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**9000 SERIES**  
**GROUND MAINTENANCE TRACTORS**  
**SERVICE MANUAL**

FORM NO. 31456 (5/79)

PRICE \$5.00  
PRINTED IN USA

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## 1.0 General Information

### 1.1 Warnings for Doing Service in a Safe Way

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**NOTE:** This warning symbol  indicates that there is danger to persons or equipment. Read these warnings carefully and follow them.

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Using this equipment in the wrong way can cause injury to persons and damage to the equipment. Persons doing maintenance on this equipment must read this Service Manual and follow the instructions in it.

It is important to understand that the warnings in this Shop Manual and any other Gravely instruction book do not list every possible danger. It is not possible for Gravely to know and tell the person doing service on the equipment all the dangers.

The dealer must give these instructions to the person operating and doing service on this equipment. The dealer must get the operator and person doing maintenance on this equipment to use eye and foot protection.

Any person doing maintenance on the equipment must follow these safety rules:

1. Use a hoist to lift the heavy parts.
2. Put stands under the tractor when working on it.
3. Use caution with gasoline. Gasoline is very flammable. Keep gasoline away from fire or hot items.
4. Never put gasoline in the fuel tank while the engine is running or when it is hot. Clean any gasoline leakage before starting the engine.
5. Never run the engine inside a building. Exhaust fumes are dangerous.
6. Always disconnect the battery cables when working on the electrical system.

## **1.2 Tools and Equipment Needed to do Service**

### **1.2.1 Hand Tools**

Box and open-end wrenches: inch sizes (ASA Standards)

Ratchet

Extensions

Sockets: inch sizes (ASA Standards)

Punches

Plastic hammer

Ball peen hammer

Grease gun

Snap ring pliers

Torque wrench (150 foot-pounds)

Ignition wrenches: metric sizes

Deep well socket (for spark plugs)

Pliers

Puller

Strap wrench (to remove filter)

Magnet

Hex wrenches ( $\frac{1}{4}$ " to  $1\frac{1}{4}$ " )

Side cutter pliers

Visè grip pliers

### **1.2.2 Measuring Tools and Gauges**

One inch, two inch, and three inch outside diameter micrometers

One inch, two inch, and three inch inside diameter (telescopic) micrometers

Zero to three inch depth micrometer

Six inch calipers

Dial indicator

Pressure gauge (zero to 4000 psi)

Feeler gauges

### **1.2.3 Lift Equipment**

Hydraulic floor jack (1 ton)

Stands

Hoist (1/2 ton)

Chain

### **1.2.4 Other Materials**

Lubricants:

Engine:

Grade . . . . . API Service SC

Viscosity . . . SAE 10W-40 above 0°F (-17°C)

. . . SAE 5W-20 below 0°F (-17°C)

Transmission Lubricant:

Mobil 423 Fluid

Gulf Universal Tractor Fluid

Amoco 1000

Citgo Tractor Hydraulic Fluid

Conoco Power Tran II

Exxon Troque Fluid 56

Union Hydraulic Tractor Fluid

Shell Donax T-4

Pennzoil Hydratranz

Ashland Valvoline Unitrac or

equivalent.

Anti-freeze

Safety solvent: Loctite No. 7S559

Adhesive: Loctite No. 601, Loctite No. 277

Gasket sealant: Loctite No. 277, Plastic-Gasket

Multi-purpose Grease

Degreaser: Intex Degreaser, Sprayon Engine and General Purpose Degreaser

### 1.3 Tractor Specifications and Capacities

#### Engine:

Manufacturer of Engine .....	Continental
Model of Engine .....	R 800-46
Number of Cylinders .....	4
Horsepower Rating @ 3200 RPM .....	26
Gap for the Points of the Distributor .....	0.018" (0.4572 mm)
Gap for the Spark Plugs .....	0.025" (0.635 mm)
Capacity of Crankcase .....	2.75 U.S. Quarts (2.61 liters) Add 1/2 U.S. Pint (.24 liter) when replacing filter

#### Transmission:

Type .....	Sliding Gear
Number of Speeds: Forward .....	8
Number of Speeds: Reverse .....	4
Speed of PTO .....	Front - 1893 RPM at 3200 Engine RPM Rear - 540 RPM at 3200 Engine RPM
Capacity of Transmission Case .....	10 U.S. Quarts (9.5 liters)

#### Electric:

Battery .....	Delco 12 Volt Maintenance-Free (F-22 Case)
Headlights .....	35 Watt 12 Volt Sealed Beam No. 441
Fuse .....	Buss AGC 30
Fuse for Temperature Gauge .....	Buss SFE 14

#### General:

Capacity of Fuel Tank .....	7 U.S. Gallons (26.5 liters)
Type of Fuel .....	86 Octane or Higher (regular grade)

#### Tires:

Front .....	20 x 8-10
Rear .....	29 x 12-15
Tire Pressure .....	20 psi, Front and Rear (1.406 kg/sq cm)

#### Dimensions:

Length .....	90.5" (2.3 m)
Height .....	48.5" (1.2 m)
Width .....	44" (1.1 m)
Turning Radius (Inside Dimension) .....	2.83 ft. (.86 m) Minimum

**Transmission:**

<b>Approximate Ground Speeds at 3200 Engine RPM</b>			
<b>Gear</b>	<b>Range</b>	<b>Forward</b>	<b>Reverse</b>
1st	LO	.54 mph (.9 kph)	1.27 mph (2.00 kph)
2nd	LO	.85 mph (1.4 kph)	1.92 mph (3.1 kph)
3rd	LO	1.21 mph (2.00 kph)	2.90 mph (4.7 kph)
4th	LO	1.92 mph (3.1 kph)	4.34 mph (7.00 kph)
1st	HI	2.77 mph (4.5 kph)	1.27 mph (2.00 kph)
2nd	HI	4.34 mph (7.00 kph)	1.92 mph (3.1 kph)
3rd	HI	6.19 mph (10.00 kph)	2.90 mph (4.7 kph)
4th	HI	9.69 mph (15.6 kph)	4.34 mph (7.00 kph)

**Bolt Torque Specifications:**

<b>BOLT SIZE</b>	<b>FOOT POUNDS (ft. lbs.)</b>	<b>NEWTON METERS (N.m)</b>
1/4"	7	9.5
5/16"	14	19
3/8"	25	34
7/16"	40	54
1/2"	60	82
9/16"	83	113
5/8"	120	163
3/4"	200	271

## 2.0 How to Lubricate the Tractor for Normal Maintenance

The most important procedure in maintenance of the tractor is to apply lubricant. Correct use of lubricant decreases the cost of repairs and increases the life of the tractor. **Use only the lubricants shown in this section.** Apply lubricants at the intervals of time shown in the Tractor Maintenance Schedule (Figure 2.0-1).

The maintenance items are shown in the left columns of the Maintenance Schedule. The correct time interval for each maintenance item is shown by the mark (X) in the daily, 40 hours, 100 hours, 250 hours, and 500 hours columns. Do each maintenance item at the correct time interval.

If the equipment is operated in dirty conditions or is operated at high temperatures, **maintenance must be done more frequently** than the time intervals on the Tractor Maintenance Schedule.

### Tractor Maintenance Schedule

Maintenance Items	Location	Time Intervals for Maintenance					
		Daily	40 Hours	100 Hours	250 Hours	500 Hours	1000 Hours
1. Check the Level of the Lubricant in the Engine	Section 2	X					
2. Check the Level of the Lubricant in the Transmission	Section 2	X					
3. Check the Level of the Cooling Fluid in the Radiator	Section 3	X					
4. Check the Radiator Screen and Clean the Radiator Core	Section 3	X					
5. Check the Air Pressure in the Tires	Section 1	X					
6. Check the Air Cleaner Bulb	Section 3	X					
7. Check the Engine Lubricant Pressure	Section 2	X					
8. *Change the Transmission Lubricant and Replace the Filter	Section 2						X
9. Change the Engine Lubricant and Replace the Lubricant Filter	Section 2		X				
10. Check the Level of the Electrolyte in the Battery (The battery is sealed)	Section 4		X				
11. Check the Tension of the Water Pump Fan Belt	Section 3		X				
12. Check the Tension of the Governor Belt	Section 3		X				
13. Check the Tension of the Alternator Belt	Section 3		X				
14. Check the Air Cleaner Element	Section 3		X				
15. Apply Lubricant to the Chassis	Section 2		X				
16. Adjust the Forward or the Reverse Clutch	Section 9			X			
17. Adjust the Clutch for the Front PTO	Section 9			X			
18. Adjust the Clutch for the Rear PTO	Section 9			X			
19. Check the Level of the Lubricant in the Governor	Section 2			X			
20. Adjust the Brakes	Section 6			X			
21. Add Lubricant to the Ends of the Governor Throttle Rod	Section 2				X		
22. Clean the Distributor and Apply Lubricant to the Distributor Cam	Engine Book				X		
23. Adjust the Distributor	Engine Book				X		
24. Change the Air Cleaner Element	Section 3				X		
25. Clean and Tighten the Battery Terminals	Section 4				X		
26. Adjust the Clearance for the Valve Tappets	Engine Book					X	
27. Check the Cooling System	Section 3					X	
28. Check the Front Wheel Alignment	Section 5					X	
29. Apply Lubricant to the Front Wheel Bearings	Section 2					X	

\*Change the transmission lubricant filter after the first 10 hours and then every 1000 hours or once a year.

Figure 2.0-1



## 2.1 Lubricant Specifications

The use of correct lubricants is important. Using the wrong lubricant can cause tractor failure. Use only clean lubricants. Storage of the lubricants must be in clean containers in a clean, dry, and cool location.

### 2.1.1 Engine Lubricants

Use engine lubricants that meet the API Service SC, SD, or SE specifications. Correct lubricant viscosities are shown in Figure 2.0-2.

Air Temperature	Viscosity
Above 0 °F (-17 °C)	SAE 10W-40
Below 0 °F (-17 °C)	SAE 5W-20

Figure 2.0-2

### 2.1.2 Transmission Lubricants

Use any of the following transmission lubricants or an equivalent lubricant:

Mobil 423 Fluid	Exxon Torque Fluid 56
Gulf Universal Tractor Fluid	Union Hydraulic Tractor Fluid
Amoco 1000	Shell Donax T-4
Citgo Tractor Hydraulic Fluid	Pennzoil Hydratranz
Conoco Power Tran II	Ashland Valvoline Unitrac

### 2.1.3 Chassis Lubricants

Use a multi-purpose grease for all grease fittings and for the front wheel bearings.

## 2.2 How to Lubricate the Engine

### 2.2.1 Engine Lubricant Capacities

The engine lubricant capacity is 2.75 U.S. quarts (2.61 liters). Add an additional 1.5 U.S. pint (.24 liter) when the filter is changed.

### 2.2.2 How to Check the Level of the Lubricant in the Engine

1. Stop the engine. Engage the parking brake. Give the oil time to drain from the top.
2. Clean the area around the dipstick (A, Figure 2.0-3) and around the tube (B).



A. Dipstick  
B. Tube

Figure 2.0-3

3. Remove the dipstick.
4. Clean the dipstick.
5. Push the dipstick all the way down into the tube.
6. Pull the dipstick out of the tube and look at the level of the lubricant on the dipstick. See Figure 2.0-4.

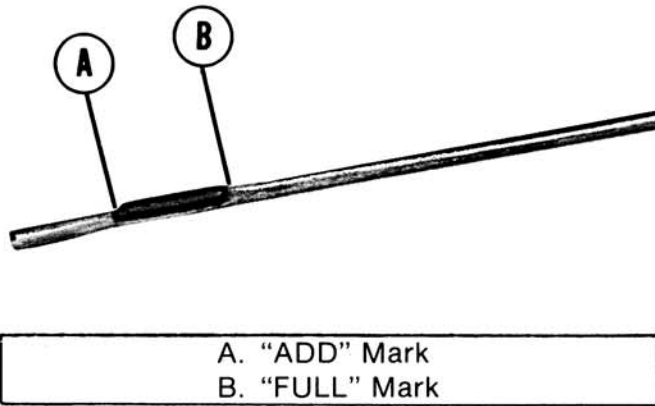
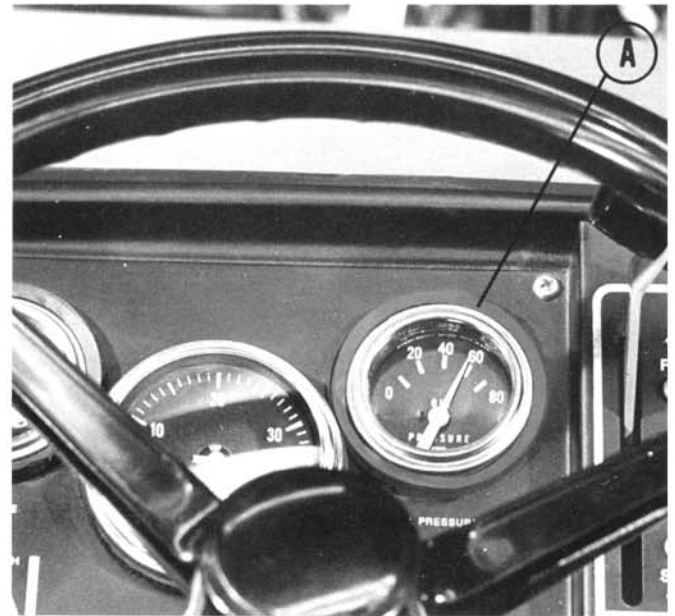


Figure 2.0-4

7. The level of engine lubricant must be on the flat section of the dipstick between the "ADD" mark (A, Figure 2.0-4) and the "FULL" mark (B).
8. Add more lubricant if the level of the engine lubricant is below the "ADD" mark. Do not overfill it. Check the level again by repeating items 3, 4, 5, 6, and 7.
9. Push the dipstick all the way down into the tube.

### 2.2.3 How to Check the Engine Lubricant System Pressure

1. After the engine is started for the first time each day, check the Lubricant Pressure Gauge (A, Figure 2.0-5).



A: Lubricant Pressure Gauge

Figure 2.0-5

2. The reading on the gauge must be between the limits shown in Figure 2.0-6.

Position of Throttle	Reading on Lubricant Pressure Gauge
"SLOW"	5-15 psi
"FAST"	40-60 psi

Figure 2.0-6

**NOTE: Readings higher or lower than these limits can cause problems in the engine.**

3. **Stop the engine immediately** if the reading is not between these limits. Correct the problem before starting the engine. See the Engine Overhaul Manual.

4. Check the lubricant pressure gauge frequently when operating the tractor. Stop the engine **immediately** if the reading is not between 40 psi and 60 psi. Correct the problem before starting the engine again.

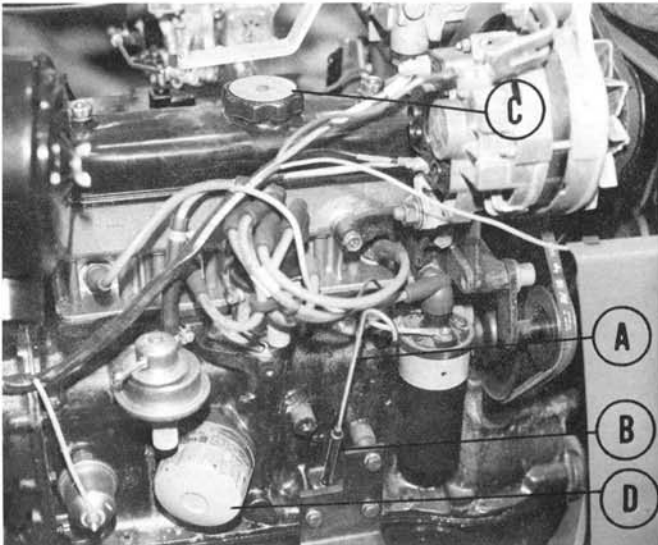
### 2.2.4 How to Change the Engine Lubricant and Replace the Lubricant Filter

1. Stop the engine. Engage the parking brake.
  - a. If the engine is warm, stop the engine.
  - b. If the engine is cold, let it run five minutes at slow RPM.

2. Open the hood.

**! WARNING: The engine muffler and other engine parts are hot.**

3. Clean the area around the dipstick, the tube, the lubricant filter, the fill cap, and the drain plug.

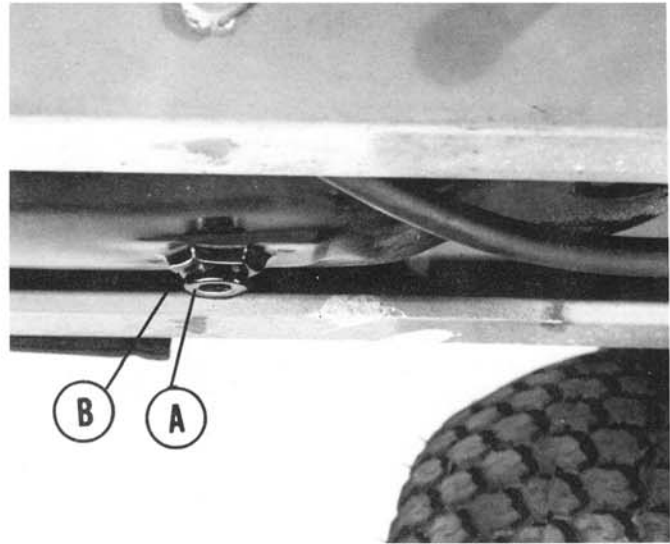


- |   |
|---|
| <p>A. Dipstick<br/>         B. Tube<br/>         C. Fill Cap<br/>         D. Lubricant Filter</p> |
|---|

Figure 2.0-7

**NOTE: Keep any dirt out of the engine.**

4. Put the dipstick in a clean area.
5. Turn the fill cap counterclockwise and remove it. Put the cap in a clean area.



- |   |
|---|
| <p>A. Drain Plug<br/>         B. Gasket</p> |
|---|

Figure 2.0-8

6. Put a 4 U.S. quart (4 liter) container under the drain plug.
7. Turn the drain plug counterclockwise and remove it.
8. Drain out all the old oil lubricant.
9. Remove the old gasket (B) from the drain plug. Destroy the old gasket.
10. Clean the drain plug and install a new gasket.
11. Install the drain plug.
12. Turn the lubricant filter counterclockwise and remove it. Also, remove the old gasket. Destroy the old lubricant filter and the old gasket.
13. Use a cloth to clean around the location of the lubricant filter.
14. Make sure the new lubricant filter (A, Figure 2.0-9) has a new gasket in the groove.



A. Lubricant Filter  
B. Gasket

Figure 2.0-9

15. Apply clean engine lubricant to the new gasket.
16. Install the new lubricant filter (turn clockwise).

17. Tighten the new lubricant filter with your hand.
  18. Fill the engine with 3 U.S. quarts (2.85 liters) of the new engine lubricant. Put the lubricant in the engine lubricant fill cap hole (C, Figure 2.0-7).
  19. Install the lubricant fill cap. Turn the cap clockwise.
  20. Push the dipstick all the way down into the tube. Check the engine lubricant level.
  21. Use a cloth to clean any lubricant on the engine or the floor.
  22. Start the engine. Check the engine lubricant pressure at the oil pressure gauge. See Section 2.2.3, "How to Check the Engine Lubricant System Pressure".
  23. Look for leakage of lubricant around the lubricant filter and around the drain plug. If there is leakage, tighten these items.
  24. Stop the engine. Check the level of lubricant in the engine. See Section 2.2.2, "How to Check the Level of Lubricant in the Engine." Add more lubricant, if needed.
  25. Close the hood.
- \*Make sure the valve cover nuts are tight. Tighten them with fingers only.

## 2.3 How to Lubricate the Transmission

### 2.3.1 How to Check the Level of Lubricant in the Transmission

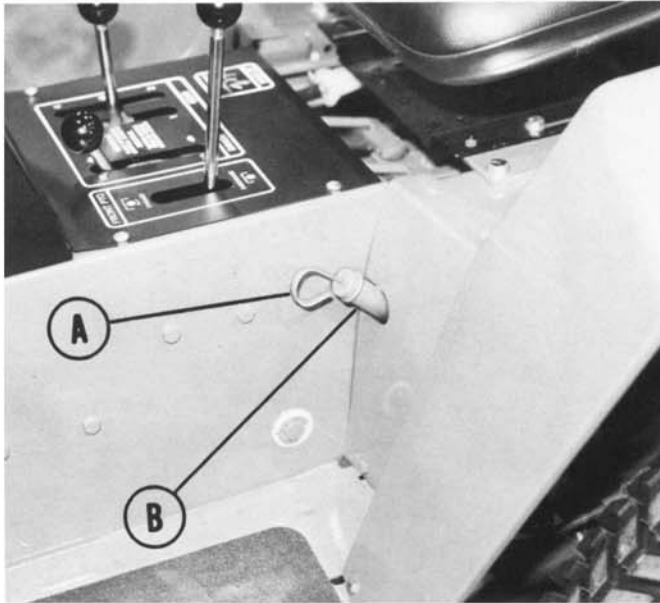
Capacity:	10 U.S. quarts (9.5 liters)		
Type of Lubricant:	Mobil 423 Fluid Gulf Universal Tractor Fluid Amoco 1000 Citgo Tractor Hydraulic Fluid Conoco Power Tran II	Exxon Torque Fluid 56 Union Hydraulic Tractor Fluid Shell Donax T-4 Pennzoil Hydratranz Ashland Valvoline Unitrac	
Intervals for Maintenance:	Daily	First 10 hours	1000 hours
	Check level	Change filter	Change filter and lubricant

Figure 2.0-10

The transmission lubricant is also the hydraulic fluid. Because of small clearances in the hydraulic system, it is important to keep the transmission lubricant clean.

To check the transmission lubricant level, follow this procedure:

1. Stop the engine. Engage the parking brake.
2. Clean the area around the dipstick (A, Figure 2.0-11) and around the tube (B).



A. Dipstick  
B. Tube

Figure 2.0-11

3. Pull the dipstick (A) out of the tube (B).
4. Clean the dipstick.
5. Push the dipstick all the way down into the tube.
6. Pull the dipstick out of the tube. Look at the level of the lubricant on the dipstick.

7. The level of transmission lubricant must be between the "FULL" mark (A, Figure 2.0-12) and the "ADD ONE QUART" mark (B).

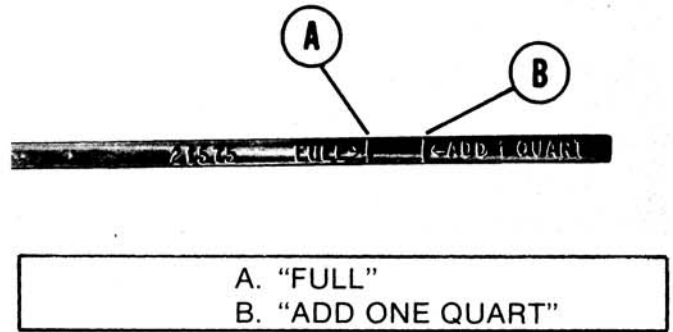


Figure 2.0-12

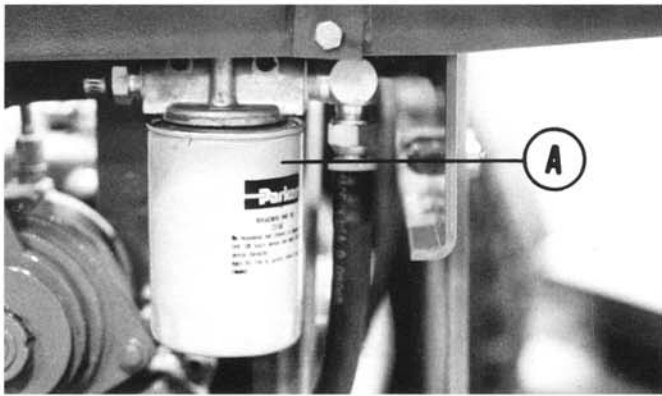
8. Add more transmission lubricant if the level is at or below the "ADD ONE QUART" mark. Put the oil in the tube.
9. Push the dipstick down into the tube.

### 2.3.2 How to Change the Transmission Lubricant and Replace the Filter

1. Stop the engine. Engage the parking brake.

**WARNING:** The exhaust pipe is hot.

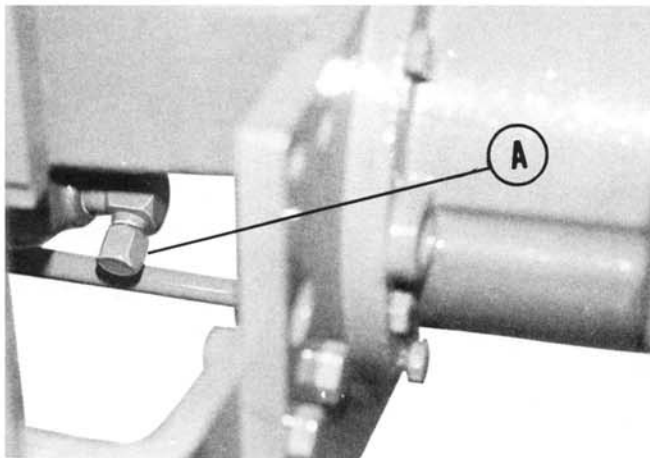
2. Clean the area around the dipstick (A, Figure 2.0-11) and around the tube (B).
3. Pull the dipstick out of the tube. Put the dipstick in a clean area.
4. Clean the area around the filter for the transmission lubricant (A, Figure 2.0-13).



A. Filter

Figure 2.0-13

5. Turn the filter counterclockwise and remove it. Destroy the old filter and the gasket.
6. Clean the area around the cap and the fitting at the bottom of the transmission (A, Figure 2.0-14).



A. Cap

Figure 2.0-14

7. Put a 14 U.S. quart (13.2 liter) container under the cap.
8. Turn the cap counterclockwise and remove it. Put the cap in a clean area.
9. Drain all the old transmission lubricant.
10. Install the cap (turn clockwise).
11. Clean the area around the filter.
12. Make sure the new filter for the transmission lubricant (A, Figure 2.0-15) has a new gasket (B) in the groove.



A. Filter

B. Gasket

Figure 2.0-15

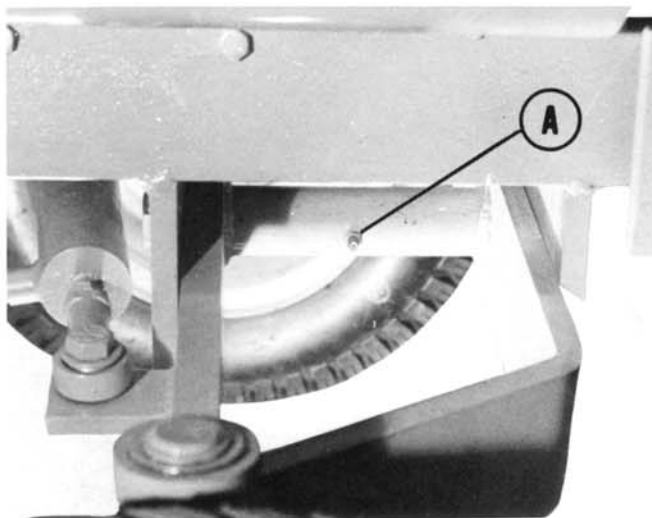
13. Apply clean transmission lubricant to the new gasket.
14. Install the new filter.
15. Tighten the filter by hand.
16. Fill the transmission through the dipstick tube with 8 U.S. quarts (9.5 liters) of new transmission lubricant (B, Figure 2.0-11). Check the fluid level and add transmission lubricant until it is up to the full mark on the dipstick.
17. Push the dipstick down into the tube.
18. Clean any transmission lubricant from the tractor or from the floor.
19. Start the engine. Push the throttle to the "FAST" position. Operate the hydraulic controls.

20. Pull the throttle to the "SLOW" position.
21. Look for any leakage of transmission lubricant around the filter and around the cap. If there is leakage, tighten the filter and/or the cap.
22. Stop the engine. Check the level of the transmission lubricant. See Section 2.3.1, "How to Check the Level of the Lubricant in the Transmission." Add more transmission lubricant, if necessary.

#### 2.4 How to Lubricate the Chassis, the Governor, and the Front Wheel Bearings

Type of Lubricant:	Multi-purpose Grease
Interval of Service:	40 hours

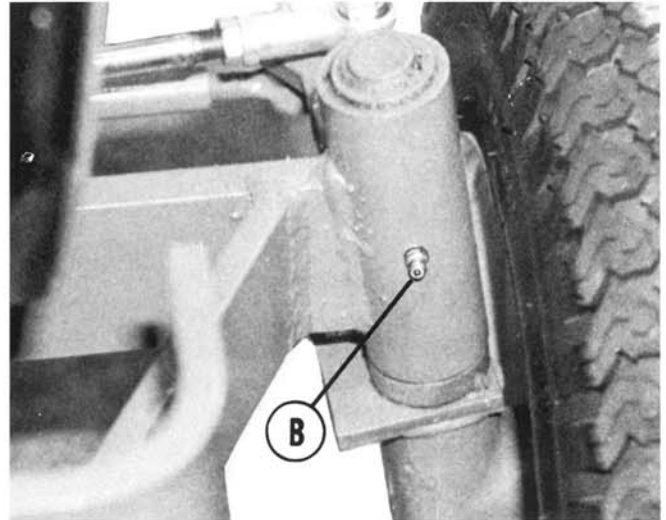
1. Stop the engine. Engage the parking brake.
2. Clean the grease fittings and the area around the grease fittings.
3. Put the multi-purpose grease in a grease fitting until it shows at the ends of the bearings.
4. The fittings to which lubrication must be added are:
  - a. The fitting for the front axle -- one fitting (Figure 2.0-16).



A. Front Axle

Figure 2.0-16

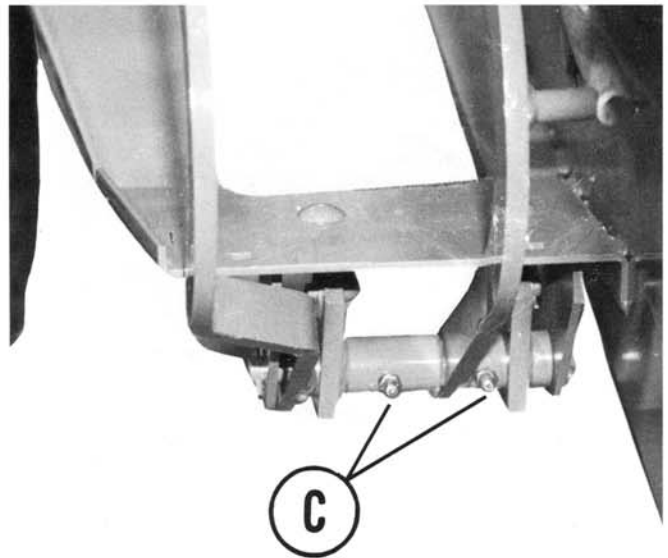
- b. The fittings for the left and the right kingpin -- two fittings (Figure 2.0-17).



B. Kingpins

Figure 2.0-17

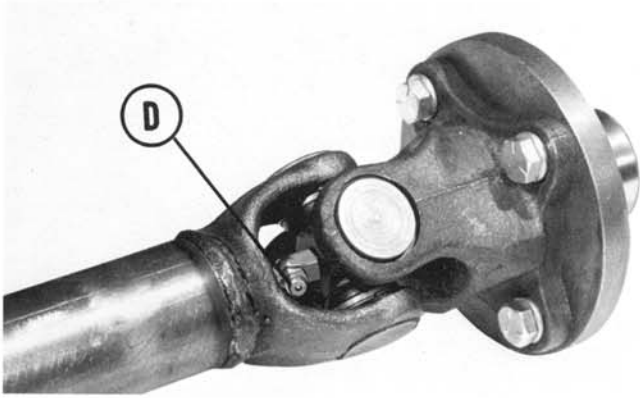
- c. The fittings for the brake pedals -- two fittings (Figure 2.0-18).



C. Brake Pedals

Figure 2.0-18

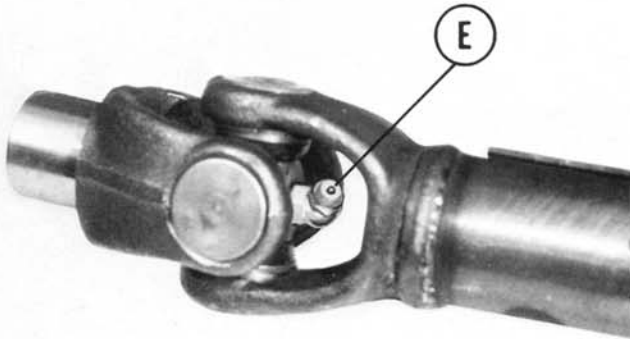
- d. The front end of the propeller shaft -- one fitting (Figure 2.0-19).



D. Propeller Shaft

Figure 2.0-19

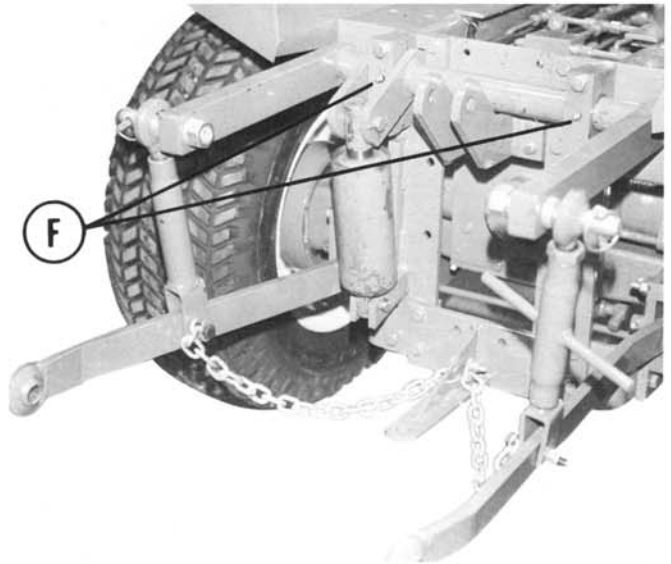
e. The rear end of the propeller shaft -- one fitting (Figure 2.0-20).



E. Propeller Shaft

Figure 2.0-20

f. The pillow block bearings for the three-point hitch (optional equipment) -- two items (Figure 2.0-21).



F. Pillow Block Bearings

Figure 2.0-21

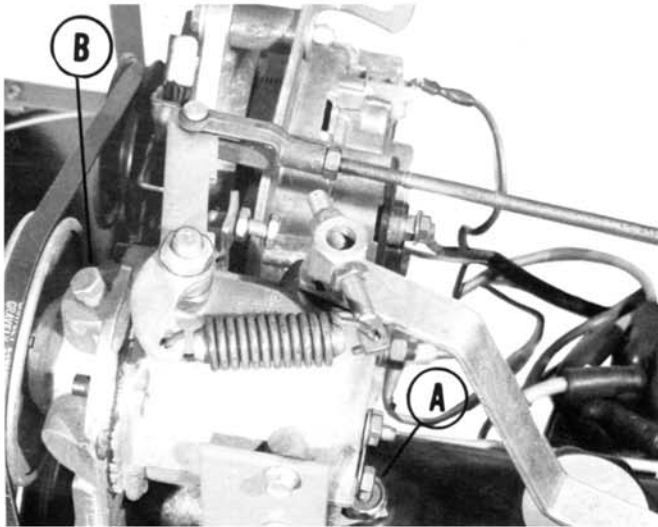
### 2.4.1 How to Check the Level of Lubricant in the Governor

Items:	Level of the Lubricant in the Governor, Governor Linkage
Types of Lubricant:	Engine Lubricant
Intervals for Maintenance:	100 hours--Check the Level --Add Lubricant to the Linkage

Figure 2.0-22



1. Stop the engine. Engage the parking brake.
2. Open the hood.
3. Clean the area around the check plug (A, Figure 2.0-23) and around the fill plug (B).



A. Check Plug  
B. Fill Plug

Figure 2.0-23

**NOTE: Do not add lubricant with the check plug installed.**

4. Turn the check plug (A) counterclockwise and remove it.

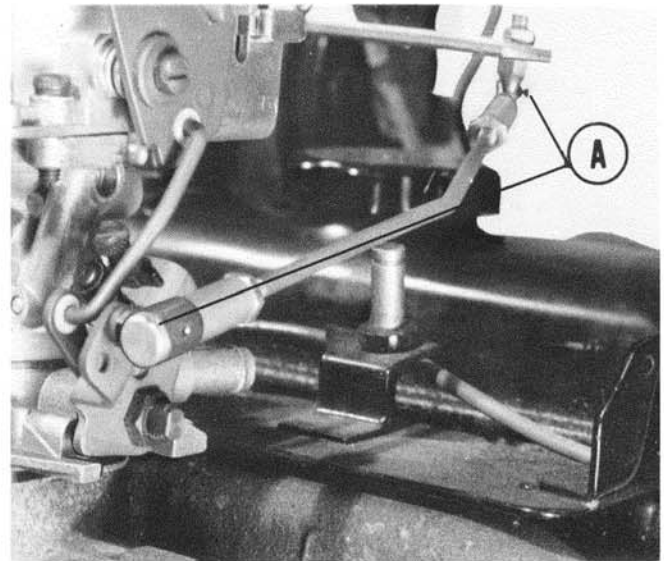
The level of the lubricant for the governor is correct if the lubricant comes out of the check plug hole. If the level is correct, go the step 7. If the lubricant **does not** come out from the check plug hole, the level is low. Continue with steps 5, 6, 7, 8, and 9.

5. Turn the fill plug (B) counterclockwise and remove it.
6. Add engine lubricant slowly into the hole. Stop adding lubricant when the lubricant comes out the check plug hole (A).

7. Install the check plug. Turn the plug clockwise.
8. Install the fill plug. Turn the plug clockwise.
9. Close the hood.

#### 2.4.2 How to Lubricate the Governor Linkage

1. Stop the engine. Engage the parking brake.
2. Open the hood.
3. Clean the area around the ends of the throttle rod (A, Figure 2.0-24).



A. Throttle Rod

Figure 2.0-24

4. Put one or two drops of engine lubricant on the ball joint at each end of the throttle rod.
5. Close the hood.

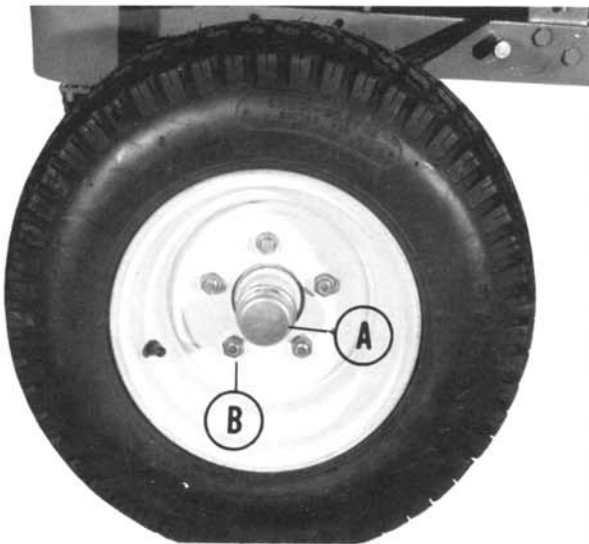
### 2.4.3 How to Remove the Front Wheel Bearings and Apply Lubricant

Type of Lubricant:	Multi-purpose Grease
Degreaser:	Intex Degreaser, Sprayon Engine and General Purpose Degreaser
Intervals for Maintenance:	500 Hours

Figure 2.0-25

**NOTE: If the tractor is run with the bearings for the front wheel under water, the bearings must be cleaned and lubricated immediately after they are removed from the water.**

1. Stop the engine. Engage the parking brake.
2. Put blocks on the ground to the front of the rear tires and to the rear of the rear tires. These blocks must be against the tires to prevent movement of the tractor.
3. Use a jack to lift the front wheels 1 inch (2.5 cm) above the ground.
4. Put stands under the right side and under the left side of the front part of the frame. Remove the jack.
5. Use a snap-on GCP-10 grease cap tool to remove the dust cap (A, Figure 2.0-26).

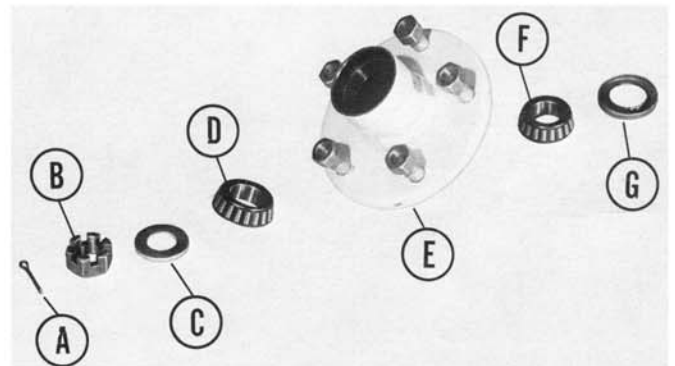


A. Dust Cap  
B. Rim Nuts

Figure 2.0-26

If a grease cap tool is not available, a screwdriver can be used. Follow this procedure:

- a. Put the blade of the screwdriver between the rim of the dust cap and the edge of the hub.
  - b. Hit the screwdriver lightly with a plastic hammer.
  - c. Repeat (a) and (b) at several points around the rim of the dust cap.
  - d. Continue to loosen the dust cap by turning the screwdriver as it is moved around the rim of the dust cap.
  - e. Repeat step (d) until the dust cap can be removed.
6. Remove the five rim nuts (B) and remove the wheel.
  7. Remove the cotter pin (A, Figure 2.0-27).



A. Cotter Pin  
B. Slotted Nut  
C. Washer  
D. Bearing Assembly  
E. Hub  
F. Bearing Assembly  
G. Oil Seal

Figure 2.0-27

8. Remove the slotted nut (B).
9. Remove the washer (C).
10. Remove the bearing assembly (D).
11. Remove the hub (E).

---

**NOTE: The bearing cups (two items) are a tight fit in the hub and are not removed from the hub. If these must be removed because of damage, use a punch and hammer.**

---

12. Remove the oil seal (G).
13. Remove the bearing assembly (F).
14. Clean the bearing cone and cage assemblies in degreaser.
15. Check the bearing cone rollers for damage. Replace them if they are damaged.
16. Clean the bearing cups and the wheel hub with degreaser.
17. Check the bearing assemblies for damage. Replace them if they are damaged.
18. Clean the axle with degreaser.
19. Check the axle for scratches or cracks. Replace the axle if it is scratched or if it has cracks.
20. Put multi-purpose grease on the bearing cone assemblies. Make sure that the bearing cage holding the rollers is full.

#### **2.4.4 How to Assemble the Bearings for the Front Wheels**

1. Install the oil seal as follows:
  - a. Put multi-purpose grease on the lip of the oil seal.
  - b. Put clean engine lubricant on the axle.
  - c. Install the oil seal on the axle with the lip of the seal toward the outer end of the axle.

2. Install the bearing assembly. Put the tapered side toward the outer end of the axle. Make sure the bearing is full of multi-purpose grease.
3. Install the hub. The studs must be toward the outer end of the axle.
4. Install the bearing assembly. Make sure the bearing is full of multi-purpose grease and put the tapered side toward the hub (E).
5. Install the washer.
6. Install the slotted nut.
7. Install the wheel and tighten the five rim nuts.
8. Tighten the slotted nut (6B) as follows:
  - a. Turn the wheel slowly by hand as you tighten the slotted nut.
  - b. Stop tightening the slotted nut when you feel resistance to the turning of the wheel.
  - c. Turn the slotted nut counterclockwise until one of the slots is in alignment with the hole for the cotterpin.
  - d. The wheel must turn freely and there must be no clearance in the bearings.
9. Install the cotter pin.
10. Install the dust cap as follows:
  - a. Put the dust cap in position.
  - b. Put the blade of a screwdriver against the rim of the dust cap.
  - c. Use a plastic hammer to LIGHTLY hit the screwdriver.
  - d. Repeat (b) and (c) at several points around the rim of the dust cap.
  - e. When the dust cap is installed, there should not be any space between the rim of the dust cap and the edge of the hub.
11. Use a jack to lift the front of the tractor.
12. Remove the stands.
13. Lower the tractor and remove the jack.
14. Remove the blocks from the rear wheels

### 3.0 How to Do Engine Service

#### 3.1 Cooling System

Capacity:	8 U.S. Quarts (7.6 liters)
Cooling Fluid:	50% solution of water and anti-freeze (permanent type).
Maintenance Schedule:	Daily -- Check the level of the cooling fluid. -- Clean the radiator screen and the core.  40 Hours -- Check the tension of the fan belt.  500 Hours -- Check the Cooling System.

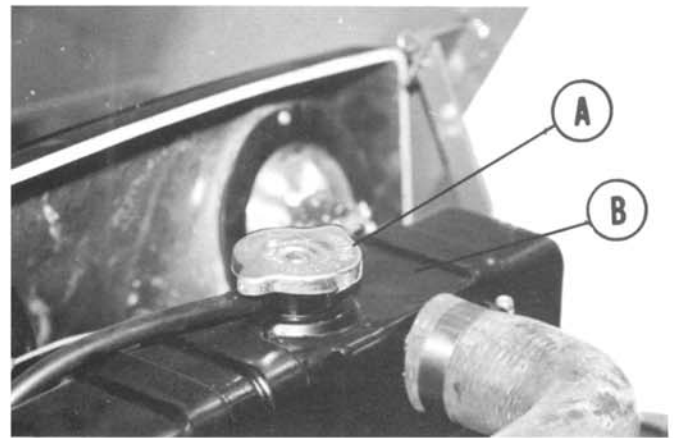
##### 3.1.1 How to Check the Level of the Cooling Fluid

**⚠ WARNING:** The cooling system has pressure when the engine is hot. To remove the radiator cap, use a cloth to cover the radiator cap. Turn the cap one notch counterclockwise to release the pressure slowly. Burns can result if this procedure is not followed.

