
# Blue Ribbon Service

GSS-1389

## INTERNATIONAL® CADET® 60

## RIDING MOWER

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.

## LIBRARY FILING INFORMATION

1. File this manual in Book 16 after Divider Tab GSS-1389.
2. Enter the following information in the Service Manual Index.

   In the Mowers and Rakes Section, under the heading of "Complete Unit Overhaul", Print, or preferably type in, the Manual Description, Form Number, and the Book Filed in.

# General Contents

# GENERAL INFORMATION


Illust. 1-1. Right side view.

Before operating the International Cadet 60 Mower, be sure to read the "Safety Rules" described in the Operators Manual. Some of the rules are repeated below because of their importance.

DO NOT MAKE ANY ADJUSTMENTS (except carburetor) WITHOUT FIRST DISCONNECTING THE SPARK PLUG WIRE.

Do NOT work on the mower with the engine running.

NEVER place hands or feet under the mower, or near any moving parts while the mower is moving.

Refer to the Operators Manual for the correct lubricant to use with this mower.

# Standard Torque Data for Nuts and Bolts

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

A. All thread surfaces are clean and lubricated with SAE-30 engine oil. (See NOTE.)

B. Joints are rigid, that is, no gaskets or compressible materials are used.

C. When reusing nuts or bolts use minimum torque values.

NOTE: Multiply the standard torque by:

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

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

## BOLT TYPE IDENTIFICATION CHART

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

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

# SPECIAL SERVICE TOOLS REQUIRED

## Section 1 — Engine

| Tool No. | Description | Tool No. | Description |
|---|---|---|---|
| 28676 | Oil seal sleeve | 670146 | Valve seat reseater |
| 28677A | Oil seal driver | 670147 | Ridge reamer |
| 28678 | Oil seal sleeve | 670152 | Governor shaft gauge |
| 670106 | No. 1 internal snap ring pliers | 670169 | Flywheel knockoff nut |
| 670117 | Piston ring expander | 670197 | Crankshaft oil seal remover (magneto end) |
| 670139 | Oil seal sleeve | 670217 | Flywheel spanner wrench |
| 670140 | Oil seal driver | 670219 | Spark plug wrench |

## Section 2 and 3

None required

Send your orders for the above service tools to:

Tecumseh Products Company, Lauson-Power Products Parts Depot Division, Grafton, Wisconsin.

# SPECIAL TORQUES

### (Inch-Pounds)

| | | | |
|---|---|---|---|
| Cylinder head bolts | 170 | Carburetor to intake pipe | 54 |
| Connecting rod to crankshaft | 98 | Air cleaner to carburetor | 18 |
| Mounting flange to cylinder | 87 | Fuel tank mounting | 120 |
| Magneto stator to cylinder | 72 | Muffler bolts to cylinder | 120 |
| Flywheel nut | 380 | Clamp lever (mechanical governor rod) | 9 |
| Spark plug | 210 | Speed control cover | 54 |
| Starter to blower housing | 43 | Starter (rewind) - #1/4 - 28 Screws | 56 |
| Blower housing to crankcase | 84 | Oil drain plug (taper pipe thread) | 108 |
| Breather cover | 28 | | |
| Valve spring cover | 23 | | |
| Intake pipe to cylinder | 84 | | |

Section 1

# ENGINE

## CONTENTS

# SPECIFICATIONS

## General

| | |
|---|---|
| Bore - inches | 2-5/8 |
| Stroke - inches | 2-1/2 |
| Displacement - inches | 13.53 |
| Compression pressure (refer to page 1-5) - psi | @ 500 rpm 60<br>@ 800 rpm 80 |
| Engine Speed (governed) | |
| Minimum speed - rpm | 1800 |
| Maximum idle speed (no load) - rpm | 3600 |
| Valve clearance (engine cold) - inch | .010 |

Ignition

| | |
|---|---|
| Spark plug gap (14 mm plug) - inch | .030 |
| Breaker point gap - inch | .020 |
| Timing (before TDC) (refer to page 1-14) - inch | .080 - .090 |

## Engine

Cylinder Bore

| | |
|---|---|
| New - inches | 2.6250 - 2.6260 |
| Maximum oversize (before reboring) - inches | 2.631 |
| Taper (new) - inch | .0005 |
| Out-of-round (new) - inch | .0005 |

Crankshaft

| | |
|---|---|
| End clearance - inch | .006 - .026 |
| Crankpin diameter (new) - inches | 1.0615 - 1.0620 |
| Bearing bore diameter - inches | 1.0000 - 1.0005 |

Connecting Rod

| | |
|---|---|
| Bore (new) - inches | 1.0630 - 1.0635 |
| Crankpin running clearance (new) - inch | .001 - .002 |
| Side clearance | .004 - .021 |

Piston

| | |
|---|---|
| New (measured just below oil ring 90 deg. from piston pin) - inches | 2.6205 - 2.6185 |
| Piston ring end gap - inch | .007 - .017 |

Piston to Cylinder Bore Clearance

| | |
|---|---|
| Top of skirt (measured just below oil ring) - inch | .0060 - .0045 |

Valves

Valve Stem (diameter)

| | |
|---|---|
| Intake (new) - inch | .3100 - .3105 |
| Exhaust (new) - inch | .3100 - .3105 |

Valve Springs

| | |
|---|---|
| Free length - inches | 1-9/16 |
| Compressed length - inches | 45/64 |

Valve Guides (inside diameter)

| | |
|---|---|
| Intake and exhaust (new) - inch | .312 - .313 |
| Intake and exhaust oversize dimension - inch | .3432 - .3442 |
| Tappet clearance in block - inch | .0010 - .0035 |
| Camshaft running clearance - inch | .0005 - .0020 |

Valve Clearance (stem end)

| | |
|---|---|
| Intake and exhaust (cold) - inch | .010 |
| Valve face angle - degree | 45 |
| Valve seat width - inch | 3/64 |
| Valve seat angle - degree | 45 |

| | |
|---|---|
| Alternator-Magneto Brush Spring Tension - lbs. | 1.129 - 1.527 |

Starter

No Load Test: 6 volts

| | |
|---|---|
| Amps | 25 |
| RPM | 6000 |

Carburetor

| | |
|---|---|
| *Float setting - inch | .180 - .200 |
| Idle speed adjusting screw setting | 1 - turn open |
| High speed adjusting screw setting | 1 - turn open |

*Measure between top of float (free end) and pad surface

Recoil Starter

| | |
|---|---|
| Preload on rewind spring | Sufficient turns to retract all rope. (Recommended length 54-inches) |

# PRE-OVERHAUL CHECK

A thorough check of the engine before overhaul will frequently point up the cause of improper operation. If a check of carburetion, page 1-16 and Electrical System, page 1-21 indicates no faulty operation, check the following:

1. Remove the spark plug and insert a compression gauge into the spark plug port. Crank the engine and check the compression reading on the gauge. If the reading is 60 lbs. or less, the engine should be disassembled and overhauled. Allow for operation of the Mechanical Compression Release.

2. If a compression gauge is not available, disconnect the spark plug lead to insure that the engine will not start and pull the starter rope slowly in the direction of normal rotation. There should be considerable resistance to turning as the piston approaches top-dead-center.

Hold the piston against compression for several seconds. If resistance to pull rapidly decreases, it indicates poor compression. Allow for the operation of the Mechanical Compression Release. Poor compression is usually the result of one or more of the following:

a. Defective head gasket.

b. Warped head.

c. Burned valves.

d. Carbon accumulation on valves.

e. Worn piston rings.

f. Worn cylinder bore.

g. Weak or broken valve springs.

h. Improper clearance between valve lifter and valve stem.

i. Ring gaps not staggered around the piston.

3. Crank the engine slowly, checking for noise, binding, scraping, or other signs of improper operation. These symptoms could be due to damaged bearings, connecting rod, valves, or to a bent crankshaft.

4. Rock the crankshaft back and forth to check for excessive play. Excessive play indicates worn rod bearings or a worn piston pin.

5. Check the oil seals for evidence of oil leaks; replace seal if necessary.

6. Remove the valve spring cover assembly and crankcase breather assembly to crankcase; remove the cover and breather.

Check the valve lifter clearance. Make sure that the clearance is checked while the piston is in either compression or power stroke so that the cams on the camshaft are free of the valve lifters. This check should be made when the engine is cold, and valve clearance should be .010 inch. Valve lash adjustment is described on page 1-13.

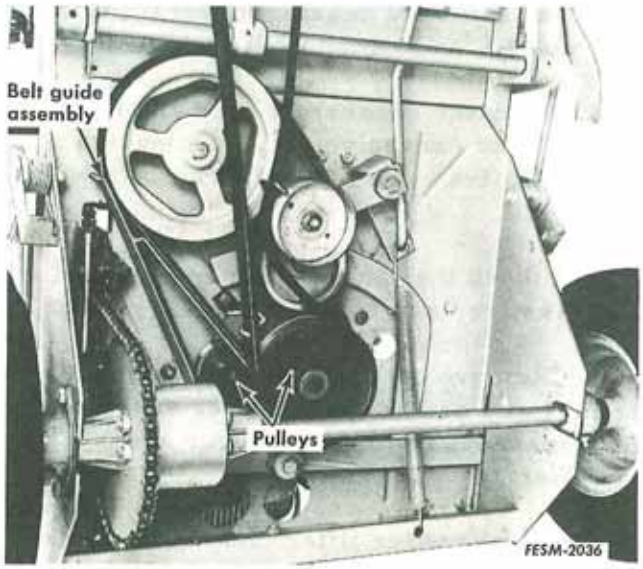
NOTE: Due to the Mechanical Compression Release, it will be necessary to position the crankshaft so that the valve lifters do not contact the valve stems.

# Removal

The following procedure applies to both, the Electric Start and Recoil Start engines except as noted.

NOTE: It is not necessary to "drop" the mower or remove the body for engine removal.

1. Electric Start Engines: Remove the wing nut securing the operators seat to the body. Remove the seat. Disconnect the battery.




Illust. 1-2. Cadet 60 underside.

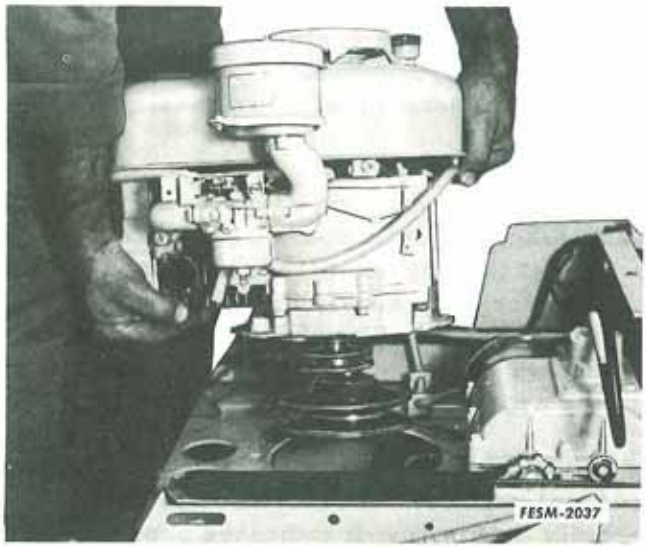
2. Remove the drive chain shield and belt guide assembly (Illust. 1-2).

3. Remove the drive belts from the engine pulleys.

4. Electric Start Engines: Disconnect the wiring harness from the rectifier panel.

NOTE: Tag the location of the leads.

5. Disconnect the throttle control cable from the carburetor.




Illust. 1-3. Removing the engine.

6. Remove the cap screws securing the engine to the main frame. Lift the engine out of the chassis (Illust. 1-3). Place the engine on a clean work bench.

# Disassembly

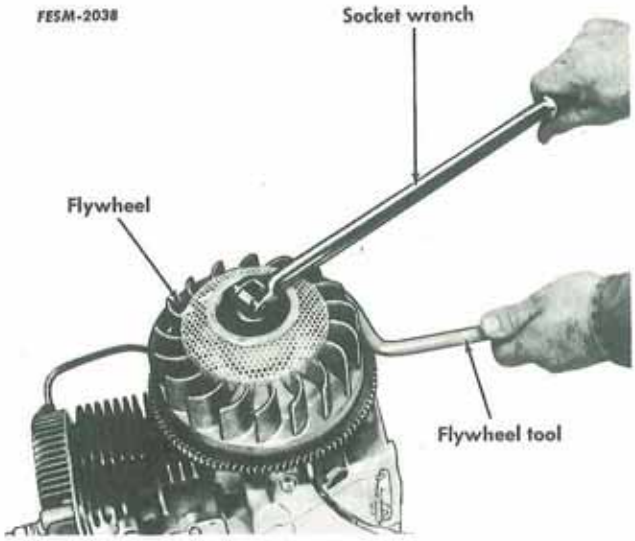
1. Drain the engine oil and the fuel tank.

2. Remove the crankshaft and camshaft belt drive pulleys (Illust. 1-2).

3. Disconnect the fuel lines from the carburetor. Remove the carburetor - air cleaner assemblies from the engine.

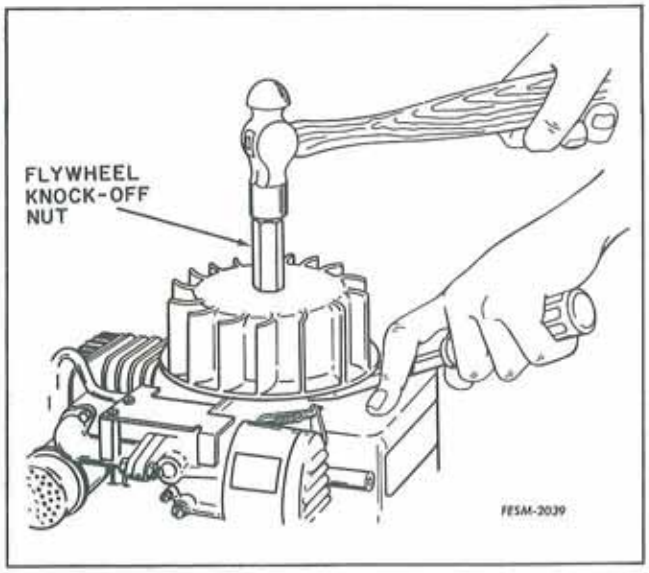
4. Remove the cranking motor, if so equipped. Remove the bayonet gauge (dip stick) and tube assembly.

5. Remove the mounting screws securing the fuel tank and the recoil starter assembly to the engine. Remove the tank and the recoil starter assembly.




Illust. 1-4. Removing the flywheel nut.

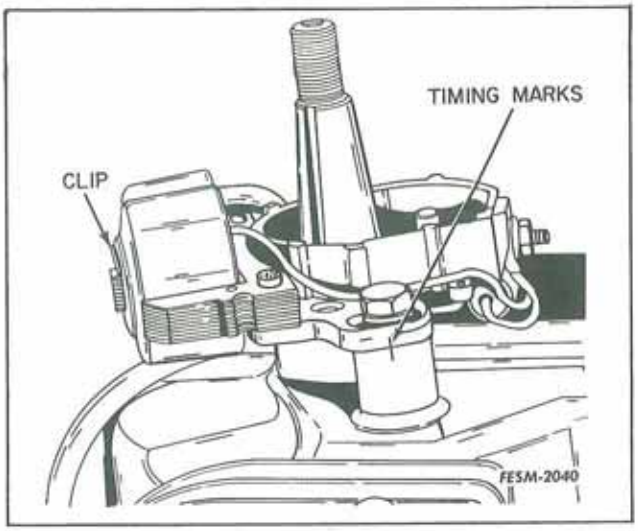
6. Using spanner wrench No. 670217 to hold the flywheel (Illust. 1-4), remove the flywheel nut, starter cup and screen.




Illust. 1-5. Removing the flywheel.

7. Thread three-fourths of the knock-off nut No. 670169 onto the crankshaft. Tap on the nut to remove the flywheel (Illust. 1-5). Remove the key from the crankshaft.

8. Remove the cap screws securing the rectifier panel and blower housing extension to the engine. Do not disconnect the magneto-alternator wiring from the panel.




Illust. 1-6. Magneto timing marks.

9. Make sure that timing marks are plainly visible on the magneto breaker plate and the crankcase (Illust. 1-6). Scribe a timing mark if necessary.

10. Remove the cap screws securing the magneto-alternator to the engine. Remove the magneto-alternator and rectifier panel - blower housing extension from the engine.

NOTE: Do not disconnect wiring from the magneto-alternator unless replacement is necessary.

11. Remove the crankcase mounting flange.

12. Rotate the crankshaft until the lifters do not contact the valve stems. Remove the camshaft and the oil pump.

13. Remove the cylinder head and gasket. Remove the ridge at the top of the cylinder bore, if present. Use ridge reamer tool No. 670147.

14. Remove the connecting rod cap and slide the piston and rod out of the top of the cylinder block.

15. Remove the crankshaft and thrust washer. Remove the crankshaft oil seal from the cylinder assembly.

16. Remove the breather cover and breather assembly.

17. Remove the intake and exhaust valves as follows:

a. Raise the lower valve springs with the blade of a screwdriver while holding the valve heads tightly against the valve seat. Remove the keepers.

b. Lift the valves from the cylinder block. Remove the valve springs from the cylinder assembly.

IMPORTANT: The exhaust valve and the intake valve are not identical. The exhaust valve is identified by an "EX" marking.

18. The valve guides are an integral part of the cylinder block. Refer to "Valve Guides" under Inspection and Repair.

# Inspection and Repair

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

## Reboring the Cylinder Block

1. The cylinder must be rebored if badly scored or exceeds 2.631 inches in diameter.

2. Always rebore, then hone, to exactly .010 or .020 inch 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.

## Camshaft

1. Check the camshaft for scored or worn bearing surfaces, broken automatic release weight and gear teeth.

2. Measure the cam lobe nose-to-heel diameter. The permissible minimum diameter is 1.262 inches. Replace the camshaft if necessary.

## Crankshaft

1. Check the crankshaft for scoring or wear. Superficial score marks can be polished out with crocus cloth soaked in oil.

2. Check the keyway and tapered part of the crankshaft for wear. If worn, replace the shaft.

3. Chase the crankshaft thread if necessary. With a micrometer, check the bearing surfaces and crankpin surface of the crankshaft. If not within the specified tolerances, replace the shaft.

4. Check the crankshaft gear for wear, broken teeth or loose fit on crankshaft. If the gear is damaged, press off the gear and remove the key from the shaft. Install a new key in the shaft and press on the new gear with I.D. chamfer of the gear toward the counterweight.

## Crankshaft Main Bearings

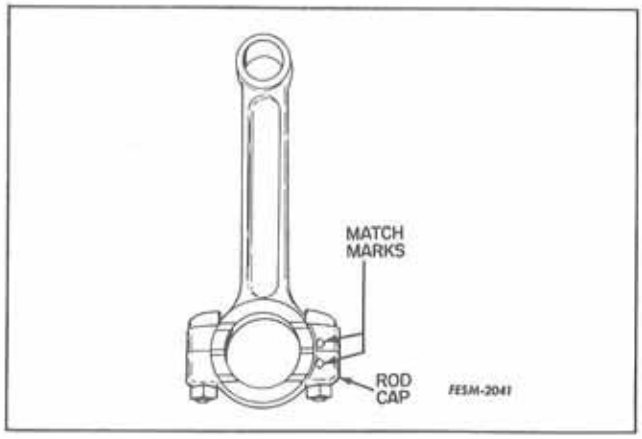
Crankshaft main bearings are not serviced separately. The bearings are integral with the cylinder assembly and the crankcase mounting flange. Check the bearings for scoring and wear. If the bearing diameter exceeds 1.0005 inches, replace the cylinder assembly and/or the crankcase mounting flange.

## Connecting Rod

If inspection reveals excessive wear, as indicated in the following steps, the connecting rod and cap must be replaced.

1. The bearings are an integral part of the rod and are not serviced separately. Check the bearings for wear and scoring.

2. The piston pin must be a snug fit in the bearing.



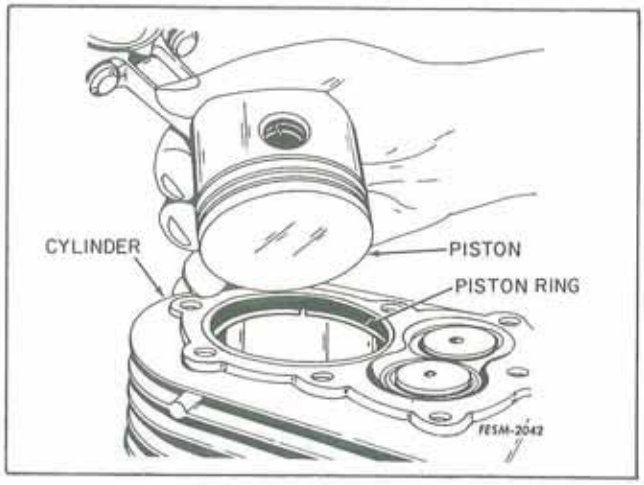

Illust. 1-7. Connecting rod and cap match marks.

3. Assemble the bearing cap to the rod. Be sure the match marks (Illust. 1-7), are aligned. The inside diameter must measure between 1.0630-1.0635 inches.

4. Visually check the rod for signs of cracking, distortion, wear or damage.

## Piston Rings, Piston and Piston Pins

1. Rings must always be replaced in sets, never singly. NEVER RE-USE OLD RINGS.




Illust. 1-8. Positioning the piston ring in the cylinder for checking.


