400 HYDROSTATIC TRACTOR

JOHN DEERE

SERVICE MANUAL

400 HYDROSTATIC TRACTOR

SM2103 (01MAR82) English

John Deere Lawn & Grounds Care Division
SM2103 (01MAR82)

LITHO IN U.S.A.
ENGLISH

CHANGING ENGINE OIL FILTER

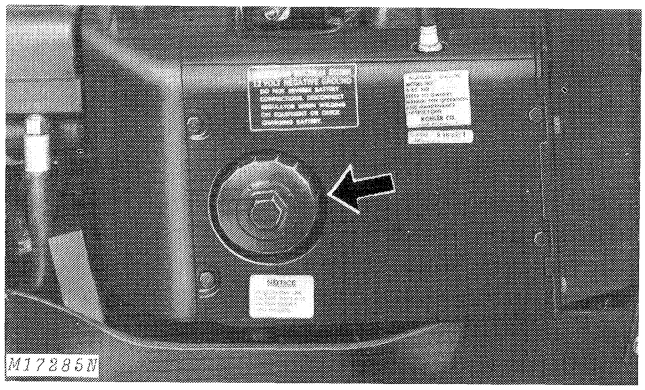


Fig. 3-Changing Engine Oil Filter

Drain engine crankcase oil, see Fig. 2.

Remove tractor right-hand side panel.

Turn filter, Fig. 3, counterclockwise to remove it. Discard old filter.

Clean the filter adaptor. Apply a thin film of clean oil on the sealing ring of the new filter. Turn new filter clockwise to install it.

IMPORTANT: The oil filter has a by-pass valve which allows the oil to circulate should the filter become plugged. Use only the correct John Deere filter for replacement.

Use a box end wrench and exert light pressure to seal filter. Do not over-tighten. Over-tightening filter may damage filter sealing ring.

Replace drain cap or tighten drain valve and fill crankcase with oil of the proper viscosity, Fig. 2.

CHECKING TRANSMISSION FLUID LEVEL

400 Tractors (Serial No. 30,001-70,000)

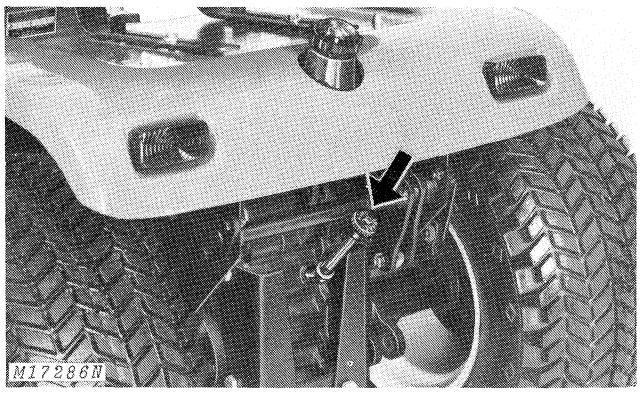
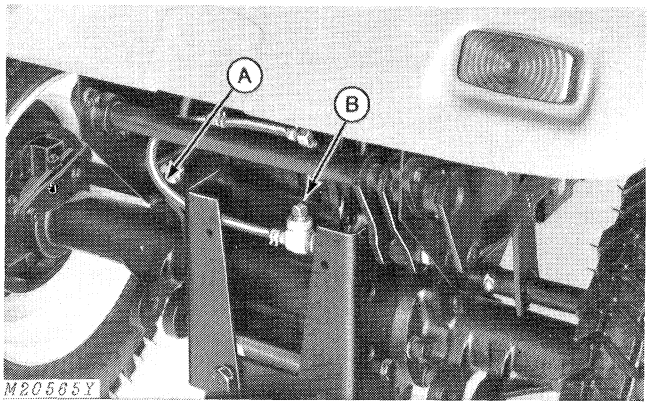


Fig. 4-Checking Transmission Fluid Level (Serial No. 30,001-70,000)

NOTE: To check transmission fluid level, park tractor on a level surface, leave engine running at idle, place hydrostatic control lever in "neutral" position and set parking brake.

Remove dipstick, Fig. 4. Check that transmission fluid level is at midpoint of "SAFE" range on dipstick.

400 Tractors (Serial No. 70,001-)



A—Fluid Level **B—Fill Plug**

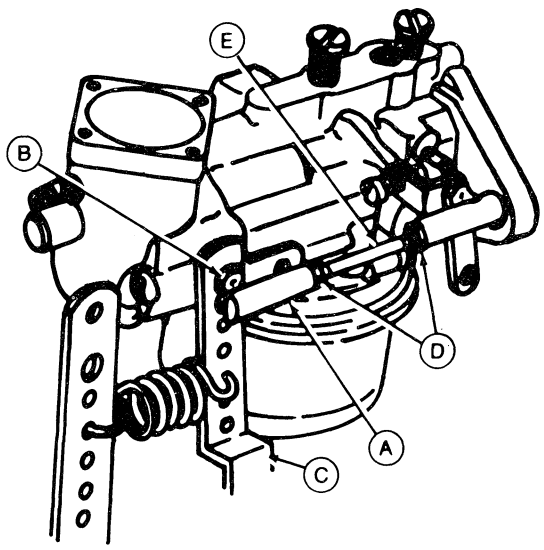
Fig. 5-Checking Transmission Fluid (Serial No. 70,001-)

Park tractor on a level surface. Place hydrostatic control lever in "neutral" position and set parking brake. Leave tractor engine running at idle speed.

When required, remove fill plug (B) Fig. 5, and add John Deere All-Weather Hydrostatic Fluid or an equivalent Type "F" Automotive Automatic Transmission Fluid. Add only enough to bring fluid up to level (A) on sight tube.

IMPORTANT: Do not overfill.

8. Adjust Carburetor to Governor Rod



A—Ball Joint Link
B—Connector Stud
C—Governor Speed Control Bracket
D—Lock Nuts
E—Control Rod

Fig. 17-Adjusting Carburetor to Governor Rod

Set throttle lever on dash board at "FAST" (wide-open) position.

Snap ball joint link (A), Fig. 17, off connector stud (B).

Pull governor speed control bracket (C) toward rear of tractor (counterclockwise direction) as far as possible. Hold bracket in this position.

Pull ball joint link (A) toward rear of tractor as far as possible.

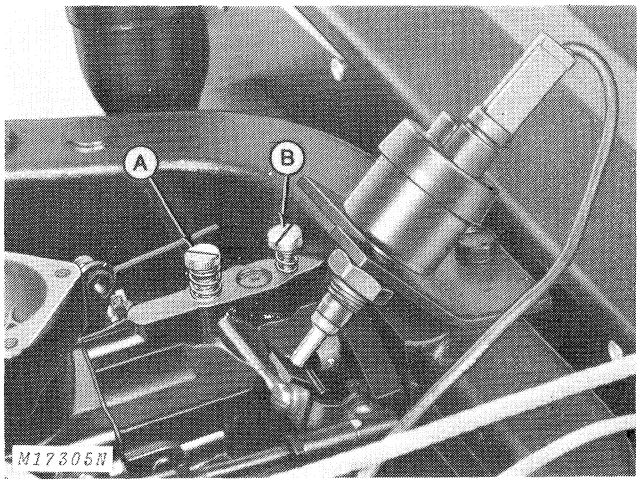
Check position of opening in ball joint link (A) in relation to connector stud (B). Opening in link (A) should be centered over stud (B). If not, loosen lock nuts (D) and thread control rod (E) into or out of links until opening in ball joint link (A) is centered over stud (B).

Connect link (A) to stud (B).

Tighten lock nuts (D).

9. Adjust Carburetor

Initial Adjustment



A—High-Speed Mixture Needle **B—Idle Mixture Needle**

Fig. 18-Initial Adjustment

Close high-speed mixture needle (A), Fig. 18, finger-tight; then, open 2 full turns. Close idle mixture needle (B) finger-tight; then, open 1¼ turns. This initial adjustment will permit the engine to be started and warmed-up before making final adjustment.

Final Adjustment

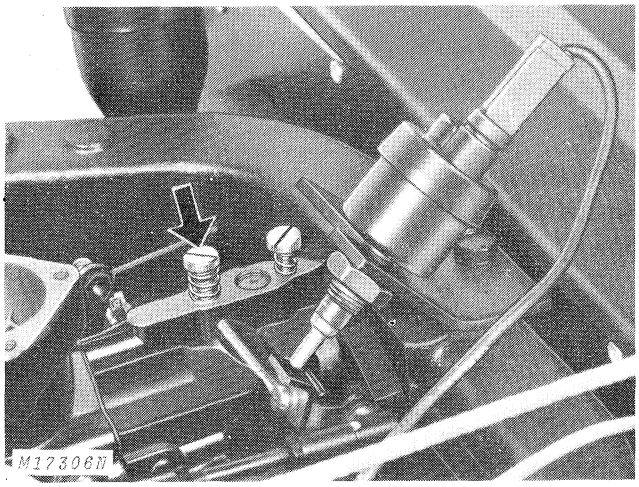


Fig. 19-Adjusting High Speed

Run engine with throttle lever in "FAST" position (3400 to 3500 rpm). Allow engine to warm up.

Turn high-speed mixture needle, Fig. 19, closed until engine starts to lose speed (lean mixture). Note position of the mixture needle.

6. Test Hydraulic System

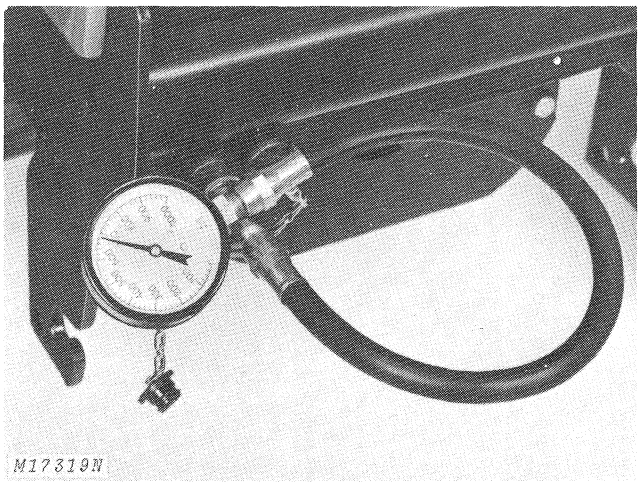


Fig. 47-Checking Hydraulic System Charge Pressure

Install pressure gauge in any front outlet, Fig. 47.

Start engine and run it at full throttle.

Operate correct hydraulic control lever.

Pressure gauge should read 650 to 750 psi.

Low pressure indicates low oil level, improperly functioning by-pass valve, worn charge pump or worn pistons and slippers in transmission.

Remove gauge.

Check all lines for leaks.

7. Check Wiring

Check all wiring for frays or loose connections.

8. Check Belts and Extra Equipment

Check all belts for wear. Check the condition of all extra equipment.

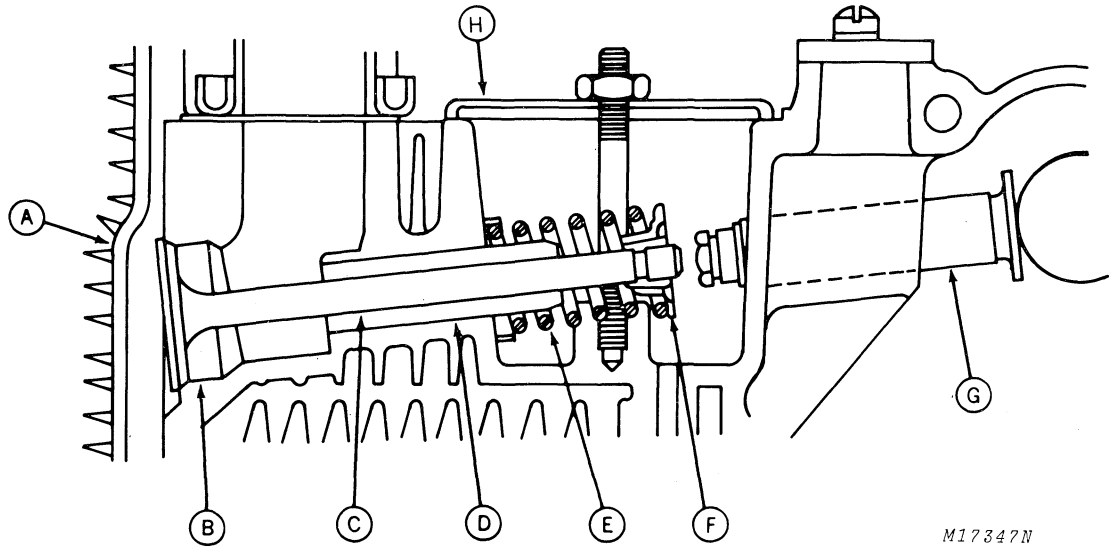
9. Check Tire Pressure

TIRE INFLATION PRESSURES*	
Tire Size	**Inflation Pressure**
18 x 8.50-8 (2-ply front)	**6 to 16 psi (41 to 110 kPa)**
26 x 12.00-12 (2-ply rear)	**5 to 10 psi (34 to 60 kPa)**

**Inflation will vary with attachment used. Inflation is shown in pounds per square inch (psi) and kilopascals (kPa).*

Group 10
CYLINDER HEADS, VALVES AND BREATHER

GENERAL INFORMATION



A—Cylinder Head B—Valve Seat C—Valve D—Valve Guide E—Valve Spring F—Retainer G—Tappet H—Valve Cover

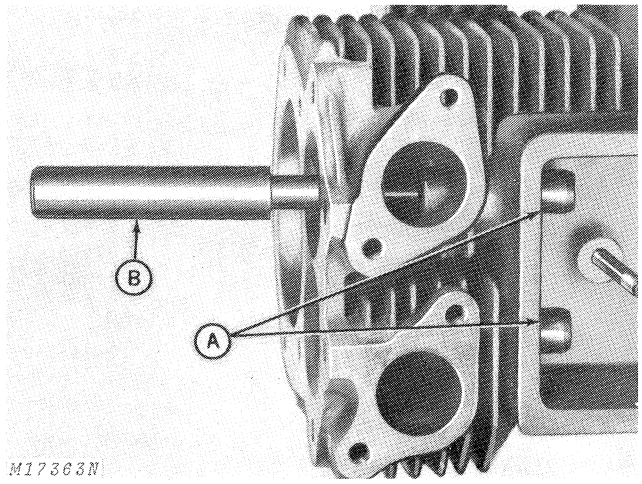
Fig. 1-Exploded View of Cylinder Head and Valves

A stellite exhaust valve (C) is used on the Kohler K532QS engine, Fig. 1.

Valve seats (B) and valve guides (D) are replaceable when wear tolerances are exceeded.

The breather assembly is mounted on the governor. The function of the breather is to maintain a slight vacuum in the crankcase which prevents oil from being forced out of engine through piston rings, oil seals or gaskets.

Replacing Valve Guides



A—Valve Guide

B—JDM-69 Valve Guide Driver

Fig. 24-Replacing Valve Guide

Drive valve guide (A) partially into valve chamber with JDM-60 valve guide driver (B) , Fig. 24.

Break off portion of valve guide in valve chamber.

IMPORTANT: Be careful not to damage tappets or cylinder block.

Drive remaining portion of valve guide into valve chamber.

Drive new valve guide (A) into cylinder block with JDM-69 valve guide driver (B) to the depth shown, page 20-10-10, Fig. 23.

Finish-ream valve guide with JDM-51-3 valve guide reamer.

Replacing Valve Seats

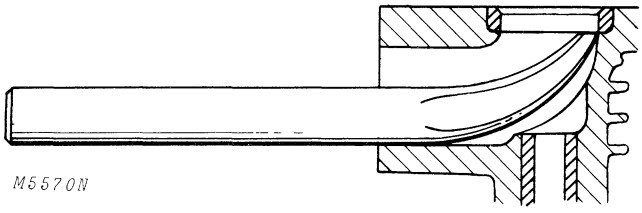


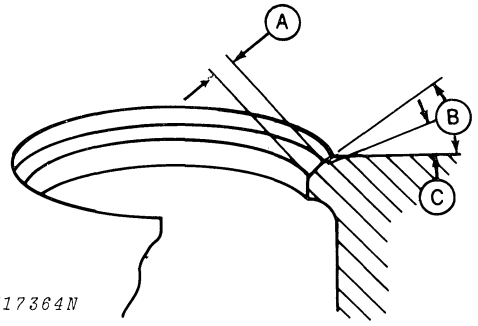
Fig. 25-Replacing Valve Seat

Remove valve seats with an extractor, Fig. 25. If extractor is not available, break the seat and remove pieces. Clean seat area thoroughly.

Chill driving tool and new seat in dry ice. Press seat into cylinder block.

Notice that seats are at an angle to the cylinder block, see page 20-10-10, Fig. 23.