1. Stop the engine. Engage the parking brake.
2. Open the hood.

**⚠ WARNING:** The radiator and other engine parts are hot.

3. Remove the radiator cap (A, Figure 3.0-1). Use caution when removing the radiator cap.



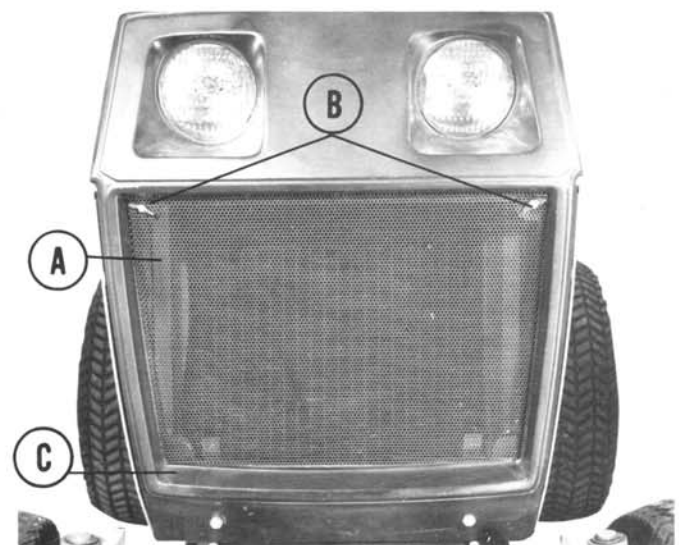
A. Radiator Cap  
B. Top Tank of Radiator

Figure 3.0-1

4. The cooling fluid **MUST** be in the top tank of the radiator. Add the correct cooling fluid, if necessary. **DO NOT ADD WATER ONLY.**
5. Install the radiator cap.
6. Close the hood.

##### 3.1.2 How to Clean the Radiator

1. Use a soft brush to remove debris from the radiator screen (A, Figure 3.0-2).

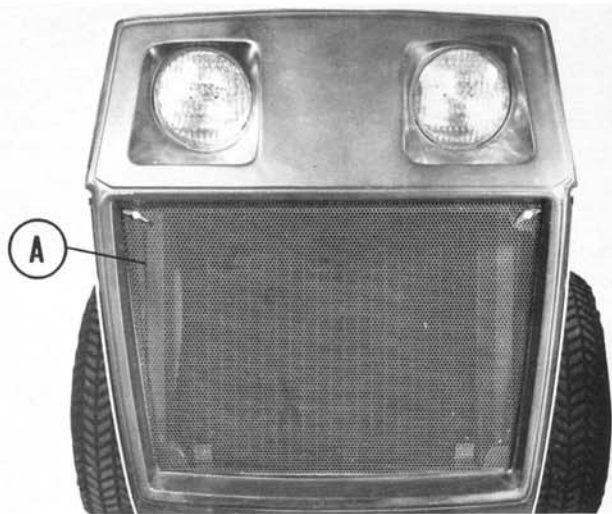


A. Radiator Screen  
B. Wing Nut  
C. Front Grill

Figure 3.0-2

2. Remove the wing nuts (B).
3. Pull the top of the radiator screen (A) and lift it away from the grill (C).
4. Remove any debris from the core of the radiator (A, Figure 3.0-3). Use a soft brush, a hose, and water (or use air) to clean the core.

**NOTE: Be careful -- the radiator core is easily damaged.**



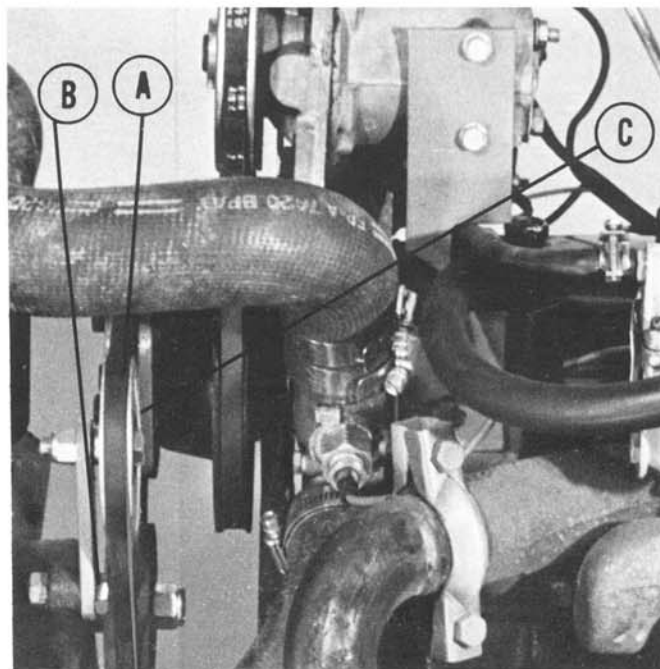
A. Radiator Core

Figure 3.0-3

5. Install the radiator screen.
  - a. Put the clips at the bottom of the screen on the rim of the front grill.
  - b. Push the top of the screen over the studs.
  - c. Install the wing nuts (B, Figure 3.0-2).

### 3.1.3 How to Check the Tension of the Fan Belt

1. Stop the engine. Engage the parking brake.
2. Open the hood.
3. The tension of the fan belt is correct when the belt moves .5 inches (1.27 cm) down when using a force of 10 pounds (4 kg). Push down on the fan belt (A, Figure 3.0-4) at the center between the fan belt pulley (not shown) and the idler (C). Adjust the belt tension, if necessary.



A. Fan Belt  
B. Nut to Adjust Tension  
C. Idler Pulley

Figure 3.0-4

### 3.1.4 How to Adjust the Tension of the Fan Belt

1. Stop the engine. Engage the parking brake.
2. Open the hood.
3. Loosen the nut (B, Figure 3.0-4) one turn.
4. Use a 15 inch bar as a lever to move the idler pulley to tighten or loosen the fan belt.
5. Tighten the nut (B) when the belt has the correct tension.
6. Close the hood.

### 3.1.5 How to Check the Cooling System

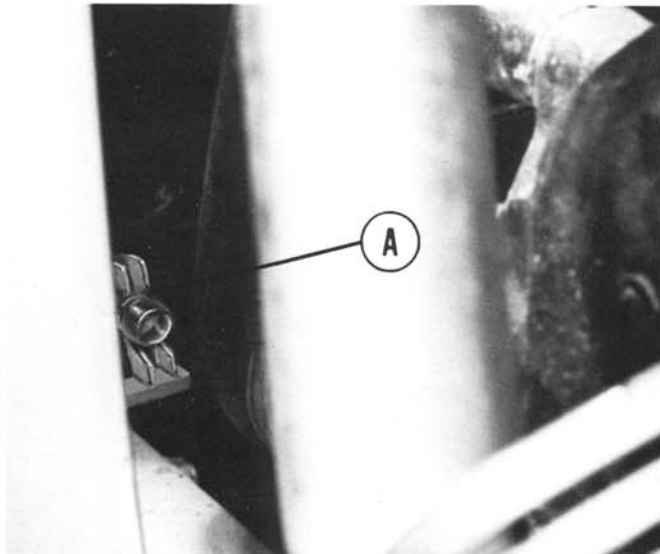
**! WARNING: The radiator and other engine parts are hot.**

1. Open the hood.
2. Check all the connections for the radiator hoses for leaks.

3. Check the radiator hoses for leaks and for any defects.

**WARNING: Use caution when removing the radiator cap.**

4. Remove the radiator cap.
5. Use a hydrometer to check the amount of anti-freeze in the cooling fluid. Add anti-freeze, if necessary.
6. Look at the color of the cooling fluid. A light rust color is normal. If the cooling fluid is normal, go to step 10.
7. If the cooling fluid is a dark rust color, remove the cooling fluid as follows:
  - a. Attach a short piece of flexible hose to the drain valve (A, Figure 3.0-5).



A. Drain Valve

Figure 3.0-5

- b. Put a container under the hose. Make sure that it can hold 3 U.S. gallons (11.40 liters). Remove the radiator cap.
  - c. Open the radiator drain valve (A) and drain all the cooling fluid from the radiator.
  - d. Close the drain valve.
  - e. Fill the radiator with clean water.
8. Flush the radiator as follows:
  - a. Start the engine. Run the engine at idle speed until the thermostat opens. This

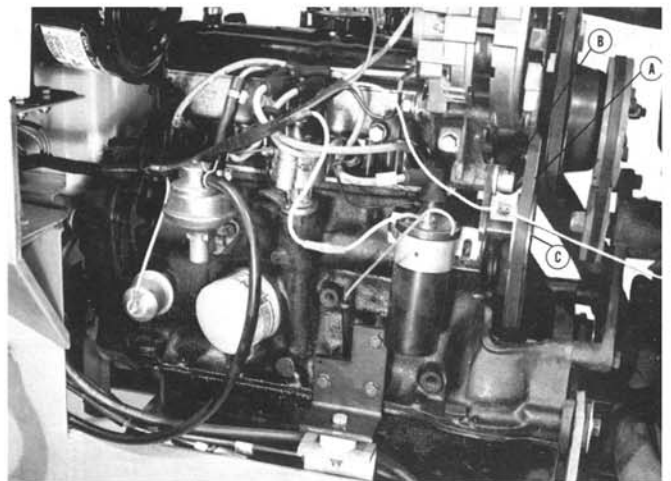
opening will be seen as a fast flow of water in the top tank of the radiator.

**WARNING: Keep hands and tools away from the fan blades and the belts.**

- b. Open the radiator drain valve.
  - c. Add water to the radiator to replace the water coming out at the valve.
  - d. Stop adding water when the water coming out of the valve is clear.
  - e. Stop the engine.
  - f. Close the drain valve.
9. Fill the radiator with a solution of 50% water and 50% anti-freeze.
10. Install the radiator cap. Run the engine and check the level.
11. Close the hood.

### 3.1.6 How to Check the Tension of the Water Pump Belt

1. Stop the engine. Engage the parking brake.
2. Open the hood.
3. The tension of the water pump belt (A, Figure 3.0-6) is correct when the belt moves .5 inches (1.27 cm) down when using a force of 10 pounds (4 kg). Push down on the water pump belt at the center between the water pump sheave (not shown) and the idler pulley (C). Adjust the belt tension, if necessary.



A. Water Pump Belt  
B. Bolt  
C. Idler Pulley

Figure 3.0-6

### 3.1.7 How to Adjust the Tension of the Water Pump Belt

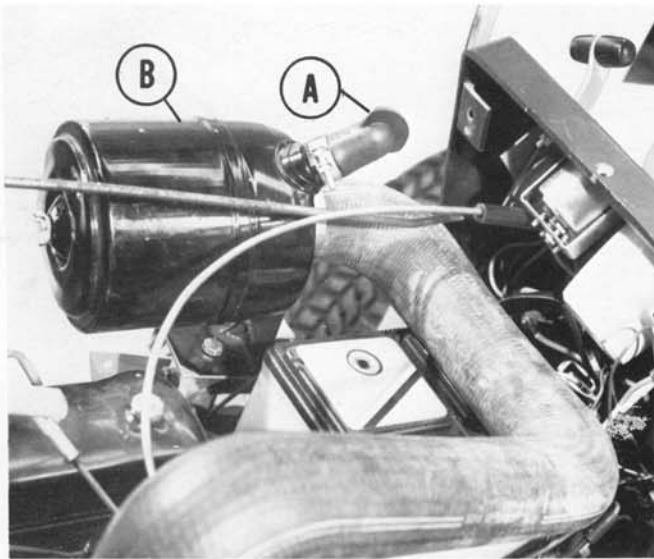
1. Stop the engine. Engage the parking brake.
2. Open the hood.
3. Loosen the bolt (B, Figure 3.0-6) one turn.
4. Use a 15 inch bar as a lever to move the idler pulley (C) to tighten or loosen the water pump belt.
5. Tighten the bolt (B) when the belt has the correct tension.
6. Close the hood.

### 3.2 Air Intake System

Maintenance Schedule:  Daily -- check the bulb 40 Hours -- check the element
---

#### 3.2.1 How to Clean the Air Cleaner Bulb

1. Open the hood.
2. Press the sides of the bulb (A, Figure 3.0-7) by hand to release any dirt.



A. Bulb B. Air Cleaner
---------------------------

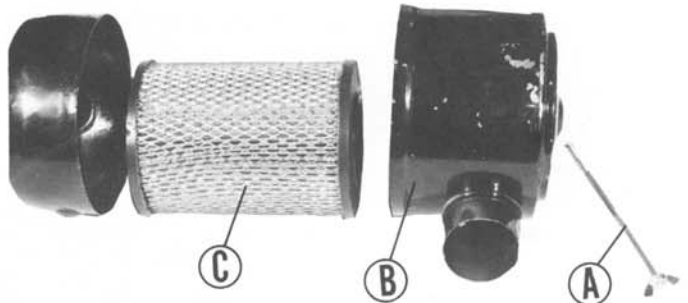
(shown rotated 90° counterclockwise)

Figure 3.0-7

3. Close the hood.

#### 3.2.2 How to Check the Air Cleaner Element

1. Open the hood.
2. Remove the wing nut (A, Figure 3.0-8).



A. Wing Nut B. Air Cleaner Cover C. Air Cleaner Element
---

Figure 3.0-8

3. Remove the air cleaner cover (B).
4. Remove the air cleaner element (C).
5. To clean the air cleaner element, hit the element lightly on a flat surface or wash the element with clean water.

**NOTE: The air cleaner element must be replaced after ten washings, after service of one year, or if it is damaged in any way.**

6. Install the element (C).
7. Install the cover (B).
8. Install the wing nut (A).
9. Inspect the air intake hose connections. Make sure the clamps for the hose are tight.
10. Close the hood.

### 3.3 Governor

Maintenance Schedule:

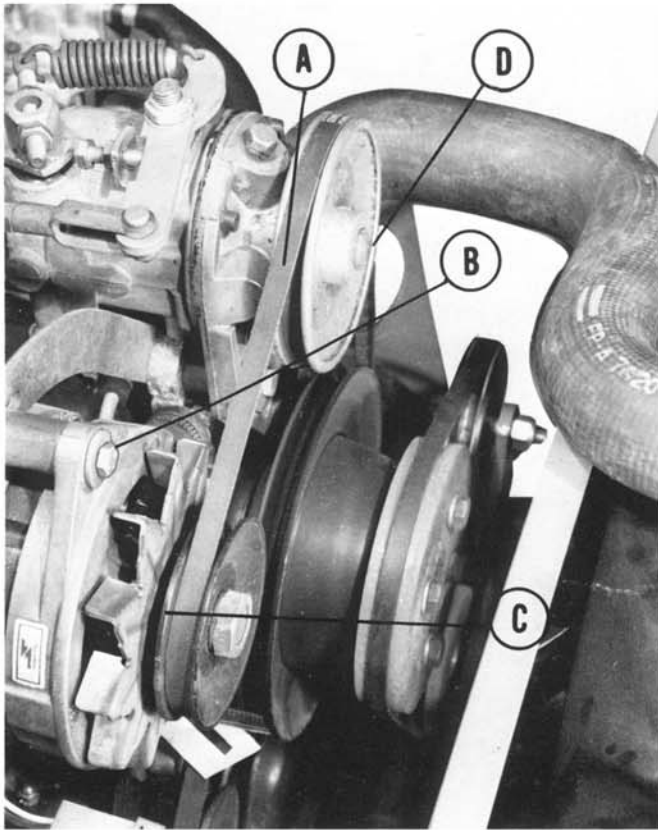
40 Hours -- check the tension of the governor belt

100 Hours -- check the oil

As needed -- adjust the governor

#### 3.3.1 How to Check the Tension of the Governor Belt

1. Stop the engine. Engage the parking brake.
2. Open the hood.
3. The tension of the governor belt is correct when the belt moves .75 inches (2.0 cm) down when using a force of 10 pounds (4 kg). Push down on the governor belt (A, Figure 3.0-9) at the center between the alternator (C) and the governor (D). Adjust the belt tension, if necessary.



A. Governor Belt  
B. Bolt  
C. Alternator  
D. Governor

Figure 3.0-9

#### 3.3.2 How to Adjust the Tension of the Governor Belt

1. Stop the engine. Engage the parking brake.
2. Open the hood.
3. Loosen the bolt (B, Figure 3.0-9) one turn.
4. Use a 15 inch bar as a lever to move the alternator (C) to tighten or loosen the governor belt.
5. Tighten the bolt (B) when the belt has the correct tension.
6. Close the hood.

#### 3.3.3 How to Adjust the Governor

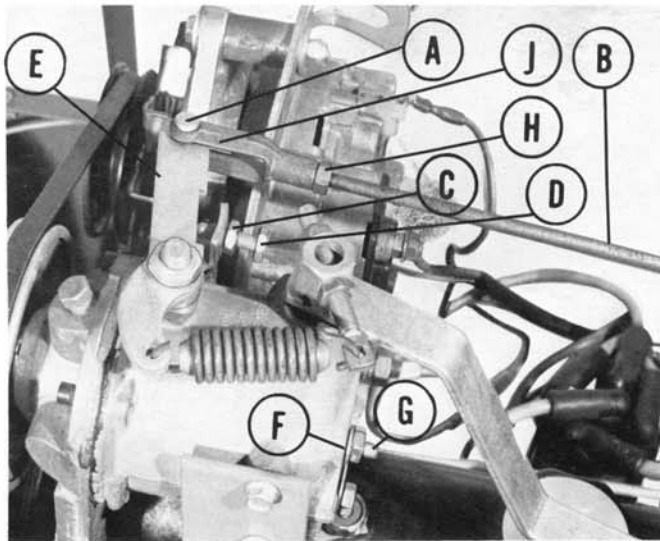
The governor is set by the manufacturer and does not normally need adjustment. If the RPM of the engine changes from fast to slow, check for the following problems before adjusting the governor:

1. Friction in the linkage from the governor to the carburetor.
2. Friction in the linkage from the throttle to the governor.
3. Tension of the belt for the governor.
4. Mixture of air and gasoline in the carburetor.
5. Timing of the engine ignition.
6. Lubricant level in the governor.

If there are no problems in these areas, use the following procedure to adjust the governor:

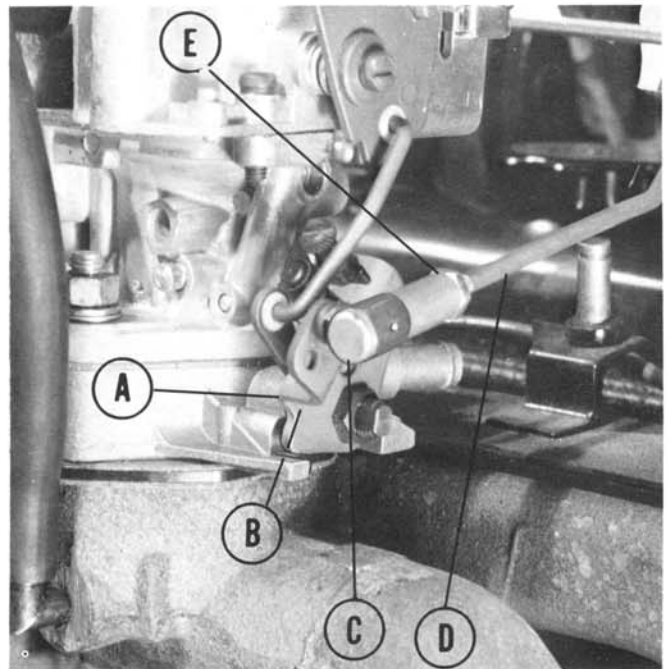
1. Stop the engine. Engage the parking brake.
2. Open the hood.
3. Unhook the throttle rod at either the carburetor lever or the governor arm. (D figure 3.0-11)





- A. Clevis Pin and Cotter Pin
- B. Throttle Linkage
- C. Jam Nut
- D. Stop Screw
- E. Governor Throttle Lever
- F. Jam Nut
- G. Governor Control Screw
- H. Jam Nut
- J. Clevis

Figure 3.0-10



- A. Bellcrank
- B. Clearance
- C. Spring Grip
- D. Throttle Rod
- E. Jam Nut

Figure 3.0-11

4. Set the throttle lever at the instrument panel in the wide open position.
5. Move the bellcrank (B) at the carburetor to the wide open position.
6. Adjust the length of the throttle rod (D) to be 1/6 to 1/8 of an inch to short to hook back up.
7. Hook the throttle rod back up and return the throttle lever to the idle position and check throttle rod for binding. Binding must be eliminated to obtain satisfactory governor control of the engine.
8. Back out the governor control screw (G Figure 3.0-10) until three or four threads are engaged and lock with locknut (F).
9. Start the engine and operate at fast idle until warmed to operating temperature.
10. Move the throttle to 3/4 of the wide open position. Check regulation by applying and removing engine load.
11. If the variation in engine speed is too great, adjust the regulation screw to draw spring nearer lever hub. The length of the regulation screw should be approximately 1.12 inches for the Pierce governor. (NOTE: this screw does not normally need to be adjusted from the factory setting).

12. If an adjustment is made in the regulation screw, the idle adjustment must be checked. With the throttle in the slow position the speed of the engine should be 800 RPM. If the engine does not run smooth at 800 RPM, turn the carburetor adjusting screw until it does.

13. If the governor surges at no-load, turn the governor control screw (G) in slowly until the surge is removed. (Check governor at several different throttle settings by tapping the governor throttle lever. If adjusted properly, it should surge only once or twice then smooth out).

**NOTE: UNDER NO CIRCUMSTANCES SHOULD GOVERNOR CONTROL SCREW BE TURNED IN FAR ENOUGH TO INCREASE THE NO—LOAD SPEED OF THE ENGINE.**

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**NOTE: Do not adjust the governor to get the RPM of the engine above 3200 RPM. When a load is engaged, the RPM drops approximately 150 RPM.**

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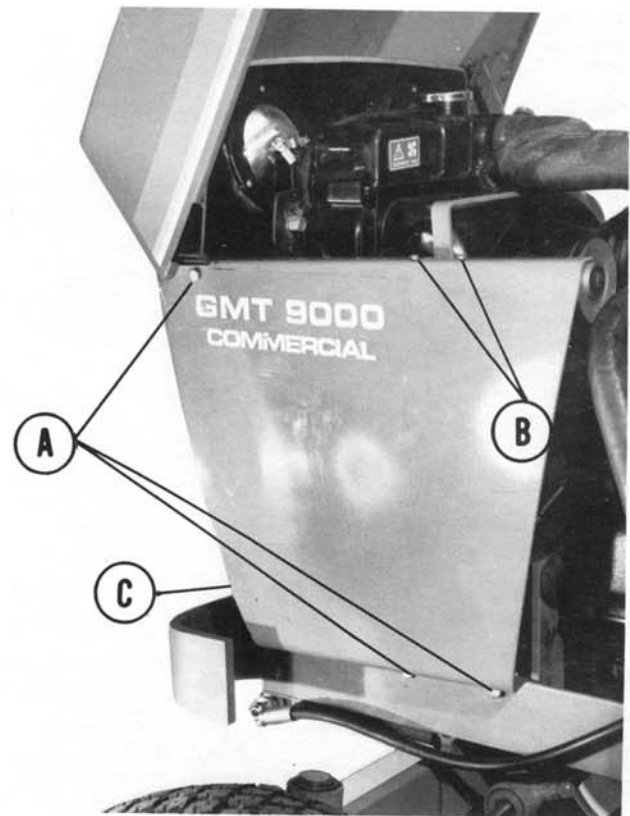
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**NOTE: If the RPM of the engine still changes in cycles from fast to slow, replace the governor.**

---

### 3.4 How to Remove the Engine

1. Put the tractor where a 1/2 ton (450 kg) hoist can be used. Stop the engine. Engage the parking brake.
2. Close the valve on the fuel tank.
3. Remove the hood as follows:
  - a. Lift the rear of the hood.
  - b. Remove the cotter pin at the top of the hood support.
  - c. Remove the cotter pins and the flat washers from the pins where the hood joins the front grill.
  - d. Pull the sides of the hood out to disengage the pins from the front grill and remove the hood.
4. To remove the left side plate:
  - a. Remove the three bolts and the lock nuts (A, Figure 3.0-12).



- |                        |
|------------------------|
| A. Bolts and Lock Nuts |
| B. Screws              |
| C. Left Side Plate     |

Figure 3.0-12

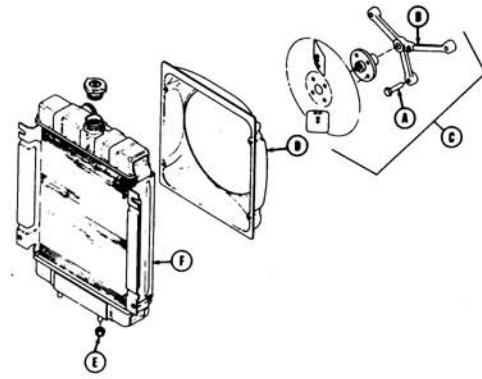
- b. Remove the two screws (B).
- c. Remove the left side plate (C).

5. Repeat step 4a for the right side plate. Instead of step 4b, follow this procedure: Remove the two clips holding the wire to the right side plate.

6. Drain the cooling fluid from the radiator.

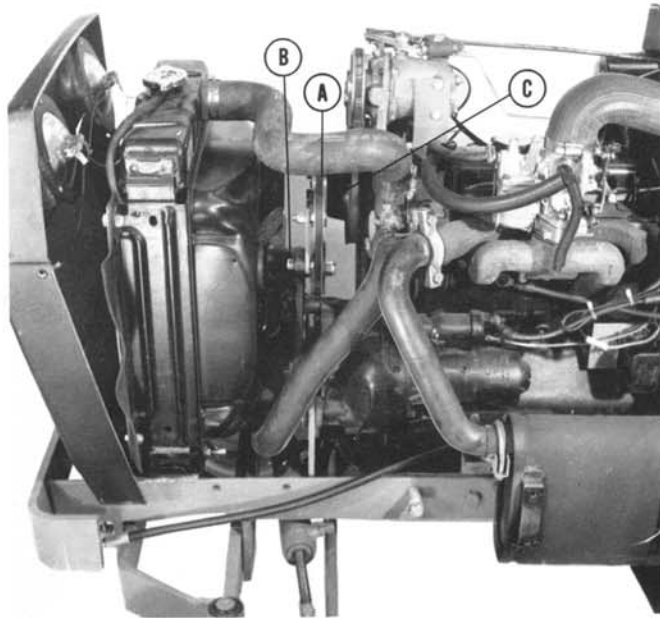
7. Remove the fan belt as follows:

- a. Loosen the nut (B, Figure 3.0-13) until the idler pulley (C) can be moved by hand.



- A. Bolts
- B. Fan Casting
- C. Fan Assembly
- D. Fan Shroud
- E. Lock Nuts
- F. Radiator

Figure 3.0-14



- A. Fan Belt
- B. Nut to Adjust Tension
- C. Idler Pulley

Figure 3.0-13

- b. Push the idler pulley toward the fan.
- c. Remove the fan belt (A).

8. Use a screwdriver to loosen the hose clamps. Disconnect the radiator hoses from the engine.

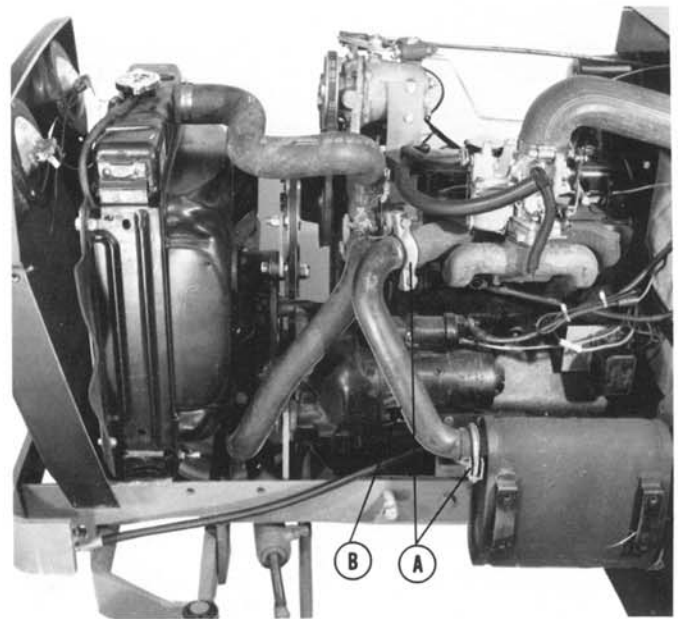
9. Remove the three bolts (A, Figure 3.0-14) from the fan casting (B).

10. Move the fan assembly (C) forward into the fan shroud (D).

11. Remove the two lock nuts (E) from below the frame of the tractor.

12. Lift the radiator (F), the fan shroud (D), and the fan assembly (C) out of the tractor.

13. Remove the exhaust pipe clamps (A, Figure 3.0-15).

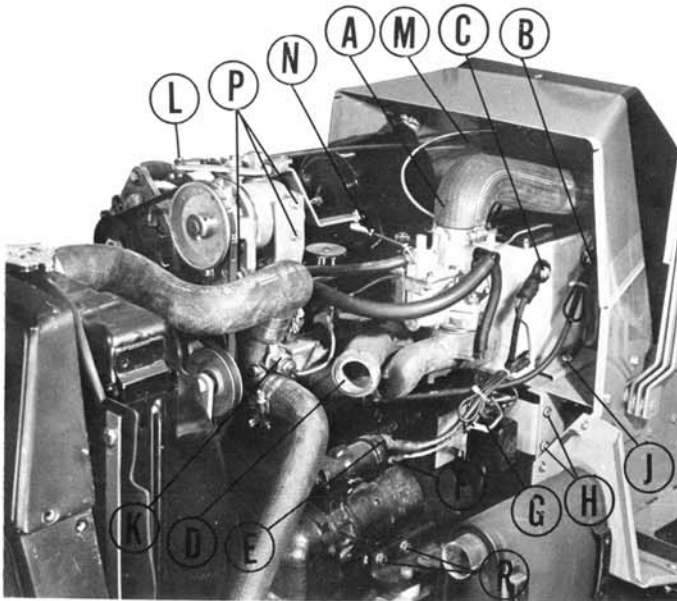


- A. Clamps
- B. Exhaust Pipe

Figure 3.0-15

14. Remove the exhaust pipe (B).

15. Remove the air cleaner hose (A, Figure 3.0-16) at the top of the carburetor.



- A. Air Cleaner Hose
- B. Negative “-” Battery Terminal
- C. Positive “+” Battery Terminal
- D. Ground Connection at Engine Block
- E. Starter Connection
- F. Wire to Starter Solenoid (Yellow-Gray)
- G. Three Wires for Voltage Regulator (Gray, Orange, Black-Orange)
- H. Bolts and Lock Nuts
- J. Bolt and Lock Nut
- K. Water Temperature Gauge Bulb
- L. Cotter Pin and Clevis Pin
- M. Cotter Pin
- N. Spring Clip and Throttle Rod
- P. Bolts and Lock Nut
- R. Bolts for Bracket

Figure 3.0-16

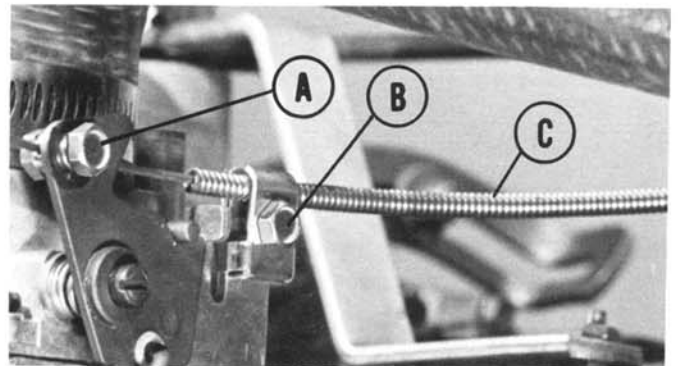
**NOTE: When removing a wire, always make two tags with the same identification. Fasten one tag on the wire. Fasten the other tag on the terminal.**

16. Remove the cable from the negative “-” terminal (B) from the battery and the engine block.
17. Remove the cable from the positive “+” terminal (C) from the battery and the engine block.
18. Remove the wire (F) to the starter solenoid.

19. Remove the three wires (G) from the voltage regulator.
20. Steps 16 to 19 disconnect the left section of the wiring harness from the engine. Push the wiring harness through the space between the engine and the battery.
21. Remove the two bolts and lock nuts (H) from the voltage regulator bracket. Remove the bracket and the voltage regulator.
22. Remove the bolt and the lock nut (J) and remove the battery mounting plate.
23. Remove the water temperature gauge bulb (K) as follows: hold the large nut near the engine block while turning the smaller nut counterclockwise.

**NOTE: Do not twist or bend the tube fastened to the bulb assembly for the water temperature gauge.**

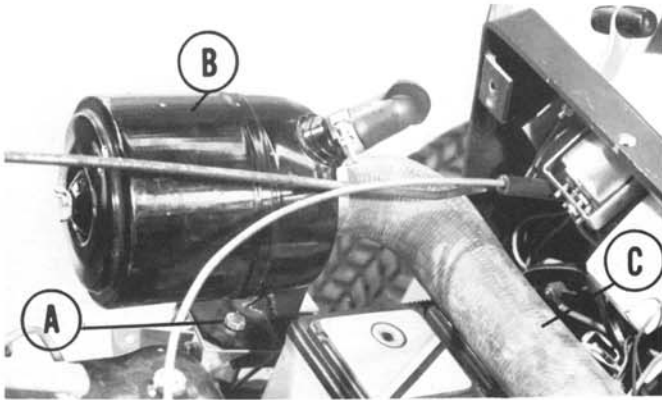
24. Remove the cotter pin and the clevis pin (L).
25. Remove the cotter pin (M) from the throttle linkage.
26. Remove the throttle linkage.
27. Remove the spring clip and the throttle rod (N).
28. Remove the bolts and the lock nut (P) from the governor. Remove the governor.
29. Remove the bolts (R) from the bracket for the engine mounting.
30. Loosen the set screw (A, Figure 3.0-17).



- A. Set Screw
- B. Clamp Screw
- C. Choke Control

Figure 3.0-17

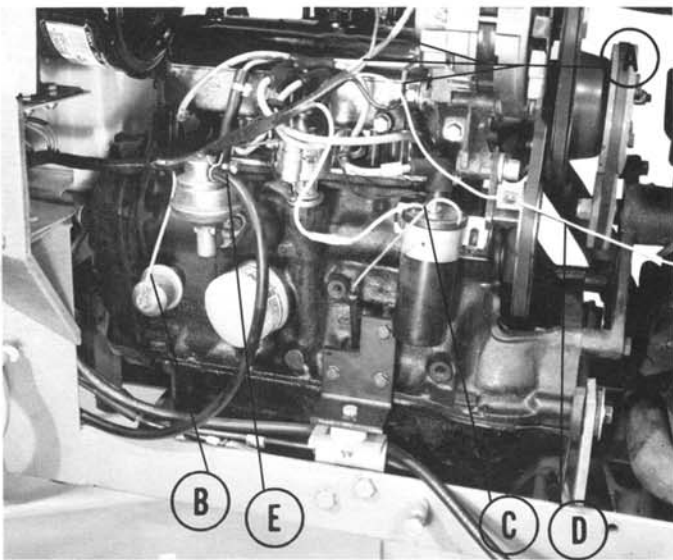
31. Loosen the clamp screw (B) and move the choke control (C) out of the way.
32. Remove the two bolts and the lock nuts (A, Figure 3.0-18).



- |                        |
|------------------------|
| A. Bolts and Lock Nuts |
| B. Air Cleaner         |
| C. Hose                |

Figure 3.0-18

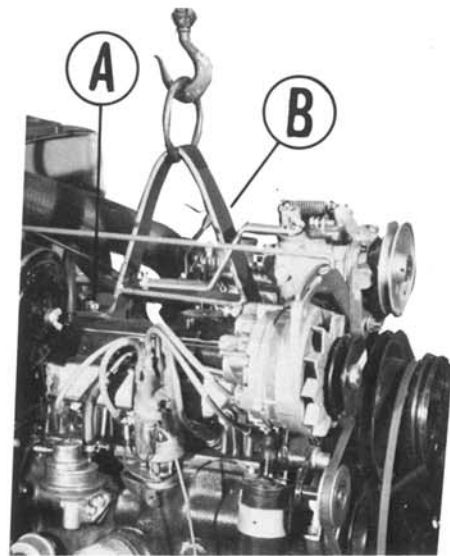
33. Remove the air cleaner (B) and the hose (C).
34. Remove the bolt and the lock nut (not shown) for the mounting plate for the battery. Remove the mounting plate.
35. Remove the battery.
36. Remove the three wires (A, Figure 3.0-19) from the alternator.



- |  |                                |
|--|--------------------------------|
| A. Wires to Alternator (Gray, Red-White, Black-Orange) | C. Wire to Ignition Coil (Tan) |
| B. Oil Pressure Sender Unit (Pink)                     | D. Wire to Headlights (Yellow) |
| E. Fuel Line   |                                |

Figure 3.0-19

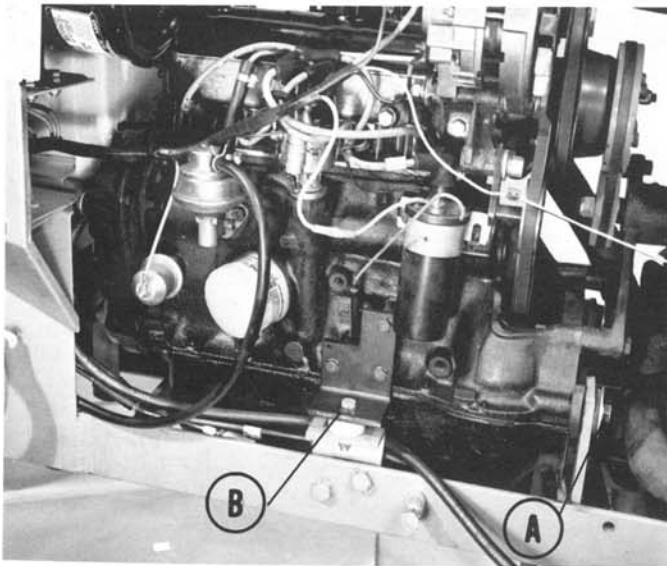
37. Remove the wire (B) from the oil pressure sender unit.
38. Remove the wire (C) from the ignition coil.
39. Remove the wire (D) from the headlights.
40. The wiring harness is now completely disconnected. Remove the wiring harness.
41. Remove the fuel line (E) from the fuel pump.
42. From under the tractor, remove four bolts and lockwashers (not shown) from the adapter for the propeller shaft. Move the propeller shaft toward the rear of the tractor.
43. Lower the propeller shaft and remove the adapter.
44. Remove the valve cover nuts (A, Figure 3.0-20).



- |                    |
|--------------------|
| A. Valve Cover Nut |
| B. Lifting Tool    |

Figure 3.0-20

45. Install the lifting tool (Renault-Continental part number 00-01-222-600) on studs for the valve cover. Install the valve cover nuts (A).
46. Move the hoist into position. Connect the chain to the lifting tool. Operate the hoist to apply tension to the chain.
47. Remove the two front engine mounts. Remove the center mount (B, Figure 3.0-21) on the right side (A).



- A. Front Engine Mount Assembly
- B. Center Engine Mount Assembly

Figure 3.0-21

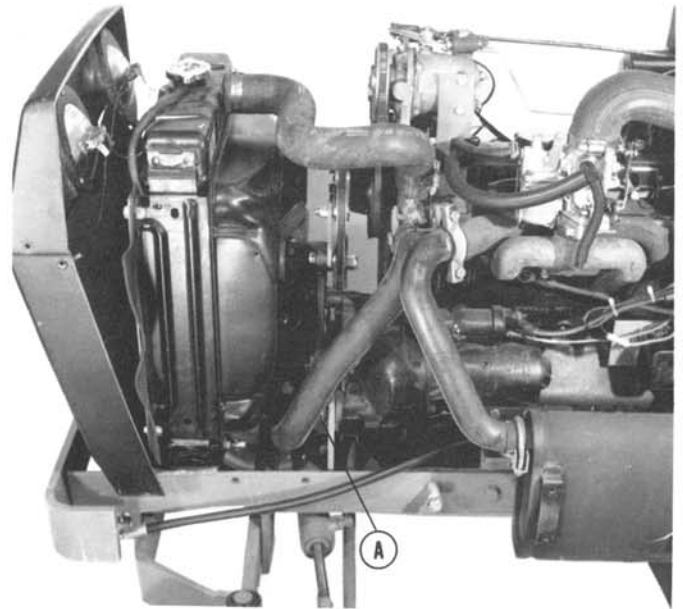
**WARNING:** Use the hoist carefully to lift the engine from the tractor. Make sure all the parts of the engine are disconnected from the tractor. Make sure there is clearance between the engine and the frame.

48. If the center mount assembly has a plastic block, remove the plastic block. If the engine has a rubber mount, then remove the top nut.

### 3.5 How to Install the Engine

**NOTE:** Before moving the hoist and the engine into position, make sure all lines, wiring harness, control rods, etc., are clear of the position for the engine. While lowering the engine into position, make sure all parts of the engine are clear of the tractor frame and the instrument panel.

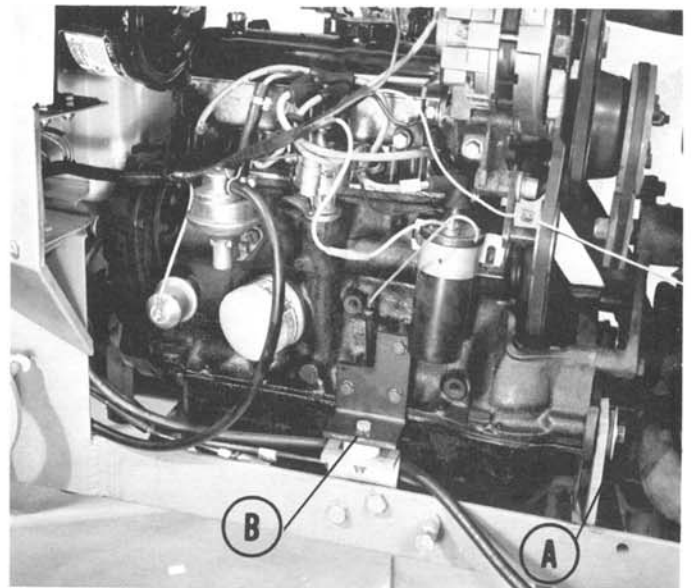
1. Move the hoist with the engine in position over the tractor frame.
2. Carefully lower the engine into the frame. Keep tension on the chain until steps 3 to 7 are finished.
3. Install the front bolt, the flat washer, and the engine mounting pad (A Figure 3.0-22). Do not tighten the front bolt fully.



- A. Front Bolt, Flat Washer, and Engine Mounting Pad

Figure 3.0-22

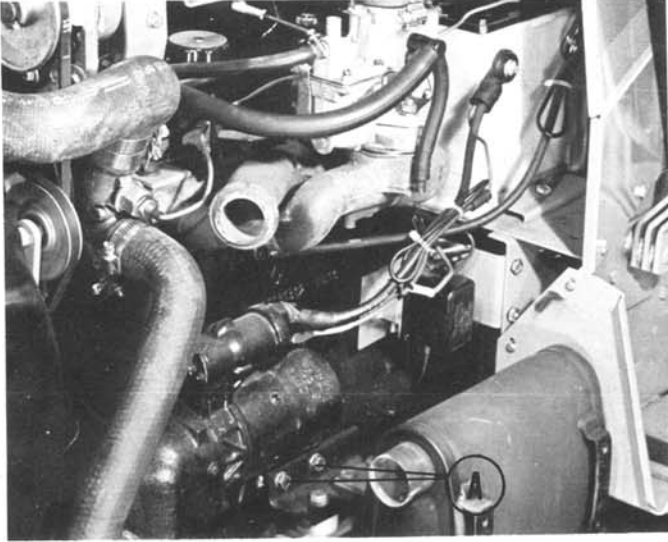
**NOTE:** Change the position of the engine, if needed, to align the holes for the engine mount with the holes for the mount in the frame (steps 3 to 6). Make sure there is no stress on the bolts as the bolts are installed.



- A. Front Bolt, Flat Washer, and Pad for Engine Mounting (Front Engine Mount Assembly)
- B. Center Bolt, Lock Nut, and Pad for Engine Mounting (Center Engine Mount Assembly)

Figure 3.0-23

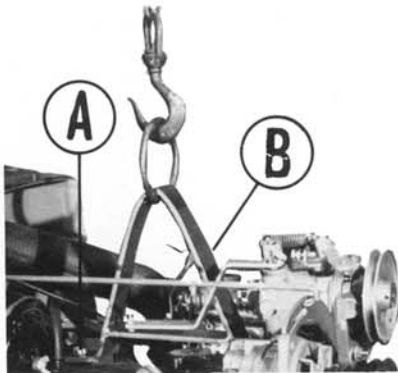
4. Install the center bolt, the lock nut, and the pad (B) for the engine mount. Do not tighten the center bolt fully.
5. Install the two bolts (A, Figure 3.0-24) for the engine mount bracket. Do not tighten the bolts fully.



