piston seal installation procedure.

IMPORTANT: Do not remove the piston O-ring unless replacement is intended.

4. Inspect the piston rod for scratches or grooves. Any minor scratches, nicks or scores can be removed with medium grit emery cloth. Polish with a rotary motion rather than lengthwise. The rod can now be checked for alignment or straightness.

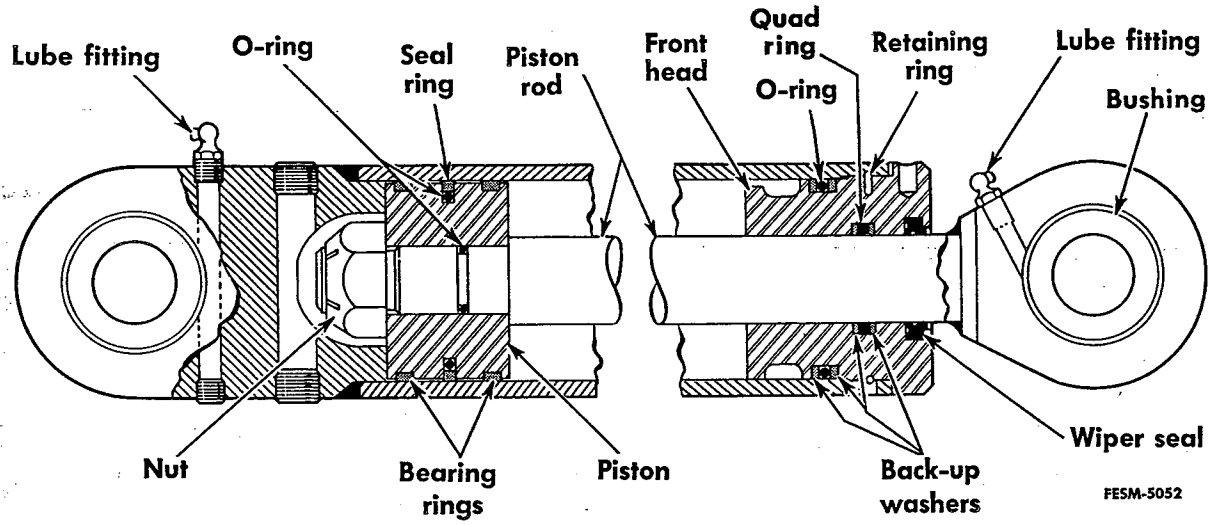
5. Replace all O-rings (except the one under the piston seal) and back-up washers.

6. Inspect all threads for damage or wear.

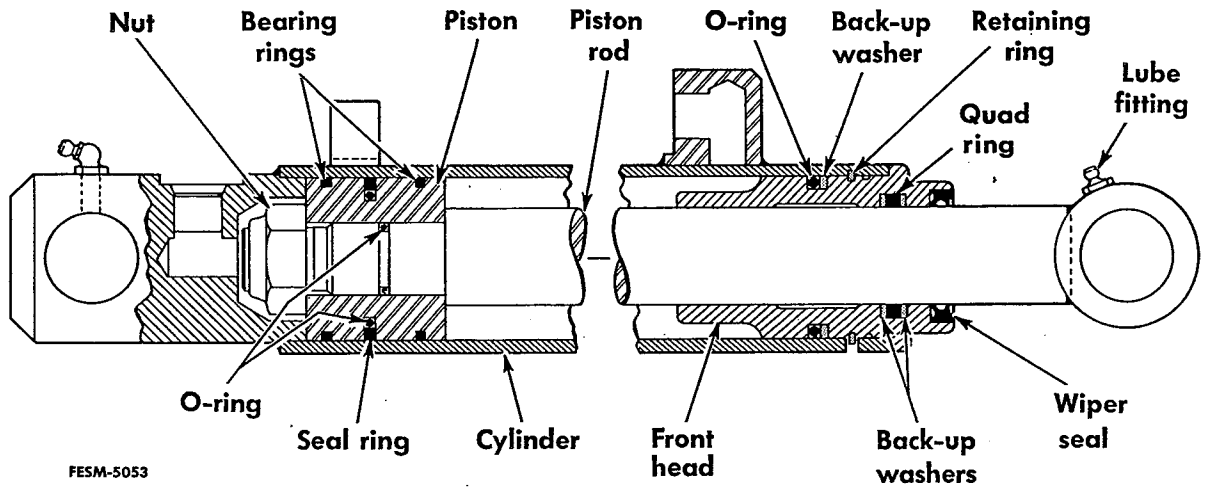
7. Clean all threads with a stiff brush and solvent.

8. Inspect the bore of the front head for scratches or burrs. Polish out as required.

Reassembly



Bullgrader tilt and angle cylinder



Bullgrader lift and loader cylinders

IMPORTANT: It will be necessary to have a clean container of Hy-Tran to dip parts in and a source of hot water (180 - 200°F) to facilitate reassembly.

1. Be certain all parts have been thoroughly cleaned and dried with compressed air.

2. Carefully press in a new wiper seal until it bottoms on its seat in the front head.

3. Install the O-rings, quad rings and back-up washers in the front head.

4. Dip the front head in clean Hy-Tran and install on the piston rod. Install the O-ring on the piston rod; and install the piston. Lubricate the piston nut with Hy-Tran and install the piston nut. Refer to specifications for proper torque.

5. If they were removed, install the piston O-ring and seal ring as follows:

(a) Place a piece of shim stock around the piston OD covering up the first groove.

(b) Dip the O-ring in Hy-Tran and "wring" it into position over the shim stock and into place in the piston groove.

(c) Place the piston seal in hot water (180° to 200°F) to increase flexibility.

(d) Remove the seal from the water and immediately install the seal over the shim stock and work it into the center groove of the piston.

(e) Using a piston ring compressor or a suitable hose clamp, compress the piston seal in its groove until ready to install it into the cylinder.

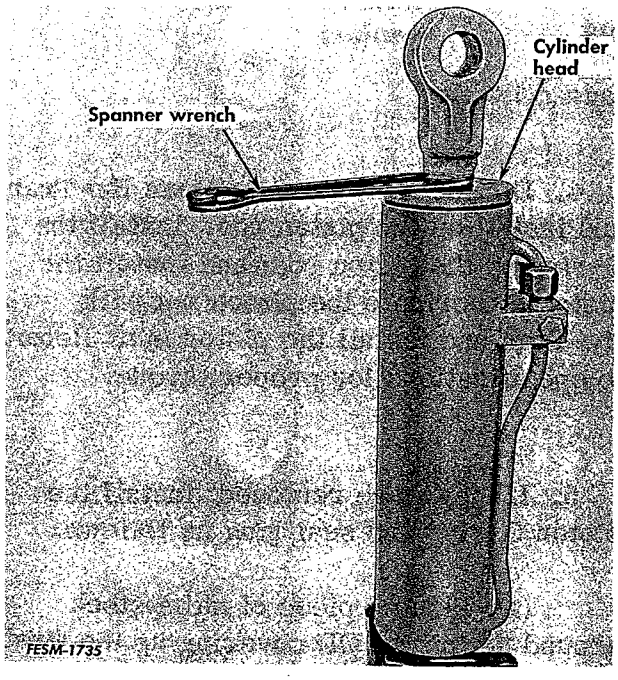
6. Install the front and rear piston bearing rings.

7. Lubricate the piston, piston rod and cylinder in clean Hy-Tran. Install the piston into the cylinder. Be very careful not to damage the seal and bearing rings when passing the cylinder bore edge or retainer groove.

8. "Twist" the front head into position. Install the retainer ring.

9. Plug the ports to prevent entrance of dirt.

Drott - Loader Clam and Grapple Cylinders

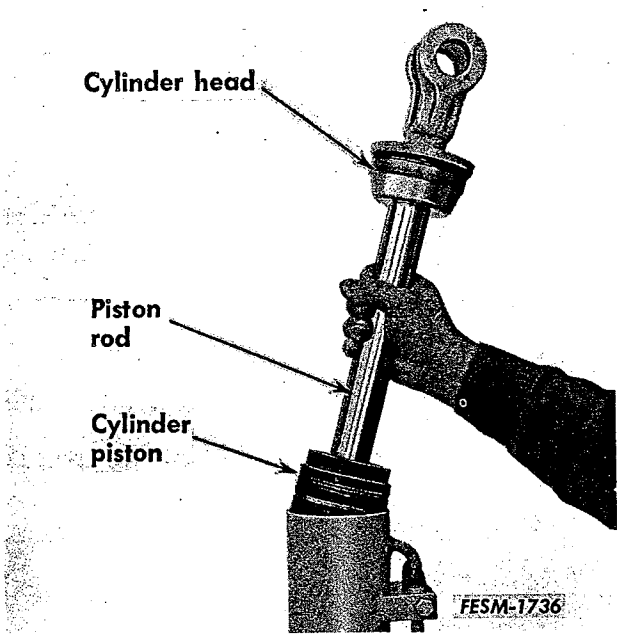


Disassembly

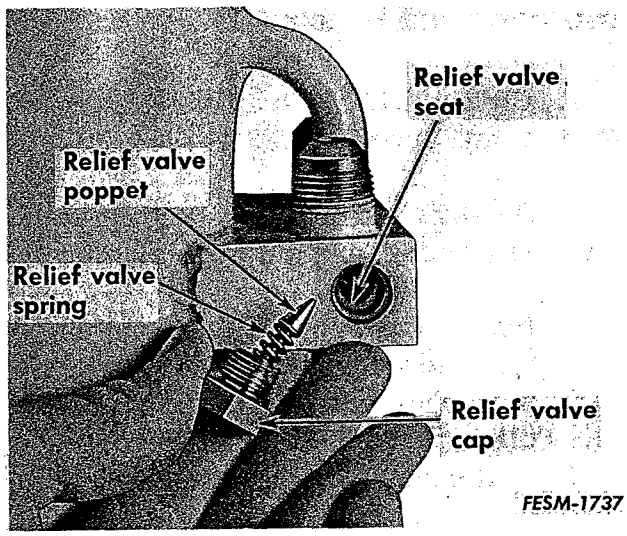
1. Drain the fluid from the cylinder.

2. Clamp the cylinder base in a vise.

3. Remove the cylinder head, using a large spanner wrench.



4. Pull the piston rod and piston assembly from the cylinder tube. Take care to keep the piston rod centered in the tube to prevent binding.



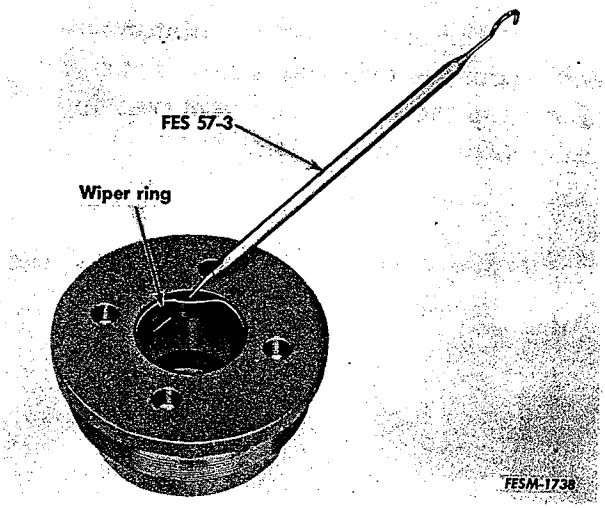
NOTE: Clam buckets using two cylinders do not have relief valves incorporated in the cylinders.

5. Remove the relief valve cap, spring, and poppet. Take care not to lose the shims between the cap and spring.

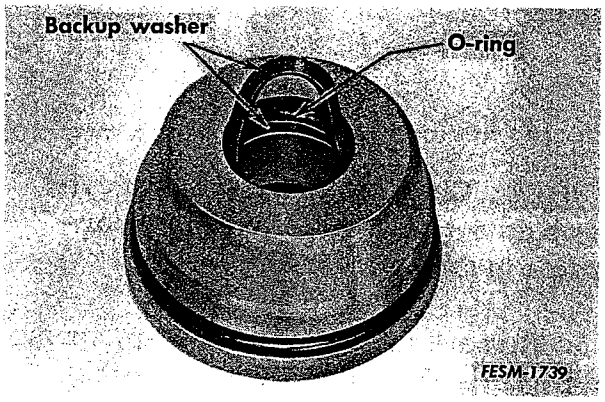
6. Remove the relief valve seat with O-ring from the relief valve bore.

7. Clamp the piston rod eye in a vise and support the piston end of the rod with a stand. Remove the self locking nut from the piston rod. Remove the large half of the cylinder piston, packing, O-ring, and small half of the piston.

8. Slide the cylinder head from the piston rod.



9. Remove the wiper ring from the cylinder head using an FES 57-3 O-ring tool. Remove the two back-up rings and O-ring from the cylinder head.



Inspection and Repair

1. Clean all parts in an evaporative solvent; and dry with compressed air.

2. Remove and discard all O-rings, cylinder packing, and the wear ring.

3. Inspect the cylinder bore and the rod for scratches and grooves. Remove slight scratches using crocus cloth and oil. Polish the surfaces using a rotary motion. Replace the tube if necessary.

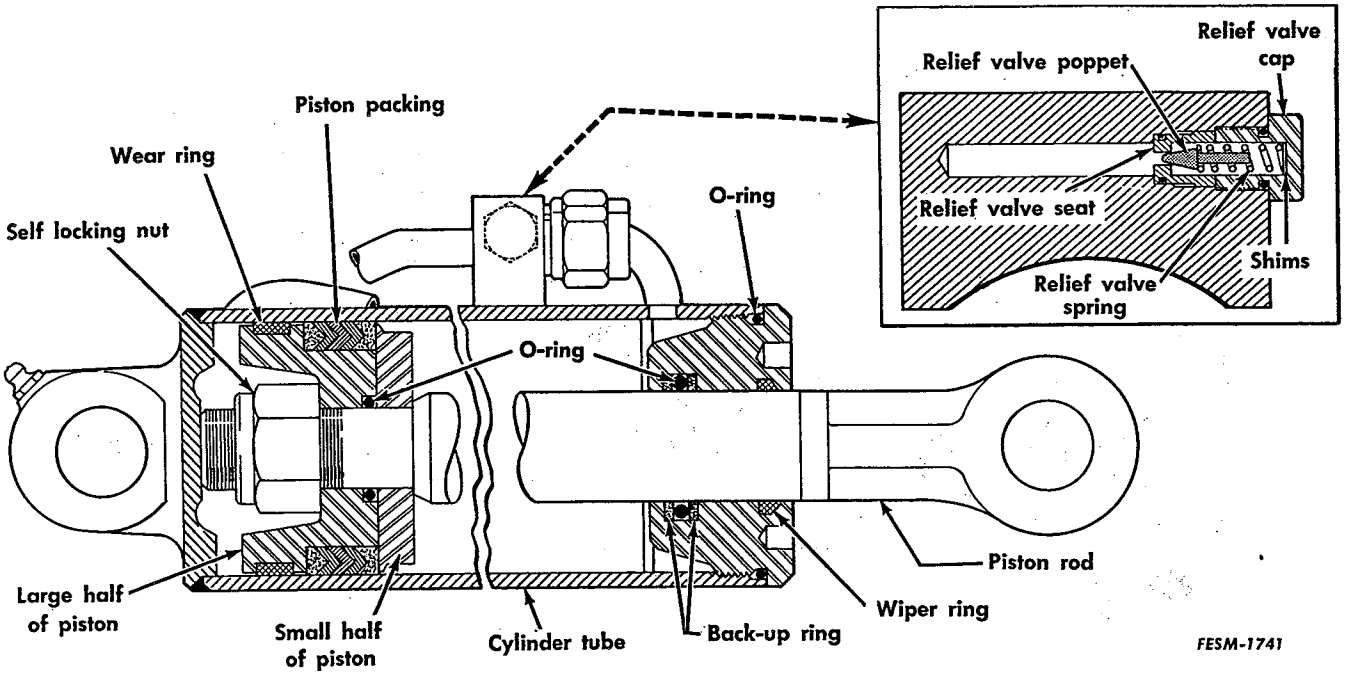
4. Inspect the cylinder for dents, and the rod for straightness. Replace damaged parts.

