TROUBLE-SHOOTING

Problem — Clutch won't release

Possible Cause	Correction
a. Oil or grease on friction disc	a. Install new friction disc
b. Improper pedal adjustment	b. Adjust clutch pedal free travel and linkage
c. Damaged pressure plate or clutch cover	c. Replace defective part
d. Friction disc hub binding on splined drive pinion shaft.	d. Clean up splines and smear with small quantity of "lubriplate (Grade 70)"
e. Distorted friction disc	e. Install new friction disc
f. Broken facings or friction disc	f. Install new friction disc
g. Dirt or foreign matter in the clutch	g. Remove clutch from flywheel and clean with dry rag. See that all working parts are free

Problem — Clutch slip

Possible Cause	Correction
a. Oil or grease on friction disc facings	a. Install new friction disc
b. Weak coil spring. If excessive slip is allowed to occur, the heat generated will soften the springs and aggravate the trouble	b. Install a new set of thrust springs
c. Binding of clutch pedal mechanism preventing its full return to stop	c. Free bearings. (NOTE: The clutch shaft bearings in the transmission case are self-lubricating. Oil or grease should not be applied.)
d. Improper pedal adjustment preventing full engagement	d. Correct pedal adjustment
e. Clutch facing worn	e. Install new friction disc

Problem — Clutch grabbing

Possible Cause	Correction
a. Oil on friction disc	a. Install new friction disc
b. Binding of clutch pedal mechanism	b. Free bearings. (NOTE: The clutch shaft bearings in the transmission case are self-lubricating. Oil or grease should not be applied.)
c. Worn out friction disc facings	c. Install new friction disc

Problem — Clutch chatter

Possible Cause	Correction
a. Oil, grease or foreign matter on friction disc facings	a. Install new friction disc
b. Contact area friction facings not evenly distributed. NOTE: 100% contact will not occur until clutch has been in use for some time, but contact area should be evenly distributed round the facings.	b. Adjust release levers correctly, using gauge. If this does not cure the trouble, install new friction disc
c. Buckled friction discs	c. Install new friction disc
d. Improper release lever height	d. Adjust release levers using tool MFN 202C

Problem — Clutch rattle

Possible Cause	Correction
a. Anti-rattle spring(s) broken. Damaged friction disc. Worn parts in release mechanism. Excessive backlash in transmission. Wear in transmission bearings.	a. Install new parts as necessary

Problem — Abnormal facing wear

Possible Cause	Correction
a. Usually caused by riding the clutch and excessive slippage	a. Instruct operator on proper operation

TRANSMISSIONS (Manual Shuttle and Instant Reverse Including Torque Converter)

INDEX

REMOVING THE TRANSMISSION

The procedures for removing the transmission from tractors with a loader installed are different than tractors without loaders installed.

If the tractor has a loader installed, the transmission removal procedures require disconnecting the loader from the rear axle housing and splitting between engine and transmission. Then roll the tractor rearward and disconnect the transmission from the center housing.

If desired, and suitable equipment is available, the loader can be hoisted above the tractor and secured in this position. Blocks are used under the loader side frames to maintain their position and the side frames are unbolted from the front end of the tractor. With this method, it is necessary to disconnect the hydraulic lines to the loader pump, and disconnect and remove the instrument panel as an assembly. The engine is disconnected from the transmission case, then the front axle and engine is rolled forward from tractor (out of the way). The transmission may then be removed from the center housing. This method will make it unnecessary to remove a backhoe or weight box from the tractor.

If the tractor does not have a loader installed, removal procedures require only splitting at each end of the transmission.

1. If the tractor has a backhoe, weight box or other equipment attached, it will be necessary to remove it.

2. Disconnect the battery "hot" lead and drain oil from the transmission and center housing — approximately 8 gallons.

3. If the tractor has a loader installed, proceed as follows:

   a. Lower the front of the loader and block up approximately 8" from the floor.

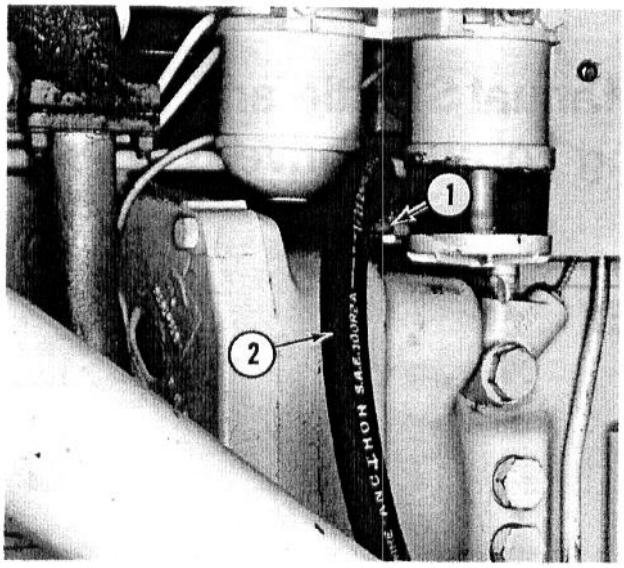

FIG. 1 — LEFT-HAND VIEW OF TRANSMISSION-TO-ENGINE ATTACHING POINT

1. Clip (Hose) 2. Crossover Hose (Lift Cylinders)

b. Remove the grille and remove the two upper bolts securing the loader frame to front of tractor.

c. Loosen the two lower bolts securing loader frame to front of tractor.

d. Disconnect the clip securing the crossover hose between the two lift cylinders. See Fig. 1.

e. Place jacks under the rear of the loader frame and remove the four bolts securing loader to rear axle. It is not necessary to remove the fenders. They can hang on their mounting bolts and lean inward.

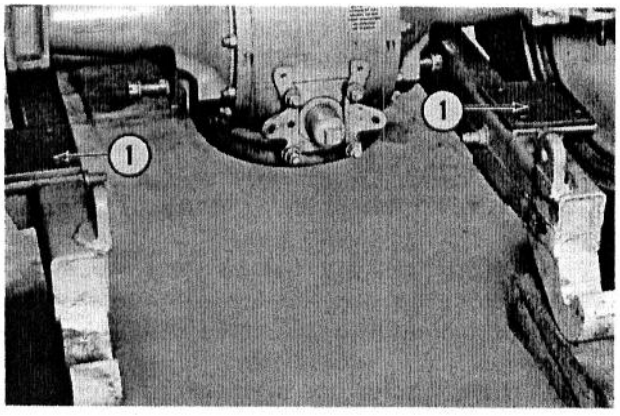

FIG. 2 — LOADER SIDE FRAMES DISCONNECTED FROM REAR AXLE HOUSINGS

1. Spacers

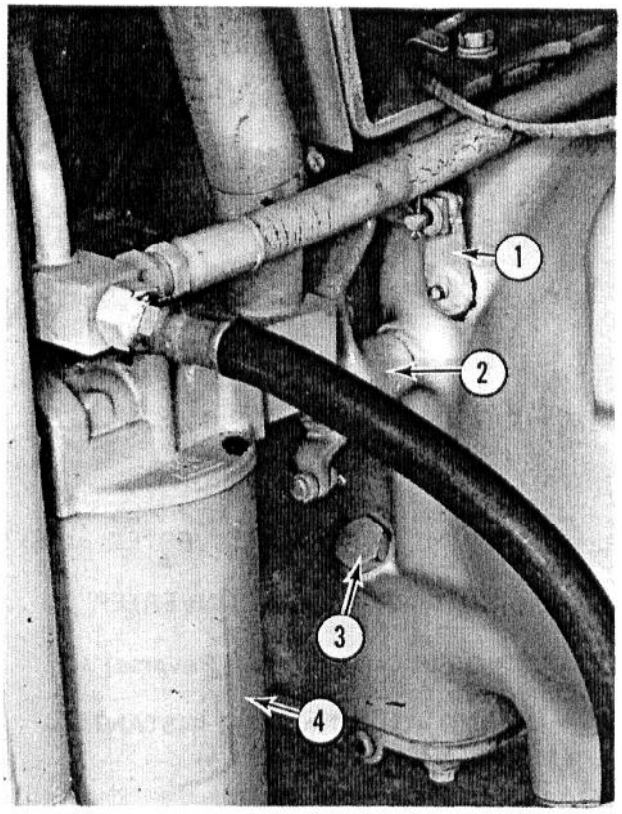

FIG. 3 — CONTROL LINKAGE — I.R. TRANS.

1. Control Valve Arm
2. Bellcrank (Throttle and Transmission Control Linkage)
3. Transmission Oil Level and Filler Plug
4. Loader Hydraulic Filter

f. Carefully lower rear of loader to the floor as shown in Fig. 2.

NOTE: On Tractors with Instant Reverse it will be necessary to disconnect and remove the throttle and shift control pivot linkage from the transmission housing to prevent damage when the loader is lowered to the floor. Fig. 3 shows this linkage.

If the rear wheel tread is set at a narrow setting, it will be necessary to pry in slightly on the loader frame so the rear wheels will clear the mounting brackets on the loader when the unit is rolled apart.

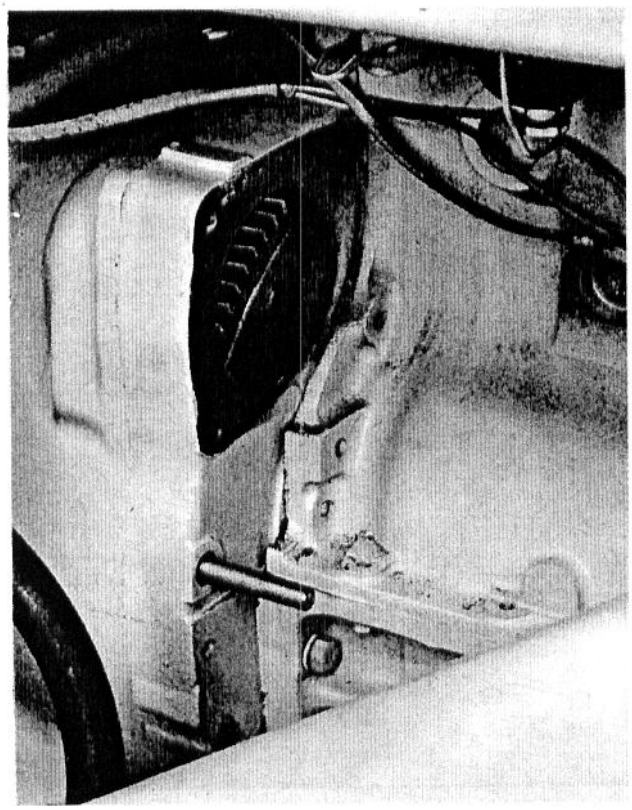

FIG. 4 — GUIDE STUDS USED WHEN "SPLITTING" I.R. TRANSMISSION FROM TRACTOR

4. Remove the front section of the exhaust pipe.

5. Remove the right and left lower instrument side panels and remove the bolts securing the steering housing to the transmission.

NOTE: It will be necessary to remove the steering wheel pivot release lever knob before the left side panel can be removed.

6. MANUAL SHUTTLE ONLY — Disconnect Manual Shuttle shift linkage from the transmission. Disconnect the accelerator linkage rod at the upper end.

NOTE: Remove the starter safety switch to avoid damage to the switch by the instrument panel bracket.

7. INSTANT REVERSE ONLY — Disconnect cooler and filter lines at left-hand side of transmission. Disconnect heat sender unit. Disconnect the throttle control linkage rod and spring at the directional pedals.

8. Disconnect light wires at rear of left step plate.

9. Disconnect the battery and remove the starter.

10. Support the engine and transmission on suitable stands or jacks. The transmission should be supported on a rolling floor jack for removal.

11. Attach a suitable hoist to the instrument panel and raise up enough to clear the transmission housing.

12. Remove the bolts securing the transmission to the engine.

NOTE: Use guide studs on I.R. Trans. Tractors to protect the pump drive lugs when the unit is split between engine and transmission. See Fig. 4.

13. Carefully roll the center housing and transmission approximately 4" away from the engine.

NOTE: If desired, the torque converter can be disconnected from the flywheel and left on the transmission when the Tractor is split.

14. Carefully lower the transmission just enough to clear the instrument panel support as shown in Figs. 5 and 6, then continue rolling the transmission and center housing assembly rearward.

NOTE: On tractors with loaders installed, the crossover hose between the two lift cylinders will have to be worked up over the transmission housing when the unit is split.

15. Uncouple step plates at front end and disconnect clutch linkage (Manual Shuttle).

16. Remove brake master cylinder.

NOTE: It may not be necessary to completely remove the master cylinder . . . just disconnect at mounting pad on side of transmission housing.

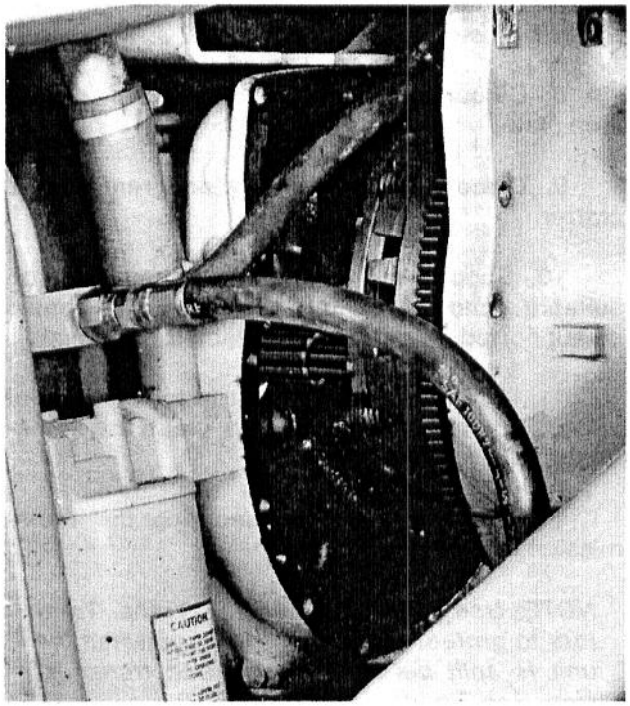

FIG. 5 — RIGHT-HAND VIEW OF I.R. TRANSMISSION "SPLIT" FROM ENGINE

17. Attach a suitable hoist to the top of transmission case.

18. Remove bolts securing transmission case to center housing and carefully slide transmission assembly away.

INSTALLING THE TRANSMISSION

1. Place a new gasket on the center housing.

2. Support the transmission on a hoist and align with bolt holes on the center housing.

NOTE: On tractors with internal hydraulics and/or PTO, it will be necessary to align splines with the counter-shaft when transmission is attached to the center housing.

3. Install bolts securing transmission to center housing and tighten to 50-55 ft.-lbs. torque.

4. Install drive coupler through opening in top of center housing, if lift cover is removed.

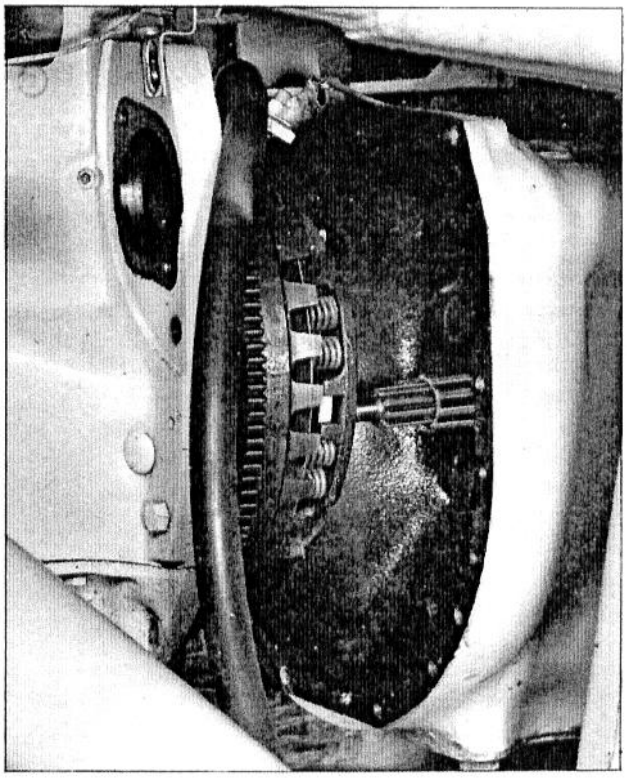

FIG. 6 — LEFT-HAND VIEW OF I.R. TRANSMISSION "SPLIT" FROM ENGINE

If not, work through inspection opening at side of center housing.

5. INSTANT REVERSE ONLY:

a. Always use guide stud to make certain that the transmission is in perfect alignment with the engine.

b. Position the impeller hub drive lugs on the torque converter in a horizontal position and the drive lugs on the transmission pump in a vertical position.

c. Mark one fin on the converter assembly with grease or paint. This mark will be used when aligning the spline on the input shaft. When the units are pushed together, rotate the converter back and forth (not to exceed 3" either direction with the mark). This will align the splines for ease of assembly.

6. Carefully roll the transmission and center housing assembly together and secure with retaining bolts.

NOTE: Do not force the two units together or damage could result. They must roll completely together before any bolts are tightened.

7. Complete installation of transmission by reinstalling the remaining parts previously removed when transmission was removed. Refill transmission with recommended type oil.

REMOVING THE TORQUE CONVERTER

1. Separate the tractor between the engine and transmission as previously outlined.

2. Remove the bolts securing the torque converter to the drive plate.

CAUTION: Use caution when removing these bolts. Be sure that the converter does not drop when the last bolt is removed.

3. Remove bolts securing drive plate to flywheel.

INSTALLING THE TORQUE CONVERTER

On gasoline model tractors, it is very important that the converter drive plate mounting surface *on the flywheel* be located 1.208" (± .020") from the rear face of the cylinder block.

During manufacturing, the distance is checked and, when necessary, the flywheel is re-machined in order to maintain the proper relationship between these two mounting surfaces.

During manufacturing of Diesel models, this distance is checked and, when necessary, shims (a maximum of 2) are added between flywheel and crankshaft to maintain a distance of .970" (±) .020" between these two mounting surfaces.

Before installing the torque converter drive plate, this distance should be checked . . . particularly after either the flywheel or cylinder block has been replaced.

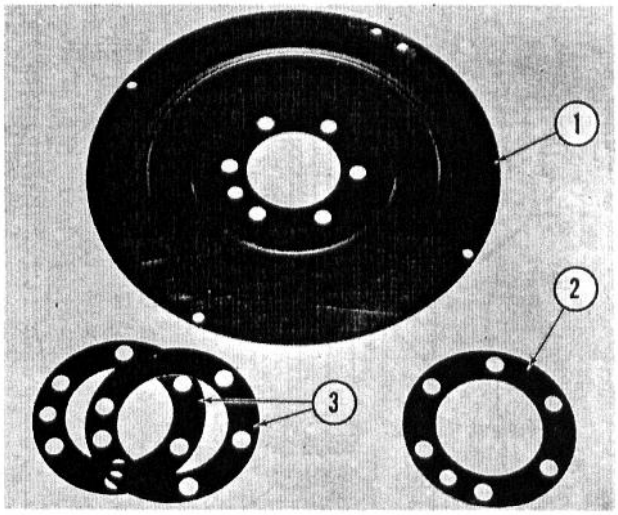

FIG. 7 — CONVERTER DRIVE PLATE COMPONENTS

1. Converter Drive Plate
2. Back-up (reinforcing) Plate 3. Shims (.020")

1. Install the converter drive plate, shown in Fig. 7 to the engine flywheel. Tighten retaining bolts to 76-85 ft.-lbs. torque on diesel models and 50-55 ft.-lbs. torque on gasoline models.

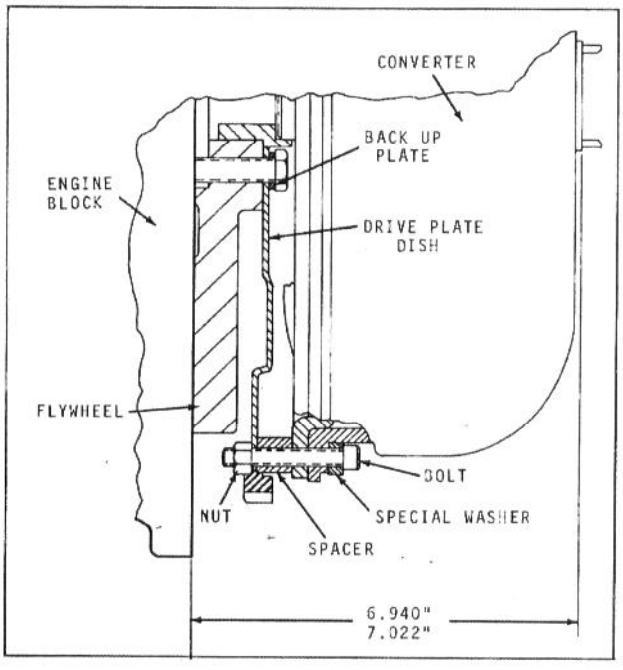

FIG. 8 — CUTAWAY ILLUSTRATION OF TORQUE CONVERTER INSTALLED ON GASOLINE ENGINES

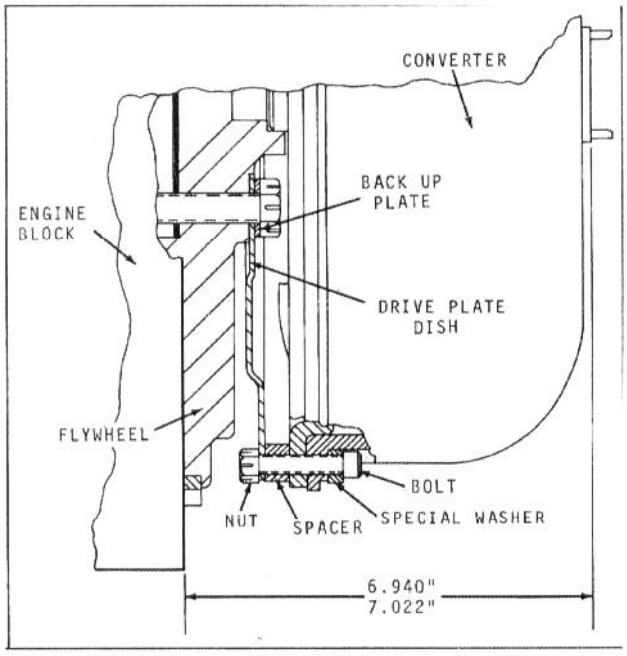

FIG. 9 — CUTAWAY ILLUSTRATION OF TORQUE CONVERTER INSTALLED ON DIESEL ENGINES

Refer to the particular tractor being serviced for installation procedures.

ON GASOLINE MODEL TRACTORS — Refer to Fig. 8 and install drive plate with dish in plate toward the converter.

ON DIESEL MODEL TRACTORS — Refer to Fig. 9 and install drive plate with dish in plate toward the flywheel.

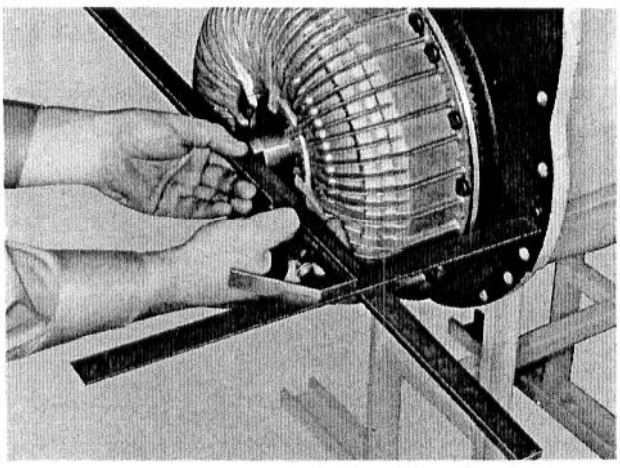

FIG. 10 — MEASURING IMPELLER HUB DISTANCE FROM REAR FACE OF ENGINE BLOCK

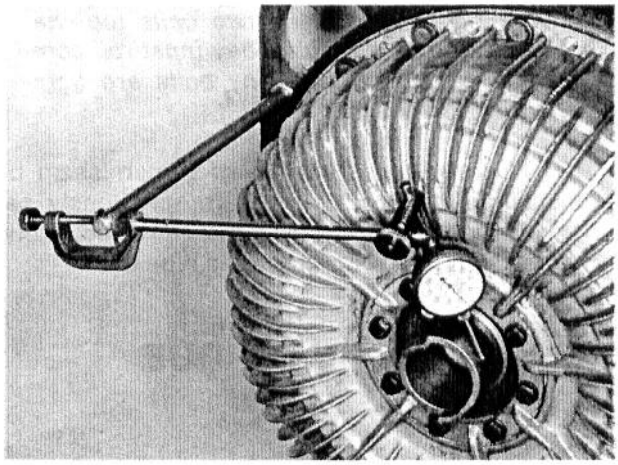

FIG. 11 — MEASURING IMPELLER HUB "RUN-OUT"

NOTE: The back-up plate shown in Figs. 8 and 9 must be installed with bevel edge against plate.

2. Attach converter to drive plate, tightening bolts to 22 ft.-lbs. torque. See Figs. 8 and 9 for arrangement of bolt, special washer, spacer and nut.

3. Lay a straightedge across the impeller hub (not on the lugs) and measure the distance from the rear face of the engine to the straightedge, as shown in Fig. 10. This distance must be maintained to not less than 6.940 inch (6-61/64 inch) and not more than 7.022 inch (7-1/64 inch).

NOTE: To adjust this dimension, shims are available in 0.020 inch thickness. These shims are to be positioned between the flange on the crankshaft and the flywheel. Tighten the bolts securing the drive plate and flywheel to the crankshaft to a torque of 76-85 ft.-lbs.

4. Check the run-out of the impeller hub with a dial indicator as shown in Fig. 11. This run-out must never be greater than 0.020 inch.

NOTE: It is more desirable to reduce this run-out to 0.005 to 0.010 inch. This may be done by slightly bending the drive plate by inserting a pry between the flywheel and converter. Bending is to take place in opposite direction and at the position of the maximum indicated run-out.

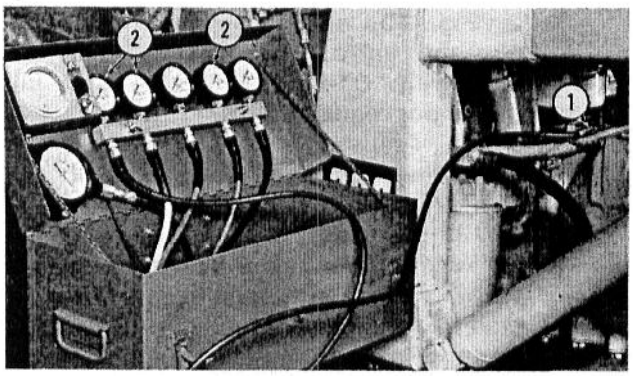

FIG. 12 — HYDRA-ANALYZER CONNECTED TO TRANSMISSION CASE

1. Test Connection Fitting 2. 400 psi Gauges

5. After the converter has been properly installed, refer to "Installing the Transmission" and reassemble the tractor. After the transmission has been filled (refer to Part 1 within this Section for recommended type oil and capacity) run the tractor engine for a short period of time then recheck transmission oil level. Add oil as necessary to maintain level with check plug hole. See Fig. 3.

ADJUSTING LINKAGE (Instant Reverse)

The control linkage for the Instant Reverse Transmission must be adjusted in conjunction with the throttle linkage. Refer to the appropriate heading in "Engines (Gas and Diesel)" for throttle linkage adjustment which also includes transmission (Instant Reverse) control linkage adjustment.

TESTING AND ADJUSTING THE INSTANT REVERSE TRANSMISSION

1. Check transmission oil level and fill as necessary (to the level flug) with the recommended type oil. Make sure that converter has already been filled . . . see Step 5 under "installing the Torque Converter".

2. Use an accurate tachometer and check the following transmission control linkage and throttle linkage adjustments. (Refer to the appropriate heading in "Engines (Gas and Diesel)" to adjust linkage if settings are not within limits.)

a. Engine Low Idle Speed:
Gas — 450-500 rpm
Diesel — 575-625 rpm

b. Transmission Engagement Speed:
Gas — 575-675 rpm
Diesel — 575-675 rpm

(Engagement speed may be checked by slowly depressing the directional pedals, one at a time, until the transmission engages. *If engagement is abrupt, adjustment of the throttle linkage is necessary.)*

c. Engine High Idle Speed (No Load):
Gas — 2400-2450 rpm
Diesel — 2335-2385 rpm

(High idle speed may be checked by depressing *both* directional pedals at the same time to maximum rpm, indicated by tachometer.)

3. After Step #2 has been satisfactorily completed, and with the tachometer connected, check the converter stall torque rpm as follows:

a. Set parking brake and block wheels (to prevent tractor from moving).

b. Place transmission in second gear and planetary in high range.

c. Depress one of the directional pedals all the way down and record the maximum tachometer reading. Stall torque rpm should be:

Gas — 1400 rpm (desirable) — (1300-1450 rpm acceptable)

Diesel — 1390 rpm (desirable) — (1300-1450 rpm acceptable)

d. Depress opposite directional pedal and repeat Step 3c. The results should be the same.

CONCLUSION: If stall torque rpm is too low, it normally indicates that the engine is in poor

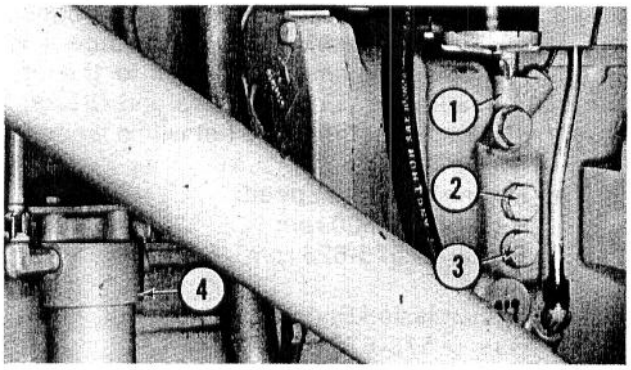

FIG. 13 — INSTANT REVERSE TRANSMISSION REGULATOR VALVES

1. Regulator Block
2. Upper Regulator Valve (80-85 psi)
3. Lower Regulator Valve (80-85 psi)
4. Transmission Oil Filter

operating condition. If stall torque rpm is too high, the transmission clutches, or the torque converter, are slipping.

If stall torque check has indicated the torque converter or transmission clutches are slipping, proceed to Step 4.

4. With tractor engine not running, remove the 1/8 pipe plug at the top of the transmission case.

NOTE: When removing the 1/8 pipe plug, make sure that the bushing does not turn with the plug or damage could occur to the copper tubing connected to the transmission assembly. If this tube is damaged, it will require splitting the tractor between engine and transmission and installing a new tube.

5. Insert the #6 fitting from the Hydra-Analyzer Kit and connect one of the hoses from a 400 psi gauge in the Hydra-Analyzer to this fitting. See Fig. 12.