A. Bolts for Engine Mount Bracket

Figure 3.0-24

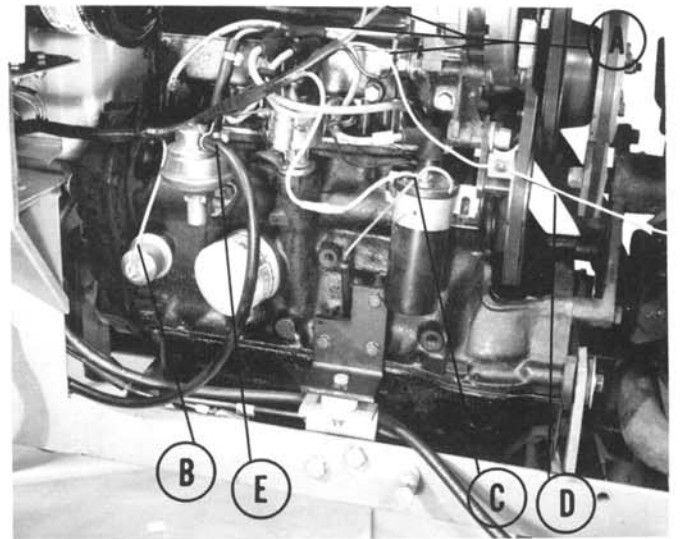
7. Tighten all the bolts installed in steps 3 to 6 as follows:
  - a. Tighten the front bolts to a torque of 30 ft. lbs. (40 N.m).
  - b. Tighten the center bolt to a torque of 30 ft. lbs. (40 N.m).
  - c. Tighten the bolts for the bracket to a torque of 30 ft. lbs. (40 N.m).
8. Move the chain and the hoist away.
9. Remove the valve cover nuts (A, Figure 3.0-25).



A. Valve Cover Nuts  
B. Lifting Tool

Figure 3.0-25

10. Remove the lifting tool.
11. Install the valve cover nuts. Tighten them with fingers only.
12. Install the propeller shaft (not shown) under the tractor as follows:
  - a. Install the adapter.
  - b. Raise the universal joint into position.
  - c. Check that the mounting holes in the adapter and in the propeller shaft are aligned. If they are not, follow these steps:
    1. Lower the universal joint.
    2. Remove the adapter.
    3. Rotate the adapter to align the holes and install the adapter.
    4. Raise the universal joint.
  - d. Install the four bolts and the lock nuts.
13. Install the fuel line (E, Figure 3.0-26) on the fuel pump.



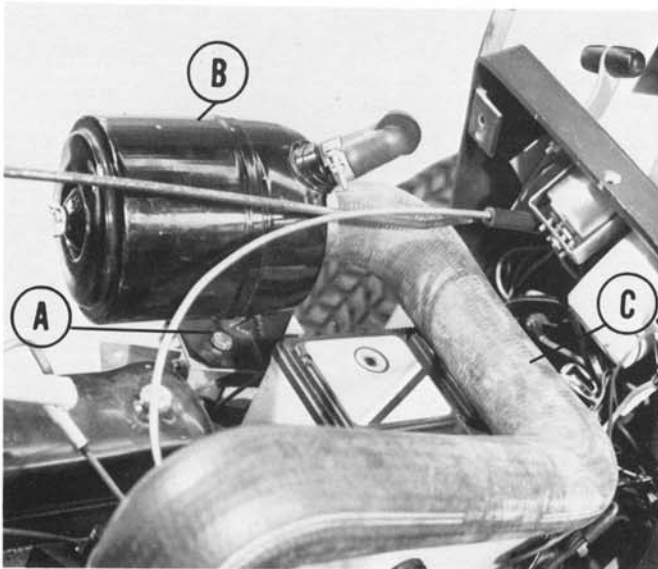
A. Wires to Alternator  
B. Oil Pressure Sender Unit  
C. Wire to Ignition Coil  
D. Wire to Headlights  
E. Fuel Line

Figure 3.0-26

**NOTE: When installing the wires, follow the tags used for identification.**

14. Move the wiring harness into position.
15. Install the wire to the headlights (D).
16. Install the wire to the ignition coil (C).

17. Install the wire to the oil pressure sender unit (B).
18. Install the three wires to the alternator (A).
19. Install the battery. Make sure the terminals are toward the left side of the tractor.
20. Put the right side mounting plate for the battery in position and install the bolt and the lock nut (not shown).
21. Put the air cleaner (B, Figure 3.0-27) and the air cleaner hose (C) in position.

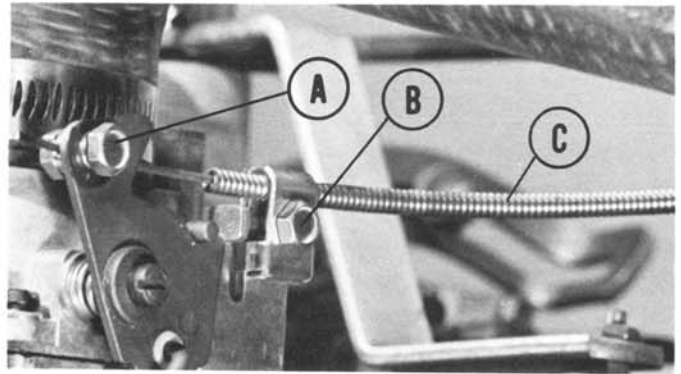


- |                        |
|------------------------|
| A. Bolts and Lock Nuts |
| B. Air Cleaner         |
| C. Air Cleaner Hose    |

Figure 3.0-27

22. Install the two bolts and the lock nuts (A).
23. Put the choke control in the swivel on the choke lever.
24. Put the choke control between the clamps.
25. Make sure the choke control knob on the instrument panel (not shown) is pushed all the way in.
26. Rotate the choke lever counterclockwise (choke open position).

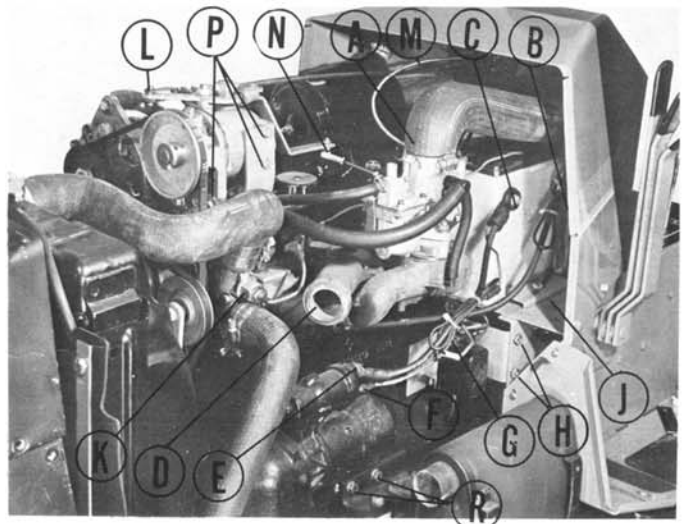
27. Tighten the bolt for the clamp (B, Figure 3.0-28)



- |                  |
|------------------|
| A. Set Screw     |
| B. Bolt          |
| C. Choke Control |

Figure 3.0-28

28. Tighten the set screw (A).
29. Put the governor in position.
30. Install the two bolts and the one bolt and the lock nut (P, Figure 3.0-29).



- |   |                                 |
|---|---------------------------------|
| A. Air Cleaner Hose   | H. Bolts and Lock Nuts          |
| B. Negative "—" Battery Terminal                                  | J. Bolt and Lock Nut            |
| C. Positive "+" Battery Terminal                                  | K. Water Temperature Gauge Bulb |
| D. Ground Connection at Engine Block                              | L. Cotter Pin and Clevis Pin    |
| E. Starter Connection   | M. Cotter Pin                   |
| F. Wire to Starter Solenoid (Yellow-Gray)                         | N. Spring Clip and Throttle Rod |
| G. Three Wires for Voltage Regulator (Gray, Orange, Black-Orange) | P. Bolts and Lock Nut           |
|   | R. Bolts for Bracket            |

Figure 3.0-29



31. Install the belt for the governor. See Section 3.3.2, "How to Adjust the Tension of the Governor Belt."

**NOTE: The alternator must be moved toward the governor to install the belt over the pulleys.**

32. Install the throttle rod and the spring clip (N).
33. Put the throttle linkage in position.
34. Install the cotter pin (M).
35. Install the clevis pin and the cotter pin (L). Read in Section 3.3.3, "How to Adjust the Governor," steps 9 through 11.

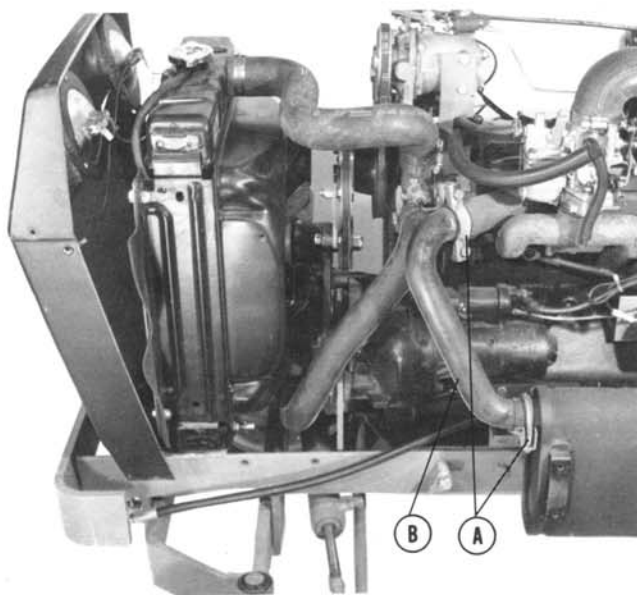
**NOTE: Do not twist or bend the tube fastened to the bulb assembly for the water temperature gauge.**

36. **Carefully** move the water temperature gauge bulb in position. Hold the large nut near the engine block and turn the smaller nut clockwise to tighten it.
37. Put the left battery mounting plate in position and fasten it with the bolt and the lock nut (J).
38. Put the voltage regulator and the bracket in position and install the two bolts and the lock nuts (H).
39. The remainder of the wires in the wiring harness are for the left side of the engine. Push this section of the wiring harness from right to left through the space between the engine and the battery.

**NOTE: When installing the wires, follow the tags for identification.**

40. Install the three wires (G) to the regulator.
41. Install the wire (F) to the starter solenoid.
42. Install the battery cable (E) to the starter solenoid.
43. Install the battery cable (D) to the engine block.

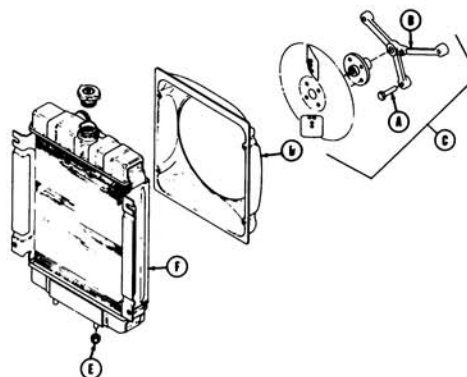
44. Install the positive "+" cable terminal to the "+" battery (C).
45. Install the cable to the negative "-" battery terminal (B).
46. Install the air cleaner hose (A) on the top of the carburetor.
47. Put the exhaust pipe (B, Figure 3.0-30) in position and install the clamps (A).



A. Clamps  
B. Exhaust Pipe

Figure 3.0-30

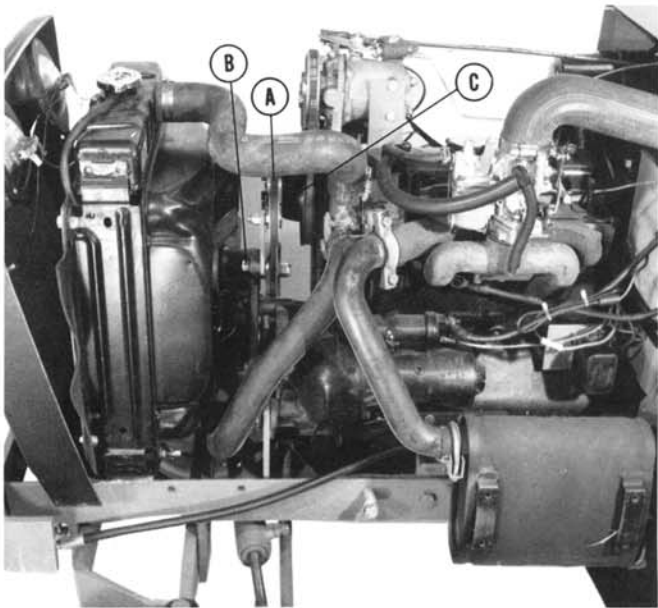
**NOTE: The fan assembly (C, Figure 3.0-31) must be loosely held in the fan shroud (D) during step 48.**



A. Bolts (3)  
B. Fan Casting  
C. Fan Assembly  
D. Fan Shroud  
E. Lock Nuts  
F. Radiator

Figure 3.0-31

48. **Carefully** lower the radiator (E), the fan shroud (D), and the fan assembly (C) in position.
49. Install the two lock nuts (E) under the frame of the tractor.
50. Connect the radiator hoses to the engine.
51. Move the fan assembly (C) into position and install the three bolts (A) to fasten the fan casting (B) to the engine.
52. Install the fan belt as follows:
  - a. Loosen the nut (B, Figure 3.0-32).

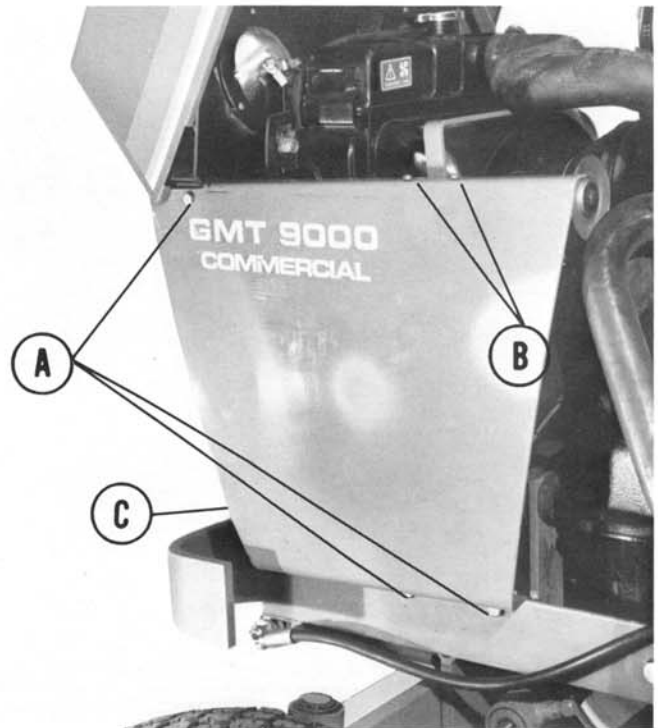


- |   |
|---|
| <p>A. Fan Belt<br/>         B. Nut to Adjust Tension<br/>         C. Idler Pulley</p> |
|---|

Figure 3.0-32

- b. Push the idler pulley (C) toward the fan.
  - c. Put the fan belt (A) around the fan pulley, the idler pulley, and the crankshaft pulley.
  - d. Pull the idler pulley (C) toward the side of the tractor. Tighten the nut (B) only enough to hold the idler pulley (C) in position.
  - e. Make an adjustment for the fan belt tension. See Section 3.1.4, "How to Adjust the Tension of the Fan Belt."
53. Close the drain valve on the radiator. Fill the cooling system with cooling fluid. Install the radiator cap.

54. Install the right side plate as follows:
  - a. Put the side plate in position.
  - b. Install the three bolts and the lock nuts (A, Figure 3.0-33).



- |  |
|--|
| <p>A. Bolts and Lock Nuts<br/>         B. Screws<br/>         C. Left Side Plate</p> |
|--|

Figure 3.0-33

- c. Install the two clips for the wire to the headlights.
55. Install the left side plate as follows:
    - a. Put the side plate in position.
    - b. Install the three bolts and the lock nuts (A).
    - c. Install the two screws (B).
  56. Put the hood in position. Install it as follows:
    - a. Where the hood joins the front grill, pull the sides of the hood out. Engage the pins with the holes in the front grill.
    - b. Install the flat washers and the cotter pins on the pins for the hood.
    - c. Push the support for the hood through the slot in the support bracket on the hood. Install the cotter pin.
    - d. Lower the hood.
  57. Open the fuel tank valve.

## 4.0 How to Do Electrical System Service

Electrical Maintenance Service:

40 Hours -- check the level of the electrolyte

250 Hours -- clean and tighten the terminals for the battery

When necessary -- replace fuses

**NOTE:** Always disconnect the battery cables when repairing or removing parts of the electrical system.

To disconnect the battery cables, follow this procedure:

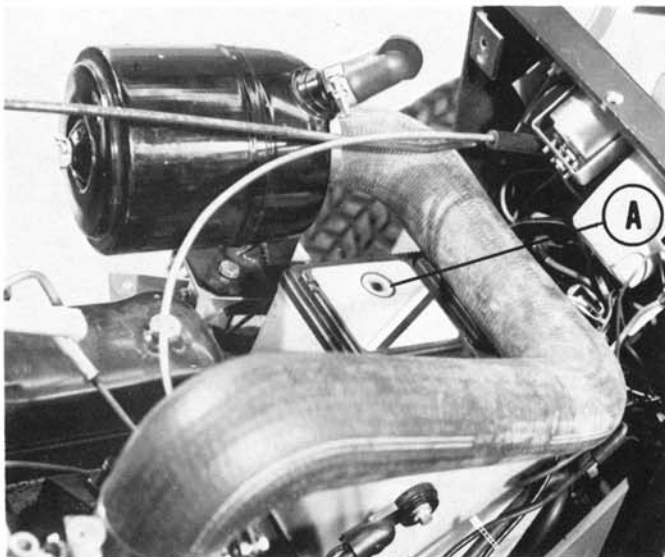
1. First, disconnect the negative “—” cable.
2. Then, disconnect the positive “+” cable.

### 4.1 How to Check the Level of the Electrolyte in the Battery

1. Stop the engine. Open the hood.

**WARNING:** If the engine has been running, the muffler and the other engine parts are hot.

2. Look at the indicator for the level of the electrolyte (A, Figure 4.0-1).



A. Indicator for Level of the Electrolyte

Figure 4.0-1

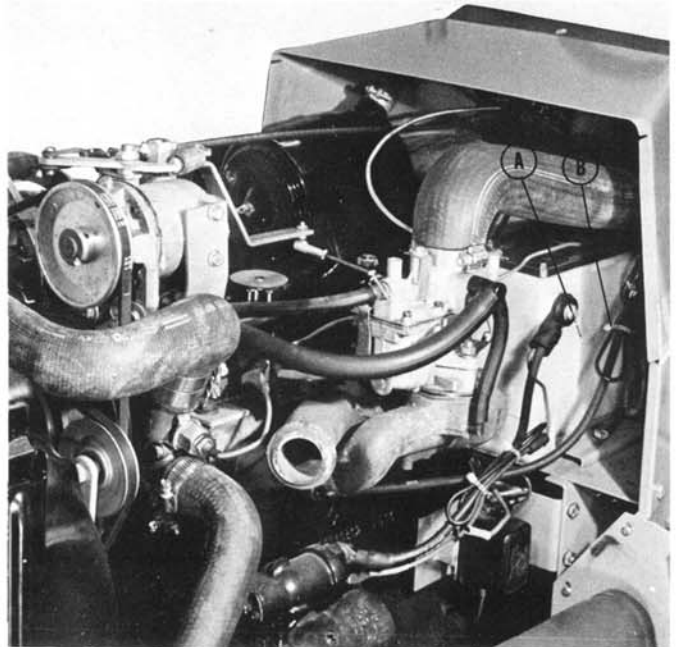
3. Close the hood.

## 4.2 How to Clean and Tighten the Terminals for the Battery

1. Stop the engine. Open the hood.

**WARNING:** If the engine has been running, the muffler and other engine parts are hot.

**WARNING:** Always disconnect the negative “—” (B, Figure 4.0-2) battery cable first.



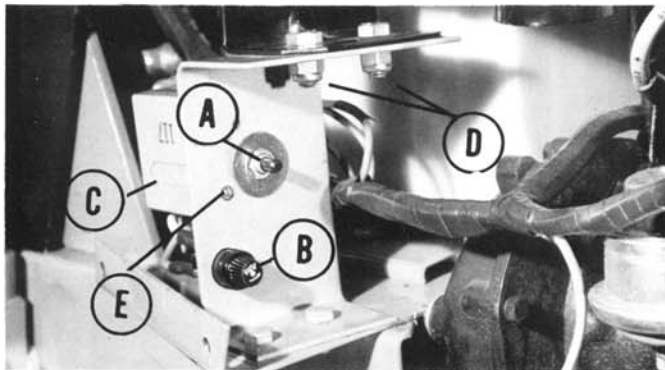
A. Positive “+” Cable  
B. Negative “—” Cable

Figure 4.0-2

2. Turn the bolt of the negative “—” battery terminal (B) counterclockwise. Remove the bolt and the cable.
3. Clean the terminal bolt and the connector for the negative “—” cable with a solution of baking soda (sodium bicarbonate) and water. (Use one unit of sodium bicarbonate to four units of water.)
4. Repeat steps 2 and 3 for the positive “+” terminal (A).
5. Reconnect the positive “+” (A) cable.
6. Reconnect the negative “—” (B) cable.
7. Close the hood.

### 4.3 How to Check the Fuses

There are two fuses in the panel under the instrument panel cowl on the right side of the tractor. One is in the magnetic ignition switch and the other is in the fuse holder. See B, Figure 4.0-3.



- A. Reset Button
- B. Fuse Holder
- C. Magnetic Ignition Switch
- D. Bolts
- E. Screw

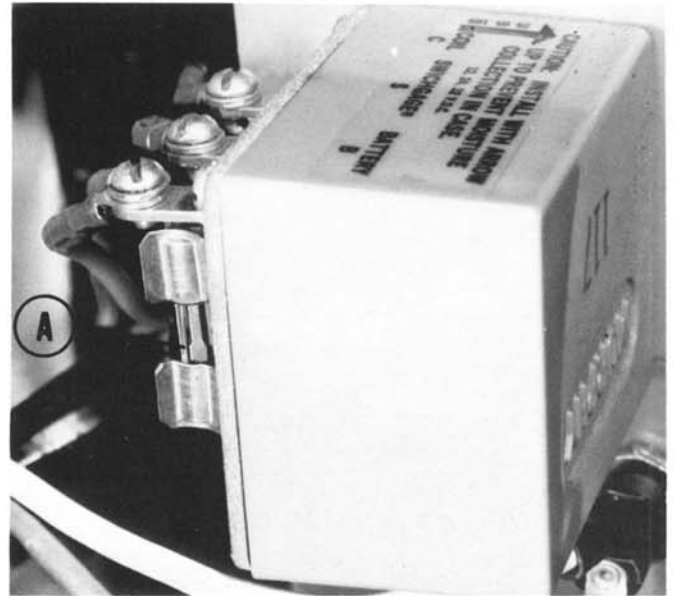
Figure 4.0-3

**WARNING:** Remove the battery cables before replacing fuses.

Always use the correct fuse (Fuse Holder: **BUSS AGC30**; Fuse for Magnetic Ignition Switch: **BUSS SFE14**). If either of these fuses is open, the starter for the engine will not operate.

1. To check and replace the panel fuse, follow these steps:
  - a. Turn the cap for the fuse holder counterclockwise and remove it.
  - b. Remove the fuse and look at the fuse wire inside the glass. If a section of the fuse wire is missing, the fuse is open and must be replaced. If no section of the fuse wire is missing, the fuse is good and can be used again.
  - c. Install a good fuse.
  - d. Install the cap of the fuse holder.
2. To check and replace the fuse for the magnetic ignition switch, follow these steps:

- a. Remove the two bolts and lock nuts from the air cleaner bracket (D, Figure 4.0-3). Remove the air cleaner.
- b. Remove the nut from the reset button (A).
- c. Remove the screw (E) (or nut and a pin on some models).
- d. Pull the fuse (A, Figure 4.0-4) out of the clip and look at the fuse wire inside the glass.



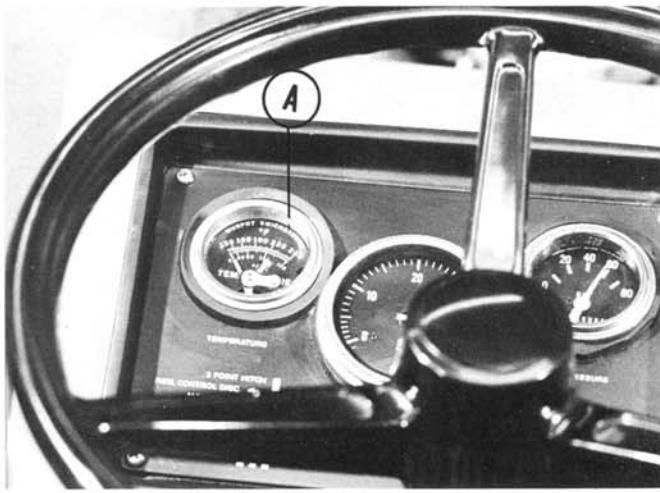
A. Fuse

Figure 4.0-4

- Repeat step 1 (b) above.
- e. Push a good fuse into the clip.
- f. Put the magnetic ignition switch in position and install the nut for the reset button. Install the screw (E, Figure 4.0-3).
- g. Put the air cleaner on the bracket and install the two bolts and the lock nuts (D, Figure 4.0-3).

### 4.4 Magnetic Ignition Switch

The tractor has a temperature gauge with a magnetic ignition switch (A, Figure 4.0-5).



A. Temperature Gauge

Figure 4.0-5

When the temperature of the cooling fluid reaches the limit for safe operation, an electrical contact in the gauge will close. An electrical signal opens the magnetic ignition switch on the temperature gauge which stops the engine (C, Figure 4.0-3). When this occurs, the engine cannot be restarted until the temperature of the cooling fluid has decreased to normal and the magnetic ignition switch has been reset. If the magnetic ignition switch stops the engine, check for the cause of the higher temperature and make correction before starting the engine again.

**WARNING:** Use caution when removing the radiator cap.

1. Check the level of the cooling fluid in the radiator. See Section 3.1.1, "How to Check the Level of the Cooling Fluid."
2. Add more cooling fluid, if necessary.
3. Clean the radiator screen and the core.
4. When the temperature of the cooling fluid has decreased, push the reset button (A, Figure 4.0-3).
5. Start the engine.

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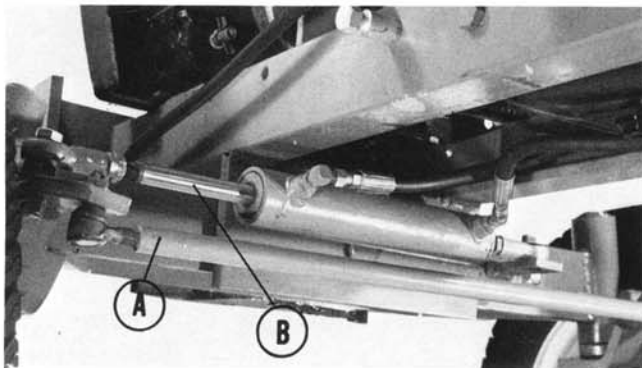
**NOTE:** If the tractor is operated on a rough surface, the shock can make the contact in the temperature gauge close. This will stop the engine. If this problem occurs and the temperature of the cooling fluid is below the limit for safe operation, the reset button can be pushed immediately. Then, the engine can be started.

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## 5.0 How to Do Front Axle Service

### 5.1 How to Remove the Kingpins

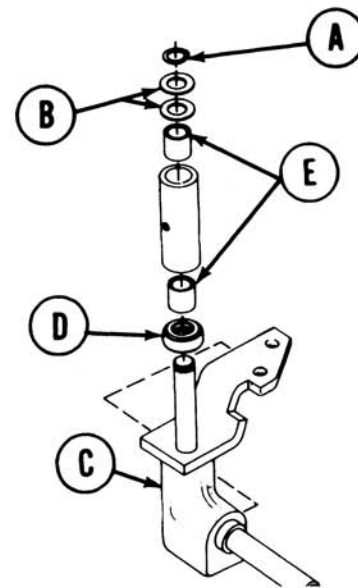
If the kingpins look like they are loose, first check the clearance in the bearings for the front wheels. If necessary, make an adjustment to the bearings for the front wheels. See step 8 and 9 in Section 2.4.4, "How to Assemble the Bearings for the Front Wheels." If the steering is still loose, then proceed as follows to replace the kingpin bearing:



A. Tie Rod  
B. Hydraulic Steering Cylinder

Figure 5.0-1

1. Figure 5.0-1 shows the front wheel removed. To remove the front wheel is optional.
2. Remove the tie rod (A) and the hydraulic cylinder push rod from the kingpin on the left side.
  - a. Remove the bolt, the hydraulic cylinder push rod, and the spacer from the kingpin.
  - b. Move the hydraulic cylinder push rod away from the kingpin.
3. Remove the snap ring (A, Figure 5.0-2).
4. Remove the two bearing races (B).
5. Pull the kingpin (C) down all the way out of the sleeve for the kingpin and remove the ball bearing (D). The bushings (E) are a tight fit in the sleeve for the kingpin. Do not remove the bushings unless they are worn.



A. Snap Ring  
B. Bearing Races  
C. Kingpin  
D. Ball Bearing  
E. Bushings

Figure 5.0-2

6. Use a cloth to clean the bushings (E).
7. Use an inside micrometer to measure the inside diameter of the bushings (E).  
New Specification: 1.005 inches (25.53 mm)  
Replacement Limit: 1.010 inches (25.65 mm)  
Replace the bushings, if needed.
8. Use a micrometer to measure the outside diameter of the kingpin.  
New Specification: .999 inches (25.27 mm)  
Replacement Limit: .994 inches (25.25 mm)  
Replace the kingpin, if needed. The kingpin must be replaced if there are deep scratches or burrs on the kingpin.
9. Clean the ball bearing (D, Figure 5.0-2) in solvent.
10. Hold the inside of the bearing cage and turn the outside of the bearing cage by hand. The rotation of the balls and the bearing cage must be smooth. If any area feels rough or loose, the ball bearings must be replaced.

## 5.2 How to Install the Kingpins

1. Put multi-purpose grease on the kingpin.
2. Put multi-purpose grease on the balls and bearing cage of the ball bearing. Make sure the bearing cage is filled with grease.
3. Put the ball bearing on the kingpin.
4. Put multi-purpose grease in the sleeve for the kingpin in the space between the bushing (E).
5. Push the kingpin all the way up into the sleeve for the kingpin.
6. Install the two bearing races (B).
7. Install the snap ring (A).
8. Put the engine lubricating oil on the end of the tie rod. Push the end of the tie rod up into the outer hole of the kingpin.
9. Install the slotted nut (B).
10. Install the cotter pin (A).
11. Left kingpin only:
  - a. Put the engine lubricating oil on the end of the hydraulic cylinder push rod.
  - b. Put the bolt down into the end of the rod.
  - c. Put the spacer for the power steering cylinder on the bolt under the end of the rod. Hold the spacer in position.
  - d. Push the end of the bolt down into the hole nearest the sleeve for the kingpin.
  - e. Install the lock nut.
12. If the front wheels were removed, see Section 2.4.4, steps 1-14, "How to Assemble the Bearings for the Front Wheels."
13. Put multi-purpose grease into the grease fitting for the kingpin.

## 5.3 How to Check the Alignment of the Front Wheels

When the alignment of the front wheels is correct, each front wheel will be turned 0 to 1/4 inch (0 to .5 cm) toward the center of the tractor. To check the alignment, follow this procedure:

1. Measure the distance (A, Figure 5.0-3) at the height of the hub.

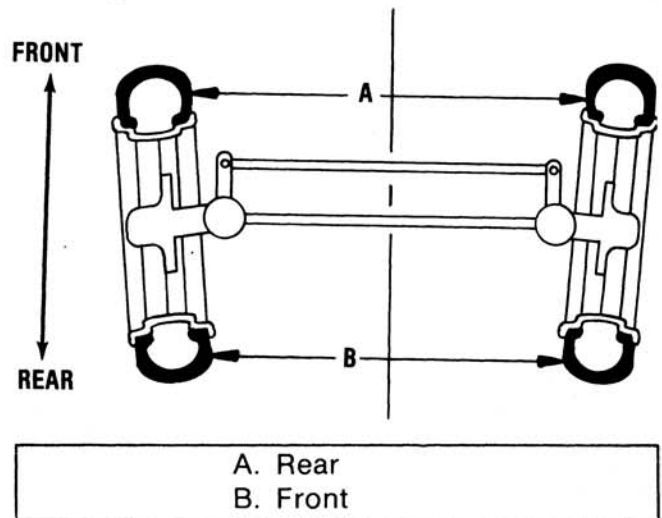


Figure 5.0-3

2. Measure the distance (B, Figure 5.0-3) at the front of the front tires in the same way.
3. Subtract "B" from "A." The result must be between 0 to 1/4 inch (0 to .5 cm). If the measurement is not between these limits, make an adjustment as follows:
  - a. Loosen the jam nut (A, Figure 5.0-4).

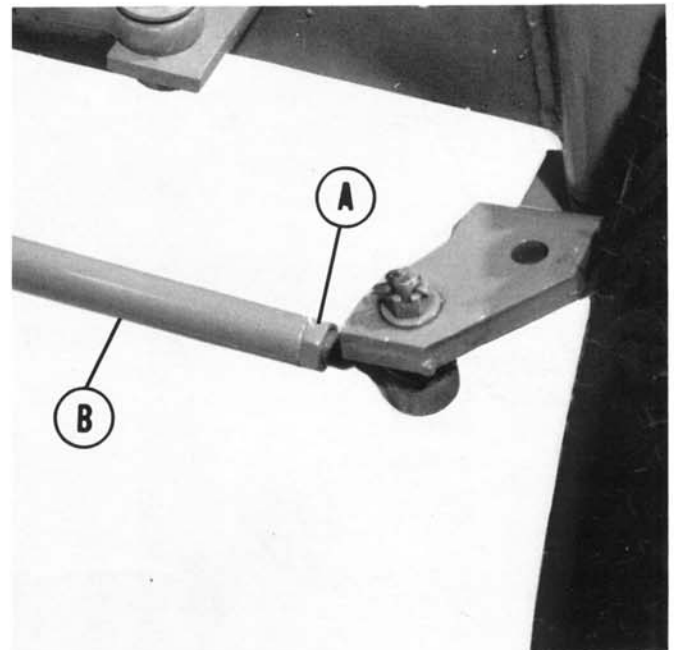


Figure 5.0-4

- b. Use pliers to turn the tie rod (B, Figure 5.0-4).
  - clockwise to decrease dimension "B"
  - counterclockwise to increase dimension "B"
4. When the alignment is correct, tighten the jam nut (A, Figure 5.0-4).



## 6.0 How to Do Brake Service

The tractor is equipped with two brake systems: one for each rear wheel. The two systems can be operated together or they can be operated separately. It is important that both brake systems have the same movement of the brake pedals to stop the tractor.

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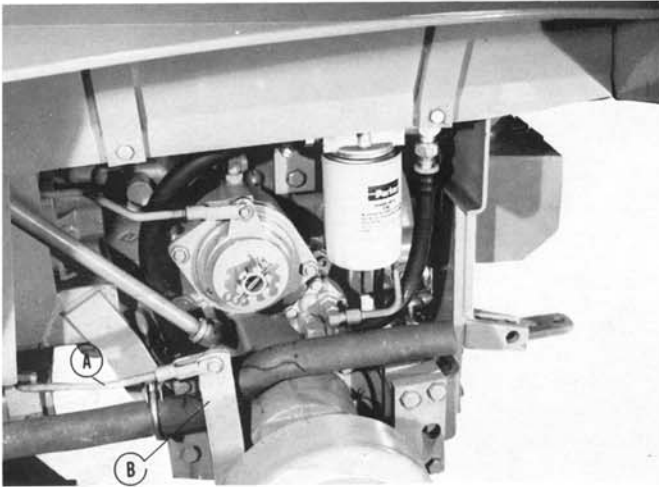
**NOTE: The brakes must be adjusted so that each wheel brake is applied at the same time when the brake pedals are connected together by the brake latch.**

---

### 6.1 Brake Maintenance Schedule

Adjust the brakes after 100 hours of operation.

The brake for the right wheel is shown in Figure 6.0-1.



A. Brake Rod  
B. Brake Actuating Arm

Figure 6.0-1

The brake for the left wheel is not shown. The adjustment procedure is the same for both brakes.

### 6.2 How to Adjust the Brakes

1. Stop the engine. **DO NOT ENGAGE THE BRAKE LATCH ON THE PARKING BRAKE.** Move the gear selector to the "NEUTRAL" position. Put the direction control in the "NEUTRAL" position.
  2. Put blocks on the ground to the front of the front tires and to the rear of the front tires. These blocks must be **against** the tires to prevent movement of the tractor.
  3. Use a jack to lift the rear of the tractor until the rear wheels are 1 inch (2.5 cm) above the ground.
  4. Put stands under the right side of the frame and under the left side of the frame at the rear of the tractor. Remove the jack.
  5. Remove the cotter pin and the clevis pin. Remove the brake rod (A, Figure 6.0-1) from the brake actuating arm (B).
- 
- NOTE: As the brakes become worn, they will need to be tightened. To tighten them, turn the clevis clockwise on the brake rod. It is not normal for the brakes to require loosening. If the brakes must be loosened, turn the clevis counterclockwise on the brake rod.**
- 
6. Turn the clevis on the brake rod one complete turn clockwise.
  7. Put the brake rod in position on the brake actuating arm and install the clevis pin.
  8. Turn the rear wheel three revolutions by hand. If there is friction between the brake shoes and the brake drum, there will be some resistance to the turning of the wheel. Go directly to step 10 if there is some resistance to the turning of the wheel.
  9. If the wheel still turns freely, remove the clevis pin and repeat steps 6, 7, and 8 until a small amount of resistance is felt as the wheel is turned in step 8.
  10. Turn the clevis one turn in a counterclockwise direction.
  11. Put the brake rod in position on the brake actuating arm.
  12. Install the clevis pin and the cotter pin.
  13. Repeat steps 5, 6, 7, 8, 9, 10, 11, and 12 for the opposite brake.
  14. Use a jack to lift the rear of the tractor from the stands. Remove the stands.

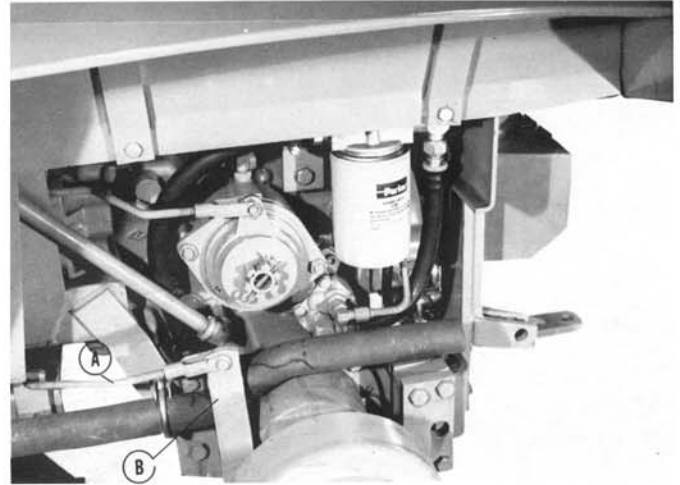
15. Lower the rear of the tractor. Remove the jack.
16. Remove the blocks by the front wheels.
17. Make a test of the brakes:
  - a. Engage the brake latch.
  - b. Operate the tractor at a slow forward speed.
  - c. Put the direction control in the "NEUTRAL" position.
  - d. Push both brake pedals.
18. The brakes must act evenly so that the tractor comes to a stop in a straight line. If it does not, repeat the adjustment procedure (Section 6.2) to make both pedals move the same distance to engage the brakes.

### 6.3 How to Replace the Brake Shoe Assemblies

The procedure for replacing the brake shoe assemblies is the same for both brakes.

#### 6.3.1 How to Remove the Brake Shoe Assemblies

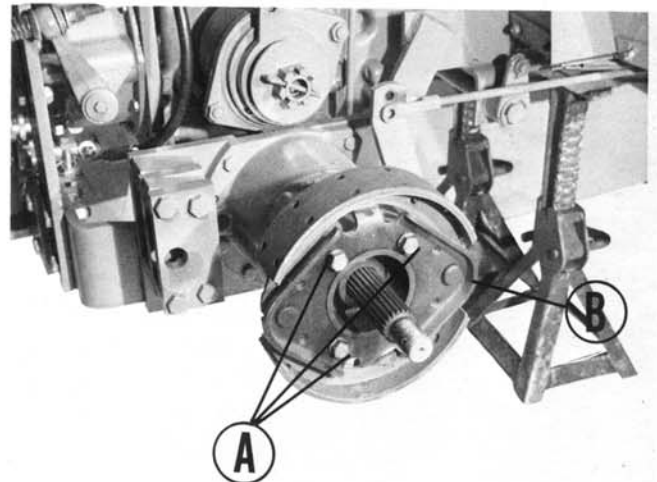
1. Stop the engine. Do not engage the parking brake.
2. Put blocks on the ground to the front of the front tires and to the rear of the front tires. These blocks must be against the tires to prevent movement of the tractor.
3. Use a jack to lift the rear of the tractor until the rear wheels are one inch (2.5 cm) above the ground.
4. Put stands under the right side of the frame and under the left side of the frame at the rear of the tractor. Remove the jack.
5. Remove the bolts that fasten the wheel assembly to the wheel hub. Remove the wheel assembly.
6. Remove the cotter pin (A, Figure 6.0-2) and the slotted nut (B). Remove the wheel hub. (C).



- |  |
|--|
| <p>A. Cotter Pin<br/>B. Slotted Nut<br/>C. Wheel Hub</p> |
|--|

Figure 6.0-2

7. Remove the bolts (A, Figure 6.0-3) that fastens the support plate (B) to the axle housing. Remove the support plate.

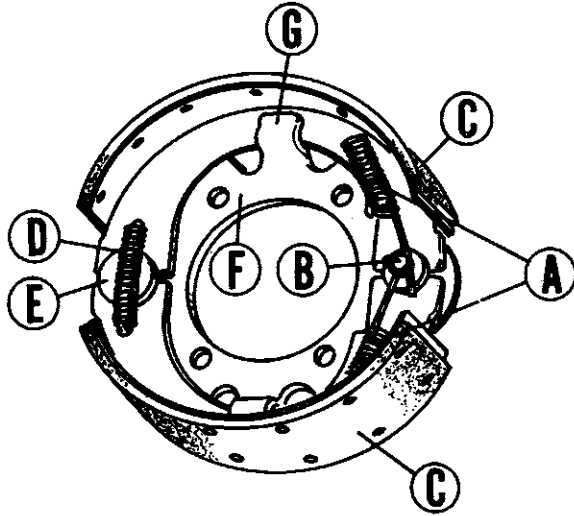


- |                                     |
|-------------------------------------|
| <p>A. Bolt<br/>B. Support Plate</p> |
|-------------------------------------|

Figure 6.0-3

**NOTE: To hold the support plate for disassembly, fasten the support plate to the axle housing with the springs towards the outside. Do not tighten the bolts.**

- Remove the shoe return springs (A, Figure 6.0-4) from the upper anchor pin (B).



- |  |
|--|
| <p>A. Shoe Return Springs<br/>         B. Upper Anchor Pin<br/>         C. Brake Shoe Assembly<br/>         D. Shoe Spring<br/>         E. Lower Anchor Pin<br/>         F. Support Plate<br/>         G. Shoe Guide Lug</p> |
|--|

Figure 6.0-4

- Pull the brake shoe assemblies (C) away from the upper anchor pin (B) and the shoe guide lugs (G). Remove the brake shoe assemblies from the lower anchor pin (E).
- Remove the shoe spring (D) from the brake shoe assemblies.

### 6.3.2 How to Install the Brake Shoe Assemblies

- Put the shoe spring (D, Figure 6.0-4) in the holes near the end of the brake shoe assemblies (C).
- Fit the notch in the brake shoe assemblies on the lower anchor pin (E).
- Pull the brake shoe assemblies apart and fit the brake shoe assemblies behind the shoe guide lugs (G) and on the upper anchor pin (B).

- Put the straight end of the shoe return springs (A) in the holes in the brake shoe assemblies.
- Put the other end of the shoe return spring on the upper anchor pin (B).
- Remove the support plate from the axle housing.
- Fasten the support plate to the axle housing with the springs towards the inside. Tighten the bolts to a torque of 40 foot pounds (54 N.m).
- Put the wheel hub on the axle.
- Fasten the wheel hub on the axle with the slotted nut and cotter pin.
- Fasten the wheel assembly to the wheel hub with the bolts that were removed.

**NOTE: Repeat the procedures in Section 6.3.1 and Section 6.3.2 for the other brake.**

- Adjust the brakes as shown in Section 6.2.
- Use a jack to lift the rear of the tractor from the stands. Remove the stands.
- Lower the rear of the tractor. Remove the jack.
- Remove the blocks in front of the front tires and to the rear of the front tires.

## 7.0 How to Do Hydraulic System Service

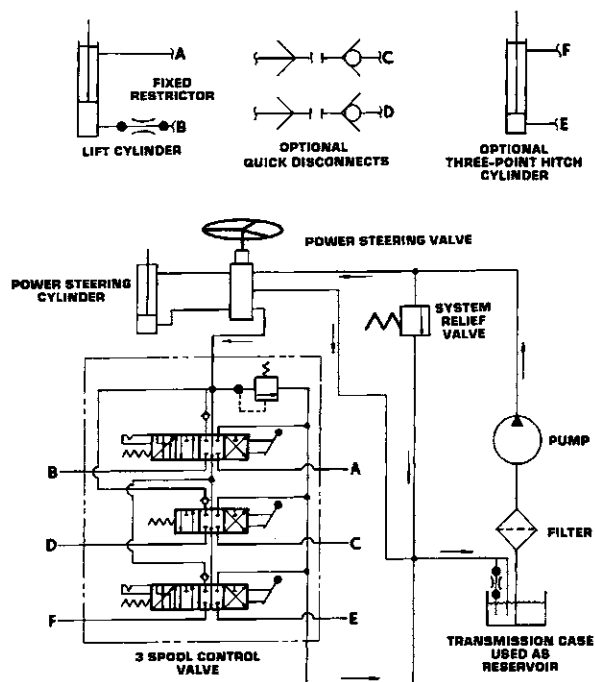
**NOTE:** Normally, the hydraulic system does not cause a problem. For this reason, do not remove any part until you have made sure that a hydraulic part is causing the problem.

