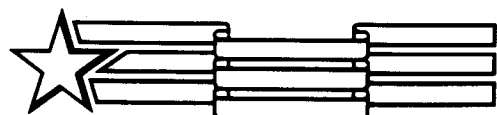


Ingersoll

**ATTACHMENT DRIVE CLUTCH
SHIM ADJUST STYLE
Model 210, 220, 222, 224
442, 444, 446, 644, 646
Service Manual No. 9-99654**



QUALITY IN THE AMERICAN TRADITION

Ingersoll Equipment Co., Inc.

Winneconne, Wisconsin 54986-9576

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This safety alert symbol indicates important safety messages in this manual. When you see this symbol, carefully read the message that follows and be alert to the possibility of personal injury or death.

ATTACHMENT DRIVE CLUTCH FOR MODELS 210, 220, 222, 224, 442, 444, 446, 644 and 646

INTRODUCTION

NOTE: The terms "right hand", "left hand", "front" and "rear" whenever used in this manual apply to the tractor when facing in the direction the tractor will move in forward operation.

The attachment drive clutch is located on the flywheel end of the engine (front of tractor). It is manually actuated and may be adjusted for wear by the addition of shim washers.

Before beginning adjustment or repair, identify the clutch style on the tractor.

Three basic styles of clutches are:

1. One piece hub shaft with snap ring located between cams. Page 4
2. Two piece hub shaft – Hub assembly and fan retained by bolt – No snap ring (intermediate style) Page 8
3. One piece hub shaft with front cam retained by snap ring (early style) Page 9



CAUTION: Before attempting to service the Attachment Drive Clutch, be sure to remove tractor key and spark plug wire(s).

TROUBLESHOOTING CHART (ALL STYLES)

CAUSE

SOLUTION

CAUSE	SOLUTION
CLUTCH JUMPS OUT OF GEAR	
1. Interference between clutch control rod and wire guide under tractor frame.	Eliminate interference by reforming rod or guide.
2. Clutch engaging arm ends misaligned.	Check with straight edge – replace arm.
CLUTCH SLIPS UNDER LOAD	
1. Excessive clearance between disc and clutch plate.	Maintain clearance at .002" - .007" by addition of shims.
2. Weak or improperly installed spring washers.	Replace and/or install as described in assembly section of this manual.
3. Clutch disc worn thin or glazed.	Replace disc.
4. Engaging arm or clutch cam notches worn.	Replace arm or cams.
CLUTCH DOES NOT RELEASE	
1. Too little clearance between clutch disc and clutch plate.	Maintain clearance at .002" - .007" by removing shims.
2. Retaining ring out of groove.	Install retaining ring properly.

**ATTACHMENT DRIVE CLUTCH
(WITH ONE PIECE HUB SHAFT AND SNAP RING LOCATED BETWEEN CAMS)**

CLUTCH DISC CLEARANCE ADJUSTMENT

GAIN ACCESS TO CLUTCH

Tractors

1. Remove Hood.
2. For tractors with muffler under the hood — Remove three screws securing oil cooler to front support and swing cooler out.

It is not necessary to drain hydraulic oil.

3. For tractors with muffler not under the hood, remove the four bolts holding the front support to the tractor frame and swing support with cooler and oil reservoir out.

It is not necessary to drain hydraulic oil.

Loaders

1. Raise loader bucket full height. Block loader lift cylinder with 17" long angle iron to prevent loader from accidentally dropping.
2. Remove grille and headlight panel.
3. Place clean drip pan under return line connection to oil cooler.
4. Loosen return line clamps at both ends of oil cooler.
5. Pull oil cooler free from lower return line connection and rotate cooler around upper hose. Tie cooler up out of way. Use suitable plug to stop return tube from leaking.

DETERMINE AMOUNT OF SHIMS TO ADD OR REMOVE

1. Place attachment drive clutch lever in the OFF position.
2. Make a measurement using two blade type feeler gauges inserted 180 degrees apart between the clutch disc and backing plate. Record this measurement.
3. Shims are available in three thicknesses, .005", .010", and .050". Consult your parts catalog for correct part numbers. Minimum clearance should be maintained at .002" to .007" to provide longest wear life before requiring readjustment.

Shims should be added to reduce clearance.
Shims should be removed to increase clearance.

4. Example: If the measurement made in step 2 was .018" clearance, the desired clearance is .002" to .007". Therefore, between .011" and .016" of shims should be added to reduce clearance.
Solution: Add one .010" and one .005" shim for total of .015". Clearance is then .003" which is within the .002" to .007" specification.

By following the above procedure, the clutch needs to be disassembled only once to arrive at the proper adjustment.