5. Inspect the piston halves for scratches and grooves. Replace if necessary.

6. Inspect the relief valve seat bore for burrs or scratches. Remove burrs or scratches with fine emery cloth.

7. Lubricate all parts with IH Hy-Tran during reassembly.

Reassembly



1. Install a new wiper ring, two new back-up rings, and a new O-ring, in the cylinder head.

2. Lightly lubricate the piston rod; and install the cylinder head on the piston rod.

3. Install the small half of the cylinder piston on the piston rod. Install a lubricated O-ring in the ID of the large half of the cylinder piston. Install the packing rings, one at a time, on the large half of the cylinder piston.

4. Install the wear ring on the large half of the cylinder piston; and install the piston on the piston rod.

5. With both halves of the piston in place, start the self-locking nut. Clamp the piston rod eye in a vise and support the piston end of the rod. Tighten the self-locking nut to 782 ft. lbs.

6. Remove the piston rod from the vise; and clamp the cylinder tube eye in the vise. Lightly lubricate the cylinder walls. Lubricate the packing rings lightly.

7. Carefully install the piston rod and piston assembly in the cylinder tube. Take care not to damage the packing rings on the threads in the cylinder tube.

8. Slide the piston rod and piston assembly into the cylinder tube. Install the cylinder head. Tighten securely with a large spanner wrench.

9. Install a new O-ring on the relief valve seat. Install the seat in the relief valve bore. Install a new O-ring on the relief valve cap. Install the shims, spring and relief valve poppet in the cap. Install the assembly in the relief valve bore.

10. Cap the two ports to prevent entrance of dirt.

PUMP TEST PROCEDURE

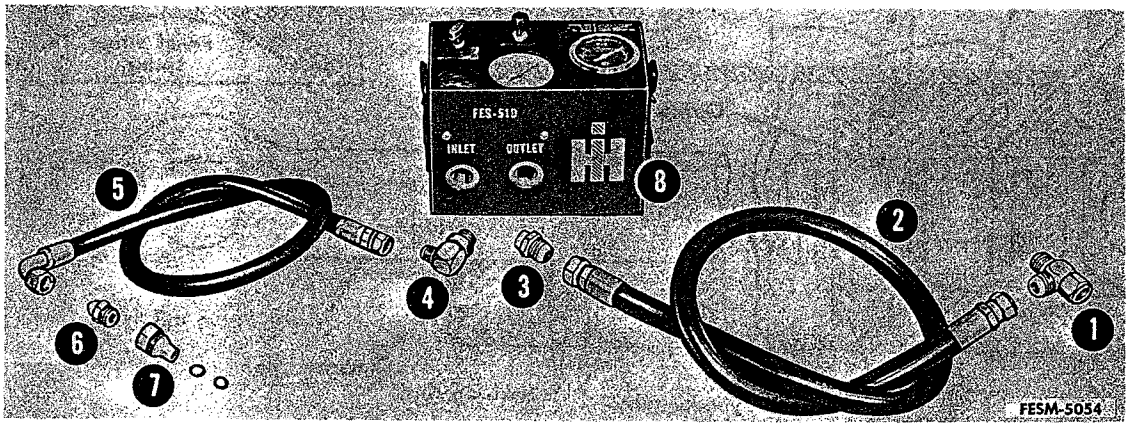
General

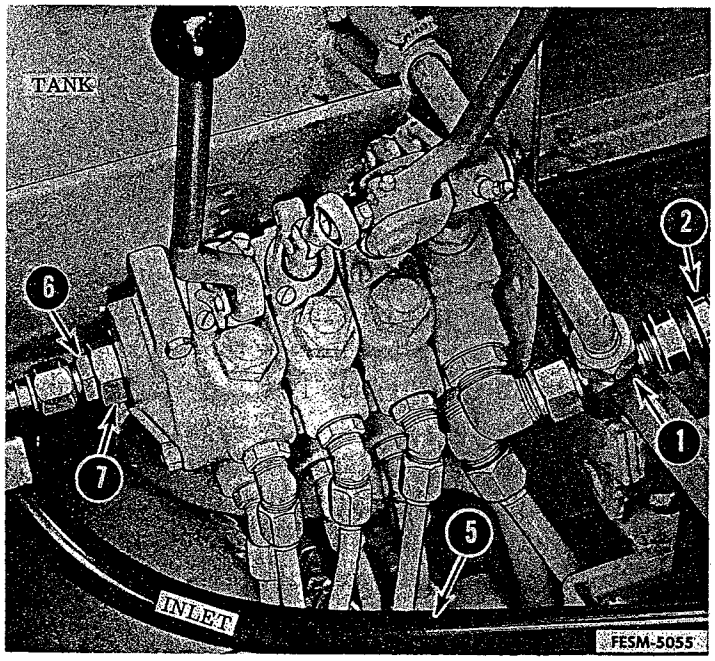
To check pump efficiency, the FES 51D Flo-Rater or a pump test bench must be used; and flow checked against pump specifications.

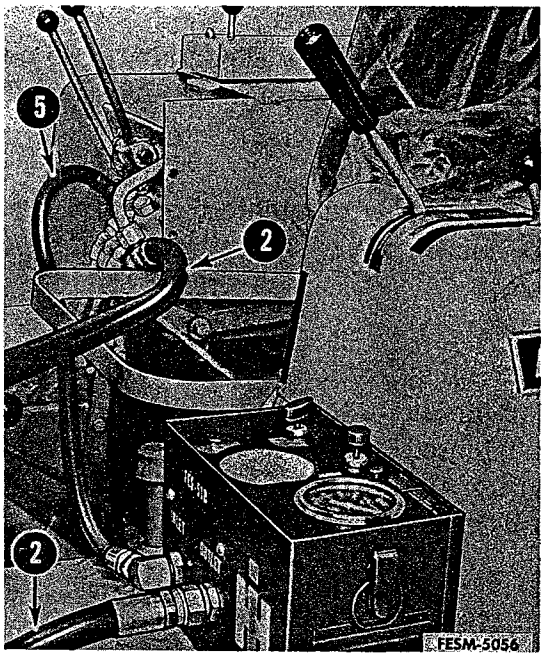
IMPORTANT: Hydraulic fluid must be at operating temperature ($120^{o} - 180^{o}$) prior to checking pump efficiency.

Flo-Rater Installation

Tractors without Remote Control or Backhoe





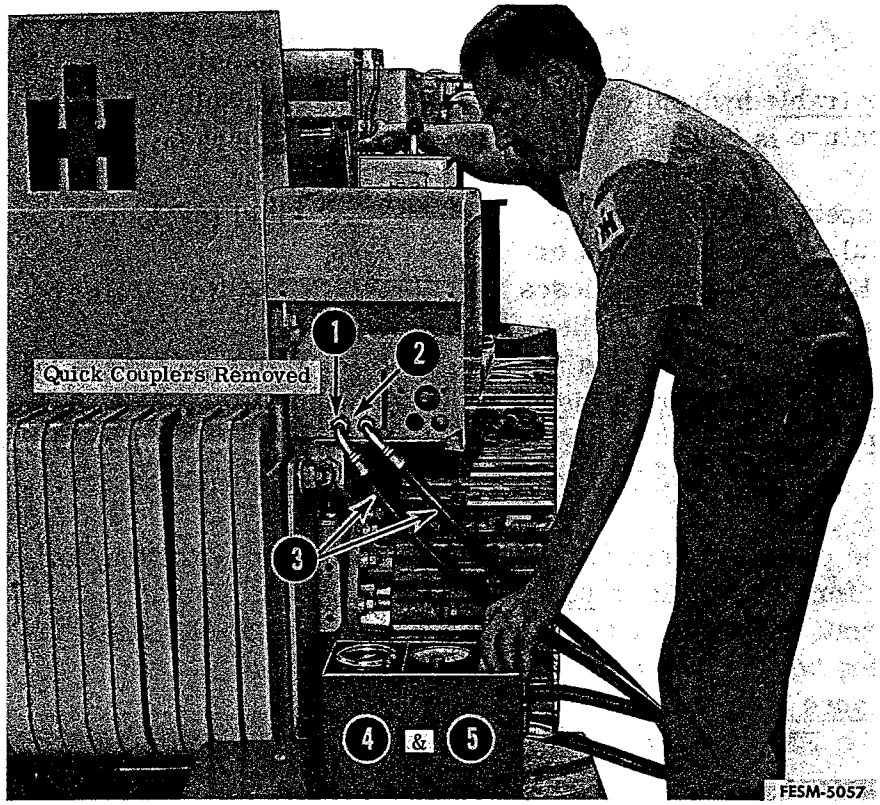


1. FES 98-25 tee
2. FES 76 hose assembly
3. FES 2-50 connector. IH part number 394 981 R1
4. FES 2-51 elbow. IH part number 633 460 R91

   or

4. FES 2-45 connector. IH part number 573 206 R1
5. FES 2-52 hose assembly. IH part number 470 251 R91
6. FES 2-10 connector. IH part number 9 410 204
7. Power beyond conversion kit. IH part number 677 732 R91
8. FES 51D Flo-Rater

Tractors with Remote Control



1. FES 2-53 union (2) IH part number 584 802 R1
2. FES 2-10 connector (2) IH part number 9 410 204
3. FES 2-52 hose assembly (2) IH part number 470 251 R91
4. FES 2-45 connector (2) IH part number 573 206 R1
5. FES 51D Flo-Rater

NOTE: Quick couplers must be removed from the remote control manifold.

Tractors with Backhoe

Refer to GSS-1371, Testing Hydraulic Systems on 3121, 3131, and 3141 backhoes.

TROUBLE SHOOTING

One of the most common complaints regarding hydraulic systems is overheating.

The maximum desirable hydraulic fluid operating temperature is 200° F.

Short periods of operating above 200°F will not be harmful to O-rings, seals or hydraulic fluid. However, the fluid loses much of its lubricating ability at higher temperatures, so bearings and gears could be damaged. Temperatures this high indicate a malfunction. Find the cause!

The fact that some part of the hydraulic system is too hot for bare hands is not a sign of harmful heat. Temperatures of 120° - 130° are too hot for comfort on bare hands. Measure the temperature of the fluid with the FES 51D Flo-Rater or an accurate thermometer.

Before investigating any service problem on the hydraulic system, the following must be checked:

1. Fluid level.
2. Condition of filters.
3. Efficiency of the hydraulic pump or pumps.
4. External leakage.
5. Age, condition, and type of fluid.
6. Air in the system or suspended in the fluid.
7. Fluid operating temperature.

Problem	Cause
Machine will not lift load.	1. Low operating pressure. 2. Excessive load. 3. Leaking fluid. 4. Relief valve(s) faulty. 5. Worn cylinder packing or damaged cylinder tube. 6. Inefficient pump. 7. Foamy fluid--wrong fluid, or air being sucked into system. 8. Valve obstruction - clean thoroughly. 9. Clogged filter (Replace fluid and filter) 10. Pump suction air leak, due to loose connections. 11. Low fluid level. 12. Collapsed suction tube.

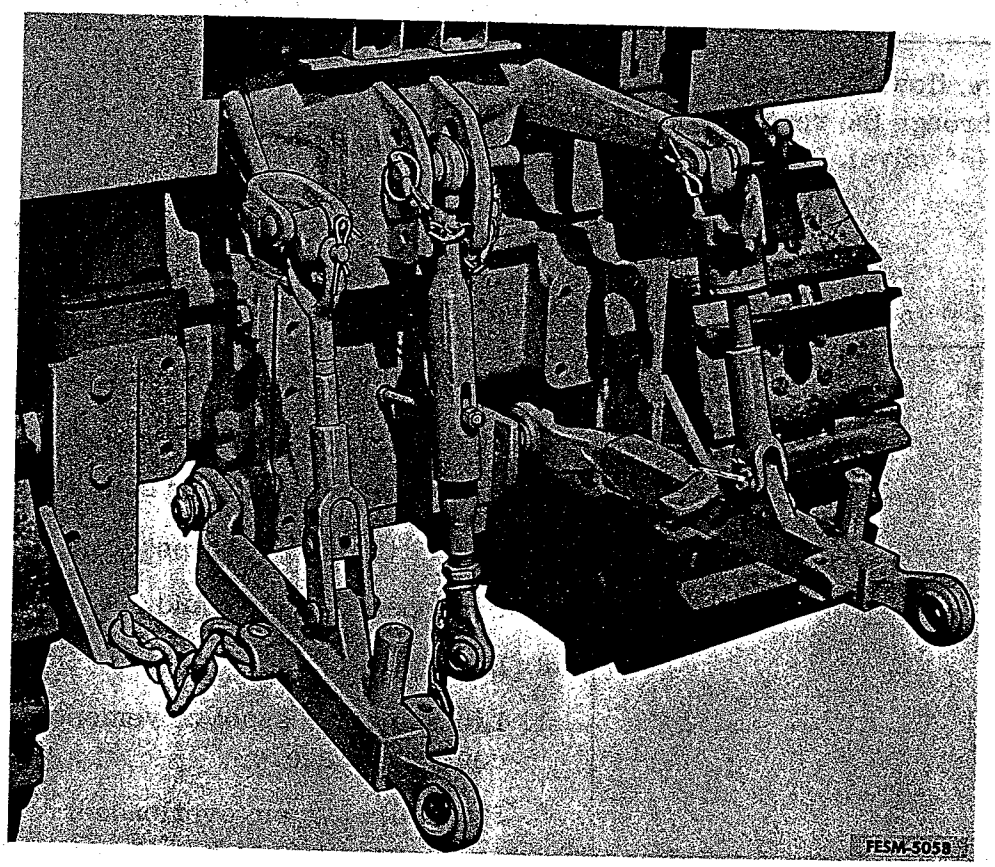
Problem	Cause
Machine will not lift load. (Continued)	13. Air leakage around filter cap, reservoir dipstick plug, or reservoir pressure relief valve. 14. Pump drive failure.
Load drops or settles excessively when the control valve is in neutral.	1. Scored piston rod or faulty seals (external leak). 2. Control valve worn. 3. Worn piston seals if piston rod extends when settling. 4. External leaks (hoses, fittings, etc). 5. Control valve port check valves and seals leaking.
Noisy pump.	1. Foamy fluid -- wrong fluid, or air being sucked into system. 2. Clogged or restricted filter. 3. Collapsed suction hose. 4. Worn or loose pump drive. 5. Air leakage at reservoir pressure relief valve, fluid dipstick or filter cap. 6. Insufficient fluid.
Leaking cylinders.	1. Scored piston rod or faulty seals.
Leakage at control valve.	1. Damaged or worn spool seal(s). 2. Scored spool or body. 3. Port fittings loose or port threads damaged. 4. O-rings between valve sections - damaged. 5. Valve sections warped from over tightening valve bank stud.
Sticky valve spool.	1. Paint or other foreign material on spool. 2. Valve bank studs or mounting bolts - incorrect torque. Retorque to specifications.

Problem	Cause
Sticky valve spool. (Continued)	3. Valve spool centering spring retainer loose or damaged. 4. Control lever linkage faulty. 5. Spool bent (Sticks at operating temperature), (OK when cold).
Valve spool will not remain in detent position.	1. Detent spring broken or weak. 2. Detent sleeve worn. 3. Spool seal leakage, filling detent cap with pressurized fluid. 4. Misadjusted valve linkage.
Leaking pump.	1. Worn pump shaft seals or bushings. 2. Damaged housing seals. 3. Loose hydraulic line connections.
Pump drive disconnects.	1. Drive shaft misalignment. (a) Loose pump mount (b) Loose bolster mount 2. Worn clutch assembly. 3. Weak clutch spring.
Front mounted pump coupling failure.	1. Misalignment. 2. Worn or broken clutch parts. 3. Improper assembly. 4. Pump mounting bolts loose.
Pump seals "blowing out".	1. Restricted hydraulic line between pressure port and system relief valve. 2. Relief valve not opening. 3. Incorrect relief valve pressure setting. 4. Pump drive misaligned. 5. Excessive clearance between gear face and end plate.