First, follow these procedures to make sure that the problem is in the hydraulic system:

1. Check the level of the transmission lubricant. If necessary, add more lubricant.
2. Make sure the engine speed is 3200 RPM.
3. Look for a large amount of leakage in any part of the hydraulic system.
4. Check the maximum permitted load for the attachments.
5. Replace the transmission lubricant filter.

## 7.1 Hydraulic System

Figure 7.0-1 is a schematic of the GMT hydraulic system.



(GMT Hydraulic Schematic)

Figure 7.0-1

## Basic Information

The hydraulic system is an **open center type**. In an open center system, the hydraulic fluid flows in the system at low pressure when the engine is running. **Transmission fluid** is the hydraulic fluid. The **transmission** is used as the **reservoir**.

### Flow of Transmission Fluid

When the engine is running, the **hydraulic pump** is also running. It is this pump which causes the transmission lubricant to flow through the system. But before the transmission lubricant gets to the pump, it flows through a **filter**.

After the transmission lubricant leaves the pump, it goes by the **system relief valve** to the **power steering valve**. If the power steering valve is actuated by the steering wheel, the transmission lubricant is sent to the **steering cylinder**. This flow causes the steering cylinder to extend or to retract.

### Three-Spool Control Valve

When the steering wheel is not turned, the transmission lubricant goes to a **three-spool control valve**. This control valve is an **open center type**: the transmission lubricant flows through the valve at low pressure unless any one of the three spools is actuated. The three control valve spools are actuated by three **hydraulic control levers**.


1. **The A--B Spool.** The **shortest lever** (which is farthest from the tractor) actuates the A--B spool. This spool controls the flow of transmission lubricant to the **lift cylinder**. When this spool is moved, the transmission lubricant flows through the A--B ports on the top of the valve to cause the lift cylinder to extend or to retract. When the handle is pushed all the way forward, the spool is moved to a position where the A--B ports are connected together, permitting the lift cylinder to move freely. There is a lock that will hold the lever in the forward position. In the other positions, this lever will automatically return to the open center position.

2. **The C--D Spool.** The **center lever** actuates the C--D control valve spool. This control valve can be used to control the flow to the optional **front or rear quick disconnects**. When the spool is moved, the transmission lubricant flows through the C--D ports on the top of the valve. The center lever will automatically return to the open center position.
3. **The E--F Spool.** The **longest lever** (which is the nearest to the tractor) actuates the E--F control valve spool. This spool controls the flow of transmission lubricant to the optional **three-point hitch cylinder**. When this spool is moved, the transmission lubricant flows through the E--F ports on the top of the valve. When the handle is pushed all the way forward, the spool is moved to a position where the E--F ports are connected together, permitting the three-point hitch cylinder to move freely. There is a lock that will hold the lever in the forward position. In the other positions, this lever will automatically return to the open center position.

### Power Steering Valve

When the **power steering valve** is actuated, it permits the transmission lubricant to flow to the **steering cylinder**. This steering cylinder becomes fully extended or retracted so no more lubricant can flow into the cylinder. The pump then causes the pressure in the hydraulic system to increase. The high pressure causes the **system relief valve** to open at 2000 psi. This open valve permits the flow of transmission lubricant to continue. Any restriction to the flow of the transmission lubricant in the hydraulic system causes the pump to increase the system pressure until the relief valve opens.

---

 **WARNING:** If the flow from the pump is completely stopped while the engine is running, the pump will be destroyed.

---

### Relief Valve in the Three-Spool Control Valve

Another **relief valve** is found in the **three-spool control valve**. When any one of the three spools is actuated, the transmission lubricant is sent to a cylinder. If the cylinder cannot extend or retract (because the load is too heavy or because of the cylinder being at the end of the stroke), the lubricant flow in the system is again restricted. The pump then increases the system pressure. This increase in pressure causes the relief valve to open when the pressure reaches 2000 psi.

### Restriction to Slow Lift Speed

There is a restrictor valve in the line that connects to the lift cylinder. The lift speed is decreased by this restriction, so the mower will not hit too hard against the tractor frame.

### Clutches and Clutch Housings

The transmission lubricant is returned to the transmission case through the forward and reverse **clutch housings**. The transmission lubricant is used to cool the **clutches**. There is a restrictor plug in the line to the forward clutch. This restriction controls the flow of transmission lubricant to the clutch housing. When there is too much transmission lubricant in the forward clutch housing, the tractor will move very slowly forward ("creep") when the clutch lever is in the "NEUTRAL" position.

### 7.1.2 Troubleshooting

If there is a problem with the hydraulic system, first check to see if there is a flow of transmission lubricant. This procedure can be done by loosening a hydraulic fitting between the pump and the steering valve. Check if the transmission lubricant will flow out. If there is no flow, there is a problem with the pump or pump drive. If there is a flow, then check if the pump will make pressure when the flow is restricted. The pump is working properly if it will make 2000 psi.

Some common hydraulic problems and their corrections are described in the Troubleshooting Chart (Figure 7.0-2).

## Hydraulic System Troubleshooting

PROBLEM	CHECK THE FOLLOWING:	CORRECTION
Attachment cannot be raised or lowered fully	<ol style="list-style-type: none"> <li>1. Weight of the attachment.</li> <li>2. Debris in the mechanism or the control system.</li> <li>3. Broken or disconnected parts in the mechanism or in the control system.</li> <li>4. Lack of flow or low pressure in the hydraulic system.</li> <li>5. Pump drives.</li> <li>6. Damage, defects, or dirt in the relief valve, the control valve, or the cylinder.</li> <li>7. Transmission lubricant level.</li> </ol>	<p>Use attachments with lower weight. Remove debris.</p> <p>Replace or connect parts.</p> <p>Relief valve is set too low or a system component is damaged or defective. Dirt in the system. Change the filter and clean the screen (on models with a screen). Remove defective or damaged components.</p> <p>Add lubricant.</p>
Attachment will not hold in the raised position	<ol style="list-style-type: none"> <li>1. Excessive leakage in the control valve.</li> <li>2. Leakage in the relief valves.</li> <li>3. Excessive leakage in the lift cylinder.</li> <li>4. Load is too heavy.</li> </ol>	<p>Replace the control valve.</p> <p>Replace the relief valves. Replace the cylinder.</p> <p>Decrease the load.</p>
Front wheels will not turn fully or the steering wheel is hard to turn	<ol style="list-style-type: none"> <li>1. Debris in the turning mechanism.</li> <li>2. Missing, disconnected, or loose parts in the steering mechanism.</li> <li>3. No flow or low pressure in the hydraulic system.</li> <li>4. Damage or defects in the power steering cylinder.</li> <li>5. Damaged or defective power steering unit.</li> </ol>	<p>Remove debris.</p> <p>Replace, connect, and tighten parts.</p> <p>Relief valve is set too low or a system component is defective or damaged. Dirt in the system. Change the filter and clean the screen (on models with a screen). Replace damaged or defective parts.</p>

Figure 7.0-2

## 7.2 How to Check the Hydraulic System

### 7.2.1 How to Check the System Pressure

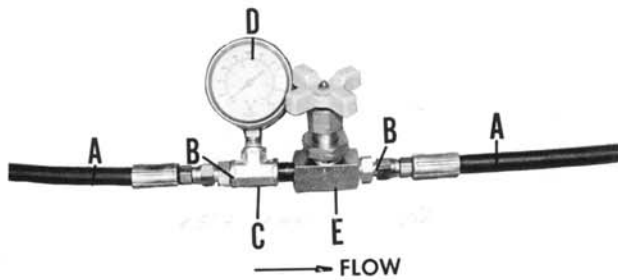
1. If both the steering and the center lift do not work, first check for flow by loosening a fitting coming out of the pump. If there is flow, the oil will come out when the tractor is running.
2. If there is no flow, change the filter element.
3. If there is still no flow, the pump or pump drive is damaged and must be replaced.
4. If there is flow, check to see if there is pressure. Make a **pressure checking assembly**.

Materials and equipment needed:

- 3/8 in. Size hose
- 3/8 in. Fittings
- 3/8 in. Tee
- 3/8 in. Gauge
- 3/8 in. Needle valve

**⚠ WARNING: Do not use a home water system valve. A needle valve rated for a minimum of 3000 psi must be used.**

Assemble the hose, fittings, tee, gauge, and needle valve as shown in Figure 7.0-3 to make a pressure checking assembly.



- |  |
|--|
| <p>A. Hose<br/>         B. Fittings<br/>         C. Tee<br/>         D. Gauge<br/>         E. Needle Valve</p> |
|--|

Figure 7.0-3

Connect the pressure checking assembly in the line between the relief valve and the steering valve with the pressure gauge next to the relief valve.

- a. Start the engine.
  - b. Make sure the needle valve is open.
  - c. Start to close the needle valve slowly until the pressure reaches 2000 psi.
5. When the needle valve is closed, if there is pressure less than 2000 psi, then set the adjustment of the relief valve for 2000 psi (+100 or -100 psi) system pressure. If there is pressure after adjusting the relief valve, then the pump is working correctly. If the pressure is over 2000 psi, then set the relief valve for 2000 psi. If the pressure cannot be brought down to 2000 psi, then replace the relief valve.
  6. If there is still no pressure after relief valve has been adjusted, then the pump or relief valve must be replaced.
  7. If the pump is replaced and the system does not work, replace the relief valve. If the system still does not have pressure, try replacing both the pump and the relief valve. (The requirement to replace both the pump and the relief valve is not normal but can be found in older systems.)
  8. If there is flow and pressure, remove the pressure checking assembly.

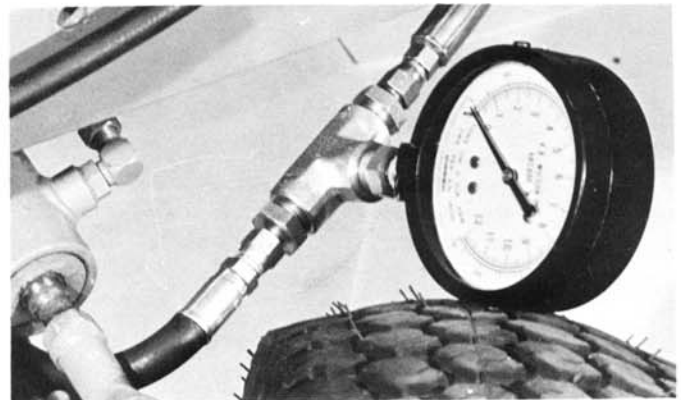
## 7.2.2 How to Check the Power Steering Cylinder

Follow this procedure if there is flow and pressure from this point, but the wheels do not move when the steering wheel is turned:

1. Check for flow to the power steering cylinder. Loosen the fitting at the steering cylinder. After loosening the fittings, there should be some leakage but no flow.
2. If there is no flow, then turn the steering wheel. There should now be flow where the fittings are loose.
3. If there is no flow, the power steering valve is damaged.
4. If there is flow, then check for pressure in the steering cylinder lines. Put the pressure checking assembly in the line from the steering valve to the cylinder. See Figure 7.0-3 for assembly instructions for the pressure checking assembly.

**NOTE: The cylinder may be taken out of the tractor. This procedure is optional.**

5. Connect the assembly to the line as shown in Figure 7.0-4.



Pressure Checking Assembly in the Steering Cylinder Line

Figure 7.0-4

6. Close the needle valve. If the steering wheel is turned to a correct direction to apply pressure to the gauge and there is 2000 psi, the steering cylinder is damaged and must be replaced.

7. If there is pressure, then put the pressure checking assembly in the other line and do the same test.
8. If there is pressure, the cylinder is damaged and must be replaced.

---

**NOTE: There is another way to find damage in the cylinder. If the cylinder will extend but not retract and if the wheels turn one way but not the other, then there is damage in the cylinder.**

---

### 7.2.3 How to Check the Cylinders Connected to the Three-Spool Control Valve

These cylinders are in the attachments, the lift, and the optional three-point hitch.

1. Use the procedure in steps 1 to 8 in Section 7.2.2, "How to Check the Power Steering Cylinder," to check the cylinders on the three-point hitch, the lift, and the quick disconnects. Put the pressure checking assembly in the line to be checked. Then, operate the control valve levers.
2. If there is no pressure, first replace the relief valve in the three-spool control valve.
3. If there is 2000 psi pressure on the A--B, C--D, and E--F ports and the cylinders will not work correctly when the valves are actuated, then the cylinders are damaged or worn and must be replaced.

### 7.2.4 How to Check the Lift System When the Mower Falls Down

---

**NOTE: These instructions also apply to the three-point hitch.**

---

When the mower slowly falls down from the raised position, it is probably a result of the leakage of the spool in the valve. If the piston in the lift cylinder is worn, the rate that the mower falls will be faster.

---

**NOTE: This problem is a result of dirt in the hydraulic system that caused scratches in the bore for the spool in the control valve.**

---

First, try changing the cylinder. If the mower still falls down, the problem is in the valve.

## 7.3 How to Replace System Components

---

**NOTE: The hydraulic system must be kept clean. Most hydraulic system failures are caused by dirt.**

---



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**NOTE: Use care when installing hydraulic parts and fittings that go through O-rings or move O-rings. Apply lubricant to these areas before installation. Make sure these fittings and seats are clean.**

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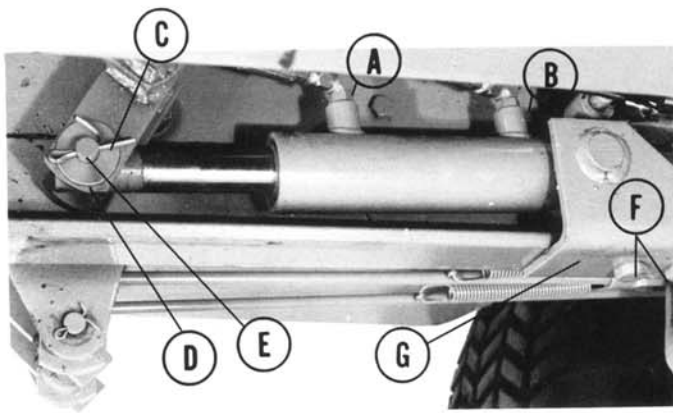
**NOTE: Use care when the hydraulic tube and hose nuts are removed and tightened. Use two wrenches: one on the nut and one on the adapter. Do not twist hoses and tubes during assembly or disassembly.**

---

### 7.3.1 How to Replace the Hydraulic Cylinder for the Center Mount

1. Engage the parking brake.
2. Lower the center mount by pushing the control lever for the center mount forward.
3. Stop the engine.
4. Make a "FRONT" tag and connect it to the hydraulic line on the front fitting (Figure 7.0-5) on the hydraulic cylinder.





- |    |                             |
|----|-----------------------------|
| A. | Hydraulic Line at Front End |
| B. | Hydraulic Line at Rear End  |
| C. | Cotter Pin                  |
| D. | Flat Washer                 |
| E. | Clevis Pin                  |
| F. | Bolts                       |
| G. | Bracket                     |

Figure 7.0-5

5. Disconnect both of the hydraulic lines at the cylinder.
6. Remove the cotter pin (C), the flat washer (D), and the clevis pin (E).
7. Remove the bolts (F) and the lock nuts (not shown). Remove the bracket (G) and the hydraulic cylinder.
8. Remove the hydraulic cylinder from the bracket (G).
9. Note the angle of the hydraulic fittings in the old cylinder. Remove the hydraulic fittings from the cylinder.
10. Install the hydraulic fittings on the new cylinder. Make sure the fittings are turned at the correct angle.
11. Put the new hydraulic cylinder on the pivot pin (not shown) on the bracket (G).
12. Put the bracket (G) in position and install the bolts (F) and the lock nuts.

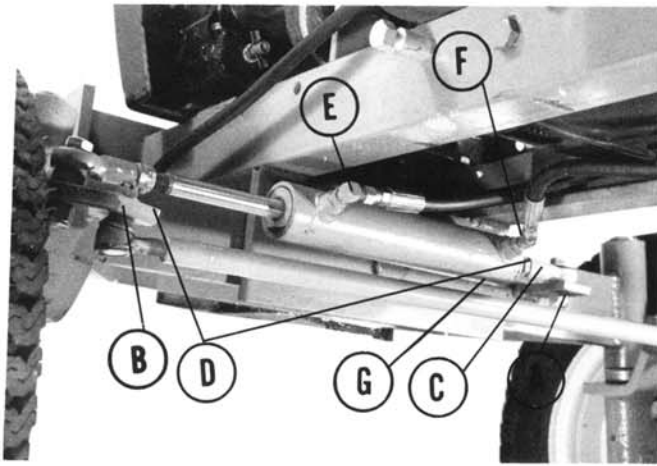
13. Align the hole in the cylinder rod with the holes in the clevis on the cross shaft.
14. Install the clevis pin (E), the flat washer (D), and the cotter pin (C).
15. Install the hydraulic line with the "FRONT" tag on the hydraulic fitting at the front of the cylinder.
16. Install the hydraulic line at the rear of the cylinder.
17. Start the engine.
18. Test the operation of the center lift. Check for leakage.
19. Stop the engine.

### 7.3.2 How to Replace the Hydraulic Cylinder for the Optional Three-Point Hitch

See Section 10.2, "How to Disassemble the Three-Point Hitch," steps 11-14 and Section 10.4, "How to Assemble the Three-Point Hitch," steps 7, 8, and 9. Make sure the attachment is lowered before starting disassembly. Remove the hydraulic adapters from the old cylinder. Install them in the new cylinder. Install them in the new cylinder in exactly the same position.

### 7.3.3 How to Replace the Power Steering Cylinder

1. Engage the parking brake.
2. Turn the steering wheel until the front wheels are turned forward.
3. Stop the engine.
4. Make a "LEFT" tag. Connect it to the hydraulic line on the left side of the steering cylinder.
5. Disconnect both hydraulic lines.
6. Remove the bolt, the spacer, and the lock nut (Figure 7.0-6).



- |    |                                 |
|----|---------------------------------|
| A. | Bolt, Spacer, and Lock Nut      |
| B. | Bolt, Flat Washer, and Lock Nut |
| C. | Rod Ends (2)                    |
| D. | Jam Nuts (2)                    |
| E. | Hydraulic Adapter, 90°          |
| F. | Hydraulic Adapter, 90°          |
| G. | Steering Cylinder               |

Figure 7.0-6

7. Remove the bolt, the flat washer, and the lock nut (B).
8. Remove the cylinder and place it in a clean area.
9. Put the new cylinder along side the old cylinder.
10. Remove the following parts from the old cylinder.
  - a. Rod ends (C)--first loosen the jam nuts (D)
  - b. Jam nuts (D)
  - c. 90° adapter (E)
  - d. 45° adapter (F)

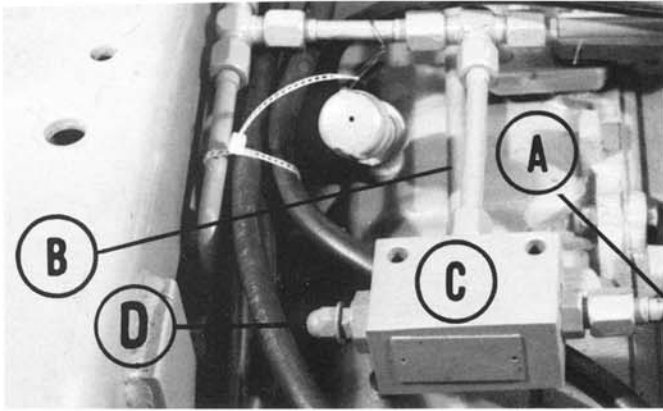
Install these parts from the old cylinder on the new cylinder in the same arrangement.

**NOTE: When installing parts on the new cylinder, make sure the adapters (E and F) are turned in the same direction as in the old cylinder. Tighten the adapters in these positions. The rod ends (C) and the jam nuts (D) are not tightened at this time. DO NOT CHANGE THE POSITION OF THE FRONT WHEELS WHILE DOING THIS PROCEDURE.**

11. Put the new cylinder assembly in position and check the alignment of the holes in the rod ends. Adjust it as follows:
  - a. Turn the rod ends clockwise until there is an equal amount of thread at each end, and the holes in the rod ends are aligned with the holes in the brackets to be installed.
12. Install the bolts, the flat washer, and the lock nut (B). Tighten the lock nut only enough to remove the clearance.
13. Install the bolt, the spacer, and the lock nut (A). The spacer must be between the rod end and the mounting bracket. Tighten the lock nut only enough to remove the clearance.
14. Connect the hydraulic line with the "LEFT" tag to the hydraulic fitting at the left side of the cylinder.
15. Connect the other hydraulic line to the hydraulic fitting at the right side of the cylinder.
16. Start the engine. Push the throttle lever to the "FAST" position.
17. Test the operation of the new cylinder. Make sure the front wheels turn all the way to the left and right. The mounting brackets will touch the axle when they are adjusted correctly.
18. Check the cylinder for leakage. Tighten the connections, if necessary.
19. Stop the engine.

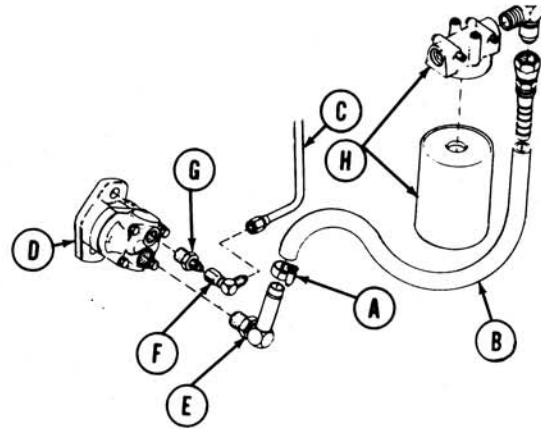
### 7.3.4 How to Replace the Pressure Relief Valve

1. Stop the engine. Engage the parking brake.
2. Remove the seat. See Section 10.2, "How to Disassemble the Three-Point Hitch," step 1.
3. Disconnect the hydraulic lines at the inlet (A, Figure 7.0-7) and at the outlet (B).



- |   |
|---|
| A. Hydraulic Line -- Inlet<br>B. Hydraulic Line -- Outlet<br>C. Pressure Relief Valve<br>D. Acorn Nut |
|---|

Figure 7.0-7



- |   |
|---|
| A. Hose Clamp<br>B. Suction Hose<br>C. Line<br>D. Pump<br>E. Adapter<br>F. 90° Adapter<br>G. Adapter<br>H. Filter |
|---|

Figure 7.0-8

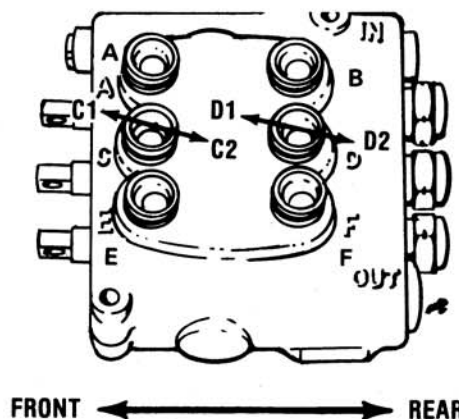
4. Remove the pressure relief valve (C).
5. Remove the hydraulic fittings for the valve removed in step 4. Install these fittings in the new valve. Tighten the fittings.
6. Put the new pressure relief valve in position.
7. Reconnect the hydraulic lines (A) and (B).
8. Remove the acorn nut (D).
9. Turn the set screw (not shown) several turns counterclockwise.
10. Connect a gauge for testing and make an adjustment of the hydraulic pressure. See Section 7.2.1, "How to Check the System Pressure," steps 1-8.

### 7.3.5 How to Replace the Hydraulic Pump

1. Stop the engine. Engage the parking brake.
2. Drain the transmission lubricant from the transmission.
3. Loosen the hose clamp (A, Figure 7.0-8) and remove the hose clamp and the suction hose (B).

4. Disconnect the line (C) at the pump.
5. Remove the two bolts (not shown) that hold the pump (D) to the transmission housing.
6. Hit the pump lightly with a soft hammer to loosen the sealing compound.
7. Remove the hydraulic pump.
8. Remove the adapters, (E) and (G), from the old pump. Install them in the same arrangement on the new pump.
9. Turn the shaft of the pump until the notch on the shaft is aligned with the key on the end of the shaft that drives the pump.
10. Install a new gasket on the new pump. Use Loctite No. 277 on both sides of the new gasket.
11. Remove the old gasket and the sealing compound from the installing surface of the transmission.
12. Put the new pump in position and install the two bolts. Make sure the key on the shaft is in the notch on the rotor for the pump.

13. Reconnect the hydraulic line (C).
14. Install the suction hose (B) and tighten the hose clamp (A).
15. Fill the transmission with clean transmission lubricant.
16. Start the engine. Run the engine at a low RPM for one minute. If there is too much noise or if the pump noise does not sound normal, stop the engine immediately.
17. Push the throttle lever to the "FAST" position.
18. Check for leakage at the pump connections. Tighten them, if necessary.
19. Stop the engine.
20. Check the level of the transmission lubricant in the transmission.



- |       |                              |
|-------|------------------------------|
| A.    | Front Center Mount           |
| B.    | Rear Center Mount            |
| C. 1. | Right Front Quick Disconnect |
| C. 2. | Left Rear Quick Disconnect   |
| D. 1. | Left Front Quick Disconnect  |
| D. 2. | Right Rear Quick Disconnect  |
| E.    | Top Three-Point Hitch        |
| F.    | Bottom Three-Point Hitch     |

In--Power Steering  
Out--Return

Figure 7.0-9

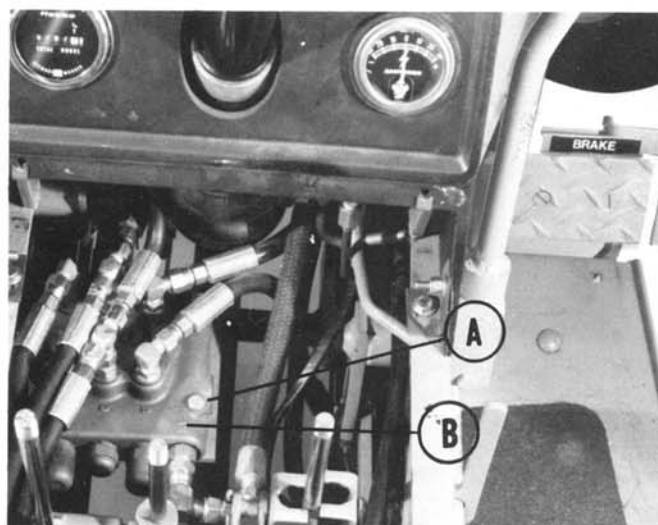
### 7.3.6 How to Replace the Control Valve

1. Stop the engine. Engage the parking brake.
2. Remove the knobs from the following control levers:
  - a. Front PTO
  - b. HI-LO Range Selector
  - c. Gear Selector
3. Remove the six screws and remove the cover plate for the controls.

**NOTE: Some GMFs have a piece of fiber glass just above the control valve. Cut it out for clearance. This piece has no effect on the instrument panel. There is a hydraulic line on the right side. The left side is open.**

4. Make tags for each item in Figure 7.0-9. Connect the tags to the hydraulic lines in the positions shown in Figure 7.0-9.

5. Disconnect all lines from the control valve.
6. Remove the cotter pins and the clevis pins from the control valve (B, Figure 7.0-10).



- |    |                             |
|----|-----------------------------|
| A. | Bolts (2) and Lock Nuts (2) |
| B. | Control Valve               |

Figure 7.0-10

7. Remove the bolts and the lock nuts (A).
8. Remove the control valve (B) and put it in a clean area.
9. Put the new control valve along side the old control valve.
10. Remove the adapters from the old valve and install the adapters on the new control valve in the same arrangement. Note the direction of angle of the adapters in the old valve and install them exactly the same direction in the new valve. Put lubricant on the O-rings before installing the fittings. Make sure all adapters are tight.
11. Put the new control valve in position and install the bolts and the lock nuts (A).
12. Install the clevis pins and the cotter pins on the control valve (B).
13. Connect the hydraulic lines in the arrangement shown in Figure 7.0-9. Tighten all the connections.
14. Start the engine. Push the throttle lever to the "FAST" position.
15. Actuate each lever for control in both directions to test the operation of the new control valve.
16. Check all the connections for leakage. Tighten them, if necessary. Do not tighten too tightly.
17. Stop the engine.
18. Put the cover plate for the controls in position and install the six screws.
19. Install the knobs on all the control levers.

### 7.3.7 How to Replace the Power Steering Valve

1. Engage the parking brake. Turn the steering wheel until the front wheels are turned forward. Stop the engine.
2. Remove the hood.

3. Disconnect the negative "-" cable from the battery.
4. Disconnect the positive "+" cable from the battery.
5. Remove the cotter pin from the rod for the throttle (under the instrument panel) and move the rod for the throttle away from the throttle lever.
6. Remove the bolts and the lock nuts (A, Figure 7.0-11).

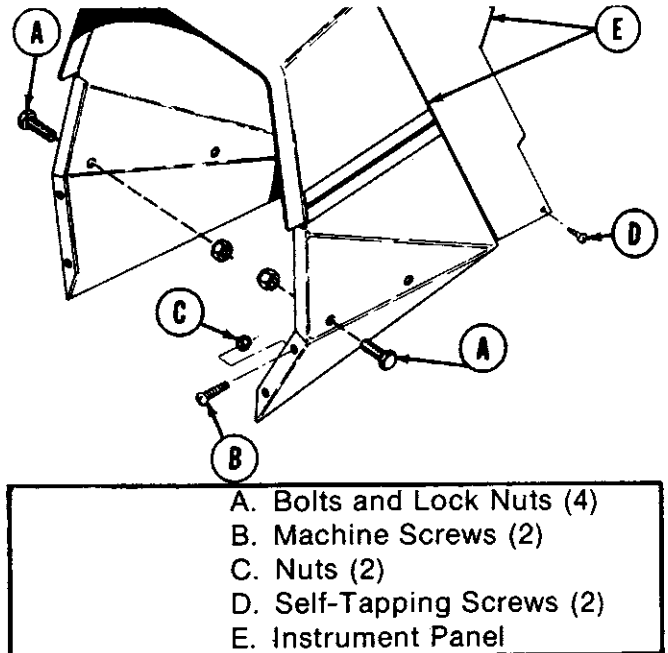
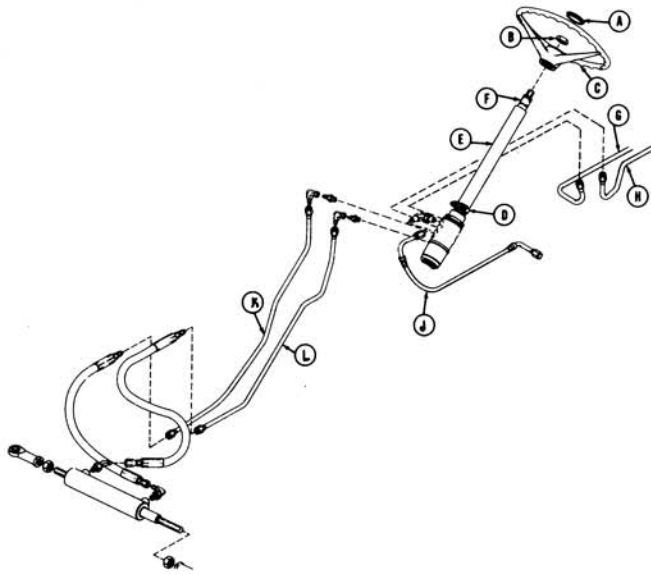


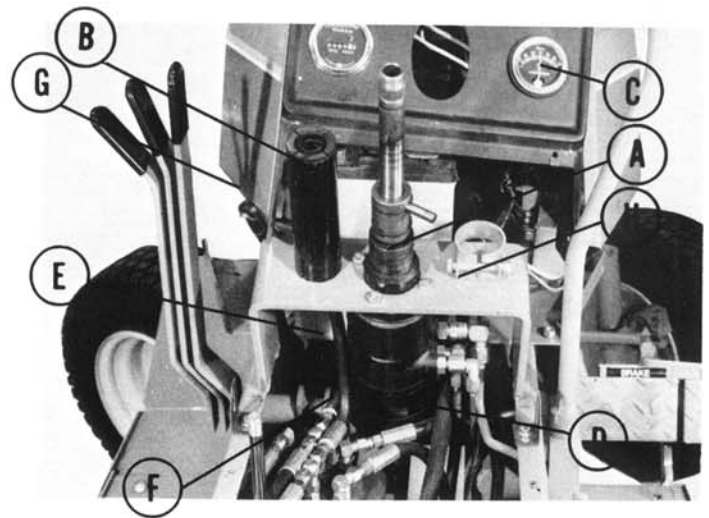
Figure 7.0-11

7. Remove the machine screws (B) and the nuts (C).
8. Remove the self-tapping screws (D).
9. Remove the knobs from the following control levers:
  - a. Front PTO
  - b. HI-LO Range Selector
  - c. Gear Selector
10. Remove the six screws from the cover plate for the controls. Remove the cover plate.
11. Remove the insert for the steering wheel (A, Figure 7.0-12).



- A. Insert
- B. Nut
- C. Steering Wheel
- D. Clamp
- E. Sleeve
- F. Steering Column
- G. Hydraulic Line -- Supply
- H. Hydraulic Line -- Return
- J. Hydraulic Line -- To Control Valve
- K. Hydraulic Line -- To Left Side Steering Cylinder
- L. Hydraulic Line -- To Right Side Steering Cylinder

Figure 7.0-12

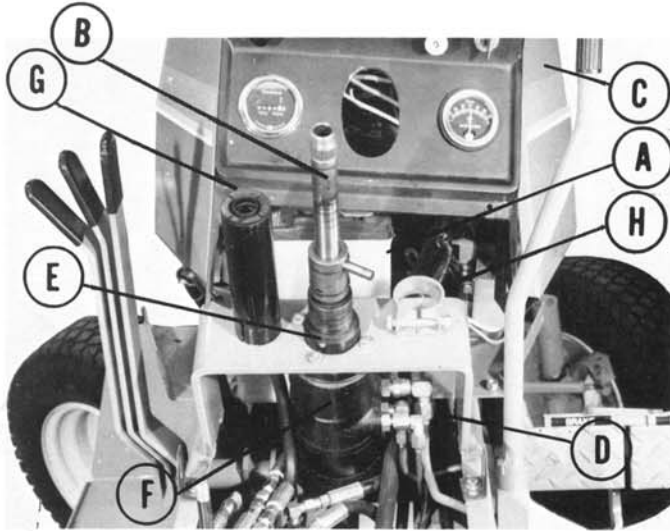


- A. Pin
- B. Steering Column
- C. Instrument Panel
- D. Hydraulic Connections
- E. Bolts (4)
- F. Valve
- G. Sleeve
- H. Clamp

Figure 7.0-13

12. Loosen the nut (B).
13. Use a puller to loosen the steering wheel (C), remove the nut (B), and remove the steering wheel (C).
14. Raise the instrument panel (E, Figure 7.0-11) until the clamp (D, Figure 7.0-12) can be seen.
15. Loosen the clamp (D).
16. Remove the sleeve (E).
17. Remove the Pin (A, Figure 7.0-13). This pin is loose and can be pushed out easily.
18. Remove the steering column (B).
19. Raise the instrument panel (C) until it is clear of the control unit (F). Be careful not to pull the wires or other connections from the terminals on the instrument panel. Move the instrument panel forward against the air cleaner.
20. Make two tags for each line shown in Figure 7.0-12. Connect one tag with the correct name to the line. Connect the tag with the same name to the adapter on the control unit for that line.
21. Disconnect all lines.
22. Remove the four bolts (E, Figure 7.0-13).
23. Remove the valve (F). Put the valve in a clean area.
24. Put a new valve along side the old valve.

25. Remove the adapters (with tags) on the old valve and put them on the new valve. Make sure to note the direction of the angle of the adapters in the old valve. Install them in exactly the same direction in the new control valve. Make sure all adapters are tight. Apply lubricant to the O-rings before installing the adapter.
26. Put the control unit (Figure 7.0-14) in position and install the four bolts (E). Make sure the control unit is installed with hydraulic adapters on the right side.

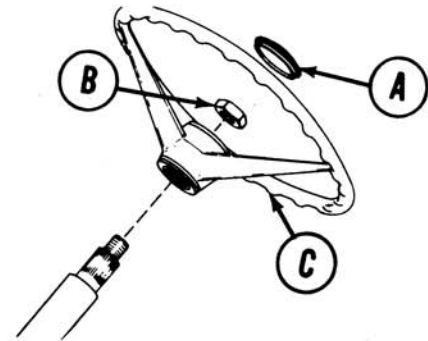


- |                     |
|---------------------|
| A. Pin              |
| B. Steering Column  |
| C. Instrument Panel |
| D. Lines            |
| E. Bolts (4)        |
| F. Valve            |
| G. Sleeve           |
| H. Clamp            |

Figure 7.0-14

27. Install the hydraulic lines (D). Use the tags to make sure the connections are correct.
28. Put the clamp (H) in position on the control unit. Do not tighten it.
29. Raise the instrument panel (C) and put it over the control unit. Do not lower the instrument panel.

30. Install the steering column (B) with the hole for the pin (A) aligned with the holes in the control unit.
31. Install the pin (A).
32. Install the sleeve (G).
33. Tighten the clamp (H).
34. Lower the instrument panel (C) into position.
35. Put the steering wheel (A, Figure 7.0-15) in position. Do not tighten it.



- |                   |
|-------------------|
| A. Insert         |
| B. Nut            |
| C. Steering Wheel |

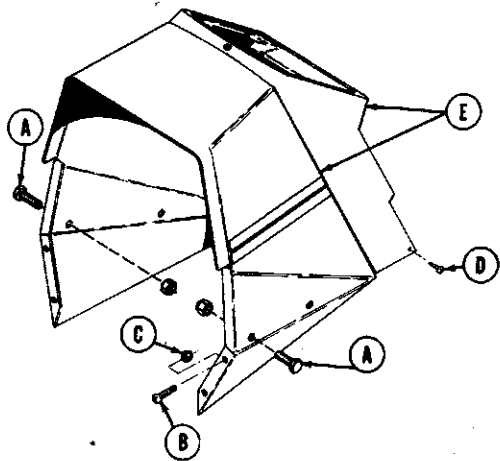
Figure 7.0-15

36. Turn the steering wheel fully clockwise.
37. Turn the steering wheel fully counter-clockwise. Remember the number of turns.
38. Divide the number of turns in step 37 by two. The result will give the center position of the control unit for the power steering. Turn the steering wheel clockwise to the center position.

**NOTE: When doing steps 36, 37, and 38, make sure the front wheels do no turn. They always must be in a straight, forward position.**

39. Remove the steering wheel. Install the steering wheel with one spoke in a straight, forward position.

40. Install the nut (B). Tighten it to a torque of 20-25 foot pounds (2.77-3.46 mkg).
41. Install the insert (C).
42. Install the self-tapping screws (D, Figure 7.0-16).



- |  |
|--|
| <p>A. Bolts and Lock Nuts (4)<br/>         B. Machine Screws (2)<br/>         C. Nuts (2)<br/>         D. Self-Tapping Screws (2)<br/>         E. Instrument Panel</p> |
|--|

Figure 7.0-16

43. Install the machine screws (B) and the nuts (C).
44. Install the bolts and the lock nuts (A).
45. Put the rod for the throttle in position on the throttle lever (under the instrument panel) and install the cotter pin.
46. Connect the positive "+" cable on the battery.
47. Connect the negative "-" cable on the battery.

48. Start the engine. Pull the throttle lever to the "SLOW" position. Let the engine run one minute; then, push the throttle lever to the "FAST" position.
49. Turn the steering wheel fully clockwise, then fully counterclockwise several times.
50. Make sure the front wheels turn the full amount in each direction.
51. Check the hydraulic connections for leakage. Tighten them, if necessary.
52. Stop the engine.
53. Put the cover plate for the controls in position and install the six screws.
54. Install the hood.



## 8.0 How to Do Transmission Service

1. Always work in a clean area when disassembling a transmission.

**NOTE: Follow the instructions from the manufacturer when using a sealing compound. Do not put sealing compound on the rollers or on the balls. Do not put sealing compound in the bore of a bushing.**

2. A sealing compound is used when bearings or bushings are installed. Use Loctite No. 601. The solvent for this sealing compound is Loctite Safety Solvent No. 7S559.
3. When a transmission is disassembled, replace all gaskets.
4. Put a sealing compound on both sides of the gaskets. Use Loctite No. 277.
5. Keep all parts for a shaft assembly together after the assembly is removed from the transmission. This includes the thrust washers, the thrust bearings, the gears, the woodruff keys, and etc. The best procedure is to keep all the parts on each shaft exactly as the parts were assembled in the transmission. By following this procedure, the shaft assemblies will be ready for installation.

### 8.1 Transmission Maintenance Schedule

Daily ..... check the level of lubricant in the transmission.

Change the filter after the first 10 hours.  
Change the oil and filter every 1000 hours or once a year.

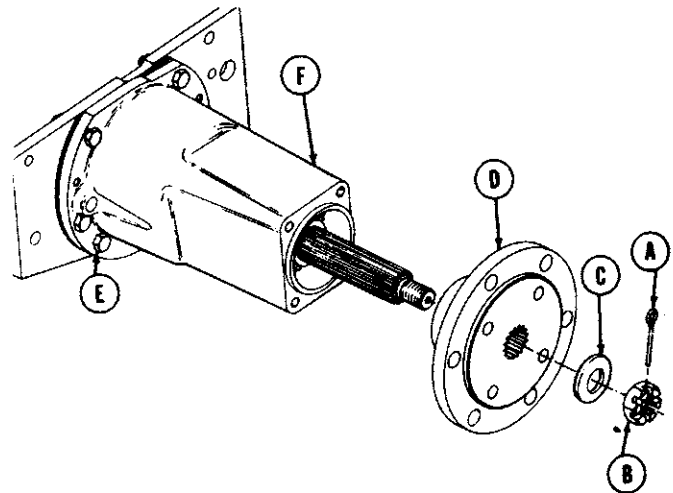
### 8.2 Drop Axle Section

#### 8.2.1 How to Disassemble the Drop Axle

**NOTE: The procedure for disassembly is the same for either drop axle. But when the left drop axle is removed, first remove the clamp for the exhaust pipe.**

1. Stop the engine. Do not engage the brake latch or the parking brake. Move the gear selector to the "NEUTRAL" position.

2. Put blocks on the ground to the front of the front tires and to the rear of the front tires. These blocks must be against the tires to prevent movement of the tractor.
3. Drain the transmission lubricant from the transmission.
4. Use a jack to lift the rear of the tractor until the rear wheels are one inch (2.5 cm) above the ground.
5. Put stands under the right side of the frame and under the left side of the frame. Both stands must be put to the front of the transmission. Remove the jack.
6. Remove the six bolts for the hub. Remove the wheel.
7. Remove the cotter pin (A, Figure 8.0-1).

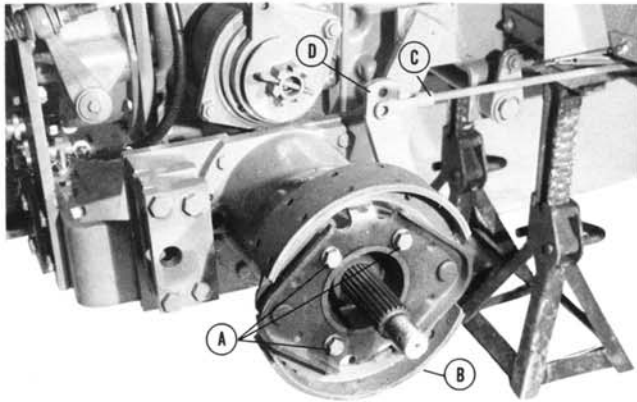


- |                            |
|----------------------------|
| A. Cotter Pin              |
| B. Slotted Nut             |
| C. Flat Washer             |
| D. Hub                     |
| E. Bolts and Lock Nuts (6) |
| F. Housing                 |

Figure 8.0-1

8. Remove the slotted nut (B).
9. Remove the flat washer (C).
10. Remove the hub (D) and the brake drum (not shown) as an assembly. It is not necessary to disassemble the hub and the brake drum.

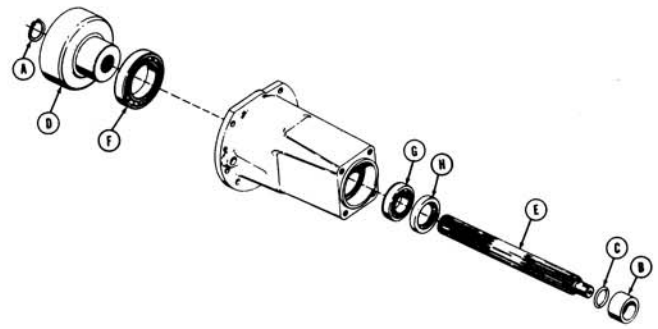
11. Remove the cotter pin and the clevis pin from the brake rod (C, Figure 8.0-2). Move the brake actuating arm (D) away.
12. Remove the four bolts (A, Figure 8.0-2).