6. Start tractor engine and run at 1000 rpm. (Do not engage directional pedals at this time.) The gauge should read a minimum of 150 psi (160 psi maximum). If pressure reading is below minimum, proceed as follows:

a. Remove the upper regulator valve, No. 2, Fig. 13, and remove spring, guide pin and valve. Then install *only* the cap (with "O"-Rings in place) back into this upper regulator port.

b. Start the tractor and run engine at 1000 rpm. Pressure gauge should read 80-85 psi. If the pressure is not correct, shut off engine, remove the lower regulator valve, spring, etc., and clean. Then install back into the lower port. Start tractor and check pressures again. If the pressure still is not 80-85 psi, remove the lower valve cap (with engine stopped). Add washers between the spring and the cap to increase the pressure (or remove washers to lower the pressure). Then recheck to obtain the correct pressure setting. Shut off tractor engine.

c. Clean and reinstall the upper regulator valve spring and plug, then check pressures as previously outlined. At this point the pressure reading should be 150-160 psi. If not, add washers between cap and spring to increase pressure (or remove washers to reduce pressure) to the correct setting. Recheck the pressure after adding (or removing) washers.

7. After Step 6 has been satisfactorily completed, check that transmission and planetary is in neutral, and start tractor engine. Then depress one of the directional pedals to engage one of the clutches while observing pressure gauge. The pressure should drop momentarily but recover to within 5 psi of the pressure reading previously obtained in Step 6c. Repeat this check while depressing the opposite directional pedal.

CONCLUSION: If the pressure does not recover to within 5 psi of the reading obtained in Step 6c, it indicates that the *engaged* clutch is leaking. (This would also have been indicated when the converter stall torque rpm was checked.)

If the converter stall torque rpm was too high, but the clutches check out satisfactory, the trouble is in the torque converter.

TROUBLE-SHOOTING THE INSTANT REVERSE

Check that transmission oil level is correct. Add the recommended type oil as necessary. Possible causes of problems are written with the assumption that the oil level and type is correct.

Refer to the problem chart and see the possible cause paragraphs (which also includes the corrections) as directed.

PROBLEM	SEE POSSIBLE CAUSE
1. Jerking (abrupt) starts	A
2. "Sluggishness"	A, B, C, D, E, F, G
3. Clutch Slippage	A, H, I, J, K
4. Clutch Fails to Release	A, J, L, M
5. Overheating	B, I, N
6. Converter "Noisy"	G

Possible Causes and Corrections

A. Transmission control and/or engine throttle linkage not correctly adjusted. Adjust throttle linkage as recommended. If unable to obtain correct adjustment of the linkage, check that the linkage is not binding or damaged (i.e.: bent control rods) and repair as necessary.

B. Operating in too high a gear. Select the correct gear-to-load ratio.

C. Engine in poor operating condition. Check stall torque rpm (see procedures under "Testing and Adjusting Instant Reverse Transmission within this Part). If poor engine condition is indicated, "Tune-up" and/or repair engine as required.

D. Oil sump screen plugged. Remove and clean oil sump screen.

E. Oil suction tube "pulling in" air. Replace seals on both ends of oil suction line.

F. Excessive oil leak in system. Locate and repair leak.

G. Damaged (or excessively worn) torque converter. Remove and repair converter.

H. Regulator valve pressures not correct. See procedures under "Testing and Adjusting the Instant Reverse Transmission" and adjust the regulator valves to the correct pressures.

I. Oil pump damaged or worn excessively. Remove and replace oil pump.

J. Worn or damaged clutch(es). If clutch is slipping, it should be indicated by the tests (see "Testing and Adjusting the Instant Reverse Transmission. Failure to release may not be indicated by the test procedures. However, in either case, repair of the clutch is necessary.

K. Bushing turned, partially closing port to clutch. Repair transmission as necessary.

L. Clutch drain holes plugged (retaining clutch pressure). Remove and repair clutch as necessary.

M. Internal binding of output shaft. Disassemble and repair transmission.

N. Oil cooler fins clogged or damaged and/or obstructions in oil cooler lines. Clean between fins and/or remove obstructions in oil lines. Replace oil cooler if necessary.

INSTANT REVERSE TRANSMISSION AND TORQUE CONVERTER

CONTENTS

This text contains the overhaul procedures for the Instant Reverse Transmission and Torque Converter. Procedures for testing, adjusting and trouble-shooting, removal and re-installation of the transmission and torque converter, may be found in the R&I section of this Manual.

The Instant Reverse Transmission consists of a torque converter, a pair of hydraulically actuated multiple disc clutches, and a two-speed sliding spur gear-type transmission, with a rear-mounted two-speed planetary reduction assembly.

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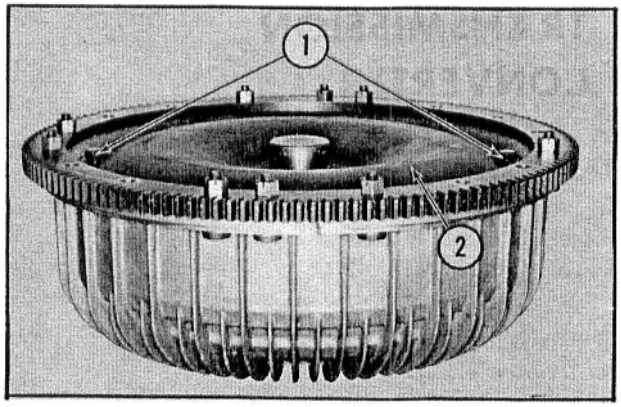


Fig. 1 – Torque Converter

1. Drain Capscrews 2. Front Cover

TORQUE CONVERTER

The Torque Converter consists of three major components: (1) a turbine assembly, (2) an impeller or pump assembly, and (3) a stator and sprag (or one-way clutch assembly).

DISASSEMBLY

1. Remove the cover to impeller mounting bolts then remove front cover. See Figs. 1 and 2.

NOTE: Check to make sure that the ring gear and front cover is marked, where the ring gear is bolted to the front cover, before disassembling units.

2. Remove and discard the cover "O"-ring seal. See Fig. 2.

3. Remove the turbine thrust washer. See Fig. 3.

4. Grasp the turbine by its hub and lift it out of the impeller. See Fig. 4. Drain any remaining oil from the turbine assembly.

5. Lift the stator assembly (with sprag clutch installed) out of the impeller. See Figs. 4 and 5.

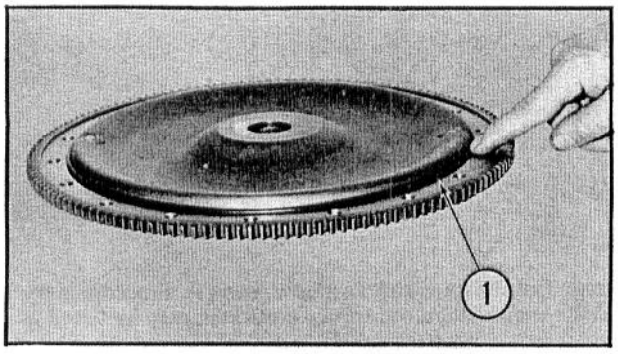


Fig. 2 – Front Cover Assembly

1. "O"-Ring Seal

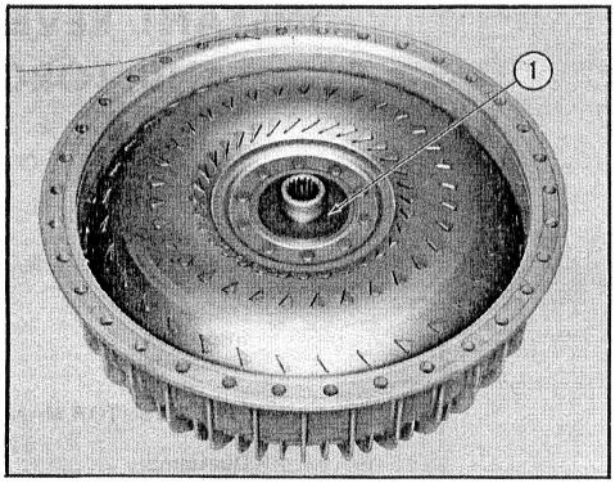


Fig. 3 – Torque Converter W/Front Cover Removed

1. Fiber Thrust Washer

6. Using a screwdriver, remove the front thrust washer retaining snap ring. See Fig. 5.

7. Turn the stator assembly over and allow the sprag assembly to fall into your hand.

NOTE: Do not let the sprag assembly fall on the work bench. The slightest damage may render it unserviceable.

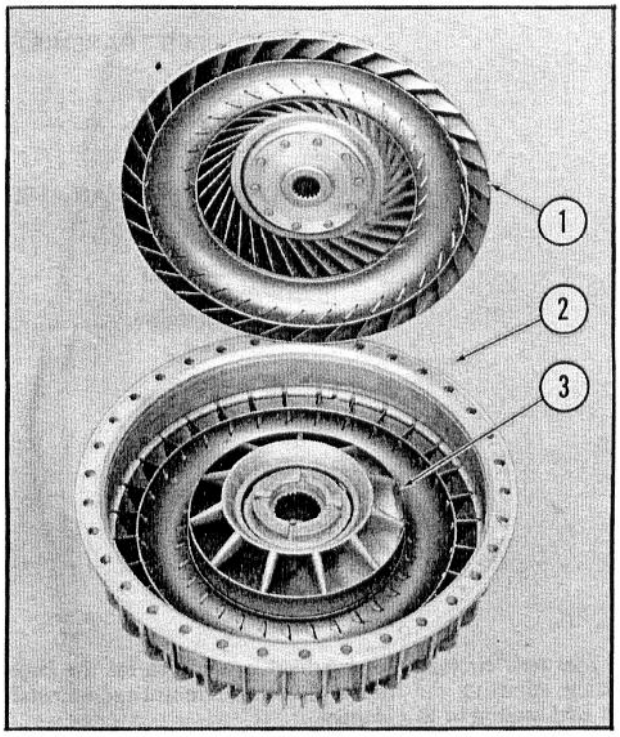


Fig. 4 – Turbine Assembly Removed

1. Turbine Assembly 2. Impeller Assembly 3. Stator Assembly

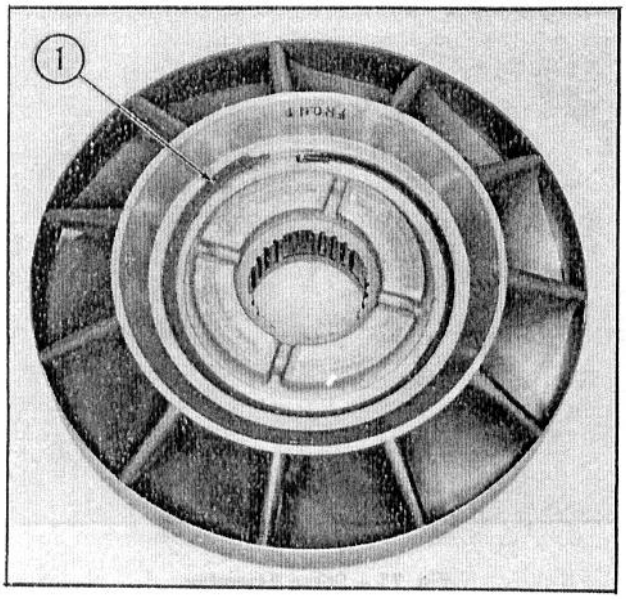


Fig. 5 – Stator Assembly

1. Snap Ring

8. Separate the stator thrust washer from the inner one-way clutch race.

9. Separate the remainder of the sprag unit by sliding the inner race and sprag out of the outer race.

NOTE: Do not damage the machine surfaces of the sprag unit.

10. If the impeller hub seal is to be replaced, mark the impeller and hub before disassembly. See Fig. 6. Remove the impeller hub mounting bolts. Remove and discard the ring seal.

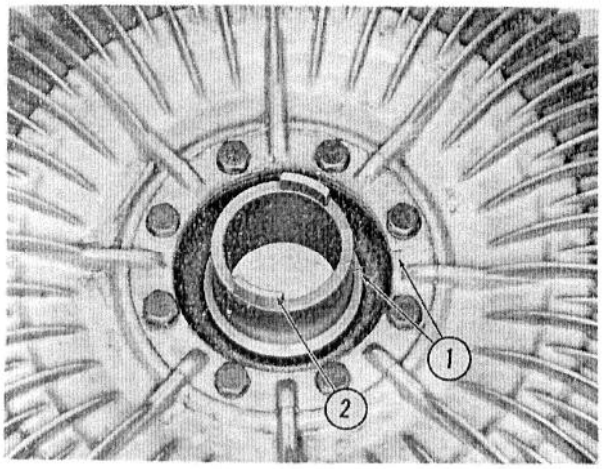


Fig. 6 – Scribing the Impeller and Hub

1. Scribe Marks 2. Lugs

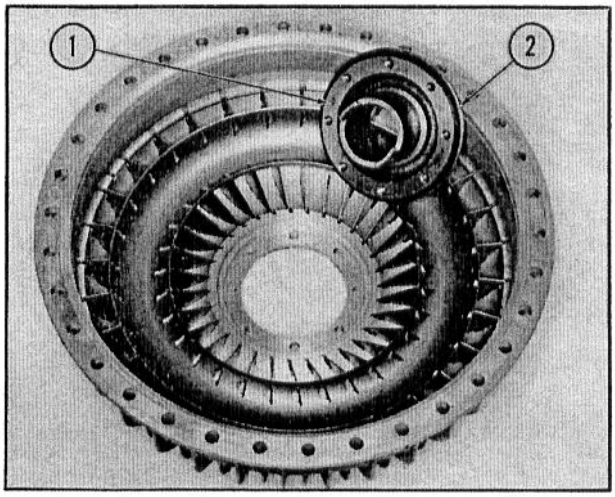


Fig. 7 – Impeller Hub Removed

1. Impeller Hub 2. Ring Seal

INSPECTION

1. Inspect the turbine, stator and impeller for loose or damaged fins. If fins are found to be faulty, repair or replace.

2. Check the sprag assembly for worn or damaged parts. If any of the component parts listed below are found to be defective, it is recommended that all three parts be replaced.

a. One-way clutch assembly

b. Inner one-way clutch race

c. Outer one-way clutch race

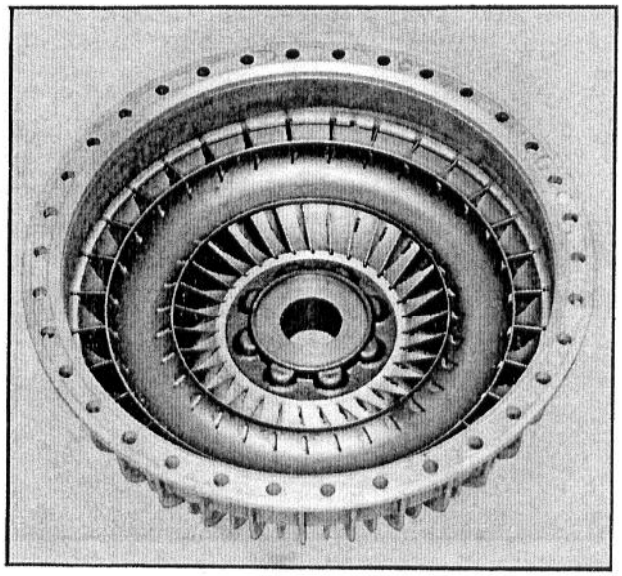


Fig. 8 – Impeller Assembly

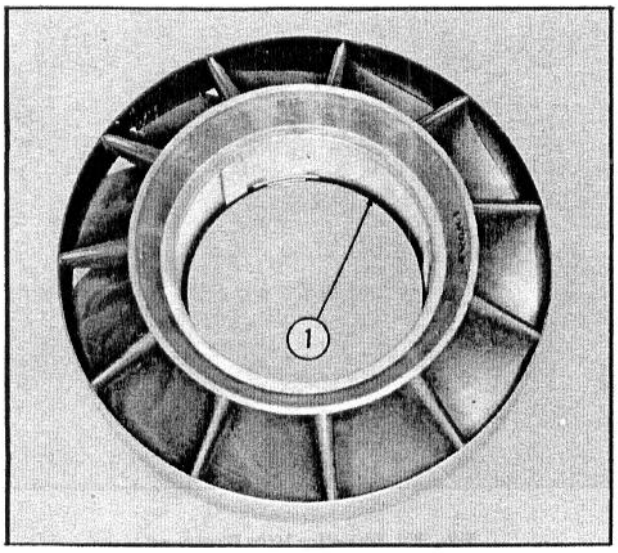


Fig. 9 – Assembling the Stator

1. Snap Ring

3. If the lugs on the impeller hub are damaged, or excessively worn (more than 0.125 inch), replace the hub.

4. Inspect all machine surfaces for nicks or burrs.

REASSEMBLY

1. Reassemble the impeller hub to the impeller, using a new ring seal. See Fig. 7. If the original hub is replaced, make sure the scribe marks are aligned.

2. Place the impeller, hub down, on the bench, as shown in Fig. 8.

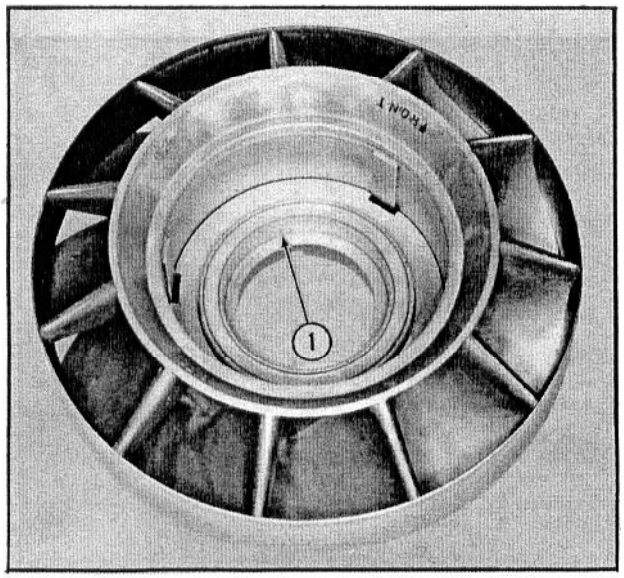


Fig. 10 – Installing the Stator Thrust Washer

1. Counterbored Side

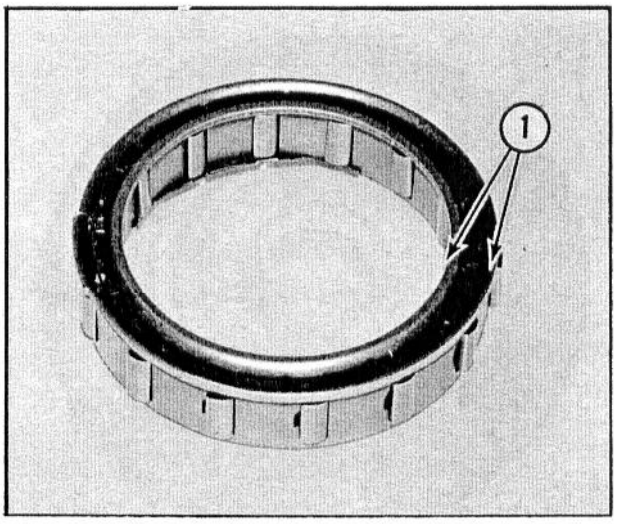


Fig. 11 – Sprag Assembly

1. Flange

3. Place the stator on the bench, with the side marked "FRONT" up (as shown in Fig. 5).

4. Install a snap ring in the bottom groove of the stator. See Fig. 9.

5. Position a stator thrust washer in the stator, with the counterbored side up, as shown in Fig. 10.

6. Install the sprag unit into the outer race so that the flanged side, or side marked "FRONT", is up. See Figs. 11 and 12.

7. Place the outer race, with sprag installed, into the stator. See Fig. 13.

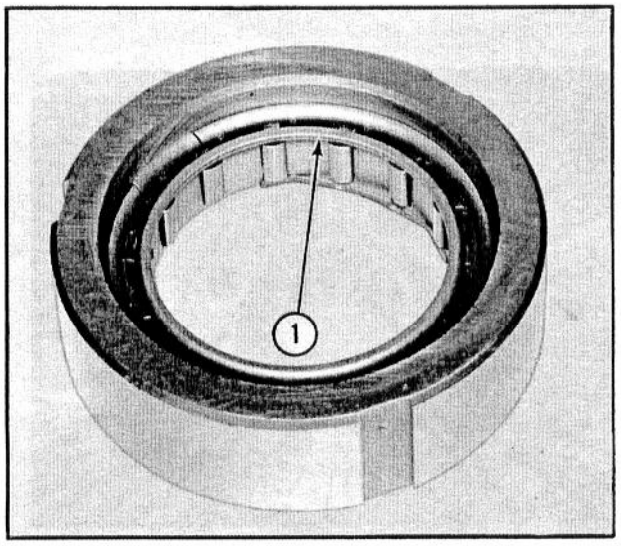


Fig. 12 – Installing the Sprag Assembly

1. Flange

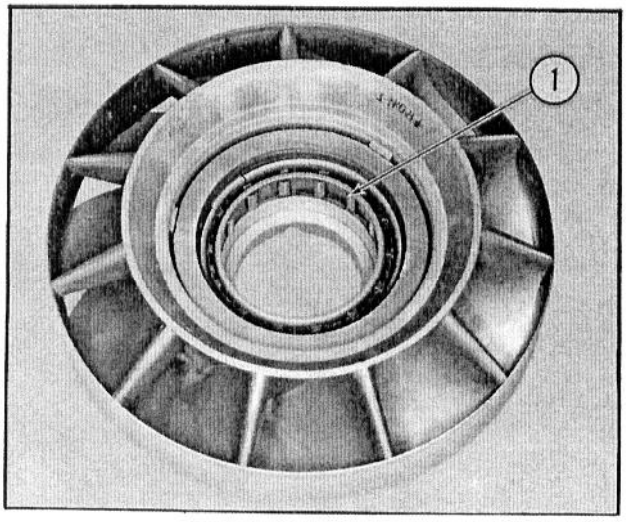


Fig. 13 — Installing the Sprag and Outer Race

1. Flange

8. Install the inner race with the splined end of the race up, as shown in Fig. 14.

9. Install the remaining stator thrust washer, with the counterbored side down, and secure with the retaining snap ring. See Figs. 15 and 16.

10. Position the stator and sprag assembly in the impeller. The side marked "FRONT" will be facing up.

NOTE: Proper installation of the sprag and stator assembly may be checked by holding the sprag inner race and turning the stator. If the stator will rotate freely in a clockwise direction, but locks when a counterclockwise rotation is attempted, it is properly installed.

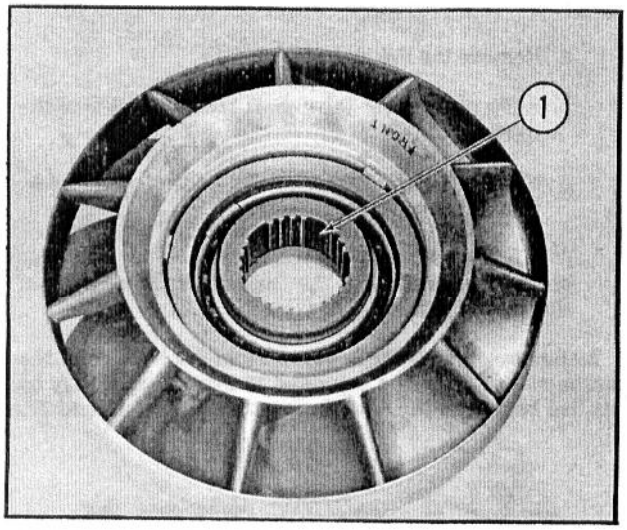


Fig. 14 — Installing the Inner Race

1. Spline

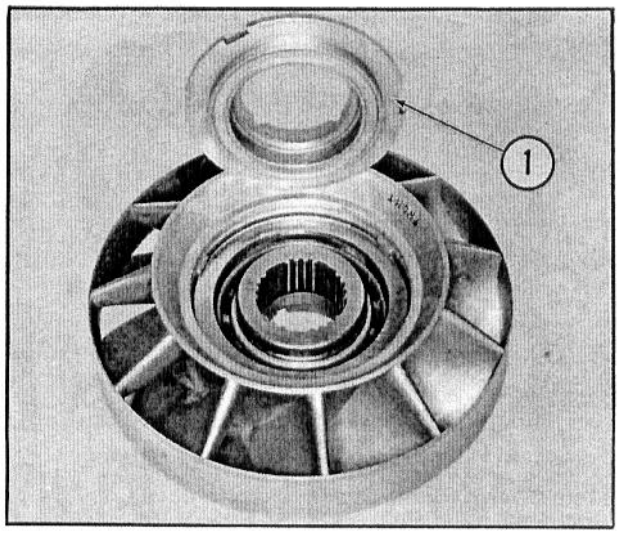


Fig. 15 — Installing Stator Thrust Washer

1. Counterbored Side

11. Install the turbine, fin side down, in the impeller, resting the hub on the stator thrust washer.

12. Install a new fiber turbine thrust washer.

13. Fit a new ring seal on the front cover assembly and install the front cover on the impeller assembly.

14. Install the front cover to impeller mounting bolts. Make sure the bolt holes used to install the converter to drive plate are left open. Use new self-locking nuts and tighten to 22 ft.-lbs. torque.

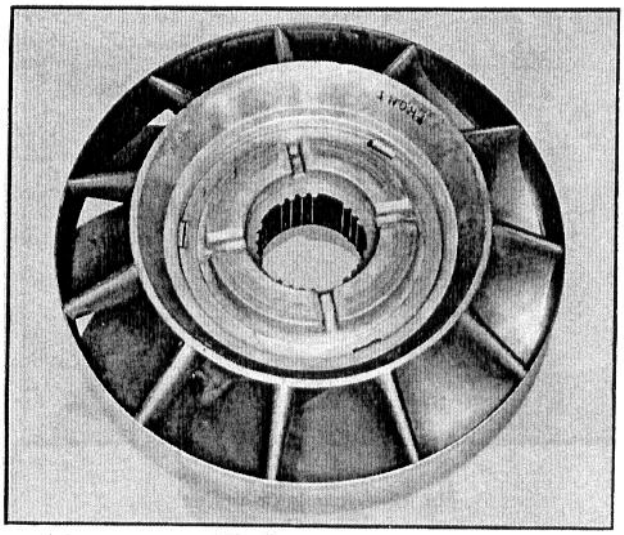


Fig. 16 — Stator Thrust Washer Installed

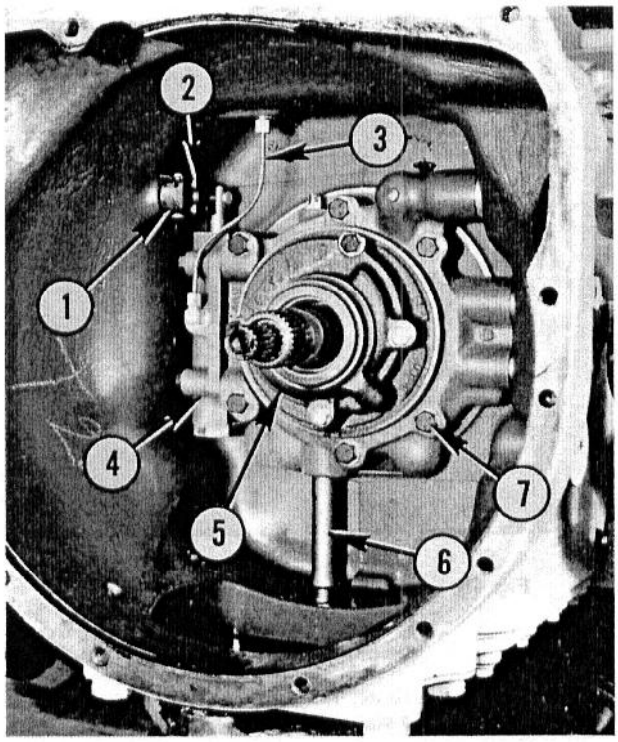


Fig. 17 – Oil Manifold, Pump and Valve Linkage

1. Link Pin
2. Control Valve Lever
3. Copper Tube
4. Control Valve
5. Pump
6. Suction Tube
7. Oil Distributor Manifold

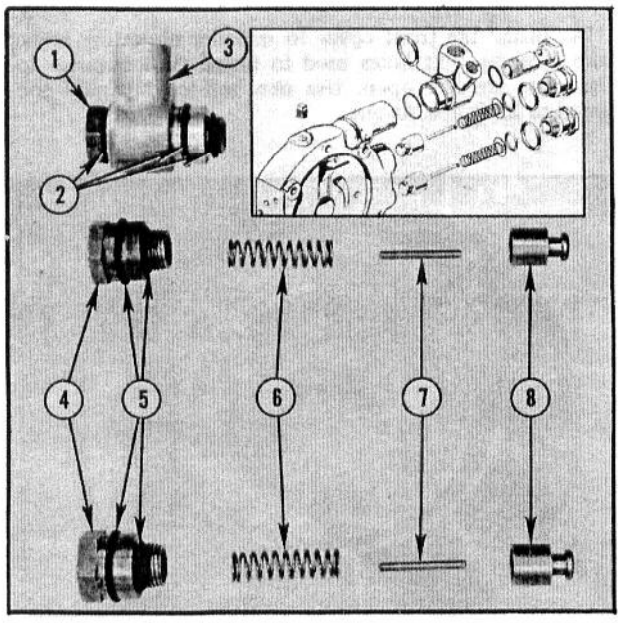


Fig. 18 – Regulator Valves

1. Valve End Cap
2. "O"-Rings
3. Valve Block
4. Valve End Caps
5. "O"-Rings
6. Springs
7. Guide Pins
8. Valves

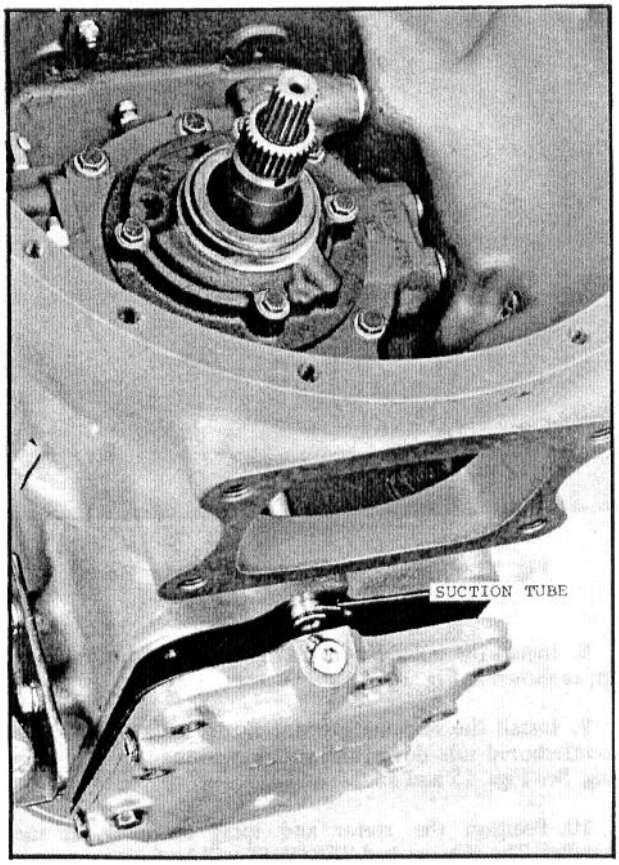


Fig. 19 – Removing Transmission Case Oil Sump

OIL DISTRIBUTOR MANIFOLD

REMOVAL

1. Disconnect and remove the control valve linkage from the right side of the transmission as follows . . . see Fig. 17:

   a. Remove the link pin.

   b. Slide the control valve shaft out of the side of the transmission.

   c. Move the forked end of the control valve lever, free of the valve.

   NOTE: Check the caged needle bearing for the control valve linkage for wear and damage. Replace, if necessary.

2. Remove the regulator valves from the left side of the transmission. Keep them separated so that the parts may be installed back into their *original* ports. See Figs. 18 and 22.