Illust. 1-9. Measuring ring gap.

2. Check the ring gap by inserting each ring, in turn, into the bore. Use the piston (Illust. 1-8) to position the ring squarely in the bore. Measure the ring gap with a feeler gauge (Illust. 1-9). The gap must be .007-.017 inch. If the gap is below .007 file the ring ends. If the gap is above .017 refer to "Reboring the Cylinder Block" page 1-8.

3. Inspect the piston for wear or scoring. Replace the piston and pin assembly as necessary.

NOTE: The piston and piston pin can be replaced only in matched pairs. If either is worn or damaged both must be replaced.

4. Clean the ring grooves in the piston and fit new rings.

5. With new rings in place, check the compression ring side clearance between the land of the piston and ring with a feeler gauge. The clearance must be .0020-.0045 inch. Replace the piston and pin assembly if necessary. Refer to Note in step 3.

6. Remove retainer rings and check the piston pin for scoring or wear. If the pin diameter does not meet the specified .6248-.6250 dimension, replace the piston and pin assembly. Refer to Note in step 3.

## Valves, Seats and Guides

1. Check for excessive play of valve stems in guides. Valve guides are an integral part of the cylinder block. The guide can be rebored to accommodate a valve with a 1/32 inch oversized stem.

2. Rebore the valve guides as follows:

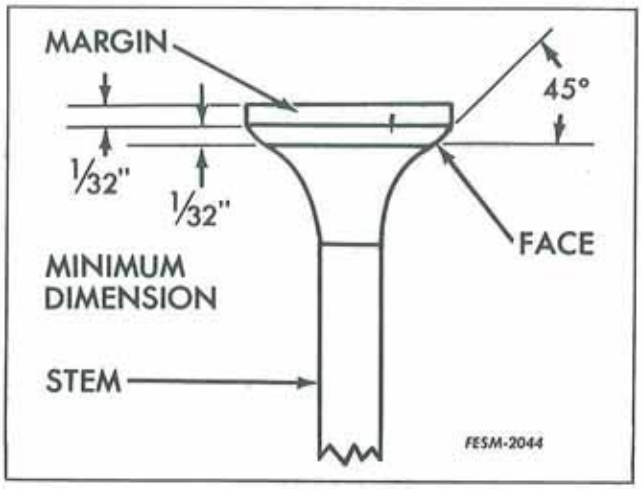
a. Ream the valve guides to .3432-.3442 inch diameter using a standard straight shanked hand reamer or low speed drill press.

3. Check the valve springs for compression and pitting. If the valve springs are less than 1-9/16 inch free length and compressed length of 45/64 inch, replace them.

4. The valve seats are made of cast iron. The seats are not removable.

If a valve seat is warped or distorted beyond repair, replace the cylinder assembly.

If the seat is over 3/64 inch wide after regrinding, use a 15 degree stone or cutter to narrow the face to .042-.052 inch.




Illust. 1-10. Valve face dimensions.

5. Reface or replace the valves as necessary. Refer to Illust. 1-10 for face angle and margin limits. Replace any valve with a margin less than 1/32 inch.

6. Lap in the valves to provide a proper seat. New or reground valves must be lapped in.

7. Regrinding the valves changes the valve lash. Refer to "Valve Lash Adjustment" on page 1-13 for adjustment procedure.

## Governor

Check the governor gear shaft for wear. Do not remove the shaft unless replacement is necessary. Refer to page 1-11 for replacement procedure.

## Crankcase Mounting Flange

1. Remove the crankshaft and camshaft oil seals with a screwdriver.

NOTE: Do not damage the bores.

2. Inspect the camshaft bearing (the bearing is an integral part of the crankcase mounting flange). Measure the bearing bore. Specified bore size is .6235-.6245 inch. Replace the mounting flange if the bore is damaged or oversize.

3. Inspect the crankshaft main bearing for scoring or wear. If the bearing diameter exceeds 1.0005 inches, replace the mounting flange.

4. Inspect the mounting flange for cracks, distortion, and worn threads. Replace the mounting flange if necessary.

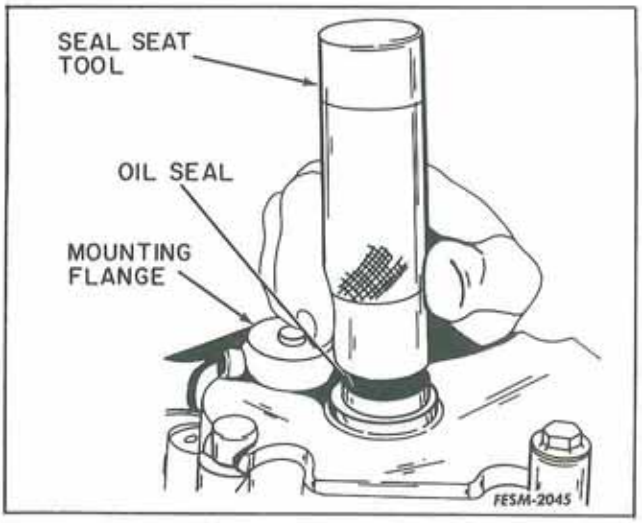
### Barrel Type Oil Pump

1. Inspect the pump plunger for rough spots or wear. If the pump plunger is scored or worn, replace the entire pump.

2. Inspect the pump outer barrel, inner barrel and bearing surfaces for scoring or wear. Replace the entire pump if necessary.

## Reassembly

### Oil Seals



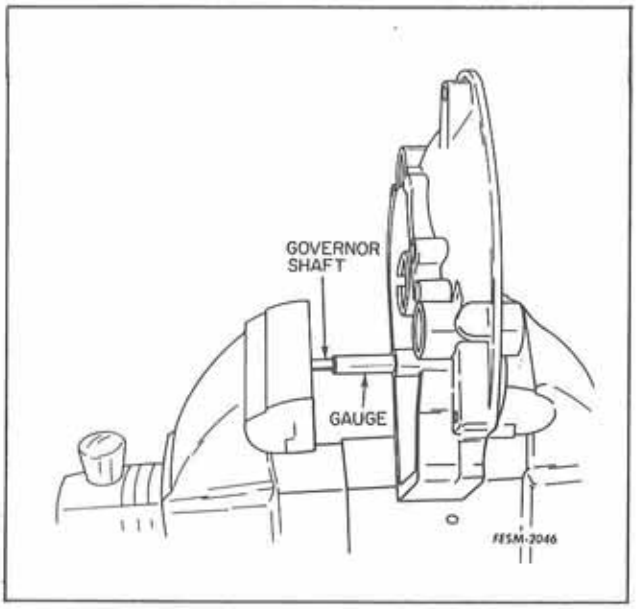

Illust. 1-11. Seating the crankshaft oil seal in the mounting flange.

Install new crankshaft and camshaft oil seals in the crankcase mounting flange. Use crankshaft seal installing tool No. 670193 and camshaft seal installing tool No. 670140.

### Governor

1. Install the governor gear shaft, if it was removed, in the mounting flange as follows:

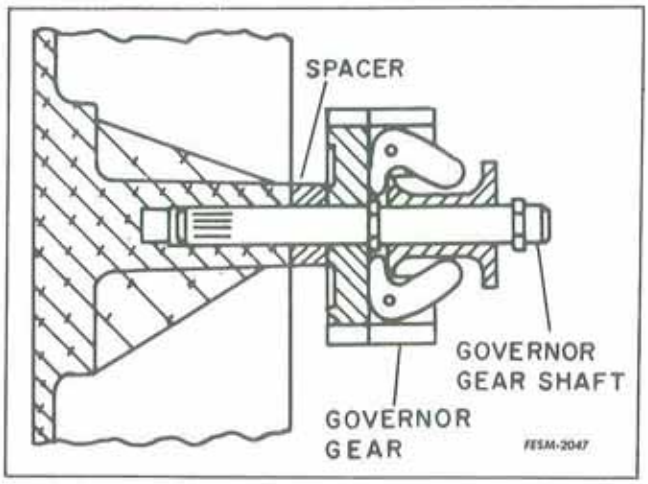
a. With light taps of the hammer, start the shaft in the mounting flange hole.




Illust. 1-12. Pressing in the governor shaft.

b. Slip gauge No. 670152 over the governor shaft. Position the mounting flange in a press. Using a suitable step plate, press the shaft into the flange bore until the step plate "bottoms" on the gauge.

NOTE: In an alternate method, shown in Illust. 1-12, the shaft can be "pressed" in using a large vise. Gauge No. 670152 must be used in order to position the shaft correctly.



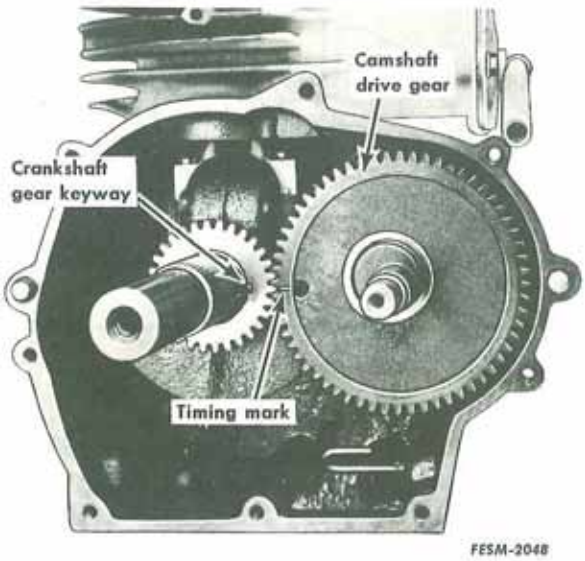

Illust. 1-13. Governor gear assembly.

2. Install the governor gear spacer, and gear assembly. Refer to Illust. 1-13.

## Crankshaft Installation

1. Lubricate the bearing surfaces of the crankshaft.

2. Using sleeve tool No. 28676, install the tapered end of the shaft through the crankcase.




Illust. 1-14. Camshaft and crankshaft timing marks.

NOTE: If the camshaft has been installed, align the crankshaft gear keyway with the camshaft gear timing mark. Refer to Illust. 1-14.

3. Rotate the crankshaft until the journal engages the connecting rod bearing.

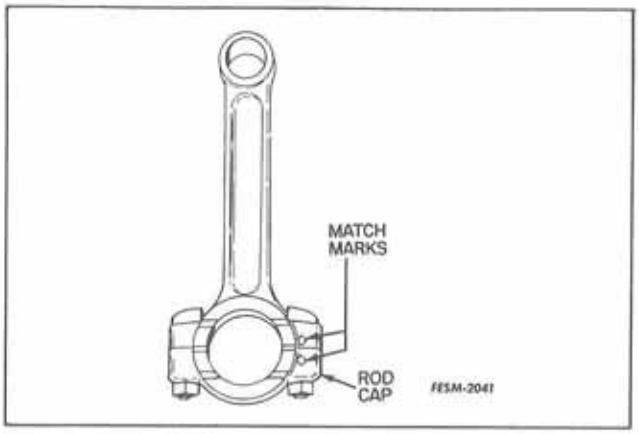
## Piston and Rod Assembly

1. Assemble the piston to the connecting rod. Use new retainer rings. Be sure the retainer rings are fully engaged in the grooves in the piston bosses.

2. Coat the piston rings with clean engine oil and install the rings on the piston. Stagger the ring gaps around the piston to prevent compression loss.

3. Coat the cylinder bore with clean engine oil. This insures lubrication when starting the engine after overhaul.

4. Using a ring compressor, install the piston in the cylinder.




Illust. 1-15. Connecting rod and cap match marks.

5. Align the bearing cap match marks (Illust. 1-15) and install the bolts and new self-locking nuts. Torque the nuts to 98 inch pounds.

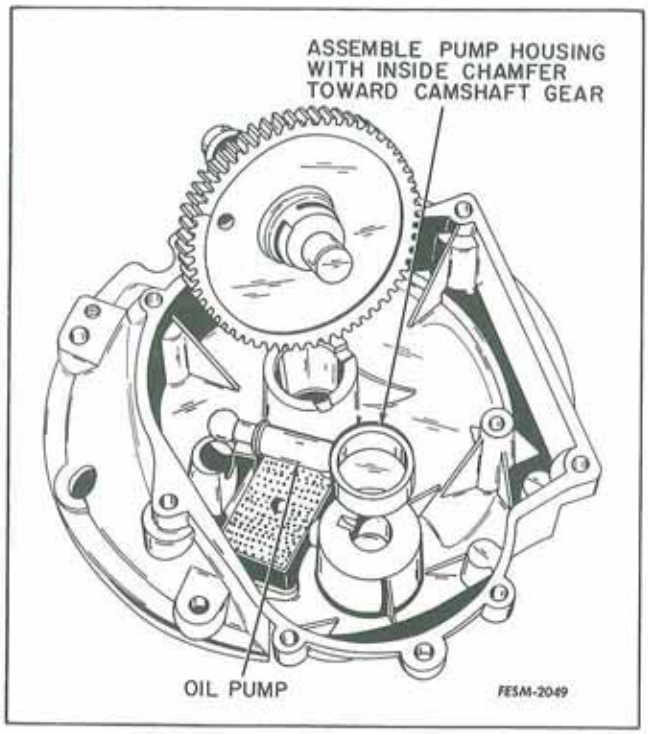
## Valve Tappets, Camshaft and Oil Pump

1. Lubricate and install the valve tappets.

2. Thoroughly lubricate the bearing surfaces of the camshaft. Align the timing mark on the camshaft gear with the keyway of the crankshaft gear and install.

3. Liberally lubricate the "working" parts of the oil pump with clean engine oil. Manually operate the pump to make sure the plunger slides freely in the barrel.

4. Lubricate the eccentric on the camshaft. The oil pump collar has a chamfer on one side only. Install the oil pump collar on the eccentric with the chamfered side of the collar toward the camshaft gear.




Illust 1-16. Oil pump installation.

5. Prime the oil pump before installing the mounting flange.

## Mounting Flange

1. Be sure the gasket surfaces of the mounting flange and crankcase are thoroughly clean and free of old gasket material. Be sure the two dowels are in place.

2. Position the new flange gasket on the crankcase.

3. Carefully press sleeve tool No. 28678 into the oil seal the full depth of the seal seat. Holding the sleeve tool firmly in place, install the mounting flange over the crankshaft.

4. Secure the mounting flange to the crankcase with cap screws. Torque the screws to 87 inch pounds.

## Valve Lash Adjustment

1. Turn the crankshaft to position the piston at TDC on compression stroke. (The tappet ends will be of equal height.)

2. Insert the valves in their guide and hold them firmly on the seats.

3. Using a feeler gauge, check the clearance between the valve stem ends and the tappets. The clearance must be .010 inch. Grind off the valve stem end on a valve grinding machine (to provide a square end), as necessary to provide the proper clearance.

## Intake and Exhaust Valve Installation

1. Position the valve springs and valve spring keepers under the valve guides.

2. Install the valves making sure the valve marked "EX" is inserted in the exhaust port. The valve stems must pass through the valve springs and keepers.

3. Install the keepers by inserting the blade of a screwdriver under the lower valve spring while holding the valve, pry the spring up and position the keepers.

## Magneto

1. Position the magneto assembly on the crankcase so that the timing marks are aligned. Refer to Illust. 1-6.

IMPORTANT: The exact aligning of the timing marks is very necessary for proper timing of the ignition system.

2. Check the engine timing. Refer to "Engine Timing" on this page.

3. Install the cylinder head. Refer to "Cylinder Head Installation" on this page.

4. Secure the rectifier panel and blower housing extension to the engine.

5. Install the flywheel, torque the nut to 380 inch pounds.

6. Install the fuel tank assembly.

## Engine Timing

When doing a complete engine overhaul, time the engine (static timing) before installing the cylinder head.

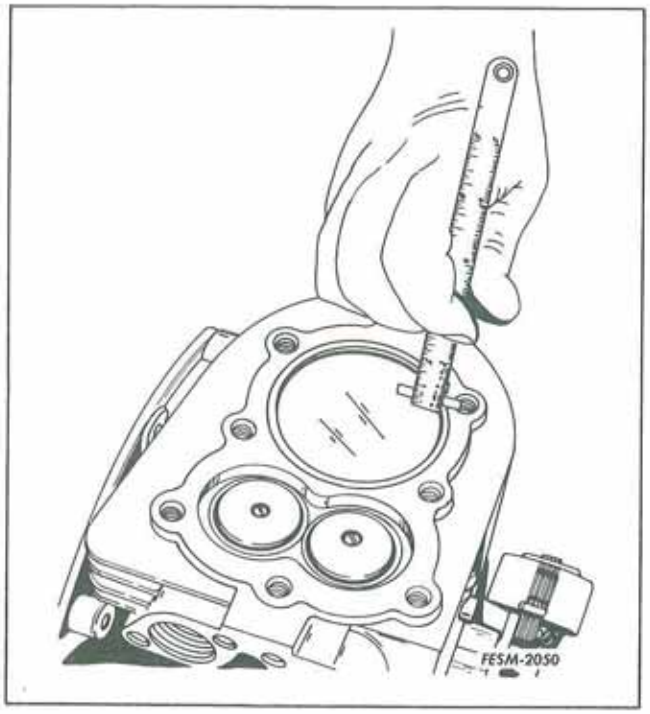
In order to time an engine not being overhauled, the cylinder head must be removed.

1. Remove the cylinder head and gasket and clean the surface.

2. Turn the crankshaft until the high point of the ignition cam causes the points to open. Adjust the point gap to .020 inch.

3. Turn the crankshaft until the piston reaches TDC on compression stroke. (Both valves closed.)

4. Turn the crankshaft counterclockwise until the dimension from the top of the piston to the top of the cylinder block is .080 - .090 inch. Refer to Illust. 1-17.




Illust. 1-17. Measuring for BTDC (engine static timing).

5. Loosen the cap screws securing the magneto assembly to the engine. Move the assembly until the ignition cam on the crankshaft just starts to open the points. Secure the assembly with the cap screws.

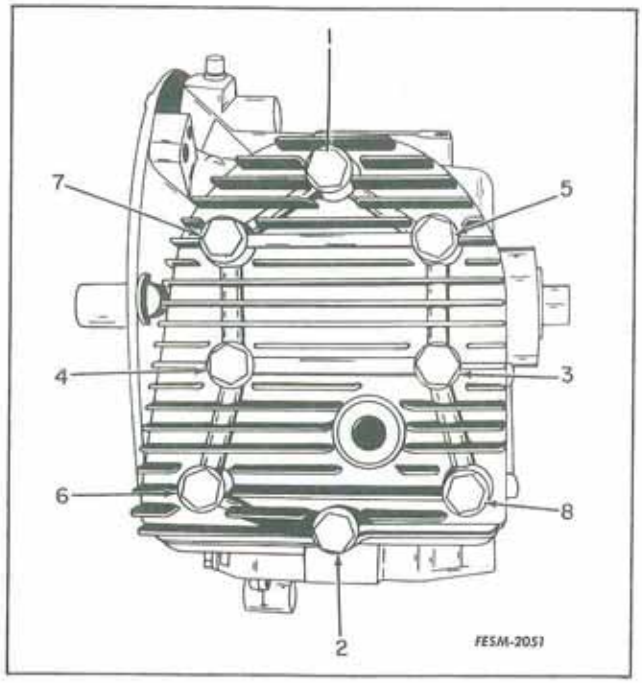
6. Install the cylinder head and new cylinder head gasket.

## Cylinder Head Installation

NOTE: Before installing the cylinder head, be sure to set the static timing. Refer to "Engine Timing", on this page.

1. Always use a new gasket when the head has been removed for service work.

2. Assemble cylinder head cover and install bolts. After the fuel tank has been installed it is important that the cylinder head cap screws be tightened evenly and in steps to 170 inch pounds torque.

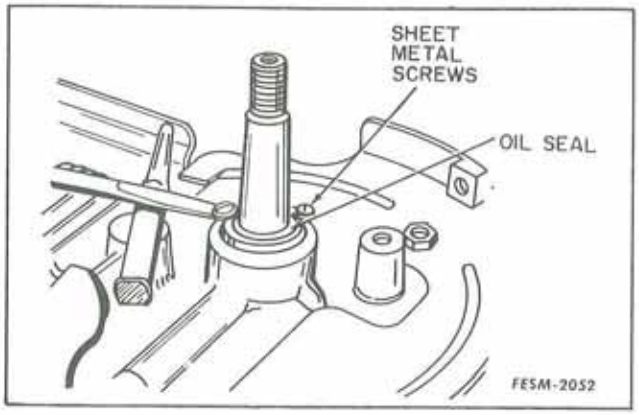



Illust. 1-18. Cylinder head bolt tightening sequence.

3. Spark plug gap should be .030 inch. Install spark plug and tighten to 270 inch pounds torque.

## **Crankshaft Oil Seal Service** (Magneto End)

Removal
(On engines other then complete overhaul)

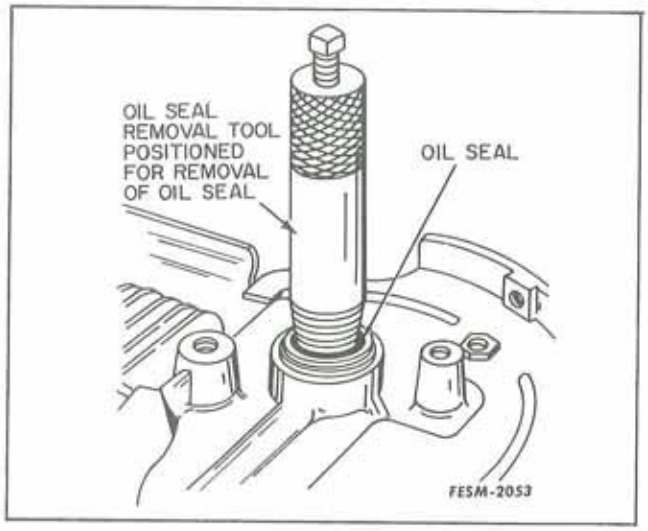



Illust. 1-19. Oil seal removal using short metal screws.