Reconditioning Valves and Seats



A—Valve Seat Width
B—Valve Seat Angle

C—Valve Seat Narrowing Angle

Fig. 26-Cutting Valve Seats

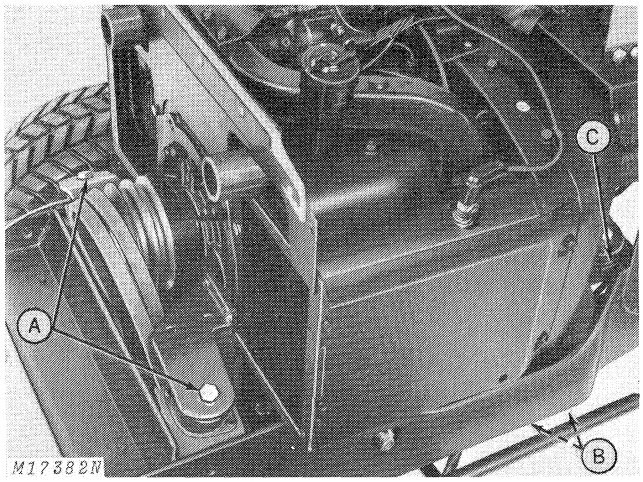
Use the 45° side of JDM-52 valve seat cutter to reface valve seats that are worn or pitted.

To correct valve seat width (A), Fig. 26, cut the valve seat angle (B) as necessary with the 30° side of JDM-52 valve seat cutter.

This results in the valve seat narrowing angle (C).

See page 20-10-10, Fig. 23, for correct valve seat width.

Removing Engine Mounting Bolts



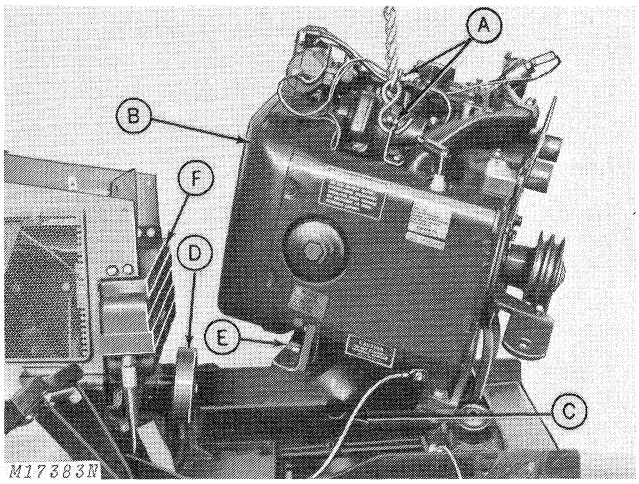
A—Front Mounting Bolts, Large Flat Washers and Nuts
B—Rear Mounting Bolt Nuts
C—Rear Cradle

Fig. 14-Removing Engine Mounting Bolts

Remove two front mounting bolts, large flat washers and nuts (A), Fig. 14.

Remove two rear mounting bolt nuts (B) that attach engine to rear cradle (C). Rear mounting bolts can be left in engine (E, Fig. 15) until engine has been removed.

Removing Engine



A—Lift Straps
B—Engine
C—Starter Cable
D—Drive Shaft Hub
E—Rear Mounting Bolt
F—Oil Cooler

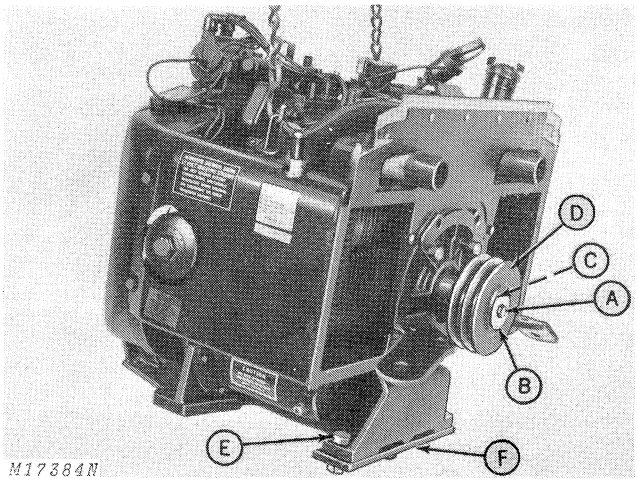
Fig. 15-Removing Engine

IMPORTANT: Starter cable (C) must be removed after engine is partially raised. Make sure drive shaft hub (D) or engine (B) do not damage oil cooler (F) or oil drain pipe during removal.

Use lift straps (A) to lift engine (B) out of tractor with a hoist, Fig. 15.

Remove two rear mounting bolts (E).

Removing PTO Pulley



A—Cap Screw
B—Large Washer
C—Square Key
D—PTO Pulley
E—Cap Screw and Nut
F—Front Spacer

Fig. 16-Removing PTO Pulley

Remove cap screw (A) and large washer (B), Fig. 16.

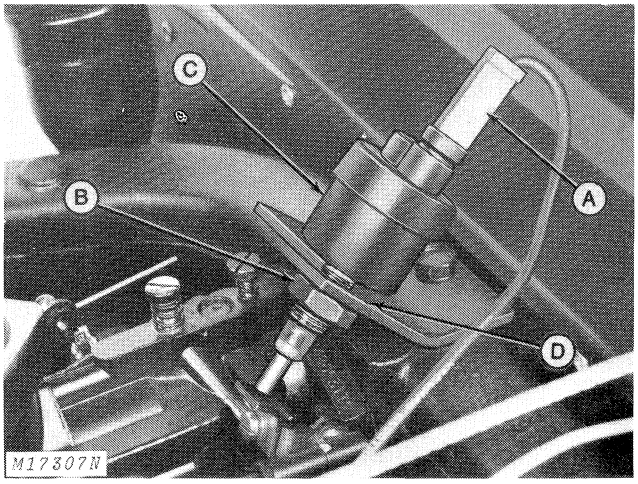
Remove PTO pulley (D) and square key (C) from engine.

Remove two cap screws and nuts (E).

Remove front spacer (F).

Slowly turn mixture needle open past the point of smoothest operation until the engine just begins to run rough (over-rich mixture). Turn the mixture needle closed until it is halfway between lean mixture and over-rich mixture. This mixture should be rich enough for best performance under load.

Adjusting Anti-Dieseling Solenoid



A—Solenoid Lead
B—Jam Nut
C—Anti-Dieseling Solenoid
D—Bracket

Fig. 45-Adjusting Anti-Dieseling Solenoid

Check engine idle speed with a tachometer. It should be 1700-1900 rpm.

If engine idle speed is incorrect, shut off tractor.

Disconnect solenoid lead (A), Fig. 45.

Loosen jam nut (B).

Turn anti-dieseling solenoid (C) into bracket to increase idle speed or away from bracket to decrease idle speed.

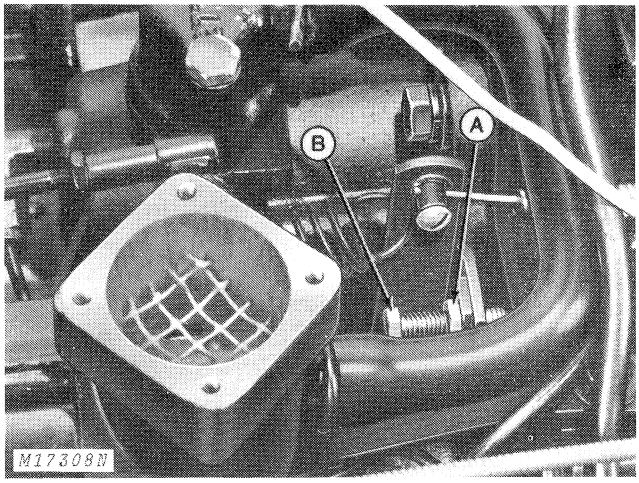
Install solenoid lead (A).

Start tractor and run engine at idle speed. Check engine speed (1700-1900 rpm).

Repeat procedure if necessary until idle speed is correct.

Tighten jam nut (B).

Adjusting Governor



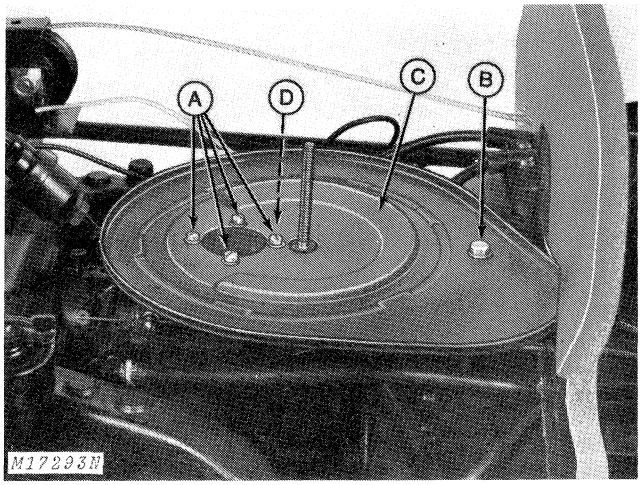
A—Lock Nut
B—Speed Stop Screw

Fig. 46-Governor Speed Adjustment

Check engine high-speed (3400-3500 rpm) with a tachometer.

Loosen lock nut (A), Fig. 46. Turn speed stop screw (B) clockwise to decrease or counterclockwise to increase engine high-speed.

Installing Air Cleaner Base



A—Slotted Screws and Washers
B—Cap Screw and Washer
C—Base
D—Gasket

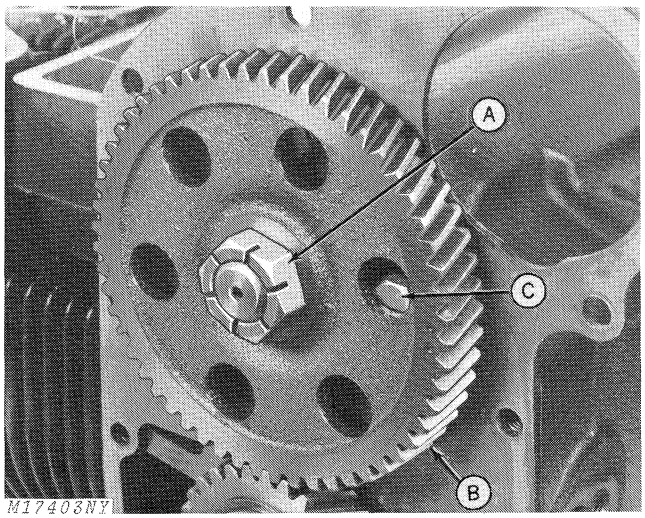
Fig. 47-Installing Air Cleaner Base on 400 Tractor (Serial No. 30,001-80,000)

Install gasket (D) and base (C) on carburetor, Fig. 47.

Install cap screw and washer (B).

Install four slotted screws and washers (A).

Removing Camshaft Gear



A—Slotted Nut **B—Camshaft Gear** **C—Cap Screw**

Fig. 17-Removing Camshaft Gear

Insert a large screwdriver through one of the holes in the camshaft gear (B) against a cap screw (C) to hold gear.

Remove slotted nut (A), Fig. 17.

Remove camshaft gear (B).

Removing Camshaft

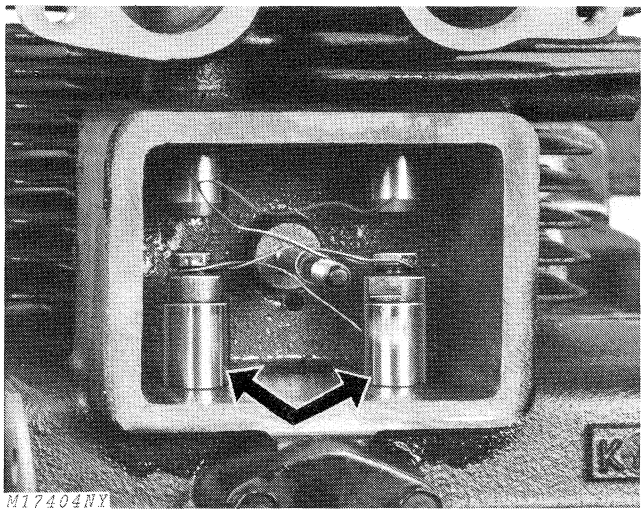
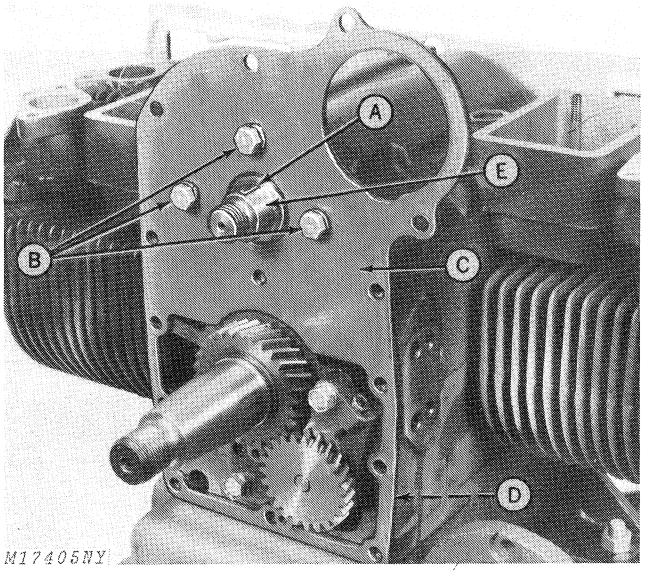


Fig. 18-Raising Tappets

Before removing camshaft, lift tappets, Fig. 18, off camshaft and wire them in the position illustrated. This will prevent tappets from falling out and being damaged during remainder of disassembly.



A—Woodruff Key
B—Cap Screws and Lock Washers
C—Cover Plate
D—Gasket
E—Camshaft

Fig. 19-Removing Camshaft

Remove Woodruff Key (A), Fig. 19.

Remove three cap screws and lock washers (B).

Remove cover plate (C).

Remove gasket (D).

Remove camshaft (E).

IMPORTANT: Hold camshaft steady during removal. Allowing camshaft to drop may damage bearing surfaces.

Inspecting Crankshaft, Connecting Rod and Bearings

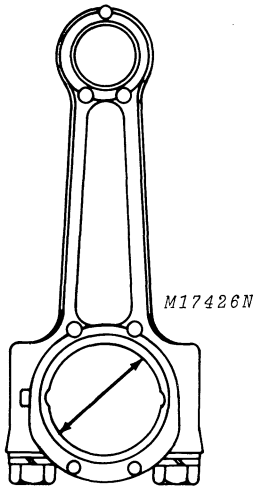


Fig. 49-Measuring Connecting Rod Bearing

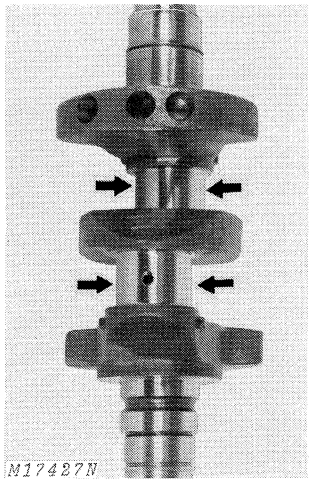


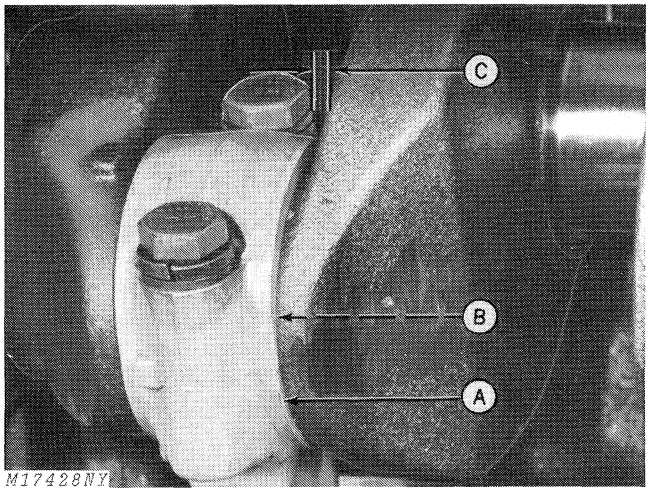
Fig. 50-Measuring Crankshaft Journal

Bolt connecting rod cap to connecting rod. Tighten bolts to correct torque, see "Specifications", Group 30.

Measure connecting rod bearing surfaces, Fig. 49, with a gauge from telescoping gauge set JDM-61.

Measure connecting rod journals on crankshaft, Fig. 50, with a dial caliper, JDM-57.

The difference between the two dimensions is the connecting rod-to-crankshaft journal running clearance. See "Specifications", Group 30, for the maximum clearance.



A—Connecting Rod
B—Crankshaft Journal
C—Connecting Rod Side Clearance

Fig. 51-Checking Crankshaft Journal-to-Connecting Rod Side Clearance

Install connecting rod on correct crankshaft journal.

Move connecting rod as far as possible to either side of crankshaft journal.

Measure the distance between crankshaft journal ridge and connecting rod, Fig. 51, with a flat feeler gauge to determine the crankshaft journal-to-connecting rod side clearance.

See "Specifications", Group 30, for correct side clearance.