CAUTION: Make sure that the regulator springs do not "fly out" and injure anyone.

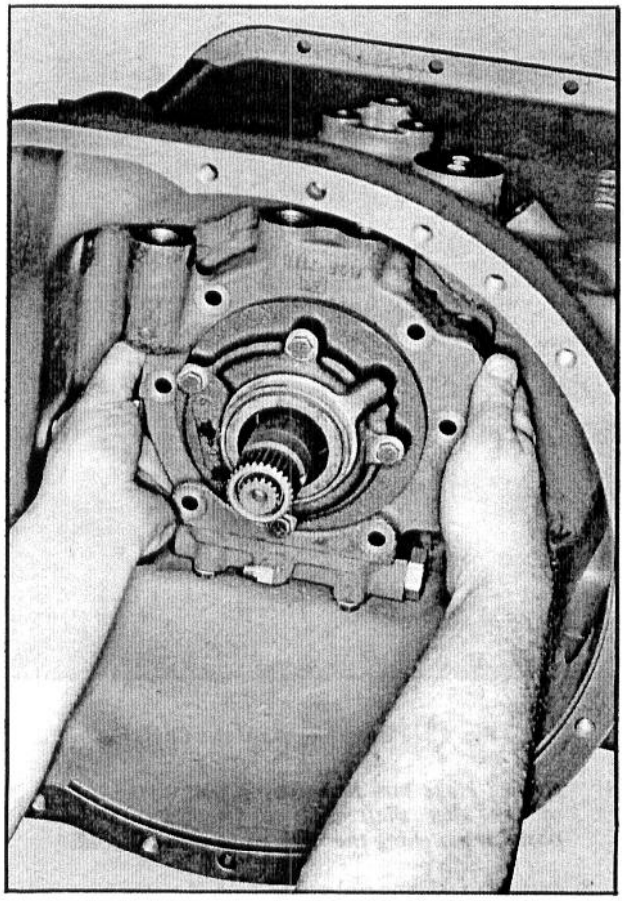


Fig. 20 – Removing/Installing Oil Distributor Manifold

3. Disconnect the small copper line going from the manifold to the pressure check outlet. See Fig. 17.

4. Remove the transmission case oil sump from the bottom of the transmission housing. See Fig. 19. Remove the oil suction tube from the bottom of the manifold.

NOTE: Resistance met when removing the sump is caused by the oil suction tube which is sealed in the sump with an "O"-ring.

5. Remove the capscrews (with the dyna-seal washers) attaching the oil manifold to the transmission. Lift out the manifold, as shown in Fig. 20.

NOTE: Be sure to lift the manifold straight up so that the steel sealing rings are not damaged.

DISASSEMBLY

Disassembly of the manifold is limited to the removal and disassembly of the control valve and pump. Refer to "Pump" heading for pump procedures.

The control valve body and spool are available only as a "matched" set; therefore, valve servicir limited to seal, spring and spring guide replacement.

1. If desired, remove the valve by taking out the two capscrews, with shake-proof washers, attaching the valve body to the oil distributor manifold. (The valve spool may be removed and disassembled without removing the valve body from the manifold. It is recommended, however, that any time the valve spool or oil distributor manifold is removed, the valve body be removed and the "O"-rings between the valve body and the oil manifold be renewed. (See Fig. 21.)

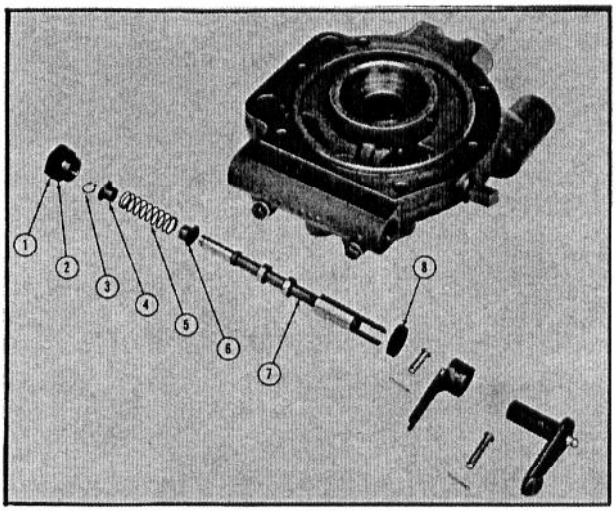


Fig. 21 – Control Valve – Identification of Parts

1. Valve End Cap
2. "O"-Ring
3. Snap Ring
4. Spring Guide
5. Spring
6. Spring Guide
7. Spool
8. Oil Seal

2. Remove any remaining pins from the valve linkage connection.

NOTE: Make certain that all burrs are removed from the clevis end of the valve spool.

3. Unscrew the valve end cap and slide the valve spool out of the end cap opening in the valve body.

4. Pry out the valve spool oil seal.

5. Compress the valve spring and lower guide and remove the snap ring.

6. Slide the two valve spring guides and the valve spring from the valve spool.

INSPECTION

Thoroughly clean all parts. Make sure that all pieces of old gaskets, "O"-rings, etc., are removed and that all surfaces are free of dirt and grit.

1. Check the manifold for cracks and damage. Replace, if necessary.

2. Inspect the valve spool and body for wear, grooving and scoring.

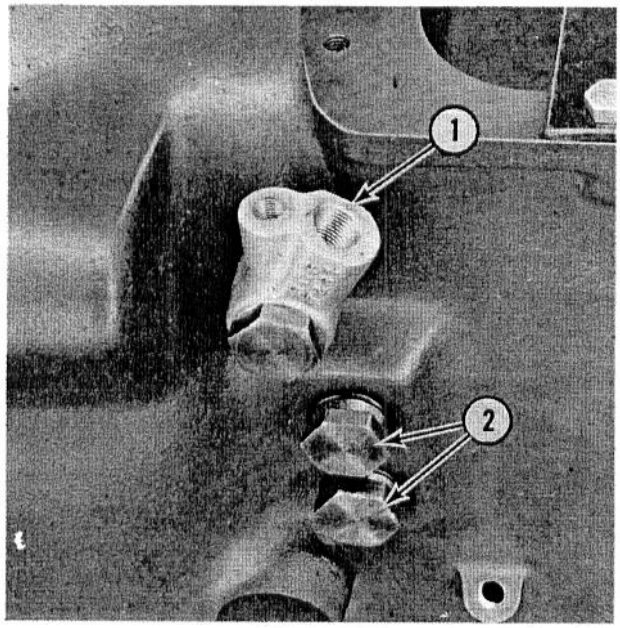


Fig. 22 – Installing the Valve Block

1. Valve Block

NOTE: If replacement of the valve spool or valve body is necessary, they must be replaced as a "matched" set.

3. Test the springs with a tester. Compare the springs with the values in the following chart.

Spring	Test Length (Inches)	Test Procedure (Pounds)
80–160 lb. Regulator	1½	10
Control Valve	7/8	5

4. Check the control valve linkage needle bearing. If replacement is deemed necessary, remove by driving on the lettered side of the needle bearing cage.

5. Inspect the regulator valves for scoring and grooving. Check the guide pins for straightness. See that they do not bind in the regulator valves. Replace, if necessary.

ASSEMBLY AND INSTALLATION

1. Assemble the valve by reversing the disassembly procedure. Press the spool oil seal in until it is flush with the face of the valve body. Replace all the "O"-rings in the valve assembly and between the valve body and manifold. Then, position the valve body onto the manifold. Using new shake-proof washers, install the capscrews and tighten them to 19 ft.-lbs. torque.

2. Position a new gasket in the transmission housing and slide the manifold straight down over the power input shaft assembly, being careful not to damage the three steel sealing rings.

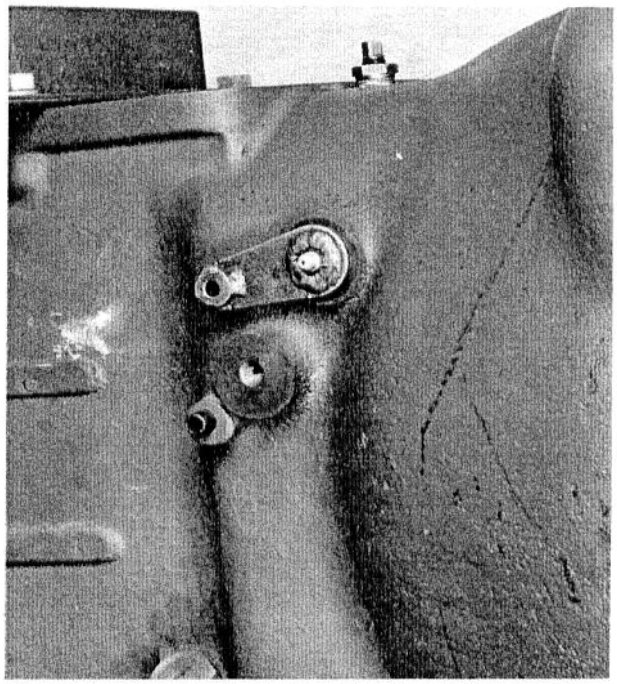


Fig. 23 – Installing the Valve Shaft

NOTE: Make sure that the roll pins at the top of the idler shaft and countershaft are in position matching the recesses in the manifold.

3. Install new Dyna-seal washers on the attaching bolts and install the bolts. Tighten them to 25 ft.-lbs. torque.

4. Position new "O"-ring seals on the regulator valve caps. Install the regulator valves, guide pins, springs and caps.

NOTE: Make sure that the guide pins are not allowed to drop out of the regulator valves while installing the caps.

5. Install "valve" block and cap.

NOTE: Install the valve block so that the smallest port opening is in the vertical position. See Fig. 22.

6. Position a new "O"-ring on each end of the oil suction tube and insert the tube into the manifold.

7. Position the oil sump screen and new gasket onto the housing oil sump and install the sump. Tighten the bolts to a 35 ft.-lbs. torque.

NOTE: Use care when installing the housing oil sump that the "O"-rings on the suction tube are not damaged.

8. Install the copper line from the pressure check outlet to the manifold.

9. Insert the shortest pin into the clevis end of the valve and install a cotter pin. Position the valve lever fork on the pin and slide the valve shaft through the needle bearings in

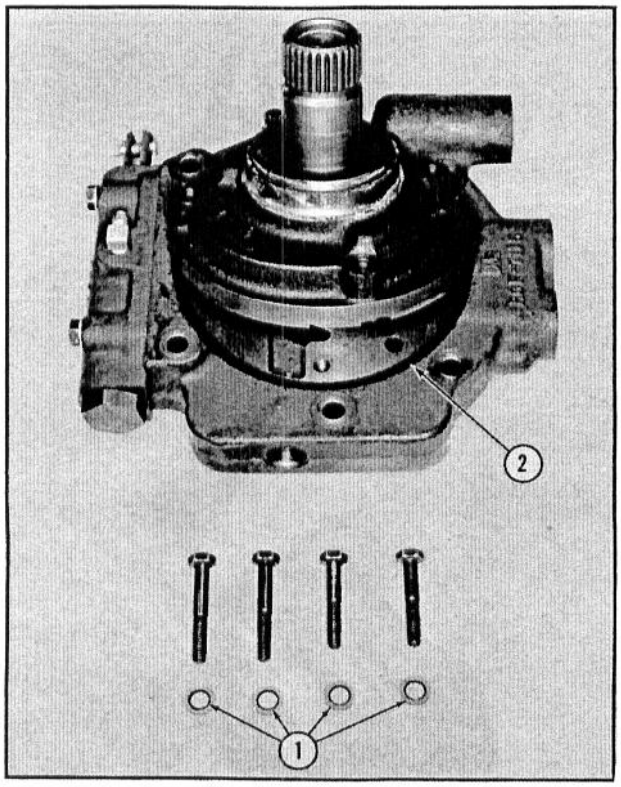


Fig. 24 – Removing the Oil Pump

1. Dyna-Seal Washers
2. Ring Seal

the housing and into the lever. Insert a pin through the lever and shaft and install a cotter pin.

NOTE: The arms of the lever and the shaft will point in the same direction. See Fig. 23.

10. Install the pump. See "Pump".

NOTE: Apply a light coat of Lubriplate (Grade 70 – or an equivalent) to the splines of the oil pump and the input shaft after installing the pump.

11. Check the performance and operation of the Instant Reverse Transmission and make necessary adjustments after re-installation in tractor.

NOTE: Whenever servicing a section of the Instant Reverse Transmission, it is recommended that the entire transmission be serviced at the same time.

PUMP

The pump is a non-repairable item. Servicing of the pump is limited to replacement of the front oil seal.

REMOVAL

1. Remove the pump-to-oil manifold attaching capscrews and dyna-seal washers. See Fig. 24.

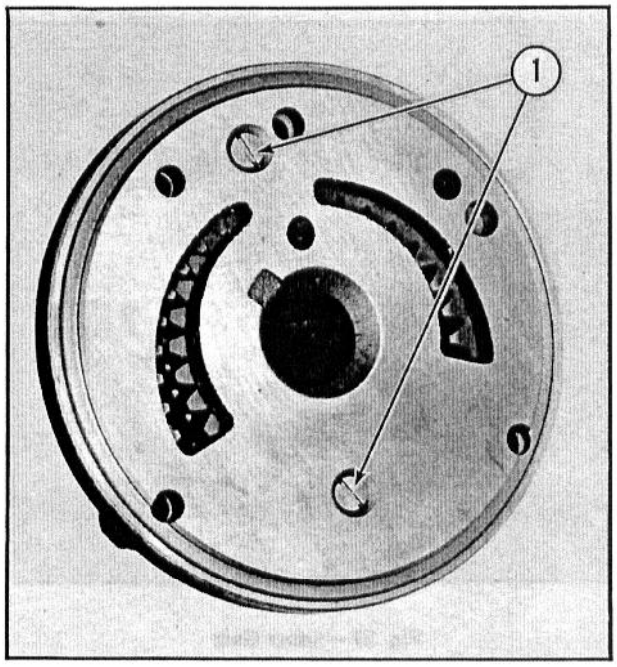


Fig. 25 – Rear View of Pump

1. Slotted-Head Screws

DISASSEMBLY

1. Discard the ring seals which are located between the oil manifold and pump.

2. Set the pump on the splined end.

3. Remove the 2 screws, located on the back of the pump, that hold the face plate and pump body together. See Fig. 25.

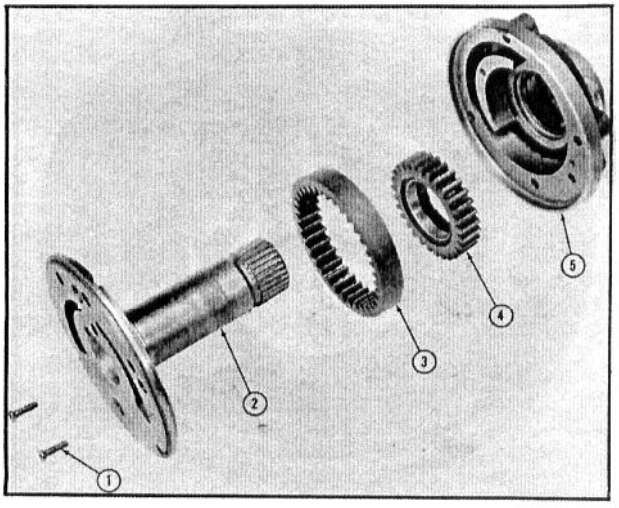


Fig. 26 – Oil Pump – Exploded View

1. Slotted-Head Screw
2. Pump Face Plate
3. Outer Gear
4. Inner Gear
5. Pump Body

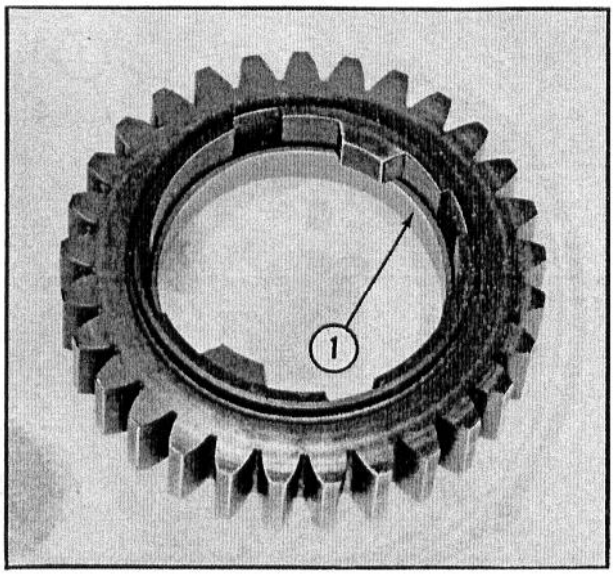


Fig. 27 – Inner Gear

1. Bronze Bushing

4. Lift the inner and outer gears out of the pump body. See Fig. 26.

INSPECTION

1. Inspect the face plate, the bottom face in the pump body and the gears for wear, damage and galling.

2. Check the bronze bushing in the inner gear for scoring, gouging and grooving. See Fig. 27.

3. Check the bronze bushing in the pump face plate shaft for wear.

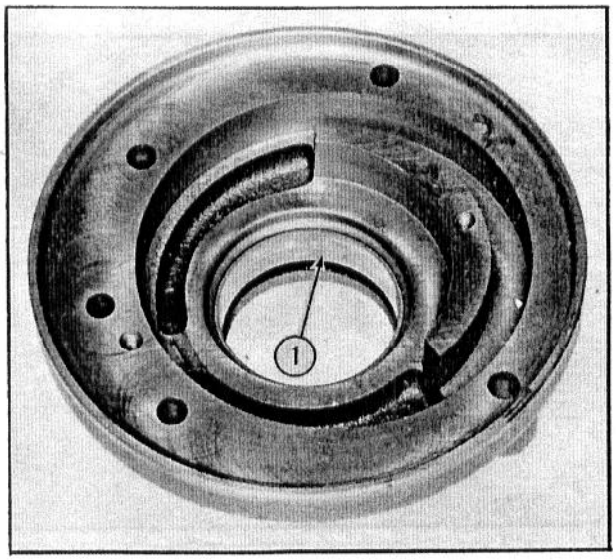


Fig. 28 – Pump Body

1. Babbit Bearing Surface

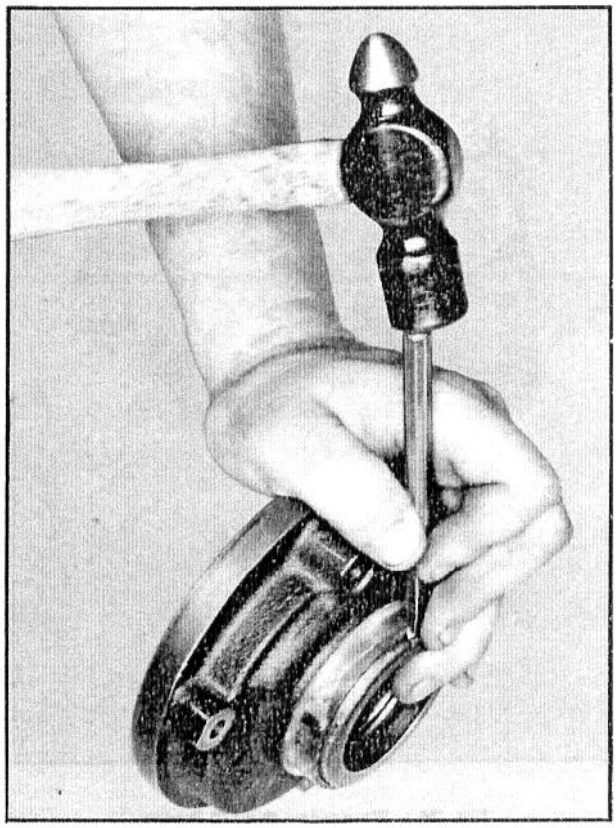


Fig. 29 – Removing Front Oil Seal

4. Check the babbit bearing surface in the pump body for scoring, gouging and grooving. See Fig. 28. (It is especially important that the babbit area be free of the defects stated, as it forms the major seal between the pump and the converter hub. The outer seal is there to stop the small amount of oil which seeps past the babbit surface. If, during the time of "splitting" the tractor, or reassembling it, guide studs are not used, it is almost certain that the lugs on the converter hub will peel, or gouge, a groove across the babbit surface. Should this happen, the front seal will become overloaded and begin to leak.)

NOTE: Never replace the front seal without disassembling the pump and inspecting the areas previously mentioned. If any of the foregoing defects are noted, it will be necessary to replace the pump.

5. Remove the front seal, see Fig. 29. When installing a new seal, press the seal in until it bottoms into the shoulder of the pump body.

ASSEMBLY AND INSTALLATION

1. Position the pump body on the bench with the front seal down.

2. Place the inner gear into the pump body, with the bronze bushing up. Mesh the outer gear (either side up) with the inner gear and allow the outer gear to slide into the pump body.

3. Insert the shaft through the pump body and carefully guide it through the babbit sealing area. Tighten the slotted head screws.

NOTE: A small amount of lightweight oil should be used when installing the face plate and shaft to the pump body.

4. Replace the gasket between the manifold and pump body. Install new dyna-seal washers on the pump attaching capscrews. Attach the pump body to the oil manifold.

NOTE: Tighten the capscrews to a torque of 14 ft.-lbs. apply a light coat of Lubriplate (Grade 70 – or an equivalent) to the oil pump and input shaft splines after installing the pump.

5. Test the performance and operation of the transmission and converter.

NOTE: Whenever servicing a section of the transmission, always service the entire transmission at the same time.

CLUTCH PACKS

Servicing of this area, shown in Fig. 30, of the Instant Reverse Transmission is best accomplished with the transmission setting with its converter end upward.

REMOVAL

1. Remove the oil manifold and pump as one unit.

2. Hook the tool, shown in Fig. 31, around the countershaft gear fiber thrust washer.

NOTE: The tool shown is made from sheet metal approximately the same thickness as the fiber thrust washer.

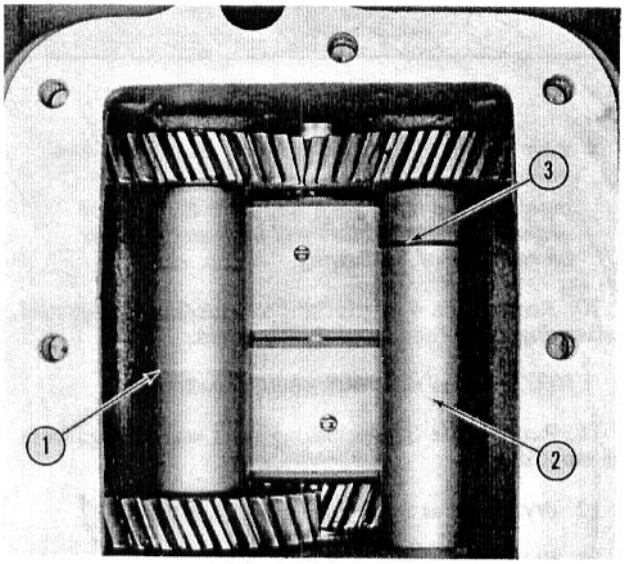


Fig. 30 – Instant Reverse

1. Countershaft
2. Idler Shaft
3. Fiber Thrust Washer

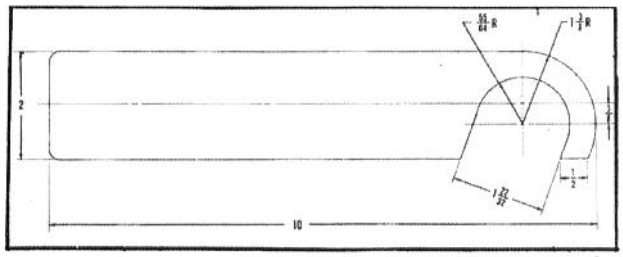


Fig. 31 – Countershaft Thrust Washer Tool

3. Remove the countershaft from the converter end of the transmission housing.

4. Slide the countershaft gear (complete with its four paths of 17 loose needle bearings totaling 68 rollers) further up the handle of the tool, as shown in Fig. 32. This keeps the loose rollers in place. Slide the tool and the countershaft gear assembly out of the transmission.

5. Remove the idler shaft from the converter end of the transmission housing.

6. Carefully grasp the idler spacer and slide it out of the transmission housing, as shown in Fig. 33.

NOTE: Do not tip or bump the idler spacer as it is brought out of the housing. The idler gear with its two paths of loose needle roller bearings (16 rollers per path – total 32 rollers) is just "balanced" on top of the spacer.

7. Grasp the input shaft of the clutch packs and lift

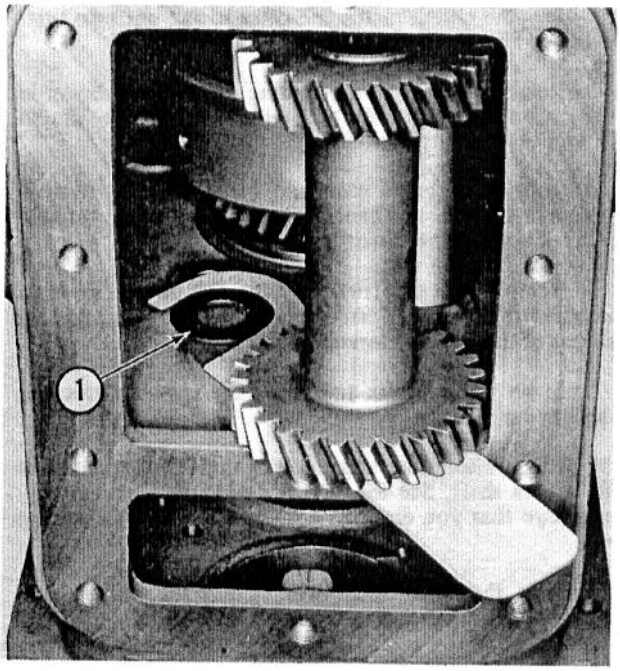


Fig. 32 – Removing the Countershaft

1. Fiber Thrust Washer

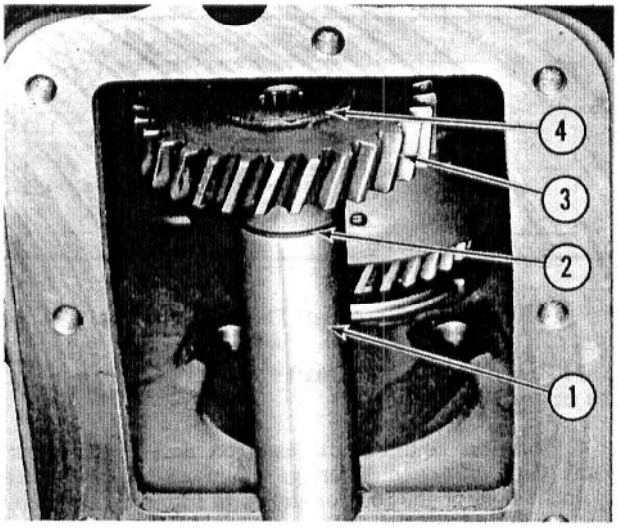


Fig. 33 – Removing the Idler Shaft

1. Idler Shaft Spacer
2. Fiber Thrust Washer
3. Idler Gear
4. Thrust Washer

them out of the housing. Make certain that the shims around the output bearing are also removed.

DISASSEMBLY

1. Stand the clutch pack assembly (shown in Fig. 34) on the output shaft gear and remove the snap ring, while holding the input shaft assembly into the forward clutch cylinder assembly. See Fig. 35.

2. Grasp the input clutch hub and slide it out of the clutch plates and discs. Invert the entire clutch assembly and allow the clutch plates and discs to fall out into your hand. See Fig. 36.

3. Remove the snap ring, holding the clutch cylinder in position on the output shaft. See Fig. 37. Slide the clutch cylinder off the output shaft.

4. Invert the clutch pack and place the output shaft through a hole in the bench, or use some other suitable means of holding the clutch pack.

5. Remove the snap ring securing the output shaft to the clutch cylinder and slide the output shaft straight up and out of the cylinder assembly. See Fig. 38.

6. Invert the cylinder and catch the clutch plates and discs in your hand.

7. Remove the snap ring securing the clutch hub to the end of the shaft. See Fig. 39. Slide the hub straight up, being sure that you do not "hang up" on the steel sealing rings.

8. Slide the fiber thrust washer and the output gear assembly off the output shaft. See Fig. 40.

9. Remove snap ring securing bearing to the output shaft and pry bearing and slinger from shaft. See Fig. 41.

NOTE: It may be necessary to use a piece of pipe over the input shaft and press shaft out of bearing. Certain tractors will have an oil slinger on each side of the bearing.

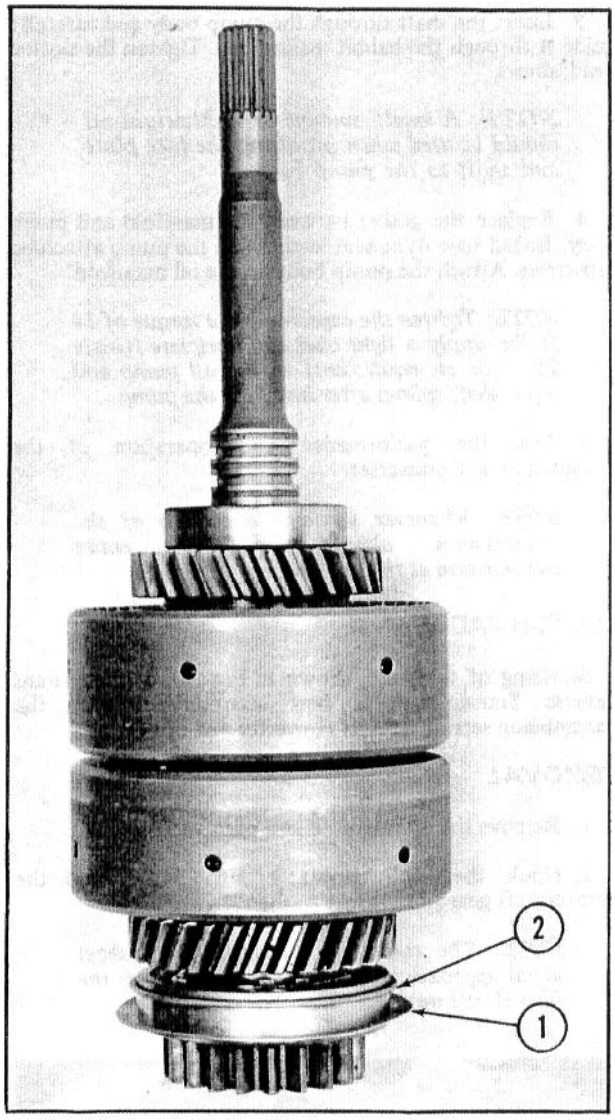


Fig. 34 – Clutch Pack Assembly

1. Shim
2. Snap Ring

10. Remove the 4 interlocking and the 2 butt joint steel sealing rings from the output shaft grooves.

NOTE: Install new rings when reassembling.