The crankshaft oil seal (at the magneto end) can be removed by either of the two methods shown in Illusts. 1-19 and 1-20.

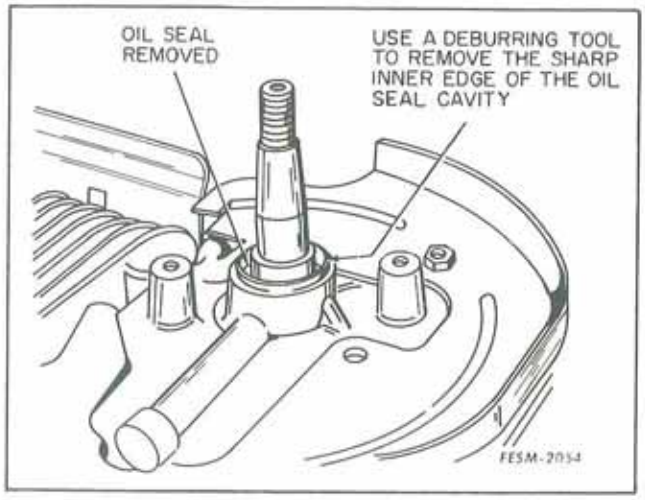
1. In Illust. 1-19, two sheet metal screws are installed in the seal. Position a punch on one of the magneto support bosses. Using a screwdriver under the metal screw heads, pry the seal free of its bore.

IMPORTANT: Do not damage the crankshaft surface when installing the metal screws or prying the seal out.




Illust. 1-20. Oil seal removal using tool.

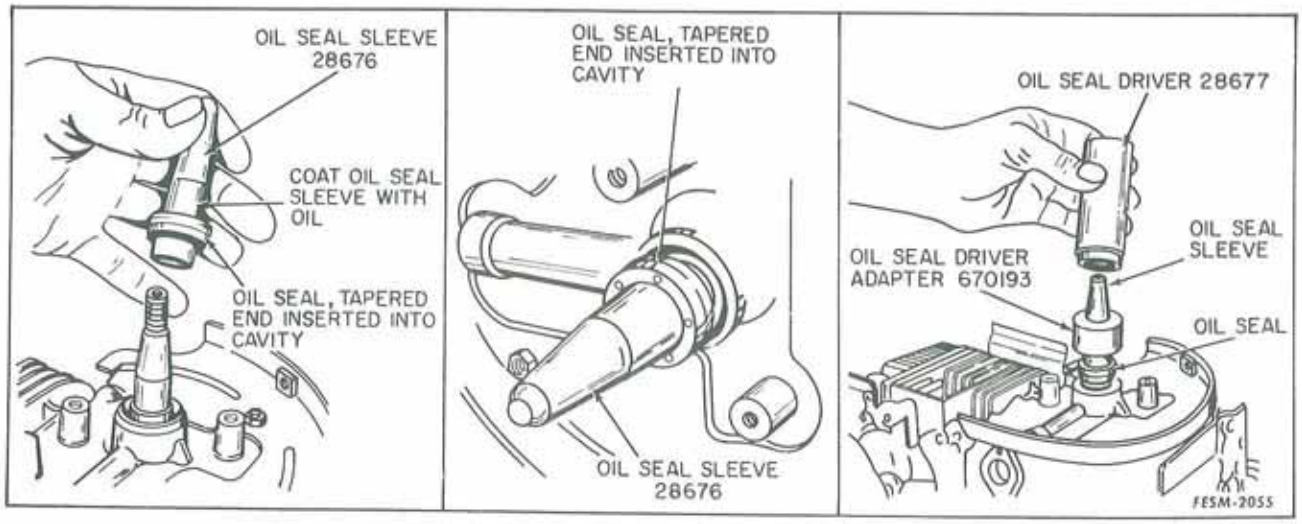
2. In Illust. 1-20 slip tool No. 670197 over the crankshaft and thread the tool into the seal. Draw the seal out of its bore by turning in the set screw of the removal tool.




Illust. 1-21. Oil seal removed.

3. Deburr sharp edges around the oil seal bore (Illust. 1-21) before installing the new seal.

Installation




Illust. 1-22. Oil seal installation.

1. Liberally lubricate the O.D. of oil seal sleeve tool No. 28676 and the lip of the oil seal with clean engine oil.

2. Slip the oil seal on the sleeve with the tapered end of the seal toward the engine (Illust. 1-22).

3. Start the seal in the bore. Using driver adapter No. 670193 and driver No. 28677 (Illust. 1-22) seat the seal in its bore.

# FUEL SYSTEM

## General Information

Service difficulties with fuel system usually originate from unclean fuel or improper carburetor adjustments or contamination of one of the components. If gum or contamination forms, completely disassemble and clean the carburetor.

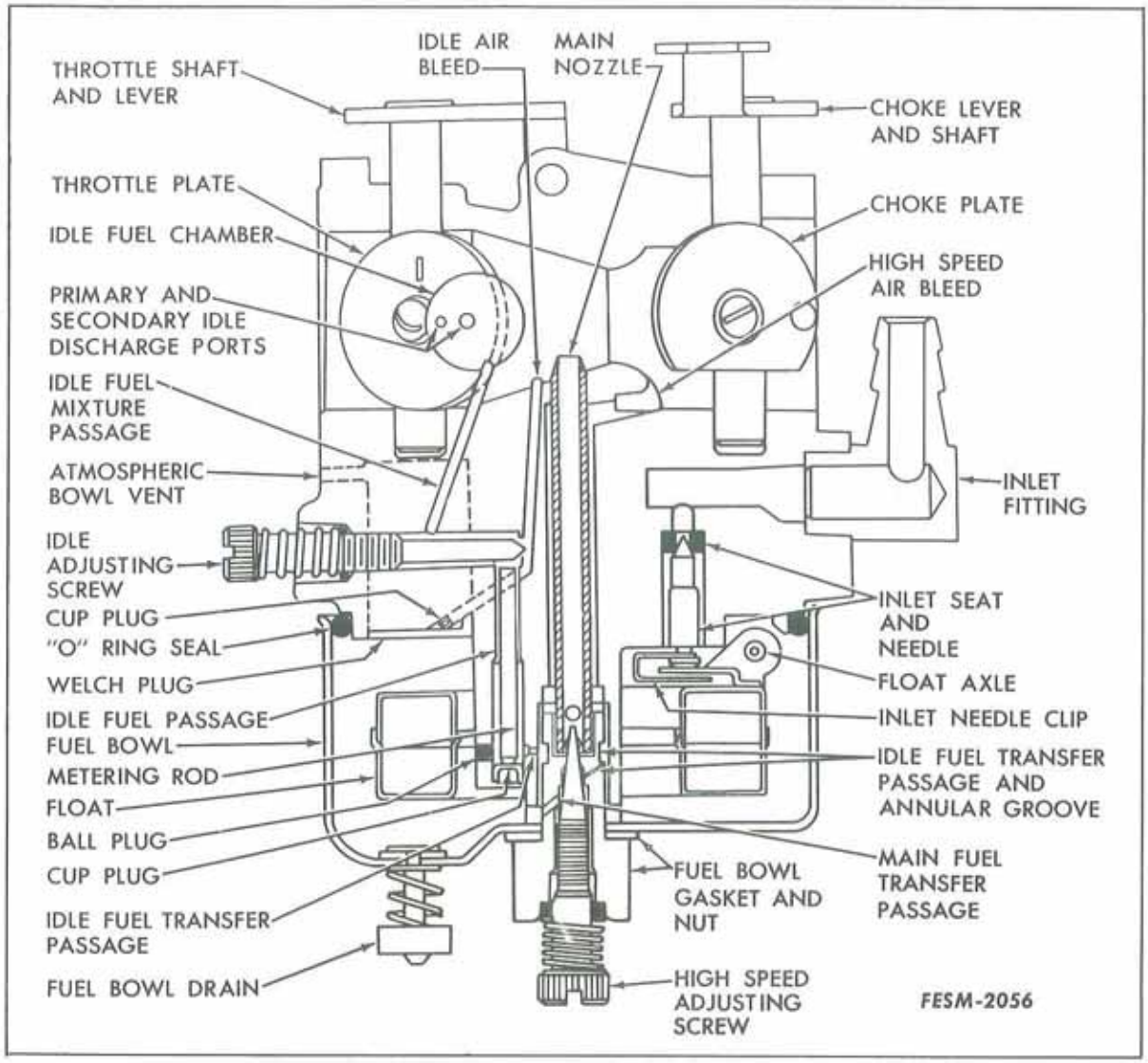
## Carburetor Adjustments

(Refer to Illust. 1-23)

The carburetor is preset at the factory. If adjustment is necessary, proceed as follows:

1. Close the high speed screw by turning to the right (clockwise). Close finger tight only. Forcing the screw will damage the seat.

2. Back out the screw (counterclockwise) one turn.




Illust. 1-23. Cross section of carburetor.

3. Close the idle screw by turning to the right (clockwise).

4. Back out the screw (counterclockwise) one turn.

5. Start the engine and run until operating temperature is reached.

6. With the engine running at full throttle, adjust the high speed screw one-eighth turn at a time in or out until the engine runs smoothly.

If the engine tends to stall under load, turn the high speed screw out (counterclockwise) to slightly enrich the mixture.

7. Move the throttle to the "Slow" position. Adjust the idle screw in or out until the engine runs smoothly.

NOTE: Allow several seconds after each adjustment in order to allow the engine to react to the new setting.

IMPORTANT: Maximum engine speeds are preset at the factory and should not be changed except by a qualified serviceman with the necessary equipment.

## Disassembly

The following instructions are to be followed in sequence when completely overhauling the carburetor.

1. Remove the throttle valve screws, valve, shaft and lever assembly.

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

Hold the choke shaft down securely into the bearing bore when replacing the choke plate. This will prevent binding and excessive choke plate wear.

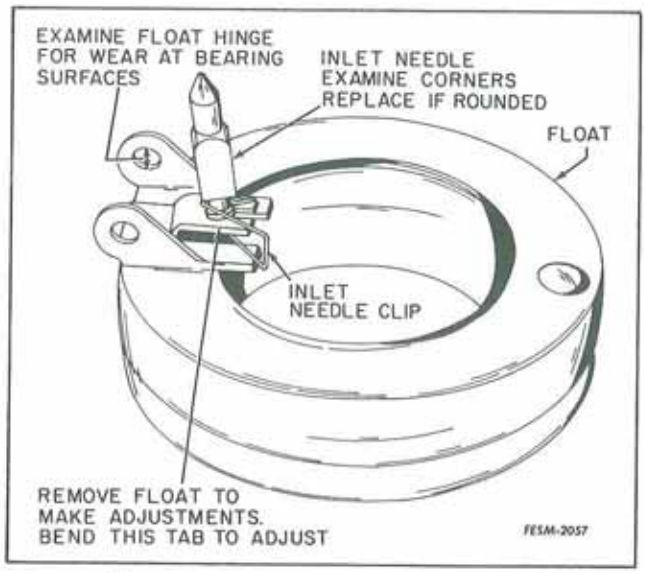
3. Remove the idle speed screw and spring. Remove the high speed adjusting screw and spring.

NOTE: The fuel bowl retainer nut contains the seat for the high speed adjusting screw.

The high speed adjusting screw and the fuel bowl retainer nut must be replaced as an assembly only.

4. Remove the fuel bowl retaining nut and fiber washer. Remove the fuel bowl and the O-ring seal.

5. Remove the float axle, float and inlet needle. Check the float axle hinge for wear. Check the float for dents or holes. Do not remove the inlet needle seat unless replacement is necessary.




Illust. 1-24. Float, inlet needle and clip.

NOTE: The inlet needle and seat in this carburetor are of a different design than is normally found in a float carburetor. The inlet needle is anchored to the float tab by means of a clip (Illust. 1-24).

6. To remove the inlet needle seat, put a few drops of heavy engine oil into the cavity and with a short blast of compressed air, blow out the inlet seat.

NOTE: The inlet seat can also be pried out with a short piece of wire with a hook on the end.

## Cleaning Carburetor Parts

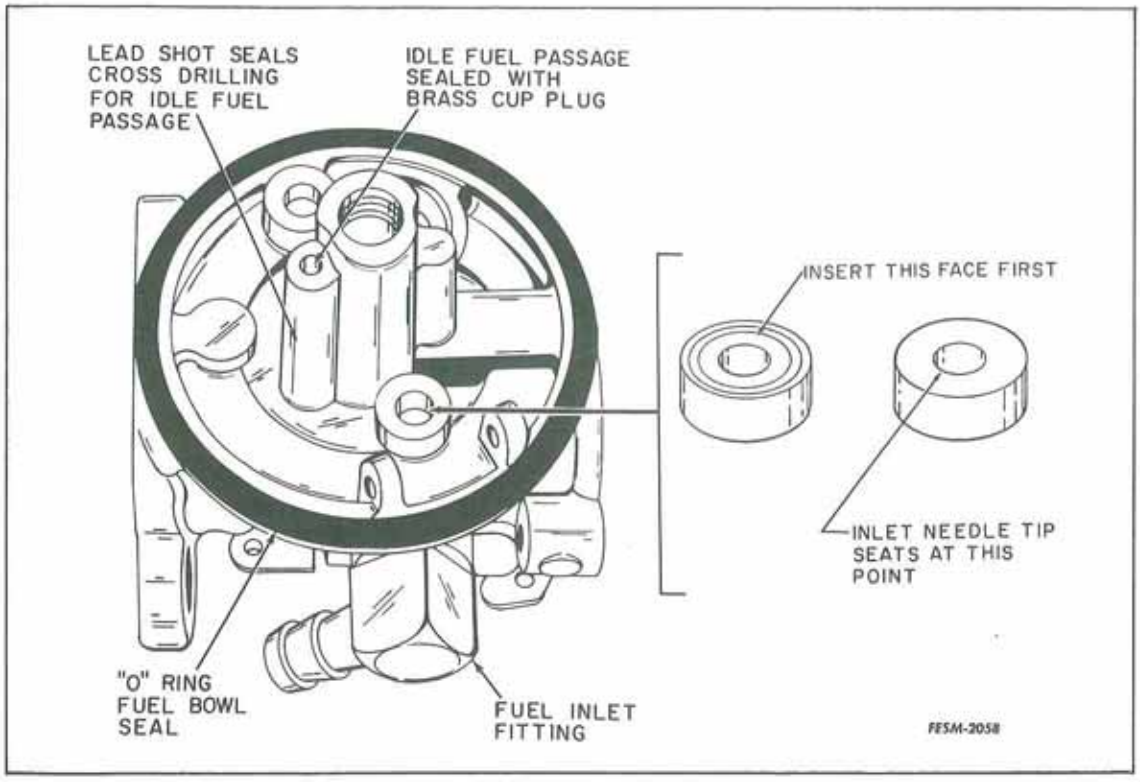
1. Clean all parts in solvent. Gum is easily removed with an alcohol or acetone solvent.

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 and O-RINGS.

# Reassembly




Illust. 1-25. Inlet seat and carburetor body passages.

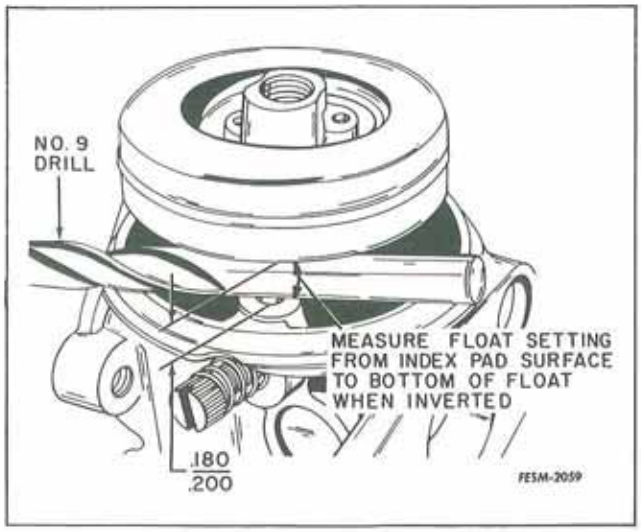
1. If it was removed, lubricate the bore and install the inlet needle seat with the grooved face of the seat inserted first (Illust. 1-25).

2. Install the float and inlet needle.

3. Set float level. Remove the float to make adjustments. Bend the tab on the float hinge to correct the setting.

a. Set the float at .180-.200 by measuring from the machined index pad on the carburetor body. For convenience use a No. 9 drill as shown in Illust. 1-26.

b. If the index pad on the carburetor body is not machined, measure the float setting from the rim of the carburetor body. The float setting from the rim of the carburetor body to the float is .209. For convenience place a No. 4 twist drill across the rim between the center leg and the unmachined index pad, parallel to the float axle. This will assure a uniform float setting.




Illust. 1-26. Float setting.

4. Position the O-ring seal on the body. Position the fuel bowl so that the flat at the base of the bowl is on the same side of the carburetor as the fuel inlet fitting.

5. Install the bowl retaining nut and fiber washer. Torque the nut to 55 inch pounds.

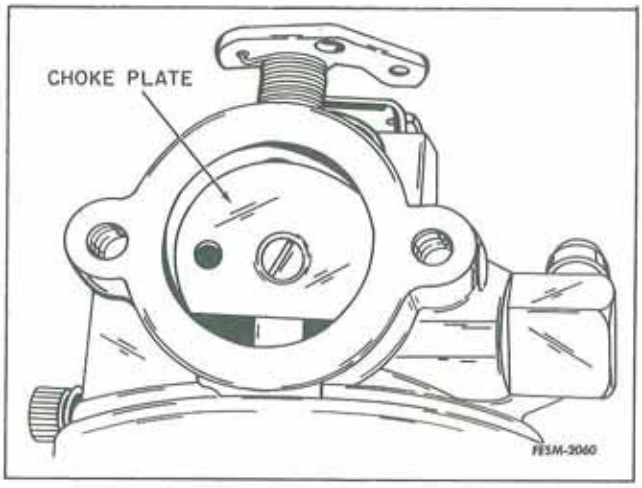
6. Install the high speed adjustment screw. Turn it in until the screw seats and back out one turn.

7. Install the idle adjusting screw. Turn it in until it seats and back out one turn.

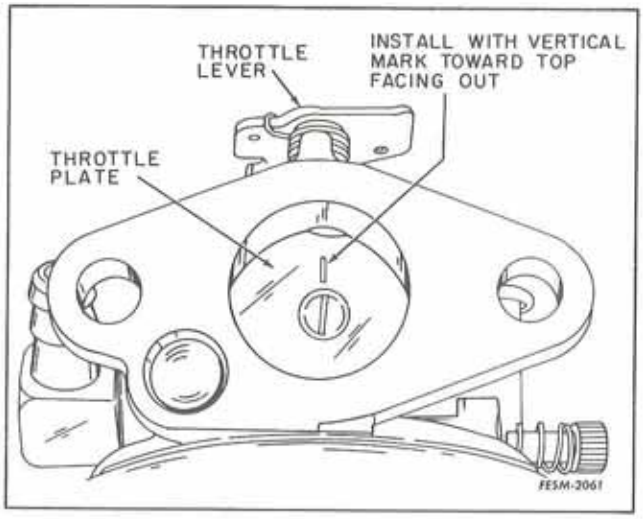
IMPORTANT: Do not jam the adjusting screws into the seats as the parts will be damaged.

8. If removed, install the choke assembly. Install the choke plate in the air horn with flat toward the fuel bowl (Illust. 1-27).

9. Install the throttle assembly. The throttle plate is installed with the line on the plate (Illust. 1-28), facing away from the fuel bowl and toward the throttle lever.




Illust. 1-27. Choke assembly.




Illust. 1-28. Throttle assembly.

## Governor Adjustment

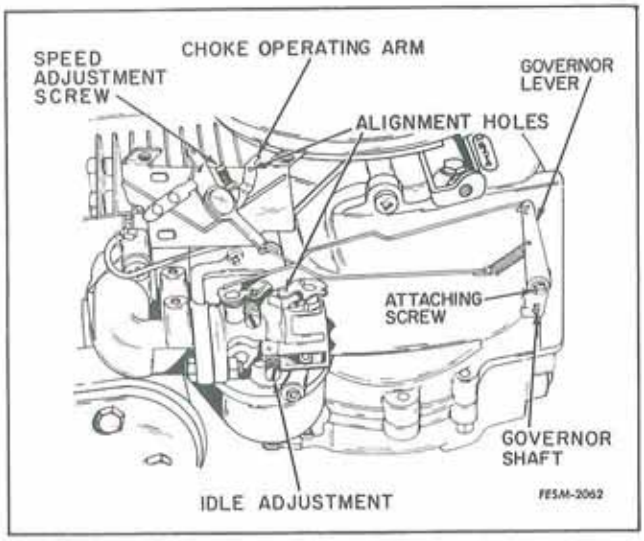
(Refer to Illust. 1-29)

1. Governor linkage (Illust. 1-29) must be attached to the throttle lever on the carburetor.

2. Loosen the governor lever attaching screw.

3. Turn the governor shaft left (counter-clockwise) until tight. Hold the shaft firmly in place and move the governor lever left (toward the carburetor) until the throttle is wide open.

