



# Blue Ribbon Service

GSS-1369

**INTERNATIONAL®**

**CUB CADET® TRACTOR**

**Models 71, 102, 122 and 123,  
and  
IH Equipment**

**INTERNATIONAL HARVESTER COMPANY**  
401 NORTH MICHIGAN AVE. CHICAGO, ILLINOIS 60611, U.S.A.

## FOREWORD

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

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

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

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

### LIBRARY FILING INFORMATION

1. File this Manual in Book 13 after Divider Tab GSS-1369.
2. Enter the following information in the Service Manual Index.

Print, or preferably type in, the Manual Description, Form Number, and the Book Filed in, on the following pages:

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# ENGINE

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# SPECIFICATIONS

General	Model 71	Model 102	Models 122 & 123
Make and model (with electric starting) . . . . . (with retractable starter) . . . . .	Kohler K-161S Kohler K-161T	Kohler K-241AS	Kohler K-301AS
Cylinders . . . . .	1	1	1
Bore . . . . .	2-7/8 inches	3-1/4 inches	3-3/8 inches
Stroke . . . . .	2-1/2 inches	2-7/8 inches	3-1/4 inches
Displacement . . . . .	16.23 cu. inches	23.9 cu. inches	29.1 cu. inches
Compression pressure (Refer to page 1-13) . . . . .	110 to 120 psi/ 1000 rpm	110 to 120 psi/ 1000 rpm	110 to 120 psi/ 1000 rpm
Rated horsepower (at 60 deg. F and 29.92 inch Hg barometric pressure) . . . . .	7.0 at 3600 rpm	10 at 3600 rpm	12.0 at 3600 rpm
Engine speed (governed)			
Minimum speed . . . . .	1000 rpm	1000 rpm	1000 rpm
Maximum idle speed (no load) . .	3780 rpm	3800 rpm	3800 rpm
Maximum (full load) . . . . .	3600 rpm	3600 rpm	3600 rpm
Valve clearance (engine cold) . . . .	.006 (intake) .017 (exhaust)	.010 (intake) .020 (exhaust)	.010 (intake) .020 (exhaust)
Ignition			
(with electric starting) . . . . .	Battery	Battery	Battery
(with retractable starter) . . . . .	Magneto		
Spark plug gap (14 mm plug) . . . .	.025 inch	.025 inch	.025 inch
Breaker point gap . . . . .	.018 to .022 inch	.018 to .022 inch	.018 to .022 inch
Timing (before TDC) . . . . .	20 degree	20 degree	20 degree
<b>Engine</b>			
Cylinder bore			
New (inch) . . . . .	2.8745 to 2.8755	3.2505 to 3.2515	3.3745 to 3.3755
Maximum oversize (before reboring) . . . . .	2.878 inch	3.2545 inch	3.3785 inch
Taper (new) . . . . .	.0005 inch	.0005 inch	.0005 inch
Maximum taper (before reboring) . . . . .	.0025 inch	.0015 inch	.0015 inch
Out-of-round (new) . . . . .	.0005 inch	.0005 inch	.0005 inch
Maximum out-of-round (before reboring) . . . . .	.005 inch	.005 inch	.005 inch
Crankshaft			
End clearance . . . . .	.002 to .023 inch	.003 to .020 inch	.003 to .020 inch
Crankpin diameter (new) (inch) . .	1.1855 to 1.1860	1.4995 to 1.5000	1.4995 to 1.5000
Crankpin, maximum out-of- round before reconditioning . . .	.0015 inch	.0015 inch	.0015 inch

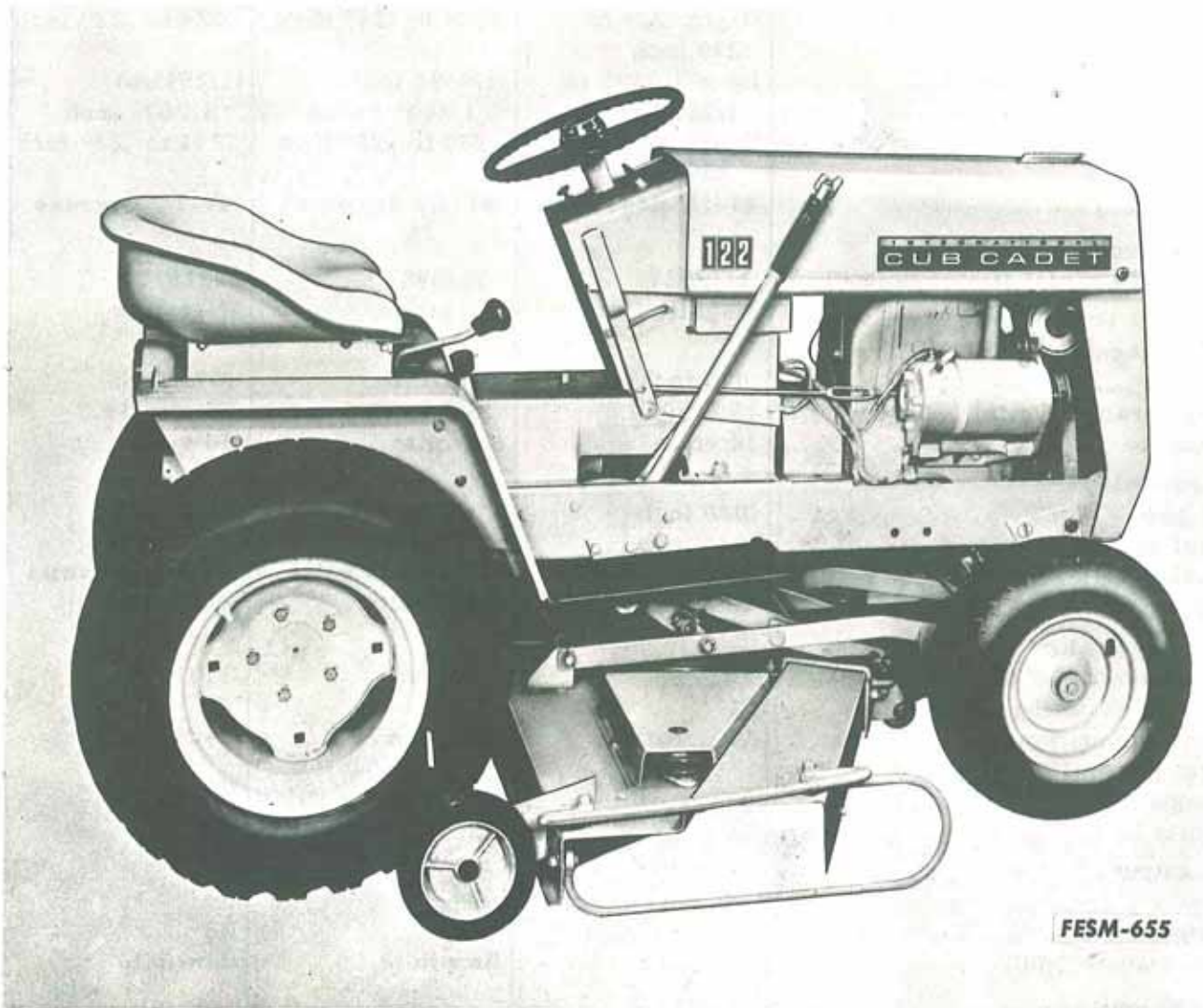


	Model 71	Model 102	Models 122 & 123
<b>Connecting rod</b>			
Bore (new) (inch) . . . . .	1.1870 to 1.1875	1.5005 to 1.5010	1.5005 to 1.5010
Maximum bore (before replacing) . . . . .	1.1890 inch	1.5030 inch	1.5030 inch
Crankpin running clearance (new) (inch) . . . . .	.0010 to .0020	.0005 to .0015	.0005 to .0015
Maximum crankpin running clearance (before recondition- ing) . . . . .	.005 inch	.005 inch	.005 inch
Side clearance . . . . .	.005 to .016 inch	.007 to .016 inch	.007 to .016 inch
<b>Piston</b>			
New (measured just below oil ring 90 deg. from piston pin) (inch) . . . . .	2.8675 to 2.8685	3.2425 to 3.435	3.3665 to 3.3675
Maximum allowable undersize (for wear) . . . . .	2.866 inch	3.2410 inch	3.3650 inch
Piston ring end gap . . . . .	.007 to .017 inch	.010 to .020 inch	.010 to .020 inch
<b>Piston to cylinder bore clearance</b>			
Top of skirt (measured just below oil ring) (inch) . . . . .	.006 to .008	.0075 to .0085	.0065 to .0095
Bottom of skirt . . . . .	.003 to .006 inch	.003 to .004 inch	.003 to .004 inch
<b>Valves</b>			
<b>Valve stem (diameter)</b>			
Intake (new) (inch) . . . . .	.3105 to .3110	.3105 to .3110	.3105 to .3110
Maximum allowable undersize (for wear) (inch) . . . . .	.3090 to .3095	.3090	.3090
Exhaust (new) (inch) . . . . .	.3090 to .3095	.3090 to .3095	.3090 to .3095
Maximum allowable undersize (for wear) . . . . .	.308 inch	.308 inch	.308 inch
<b>Valve guides (inside diameter)</b>			
Intake and exhaust (new) . . . . .	.312 to .313 inch	.312 to .313 inch	.312 to .313 inch
Intake and exhaust maximum (allowable oversize for wear) . .	.315 inch	.315 inch	.315 inch
<b>Valve guide depth from top of block . . . . .</b>			
	1-5/16 inch	1-15/32 inch	1-15/32 inch
Tappet clearance in block (inch) . .	.0005 to .002	.0008 to .0023	.0008 to .0023
<b>Camshaft running clearance</b>			
(inch) . . . . .	.001 to .003	.001 to .0035	.001 to .0035
Camshaft end clearance . . . . .	.005 to .010 inch	.005 to .010 inch	.005 to .010 inch
<b>Valve clearance (stem end)</b>			
Intake (cold) . . . . .	.006 to .008 inch	.008 to .010 inch	.008 to .010 inch
Exhaust (cold) . . . . .	.015 to .017 inch	.017 to .020 inch	.017 to .020 inch
Valve face angle . . . . .	45 degrees	45 degrees	45 degrees



	Model 71	Model 102	Models 122 & 123
Valve seat inserts (service only)			
Intake . . . . .	Bore 1.4995 to 1.5005 inch Depth .224 to .229 inch	1.4995 to 1.5005 inch .224 to .229 inch	1.4995 to 1.5005 inch .224 to .229 inch
Exhaust . . . . .	Bore 1.2595 to 1.2605 inch Depth .234 to .239 inch	1.2595 to 1.2605 inch .234 to .239 inch	1.2595 to 1.2605 inch .234 to .239 inch
Seat angle . . . . .	44-1/2 degrees	44-1/2 degrees	44-1/2 degrees
Current-voltage regulator			
Make and model (Delco-Remy) . .	1118987	1118987	1118987
Ground . . . . .	Negative	Negative	Negative
Voltage regulator			
Air gap . . . . .	.075 inch	.075 inch	.075 inch
Setting range (volts) . . . . .	13.6 to 14.5	13.6 to 14.5	13.6 to 14.5
Adjust to . . . . .	14 volts	14 volts	14 volts
Cut-out relay			
Air gap . . . . .	.020 inch	.020 inch	.020 inch
Point opening . . . . .	.020 inch	.020 inch	.020 inch
Closing voltage . . . . .	11.8 to 14 volts	11.8 to 14 volts	11.8 to 14 volts
Adjust to . . . . .	12.8 volts	12.8 volts	12.8 volts
Motor-generator			
Make and model (Delco-Remy) . .	1101996	1101996	1101996
Rotation (viewing drive end) . . .	CC	CC	CC
Brush spring tension . . . . .	24-32 oz.	24-32 oz.	24-32 oz.
Field current (at 80 deg. F)			
Amps . . . . .	1.5 to 1.6	1.5 to 1.6	1.6 to 1.6
Volts . . . . .	12	12	12
Cold output			
Amps . . . . .	14	14	14
Volts . . . . .	15	15	15
Approximate rpm . . . . .	Low idle	Low idle	Low idle
No load test:			
Volts . . . . .	11	11	11
Amps . . . . .	10 to 14	10 to 14	10 to 14
RPM . . . . .	1650 to 1950	1650 to 1950	1650 to 1950
Carburetor			
*Float setting (inch) . . . . .	11/64 ± 1/32	11/64 ± 1/32	11/64 ± 1/32
Idle speed adjusting screw setting . . . . .	3/4 to 1-1/2 turns open	3/4 to 1-1/2 turns open	3/4 to 1-1/2 turns open
High speed adjusting screw setting . . . . .	1-1/4 to 2 turns open	1-1/4 to 2 turns open	1-1/4 to 2 turns open
*Measure between top of float (free end) and casting body.			
Recoil starter			
Preload on rewind spring . . . . .	4 turns		

## GENERAL INFORMATION



Illust. 1-1. Left front view cadet.

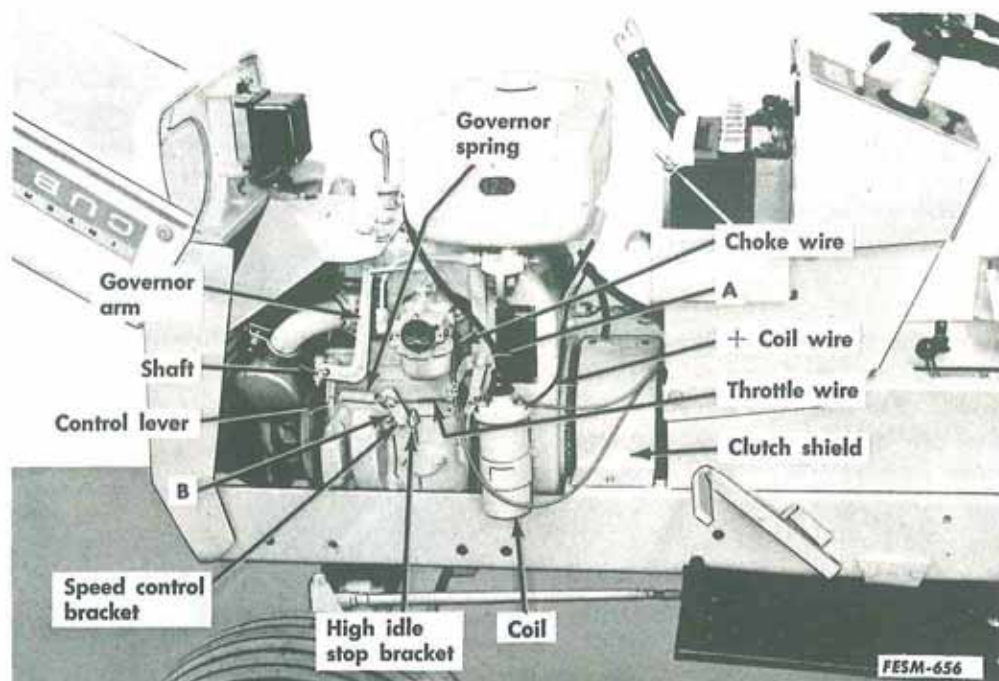
The model 71 is powered by a 7 horsepower, four cycle, air cooled, gasoline engine and is available with retractable hand starting or electric starting. The model 102 is powered by a 10 horsepower, four cycle, air cooled, gasoline engine and is available with electric starting only. The model 122 and 123 is powered by a 12

horsepower, four cycle, air cooled gasoline engine and is available with electric starting only.

The electrical systems of these tractors are automatically polarized when the starter button is pressed.

# ENGINE

## Removal



Illust. 1-2. Left side view Model 122 with air cleaner removed.

### Manual Starting

1. Remove the grille and hood.

**NOTE:** Four cap screws (2 on each side) hold the grille to the tractor main frame.

2. Remove the clutch shield. Refer to Illust. 1-2.
3. Disconnect the throttle wire from the governor speed control disc.
4. Disconnect the choke wire from the carburetor.
5. Disconnect the engine from the main frame.

**NOTE:** Four cap screws (two on each side) go through the frame into tapped holes in the engine oil pan base. Refer to Illust. 1-3.

6. Slide the engine forward in the frame to disengage the clutch drive plate pins

from the driven disc and disengage the clutch shaft from its pilot bushing. Refer to Illust. 1-4.

7. The engine can now be lifted from the tractor frame and chassis.

**NOTE:** One cylinder head cap screw can be removed and a 3/8" N.C. eyebolt installed to lift the engine if desired. Refer to Illust. 1-4.

### Electric Starting

1. Disconnect the battery cables and remove the battery.
2. Remove the grille and hood. Lay the grille and hood (grille face down) in front of the tractor. Refer to Illust. 1-4.
3. Remove the clutch shield (Illust. 1-2).



4. Remove the air cleaner.

5. Remove cap screw "A" and loosen screw "B" (Illust. 1-2). Remove the choke wire from the carburetor, and the throttle wire from the speed control bracket.

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

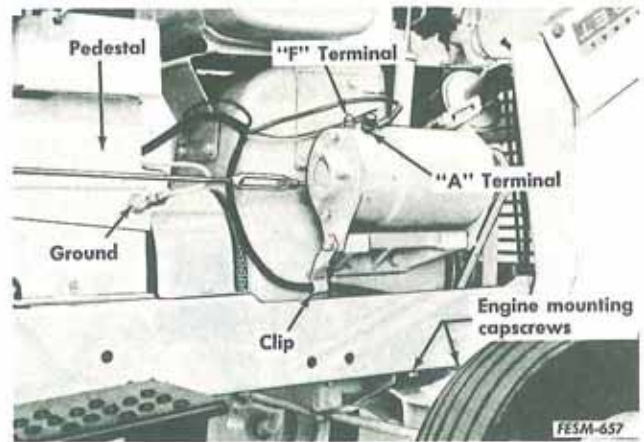
7. If the ground cable is connected to the starter-generator pivot cap screw, disconnect it.

8. Disconnect the two wires from the Generator "A" terminal and one wire from the "F" terminal. Tie the two wires removed from the "A" terminal together and identify them for reassembly.

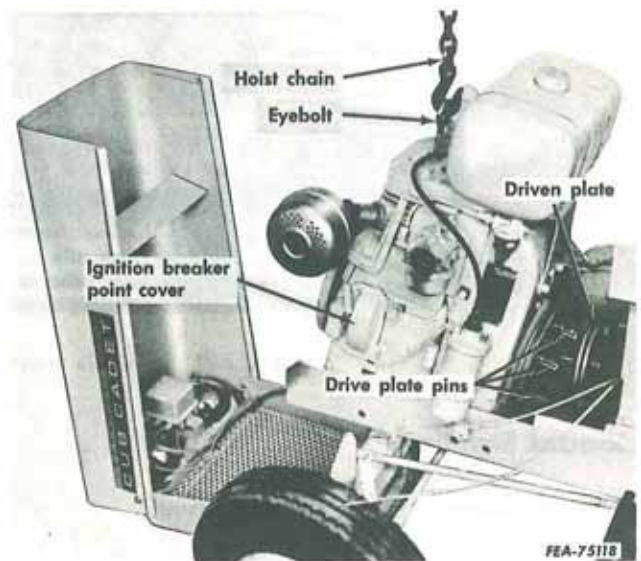
9. Disconnect the engine from the main frame. Two engine mounting cap screws on each side hold the engine to the frame. Refer to Illust. 1-3.

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. An eyebolt (3/8" N.C.) can be installed in place of one cylinder head bolt. Refer to Illust. 1-4.



Illust. 1-3. Right side view Model 122.



Illust. 1-4. Lifting the engine from the frame. (Model 71 shown.)

## Disassembly

1. Drain engine oil.

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

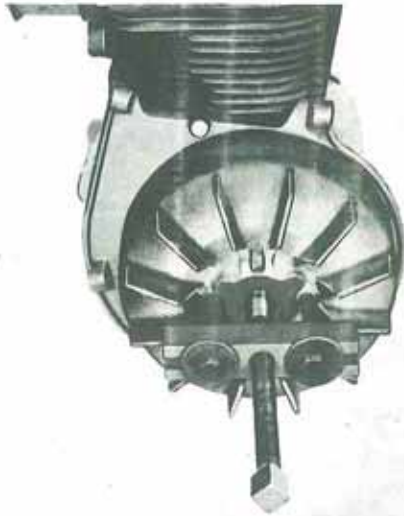
3. Remove breaker point assembly and breaker point push rod.

4. Remove rotating screen and drive pulley assembly.

5. Remove blower housing, cylinder baffle and head baffle.

6. Remove breather plate assembly.





FEA-75122

Illust. 1-5. Removing flywheel.

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

**NOTE:** The flywheel is mounted on a tapered shaft and can be removed with the use of a puller. If flywheel seizes to the shaft, screw the puller tight and rap end of the puller sharply with a hammer (Illust. 1-5).

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

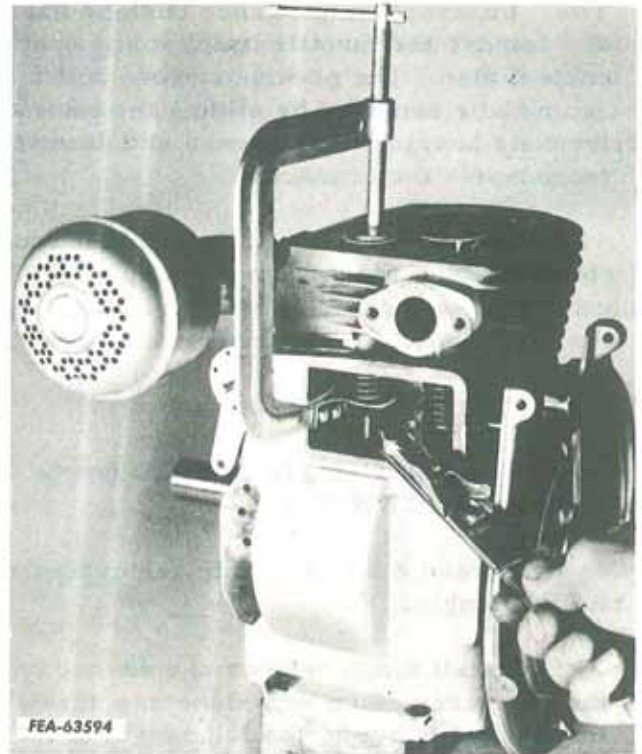
9. On manual starting engines, remove the retractable starter assembly and its mounting plate.

10. Remove the cylinder head.

11. Compress the valve springs and remove the valve keepers, springs, retainers and valves (Illust. 1-6).

12. Remove the oil base.

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



FEA-63594

Illust. 1-6. Valve spring compressed to remove or install keepers.

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

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

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

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

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

18. Loosen the screw (located below and to the right of the governor bushing nut) until governor gear is free to slide up, off the stub shaft. Do not remove the screw.

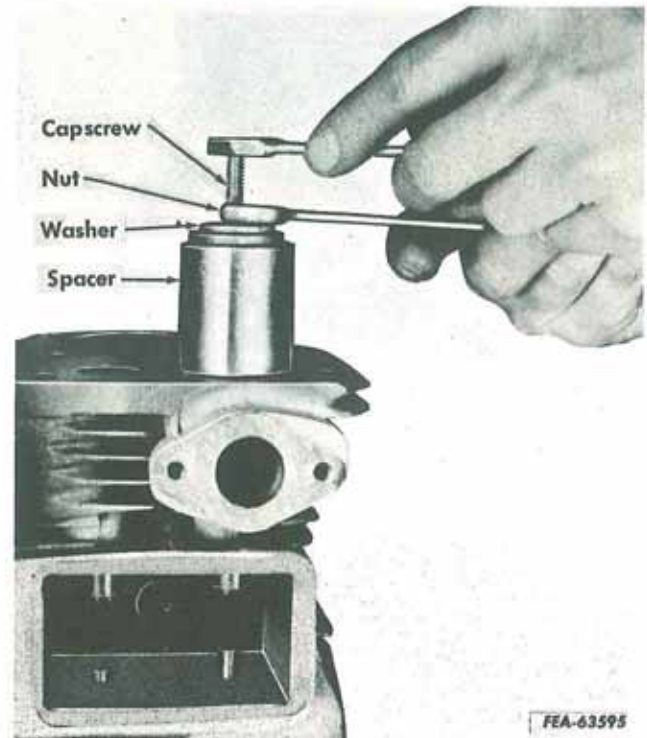
19. To remove the valve guides:

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

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

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

Hold the cap screw and turn the nut, as shown in Illust. 1-7.



Illust. 1-7. Removing valve guides.

## 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 rebores then hone to exactly .010, .020, or .030 over standard bore size.

3. Use an inside micrometer or dial gauge to determine cylinder size and condition before and during honing.

4. Oversize piston and ring assemblies must be used in crankcases which have been rebored.

5. Any commercial 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 - - - - - 1.1855 to 1.1860

K-241 and K-301 - 1.4995 to 1.5000

If out-of-round, replace shaft or regrind to .010 undersize.

3. Check gear, keyway and tapered part of shaft for wear. If worn, replace shaft.

## Connecting Rod

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

2. Connecting rod bearings are an integral part of the rod and not separately replaceable.

3. Connecting rods .010 undersize are available for reground crankshafts.

## Piston

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

2. NEVER RE-USE OLD RINGS.

3. When inserted in cylinder, piston ring end clearance should be as follows:

K-161 - - - - - .007 to .017 inch

K-241 and K-301 - .010 to .020 inch

4. Clean grooves and fit new rings.

5. With rings in place, check clearance with a feeler gauge. Replace piston if a .005 feeler can be inserted between ring and land.

## 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 large end of rod, it is advisable to install a new piston pin.

3. Oversize pins are available.

4. Assemble piston to connecting rod. Use a commercial rod aligner. Piston must be square with cylinder bore and crankshaft.

## Valves, Seats and Guides

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

2. If worn, replace valve guides. Press new guide into the crankcase a depth below top surface of cylinder block as specified:

K-161 - - - - - 1-5/16 inches

K-241 and K-301 - 1-15/32 inches

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

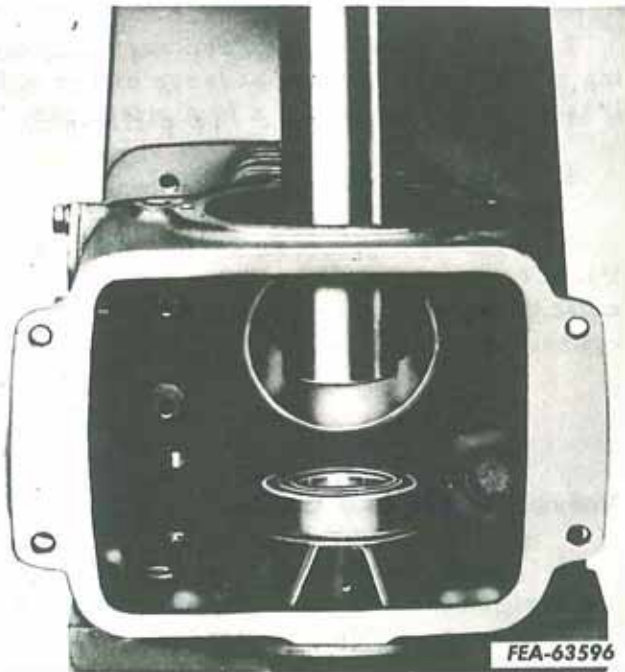
3. Intake valve seat is machined into block. An insert is available for service. Refer to Specifications for bore and depth for machining block before installing the insert.

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

5. The valve seat should be held as nearly as possible to 1/32 inch in width. Seats with more than 1/16 inch width should be reconditioned with 45 degree or 15 degree cutters and ground to form proper seat.

6. Check the governor stub 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, or valve spring compartment.

## Reassembly



Illust. 1-8. Installing rear main bearing.

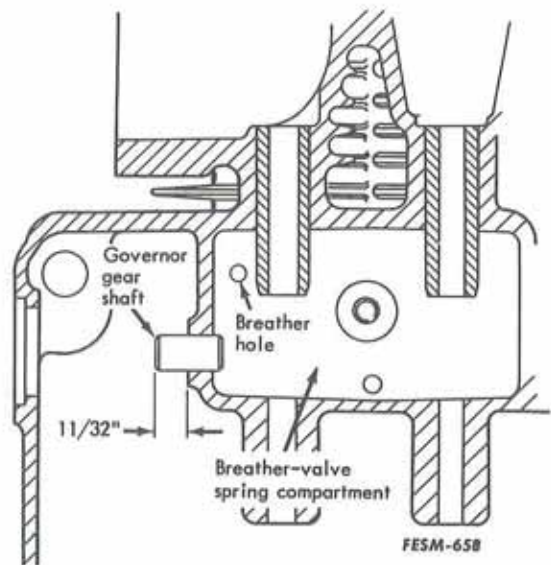
Install rear main bearing by pressing it into cylinder block with shielded side facing to inside of block (Illust. 1-8).

### Governor

1. Install the governor stub shaft and expansion plug, if they were removed. See Illust. 1-9.

2. Place spacer washer on stub shaft and slide governor gear assembly into place.

3. Place cylinder block on its side. Slide governor cross-shaft into place from



Illust. 1-9. Height of governor gear shaft.

inside of block. Make sure tab on governor shaft is against pin in end of governor gear.

4. Place speed control disc on governor bushing nut and thread bushing nut into block, clamping throttle bracket into place.

5. 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.

6. Tighten holding screw from outside of cylinder block. This screw prevents governor gear from sliding off stub shaft during assembly.

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



## Automatic Compression Release



FESM-659

Illust. 1-10. Starting position.



FESM-660

Illust. 1-11. Running position.

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.

