John Deere
Service Manual
110 and 112 Lawn and Garden Tractors
(Serial No. -100,000)
SM-2059-(Apr-67)

John Deere Horicon Works
SM2059 (Apr-67)
LITHO IN U.S.A.
ENGLISH

BOLT TORQUE CHART

Grade of Bolt		SAE-2	SAE-5	SAE-8		
Min. Tensile Strength		64,000 PSI	105,000 PSI	150,000 PSI		
Grade Marking on Bolt					Socket or Wrench Size	
U.S. Standard					U.S. Regular	
Bolt Dia.	U.S. Dec. Equiv.	TORQUE IN FOOT POUNDS			Bolt Head	Nut
1/4	.250	6	10	14	7/16	7/16
5/16	.3125	13	20	30	1/2	1/2
3/8	.375	23	35	50	9/16	9/16
7/16	.4375	35	55	80	5/8	11/16
1/2	.500	55	85	120	3/4	3/4
9/16	.5625	75	130	175	13/16	7/8
5/8	.625	105	170	240	15/16	15/16
3/4	.750	185	300	425	1-1/8	1-1/8
7/8	.875	*160	445	685	1-5/16	1-5/16
1	1.000	250	670	1030	1-1/2	1-1/2

Multiply Readings by 12 for inch pound values.

"B" Grade bolts larger than 3/4-inch are sometimes formed hot rather than cold which accounts for the lower recommended torque.

NOTE: Allow a tolerance of plus or minus 10% on all torques given in this chart.

SET SCREW SEATING TORQUE CHART

Screw Size	Cup Point	Square Head
	Torque in Inch Pounds	
#5	9	--
#6	9	--
#8	20	--
#10	33	--
1/4	87	212
5/16	165	420
3/8	290	830
7/16	430	--
1/2	620	2100
9/16	620	--
5/8	1225	4250
3/4	2125	7700

Divide Readings by 12 for foot pound values
NOTE: Allow a tolerance of plus or minus 10% on all torques given in this chart.

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DIAGNOSING MALFUNCTIONS—Continued

Engine Loses Power

Crankcase low on oil.
Fill crankcase to proper level.
Change oil if tractor has been operated 8 hours since last oil change.

Engine shrouding plugged.
Remove shrouding and clean engine fins and inside of shrouding.

Excessive engine load.
Reduce engine load by shifting transmission in lower gear and/or by moving variable-speed control lever back.

Restricted air filter.
Clean and check air filter element condition.
Replace filter if necessary.

Dirt or water in fuel system.
Remove fuel system and clean dirt and water from system.
Install new gaskets.
Install caruburetor kit if necessary.

High speed and idle mixture needle not properly adjusted.
Adjust needles properly.

Spark plug fouled or pitted, incorrect gap.
Check spark plug condition.
Clean and regap.
Replace spark plug if necessary.

Too much oil in crankcase.
Drain oil and refill crankcase with proper amount of crankcase lubricant.

Low engine compression.
Check compression.
Repair and replace parts as necessary.
Torque head bolts.

Worn cylinder bore.
Check cylinder condition.
Repair as necessary.

Engine Overheats

Dirty or plugged shrouding and engine fins.
Remove shrouding and clean engine fins and shrouding.

High speed and idle mixture needles not properly adjusted.
Adjust needles properly.

Too much oil in crankcase.
Drain oil and fill crankcase with proper amount of crankcase lubricant.

Worn valve stem and/or guides.
Check condition of valve stems and guides.
Replace valves and/or guides if necessary.

Crankcase low on oil.
Fill crankcase to proper level.
Change oil if tractor has been operated 8 hours since last oil change.

Excessive engine load.
Reduce work load by shifting transmission in lower gear and/or by moving variable-speed control lever back.

Faulty breather causing low crankcase vacuum.
Clean breather assembly.
Replace parts as necessary.

Engine Knocks

Engine out of time.
Time ignition.

Old fuel.
Drain fuel tank and refill with good grade of regular gasoline.

Excessive engine load.
Reduce engine load by shifting transmission in lower gear and/or by moving variable-speed control lever back.

Crankcase low on oil.
Fill crankcase to proper level.
Change oil if tractor has been operated 8 hours since last oil change.

Engine Backfires

High speed and idle mixture needles not properly adjusted.
Adjust needles properly.

Loose cylinder head or blown head gasket.
Torque head bolts.
Replace head gasket if necessary.

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REPLACING VALVE GUIDES—Continued

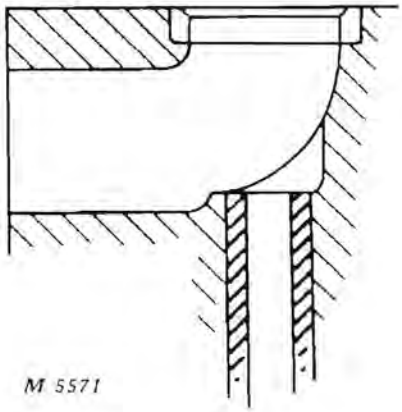

Fig. 20–Installing Valve Guides

Thoroughly clean hole and press valve guide into hole 1-5/16 inches from top of block. After installing new guide, ream hole as required for necessary valve clearance in guide. Refer to Specifications, page 10-11, for valve guide clearances.

REPLACING EXHAUST VALVE INSERT

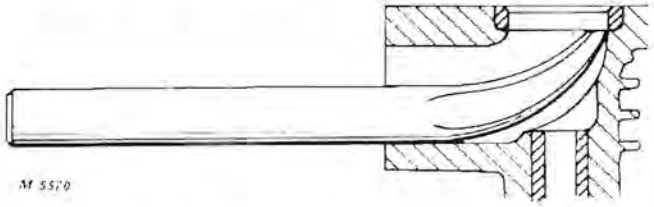

Fig. 21–Removing Exhaust Valve Insert

To remove exhaust seat insert, use extractor, Figure 21 or a valve seat puller. Clean seat area thoroughly before installing new insert. If extractor is not available, break insert and drive out.

Exhaust valve insert is retained by press fit only. Chill both the insert and driving tool in dry ice before pressing insert into block.

INSTALLING INTAKE VALVE INSERT

If the intake valve seat is beyond repair in the cast iron block, an insert is available for service. Bore block to depth shown, Figure 22, and install insert as explained above for exhaust valve inserts.

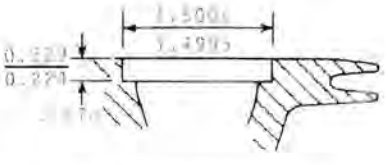

Fig. 22–Intake Valve Seat

CHECKING VALVE CLEARANCE

Fig. 23–Checking Valve Clearance

Valve grinding changes the tappet and valve clearance. After grinding or installing new valves, check clearance as follows:

1. Rotate crankshaft until piston is top dead center (end of compression stroke) and crankshaft keyway is at exactly 12 o'clock (top) position. If breaker points are properly adjusted, they will be opening at this time. It is important that this procedure be followed to insure that the exhaust tappet is NOT riding on the automatic compression release mechanism on engines so equipped.

2. Insert valves in their guides and hold valves firmly on seats.

3. Check clearance between bottom of each valve stem and its tappet with feeler gauge, Figure 23. Refer to Specifications, page 10-11, for proper valve clearance. Grind off tip of valve stem in a valve resurfacing machine set to grind a perfectly square face. Grind tip of stem until proper clearance is obtained.

PISTON RING ANALYSIS—Continued

Fig. 11—Worn Oil Rings Which Cannot Provide Oil Control

Rails of the oil ring are worn down to the steel expander spacer and the oil ring surface is worn flat. This can only come from cylinder wall contact after much use and possible entry of abrasives. Compression rings will also be worn thin.

Badly worn oil rings will have:

1. Extra large gap.
2. Low tension.

INSPECTING PISTON

Remove deposits from piston surfaces. Clean gum and varnish from the piston skirt.

Do not use a caustic cleaning solution or a wire brush to clean pistons.

Be sure the oil ring holes are clean.

Clean carbon from piston ring grooves with a ring groove cleaner. If cleaning tool is not available, break an old ring and use it to clean groove, Figure 12.

Fig. 12—Cleaning Ring Grooves

Fig. 13—Measuring Ring Clearance

Check ring grooves for excessive wear by inserting a new ring in the proper groove at several points around the piston. Measure clearance between ring and groove with a feeler gauge, Figure 13. Refer to Specifications, page 15-18, for ring groove side clearance. Replace piston having ring clearance beyond wear limits.

Inspect piston for fractures at the ring lands, skirts and ring bosses and for rough or scored skirts.

Analyze the condition of the piston by studying the illustrations beginning on page 15-7. Replace faulty pistons.

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ATTACHING ROD TO CRANKSHAFT

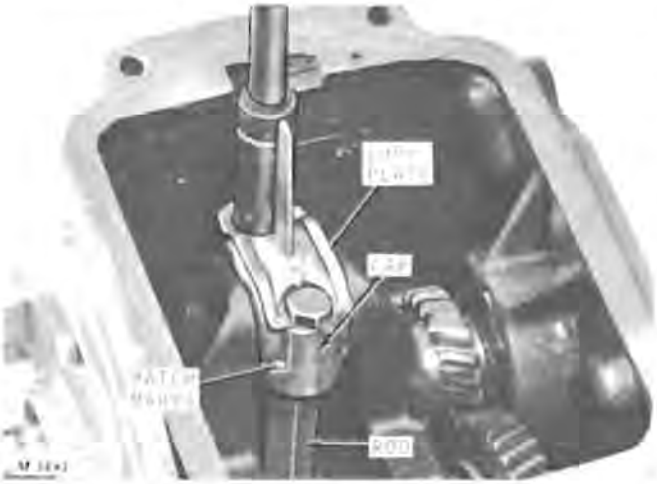

Fig 39–Rod and Crankshaft Assembly

After piston assembly is installed, place block on end and oil connecting rod and crank pin. Be sure that match marks on connecting rod and cap, Figure 39, are aligned and face flywheel side of engine.

Attach connecting rod cap, lock plate and cap screws to the connecting rod.

Use a torque wrench to tighten connecting rod cap screws to 220-inch pounds. Back off screws and tighten to 200-inch pounds. This two step procedure will assure a tight fit of rod to crankshaft and avoids possibility of screws tightening in threads while rod remains loose on crankshaft.

IMPORTANT: Bend lips of lockplate to rod cap screw heads to prevent screws from loosening.

INSTALLING OIL PAN ON BLOCK

Place a new gasket on oil pan. Position oil pan to match cylinder block, Figure 40. Place coil bracket on front of cylinder block. Install two 3/8 x 1-1/4-inch cap screws through coil bracket and engine block. Install two 3/8 x 1-inch cap screws through rear of engine block. Refer to Torque Chart, Section 10 and torque cap screws accordingly.

