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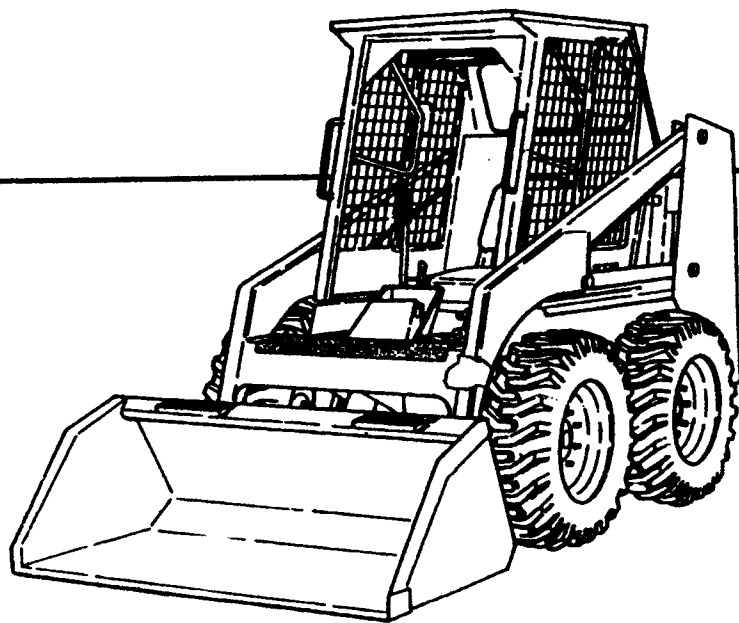
M600

M610



Bobcat®

SERVICE MANUAL



6558602

IR Bobcat.
Printed in U.S.A.

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DIESEL
ENGINES

DRIVE
SYSTEM

ELECTRIC
MOTORS

GASOLINE &
LP ENGINES

GENERAL
MAINT

GEN. SERV
INFO

HYDRAULIC
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**DRIVE
SYSTEM**

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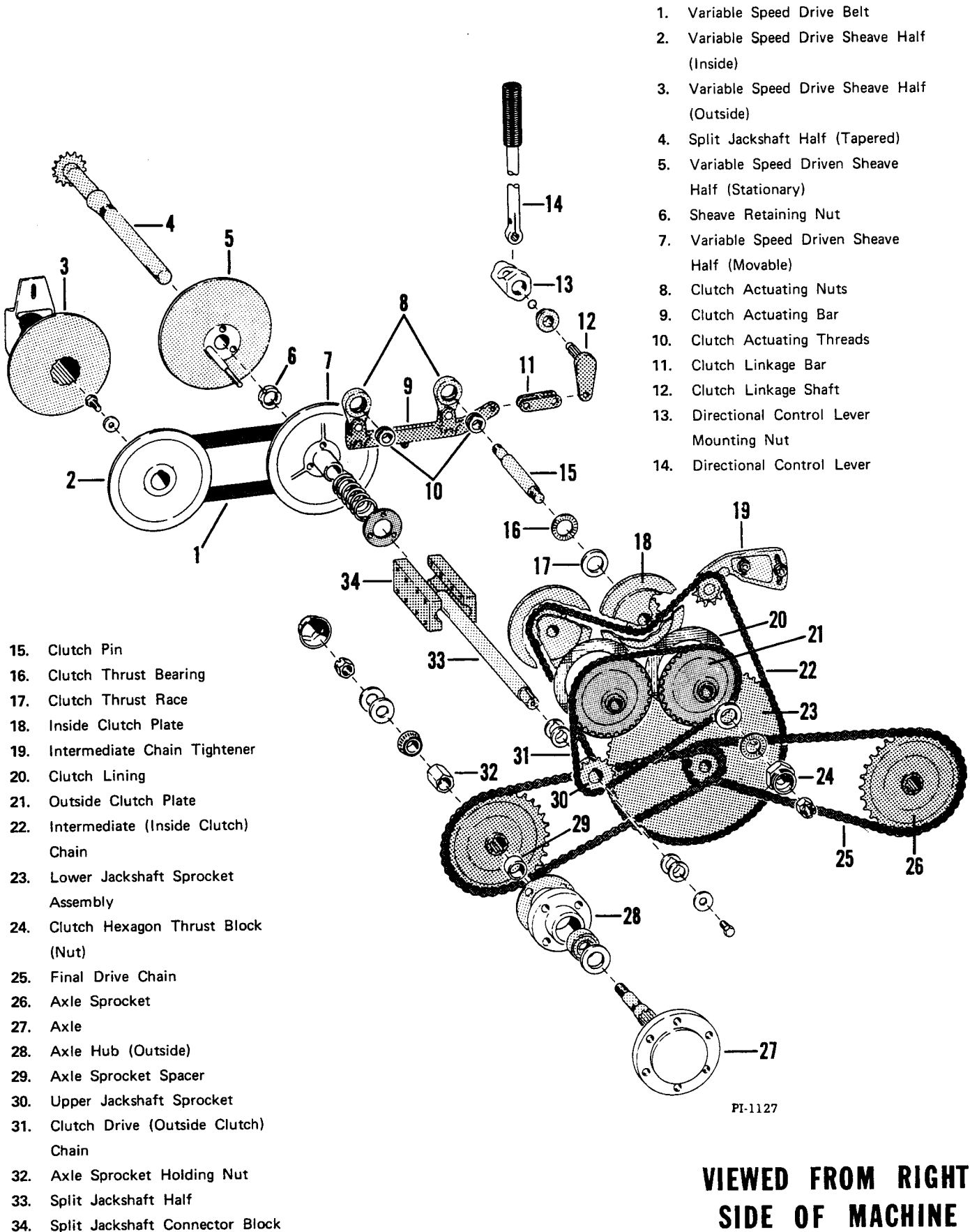
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PICTORIAL SCHEMATIC (Drive System)



1. Variable Speed Drive Belt
2. Variable Speed Drive Sheave Half (Inside)
3. Variable Speed Drive Sheave Half (Outside)
4. Split Jackshaft Half (Tapered)
5. Variable Speed Driven Sheave Half (Stationary)
6. Sheave Retaining Nut
7. Variable Speed Driven Sheave Half (Movable)
8. Clutch Actuating Nuts
9. Clutch Actuating Bar
10. Clutch Actuating Threads
11. Clutch Linkage Bar
12. Clutch Linkage Shaft
13. Directional Control Lever Mounting Nut
14. Directional Control Lever

15. Clutch Pin
16. Clutch Thrust Bearing
17. Clutch Thrust Race
18. Inside Clutch Plate
19. Intermediate Chain Tightener
20. Clutch Lining
21. Outside Clutch Plate
22. Intermediate (Inside Clutch) Chain
23. Lower Jackshaft Sprocket Assembly
24. Clutch Hexagon Thrust Block (Nut)
25. Final Drive Chain
26. Axle Sprocket
27. Axle
28. Axle Hub (Outside)
29. Axle Sprocket Spacer
30. Upper Jackshaft Sprocket
31. Clutch Drive (Outside Clutch) Chain
32. Axle Sprocket Holding Nut
33. Split Jackshaft Half
34. Split Jackshaft Connector Block

PI-1127

**VIEWED FROM RIGHT
SIDE OF MACHINE**

DRIVE SYSTEM SERVICE

ROUTINE CLUTCH ADJUSTMENT

The Bobcat has two separate drive trains (one on each side of the machine), each equipped with two clutches. These clutches are engaged and disengaged by the directional control levers. When lever travel (from neutral) exceeds four inches in either direction, the clutches need adjustment. This may occur shortly (about 50 hours) after a new machine is put into service. After the clutch facings are "seated", lever travel should be checked every 100 hours and the clutches adjusted only if lever travel is excessive.

On either side of the machine, the clutch toward the front is the reverse travel clutch and the clutch toward the rear is the forward travel clutch. Adjust according to the following procedure:

1. Shut off the engine before attempting to adjust the clutches.
2. With the large clutch cap wrench, remove the protective caps from the four clutch pins.
3. Remove the cotter pins which hold the castle nuts in place.
4. With the directional control lever in neutral position, tighten the front castle nut 1/2 slot. Move the lever back to check the adjustment. Repeat this until no more adjustment is needed. When the handle (hand grip) of the lever can be moved 3 to 4 inches (maximum) back from neutral to fully engaged position, adjustment of the reverse travel clutch is correct for that side. You may need to use the small end of the clutch wrench to make the adjustment (Figure 14).
5. Tighten the rear castle nut in the same manner, moving the lever forward to check travel (maximum) from neutral, adjustment of the forward travel clutch is correct for that side.
6. Repeat these adjustments on the other side of the machine. When you have finished, the levers on both sides should be in line when they are both moved forward or back to fully engaged position.
7. After completing this adjustment, secure each castle nut with a cotter pin and tighten the protective caps over the clutch pins with a clutch cap wrench.
8. If the quad ring seal sticks to the side panel when a clutch cap is removed, carefully pull the quad ring from the panel and place it in its groove in the cap. Spread a little oil around the quad ring seal before replacing the cap. If oil leakage is noted around the clutch caps, the quad ring seals must be replaced.

WARNING

Do not overtighten the clutches. Overtightening will cause the clutches to be partially engaged when the control lever is in neutral. This causes hard starting and clutch wear.

After all four clutch pins have been adjusted and the protective caps have been installed, sit in the operator's seat and start the engine. With the directional control levers in neutral, the machine should stand still. If the machine creeps, rocks, or jumps back and forth, the clutches are set too tight and must be readjusted.