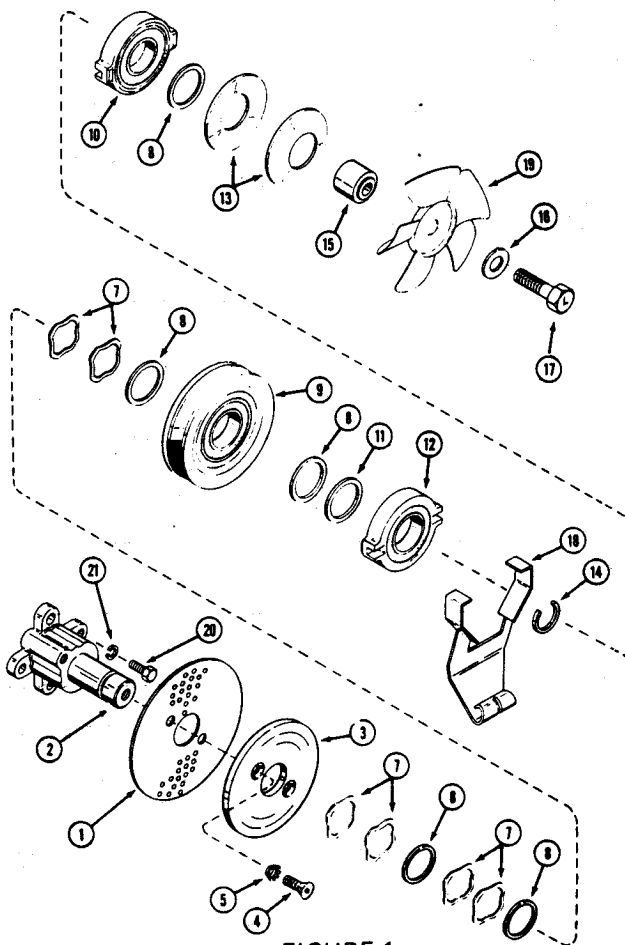
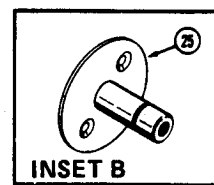
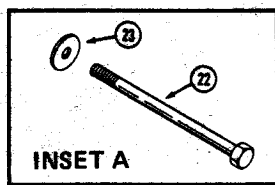


FIGURE 1

SHIM INSTALLATION PROCEDURE

1. Place attachment drive clutch in the OFF position.
2. Note the position of cam notches before disassembly. The front cam is installed with the shorter side up and the rear cam with shorter side down. The cams must be reassembled in this manner to insure proper operation.
3. Grip spacer (15) with suitable slip joint pliers and remove bolt (17). (Right hand thread on 646 Loaders, LEFT HAND THREAD on all other Models). Remove fan (19), spacer (15), springs (13), shim (8) and front cam and bearing assembly (10). Swing engaging arm (18) down.
4. Remove snap ring (14), rear cam and bearing assembly (12). Check for shims that might have stuck to rear cam and bearing assembly (12).
5. Add proper amount of shims as previously determined. Install shims so there is one .050" shim on each end of shim stack.
6. Reinstall components in reverse order of disassembly. Be sure to position cams — rear cam, shorter side down, front cam, shorter side up.
7. Torque bolt (17) to 45 ft. lb.

