



Blue Ribbon Service

GSS-1398

INTERNATIONAL[®]

CUB CADET[®] TRACTOR

Models 72, 104, 105, 124 and 125

and

IH Equipment

INTERNATIONAL HARVESTER COMPANY

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

FOREWORD

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

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

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

Service on other Cub Cadet equipment is available at your International Cub Cadet dealer.

LIBRARY FILING INFORMATION

1. File this Manual in Book 17 after Divider Tab GSS-1398.
2. Enter the following information in the Service Manual Index.

In the following Sections, print, or preferably type in, the Manual Description, Form Number, and the Book Filed in.

General
Tractor Specifications
Tractor Engine
Tractor Fuel System
Tractor Electrical System
Tractor Transmission
Tractor Differential and Final Drive
Tractor Clutch
Tractor Brakes
Tractor PTO and Belt Pulley
Tractor Chassis
Mowers and Rakes
Tillage Tools

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IH EQUIPMENT

SPECIAL SERVICE TOOLS REQUIRED

FES 54-4	Seal Protector - Rear
FES 54-5	Seal Protector - Front
FES 54-6	Seal Driver

Order from: Service Tools, Inc.
1901 S. Indiana Avenue
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 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 2 (all lengths)		Type 3 (all lengths)		Type 4 (all lengths)			
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Only when used in cast (gray) iron		All other applications	
											Min.	Max.	Min.	Max.
1/4	5	6	5	6	3	3	9	10	11	13	11	13	12	14
5/16	12	13	12	13	6	7	19	21	24	27	24	27	27	30
3/8	21	24	21	24	11	13	33	37	43	47	43	47	45	50
7/16	35	38	35	38	19	21	53	60	69	76	69	76	75	85
1/2	52	58	52	58	29	32	80	90	104	117	104	117	115	130
9/16	70	80	70	80	41	46	115	130	150	170	150	170	165	185
5/8	98	110	98	110	57	63	160	180	210	230	210	230	220	250
3/4	174	195	174	195	100	112	290	320	350	390	350	390	400	450
7/8	300	330	162	181	162	181	420	470	570	630	570	630	650	730
1	420	470	250	270	250	270	630	710	850	950	850	950	970	1090
1-1/8	600	660	350	380	350	380	850	950	1200	1350	1200	1350	1380	1550
1-1/4	840	940	490	540	490	540	1200	1350	1700	1900	1700	1900	1940	2180
1-3/8	1100	1230	640	710	640	710	1570	1760	2300	2500	2300	2500	2600	2800
1-1/2	1470	1640	850	940	850	940	2000	2300	3000	3300	3000	3300	3300	3700
1-3/4	2350	2450	1330	1490	1330	1490	3300	3700	4700	5200	4700	5200	5300	6000
2	3500	3900	2000	2200	2000	2200	5000	5500	7000	7800	7000	7800	8000	9000

BOLT TYPE IDENTIFICATION CHART

IH TYPE	S.A.E. GRADE	DESCRIPTION	BOLT HEAD MARKING *
1	Equivalent 1 or 2	WILL HAVE IH STANDARD MONOGRAM IN THE CENTER OF THE HEAD Low or Medium Carbon Steel Not Heat Treated	
2	5	WILL HAVE AN IH AND 3 RADIAL LINES Quenched and Tempered Medium Carbon Steel	
3	6	WILL HAVE AN IH AND 4 RADIAL LINES No longer used in production. For replacement, use Type 4 if Type 3 is not available.	
4	8	WILL HAVE AN 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 a raised dot which previously identified IH bolts.

Section 1

ENGINE

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SPECIFICATIONS

	Model 72	Models 104 & 105	Models 124 & 125
General			
Make and model (with electric starting)	Kohler K-161S	Kohler K-241AS	Kohler K-301AS
(with retractable starter)	Kohler K-161T		
Cylinders	1	1	1
Bore - inches	2-7/8	3-1/4	3-3/8
Stroke - inches	2-1/2	2-7/8	3-1/4
Displacement - cu. inches	16.23	23.9	29.1
Compression pressure (Refer to page 1-7 and 1-16)	110 to 120 psi	110 to 120 psi	110 to 120 psi
Rated horsepower (at 60 deg. F and 29.92 inch Hg barometric pressure) - rpm	7.0 at 3600	10 at 3600	12.0 at 3600
Engine speed (governed)			
Minimum speed - rpm	1000	1000	1000
Maximum idle speed (no load) - rpm	3780	3800	3800
Maximum (full load) - rpm	3600	3600	3600
Valve clearance (engine cold)			
Intake - inch . . . . .	.006 to .008	.008 to .010	.008 to .010
Exhaust - inch . . . . .	.015 to .017	.017 to .019	.017 to .019
Ignition			
(with electric starting)	Battery	Battery	Battery
(with retractable starter)	Magneto		
Spark plug gap (14 mm plug) - inch . . . . .	.025	.025	.025
Breaker point gap - inch . . . . .	.018 to .022	.018 to .022	.018 to .022
Timing (before TDC) - degrees	20	20	20
Engine			
Cylinder bore			
New - inches	2.8745 to 2.8755	3.2505 to 3.2515	3.3745 to 3.3755
Maximum out-of-round (before re boring) - inch . . . . .	.005	.005	.005
Crankshaft			
End clearance - inch . . . . .	.002 to .023	.003 to .020	.003 to .020
Crankpin diameter (new) - inches	1.1855 to 1.1860	1.4995 to 1.5000	1.4995 to 1.5000
Crankpin, maximum out-of-round before reconditioning - inch . . . . .	.0015	.0015	.0015

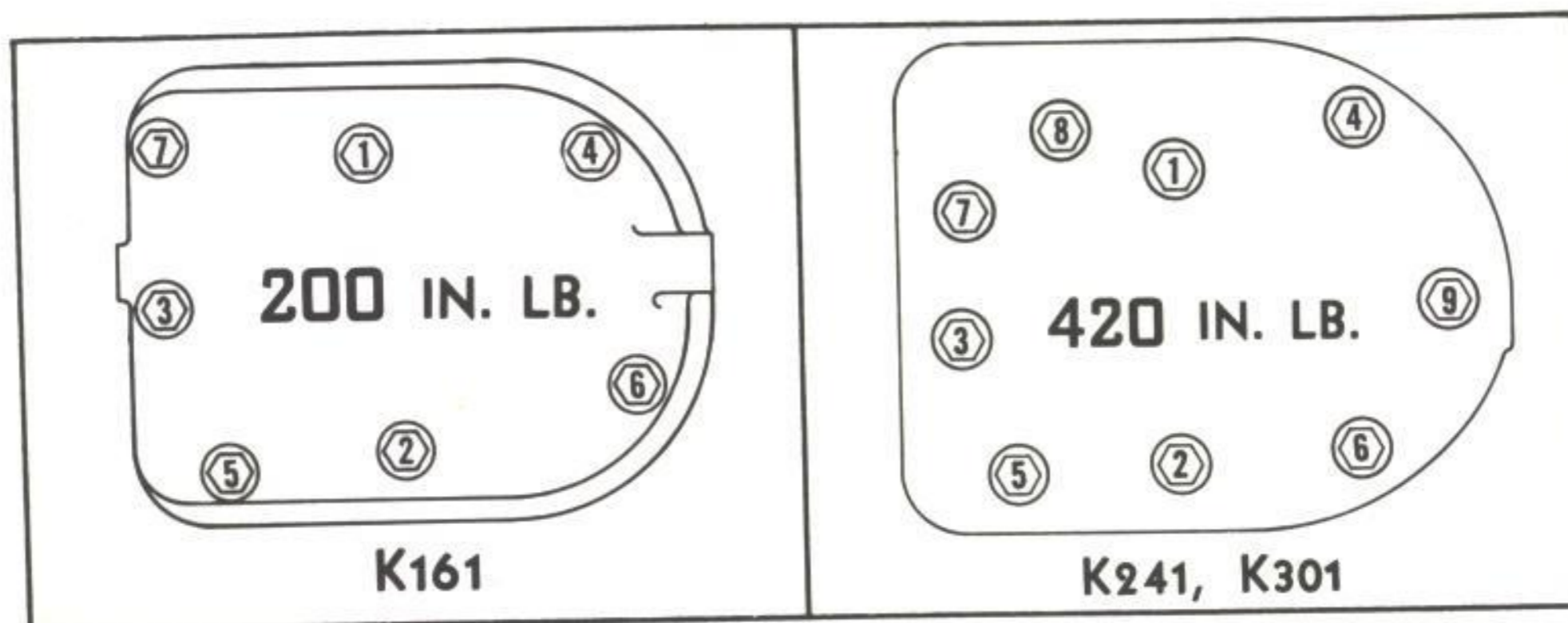
	Model 72	Models 104 & 105	Models 124 & 125
Connecting rod			
Bore (new) - inches	1.1870 to 1.1875	1.5010 to 1.5015	1.5010 to 1.5015
Crankpin running clearance (new) - inch . . . . .	.0010 to .0020	.001 to .002	.001 to .002
Maximum crankpin running clearance (before reconditioning) - inch . . . . .	.003	.003	.003
Side clearance - inch . . . . .	.005 to .016	.007 to .016	.007 to .016
To wrist pin clearance - inch . . . .	.0006 to .0011	.0003 to .0008	.0003 to .0008
Wrist pin to piston boss - inch . . . .	.0001 Int. to .0003 loose	.0000 to .0003 loose select fit	One thumb push fit
Piston			
New (measured just below oil ring 90 deg. from piston pin) - inches	2.8660 to 2.8675	3.2415 to 3.2445	3.3655 to 3.3685
Maximum allowable undersize (for wear) - inch	2.8645	3.2400	3.3640
Piston ring end gap - inch . . . . .	.007 to .017	.010 to .020	.010 to .020
Piston to cylinder bore clearance			
Top of skirt (measured just below oil ring) - inch . . . . .	.006 to .0075	.0075 to .0085	.0065 to .0095
Bottom of skirt - inch . . . . .	.0045 to .0065	.003 to .004	.003 to .004
Piston pin bore - inch . . . . .	.62565	.85975	.85975
Piston pin diameter - inch . . . . .	.625	.860	.860
Valves			
Valve stem clearance in guide			
Intake - inch . . . . .	.001 to .0025	.001 to .0025	.001 to .0025
Exhaust - inch . . . . .	.0025 to .004	.0025 to .004	.0025 to .004
Valve stem (diameter)			
Intake (new) - inch . . . . .	.3105 to .3110	.3105 to .3110	.3105 to .3110
Maximum allowable undersize (for wear) - inch . . . . .	.3090	.3090	.3090
Exhaust (new) - inch . . . . .	.3090 to .3095	.3090 to .3095	.3090 to .3095
Maximum allowable undersize (for wear) - inch . . . . .	.308	.308	.308
Intake and exhaust maximum (allowable oversize for wear) - inch . . . . .	.315	.315	.315
Valve guide depth from top of block - inches	1-5/16	1-15/32	1-15/32
Tappet clearance in block - inch . . . .	.0005 to .002	.0008 to .0023	.0008 to .0023
Camshaft running clearance - inch . . . . .	.001 to .0035	.001 to .0035	.001 to .0035
Camshaft end clearance - inch . . . .	.005 to .025	.005 to .010	.005 to .010

	Model 72	Models 104 & 105	Models 124 & 125
Valve clearance			
Intake (cold) - inch . . . . .	.006 to .008	.008 to .010	.008 to .010
Exhaust (cold) - inch . . . . .	.015 to .017	.017 to .019	.017 to .019
Valve face angle - degrees	45	45	45
Valve seat inserts (service only)			
Intake - inches	Bore 1.4995 to 1.5005	1.4995 to 1.5005	1.4995 to 1.5005
	Depth .224 to .229	.224 to .229	.224 to .229
Exhaust - inches	Bore 1.2495 to 1.2505	1.2495 to 1.2505	1.2495 to 1.2505
	Depth .224 to .229	.224 to .229	.224 to .229
Seat angle - degrees	44-1/2	44-1/2	44-1/2
Valve seat width - inch . . . . .	.037 to .045	.037 to .045	.037 to .045
Current-voltage regulator			
Make and model (Delco-Remy) . . .	1118987	1118987	1118987
Ground	Negative	Negative	Negative
Voltage regulator			
Air gap - inch . . . . .	.075	.075	.075
Setting range (volts)	13.6 to 14.5	13.6 to 14.5	13.6 to 14.5
Adjust to	14 volts	14 volts	14 volts
Cut-out relay			
Air gap - inch . . . . .	.020	.020	.020
Point opening - inch . . . . .	.020	.020	.020
Closing voltage (volts)	11.8 to 14	11.8 to 14	11.8 to 14
Adjust to	12.8 volts	12.8 volts	12.8 volts
Motor-generator			
Make and model (Delco-Remy) . . .	1101996	1101996	1101996
Rotation (viewing drive end)	CC	CC	CC
Brush spring tension - oz.	24 to 32	24 to 32	24 to 32
Field current (at 80 deg. F)			
Amps	1.5 to 1.6	1.5 to 1.6	1.5 to 1.6
Volts	12	12	12
Cold output			
Amps	14	14	14
Volts	15	15	15
Approximate rpm	High idle	High idle	High idle
No load test:			
Volts	11	11	11
Amps	10 to 14	10 to 14	10 to 14
RPM	1650 to 1950	1650 to 1950	1650 to 1950

	Model 72	Models 104 & 105	Models 124 & 125
Carburetor			
*Float setting - inch	11/64 ± 1/32	11/64 ± 1/32	11/64 ± 1/32
Idle mixture screw setting	3/4 to 1-1/2 turns open	3/4 to 1-1/2 turns open	3/4 to 1-1/2 turns open
High speed mixture screw setting	1-1/4 to 2 turns open	1-1/4 to 2 turns open	1-1/4 to 2 turns open
*Measure between top of float (free end) and casting body.			
Recoil starter			
Preload on rewind spring	4 turns		

Special Torques

Engine		
Head bolts - tighten evenly in steps to K-161	200 in. lbs.	
		K-241 and K-301 420 in. lbs.
Rod bolts - K-161 tighten to 200 in. lbs. loosen then tighten to	180 in. lbs.	
		K-241 and K-301 tighten to 300 in. lbs. loosen then tighten to 280 in. lbs.
Crankshaft nut	60 ft. lbs.	
Spark Plug	27 ft. lbs.	



FESM-2784

Illust. 1-1. Head bolt torque and torquing sequence.

Compression Check

Engines equipped with Automatic Compression Release require a different procedure for checking compression than ordinary engines. Since the A. C. R. relieves compression pressure during lower cranking speeds, a compression check is not possible in the normal manner.

Engines should be checked using the following procedures and should show a compression of 110 to 120 p. s. i. if in top mechanical condition. If reading is below 100 p. s. i., engine should be reconditioned.

Method No. 1 - Checking by "feel" of compression. Rotate flywheel backward against power stroke. Resistance should be felt. If little or no resistance is felt, check with gauge.

Method No. 2 - Checking with gauge on manual start engine.

a. Wind rope on flywheel pulley so that engine may be cranked in reverse direction.

b. Hold throttle in wide open position.

c. Crank engine. Reading should be normal since engine will develop full compression when power stroke is reversed.

NOTE: Engine should be cycled more than once to obtain accurate reading.

Method No. 3 - Checking with gauge on electric start engine. Crank engine electrically in normal manner. Engine will reach a high enough r. p. m. range to disengage A. C. R. and will then slow down slightly. Normal reading should then be obtained. If reading is below 100 p. s. i., recheck manually using Method No. 2.

GENERAL INFORMATION



FESM-2785

Illust. 1-2. Cub Cadet 124 tractor.

The model 72 is powered by a 7 horsepower, four cycle, air cooled, gasoline engine and is available with retractable hand starting or electric starting.

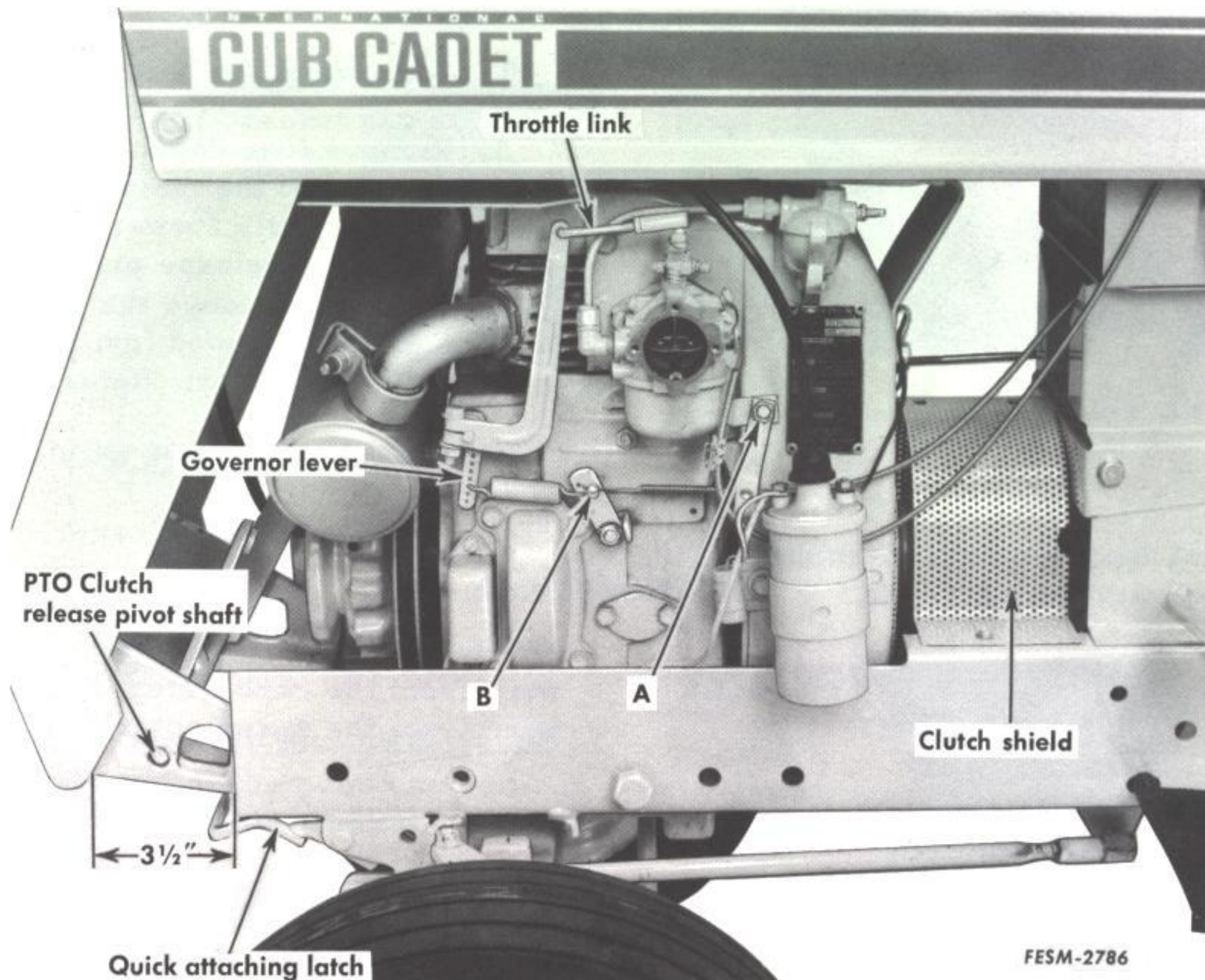
The model 104 and 105 are powered by a 10 horsepower, four cycle, air cooled,

gasoline engine and are available with electric starting only.

The model 124 and 125 are powered by a 12 horsepower, four cycle, air cooled gasoline engine and are available with electric starting only.

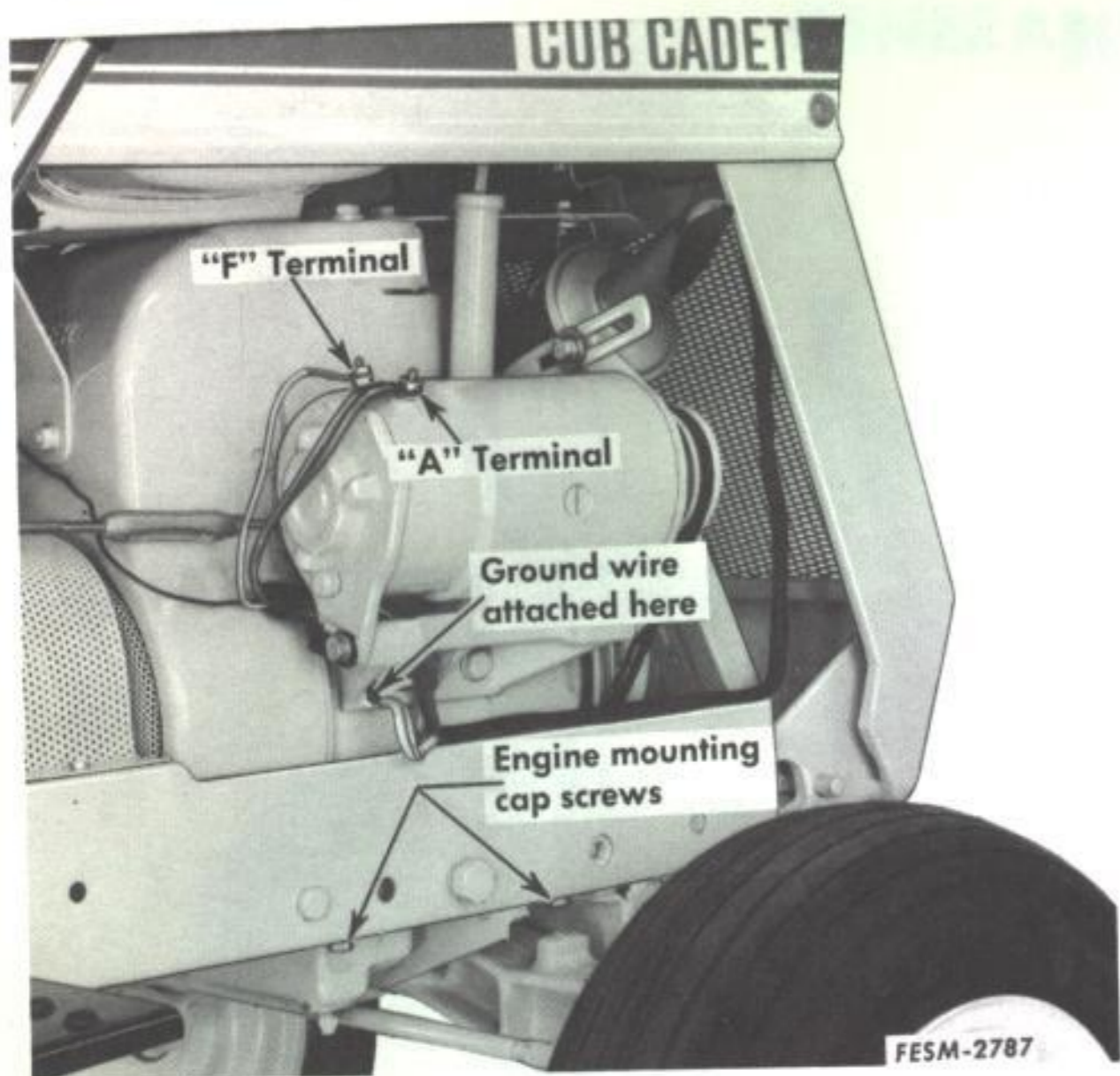
ENGINE Removal

Manual Starting



Illust. 1-3.

1. Remove grille and hood:
 - a. Remove four capscrews and nuts that hold the grille to the tractor main frame.
 - b. Slide bottom of grille forward 3-1/2" and remove clutch release pivot shaft from grille casting.
 - c. Remove the grille and hood. Lay the grille and hood (grille face down) in front of the tractor (Illust. 1-5).
2. Remove clutch shield (Illust. 1-3).
3. Remove air cleaner.
4. Disconnect throttle wire. (Illust. 1-3 Item B.)
5. Disconnect choke wire from the carburetor.
6. Disconnect switch wire (not shown).



Illust. 1-4. Right side view Model 124.

9. Slide engine forward to disengage the drive pins from the clutch driven disc.

10. The engine can now be lifted from the tractor.

Electric Starting

1. Disconnect the battery cables.

2. Remove four capscrews and nuts that hold the grille to the main frame. Slide the bottom of the grille forward 3-1/2" and remove the clutch release pivot shaft from the grille casting. Remove the grille and hood. Lay the grille and hood (grille face down) in front of the tractor. Refer to Illust. 1-5.

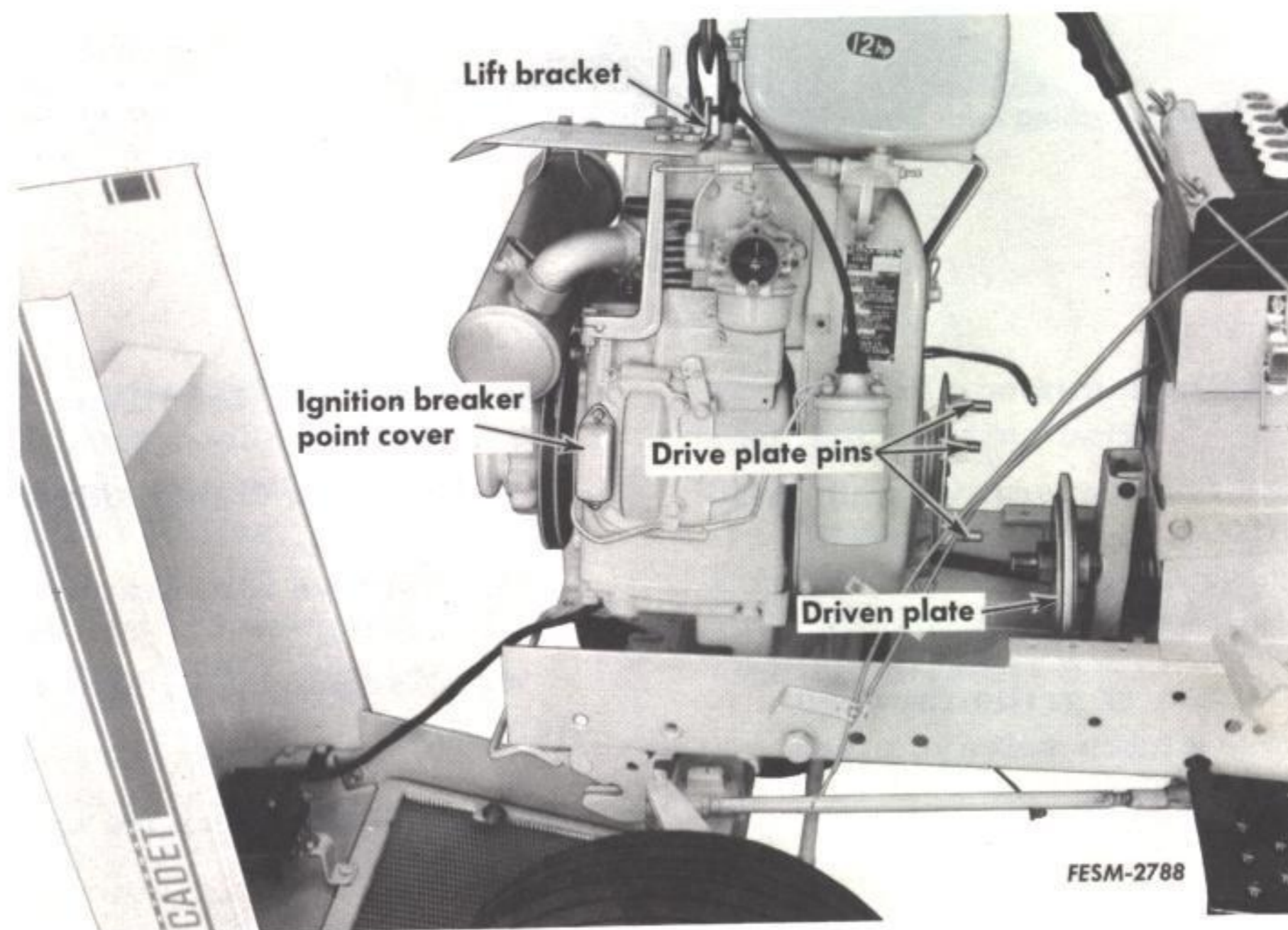
3. Remove the clutch shield (Illust. 1-3).

4. Remove the air cleaner.

5. Remove cap screw "A" and loosen screw "B" (Illust 1-3). Remove the choke wire from the carburetor, and the throttle wire from the speed control lever.

7. Remove four cap screws holding engine to the frame (Illust. 1-4).

8. Attach lifting equipment to motor lift bracket on head bolt (Illust. 1-5).



Illust. 1-5. Lifting the engine from the frame.

6. Disconnect the positive (+) coil wire from the coil.

7. Disconnect the wires from the Generator "A" terminal and from the "F" terminal.

NOTE: Large wire to "A" terminal. Small wire to "F" terminal.

8. Disconnect the ground cable connected to a starter-generator bracket cap screw

and remove starter-generator and coil wires from the generator bracket (Illust. 1-4).

9. Remove four cap screws holding the engine to frame. Two on each side (Illust. 1-4).

10. Slide the engine forward to disengage the drive pins from the clutch driven disc.

11. The engine can now be lifted from the frame using the engine lift bracket on a head bolt. Refer to Illust. 1-5.

Disassembly

1. Drain engine oil.

2. Disconnect the coil-to-breaker point wire (if so equipped) at the points and remove coil and bracket from engine.

3. Remove breaker point assembly and breaker point push rod.

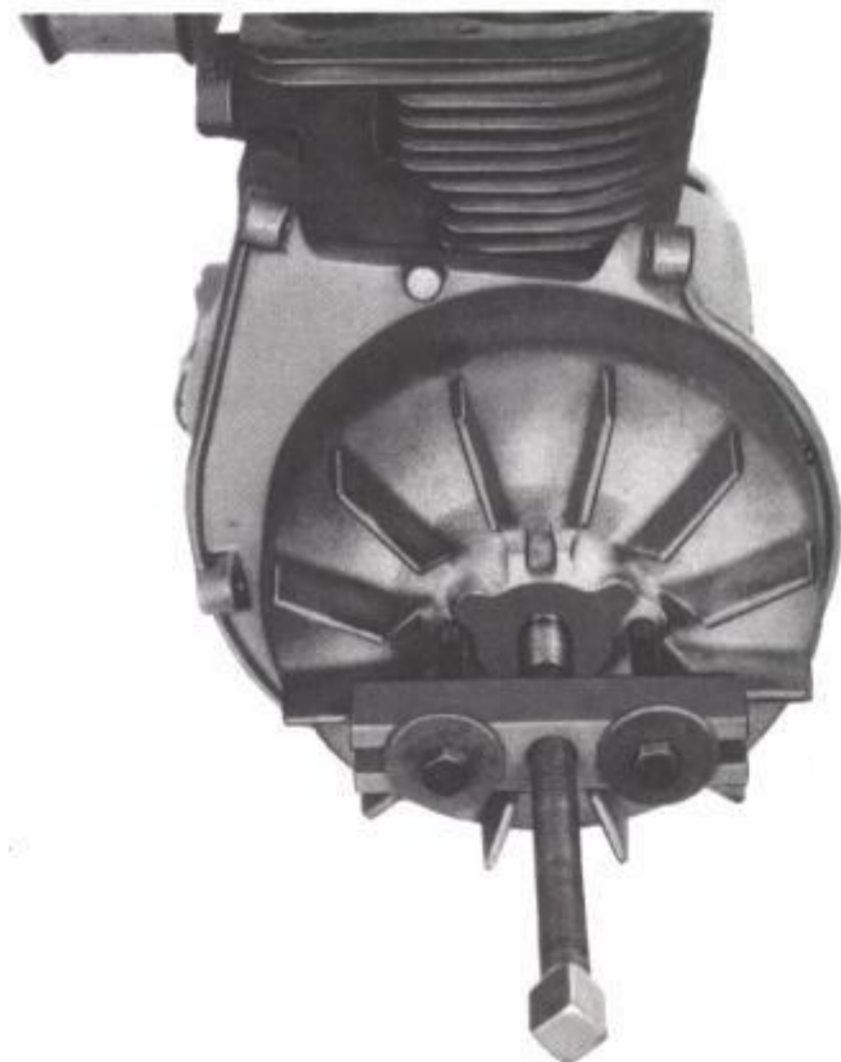
4. Remove rotating screen and drive pulley assembly.

5. Remove fuel tank, blower housing, cylinder baffle, head baffle, muffler and baffle.

6. Remove breather plate assembly. See Illust. 1-24.

7. Remove the flywheel and (magneto, if so equipped).

NOTE: The flywheel is mounted on a tapered shaft and must be removed with the use of a puller (Illust. 1-6). Do not Hammer on puller or nut. If necessary tap lightly.

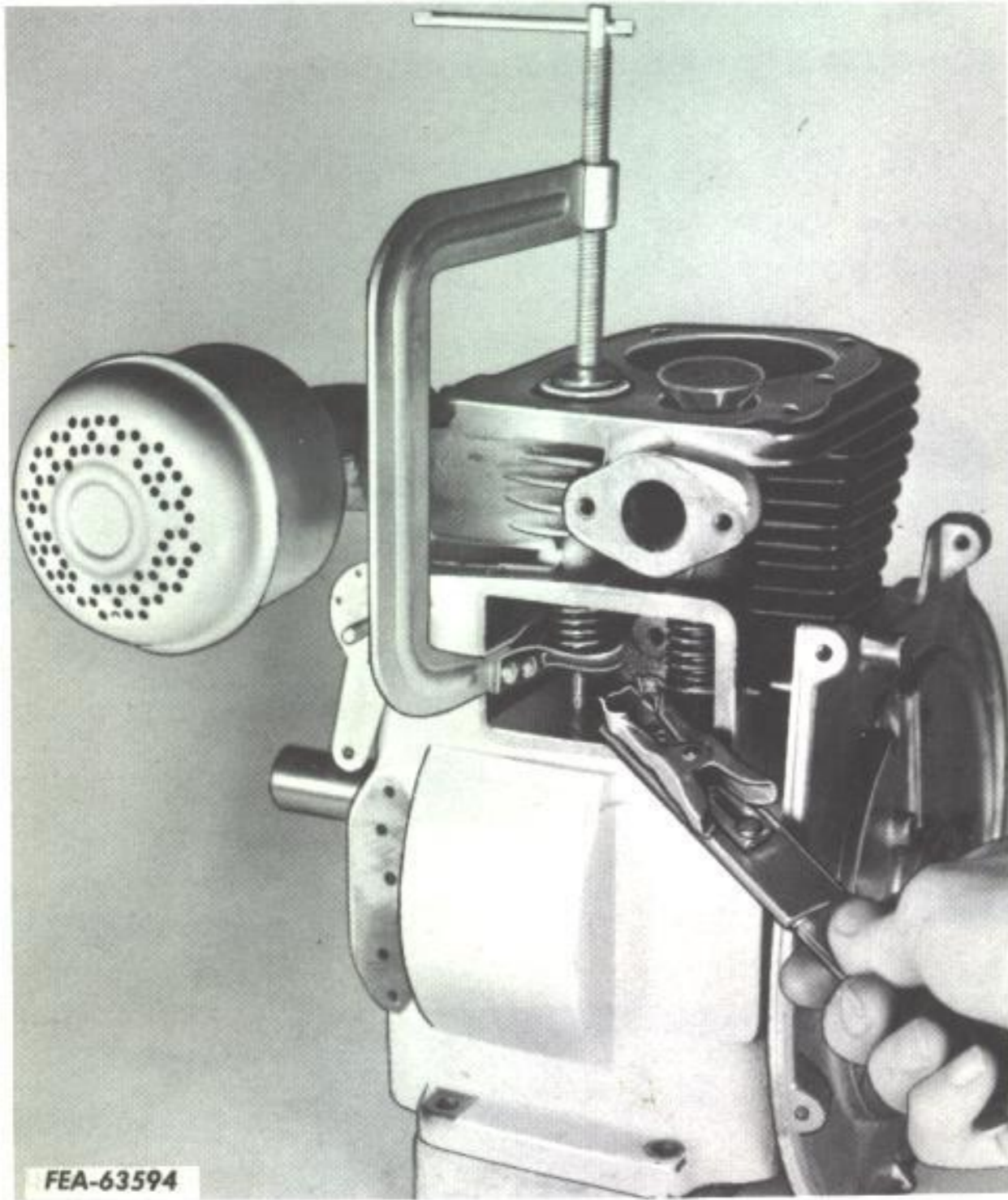


Illust. 1-6. Removing flywheel.

8. Remove the two Allen set screws in the front pulley hub. Remove the pulley with two long screwdrivers. Place the screwdrivers between the pulley and the crankcase, 180 degrees apart. Pry against the pulley near the crankshaft to prevent bending the pulley.

9. On manual starting engines, remove the retractable starter assembly and its mounting plate.

10. Remove the cylinder head.



Illust. 1-7. Valve spring compressed to remove or install keepers.

11. Compress the valve springs and remove the valve keepers, springs, retainers and valves (Illust. 1-7).

12. Remove the oil base.

13. Remove connecting rod cap. Remove ridge at top of cylinder wall, if present, and slide piston and rod out the top of the cylinder block.

14. Remove crankshaft, oil seals and if necessary press out the crankshaft main ball bearings.

NOTE: It may be necessary to press the crankshaft out of the cylinder block. The bearing plate should be removed first if this is done. The bearing plate can be removed with a bridge type puller, using the two tapped holes in the bearing plate.

15. Turn the cylinder block upside down and using a small punch, drive out camshaft pin from the gear end of the camshaft. The pin will slide out easily after it is driven free of front side of cylinder block.

16. Remove the camshaft and valve tappets. Save the washer type shim or shims if any located between the end of the camshaft (Opposite camshaft gear), and the cylinder block. These shims will be reused in reassembly.

17. Unscrew the governor bushing nut and remove the throttle bracket and speed control disc. The governor cross-shaft can now be removed by sliding the pilot end from its bearing, then inward and downward from inside the crankcase.

18. Remove the holding screw located to the right of the governor bushing nut to allow governor gear and weight assembly to be removed from the shaft inside the crankcase.

Inspection and Repair

Clean all parts and inspect them to determine which parts are reusable.

Reboring Cylinder Block

1. The cylinder should be rebored if badly scored, or worn in excess of taper or out-of-round limits.
2. Always rebore and hone to use a .010, .020, or .030 inch over standard size piston.
3. Use an inside micrometer or cylinder taper gauge to determine cylinder size and condition before and during honing.
4. Oversize piston and ring assemblies must be used in crankcases which have been rebored.
5. A cylinder hone can be used with either a drill press or a portable electric drill. The drill press is preferred, for it is important to keep bore in alignment with crankshaft cross-bore.
6. Finish by washing cylinder walls with SAE-10 oil and a clean cloth.

Crankshaft

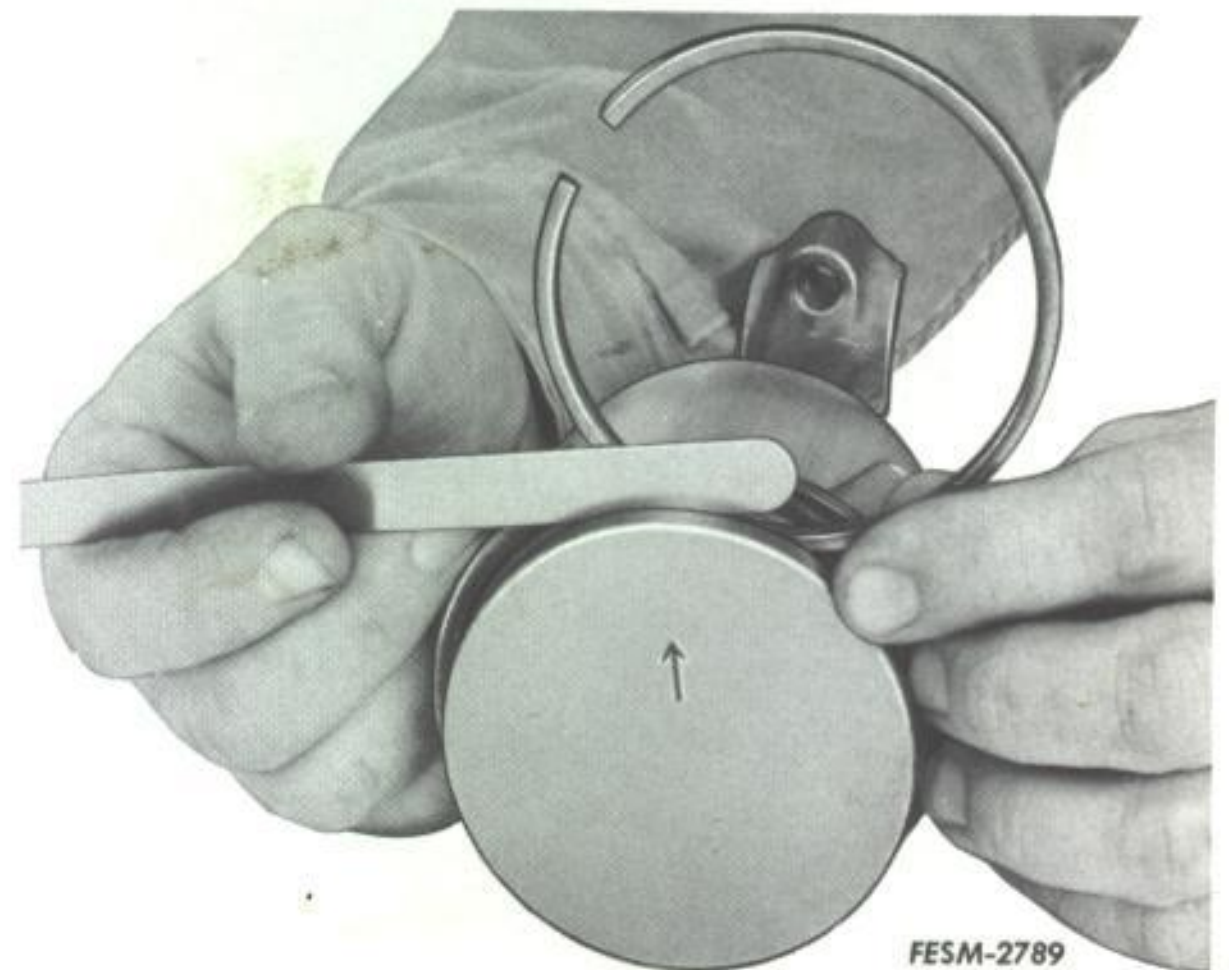
1. Check for score marks and metallic pick-up. Superficial score marks can be polished out with crocus cloth soaked in oil.
2. With a micrometer, check crankpin diameter for out-of-round specified as follows:
K-161 (new) - - - - - 1.1855 to 1.1860
K-241 and K-301 (new) - 1.4995 to 1.5000
If out-of round, replace shaft or regrind to .010 undersize.
3. Check gear, keyway and tapered part of shaft for wear. If worn, replace shaft.

Connecting Rod

1. Check rod for wear, score marks, running clearances, and side clearance. Replace rod if worn beyond high limit of clearances shown in specifications.
2. Connecting rod bearings are an integral part of the rod and not separately replaceable.
3. Connecting rods .010 undersize are available for reground crankshafts.

Piston and Rings

1. If cylinder block does not require reboring and old piston is free of score and scuff marks, check piston ring grooves and lands.



Illust. 1-8. Checking ring groove.

2. Clean ring grooves and check width with a new ring and thickness gauge. Replace piston if .005 or more gauge can be inserted between ring and land (Illust. 1-8).
3. NEVER RE-USE OLD RINGS.
4. When inserted in cylinder, piston ring end clearance should be as follows:
K-161 - - - - - .007 to .017 inch
K-241 and K-301 - .010 to .020 inch

Piston Pin

1. Very little wear takes place on piston pin or in piston bosses.
2. If it is necessary to replace connecting rod because of wear at crank end of rod, it is advisable to install a new piston pin.
3. Assemble pin to rod. Use a rod aligner to check rod for proper alignment. Straighten as necessary.

Valves, Seats and Guides

1. Check clearance of valve stems in guides. Refer to Specifications.
2. If necessary, remove valve guides as follows:

Tap the valve guide its full length using a $3/8$ inch N. C. tap.

Thread a $3/8$ N. C. x 6 inch cap screw its full length.

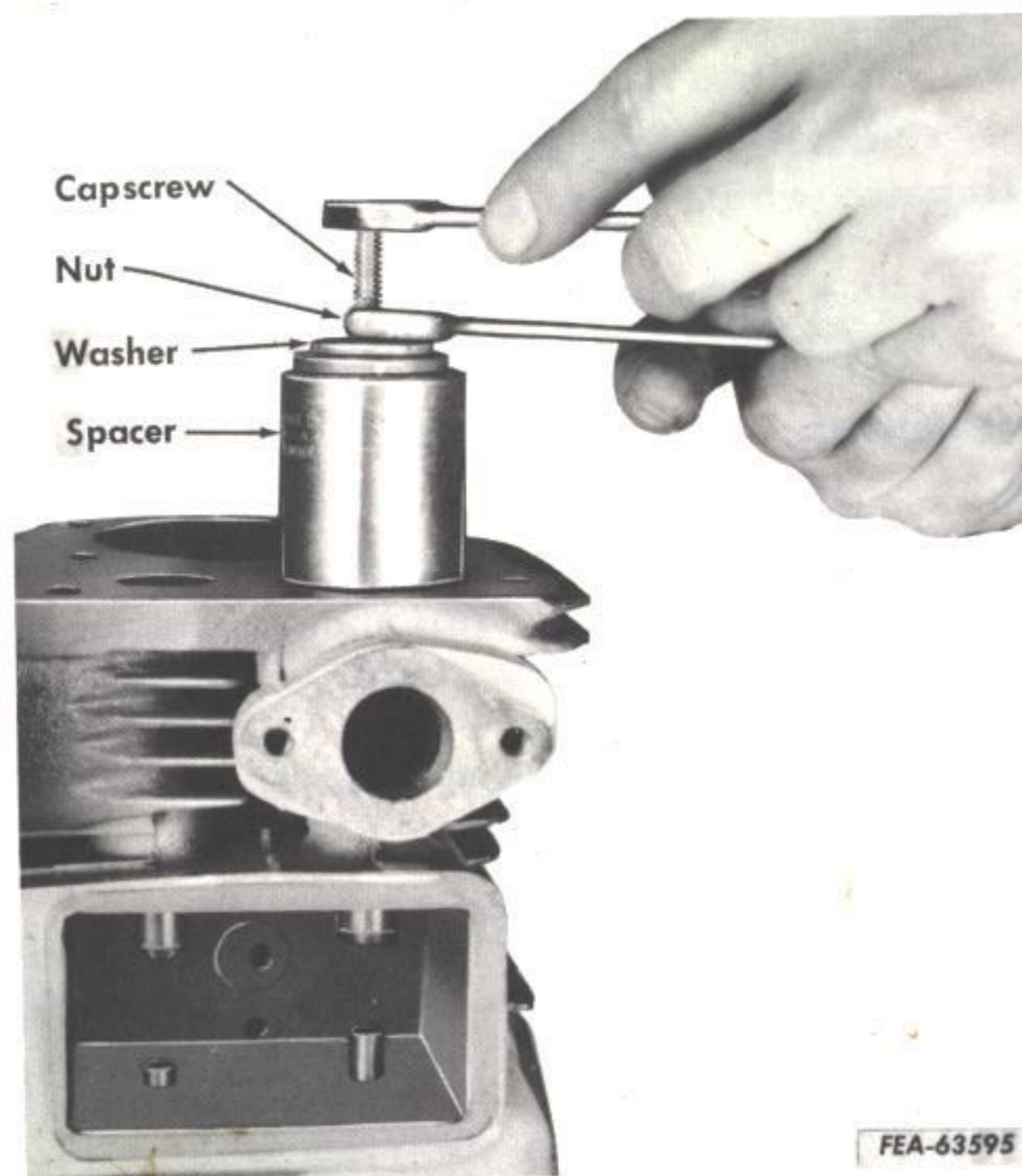
Install a nut, washer and spacer on the cap screw, then screw the cap screw into the valve guide, the full length of the valve guide.

Hold the cap screw and turn the nut, as shown in Illust. 1-9.

3. Press new guide into the crankcase a depth below top surface of cylinder block as specified:

K-161 - - - - - 1-5/16 inches
K-241 and K-301 - 1-15/32 inches

It will be necessary to ream guides to gain correct fit. Refer to Specifications for proper clearance.



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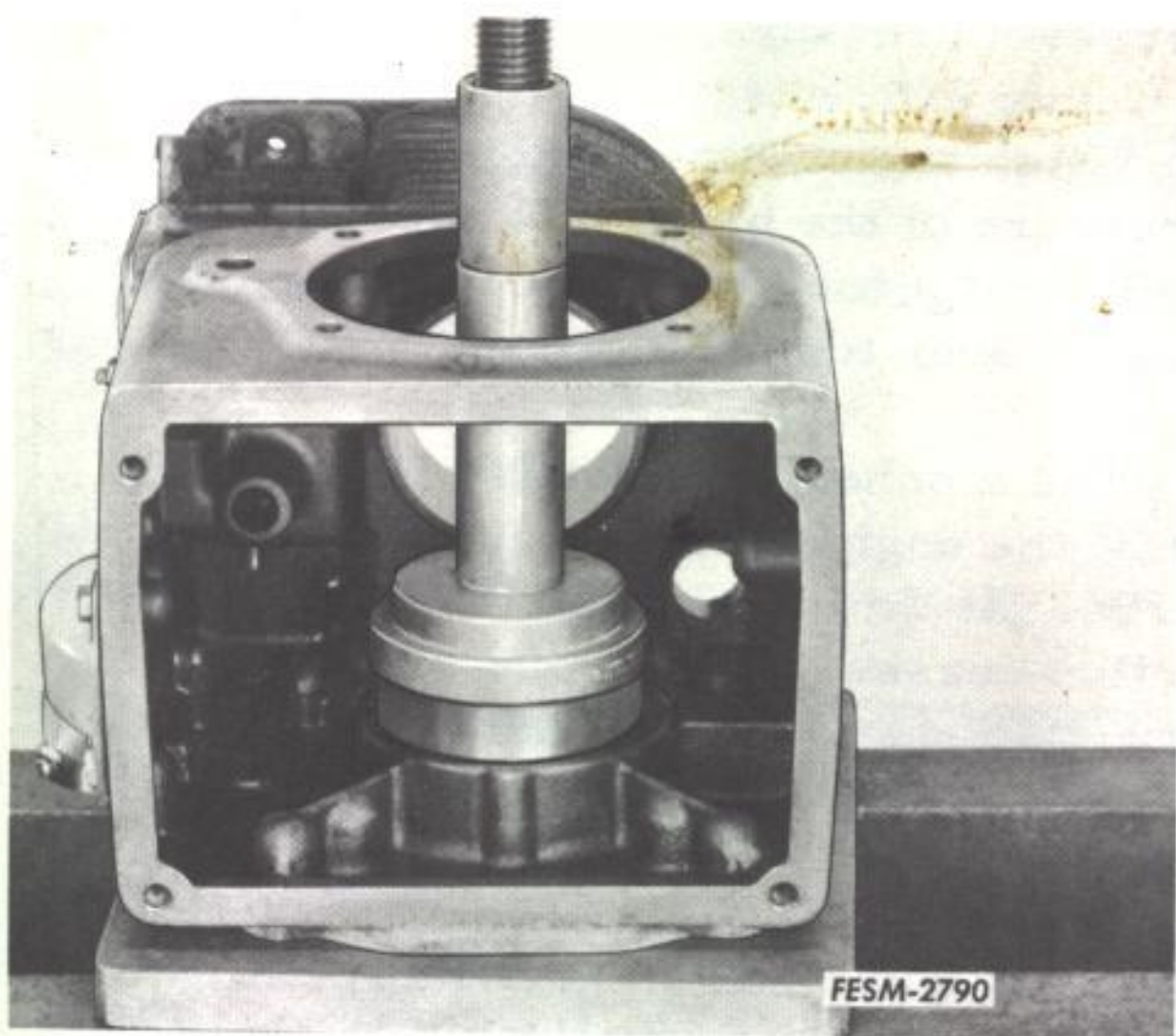
Illust. 1-9. Removing valve guides.

4. The valve seat should be held as nearly as possible to .037 inch in width. Seats with more than .045 inch width should be reconditioned.

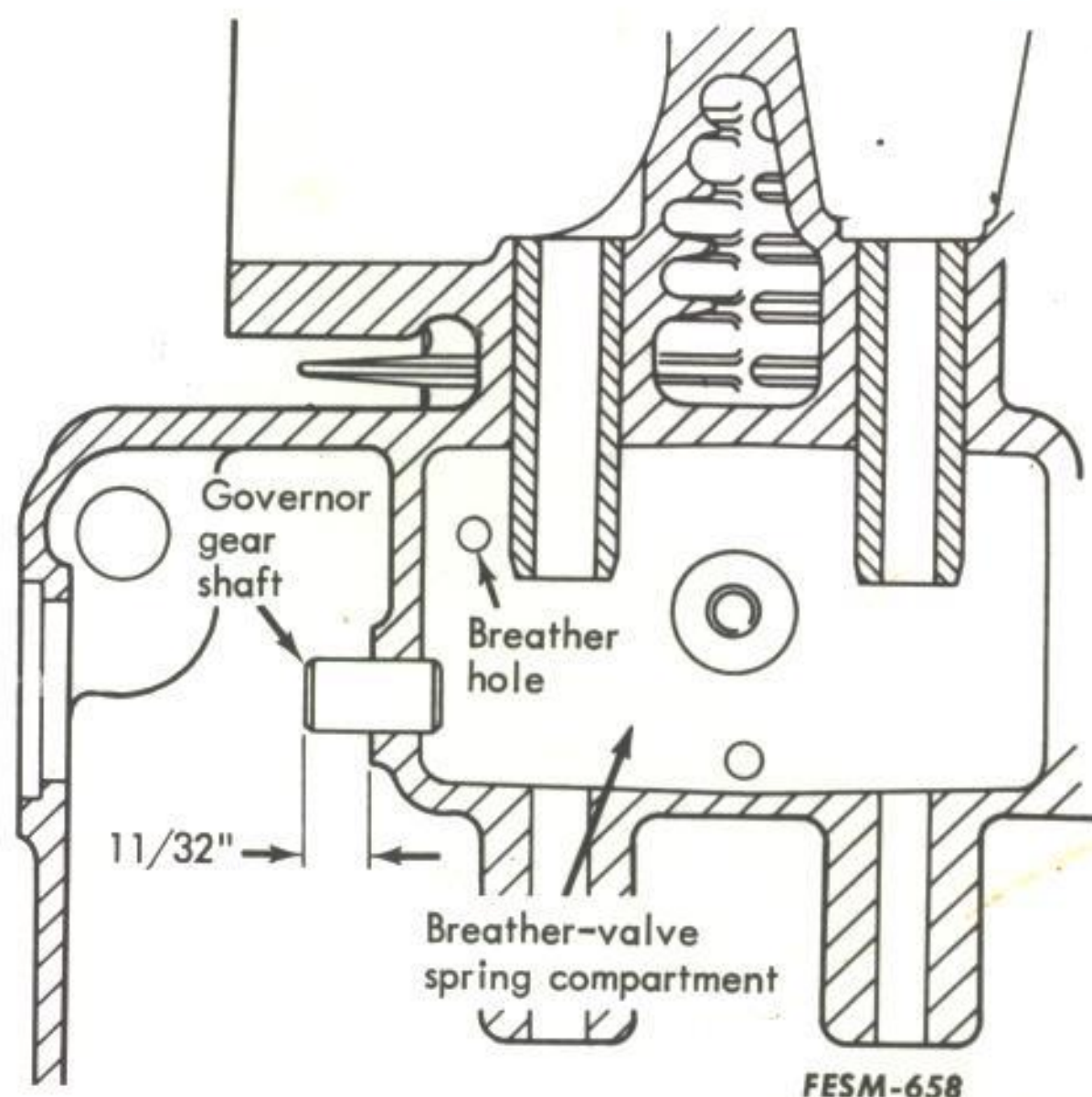
5. Intake valve seat is machined into block. If seat is ground too deep an insert is available for service. Refer to Specifications for bore and depth for machining block before installing the insert.

6. The exhaust valve seat is a Moly Nickel Chrome or Stellite insert. An over-size insert is available for service. Refer to Specifications for bore and depth for machining block before installing the insert.

Reassembly



Illust. 1-10. Installing front main bearing.



Illust. 1-11. Height of governor gear shaft.

Governor

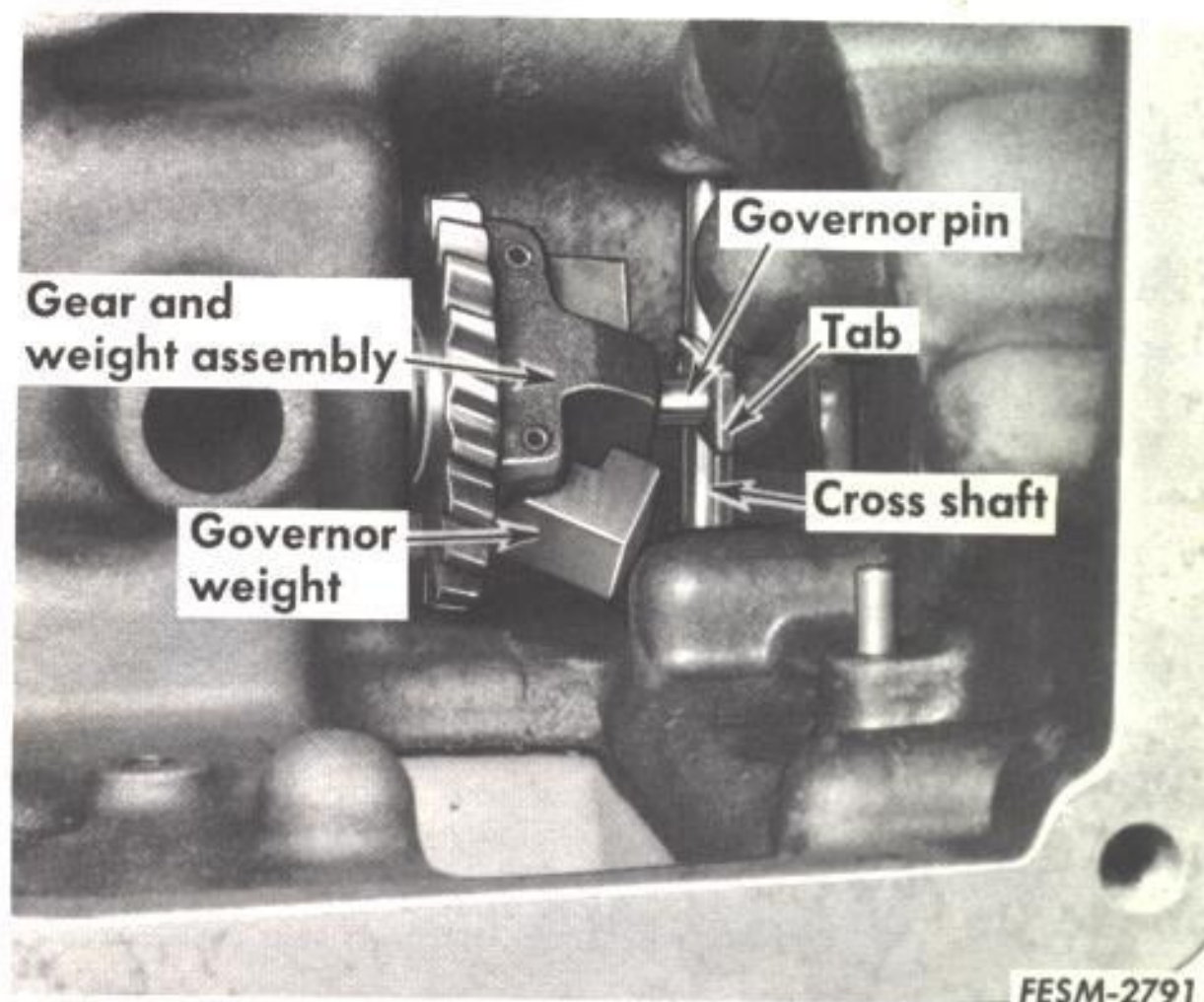
Install front main bearing by pressing into cylinder block (shielded side on 7 H. P. to inside of block). See Illust. 1-10.

1. Check the governor gear shaft for wear. Do not remove the shaft unless it needs to be replaced. To remove the shaft, remove the expansion plug and drive the shaft into the inside of breather valve spring compartment.

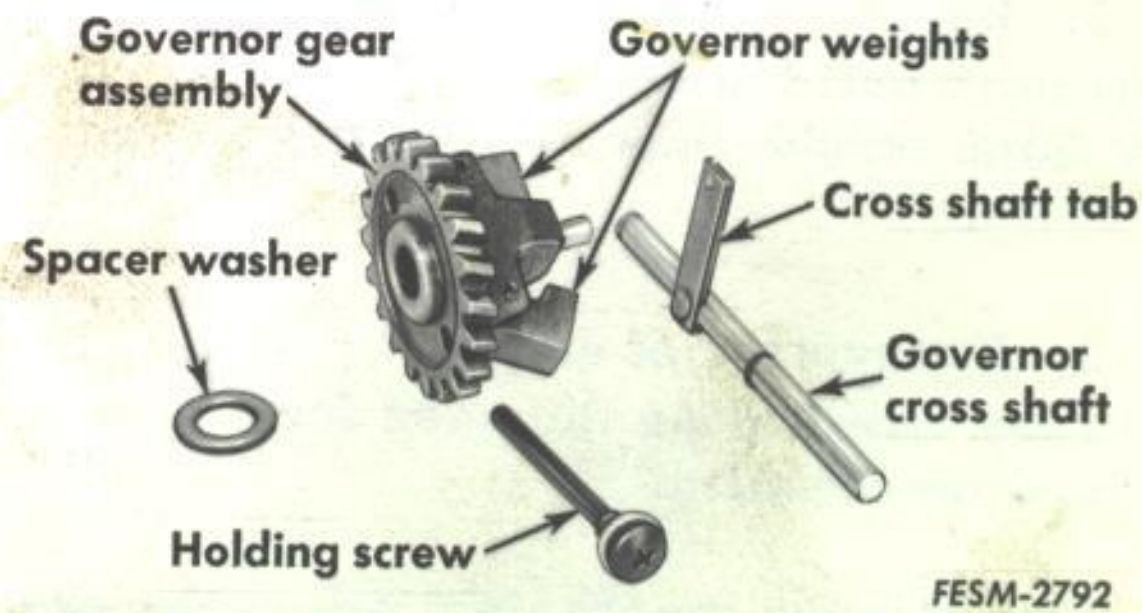
Install the governor gear shaft and expansion plug, if they were removed. See Illust. 1-11 for proper positioning.

2. Place spacer washer on gear shaft and slide governor gear assembly into place and secure with holding screw (Illust. 1-13). This screw prevents governor gear from sliding off gear shaft.

3. Place cylinder block upside down. Slide governor cross-shaft (Illust. 1-12) into place from inside of block. Make sure tab on governor shaft is against pin in end of governor gear.



Illust. 1-12. Governor gear and cross shaft installed.



Illust. 1-13. View of governor parts.

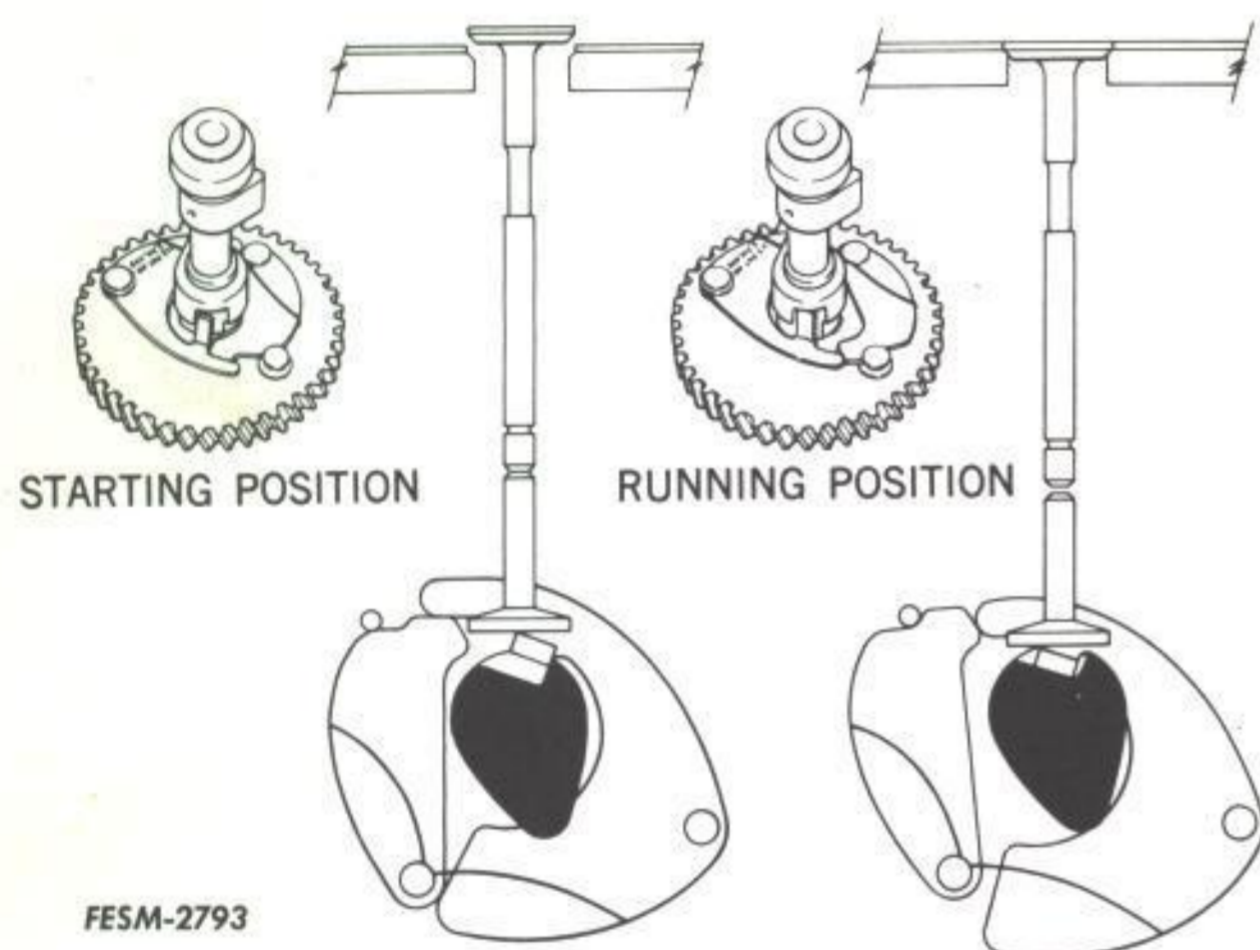
On the K-161 place speed control disc on governor bushing nut and thread bushing nut into block, clamping throttle bracket into place (Illust. 1-29).

On the K-241 and K-301 the bushing nut is installed without any additional parts.

4. Governor shaft can be adjusted for end clearance by moving needle bearing in block. Set bearing to allow a slight back-and-forth movement of the shaft.

5. Rotate governor gear assembly to be sure the holding screw does not contact the weight section of the gear.

Automatic Compression Release



Illust. 1-14. ACR operation.

The Kohler Automatic Compression Release provides:

1. Reduction of the cranking effort required to pull the engine through the compression stroke thus making the engine easy to start.

2. Prevention of engine "kick back" thereby eliminating the need for a spark retard mechanism.

The release mechanism opens the exhaust valve slightly during the first part of

the compression stroke allowing part of the mixture to escape and lowering the compression pressure.

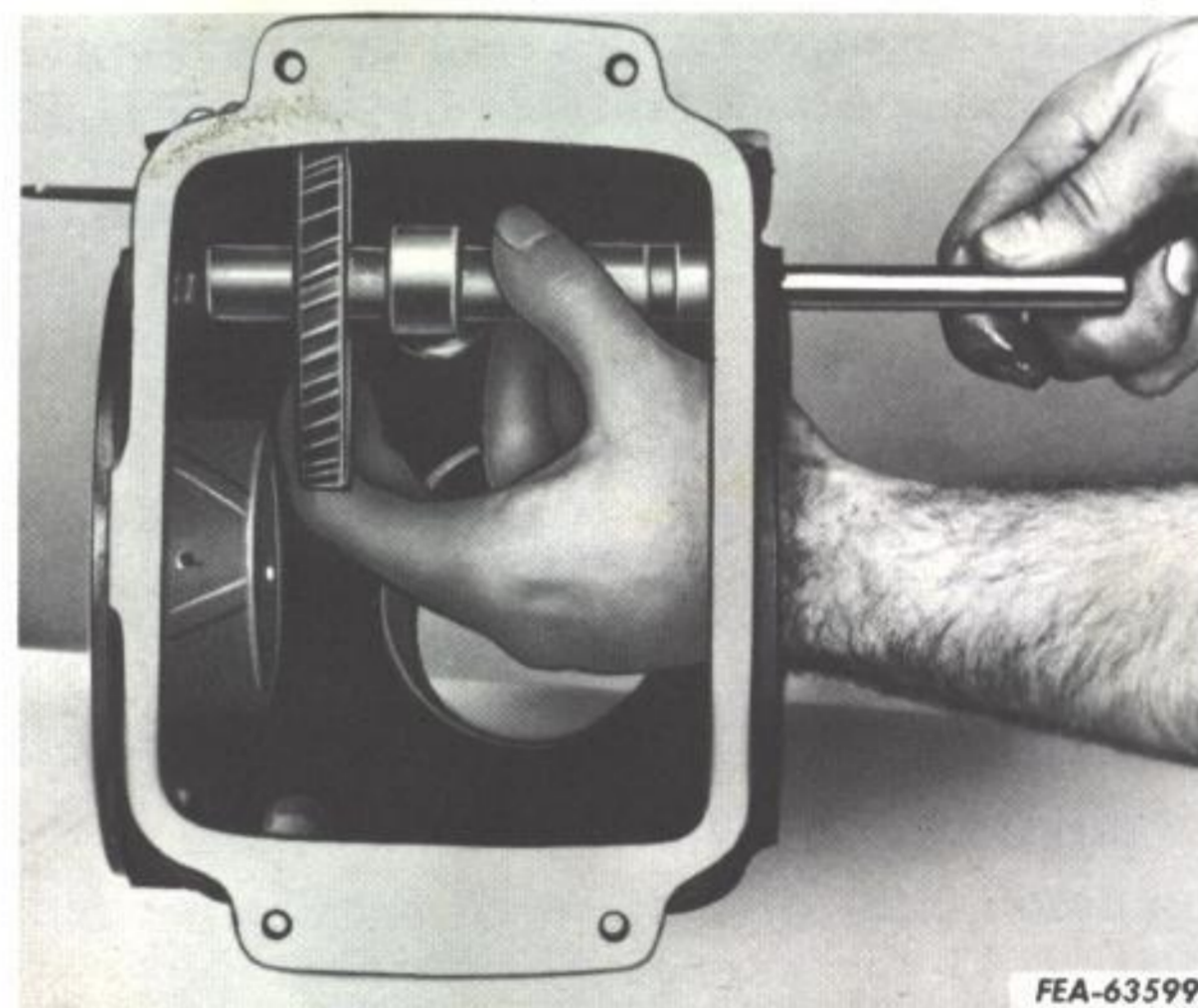
"Kick back" is prevented because the pressure of the burning mixture is reduced sufficiently for the flywheel to carry the engine over top dead center.

The mechanism remains in operation until the engine reaches approximately 650 RPM. At this speed all decompression action ceases. The engine operates in the standard manner at all higher speeds with no loss of power.

Compression release weights are not serviced separately. Weight spring is available for service.

Valve Tappets and Camshaft

1. Turn the cylinder block upside down and place valve tappets in tappet guides.



Illust. 1-15. Installing camshaft.

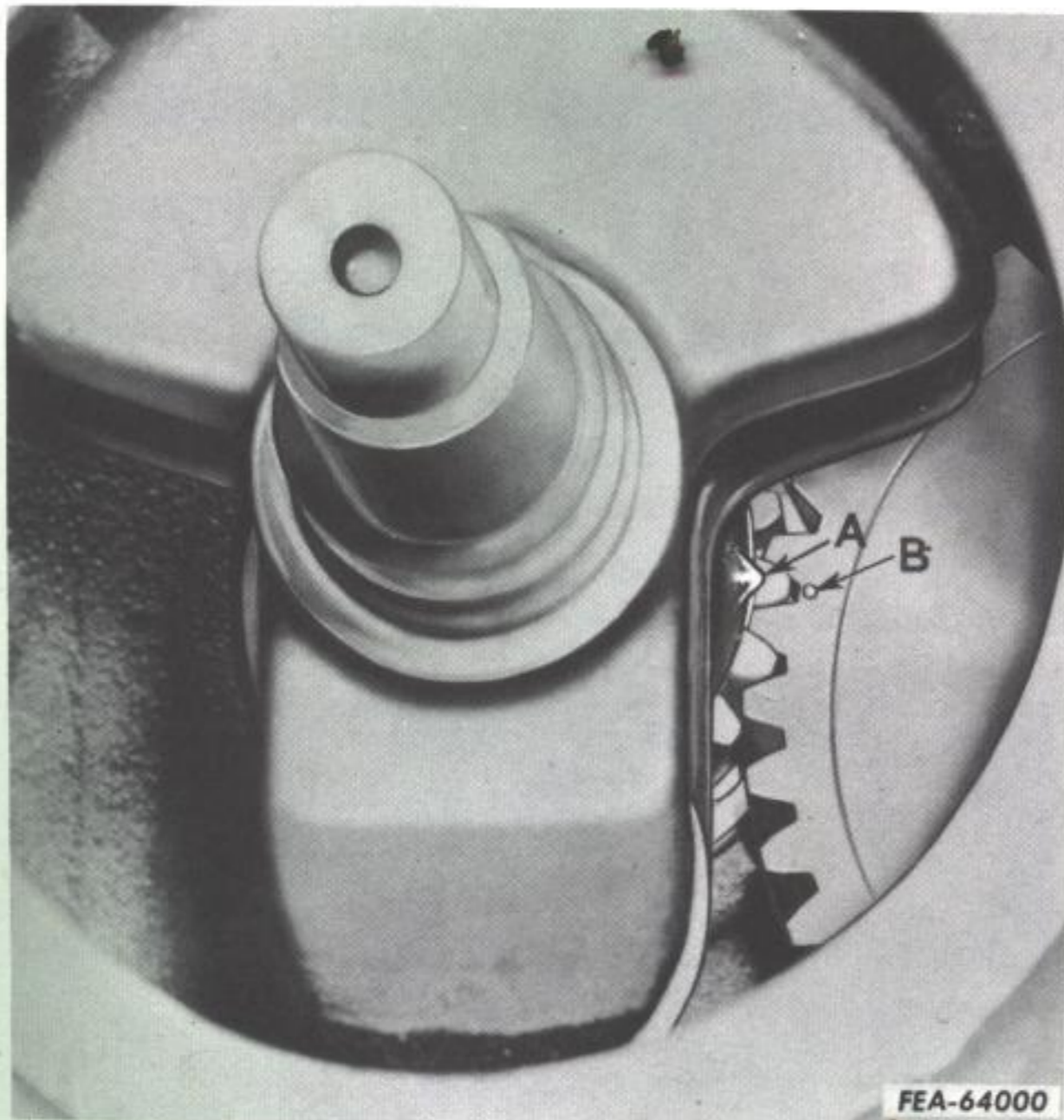
2. Position the camshaft in the block with washer type shims (that were removed during disassembly) between the end of the camshaft and the bearing plate side of the block. Slide the camshaft pin through the shims and camshaft from the bearing plate side (Illust. 1-15), and press into the front side of the block.

3. Check camshaft end clearance specified as follows:

- K-161 - - - - - .005 to .025 inch
- K-241 and K-301 - .005 to .010 inch

Clearance can be changed by adding or removing shims as required.

Installation of Crankshaft



Illust. 1-16. Crankshaft installation, A and B are timing marks.

1. The installation of the crankshaft in the cylinder block is shown in Illust. 1-16.

2. Timing marks are provided on the crankshaft and camshaft gear for correct timing of engine. When in place, the mark "B" between teeth of camshaft gear (Illust. 1-16) must line up with the mark on shoulder of crankshaft "A" (Illust. 1-16). Chalk timing mark positions for ease of viewing during assembly.

Bearing Plate

1. Press the rear main bearing into the bearing plate (shielded side to the inside of 7 H. P. only).

2. Crankshaft end play is determined by the bearing plate gasket thickness. Use of about .030 of gaskets should bring end play within limits. Clearance must be checked after assembly between front main bearing inner race and shoulder on crankshaft as follows:

- K-161 - - - - - .002 - .023
- K-241 and K-301 - .003 - .020

3. Carefully press the bearing plate assembly onto the crankshaft and into the block.

4. Install four cap screws with copper washers. Draw cap screws up evenly and check end play.

Piston and Rod Assembly

1. Assemble the piston to the rod so the arrow on the piston (when so marked) faces away from the valves and the connecting rod marking "A" (Illust. 1-18) is toward the camshaft side of the engine. Secure piston pin with retainer rings. Always use new retainer rings. Be sure the retainer rings are fully engaged in the grooves in piston bosses.



FEA-64001

Illust. 1-17. Installing piston assembly.