11. Remove the 3 interlocking steel sealing rings from the input shaft.

12. Pry the input shaft bearing from the shaft.

13. Both clutch cylinder assemblies may be disassembled, as follows:

a. Use a suitable tool to compress the cylinder return spring slightly and remove the spiral snap ring. See

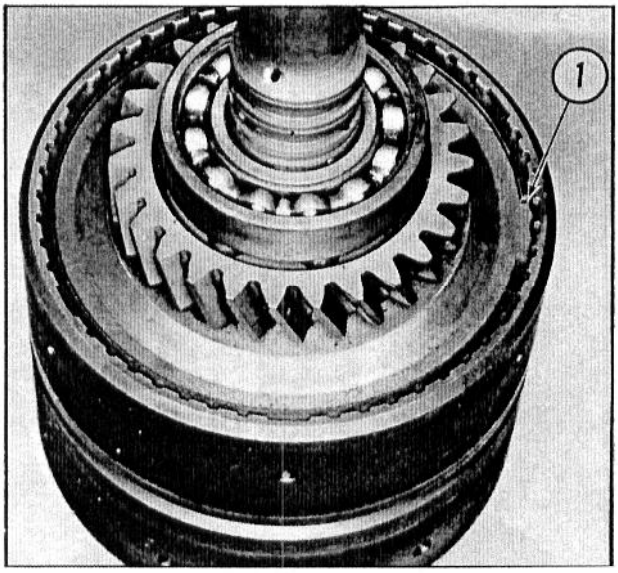


Fig. 35 – Removing the Input Shaft

1. Snap Ring

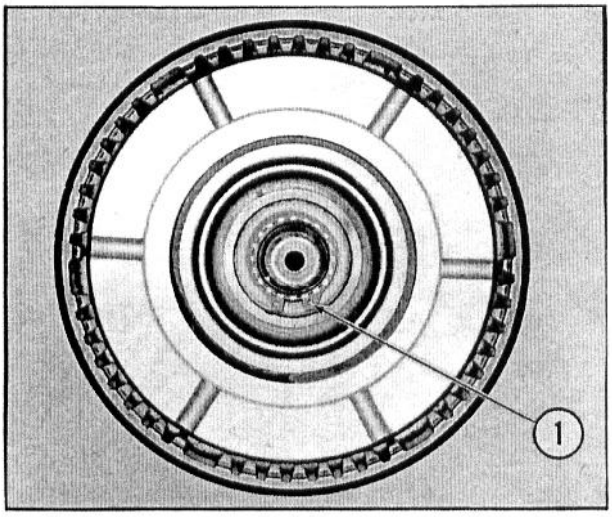


Fig. 37 – Removing the Cylinder

1. Snap Ring

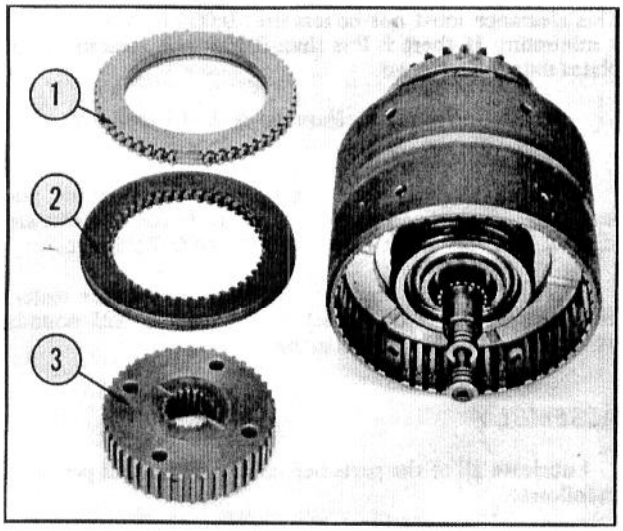


Fig. 36 – Clutch Pack Cylinder Assembly Components

1. Clutch Plates 2. Clutch Discs 3. Clutch Hub

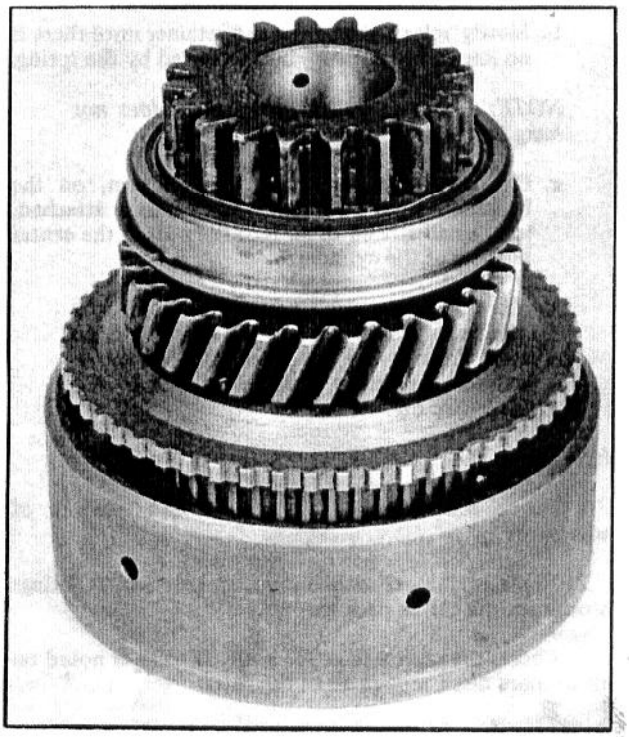


Fig. 38 – Output Shaft Removed

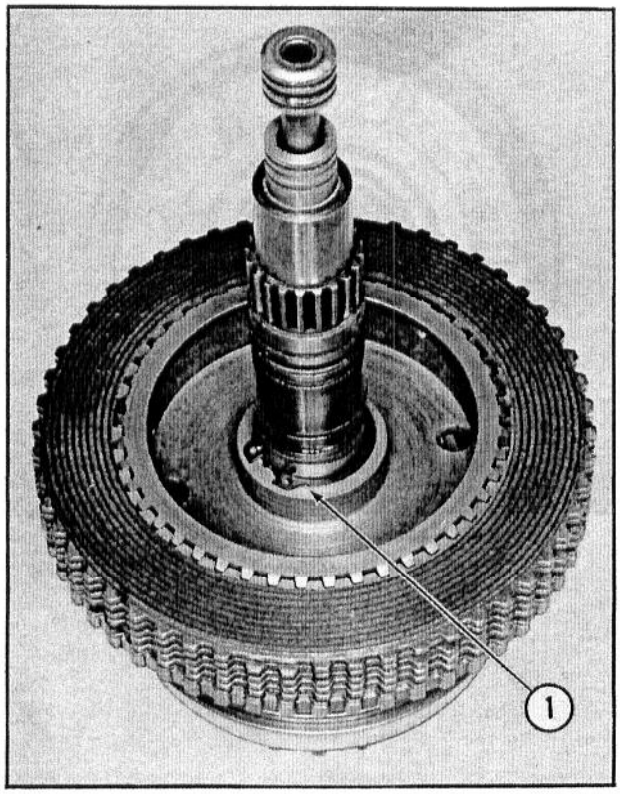


Fig. 39 – Removing the Clutch Hub

1. Snap Ring

Fig. 42. A press may be used, if desired.

b. Slowly release the spring and retainer until there is no longer any pressure being exerted by the spring.

NOTE: Make sure that the retainer does not hang up in the spiral snap ring groove.

c. Place the cylinder, cupped side down, on the bench. Using an air hose, with a nozzle attached, jet a small stream of air into the port in the center bushing of the cylinder.

NOTE: Using "spurts" of air, rather than a continuous stream, will facilitate piston removal. Do not lose the small steel ball which is between the piston and the backside of the cylinder. See Fig. 43.

INSPECTION

1. Check the bearings for damage and freedom of movement.

2. Replace all steel sealing rings, gaskets and "O"-rings throughout the clutch pack assembly.

3. Check the clutch discs for wear. If wear is noted on one or more discs, replace all of the discs.

4. Lay the clutch plates on a surface plate (or plate glass, if surface plate is not available), with the "dished" side of the clutch plate down. Using a feeler gauge, check

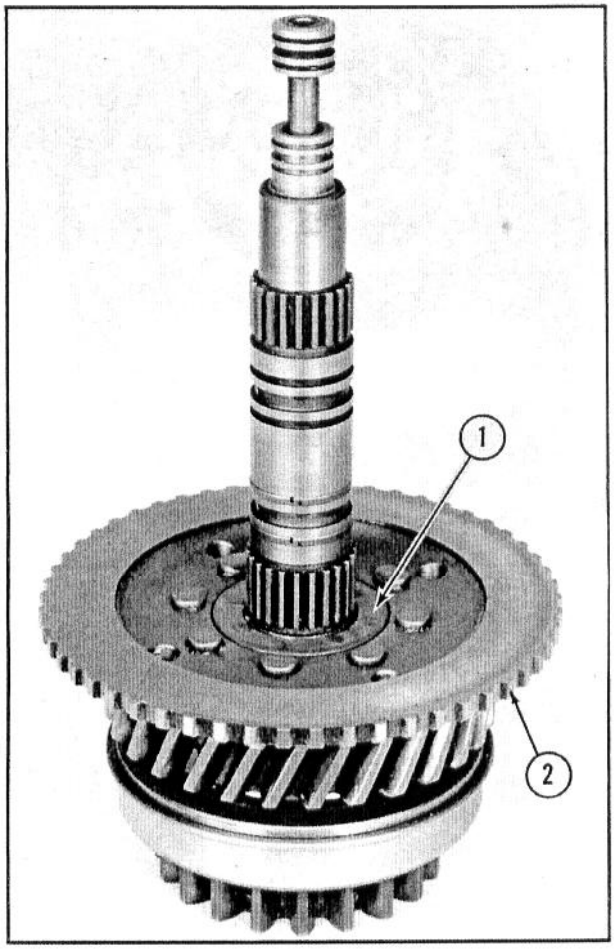


Fig. 40 – Output Gear Assembly Installed

1. Thrust Washer 2. Output Gear Assembly

the clearance at the inner diameter, as shown in Fig. 44. This clearance must not be less than 0.005 to 0.007 inch as a minimum. If there is less than 0.005 inch clearance, the plates must be replaced.

NOTE: New plate clearance is 0.015 to 0.018 inch.

5. Check all bushings to make sure that they are not scored or damaged and that all of the ports and oil holes are aligned. Radial clearance must not exceed 0.0035 inch.

6. Test the clutch springs with a spring pressure tester. The test reading on the spring should be 200–225 pounds when compressed to 1-3/16 inches.

ASSEMBLY

Lubricate all of the parts before assembling and proceed, as follows:

1. Place a small steel ball in the recess in the cylinder. Install a new ring in place on the piston and around the center hub of the cylinder. Lubricate these areas and slide the piston into position in the cylinder. See Fig. 45.

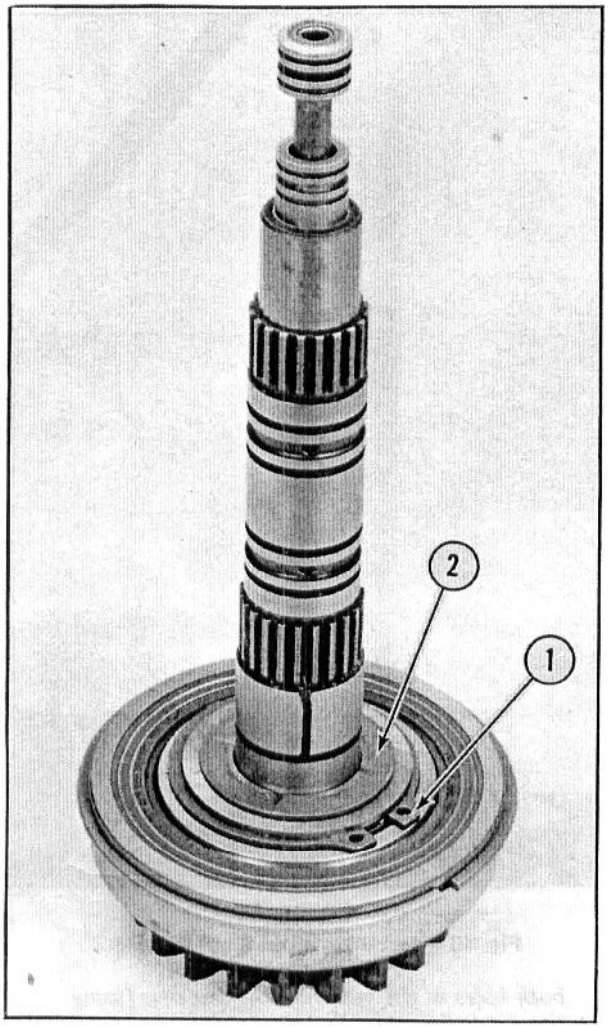


Fig. 41 – Output Shaft Bearing Installed

1. Snap Ring
2. Thrust Washer

2. Position the spring, spring retainer and spiral snap ring over the piston hub and mount the cylinder in a press or install the compressing tool.

3. Compress the spring and install the spiral snap ring. Make sure that the spring retainer does not hang up on the spiral snap ring groove.

NOTE: Repeat Steps 1, 2 and 3 for each of the clutch cylinders.

4. Mount the input shaft in a press and press the input shaft bearing on until it bottoms against the shoulder. See Fig. 46.

NOTE: Make sure that the press sleeve only contacts the inner race of the bearing and is of sufficient length so that the press does not strike (or come in contact with) the end of the input shaft.

5. With the output shaft setting on the output gear, install the slinger over the shaft and then press on the outer

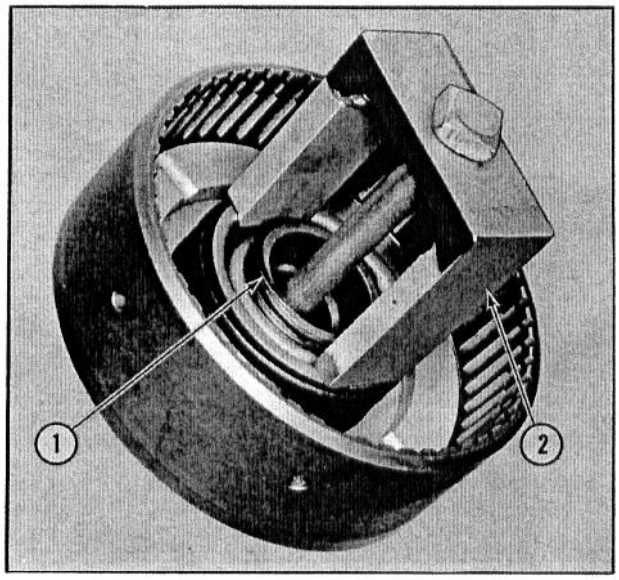


Fig. 42 – Removing Spiral Snap Ring

1. Spiral Snap Ring
2. Tool Used to Compress Spring

bearing. See Fig. 47. Install another oil slinger and secure with snap ring.

NOTE: A second slinger must be added to prevent mixing of the transmission oils. Position the slingers with "dish" toward bearing. Install bearing with snap ring groove away from gear.

6. Position a thrust washer over the output shaft and then install the output gear assembly (with the gear down). Place a second thrust washer down over the output shaft. See Figs. 40 and 41.

7. Closely examine the clutch hubs. Notice that there are three levels of drain holes, approximately 180° apart,

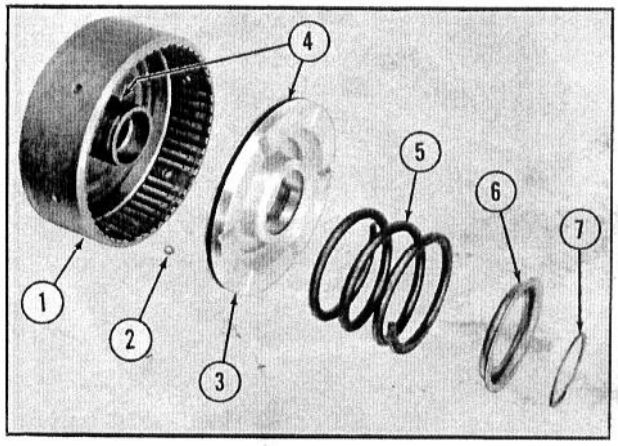


Fig. 43 – Cylinder Assembly – Exploded View

1. Cylinder
2. Steel Ball
3. Piston
4. Ring
5. Spring
6. Retainer
7. Snap Ring

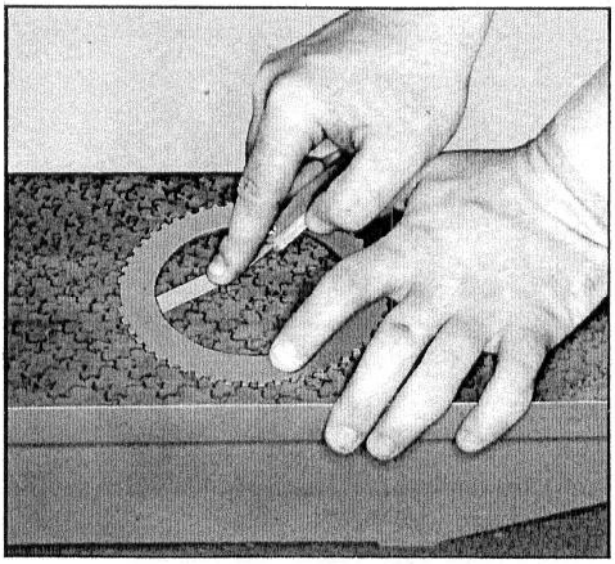


Fig. 44 – Checking Clutch Plate "Dish"

drilled through the sides of the hubs. Knowing that this assembly uses 6 discs, it is recommended that the "cut-out" portion of two of these discs line up with these holes at each level. The easiest means of marking these hubs is to first mark the edge of the hub (identifying the spline where the hole is) and then use the number "1" to designate the lowest level, number "2" to indicate the middle level and number "3" to designate the third hole level. See Fig. 48.

8. Closely examine the clutch discs. Notice that there are two "cut-out" portions in the internal splines of each disc. See Fig. 49.

NOTE: If, when installing the discs over the hubs, the cut-out portions do not align with both holes in the hub, turn the disc over (using the cut-out areas as the pivot points) and they will align. See Fig. 48.

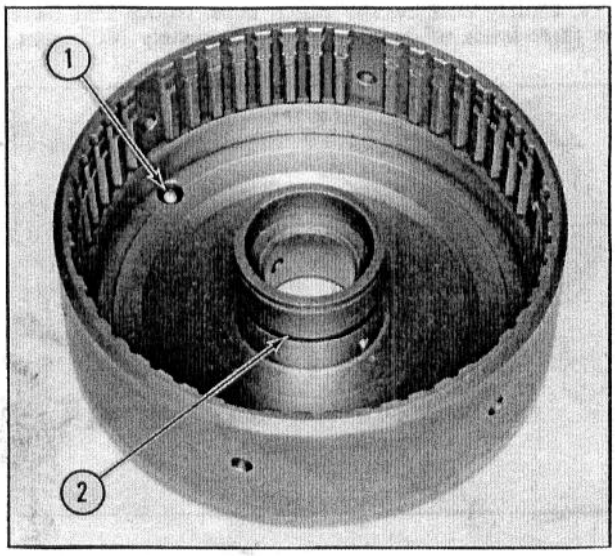


Fig. 45 – Preparing the Cylinder for Assembly

1. Steel Ball 2. Ring

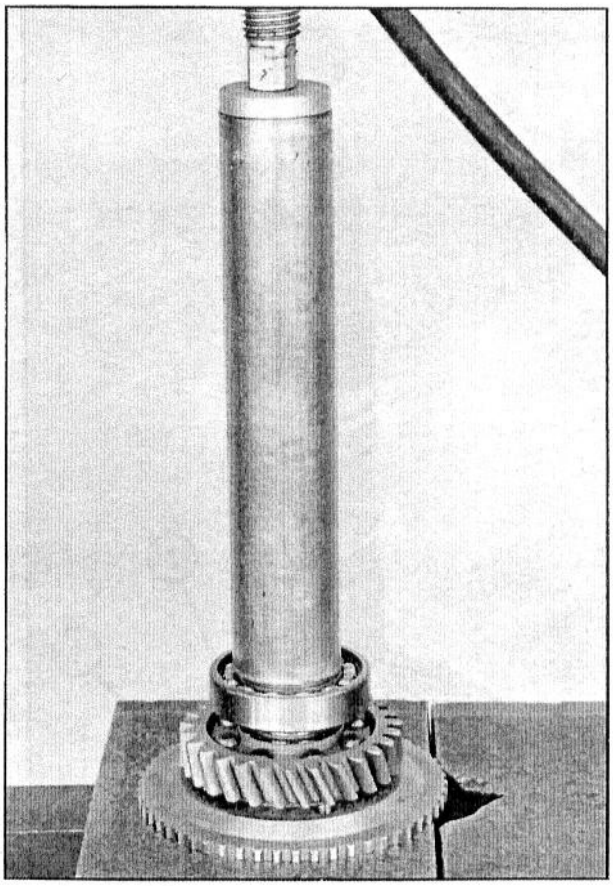


Fig. 46 – Installing Input Shaft Bearing

9. Examine the clutch plates. Notice that they are slightly "dished" and that there are two cut-out portions in the external splines of the plates. See Fig. 50.

10. Notice that there are six cut-out portions in the splined area of the cylinder. See Fig. 45.

11. Position the hub, cupped side down over the spring and retainer, in the cylinder. Install a clutch plate first, and then a clutch disc, until six plates and six discs have been placed into the clutch cylinder.

NOTE: Keep in mind to match the discs with the marks on the hubs; align the cut-out portions of the plates so that they are all at one cut-out area of the cylinder. The "dish" of the plates must all be in the same direction. It makes no difference if the dish is up or down.

12. Install the new lower steel interlocking sealing rings, one on either side of the bottom oil groove in the output shaft.

13. With the cylinder on the bench, invert the output shaft and slide it into the hub, cylinder, and assembled discs and plates.

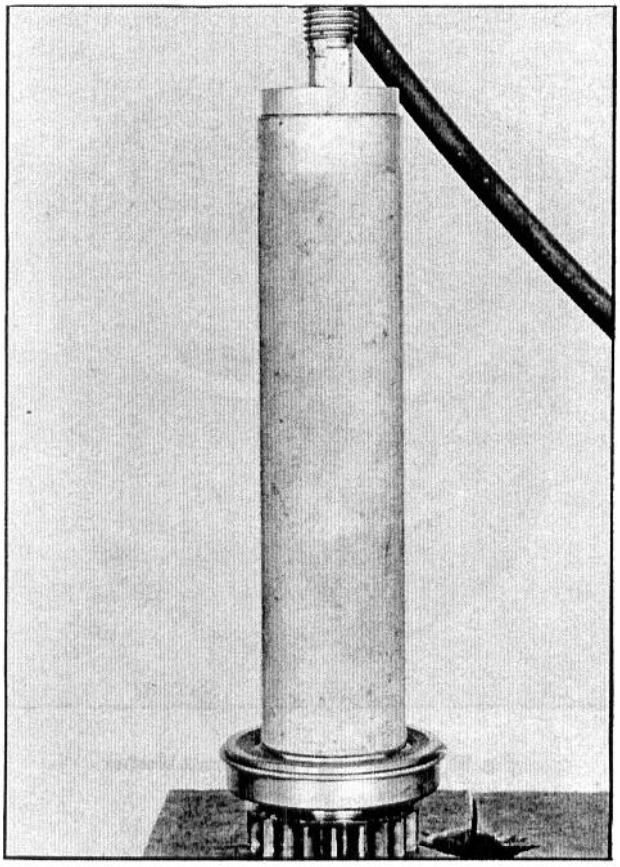


Fig. 47 – Installing Output Shaft Bearing

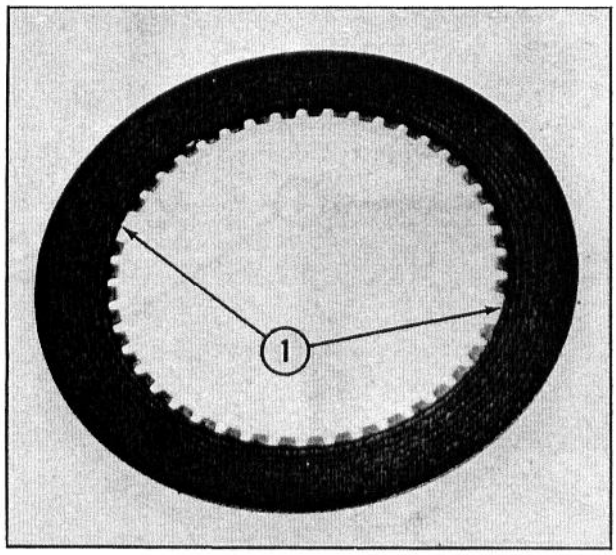


Fig. 49 – Clutch Disc

1. Cut-Out Portion

NOTE: Use care that the steel sealing rings are not damaged when installing the output shaft.

14. Invert the entire assembly, holding it together with your hands, and set it on the output shaft gear. Rock the cylinder back and forth several times and then lift the cylinder straight up, leaving the hub setting in position on the output shaft and the disc and plate splines properly aligned.

15. Install the snap ring securing the hub to the output shaft. See Fig. 39.

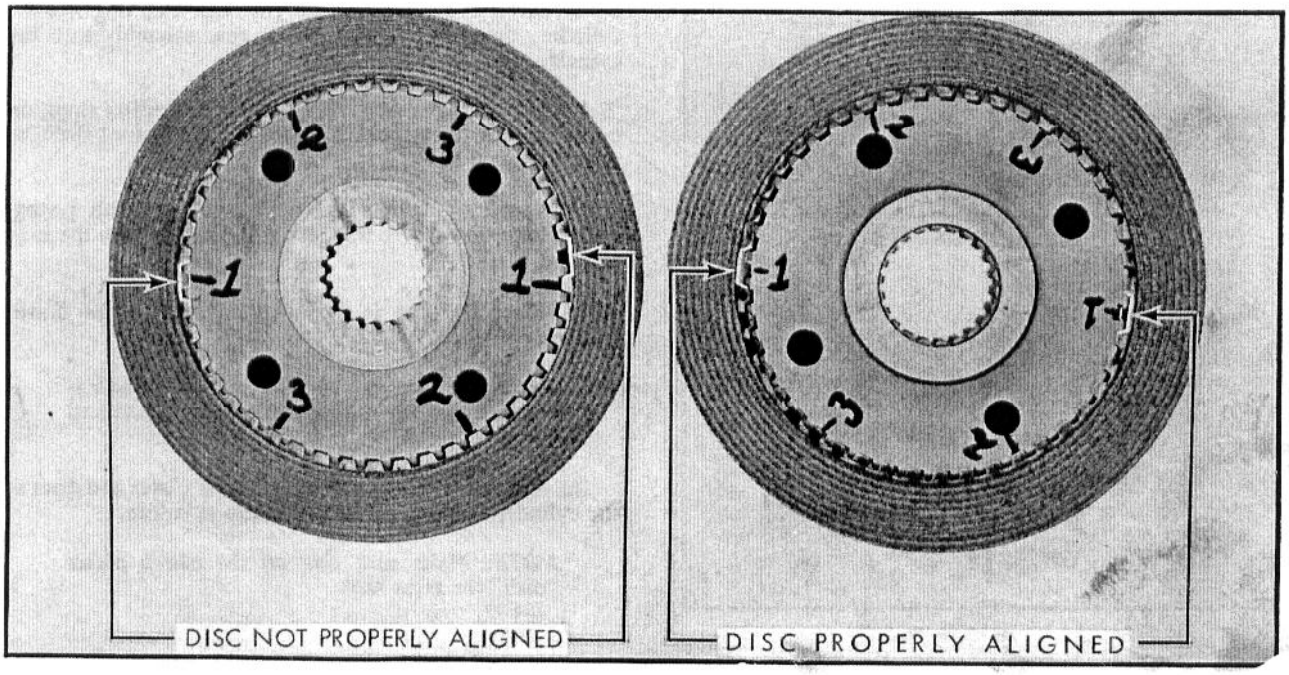


Fig. 48 – Clutch Disc-to-Hub Alignment

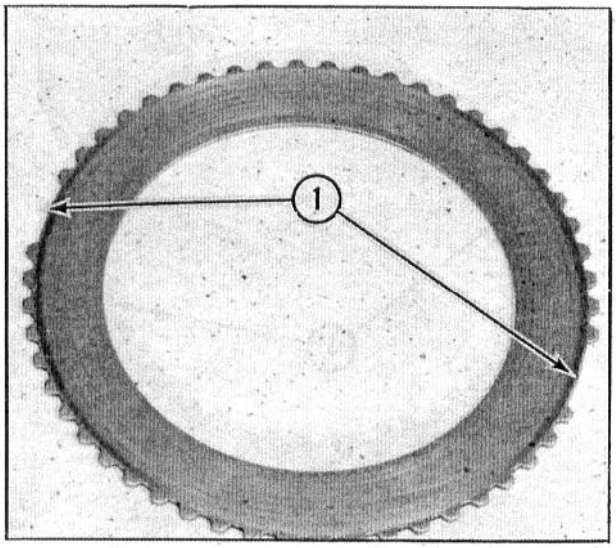
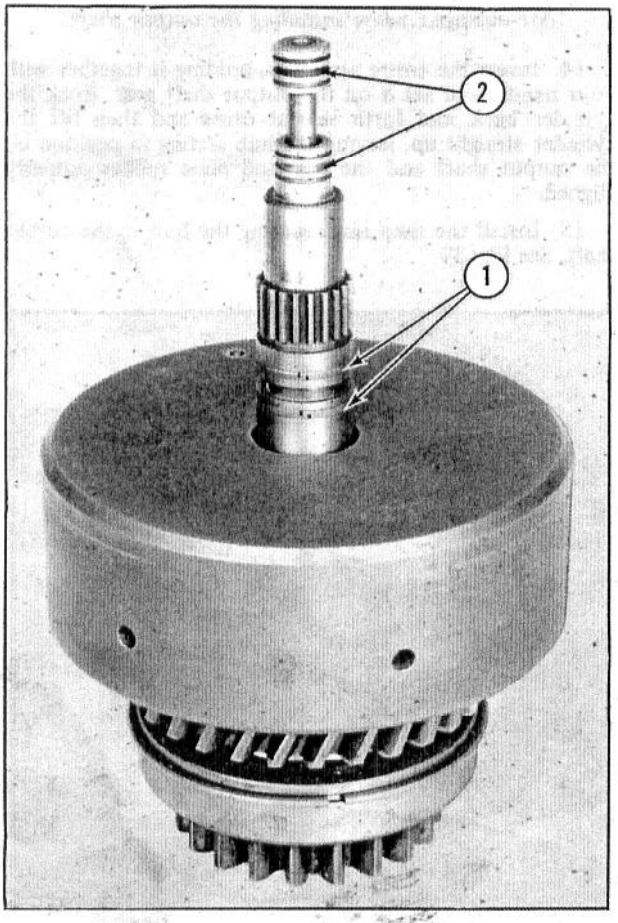


Fig. 50 – Clutch Plate

1. Cut-Out Portion



ig. 51 – Installing Steel Sealing Rings

1. Interlocking Steel Sealing Rings

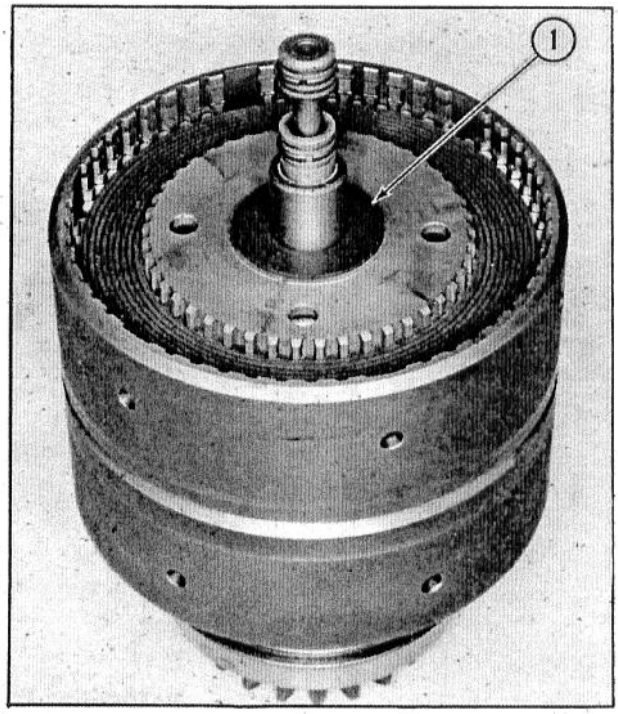


Fig. 52 – Installing Fiber Thrust Washer

1. Fiber Thrust Washer

NOTE: Do not disturb the arrangement or alignment of the clutch plates or discs while doing this.