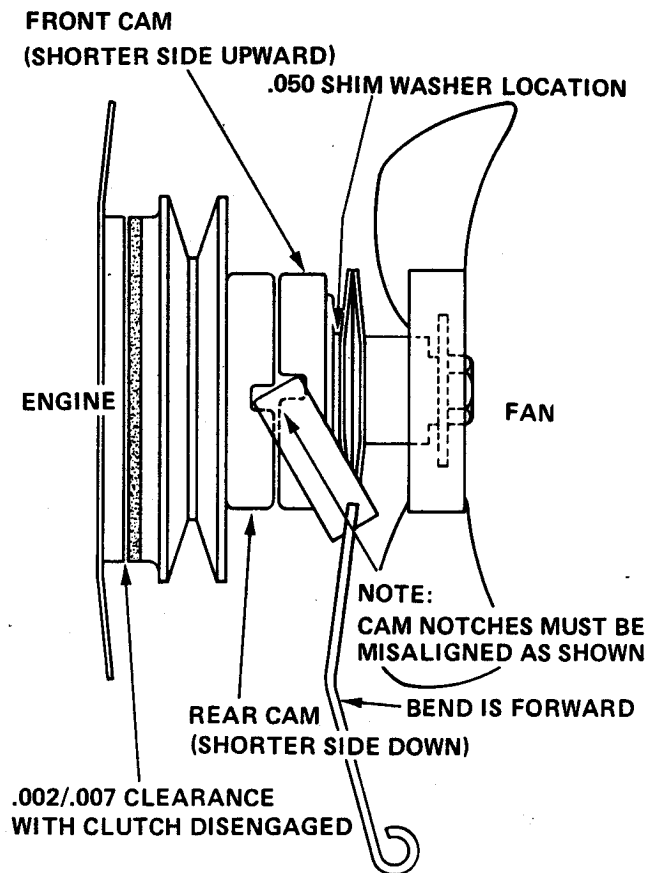


FIGURE 2

CLUTCH REMOVAL

1. Follow steps for CLUTCH DISC CLEARANCE ADJUSTMENT up to and including removal of rear cam and bearing assembly (12). (Step 4, SHIM INSTALLATION PROCEDURE).
2. Remove shim washers (8) and (11), pulley, disc and bearing assembly (9) six springs (7) and 3 washers (8).
3. Remove machine screws (4), lockwashers (5), clutch plate (3) and grass screen (1).
4. All models except 446 and 646, remove the four bolts (20) and lockwashers (21) and detach drive hub (2) from engine flywheel.

This completes removal on Models 446 and 646.

INSPECTION

Check to see that none of the springs (7) and (13) are cracked or broken.

NOTE: If clutch was slipping under heavy load even though friction disc clearance was within tolerance, new springs (13) should be installed.

Inspect the cam notches (10) and (12) and engaging arm (18) for excessive wear. Also check to make certain the bearing flanges in the cams are not cracked or damaged.

Rotate the three sealed bearings to check for freeness and quiet operation. Replace bearings which are rough and noisy or do not turn freely.

Inspect the friction disc for glaze and wear. Replace if thickness measures less than 1/8" or if it is glazed.

The disc should be bonded to the pulley and must be heated under pressure to insure proper adhesion per the following procedure.

1. The pulley surface must be clean and free of rust, oil or grease. Wear patterns on the pulley surface will not effect the bonding unless they are severe.

Bonding material from the previous friction disc may be removed by heating (such as with a propane torch) and scraping.

2. A clamping device such as the one shown below should be fabricated:

Use 1/4" Thick Plate
1/2" x 2-1/2" N.C. Hex Head Bolt

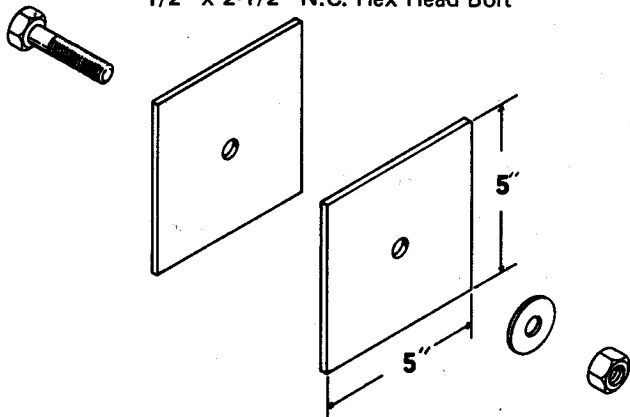


FIGURE 3

3. Position friction disc, with coated side facing pulley, on pulley shoulder.
4. Bolt clamping device as illustrated and torque bolt to 80 foot pounds.
5. Preheat oven to 400° F.
6. Place assembly in 400° F. oven for 30 minutes.
7. Allow to cool, disassemble clamping device and install new bonded disc and pulley assembly in tractor.

NOTE: DO NOT USE MICROWAVE OVEN

VERY

IMPORTANT: If it is elected not to bond the disc to the pulley, remove all bonding material from the disc before installation.

Failure to do this may result in erratic clutch operation.

Inspect the friction disc contact areas on the clutch plate (3) for scratches or roughness. A polished surface is normal due to friction disc contact. Replace the clutch plate if score marks are present which cannot be polished out.

Check the fit of the cam bearings and pulley bearings on the drive hub (2). The bearings must slide back and forth freely for proper clutching and declutching. Polish off any nicks or burrs which could cause the bearings to bind.

Check the edges of the engaging arm which contact the notches in the cams. To insure full clutch engagement, they must be rounded as shown in Figure 3. If required, edges of the arm can be rounded with a file or grinding wheel. Take care, however, not to reduce overall width of arm. See Figure 4.

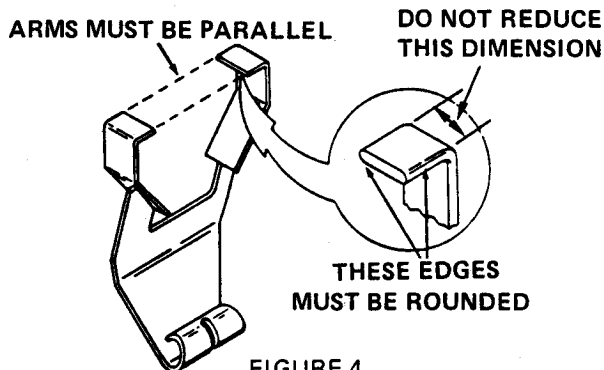


FIGURE 4

Both engaging arms must be square and parallel with each other as shown in Figure 3. If the arms are misaligned, the lever must be replaced.