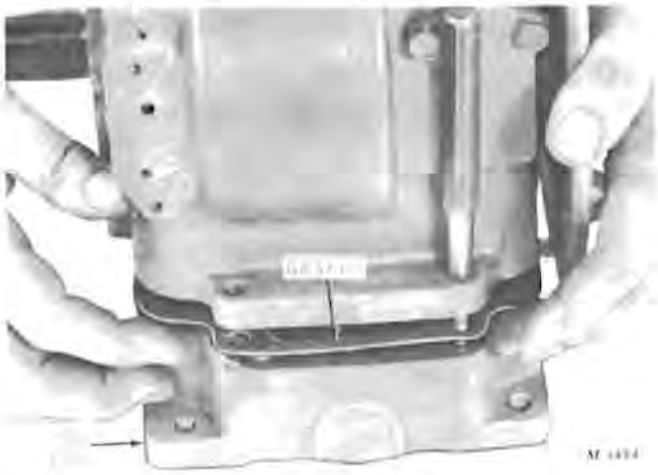

Fig. 40–Oil Pan and Gasket Assembly

INSTALLING FLYWHEEL

Fig 41–Flywheel Assembly

Place square key in crankshaft keyway.

Assemble flywheel, washer and nut on end of crankshaft and tighten nut.

Place bar between flywheel fins or use strap wrench, Figure 41, while torquing nut. See Specifications, page 15-18, for proper flywheel nut torque.

Refer to Group 10 and install valves, breather and cylinder head.

ASSEMBLING CAMSHAFT—Continued

Use feeler gauge to check camshaft end clearance. See Specifications, page 20-8. Use 0.005 to 0.010-inch spacer washers as required to obtain correct clearance.

Spin camshaft to be sure governor and camshaft turn freely.

INSTALLING GOVERNOR ARM

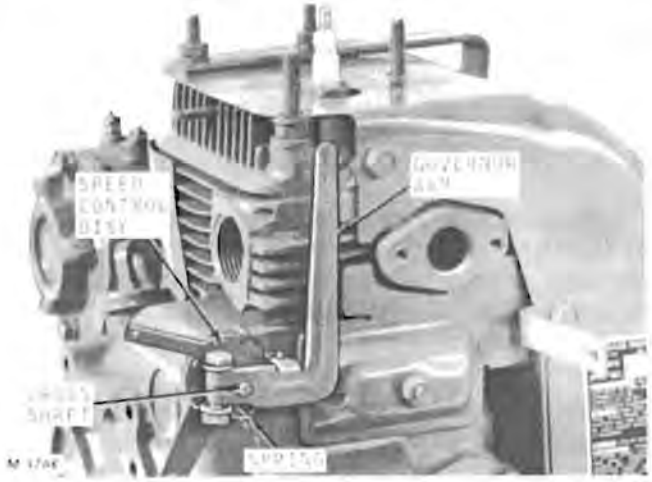

Fig. 14–Positioning Governor Arm

Turn block upright and slide governor arm, spring and bolt assembly on end of cross shaft. *Be sure spring is positioned into slot in speed control disk.*

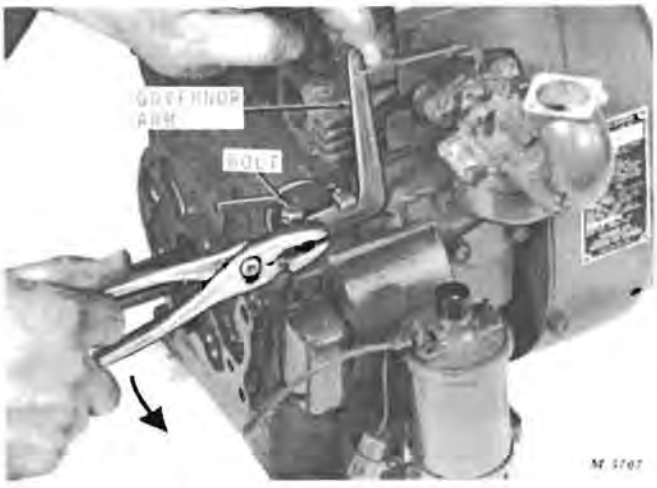

Fig. 15–Adjusting Governor Arm

Before tightening bolt on cross shaft, turn governor shaft counterclockwise as far as possible. While holding governor arm to the left (away from block) tighten bolt. Figure 15. Move governor through its full arc of travel to be sure it operates loosely. Relieve pressure on bushing nut if too tight.

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Refer to "Installation" on pages 10-9 and 15-13 to complete engine assembly.

CONNECTING GOVERNOR ARM TO CARBURETOR

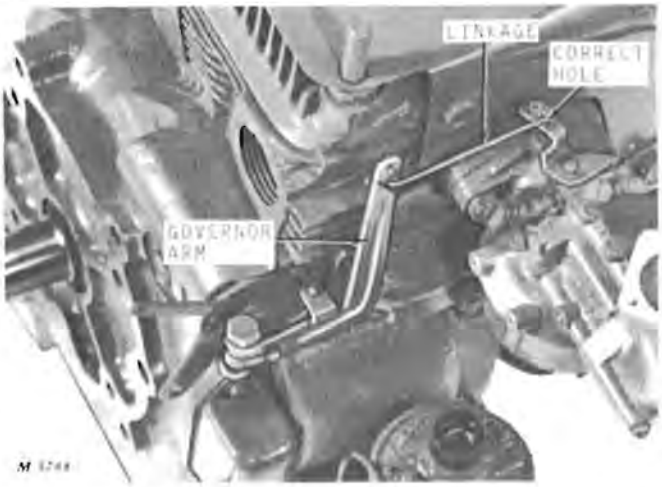

Fig. 16–Governor-to-Carburetor Linkage

Connect linkage between governor arm and carburetor in correct holes as indicated, Figure 16.

INSTALLING ENGINE IN TRACTOR

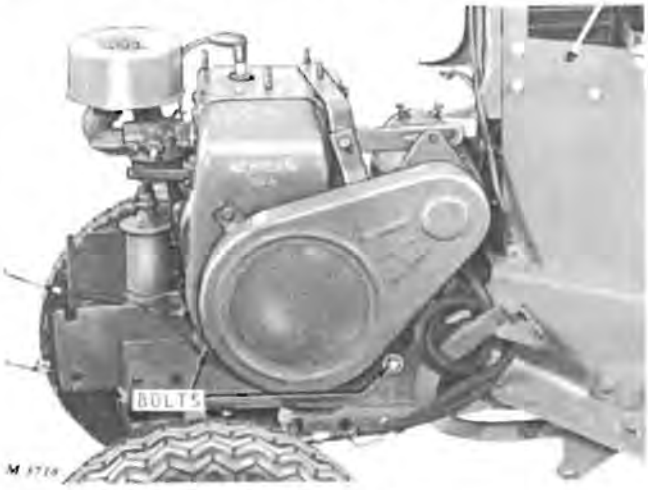

Fig. 17–Installing Engine

Position engine in tractor and attach engine base to same holes in tractor frame.

Engine Knocks—Continued

Crankcase low on oil.
Fill crankcase to proper level.
Change oil if tractor has been operated 8 hours since last oil change.

Engine Backfires

High speed and idle mixture needles not properly adjusted.
Adjust needles properly.

Loose cylinder head or blown head gasket.
Torque head bolts.
Replace head gasket if necessary.

Intake valve sticking in guide.
Free valve stem in guide.

Ignition out of time.
Set engine timing.

Engine Low on Power at High Speed

Restricted air filter.
Clean and check air filter element condition.
Replace filter if necessary.

Spark plug fouled or pitted, incorrect gap.
Check spark plug condition.
Clean and regap.
Replace spark plug if necessary.

Incorrect spark plug.
Install correct plug.

Restricted exhaust.
Repair and clean muffler.
Replace muffler if necessary.

Breaker points out of adjustment, worn and pitted.
Clean and adjust.
Replace points if necessary.

Clogged fuel line or air lock.
Clean and bleed air from fuel line.
Replace fuel line if necessary.

Broken choke cable.
Replace cable and adjust choke valve to correspond with control on panel.

Clogged breather assembly.
Clean breather assembly.
Install new parts as necessary.

Defective ignition coil.
Check coil.
Replace coil if necessary.

Engine Does Not Maintain Constant Speed (surges)

High speed and idle mixture needles not properly adjusted.
Adjust needles properly.

Spark plug gap incorrect.
Check spark plug condition.
Clean and regap spark plug.
Install new spark plug if necessary.

Throttle to governor linkage not properly assembled.
Assemble linkage correctly.

Breaker points out of adjustment, worn or pitted.
Clean and adjust.
Replace points if necessary.

Dirt or water in fuel system.
Remove fuel system and clean dirt and water from system.
Install new gaskets.
Install carburetor kit if necessary.

Engine Uses Excessive Amount of Oil

Clogged breather assembly.
Clean breather assembly.
Replace parts as necessary.

Breather not assembled properly.
Assemble breather properly.

Worn or broken piston rings.
Install new rings.

Worn cylinder bore.
Recondition cylinder.
Replace parts as necessary.

Clogged oil holes in piston.
Clean piston and check piston condition.
Install new parts as necessary.

Wrong size piston rings.
Install proper rings.

Worn valve stems and/or valve guides.
Check condition of valve stems and guides.
Replace valves and guides if necessary.

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REMOVING AND INSTALLING EXHAUST VALVE SEAT INSERT

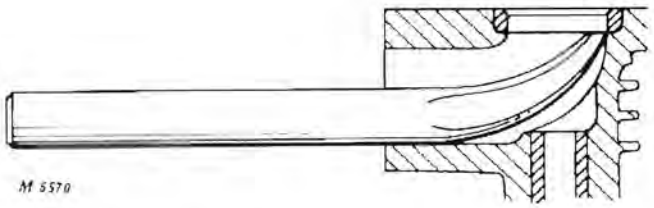

Fig. 21–Removing Exhaust Valve Seat Insert

To remove exhaust valve seat insert, use extractor, Figure 21, or a valve seat puller. Clean seat area thoroughly before installing new insert. If extractor is not available, break insert and drive out.

The exhaust valve insert is retained by a press fit only. Chill both the insert and driving tool in dry ice before pressing insert into block.