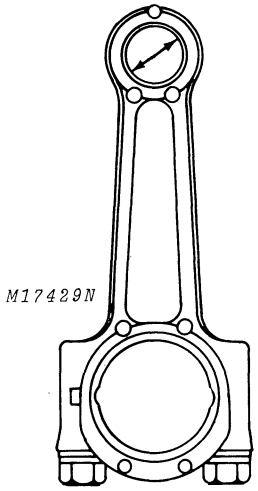


Fig. 52-Measuring Connecting Rod Bearing

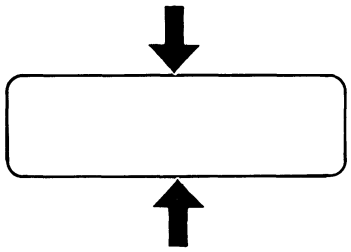


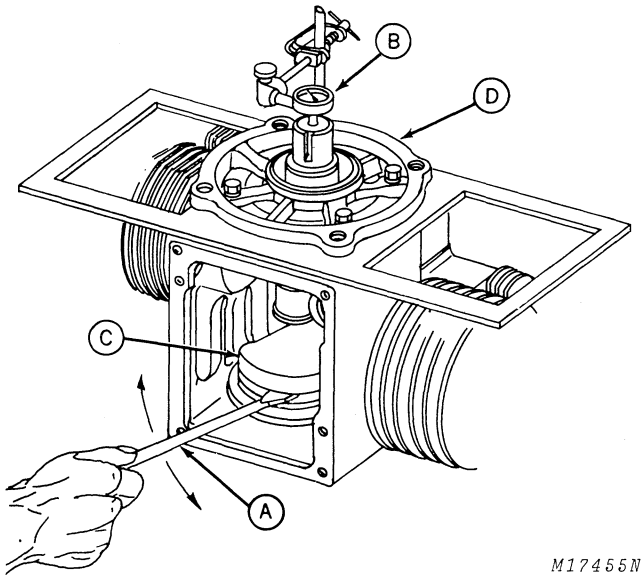
Fig. 53-Measuring Piston Pin

Measure connecting rod bearing surface, Fig. 52, with a gauge from telescoping gauge set JDM-61.

Measure diameter of piston pin, Fig. 53, with a dial caliper, JDM-57.

The difference between the two dimensions is the connecting rod-to-piston pin clearance. See "Specifications", Group 30, for the correct clearance.

Checking Crankshaft End Play



A—Pry Bar
B—Dial Indicator
C—Crankshaft Counterweight
D—Closure Plate

Fig. 82-Checking Crankshaft End Play

Tap the flywheel end of crankshaft with a softhead mallet to make sure main bearing is fully seated in closure plate.

Install dial indicator (B) on PTO end of crankshaft, Fig. 82.

Set the dial indicator at zero.

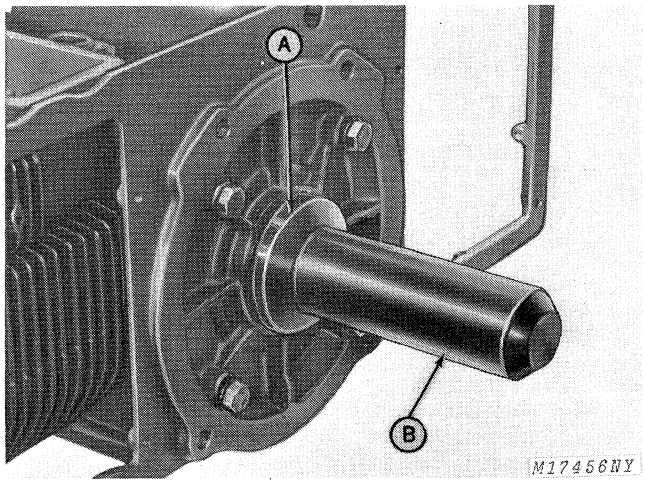
Place a pry bar (A) between crankshaft counterweight (C) and cylinder block.

Pry crankshaft toward closure plate (D).

Observe the reading on the dial indicator (B).

NOTE: The main bearing is locked in position on the crankshaft and closure plate. If the crankshaft end play is beyond the end play limits, check the condition of the main bearing, retaining rings and ring grooves.

Installing Closure Plate Oil Seal

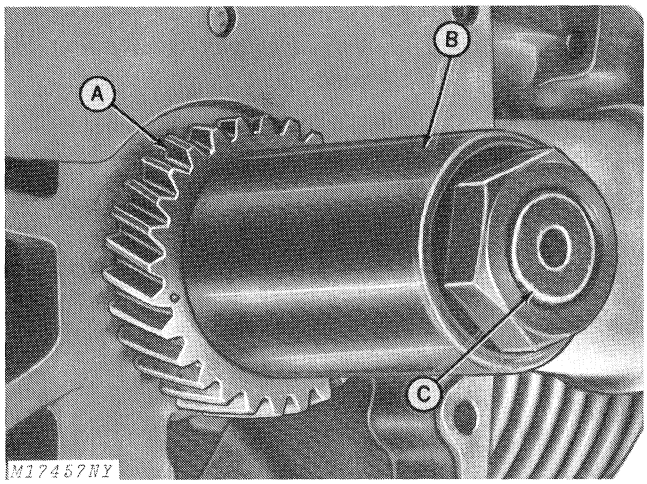


A—Oil Seal **B—Oil Seal Driver**

Fig. 83-Installing Closure Plate Oil Seal

Install closure plate oil seal (A) with oil seal driver, JDM-66-5, Fig. 83.

Install Crankshaft Gear



A—Crankshaft Gear **B—Driver** **C—Crankshaft**

Fig. 84-Installing Crankshaft Gear

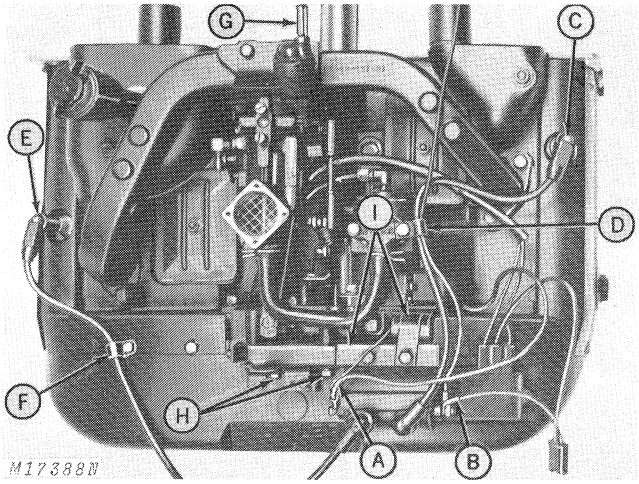
Install Woodruff Key (not illustrated) on crankshaft (C).

Align keyways on crankshaft gear (A) and crankshaft (C).

Install crankshaft gear (A) with JDM-66-4 driver (B), Fig. 84.

Install crankshaft gear retaining ring (not illustrated) on crankshaft.

Installing Coil and Condenser Assembly



A—Breaker Point Lead
B—Wiring Harness Lead
C—Spark Plug Wire
D—Clip
E—Spark Plug Wire
F—Clip
G—Solenoid Lead
H—Cap Screws and Lock Washers
I —Coil and Condenser Assembly

Fig. 110-Installing Coil and Condenser Assembly

Place coil and condenser assembly (I) on engine, Fig. 110.

Install two cap screws and lock washers (H).

Connect anti-dieseling solenoid lead (G) to solenoid.

Install clip (F) with cap screw and lock washer.

Connect spark plug wire (E) on spark plug.

Install clip (D) with cap screw and lock washer.

Connect spark plug wire (C) on spark plug.

Install wiring harness lead (B) on coil.

Install breaker point lead (A) on coil.

Section 30
FUEL SYSTEM
Group 5
GENERAL INFORMATION

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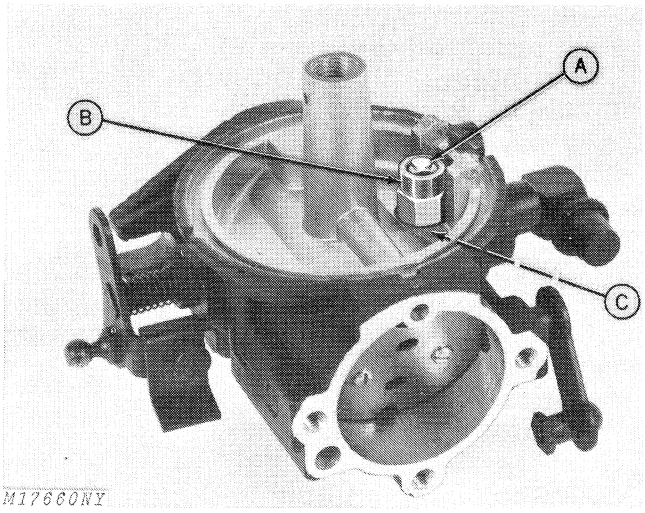
Litho in U.S.A.

ASSEMBLY

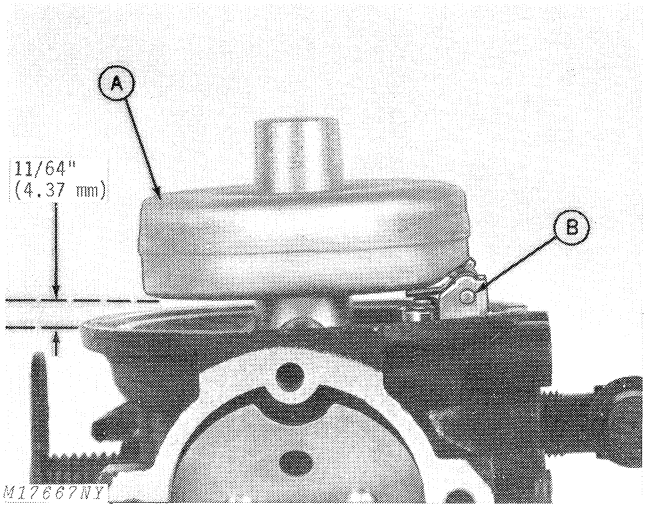


A—Float Valve **B—Fuel Inlet Seat** **C—Gasket**

Fig. 17-Installing Float Valve and Seat

Install a new fuel inlet seat (B) and gasket (C), Fig. 17.

Place a new float valve (A) in seat.



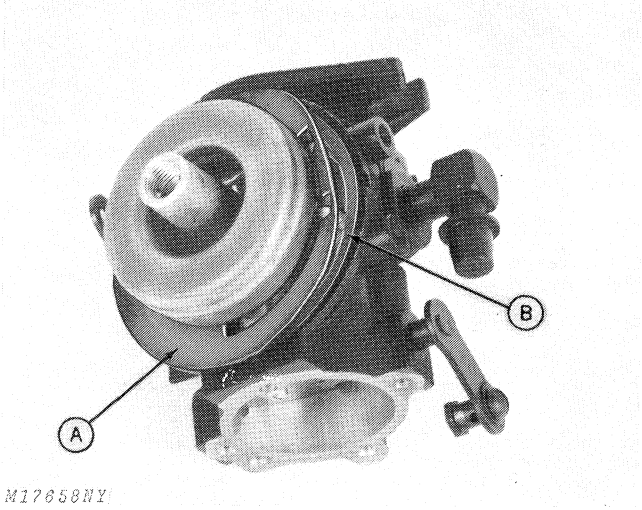
A—Float **B—Pin**

Fig. 18-Installing Float

Install Float (A) and float pin (B), Fig. 18.

Check that 11/64-inch (4.37 mm) clearance exists between free end of float and machined surface of carburetor body.

If not, adjust clearance by carefully bending float lip with a needle-nose pliers.

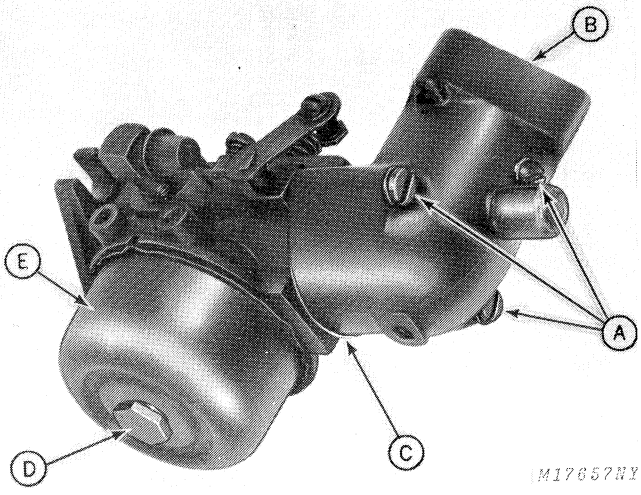


A—Baffle **B—Bowl Gasket**

Fig. 19-Installing Baffle

Place a new bowl gasket (B) in recess in carburetor body, Fig. 19.

Install a new baffle (A).



A—Slotted Screws and Lock Washers
B—Adapter
C—Gasket
D—Nut
E—Bowl

Fig. 20 Installing Bowl and Adapter

Place bowl (E) on carburetor body, Fig. 20.

Install nut (D). Tighten nut.

Install gasket (C), adapter (B) and three slotted screws and lock washers (A). Tighten slotted screws.

INSPECTION AND REPAIR

Inspecting Crankcase Breather

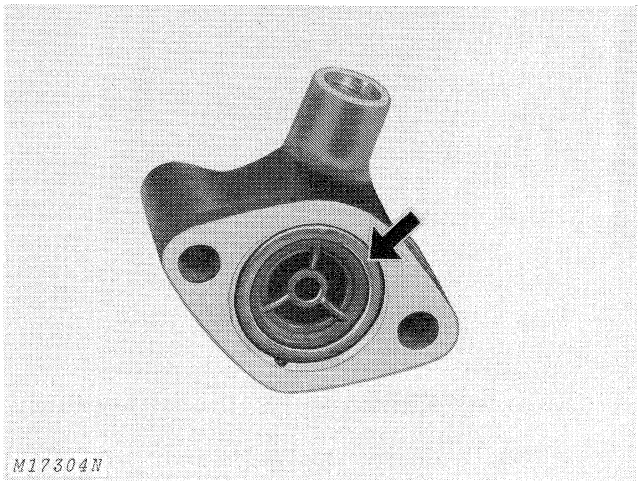
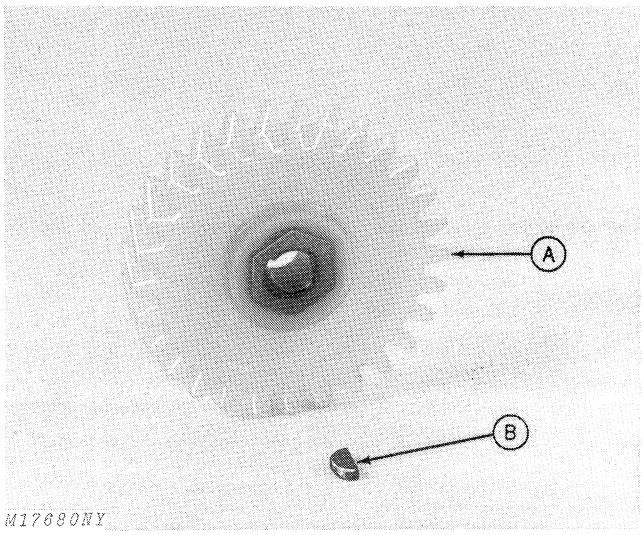


Fig. 12-Inspecting Crankcase Breather

Inspect crankcase breather valve, Fig. 12. If breather valve is stuck, it can be cleaned with solvent to remove dirt and grime. If solvent does not release the valve, pry the valve out of housing. Press new valve into housing until it is fully seated in housing.

Inspecting Governor Gear and Key



A—Governor Gear **B—Key**

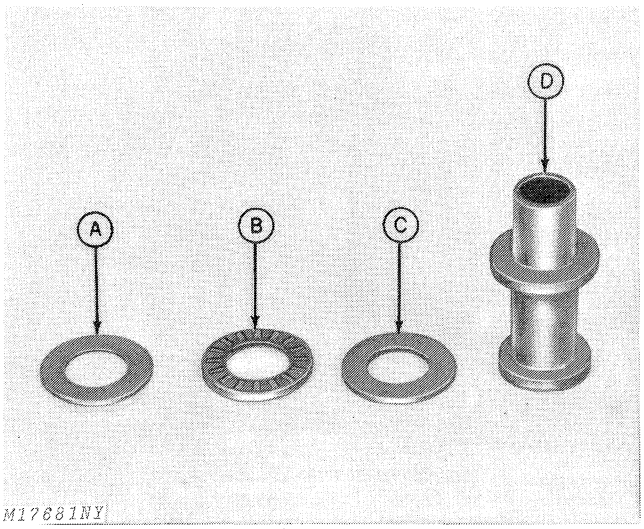
Fig. 13-Inspecting Governor Gear and Key

Inspect governor gear (A) for chipped or broken teeth, Fig. 13.

Governor gear can be cleaned in solvent.

Check key (B) and governor gear keyway for wear or damage.