Check the mounting face of engine flywheel for flatness. If necessary file or grind smooth to insure that runout at the end of the drive hub does not exceed .006". Pay particular attention to the mounting holes as the tapping operation will sometimes leave a high spot on the flywheel face.

CLUTCH INSTALLATION

1. All clutches except 646 and 446 models:
 - a. Connect the drive hub (1) to the engine flywheel with original four cap screws (20) and new 3/8" lockwashers (21).
 - b. Secure the screen and clutch plate to the drive hub with original machine screws (4) and new lockwashers (5). Tighten the machine screws securely.
2. All 646 and 446 clutches only: Secure the drive hub to the flywheel with original machine screws and new lockwashers. Tighten the machine screws securely.
3. Fit two springs (7) together and place on drive hub. Install .050" shim (8) then match two more springs and install. Place second .050" shim on hub and install the last two springs and .050" shim for a total of six springs and three shims.
4. Place disc pulley and bearing assembly on clutch hub with disc facing backing plate (3). If disc is not bonded to pulley, make sure disc remains on pulley shoulder during assembly procedure.
5. Install correct amount of shims.
 - a. If the reassembly contains no new parts, install shims as explained in CLUTCH DISC CLEARANCE ADJUSTMENT section of this manual. Page 4.

b. If the reassembly contains some new parts, assemble clutch with .180" shims and then follow procedure in the clutch disc adjustment section of this manual and adjust if necessary.

6. Place rear cam (12) on drive hub (2) or (25) so that notch faces out, then install retaining ring (14) and front cam with notches facing in.

7. See Figure 6. Rotate the cams until the lever notches are misaligned as shown. The rear cam on drive hub must be positioned so the shorter side is downward and the front cam must have the shorter side upward.

8. Separate the cams enough to insert the engaging lever. The engaging lever must be installed so the bend for the control rod is toward the front of the tractor.

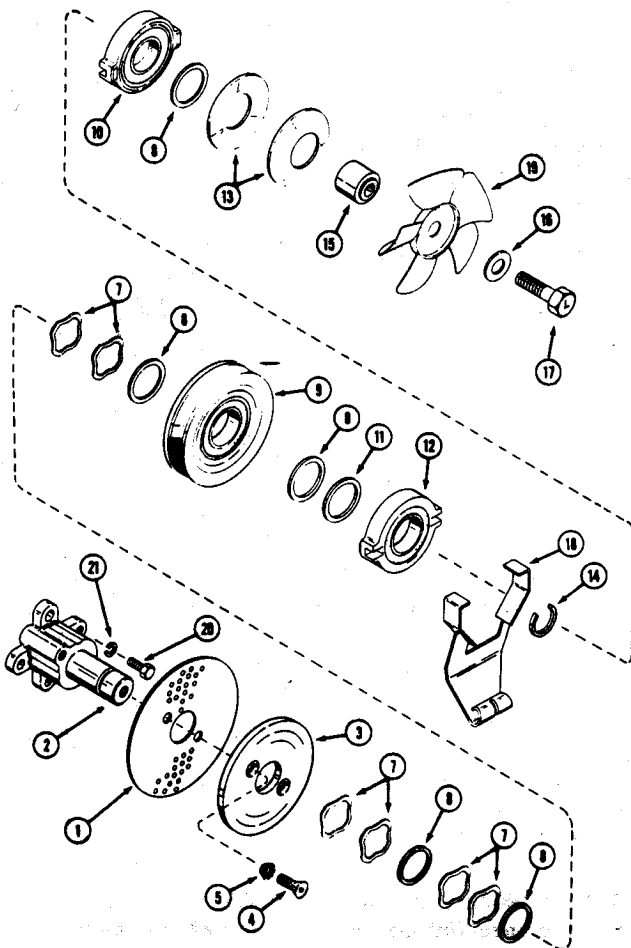
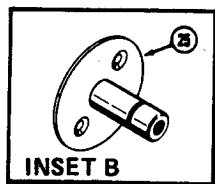
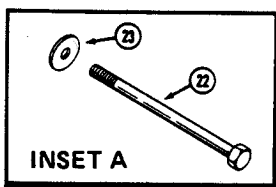


