



Blue
Ribbon
Service

Service

Manual

INTERNATIONAL®
CUB CADET® 73, 106, 107,
126, 127 & 147 TRACTORS
AND IH EQUIPMENT

GSS-1404 W/Revision 4
July, 1979

INTERNATIONAL HARVESTER

NORTH AMERICA OPERATIONS

AGRICULTURAL EQUIPMENT GROUP

401 NORTH MICHIGAN AVENUE • CHICAGO, ILLINOIS, 60611, U.S.A.

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

When changes and improvements are made in our products, periodic revisions may be made to this manual to keep it up-to-date. It is suggested that customers contact their dealer for information on the latest revision.

General Contents

	Page
Special Service Tools Required	IV
Standard Torque Data for Nuts and Bolts	V

Section
1

ENGINE

Section
2

CHASSIS

Section
3

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

CONTENTS

	Page
Specifications	1-3
Special Torques	1-6
Compression Check	1-7
General Information	1-8
Engine	
Removal	1-9
Disassembly	1-10
Inspection and Repair	1-12
Reboring Cylinder Block	1-12
Crankshaft	1-12
Dynamic Balance Gears (Model 147)	1-12
Connecting Rod	1-12
Piston and Rings	1-13
Piston Pin	1-13
Valves, Seats and Guides	1-13
Reassembly	1-14
Governor	1-14
Automatic Compression Release	1-16
Valve Tappets and Camshaft	1-16
Installation of Crankshaft	1-17
Installation of Crankshaft, Stub Shafts and Dynamic Balance Gears (Model 147)	1-17
Bearing Plate	1-18
Piston and Rod Assembly	1-19
Attaching Rod to Crankshaft	1-19
Installation of Oil Seals on Crankshaft	1-20
Oil Base	1-20
Installing and Setting Valves	1-21
Cylinder Head	1-21
Breather Assembly	1-22
Flywheel, Blower Housing, Tank Brackets and Fuel Tank	1-23
Starting Pulley	1-23
Breaker Points	1-23
Carburetor	1-23
Governor Arm and Linkage	1-23
Motor-Generator	1-23

Fuel System

General Information 1-24

Carburetor Adjustments 1-24

Disassembly of Carburetor 1-25

Cleaning Carburetor Parts 1-26

Reassembly of Carburetor 1-26

Governor

Model 73 1-27

 Throttle Control 1-27

Models 106, 107, 126, 127 and 147 1-28

 Governor Adjustments 1-28

 Throttle Control 1-28

Electrical System

Battery Ignition 1-28

 Solenoid and Switches 1-28

Motor-Generator 1-31

Current-Voltage Regulator 1-31

 Contact Points 1-31

 Cut-Out Relay Adjustments 1-32

 Regulator Adjustment 1-33

Ignition Timing 1-34

Breaker Assembly 1-35

Spark Plug 1-35

Testing Condenser 1-35

SPECIFICATIONS

	Model 73	Models 106 & 107	Models 126 & 127	Model 147
General				
Make	Kohler	Kohler	Kohler	Kohler
Model	K-161S	K-241AS	K-301AS	K-321A
Cylinders	1	1	1	1
Bore - inches	2-7/8	3-1/4	3-3/8	3-1/2
Stroke - inches	2-1/2	2-7/8	3-1/4	3-1/4
Displacement - cu. inches	16.23	23.9	29.1	31.27
Compression pressure (Refer to pages 1-7 and 1-16)	110-120 psi	110-120 psi	110-120 psi	110-120 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	14 at 3600
Engine speed (governed)				
Minimum speed - rpm	1000	1000	1000	1000
Maximum idle speed (no load) - rpm	3780	3800	3800	3800
Maximum (full load) - rpm	3600	3600	3600	3600
Valve clearance (engine cold)				
Intake - inch . . . . .	.006-.008	.008-.010	.008-.010	.008-.010
Exhaust - inch . . . . .	.015-.017	.017-.019	.017-.019	.017-.019
Ignition	Battery	Battery	Battery	Battery
Spark plug gap (14 mm plug) - inch . . . . .	.025	.025	.025	.025
Breaker point gap - inch . . . . .	.018-.022	.018-.022	.018-.022	.018-.022
Timing (before TDC) - degrees	20	20	20	20
Engine				
Cylinder bore				
New - inches	2.8745-2.8755	3.2505-3.2515	3.3745-3.3755	3.4995-3.5005
Maximum out-of-round (before reborng) - inch . . . . .	.005	.005	.005	.005
Crankshaft				
End clearance - inch . . . . .	.002-.023	.003-.020	.003-.020	.003-.020
Crankpin diameter (new) - inches	1.1855-1.1860	1.4995-1.5000	1.4995-1.5000	1.4995-1.5000
Crankpin, maximum out-of- round before reconditioning - inch . . . . .	.0015	.0015	.0015	.0015

	Model 73	Models 106 & 107	Models 126 & 127	Model 147
Connecting rod				
Bore (new) - inches	1.1870-1.1875	1.5010-1.5015	1.5010-1.5015	1.5010-1.5015
Crankpin running clearance (new) - inch . . . . .	.0010-.0020	.001-.002	.001-.002	.001-.002
Maximum crankpin running clearance (before recondi- tioning) - inch . . . . .	.003	.003	.003	.003
Side clearance - inch . . . . .	.005-.016	.007-.016	.007-.016	.007-.016
To wrist pin clearance - inch . .	.0006-.0011	.0003-.0008	.0003-.0008	.0003-.0008
Wrist pin to piston boss - inch .	.0001 Int. - .0003 loose	.0000-.0003 Loose select fit	One thumb push fit	One thumb push fit
Piston				
New (measured just below oil ring 90 deg. from piston pin) - inches	2.8660-2.8675	3.2415-3.2445	3.3655-3.3685	3.4900-3.4925
Maximum allowable undersize (for wear) - inch	2.8645	3.2400	3.3640	3.4885
Piston ring end gap - inch . . . .	.007-.017	.010-.020	.010-.020	.010-.020
Piston to cylinder bore clearance				
Top of skirt (measured just below oil ring) - inch . . . . .	.006-.0075	.0075-.0085	.0065-.0095	.007-.010
Bottom of skirt - inch . . . . .	.0045-.0065	.003-.004	.003-.004	.0035-.0045
Piston pin bore - inch . . . . .	.62565	.85975	.85975	.85975
Piston pin diameter - inch . . . . .	.625	.860	.860	.860
Valves				
Valve stem clearance in guide				
Intake - inch . . . . .	.001-.0025	.001-.0025	.001-.0025	.001-.0025
Exhaust - inch . . . . .	.0025-.004	.0025-.004	.0025-.004	.0025-.004
Valve stem (diameter)				
Intake (new) - inch . . . . .	.3105-.3110	.3105-.3110	.3105-.3110	.3105-.3110
Maximum allowable undersize (for wear) - inch . . . . .	.3090	.3090	.3090	.3090
Exhaust (new) - inch . . . . .	.3090-.3095	.3090-.3095	.3090-.3095	.3090-.3095
Maximum allowable undersize (for wear) - inch . . . . .	.308	.308	.308	.308
Intake and exhaust maximum (allowable oversize for wear) - inch . . . . .	.315	.315	.315	.315
Valve guide depth from top of block - inches	1-5/16	1-15/32	1-15/32	1-15/32
Tappet clearance in block - inch .	.0005-.002	.0008-.0023	.0008-.0023	.0008-.0023
Camshaft running clearance - inch . . . . .	.001-.0035	.001-.0035	.001-.0035	.001-.0035
Camshaft end clearance - inch . .	.005-.025	.005-.010	.005-.010	.005-.010

	Model 73	Models 106 & 107	Models 126 & 127	Model 147
Valve clearance				
Intake (cold) - inch . . . . .	.006-.008	.008-.010	.008-.010	.008-.010
Exhaust (cold) - inch . . . . .	.015-.017	.017-.019	.017-.019	.017-.019
Valve face angle - degrees	45	45	45	45
Valve seat inserts (service only)				
Intake - inches	Bore 1.4995 - 1.5005	1.4995-1.5005	1.4995-1.5005	1.4995-1.5005
	Depth .224 - .229	.224-.229	.224-.229	.224-.229
Exhaust - inches	Bore 1.2495 - 1.2505	1.2495-1.2505	1.2495-1.2505	1.2495-1.2505
	Depth .224 - .229	.224-.229	.224-.229	.224-.229
Seat angle - degrees	44-1/2	44-1/2	44-1/2	44-1/2
Valve seat width - inch . . . . .	.037-.045	.037-.045	.037-.045	.037-.045
Current-voltage regulator				
Make and model (Delco-Remy)	1118987	1118987	1118987	1118987
Ground	Negative	Negative	Negative	Negative
Voltage regulator				
Air gap - inch . . . . .	.075	.075	.075	.075
Setting range (volts)	13.6-14.5	13.6-14.5	13.6-14.5	13.6-14.5
Adjust to	14 volts	14 volts	14 volts	14 volts
Cut-out relay				
Air gap - inch . . . . .	.020	.020	.020	.020
Point opening - inch . . . . .	.020	.020	.020	.020
Closing voltage (volts)	11.8-14	11.8-14	11.8-14	11.8-14
Adjust to	12.8 volts	12.8 volts	12.8 volts	12.8 volts
Motor-generator				
Make and model (Delco-Remy)	1101996	1101996	1101996	1101996
Rotation (viewing drive end)	CC	CC	CC	CC
Brush spring tension - oz.	24-32	24-32	24-32	24-32
Field current (at 80 deg. F)				
Amps	1.5-1.6	1.5-1.6	1.5-1.6	1.5-1.6
Volts	12	12	12	12
Cold output				
Amps	14	14	14	14
Volts	15	15	15	15
Approximate rpm	High idle	High idle	High idle	High idle
No load test:				
Volts	11	11	11	11
Amps	10-14	10-14	10-14	10-14
RPM	1650-1950	1650-1950	1650-1950	1650-1950

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 psi if in top mechanical condition. If reading is below 100 psi, 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 manually.

- a. Remove the clutch shield.

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

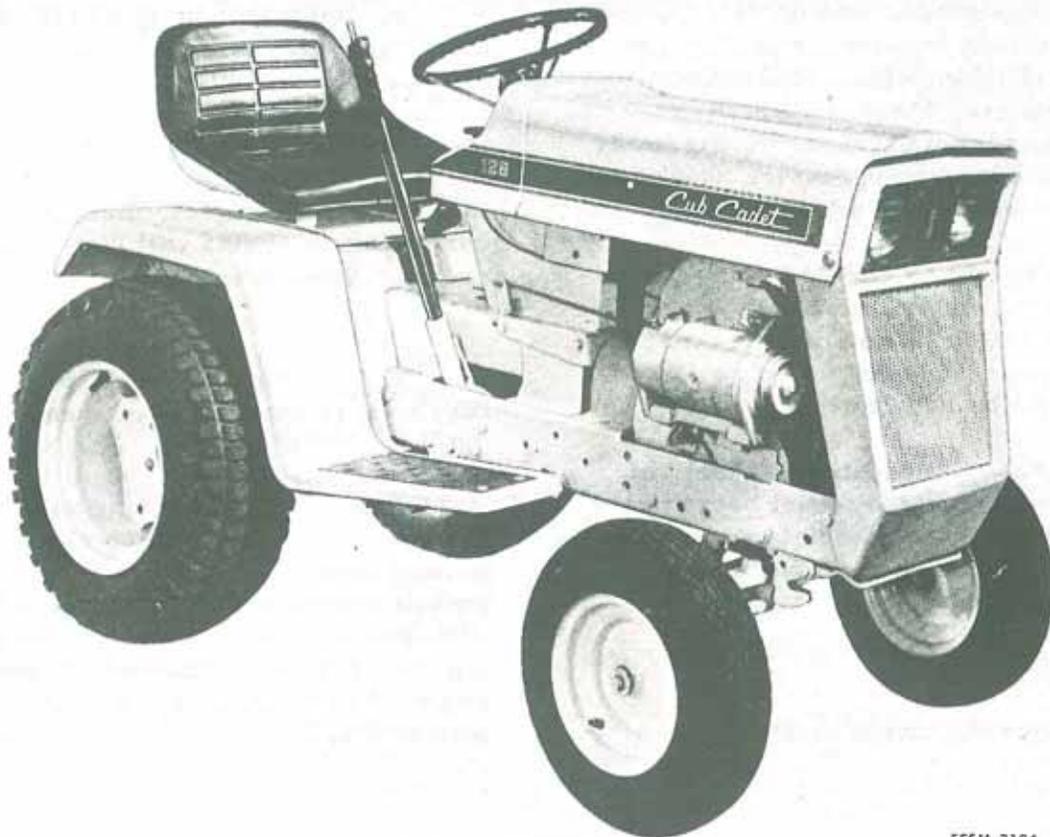
- c. Hold throttle in wide open position.

- d. 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 electrically. Crank engine electrically in normal manner. Engine will reach a high enough rpm range to disengage A.C.R. and will then slow down slightly. Normal reading should then be obtained. If reading is below 100 psi, recheck manually using Method No. 2.

GENERAL INFORMATION



FESM-3104

Illust. 1-2. Cub Cadet tractor.

The Model 73 is powered by a 7 horsepower, four cycle, air cooled, gasoline engine with electric starting.

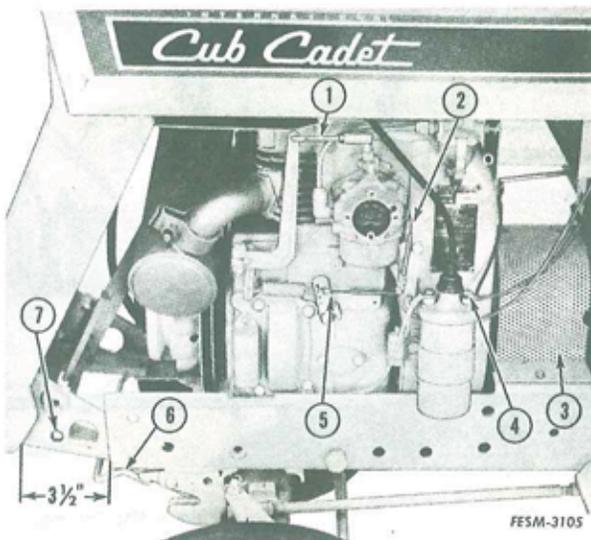
The Models 106 and 107 are powered by a 10 horsepower, four cycle, air cooled, gasoline engine with electric starting.

The Models 126 and 127 are powered by a 12 horsepower, four cycle, air cooled gasoline engine with electric starting.

The Model 147 is powered by a 14 horsepower, four cycle, air cooled, dynamically balanced gasoline engine with electric starting.

ENGINE

Removal



Illust. 1-3. Left side view of tractor.

1. Throttle link
2. Choke wire
3. Clutch shield
4. Positive coil wire
5. Throttle wire
6. Quick attaching latch
7. PTO clutch release pivot shaft

1. Disconnect the battery ground cable.

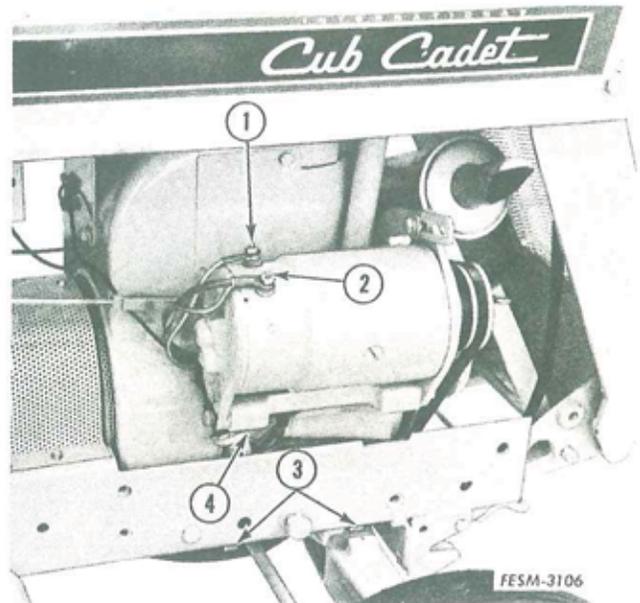
2. Remove six capscrews and nuts that hold the grille to the main frame. Slide the bottom of the grille forward 3-1/2" and remove the clutch release pivot shaft from the grille casting. Remove the grille and hood. Lay the grille and hood (grille face down) in front of the tractor. Refer to Illust. 1-5.

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

4. Remove the air cleaner.

5. Remove the choke wire from the carburetor, and the throttle wire from the speed control lever (Illust. 1-3).

6. Disconnect the positive (+) coil wire from the coil. See Illust. 1-3.



Illust. 1-4. Right side view of tractor.

1. "F" terminal
2. "A" terminal
3. Engine mounting capscrews
4. Ground wire attached here

7. Disconnect the wires from the Generator "A" terminal and from the "F" terminal. See Illust. 1-4.

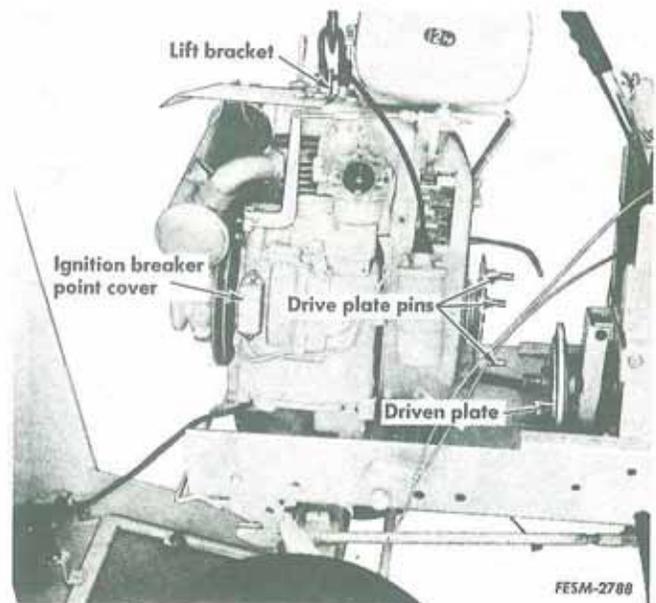
NOTE: Large wire to "A" terminal. Small wire to "F" terminal.

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 the four cap screws two on each side, holding the engine to the frame (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.

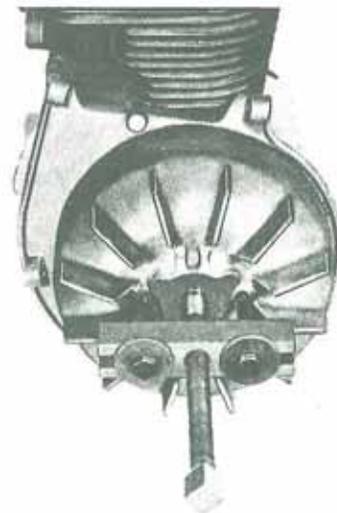


Illust. 1-5. Lifting the engine from the frame.

Disassembly

1. Drain engine oil.
2. Disconnect the coil-to-breaker point wire 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. 1-27.
7. Remove the flywheel.

NOTE: The flywheel is mounted on a tapered shaft and must be removed with

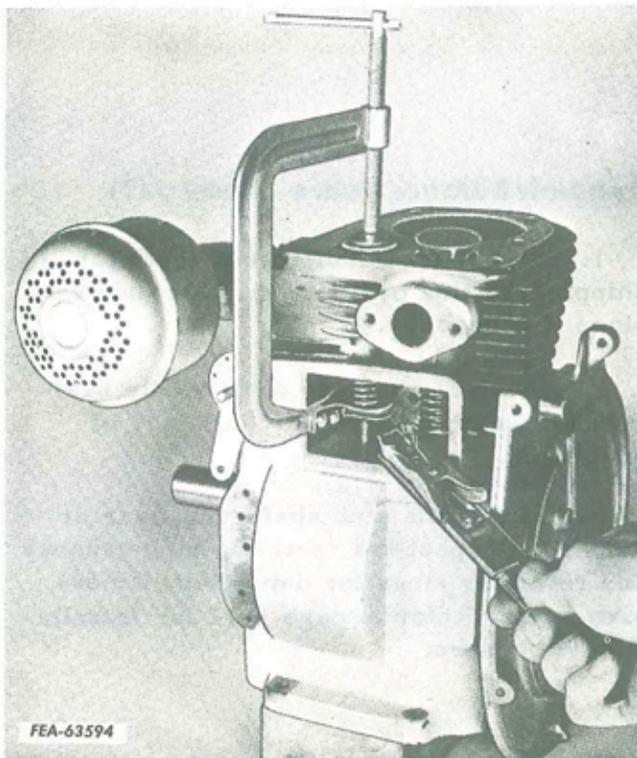


Illust. 1-6. Removing flywheel.

the use of a puller (Illust. 1-6). Do not hammer on puller or nut. If necessary tap lightly.

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. Remove the cylinder head.



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

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

11. Remove the oil base.

12. 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.

13. 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.

14. 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.

15. 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 re-used in reassembly.

16. 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.

17. 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.

18. 14 HP Engine: Remove the retaining rings securing the dynamic balance gears to their shafts. Remove the gears and shims. Retain the shims for use in re-assembly.

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 cylinders 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, K-301 and
K-321 - - - - - 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.

Dynamic Balance Gears (Model 147)

1. Inspect the balance gear teeth for chipping, pitting or other damage and replace if necessary.
2. Check the balance gear needle bearings for wear, pitting and roughness of operation.
3. Inspect the stub shafts for wear or damage. Inspect the retaining ring grooves and retaining rings for damage or excessive wear. Refer to page 1-17 for Installation Procedure.

Connecting Rod

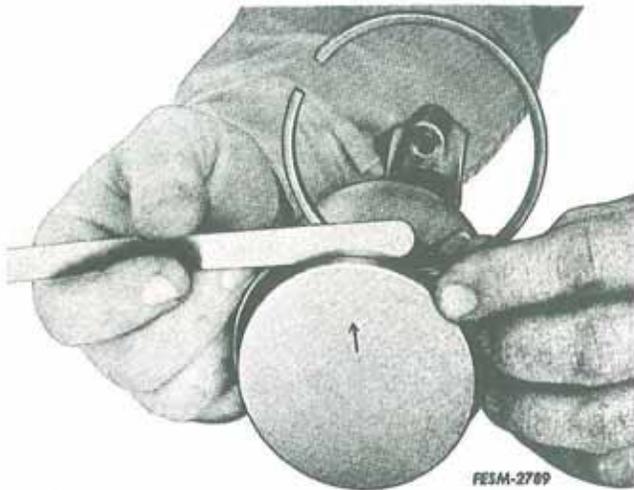
1. Check rod for wear, score marks, running clearances, and side clearance. Replace rod if worn beyond high limit of clearances shown in specifications.

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, K-301 and	
K-321- - - - -	.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

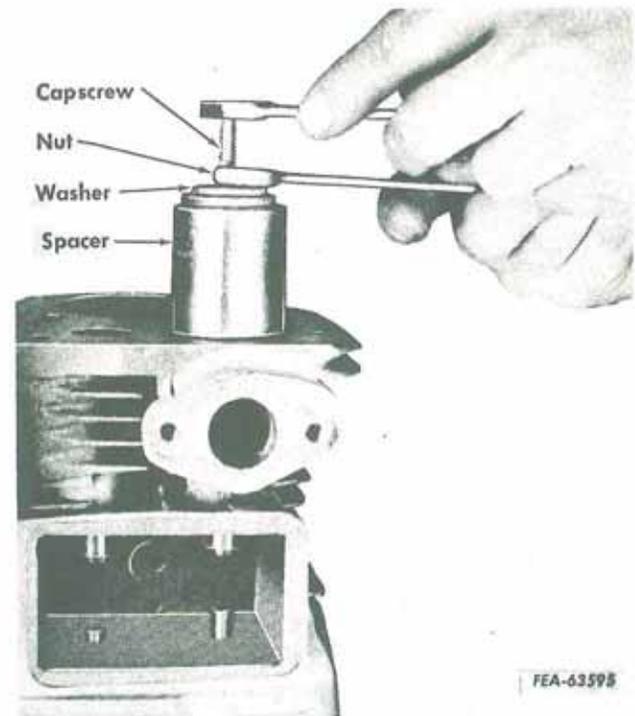
1. Check clearance of valve stems in guides. Refer to Specifications.

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 capscrew its full length.

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



Illust. 1-9. Removing valve guides.

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

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

- K-161 - - - - - 1-5/16 inches
- K-241, K-301 and
- K-321 - - - - - 1-15/32 inches

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

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. The intake valve seat is machined into the 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.

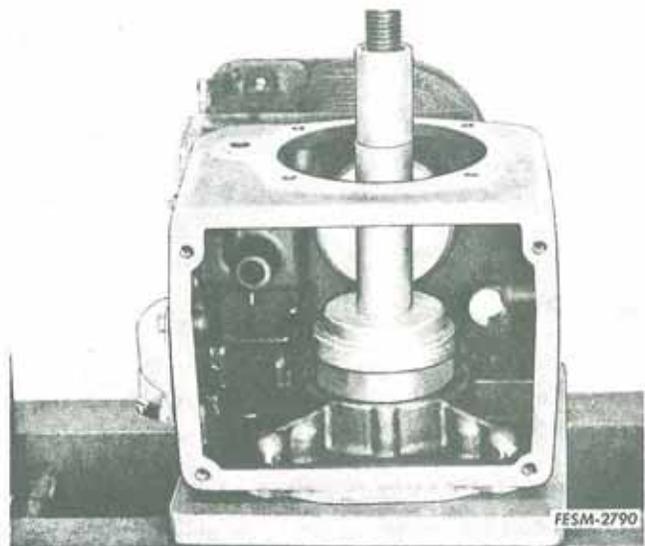
6. The exhaust valve seat is a Moly Nickel Chrome or Stellite insert. An over-size insert is available for service. Refer to Specifications for bore and depth for machining block before installing the insert.

Reassembly

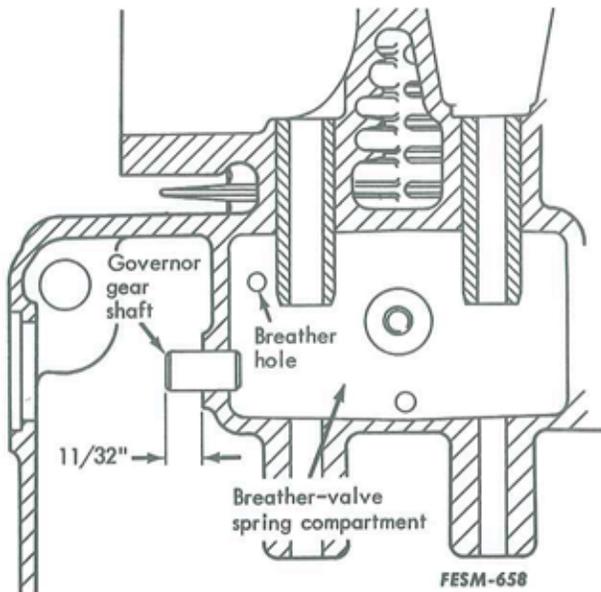
Governor

Install front main bearing by pressing into cylinder block (shielded side on 7 HP 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.



Illust. 1-10. Installing front main bearing.



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

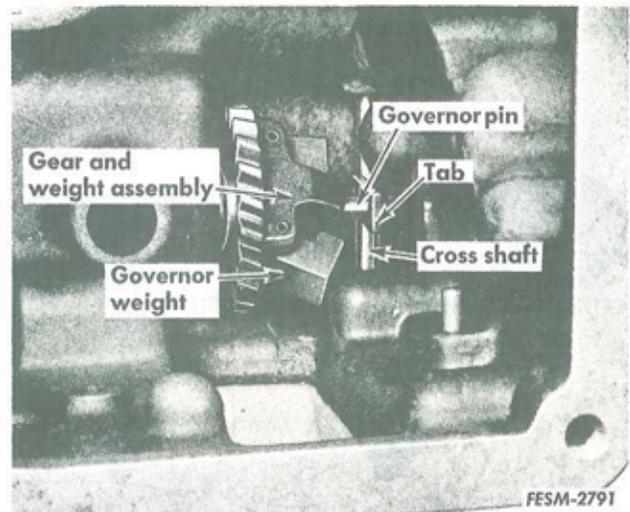
Install the governor gear shaft and expansion plug, if they were removed. See Illust. 1-11 for proper positioning.

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.

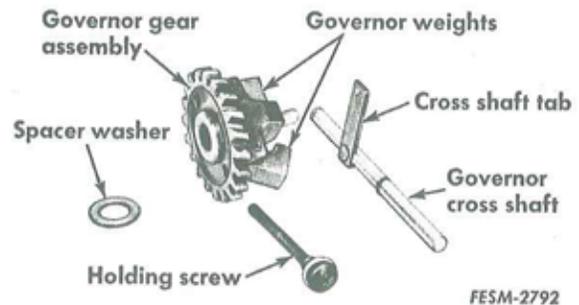
3. Place cylinder block upside down. Slide governor cross-shaft (Illust. 1-12) into place from inside of block. Make sure tab on governor shaft is against pin in end of governor gear.

On the K-161 place speed control disc on governor bushing nut and thread bushing nut into block, clamping throttle bracket into place (Illust. 1-31).

On the K-241, K-301 and K-321 the bushing nut is installed without any additional parts.



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

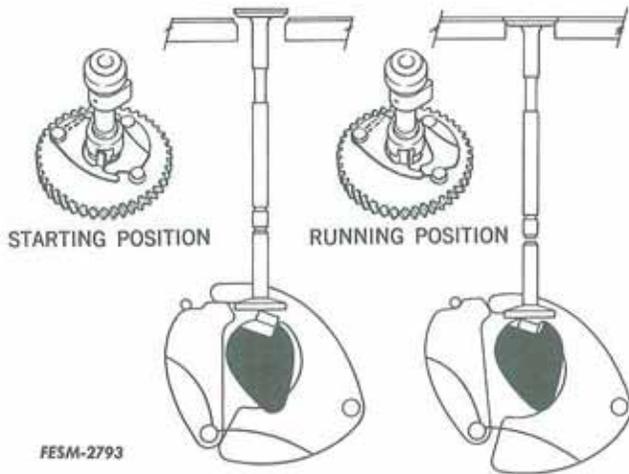


Illust. 1-13. View of governor parts.

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.

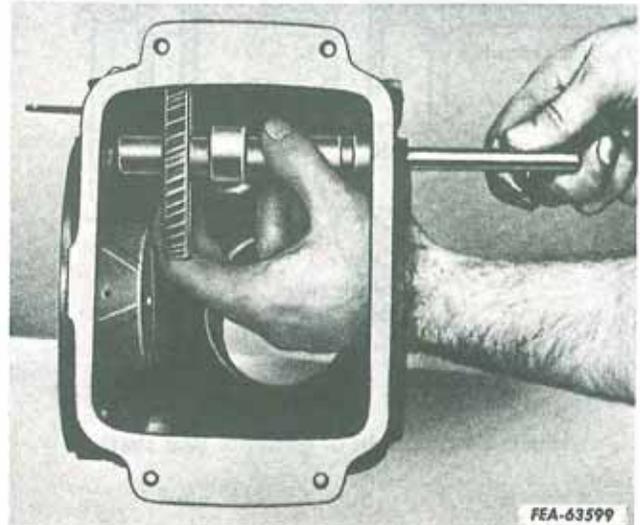
"Kick back" is prevented because the pressure of the burning mixture is reduced sufficiently for the flywheel to carry the engine over top dead center.

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.

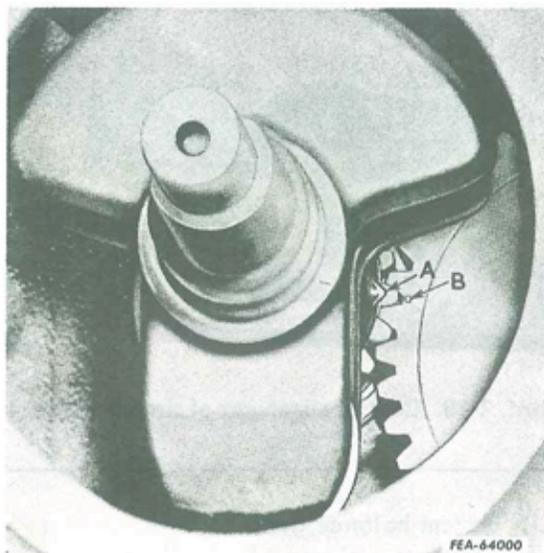
3. Check camshaft end clearance specified as follows:

K-161 - - - - -	.005 to .025 inch
K-241, K-301 and	
K-321- - - - -	.005 to .010 inch

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

Installation of Crankshaft

(except Models with dynamic balance gears)



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.

Installation of Crankshaft, Stub Shafts and Dynamic Balance Gears (Model 147)

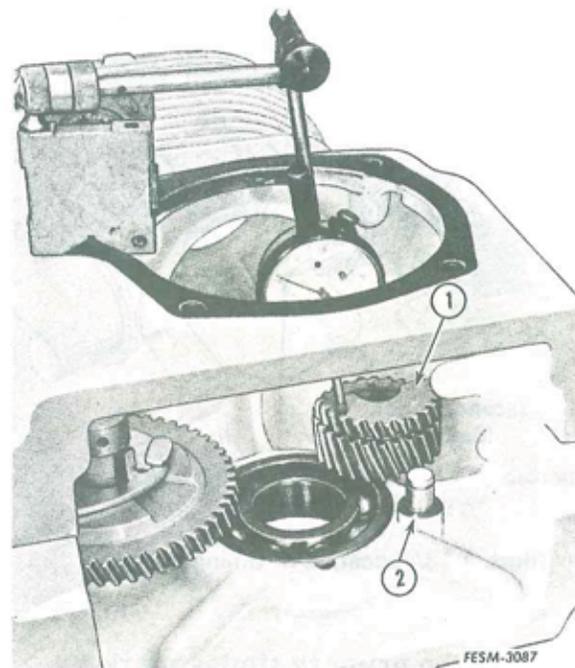
1. If new stub shafts are required, proceed with the following steps.

a. Press the shafts into their bores until they protrude approximately 3/4" above the block surface.

b. Install one .010 inch spacer on the shaft and then install the balance gear, one .005 inch spacer, two .010 inch spacers, one .020 inch spacer and the snap ring.

c. Press the shaft into the bore until there is no gear end play.

d. Remove the snap ring, the .020 inch spacer and one .010 inch spacer.



Illust. 1-17. Checking end play.

1. Top balance gear

2. Stub shaft

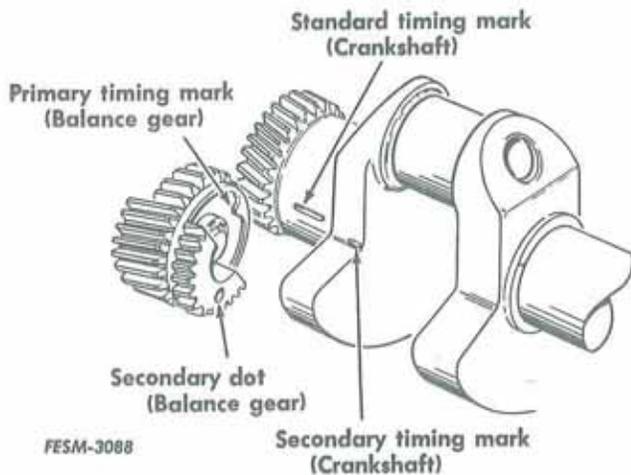
e. Install the .020 inch spacer only and the snap ring; and check the end play with a dial indicator or feeler gauge (Illust. 1-17).

f. If the end play is not within the specified .005 to .010 inch, adjust by adding or removing .005 inch spacers.

2. If the stub shafts are not replaced, install one .010" spacer on the top stub shaft and then install the top balance gear and bearing assembly. Be sure the timing marks are pointing out.

3. The specified end play is .005 to .010 inch and is attained with one .005 inch spacer, one .010 inch spacer and one .020 inch spacer. These spacers are installed on the snap ring retainer end of the stub shaft with the thickest spacer (.020 inch) next to the snap ring.

4. Install the snap ring and check the end play with a dial indicator or feeler gauge (Illust. 1-17). If the end play is not within the specified .005 to .010 inch, adjust by adding or removing .005 inch spacers.



FESM-3088

Illust. 1-18. Location of timing marks.

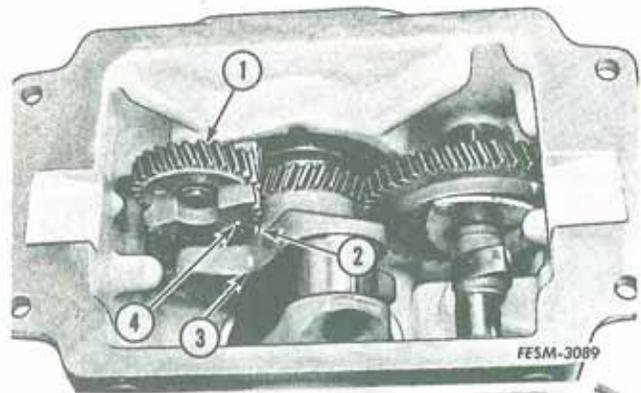
5. Align the primary timing mark on the top balance gear with the standard timing mark on the crankshaft (Illust. 1-18). Press the crankshaft into the block until the crankgear is engaged 1/16 inch into the top balance gear.

6. Rotate crankshaft to align the standard timing mark on the crankshaft with the mark on the cam gear. Press the crankshaft the remainder of the way into the block.

7. Rotate the crankshaft until the timing marks are facing the bottom stub shaft.

8. Put one .010 inch spacer on the stub shaft. Install the bottom gear-bearing assembly on the stub shaft being sure the secondary timing dot (4) is aligned with the standard timing mark (2) after installation (Illust. 1-19).

9. Use one .005 inch spacer, one .010 inch spacer and one .020 inch spacer (largest next to retainer) to obtain the specified end play of .005 to .010 inch.



FESM-3089

Illust. 1-19. Correct alignment of timing marks.

- | |
|---|
| <ol style="list-style-type: none"> 1. Bottom balance gear 2. Standard timing mark 3. Secondary timing mark (crankshaft) 4. Secondary dot (balance gear) |
|---|

10. Install the snap ring retainer and check the end play. Add or remove .005 inch spacers to adjust end play as needed.

Bearing Plate

1. Press the rear main bearing into the bearing plate (shielded side to the inside on 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:

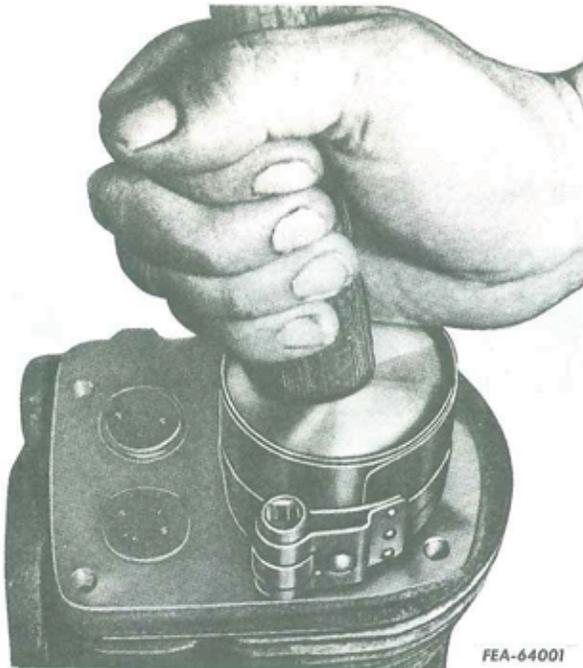
K-161 - - - - -	.002 - .023
K-241, K-301 and	
K-321 - - - - -	.003 - .020

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

4. Install four capscrews with copper washers. Draw capscrews 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. 1-21) 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.