CHECKING VALVE CLEARANCE

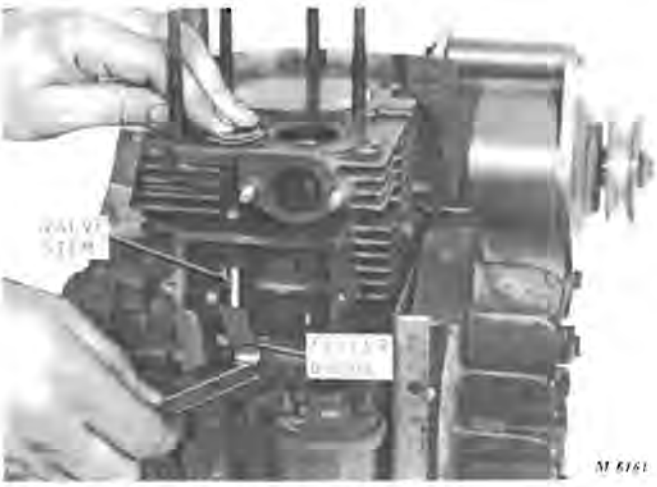

Fig. 22–Checking Valve Clearance

Valve grinding changes the lifter and valve clearance. After grinding or installing new valves, check clearance as follows:

1. Rotate crankshaft until piston is top dead center (end of compression stroke) and crankshaft keyway is at exactly 12 o'clock (top) position. If breaker points are properly adjusted, they will be open at this time. It is important that this procedure be followed to insure that the exhaust lifter is NOT riding on the EZEE-start mechanism.

2. Insert valves in their guides and hold valves firmly on seats.

3. Check clearance between bottom of each valve stem and its lifter with a feeler gauge, Figure 22. Refer to "Specifications," page 30-11, for proper valve clearance. Grind off tip of valve stem in a valve resurfacing machine set to grind a perfectly square face. Grind tip of stem until proper clearance is obtained.

Fig. 12–Scratched Ring Faces Caused by Abrasives in the Engine

Vertical scratches across the faces of piston rings are the result of an abrasive entering the engine. Abrasives may be airborne, may have been left in during overhaul or are loose lead and carbon deposits.

When this condition is found, always check and correct the source of abrasives because the life of a new set of rings will be short otherwise.

Common causes for abrasives in the engine are:

1. Damaged, collapsed or improperly installed air filter.
2. Loose connection or damaged gasket between air filter and carburetor.
3. Air leak around carburetor to block gasket.
4. Air leakage around throttle shaft.
5. Failure to properly clean cylinder bore.

Fig. 13–Worn Oil Rings Which Cannot Provide Oil Control

Rails of the oil ring are worn down to the steel expander spacer and the oil ring surface is worn flat. This can only come from cylinder wall contact after much use and possible entry of abrasives. Compression rings will also be worn thin.

Badly worn oil rings will have:

1. Extra large gap.
2. Low tension.

INSPECTING PISTON

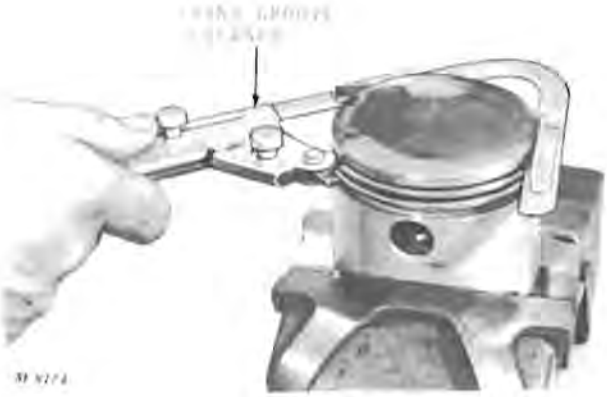

Fig. 14–Cleaning Ring Grooves

Remove deposits from piston surfaces. Clean gum and varnish from the piston skirt.

Do not use a caustic cleaning solution or a wire brush to clean pistons.

CHECKING CRANKSHAFT END CLEARANCE

Fig. 37–Seating PTO Bearing

Invert engine, Figure 37. PTO end of crankshaft must extend freely.

Turn the crankshaft until the piston is at T.D.C. Tighten bearing retainer screws lightly and tap the flywheel end of the crankshaft lightly with a mallet to seat bearing.

Fig. 38–Checking Gap Between Cylinder Block and Retainer

Remove three screws from bearing retainer. Insert a feeler gauge between the bearing retainer and machined surface of cylinder block, Figure 38, and record the reading. If space does not exist between the retainer and the machined gasket surface to allow insertion of the feeler gauge, use a 0.010-inch steel spacer. Place steel spacer between bearing cup and inside surface of the retainer. More than one may be used if required.

After determining the gap between the cover and the machined surface on cylinder block, determine the shim thickness as follows to obtain the required 0.002-0.003-inch crankshaft end play.

0.003-inch—clearance between cover and cylinder.

+0.003-inch—required end play.

0.006-inch—shim thickness required.

+0.003-inch—add half of shim thickness required to compensate for gasket compression

0.009-inch—use shim gaskets that total this amount. In this case, using two 0.004 to 0.005-inch thick gaskets would allow correct crankshaft end play.

Secure bearing retainer with three cap screws with lock washers. Refer to "Specifications," page 35-18, for correct torque and torque screws accordingly.

INSTALLING SEALS

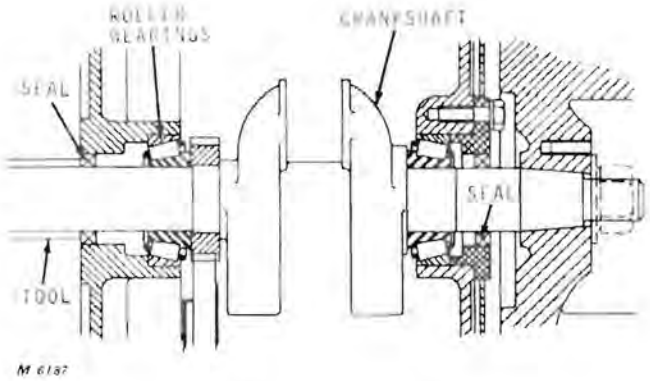

Fig. 39–Installing Seals

Install oil seal with lip facing inward. Use oil seal sleeve tool to prevent seal damage. Tap seal in place with a piece of tubing. Seal must be square in seal bore and pressed in to a distance of flush or 0.025 inch beyond flush of cylinder cover and bearing retainer exterior, Figure 39. Install blower housing baffle. See "Torque Chart" in Section 10 and tighten baffle bolts accordingly.

INSTALLING BREAKER CAM ON CAMSHAFT

Fig. 14–Breaker Cam Position

Install breaker cam with notch toward camshaft gear. Align notch with tab on camshaft, Figure 14.

INSTALLING TAPPETS AND CAMSHAFT

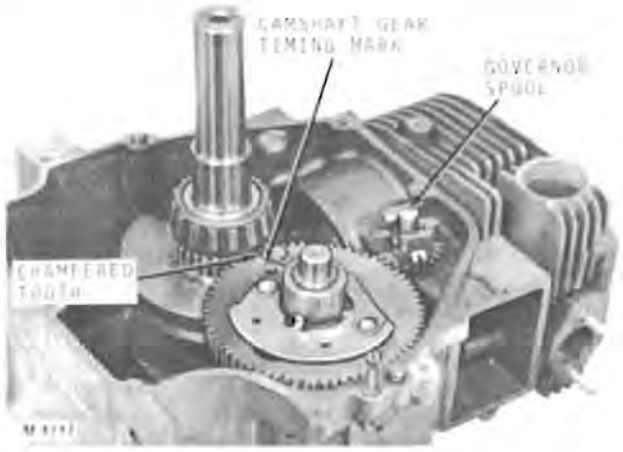

Fig. 15–Valve Timing

Install tappets in the same guides from which they were removed during disassembly. Install camshaft, matching chamfered tooth on crankshaft gear with mark and hobbing hole on camshaft gear, Figure 15.

INSTALLING GOVERNOR ROD AND LEVER

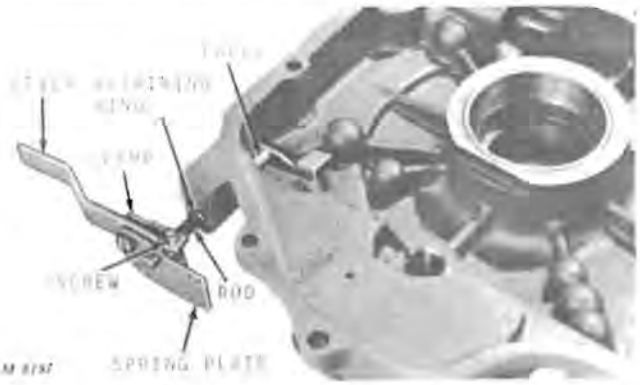

Fig. 16–Installing Governor Rod

Install spacer on governor rod. Oil governor rod and install rod in cylinder cover. Secure rod with retaining ring, Figure 16.

Assemble lever, clamp and spring plate, Figure 16. Slide assembly on governor rod as far as undercut permits. Tighten clamp screw firmly.

Refer to Group 35 and reassemble the engine.

CONNECTING GOVERNOR LEVER

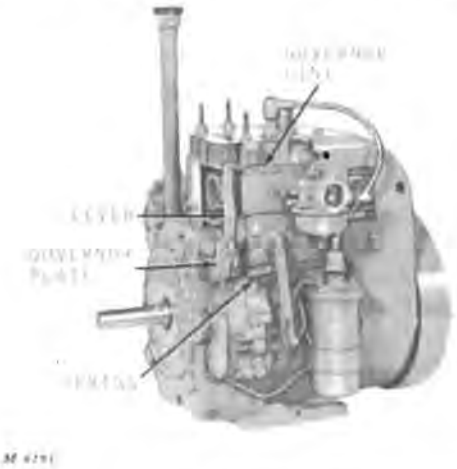

Fig. 17–Connecting Governor Lever

Connect governor spring to bottom hole of governor plate, Figure 17.

Refer to Group 35 and install all external components. Connect governor link and adjust as instructed on the next page.

INSTALLING FLOAT AND FLOAT SHAFT

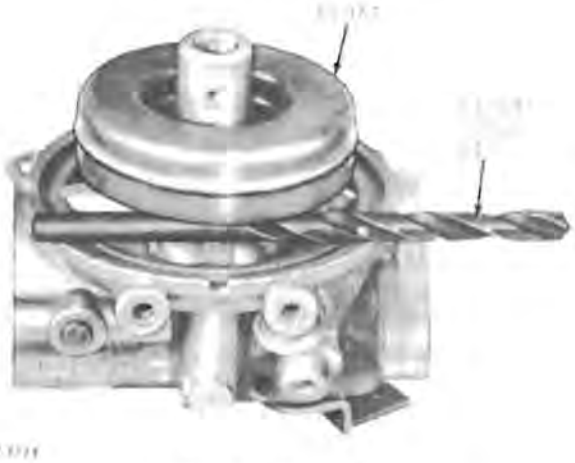

Fig. 6–Adjusting Float

Assemble float (18), Figure 2, to carburetor housing with float pin (19). Invert carburetor, Figure 6. With float resting lightly on float valve, the distance between float and machined surface of carburetor body should be 13/64 inch. To increase or decrease the distance, bend lip on float. Dimension should be made on free end of float (opposite valve seat), Figure 6.