- |   |
|---|
| <p>A. Bolts<br/>         B. Brake Shoe Assembly<br/>         C. Brake Rod<br/>         D. Brake Actuating Arm</p> |
|---|

Figure 8.0-2

13. Remove the brake shoe assembly (B). It is not necessary to disassemble the brake shoe assembly in this procedure.
14. Remove the brake actuating arm (D).
15. Remove the lock nut from the strut (not shown) at the bottom of the flange on the housing (F, Figure 8.0-1).
16. Remove the six bolts and the lock nuts (E, Figure 8.0-1) from the flange on the housing (F).
17. Use a hammer with a soft face to hit the housing (F) to loosen the sealing compound.
18. Remove the drop axle assembly.
19. Remove the retaining ring (A, Figure 8.0-3).



- |   |
|---|
| <p>A. Retaining Ring<br/>         B. Spacer<br/>         C. O-ring<br/>         D. Ring Gear<br/>         E. Drop Axle<br/>         F. Ball Bearing<br/>         G. Ball Bearing<br/>         H. Oil Seal</p> |
|---|

Figure 8.0-3

20. Remove the spacer (B).
21. Remove the O-ring (C).
22. Remove the ring gear (D).
23. Remove the drop axle (E).
24. Make an inspection of the parts as follows:
  - a. Look for parts that have damage and replace them.
  - b. Turn the inner race of the ball bearing (F) by hand. The rotation of the balls and cage must be smooth. If there is any friction or, if any area is loose, replace the ball bearing.
  - c. Repeat step 24(b) for the ball bearing (G).
  - d. Look at the lip of the oil seal (H). Replace the oil seal if any part of the lip has a crack or is missing.
  - e. Look at the O-ring (C). Replace a broken O-ring or an O-ring that has cracks.
  - f. Use an inside micrometer to measure the diameter of the section of the ring gear that is installed in the ball bearing (F).

New Specification:	2.3600 to 2.3622 inches (59.944 to 60.001 mm)
Replacement Limit:	2.359 inches (59.919 mm)

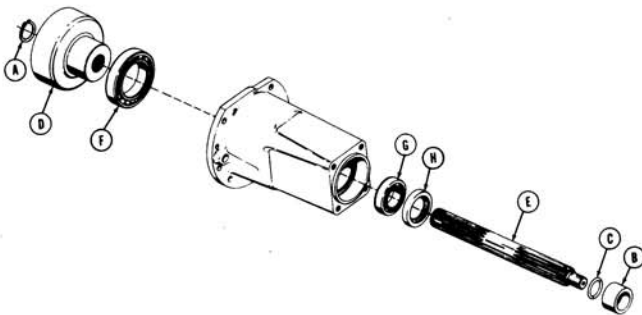
- g. Use an outside micrometer to measure the diameter of the section of the axle that is installed in the ball bearing (G).

New Specification:	1.3775 to 1.3785 inches (34.99 to 35.01 mm)
Replacement Limit:	1.377 inches (34.98 mm)

25. Look at the pinion for the drop axle (not shown) that is on the axle for the differential. Replace any pinion with damage.
26. Use a solvent to clean the sealing compound from the flange and the plate.

### 8.2.2 How to Assemble the Drop Axle

1. Install the drop axle (E, Figure 8.0-4). Make sure the splines on the drop axle do not cut the lip of the oil seal (H).

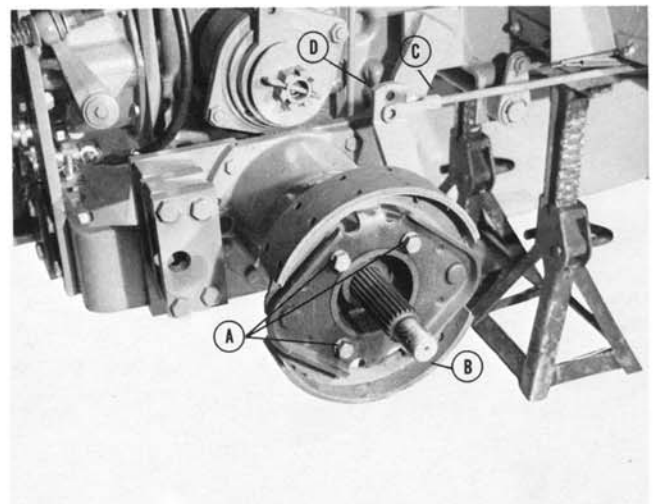


A. Retaining Ring	E. Drop Axle
B. Spacer	F. Ball Bearing
C. O-ring	G. Ball Bearing
D. Ring Gear	H. Oil Seal

Figure 8.0-4

2. Install the ring gear (D).
3. Install the retaining ring (A).

4. Put Loctite No. 277 on the flange of the housing for the drop axle.
5. Make sure the two dowel pins (not shown) are in the plate for the housing of the drop axle assembly.
6. Put the drop axle assembly in position. Install the six bolts and the lock nuts (E, Figure 8.0-1).
7. Install the lock nut on the strut (not shown) at the bottom of the flange.
8. Install the O-ring (C, Figure 8.0-4).
9. Install the spacer (B).
10. Install the brake actuating arm (D, Figure 8.0-5).

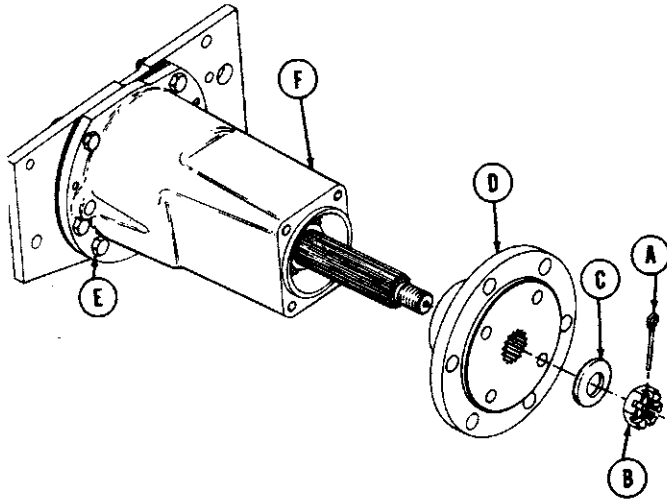


A. Bolt
B. Brake Shoe Assembly
C. Brake Rod
D. Brake Actuating Arm

Figure 8.0-5

11. Put the brake shoe assembly (B) in position. Install the four bolts (A).
12. Put the brake actuating arm (D) and the brake rod (C) in position. Install the clevis pin and the cotter pin.

13. Install the hub (D, Figure 8.0-6) and the brake drum assembly.



- |  |
|--|
| <p>A. Cotter Pin<br/>         B. Slotted Nut<br/>         C. Flat Washer<br/>         D. Hub<br/>         E. Bolts and Lock Nuts (6)<br/>         F. Housing</p> |
|--|

Figure 8.0-6

14. Install the flat washer (C).
15. Install the slotted nut (B). Tighten the slotted nut until there is no clearance in the assembly.

**! WARNING: Too much force on the slotted nut (B) causes damage to the retaining ring (A, Figure 8.0-4).**

16. Install the cotter pin (A, Figure 8.0-6).
17. Put the rear wheel in position and install the six bolts for the hub.
18. Use a jack to lift the rear of the tractor.
19. Remove the stands.
20. Lower the tractor and remove the jack.
21. Put 8 U.S. quarts (9.5 liters) of transmission lubricant in the transmission. Check the transmission lubricant level. If necessary, add more transmission lubricant.
22. Remove the blocks from the front wheels.

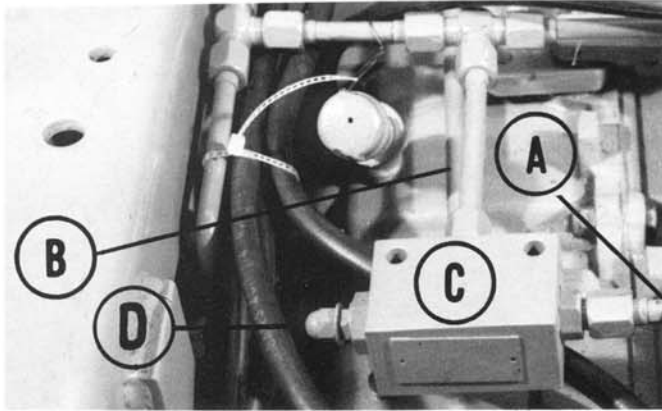
23. Test the operation of the drop axle as follows:

- a. Start the engine.
- b. Select the range and the gear.
- c. Operate the direction control in both the forward and the backward direction.
- d. Check the operation of the drop axle.

## 8.3 Transmission Section

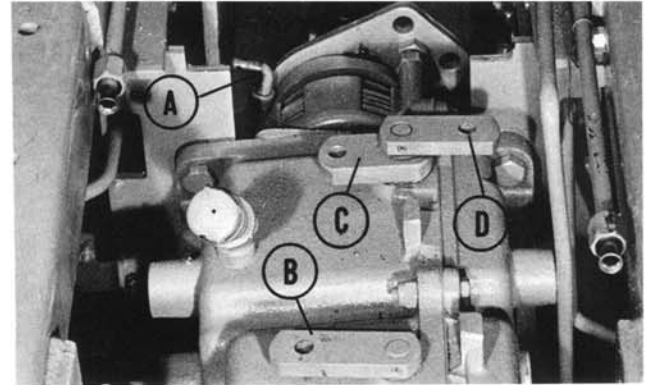
### 8.3.1 How to Remove the Transmission from the Tractor

1. Stop the engine. Do not engage the brake latch or the parking brake.
2. Move the gear selector to the "NEUTRAL" position.
3. Move the range selector to "LO."
4. Disengage the direction control.
5. Put the blocks on the ground to the front of the front tires and to the rear of the front tires. These blocks must be against the tires to prevent movement of the tractor.
6. Drain the transmission lubricant from the transmission.
7. Use a jack to lift the rear of the tractor until the rear wheels are one inch (2.5 cm) above the ground.
8. Put stands under the right side of the frame and under the left side of the frame. Both stands must be put to the front of the transmission. Remove the jack.
9. Remove the quick disconnects as follows:
  - a. Remove the four bolts and the lock nuts (G, Figure 8.0-7).



- A. Angle Bracket
- B. Thick Bracket
- C. Thin Bracket
- D. Plug
- E. Quick Disconnect
- F. Ring
- G. Bolt and Lock Nut

Figure 8.0-7



- A. Rod for Clutch Cam for Front PTO
- B. Shifter Arm for HI-LO Selector
- C. Shifter Arm for Gear Selector for Gears 1 and 3
- D. Shifter Arm for Gear Selector for Gears 2 and 4

Figure 8.0-8

- b. Remove the two thin brackets (C).
  - c. Remove the two quick disconnects (E), the two rings (F), and the two plugs (D).
  - d. Install loosely the two thin brackets (C) and the four bolts and the lock nuts (G).
10. Remove the three-point hitch. Read Section 10.2, "How to Disassemble the Three-Point Hitch," steps 1-18 (do not include step 17).
  11. Remove both rear wheels and both drop axle assemblies. See Section 8.2.1, "How to Disassemble the Drop Axle," steps 6 to 18.

**NOTE: When both drop axle assemblies are removed, remove the strut (not shown) between mounting plates for drop axles.**

12. Remove the knobs from:
  - a. The control lever for the front PTO.
  - b. The control lever for the gear selector.
  - c. The control lever for the range selector.
13. Remove the six screws for the control cover plate. Remove the control cover plate.
14. Disconnect the control linkages as follows:

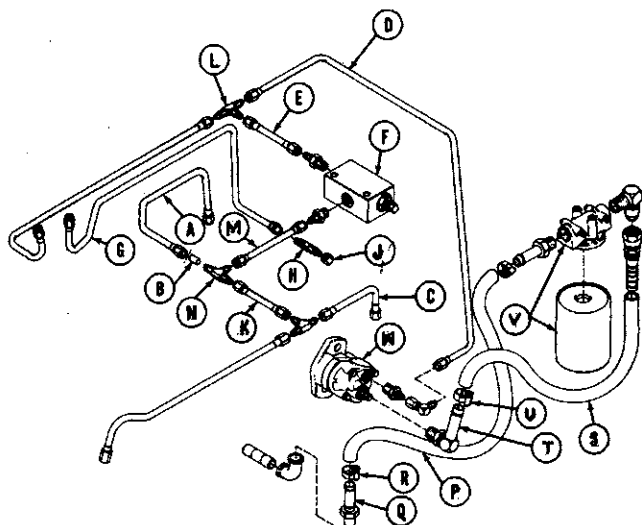
- a. Remove the cotter pin from the rod for the clutch cam for the front PTO (A, Figure 8.0-8).

- b. Disengage the control lever for the front PTO and push it forward.
  - c. Remove the clip pin from the rod for the range selector at the shifter arm (B).
  - d. Rotate the rod for the range selector forward against the control panel.
  - e. Repeat steps 14c and 14d for the rod for the gear selector for 1 and 3 (C).
  - f. Repeat steps 14c and 14d for the rod for the gear selector for gears 2 and 4 (D).
15. Use a side cutter to cut the cable ties that hold the hoses.
    - a. Move the quick disconnect and the three-point hitch hydraulic lines to a position forward of the transmission.
    - b. Repeat step 15a for the fuel line and the fuel filter.
  16. Remove the hydraulic lines and the fittings as follows:

**NOTE: The hydraulic tubes are removed by turning the couplings at each end counter-clockwise. Use an open end wrench. Remove fittings only when shown in the procedure. Use a wrench to hold the fitting when turning the coupling.**

- a. Remove the hydraulic line (A, Figure 8.0-9) to the forward clutch assembly.

**NOTE: Do not let restriction (B) fall. The restriction must be installed in the same position when it is reassembled.**



- |    |                                       |
|----|---------------------------------------|
| A. | Line to Forward Clutch                |
| B. | Restriction                           |
| C. | Line to Reverse Clutch                |
| D. | Line for Hydraulic Pump               |
| E. | Line to Relief Valve                  |
| F. | Relief Valve                          |
| G. | Line from Power Steering Housing      |
| H. | Tee Fitting at Bottom of Transmission |
| J. | Cap                                   |
| K. | Line                                  |
| L. | Tee Fitting                           |
| M. | Tee Fitting for Relief Valve          |
| N. | Tee Fitting                           |
| P. | Suction Hose from Transmission        |
| Q. | Adapter                               |
| R. | Hose Clamp                            |
| S. | Suction Hose from Filter              |
| T. | Adapter                               |
| U. | Hose Clamp                            |
| V. | Filter                                |
| W. | Pump                                  |

- b. Remove the line (C) to the reverse clutch assembly.
- c. Remove the line (D) from the pump.
- d. Disconnect the line (E) at the tee fitting (L).
- e. Remove the line (G) from the power steering housing.
- f. Remove the tee fitting (H) with the cap (J).
- g. Remove the line (K).
- h. Lift out the relief valve (F). The lines (E) and (M) and the tee fitting (N) are still connected to the relief valve (F). Do not disassemble these parts.

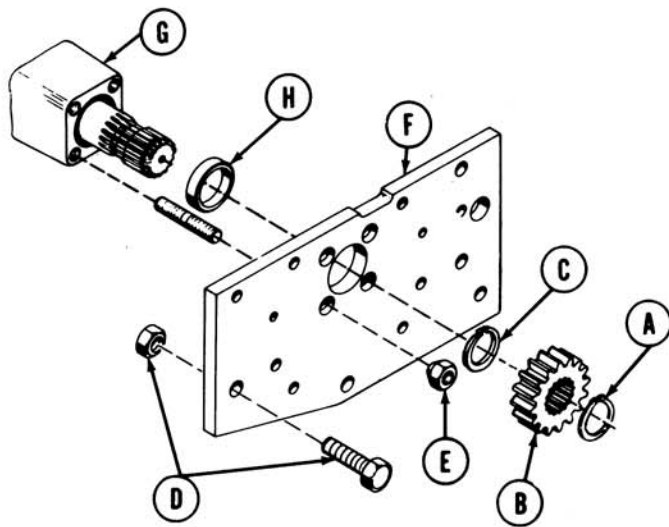
**NOTE: The suction hoses are removed by loosening the hose clamp. Use a screwdriver. When the clamp is loosened, the hose can be pulled from the adapter.**

- i. Remove the suction hose (P) at the adapter (Q).
- j. Remove the suction hose (S) at the adapter (T).

**NOTE: How to remove the pump (W) is not included in this procedure. If there is a problem, see Section 7.3.5, "How to Replace the Hydraulic Pump."**

17. Remove the rear PTO.
18. Remove the rods for the direction control on the forward and the reverse clutches.
19. Remove the right plate for mounting the drop axle as follows:
  - a. Remove the retaining ring (A, Figure 8.0-10).

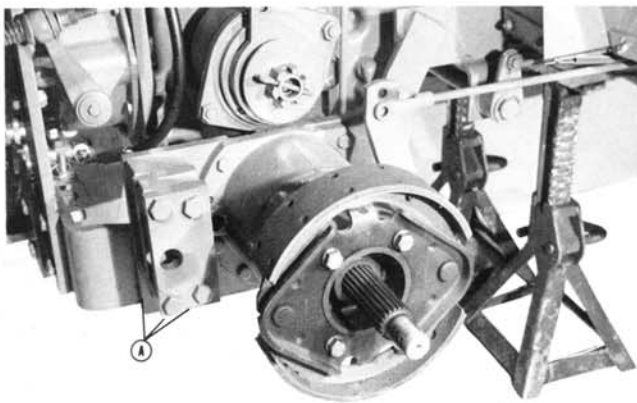
Figure 8.0-9



- A. Retaining Ring
- B. Pinion Gear
- C. Retaining Ring
- D. Bolt and Lock Nut
- E. Nuts (4)
- F. Mounting Plate for Drop Axle
- G. Transmission Housing
- H. Bushing

Figure 8.0-10

- b. Remove the pinion gear (B) for the drop axle.
- c. Remove the retaining ring (C).
- d. Remove the three bolts (A, Figure 8.0-11) and the lock nuts.



- A. Bolts (3) and Lock Nuts

Figure 8.0-11

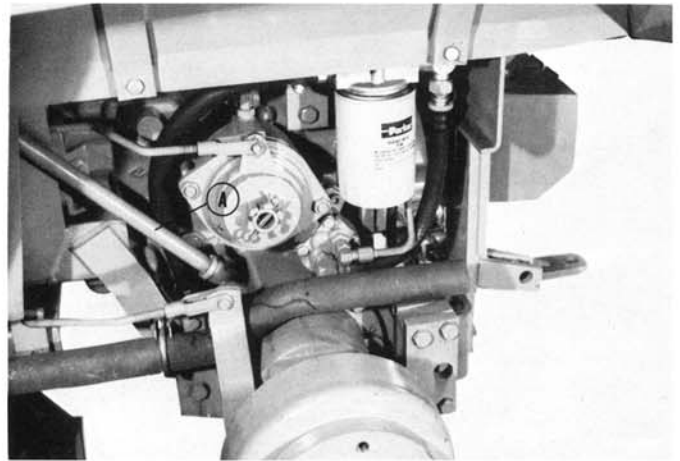
- e. Remove the bolt and the lock nut (D, Figure 8.0-10).

**NOTE: Do not include steps 19f, 19g, or 19h for the mounting plate for the drop axle on the left side. Blocks will be used under the mounting plate after the transmission is removed. The bushing (H, Figure 8.0-10) will hold the differential and axle assembly while the transmission is disassembled.**

- f. Remove the four nuts (E).
- g. Use a plastic hammer to hit the mounting plate for the drop axle (F). This loosens the sealing compound between the mounting plate (F) and the transmission housing (G).
- h. Remove the mounting plate for the drop axle (F).

- 20. Remove the dipstick.

- 21. Use vise-grip pliers to turn the tube (A, Figure 8.0-12) counterclockwise. Remove the tube.

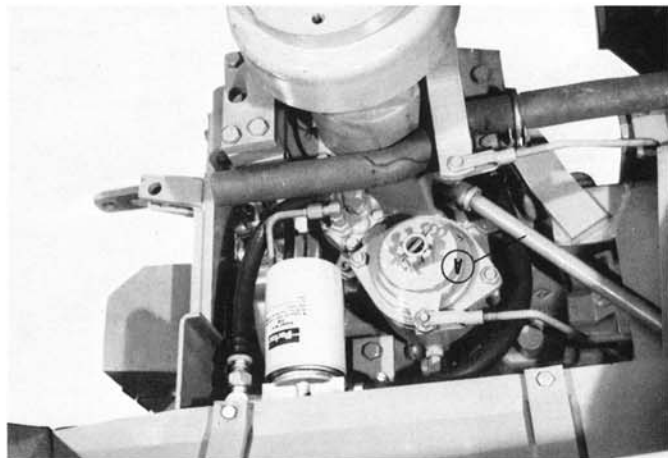


- A. Tube for Filling Transmission

Figure 8.0-12

- 22. Repeat steps 19a, 19b, and 19c for the pinion gear on the left side.
- 23. Repeat steps 19d and 19c for the mounting plate for the drop axle on the left side.
- 24. Put a jack under the center of the transmission. Raise the jack until it is against the bottom of the transmission.

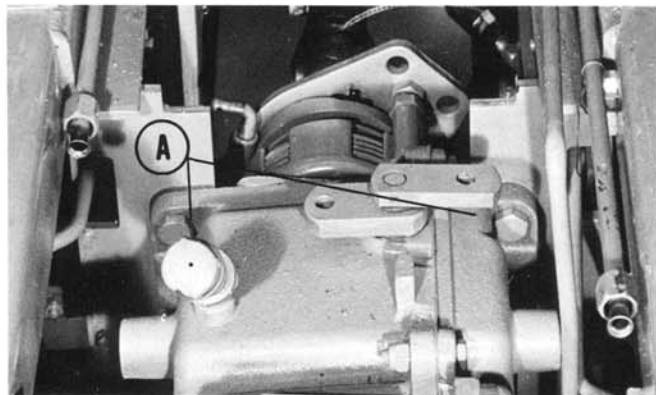
25. Remove the bolt (A, Figure 8.0-13) and the spacer (B) from the bracket (C).



A. Bolt  
B. Spacer  
C. Bracket

Figure 8.0-13

26. Repeat step 25 for the right side of the transmission.
27. Remove the four bolts and the lock nuts (A, Figure 8.0-14) at the front of the transmission.



A. Bolts and Lock Nuts  
(four, two shown)

Figure 8.0-14



**WARNING: Use caution when removing the transmission. INJURY CAN RESULT.**

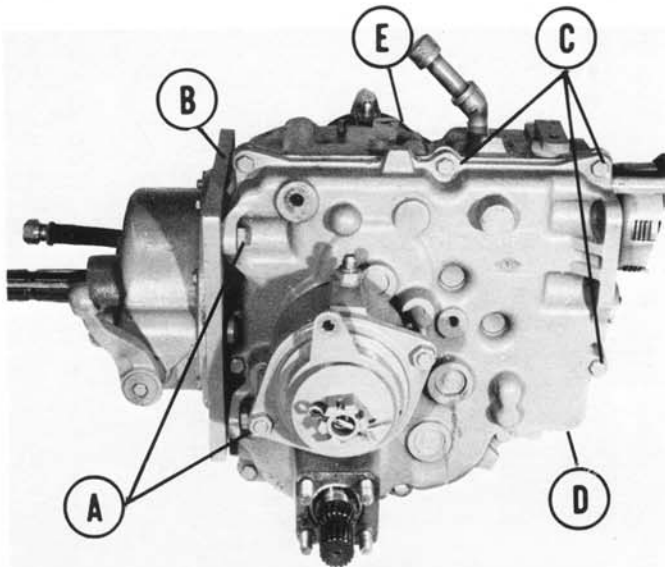
28. Get assistance to keep the transmission vertical. Use the jack to lower the transmission approximately one inch (2.5 cm).
29. Make sure all the parts of the transmission are clear of the frame, linkages for the hydraulic lines, etc.
30. Roll the jack toward the rear of the tractor until the transmission is clear of the frame.
31. Move the jack and the transmission to a clean area where work is to be done on the transmission.
32. Put blocks under the mounting plate for the drop axle on the left side.

### 8.3.2 How to Disassemble the Transmission

To disassemble the transmission is a large job. It must not be started until you are sure the problem is inside the transmission. Remember the following:

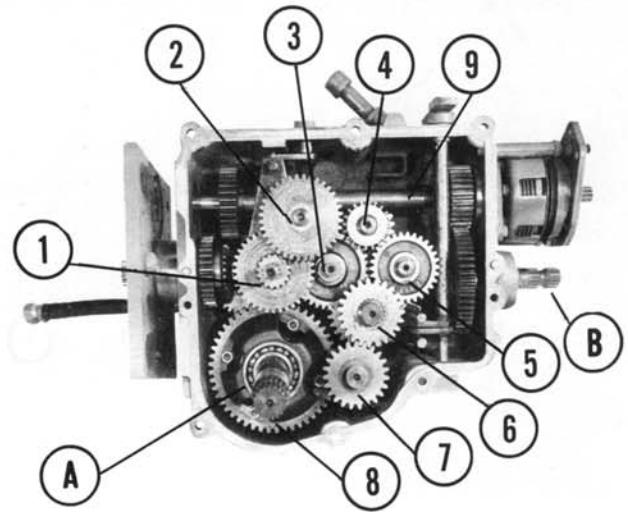
- (1) Always work in a clean area.
  - (2) When a shaft assembly is removed, assemble all parts removed with the shaft exactly as the parts were assembled in the transmission. Place the assembly in a clean area.
  - (3) If a file or other tool is used to remove metal, ALWAYS remove chips from inside the transmission. Use a magnet.
1. Remove the four bolts (A, Figure 8.0-15) from the adapter plate (B).





- A. Bolts (4)  
 B. Adapter Plate  
 C. Bolts and Lock Nuts (8)  
 D. Cover Plate  
 E. Shifter Arm

Figure 8.0-15



1. Shaft Assembly Number 1\*  
 2. Shaft Assembly Number 2\*  
 3. Shaft Assembly Number 3\*  
 4. Shaft Assembly Number 4  
 5. Shaft Assembly Number 5  
 6. Shaft Assembly Number 6  
 7. Shaft Assembly Number 7\*  
 8. Shaft Assembly Number 8  
 9. Shaft Assembly Number 9  
 A. Ball Bearing  
 B. Front PTO Shaft

Figure 8.0-16

\* The shaft assemblies have thrust washers on the end that fit into the cover plate.

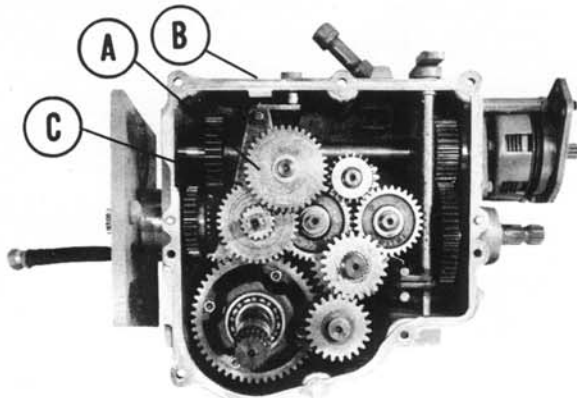
**NOTE: Do not damage the O-ring.**

2. Hit the adapter plate (B) with a soft face hammer to loosen the sealing compound.
3. Slide the adapter plate (B) and the shaft assembly for the sun gear (not shown) all the way to the rear.
4. Push the shifter arm (E) for the range selector toward the front until it holds in the "LO" position.
5. Remove eight bolts and lock nuts (C) from the cover plate (D) for the transmission.
6. Hit the cover plate (D) with a soft face hammer in several areas around the edge to loosen the sealing compound.
7. Lift the cover plate and remove it. Put the cover plate in a clean area.
8. If a ball bearing (A, Figure 8.0-16) is removed with the cover plate, install it on the shaft assembly number 8.

**NOTE: The shaft assemblies number 1, 2, 3, and 7 have thrust washers on the ends that fit into the cover plate (D). Any washers that are removed with the cover plate must be immediately installed on the correct shaft assembly. This procedure will avoid errors when the transmission is assembled.**

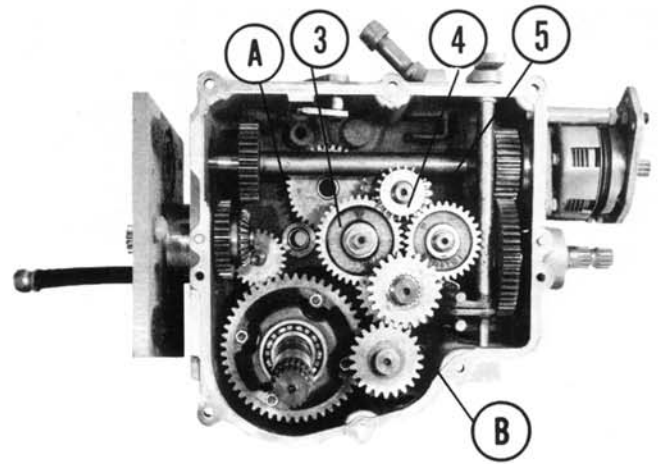
**NOTE: If there is a problem only in the forward gear and the bearing assembly on the cover plate, go to step 32 in Section 8.3.2, "How to Disassemble the Transmission".**

9. Remove the idler gear (A, Figure 8.0-17) from the shaft assembly number 2 (shaft assembly for the reverse clutch).



- |  |
|--|
| <p>A. Idler Gear<br/>         B. Plug, Spring, and Detent Ball<br/>         C. Shifter Fork Shaft Assembly</p> |
|--|

Figure 8.0-17



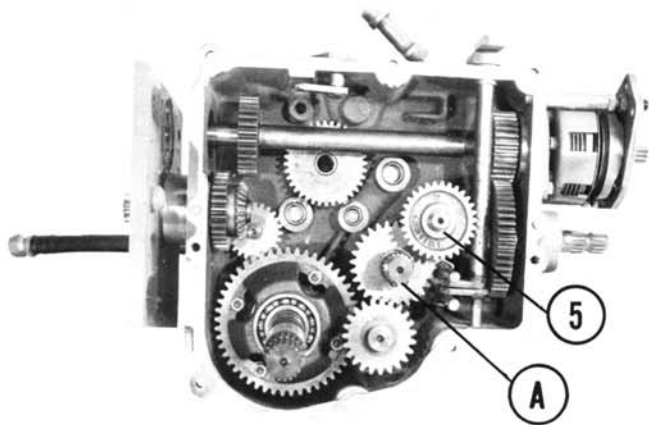
- |  |
|--|
| <p>A. Reverse Gear and Bearing Assembly<br/>         B. Gear with 32 Teeth, Shaft Number 6<br/>         3. Shaft Assembly Number 3<br/>         4. Shaft Assembly Number 4<br/>         5. Shaft Assembly Number 9</p> |
|--|

Figure 8.0-18

10. Remove the pipe plug and the spring (B). Use a magnet to remove the detent ball at the bottom of the hole.
11. Remove the shifter fork (C).
12. Remove the shaft assembly 1 (shaft assembly for forward clutch).
13. Remove all of the shaft assembly number 2 except the reverse gear and the bearing assembly (A, Figure 8.0-18). This is the gear next to the reverse clutch. Install the idler gear (removed in step 10) on the shaft assembly number 2.

**NOTE: The reverse gear and the bearing assembly has a Woodruff Key that is necessary for correct operation of the reverse clutch. If this gear assembly must be removed for any reason, make sure the Woodruff Key is installed correctly during the procedure for assembly.**

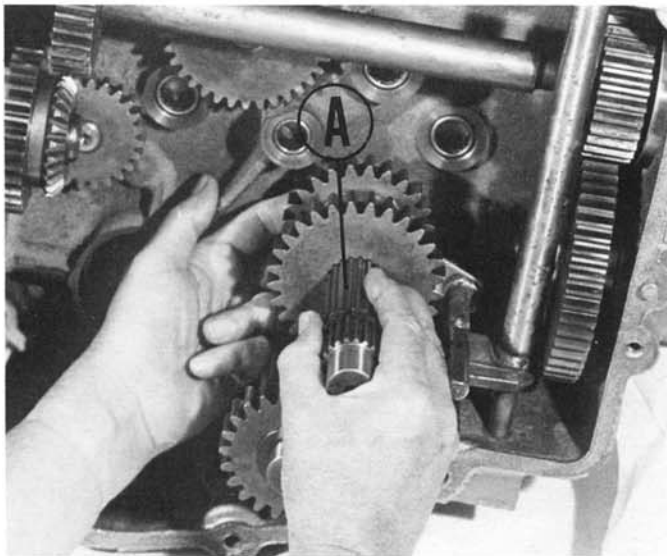
14. Remove the shaft assembly number 4 (4, Figure 8.0-18). When this shaft assembly is removed, the gear next to the transmission case will fall and can be removed from behind the shaft assembly number 9. Assemble the gear on the shaft.
15. Remove the gear (B) from the shaft assembly number 6.
16. Remove the shaft assembly number 3.
17. Remove the shaft assembly number 5.
18. Remove the spline shaft (A, Figure 8.0-19) for the shaft assembly number 6 as follows:



5. Shaft Assembly Number 5  
A. Spline Shaft

Figure 8.0-19

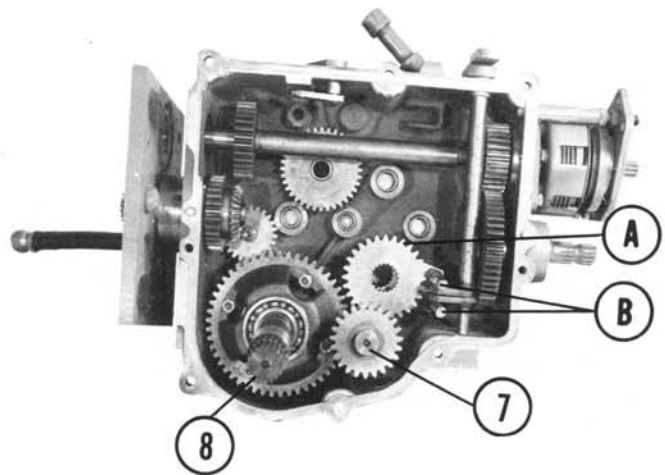
- a. Put your fingers behind the gears on the shaft assembly number 6.
- b. Hold the thrust washer next to the case (Figure 8.0-20).
- c. Remove the spline shaft (A).



A. Spline Shaft

Figure 8.0-20

- d. Remove the sliding gears, (A, Figure 8.0-21) by turning them away from the shifter forks.



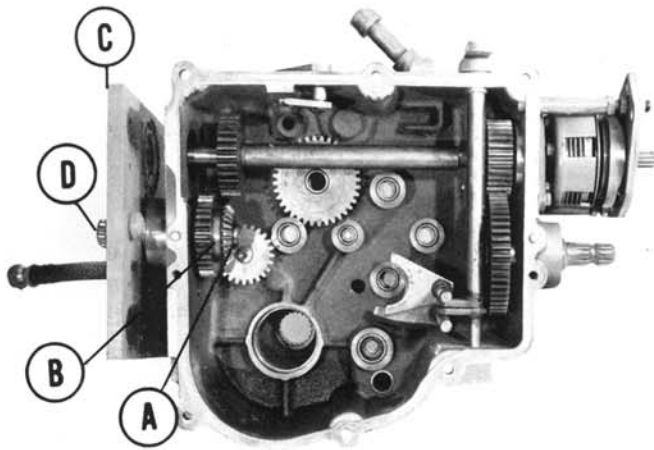
A. Sliding Gears,  
Shaft Assembly Number 6  
B. Shifter Forks  
7. Shaft Assembly Number 7  
8. Shaft Assembly Number 8

Figure 8.0-21

- e. Remove the thrust washer.
- f. Assemble all the parts on the spline shaft, including the gear removed in step 15.

**NOTE: Unless there is a problem with the shifter forks, it is not necessary to remove the shifter forks at this time.**

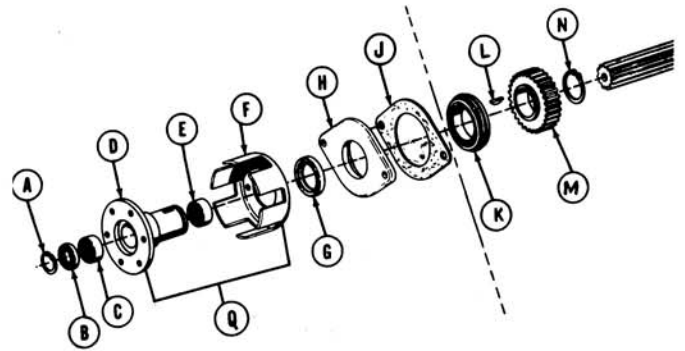
19. Remove the shaft assembly number 7 (final drive pinion).
20. Remove the shaft assembly number 8 (differential and axle assembly).
  - a. The ball bearing (not shown) behind this shaft assembly is removed from the case and is installed on the shaft assembly.
21. Remove the adapter plate and the sun gear shaft (C and D, Figure 8.0-22) as follows:



- A. Retaining Ring  
 B. Bevel Gear and Gear with 32 Teeth  
 C. Adapter Plate  
 D. Sun Gear Shaft Assembly

Figure 8.0-22

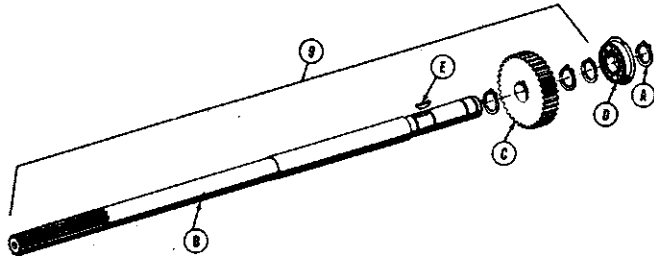
- a. Remove the retaining ring (A).
  - b. Remove the bevel gear and the gear with 32 teeth (B).
  - c. Do not let the Woodruff Key (not shown) fall.
  - d. Hold the adapter plate (C) and remove the sun gear shaft (D).
  - e. Remove the adapter plate (C).
22. Remove the clutch for the front PTO. See Section 9.2.2, "How to Disassemble the Clutch for the Front PTO," steps 8 to 11.
  23. Remove the retaining ring (A, Figure 8.0-23).



- A. Retaining Ring  
 B. Oil Seal  
 C. Needle Bearing  
 D. Hub for Clutch  
 E. Needle Bearing  
 F. Driven Cup  
 G. Oil Seal  
 H. Cap  
 J. Gasket for Cap  
 K. Ball Bearing  
 L. Woodruff Key  
 M. Spur Gear  
 N. Retaining Ring  
 P. Input Shaft for Transmission  
 Q. Driven Cup and Hub Assembly

Figure 8.0-23

24. Remove the retaining ring (N).
25. Slide the gear (M) to the rear and remove the Woodruff Key (L).
26. Remove the two bolts (not shown) from the cap for the front PTO.
27. Remove the driven cup and the hub (Q).
28. Remove the shaft assembly number 9 (Figure 8.0-24), input shaft for the transmission as follows:



- |     |                         |
|-----|-------------------------|
| A.  | Retaining Ring          |
| B.  | Input Shaft             |
| C.  | Input Gear              |
| D.  | Ball Bearing            |
| E.  | Woodruff Key            |
| 9 - | Shaft Assembly Number 9 |

Figure 8.0-24

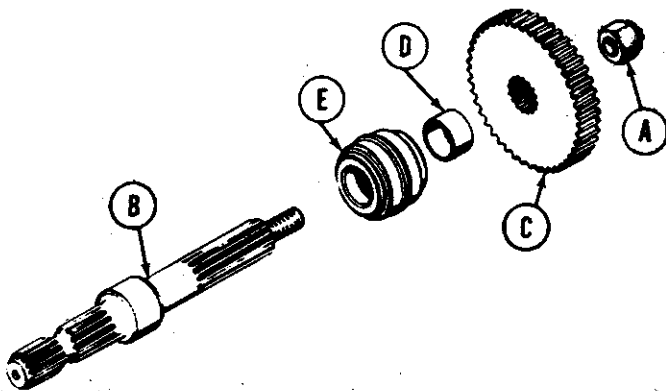
- a. Use a tool that has an inside spline the same as the spline on the forward end of the shaft for the front PTO (B). This is used to hold the shaft.
- b. Use a 15/16 inch socket wrench to remove the nut (A).
- c. Hold the spur gear (C) and the spacer (D).
- d. Pull the shaft (B) forward carefully. Do not cause damage to the oil seal in the transmission case.

**NOTE: It is not necessary to remove the shifter forks unless there is a problem with them.**

30. Remove the shifter forks as follows (use the same procedure for both shifter forks):
  - a. Remove the pipe plug and the spring (A, Figure 8.0-26).

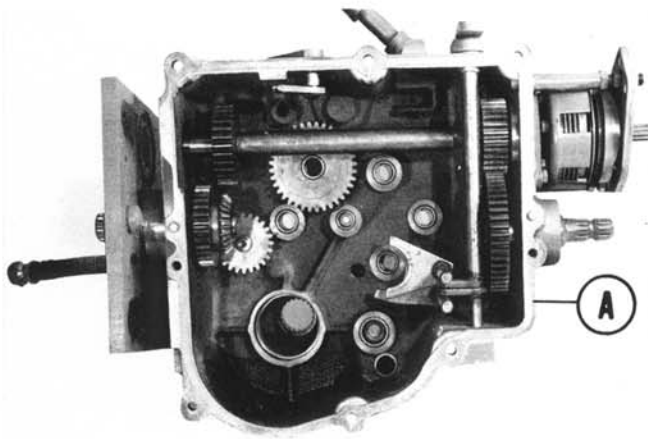
- a. Remove the retaining ring (A)
- b. Use a hammer with a soft face to hit the front end of the shaft (B) lightly. This will loosen the sealing compound on the ball bearing (D).
- c. Remove the ball bearing (D).
- d. Tilt the shaft assembly number 9 and remove it.

29. Remove the shaft for the front PTO (Figure 8.0-25) as follows:



- |    |                           |
|----|---------------------------|
| A. | Nut                       |
| B. | Shaft for PTO             |
| C. | Spur Gear for PTO         |
| D. | Spacer                    |
| E. | Ball Bearing and Oil Seal |

Figure 8.0-25



A. Pipe Plugs, Springs, and Detent Balls

Figure 8.0-26

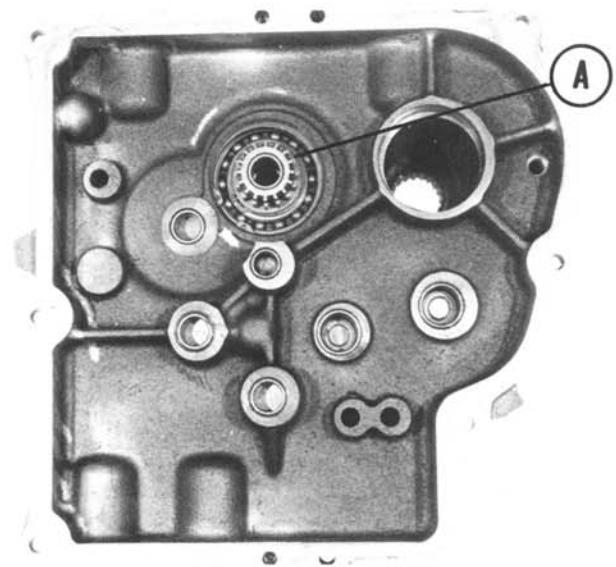
- b. Use a magnet to remove the detent ball.
- c. Remove the shifter fork.

This finishes the normal disassembly of the transmission. The remainder of the items in the transmission are:

1. The forward gear and the bearing assembly on the cover plate for the transmission.
2. The reverse gear and the bearing assembly.
3. The hydraulic pump and the drive gear assembly.

If there is a problem with these items, the disassembly procedures are as follows:

31. To disassemble the forward gear and the bearing assembly on the cover plate for the transmission:
  - a. Remove the forward gear and the bearing assembly (A, Figure 8.0-27).



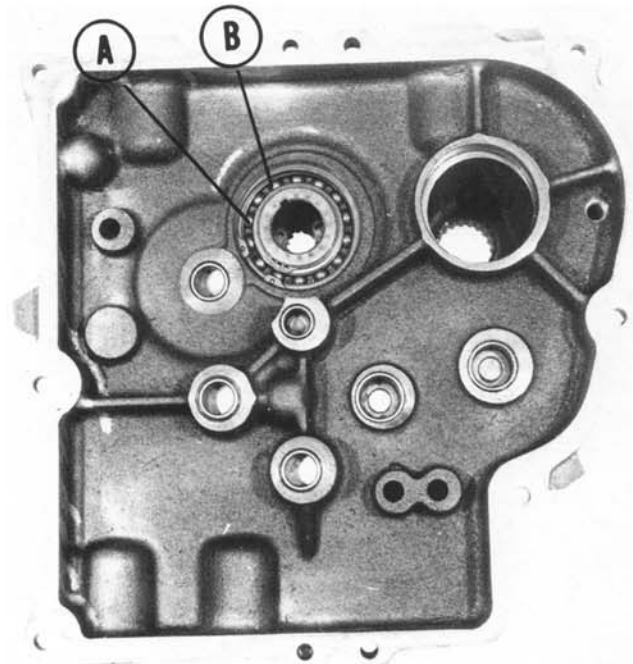
A. Forward Gear and Bearing Assembly

Figure 8.0-27

- b. Remove the Woodruff Key (not shown).

**NOTE: The Woodruff Key is necessary for correct operation of the forward clutch. Make sure the Woodruff Key is correctly installed during the procedure for assembly.**

- c. Remove the retaining ring (A, Figure 8.0-28).