Illust. 1-20. 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, K-301 and
 K-321- - - - - .010 to .020 inch

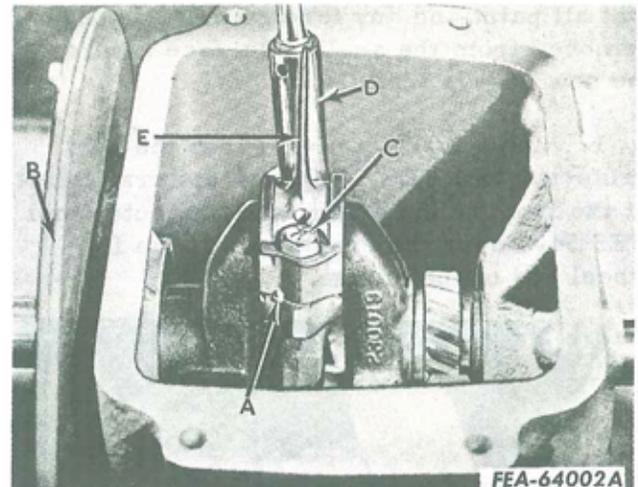
Remove the first ring and install the other rings and repeat the foregoing procedure.

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. 1-21) is toward camshaft side of engine. Use a ring compressor to prevent ring breakage during installation (Illust. 1-20).

Attaching Rod to Crankshaft

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



Illust. 1-21. Tightening connecting rod capscrews.

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

2. Install connecting rod cap, lock and capscrews to connecting rod (Illust. 1-21). K-241, K-301 and K-321 use flat washer for lock. The oil hole in the cap is on the camshaft side of the engine when properly installed.

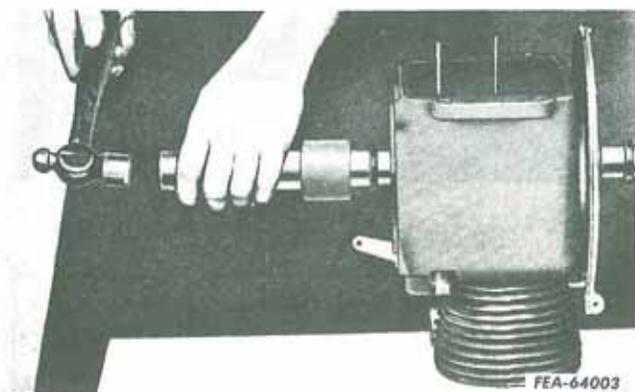
3. Use the torque wrench to tighten capscrews to 200 inch pounds on the K-261, and 300 inch pounds on the K-241, K-301 and K-321. Back off the screws and re-tighten capscrews to 180 inch pounds on the K-161, and 280 inch pounds on the K-241, K-301 and K-321. This two-step procedure will assure a tight 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. 1-21).

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 fly-wheel end of the engine.



Illust. 1-22. Installing oil seal on front side of engine.

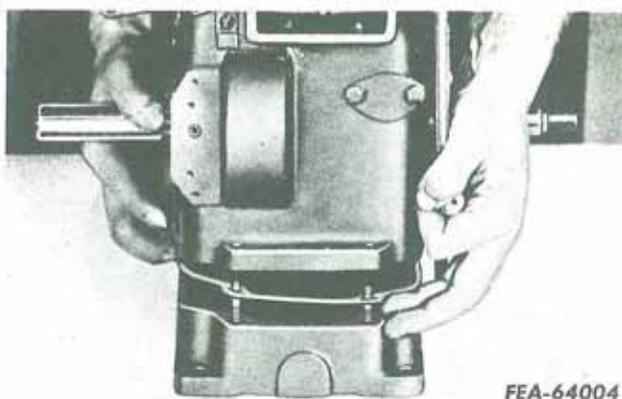
2. Lubricate the seals and slide them onto the protector tools. Drive the front seal in flush with the cylinder block and the rear seal flush with the bearing plate, with seal driver FES 54-6 (Illust. 1-22).

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, K-301 and K-321: Remove any burrs or sharp edges from the crankshaft keyway. Lubricate and install the seals flush with the bearing plate.

Oil Base



Illust. 1-23. Installing oil base.

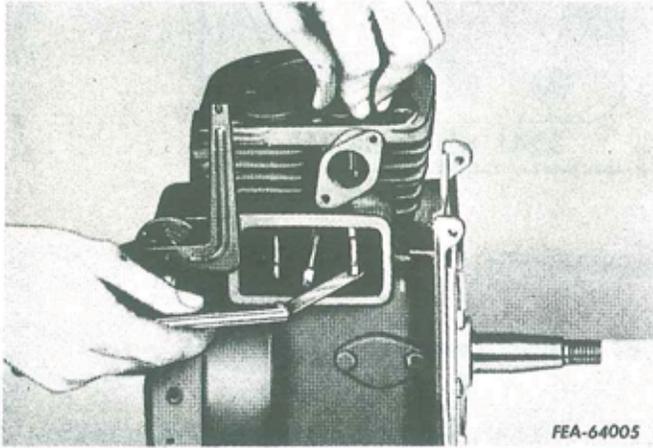
1. Assemble oil base to the block with four screws (Illust. 1-23).

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.



Illust. 1-24. 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. 1-24).

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.

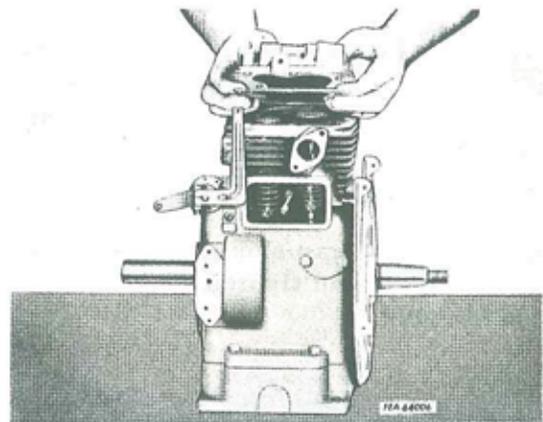
4. On K-241, K-301 and K-321 tappets are adjustable and grinding of valve stems is not necessary. Assemble valves, springs, retainers and keepers and then adjust tappets to proper clearance.

K-161 - .006 to .008 cold (Intake)
.015 to .017 cold (Exhaust)

K-241 }
K-301 } .008 to .010 cold (Intake)
and } .017 to .019 cold (Exhaust)
K-321 }

Cylinder Head

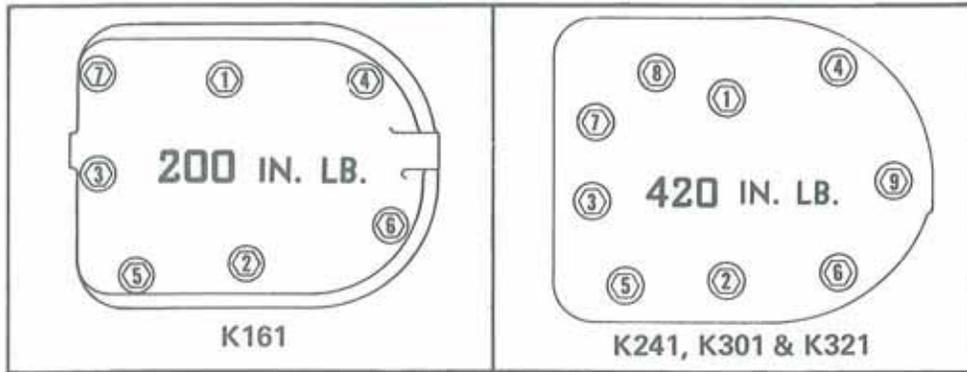
NOTE: A package to provide increased engine cooling is available and its installation is recommended on 10 and 12 hp Models built with chassis serial numbers prior to 315300 on the 10 hp and 318847 on the 12 hp.



Illust. 1-25. 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.



FESM-3103

Illust. 1-26. Head torquing sequence.

3. It is important that cylinder head capscrews and nuts be tightened evenly and in steps until inch pounds torque specified is reached (Illust. 1-26).

K-161 - - - - - 200 inch pounds
 K-241, K-301 and
 K-321- - - - - 420 inch pounds

NOTE: If the engine is equipped with cylinder head capscrews only, do not torque head until steps 1 and 2 of Flywheel, Blower Housing Section page 1-23 have been completed.

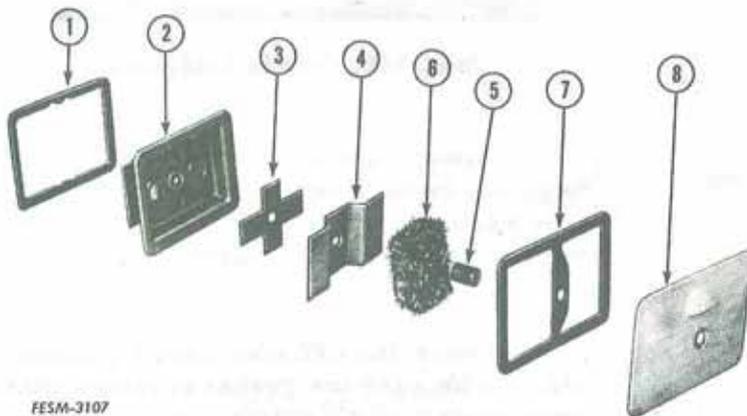
4. Spark plug gap should be .025. Install spark plug and tighten to 27 foot pounds torque.

Breather Assembly

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

2. The correct order for assembly of the breather is as follows (Illust. 1-27):
 1. - Gasket, 2. - Breather plate assembly (baffle welded to breather plate points towards the engine block), 3. - Reed, 4. - Breather baffle, 5. - Seal, 6. - Filter, 7. - Gasket, 8. - Cover. Improper assembly will result in oil leakage.

3. Tighten cover securely to prevent leaks.



FESM-3107

- 1. Gasket
- 2. Breather plate assembly
- 3. Reed
- 4. Breather baffle
- 5. Seal
- 6. Filter
- 7. Gasket
- 8. Breather cover

Illust. 1-27. Exploded view of breather and vent 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. If equipped with head bolts only, remove enough head bolts to locate blower housing, head baffle, tank bracket and install. Torque head as instructed in Cylinder Head Section (Illust. 1-26).
3. If equipped with head bolts and studs, install spacers on the studs. Install the baffles on the studs and then install the nuts and lock washers and tighten to 30 ft. lbs.
4. Install screen, "V" pulley, lock washer, and flywheel nut. Tighten nut to 60 ft. lbs.
5. Install the main clutch drive plate on the "V" pulley.
6. Install fuel tank, sediment bowl and connect to carburetor.
7. 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, K-301 and K-321. Be sure the pulley set screws are torqued to 12 to 14 ft. lbs. torque.

IMPORTANT: The set screw that contacts the key must be tightened first; then tighten the set screw that contacts the engine shaft.

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 coil lead. For precision ignition setting, refer to Ignition Timing, page 1-34.

Carburetor

1. Using a new gasket attach the carburetor.
2. Refer to FUEL SYSTEM, page 1-24 for carburetor adjustment procedure. For Service, refer to page 1-26.

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 1-27 and 1-28 in Governor Section for proper adjustments.

Motor-Generator

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 1-29 and 1-30) 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.

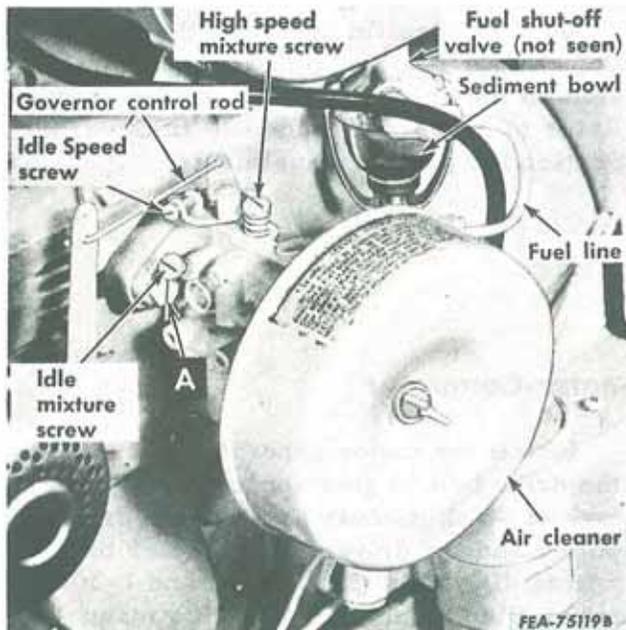
Throttle shafts, choke shafts, main fuel nozzles and other parts are not serviced separately.

Carburetor Adjustments

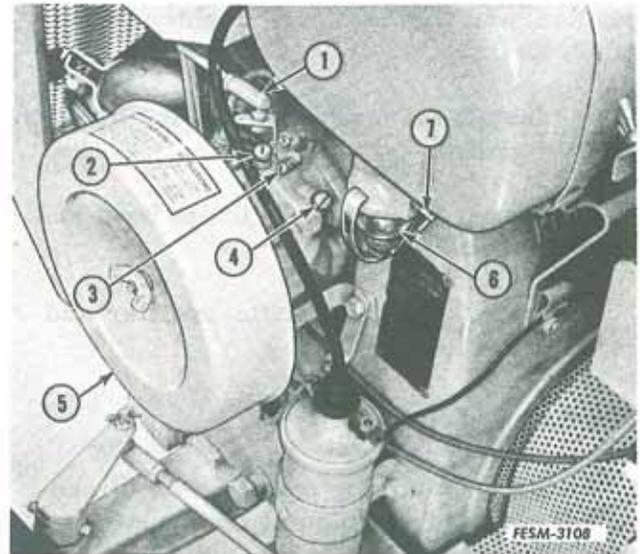
(Refer to Illusts. 1-28 and 1-29)

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 affects the other.



Illust. 1-28. Carburetor for Model 73.



Illust. 1-29. Carburetor for Models 106, 107, 126, 127 and 147.

1. Governor control rod
2. High speed mixture screw
3. Idle speed screw
4. Idle mixture screw
5. Air cleaner
6. Sediment bowl
7. Fuel shut-off valve

1. Turn the high speed mixture screw counterclockwise 2-1/2 turns from closed position, turn the idle mixture screw 1-3/4 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 counterclockwise 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.

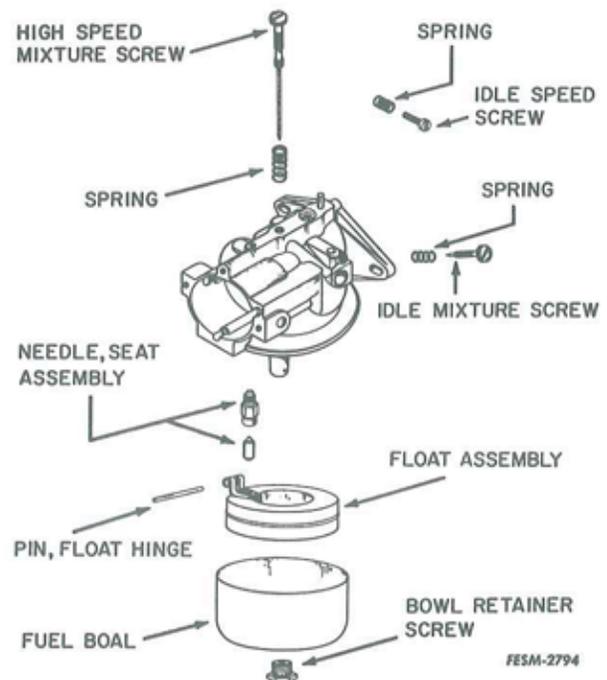
3. The final idle adjustment should be made at an engine speed of not less than 1000 rpm. Adjust until smoothest idle is obtained.

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. 1-30)

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. 1-30. 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. 1-30)

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 approximately 2-1/2 turns.

6. Install idle mixture screw and spring. Back out approximately 1-3/4 turns after seating lightly.

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

GOVERNOR

Model 73

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.

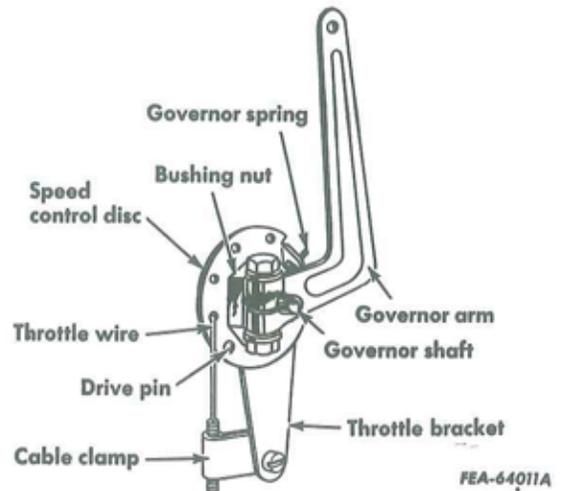
3. Operate control handle, rotating the disc from idle to full speed.

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. 1-31).

To Change Speed Range Setting (Illust. 1-31):

1. Loosen bushing nut slightly.

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



Illust. 1-31. 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 106, 107, 126, 127 and 147

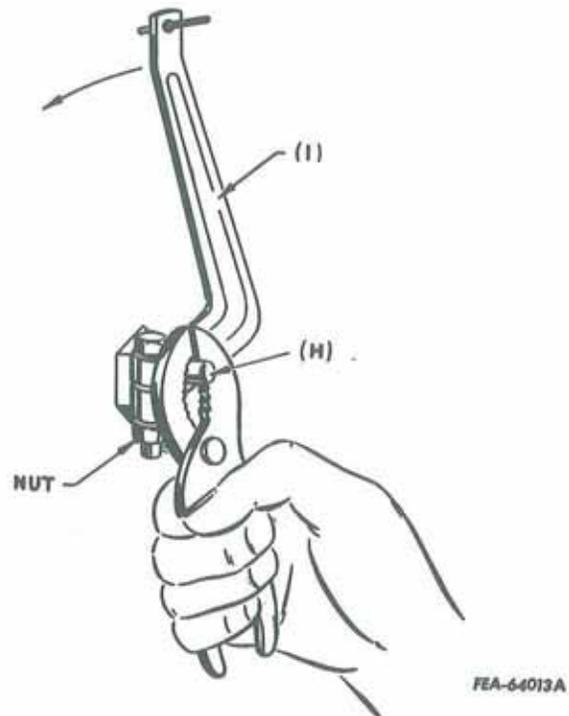
K-241, K-301 and K-321 Engines are equipped with internal mechanical governors and operating speed is determined by speed control lever setting. The governor maintains engine speed under varying loads and also serves as a top speed limiting device.

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.

Governor Adjustments

1. To reset the governor (Illust. 1-32), loosen the nut which holds the governor arm (I) to shaft (H).
2. Turn shaft counterclockwise as far as possible with a pair of pliers.
3. Pull arm (I) all the way to the left



Illust. 1-32. Resetting governor.

(away from carburetor). Tighten nut. Check for freedom of movement.

Throttle Control

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

ELECTRICAL SYSTEM

Battery Ignition

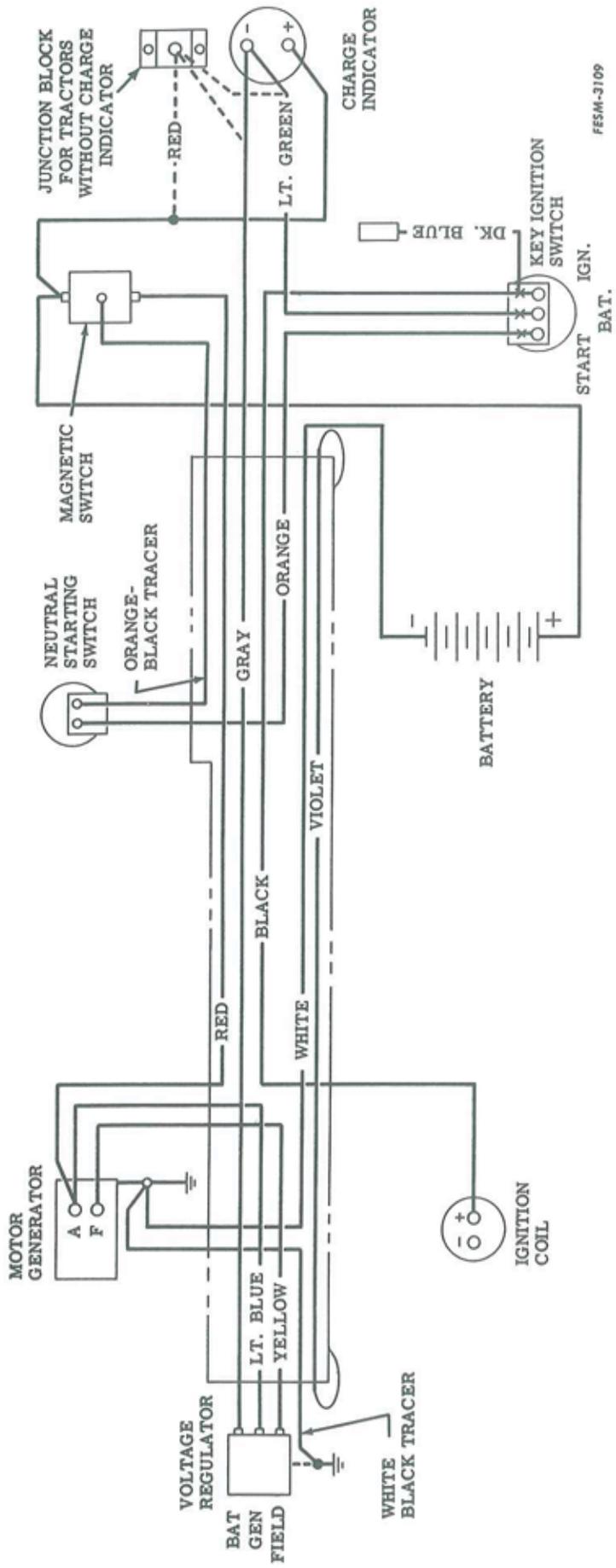
The electrical system consists of a motor-generator, solenoid, voltage regulator, key start ignition switch, safety switch, battery, ignition coil and breaker point assembly.

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

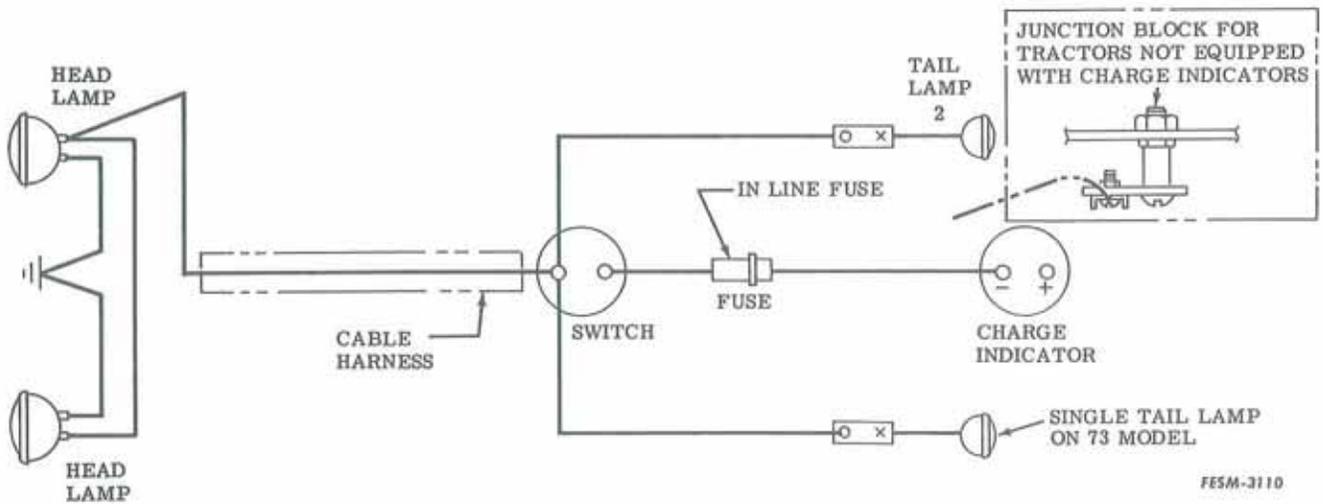
The voltage regulator controls current and voltage to the battery at all engine speeds.

Solenoid and Switches

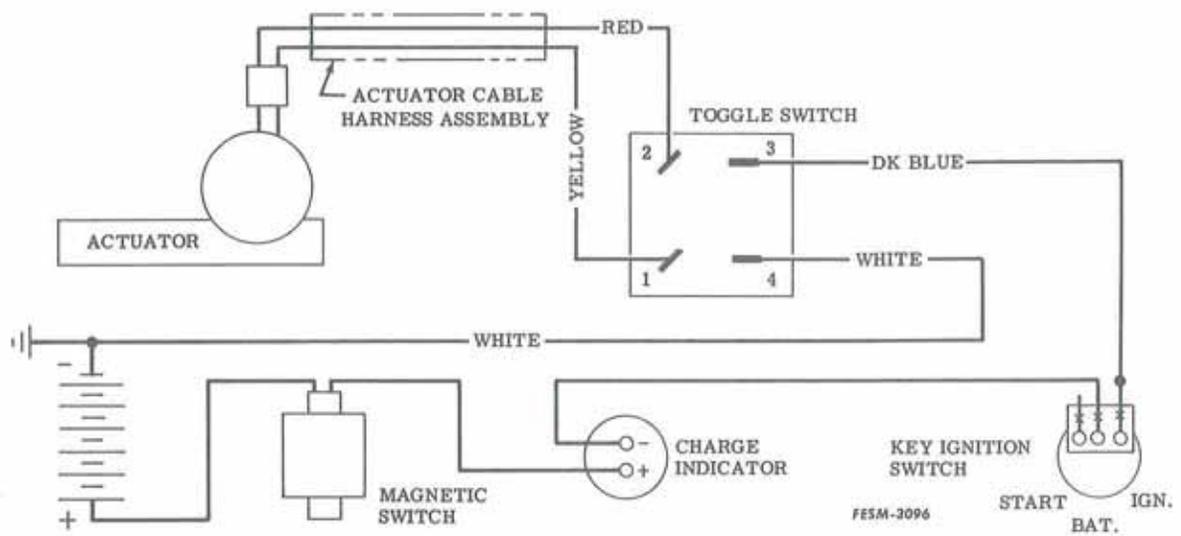
If a solenoid, key start switch or safety starting switch malfunctions, replacement will be necessary.



Illust. 1-33. Electric starting wiring diagram.



Illust. 1-34. Electric lighting wiring diagram.



Illust. 1-35. Electric lift wiring diagram.

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.

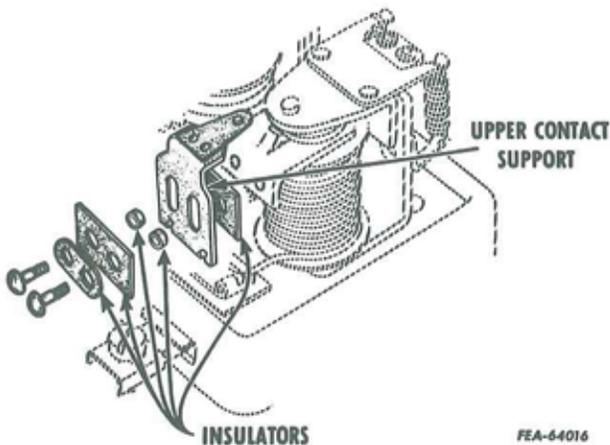
2. Brushes can be inspected or re-

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. 1-36. 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. 1-36. 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.

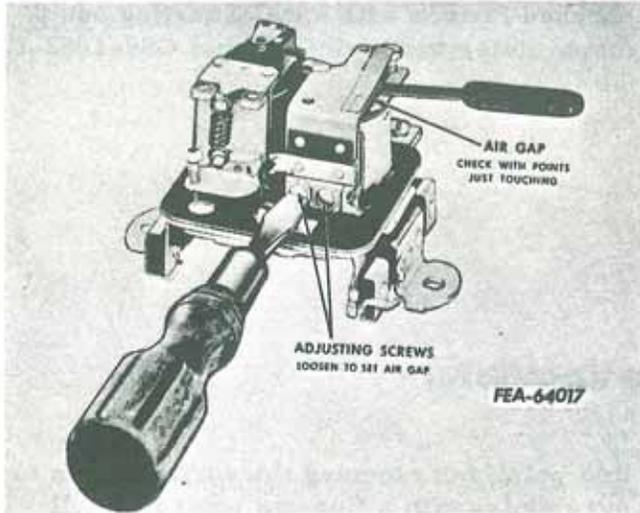
CAUTION: Avoid excessive removal of contact point metal. Never use sandpaper or emery cloth to clean points.

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.

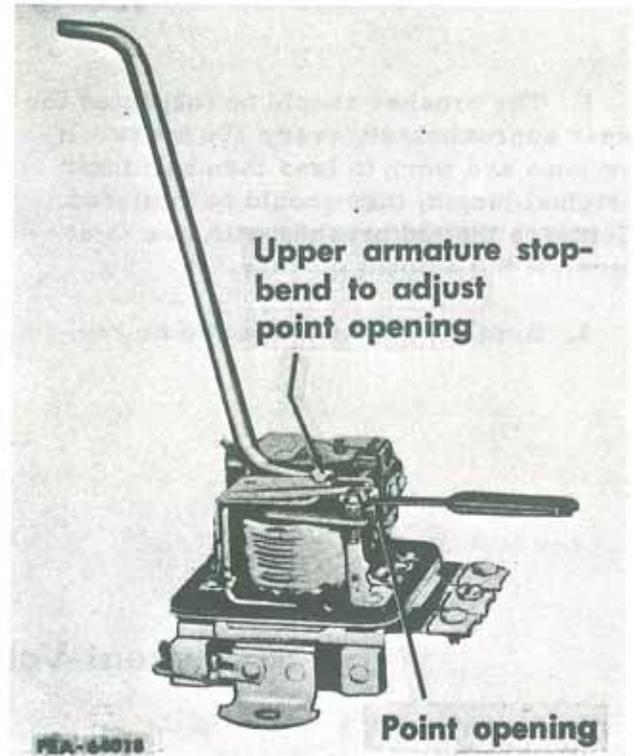


Illust. 1-37. Cut-out relay air gap inspection and adjustment.

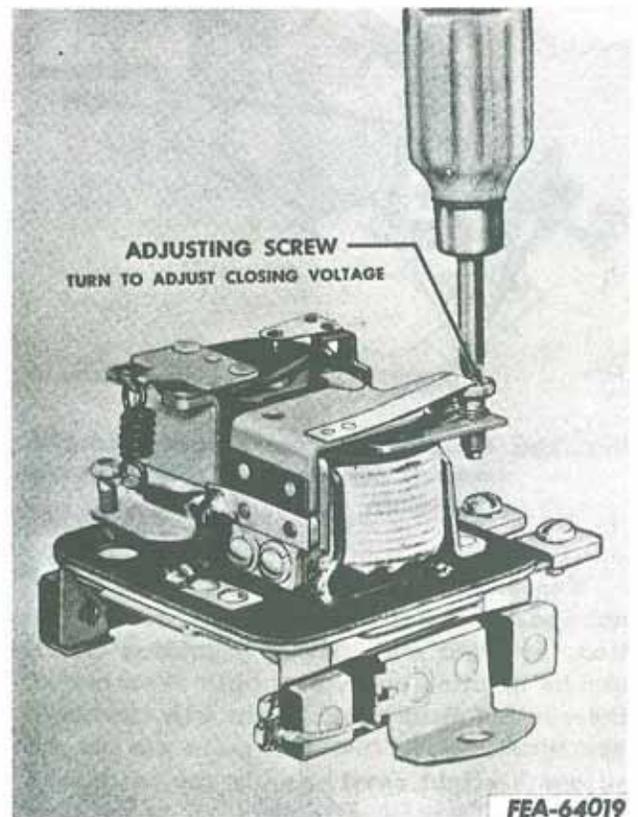
1. Air gap. Place your fingers on the armature directly above the core and press the armature down until the points just close. Then measure the air gap between the armature and the center of the core. See Illust. 1-37. The air gap should be .020 inch. Adjust by raising or lowering the armature at its hinge mounting. Retighten screws after adjustment.

2. Point opening. Adjust the point opening by bending the armature stop as shown in Illust. 1-38. 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. 1-39.



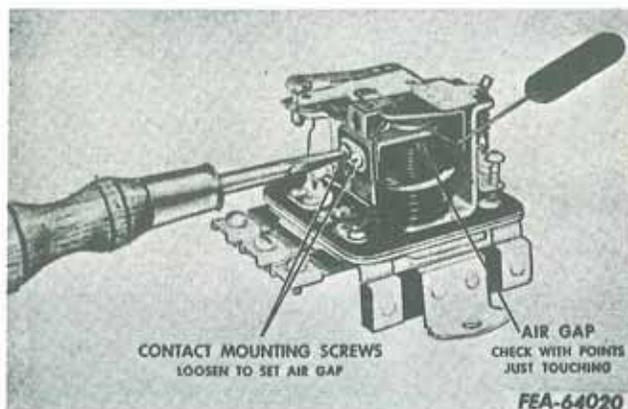
Illust. 1-38. Cut-out relay point opening inspection and adjustment.



Illust. 1-39. 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.

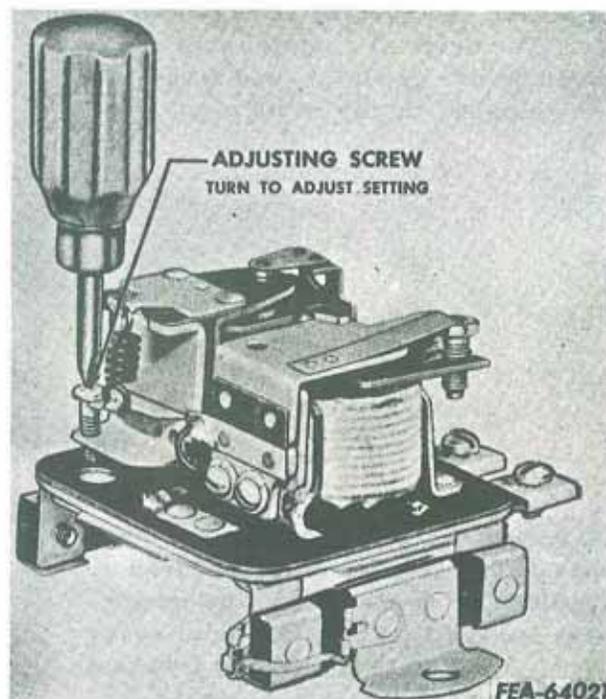


Illust. 1-40. Current-voltage regulator air gap inspection and adjustment.

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. 1-40.

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. 1-41.

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. 1-41. 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.

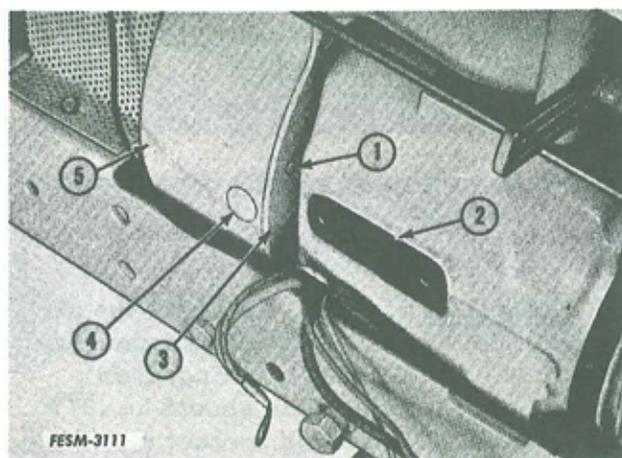
Ignition Timing

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 73 and in the right side of the blower housing on the Models 106, 107, 126, 127 and 147 (Illust. 1-42).

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. 1-42).

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



Illust. 1-42. Location of timing sight hole. (Starter-generator has been removed to better illustrate location.)

- 1. Model 73 and 147
- 2. Starter - generator mounting
- 3. Bearing plate
- 4. Models 106, 107, 126 and 127
- 5. Blower housing

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. 1-27, 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.

Section 2

CHASSIS

CONTENTS

	Page
Specifications	2-2
General Information	2-5
Steering Assembly	2-10
Front Wheels and Bearings	2-13
Front Axle	2-14
Clutch	2-15
Brakes	
Model 73	2-19
Models 106, 107, 126, 127 and 147	2-21
Splitting and Recoupling the Tractor	
Models 73, 106 and 126	2-23
Reduction Drive	
Model 73	2-25
Models 106 and 126	2-28
Transmission and Differential	
Models 73, 106 and 126	2-30
Rear Axle	2-34
Hydrostatic Transmission	
Models 107, 127 and 147	2-36
Principles of Hydrostatics	2-36
General Information	2-39
Splitting and Recoupling the Tractor	
Models 107, 127 and 147	2-40
Charge Pump Service	2-45
Charge Pump Relief Valve Service	2-46
Check Valve Service	2-47
Removal and Installation of Hydrostatic Unit	
Models 107, 127 and 147	2-48
Hydrostatic Transmission Service	2-51
Differential	
Models 107, 127 and 147	2-57
Adjustments	
Models 107, 127 and 147	2-62
Trouble Shooting	2-65
Creep Drive	2-66
Front PTO Clutch	2-69
Rear PTO	2-74
Electric Power Lift	2-76

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 (Model 73)

Brake pad thickness - inch	5/16
Type	Disc
Location	On transmission countershaft

Brakes (Models 106, 107, 126, 127 and 147)

Type	Caliper
Location	Outer end of axles

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 - inch . . . . .	.310 to .314
Between 1st speed driven gear and reverse driven gear - inch . . . . .	.686 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) - psi	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 capscrews	52
Center section-to-transmission case capscrews	35
Motor swash plate (fixed) hexagon socket head capscrews	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 pinion and drive gear backlash - inch . . . . .	.003 to .005
Bevel pinion location	Integral part of countershaft
Drive gear location	In differential case
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 capscrews	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.

Models equipped with electric power lift have a control lever located on the right side of the instrument panel for implement control.

Models not equipped with electric power lift have an implement control lever conveniently located on the right side of the tractor.

On gear driven models power is transferred 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 (Model 73)

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.

Brakes (Models 106, 107, 126, 127 and 147)

Friction material pads apply "Caliper Type" holding to brake discs located on the outer end of both rear axles. Braking is applied to both rear wheels through their individual disc brake assembly.

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 differential drive 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 (Model 73) and a needle bearing (Models 106, 107, 126, 127 and 147) in each axle carrier supports the rear axle outer end.

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.