NOTE: Be sure carburetor-to-bowl gasket has a perfect seat and forms an air tight joint.

Position bowl gasket (14), fuel bowl (15), bowl nut gasket (16) and bowl nut (17). Tighten screw firmly.

Install idle mixture needle (9), through spring (10) and high speed mixture needle (1) through spring (2) and into carburetor body.

CAUTION: Do not force needles too firmly against seat as it will groove needle point and cause carburetor malfunction.

INSTALLATION

Fig. 7–Installing Carburetor Assembly to Cylinder Block

Connect governor link in bottom hole of governor arm and in hole closest to throttle shaft in throttle arm, Figure 7.

Place new gasket between carburetor flange and cylinder block and bolt carburetor to cylinder block.

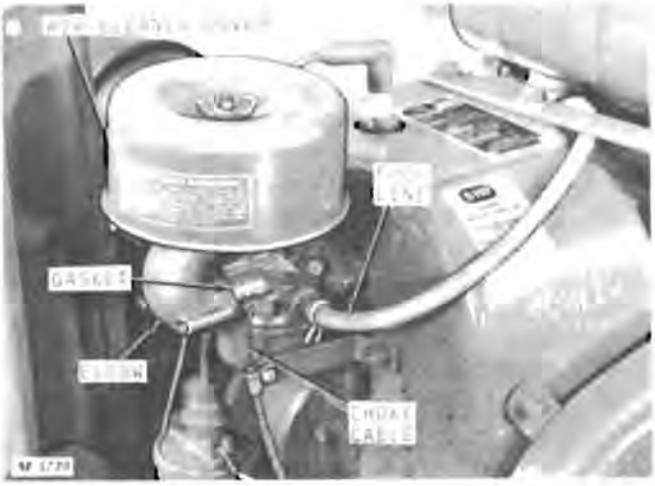

Fig. 8–Installing Carburetor Components

Attach fuel line and control cables to carburetor, Figure 8.

Secure conduit clamps to supporting brackets, Figure 8. Throttle linkage is not illustrated.

Place new gasket on carburetor body and bolt elbow to carburetor, Figure 8.

Place filter element on base making sure it seats tightly around base. Install cover and tighten wing nut finger tight, Figure 8.

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112 TRACTOR

GENERAL INFORMATION

Fig. 3–Air Filter

The air cleaner consists of the base mounted on the carburetor, an air filter element and a cover that fits over the filter element which is held down by a wing nut. The AM31000 Filter Element is made of treated paper with a soft sealing edge, Figure 3.

Care of the air cleaner is important since all the air that enters the engine goes through the air filter element. A clogged air filter element restricts air flow and reduces engine efficiency. A damaged air filter element allows dirt to enter the engine and causes immediate damage to internal working parts.

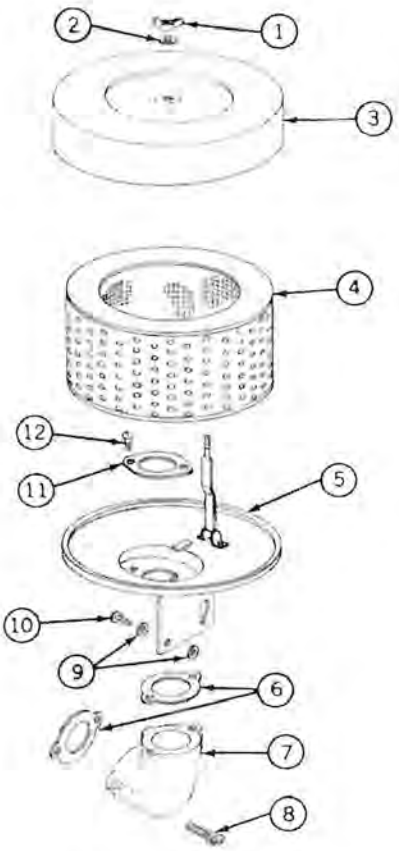
SERVICE

The most damaging engine wear can be traced to entry of dirt or dust through an improperly serviced air filter element.

CLEANING

The air filter element should be cleaned every 5 hours of operation. This is done by tapping the air cleaner lightly against a flat surface.

Do not dip the air filter element into a liquid cleaner of any type. Replace filter if bent, crushed or damaged. Replace element if extremely dirty. When in doubt, replace element. This is inexpensive insurance to protect the engine.



1 – Wing Nut
2 – Fiber Washer
3 – Cover
4 – Air Filter
5 – Bracket
6 – Gasket (2 used)
7 – Elbow
8 – Machine Screw (2 used)
9 – Washer (4 used)
10 – Tapping Screw (2 used)
11 – Spacer
12 – Machine Screw (2 used)

Fig. 4–Exploded View of Air Cleaner Components

IMPORTANT: Never run the engine with air filter element removed.

Wipe air cleaner base and inside of air cleaner cover with a clean cloth dampened with water. Install air filter element making sure it seats around base. Assemble cover and tighten wing nut on cover finger tight.

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SPARK PLUG—Continued

Use a spark plug wrench to remove plug. Always use a new spark plug gasket when replacing plug.

Examine the firing end of the spark plug, noting the type of deposits and the degree of electrode erosion. Refer to pages 10-3 and 10-4 for various types of spark plug fouling and their causes.

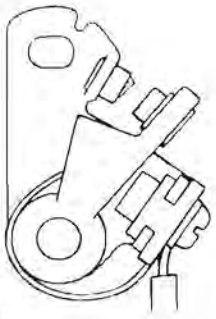
Clean the plug on a sand blast cleaner, following manufacturers instructions. Do not prolong the use of the abrasive blast as it will erode the insulator and electrodes. Clean ALL abrasive from plug before turning into engine.

Brush threads with a wire brush.

Clean the electrode surfaces with a small file, Figure 18. Dress the electrodes to obtain flat parallel surfaces on both the center and side electrode.

After cleaning, examine the plug carefully for cracked or broken insulator, badly pitted electrodes, and other signs of failure. Replace if damaged. Adjust spark plug gap, Figure 30. Torque plug to recommended specifications.

BREAKER POINTS



M 5600

Fig. 19–Burned Breaker Points

Breaker points can be burned from excessively high voltage, oily or dirty points, a faulty condenser or improper point adjustment.

Pitted points and some transfer of material between the points is considered normal. If point transfer is 0.020 inch or more, replace the points.

Rough contacts which are greyish in color often have a greater area of contact than new contacts, and will provide satisfactory service until most of the tungsten is worn off.

Clean the points with a few strokes of a clean oil free fine-cut contact (riffle) file. Do not attempt to remove all roughness nor dress the point surfaces smooth; merely remove the scale or dirt. Never use emery cloth or sand paper to clean the points since abrasive particles will embed in the point surface and cause arcing and rapid burning of the points.

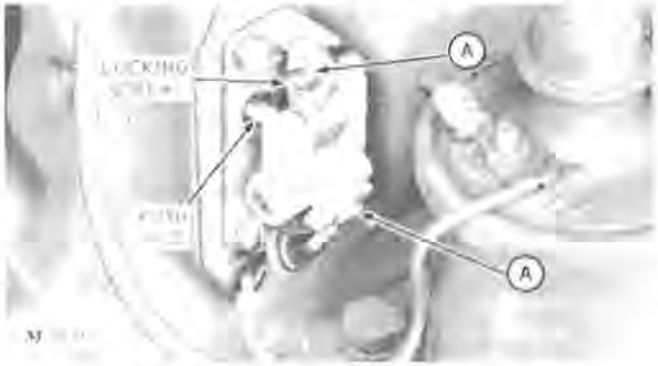


Fig. 20–110 Tractor Point Replacement

When replacing points, remove screws "A". Be sure lock washers are in place on 110 Tractor before reassembly.

Replacement points for 112 Tractor are packaged with a new fiber push rod. Be sure to install new push rod whenever replacing points.

Refer to Figures 28 or 29 and adjust breaker point gap.

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Group 15
CHARGING SYSTEM

GENERAL INFORMATION

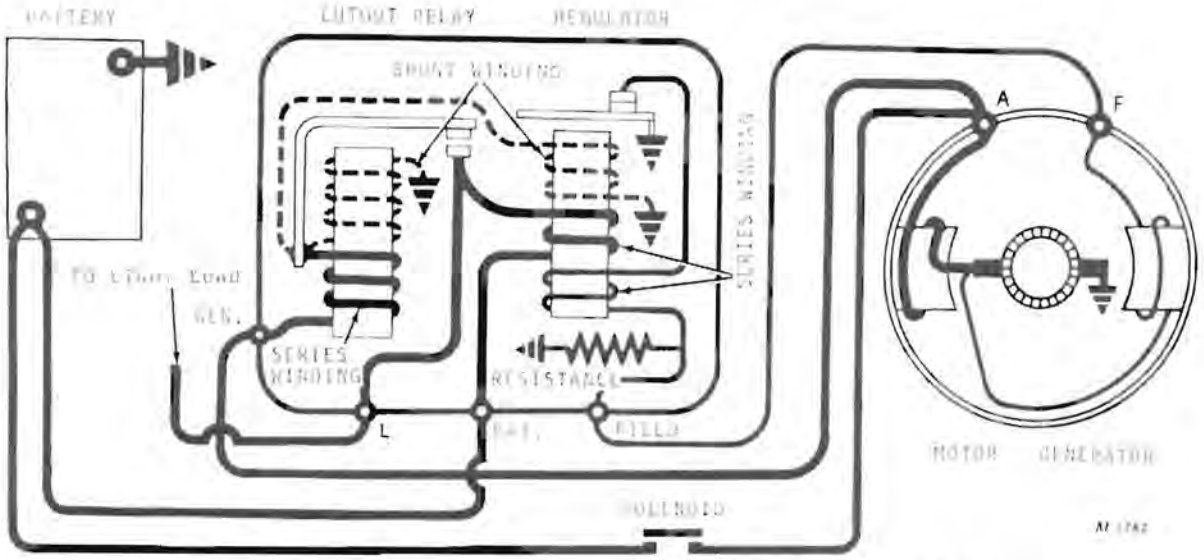

Fig. 1–Wiring Diagram Showing Motor-Generator, Regulator, Battery and Switch

The Delco-Remy Motor-Generator functions as a cranking motor when the solenoid is closed. After the engine is operating and the motor switch opens the circuit, the unit functions as a generator.