## Identification

Engines equipped with Automatic Compression Release may be identified as follows:

- K-161 - Specification suffix J or higher
- K-241 - Specification suffix D or higher
- K-301 - Specification suffix B or higher

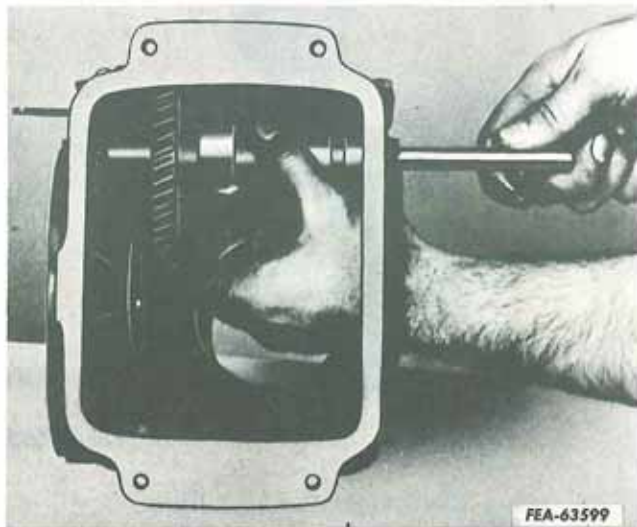
## Valve Adjustments

When setting valve clearances, the following procedure must be followed:

1. The piston must be at top dead center (end of compression stroke) to insure that the exhaust tappet is not riding on the release mechanism.
2. Valves must be set in normal way.
3. Automatic Compression Release engines do not have a spark advance mechanism. Breaker point gap should be set at .020 fully opened and final timing may be set with the use of a timing light using the "SP" mark on the flywheel at any speed.

## Valve Tappets and Camshaft

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



Illust. 1-12. 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. 1-12), and press into the front side of the block.

3. Check camshaft end clearance specified as follows:

K-161 - - - - - .005 to .025 inch

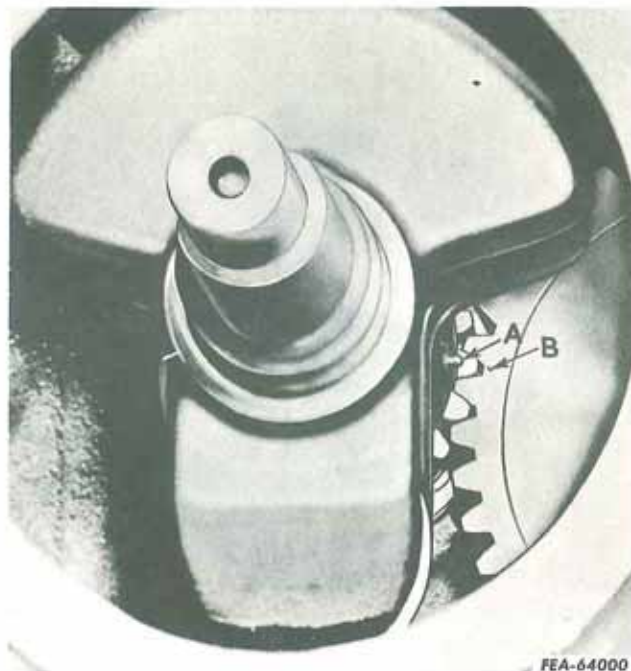
K-241 and K-301 - .005 to .010 inch

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

## Installation of Crankshaft

1. The installation of the crankshaft in the cylinder block is shown in Illust. 1-13.

2. Timing marks are provided on the crankshaft and camshaft gears for correct timing of engine. When in place, the mark between teeth of camshaft "B" (Illust. 1-13) must line up with the mark on shoulder of crankshaft "A" (Illust. 1-13). Chalk timing mark positions for ease of viewing during assembly.



Illust. 1-13. Crankshaft installation, A and B are timing marks.

## Bearing Plate

1. Press front main bearing, shielded side up, into bearing plate.
2. Place bearing plate and gasket on crankshaft.
3. Carefully press the bearing plate assembly onto the crankshaft and into the block.
4. Install four cap screws with copper washers. Draw cap screws up evenly.

## 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. 1-15 is toward the flywheel side of the engine. Secure piston pin with retainer rings. Always use new retainer rings. Be sure the retainer rings are fully engaged in the grooves in piston bosses.





FEA-64001

Illust. 1-14. 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. Position a feeler gauge between the ends of the ring and compare the existent gap against the specified gap for a new ring. Specified gap as follows:

K-161 - - - - - .007 to .017 inch

K-241 and K-301 - .010 to .020 inch

Remove the first ring and install the other one and repeat the foregoing procedure. This check is not necessary with the oil ring.

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. 1-15) is toward flywheel side of engine. Use a ring com-

pressor to prevent ring breakage during installation (Illust. 1-14).

### Attaching Rod to Crankshaft

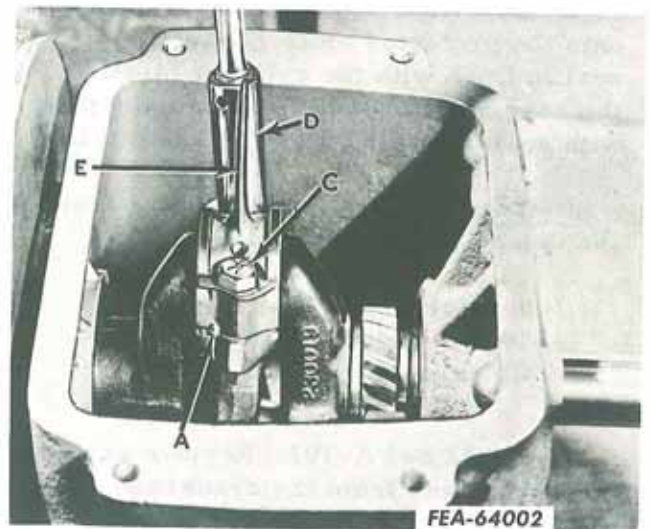
1. After piston assembly is installed, place the block on end and oil connecting rod and crankpin.

2. It is important that marks on the connecting rod and cap "A" (Illust. 1-15) line up and face flywheel end of engine "B" (Illust. 1-15). The oil hole in the cap is on the camshaft side of the engine when properly installed.

3. Install connecting rod cap, lock and cap screws to connecting rod (Illust. 13).

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

**NOTE:** Be careful not to bend the oil slinger "E" (Illust. 1-15).



FEA-64002

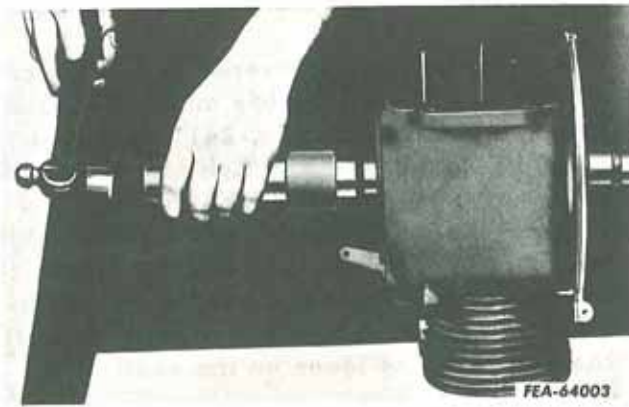
Illust. 1-15. Tightening connecting rod cap screws.

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

## Installation of Oil Seals on Crankshaft

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

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



FEA-64003  
Illust. 1-16. 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. 1-16).

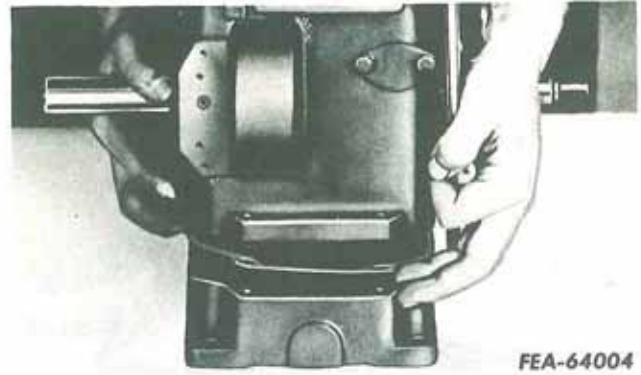
**NOTE:** The two seal protector tools and the driver can be ordered from:

Service Tools Inc.,  
1901 S. Indiana Ave.  
Chicago 16, Illinois

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

### Oil Base

1. Assemble oil base to the block with four screws (Illust. 1-17).



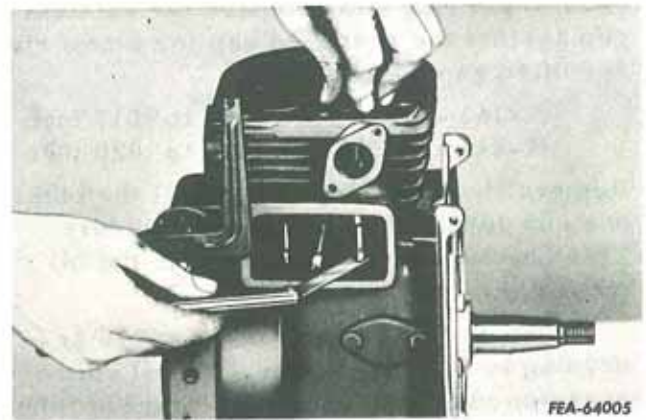
FEA-64004  
Illust. 1-17. Installing oil base.

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. Valves and seats should be ground to obtain a good valve seal. Keep valve seat from 1/32 inch to 1/16 inch in width. Valve face and seat angle is 45 degrees.



FEA-64005  
Illust. 1-18. Checking valve clearance.

2. Illust. 1-18 illustrates checking valve clearance. Specified valve clearances are as follows:

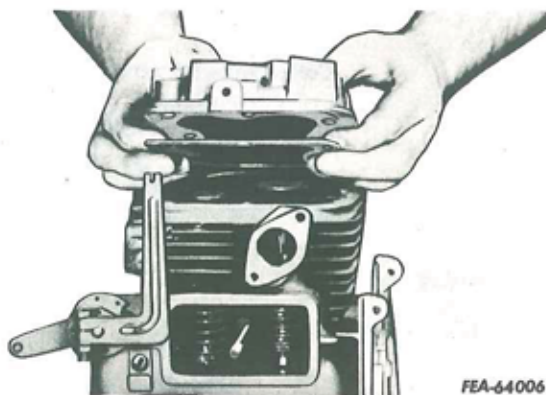
K-161	.006 to .008 cold (Intake)
	.015 to .017 cold (Exhaust)
K-241 and K-301	.008 to .010 cold (Intake)
	.017 to .020 cold (Exhaust)



Valves that do not have sufficient clearance on K-161 engine must be removed and stem ends ground until desired clearance is obtained. Tappets on the K-241 and K-301 engines are adjustable. 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. Positioning of the camshaft so the tappet is retracted will make the installation of the locking keys easier.

### Cylinder Head



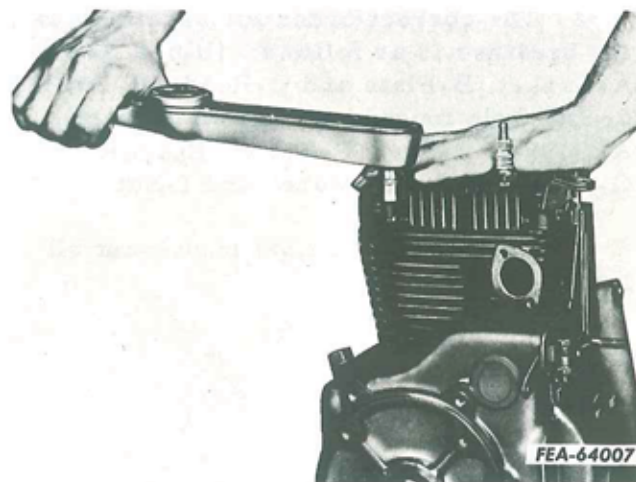
Illust. 1-19. Cylinder head assembly.

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

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

3. It is important that cylinder head cap screws be tightened evenly and in steps until inch pounds torque specified is reached: (Illust. 1-20.)

K-161 - - - - - 200 inch pounds  
 K-241 and K-301 - 300 inch pounds

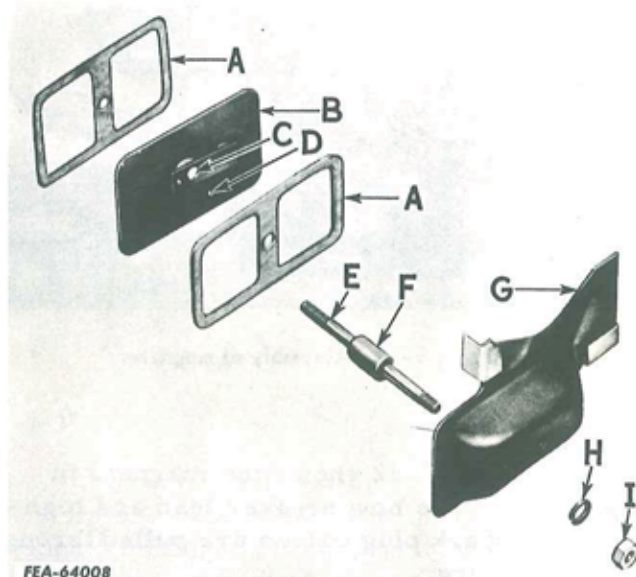


Illust. 1-20. Tightening cylinder head cap screws.

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

### Breather Assembly

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



Illust. 1-21. Exploded view of breather and vent assembly.

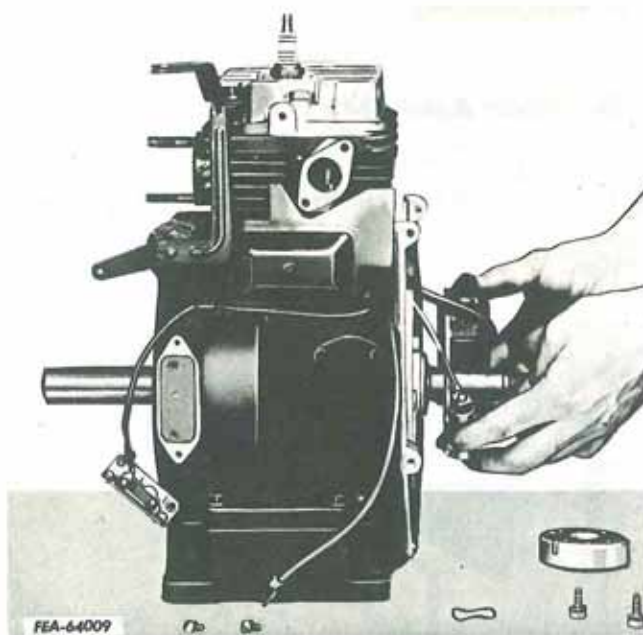
A - Gaskets	D - Hole	G - Cover
B - Plate	E - Stud	H - Washer
C - Reed	F - Spacer	I - Nut

2. The correct order for assembly of the breather is as follows: (Illust. 1-21) A-Gasket, B-Plate and C-Reed, (D-small drilled hole must be at bottom of plate), A-Gasket, E-Stud, F-Rubber Spacer, G-Cover, H-Lock washer and I-Nut.

3. Cover must be tight to prevent oil leaks.

### Magneto (If equipped)

1. Install square key in slot of crankshaft.



Illust. 1-22. Assembly of magneto.

2. Illust. 1-22 shows the magneto in position. Note how breaker lead and high tension spark plug cables are pulled through plate opening.

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

### Flywheel

**NOTE:** At this time it is desirable to clean the "SP" mark area so it will be readily visible for engine timing.

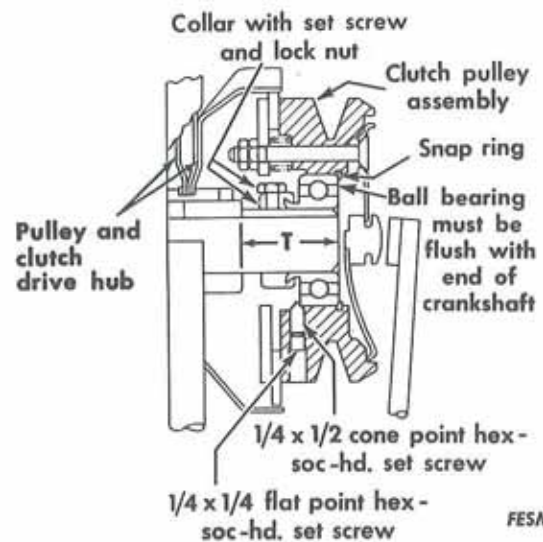
1. Place tension washer (engines with retractable starter) on crankshaft and place flywheel in position. (The square key holds flywheel on shaft.)

2. Install blower housing, screen, "V" pulley, lock washer, and flywheel nut. Torque the nut to 75 ft. lbs.

3. Install the main clutch drive plate to the "V" pulley.

4. Attach motor-generator brace (when so equipped) with cap screw in proper hole.

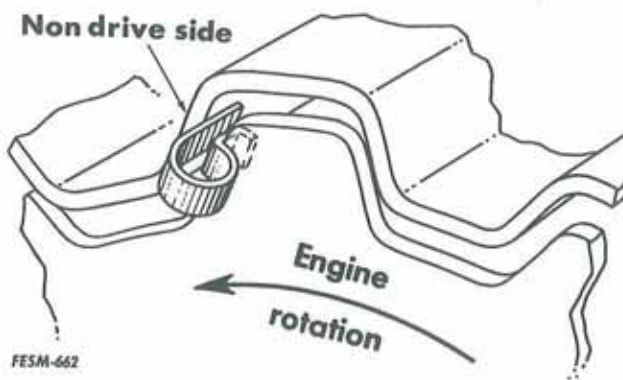
5. Install the retractable starting assembly and its mounting plate (if so equipped).



Illust. 1-23. Correct installation of PTO clutch.

6. Install the starting pulley and clutch if so equipped (Illust. 1-23). The dimension "T" from the front face of the starter-generator pulley hub to the end of the crankshaft must be 1-1/2 inches for the Cub Cadet 71 Tractors, and 1-1/4 inches for the Cub Cadet 102, 122, and 123 Tractors. Be sure the pulley set screws are torqued to 12 to 14 foot pounds. If these screws must be tightened, the set screw that contacts the engine shaft must be tightened first; then tighten the set screw that contacts the key.





Illust. 1-24. Correct installation of friction disc springs.

7. Equally space and install three disc springs on the friction disc lugs on the non-drive side of the lugs, see Illust. 1-24.

### Breaker Points

1. Install push rod.
2. Fasten breaker in place with two screws.
3. Place the cover gasket in position and attach the magneto lead or coil lead.
4. Set breaker gap at .020. For precision ignition setting refer to Ignition Timing, page 1-28.
5. Make final adjustments before installing the breaker point cover. Be sure breaker lead grommet is in place.
6. Fasten the coil (if equipped) to blower housing and attach high tension lead to spark plug.

### Carburetor

1. Insert a new gasket and assemble the carburetor to the intake port with two screws.
2. Refer to FUEL SYSTEM, page 1-19 for carburetor adjustment procedure.

### Governor Arm and Linkage

1. Insert carburetor linkage in throttle arm.
2. Connect the governor arm to carburetor linkage and slide the governor arm onto the governor shaft.
3. On the Model 71, position the governor spring in the speed control disc. On the Model 102, 122 and 123, install the governor spring, as shown in Illust. 1-2.
4. Before tightening clamp bolt, turn the shaft counterclockwise as far as possible with a pair of pliers, move the governor arm as far as possible (away from carburetor on the 71 and toward the carburetor on the 102, 122 and 123). Tighten the nut and check for freedom of movement.

### Cylinder Baffles and Fuel Tank

1. Install the cylinder baffles and the head baffle.
2. Gasoline fuel tank and brackets are installed at the same time as the baffles.
3. Connect the fuel line between the sediment bowl and carburetor.

### Motor-Generator (If equipped)

Install the generator-cranking motor 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 1-24 and 1-25) under Electrical System of this manual for the proper electrical connections.

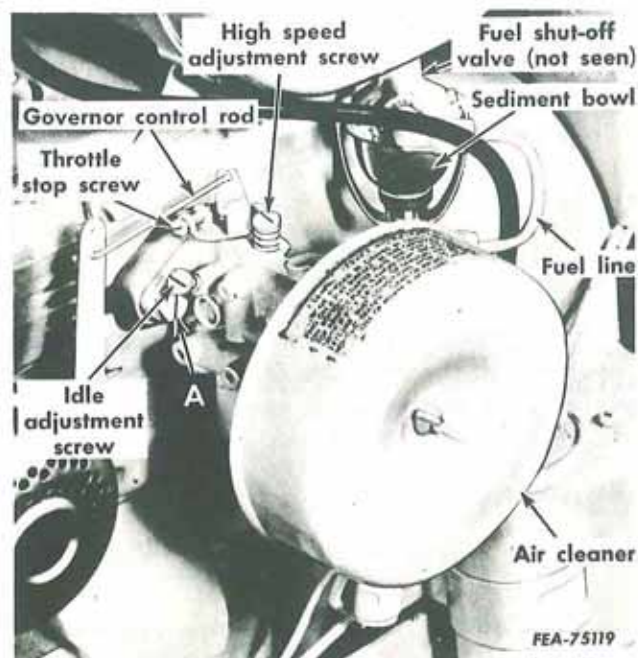


# FUEL SYSTEM

## 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 or dirt in one of the components. If gum forms in the components it will be necessary to completely disassemble and thoroughly clean the carburetor.



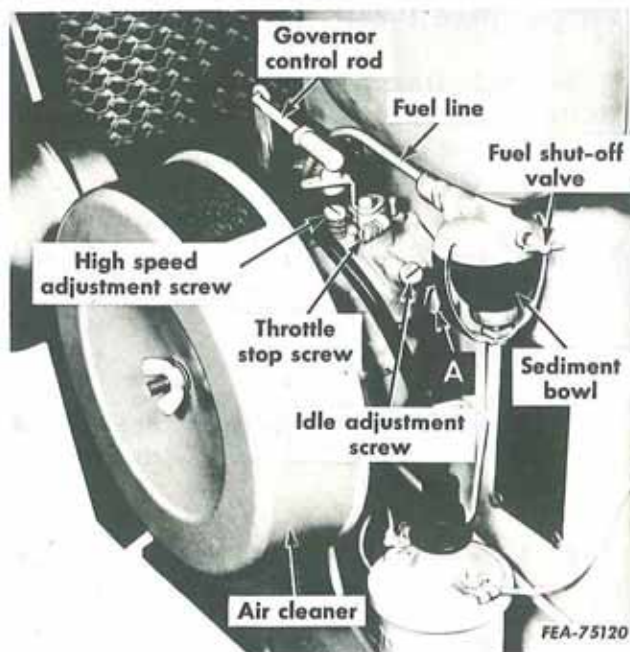
Illust. 1-25. Carburetor for Model 71.

## Carburetor Adjustments

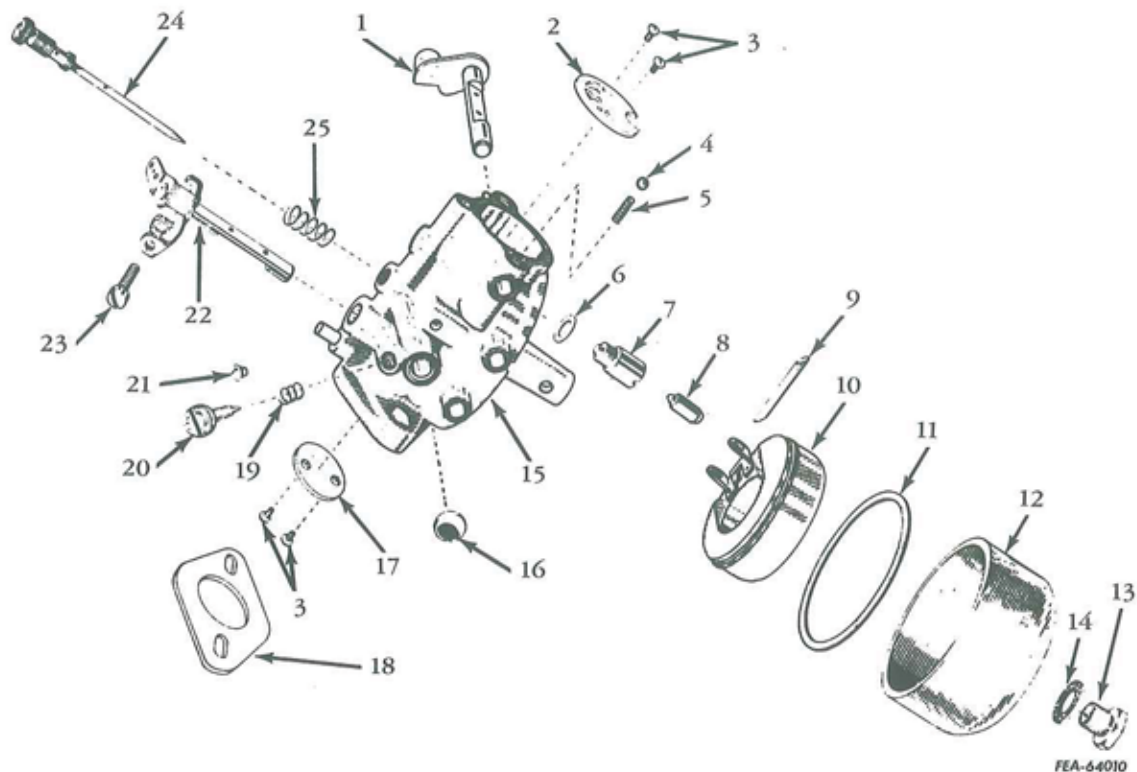
(Refer to Illust. 1-27)

The carburetor is adjusted at the factory and under normal operating conditions will not require readjusting. If readjustment is necessary because of fuel values and oil conditions, the following procedure is recommended:

1. Turn the high speed adjustment screw counter-clockwise two turns from closed position, turn the idle adjusting screw 1-1/2 turns from the closed position and start the engine.
2. After the engine has reached normal operating temperature, accelerate and check the response. Place the engine under full load and adjust the high speed adjustment screw for leanest mixture that will still allow satisfactory acceleration and steady governor operation.



Illust. 1-26. Carburetor for Model 102, 122 and 123.



Illust. 1-27. Exploded view of carburetor.

- |                                   |                      |                           |                                 |
|-----------------------------------|----------------------|---------------------------|---------------------------------|
| 1. Choke shaft and lever assembly | 6. Gasket            | 14. Gasket                | 21. Rivet plug                  |
| 2. Choke valve                    | 7. Float needle seat | 15. Body                  | 22. Throttle shaft              |
| 3. Screws                         | 8. Float needle      | 16. Expansion plug        | 23. Low idle stop screw         |
| 4. Choke shaft ball               | 9. Float pin         | 17. Throttle plate        | 24. High speed adjusting needle |
| 5. Choke shaft spring             | 10. Float            | 18. Gasket                | 25. Spring                      |
|                                   | 11. Gasket           | 19. Spring                |                                 |
|                                   | 12. Bowl             | 20. Idle adjustment screw |                                 |
|                                   | 13. Cap screw        |                           |                                 |

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

4. If engine shows sooty exhaust and is sluggish under full load, the high speed mixture is too rich. The high speed adjustment screw must be turned clockwise 1/4 turn at a time until the condition is corrected.

5. Final check of high speed adjustment; operate the engine under full load

and make any corrections necessary for smooth operation.

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

7. 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 adjustment screw or idle speed screw -- they will be damaged.



## Disassembly of Carburetor

(Refer to Illust. 1-27)

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 on the float lip. Check float pin holes for wear.
4. Remove the bowl ring gasket.
5. Remove the idle speed screw and high speed adjustment screw and spring

6. Remove throttle valve screws, valve, shaft and lever assembly.

7. Do not remove the choke valve and shaft unless replacement of these parts is necessary.

8. A spring loaded ball retains the choke in wide-open position.

**CAUTION:** Hold a screwdriver handle or small piece of wood over the threaded hole in air horn (side opposite choke lever) to prevent the ball from flying out when shaft is removed.

## 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. ALWAYS USE NEW GASKETS.

## Reassembly of Carburetor

(Refer to Illust. 1-27)

1. Install throttle, shaft and valve. Valve must be installed with trademark "C" on side towards idle port when viewing from flange side.

2. With valve screws loose and the throttle lever set screw backed out, seat the valve by tapping lightly with a small screwdriver. Hold in place while tightening screws.

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

4. 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).

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

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

7. Install high speed adjustment screw assembly. Turn in until the screw seats in nozzle and back out two turns.

8. Install idle adjusting screw assembly. Back out approximately 1-1/2 turns after seating lightly against jet.

**CAUTION:** Do not jam the adjusting screw into the seat as this will damage idle adjustment screw.



# GOVERNOR

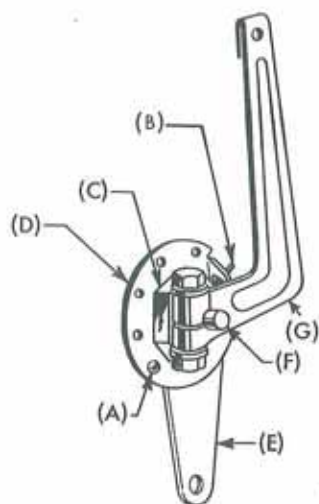
## Model 71

### 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, stop "A" is just touching the throttle control bracket "E" (Illust. 1-28).



FEA-64011

Illust. 1-28. Governor linkage.

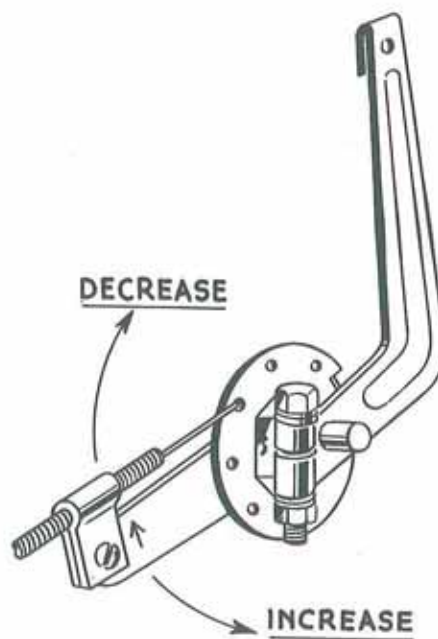
- |                     |                        |
|---------------------|------------------------|
| A - Drive Pin       | D - Speed Control Disc |
| B - Governor Spring | E - Throttle Bracket   |
| C - Bushing Nut     | F - Governor Shaft     |
| G - Governor Arm    |                        |

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.