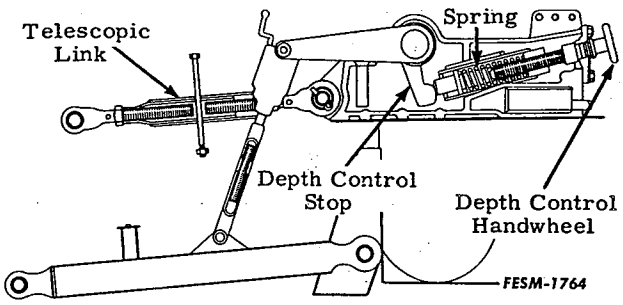
Problem	Cause
Excessive wear on pins and/or bushings. (Loader or Bullgrader).	1. Insufficient or improper lubrication. 2. Locking pins broken or loose on fixed pins. 3. Wrong parts used. 4. Misalignment.
Broken welds.	1. Loose bolts. Follow "Daily Check" in Operator's Manual. 2. Overloading or abuse. 3. Insufficient lubrication of pins and bushings. 4. Misalignment. 5. Improper operation of system and/or circuit relief valves.
Bending cylinder rods.	1. Improper operation of system and/or circuit relief valves. 2. Improper location of circuit relief valves. 3. Crossed lines. 4. Overloading and abuse.
Reservoir overflows (Fluid is discharged through the reservoir pressure relief valve).	1. Air in system. 2. Load dropping too fast. 3. Dropping loads with engine not running. 4. Restricted filter. 5. Reservoir is overfull.
Slow operation.	1. Restricted filter or suction line. 2. Faulty system relief valve. 3. Suction hose leaking or collapsed. 4. Restriction in high pressure line(s). 5. Improper or faulty fluid. 6. Inefficient pump. 7. Limited valve spool movement -- check control linkage. 8. Hydraulic system overloaded.

Problem	Cause
Overheating. NOTE: See Introduction to Troubleshooting	1. Improper operation. 2. Incorrect or faulty fluid. 3. Restrictions in fluid lines. 4. Air in system. 5. Oil cooler plugged, either externally or internally.* 6. Faulty relief valve. 7. Inefficient pump (internal slip). 8. Fan belt slips.* 9. Fan worn out.* 10. Using blower fan with backhoe unit. *Tractors equipped with backhoe only.

THREE POINT HITCH HOUSING



General



The three point hitch consists of the top' housing, which contains the rock shaft and the operating mechanism, the lower linkage and the top telescoping link.

The hitch is operated by a control valve mounted in the right console of the tractor. The rockshaft is actuated by a single acting cylinder which is controlled by a single acting spool valve with a float position. The float position enables the operator to allow a machine to trail free, following the contour of the ground. The depth of a machine may be controlled with the hydraulic system or with a mechanical depth control, adjustable by a hand wheel.

The rockshaft arms may be lifted by pulling the hydraulic control lever to the rear. When the lever is released it will return to neutral and the rockshaft will be held in this position. If it is desired to lower the rockshaft the lever is moved forward until the required position is reached. The lever will again return to neutral by itself, holding the rockshaft in this position.

If a floating position is required, the valve lever is pushed forward past the lower position locking the spool into the detent. The spool will remain in this position allowing fluid to pass from the cylinder into the reservoir or vice versa whenever pressure is exerted on the piston by the linkage. The rockshaft and arms are free to move to any position.

The piston is fitted with a pressure relief valve. This valve comes into operation only when a pressure build-up resulting from an increase in fluid temperature occurs, when the piston is at the end of its travel, or from a shock load on the piston.

Weight Transfer

Weight transfer depends on the weight of the implement transmitted through the depth control stop. However, when the top link undergoes telescopic action because of uneven ground conditions, this contact would be lost. This is overcome by incorporating a compensating spring in the depth control stop which keeps this vital contact in operation.

When using weight transfer for long heavy ground working implements, the slotted setting on the telescoping link should always be used. In working position, correctly set for implement pitch and on level ground, the top link should be in compression (adjustment downward may be made on the turnbuckle). Then when the tractor pitches downward into a depression, the top link will momentarily be in tension and therefore extend and the work will remain level. For other usage, the top link should be in its fixed position; such as with any ground implements of light draft.

By use of the telescopic top link and a compensating spring within the depth control stop, the implement is less affected by the forward or rearward pitch of the tractor over uneven ground. A high standard of regular depth control can therefore be maintained.

Hydraulic Flow

Fluid at system pressure flows from the control valve to the hitch lift cylinder. The system is of the single action design.

The 12 gpm pump flow is direct while the 17 gpm system is via a "two-way" restrictor creating a restricted "lift" fluid supply thereby preventing implement over-travel.

Fluid under pressure flows into the cylinder "lifting" the hitch arms through a linkage mechanism. Fluid displaced by this action (back-side of cylinder) is forced into the housing and returned to the reservoir by a hose that contains a 2-way restrictor valve. Return flow in this instance lifts the restrictor to provide unrestricted return to the reservoir.

Placing the control valve in lower (or float if the operator desires) permits the implement weight to force the fluid previously trapped in the cylinder, to return to the reservoir via the control valve. If the system is of the 17 gpm configuration this return flow "lifts" the two-way check valve to provide unrestricted return.

The movement of the piston during the "lowering" cycle creates a void behind the piston and in turn the hitch housing. Fluid to fill this void flows from the reservoir through the 2-way restrictor, which, due to fluid flow direction seats thereby restricting the flow rate and in turn retarding the speed of the hitch (implement) fall.

The restrictor in this instance prevents sudden pressure surges and reduces the system shock loading as well as providing better control over the implement.

Operation in "float" position merely permits the implement to raise or lower of its own free will.

Depth Control

The handwheel, which is convenient to the operator's right hand, adjusts the position of the mechanical depth control stop within the hydraulic housing.

The limit of the fall of the lift link arms can be varied by turning the depth control handwheel. Turning clockwise lowers the limit of linkage fall and turning counterclockwise brings the limit of fall to a higher position. One full turn of the handwheel, either clockwise or counterclockwise, affects the linkage height by approximately one inch relative to the previous setting.

Removal

1. Thoroughly clean the area around the hitch housing.

2. Disconnect and remove the top link and two lift rods.

3. Remove the operators seat, seat support and shield. Remove the fuel tank and filler strips on the outside of the clutch covers.

4. CAUTION: Remove the tension from the steering assist springs and disconnect the steering rods.

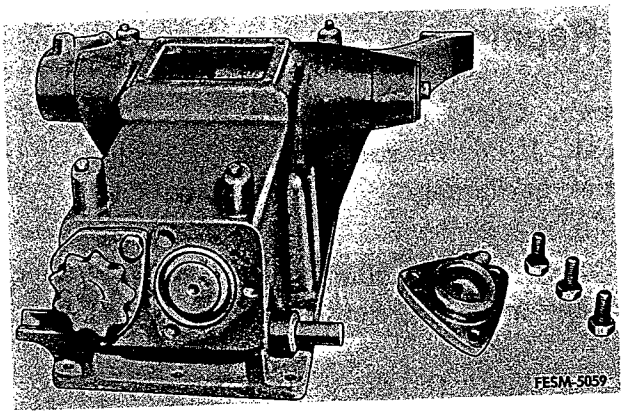
5. CAUTION: Remove the hydraulic reservoir filler plug slowly to allow air under pressure to escape.

6. Remove, and cap or plug the hydraulic lines from the hitch housing.

7. Remove the cap screws securing the steering clutch housing covers to the rear frame; and slide the housings outward to provide clearance for the removal of the hitch housing.

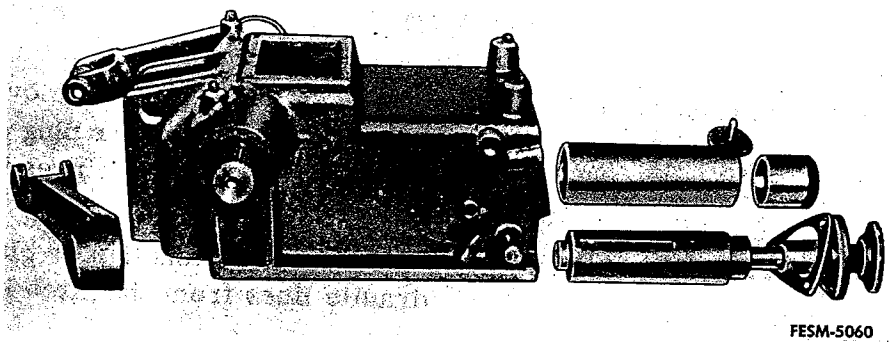
8. Remove the cap screws securing the hitch housing to the rear frame. Lift the hitch housing from the rear frame.

Disassembly



1. Thoroughly clean the hitch housing.

2. Remove the cap screws securing the lift cylinder cap to the hitch housing and remove the cap. Remove the cover from the top of the hitch housing.

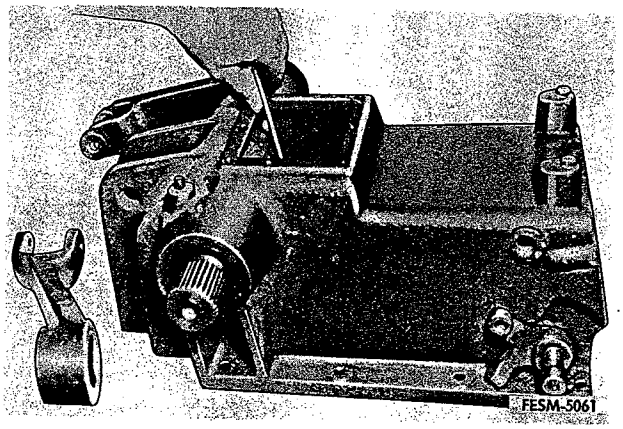

FESM-5060

3. Install a cap screw in the end of the cylinder piston and pull the piston from the cylinder. Remove the connecting rod from the rocker arm.

4. Remove the cylinder, if it did not come out with the piston, by tapping the rear of the cylinder with a wood block.

5. Remove the cap screws from the depth control assembly, turn the assembly if necessary to align the key on the side of the depth control spring with the keyway in the housing and remove the depth control assembly.

6. If it is necessary to remove the rockshaft, remove the cap screws and retaining plates from the ends of the rockshaft and remove both lift arms.


FESM-5061

7. Remove the set screws from the cylinder rocker arm and the depth control cam by working through the opening in the top of the housing.

8. The rockshaft may now be driven from the housing from either side. The bushing and oil seal will come out with the shaft. These must be replaced. The other bushing and seal should also be removed and replaced.

Inspection and Repair

1. Thoroughly clean all components of the hitch and blow dry with compressed air.

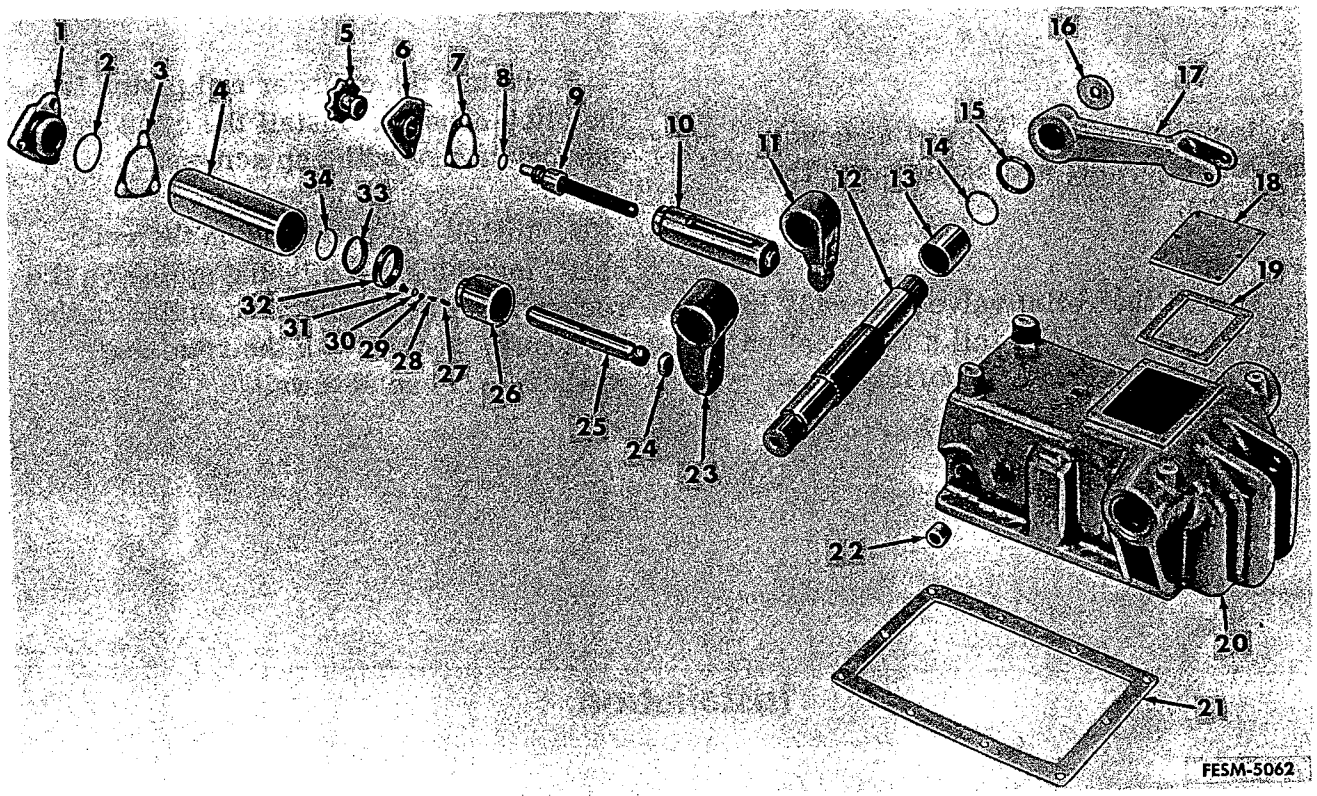
2. Remove the relief valve plug from the piston. Remove the relief valve ball, ball rider, and spring; and inspect for damage.

3. Inspect the piston and cylinder for wear. Check the condition of the piston seal. It can be reused if it shows no wear or damage.

4. Check the condition of the rockshaft, rocker arm, and depth control cam.

5. Check the depth control spring for damage.

Reassembly



1. Lift cylinder cap
2. O-ring
3. Gasket
4. Lift cylinder
5. Handwheel
6. Support
7. Gasket
8. Sealing ring
9. Depth control screw
10. Depth control spring
11. Depth control cam
12. Rockshaft
13. Bushing
14. Washer
15. Seal
16. Retaining plate
17. Lift arm
18. Housing cover
19. Gasket
20. Hitch housing
21. Gasket
22. Bushing
23. Rocker arm
24. Bushing
25. Connecting rod
26. Piston
27. Relief valve spring
28. Ball rider
29. Relief valve ball
30. O-ring
31. Relief valve plug
32. Seal
33. Seal retainer
34. Seal retaining ring

1. Install the rockshaft into the housing, installing the rocker arm and depth control cam as the rockshaft is installed. There is a missing spline on the rockshaft which must be engaged with the matching spline on the rocker arm and depth control cam.

2. Install the rockshaft bushing, taking care not to damage the ends of the bushing.

3. Install the rockshaft washer and seal on each end of the rockshaft. Shim stock should be used over the splines to prevent damage to the seals during installation.

4. Install the set screws in the rocker arm and depth control cam. Install the connecting rod bushing in the rocker arm and install the connecting rod.

5. Assemble the depth control spring assembly. Use a new gasket and sealing ring.

6. Install the depth control assembly in the hitch housing and secure with the cap screws.

7. Install the relief valve assembly in the cylinder piston. Install a new seal on the piston if necessary. Lubricate the piston with Hy-Tran and install in the cylinder.

8. Install the cylinder and piston into the hitch housing. Install the cylinder cap and secure with cap screws.

9. Install the lift arms on the rockshaft, matching the missing spline on the rockshaft with the matching spline in the lift arms. Secure with the retaining washers and cap screws.