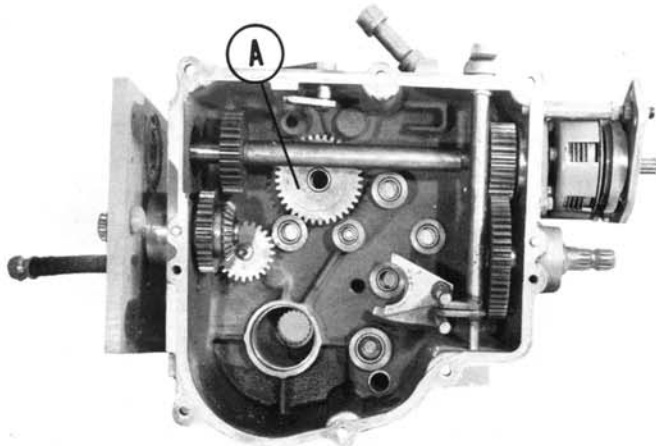
A. Retaining Ring      B. Ball Bearing

Figure 8.0-28

- d. Put Loctite safety solvent No. 7S559 around the large diameter of the ball bearing (B).
- e. Remove the ball bearing (B).
- f. Remove the forward clutch assembly. See Section 9.1.2, "How to Disassemble the Forward Clutch or the Reverse Clutch."

32. To disassemble the reverse gear and the bearing assembly:

- a. Remove the reverse gear and the bearing assembly (A, Figure 8.0-29).



A. Reverse Gear and Bearing Assembly

Figure 8.0-29

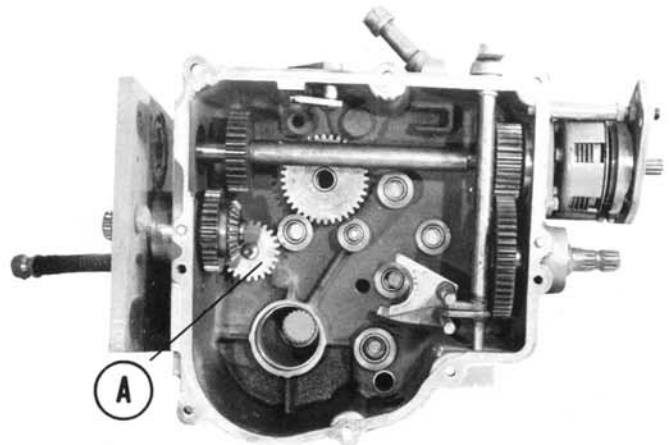
- b. Remove the Woodruff Key (not shown).

**NOTE: The Woodruff Key is necessary for correct operation of the reverse clutch. Make sure the Woodruff Key is correctly installed during the procedure for assembly.**

- c. Remove the retaining ring (not shown, but it is similar to the retaining ring in step 31c).
- d. Put Loctite safety solvent No. 7S559 around the large diameter of the ball bearing (similar to step 31d).
- e. Remove the ball bearing
- f. Remove the reverse clutch assembly. See Section 9.1.2, "How to Disassemble the Forward or the Reverse Clutch."

33. To disassemble the drive gear for the hydraulic pump:

- a. Remove the retaining ring (not shown).
- b. Remove the drive gear (A, Figure 8.0-30).



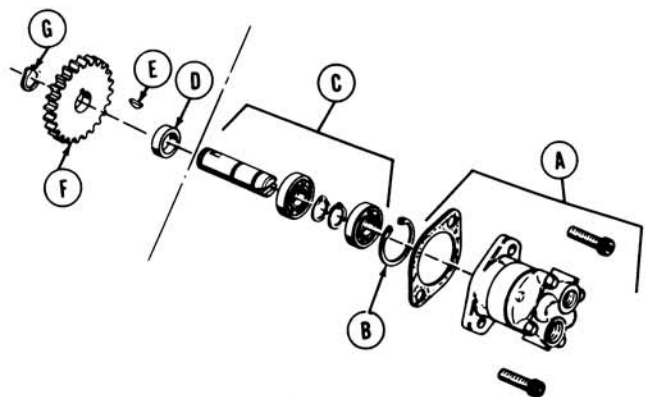
A. Drive Gear for Hydraulic Pump

Figure 8.0-30

- c. Remove the Woodruff Key (not shown).

**NOTE: The Woodruff Key is necessary for correct operation of the hydraulic pump. Make sure the Woodruff Key is correctly installed during the procedure for assembly.**

- d. Remove the spacer (not shown).
- e. Remove the hydraulic pump assembly (A, Figure 8.0-31). See Section 7.3.5, "How to Replace the Hydraulic Pump."



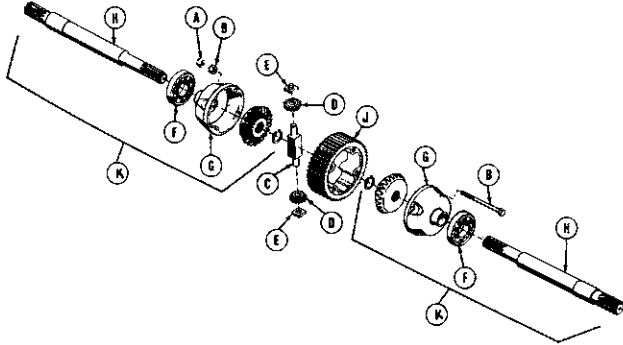
A. Hydraulic Pump  
 B. Retaining Ring  
 C. Drive Shaft Assembly  
 D. Spacer  
 E. Woodruff Key  
 F. Drive Gear  
 G. Retaining Ring

Figure 8.0-31

- f. Remove the retaining ring (B).
- g. Remove the drive shaft assembly (C).

34. Disassemble the shaft assembly number 8 (differential and axle) as follows:

- a. Remove the four jam nuts (A, Figure 8.0-32).



- |   |
|---|
| <ul style="list-style-type: none"> <li>A. Jam Nuts (4)</li> <li>B. Bolts and Lock Nuts (4)</li> <li>C. Spider Pin (1)</li> <li>D. Bevel Gears (2)</li> <li>E. Blocks for Drive (2)</li> <li>F. Ball Bearings (2)</li> <li>G. End Caps (2)</li> <li>H. Axles (2)</li> <li>J. Final Drive Gear</li> <li>K. End Cap and Axle Assembly (2)</li> </ul> |
|---|

Figure 8.0-32

- b. Remove the four bolts and lock nuts (B).
- c. Remove the end cap and the axle assemblies (K).
- d. Remove the spider pin (C), the bevel gears (D), and the blocks for drive (E).
- e. Remove the ball bearings (F).

### 8.3.3 How to Check Transmission Parts

1. Inspect all parts for damage or defects. A small amount of wear is normal. Replace any part with:
  - a. Damage or defects.
  - b. Deep grooves caused by wear.
  - c. Damaged gear teeth.

2. Replace all ball bearings that have loose or missing balls.
3. Replace all needle bearings that have missing needles.
4. Replace all thrust bearings that have missing needles.
5. Put the correct shaft in each needle bearing and then turn the shaft. If there is friction, replace the needle bearing.
6. Repeat step 5 for shafts that rotate in ball bearings. Replace ball bearings, if there is friction.
7. Use an outside micrometer to measure the sections of shafts that rotate in ball bearings. See Figure 8.0-33.
8. Replace needle bearing thrust washers that are worn.



### Ball Bearing Specifications

Size of Bore for Bearing	New Shaft Specification	Replacement Specification
.6693 (17.00 mm)	.670 (17.01 mm) .669 (16.00 mm)	.6685 (16.98 mm)
1.3780 (35.00 mm)	1.3785 (35.01 mm) 1.3775 (34.99 mm)	1.3770 (34.98 mm)
1.5748 (40.00 mm)	1.5753 (40.01 mm) 1.5743 (39.99 mm)	1.5738 (39.97 mm)
.9843 (25.00 mm)	.984 (24.99 mm) .983 (24.97 mm)	.9825 (24.96 mm)
1.9685 (50.00 mm)	1.9690 (50.01 mm) 1.9685 (50.00 mm)	1.9680 (49.99 mm)
2.3622 (60.00 mm)	2.3622 (59.99 mm) 2.360 (59.94 mm)	2.359 (59.92 mm)

Figure 8.0-33

9. Repeat step 7 for sections of shafts that rotate in the needle bearings. See Figure 8:0-34.

### Needle Bearings Specifications

Size of Bore for Bearing	New Shaft Specification	Replacement Specification
1.500 (38.10 mm)	1.50000 (38.10 mm) 1.4994 (38.08 mm)	1.4990 (38.07 mm)
.750 (19.05 mm)	.750 (19.05 mm) .749 (19.02 mm)	.7485 (19.01 mm)
.875 (22.23 mm)	.875 (22.23 mm) .874 (22.20 mm)	.8735 (22.19 mm)
1.000 (25.40 mm)	1.0000 (25.40 mm) .9995 (25.39 mm)	.999 (25.37 mm)

Figure 8.0-34

10. Repeat step 7 for sections of shafts that rotate in oil seals. See Figure 8.0-35.

### Oil Seal Specifications

Size of Bore for Oil Seal	New Shaft Specification	Specification Replacement
2.000 (50.80 mm)	2.003/1.997 (50.88/50.72 mm)	1.996 (50.70 mm)
1.875 (47.63 mm)	1.874/1.872 (47.60/47.55 mm)	1.871 (47.52 mm)
.750 (19.05 mm)	.750/.749 (19.05/19.02 mm)	.748 (19.00 mm)
1.375 (34.93 mm)	1.373/1.372 (34.87/34.85 mm)	1.371 (34.82 mm)

Figure 8.0-35

11. Inspect all O-rings. Replace O-rings that have cracks or that are broken.
12. Inspect all oil seals. Replace oil seals that have cracks or that have missing sections of the lip.

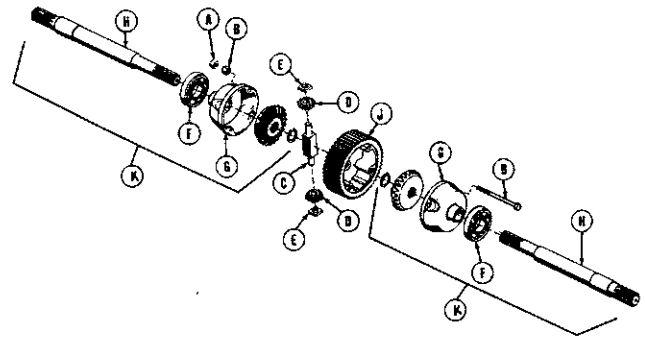
13. Check the holes for the detent balls for the shifter forks. Balls must fall freely through the holes. If not, lightly file the inside of the holes. Remove all metal chips with a magnet.
14. If any parts show more than normal wear or have damage, carefully inspect and remove all metal chips from the transmission case and cover.
15. Remove all deposits of carbon and dirt from the case and cover of the transmission and from all transmission parts.

### 8.3.4 How to Assemble the Transmission

**NOTE:** Use Loctite No. 601 where installing the bearings. Do not put Loctite on the balls or on the needles or on the bores of bearings. Do not use Loctite on the needle thrust bearings.

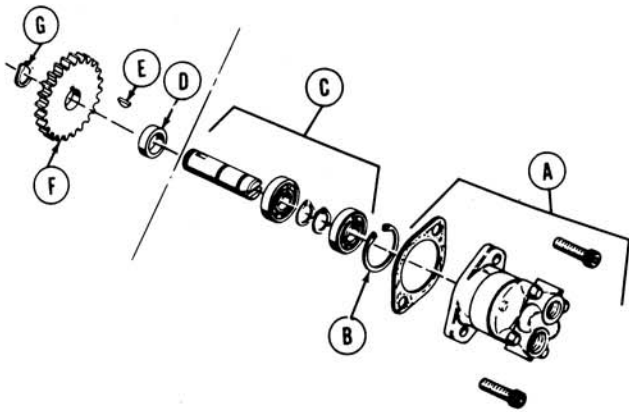
Clean all gasket surfaces before installing the gaskets. Use new gaskets. Use Loctite No. 277 on both sides of the gaskets.

1. Assemble the shaft assembly number 8 (differential and axle) as follows:
  - a. Install the ball bearings (F, Figure 8.0-36) on the end cap and the axle assemblies (A).
  - b. Assemble the spider pin (C), the bevel gears (D), and the blocks for drive (E) as shown in Figure 8.0-36. Install the assembly in the final drive gear (J).
  - c. Put the end cap and axle assemblies (K) in position. Install the four bolts and the lock nuts (B). Tighten to a torque of 25 to 30 foot pounds (3.5 to 4.2 mkg).
  - d. Install the four jam nuts (A). Tighten to a torque of 25 to 30 foot pounds (3.5 to 4.2 mkg).
2. Assemble the drive gear for the hydraulic pump as follows:
  - a. Install the drive shaft assembly (C, Figure 8.0-37) from the outside of the transmission case.



- |    |                               |
|----|-------------------------------|
| A. | Jam Nuts (4)                  |
| B. | Bolts and Lock Nuts (4)       |
| C. | Spider Pin (1)                |
| D. | Bevel Gears (2)               |
| E. | Blocks for Drive (2)          |
| F. | Ball Bearings (2)             |
| G. | End Caps (2)                  |
| H. | Axles (2)                     |
| J. | Final Drive Gear              |
| K. | End Cap and Axle Assembly (2) |

Figure 8.0-36



- A. Hydraulic Pump
- B. Retaining Ring
- C. Drive Shaft Assembly
- D. Spacer
- E. Woodruff Key
- F. Drive Gear
- G. Retaining Ring

Figure 8.0-37

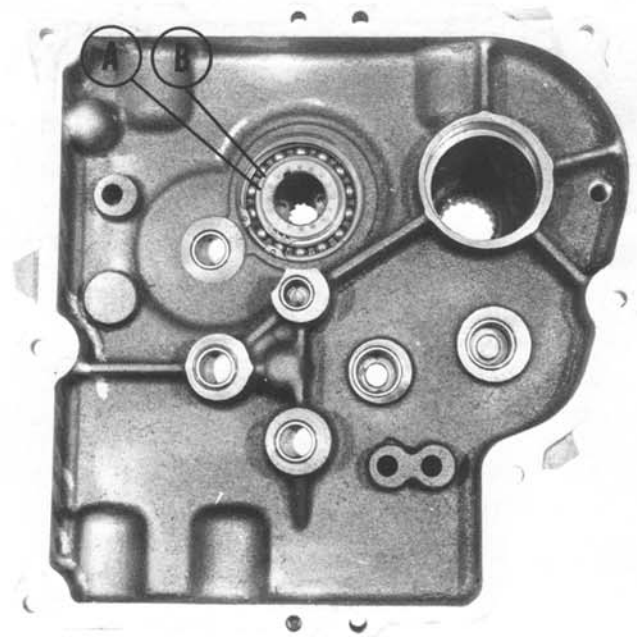
- b. Install the retaining ring (B).
- c. Install the spacer (D) from inside the transmission case.
- d. Install the Woodruff Key (E).

**NOTE: The Woodruff Key is necessary for the operation of the hydraulic pump.**

- e. Install the drive gear (F).
- f. Install the retaining ring (G).
- g. Check the correct location of the Woodruff Key by turning the drive gear (F) by hand. Make sure the drive shaft assembly (C) turns at the same time. Make sure there is no clearance between the gear and the shaft.
- h. Install the hydraulic pump (A). See Section 7.3.5, "How to Replace the Hydraulic Pump."

3. Assemble the forward gear and the bearing assembly as follows:

- a. Install the forward clutch assembly. See Section 9.1.3, "How to Assemble the Forward Clutch or the Reverse Clutch."
- b. Install the ball bearing (B, Figure 8.0-38). Use Loctite No. 601.



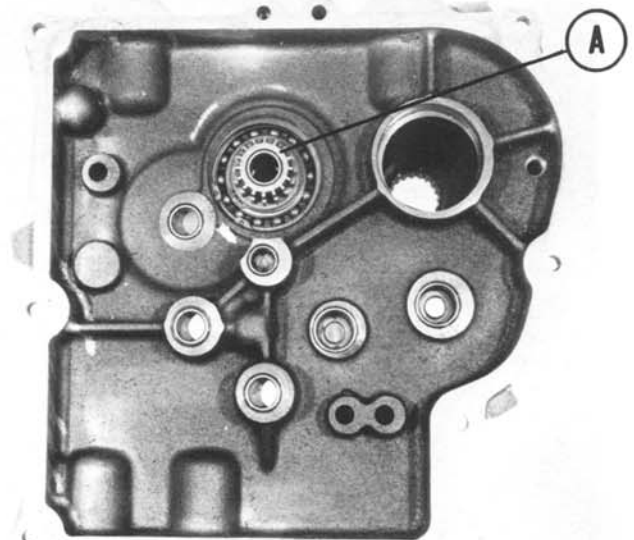
- A. Retaining Ring
- B. Ball Bearing

Figure 8.0-38

- c. Install the retaining ring (A).
- d. Install the Woodruff Key (not shown).

**NOTE: The Woodruff Key is necessary for the operation of the forward clutch.**

- e. Install the forward gear and the bearing assembly (A, Figure 8.0-39).



- A. Forward Gear and Bearing Assembly

Figure 8.0-39

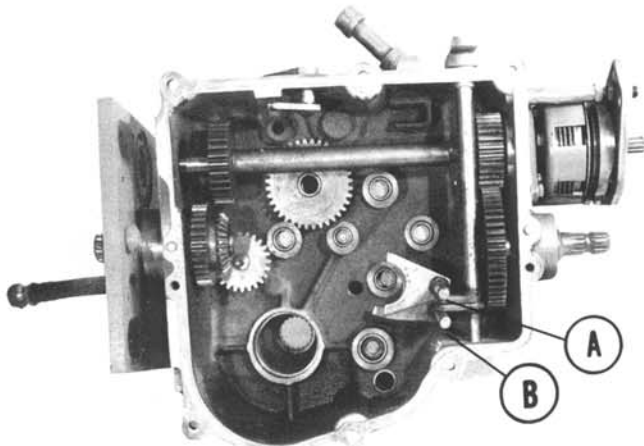
f. Check the correct location of the Woodruff Key by turning the forward drive gear (A) by hand. At the same time, push the clutch cam toward the front and make sure the adjusting nut turns. There must be no clearance between the gear and the hub for the clutch.

4. Assemble the reverse gear and the bearing assembly as follows:

- a. Install the reverse clutch assembly. See Section 9.1.3, "How to Assemble the Forward Clutch or the Reverse Clutch."
- b. Repeat steps 3b, 3c, 3d, 3e, and 3f for the reverse clutch.

5. If the shifter forks were not removed, go to step 6. If the shifter forks were removed, install them as follows:

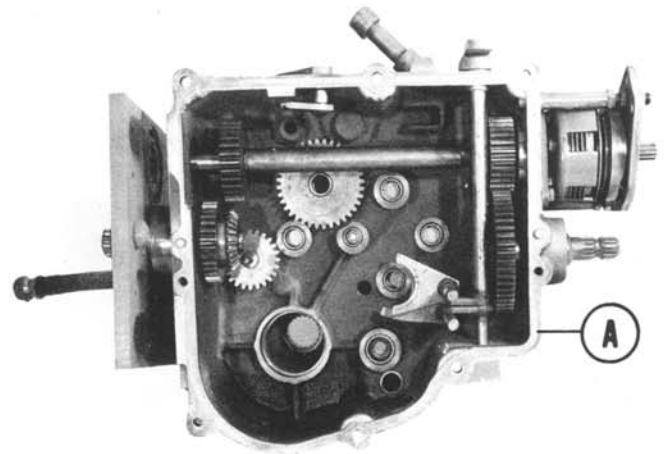
- a. Put the shifter shaft with the fork near the notches (A, Figure 8.0-40) in the bottom hole for the shifter shafts.



A. Shifter Shaft for 2-4 Range  
B. Shifter Shaft for 1-3 Range

Figure 8.0-40

- b. Put the shifter shaft with the fork farthest from the notches (B) in the top hole for the shifter shafts.
- c. Install the detent ball, the spring, and the plug, (A, Figure 8.0-41).



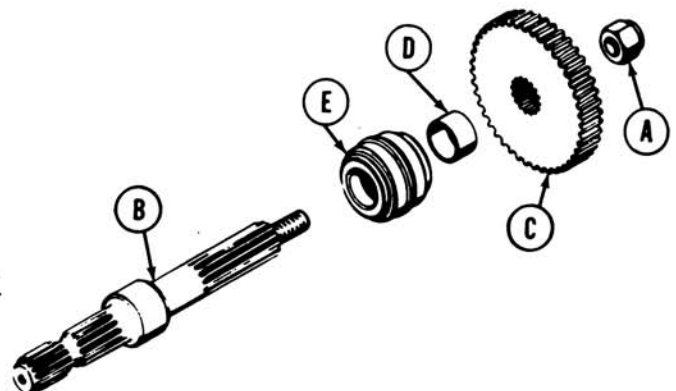
A. Pipe Plugs, Springs, and Detent Balls

Figure 8.0-41

- d. Make sure the pins in the shifter forks engage the notches on the shifter shafts.

6. Install the shaft for the front PTO as follows:

- a. Push the shaft (B, Figure 8.0-42) in from the front. Do this procedure carefully. Do not cause damage to the oil seal in the case.



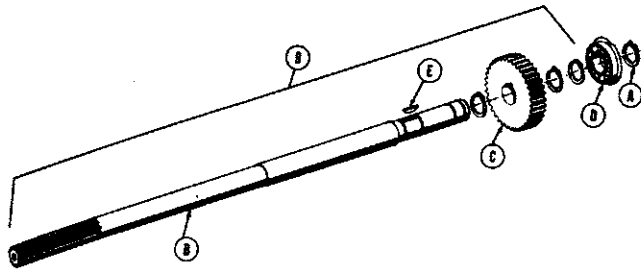
A. Nut  
B. Shaft for PTO  
C. Spur Gear for PTO  
D. Spacer  
E. Ball Bearing and Oil Seal

Figure 8.0-42

- b. Install the spacer (D).
- c. Install the spur gear (C).
- d. Use a tool that has an inside spline the same as the spline on the front end of the PTO shaft. Hold the shaft with this tool.
- e. Install the nut (A).

7. Install the shaft assembly number 9 as follows:

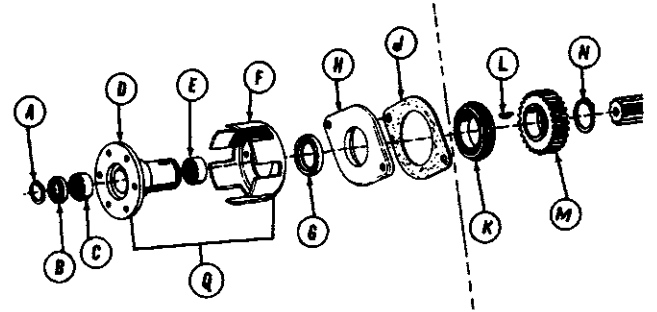
- a. Make sure the Woodruff Key (E, Figure 8.0-43) is installed correctly.



- |   |
|---|
| <ul style="list-style-type: none"> <li>A. Retaining Rings</li> <li>B. Input Shaft</li> <li>C. Input Gear</li> <li>D. Ball Bearing</li> <li>E. Woodruff Key</li> <li>9. Shaft Assembly Number 9</li> </ul> |
|---|

Figure 8.0-43

- b. Install the ball bearing (K, Figure 8.0-44).



- |   |
|---|
| <ul style="list-style-type: none"> <li>A. Retaining Ring</li> <li>B. Oil Seal</li> <li>C. Needle Bearing</li> <li>D. Hub for Clutch</li> <li>E. Needle Bearing</li> <li>F. Driven Cup</li> <li>G. Oil Seal</li> <li>H. Cap</li> <li>J. Gasket for Cap</li> <li>K. Ball Bearing</li> <li>L. Woodruff Key</li> <li>M. Spur Gear</li> <li>N. Retaining Ring</li> <li>P. Input Shaft for Transmission</li> <li>Q. Drive Cup and Hub Assembly</li> </ul> |
|---|

Figure 8.0-44

- c. Slide the retaining ring (N) on the front end of the shaft.
- d. Put the shaft assembly number 9 behind the shifter rods with the rear end tilted down.
- e. Slide the gear (M, Figure 8.0-44) on the front end of the shaft number 9, between the case and the shifter rods.
- f. Put the front end of the shaft through the ball bearing (K, Figure 8.0-44).
- g. Raise the rear end of the shaft assembly number 9 and put it into the correct hole in the rear of the transmission case. Move the shaft assembly approximately 1/2 inch (1 cm) toward the rear of the transmission.
- h. Put the gasket (J, Figure 8.0-44), the cap (H), and the oil seal (G) in position. Install the bolts for the cap (not shown) and tighten them.

- i. Push the driven cup and the hub assembly (A, Figure 8.0-44) in from the front. Do this procedure carefully. Do not cause damage to the oil seal (G).
- j. Install the Woodruff Key (L).

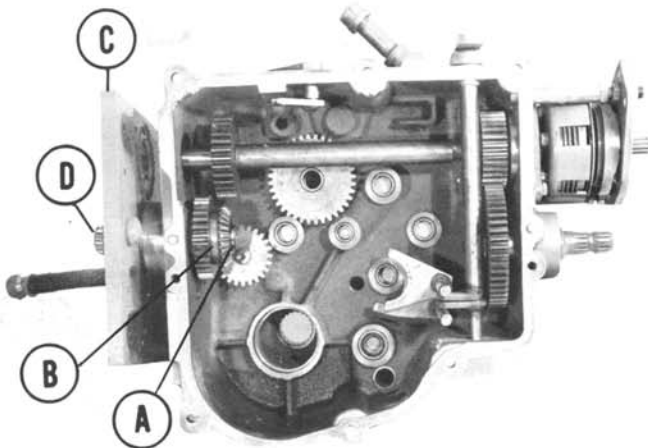
**NOTE: The Woodruff Key is necessary for the operation of the front PTO.**

- k. Put the spur gear (M) in position. Install the retaining ring (N).
- l. Check the correct location of the Woodruff Key by turning the spur gear (M) by hand. Check that the driven cup and the hub assembly (Q) turn at the same time. There must be no clearance between the spur gear and the hub.
- m. Install the bearing (D, Figure 8.0-43).
- n. Install the retaining ring (A).

8. Install the clutch for the front PTO. See Section 9.2.3, "How to Assemble the Clutch for the Front PTO."

9. Install the sun gear shift assembly for the rear PTO as follows:

- a. Install the O-ring (not shown) over the hub of the adapter plate (C, Figure 8.0-45).



- A. Retaining Ring
- B. Bevel Gear and Gear with 32 Teeth
- C. Adapter Plate
- D. Sun Gear Shaft Assembly

Figure 8.0-45

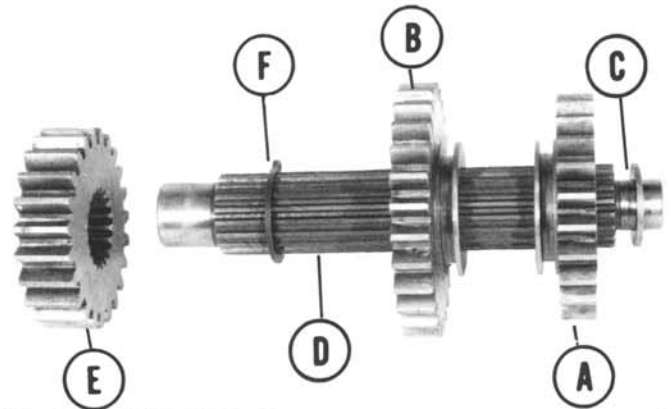
- b. Hold the adapter plate (C) in position at the rear of the transmission.
- c. Put the sun gear shaft assembly (D) in from the rear.
- d. Install the Woodruff Key (not shown).

**NOTE: The Woodruff Key is necessary for the operation of the rear PTO.**

- e. Install the gear and the bevel gear assembly (B).
- f. Install the retaining ring (A).
- g. Check the correct location of the Woodruff Key by turning the bevel gear assembly (B) by hand. Check that the sun gear shaft assembly (D) turns at the same time. There must be no clearance between the bevel gear assembly and the sun gear shaft.

10. Install the shaft assembly number 6 as follows:

- a. Put the smaller sliding gear (A, Figure 8.0-46) on the shifter fork that is farthest in.



- A. Smaller Sliding Gear
- B. Larger Sliding Gear
- C. .095 Inch (2.4 mm) Thrust Washer
- D. Spline Shaft
- E. Gear with 32 Gear Teeth
- F. Retaining Ring

Figure 8.0-46

- b. Put the larger sliding gear (B) on the other shifting fork.

- c. With your fingers, hold the .095 inch (2.4 mm) thrust washer (C) behind the smaller sliding gear (Figure 8.0-47).

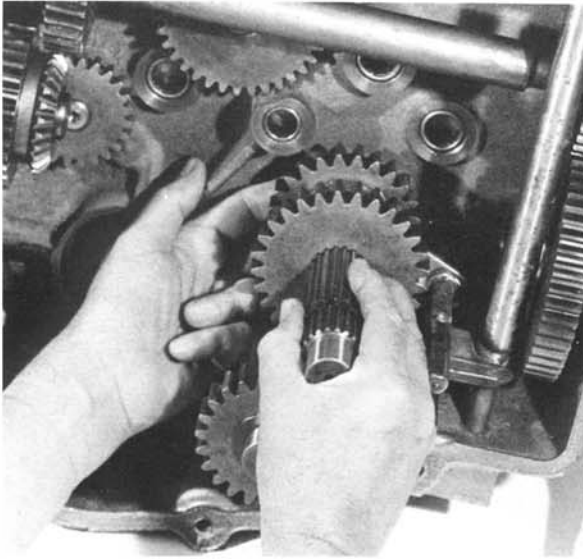
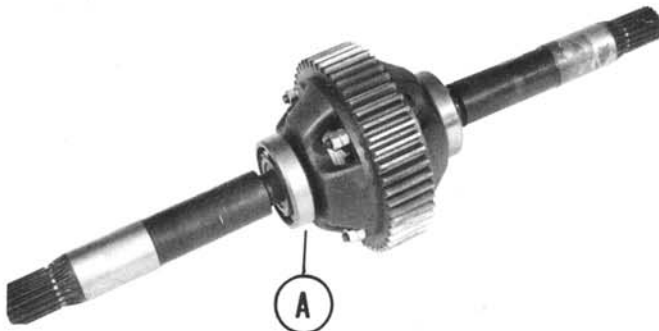


Figure 8.0-47

- d. Put the spline shaft (D, Figure 8.0-46) through the sliding gears and the .095 inch (2.4 mm) thrust washer. Make sure the thrust washer is on the shaft.  
e. Put the inner end of the spline shaft (D) in the needle bearing behind the sliding gears.

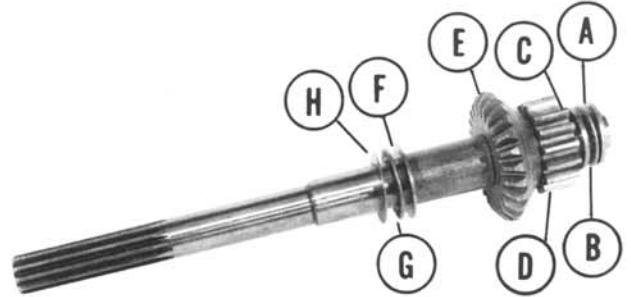
11. Install the shaft assembly number 8. Both of the ends are the same. Put one end in the needle bearing for the axle in the transmission case.  
a. Make sure the ball bearing (A, Figure 8.0-48) is in the correct position in the case.



A. Ball Bearing

Figure 8.0-48

12. Install the shaft and the inner gears for the shaft assembly number 1 as follows:  
a. Make sure the parts are assembled on the shaft in the arrangement shown in Figure 8.0-49.

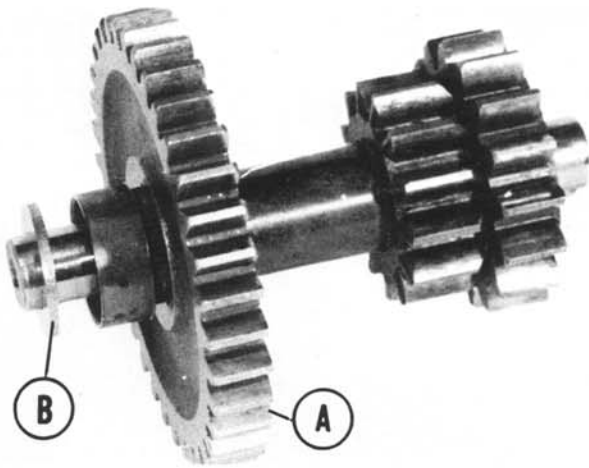


- A. .095 Inch (2.4 mm) Thrust Washer  
B. Needle Thrust Bearing  
C. .095 Inch (2.4 mm) Thrust Washer  
D. Gear with 32 Gear Teeth  
E. Bevel Gear  
F. .060 Inch (1.5 mm) Thrust Washer  
G. Needle Thrust Bearing  
H. .030 Inch (0.76 mm) Thrust Washer

Figure 8.0-49

- b. Make sure the bevel gear has the key correctly installed (key not shown).  
c. Put the end with the gears in the needle bearing for the shaft assembly number 1.  
13. Install the shaft assembly number 3 as follows:  
a. Make sure the parts are assembled on the shaft in the arrangement shown in Figure 8.0-50.

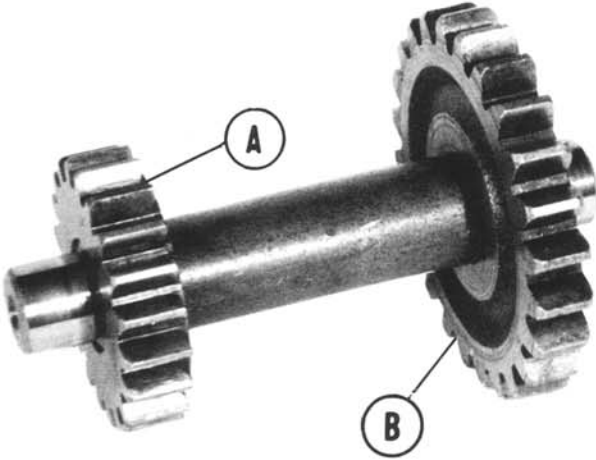




A. Outer Gear  
 B. .090 Inch (2.3 mm) Thrust Washer

Figure 8.0-50

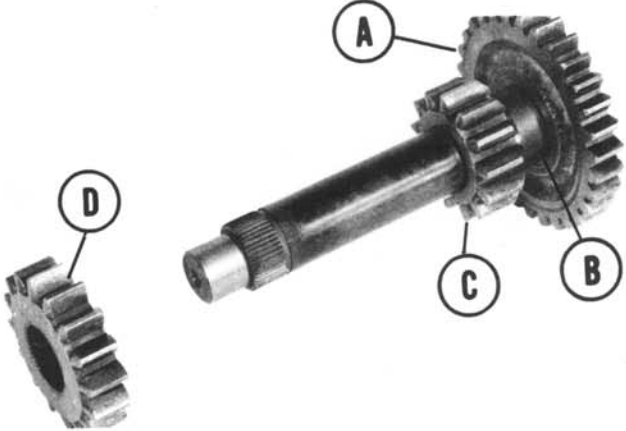
- b. Put the end with the smaller gears in the needle bearing for the shaft assembly number 3.
- 14. Install the shaft assembly number 4 as follows:
  - a. Make sure the parts are assembled on the shaft in the arrangement shown in Figure 8.0-51.



A. Gear with 20 Gear Teeth  
 B. Gear with 24 Gear Teeth

Figure 8.0-51

- b. Put the end with the gear (B, Figure 8.0-51) in the needle bearing for the shaft assembly number 4.
- 15. Install the shaft assembly number 5 as follows:
  - a. Make sure the parts are assembled on the shaft in the arrangement shown in Figure 8.0-52.

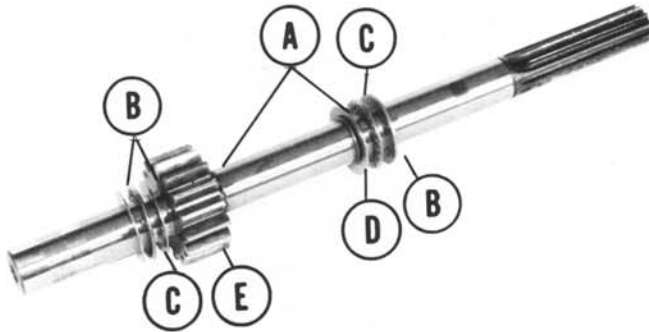


A. Gear with 30 Gear Teeth  
 B. Spacer  
 C. Gear with 13 Gear Teeth  
 D. Gear with 16 Gear Teeth

Figure 8.0-52

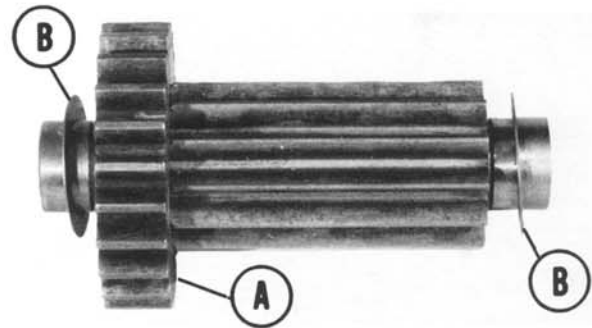
- b. Put the end with the gear (D) in the needle bearing for the shaft assembly number 5.
- 16. Install the shaft and the inner gear for the shaft assembly number 2 as follows:

- a. Make sure the parts are assembled on the shaft in the arrangement shown in Figure 8.0-53.



- |  |
|--|
| <p>A. Retaining Rings (2)<br/>         B. .030 Inch (0.76 mm) Thrust Washers<br/>         C. Needle Thrust Bearings (2)<br/>         D. .060 Inch (1.5 mm) Thrust Washer<br/>         E. Gear with 16 Gear Teeth</p> |
|--|

Figure 8.0-53



- |   |
|---|
| <p>A. Gear with 23 Gear Teeth<br/>         B. .030 Inch (0.76 mm) Thrust Washer (2 total)</p> |
|---|

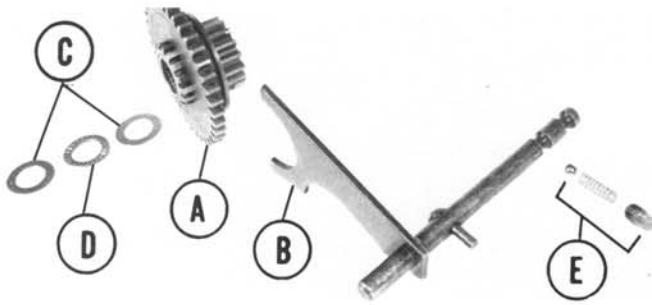
Figure 8.0-54

- b. Make sure the gear (E) has the key correctly installed. (Key not shown).
- c. Put the spline end in the reverse gear and the bearing assembly.
- d. Turn the shaft a small amount to align the spline with the spline in the hub of the clutch.
- e. Push the shaft assembly all the way down into the clutch assembly.
17. Install the shaft assembly number 7 as follows:
- a. Make sure the parts are assembled on the shaft in the arrangement shown in Figure 8.0-54.

- b. Gear (A) is the outer gear. Put the **opposite end** in the needle bearing for the shaft assembly number 7.

18. Install the gear (E, Figure 8.0-46) on the shaft assembly number 6.
19. Install the two-speed gear and the shifter fork for the shaft assembly number 1 as follows:

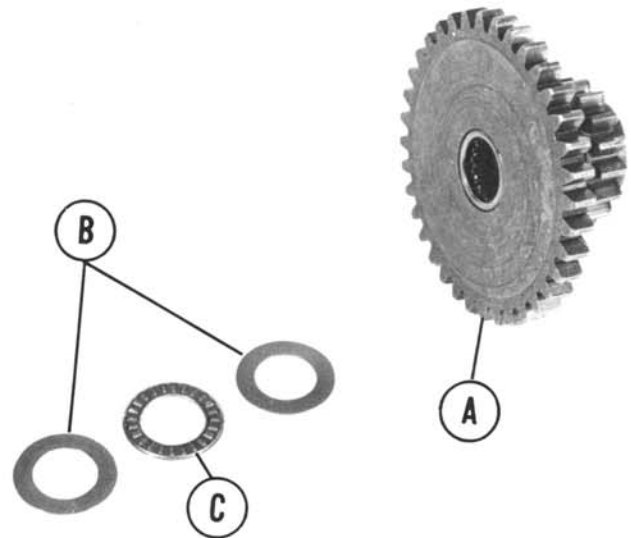
- a. Put the two speed gear (A, Figure 8.0-55) on the shifter fork (B).



- |   |
|---|
| <p>A. Two Speed Gear<br/>         B. Shifter Fork<br/>         C. .030 Inch (0.76 mm) Thrust Washers (2)<br/>         D. Needle Thrust Bearing<br/>         E. Detent Ball, Spring, Pipe Plug</p> |
|---|

Figure 8.0-55

- b. Put the assembly on the shaft assembly number 1. At the same time, put the inner end of the shifter shaft in the shifter shaft hole in the case.
  - c. Engage the pin in the shifter shaft with the notch in the weldment for the shifter rod.
  - d. Install the thrust washers (C) and the needle thrust bearing (D) in the arrangement as shown in Figure 8.0-55.
  - e. Install the detent ball, the spring, and the pipe plug (E).
20. Install the idler gear (A, Figure 8.0-56) on the shaft assembly number 2.



- |   |
|---|
| <p>A. Idler Gear<br/>         B. .030 Inch (0.76 mm) Thrust Washers (2 total)<br/>         C. Needle Thrust Bearing</p> |
|---|

Figure 8.0-56

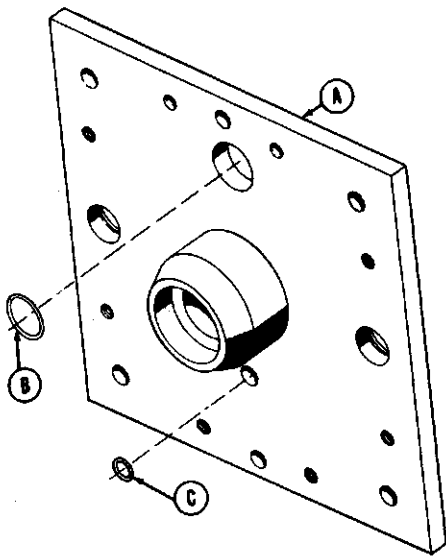
21. Install the thrust washers (B) and the needle thrust bearing (C) on the shaft assembly number 2 in the arrangement as shown in Figure 8.0-56.
22. Install new gasket for the cover for the transmission. Seal it with Loctite No. 277.
23. Put the cover plate for the transmission in position and install the six shorter bolts and the lock nuts in the thin sections of the flange on the cover.

---

**NOTE: Make sure the forward gear and the bearing assembly with the Woodruff Key are correctly installed with the cover plate.**

---

24. Install the two longer bolts and the lock nuts in the thick sections of the flange on the cover.
25. Put O-rings (B and C, Figure 8.0-57) in position as shown.



- |  |
|--|
| <p>A. Adapter Plate<br/>         B. 2.375 Inch (60.3 mm) O-Ring<br/>         C. .549 Inch (13.9 mm) O-Ring</p> |
|--|

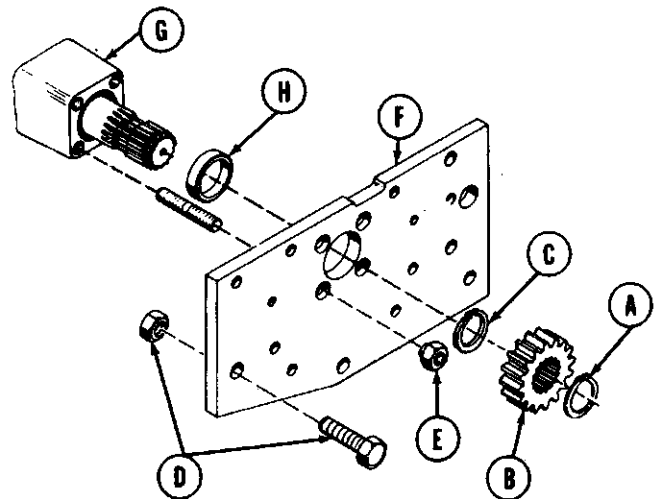
Figure 8.0-57

26. Put the adapter plate (A) and the sun gear shaft assembly (not shown) in position against the rear of the transmission.
27. Install the four bolts that hold the adapter plate to the transmission case.

### 8.3.5 How to Install the Transmission in the Tractor

1. Make sure all the hydraulic lines, the linkages for control, etc., are clear of the area where the transmission will be installed in the tractor.
2. If the transmission is not already on a jack, use a hoist to put it on a jack.
3. Get assistance to keep the transmission vertical. Remove the hoist.
4. Use the jack to roll the transmission into position in the tractor.
5. Raise (or lower) the jack until the four bolt holes on the front of the transmission are aligned with the bolt holes in the frame. Install the four bolts and the lock nuts. Do not tighten the bolts at this time. Install the propeller shaft.

6. Make an alignment of the transmission and install the spacer and the bolt in the bracket on the left side of the transmission. Do not tighten it at this time.
7. Repeat step 6 for the bolt and the spacer on the right side.
8. Install the rear PTO. See Section 9.3.3, "How to Assemble the Clutch for the Rear PTO."
9. Install the right plate for mounting the drop axle as follows:
  - a. Put Loctite No. 277 on surface that seals on the transmission housing (G, Figure 8.0-58).