2. Coat the cylinder bore and each piston ring with clean engine oil. Insert one ring into the bore. Use the piston to force the ring squarely down inside the bore below normal ring travel. Position a feeler gauge between the ends of the ring and compare the existent gap against the specified gap for a new ring. Specified gap as follows:

K-161 - - - - - .007 to .017 inch
 K-241 and K-301 - .010 to .020 inch

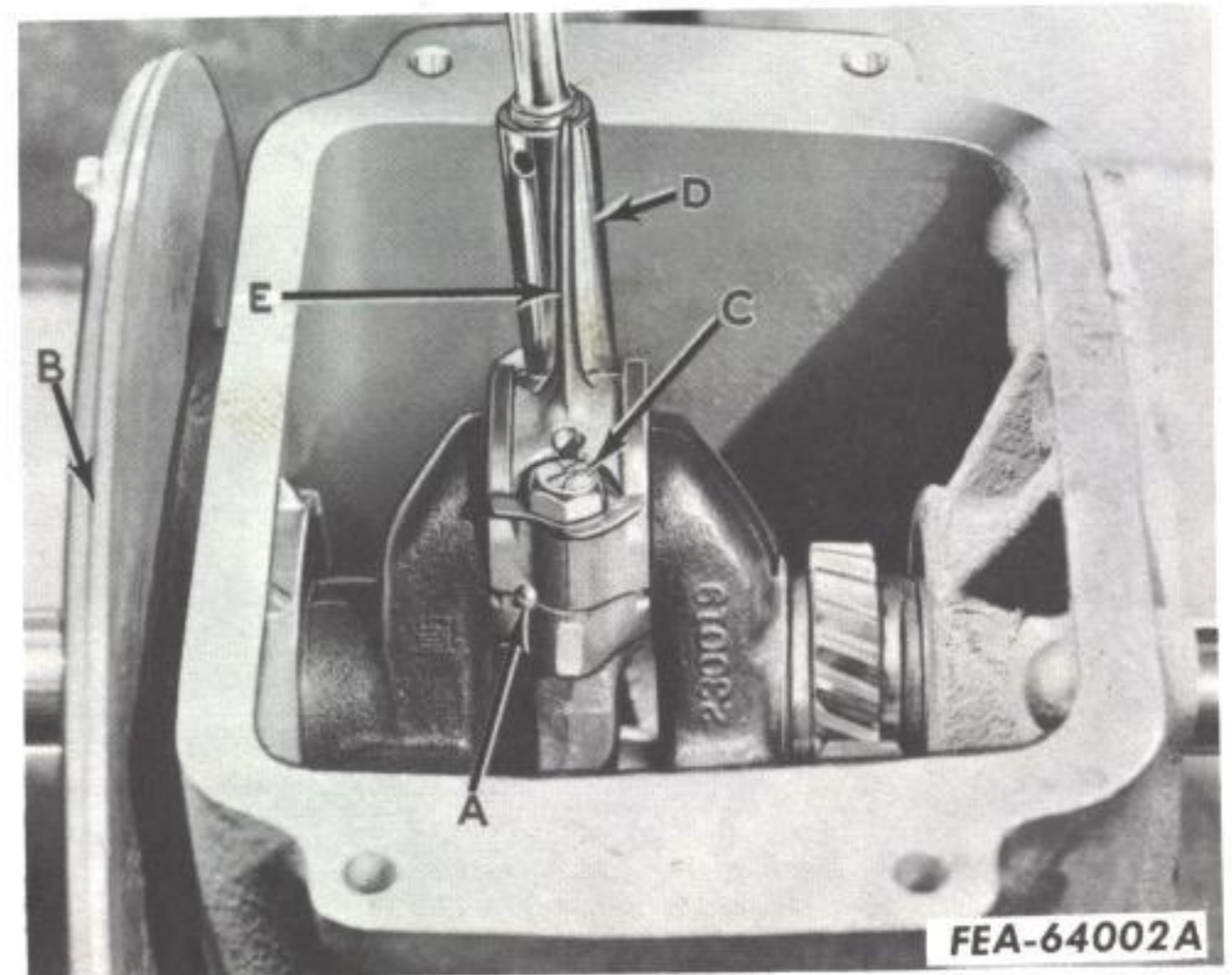
Remove the first ring and install the other rings and repeat the foregoing procedure.

3. Piston rings must be installed according to their markings. Install compression ring with groove or bevel up when it is located on the inside of the ring. The groove or bevel goes down when located on the outside of ring.

4. After rings are in proper position and in the correct grooves, oil the complete assembly, stagger ring gaps so they are not in line and insert complete assembly into cylinder bore. Be sure connecting rod marking "A" (Illust. 18) is toward camshaft side of engine. Use a ring compressor to prevent ring breakage during installation (Illust. 1-17).

Attaching Rod to Crankshaft

1. After piston assembly is installed, place the block on end and oil connecting rod and crankpin.



Illust. 1-18. Tightening connecting rod cap screws.

A - Connecting Rod Marks	C - Cap Screw
B - Bearing Plate	D - Socket Wrench
	E - Oil Slinger

2. Install connecting rod cap, lock and cap screws to connecting rod (Illust. 1-18). K-241 and K-301 use flat washer for lock. The oil hole in the cap is on the camshaft side of the engine when properly installed.

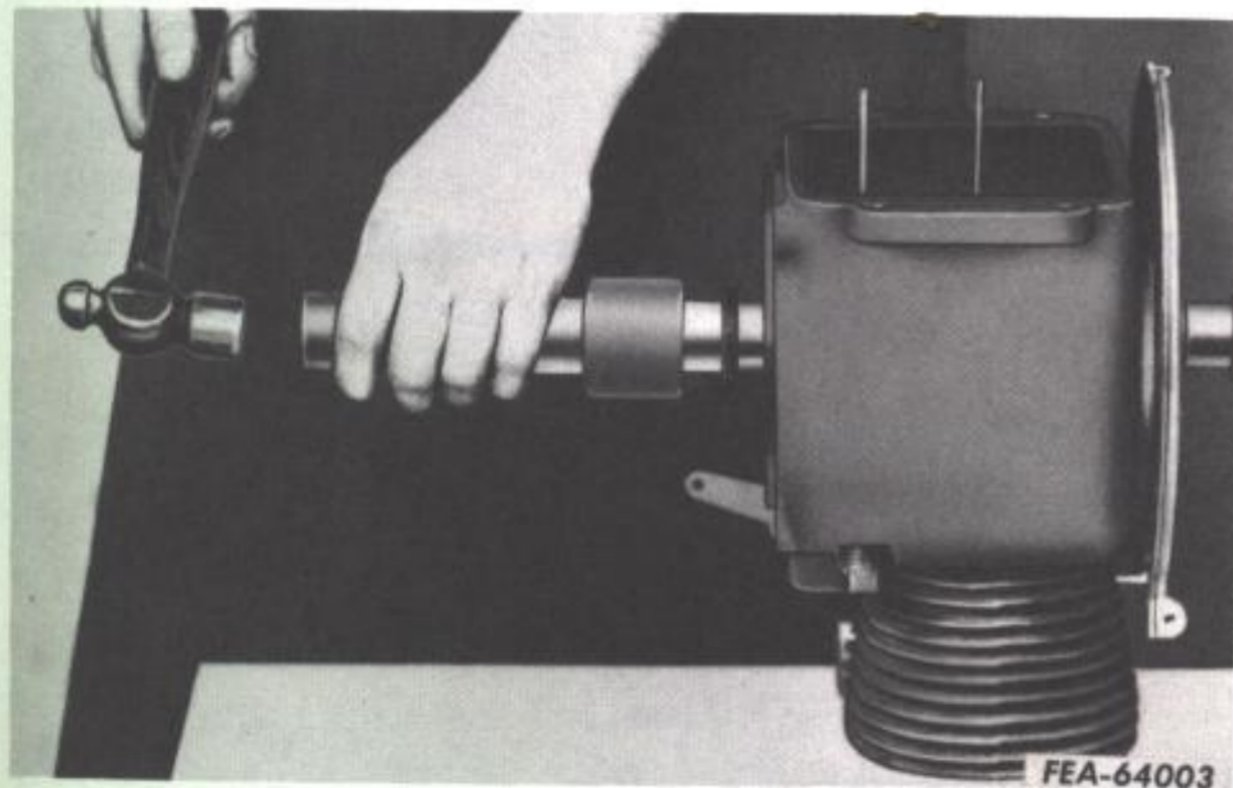
3. Use the torque wrench to tighten cap screws to 200 inch pounds on the K-161, and 300 inch pounds on the K-241 and K-301. Back off the screws and retighten cap screws to 180 inch pounds on the K-161, and 280 inch pounds on the K-241 and K-301. This two-step procedure will assure a tight fit of cap to rod and avoids the possibility of screws tightening in threads while the cap remains loose.

NOTE: Be careful not to bend the oil slinger "E" (Illust. 1-18).

Installation of Oil Seals on Crankshaft

IMPORTANT: The oil seal at the front of the engine is countersunk 1/8 inch in factory production. This is not necessary for service. The service oil seal is to be installed flush with the crankcase. Since the seal will be seating on a new portion of the crankshaft, it is extremely important that all paint and any foreign material be removed from the sealing surface before the new seal is installed.

1. Model K-161 Only: Place the seal protector tool FES 54-5 over the crankshaft at the front of the engine and protector tool FES 54-4 over the crankshaft at the flywheel end of the engine.



Illust. 1-19. Installing oil seal on front side of engine.

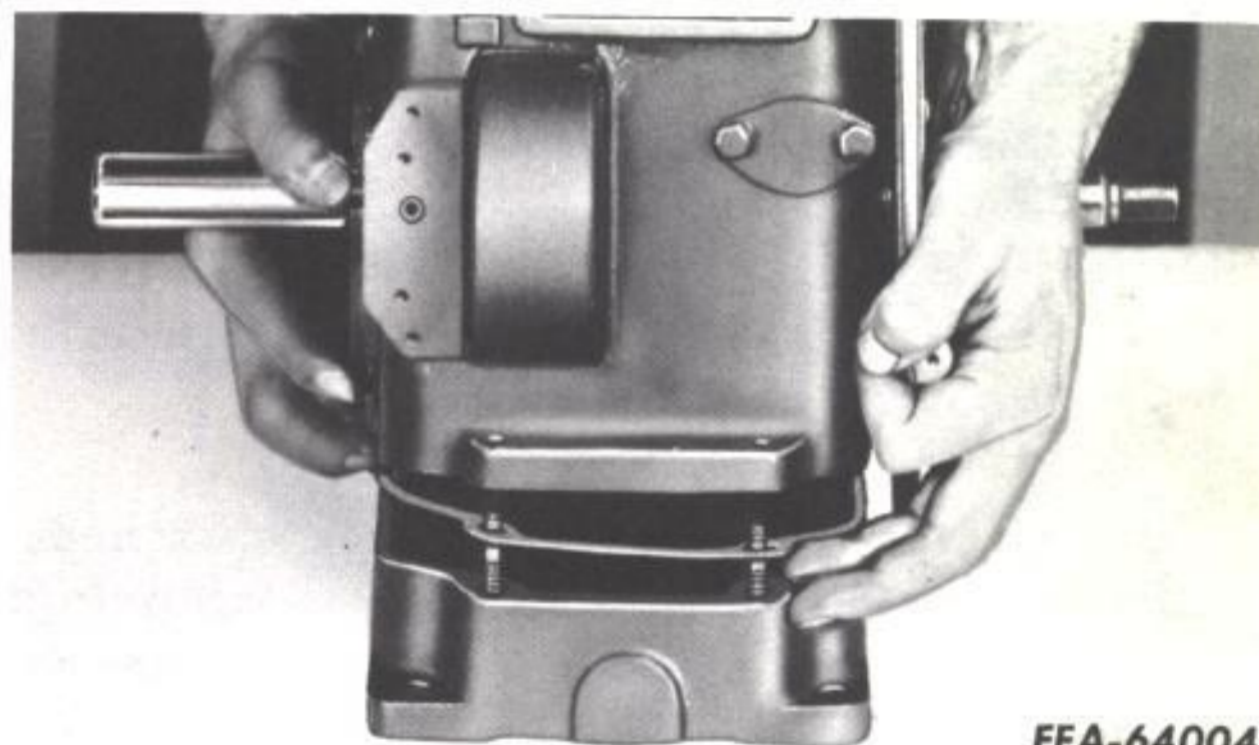
2. Lubricate the seals and slide them onto the protector tools. Drive the front seal in flush with the cylinder block and the rear seal flush with the bearing plate, with seal driver FES 54-6 (Illust. 1-19).

NOTE: The two seal protector tools and the driver can be ordered from:

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

3. K-241 and K-301: Remove any burrs or sharp edges from the crankshaft keyway. Lubricate and install the seals flush with the bearing plate.

Oil Base



Illust. 1-20. Installing oil base.

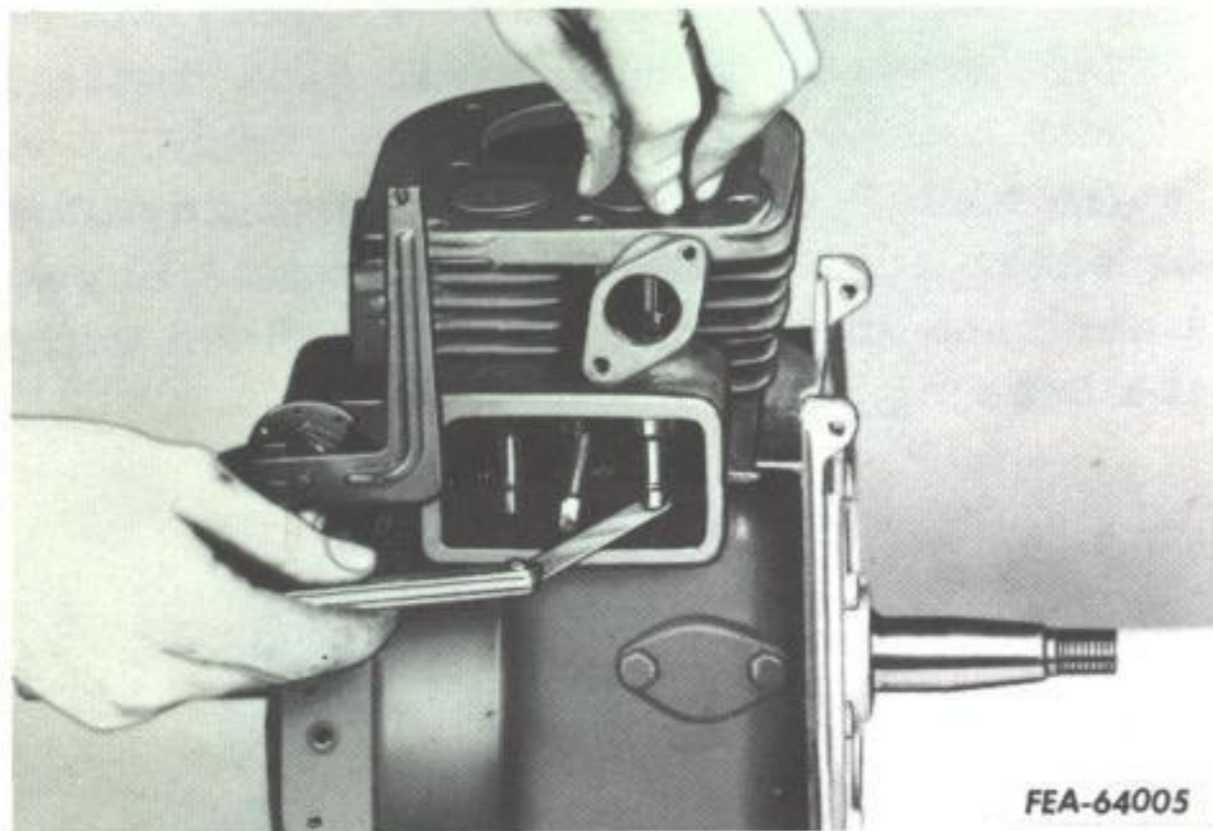
1. Assemble oil base to the block with four screws (Illust. 1-20).

2. It is important that a new gasket be used to prevent oil leakage.

3. Use 5/16 inch pilot studs to align the cylinder block, gasket and oil base.

Installing and Setting Valves

1. Valves, valve seats and ports should be thoroughly cleaned.



FEA-64005

Illust. 1-21. Checking valve clearance.

2. Turn crankshaft to top dead center at end of compression stroke. On K-161 install valves less springs and keepers and check clearance (Illust. 1-21).

Valves that do not have sufficient clearance on K-161 engine must be removed and stem ends ground until desired clearance is obtained. ENDS MUST BE GROUND SQUARE AND ALL BURRS MUST BE REMOVED. If clearance is excessive install new valves.

3. After correct clearance is obtained, remove the valves and install valve springs and retainers. Replace the valves, compress the springs (using a spring compressor) and place locking key in grooves of the valve stems.

4. On K-241 and K-301 tappets are adjustable and grinding of valve stems is not necessary. Assemble valves, springs, retainers and keepers and then adjust tappets to proper clearance.

K-161	-	.006 to .008 cold (Intake)
		.015 to .017 cold (Exhaust)
K-241	}	.008 to .010 cold (Intake)
and		.017 to .019 cold (Exhaust)
K-301		

Cylinder Head



FEA-64006

Illust. 1-22. Cylinder head assembly.

1. Always use a new gasket when the head has been removed for service work. It is recommended that head gaskets be soaked in water before assembly.

2. Check the cylinder head on a face plate to be sure the gasket surfaces make good contact at all points.

3. It is important that cylinder head cap screws be tightened evenly and in steps until inch pounds torque specified is reached (Illust. 1-23).

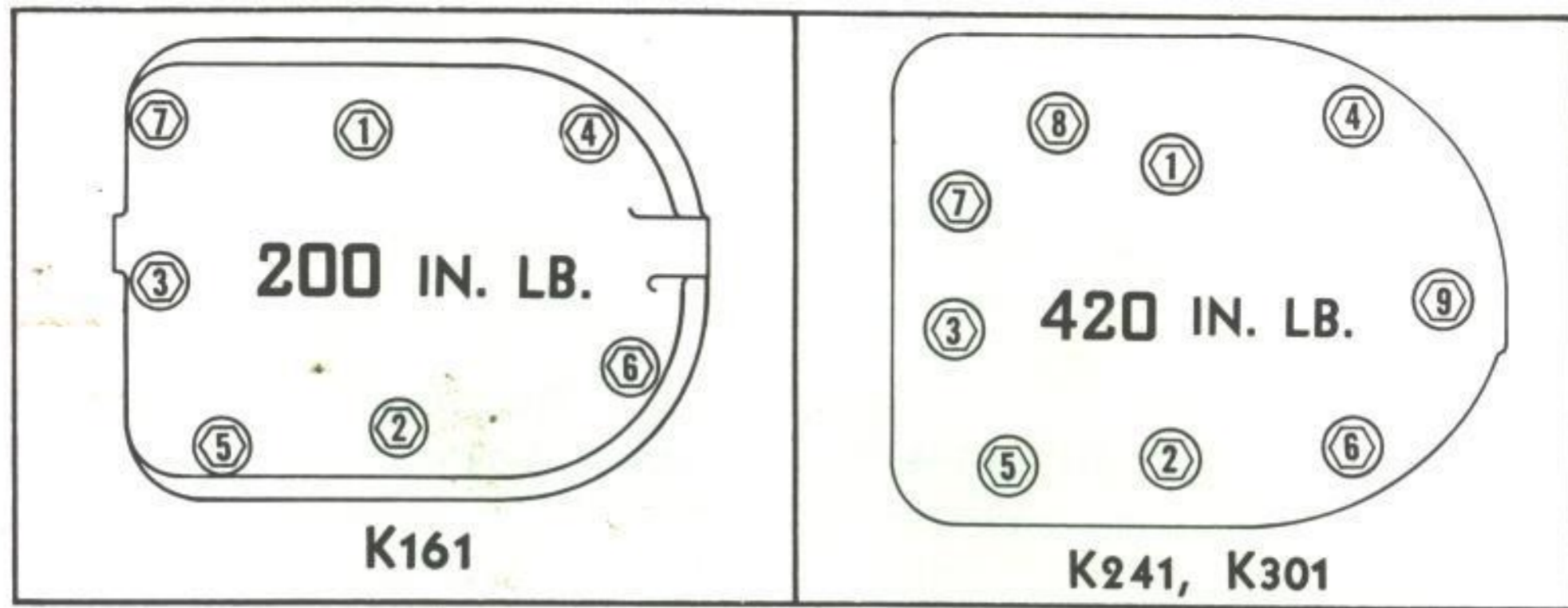
K-161 - - - - - 200 inch pounds
K-241 and K-301 - 420 inch pounds

NOTE: Do not torque head until steps 1 and 2 of Flywheel, Blower Housing Section page 1-22 have been completed.

4. Spark plug gap should be .025. Install spark plug and tighten to 27 foot pounds torque.

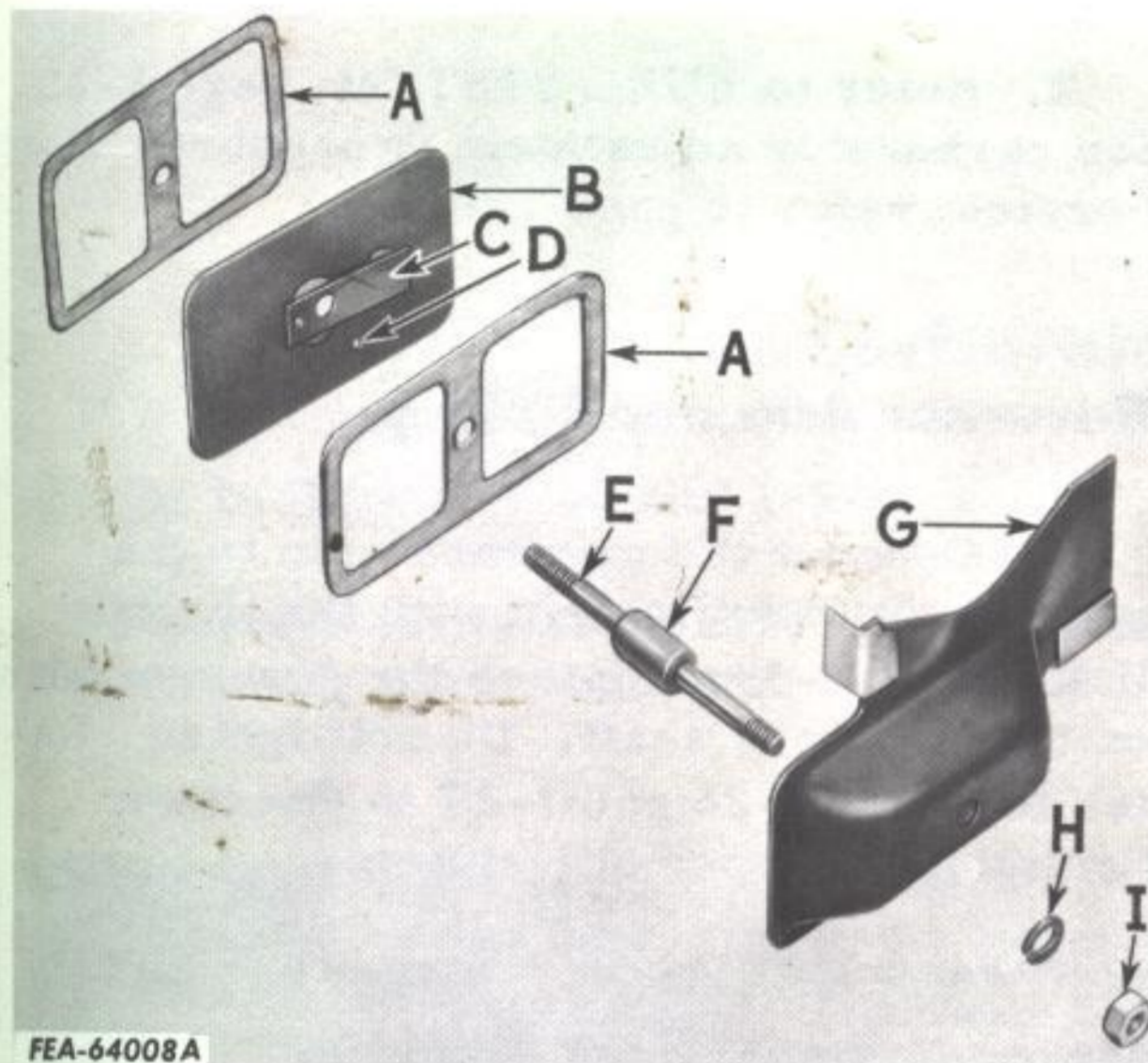
Breather Assembly

1. The reed type breather valve maintains a slight vacuum in engine crankcase. All parts must be clean and in good condition. Parts can be replaced as necessary.



FESM-2784

Illust. 1-23. Head torquing sequence.



FEA-64008A

Illust. 1-24. Exploded view of breather and vent assembly.

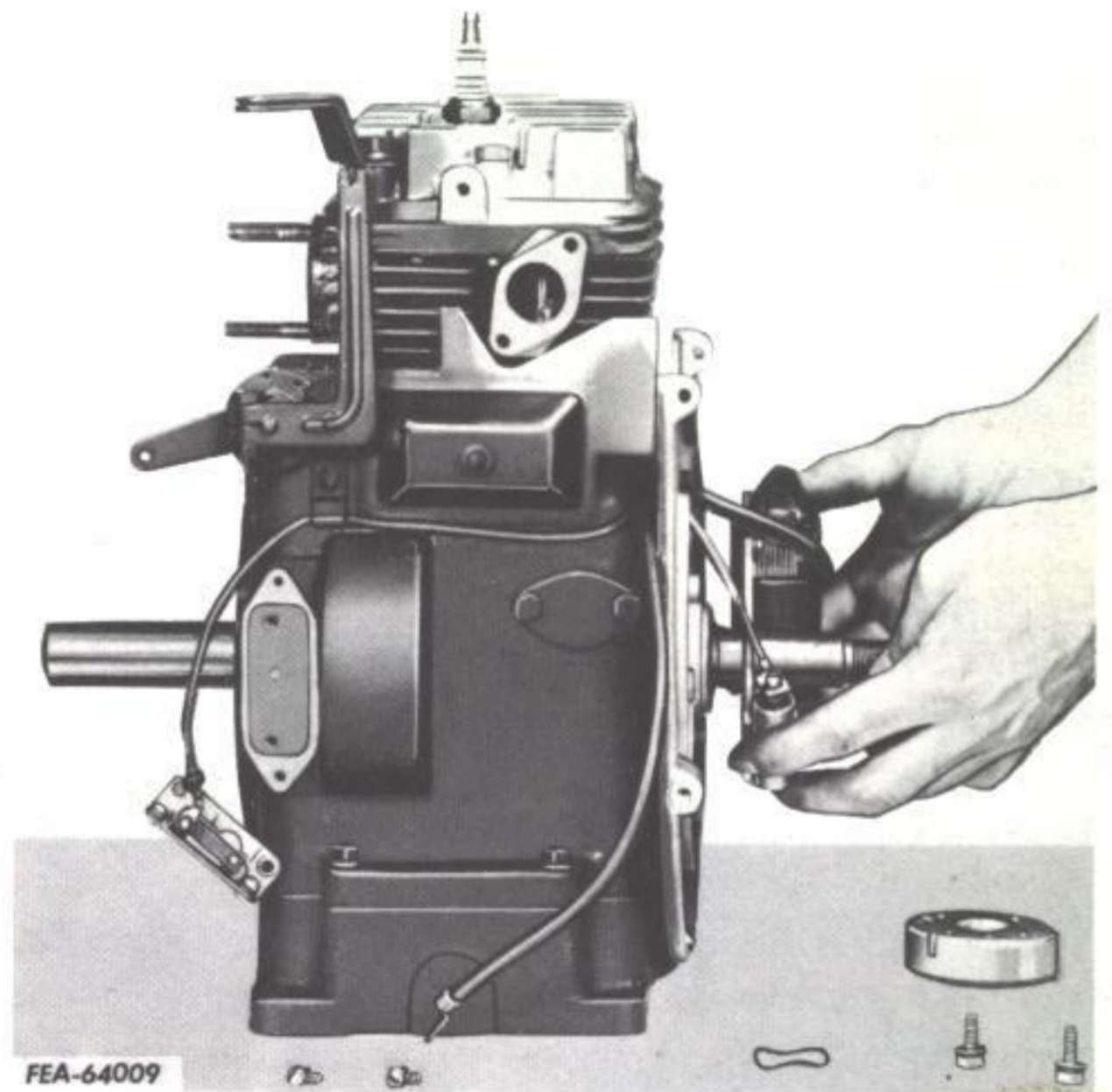
A - Gaskets	D - Hole	G - Cover
B - Plate	E - Stud	H - Washer
C - Reed	F - Spacer	I - Nut

2. The correct order for assembly of the breather is as follows (Illust. 1-24): A-Gasket, B-Plate and C-Reed, D-small drilled hole must be at bottom of plate and reed to the outside. Improper assembly will result in oil leakage.

3. Cover must be tight to prevent oil leaks.

Magneto (If equipped)

1. Install square key in slot of crankshaft.



FEA-64009

Illust. 1-25. Assembly of magneto.

2. Illust. 1-25 shows the magneto in position. Note how breaker lead and high tension spark plug cables are pulled through plate opening.

3. After the magneto assembly has been fastened to the bearing plate, the rotating magnet is pressed onto the crankshaft. Magnet is marked "ENGINE SIDE" for correct assembly.

Flywheel, Blower Housing, Tank Brackets and Fuel Tank

NOTE: At this time it is desirable to clean the area around the timing mark "S" on the flywheel so it will be readily visible for engine timing.

1. Place flywheel in position (the square key aligns flywheel on shaft).
2. Remove enough head bolts to locate blower housing, head baffle, tank bracket and install. Torque head as instructed in Cylinder Head Section (Illust. 1-23).
3. Install screen, "V" pulley, lock washer, and flywheel nut. Torque nut to 60 ft. lbs.
4. Install the main clutch drive plate on the "V" pulley.
5. Install fuel tank, sediment bowl and connect to carburetor.
6. Install cylinder baffle, muffler and muffler baffle.

Starting Pulley

Install the starting pulley. The dimension from the front face of the starter-generator pulley hub to the end of the crankshaft must be 1-1/2 inches for the K-161 Engine and 1-1/4 inches for the K-241 and K-301. Be sure the pulley set screws are torqued to 12 to 14 foot pounds. The set screw that contacts the engine shaft must be tightened first; then tighten the set screw that contacts the key.

If equipped with front PTO refer to Chassis Section for service or installation.

Breaker Points

1. Install push rod.
2. Fasten breaker in place with two screws.
3. Place the cover gasket in position and attach the magneto lead or coil lead. For precision ignition setting, refer to Ignition Timing, page 1-33.

Carburetor

1. Using a new gasket attach the carburetor.
2. Refer to FUEL SYSTEM, page 1-23 for carburetor adjustment procedure. For Service, refer to page 1-24.

Governor Arm and Linkage

1. Connect the governor arm to the carburetor throttle arm with the throttle link (Illust 1-3) and place the governor arm on the governor shaft. Do not tighten. Refer to pages 1-26 and 1-27 in Governor Section for proper adjustments.

Motor-Generator (If equipped)

Install the motor generator and adjust the drive belt to give approximately 1/4 inch of slack midway between the driven pulley and the drive pulley. Refer to wiring diagrams (pages 1-28 and 1-29) under Electrical System of this manual for the proper electrical connections.

FUEL SYSTEM

General Information

The fuel system consists of a gasoline storage tank, shut-off valve, sediment bowl, fuel line with connections, and carburetor.

Service difficulties with fuel systems usually originate from improper carburetor adjustments, dirt or gum. If gum forms in the components it will be necessary to disassemble and thoroughly clean the carburetor.

Any carburetor having loose worn shafts

or a damaged fuel nozzle must be replaced by a new carburetor assembly. Wear in the throttle (or choke) shaft area is extremely critical for this not only upsets mixture control but allows entrance of unfiltered air which will quickly ruin the engine.

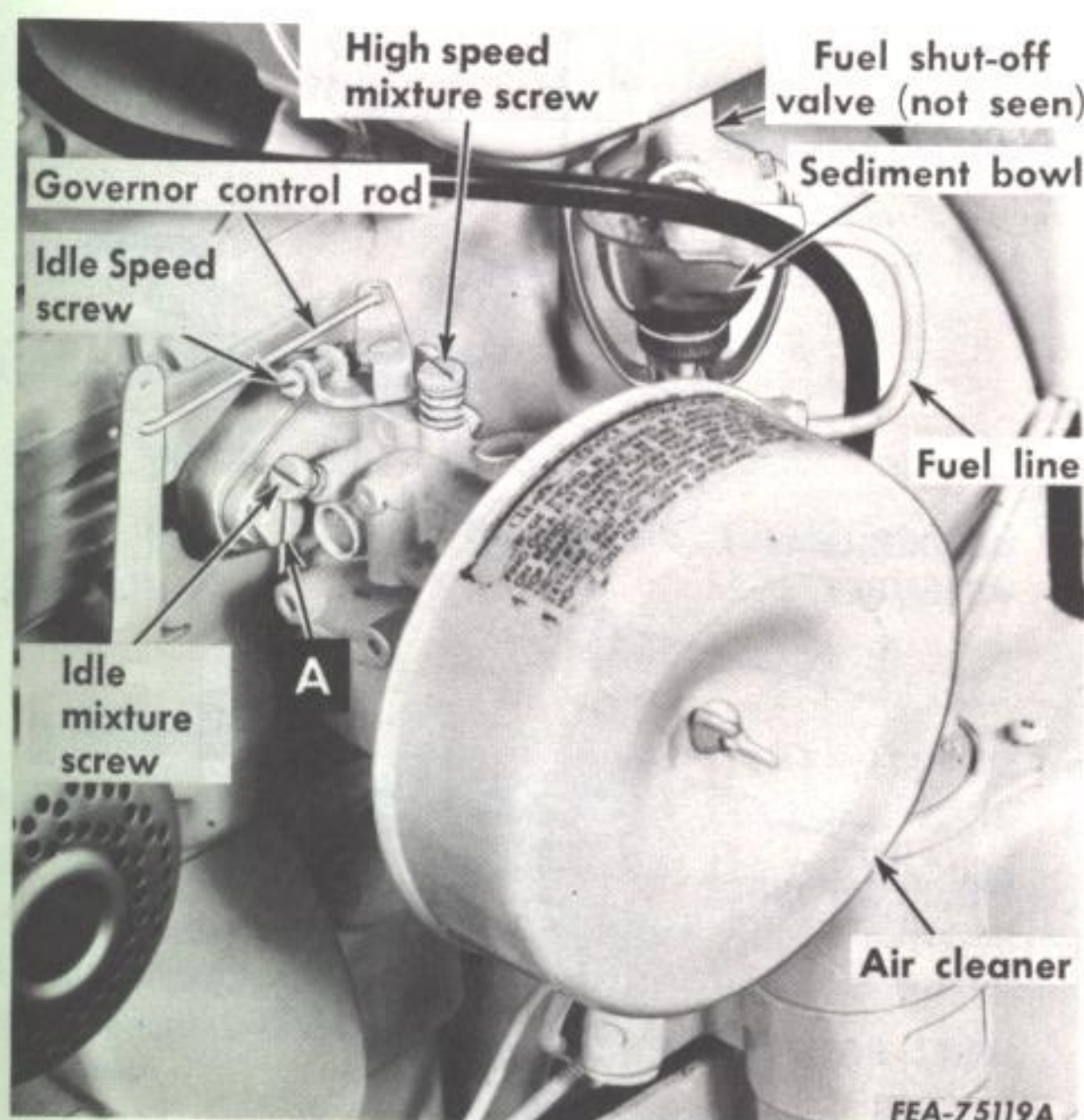
Throttle shafts, choke shafts, main fuel nozzles and other parts are not serviced separately.

Carburetor Adjustments

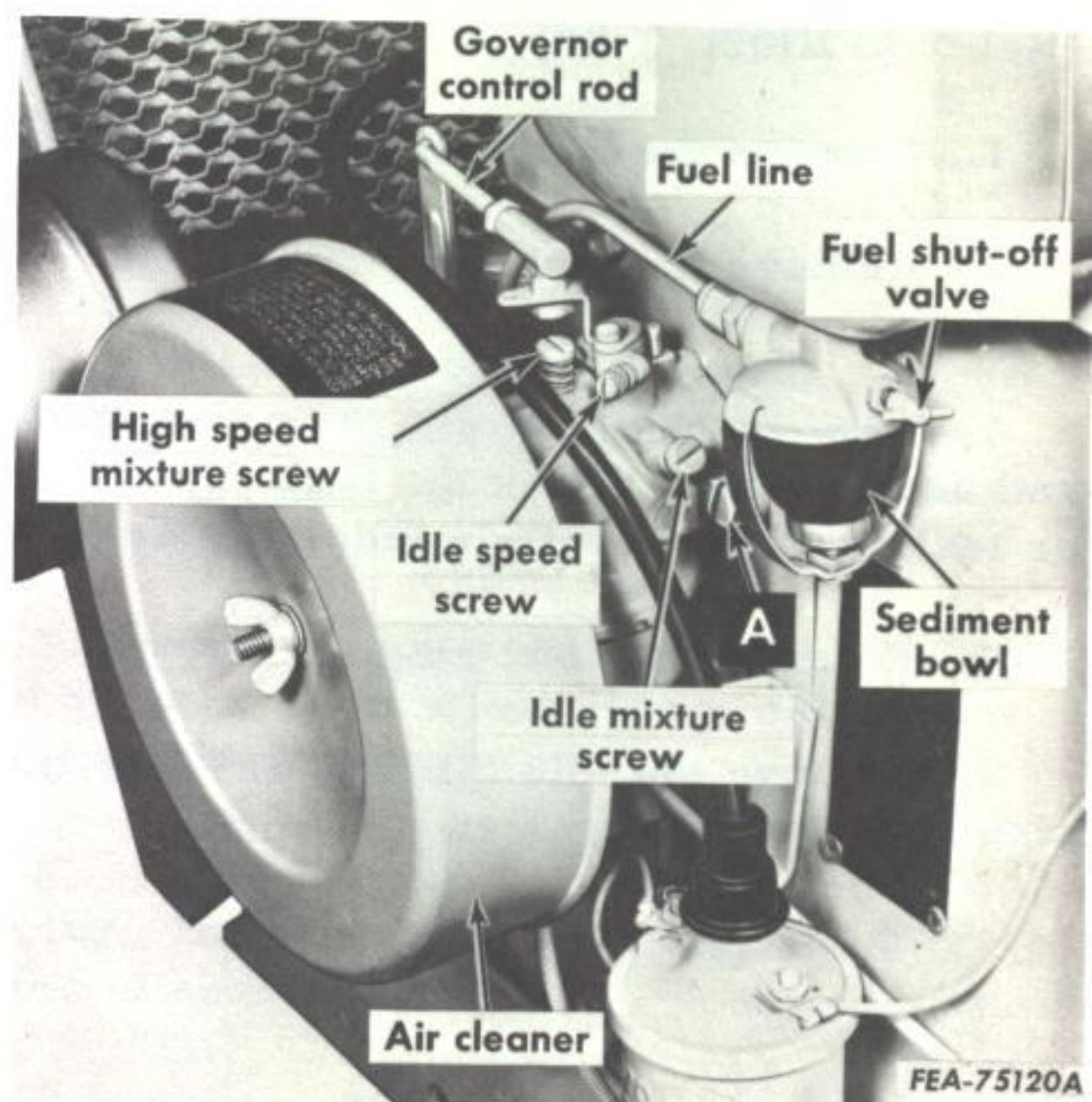
(Refer to Illusts. 1-26 and 1-27)

If adjustment is necessary, the following procedure is recommended.

Idle mixture screw adjustment should be made at the same time as high speed mixture screw adjustments, as each effects the other.



Illust. 1-26. Carburetor for Model 72.



Illust. 1-27. Carburetor for Model 104, 105, 124 and 125.

1. Turn the high speed mixture screw counter-clockwise two turns from closed position, turn the idle mixture screw 1-1/2 turns from the closed position and start the engine.

2. After the engine has reached normal operating temperature, accelerate and check the response. Place the engine under full load and adjust as follows:

a. If the engine misses and backfires under full load, the high speed mixture is too lean. The high speed mixture screw must be turned counter-clockwise 1/4 turn at a time until the condition is corrected.

b. If engine shows sooty exhaust and is sluggish under full load, the high speed mixture is too rich. The high speed mixture screw must be turned clockwise 1/4 turn at a time until the condition is corrected. Final check of high speed mixture; operate the engine under full load and make any corrections necessary for smooth operation.

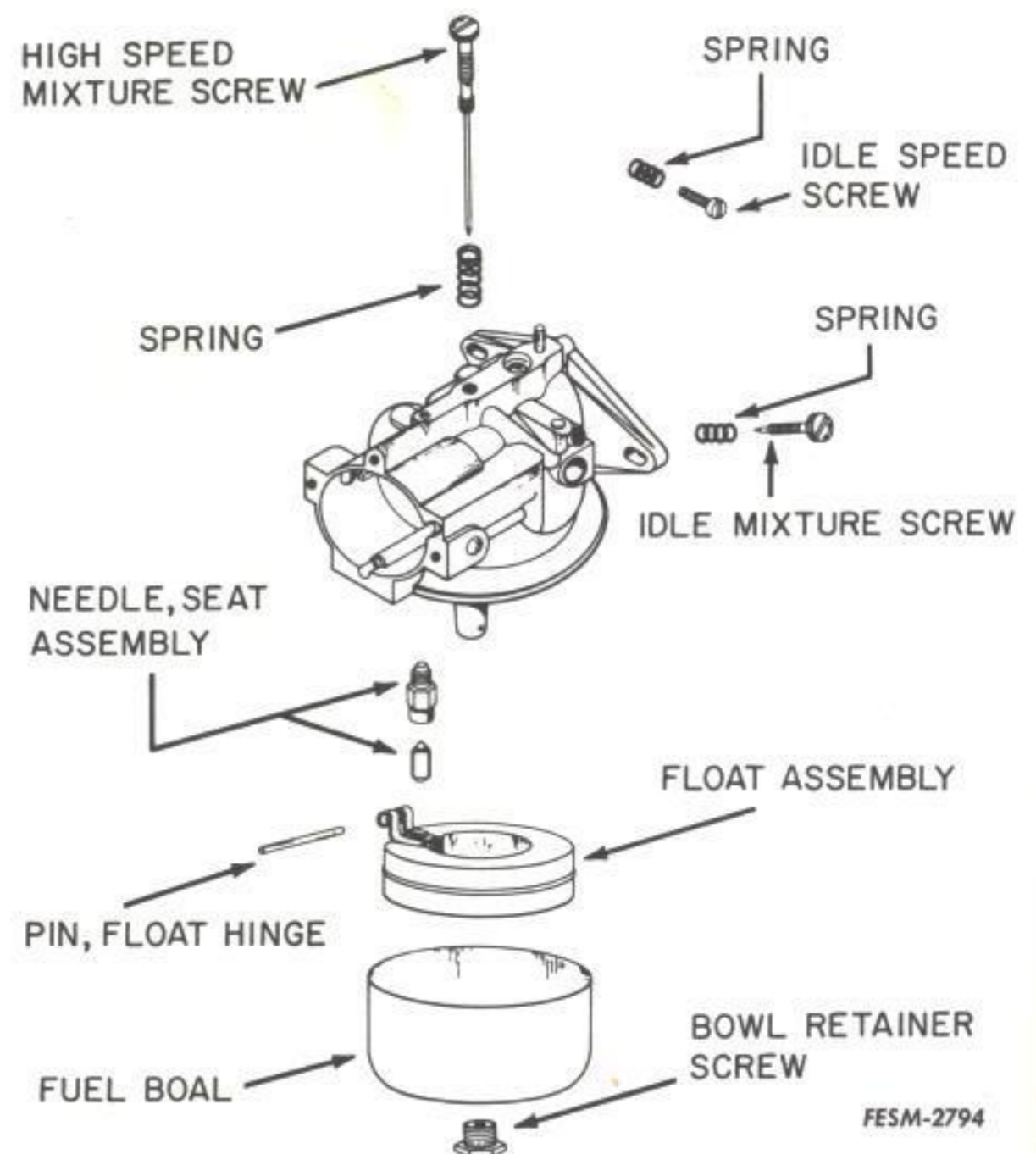
3. The final idle adjustment should be made at an engine speed of not less than 1000 rpm. Adjust until smoothest idle is obtained.

CAUTION: Do not use force on high speed mixture screw or idle speed mixture screw - - they will be damaged.

Disassembly of Carburetor

(Refer to Illust. 1-28)

1. Remove the carburetor from engine.
2. Remove the bowl nut, gasket, and bowl.
3. Remove the float pin, float, needle and needle seat. Check the float for dents or leaks. Check float pin holes for wear.
4. Remove the bowl ring gasket.
5. Remove the idle mixture screw and high speed mixture screw and spring.



Illust. 1-28. Exploded view of carburetor.

Cleaning Carburetor Parts

1. Clean all parts in solvent. Gum is easily removed with an alcohol or acetone solvent.

2. Be sure all carbon deposits are removed from bore, especially where the throttle valve seats in the casting.

3. Blow out all passages with compressed air.

4. Replace all worn and damaged parts that are serviced separately. ALWAYS USE NEW GASKETS.

Reassembly of Carburetor

(Refer to Illust. 1-28)

1. Install needle seat, needle, float and float pin.

2. Set float level. With the carburetor casting inverted and the float resting lightly against the needle in its seat, there should be $11/64 \pm 1/32$ inch clearance between machined surface of casting and free end of float (side opposite needle seat).

3. Adjust by bending lip of float with a small screwdriver.

4. Install new bowl ring gasket, new bowl gasket, new bowl nut gasket and bowl nut. Tighten securely after making sure bowl is centered on gasket.

5. Install high speed mixture screw and spring. Turn in until the needle seats and back out two turns.

6. Install idle mixture screw and spring. Back out approximately 1-1/2 turns after seating lightly.

CAUTION: Do not jam the mixture screws into their seats as this will damage them.

GOVERNOR

Model 72

The engine is equipped with a centrifugal governor and operating speed is determined by throttle control setting. The governor maintains engine speed under varying loads and serves as a top speed limiting device.

Throttle Control

Installation and Adjustment:

1. With the control handle in an open position, insert throttle wire into speed control disc in the first hole clockwise from drive pin.

2. Install cable clamp and bolt to throttle bracket.

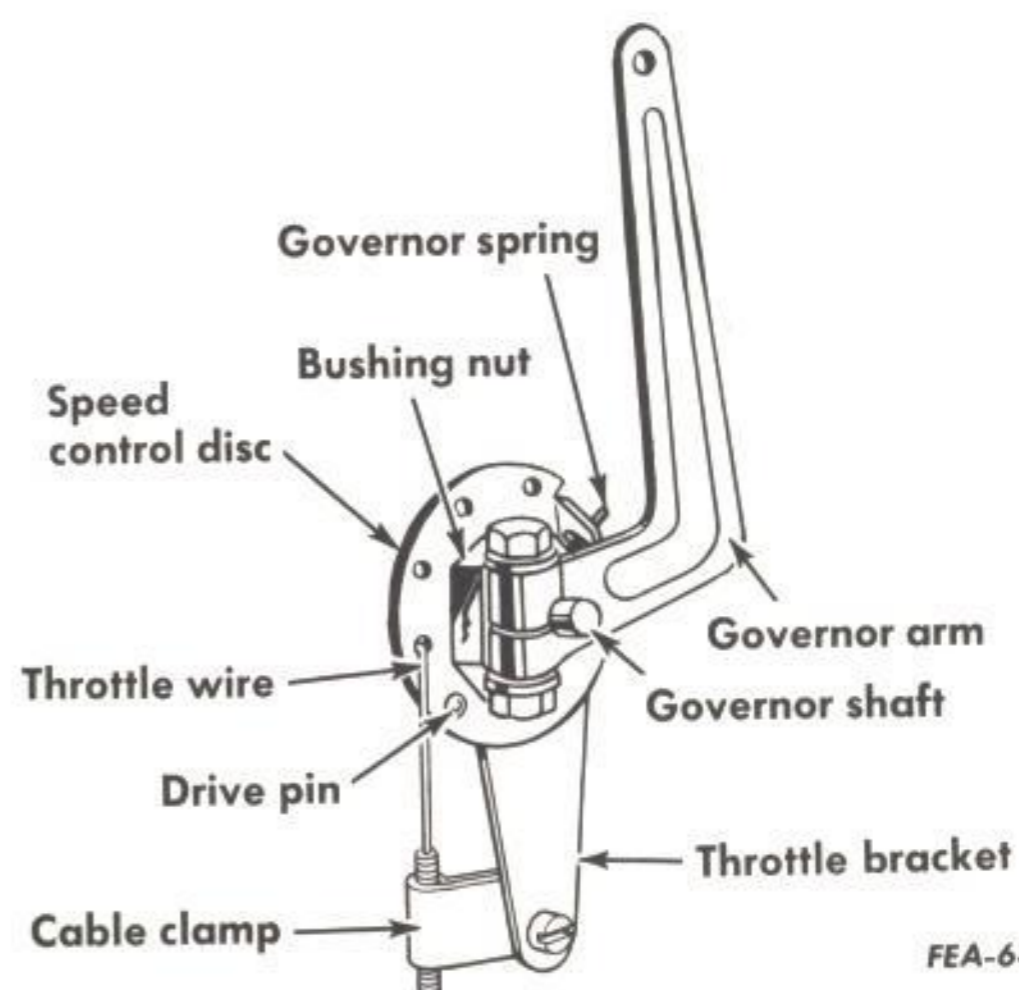
3. Operate control handle, rotating the disc from idle to full speed.

NOTE: Throttle wire should be adjusted so that when the throttle is in full speed position, drive pin is just touching the throttle control bracket (Illust. 1-29).

To Change Speed Range Setting (Illust. 1-29):

1. Loosen bushing nut slightly.

2. Moving the throttle bracket counter-clockwise will rotate the speed control disc,



FEA-64011A

Illust. 1-29. Governor linkage.

increasing the tension on the governor spring, resulting in increased engine speed.

3. To decrease the engine speed, move the throttle bracket clockwise.

4. Tighten governor bushing nut to lock throttle bracket, in desired position.

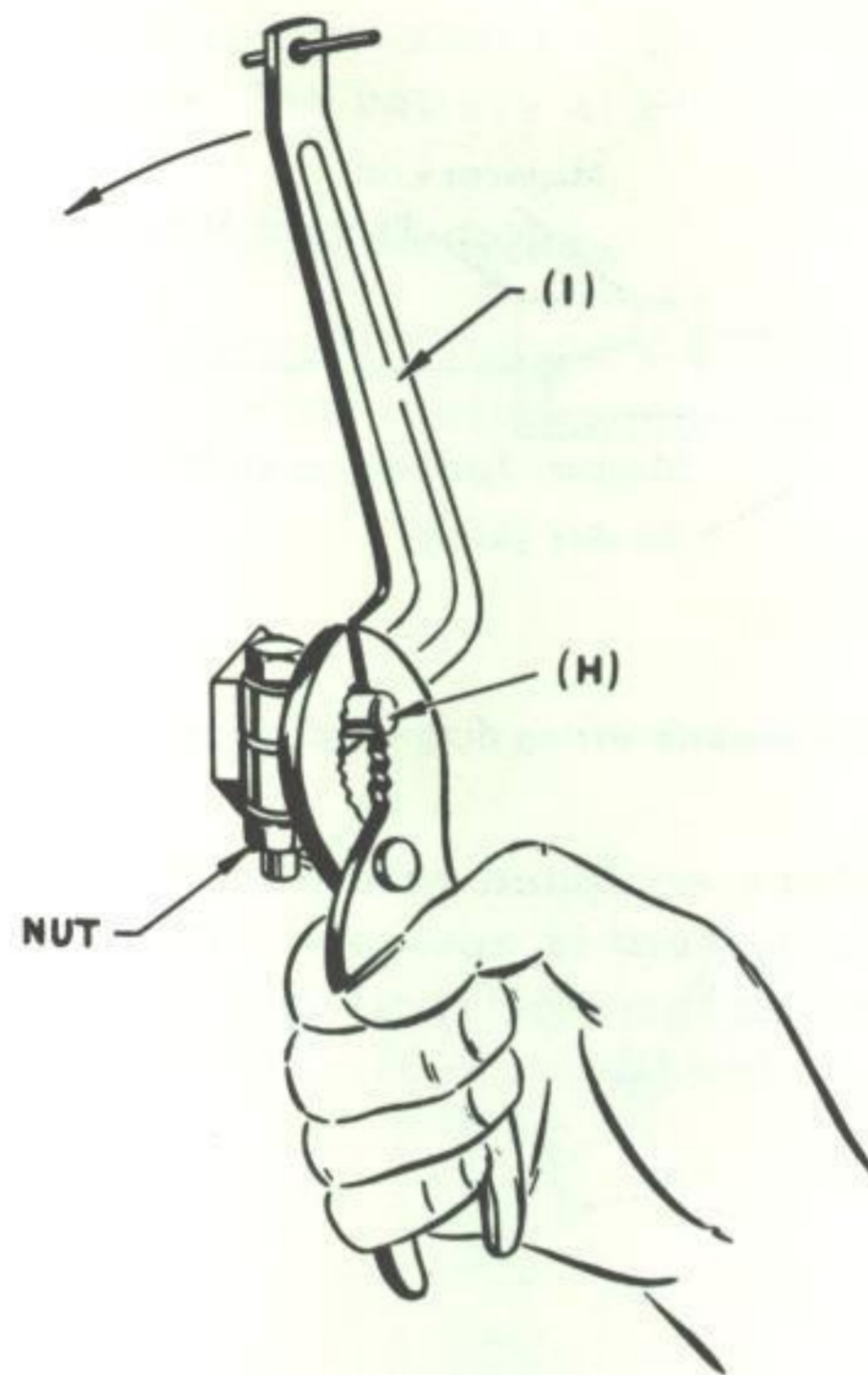
CAUTION: Do not apply excessive pressure on bushing nut.

Models 104, 105, 124 and 125

K-241 and K-301 Engines are equipped with internal mechanical governors and operating speed is determined by speed control lever setting. The Governor maintains engine speed under varying loads and also serves as a top speed limiting device.

Governor sensitivity may be adjusted by means of changing the location of the Governor spring on the governor lever (Illust. 1-3). If too sensitive, speed surging may occur on change of load. A big drop in speed when load is applied indicates governor should be set for greater sensitivity.

Increasing the tension of the governor spring will give greater sensitivity; conversely decreasing spring tension will allow broader governor action.



FEA-64013A

Illust. 1-30. Resetting governor.

Governor Adjustments

1. To reset the governor (Illust. 1-30), loosen the nut which holds the governor arm (I) to shaft (H).

2. Turn shaft counter-clockwise as far as possible with a pair of pliers.

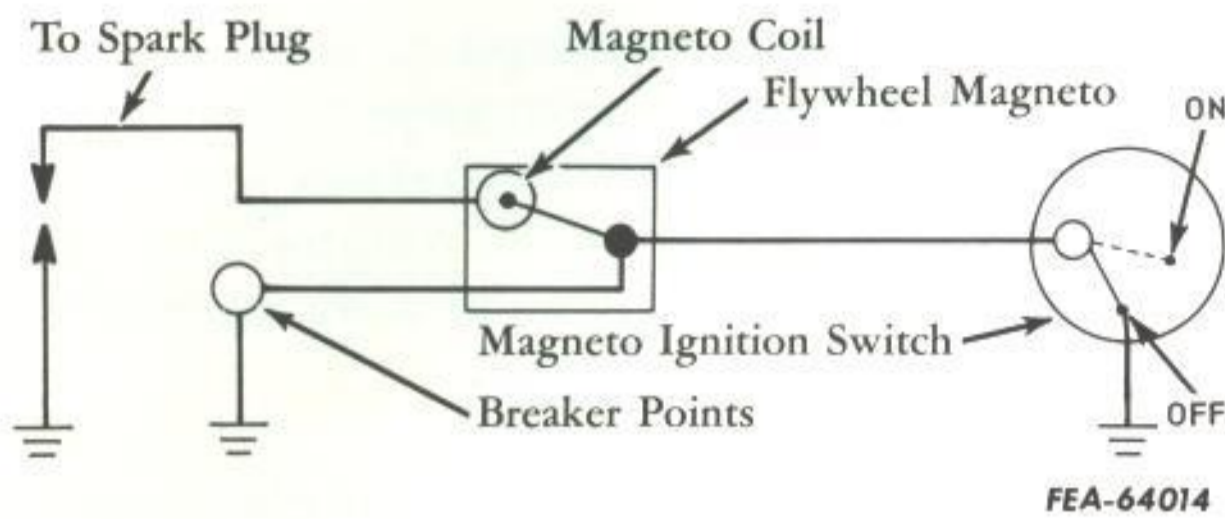
3. Pull arm (I) all the way to the left (away from carburetor). Tighten nut. Check for freedom of movement.

Throttle Control

Install throttle wire into clamp and tighten screw "B". Refer to Illust. 1-3.

ELECTRICAL SYSTEM

Magneto Ignition



Illust. 1-31. Schematic wiring diagram of magneto ignition.

On tractors equipped with Recoil Starter, the ignition system is equipped with a magneto to furnish the electrical impulse at the spark plug. See Illust. 1-31.

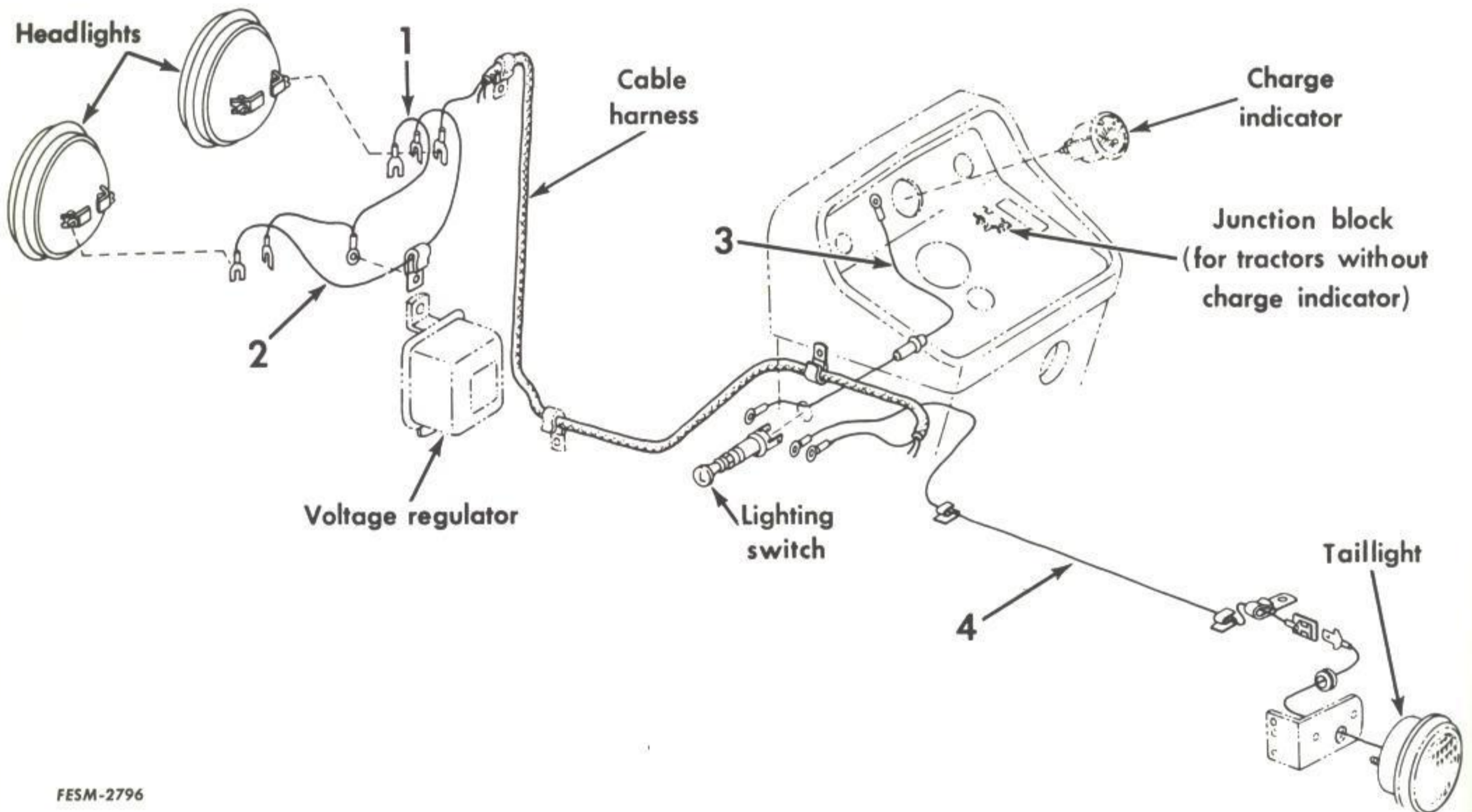
Testing Magneto

1. Check magneto output by placing the end of the spark plug cable about 1/8 inch from the crankcase and the engine. Remove the spark plug to make cranking easier.

2. If there is no spark, check the breaker points.

3. After the breaker points have been cleaned or replaced and there is still no spark, the magneto is at fault.

4. If a good tester is available, components of the magneto can be checked. Refer to tester manufacturer's instructions for acceptance limit of coils.



Illust. 1-32. Electric lighting wiring diagram.

- 1 Cable - headlight to ground.
- 2 Cable - right headlight to left headlight.

- 3 Cable - with-in-line fuse lighting switch to charge indicator.
- 4 Cable - lighting switch to taillight.

Battery Ignition

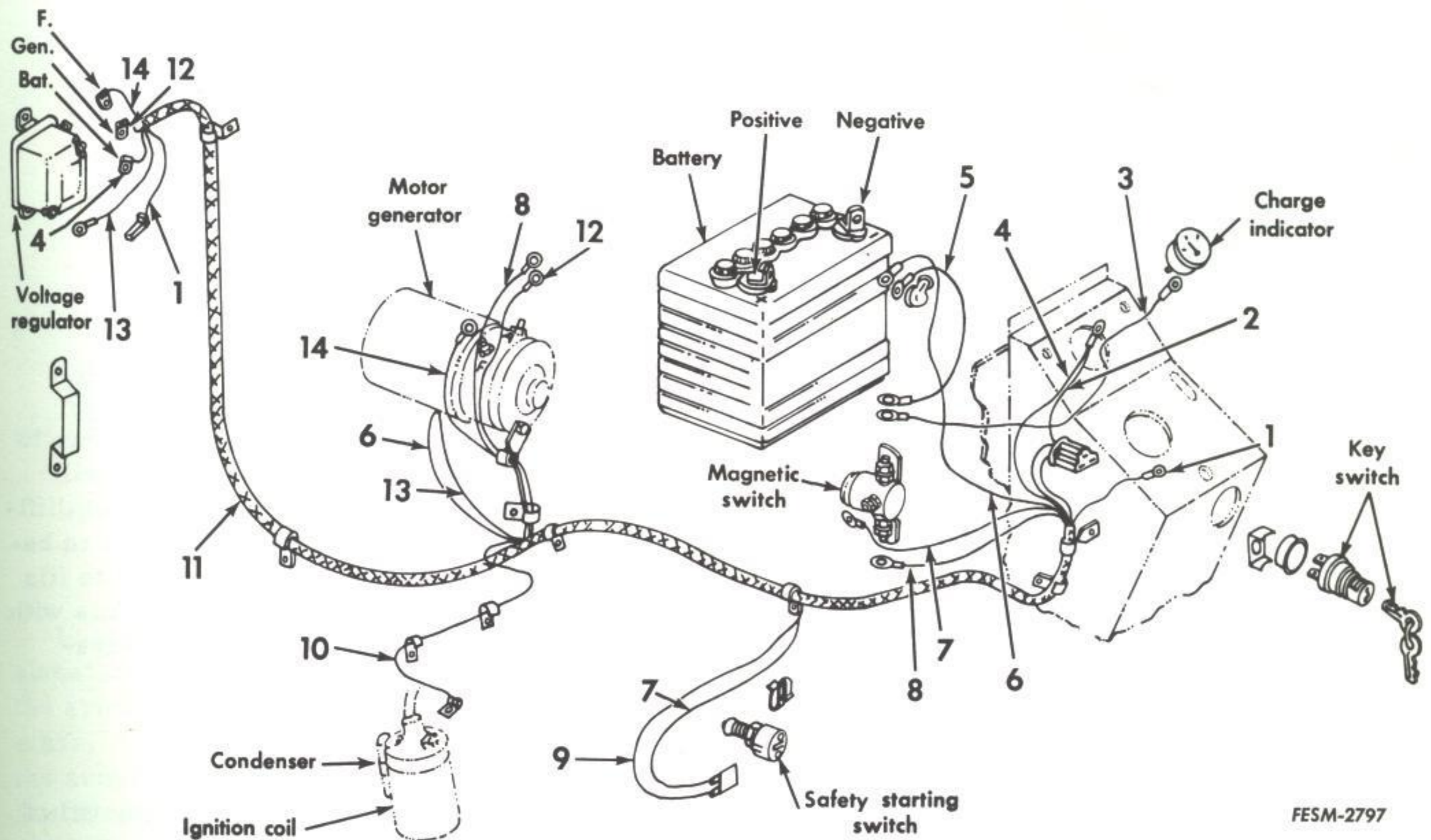
On tractors equipped with an electric starter, the electrical system consists of a motor-generator, solenoid, voltage regulator, key start ignition switch, safety switch, battery, ignition coil and breaker point assembly.

The motor-generator acts as a cranking motor when the starter switch is closed

and a generator when the switch is open. The voltage regulator controls current and voltage to the battery at all engine speeds.

Solenoid and Switches

If a solenoid, key start switch or safety starting switch malfunctions, replacement will be necessary.



FESM-2797

Illust. 1-33. Electric starting wiring diagram.

- | | | | |
|---|--|----|--|
| 1 | Cable - lighting switch to headlamp junction - violet. | 8 | Cable - magnetic switch to generator "A" terminal - red. |
| 2 | Cable - key switch "BAT" terminal to charge indicator "NEG." terminal - light green. | 9 | Cable - safety starting switch to key ignition switch "ST" terminal - orange. |
| 3 | Cable assembly. Charge indicator to magnetic switch. | 10 | Cable - ignition coil positive (+) terminal to key ignition switch "IGN" terminal - black. |
| 4 | Cable - charge indicator "NEG." terminal to regulator "BAT" terminal - gray. | 11 | Cable harness. |
| 5 | Cable - battery positive (+) terminal to magnetic switch. | 12 | Cable - regulator "GEN" terminal to generator "A" terminal - light blue. |
| 6 | Cable - battery negative (-) terminal to motor generator ground - white. | 13 | Cable - ground junction to voltage regulator base ground - white with black tracer. |
| 7 | Cable - safety starting switch to magnetic switch - orange w/black tracer. | 14 | Cable - generator "F" terminal to voltage regulator "F" terminal - yellow. |

Motor-Generator

1. The brushes should be inspected for wear approximately every 200 hours. If brushes are worn to less than half their original length, they should be replaced. Compare the old brushes with new to determine the amount of wear.

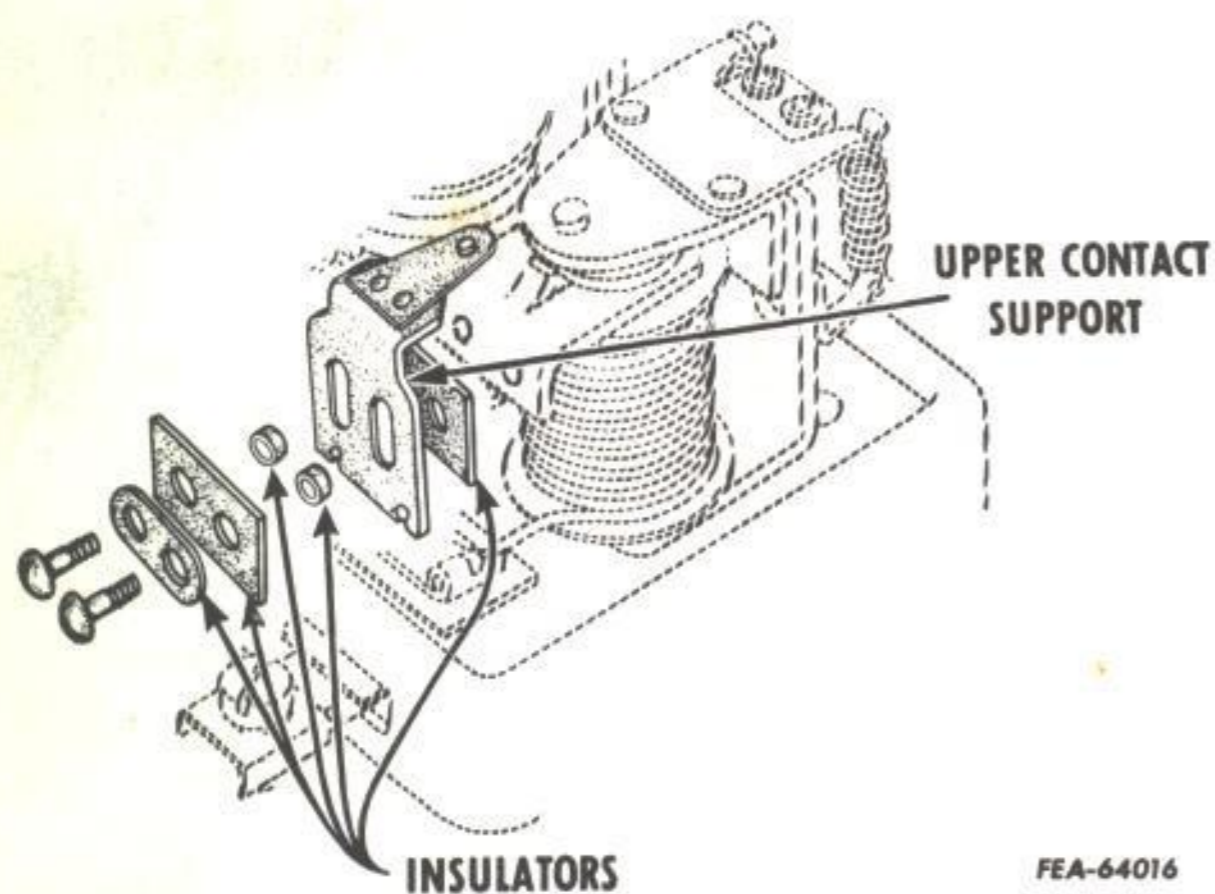
2. Brushes can be inspected or re-

placed by removing the two through bolts and the commutator end frame.

3. After checking or replacing brushes, if the motor-generator still fails to operate satisfactorily the unit will have to be checked further with special testing equipment. Refer to Service Manual GSS-1052-C.

Current-Voltage Regulator

Contact Points



Illust. 1-34. Disassembly of upper contact support for cleaning. Use new insulator bushings upon reassembly.

The contact points of a regulator will not operate indefinitely without some attention. A great majority of regulator troubles can be eliminated by a simple cleaning of the contact points and slight adjustments. See Illust. 1-34. The flat point always develops a slight cavity and is the point that requires the most attention. It is not necessary to have a perfectly flat surface on

this point, but cleaning the surface down to pure metal with a fine-cut point file will insure long periods of service without difficulty. The file should not be allowed to become greasy and should not be used to file other metals. After filing, wipe points with lintless cloth saturated in carbon tetrachloride to insure clean surfaces.

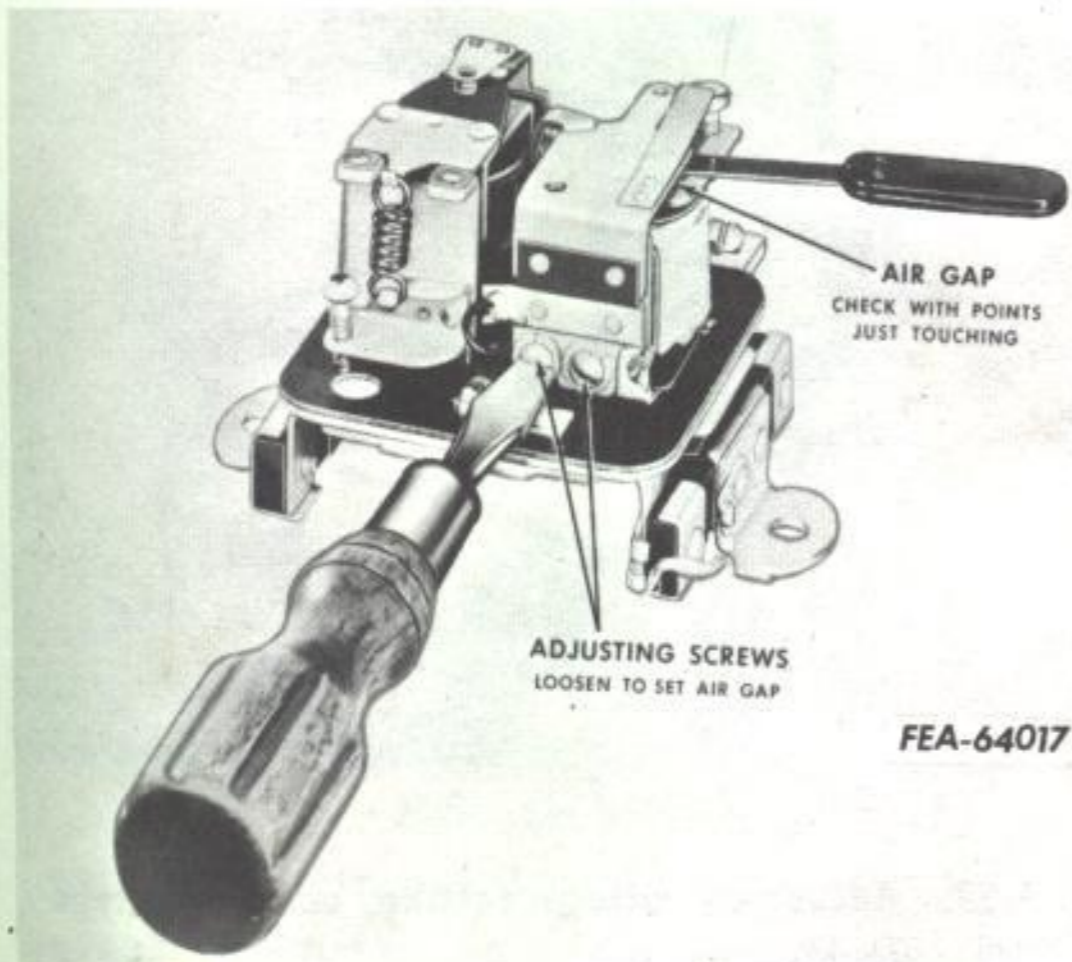
CAUTION: Avoid excessive removal of contact point metal. Never use sandpaper or emery cloth to clean points.

On (-) negative grounded system regulators the flat point is in the armature. Clean them by loosening the upper contact support and moving it to one side.

NOTE: Regulators are designed for use with a system having a given battery ground polarity. Using the wrong polarity regulator on an installation will shorten the life of the regulator contact points. Be careful to avoid interchanging the two types of regulators in service. Check the parts catalog for the regulator part number when a replacement is necessary.

Cut-Out Relay Adjustments

There are three adjustments of the cut-out relay: Armature to core air gap, contact point opening, and voltage required to close points. The air gap and point opening adjustments must be made with the battery disconnected.

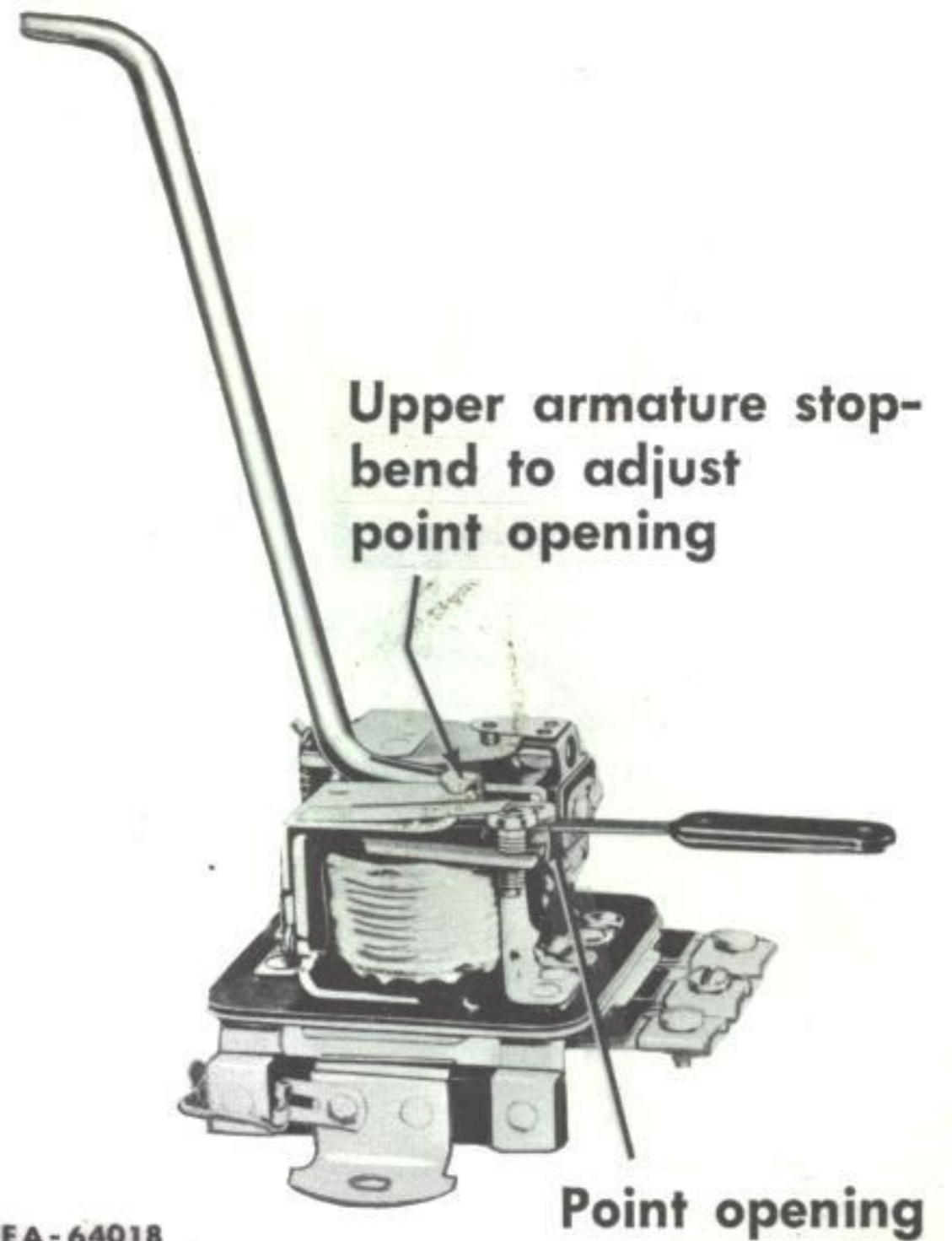


Illust. 1-35. Cut-out relay air gap inspection and adjustment.

