

## SECTION IX — ENGINE CLUTCH AND TORQUE CONVERTER

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### 1. ENGINE CLUTCH

#### A. Description

The engine clutch (tractors without torque converter) is a single plate, dry clutch having an over-center engaging action. A shifting sleeve and bearing mechanism, carried on the clutch shaft and connected by linkage to the clutch actuating levers, is actuated by the clutch operating lever to engage and disengage the clutch. A threaded adjusting ring provides a means of maintaining the necessary adjustment to compensate for normal wear on the clutch facings.

The engine clutch (tractors with torque converter) is a single plate, dry clutch having an over-center engaging action. A shifting sleeve, sleeve collar, and bearing mechanism, carried on the torque converter input shaft and connected by levers and links to the clutch pressure plate, is actuated by the clutch operating lever to engage and disengage the clutch. A threaded adjusting ring provides a means of maintaining the necessary adjustment to compensate for normal wear on the clutch facings.

A clutch brake (tractors without torque converter) consisting of a stationary lined plate, attached to the clutch shifter bearing carrier, and a steel brake disc bolted to the clutch shaft, is provided for stopping the rotation of the clutch shaft and the transmission top shaft when shifting. The clutch brake is applied by pushing forward on the engine clutch operating lever after disengaging the clutch. The clutch shifting sleeve, clutch shifting sleeve bearing (throwout bearing) and the clutch shaft rear bearing require periodic lubrication.

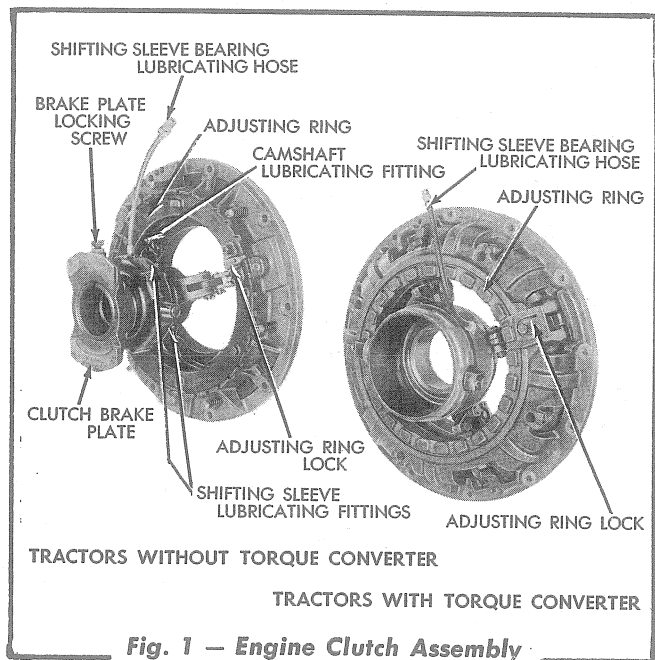
Tractors with a torque converter are not equipped with a clutch brake, as the fluid in the torque converter acts as a brake and stops the rotation of

the clutch driven plate and the torque converter input shaft when the clutch is disengaged. The clutch shifting sleeve bearing (throwout bearing), and the torque converter bearings require periodic lubrication.

The clutch back plate is bolted to the rear face of the engine flywheel and carries most of the clutch weight, thus adding to the flywheel effect. The clutch driven plate assembly, which is splined to the clutch shaft on tractors without a torque converter or splined to the torque converter input shaft on tractors with a torque converter, is friction engaged between the clutch pressure plate and the rear face of the flywheel when the clutch is engaged. When the clutch is disengaged, the friction between the clutch pressure plate, clutch driven plate, and the flywheel is relieved, and the clutch brake assembly or the fluid in the torque converter stops the rotation of the clutch driven plate and the clutch shaft or torque converter input shaft. The other components of the clutch continue to turn with the engine flywheel.

On tractors without a torque converter, the front end of the clutch shaft is supported by the clutch shaft front ball bearing (pilot bearing) installed in the counterbore of the engine flywheel; the rear end of the clutch shaft is supported by the clutch shaft rear ball bearing, installed in the clutch shaft rear bearing retainer. The clutch shaft is connected to the transmission top shaft (input shaft) by a universal joint assembly. By removal of the universal joint assembly, the engine clutch can be removed without disturbing the engine or the transmission.

On tractors with a torque converter, the clutch driven plate is splined to the torque converter input shaft which is supported by a ball bearing in a

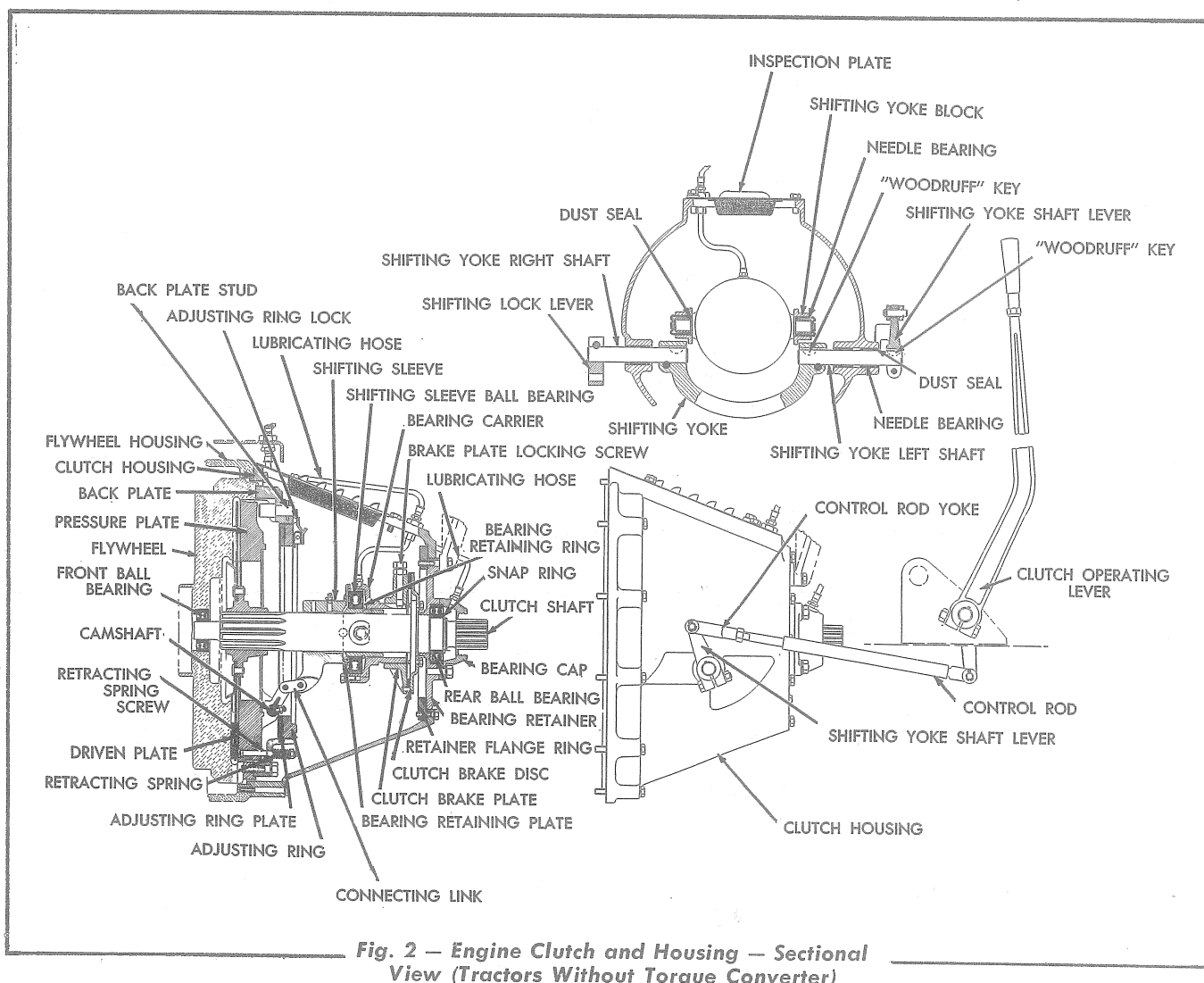


bearing carrier attached to the clutch housing, eliminating the use of a clutch pilot bearing in the engine flywheel. When assembled the torque converter housing and the engine clutch housing are attached together. The engine clutch housing serves as an integral part of the converter assembly, and is attached to the engine flywheel housing. By removing the drive shaft universal joint assembly, the engine clutch and torque converter assembly can be removed without disturbing the engine or the transmission.