4. Tighten the governor lever attaching screw.



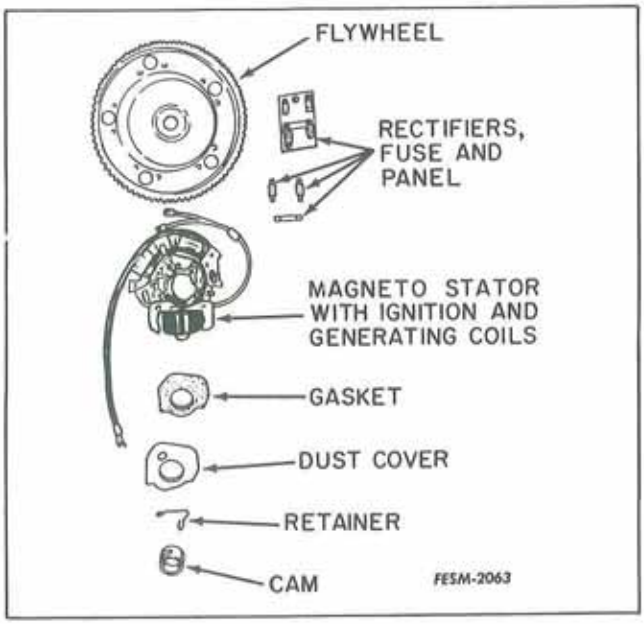

Illust. 1-29. Mechanical governor.

# ELECTRICAL SYSTEM

## General Information

The engine ignition system consists of an alternator-magneto, a spark plug, and a high tension lead connecting the two. Refer to Illust. 1-30 for magneto components.

The alternator magneto consists of the usual coil, condenser and point set for firing engines. Also incorporated are extra generating coils and flywheel magnets to generate current for recharging of battery. Charging rate at 3600 RPM is approximately 3 amps. with both rectifiers in place. Removing one rectifier will cut the charging rate to 1.5 amps.




Illust. 1-30. Typical alternator-magneto and components.

## Testing the Ignition System

1. Remove the high tension cable from the spark plug.

2. Grasp the insulated portion of the cable and hold the terminal end about 1/8 inch from the metal body of the spark plug.

3. Crank the engine with the starting device as in normal starting and observe the spark. Ignition switch should be turned to "ON".

4. If a bright hot spark jumps the gap, magneto is operating correctly.

5. Remove the spark plug from the engine and reconnect the high tension lead to the spark plug terminal.

6. Hold the metal base of spark plug firmly against a bare spot on the engine with the plug points facing up so that they can be observed.

7. Crank the engine and observe if spark jumps. If a hot spark jumps the spark gap and timing is correct, the ignition system is operating satisfactorily.

## Removal and Dissassembly

If magneto fails to produce a proper spark even after adjusting or replacing breaker points, remove and disassemble magneto components for testing as follows:

1. Remove the fuel tank and flywheel. Refer to page 1-6 for procedure.

2. Disconnect the electrical leads from the rectifier and fuse panel. Disconnect the high tension cable from the spark plug.

3. Check to make sure that there are timing match marks plainly visible on the magneto breaker plate and on the crankcase. If timing marks are not plainly visible, use a prick punch to make some similar to those shown in Illust. 1-6.

4. The magneto is mounted with cap screws. Remove the cap screws, and remove the magneto from the crankcase.

5. Remove the cover and gasket from the magneto. Remove the movable contact from the stud on the stationary breaker.

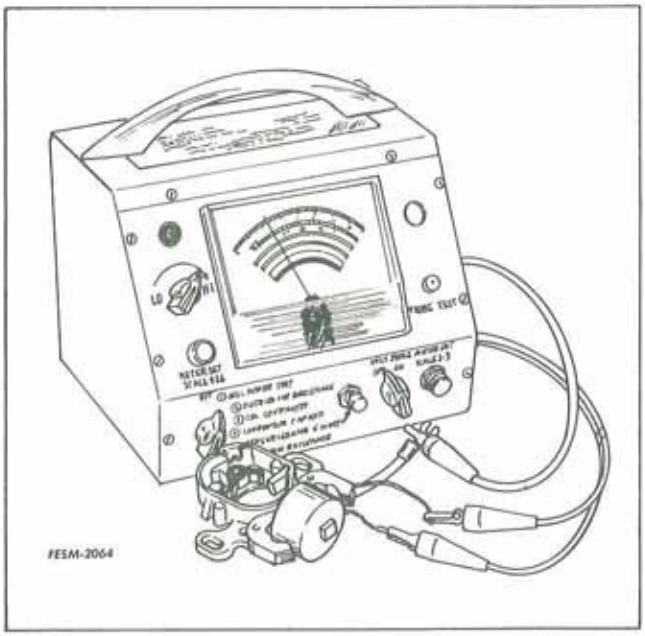
6. Remove the screw that holds the stationary contact; remove the stationary contact.

7. Do not remove the coil from the core assembly unless it is damaged.

8. Remove the breaker cam from the crankshaft.

## Magneto Coil Assembly

1. Inspect the coil assembly for damage that may effect its operation. Look especially for cracks or gouges in insulation, evidence of overheating or other damage. Make sure the electrical leads are intact, especially where they enter the coil.



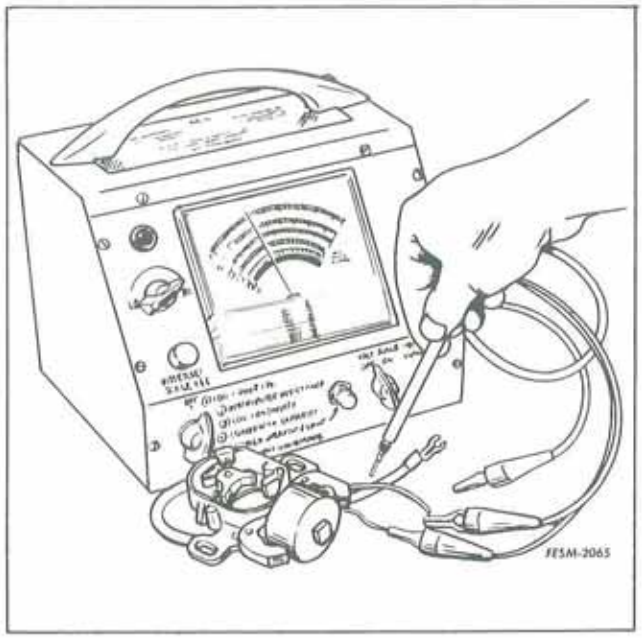

Illust. 1-31. Testing the magneto coil on the coil tester.

2. With the coil assembly installed on the core assembly, check the operation of the coil on an approved coil tester, similar to that shown in Illusts. 1-31 and 1-32.

When the coil is in good condition, it will produce a spark across the gap at the recommended dial setting.

Refer to the specification chart supplied by the test equipment manufacturer and use appropriate control setting for coil assembly being tested.

If the coil fails to produce a continuous spark at this setting, coil should be replaced.



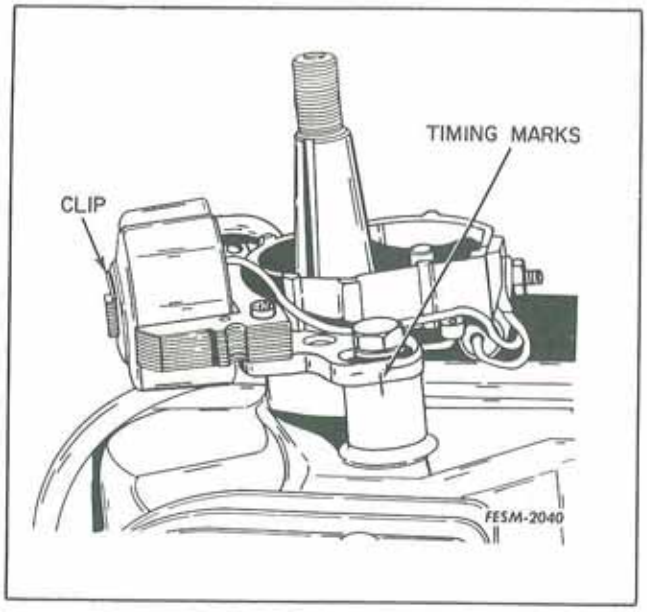

Illust. 1-32. Checking the magneto coil insulation.

3. Check the outer insulation of the coil for high tension leaks. Use the probe provided with test equipment. Move the probe slowly around the coil, holding the probe 1/8 inch from the insulation. If a weak spot is present in the insulation, a spark will jump from the coil to the probe. Replace a coil that has weak insulation.

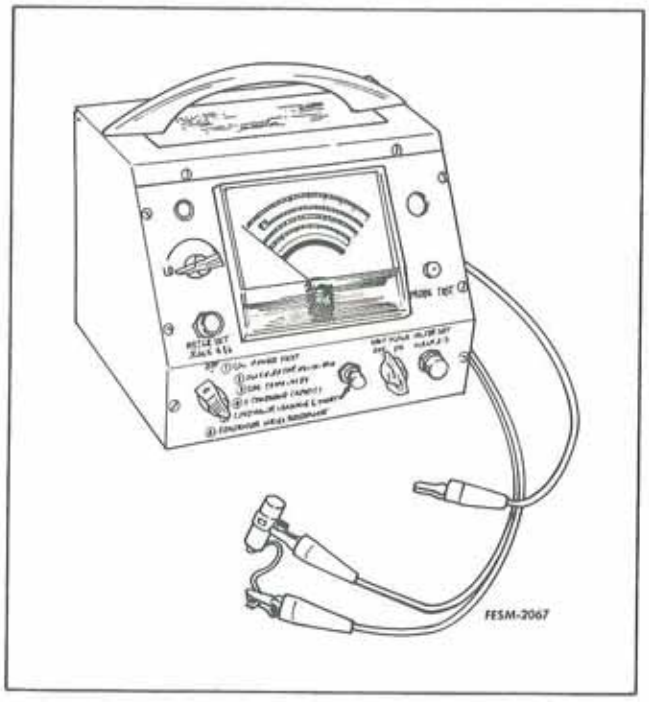
If a coil tester is not available, substitute the new coil for the old and try out the equipment. If it operates properly, the coil was at fault.

### Coil Removal

To remove the coil assembly from the core assembly, disengage the coil retainer clip (Illust. 1-33) and pull the coil from the core assembly.




Illust. 1-33. Coil installed.




Illust. 1-34. Testing a condenser.

2. Check the condenser on a good quality tester. Follow test equipment manufacturer's instructions to check for breakdown capacitance and series resistance.

3. If the condition of the condenser is in any way in doubt, replace it.

## Testing the Condenser

(Refer to Illust. 1-34)

1. Inspect the condenser for visible damage. Look especially for damaged terminal lead, dents or gouges in the can, or broken mounting clip.

## Generating Coils

1. Generating coils are supplied in pairs and can only be replaced in pairs. Replace the coils if insulation is broken or cracked or the coils are otherwise damaged.

2. "Burn Out" of the generating coils (if the system is not protected by 6 amp. fuse at the rectifier panel) will occur if polarity is reversed either at the rectifier panel or the battery, allowing battery voltage to be drawn back through the system.

Replace the fuse if the polarity is reversed or the rectifiers short out.

3. To test the coils, remove both rectifiers from the rectifier panel. With the engine running, short each generator terminal (as marked on the rectifier panel) momentarily to ground with a jumper wire. If either terminal produced NO spark, replace both coils.

## Rectifiers

All lead connections are clearly marked on the panel and must be followed. Rectifiers are silicone type and are directional.

One end of the rectifier is undercut to insure proper insertion in holding clips. Rectifiers change generated AC current to DC for battery charging.

Rectifiers should be removed from panel when running the engine with battery leads disconnected, or on a dead battery.

If the battery shows signs of overcharging (fuming or boiling) remove one rectifier from the panel which will cut the charging rate to approximately 1.5 amps.

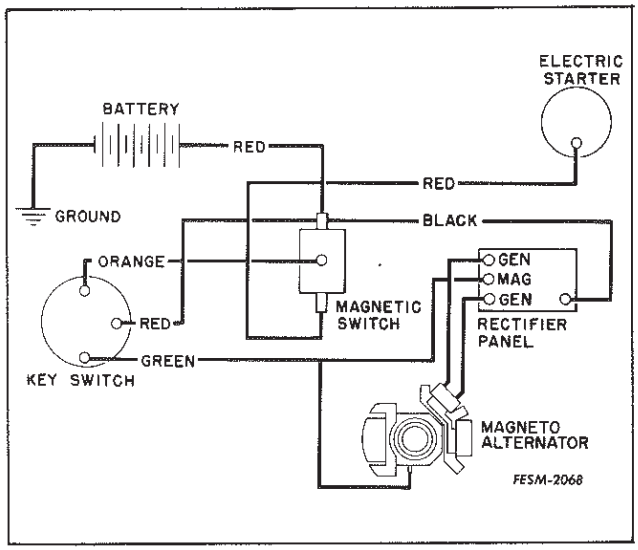
1. To test the rectifiers, remove the positive battery lead and place an ammeter in the circuit. Remove 1 rectifier and start the engine. Any reading on the meter, though small indicates a good rectifier. If no reading is obtained replace the defective rectifier. Test the second rectifier in the same manner.

NOTE: Test the coils first as in step 3 of "Generating Coils" on this page.

2. If an ammeter is not available, remove the positive battery lead at the rectifier panel.

Remove one rectifier from the panel and start the engine.

Short the remaining rectifier to ground momentarily with a jumper wire connected to the positive battery terminal on the rectifier panel. If the spark results, the rectifier is good. Repeat the procedure using the other rectifier.




Illust 1-35. Schematic wiring diagram (electric start).

3. MAKE SURE all leads at the rectifier panel are positioned so as to prevent any shorting between leads.

## Magneto Adjustment

In order to adjust the magneto breaker points, it is necessary to remove the fuel tank and flywheel. Refer to page 1-6 for procedure.

1. After the flywheel has been removed, remove the dust cover and the gasket from the magneto.

2. Crank the engine slowly until the breaker points of the magneto are fully opened. Check the condition of the points. If the points are burned or pitted, replace the points.

3. With the breaker points fully opened, check the point gap with a feeler gauge. The point gap should be .020 inch.

4. If the point gap is incorrect, loosen the screw that holds stationary point and move the breaker point with a screwdriver to correct the gap.

5. Tighten the screw that holds the stationary point. Recheck the adjustment after tightening the screw.

## Breaker Point Replacement

If frequent breaker point replacement is necessary, it may be the fault of the condenser. Check the condenser on a tester, and if substandard, replace. Replace the breaker points as follows:

1. With the flywheel and magneto dust cover removed, remove the electrical leads on the movable breaker point spring.

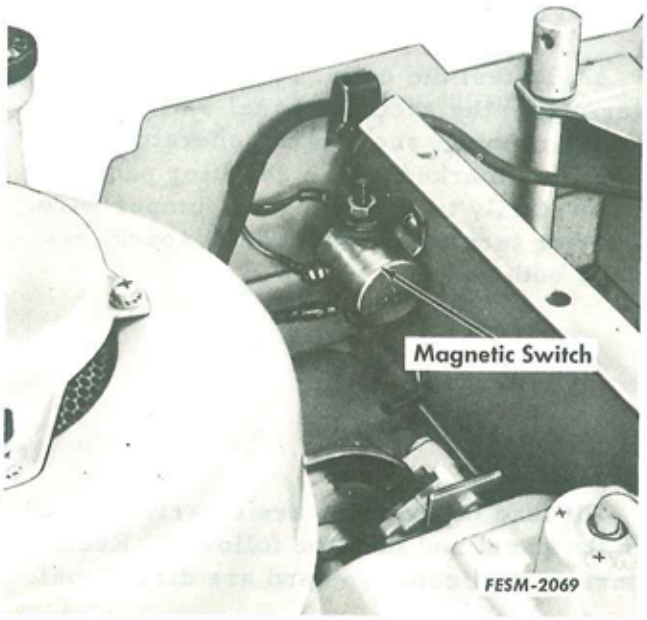
2. Remove the screw holding the stationary breaker point; remove the breaker points.

3. Position a new stationary breaker point; install the screw, but do not tighten.

4. Position a new movable breaker point on the stud. Position the leads on the spring end of the movable breaker point and secure with nuts.

5. Adjust the magneto breaker point gap and tighten the screw that holds the stationary breaker point. (Refer to "Magneto Adjustment", page 1-25.

## Magnetic Switch and Key Start Switch




Illust. 1-36. Magnetic switch installed.

If the magnetic switch (Illust. 1-36) or the key start switch malfunction, replacement will be necessary.

## Flywheel Magnets

1. The Alnico magnets that are cast into the flywheel rarely lose their magnetic strength. If it is suspected that the magnets are the fault of improper operation of the magneto, place the flywheel upside down on a wooden surface.

Hold a screwdriver by the extreme end of handle with the point down. Move the blade to within one inch of the magnets cast into the flywheel. The magnets should attract the screwdriver, pulling blade against magnet. This is a rough test to determine the strength of the magnetic field.

NOTE: Alnico magnets cannot be recharged on a conventional charger. Never store flywheels in nested piles. It may dissipate the magnetic strength of the magnets.

### Reassembly and Installation of Magneto

1. If the coil was removed from the core assembly, install the coil, carefully supporting the center of the core assembly to prevent distorting the laminations while sliding on the coil. Secure the retainer.

2. Position the magneto assembly on the crankcase so that the timing marks are aligned. The exact aligning of the timing marks is very necessary for proper timing of ignition system.

IMPORTANT: If either of the parts on which timing marks were made have been replaced, time the magneto as described in "Engine Timing" on page 1-14.

## Starter Service

### Rewind Starter

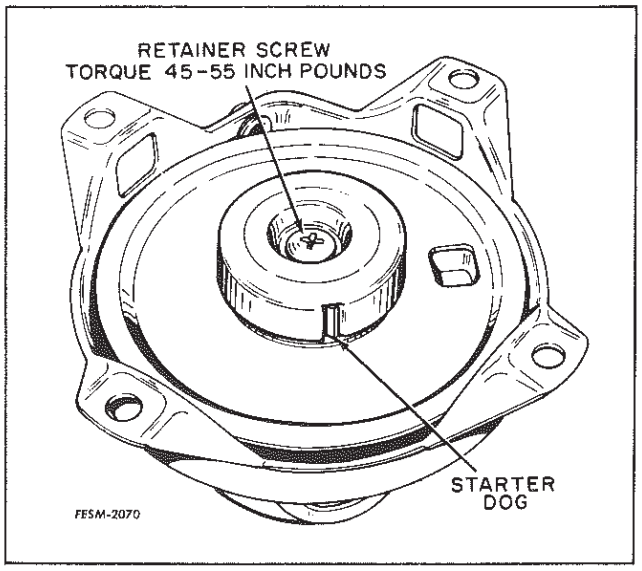
#### General Information

This is a bolt on type of starter. The following points should be checked in event service is required because of failure to engage.

1. Loose starter hub. Tighten the flywheel nut to correct torque.

2. Damaged starter hub. Replace.

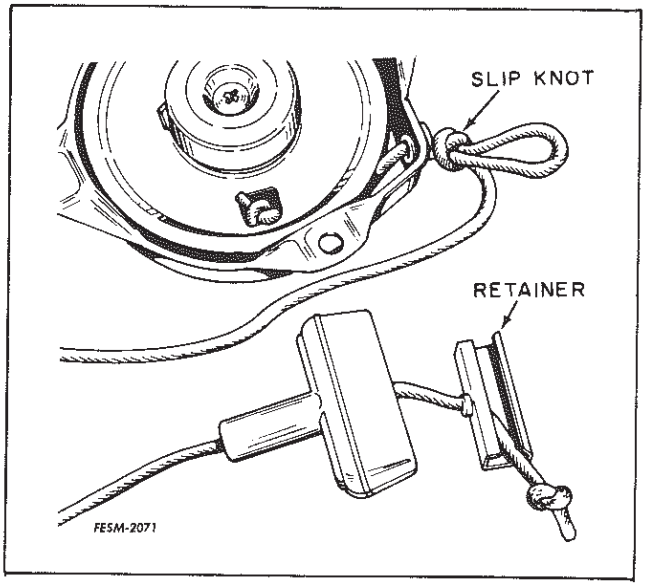
3. Difficult to engage the starter with the engine. Check the following parts and replace if necessary; retainer, retainer screw and brake spring. Torque the retainer screw to 50 inch pounds (Illust. 1-37).




Illust. 1-37. Engaging mechanism.

## Disassembly

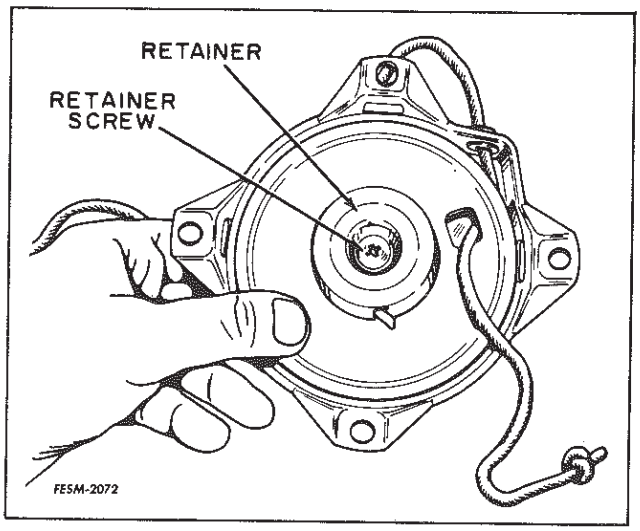
Note the position of the starter handle so that it can be reinstalled in the same position. After removal from the engine, operate the starter slowly and observe starter dog. It should emerge as soon as the rope is pulled. Failure to do so requires tightening of the retainer screw (Illust. 1-37).