16. Carefully fit the cylinder back down over the hub, discs and plates. Holding the assembly together with your hands, invert it again and install the large snap ring into the cylinder, thus holding the output gear assembly into the cylinder.

17. Install two new interlocking steel sealing rings, on either side of the upper oil groove on the output shaft, as shown in Fig. 51.

18. Carefully slide a cylinder, complete with piston, spring, etc., down over these rings and secure with the snap ring.

19. Place the hub in the cylinder, cupped side down, over the spring.

NOTE: Be sure that the flat side of the hub is marked showing the drain hole locations and levels.

20. Position the remaining six clutch plates and discs in the cylinder, using the same procedure as before.

NOTE: Make sure that all the clutch plates "dish" the same way.

21. Install the two butt joint steel sealing rings in the upper end of the output shaft. One ring goes in the center groove of each 3 groove cluster. See Fig. 51.

22. Install the fiber thrust washer, shown in Fig. 52, and then carefully slide the input shaft straight down over the output shaft. Install the large diameter snap ring, holding the input shaft into the forward clutch assembly.

NOTE: Do not damage the steel sealing rings as you slide the input shaft down over the output shaft. It may be necessary to place a "block" between the two clutch cylinders in order to have sufficient groove exposure for installing the large snap ring.

23. Install the three steel interlocking sealing rings in the appropriate grooves in the input shaft.

INSTALLATION

1. Position the transmission with the converter end up.

2. Install the clutch assembly with the original shim pack in place around the output bearing so that the shim is between the snap ring and the transmission partition.

NOTE: Be sure no sharp edges are on the oil slinger.

3. Position two paths (16 rollers in each path) of loose needle bearings in the idler gear, as follows: first, install a spacer washer, a path of 16 loose rollers, a second spacer washer, a second path of 16 loose rollers and then, a third spacer washer. These bearings should "keystone" and remain in place when the gear is held in a horizontal position. If they will not, excessive wear is indicated and the loose rollers must be replaced.

NOTE: The loose rollers are interchangeable with the rollers in the counter gear shaft assembly and the idler gear assembly. However, the spacer washers are not the same because of a difference in diameter. Use inner diameter hole in the idler gear shaft assembly.

4. Install the idler gear in the housing to the right of center, as follows: Spacer is to the bottom with a fiber thrust washer setting on top of it. On top of the thrust washer is the idler gear. Slide the idler gear into mesh with the clutch pack and install the idler shaft through the gear, spacer and thrust washers from the bell end of the transmission. Slide the shaft all the way in until the roll pin, through the end of the shaft, rests against the transmission partition. See Fig. 33.

5. Assemble the loose rollers into the counter gear shaft assembly, as follows: Place the gear on end with the countershaft inserted through the center hole. Position one spacer washer, 17 loose rollers, a second spacer washer, 17 loose rollers, a third spacer washer, the bearing spacer sleeve, a fourth spacer washer, 17 loose rollers, and then, a sixth and final spacer washer. The shaft can now be removed as the loose rollers "keystone" in the gear hub.

NOTE: If the bearings will not remain in place when the countershaft gear assembly is held in a horizontal position, the rollers are worn excessively and require replacing.

6. Insert a fiber thrust washer into the hood of the special tool and place the countershaft gear assembly onto the handle of the tool, with the small gear up.

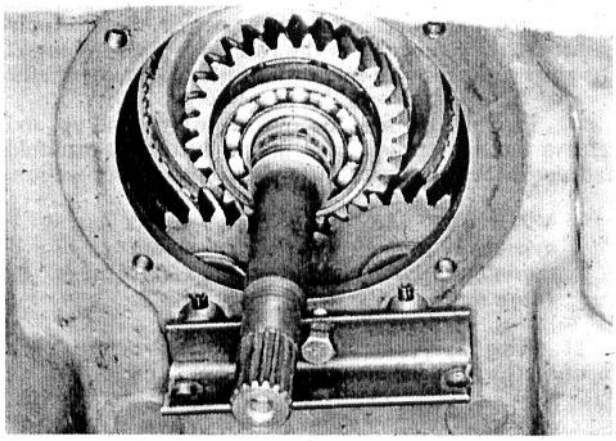


Fig. 53 – Installing Idler and Countershaft Stop

7. Place a fiber thrust washer on top of the gear assembly and slide the assembly into the housing until the top countershaft gear meshes with the idler gear and the bottom countershaft gear meshes with the lower clutch pack output gear. Align the upper and lower thrust washers and the bearings with the hole in the housing and slide the countershaft in from the bell end of the transmission housing until the roll pin sets against the partition in the transmission. See Fig. 32.

8. Position a block, or stop, across the ends of the idler and countershafts, as shown in Fig. 53.

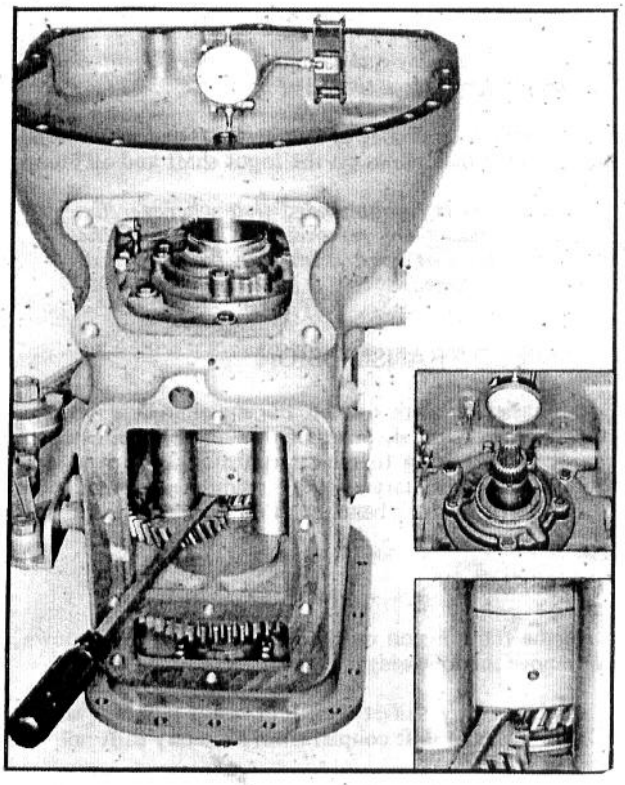


Fig. 54 – Checking Clutch Pack End-Play

9. Stand the transmission on the converter end. Apply gasket sealing compound to the two welsh plugs and install the plugs at the forward ends of the idler and countershafts.

10. Turn the transmission over, converter end up, and remove the shaft stop. Install the oil distributor manifold and pump. See the appropriate paragraphs of this section.

NOTE: Be sure to use new gaskets and dyna-seal washers. Do not install the transmission housing oil sump and suction tube at this time.

11. Using a pry, check the end-play of the clutch pack input shaft with a dial indicator, as shown in Fig. 54.

NOTE: Minimum allowable end-play is 0.031 inch or 1/32 inch. Maximum allowable end-play is 0.050 inch.

12. Shims are available in 0.016 inch (1/64 inch) thicknesses. If end-play requires changing, the clutch pack must be removed and the shim added around the output bearing so that the shim is between the snap ring on the output bearing and the transmission partition. Add shims to decrease end-play and remove shims to increase end-play.

NOTE: If less than 0.031 inch end-play is obtained, with all the shims removed, remove the oil manifold and add a second gasket between the manifold and the transmission partition. Reassemble and check the end-play as before.

13. Install the oil suction tube and transmission housing oil sump and screen.

NOTE: Use new gaskets and "O"-rings. Tighten the capscrews to a torque of 35 ft.-lbs.

14. Apply a light coat of Lubriplate (Grade 70 – or an equivalent) to the splines on the input shaft and oil pump.

NOTE: It is recommended that whenever the clutch packs are removed for servicing, the other areas of the transmission be serviced at the same time.

TWO-SPEED TRANSMISSION

It is easier to work on the transmission in a vertical, rather than horizontal, position. Therefore, the overhaul procedures pertaining to the transmission two-speed gear section and the planetary assembly recommends placing the transmission on a work bench with the converter end down.

DISASSEMBLY

Set the transmission on the bench, converter end down, and remove the following:

a. Planetary shifter fork lock wire, setscrew, shifter fork and shift coupler from planetary shift rail.

b. Capscrews attaching planetary assembly to rear of transmission housing.

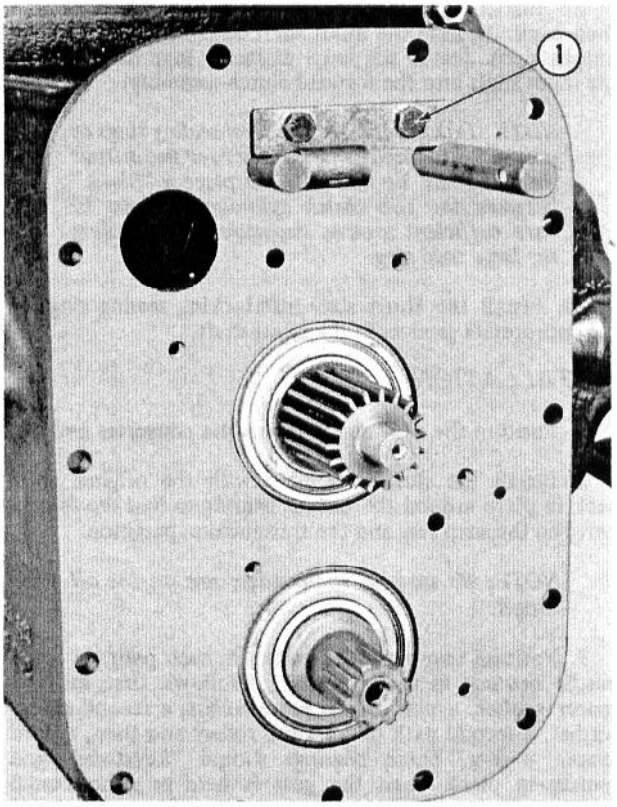


Fig. 55 – Removing Shift Rail Stop

1. Shift Rail Stop

c. Shift rail stop from rear of transmission housing. See Fig. 55.

d. Lock wires and setscrews from shift rails securing selectors to the rails. See Fig. 56.

e. Shift rails from transmission housing.

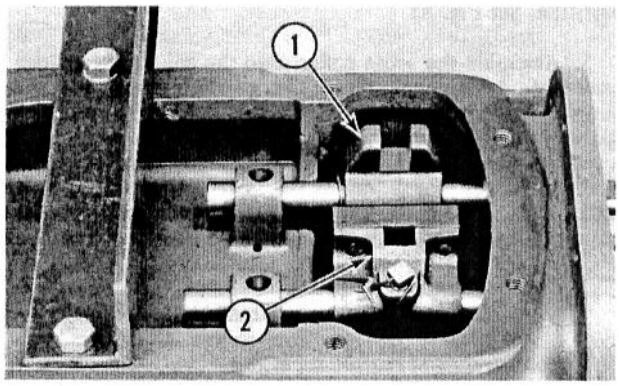


Fig. 56 – Gearshift Selectors

1. Planetary Selector 2. 2-Speed Gearshift Selector

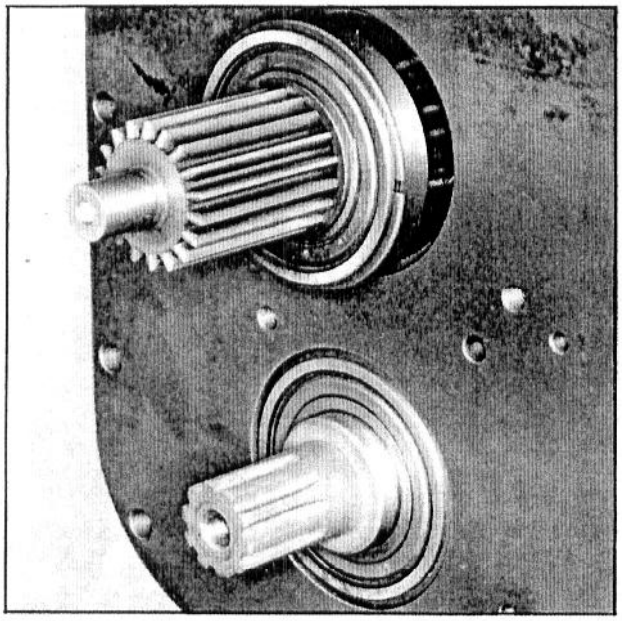


Fig. 57 – Removing the Main Shaft

CAUTION: Use care that the detent pins (backed up by the detent springs) do not fly out of the housing.

f. Detent pins and springs from the transmission housing.

g. The main shaft by pulling it from the rear of the transmission, as shown in Fig. 57.

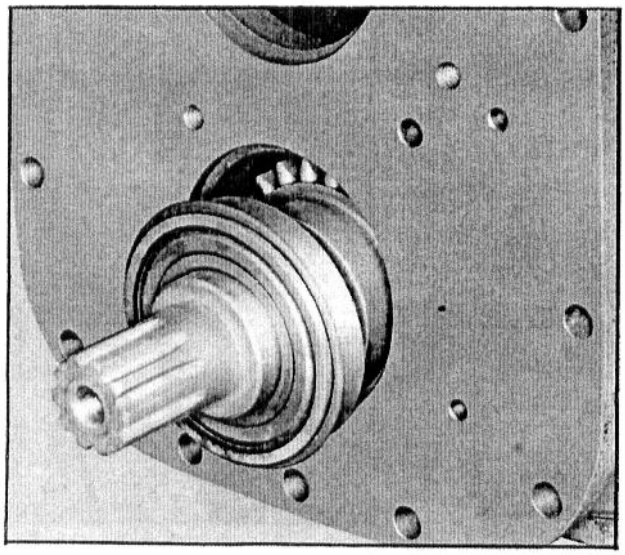


Fig. 58 – Removing the Lower Shaft

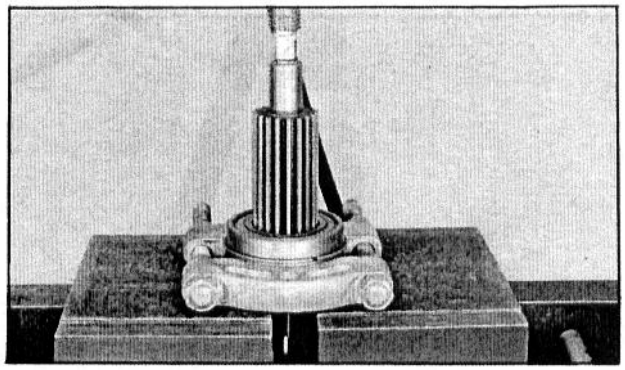


Fig. 59 – Removing the Rear Main Shaft Bearing

NOTE: The bearings are a "slip fit" onto the shaft and into the housing. Therefore, the shaft should pull easily from the transmission housing.

h. The main shaft two-gear cluster from the top of the transmission.

i. The lower transmission shaft from the rear of the transmission, as shown in Fig. 58.

NOTE: This shaft is also a "slip fit" into the transmission.

j. The three gears from the bottom of the transmission.

INSPECTION

1. Remove the caged roller bearing from the upper shaft and check it for pitted and damaged rollers. Replace, if necessary.

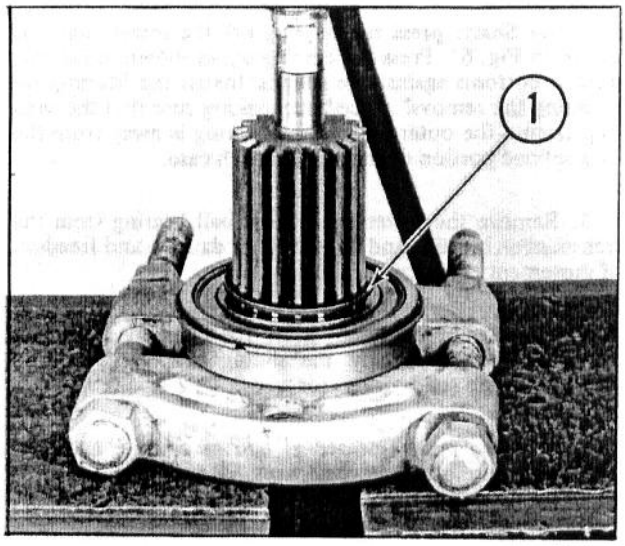


Fig. 60 – Installing the Rear Main Shaft Bearing

1. Snap Ring

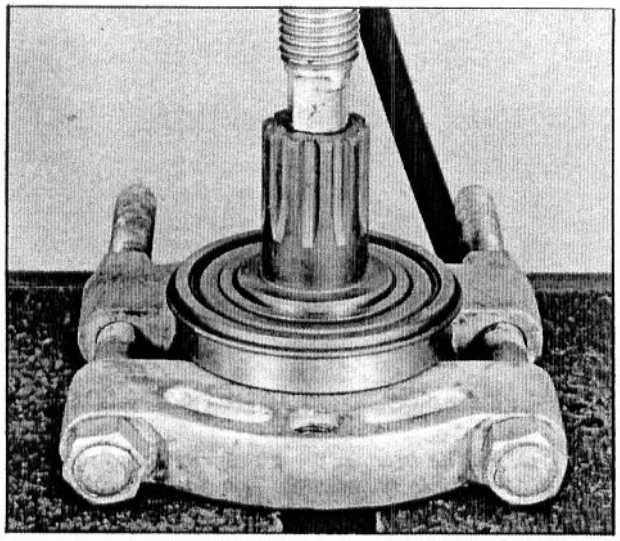


Fig. 61 – Removing the Rear Lower Shaft Bearing

2. Rotate the shielded ball bearings on the upper and lower transmission shafts and check them for damage and freedom of movement.

If they must be replaced, remove and install them, as follows:

Upper Shaft: remove the snap ring on the long splined side of the bearing and press the bearing off, as shown in Fig. 59.

NOTE: The bearing MUST be pressed on and off over the longer splined portion of the shaft because the short splined portion of the shaft is slightly larger in diameter. When pressing the bearing on, install the snap ring first, and then, press the bearing on, as shown in Fig. 60.

Lower Shaft: press the bearing off the lower shaft, as shown in Fig. 61. Press the bearing on, as shown in Fig. 62, until it bottoms against the splines. Install the bearings by reversing the removal procedure, making sure that the snap ring around the outer race of the bearing is away from the long splined portion of the shaft in each case.

3. Remove the lower shaft front ball bearing from the transmission housing and inspect it for damage and freedom of movement. Replace, if necessary.

4. Thoroughly check all gears for chipped teeth and excessive wear, especially the sliding coupler gear. Also check the loose roll bearings for wear.

5. If Welsh plugs (located at end of counter and idler gear shafts) are not removed, check for leaks. This may be done by placing transmission with bell end up and filling holes with solvent.

6. Check the detent springs with a spring tester. They should test 15 lbs. pressure when compressed to 13/16 inch in length.

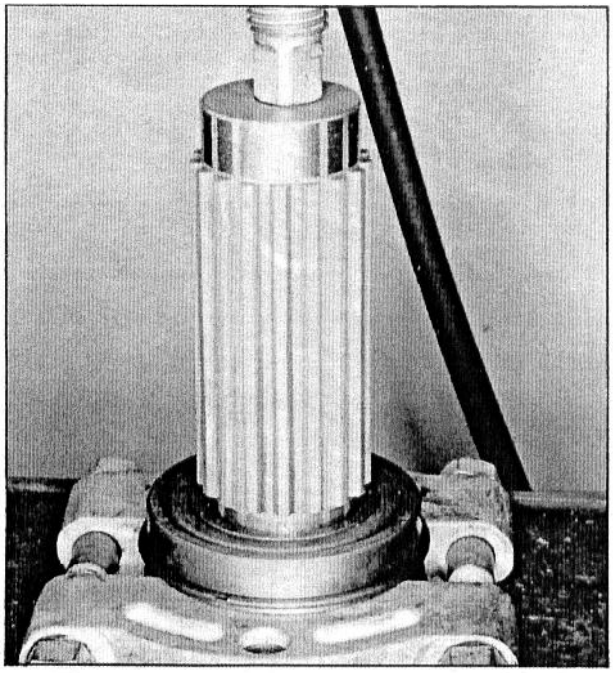


Fig. 62 – Installing the Rear Lower Shaft Bearing

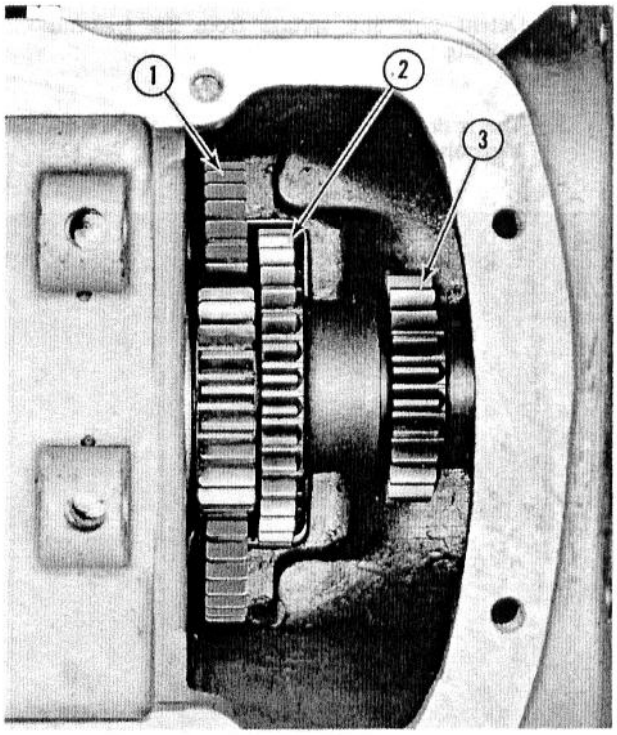


Fig. 63 – Lower Shaft and Gears Installed

1. Large Gear 2. Intermediate Gear 3. Small Gear

ASSEMBLY

1. With the lower shaft front bearing in place, position the three gears in the bottom of the transmission. Refer to Fig. 63 and proceed as follows:

   a. Install the large gear next to the front bearing, with the long hub to the rear.

   b. Install intermediate gear in the center, with the long hub to the rear.

   c. Install small gear to the rear of the compartment, with the long hub to the front of the transmission housing.

2. With the rear support bearing in position on the lower shaft, thread the shaft through the gears and into its front support bearing.

3. Install the caged roller bearing assembly in position in the recess of the output shaft coming back from the Instant Reverse clutch packs.

4. Position the upper shaft two-gear cluster in the transmission, with the large gear to the rear.

5. With the rear support bearing installed onto the upper main drive shaft, thread the shaft through the gear cluster and into its front support. See Fig. 64.

6. Complete assembly of the transmission by following Steps 1 through 6 of "Disassembling the Transmission", in reverse order.

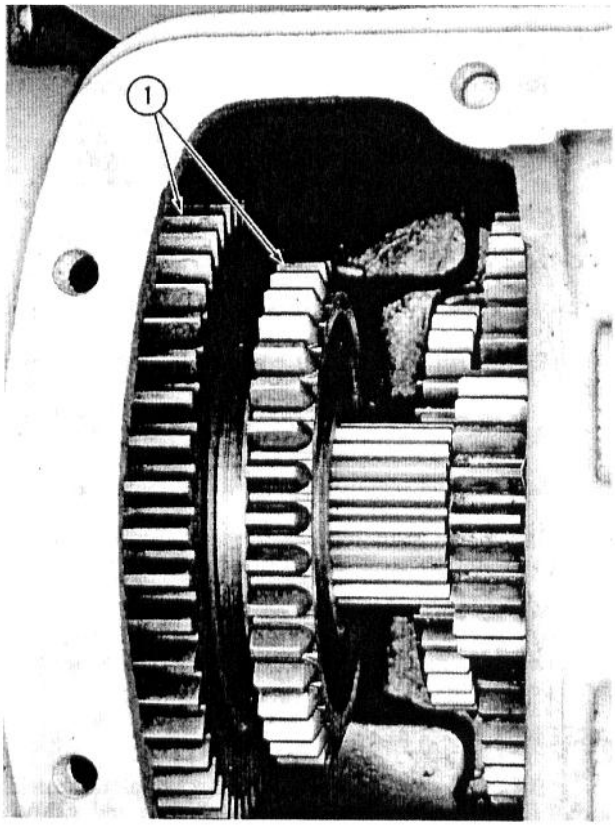


Fig. 64 – Main Shaft and 2-Gear Cluster Installed

1. 2-Gear Cluster

PLANETARY GEAR ASSEMBLY

REMOVAL

1. Remove lock wire and lockscrew from the planetary shifter fork.

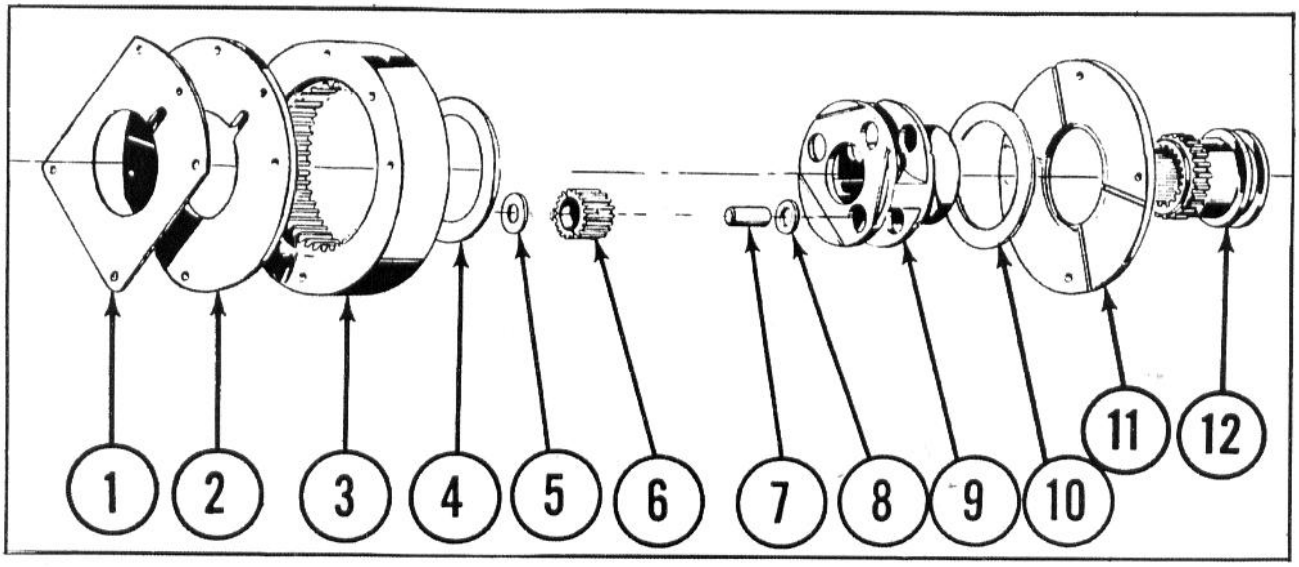


Fig. 65 – Planetary Assembly Nomenclature

1. Shim
2. Front Cover Plate
3. Ring Gear
4. Ring Gear Thrust Washer
5. Pinion Gear Thrust Washer
6. Pinion Gear
7. Pinion Gear Shaft
8. Pinion Gear Thrust Washer
9. Pinion Gear Carrier
10. Ring Gear Thrust Washer
11. Cover Plate
12. Shift Coupler

2. Remove the planetary shifter fork and the planetary shift coupler.

3. Remove the attaching capscrews and remove the planetary gear assembly.

NOTE: The planetary gear assembly is dowelled to the transmission housing, but can be removed by prying with two screwdrivers.

DISASSEMBLY

See Fig. 65.

1. Remove the shim, front cover plate, and rear cover plate.

2. Remove the front and rear ring gear thrust washers.

3. Separate the pinion carrier assembly from ring gear.

4. The pinion gears may be removed from the pinion carrier assembly by pressing out the pinion gear shaft.

NOTE: The pinion gears contain a double row of needle bearings. Care must be used, when removing the pinion gears, that none of these bearings are lost.

ASSEMBLY

1. The pinion gears are replaced into the pinion carrier with a full set of needle bearings in each gear and a thrust washer on each side of the pinion gear.

2. The pinion gear shaft may then be placed into the carrier and driven in with a rawhide mallet. Make sure that the shafts do not extend beyond the machined face of the pinion gear carrier.

NOTE: Do not damage the machined surface of the pinion carrier.

INSTALLATION

1. Place the front ring gear thrust washer into the recess on the dowelled side of the planetary ring gear.

2. Place the front ring gear cover and the front cover shim over the dowels of the planetary ring gear.

NOTE: The cover plate is turned so that the oil grooves face the bronze thrust washer. The shim is next to the transmission housing.

3. Hold the thrust washer into the recess of the ring gear with the finger tips, and lightly tap the dowelled ring gear into place on the rear of the transmission with a lead or bronze hammer.

NOTE: The thrust washer must remain in the recess and be free to rotate.

4. Install the pinion carrier assembly in the ring gear.

5. Install the rear bronze thrust washer in the recess of the planetary ring gear.

6. Install the ring gear cover and secure planetary gear assembly to transmission housing with the capscrews.

NOTE: Make sure that the thrust washer is not jarred from the recess in the ring gear while installing the rear cover plate.