NOTE: If nothing happens when a directional control lever is moved one way, but the clutch engages when the lever is moved the opposite way, (1) there has been a clutch failure, (2) the needle thrust bearings may be defective, (3) the clutch actuating thread may be stripped.

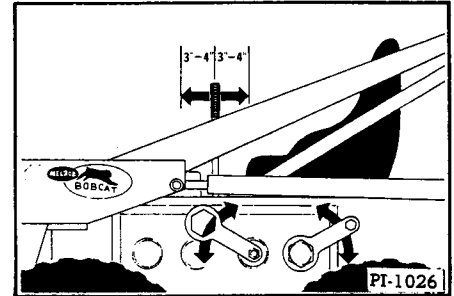


Fig. 14 Routine Clutch Adjustment

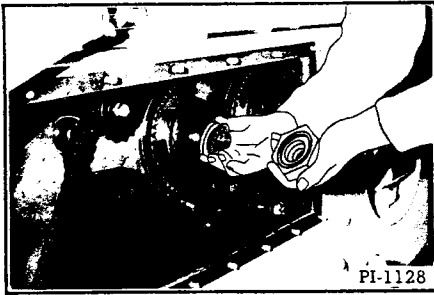


Fig. 15 Remove Thrust Bearings and Races

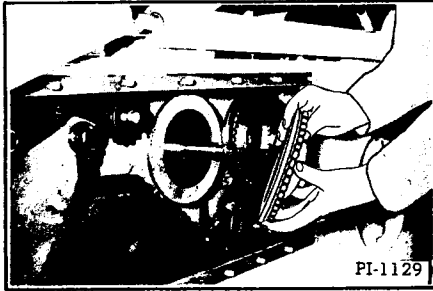


Fig. 16 Removing Outside Clutch Plate

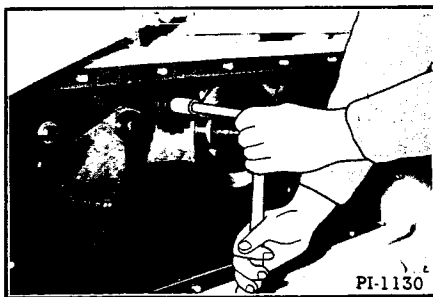


Fig. 17 Removing Sprocket From Idler

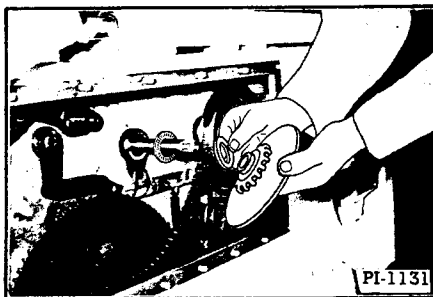


Fig. 18 Removing Inside Clutch Plates



Fig. 19 Removing Hyd. Lines To Clutch Pins

CLUTCH REMOVAL AND REPAIR [2.5 hr.]

The directional control clutches are located inside the gearcases and are actuated by a large square thread screw mechanism on each clutch. One clutch on each side of the machine is controlled by a right hand thread nut, the other by a left hand thread nut. Moving the directional control lever turns both of the clutch actuating nuts in the same direction at the same time. Because one is a right hand thread and the other is a left hand, they will cause one clutch to engage while the other clutch moves away from engagement. One of these clutches controls forward movement of the wheels on that side of the machine; the other clutch controls the reverse movement of the wheels.

Directional control clutch failure is usually caused by a thrust bearing failure or failure of the clutch actuating nuts.

The clutch failure may be one of several types:

1. The clutch actuating nuts may come out of adjustment if the clutch pins they are mounted on turn in the gearcase inner sidewall.
2. The actuating threads and nuts may wear and become sticky. In some cases a wear pattern in the actuating nut will cause the clutches to stick in engaged position.
3. The actuating nut may wear enough so that it rubs on the inside gearcase sidewall.

Clutch lining life is quite long and lining replacement is usually not necessary. The clutch thrust bearings and the hardened clutch thrust races that the bearings run between usually fail prior to clutch lining failure. The hardened clutch thrust races are ground on both sides and may be turned over to secure a new wear surface. The clutch thrust bearings should normally be replaced when the clutches are removed for actuating nut service.

Follow this procedure to remove the clutch and actuating assembly:

1. Remove the protective clutch caps and the gearcase cover.
2. Loosen the clutch drive (outside clutch) chain idler sprocket and remove the clutch drive chain.
3. Remove the cotter pins from the castle nuts and remove the castle nuts.
4. Remove the large hexagon clutch thrust blocks (nuts).
5. Remove the thrust bearings and races. Notice that each clutch thrust bearing is mounted between two hardened clutch thrust races (Figure 15).
6. Remove the outside clutch plate and lining (Figure 16).
7. Remove the sprocket from the intermediate idler (Figure 17). This is necessary to gain enough slack in the intermediate (inside clutch) chain so that the chain can be released from the inside clutch sprockets.
8. Remove the inside clutch plates, hardened races and thrust bearings (Figure 18).
9. Disconnect the clutch actuating linkage and centering spring.

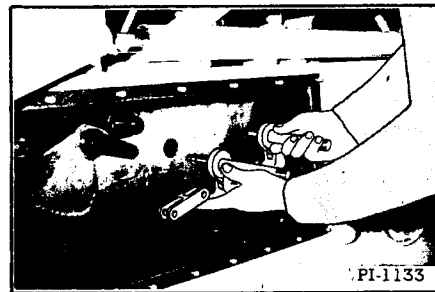


Fig. 20 Removing Clutch Pins & Bar

10. Remove the seat and engine cover.
11. Remove the hydraulic lines to the clutch pins (Figure 19).
12. Remove the clutch pin holding nuts.
13. Remove the clutch pins and actuating bar (Figure 20).

To reinstall the clutch pins, proceed as follows:

1. Assemble the clutch actuating nuts onto the actuating bar:
 - A. Face the actuating bar as you would if it were in the machine.
 - B. Place the right hand threaded actuating nut into the right clevis and the left hand actuating nut into the left clevis.
 - C. Install the socket head shoulder screws, being sure that a small spring washer is placed into the clevis behind each actuating nut. Watch the washer to be sure it doesn't slip off the shoulder of the socket head screw when the screw is being tightened. This would cause it to be flattened against the back of the actuating bar clevis.
 - D. Turn the clutch pins into the actuating nuts.
2. Install the assembly into the machine.
 - A. Grasp the right clutch pin in your right hand and the left clutch pin in your left hand.
 - B. Place the assembly in the clutch pin mounting holes.

NOTE: Install a new lead seal over the clutch pin threads each time.

- C. Turn the clutch pin holding nuts (large 7/8" nuts) onto the clutch pins and draw the clutch pins up until they are just snug in the frame.

NOTE: The nuts must be tight enough so the pins will not turn under hand pressure.

- D. Connect the actuating bar to the lever linkage bar.

3. To insure positive clutch engagement the clutch pins are adjusted at this point.

- A. Move the directional control lever forward so the hand grip is approximately 4" ahead of its neutral position (Figure 22).

- B. Turn the rear clutch pin so there is full thread contact between the actuating threads (Figures 22 and 23).



NOTE: The sharp edges are purposely broken from the actuating threads to keep them from breaking in use and jamming the threads.