The motor-generator contains a series and a shunt field. Both fields are effective for developing torque when the unit performs as a cranking motor. Figure 1 illustrates the circuitry of the two terminal motor-generator with the two unit regulator used on 110 and 112 Tractors. When this unit operates as a generator, the shunt field is the main field and the series field acts as a bucking field, which tends to limit generator output at high speed.

The combination current-voltage regulator is a device which provides control of the generator output and circuit voltage so as to meet various battery and operating requirements.

The cutout relay is a device which closes the circuit between the generator and battery when the generator is operating at sufficient speed to charge the battery and which opens this circuit when the generator slows down or stops to prevent the battery from discharging back through the generator.

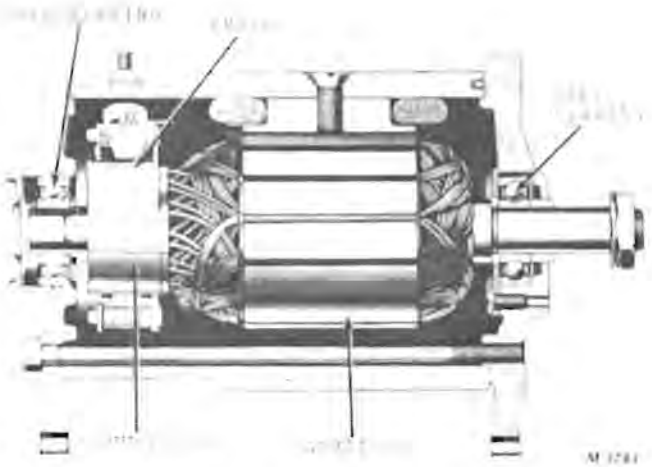

Fig. 2–Cross Sectional View of Motor-Generator

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Correction in tension can be made by bending the brush spring as required. If the brush spring shows evidence of overheating by appearing blued or burned, a new spring should be installed. Overheating will cause a spring to lose its temper. If the brushes are worn down to one-half their original length, when compared with new brushes, they should be replaced.

Brush Holders

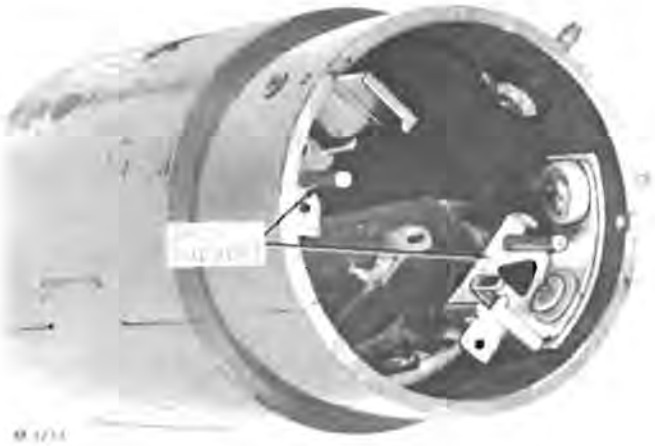


Fig. 16–Installing Brush Holders

The brush holder assemblies are mounted on the inside of the generator frame, Figure 16. Replace damaged brush holders. To remove brush holder(s), drill out rivets holding them to frame. Secure new holders to frame with screws, nuts and washers provided in the replacement package.

Armature

When inspecting the motor-generator, also note the condition of the commutator. If the commutator is glazed or dirty, it can be cleaned by placing the armature in a lathe. While the armature is rotating, hold a strip of number 00 sandpaper lightly against the commutator, moving the sandpaper back and forth, Figure 17.

Blow out all dust after sanding the commutator. If the commutator is rough, out of round, has high mica, or is extremely dirty, it will require "turning down" in a lathe and the mica undercut between the bars.

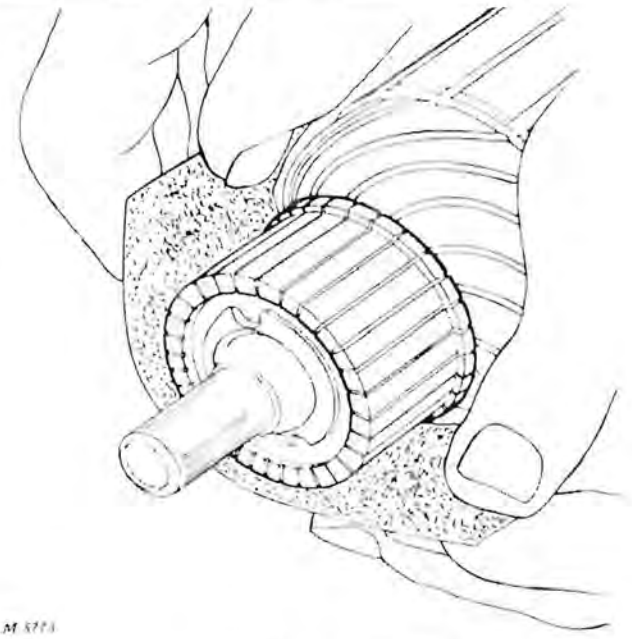
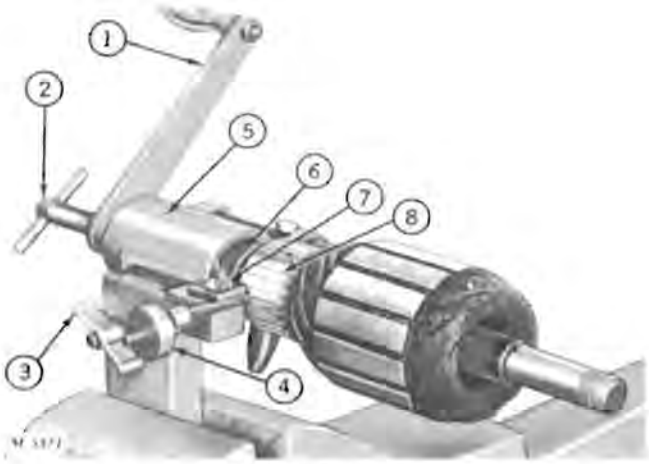


Fig. 17–Cleaning Commutator



1 – Operating Handle
2 – Removal Screw
3 – Clamp Wing Nut
4 – Tool-Adjusting Nut
5 – Frame
6 – Mandrel
7 – Lock Wing Nut
8 – Commutator

Fig. 18–Turning Down Generator Commutator

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Group 20
ELECTRICAL ACCESSORIES

HEADLIGHTS

Fig. 1–Adjusting Headlights

Turn adjusting nut, Figure 1 to regulate direction of light beam. Tighten nuts firmly.

Rewiring Voltage Regulator (-3550)

When headlights are installed on 110 Tractors (Serial No. -3550), or other electrical equipment is connected to the accessory lead, it is very important to rewire the voltage regulator as indicated in Figure 2. The rewiring will allow the regulator to compensate for the increased electrical load.

Rewire the regulator as follows:

1. Remove battery and gas tank.

2. Remove nut and green wire from solenoid.

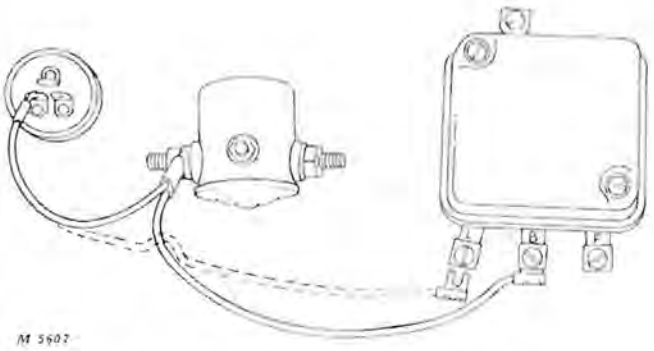

Fig. 2–Rewiring Regulator for Increased Electrical Load - 110 Tractors (-3550)

3. Push back rubber grommet and cut off the one green wire at large connector from ignition switch. Be sure stub end of wire is pushed back under rubber grommet. Reassemble green wire with eyelet to solenoid.

4. Install flag connector on end of green wire which was cut off at (3).

5. Connect green wire with new flag connector (4) to the "L" terminal of the voltage regulator.

Excessive Primary Belt Wear.
Clutch rod not adjusted properly.
Adjust linkage.

Dirty or gummy variator sheave hub.
Clean hub and variator center sheave bearing.

Dirt in variator sheave grooves.
Clean dirt from grooves.

Excessive Secondary Bell Wear.
Weak secondary idler spring.
Increase spring tension.
Install new spring if necessary.

Worn, bent or nicked input sheave.
Replace sheave.

Belt worn or lumpy.
Replace belt, move transaxle to rear position.

Worn or nicked variator sheaves.
Check condition of sheaves.
Replace parts as necessary.

Dirt in sheave grooves.
Clean dirt from grooves.

Secondary belt idler arm pivot binding.
Clean and lubricate pivot.
Replace parts as necessary.

Oil or grease on belt.
Clean belt.
Replace belt if necessary.

VARIATOR

Noisy Variator.
Worn center variator sheave bearing.
Replace center sheave assembly.

Worn variator bearing.
Replace bearing.

Variator Squeals - 110 Tractors (-9082).
Variator brake.
Remove variator brake assembly.
Install new input sheave.

CLUTCH

Clutch Hard to Operate.
Engine not running.
Run engine when operating clutch.

Brake rod not properly adjusted.
Adjust brake rod.

Clutch rod not properly adjusted.
Adjust clutch rod.

Variator arm binding in pivot (in pedestal).
Lubricate pivot.
Replace parts if necessary.

Secondary belt idler arm pivot binding.
Clean and lubricate pivot.
Replace parts as necessary.

Dirty or gummy variator hub.
Clean hub and variator center sheave bearing.

Clutch Pedal Goes Down Beyond Top of Footrest.
Brake rod not properly adjusted.
Adjust brake rod.

Clutch Pedal Creeps Down Under Load.
Load and torque sensitive feature operating.
This is a characteristic of drive when encountering loads with variable speed control lever fully forward.

Weak variator spring.
Replace spring.

Variator linkage not properly adjusted.
Adjust variator.

Clutch-Brake Pedal Strikes Bottom of Footrest.
Clutch rod not properly adjusted.
Adjust linkage.

Primary belt too long.
Replace belt.

Variator linkage not properly adjusted.
Adjust linkage.