Installation

1. Install the hitch housing with a new gasket.

2. Force the clutch covers toward the center line of the tractor; and tighten the cap screws to 85 ft. lbs.

3. Connect the steering rods and hydraulic lines. Then refill the hydraulic reservoir.

4. Install the fuel tank, filler strips, and operators seat assembly.

5. Connect the top link and two lift rods.

6. Start the engine and run for several minutes. Cycle the hitch up and down several times to remove air.

7. Stop the engine; check for leaks; and refill the hydraulic reservoir to the proper level.

THREE POINT HITCH-LINKAGE SERVICE

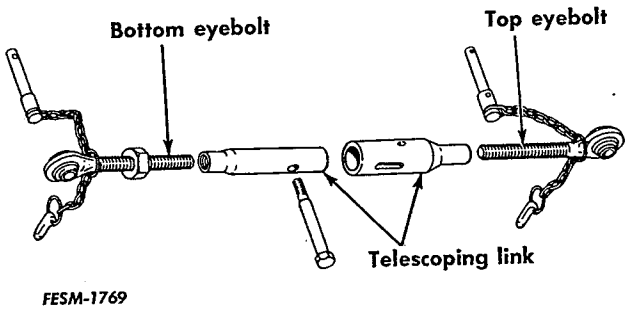
NOTE: The three point draft control hitch is designed to accommodate category 1 implements only. Refer to the Operator's Manual for mounting procedure.

Top Link

Removal and Disassembly

1. Clean off all excess dirt and foreign matter from the linkage.

2. Remove the pin and top link from the tractor hitch housing.



Top link disassembled

3. Remove the bottom eyebolt assembly, jam nut, cotter pin, chain, and pin from the telescoping link.

4. Remove the top eyebolt assembly, cotter pin, chain, and pin, from the telescoping link.

5. Thoroughly clean and inspect all parts for wear or cracks. Replace as necessary.

Reassembly and Installation

Reassembly and installation is the reverse of removal and disassembly. Lubricate the threads of the link and eyebolt assemblies.

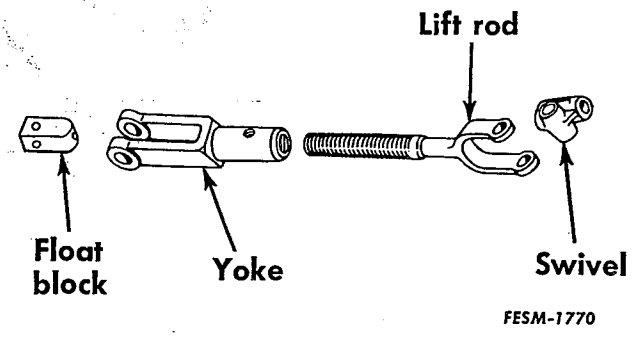
Lift Rod

Removal and Disassembly

1. Clean off all excess dirt and foreign matter from the linkage.

2. Remove the cotter pin and the pin holding the lift rod to the lift arm.

3. Remove the cotter pin and pin holding the lift rod yoke to the lower link assembly and remove the lift rod assembly.



Lift rod disassembled

4. Unscrew the lift rod from the float block.

5. Separate the lift rod from the yoke.

6. Thoroughly clean all parts. Inspect all parts for wear or cracks. Replace as necessary.

Reassembly and Installation

Reassembly and installation is the reverse of removal and disassembly. Lubricate the lift rod and float block threads.

Leveling Rod

Removal and Disassembly

1. Remove all dirt and foreign matter from the linkage.

2. Remove the cotter pin, and the pin holding the leveling rod to the lift arm.

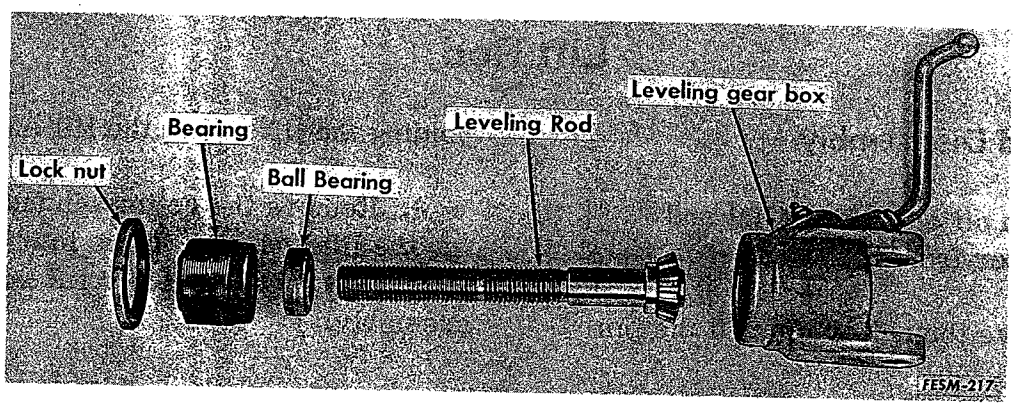
3. Remove the cotter pin, and the pin holding the leveling rod to the lower link assembly; and remove the rod.

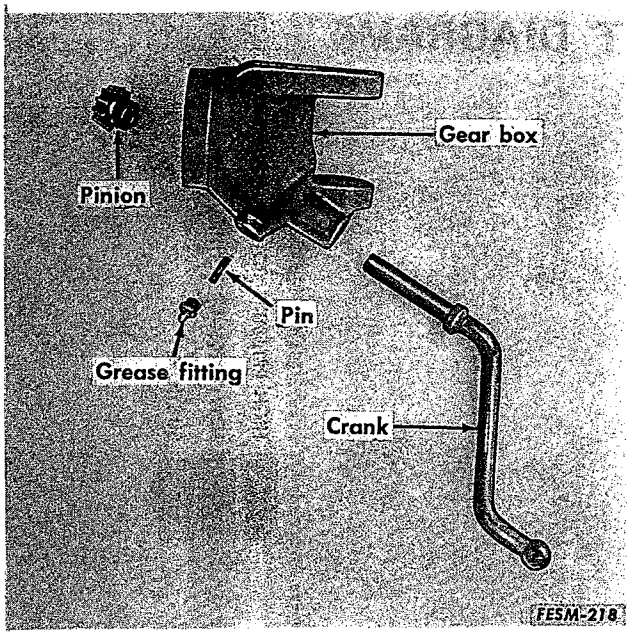
4. Unscrew the gear box assembly from the leveling rod yoke.

5. Clamp the gear box assembly in a vise; and remove the lock nut bearing and ball bearing.

6. Lift out the leveling rod and pinion.

7. If necessary, press the leveling rod pinion from the shaft.





8. Remove the grease fitting; and through the exposed hole, drive out the pin holding the leveling rod pinion to the leveling crank.

9. Remove the crank and pinion.

Inspection and Repair

Visually inspect the parts for wear, breaks, or cracks. Some wear can occur without affecting operation. Whenever mating parts are worn so that play is visible or can be easily felt, continued use without replacing one or both parts may create shock loads resulting in casting breakage or more serious damage.

Reassembly and Installation

1. Install the crank into the gear box.

2. Install the pinion; and drive in the pin through the grease fitting hole.

3. If it was removed, press the leveling crank pinion onto the rod.

4. Install the pinion and shaft assembly into the gear box, pinion end first.

5. If it was removed, install the ball bearing into the bearing block, thrust face up.

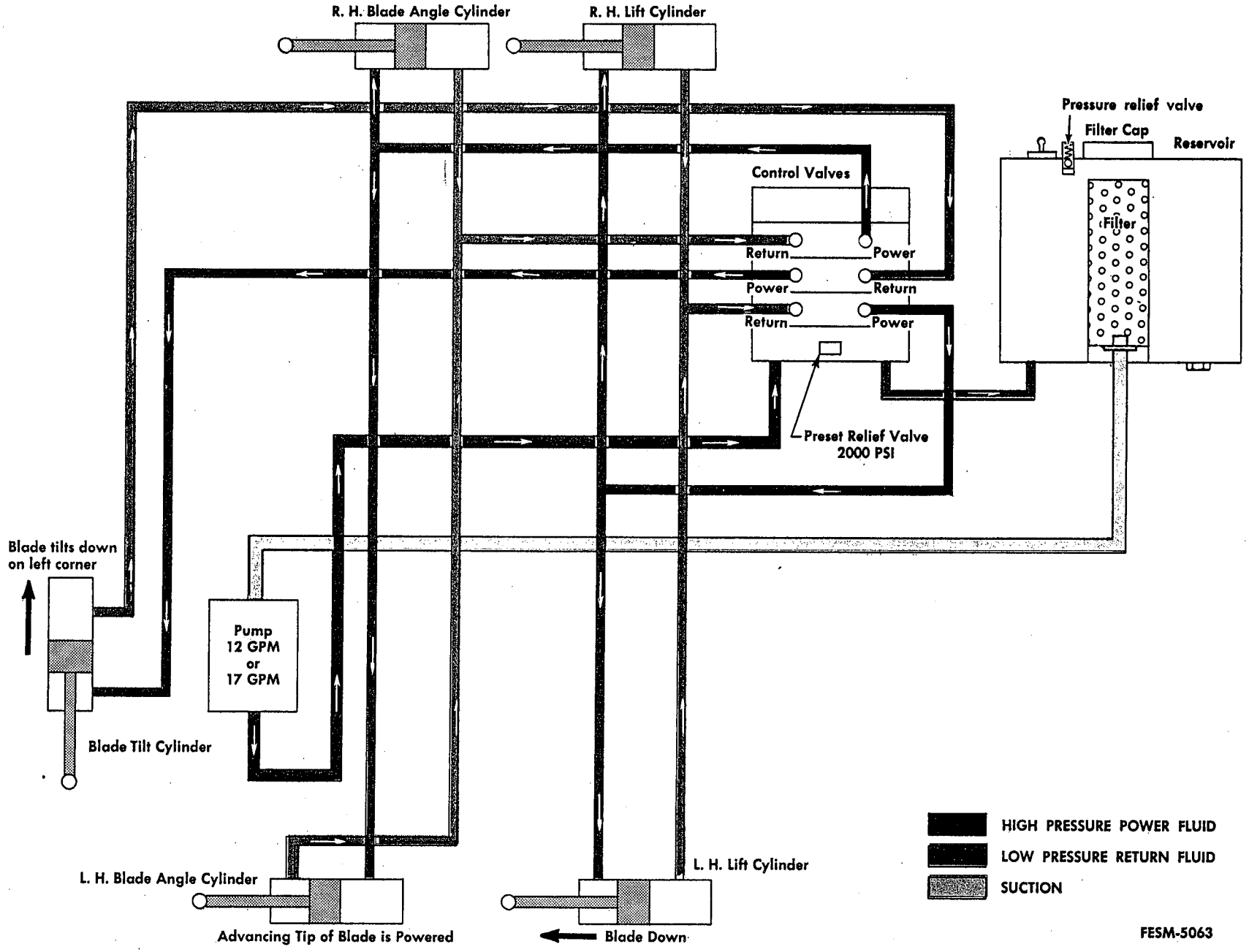
6. Install the bearing block into the gear box.

7. Install the bearing lock nut.

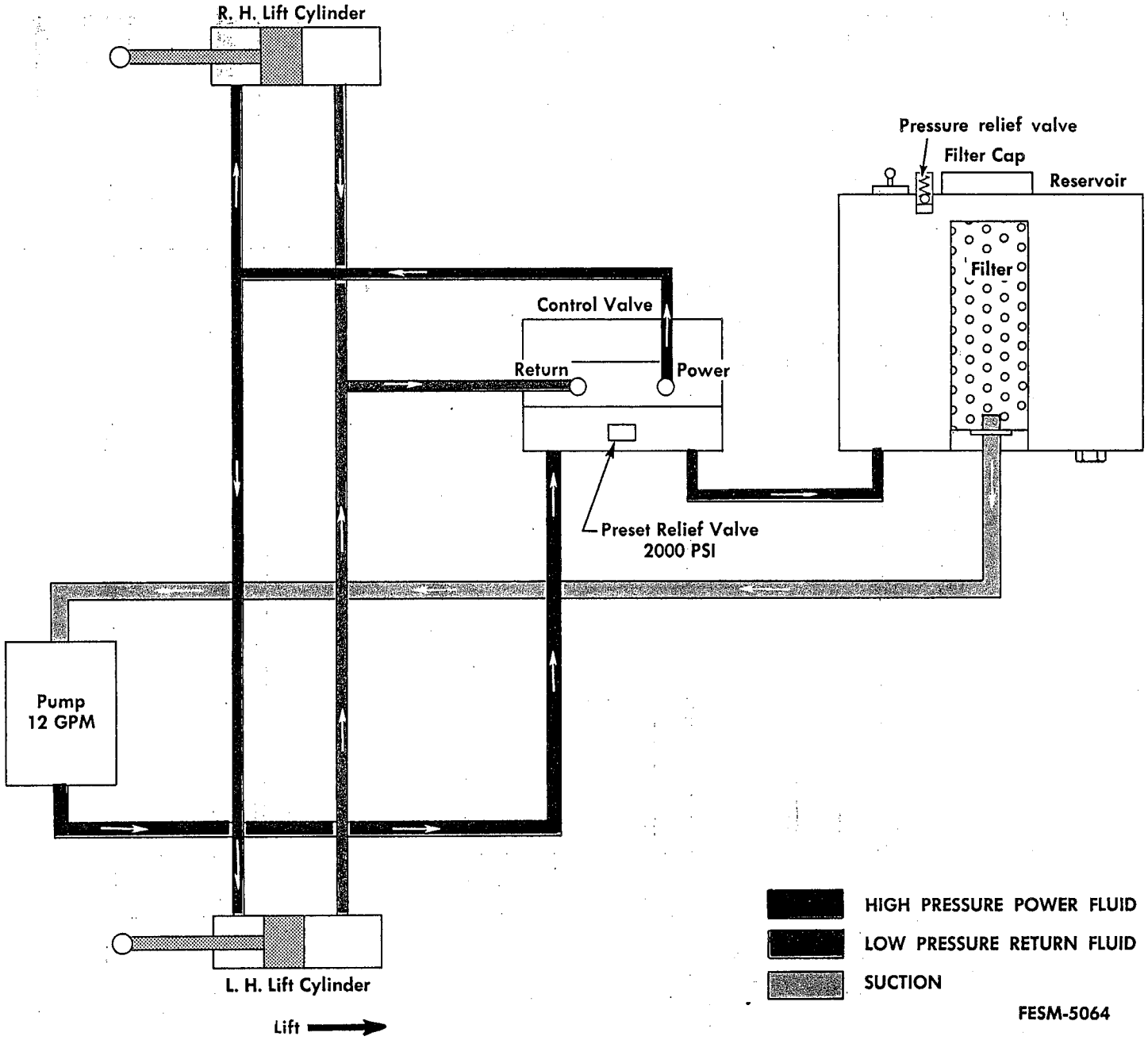
8. Install the gear box onto the leveling rod yoke.