Fig. 21 Actuating Thread

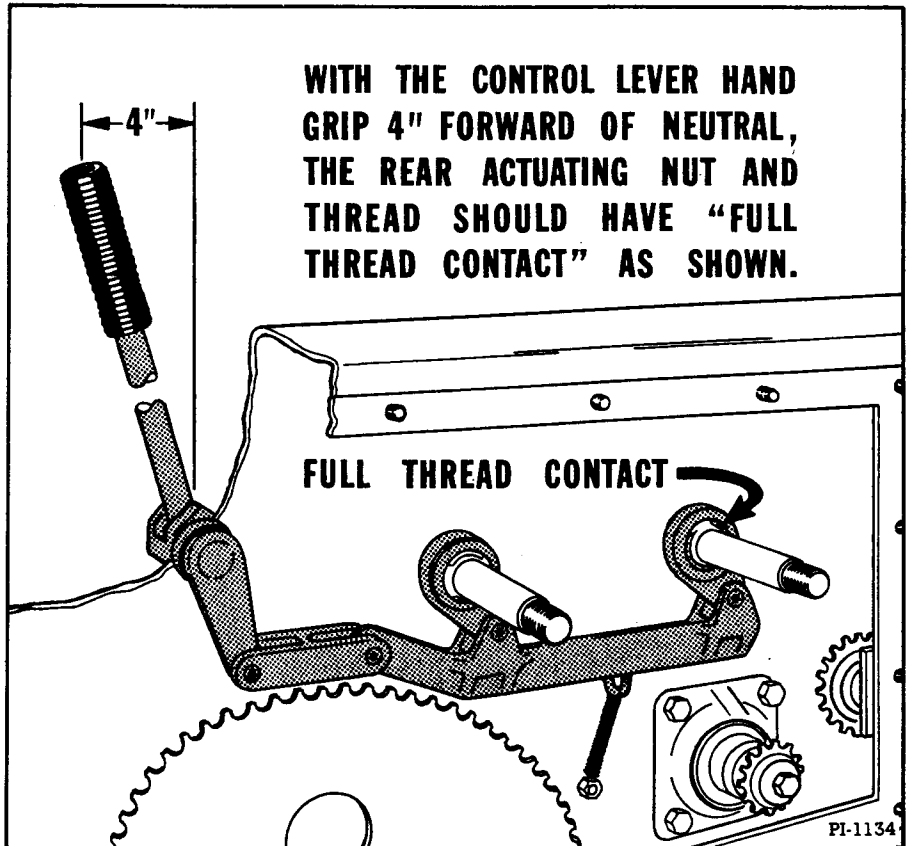


Fig. 22 Full Thread Contact at Rear Pin

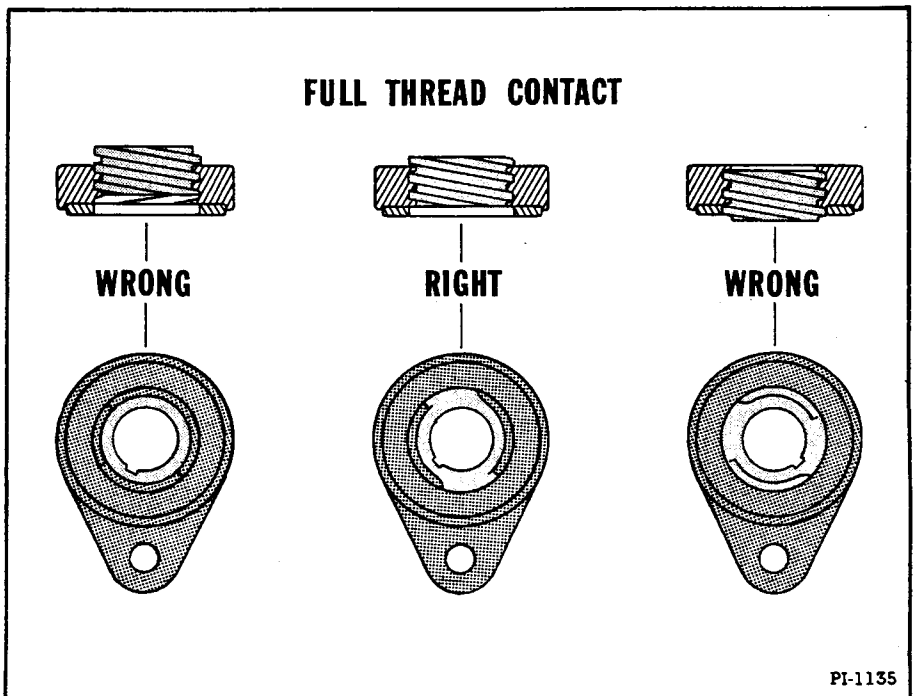


Fig. 23 Full Thread Contact

NOTE: To turn the clutch pin, turn the castle nut onto the outside of the clutch pin so the slots in the nut are toward the machine. Put a pin through the slots in the nut and the hole in the pin. Turn the pin with a wrench.

- C. When the rear clutch pin has the right adjustment, tighten the clutch pin holding nut. Use a wrench on the castle nut to hold the clutch pin while you are tightening the holding nut. This prevents turning the clutch pin.
- D. Mount the inside clutch plates.

WARNING

The clutch thrust bearing may fall from the end of the clutch hub when an inside clutch is being installed. Put a small amount of grease on the thrust bearing to hold it on the hub, or hold it with your fingers as you replace the clutch plate. Use new thrust bearings.

- E. Align the front clutch plate to the rear clutch plate with both clutches in neutral position. Lay a straightedge along the faces of the clutch plates and turn the front clutch pin until the clutch plates are in line (Figure 24). Tighten the holding nut, holding the clutch pin so it doesn't turn.

- 4. Mount the intermediate (inside clutch) chain and replace the idler sprocket. Tighten the chain.

NOTE: The intermediate chain goes over the idler sprocket, under the sprocket on the front clutch and over the sprocket on the rear clutch.

- 5. Install the clutch linings onto the inside clutch plates. Make sure the linings fit easily over the shoulders on the inside clutch plates. If a lining does not slide easily over the shoulder, file or sandpaper the inside diameter of the lining until it fits loosely on the shoulder.

WARNING

If the lining is forced onto the shoulder of the clutch plate it may crack the center member of the lining and cause a lining failure after only a few hours service. It must turn freely on the clutch plate.

- 6. Mount the outside clutch plates.
- 7. Install the hardened thrust races and clutch thrust bearings on the outside clutch plates. The hardened race is mounted on the shoulder of the clutch plate, followed by the thrust bearing.

NOTE: Turn the thrust race mounted in the large hexagon thrust block (nut) and the thrust race on the clutch plate to the sides that have not been in contact with the thrust bearing. If both sides have been worn, replace the thrust races. Install new thrust bearings.

- 8. Loosen the self aligning portion of the large hexagon thrust block (nut) with the handle of a screwdriver (Figure 25). If it cannot be loosened by this method, place it into a vise or press and loosen it, being careful not to damage the wearing surface of the hardened race.
- 9. Install the large hexagon thrust blocks (nuts).
- 10. Install the castle nuts and cotter pins.
- 11. With a straightedge, check the alignment of the upper jackshaft sprocket with the outside clutch sprockets (Figure 26).

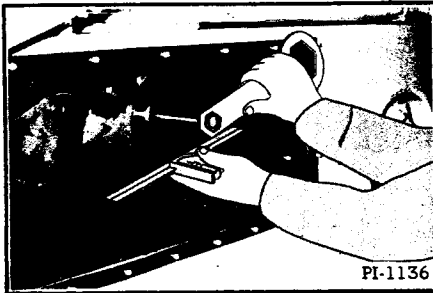
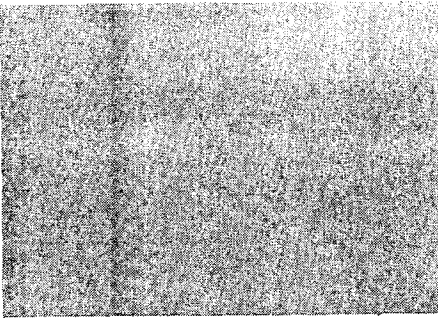


Fig. 24 Aligning Clutch Plates

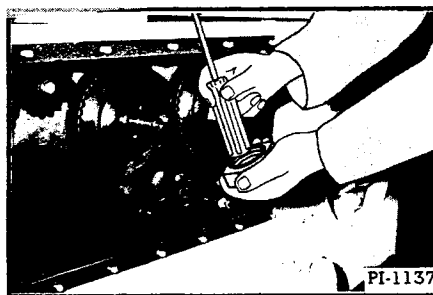
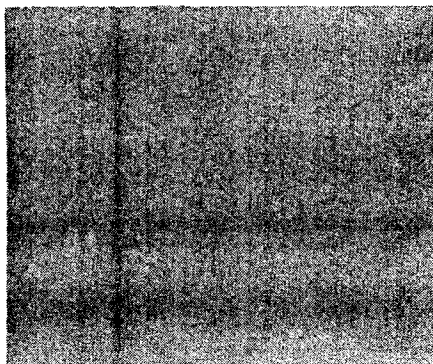


Fig. 25 Loosening Hardened Race

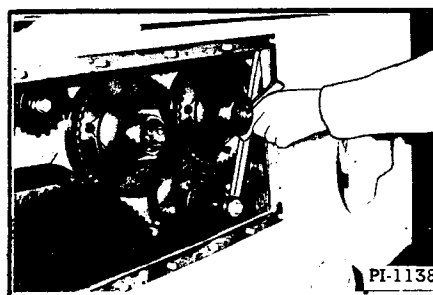


Fig. 26 Checking Sprocket Alignment

12. Reinstall the clutch drive (outside clutch) chain, tightening it hand tight (Figure 27). It should be tight enough so that it can be deflected 1/4" under 10 lbs. spring scale tension (Figure 28).
13. Install the gearcase cover.
14. Check the lever travel and adjust the clutches if necessary (See Routine Clutch Adjustment).
15. Replace the protective clutch caps.
16. Replace the hydraulic lines to the clutch pins.

In most cases you will not be removing the forward and reverse clutches at the same time. To remove one of the clutches and its actuating nut, proceed as follows:

1. Remove the protective clutch caps and the gearcase cover.
2. Loosen the clutch drive (outside clutch) chain idler sprocket and remove the clutch drive chain.
3. Remove the cotter pin from the castle nut and remove the castle nut.
4. Remove the hexagon clutch thrust block (nut).
5. Remove the thrust bearing and the hardened thrust race. Notice that the clutch thrust bearing is mounted between two hardened clutch thrust races (Figure 15).
6. Remove the outside clutch plate and lining (Figure 16).
7. Loosen the intermediate chain idler. Remove the sprocket from the intermediate idler (Figure 17). This is necessary to gain enough slack in the intermediate (Inside clutch) chain so that the chain can be released from the inside clutch sprockets.
8. Remove the inside clutch plate, hardened thrust race and thrust bearing (Figure 18).
9. Remove the socket head shoulder screw that fastens the clutch actuating bar to the actuating nut. Be careful to save the small spring washer which is located in the actuating bar clevis (behind the actuating nut).
10. Remove the hydraulic tubeline (Figure 19) and clutch pin holding nut on the inside of the loader frame.
11. Remove the clutch pin from the frame.

The clutch actuating nut is mated to the clutch actuating thread, which is fastened to the clutch pin with a woodruff key. To change the clutch actuating nut and thread, tap the assembly off the clutch pin and replace with a new thread and nut.