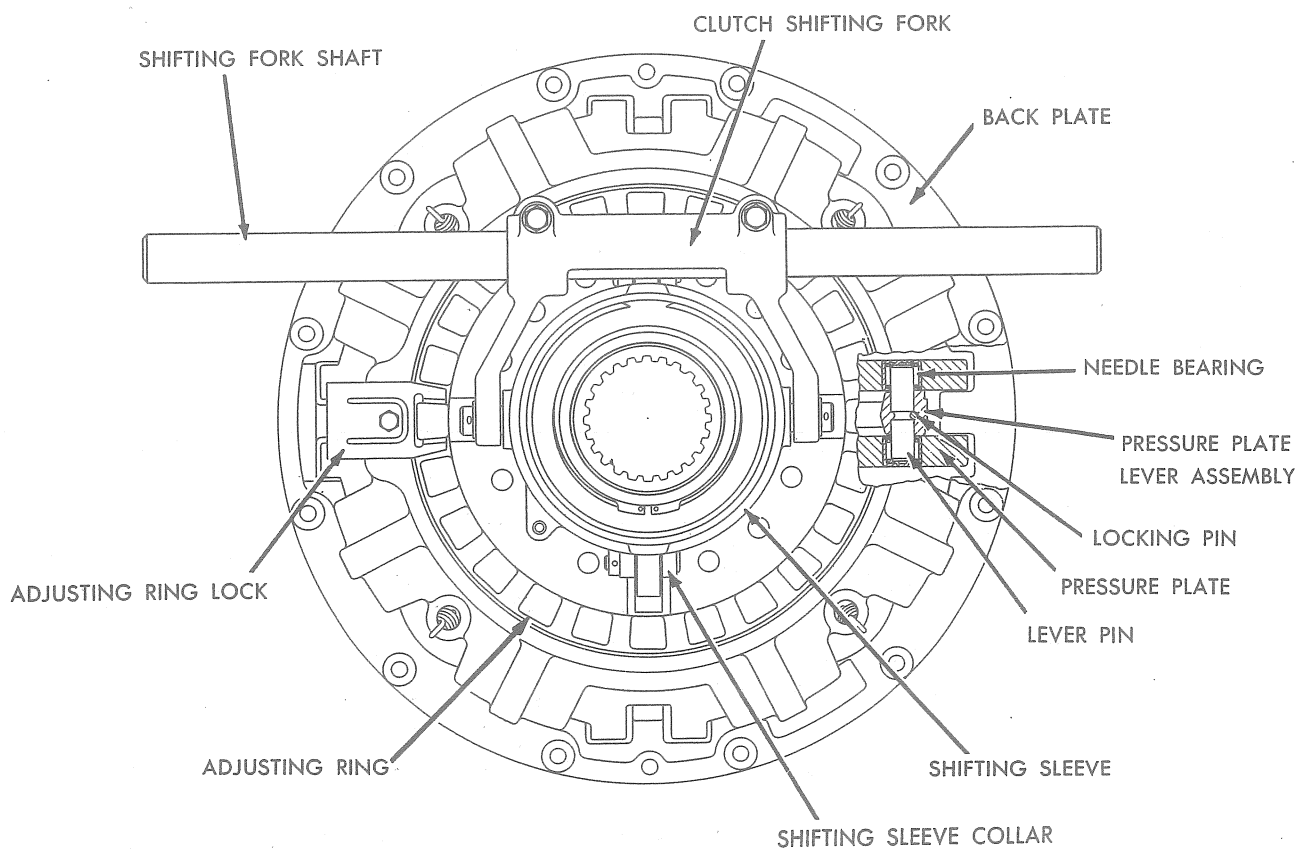
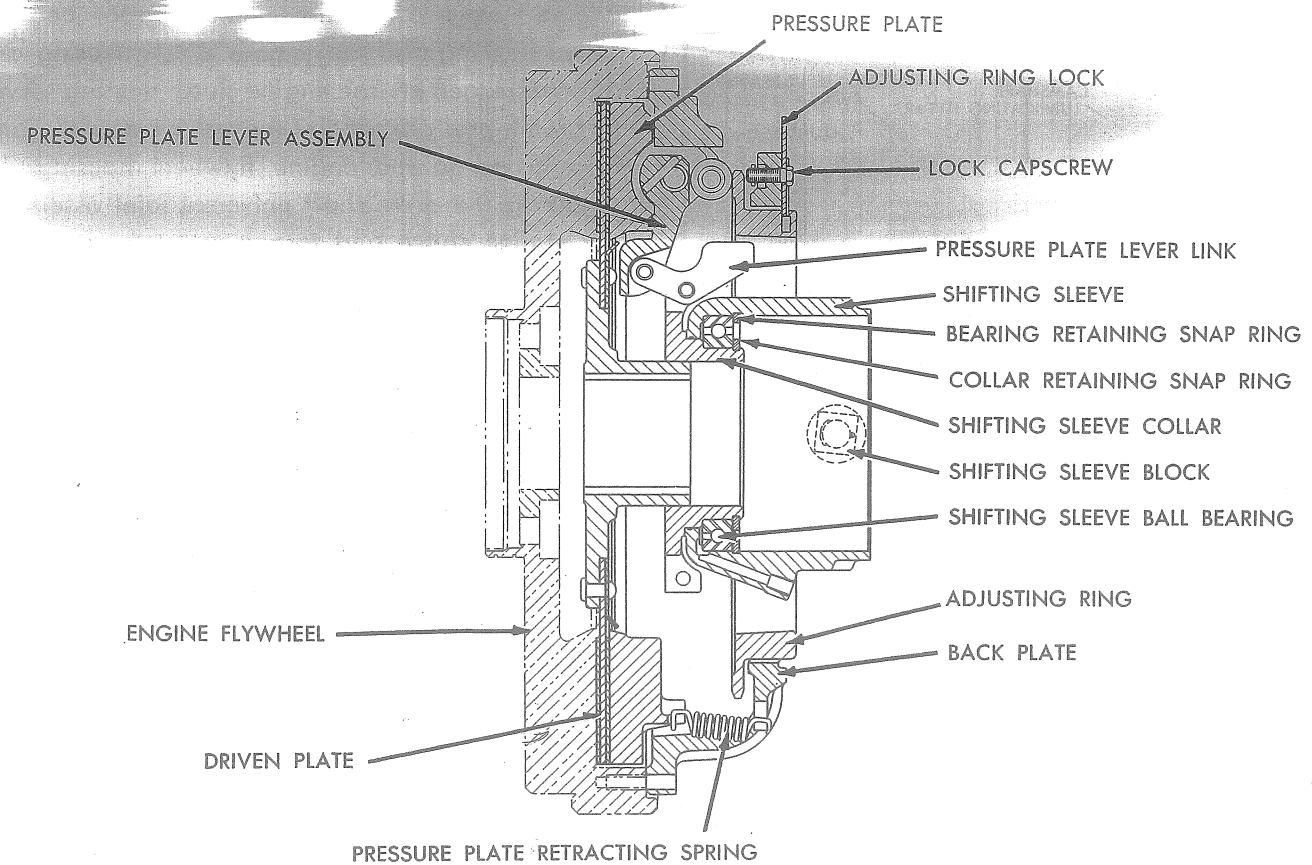
## B. Service of Engine Clutch

Specified time intervals between clutch adjustments cannot be established because of the variable operating conditions which determine the amount of clutch facing wear. Keep the clutch adjusted so that a pull of 25 to 30 pounds (30 pounds maximum) is required on the clutch operating lever to

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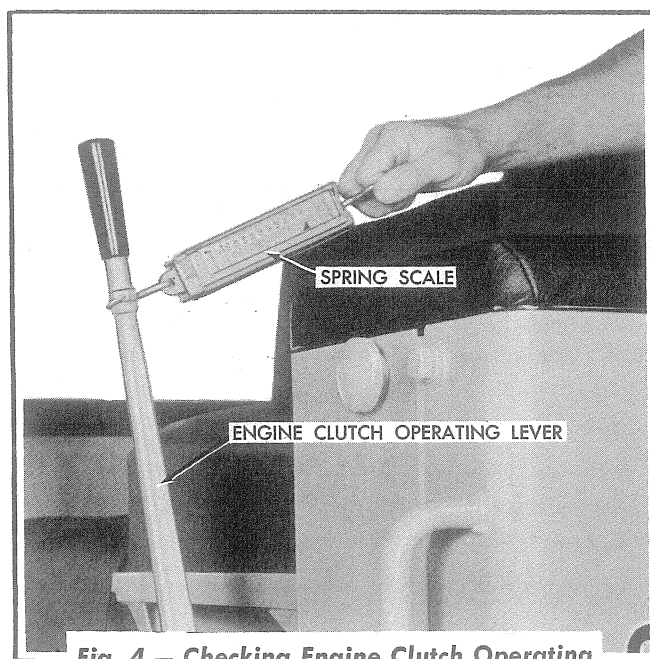
**Fig. 3 — Engine Clutch — Sectional View**  
(Tractors with Torque Converter)

engage the clutch (engine stopped). As the clutch facings wear, the pull required on the clutch operating lever, to engage the clutch, decreases. When the pull on the lever diminishes to 15 pounds, an adjustment is necessary. **CAUTION:** Do not operate the tractor when the pull on clutch operating lever is less than 15 pounds or more than 30 pounds.

Frequent adjustments may be an indication that the facings on the driven plate are worn excessively and the driven plate must be replaced. The driven plate assembly and facings are serviced as an assembly and cannot be purchased separately.

**IMPORTANT:** Since most engine clutch failures are the result of improper maintenance, it is very important that the clutch and clutch brake (used on tractors without torque converter) are kept properly adjusted at all times and that the clutch components are lubricated as recommended. Do not slip the clutch excessively when engaging.

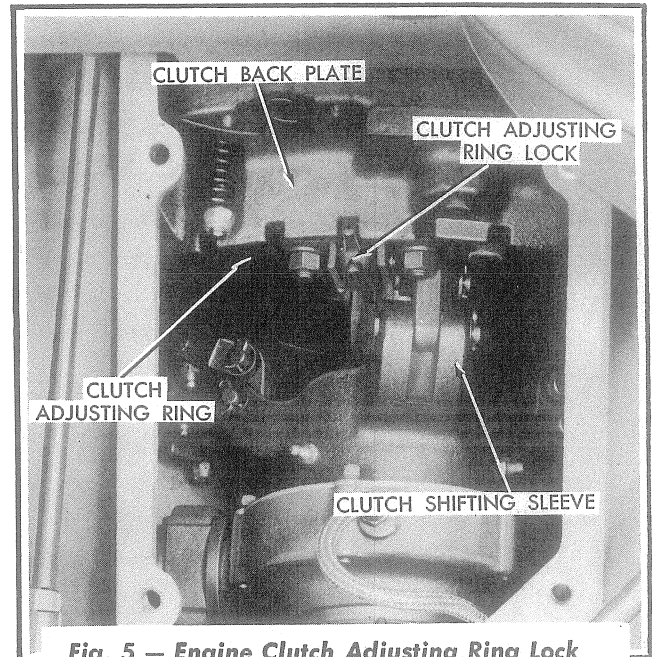
To check the engine clutch operating lever pull, attach a spring scale to the engine clutch operating lever (attach scale just below the lever hand grip) as shown in Fig. 4 and weigh the pull required to engage the clutch. When the clutch is properly adjusted, a pull of 25 to 30 pounds (30 pounds maximum) is required on the clutch operating lever for its engagement. The clutch must engage with a distinct over-center snap.