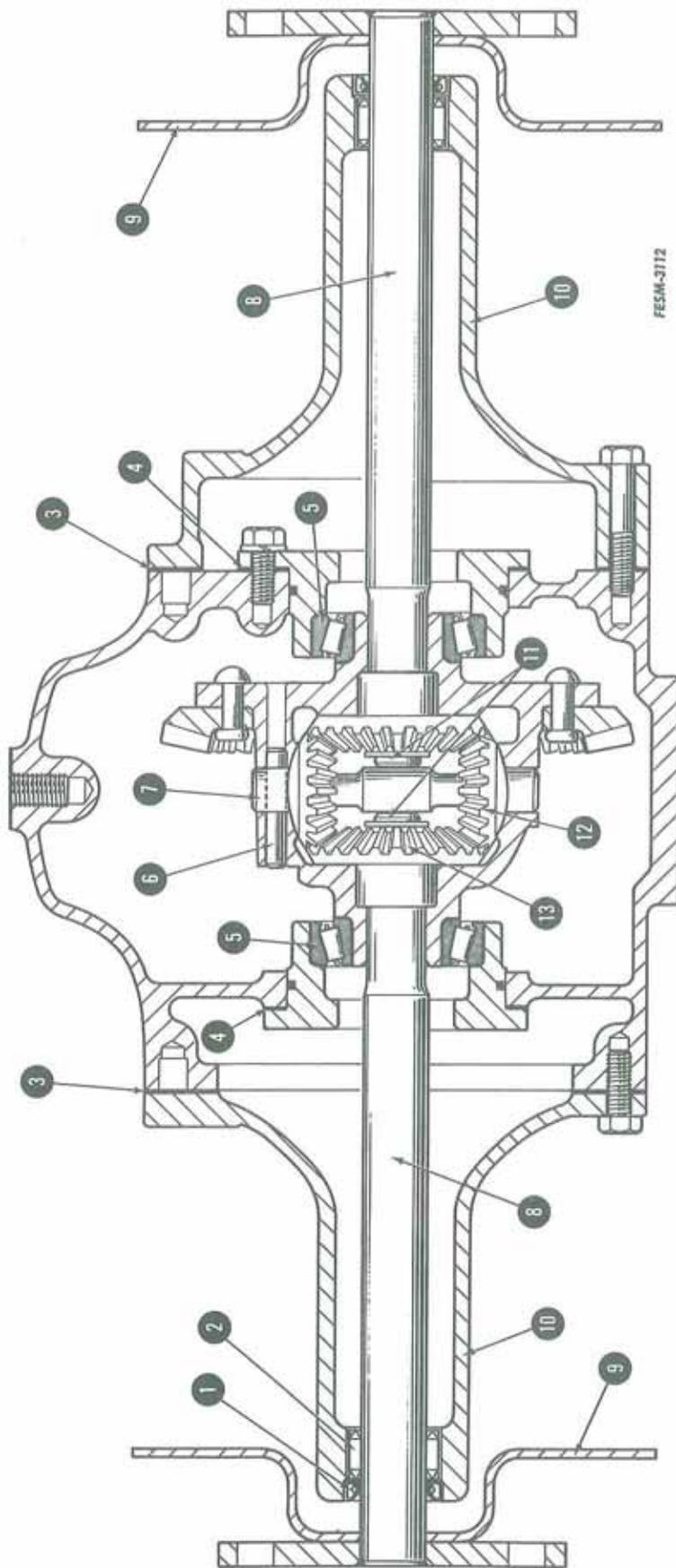
A spiral worm cam and lever with single follower and control arm actuates the ball socket drag link to the left front steering knuckle. The ball socket tie rod connects the right and left steering knuckles. The worm (cam) shaft is supported by ball bearings. Design features provide camber, and toe-in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

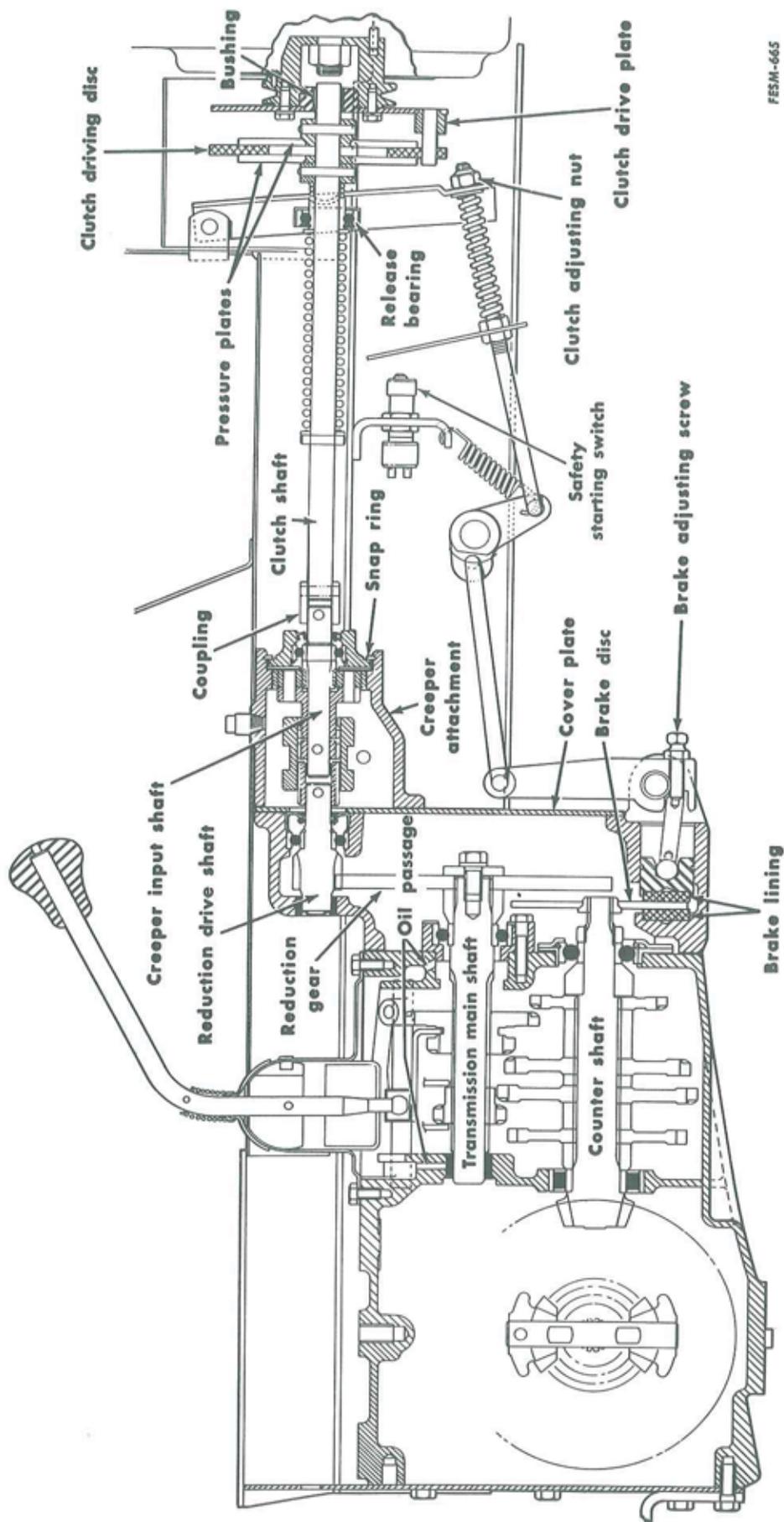
Creeper Attachment

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.



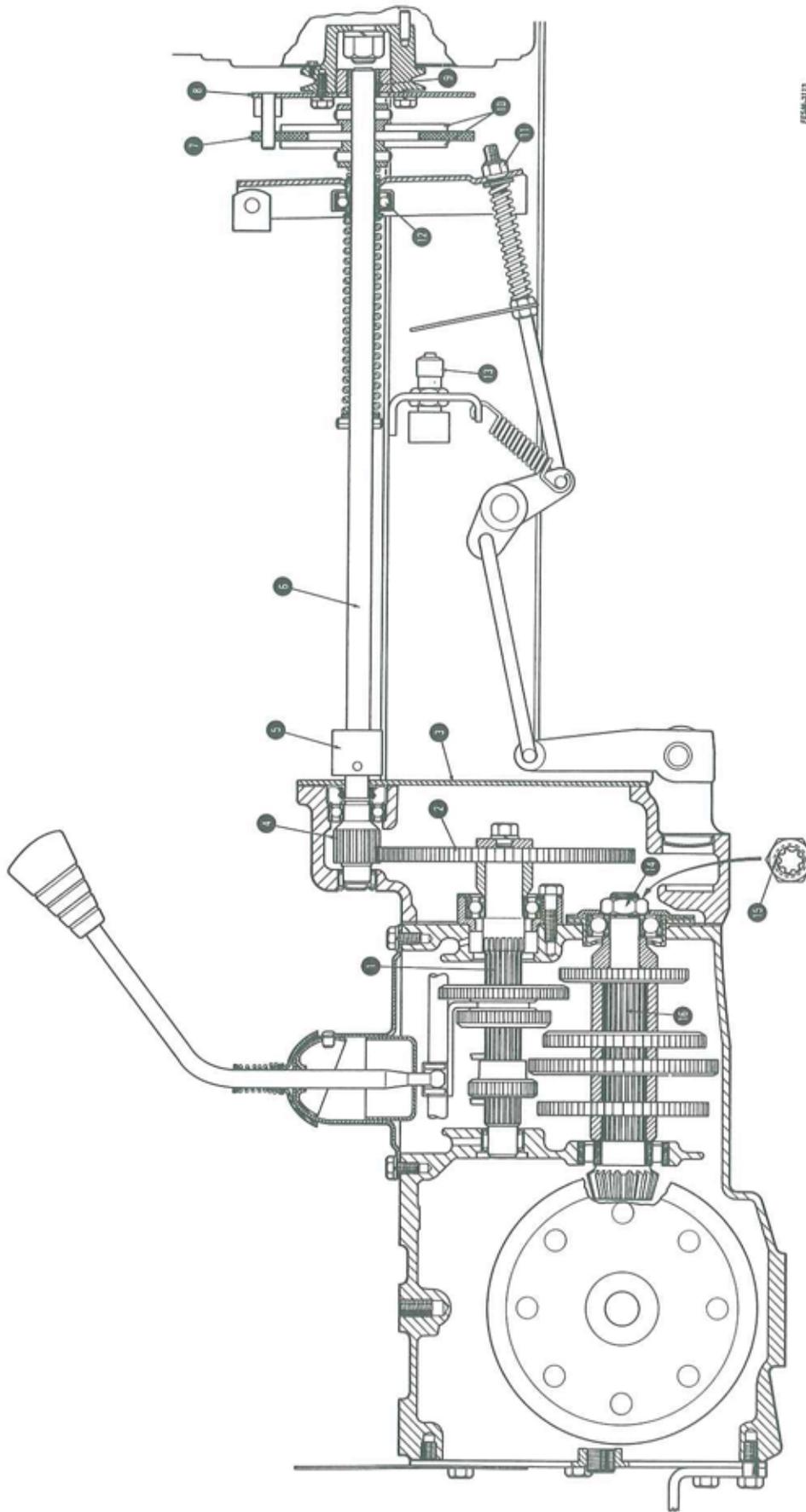
Illust. 2-1. Cross section - rear axle assembly.

- | | |
|------------------------------|-------------------------|
| 1. Oil seal | 8. Rear axles |
| 2. Needle bearing or bushing | 9. Brake discs |
| 3. Gaskets | 10. Rear axle carriers |
| 4. Shims | 11. Snap ring retainers |
| 5. Differential bearings | 12. Differential pinion |
| 6. Lock pin | 13. Side gear |
| 7. Pinion shaft | |



FESM-665

Illust. 2-2. Cross section - power train for Model 73.



FE64-3173

Illust. 2-3. Cross section - power train for Models 106 and 126.

- 1. Transmission mainshaft
- 2. Reduction gear
- 3. Cover plate
- 4. Reduction drive shaft
- 5. Coupling
- 6. Clutch shaft

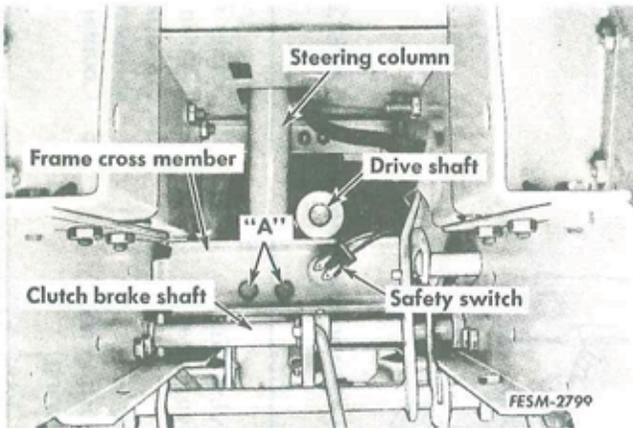
- 7. Clutch driving disc
- 8. Clutch drive plate
- 9. Bushing
- 10. Pressure plates
- 11. Clutch adjusting nut
- 12. Release bearing

- 13. Safety starting switch
- 14. Tighten nut to 75 to 100 ft. lbs.
- 15. Stake nut once in space between any two spline teeth
- 16. Countershaft

STEERING ASSEMBLY

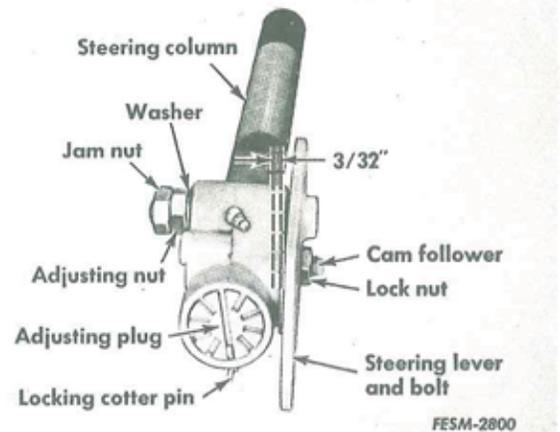
Removal

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.
3. Remove clutch shield bottom sheet.



Illust. 2-4. Underside view of steering support and frame cross member.

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

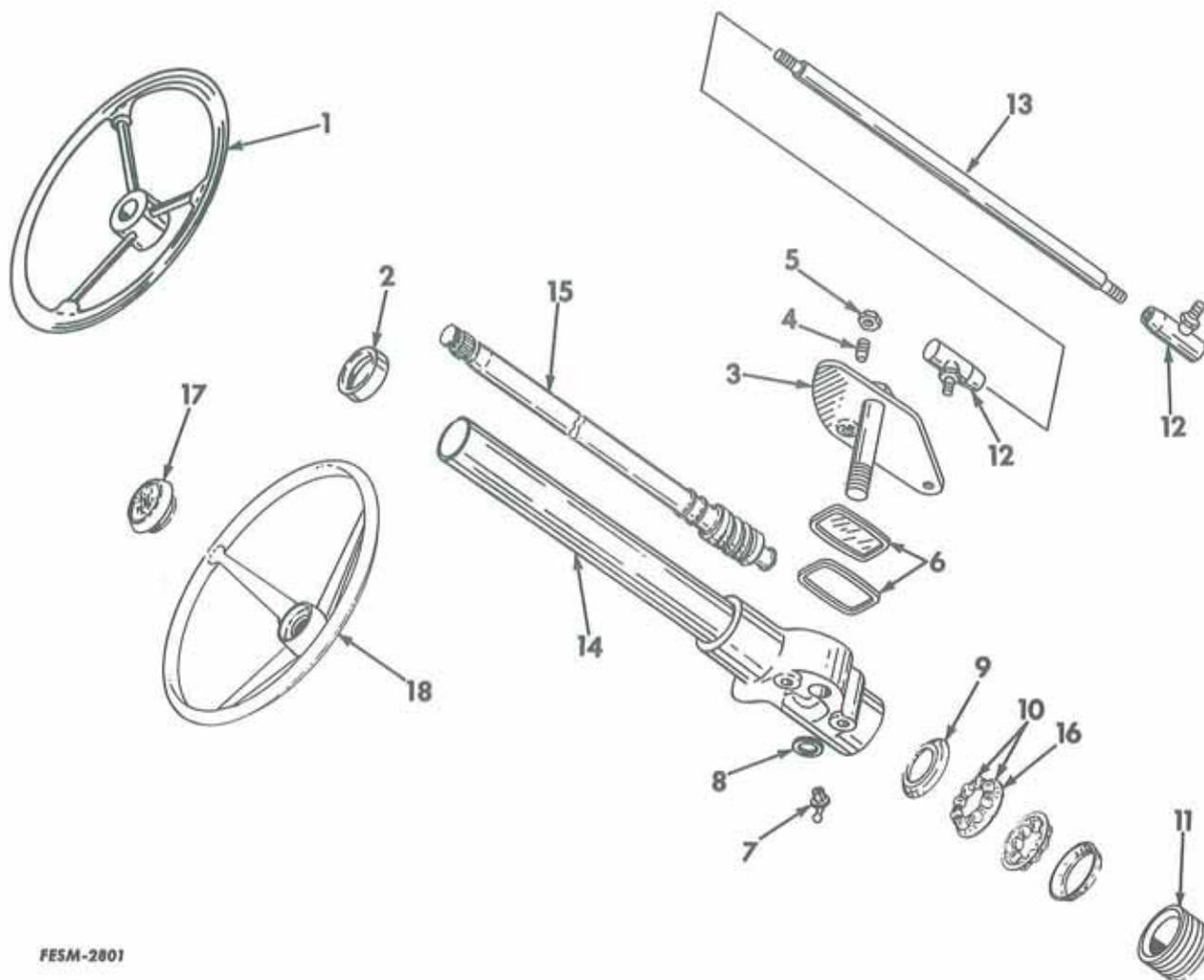


Illust. 2-5. Steering assembly.

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. 2-6)



FESM-2801

Illust. 2-6. Exploded view of steering assembly.

1. Wheel (Model 73)	7. Fitting	13. Link, steering
2. Bearing	8. Washer	14. Tube assembly
3. Lever	9. Bearing	15. Cam and tube
4. Stud	10. Retainer and ball assembly	16. Retainer
5. Nut	11. Plug, Adjusting	17. Cap, steering wheel
6. Seal and retainer	12. Joint	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. 2-6)

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. 2-5).

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. 2-6).

8. Install the washer and adjusting nut. Tighten the adjusting nut sufficiently to provide good seal compression. Refer to Illust. 2-5 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.

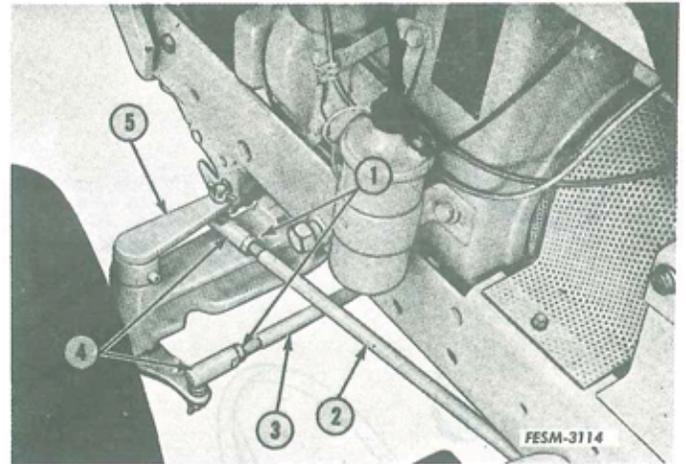
10. Adjust the cam follower inward to eliminate backlash, then tighten locknut to 40 ft. lbs. Turn steering shaft full right and left to check for binding.

11. Replace the steering assembly in the tractor chassis. Secure with two capscrews 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. 2-7. Steering tie rod and drag link ball joints.

1. Locknuts
2. Drag link
3. Tie rod
4. Ball joints
5. Drag link arm

15. Adjust the tie rod (No. 3 in Illust. 2-7) to provide $1/32''$ to $1/8''$ toe-in as follows:

a. Remove one of the tie rod ball joints and loosen the locknut. Refer to Illust. 2-7.

b. Screw the ball joint in or out to obtain the specified toe-in of $1/32''$ to $1/8''$ and tighten the locknut.

c. Connect the ball joint to the steering knuckle and be sure to install the cotter pin.

16. Adjust the drag link (No. 2 in Illust. 2-7) to proper length to place front wheels in the straight ahead position when the steering assembly is "centered."

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

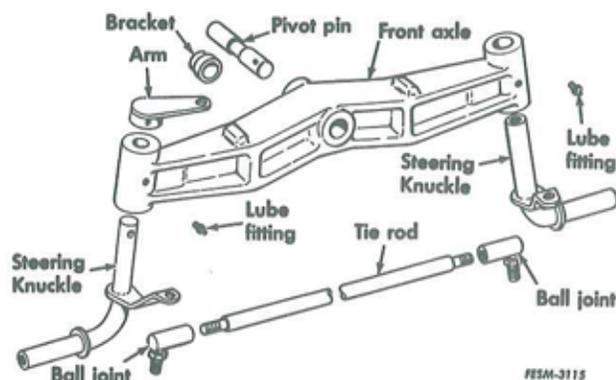
1. If the bearings were removed, lubricate and press in new ones. Be sure force is directed to the outer race only.

2. Slide the wheel and bearing assembly over the spindle and secure with capscrew 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. 2-8)



Illust. 2-8. 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 capscrew 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 (4) from the drag link arm (No. 5 in 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. 2-8).

3. Remove the pivot pin. The front axle is now free of its mounting and can be removed.

Inspection and Repair

1. Inspect all parts closely for wear or damage and replace as necessary.
2. If the pivot pin support brackets are damaged or show excessive wear, replace with new brackets available through service parts and weld them in place.

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. 2-8)

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 capscrew 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 moving the engine forward, then removing the clutch assembly.

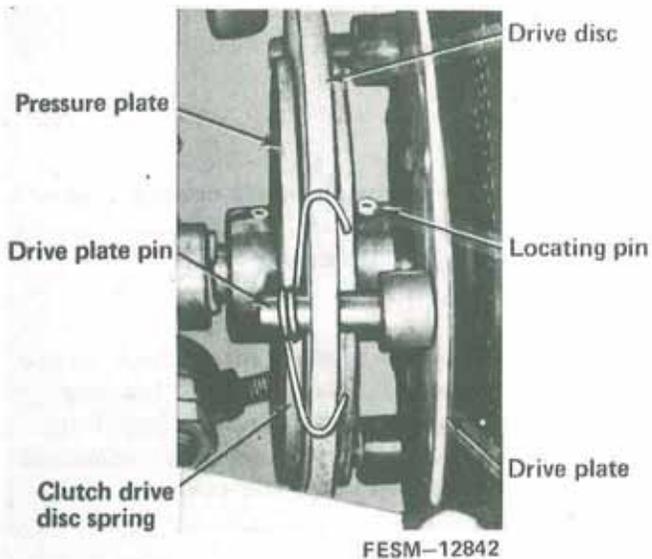
NOTE: Models 106 and 126 will require the removal of the muffler and heat shield before moving the engine forward.

To remove the clutch assembly, remove the clutch shield, clutch shaft coupling rear pin, clutch release lever pin and disconnect the clutch release rod from the pedal arm. Refer to Illust. 2-2 or 2-3.

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.

2. Remove the clutch shield.



Illust. 2-9. Clutch shield removed showing clutch drive.

3. Using a hammer and punch, drive out the pressure plate locating pin (Illust. 2-9).

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

NOTE: Wiring cable clips will need spreading so that wires can follow the engine as it is moved.

5. Release the clutch and brake pedal, then move the engine forward far enough to clear the 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. 2-9).

7. Slide the engine rearward while aligning the clutch shaft and driving plate pins (Illust. 2-9).

8. Depress and lock the clutch-brake pedal.

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

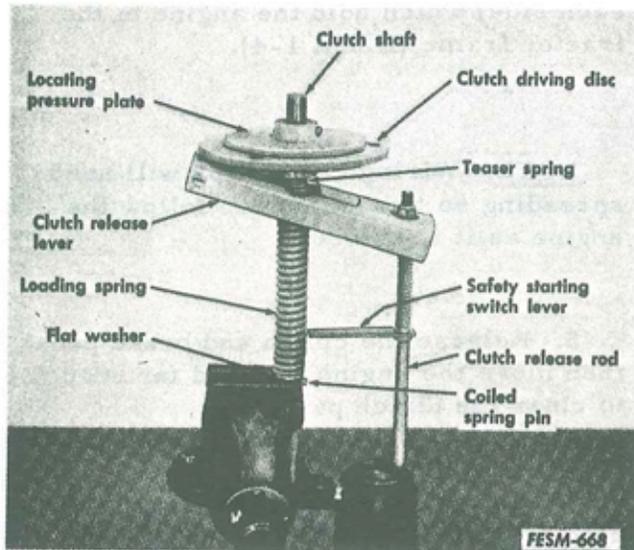
10. Align the engine to the frame and replace the securing capscrews.

11. Secure the wires and cables in their clips.

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

13. Replace the clutch shield.

Disassembly



Illust. 2-10. Clutch shaft secured in vise for removal of pin.

1. Clamp the clutch shaft in a vise as shown in Illust. 2-10 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.

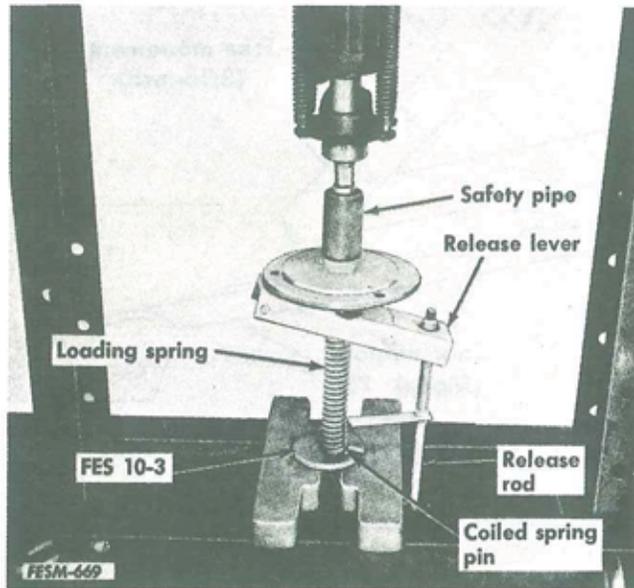
9. Clutch shaft coupling pin holes should not be "wallowed out" or elongated.

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. 2-11. Compressing the loading spring for pin installation.

8. Place the assembly in a press as shown in Illust. 2-11. 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 capscrew holes and install the capscrews.

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

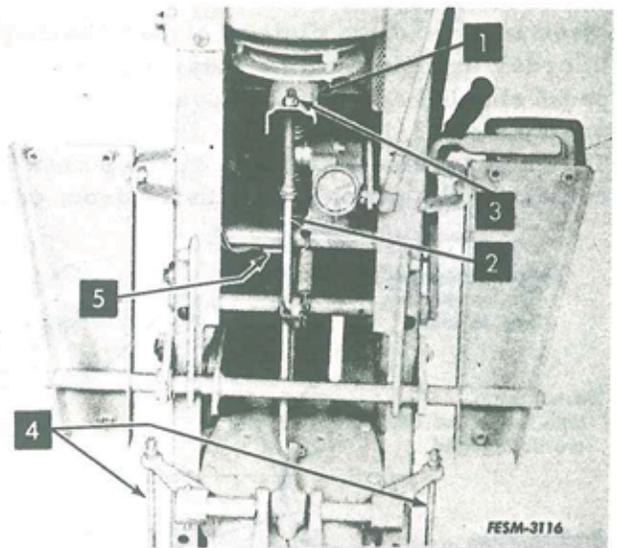
7. Connect the clutch release rod to its pedal shaft lever and secure with the return spring.

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.

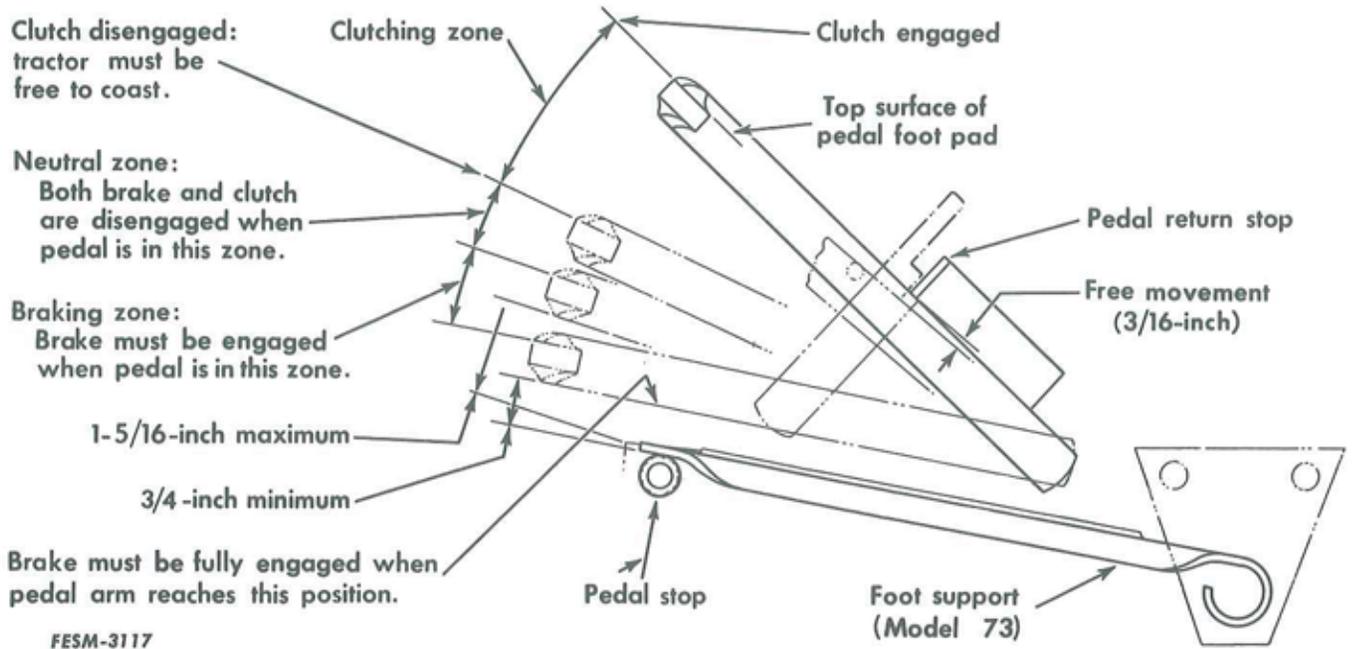


Illust. 2-12. Underside view of brake and clutch control linkage.

- | | |
|-------------------------|------------------------|
| 1. Clutch release lever | 4. Brake rods |
| 2. Release rod | 5. Safety start switch |
| 3. Adjusting nut | |

12. Check the clutch pedal and linkage for proper adjustment.

Adjusting the Clutch

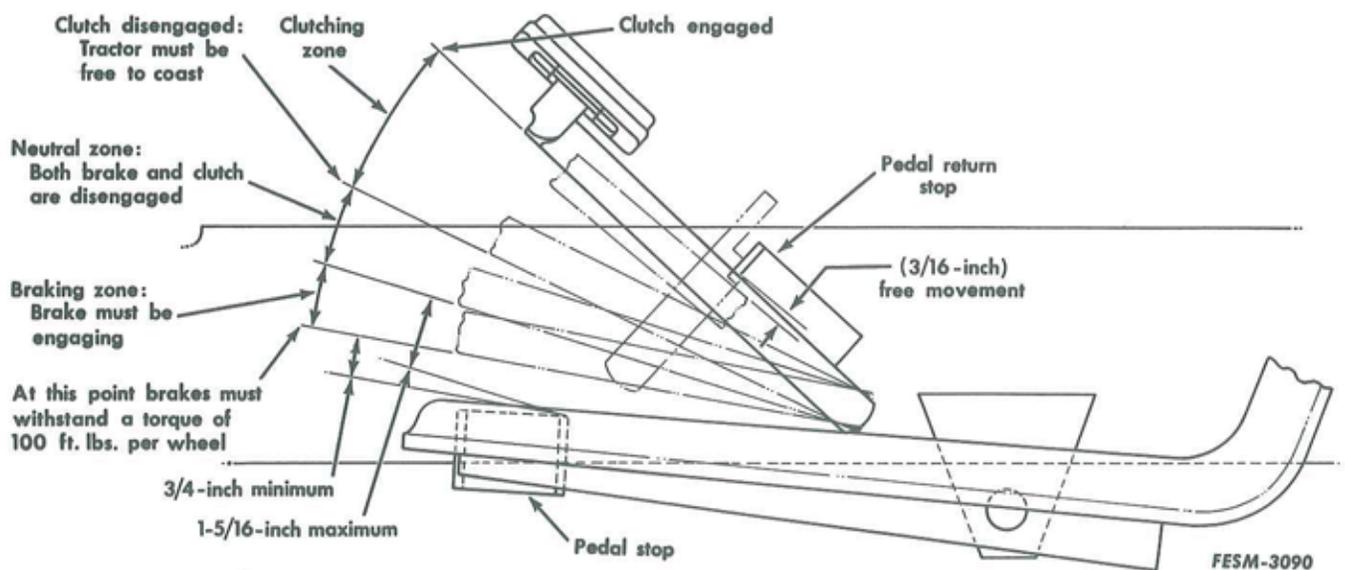


Illust. 2-13. Clutch and brake pedal linkage adjustments (Model 73).

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. 2-13. 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 (3) on the clutch release rod (Illust. 2-12) in or out as required to get the proper measurements.



Illust. 2-14. Clutch and brake pedal linkage adjustments (Models 106 and 126).

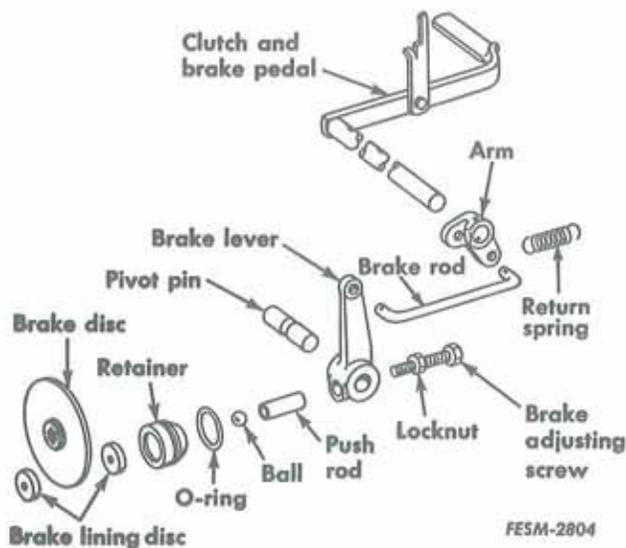
BRAKES

Model 73

NOTE: Tractors equipped with a "creeper" attachment will require "splitting", and the creeper removed before complete brake service can be performed. Refer to page 2-23 of this manual for splitting procedure.

Removal

1. Drain the transmission lubricant.



Illust. 2-15. Exploded view of brake components.

2. Remove the brake adjusting screw and locknut from its lever (Illust. 2-15).
3. Remove the brake lever, pivot pin and push rod (Illust. 2-15).

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 2-15.

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 capscrew. Tighten capscrew 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 locknut.

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

Adjusting the Brake – Model 73

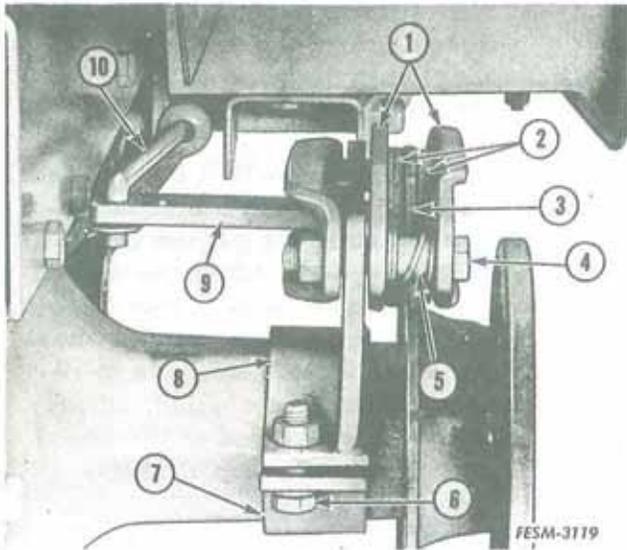
The brake should engage when the pedal arm is pressed down to within a maximum of 1-5/16 inches and a minimum of 3/4 inch distance above the top of the left foot support which serves as the pedal stop. See Illust. 2-13.

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 locknut and turn the brake lever adjusting screw (Illust. 2-15) in or out as required to get the above measurements. The brake must not engage before the pedal arm is within the maximum distance of 1-5/16 inches above the pedal stop.

Models 106, 107, 126, 127 and 147

Removal



Illust. 2-16. Brake assembly with wheel removed for ease of viewing.

1. Remove the brake rod (10) from the brake arm (No. 9 in Illust. 2-16).

2. Remove the cap screws (6) from the mounting flange (7) and remove the brake assembly from the axle carrier (Illust. 2-16).

3. Remove the cap screws (4) securing the caliper assembly (1) to the bracket assembly (No. 8 in Illust. 2-16).

Inspection and Repair

1. Inspect the control rods and levers for wear at their connecting pivot points.

2. Inspect the brake pads for excessive wear. Replace if necessary.

1. Caliper assembly
2. Brake pads
3. Brake disc
4. Cap screw
5. Spacer and spring
6. Cap screw
7. Mounting flange
8. Bracket assembly
9. Brake arm
10. Brake rod

3. Check the brake discs for excessive wear or damage.

4. Check the pedal return spring ends for wear.

Installation

1. Assemble the caliper assembly to the bracket assembly. Be sure to install the spacers and springs (5) as shown in Illust. 2-16.

2. Install the caliper assembly and bracket assembly on the disc and axle carrier.

3. Assemble the mounting flange to the bracket assembly and secure with the cap screws.

4. Install the brake rods in the brake arms.

Adjusting the Brakes – Models 106 and 126

NOTE: For 107, 127 and 147 refer to page 2-62.

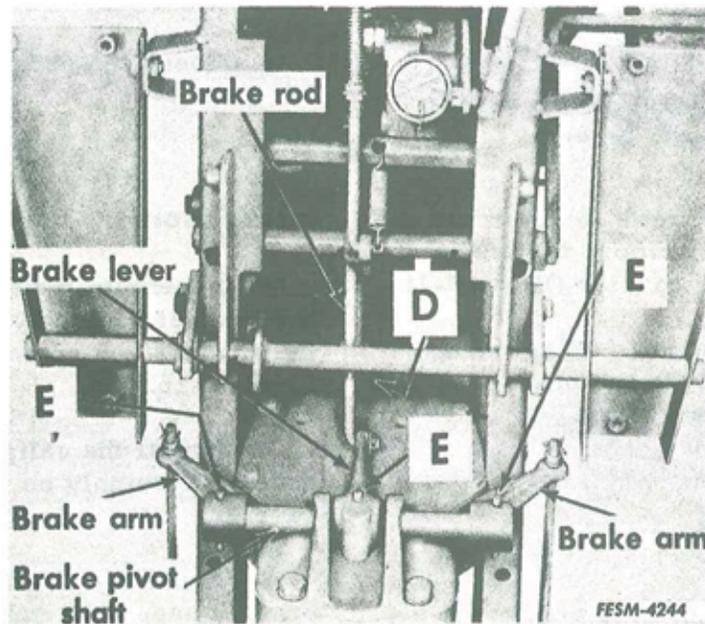
The disc brakes should engage when the pedal arm is pressed down to within a maximum of 1-5/16 inches and a minimum of 3/4 inch distance above the pedal stop. Refer to Illust. 2-14.

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.

NOTE: At 3/4 inch distance the brakes must withstand a torque of 100 ft. lbs. per wheel.

To adjust the brakes block the front wheels securely and raise the tractor so the rear wheels are off the ground and turn freely. Adjust the jam nuts on the ends of the brake rods (Illust. 2-17). The brakes must not engage before the pedal arm is within the maximum distance of 1-5/16 inches. Refer to Illust. 2-14.

NOTE: It is very important to have the brakes equalized. To check the equalization of the brakes start the engine and shift the gears to third speed. After the wheels are turning, apply the brakes. Both wheels should stop at the same time. If one wheel stops and the other wheel continues to revolve when the brakes are applied, adjust the jam nuts on the brake rod of the wheel that stops so both wheels stop simultaneously.