To reinstall a clutch, follow this procedure:

1. Install the clutch pin, with an actuating thread and nut on it, into the clutch pin mounting hole. Use a new lead washer each time. Turn the clutch holding nut onto the clutch pin and draw the clutch pin up until it is just snug in the frame.
2. Fasten the actuating nut to the actuating bar. Be sure to insert the small spring washer into the clevis behind the actuating nut. Be sure the washer doesn't slip off the shoulder of the socket head shoulder screw when you're tightening the screw. This would cause it to be flattened against the back of the actuating bar clevis. Check for straightness of the actuating bar. Straighten if necessary.
3. Remove these parts from the other clutch assembly:
 - A. Cotter pin and castle nut.
 - B. Hexagon thrust block (nut), thrust bearing and race (Figure 15).
 - C. Outside clutch plate (Figure 16) and clutch lining.
 - D. Inside clutch plate, thrust race and bearing (Figure 18).

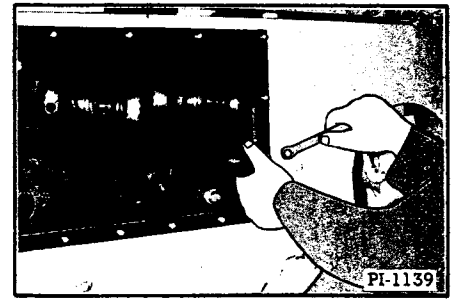


Fig. 27 Tightening Clutch Drive Chain

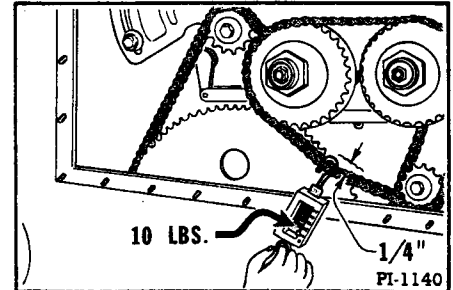


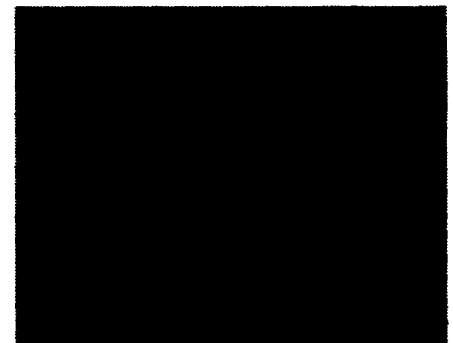
Fig. 28 Checking Tension of Clutch Chain

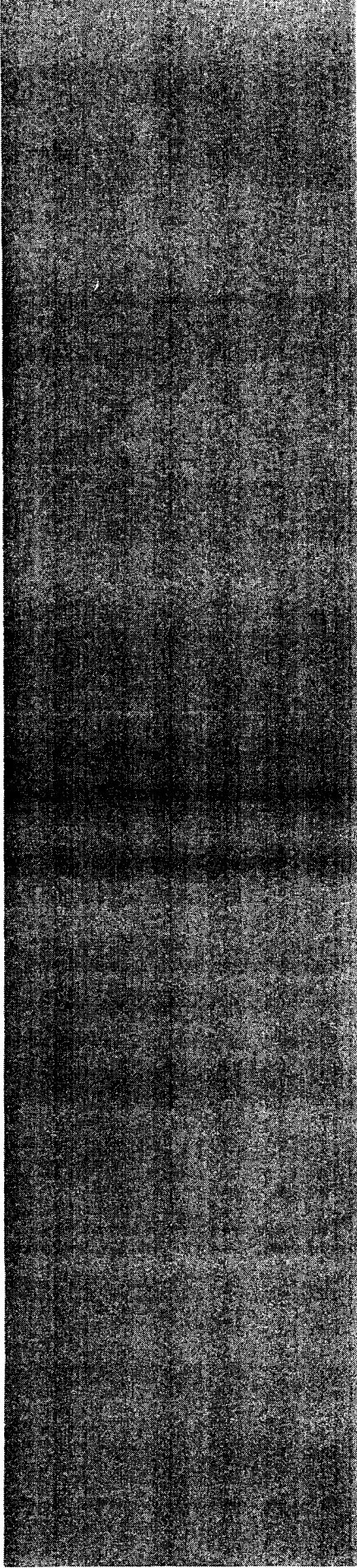


NOTE: Proper sprocket alignment and chain tension are necessary for satisfactory chain life.

WARNING

Do not adjust or fully engage the clutches until the side panel is in place or you might jam the self-aligning portion of the nut.



- 
- E. Loosen the hydraulic tubeline at the clutch pin holding nut end. Loosen the clutch pin holding nut slightly (this nut is located inside the loader frame).
4. To insure positive clutch engagement the clutch pins are adjusted at this point:
 - A. Move the directional control lever forward so the hand grip is approximately 4" ahead of its neutral position (Figure 22).
 - B. Turn the rear clutch pin so there is full thread contact between the actuating nut and actuating thread (Figures 22 and 23).

NOTE: To turn the clutch pin, turn the castle nut onto the outside of the clutch pin so the slots in the nut are toward the machine. Put a pin through the slots in the nut and the hole in the pin. Turn the pin with a wrench.

- C. When the rear clutch pin has the right adjustment, tighten the clutch pin holding nut. Use a wrench on the castle nut to hold the clutch pin while you are tightening it.
- D. Mount the inside clutch plates.

WARNING

The clutch thrust bearing may fall from the end of the clutch shoulder when an inside clutch is being installed. Put a small amount of grease on the thrust bearing to hold it on the shoulder, or hold it with your fingers as you replace the clutch plate. Use a new thrust bearing. Turn the hardened thrust races so an unworn side comes in contact with the new thrust bearing.

- E. Align the front clutch plate to the rear clutch plate with both clutches in neutral position. Lay a straightedge along the faces of the clutch plates and turn the front clutch pin until the clutch plates are in line (Figure 24). Tighten the clutch pin holding nut, holding the castle nut with a wrench to keep the clutch pin from turning.
5. Mount the intermediate (inside clutch) chain and replace the idler sprocket. Tighten the chain.

NOTE: The intermediate chain goes over the idler sprocket, under the sprocket on the front clutch and over the sprocket on the rear clutch.

6. Install the clutch linings onto the inside clutch plates. Make sure the linings fit easily over the shoulders on the inside clutch plates. If a lining does not slide easily over the shoulder, file or sandpaper the inside diameter of the lining until it fits properly.

WARNING

If the lining is forced onto the shoulder of the clutch plate it may crack the center member of the lining and cause a lining failure after only a few hours service. It must turn freely on the clutch plate.

7. Mount the outside clutch plates.
8. Install the hardened thrust races and clutch thrust bearings on the outside clutch plates. The hardened race is mounted on the shoulder of the clutch plate, followed by the thrust bearing.

NOTE: Turn the thrust race mounted in the large hexagon thrust (nut) and the thrust race on the clutch plate to the sides that have not been in contact with the thrust bearing. If both sides have been worn, replace the thrust races. Install new thrust bearings.

9. Loosen the self aligning portion of the large hexagon thrust block (nut) with the handle of a screwdriver (Figure 25). If it cannot be loosened by this method, place it into a vise or press and loosen it, (being careful not to damage the wearing surface of the hardened race) or replace it with a new assembly.
10. Install the large hexagon thrust blocks (nuts).
11. Install the castle nuts and cotter pins.
12. With the directional control lever in neutral, check the alignment of the upper jackshaft sprocket with the rear outside clutch sprockets (Figure 26).

NOTE: On the left side of the machine (with tapered jackshaft) align the belt, then shim the upper jackshaft sprocket for alignment. Refer to page 12.

13. Reinstall the clutch drive (outside clutch) chain, tightening it hand tight (Figure 27). It should be tight enough so that it can be deflected 1/4" under 10 lbs. spring scale tension (Figure 28).

Be sure the intermediate chain has been tightened (Figure 29). It should require 15 lbs. spring scale tension to deflect it 1/4" (Figure 30).

14. Install the gearcase cover. Check the condition of the gasket.
15. Check the lever travel and adjust the clutches if necessary (See Routine Clutch Adjustment).
16. Replace the protective clutch caps. Check the condition of the quad ring seals.
17. Replace the hydraulic lines to the clutch pins.

REPLACING CLUTCH NEEDLE BEARINGS

When replacing clutch needle bearings, press one bearing in from each side of the clutch plate. The bearings should be pressed in so they are flush with the outside of the hub (Figure 31).

NOTE: If the chains are too tight, both bearings will work inward toward the center of the hub.

VARIABLE SPEED DRIVE

The variable speed drive mechanism on every Bobcat is factory adjusted, but it may, in time, require further adjustment. Several conditions can cause loss of power through the variable speed drive belt. They are listed below with their remedies:

1. If the belt is bottoming and slipping in the drive (engine) sheave, the operator should nudge the variable speed lever slightly toward higher speed. This will bring the sides of the sheave in to where they can grip the belt.

NOTE: Most belt bottoming and slipping can be avoided. Whenever the operator places the variable speed in low speed position, he should nudge the lever forward to move the belt slightly outward from the hub.

2. If the belt slips and is not bottoming, tighten it by turning the three nuts on the spring loaded jackshaft sheave. Tighten these nuts evenly, one turn at a time. After tightening each nut one turn, start the machine and check for slippage.
3. If the belt continues to slip, it may be worn too narrow to be gripped by the drive sheave, in which case it should be replaced with a new belt. The spring loaded jackshaft sheave must be readjusted after replacing the belt. A new belt is 1-13/16" wide at the top. When a new belt is installed adjust the three nuts on the spring loaded jackshaft sheave so 1/4 inch of thread shows past the three nuts.