FIGURE 5

9. Install .050" shim (8) and belleville spring washers (13), dished out as pictured.

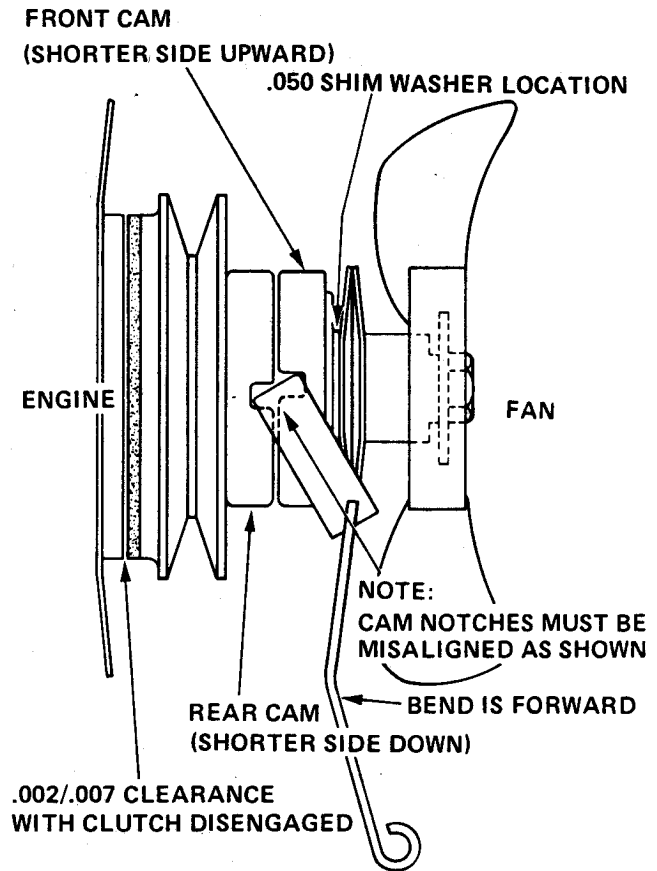


FIGURE 6

10. Assemble washer (16), fan if equipped (19) and spacer (15) on special bolt (17) or (22) and install on hub (2) or (25).

Torque bolt to 45 ft. lb.

11. With the clutch disengaged, check the friction disc. Clearance should measure between .002" and .007". Use two "blade-type" feeler gauges 180 degrees apart when measuring. To increase clearance, add shims (8) or (11) as required between the pulley (9) and rear cam (12).

NOTE: If clutch does not engage or disengage properly, check for correct cam assembly according to steps 7 and 8 above. When correctly installed, the facing notches on the front and rear cams are "out of alignment" in the manner shown in Figure 6 with the clutch in both the engaged or disengaged positions. Repeat steps 7, 8 and 11 to correct either friction clearance or cam assembly.

12. Reassemble oil cooler and the hood, or grille and headlight panel.

**ATTACHMENT DRIVE CLUTCH (INTERMEDIATE STYLE)
(WITH TWO PIECE HUB SHAFT AND HUB ASSEMBLY RETAINED BY BOLT – NO SNAP RING)**

This clutch is very similar to the clutch with one piece hub shaft. Therefore, follow the service procedures on pages 4-7 with the following exceptions.

CLUTCH DISC CLEARANCE ADJUSTMENT

- a. GAIN ACCESS TO CLUTCH – No change
- b. DETERMINE AMOUNT OF SHIMS TO ADD OR REMOVE – No change
- c. SHIM INSTALLATION PROCEDURES

Steps 1 through 3 – No change

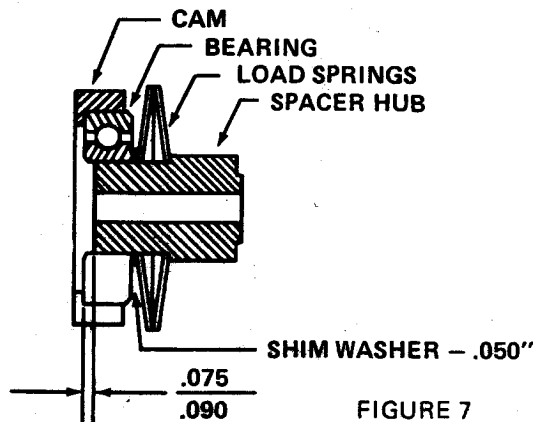
Step 4 – There is no snap ring (14) provided in this assembly.