Inspecting Governor Plunger

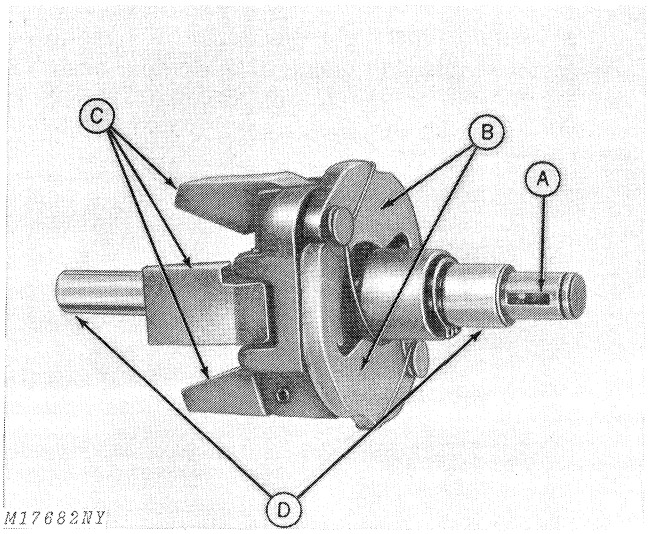


A—Thick Washer **C—Thin Washer**
B—Roller Bearing **D—Plunger**

Fig. 14-Inspecting Governor Plunger

Check thick washer (A), roller bearing (B), thin washer (C) and plunger (D) for wear or damage, Fig. 14. Replace parts as necessary.

Inspecting Governor Shaft



A—Keyway **C—Flyweights**
B—Counterweights **D—Bearing Surface**

Fig. 15-Inspecting Governor Shaft

Inspect keyway (A) for damage, Fig. 15.

Move counterweights (B) open and closed. Counterweights should move freely and return quickly to closed position by the springs.

Make sure flyweights (C) move freely.

Inspect bearing surfaces (D) for excessive wear or damage caused by defective bearings.

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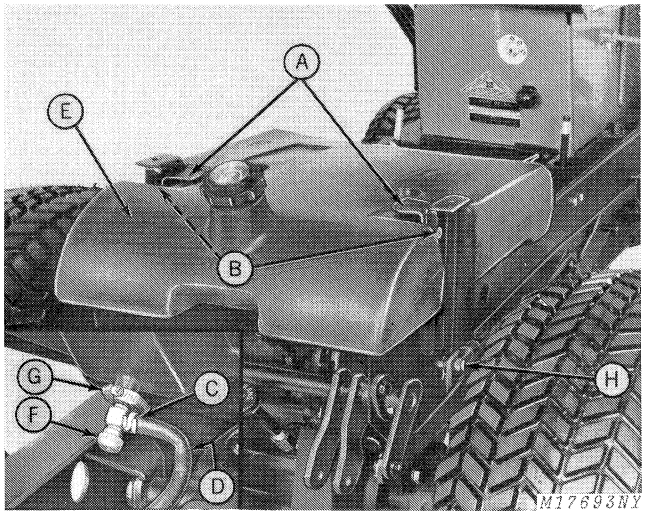
Removing Fuel Tank



A—Fuel Tank Clamps **C—Clamp** **F—Fuel Shut-Off Valve**
B—Cap Screws **D—Fuel Line** **G—Clamp**
E—Fuel Tank

Fig. 5-Removing Fuel Tank

Remove two cap screws (B), Fig. 5.

Remove fuel tank clamps (A).

Close fuel shut-off valve (F).

Loosen clamp (C) and disconnect fuel line (D).

Remove fuel tank (E) from tractor.

If necessary open fuel shut-off valve and drain fuel into a clean container.

Removing Fuel Shut-Off Valve

To remove fuel shut-off valve, loosen clamp (G), Fig. 5.

INSPECTION AND REPAIR

Cleaning Fuel Strainer

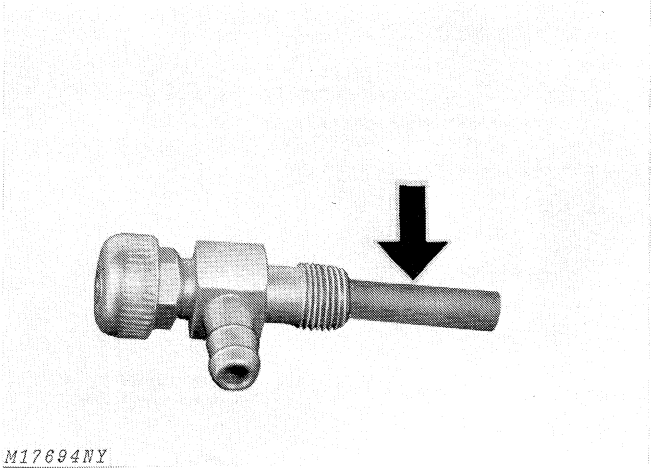


Fig. 6-Cleaning Fuel Strainer

Clean the fuel strainer, Fig. 6. on the end of the fuel shut-off valve with solvent. Brush off any particles left on outside of screen.

Inspecting Fuel Tank

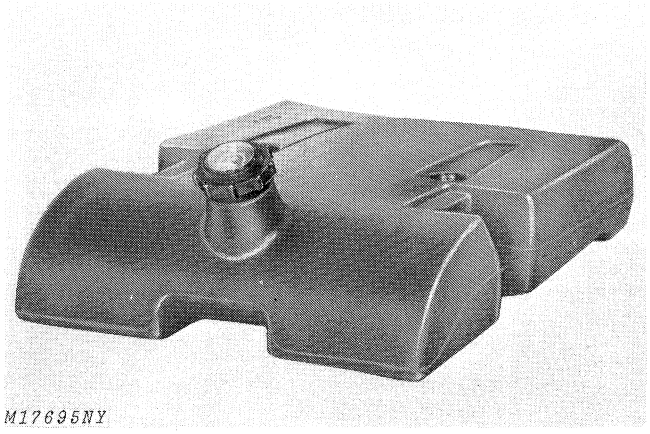
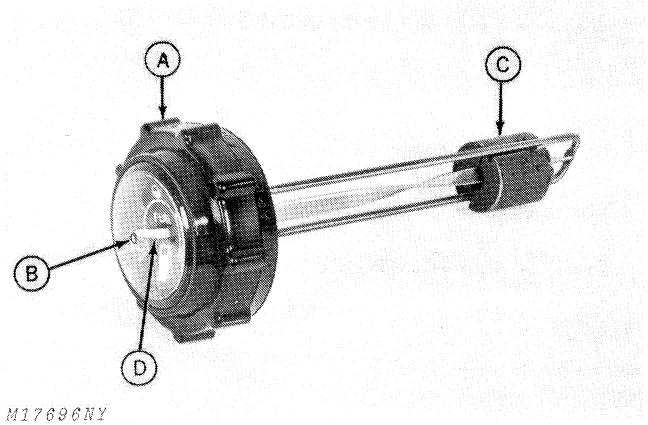


Fig. 7-Inspecting Fuel Tank

If an excessive amount of dirt or foreign material was observed on the fuel strainer, flush the fuel tank clean with fresh gasoline.

Inspect fuel tank, Fig. 7, for cracks or leaks. Replace fuel tank if damaged. Do not repair fuel tank.

Inspecting Fuel Tank Cap and Gauge



A—Fuel Tank Cap **B—Vent** **C—Float** **D—Indicator**

Fig. 8-Inspecting Fuel Tank Cap and Gauge

Inspect fuel tank cap (A), Fig. 8, for visable damage.

Make sure vent (B) is not plugged.

Check that float (C) moves freely up and down its track. Indicator (D) should move as you move the float (C).

Testing 400 Tractors (Serial No. 30,001-70,000)—Continued

Test 5 - Circuit Breaker Lead

Connect voltmeter betwen test points 3 and 14, Fig. 3.

LOW OR NO VOLTAGE
A. Check for defective circuit breaker lead.
B. Check for loose connections.

VOLTAGE
A. Go to Test 6.

Test 6 - Circuit Breaker

Connect voltmeter betwen test points 4 and 14, Fig. 3.

LOW OR NO VOLTAGE
A. Replace circuit breaker.

VOLTAGE
A. Go to Test 7.

Test 7 - Key Switch Lead

Connect voltmeter between test points 5 and 14, Fig. 3.

LOW OR NO VOLTAGE
A. Check for defective key switch lead.
B. Check for loose connections.

VOLTAGE
A. Go to Test 8.

IMPORTANT: The remaining tests must be performed with the key switch in the "START" position, the hydrostatic control lever in neutral, and the PTO disengaged.

Test 8 - Key Switch

Connect voltmeter between test points 6 and 14, Fig. 3.

LOW OR NO VOLTAGE
A. Replace key switch.

VOLTAGE
A. Go to Test 9.

Test 9 - PTO Neutral-Start Switch Lead

Connect voltmeter between test points 7 and 14, Fig. 3.

LOW OR NO VOLTAGE
A. Check for defective lead.
B. Check for loose connections.

VOLTAGE
A. Go to Test 10.

Test 10 - PTO Neutral-Start Switch

Connect voltmeter between test points 8 and 14, Fig. 3.

LOW OR NO VOLTAGE
A. PTO lever engaged.
B. Check for incorrectly adjusted switch.
C. Defective switch.

VOLTAGE
A. Go to Test 11.

Test 11 - Transmission Control Lever Neutral-Start Switch Lead

Connect voltmeter between test points 9 and 14, Fig. 3.

LOW OR NO VOLTAGE
A. Check for defective lead.
B. Check for loose connections.

VOLTAGE
A. Go to Test 12.

Test 12 - Transmission Control Lever Neutral-Start Switch

Connect voltmeter between test points 10 and 14, Fig. 3.

LOW OR NO VOLTAGE
A. Transmission control lever not in neutral position.
B. Check for incorrectly adjusted switch.
C. Defective switch.

VOLTAGE
A. Go to Test 13.

Test 13 - Solenoid Lead

Connect voltmeter between test points 11 and 14, Fig. 3.

LOW OR NO VOLTAGE
A. Check for defective lead.
B. Check for loose connections.

VOLTAGE
A. Go to Test 14.

Test 14 - Solenoid

Connect voltmeter between test points 12 and 14, Fig. 3.

LOW OR NO VOLTAGE
A. Check for defective solenoid.

VOLTAGE
A. End of test.

Testing Accessory System 400 Tractor (Serial No. 30,001-70,000)

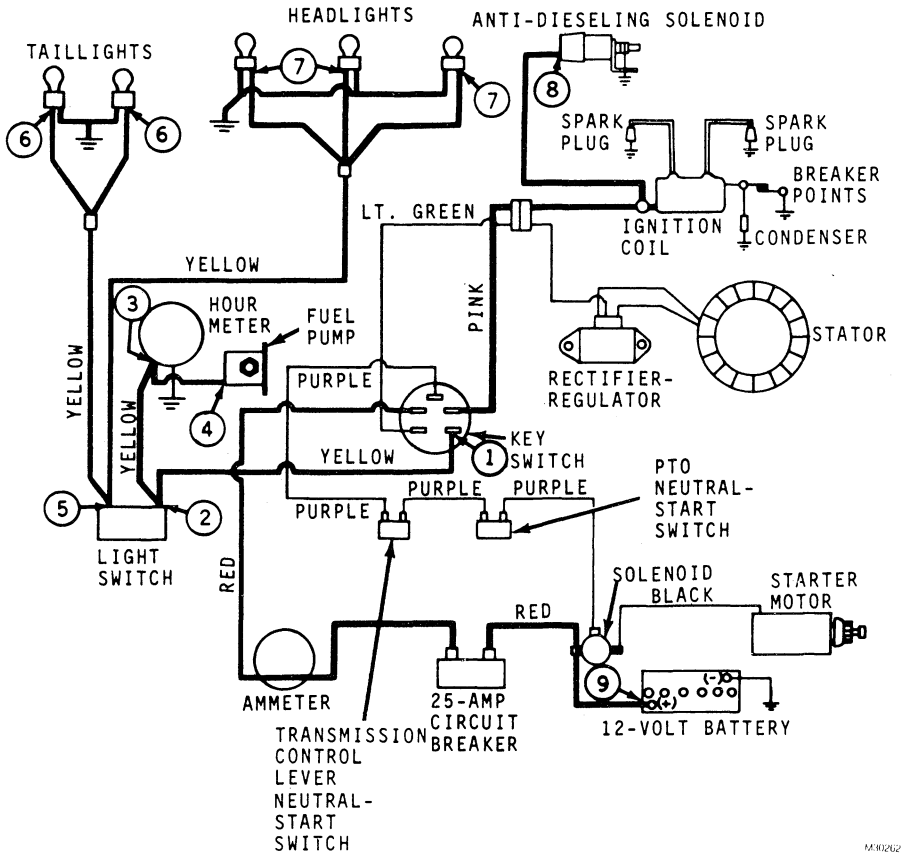


Fig. 12-Accessory System Wiring Diagram For 400 Tractor (Serial No. 30,001-70,000)

Test the accessory system if the cranking system, ignition system and charging system are working correctly but a problem exists with the lights, hourmeter, fuel pump or anti-dieseling solenoid.

Make tests with the key switch in the "RUN" position.

Testing Hourmeter and Fuel Pump

Test 1 - Key Switch

Connect voltmeter between test points 1 and 9, Fig. 12.

LOW OR NO VOLTAGE
A. Defective key switch.

VOLTAGE
A. Go to Test 2.

Test 2 - Light Switch Lead

Connect voltmeter between test points 2 and 9, Fig. 12.

LOW OR NO VOLTAGE
A. Bad connection.

VOLTAGE
A. Go to Test 3.

Test 3 - Hourmeter

Connect voltmeter between test points 3 and 9, Fig. 12.

LOW OR NO VOLTAGE
A. Bad connections.
B. Defective hourmeter lead.

VOLTAGE (HOURMETER DOES NOT WORK)
A. Defective hourmeter.

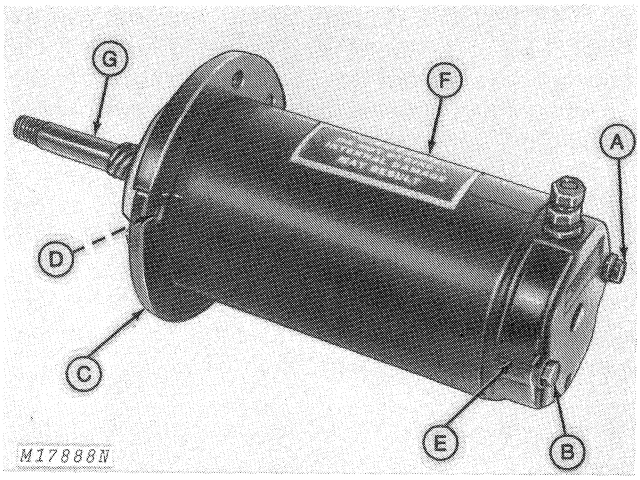
VOLTAGE (HOURMETER DOES WORK)
A. Go to Test 4.

Test 4 - Fuel Pump

Connect voltmeter between test points 4 and 9, Fig. 12.

LOW OR NO VOLTAGE
A. Bad connection.
B. Defective fuel pump lead.

VOLTAGE
A. End of test.



A—Thru Bolt and Washer
B—Thru Bolt, Washer and Spacer
C—Drive End Cap
D—Thrust Washer
E—End Cap
F—Body
G—Armature

Fig. 12- Disassembling Starter

Remove thru bolt and washer (A), Fig. 12.

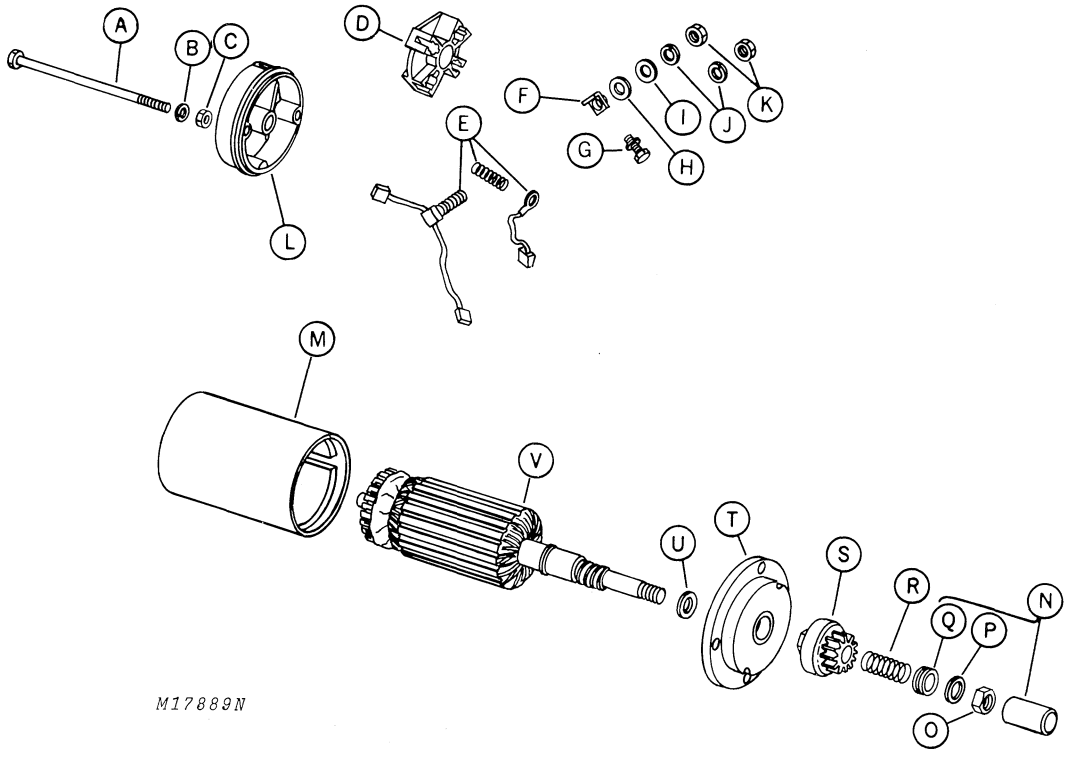
Remove thru bolt, washer and spacer (B).