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The brake shoe is not required on 110 Tractors having the lighter sheet metal input sheave. The shoe may be removed on these tractors.

If the brake shoe causes undesirable squealing on tractors having the brake shoe and cast iron sheave, remove the brake shoe and replace the cast iron input sheave with the lighter sheet metal sheave. Remove the variator brake assembly only on tractors equipped with sheet metal sheave.

REPLACING BRAKE BANDS

110 and 112 Tractors (15001-100,000)

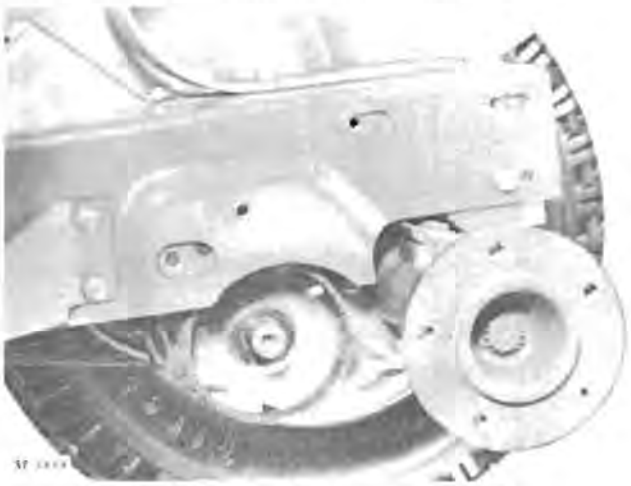

Fig. 29–Brake Band Replacement on 110 Tractors (15001-100,000) and 112 Tractors (-100,000)

Remove left-hand fender by removing three cap screws. Refer to brake band replacement for 110 Tractors (-3550) to remove brake band having brake bracket with one hole as shown in Figure 29.

To remove brake band on 110 Tractors with two holes in brake bracket, Figure 30, and all 112 Tractors, remove left-hand fender by removing three cap screws. Loosen brake pulley set screw and pull brake pulley from shaft with a puller.

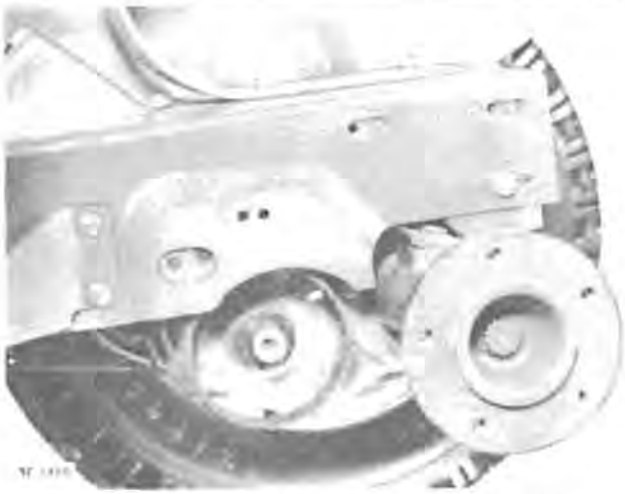

Fig. 30–Brake Bracket Used on Later 110 and All 112 Tractors

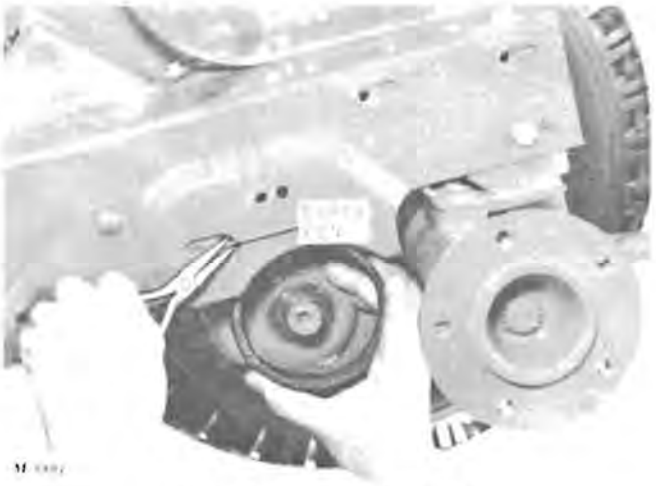

Fig. 31–Removing Brake Pin

Remove brake band pivot bolt through slotted hole in tractor frame.

Then lift brake band until brake pin is aligned with hole in brake bracket. Using a needle nose pliers, pull brake pin through hole as shown in Figure 31.

Lubricate lever pivot before reassembly.

Apply Loctite to threads before tightening set screw in brake pulley.

After assembling brake, refer to "Adjustment," page 10-16 and adjust linkage accordingly.

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REMOVING TRANSAXLE

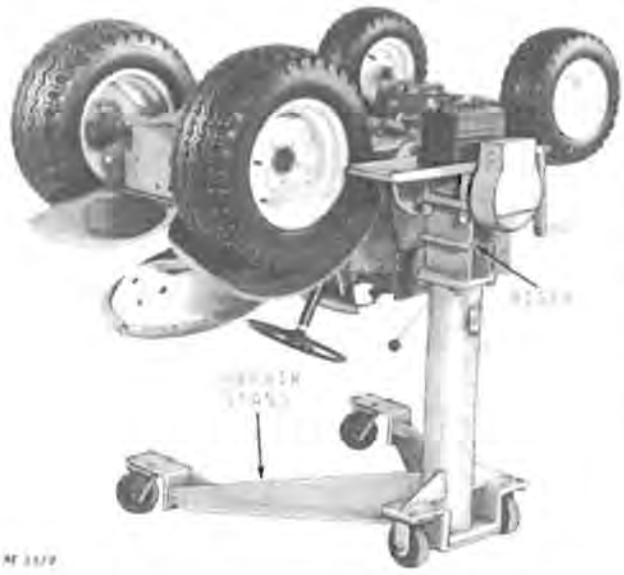

Fig. 9–Tractor Inverted on Repair Stand for Easy Transaxle Removal

For ease of transaxle removal, mount tractor on repair stand as shown in Figure 9. See "Special Tools," pages 20-21 and 20-22 in this section for repair stand information and how to make the adapters for 110 and 112 Tractors.

Run engine and move variable speed control lever forward (fast speed position) before placing tractor on repair stand. This will aid in secondary belt removal.

The following procedure must be taken before mounting tractor on repair stand.

1. Shut off fuel at sediment bowl.
2. Remove gas tank.
3. Remove battery.
4. Drain engine crankcase.
5. Replace vented filler cap on hydraulic reservoir with pipe plug to prevent leakage.

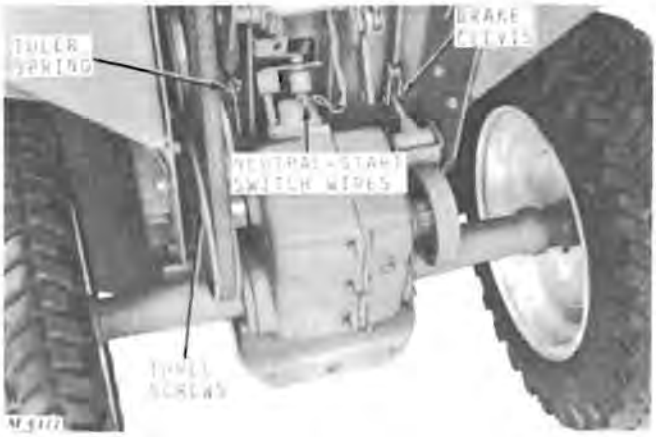

Fig. 10–3-Speed Transaxle Removal

With tractor inverted, disconnect brake clevis pin, idler spring and neutral-start wires from switch.

Remove three cap screws from driven pulley on input shaft, Figure 10.

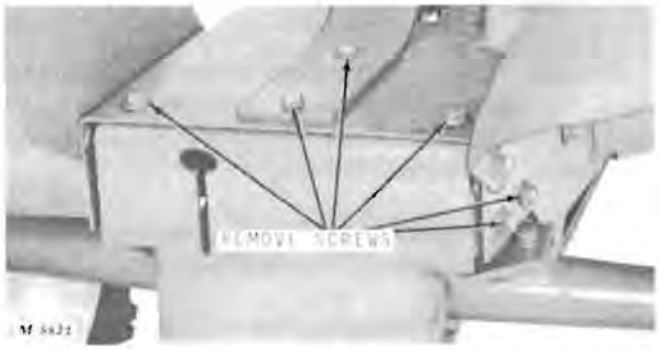

Fig. 11–Removing 3-Speed Transaxle from Tractor Base

Remove wheels, then remove the remaining screws that hold the transaxle support and hitch plate to tractor base. Lift transaxle away from tractor.

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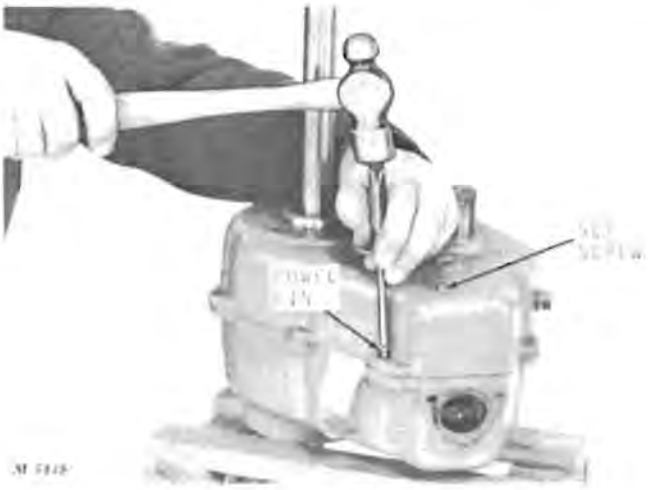

Fig. 43–Inserting Dowel Pins

Align and insert dowel pins, Figure 43. Start socket head cap screws from bottom.