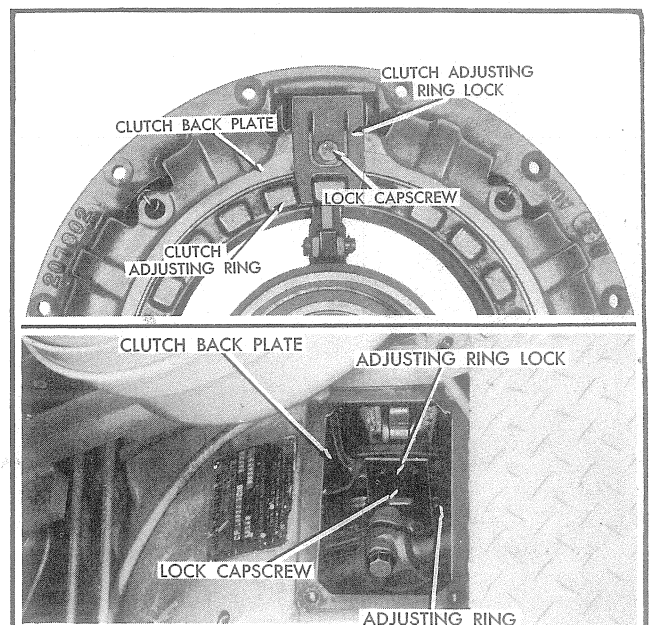
**Fig. 4 — Checking Engine Clutch Operating Lever Pull**

### C. Adjustment of Engine Clutch

1. Remove the center section of the front floor plate and the clutch inspection plate from the engine clutch housing.
2. Make certain the engine shut-off knob is pulled all the way back to the stop position. With the clutch disengaged, crank the engine with the starter until the clutch adjusting ring lock (Figs. 5 and 6) may be reached through the inspection hole.

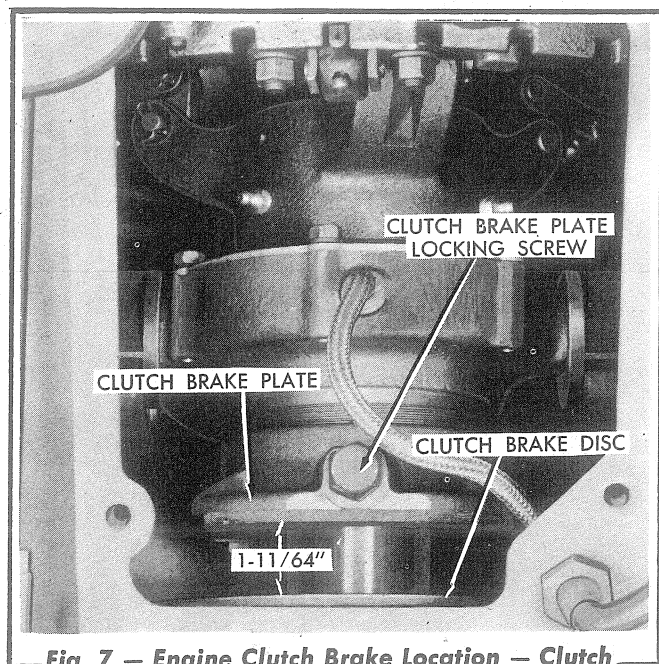


**Fig. 5 — Engine Clutch Adjusting Ring Lock Location (Tractors Without Torque Converter)**



**Fig. 6 — Engine Clutch Adjusting Ring Lock Location (Tractors with Torque Converter)**

3. Disengage the adjusting ring lock from the adjusting ring. *NOTE: On tractors with a torque converter it is necessary to loosen the lock capscrew to disengage the lock (refer to Fig. 6).*
4. Tighten the clutch by turning the adjusting ring in the clockwise direction (viewed from rear). Turning the adjusting ring 1 to 2 notches is generally sufficient. Attach a spring scale to the clutch operating lever (attach scale just below the lever hand grip) as shown in Fig. 4, and weigh the pull required to engage the clutch. When the clutch is properly adjusted, a pull of 25 to 30 pounds (30 pounds maximum) is required on the clutch operating lever to engage the clutch.
5. Engage the clutch adjusting ring lock with the nearest slot or lug of the adjusting ring. *NOTE: On tractors with a torque converter tighten the lock capscrew securely.*
6. Install the clutch inspection plate and the center section of the front floor plate. On tractors with a torque converter make certain that the inspection plate gasket is in position and in good condition.



**Fig. 7 — Engine Clutch Brake Location — Clutch Engaged (Tractors Without Torque Converter)**

#### **D. Adjustment of Engine Clutch Brake (Tractors Without Torque Converter)**

The adjustment of the clutch brake should be checked after each adjustment of the engine clutch. Proper adjustment of the clutch brake must be maintained to avoid gear clashing when shifting. The clutch brake is properly adjusted when there is  $1\frac{11}{16}$ " between the clutch brake plate facing and the clutch brake disc with the engine clutch engaged. Inspect the clutch brake plate facing periodically and replace the facing when it is worn. Check and adjust the clutch brake as follows:

1. Remove the center section of the front floor plate and the clutch inspection plate from the engine clutch housing.
2. Engage the engine clutch and loosen the clutch brake plate locking screw jam nut.
3. Loosen the clutch brake plate locking screw and turn the clutch brake plate "in" or "out" to obtain  $1\frac{11}{64}$ " clearance between the brake facing and the clutch brake disc (Fig. 7).
4. Align the clutch brake plate locking screw with the notch in the threads of the shifting sleeve and tighten the clutch brake plate locking screw. Tighten the clutch brake plate locking screw jam nut.
5. Install the clutch inspection plate and the center section of the front floor plate.

#### **E. Adjustment of Engine Clutch Linkage**

The engine clutch operating control rod should be adjusted to provide a clearance of approximately  $\frac{1}{4}$ " between the front of the engine clutch operating lever (lever in its disengaged position) and the floor plate.

Adjust the engine clutch operating control rod by turning the control rod yoke, lengthening or shortening the rod as necessary, to obtain  $\frac{1}{4}$ " clearance between the front of the engine clutch operating lever and the floor plate.

## F. Washing of Engine Clutch

Oil leaking into the clutch compartment or over-lubrication of the clutch components may cause the clutch facings to become coated with grease or oil. This will cause the clutch to slip even though it is properly adjusted. In this event the clutch must be washed.

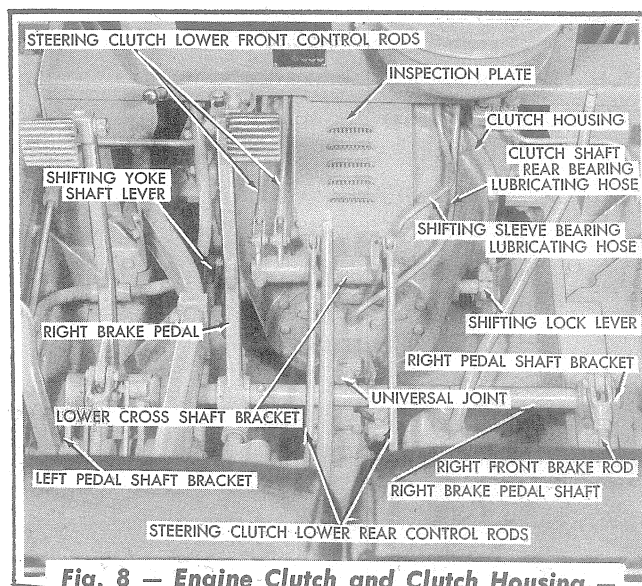
1. Install the drain plug in the bottom of the engine flywheel housing. Remove the center section of the front floor plate and the clutch inspection plate from the engine clutch housing.
2. Pour approximately one gallon of cleaning solvent into the engine clutch housing (tractors without torque converter) or two gallons of cleaning solvent (tractors with torque converter). Install the clutch inspection plate and operate the engine at low idle speed for approximately 5 minutes with the clutch disengaged.
3. Stop the engine. Remove the drain plug to drain the solvent, and if the solvent is excessively "oily," repeat the washing process using clean solvent. **CAUTION:** *On tractors without a torque converter lubricate the clutch shifting sleeve bearing, shifting sleeve, clutch rear bearing, and the clutch camshafts (3 points). On tractors with a torque converter lubricate the clutch shifting sleeve bearing and the torque converter front bearing after the clutch has been washed and the housing drained as the lubricant may have been washed out of these components in the washing process.*
4. Operate the tractor with a light load in low gear for a short period of time until the clutch dries to prevent slippage due to the presence of solvent on the clutch parts.

## G. Removal of Engine Clutch

1. Remove the seat cushions. Remove the two steering clutch throwout bearing lubricating pipes, located at the right side of the tool box. Remove the jam nuts and lock-

washers securing the upper end of the steering clutch lubricating hoses to the tool box supporting bracket. Remove the seat frame and tool box.

2. Remove the floor plates and the floor plate supporting channels.
3. Disconnect and remove the steering clutch lower rear control rods and the lower front control rods. Remove the cross shaft bracket with levers as an assembly.
4. Remove the yoke pin attaching the right front brake rod to the right pedal shaft outer lever. Remove the capscrews attaching the right brake pedal shaft bracket to the main frame and remove the bracket, right brake pedal shaft, and right brake pedal as an assembly. Tie the brake pedal shaft bracket shims to the bracket to prevent loss.
5. Remove the capscrews and capscrew locks attaching the universal joint spider assemblies to the front and rear yokes. Place a pry bar between the spider assembly and the front yoke, then pry the front yoke forward to clear the spider assembly. Remove the universal joint assembly, then remove the front yoke.
6. For removal of engine clutch on tractors without a torque converter, proceed as follows:



**Fig. 8 — Engine Clutch and Clutch Housing — Installed (Tractors Without Torque Converter)**



a. Remove the capscrews securing the shifting yoke shaft lever to the shifting yoke left shaft, and the shifting lock lever to the shifting yoke right shaft (Fig. 8) and lower the lever assemblies to provide clearance for the removal of the engine clutch.