Illust. 2-17. Brake pedal linkage adjustments.

SPLITTING AND RECOUPLING THE TRACTOR

Models 73, 106 and 126

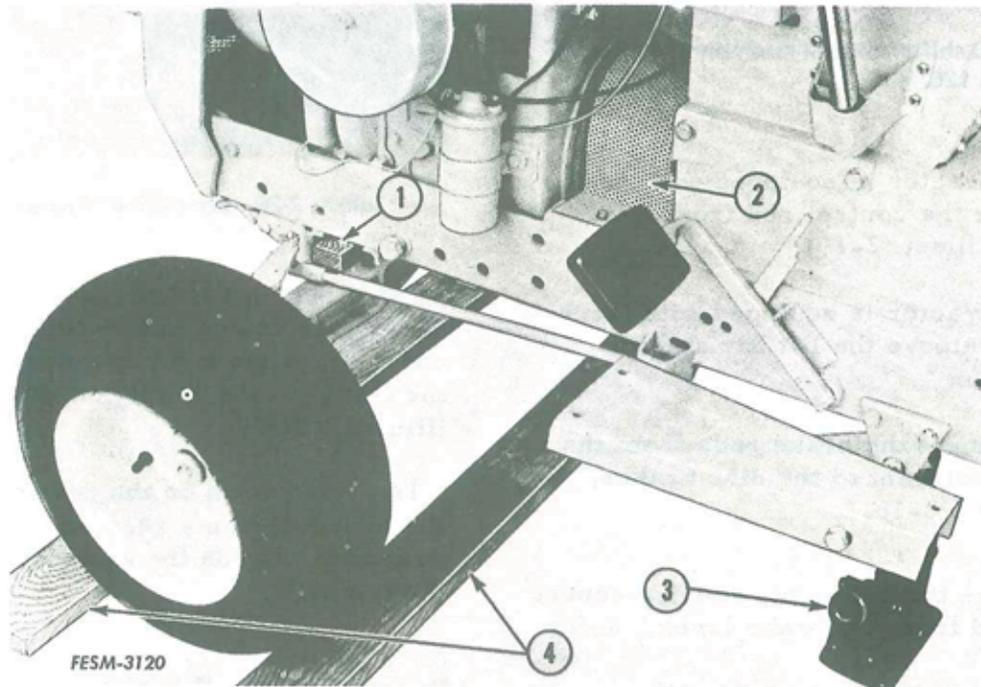
Splitting the Tractor (For Models 107, 127 and 147, refer to page 2-40.)

NOTE: Disconnect battery ground cable.

1. Disconnect the tail light wires (if so equipped).
2. Remove the electric lift foot guard (if so equipped).
3. Remove the fender and seat support assembly by removing the four capscrews in the bottom of the tool box under the seat and removing the six truss head machine screws, three each on the left and right foot supports.

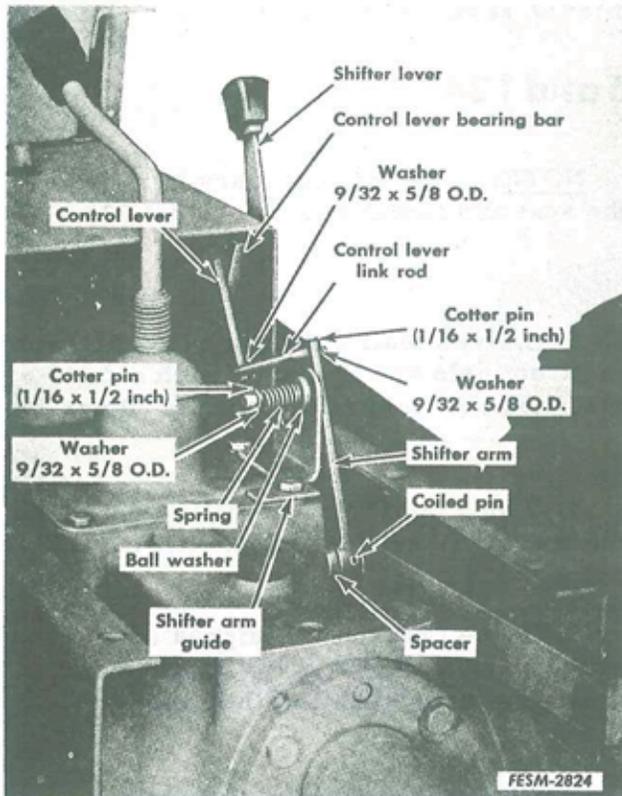
NOTE: It is not necessary to remove the seat and fenders on the Model 73.

4. Drive small wooden wedges between the front axle and frame on each side to stabilize the front of the tractor (Illust. 2-18).
5. Block both front wheels as shown so the tractor is secure and can not move.
6. If the tractor is equipped with creeper attachment, shift the lever forward and remove the lever knob and the breather.



Illust. 2-18. Front axle and wheels wedged and blocked for tractor split.

- | | |
|-----------------------------|---------------------------------------|
| 1. Wooden wedge (each side) | 3. Hydraulic jack |
| 2. Clutch shield | 4. 2" x 4" blocks (both front wheels) |



Illust. 2-19. PTO shifter control assembly - Models 106 and 126.

7. If the tractor is equipped with rear PTO, remove the control rod from the shifter arm (Illust. 2-19).

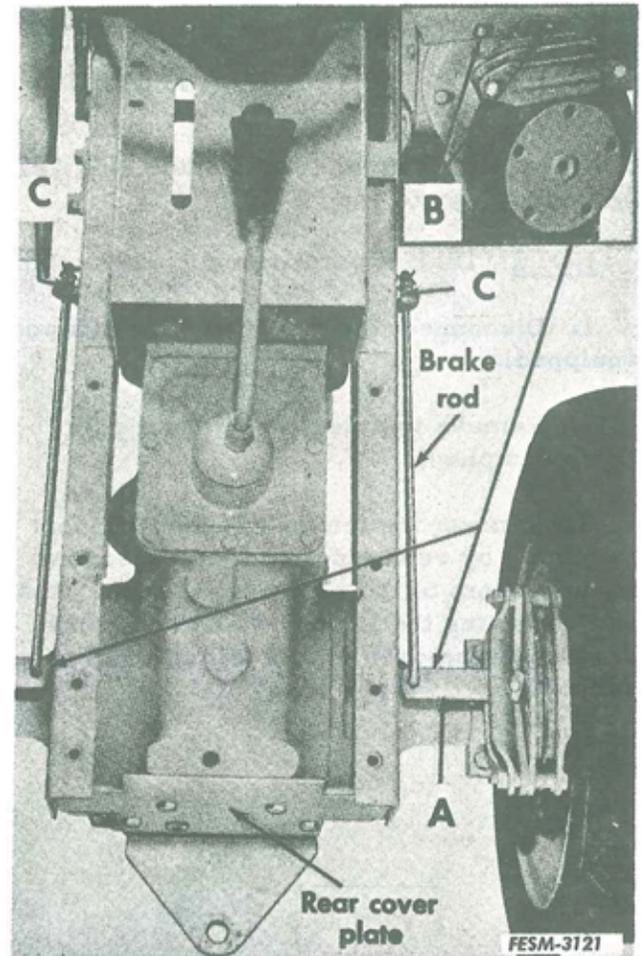
8. If the tractor is equipped with three point hitch, remove the lift bar and its attaching plate.

9. Disconnect the brake rods from the brake arms adjacent to the disc brakes. Refer to Illust. 2-16.

10. Remove the cotter pin and disconnect the brake rod from the brake lever. Refer to Illust. 2-17.

11. Remove the coiled spring pin "D" from the rear hole in the clutch shaft coupling. Refer to Illust. 2-17.

12. Place a jack under the implement lift cross shaft to support the frame.



Illust. 2-20. Location of frame capscrews.

13. Remove the four capscrews "B" holding the frame to the rear axle carriers and remove the two capscrews "C" holding the frame to the reduction gear housing (Illust. 2-20).

14. Push down on the drawbar and pull the transmission - rear end assembly rearward. Guide the assembly from under the frame.

Recoupling the Tractor

1. Tip the unit into recoupling position.

2. Recouple the split sections of the tractor being sure to align the clutch shaft and secure with the six capscrews. Refer to Illust. 2-20.

3. Attach the coupling at the end of the clutch shaft using the coiled spring pin "D". Refer to Illust. 2-17.

4. Connect the brake rod to the brake lever. See Illust. 2-17.

5. Connect the brake rods to the brake arms adjacent to the disc brakes.

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

7. Install the rear PTO control rod in

the shifter arm (if so equipped). See Illust. 2-19.

8. Replace the creeper lever knob and breather (if so equipped).

9. Install the fenders and seat support assembly (except Model 73). Connect the tail light wires (if so equipped).

10. Install the electric lift foot guard (if so equipped).

11. Check oil level and fill to proper level with Hy-Tran fluid.

REDUCTION DRIVE

Model 73

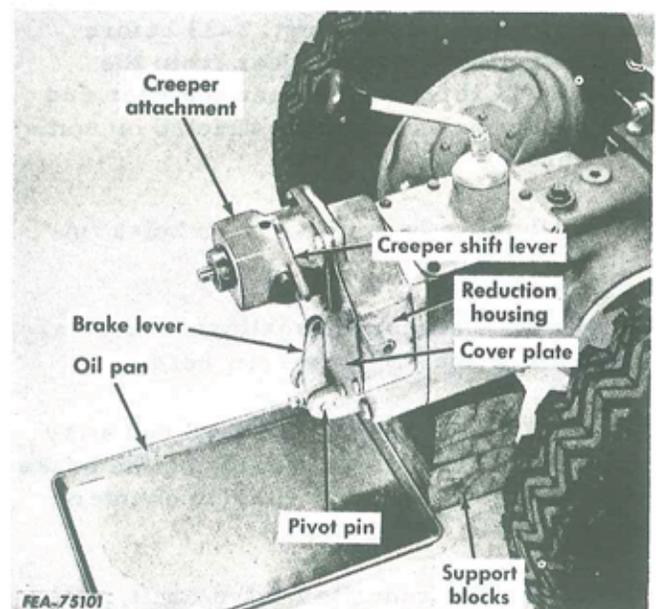
Removal and Disassembly

1. Split the tractor. Refer to page 2-23 for splitting procedure.

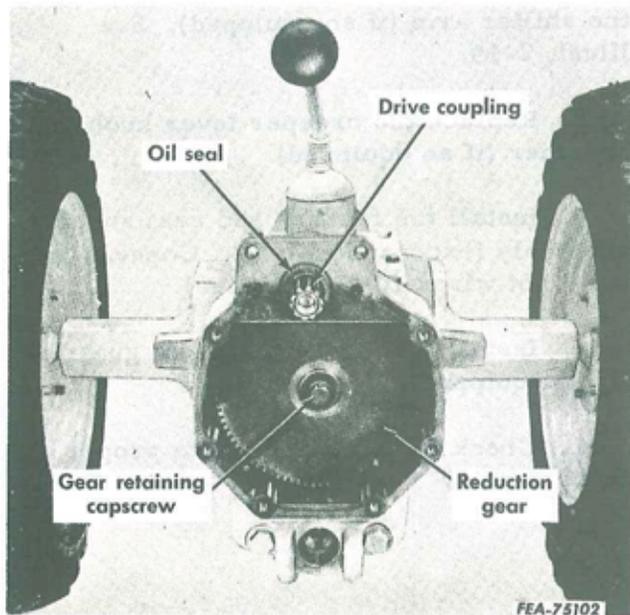
2. Place an oil pan under the reduction housing and remove the creeper assembly (if tractor is so equipped).

3. Remove the brake lever, pivot pin and push rod (Illust. 2-21).

4. Remove the reduction housing front cover plate (Illust. 2-21).



Illust. 2-21. Power train supported for disassembly.



Illust. 2-22. Reduction drive exposed.

5. Hold the drive coupling and shaft from turning and remove the reduction gear retaining capscrew and washers. Remove the gear (Illust. 2-22).

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

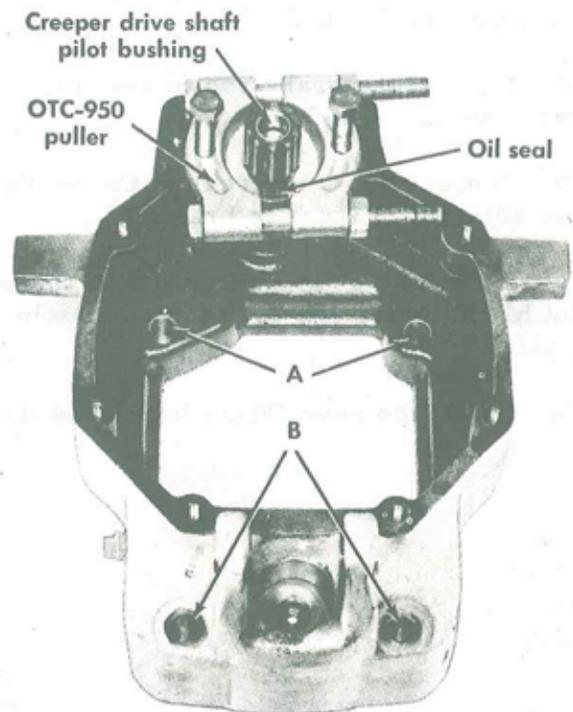
NOTE: It may be more convenient to pull the reduction drive shaft, seal and bearing as shown in Illust. 2-23 before removing the reduction gear from the housing. Clearance between the gear and the capscrew bosses is restricted on some tractors.

7. Remove capscrews from holes "A" and "B" (Illust. 2-23).

NOTE: Soft copper sealing washers are used under the "B" capscrew 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**.



Illust. 2-23. Pulling reduction drive shaft, seal and bearing.

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 capscrews. Refer to "B" (Illust. 2-23). Tighten capscrews 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 capscrew, flat and lockwasher. Tighten capscrew 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 capscrew 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, brake lever and pivot pin.

16. Recouple the tractor by reversing the splitting procedure.

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

Models 106 and 126

Removal and Disassembly

1. Split the tractor. Refer to page 2-23 for splitting procedure.
2. Remove the transmission drain plug and allow the lubricant to drain completely; then replace the plug.
3. Remove the creeper assembly (if tractor is so equipped).
4. Remove the three coiled spring pins (E) to disconnect the brake arms and brake lever from the reduction housing. Refer to Illust. 2-17.

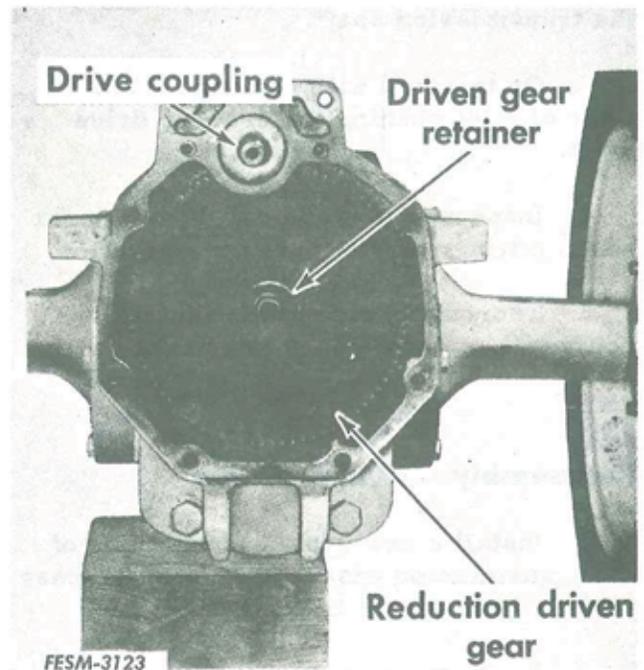


Illust. 2-24. Power train supported for disassembly.

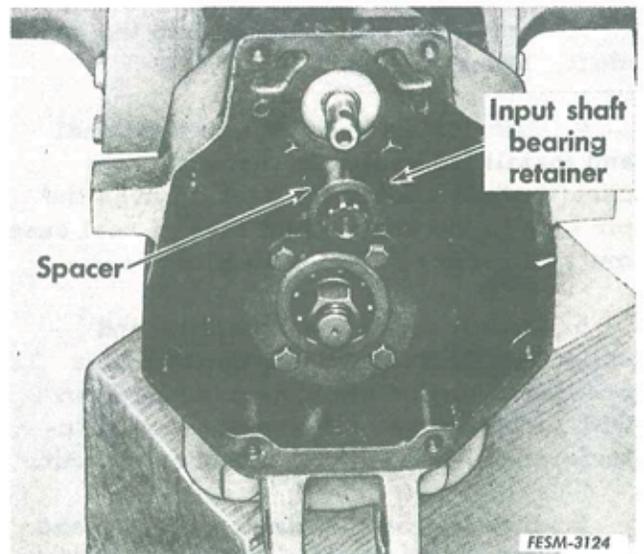
5. Remove the reduction housing cover plate (Illust. 2-24).
6. Remove the reduction driven gear by removing the capscrew, lock washer and driven gear retainer (Illust. 2-25).

NOTE: It may be more convenient to pull the reduction drive shaft, seal and bearing (see Illust. 2-23) before removing the reduction gear from the housing. Clearance between the gear and capscrew bosses is restricted on some tractors.

7. Remove the spacer from the input shaft (Illust. 2-26).



Illust. 2-25. Reduction drive exposed.



Illust. 2-26. Transmission input shaft exposed.

8. Remove the capscrews securing the transmission input shaft bearing retainer to the transmission and remove the retainer (Illust. 2-26).

9. Remove the capscrews from holes "A" and "B" as shown in Illust. 2-23.

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

10. Move the reduction housing forward and away from the transmission housing.

11. Pull the reduction drive shaft, seal and bearing from the reduction housing (see Illust. 2-23) if it was not removed in step 6 NOTE.

12. 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.

13. Press the reduction drive shaft from the ball bearing.

14. Press the needle bearing rearward from the housing.

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 bearings and ball bearings for wear, pitting and roughness of operation.

5. Thoroughly clean the reduction housings, bearings and gears.

Reassembly and Installation

1. Install a new gasket to the front of the transmission case.

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

3. Press the ball bearing onto the reduction drive shaft.

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. Refer to Illust. 2-3.

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 the reduction housing to the transmission case. Be sure the gasket and dowels are in place.

7. Install new copper sealing washers on the two lower capscrews. Refer to "B" in Illust. 2-23. Tighten the capscrews at "A" and "B" to 80 ft. lbs.

8. Install the reduction gear and spacer on the transmission mainshaft and secure with the retainer, capscrew and lock washer. Refer to Illust. 2-3.

9. Tighten the reduction gear retaining capscrew to 55 ft. lbs. and lock in place as shown in Illust. 2-3.

10. Install the reduction drive shaft with ball bearings, 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.

11. Install a new gasket and install the housing front cover.

12. Install a new gasket and install the creeper unit (on tractors so equipped).

13. Install the brake lever and brake arms on the pivot shaft and reduction housing. Refer to Illust. 2-17.

14. Recouple the tractor. Refer to page 2-24.

15. Fill the transmission and creeper to proper level with specified lubricant.

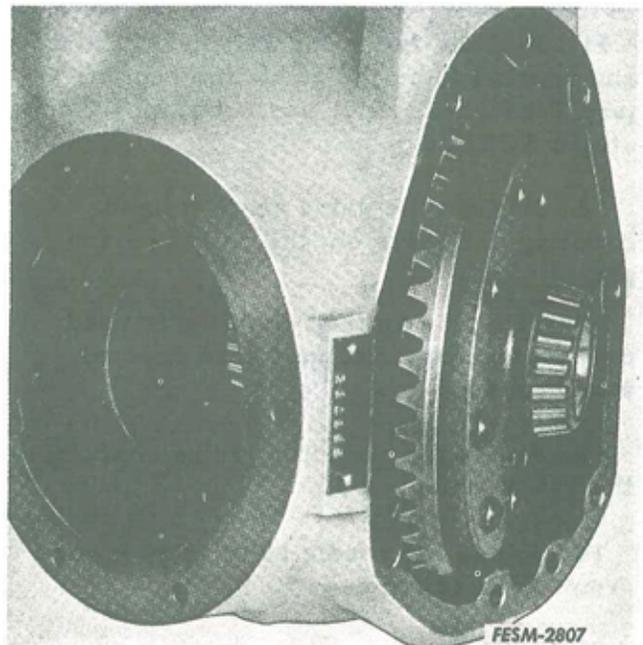
TRANSMISSION AND DIFFERENTIAL

Models 73, 106 and 126

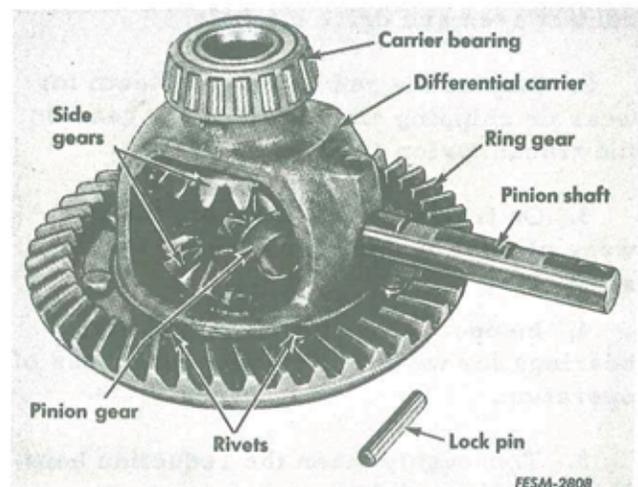
Complete service of the transmission requires splitting of the tractor, removal of the reduction drive (and creeper if so equipped), rear axles, carriers and the differential. The differential can be removed and replaced without disassembling the transmission, however, the transmission countershaft should 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 2-23.)
3. Remove the reduction drive. (Refer to page 2-25.)
4. Remove the rear axles and their carriers. (Refer to page 2-34.)
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. 2-27 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 drive gear requires separate replacement, press out the eight retaining rivets.



Illust. 2-27. Removing differential carrier from the transmission differential housing.



Illust. 2-28. 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 2-30.

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.

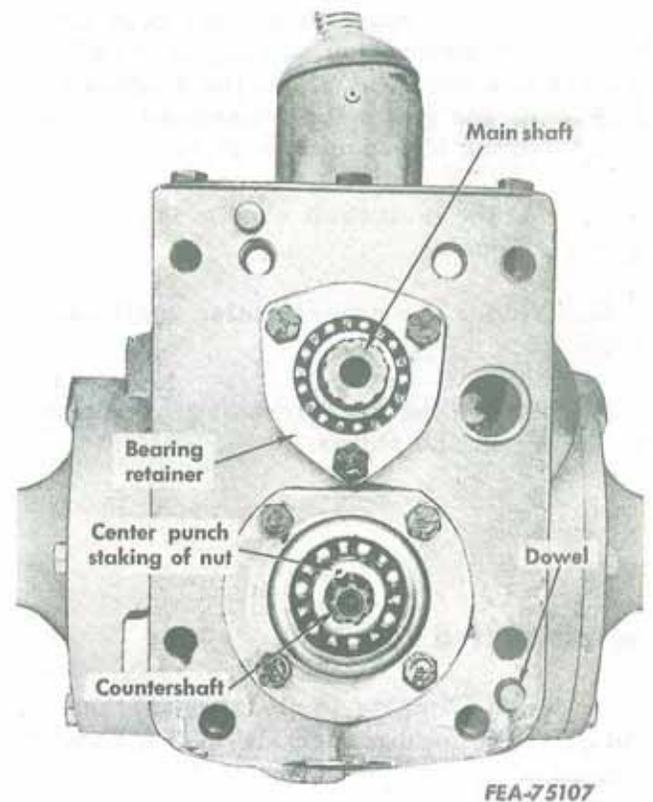
3. Remove the shifter fork set screws.

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

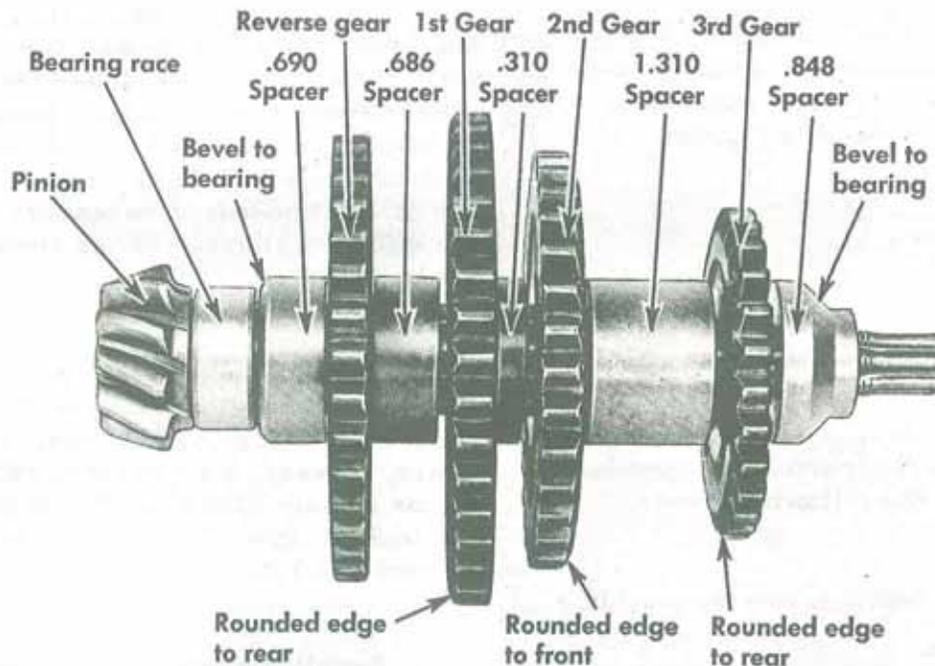
Drive the shifter rods forward and out of the transmission.

4. Remove the capscrews from the mainshaft front bearing retainer. Refer to Illust. 2-29.

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



Illust. 2-29. Front view of transmission.



Illust. 2-30. 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.

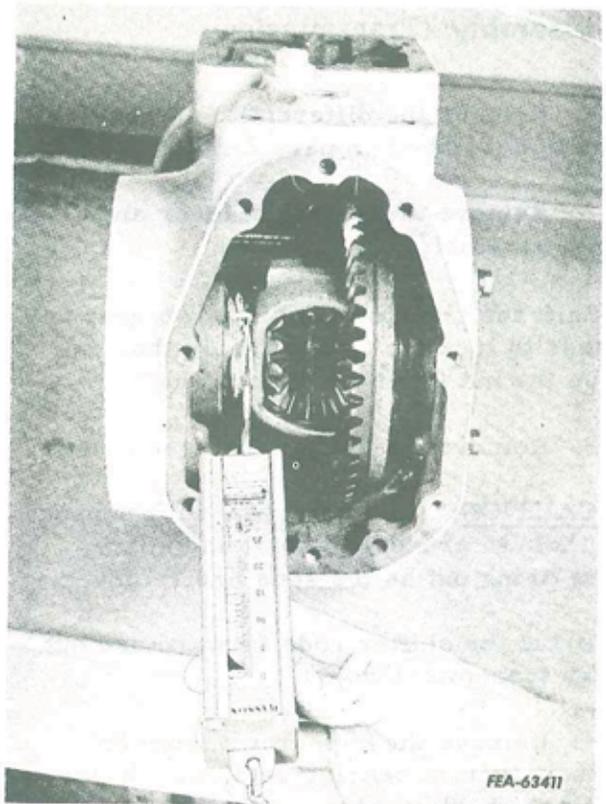
4. Inspect the housing for cracks, restricted oil passages or raised places on its machine faces. Smooth off raised places with a file.

Reassembly

Reassembly is basically the reverse of disassembly; however, particular attention should be given to the following steps.

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.

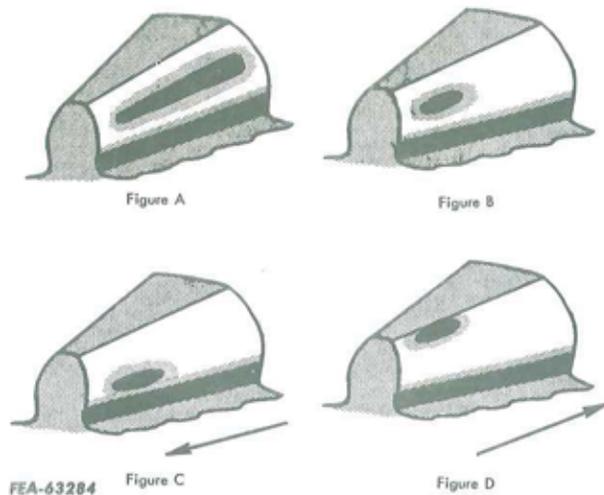


Illust. 2-31. Checking pre-load of differential bearings.

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 eight pounds is necessary to rotate the differential assembly as shown in Illust. 2-31.

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. 2-30). 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. 2-32. Tooth bearing pattern.

6. Check the backlash between the drive gear and bevel pinion and the gear teeth bearing pattern as follows. Refer to Illust. 2-32.

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. 2-32. 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 drive 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 bevel pinion. If low tooth bearing on bevel pinion is indicated (as shown in Figure "C") the bevel pinion must be adjusted toward the drive gear. If high tooth bearing on the bevel pinion is indicated (as shown in Figure "D") the bevel pinion must be adjusted away from the drive gear.

NOTE: If it is necessary to move the bevel pinion in or out to correct "Root-to-crown" bearing, the drive 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. 2-29.

12. Continue the assembly in reverse order of disassembly.

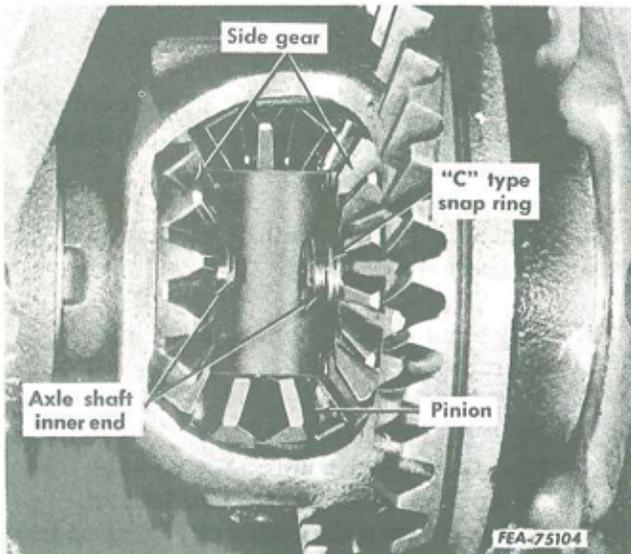
13. Fill housing to proper level with specified lubricant.

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. 2-18.
3. Split the tractor. Refer to page 2-23.
4. Remove the drawbar and differential housing rear cover.
5. Remove the brake assemblies from both axle carriers (except Model 73). Refer to page 2-21.

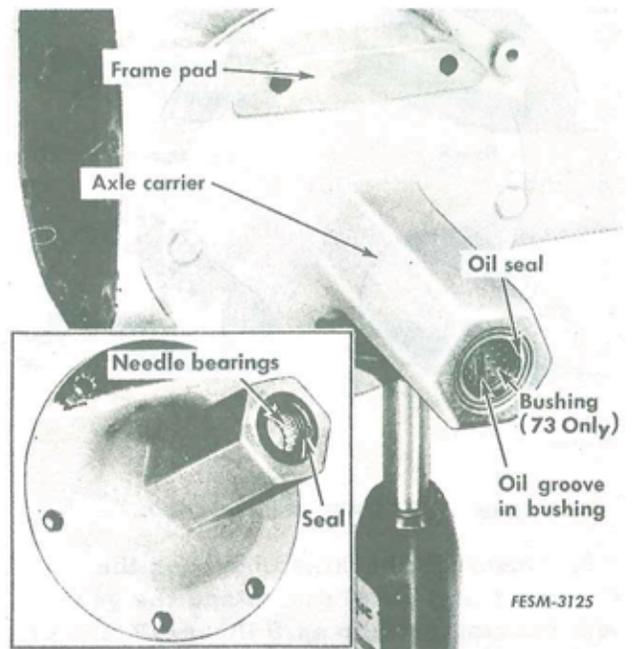


Illust. 2-33. Differential and rear axle assembly.

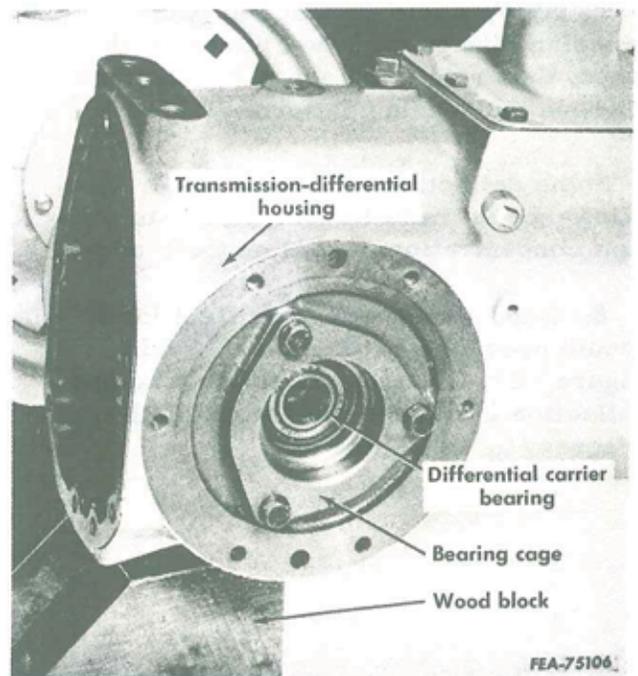
6. Place a jack under either rear axle carrier and raise the rear wheel off the floor. Remove the "C" type snap ring from the axle shaft inner end. Refer to Illust. 2-33.

7. Slide the axle out of the differential side gear and axle carrier. Refer to Illust. 2-34.

8. Support the transmission - differential housing on a block and remove the axle carrier. Refer to Illust. 2-35.



Illust. 2-34. Rear axle removed.



Illust. 2-35. Rear axle carrier removed.

9. Press the carrier bushing from the carrier.
10. Drive the oil seal from the carrier.
11. 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 73 only). The oil groove must be at the bottom. Press a new needle bearing into the axle carrier on 106, 107, 126, 127 and 147 Models (Illust. 2-34).
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. 2-34.

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. Install the brake assemblies on the outer ends of the axle carriers (except Model 73). See page 2-21 for procedure.

9. Recouple the tractor. Refer to page 2-24.

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

HYDROSTATIC TRANSMISSION

Models 107, 127 and 147

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. 2-36. 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.

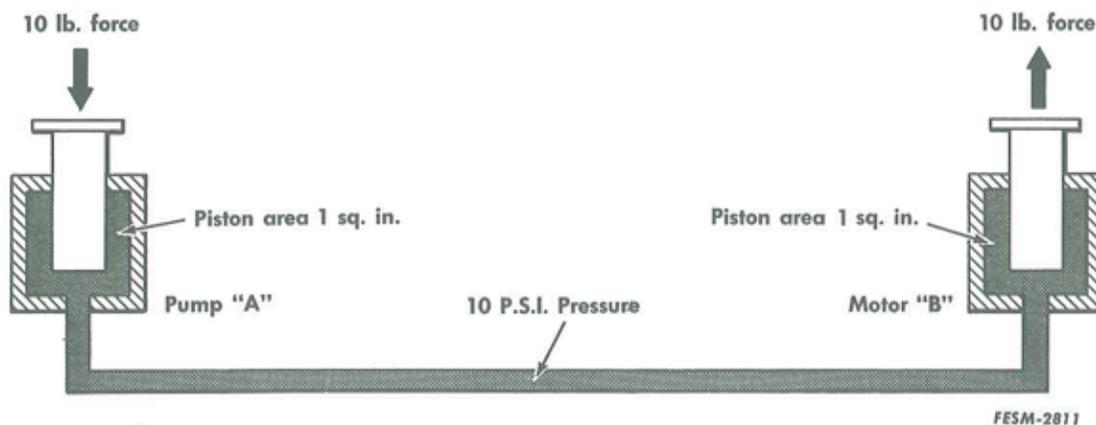
This illustrates the basic principles in their simplest form. Modern hydrostatic

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. 2-36.

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. 2-36.

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. 2-36. Simple hydrostatic transmission.

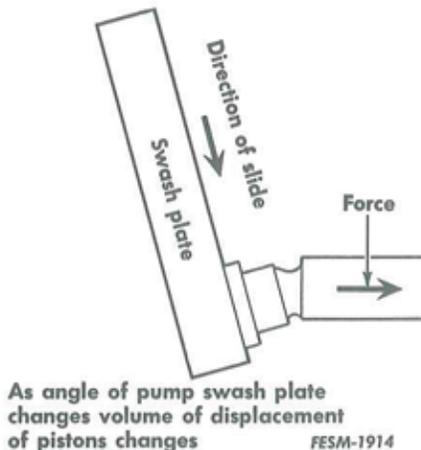
Since infinite control of these three basic items is possible, it therefore follows that a hydrostatic drive is infinitely controllable. Infinite control over the rate of fluid flow results in control of the output speed. Infinite control over the direction of fluid flow results in control of the rotation 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. 2-37. 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. 2-37. 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. 2-37. 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.

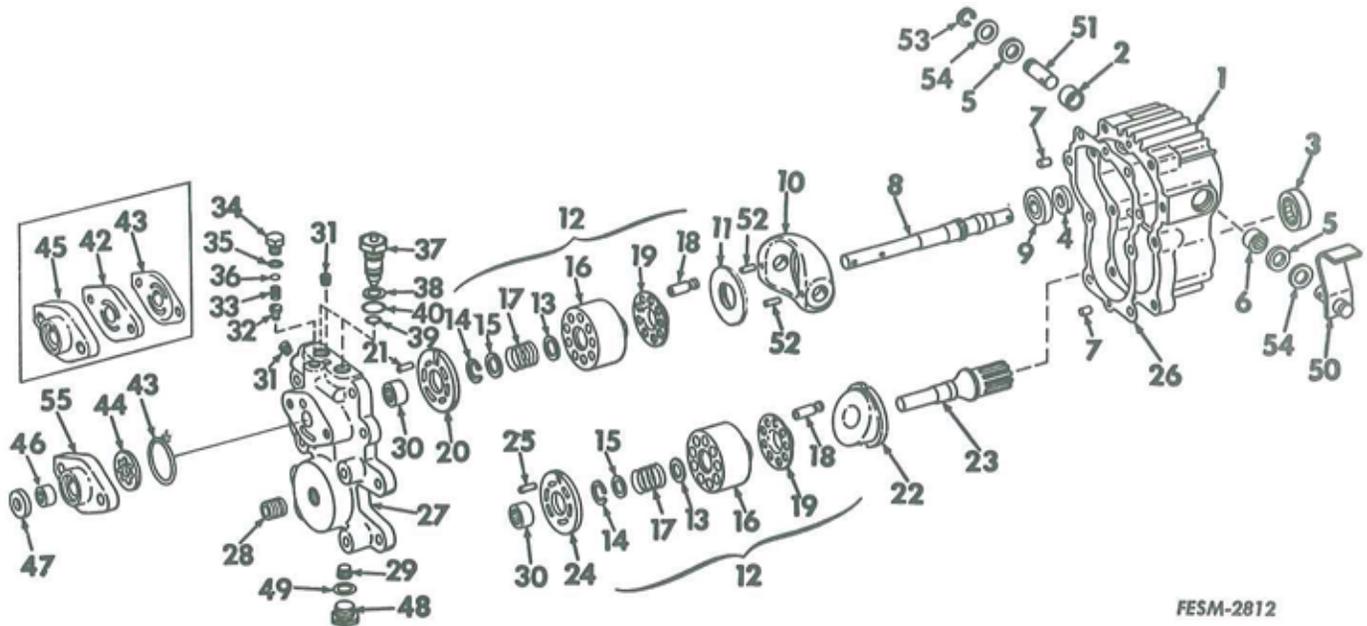
General Information

Refer to Illust. 2-38 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. 2-38. Exploded view of the hydrostatic transmission.