7. Position the shift fork onto the shift rail and the shift coupler into the planetary assembly at the same time.

8. Install the lockscrew and lock wire.

SERVICING THE MANUAL SHUTTLE SINGLE CLUTCH TRANSMISSION

INDEX

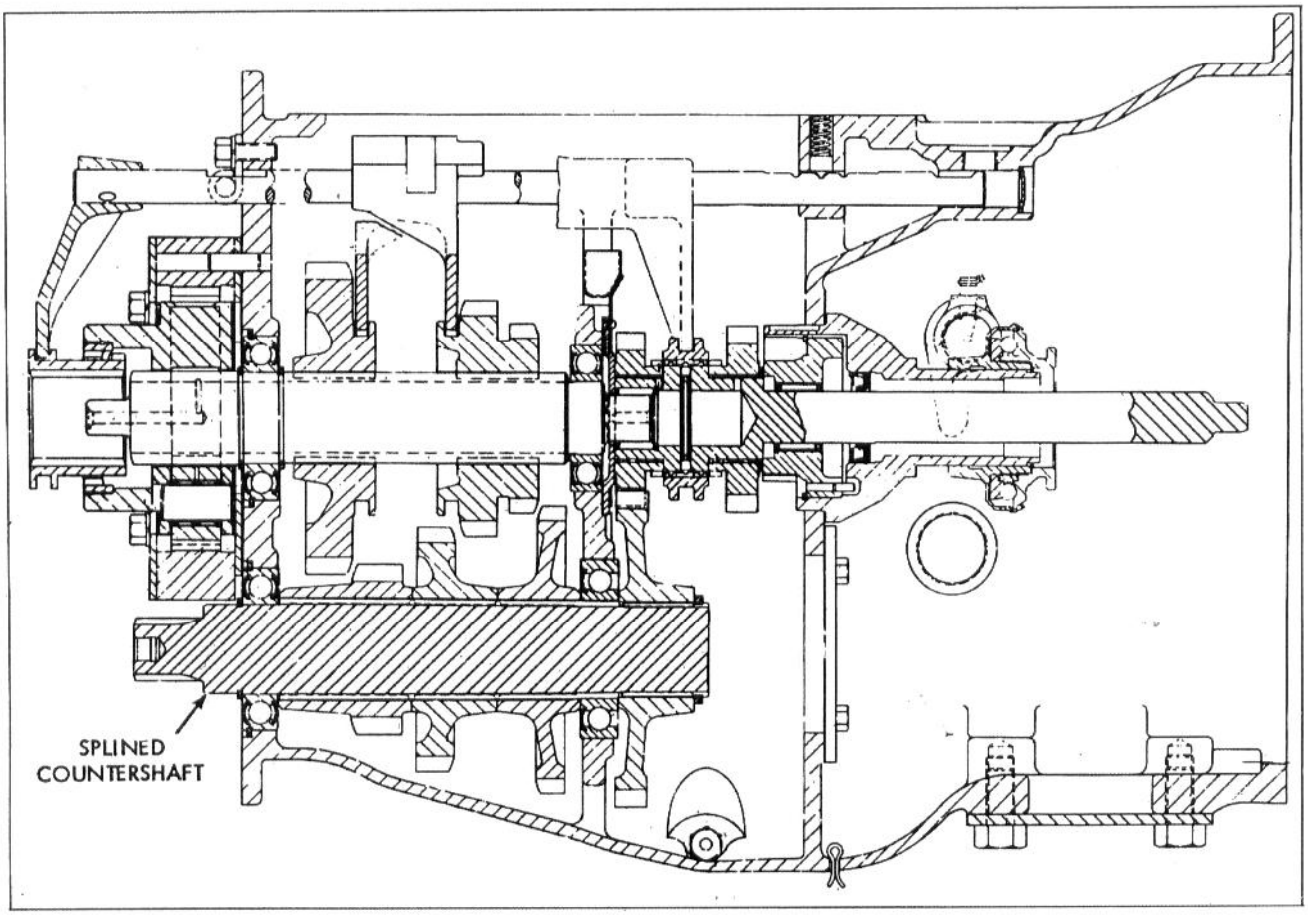


Fig. 1 – Sectional View of Transmission Having Splined-Type Countershaft

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INTRODUCTION

This part pertains to servicing the Manual Shuttle single clutch transmission, removed from the tractor and placed on a stand. To obtain removal or reinstallation procedures, refer to the section which concerns the particular tractor being serviced.

The directions, left and right, given in these procedures have been written with the input shaft end of the transmission always considered the front.

Some transmissions have a gear made on the countershaft, but the disassembly or reassembly will remain the same as transmissions with a splined countershaft, unless otherwise specified. See Figs. 1 and 2.

DISASSEMBLING THE TRANSMISSION

1. Remove shift rails and forks, as follows:
   a. Remove planetary shift fork and hub.
   b. Remove the two capscrews securing the shift rail retainer at rear of transmission and remove retainer assembly.
   c. Remove setscrews securing the shift forks to shift rails and remove detents and springs.
   d. Slide the left shift rail (2nd and 3rd speed) out of shift fork and out of transmission housing.
   e. Slide the center shift rail (low speed)

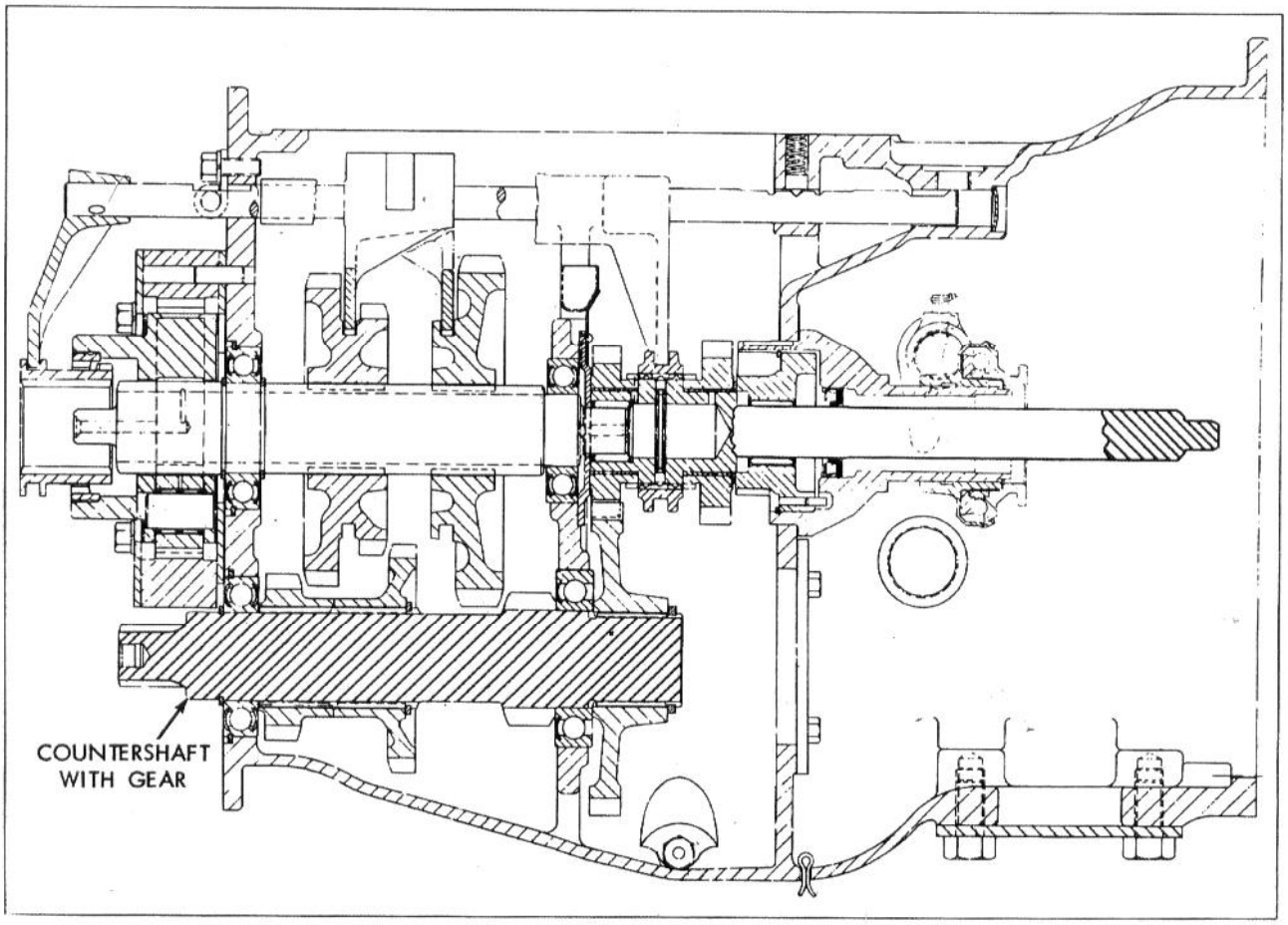

Fig. 2 – Sectional View of Transmission Having Spur Gear Made on Countershaft

out of shift fork and out of transmission housing.

f. Slide planetary (HI-LO) shift rail out of shuttle shift fork and gearshift lever selector and remove selector and rail.

g. Lift the shuttle shift fork out of the transmission housing.

h. Lift out the other two shift forks (low speed and 2nd and 3rd speed forks).

2. Remove clutch shaft, fork and release bearing, as follows:

a. Unhook release springs and remove clutch release bearing and carrier assembly.

b. Remove lock wire and remove setscrews securing clutch release fork to shaft.

c. Slide clutch shafts out of fork and housing and remove release fork.

3. Remove input shaft assembly, as follows:

NOTE: Check end play of input shaft before removing it. If the end play exceeds .020", new shims must be installed during reassembly.

a. Remove 4 capscrews securing input shaft retainer assembly to the transmission housing.

b. Slide the retainer housing off of the input shaft.

NOTE: When the retainer housing is removed over the input shaft, the splines on the shaft will damage the oil seal in the retainer. If it is desired to reuse the oil seal, it will be necessary to use special tool FT 357 when removing the retainer housing.

c. Hold the two pinion gears and shift collar assembly at the rear end of the input shaft together, then slide the input shaft and pinion gears out of the housing as one assembly, see Fig. 3.

FOR DISASSEMBLY OR SERVICING OF THIS UNIT, REFER TO THE HEADING "SERVICING INPUT SHAFT, PINION GEARS AND RETAINER ASSEMBLY".

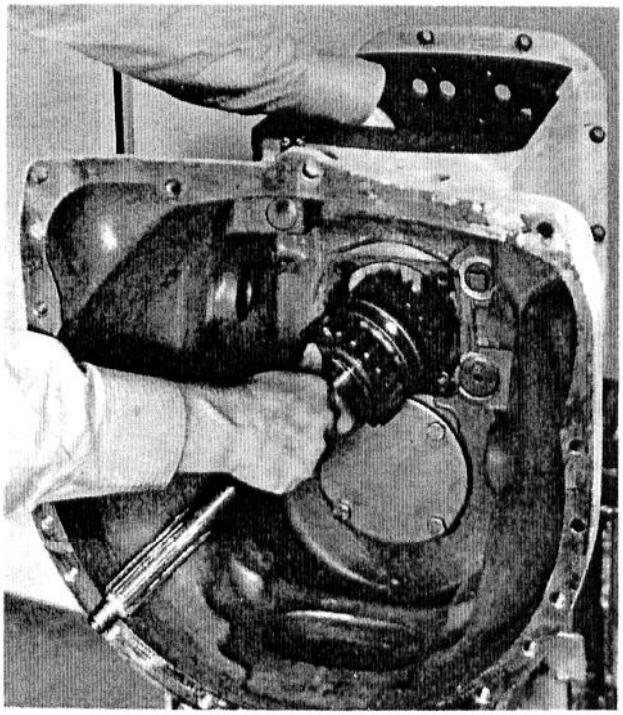

Fig. 3 – Removing Input Shaft Assembly

NOTE: Twenty-three needle bearings and 2 washers are in the rear end of the input shaft and will probably fall out when the shaft is removed.

4. Remove spacer washer and oil trough assembly.

5. Remove 4 bolts securing the planetary assembly to rear of transmission housing and remove the complete planetary assembly. FOR DISASSEMBLY AND SERVICING OF THIS UNIT, REFER TO THE HEADING "SERVICING THE PLANETARY ASSEMBLY".

6. Remove main shaft and gears, as follows:

a. Slide shaft and bearings rearward far enough to move bearings out of their bore in the case.

b. Use the shaft as a sliding hammer action to remove the front bearing from the shaft, as shown in Fig. 4.

c. Remove shaft and rear bearing from rear of housing while, at the same time, removing 2nd and 3rd speed sliding gear, also lst speed sliding gear.

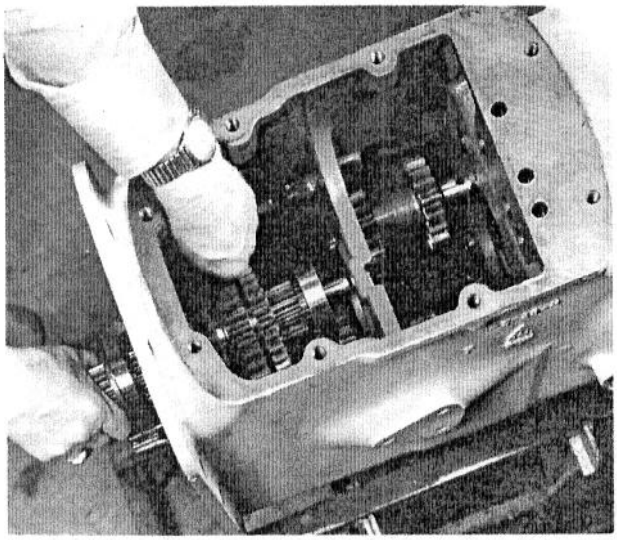

Fig. 4 – Removing Front Bearing From Main Shaft

7. Remove reverse idler gear, as follows:

   a. Slide shaft forward and out of the reverse idler gear.

   b. Remove gear, thrust washers, spacers, and 46 needle bearings.

   NOTE: When the reverse idler gear shaft is removed, 2 thrust washers, 2 spacer washers, 46 needle bearings and 1 spacer will probably fall out of the gear.

8. Remove countershaft and gears, as follows:

   a. Remove 4 capscrews securing cover at front end of countershaft and remove cover.

   b. Remove snap ring from front of countershaft, then slide constant mesh gear off the shaft and out of the transmission housing.

   c. Remove snap ring from rear of countershaft.

   d. Use a puller, as shown in Fig. 5, and push the countershaft forward and out of rear bearing.

   e. Carefully slide shaft, with front bearing, forward out of the gears and transmission housing, as shown in Fig. 6.

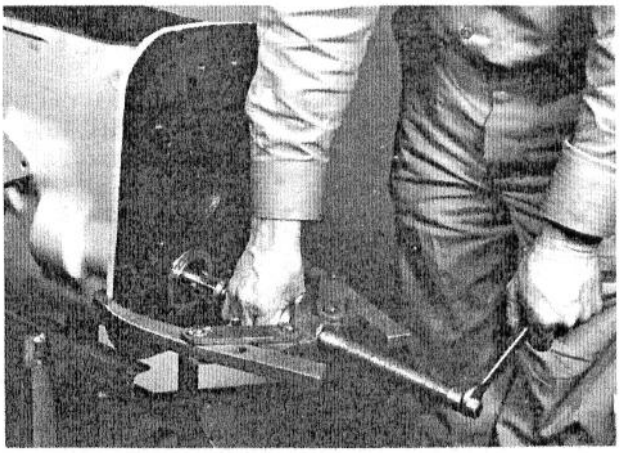

Fig. 5 – Pushing Countershaft Out of Rear Bearing

SERVICING INPUT SHAFT, PINION GEARS AND RETAINER ASSEMBLY

The input shaft consists of three major units: the main input shaft, the pinion gears and the retainer assembly.

DISASSEMBLY

1. If the retainer assembly has not been removed, slide it off the input shaft.

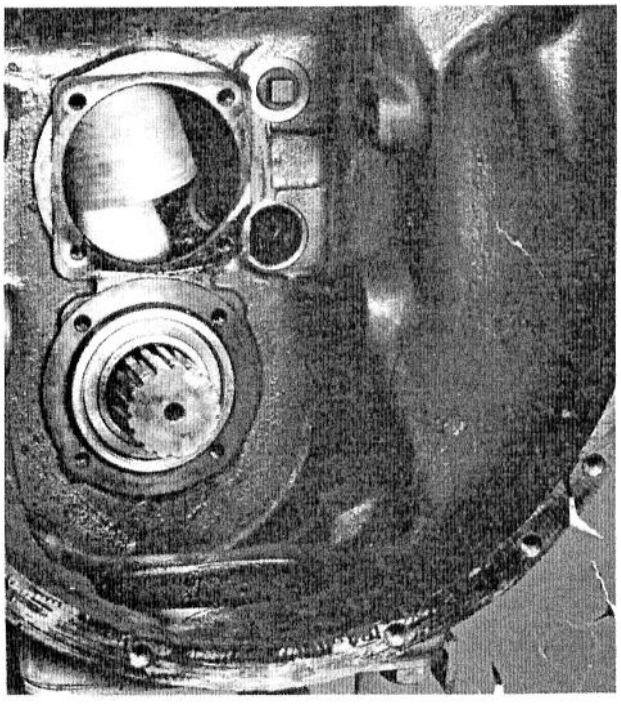

Fig. 6 – Removing Countershaft and Front Bearing

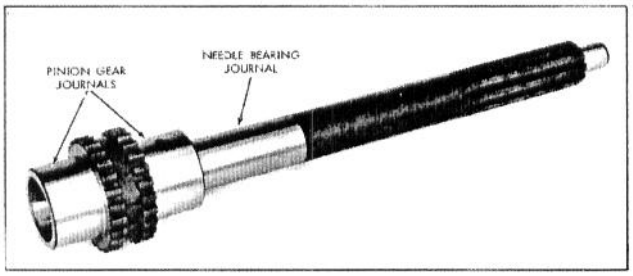

Fig. 7 – Main Input Shaft

2. Slide the shim, thrust washer and reverse pinion off the forward end of the input shaft.

3. Slide the forward pinion off the rear of shaft.

4. Place the input shaft on a bench with the rear portion down. Hold a cloth over the shift collar (to retain detents) and push down on shift collar. Then, remove collar, detents, spring and guide.

NOTE: Two types of detents and shift collars are used. In the event a ball detent-type collar requires replacement, a complete pin-type assembly may be supplied. If the shift collar and ball detents are replaced with a pin-type detent, they must be replaced as an assembly.

5. Remove snap ring and remove spacer and bearing assembly out of the retainer housing. This assembly will have to be removed before the input shaft oil seal can be replaced in the retainer housing.

INSPECTING AND SERVICING THE COMPONENT PARTS

Wash all parts in a suitable cleaning solution and inspect, as follows:

1. Visually inspect the input shaft for wear or damage. If the shaft appears serviceable, measure the bearing journals. If either of the pinion gear journals measures 1.748", or less, the shaft must be replaced. If the needle bearing journal measures 1.123", or less, the shaft must be replaced. See Fig. 7.

2. Visually inspect the reverse and forward pinions for wear or damage. If the pinions appear serviceable, measure the I. D. of the pinion bushing. If the bushing I. D. measures 1.756", or more, the bushing or gear with bushing must be replaced. To replace the pinion bushing, proceed, as outlined:

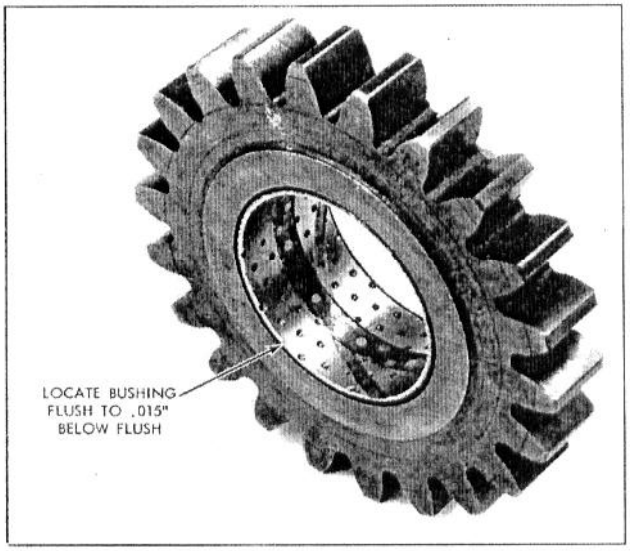

Fig. 8 – Bushing Properly Installed in Pinion

a. Remove old bushing, being careful not to damage I. D. of pinion.

b. Carefully press new bushing into large tooth side of pinion. Locate bushing flush to .015" below machined surface of pinion. See Fig. 8.

c. After bushing is located in pinion, machine it to an I. D. of 1.7535" to 1.7545".

3. Inspect needle bearing in the spacer. If replacement is required, press out old bearing and press new bearing in. Always press against lettered side of new needle bearing.

4. Replace oil seal in retainer assembly, as follows:

a. Use a punch and hammer and carefully drive the old seal out of the retainer.

b. Install the new oil seal in the retainer, with lip of seal toward needle bearing.

REASSEMBLY

1. To reinstall the detents and shift collar on the input shaft, position the spring, guide

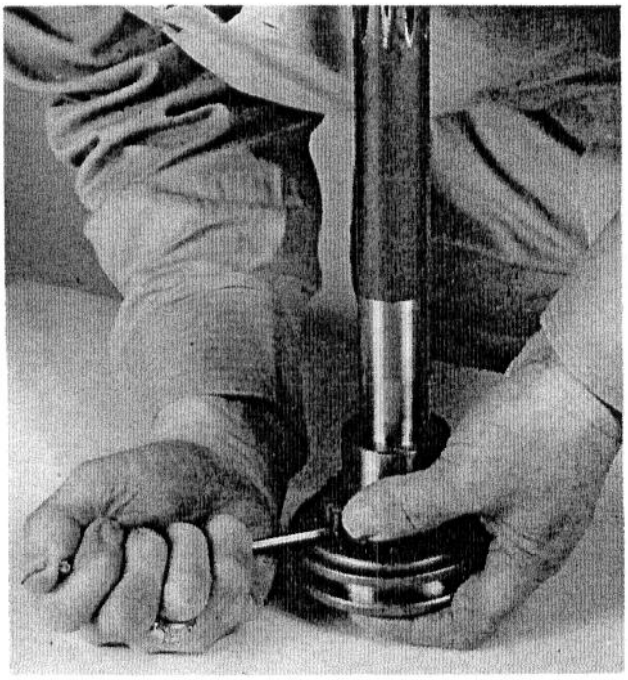

Fig. 9 – Installing Shift Collar Over Detents

and one detent in the shaft. Then, start shift collar on shaft, with detent notches over the one detent. With a hollow pointed tool, hold in on the other detent and slide shift collar in place, as shown in Fig. 9.

2. Position the pinion gears on the main input shaft, with small gear teeth toward shift collar and larger gear forward. Fig. 10 shows gears, thrust washer and shim partially placed on shaft.

3. Grease thrust washer and shim (to hold in place) and slide over shaft and against reverse gear.

4. Pack oil seal in retainer assembly with grease. Then, install spacer and bearing assembly and secure with snap ring. Do not install retainer on the input shaft at this time. The procedure for installing this unit is outlined under transmission reassembly.

SERVICING THE PLANETARY ASSEMBLY

Visually inspect the planetary assembly for worn or damaged gear teeth, bearings, etc. If any parts require replacement, it will be necessary to disassemble the complete unit.

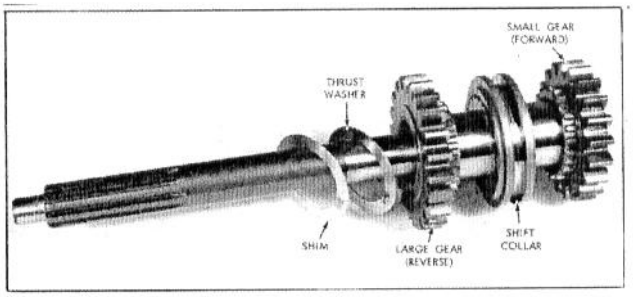

Fig. 10 – Input Shaft and Component Parts

DISASSEMBLY

1. After the planetary has been removed from the transmission and placed on the bench, lift the shim and rear cover plate off the ring gear.

2. Lift the pinion carrier and rear thrust washer out of the ring gear.

3. Place the carrier assembly in a press, with the hub portion up, as shown in Fig. 11.

4. Carefully press shaft out of pinion gear, as shown, then remove pinion and loose needle bearings.

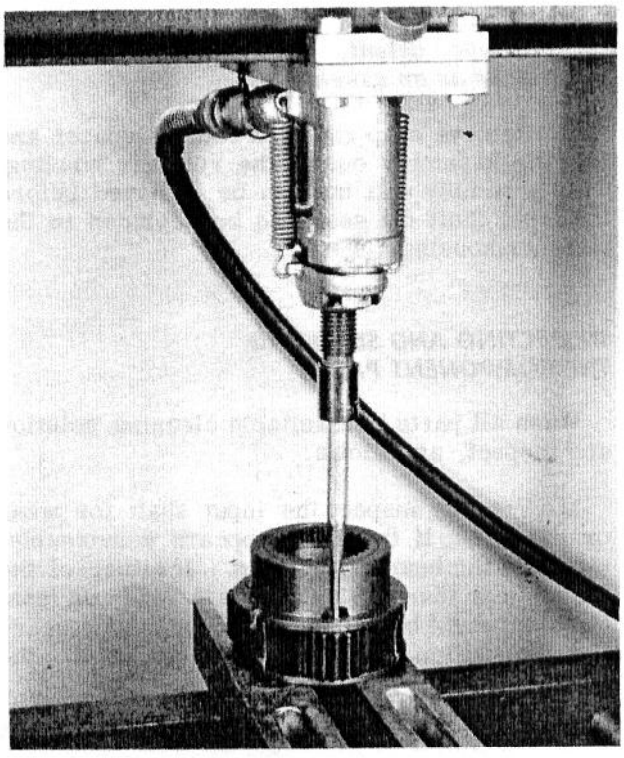

Fig. 11 – Pressing Shaft Out of Pinion

NOTE: The tool used is a drift punch and a suitable sleeve or socket to hold punch and press arbor in alignment.

5. Repeat steps 3 and 4 to remove the other pinion gears from the pinion carrier.

INSPECTION

1. Clean all parts with a suitable cleaning solution and dry with compressed air.

2. Inspect all parts for wear or damage. Replace, if necessary.

REASSEMBLY

1. Place a light coat of grease on the inside of each pinion gear and on one side of each thrust washer.

2. Place one thrust washer (with grease side up) on the bench and position pinion gear over this washer.

3. Install one spacer washer inside of pinion gear, followed by one row of needle bearings (27 needles).

4. Install center spacer washer inside of pinion gear and against needle bearings.

5. Position second row of needle bearings in pinion gear and place a third spacer washer against bearings.

6. Place a second thrust washer against pinion gear (with grease side next to gear).

7. Position the assembled pinion gear into the carrier and align shaft hole.

8. Carefully press pinion shaft into gear and carrier until shaft is flush with edges of carrier assembly.

REASSEMBLING THE TRANSMISSION

Inspect all parts for excessive wear or damage. Replace, if necessary, and install new seals and gaskets.

1. Install countershaft and gears by referring to the appropriate heading below, and proceed, as outlined:

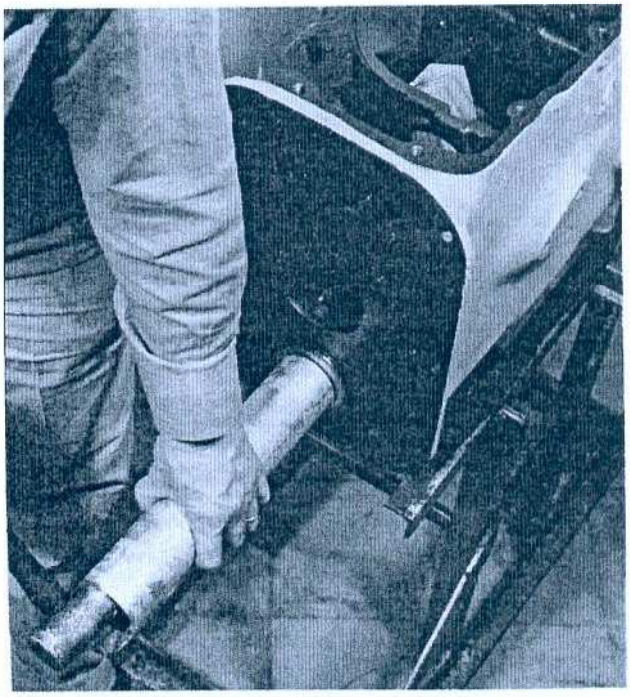

Fig. 12 – Install Rear Bearing on Countershaft

Transmission models with splined countershaft:

a. Inspect front bearing on shaft. If worn or damaged, press old bearing off shaft. Reinstall new bearing, with shield side of bearing rearward.

b. Place the countershaft gears in the transmission housing, as follows: large gear in front, with hub of gear rearward, followed by middle size gear, with hub forward, and small gear, with hub rearward.

c. Carefully slide the countershaft, with front bearing, through front of transmission housing and into splines in countershaft gears.

d. Start rear bearing on shaft, place a block of wood against front end of shaft, then, with a suitable tool (such as a piece of pipe), tap bearing into place on shaft, as shown in Fig. 12. Secure with snap ring.

e. Slide shaft and bearings into position in transmission housing.

f. Install constant mesh countershaft gear

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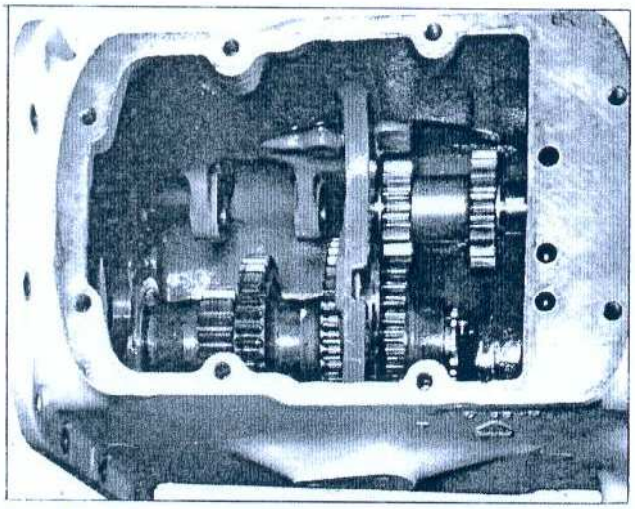

Fig. 13 – Countershaft Gear and Reverse Idler Properly Installed

on front of countershaft and secure with snap ring. Fig. 13 shows the countershaft and gears properly installed.

g. Install cover and a new gasket at opening in front of countershaft.

Transmission models having spur gear made on countershaft:

a. Inspect front bearing on shaft. If worn or damaged, press old bearing off shaft. Reinstall new bearing, with shield side of bearing rearward.

b. Place the two countershaft gears in the transmission housing, with hubs together and small gear to the rear.

c. Carefully slide the countershaft, with spur gear attached, and front bearing through bearing bore in front of transmission housing and into the splines in the two countershaft gears.

d. Start rear bearing on shaft, place a block of wood against front end of shaft, then, with a suitable tool (such as a piece of pipe), tap bearing into place on shaft, as shown in Fig. 12. Secure with snap ring.

e. Slide shaft and bearings into position in transmission housing.

f. Install constant mesh countershaft gear on front of countershaft and secure with snap ring.

g. Install cover and a new gasket at opening in front of countershaft.

2. Install the reverse idler gear, as follows:

a. If the needle bearings and spacer washers are not installed in the reverse idler gear, proceed, as follows:

(1) Apply a coating of grease in the bore of the reverse idler gear to hold the 46 needle bearings in place during reassembly.

(2) Hold gear, with 1 retainer washer, in one hand and insert 23 needle bearings into the gear against the retainer washer. Then, insert the center spacer, followed by another row of 23 needle bearings and a retainer washer.

b. Install a new "O"-ring on the reverse idler shaft and start into front side of transmission housing.

c. Start 1 thrust washer on end of shaft. Then, hold the reverse idler gear in place, with larger gear forward, and carefully slide shaft through gear and bearings. Install another thrust washer against the gear and slide shaft into place. See Fig. 13.

NOTE: The reverse idler shaft must be installed with the large hole in shaft up. When the oil hole is up, the roll pin in the front end of the shaft will be toward the top.