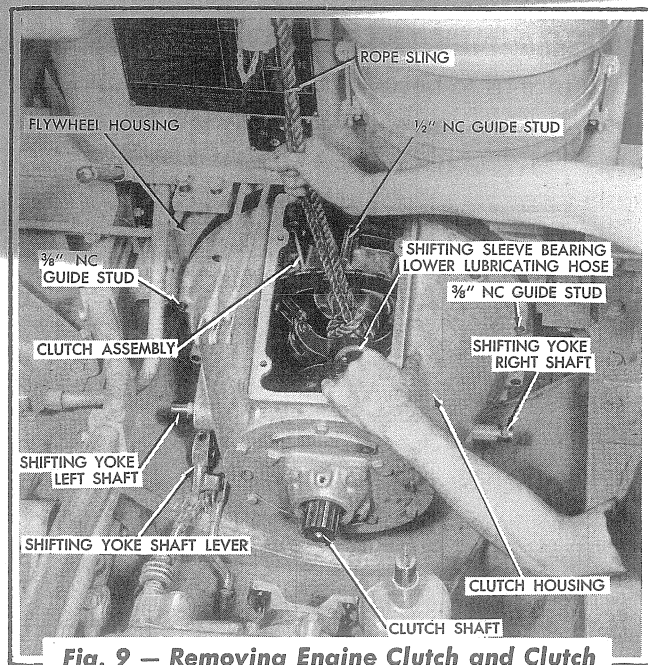
b. Remove the engine clutch inspection plate from the clutch housing. Remove the jam nuts securing the clutch shifting sleeve bearing and the clutch shaft rear bearing lubricating hoses to the cowl. Unscrew and remove the lubricating hose from the upper end of the shifting sleeve bearing lower lubricating hose. Remove the jam nut securing the lower lubricating hose to the clutch housing and push the upper end of the lower lubricating hose into the clutch housing. Unscrew and remove the clutch shaft rear bearing lubricating hose from the clutch shaft rear bearing cap.

c. Working through the inspection hole in the clutch housing, remove the capscrews and lockwashers attaching the engine clutch assembly to the engine flywheel. **NOTE:** To facilitate removal of the clutch assembly it is advisable to install a  $\frac{1}{2}$ " NC guide stud, approximately  $5\frac{3}{4}$ " long, in one of the cap-screw holes near the top of the flywheel as shown in Fig. 9.

d. Remove two of the capscrews and lockwashers attaching the engine clutch housing to the flywheel housing (one cap-screw from each side of the housing) and install a  $\frac{3}{8}$ " NC guide stud approximately  $4\frac{1}{4}$ " long in each of the holes as shown in Fig. 9. Remove the remaining capscrews and lockwashers attaching the clutch housing to the flywheel housing.

e. Using a rope sling around the clutch shaft as shown in Fig. 9, remove the clutch housing, engine clutch shaft, and engine clutch assembly as a unit. **CAUTION:** When removing the clutch

assembly, use care and do not drop or damage the clutch driven plate.



**Fig. 9 — Removing Engine Clutch and Clutch Housing (Tractors Without Torque Converter)**

7. For removal of engine clutch on tractors with a torque converter proceed as follows:

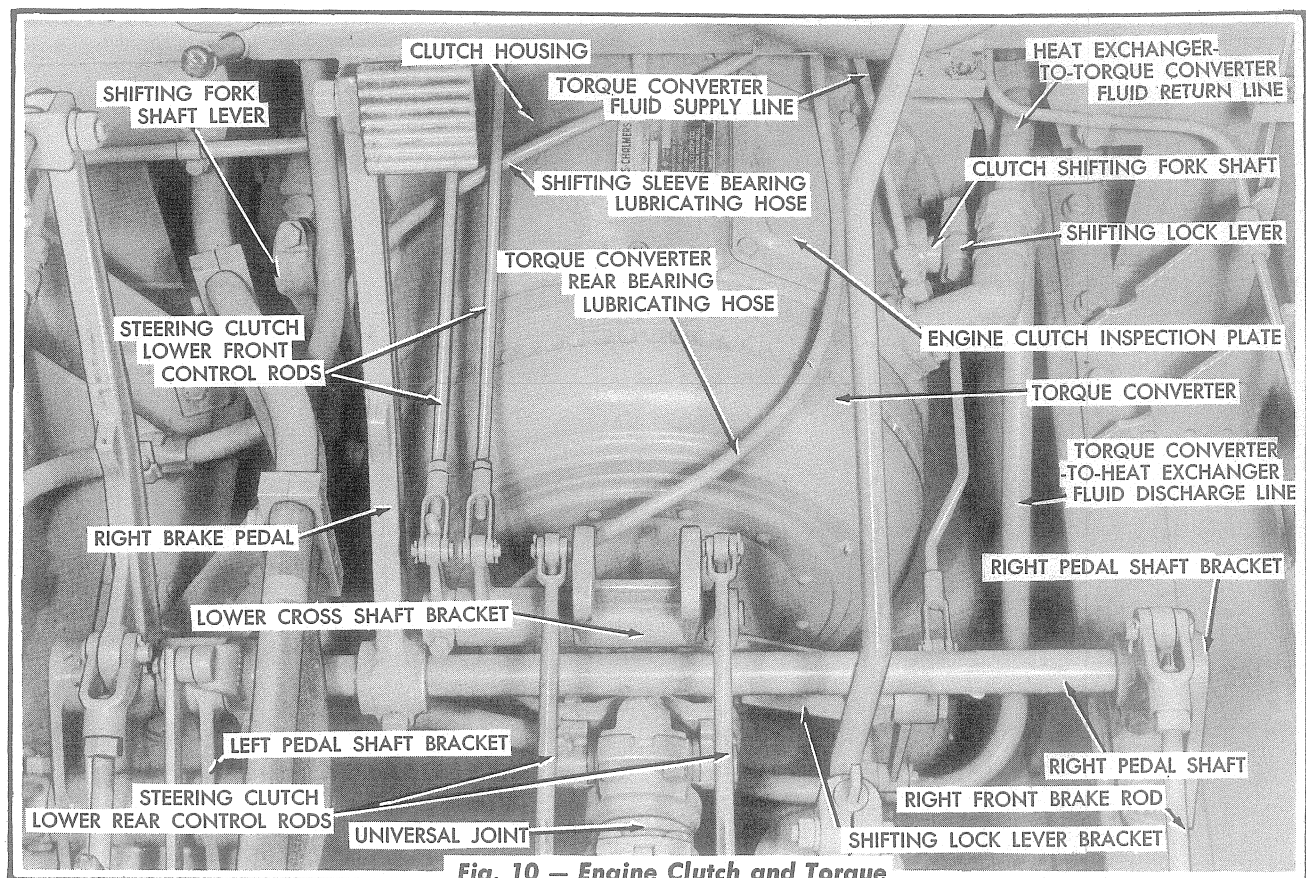
a. Close the fuel tank shut-off valve located at the lower left front of the fuel tank. Remove the square head pipe plug from the bottom of the torque converter housing and drain the fluid from the housing.

b. Disconnect the shifting lock plunger rod from the shifting lock plunger. Remove the capscrew securing the shifting lock lever to the clutch shifting fork shaft and remove the lever from the shaft. Remove the capscrews attaching the shifting lock lever bracket to the torque converter and remove the bracket and rods as an assembly.

c. Disconnect the front end of the clutch operating control rod from the shifting fork shaft lever. Remove the capscrew securing the shifting fork shaft lever to the shifting fork shaft and remove the lever.

d. Remove the jam nuts securing the shifter sleeve bearing, and the torque con-

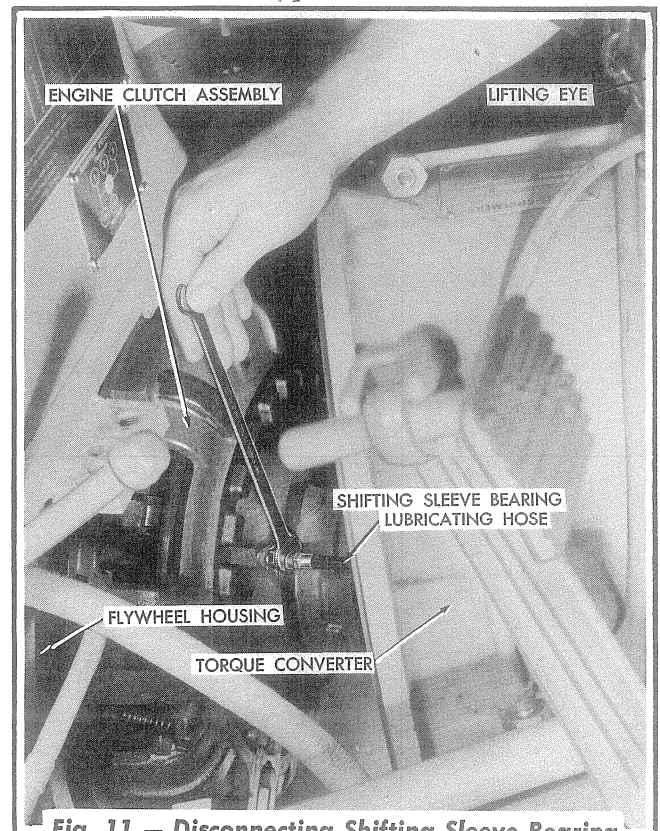




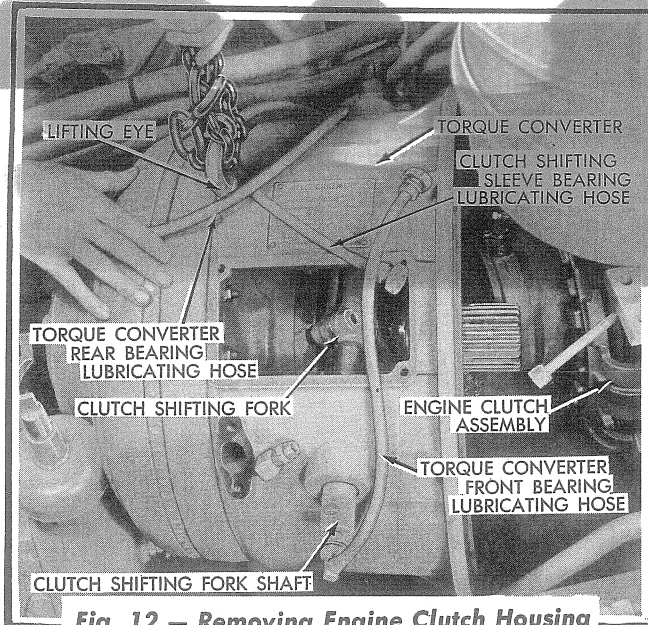
**Fig. 10 — Engine Clutch and Torque Converter — Installed**