To change high speed setting:

1. Loosen bushing nut (C, Illust. 1-28) slightly.
2. Moving the throttle bracket "E" (Illust. 1-28) counter-clockwise will rotate the speed control disc, increasing the tension on the governor spring "B" (Illust. 1-28), resulting in increased engine speed.
3. To decrease the engine speed, move the throttle bracket clockwise.
4. Tighten governor bushing nut "C" to lock throttle bracket "E", in desired position (Illust. 1-28).

**CAUTION:** Do not apply excessive pressure on bushing nut.



FEA-64012

Illust. 1-29. Speed range adjustments.

4. Operating speed range can be changed by moving the throttle bracket as shown in Illust. 1-29.

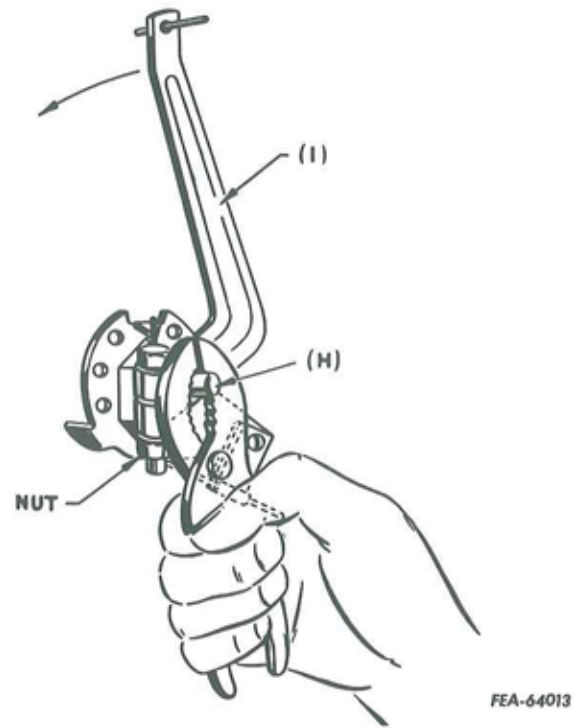
## Governor Adjustment

Governors are set when the engines are assembled and should not require readjustment unless the governor arm is loosened or removed from the governor shaft.

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

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

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



Illust. 1-30. Resetting governor.

## Model 102, 122 and 123

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

Governor sensitivity may be adjusted by means of changing the setting of the Governor spring in the governor lever (Illust. 1-2). 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.

## Throttle Control

Install throttle wire into clamp and tighten screw "B". Refer to Illust. 1-2.

## Governor Adjustment

Governors are set when the engines are assembled and should not require readjustment unless governor arm is loosened or removed from governor shaft.

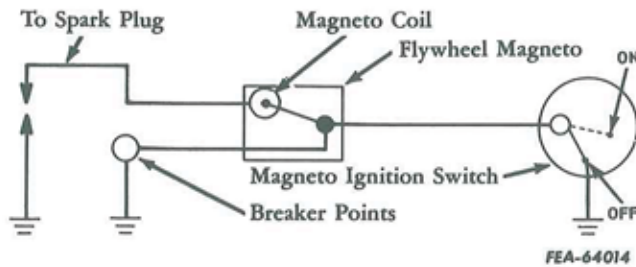
1. To reset governor loosen clamp bolt which holds governor arm, to shaft (Illust. 1-2).

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

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

# ELECTRICAL SYSTEM

## Magneto Ignition



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

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

### Testing Magneto

1. Check magneto output by placing the end of the spark plug cable about 1/8 inch from the crankcase and the engine. Remove the spark plug to make cranking easier.
2. If there is no spark, check the breaker points.
3. After the breaker points have been cleaned or replaced and there is still no spark, the magneto is at fault.
4. If a good commercial tester is available, components of the magneto can be checked. Refer to tester manufacturer's instructions for acceptance limit of coils.

## Battery Ignition

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

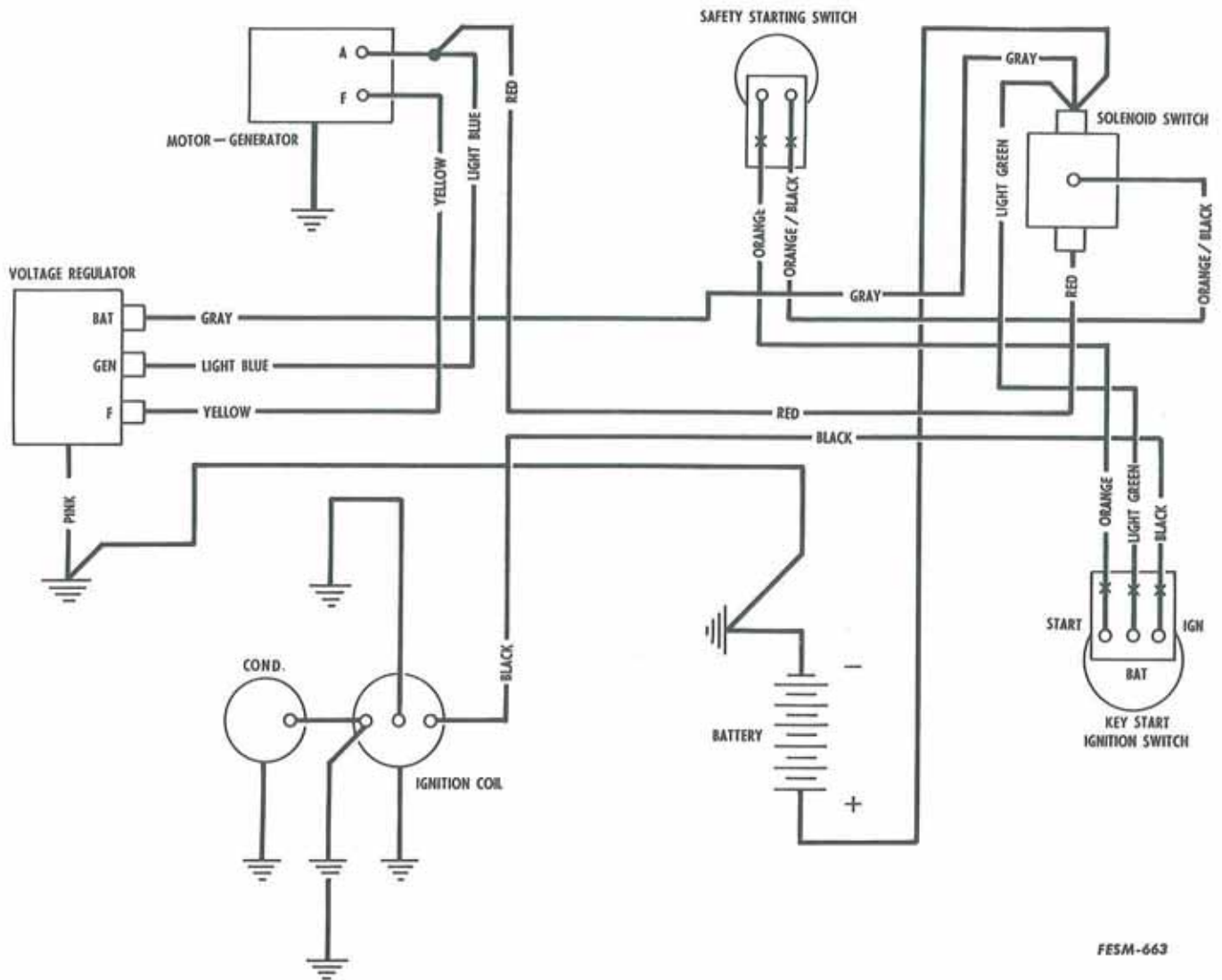
The motor-generator acts as a cranking motor when the starter switch is closed and a generator when the switch is open.

The voltage regulator controls current and voltage to the battery at all engine speeds. See Illust. 1-32.

### Solenoid and Switches

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





FESM-663

Illust. 1-32. Schematic wiring diagram of battery ignition for 71, 102, 122 and 123.

## 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.

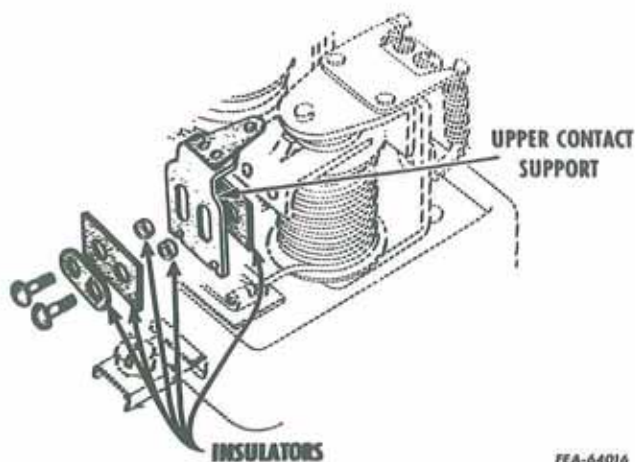
2. Brushes can be inspected or replaced by removing the two through bolts

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. Instructions for performing the test can be found in literature furnished with the test equipment.

## Current-Voltage Regulator

### Contact Points



Illust. 1-33. 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. 1-33. 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.

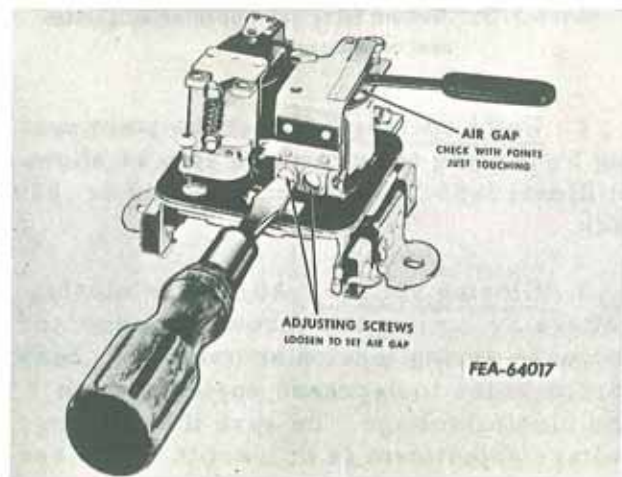
On (-) negative grounded system regulators the flat point is in the armature. Clean them by loosening the upper contact support and moving it to one side.

**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.

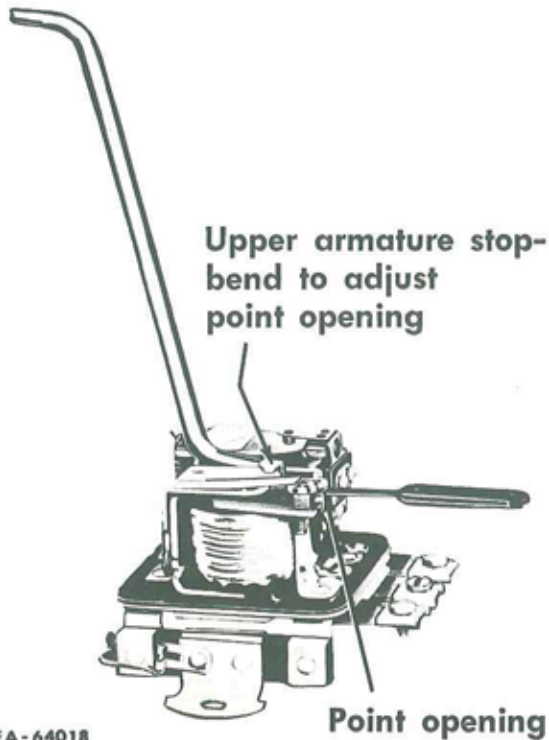
### Cut-Out Relay Adjustments

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.



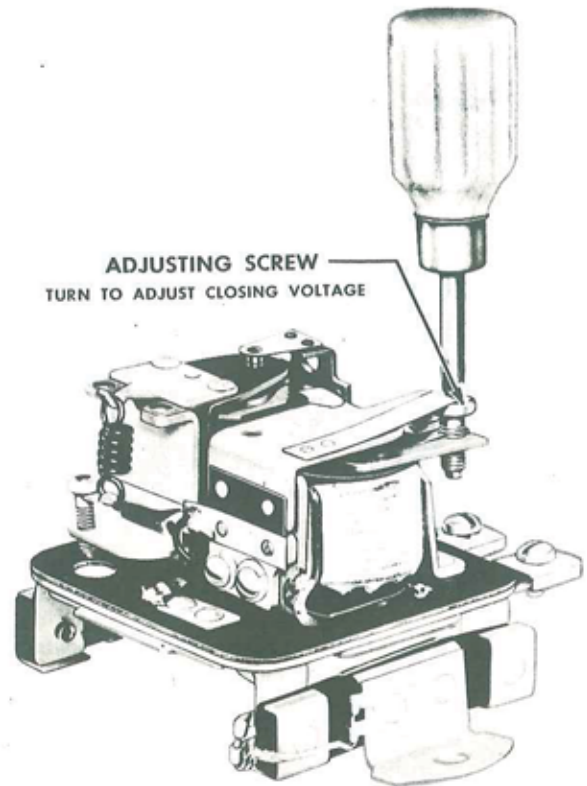
Illust. 1-34. Cut-out relay air gap inspection and adjustment.

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. 1-34. The air gap should be .020 inch. Adjust by raising or lowering the armature at its hinge mounting. Retighten screws after adjustment.



FEA-64018

Illust. 1-35. Cut-out relay point opening inspection and adjustment.



FEA-64019

Illust. 1-36. Adjustment of cut-out relay closing voltage.

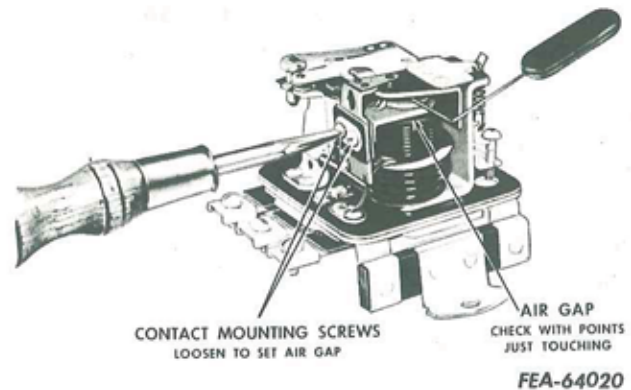
2. Point opening. Adjust the point opening by bending the armature stop as shown in Illust. 1-35. The opening should be .020 inch.

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. 1-36.

## Regulator Adjustment

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

1. Regulator air gap. To check the air gap, push the armature down until the contact points are still just touching; then

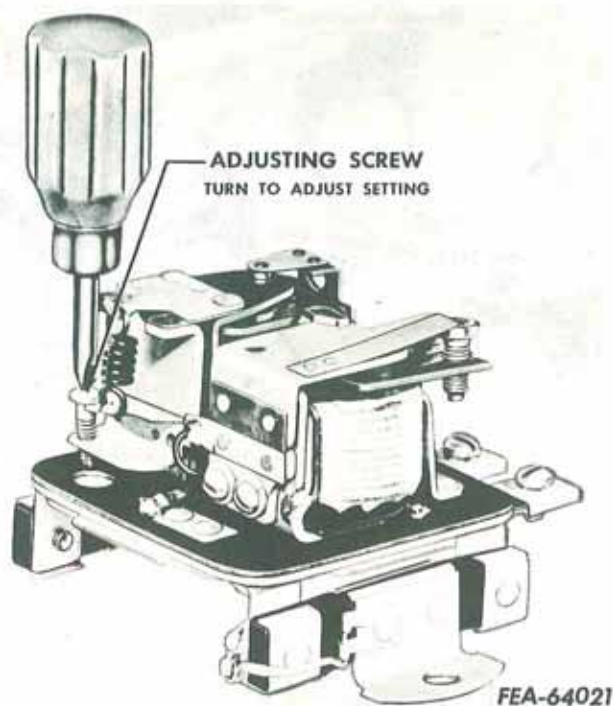


FEA-64020

Illust. 1-37. Current-voltage regulator air gap inspection and adjustment.

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. 1-37.





Illust. 1-38. Adjusting voltage setting, current-voltage regulator unit.

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. 1-38.

**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 pres-

sure is relieved. If this happens, turn the screw counterclockwise until enough clearance develops between the screw head 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.

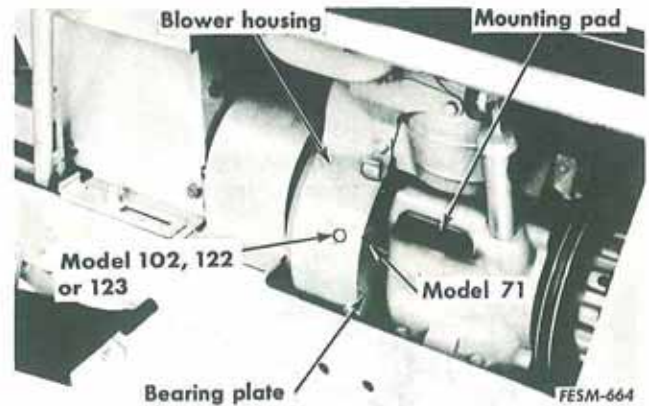
## Ignition Timing

1. For static ignition timing, remove the ignition breaker point cover (Illust. 1-4). 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 71 and in the right side of the blower housing on the Model 102, 122 or 123. (Illust. 1-39)

3. If timing light is available, adjust breaker point gap while the engine is running until "SP" mark on flywheel is centered in sight hole (Illust. 1-39).

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



Illust. 1-39. Location of timing sight hole. (Starter-generator has been removed to better illustrate location.)

## Breaker Assembly

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

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

3. Pitted or burned points should be

replaced. See ignition timing for proper setting.

**NOTE:** If excessive crankcase oil is present in the breaker point assembly, it is an indication that the breather assembly components are assembled improperly, see Illust. 1-21, or the breather hole in the valve compartment of the crankcase is plugged, see Illust. 1-9.

## Spark Plug

1. Service periodically to reduce fouling. The deposits are hard to remove if allowed to remain longer than 100 operating hours.

2. Degrease wet or oily plug and dry thoroughly.

**CAUTION:** If spark plug is sand blasted, make sure all sand is removed by washing

in a cleaning solvent and dry with compressed air.

3. File electrode sparking area to obtain 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 commercial condenser tester. Replace as necessary.



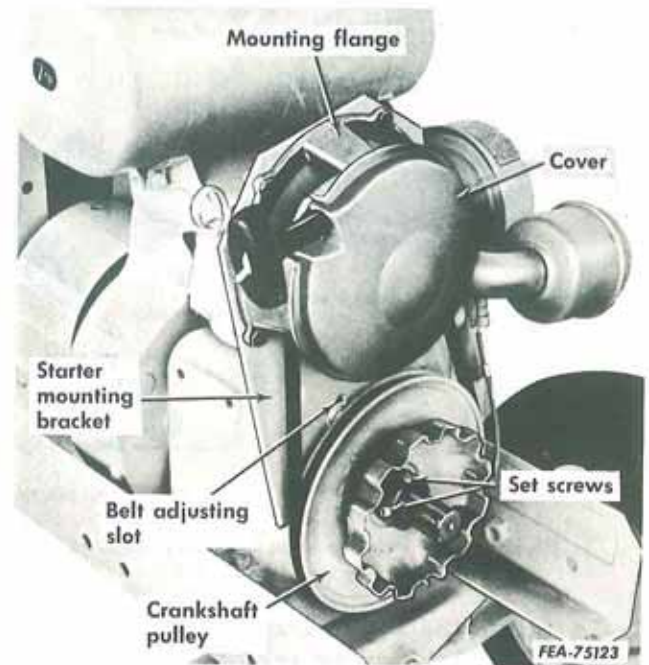
# RECOIL STARTER

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

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

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

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

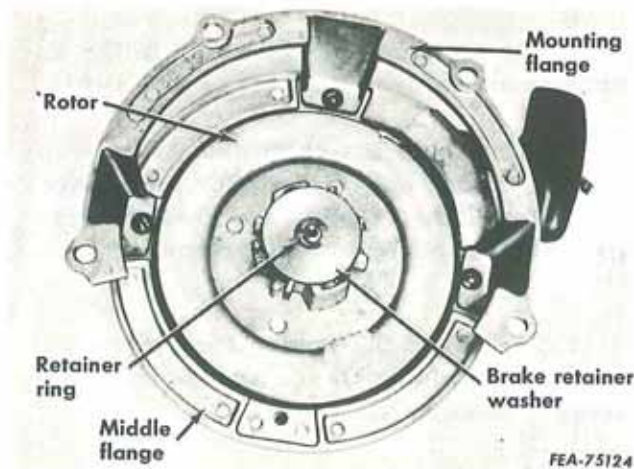


Illust. 1-40. Model 71. Recoil starter and mounting bracket.

## Removal

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

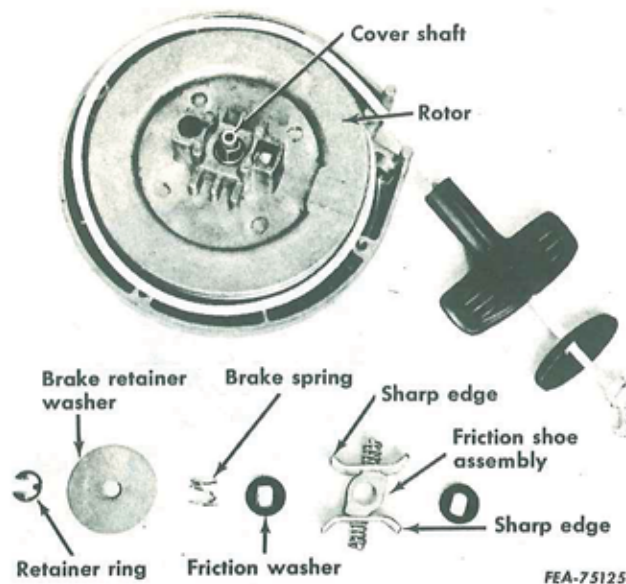
## Disassembly



Illust. 1-41. Starter assembly rear view.

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

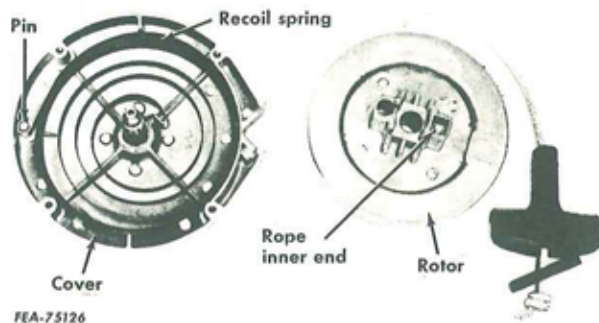




Illust. 1-42. Friction shoe assembly removed.

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

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



Illust. 1-43. Rotor removed to show recoil spring in cover.

8. Remove the recoil spring from the cover.

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

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

## Inspection and Reassembly

1. Clean the recoil spring in solvent, inspect the hook ends, lubricate spring with light oil then install the spring in the cover. Spring must spiral in a clockwise direction as you follow the spring from the outside end to the inside. Refer to Illust. 1-43.

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

3. Install the rope (clip end) through the rotor then double the clip end back and retrieve the rope to "lock-in" the clip end.

Wrap the rope around the rotor in the direction shown in Illusts. 1-42 and 1-43.

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

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

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

7. Check the friction shoe sharp ends, replace if worn then install the shoe assembly to the shaft and rotor. Be sure the shoe assembly is right-side-up as shown in Illust. 1-42.

8. Install the second friction washer.

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

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

NOTE: Some starter assemblies available from parts depots have a long rolled pin in the end of the cover shaft. Pull this

pin from the shaft. It is not used on the Model 71 cadet tractor.

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

NOTE: The starter pulley is a press fit on its bearing shaft. A wire clip holds the sealed bearing assembly in the bracket. If replacement of the support bracket is necessary, both set screws in the crankshaft pulley hub must be loosened to move pulley forward then bracket capscrews can be removed. For replacement refer to Illust. 1-23, page 1-18.





# CHASSIS

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## 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	5-6
Clutch, 1/4 x 1/4 inch flat point set screws	6-7

### 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	Same as engine speed

### Bearings (PTO shaft)

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

### Shaft, PTO (diameters)

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

### Retainer (rear bearing and oil seal)

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

Oil Seal is installed with lip toward lubricant

## Brake

Type	Disc
Location	On transmission countershaft

## Reduction Drive

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



## Transmission

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 . . . . . .848 to .852 inch  
Between 3rd speed driven gear and 2nd speed driven gear . . . . . 1.310 to 1.314 inches  
Between 2nd speed driven gear and 1st speed driven gear . . . . . .310 to .314 inch  
Between 1st speed driven gear and reverse driven gear . . . . . .686 to .690 inch  
Between reverse driven gear and rear bearing . . . . . .690 to .694 inch

## 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 . . . . . 1.5 to 8.0 in. lbs.  
Adjusting shims . . . . . .004, .007, .015, .030 inch  
Bevel gear and pinion backlash . . . . . .003 to .005 inch  
Bevel gear location . . . . . On differential case  
Pinion location . . . . . Integral part of countershaft  
Ratio (bevel gear and pinion) . . . . . 13 to 46

# GENERAL INFORMATION

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

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

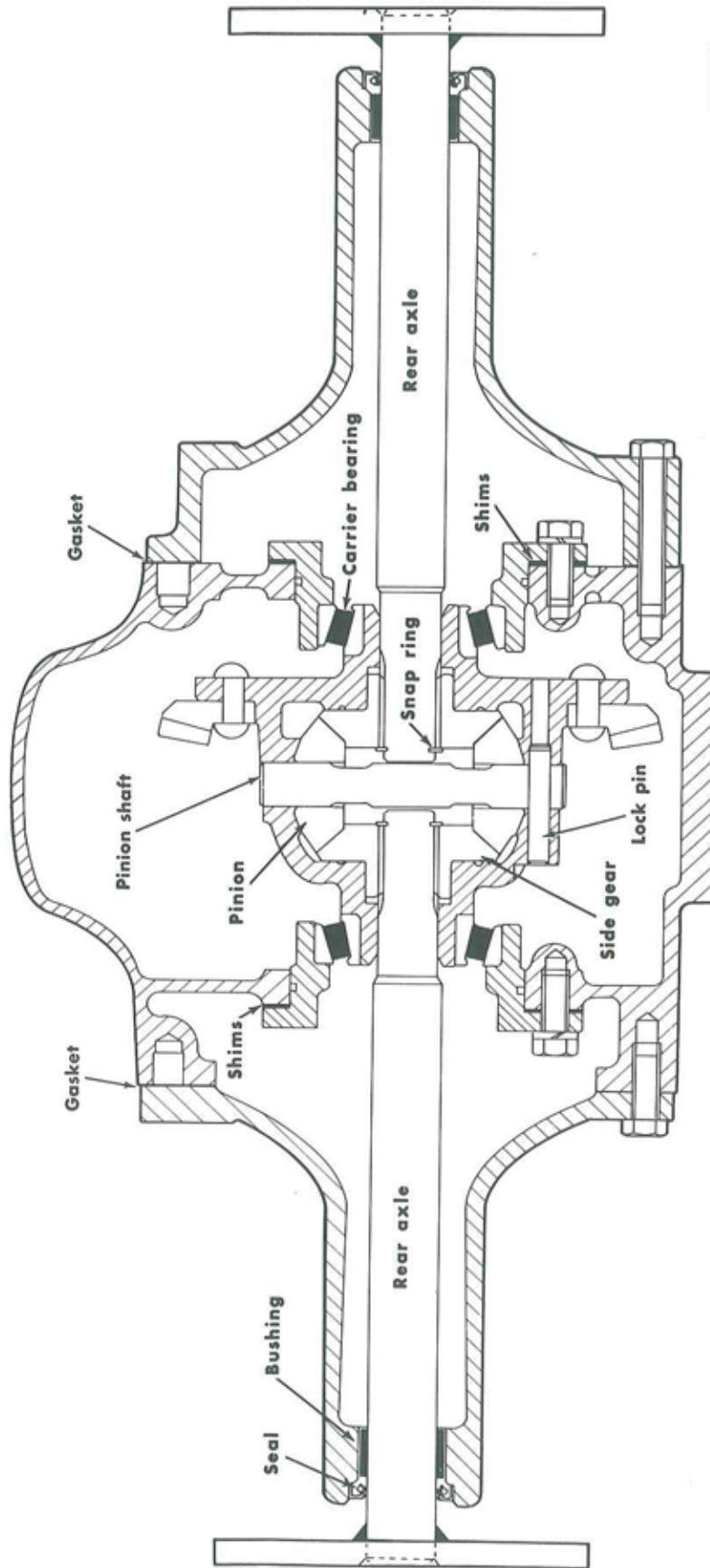
Power is transferred directly to the clutch by a driving plate attached to the engine flywheel pulley.