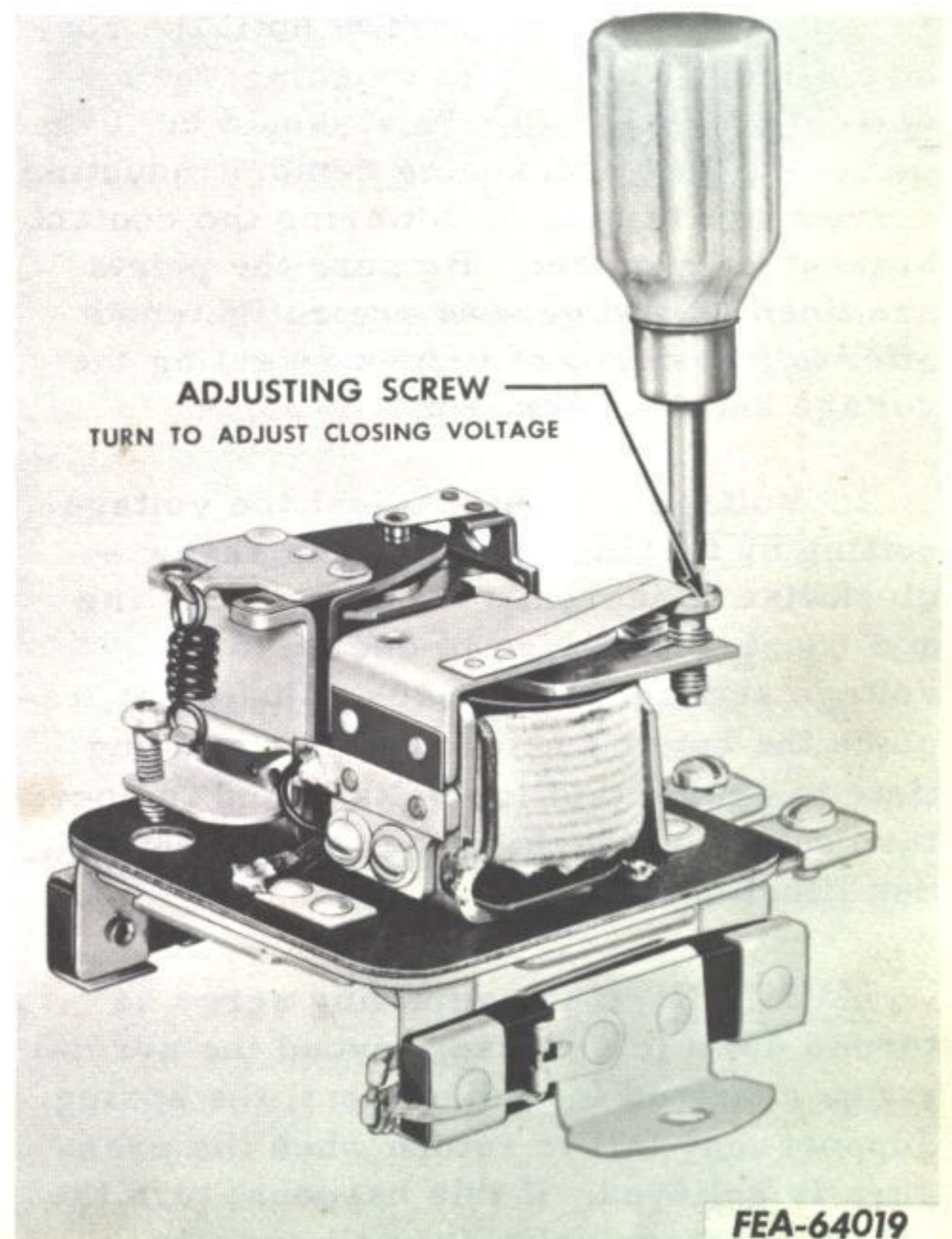
1. Air gap. Place your fingers on the armature directly above the core and press the armature down until the points just close. Then measure the air gap between the armature and the center of the core. See Illust. 1-35. The air gap should be .020 inch. Adjust by raising or lowering the armature at its hinge mounting. Retighten screws after adjustment.

2. Point opening. Adjust the point opening by bending the armature stop as shown in Illust. 1-36. The opening should be .020 inch.

3. Closing voltage. Adjust the closing voltage by turning the screw clockwise to increase spring tension and voltage, counterclockwise to decrease spring tension and closing voltage. Be sure that closing voltage adjustment is at least 0.5 volt less than the current-voltage regulator unit setting. Refer to the specifications table for range and adjustment. See Illust. 1-37.



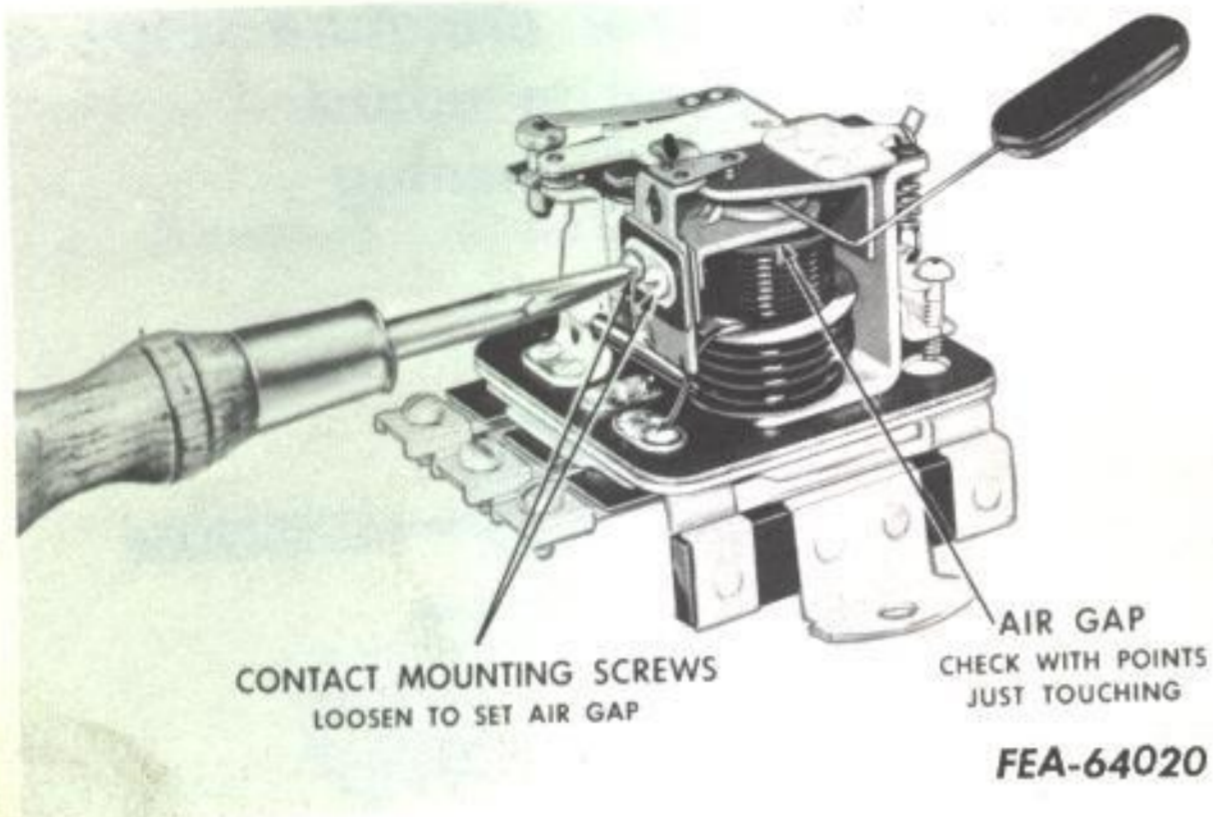
Illust. 1-36. Cut-out relay point opening inspection and adjustment.



Illust. 1-37. Adjustment of cut-out relay closing voltage.

Regulator Adjustment

The current-voltage regulator unit requires two inspections and adjustments: the armature air gap, and the voltage setting.

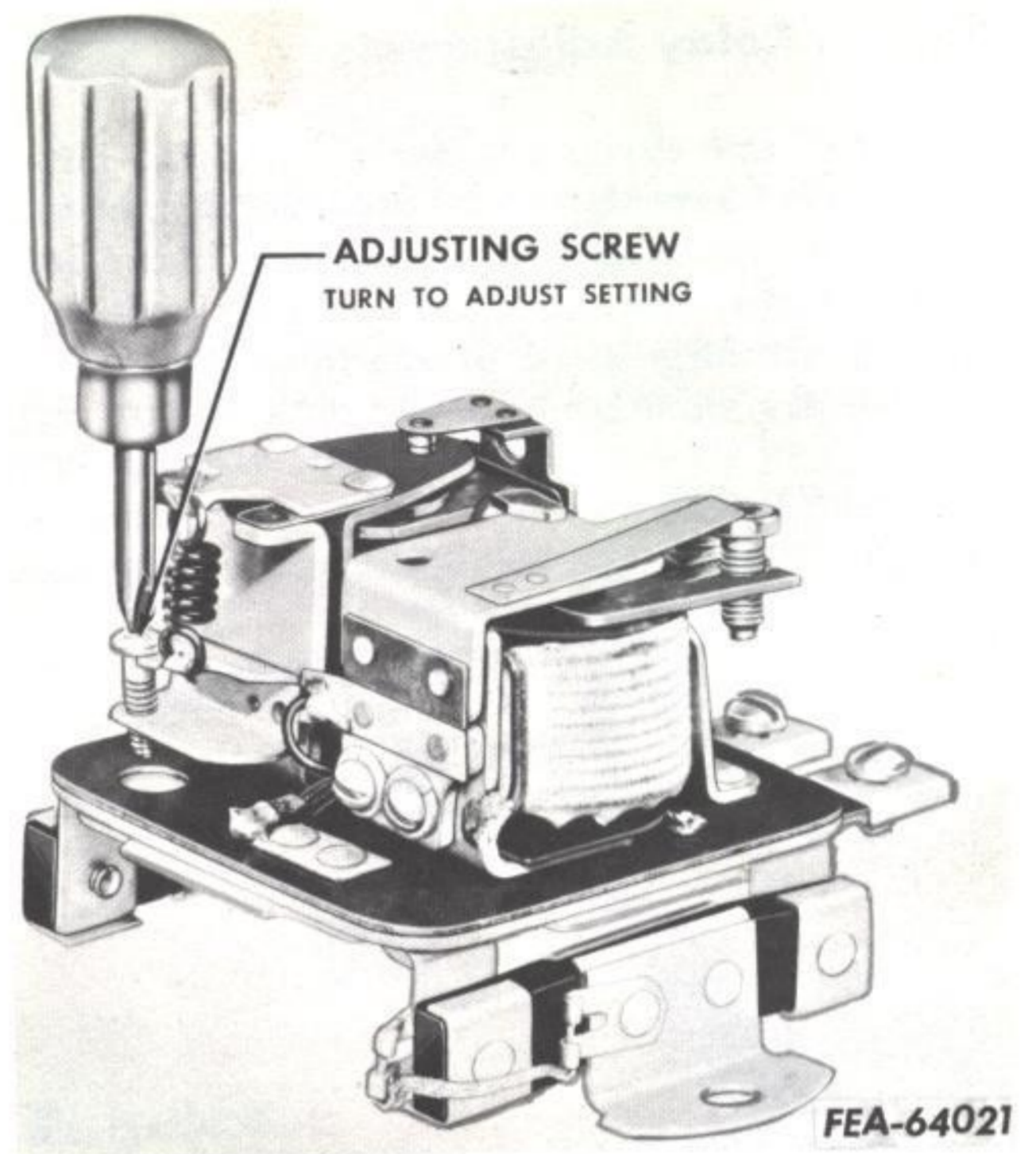


Illust. 1-38. Current-voltage regulator air gap inspection and adjustment.

1. Regulator air gap. To check the air gap, push the armature down until the contact points are still just touching; then measure the air gap. This should be .075 inch. Adjust by loosening contact mounting screws and raising or lowering the contact bracket as required. Be sure the points are lined up and screws are retightened after adjustment and before retesting the voltage setting. See Illust. 1-38.

2. Voltage setting. Adjust the voltage setting by turning the adjusting screw — clockwise to increase the voltage setting and counterclockwise to decrease the voltage setting. After each adjustment, replace the cover and allow ample running time to again stabilize voltage and temperature before rechecking the voltage setting. See Illust. 1-39.

CAUTION: If the adjusting screw is turned down (clockwise) beyond the normal range required for adjustment, the spring support may fail to return when the pressure is relieved. If this happens, turn the screw counterclockwise until enough clearance develops between the screw head



Illust. 1-39. Adjusting voltage setting, current-voltage regulator unit.

and the spring support. Then bend the spring support upward carefully with small pliers until contact is made with the screw head. The final setting should always be approached by increasing the spring tension. In other words, if the setting is too high, the unit should be adjusted below the required value and then raised to the exact setting by increasing the spring tension. Be sure the screw is exerting force on the hanger.

3. Replacing the regulator spring, when necessary, requires care to prevent bending or distorting the spring support or the armature hinge. Preferably, the spring should be hooked at the lower end first and then stretched up with a screwdriver blade, or other suitable tool, inserted between the turns until the upper end of the spring can be hooked.

CAUTION: Do not try to pry the upper end of the spring over the armature hook.

4. The resistor. "F" terminal to ground, when open circuited will cause rapid pitting and burning of regulator unit points. The original resistor unit can be removed by use of pliers, and a new unit can be soldered firmly in its place.

5. Ground lead assembly may also be replaced when necessary by soldering a new assembly into place between the regulator base plate and mounting bracket on the rubber shock mounting.

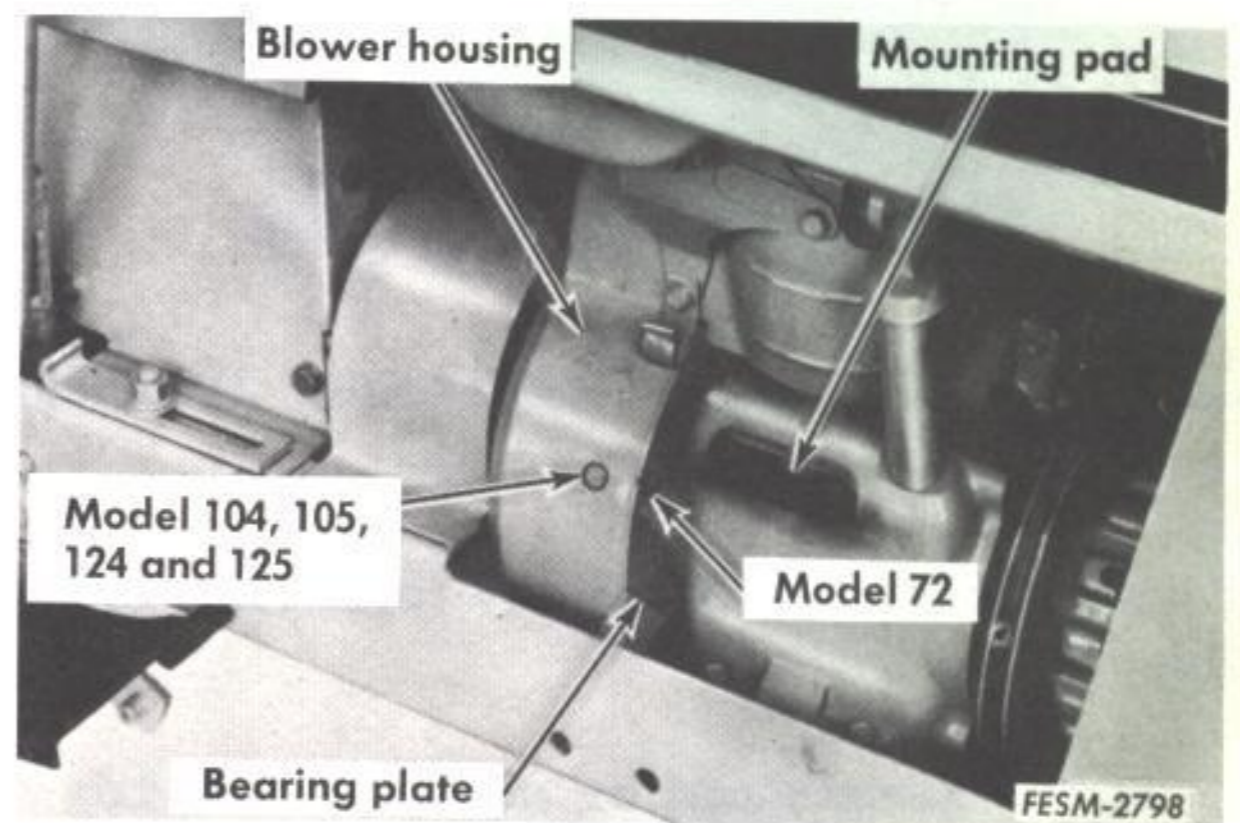
Ignition Timing

1. Automatic Compression Release engines do not require a spark advance mechanism. For static ignition timing, remove the ignition breaker point cover (Illust. 1-5). Rotate the engine flywheel until breaker point cam has opened the points to their maximum. Adjust the points to .020 inch gap.

2. The engine is equipped with a timing sight hole in the right side of the engine bearing plate on the Model 72 and in the right side of the blower housing on the Model 104, 105, 124 or 125. (Illust. 1-40.)

3. If timing light is available, adjust breaker point gap while the engine is running until "S" mark on flywheel is centered in sight hole (Illust. 1-40).

NOTE: The "S" mark will appear 20 degrees before top dead center. Top dead center is stamped with "DC" below its mark.



Illust. 1-40. Location of timing sight hole. (Starter-generator has been removed to better illustrate location.)

Breaker Assembly

1. Breaker points are operated by a cam on engine camshaft.

2. Dirty contact points can be cleaned with gasoline. Wipe dry and make sure that no lint or oil film is left between breaker point surfaces.

3. Pitted or burned points should be

replaced. See ignition timing for proper setting.

NOTE: If excessive crankcase oil is present in the breaker point assembly, it is an indication that the breather assembly components could be assembled improperly, see Illust. 1-24, or the breather hole in the valve compartment of the crankcase is plugged, see Illust. 1-11. Excessive blow-by at rings can also cause excessive crankcase pressure.

Spark Plug

1. Service periodically to reduce fouling.

2. Degrease wet or oily plug and dry thoroughly.

3. File electrode sparking area to ob-

tain bright, flat surfaces.

4. Set gap at .025 inch.

5. Use new gasket when installing new or serviced spark plug. Torque to 27 ft. lbs.

Testing Condenser

Check condenser with a reliable condenser tester. Replace as necessary.

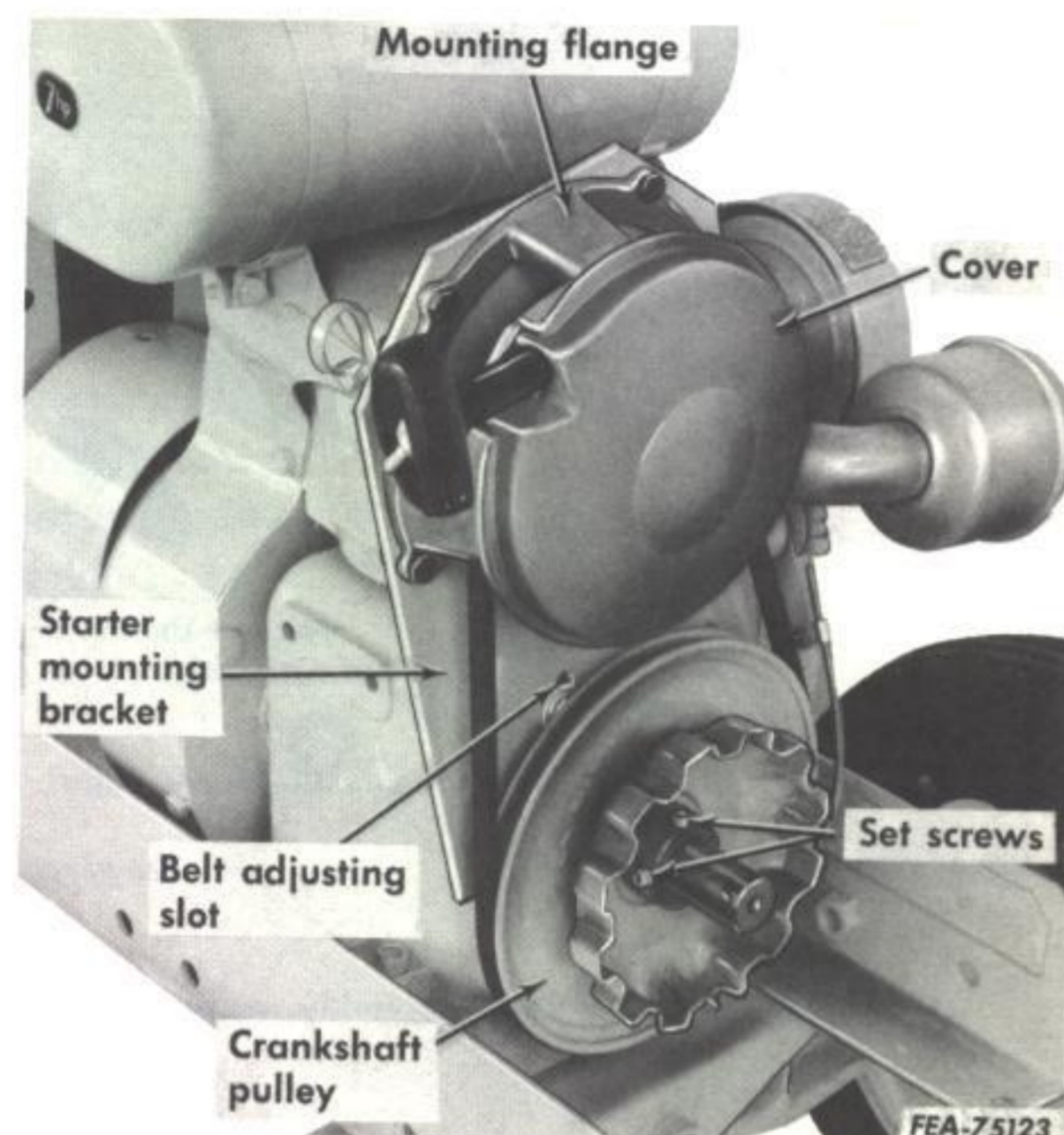
RECOIL STARTER

This unit is made by Fairbanks-Morse and has a cast aluminum housing, rotor, and mounting flange.

A steel bracket bolted to the front of the engine supports the starter unit and the starter pulley and bearing assembly.

Twin friction shoes, of the starter unit, are activated to engage the drive cup of the starter pulley.

A "V" belt connects the starter pulley to a "V" pulley on the engine crankshaft.

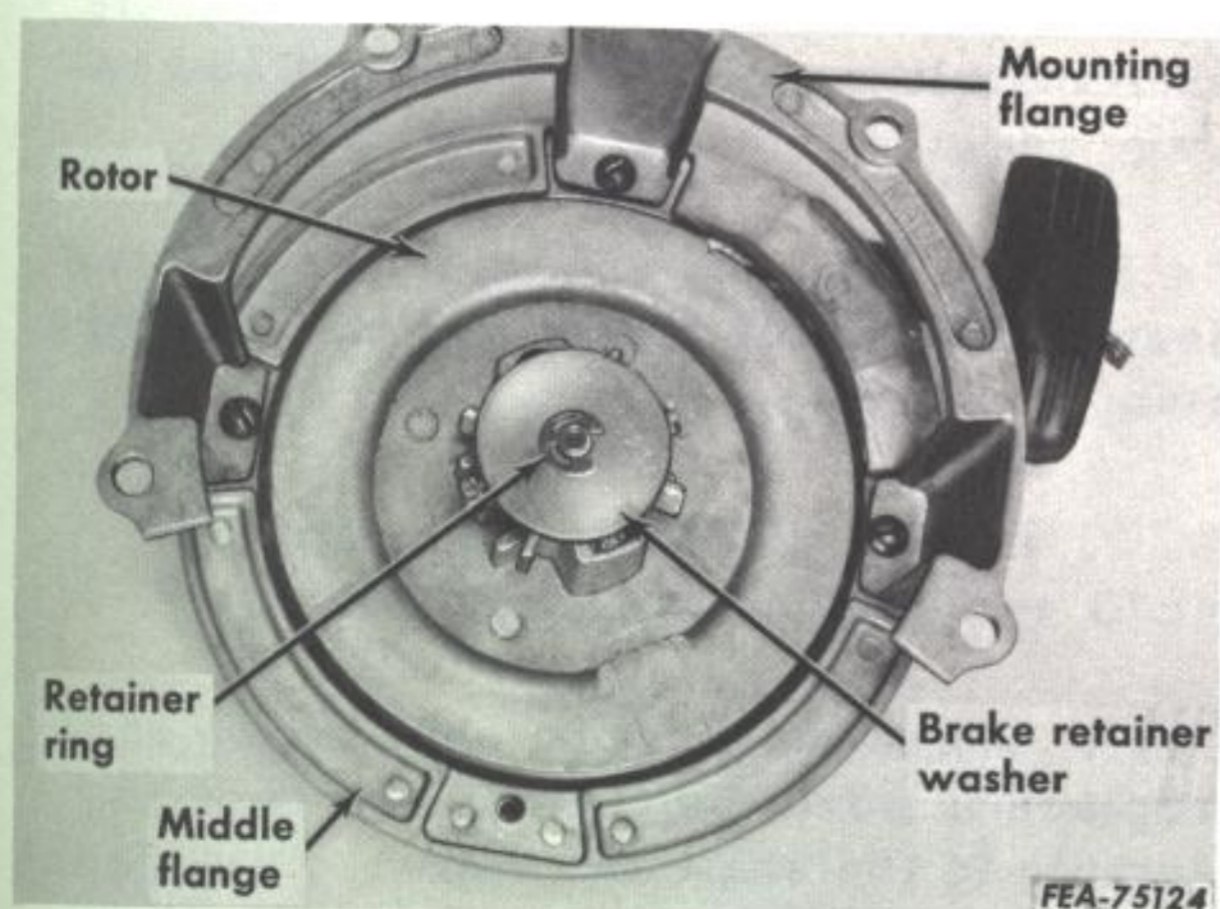


Illust. 1-41. Model 72. Recoil starter and mounting bracket.

Removal

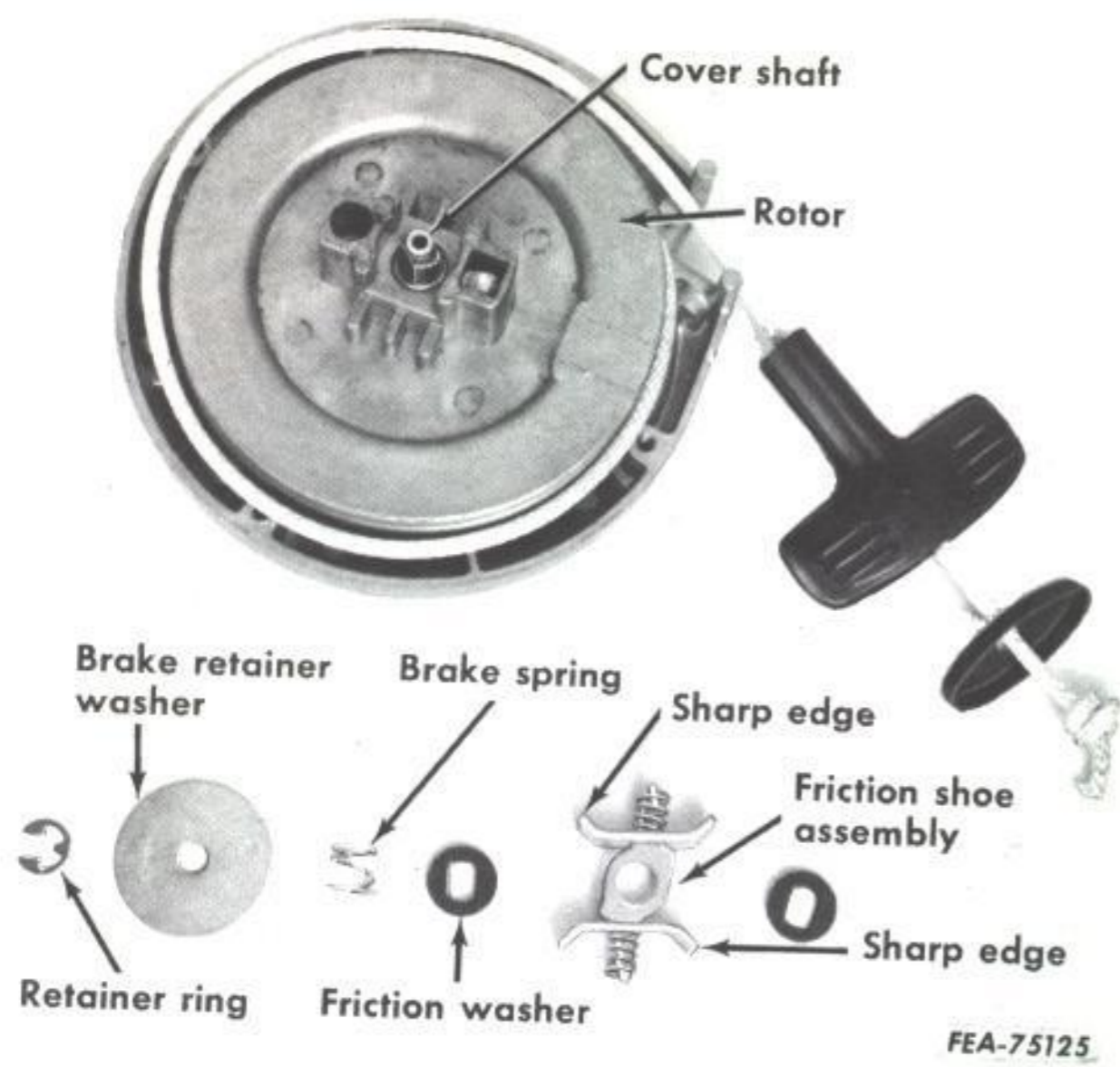
1. Remove the four bolts which secure the starter assembly to its mounting bracket.
2. Move the starter unit forward and upward from the pulley assembly.

Disassembly



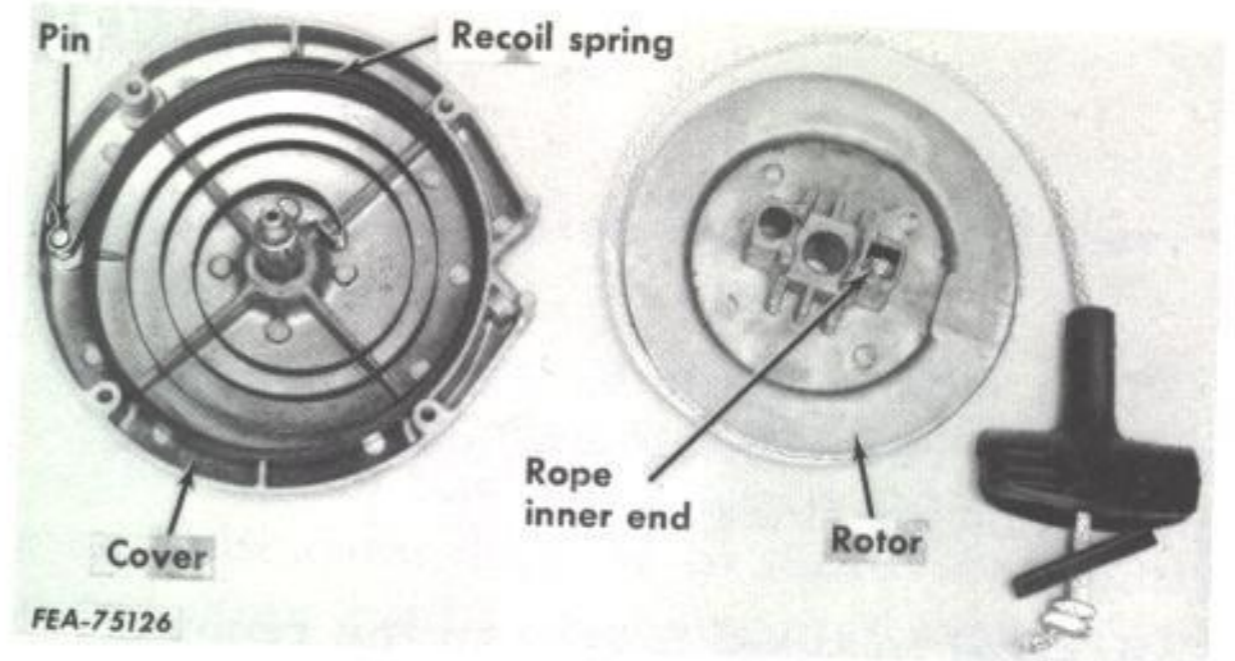
Illust. 1-42. Starter assembly rear view.

1. Place the starter assembly rear side upward on a work bench, as shown.
2. Hold down on the brake retainer washer and remove the retainer ring.
3. Remove the brake retainer washer and the coil spring under the washer.
4. Remove the three slotted head screws which hold the mounting flange and middle flange to the cover. Remove the flanges.
5. Slide the friction shoe assembly and friction washers up off the cover shaft.



Illust. 1-43. Friction shoe assembly removed.

6. Hold the rope handle in one hand and the cover in the other and allow the rotor to turn counterclockwise to unwind the recoil spring pre-load.



Illust. 1-44. Rotor removed to show recoil spring in cover.

7. Lift the rotor from the cover, shaft and recoil spring.

8. Remove the recoil spring from the cover.

CAUTION: Allow the spring to uncoil slowly to avoid personal injury.

9. Unwind the rope from the rotor, push the inner end through the rotor to permit the "end-double-back" to straighten then the rope can be removed.

Inspection and Reassembly

1. Clean the recoil spring in solvent, inspect the hook ends, lubricate spring with light oil then install the spring in the cover. Spring must spiral in a clockwise direction as you follow the spring from the outside end to the inside. Refer to Illust. 1-44.

2. Inspect the rope and the clip on its inner end. Rope must be free of cuts and frayed or worn spots. Clip must be tight on the end.

3. Install the rope (clip end) through the rotor then double the clip end back and retrieve the rope to "lock-in" the clip end. Wrap the rope around the rotor in the direction shown in Illusts. 1-43 and 1-44.

4. Lubricate the shaft and its bore in the rotor with chassis lube or lubriplate then install the rotor to the shaft and engage recoil spring inner end hook.

5. Pre-load the spring four turns and install the middle flange and the mounting flange. Secure with screws.

6. Install one friction washer to the shaft and push down against the rotor.

7. Check the friction shoe sharp ends, replace if worn then install the shoe assembly to the shaft and rotor. Be sure the shoe assembly is right-side-up as shown in Illust. 1-43.

8. Install the second friction washer.

9. Install the spring, retainer washer and retainer ring.

10. Pull the rope. The sharp ends of the friction shoe plates should extend.

NOTE: Some starter assemblies available from parts depots have a long rolled pin in the end of the cover shaft. Pull this pin from the shaft. It is not used on the Model 72 tractor.

11. Replace the starter to the support bracket. Check starter belt tension and adjust if necessary.

NOTE: The starter pulley is a press fit on its bearing shaft. A wire clip holds the sealed bearing assembly in the bracket. If replacement of the support bracket is necessary, both set screws in the crankshaft pulley hub must be loosened to move pulley forward then bracket capscrews can be removed. For replacement refer to page 1-22.

Section 2

CHASSIS

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SPECIFICATIONS

Steering

Type	Cam and lever
Bearings	Ball

Front Wheels

End play - inch	Maximum 1/32
Bearings	Sealed pre-lubricated ball
Hub I.D. - inches	1.375 to 1.380
Toe-in - inch	1/32 to 1/8
Camber angle - degrees	2-1/2
Caster angle - degrees	0
Turning radius	6 ft. 9 inches

Front Axle

Construction	I-Beam
Support - inch	Center pivot shaft dia. .747 to .750
Steering knuckle diameter - inch .....	.747 to .750
Steering knuckle bore - inch .....	.751 to 04.005

Tire Size

Front standard on all models	480X8
Alternate on all models	16X6:50X8
Rear standard on 72, 104 and 105 models	6X12
Alternate	23X8:50X12
Standard on 124 and 125 models	23X8:50X12

Wheelbase - inches	43
Tread - inches	27
Length, over-all - inches	63
Width, over-all - inches regular tires	33-1/4
alternate tires	36
Ground clearance - inches	6

Clutch

Type	Single dry disc, spring loaded
Size - inches	4-1/2
Clutch release bearing	Sealed, pre-lubricated ball
Clutch loading spring	
Free length - inches	6.70
Test length - inches	5.18
Test load - lbs.	235 to 240
Clutch teasing spring	
Free length - inch .....	.442
Test length - inch .....	.370
Test load - lbs.	50

Creeper Drive

Type	Planetary gears
Sun gear	Integral part of case
Planet gears	3 - spur type
Bearings	Ball - front Bushing - rear
Reduction ratio	4 to 1

Front PTO Clutch

Torques

Clutch, 1/4 x 1/2 inch cone point set screws	60 to 72 in. lbs.
Clutch, 1/4 x 1/4 inch flat point set screws	72 to 84 in. lbs.
Minimum clearance between the wear button and thrust button (clutch fully engaged) - inch	1/64
Maximum out of flat of clutch pressure plate - inch .....	.010

Rear PTO

Type	Transmission driven
Size	978 diameter - 10 spline
Speed	515 rpm CCW at governed engine speed

Bearings (PTO shaft)

Rear	Ball
Front (pilots into transmission clutch shaft)	Bronze bushing
I.D. (after pressing into shaft) - inch .....	.3755

Shaft, PTO (diameters)

Front bushing location - inch .....	.3725 to .3732
Rear bearing location - inch .....	.9842 to .9846

Retainer (rear bearing and oil seal)

Bore for rear bearing - inches	2.0470 to 2.0478
Bore for oil seal - inches	1.874 to 1.875

Oil Seal is installed with lip toward lubricant

Brake

Brake Pad Thickness - inch	5/16
Type	Disc
Location	On transmission countershaft

Reduction Drive

Input shaft with integral gear	12 teeth
Driven gear	84 teeth
Backlash - inch .....	.004 to .011
Bearings	Ball - front Needle - rear

Transmission-Gear Drive

Type Selective sliding spur gears
 Gears forward 3
 Gears reverse 1

Bearings

Countershaft Ball - front
 Roller - rear
 Main shaft Ball - front
 Needle - rear

Countershaft and bearing spacer lengths:

Between front bearing and 3rd speed driven gear - inch Beveled edge to bearing
 .848 to .852
 Between 3rd speed driven gear and 2nd speed driven gear - inches 1.310 to 1.314
 Between 2nd speed driven gear and 1st speed driven gear - inch310 to .314
 Between 1st speed driven gear and reverse driven gear - inch686 to .690
 Between reverse driven gear and rear bearing - inch Beveled edge to bearing
 .690 to .694

Special Torques (foot pounds)

Reduction gear 55
 Transmission countershaft nut 85
 Transmission countershaft bearing retainers 20
 Reduction housing to transmission 80

Hydrostatic Drive

Pressure

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

Tolerances

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

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

Spring Specifications

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

Special Torques (foot pounds)

Charge pump cap screws	52
Center section-to-transmission case cap screws	35
Motor swash plate (fixed) hexagon socket head cap screws	67
Hydrostatic unit to differential housing	30

Differential

Type	Bevel gears and pinions
Number of pinions	2 (10 teeth)
Number of side gears	2 (16 teeth)
Bearings (two)	Tapered roller
Pre-load - in. lbs.	1.5 to 8.0
Adjusting shims - inch . . . . .	.004, .007, .015, .030
Bevel gear and pinion backlash - inch . . . . .	.003 to .005
Bevel gear location	On differential case
Pinion location	Integral part of countershaft
Ratio (bevel gear and pinion)	13 to 46

General-Special Torques (foot pounds)

Wheel lug bolts	56 to 63
Steering wheel	32 to 37
Front wheel cap screws	35 to 40
Drag link and tie rod ball joint nuts	35 to 40
Steering sector jam nut	40
Cam follower lock nut	40

GENERAL INFORMATION

The clutch and brake are operated by a single foot pedal located on the left side of the tractor. Separate adjustments are provided for each unit.

All models are equipped with an implement control lever, conveniently located on the right side of the tractor.

On gear driven models power is trans-

ferred directly to the clutch by a driving plate attached to the engine flywheel pulley.

Clutch

A friction disc, held between two spring loaded plates on the clutch shaft, transfers power through the clutch shaft to the gear reduction unit on standard tractors, and to the underdrive (creeper) unit on tractors so equipped.

Brake

Two friction material inserts apply "Caliper Type" holding to a round flat plate located on the splined front end of the transmission countershaft; thus, braking is applied through the differential to both rear wheels.

Reduction Drive-Gear Drive

The reduction drive housing is located ahead of and is secured to the transmission housing. The reduction input shaft with gear is driven by the clutch shaft (or creeper attachment if so equipped), and drives the reduction gear located on the front end of the transmission input shaft. The ratio of reduction is seven to one. The input shaft with gear is supported by a ball bearing at the front and a needle roller bearing at the rear.

Transmission-Gear Drive

Sliding spur gears are located on the transmission input shaft and mesh with spur gears on the countershaft. Shafts are mounted in ball, roller, and needle bearings. Gears have crowned induction hardened teeth with rounded edges for ease of shifting and long life. The reverse idler gear is mounted on a separate shaft.

Differential

Two pinions, a pinion shaft and two side gears are positioned in the one piece cast iron carrier case. The gears are carburized, hardened alloy steel.

The bevel gear is riveted to the carrier case. The carrier assembly is mounted in tapered roller bearings. Bearings are pre-loaded to control deflection of the assembly when loaded.

Rear Axles

The rear axles are splined on their inner end where they are supported and driven by the differential side gears. Snap rings secure the axle shafts in the side gears.

A bronze bushing on the model 72 and a needle bearing on the 104, 105, 124 and 125, in each axle carrier supports the rear axle outer end.

A flange is welded to the axle outer end to receive the rear wheels.

Front Axle and Steering

The cast iron front axle has "I" beam construction with raised arch center section. The axle is supported by a pivot shaft in the main frame cross channel bracket.

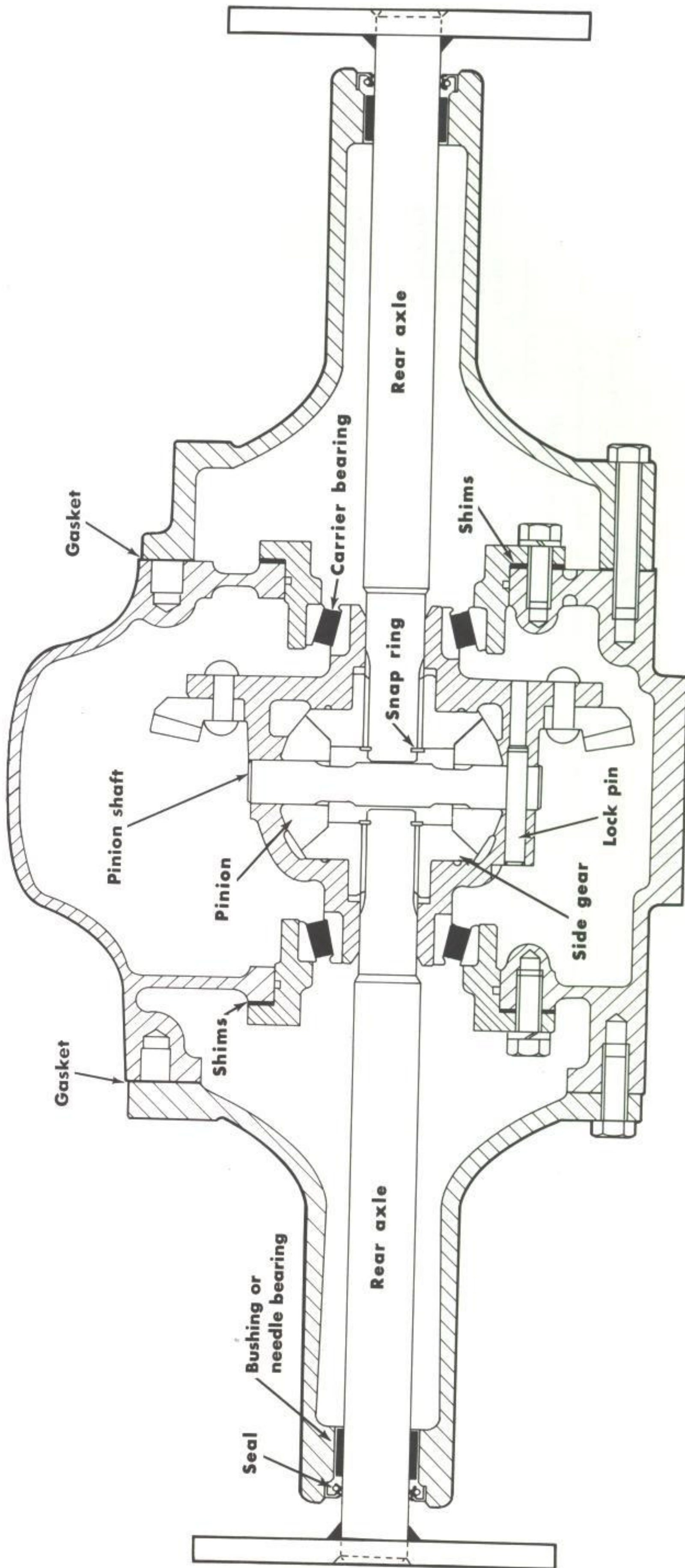
A spiral worm cam and lever with single follower and control arm actuates the ball socket drag link to the left front steering knuckle. The ball socket tie rod connects the right and left steering knuckles. The worm (cam) shaft is supported by ball bearings. Design features provide camber, and toe-in for easy steering and trouble free operation.

Front Wheels

The wheels are formed from sheet steel and welded to steel tubing. A pre-lubricated sealed ball bearing is pressed into each side. These wheels can be used for service on older models by removing the ball bearings and pressing in service bushings.

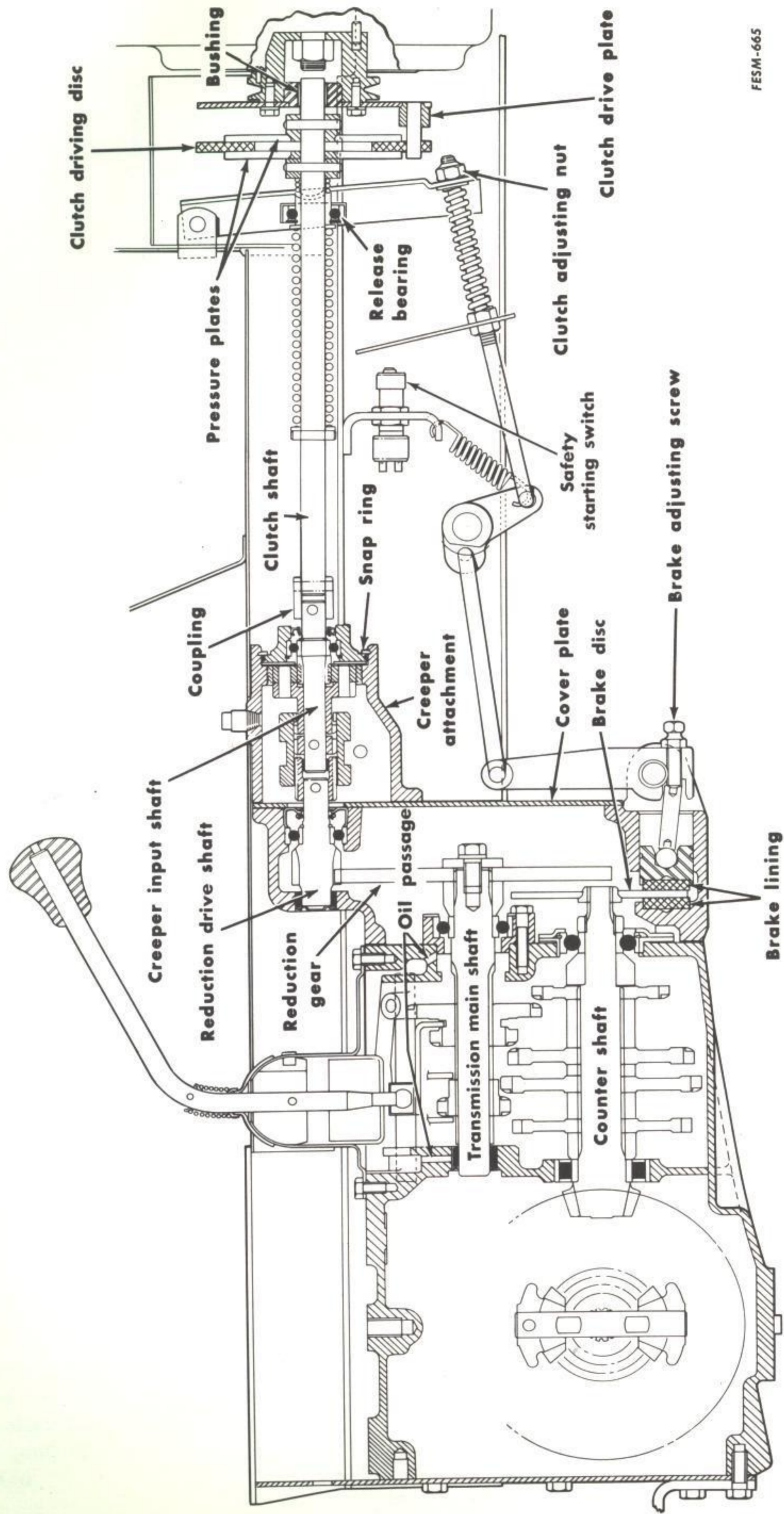
Creeper Attachment

A four to one ratio unit is available for field application. This planetary gear reduction unit is mounted ahead of and is secured to the front of the reduction drive. A speed selection lever provides standard or "creeper" speed as desired.



FEB-14035 A

Illust. 2-1 Cross section - rear axle assembly.



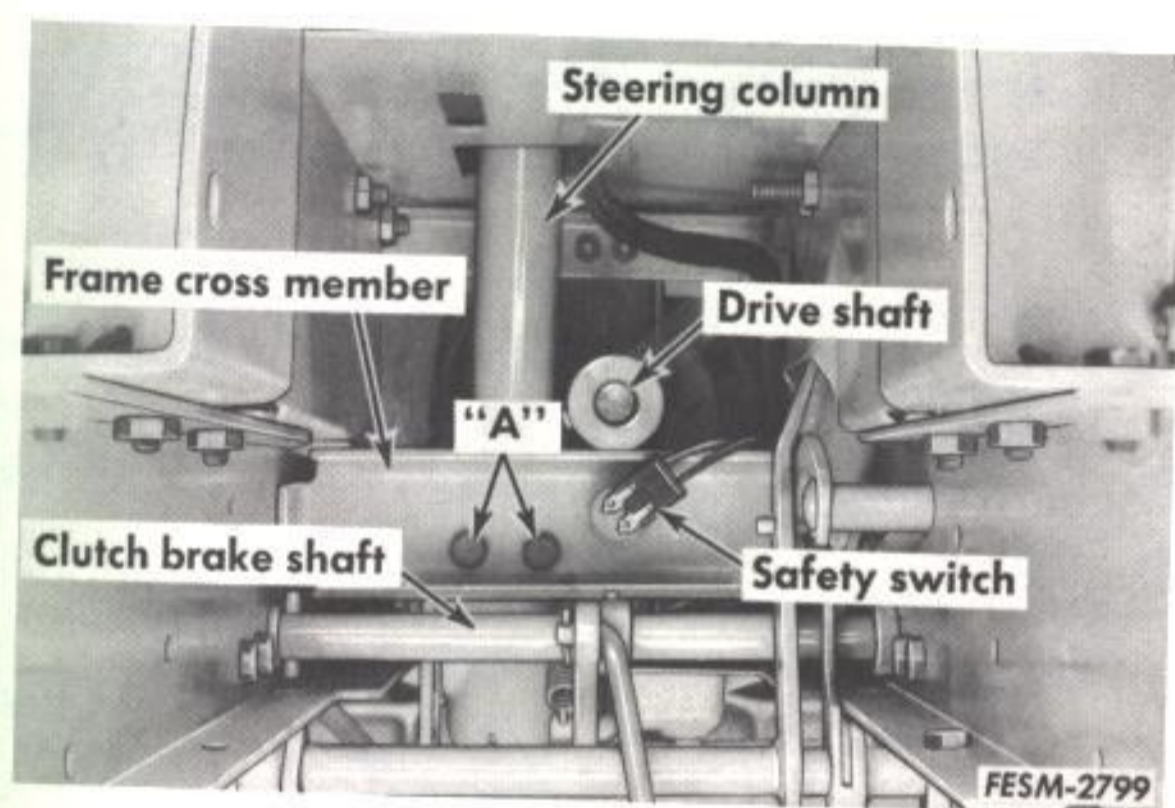
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Illust. 2-2. Cross section - power train.

STEERING ASSEMBLY

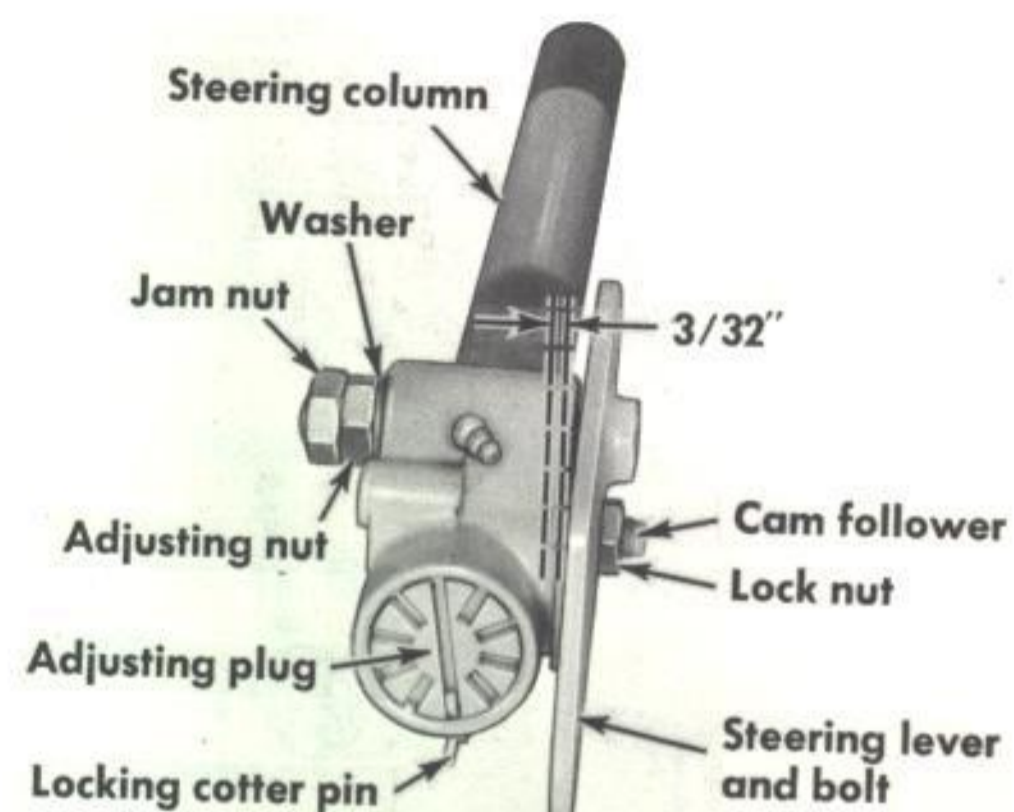
Removal

1. Hold the steering wheel with front wheels in straight ahead position. Remove the steering wheel.
2. Remove the drag link rear ball joint from the steering unit lever.



Illust. 2-3. Underside view of steering support and frame cross member.

3. Remove clutch shield bottom sheet.
4. Remove capscrews "A" (Illust. 2-3) from the frame cross member and steering unit.
5. Lower the steering column assembly through the instrument panel pedestal and grommet.

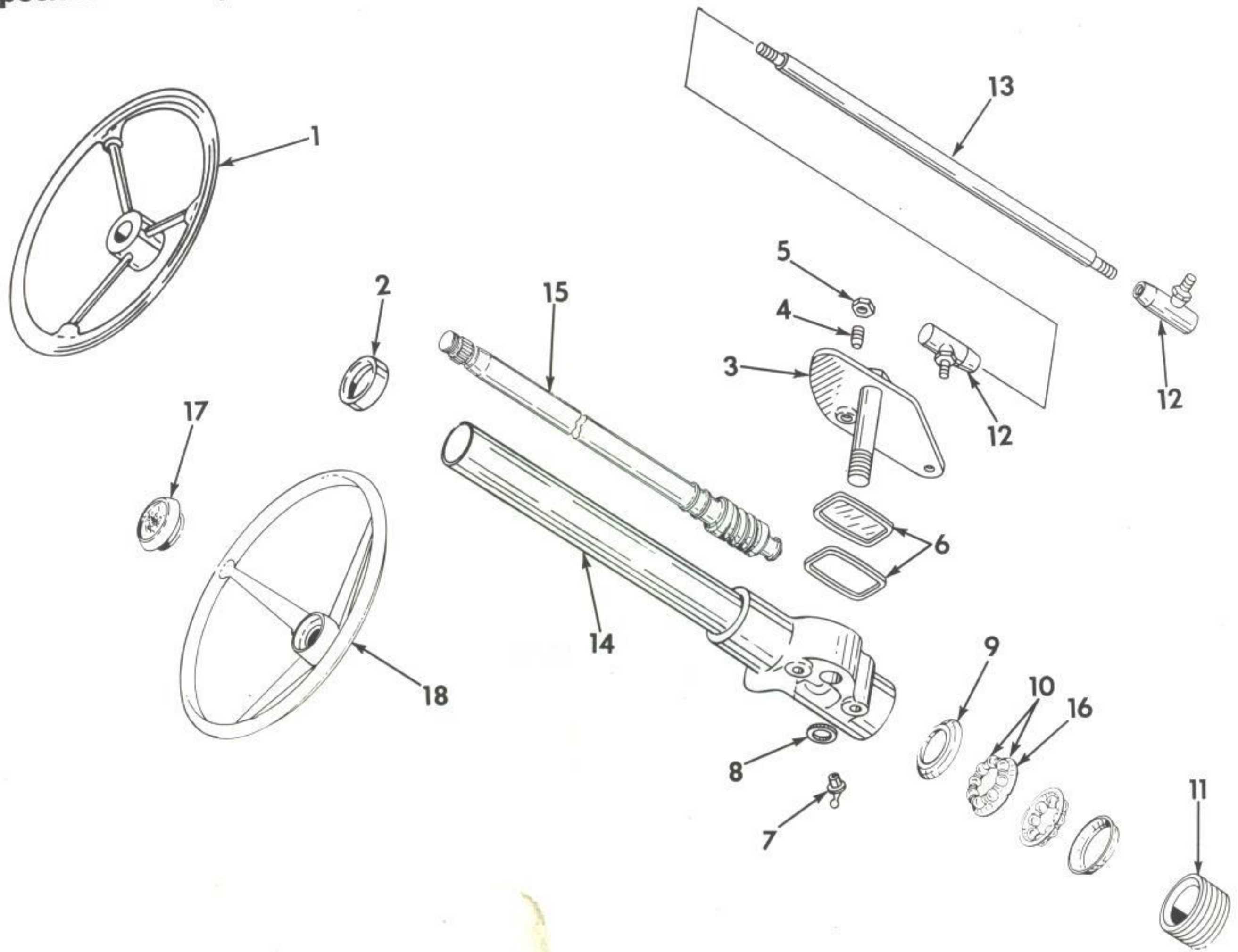


Illust. 2-4. Steering assembly.

Disassembly

1. Secure the steering lever and bolt in a vise.
2. Remove the lever bolt jam nut, adjusting nut, and washer.
3. Slide the column and housing assembly away from the lever, bolt and cam follower.
4. Remove the adjusting plug.
5. Remove the steering cam and bearings from the housing.

Inspection and Repair (Illust. 2-5)



FESM-2801

Illust. 2-5. Exploded view of steering assembly.

1. Wheel (Model 72)
2. Bearing
3. Lever
4. Stud
5. Nut
6. Seal & retainer

7. Fitting
8. Washer
9. Bearing
10. Retainer and ball assembly
11. Plug, Adjusting
12. Joint

13. Link, Steering
14. Tube assembly
15. Cam and tube
16. Retainer
17. Cap, Steering wheel
18. Steering wheel

1. Wash all parts in cleaning solvent, then dry thoroughly.

2. Inspect the cam follower for wear (flat spots).

3. Inspect the cam ends, bearings and races for wear, roughness and pitting.

4. Inspect the cam grooves for wear, roughness and galling.

5. Inspect the housing for cracks and stripped threads.

6. Inspect the upper bearing (nylon bushing) for wear or damage.

Reassembly and Adjustment (Illust. 2-5)

1. Thoroughly coat the cam ends, balls and races with chassis lubricant.
2. Install the balls and races on the cam ends.
3. Thoroughly coat the cam with chassis lubricant then install into the housing and column assembly.

NOTE: Be sure the races enter the housing squarely and are not "cocked."

4. Install the adjusting plug. Screw the plug inward until end play of the cam is removed but turns freely. Insert the cotter pin in the nearest hole. (Illust. 2-4.)

5. Fill the housing with chassis lubricant.

6. Loosen the cam follower locknut, then "back out" the cam follower two turns.

7. Install the seal, retainer and lever-bolt assembly to the housing (Illust. 2-5).

8. Install the washer and adjusting nut. Tighten the adjusting nut sufficiently to provide good seal compression. Refer to Illust. 2-4 for adjustment dimensions. Secure with the jam nut. Tighten jam nut to 40 ft. lbs. Lubricate at the fitting in the housing slowly until lubricant begins to seep out.

9. "Center" the steering cam by rotating the steering shaft half way between full right and full left turn.

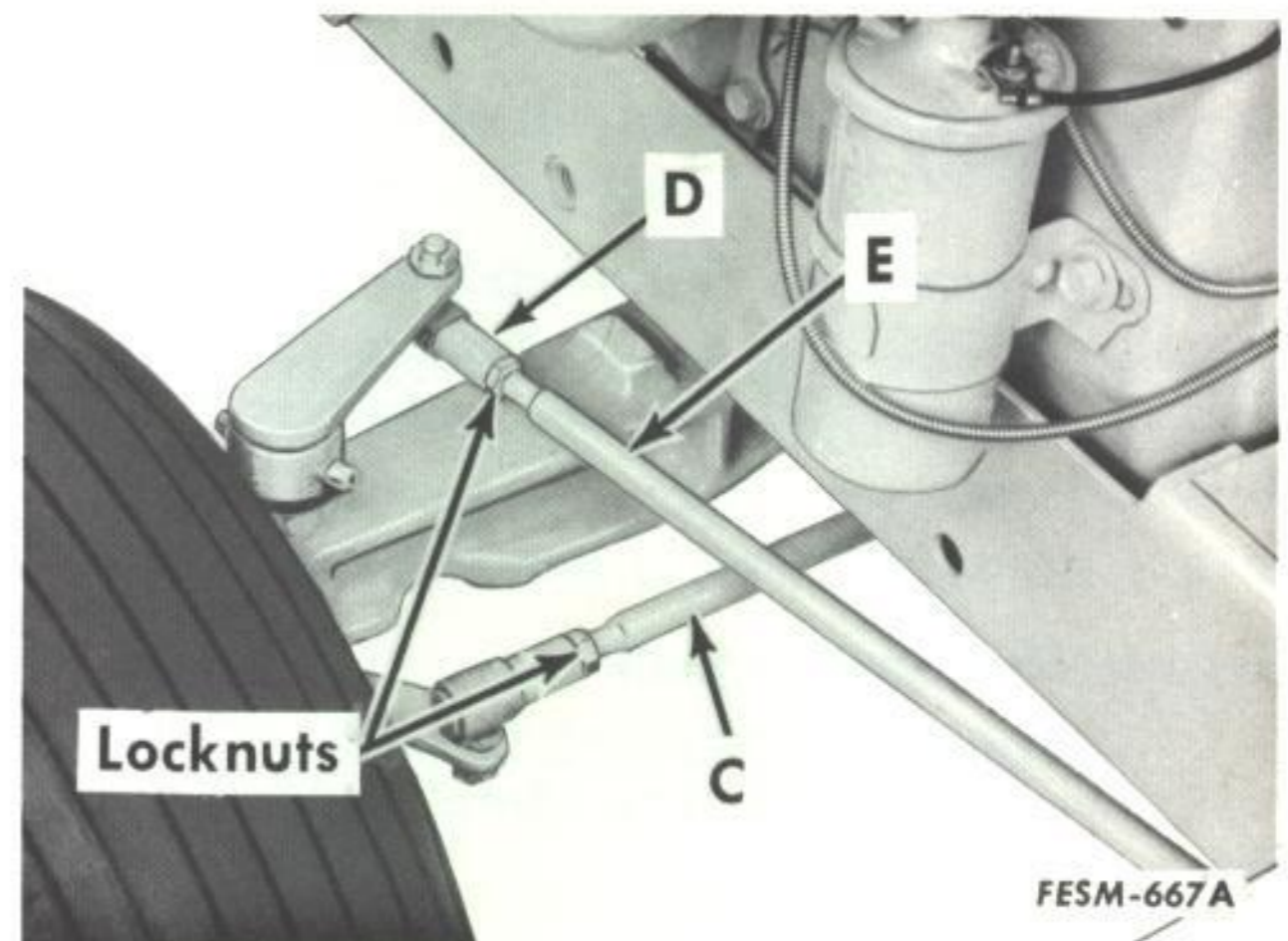
10. Adjust the cam follower inward to eliminate backlash, then tighten locknut to 40 ft. lbs. Turn steering shaft full right and left to check for binding.

11. Replace the steering assembly in the tractor chassis. Secure with two cap-screws through the frame cross member.

12. Replace clutch shield bottom sheet.

13. Connect the drag link.

14. Replace the steering wheel and secure with nut.



Illust. 2-6. Steering tie rod and drag link ball joints.

15. Adjust the drag link "E" (Illust. 2-6) to proper length to place front wheels in the straight ahead position when the steering assembly is "centered."

16. Adjust tie rod "C" (Illust. 2-6) to provide 1/32" to 1/8" toe-in.

NOTE: Do not remove ball-joint ends. Loosen locknuts and turn rod clockwise or counterclockwise to adjust.

FRONT WHEELS AND BEARINGS

Removal

1. Lock the brake and block the rear wheels. Jack up the front axle.
2. Remove the capscrew and flat washer from the outer end of the front spindle.
3. Slide the wheel and bearings from the spindle.

NOTE: The bearings are a press fit in the wheel and a slip fit on the spindle.

Disassembly

Wheel bearings can be driven from the wheel hub with a hammer and long drift punch. Drive from the inside toward the outside.

Inspection and Repair

1. Inspect the entire wheel and hub for wear or damage.

2. Bearings and seal should be inspected and replaced as necessary.

3. Bearing fit to wheel must be tight. If not, replace or repair wheel.

Reassembly

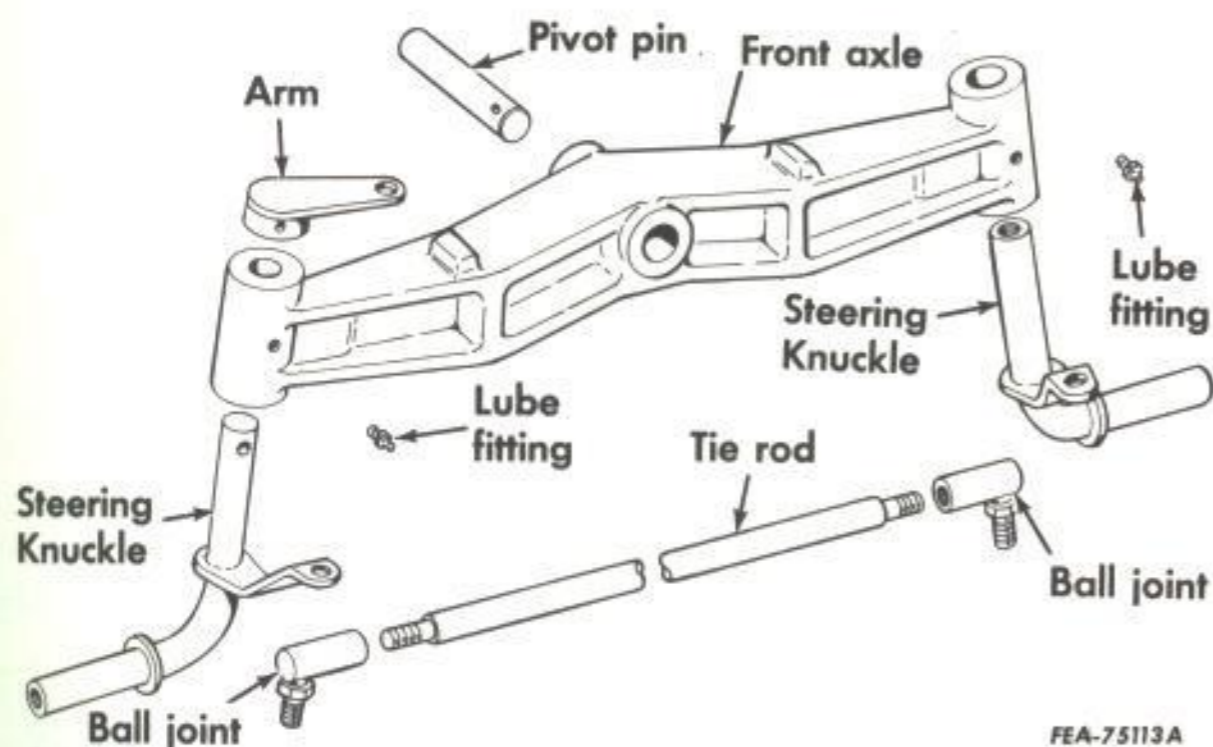
1. If the bearings were removed, lubricate and press in new ones. Be sure force is directed to the outer race only.

2. Slide the wheel and bearing assembly over the spindle and secure with cap screw and flat washer.

3. If excessive end play exists (maximum $1/32''$), place a sufficient thickness of shim washers (3-4" ID) over the outer end of the spindle and between the retaining washer and wheel bearing to take up excess end play.

FRONT AXLE

Steering Knuckle Removal (Illust. 2-7)



Illust. 2-7. Front axle components.

1. Lock the brake, jack up the front of the tractor and support it on a suitable stand.
2. Remove the front wheels.
3. Disconnect the tie rod ball joints from left and right steering knuckles.
4. Using a pin punch and hammer, drive out the coiled spring pin from the drag link arm on the left steering knuckle.
5. Remove the steering knuckle from the axle.
6. Remove the cap screw and flat washer from the upper end of the right steering knuckle.
7. Remove the right steering knuckle from the axle.

Removal of Front Axle

1. Disconnect the drag link ball joint "D" (Illust. 2-6) from the drag link arm (Illust. 2-7).
2. With the front of the tractor frame supported on a suitable stand, drive out the retaining pin from the front of the axle pivot pin (Illust. 2-7).

3. Remove the pivot pin. The front axle is now free of its mounting and can be removed (Illust. 2-7).

Inspection

1. Inspect all parts closely for wear or damage and replace as necessary.

Reassembly of Front Axle

1. Apply chassis lubricant liberally to the axle pivot pin and its bore in the axle.
2. Position the axle in its support bracket channel, align the pivot pin holes and insert the pin.
3. Align the retaining pin holes (through the front of the pivot pin and through the front collar of the support bracket) then drive the retaining pin through both parts.

Reassembly of Steering Knuckles

(Illust. 2-7)

1. Apply chassis lubricant liberally to the steering knuckle arm thrust surface and the bottom of the axle ends.
2. Insert the right hand steering knuckle in its respective bore in the axle and secure with the cap screw and flat washer.
3. Insert the left hand steering knuckle in its bore in the axle and position the drag link arm on it.
4. Secure the drag link arm and knuckle with the coiled spring pin.

NOTE: Spring pin must extend through the drag link arm an equal amount on each side.

5. Install the tie rod.
6. Install the front wheels and check toe-in adjustment.

CLUTCH

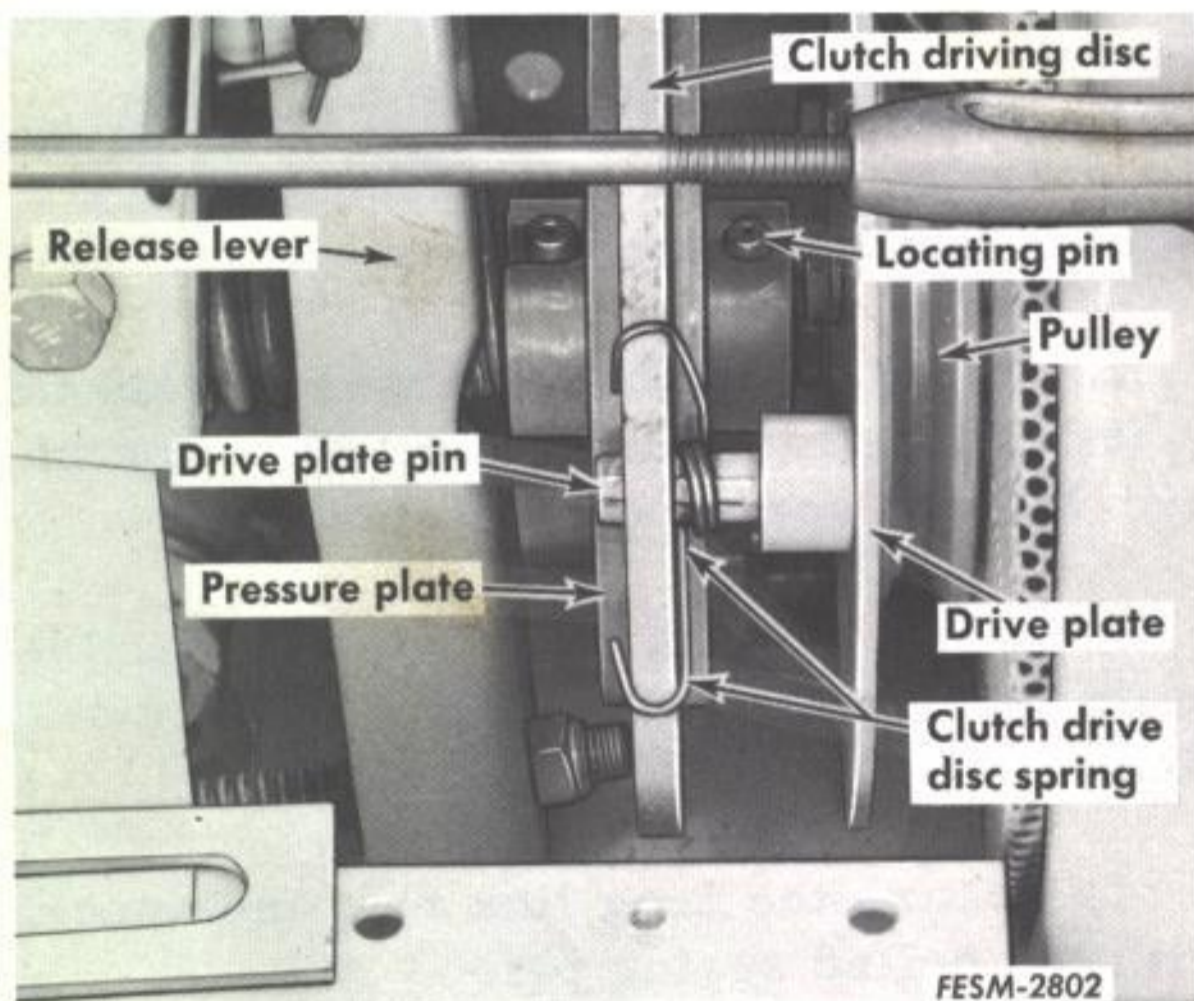
-Removal

Complete service of the clutch shaft, loading spring, release bearing, and cushion spring will require removal of the tractor engine, then the clutch assembly.

Refer to the Engine section of this manual for engine removal procedure then remove the clutch shaft coupling rear pin, clutch release lever pin, and disconnect the clutch release rod from the pedal arm.