verter front and rear bearing lubricating hoses to the cowl and remove the hoses.

- e. Remove the capscrews and lockwashers attaching the heat exchanger-to-torque converter fluid return line to the heat exchanger and to the torque converter and remove the line. On earlier model tractors, disconnect the torque converter fluid supply line from the right side of the torque converter.
- f. Remove the capscrews and lockwashers attaching the discharge line elbow to the left side of the torque converter and remove the discharge line supporting clip from the rear of the torque converter. **IMPORTANT: Cover all openings to prevent the entrance of dirt.**
- g. Remove the two front capscrews and loosen the two rear capscrews securing the inspection plate to the clutch housing and remove the plate.

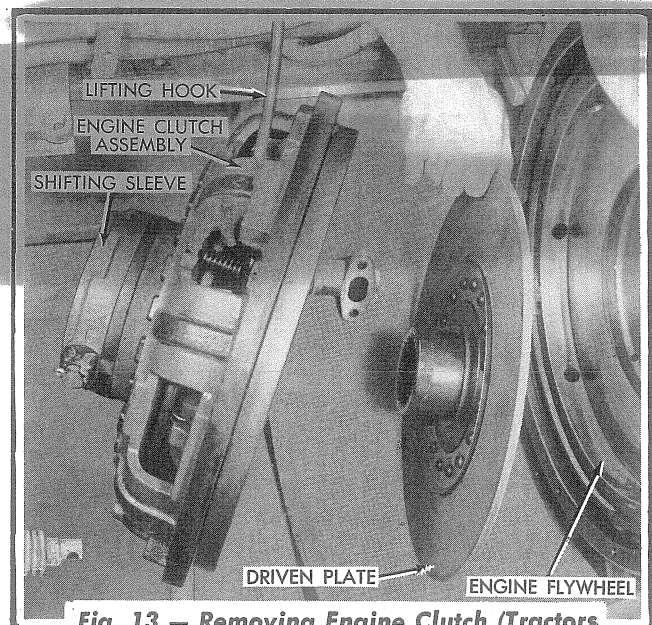


**Fig. 11 — Disconnecting Shifting Sleeve Bearing Lubricating Hose (Tractors with Torque Converter)**



**Fig. 12 — Removing Engine Clutch Housing and Torque Converter**

- h. Remove the lifting hole thread protecting plug, located in the top of the clutch housing, and screw a lifting eye having  $\frac{5}{8}$ " NC threads into the hole in the housing (Fig. 12). Attach a suitable hoist to the lifting eye, remove the capscrews attaching the engine clutch housing to the flywheel housing and move the clutch housing rearward approximately 4". Disconnect the clutch shifting sleeve bearing lubricating hose (Fig. 11) from the clutch shifting sleeve. Remove the engine clutch housing and torque converter as an assembly (refer to Fig. 12). As the clutch housing and torque converter assembly is removed, the clutch shifting fork will disengage from the shifting sleeve blocks and will be removed with the assembly.
- i. Remove the capscrews attaching the engine clutch assembly to the engine flywheel and using a suitable hoist, remove the engine clutch assembly (refer to Fig. 13). The clutch driven plate can now be removed. **CAUTION:** When removing the clutch assembly, use care and do not drop or damage the driven plate.

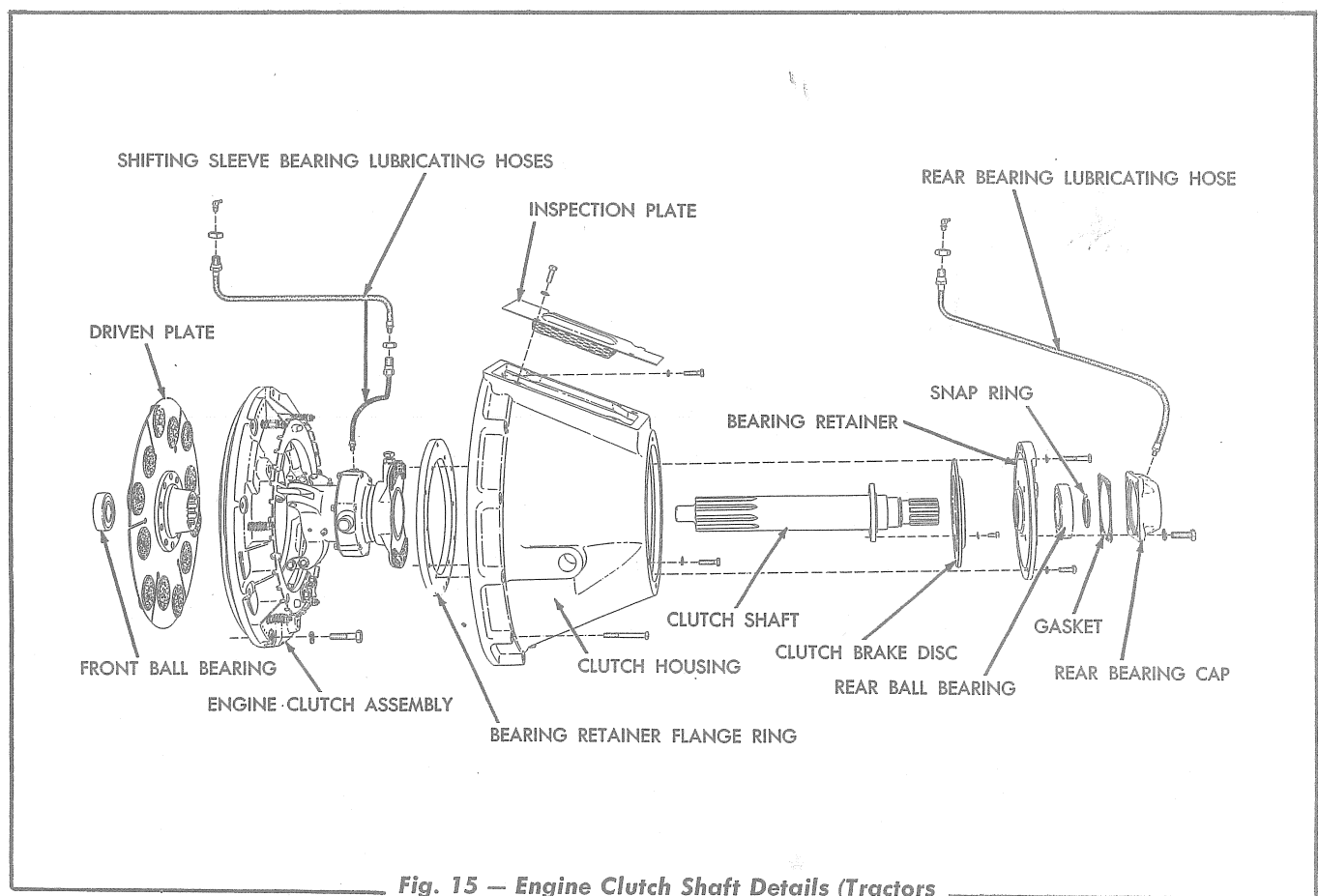
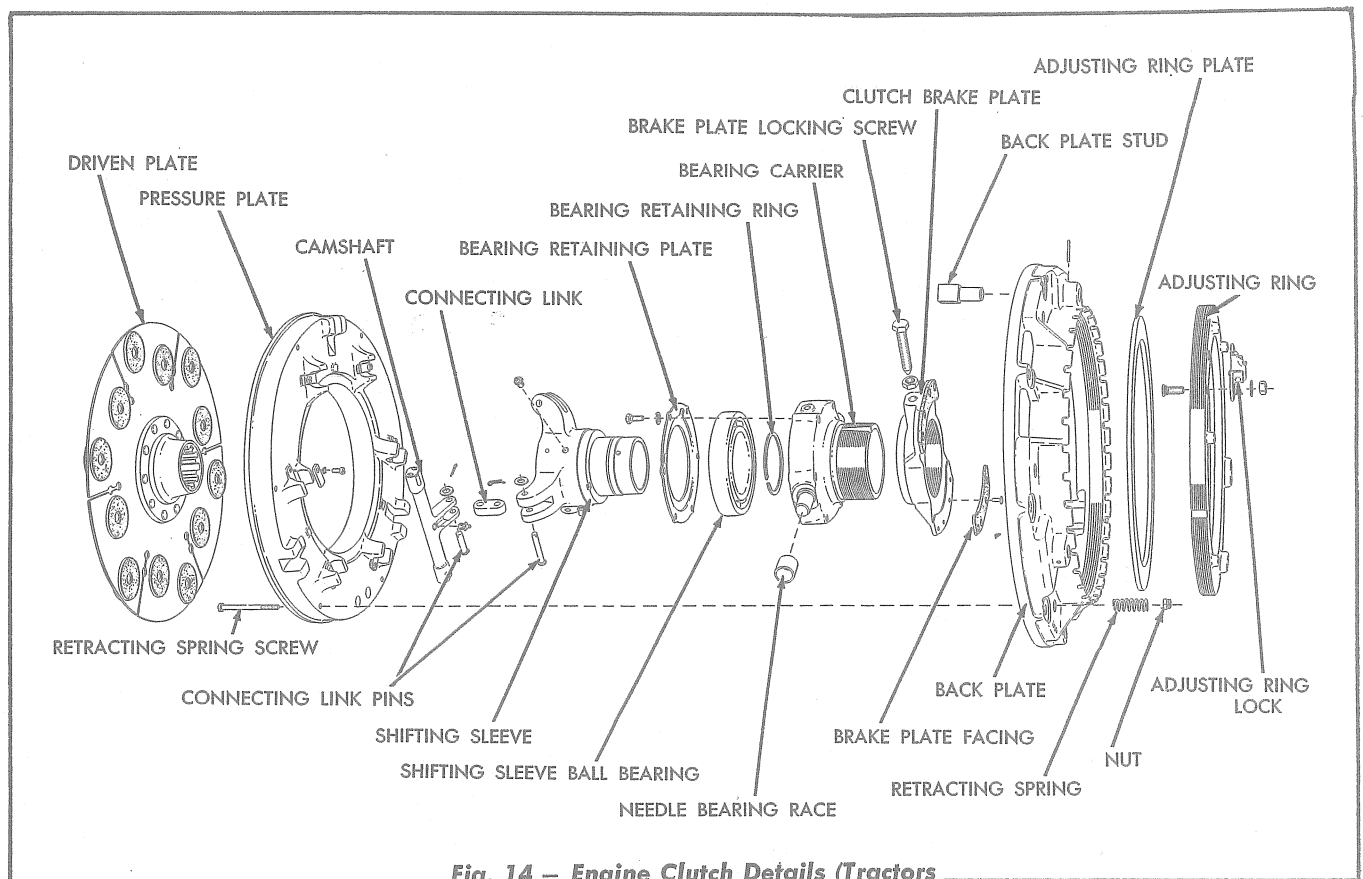