WARNING

Do not overtighten the spring-loaded jackshaft sheave because this will cause the belt to wear excessively.

NOTE: Correct sprocket alignment is necessary for satisfactory chain life.

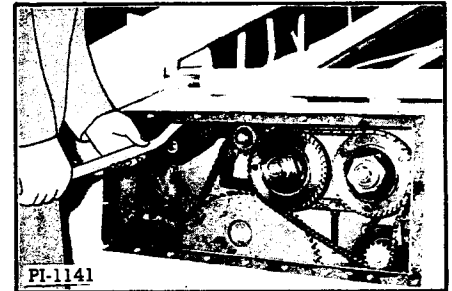


Fig. 29 Tightening Intermediate Chain

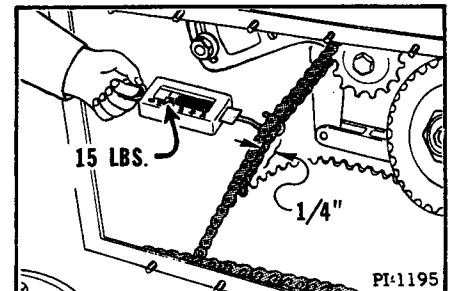


Fig. 30 Checking Tension of Chain

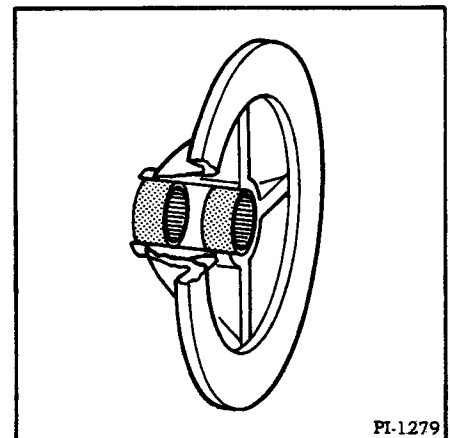
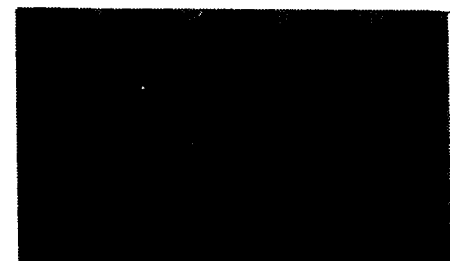


Fig. 31 Replacing Clutch Needle Bearings



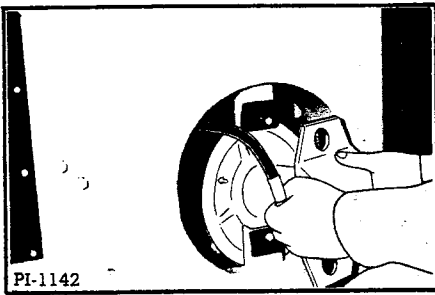


Fig. 32 Removing Engine Sheave Half

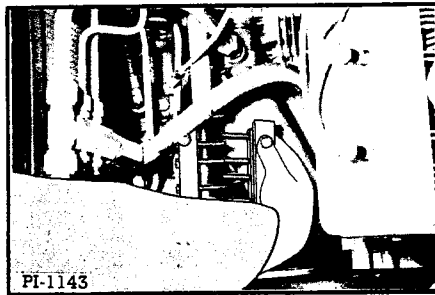


Fig. 33 Removing Jackshaft Connector

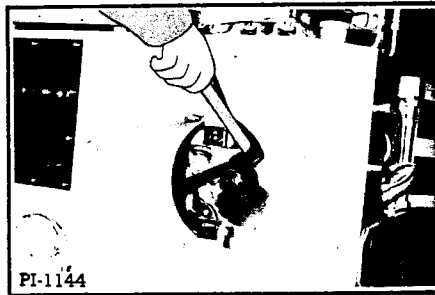


Fig. 34 Pulling Belt into Driven Sheave

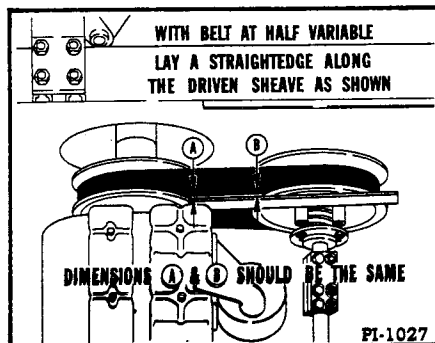
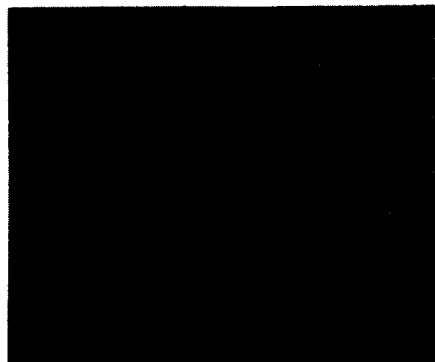


Fig. 35 Checking Belt Alignment



DRIVE BELT REPLACEMENT (Split Jackshaft) [1.5 hr.]

On machines with a split jackshaft use the following procedure:

1. Remove the outside portion of the engine variable width sheave and hydraulic cylinder assembly, located at the left rear of the machine, on the engine output shaft (Figure 32). Clean the cylinder and hose before disconnecting the fitting. Plug the cylinder port and hose to keep out dirt.

NOTE: Observe whether there are any spacers between the variable speed cylinder mounting bracket and the frame brackets. These spacers must be replaced as they were (M-600 and M-500 gasoline and LP gas).

On machines with a swivel coupling, remove the swivel, then remove the large holding nut to separate the sheave halves (M-600 and M-500 diesel, M-600 and M-500 electric, M-444 gasoline and LP gas).

2. Remove the split jackshaft connector (Figure 33). The connector must be replaced in the same position as it was before removal. Matched ends are punch marked. Keep the marked ends of the block toward the sheave.
3. Pass the worn belt between the shaft ends and replace it with a new belt.
4. Reinstall the split jackshaft connector, exactly as it was before. Four screw heads should be up and four down. Retorque the eight connector screws to 18-20 ft. lbs. torque. The screws must be tightened down evenly.
5. Pull the belt with a pry bar to force it into the driven sheave (Figure 34). This will make it possible to replace the outside (engine) sheave half. Do not use a flat bar, as it will damage the belt.

NOTE: The spring loaded variable width sheave will have to be readjusted after a new belt is installed because a new belt is wider than an old, worn belt.

6. Reinstall the outside drive sheave half and reconnect the hydraulic hose. Align the balance marks on the sheave halves when reinstalling.
7. Check the belt alignment of the drive and driven sheaves (Figure 35).

DRIVE BELT REPLACEMENT (One Piece Jackshaft) [5 hr.]

On machines with a one piece jackshaft, use the following procedure:

1. Remove the outside portion of the engine variable width sheave and hydraulic cylinder assembly, located at the left rear of the machine, on the engine output shaft (Figure 32). Clean the cylinder and hose before disconnecting the fitting. Plug the cylinder port and hose to keep out dirt.

NOTE: Observe whether there are any spacers between the variable speed cylinder mounting bracket and the frame brackets. These spacers must be replaced as they were (M-500 gasoline and LP gas).

On machines with a swivel coupling, remove the swivel, then remove the large holding nut to separate the sheave halves (M-500 diesel, M-600 and M-500 electric, M-444 gasoline and LP gas).

2. Remove the protective clutch caps from both sides of the machine.
3. Remove both gearcase covers.
4. Loosen the clutch drive (outside clutch) chain tighteners and remove the clutch drive chains.
5. Remove the sprocket retaining screws and the sprockets from both ends of the jackshaft.

NOTE: You may need to use a puller to remove the sprocket from the end of the shaft. Remove the sprocket retaining screw from the jackshaft and remove the retaining washers. Turn the screw back into the end of the shaft. (Figure 36).

6. Loosen the set screws in the hub of the stationary half of the driven sheave.
7. Drive the driven sheave assembly toward the right far enough so the square key can be removed from the jackshaft.
8. Remove the square key and move the sheave assembly back toward the left.
9. Remove the bearing locking collar from each end of the jackshaft. Loosen the set screw in the bearing locking collar (Figure 37) and rotate the collar opposite the shaft rotation until it is loose on the bearing (Figure 38). Rotating it about 3/4" will unlock it. Rotating it too far will relock it (backward).
10. Thoroughly clean that portion of the right end of the jackshaft which will be driven through the right bearing.
11. Drive the jackshaft to the right (through the sheave) far enough to pass the belt between the jackshaft and the machine sidewall.
12. Remove the worn belt and replace it with a new one.
13. To reassemble, align the jackshaft sprocket with the outside clutch sprockets on the right side of the machine. When they are aligned, lock the bearing locking collar onto the bearing hub by rotating it in the direction of shaft rotation (Figure 39). Tighten the locking collar set screw (Figure 37).
14. Mount the sprocket on the left end of the jackshaft and align it to the outer clutch sprockets. Use shim washers if necessary. Lock the locking collar by turning it in the direction of shaft rotation. Tighten the locking collar set screw (Figure 37).

NOTE: The spring loaded driven sheave will have to be readjusted after a new belt is installed because a new belt is wider than an old, worn belt.

15. Reinsert the key and set screws in the driven sheave hub. Check the alignment of the drive and driven sheaves (Figure 35). Move the driven sheave on the jackshaft to align. Tighten the set screws.