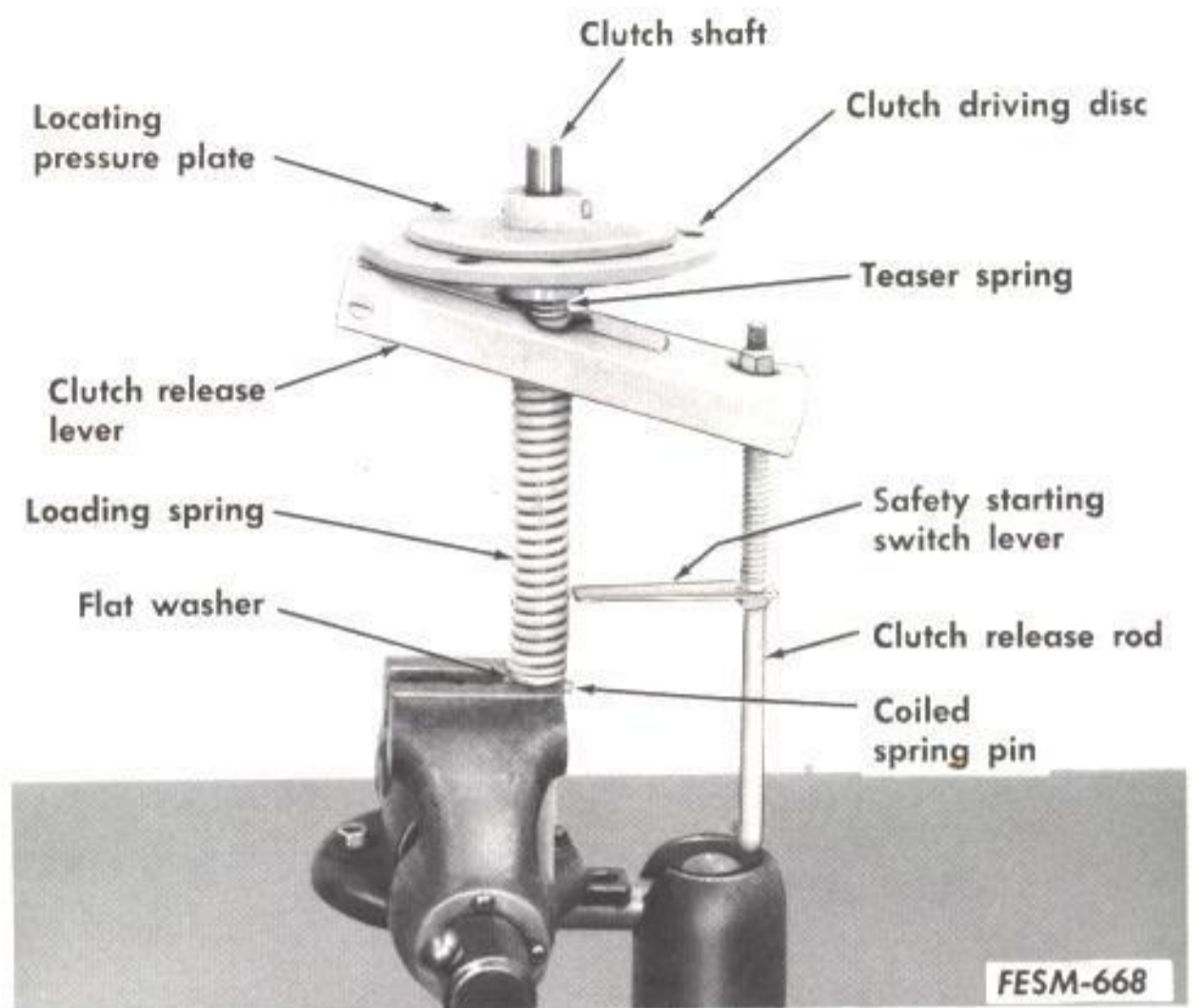
When minor service (replacing the driving disc, driving plate or pressure plates) only is required, perform the following steps 1 through 13.

1. Depress the clutch and brake pedal and lock it.



Illust. 2-8. Clutch shield removed showing clutch drive.

2. Remove the clutch shield.



Illust. 2-9. Clutch shaft secured in vise for removal of pin.

3. Using a hammer and punch, drive out the pressure plate locating pin (Illust. 2-8).

4. Remove the four cap screws (two on each side) which hold the engine to the tractor frame (Illust. 1-4).

NOTE: Wiring cable clips (on tractors equipped with electric starting) will need spreading so that wires can follow engine as it is moved.

5. Release the clutch and brake pedal, then lift engine far enough to clear clutch parts.

6. Replace the pressure plate, driving disc or driving plate as necessary. Replace clutch driving disc spring(s) on driving plate pins (Illust. 2-8).

7. Slide the engine rearward while aligning the clutch shaft and driving plate pins (Illust. 2-8).

8. Depress and lock the clutch-brake pedal.

9. Replace the pressure plate locating pin (Illust. 2-8).

10. Align the engine to the frame and replace the securing cap screws.

11. Secure the wires and cables in their clips.

12. Connect the ground cable (if it was disconnected).

13. Replace the clutch shield.

Disassembly

1. Clamp the clutch shaft in a vise as shown in Illust. 2-9 and drive the coiled spring pin out.

2. Slowly release the vise allowing the spring to extend as the shaft slips through the vise jaws.

3. Support the hubs of the pressure plates, then drive their coiled spring pins out.

4. Support the clutch shaft coupling, then drive the coiled spring pin out.

Inspection and Repair

1. Inspect the clutch driving disc for wear from pressure plates and for elongated holes from the driving plate pins. Disc must be free of grease and oil.

2. Inspect both pressure plates for warping and wear on their contact faces.

3. Inspect the slotted hub of the rear pressure plate for pin wear. If the slots are cupped from pin wear the plate must be replaced.

4. Inspect the teaser spring ends. Ends should be rounded to prevent gouging the clutch shaft. Check the spring tension. (Refer to Specifications.)

5. Inspect the loading spring ends. Ends should be rounded to prevent gouging the clutch shaft. Check the spring tension. (Refer to Specifications.)

6. Inspect the clutch release lever channel for wear on the curved area where contact is made with the release bearing.

7. Inspect the clutch shaft for wear at the front (pilot bushing area). Pin holes should not be "wallowed out" or elongated.

8. Release bearing area and teaser spring area should be free from scoring.

9. Clutch shaft coupling pin holes should not be "wallowed out" or elongated.

Reassembly

1. Install the clutch shaft coupling onto the rear end of the shaft, align the pin holes and secure by installing the coiled spring pin.

2. Install parts to the clutch shaft in the following sequence: flat washer, loading spring, flat washer, release bearing (long sleeve end forward), release lever (channel flanges toward rear) and the teaser (cushion) spring.

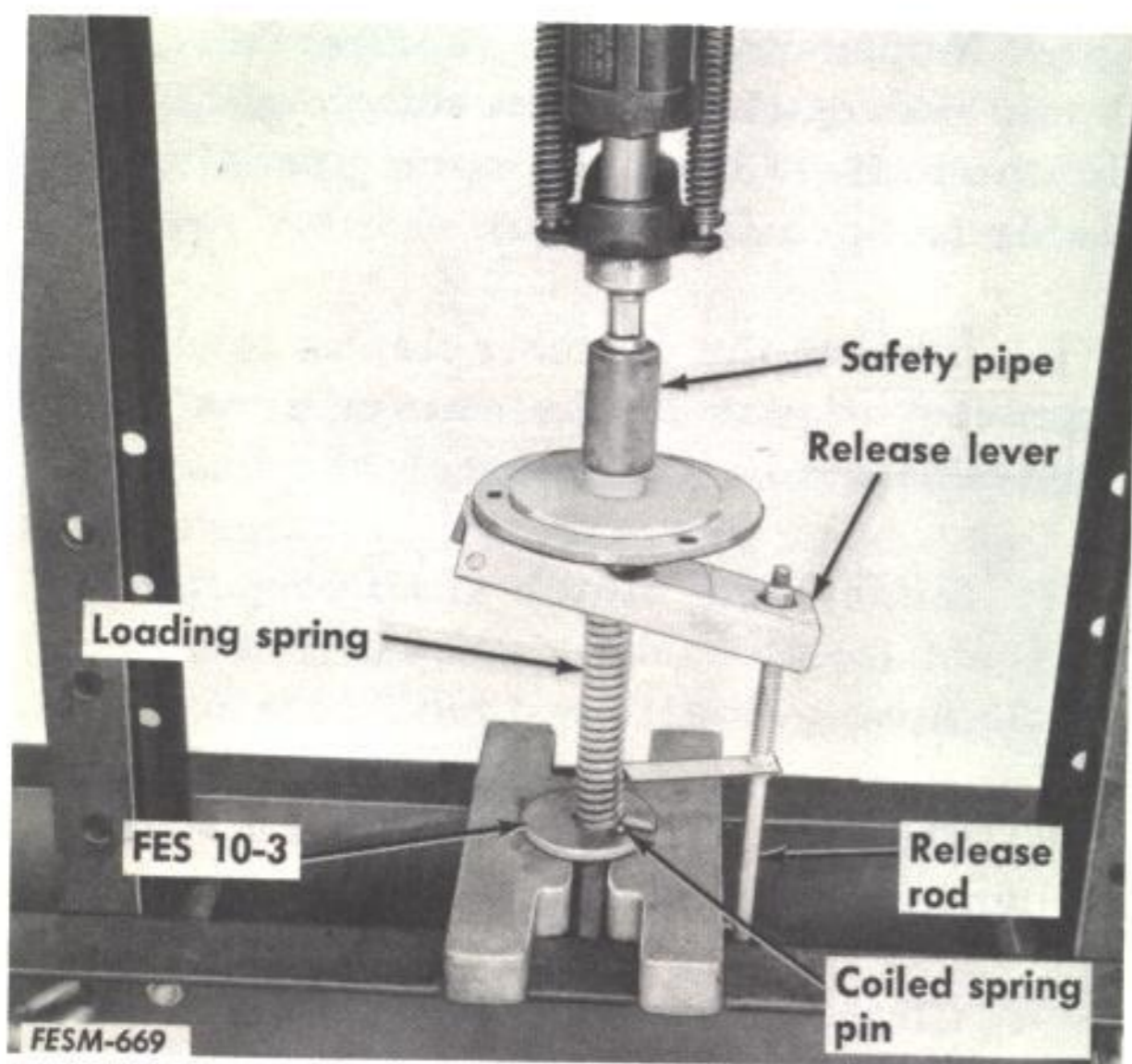
3. Install coiled spring pin through the shaft (second hole from shaft front end).

4. Install rear pressure plate over shaft so that pin slots in the hub engage the pin.

5. Install the friction driven disc and the locating pressure plate.

6. Align the pin holes of the shaft and locating pressure plate hub and secure with coiled spring pin.

7. Apply chassis lubricant or "Lubriplate" to that area of the clutch shaft which will be covered by the teaser spring and release bearing.



Illust. 2-10. Compressing the loading spring for pin installation.

8. Place the assembly in a press as shown in Illust. 2-10. Center the clutch driven disc and compress the loading spring sufficient to install the coiled spring pin.

Installation and Adjustment

1. Place the clutch shaft over the frame cross member and move it rearward to engage the coupling to the reduction unit or "creeper" drive shaft.

2. Align the release lever to its bracket, install the pin and secure with cotter.

3. Apply chassis lubricant or "Lubriplate" liberally to the clutch shaft pilot bushing.

4. Slide the engine rearward while aligning the clutch shaft into its pilot bushing and the drive plate pins into their holes in the driven disc.

5. Align the engine mounting cap screw holes and install the cap screws.

6. Align the clutch shaft coupling rear pin hole with pin hole in reduction drive (or "creeper" drive) shaft and install the pin.

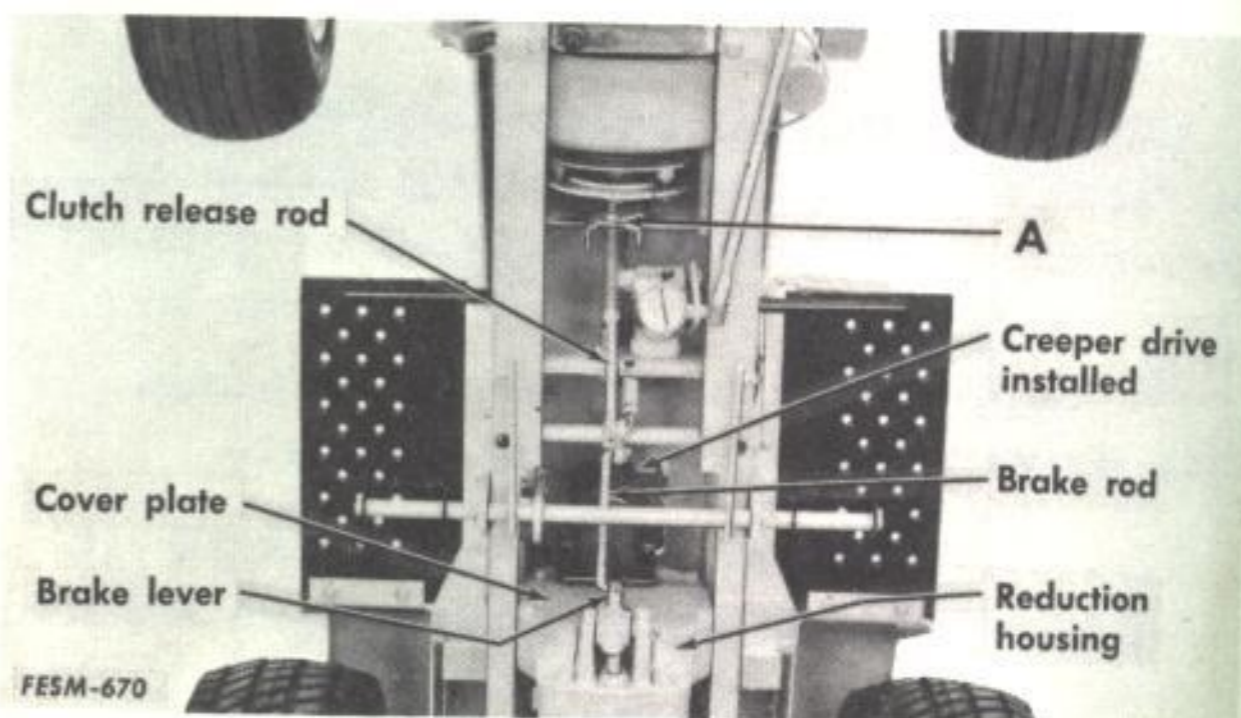
7. Connect the clutch release rod to its pedal shaft lever and secure with the return spring.

8. Depress the pedal and release the clutch to allow components to move into final alignment.

9. Position the wires and cables in their clips and secure.

10. Connect the battery cables.

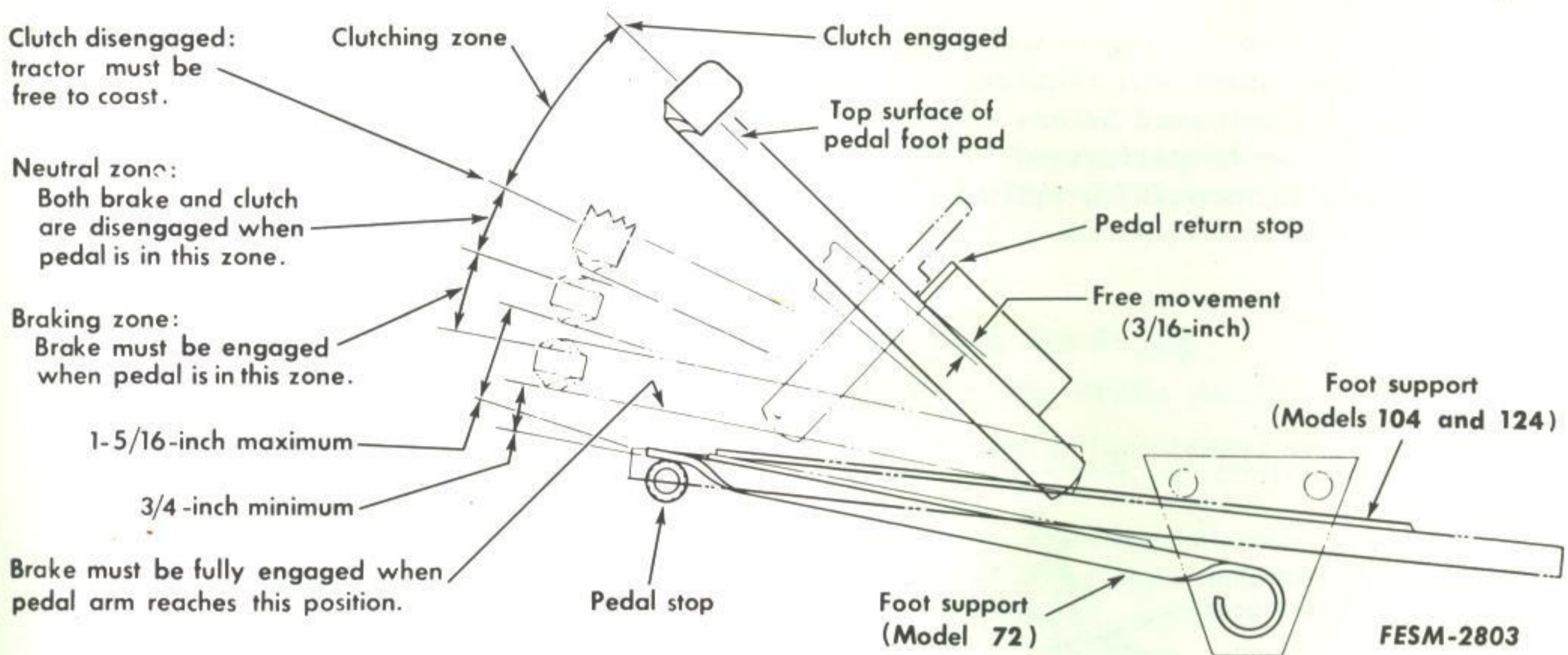
11. Replace the clutch shield.



Illust. 2-11. Underside view of brake and clutch control linkage.

12. Check the clutch pedal and linkage for proper adjustment. Refer to Illusts. 2-11 and 2-12.

Adjusting the Clutch



Illust. 2-12. Clutch and brake pedal linkage adjustments.

It is important that a clearance of .050 inch be maintained between the clutch release lever and the clutch release bearing. In order to maintain this clearance, the pedal should have a free movement of approximately 3/16 inch. See Illust. 2-12. This measurement is taken at the point of contact of the pedal arm with the front edge

of the pedal return stop.

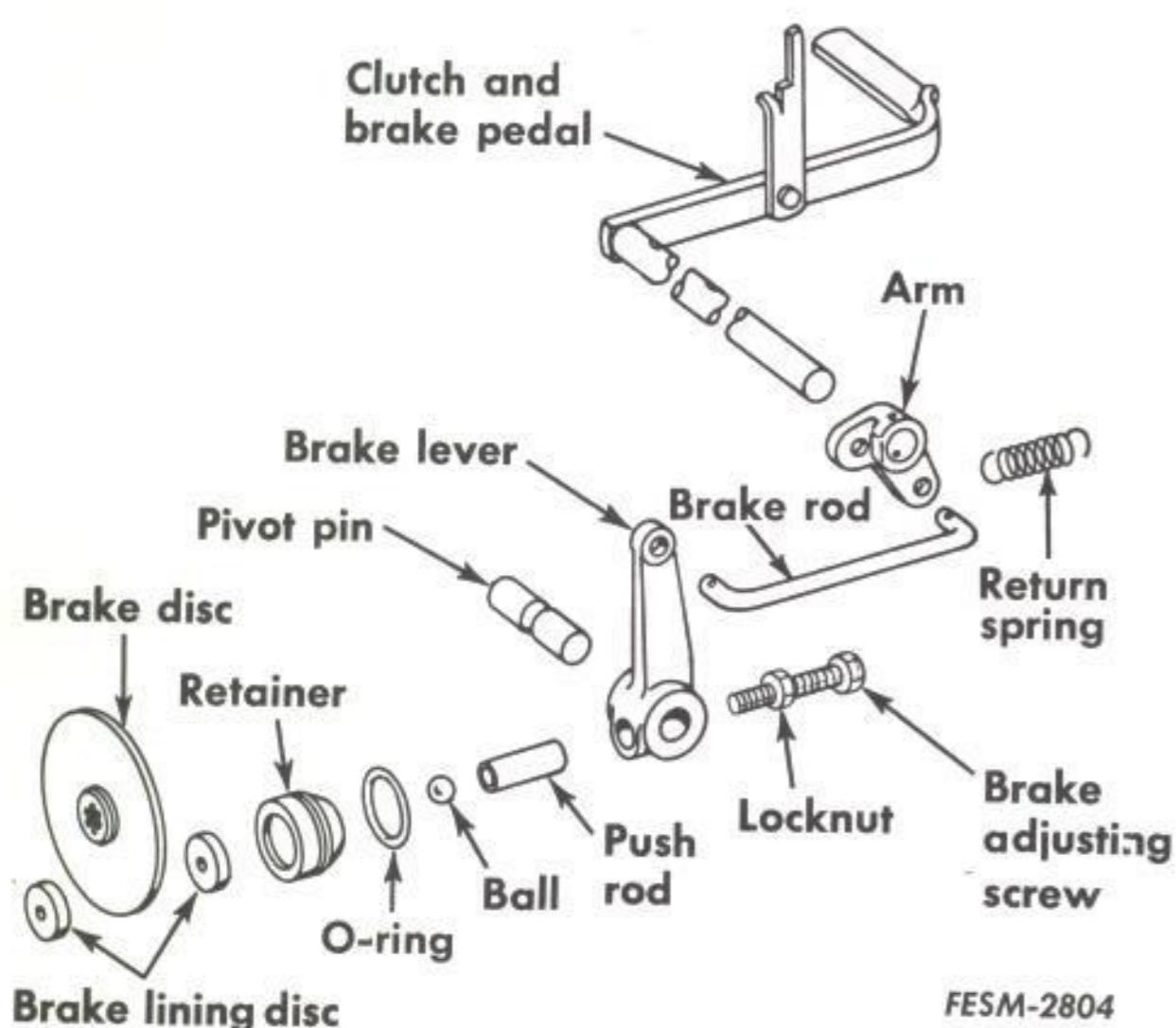
The clutch pedal adjustments should not require frequent attention. When it is necessary to adjust the clutch, turn the adjusting nut "A" on the clutch release rod (Illust. 2-11) in or out as required to get the proper measurements.

BRAKE

NOTE: Tractors equipped with a "creeper" attachment will require "splitting", and the creeper removed before complete brake service can be performed. Refer to page 2-20 of this manual for splitting procedure.

Removal

1. Drain the transmission lubricant.



Illust. 2-13. Exploded view of brake components.

2. Remove the brake adjusting screw and lock nut from its lever (Illust. 2-13).
3. Remove the brake lever, pivot pin and push rod (Illust. 2-13).
4. Remove the reduction housing front cover plate and slide it forward on the clutch shaft. Also see "Note" above.

5. Remove the reduction gear from the front of the transmission main shaft. Refer to Illust. 2-2.

6. Move the gear upward and the bottom of the gear forward to clear the cover screw bosses as the gear is lifted from the housing.

7. Slide the brake disc forward on the countershaft as the front lining and retainer are moved forward in their bore. Refer to Illusts. 2-2 and 2-13.

NOTE: Both linings and the disc can be removed without removing the front lining retainer; however, removal of the retainer is recommended for inspection and replacement of the retainer O-ring.

Inspection

1. Inspect the control rods and levers for wear at their connecting pivot points.
2. Inspect the linings and disc for wear.
3. Inspect the disc hub splines for wear.
4. Check the splines on the countershaft for wear.
5. Check the pedal return spring ends for wear.

Reassembly and Adjustment

1. Clean the brake cavity and lining recess in the reduction housing.
2. Place a small quantity of grease in the rear brake lining recess in the reduction housing then insert the lining.
3. Install the disc on the countershaft and slide it rearward against the rear lining.
4. Install the front lining in the retainer.
5. Install a new O-ring on the front lining retainer, lubricate the retainer and O-ring then push them into the retainer bore in the reduction housing.
6. Install the reduction gear on the transmission main shaft and secure with flat washer, lock washer and cap screw. Tighten cap screw to 55 ft. lbs.
7. Install a new cover gasket, then replace the cover plate.

8. Be sure the ball is in place in the front lining retainer then replace the push rod, lever, pivot pin, adjusting screw and lock nut.

9. Fill transmission to proper level with Hy-Tran fluid or SAE 30 engine oil as specified in the Operator's Manual.

Adjusting the Brake

Adjusting the Brake (Models 72, 104 & 124)

NOTE: For 105 & 125 (Refer to page 2-54)

Loosen the lock nut and turn the brake lever adjusting screw (Illust. 2-13) in or out as required.

The brake should engage when the pedal arm is pressed down to within a maximum of $1\frac{5}{16}$ inches and a minimum of $\frac{3}{4}$ inch distance above the top of the left foot support, which serves as the pedal stop. See Illust. 2-12.

It may be possible to push the pedal all the way down to the pedal stop, but this is of no concern as long as the brake is engaged within above limits.

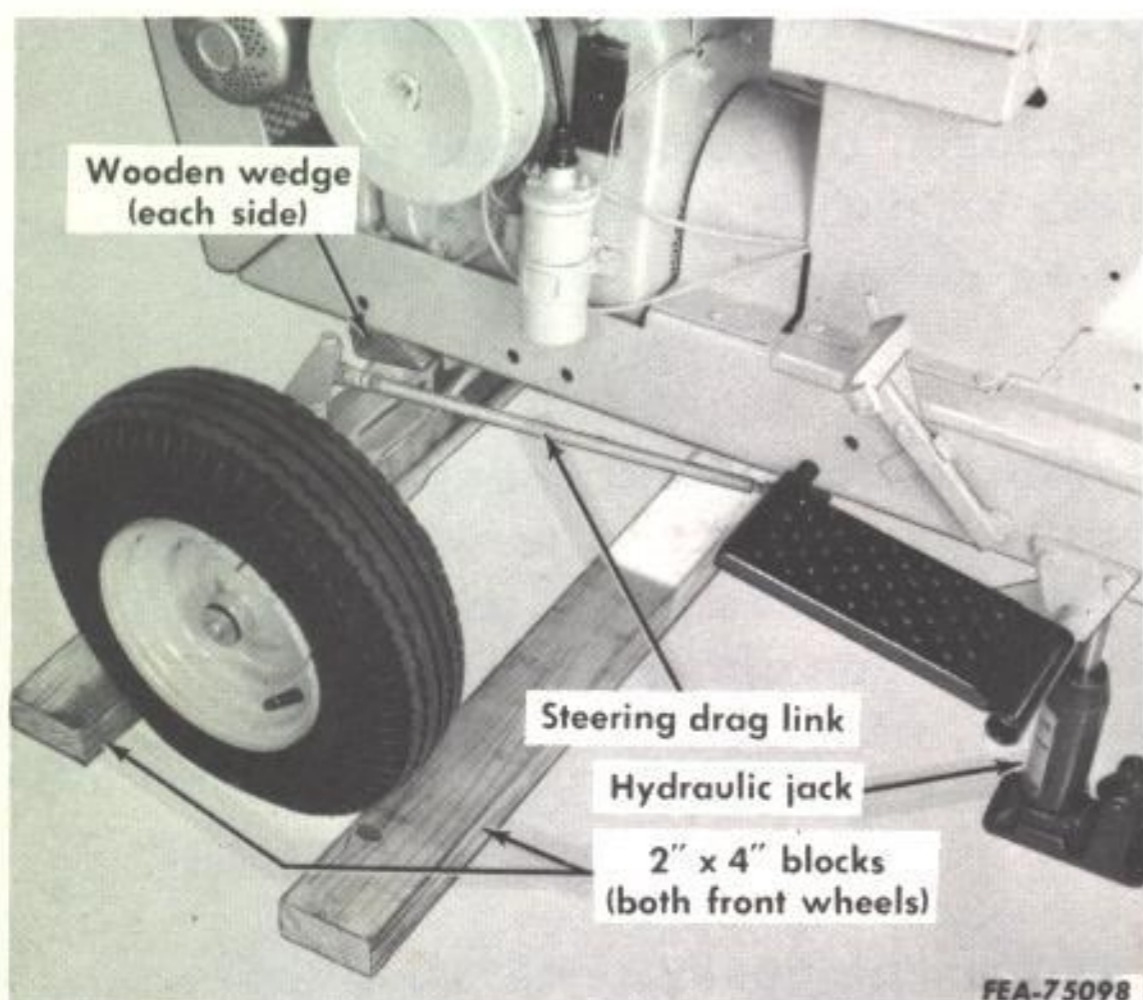
SPLITTING AND RECOUPLING THE TRACTOR

Models 72, 104 and 124

Splitting the Tractor

NOTE: Disconnect battery ground cable.

1. Remove the clutch shaft coupling rear pin. (Connects coupling to creeper or reduction drive shaft.)



Illust. 2-14. Front axle and wheels wedged and blocked for tractor split.

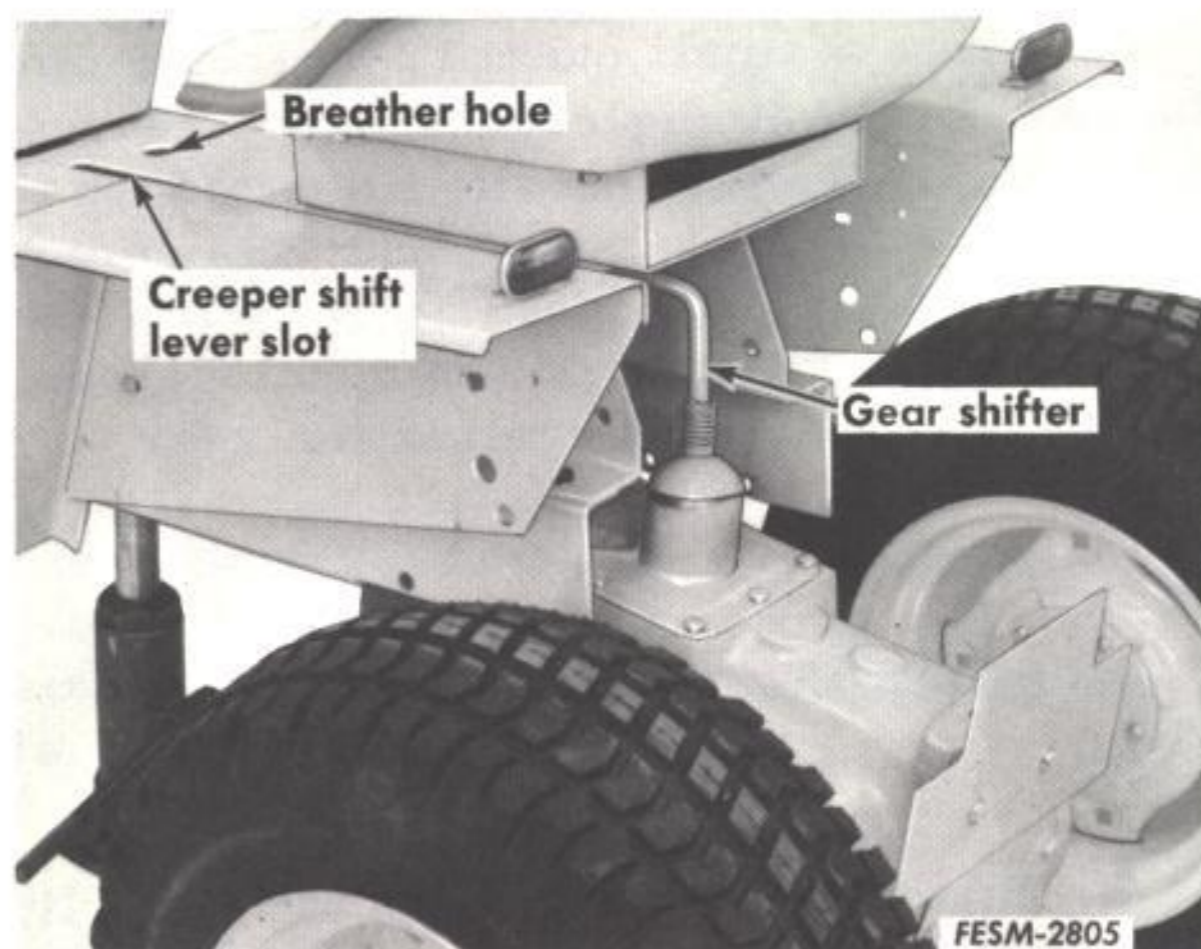
2. Drive a small wooden wedge between the front axle and frame on each side as shown in Illust. 2-14.

3. Block both front wheels as shown.

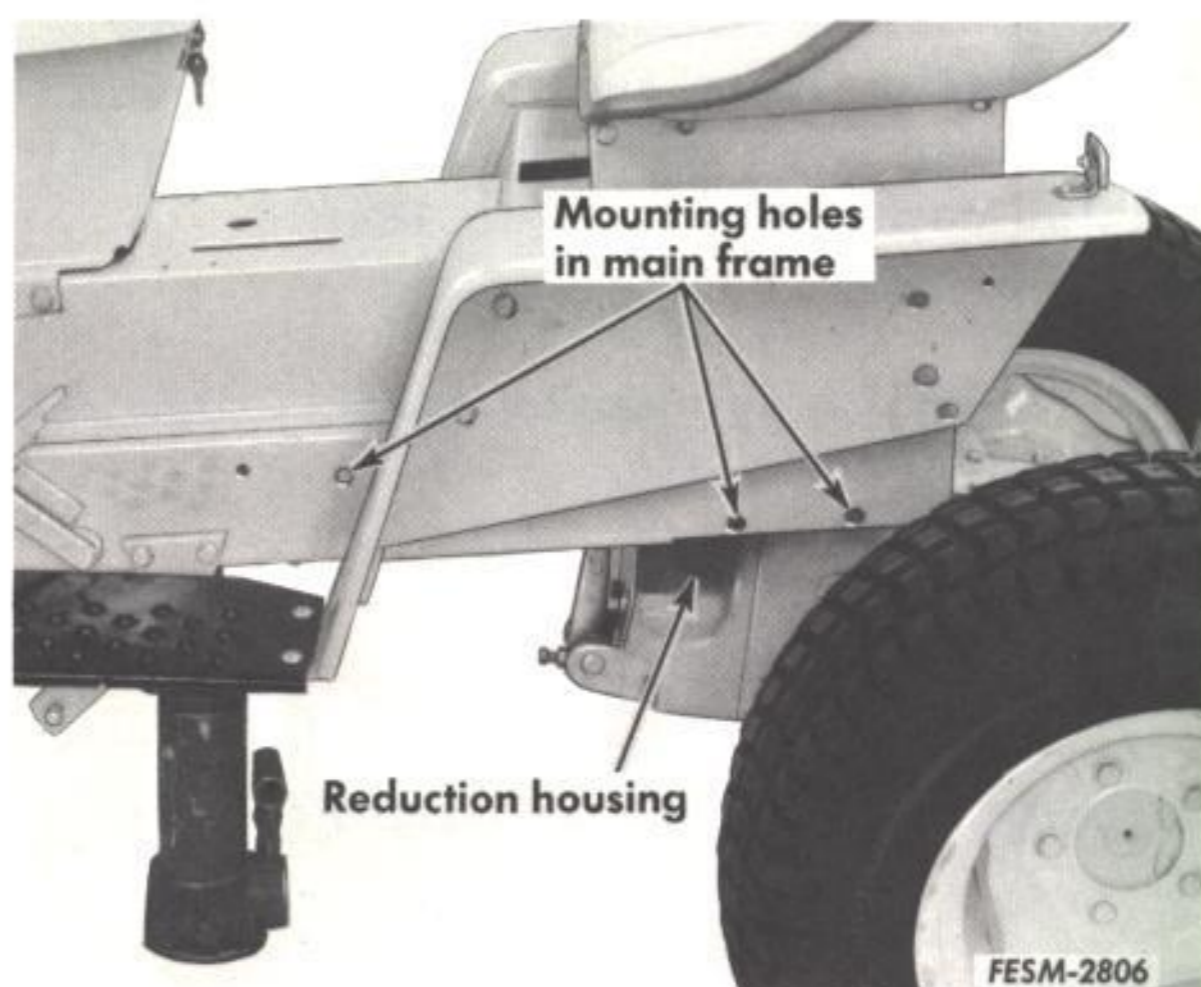
4. If tractor is equipped with creeper attachment, shift the lever forward then remove the lever knob and the breather. Also remove gear shift knob.

5. Disconnect the brake rod from the brake lever.

6. If tractor is equipped with three-point hitch, remove the lift bar and its attaching plate.



Illust. 2-15. Splitting the tractor.



Illust. 2-16. Tractor split for service of creeper, reduction drive, transmission and differential.

7. Place a jack under the implement lift handle cross-shaft to support the frame. Refer to Illust. 2-14.

8. Remove three cap screws from each side of frame. Holes in frame are seen in Illust. 2-16.

9. Raise frame and fender assembly high enough to clear gear shifter.

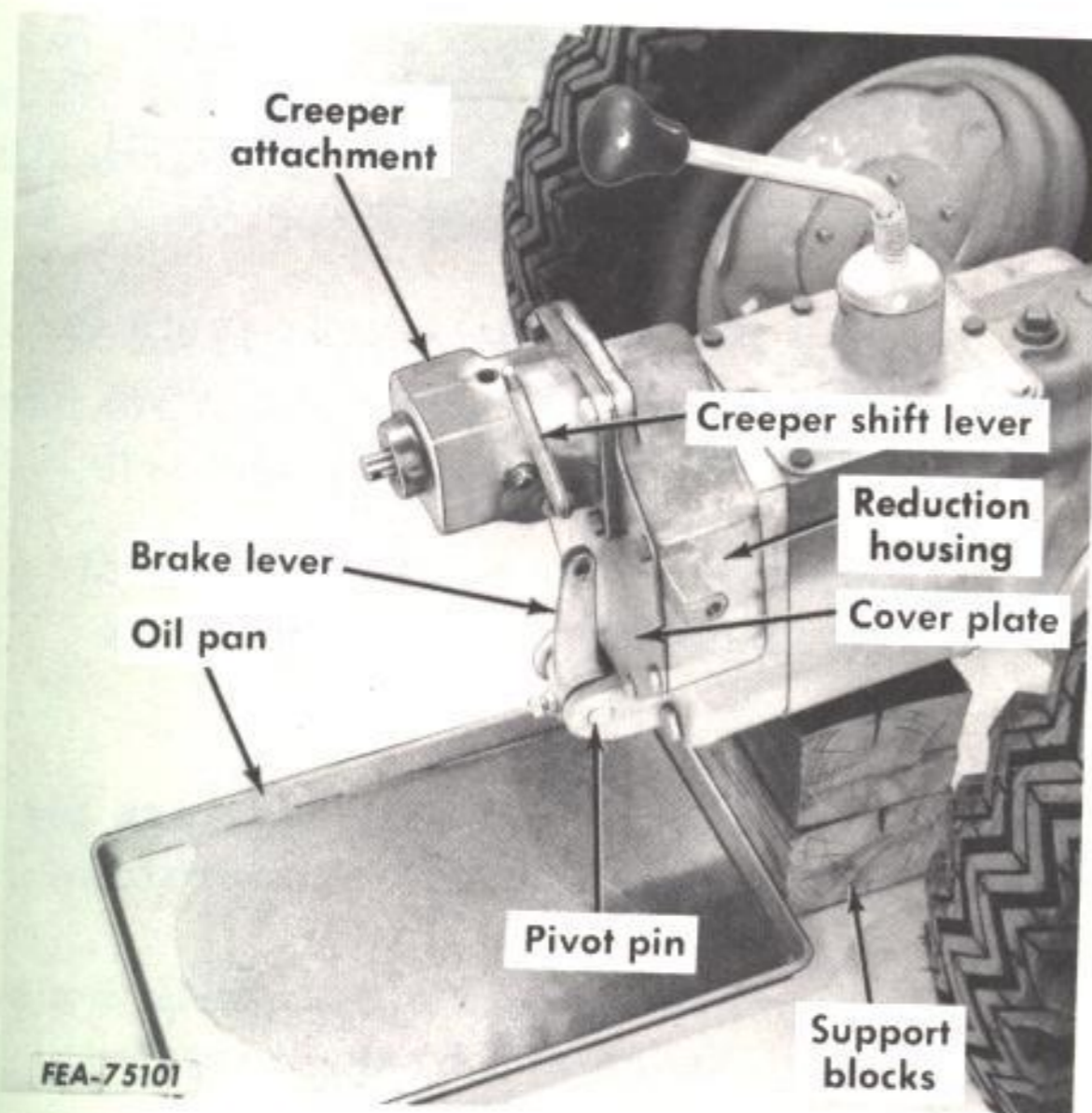
10. Push down on the drawbar and pull rearward. Refer to Illust. 2-15. Guide transmission and rear end assembly from under frame.

Recoupling the Tractor

Recoupling of the tractor is the reverse of splitting; however, precautions should always be taken to safeguard against damage to shafts, bearings, seals etc. when aligning and securing components which work together.

REDUCTION DRIVE

Removal and Disassembly

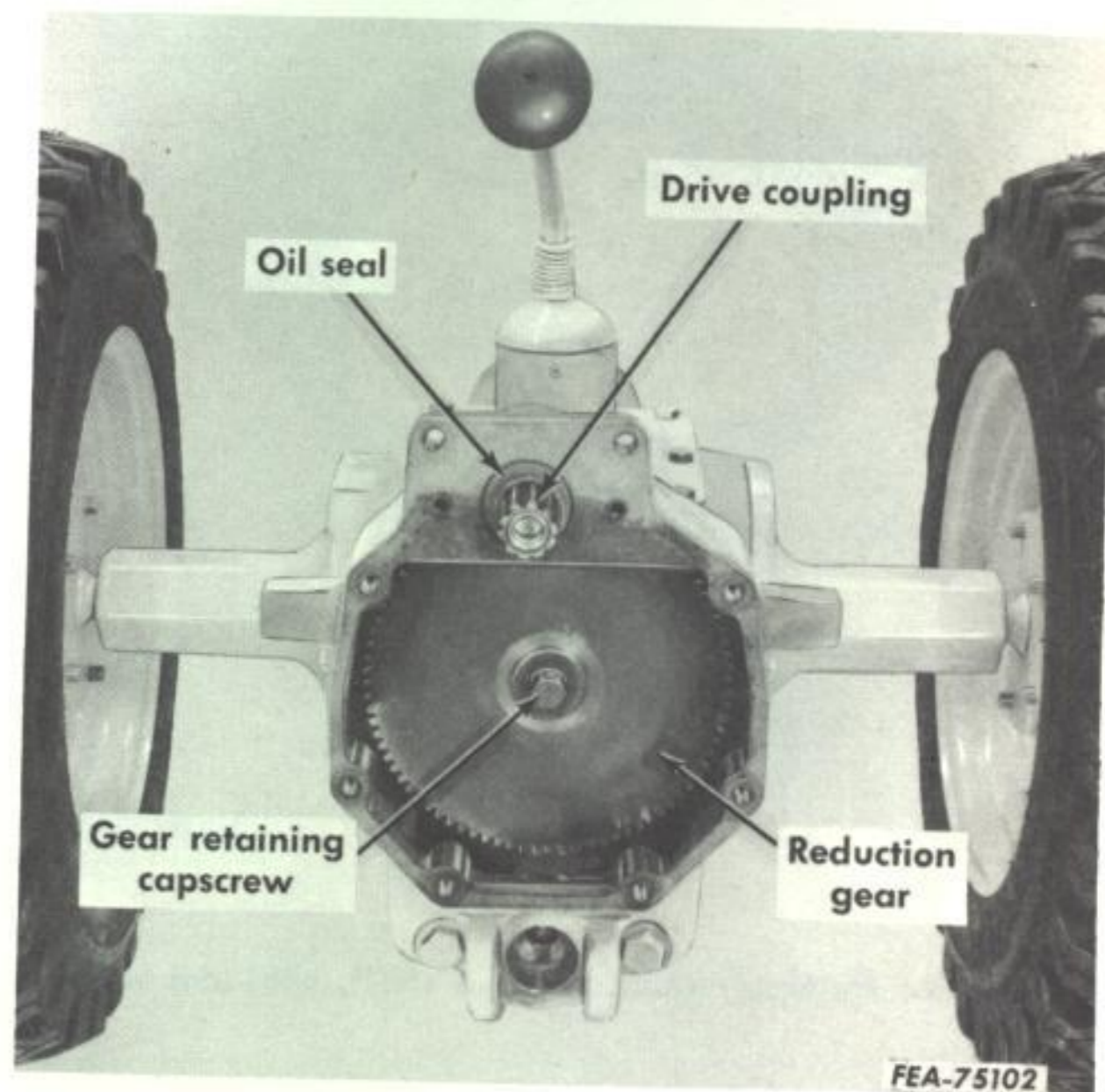


Illust. 2-17. Power train supported for disassembly.

1. Split the tractor. Refer to page 2-20 for splitting procedure.

2. Place an oil pan under the reduction housing and remove the creeper assembly (if tractor is so equipped).

3. Remove the brake lever, pivot pin and push rod (Illust. 2-17).



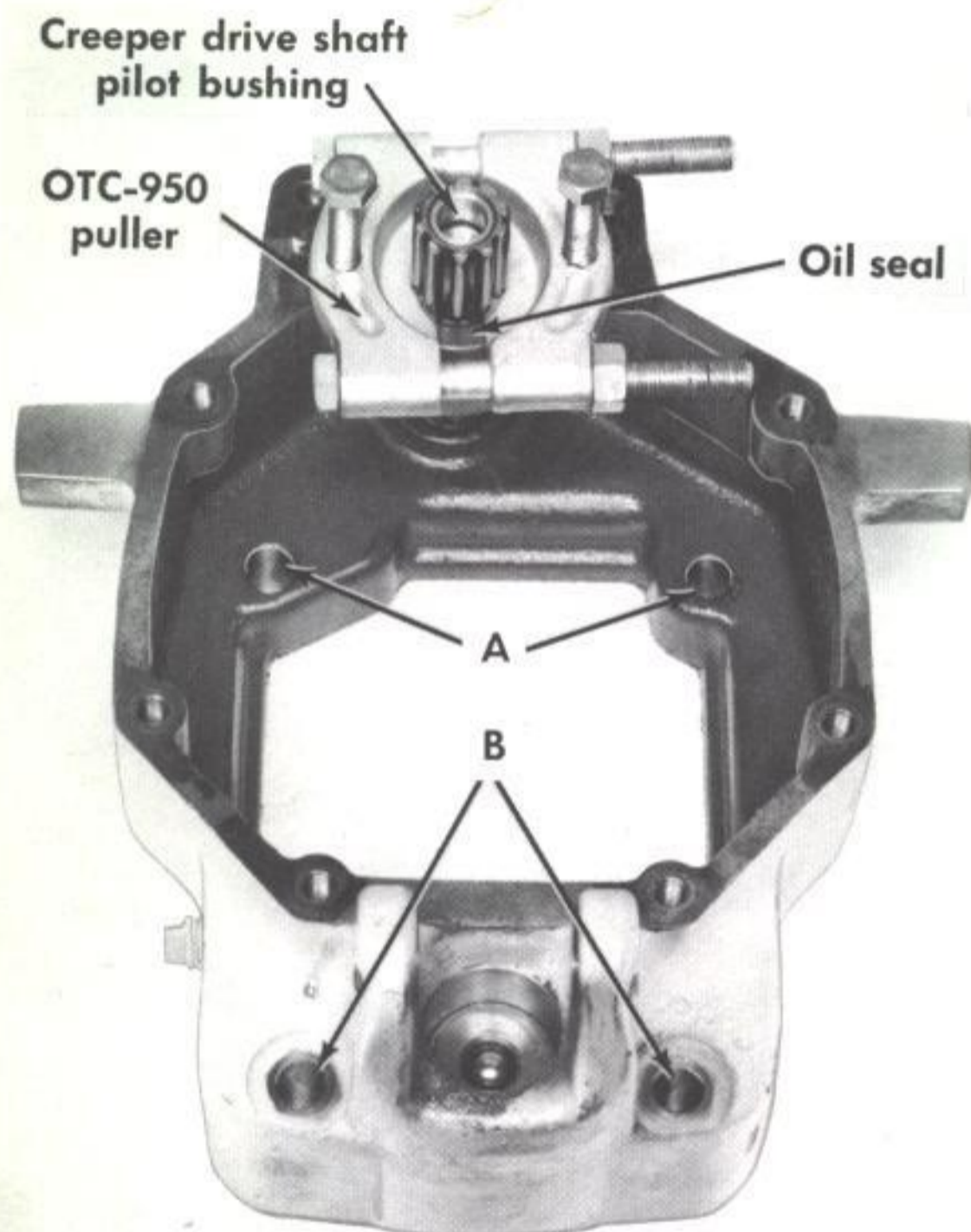
Illust. 2-18. Reduction drive exposed.

4. Remove the reduction housing front cover plate (Illust. 2-17).

5. Hold the drive coupling and shaft from turning and remove the reduction gear retaining cap screw and washers. Remove the gear. (Illust. 2-18.)

6. Remove the reduction gear spacer from the transmission shaft.

NOTE: It may be more convenient to pull the reduction drive shaft, seal and bearing as shown in Illust. 2-19 before removing the reduction gear from the housing. Clearance between the gear and the cap screw bosses is restricted on some tractors.



FEA-75103

Illust. 2-19. Pulling reduction drive shaft, seal and bearing.

7. Remove cap screws from holes "A" and "B" (Illust. 2-19).

NOTE: Soft copper sealing washers are used under the "B" cap screw heads.

8. Move the housing forward and away from the transmission housing as the brake disc slides off the transmission counter-shaft.

9. Pull the reduction drive shaft, seal and bearing from the reduction housing if it was not removed in step 6 **NOTE.**

10. Support the drive shaft splined coupling and drive out the coiled spring pin.

NOTE: The splined coupling is used only on tractors equipped with creeper attachment.

11. Press the drive shaft from the ball bearing.

12. Press the needle bearing rearward from the housing.

13. Remove the brake components.

Inspection and Repair

1. Inspect the drive shaft for wear on the gear teeth, needle bearing area, oil seal contact area and drive pin hole.

2. Inspect the reduction gear teeth for wear or chipping and the fit of the gear on the transmission shaft.

3. On tractors with creeper, inspect wear of pilot bushing for creeper drive shaft.

4. Inspect needle and ball bearings for wear, pitting and roughness of operation.

5. Thoroughly clean the reduction housing, bearings, gears and brake parts.

Reassembly and Installation

1. Install a new gasket to the front of the transmission case. Dowels in the case will hold the gasket in place.

2. Press the needle bearing into the reduction housing from the rear. Rear end of bearing should be flush with housing.

3. Press the ball bearing onto the drive shaft. Refer to Illust. 2-2.
4. Lubricate the lip of a new oil seal and install the seal onto the shaft. Be careful when sliding the seal lip over the pin hole in the shaft. Flat face of seal case must be forward. Refer to Illust. 2-2.
5. Install the splined coupling and coiled pin (if tractor is equipped with a creeper). Coiled pin ends must be even with or below the spline root to avoid interference when shifting the creeper unit.
6. Install a new O-ring onto the brake lining retainer and install in the reduction housing.
7. Install the reduction housing to the transmission case. Be sure the gasket and dowels are in place.
8. Install new copper sealing washers on the two lower cap screws. Refer to "B" (Illust. 2-19). Tighten cap screws at "A" and "B" to 80 ft. lbs.
9. Install the brake linings and disc then push the front lining retainer rearward to hold disc and linings in place.

10. Install the reduction gear and spacer to the transmission mainshaft and secure with the cap screw, flat and lockwasher. Tighten cap screw after drive shaft is installed.

11. Install the drive shaft with ball bearing, seal and splined coupling (on tractors with creeper). Seal case should be flush with housing.

NOTE: Seal holds ball bearing in place and front cover holds seal in place.

12. Tighten reduction gear retaining cap screw to 55 ft. lbs.

13. Install new gasket and housing front cover.

14. Install new gasket and creeper unit (on tractors so equipped).

15. Replace the brake push rod, ball, lever and pivot pin.

16. Recouple the tractor by reversing the splitting procedure.

17. Fill transmission and creeper to proper level with specified lubricant.

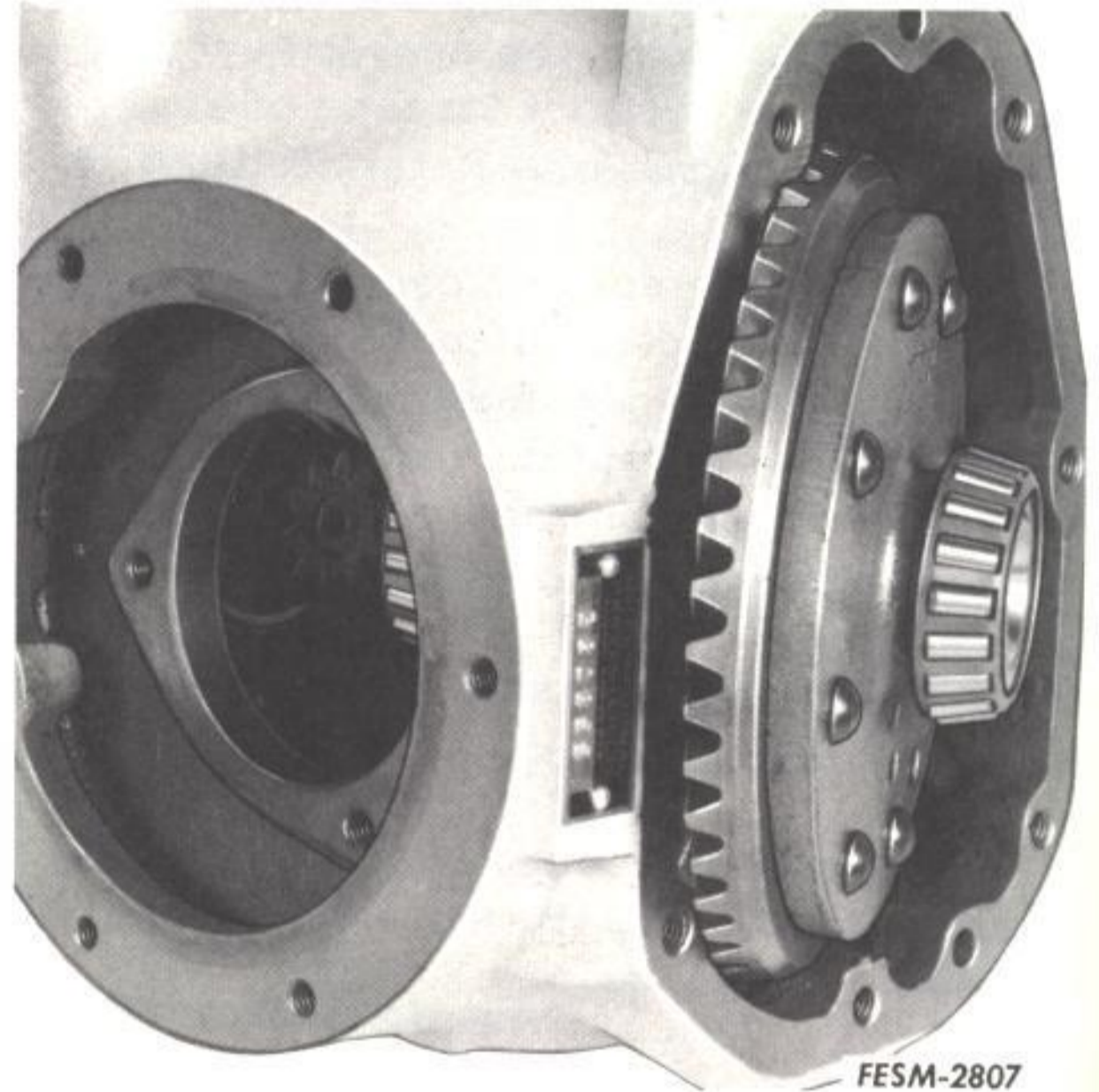
TRANSMISSION AND DIFFERENTIAL

Models 72, 104 and 124

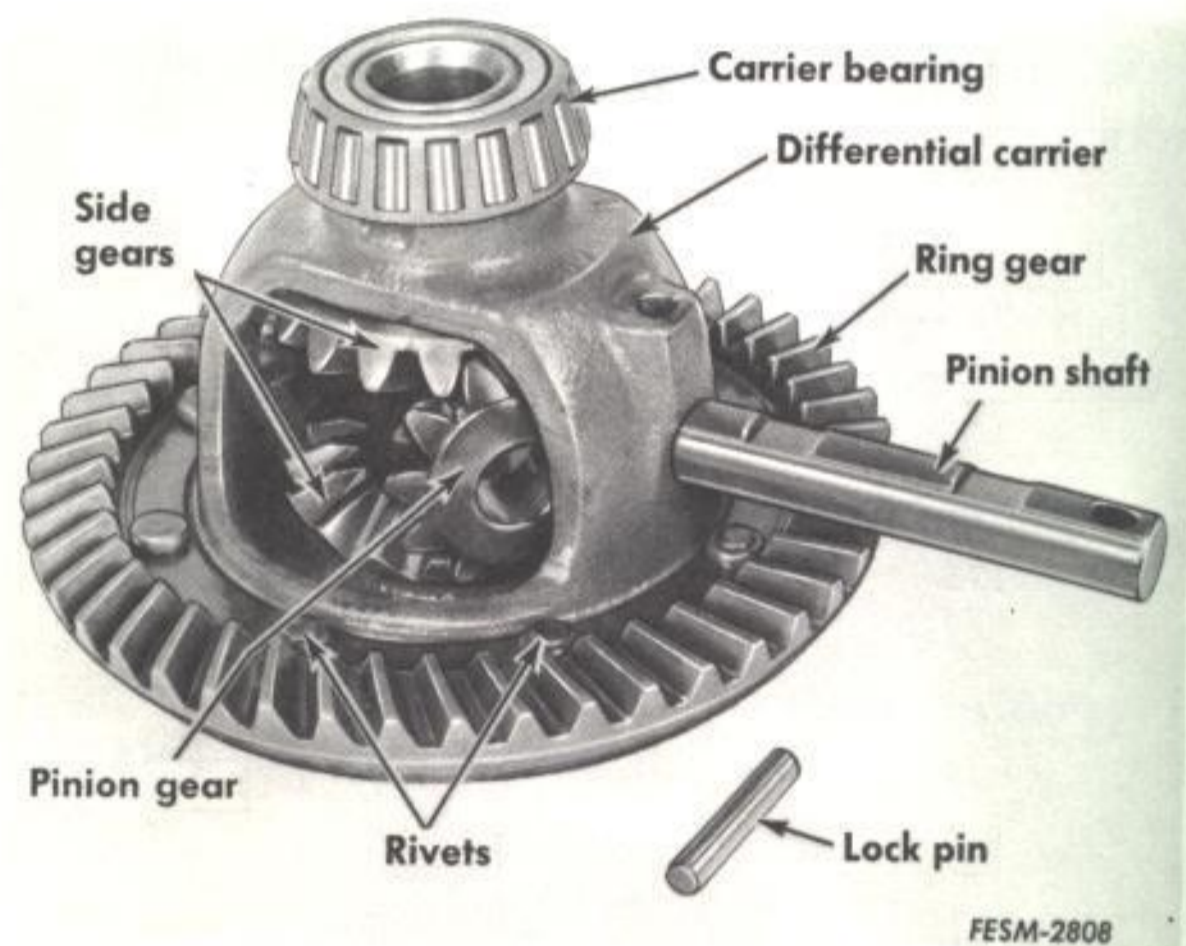
Complete service of the transmission requires splitting of the tractor, removal of the reduction drive (and creeper if so equipped), rear axles, carriers and the differential. The differential can be removed and replaced without disassembling the transmission, however, the transmission countershaft should be removed when checking preload of the differential carrier bearings. The transmission and differential are therefore covered together.

Removal and Disassembly (Differential)

1. Drain the lubricant.
2. Split the tractor. (Refer to page 2-20.)
3. Remove the reduction drive. (Refer to page 2-21.)
4. Remove the rear axles and their carriers. (Refer to page 2-28.)
5. Remove the differential carrier bearing cage and shims from each side. Keep the shims with each cage and identified for each side.
6. Turn the differential into the position shown in Illust. 2-20 and remove it from the transmission case. If the assembly will not clear the side of the transmission case, it will be necessary to remove one of the differential carrier bearings.
7. Drive out the pinion shaft lock pin.
8. Remove the pinion shaft.
9. Remove the pinion gears and side gears.
10. If the ring gear requires separate replacement, press out the eight retaining rivets.



Illust. 2-20. Removing differential carrier from the transmission differential housing.



Illust. 2-21. Differential partially disassembled.

11. Remove the carrier bearing cones from the differential carrier if they are to be replaced.
12. Remove the bearing cups from each cage if replacement is necessary.

Disassembly (Transmission)

1. Remove the differential as previously described on page 2-24.

2. Remove the gearshift lever and cover assembly.

Shift the transmission into two gear speeds to lock the transmission then remove the nut from the countershaft.

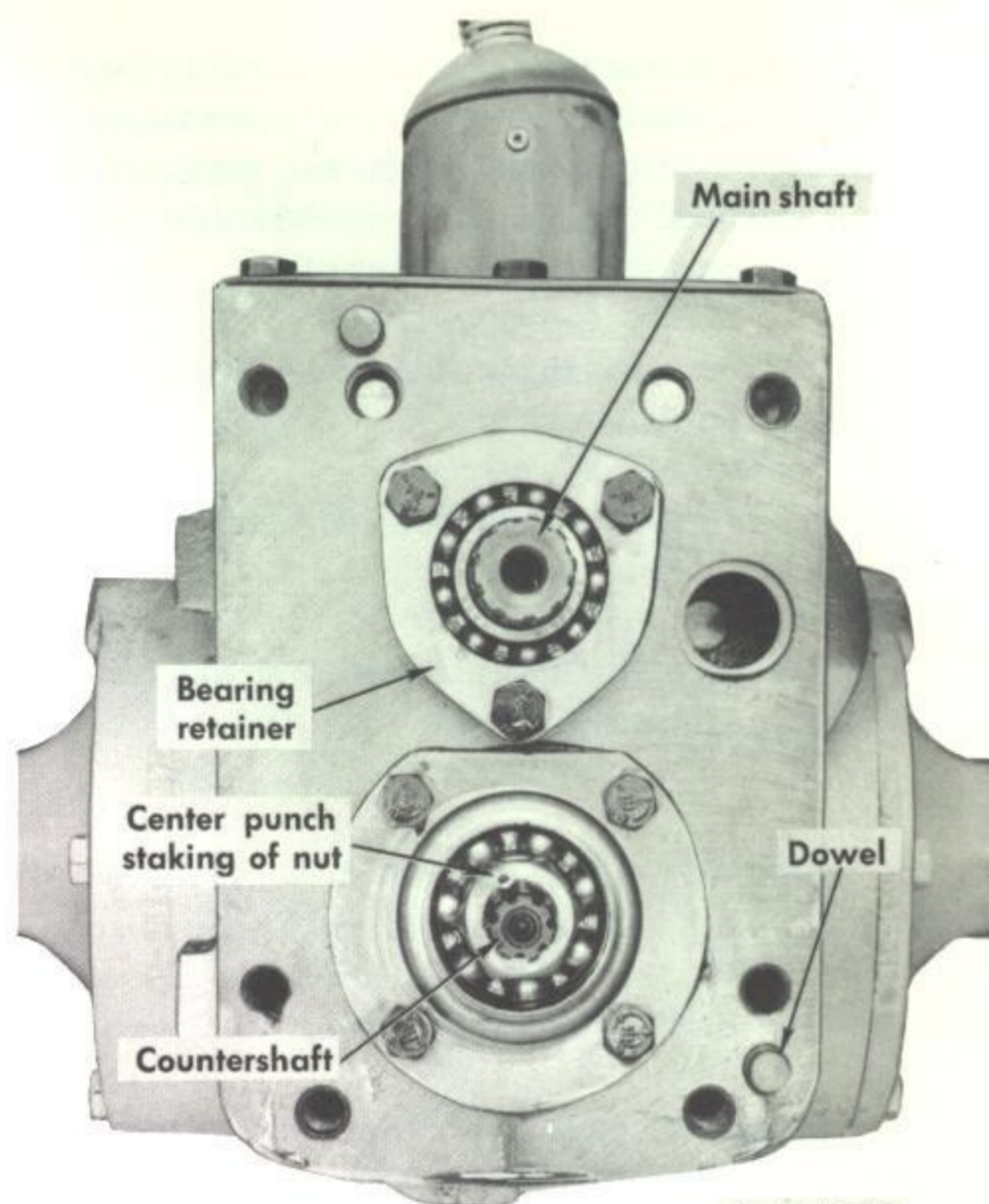
3. Remove the shifter fork set screws.

CAUTION: Cover the gearshift poppet ball hole to prevent the ball and spring from flying out as the rods are removed.

Drive the shifter rods forward and out of the transmission.

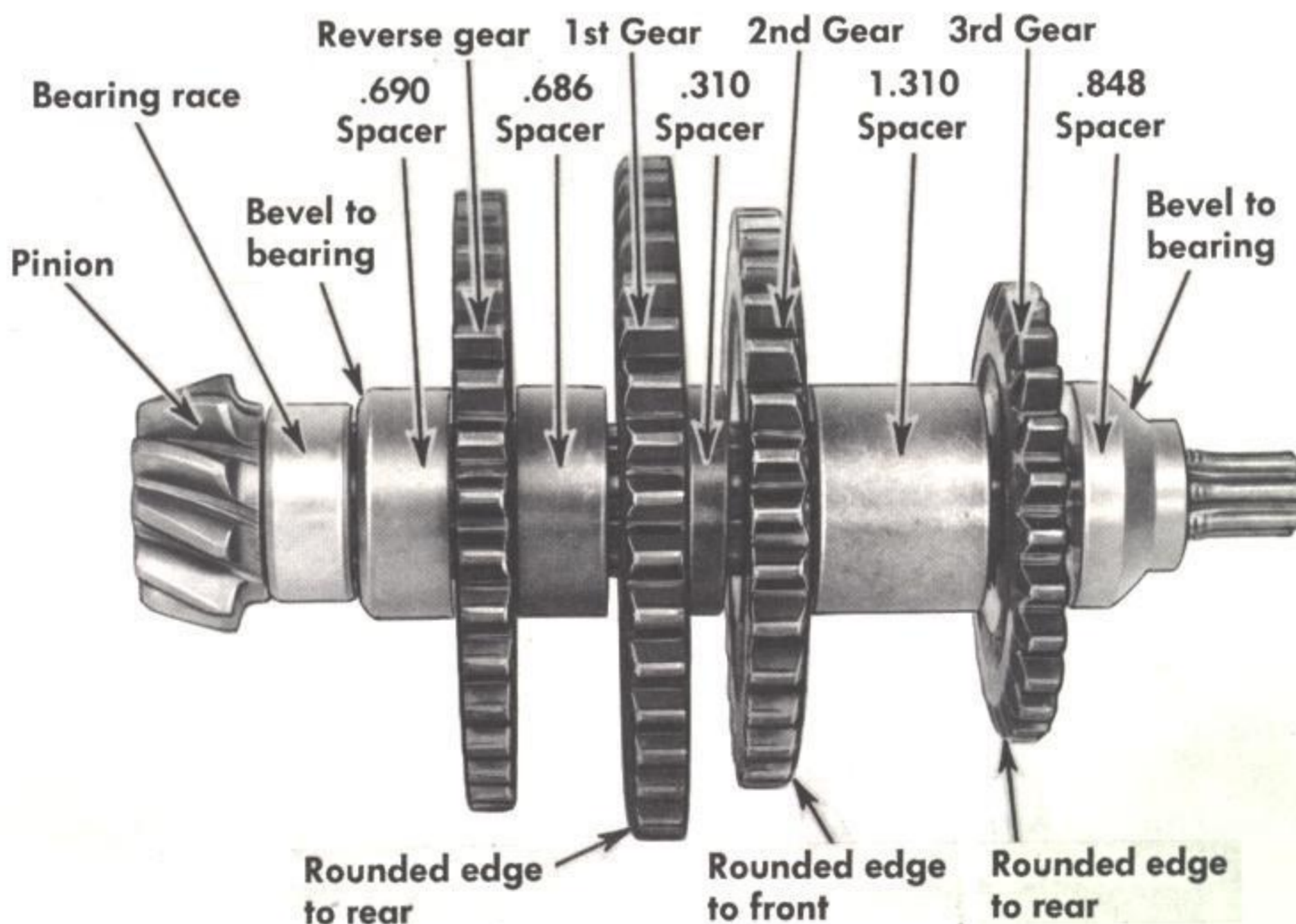
4. Remove the capscrews from the mainshaft front bearing retainer. Refer to Illust. 2-23.

5. Pull the mainshaft forward and out of the transmission as the gears are removed.



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Illust. 2-23. Front view of transmission.



FESM-2809

Illust. 2-22. View of countershaft assembly.

6. Push the countershaft rearward and out of the transmission as the gears and spacers are removed. Note the sequence of spacers and gears for reassembly. See Specifications for spacer lengths.

7. Pull the mainshaft needle bearing from the housing.

8. Remove the reverse idler shaft and gear.

9. Remove the countershaft front bearing, retainer and shims.

Inspection and Repair

1. Wash all parts in cleaning solvent and dry with compressed air. Do not spin bearings.

2. Check all bearings for looseness, wear, roughness, pitting and scoring.

3. Check gears and shafts for wear and burrs. Remove any burrs with a fine stone.

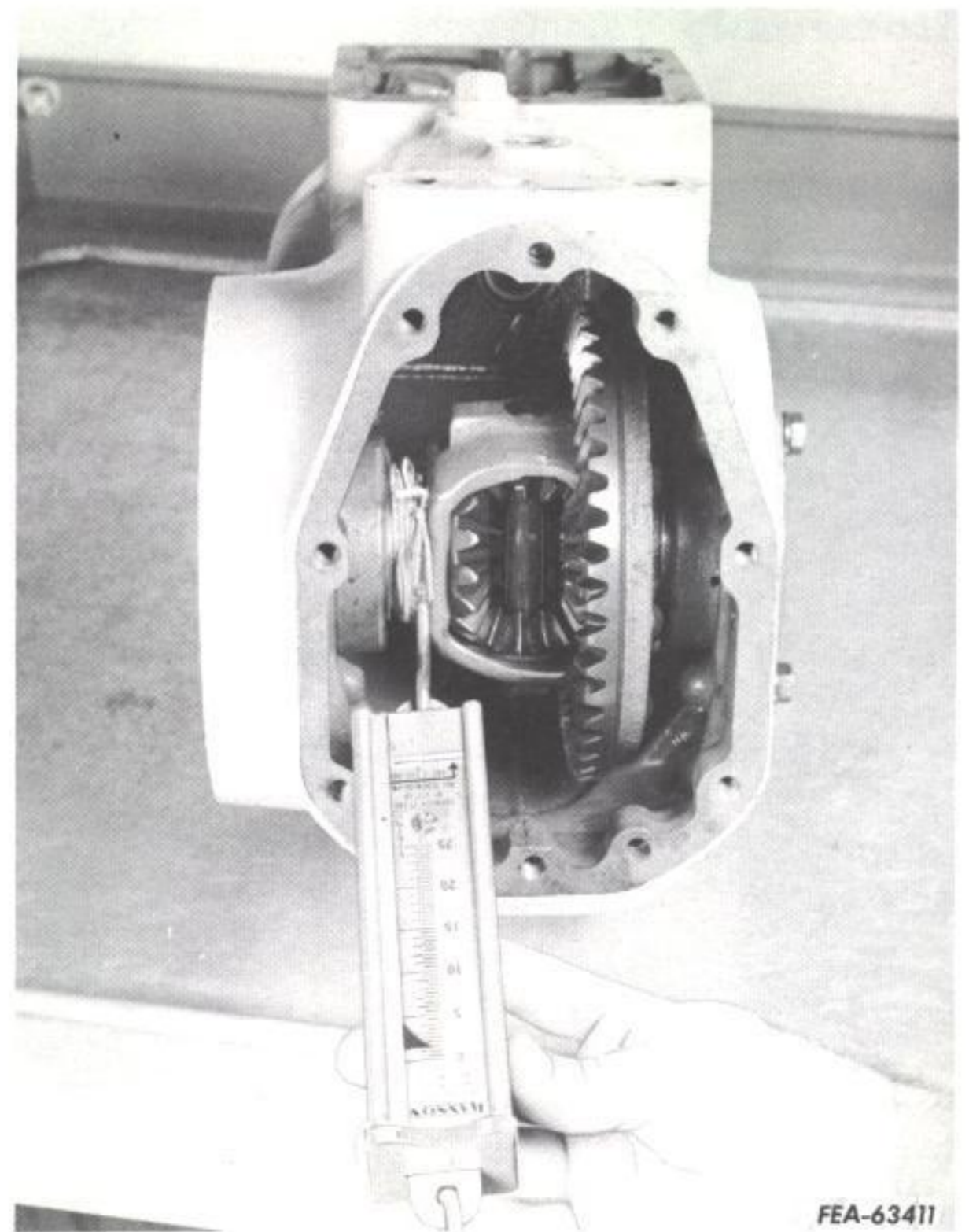
4. Inspect the housing for cracks, restricted oil passages or raised places on its machine faces. Smooth off raised places with a file.

Reassembly

Reassembly is basically the reverse of disassembly; however, particular attention should be given to the following steps. Refer to Illust. 2-22 for location of parts.

1. Be sure all bearings are thoroughly lubricated.

2. The transmission mainshaft needle bearing must be installed with its oil hole aligned with the oil hole in the housing.



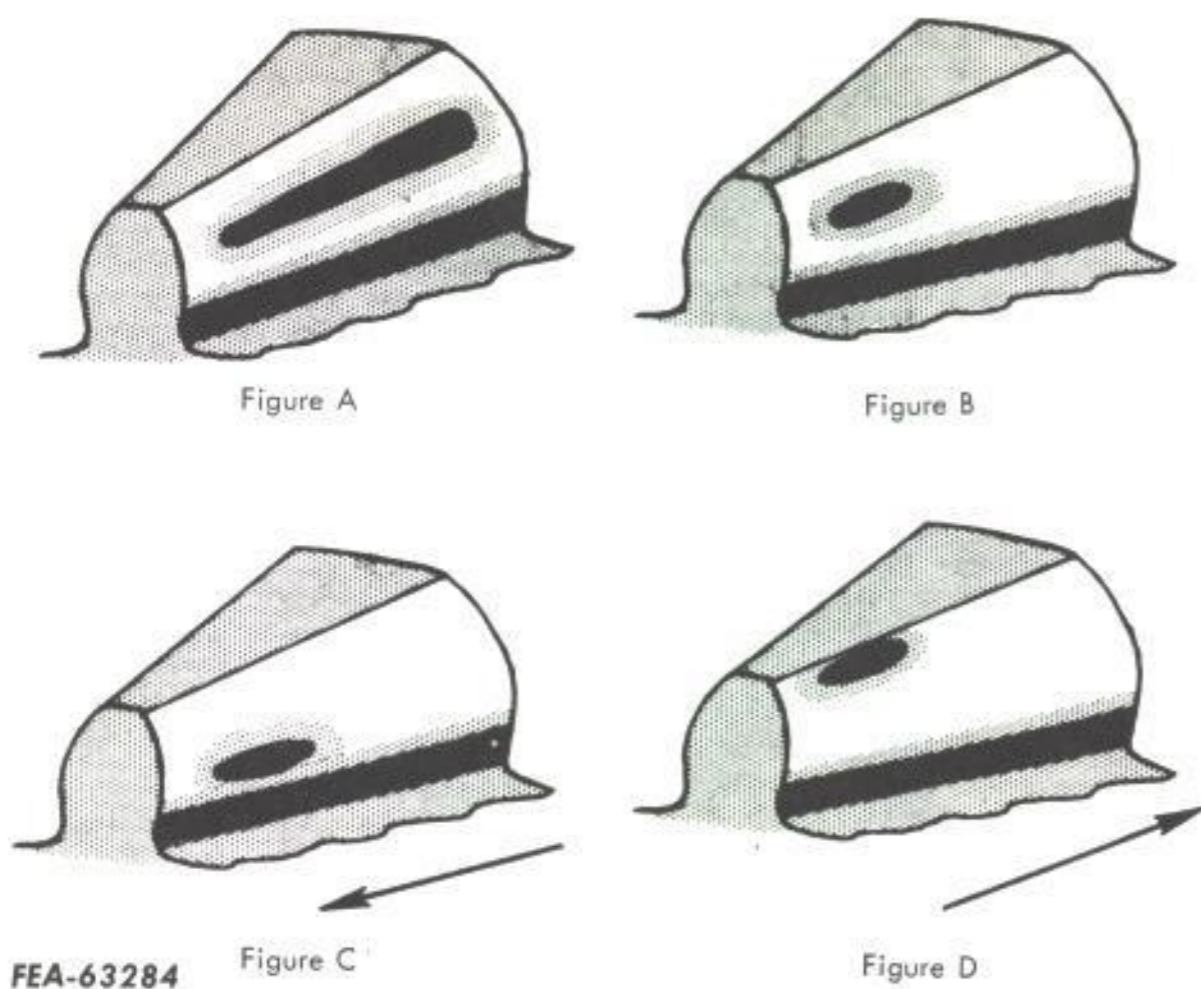
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Illust. 2-24. Checking pre-load of differential bearings.

3. Assemble the differential, carrier bearings, cages and shims. Check bearing pre-load and adjust as necessary before replacing the transmission countershaft. Install or remove shims as necessary. Pre-load is correct when a steady pull of one to three pounds is necessary to rotate the differential assembly as shown in Illust. 2-24.

4. Remove the differential assembly, keep the shims with the cages then install the transmission countershaft, bearings, gears, spacers, front bearing retainer, shims and nut (Illust. 2-22). Tighten the nut to 85 ft. lbs. Tighten retainer cap screws to 20 ft. lbs.

5. Install the differential assembly, keeping the pre-load shim pack correct as previously established. Drive gear must be on the right with teeth facing left.



Illust. 2-25. Tooth bearing pattern.

6. Check the backlash between the drive gear and pinion and the gear teeth bearing pattern as follows. Refer to Illust. 2-25.

7. Apply a thin coat of red lead or prussian blue to the bevel pinion teeth faces, then rotate the gears by hand and observe the bearing pattern.

Some deflection will occur under load. Allowance is made in gear design to prevent concentration of load on tooth edges.

8. Hand testing and very light loads should provide a pattern as shown in Figure "B" Illust. 2-25. When load and deflection increases the pattern will progress as in Figure "A".