Steps 5 through 7 – No change

CLUTCH REMOVAL – No change

INSPECTION – Add the following information

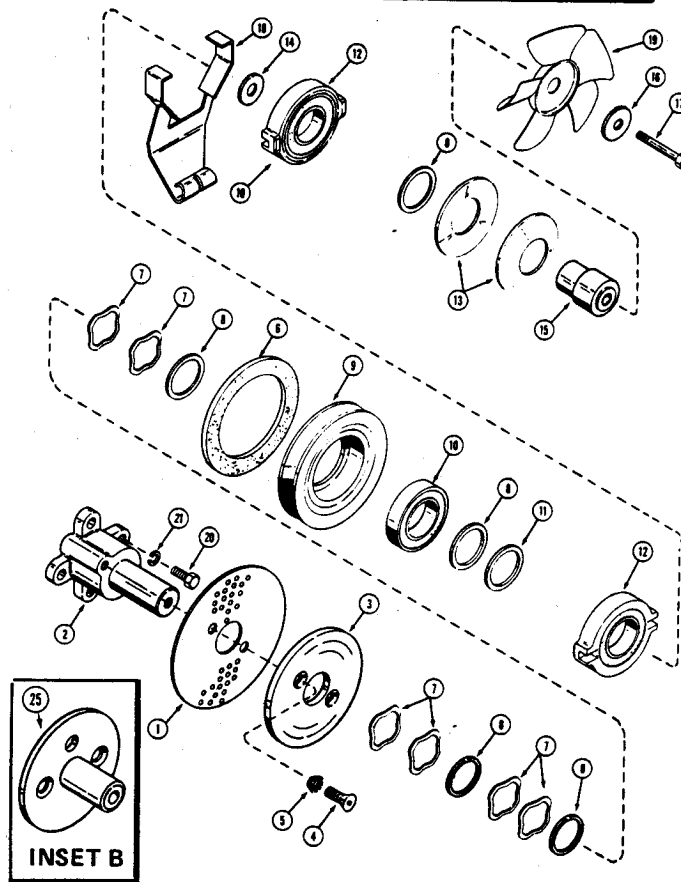
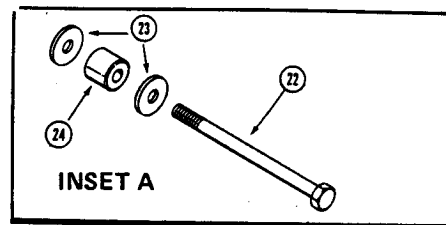
- a. Check fit of front cam bearing on the spacer hub (15).
- b. Place the two load springs, one .050" spacer and bearing on the spacer hub as shown in Figure 7. The measurement from end of the hub to extreme edge of the bearing inner race should be .075" - .090". Use .010" or .050" shim washers, positioned between the load spring and the bearing inner race, as required to obtain the .075" - .090" dimension.



INSTALLATION

Steps 1 through 5 – No change

Step 6 – Place rear cam on drive hub so that notches face out. Assemble washer (16) or (23), fan (19) if equipped, spacer hub (15) or (24), Belleville spring washers (13) dished outward, .050" shim washer (8), cam (12) and spacer (14) or (23) in that order on special bolt (17) or (22).



Step 7 – No change

Step 8 – Place assembly from Step 6, above, on hub with engaging lever properly positioned between cams. The bend for the control rod on the engaging lever must face forward.

Step 9 – Torque bolt to 45 ft. lb.

Step 10 – Disregard

Step 11-12 – No change

NOTE: C19472 Clutch Kit is available to service this clutch. With application of this kit, this clutch will become the same as the single piece hub. The Kits consist of hub, shims, snap ring, spacer, fan, washer and bolt.

ATTACHMENT DRIVE CLUTCH (EARLY STYLE) (WITH ONE PIECE HUB SHAFT AND FRONT CAM RETAINED BY SNAP RING)

This Clutch Assembly was originally with Model 220, 222, 442 and 444 tractors prior to serial number 9641001.

Spacer Kit, part number C16483, is available to replace the snap ring (5) in the event the groove in the drive hub (10) is worn. See inset B reference 13 in Figure 9. Therefore, it is not necessary to replace the drive hub (10) because the snap ring does not hold.

REMOVAL

1. Remove the tractor hood.
2. Remove the four bolts which hold the head exchanger support to the frame but leave the hose connected to the valve return tube.
3. Rotate the heat exchanger ahead for access to the clutch.
4. Disconnect the PTO control rod from the engaging arm (1), Figure 9.
5. Remove the RIGHT HAND THREAD bolt, Inset "A", Figure 9 (20) with lockwasher and plain washer and remove the fan (17) and spacer (16).
6. Carefully remove the clutch with a "puller" using the original 3/8x3-1/2" long bolt as a guide on the engine shaft.
7. Before disassembling check and record the total clearance between the pulley and friction liner. Use two "blade-type" feeler gauges of the same thickness — insert 180° apart. The proper total clearance is between .002" and .012" with clutch disengaged. This will determine the number of shims to be added during assembly providing a new friction liner is not installed.
8. Carefully clamp the clutch assembly in a vise and compress the load springs (4) enough to remove the snap ring (5).
9. Remove the clutch from the vise. Clean off paint and remove any burrs from the snap ring end of the hub assembly (10).
10. Remove the springs (4), outer cam (2) and engaging arm (1).
11. Remove the inner cam (2). Check for and remove any shim washers (9) or (11) which may have come off attached to the cam.
12. Remove the shim washers (9) and (11), pulley (7), friction disc (6), and shim washers (11) and springs (12) from the drive hub (10).