DRIVEN SHEAVE REMOVAL (Split Jackshaft) [3 hr.]

To remove a driven (spring loaded) sheave, proceed as follows:

1. Remove the outside portion of the engine variable width sheave and hydraulic cylinder assembly, located at the left rear of the machine, on the engine output shaft (Figure 32). Clean the cylinder and hose before disconnecting the fitting. Plug the cylinder port and hose to keep out dirt.

NOTE: Observe whether there are any spacers between the variable speed cylinder mounting bracket and the frame brackets. These spacers must be replaced as they were (M-500 Kohler & M-600 Wisconsin).

On machines with a swivel coupling, remove the swivel, then remove the large holding nut to separate the sheave halves.

2. Remove the protective clutch caps from the left gearcase cover.
3. Remove the gearcase cover.
4. Loosen the clutch drive (outside clutch) chain tightener and remove the clutch drive chain.
5. Remove the sprocket retaining screw and the sprocket from the end of the jackshaft.

NOTE: You may need to use a puller to remove the sprocket from the end of the shaft. Remove the sprocket retaining screw from the jackshaft and remove the retaining washers. Turn the screw back into the end of the jackshaft (Figure 36).

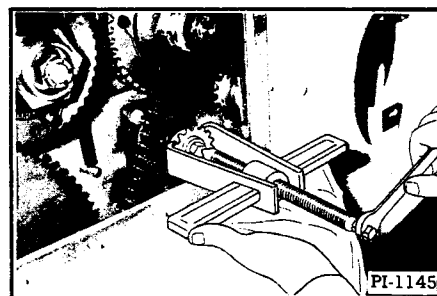


Fig. 36 Pulling Upper Jackshaft Sprocket

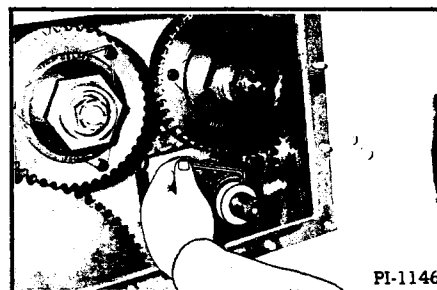


Fig. 37 Loosening Set Screw

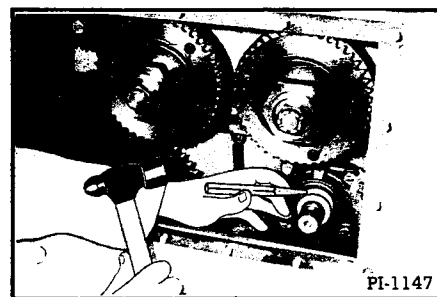


Fig. 38 Removing Bearing Locking Collar

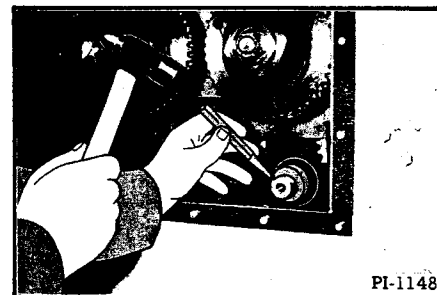


Fig. 39 Reinstalling Bearing Locking Collar

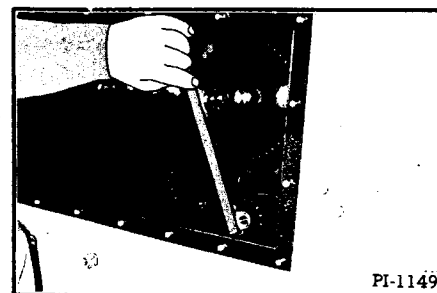


Fig. 40 Checking Sprocket Alignment

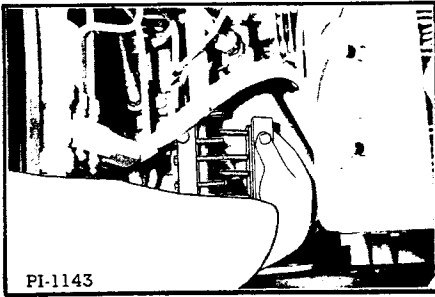


Fig. 41 Removing Split Jackshaft

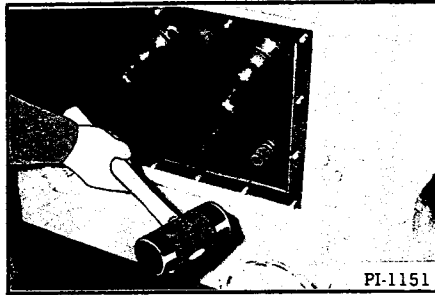


Fig. 42 Driving Jackshaft Half

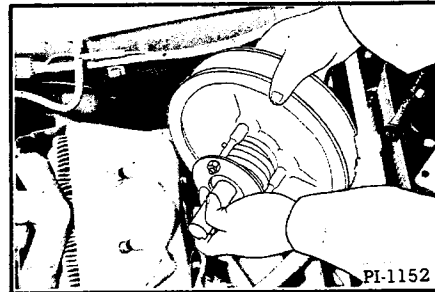


Fig. 43 Inserting Driven Sheave Assembly



Fig. 44 Pulling Belt Into Driven Sheave

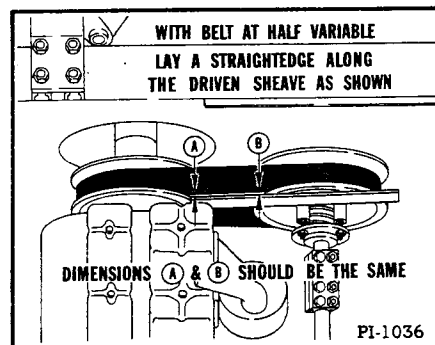


Fig. 45 Checking Belt Alignment

6. Remove the bearing locking collar from the jackshaft. Loosen the set screw in the bearing locking collar (Figure 37) and rotate the collar opposite the shaft rotation until it is loose on the bearing (Figure 38). Rotating it 3/4" will unlock it. Rotating it too far will relock it (backward).
7. Remove the split jackshaft connector (Figure 41). The connector must be replaced in the same position as it was before removal.
8. Drive the jackshaft half toward the center of the machine with a rubber or plastic mallet (Figure 42).
9. Pull the assembly into the opening in front of the engine and remove it by pulling it straight up on all machines except the M-500 gasoline and LP gas (Figure 43). On these models (M-500 gasoline and LP gas) take the assembly out through the bottom of the machine.

These parts must be removed from the machine to make removal of the jackshaft and sheave assembly possible.

- A. On M-600 gasoline and LP gas machines, remove the following:
 - a. The hydraulic tubeline from the clutch lubrication manifold to the left rear clutch pin.
 - b. Disconnect and remove the battery.
 - c. Remove the hydraulic lines from the variable speed control valve to the check (lock) valve. If the machine is not equipped with a check valve, remove the hydraulic line from the variable speed control valve to the variable speed cylinder hose.
- B. On M-600 and M-500 diesel machines, remove the following:
 - a. The hydraulic tubeline from the clutch lubrication manifold to the left rear clutch pin.
 - b. Remove the hydraulic lines from the variable speed control valve to the check (lock) valve. If the machine is not equipped with a check valve, remove the hydraulic line from the variable speed control valve to the variable speed cylinder hose.

To reinstall a driven (spring loaded) sheave, proceed as follows: (Split Jackshaft)

1. Insert the assembly (spring loaded sheave and jackshaft half) into the machine (Figure 43).
2. Install a variable speed belt over the jackshaft.
3. Reinstall the split jackshaft connector, matched ends together (Figure 41). Four screw heads should be up and four down. Tighten the screws down evenly.
4. Pull the belt into the driven sheave with a pry bar (Figure 44). This will make it possible to replace the outside (engine) sheave half. Do not use a flat bar, as this will damage the belt.
5. Reinstall the outside drive sheave half and reconnect the hydraulic hose. Align the balance marks on the sheave halves when reinstalling.
6. Mount the sprocket on the end of the jackshaft. Align the sprocket with the outside clutch sprockets (Figure 40).
7. Lock the bearing locking collar on the bearing hub by turning it in the direction of shaft rotation (Figure 39).
8. Tighten the locking collar set screw (Figure 37).
9. Reinstall the clutch drive chain. Tighten the chain hand tight (Figure 46). You should be able to deflect the chain 1/4" using 10 lbs. of spring scale tension (Figure 47).
10. Reinstall the gearcase cover and protective clutch caps.

11. Reinstall the split jackshaft connector and tighten the screws down evenly to 18-20 ft. lbs.
12. Check the belt alignment of the drive and driven sheaves (Figure 45). If the belt is not properly aligned, do this:
 - A. Start the engine and move the variable speed belt to half variable position. Stop the engine.
 - B. Loosen the set screws on the hub of the stationary half of the sheave. Move the sheave sideways on the jackshaft until proper alignment is achieved.

DRIVEN SHEAVE DISASSEMBLY [.5 hr.]

To disassemble the driven sheave assembly after it has been removed from the machine, follow this procedure: (tapered split jackshaft)

1. Remove the grease fitting.
2. Remove the three spring retaining nuts.
3. Remove the spring.
4. Remove the movable half of the sheave from the shaft.
5. Remove the sheave retaining nut. A special wrench is available for this.
6. Remove the sheave half by tapping the end of the shaft on a block of wood (Figure 48).