### 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.

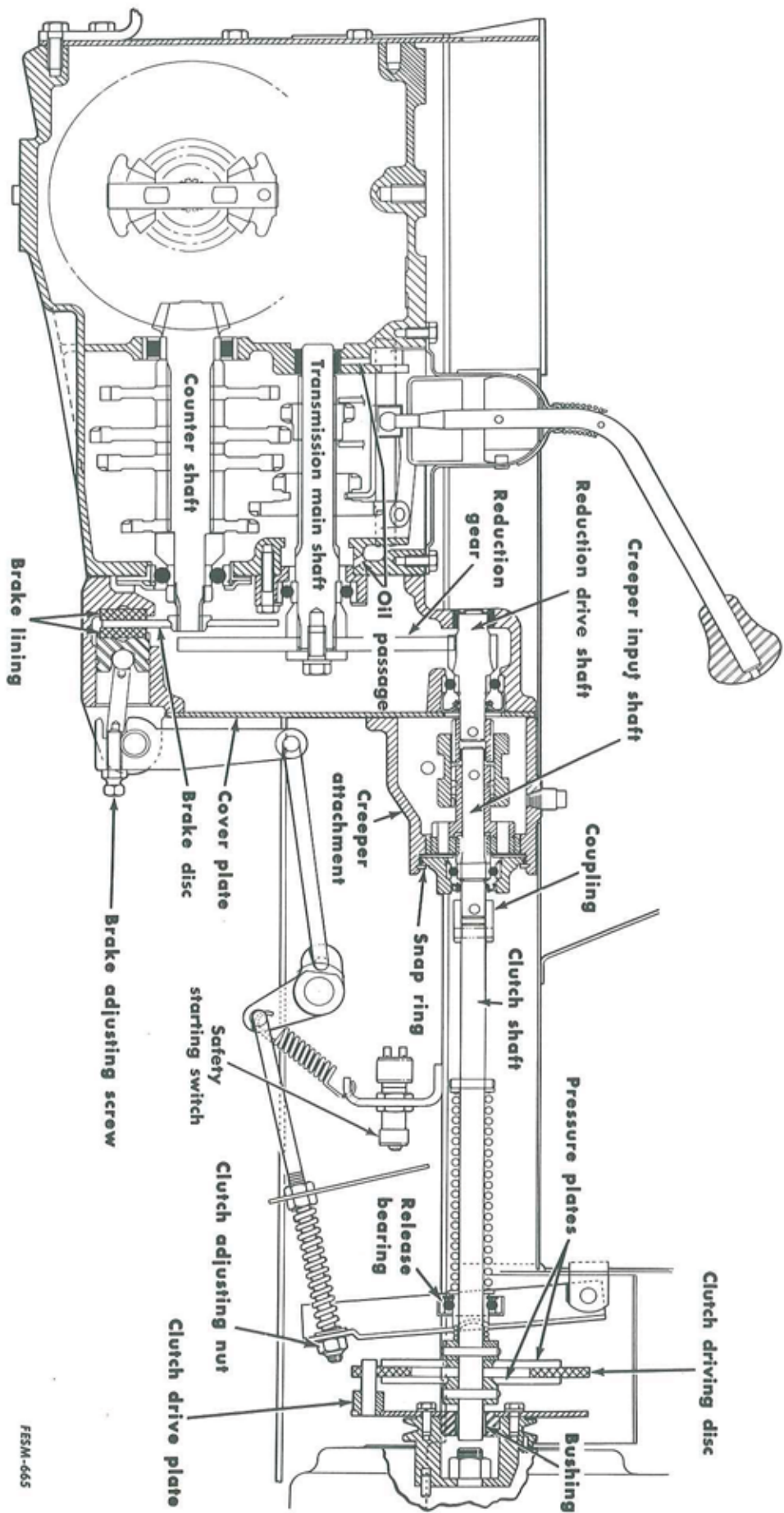
### Brake

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.



FEB-14035

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



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

FESM-665



## Reduction 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

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

## Differential

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

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

## Rear Axles

The rear axles are splined on their inner end where they are supported and driven by the differential side gears. Snap rings secure the axle shafts in the side gears. A bronze bushing in each axle carrier supports the rear axle outer end. A flange is welded to the axle outer end to receive the rear wheels.

## Front Axle

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.

## 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 model cadets by removing the ball bearings and pressing in service bushings.

## Steering

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 caster, camber, and toe-in for easy steering and trouble free operation.

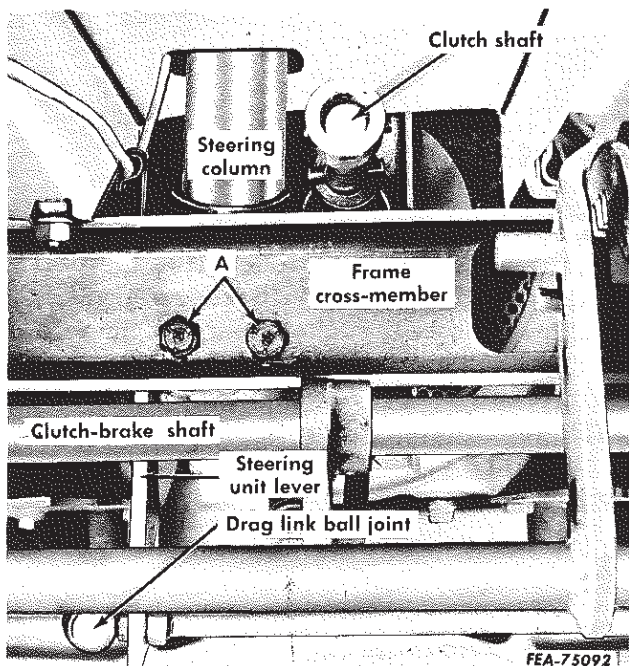
## Creeper Attachment

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 shifting as desired.

# STEERING ASSEMBLY

## Removal

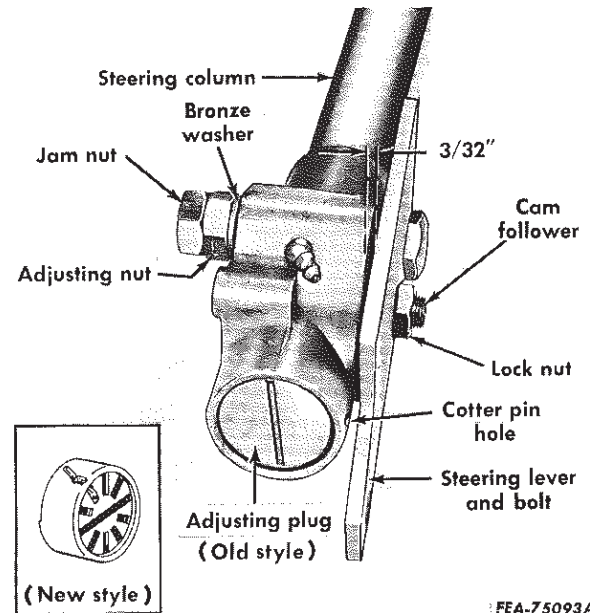
1. Hold the steering wheel with front wheels in straight ahead position. Remove the steering wheel.
2. Remove the felt seal, retainer, bearing and bearing retainer from the upper end of the steering column.
3. Remove the drag link rear ball joint from the steering unit lever.



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

4. Remove capscrews "A" (Illust. 2-3) from the frame cross member and steering unit. Remove stabilizer bolt from right side of frame if tractor is so equipped.

5. Lower the steering column assembly through the instrument panel pedestal and grommet.

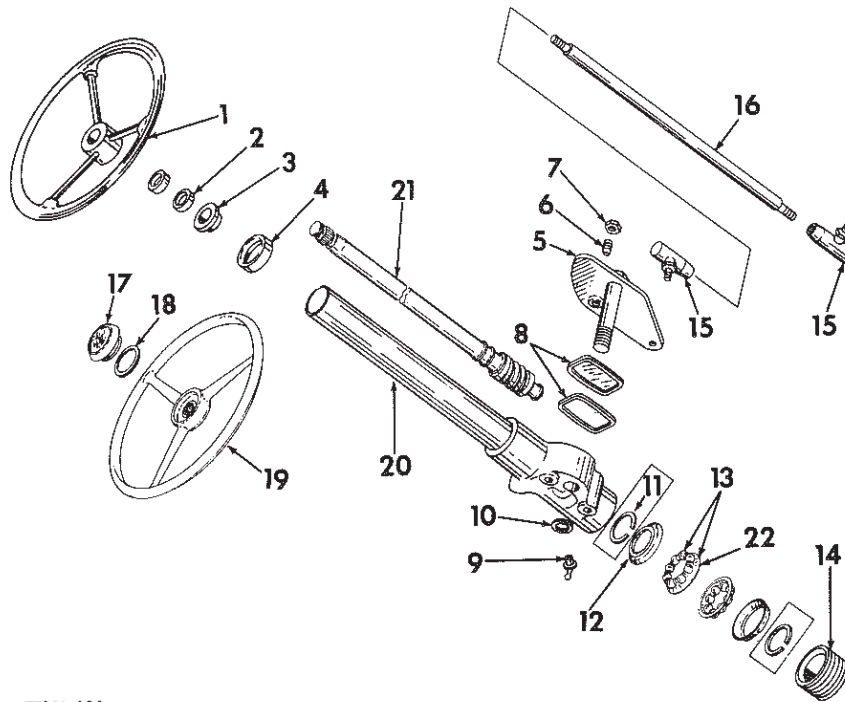


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Illust. 2-4. Steering assembly.

## Disassembly

1. Secure the steering lever and bolt in a vise.
2. Remove the adjusting plug.
3. Remove the lever bolt jam nut, adjusting nut, and bronze washer.
4. Slide the column and housing assembly away from the lever, bolt and cam follower.
5. Remove the steering cam and bearings from the housing.
6. Remove the bearing race retainer snap rings. (Illust. 2-5)



FESM-666

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

- |              |                      |                    |                |
|--------------|----------------------|--------------------|----------------|
| 1. Not used  | 7. Nut               | 13. Retainer       | 18. Retainer   |
| 2. Felt seal | 8. Seal and retainer | 14. Adjusting plug | 19. Wheel      |
| 3. Bearing   | 9. Fitting           | 15. Joint          | 20. Tube       |
| 4. Retainer  | 10. Bronze washer    | 16. Link           | 21. Cam & tube |
| 5. Lever     | 11. Not used         | 17. Cap            | 22. Retainer   |
| 6. Stud      | 12. Retainer         |                    |                |

### Inspection and Repair (Illust. 2-5)

1. Wash all parts in cleaning solvent, then dry thoroughly.
2. Inspect the cam follower for wear (flat spots).
3. Inspect the cam ends, bearings and races for wear, roughness and pitting.
4. Inspect the cam grooves for wear, roughness and galling.
5. Inspect the housing for cracks and stripped threads.
6. Inspect the upper bearing (nylon bushing) for wear or damage.

### Reassembly and Adjustment (Illust. 2-5)

1. Thoroughly coat the cam ends, balls and races with chassis lubricant.
  2. Install the balls and races on the cam ends and secure with their retaining snap rings.
  3. Thoroughly coat the cam and bearings with chassis lubricant then install them 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 and the cam turns free.



5. If the plug has only one slot (old style), adjust and stake the plug by inserting a small center punch through the housing hole and spread the plug threads to keep the plug from loosening. If the plug has several slots (new style), adjust and insert cotter pin in the nearest hole (Illust. 2-4).

6. Fill the housing with chassis lubricant.

7. Loosen the cam follower locknut, then "back out" the cam follower one turn.

**NOTE:** Refer to the Parts Catalog for the proper seal package.

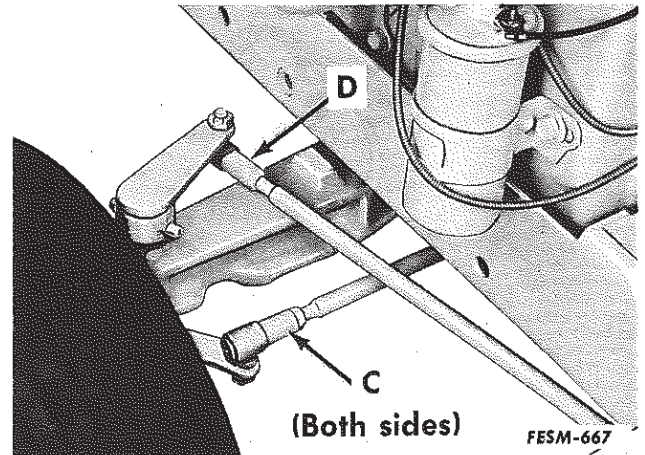
8. Install the seal, retainer and lever-bolt assembly to the housing.

9. Install the bronze washer and adjusting nut. Tighten the adjusting nut sufficiently to provide good seal compression. Refer to Illust. 2-4 for adjustment dimensions. Secure with the jam nut. Tighten jam nut to 40 ft. lbs. Lubricate the lever-bolt at the fitting.

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

11. 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.

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



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

13. Connect the drag link.

14. Install the upper column bearing, retainer, felt seal and retainer.

15. Replace the steering wheel and secure with nut.

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

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

## 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

1. 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 weld separation, split hub tube and rim bending.

2. Bearings should be inspected for wear, seizure and seal condition.

## Reassembly

1. If the bearings were removed, lubricate and press in new ones. Be sure force

is directed to the outer race only when being pressed in.

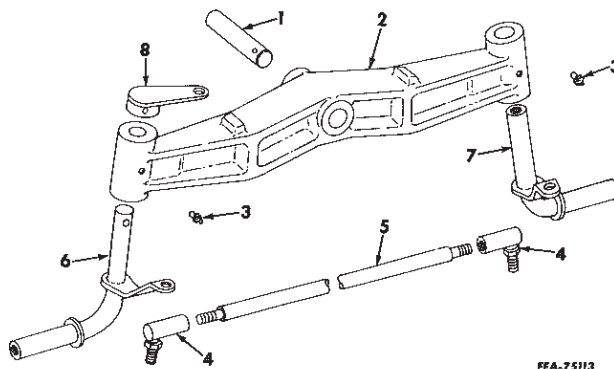
## Installation

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

2. If excessive end play exists, 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.

# FRONT AXLE

## Steering Knuckle Removal (Illust. 2-7)



Illust. 2-7. Front axle components.

1. Lock the brake, jack up the front of the tractor and support it on a suitable stand.

2. Remove the front wheels.

3. Disconnect the tie rod ball joints (4) from left steering knuckle (6) and right steering knuckle (7).

4. Using a pin punch and hammer, drive out the coiled spring pin from the drag link arm (8) and steering knuckle (6).

5. Remove the steering knuckle (6) from the axle (2).

6. Remove the cap screw and flat washer from the upper end of the steering knuckle (7).

7. Remove the steering knuckle (7) from the axle (2).

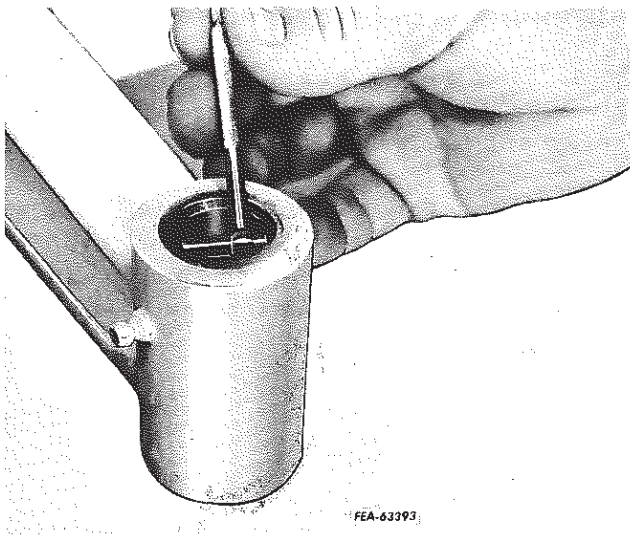
## Removal of Front Axle

1. Disconnect the drag link ball joint "D" (Illust. 2-6) from the drag link arm (8) (Illust. 2-7).

2. With the front of the tractor frame supported by a suitable stand, drive out the retaining pin from the front of the axle pivot pin (1) (Illust. 2-7).

3. Remove the pivot pin (1). The front axle (2) is now free of its mounting and can be removed (Illust. 2-7).

## Inspection and Repair



Illust. 2-8. Checking wear in front axle for steering knuckle pins.

1. Inspect all parts closely for wear, bending and breaks.
2. Check fit of steering knuckle pivot pins to their respective bore in the axle. Each part may be checked with micrometers and snap gauges to determine the extent of wear.
3. Check front axle pivot pin and its fit in the axle.

## Removal

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

Refer to the Engine section of this manual for engine removal procedure then re-

## Reassembly of Front Axle

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

## Reassembly of Steering Knuckles (Illust. 2-7)

1. Apply chassis lubricant liberally to the steering knuckle arm thrust surface and the bottom of the axle ends.
2. Insert the right hand knuckle pin (7) in its respective bore in the axle and secure with the cap screw and flat washer.
3. Insert the left hand knuckle pin (6) in its bore in the axle and position the drag link arm (8) on the pin.
4. Secure the drag link arm (8) and knuckle (6) 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 (5).
6. Install the front wheels and check toe-in adjustment.

# CLUTCH

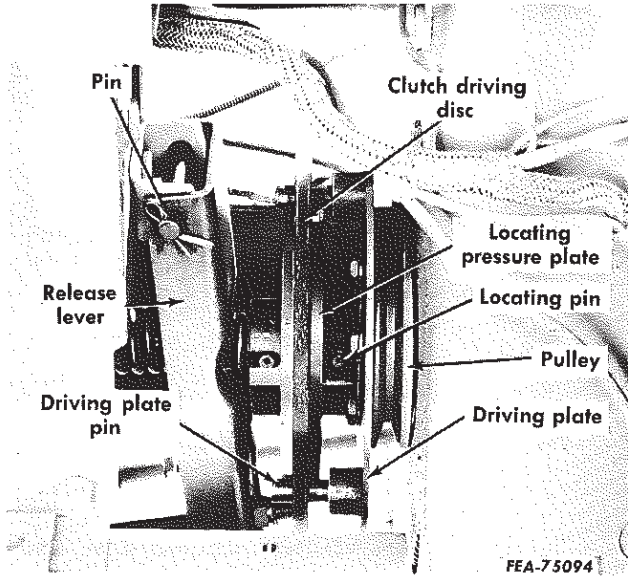
move the clutch shaft coupling rear pin, clutch release lever pin, and disconnect the clutch release rod from the pedal arm.

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



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

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 cap screws (two on each side) which hold the engine to the tractor frame.

5. Release the clutch and brake pedal, then slide the engine forward in the frame.

6. Replace the pressure plates, driving disc or driving plate as necessary (Illust. 2-9).

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

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).

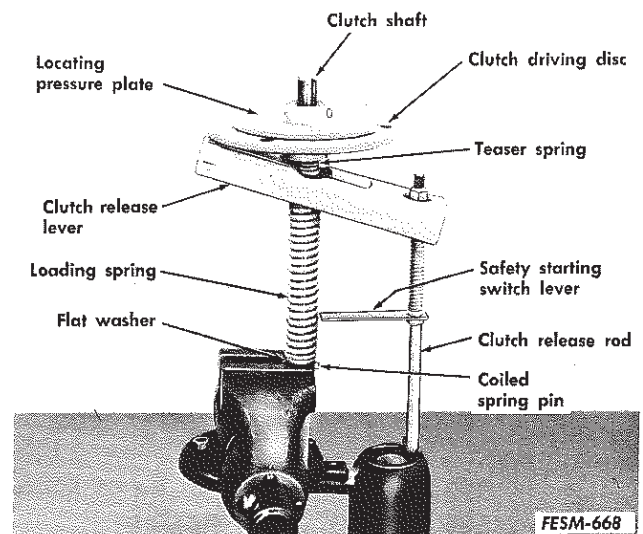
10. Align the engine to the frame and replace the securing cap screws.

11. Secure the wires and cables in their clips.

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

13. Replace the clutch shield.

## Disassembly



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 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.

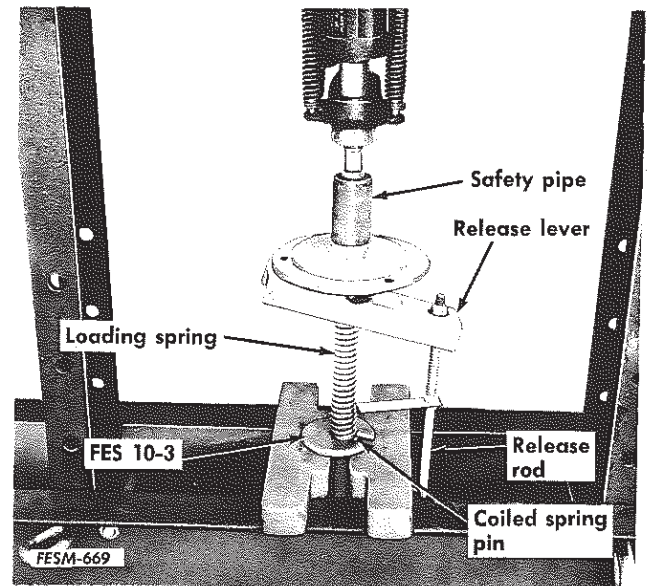
## Reassembly

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.



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

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.

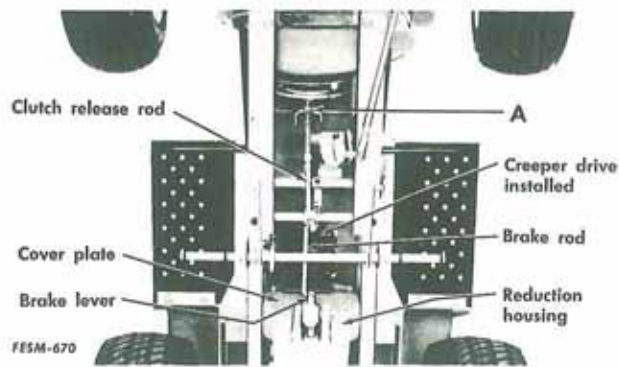
8. Place the assembly in a press as shown in Illust. 2-11. Center the clutch driven disc and compress the loading spring sufficient to install the coiled spring pin.

## 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.



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

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

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

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

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

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

9. Tighten the engine mounting cap screws.

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

11. Connect the battery ground cable.

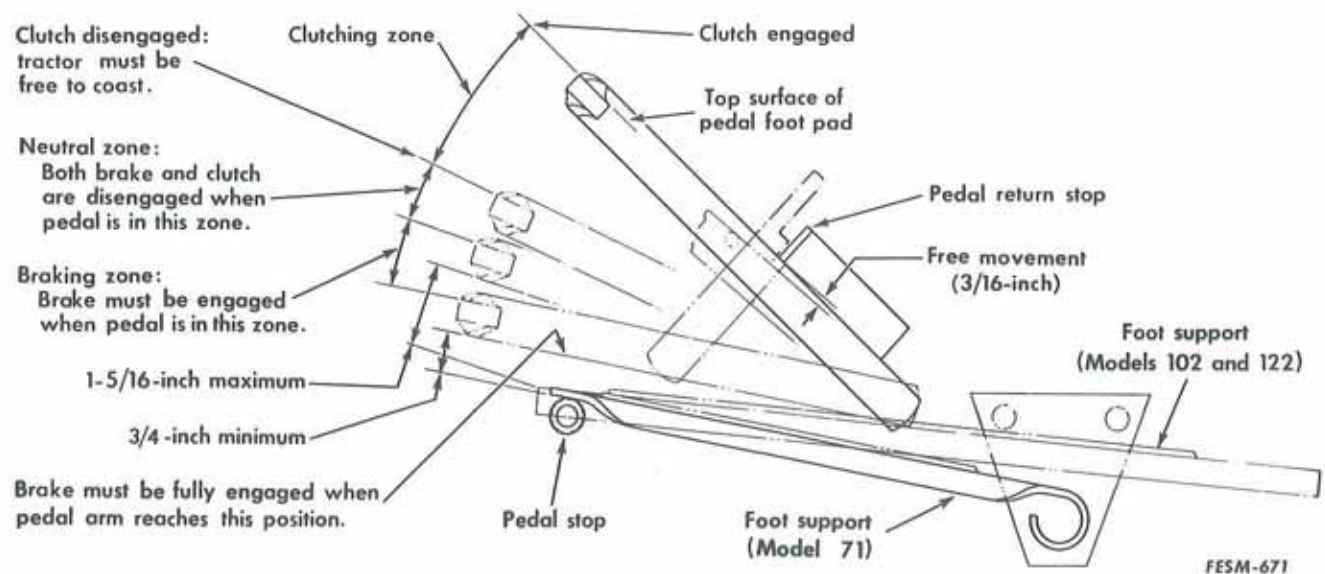
12. Replace the clutch shield.

13. Check the clutch pedal and linkage for proper adjustment. Refer to Illusts. 2-12 and 2-13.

### Adjusting the Clutch

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 are set at the factory and should not require frequent attention unless the linkage has been disturbed or when the pedal movement becomes less than 3/16-inch. When it is necessary to adjust the clutch, turn the adjusting nut "A" on the clutch release rod (Illust. 2-12) in or out as required to get the proper measurements.



Illust. 2-13. Clutch and brake pedal linkage adjustments.



# BRAKE

Tractors equipped with a "creeper" attachment will require "splitting", and the creeper removed before complete brake service can be performed. Refer to page 2-18 of this manual for splitting procedure.

## Removal

1. Drain the transmission lubricant.
2. Remove the brake adjusting screw and lock nut from its lever (Illust. 2-14).
3. Remove the brake lever, pivot pin and push rod (Illust. 2-14).
4. Remove the reduction housing front cover plate and slide it forward on the clutch shaft (Illust. 2-12).

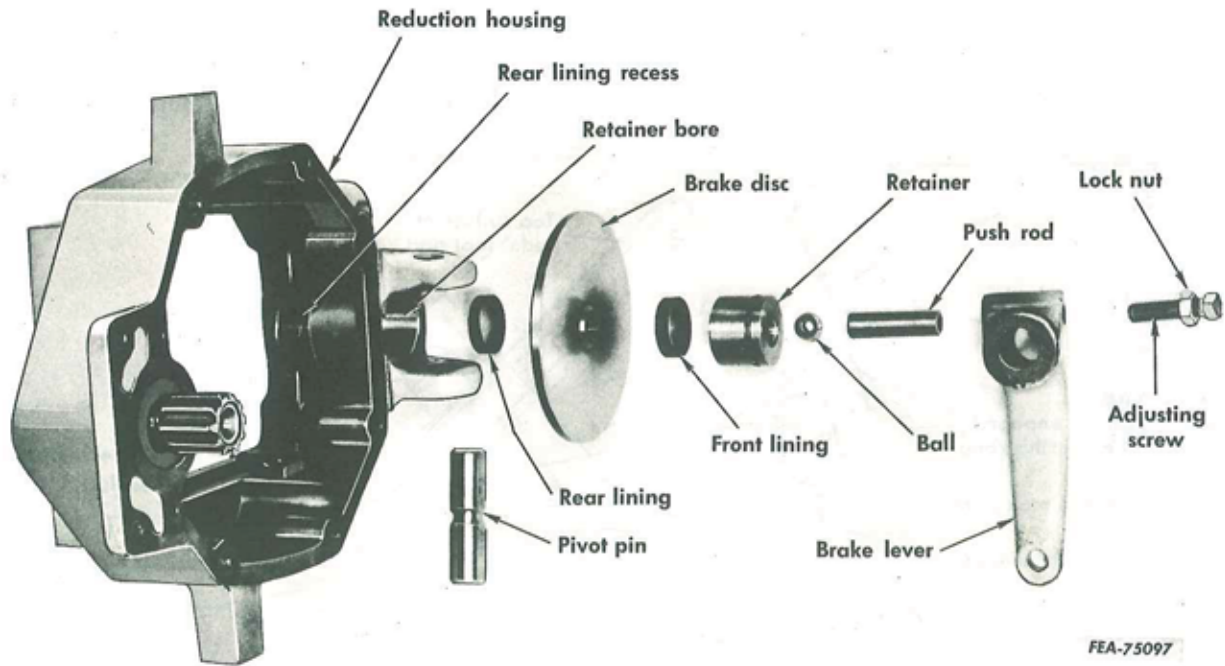
5. Remove the reduction gear from the front of the transmission main shaft. Refer to Illusts. 2-2 and 2-19.

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.

NOTE: See NOTE, paragraph 6, page 2-20.

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 2-14.

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.



Illust. 2-14. Exploded view of brake components and reduction housing.

## 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 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.
5. Install the front lining in the retainer lining recess and push the retainer and lining rearward against the disc.
6. Install the reduction gear on the transmission main shaft and secure with

flat washer, lock washer and cap screw. Tighten cap screw to 55 ft. lbs.

7. Install a new cover gasket, then replace the cover plate.

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

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

10. Refer to Illusts. 2-13 and 2-14 for adjustment.

**ADJUSTING THE BRAKE:** 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 lock nut and turn the brake lever adjusting screw (Illust. 2-14) in or out as required to get this measurement. The brake must not engage before the pedal arm is within the maximum distance of 1-5/16-inches above the pedal stop.