9. The desirable (no load) pattern in Figure "B" is the result of adjusting the bevel gear lateral position to the specified range of .003" to .005" backlash.

10. Tooth bearing position from the root to the crown of the tooth is controlled by lateral position of the pinion. If low tooth bearing on bevel pinion is indicated (as shown in Figure "C") the pinion must be adjusted toward the bevel gear. If high tooth bearing on the bevel pinion is indicated (as shown in Figure "D") the pinion must be adjusted away from the bevel gear.

NOTE: If it is necessary to move the pinion in or out to correct "Root-to-crown" bearing, the bevel gear must also be moved laterally to maintain the specified backlash.

11. Stake the countershaft nut by center-punching the face of the nut over a spline groove. Refer to Illust. 2-23.

12. Continue the assembly in reverse order of disassembly.

13. Fill housing to proper level with specified lubricant.

NOTE: Creeper attachment has its own lubricant separate of the transmission. Fill creeper at breather and check at side plug in creeper housing.

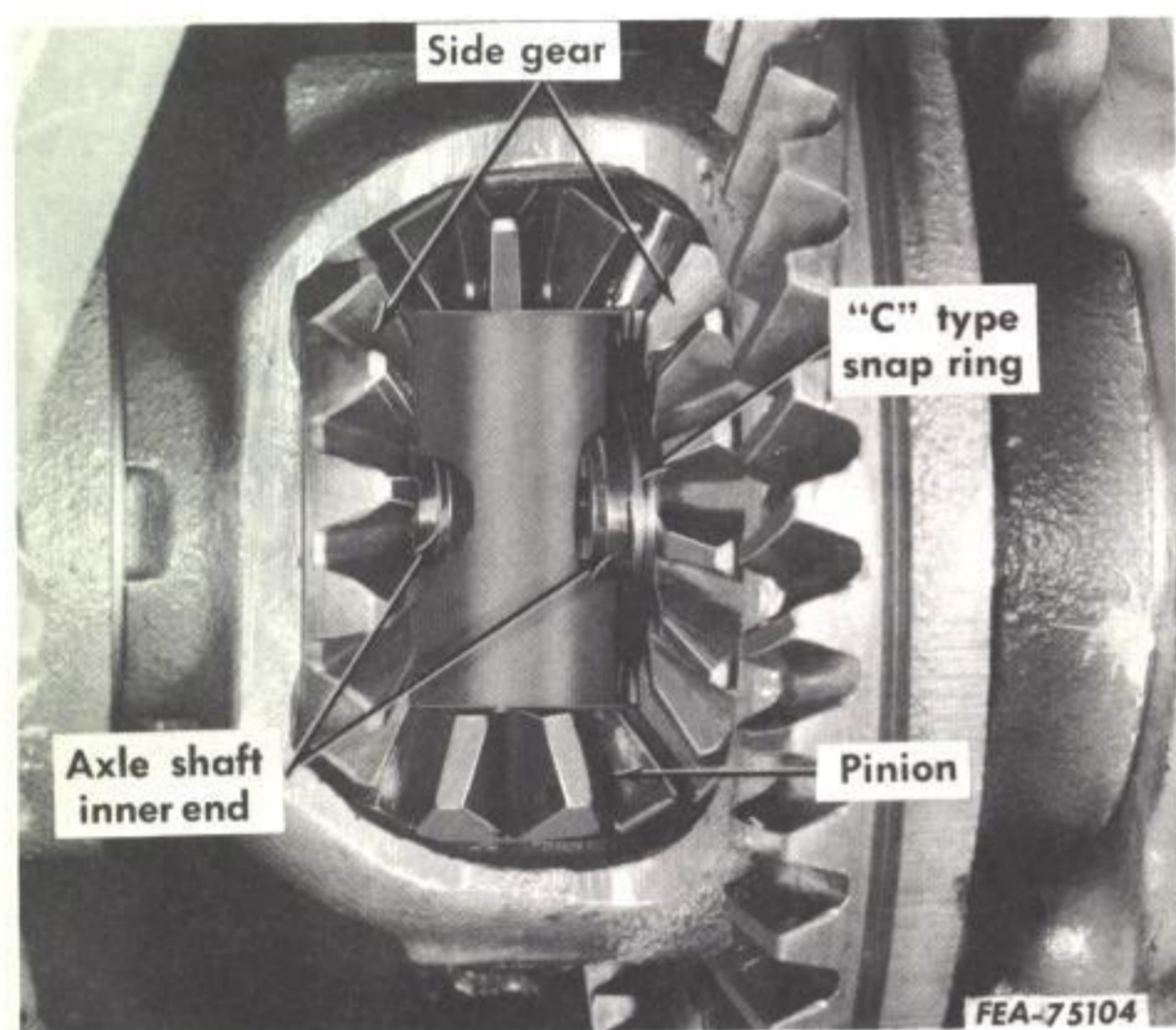
REAR AXLE

Removal

1. Drain the transmission lubricant.

2. Stabilize the tractor by driving wooden wedges between the front axle and frame on each side and block the front wheels. Refer to Illust. 2-14.

3. Remove the drawbar and differential housing rear cover.



Illust. 2-26. Differential and rear axle assembly.

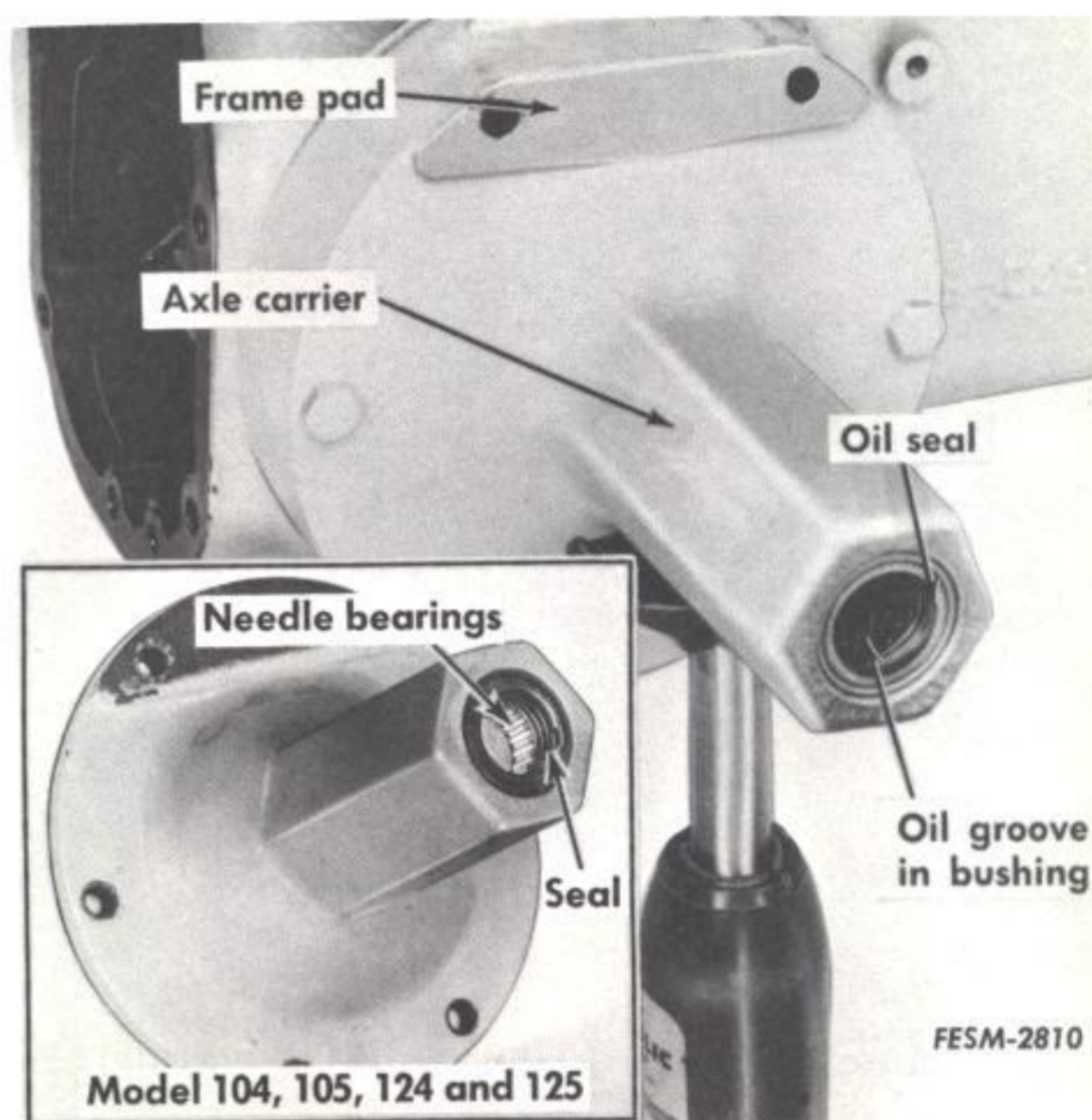
4. Place a jack under either rear axle carrier and raise the rear wheel off the floor. Remove the "C" type snap ring from the axle shaft inner end. Refer to Illust. 2-26.

5. Slide the axle out of the differential side gear and axle carrier. Refer to Illust. 2-27.

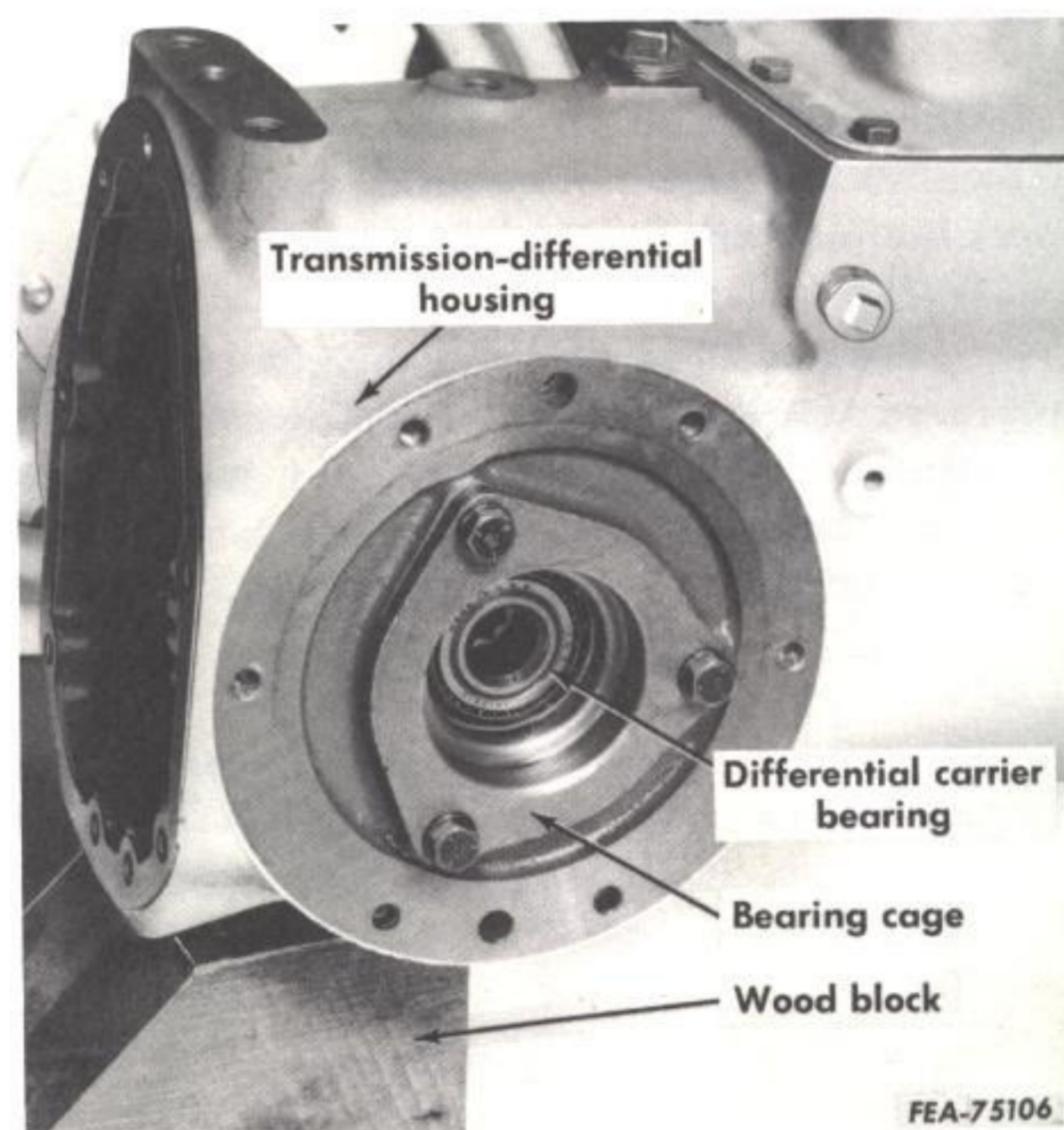
6. Support the transmission - differential housing on a block and remove the axle carrier. Refer to Illust. 2-28.

7. Press the carrier bushing from the carrier.

8. Drive the oil seal from the carrier.



Illust. 2-27. Rear axle removed.



Illust. 2-28. Rear axle carrier removed.

9. Clean the gasket surface of the axle carrier and differential housing.

Inspection

1. Inspect the axle shaft for wear at the oil seal area, bearing location and splines on the inner end.
2. Roll the axle shaft along a flat surface to detect any warping or bending.
3. Check the axle carriers for cracks or breaks. Remove any high spots from the gasket surface with a flat file.

Reassembly

1. Press a new bushing into the axle carrier. (Model 72 only.) The oil groove must be at the bottom. Press a new needle bearing into the axle carrier on 104, 105, 124 and 125 Models. (Illust. 2-27.)
2. Press a new oil seal into the axle carrier.

3. Using a new gasket, install the axle carrier to the differential housing. Cap screw threads should be coated with a non-hardening sealer (permatex) to avoid oil leaks. The frame pad of the axle carrier must be to the top as shown in Illust. 2-27.

4. Fill the cavity between the lips of the oil seal with chassis lube or heavy oil.

5. Lubricate the axle shaft and bushing then slide the shaft through the seal, bushing, carrier and differential side gear. Rotate the axle as it is pushed through to avoid damage to the seal. Wipe off excess lubricant.

6. Install a new "C" type snap ring to the inner end of the axle shaft.

7. Replace the rear cover and drawbar.

8. Fill differential housing to proper level with specified lubricant.

HYDROSTATIC TRANSMISSION

Models 105 and 125

Principles of Hydrostatics

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

A simple hydrostatic drive is shown in Illust. 2-29. A 10 lb. force on "pump" piston (A) creates 10 psi pressure on the fluid connecting the "pump" and "motor". Since the fluid under pressure exerts 10 psi equally and in all directions, the "motor" piston (B) moves up with a force of 10 lbs. since its area is 1 square inch. If the "pump" piston (A) is moved 1 inch, the "motor" piston (B) will also move 1 inch since its area is the same area as the pump piston.

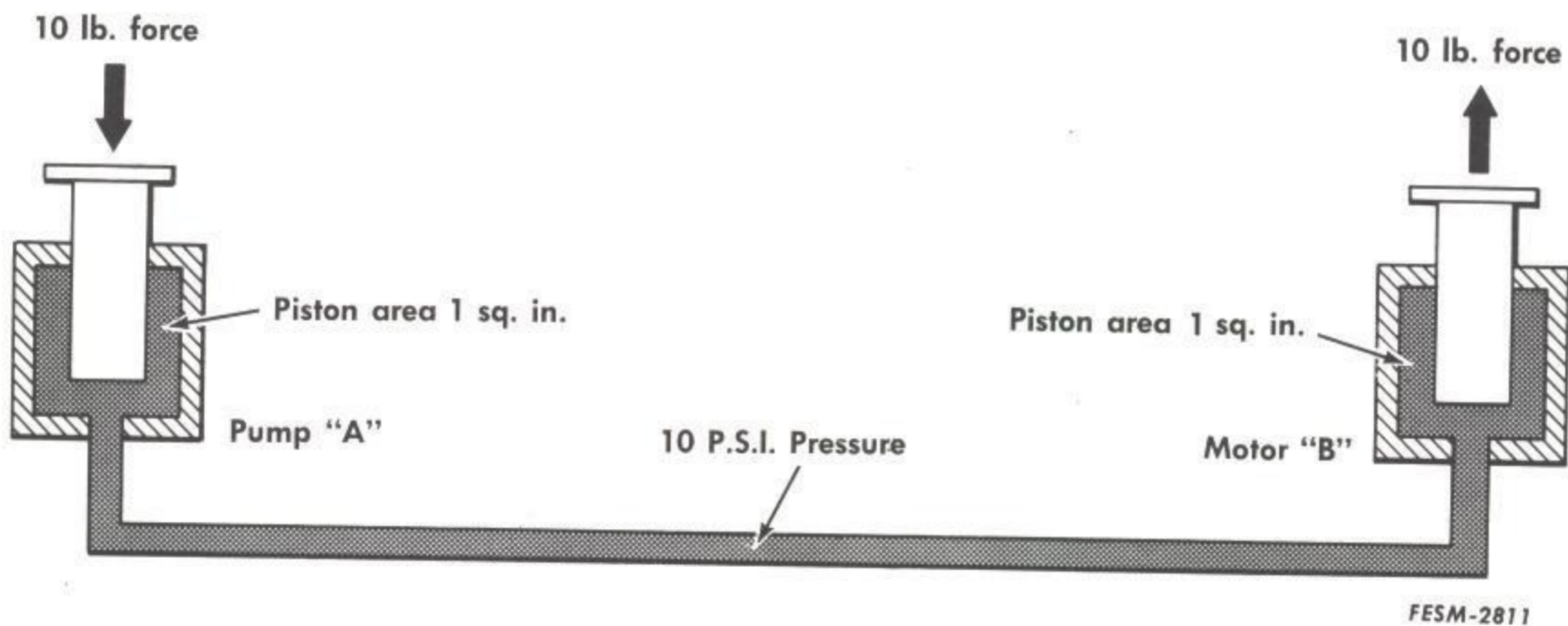
This illustrates the basic principles in their simplest form. Modern hydrostatic

transmission consist of multiple piston pumps and multiple piston motors arranged in a manner so as to continuously perform the transfer of energy shown in Illust. 2-29.

The piston pump is designed with a rotating shaft which imparts a reciprocating motion to its pistons, pumping fluid in a continuous stream to a motor which accepts the fluid under pressure in its pistons, which in turn imparts a rotating motion to the motor shaft. This arrangement is still based on the basic principles shown in Illust. 2-29.

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

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



Illust. 2-29. Simple hydrostatic transmission.

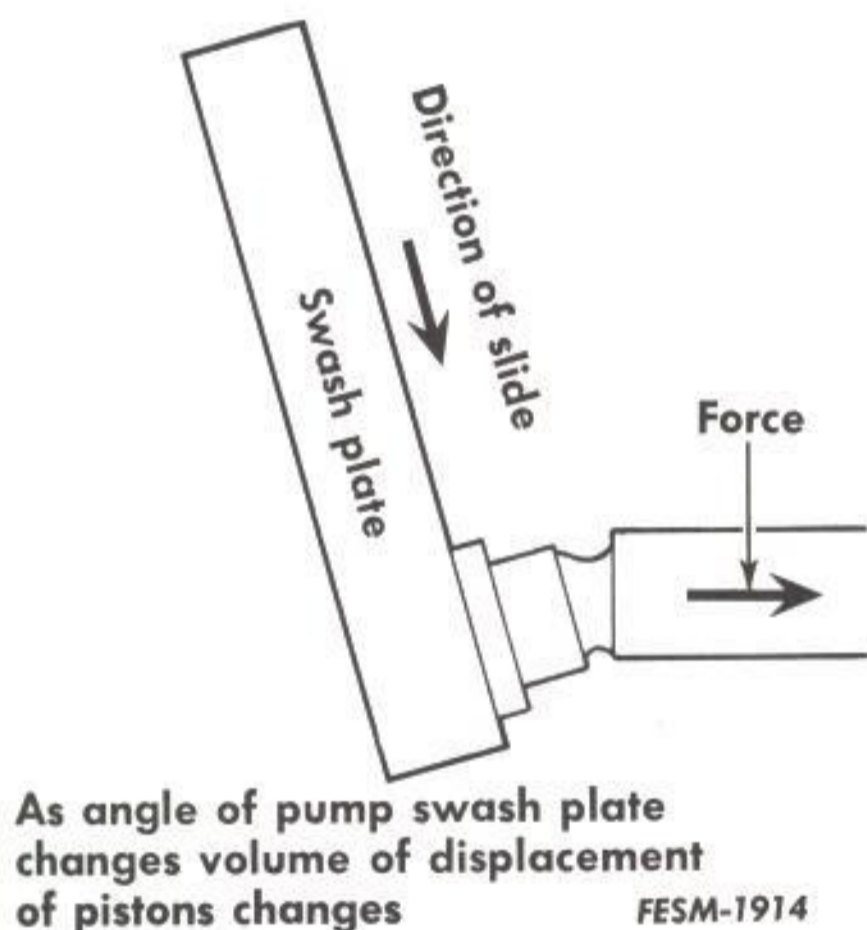
Since infinite control of these three basic items is possible, it therefore follows that a hydrostatic drive is infinitely controllable. Infinite control over the rate of fluid flow results in control of the output speed. Infinite control over the direction of fluid flow results in control of the rotation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

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

How It Works

(Refer to foldout at back of manual)

Variable Displacement Pump and Fixed Motor



Illust. 2-30. Swash plate and piston.

The pump drive shaft is coupled to the engine drive shaft. Nine (9) pistons are located in the cylinder block and they reciprocate in the cylinder block as it rotates. The distance they reciprocate depends on the angle of the swash plate, Illust. 2-30. The drive shaft and cylinder block assembly are the only parts that rotate. The pump cylinder block always rotates the same direction as the engine.

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

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

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

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

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

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

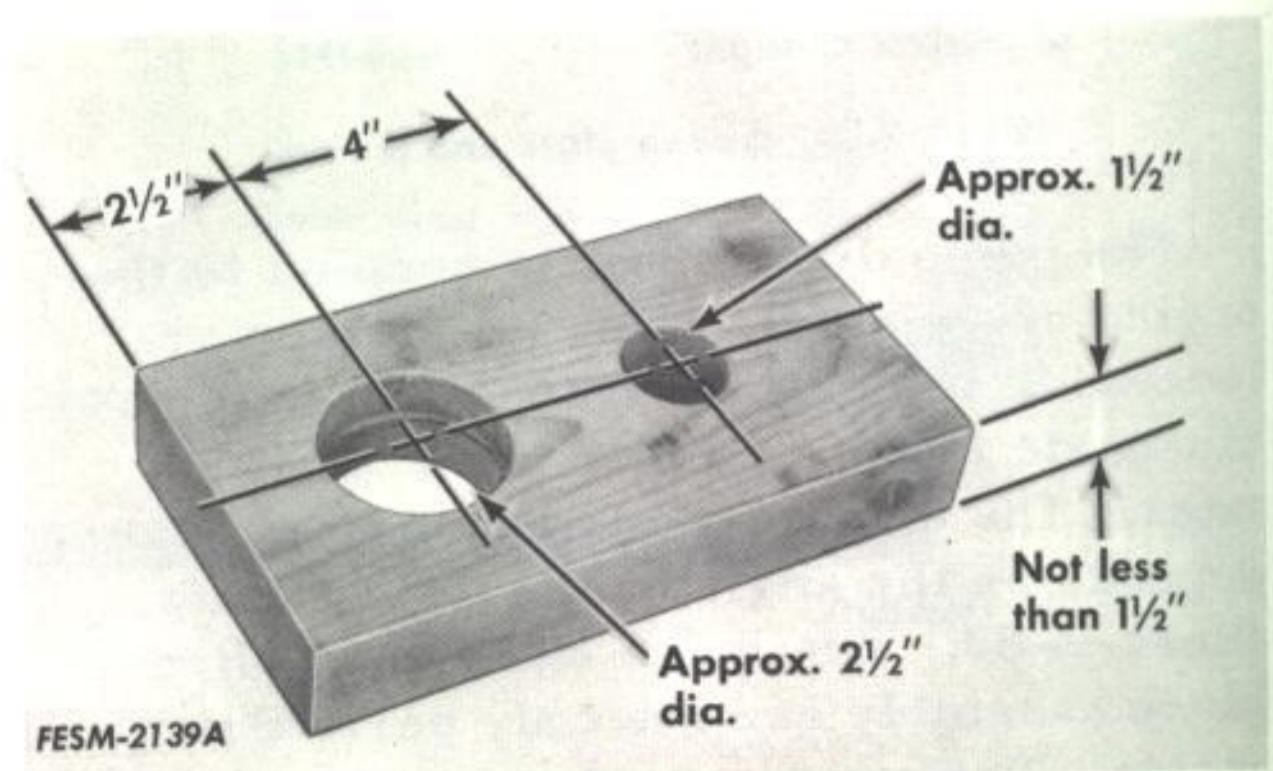
The motor used is an axial piston fixed displacement motor of the same design as the pump. A splined output shaft is splined to the cylinder block and is driven by it. As fluid under pressure is introduced from the pump, force is exerted against the pistons in the motor cylinder block. Since the swash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

motor cylinder block. See Illust. 2-30. As the cylinder continues to rotate fluid is expelled. When the swash plate angle is moved beyond vertical, fluid under pressure is introduced by the pump into the opposite kidney and the motor cylinder block and output shaft will rotate in the opposite direction. There is very little flow of high pressure fluid. The charge pump furnishes fluid to make up for leakage and to furnish circulation for cooling.

The only connection between the pump and motor is the hydraulic porting in the center section referred to above as kidneys.

General Information

A holding fixture, made of wood, is necessary to conveniently service this unit. Refer to Illust. 2-31 for dimensions.



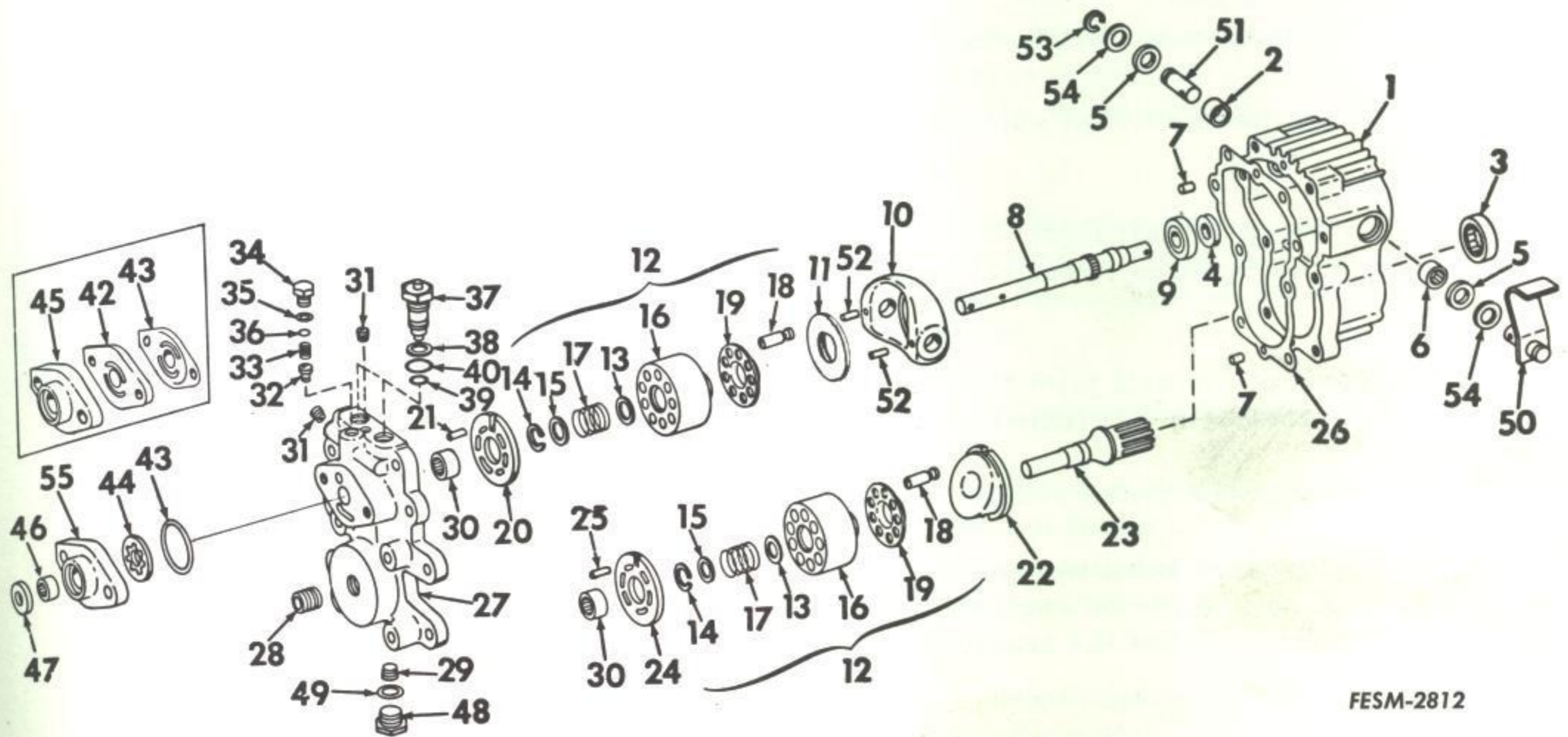
Illust. 2-31. Holding fixture.

Refer to Illust. 2-32 for additional reference to the parts described during service procedures in this manual.

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

must be taken to prevent damage during disassembly and reassembly.

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



FESM-2812

Illust. 2-32. Exploded view of the hydrostatic transmission.

- | | | |
|----------------------------|----------------|--------------------|
| 1. Housing | 19. Retainer | 37. Valve assembly |
| 2. Not serviced separately | 20. Plate | 38. Washer |
| 3. Bearing | 21. Pin | 39. O-ring |
| 4. Seal | 22. Swashplate | 40. O-ring |
| 5. Seal | 23. Shaft | 41. Gasket |
| 6. Bearing | 24. Plate | 42. Plate |
| 7. Pin | 25. Pin | 43. O-ring |
| 8. Shaft | 26. Gasket | 44. Rotor assembly |
| 9. Bearing | 27. Housing | 45. Housing |
| 10. Swashplate | 28. Fitting | 46. Bearing |
| 11. Plate | 29. Plug | 47. Seal |
| 12. Kit | 30. Bearing | 48. Plug |
| 13. Washer | 31. Plug | 49. O-ring |
| 14. Ring | 32. Cone | 50. Shaft assembly |
| 15. Washer | 33. Spring | 51. Shaft |
| 16. Block | 34. Plug | 52. Pin |
| 17. Spring | 35. O-ring | 53. Ring |
| 18. Piston assembly | 36. Shim | 54. Washer |
| | | 55. Housing |

SPLITTING AND RECOUPLING THE TRACTOR

Model 105 and 125

Splitting the Tractor

NOTE: Disconnect battery ground cable.

1. Remove the seat, seat support and fenders.
2. Disconnect the tail light wire (if so equipped) at the junction under the seat support.
3. Disconnect the ball joint (13) from the speed control cam (6), (Illust. 2-33.)
4. Disconnect the brake rod (Illust. 2-36).
5. Drive small wooden wedges between the front axle and frame on each side to stabilize the front end of the tractor. (Illust. 2-14.)

6. Block the front wheels in the front and back. (Illust. 2-14.)

7. Place a jack under the lift handle cross shaft. (Illust. 2-14.)

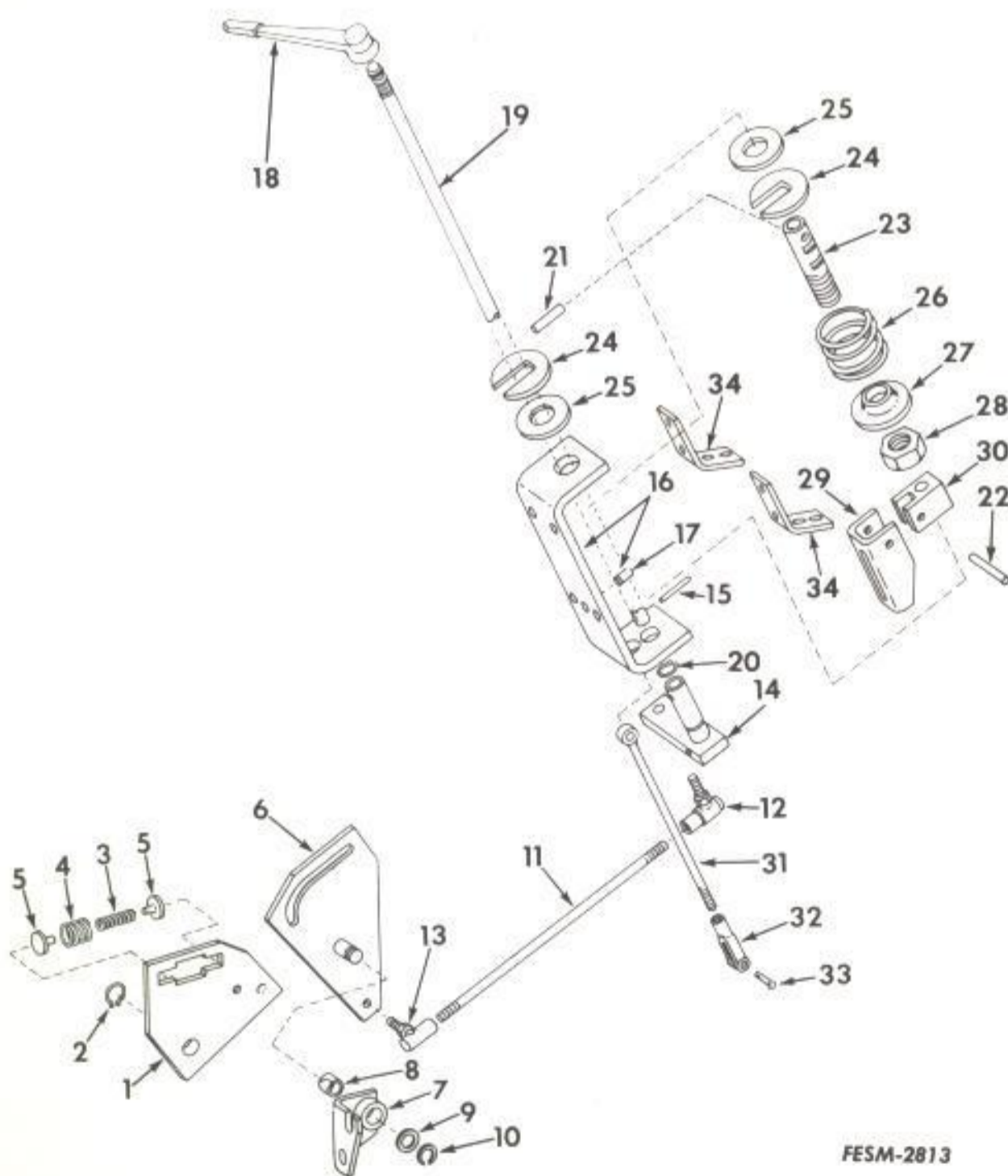
8. Remove six cap screws (three each side) from the frame (Illust. 2-34).

9. Move the transmission-differential rear end assembly rearward far enough to permit access to the hydrostatic unit.

Recoupling the Tractor (Hydrostatic)

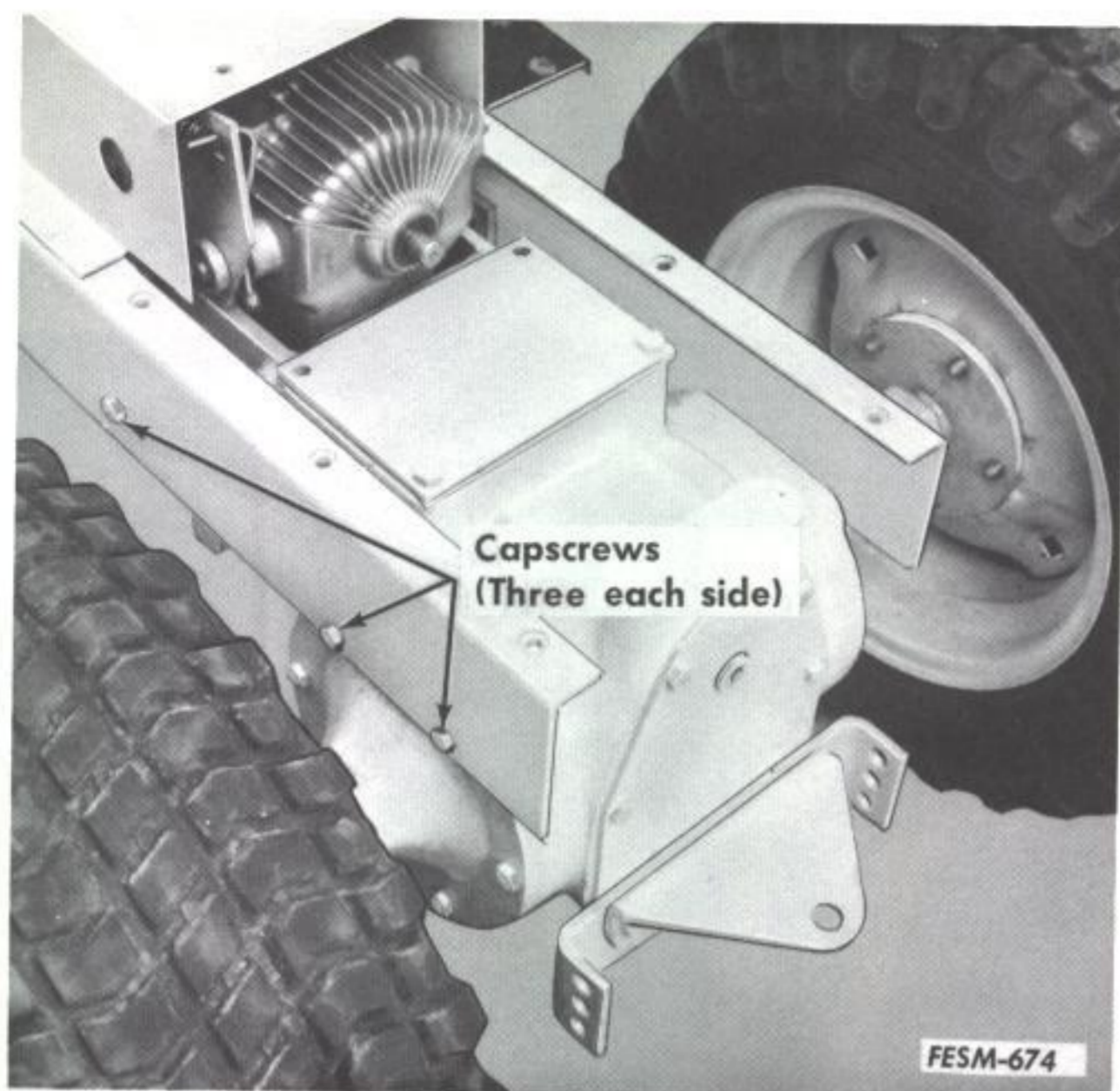
1. Tip the unit into recoupling position and lubricate the cam slot with chassis lubricant.

2. Fill the transmission-differential case with seven (7) quarts of Hy-Tran fluid.



Illust. 2-33. Exploded view of transmission controls.

- | | |
|------------------------------|--------------------------------|
| 1. Damper spring | 16. Bracket |
| 2. Retaining ring | 17. Dowel pin |
| 3. Spring (light) | 18. Handle |
| 4. Spring (heavy) | 19. Rod |
| 5. Guide pin | 20. Ring |
| 6. Speed control cam | 21. Dowel pin |
| 7. Bracket | 22. Dowel pin |
| 8. Bushing | 23. Frictional adjusting shaft |
| 9. Washer | 24. Retainer |
| 10. Retaining ring | 25. Washer |
| 11. Speed control rod | 26. Spring |
| 12. Ball joint (L.H. thread) | 27. Washer |
| 13. Ball joint (R.H. thread) | 28. Stop nut |
| 14. Lever assembly | 29. Cam channel |
| 15. Slotted pin | 30. Swivel cam |
| | 31. Rod |
| | 32. Clevis |
| | 33. Pin |
| | 34. Brace |



Illust. 2-34. Location of frame capscrews.

3. Re-couple the split sections of the tractor being sure of the following:

a. That the brake rod goes over the lift handle cross shaft. Be sure to guide the drive shaft through the fan shroud and air baffle plate.

b. That the dowel pin on the front end of the drive shaft is positioned to engage the slot in the drive plate hub on the engine.

4. Install and tighten securely the three cap screws on each side of the frame.

5. Connect the brake rod (Illust. 2-36).

Speed Control Lever Linkage and Cam Bracket Adjustment

NOTE: The brake pedal must be properly adjusted before beginning the speed control adjustment. Refer to page 2-19.

If the tractor "creeps" in the "N" position or, if the speed control linkage has been disassembled or removed for any reason, the following adjustment must be made.

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

a. Remove the battery.

b. Place a small wedge between the hand-control mounting bracket and the adjusting nut. Refer to foldout at back of manual.

c. Move the lever towards the "F" or forward position to tighten the nut.

d. Remove the wedge.

e. Check the friction adjustment with a scale. The reading should be 10 pounds when pulled in either direction from the offset in the lever.

f. Replace the battery.

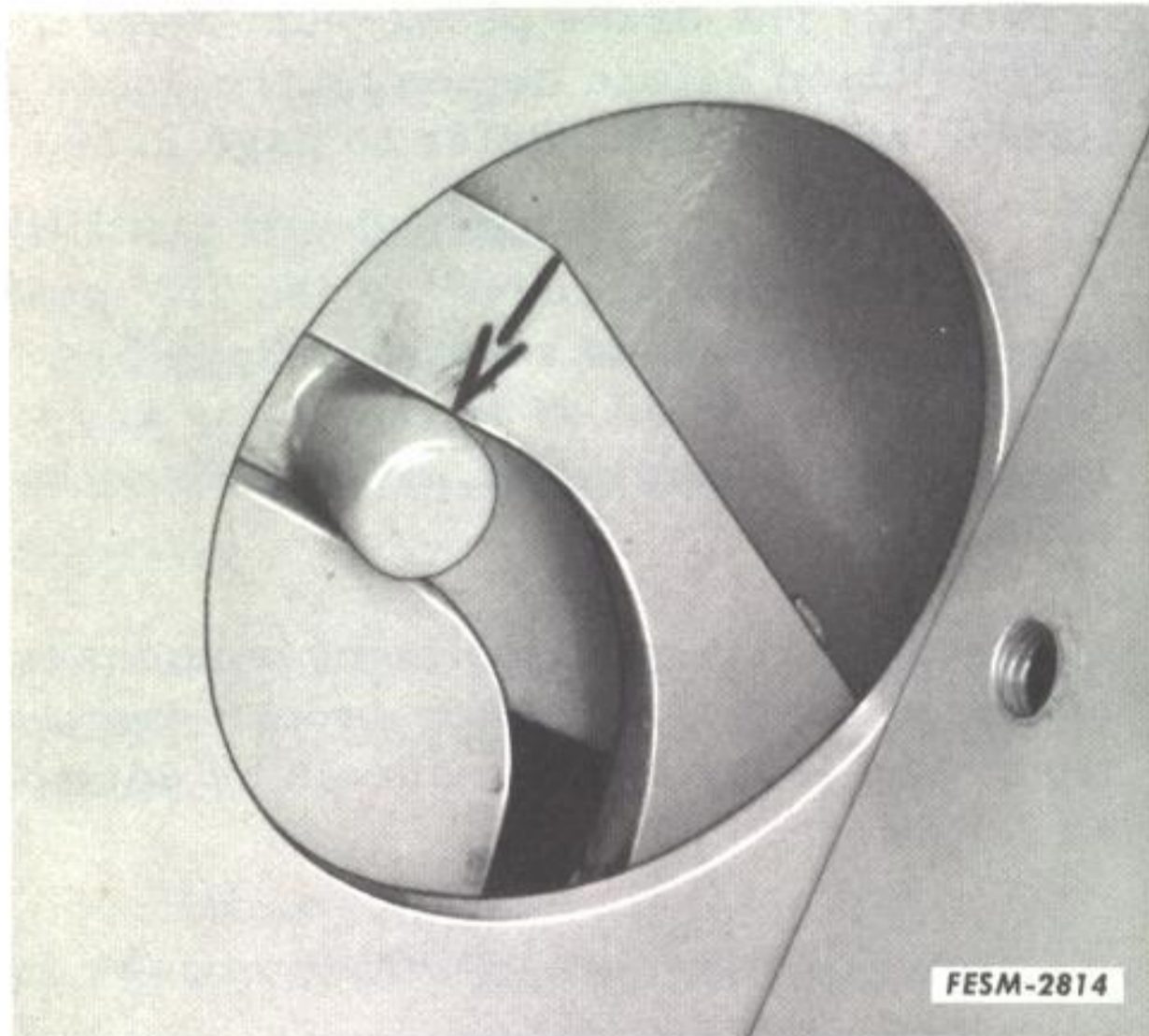
1. Block the tractor so the left rear wheel is off the ground and tractor is secured so it cannot move forward or backward.

2. Depress brake pedal and lock to set brake.

3. Disconnect connecting rod at the ball joint (13) (Illust. 2-33).

4. Loosen cam bracket mounting cap screws if not previously left loose (Illust. 2-45). Move the cam bracket to its lowest position in the slotted holes and tighten slightly to hold in position.

5. Start the engine and run at half throttle or faster.

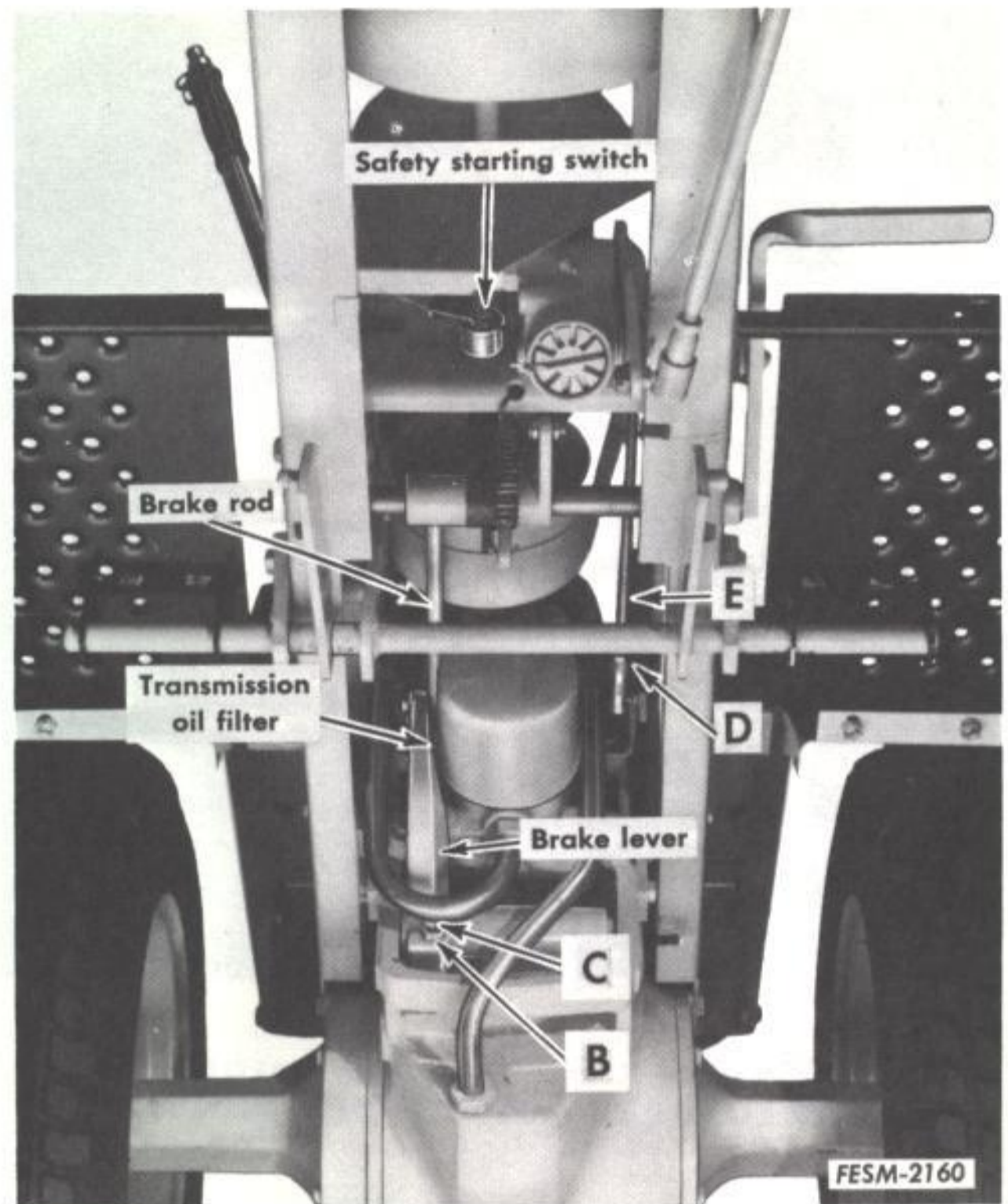


Illust. 2-35. Camplate with arrow and pin viewed through access hole in left side of frame.

6. With the engine running align the arrow with the pin as in (Illust. 2-35). At this position the hydrostatic unit is pulling against the brake. Adjust the cam bracket upward with a punch and hammer until a neutral condition is reached while the arrow and pin are kept aligned. Tighten the cam bracket cap screws. Connect the rod and ball joint to the cam plate.

Connect the rod and ball joint to the cam plate.

7. Release the brake pedal and move the speed control lever to the forward position. The wheel should rotate in the forward direction. Depress the brake pedal all the way down and release. The speed control lever should return to the "N" position and the wheel stops turning.



Illust. 2-36. Brake adjustments.

8. If the wheel continues to turn in the forward direction, loosen jam nut "D" and turn the connecting rod "E" to lengthen it until the wheel stops turning after depressing the pedal. (See Illust. 2-36.)

9. If the wheel turns in the reverse direction turn the connecting rod "E" to shorten it until wheel stops. Tighten the jam nut "D". (See Illust. 2-36.)

Charge Pump Service

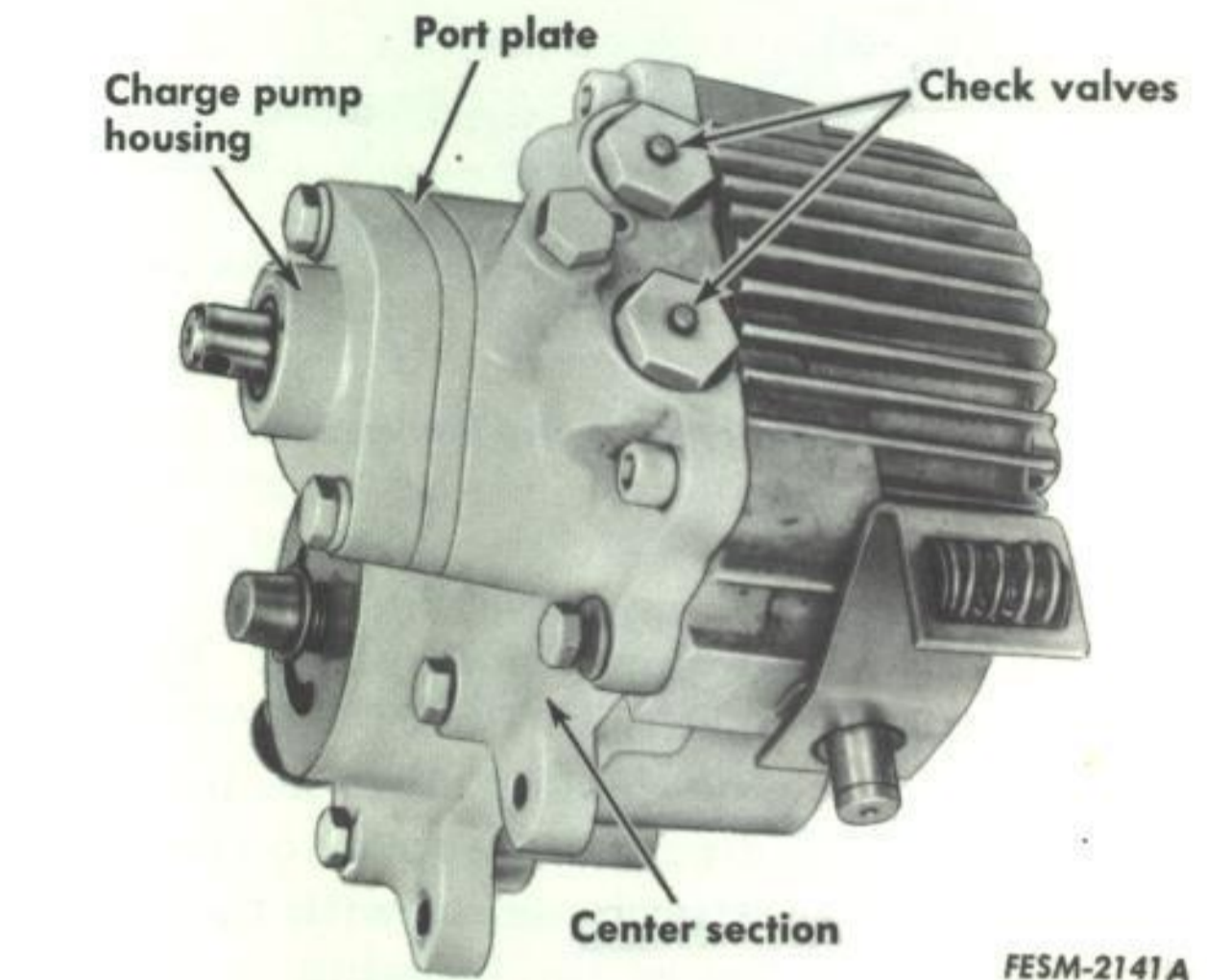
Two types of charge pumps may be found used in model 105 and 125 tractors. Both assemblies are illustrated in the following section.

Removal and Disassembly

NOTE: The charge pump can be serviced without removing the transmission from the tractor. However, the tractor must be split. Refer to Splitting and Recoupling the Tractor, page 2-34.

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

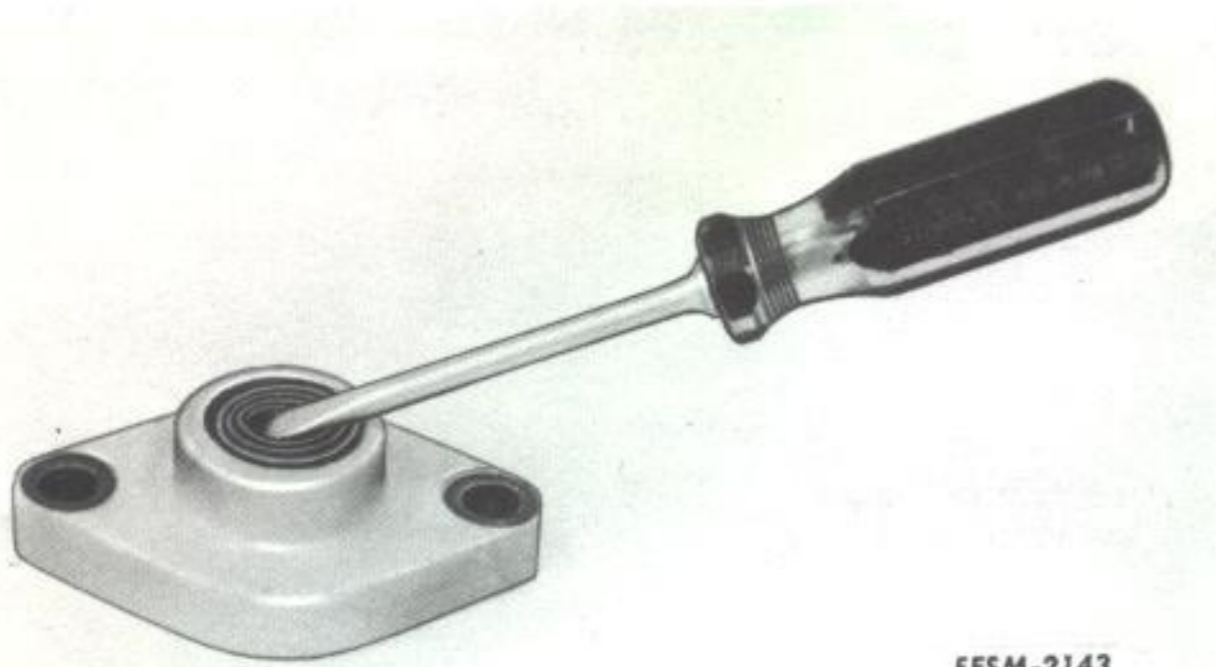
2. Remove the cap screws securing the charge pump housing to the center section housing (Illust. 2-37). Carefully remove the pump housing. The rotor assembly may stick to the housing. Do not drop the assembly.



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Illust. 2-37 Hydrostatic transmission.

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



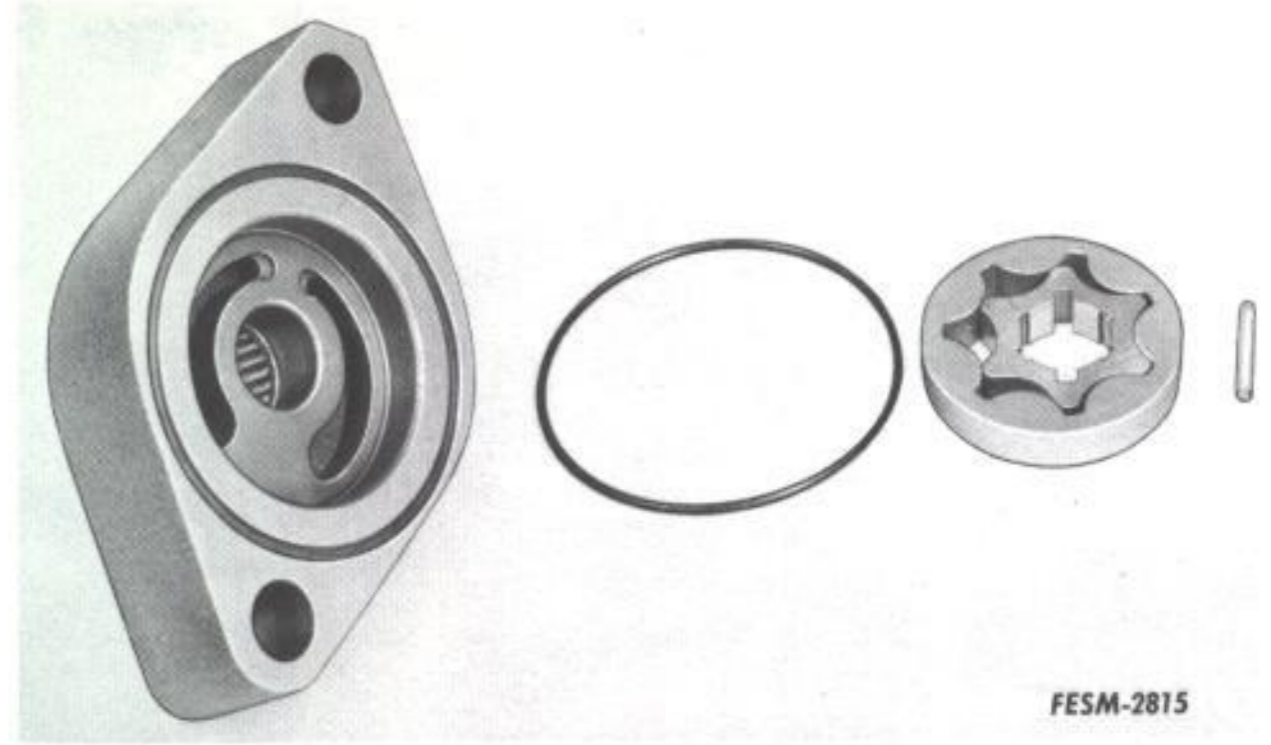
FESM-2143

Illust. 2-38. Removing the lip seal.

4. Remove the pump port plate. NOTE THE POSITION OF THE PORT PLATE GASKET. The new gasket must be installed with the circular groove to the top of the center section housing with the flat end toward the flat of the housing (Illust. 2-39)

5. Using a screwdriver, pry the lip seal out of the pump housing (Illust. 2-38).

6. Check needle bearing and replace if necessary (Illust. 2-40).



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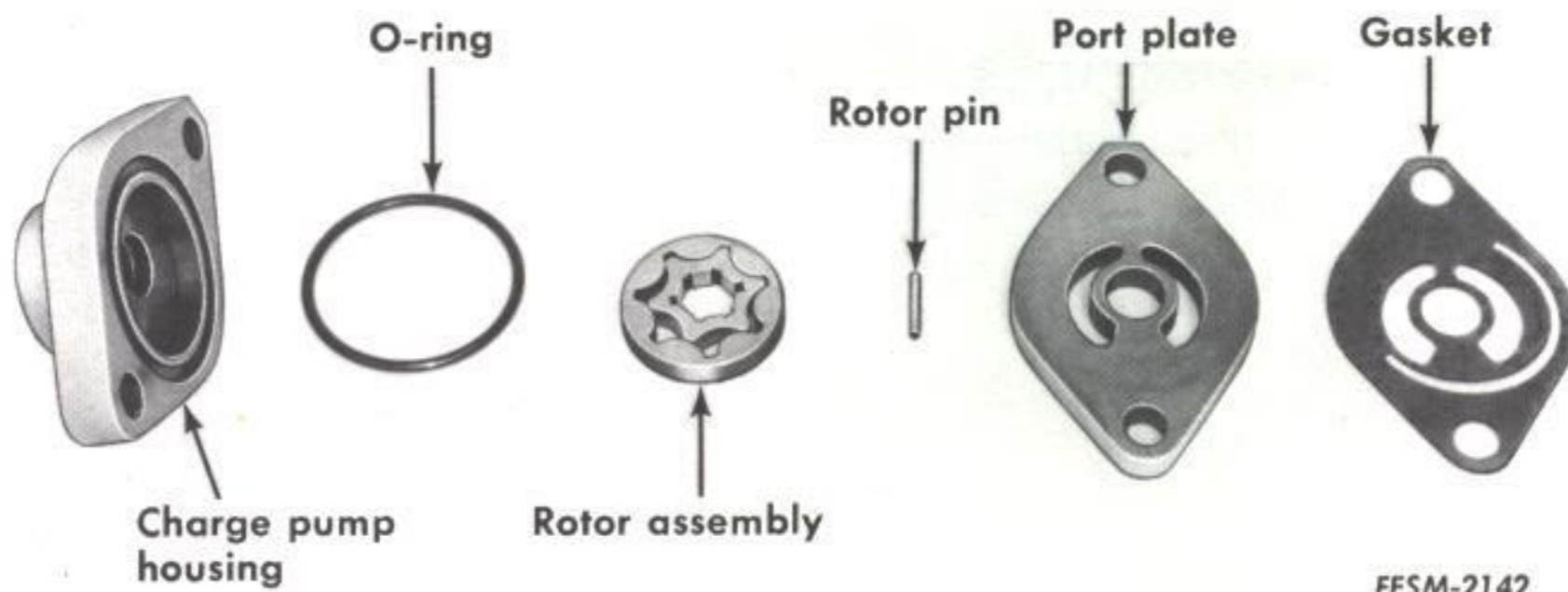
Illust. 2-40. Exploded view of charge pump less port plate and gasket.

Inspection and Repair

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

Inspect all parts for excessive wear or damage.

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



FESM-2142

Illust. 2-39. Exploded view of charge pump with port plate.

Reassembly and Installation

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

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

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

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

4. If required install the pump port plate gasket with the circular groove to the top of the center section housing and flat end toward the right side of the center section.

5. Install the port plate with the flat end toward the right side of the center section and the pump housing with the flat end toward the right side of the center section.

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

Charge Pump Relief Valve Service

The tractor must be split to service the relief valve. Refer to page 2-34.

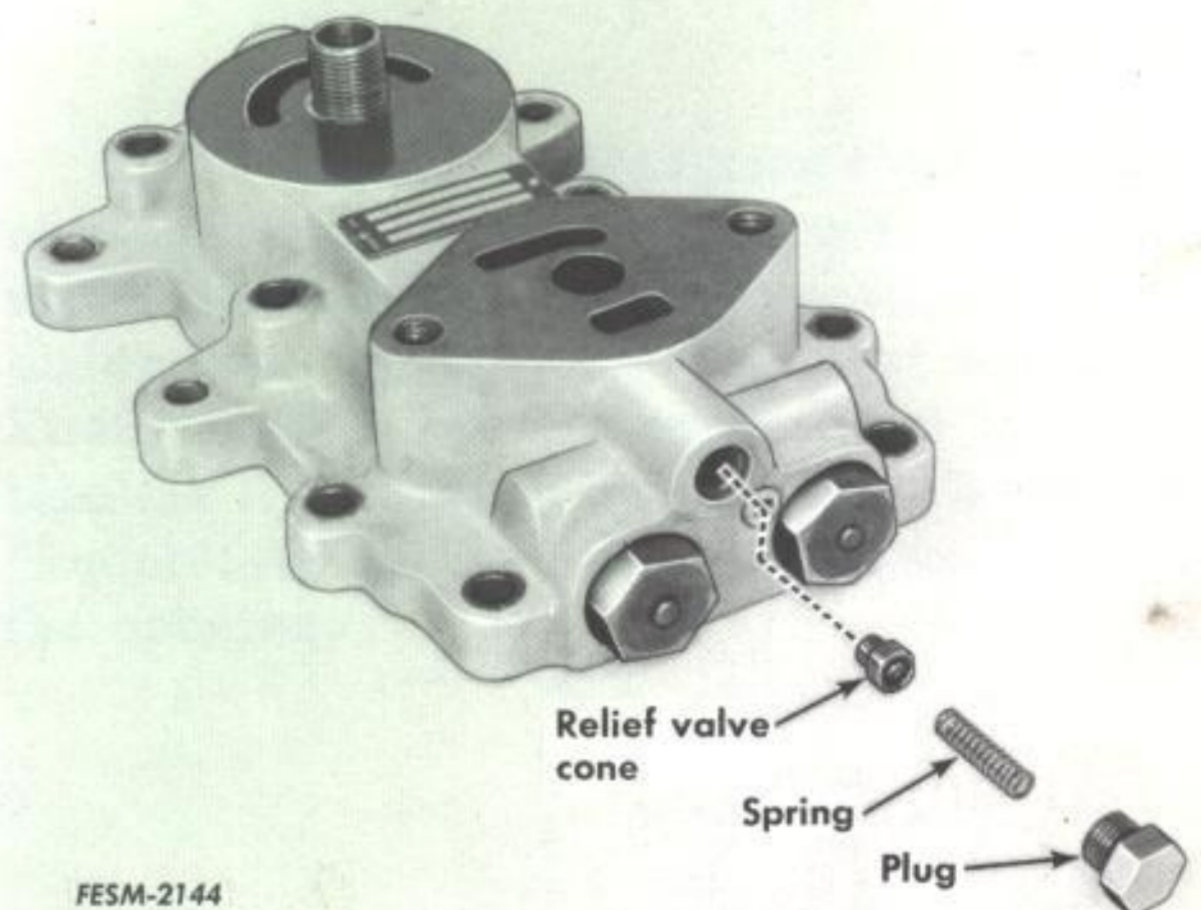
1. Remove the relief valve plug, shim pack (if any), spring and cone (Illust. 2-41) from the center section housing.

2. Wash and dry the components.

3. Check the spring for pitting and rust.

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

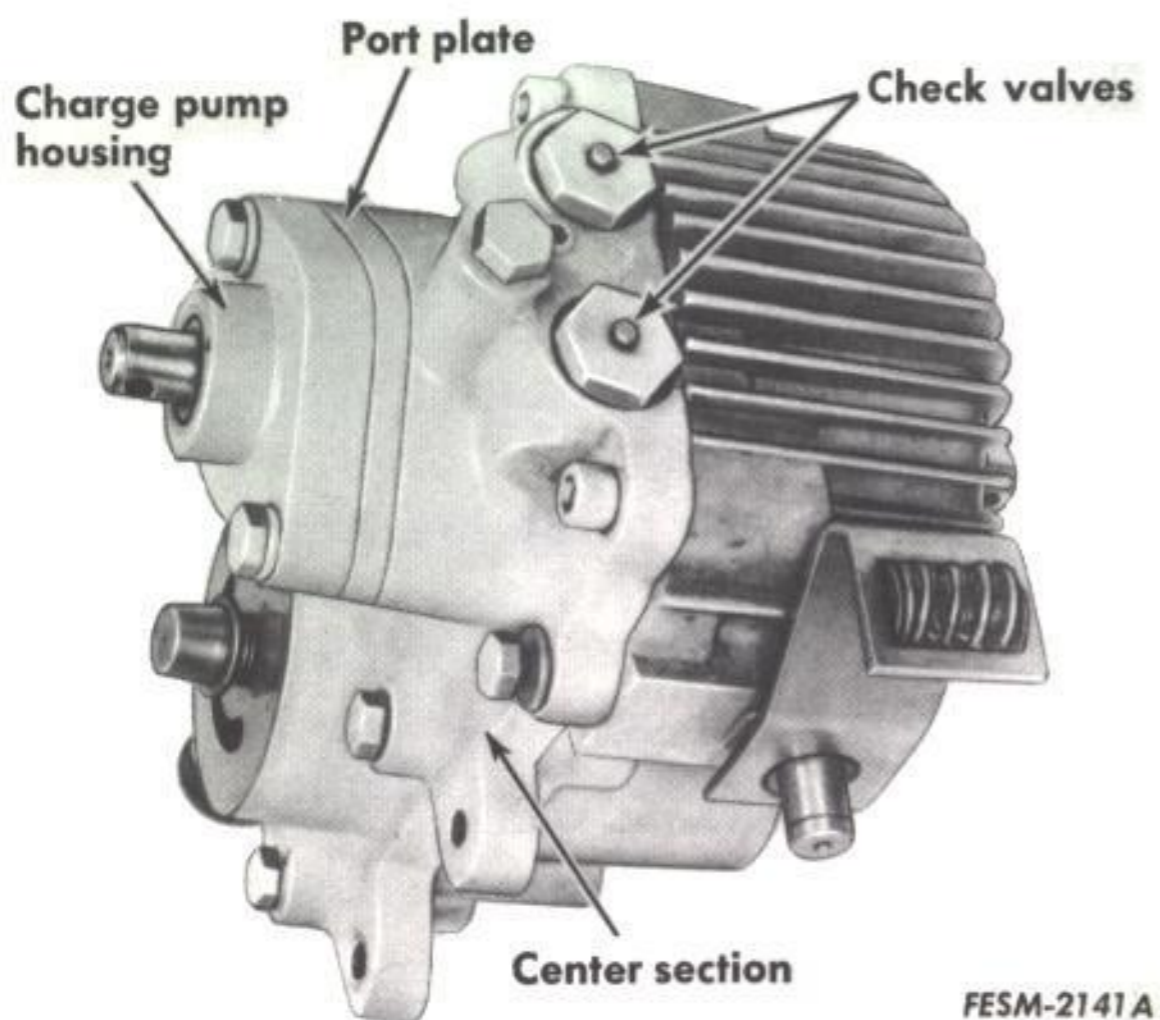
5. Install the relief valve in the reverse order of removal. Be sure to use a new O-ring on the plug.



Illust. 2-41. Relief valve removed.

6. Recouple the tractor and check the operation of the relief valve. Refer to "Trouble Shooting" on page 2-56.

Check Valve Service



Illust. 2-42. Center section housing check valves.

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

Remove the check valves from the center housing section.

Thoroughly wash the valves in clean solvent and air dry.

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

Replace all O-rings and back-up washers.

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

NOTE: The valves are identical, therefore they are interchangeable.

REMOVAL AND INSTALLATION OF HYDROSTATIC UNIT

Model 105 and 125

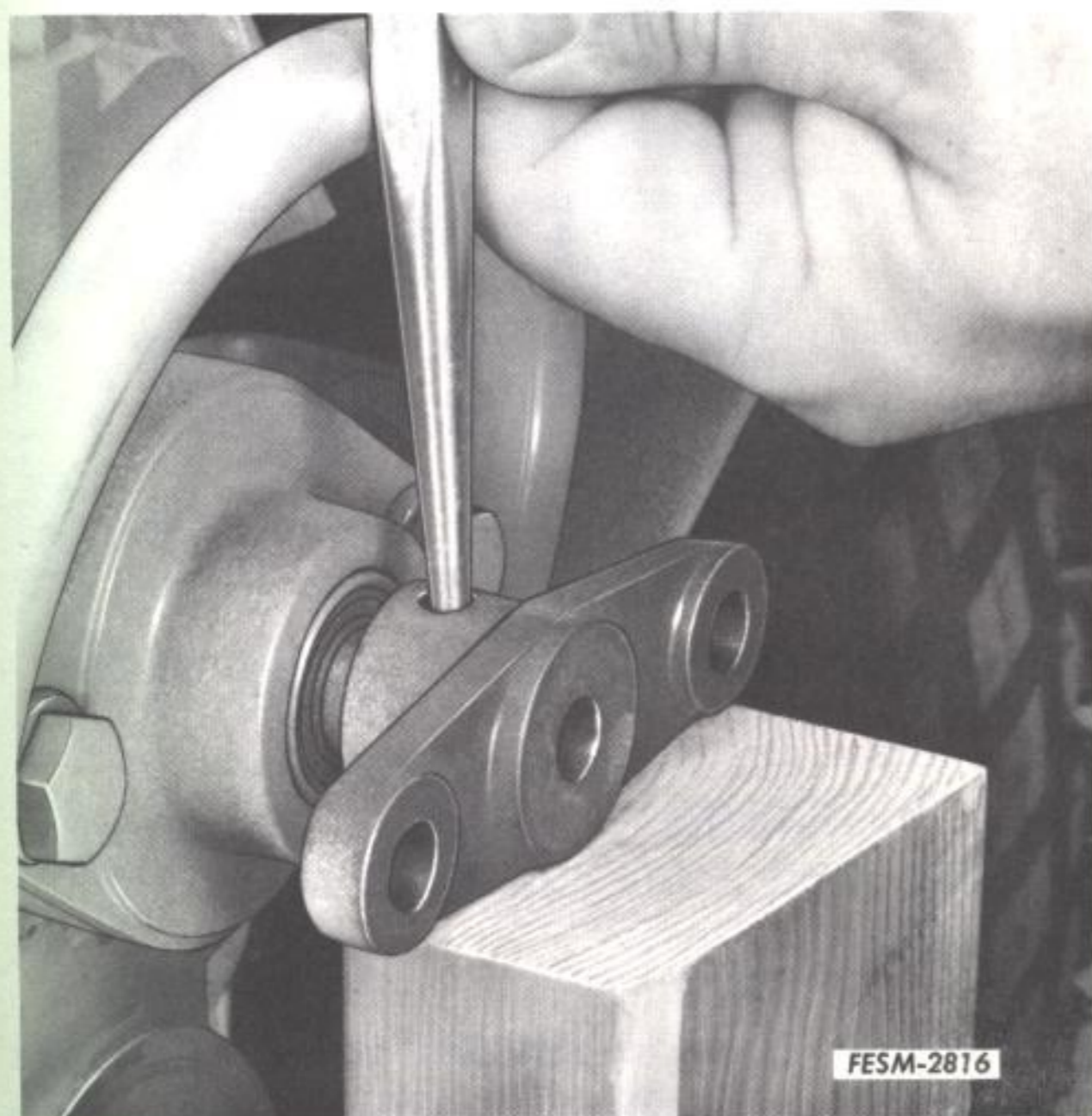
The following service information covers removal and replacement of the Hydrostatic unit.

Oil filter must be changed in the following intervals:

At 10 hours of operation
At 50 hours of operation
Every 150 hours - not to exceed one year.

Removal

1. Split the tractor. (Refer to page 2-34).
2. Loosen the transmission rear cover plate and drain the lubricant from the transmission-differential case.
3. Remove the oil filter. Plug the opening. Tape all openings.



Illust. 2-43. Removing coupling.