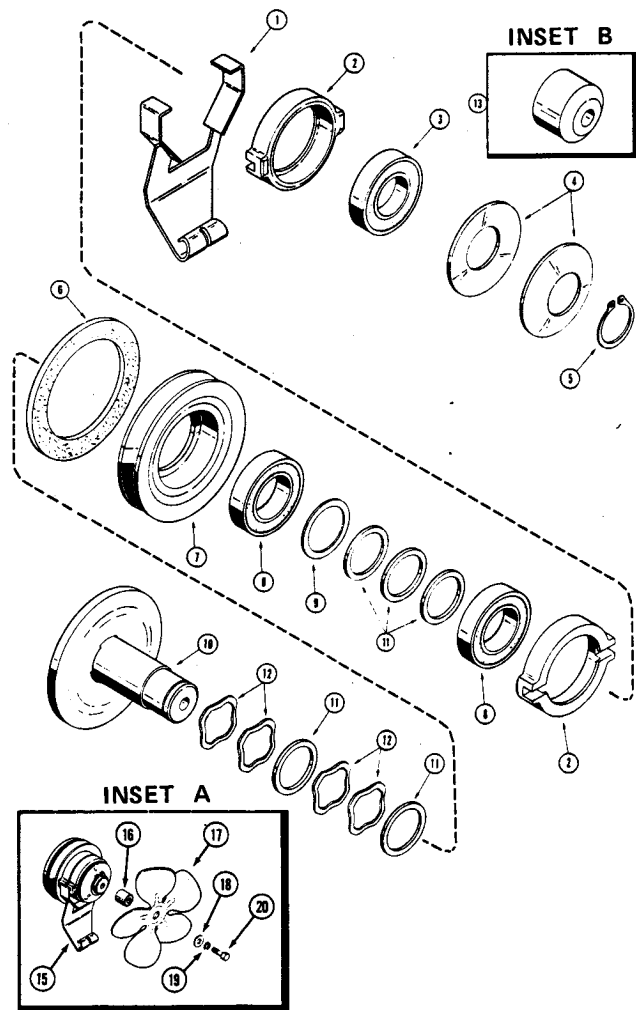


FIGURE 9

INSPECTION

Check to see that none of the springs (4) and (12) are cracked or broken.

NOTE: If clutch was slipping under heavy load even though friction disc clearance was within tolerance, new springs (4), part number C16786, should be installed. Also, if new springs are installed, the clutch must be reassembled with the spacer kit (13), part number C16483, instead of the snap ring.

Inspect the cam notches (2) and engaging arm (1) for excessive wear. Also check to make certain the bearing flanges in the cams are not cracked or damaged.