# SPLITTING AND RECOUPLING THE TRACTOR

## Models 71, 102 and 122

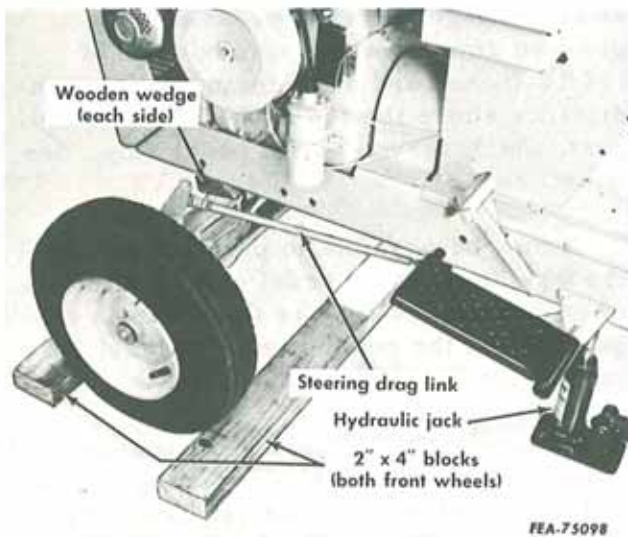
### Splitting the Tractor

1. Remove the fenders and their support assemblies (if tractor is so equipped) or the seat support and fender assembly.

2. Remove the seat and its support bracket.

**NOTE:** Disconnect tail light wire at junction under seat support (if tractor is so equipped).

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



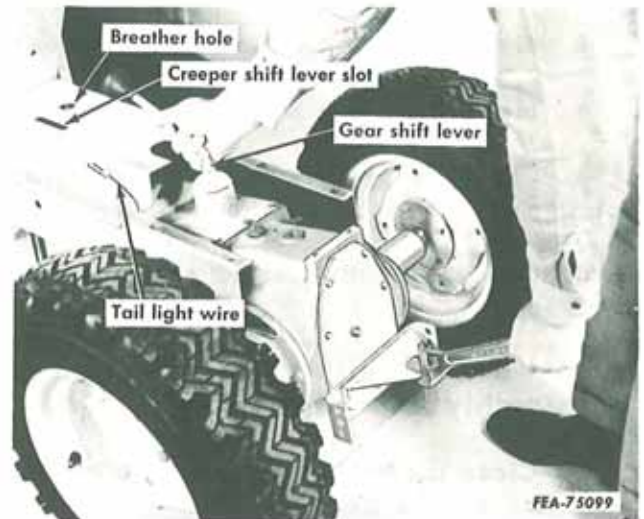
Illust. 2-15. Front axle and wheels wedged and blocked for tractor split. (71 shown, others similar.)

4. Drive a small wooden wedge between the front axle and frame on each side as shown in Illust. 2-15.

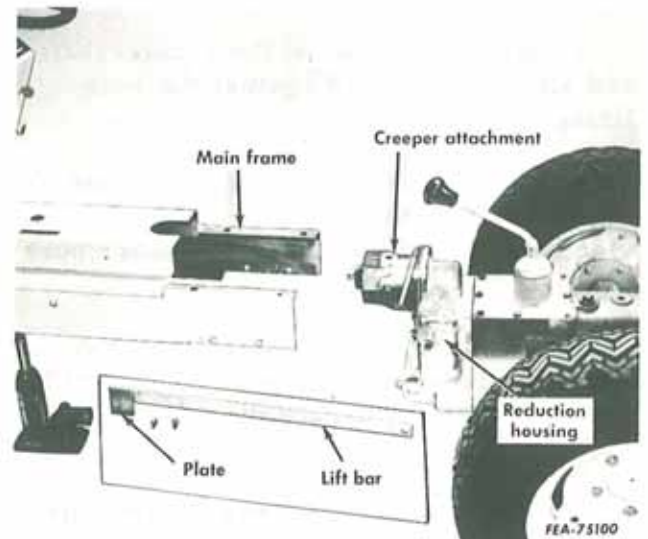
5. Block both front wheels as shown.

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

7. Disconnect the brake rod from the brake lever.



Illust. 2-16. Splitting the tractor.



Illust. 2-17. Tractor split for service of creeper, reduction drive, transmission and differential.

8. If tractor is equipped with three-point hitch, remove the lift bar and its attaching plate. See Illust. 2-17 insert.

9. Place a jack under the implement lift handle cross-shaft to support the frame. Refer to Illust. 2-15.



10. Remove three cap screws from each side of frame.

NOTE: Cap screws hold frame to the rear axle, transmission and reduction drive housings. Holes in frame are seen in Illust. 2-17).

11. Push down on the drawbar and pull rearward on the transmission shifter lever. Refer to Illust. 2-16.

Move the transmission-differential-rear end assembly rearward far enough to disengage from the clutch shaft coupling. Lower the front end (creeper) to clear

creeper shift lever through frame slot, then assembly can be moved rearward and away from the frame.

12. Support the transmission housing on a stand or block and drain the lubricant if internal service is to be performed.

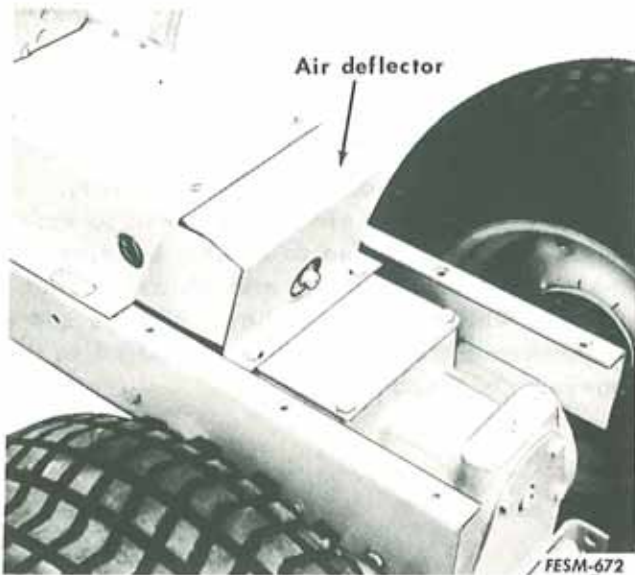
### **Recoupling the Tractor**

13. Recoupling of the tractor is basically the reverse of splitting; however, precautions should always be taken to safeguard against damage to shafts, bearings, seals etc. when aligning and securing components which work together. Always use recommended lubricants as specified in the Operator's Manual.

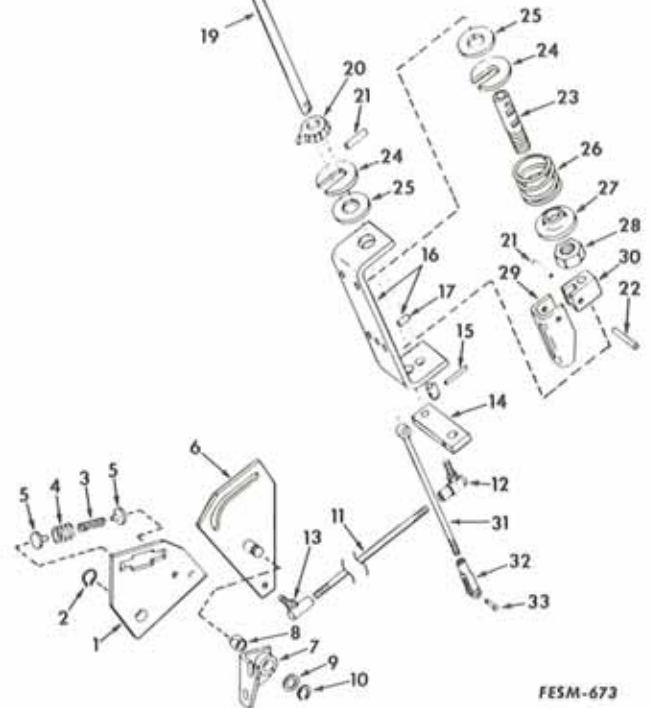
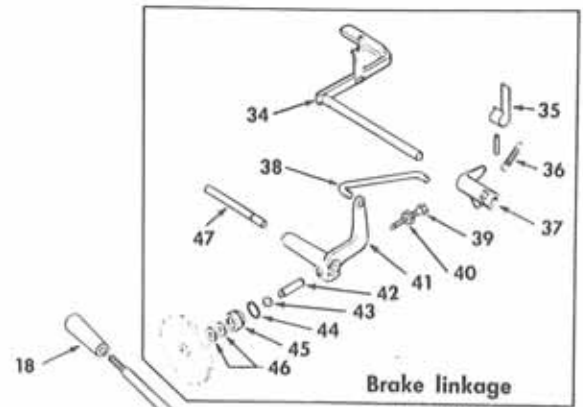
# SPLITTING AND RECOUPLING THE TRACTOR

## Model 123

### Splitting the Tractor



Illust. 2-18. Location of air deflector.



Illust. 2-19. Exploded view of transmission controls and brake linkage.

### Legend for Illust. 2-19

- |                              |                                |                           |                 |
|------------------------------|--------------------------------|---------------------------|-----------------|
| 1. Damper spring plate       | 16. Bracket                    |                           |                 |
| 2. Retaining ring            | 17. Dowel pin                  |                           |                 |
| 3. Spring (light)            | 18. Grip                       |                           |                 |
| 4. Spring (heavy)            | 19. Rod                        |                           |                 |
| 5. Guide pin                 | 20. Indicator                  |                           |                 |
| 6. Speed control cam         | 21. Dowel pin                  |                           |                 |
| 7. Bracket                   | 22. Dowel pin                  |                           |                 |
| 8. Bushing                   | 23. Frictional adjusting shaft |                           |                 |
| 9. Washer                    | 24. Retainer                   |                           |                 |
| 10. Retaining ring           | 25. Washer                     |                           |                 |
| 11. Speed control rod        | 26. Spring                     |                           |                 |
| 12. Ball joint (L.H. thread) | 27. Washer                     |                           |                 |
| 13. Ball joint (R.H. thread) | 28. Stop nut                   |                           |                 |
| 14. Bar                      | 29. Cam channel                |                           |                 |
| 15. Slotted pin              | 30. Swivel                     |                           |                 |
|                              | 31. Rod                        |                           |                 |
|                              | 32. Clevis                     |                           |                 |
|                              | 33. Pin                        |                           |                 |
|                              | 34. Brake pedal                |                           |                 |
|                              |                                | 35. Clip                  | 41. Brake lever |
|                              |                                | 36. Spring                | 42. Pin         |
|                              |                                | 37. Brake rod lever       | 43. Ball        |
|                              |                                | 38. Brake rod             | 44. O-ring      |
|                              |                                | 39. Brake adjusting screw | 45. Retainer    |
|                              |                                | 40. Jack nut              | 46. Disc        |
|                              |                                |                           | 47. Pin         |

1. Remove the seat, seat support and fenders.

**NOTE:** Disconnect the tail light wire (if so equipped) at the junction under the seat support.

2. Remove the air deflector (Illust. 2-18).

3. Disconnect the ball joint (13) from the speed control cam (6), (Illust. 2-19).

4. Disconnect the brake rod (38) from the rod lever (37), (Illust. 2-19). Loosen the jam nut (40) and brake adjusting screw (39).

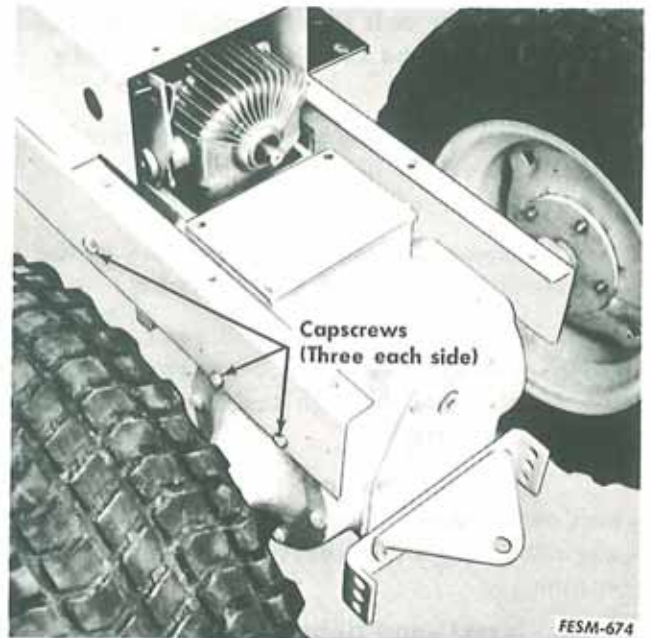
5. Drive small wooden wedges between the front axle and frame on each side to stabilize the front end of the tractor.

6. Block the front wheels in the front and back.

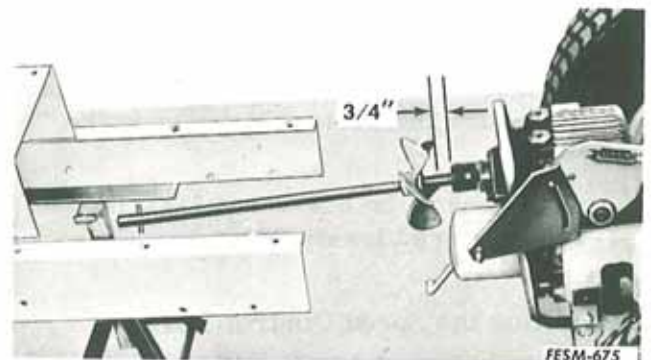
7. Place a jack on each side of the tractor main frame in front of the foot rests.

8. Support the transmission-differential rear end assembly with blocks. Be sure not to contact the oil tube.

9. Remove six capscrews (three each side) from the frame (Illust. 2-20).



Illust. 2-20. Location of frame capscrews.



Illust. 2-21. Tractor split.

10. Position the tow lever in the "Tow" position. Move the transmission-differential rear end assembly rearward far enough to permit access to the hydrostatic unit. Be sure the drive shaft pin clears the hole in the separator (Illust. 2-21).



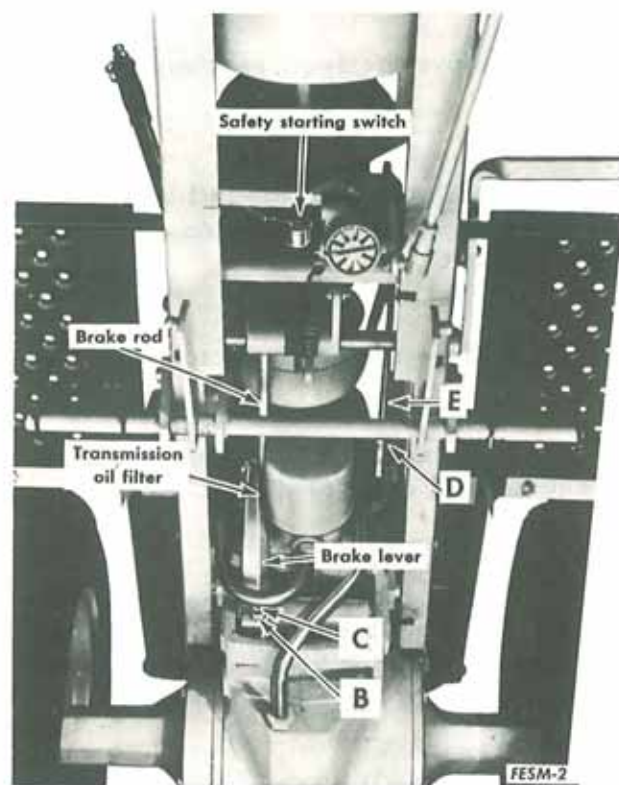
## Recoupling the Tractor

1. Tip the unit into recoupling position and lubricate the cam slot with chassis lubricant.
2. Fill the transmission-differential case with seven (7) quarts of Hy-Tran fluid.
3. Re-couple the split sections of the tractor being sure of the following:
  - a. That the brake rod goes over the lift handle cross shaft. Be sure to guide the drive shaft through the fan shroud and air baffle plate.
  - b. That the dowel pin on the front end of the drive shaft is positioned to engage the slot in the drive plate hub on the engine.
4. Install and tighten securely the three capscrews on each side of the frame.
5. Connect the speed control rod ball joint (13), (Illust. 2-19) to the speed control cam (6).
6. Depress the brake pedal and release it to be sure the control lever is in the "N" position.
7. Connect the brake rod (38), (Illust. 2-19) to the rod lever (37).

## Adjusting the Speed Control Lever

NOTE: The brake pedal must be properly adjusted before beginning the speed control lever adjustment. Refer to page 2-17. If the tractor "creeps" in the "N" position or, if the speed control linkage has been disassembled or removed for any reason, the following adjustment must be made.

1. Block the tractor so the left rear wheel is off the ground.
2. Start the engine at half throttle or faster.
3. Move the speed control lever to the forward position. The rear wheel should rotate in the forward direction. Depress the brake pedal all the way down and release. The speed control lever should return to the "N" position and the rear wheel stop turning.



Illust. 2-22. Brake adjustments.

4. If the rear wheel turns in the forward direction, loosen jam nut "D" and turn the connecting rod "E" counterclockwise to lengthen it until the wheel stops turning. (See Illust. 2-22.)

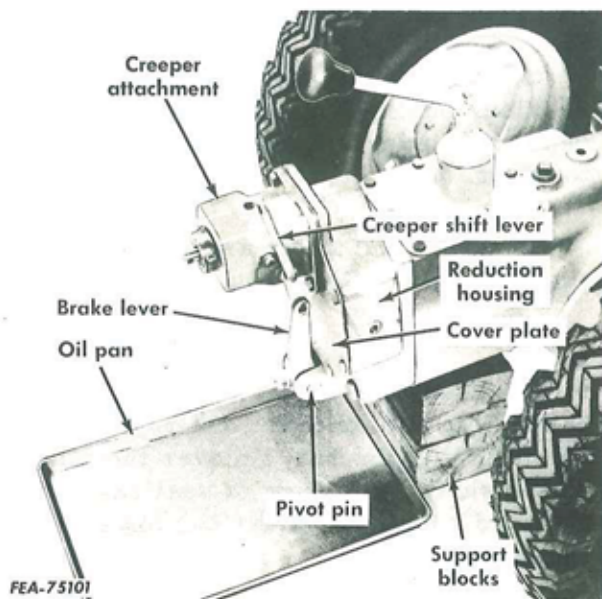
5. If the wheel turns in the reverse direction turn the connecting rod "E" clockwise. Tighten the jam nut "D".

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

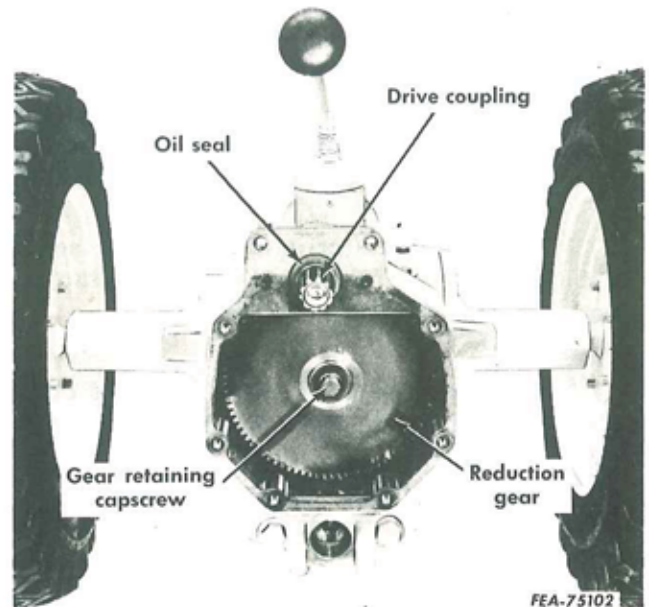
- a. Remove the battery.
- b. Place a small wedge between the hand-control mounting bracket and the adjusting nut.
- c. Move the lever towards the "F" or forward position to tighten the nut.
- d. Remove the wedge.
- e. Check the friction adjustment with a fish scale. The reading should be 10 pounds when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

# REDUCTION DRIVE

## Removal and Disassembly



Illust. 2-23. Power train supported for disassembly.



Illust. 2-24. Reduction drive exposed.

1. Split the tractor. Refer to page 2-18 this manual for splitting procedure.

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

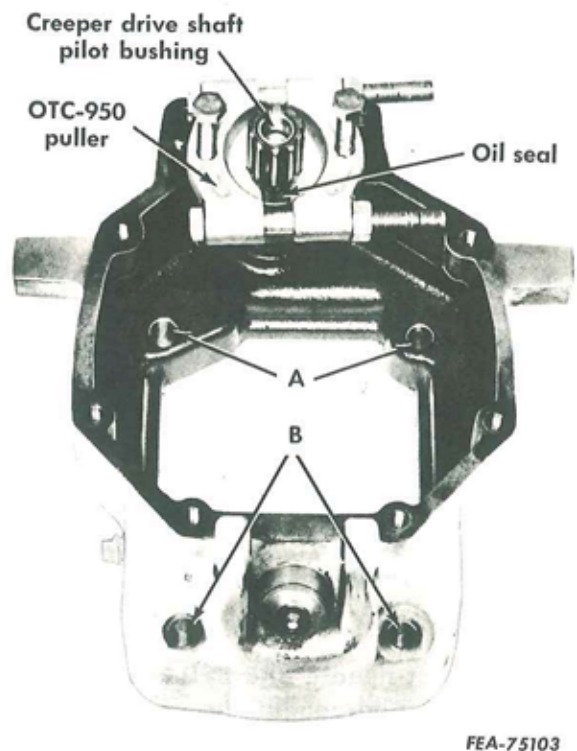
3. Remove the brake lever, pivot pin and push rod (Illust. 2-23).

4. Remove the reduction housing front cover plate (Illust. 2-23).

5. Hold the drive coupling and shaft from turning and remove the reduction gear retaining cap screw and washers. Remove the gear spacer (Illust. 2-24).

6. Remove the reduction gear from the transmission shaft and from the housing.

**NOTE:** It may be more convenient to pull the reduction drive shaft, seal and bearing as shown in Illust. 2-25 before removing the reduction gear from the housing. Clearance between the gear and the cap screw bosses is restricted on some tractors.



Illust. 2-25. Pulling reduction drive shaft, seal and bearing.



7. Remove cap screws from holes "A" and "B" (Illust. 2-25).

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

8. Move the housing forward and away from the transmission housing as the brake disc slides off the transmission countershaft.

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

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

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

11. Press the drive shaft from the ball bearing.

12. Press the needle bearing rearward from the housing.

13. Remove the brake components.

## Inspection and Repair

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

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

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

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

5. Thoroughly clean the reduction housing.

## 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. Refer to Illust. 3.

3. Press the ball bearing onto the drive shaft. Refer to Illust. 2-1.

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 for arrangement of parts.

5. Install the splined coupling and coiled pin (if tractor is equipped with a creeper). Coiled pin ends must be even with or below the spline root to avoid interference when shifting the creeper unit.

6. Install a new O-ring onto the brake lining retainer and install in the reduction housing.

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

8. Install new copper sealing washers on the two lower cap screws. Refer to "B" (Illust. 2-25). Tighten cap screws at "A" and "B" to 80 ft. lbs.

9. Install the brake linings and disc then push the front lining retainer rearward to hold disc and linings in place.

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



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

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

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

13. Install new gasket and housing front cover.

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

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

16. Recouple the tractor by reversing the splitting procedure.

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

## REAR AXLES

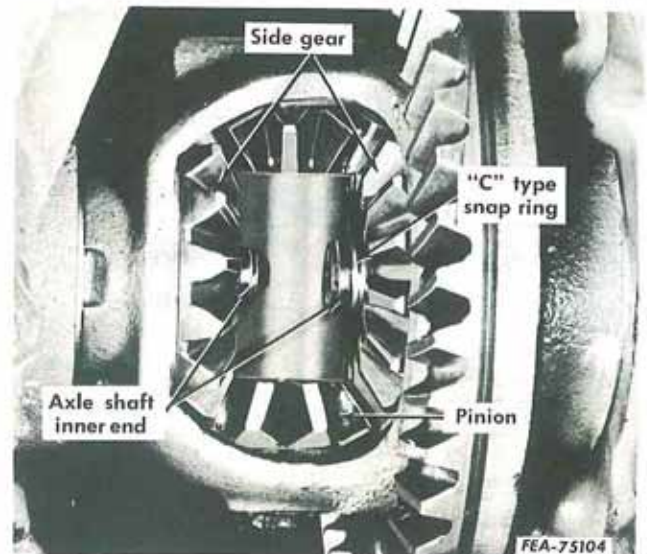
### Removal

1. Drain the transmission lubricant.

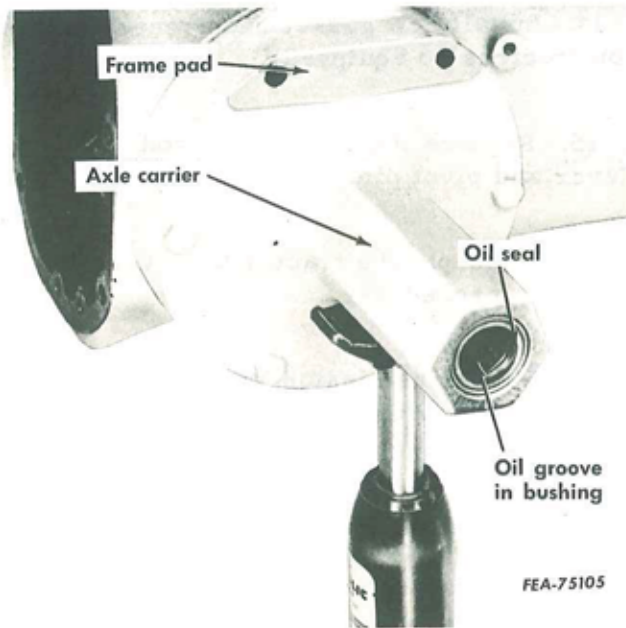
2. Stabilize the tractor by driving wooden wedges between the front axle and frame on each side and block the front wheels. Refer to Illust. 2-15.

3. Remove the drawbar and differential housing rear cover.

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

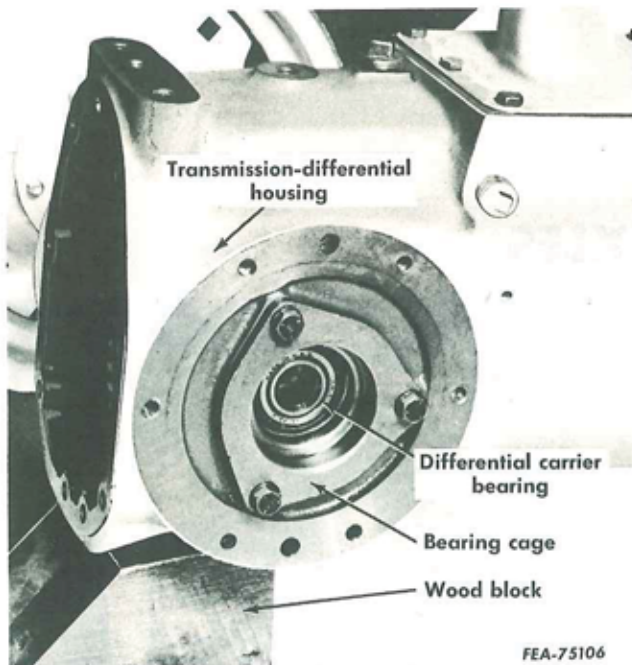


Illust. 2-26. Differential and rear axle assembly.



Illust. 2-27. Rear axle removed.

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



Illust. 2-28. Rear axle carrier removed.

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

7. Press the carrier bushing from the carrier.

8. Drive the oil seal from the carrier.

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

## Inspection

1. Inspect the axle shaft for wear at the oil seal area, bushing 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. The oil groove must be at the bottom.

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. 2-22.

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

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

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

7. Replace the rear cover and drawbar.

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



# TRANSMISSION AND DIFFERENTIAL

## Models 71, 102 and 122

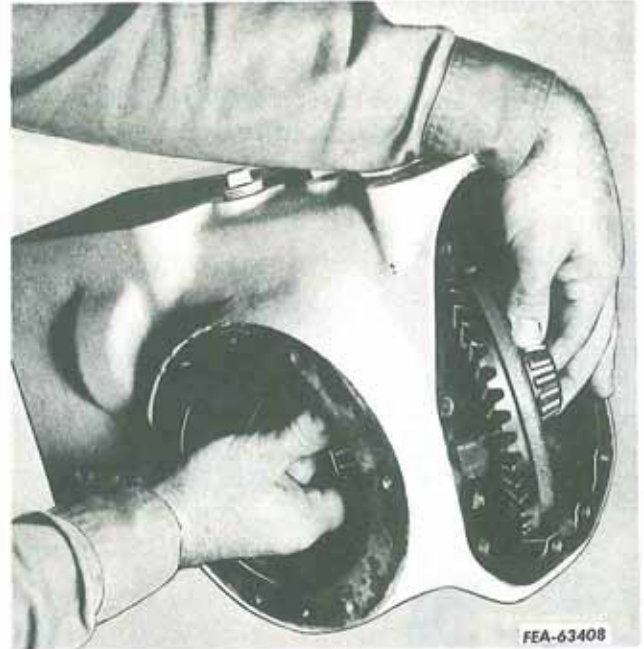
Complete service of the transmission requires splitting of the tractor, removal of the reduction drive (and creeper if so equipped), rear axles, carriers and the differential. The differential can be removed and replaced without disassembling the transmission, however, the transmission countershaft should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

### Removal and Disassembly (Differential)

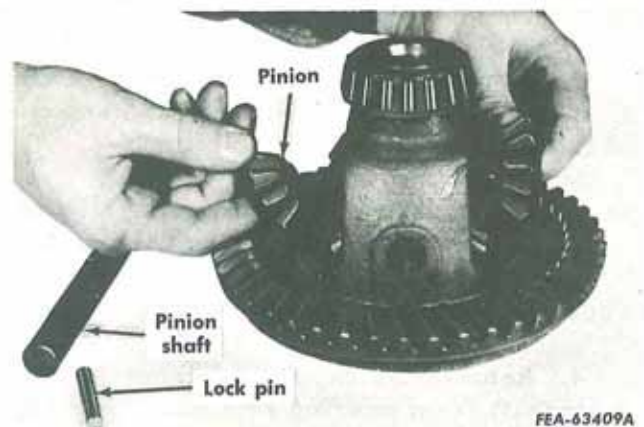
1. Drain the lubricant.
2. Split the tractor. (Refer to page 2-18.)
3. Remove the reduction drive. (Refer to page 2-23.)
4. Remove the rear axles and their carriers. (Refer to page 2-25.)
5. Remove the differential carrier bearing cage and shims from each side. Keep the shims with each cage and identified for each side.
6. Remove the differential from the transmission case.

**NOTE:** The differential must be turned into position shown in Illust. 2-29 before it can be removed.

7. Drive out the pinion shaft lock pin.
8. Remove the pinion shaft.
9. Remove the pinion gears and side gears.
10. If the differential drive gear requires separate replacement, press out the eight retaining rivets.