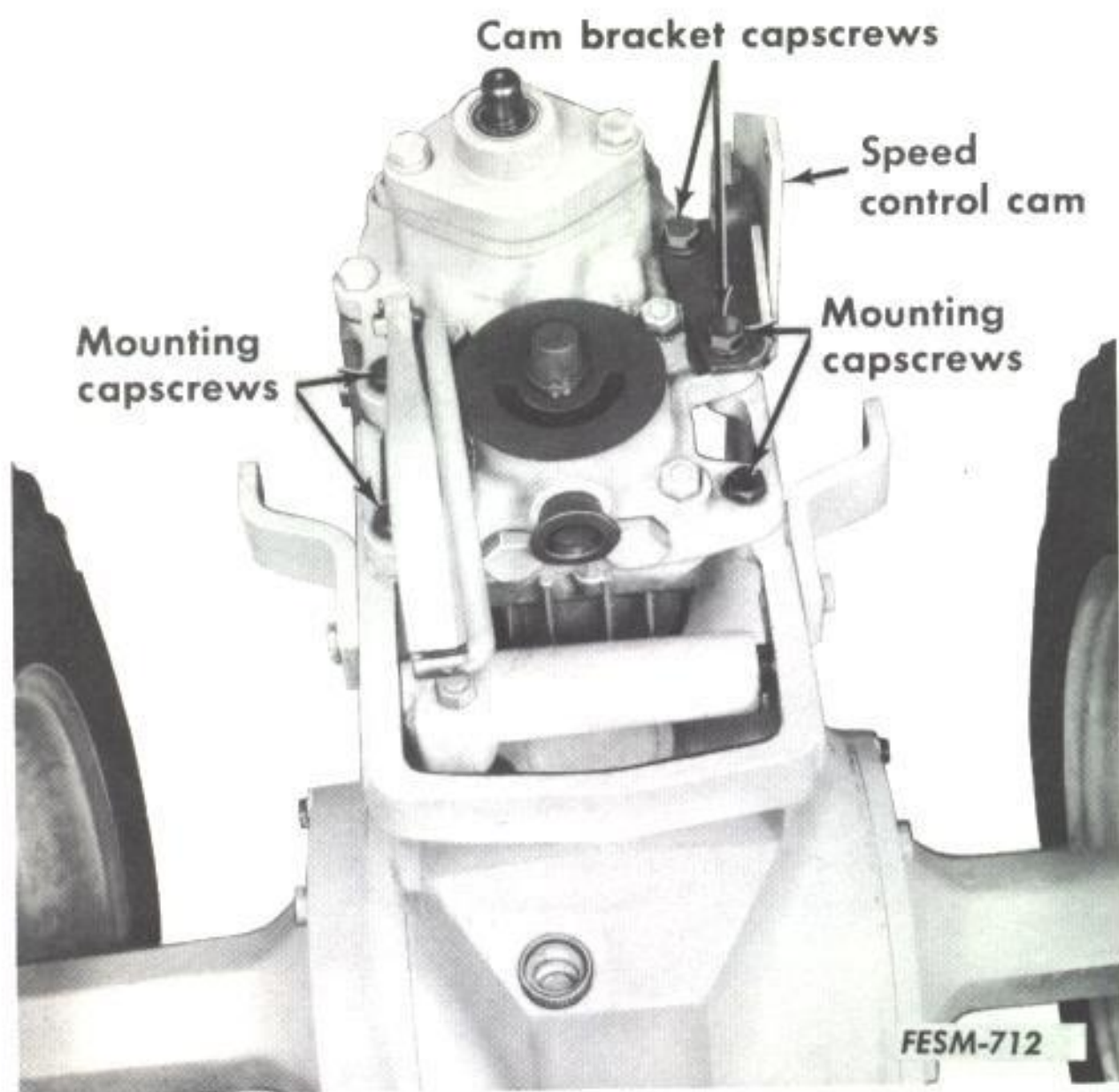
4. Block the rear wheels and support the coupling as shown in Illust. 2-43.

5. Remove the pin securing the coupling to the hydrostatic unit shaft. (Illust. 2-43.)



Illust. 2-44. Suction tube partially removed.

6. To remove the suction tube it will be necessary to loosen both connections. Lift up on the end of the tube that goes into the differential case to move it part way out. Then, remove the end of the tube that goes into the hydrostatic unit (Illust. 2-44). Completely remove the tube. Plug or tape the openings.



Illust. 2-45. Location of speed control cam bracket.

NOTE: Index the cam bracket to the housing for ease of reassembly.

7. Remove the cam bracket cap screws (Illust. 2-45) and remove the bracket and speed control cam assembly. If it is necessary to service this assembly, remove the snap ring that holds the speed control cam in the bracket.

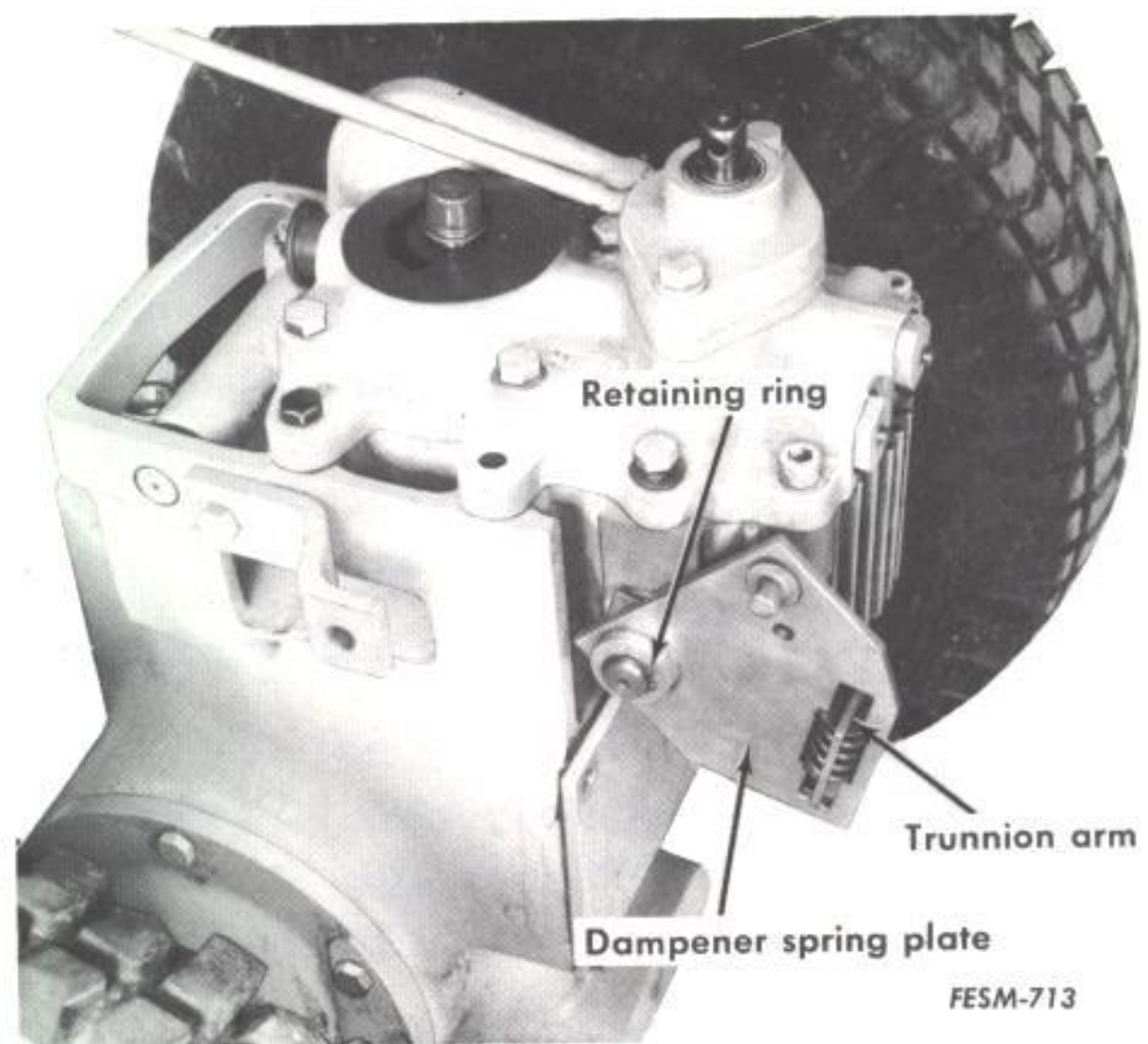
8. Remove the retaining ring that secures the dampener spring plate to the unit (Illust. 2-46). Remove the plate.

9. Remove the springs and the guide pins from the trunnion arm (Illust. 2-46).

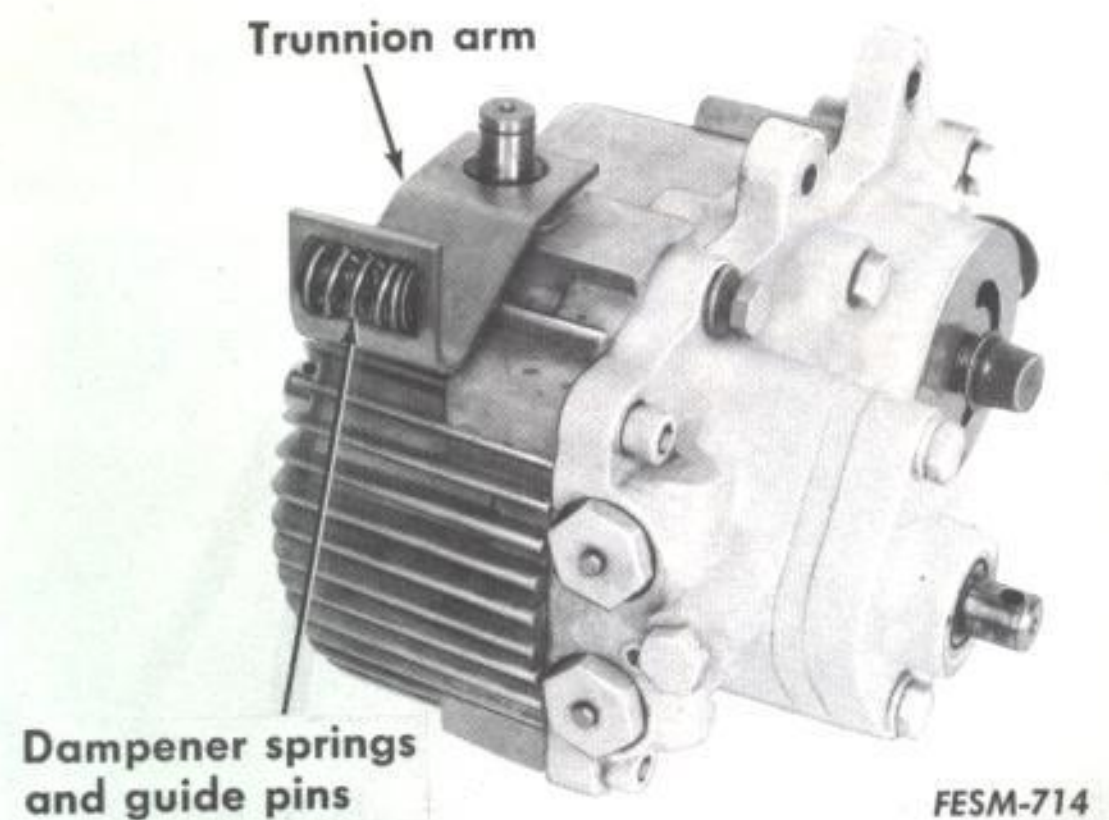
10. Remove the three remaining mounting cap screws (Refer to Illust. 2-45) and remove the unit.

Installation

1. **IMPORTANT:** Prior to attaching a new hydrostatic drive replacement unit onto the differential case, squirt oil into the drain which is directly underneath the motor output shaft and the filter port. Turn the unit upside down to allow oil to flow into the passages. Rotate the input pump shaft and output motor shaft to insure free rotation.



Illust. 2-46. Location of dampener spring plate retaining ring.

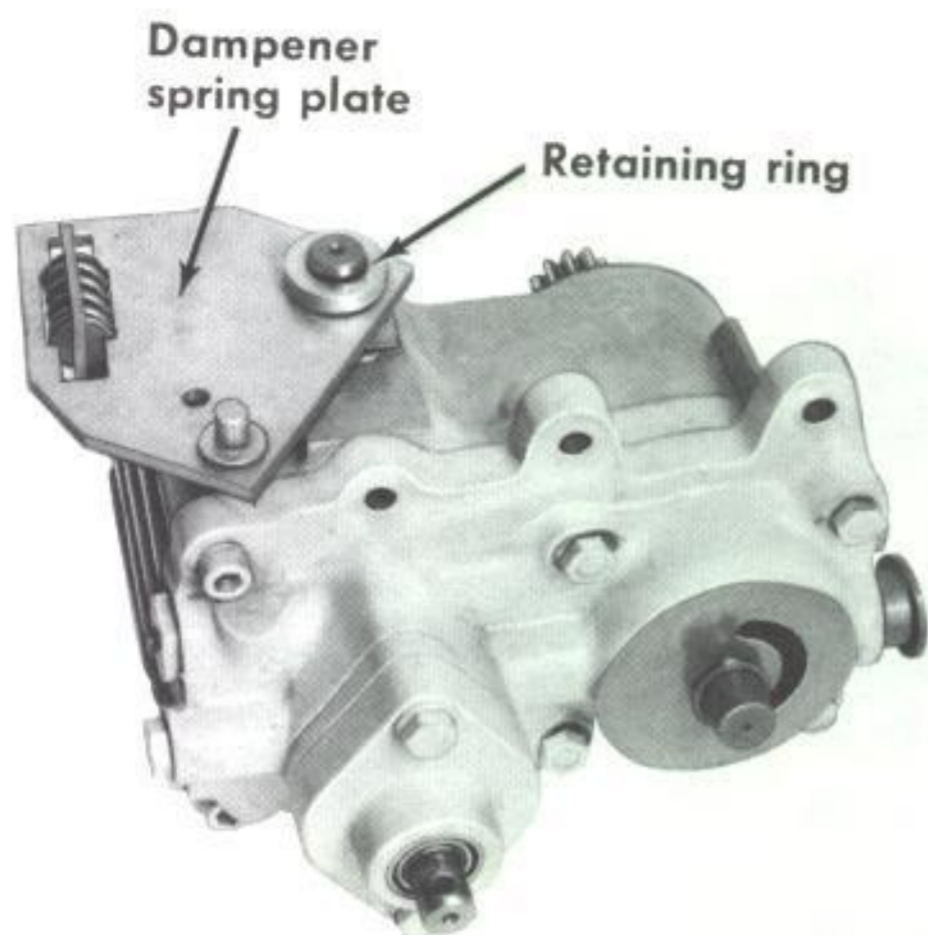


Illust. 2-47. Dampener springs and guide pins installed.

2. Install the light and heavy dampener springs with guide pins into the trunnion arm (Illust. 2-47).

3. Install the dampener spring plate and secure it to the shaft with the retaining ring (Illust. 2-48).

4. If the speed control cam was removed from the bracket, reassemble it and install the retaining ring.



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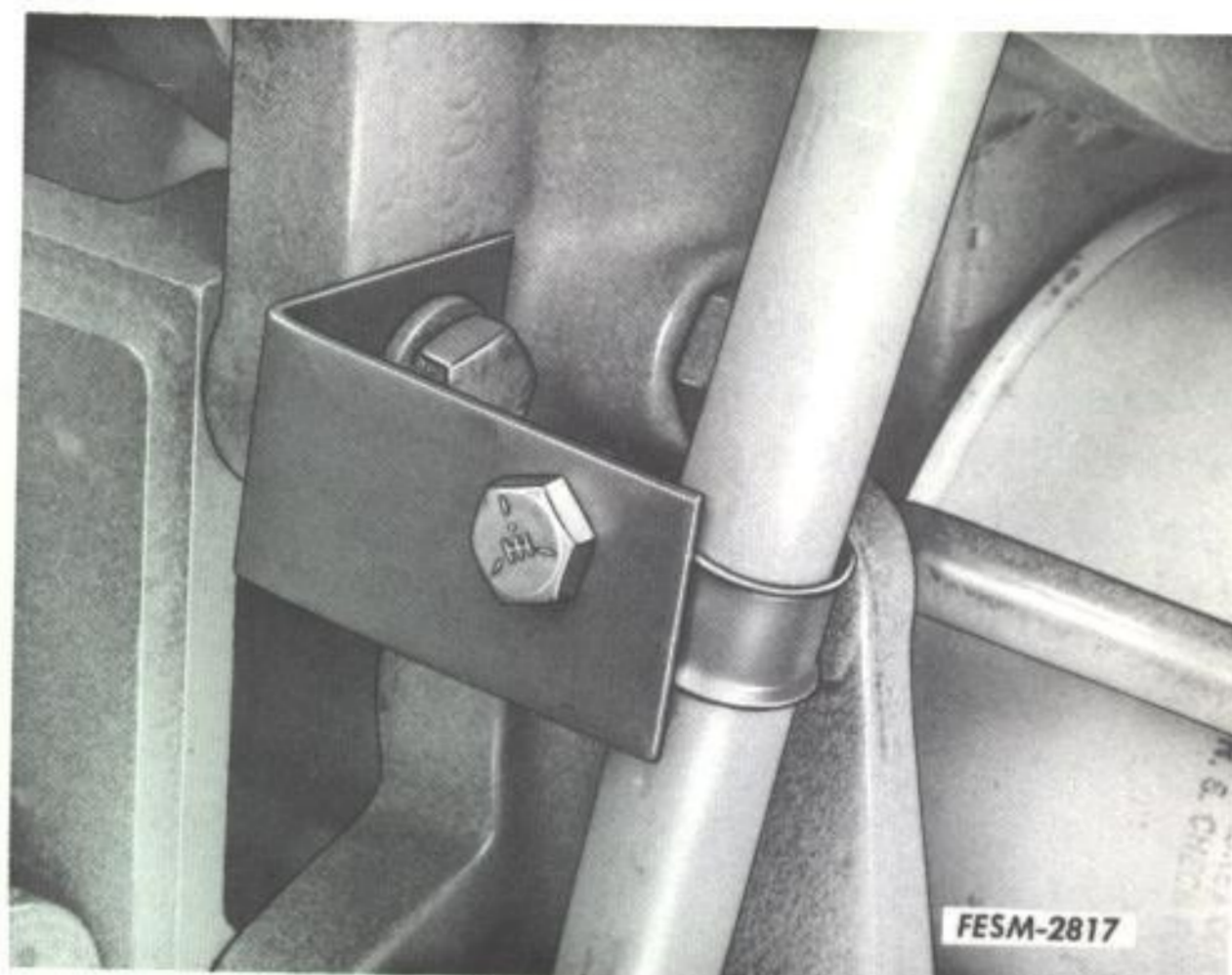
Illust. 2-48. Dampener spring plate installed.

5. Install the cam and bracket assembly on the unit so it is at the bottom end of the slot and fasten it in place just snug using the slotted end of the bracket as a fastening point. Be sure there is a washer between the cap screw and the bracket.

NOTE: The elongated hole in the bracket is also used as a mounting bolt hole. Do not install this cap screw at this time.

6. Using a new gasket, install the unit on the differential case and fasten it securely with the three cap screws. Torque the cap screws to 30 ft. lbs. (Illust. 2-45). The mounting cap screw that goes through the cam bracket should be tightened just snug as further adjustment is necessary after recoupling of tractor.

7. Install the oil tube on the unit. Install the differential case end of the tube first, then the end that goes into the hydrostatic drive unit. Be sure the ferrules seat in their shoulders in the cases. Start the nuts and screw them in until they just touch the ferrules, then tighten the nuts 1/4 turn only.



Illust. 2-49. Suction line bracket and clip installation.

It is suggested that the stabilizer bracket 406 866 R1 and clip 406 867 R1 be installed on the suction line (Refer to Illust. 2-49).

8. Install a new oil filter as follows:
 - a. Apply oil to gasket.
 - b. Thread filter on, by hand until tight to seat gasket.
 - c. Loosen filter.
 - d. Turn again until gasket contacts base.
 - e. Tighten filter an additional three quarter turn.
 - f. Check for leaks.

9. Install the drive shaft and coupling to the drive unit input shaft. **FIRMLY SUPPORT THE INPUT SHAFT** and install the pin. (Illust. 2-43.)

10. If the cooling fan was removed from the drive shaft it will be necessary to position it on the shaft so that the rear edges of the blades are 3/8 of an inch from the front edge of the coupling arms.

11. Recouple the tractor and adjust linkage. (Refer to page 2-34.)

Hydrostatic Transmission Service

Disassembly

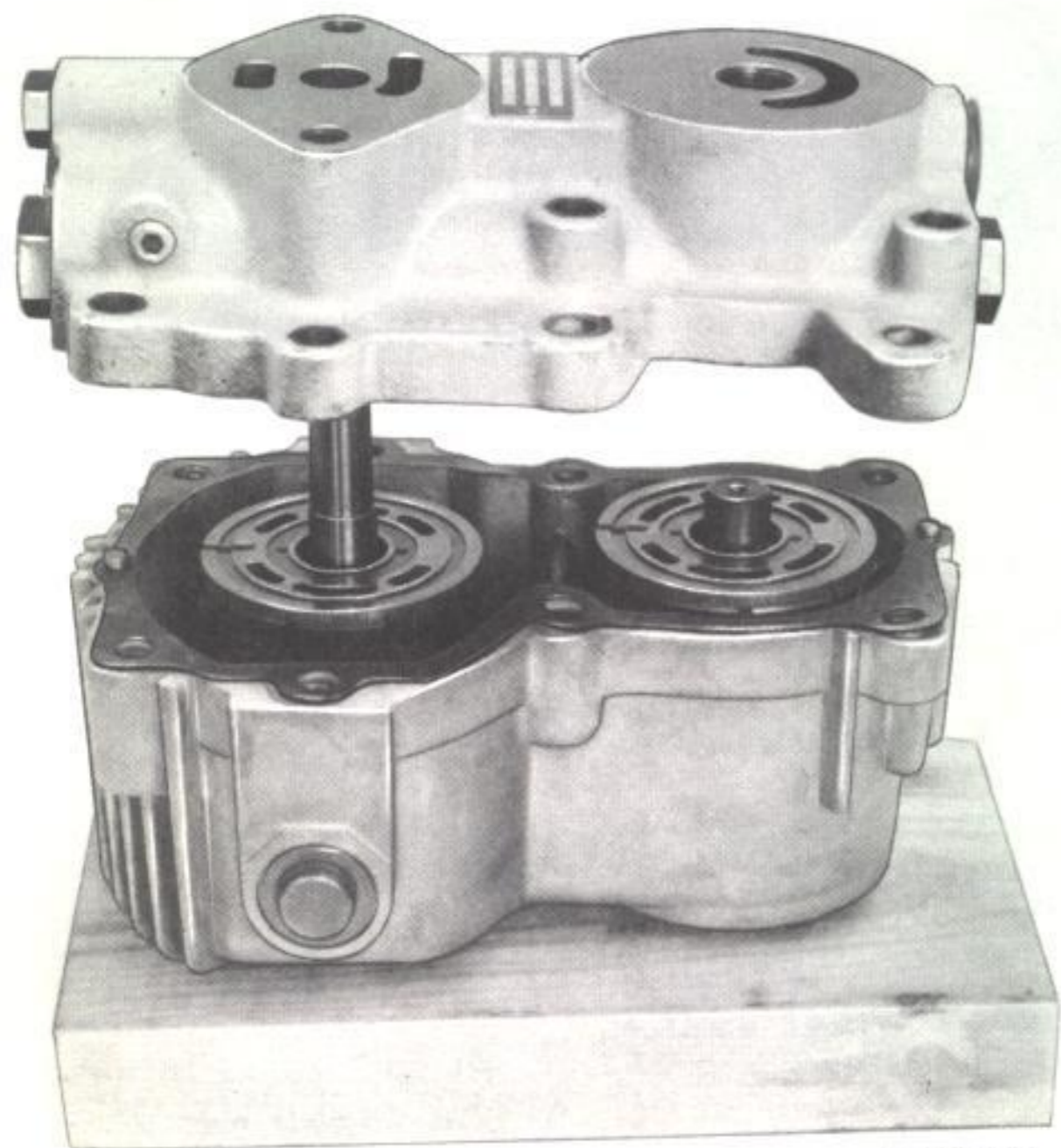
1. Be sure the outside surfaces of the transmission have been thoroughly cleaned. Place the transmission assembly in the holding fixture.

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

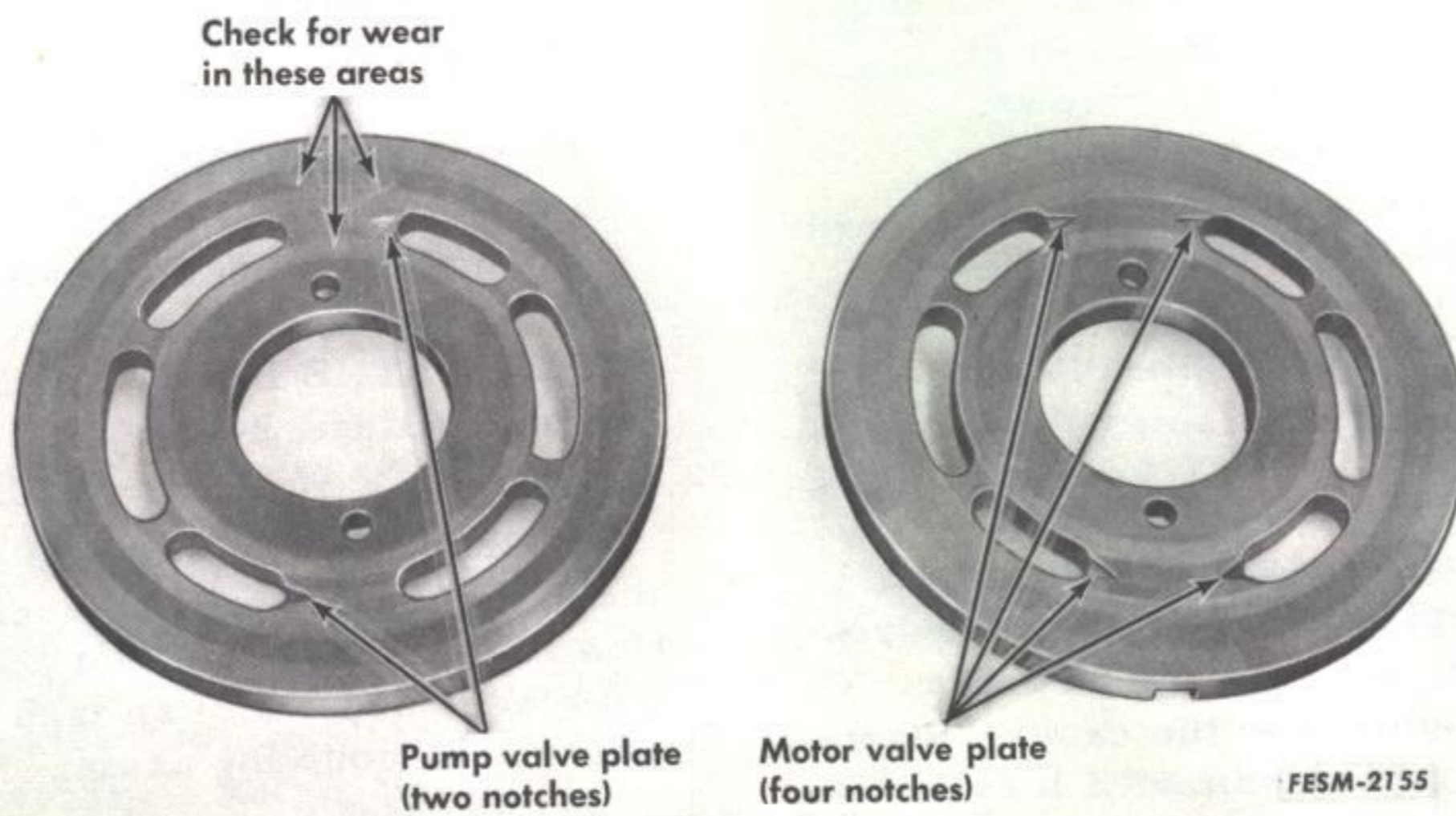
3. Lift the center section housing from the transmission housing (Illust. 2-50).

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

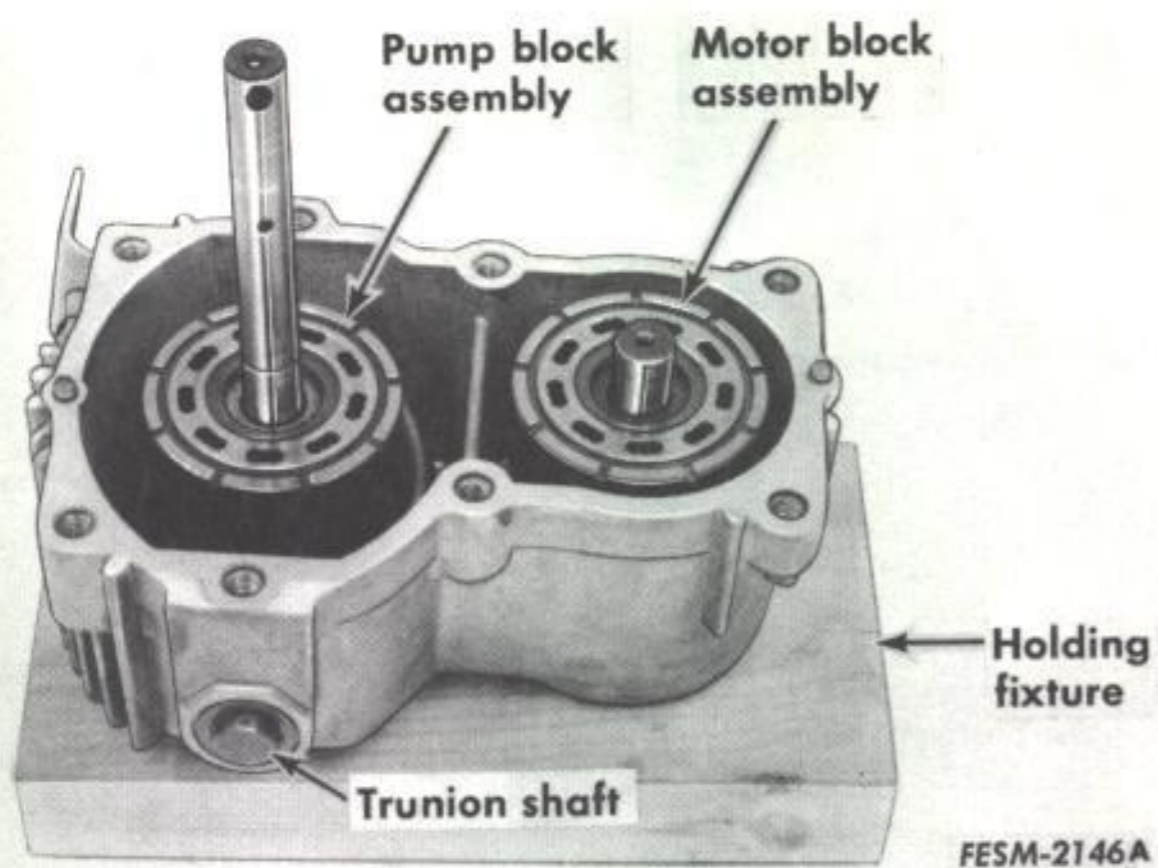
4. Remove the pump and motor valve plates (Illust. 2-51), (if not removed in step 3) noting the location of each plate. The valve plate with two notches is used on the pump assembly and the plate with four notches on the motor assembly. Remove the valve plate pins.



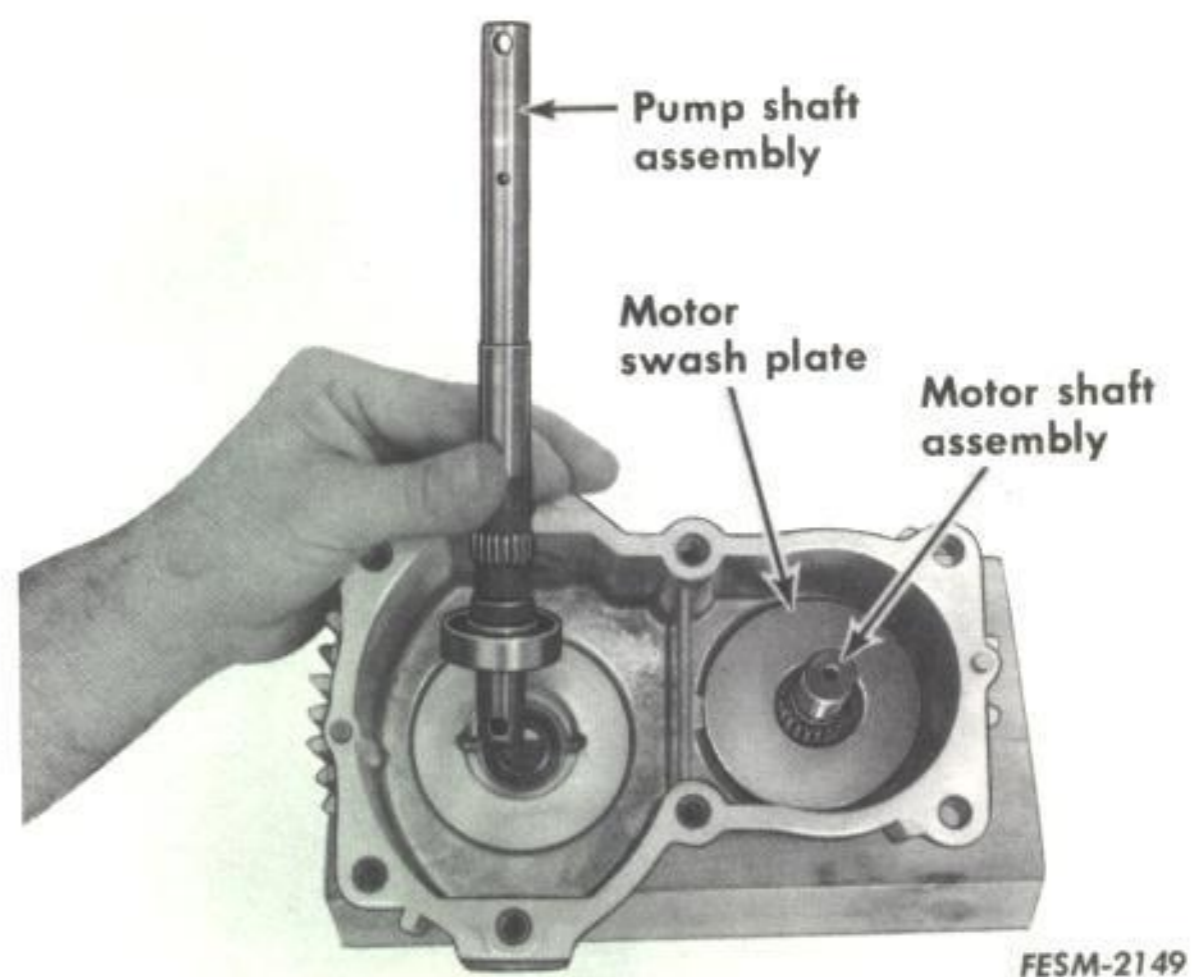
Illust. 2-50. Removing the center section.



Illust. 2-51. Pump and motor valve plates.



Illust. 2-52. Transmission case assembly.



Illust. 2-54. Removing the pump shaft assembly.

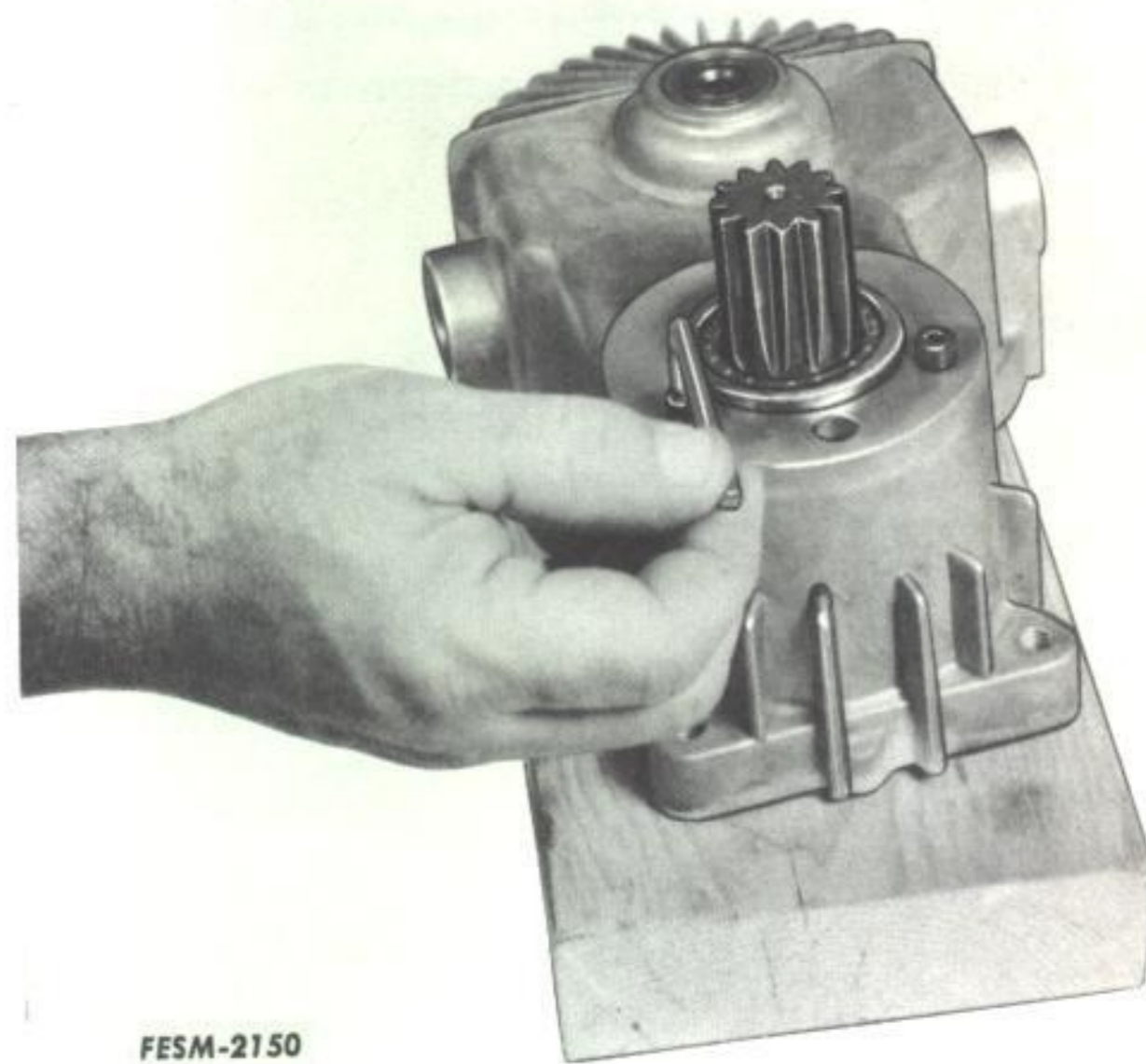
7. Remove the pump shaft assembly (Illust. 2-54).



Illust. 2-53. Block assembly removed.

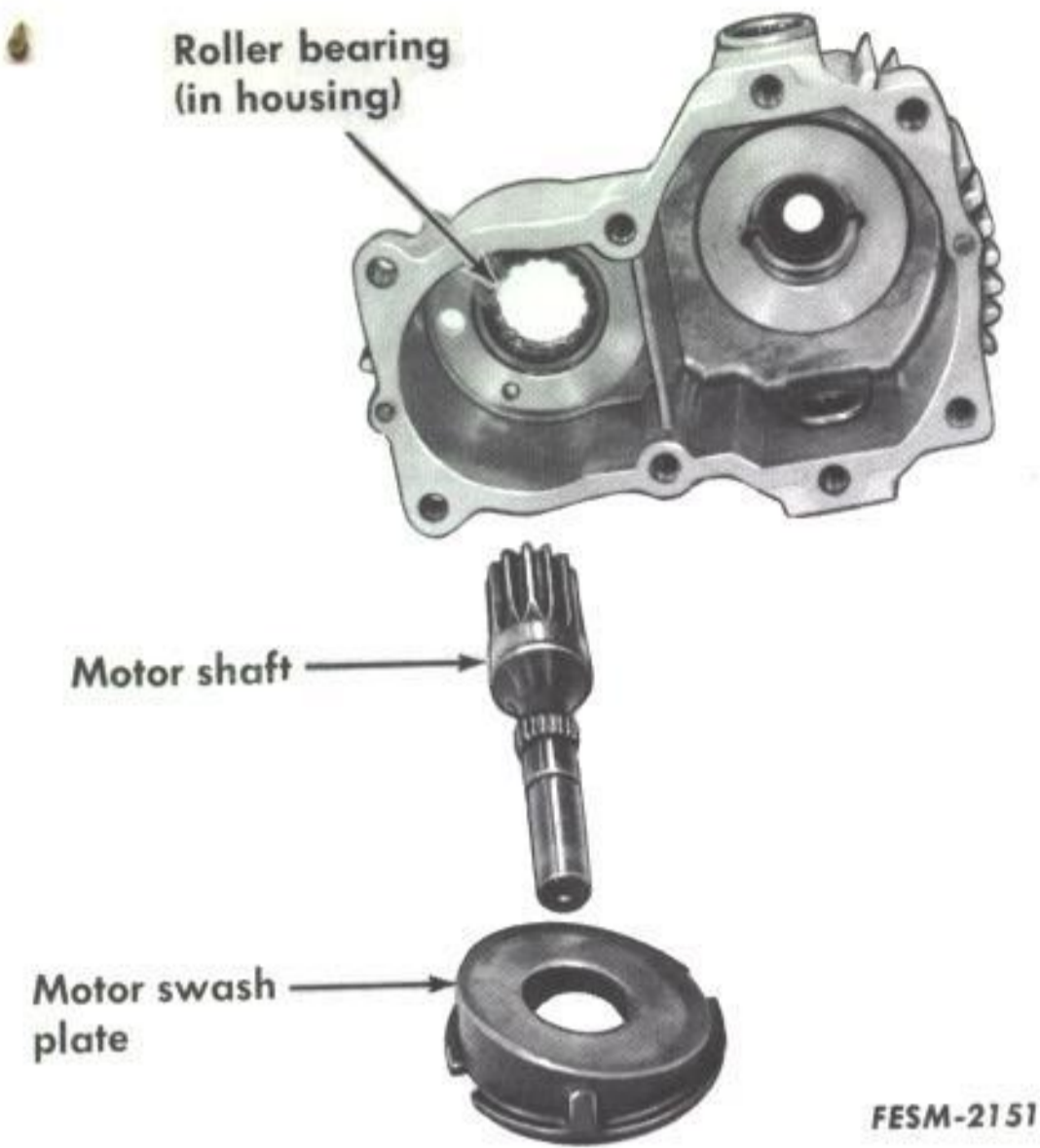
5. Tip the transmission housing so that the pump and motor cylinder block assemblies can be removed (Illust. 2-53). Grasp the assemblies so that the pistons will not fall out and be damaged.

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



Illust. 2-55. Removing the hydraulic motor swash plate cap screws.

8. Remove the socket head cap screws securing the hydraulic motor swash plate (Illust. 2-55).

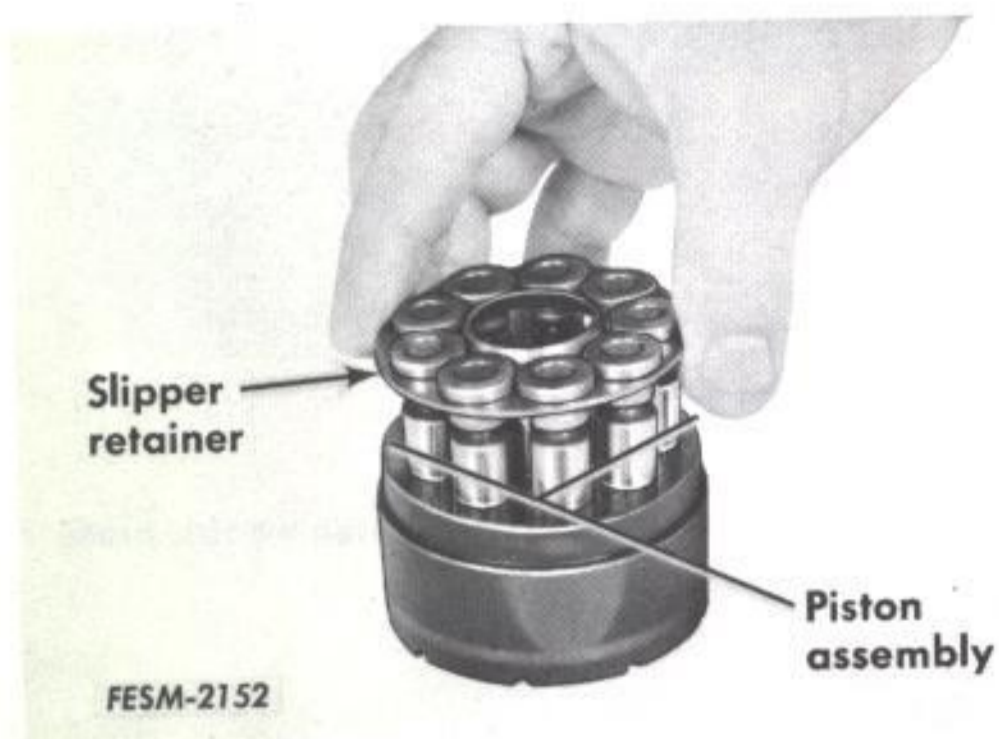


Illust. 2-56. Transmission motor shaft and swash plate removed.

9. Remove the transmission motor shaft and swash plate from the housing (Illust. 2-56)

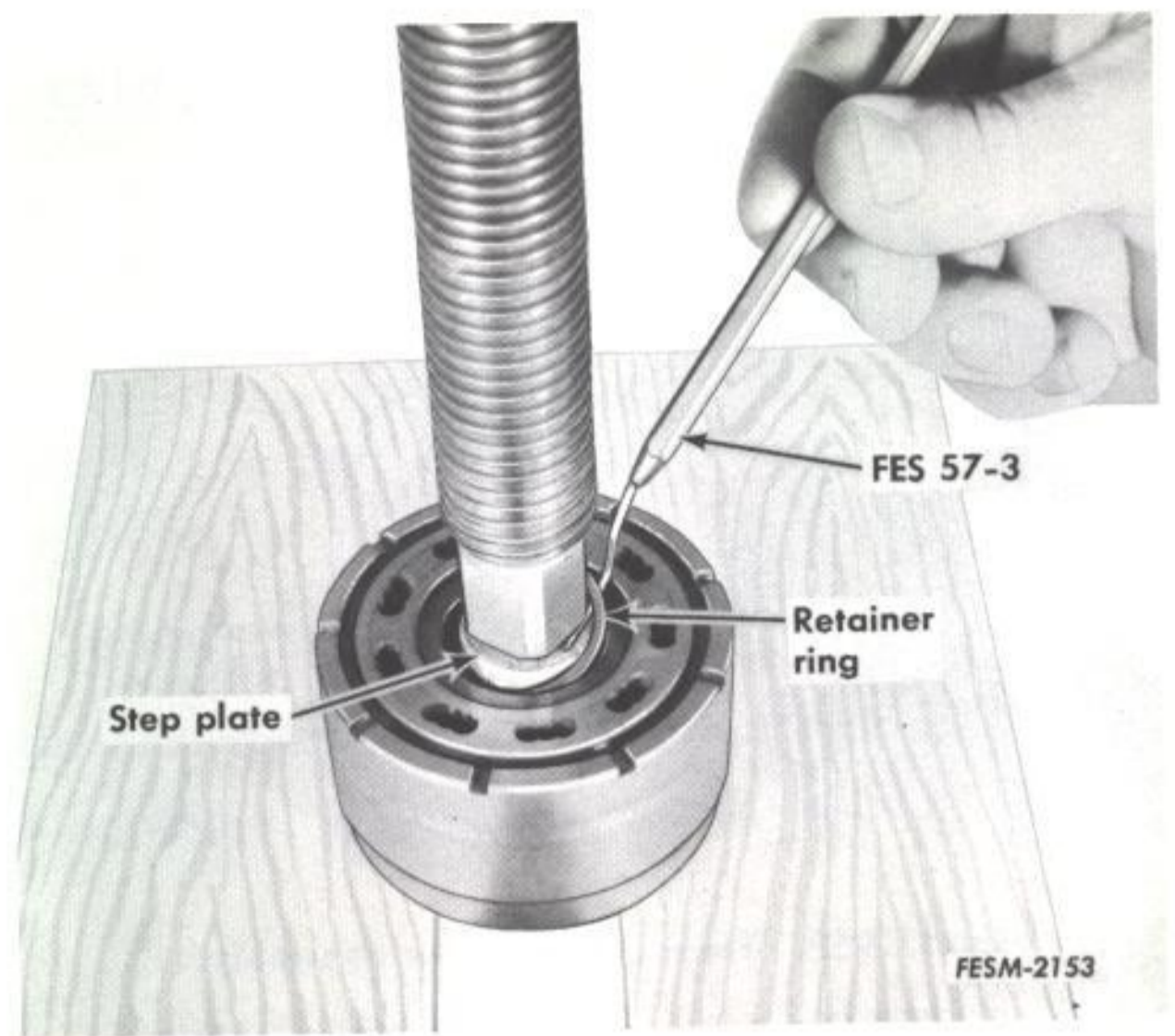
Inspection and Repair

Thoroughly clean all parts and dry with compressed air.



Illust. 2-57. Removing pistons and slipper retainer.

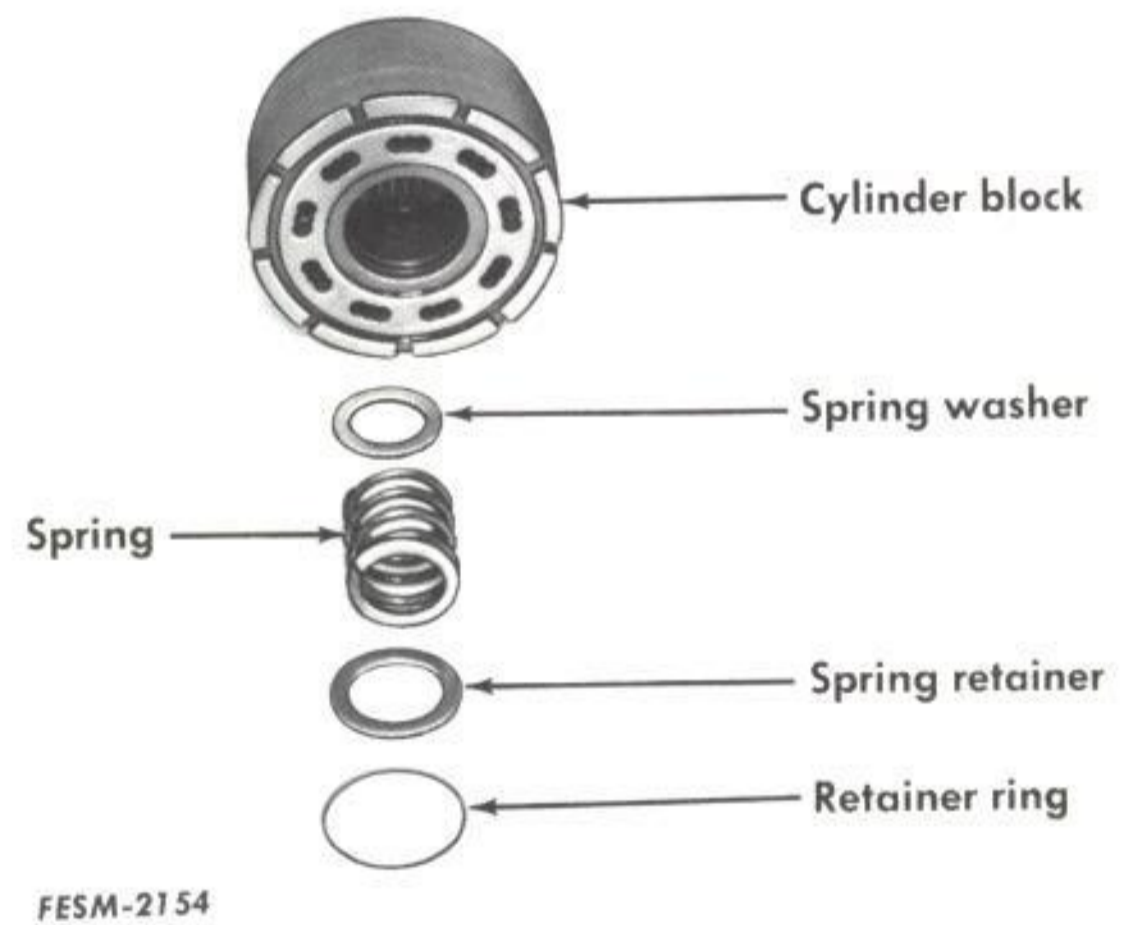
1. Remove piston and slipper assembly (Illust. 2-57).



Illust. 2-58. Removing retaining ring.

2. Place the cylinder block assembly in a press on wood blocks (Illust. 2-58).

3. Press on the spring retainer, using a step plate to compress the cylinder block spring (Illust. 2-58). Remove the retaining ring.



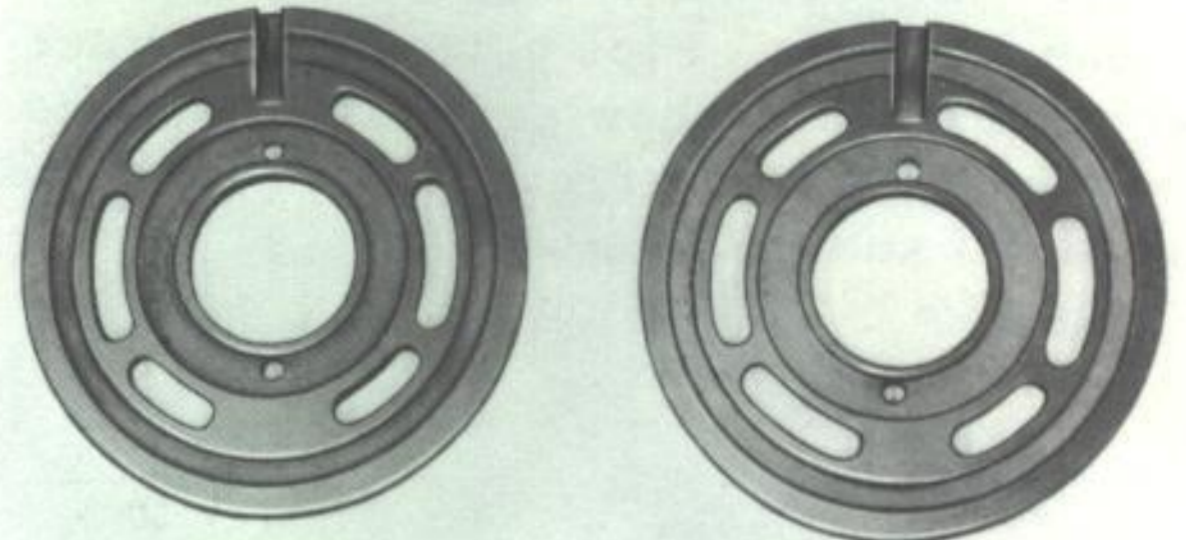
Illust. 2-59. Cylinder block disassembled.

4. Carefully release the press. Remove the spring retainer, spring and spring washer (Illust. 2-59). Remove the cylinder block from the press.

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

6. Check the spring against specifications.
7. Check the cylinder block valve face for damage and the piston bushings for excessive wear. Any linear scratches along the length of the bore will reduce efficiency. Check piston fit in the bushings.
8. Install the spring washer (bevel side in), spring and spring retainer. Place the assembly in a press.
9. Compress the spring, using a step plate. Install the retaining ring.
10. Release the press and wrap the assembly in clean paper or lint free cloth before setting aside.
11. Remove the pistons from the slipper retainer. Thoroughly clean the pistons and blow dry with compressed air. Be certain center oil passage is open.
12. Carefully inspect each piston for scoring, wear or scratches.
13. Check the slippers for severe scratches or embedded material. Slippers may be lapped, but do not remove more than .005 inch. All slippers must be within .002 inch thickness of each other. Refer to the Specifications on page 2-2.
14. If cylinder bores or pistons are badly worn or scored a block assembly with pistons is available for replacement. Pistons or block are not serviced as individual parts.
15. Wrap the pistons in clean paper or lint free cloth or reinstall in the cylinder block and wrap the assembly.
16. Thoroughly clean the valve plate and blow dry with compressed air.
17. Inspect the valve plate for scratches, excessive wear or erosion (Illust. 2-51). A worn or scored valve plate reduces pump efficiency.

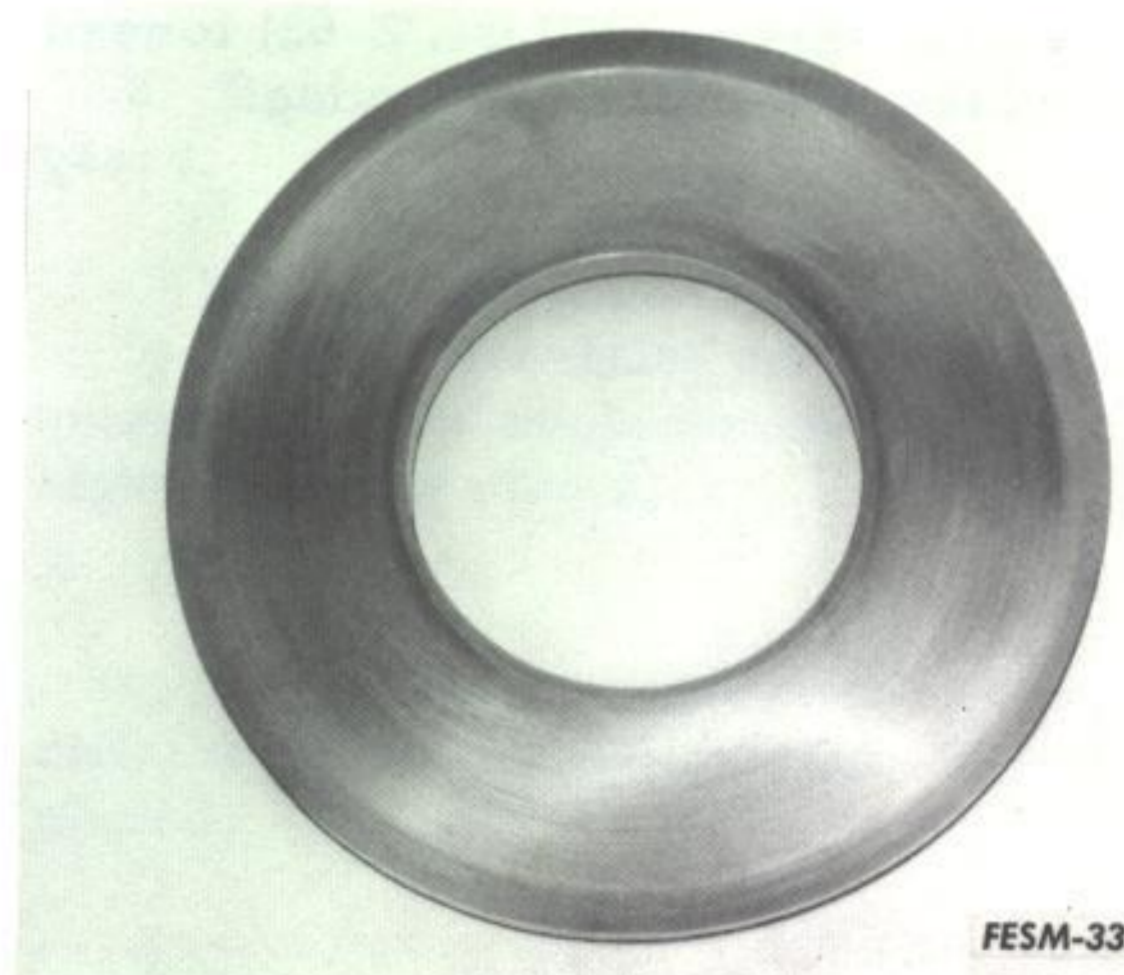
NOTE: To check the plate for wear, run your finger nail or a sharp pencil across the face of the plate. If wear is felt, replace the plate.



FESM-2147

Illust. 2-60. Valve plate grooves.

18. Inspect the pin slot and grooves of the valve plate (Illust. 2-60). Clean out any foreign matter and deburr the surface as necessary.
19. Inspect the slipper retainer for damage. A slight wear pattern where the slippers ride is normal. Replace if wear is excessive.



FESM-337

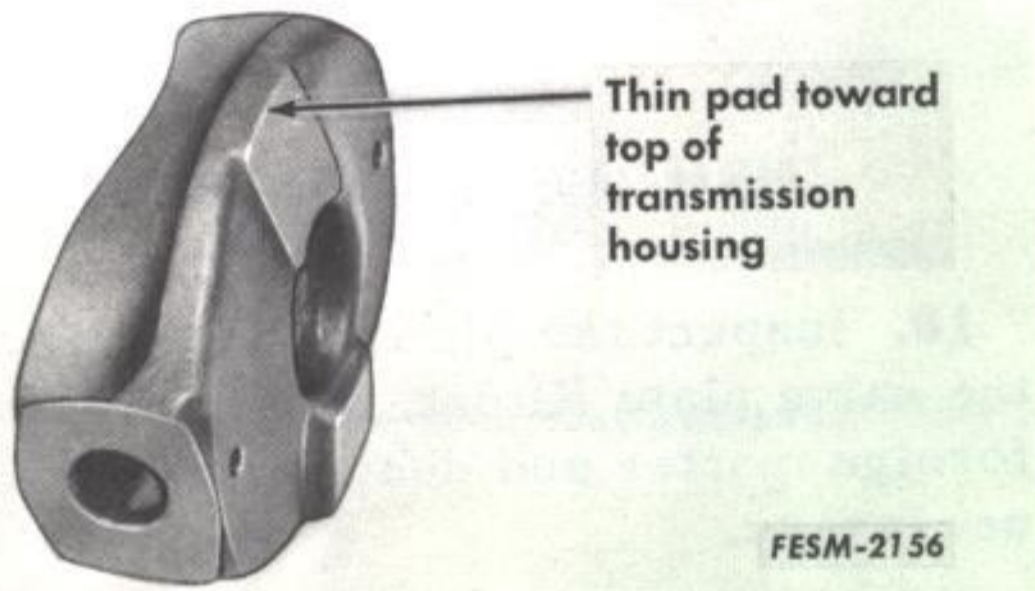
Illust. 2-61. Thrust plate inspection.

20. Inspect the thrust plate (for the hydraulic pump swash plate) for wear, embedded material, or scoring (Illust. 2-61).
21. Inspect all the bearings and replace as necessary.

Reassembly

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

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



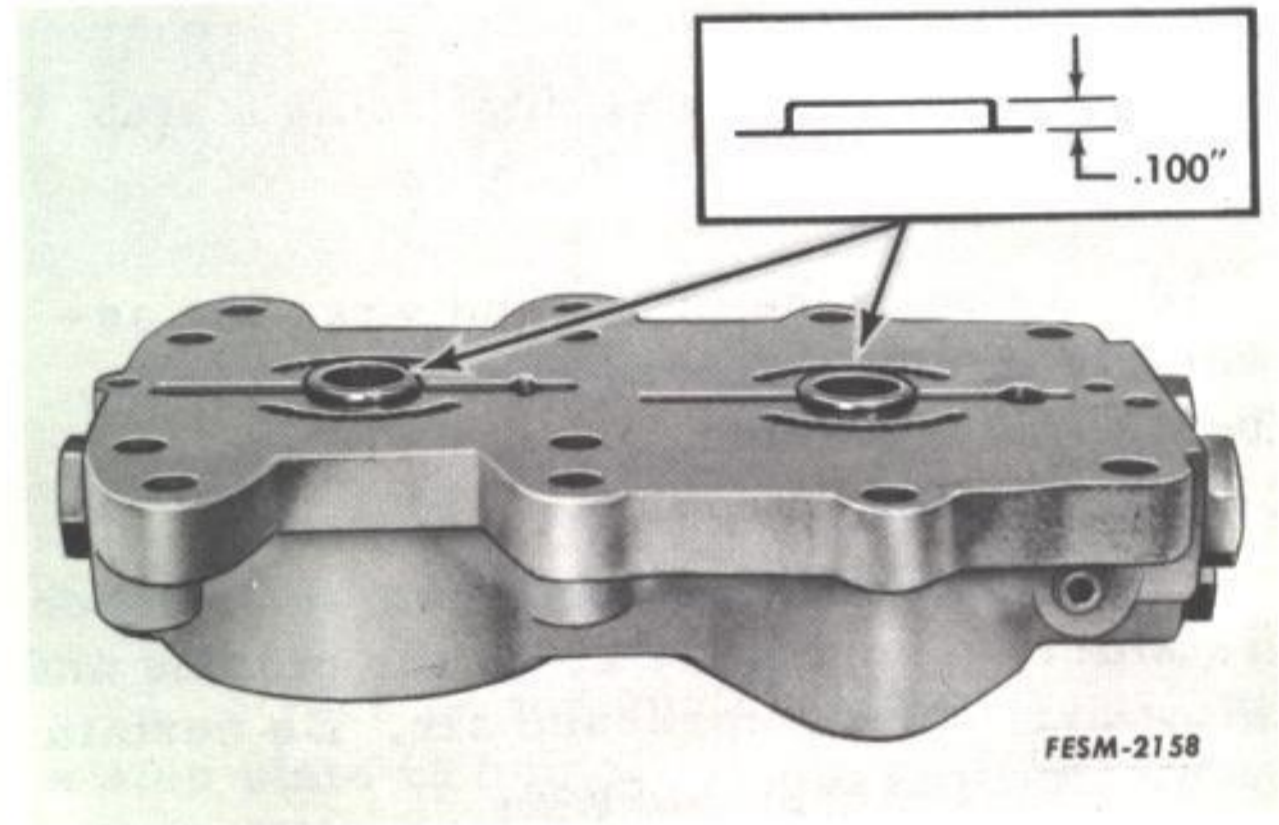
Illust. 2-62. Pump swash plate pads.

2. Be sure to install the pump swash plate with the thin pad (Illust. 2-62) toward the top of the transmission housing.

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

The valve plate with two notches is used in the pump assembly and the plate with the four notches is used in the motor assembly (Illust. 2-51).

4. The thickness of the piston slippers in the block assembly must not vary more than .002 inch of each other.



Illust. 2-63. Center section needle bearings.

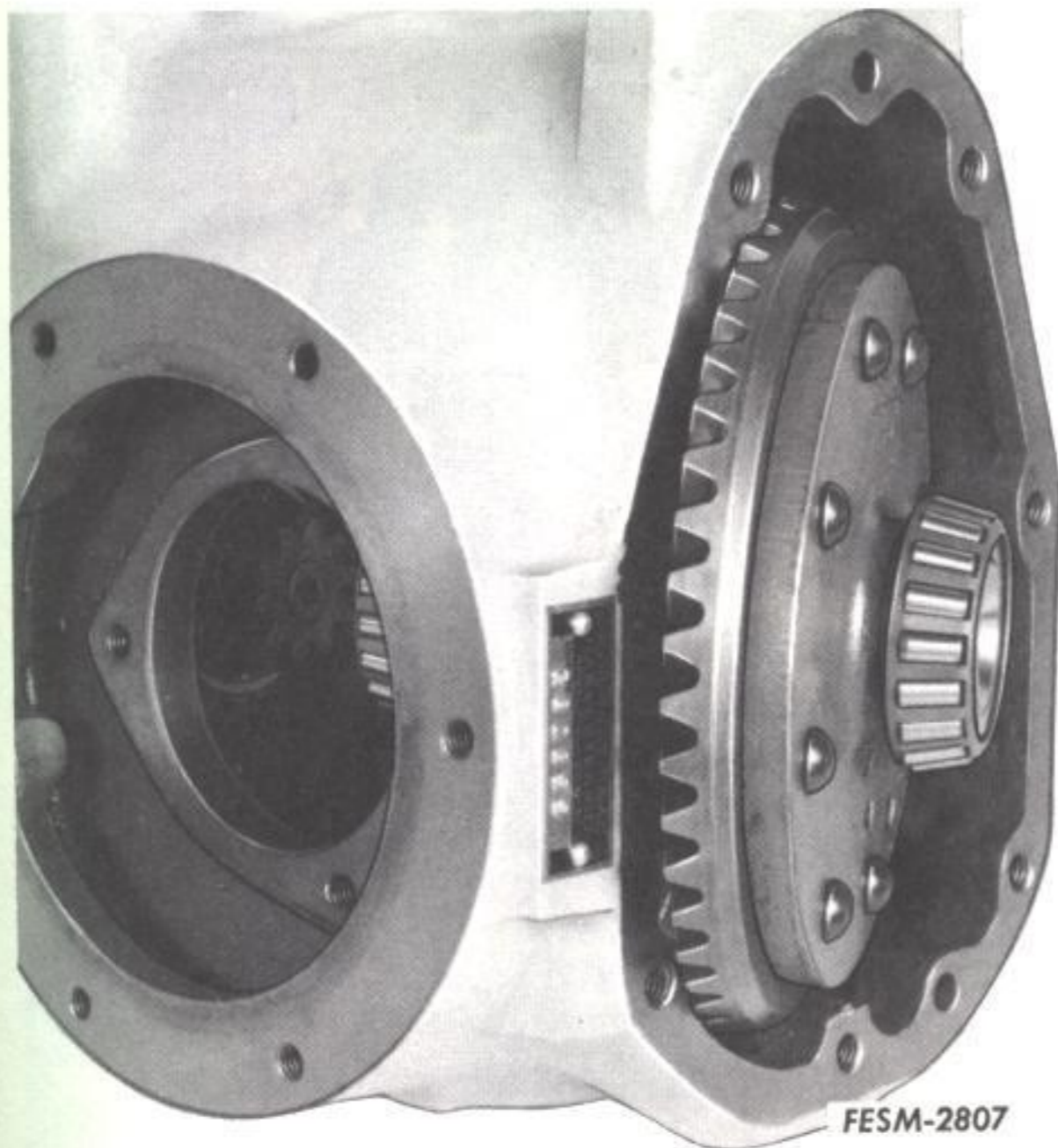
5. New center section needle bearings must be installed so that they extend .100 inch above the machined surface of the center section (Illust. 2-63). The bearings "pilot" the valve plates when the unit is reassembled.

DIFFERENTIAL

Model 105 and 125

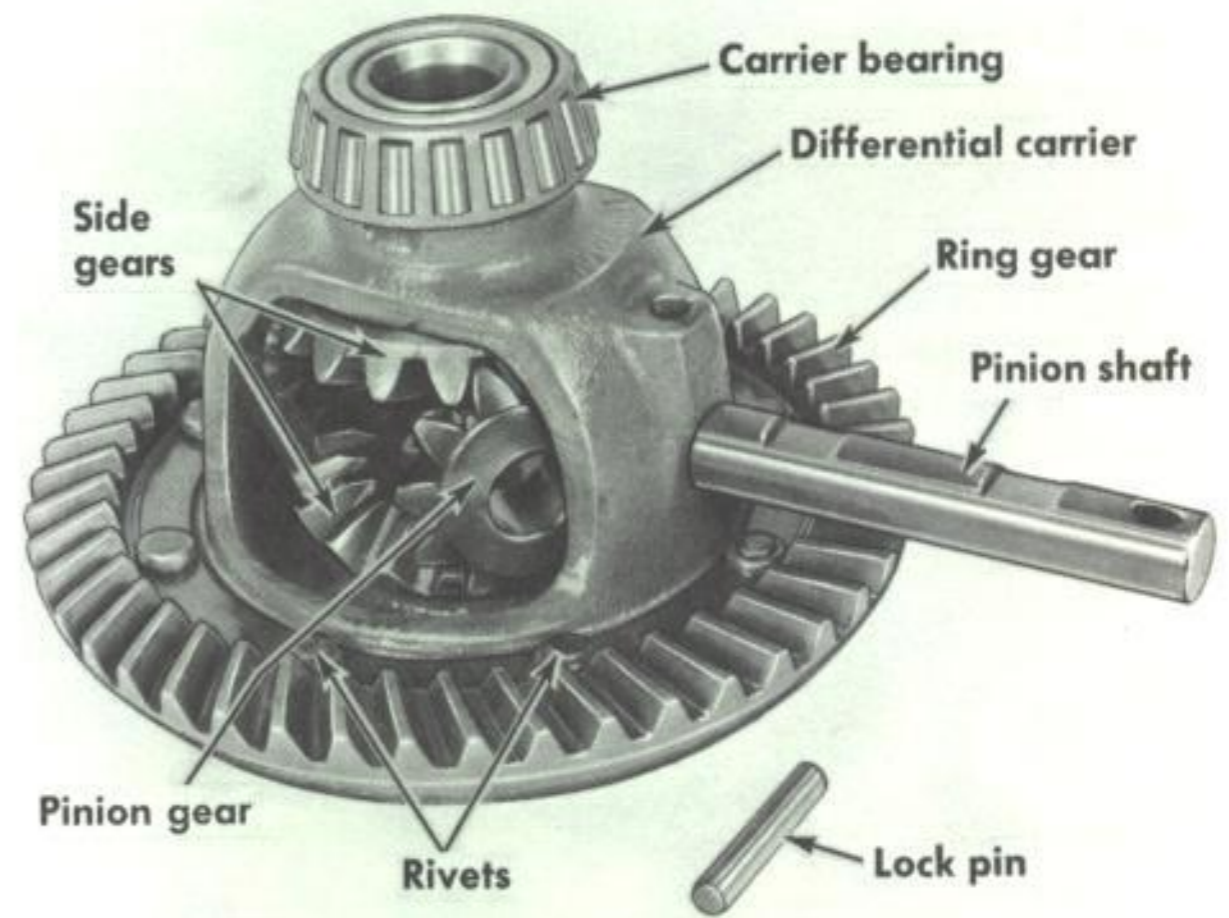
Removal and Disassembly

1. Drain the lubricant.
2. Split the tractor. (Refer to page 2-34.)
3. Remove the rear axles and their carriers. (Refer to page 2-28.)
4. Remove the differential carrier bearing cage and shims from each side. Keep the shims with each cage and identified for each side.



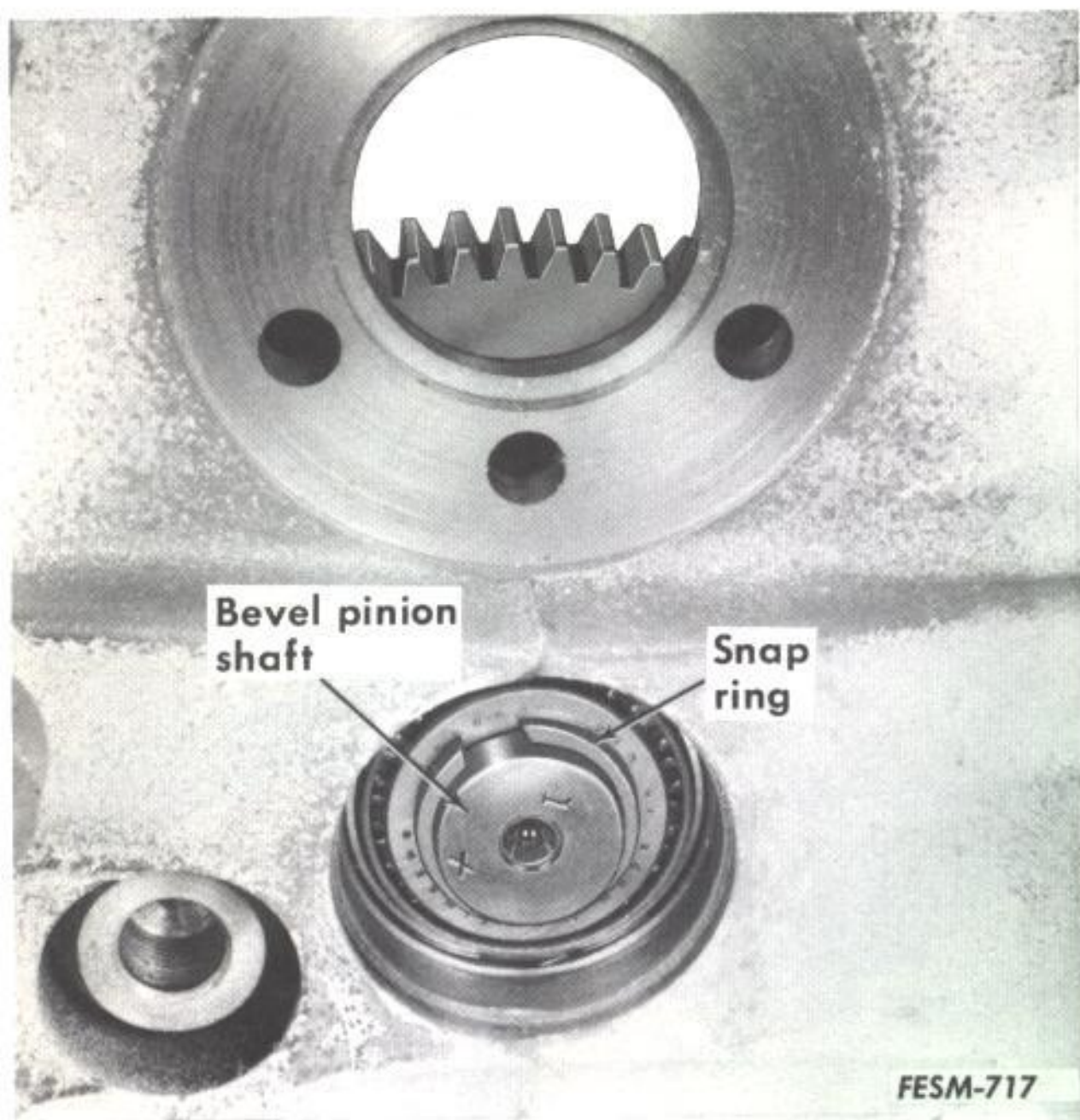
Illust. 2-64. Removing differential from the case.

5. Turn the differential into the position shown in Illust. 2-64 and remove it from the transmission case. If the assembly will not clear the side of the transmission case, it will be necessary to remove one of the differential carrier bearings.



Illust. 2-65. Differential partially disassembled.