Remove commutator end cap (E) carefully so that brush springs will not be lost.

Remove drive end cap (C) and thrust washer (D).

Remove armature (G) from body (F).

Inspection and Repair

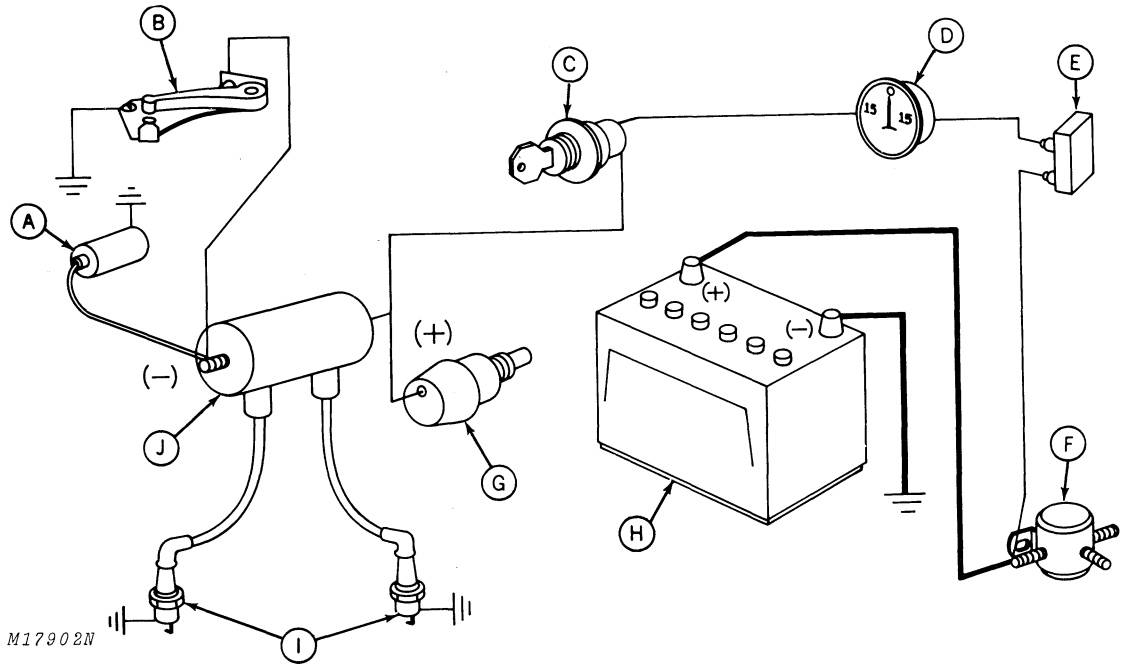


A—Thru Bolt (2 used)
B—5/16″ Lock Washer (2 used)
C—Spacer
D—Brush Holder
E—Brush and Spring Assembly
F—Insulator
G—No. 10x5/8″ Screw (2 used)
H—Insulating Washer
I —Flat Washer
J —1/4″ Lock Washer (2 used)
K—1/4″ Nut (2 used)
L—Commutator End Cap
M—Body
N—Dust Shield Kit
O—Nut
P—Washer
Q—Spacer
R—Anti-Drift Spring
S—Drive Assembly
T—Drive End Cap
U—Thrust Washer
V—Armature

Fig. 13-Exploded View of Starter Motor

Group 15
IGNITION SYSTEM

PRINCIPLE OF OPERATION



A—Condenser **C—Key Switch** **E—Circuit Breaker** **G—Anti-Dieseling Solenoid** **I—Spark Plug**
B—Breaker Points **D—Ammeter** **F—Solenoid** **H—Battery** **J—Ignition Coil**

Fig. 1-Ignition System Components

Fig. 1 illustrates the 400 Tractor battery ignition system.

With the key switch (C) in the "RUN" position, current flows from the battery (H) to the primary windings of the ignition coil (J), and through the closed breaker points (B) to ground.

At the point when the piston is near top-dead-center (8° BTDC for starting or 27° BTDC for running speed) on the compression stroke, the breaker points are opened by a cam on the governor shaft and a push rod.

When the points are opened, the current flow in the primary windings of the coil is interrupted and the magnetic field surrounding the coil windings collapses. This causes a high-voltage in the secondary coil windings, which results in a spark at the spark plug (I).

The voltage built up in the secondary coil windings which has up to 100 times as many turns as the primary windings could go as high as 25,000 volts. Normally, however, voltage increases only to the point required to bridge the spark plug gap. This is usually between 6,000 and 20,000 volts depending on compression, rpm, condition of spark plug electrodes and width of spark plug gap.

The residual current in the primary winding is absorbed by the condenser (A). This eliminates arching at the points and aids in producing a stronger spark at the spark plug.

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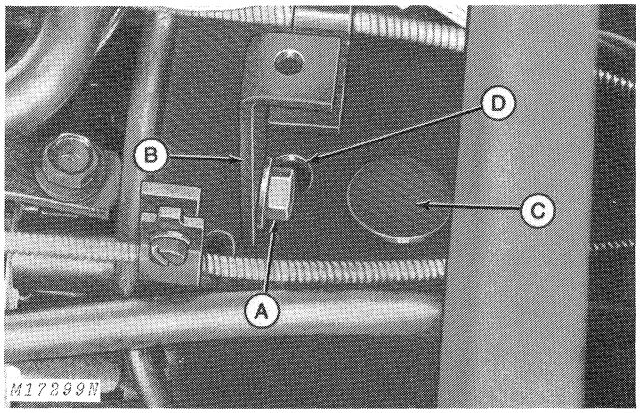
Checking and Adjusting Timing

NOTE: Some engines were built with a timing sight hole that was too small. Enlarge the small hole as shown, Fig. 22.



A—Cap Screw and Lock Washer
B—Throttle Cable Bracket
C—Small Hole
D—Expansion Plug

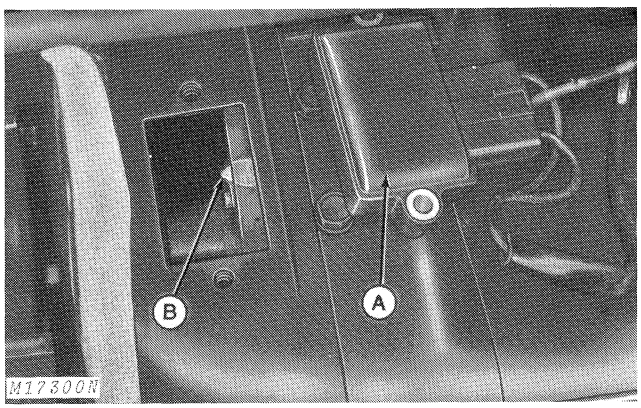
Fig. 22-Drilling Timing Sight Hole

Remove cap screw and lock washer (A), Fig. 22.

Move throttle cable bracket (B) out of way, but do not stretch cable.

Enlarge small hole (C) with a 3/8-inch drill bit. Remove shavings from engine.

Remove expansion plug.



A—Rectifier-Regulator
B—SP Timing Mark

Fig. 23-Chalking Timing Mark

Remove rectifier-regulator (A), Fig. 23.

Rotate flywheel manually until "SP" timing mark (B) is visable.

Chalk the top of the projection between "S" and "P".

Reinstall rectifier-regulator (A).

POWER TRAIN TROUBLE SHOOTING GUIDE

PROBLEM	HYDROSTATIC TRANSMISSION						TWO-SPEED REAR AXLE		BRAKES	
	Control Linkage	Drive Shaft	Low Pressure	Check Valves	Oil Cooler	Worn Parts	Control Linkage	Worn Parts	Linkage	Worn Parts
Neutral Hard to Find	X					X				
System Operates Hot			X		X	X		X		
Jerky Starting	X			X						
Loss of Power	X	X	X	X				X	X	
No Movement in Either Direction	X	X	X	X		X	X	X		
Brakes not Effective									X	X
Brakes Locked									X	X

Hydrostatic Transmission Causes

Check Valves

1. Worn valves.
2. Damaged Seat.
3. Broken Spring.

Worn Parts

1. Check all internal components.

Low Pressure

1. Low fluid level.
2. Broken line.
3. Damaged suction tube.
4. Plugged filter.
5. Sheared charge pump drive pin.
6. Improperly functioning by-pass valve.

Oil Cooler

1. Poor air circulation.
2. Poor fluid circulation.

Control Linkage

1. Defective shock absorber.
2. Broken slide assembly springs (Serial No. 30,001-55,000)
3. Roller too deep in groove.
4. Binding linkage.

Drive Shaft

1. Damaged universal joints.
2. Damaged keys.

Two-Speed Rear Axle Causes

Control Linkage

1. In neutral.
2. Binding linkage.

Worn Parts

1. Check all internal components.

Brake Causes

Linkage

1. Linkage binding.
2. Damaged return spring.

Worn Parts

1. Check all internal components.

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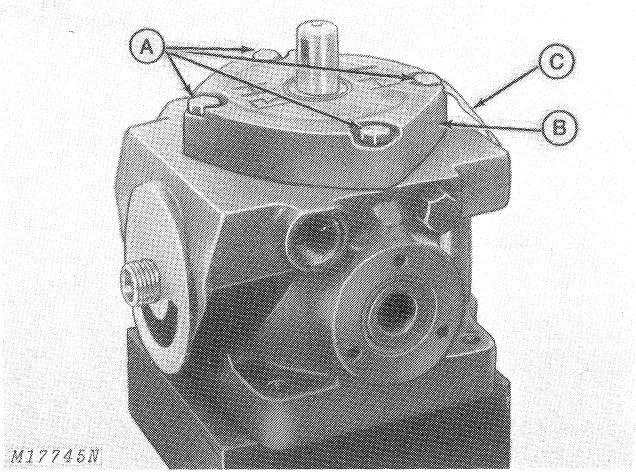
Removing Charge Pump Housing



A—Cap Screws **B—Charge Pump Housing** **C—Serial Number Plate**

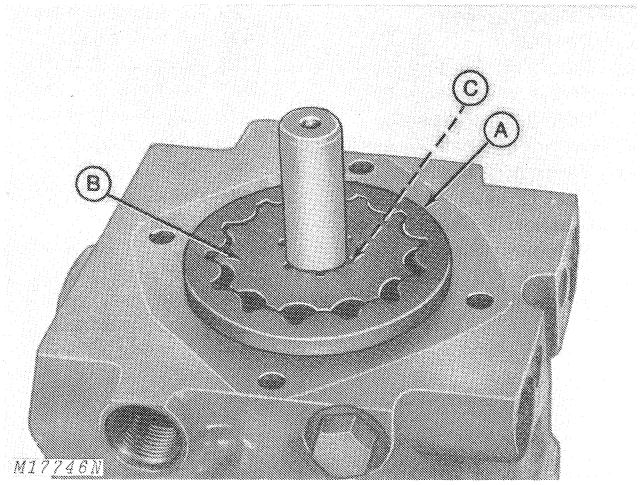
Fig. 22-Removing Charge Pump Housing

Remove four cap screws (A), Fig. 22.

Remove charge pump housing (B).

Do not lose serial number plate (C).

Removing Gerotor



A—Outer Rotor Gear **B—Rotor** **C—Pin**

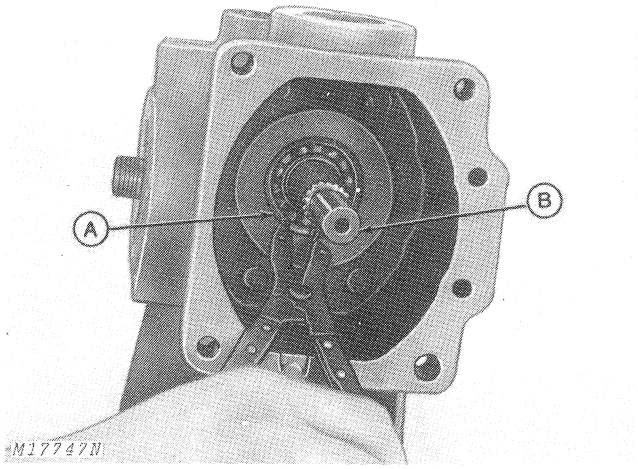
Fig. 23-Removing Gerotor

Remove outer rotor gear (A), Fig. 23.

Remove rotor (B).

Remove and discard pin (C).

Removing Pump Shaft



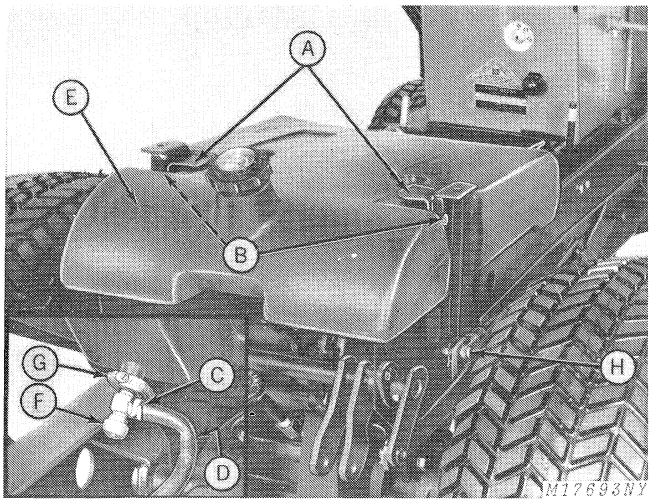
A—Snap Ring **B—Pump Shaft**

Fig. 24-Removing Pump Shaft

Remove snap ring (A), Fig. 24.

Remove pump shaft (B).

Installing Fuel Tank



A—Fuel Tank Clamp
B—Cap Screws
C—Clamp
D—Fuel Line
E—Fuel Tank
F—Fuel Shut-Off Valve
G—Clamp

Fig. 56-Installing Fuel Tank

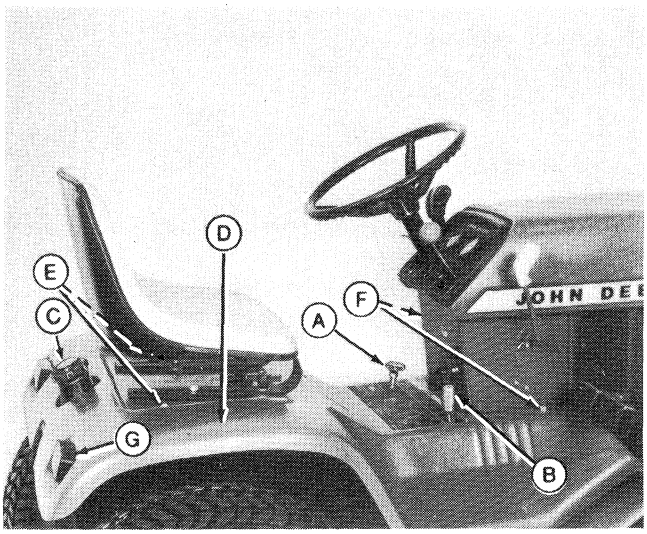
Connect fuel line (D) to tank with clamp (C), Fig. 56.

Lower fuel tank (E) onto tractor and install fuel tank clamps (A).

Install two cap screws (B).

Open fuel shut-off valve (F).

Installing Fender-Deck



A—Depth Control Knob
B—Two-Speed Axle Shift Knob
C—Fuel Tank Cap
D—Fender-Deck
E—Crown Nuts
F—Cap Screws and Flat Washers
G—Taillight Bulb

Fig. 57-Installing Fender-Deck

Place fender-deck (D) on tractor and install taillight bulbs (G), Fig. 57.

NOTE: On 400 Tractors Serial No. 70,001 and up, insert seat switch wiring harness coupler through hole in fender-deck under seat. Connect seat switch wiring harness couplers together.

Install two cap screws and flat washers (F).

NOTE: On 400 tractors (Serial No. 80,001 -), standard nuts are used in place of crown nuts (E).

Install two crown nuts (E).

Install fuel tank cap (C).

Install two-speed axle shift knob (B).

Install depth control knob (A) and nut.

Filling Transmission with Fluid (Tractors Serial No. 30,001-70,000

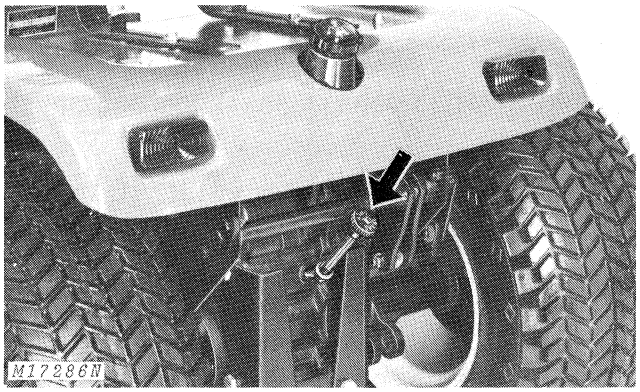


Fig. 58-Filling Transmission with Fluid

Install drain plug in transmission.