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

SPLITTING AND RECOUPLING THE TRACTOR

Models 107, 127 and 147

Splitting the Tractor

NOTE: Disconnect battery ground cable.

1. Disconnect the tail light wires (if so equipped).

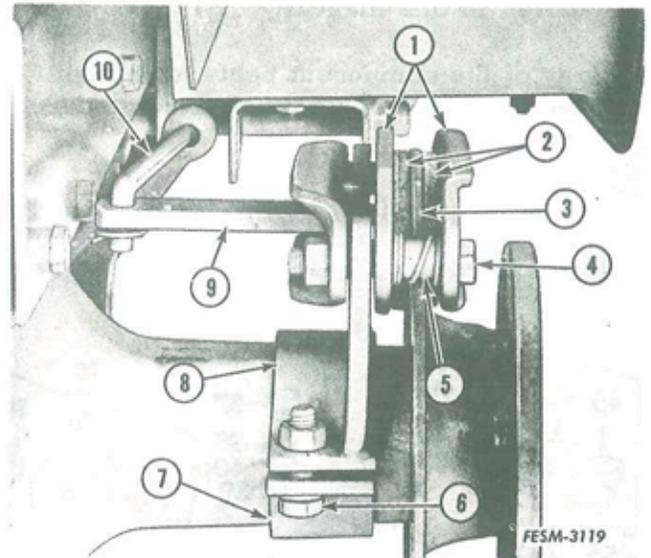
2. Remove the electric lift foot guard (if so equipped).

3. Remove the fenders and seat support assembly by removing the four capscrews in the bottom of the tool box under the seat and the six truss head machine screws, three each on the left and right foot rests.

4. Drive small wooden wedges between the front axle and frame on each side to stabilize the front of the tractor. See Illust. 2-38A.

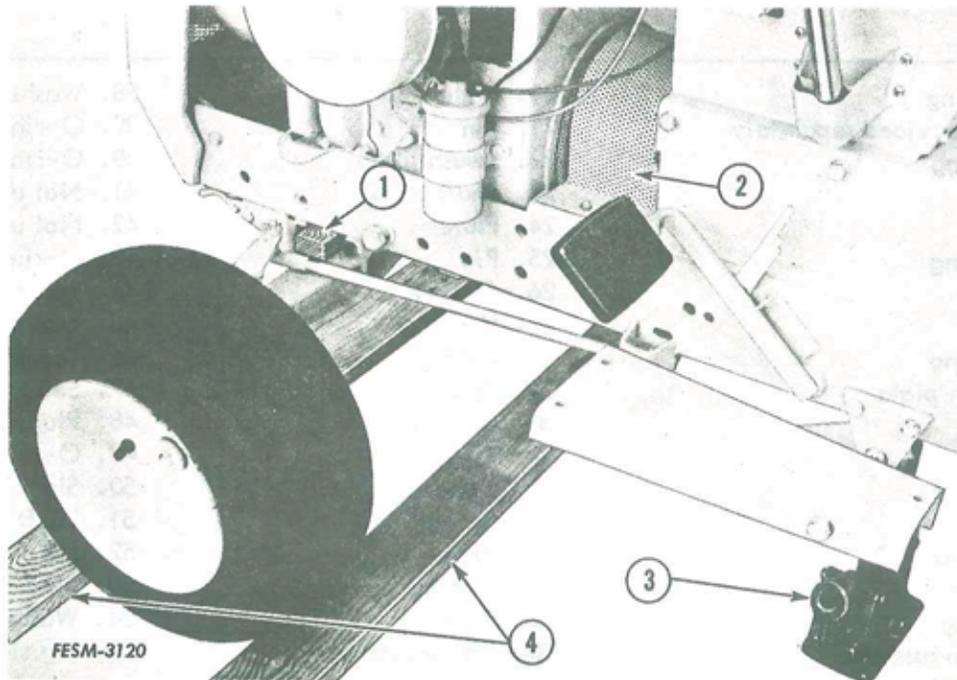
5. Block both front wheels, as shown so the tractor is secure and cannot move. See Illust. 2-38A.

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



Illust. 2-39. Brake assembly with wheel removed for ease of viewing.

7. Disconnect the brake rods (10) from the brake arms (9) adjacent to the disc brakes. See Illust. 2-39.



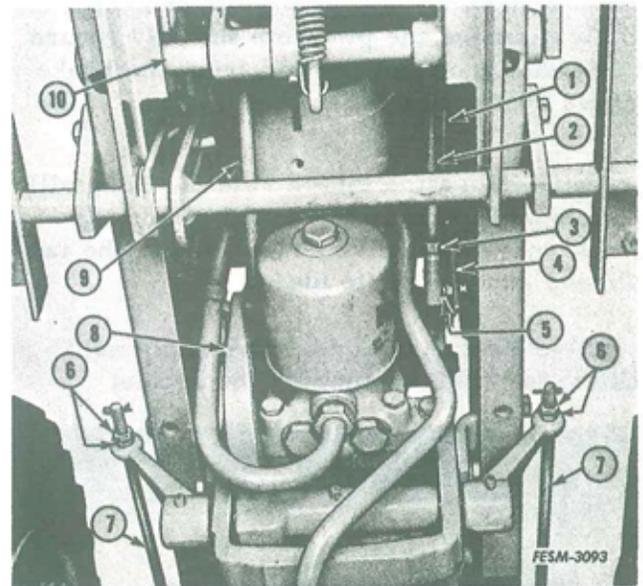
Illust. 2-38A. Front axle and wheels wedged and blocked for tractor split.

8. Depress the brake pedal and lock it in place

9. Disconnect the brake rod (9) from the brake cross shaft (10) (Illust. 2-40).

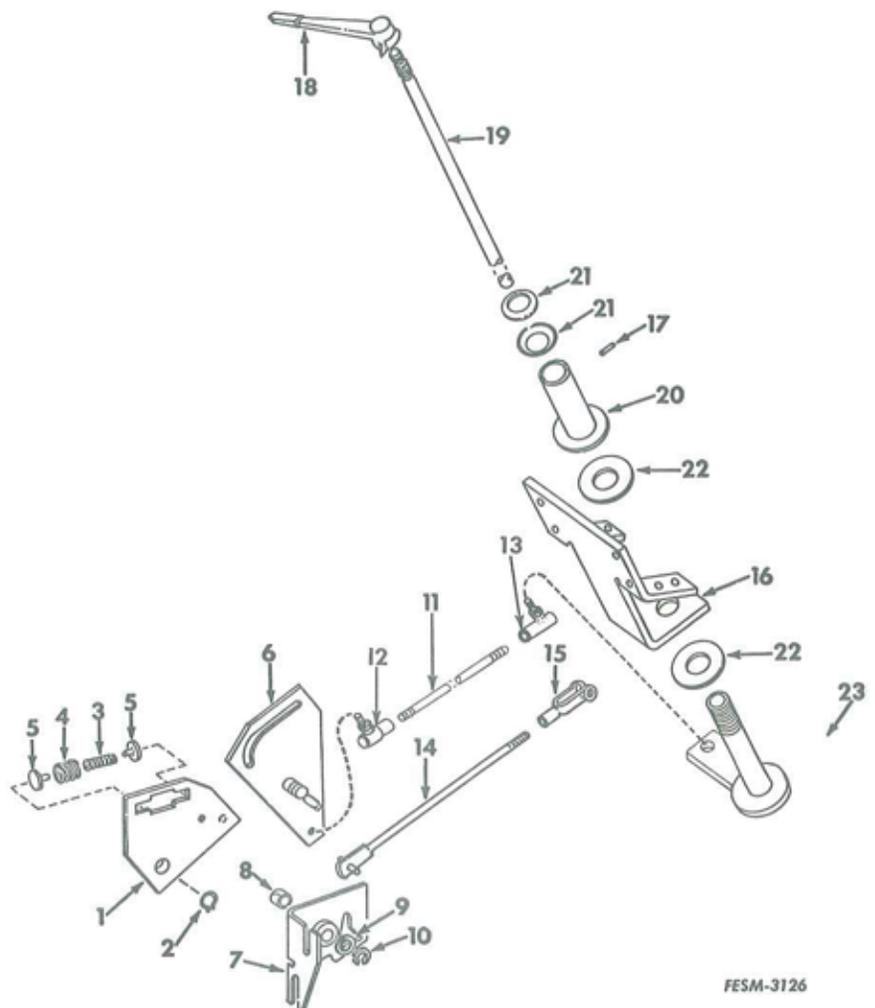
10. Disconnect the ball joint (12) from the speed control cam (6) (Illust. 2-40A).

- | | |
|----------------------|-----------------------|
| 1. "N" return rod | 6. Adjusting nuts |
| 2. Speed control rod | 7. Brake rods |
| 3. Jam nut | 8. Brake lever |
| 4. Speed control rod | 9. Brake rod |
| 5. Ball joint | 10. Brake cross shaft |



Illust. 2-40. Underside view of tractor.

- | |
|--------------------------|
| 1. Damper spring plate |
| 2. Retaining ring |
| 3. Spring |
| 4. Spring |
| 5. Guide pins |
| 6. Speed control cam |
| 7. Cam pivot bracket |
| 8. Bushing |
| 9. Washer |
| 10. Retaining ring |
| 11. Speed control rod |
| 12. Ball joint |
| 13. Ball joint |
| 14. Speed control rod |
| 15. Clevis |
| 16. Hand control support |
| 17. Pin |
| 18. Speed control handle |
| 19. Speed control rod |
| 20. Friction collar |
| 21. Bellville spring |
| 22. Friction disc |
| 23. Friction adj. shaft |

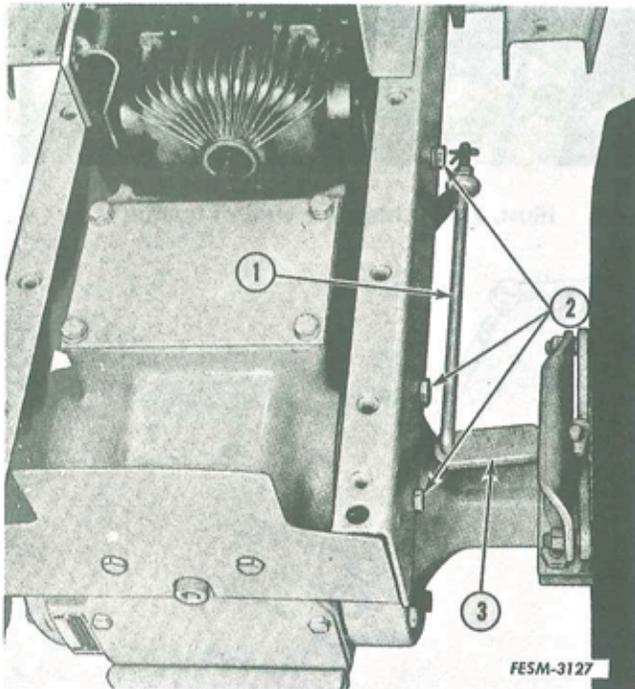


Illust. 2-40A. Exploded view of transmission controls.

11. Remove the pin from the "N" return rod and disconnect the rod from the brake cross shaft. See Illust. 2-40.

12. Remove the clutch shield. This will enable you to guide the dowel pin on the front end of the drive shaft through the fan shroud and air baffle plate.

13. Place a jack under the implement lift cross shaft to support the frame.



Illust. 2-41. Location of frame capscrews.

- | |
|--|
| <ol style="list-style-type: none">1. Brake rod2. Capscrews3. Brake arm |
|--|

14. Remove the six capscrews (2), three on each side, holding the frame to the transmission assembly (Illust. 2-41).

15. Push down on the drawbar and pull the transmission assembly rearward. Guide the assembly from under the frame.

Recoupling

NOTE: The cam pivot bracket capscrews should be loosened slightly for ease of cam bracket adjustment.

1. Lubricate the cam slot with chassis lubricant.

2. Recouple the split sections of the tractor being sure of the following:

a. The brake rod and "N" return rod go over the implement lift cross shaft and into position on the brake cross shaft.

b. Be sure to guide the drive shaft through the fan shroud and air baffle plate.

c. 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.

3. Install and tighten the three capscrews on each side of the frame. See Illust. 2-41.

4. Install the clutch shield.

5. Install the "N" return rod and pin on the brake cross shaft. See Illust. 2-40.

6. Install the ball joint on the speed control cam. See Illust. 2-40A.

7. Depress the brake pedal and lock in place. Install the brake rod on the brake cross shaft. See Illust. 2-40.

8. Release the brake pedal and install the brake rods on the brake arms adjacent to the disc brakes.

9. Check for oil leaks. Check the oil level and fill to correct level with Hy-Tran fluid.

10. If the tractor is equipped with three point hitch, install the lift bar and its attaching plate.

11. Install the fender and seat support assembly. Connect the tail light wires (if so equipped).

12. Install the electric lift foot guard (if so equipped).

13. Adjust the linkage.

Speed Control Lever Linkage and Cam Bracket Adjustment

NOTE: The brake pedal must be properly adjusted before beginning the speed control linkage adjustment. Refer to page 2-62.

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.

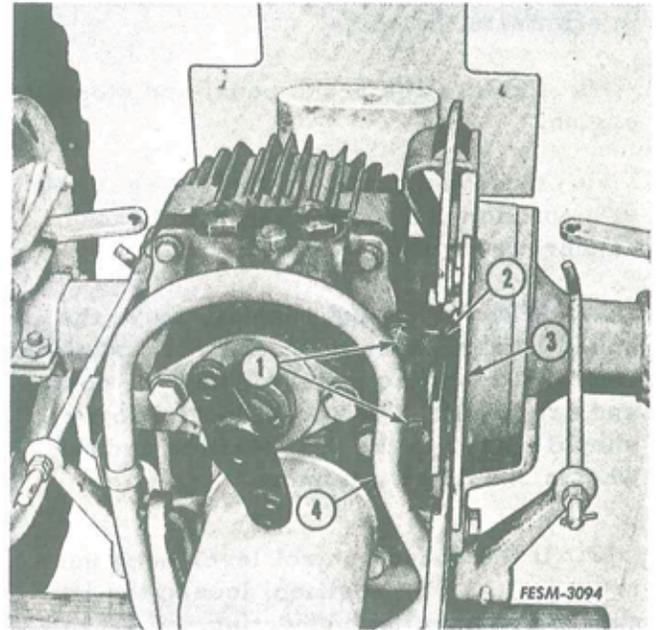
Proper friction adjustment is necessary on speed control lever for proper operation. The lever friction should be adjusted as follows:

- a. Remove the battery.
- b. Place a small wedge or key stock of proper size between the mounting bracket and the adjusting nut. Refer to foldout at back of manual.
- c. Move the lever towards the "R" or reverse position to increase the friction or toward the "F" or forward position to decrease the friction.
- 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. Remove the seat and fender assembly.

2. Block the tractor so the rear wheels are off the ground and the tractor is secured so it can not move.

3. Move the speed control lever to the "F" or forward position.



Illust. 2-42. Location of cam bracket capscrews.

- | |
|---|
| <ol style="list-style-type: none">1. Cam bracket mounting capscrews2. Cam bracket3. Speed control cam4. Suction tube |
|---|

4. Loosen the cam bracket mounting capscrews (1) if not previously left loose (Illust. 2-42).

NOTE: It may be necessary to deflect the suction tube slightly for clearance in order to loosen the cam bracket capscrews.

5. Move the cam bracket to its highest position in the slotted holes and tighten the capscrews slightly to hold it in place.

6. Start the engine and with a punch and hammer adjust the cam bracket downward until the wheels stop turning.

7. Move the speed control lever to the forward position. Depress the brake pedal and lock in place.

8. If there is excessive vibration or noise in the transmission when the brake pedal is depressed, adjust the cam bracket to eliminate the noise.

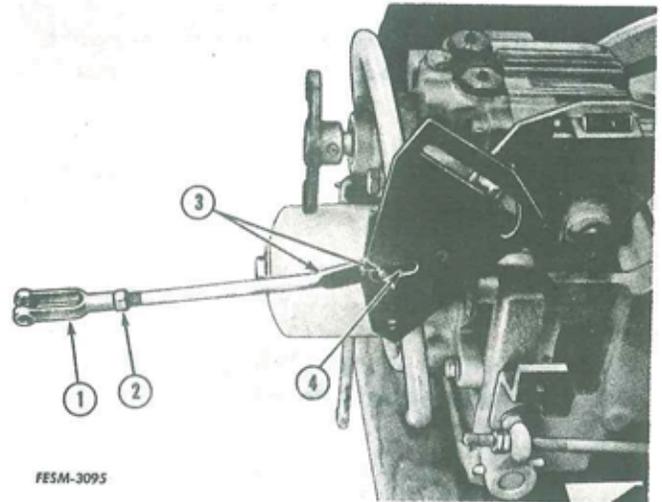
9. Release the brake pedal and stop the engine.

10. Move the speed control lever to the "F" position and tighten the cam bracket capscrews.

11. With the engine running, move the speed control lever to the forward position. Depress the brake pedal all the way down and release it. The speed control lever should return to the "N" position and the wheels should stop turning.

12. If the speed control lever does not return to the "N" position, loosen the jam nut (3) and turn the connecting rod (2) to lengthen or shorten it until the speed control lever is in the "N" position when the brake pedal is depressed. Tighten the jam nut. Refer to Illust. 2-40.

13. Check the rod in the speed control cam slot. The rod should not be touching the end of the slot when the brake pedal is fully depressed (Illust. 2-43).



Illust. 2-43. Cam slot clearance.

1. Clevis
2. Jam nut
3. "N" return rod
4. Speed control cam slot

14. If the rod touches the end of the slot adjust as follows:

Remove the clevis end (1) of the rod from the brake cross shaft. Loosen the jam nut (2) and turn the clevis to lengthen the rod to prevent it from hitting the end of the slot. See Illust. 2-43.

15. Tighten the jam nut and install the clevis on the brake cross shaft.

16. Install the seat and fender assembly.

Charge Pump Service

Removal and Disassembly

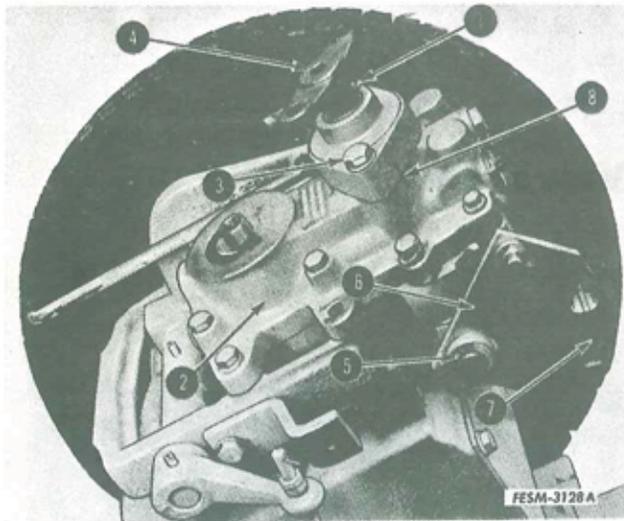
NOTE: The charge pump can be serviced without removing the transmission from the tractor. However, the tractor must be split. Refer to Splitting and Recoupling the Tractor, page 2-40.

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

2. Remove the drive shaft and flexible drive coupling.

3. Block the rear wheels and support the coupling as shown in Illust. 2-49.

4. Remove the pin securing the coupling to the hydrostatic unit shaft.



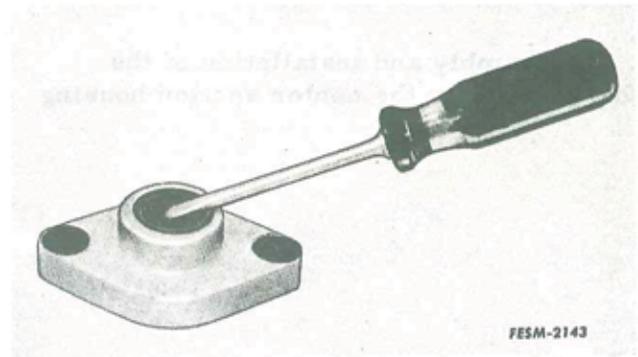
Illust. 2-44. Hydrostatic transmission.

- | | |
|------------------------|--|
| 1. Pin | 6. Dampener spring plate |
| 2. Center section | 7. Trunnion arm |
| 3. Charge pump housing | 8. Charge pump marked for correct reassembly |
| 4. Coupling | |
| 5. Retaining ring | |

IMPORTANT: Mark the charge pump housing before disassembly, as it is possible to install the pump incorrectly resulting in low charge pressure (Illust. 2-44).

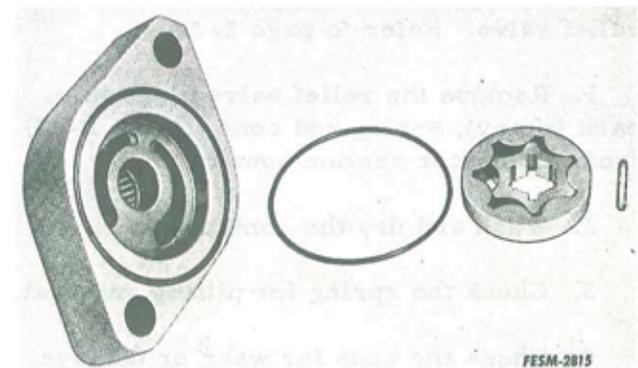
5. Remove the capscrews securing the charge pump housing to the center section housing (Illust. 2-44). Carefully remove the pump housing. The rotor assembly may stick to the housing. Do not drop the assembly.

6. Remove the rotor and pin assembly (if it was not removed in step 5). Because of the polished surface, be sure to protect the assembly against nicks, scratches and rust.



Illust. 2-45. Removing the lip seal.

7. Using a screwdriver, pry the lip seal out of the pump housing (Illust. 2-45).



Illust. 2-46. Exploded view of charge pump.

8. Check needle bearing and replace if necessary (Illust. 2-46).

Inspection and Repair

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

Inspect all parts for excessive wear or damage, and replace if necessary.

Use a new lip seal and O-ring.

Reassembly and Installation

Reassembly and installation of the charge pump to the center section housing

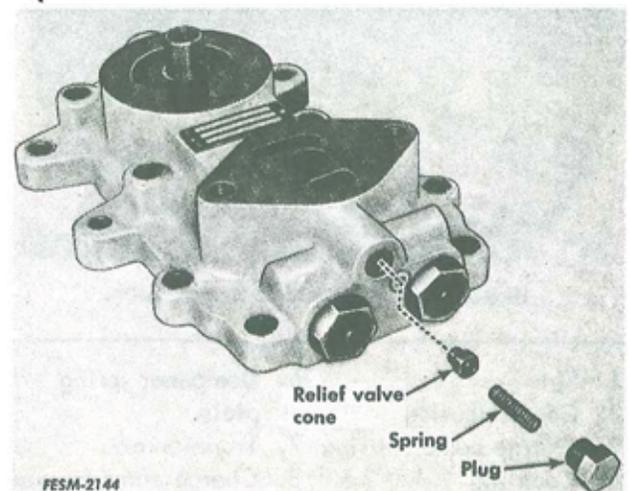
is the exact reverse of removal and disassembly with particular attention paid to the following:

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. Torque the pump housing capscrews evenly to 52 ft. lbs. Rotate the pump shaft while tightening the capscrews. Loosen and retighten the capscrews 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 2-40.

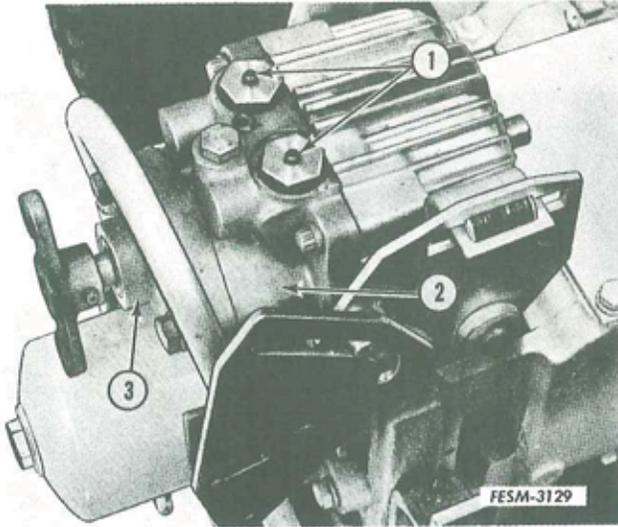
1. Remove the relief valve plug, shim pack (if any), spring and cone (Illust. 2-47) from the center section housing.
2. Wash and dry the components.
3. Check the spring for pitting and rust.
4. Check the cone for wear or damage. Check the valve seat in the center section housing for dirt, nicks and scratches.
5. Install the relief valve in the reverse order of removal. Be sure to use a new O-ring on the plug.



Illust. 2-47. Relief valve removed.

6. Recouple the tractor and check the operation of the relief valve. Refer to "Trouble Shooting" on page 2-65.

Check Valve Service



Illust. 2-48. 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.

1. Check valves
2. Center section
3. Charge pump housing

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

Models 107, 127 and 147

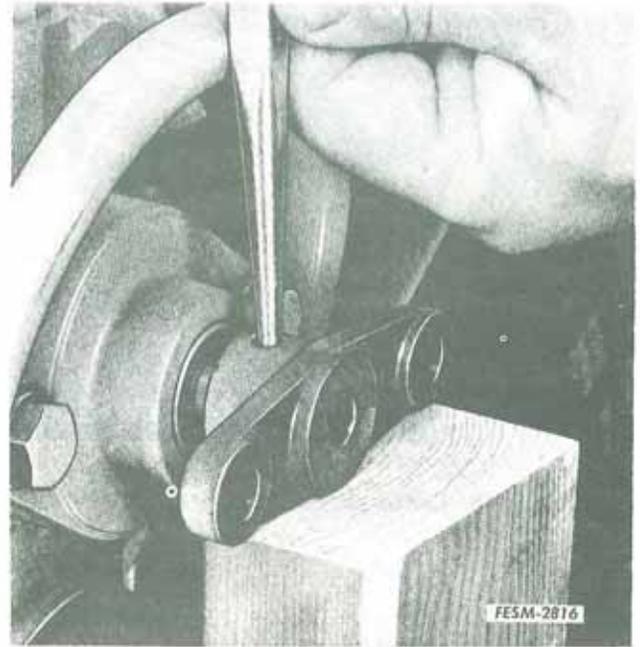
The following service information covers removal and replacement of the Hydrostatic unit.

Oil filter must be changed in the following intervals:

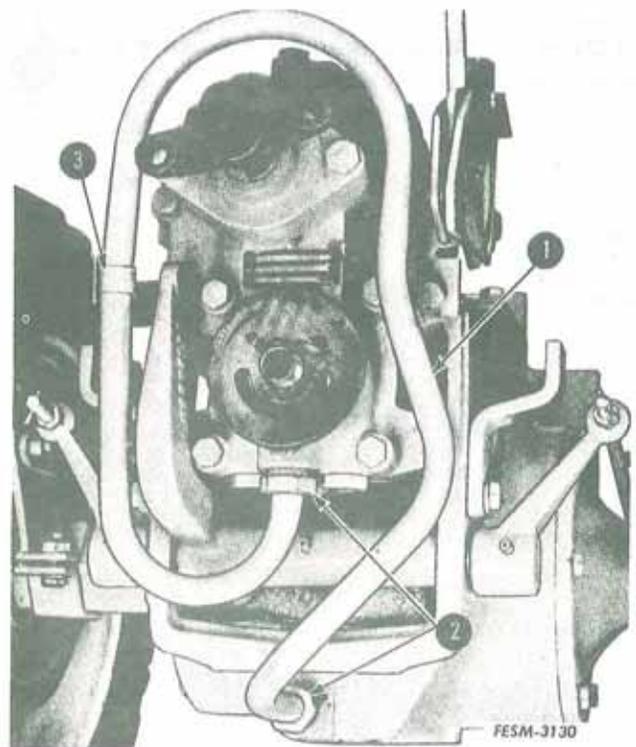
- At 10 hours of operation
- At 50 hours of operation
- Every 150 hours - not to exceed one year.

Removal

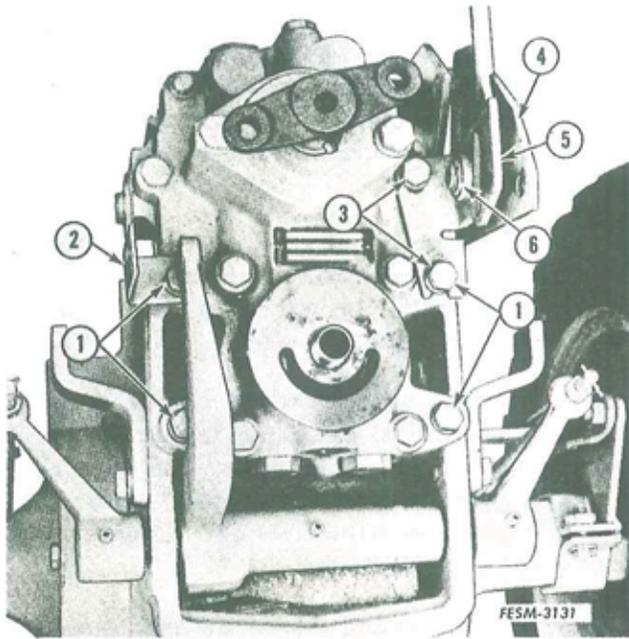
1. Split the tractor. (Refer to page 2-40.)
2. Loosen the transmission rear cover plate and drain the lubricant from the transmission-differential case.
3. Remove the oil filter. Plug the opening. Tape all openings.
4. Remove the flexible drive coupling and drive shaft.
5. Block the rear wheels and support the coupling as shown in Illust. 2-49.
6. Remove the pin securing the coupling to the hydrostatic unit shaft (Illust. 2-49).
7. To remove the suction tube (1) it will be necessary to remove the support clamp (3) and loosen both connections (2). 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. 2-50). Completely remove the tube. Plug or tape the openings.



Illust. 2-49. Removing coupling.



Illust. 2-50. Suction tube and support clamp.



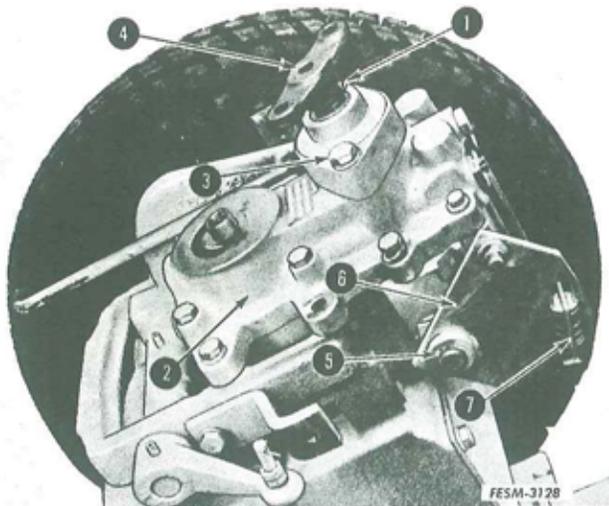
Illust. 2-51. Location of speed control cam bracket.

8. Remove the cam bracket capscrews (Illust. 2-51) 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.

1. Mounting capscrews
2. Stabilizer bracket
3. Cam bracket capscrews
4. Speed control cam
5. Cam bracket
6. Retaining ring

10. Remove the springs and the guide pins from the trunnion arm (7) (Illust. 2-52).

11. Remove the three remaining mounting capscrews (Refer to Illust. 2-51) and remove the unit.



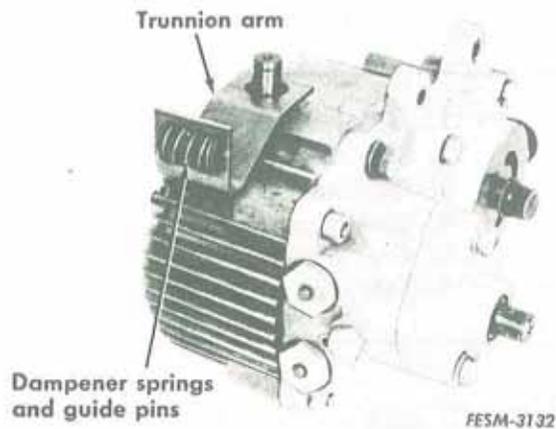
Illust. 2-52. Location of dampener spring plate retaining ring.

9. Remove the retaining ring (5) that secures the dampener spring plate (6) to the unit (Illust. 2-52). Remove the plate.

1. Pin
2. Center section
3. Charge pump housing
4. Coupling
5. Retaining ring
6. Dampener spring plate
7. Trunnion arm

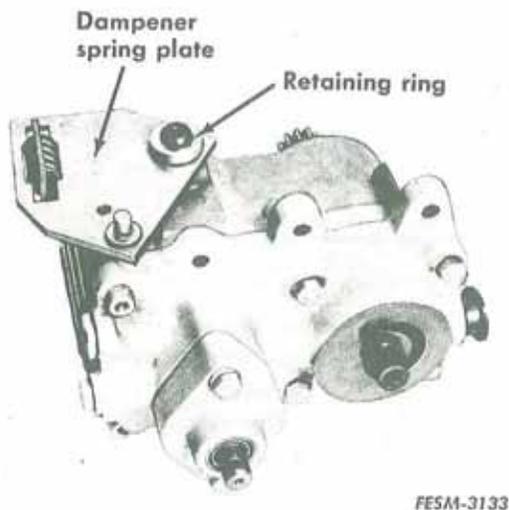
Installation

1. **IMPORTANT:** Prior to attaching the hydrostatic drive 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. 2-53. Dampener springs and guide pins installed.

2. Install the light and heavy dampener springs with guide pins into the trunnion arm (Illust. 2-53).



Illust. 2-54. Dampener spring plate installed.

3. Install the dampener spring plate and secure it to the shaft with the retaining ring (Illust. 2-54).

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

5. Install the cam and bracket assem-

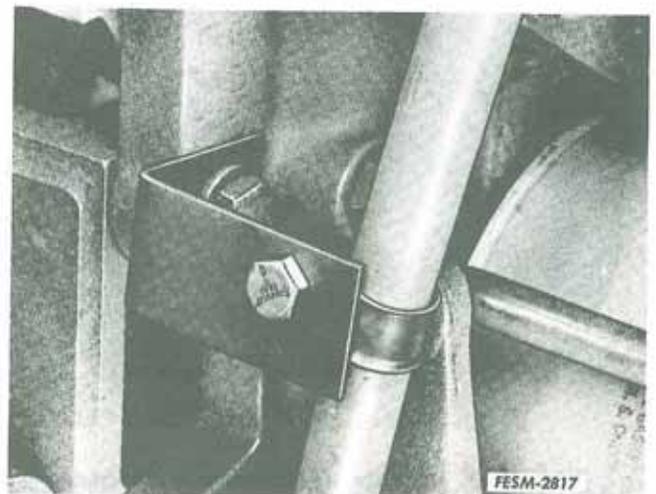
bly on the unit so it is at the upper end of its travel in the slots. Fasten the assembly in place with the upper capscrew only just tight enough to hold it in place. Be sure there is a washer between the capscrew and the bracket.

NOTE: The lower slot in the bracket is also used as a mounting bolt hole for the hydrostatic unit. Do not install this capscrew at this time.

6. Using a new gasket, install the unit on the differential case and fasten it securely with three capscrews. Be sure to install the stabilizer bracket (2) under the upper capscrew (Illust. 2-51). Tighten the capscrews to 30 ft. lbs.

7. The mounting capscrew that goes through the lower cam bracket slot should be installed and tightened just snug as further adjustment is necessary after re-coupling of the tractor.

8. 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. 2-55. Suction line bracket and clip installation.

9. Install the stabilizer clip on the suction line and bracket (Illust. 2-55).

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 $\frac{3}{8}$ of an inch from the front edge of the coupling arms.

11. Install the drive shaft and coupling to the drive unit input shaft. **FIRMLY SUPPORT THE INPUT SHAFT** and install the pin. Refer to Illust. 2-49.

12. Install a new oil filter as follows:

a. Apply oil to the gasket.

b. Thread the filter on by hand until tight to seat the gasket.

c. Loosen the filter.

d. Turn again until the gasket contacts the base.

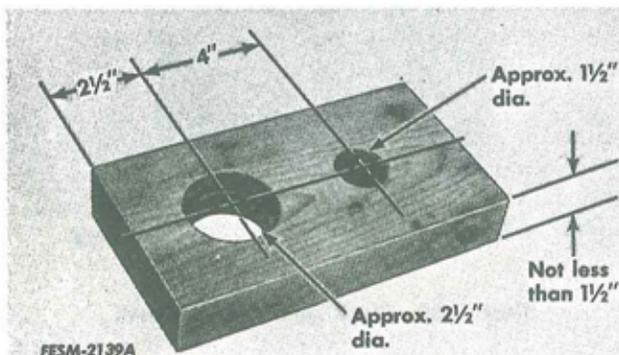
e. Tighten the filter an additional three quarter turn.

f. Check for leaks.

13. Recouple the tractor and adjust the linkage. Refer to page 2-42.

Hydrostatic Transmission Service

Refer to Illust. 2-38 for additional information on parts being described.



Illust. 2-56. Holding fixture.

A holding fixture, made of wood, is necessary to conveniently service this unit. Refer to Illust. 2-56 for dimensions.

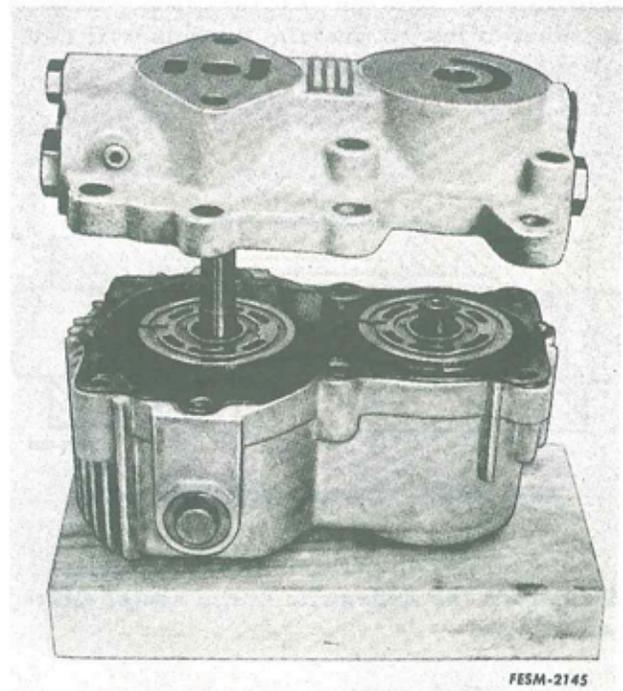
Disassembly

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

IMPORTANT: Mark the charge pump housing before disassembly, as it is possible to install the pump incorrectly resulting in low charge pump pressure (Illust. 2-44).

2. Remove the charge pump. Remove GSS-1404 Rev. 1 12-70

the capscrews securing the center section housing to the transmission housing.