Illust. 2-29. Removing differential from the transmission case.



Illust. 2-30. Differential partially disassembled.

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

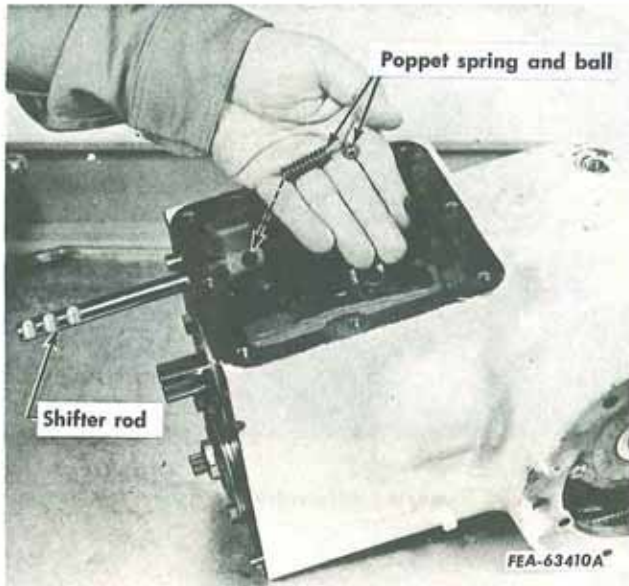


## Disassembly (Transmission)

1. Remove the differential as previously described on page 2-23.

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.



Illust. 2-31. Removing shifter rods.

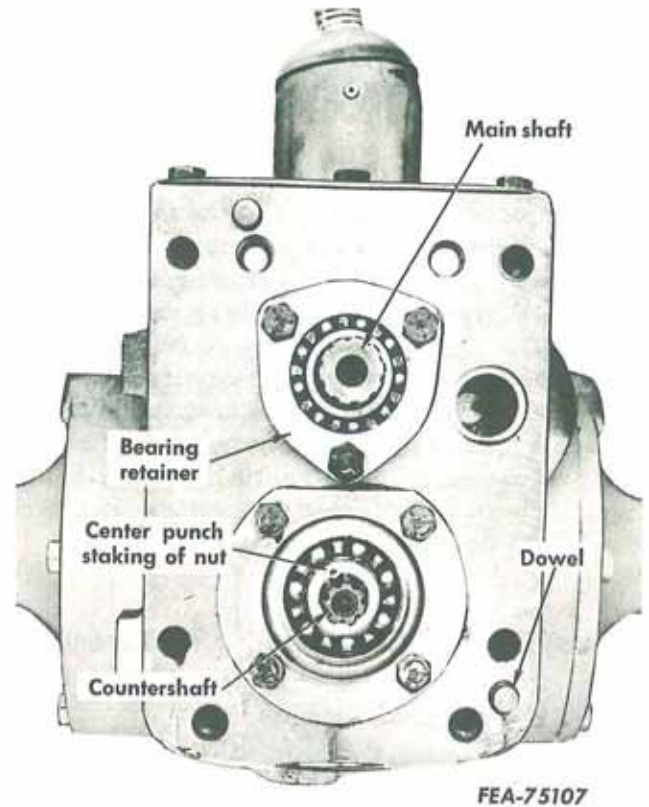
3. Remove the shifter fork set screws then drive the shifter rods forward and out of the transmission.

**CAUTION:** Cover the gearshift poppet ball hole to prevent the ball and spring from flying out as the rods are removed. Refer to Illust. 2-31.

4. Remove the capscrews from the mainshaft front bearing retainer. Refer to Illust. 2-32).

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

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.



Illust. 2-32. Front view of transmission.

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.

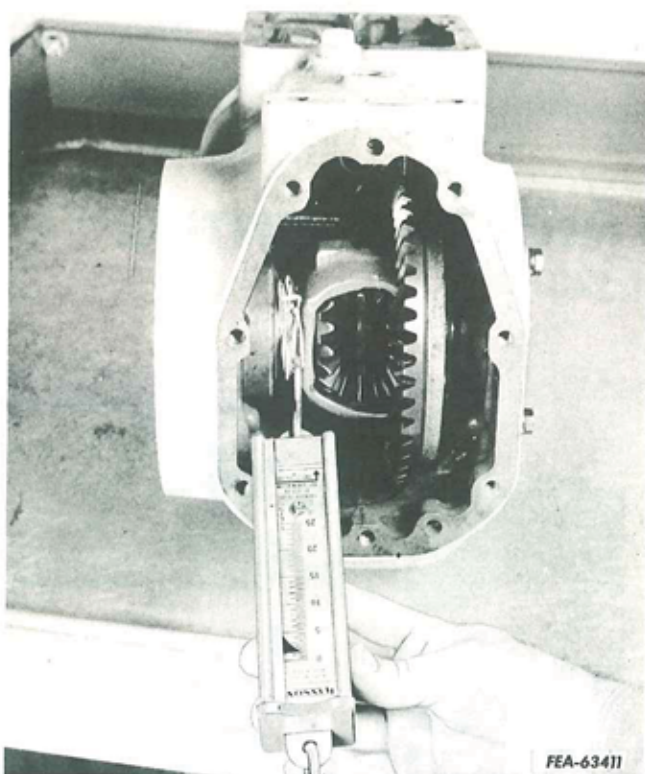
4. Inspect the housing for cracks, restricted oil passages and dents or raised places on its machine faces. Smooth off raised places with a file.

## Reassembly

Reassembly is basically the reverse of disassembly; however, particular attention should be given to the following steps. Refer to Illust. 2-1 for location of parts.

1. Be sure all bearings are thoroughly lubricated.

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



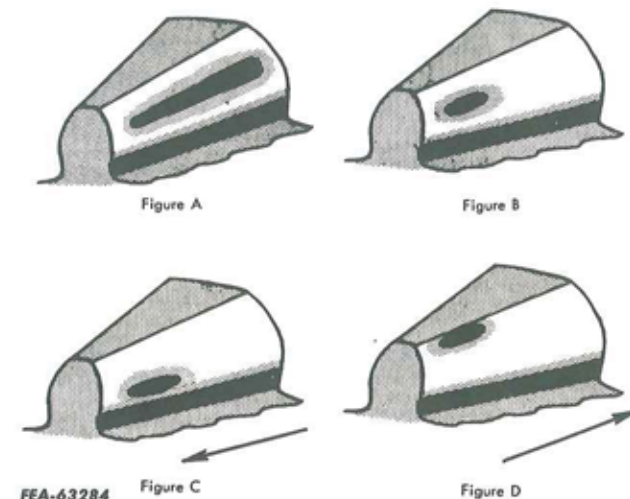
Illust. 2-33. Checking pre-load of differential bearings.

3. Assemble the differential, carrier bearings, cages and shims. Check bearing pre-load and adjust as necessary before replacing the transmission countershaft. Install or remove shims as necessary. Pre-load is correct when a steady pull of one to three pounds is necessary to rotate the differential assembly as shown in Illust. 2-33.

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. 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. 2-34. Tooth bearing pattern.

6. Check the backlash between the drive gear and pinion and the gear teeth bearing pattern as follows. Refer to Illust. 2-34.

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 teeth edges.

8. Hand testing and very light loads should provide a pattern as shown in Figure "B" Illust. 2-34. When load and deflection increases the pattern will progress as in Figure "A".

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



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

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

11. Stake the countershaft nut by center-punching the face of the nut over a spline groove. Refer to Illust. 2-32.

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.

## HYDROSTATIC DRIVE AND DIFFERENTIAL Model 123

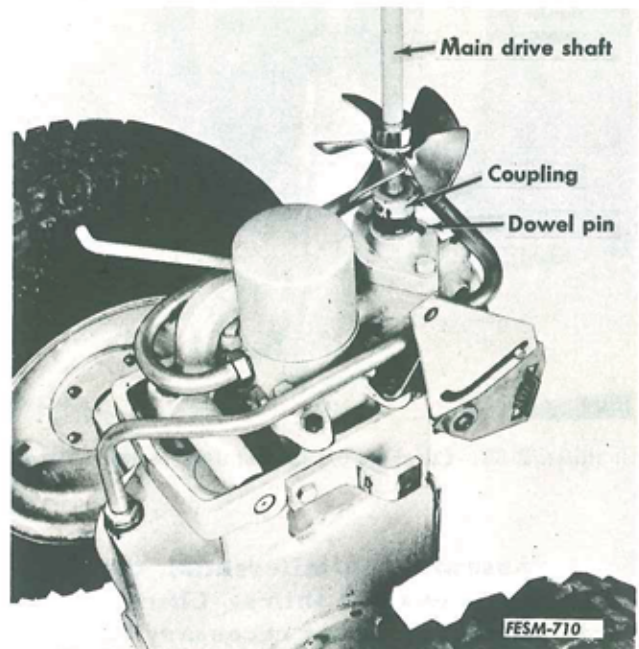
The following service information covers linkage adjustment, removal and replacement of the Hydrostatic unit. A separate service manual will cover the detailed servicing of this unit.

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

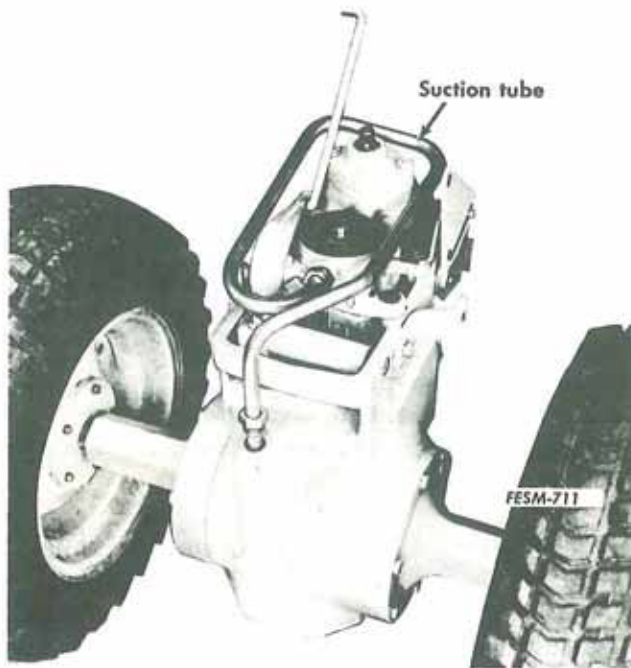
1. Split the tractor. (Refer to page 2-20.)
2. Loosen the transmission rear cover plate and drain the lubricant from the transmission-differential case.
3. Remove the oil filter. Plug the opening. Tape all openings.
4. Block the rear wheels and tip the unit up as shown in Illust. 2-35.



Illust. 2-35. Dowel pin partially removed from main shaft coupling.

5. Be sure to support the collar and shaft firmly. Remove the rear pin securing the main drive shaft coupling to the hydrostatic unit shaft (Illust. 2-35).





Illust. 2-36. Suction tube partially removed.

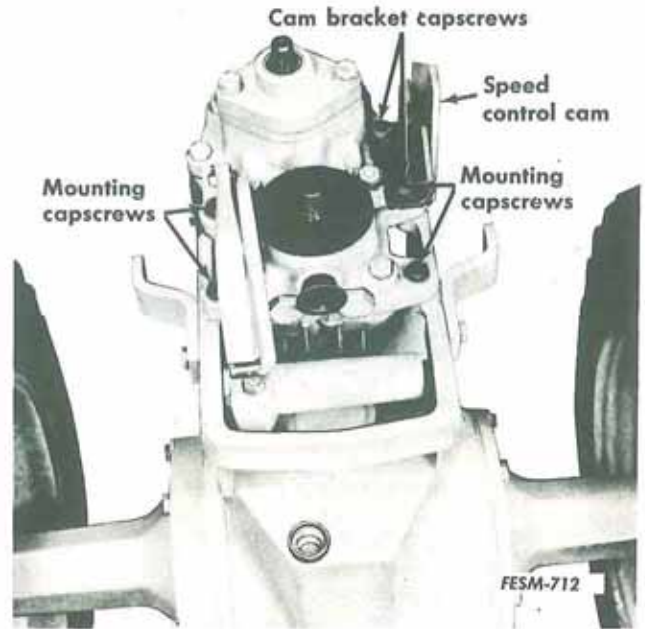
6. To remove the suction tube it will be necessary to loosen both connections. Lift up on the end of the tube that goes into the differential case to move it part way out. Then, remove the end of the tube that goes into the hydrostatic unit (Illust. 2-36). Completely remove the tube. Plug the openings.

7. Remove the cam bracket capscrews (Illust. 2-37) and remove the bracket and speed control cam assembly. If it is necessary to service this assembly, remove the snap ring that holds the speed control cam in the bracket.

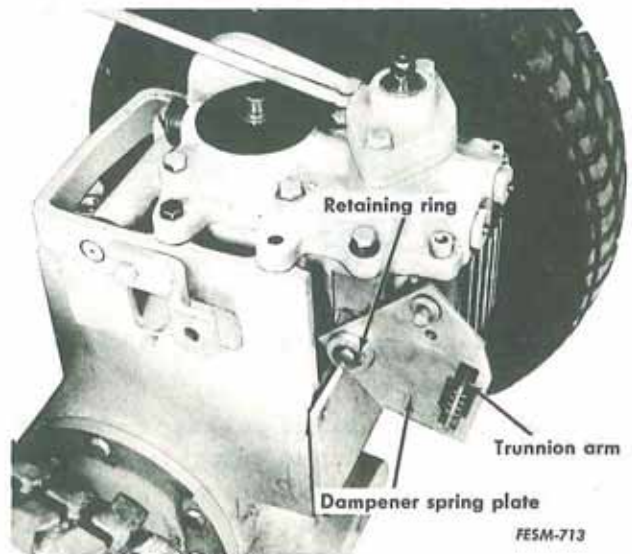
8. Remove the retaining ring (2), (Illust. 2-19), that secures the dampener spring plate to the unit (Illust. 2-38). Remove the plate.

9. Remove the springs and the guide pins from the trunnion arm (Illust. 2-38).

10. Remove the three remaining mounting capscrews (Refer to Illust. 2-37) and remove the unit.



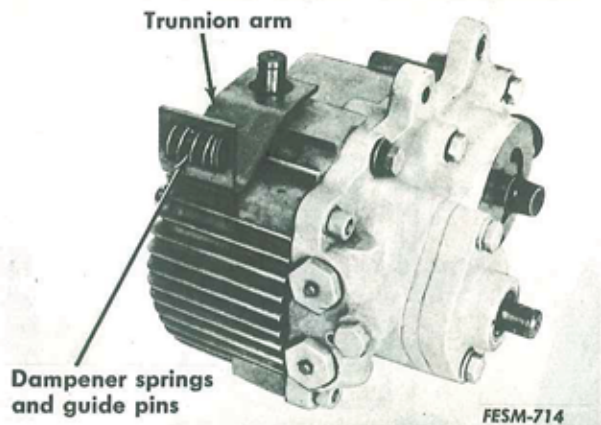
Illust. 2-37. Location of speed control cam bracket.



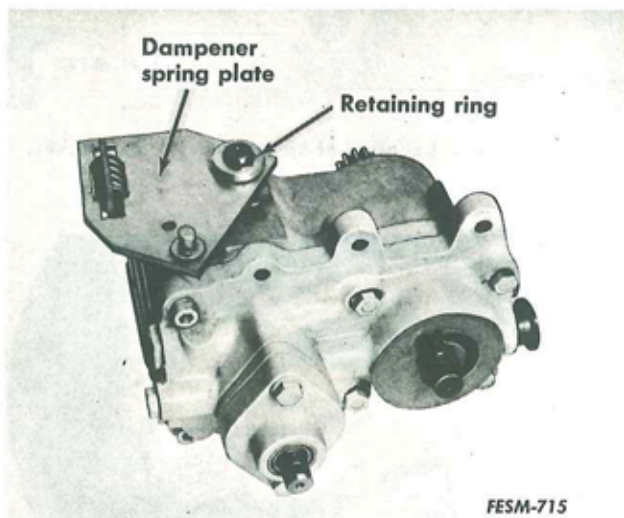
Illust. 2-38. Location of dampener spring plate retaining ring.

## Installation

1. **IMPORTANT:** Prior to attaching a new hydrostatic drive replacement unit on to the transmission-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



Illust. 2-39. Dampener springs and guide pins installed.



Illust. 2-40. Dampener spring plate installed.

allow oil to flow into the passages. Rotate the input pump shaft and output motor shaft to insure they are free to turn.

2. Install the light and heavy dampener springs with guide pins into the trunnion arm (Illust. 2-39).

3. Install the dampener spring plate and secure it to the shaft with the retaining ring (Illust. 2-40).

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

5. Install the cam and bracket assembly on the unit so it is at the bottom end of the slot and fasten it in place just snug using

the slotted end of the bracket as a fastening point. Be sure there is a washer between the capscrew and the bracket.

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

6. Using a new gasket, install the unit on the transmission-differential case and fasten it securely with the three capscrews. Torque the capscrews to 30 ft. lbs. (Illust. 2-37). The mounting capscrew that goes through the cam bracket should be tightened just snug.

7. Install the oil tube on the unit. Install the differential case end of the tube first, then the end that goes into the hydrostatic drive unit. Be sure the ferrules seat in their shoulders in the cases. Start the nuts and screw them in until they just touch the ferrules, then tighten the nuts 1/4 turn only. **DO NOT PAINT THE OIL TUBE.**

8. Install a new oil filter as follows:

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

9. Install the drive shaft and coupling to the drive unit input shaft. **FIRMLY SUPPORT THE INPUT SHAFT** and install the pin to lock the shafts together.

10. If the cooling fan was removed from the drive shaft it will be necessary to position it on the shaft so that the rear edges of the blades are 3/4 of an inch from the front edge of the collar (refer to Illust. 2-21).

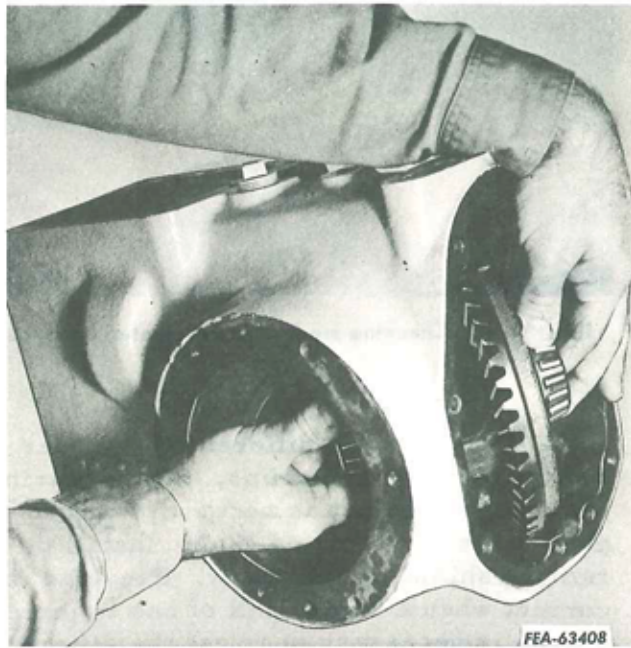
11. Recouple the tractor. (Refer to page 2-22.)



# DIFFERENTIAL

## Removal and Disassembly

1. Drain the lubricant.
2. Split the tractor. (Refer to page 2-20.)
3. Remove the rear axles and their carriers. (Refer to page 2-25.)
4. Remove the differential carrier bearing cage and shims from each side. Keep the shims with each cage and identified for each side.

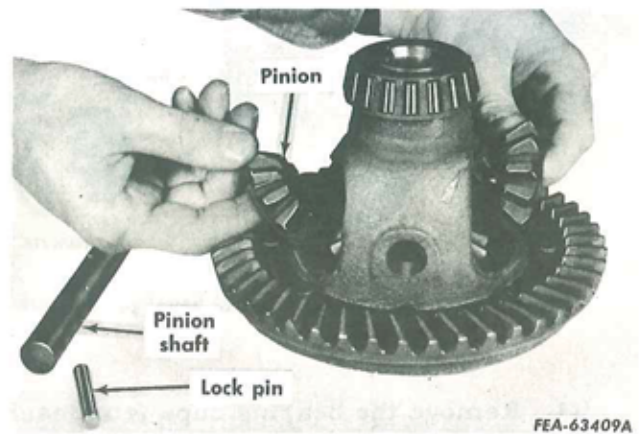


Illust. 2-41. Removing differential from the transmission case.

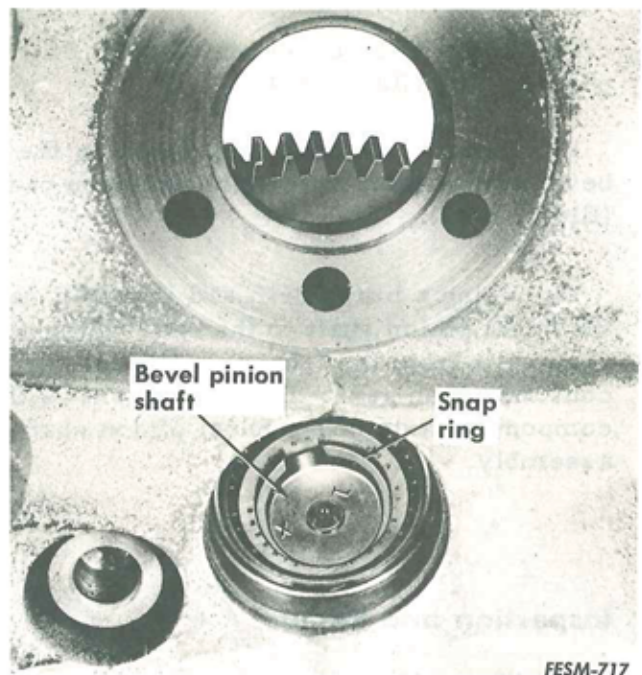
5. Remove the differential from the transmission case.

**NOTE:** The differential must be turned into position shown in Illust. 2-41 before it can be removed.

6. Drive out the pinion shaft lock pin.
7. Remove the pinion shaft.



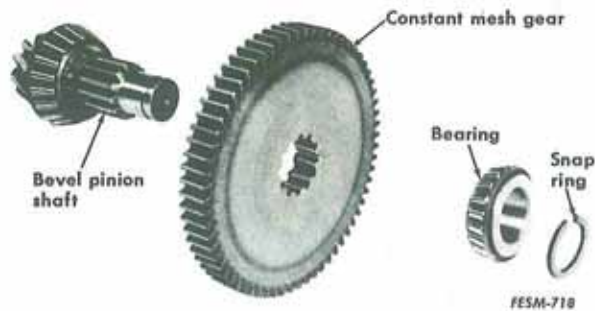
Illust. 2-42. Differential partially disassembled.



Illust. 2-43. Location of bevel pinion shaft snap ring.

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.





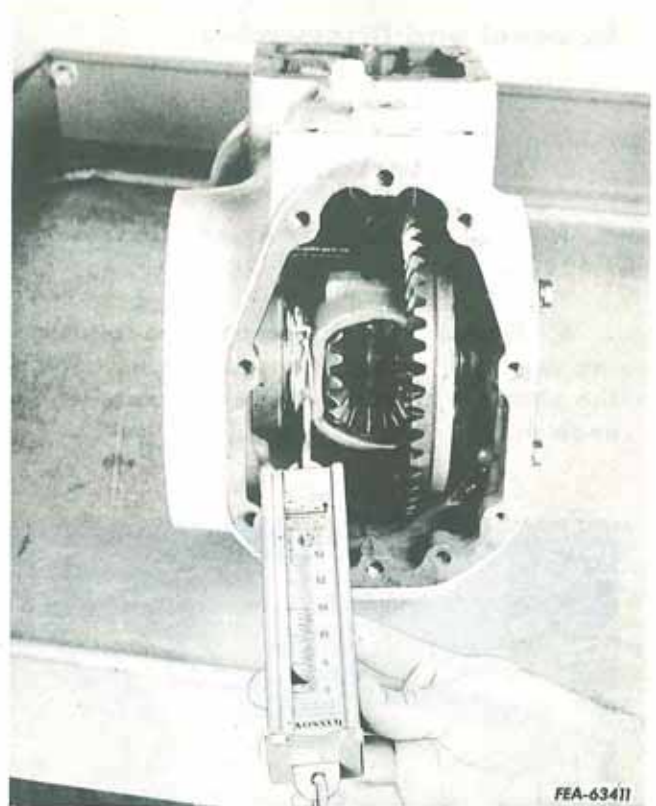
Illust. 2-44. Components parts of bevel pinion shaft assembly.

11. Remove the bearing cups from each cage if replacement is necessary.
12. Remove the hydrostatic drive. (Refer to page 2-30.)
13. Remove the bevel pinion shaft expansion plug (Illust. 2-43).
14. Remove the snap ring securing the bevel pinion shaft in the transmission case (Illust. 2-43).
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. 2-44 shows the component parts of the bevel pinion shaft assembly.

## Inspection and Repair

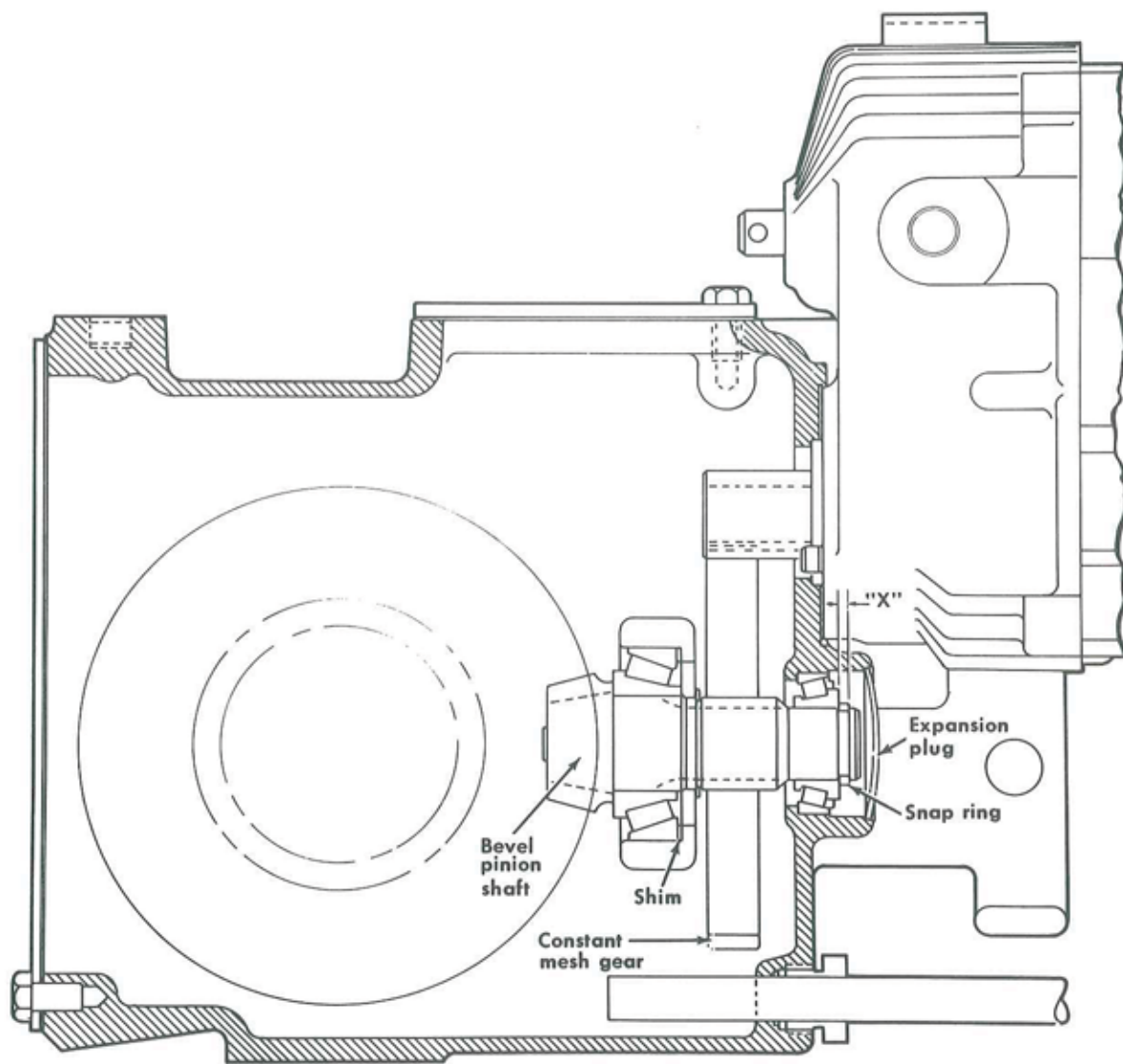
1. Wash all parts in cleaning solvent and dry with compressed air. Do not spin bearings.
2. Check all bearings for looseness, wear, roughness, pitting and scoring.
3. Check gears and shafts for wear and burrs. Remove any burrs with a fine stone.
4. Inspect the housing for cracks, restricted oil passages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

## Reassembly



Illust. 2-45. Checking pre-load of differential bearings.

1. Assemble the differential, carrier bearings, cages and shims. Check bearing pre-load and adjust as necessary before replacing the bevel pinion shaft. Install or remove shims as necessary. Pre-load is correct when a steady pull of one to three pounds is necessary to rotate the differential assembly as shown in Illust. 2-45.
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. 2-47) and the number stamped on the end of the bevel pinion shaft and add them together.



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Illust. 2-46. Cross section of bevel pinion shaft area in transmission case.