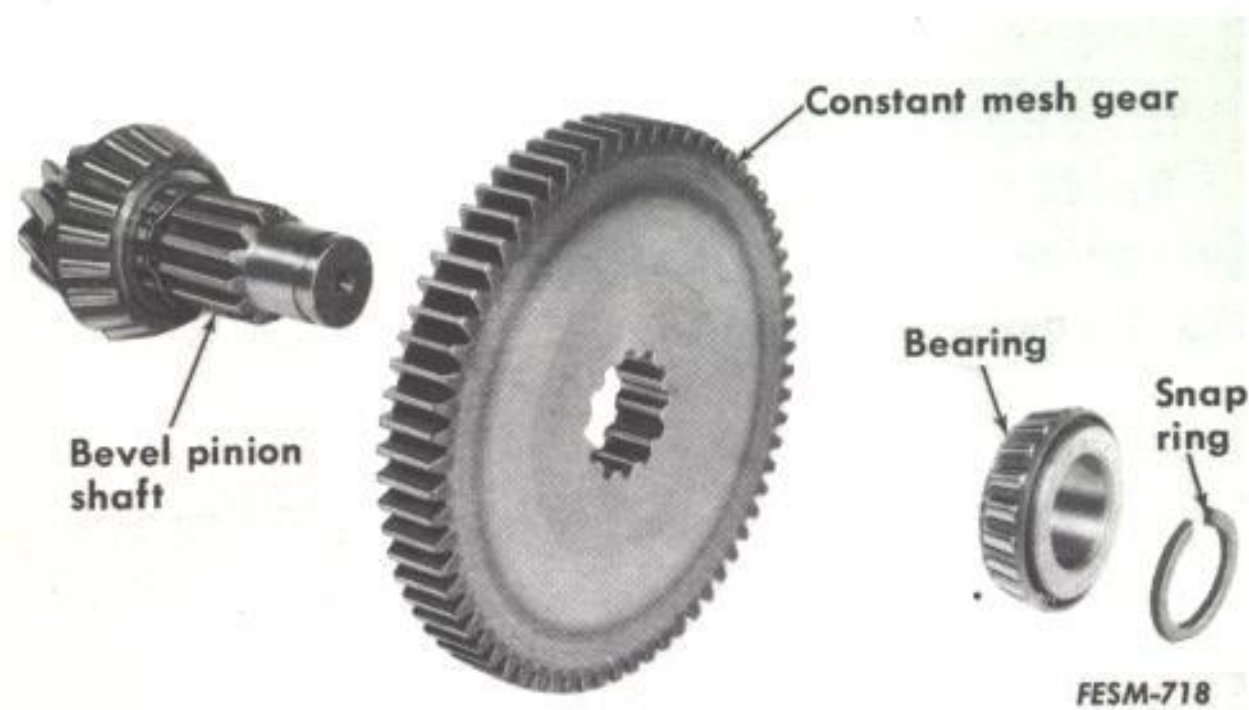
6. Drive out the pinion shaft lock pin.
7. Remove the pinion shaft.
8. Remove the pinion gears and side gears.
9. If the differential drive gear requires separate replacement, press out the eight retaining rivets.
10. Remove the bearing cones from the differential carrier if they are to be replaced.
11. Remove the bearing cups from each cage if replacement is necessary.
12. Remove the hydrostatic drive. (Refer to page 2-41.)



Illust. 2-66. Location of bevel pinion shaft snap ring.

13. Remove the bevel pinion shaft expansion plug (Illust. 2-66).

14. Remove the snap ring securing the bevel pinion shaft in the transmission case (Illust. 2-66).



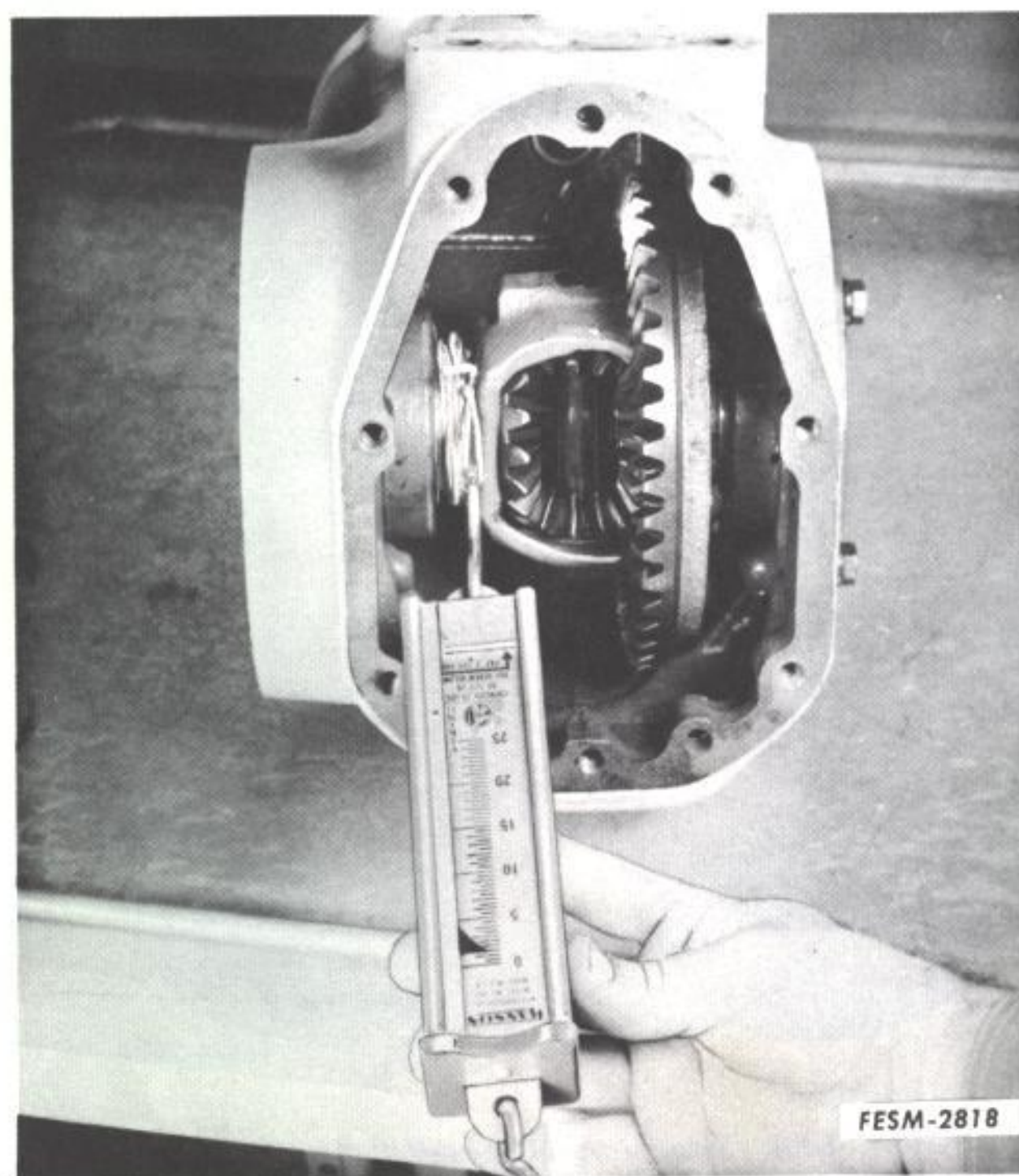
Illust. 2-67. Components parts of bevel pinion shaft assembly.

15. Using a brass drift and hammer, tap the bevel pinion shaft to the rear which will release it from the front bearing and the constant mesh gear. Illust. 2-67 shows the component parts of the bevel pinion shaft assembly.

Inspection and Repair

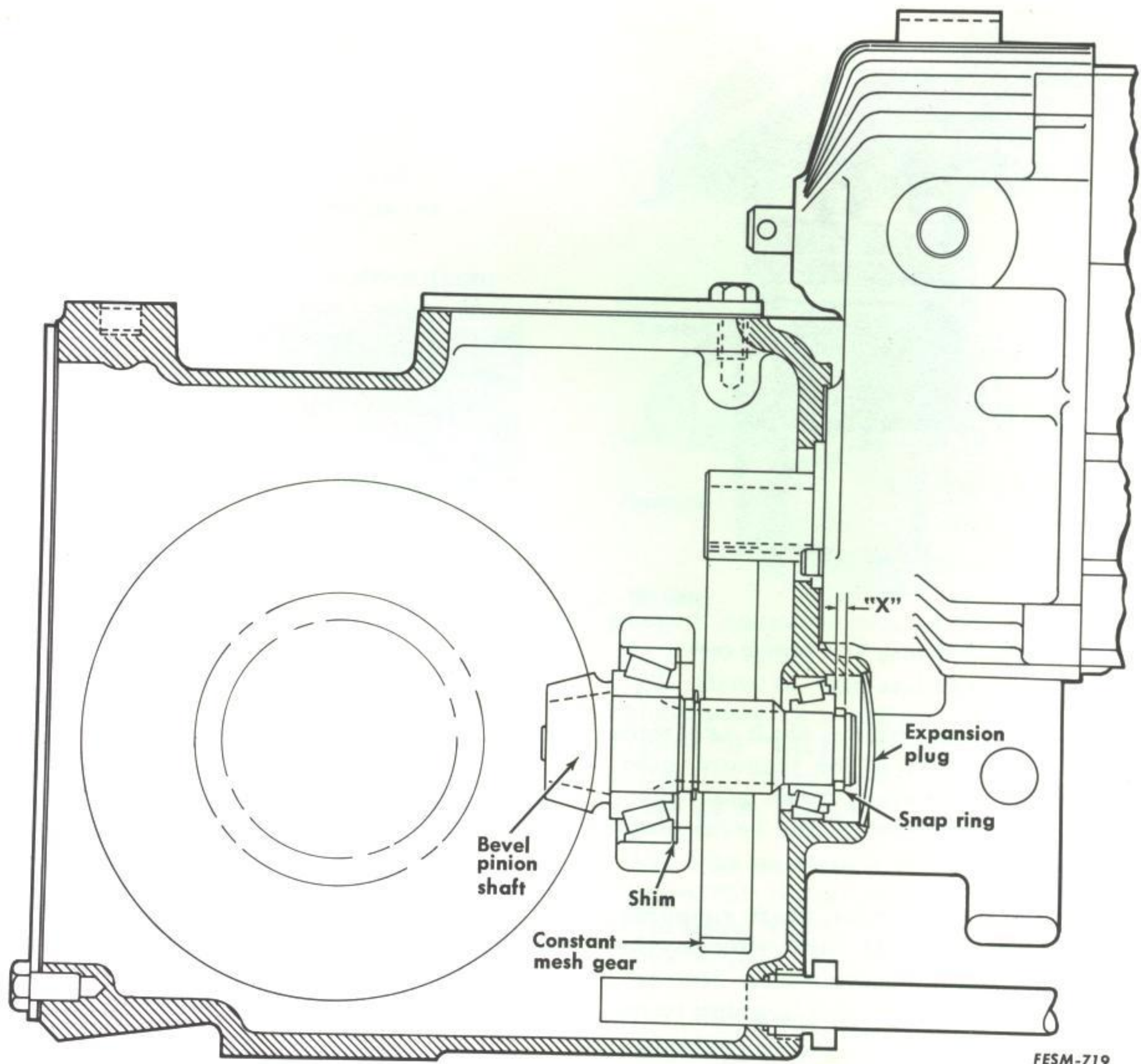
1. Wash all parts in cleaning solvent and dry with compressed air. Do not spin bearings.
2. Check all bearings for looseness, wear, roughness, pitting and scoring.
3. Check gears and shafts for wear and burrs. Remove any burrs with a fine stone.
4. Inspect the housing for cracks, restricted oil passages and dents or raised places on its machine faces. Smooth off raised places with a file.

Reassembly



Illust. 2-68. Checking pre-load of differential bearings.

1. Assemble the differential, carrier bearings, cages and shims. Check bearing pre-load and adjust as necessary before replacing the bevel pinion shaft. Install or remove shims as necessary. Pre-load is correct when a steady pull of one to three pounds is necessary to rotate the differential assembly as shown in Illust. 2-68.



Illust. 2-69. Cross section of bevel pinion shaft area in differential case.

2. Remove the differential assembly, keep the shims with the cages.

3. If the original bevel pinion shaft and transmission case is used, skip step 4.

4. If a new bevel pinion shaft, transmission case or rear bearing cup and cone are used proceed as follows:

a. Take the number stamped on the case (Illust. 2-70) and the number stamped on the end of the bevel pinion shaft and add them together.

b. Add .015 inch.

c. Install sufficient shims, to total

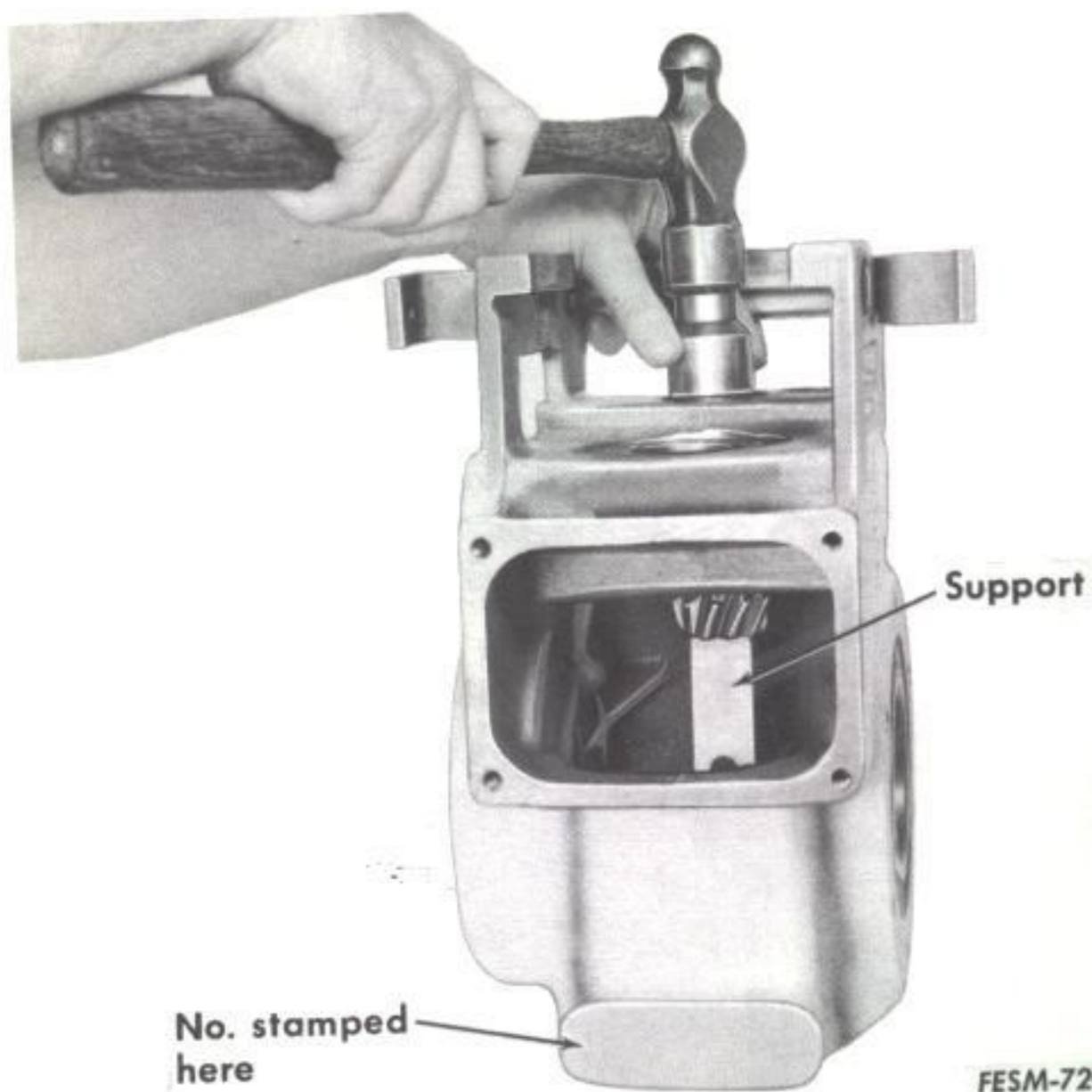
the figure obtained previously, in the bore for the rear bearing cup.

d. Press the cup in its bore till it bottoms against the shims (Illust. 2-69).

NOTE: Shims are available in .004, .007 and .015 inch.

5. If it was removed, press the rear bearing cone on the bevel pinion shaft until it bottoms against the shoulder on the shaft.

6. Install the constant mesh gear retaining ring on the pinion shaft (Illust. 2-69). Be sure the brake lining disc is installed and in position in transmission case. Hold with grease.



Illustr. 2-70. Installing front bearing cone.

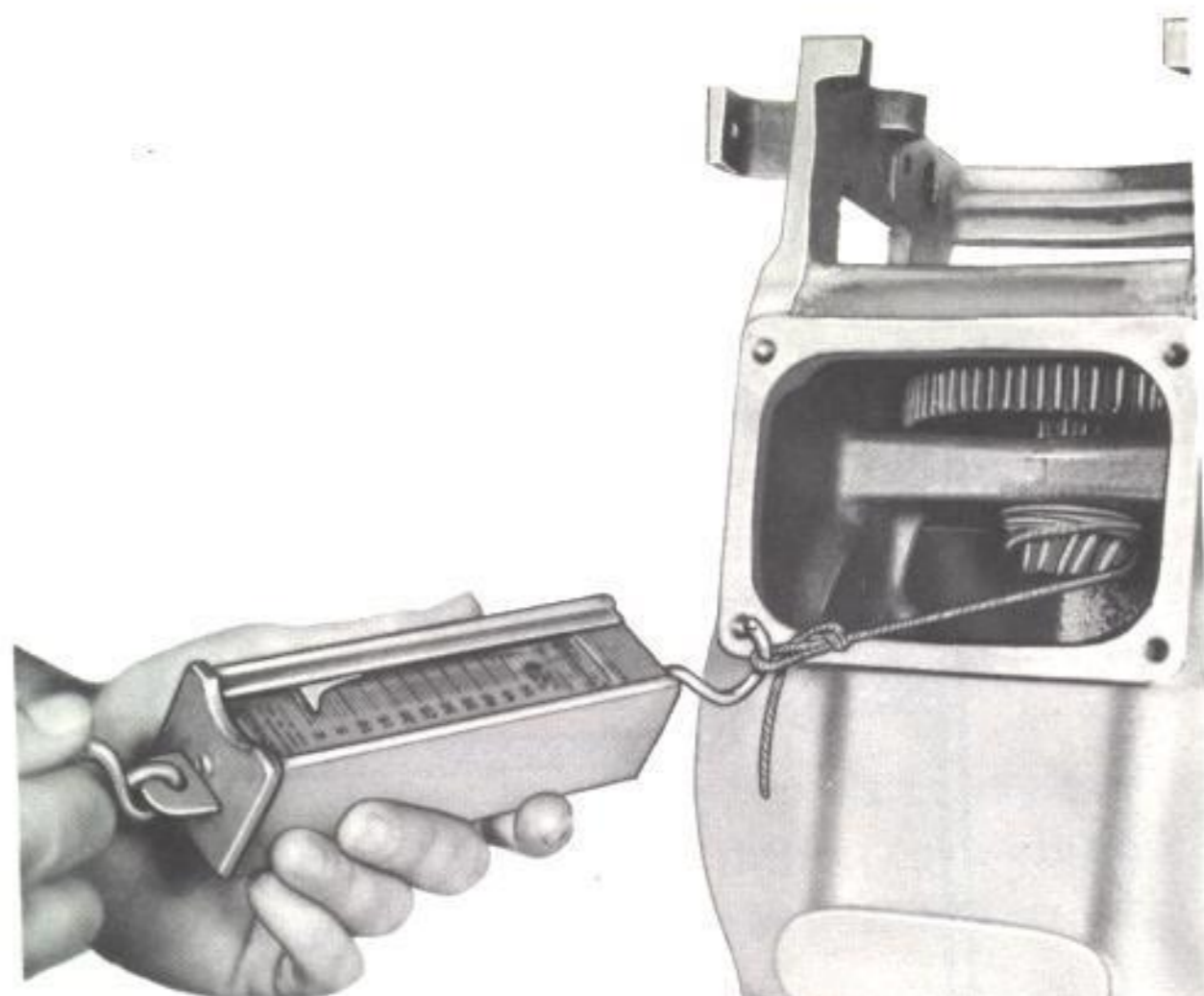
7. Start the bevel pinion shaft assembly in its bore in the rear of the transmission case. Install the constant mesh gear and complete the installation of the bevel pinion shaft assembly.

8. With the bevel pinion shaft supported at the gear end, gradually press or tap the front bearing cone onto the shaft. Rotate the shaft while installing the bearing to be sure the bearing does not get cocked or damaged. Press the bearing cone onto the shaft until the bearings are pre-loaded within the range of 5 inch pounds to 30 inch pounds rolling torque (Illustr. 2-71).

9. With the rolling torque figure obtained in step 8, refer to the table below to determine the amount of axial pre-load in the assembly at this time.

<u>Rolling Torque, inch lbs.</u>	<u>Pre-load*</u>
5	.0045
10	.0060
15	.0075
20	.0090
25	.0105
30	.0120

*The distance the bearings are telescoped beyond the desired .003 inch end play.



FESM-721

Illustr. 2-71. Checking rolling torque of pre-loaded bearings.



FESM-722

Illustr. 2-72. Measuring snap ring groove gap.

10. Using a feeler gauge, measure the gap between the cone surface of the front bearing to the furthest edge of the groove for the snap ring (Illustr. 2-72). The measurement obtained is to be considered "X" (Illustr. 2-69).

Snap Ring Thickness Chart
(inch)

Class

A	.122 or up
B	.122 - .116
C	.116 - .110
D	.110 or under

11. Using the dimension obtained from the table in step 9, subtract the value of pre-load from the figure obtained for "X" in step 10. This value will be the correct size for the snap ring to give an average of .003 inch end play.

Example:

a. The distance from the cone surface to the furthest side of the snap ring groove is .117 inch.

b. Rolling torque is 15 inch pounds.

c. From the table, 15 inch pounds torque equals .0075 inch pre-load.

d. Exact snap ring thickness should be $.117 - .0075 = .1095$ inch.

e. .1095 would use a class "D" snap ring.

12. Install the snap ring selected and be sure it bottoms in its groove. Tap the pinion shaft back to seat the front bearing against the snap ring.

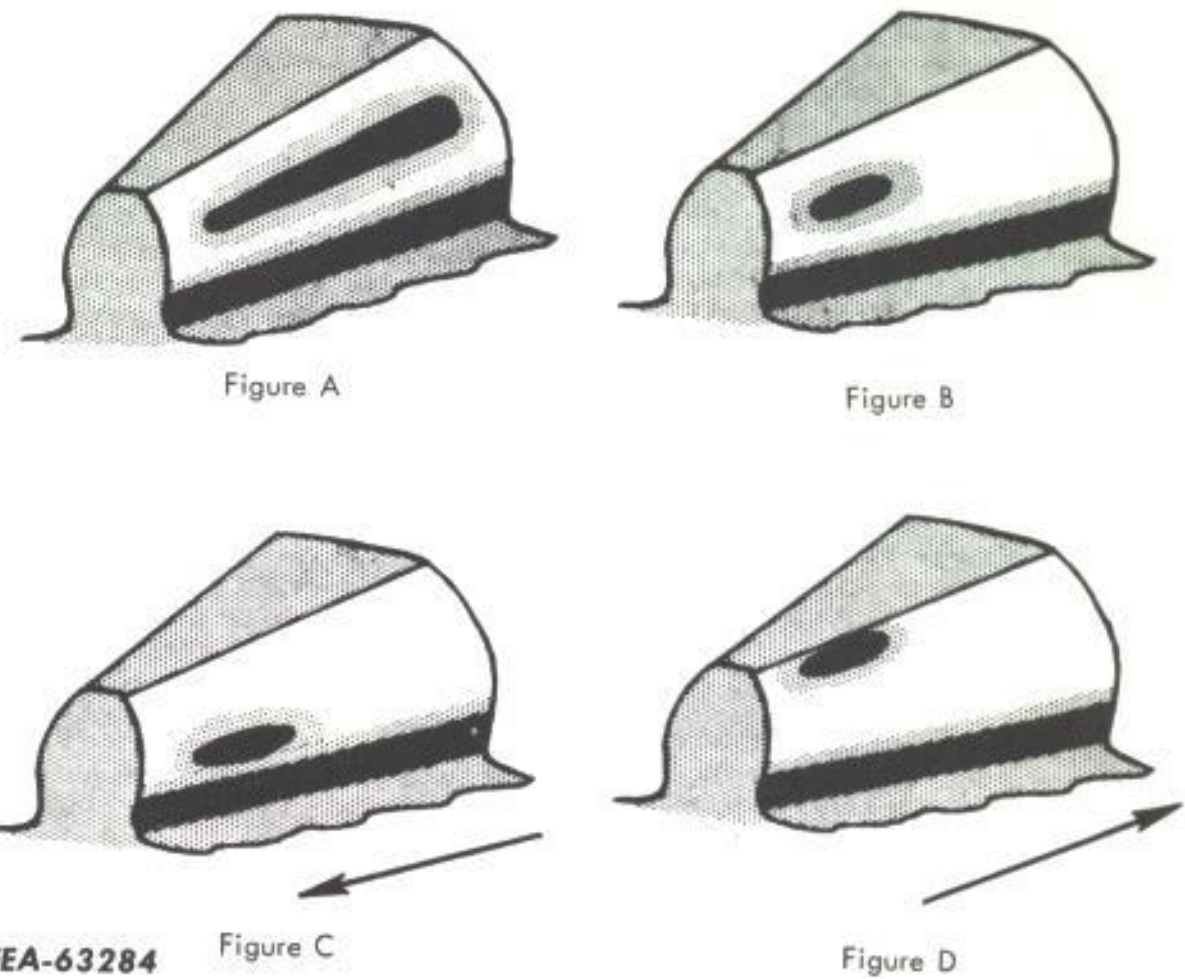
13. Install a new expansion plug.

14. Install the differential assembly, keeping the pre-load shim pack correct as previously established. Drive gear must be on the right with teeth facing left.

15. Check the backlash between the drive gear and pinion and the gear teeth bearing pattern as follows. Refer to Illust. 2-73.

16. Apply a thin coat of red lead or prussian blue to the bevel pinion teeth faces, then rotate the gears by hand and observe the bearing pattern.

Some deflection will occur under load. Allowance is made in gear design to



Illust. 2-73. Tooth bearing pattern.

prevent concentration of load on teeth edges.

17. Hand testing and very light loads should provide a pattern as shown in Figure "B" (Illust. 2-73). When load and deflection increases the pattern will progress as in Figure "A".

18. The desirable (no load) pattern in Figure "B" is the result of adjusting the bevel gear lateral position to the specified range of .003" to .005" backlash.

19. Tooth bearing position from the root to the crown of the tooth is controlled by lateral position of the pinion. If low tooth bearing on bevel pinion is indicated (as shown in Figure "C") the pinion must be adjusted toward the bevel gear. If high tooth bearing on the bevel pinion is indicated (as shown in Figure "D") the pinion must be adjusted away from the bevel gear.

NOTE: If it is necessary to move the pinion in or out to correct "Root-to-crown" bearing, the bevel gear must also be moved laterally to maintain the specified backlash.

20. Install the rear axles and wheels. (Refer to page 2-28.)

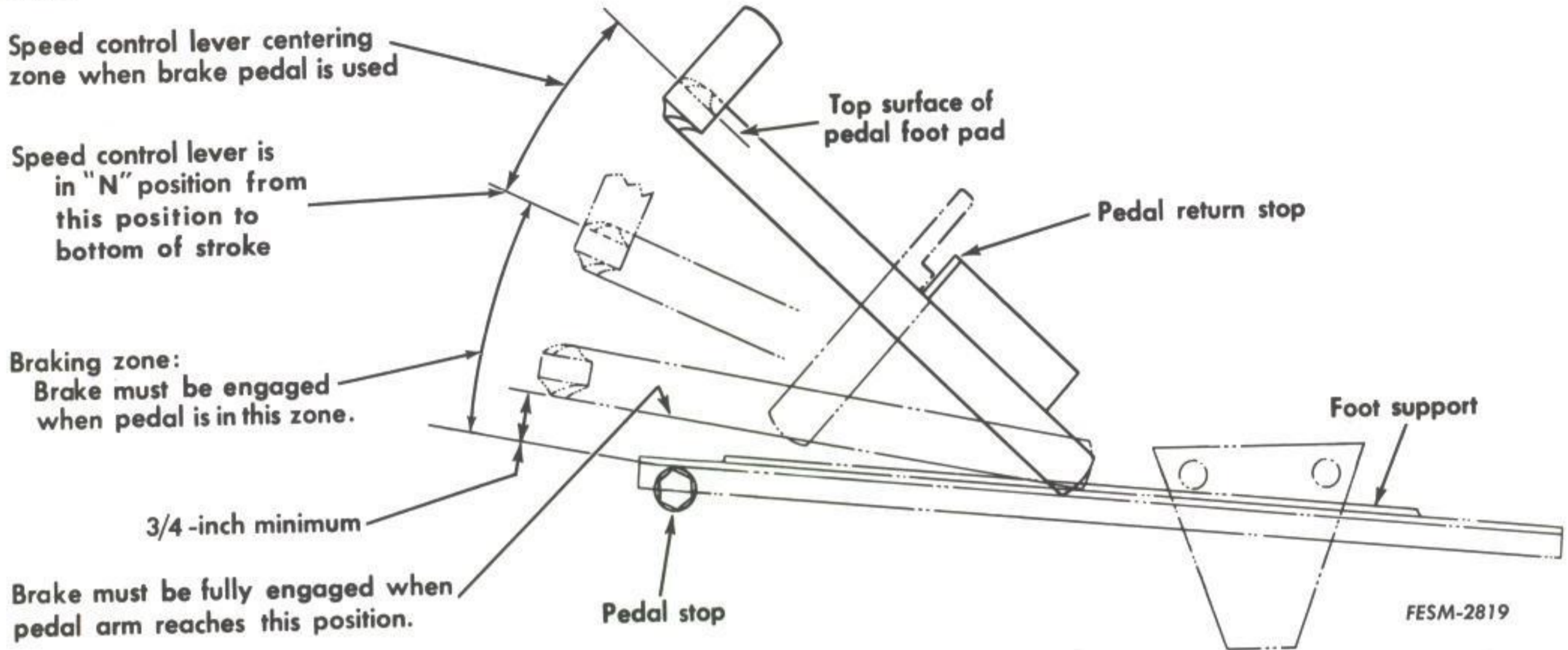
21. Install the hydrostatic drive. (Refer to page 2-42.)

22. Recouple the tractor. (Refer to page 2-34.)

ADJUSTMENTS

Models 105 and 125

Brake

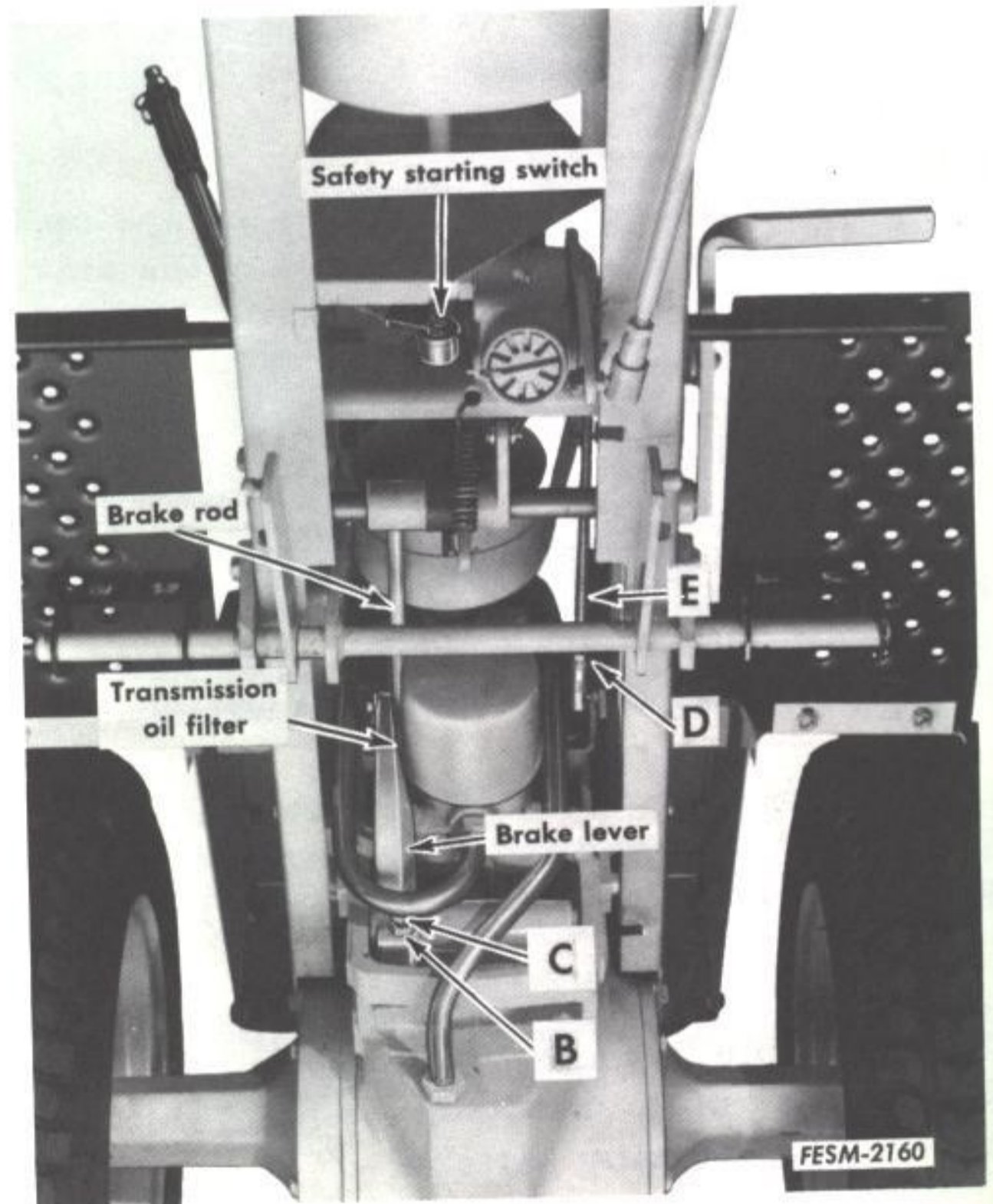


Illust. 2-74. Brake adjustments.

As the brake is applied, the speed control lever will move to the center or "N" position. The brake should start to engage at this point and be fully engaged when the pedal arm is a minimum of 3/4 inch from the foot support, which serves as the pedal stop. See Illust. 2-74.

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

To adjust the brake, loosen the jam nut "B" and turn the brake lever adjusting screw "C" (Illust. 2-75) in or out as required to get this measurement.



Illust. 2-75. Brake adjustments.

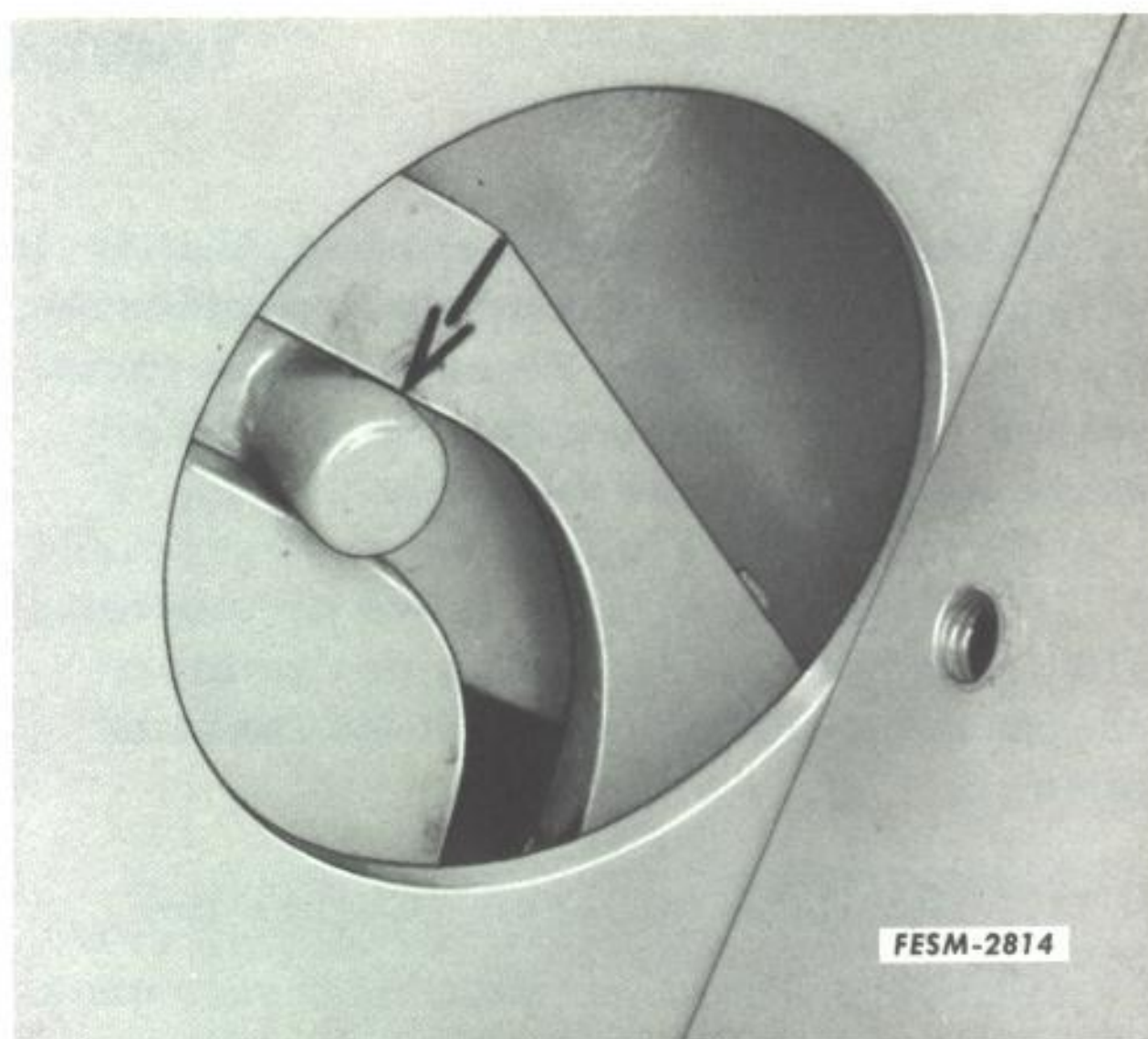
Speed Control Lever Linkage and Cam Bracket Adjustment

NOTE: The brake pedal must be properly adjusted before beginning the speed control adjustment. Refer to page 2-54.

If the tractor "creeps" in the "N" position or, if the speed control linkage has been disassembled or removed for any reason, the following adjustment must be made.

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

- a. Remove the battery.
 - b. Place a small wedge between the hand control mounting bracket and the adjusting nut. Refer to foldout at back of manual.
 - c. Move the lever towards the "F" or forward position to tighten the nut.
 - d. Remove the wedge.
 - e. Check the friction adjustment with a fish scale. The reading should be 10 pounds when pulled in either direction from the offset in the lever.
 - f. Replace the battery.
1. Block the tractor so the left rear wheel is off the ground and tractor is secured so it cannot move forward or backward.
 2. Depress brake pedal and lock to set brake.
 3. Disconnect connecting rod at the ball joint (13) (Illust. 2-33).
 4. Loosen cam bracket mounting cap-screws if not previously left loose (Illust. 2-45). Move the cam bracket to its lowest position in the slotted holes and tighten slightly to hold in position.



Illust. 2-76. Camplate with arrow and pin viewed through access hole in left side of frame.

5. Start the engine and run at half throttle or faster.
6. With the engine running align the arrow with the pin as in (Illust. 2-76). At this position the hydrostatic unit is pulling against the brake. Adjust the cam bracket upward with a punch and hammer until a neutral condition is reached while the arrow and pin are kept aligned. Tighten the cam bracket cap screws. Connect the rod and ball joint to the cam plate.
7. Release the brake pedal and move the speed control lever to the forward position. The wheel should rotate in the forward direction. Depress the brake pedal all the way down and release. The speed control lever should return to the "N" position and the wheel stop turning.
8. If the wheel continues to turn in the forward direction, loosen jam nut "D" and turn the connecting rod "E" to lengthen it until the wheel stops turning, after depressing the pedal. (See Illust. 2-75.)
9. If the wheel turns in the reverse direction turn the connecting rod "E" to shorten until wheel stops turning. Tighten the jam nut "D". Refer to Illust. 2-75.

Trouble Shooting

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

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

1. Check the oil level. Change the oil filter.
2. Block the tractor so that the left rear wheel is off the ground and block the front wheels.
3. Depress both check valve spools (see Foldout at back of manual) with the tow lever.
4. Remove the transmission case top cover. Start engine and check for suction line leak indicated by air or foam in oil.
5. Check the drive shaft rotation into the charge pump and out the rear of the transmission case for mechanical break down. "Work" the control lever to make sure there is no binding in the cam plate or linkage.

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

6. Check to see that both check valve spools have returned from the depressed position.
7. If neither valve spool returns "work" the speed control lever to make sure that no mechanical bind exists in the linkage, control cam and the control drive plate (see Foldout at the back of this manual).
8. If both valve spools are still depressed, either the charge pump, the charge pump relief valve, or the check valves are at fault. Refer to pages 2-37 thru 2-40 for service of these components.
9. If only one valve spool returns, the tractor must be split and the defective check valve replaced.

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

CREEPER DRIVE

Removal

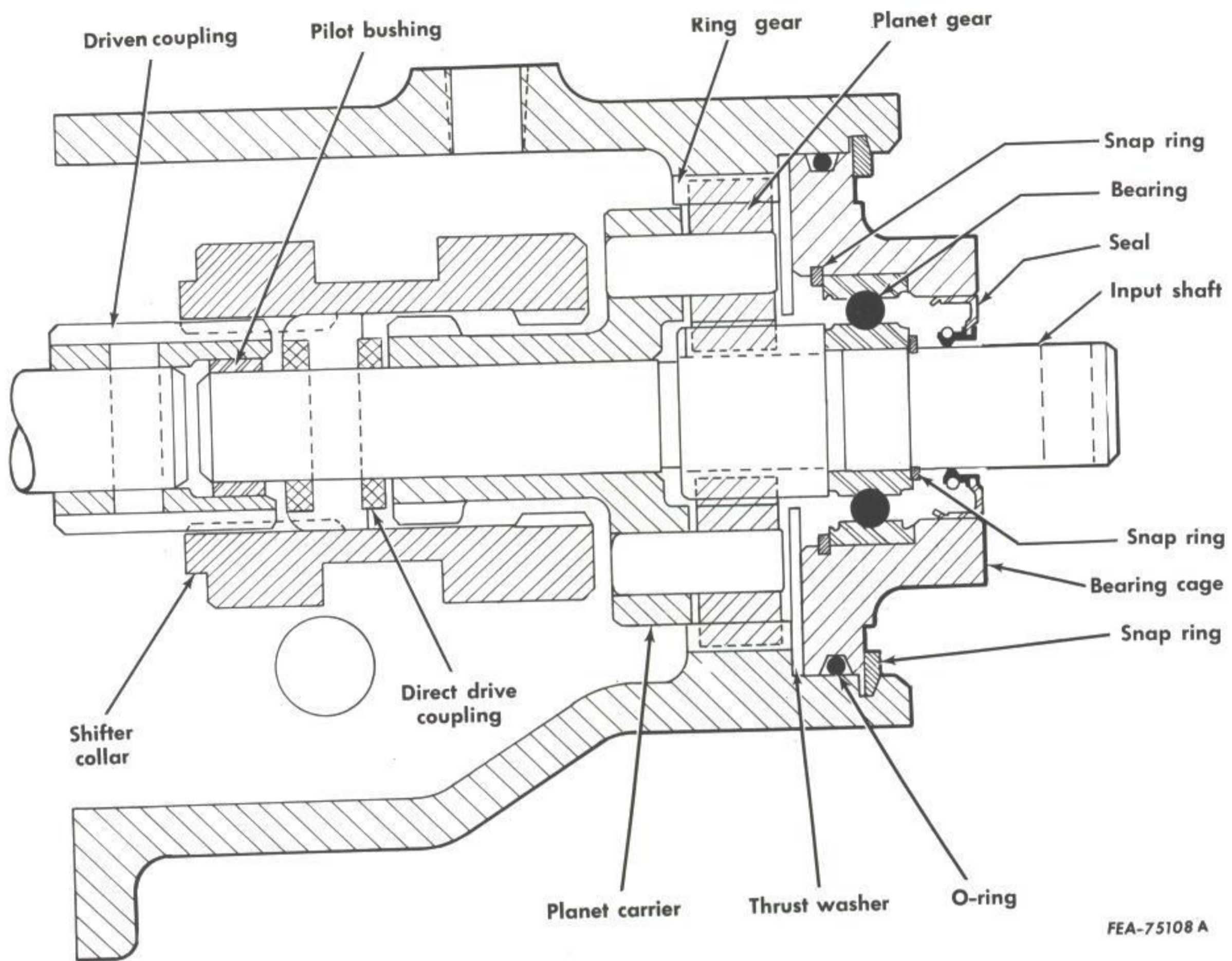
1. Split the tractor. Refer to page 2-20 this manual for splitting procedure.
2. Support the transmission and reduction housing on a suitable block, place in oil drip pan under the creeper unit and drain creeper lubricant. Refer to Illust. 2-17.
3. Four cap screws hold the creeper housing to the reduction housing cover plate. Remove the cap screws.
4. Bump the creeper to the side to loosen the housing from its gasket and dowels. Pull the creeper forward from the reduction cover and splined coupling.
5. If the driven coupling or the pilot bushing needs replacing, support the coupling and drive out the coiled spring pin. Remove the coupling.

Disassembly (Illusts. 2-77 and 2-78.)

1. Remove the snap ring which holds the input shaft bearing cage in the housing.
2. Pull the shaft, bearing, retainer, planetary assembly and the direct drive coupling from the housing.

NOTE: The spline grooves of the direct drive coupling must align with the splines of the shifter collar.

3. Support the direct drive coupling and drive the coiled spring pin out. Remove the coupling from the shaft.
4. Slide the planet carrier off the input shaft and the planet gears off the carrier pins.
5. Remove the flat thrust washer.
6. A snap ring holds the ball bearing outer race in the retainer. Remove the snap ring then push the bearing and shaft from the retainer.
7. The ball bearing is held on the shaft by a snap ring. Remove the snap ring. The shaft can now be pressed from the bearing.
8. Press the oil seal from the bearing retainer.
9. Drive the shift poppet pin from the shaft and remove the poppet.
10. Shift the lever and shifter collar toward the rear of the case and at the same time lift the shifter collar up to disengage it from the shift yoke.
11. Drive the pin out of the shift yoke and lever shaft.
12. Slide the lever shaft from the yoke and housing.
13. Remove the O-rings from the shaft, housing and bearing retainer.
14. Wash all parts in cleaning solvent then dry thoroughly.



Illust. 2-77. Cross section - side view of creeper drive assembly.

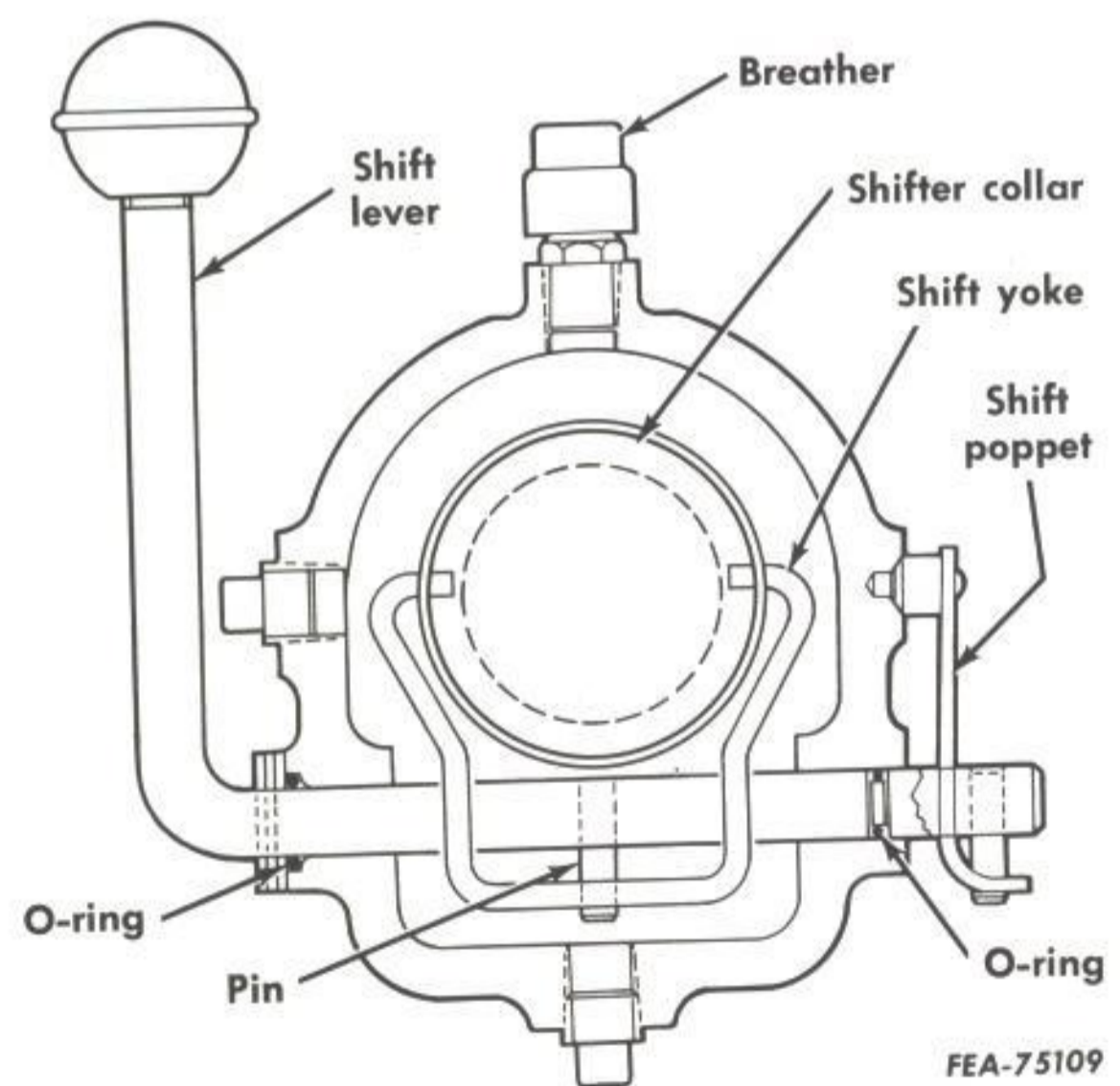
Inspection and Repair

1. Check the input drive shaft for oil seal groove wear, worn or chipped teeth on the integral gear and pilot bushing wear on the rear end.

2. Check the splines of the direct drive coupling, planet carrier and the shifter collar for wear and chipping.

3. Check the housing for cracks and the integral sun gear for wear and broken teeth.

4. Inspect the ball bearing for pitting, scoring, wear and rough operation.



Illust. 2-78. Cross section - end view of creeper shifting components.

Reassembly (Illust. 2-77)

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

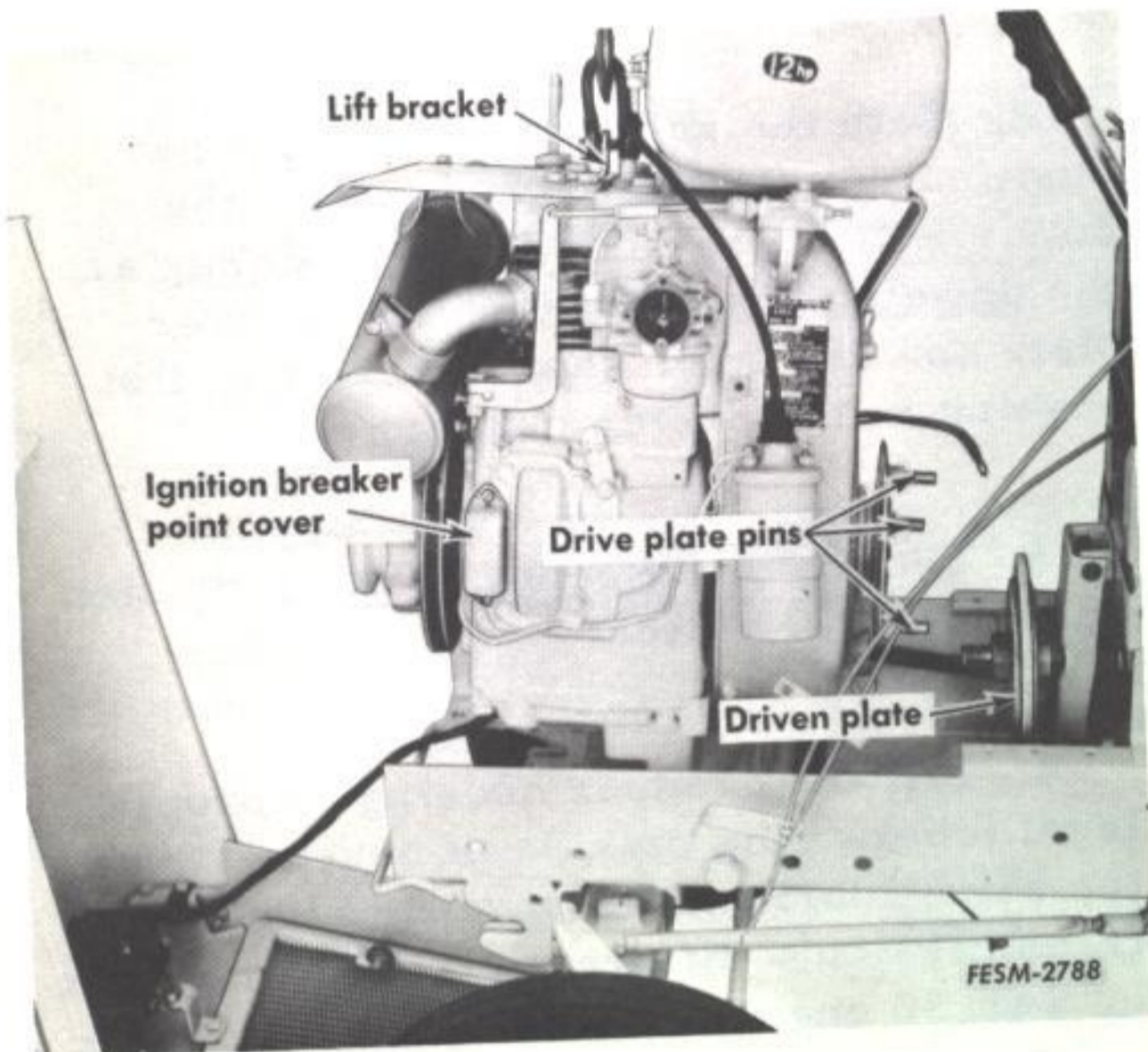
1. Always use new O-rings, gaskets and oil seals. O-rings and oil seals should be coated with lubriplate or chassis lubricant to assist in installation and provide initial lubrication.
2. Install the oil seal after completing the drive assembly in the housing.
3. The pins which secure the direct drive coupling and the driven coupling to their respective shafts must be flush or below the spline groove so as not to interfere with shifting.
4. The long internal splines of the shifter collar go toward the rear.
5. The machined shoulder of the direct drive coupling goes toward the planet carrier.
6. Lubricate the components and rotate the drive shaft several turns with the shifter in each speed selection to insure freedom of movement and rotation.

Installation

1. Place a new gasket on the mounting face of the creeper housing. The dowels will hold it in place.
2. With the shifter collar in its rear position, rotate the drive shaft so the collar will engage the driven coupling as the dowels engage the reduction cover plate and the drive shaft enters its pilot bushing in the driven coupling.
3. Secure the creeper to the reduction housing cover plate.
4. Fill the creeper housing to proper level (check plug on side of housing) with the same lubricant as specified for the transmission - differential. Hy-Tranfluid or SAE 30 engine oil.
5. Shift the unit several times to insure freedom of movement. Leave the shifter lever in its forward position for re-coupling the split tractor.
6. Reassemble the split tractor. (Refer to page 2-20.)

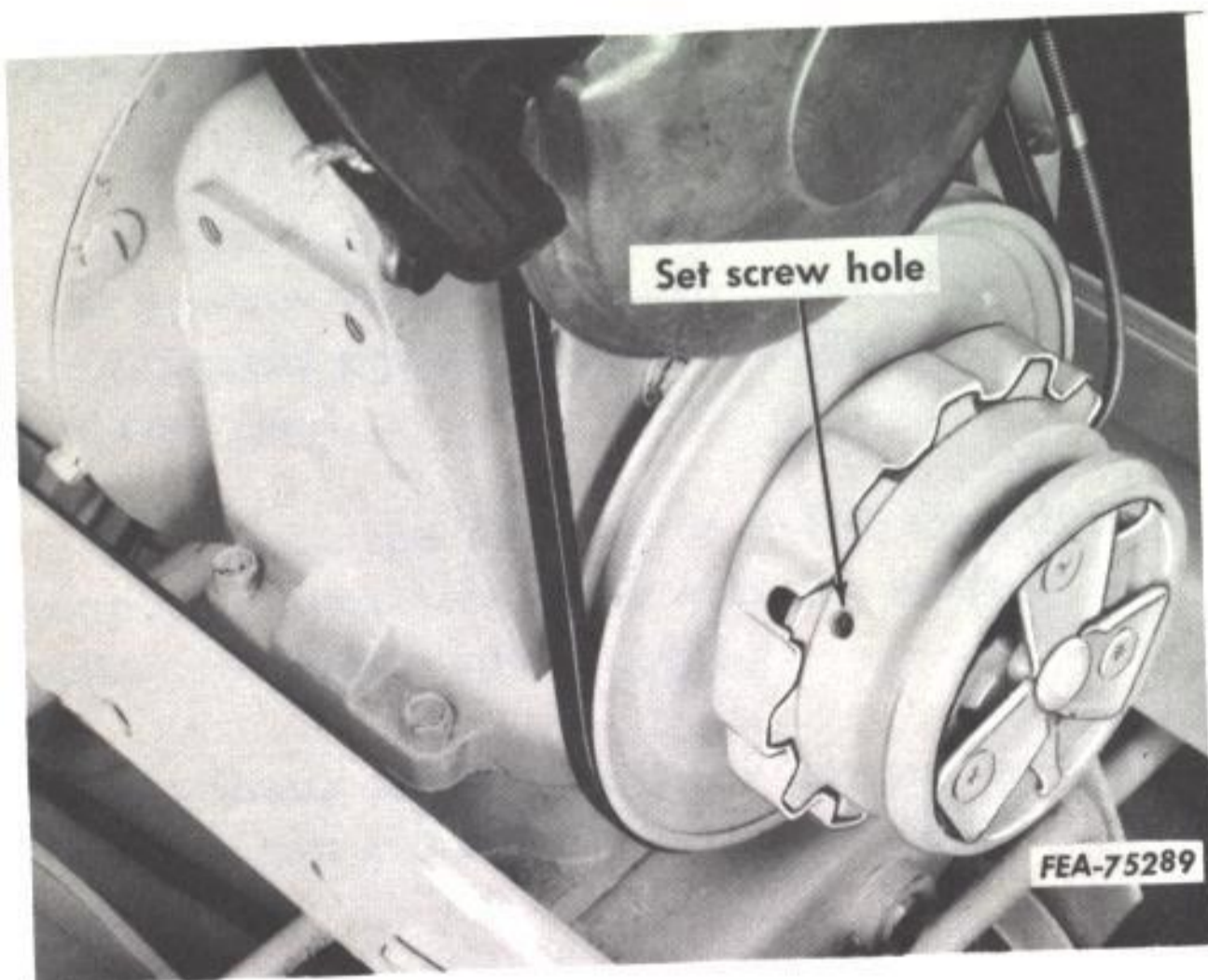
FRONT PTO CLUTCH

Removal



Illust. 2-79.

1. Remove grille and hood and disconnect clutch pivot rod from grille casting. Lay (grille face down) in front of tractor. Refer to Illust. 2-79.



Illust. 2-80. Location of set screw holes in clutch pulley housing.

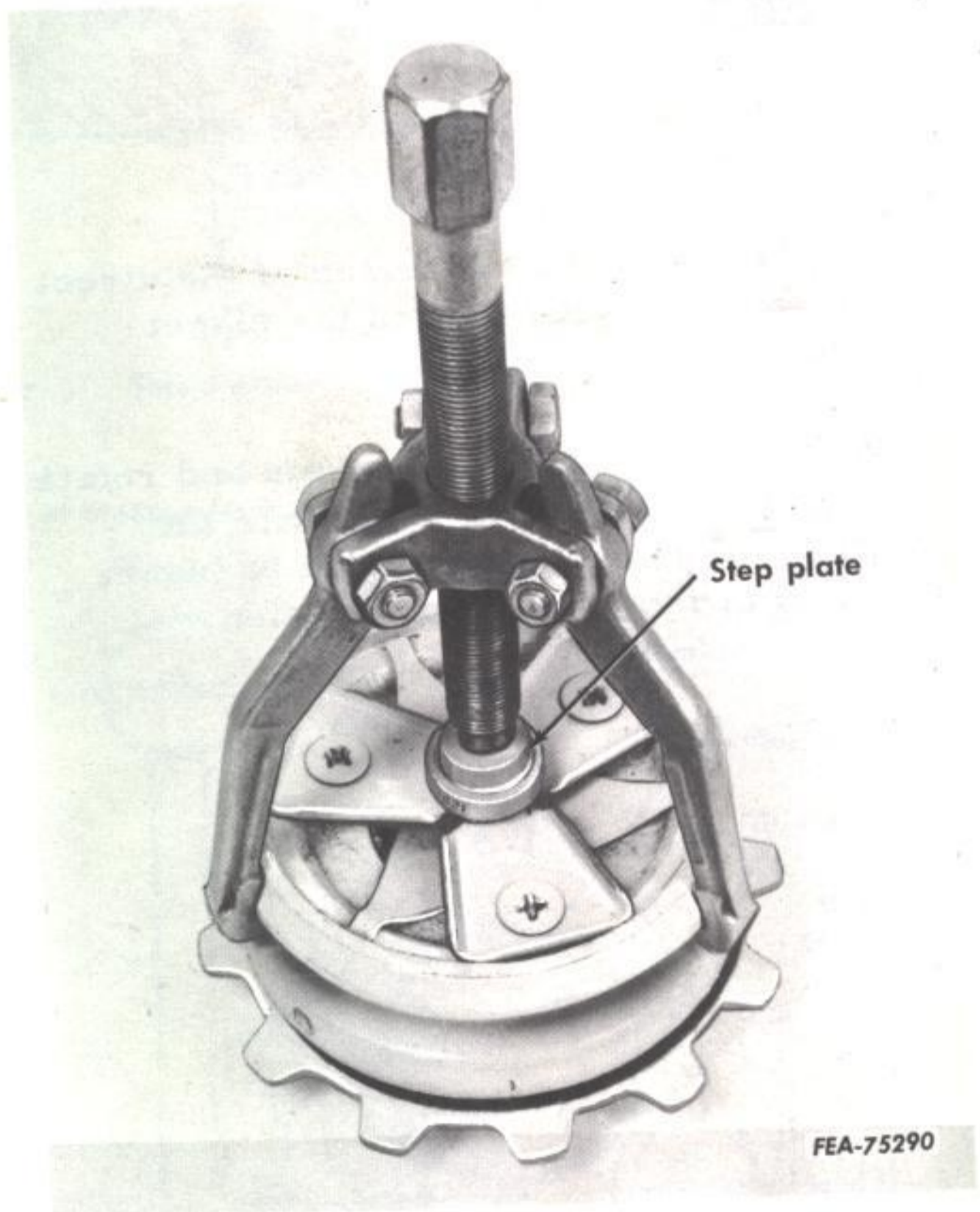
2. Remove the jam set screw and lock set screw from each of the three holes in the clutch pulley housing (Illust. 2-80).

NOTE: These set screws lock the clutch to the bearing on the tractor crankshaft.

3. Remove the clutch from the tractor as an assembly.

4. Loosen locking collar on crankshaft bearing and remove bearing.

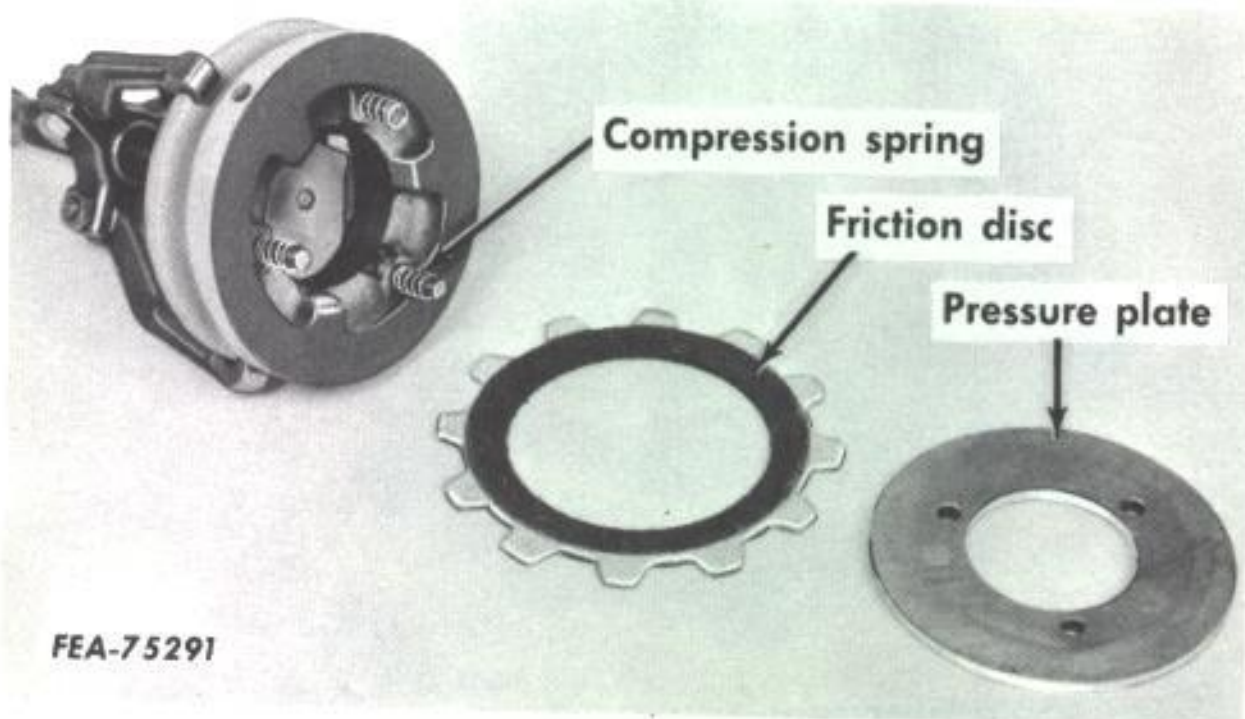
Disassembly



Illust. 2-81. Three jaw puller installed on clutch assembly.

1. Install a three jaw puller on the clutch assembly so the jaws hook into belt pulley groove and are located between the throw-out levers (Illust. 2-81). Use a step plate between the thrust button and the puller bolt.

2. Tighten up on the puller bolt just until the friction disc disengages the pressure plate.



Illust. 2-82. Pressure plate and friction disc removed.

3. Remove the throw-out lever screw jam nuts and remove the pressure plate and friction disc (Illust. 2-82).

4. Release the pressure applied to the clutch button by the puller and the remaining components of the clutch assembly can be removed.

Inspection and Repair

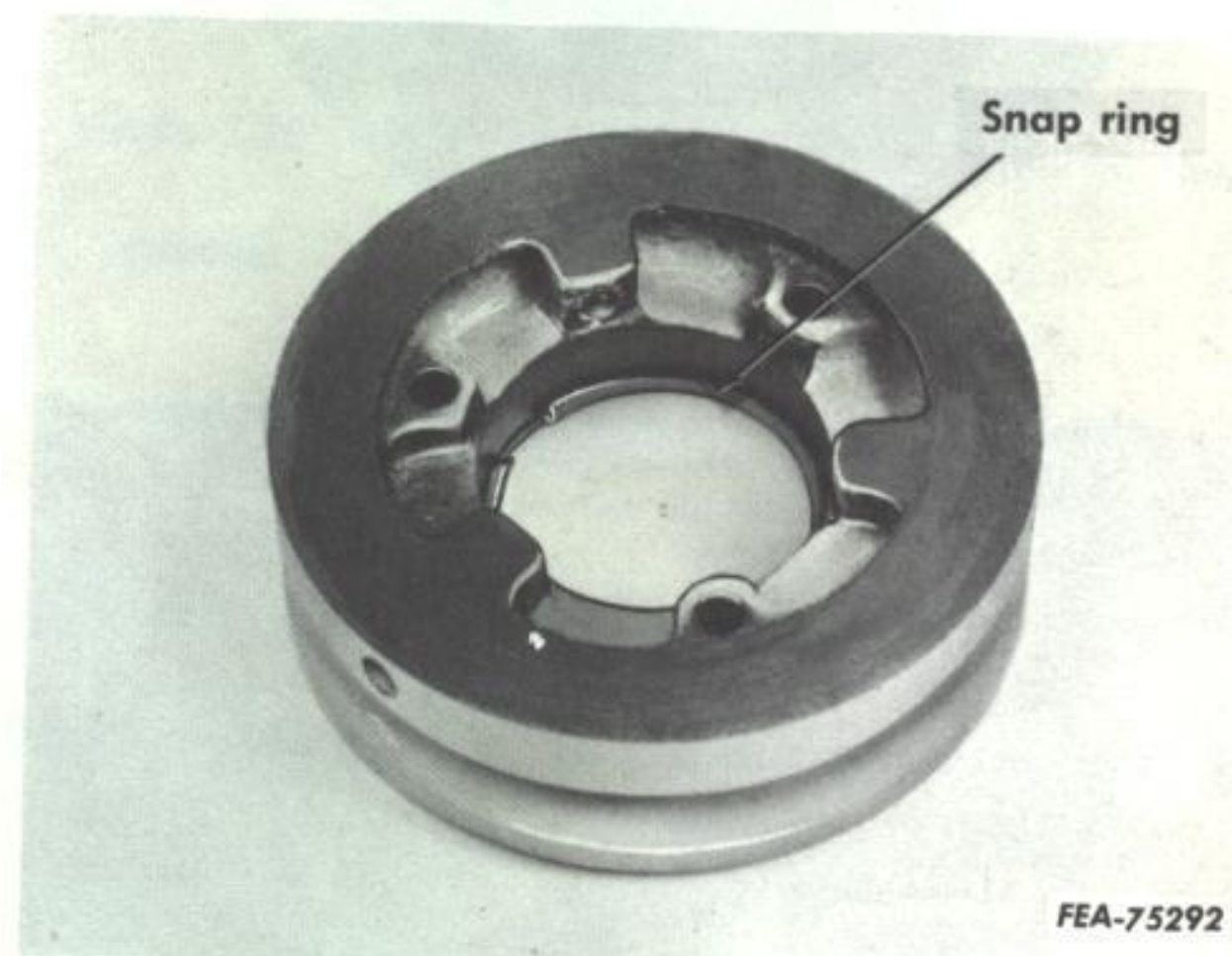
1. Inspect the pressure plate for scoring or excessive warpage. If it is .010 inch or more out of flat it must be replaced.

2. Inspect the friction disc for scoring, cracks or damaged lugs.

NOTE: The clutch will operate satisfactorily if four lugs are broken, providing the four broken lugs are not grouped together. If it is necessary to replace the friction disc, the pressure spring must be replaced at the same time.

3. Inspect the thrust button for damage or wear and replace if necessary.

4. Inspect the pulley groove for burrs, nicks or grooves that may cause damage to the belt. Repair or replace the pulley if necessary.



Illust. 2-83. Location of pulley snap ring.

5. Inspect the bearing snap ring and groove for wear and replace if necessary (Illust. 2-83).

6. Inspect the clutch bearing on the engine crankshaft to be sure it turns free. Replace the bearing if loose or rough.

7. Inspect the wear button on the clutch release shaft assembly for wear and replace if necessary.

8. If new throw-out lever screws are to be used in reassembly, be sure they are those as listed in the parts catalog as these are special machine screws.

Reassembly

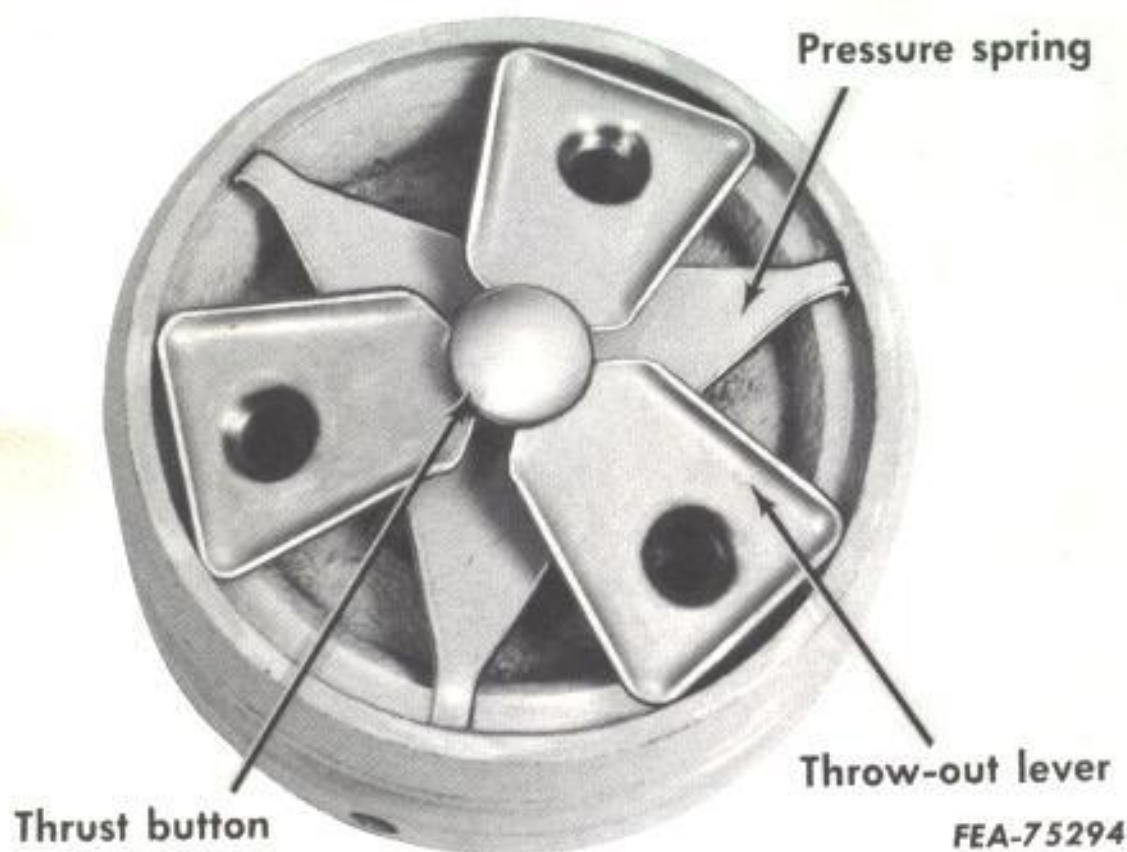


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Illust. 2-84. Pressure spring located on pulley.

1. Position the pressure spring on the actuating pulley so the tips are equally spaced between the screw holes (Illust. 2-84).

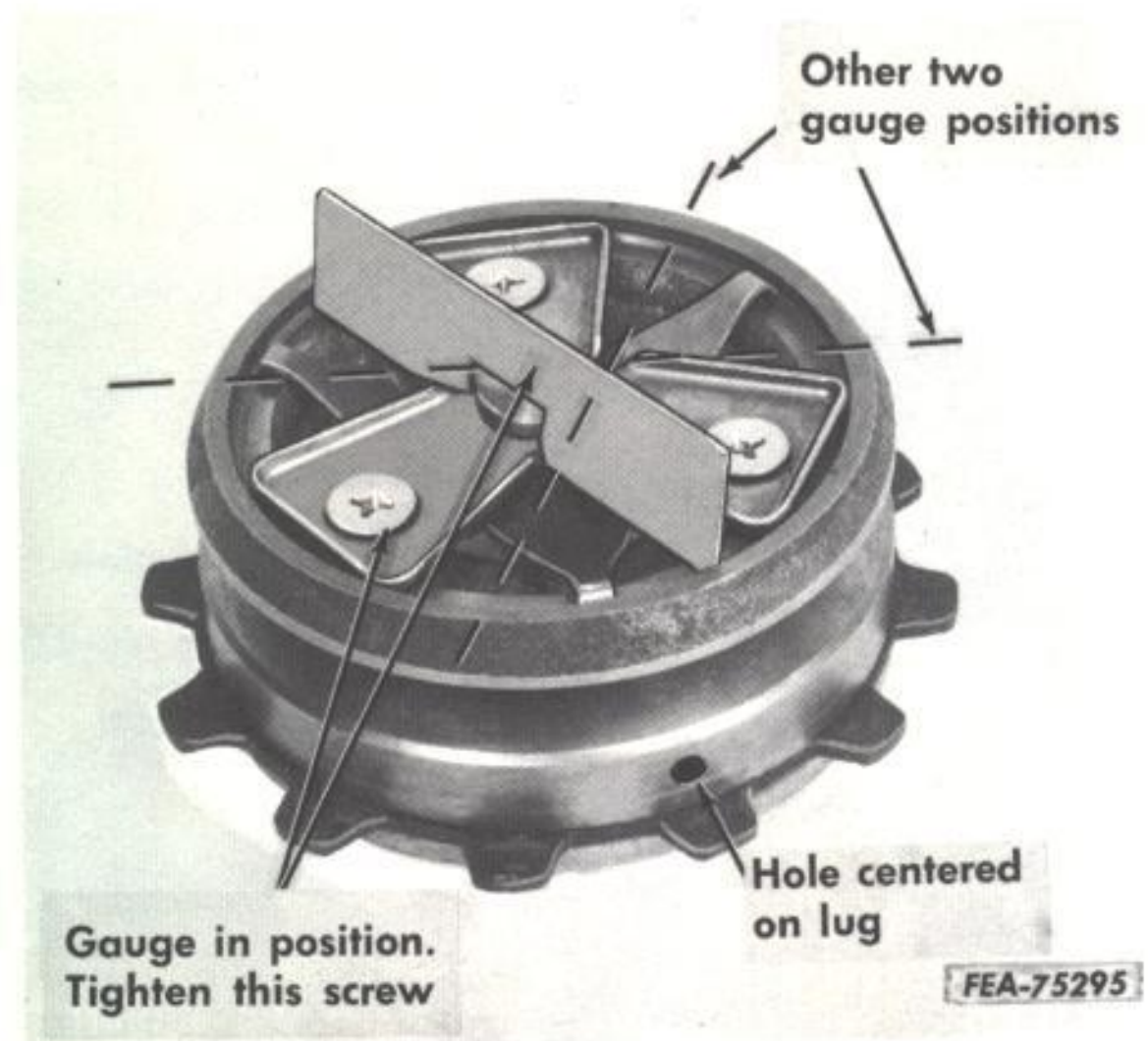
2. Install the thrust button on the pressure spring.