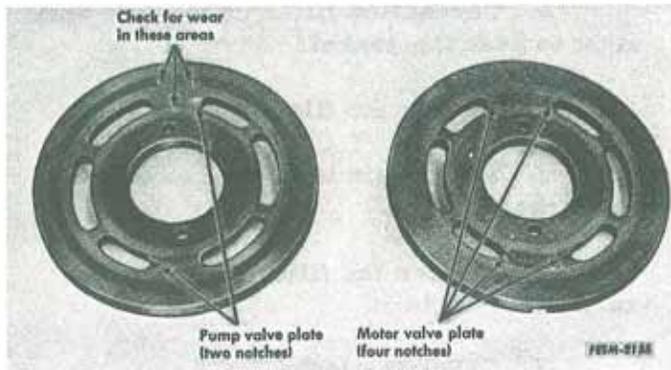


Illust. 2-57. Removing the center section.

3. Lift the center section housing from the transmission housing (Illust. 2-57).

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

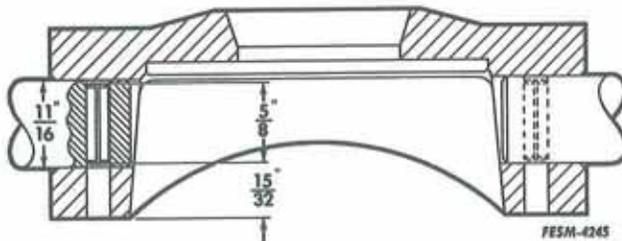
Printed in United States of America



Illust. 2-58. Pump and motor valve plates.

4. Remove the pump and motor valve plates (Illust. 2-58), (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.

5. Tip the transmission housing so that the pump and motor cylinder block assemblies can be removed (Illust. 2-60). Grasp the assemblies so that the pistons will not fall out and be damaged.

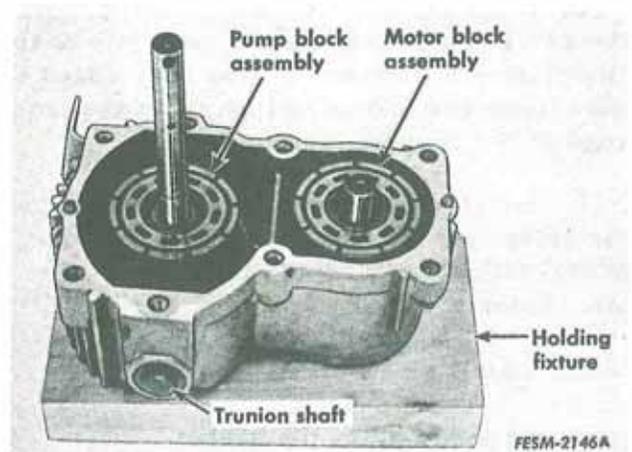


Illust. 2-58A. Hydraulic pump swash plate.

6. Remove the trunnion shaft assemblies from the hydraulic pump swash plate as follows:

- a. Mark or tape a punch exactly 15/32 inch from the end.
- b. Drive on the spring pins very carefully until the mark on the punch is even with the top surface of the swash plate, a distance of 15/32 inch (Illust. 2-58A). At this point the spring pins should be

GSS-1404 Rev. 1 12-70



Illust. 2-59. Transmission case assembly.



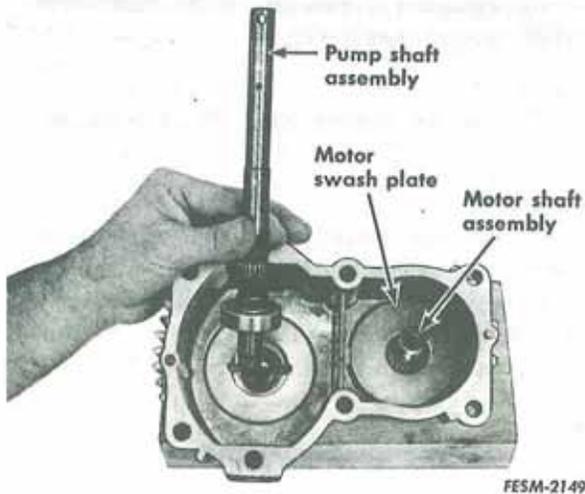
Illust. 2-60. Block assembly removed.

centered in the trunnion shafts, and the shafts are free of the swash plate. See Illust. 2-58A.

c. Remove the trunnion shafts and swash plate from the transmission case.

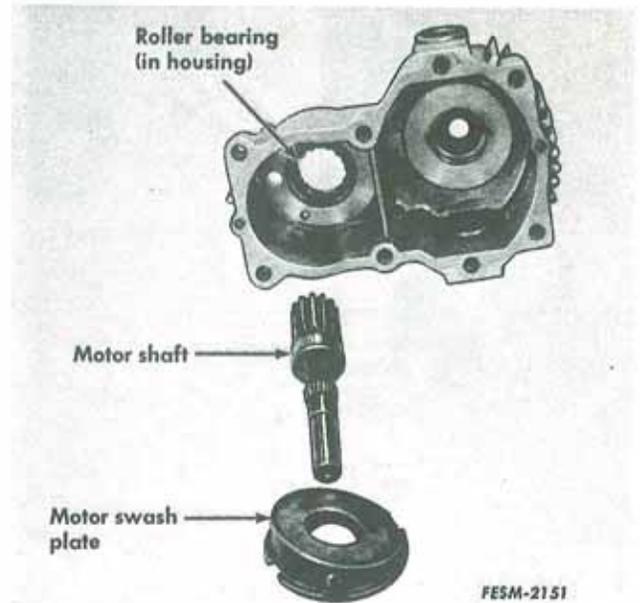
IMPORTANT: Some swash plates have the spring pin holes drilled through both walls. **DO NOT** drive the spring pins through the shaft and into the holes in the bottom of the swash plate as removal is then very difficult.

Printed in United States of America



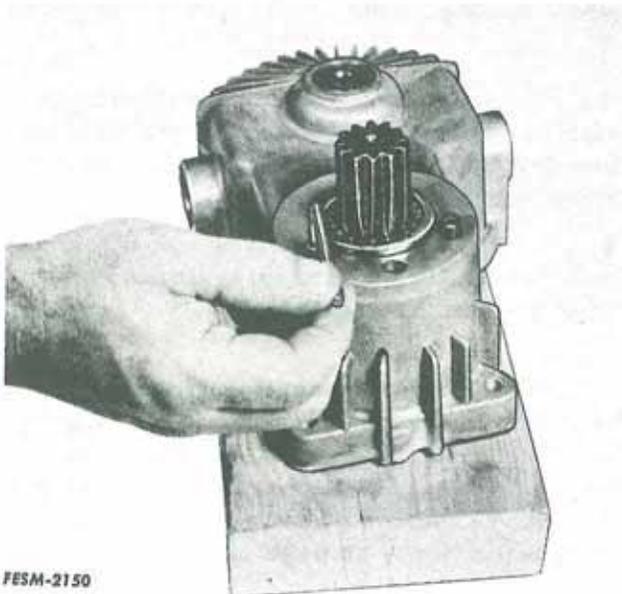
Illust. 2-61. Removing the pump shaft assembly.

7. Remove the pump shaft assembly (Illust. 2-61).



Illust. 2-63. Transmission motor shaft and swash plate removed.

9. Remove the transmission motor shaft and swash plate from the housing (Illust. 2-63).



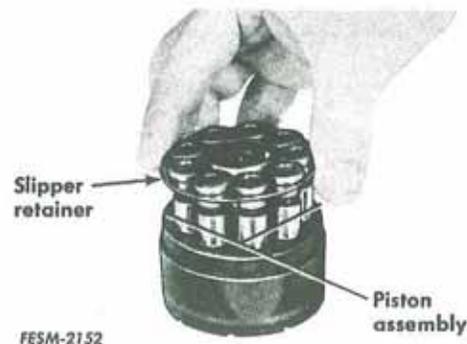
Illust. 2-62. Removing the hydraulic motor swash plate cap screws.

8. Remove the socket head cap screws securing the hydraulic motor swash plate (Illust. 2-62).

NOTE: Some models have Allen head screws and others have 12 point socket head screws.

GSS-1404 Rev. 1 12-70

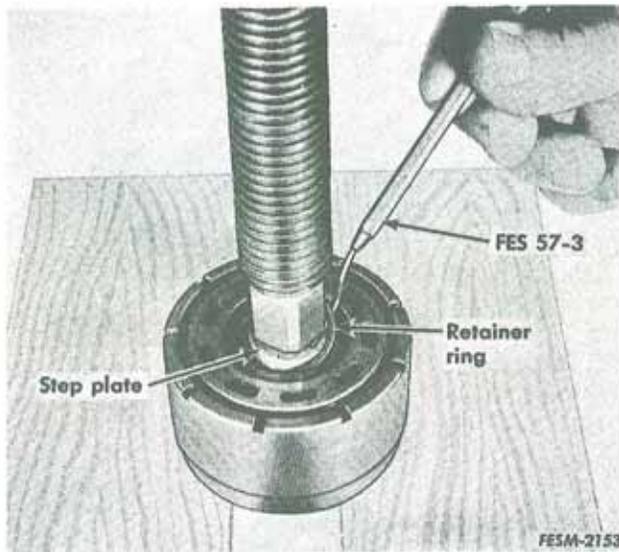
Inspection and Repair



Illust. 2-64. Removing pistons and slipper retainer.

1. Remove piston and slipper assembly (Illust. 2-64).

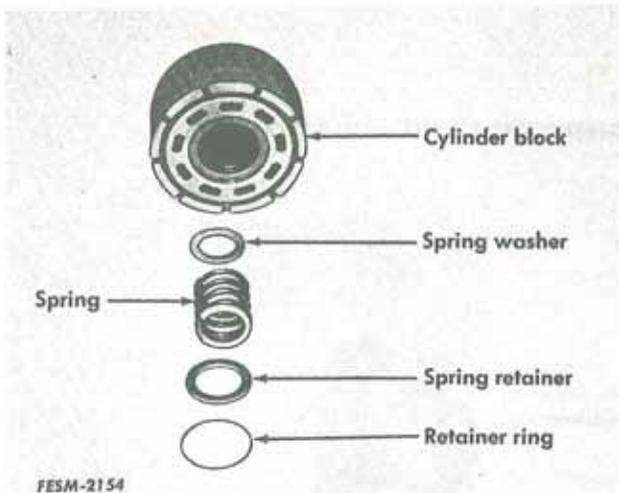
Printed in United States of America



Illust. 2-65. Removing retaining ring.

2. Place the cylinder block assembly in a press on wood blocks (Illust. 2-65).

3. Press on the spring retainer, using a step plate to compress the cylinder block spring (Illust. 2-65). Remove the retaining ring.



Illust. 2-66. Cylinder block disassembled.

4. Carefully release the press. Remove the spring retainer, spring and spring washer (Illust. 2-66). 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.

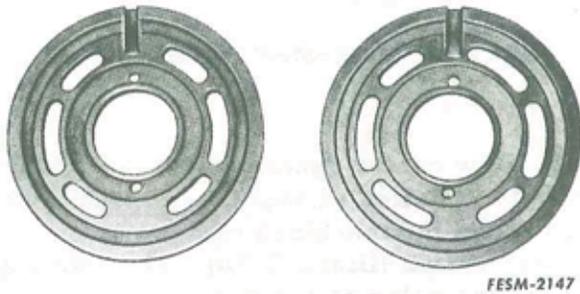
14. If cylinder bores or pistons are badly worn or scored a block assembly with pistons is available for replacement. Pistons or block are not serviced as individual parts.

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. 2-58). A worn or scored valve plate reduces pump efficiency.

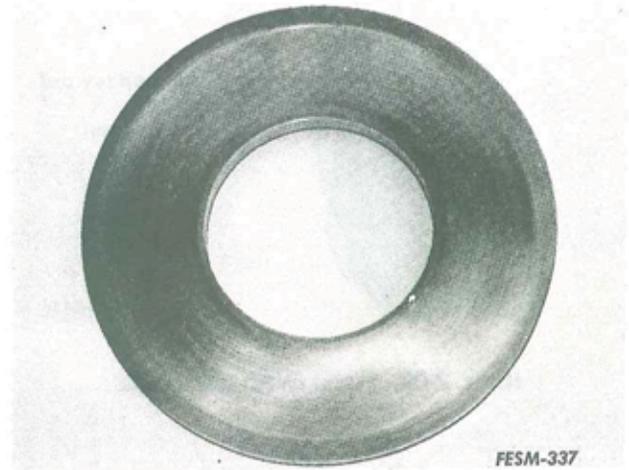
NOTE: To check the plate for wear, run your finger nail or a sharp pencil across the face of the plate. If wear is felt, replace the plate.



Illust. 2-67. Valve plate grooves.

18. Inspect the pin slot and grooves of the valve plate (Illust. 2-67). Clean out any foreign matter and deburr the surface as necessary.

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



Illust. 2-68. Thrust plate inspection.

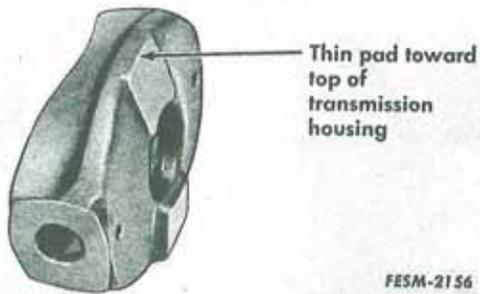
20. Inspect the thrust plate (for the hydraulic pump swash plate) for wear, embedded material, or scoring (Illust. 2-68).

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.



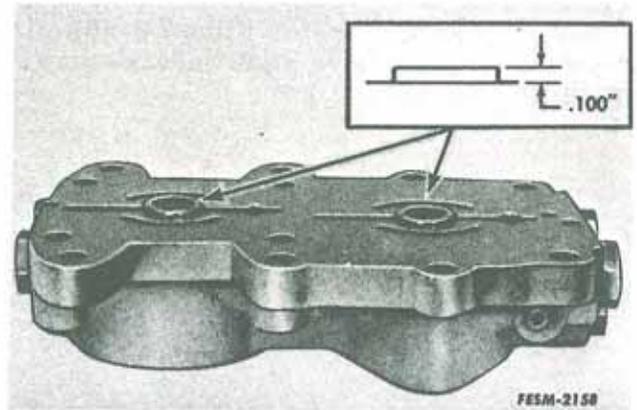
Illust. 2-69. Pump swash plate pads.

2. Be sure to install the pump swash plate with the thin pad (Illust. 2-69) 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. 2-58).

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



Illust. 2-70. Center section needle bearings.

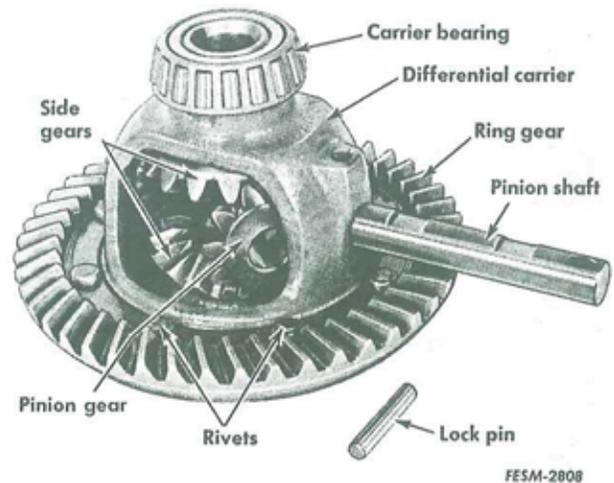
5. New center section needle bearings must be installed so that they extend .100 inch above the machined surface of the center section (Illust. 2-70). The bearings "pilot" the valve plates when the unit is reassembled.

DIFFERENTIAL

Models 107, 127 and 147

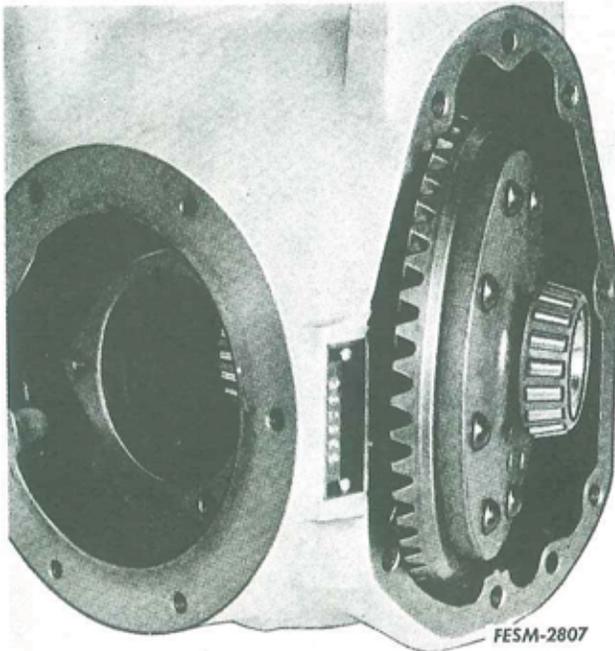
Removal and Disassembly

1. Drain the lubricant.
2. Split the tractor. (Refer to page 2-40.)
3. Remove the rear axles and their carriers. (Refer to page 2-34.)
4. Remove the differential carrier bearing cage and shims from each side. Keep the shims with each cage and identified for each side.



FESM-2808

Illust. 2-72. Differential partially disassembled.

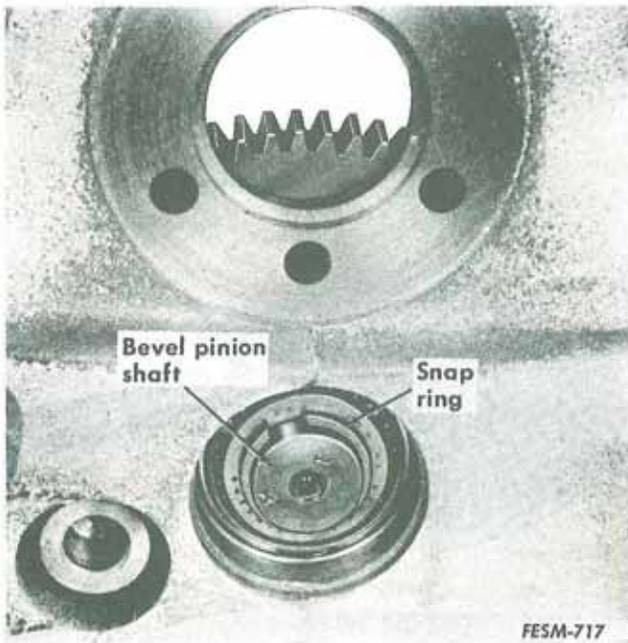


FESM-2807

Illust. 2-71. Removing differential from the case.

5. Turn the differential into the position shown in Illust. 2-71 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.

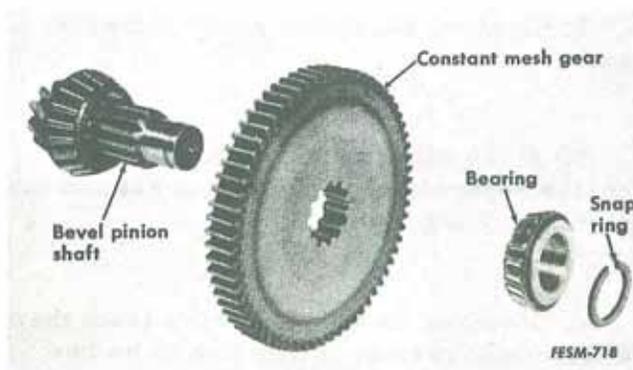
6. Drive out the pinion shaft lock pin.
7. Remove the pinion shaft.
8. Remove the pinion gears and side gears.
9. If the differential drive gear requires separate replacement, press out the eight retaining rivets.
10. Remove the bearing cones from the differential carrier if they are to be replaced.
11. Remove the bearing cups from each cage if replacement is necessary.
12. Remove the hydrostatic drive. (Refer to page 2-48.)



Illust. 2-73. Location of bevel pinion shaft snap ring.

13. Remove the bevel pinion shaft expansion plug (Illust. 2-73).

14. Remove the snap ring securing the bevel pinion shaft in the transmission case (Illust. 2-73).



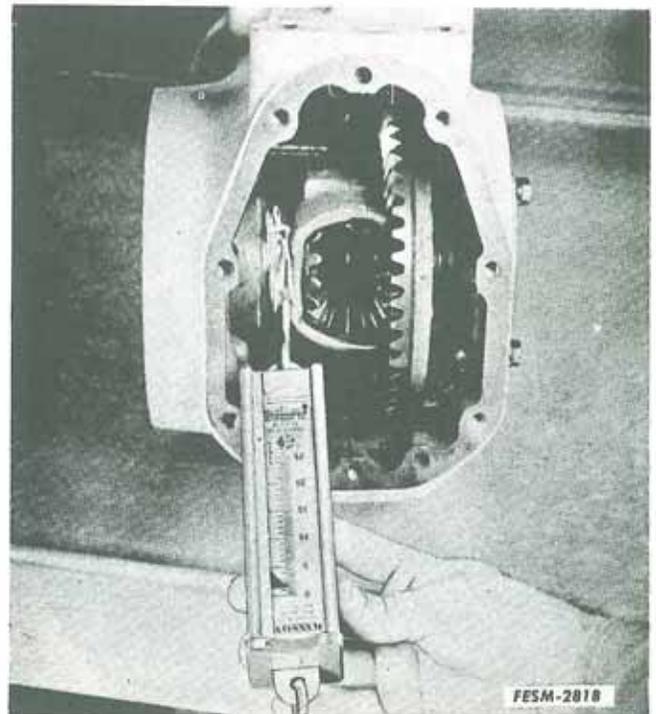
Illust. 2-74. Components parts of bevel pinion shaft assembly.

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. 2-74 shows the component parts of the bevel pinion shaft assembly.

Inspection and Repair

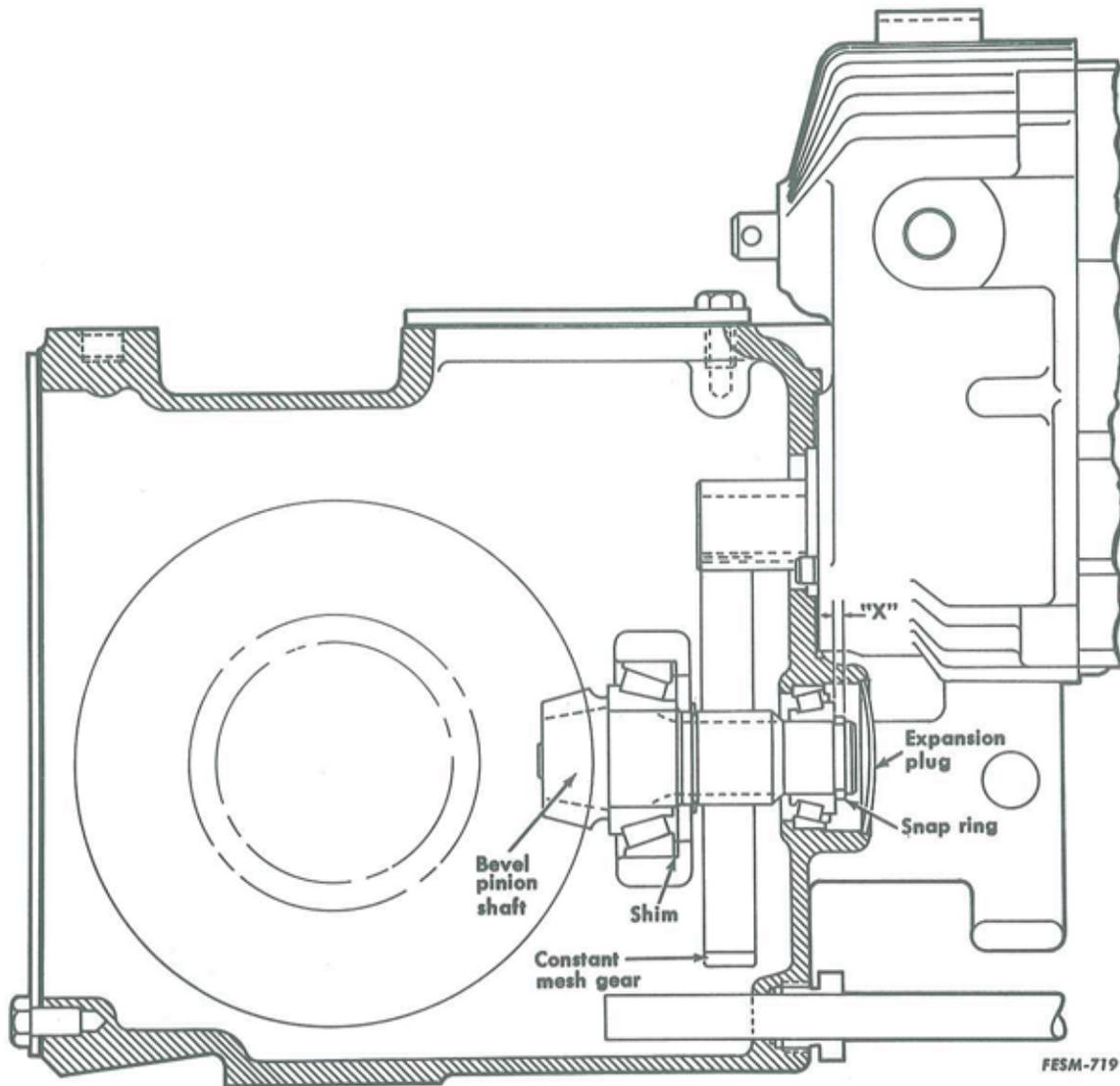
1. Wash all parts in cleaning solvent and dry with compressed air. Do not spin bearings.
2. Check all bearings for looseness, wear, roughness, pitting and scoring.
3. Check gears and shafts for wear and burrs. Remove any burrs with a fine stone.
4. Inspect the housing for cracks, restricted oil passages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

Reassembly



Illust. 2-75. 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 eight pounds is necessary to rotate the differential assembly as shown in Illust. 2-75.



FESM-719

Illust. 2-76. 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. 2-77) 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

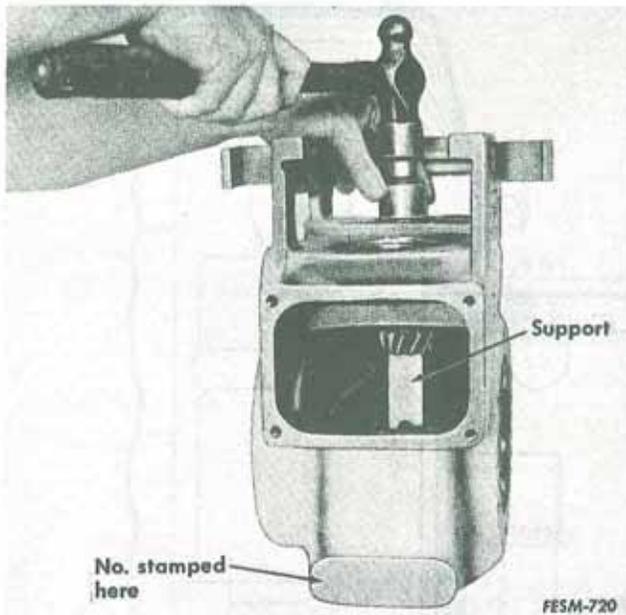
the figure obtained previously, in the bore for the rear bearing cup.

d. Press the cup in its bore till it bottoms against the shims (Illust. 2-76).

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. 2-76). Be sure the brake lining disc is installed and in position in transmission case. Hold with grease.



Illust. 2-77. Installing front bearing cone.

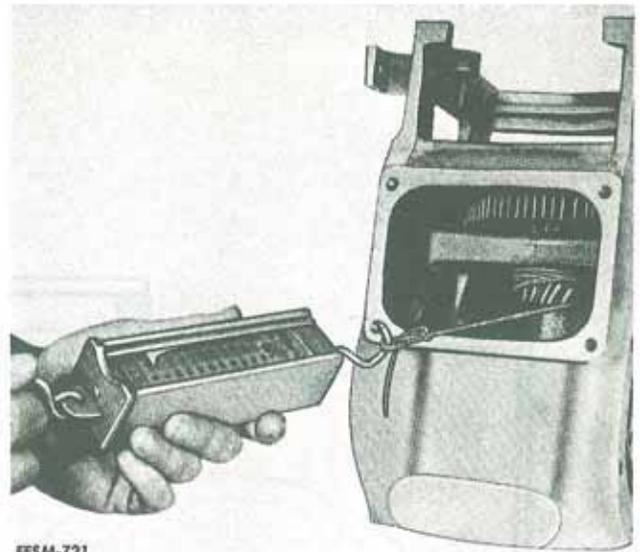
7. Start the bevel pinion shaft assembly in its bore in the rear of the transmission case. Install the constant mesh gear and complete the installation of the bevel pinion shaft assembly.

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 (Illust. 2-78).

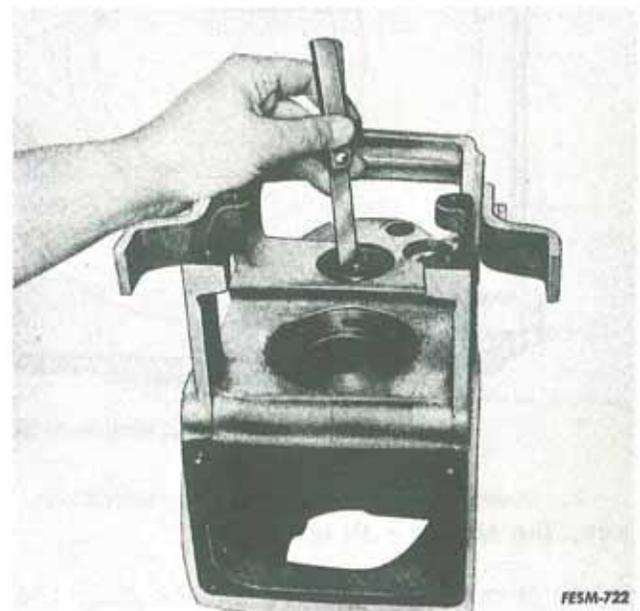
9. With the rolling torque figure obtained in step 8, refer to the table below to determine the amount of axial pre-load in the assembly at this time.

<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.



Illust. 2-78. Checking rolling torque of pre-loaded bearings.



Illust. 2-79. 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 (Illust. 2-79). The measurement obtained is to be considered "X" (Illust. 2-76).

Class	Snap Ring Thickness Chart (inch)
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.

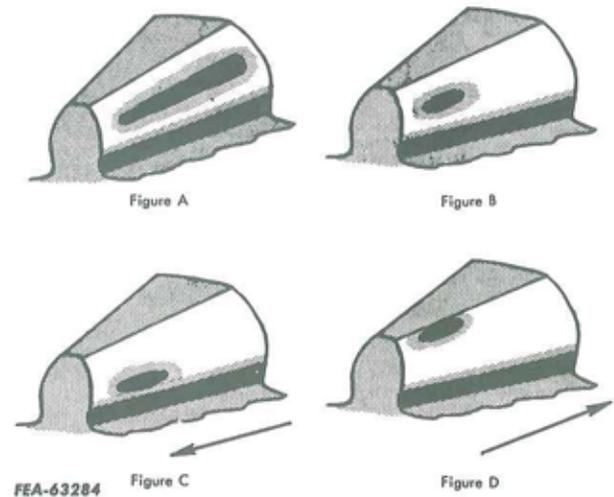
13. Install a new expansion plug.

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 bevel pinion and the gear teeth bearing pattern as follows. Refer to Illust. 2-80.

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



FEA-63284 Illust. 2-80. 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. 2-80). 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 drive 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 bevel pinion. If low tooth bearing on bevel pinion is indicated (as shown in Figure "C") the bevel pinion must be adjusted toward the drive gear. If high tooth bearing on the bevel pinion is indicated (as shown in Figure "D") the bevel pinion must be adjusted away from the drive gear.

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

20. Install the rear axles and wheels. (Refer to page 2-34.)

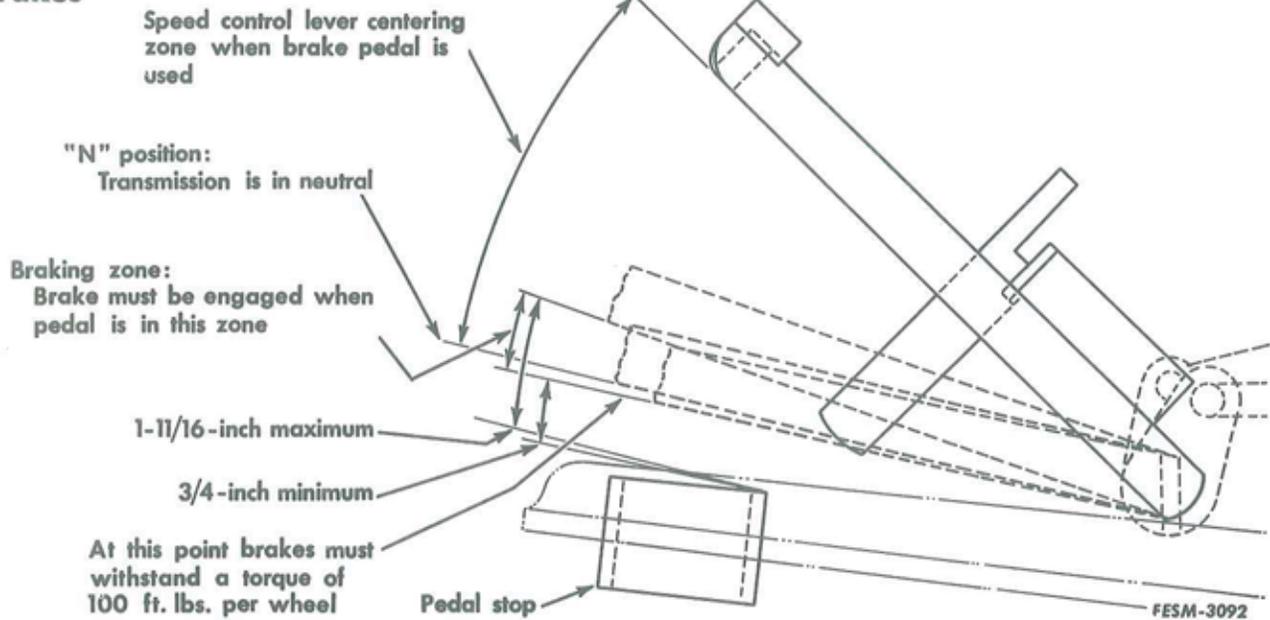
21. Install the hydrostatic drive. (Refer to page 2-48.)

22. Recouple the tractor. (Refer to page 2-42.)

ADJUSTMENTS

Models 107, 127 and 147

Brakes



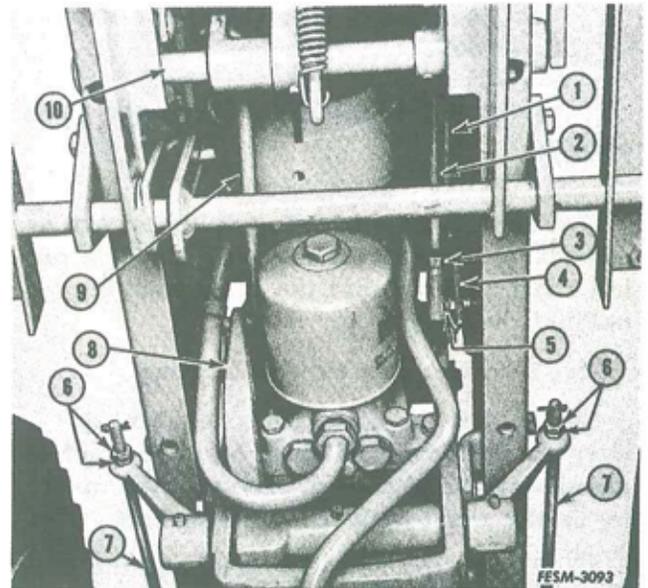
Illust. 2-81. Brake adjustments.

As the brake is applied the speed control lever will move to the center or "N" position. The mechanical disc brakes should engage when the pedal is pressed down to within a maximum of 1-11/16 inches and a minimum of 3/4 inch above the pedal stop (Illust. 2-81).

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 brakes are engaged when the pedal arm is at least 3/4 inch above the pedal stop.

NOTE: At the 3/4 inch minimum distance, the brakes must withstand a torque of 100 ft. lbs. per wheel.

To adjust the brakes, block the front wheels securely and raise the tractor so the rear wheels are off the ground and turn freely. Then adjust the jam nuts on the ends of the brake rods (Illust. 2-82). The brakes must not engage before the pedal is within the maximum distance of 1-11/16 inches.



Illust. 2-82. Brake pedal linkage adjustment.

- | | |
|----------------------|-----------------------|
| 1. "N" return rod | 6. Adjusting nuts |
| 2. Speed control rod | 7. Brake rods |
| 3. Jam nut | 8. Brake lever |
| 4. Speed control rod | 9. Brake rod |
| 5. Ball joint | 10. Brake cross shaft |

NOTE: It is very important to have the brakes equalized. To check the equalization of the brakes, start the engine and move the speed control lever to the forward position. Apply the brakes and both wheels should stop at the same time. If one wheel stops and the other wheel continues to revolve when the brakes are applied, adjust the jam nuts on the brake rod on the wheel that stops so both wheels stop simultaneously.

Speed Control Lever Linkage and Cam Bracket Adjustment

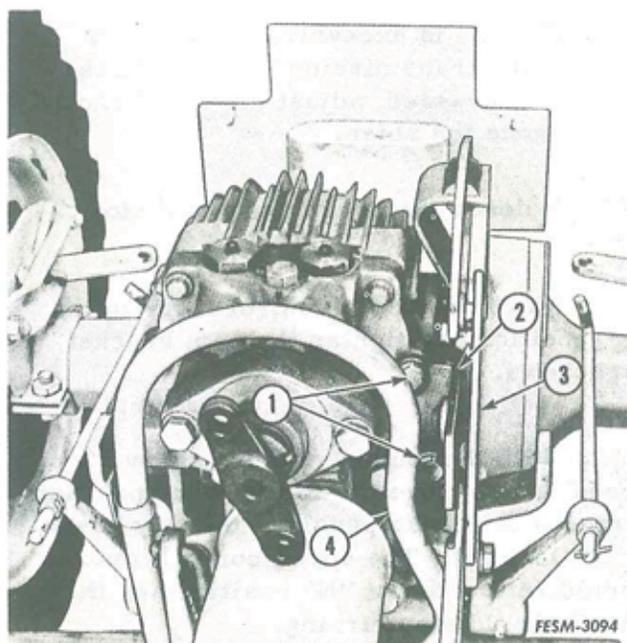
NOTE: The brake pedal must be properly adjusted before beginning the speed control linkage adjustment. Refer to page 2-62.

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 or key stock of proper size between the mounting bracket and the adjusting nut. Refer to foldout at back of manual.
- c. Move the lever towards the "R" or reverse position to increase the friction or toward the "F" or forward position to decrease the friction.
- 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. Remove the seat and fender assembly.
2. Block the tractor so the rear wheels are off the ground and the tractor is secured so it can not move.
3. Move the speed control lever to the "F" or forward position.



Illust. 2-83. Location of cam bracket capscrews.

- | |
|--|
| <ol style="list-style-type: none"> 1. Cam bracket mounting capscrews 2. Cam bracket 3. Speed control cam 4. Suction tube |
|--|

4. Loosen the cam bracket mounting capscrews (1) if not previously left loose (Illust. 2-83).

NOTE: It may be necessary to deflect the suction tube slightly for clearance in order to loosen the cam bracket capscrews.

5. Move the cam bracket to its highest position in the slotted holes and tighten the capscrews slightly to hold it in place.

6. Start the engine and with a punch and hammer adjust the cam bracket downward until the wheels stop turning.

7. Move the speed control lever to the forward position. Depress the brake pedal and lock in place.

8. If there is excessive vibration or noise in the transmission when the brake pedal is depressed, adjust the cam bracket to eliminate the noise.