9. Install the pin and cotter pin holding the leveling rod to the lower link assembly.

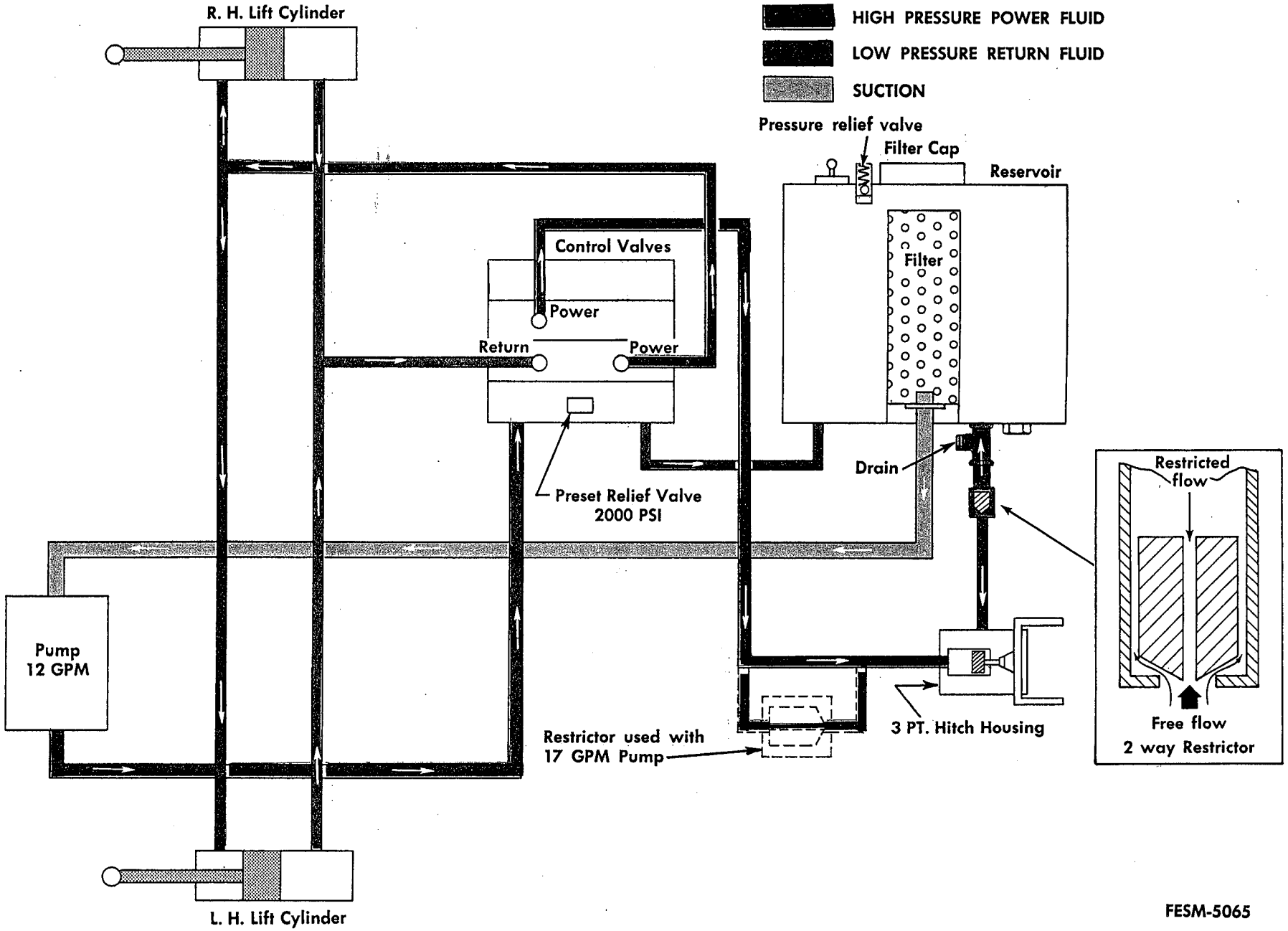
10. Install the pin and cotter pin holding the leveling rod to the lift arm.



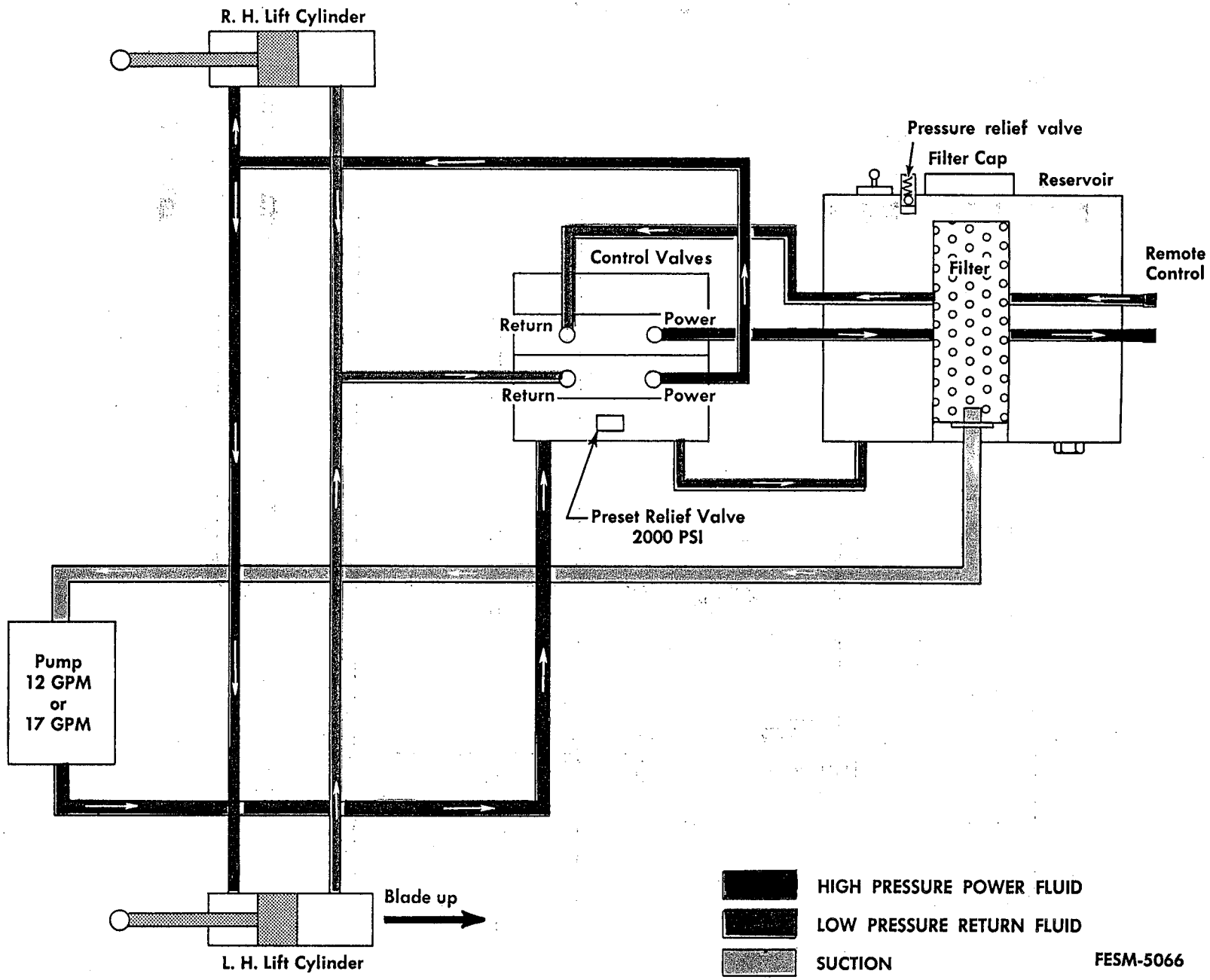
500-C Crawler Tractor with No. 510 Bullgrader



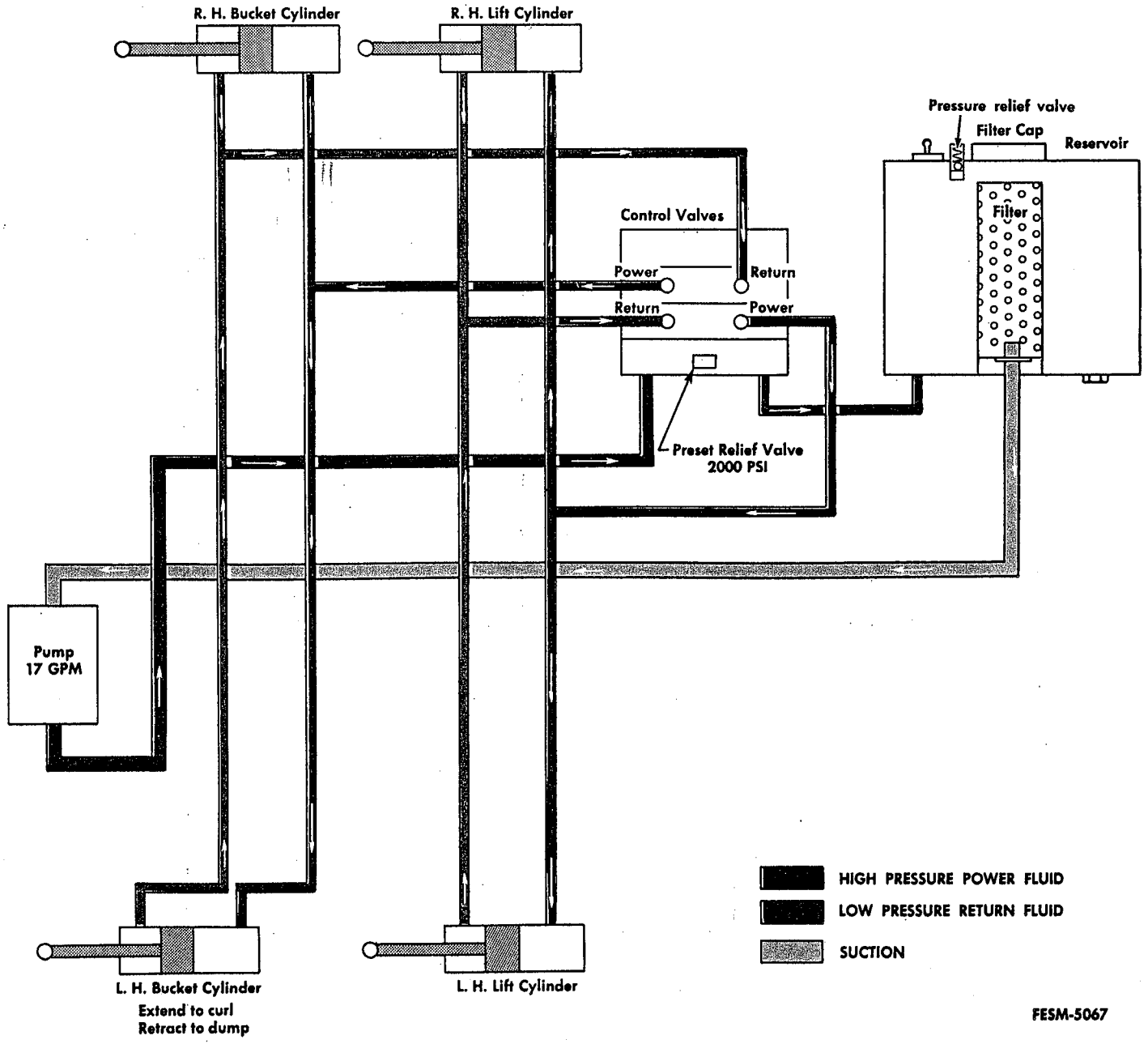
500-C Crawler Tractor with No. 511 or 512 Bullgrader



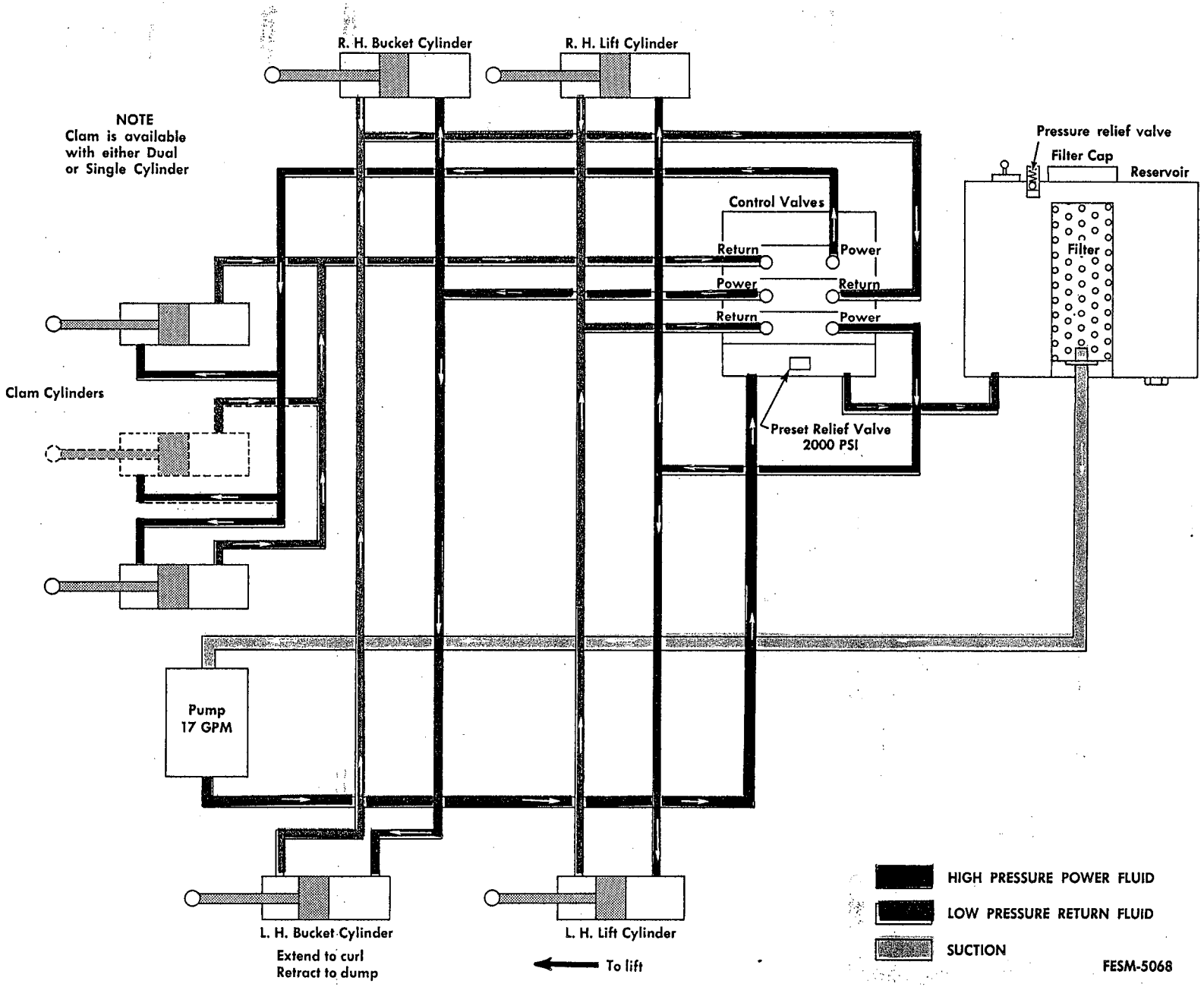
500-C Crawler Tractor with No. 511 or 512 Bullgrader and Hitch or Remote Control Single Acting Cylinder



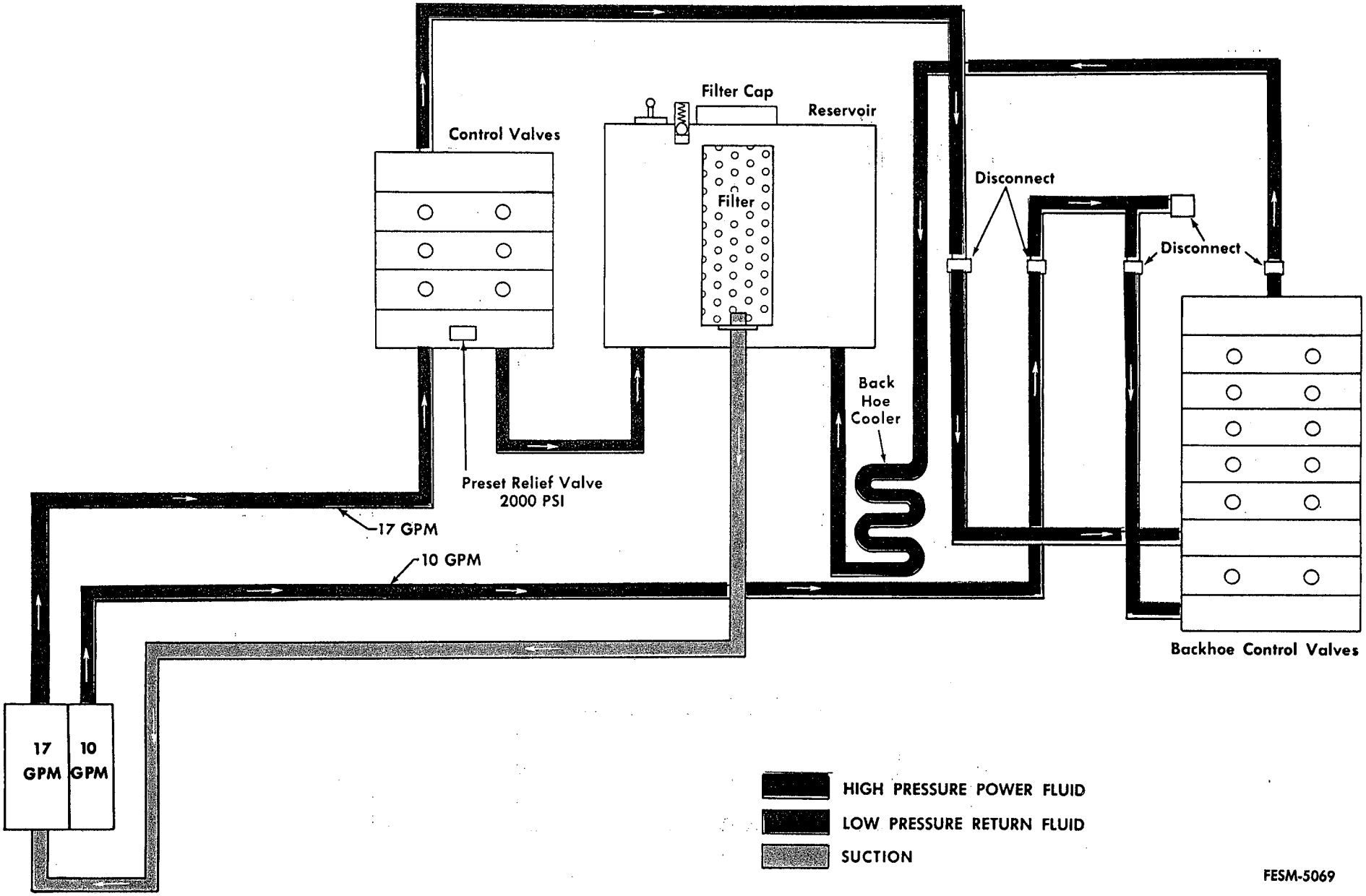
500-C Crawler Tractor with No. 511 or 512 Bullgrader and Remote Control Double Acting Cylinder — Ripper, Plow, etc.