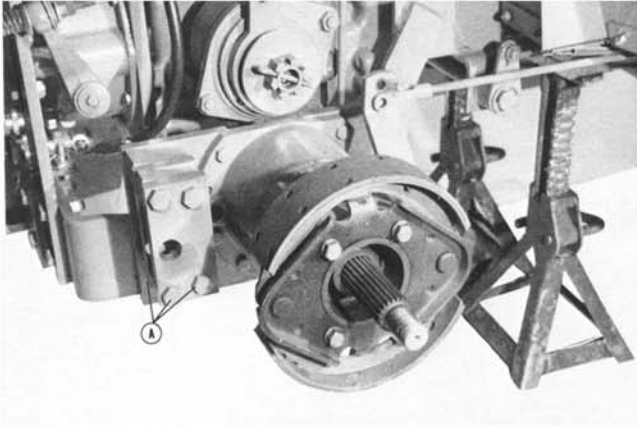


- |  |
|--|
| <p>A. Retaining Ring<br/>         B. Pinion Gear<br/>         C. Retaining Ring<br/>         D. Bolt and Lock Nut<br/>         E. Nuts (4)<br/>         F. Mounting Plate for Drop Axle<br/>         G. Transmission Housing<br/>         H. Bushing</p> |
|--|

Figure 8.0-58

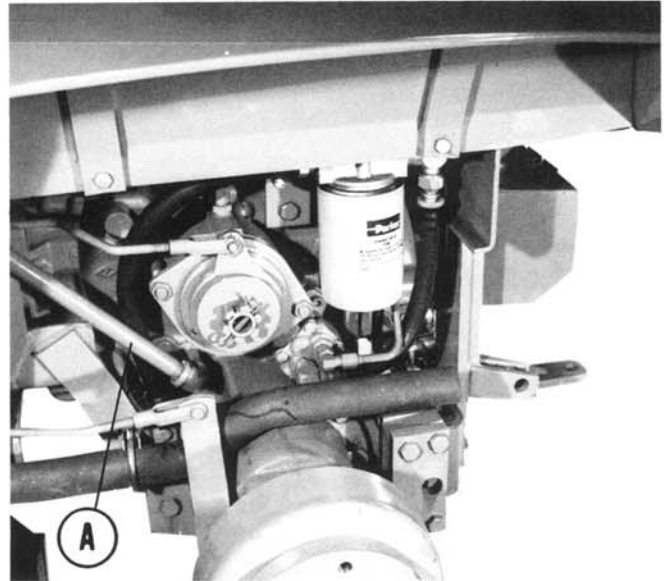
- b. Put the plate for the mounting (F) in position. Install the four nuts (E). Tighten to a torque of 85 foot-pounds (11.8 mkg).
- c. Install the bolt and the lock nut (D) that hold the plate (F) to the bracket on the frame.

- d. Install the three bolts and the lock nuts (A, Figure 8.0-59)



A. Bolts (3) and Lock Nuts

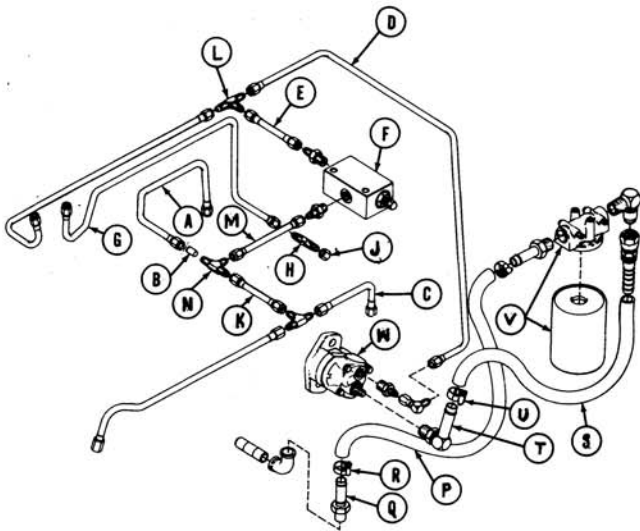
Figure 8.0-59



A. Tube for Filling Transmission

Figure 8.0-60

- e. Install the retaining ring (C, Figure 8.0-58). The flat side of the ring must be toward the transmission.
- f. Install the pinion gear (B) for the drop axle.
- g. Install the retaining ring (A). The flat side of the ring must be toward the outer end of the axle.
10. Repeat steps 9c, 9e, 9f, and 9g for the left drop axle.
  11. Tighten the bolts and the lock nuts installed in steps 5, 6, and 7 above. Remove the jack.
  12. Put the strut in position at the bottom between the two mounting plates for the drop axles. Install the lock nut on the left side only.
  13. Install the tube (A, Figure 8.0-60).
  14. Install the dipstick.
  15. Install the right drop axle. See Section 8.2.2, "How to Assemble the Drop Axle," steps 4 to 16.
  16. Repeat step 15 for the left drop axle.
  17. Install the clamp for the exhaust pipe.
  18. If either the forward clutch or the reverse clutch were disassembled as part of this repair, make an adjustment to the clutches at this time. See Section 9.1.1, "How to Adjust the Forward Clutch or the Reverse Clutch".
  19. Install the linkages for the control for the forward and the reverse clutches.
  20. Install the hydraulic lines as follows:
    - a. Install the suction hose (S, Figure 8.0-61) on the adapter (T). Tighten the hose clamp (U).



- A. Hydraulic Line to Forward Clutch
- B. Restriction
- C. Hydraulic Line to Reverse Clutch
- D. Hydraulic Line from Hydraulic Pump
- E. Hydraulic Line to Relief Valve
- F. Relief Valve
- G. Hydraulic Line from Housing for Power Steering
- H. Tee Fitting at Bottom of Transmission
- J. Cap
- K. Hydraulic Line
- L. Tee Fitting
- M. Tee Fitting from Relief Valve
- N. Tee Fitting
- P. Suction Hose from Transmission
- Q. Adapter
- R. Hose Clamp
- S. Suction Hose from Filter
- T. Adapter
- U. Hose Clamp
- V. Filter
- W. Hydraulic Pump

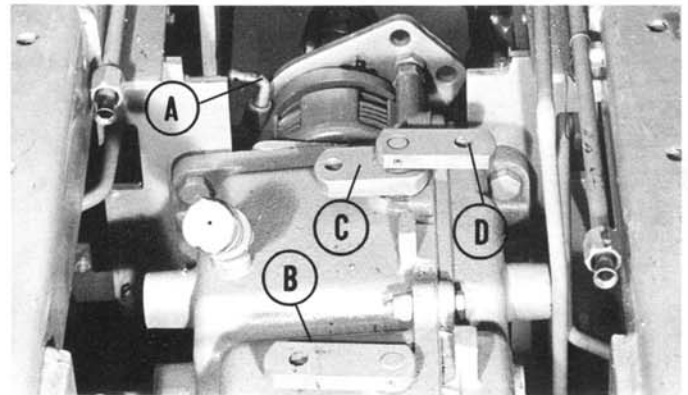
Figure 8.0-61

- b. Install the suction hose (P) on the adapter (Q). Tighten the hose clamp (R).
- c. Put the relief valve (F) in position. The hydraulic lines (E) and (M), and the tee fitting (N) are still connected to the relief valve (F).
- d. Install the hydraulic line (K) to the hydraulic pump.
- e. Install the tee fitting (B) with the cap (J).
- f. Install the hydraulic line (G).

- g. Connect the hydraulic line (E) at the tee fitting (L).
- h. Install the hydraulic line (D).
- i. Install the hydraulic line (C).
- j. Put the restriction (B) in the hydraulic line (A) at the tee fitting (N). Install the hydraulic line (A).

- 21. Put the hydraulic lines for the three-point hitch and the quick disconnect in position. Put the fuel line and the filter in position.
- 22. Install the linkage for the rear PTO. See Section 9.3.3, "How to Assemble the Clutch for the Rear PTO."
- 23. Make an adjustment to the clutch for the front PTO. See Section 9.2.1, "How to Adjust the Clutch for the Front PTO."
- 24. Connect control linkages as follows:

- a. Put the rod for the range selector in position on the shifter arm (B; Figure 8.0-62). Install the clip pin.

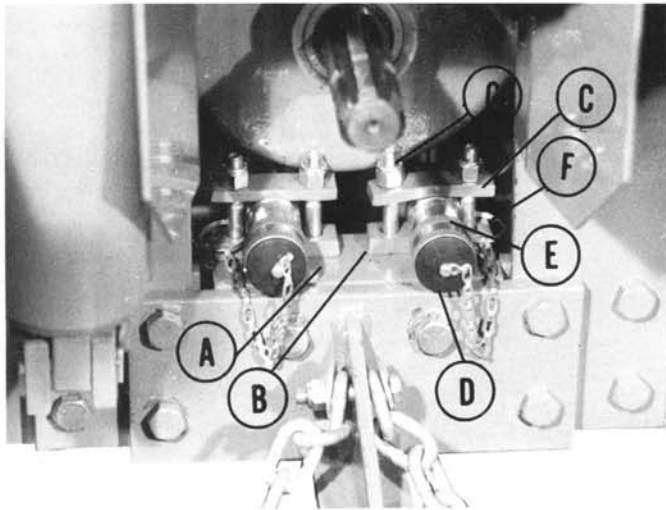


- A. Rod for Clutch Cam for Front PTO
- B. Shifter Arm for HI-LO Range Selector
- C. Shifter Arm for Gear Selector for Gears 1 and 3
- D. Shifter Arm for Gear Selector for Gears 2 and 4

Figure 8.0-62

- b. Repeat step 24a for the rod for the gear selector for gears 1 and 3 (C).
- c. Repeat step 24a for the rod for the gear selector for gears 2 and 4 (D).
- d. Put the control lever for the front PTO in position on the clutch cam for the front PTO (A). Install the cotter pin.

25. Put the control cover plate in position. Install the six screws.
26. Install the knobs on:
  - a. The control lever for the front PTO.
  - b. The control lever for the gear selector.
  - c. The control lever for the range selector.
27. Install the rear wheels.
28. Install the three-point hitch. See Section 10.4, "How to Assemble the Three-Point Hitch." This procedure includes installation of the fuel tank and the seat.
29. Install the quick disconnect as follows:
  - a. Remove the four bolts and the lock nuts (G, Figure 8.0-63) and the two thin brackets (C).
    - b. Install the two quick disconnects (E), two rings (F), and the two plugs (D).
    - c. Install the two thin brackets (C) and the two bolts and the lock nuts (G).
30. Use a jack to lift the rear of the tractor. Remove the stands. Lower the tractor and remove the stands.
31. Install a new filter.
32. Fill the transmission with lubricant.
33. Remove the blocks from the front wheels.
34. Make a check of the pressure in the hydraulic system.
35. Stop the engine. Engage the parking brake.



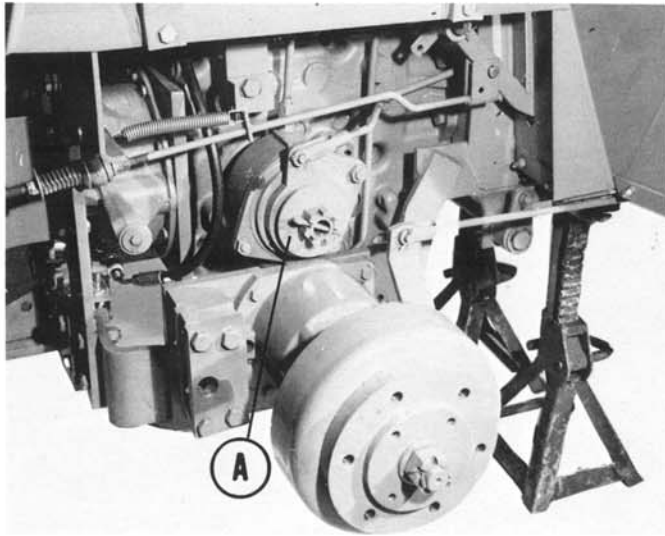
- |   |
|---|
| <p>A. Angle Bracket<br/>         B. Thick Bracket<br/>         C. Thin Bracket<br/>         D. Plug<br/>         E. Quick Disconnect<br/>         F. Ring<br/>         G. Bolt and Lock Nut</p> |
|---|

Figure 8.0-63

## 9.0 How to Do Clutch Service

### 9.1 The Forward and Reverse Clutches

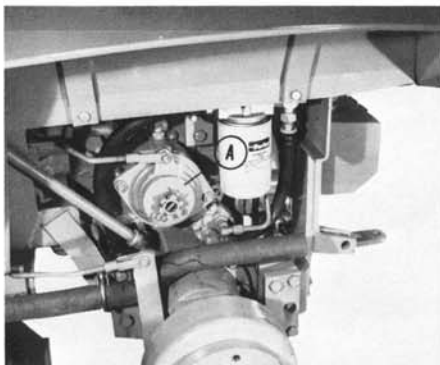
The wet clutch that moves the tractor forward is called the forward clutch (A, Figure 9.0-1).



A. Forward Clutch

Figure 9.0-1

It is on the right side of the transmission, above the drop axle for the rear wheel. The wet clutch that moves the tractor backward is called the reverse clutch (A, Figure 9.0-2).



A. Reverse Clutch

Figure 9.0-2

It is on the left side of the transmission, above the drop axle for the rear wheel. Both clutches are the same except for the gear and the bearing assemblies. These gear and bearing assemblies are on the inside of the transmission and are not included in this disassembly and assembly instructions.

#### Clutch Maintenance Schedule:

100 hours ..... Put the lubricant on the linkages and the pivots. Check the adjustment of the forward clutch and/or the reverse clutch.

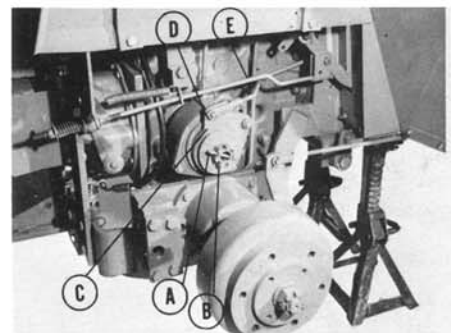
#### 9.1.1 How to Adjust the Forward Clutch or the Reverse Clutch

**NOTE:** The procedure is the same for both clutches. This procedure is easier to do when the rear wheel is removed.

1. Stop the engine. Engage the parking brake.
2. Put the lever for the direction control in the vertical position/"NEUTRAL."
3. Put blocks on the ground to the front of the front tires and to the rear of the front tires. These blocks must be against the tires to prevent accidental movement of the tractor.
4. Use a jack to lift the rear of the tractor until the rear wheels are one inch (2.5 cm) above the ground.
5. Put the stands under the right side of the frame and under the left side of the frame at the rear of the tractor. Remove the jack.
6. Remove the six bolts for the hub of the rear wheel and remove the rear wheel.

**WARNING:** The exhaust pipe on the left side of the tractor will be hot.

7. Remove the cotter pin (A, Figure 9.0-3).



- A. Cotter Pin
- B. Adjusting Nut
- C. Clutch Arm
- D. Cotter Pin and Clevis Pin
- E. Rod for Direction Control

Figure 9.0-3



8. Remove the cotter pin and remove the clevis pin (D). Move the rod for direction control (E) away.
9. Turn the adjusting nut (B) clockwise until the clutch cam (C) has no clearance when moved by hand.

---

**NOTE: The friction discs for the clutch must be replaced when the clearance cannot be removed in step 9.**

---

**⚠ WARNING: Do not turn the adjusting nut more than one turn counterclockwise.**

---

10. Turn the adjusting nut (B) 3/4 of a turn counterclockwise. Continue to turn the adjusting nut counterclockwise until one of the slots in the adjusting nut is aligned with the hole for the cotter pin (A).
11. Install the cotter pin (A).
12. Put the rod for the direction control (E) in position and install the clevis pin and the cotter pin (D).
13. Install the rear wheel and install the six bolts for the hub of the rear wheel.
14. Repeat steps 6 to 13 for the outer clutch.
15. Use a jack to lift the rear of the tractor.
16. Remove the stands.
17. Lower the tractor and remove the jack.
18. Check the lever for direction control to see that it is in the vertical position.
19. Start the engine and disengage the parking brake.
20. Test the operation of the tractor in the forward and the backward direction. Make sure the lever for the direction control holds in position when pushed to the stop in both directions.
21. If the lever for the direction control does not hold in either position and the adjustment was done correctly, there is damage inside the clutch.

22. If the tractor moves slowly in either direction, the adjusting nut (B) for that clutch is too tight. Read Section 9.1.1, "How to Adjust the Forward Clutch or the Reverse Clutch," step 10.

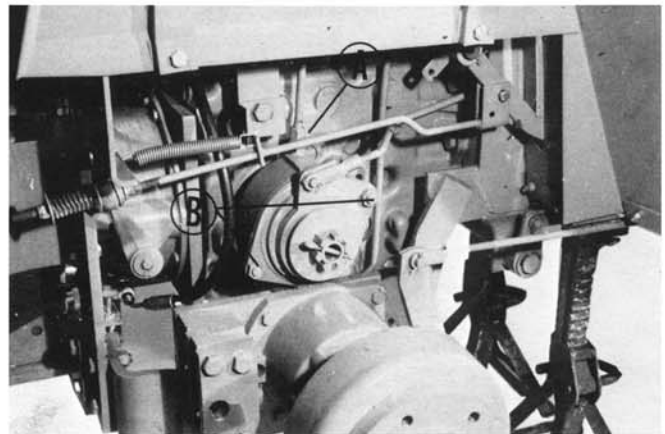
### 9.1.2 How to Disassemble the Forward Clutch or the Reverse Clutch

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**NOTE: The procedure is the same for both clutches.**

---

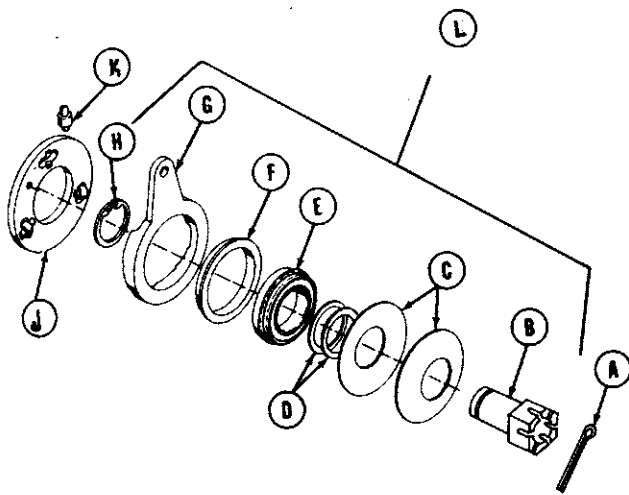
1. Stop the engine. Engage the parking brake.
2. Put the lever for the direction control in the vertical position.
3. Put the blocks on the ground to the front of the front tires and to the rear of the front tires. These blocks must be against the tires to prevent accidental movement of the tractor.
4. Use a jack to lift the rear of the tractor until the rear wheels are one inch (2.5 cm) above the ground.
5. Put the stands under the right side of the frame and under the left side of the frame at the rear of the tractor. Remove the jack.
6. Remove the six bolts for the hub of the rear wheel and remove the rear wheel.
7. Remove the cotter pin and remove the clevis pin (D, Figure 9.0-3). Move the rod for direction control (E) away.
8. Remove the hydraulic line (A, Figure 9.0-4).



A. Hydraulic Line  
B. Lock Nuts

Figure 9.0-4

9. Remove the cotter pin (A, Figure 9.0-5).



- |    |                     |
|----|---------------------|
| A. | Cotter Pin          |
| B. | Adjusting Nut       |
| C. | Spring Washers (2)  |
| D. | .030 Inch Shims (2) |
| E. | Ball Bearing        |
| F. | Adapter             |
| G. | Clutch Cam          |
| H. | Retaining Ring      |
| J. | Clutch Plate        |
| K. | Clutch Roller       |
| L. | Clutch Cam Assembly |

Figure 9.0-5

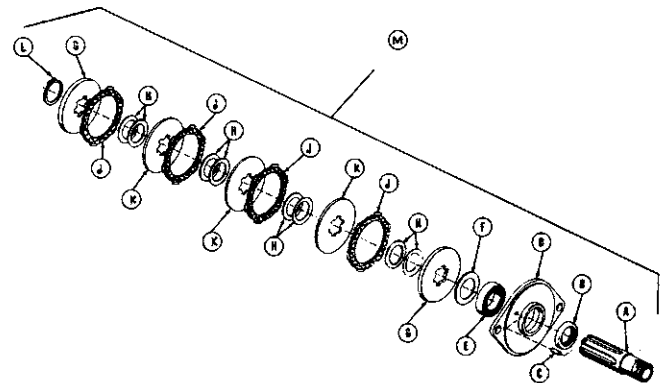
10. Turn the adjusting nuts (B, Figure 9.0-5) counterclockwise. Remove the clutch cam assembly (K) and put the assembly in a clean area.

**NOTE: The adapter for the clutch cam (F, Figure 9.0-5) and the clutch cam (G) will be loose, but it can be removed as a part of the clutch cam assembly (L).**

11. Remove the clutch plate (J) and the three clutch rollers (K). Make sure that the clutch rollers (K) do not fall. Put them in a clean area.
12. Remove the retaining ring (H) and remove all the parts from the adjusting nut (B).
13. Make an inspection of the parts.
  - a. Check for damaged parts and replace them, if necessary.
  - b. Look for any flat areas on the clutch rollers (K). Replace the clutch rollers that have flat areas.

- c. Turn the inner race of the ball bearing (E) by hand. The rotation of the balls and the cage must be smooth. If there is friction in any area or if any area is loose, replace the ball bearing.
- d. Put all the parts on the adjusting nut (B) in the arrangement as shown in Figure 9.0-5.
- e. Install the retaining ring (H).

14. Remove the lock nuts (B, Figure 9.0-4).
15. Hold the clutch housing with one hand. Pull the clutch disc and the hub assembly (M, Figure 9.0-6) all the way out of the housing. Put the assembly in a clean area.



- |    |                              |
|----|------------------------------|
| A. | Hub for Clutch Discs         |
| B. | Oil Seal                     |
| C. | Spring Pin                   |
| D. | Cover for Clutch Housing     |
| E. | Ball Bearing                 |
| F. | Thrust Washer                |
| G. | Pressure Plates (2)          |
| H. | Spring Washers (8)           |
| J. | Friction Discs (4)           |
| K. | Clutch Discs (3)             |
| L. | Retaining Ring               |
| M. | Clutch Disc and Hub Assembly |

Figure 9.0-6

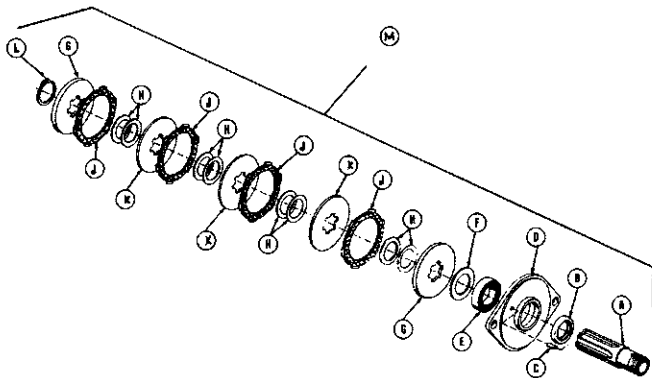
16. Remove the retaining ring (L) and remove all the parts from the hub for the clutch discs (A).
17. Make an inspection of the parts.
  - a. Look for damaged parts and for parts that have defects. Replace any damaged parts or parts with defects.

- b. Look for deep scratches or grooves on the clutch discs (K) and on the pressure plates (G). Replace them, if necessary.
- c. Measure the thickness of the friction discs. If any friction disc measures below .041" (1.04 Nm), replace all the friction discs.
- d. Turn the inner race of the ball bearing (E) by hand. The rotation of the balls and the cage must be smooth. If there is friction in any area or if any area is loose, replace the ball bearing.
- e. Look at the lip of the oil seal (B). Replace the oil seal if any part of the lip is cracked or missing.
- f. Put all parts on the hub for clutch discs in the arrangement shown in Figure 9.0-6.
- g. Install the retaining ring (L).

### 9.1.3 How to Assemble the Forward Clutch or the Reverse Clutch

**NOTE: The procedure is the same for both clutches.**

1. Hold the hub for the clutch discs (A, Figure 9.0-7) in one hand.



- |   |
|---|
| <p>A. Hub for Clutch Discs<br/>         B. Oil Seal<br/>         C. Spring Pin<br/>         D. Cover for Clutch Housing<br/>         E. Ball Bearing<br/>         F. Thrust Washer<br/>         G. Pressure Plates (2)<br/>         H. Spring Washers (8)<br/>         J. Friction Discs (4)<br/>         K. Clutch Discs (3)<br/>         L. Retaining Ring<br/>         M. Clutch Disc and Hub Assembly</p> |
|---|

Figure 9.0-7

With the other hand:

- a. Align the sections of the friction discs (J) that have the largest diameter with the slots in the driven cup (C, Figure 9.0-7).
- b. Turn the cover for the clutch housing (D) until:
  - (1) The holes for the mounting are aligned with the studs for mounting.
  - (2) The spring pin (C) is on the left side of the hub for the clutch discs.

**NOTE: The clutch will not operate if the spring pin is not in the correct position.**

2. When the parts are correctly aligned, push the clutch disc and hub assembly (M, Figure 9.0-7) into the clutch housing assembly.

**NOTE: The hub for the clutch discs (A) must be turned a small amount to align the spline of the hub with the spline of the clutch shaft in the transmission.**

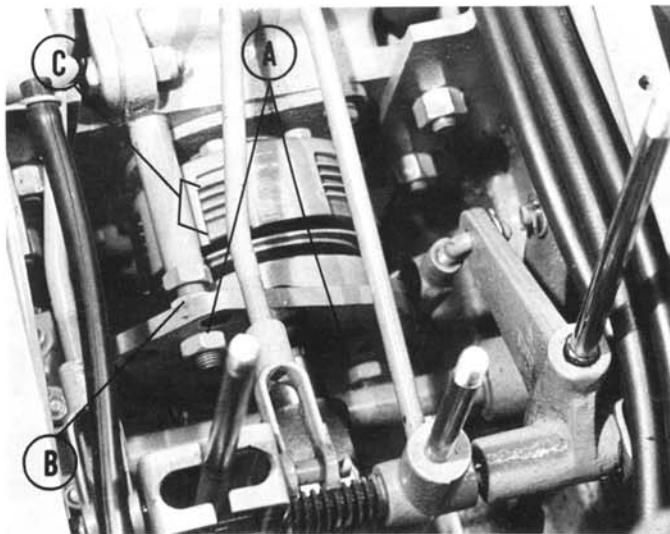
3. Install the lock nuts (B, Figure 9.0-4).
  - a. Hold the clutch housing firmly against the transmission housing and tighten the lock nuts evenly to a torque of 30-35 foot pounds (82.N.m).
4. Install the clutch plate (J, Figure 9.0-5) and the clutch rollers (K).
5. Put the clutch cam assembly (L, Figure 9.0-5) in position.
  - a. Turn the clutch cam (G) by hand to the vertical position and hold the clutch cam in this position.
  - b. Turn the adjusting nut (B) by hand two or three turns clockwise.
6. Install the hydraulic line (A, Figure 9.0-4).
7. Make an adjustment to the clutch. Follow the procedure in steps 9 to 22 of Section 9.1.1, "How to Adjust the Forward Clutch or the Reverse Clutch."

## 9.2 Front PTO Clutch

### 9.2.1 How to Adjust the Clutch for the Front PTO

1. Stop the engine. Engage the parking brake.

2. Pull the control lever for the front PTO backward to disengage the clutch.
3. Remove the knobs from:
  - a. The control lever for the front PTO.
  - b. The control lever for the gear selector.
  - c. The control lever for the range selector.
4. Remove the six screws for the control cover plate. Remove the control cover plate.
5. Turn the lock nuts (A, Figure 9.0-8) one turn counterclockwise.



<p>A. Lock Nuts (2)          B. Jam Nuts (one to each stud)          C. Clutch Disc Assembly</p>
--

Figure 9.0-8

6. Loosen the jam nuts (B). Turn each jam nut three turns clockwise.
7. Using a flat bar, push on the hub of the clutch for the front PTO (not shown) until there is no clearance between the clutch discs in the clutch disc assembly (C).
8. Hold the clutch disc assembly in this position. Tighten each lock nut (A) the same amount until the clutch disc assembly does not move when the bar is removed.

9. Turn each lock nut (A) counterclockwise 3/4 of one turn.
10. Tighten the jam nuts (B).

---

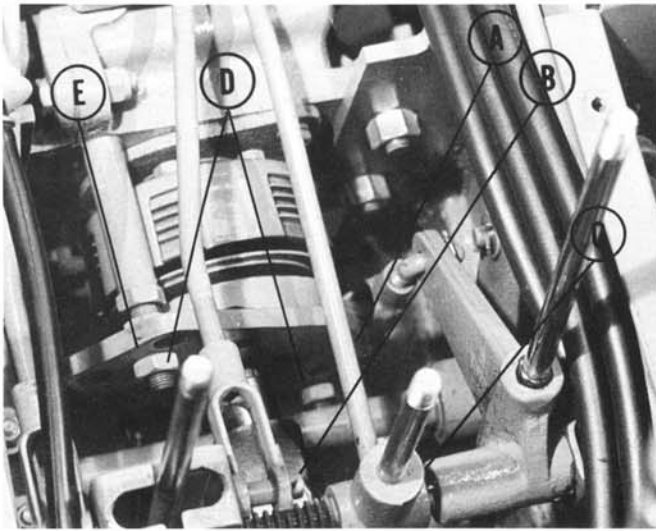
**NOTE: This adjustment gives .040 inch (1.0 cm) clearance between the clutch disc assembly (C) and the clutch plate in the cup. There is no adjustment for clearance in the clutch disc assembly. If there is too much clearance in the assembly, replace the clutch discs.**

---

11. Install the control cover plate and the six screws for the control cover plate.
12. Install the knobs for the control levers.
13. Test the operation of the clutch for the front PTO.
  - a. Start the engine.
  - b. Lift the control lever for the front PTO and push the control lever forward.
  - c. The control lever for the front PTO must hold in the forward position when the adjustment for the clutch for the front PTO is correct.

### 9.2.2 How to Disassemble the Clutch for the Front PTO

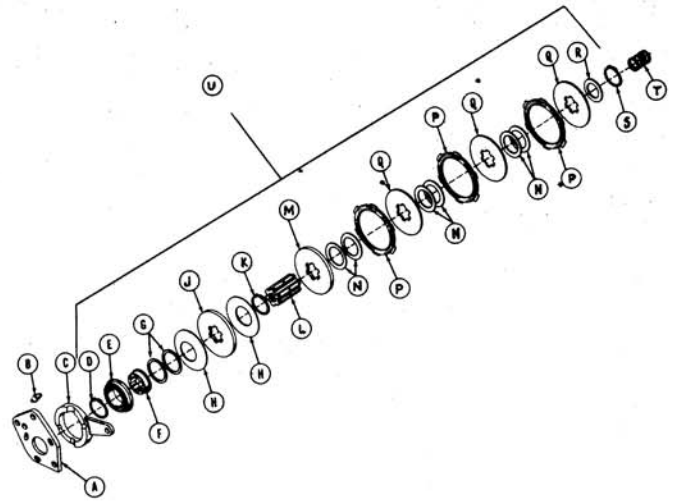
1. Stop the engine. Engage the parking brake.
2. Pull the control lever for the front PTO backward to disengage the clutch.
3. Remove the knobs from:
  - a. The control lever for the front PTO.
  - b. The control lever for the gear selector.
  - c. The control lever for the range selector.
4. Remove the six screws for the control cover plate. Remove the control cover plate.
5. Remove the cotter pin and the clevis pin for the control lever for the front PTO (A, Figure 9.0-9) and move the control lever away.



- A. Cotter Pin and Clevis Pin for Control Lever for Front PTO
- B. Cotter Pin and Clevis Pin for the Linkage for Gear Selector for Gears 1 and 3
- C. Cotter Pin for the Linkage for Range Selector
- D. Lock Nuts
- E. Clutch Plate for Front PTO

Figure 9.0-9

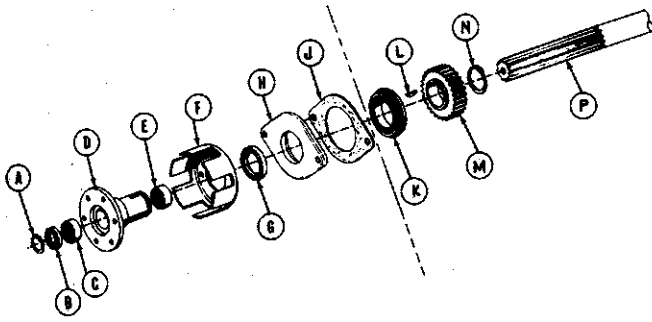
6. Remove the cotter pin (C) and move the linkage for the gear selector for gears 1 and 3 away.
7. Remove the cotter pin (C) and move the linkage for the range selector away.
8. Remove the propeller shaft. See steps 44 and 45 in Section 3.4, "How to Remove the Engine."
9. Remove the lock nuts (D).
10. Remove the clutch plate for the front PTO (E) and the three clutch rollers (not shown). Make sure the clutch rollers do not fall. Put the clutch plate and the clutch rollers in a clean area.
11. Remove the clutch assembly for the front PTO (U, Figure 9.0-10) and put it in a clean area.



- A. Clutch Plate
- B. Clutch Rollers (3)
- C. Clutch Cam
- D. Retaining Ring
- E. Ball Bearing
- F. Adapter for Clutch Cam
- G. Shims (2)
- H. Spring Washers (2)
- J. Spacer
- K. Retaining Ring
- L. Hub for Clutch Discs
- M. Pressure Plate
- N. Spring Washers (6)
- P. Friction Discs (3)
- Q. Clutch Discs (3)
- R. Shim (1 to 3, as needed)
- S. Retaining Ring
- T. Compression Spring
- U. Clutch Assembly for Front PTO

Figure 9.0-10

12. Remove the compression spring (T).
13. The remainder of the parts (Figure 9.0-11) must be removed from the inside of the transmission. Removing these parts is not included in this disassembly procedure. Read Section 8.3, "Transmission Section." If there is leakage of oil inside these parts, the transmission must be opened and the oil seals for the front PTO (B and G, Figure 9.0-11) must be replaced.



- |    |                              |
|----|------------------------------|
| A. | Retaining Ring               |
| B. | Oil Seal                     |
| C. | Needle Bearing               |
| D. | Hub for Clutch               |
| E. | Needle Bearing               |
| F. | Driven Cup                   |
| G. | Oil Seal                     |
| H. | Cap                          |
| J. | Gasket for Cap               |
| K. | Ball Bearing                 |
| L. | Woodruff Key                 |
| M. | Spur Gear                    |
| N. | Retaining Ring               |
| P. | Input Shaft for Transmission |

Figure 9.0-11

14. Remove the retaining ring (D, Figure 9.0-10).
15. Remove the parts (C), (E), (F), (G), (H), and (J) from the hub for the clutch discs (L).
16. Remove the retaining ring (K).
17. Remove the remainder of the parts from the hub for the clutch discs (L).
18. Make an inspection of the parts.
  - a. Look for damaged parts and for parts that have defects. Replace any damaged parts or parts with defects.
  - b. Turn the inner race of the ball bearing (E, Figure 9.0-6) by hand. The rotation of the balls and cage must be smooth. If there is friction in any area or if any area is loose, replace the ball bearing.

- c. Look for deep scratches or grooves on the clutch discs (Q, Figure 9.0-10) and on the pressure plates (M). Replace them if necessary.
- d. Measure the thickness of the friction discs. If any friction disc measures below .037 inches (.99 mm), replace all friction discs.
- e. Look for any flat areas on the clutch rollers (B, Figure 9.0-10). Replace the clutch rollers that have flat areas.

19. Put all parts on the hub for the clutch discs (L) in the arrangement shown in Figure 9.0-10.

### 9.2.3 How to Assemble the Clutch for the Front PTO

1. Install the compression spring (T, Figure 9.0-10) on the input shaft of the transmission (P, Figure 9.0-11).
2. Hold the clutch assembly (A, Figure 9.0-10) in one hand.
  - a. With the other hand, align the sections of the friction discs (P, Figure 9.0-10) that have the largest diameter with the slots in the driven cup (F, Figure 9.0-11).
  - b. Turn the clutch cam (C, Figure 9.0-10) by hand until the hole for the clevis pin for the control lever is on the right when you look toward the rear of the tractor.
3. When the parts are correctly aligned, push the clutch assembly (A, Figure 9.0-10) into the driven cup (F, Figure 9.0-11).

**NOTE:** The hub for the clutch discs must be turned a small amount to align the spline of the hub for the clutch discs (L, Figure 9.0-10) with the spline of the input shaft for transmission (P, Figure 9.0-11).

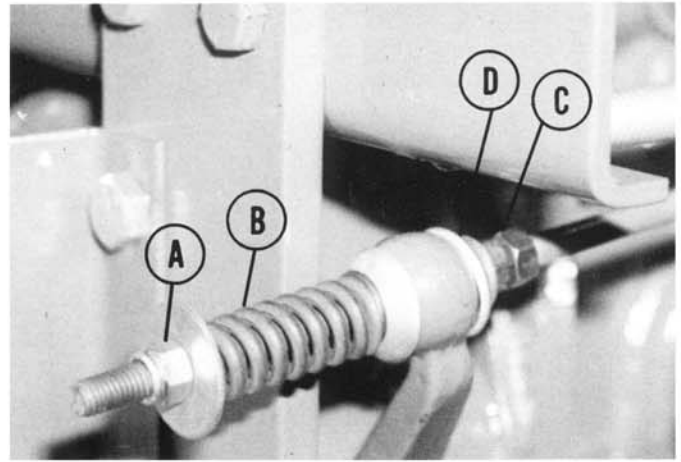
4. Install the clutch plate and the three clutch rollers (A and B, Figure 9.0-10).
5. Install the lock nuts (D, Figure 9.0-9).
6. Make an adjustment of the clutch. Follow the procedure in Section 9.2.1, "How to Adjust the Clutch for the Front PTO," steps 6 to 10.

7. Install the propeller shaft. See Section 3.5, "How to Install the Engine," step 12.
8. Put the linkage for the range selector in position and install the cotter pin (C, Figure 9.0-9).
9. Put the linkage for the gear selector for gears 1 and 3 in position and install the cotter pin (B, Figure 9.0-9).
10. Put the linkage for the control lever for the front PTO in position and install the cotter pin and the clevis pin (A, Figure 9.0-9).
11. Install the control cover plate and the six screws for the control cover plate.
12. Test the operation of the clutch for the front PTO. Follow the procedure in Section 9.2.1, "How to Adjust the Clutch for the Front PTO," step 13.

### 9.3 Rear PTO Clutch

#### 9.3.1 How to Adjust the Clutch for the Rear PTO

1. Stop the engine. Engage the parking brake.
2. Pull the control lever for the rear PTO up to the "ON" position.
3. Turn the lock nut (A, Figure 9.0-12) against the spring until there is a .010 inch (.25 cm) gap (B) between the coils of the spring.



- |  |
|--|
| <p>A. Lock Nut<br/>         B. Gap for Spring Coil<br/>         C. Jam Nuts<br/>         D. Gap for Bushing and Washer</p> |
|--|

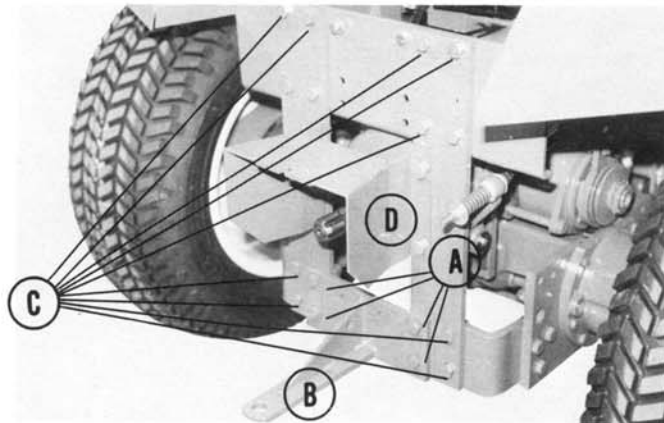
Figure 9.0-12

4. Turn the jam nuts (C) until there is a .060 inch (1.5 cm) gap (D) between the bushing and the washer. Tighten the jam nuts together.
5. Push the control lever for the rear PTO down to the "OFF" position.
6. To test the operation of the clutch for the rear PTO:
  - a. Start the engine.
  - b. Pull the control lever for the rear PTO to the "ON" position.
  - c. The control lever must hold in this position.
  - d. The shaft for the rear PTO (not shown) must rotate.
  - e. Push the control lever for the rear PTO down to the "OFF" position.
  - f. The control lever must hold in this position.
  - g. The shaft for the rear PTO must not rotate.
  - h. If the operation of the rear PTO is not correct, the problem is inside the rear PTO.

#### 9.3.2 How to Disassemble the Rear PTO

**NOTE:** Remove any implements fastened to the rear of the tractor. Remove the three-point hitch before disassembling the rear PTO. See Section 10.0, "The Three-Point Hitch."

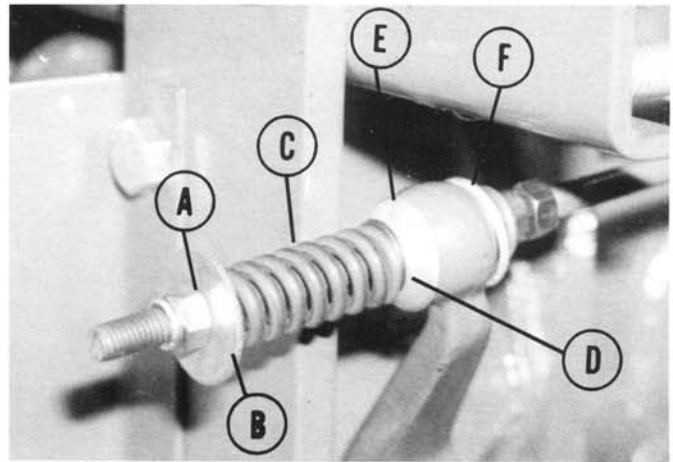
1. Stop the engine. Engage the parking brake.
2. Remove the bolts and the lock nuts for the rear hitch arm (A, Figure 9.0-13). Remove the rear hitch arm (B).



- |   |
|---|
| <p>A. Bolts for Rear Hitch Arms (4)<br/>         B. Rear Hitch Arm<br/>         C. Bolts for Plates for Rear Frame (12)<br/>         D. Shield for Rear PTO</p> |
|---|

Figure 9.0-13

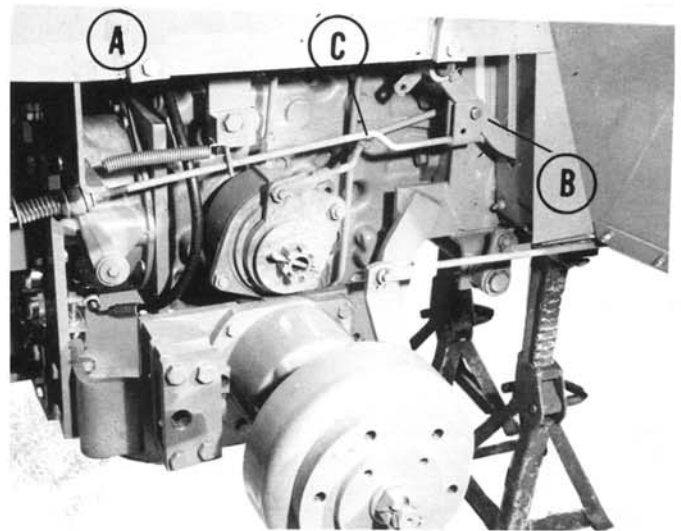
3. Remove the bolts and the lock nuts for plates for the rear frame (C). Remove the plates for the rear frame and the shield for the rear PTO.
4. Drain the transmission lubricant from the transmission into a 5 gallon (20 liters) container. See Section 2.3.2, "How to Change the Transmission Lubricant and Replace the Filter." Make sure the container is clean. After the transmission lubricant is removed, put a clean cloth over the container to prevent dirt or debris from falling into the transmission fluid.
5. Remove the lock nut (A, Figure 9.0-14).



- |   |
|---|
| <p>A. Lock Nut<br/>         B. Flat Washer<br/>         C. Compression Spring<br/>         D. Flat Washer<br/>         E. Cup Washer<br/>         F. Bushing (hidden)</p> |
|---|

Figure 9.0-14

6. Remove the flat washer (B), the compression spring (C), the flat washer (D), the cup washer (E), and the bushing (F).
7. Remove the extension spring (A, Figure 9.0-15).



- |   |
|---|
| <p>A. Extension Spring<br/>         B. Cotter Pin and Clevis Pin<br/>         C. Linkage for Rear PTO</p> |
|---|

Figure 9.0-15

8. Remove the cotter pin and the clevis pin (B).



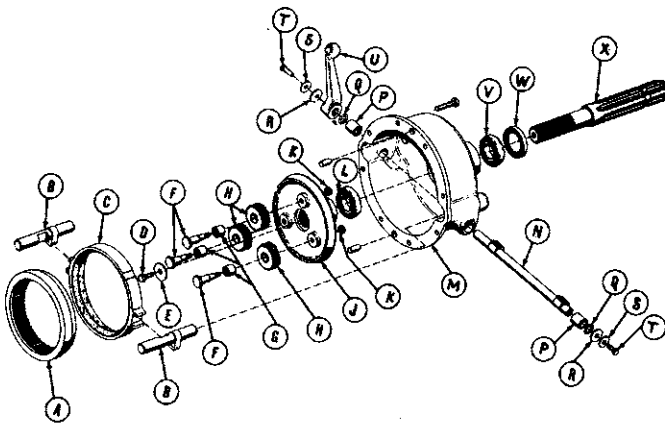
9. Remove the linkage for the rear PTO (C). Do not let the remainder of the parts on the linkage fall.
10. Remove the eight bolts (not shown) from the flange of the housing for the rear PTO.
11. Hit the housing for the rear PTO with a soft head hammer to loosen the sealing compound on the gasket for the housing for the rear PTO.
12. Hold the lever for actuating the rear PTO to prevent it from turning.
13. Pull the rear PTO assembly away from the transmission. Make sure the ring gear does not fall. Put the assembly in a clean area.
14. Remove the ring gear (A, Figure 9.0-16).