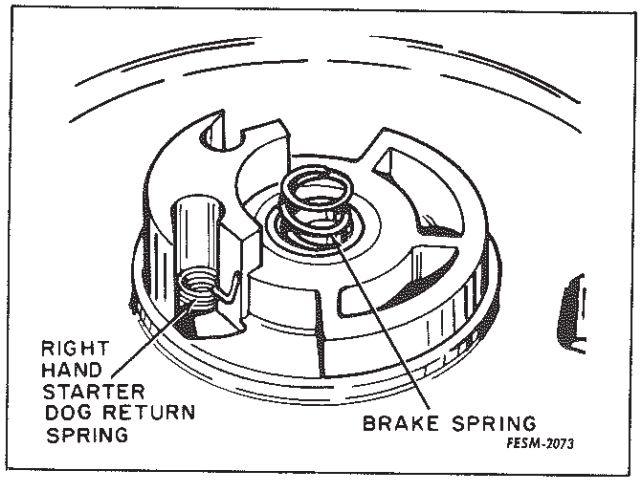

Illust. 1-38. Handle removal.

1. Relieve the spring tension prior to disassembly. Pull the rope to full length, tie a slip knot outside the starter housing, remove the handle and insert (Illust. 1-38). Hold as shown in Illust. 1-39, untie the slip knot outside the starter housing, pull out the rope, relieve thumb pressure to allow pulley to unwind slowly.

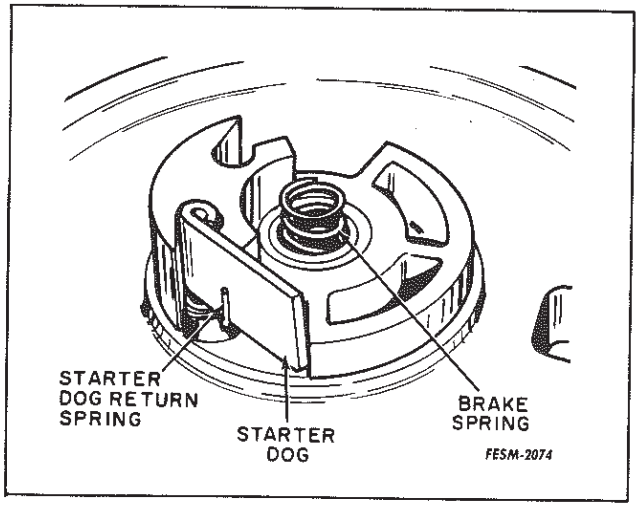
2. Removal of the retainer screw (Illust. 1-39) will allow complete disassembly of the starter. Note the positioning of the dog return spring (Illust. 1-40).



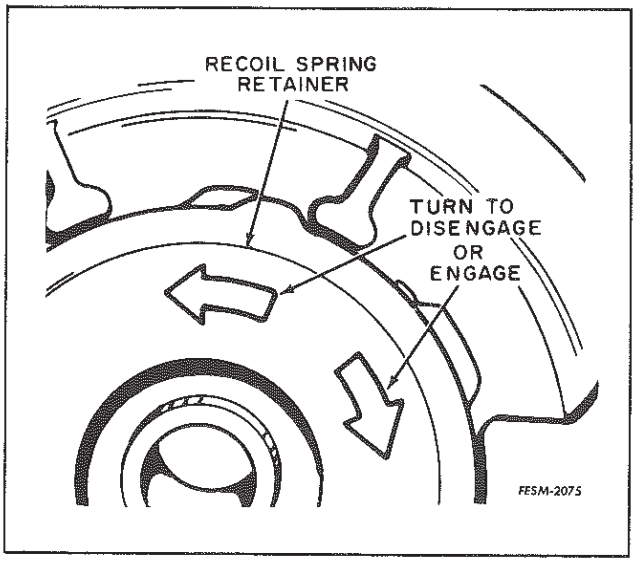

Illust. 1-39. Rope replacement.



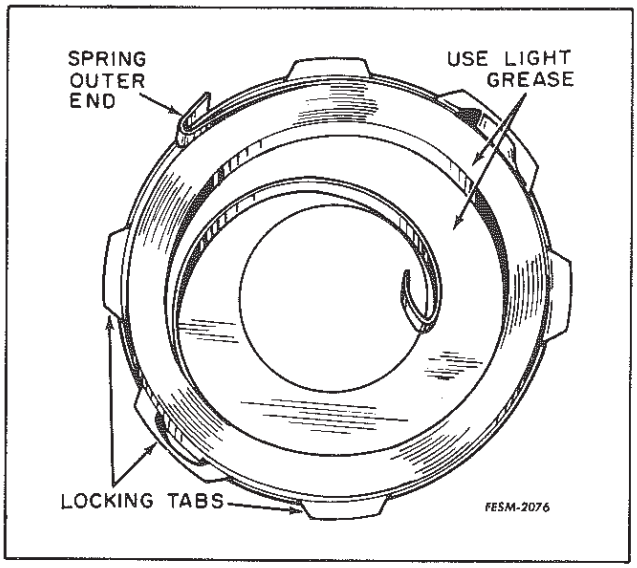

Illust. 1-40. Installing starter dog return spring.




Illust. 1-41. Starter dog positioning.




Illust. 1-42. Locking and unlocking recoil spring retainer.




Illust. 1-43. Recoil spring and retainer.

3. Illusts. 1-42 and 1-43 illustrate the encased recoil spring and how it is retained within the pulley (Illust. 1-42) illustrates the correct installation and how the tabs on the spring retainer lock into the pulley. Grease the spring lightly.

## Reassembly

Grease the center post and recoil spring lightly. Reassemble the entire starter prior to winding the spring. Secure with the retainer screw, torque to 50 inch pounds.

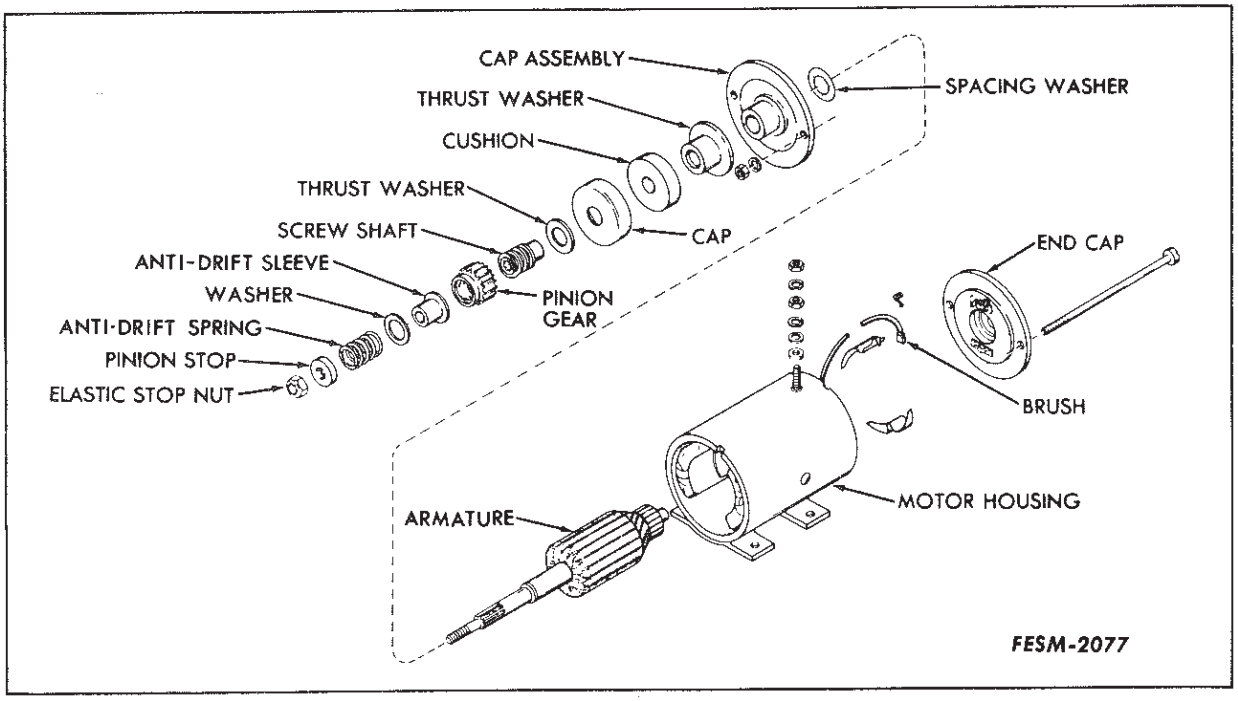
1. Hold the starter as illustrated (Illust. 1-41) using the thumb as a brake to retain the pulley as it is being wound.

Insert a suitable tool in the knot opening in the pulley and wind until tight. Allow the pulley to unwind only sufficiently so that the knot opening is positioned as in Illust. 1-39.

Insert the rope as illustrated in Illust. 1-39, seat the knot in the opening in the pulley, tie a slip knot on the outside of the starter housing (Illust. 1-38). Attach the handle, release the slip knot.

2. Test by pulling the rope. Action should be smooth, the starter dog should emerge quickly and the rope should retract completely if properly wound and if it is of the correct length (approximate 54 inches).

## Electric Starter




Illust. 1-44. 12 volt DC starting motor.

### Removal

The starter is readily removed from the engine by disconnecting the electrical lead from the starter and removing the mounting cap screws.

### Disassembly (Refer to Illust. 1-44)

1. Hold the pinion gear firmly in a brass jawed vise. Remove the elastic stop nut.

2. Remove the drive components from the end cap.

3. Remove the thru-bolts securing the end caps. Remove the end caps. Remove the armature.

### Servicing the Components

Field coil, armature and brushes should be cleaned with a soft cloth and compressed air.

### Reassembly and Installation

Reassembly and installation is the reverse of removal and disassembly with special attention to the following:

1. Apply a film of SAE-10 oil to the bearing portions and splines of the armature shaft before assembly.

2. The brush shunt is approximately 3/4 inch longer than is necessary for the grounded brush. Remove any excess shunt remaining after soldering to the grounded brush terminal.

3. Torque the thru-bolts to 33 inch pounds.

4. Torque the input terminal nut next to the housing to 50 inch pounds.

5. Use as many spacers as needed to obtain an armature end play of .005-.015 inch.

6. Install the thrust spacer to the commutator end cap bearing bore with the convex surface facing the open end of the bore.

7. Torque the drive assembly elastic stop nut to 100 inch pounds. If necessary, tighten the nut until the slot in the nut is aligned with the hole in the shaft. Install the cotter pin.

### Performance Test (No Load)

This motor should NOT BE operated continuously for more than 15 seconds when testing.

| | |
|---|---|
| Applied Voltage | 6.0 |
| Minimum RPM | 6500 |
| Maximum Current Draw | 25 Amperes |

Use a fully charged 6 volt battery and connect it to the input terminal of the starting motor through a switch. Use test leads of No. 10 cable or larger which should not be over 6 feet in length. Check the operation of the drive assembly by applying rated voltage momentarily.

If the unit does not meet the foregoing test, check for the following:

Binding armature
Annealed brush springs
Improperly seated brushes
Insufficient armature end play
Shorted or open armature
Shorted or grounded field
Poor electrical connections

## Engine Installation

Installation is the reverse of removal with particular attention paid to the following:

Electric Start Engines: The rectifiers are directional. One end of the rectifier is undercut to insure proper insertion in the holding clips.

IMPORTANT: Electric Start Engines. Remove the rectifiers if the engine is to be run without the battery in the circuit.

Section 2

# CHASSIS

## CONTENTS





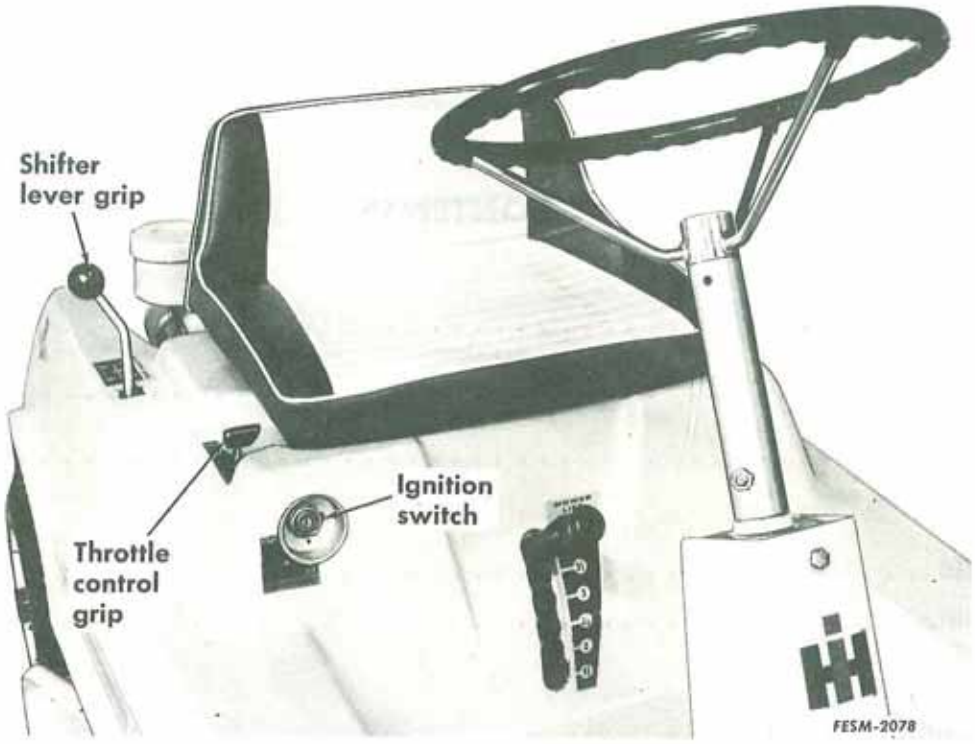
## SPECIFICATIONS

Bolt torques . . . . . Refer to page V

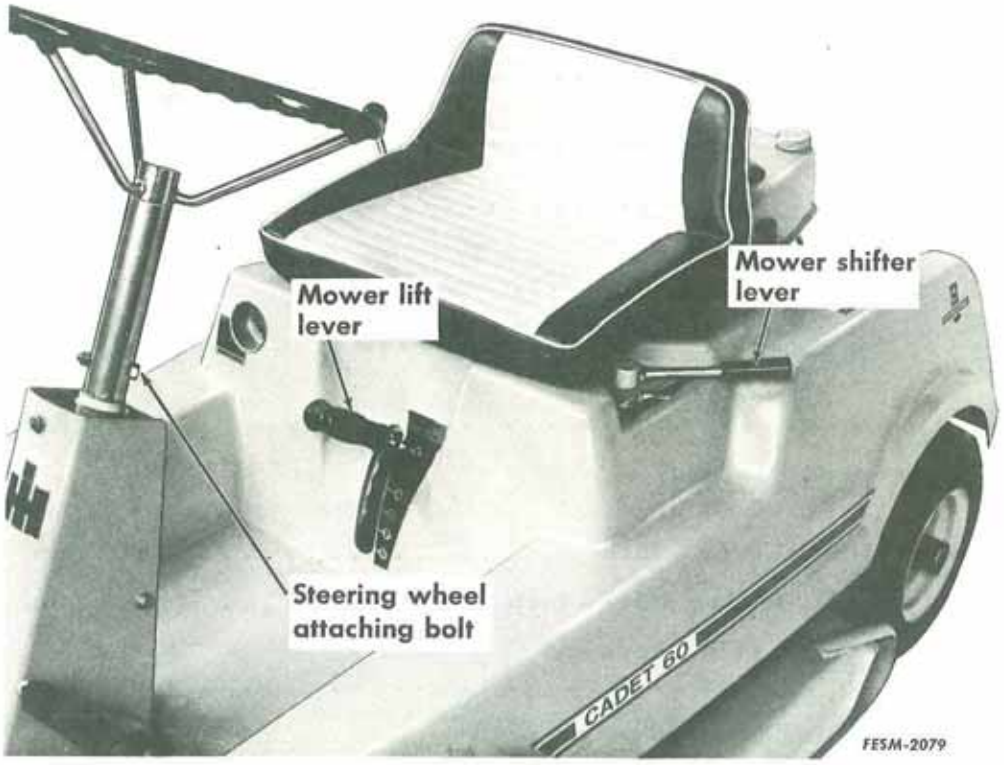
Transmission (Refer to Illust. 2-27)

| | |
|---|---|
| Backlash-pinion-to-bevel gear - inch | .001 min. - .007 max. |
| Shaft assembly end play (either side) - inch | .001 min. - .010 max. |
| Clearance between clutch collar keys and gear hubs - inch | .001 min. - .030 max. |
| Clearance between bevel gear and output shaft-first gear - inch | .025 absolute min. |
| Washer thickness available for adjustments - inch | .030, .040 and .050 |

# MOWER BODY




Illust. 2-1. Right side view.




Illust. 2-2. Left side view.

## Removal

1. Remove the wing nut securing the operator's seat. Remove the seat.

2. Electric start models: Disconnect the battery. Remove the nut securing the ignition switch (Illust. 2-1).

3. Remove the transmission shifter lever and the throttle control lever grips (Illust. 2-1).

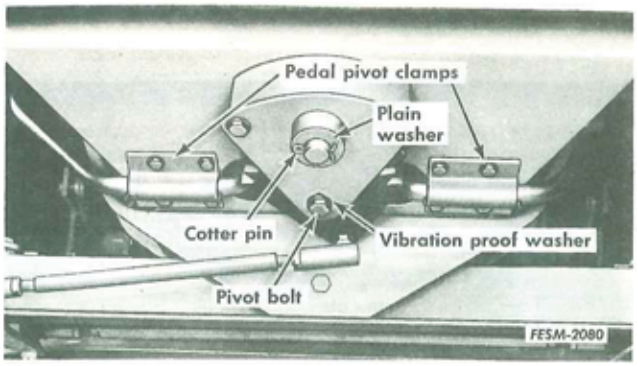
4. Remove the cap screws securing the throttle control lever assembly to the body.

5. Remove the mower shifter lever (Illust. 2-2).

6. Remove the bolt securing the steering wheel assembly to the shaft (Illust. 2-2). Remove the assembly.

7. Remove the mower lift lever grip (Illust. 2-2). Remove the lever by removing the spring loaded cap screw.

8. Remove the exhaust assembly from the engine.




Illust. 2-3. Pedal pivot clamps.

9. Remove the pedal pivot clamps (Illust. 2-3). Remove the cotter pins securing the pedal assembly to the transmission control rods. Remove the pedal assemblies from the body.

10. Remove the cap screws securing the body to the frame. Make note of the body mounting spacers and the rear seat support bumpers. These must be reinstalled to their original locations.

11. Remove the body by simultaneously lifting up the front end and sliding toward the rear sufficiently to clear the engine spark plug.

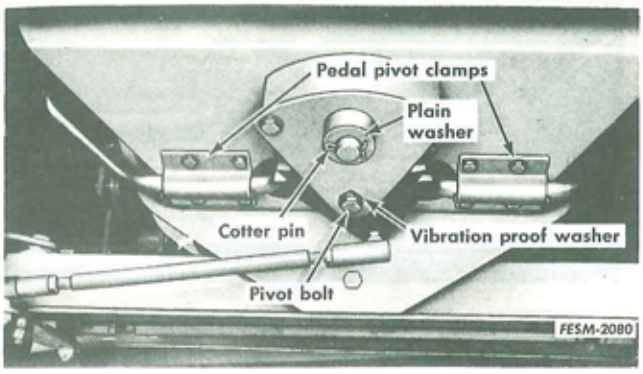
NOTE: Store the body in a safe place to prevent unnecessary abuse until it is reinstalled on the mower frame.

## Installation

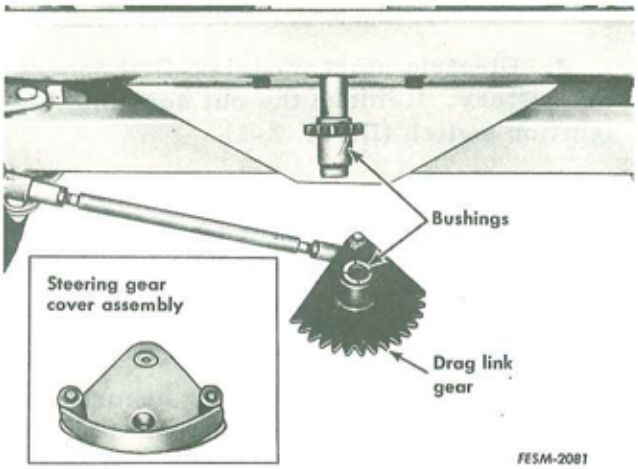
Installation is the exact reverse of removal. Be sure to install the body spacers and seat support bumpers to their proper location. Refer to "Standard Torque Chart" on page V for correct bolt torques.