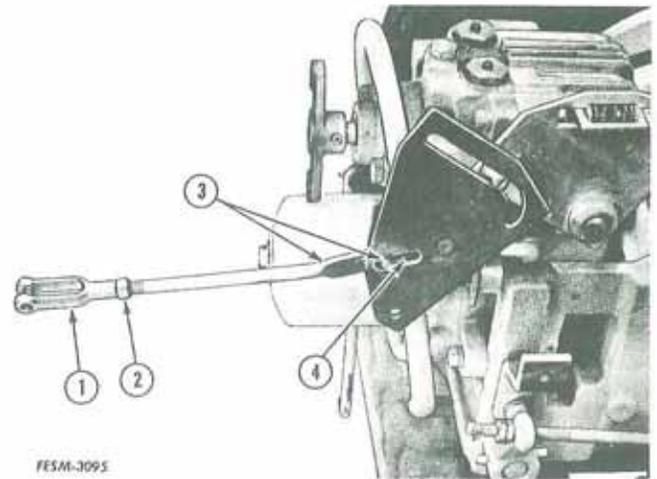
9. Release the brake pedal and stop the engine.

10. Move the speed control lever to the "F" position and tighten the cam bracket capscrews.

11. With the engine running, move the speed control lever to the forward position. Depress the brake pedal all the way down and release it. The speed control lever should return to the "N" position and the wheel should stop turning.

12. If the speed control lever does not return to the "N" position, loosen the jam nut (3) and turn the connecting rod (2) to lengthen or shorten it until the speed control lever is in the "N" position when the brake pedal is depressed. Tighten the jam nut. Refer to Illust. 2-82.

13. Check the rod in the speed control



Illust. 2-84. Cam slot clearance.

1. Clevis
2. Jam nut
3. "N" return rod
4. Speed control cam slot

cam slot. The rod should not be touching the end of the slot when the brake pedal is fully depressed (Illust. 2-84).

14. If the rod touches the end of the slot adjust as follows:

Remove the clevis end (1) of the rod from the brake cross shaft. Loosen the jam nut (2) and turn the clevis to lengthen the rod to prevent it from hitting the end of the slot. See Illust. 2-84.

15. Tighten the jam nut and install the clevis on the brake cross shaft.

16. Install the seat and fender assembly.

Trouble Shooting

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. Remove the fender and seat assembly.
3. Block the tractor so that the left rear wheel is off the ground and block the front wheels.
4. Depress both check valve spools (see Foldout at back of manual) with the tow lever.
5. Remove the transmission case top cover. Start engine and check for suction line leak indicated by air or foam in oil.
6. Check the drive shaft rotation into the charge pump and out the rear of the transmission case for mechanical breakdown. "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.

7. Check to see that both check valve spools have returned from the depressed position.
8. 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).
9. 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 2-45 thru 2-47 for service of these components.
10. 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 2-23 this manual for splitting procedure.

2. Support the transmission and reduction housing on a suitable block, place an oil drip pan under the creeper unit and drain creeper lubricant. Refer to Illust. 2-21.

3. Four capscrews hold the creeper housing to the reduction housing cover plate. Remove the capscrews.

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.

3. Support the drive 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.

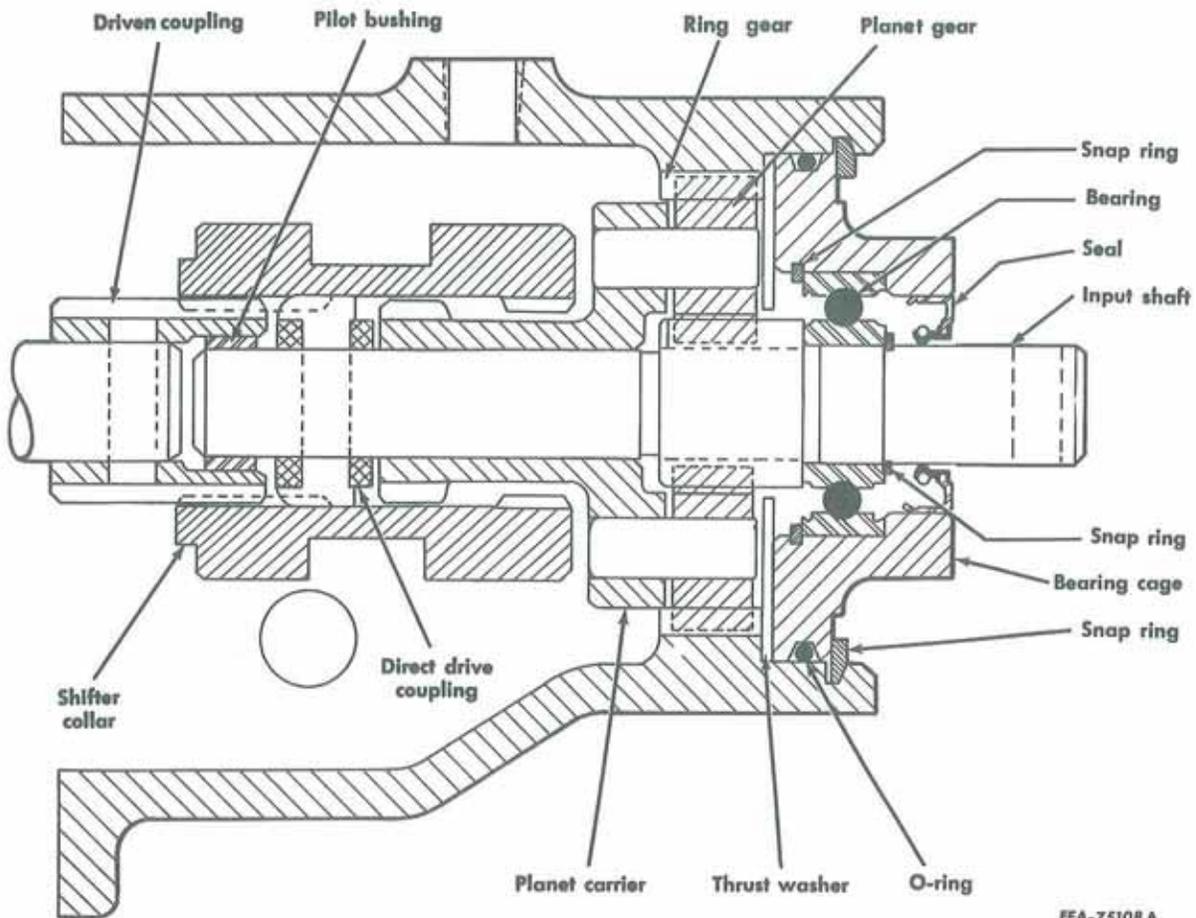
14. Wash all parts in cleaning solvent then dry thoroughly.

Disassembly (Illusts. 2-85 and 2-86)

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.



Illust. 2-85. Cross section - side view of creeper drive assembly.

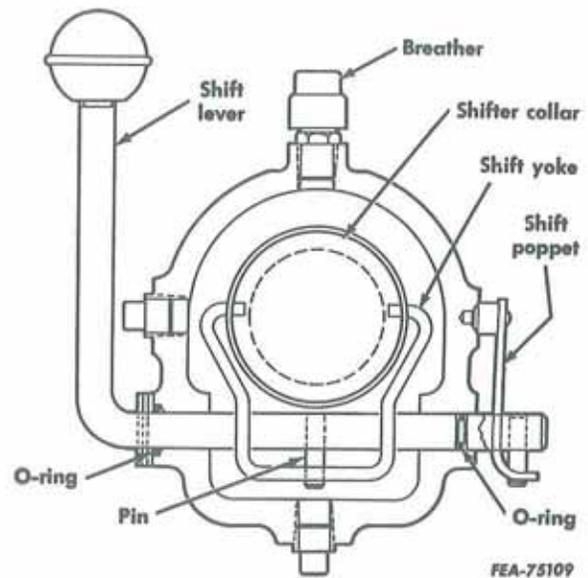
Inspection and Repair

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. 2-86. Cross section - end view of creeper shifting components.

Reassembly (Illust. 2-85)

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.

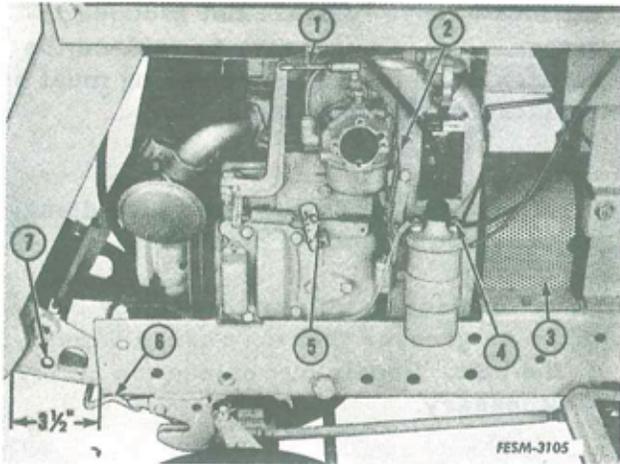
4. Fill the creeper housing to proper level (check plug on side of housing) with the same lubricant as specified for the transmission - differential.

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 2-24.)

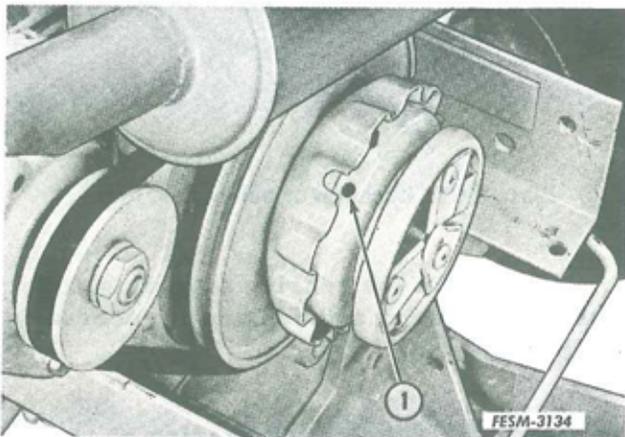
FRONT PTO CLUTCH

Removal



Illust. 2-87. Grille housing moved forward.

NOTE: Clutch service can be performed by removing the grille and disconnecting the rear clutch rod from the PTO control rod assembly. However, if the clutch release pivot shaft (7) requires replacement, the grille housing must be moved forward approximately 3-1/2 inches to remove the shaft (Illust. 2-87).



Illust. 2-88. Location of set screw holes in clutch pulley housing (grille housing removed for ease of viewing).

1. Set screw hole

1. Disengage the clutch and align the set screw holes (1) with the notches in the crankshaft pulley.

2. Remove the jam set screw and lock set screw from each of the three holes in

GSS-1404 Rev. 1 12-70

- | | |
|-----------------------|-----------------------------------|
| 1. Throttle link | 5. Throttle wire |
| 2. Choke wire | 6. Quick attaching latch |
| 3. Clutch shield | 7. PTO clutch release pivot shaft |
| 4. Positive coil wire | |

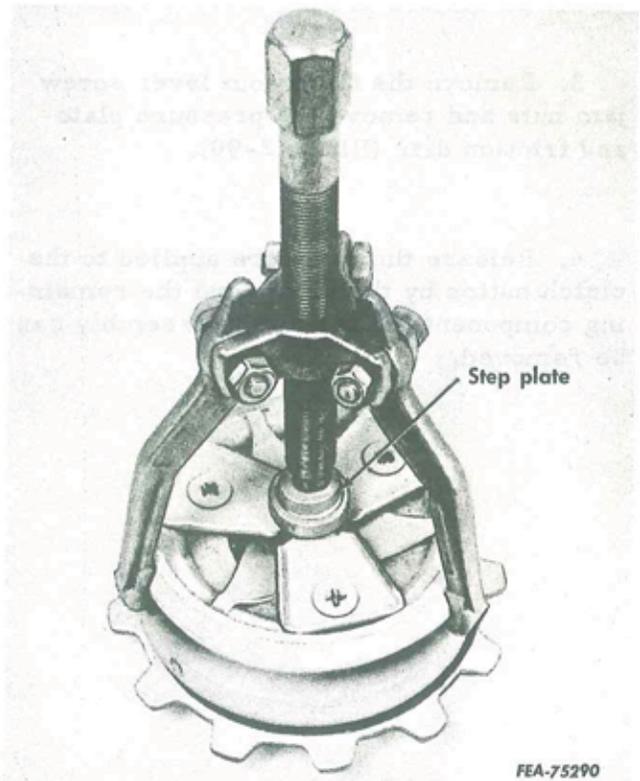
the clutch pulley housing (Illust. 2-88).

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

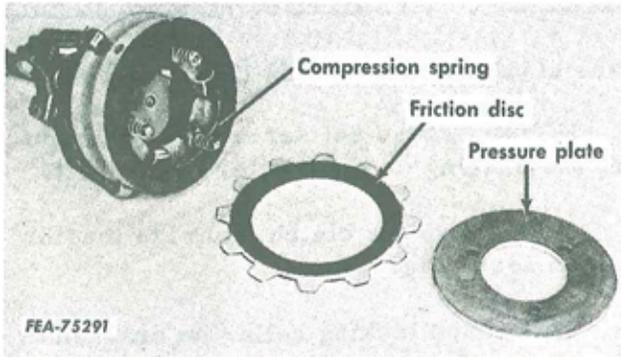


Illust. 2-89. Three jaw puller installed on clutch assembly.

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. 2-89). Use a step plate between the thrust button and the puller bolt.

Printed in United States of America

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



Illust. 2-90. Pressure plate and friction disc removed.

3. Remove the throw-out lever screw jam nuts and remove the pressure plate and friction disc (Illust. 2-90).

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

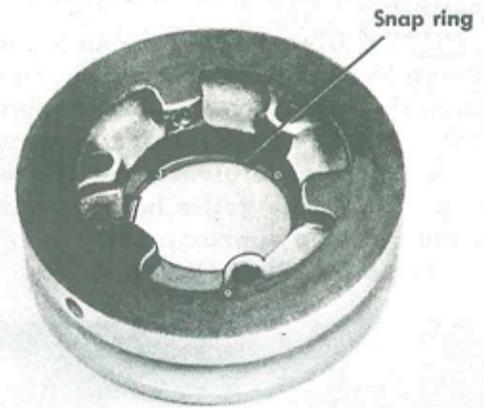
1. Inspect the pressure plate for scoring or excessive warpage. If it is .010 inch or more out of flat it must be replaced.

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. 2-91. Location of pulley snap ring.

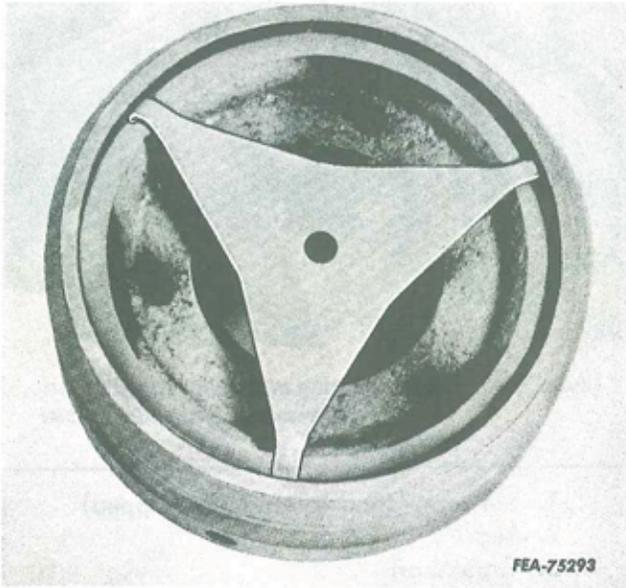
5. Inspect the bearing snap ring and groove for wear and replace if necessary (Illust. 2-91).

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.

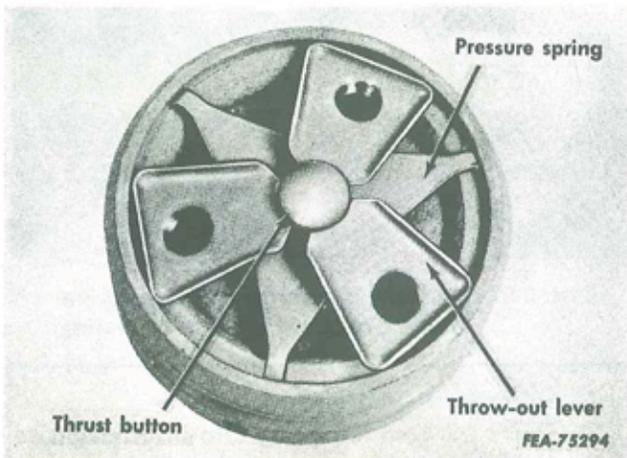
8. If new throw-out lever screws are to be used in reassembly, be sure they are those as listed in the parts catalog as these are special machine screws.

Reassembly



Illust. 2-92. Pressure spring located on pulley.

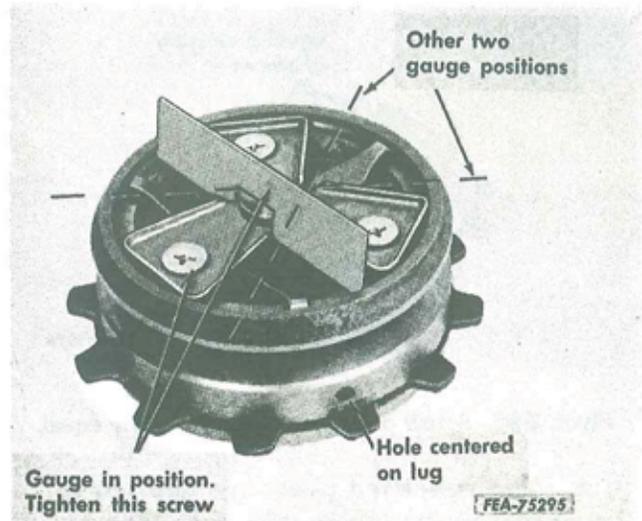
1. Position the pressure spring on the actuating pulley so the tips are equally spaced between the screw holes (Illust. 2-92).
2. Install the thrust button on the pressure spring.



Illust. 2-93. 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. 2-93).

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. 2-90).



Illust. 2-94. 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. 2-94).

Adjustment

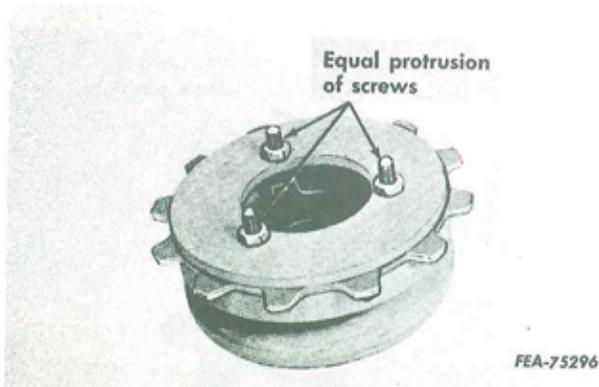
1. Install the adjusting gauge in position shown in Illust. 2-94.

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. 2-95. 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. 2-95). 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.

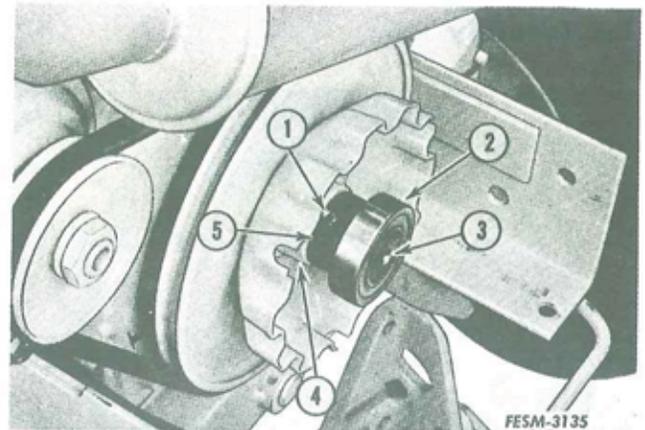
Installation

NOTE: The drive pulley hub must be 1-1/2" from end of crankshaft on 7 HP Model and 1-1/4" on 10, 12 and 14 HP Models.

IMPORTANT: The set screw that contacts the key must be tightened first; then tighten the set screw that contacts the engine shaft. Tighten the set screws to 12 to 14 ft. lbs. torque.

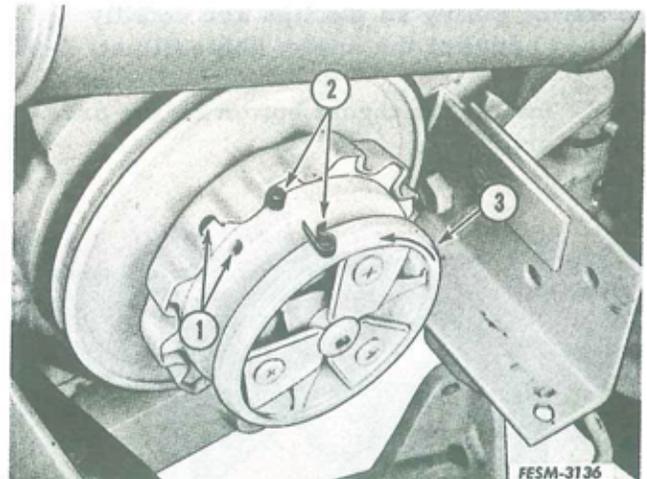
1. If a new clutch bearing is to be used, install it on the crankshaft so it is flush with the end of the crankshaft. Lock it in place with the locking collar. Be sure to lock the collar to the bearing in the direction of crankshaft rotation. Lock the collar in place with the set screw and nut (if equipped) (Illust. 2-96).

GSS-1404 Rev. 1 12-70



Illust. 2-96. Clutch bearing and collar installed on shaft (grille housing removed for ease of viewing).

1. Set screw (and locknut if equipped)
2. Bearing
3. Crankshaft
4. Drive pulley hub
5. Locking collar



Illust. 2-97. Installing the clutch assembly (grille housing removed for ease of viewing).

1. Set screw hole aligned with slot
2. Shows position for spring clip installation
3. Rotation

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. 2-97).

Printed in United States of America

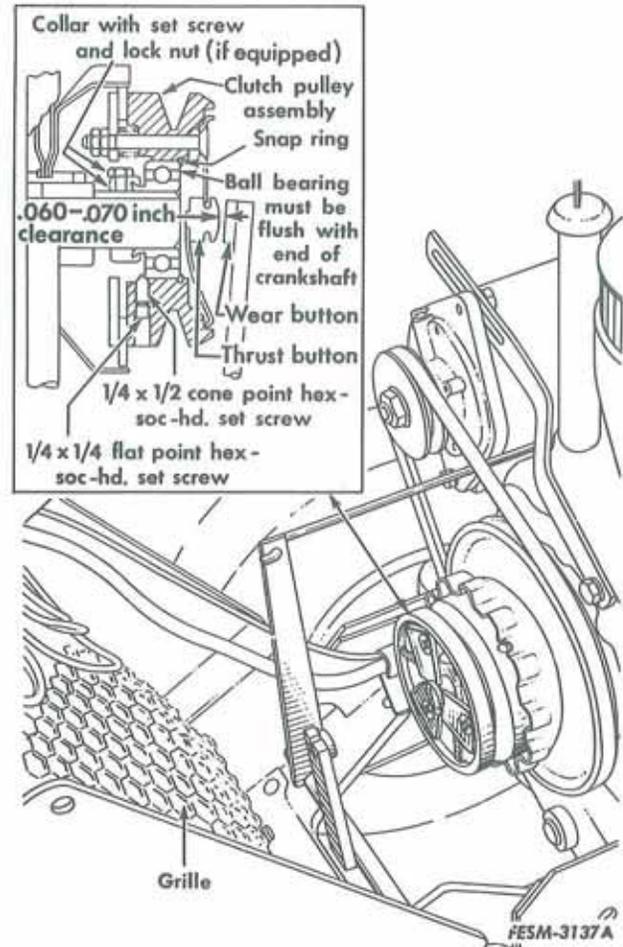
3. Equally space and install 3 friction disc springs on the friction disc lugs on the non-drive side of the lugs. The non-drive side of the lugs is the left hand side of the lug when looking at the front of the clutch (Illust. 2-97). Place flat side of springs inside the cup. Push the clutch assembly 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 x 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.

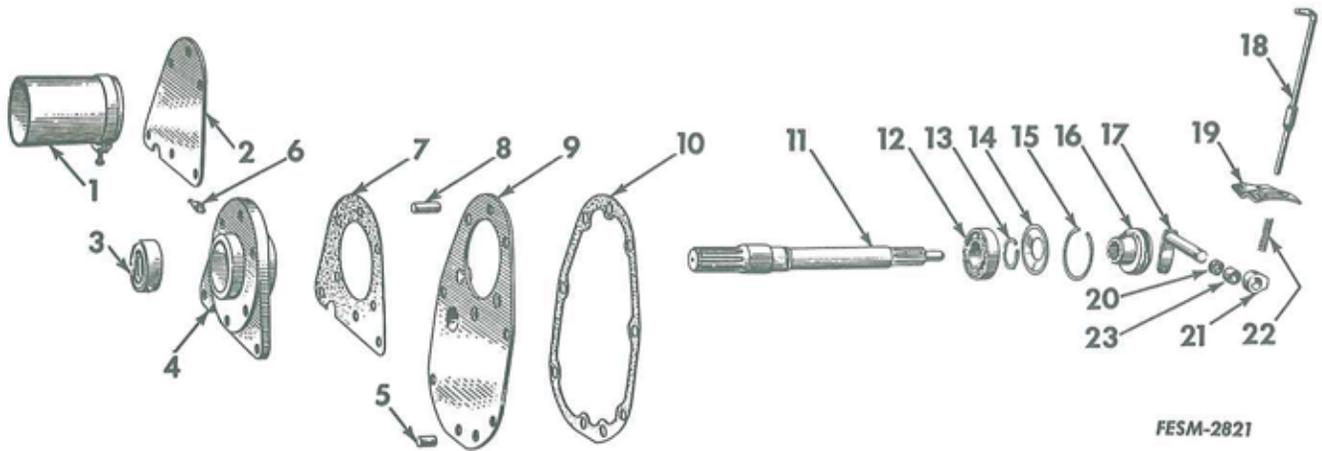
7. With the hand lever in the forward position (clutch fully engaged), adjust the turnbuckle so there is .060 to .070 inch minimum clearance between the wear button and thrust button (Illust. 2-98). Secure the turnbuckle with the jam nut.



Illust. 2-98. Clutch diagram.

REAR PTO

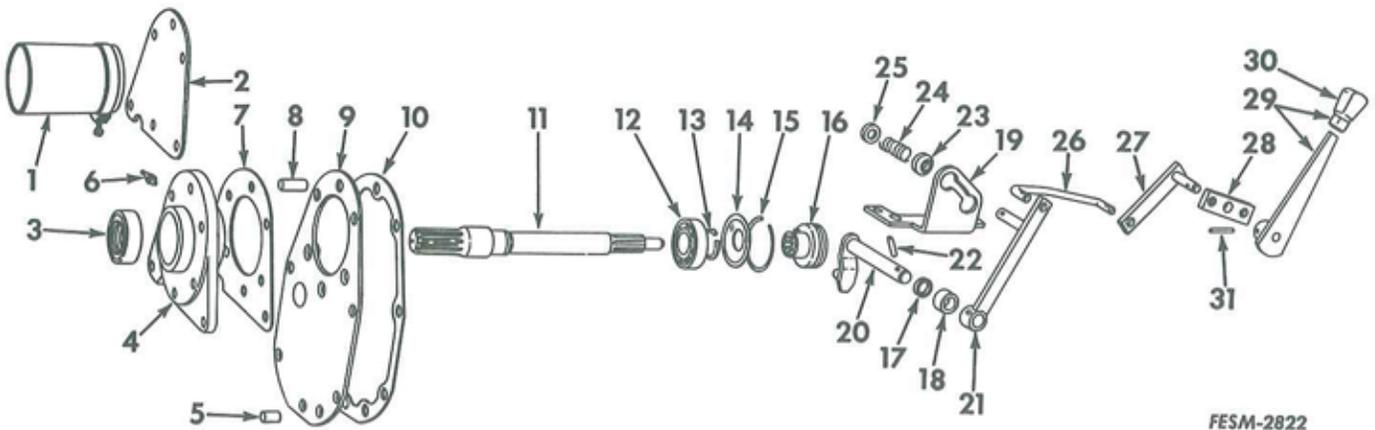
Model 73



Illust. 2-99. Exploded view of rear PTO Model 73.

- | | | | |
|------------------|-------------|---------------------|------------|
| 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 | |

Models 106 and 126



Illust. 2-100. Exploded view of rear PTO Models 106 and 126.

- | | | | |
|-------------|-------------|------------|------------|
| 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 | |

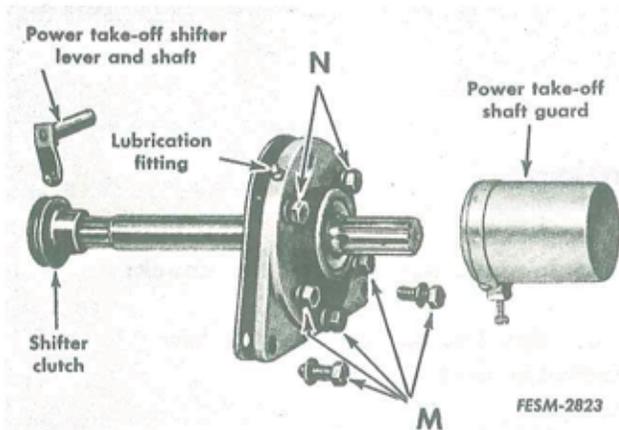
Removal

Remove 7 capscrews 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.

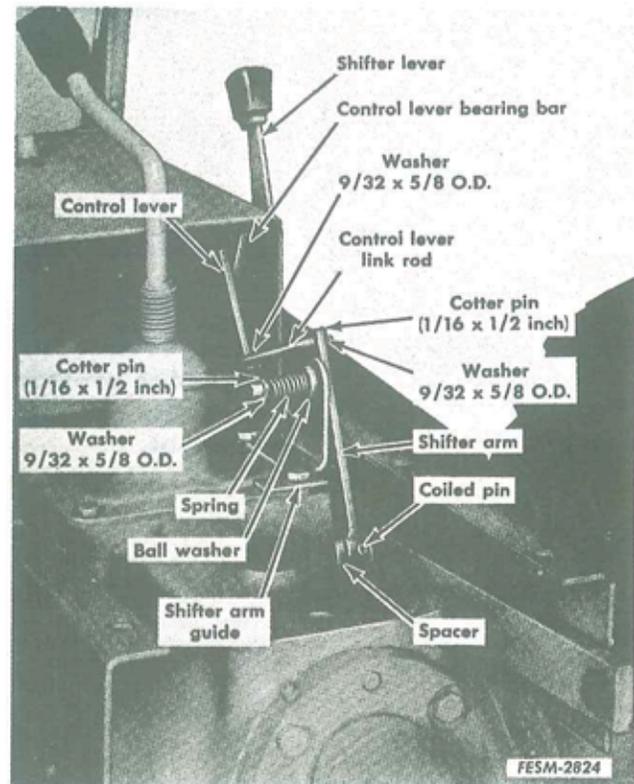
Assembly



Illust. 1-101. Rear PTO drive parts.

Slide shifter clutch on to the power take off shaft and secure with set screw and nut (Illust. 2-101).

Apply a coating of grease on the pilot end of the power take off shaft. Making sure oil seal is installed with lip towards



Illust. 2-102. PTO shifter control assembly - Models 106 and 126.

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 capscrews removed.

Refer to Illust. 2-102 for control assembly.

ELECTRIC POWER LIFT

General Information

The electric lift is a self-contained unit designed to provide power with fingertip control for raising and lowering mounted equipment.

Trouble Shooting

If electric lift fails to operate, check the following before disassembling:

1. Battery may be discharged.
2. Overload switch open due to overheated motor.

Overheating can be caused by:
 - a. Holding switch too long at end of stroke. Allow unit to cool for 5-10 seconds.
 - b. Motor drawing excessive current.
3. Loose or broken wires. Refer to wiring diagram, Illust. 1-35.
4. The electric lift toggle switch may be faulty if the unit operates in one direction only, does not operate at all, or operates only after repeated movements of the switch lever.

If the electric lift operates more than

eight seconds for full stroke, check:

1. For low battery and/or low generator output.
2. For binding linkage.
3. For low current draw indicated by ammeter pointer not going beyond first mark on discharge side with lift raising the implement. This check is made with engine off and ignition switch on.
 - a. Poor or loose wiring connections.
 - b. Motor defective.
4. For high current draw indicated by ammeter pointer going beyond last mark on discharge side with lift raising the implement. This check is made with engine off and ignition switch on.
 - a. Motor defective.
 - b. Internal binding of unit.

Removal

IMPORTANT: Disconnect battery ground cable.

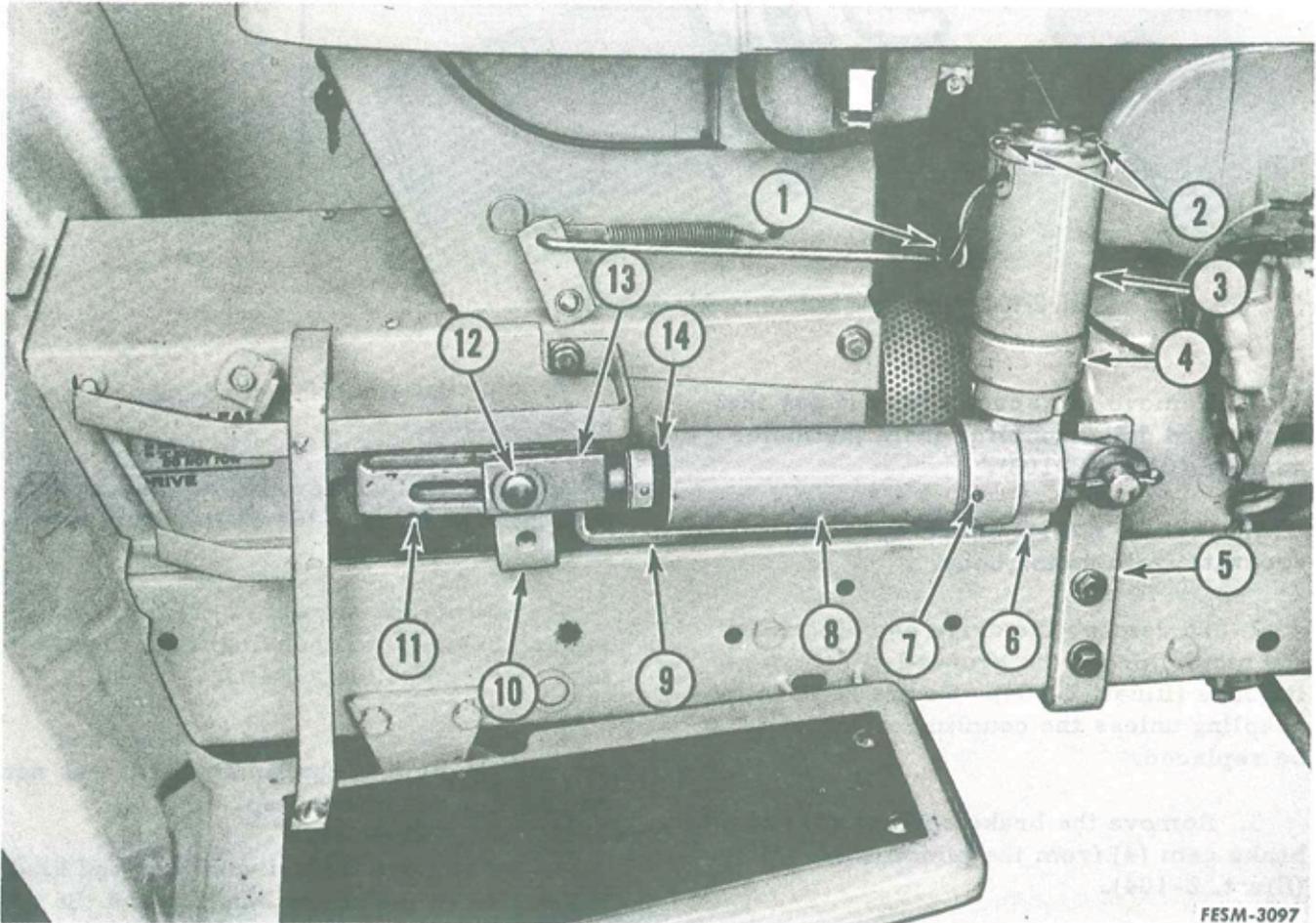
1. Disconnect the wires to the motor at the multiple connector (No. 1 in Illust. 2-103).

2. Remove the cotter pin and washer

securing the lift assembly to the mounting bracket (No. 5 in Illust. 2-103).

3. Remove the cotter pin, washer, locking clip pin (12) and locking clip from the clevis and the lift arm (Illust. 2-103).

4. Remove the electric lift assembly.

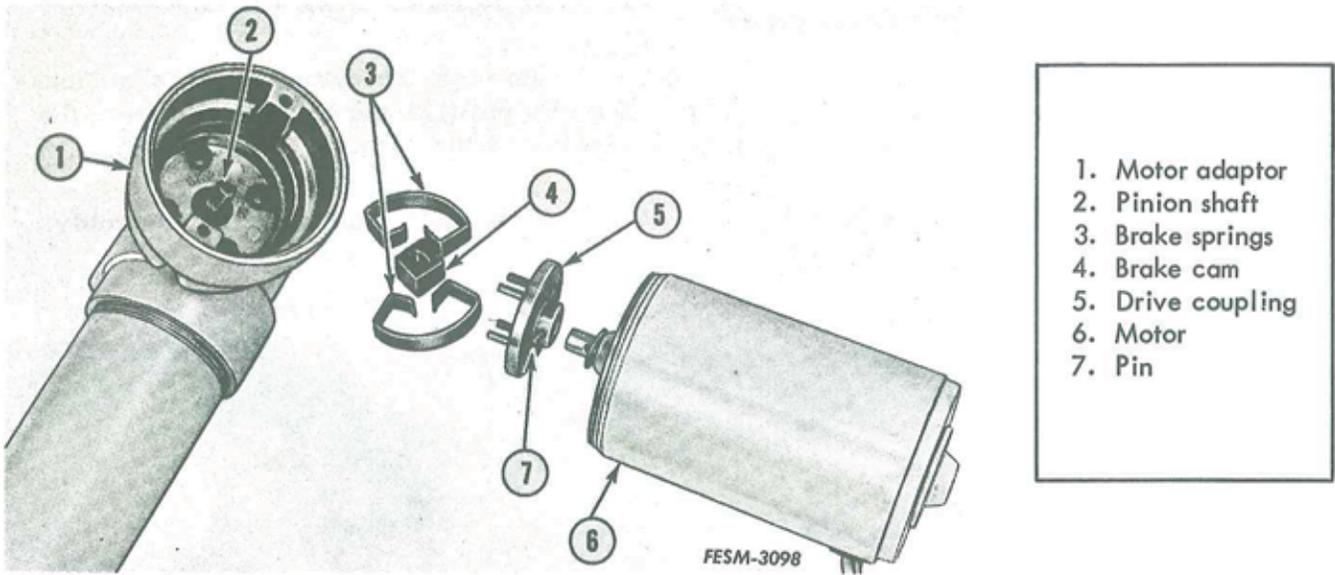


FESM-3097

Illust. 2-103. Electric lift assembly.