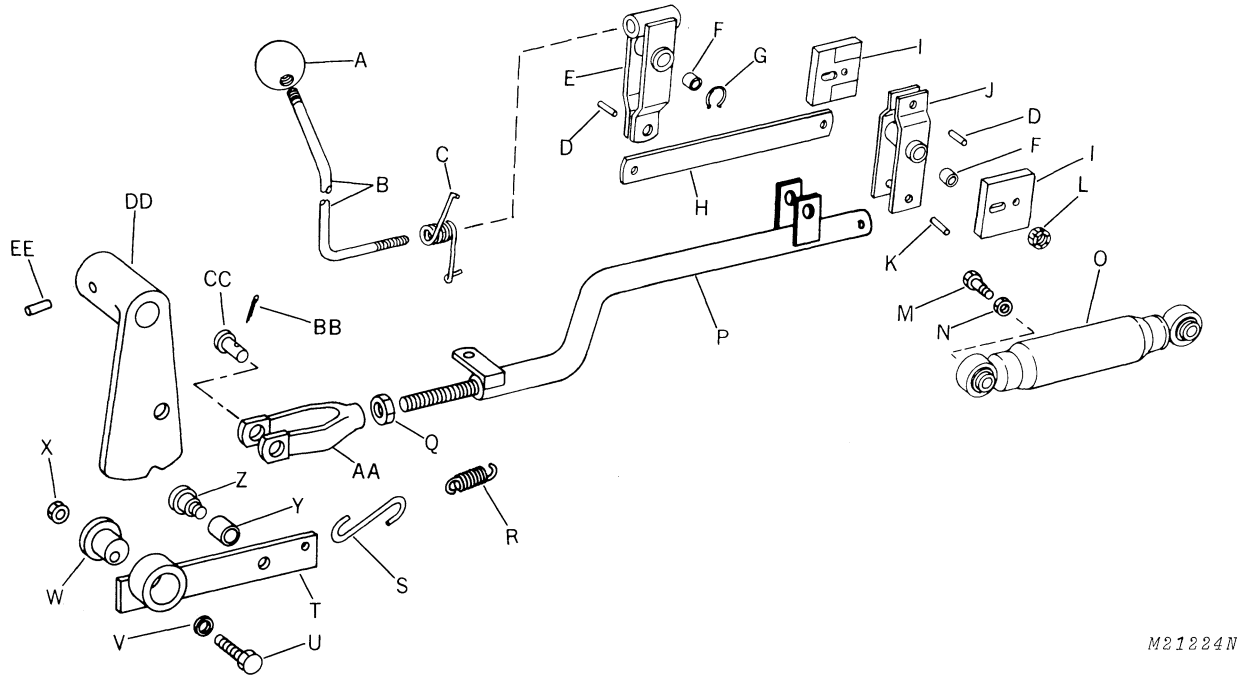
IMPORTANT: Before operating hydrostatic control lever, start engine and move inner hydraulic control lever back and forth several times. Observe that lift system is operating before operating hydrostatic control lever. This insures that the entire system is lubricated.

Remove transmission dipstick, Fig. 58.

Pour 4 quarts (3.80 l) of transmission fluid into transmission fill tube. Start engine. Check fluid level with dipstick. Add fluid until level is to the midpoint of the "SAFE" range on dipstick.

INSPECTION AND REPAIR—Continued

400 Tractor (Serial No. 55,001-)

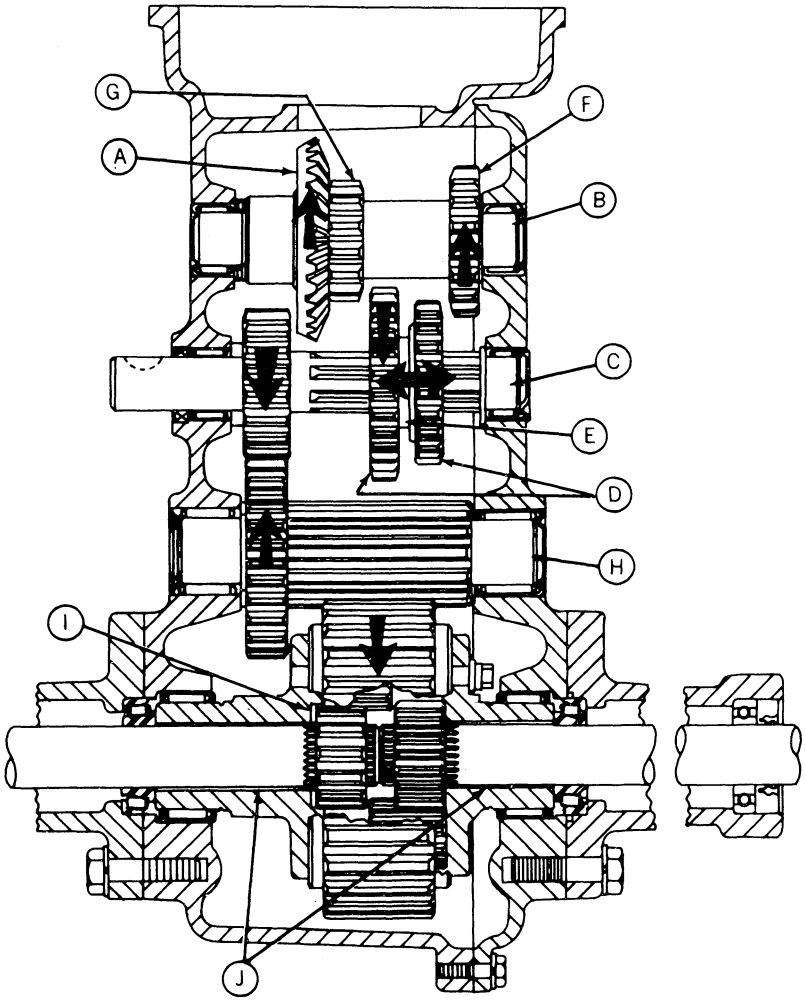


A—Knob
B—Hydrostatic Control Lever
C—Spring
D—Spring Pin
E—Control Crank
F—Bearing
G—Retaining Ring
H—Connector Link
I —Brake Pads
J—Pivot
K—Spring Pin
L—Stop Nut
M—Cap Screw
N—Lock Nut
O—Shock Absorber
P—Control Rod
Q—Jam Nut
R—Spring
S—Hook
T—Roller Arm
U —Bolt
V —Flat Washer
W —Adjustable Bearing
X —Hex. Nut
Y —Roller Cam
Z —Shoulder Bolt
AA—Adjustable Yoke
BB—Cotter Pin
CC—Drilled Pin
DD—Cam Arm
EE—Groove Pin

Fig. 20-Exploded View of Hydrostatic Control Linkage for 400 Tractor (Serial No. 55,001-)

Group 20
TWO-SPEED REAR AXLE

PRINCIPLE OF OPERATION



A—Input Bevel Gear **C—Shifter Shaft** **E—Shifter Fork** **G—Spur Gear** **I—Differential**
B—Countershaft **D—Cluster Gear** **F—Spur Gear** **H—Output Pinion** **J—Axle Shaft**

Fig. 1-Section View of Two-Speed Rear Axle (View from Bottom, Rear Axle in Neutral Position)

The two-speed rear axle, Fig. 1, is the final drive of the power train. It is driven by the hydrostatic transmission which is meshed with the input bevel gear (A) on the countershaft (B).

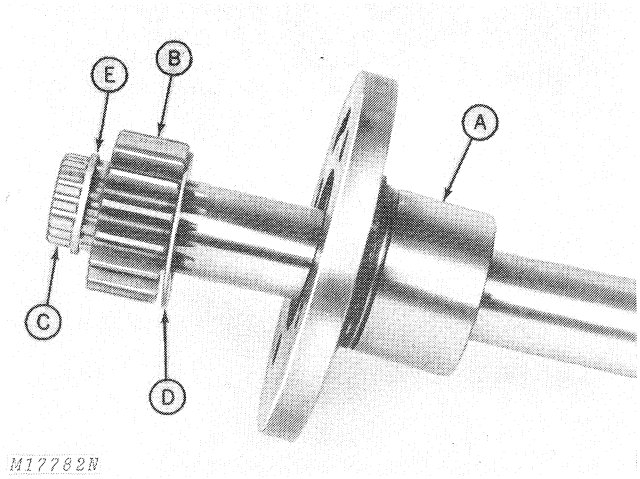
The shifter shaft (C) has a cluster gear (D) which is moved from side-to-side by the shifter fork (E).

In high range, the small gear on the cluster gear (D) engages with the spur gear (F) on the countershaft.

In low range, the large gear on the cluster gear (D) engages with the spur gear (G) on the countershaft.

In high range or low range, the shifter shaft (C) drives the output pinion (H) which drives the differential (I). The differential transfers power to both axle shafts (J) causing the rear wheels to rotate.

In neutral, the cluster gear (D) sets between the spur gear (F) and spur gear (G). The countershaft spins freely causing no movement in the rest of the rear axle.



A—Carrier **C—Axle** **E—Retaining Ring**
B—Side Gear **D—Thrust Washer**

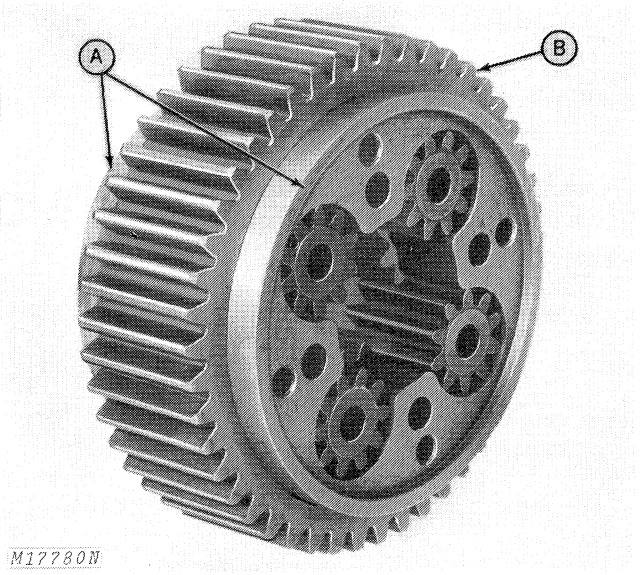
Fig. 25-Inspecting Side Gear and Carrier

Inspect bearing surface on carrier (A) for wear or damage, Fig. 25.

Inspect side gear (B) for worn or damaged teeth.

Inspect splines on axle (C) for wear or damage.

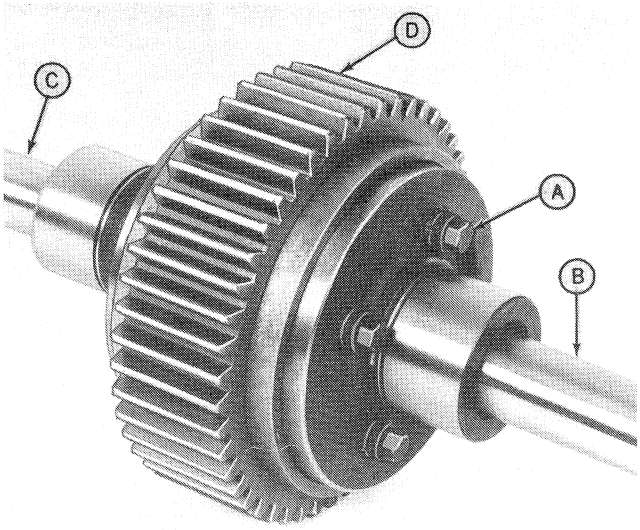
To replace a side gear, remove retaining ring (E) and remove side gear from axle.



A—Pinion Gear Assemblies **B—Ring Gear**

Fig. 26-Assembling Differential

Install pinion gear assemblies (A) on each side of ring gear (B), Fig. 26.



A—Shoulder Bolt and Washer **C—Left-Hand Axle**
B—Right-Hand Axle **D—Differential**

Fig. 27-Installing Axles

NOTE: The left-hand axle is longer than the right-hand axle. The carrier on the left-hand axle has threaded holes and the carrier on the right-hand axle has drilled holes.

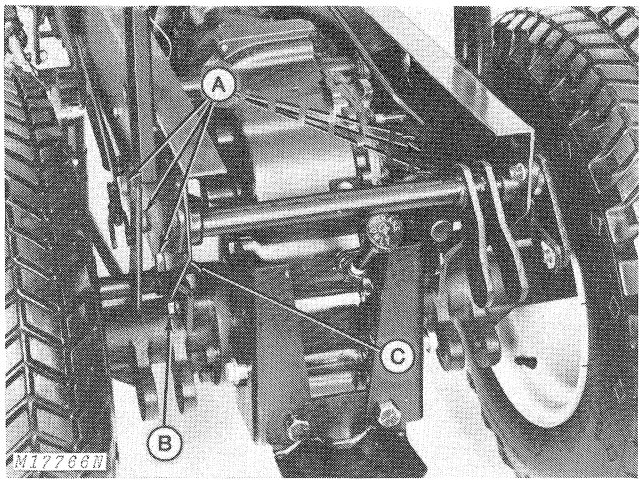
Mesh the axle side gears into differential gears while installing axles.

Install right-hand axle (B) in differential (D), Fig. 27.

Install left-hand axle (C) in differential (D).

Install four shoulder bolts and lock washers (A). Torque bolts to 35 to 40 ft-lbs (47.46 to 54.64 Nm).

Securing Rear Axle



A—Cap Screws and Nuts **B—Cap Screws** **C—Bracket**

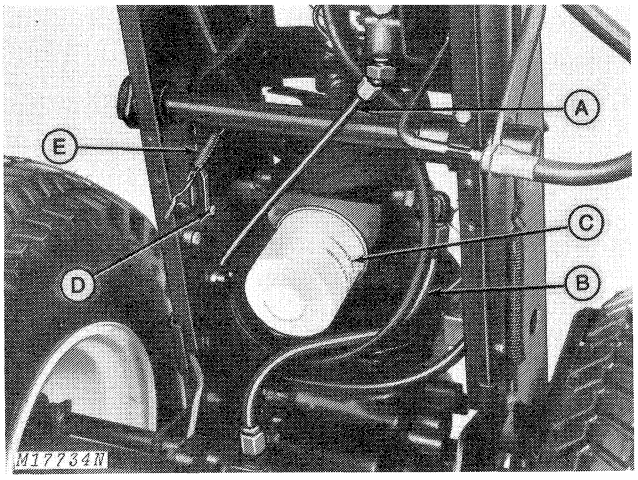
Fig. 52-Securing Rear Axle

Tighten cap screws (B), Fig. 52.

Install six cap screws and nuts (A). Tighten nuts.

Remove jackstands from under tractor frame.

Installing Lower Transmission Lines and Linkage



A—Supply Tube **C—Oil Filter** **E—Spring**
B—Suction Tube **D—Drilled Pin**

Fig. 53-Installing Lower Transmission Lines and Linkage

Install drilled pin (D), Fig. 53.

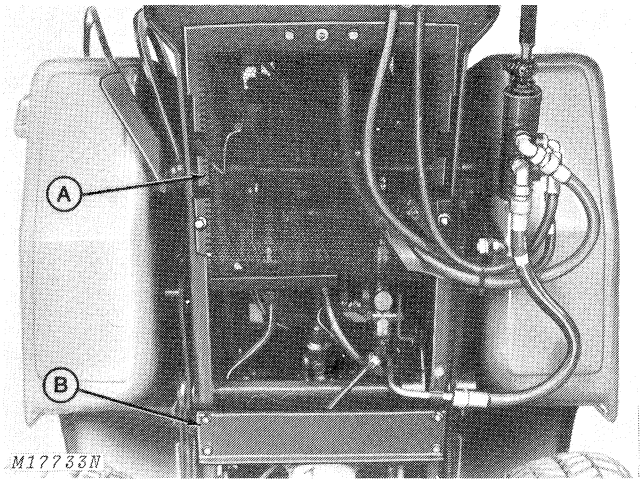
Connect spring (E) to control lever.

Install new oil filter (C) and hand-tighten only.

Install suction tube (B).

Install supply tube (A).

Installing Bottom Screen and Fan Guard



A—Bottom Screen **B—Fan Guard**

Fig. 54-Installing Bottom Screen and Fan Guard

Install bottom screen (A), Fig. 54.

Install fan guard (B).

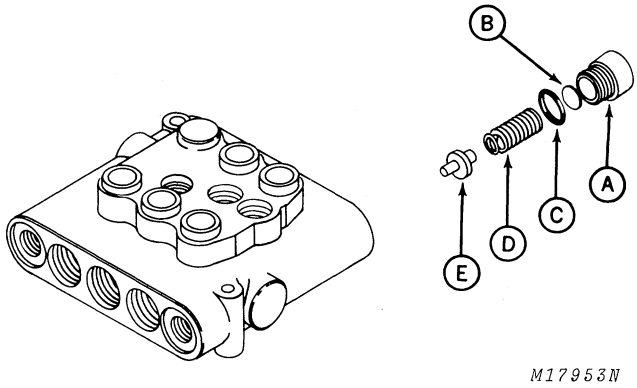
Litho in U.S.A.