Illust. 2-85. Clutch partially assembled.

3. Install the three throw-out levers so they engage the slot in the thrust button. Line up the screw holes and install the screws (Illust. 2-85).

4. Holding the throw-out levers, screws, thrust button and pressure spring in place, turn the assembly over and install the compression springs (one to each screw), friction disc and pressure plate. (Illust. 2-82.)



Illust. 2-86. Adjusting gauge in position.

5. Install the nuts on the screws and tighten them finger tight. Be sure the friction disc is centered and that a lug on the disc is centered with a set screw hole in the pulley housing (Illust. 2-86).

Adjustment

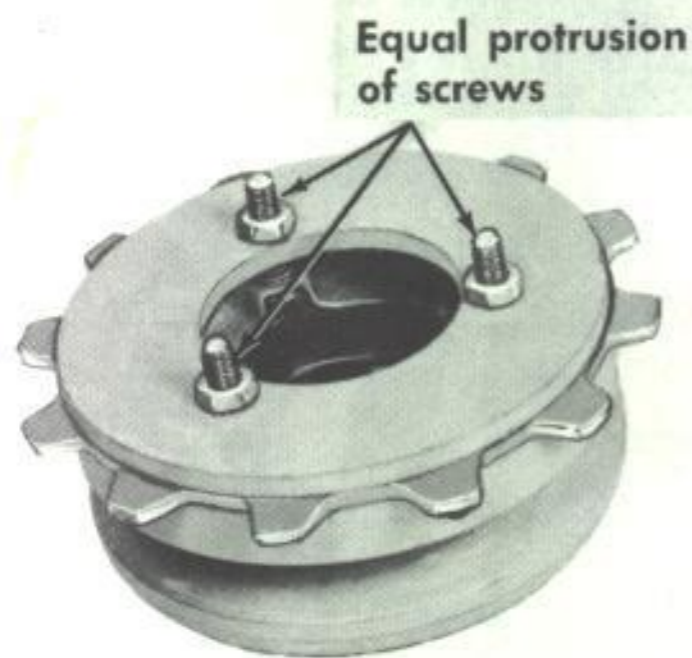
1. Install the adjusting gauge in position shown in Illust. 2-86.

NOTE: Adjusting gauge is supplied with clutch disc repair kit.

2. Tighten the special machine screw (in line with the center of the gauge) until the gauge ends contact the recessed machined surface of the pulley. The gauge should not rock the tips.

3. Repeat step 2 for the remaining two gauge positions.

4. Recheck each of the three positions with the gauge a second time after all three screws have been adjusted to be sure all three adjustments are equal.



Illust. 2-87. Screw protrusion approximately equal.

5. The specified pressure applied to the pressure spring is now set. The protruding ends of the screws should be approximately equal (Illust. 2-87). If they are quite different, something is wrong and the clutch will have to be disassembled, checked, reassembled and adjusted.

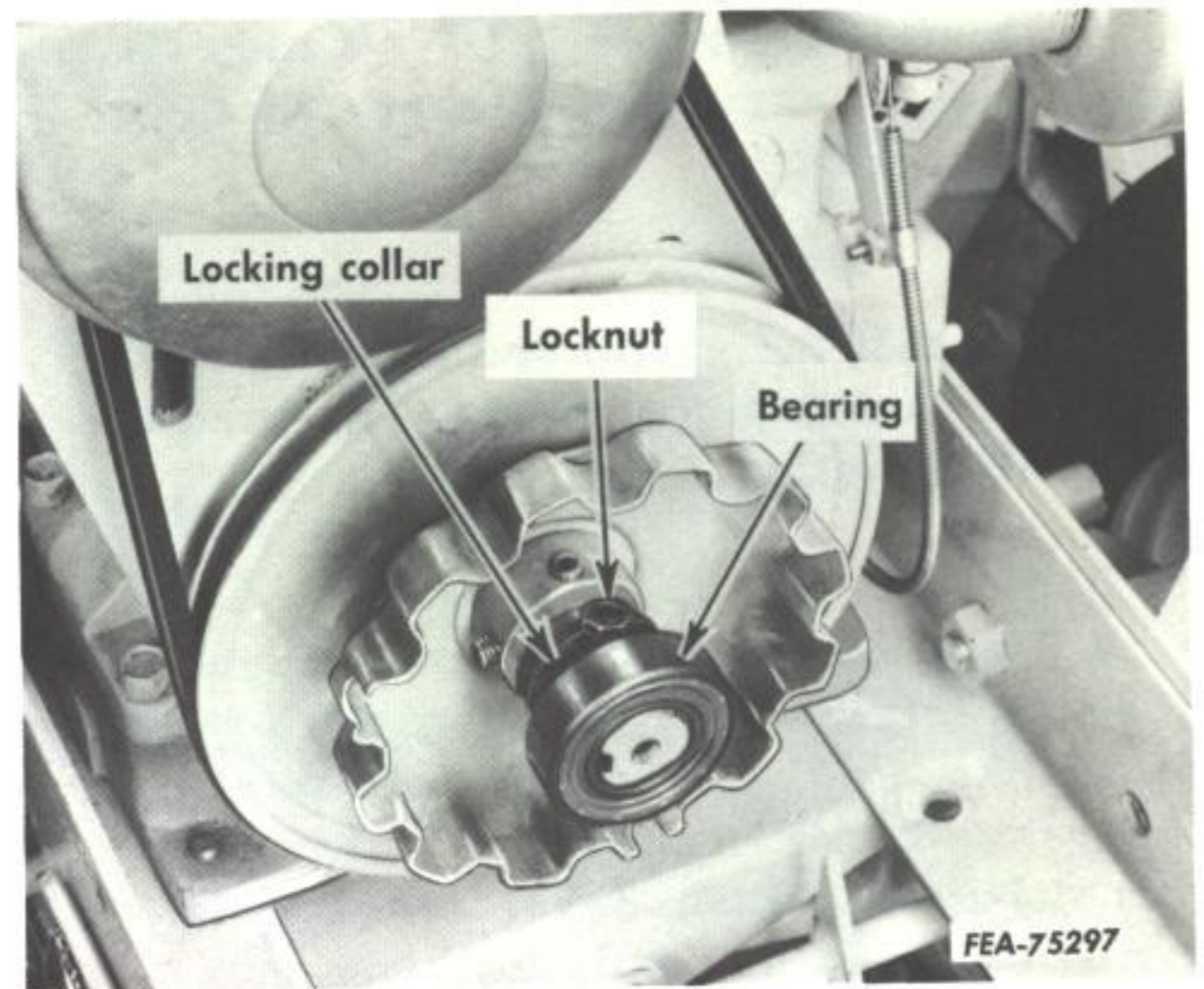
6. Install the machine screw lock nuts and tighten them to 6 - 7 ft. lbs. torque.

Installation

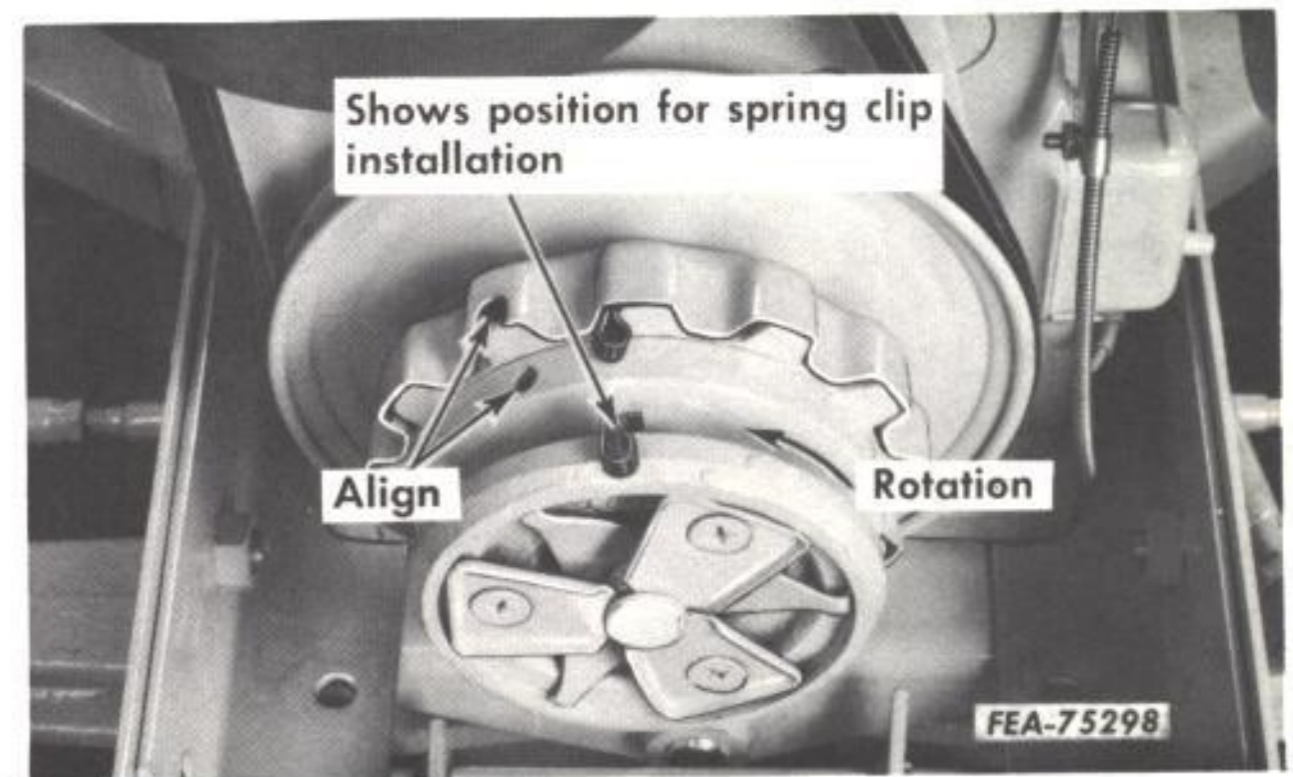
NOTE: The drive pulley hub must be $1\text{-}1/2''$ from end of crankshaft on 7 HP Model and $1\text{-}1/4''$ on 10 and 12 HP Models.

1. If a new clutch bearing is to be used, install it on the crankshaft so it is flush with the end of the crankshaft. Lock it in place with the locking collar. Be sure to lock the collar to the bearing in the direction of crankshaft rotation. Lock the collar in place with the set screw and nut (Illust. 2-88).

2. Install the clutch assembly on the bearing part way. Be sure the set screw holes in the clutch pulley housing line up with the slots in the drive pulley cup (Illust. 2-89).



Illust. 2-88. Clutch bearing and collar installed on shaft.



Illust. 2-89. Installing the clutch assembly.

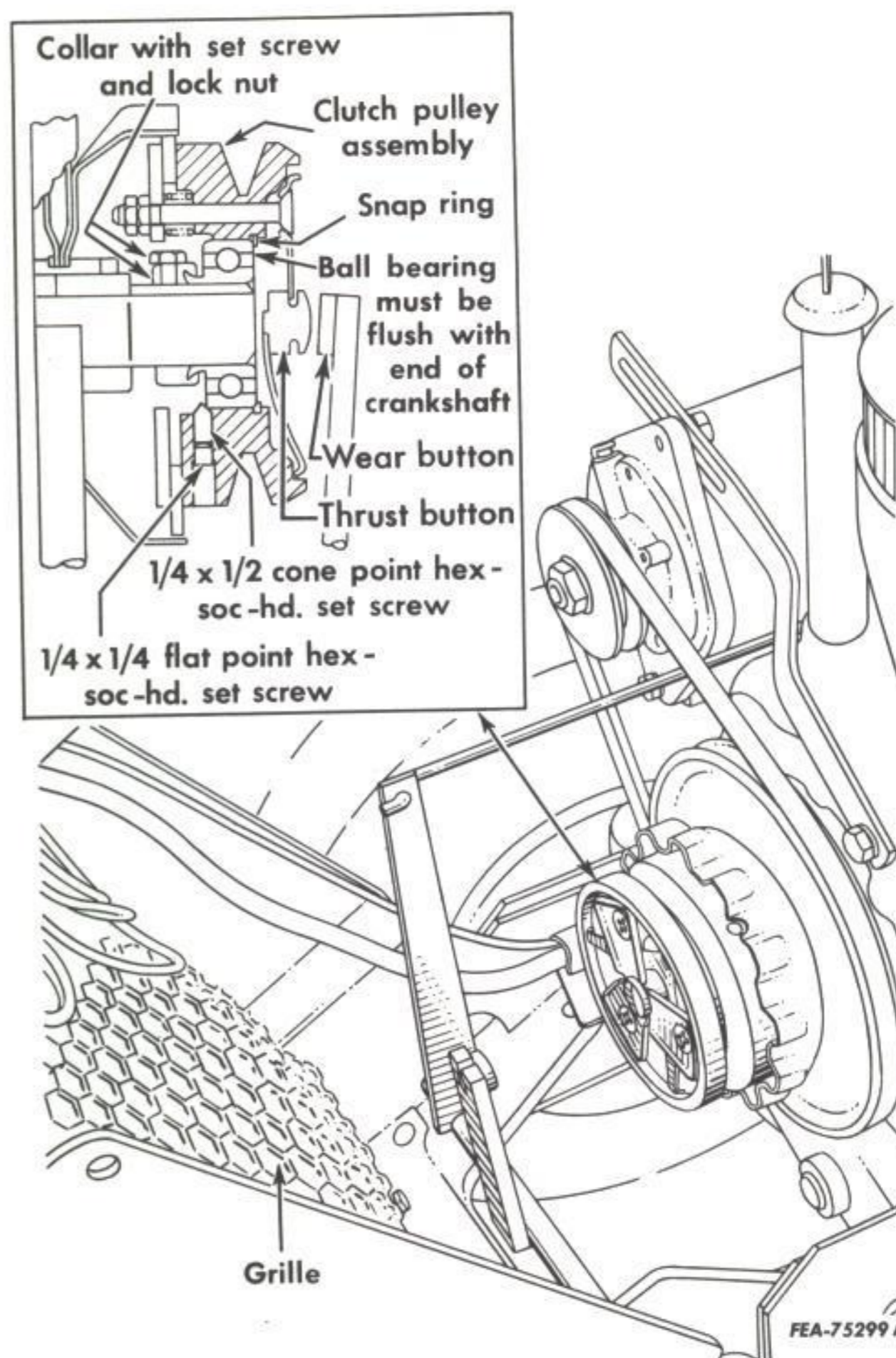
3. Equally space and install 3 friction disc springs on the friction disc lugs on the non-drive side of the lugs. The non-drive side of the lugs is the left hand side of the lug when looking at the front of the clutch (Illust. 2-89). Place flat side of springs inside the cup. Push the clutch assembly the rest of the way on the bearing until the snap ring in the clutch is flush with the bearing. Be sure the complete thickness of the disc is inside the drive pulley cup.

4. Install the three $1/4 \times 1/2$ inch cone point hex socket set screws in the clutch pulley and torque them to 60-72 in. lbs.

5. Install the three 1/4 x 1/4 inch flat point hex set screws and torque them to 72 - 84 in. lbs.

6. Install the grille and hood being sure the clutch pivot shaft is inserted in the grille casting.

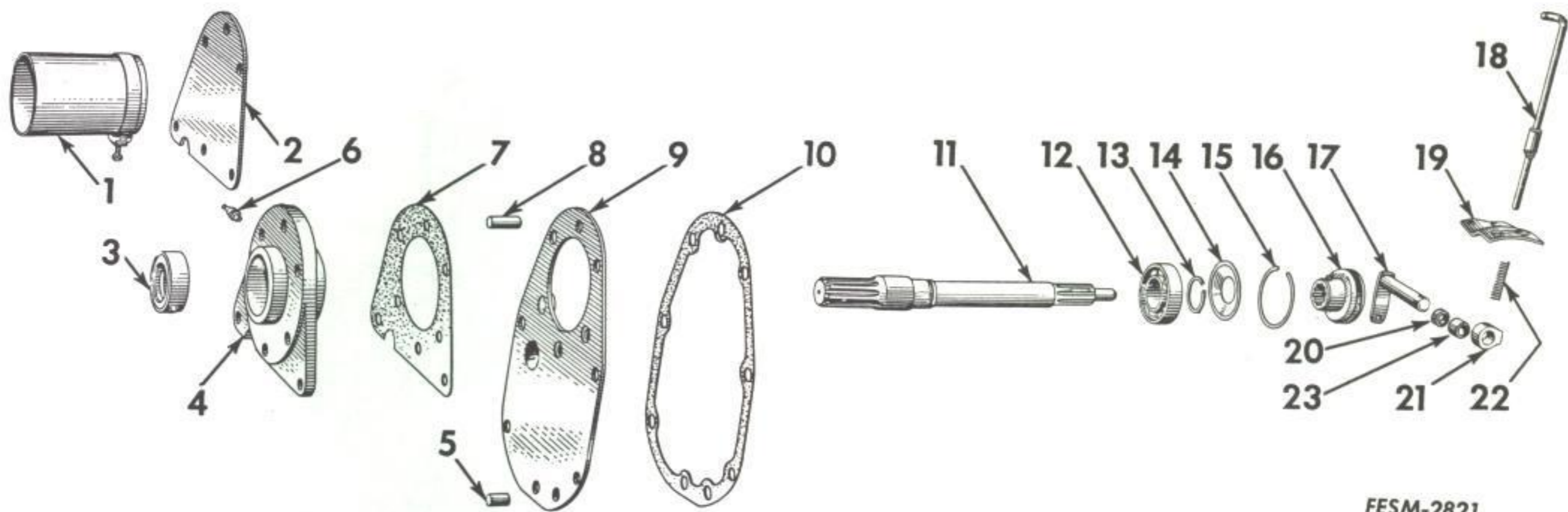
7. With the hand lever in the forward position (clutch fully engaged), adjust the turnbuckle so there is 1/64 inch minimum clearance between the wear button and thrust button (Illust. 2-90). Secure the turnbuckle with the jam nut.



Illust. 2-90. Clutch diagram.

REAR PTO

Model 72

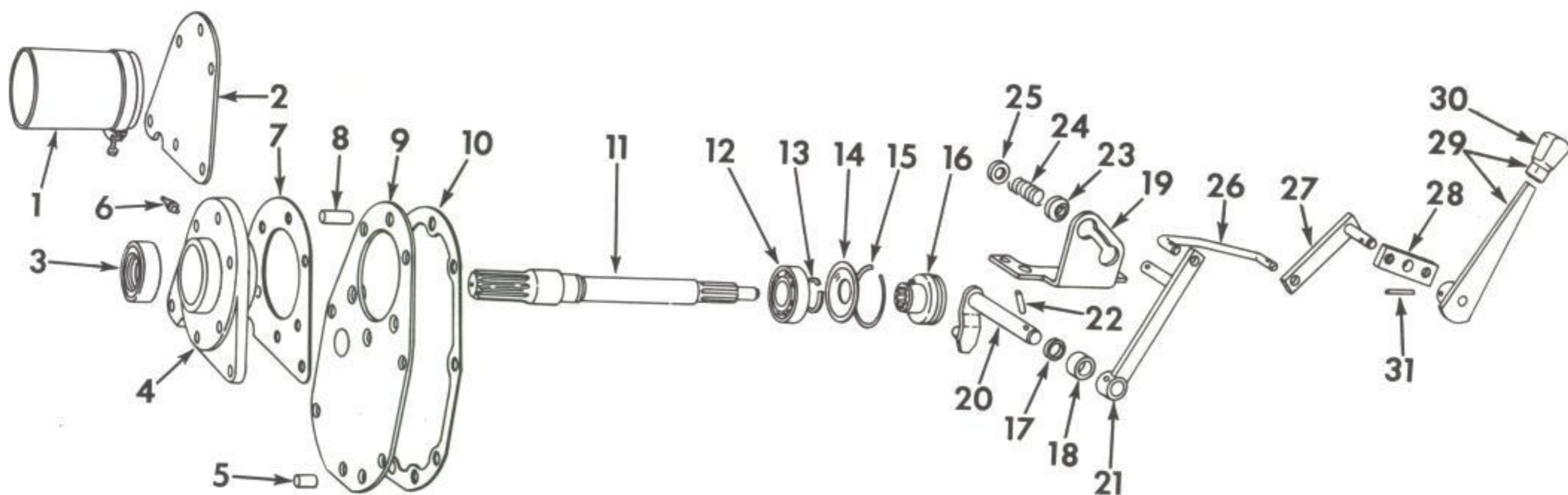


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Illust. 2-91. Exploded view of rear PTO Model 72.

- | | | | |
|------------------|-------------|---------------------|------------|
| 1. Guard | 7. Gasket | 13. Snap ring | 19. Guide |
| 2. Adapter cover | 8. Dowel | 14. Shield | 20. Seal |
| 3. Oil seal | 9. Adapter | 15. Snap ring | 21. Collar |
| 4. Retainer | 10. Gasket | 16. Shifter clutch | 22. Spring |
| 5. Dowel | 11. Shaft | 17. Lever and shaft | 23. Spacer |
| 6. Fitting | 12. Bearing | 18. Shifter rod | |

Model 104 and 124



FESM-2822

Illust. 2-92. Exploded view of rear PTO Model 104 and 124.

- | | | | |
|-------------|-------------|------------|------------|
| 1. Guard | 9. Plate | 17. Seal | 25. Washer |
| 2. Cover | 10. Gasket | 18. Spacer | 26. Rod |
| 3. Seal | 11. Shaft | 19. Guide | 27. Lever |
| 4. Retainer | 12. Bearing | 20. Lever | 28. Bar |
| 5. Pin | 13. Ring | 21. Arm | 29. Handle |
| 6. Fitting | 14. Shield | 22. Pin | 30. Knob |
| 7. Gasket | 15. Ring | 23. Washer | 31. Pin |
| 8. Pin | 16. Clutch | 24. Spring | |

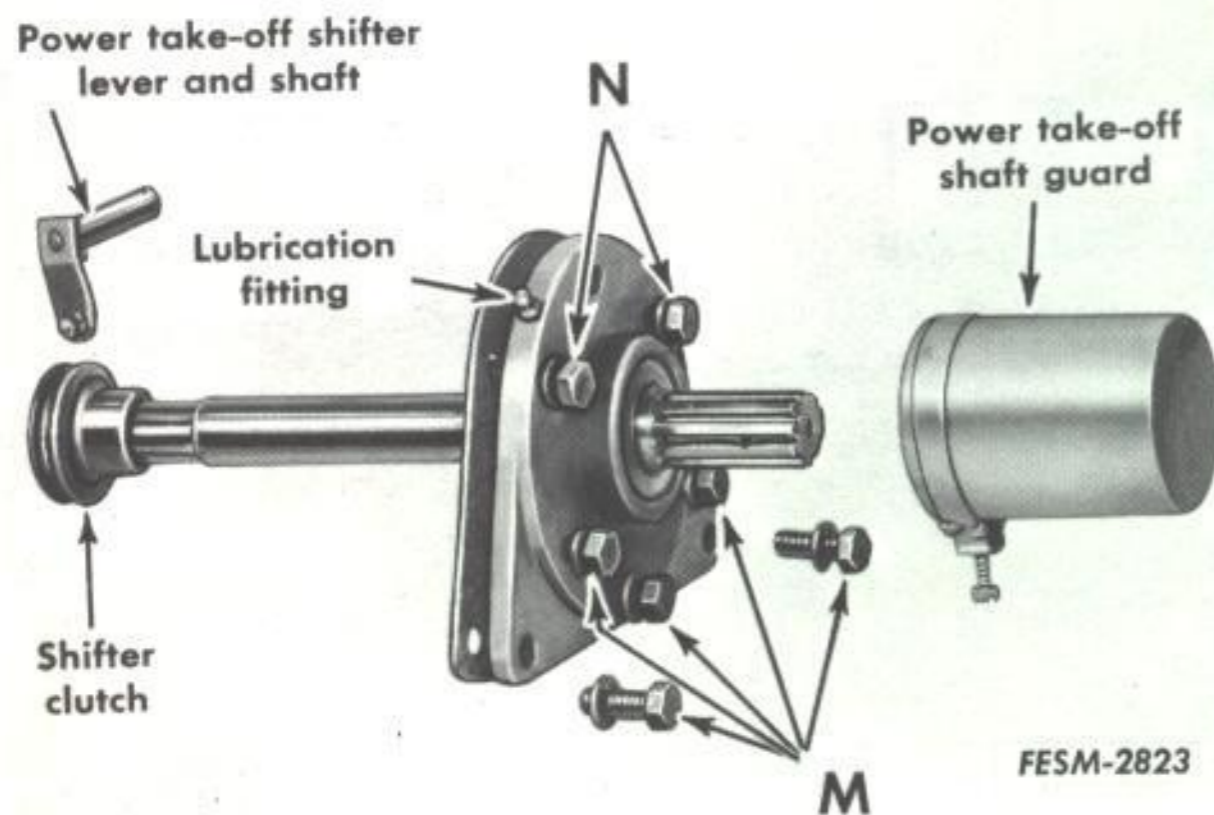
Removal

Remove 7 cap screws M and N around rear oil seal and bearing retainer. Pull shaft, retainer, shifter clutch to the rear letting the front clutch disengage from the shift lever shaft.

Inspection

Check shifter clutch for excessive wear. Check lock screw and nut for damage. Inspect bearing and splines. Check lever shaft pin for flat sides.

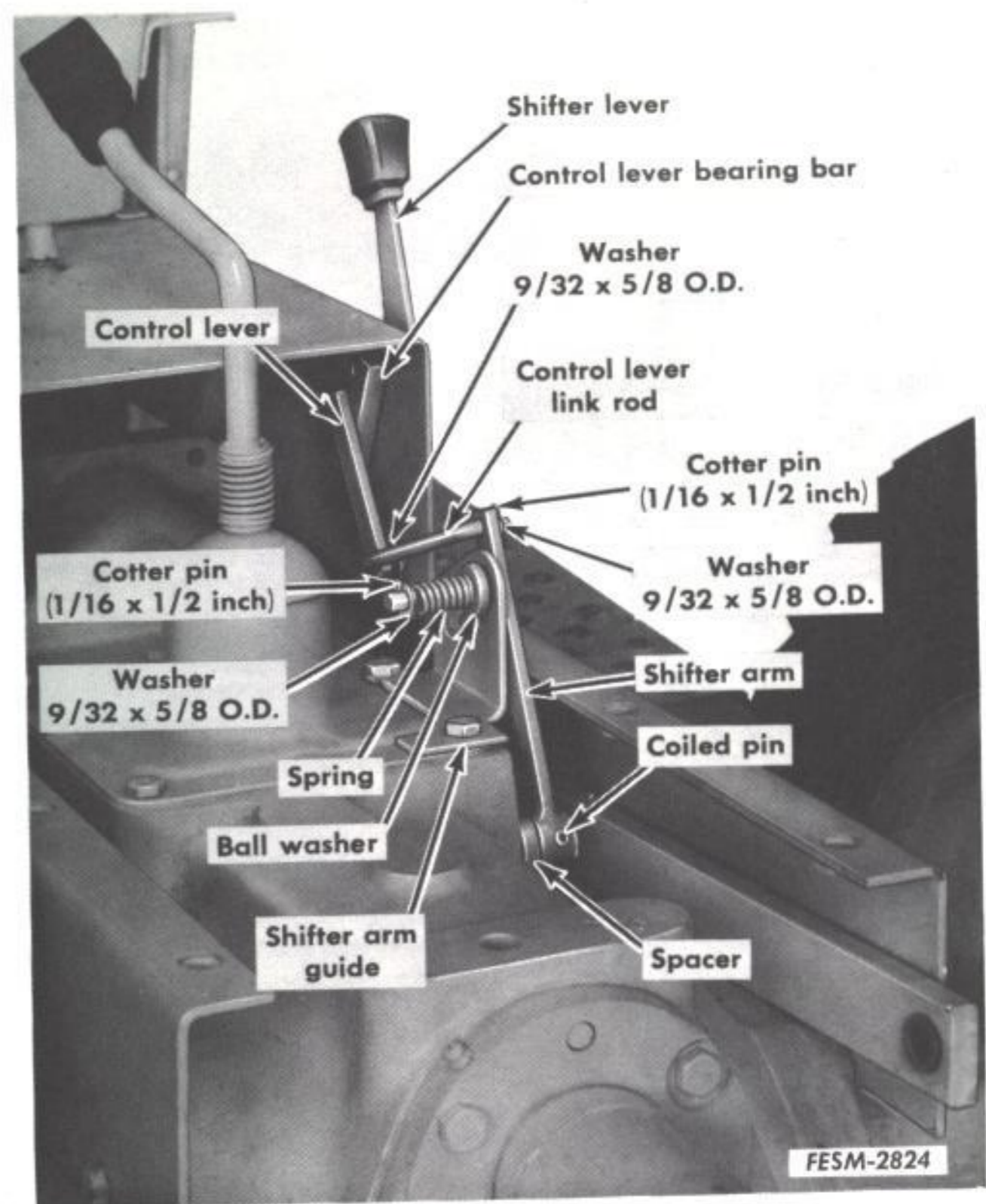
Assembly



Illust. 2-93. Rear PTO drive parts.

Slide shifter clutch on to the power take off shaft and secure with set screw and nut (Illust. 2-93).

Apply a coating of grease on the pilot end of the power take off shaft. Making



Illust. 2-94. PTO shifter control assembly - Model 104 and 124.

sure oil seal is installed with lip towards inside and gaskets are in place insert power take off shaft assembly through the hole in the adapter plate and engage the pin on the shifter shaft lever with the groove in the clutch.

Move the assembly forward and engage the pilot end of the shaft with the female end of the transmission input shaft.

Fasten the power take off assembly into place with the cap screws removed.

Refer to Illust. 2-94 for control assembly.

Section 3

IH EQUIPMENT

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SPECIFICATIONS

Mowers

Torques (foot pounds)

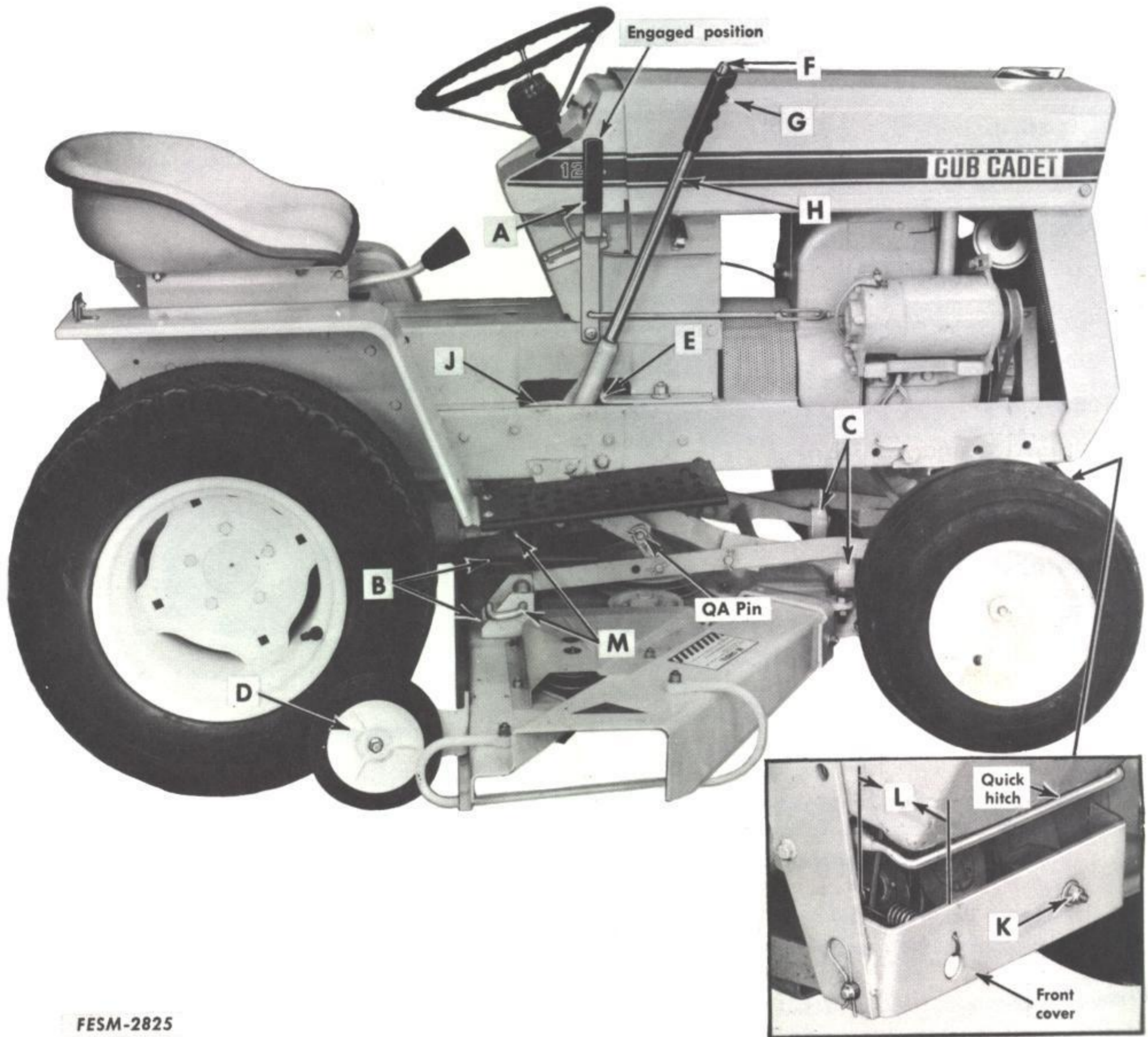
Spindle end bolt	38 to 45
Blade nut	55 to 60

Snow Thrower

Gear backlash - inch006 to .018
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MOWER

Removal



FESM-2825

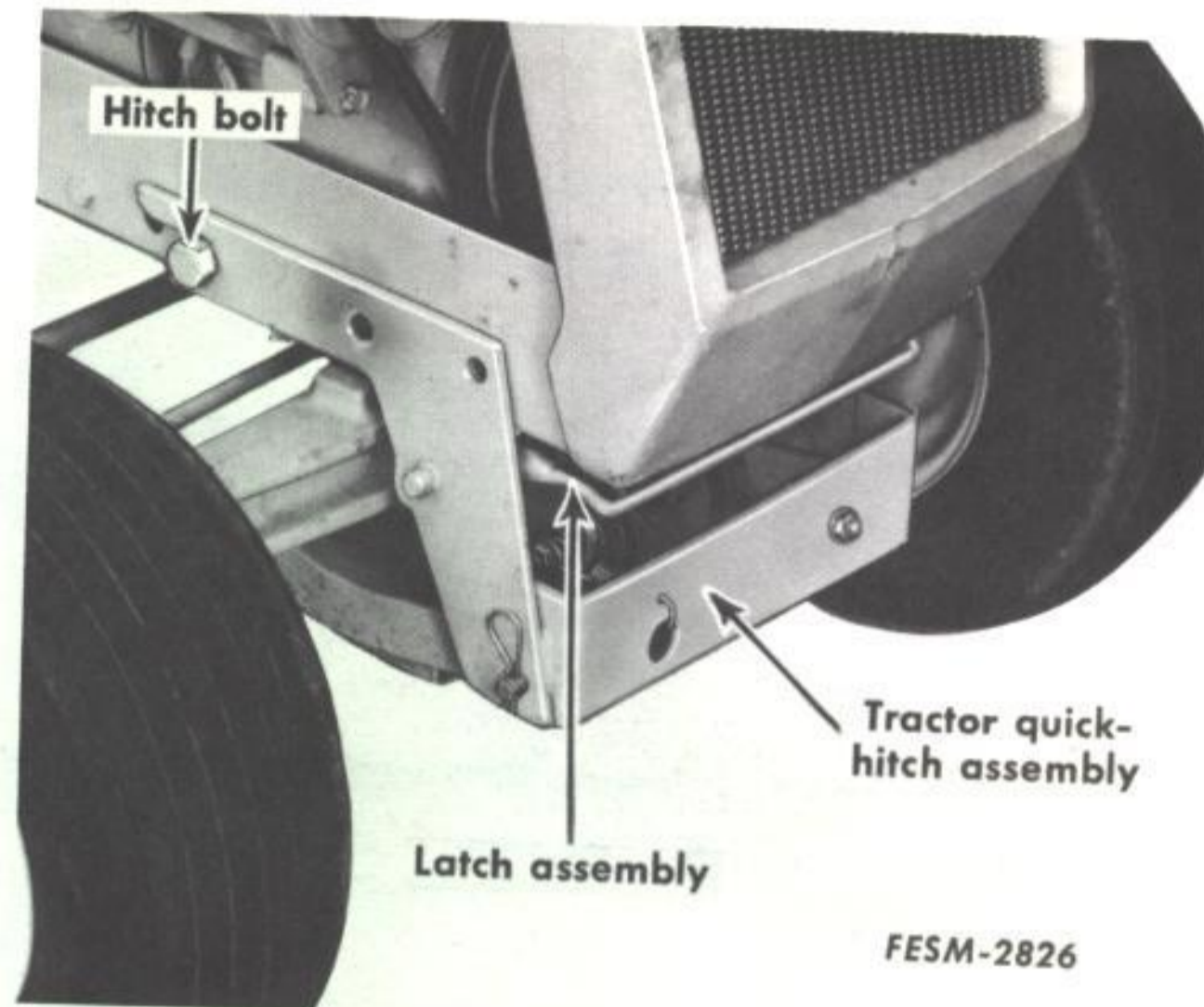
Illust. 3-1.

(Refer to Illust. 3-1.)

1. Lower the mower to the ground.
2. Pull support pins "M" to release mower from lift frame.
3. Slide mower forward to free from lift clevises "C". Pull lift handle back to raise lift frame.
4. Position front wheels to allow mower to be removed.

To remove lift frame detach the two "Q - A" cotters (Illust. 3-1) one on each side and push the tractor quick hitch latch assembly down. (Illust. 3-2.)

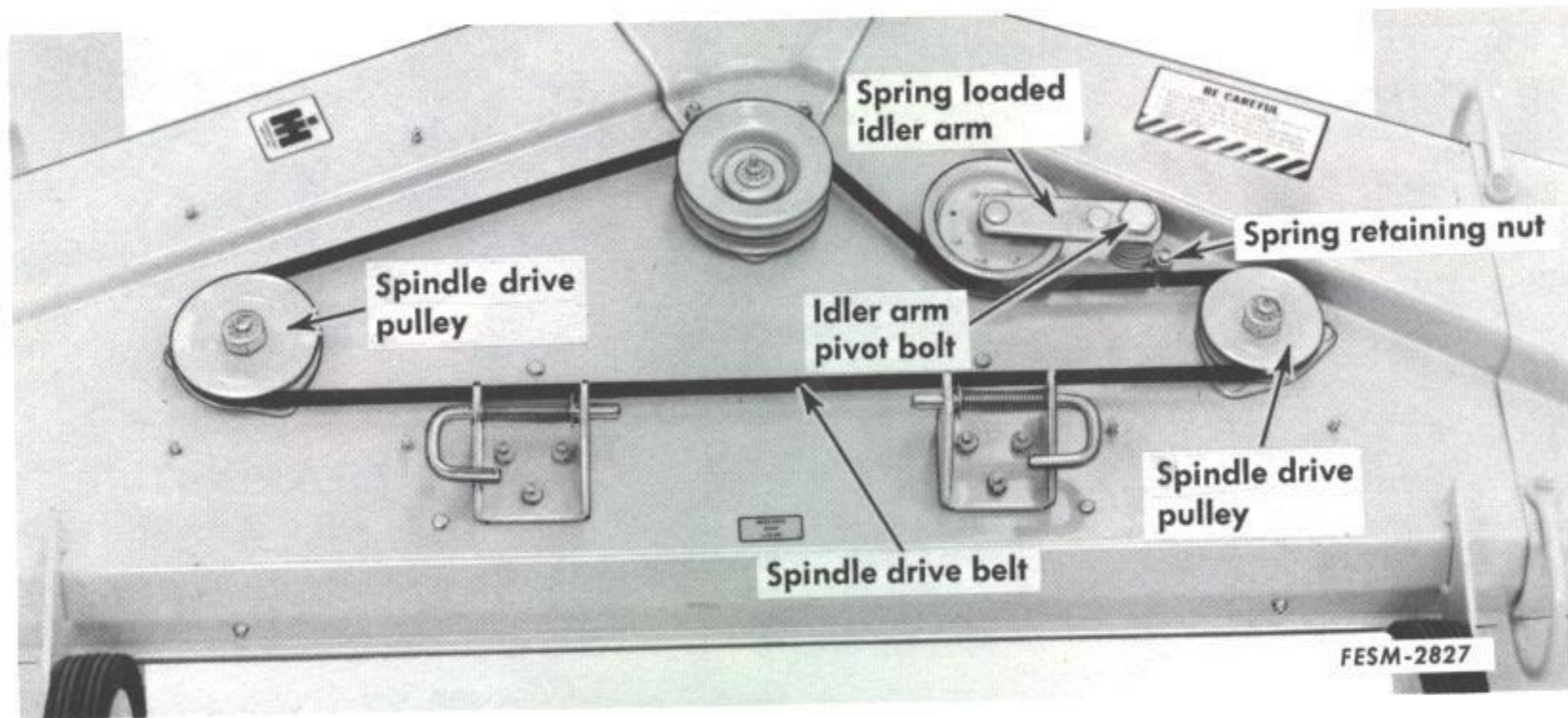
Pull hanger assembly forward to uncouple from tractor.



Illust. 3-2. View of quick hitch assembly.

Disassembly

(Refer to Illust. 3-3.)



Illust. 3-3. Top view of mower assembly.

1. Remove the L. H. and R. H. belt shields.

2. Remove the spindle drive belt.

3. Remove the nut and washer securing the idler arm spring.

4. Remove the nut from the idler arm pivot bolt to remove arm assembly.

5. Remove the spindle end bolt from the center pulley and remove the pulley. The spindle assembly will drop out the bottom.

6. To remove either of the two outer pulleys and spindle assemblies, install a wrench on the pulley to hold it in place and

remove the spindle end bolt (Illust. 3-5). Blade and spindle assembly will come out bottom. Hold spindle and blade assembly in vise to remove blade nut.

7. Remove the pulley spacers from the seals. Using a brass drift, tap against the top of the cone spacer to remove the bottom oil seal and bearing cone.

8. Turn the mower over and tap against the inner race of the bearing cone to remove it and the top oil seal (Illust. 3-5).

9. Any spindle housing may be removed from mower by removing the three attaching bolts.

Inspection and Repair

1. Wash all parts in cleaning solvent and dry with compressed air.

NOTE: Do not allow bearings to spin while drying with compressed air.

2. Inspect the bearing cups and cones for wear or roughness of operation and replace if necessary.

IMPORTANT: If bearings are to be replaced, the bearing cups, cones and cone spacers must be replaced as an assembly.

3. Inspect the spindle drive belt for wear and replace if necessary.

4. Inspect the pulleys for wear and replace if necessary.

5. Inspect the blades for excessive wear and nicks. Refer to "BLADE SHARPENING".

6. Inspect the blade drive spindle shafts for wear or roughness and replace if necessary.

7. Inspect the spindle friction discs for damage and replace if necessary.

8. Inspect the spindle rotor housings for cracks etc. and replace if necessary.

9. Inspect the shroud assembly for dents etc. and repair or replace if necessary.

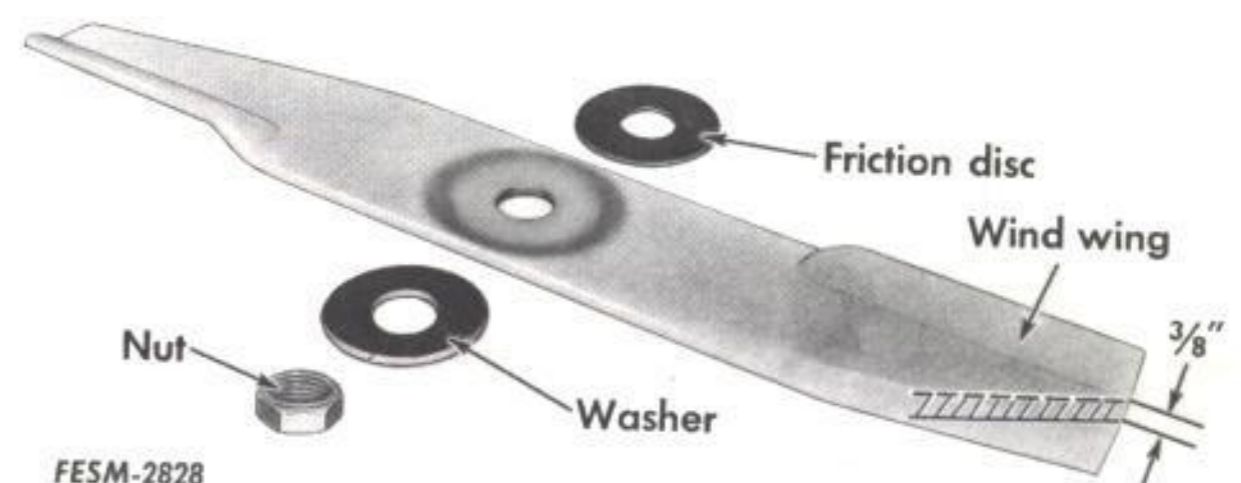
10. Inspect the main drive belt for wear and replace if necessary.

11. Inspect the drive belt idler pulleys for freeness of rotation and replace if necessary.

Blade Sharpening

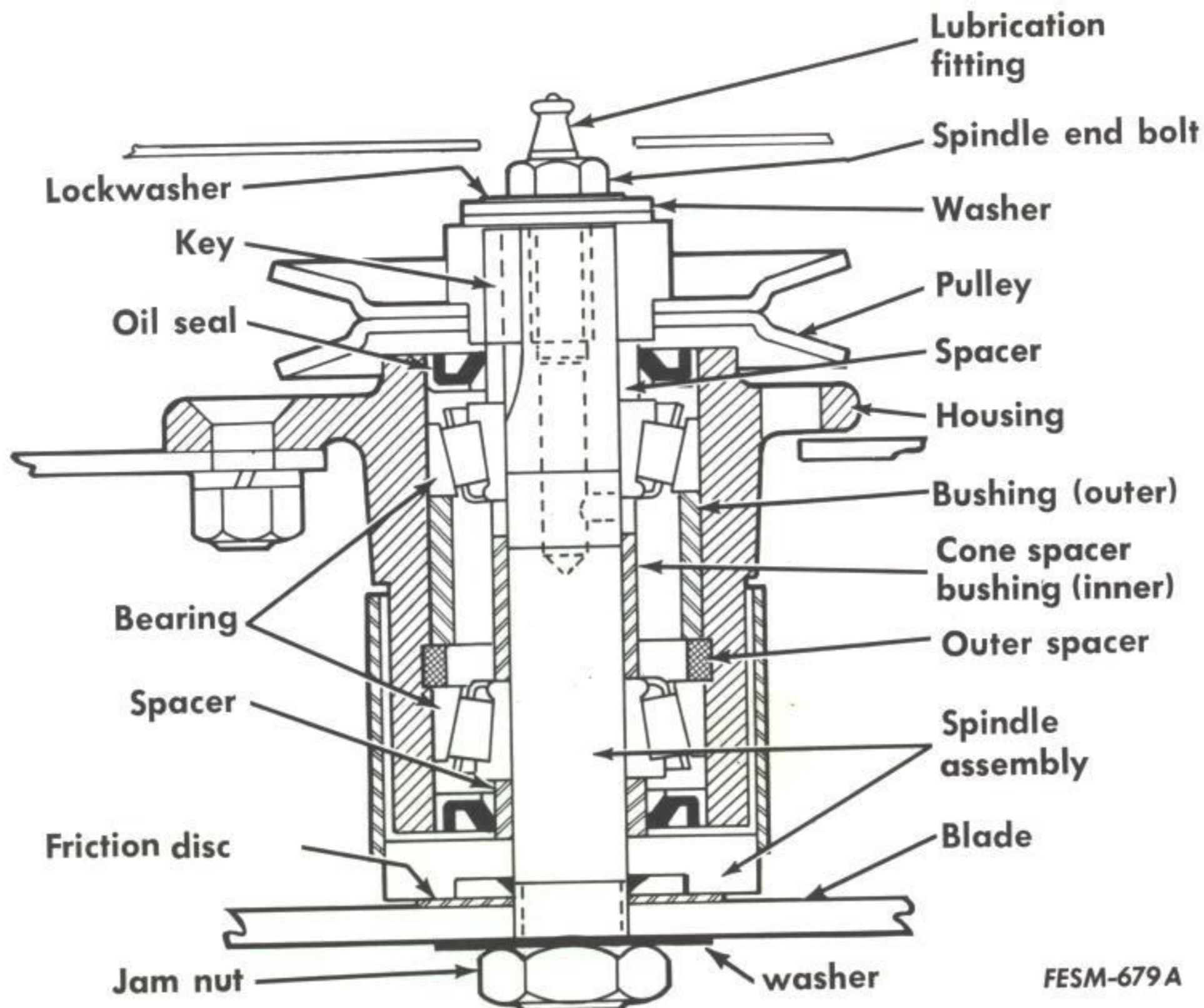
The cutting blades must be kept sharp at all times. The blades can be sharpened on the mower (mower removed from tractor) with a file, or they can be removed and sharpened on a grinding wheel.

Sharpen blade ends evenly so the blade remains balanced. If the cutting edge of the blade is within $\frac{3}{8}$ inch of the blade wind wing (Illust. 3-4), it is recommended that a new blade be installed.



Illust. 3-4. Blade re-conditioning.

Reassembly



Illust. 3-5. Cross section view of spindle rotor housing for 48 inch mower.

Steps 1 thru 9 cover reassembly of one spindle.

1. Pack bearings with specified chassis lubricant. If installing new bearings, install the new bearing cups into each end of the spindle rotor housing and be sure they bottom against the split outer spacer (Illust. 3-5).

2. Install the bottom bearing cone and oil seal. Be sure the oil seal is flush with the housing.

3. Install the cone spacer in the housing through the top of the housing (Illust. 3-5).

4. Install the top bearing cone and the oil seal.

5. Lubricate the rubber portions of the oil seals. Install the top and bottom pulley spacers in the oil seals.

6. Install the spindle assembly through the bottom of the mower (Illust. 3-5).

7. Install the key in the spindle and install the pulley.

NOTE: The small spindle drive pulley must be installed on the right or discharge side on 48 inch mower.

8. Secure the pulley to the spindle with flat washer, star lockwasher and spindle end bolt. Torque the end bolt to 38 - 45 ft. lbs.

NOTE: To use a socket on the center pulley end bolt, it is necessary to remove the lubrication fitting.

9. Install the friction washer, blade and blade nut. Torque the blade nut to 55 - 60 ft. lbs.

10. Install the idler pulley and arm with spring assembly. Install the spindle drive belt. Spindle belt tension is controlled by the spring loaded idler.

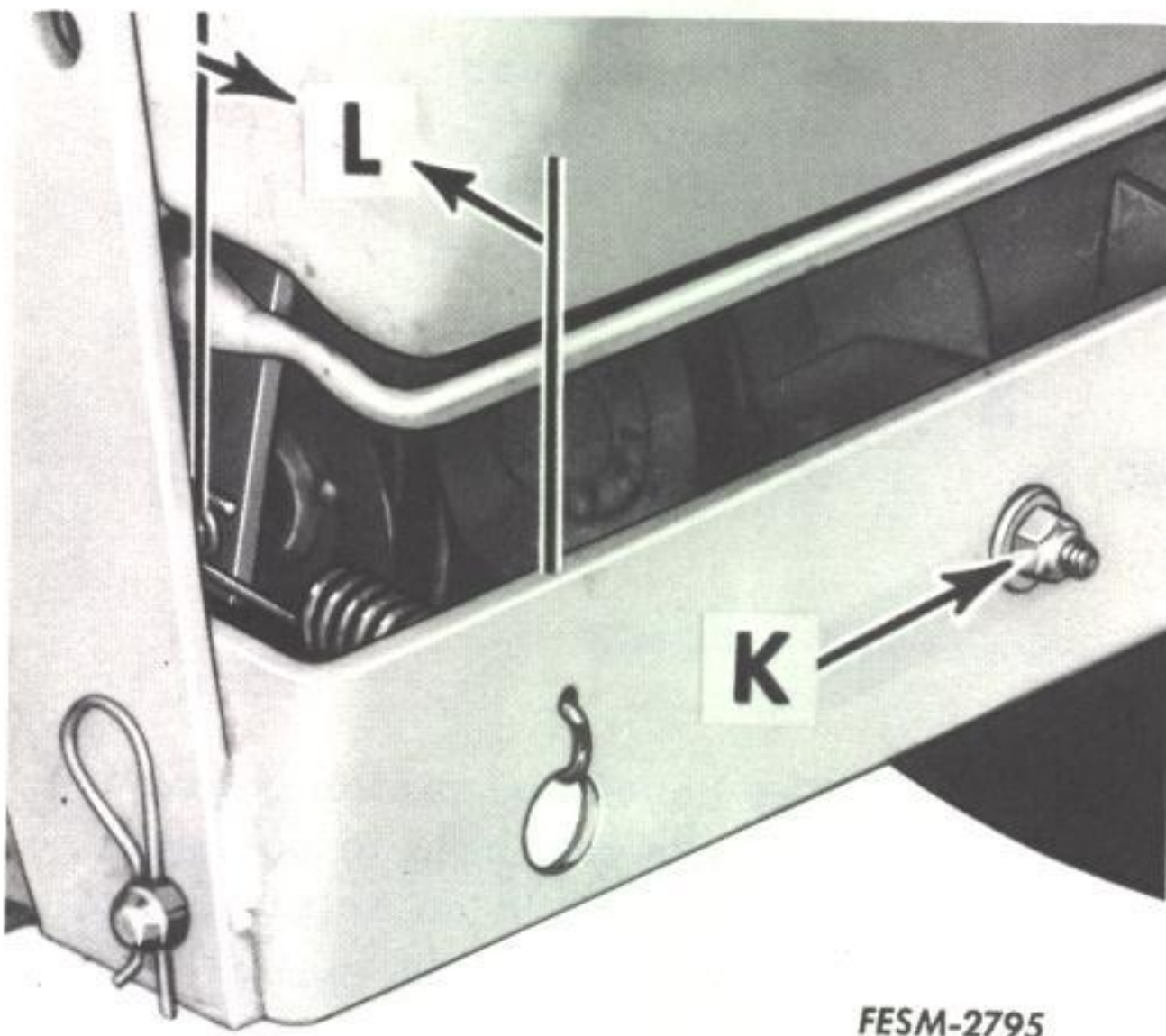
11. Install the L.H. and R.H. belt shields.

Installation and Adjustment

Installation

Installation is the reverse of removal procedure except for the adjusting of the main drive belt.

Adjustment of Main Drive Belt



Illust. 3-6. Main drive belt adjustment.

Adjust nut "K" to get 3-5/16" at "L"
Illust. 3-6. Maintain this adjustment for proper belt tension. "L" measurement is taken between center of pulley to inner surface of the front hanger.

Level Adjustment

Before adjusting mower on tractor check the tires for proper inflation before making a level and height adjustment.

To adjust the mower for level, first place the tractor on a level surface, preferably a hard surface area such as a garage floor or sidewalk.

Side to Side

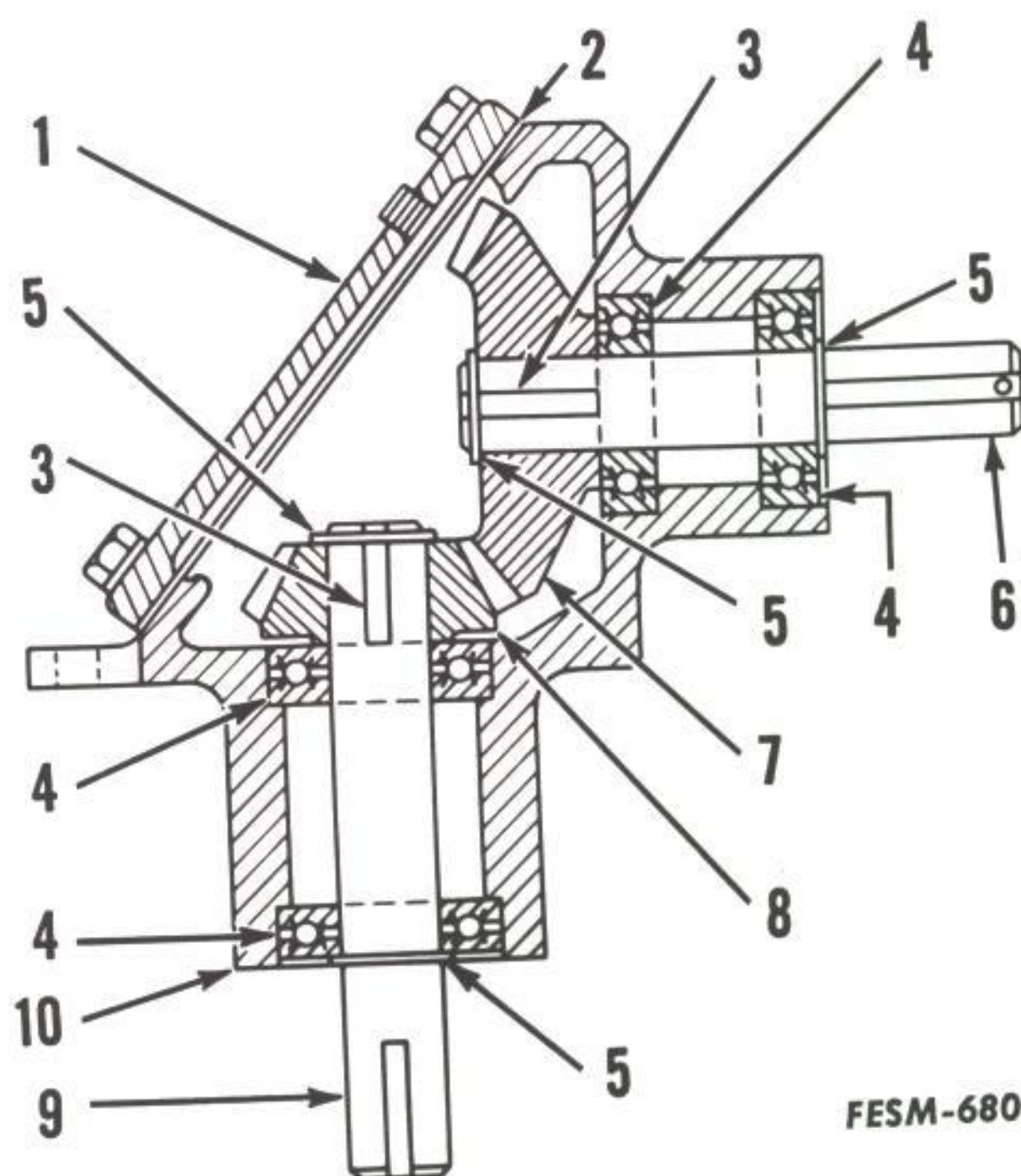
Lower the mower almost to the ground making sure the gauge wheels do not touch the ground. Add 13/32 x 13/16 x .065-inch flat washers, as required, under the left or right mower support brackets "B" (Illust. 3-1) so the height from the top of the mower housing to the ground is equal on each side. Then tighten support brackets securely.

Front to Rear

Push the tractor lift handle all the way forward to lower the mower to mowing height. Rotate the center and one outer blade so they are parallel and pointing straight to the front and rear. Then adjust the left and right support clevises "C" (Illust. 3-1) so the front edge of the center blade is level with the back edge of the outer blade. Rotate blades 180° and recheck.

If mower leveling is difficult, check for bent blades.

SNOW THROWER



1. Cover
2. Gasket
3. Key
4. Bearing
5. Snap ring
6. Output shaft
7. Bevel gear
8. Pinion gear
9. Input shaft
10. Gear box

FESM-680

Illust. 3-7. Sectional view of gear box.

The gear box for the snow thrower is the only assembly that requires servicing information. The four bearings are bottomed against shoulders in the gear box. The bearings at the outer ends of the shaft are retained in the gear box with

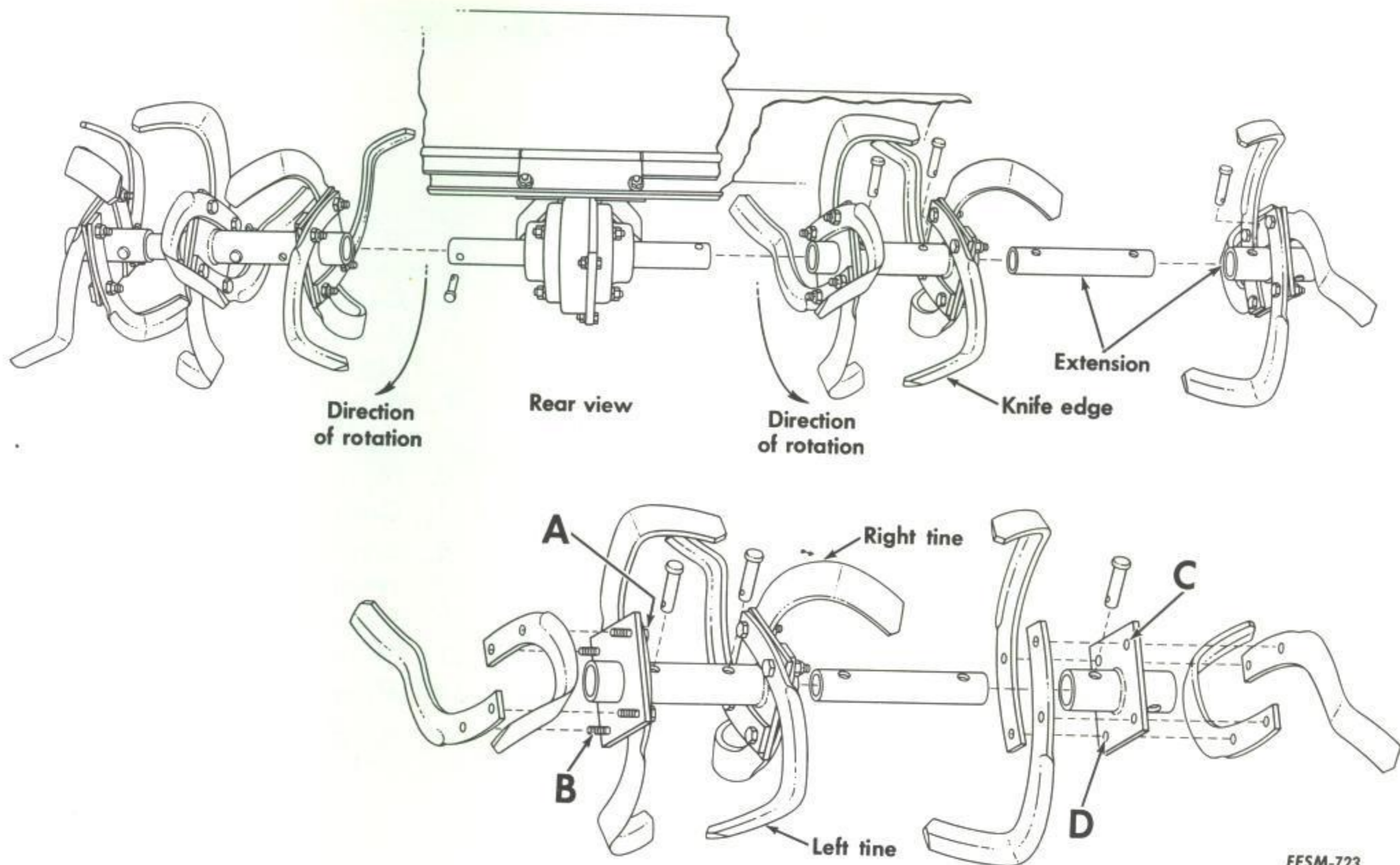
snap rings. The bevel and pinion gears are keyed to their shafts and held in position with snap rings. There is no shimming of the gears for backlash as this is predetermined by the manufacturer. Specified backlash is .006 to .018 inch.

INTERNATIONAL[®] 1 ROTARY TILLER

Replacing Tines

The tines are marked and identified as "lefts" and "rights". They must be re-installed in the same identical position as they were before removal so the knife edge will always lead in the direction of rotation.

When the tines are properly assembled on the shaft, the knife edges of the tines create a clockwise spiral effect around the shaft when viewed from the right side of the machine.



FESM-723

Illust. 3-8. Rear view showing proper tine assembly for correct timing.

The left and right tines are always positioned 90 degrees from each other and bolted on opposite sides on the mounting plate.

Attach the right tines to the right side and the left tines to the left side of the mounting plate when viewed from the rear of the machine. See Illust. 3-8.

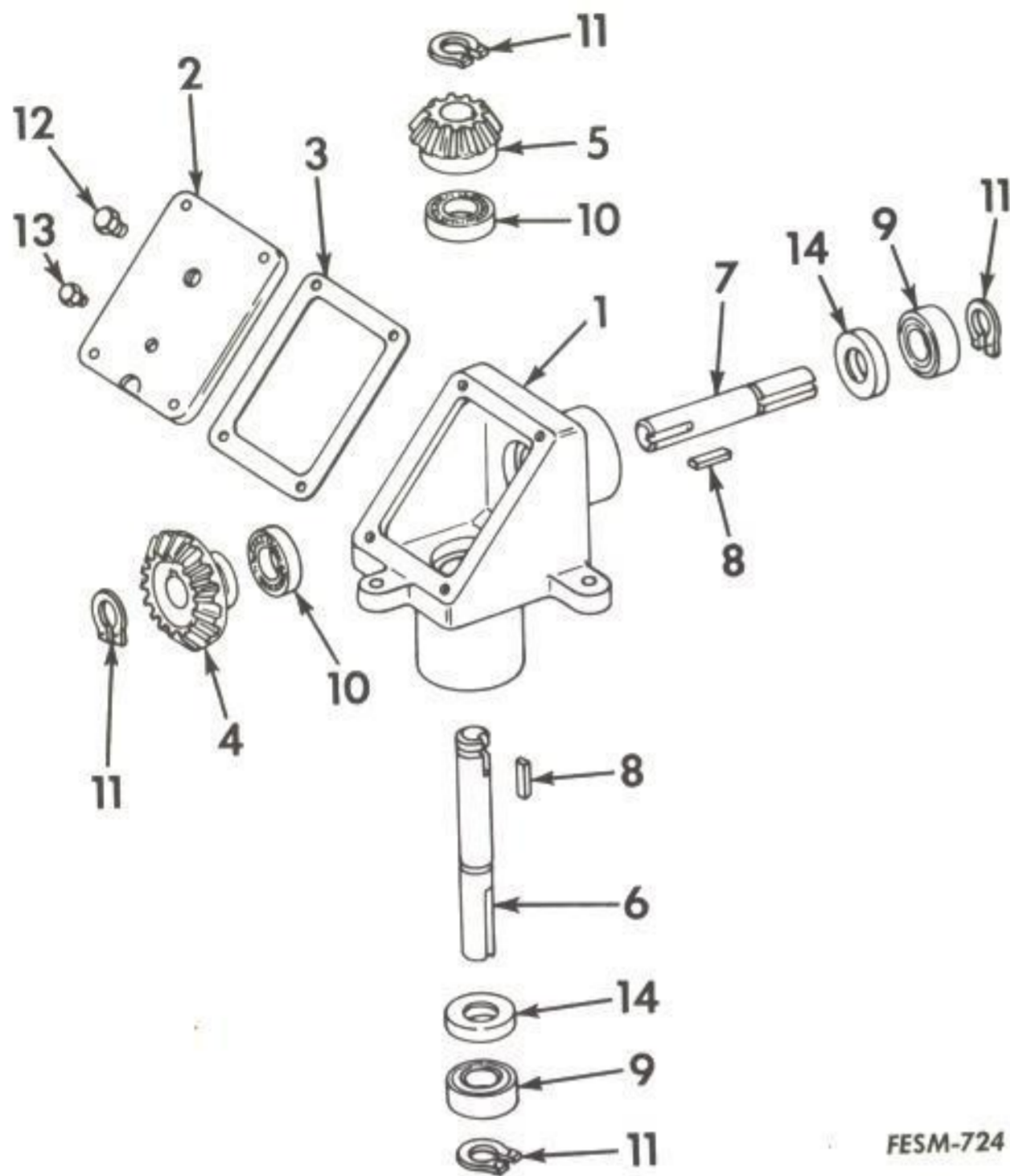
The tine shaft having two mounting plates has one plate with bolt holes "A" and "B" in line with the shaft pin hole.

Position the shaft with this particular plate toward the left. Then, locate the end hole of a right tine at hole "A" and the end hole of the other right tine at hole "B" on the right side of the mounting plate. Locate the inner hole of a left tine at hole "A" and the inner hole of the other left tine at hole

"B" on the left side of the mounting plate. Complete the tine shaft assembly as shown in Illust. 3-8. The completed assembly is the same for each side of the tiller; make sure the knife edges (cutting edges) lead in the direction of rotation.

Position the extension mounting plate so the shaft pin hole that lines up with bolt holes "C" and "D" is toward the left. Then locate the end hole of a left tine at hole "C" and the end hole of the other left tine at hole "D" on the left side of the mounting plate. Locate the inner hole of a right tine at hole "C" and the inner hole of the other right tine at hole "D" on the right side of the mounting plate. Complete the assembly as shown in Illust. 3-8. The completed extension assembly is the same for each side of the tiller; make sure the knife edges lead in the direction of rotation.

Servicing Gear Box



1. Case
2. Cover
3. Gasket
4. Bevel gear (30 tooth)
5. Bevel gear (20 tooth)
6. Input shaft
7. Output shaft
8. Key
9. Bearing
10. Bearing
11. Snap ring
12. Plug, 1/8 inch
13. Plug, 1/4 inch
14. Oil seal

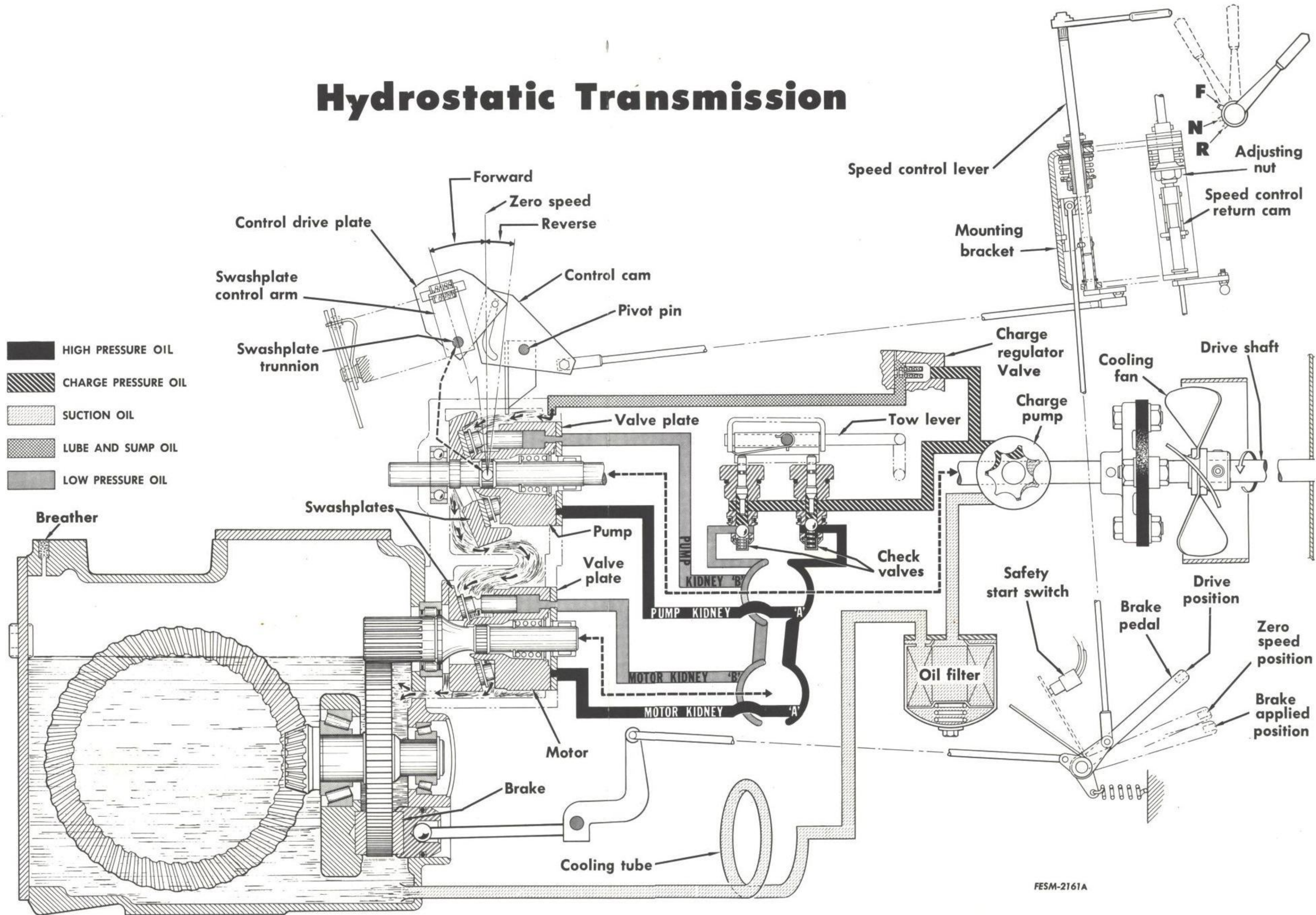
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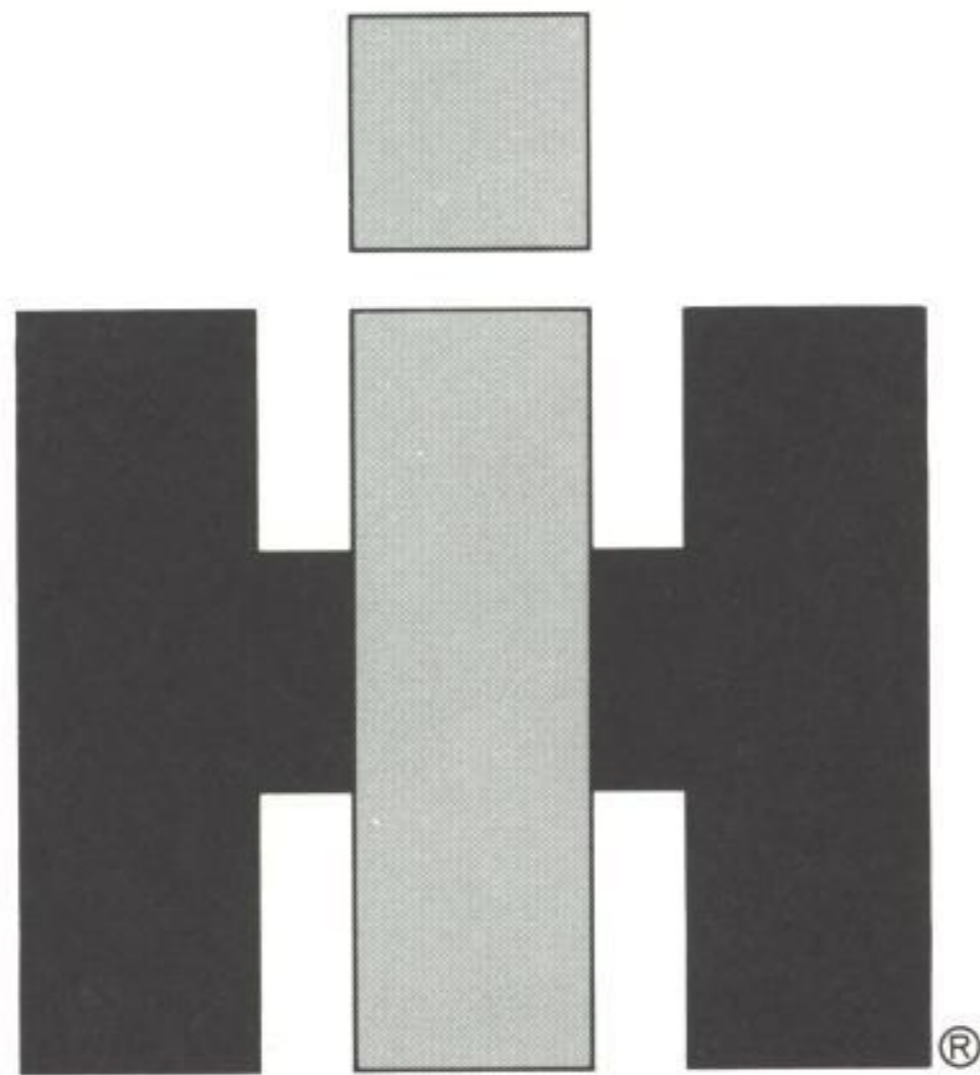
Illust. 3-9. Exploded view of gear box.

The gear box for the rotary tiller is the only assembly that requires servicing information. The four bearings are bottomed against shoulders in the gear box. The bearings at the outer ends of the shaft are retained in the gear box with snap rings.

The bevel gears are keyed to their shafts and held in position with snap rings. There is no shimming of the gears for backlash as this is predetermined in manufacturing. Always replace the oil seals when the gear box is disassembled.

Hydrostatic Transmission





**FARM & INDUSTRIAL
EQUIPMENT**

1st in service