**Fig. 13 — Removing Engine Clutch (Tractors with Torque Converter)**

## H. Disassembly of Clutch (Tractors Without Torque Converter)

On tractors without a torque converter, refer to Figs. 14 and 15, and disassemble the clutch as follows:

1. Place the engine clutch assembly on a clean work bench with the pressure plate side of the clutch down.
2. Remove the brake plate locking screw and turn the clutch brake plate off the shifting sleeve bearing carrier.
3. Remove the three pins used to connect the connecting links to the shifting sleeve and remove the shifting sleeve and the shifting sleeve bearing carrier as a unit. Remove the capscrews attaching the shifting sleeve bearing retaining plate to the front of the shifting sleeve bearing carrier, then using a soft hammer, drive the shifting sleeve bearing carrier off the shifting sleeve ball bearing.
4. Remove the bearing retaining ring from the shifting sleeve and press the shifting sleeve out of the bearing. Remove the bearing retaining plate from the shifting sleeve.



5. Unlock the clutch adjusting ring and turn the ring out of the clutch back plate, then remove the adjusting ring plate. Remove the three clutch camshafts. If necessary, the connecting links may be removed from the camshafts.
6. Remove the nuts from the six retracting spring screws and remove the pressure plate retracting springs.
7. Lift the clutch back plate off the pressure plate. Remove the six retracting spring screws from the pressure plate.
8. Remove the capscrews attaching the clutch shaft rear bearing retainer to the rear bearing retainer flange ring and remove the clutch shaft and rear bearing retainer as a unit.
9. Remove the capscrews attaching the clutch shaft rear bearing cap to the bearing retainer and remove the bearing cap and the cap gasket.
10. Remove the clutch shaft snap ring from the

rear end of the clutch shaft and drive or press the clutch shaft from the rear bearing. Remove the capscrews attaching the clutch brake disc to the clutch shaft and remove the brake disc. Remove the rear ball bearing from the rear bearing retainer.

### I. Disassembly of Engine Clutch (Tractors with Torque Converter)

On tractors with a torque converter, refer to Figs. 3 and 16 and disassemble the clutch as follows:

1. Place the engine clutch assembly on a clean work bench with the pressure plate side of the clutch down.
2. Remove the four pressure plate retracting springs, then lift the back plate and adjusting ring off the pressure plate as an assembly. Loosen (but do not remove) the adjusting ring lock capscrew and turn the adjusting ring out of the back plate.
3. Remove the roll pins, pin retaining collars, and shifting sleeve collar pins attaching the pressure plate lever links to the shifting

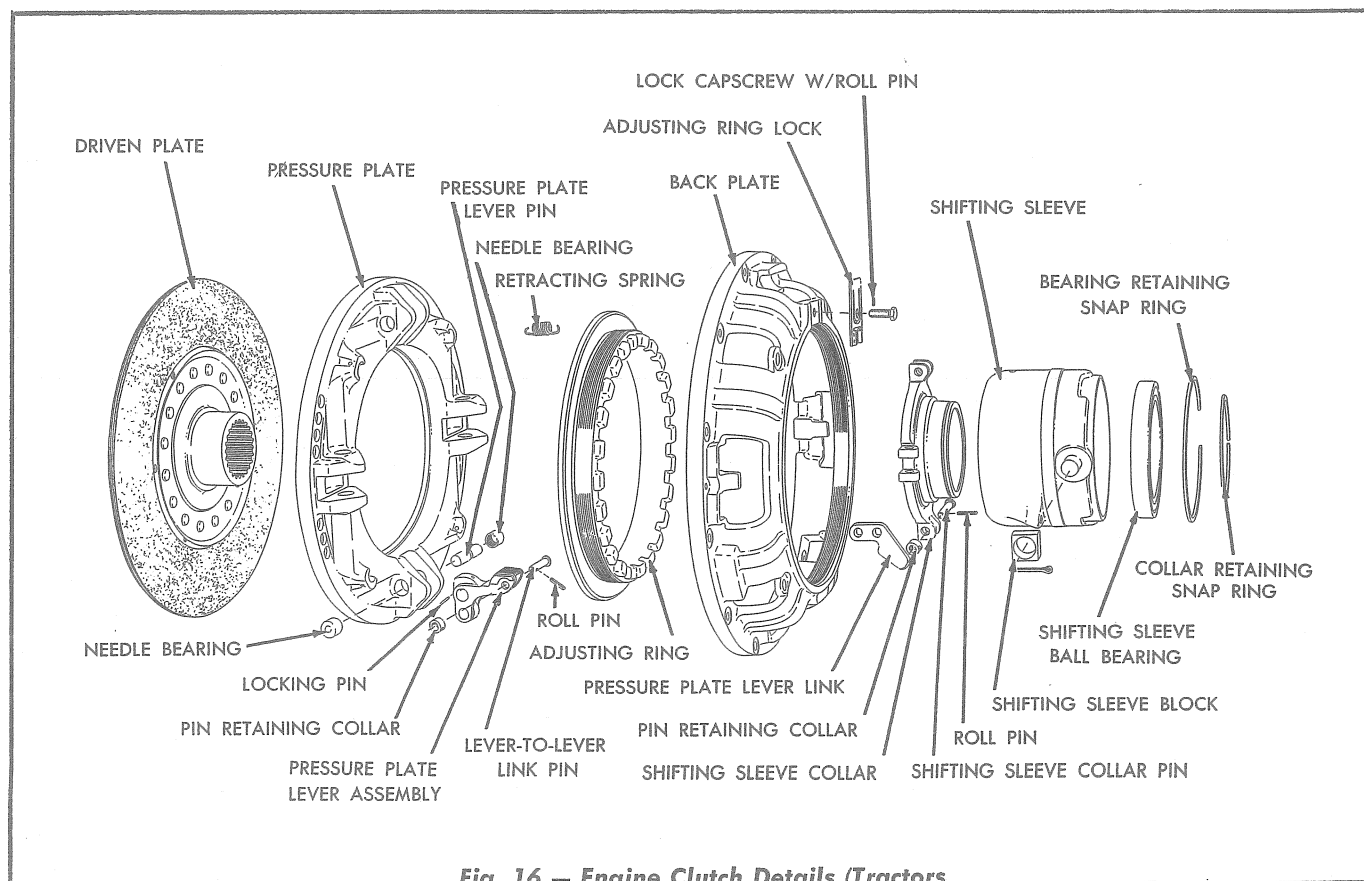


Fig. 16 — Engine Clutch Details (Tractors with Torque Converter)



sleeve collar and remove the shifting sleeve and shifting sleeve collar from the pressure plate.

4. Remove the collar retaining snap ring from the shifting sleeve collar, then press the collar out of the shifting sleeve ball bearing. **IMPORTANT:** *Do not drive on the inner surface of the collar to remove it, or damage to the snap ring groove will result.*
5. Remove the bearing retaining snap ring from the shifting sleeve. The shifting sleeve ball bearing can now be removed from the shifting sleeve by bumping the sleeve on a block of wood.
6. The needle bearings in the pressure plate levers are grease packed and require no further lubrication, however, if replacement of the bearings and the lever pins becomes necessary, remove the locking pin from the pressure plate levers, then drive through one of the bearing retainers and drive the lever pin and the other bearing assembly out of the lever and the pressure plate.