3. Install the main shaft and gears by referring to the appropriate heading below, and proceed, as outlined:

Transmission models with splined countershaft:

a. Inspect the rear bearing on shaft. If worn or damaged, press old bearing off the shaft over the long splined end of shaft, as shown in Fig. 14.

b. Start shaft and rear bearing into rear of transmission housing and into the sliding gears in the following sequence: large gear, with shifter hub forward,

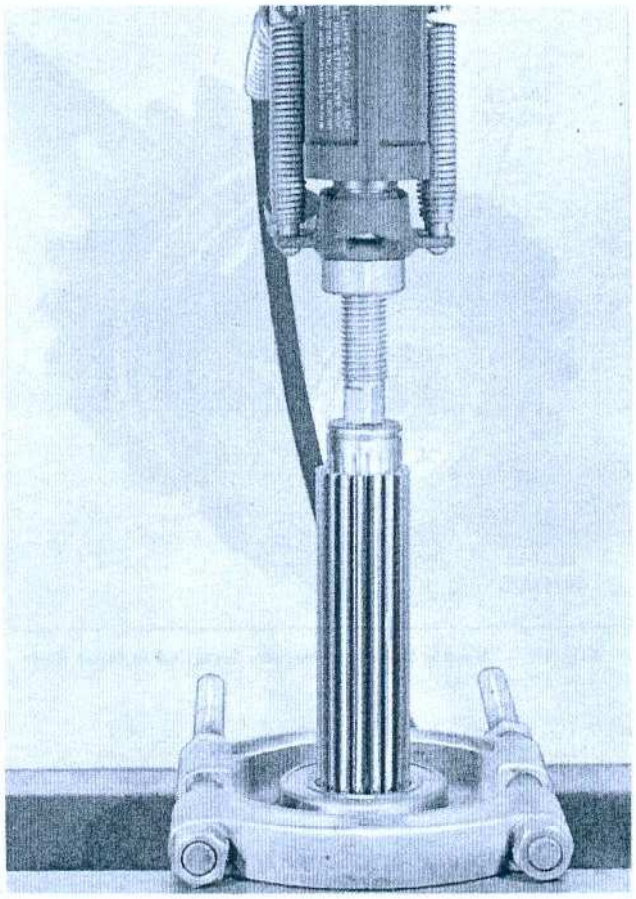

Fig. 14 – Removing Rear Bearing From Main Shaft

2nd and 3rd cluster gear, with shifter hub rearward. See Fig. 15.

c. Start front bearing on shaft. Place tool MFN 458 between bearing and bearing bore and tap rear of main shaft with a soft hammer to seat bearing on shaft. See Fig. 16.

d. Remove tool and slide main shaft and bearings into place.

Transmission models having spur gear made on countershaft:

a. Inspect the rear bearing. If damaged or worn, press old bearing off shaft over the long splined end, as shown in Fig. 14.

b. Start shaft and rear bearing into rear of transmission housing and into the sliding gears in the following sequence:

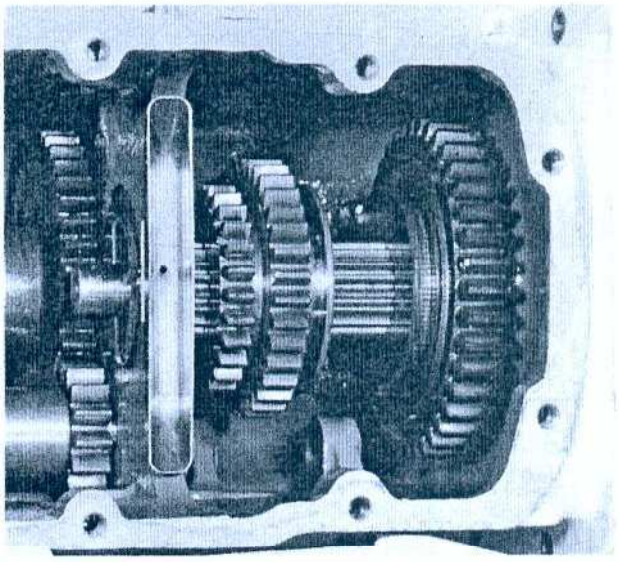

Fig. 15 – Correct Installation of Gears And Oil Trough Assembly on Main Shaft

2nd and 3rd cluster gear, with large gear rearward, followed with large gear, with shifter hub rearward.

c. Start front bearing on shaft. Place tool MFN 458 between bearing and bearing bore and tap rear of main shaft with a soft hammer to seat bearing on shaft, as shown in Fig. 16.

d. Remove tool and slide main shaft and bearings into place.

4. Install spacer washer and oil trough as-

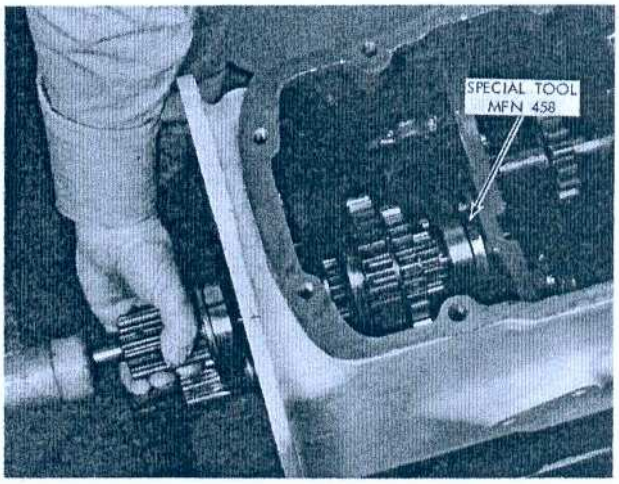

Fig. 16 – Installing Front Bearing on Main Shaft (Using Special Tool MFN 458)

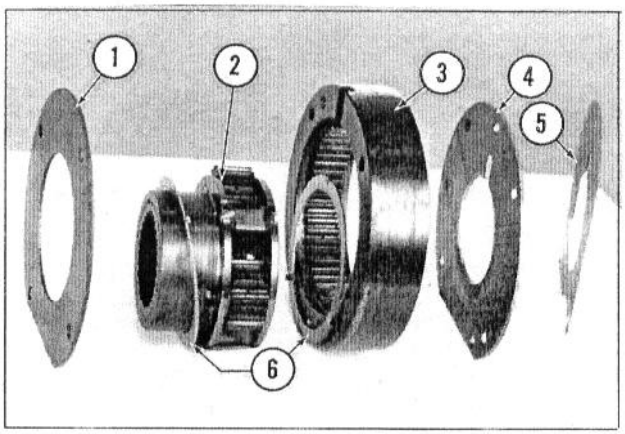

Fig. 17 – Dual Range Planetary Assembly (Identification and Sequence of Parts)

1. Rear Cover
2. Carrier Assembly
3. Ring Gear
4. Front Cover
5. Shim
6. Thrust Washer

sembly over front end of main shaft and position in slot in housing.

5. Install the planetary assembly, as follows:

   a. If the planetary has been disassembled, refer to Fig. 17, and proceed, as follows:

      (1) Place the carrier assembly, No. 2, into ring gear, No. 3.

      (2) Position the two thrust washers, No. 6, in notches on each side of the carrier assembly.

      (3) Place rear cover, No. 1, over carrier assembly, No. 2, with oil grooves toward ring gear. The cut-out portion in the ring gear must be positioned down when installed.

      (4) Insert 4 retaining bolts through holes in ring gear.

      (5) Place front cover, No. 4, over bolts, with oil grooves toward ring gear.

      (6) Place shim, No. 5, over bolts against rear cover.

   b. Hold the complete planetary assembly together and install over main shaft and against transmission housing, as shown in Fig. 18.

   c. Secure with retaining bolts.

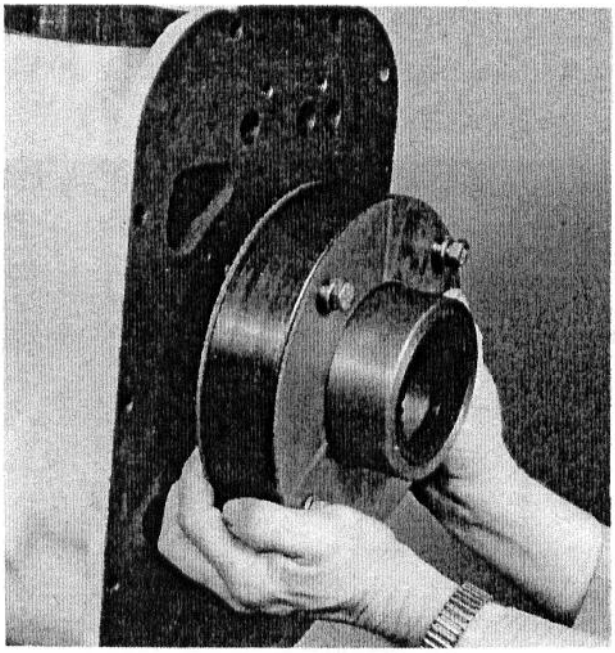

Fig. 18 – Installing Planetary Assembly on Transmission

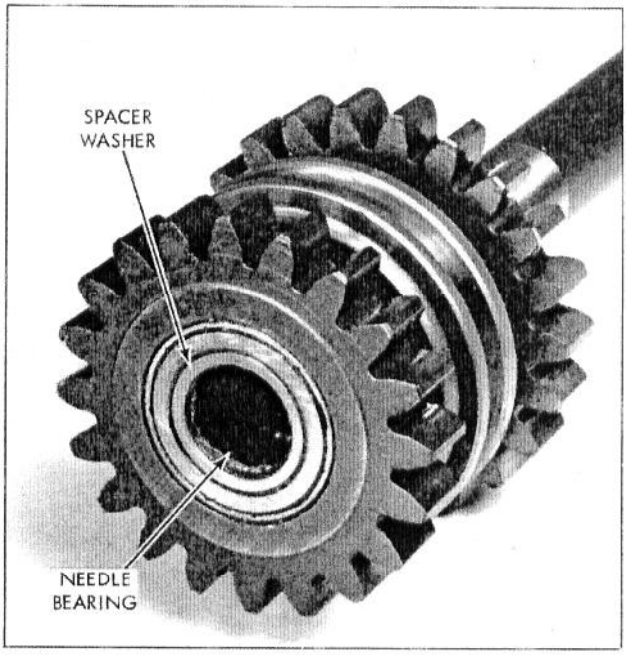

Fig. 19 – Needle Bearings Properly Installed in Input Shaft

6. Install the input shaft assembly, as follows:

NOTE: If the input shaft end play was checked before disassembly and found to be within specifications, the same shim may be used. If not within speci-

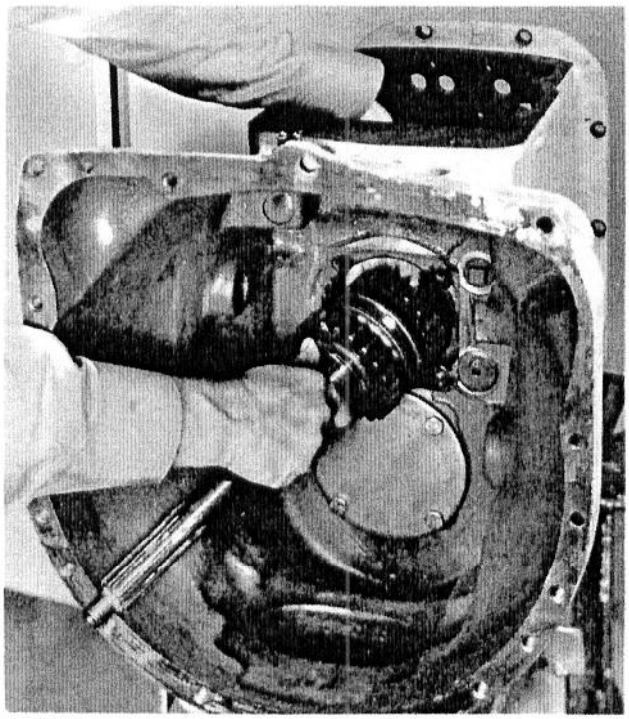

Fig. 20 – Installing Input Shaft Assembly

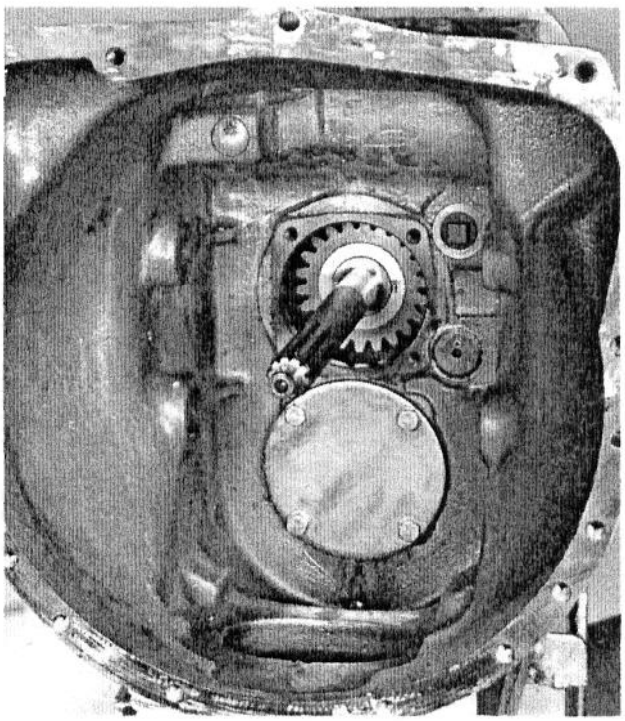

Fig. 21 – Thrust Washer and Shim Properly Positioned on Input Shaft

fications, select the correct thickness of shim, as outlined under step 7.

a. If the needle bearings are not in place in the input shaft, proceed, as follows:

   (1) Place one spacer washer in bearing bore in the rear end of the input shaft.

   (2) Coat the bearing bore with grease (to hold bearings in place) and insert 23 needle bearings, followed by another spacer washer. See Fig. 19.

b. Hold the pinions and shift collar together and carefully slide input shaft onto end of main shaft, as shown in Fig. 20.

c. Place grease on thrust washer and shim (to hold against pinion gear) and slide on input shaft and against pinion, as shown in Fig. 21.

d. Lubricate seal protector (special tool FT 357) and carefully start into front end of retainer assembly and into oil seal.

NOTE: The seal protector will not pass through the needle bearing in retainer. Therefore, it must be installed into the seal in the reverse direction. Check end of seal protector for sharp edges or nicks.

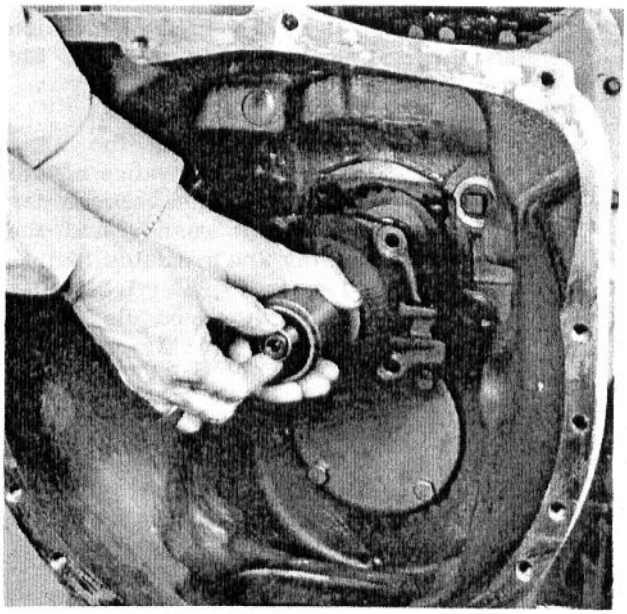

Fig. 22 – Installing Retainer Assembly on Input Shaft

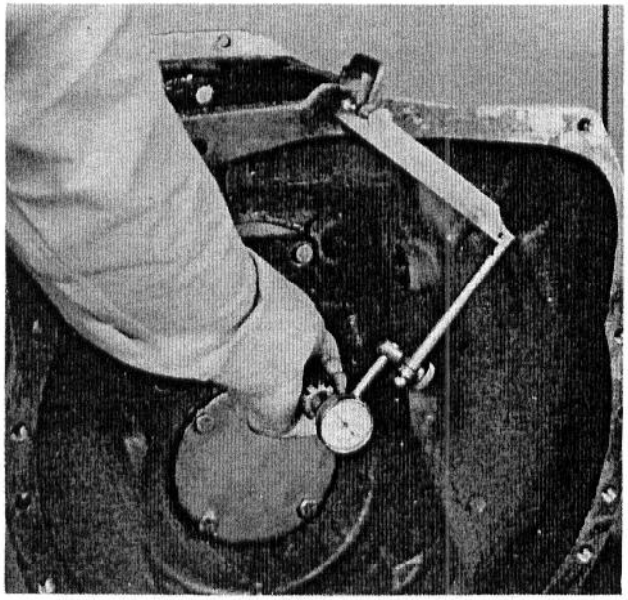

Fig. 23 – Checking Input Shaft End Play

e. Slide retainer assembly and new gasket over input shaft, as shown in Fig. 22, and secure with retaining capscrews. Alternately tighten retaining capscrews. After assembly, the input shaft should be free to turn by hand with transmission in neutral.

f. Check end play of input shaft.

7. Check the input shaft end play, as follows:

a. Attach a dial indicator to transmission housing and against the front end of the input shaft, as shown in Fig. 23.

b. Check end play by moving the input shaft in and out. This clearance should be .010" to .020". Shims between the reverse pinion thrust washer and the retainer assembly are available in different thicknesses. Selectively fit shims to obtain the desired clearance. Shims are available in the following sizes: .010" - .020" - .030" - .040" and .050".

NOTE: To correct the end play, remove only the input shaft retainer from the shaft and select a shim of the correct thickness. Be sure to use a seal protector to prevent damage to the oil seal. See Fig. 22.

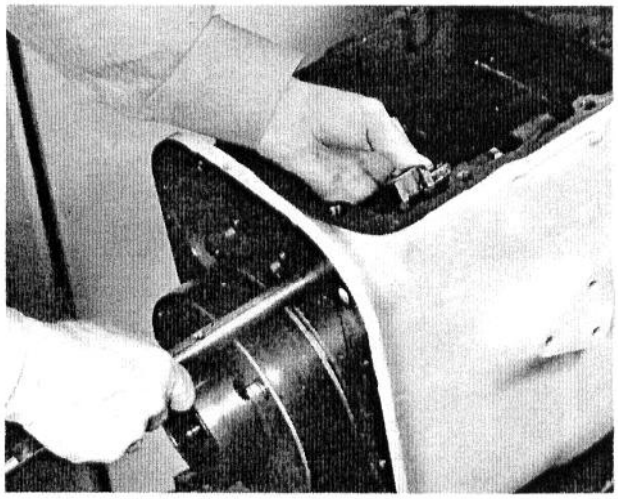

Fig. 24 – Installing Planetary Shift Selector and Rail

8. Install clutch shaft, fork and release bearing, as follows:

a. Slide clutch shafts through housing on each side and into release fork.

b. Position fork on shafts and secure with setscrews. Lock wire the setscrews.

c. Pack the inside groove of the release bearing retainer with grease. Then, slide the bearing and retainer assembly on the input shaft retainer.

d. Hook the two return springs into the input shaft retainer and into release bearing retainer.

9. Install shifter forks and rails by referring to the appropriate heading below, and proceed, as outlined:

Transmission models with splined countershaft:

a. Place Manual Shuttle shifter fork in the shift collar. It may be necessary to move the shift collar forward to install this shifter fork.

b. Hold planetary shift selector (with notch rearward and to right) and slide shift rail through shift fork and selector, as shown in Fig. 24.

c. Place 1st gearshift fork over 1st gear,

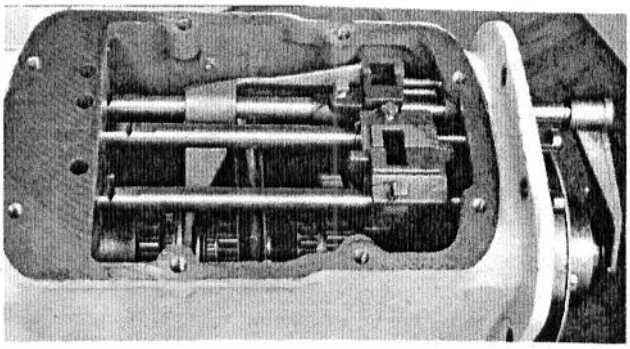

Fig. 25 – Shift Forks and Rails Properly Installed

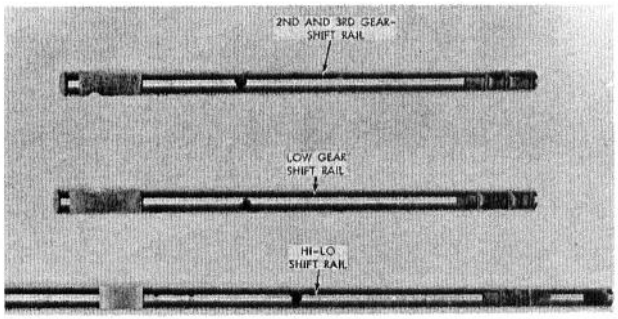

Fig. 26 – Identification of Shift Rails

with gearshaft lever notch forward and to the left side.

d. Place 2nd and 3rd speed gearshift fork in gear, with shift lever notch forward and to the right side.

e. Slide the shift rails into their respective forks and secure with setscrews and lock wire. Install retainer plate at rear of shift rails. Fig. 25 shows the shift forks and rails correctly installed. Refer to Fig. 26 for identification of shift rails.

Transmission models having spur gear made on countershaft:

a. Place Manual Shuttle shifter fork in the shift collar. It may be necessary to move the shift collar forward to install the shifter fork.

b. Hold planetary shift selector (with notch rearward and to right) and slide shift rail through fork and selector, as shown in Fig. 24.

c. Place shifter forks in sliding gears, with gearshift lever notches together (both shifter forks are interchangeable).

d. Slide the shift rails into their respective forks and secure with setscrews and lock wire. Install retainer plate at rear of shift rails. Refer to Fig. 26 for identification of shift rails.

10. Install transmission cover, as follows:

a. Inspect the Manual Shuttle shift lever for binding or wear in the ball and cup. The lever ball binding in the cup could prevent the shift rails from going to full detent. Therefore, the forward or reverse gears could jump out of mesh. The lever ball being worn or too loose in the cup could also cause the same problem. If the cup, lever ball or retaining pin is worn, replace as required, making sure no binding exists.

b. Place a new gasket on top of transmission housing. Then, carefully align shift levers in shift forks and install top cover.

c. Move shift lever in each gear, making sure the detents fully engage.

DRIVE AXLE ASSEMBLIES

Master Contents Page

DRIVE AXLE ASSEMBLY
Planetary Type

CONTENTS

DRIVE AXLE ASSEMBLY
Non-Planetary Type

CONTENTS

Refer to the Contents page found at the beginning of each axle type. Note that each axle type begins with Page 1. Refer to the specific Tractor or Unit Model in the appropriate Group, Section and Part for procedures and adjustments related to that machine which are not found here.

(INSERT THIS PAGE AFTER THE DRIVE AXLE ASSEMBLIES DIVIDER TAB)

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DRIVE AXLE ASSEMBLY

CONTENTS

NOTE: This supplemental information covers wet brakes on the MF50A Tractor/Backhoe/Loader Service Manual, Form No. 1448 990 M1.
Under Tab 5, replace the contents page — Drive Axle Assembly.
Also under Tab 5, replace Page 1 of Drive Axle Assembly (Planetary Type).
Place Pages 43 and up after Page 42 of Drive Axle Assembly (Planetary Type).

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Rev. JUN 72

SPECIFICATIONS

GENERAL:

Differential Carrier Bearing Pre-Load ..... Requires special Tool MFN 245UK. Refer to pre-load tables under "Drive Axle", and Axle Housing — Wet Brakes.

Axle Planetary Carrier Bearing Pre-Load ..... Wide Ring Gear .006" — .016"
Use Special Tool MFN 267Y

Axle Planetary Carrier Bearing Pre-Load ..... Narrow Ring Gear .005" — .012"
Use Special Tool MFN 267Y

Drive Pinion Bearing Pre-Load ..... 18 — 22 in.-lbs. torque
Ring Gear and Pinion Backlash ..... .003" — .019"

FASTENER TORQUES:

Axle Housing-to-Center Housing Nuts ..... 76 — 85 ft.-lbs.
Axle Planetary Drain Plug ..... 8 — 10 ft.-lbs.
Axle Planetary Drive Cover-to-Axle Housing Bolts ..... 50 — 55 ft.-lbs.
Axle Planetary Filler Plug ..... 40 — 45 ft.-lbs.

Axle Planetary Pinion Shaft Retainer Capscrew (Narrow Ring Gear) ..... 30 — 35 ft.-lbs.

Axle Planetary Pinion Shaft Retaining Screw (w/Loctite) (Wide Ring Gear) ..... 10 — 13 ft.-lbs.

Center Housing-to-Transmission Bolts ..... 50 — 55 ft.-lbs.
Differential Case Capscrews ..... 76 — 85 ft.-lbs.
Differential Lock Arm Shaft Bolt ..... 75 — 80 ft.-lbs.
Drive Pinion Assembly Flange-to-Center Housing Capscrews ..... 75 — 80 ft.-lbs.
Ring Gear-to-Differential Case (w/Loctite) Bolts ..... 110 — 120 ft.-lbs.
Side Covers-to-Center Housing Capscrews ..... 33 — 38 ft.-lbs.
Wheel Nuts ..... 180 — 200 ft.-lbs.

LUBRICATION (capacities approximate)

Drive Axle Planetaries
- Low plug location ..... 1 U.S. qt.
- High plug location ..... 1½ U.S. qt.

Dry Brake Type Axle
- Differential and Manual Shuttle Transmission ..... 8 U.S. gal.
- Differential, Instant Reverse and Torque Convertor ..... 8½ U.S. gal.

Use E.P. Transmission Oil conforming to Massey-Ferguson specification M-1129A. (Spec. No. is on the container.)

Wet Brake Type Axle
- Differential and Manual Shuttle Transmission ..... 9½ U.S. gal.
- Differential, Instant Reverse and Torque Convertor ..... 10 U.S. gal.

Use E.P. Transmission Oil for wet disc brakes conforming to Massey-Ferguson specification M-1135 or M-1127.

DESCRIPTION

The Drive Axle Assembly includes the center housing, axle housings, axle planetaries, drive pinion and ring gear, and differential assembly.

The Drive Axle Assembly power train consists of a single reduction, spiral bevel, drive pinion and ring gear, driving full floating axle shafts on each side of the tractor thru a four pinion differential, and a side gear. The outer ends of the axle shafts turn 3 pinion, planetary reduction assemblies that drive the wheel axles (stub axles).

A grooved drive shaft coupler, connecting the drive shaft to the drive pinion, provides overload protection. A severe overload will break this coupler, instead of damaging other parts of the drive train.

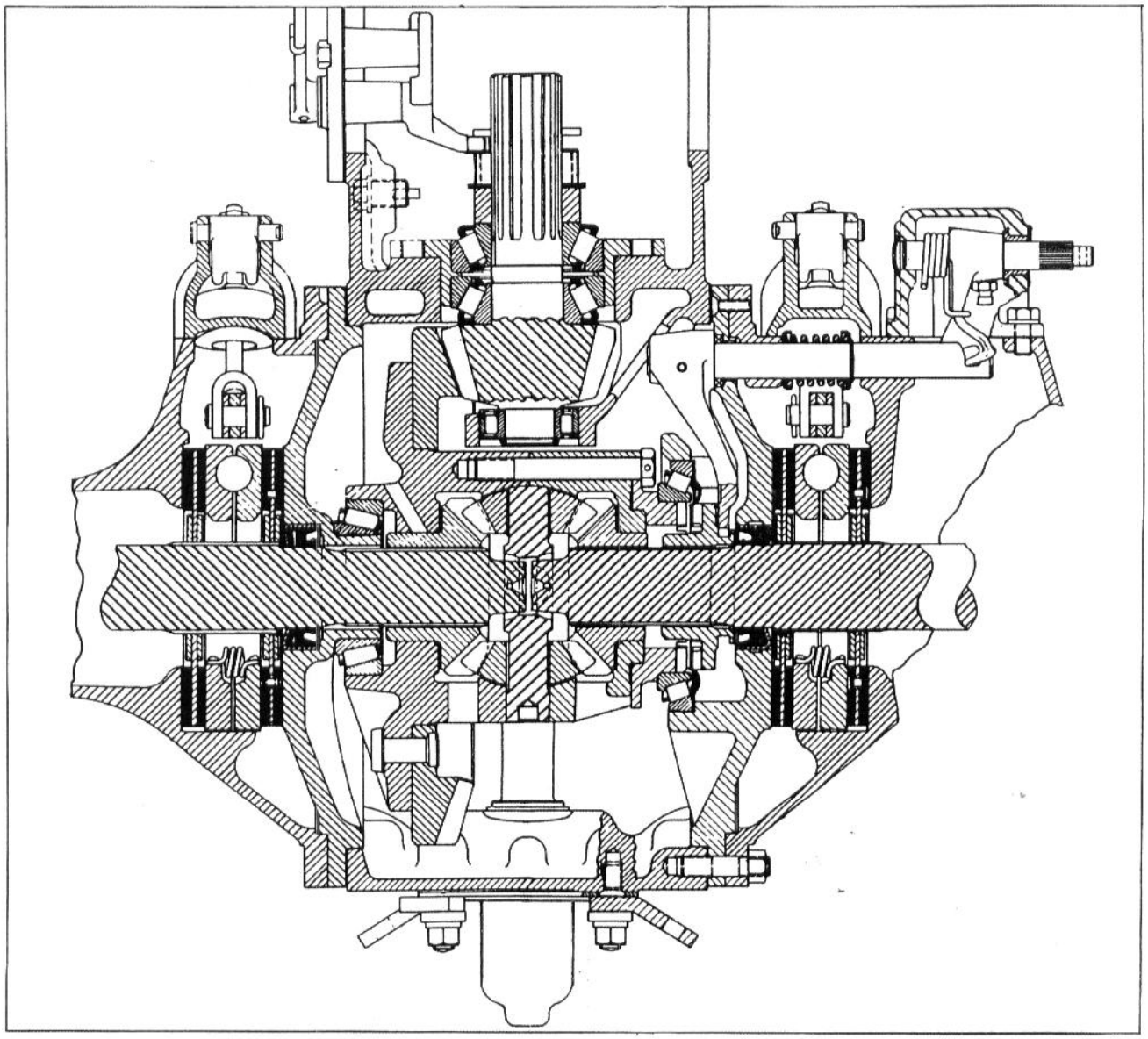

FIG. 1 — DRIVE AXLE ASSEMBLY — PARTIAL CROSS SECTION (W/DIFF. LOCK)

The engine end of the tractor is the front; the drive axle, the rear. Left and right are determined looking forward from the rear of the tractor.

Double-disc brakes are located in each axle housing. They are actuated individually by mechanical pedal linkage, and together, by a hydraulic master cylinder — also pedal operated. Oil seals at the inner and outer ends of the main axle shafts prevent lubricant from entering the brake chambers.

Refer to the "Specifications" pages for lubricant type and capacities for the different models.

The differential lock actuating mechanism (when so equipped) is located in the right-hand axle housing and is mechanically actuated with a hand lever.

Differential carrier bearing pre-load is determined by special tool MFN 245UK, and is set by use of the proper carrier bearing shield or shims. Axle planetary bearing pre-load is also "shim-adjustable" and requires use of special tool MFN 267Y for determination. Ring gear and pinion backlash is "shim-adjustable."