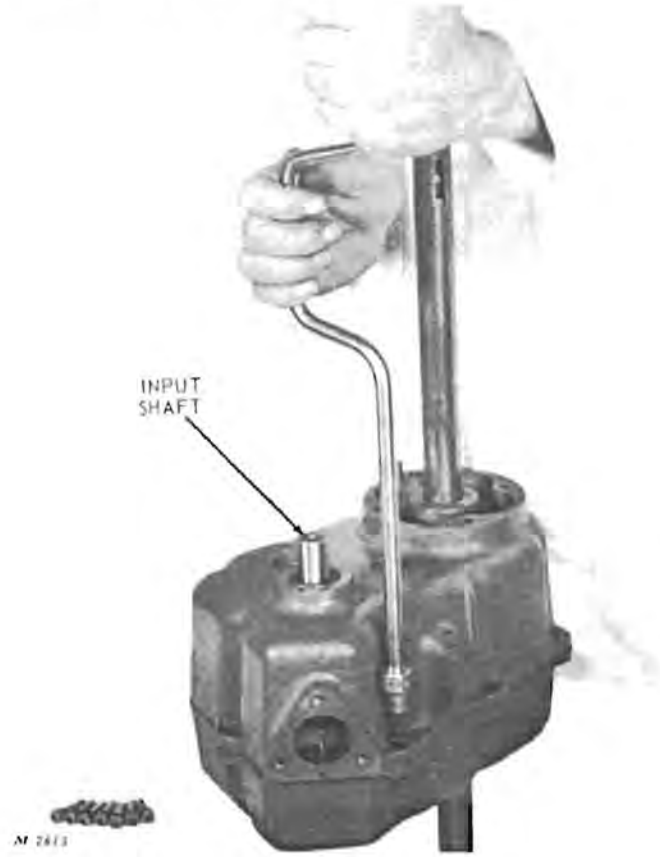

Fig. 44–Transaxle Inverted

Invert transaxle and tighten case screws securely to 120 in-lbs. Put Loctite on threads, then tighten set screw against the shifter shaft, Figure 43, on transaxles so equipped.

INSTALLING SEALS

Fig. 45–Installing Seals

Use seal driver to install seals or seal with retainer. Refer to "Special Tools," page 20-21, for proper seal driver. Install seal after shaft has been installed.

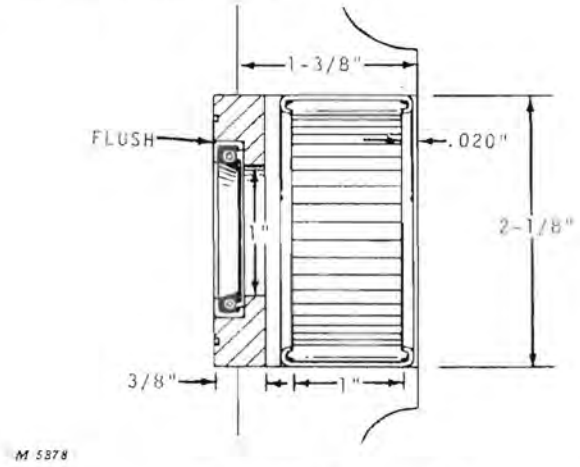

Fig. 46–Seal Retainer and Bearing Installation

Be sure seal is installed with lip inward, Figure 46.

Fig. 47–Axle Support Installation

Install axle supports, Figure 47. Refer to "Bolt Torque Chart," page 10-4 of Section 10 and torque axle bolts accordingly.

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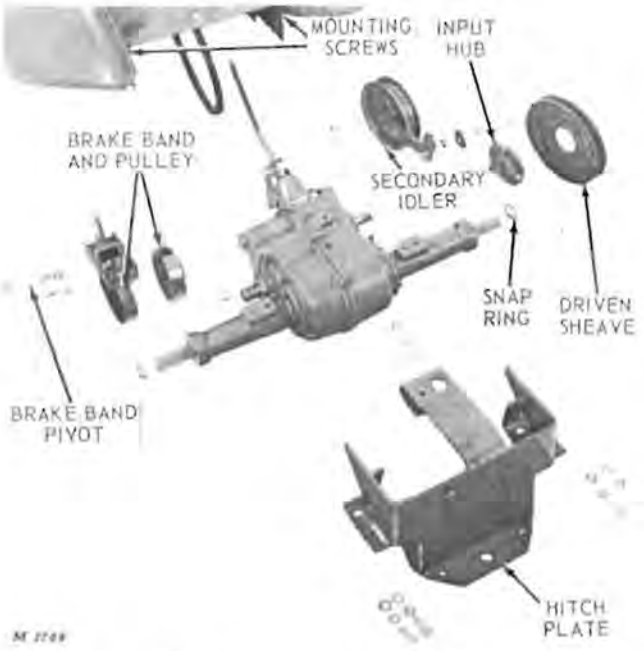

Fig. 12–Removing External Parts

Remove brake, idler arm, hitch plate, input hub and wheel hub assemblies from transaxle, Figure 12. Use a puller to prevent hub breakage or internal differential damage.

CAUTION: Never use hammer on end of axles. Never drive shafts toward transmission.

Position shift lever in neutral. Remove neutral start bracket with switch, shifter assembly, axle housings, O-rings and retainers with seal, Figure 13. Use extreme care when removing axle supports since they are machined to a light press fit.

Clean and polish axles as necessary to permit easy removal of axle housing.

Fig. 13–Removing External Parts

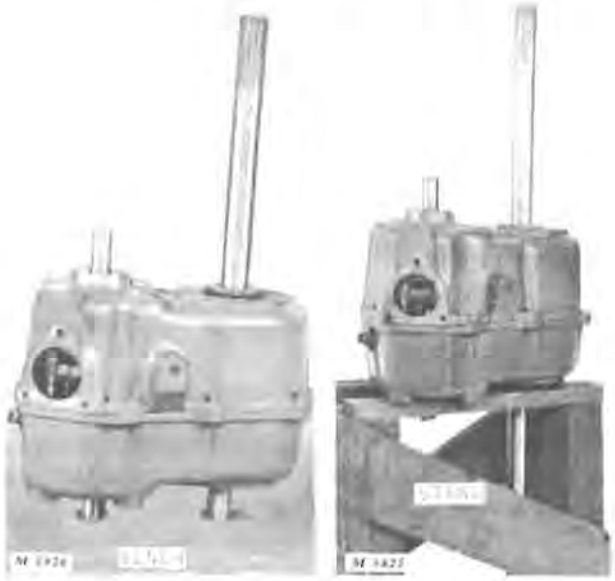

Fig. 14–Transaxle Repair Stands

Drill two holes in a sturdy work bench about 8 inches from the front of the bench. A wooden stand may be used instead.

INSTALLING CLUSTER GEAR AND THRUST WASHER

Fig. 41–Transmission Assembled

Install gear cluster and thrust washer on pinion shaft as shown in Figure 41.

All parts assembled thus far should appear as shown in Figure 41.

INSTALLING DIFFERENTIAL

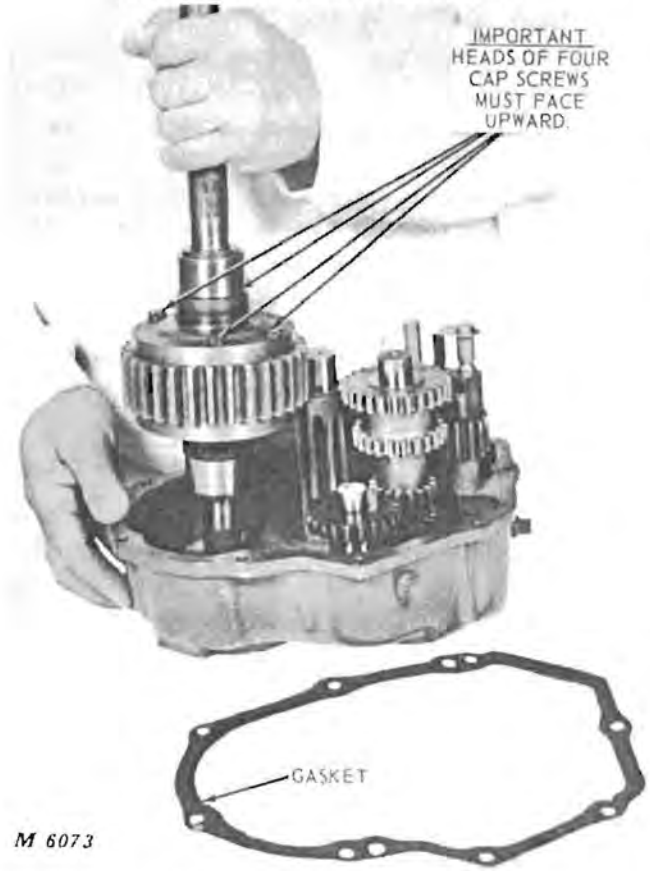

Fig. 42–Installing Differential

Install differential assembly into left-hand case with bolt heads facing upward as shown in Figure 42.

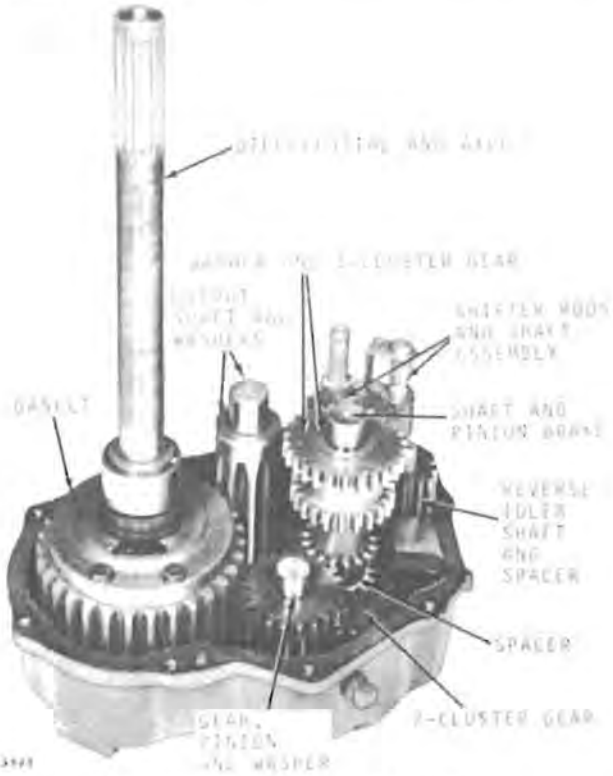

Fig. 43–Completed Internal Assembly

The internal components should now appear as shown in Figure 43.

Position the gasket on the lower (left-hand) case at this time. Use new gasket.

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TESTING

A pressure gauge or a hydraulic test unit incorporating a pressure gauge and flow meter can be used to test hydraulic pressure.

Before making tests, check the reservoir for proper oil level. Inspect hoses and connections for leaks or damage.

NOTE: Run the tractor for about five minutes at 1/2 throttle to bring the hydraulic oil to operating temperature. Operate hydraulic control lever several times during the warm-up period.

Before stopping engine, lower hydraulic lift lever until cylinder is fully retracted.

Wipe dirt and dust from unit and hoses with a clean cloth.

The following illustrations are reference guides for connecting a pressure gauge or hydraulic tester to check system pressure. The Owatonna Tool Co. Model No. Y-90 Hydraulic Tester, Figure 9, can also be used to measure flow. Refer to instructions supplied by test equipment manufacturer.