#### **J. Inspection and Repair of Engine Clutch (Tractors Without Torque Converter)**

1. Wash all the clutch components thoroughly and inspect them to see that they are in good condition.
2. Inspect the facings on the driven plate for wear and looseness of the facings on the plate. Also check the splines in the hub of the plate for wear. The specified thickness (including facings) of the driven plate when new is .458" to .490". Measure the thickness of the driven plate being inspected and if it is worn to approximately .302", a new driven plate must be installed.
3. Inspect the face of the pressure plate for roughness, heat cracks, and warpage. If the face of the pressure plate is in a rough condition, it may be machined smooth. Replace the pressure plate if more than  $\frac{1}{16}$ " stock must be removed to smooth it.

4. Inspect the camshafts and the rollers in the camshafts for wear and make certain that the rollers are free to rotate. Also check to see if the lubricant when applied to the lubricating fitting in each camshaft emerges from around the camshaft rollers. Inspect the six camshaft blocks, attached to the back of the pressure plate, for wear and replace if necessary. **NOTE:** *If it is necessary to replace any of these small blocks, it is recommended that all six of them be replaced at the same time.*
5. Inspect the bushings in the shifting sleeve for wear and roughness and replace the sleeve assembly if necessary.
6. Check the clutch back plate for cracks and replace if cracks are evident.
7. Inspect the shifting sleeve bearing for wear and roughness. Replace the bearing if it is worn excessively or if it does not turn smoothly when rotated by hand.
8. Remove the two shifting sleeve blocks used on the shifting sleeve bearing carrier. Inspect the needle bearings, needle bearing inner races, and dust seals for wear and damage and replace the necessary parts.
9. Inspect the six pressure plate retracting springs for breakage and replace if necessary.
10. Inspect the clutch wearing surface of the flywheel and make certain that the surface is flat and smooth. If it is scored and heat checked it may be machined smooth. Replace the flywheel if more than  $\frac{1}{16}$ " stock must be removed to smooth it. **NOTE:** *In cases where it is necessary to machine the face of the flywheel and also machine the face of the engine clutch pressure plate, the depth of the counterbore in the flywheel for the clutch back plate should be increased a corresponding amount. This is necessary to assure sufficient adjustment of the clutch to compensate for clutch facing wear.*



11. Inspect the clutch shaft front bearing (pilot bearing) for wear and lubrication. In case the bearing shows signs of improper lubrication, install a new oiling wick in the pilot bearing oiling wick holder (refer to Section VIII, Topic 5).

12. Inspect the holes in the clutch shifting sleeve and in the connecting links for wear and elongation and replace the necessary parts. If the connecting link pins are worn, they must be replaced.

13. Inspect the clutch shaft rear bearing for wear and roughness. Replace the bearing if it is worn excessively or if it does not turn smoothly when rotated by hand.

14. Inspect the clutch shaft. If the shaft is excessively worn at the location of the clutch shifting sleeve, or if the splines show excessive wear, the shaft must be replaced.

15. Inspect the lubricating hoses for the clutch shaft rear bearing and for the shifting sleeve bearing and replace if they are not in good condition.

16. Inspect the clutch brake plate. If the brake facing is worn down close to the rivet heads, the facings must be replaced. Inspect the brake disc for wear and scoring. Slight scoring or uneven wear can be removed by machining, however, if the disc is worn or scored excessively, replacement is necessary.

#### **K. Inspection and Repair of Engine Clutch (Tractors with Torque Converter)**

1. Wash all the clutch components thoroughly and inspect them to see that they are in good condition.

2. Inspect the facings on the driven plate for wear and for looseness of the facings on the plate. Also check the condition of the splines in the hub of the plate. The specified thickness (including facings) of the driven plate when new is .310" to .316". Measure the thickness of the driven plate being inspected and if it is worn to a thickness of

.185" or less a new plate assembly must be installed.

3. Inspect the face of the pressure plate for roughness, heat cracks, and warpage. If the face of the pressure plate is in a rough condition, it may be machined smooth. Replace the pressure plate if more than  $\frac{1}{16}$ " stock must be removed to smooth it.

4. Inspect the pressure plate retracting springs for breakage. Replace if necessary.

5. Inspect the levers, lever links, pins, and needle bearings for wear. Install new parts where necessary. Pack the needle bearings with lubricant when assembling.

6. Check the clutch back plate for cracks. Replace if cracks are evident.

7. Check the shifting sleeve for roughness or wear. Replace the shifting sleeve bearing if it is worn excessively or does not turn freely.

#### **L. Inspection and Replacement of Engine Clutch Shifting Yoke (Tractors Without Torque Converter)**

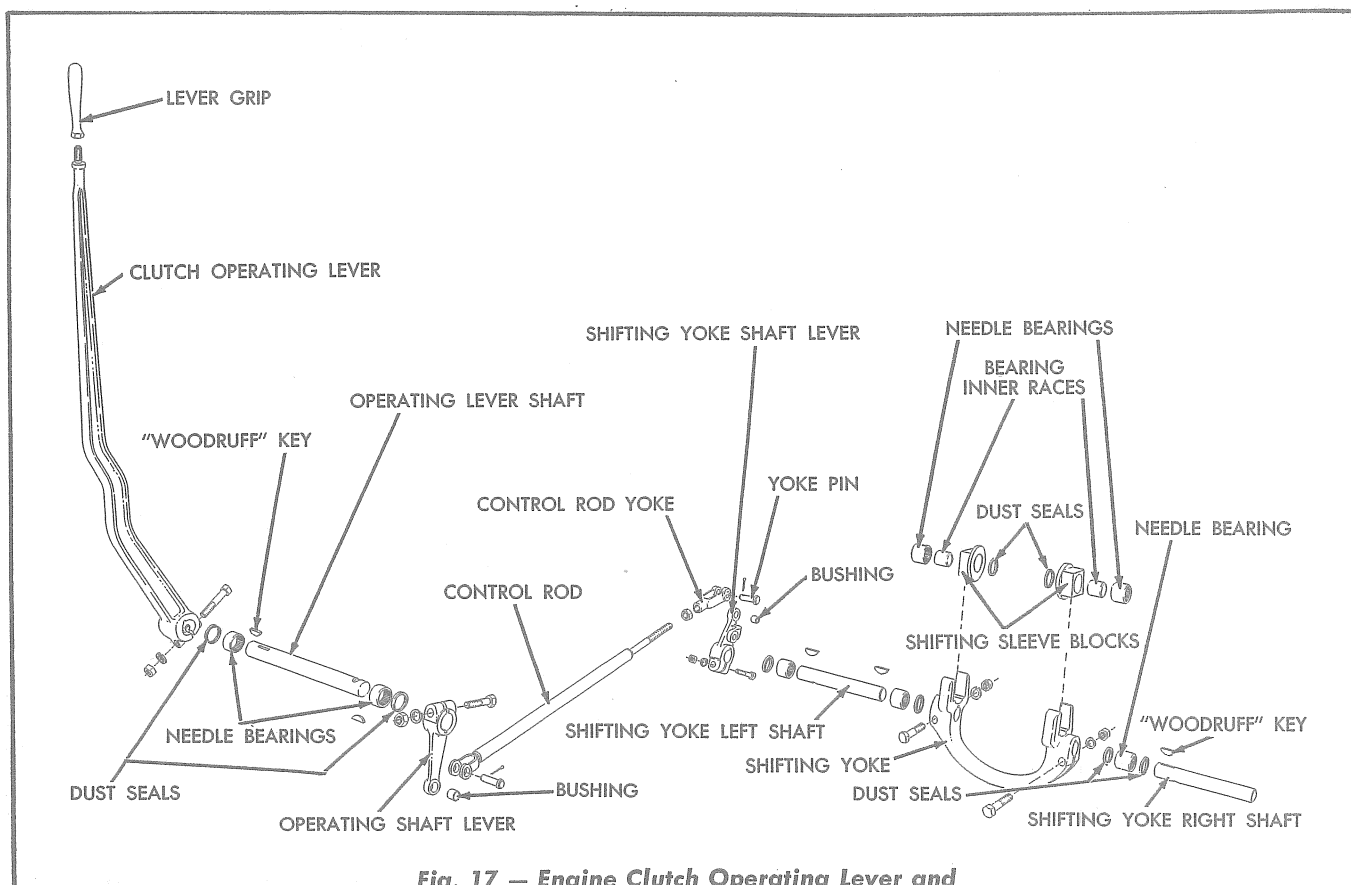
1. With the engine clutch removed, place each shifting sleeve block in position in the clutch shifting yoke (Fig. 17). If there is excessive looseness between the parts due to wear, replacement of both the yoke and the shifting sleeve blocks is necessary.

2. Replace the clutch shifting yoke as follows:

a. Remove the capscrews, nuts, and lock-washers clamping the clutch shifting yoke to the shifting yoke shafts.

b. Spread the opening in each end of the shifting yoke, using a broad face chisel or similar tool, to free the yoke on the shafts.

c. Drive the shifting yoke shafts inward, through the yoke, far enough to permit the removal of the "Woodruff" key from the inner end of each shaft.



**Fig. 17 — Engine Clutch Operating Lever and Shifting Yoke Details (Tractors Without Torque Converter)**

- d. Remove the "Woodruff" key from the inner end of each shaft and pull the shafts out of the shifting yoke and the shaft needle bearings. Inspect the bearings, shafts, and dust seals for wear and replace if necessary.