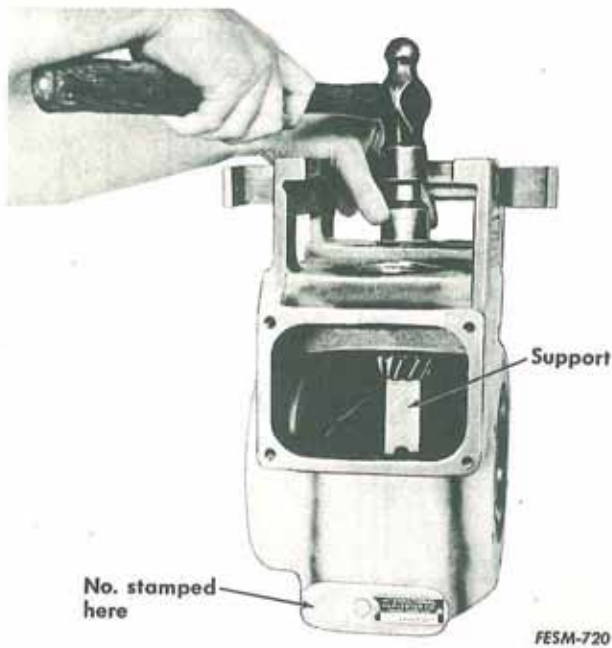
- b. Add .015 inch.
  - c. Install sufficient shims, to total the figure obtained previously, in the bore for the rear bearing cup.
  - d. Press the cup in its bore till it bottoms against the shims (Illust. 2-46).
- NOTE: Shims are available in .004, .007 and .015 inch.

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

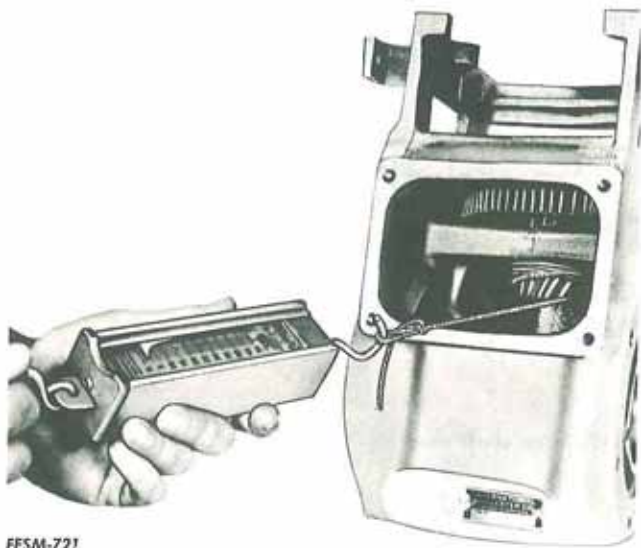
6. Install the constant mesh gear retaining ring on the pinion shaft (Illust. 2-46). Be sure the brake lining disc is installed and in position in transmission case. Hold with grease.

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



Illust. 2-47. Installing front bearing cone.



Illust. 2-48. Checking rolling torque of pre-loaded bearings.

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. 2-48).

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. 2-49. 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. The measurement obtained is to be considered "X" (Illust. 2-49).

<u>Class</u>	<u>Snap Ring Thickness Chart (Inch)</u>
A	.122 or up
B	.122 - .116
C	.116 - .110
D	.110 or under



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

**Example:**

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

(b) Rolling torque is 15 inch pounds.

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

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

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

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

13. Install a new expansion plug.

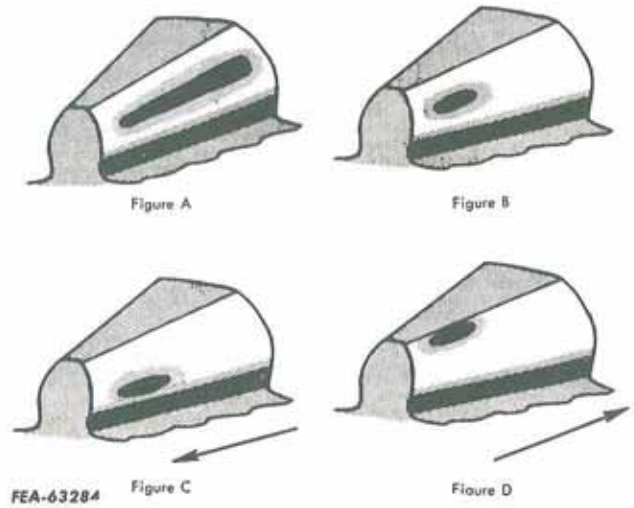
14. Install the differential assembly, keeping the pre-load shim pack correct as previously established. Drive gear must be on the right with teeth facing left.

15. Check the backlash between the drive gear and pinion and the gear teeth bearing pattern as follows. Refer to Illust. 2-50.

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 prevent concentration of load on teethegdes.

17. Hand testing and very light loads should provide a pattern as shown in Figure "B" (Illust. 2-50). When load and de-



Illust. 2-50. Tooth bearing pattern.

flection increases the pattern will progress as in Figure "A".

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

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

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

20. Install the rear axles and wheels. (Refer to page 2-26.)

21. Install the hydrostatic drive. (Refer to page 2-31.)

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

# CREEPER DRIVE

## Removal

1. Split the tractor. Refer to page 2-18 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 the creeper lubricant. Refer to Illust. 2-17.

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

4. Bump the creeper to the side to loosen the housing from its gasket and dowels. Pull the creeper forward from the reduction cover and splined coupling.

5. If the driven coupling or the pilot bushing needs replacing, support the coupling and drive out the coiled spring pin. Remove the coupling.

3. Support the direct drive coupling and drive the coiled spring pin out. Remove the coupling from the shaft.

4. Slide the planet carrier off the input shaft and the planet gears off the carrier pins.

5. Remove the flat thrust washer.

6. A snap ring holds the ball bearing outer race in the retainer. Remove the snap ring then push the bearing and shaft from the retainer.

7. The ball bearing is held on the shaft by a snap ring. Remove the snap ring. The shaft can now be pressed from the bearing.

8. Press the oil seal from the bearing retainer.

9. Drive the shift poppet pin from the shaft and remove the poppet.

10. Shift the lever and shifter collar toward the rear of the case and at the same time lift the shifter collar up to disengage it from the shift yoke.

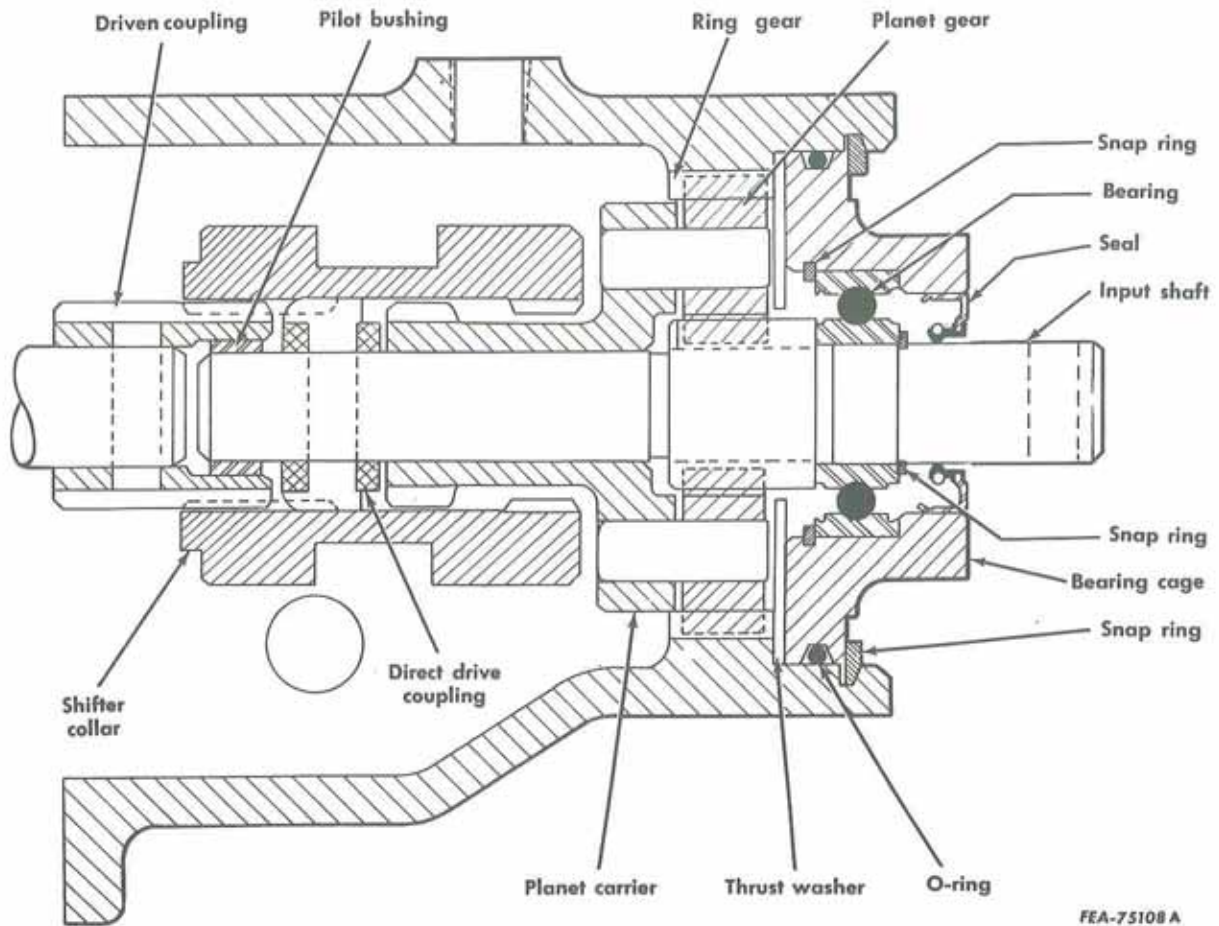
11. Drive the pin out of the shift yoke and lever shaft.

## Disassembly (Illust. 2-49)

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.



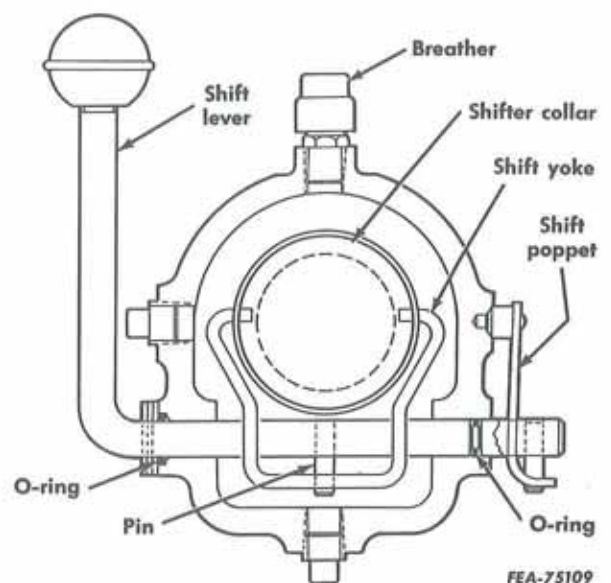
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Illust. 2-51. Cross section - side view of creeper drive assembly.

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.



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Illust. 2-52. Cross section - end view of creeper shifting components.



## 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.

## Reassembly (Illust. 2-30)

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

1. Always use new O-rings, gaskets and oil seals. O-rings and oil seals should be coated with lubriplate or chassis lubricant to assist in installation and provide initial lubrication.

2. Install the oil seal after completing the drive assembly in the housing.

3. The pins which secure the direct drive coupling and the driven coupling to their respective shafts must be flush or below the spline groove so as not to interfere with shifting.

4. The long internal splines of the shifter collar go toward the rear.

5. The machined shoulder of the direct drive coupling goes toward the planet carrier.

6. Lubricate the components and rotate the drive shaft several turns with the shifter in each speed selection to insure freedom of movement and rotation.

## Installation

1. Place a new gasket on the mounting face of the creeper housing. The dowels will hold it in place.

2. With the shifter collar in its rear position, rotate the drive shaft so the collar will engage the driven coupling as the dowels engage the reduction cover plate and the drive shaft enters its pilot bushing in the driven coupling.

3. Secure the creeper to the reduction housing cover plate.

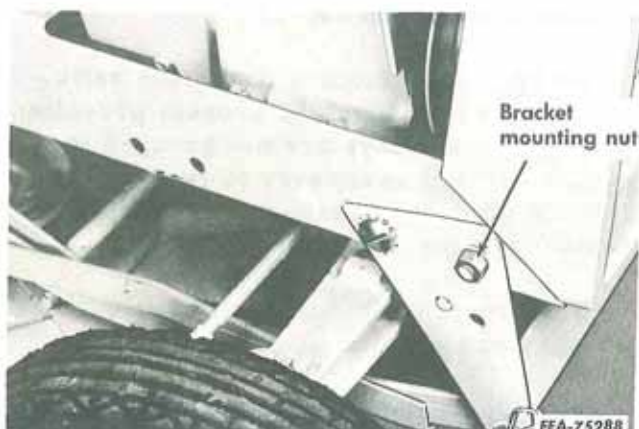
4. Fill the creeper housing to proper level (check plug on side of housing) with the same lubricant as specified for the transmission - differential. Hy-tran fluid or SAE 30 Engine oil.

5. Shift the unit several times to insure freedom of movement. Leave the shifter lever in its forward position for re-coupling the split tractor.

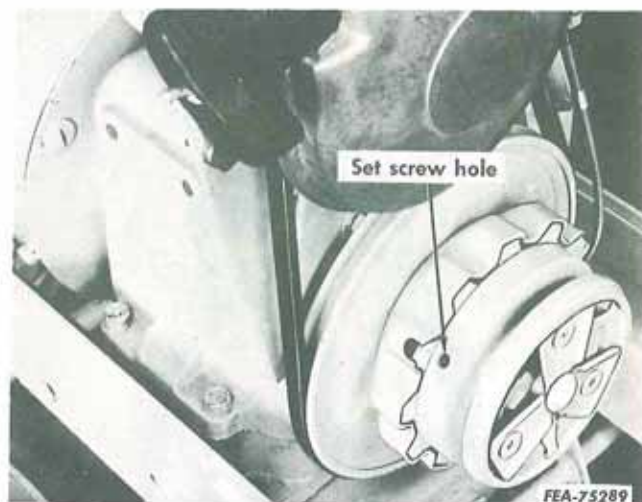
6. Reassemble the split tractor. (Refer to page 2-19.)

# FRONT PTO CLUTCH

## Removal



Illust. 2-53. Location of mounting bracket.



Illust. 2-54. Location of set screw holes in clutch pulley housing.

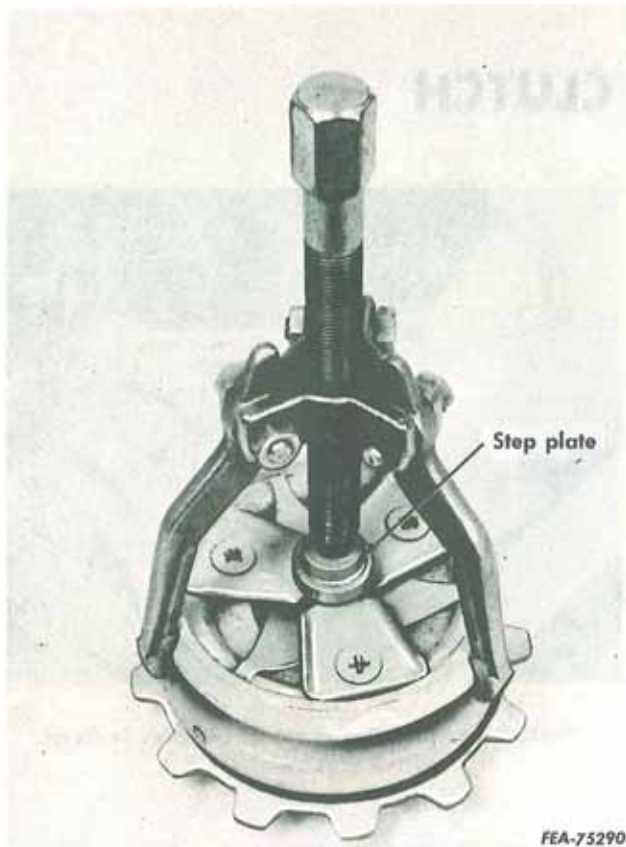
1. Loosen the idler pulley adjusting nut.
2. Remove the nut, lockwasher and cap screw on each side of the grille guard that secures the mounting bracket to the tractor frame (Illust. 2-53).
3. Disconnect the front clutch rod from the turnbuckle.
4. Remove the four nuts, lockwashers and cap screws securing the grille guard to the tractor frame. Remove the grille guard, hood and clutch shaft with rod from the tractor as an assembly.
5. Remove the jam set screw and lock set screw from each of the three holes in the clutch pulley housing (Illust. 2-54).

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

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

## Disassembly

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. 2-55). Use a step plate between the thrust button and the puller bolt.
2. Tighten up on the puller bolt just until the friction disc disengages the pressure plate.
3. Remove the throw-out lever screw jam nuts and remove the pressure plate and friction disc (Illust. 2-56).
4. Release the pressure applied to the clutch button by the puller and the remaining components of the clutch assembly can be removed.



Illust. 2-55. Three jaw puller installed on clutch assembly.



Illust. 2-56. Pressure plate and friction disc removed.

## Inspection and Repair

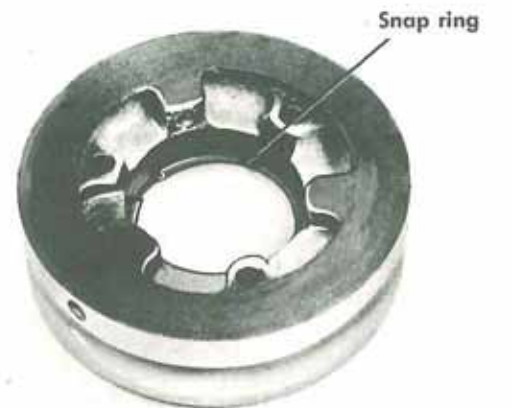
1. Inspect the pressure plate for scoring or excessive warpage. If it is .010 inch or more out of flat it must be replaced.

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. 2-57 Location of pulley snap ring.

5. Inspect the bearing snap ring for grooves or wear and replace if necessary (Illust. 2-57).

6. Inspect the clutch bearing on the engine crankshaft to be sure it turns free. Replace the bearing if there is any doubt as to its serviceability.



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

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

## Reassembly



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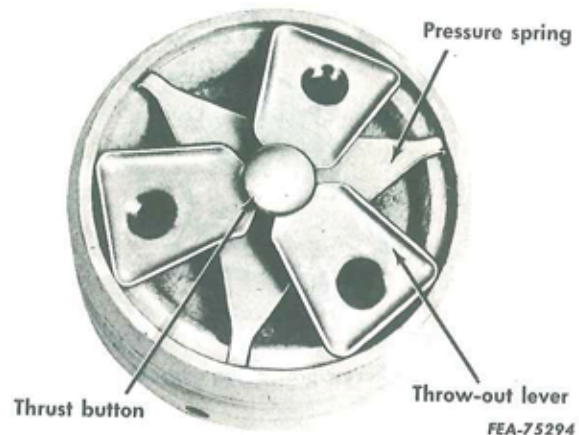
Illust. 2-58. Pressure spring located on pulley.

1. Position the pressure spring on the actuating pulley so the tips are equally spaced between the screw holes (Illust. 2-58).

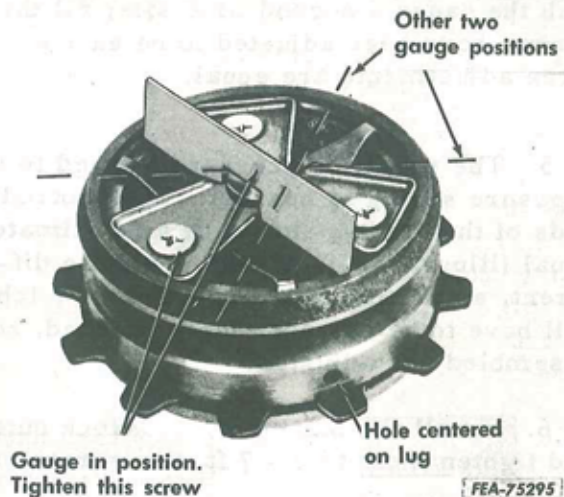
2. Install the thrust button in the pressure spring.

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. 2-59).

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. 2-59. Clutch partially assembled.



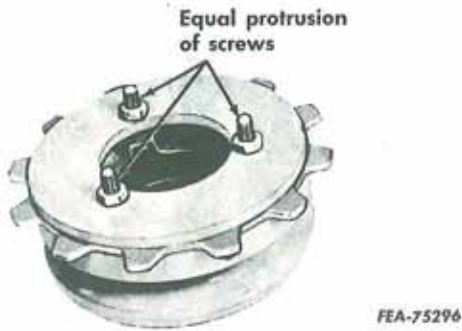
Illust. 2-60. Adjusting gauge in position.

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. 2-60).

## Adjustment

1. Install the adjusting gauge in position shown in Illust. 2-60.

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.



Illust. 2-61. Screw protrusion approximately equal.

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.

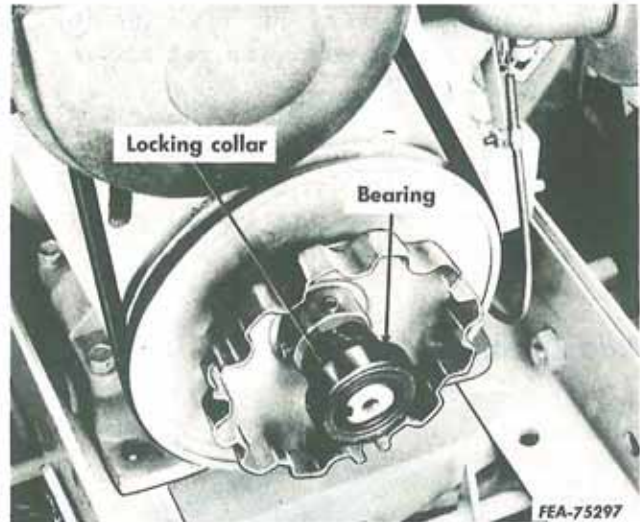
5. The specified pressure applied to the pressure spring is now set. The protruding ends of the screws should be approximately equal (Illust. 2-61). If they are quite different, something is wrong and the clutch will have to be disassembled, checked, re-assembled and adjusted.

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

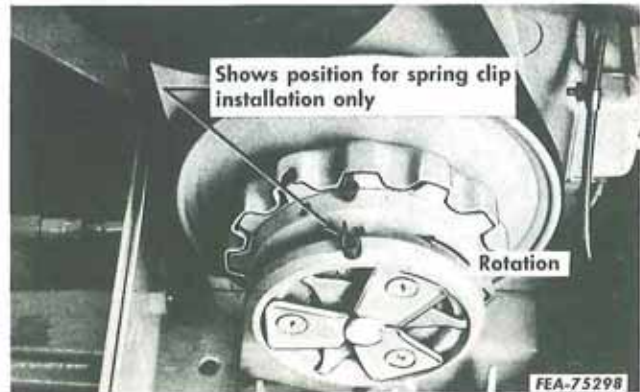
## Installation

1. If a new clutch bearing is to be used, install it on the crankshaft so it is flush with the end of the crankshafts. Lock it in place with the locking collar. Be sure to lock the collar to the bearing in the direction of crankshaft rotation. Lock the collar in place with the set screw and nut (Illust. 2-62).

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 crankshaft pulley (Illust. 2-62).



Illust. 2-62. Clutch bearing and collar installed on shaft.



Illust. 2-63. Installing the clutch assembly.

3. Equally space and install 3 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. 2-63). 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 under 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 5 - 6 ft. lbs.

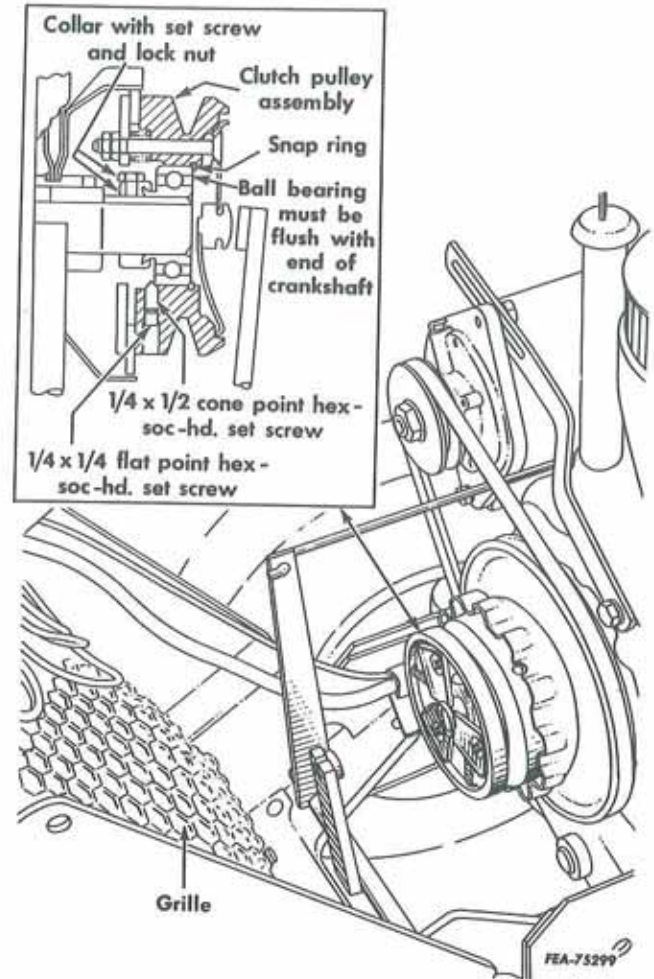
5. Install the three 1/4 x 1/4 inch flat point hex set screws and torque them 6 - 7 ft. lbs.



6. Install the grille and hood being sure the clutch rod is inserted through the engine front plate on hand start units and between the engine and motor-generator on electric start units.

7. Install the cap screw, lockwashers and nut on each side of the grille guard that secures the mounting bracket to the tractor frame.

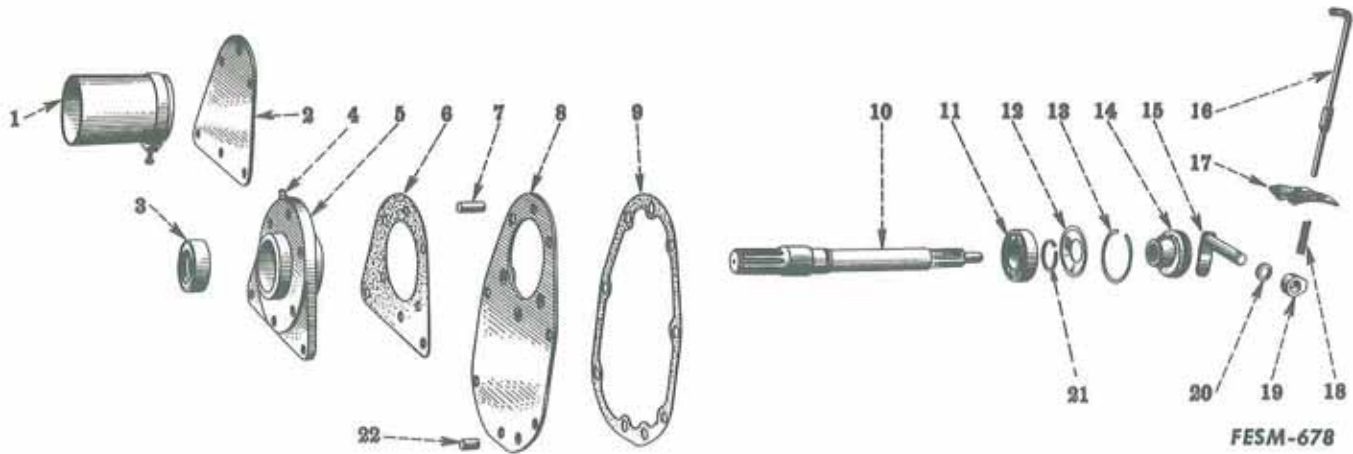
8. Connect the front clutch rod to the turnbuckle. With the hand lever in the forward position (clutch fully engaged), adjust the turnbuckle so there is  $1/64$  inch minimum clearance between the wear button and thrust button (Illust. 2-64). Secure the turnbuckle with the jam nut.



Illust. 2-64. Clutch linkage adjustment diagram.



# REAR PTO



Illust. 2-65. Exploded view of rear PTO.

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

The servicing of the rear PTO is basically easy as shown in Illust. 2-65. It is removed by removing the seven cap screws securing it to the transmission case. The PTO shaft bearing (11) is held on the shaft

with snap ring (21) and in the retainer (5) with snap ring (13). Always be sure to replace the oil seal (3) when service is performed to the assembly.