15. Turn the lever for actuating the rear PTO toward the open end and remove the sliding rods (B) and the clutch cup (C).
16. Make a mark on the rim of the clutch cup that was toward the ring gear.

**NOTE: The position of the clutch cup can be reversed. The mark on the rim will show the side that was used.**

17. Remove the bolt (D) and the flat washer (E).
18. Remove the assembly that includes:
  - a. The carrier for the planetary gears (J).
  - b. The planetary gears (H).
  - c. The needle bearings (G).
  - d. The pins for the planetary gears (F).
  - e. The lock nuts (K).
19. Remove the shaft for the rear PTO (X).
20. Check the remainder of the parts in the housing for the rear PTO.

- a. Look for damaged parts and replace them, if necessary.
- b. Turn the inner race of the ball bearing (L) by hand. The rotation of the balls and the cage must be smooth. If there is friction in any area or if any area is loose, replace the ball bearing.
- c. Repeat step b. for the ball bearing (V).
- d. Look at the lip of the oil seal (W). Replace the oil seal if any part of the lip is cracked or missing.
- e. Turn the lever for actuating the rear PTO (U) by hand. The rotation must be smooth. If there is any friction or if the shaft to actuate the clutch (N) is loose, disassemble the shaft.
  - (1) Remove the bolts (T).
  - (2) Remove the flat washers (R and S).
  - (3) Remove the O-rings (Q).
  - (4) Remove the lever for actuating the rear PTO (U).
  - (5) Use a soft head hammer to hit the end of the shaft (N) to push the bushing (P) on the opposite side of the housing.
  - (6) Repeat step e, (1) to (4) for the other bushing (P).
- f. Measure the outside diameter of the shaft to actuate the clutch. The measurement is made in the areas that turn in the bushings (P).



- |    |                              |
|----|------------------------------|
| A. | Ring Gear                    |
| B. | Sliding Rod for Clutch (2)   |
| C. | Clutch Cup                   |
| D. | Bolt                         |
| E. | Flat Washer                  |
| F. | Pins for Planetary Gears     |
| G. | Needle Bearings              |
| H. | Planetary Gears              |
| J. | Carrier for Planetary Gears  |
| K. | Lock Nut                     |
| L. | Ball Bearing                 |
| M. | Housing for Rear PTO         |
| N. | Shaft to Actuate the Clutch  |
| P. | Bushing                      |
| Q. | O-ring                       |
| R. | Flat Washer (small hole)     |
| S. | Flat Washer (large hole)     |
| T. | Bolt                         |
| U. | Lever for Actuating Rear PTO |
| V. | Ball Bearing                 |
| W. | Oil Seal                     |
| X. | Shaft for Rear PTO           |

Figure 9.0-16

Specification for new shaft: .745"  
(18.92 mm)  
Replacement limit: .740" (18.80 mm)

Replace the shaft if it is smaller than the replacement limit or if it has deep grooves or scratches.

- g. Measure the inside diameter of the bushings (P).

Specification for new bushing: .751"  
(19.08 mm)  
Replacement limit: .756" (19.20 mm)

Replace the bushings if the measurement is larger than the replacement limit or if the bushings have deep grooves or scratches.

- h. Put the shaft (N) in position in the housing for the rear PTO (M).  
i. Press the bushings (P) into the housing (M).  
j. Put the remainder of the parts on the shaft (N) in the arrangement as shown in Figure 9.0-16.

21. Look at the parts on the carrier for the planetary gears (J).
- Look for damaged parts and for defective parts and replace them, if necessary.
  - Turn the planetary gears (H) by hand. The rotation of the gears must be smooth. If there is friction in any gear or if any gear is loose, replace the needle bearing (G) for the gear.

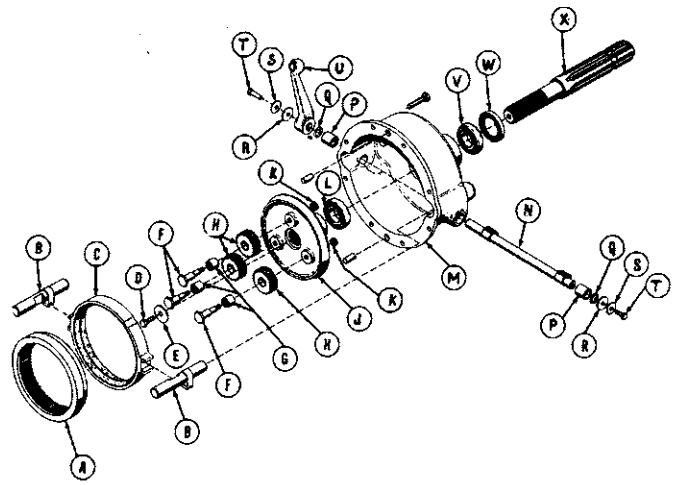
22. Look at the clutch cup (C). If the friction ring on the side with the mark (step 16) is damaged, make sure to install it with the opposite side toward the ring gear. If both friction rings are defective, replace the clutch cup.

23. Look at the sliding rods (B). Make sure there is no damage to the notches on the rods.

24. Look at the ring gear for damage and replace it, if necessary.

### 9.3.3 How to Assemble the Clutch for the Rear PTO

1. Install the shaft for the Rear PTO (X, Figure 9.0-17).

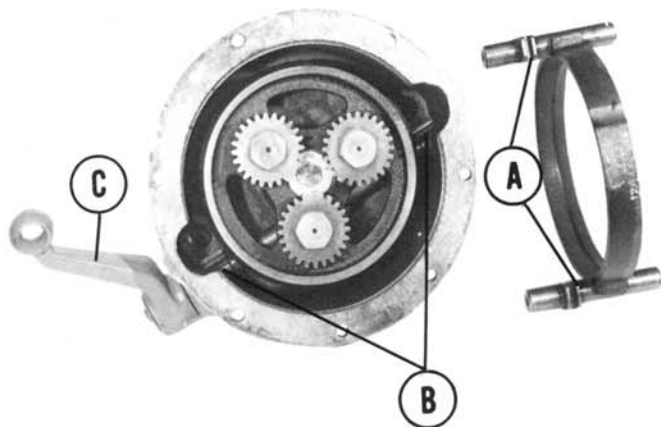


- |    |                              |
|----|------------------------------|
| A. | Ring Gear                    |
| B. | Sliding Rod for Clutch (2)   |
| C. | Clutch Cup                   |
| D. | Bolt                         |
| E. | Flat Washer                  |
| F. | Pins for Planetary Gears     |
| G. | Needle Bearings              |
| H. | Planetary Gears              |
| J. | Carrier for Planetary Gears  |
| K. | Lock Nut                     |
| L. | Ball Bearing                 |
| M. | Housing for Rear PTO         |
| N. | Shaft to Actuate the Clutch  |
| P. | Bushing                      |
| Q. | O-ring                       |
| R. | Flat Washer (small hole)     |
| S. | Flat Washer (large hole)     |
| T. | Bolt                         |
| U. | Lever for Actuating Rear PTO |
| V. | Ball Bearing                 |
| W. | Oil Seal                     |
| X. | Shaft for Rear PTO           |

Figure 9.0-17

2. Install the assembly that includes:
- The carrier for the planetary gears (J).
  - The planetary gears (H).
  - The needle bearings (G).
  - The pins for the planetary gears (F).
  - The lock nuts (K).
3. Install the flat washer (E) and the bolt (D).
4. Put the sliding rods (B) in position on the clutch cup (C). Make sure the mark on the rim is installed correctly. See Section 9.3.2, "How to Disassemble the Rear PTO," step 22.

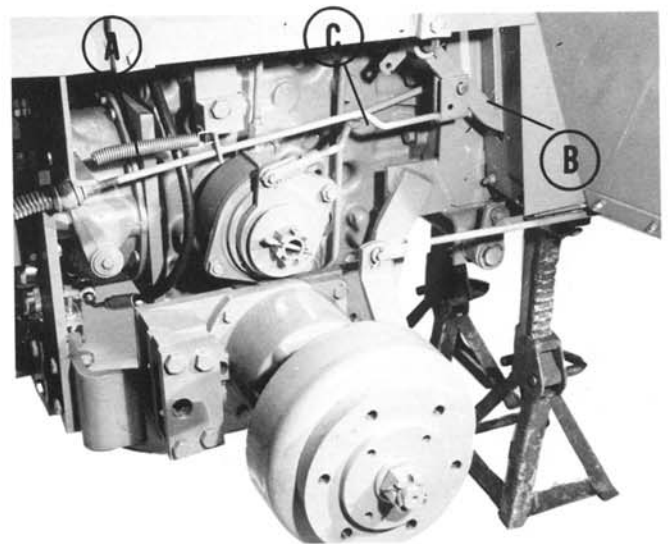
5. Turn the lever for actuating the rear PTO (C, Figure 9.0-18) until the cams on the shaft to actuate the clutch are toward the open end of the housing for the clutch.



- |  |
|--|
| <p>A. Notches on Sliding Rods<br/>         B. Cams on the Shaft to Actuate the Clutch<br/>         C. Lever for Actuating the Rear PTO</p> |
|--|

Figure 9.0-18

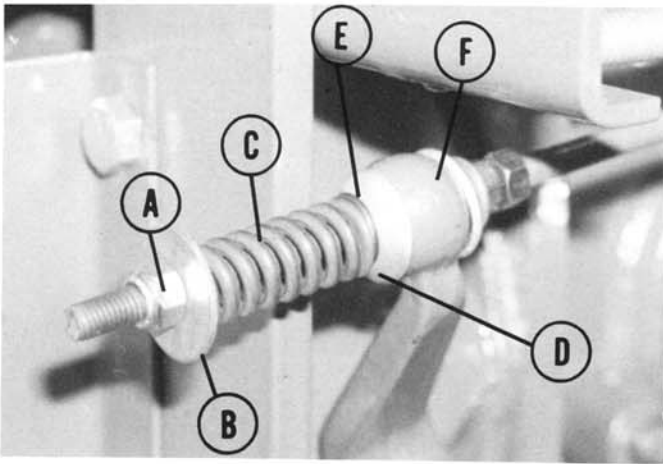
6. Install the clutch cup (C, Figure 9.0-17) and the sliding rods (B). Make sure the cams on the shaft to actuate the clutch (B, Figure 9.0-18) engage the notches on the sliding rods (A, Figure 9.0-18).
7. Install the ring gear (A, Figure 9.0-17). Make sure the tapered side of the ring gear is toward the clutch cup (C, Figure 9.0-17).
8. Put sealing compound on the gasket for the housing for the rear PTO (not shown).
9. Put the rear PTO assembly in position on the transmission. Make sure the lever for actuating the rear PTO (U, Figure 9.0-17) is on the right side of the tractor. Install the eight bolts on the flange of the housing for the rear PTO.
10. Pull the linkage for the rear PTO (C, Figure 9.0-19) in position on the lever for actuating the rear PTO. Make sure the cup washer and the flat washer are between the lever and the jam nuts and that the open end of the cup washer is toward the lever for actuating the rear PTO (U, Figure 9.0-17).



- |   |
|---|
| <p>A. Extension Spring<br/>         B. Cotter Pin and Clevis Pin<br/>         C. Linkage for Rear PTO</p> |
|---|

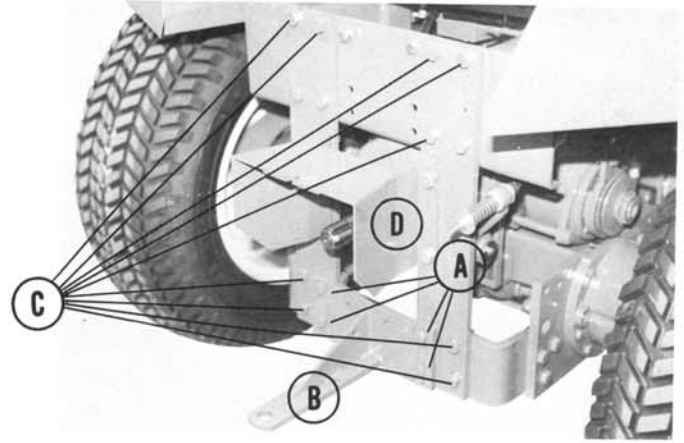
Figure 9.0-19

11. Install the clevis pin and the cotter pin.
12. Install the extension spring.
13. Install the following:
  - a. The bushing.
  - b. Cup washer (E). Make sure the open end of the cup washer is toward the lever for actuating the rear PTO (C, Figure 9.0-18).
  - c. Flat washer (D, Figure 9.0-20).
  - d. Compression spring (C).
  - e. Flat washer (B).



- |   |
|---|
| <p>A. Lock Nut<br/>         B. Flat Washer<br/>         C. Compression Spring<br/>         D. Flat Washer<br/>         E. Cup Washer<br/>         F. Bushing (hidden)</p> |
|---|

Figure 9.0-20



- |  |
|--|
| <p>A. Bolts for Rear Hitch Arm<br/>         B. Rear Hitch Arm<br/>         C. Bolts for Plates for Rear Frame (12)<br/>         D. Shield for Rear PTO</p> |
|--|

Figure 9.0-21

14. Install the lock nut (A).
15. Make an adjustment to the clutch for the rear PTO. See Section 9.3.1, "How to Adjust the Clutch for the Rear PTO," steps 2 to 5.
16. Fill the transmission with transmission lubricant.
17. Check the level of the transmission lubricant in the transmission. Add transmission lubricant, if necessary.
18. Test the operation of the clutch for the rear PTO. See Section 9.3.1, "How to Adjust the Clutch for the Rear PTO," step 6.

**⚠ WARNING: The shield for the rear PTO is not in place. Keep away from the shaft for the rear PTO.**

19. Put the plates for the rear frame and the shield for the rear PTO in position and install the bolts and the lock nuts (C, Figure 9.0-21).

20. Put the rear hitch arm (B) in position and install the bolts and the lock nuts (A).

## 10.0 The Three-Point Hitch

The three-point hitch is shown in Figure 10.0-1.

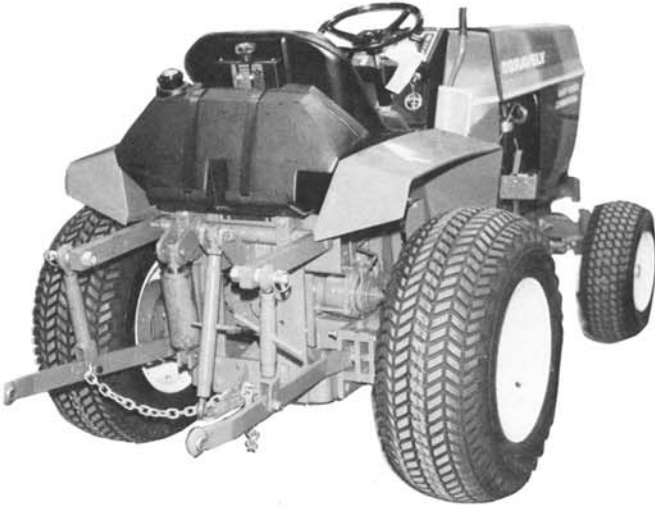


Figure 10.0-1

The three-point hitch is optional equipment used for implements connected to the rear of the tractor. There is a hydraulic cylinder to raise and to lower the implement. The hitch is operated by the control lever nearest the hood on the left side of the tractor. Read GRAVELY Set-up Instructions (form number 24665) before installing the three-point hitch on the tractor.

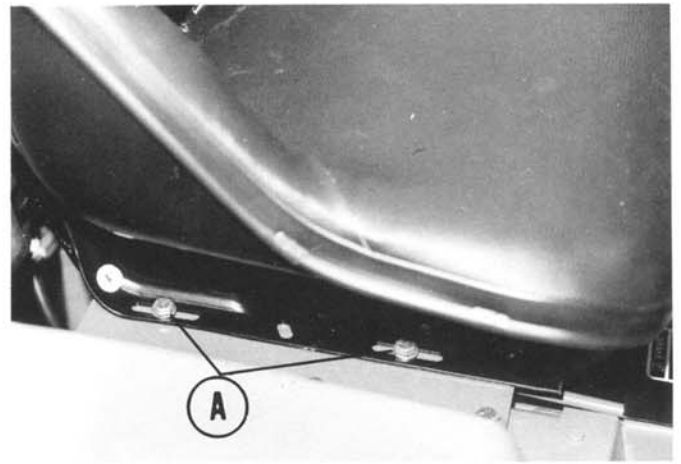
### 10.1 The Three-Point Hitch Maintenance Schedule

40 hours -- Lubricate the pillow block bearings  
Use -- Multi-purpose Grease

### 10.2 How to Disassemble the Three-Point Hitch

The three-point hitch must be disassembled for work on the Rear PTO or for work on the transmission. To disassemble the three-point hitch, follow this procedure:

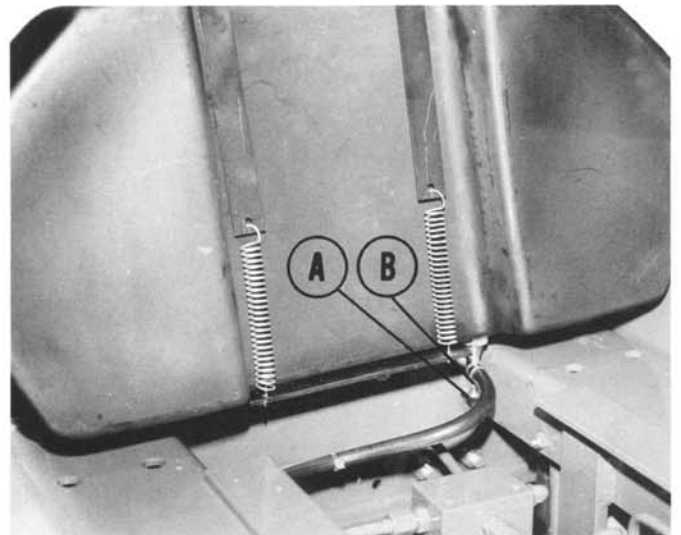
1. Remove the four bolts (A, Figure 10.0-2) which hold the seat. Remove the seat.



A. Bolts

Figure 10.0-2

2. Close the valve on the fuel tank (A, Figure 10.0-3).

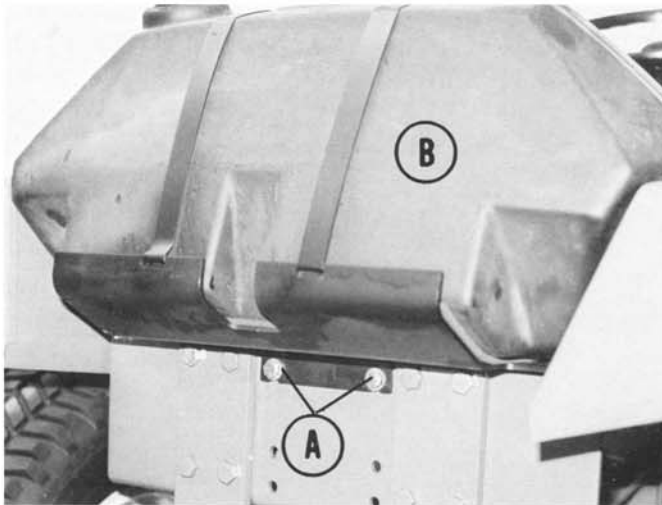


A. Valve  
B. Fuel Line

Figure 10.0-3

3. Remove the fuel line (B) at the valve.

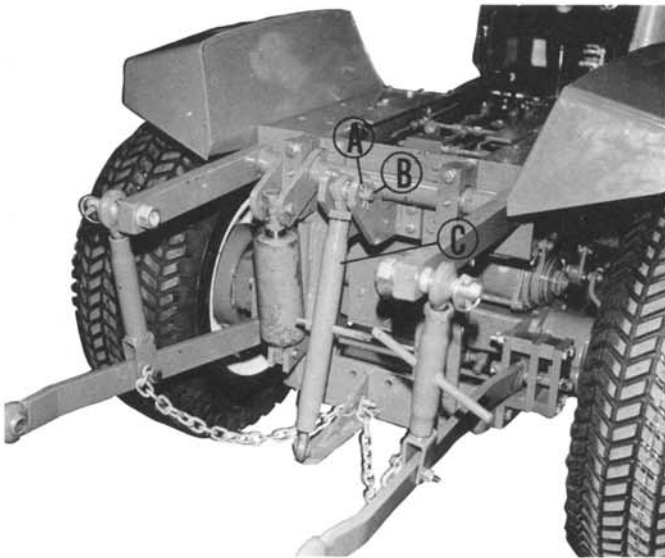
- Loosen the bolts for the fuel tank (A, Figure 10.0-4). Remove the fuel tank (B).



- A. Bolts
- B. Fuel Tank

Figure 10.0-4

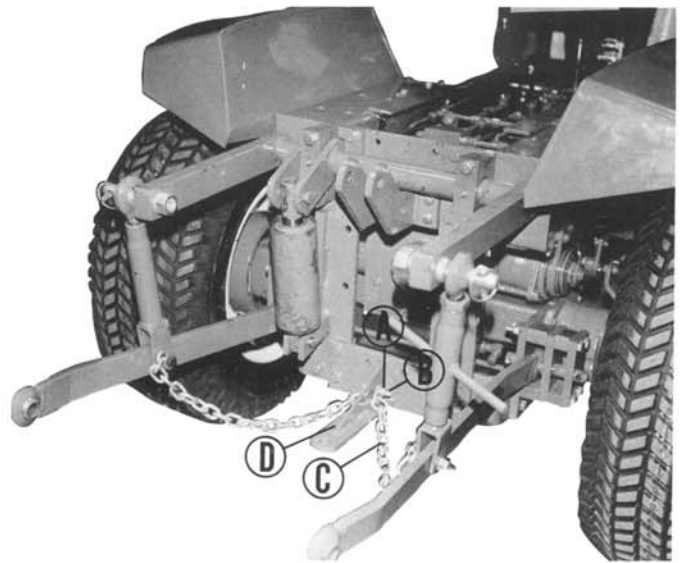
- Remove the cotter pin (A, Figure 10.0-5). Remove the pin (B) and the top link (C).



- A. Cotter Pin
- B. Pin
- C. Top Link

Figure 10.0-5

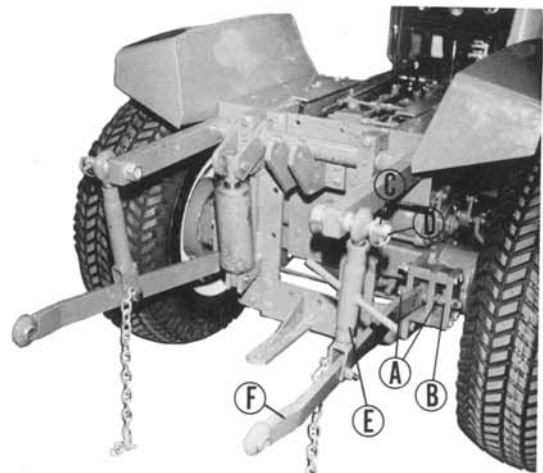
- Remove the lock nut (A, Figure 10.0-6) the washers and bolt (B) that fastens the sway chains (C) to the rear hitch arm (D).



- A. Lock Nut
- B. Bolt
- C. Sway Chains
- D. Rear Hitch Arm

Figure 10.0-6

- Remove the cotter pins (A, Figure 10.0-7) from the right and the left pivot pins (B). Remove the pivot pins.

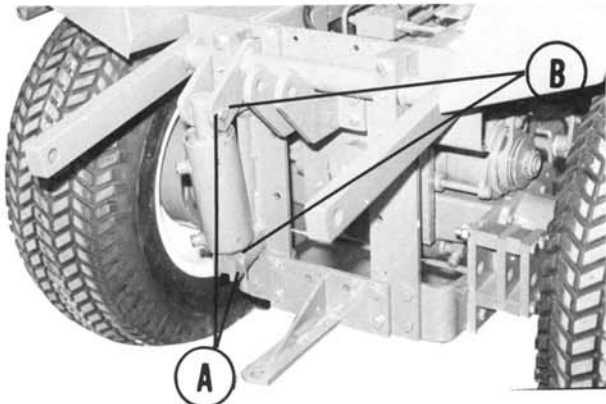


- A. Cotter Pins
- B. Lower Pivot Pin
- C. Pin
- D. Sholder Pin
- E. Side Link
- F. Lower Link

Figure 10.0-7

- Remove the pins (C) from the sholder pins (D).

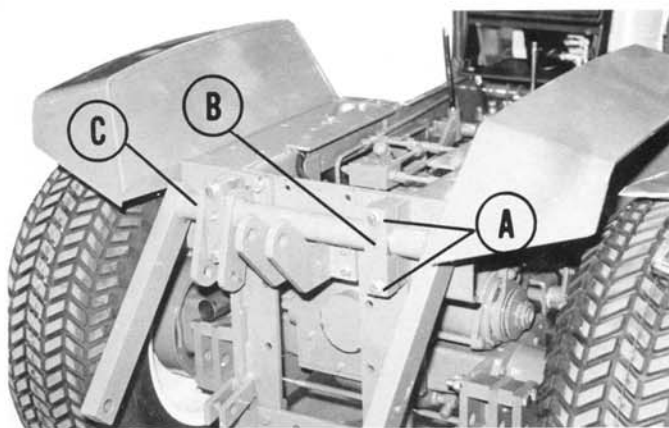
9. Remove the side links (E) from the sholder pins.
10. Remove the hydraulic hoses from the hydraulic cylinder.
11. Remove the cotter pins (A, Figure 10.0-8). Remove the pins (B) and the hydraulic cylinder.



A. Cotter Pins  
B. Pins

Figure 10.0-8

12. Remove the four bolts (A, Figure 10.0-9) and the lock nuts from the pillow block bearings (B).



A. Bolts  
B. Pillow Block Bearings  
C. Cross Shaft

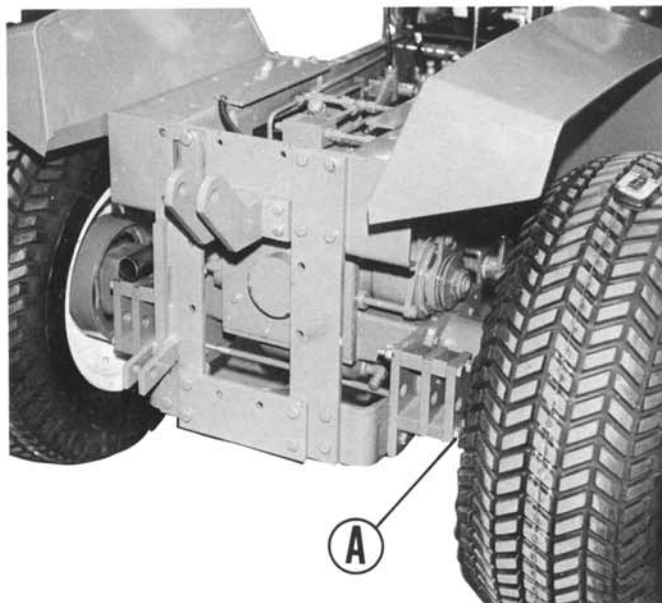
Figure 10.0-9

13. Remove the pillow block bearings and the cross shaft (C).

**NOTE: The halves of the pillow block bearings are a set and must remain together. Leave the halves of the pillow block bearings around the cross shaft and put the bolts for the pillow block bearings through the two halves. Put the lock nuts on the bolts to keep these parts together.**

**NOTE: The rear hitch arm is in the position to put the jack to raise the rear of the tractor. If the transmission is to be removed, do no more disassembly until the rear of the tractor has been raised and stands have been put under the frame, forward of the transmission.**

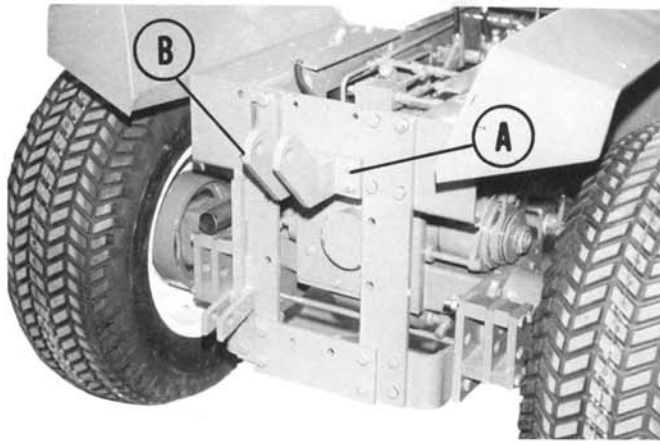
14. Remove the four bolts and the lock nuts (A, Figure 10.0-10). Remove the lower hitch arm assemblies from both sides of the tractor.



A. Bolts

Figure 10.0-10

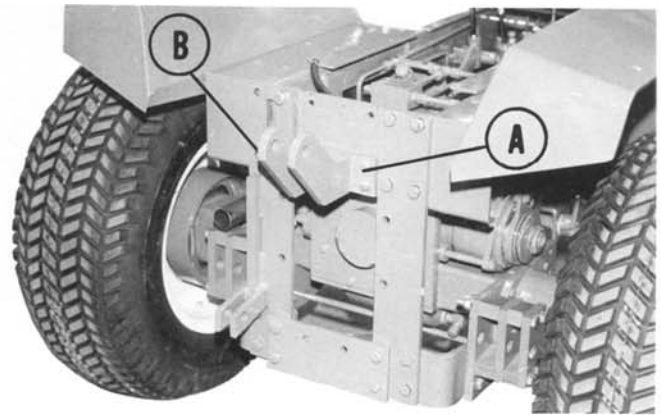
15. Remove the four bolts and the lock nuts (A, Figure 10.0-11). Remove the top link plate (B).



A. Bolts  
B. Top Link Plate

Figure 10.0-11

2. Install the quick disconnect (if so equipped).
3. Install the top link plate (B, Figure 10.0-12).



A. Bolts  
B. Top Link Plate

Figure 10.0-12

16. If a quick disconnect is installed (optional equipment), remove the two bolts and the lock nuts from the quick disconnect bracket (not illustrated).
17. Remove the remaining eight bolts and the lock nuts. Remove the rear plates for the frame, the rear hitch arm, and the brackets for the rear frame as an assembly.

### 10.3 How to Clean and Check the Parts for the Three-Point Hitch

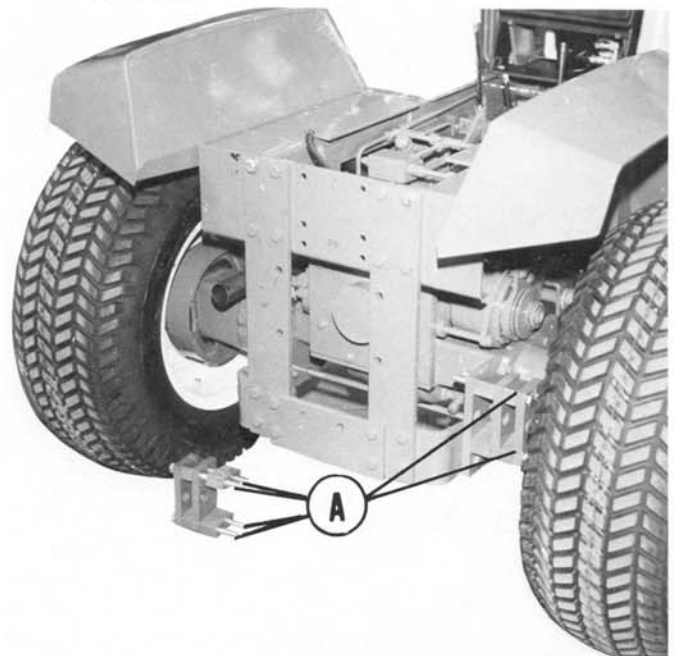
When the three-point hitch has been disassembled for any reason, clean and inspect all parts of the hitch. Use the following procedure:

1. Clean and inspect all the pins for wear. Replace any that are badly worn.
2. Inspect the sway chains for broken links. Replace them, if necessary.
3. Apply engine lubricant to the threads on the two side links and on the top link.

### 10.4 How to Assemble the Three-Point Hitch

1. Install the rear plates for the framing of the rear hitch arm and the brackets for the rear frame that were removed as an assembly. Install the eight bolts and the lock nuts.

4. Install the lower hitch arm assemblies with the four bolts and lock nuts (A, Figure 10.0-13).

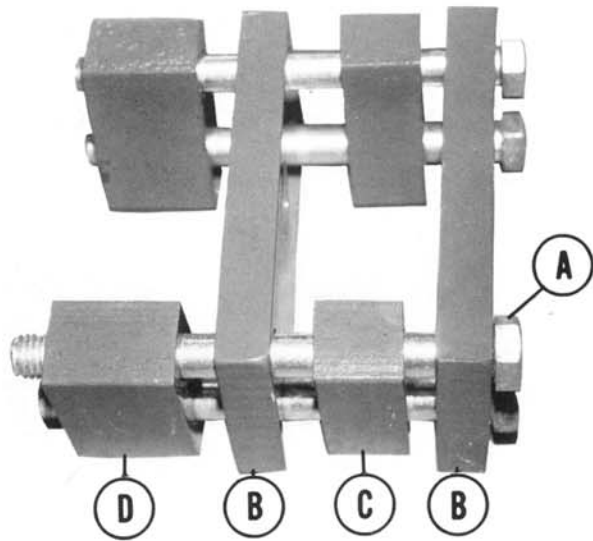


A. Bolts

Figure 10.0-13

See Figure 10.0-14 for correct assembly.





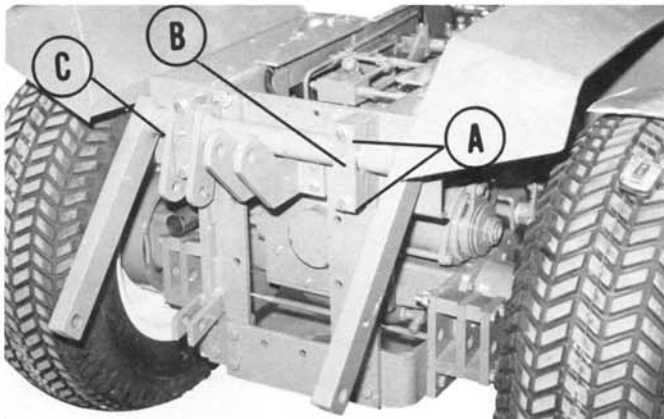
- A. Bolt
- B. Mounting Plates
- C. Spacer Block
- D. Spacer Block

Figure 10.0-14

5. Remove the lock nuts from the pillow block bearing bolts.

**NOTE: The halves of the pillow block bearings are a set and must remain together.**

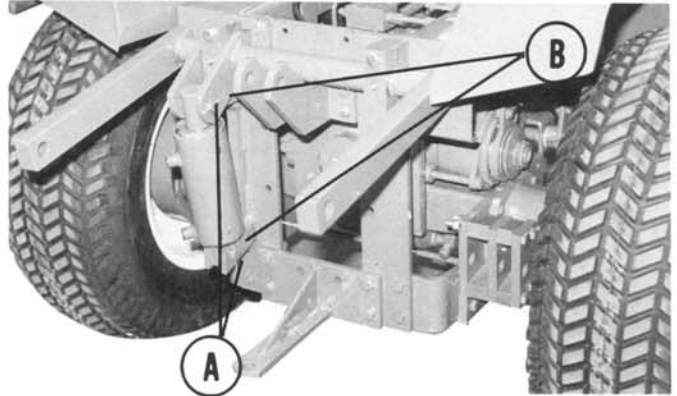
6. Install the cross shaft and the pillow block bearings (Figure 10.0-15).



- A. Bolts
- B. Pillow Block Bearings
- C. Cross Shaft

Figure 10.0-15

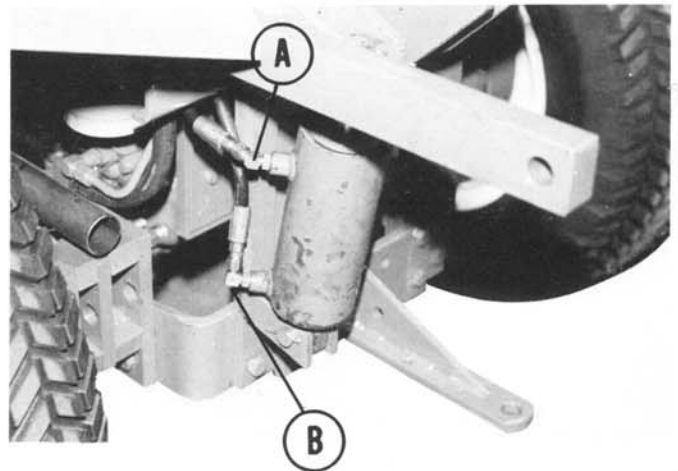
7. Put the hydraulic cylinder in position. Install the pins for the cylinder (B, Figure 10.0-16) and the cotter pins (A).



- A. Cotter Pins
- B. Pins

Figure 10.0-16

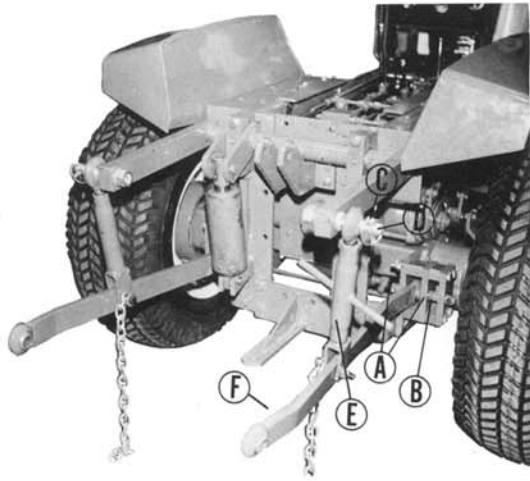
8. Install the bottom hydraulic line on the bottom hydraulic fitting (B, Figure 10.0-17).



- A. Top Hydraulic Fitting
- B. Bottom Hydraulic Fitting

Figure 10.0-17

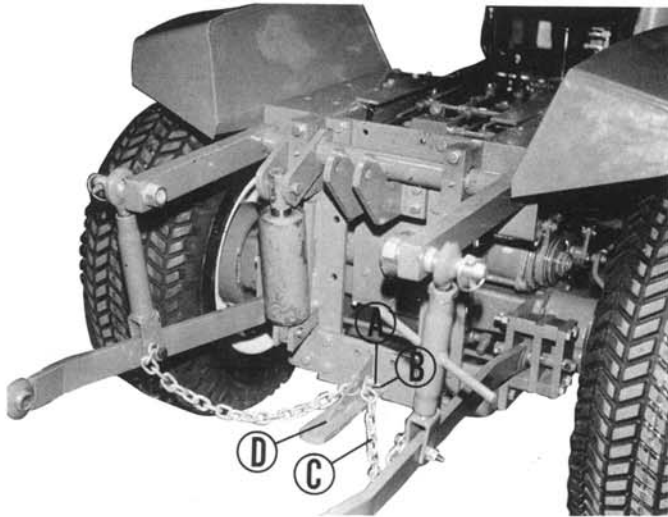
9. Install the top hydraulic line on the top hydraulic fitting (A).
10. Put the side links (E, Figure 10.0-18) on the shoulder pins (D).



- A. Cotter Pins
- B. Lower Pivot Pin
- C. Pin
- D. Shoulder Pin
- E. Side Link
- F. Lower Link

Figure 10.0-18

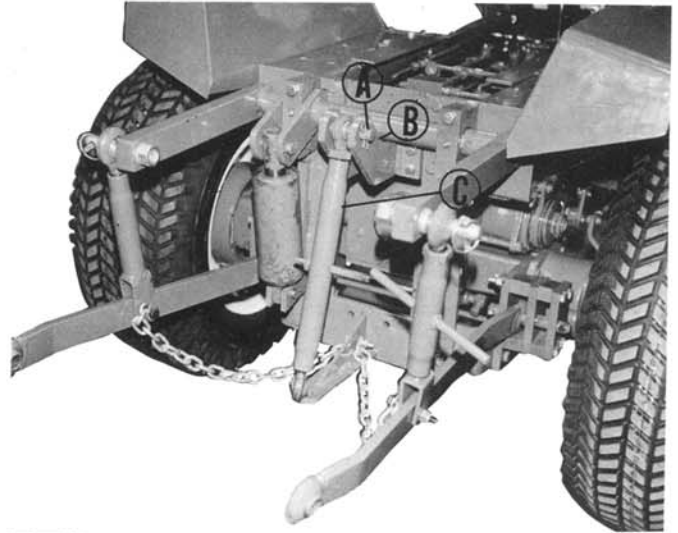
11. Install the pins (C) in the shoulder pins.
12. Put the lower links (F) in position and install the lower pivot pins (B).
13. Install the cotter pins (A).
14. Fasten the sway chains (C, Figure 10.0-19) in position with the bolt (B), the washers, and the lock nut (A).



- A. Lock Nut
- B. Bolt
- C. Sway Chains
- D. Rear Hitch Arm

Figure 10.0-19

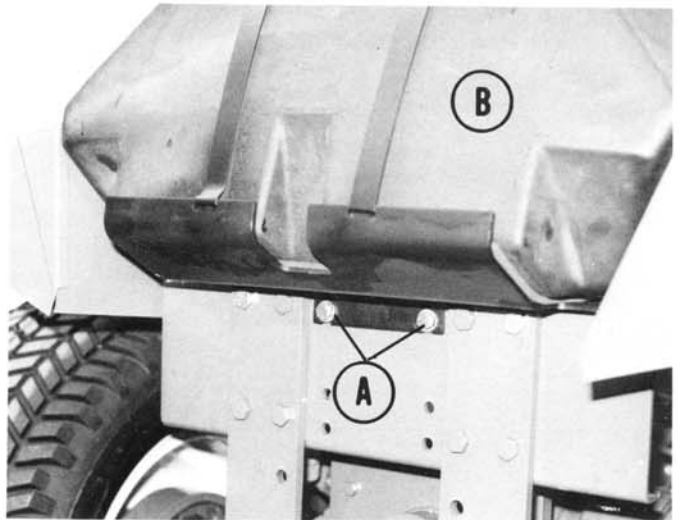
15. Put the top link (C, Figure 10.0-20) in position and install the pin (B) and the cotter pin (A).



- A. Cotter Pin
- B. Pin
- C. Top Link

Figure 10.0-20

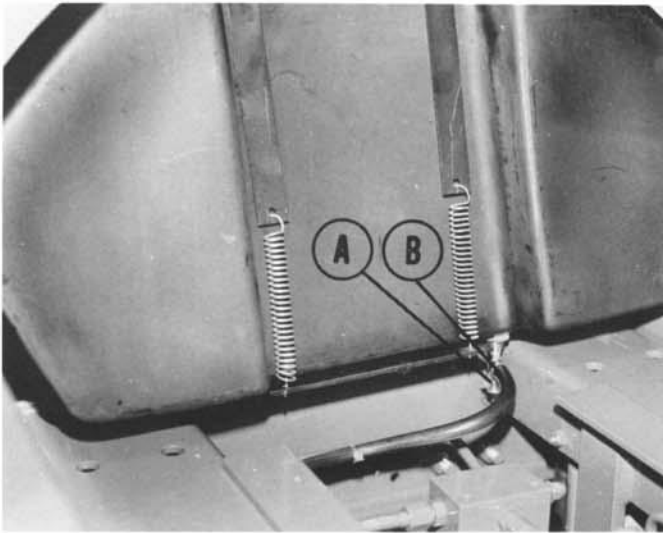
16. Put the fuel tank (B, Figure 10.0-21) in position. Tighten bolts for the fuel tank (A).



- A. Bolts
- B. Fuel Tank

Figure 10.0-21

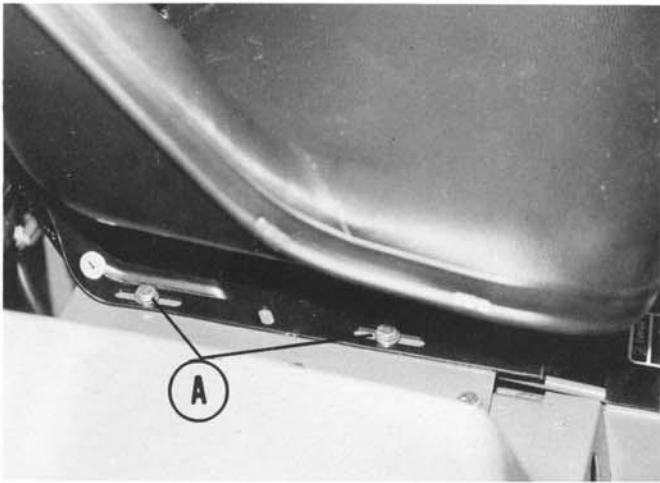
17. Install the fuel line (B, Figure 10.0-22) and open the fuel tank valve (A).



A. Valve  
B. Fuel Line

Figure 10.0-22

18. Put the seat in position and install the four bolts (A, Figure 10.0-23).



A. Bolts

Figure 10.0-23