After gauge or hydraulic tester is connected, start engine and raise throttle lever until engine is running at 3600 rpm. Raise hydraulic lift lever and observe reading. Refer to "Specifications," page 15-10, for system pressure. Refer to "Diagnosing Malfunctions," page 5-6, to correct low system pressure.

PRESSURE GAUGE

Fig. 7–Pressure Gauge Installed on Valve

HYDRAULIC TEST UNIT

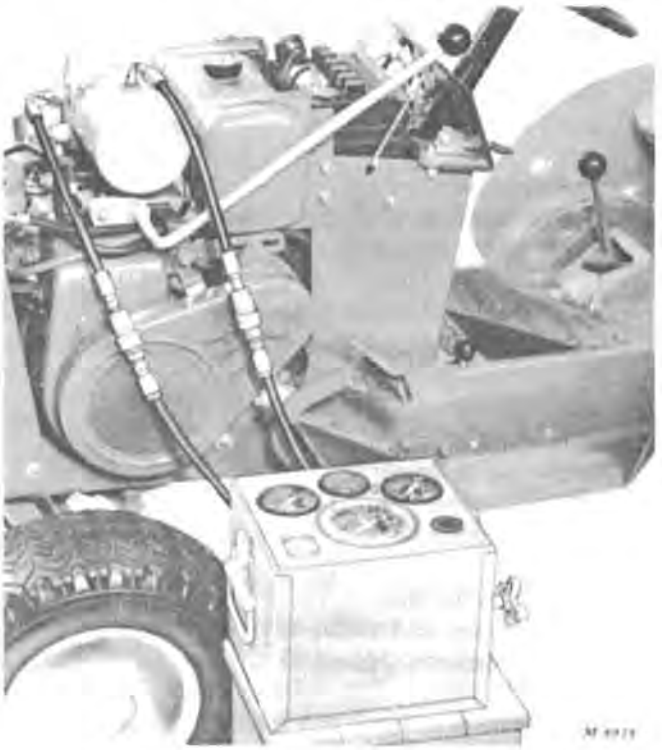

Fig. 8–OTC Model No. Y-81-2-1 Hydraulic Tester Installed for Pressure Test

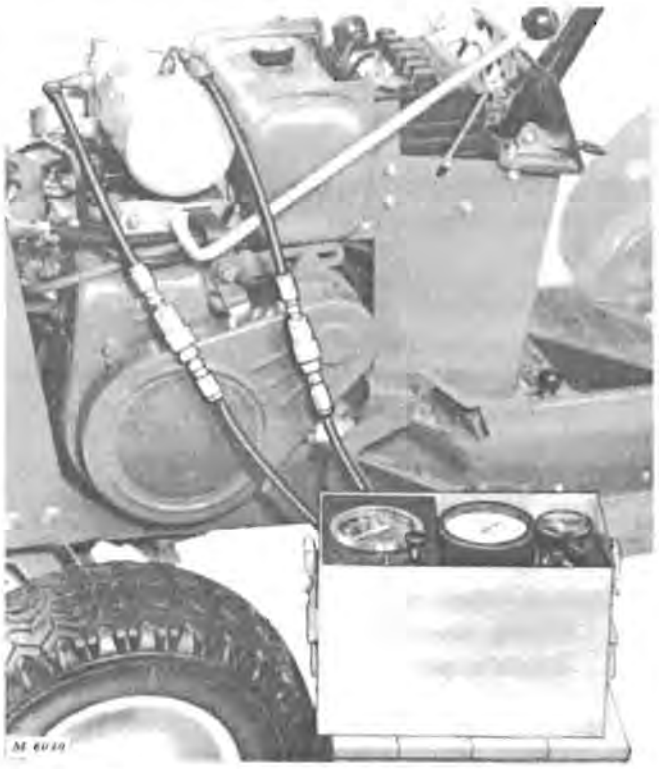

Fig. 9–OTC Model No. Y-90 Hydraulic Tester Installed for Flow and Pressure Test

Install key in shaft, install sheave on shaft and secure with elastic stop nut. Install drive belt.

Adjust drive belt tension, page 15-8.

Refer to Figure 2 and connect hoses to valve assembly. Fill reservoir with fluid, page 5-3. Refer to Section 10 for Hydraulic System capacity.

Fig. 22–Installing Drive Components

TORQUE FOR HARDWARE

Location	*Torque*
Spool shoulder bolt	60-65 in. lbs.
Valve body cap screws	7-10 ft. lbs.

SPECIAL TOOLS

Name	*No.*	*Use*
Retaining Ring Pliers	OTC 1120	Removing snap ring from valve body.

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LIFT LEVER STOP

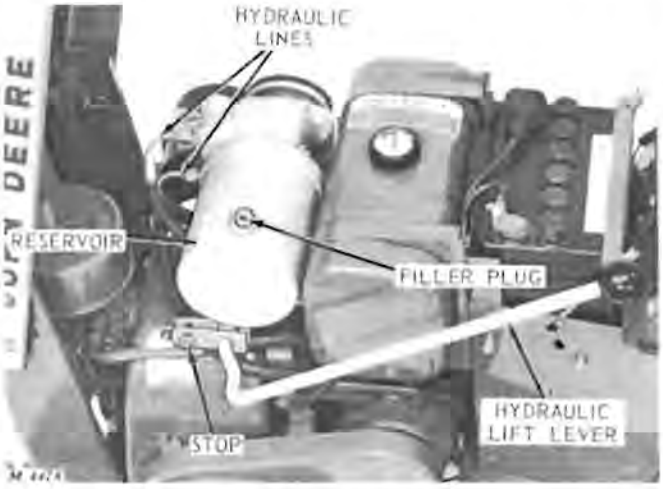

Fig. 23–Adjusting Lever Stop

Loosen jam nuts on outer stop and move lift lever to full raised position.

Position head end of bolt in bottom of slot in inner stop. *NOTE: Be sure to keep 1/32 to 1/16-inch clearance between the bolt head and inner stop.*

Tighten nuts. Allow lift lever to return to neutral position. Check for equal travel of lift lever in both raised and lowered position.

DIRECTION OF LIFT

Hydraulic lines are connected at the factory to permit the equipment to raise when the lift lever is raised and lower when the lift lever is lowered. If, for any reason, you wish to reverse the lifting direction, disconnect hydraulic lines at the pump, Figure 23, and reverse the lines.

DISASSEMBLING STEERING GEAR

Loosen jam nut on tapered stud (22, Figure 8) in lever arm. Turn stud counterclockwise until resistance is felt. Remove nuts from lever arm cross bolt (21, Figure 8) and remove from housing. Remove plug in steering gear housing and slide shaft with cam and bearings from column.

INSPECTING STEERING GEAR PARTS

Wash parts in a clean, safe solvent and dry with compressed air and clean cloth.

Refer to Section 20, Group 15, to check bearing condition. Inspect cam, housing and plug for cracks, scoring and other damage especially in the bearing area. Replace parts showing excessive wear or damage.

Fig. 11–Steering Gear Disassembled

ASSEMBLY

ASSEMBLING STEERING GEAR

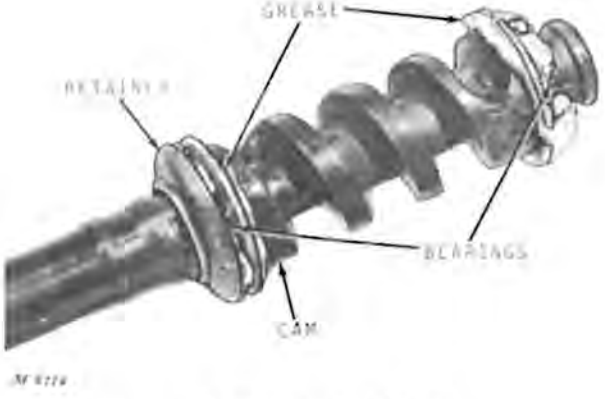

Fig. 10–Installing Bearing

Apply grease and place bearing balls, ball cups and retaining rings on both ends of cam, Figure 10.

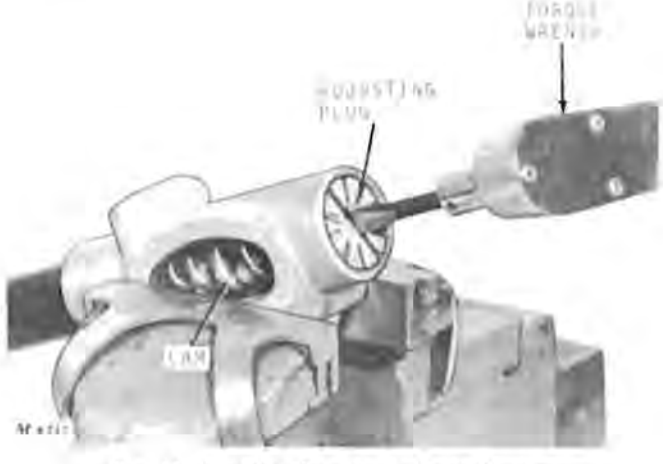

Fig. 12–Installing Cam Assembly in Housing

Grease cam lightly with multi-purpose type grease.

Slide cam and tube assembly into housing and jacket tube. Install plug and torque according to "Specifications," page 5-11.

ADJUSTMENT

FRONT WHEEL BEARING

Fig. 13–Adjusting Wheel Bearing

Adjust the front wheel bearings if the wheel is loose on the spindle or if the wheel does not rotate freely.

1. Raise the tractor until the front tires clear the floor.
2. Remove the grease cap from wheel.
3. Wipe the excess grease from the end of the spindle and remove cotter pin and slotted nut.
4. While rotating the wheel and tire, torque the slotted nut to within 60 to 120 in-lbs to seat the bearings, Figure 13. Back off slotted nut until wheel turns freely.
5. Using a 15/16-inch open end wrench, back off the nut until the slot in nut aligns with cotter pin hole in spindle.
6. Install a new cotter pin and bend the long end of the cotter pin around the end of the axle.
7. Install cap.

SPECIFICATIONS

Item	New Part	Wear Tolerance
Front Axle Spindle Bushings	0.751-0.755 in.	0.770 in.

TORQUE FOR HARDWARE

Item	Torque
Spindle Slotted Nut	60-120 in-lbs. Back off nut. See adjustments.

SPECIAL TOOLS

Name	Part No.	Use
Retaining Ring Pliers	OTC No. 1340	To remove retaining ring from spindle.
Retaining Ring Pliers	OTC No. 614	To remove retaining ring from spindle.
Grease Cap Tool	SNAP-ON GCP-10	To remove grease cap from wheel.

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