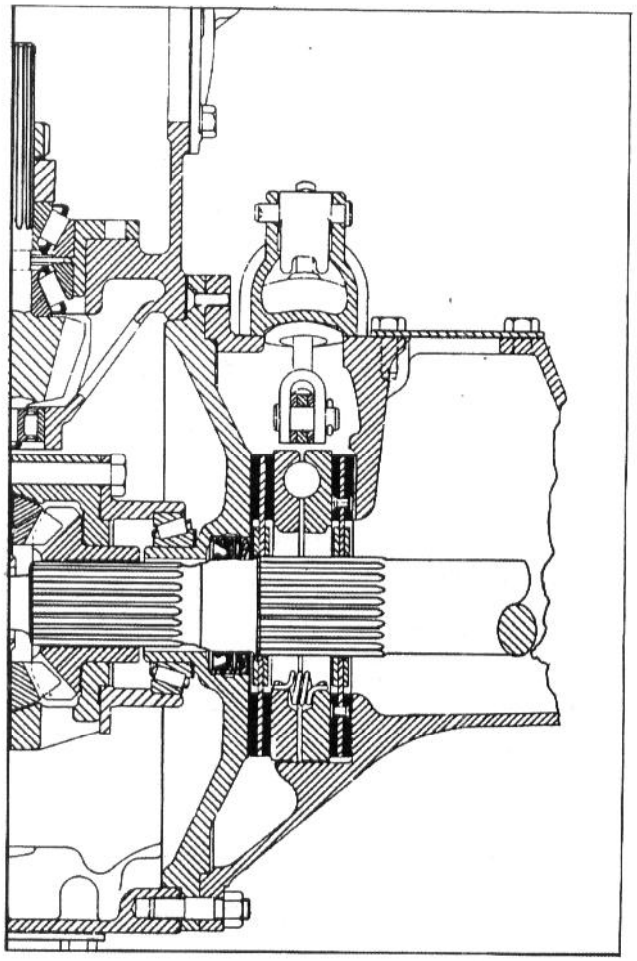

FIG. 2 — DRIVE AXLE ASSEMBLY — PARTIAL CROSS SECTION (W/O DIFF. LOCK)

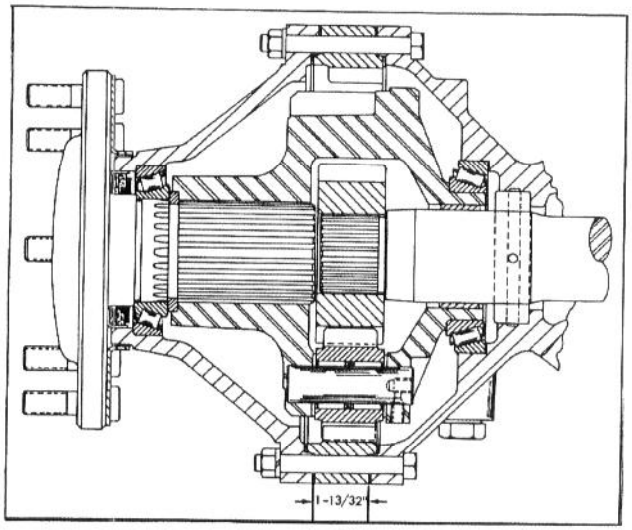

FIG. 3 — AXLE PLANETARY ASSEMBLY — WIDE RING GEAR

DRIVE AXLE ASSEMBLY (Center Housing with Axles)

REMOVAL

1. Drain the center housing.

2. Drop loader (if installed) from drive axle assembly. Refer to Fig. 5.

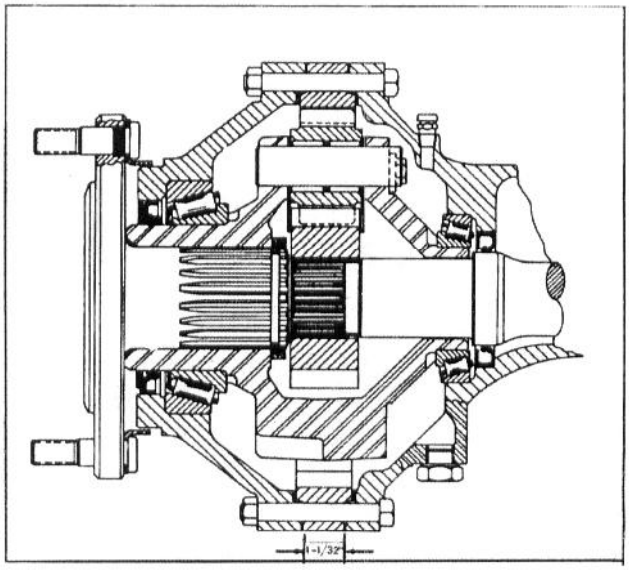

FIG. 4 — AXLE PLANETARY ASSEMBLY — NARROW RING GEAR

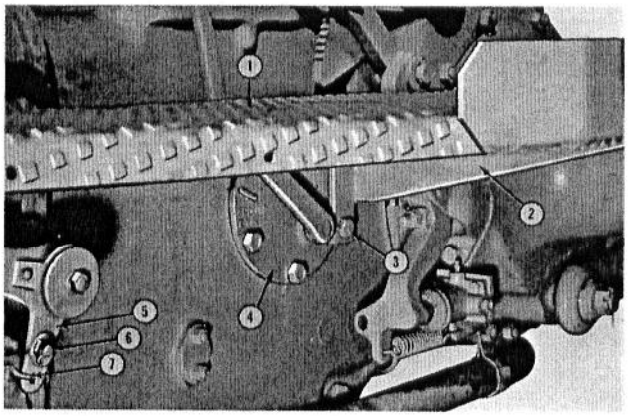

FIG. 6 — L.H. SIDE — DRIVE AXLE

1. L.H. Step Plate
2. Rear Mounting Bracket
3. Bolt — Mounting Bracket
4. L.H. Side Cover — Center Housing
5. Clutch Pedal
6. Clutch Pedal Rod
7. Clutch Pedal Return Spring

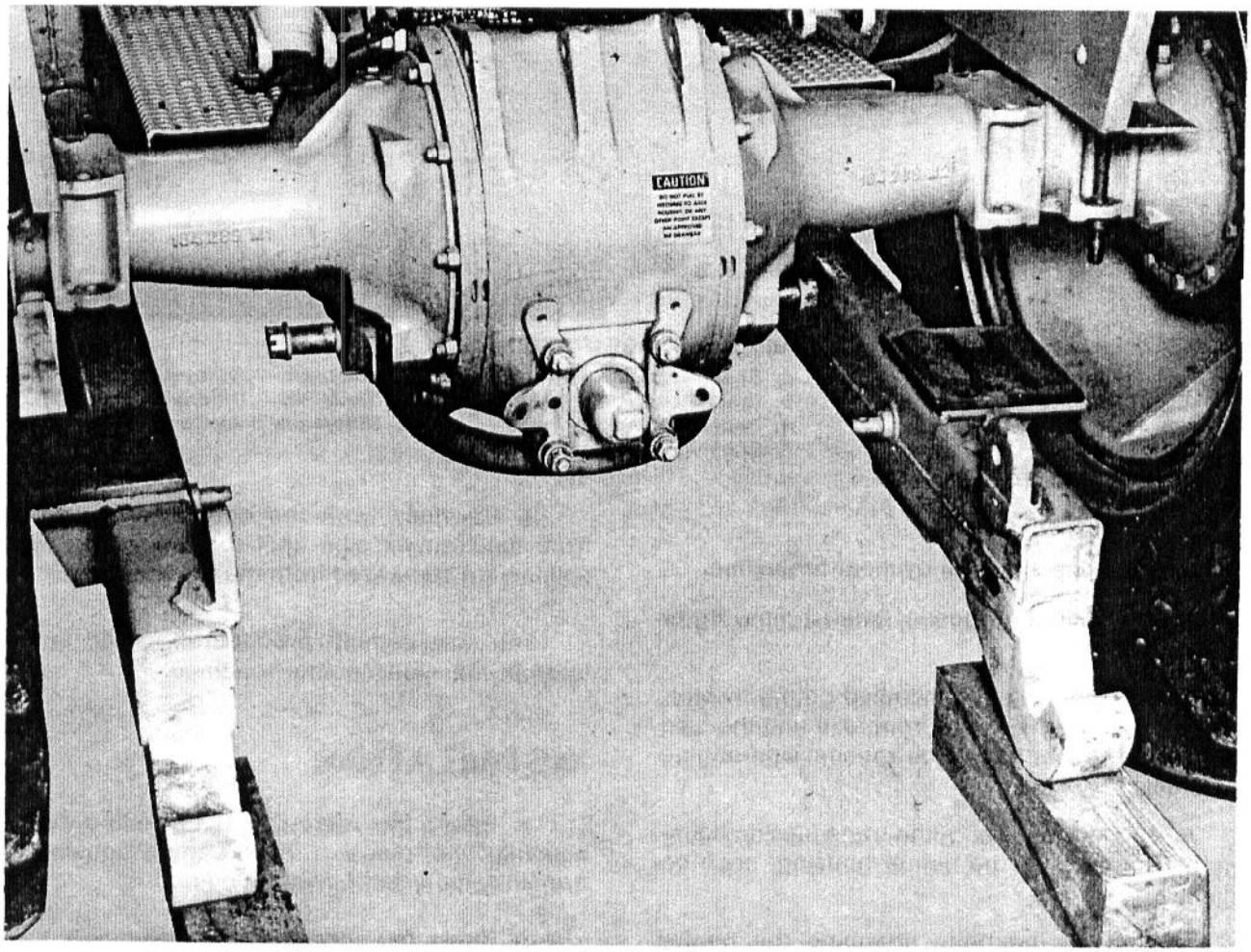

FIG. 5 — DRIVE AXLE ASSEMBLY WITH LOADER FRAME REMOVED

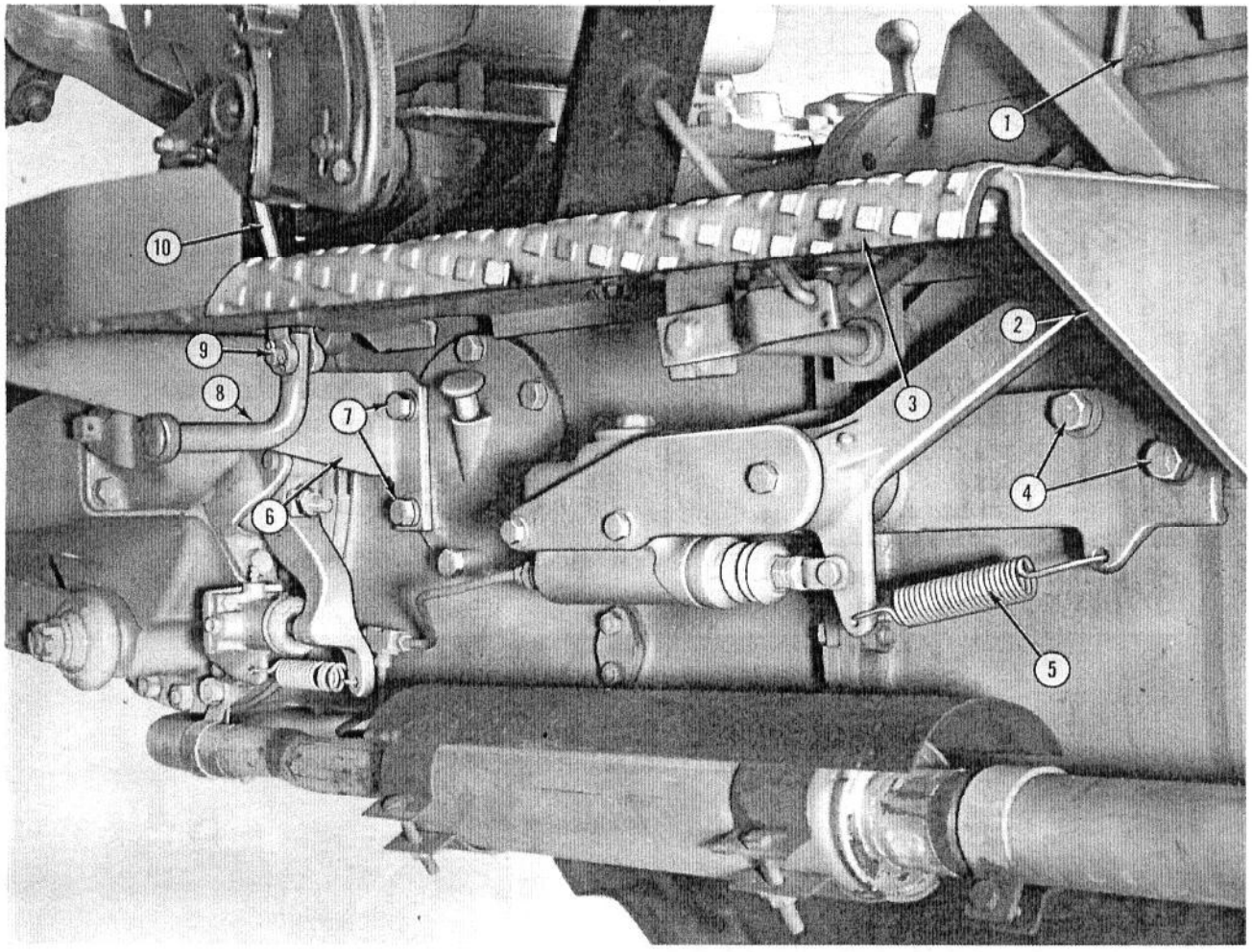

FIG. 7 — R.H. SIDE — DRIVE AXLE

1. Throttle Rod
2. Forward Mounting Bracket
3. R.H. Step Plate
4. Bolts — Mounting Bracket
5. Brake Pedal Return Spring
6. Rear Mounting Bracket
7. Bolts — Mounting Bracket
8. Shaft Arm — Differential Lock
9. Clevis Pin — Differential Lock
10. Differential Lock Control Rod

3. Remove step plates.

4. Disconnect master cylinder brake line.

5. Disconnect or loosen exhaust pipe. Refer to Figs. 6 and 7.

6. If a Loader is not installed on the tractor, drive wedges between the front axle and the axle support to prevent tipping of transmission-engine assembly.

7. Support the rear of the transmission housing and the front of the center housing, each on a jack.

8. Remove the bolts attaching the center housing to the transmission housing.

9. Carefully work the center housing away from the transmission until the main drive shaft splines are separated from the transmission.

For disassembly procedures, refer to the appropriate subassembly headings.

INSTALLATION

1. Insert the attaching bolts in the center housing and place a new center housing-to-transmission gasket over the bolts.

2. Place the drive shaft coupler and drive shaft in position on the drive pinion shaft.

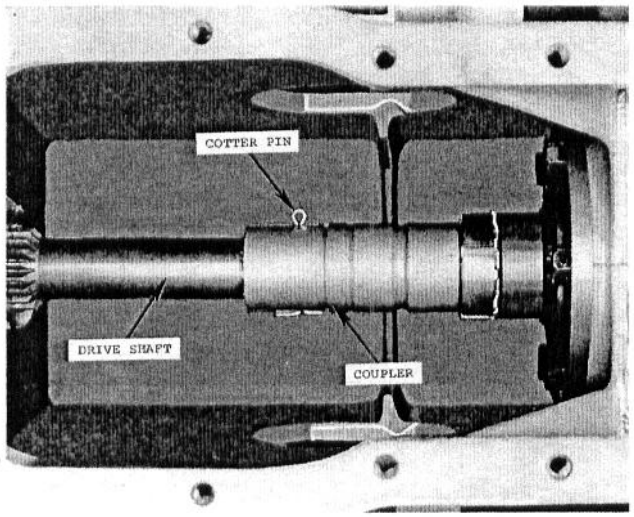

FIG. 8 — DRIVE SHAFT COUPLER POSITION

NOTE: Position the coupler so the cotter pin is closest to the transmission. Refer to Fig. 8.

3. Align the center housing with the transmission, start the main drive shaft and carefully work the housings together.

NOTE: It may be necessary to remove a side cover, top cover, or lift cover to properly align the main drive shaft.

4. Install the retaining nuts and tighten to 50 to 55 ft.-lbs. torque.

5. Reconnect exhaust pipe.

6. Reconnect brake line and bleed brakes.

7. Install step plates.

8. Install loader frame and fenders.

9. Remove jacks and blocking.

10. Refill the center housing with M-1129 or M-1129A lubricant.

AXLE HOUSING ASSEMBLY

This assembly consists of the axle planetary assembly, axle shaft, brake assembly, carrier plate, differential lock actuating mechanism, axle housing and associated seals and bearings.

The axle planetary assemblies and the main axle shafts may be serviced without removing the axle housing.

Axle housings used with "narrow ring gear" planetaries measure 5-1/8" deep at the fender mounting pads. Most of the axle housings used with "wide ring gear" planetaries measure 5-5/8" deep at this point. Axle housings (w/wide ring gear) with casting numbers 894 773 M1 and 894 774 M1 are 5-1/8" deep at the fender mounting pads.

REMOVAL — Refer to Figs. 6 and 7.

1. Remove the wheel and securely block the center housing up.

2. Drain the center housing lubricant. Note drain plugs in both center housing and transmission. Capacity does not normally exceed 9 gallons and, depending on model, may be as little as 7 gallons.

3. If loader is installed, drop the loader side frame and remove fender from the axle housing to be removed.

4. Remove the step plate and rear step plate bracket.

5. *Right-hand axle housing* — Disconnect the differential lock arm from the actuating rod.

6. Loosen or disconnect the exhaust pipe.

7. Disconnect the hydraulic brake line from the actuating cylinder.

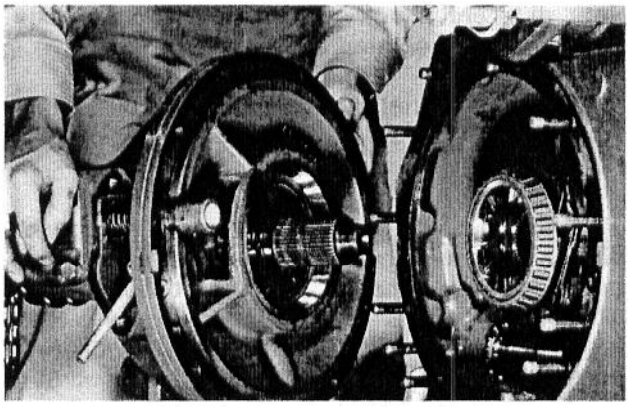

FIG. 9 — R.H. AXLE HOUSING ASSEMBLY REMOVAL OR INSTALLATION

8. Attach a hoist to the axle housing assembly and apply light tension.

9. Remove the axle housing retaining nuts.

NOTE: The brake lever supports may be removed for access to the nuts behind them.

10. Remove the brake pedal brackets and work the axle housing assembly free of the center housing. Refer to Figs. 9 or 10.

11. Remove the center housing gasket and clean the gasket surfaces. See the heading "Axle Planetaries" in this Part for identification of components.

INSTALLATION

Install the *left-hand* axle housing assembly as described (right), then remove the right-hand axle housing, and check carrier bearing pre-load as described in "Carrier Bearing Pre-Load Adjustment — Planetary Axles".

Install the *right-hand* axle housing assembly *only* after carrier bearing pre-load has been determined as described in "Carrier Bearing Pre-Load Adjustment — Planetary Axles". Refer to Figs. 9 and 10.

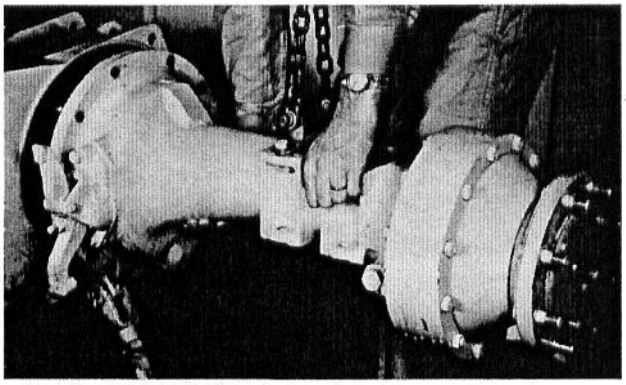

FIG. 10 — L.H. AXLE HOUSING ASSEMBLY REMOVAL OR INSTALLATION

1. Determine differential carrier bearing pre-load as described in "Carrier Bearing Pre-Load — Planetary Axles" under the "Drive Axle".

2. Install a new center housing-to-axle housing gasket.

3. Align the assembly with the differential and the center housing and slide into position.

4. Install brake pedal bracket, light wire clips, and the brake actuating cylinder bracket on the axle housing studs.

5. Install the axle housing retaining nuts and tighten to 75 to 80 ft.-lbs. torque. (Install brake lever supports if removed.)

6. Connect the hydraulic brake line to the actuating cylinder and bleed brake lines.

7. Tighten the exhaust pipe connections if loosened or removed.

8. *Right-hand side:*

a. Reconnect differential lock rod.

b. Move the differential lock lever to see that there is no binding of the linkage and that the lock will fully engage.

CAUTION: Be certain that the lever will not stay in an "over-center" position. The differential lock may not release if the lever goes over-center.

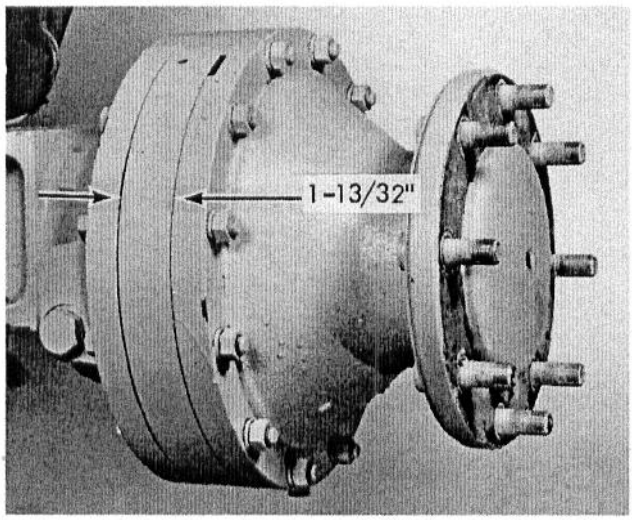

FIG. 11 — AXLE PLANETARY ASSEMBLY IDENTIFICATION — WIDE RING GEAR

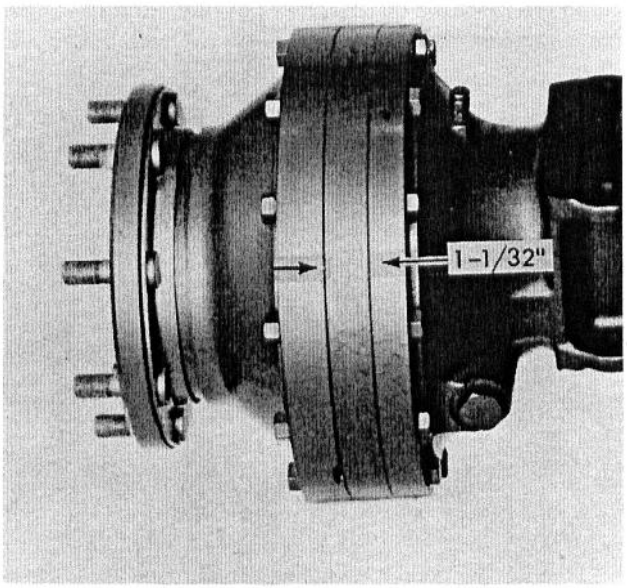

FIG. 12 — NARROW RING GEAR AXLE PLANETARY IDENTIFICATION (FRONT VIEW)

10. Install the step plate and rear step plate bracket.

11. Attach the loader side frame and fender.

12. Fill axle planetaries to oil filler plug with M-1129 or M-1129A oil, if drained. One quart is approximate capacity.

13. Install tire and remove blocking and jacks.

14. Fill the center housing to the proper level with M-1129 or M-1129A lubricant.

AXLE PLANETARY ASSEMBLY IDENTIFICATION

Two kinds of 3 pinion axle planetaries are used. They may be identified by the *external* width of the axle planetary ring gear and will be referred to as "wide ring gear" and "narrow ring gear" type planetaries.

The wide ring gear measures 1.409/1.404 inches, (about 1-13/32"), wide across the exposed edges of the gear. See Fig. 11.

The narrow ring gear measures 1.034/1.029 inches, (about 1-1/32"), wide across the exposed edge of the gear. See Fig. 12. Different servicing and bearing pre-load adjustment procedures are required for the two assemblies. Assembly removal and installation is similar for the two assemblies.

Refer to the "Drive Axle" heading and find the "Wide", or "Narrow" Axle Planetary heading for complete removal, servicing, and installation details.

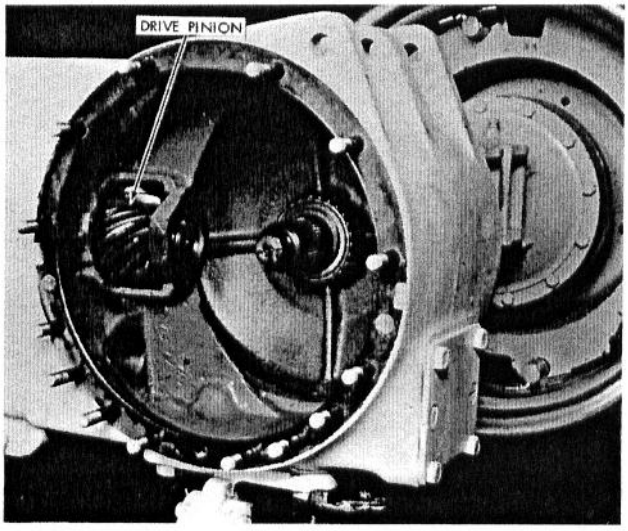

FIG. 13 — DRIVE PINION LOCATION

DRIVE AXLE ASSEMBLY

PLANETARY TYPE

CONTENTS

The Drive Axle Assembly includes the center housing, axle housing, axle planetaries, drive pinion assembly and ring gear, differential carrier assembly, and brakes.

Removing and installing this assembly from the tractor or unit is covered under the appropriate Model heading because of the many variations in external connections and mounting. This Assembly is attached to the transmission and may be further attached to side frames at the axle housing, depending on Model.

Locations given as front, rear, left and right are based on a "normal" tractor and axle arrangement where the engine is located at the front of the unit, and the drive axle assembly, the rear. Left and right are determined standing behind the drive axle facing forward.

Other arrangements are noted under the appropriate Model elsewhere in this Manual. For instance, the differential lock is located on the right side of the drive axle assembly, and carrier bearing pre-load is determined on the right side of the center housing regardless of their location when installed in a specific Model. The drive pinion assembly is located at the front of the ring gear.

Revised June 72 — Printed in U.S.A.

AXLE SHAFT SERVICING—Planetary Type Axle

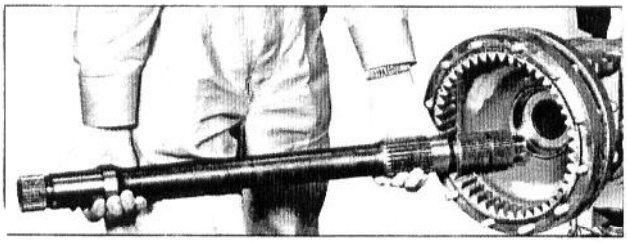

Fig. 1 – Axle Shaft Removal or Installation (Used W/Narrow Ring Gear)

REMOVAL

1. Remove the axle planetary as described under that heading.

NOTE: It is not necessary to remove the axle housing to remove the axle shaft. If the axle housing assembly has been removed, the axle planetary assembly must be removed from "Narrow Ring Gear" models before the axle shaft can be removed.

2. Lock, or wedge, the brake in the engaged position to prevent the brake discs from dropping when the axle shaft is removed (if axle housing is still in place on the tractor).

3. Remove the axle shaft as shown in Fig. 1 or Fig. 2.

4. Remove the axle shaft outer oil seal if inspection shows damage or excessive leakage. Refer to Fig. 3.

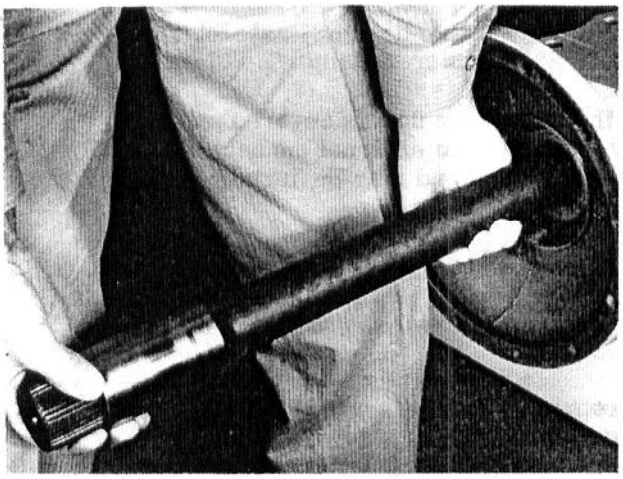

Fig. 2 – Axle Shaft Removal or Installation (Used W/Wide Ring Gear)

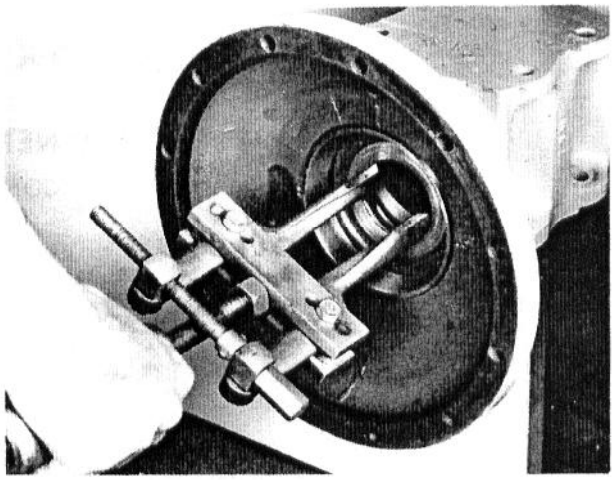

Fig. 3 – Oil Seal Removal

INSPECTION

1. Examine all splines for excessive wear, cracks or other damage. Replace the axle if necessary.

2. Examine the oil seal contact surfaces on the axle shaft for scratches and other irregularities. Smooth the surfaces with very fine emery cloth.

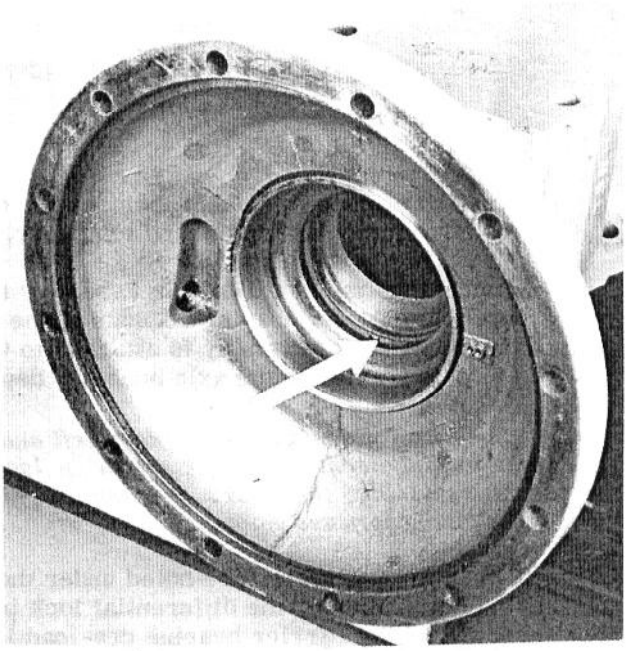

Fig. 4 – Oil Seal Drain Hole Location (Wide Ring Type Only)