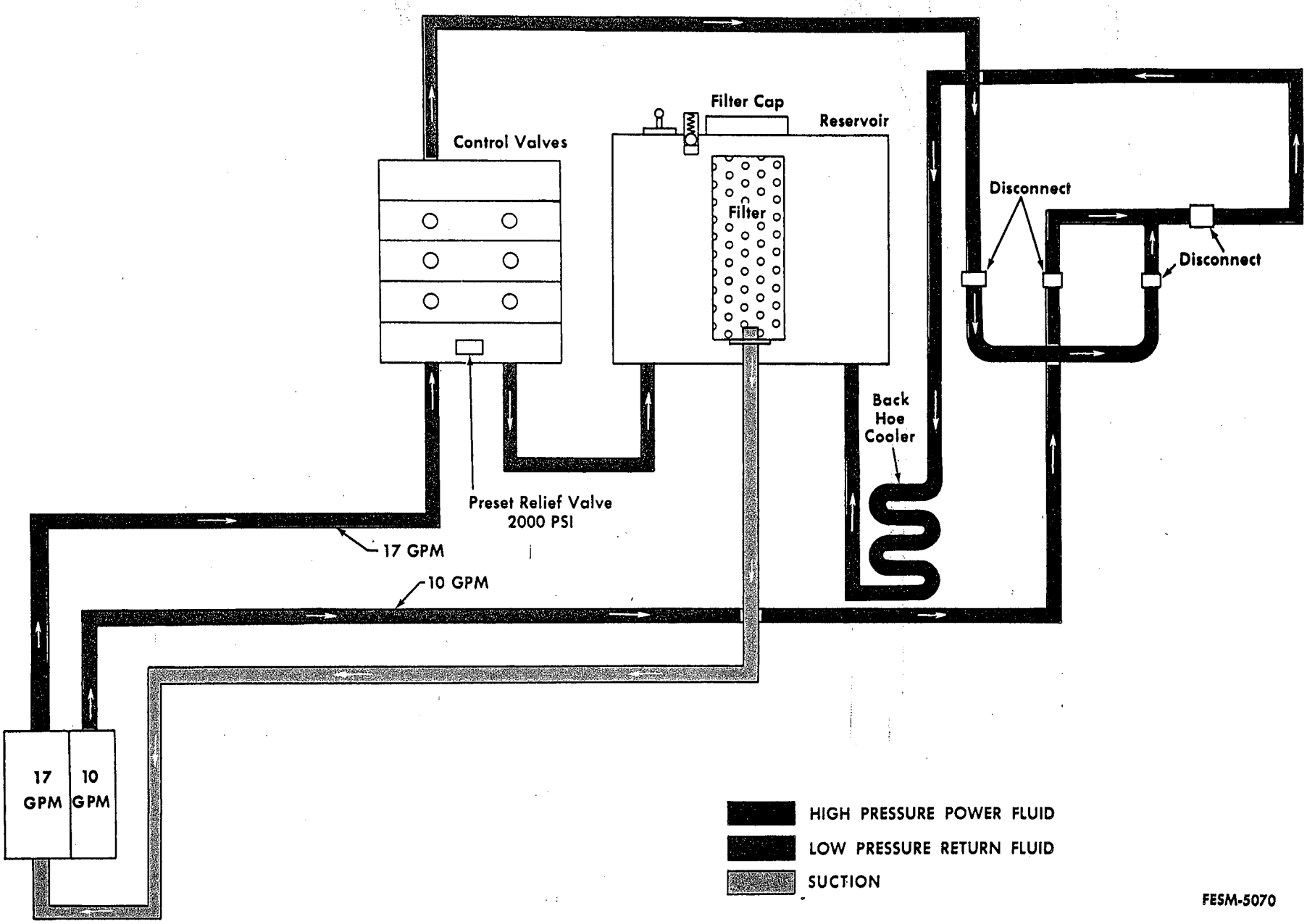
75 Loader with General Purpose Bucket



75 Loader with Drott 4 in 1 Bucket (single or dual cylinders) or Grapple with dual cylinders.



500-C Backhoe Hydraulics



500-C Backhoe Removed

Section 12

ADJUSTMENTS

CONTENTS

SPECIFICATIONS

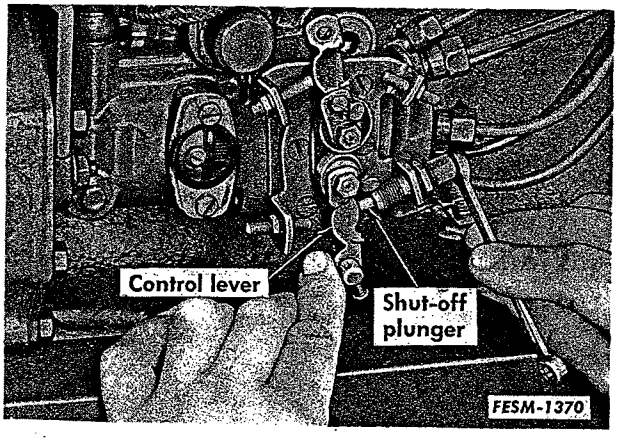
	Diesel Engine	Gasoline Engine
Start and stop positions	See text	———
Low idle speed (rpm)	550	425
High idle speed (rpm)	2750	2700
Fan belt tension (inch deflection with 25 lb. force)	3/4	5/8

Throttle linkage)
Decelerator pedal linkage) ..... See foldout #1

Power control pedal linkage ..... See text
Clutch pedal-free travel (inches) 1-1/8
Directional control lever linkage ..... See foldout #1
Starter safety switch adjustment ..... See text
Steering lever free play measured at lever tip (inches) ..... 1 to 1-1/4
Adjustable steering rod length ..... See text
Brake cross shaft arm - free travel (inch) 1/4
Steering and brake actuating lever clearance (inch) 3/8
Steering assist springs ..... See text
Track chain tension (inches sag in track chain - measured between top idler and front sprocket) ..... 1-1/4 to 1-1/2
Roller shaft bolt torque (ft. lbs.) 230
Loader tilt lever end play (inch) ..... .030
Loader frame pivot shaft nut torque - ft. lbs. 300

DIESEL ENGINE

Stop and Start Position



1. Disconnect the shut-off cable. Loosen the locknut on the shut-off plunger. Back the stop out several turns.

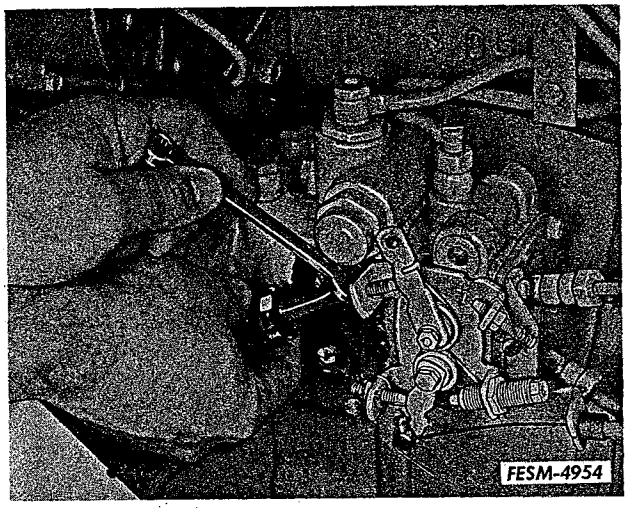
2. With the engine running at approximately 900 rpm, move the control lever rearward until engine speed increases. Turn the stop in until the plunger just contacts the lever. Recheck several times.

NOTE: If the control lever is moved slowly rearward, the engine may die before this position is reached.

3. Move the control lever fully rearward to depress the plunger. The engine must shut off at all throttle settings. Check for shut-off at high idle. Readjust if necessary.

4. Be certain the cable works freely before reconnecting to the control lever.

Low and High Idle

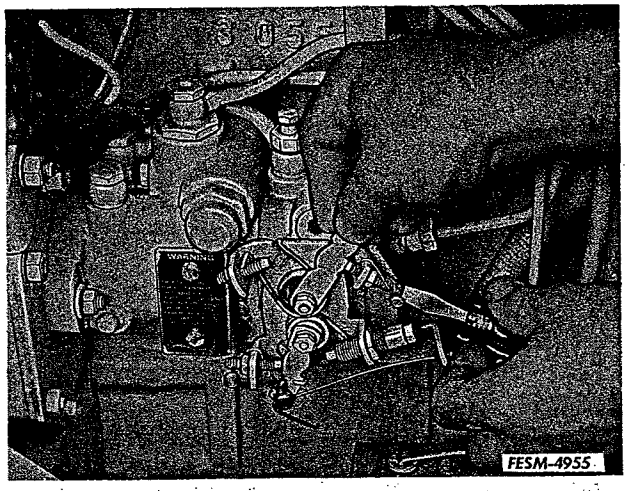


Setting the low idle speed.

1. Start the engine and disconnect the throttle linkage.

2. Loosen the low idle screw locknut; and adjust the low idle to 550 rpm, using the FES 118 portable tachometer to indicate engine speed.

3. Secure the locknut; and recheck rpm.

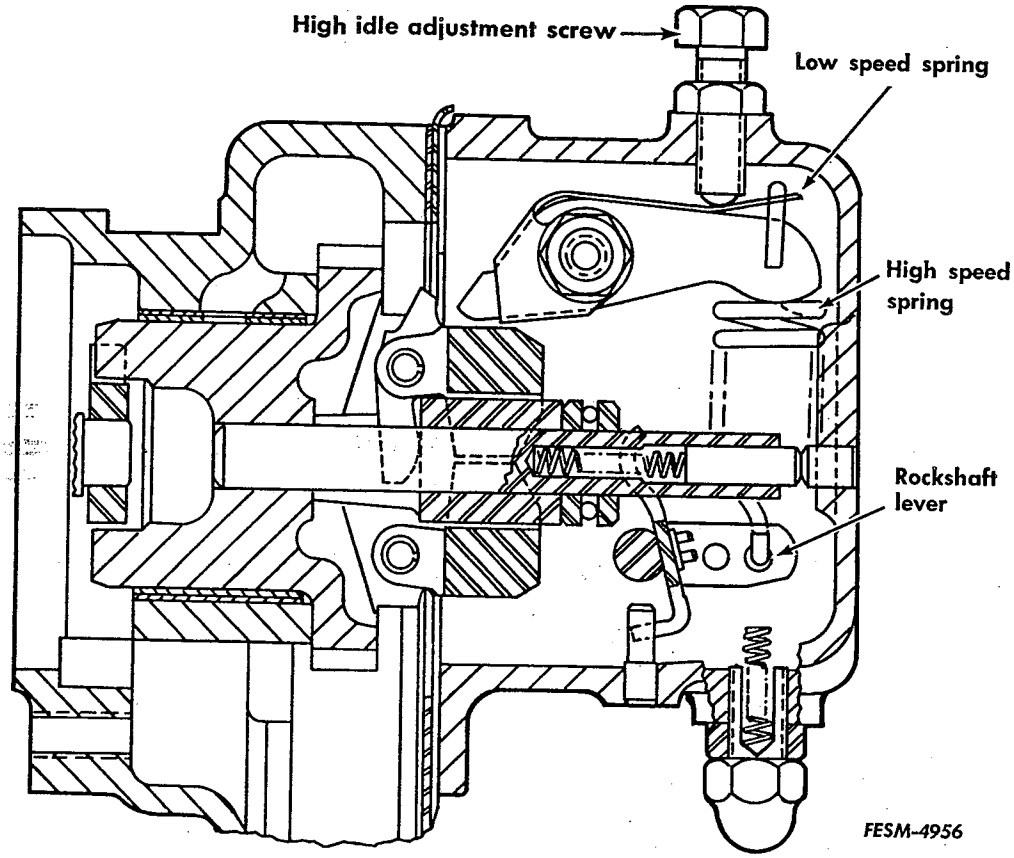


Setting the high idle speed.

4. Remove the spring from the throttle lever; and hold the lever against the high idle adjusting screw. Then adjust the high idle to 2750 rpm, using the FES 118 portable tachometer to indicate engine speed.

GASOLINE ENGINE

Low and High Idle



Governor assembly

1. Adjust the carburetor idle speed adjusting screw to obtain a low idle speed of 425 rpm, using the FES 118 portable tachometer to indicate engine speed.

2. Loosen the locknut; and adjust the governor high idle screw to obtain a high idle speed of 2700 rpm, using the FES 118 portable tachometer to indicate engine speed.

THROTTLE LINKAGE

(Refer to Fold-out No. 1 in this Section)

1. Bend the throttle lever (A) if necessary to insure positive tooth engagement in the quadrant (B).

2. Adjust the throttle linkage so that both low and high idle are obtained by moving the operators throttle control lever.

3. TRACTORS WITH TORQUE CONVERTER: Adjust the decelerator pedal control rod (G) to provide 1/4-inch clearance between the pedal and the deck plates when in the decelerated position.

4. TRACTORS WITH GASOLINE ENGINE: Adjust the governor compensating spring at (F) to obtain minimum throttle control lever effort.

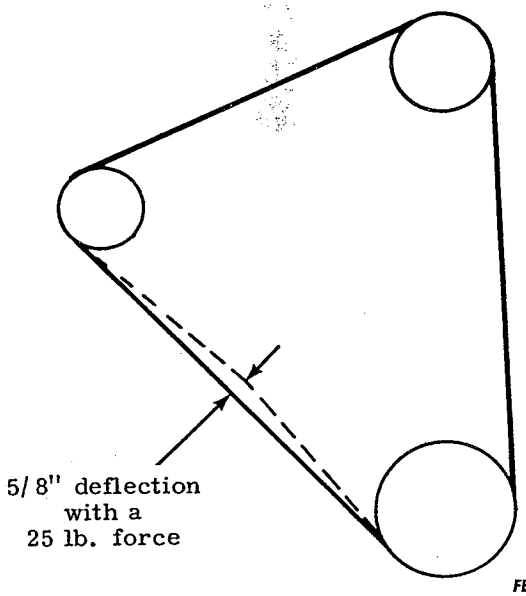
FAN BELT TENSION

Check the tension of the fan and alternator belt frequently, to avoid overheating and loss of power as a result of belt slippage. This is particularly important with a new tractor or a new belt, as the belt can stretch during the break-in period.

It is recommended that the belt tension be checked every 10 hours of operation until the length has stabilized, then check it periodically thereafter.