To reassemble the sheave onto the tapered split jackshaft:

1. Tap the shaft into the tapered bore on the fixed half of the sheave (Figure 49). Be sure the key is being included in the assembly.
2. Mount the retaining nut. Tighten the nut to 130 ft. lbs. torque. Use a spanner wrench or a punch and hammer.
3. Check the movable half of the sheave to determine the condition of the grease seals. Replace the seals if they have been allowing grease to pass. Replace the bushings if they are worn and allowing the movable half of the sheave to vibrate or wobble on the shaft.
4. Mount the movable half of the sheave on the shaft.
5. Mount the spring.
6. Loosen the nut on one of the guide bolts and slide the bolt through far enough so a spring retaining nut can be started (Figure 50).
7. Retighten the nut on the guide bolt to its former position.
8. Start the other spring retaining nuts and tighten them until they are flush with the ends of the guide bolts.
9. Insert the grease fitting (Figure 51).

To disassemble the driven sheave assembly after it has been removed from the machine, follow this procedure: (all except tapered jackshaft units)

1. Remove the grease fitting.
2. Remove the three spring retaining nuts.
3. Remove the spring.
4. Separate the sheave halves.

To reassemble:

1. Check the movable half of the sheave to determine the condition of the grease seals. Replace the seals if they have been allowing grease to pass. Replace the bushings if

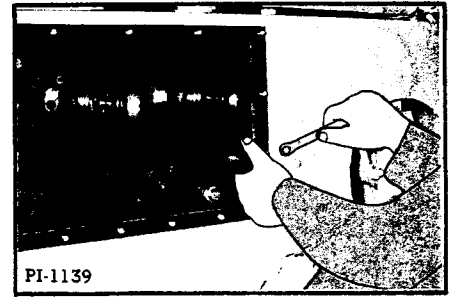


Fig. 46 Tightening Clutch Drive Chain

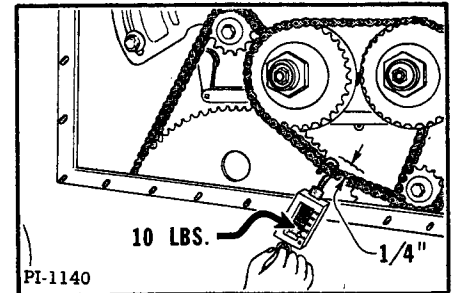


Fig. 47 Checking Clutch Drive Chain

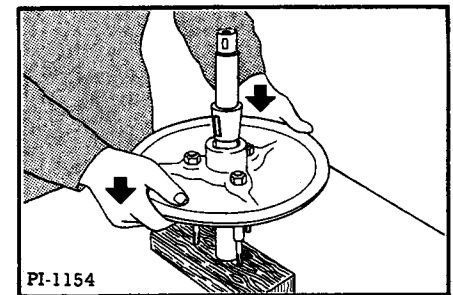


Fig. 48 Removing Sheave Half From Shaft

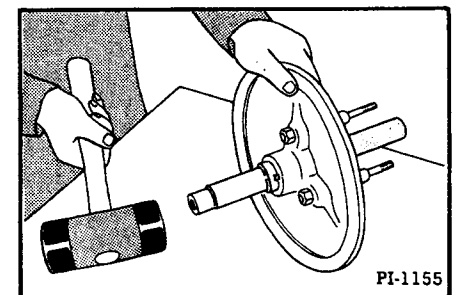


Fig. 49 Driving Shaft Into Sheave

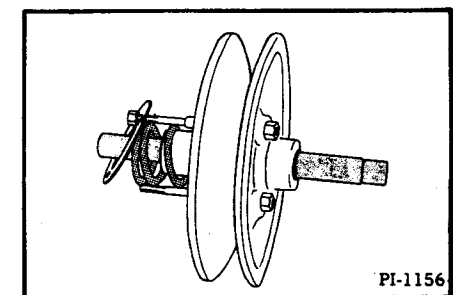


Fig. 50 Mounting Spring Retaining Plate

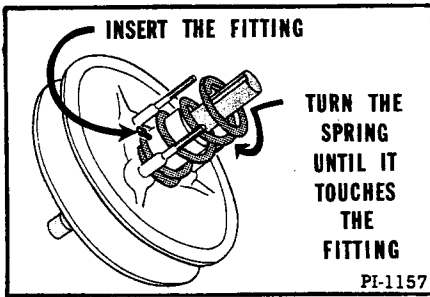


Fig. 51 Insert The Grease Fitting

MODEL	PART NO.	A
M-500G M-600D M-500D	6503352	3-7/8"
M-600G M-600E	6503348	4-1/4"
M-500E	6503379	4"

Fig. 52 Split Tapered Jackshaft

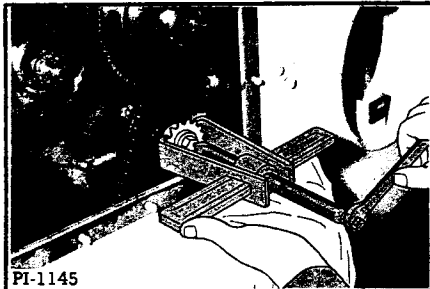


Fig. 53 Remove Upper Jackshaft Sprocket

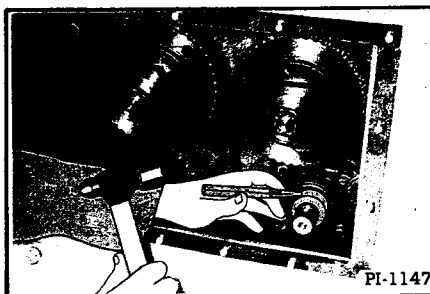


Fig. 54 Removing Bearing Locking Collar



Fig. 55 Reinstalling Bearing Locking Collar

they are worn and allowing the movable half of the sheave to vibrate or wobble on the shaft.

2. Mount the movable half of the sheave over the guide bolts.
3. Mount the spring.
4. Loosen the nut on one of the guide bolts and slide the bolt through far enough so a spring retaining nut can be started (Figure 50).
5. Retighten the nut on the guide bolt to its former position.
6. Start the other spring retaining nuts and tighten them until they are flush with the ends of the guide bolts.
7. Insert the grease fitting (Figure 51). The grease fitting must be slotted relief type to prevent overgreasing and seal damage.

NOTE: Not all tapered jackshaft halves are the same. See Figure 52 for dimensional differences and models used on.

DRIVEN SHEAVE ALIGNMENT (Belt Alignment)

1. Check to be sure the fixed half of the sheave is tight on the jackshaft, and has not moved sideways on the shaft, causing belt misalignment. This can be checked by laying a straightedge along the driven sheave with the belt at half variable position. The belt should be parallel to the straightedge along its entire length (Figure 45).
2. Check the condition of the movable half of the sheave to see that it slides freely on the shaft. It may have to be cleaned and relubricated, and new grease seals installed.
3. Check the condition of the three sliding studs (guide bolts) and related oilite bearings to be sure excessive wear has not caused wobbly motion (or vibration) of the two sheave halves and belt breakage.

If the variable speed belt is not properly aligned it will be necessary to move the driven sheave sideways until it is. On machines with tapered split jackshaft, do this:

1. Remove the left gearcase cover.
2. Loosen the split jackshaft connector.
3. Remove the clutch drive (outside clutch) chain.
4. Remove the sprocket retaining screw and the sprocket from the end of the jackshaft.

NOTE: You may need to use a puller to remove the sprocket from the end of the shaft. Remove the sprocket retaining screw from the jackshaft and remove the retaining washers. Turn the screw back into the end of the jackshaft (Figure 53).

5. Remove the bearing locking collar set screw (Figure 37) and the bearing locking collar (Figure 54) from the jackshaft. Loosen the bearing locking collar by turning it opposite the direction of shaft rotation.
6. Slide the jackshaft half to the desired position and tighten the 8 connector screws. Tighten the screws evenly to 18-20 ft. lbs. torque.
7. Recheck the alignment (Figure 45).
8. Reinstall and tighten the bearing locking collar on the bearing hub. To tighten it, turn it in the direction of rotation (Figure 55).
9. Mount the jackshaft sprocket. Use spacer washers to align the sprocket with the outside clutch sprockets. Check the alignment (Figure 40). Install the sprocket retaining washer and screw.
10. Reinstall the clutch drive chain. Tighten the chain hand tight (Figure 46). You should be able to deflect the chain 1/4" using 10 lbs. of spring scale tension (Figure 47).
11. Reinstall the gearcase cover and the protective clutch caps.

On machines without a tapered split jackshaft it is not necessary to remove the gearcase cover and jackshaft sprocket when aligning the belt. Proceed as follows:

1. Loosen the two set screws which hold the driven sheave to the shaft. They are located on the hub of the stationary half of the sheave (between the sheave assembly and the machine sidewall).
2. Slide or drive the sheave in the direction needed to give proper belt alignment.
3. Recheck the alignment (Figure 56).
4. Tighten the two set screws securely.

UPPER JACKSHAFT BEARING REPLACEMENT [1.5 hr.]

Remove and replace an upper jackshaft bearing as follows:

1. Remove the protective clutch caps and the gearcase cover.
2. Remove the clutch drive (outside clutch) chain.
3. Remove the sprocket retaining screw and the sprocket from the end of the jackshaft.
NOTE: You may need to use a puller to remove the sprocket from the end of the shaft. Remove the sprocket retaining screw from the jackshaft and remove the retaining washers. Turn the screw back into the end of the jackshaft (Figure 53).
4. Remove the bearing locking collar set screws (Figure 37) and the bearing locking collar (Figure 54) from the jackshaft. Loosen the bearing locking collar by turning it opposite the direction of shaft rotation.
5. Remove the four nuts which hold the bearing housing to the gearcase sidewall and pull the bearing and housing from the shaft.
6. Insert a length of shaft material (same diameter as the jackshaft) into the bearing and pull on the shaft until the bearing becomes free of the housing (Figure 57).