# STEERING ASSEMBLY

## Removal and Disassembly




Illust. 2-4. Steering assembly.




Illust. 2-5. Steering drag link gear assembly.

1. Remove the cotter pin and plain washers from the steering shaft (Illust. 2-4).

2. Loosen the vibration proof lock washer under the pivot bolt (Illust. 2-4). The pivot bolt will turn with the lock washer until the bolt is loosened. Remove the bolt and washer.

3. Remove the steering drag link gear cover assembly (Illust. 2-5).

NOTE: The steering drag link gear assembly will disengage from the steering shaft gear as the cover is removed.

4. To replace, remove the drag link gear from the ball joint.

5. Remove the steering wheel by removing the attaching bolt (Illust. 2-2).

6. Lower the steering shaft assembly through the support.

7. To repair or replace, remove the drag link and/or the tie rod assembly from the spindles.

## Inspection and Repair

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

2. Inspect the nylon bearings for wear or damage. Replace as necessary.

3. Check for broken teeth, bent shafts and stripped threads. Replace the damaged parts.

## Reassembly, Installation and Adjustment

1. Reassemble and install in the reverse order of removal and disassembly. Apply IH 251 HEP grease or equivalent #2 multi-purpose lithium grease liberally to the gear assembly, bearings and shaft.

2. Install the drag link ball joint in the R.H. spindle, if it was removed.

3. Set the front wheels in a "straight ahead" position. Position the steering drag link gear assembly to the steering shaft gear so that an equal number of teeth are on either side of the drag link gear when engaging the steering shaft gear. Install and secure the cover.

# WHEELS

## Front Wheels

(Refer to Illust. 2-6)

### Removal

1. Engage the brake and block up the front wheel(s) to be removed.

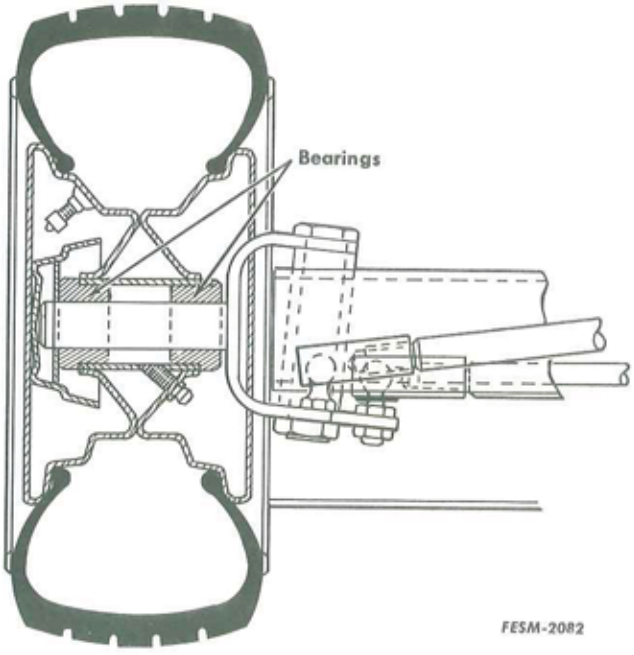
2. Remove the cotter and flat washer from the outer end of the spindle.

3. Slide the wheel from the spindle.

### Inspection and Repair

1. Disassemble and inspect the entire wheel and hub for weld separation, split tube hub and rim bending.

2. Inspect the bearings for wear or damage.




Illust. 2-6. Cross section of front wheel assembly.

### Reassembly and Installation

Reassemble the wheel. Lubricate the spindle and slide the wheel on the spindle. Using a sufficient amount of flat washers to eliminate excessive end play, secure the wheel to the spindle with a cotter pin.

# Rear Wheels

(Refer to Illust. 2-7)

## Removal

1. Engage the brake and block up the wheel to be removed.

NOTE: If both rear wheels are to be removed, be sure to block the front wheels.

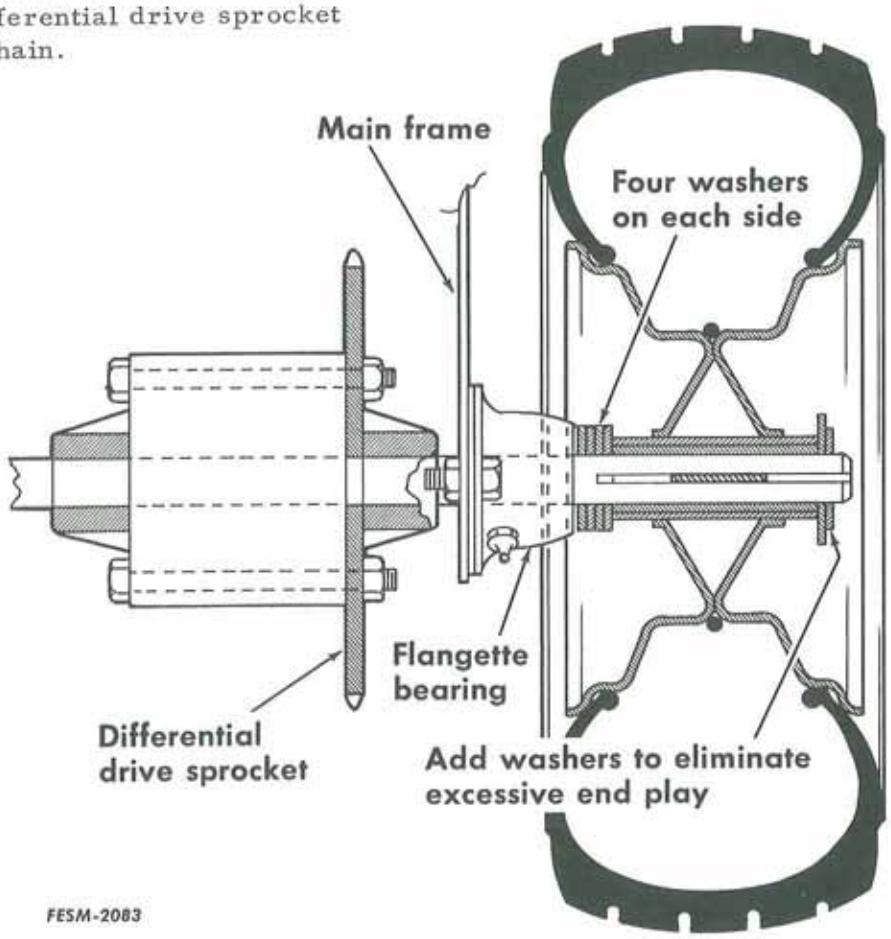
2. Remove the cotter and flat washer. Remove the wheel and key. Note that there are four washers between the wheel and the bearing. These must be reinstalled to "center" the differential drive sprocket with the drive chain.

## Inspection and Repair

1. Inspect the entire wheel for rim bending.

2. Check the axle for bends, damaged key and keyway. Remove nicks, rust and paint wherever necessary.

3. Check the axle bearing for wear. Replace if necessary.




Illust. 2-7. Cross section of rear wheel assembly.

## Installation

Install the rear wheels in the reverse of removal. Be sure the four washers are reinstalled between the bearing and wheel in order to keep the differential drive sprocket in line with the chain idler sprocket and the transmission drive gear.

If more than 1/8 inch end play exists, add washers as necessary to outer end of each wheel, in sequence, beginning with the right hand wheel until the end play is less than 1/8 inch.

Secure the wheels with a cotter pin.

# FRONT AXLE

## Steering Spindle Removal

(Refer to Illust. 2-8)

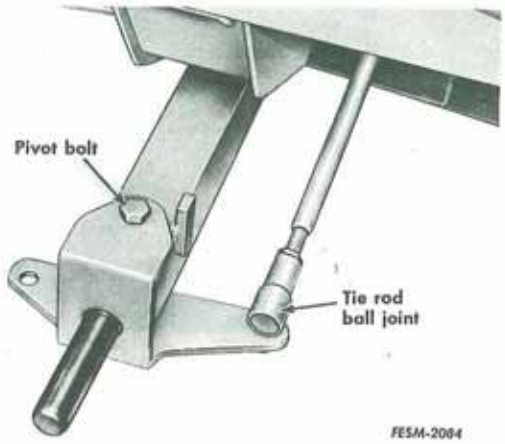
1. Lock the brake, raise the front end of the mower and support it securely.

2. Remove the front wheels.

3. Disconnect the tie-rod ball joints. Disconnect the drag link ball joint from the right hand spindle.

4. Remove the pivot bolt securing the spindle to the axle and remove the spindle.

5. Remove spindle bushing and nylon bearings.




Illust. 2-8. Left hand spindle with wheel removed.

## Front Axle Removal

With the front of the mower supported, remove the axle pivot bolt. Remove the axle and bearing.

## Inspection and Repair

1. Inspect all parts closely for wear, bending or breaks.

2. Check nylon bearings and bushing for wear. Replace as necessary.

## Reassembly

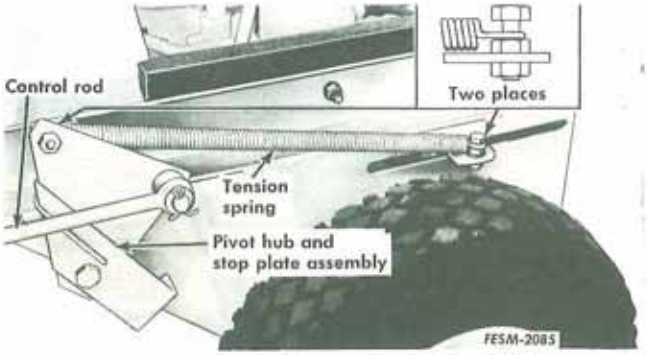
Reassemble the front axle and spindles in the reverse order of disassembly.

Thoroughly lubricate the front axle bearing, spindle bore and spindles with IH 251 HEP grease or equivalent #2 multi-purpose lithium base grease.

# FORWARD-REVERSE CONTROLS

## Removal

(Refer to Illust. 2-9)




Illust. 2-9. Reverse drive control pivot assembly (mower body removed for clarity).

NOTE: Illust. 2-9 shows the reverse drive pivot assembly. Forward drive pivot assembly is identical.

The forward and reverse controls can be removed without disturbing the mower body.

1. Lower the rotary mower to the ground with the mower lift lever.

2. Remove the forward and reverse pedals from the control rods. Refer to step 9 on page 2-3.

3. Remove the cotter pin securing the control rod(s) to the pivot hub assembly. Remove the rod.

4. Remove the cap screw securing the drive tension spring.

5. Remove the control lever pivot hub and stop plate assembly.

6. Remove the cotter pin securing the control pedal rod to the pivot hub. Remove the rod.

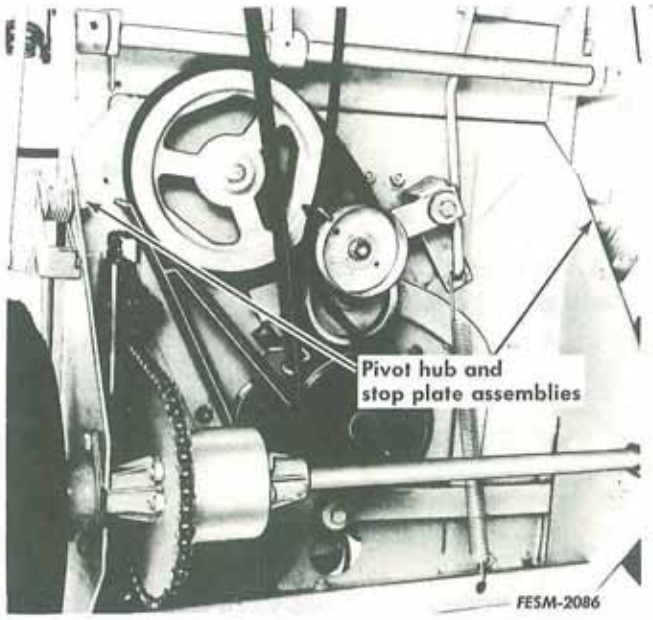
## Reassembly and Installation

Reassemble and install in the reverse of removal and disassembly.

Be sure that all rusted and pitted parts have been thoroughly cleaned or replaced.

Refer to Illusts. 2-9 and 2-10 for spring installation.

The ends of the tension springs must be free to "float" (Illust. 2-9).




Illust. 2-10. Pivot hub and stop plate assemblies installed.

# BRAKE

## Removal and Disassembly

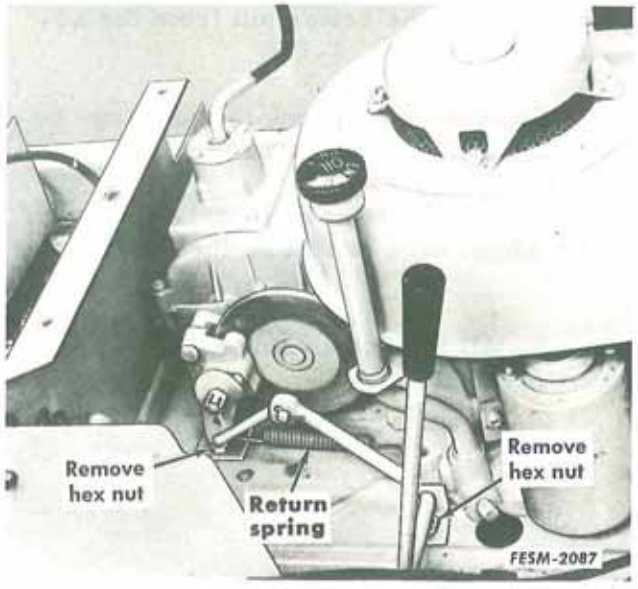
(Refer to Illust. 2-11)

1. Disconnect the brake return spring.

2. Remove the cap screws securing the brake lever bracket and disc hub assemblies to the chassis. Lift the assembly from the mower.

3. Disassemble the brake as necessary.

4. Slip the brake disc from the transmission shaft.

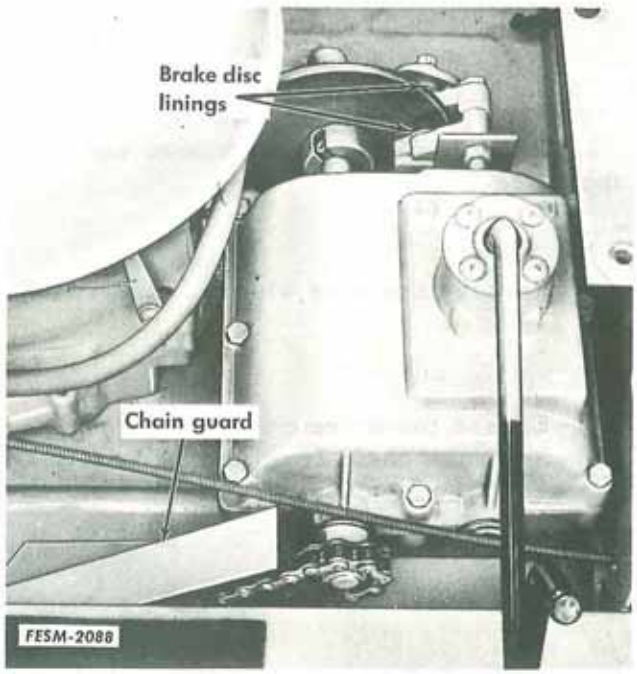



Illust. 2-11. Brake assembly.

## Inspection, Reassembly and Installation

1. Replace the worn or damaged parts as needed. Replace the brake disc lining if necessary (Illust. 2-12).

2. Reassemble and install the brake in the reverse order of removal and disassembly.




Illust. 2-12. Brake disc lining locations.

## Adjustment

Adjust the brake as follows:

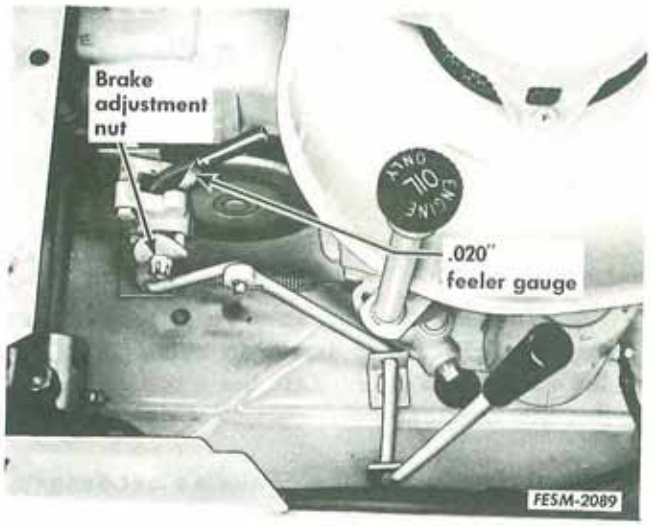
1. Place the brake lever in the disengaged position.

2. Remove the cotter pin from the adjustment nut (Illust. 2-13).

3. Position a .020 inch feeler gauge between the brake disc and brake lining.

4. Draw up the brake adjustment nut until a slight drag is felt on the feeler gauge.

5. Install the cotter pin to secure the adjustment nut.




Illust. 2-13. Brake adjustment points.

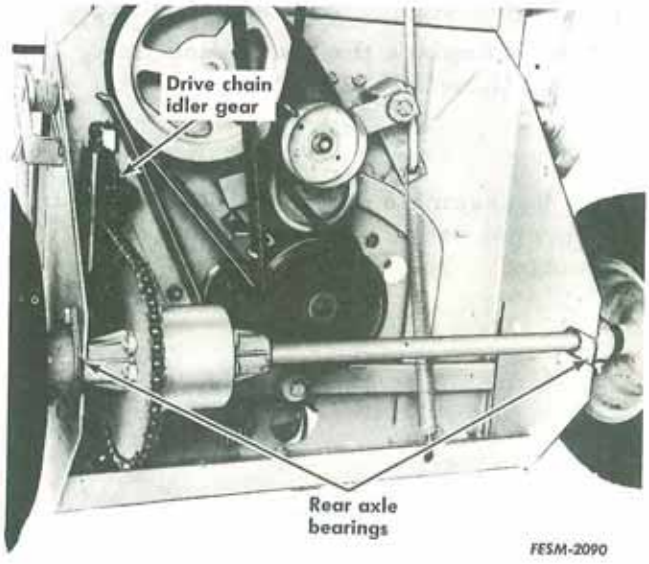
# DIFFERENTIAL AND REAR AXLE

## Removal

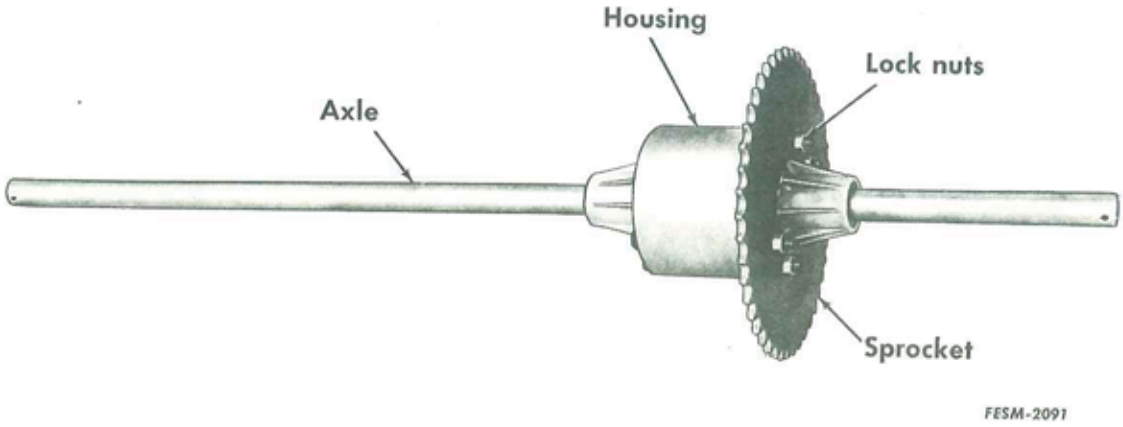
1. Raise the rear of the mower and support securely.

2. Remove the rear wheels. Refer to page 2-6.

3. Loosen the drive chain idler gear and remove the chain from the differential sprocket (Illust. 2-14).




Illust. 2-14. Differential and rear axle.



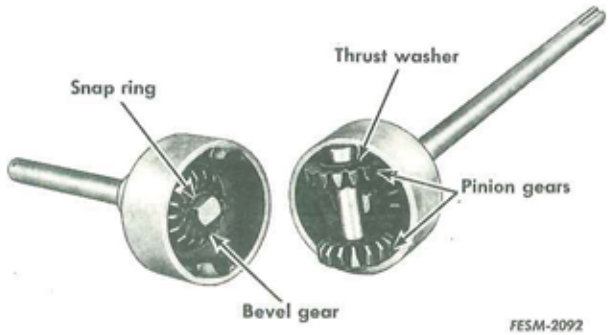

Illust. 2-15. Differential and rear axle removed.

4. Remove the bolts securing the rear axle flangette bearings to the rear frame (Illust. 2-14). Remove the rear axle and differential (Illust. 2-15).