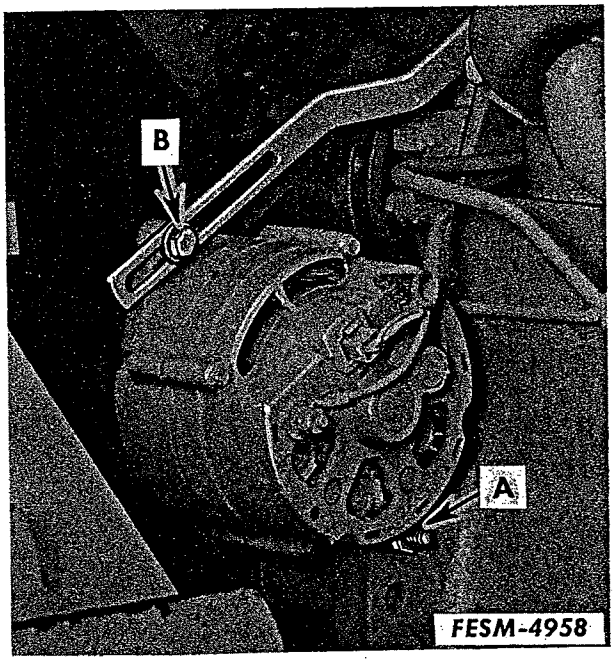
If the belt becomes grease soaked or so badly worn that it bottoms in the pulleys, replace the belt immediately.

Gasoline Engine



FESM-4957

For a gasoline engine, the belt tension is correct when the belt can be deflected approximately 5/8" with a force of 25 lbs., at a point midway between the alternator and crankshaft pulleys.

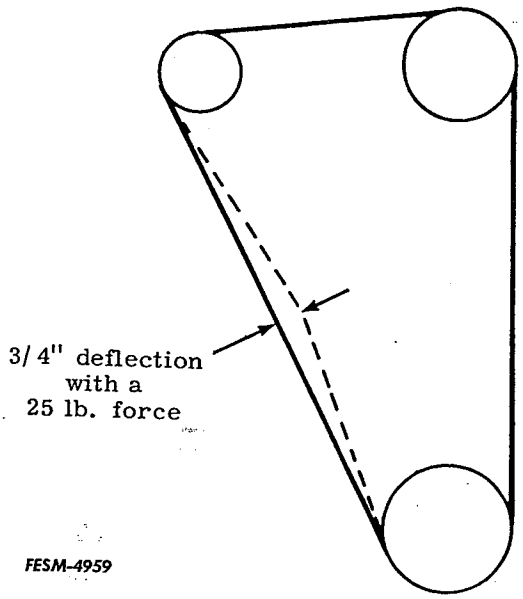


FESM-4958

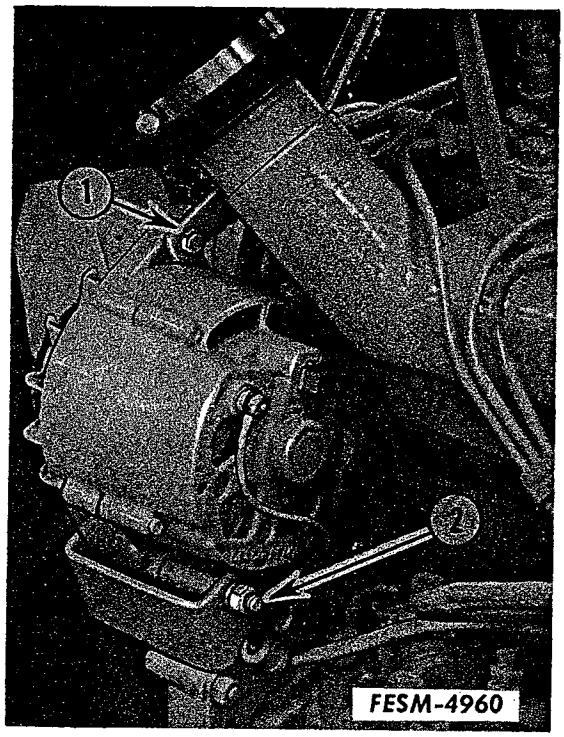
To adjust the belt, loosen the alternator pivot bolt indicated at "A" and the alternator brace bolt indicated at "B" in the illustration. Move the alternator until the correct tension is obtained. Tighten the bolts at "A" and "B".

A	Pivot bolt
B	Brace bolt

Diesel Engine



For a diesel engine, the belt is tensioned correctly when it can be deflected 3/4" approximately with a force of 25 lbs., at a point midway between the alternator and crankshaft pulleys.



To adjust the belt, slacken the alternator pivot bolt and the bolt in the slotted hole of the alternator brace. Move the alternator toward or away from the engine until the correct tension is obtained then tighten both bolts.

1. Brace bolt
2. Pivot bolt

DECELERATOR PEDAL

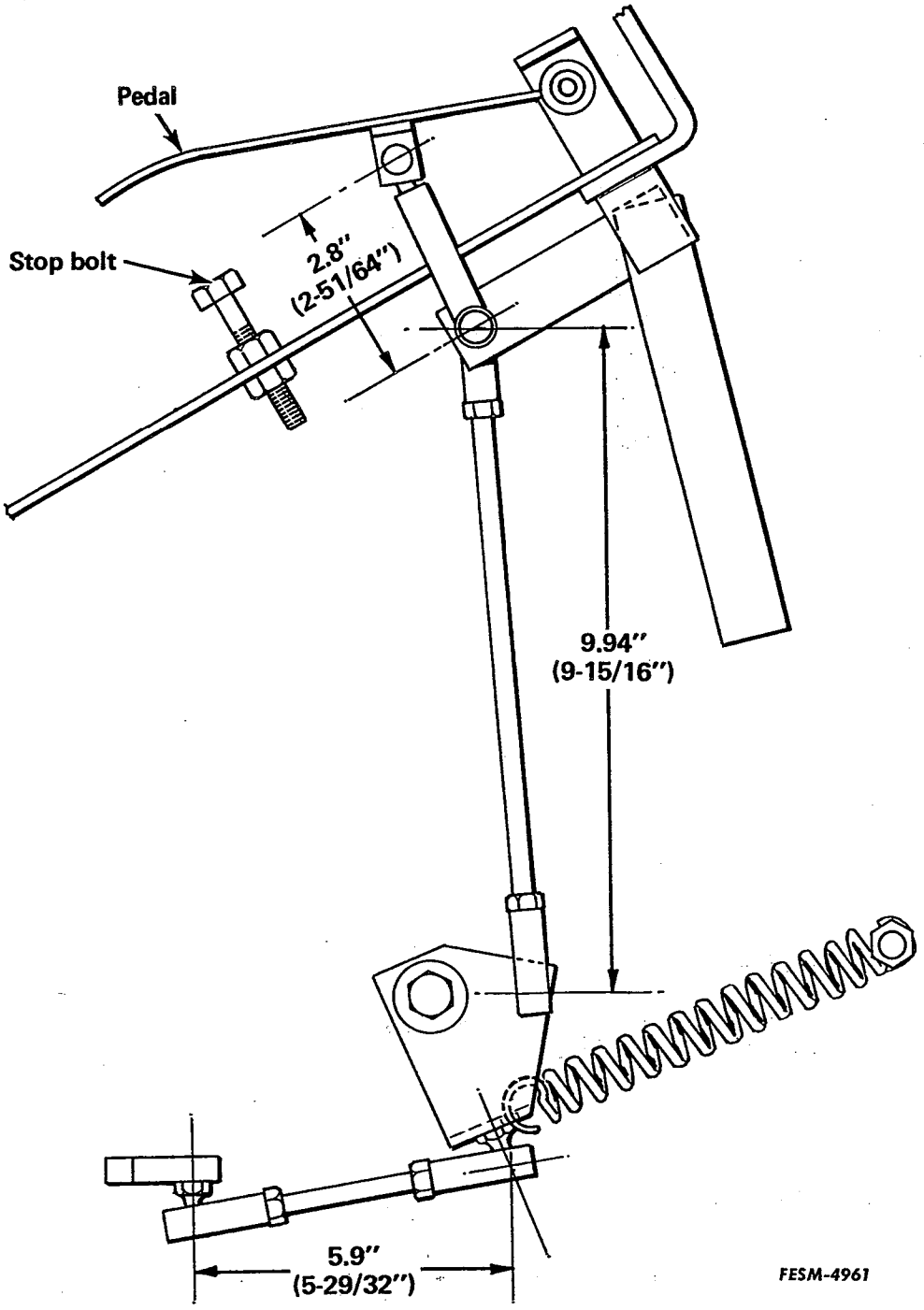
Tractors with Torque Converter

(Refer to Fold-out No. 1 in this Section)

Adjust the decelerator pedal control rod (G) to provide 1/4-inch clearance between the pedal and the deck plates when in the decelerated position.

POWER CONTROL PEDAL

Tractors with Power Shift Reverser, without Torque Converter

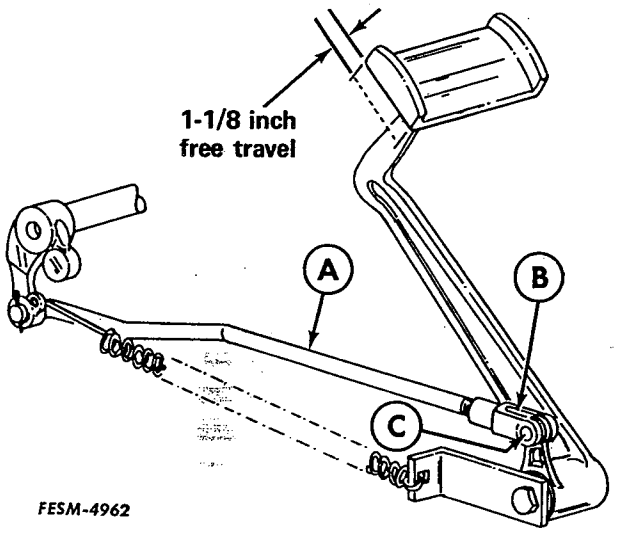


Adjust the pedal stop bolt to allow full travel of the control valve spool.

IMPORTANT: The pedal stop bolt must be properly adjusted to prevent damage to the valve spool linkage.

CLUTCH PEDAL

Standard Mechanical Spur Gear Transmission



A Rod
B Clevis
C Clevis pin

The clutch pedal should have approximately 1-1/8" of free travel. As a result of normal clutch facing wear, the free travel between the clutch release fork and the release bearing is reduced. Lack of free travel causes overheating of the clutch, loss of power, and leads to an early replacement of the clutch facing.

To adjust the clutch pedal, remove the small cover plate below the clutch pedal. Remove the clevis pin "C", and rotate the clevis "B" until the 1-1/8" of free pedal travel is obtained. Lengthening the rod "A" decreases the free travel while shortening the rod "A" increases the free travel.

DIRECTIONAL CONTROL LEVER

Tractors with Power Shift Reverser

(Refer to Fold-out No. 1 in this Section)

1. Remove the inspection plate from the operator's compartment deck plate; and remove the control rod from the reverser control valve arm at "C".

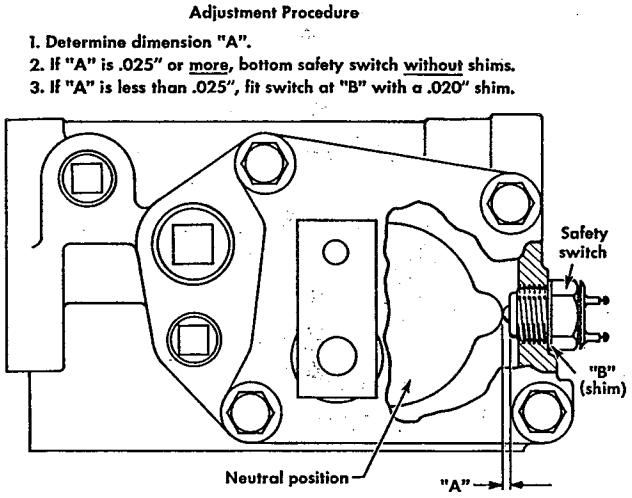
2. Lock the control lever (E) in the neutral position; and place the valve arm (C) in the neutral detent position.

3. Adjust the control rod length at "D", as necessary, so that the rod aligns with the hole in the control arm at "C".

4. Install spacer washers between the rod and control valve lever, at "C" to allow .010 to .020 inch rod endplay.

STARTER SAFETY SWITCH

Tractors with Power Shift Reverser



POWER SHIFT REVERSER CONTROL VALVE
STARTER SAFETY SWITCH ADJUSTMENT FESM-4476

1. Remove the inspection plate from the operator's compartment deck plate. Then disconnect the control rod; and remove the top cover.

2. Measure "A", the distance the ball protrudes from the switch capsule. If the measurement is less than .025 inch, shim the capsule at "B" with a .020 inch shim. Refer to the parts catalog for ordering information.

STEERING CLUTCHES AND BRAKES

Left and right steering clutch and brake adjustments are made separately, as they are operated independently by the steering levers. The brake bands however are also operated simultaneously by the brake pedal and therefore require close settings. This setting must provide even braking on both drives, and also avoid partial brake engagement when the pedal is in the normal raised position.

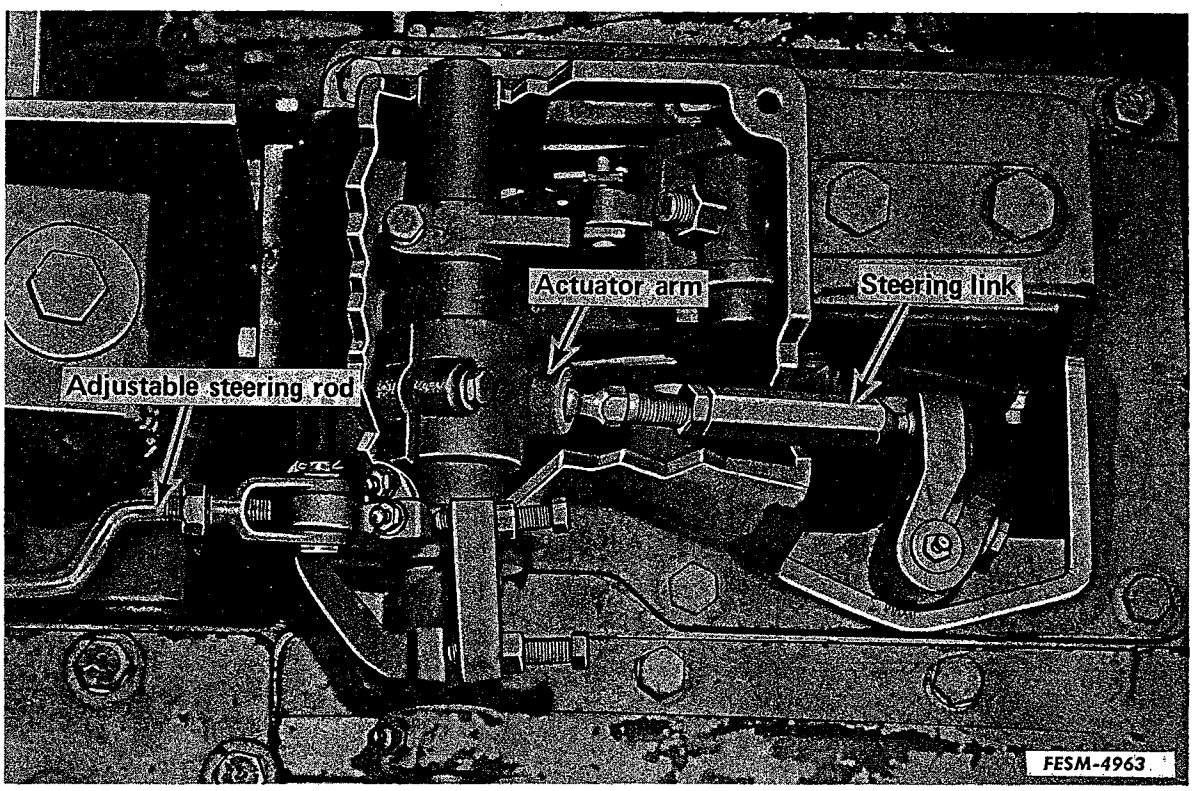
The operating sequence of the steering clutches and brakes may be checked by driving the tractor on an incline of sufficient pitch to permit the tractor to roll back when the clutches are disengaged. As the tractor is moving forward, move the steering levers back evenly, and observe the following:

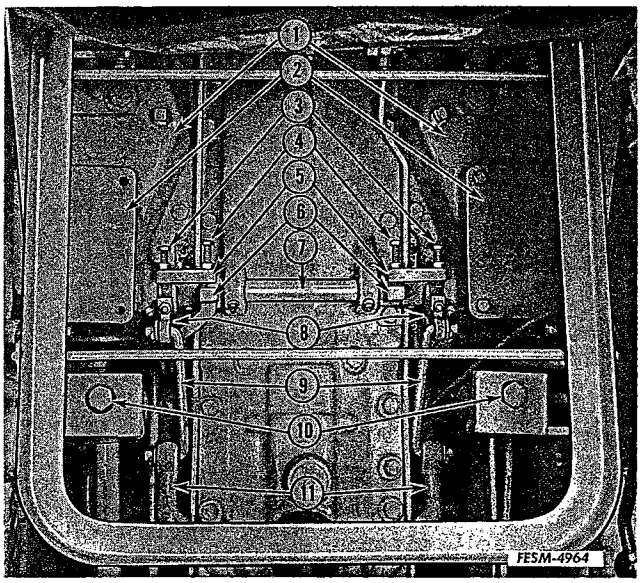
1. The steering clutches completely disengage the drive.