# IH EQUIPMENT

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## SPECIFICATIONS

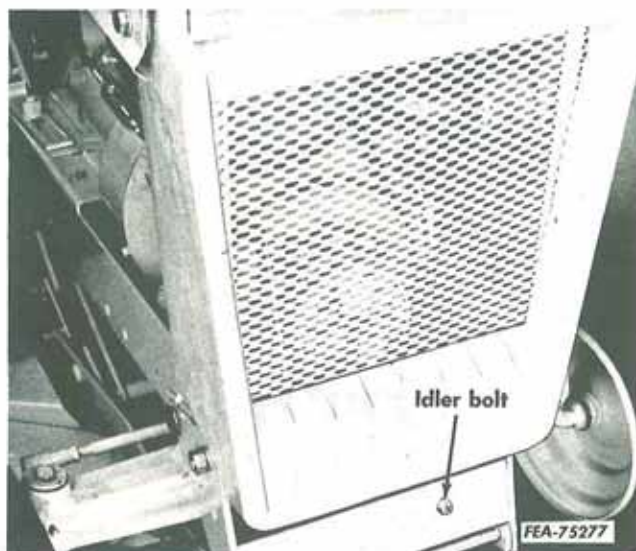
### Mowers

Torques (ft. lbs.)	
Spindle end bolt . . . . .	38-45
Blade nut . . . . .	55-60
<b>CW-36 Snow Thrower</b>	
Gear backlash . . . . .	.006 to .018 inch

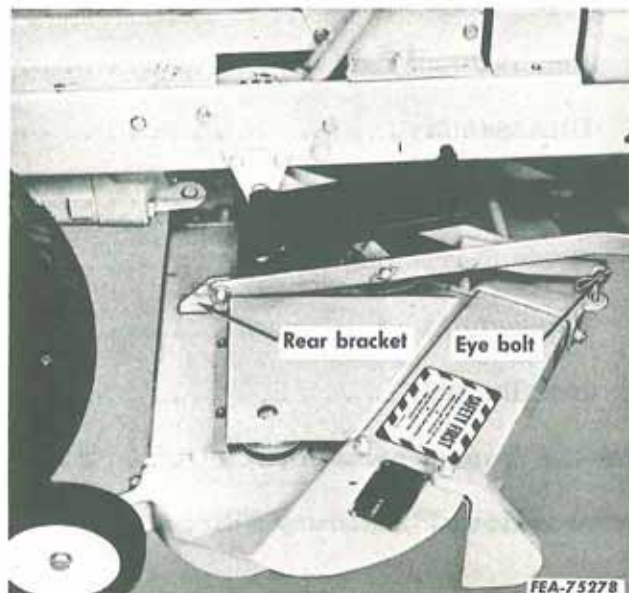
# MOWER

(3 Spindle)

## Removal



Illust. 3-1. Location of idler bolt.



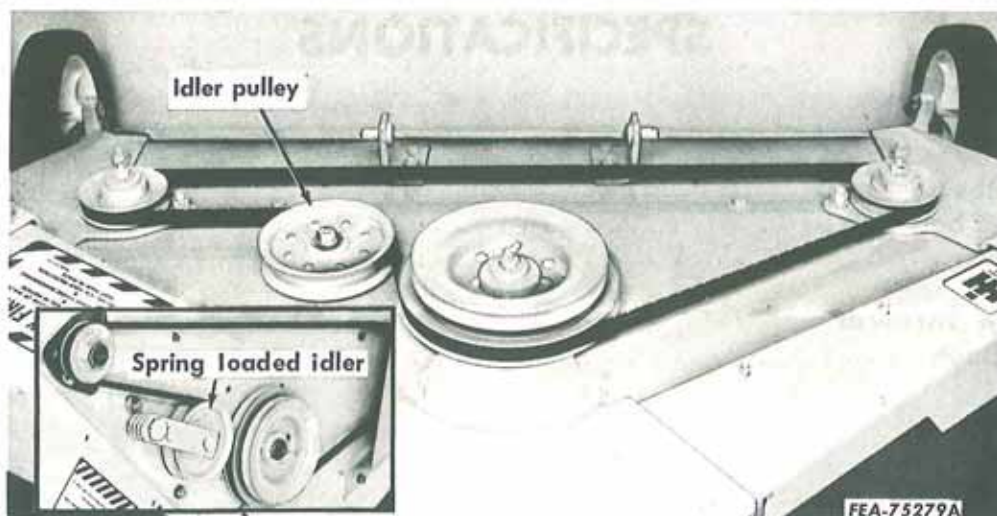
Illust. 3-2. Location of "QA" pins.

1. Lower the mower to the ground.
2. Loosen the idler bolt to allow enough slack in the drive belt for its removal (Illust. 3-1).
3. Remove the "QA" pins and washers securing the eye bolts to the lift frame (Illust. 3-2).
4. Remove the "QA" pins and washers securing the rear brackets to the lift frame.

5. Unhook the pins from the brackets and raise the lift handle.

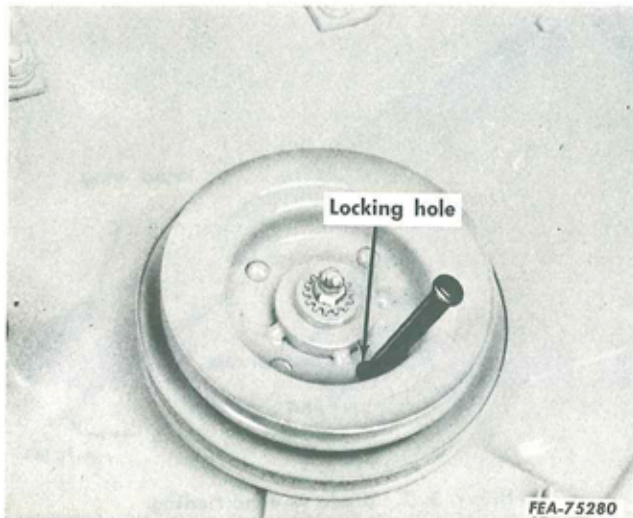
## Disassembly

1. Remove the L.H. and R.H. belt shields.
2. Remove the nut, lockwasher and carriage bolt securing the idler pulley in place and remove the pulley (Illust. 3-3).



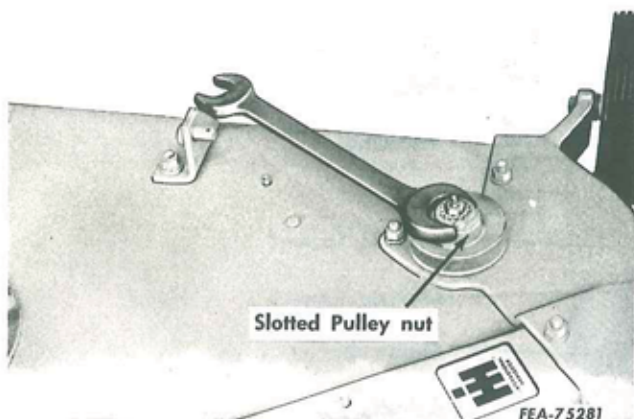
Illust. 3-3. Top view of mower assembly.





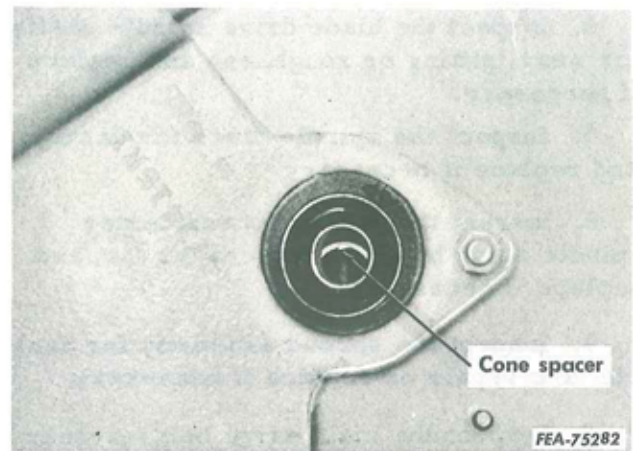
Illust. 3-4. Punch installed in locking hole.

3. Remove the spindle drive belt.
4. Install a punch in the locking hole in the center pulley and housing (Illust. 3-4).
5. Remove the nut and friction washer securing the center blade to the center end bolt.
6. Remove the spindle end bolt from the center pulley and remove the pulley. The spindle and disc assembly will drop out the bottom.



Illust. 3-5. Wrench locking outer pulley in place.

7. To remove either of the two outer pulleys and spindle and disc assemblies, install a wrench on the pulley to hold it in place and remove the blade nuts and spindle end bolts (Illust. 3-5).



Illust. 3-6. Cone spacer location.

8. 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.
9. Turn the mower over and tap against the inner race of the bearing cone to remove it and the top oil seal (Illust. 3-6).

## Inspection and Repair

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

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

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

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

3. Inspect the spindle drive belt for wear and replace if necessary.
4. Inspect the pulleys for wear and replace if necessary.
5. Inspect the blades for excessive wear and nicks. Refer to "BLADE SHARPENING", on page 3-4.

6. Inspect the blade drive spindle shafts for wear, pitting or roughness and replace if necessary.

7. Inspect the spindle discs for damage and replace if necessary.

8. Inspect the left, right and center spindle rotor housings for cracks etc. and replace if necessary.

9. Inspect the shroud assembly for dents etc. and repair or replace if necessary.

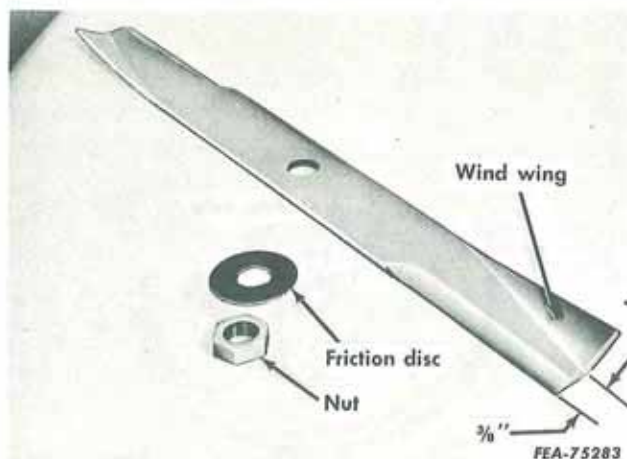
10. Inspect the main drive belt for wear and replace if necessary.

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 few strokes of 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



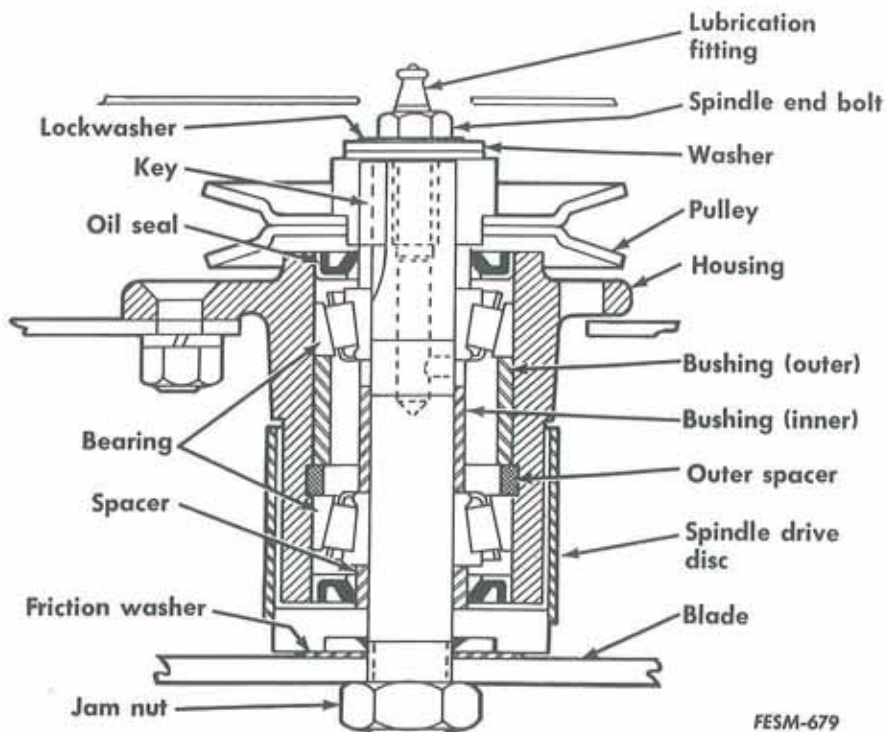
Illust. 3-7. Blade re-conditioning.

blade is within 3/8 inch of the blade wind wing (Illust. 3-7), it is recommended that a new blade be installed.

## Reassembly

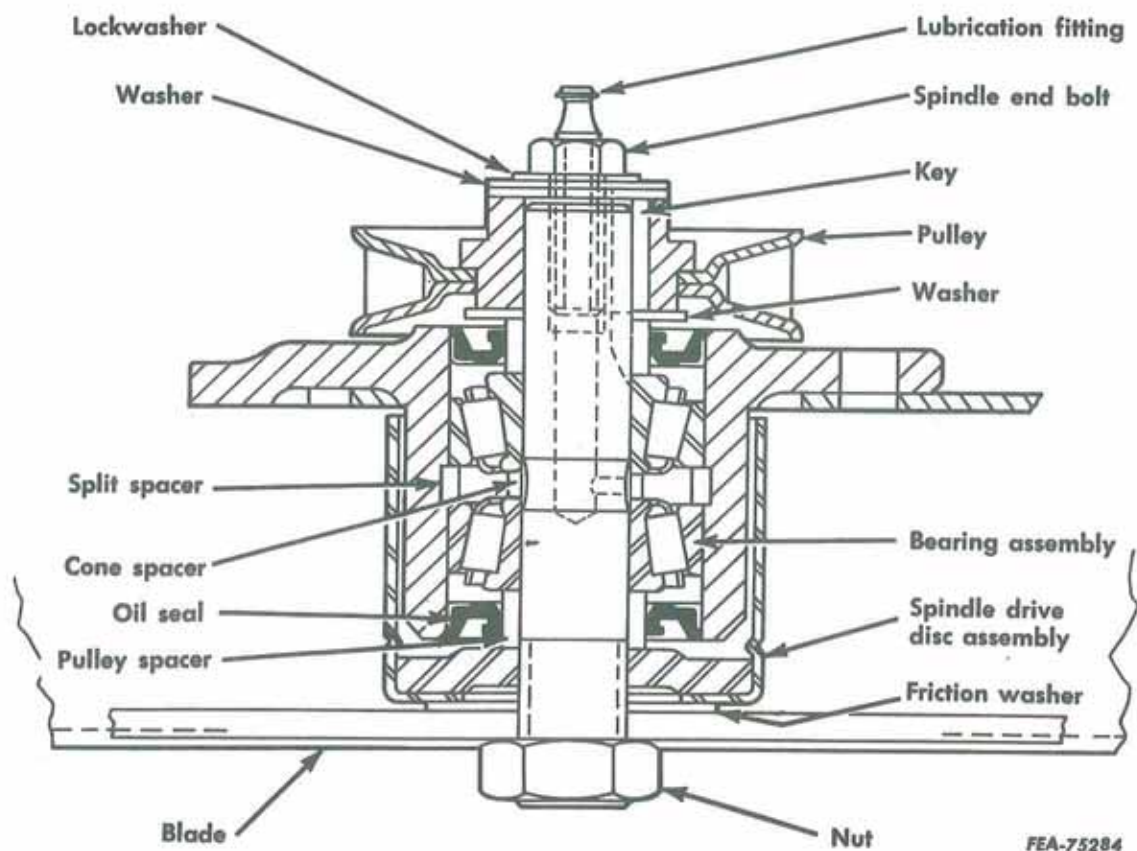
Steps 1 thru 9 cover reassembly of one spindle.

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. 3-9).



Illust. 3-8. Cross section view of spindle rotor housing for 48 inch mower.





Illust. 3-9. Cross section view of spindle rotor housing for 38 and 42 inch mowers.

2. Install the bottom bearing cone and oil seal. Be sure the oil seal is flush with the housing.

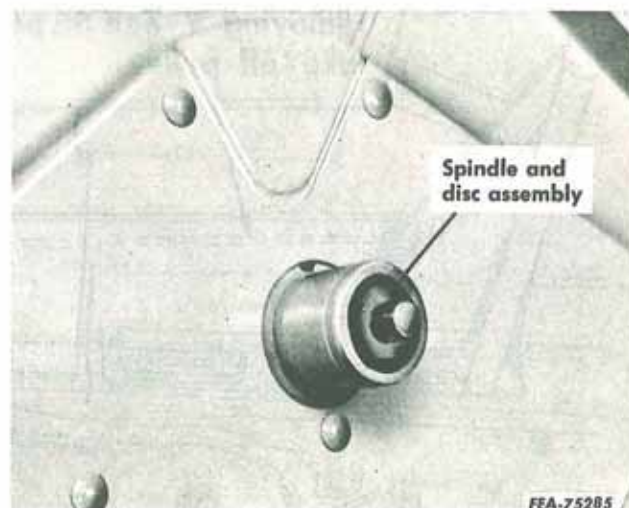
3. Install the cone spacer in the housing through the top of the housing (Illust. 3-6).

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 and disc assembly through the bottom of the mower (Illust. 3-10). Install the flat washer between the pulley spacer and the pulley.

7. Install the key in the spindle and install the pulley.



Illust. 3-10. Spindle and disc assembly installed.



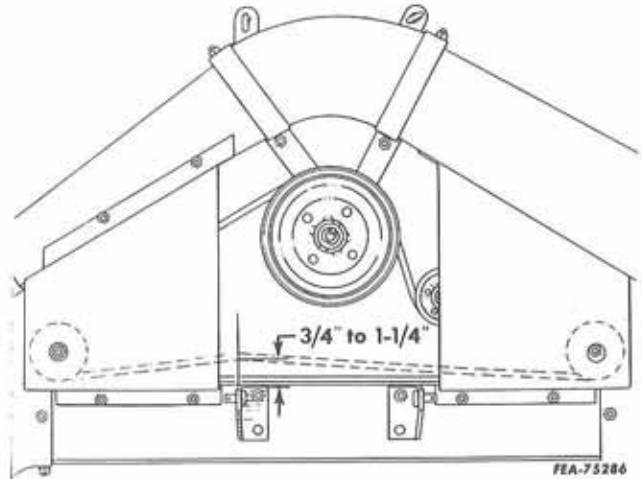
8. Secure the pulley to the spindle with two flat washers, star lockwasher and spindle end bolt. Torque the end bolt to 38 - 45 ft. lbs.

**NOTE:** To use a socket on the center pulley end bolt, it is necessary to remove the tip of the lubrication fitting.

9. Install the blade friction washer, blade and blade nut. Torque the blade nut to 55 - 60 ft. lbs.

10. Install the flat idler pulley in the slotted section of the mower housing. Install the spindle drive belt. If equipped with spring loaded idler, no adjustment is necessary. Adjust the idler pulley to the specified tension. (Refer to Illust. 3-11.)

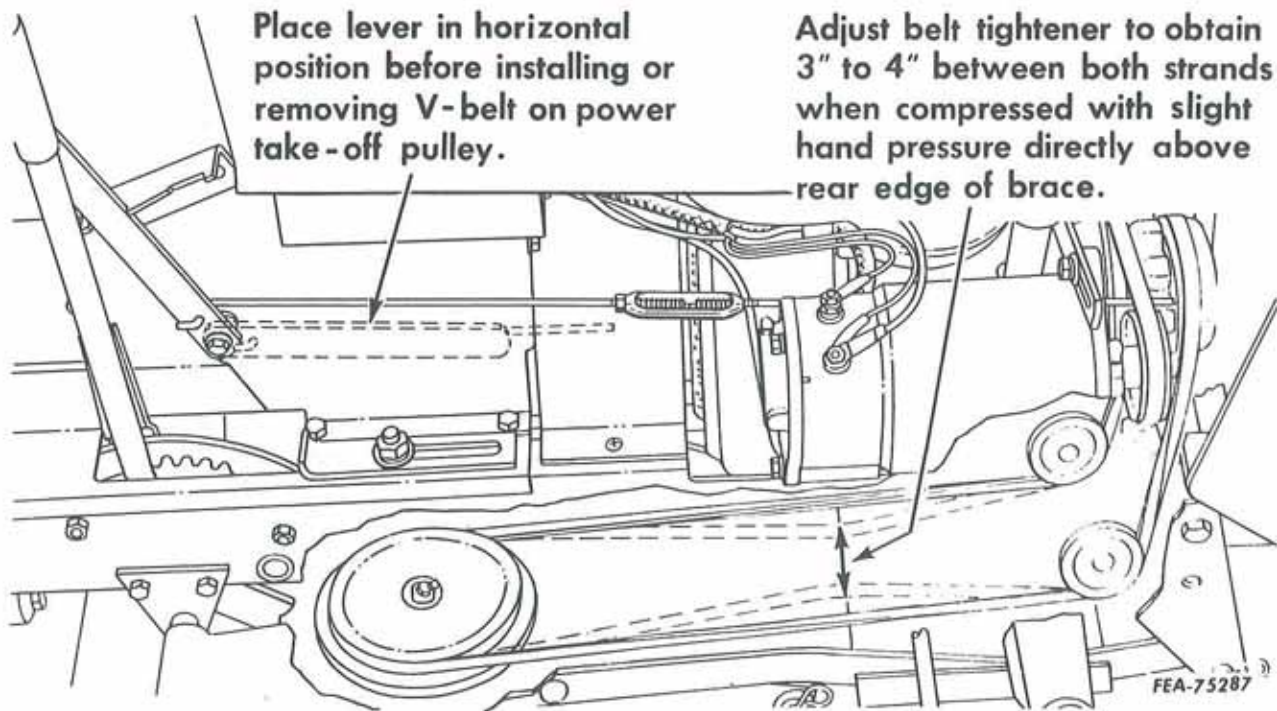
11. Install the L.H. and R.H. belt shields.



Illust. 3-11. Specified belt tension.

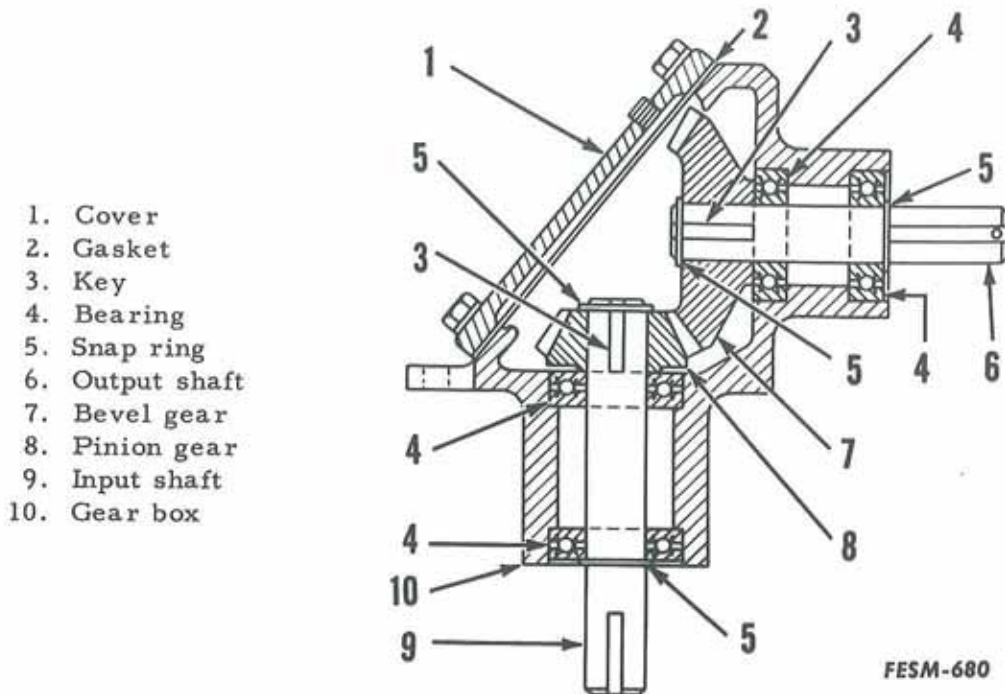
### Installation

Installation is the reverse of removal procedure except for the adjusting of the main drive belt. Adjust the main drive belt as shown in Illust. 3-12.



Illust. 3-12. Main drive belt adjustment diagram.

## CW-36 SNOW THROWER

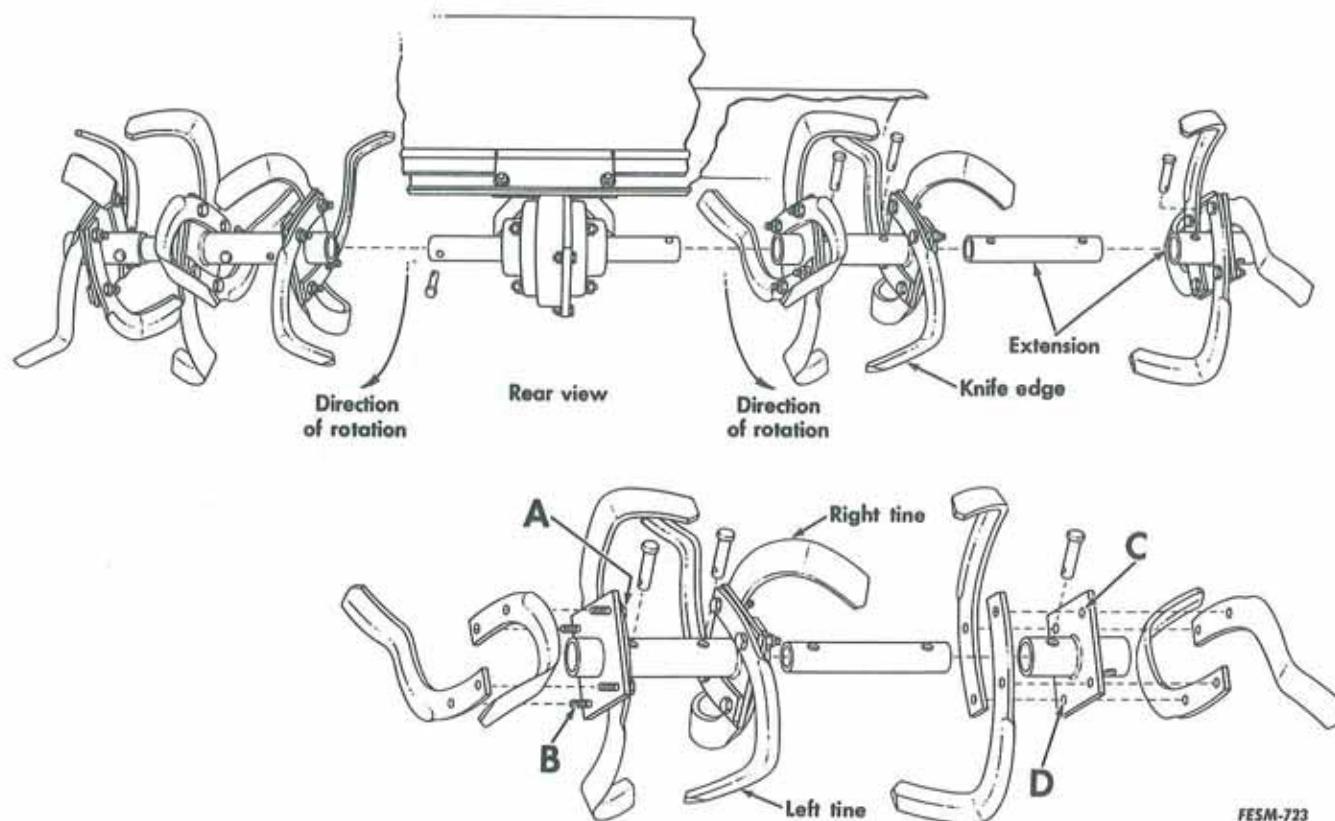


Illust. 3-13. Sectional view of gear box.

The gear box for the snow thrower is the only assembly that requires servicing information. The four bearings are bottomed against shoulders in the gear box. The bearings at the outer ends of the shaft are retained in the gear box with snap rings.

The bevel and pinion gears are keyed to their shafts and held in position with snap rings. There is no shimming of the gears for backlash as this is predetermined by the manufacturer. Specified backlash is .006 to .018 inch.

# INTERNATIONAL® 1 ROTARY TILLER



Illust. 3-14. Rear view showing proper tine assembly for correct timing.

FESM-723

## 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.

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 reviewed from the rear of the machine. See Illust. 3-14.

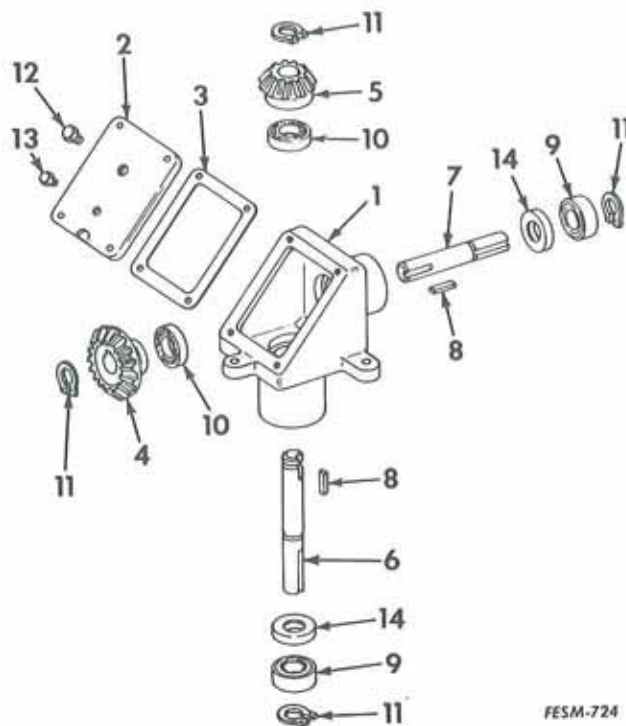
The tine shaft having two mounting plates has one plate with bolt holes "A" and "B" in line with the shaft pin hole.

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. 3-14. 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. 3-14. The completed extension assembly is the same for each side of the tiller; make sure the knife edges lead in the direction of rotation.



FESM-724

Illust. 3-15. Exploded view of gear box.

### Servicing Gear Box

The gear box for the rotary tiller is the only assembly that requires servicing information. The four bearings are bottomed against shoulders in the gear box. The bearings at the outer ends of the shaft are retained in the gear box with snap rings. The bevel gears are keyed to their shafts and held in position with snap rings. There is no shimming of the gears for backlash as this is predetermined in manufacturing. Always replace the oil seals when the gear box is disassembled.

- |                          |                    |
|--------------------------|--------------------|
| 1. Case                  | 7. Output shaft    |
| 2. Cover                 | 8. Key             |
| 3. Gasket                | 9. Bearing         |
| 4. Bevel gear (30 tooth) | 10. Bearing        |
| 5. Bevel gear (20 tooth) | 11. Snap ring      |
| 6. Input shaft           | 12. Plug, 1/8 inch |
|                          | 13. Plug, 1/4 inch |
|                          | 14. Oil seal       |









**1<sup>st</sup> in service**