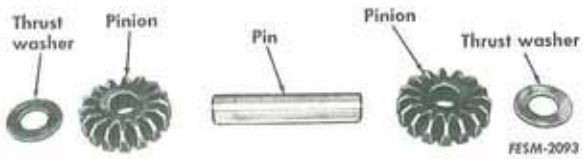
## Disassembly

1. Thoroughly clean the outside of the differential. Deburr the axle around the keyways and holes.

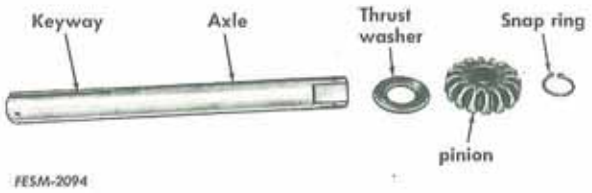
2. Remove the thru-bolts securing the sprocket and differential carriers. Remove the sprocket. Separate the carriers (Illust. 2-16).




Illust. 2-16. Differential carriers separated.




Illust. 2-17. Exploded view of drive pinion.




Illust. 2-18. Exploded view of axle (one end shown).

3. Remove the drive pin, pinion gears and thrust washers (Illust. 2-17).

4. Remove the snap ring, bevel gear and thrust washer from the axle. Slide the axle from the differential carrier.

## Inspection and Repair

1. Inspect the axle shaft for wear at the bearing location.

2. Roll the axle shaft along a flat surface to detect any warping or bending.

3. Check the differential carriers for cracks or breaks. Remove any high spots from the mating surface with a flat file.

4. The differential housing bearings are cast into the housing. If bearings need replacement, replace the housing.

5. Check the flangette bearings. Replace if necessary.

## Reassembly and Installation

Reassembly and installation is the reverse of removal and disassembly. Thoroughly lubricate the axles (around bearing surfaces) and the differential housing gears.

Use 1 ounce IH 251 HEP grease or equivalent #2 multi-purpose lithium base grease in the differential housing.

NOTE: No seals or gaskets are required with this unit.

Be sure to use four washers between the rear wheels and the axles to center the differential sprocket and take up any end play by adding washers to outside of the wheels. Refer to "Rear Wheels" on page 2-6.

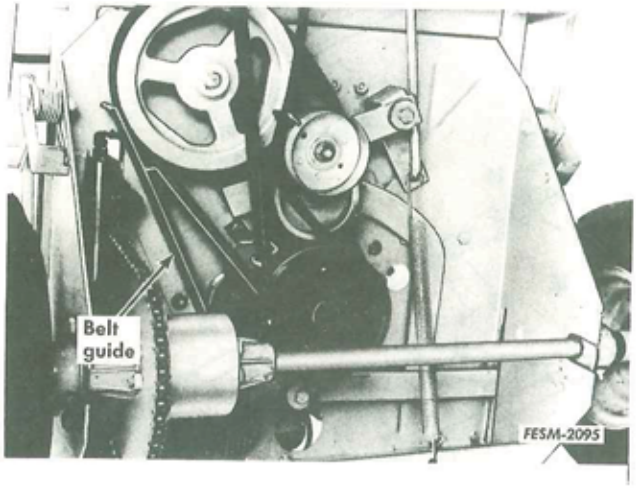
# TRANSMISSION

The mower and mower body must be removed before the transmission can be serviced.

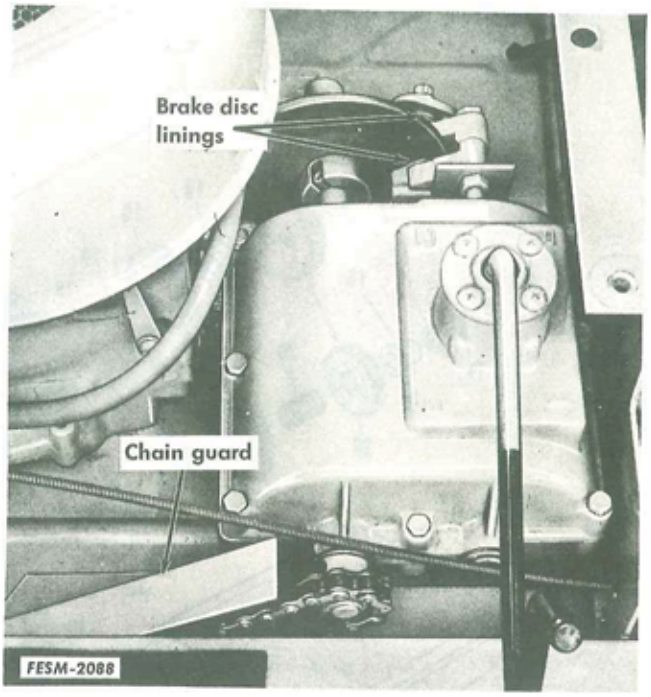
## Removal

1. Remove the mower. (Refer to page 3-2.)

2. Remove the mower body from the chassis. (Refer to page 2-3.)




Illust. 2-19. Belt guide.




Illust. 2-20. Chain guard.

3. Remove the chain guard and belt guides (Illusts. 2-19 and 2-20).

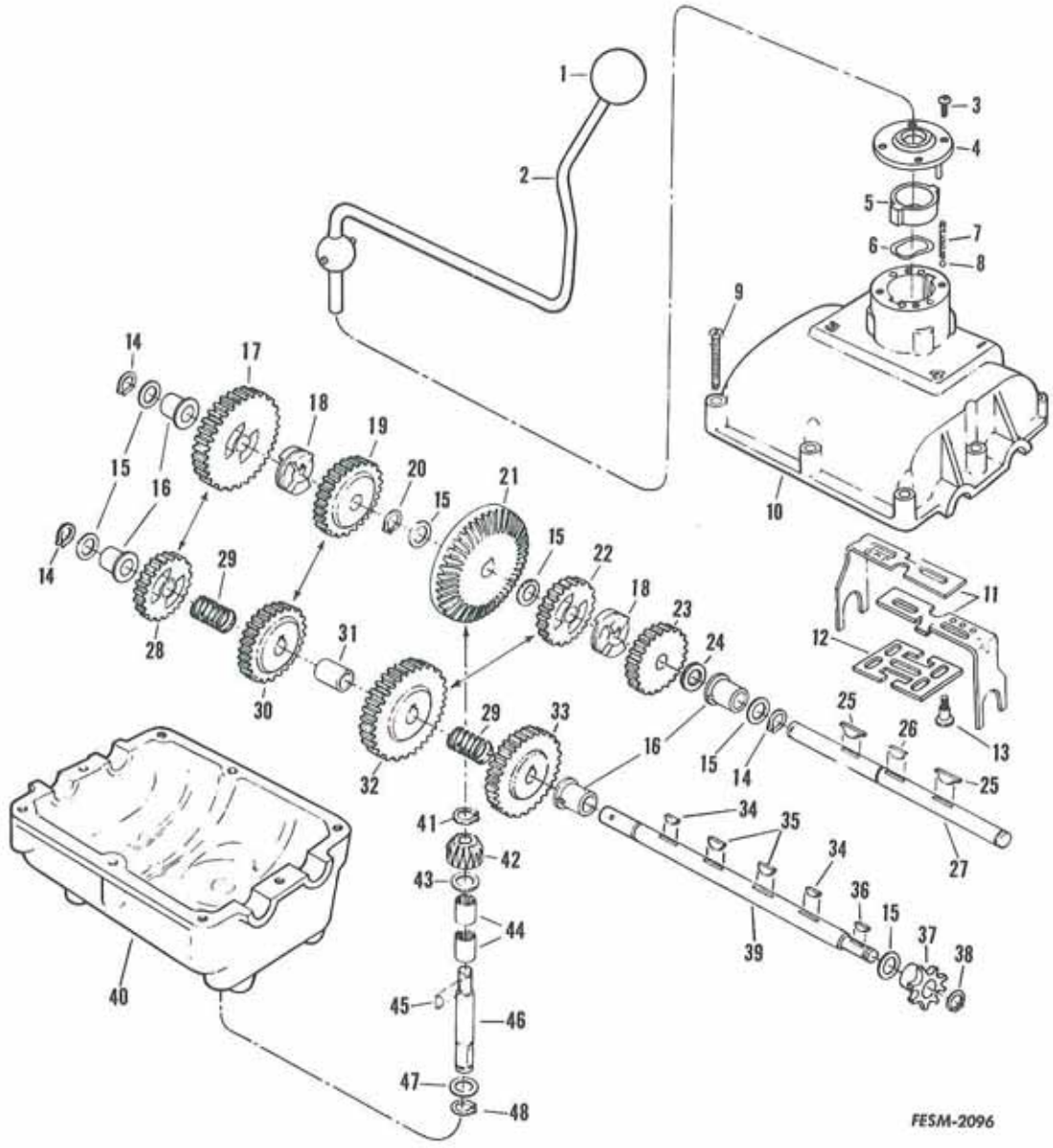
4. Remove the drive belts from the transmission pulley.

5. Remove the snap ring securing the drive pulley to the input shaft. Remove the pulley with a three jaw puller.

6. Loosen the drive chain idler gear assembly and remove the chain from the transmission gear.

7. Remove the cap screws securing the transmission to the chassis. Lift the transmission from chassis.

# Disassembly

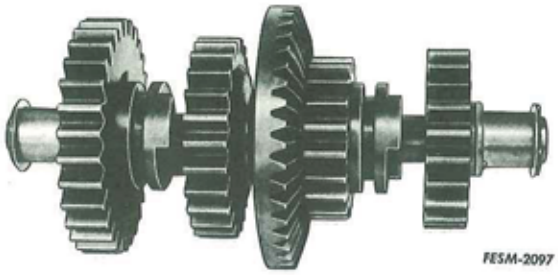



Illust. 2-21. Exploded view of transmission.

1. Knob
2. Lever
3. Screw
4. Cover
5. Nylon insert
6. Wave washer
7. Detent spring
8. Ball
9. Screw
10. Upper housing
11. Shifter fork
12. Shifter lock-out plate
13. Screw
14. Snap ring
15. Washer
16. Flange bearing
17. Gear
18. Clutch collar
19. Gear
20. Snap ring
21. Bevel gear
22. Gear
23. Gear
24. Thrust washer
25. Key
26. Woodruff key
27. Drive shaft
28. Gear (with keyway)
29. Spring
30. Gear (with keyway)
31. Spacer
32. Gear (with keyway)
33. Gear (with keyway)
34. Woodruff key #3
35. Woodruff key #61
36. Woodruff key #4
37. Sprocket
38. Snap ring
39. Output shaft
40. Lower housing
41. Snap ring
42. Pinion
43. Thrust washer
44. Needle bearing
45. Woodruff key #2
46. Input shaft
47. Washer (.060")
48. Snap ring

(Ref. Nos. Refer to Illust. 2-21)

1. Remove the cap screws securing the upper housing assembly (10) to the lower housing (40). Remove the upper housing.




Illust. 2-22. Drive shaft assembly.

2. Remove the drive shaft (27) assembly from the lower housing (40). See Illust. 2-22.


Illust. 2-23. Output shaft assembly.

3. Remove the output shaft (39) assembly. See Illust. 2-23.

4. Thoroughly wash the gear assemblies and the housings in a clean solvent and dry with air.

5. Disassemble drive shaft (27) assembly as follows:

a. Remove snap ring (14). Remove washer (15), flange bearing (16) and washer (24).

b. Remove gear (23) and clutch collar (18).

c. Remove key (25). Remove gear (22), washer (15), bevel gear (21) and key (26).

d. Remove washer (15), snap ring (20) and gear (19).

e. Remove clutch collar (18) and key (25).

f. Remove gear (17), flange bearing (16), washer (15) and snap ring (14).

6. Disassemble the output shaft (39) assembly as follows:

a. Remove snap ring (38), sprocket (37), washer (15) and key (36).

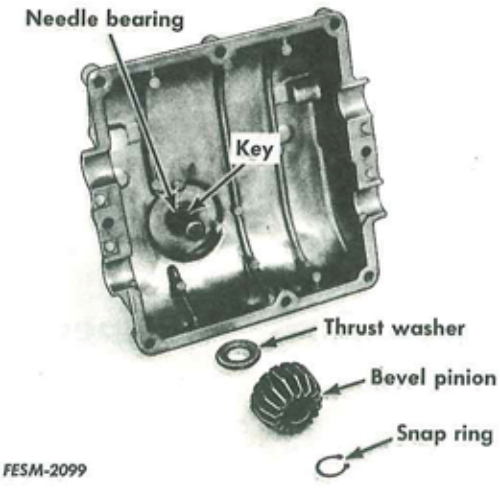
b. Remove flange bearing (16), gear (33) and spring (29).

c. Remove gear (32), spacer (31), gear (30) and spring (29).

d. Remove gear (28), snap ring (14), washer (15) and flange bearing (16).

e. Remove the keys from the shaft if replacement is necessary.

7. Remove the snap ring (41) securing the bevel pinion (42) to the input shaft (46).



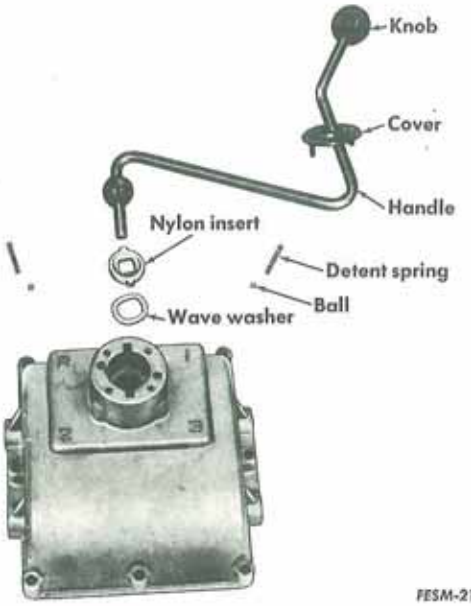

Illust. 2-24. Bevel pinion.

8. Press on the input shaft (46) until a suitable jaw puller, if necessary can be installed, then, remove the bevel pinion from the shaft. (Refer to Illust. 2-24.)

IMPORTANT: Be careful, when pressing on the input shaft, that the key (45) does not enter and damage the needle bearing (44) directly below washer (43).

9. Remove the key (45) from the input shaft and slide the shaft out of the housing (40).

10. Remove the needle bearings (44) only if replacement is necessary.



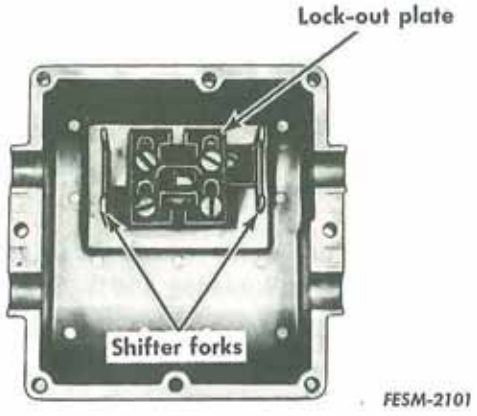

Illust. 2-25. Exploded view of shifter lever assembly.

11. Disassemble the shifter lever assembly as follows: (Refer to Illust. 1-9.)

a. Remove the cap screws (3) securing the cover (4) to the upper housing (10) and lift the lever out of the housing.

b. Remove the wave washer (6) from the housing bore.

c. If necessary, remove the detent springs (7) and balls (8).




Illust. 2-26. Shifter fork assembly.

NOTE: The detent balls can be removed easily by removing the shifter forks (Illust. 2-26).

d. If necessary, remove the shifter lock-out plate (12) and shifter forks (11).

## Inspection and Repair

1. Wash all parts in a cleaning solvent and blow dry.

2. Check the bearings for loose fit on the shafts; wear, roughness and scoring.

3. Check the gears for broken teeth, wear and burrs.

4. Check the shafts for wear at the bearing locations. Remove any burr with a fine stone.

5. Check the clutch collars for nicks and burrs which may prevent smooth mesh with the gears.

6. Inspect the housings for cracks.

# Reassembly

(Ref. Nos. Refer to Illust. 2-21)

Reassemble in the reverse of disassembly. Particular attention should be given to the following:

1. Install the shaft assemblies in the lower housing (40).

2. Washer (15) is available in .030, .040 and .050 inch thicknesses. The washer is used to establish required backlash and end-play in the assembly. Refer to Illust. 2-27 for the backlash and clearance check points.

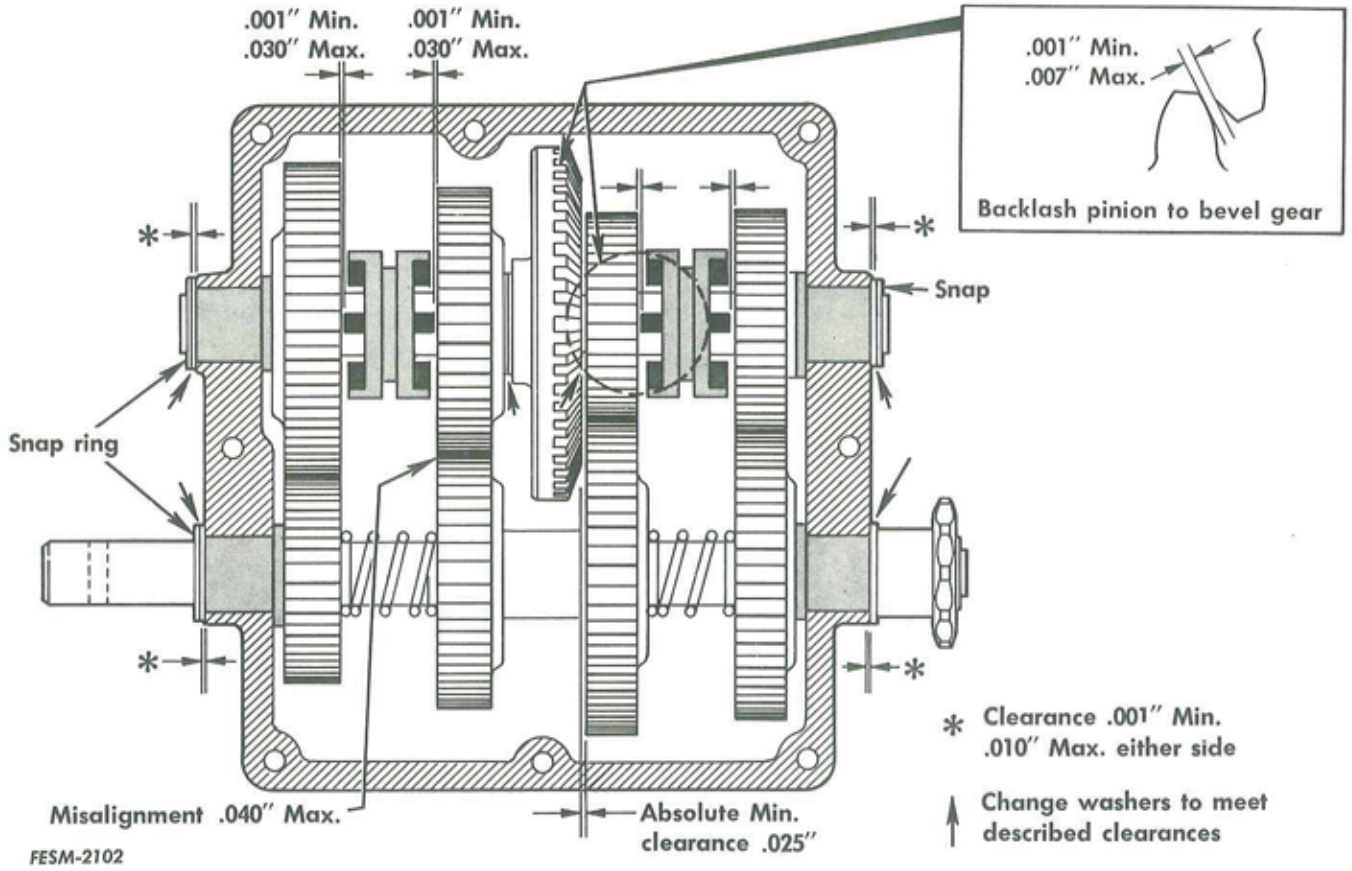
Check the following with a feeler gauge and make the adjustments by changing washers as necessary:

a. Shaft end-play: Minimum .001 inch; maximum .010 inch on either side of the housing.

b. Clearance between clutch collar (18) keys and the gear hubs: Minimum .001 inch; maximum .030 inch.

3. Place input shaft (46) in vise. Pull down on shaft end to bottom the pinion before locking the shaft in the vise. With a dial indicator, check the pinion gear-to-bevel gear backlash. Minimum .001 inch; maximum .007 inch. Change washers as necessary.

4. Check the clearance between the bevel gear face and the output shaft first gear. Absolute minimum clearance is .025 inch.




Illust. 2-27. Backlash and clearance check points.

5. Maximum permissible gear misalignment is .040 inch.

6. Fill the lower housing with 1/2 lb. of IH 251 HEP grease or equivalent #2 multipurpose lithium grease. Thoroughly lubricate the gear assemblies and the shifting mechanism in the upper housing.

7. Install the upper housing. Be sure the shifter forks are engaged with the clutch collars. Secure the housings with the cap screws.

## Installation

1. Position the transmission on the chassis. Install the drive chain and secure the transmission to the chassis with cap screws.