To reinstall:

1. Place a new bearing vertically into the housing. You should be able to turn it freely in the housing (Figure 58). If you can't, replace the housing with a new one.
2. With a length of shaft material inserted into the bearing, rotate it into the housing (Figure 57). It should not take over 200 in. lbs. force to rotate the bearing into the housing.
NOTE: The offset hub of the bearing must be toward the flanged side of the housing (not at the flat mounting side).
3. When mounting the housing to the gearcase inner sidewall, use new sealing washers behind the nuts to prevent oil leakage.

ENGINE VARIABLE DRIVE SHEAVE REMOVAL [1 hr.]

Use the following procedure to pull an engine variable drive sheave (M-600D, M-500D & M-600G):

1. Remove the holding screw and machined holding washer (Figure 59).
2. Remove the washer from the holding screw and replace the screw in the end of the crankshaft. Turn it in until the head of the screw bottoms against the crankshaft.
3. Insert 1/4" cap screws into the tapped holes in the fixed sheave hub.
4. Mount a puller on the sheave half (Figure 60) behind the cap screws.

WARNING

Do not substitute a common flat washer for the machined holding washer when reassembling the variable drive sheave to the engine shaft.

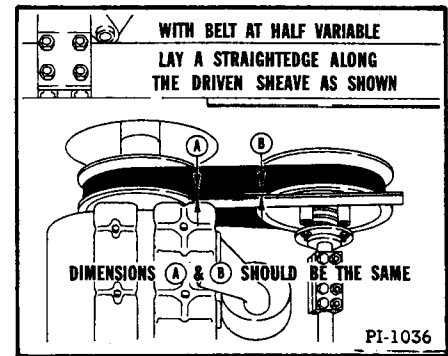


Fig. 56 Checking Belt Alignment

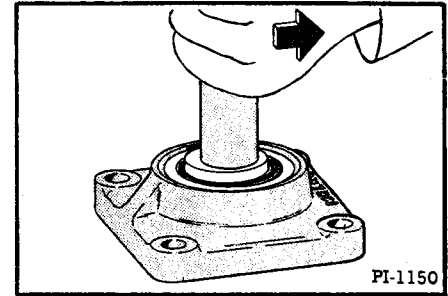


Fig. 57 Removing Bearing from Housing

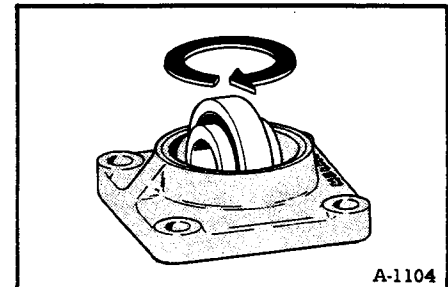


Fig. 58 Checking Housing Tolerance

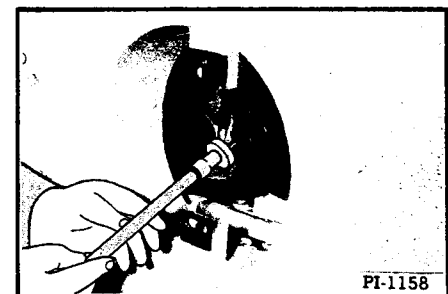


Fig. 59 Removing Holding Screw & Washer

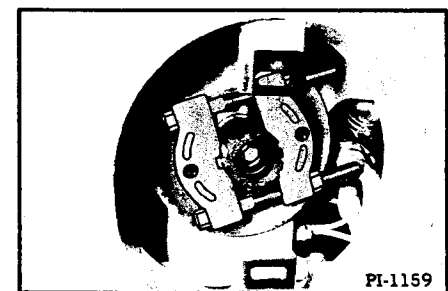


Fig. 60 Mount Puller on Sheave Half



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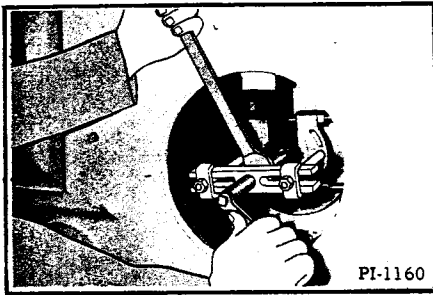


Fig. 61 Pulling Sheave Half from Shaft

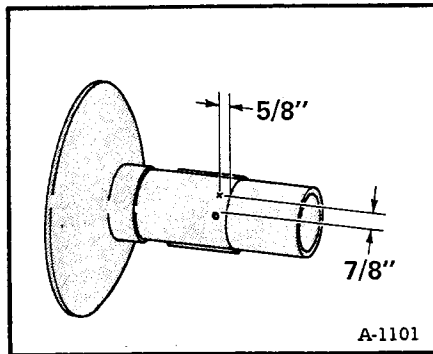


Fig. 62 Location of Alignment Hole

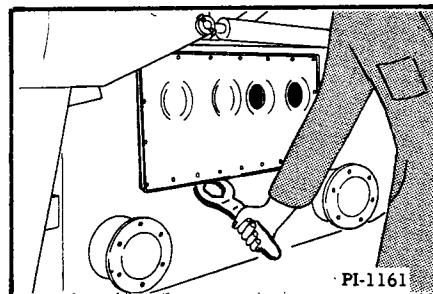


Fig. 63 Removing Gearcase Cover

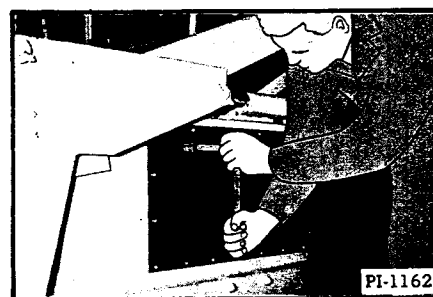


Fig. 64 Loosen the Intermediate Chain

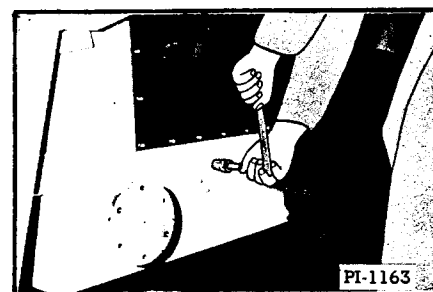


Fig. 65 Loosen the Final Drive Chains

5. Pull the sheave half from the engine shaft (Figure 61).

Use the following procedure to pull an engine variable drive sheave (M-500G, M-444, M-600E & M-500E).

1. Loosen the two set screws in the stationary sheave half.
2. Install a bearing puller (Figure 60), tightening the puller firmly behind the keys.
3. Pull the sheave half from the engine shaft (Figure 61).

DRIVE SHEAVE MODIFICATION (M-444, M-600D, M-500D, M-600E & M-500E) [2 hr.]

Replacing the roll pins in these sheave half assemblies with set screws will prevent possible sheave damage due to roll pins working out of place. To modify, follow these steps:

1. Press the cylinder barrel into the sheave half as far as it will go. Use a long bolt with large washers on each end to hold it in place.
2. Locate and drill a 19/64" hole (Figure 62).
3. Insert a 5/16" x 1/2" long roll pin into the hole. This will assure alignment when drilling future holes.
4. Using the pilot holes in the sheave half, drill three 15/16" holes through the cylinder barrel.
5. Tap the holes 3/8" NC, but only to within 1/16" of cylinder barrel inner surface.

NOTE: It is important that the set screws bottom out in the threads of the cylinder barrel. Use **Loc-Tite®** on the screws to keep them securely in place.

6. When assembling the sheave halves be sure to align the arrow on the movable half to the chisel mark on the fixed half.

AXLE REMOVAL [Remove and Replace 2.5 hr. (front) 3.5 hr. (rear)]

To remove an axle from the Bobcat loader: (front axle)

1. Drain the oil from the gearcase.
2. Raise the side of the machine that the axle will be removed from.

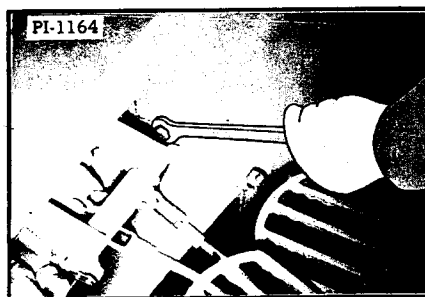


Fig. 66 Loosen the Final Drive Chains

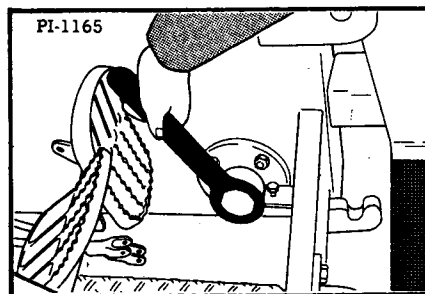


Fig. 67 Removing Oil Cap end of Axle

3. Disconnect the linkage from the foot pedals.
4. Remove the floor panels.
5. Remove the wheel from the axle that is to be removed.
6. Remove the gearcase cover (Figure 63).
7. Loosen the intermediate (inside clutch) chain (Figure 64).
8. Loosen the final drive chains (Figures 65 and 66).
9. Remove the oil cap at the end of the axle (Figure 67).

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