Section 60
HYDRAULIC SYSTEM
Group 5
GENERAL INFORMATION

TABLE OF CONTENTS

Litho in U.S.A.

Removing Relief Valve



A—Plug
B—Shim
C—O-Ring
D—Spring
E—Poppet

Fig. 9-Removing Relief Valve

Remove plug (A), shim (B) and O-Ring (C), Fig. 9.

Remove spring (D) and poppet (E) from valve body.

Removing O-Rings

Replace all O-rings before reassembling valve, see page 60-10-9, Figs. 15 and 16.

Group 20
POWER STEERING CONTROL VALVE

PRINCIPLE OF OPERATION

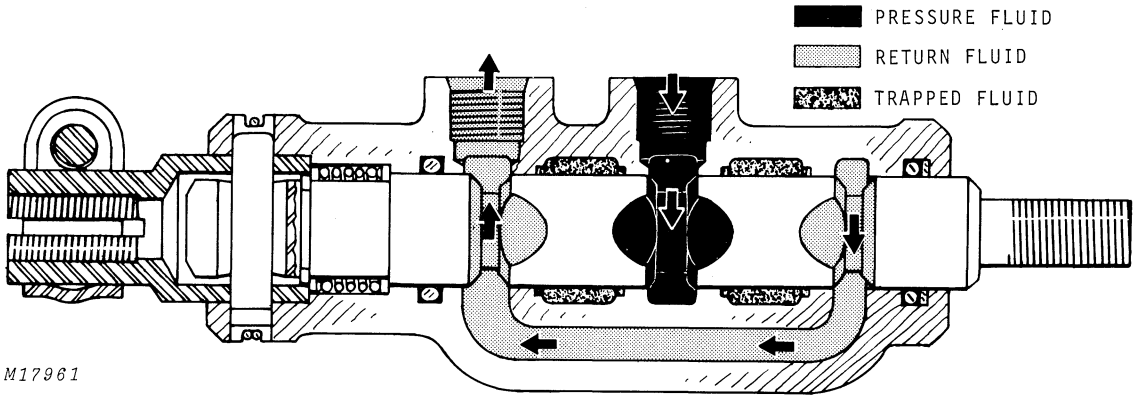


Fig. 1-Power Steering Control Valve in Centered Position

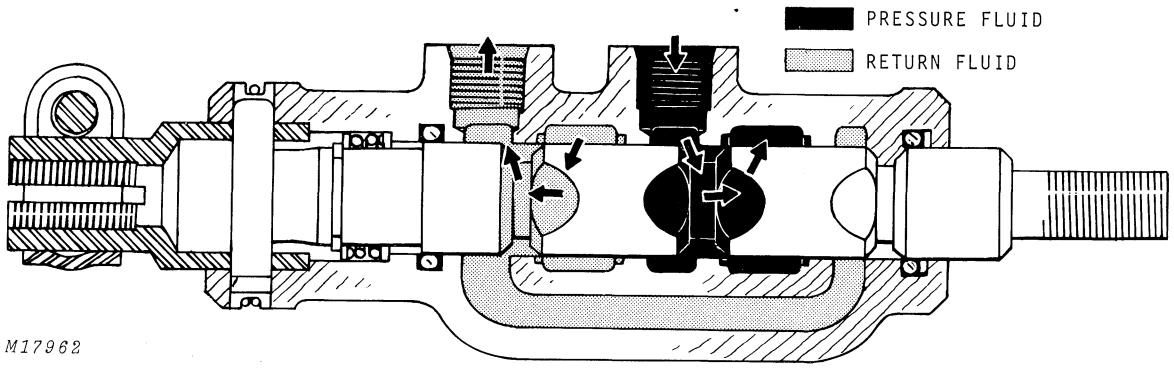


Fig. 2-Power Steering Control Valve in Right Turn Position

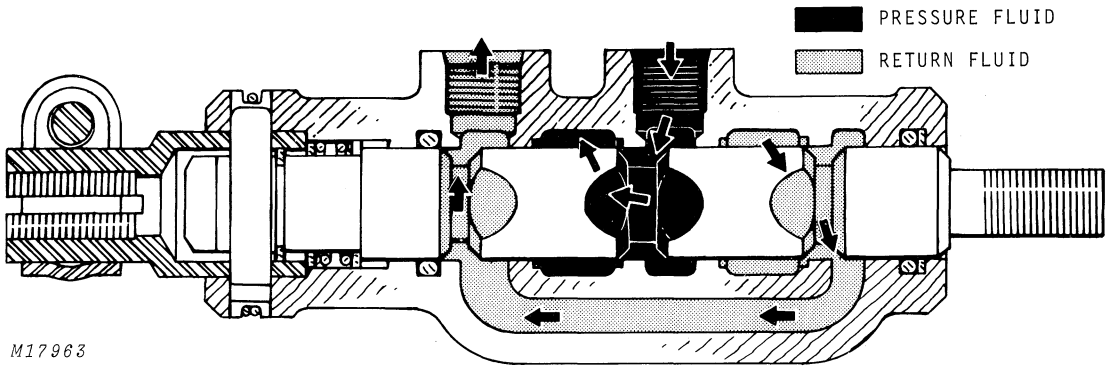


Fig. 3-Power Steering Control Valve in Left-Turn Position

In the centered position, Fig. 1, the power steering control valve receives pressure fluid constantly and returns it to the reservoir.

In the right turn position, Fig. 2, the power steering control valve receives pressure fluid and delivers it to the line that extends the power steering cylinder. The opposite cylinder line returns oil to the valve and on to the reservoir.

In the left turn position, Fig. 3, the power steering control valve receives pressure fluid and delivers it to the line that retracts the power steering cylinder. The other cylinder line returns oil to the valve and on to the reservoir.

Litho in U.S.A.

TROUBLE SHOOTING GUIDE

Problem	HYDRAULIC SYSTEM CAUSES				STEERING CAUSES			
	Low Pressure	Implement Control Valve	Steering Control Valve	Steering Cylinder	Lubrication and Adjustment	Linkage	Steering Gear	Tires
Loose Steering					X	X	X	
Hard Steering	X	X	X	X	X	X	X	X
Tractor Turns Shorter One Way				X	X	X		
Tire Strikes On Turn				X	X	X		
Tire Wear					X	X		X
Noisy Steering			X	X	X		X	
Excessive End Play					X		X	

Hydraulic System Causes

Low Pressure

Engine RPM too low.
Fluid level low.
Filter clogged and dirty.
Dirt in system.
Pinched or damaged lines.
Charge pump pin broken.
Worn charge pump.

Implement Control Valve

Dirt in control valve.
By-pass valve stuck.
Worn components.

Steering Control Valve

Valve not centered.
Dirt in valve.
Worn components.

Steering Cylinder

Improperly adjusted.
Packing or O-ring leaking.
Worn components.

Steering Causes

Lubrication and Adjustment

Steering gear improperly lubricated.
Spindles improperly lubricated.
Linkage out of adjustment.
Steering valve out of adjustment.
Steering cylinder out of adjustment.
Tie rod improperly adjusted.
Excessive toe-in and toe-out.

Linkage

Adjusted incorrectly.
Improperly lubricated.
Ball joints worn, too loose and too tight.
Drag link incorrectly installed.
Bent and damaged linkage.

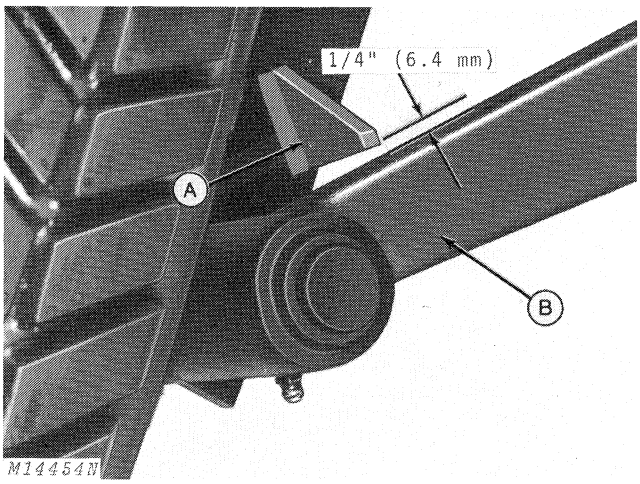
Steering Gear

Out of adjustment.
Improperly lubricated.
Worn or damaged.

Tires

Improperly inflated.

Litho in U.S.A.

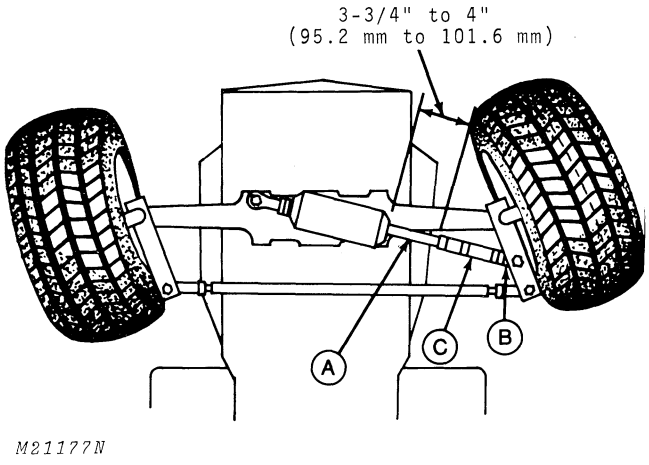


A—Spindle Stop **B—Axle**

Fig. 32-Spindle Stop Clearance

Start engine and turn steering wheel to the right until spindle stop (A) is 1/4-inch (6.4 mm) away from axle (B), Fig. 32.

Adjust steering arm stop (B), Fig. 31, so that the steering arm (A) rests against the rear leg of the stop. Tighten the two screws holding the steering arm stop.



A—Steering Cylinder Ram **B—Ball Joint**
C—Extension

Fig. 33-Adjusting Steering Cylinder

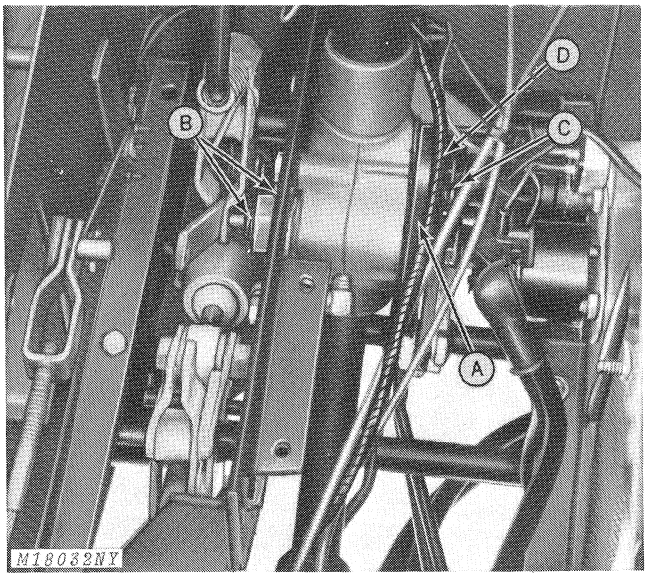
Turn front wheels to the extreme right.

Measure the length of the steering cylinder ram (A), Fig. 33. It should be 3-3/4 to 4 inches (95.2 to 101.6 mm). Disconnect ball joint (B) and thread it onto or off extension (C) until steering cylinder length is correct. Reinstall ball joint and tighten lock nuts.

Adjusting Steering Gear

To adjust steering gear bearings, remove the steering gear and torque adjusting plug as instructed on page 70-5-8, Fig. 18.

To properly adjust backlash, turn steering wheel until front edge of lever arm (A), Fig. 34, is in a vertical position.



A—Lever Arm **C—Tapered Stud**
B—Jam Nuts **D—Lock Nut**

Fig. 34-Adjusting Backlash

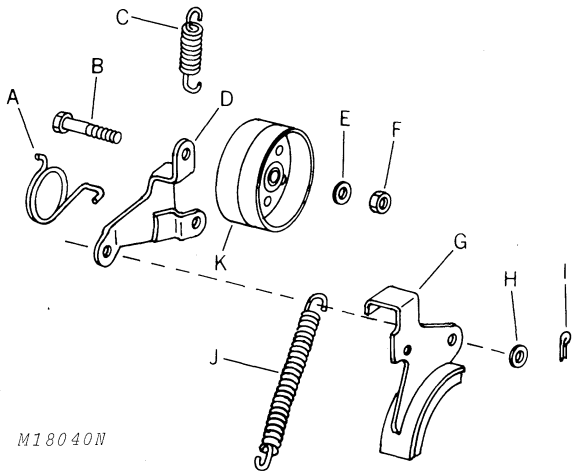
Place a 0.100-inch (2.540 mm) thick shim between lever arm (A) and housing face.

Tighten inside jam nut (B) against shim. Loosen jam nut just enough to remove shim. Tighten outside jam nut to 40 ft-lbs (54.23 Nm) torque, Fig. 34.

Test adjustment by turning steering wheel through its full range in both directions. When properly adjusted, a slight drag can be detected at midpoint.

INSTALLATION

Installing Idler and Brake



A—Return Spring
B—3/8"x2" Cap Screw
C—PTO Cable Spring
D—Belt Tightener Arm
E—Washer
F—3/8" Nut
G—Brake
H—Washer
I—3/32"x1" Cotter Pin
J—Brake Spring
K—Idler

Fig. 12-Installing Idler and Brake

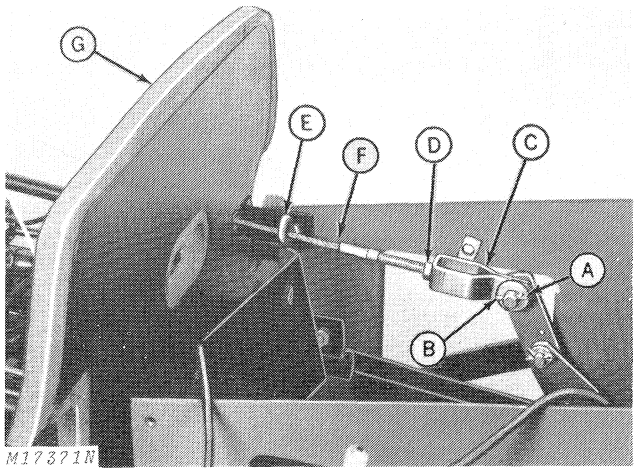
Install idler (K) on belt tightener arm (D) with cap screw (B) washer (E) and nut (F).

Install spring (A) and belt tightener arm (D).

Install brake (G) washer (H) and cotter pin (I).

Install brake spring (J) and PTO cable spring (C).

Installing PTO Cable



A—Cotter Pin
B—Washer
C—Clevis
D—Lock Nut
E—Eye Bolt
F—PTO Cable
G—Heat Shield

Fig. 13-Connecting PTO Cable

Connect PTO cable to spring (C), Fig. 12.

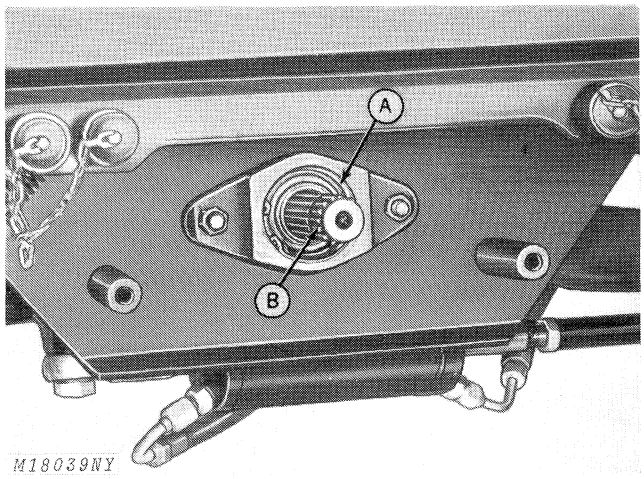
Guide PTO cable up through cable idler heat shield (G) and eye bolt (E), Fig. 13.

Thread lock nut (D) and clevis (C) onto PTO cable (F). Clevis should be turned onto cable until spring (C, Fig. 12) is 3-3/4 to 4-1/4 inches (95.25 to 107.95 mm) long when the PTO lever is engaged. Turn lock nut (D) against clevis (C) to lock it in position, Fig. 13.

Install washer (B) and cotter pin (A).

NOTE: On 400 Tractors (Serial No. 155,001-), the clevis (C) is L-shaped rather than U-shaped as shown in Fig. 13. The adjustment procedure is the same for both styles of clevis.

Installing PTO Shaft



A—Snap Ring
B—PTO Shaft

Fig. 14-Installing PTO Shaft

Place PTO shaft (B) in axle pivot, Fig. 14.

Drive PTO shaft into axle pivot with a driver of the proper size for the PTO shaft bearing until snap ring groove is exposed.

Install snap ring (A).