2. The levers move a little further with no power to the track, and no braking.

3. The levers engage the brakes evenly.

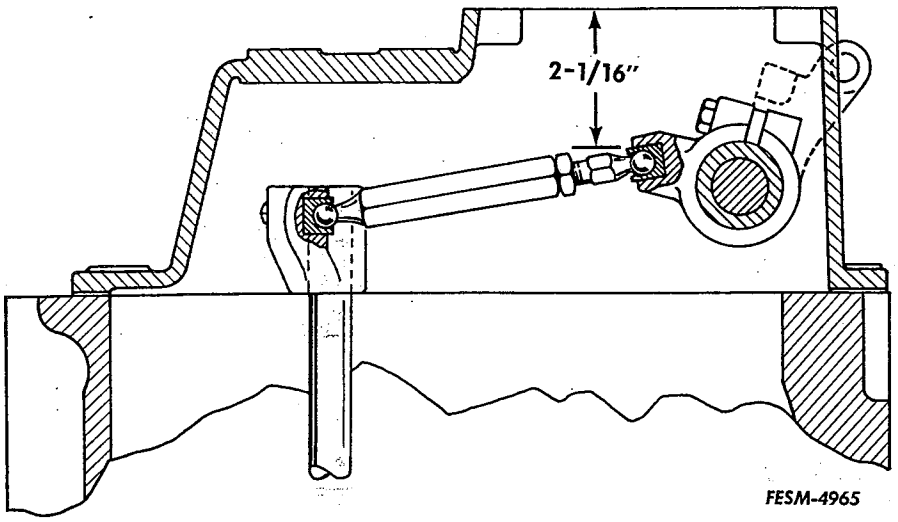
If these results are not obtained, adjustment to the linkage is necessary.



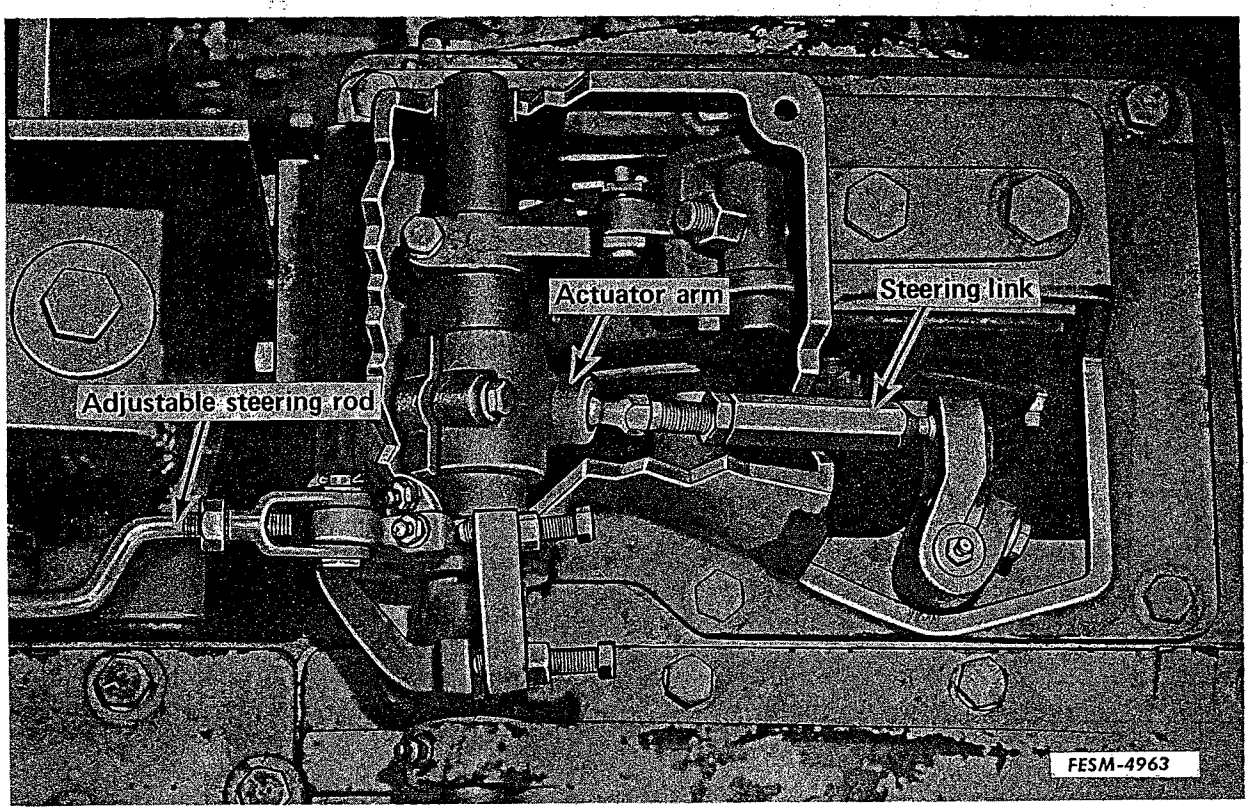


NOTE: Tractors above serial number 828 are equipped with adjustable steering rods. The rod length is factory set, and requires no further adjustment.

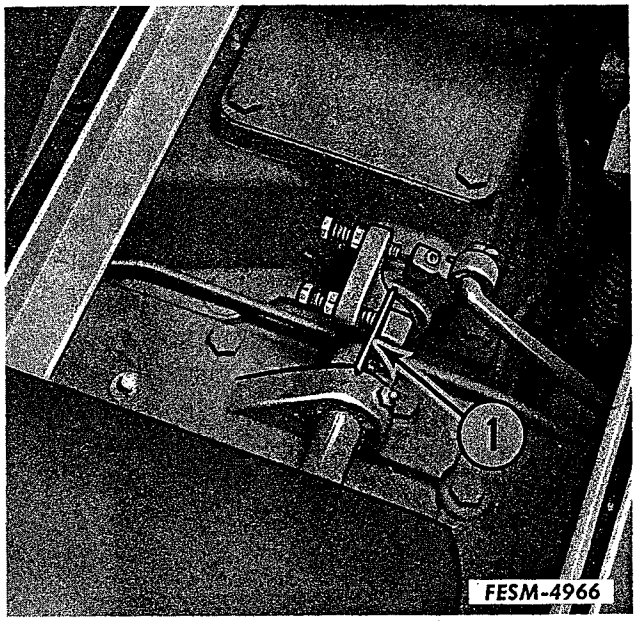
1. Steering clutch cover (2)
2. Cover plate (2)
3. Outer capscrew (2)
4. Inner capscrew (2)
5. Brake actuating lever
6. Brake cross shaft arm (2)
7. Brake cross shaft
8. Steering actuating lever (2)
9. Steering rod (2)
10. Balance spring screw (2)
11. Steering lever (2)



1. If the steering rods are to be replaced, release the tension from the balance springs; and install the rods. Then adjust each rod so that the distance between the top of the actuating arm cup and the top of the steering clutch cover is 2-1/16 inch, with the steering levers in the engaged, forward position.

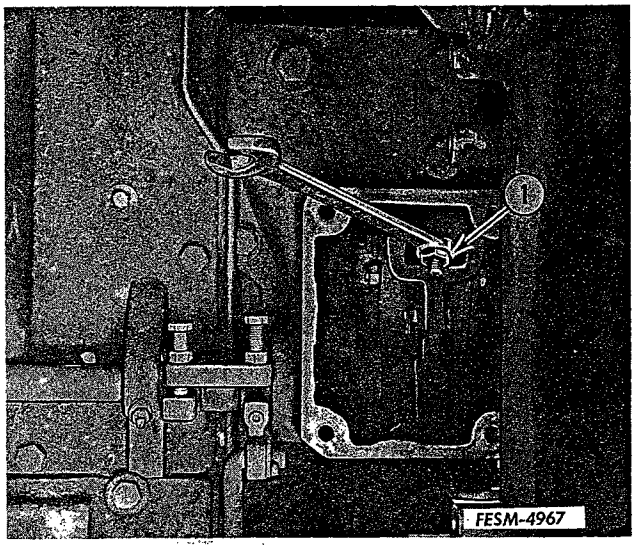


2. Adjust the steering links to obtain 1-1/4 inch steering lever free play, at the upper end of each steering lever.



3. With the brake pedal in the disengaged position, hold one brake actuating lever rearward; and adjust the inner capscrew to obtain 1/4 inch clearance between the screw and the brake cross shaft arm. Repeat for the other brake.

1. 1/4 inch drill bit



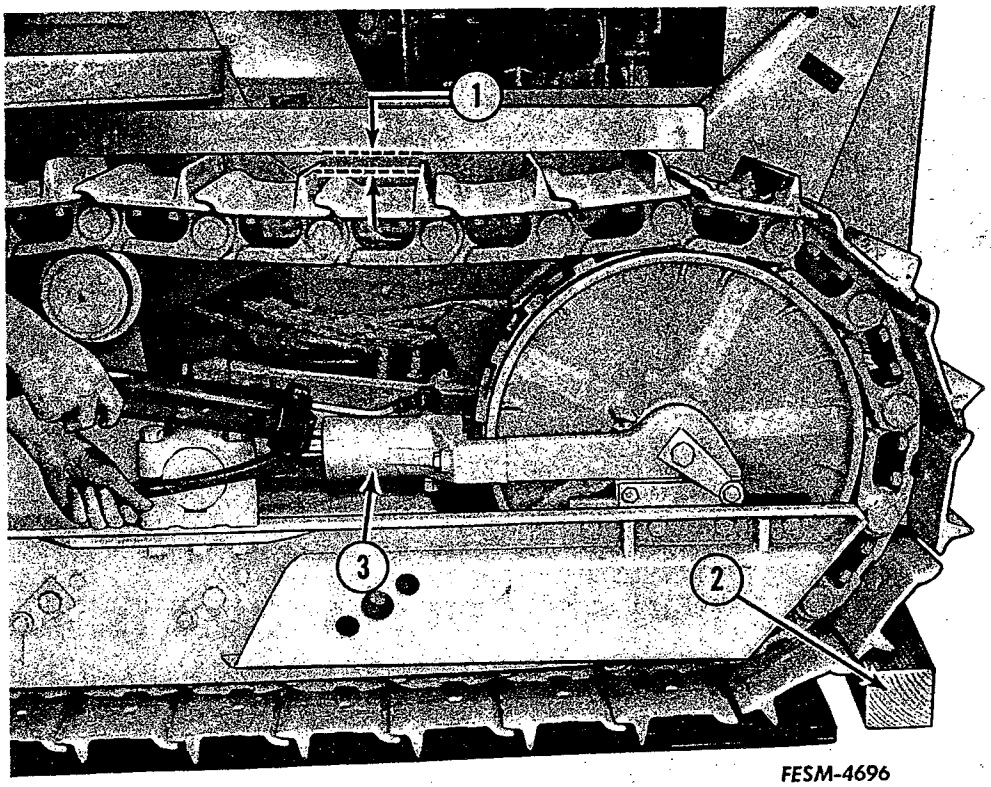
1. Brake adjusting nut

NOTE: If the 1/4 inch clearance cannot be obtained, back the brake actuating lever capscrews out of the lever until they do not protrude. Hold the lever to the rear; and tighten the brake adjusting nut to obtain 3/8 inch clearance between the lever and arm. Then adjust the inner capscrew to obtain the 1/4 inch dimension.

4. Hold one brake actuating lever to the rear; and adjust the outer brake actuating lever capscrew to obtain 3/8 inch clearance between the screw and steering actuating lever. Repeat for the other brake.

5. Adjust the steering assist springs so that the steering levers will remain in the disengaged position when pulled to the rear. Then turn the adjusting bolt two (2) turns counter clockwise, to allow the levers to return automatically to the engaged or forward position.

TRACK CHAIN TENSION



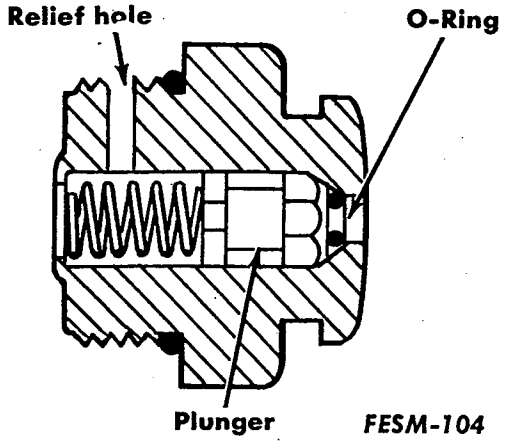
FESM-4696

1. 1-1/4 – 1-1/2 inches
2. Chain wedged against block
3. Hydraulic adjuster

1. Place a wooden block, approximately one foot (1 ft.) in height, under the foremost track shoe grouser lug. Drive the tractor slowly forward until the track chain just starts to climb the block; then apply and lock the steering brakes and stop the engine. This will remove the slack from the bottom of the track chain. Jump on the top of the track chain between the front idler and the track top idler.

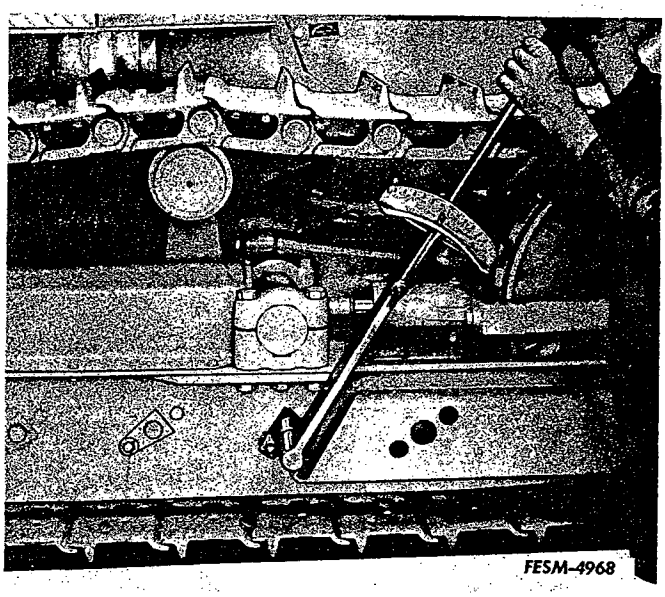
2. Place a long straight edge or board on top of the track chain so each end of the straight edge rests on the track chain over the track top idler and front idler. With a rule, measure the clearance between the bottom of the straight edge and the top of the grouser nearest to the midway point between the track top idler and front idler. This clearance should be 1-1/4" to 1-1/2". If the clearance is more or less than this measurement, the track chain tension should be adjusted.

3. To adjust track chain tension, position a grease gun on the high pressure fitting which is located on the upperside of the hydraulic track adjuster cylinder, and force in sufficient lubricant to correct chain tension. If the track chain is too tight loosen the fitting slightly. This will allow the fluid to escape through the relief hole in the threaded portion of the fitting. Do not remove the fitting until the pressure is completely released.



IMPORTANT: Only a high pressure fitting with straight threads should be used in this track adjuster cylinder. Do not use a fitting from a roller or idler which is not a high pressure fitting, as it will destroy the threads in the adjuster cylinder. The tractor should be moved forward and back to determine final adjustment.

TIGHTENING ROLLER SHAFT BOLTS AFTER LUBRICATION



The roller fittings are located under the roller center bolts on the outer side of the track frame. Remove one bolt at a time to lubricate; torque the bolt to 230 foot pounds after assembly. A special lubrication gun coupler is available from your International Harvester dealer to fit the roller lubrication opening.