- | | |
|-----------------------|----------------------|
| 1. Multiple connector | 8. Outer tube |
| 2. Screws | 9. Lift arm stop |
| 3. Motor | 10. Lift arm |
| 4. Motor adaptor | 11. Clevis assembly |
| 5. Mounting bracket | 12. Locking clip pin |
| 6. Housing | 13. Locking clip |
| 7. Set screw | 14. Translating tube |

Disassembly



Illust. 2-104. Motor and brake assembly removed.

1. Remove two screws (2) and pry the motor and drive coupling from the motor adaptor (Illust. 2-103).

NOTE: Do not let motor end plates separate from motor body.

2. To remove the drive coupling from the motor, press the grooved pin (7) out of its bore (Illust. 2-104). Do not remove the coupling unless the coupling or motor is to be replaced.

3. Remove the brake springs (3) and brake cam (4) from the pinion shaft (2) (Illust. 2-104).

4. Remove the four screws and remove the motor adaptor.

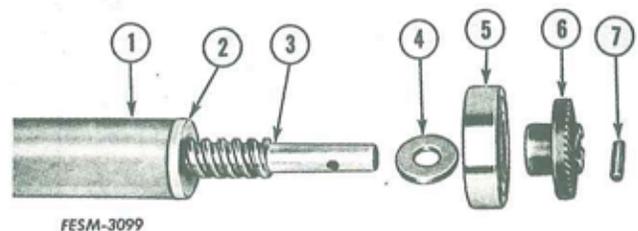
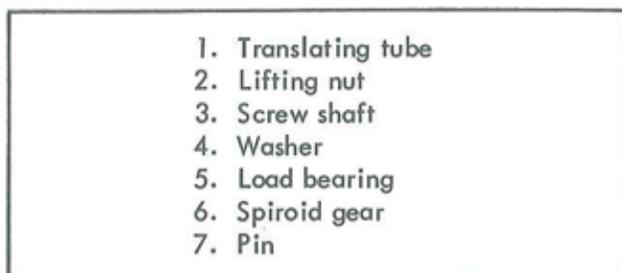
5. Pull the pinion shaft and bearing out of the housing.

6. Remove the retaining ring securing the pinion bearing to the pinion shaft and remove the bearing.

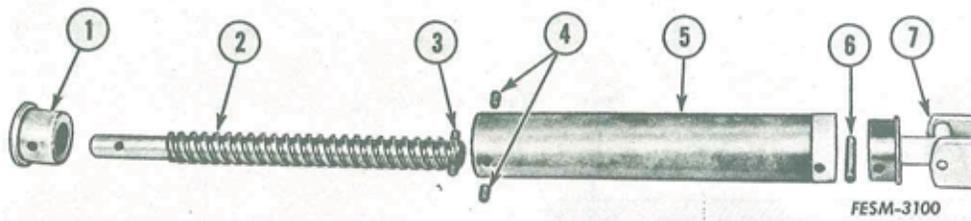
7. Loosen the set screw (7) in the housing and unscrew the housing from the outer tube. Refer to Illust. 2-103.

8. Pull the screw, load bearing, and spiroid gear out of the housing if it was not removed in the above step.

9. To remove the spiroid gear and load bearing from the screw shaft, press the pin (7) out of the gear hub groove and screw shaft bore. Pull the gear, bearing and washer off the shaft (Illust. 2-105).



Illust. 2-105. Screw with spiroid gear removed.



- | |
|---------------------|
| 1. Lifting nut |
| 2. Screw shaft |
| 3. Stop pin |
| 4. Pin (2) |
| 5. Translating tube |
| 6. Pin |
| 7. Clevis assembly |

Illust. 2-106. Screw and nut removed from translating tube.

10. Early model:

Press the pin (6) securing the clevis to the translating tube out and remove the clevis (Illust. 2-106).

Late model:

Remove the screws securing the clevis and slip clutch assembly to the translating tube and remove the clevis.

11. Remove the screw and nut from the translating tube as follows:

a. Remove the screw from the nut and translating tube.

b. Press the two pins (4), securing the nut to the translating tube, out through the tube and nut and press the nut (1) out of the tube. See Illust. 2-106.

NOTE: Do not attempt to press the two pins out of the translating tube while the screw is still in the nut.

12. Drive the stop pin (3) out of the screw. See Illust. 2-106.

Inspection and Repair

1. Clean and inspect all bearings for damage or noticeable play indicating excessive wear. If bearings are not to be discarded, they should be oiled and wrapped in oil proof paper to keep them clean until reassembly.

2. Inspect the bushings for wear or damage and if there is any doubt of their serviceability replace the bushings.

3. Inspect all gear teeth for pitting, chipping and rounding off of teeth due to excessive wear.

4. Inspect the screw and nut for damage or excessive wear.

5. Inspect the snap ring and snap ring groove for wear or damage.

6. Inspect the brake springs, brake cam and brake liner insert for damage or noticeable wear.

7. Inspect the drive coupling for wear or damage.

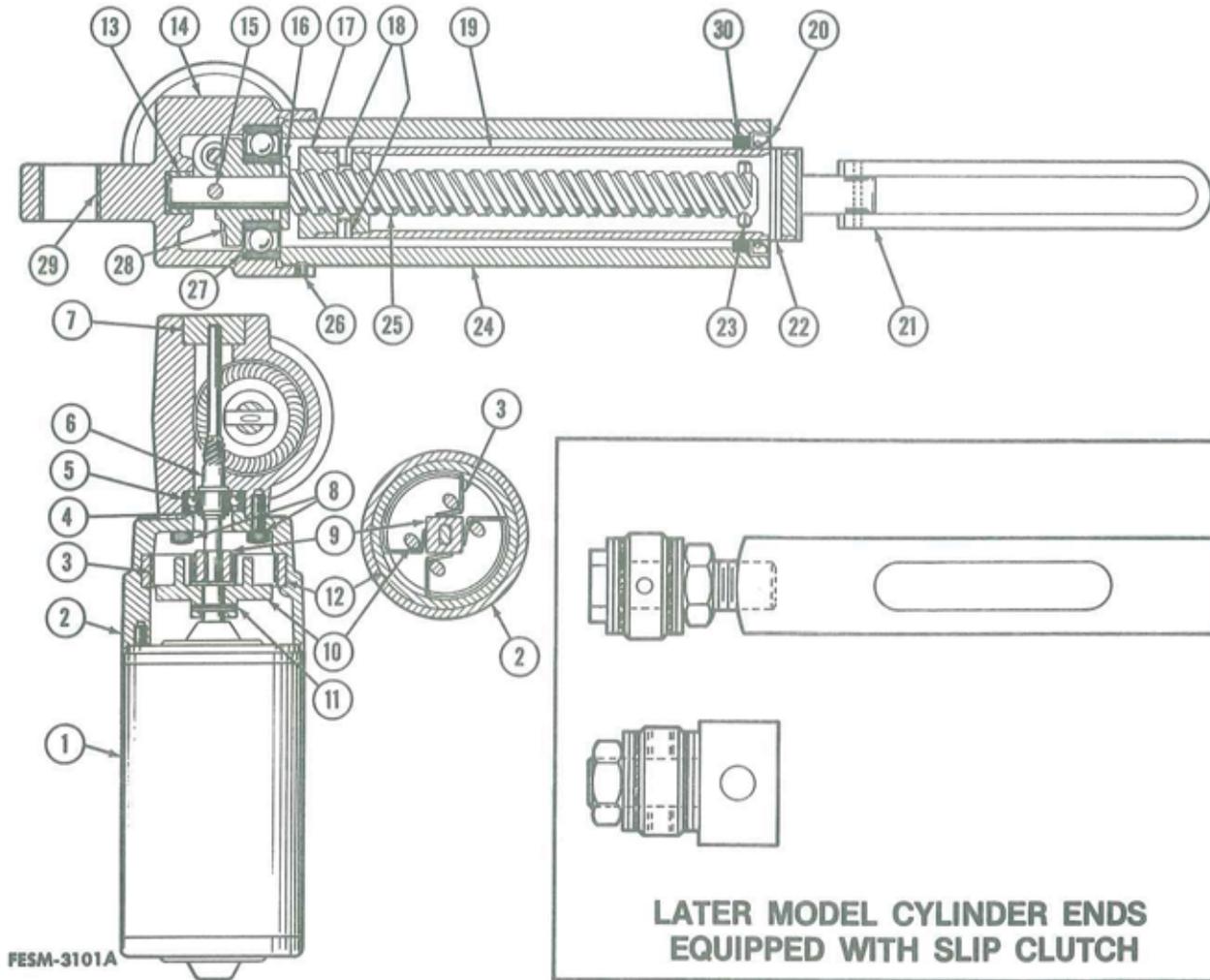
8. Replace the oil seal in the outer tube.

9. The motor is serviced as a complete unit, and should be replaced if necessary.

10. Inspect all wiring for damage and loose or grounded connections.

11. Lubricate all parts before reassembly with grease, IH 251 HEP or equal.

Reassembly



Illust. 2-107.

- | | | |
|--------------------|----------------------|---------------------|
| 1. Motor | 11. Pin | 21. Clevis assembly |
| 2. Motor adaptor | 12. Liner insert | 22. Pin |
| 3. Brake springs | 13. Screw bushing | 23. Stop pin |
| 4. Retaining ring | 14. Housing | 24. Outer tube |
| 5. Pinion bearing | 15. Pin | 25. Screw |
| 6. Pinion shaft | 16. Washer | 26. Set screw |
| 7. Pinion bushing | 17. Lifting nut | 27. Load bearing |
| 8. Tap Tite screws | 18. Pins | 28. Spiroid gear |
| 9. Brake cam | 19. Translating tube | 29. Bushing |
| 10. Drive coupling | 20. Oil seal | 30. Guide bushing |

1. Drive the stop pin (23) into the end of the screw. The pin must be equally spaced with the same amount extending on either side of the screw. Refer to Illust. 2-107. Liberally coat the screw with grease, IH 251 HEP or equivalent.

2. Mate the translating tube to the nut being sure the holes in the nut line up with the holes in the tube. Drive the two pins (18) into the translating tube and nut until they are flush with the translating tube outer diameter. Refer to Illust. 2-107.

3. Be sure to grease the screw and assemble it in the translating tube and nut.

4. Early model:

Align the pin bores and install the clevis in the translating tube. Drive the pin (22) into its bore until the ends are flush with the outer diameter of the translating tube. See Illust. 2-107.

Late model:

Attach the clevis with slip clutch to the tube with screws.

5. Install a new oil seal in the outer tube. Be sure the lip of the seal is pointing into the tube when installed. Peen the tube at three points to lock the seal in place.

6. Lubricate the seal and assemble the outer tube on the translating tube.

7. Assemble the washer, load bearing and spiroid gear on the end of the screw shaft. Refer to Illust. 2-105. Drive the pin (7) into the gear hub groove and the

bore in the screw. The pin must be equally spaced with the same amount extending on each side of the screw.

8. Grease the spiroid gear and load bearing.

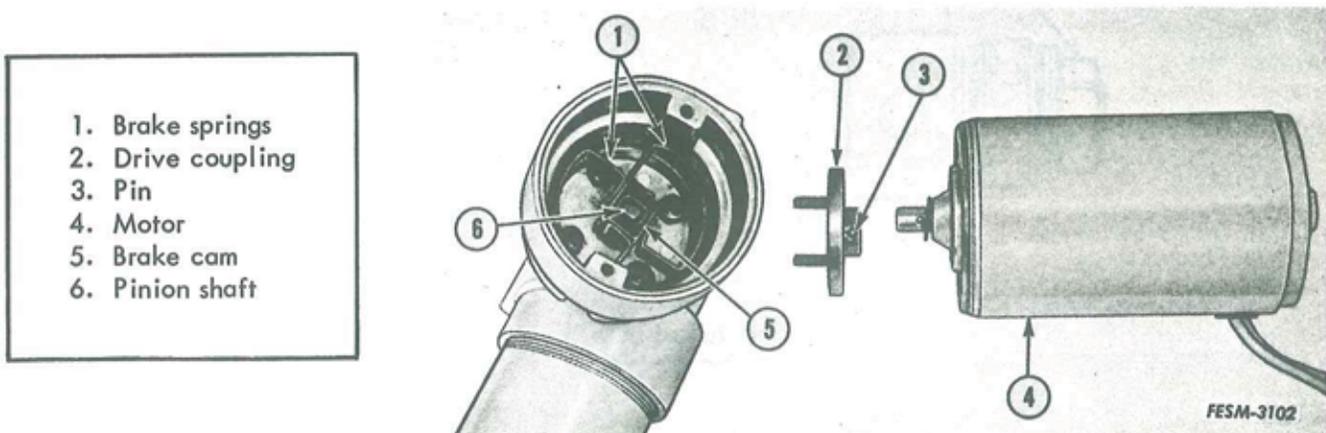
9. Screw the housing into the outer tube until tight. Lock the tube in place with the set screw.

NOTE: If a new outer tube is installed, tighten the tube and spot drill (No. 25) a hole through the tapped hole in the housing into the outer tube about 1/16 inch deep. Lock the tube in place with the set screw.

10. Assemble the pinion bearing onto the pinion shaft and secure with the snap ring retainer. Grease the assembly with IH 251 HEP or equivalent.

11. Install the pinion and bearing assembly in the housing. Install the motor adaptor on the housing and secure it with the four screws. Be sure the two screw holes in the motor adaptor are in line with the outer tube. See Illust. 2-108.

12. Lightly grease the inside of the motor adaptor and install the brake cam on the pinion shaft. Install the brake springs on the cam with the outside of the springs against the steel insert brake lining (Illust. 2-108).



Illust. 2-108. Brake cam and springs installed.

13. Pin the drive coupling to the motor if it was removed.

14. Install the motor and drive coupling on the motor adaptor. Be sure the drive pins are installed in the brake springs (3) correctly. See Illust. 2-107. Be sure the motor is positioned so the multiple connector and wires are pointing toward the tube. Refer to Illust. 2-103.

Installation

1. Install the electric lift assembly on the mounting bracket and the lift arm.

2. Install the locking clip, locking clip pin, washer and cotter pin on the clevis and the lift arm. See Illust. 2-103.

3. Install the washer and cotter pin on the mounting bracket.

4. Connect the wires to the motor at the multiple connector.

5. Connect the battery ground cable.

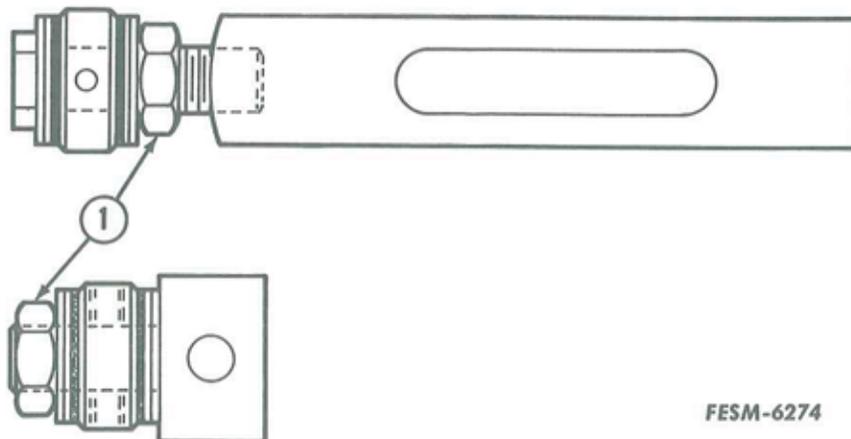
Adjustment

The slip clutch is adjusted on the tractor by lifting an implement and observing the slip clutch action.

The clevis type end is adjusted externally.

The sand trap rake end must be removed from the translating tube to make the adjustment.

Adjustments must be made in small increments. $1/8$ of a turn will change the tension quickly and considerably as you approach the correct setting. The lift should pick the load up without slipping but must rotate freely at the end of the stroke. A slight slip on engagement of load is permissible but once the load is moving slippage should not occur until maximum stroke is reached.



FESM-6274

1. Adjust here

Section 3

IH EQUIPMENT

CONTENTS

	Page
Specifications	3-1
Mower	
Removal	3-2
Disassembly	3-4
Inspection and Repair	3-5
Blade Sharpening	3-5
Reassembly	3-6
Installation and Adjustment	3-7
Snow Thrower	3-8
International® 1 Rotary Tiller	
Replacing Tines	3-8
Servicing Gear Box	3-10

SPECIFICATIONS

Mowers

Torques (foot pounds)

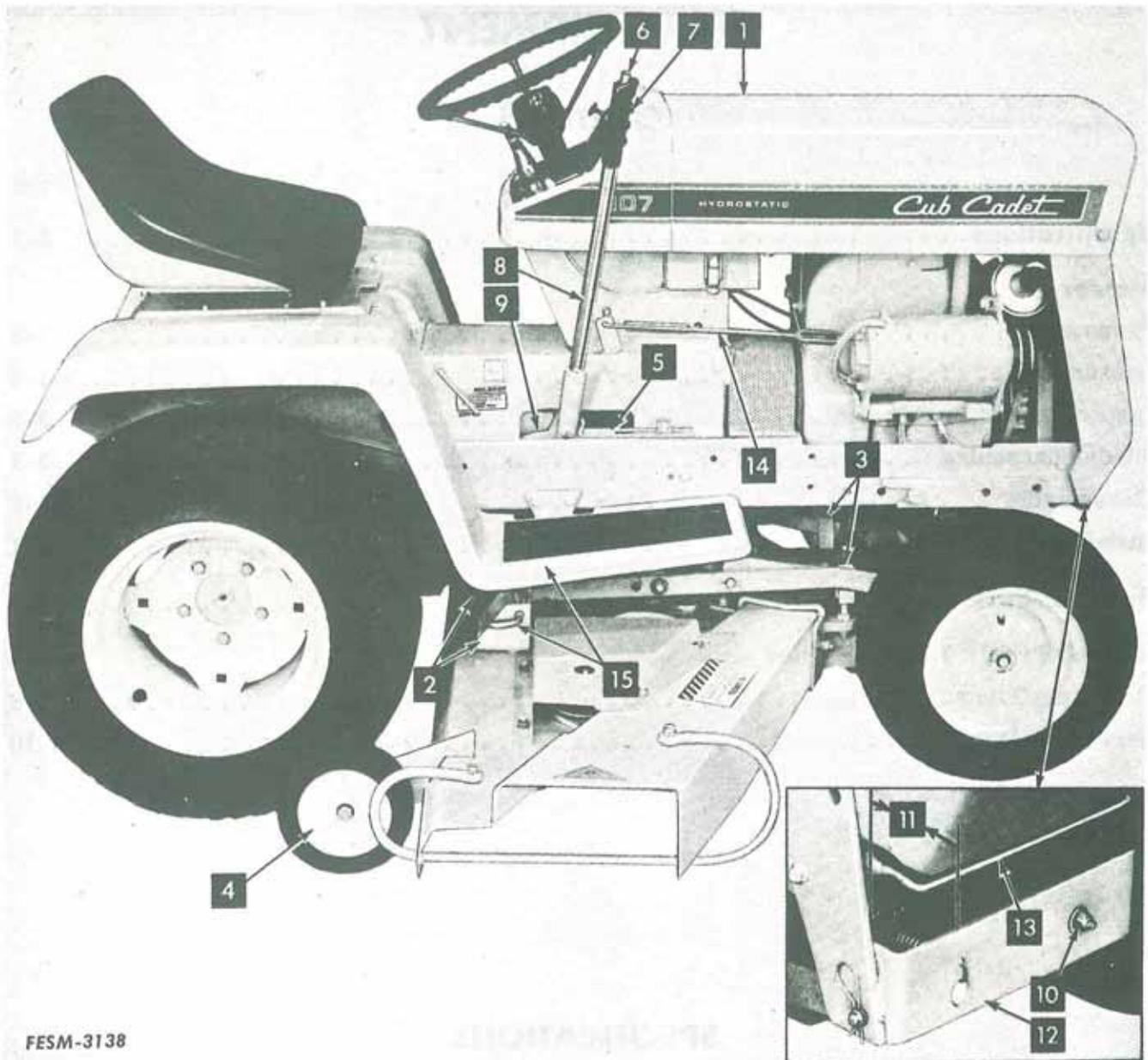
Spindle end bolt	38 to 45
Blade nut	55 to 60

Snow Thrower

Gear backlash - inch006 to .018
--------------------------------	--------------

MOWER

Removal



FESM-3138

Illust. 3-1.

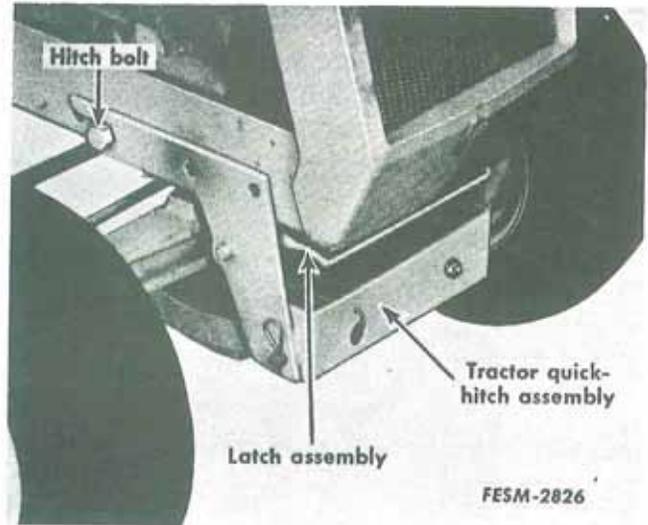
- | | | |
|---|-------------------------|----------------------------------|
| 1. Power take-off clutch lever (not seen) | 6. Release button | 11. 3-1/2 inches |
| 2. Mower support brackets | 7. Lock button | 12. Front hanger cover |
| 3. Mower support clevises | 8. Lift handle | 13. Quick hitch |
| 4. Gauge wheels | 9. Lift handle quadrant | 14. Power take-off clutch rod |
| 5. Lift handle stop | 10. V-belt tension bolt | 15. Support pins (spring loaded) |

(Refer to Illust. 3-1)

1. Lower the mower to the ground.
2. Pull support pins (15) to release mower from lift frame.
3. Slide mower forward to free from lift support clevises (3). 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. 3-2) one on each side and push the tractor quick hitch latch assembly down (Illust. 3-2).

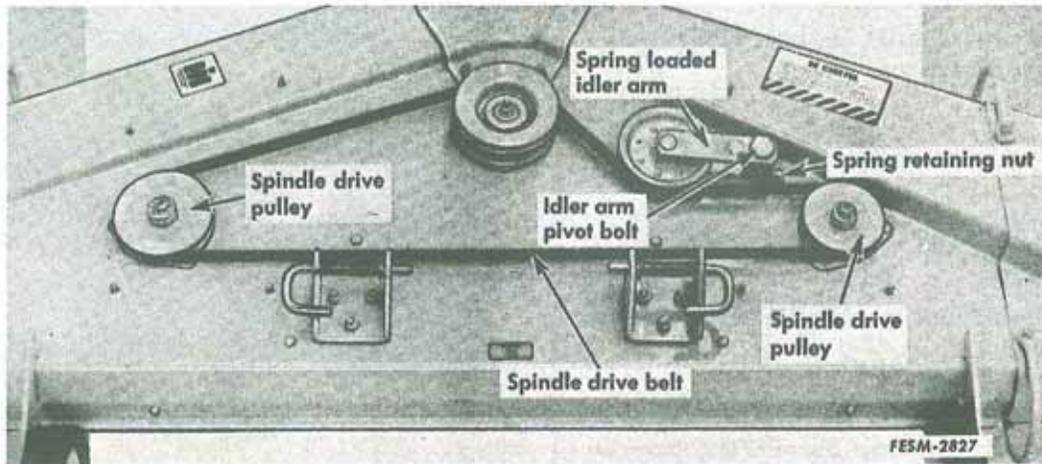
Pull hanger assembly forward to uncouple from tractor.



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 clean 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.

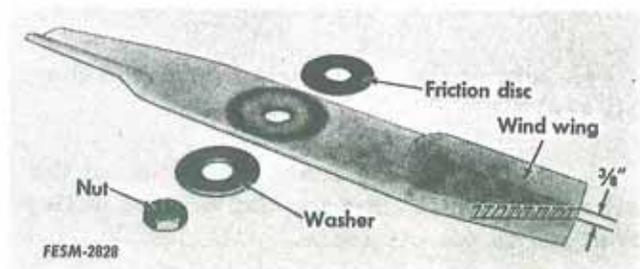
10. Inspect the main drive belt for wear and replace if necessary.

11. Inspect the drive belt idler pulleys for freeness of rotation and replace if necessary.

Blade Sharpening

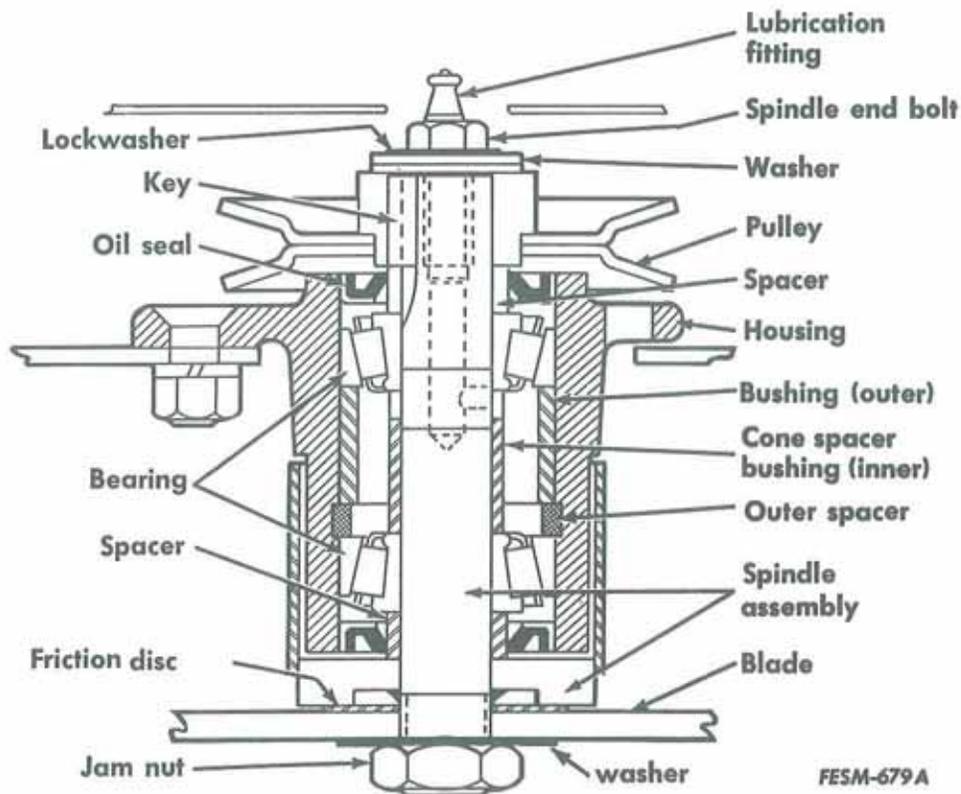
The cutting blades must be kept sharp at all times. The blades can be sharpened on the mower (mower removed from tractor) with a file, or they can be removed and sharpened on a grinding wheel.

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.

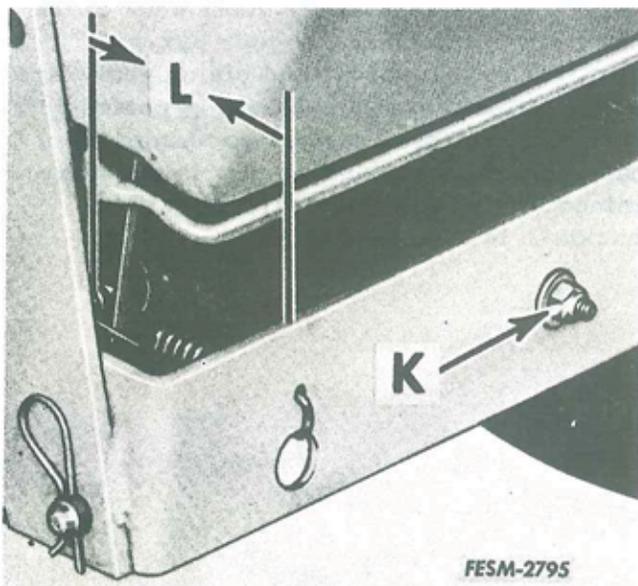
11. Install the L.H. and R.H. belt shields.

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 3-1/2" 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

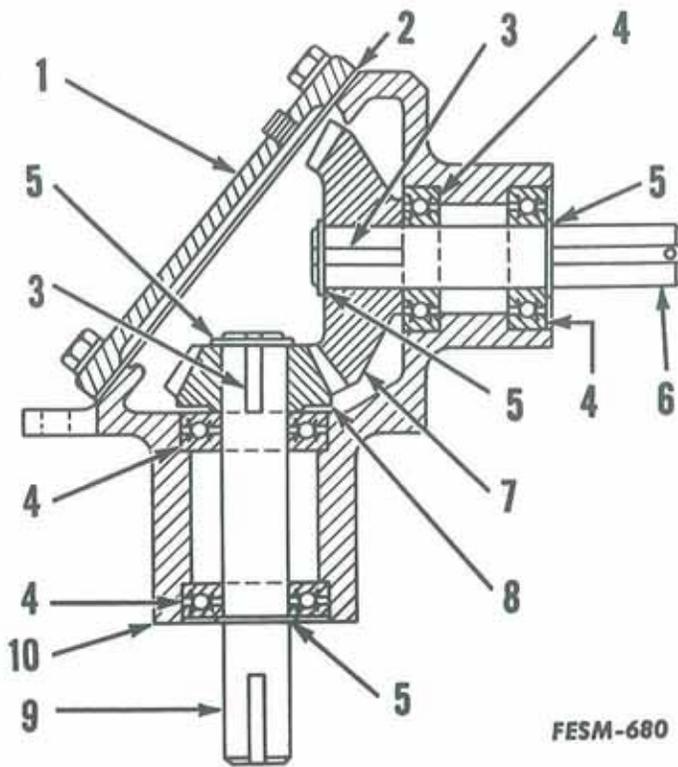
Lower the mower almost to the ground making sure the gauge wheels do not touch the ground. Add 13/32 x 13/16 x .065 inch flat washers, as required, under the left or right mower support brackets (2) (Illust. 3-1) so the height from the top of the mower housing to the ground is equal on each side. Then 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 (3) (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 re-check.

If mower leveling is difficult, check for bent blades.

SNOW THROWER



- | | |
|--------------|-----------------|
| 1. Cover | 6. Output shaft |
| 2. Gasket | 7. Bevel gear |
| 3. Key | 8. Pinion gear |
| 4. Bearing | 9. Input shaft |
| 5. Snap ring | 10. 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.

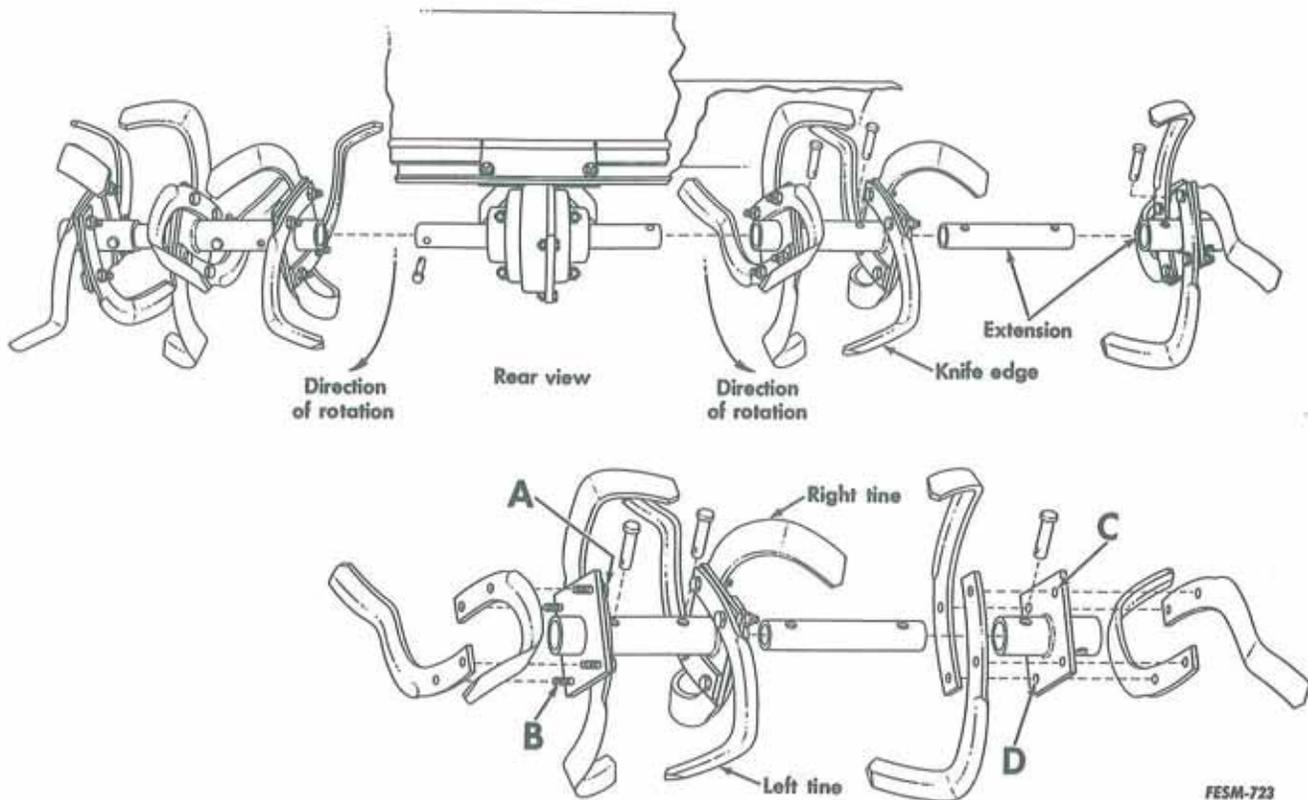
Illust. 3-7. Sectional view of gear box.

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.



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.

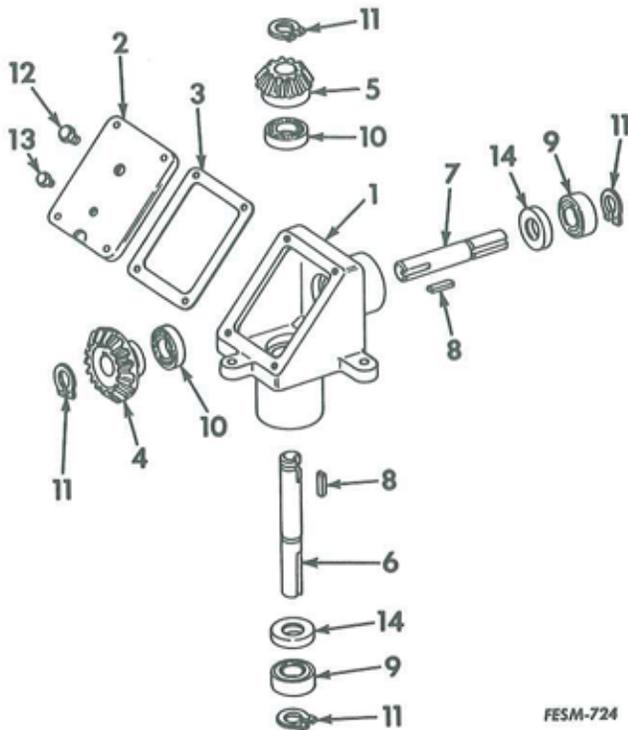
The tine shaft having two mounting plates has one plate with bolt holes "A" and "B" in line with the shaft pin hole.

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

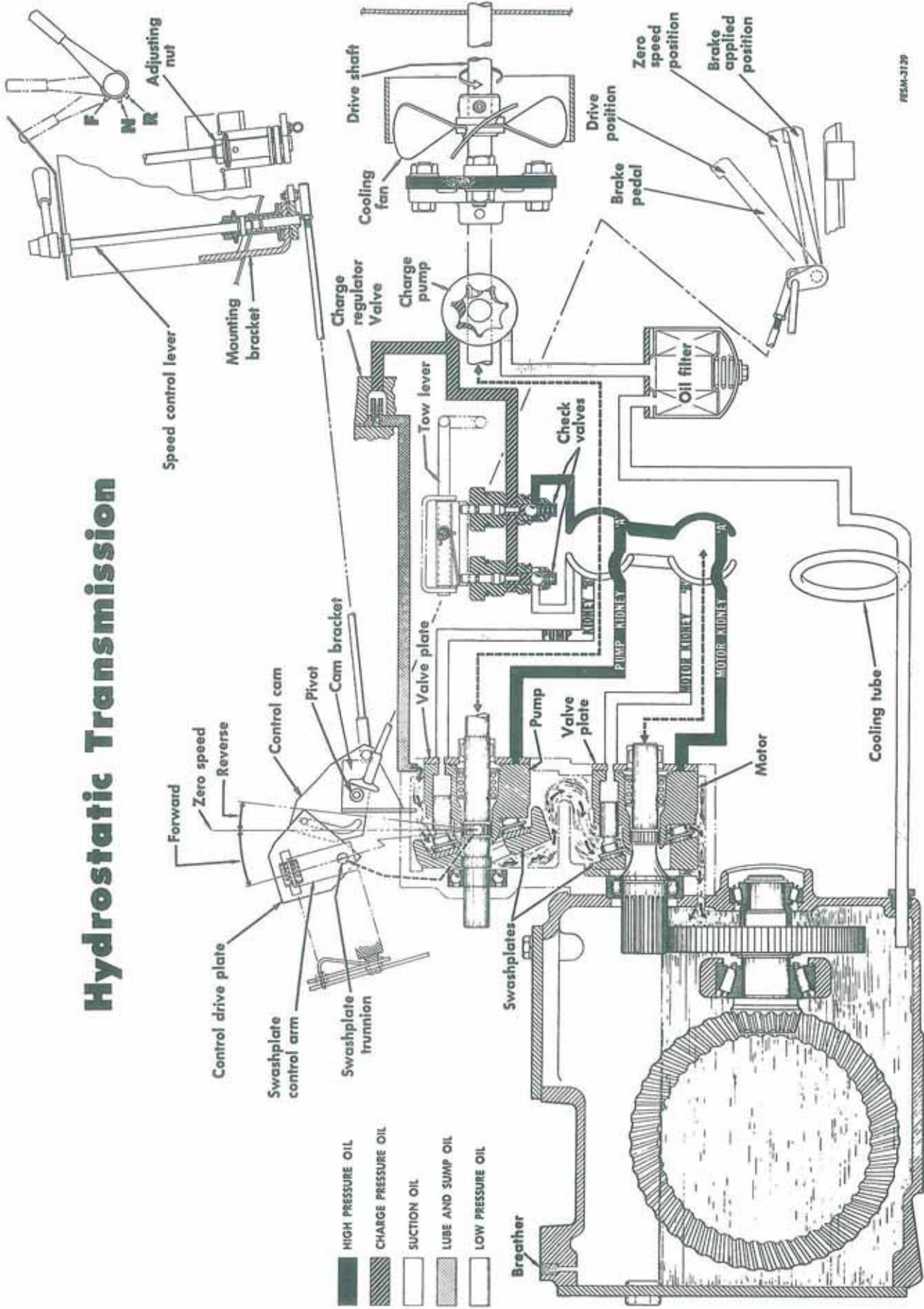
FESM-724

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 pre-determined in manufacturing. Always replace the oil seals when the gear box is disassembled.

Hydrostatic Transmission



- HIGH PRESSURE OIL
- CHARGE PRESSURE OIL
- SUCTION OIL
- LUBE AND SUMP OIL
- LOW PRESSURE OIL



INTERNATIONAL HARVESTER