2. Install the transmission drive pulley. Secure the pulley with a snap ring.

3. Install the drive belt on the transmission pulley.

4. Install the belt guide and the chain guard.

5. Move the chain idler sprocket just enough to take up the slack and secure the sprocket.

6. Install the mower body. Refer to page 2-3.

Section 3

# MOWER

## CONTENTS



## SPECIFICATIONS

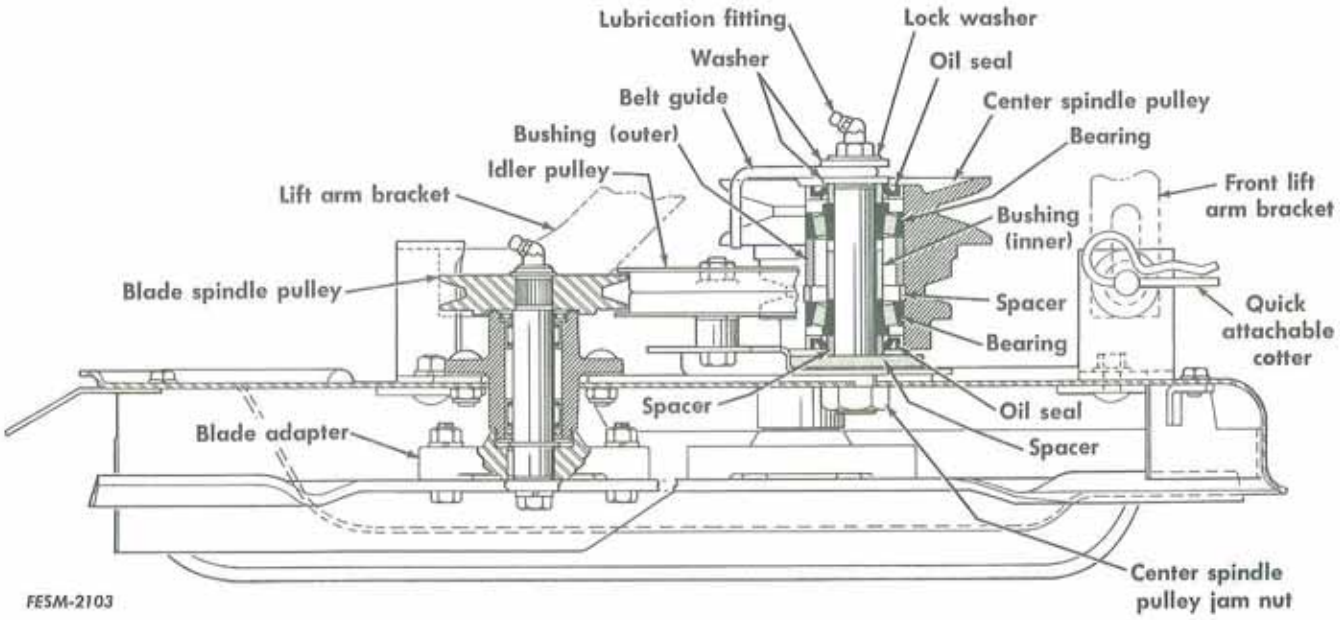
| | |
|---|---|
| Type cutter bar | Suction lift |
| Width of cut - inches | 32 |
| Adjustable cutting height - inches | 1-1/2 - 4 |

Special Torques (foot pounds)

| | |
|---|---|
| Center spindle jam nut | 185 |
| Blade spindle bolts | 57 |

Refer to standard torque chart on page V for all other torques.

# REMOVAL




Illust. 3-1. Cross-section view of mower.

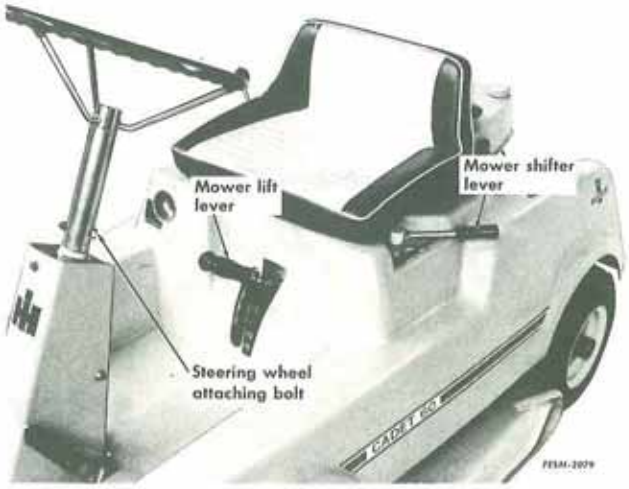
1. Lower the mower to the ground with the lift handle (Illust. 3-2).

2. Remove the quick-attachable cotters and the pins securing the front mower brackets to the lift arm assembly (Illust. 3-1).

NOTE: Pay particular attention to the drive belt position at the belt guide on the mower shifter idler pulley (Illust. 3-6).

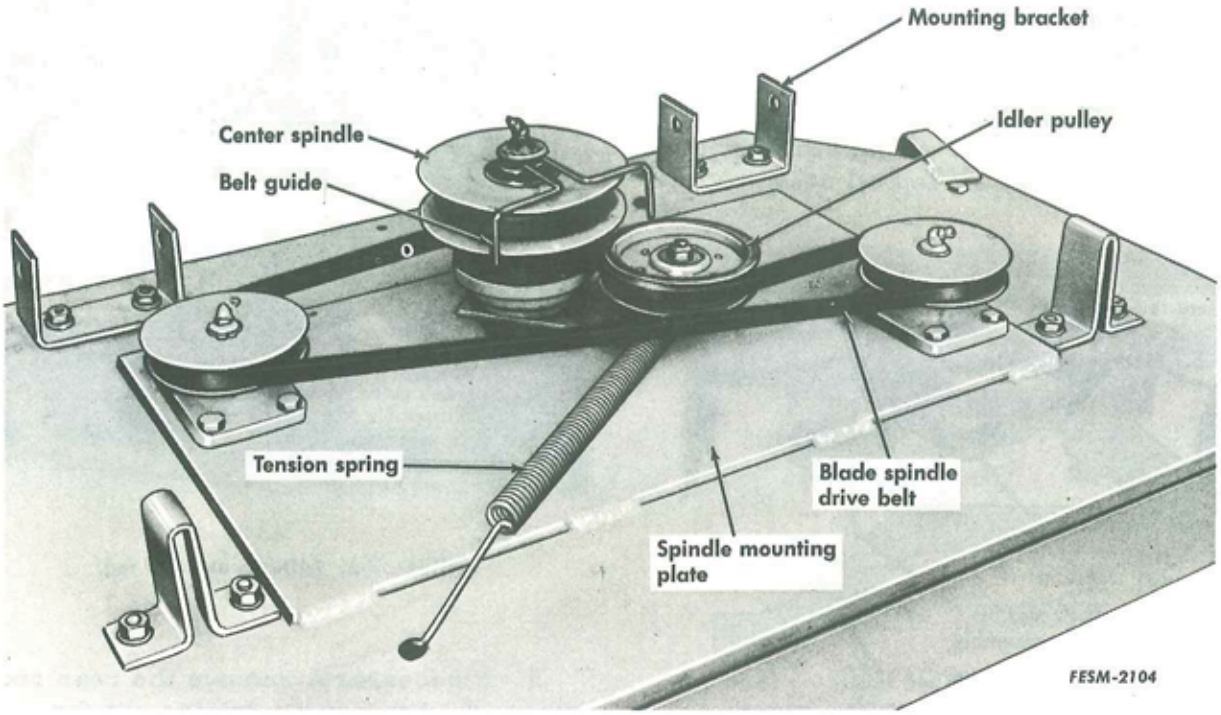
3. Remove the mower drive belt from the center spindle and "work" the belt free of the spindle belt guide.

4. Shift the mower rear brackets clear of the rear lift arm assembly. Slide the mower clear of the chassis.




Illust. 3-2. Mower control levers.

# DISASSEMBLY




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

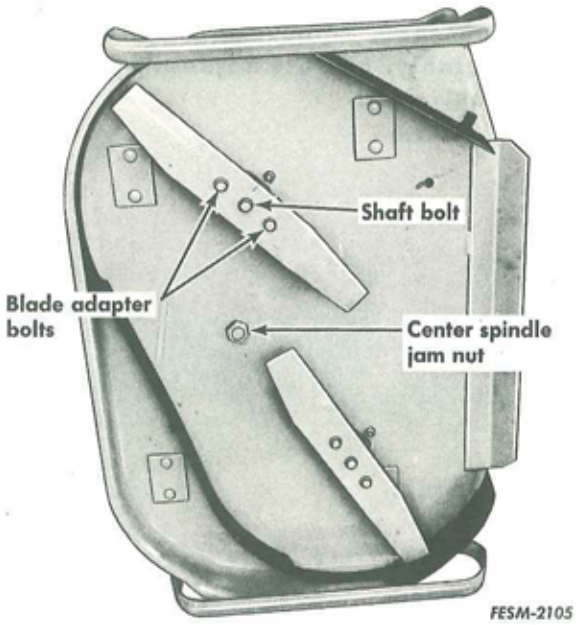
1. Remove the idler spring. Remove the spindle drive belt (Illust. 3-3).

2. Remove the jam nut (Illust. 3-4), securing the center spindle shaft assembly to the mounting plate. Remove the pulley and shaft.

3. To remove the blade pulley and shaft assembly, remove the shaft bolt (Illust. 3-4). Remove the blade adapter and blade as an assembly (Illust. 3-1).

Remove the bolts securing the shaft bearing housing to the mounting plate (Illust. 3-3). Remove the pulley and shaft assembly from the mounting plate.

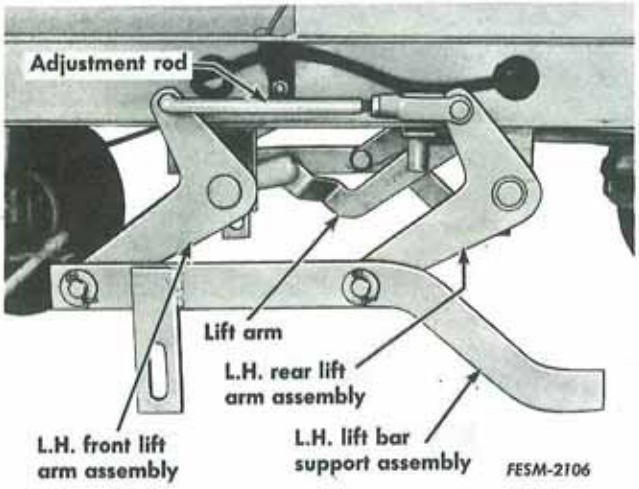
4. To remove the shaft from the bearing housing, remove the snap ring at the blade end of the housing (Illust. 3-8). Slide the pulley and shaft assembly out of the housing.




Illust. 3-4. Underside of mower assembly.

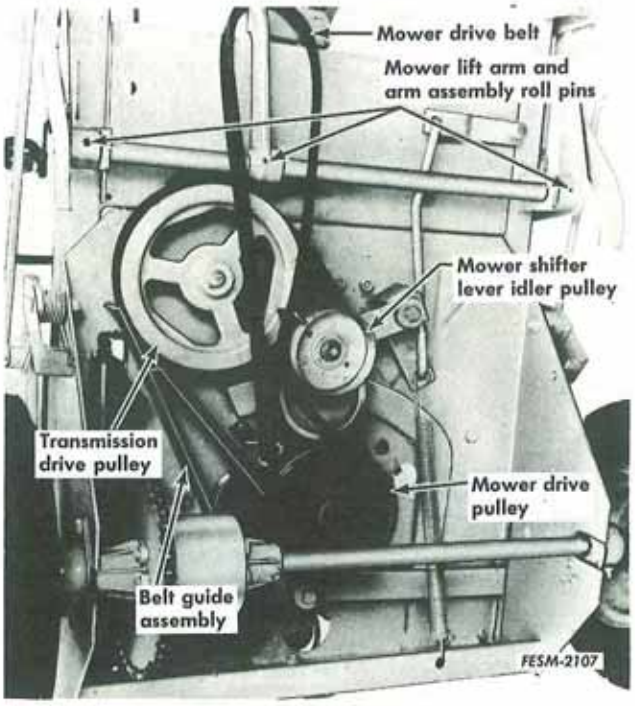
5. To remove the pulley from the shaft, remove the grease fitting and snap ring. Press the shaft out of the pulley.

6. To disassemble the center spindle shaft bearing (Illust. 3-1), 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. Turn the housing over and tap against the inner race of the bearing cone to remove it and the top oil seal.




Illust. 3-5. Mower lift linkage.

7. If necessary, remove the lift bar support assembly, and the adjusting rod. Refer to Illust. 3-5.




Illust. 3-6. Lift arm and rear rod.

8. If necessary, remove the rear rod and/or the lift arm by driving out the roll pins (Illust. 3-6) and slide the rear rod out.

# 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 belts 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 this page.

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

7. Inspect the shaft housings for cracks etc. and replace if necessary.

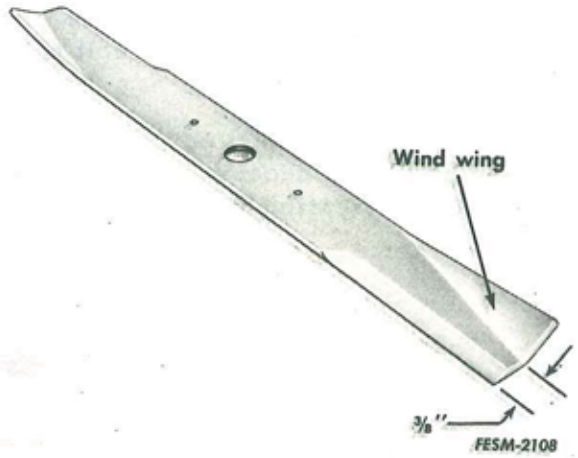
8. Inspect the shroud assembly for dents etc. and repair or replace if necessary.

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




Illust. 3-7. Blade re-conditioning.

## REASSEMBLY

Steps 1 thru 9 cover reassembly of the center pulley spindle.

1. Pack bearings with IH 251 HEP grease or equivalent #2 lithium base grease. If installing new bearings, install the new bearing cups into each end of the shaft housing and be sure they bottom against the split outer spacer (Illust. 3-1).

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 bearing housing through the top of the housing.

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.

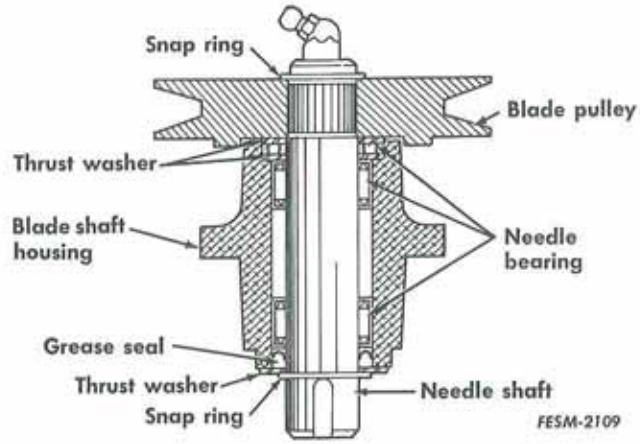
6. Install the idler pulley assembly and the center spindle. Torque the center spindle jam nut to 185 foot pounds.

7. Install the pulley. Install the flat washer between the pulley spacer and the pulley.

8. Position the belt guide on the center pulley spindle (Illusts. 3-9 and 3-11) between washers.

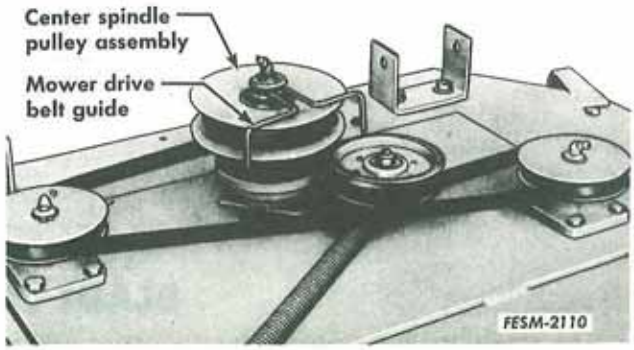
9. Secure the pulley to the shaft with two flat washers, star lockwasher and spindle end bolt. Torque the end bolt to 40 ft. lbs.

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




Illust. 3-8. Cross-section view of blade spindle housing.

10. Reassemble the blade pulley spindle. Refer to Illust. 3-8. Install the spindle assembly on the mower mounting plate.




Illust. 3-9. Belt guide installed.

11. Install the blade to the adapter, if removed.

12. Install the adapter and blade assembly to the spindle. Torque the spindle nut to 57 ft. lbs.

## INSTALLATION

Installation is the reverse of removal. Be sure the belt guide on the center pulley is properly positioned (Illust. 3-11). Refer to Illust. 3-6 for the position of the drive belt at the shifter idler pulley.

# ADJUSTMENTS

## Leveling of Mower

(Refer to Illust. 3-5)

A properly leveled mower is one where the blades are cutting parallel to the ground. Follow this procedure to level mower:

1. Drive the tractor on a hard, flat surface.

2. Turn the ignition off.

3. Lock the tractor brake.

4. Lower the mower to the lowest position.

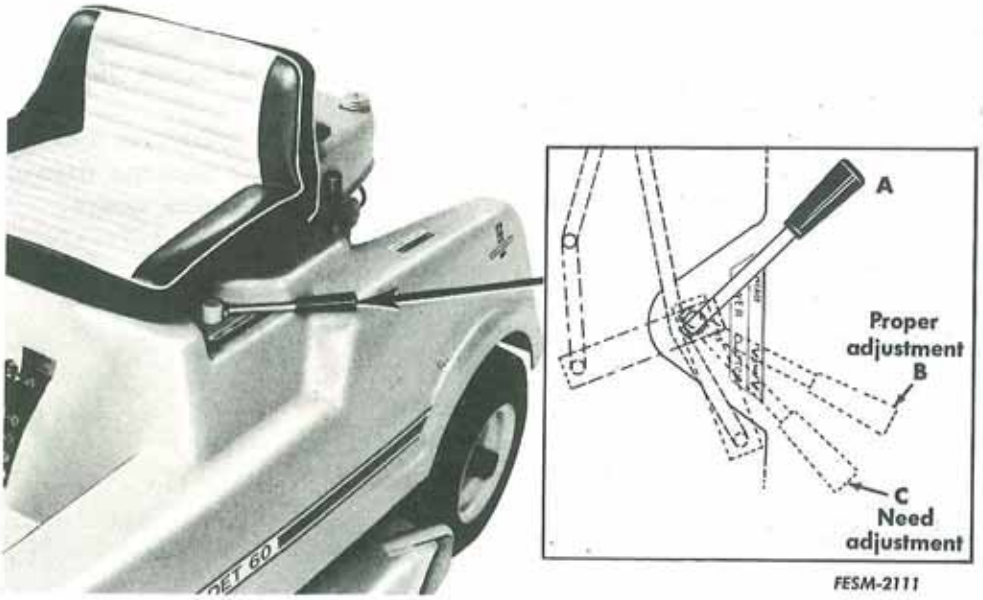
5. Disconnect the clevis from the lift arm (both sides).

6. To raise the front of the mower, turn the clevis further onto the rod.

7. Connect the clevis to lift the arm.

## Mower Belt Adjustment

(Refer to Illusts. 3-10 and 3-11)




Illust. 3-10. Mower shift lever operating positions.

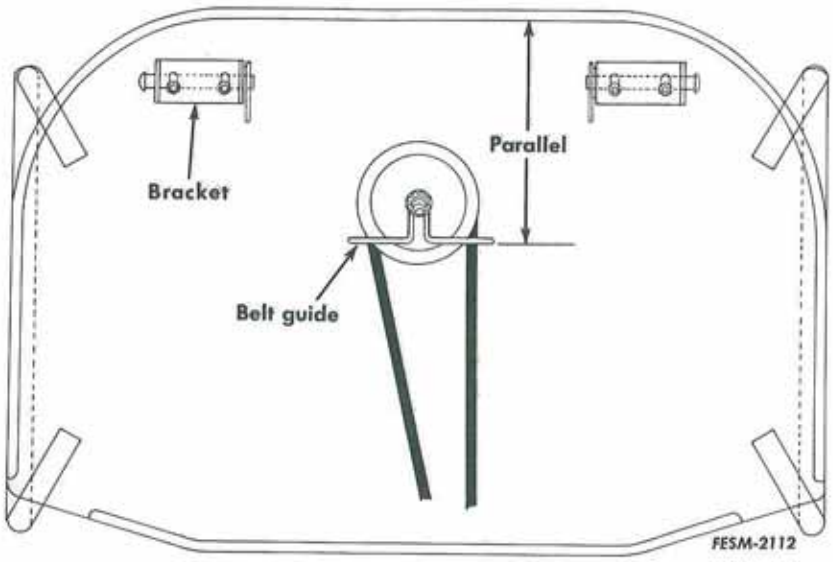
Position "A" is the disengaged. Position "B" is directly over the diamond on the decal and this is the proper position for a newly adjusted belt. Position "C" is directly over the diamond on the decal and this indicates the belt needs adjustment. When the lever is in position "C" follow the procedure indicated below.

1. Turn the ignition off.

2. Lock the tractor brake.

3. Lower the mower to the lowest position.

4. Place the mower clutch lever in position "B". This may be accomplished by putting a block of wood between the body and the handle.




Illust. 3-11. Mower drive belt adjustment brackets.

5. Loosen the bolts on the front hanger brackets.

6. Move the mower forward until all slack in the drive belt is taken up. This position can be felt because forward motion of mower will be resisted by belt tension. The mower should be moved forward the same amount on each side.

7. Retighten the hanger bracket bolts and remove the block of wood.

8. Start the tractor and engage the mower. Check that the mower lever is operating in proper range.

# SERVICE BULLETIN RECORD

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

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