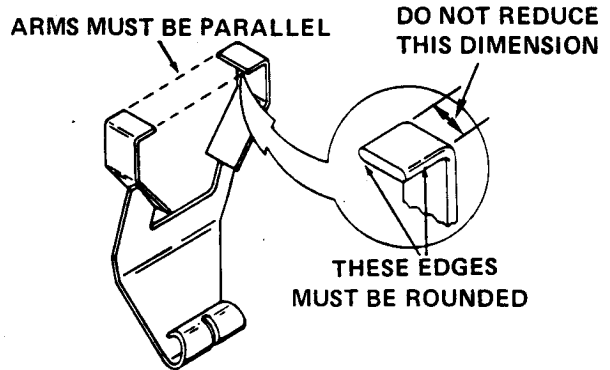


FIGURE 11

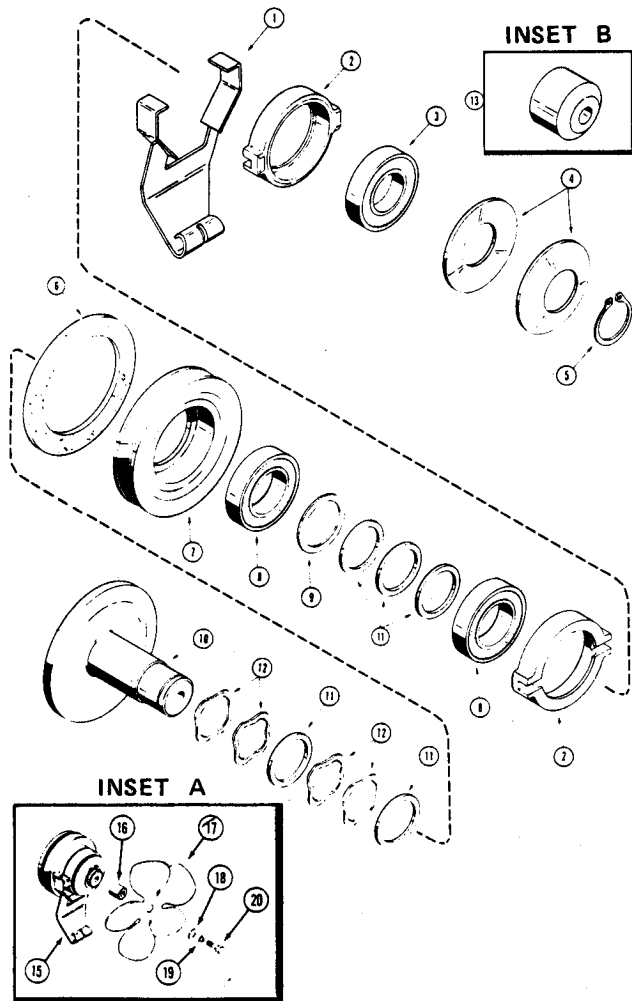


FIGURE 10

Rotate the three sealed bearings to check for freeness and quiet operation. Replace bearings which are rough and noisy or do not turn freely.

Inspect the friction disc (6) for glaze and wear. Replace if thickness measures less than 1/8" or if it is glazed.

Inspect the friction disc contact areas on the drive hub (10) and pulley (7) for scratches or roughness. A polished surface is normal due to friction disc contact. Replace the clutch plate or pulley if score marks are present which cannot be polished out.

Check the fit of the outer cam bearing (3) on the drive hub (10) and the fit of the inner cam and pulley bearings (8) on the drive hub (10). The bearings must slide back and forth freely for proper clutching and de-clutching. Polish off any nicks or burrs which could cause the bearings to bind.

Check the edges of the engaging arm which contact the notches in the cams. To insure full clutch engagement, they must be rounded as shown in Figure 11. If required, edges of the arm can be rounded with a file or grinding wheel.

Both engaging arms must be square and parallel with each other as shown in Figure 11. If the arms are misaligned, the lever must be replaced.

ASSEMBLY

1. Fit two springs (12) together and place on drive hub. Install a .050" shim (11), then match the outer two springs and install. Place a second shim (11) on the hub for a total of 4 springs and 2 shims.
2. Place friction disc (6) over the shoulder of clutch pulley (7) and place both on the drive hub.
3. Place original shim stock (9) and (11) on the drive hub.

NOTE: If the friction disc clearance was measured and noted prior to clutch disassembly and no new parts were installed, adjust the shim stacks at this point to correct specification (.002" to .007") with clutch disengaged.

4. Place the two cam assemblies (2) on the drive hub.
5. See Figure 12. Rotate the cams until the lever notches are misaligned as shown. The inner cam must be positioned so the shorter side is downward and the outer cam must have the shorter side upward.
6. Separate the cams enough to insert the engaging lever (1). The engaging lever must be installed so the bend for the control rod is toward the front of the tractor.
7. Place the two springs (4) dished outward on the drive hub.
8. If the snap ring (5) is to be used rather than the spacer kit (13), compress the load springs enough in a vise to expose the groove.

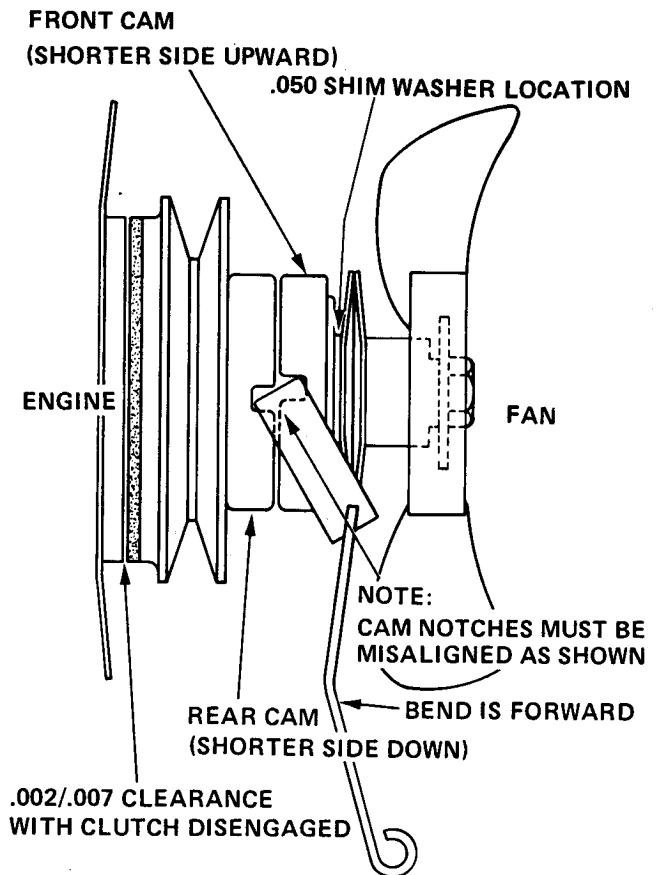


FIGURE 12

NOTE: Make certain the friction disc is flush against the face of the pulley so it is over the shoulder before compressing the springs and installing the snap ring.

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