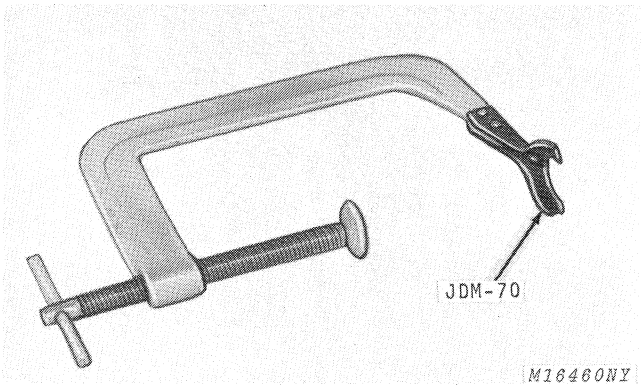


Fig. 17-JDM-70 Valve Spring Compressor

For Briggs & Stratton and Kohler Engines

JDM-70 Valve Spring Compressor, Fig. 17, compresses valve springs to remove or install intake and exhaust valves.

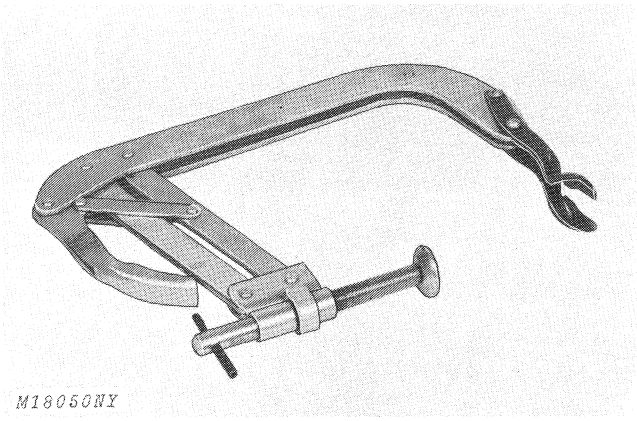


Fig. 18-KD-385 Valve Spring Compressor

For Kohler Engines

KD-385 Valve Spring Compressor, Fig. 17, compresses valve springs to remove or install intake and exhaust valves. Its reach enables valve removal and installation without removing the engine sheet metal.

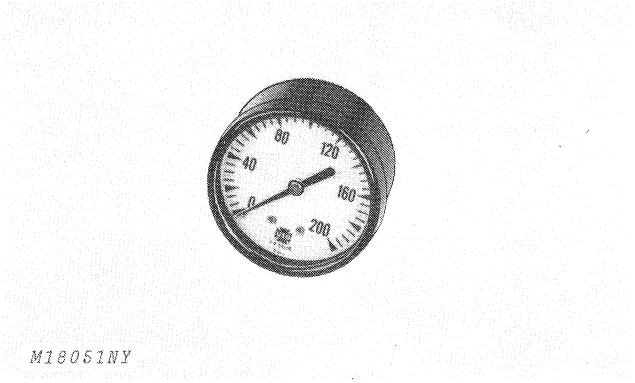


Fig. 19-FES-14 Oil Pressure Gauge

For Kohler Engines

FES-14 Oil Pressure Gauge, Fig. 19, is capable of measuring up to 300 psi in 5 psi increments.

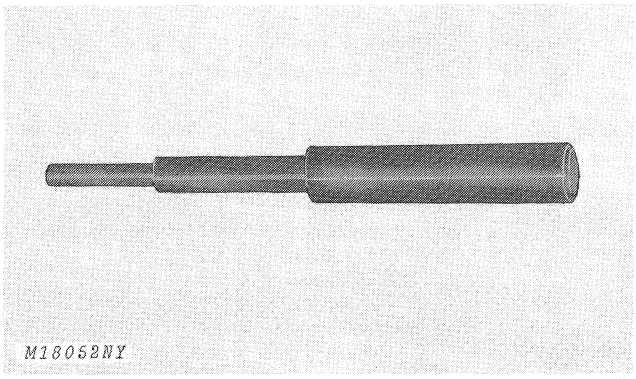


Fig. 20-JDM-69 Valve Guide Driver

For Kohler Engines

JDM-69 Valve Guide Driver, Fig. 20, makes removing and installing valve guides easier.

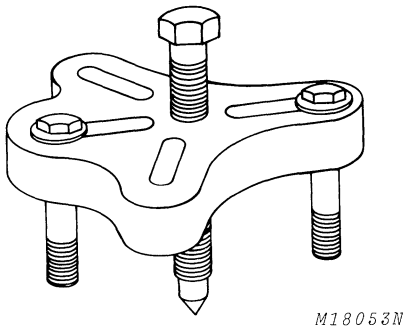


Fig. 21-JDM-68 Flywheel Puller

For Kohler Engines

JDM-68 Flywheel Puller, Fig. 21, is a general purpose puller used to remove the flywheel. It also works in balancers and gears having two or three tapped holes.

REPLACING ROTOR DRIVE CHAIN

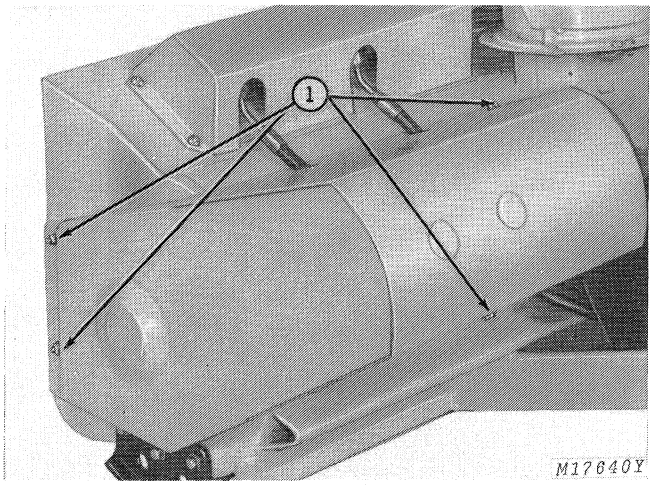


Fig. 3-Removing Drive Chain Shield

1. Remove two cap screws and two lock nuts. Remove drive chain shield, Fig. 3.

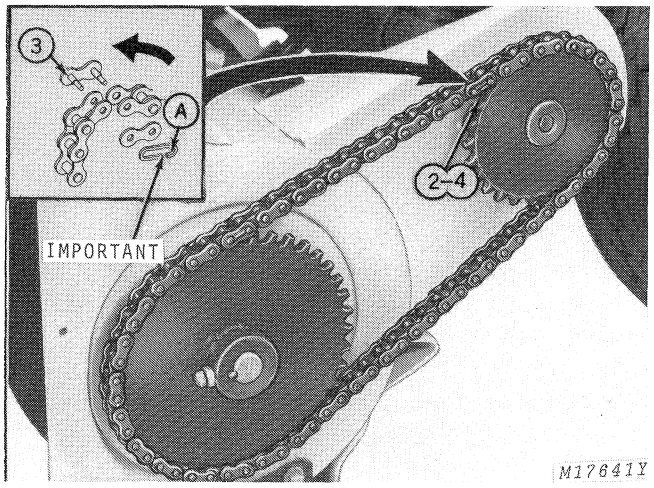


Fig. 4-Replacing Drive Chain

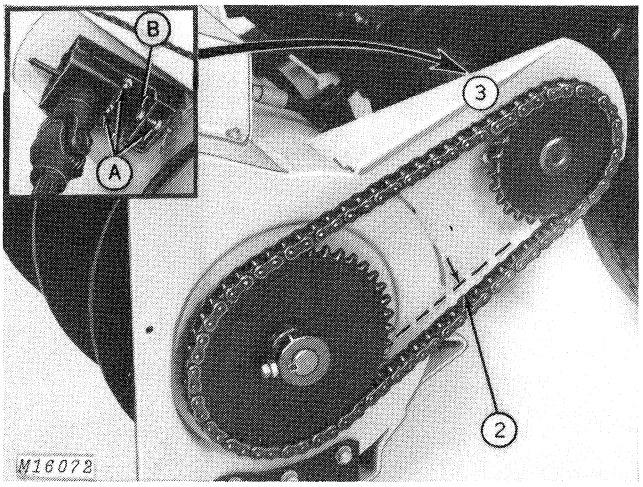
2. Disconnect coupler link and remove drive chain, Fig. 4.

3. Install drive chain around sprockets and connect chain with coupler link.

IMPORTANT: Be sure spring clip (A) is installed so closed end of clip is facing direction of chain travel.

4. Adjust chain tension as explained under Fig. 5.

ADJUSTING ROTOR DRIVE CHAIN TENSION



A—Nuts **B—Adjusting Bolt**

Fig. 5-Adjusting Drive Chain Tension

1. Remove drive chain shield as explained under Fig. 3.

2. Lift lower part of chain upward between the two sprockets. Deflection should be 3/16 to 1/2 inch (4.77 mm to 12.70 mm).

3. To adjust tension, loosen nuts (A), Fig. 5, and turn adjusting bolt (B). Tighten nuts (A) after adjusting chain to proper tension.

4. Reinstall drive chain shield, Fig. 3.

Installing Gear Case

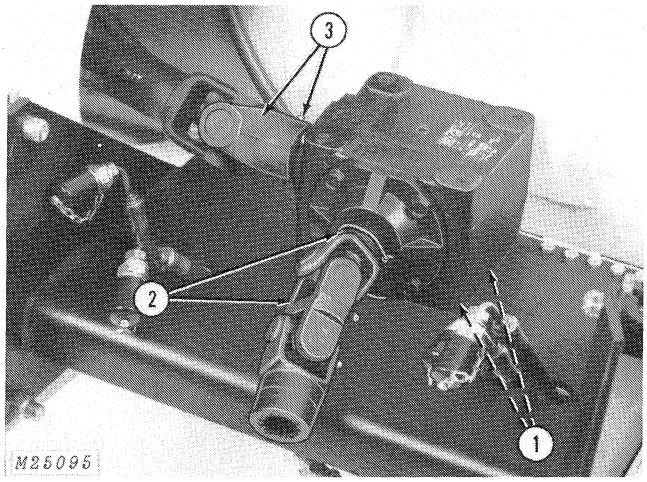


Fig. 33-Installing Gear Case

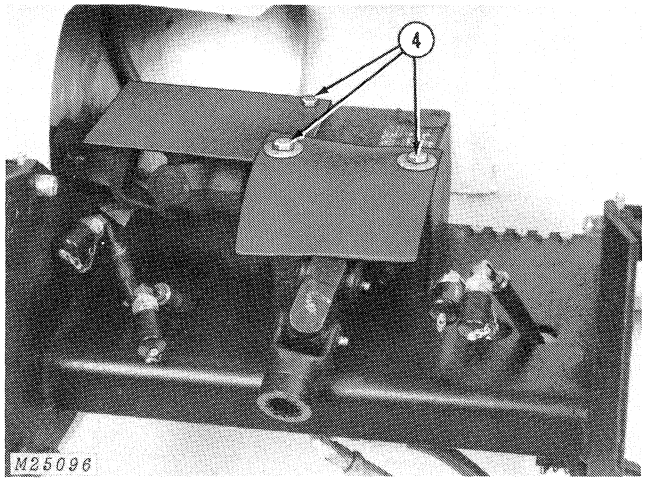


Fig. 34-Installing Guards

1. Attach gear case to mounting bracket with four cap screws, Fig. 33.

2. Attach drive coupler to gear case shaft with spring pin. Insert a piece of wire through spring pin and twist ends of wire.

3. Attach drive shaft to gear case shaft with spring pin. Insert a piece of wire through spring pin and twist ends of wire.

4. Install guards, Fig. 34, with three cap screws and washers.

5. Reinstall snow thrower on tractor.

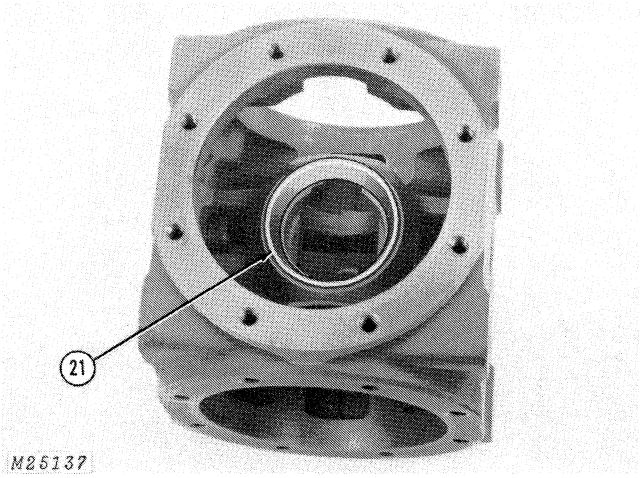


Fig. 14-Removing Bearing Cup From Gear Case Housing

21. Remove bearing cup from housing using a slide hammer puller, Fig. 14.

Assembling Chain Case

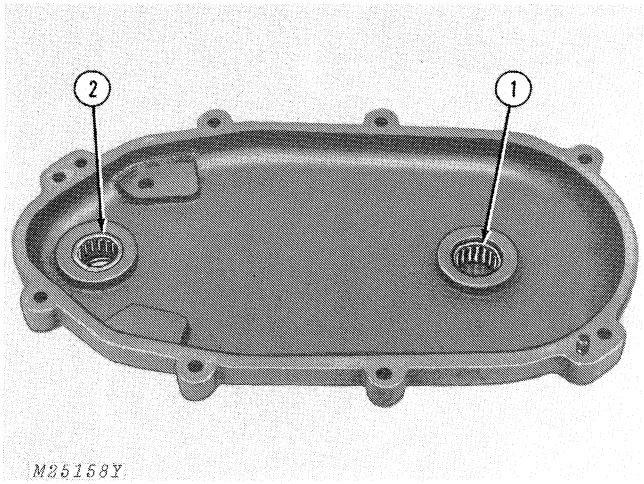


Fig. 35-Installing Bearings in Case Half

1. Press open end bearing into case half, Fig. 35.

2. Press closed end bearing into case half.

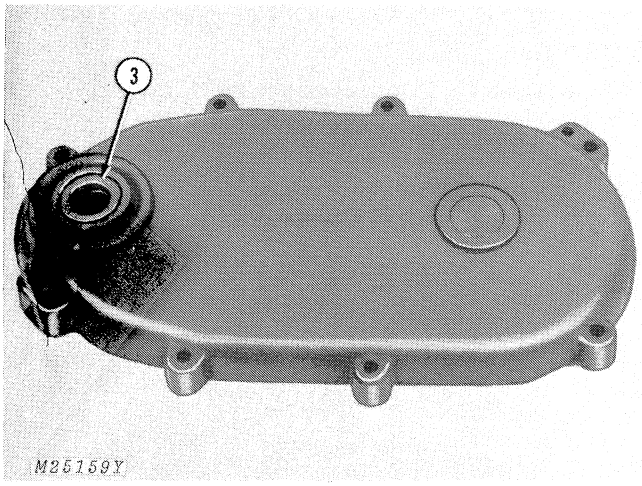


Fig. 36-Installing Oil Seal in Case Half

3. Apply Permatex to cage surface of seal and press seal into case, Fig. 36.

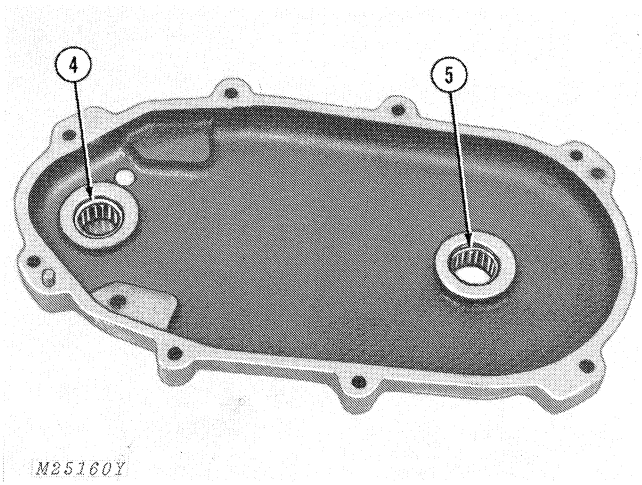


Fig. 37-Installing Bearings in Case Half

4. Press closed end bearing into case half, Fig. 37.

5. Press open end bearing into case half.

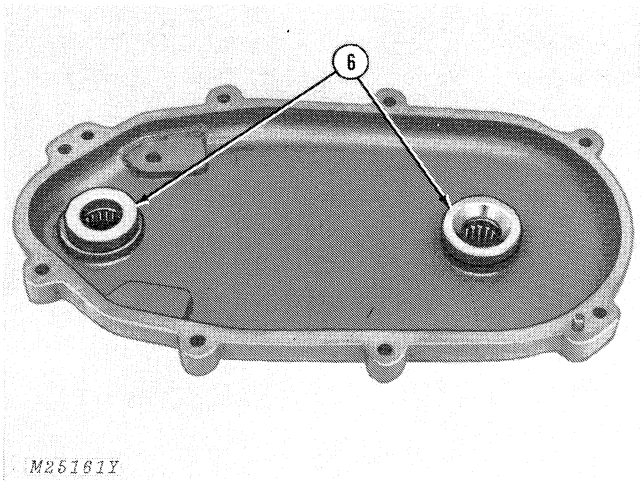


Fig. 38-Placing Spacers in Case Half

6. Place plain flat spacer in lower part of case half and machined spacer in top part of case half. Be sure machined surface on spacer is facing inward as shown in Fig. 38.