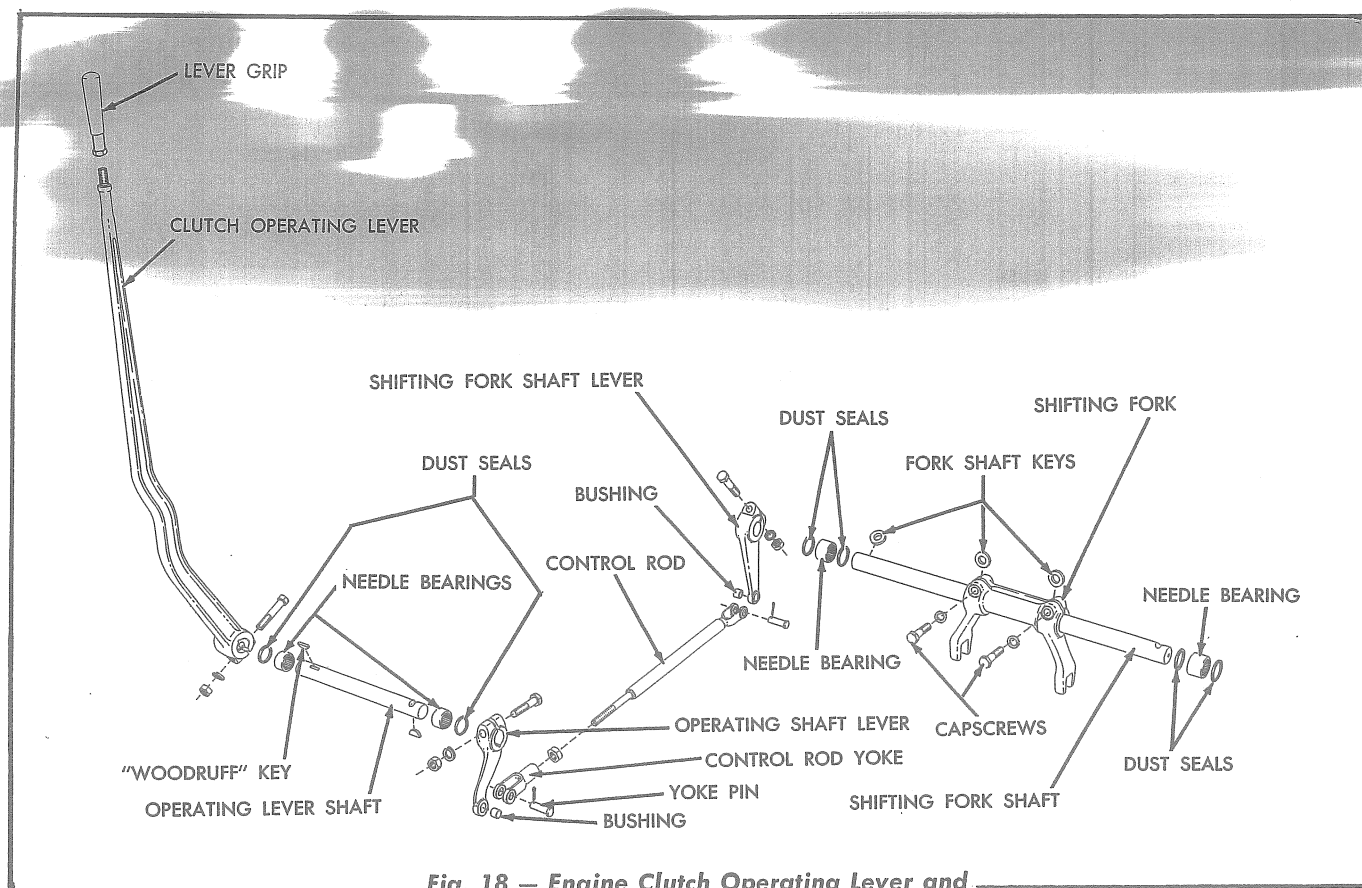
- e. Pack the shifting yoke shaft needle bearings with grease. Start the shifting yoke shafts into position in the clutch housing. Hold the shifting yoke in position and insert the shifting yoke shafts through the bore in the yoke for a distance far enough to permit the installation of the "Woodruff" key in the inner end of each shaft.

- f. Install a "Woodruff" key in position in the keyway of each shaft, align the key in each shaft with the keyway in the yoke, and drive the shafts outward to properly position the shafts in the shifting yoke. Install the capscrews, lock-washers, and nuts used to clamp the

shifting yoke to each shaft and tighten the nuts securely.

#### **M. Inspection and Replacement of Engine Clutch Shifting Fork (Tractors with Torque Converter)**

1. Inspect the clutch shifting sleeve blocks for excessive looseness on the shifting sleeve and in the shifting fork. If there is excessive looseness between the parts due to wear, replacement of the parts will be necessary.
2. Replace the clutch shifting fork as follows:
  - a. Remove the capscrews clamping the shifting fork to the shifting fork shaft, then remove the two "washer type" keys from the keyways in the shaft.
  - b. Spread the opening in each end of the shifting fork, using a broad faced chisel or similar tool, to free the fork on the shaft. Pull the shifting fork shaft out of the fork and the clutch housing.



**Fig. 18 — Engine Clutch Operating Lever and Shifting Fork Details (Tractors with Torque Converter)**

- c. Inspect the needle bearings, the bearing dust seals, and the shifting fork shaft for wear. Replace the necessary parts.
- d. Pack the shifting fork shaft needle bearings with grease and start the shaft into place in the clutch housing.
- e. Install the shifting fork by a reversal of the removal procedure. Make sure the cap screws and lockwashers securing the clutch shifting fork to the shifting fork shaft are installed with the heads of the cap screws facing toward the rear of the clutch housing.

#### **N. Assembly of Engine Clutch (Tractors Without Torque Converter)**

Refer to Figs. 2, 14, and 15 and assemble the engine clutch by a direct reversal of the disassembly procedure. **IMPORTANT:** When installing the pins used to connect the connecting links to the clutch camshafts, install them so that the heads of

the pins are to the right when the pin is located at the top and viewed from the rear of the clutch. When installing the pins used to connect the connecting links to the shifting sleeve, install them so that the heads of the pins are to the left when the pin is located at the top and viewed from the rear of the clutch.

When installing the retracting spring nuts, tighten the nuts against the retracting springs so that the assembled length of each spring is  $1\frac{3}{16}$ " (measured to bottom of recess in clutch back plate). Pack the needle bearings in the shifting sleeve blocks with grease when assembling the blocks in position on the shifting sleeve bearing carrier. Lubricate the clutch camshaft, clutch shifting sleeve, shifting sleeve bearing, and the clutch shaft rear bearing thoroughly when assembly of the clutch is completed. Lubricate the connecting link pins sparingly.

#### **O. Assembly of Engine Clutch (Tractors with Torque Converter)**

Refer to Figs. 3 and 16 and assemble the clutch by a direct reversal of the disassembly procedure.

When assembling, make certain that the pressure plate retracting springs are installed with the hooks of the springs toward the back plate.

Install the shifting sleeve ball bearing into the shifting sleeve with the shielded side of the bearing toward the rear. **IMPORTANT:** *When installing the shifting sleeve collar pins and the lever-to-lever link pins, make certain that they are installed so that the head of each pin is to the left with the pin located at the top of the clutch and when viewed from the rear of the clutch. Grease the clutch linkage and pins sparingly when assembling.*

## **P. Installation of Engine Clutch**

1. For the installation of the engine clutch and clutch housing on tractors without a torque converter proceed as follows:

- a. Make certain that the face of the flywheel is clean. Place the clutch driven plate in position against the engine flywheel making certain that the side of the plate having the oil slinger, is next to the flywheel.
- b. Place the clutch brake disc in position on the clutch shaft and secure the disc to the flange on the shaft with capscrews and lockwashers.
- c. Press the clutch shaft rear ball bearing into position in the bearing retainer, and using a suitable sleeve or tube press the rear ball bearing and bearing retainer onto the clutch shaft until the bearing is tight against the shoulder on the shaft. **NOTE:** *When pressing the ball bearing and bearing retainer onto the shaft, press against the inner race of the bearing only.* Install the clutch shaft snap ring on the clutch shaft.
- d. Place the bearing retainer flange ring in position in the clutch housing and attach the ring to the housing with capscrews and lockwashers. Install the rear bearing retainer, with the clutch shaft and bearing, in position in the rear of the clutch housing as shown in Fig. 2. Secure the bearing retainer to the bear-

ing retainer flange ring with capscrews and lockwashers; tighten the capscrews securely.

- e. Install the rear bearing cap and gasket in position on the rear of the bearing retainer so that the tapped hole for the lubricating hose is to the top. Install the attaching capscrews and lockwashers and tighten securely.
- f. Install the engine clutch assembly in the engine clutch housing, inserting the shifting sleeve blocks in position in the shifting yoke as the clutch assembly is moved into position in the clutch housing.
- g. Reaching through the clutch inspection plate opening, insert the upper end of the clutch shifting sleeve bearing lower lubricating hose into the hole in the engine clutch housing and secure with a jam nut.
- h. If the guide studs (Fig. 9) were removed from the engine flywheel and flywheel housing they should now be reinstalled for installation of the engine clutch and clutch housing assembly.
- i. Using a rope sling around the clutch shaft, as shown in Fig. 9, install the engine clutch and clutch housing assembly in position and secure the clutch housing to the flywheel housing with capscrews and lockwashers. Remove the two guide studs from the flywheel housing and install the remaining capscrews and lockwashers. Working through the inspection hole in the clutch housing, install at least two capscrews and lockwashers attaching the engine clutch assembly to the engine flywheel, then remove the guide stud. Install the remaining capscrews and lockwashers and tighten the capscrews evenly so that the clutch back plate enters the recess in the flywheel.
- j. Install the clutch shifting sleeve bearing lubricating hose and the clutch shaft rear bearing lubricating hose. Install

the shifting yoke shaft lever on the shifting yoke left shaft and the shifting lock lever on the shifting yoke right shaft (Fig. 8).

2. For installation of the engine clutch on tractors with a torque converter proceed as follows:

- a. Make certain that the face of the flywheel is clean. Place the clutch driven plate in position against the engine flywheel, making certain that the side of the plate having the oil slinger is toward the rear.
- b. Place the clutch assembly in position on the flywheel. Start all of the attaching capscrews and lockwashers and tighten evenly so that the clutch back plate enters the recess in the flywheel.

**IMPORTANT:** *Make certain that the clutch adjusting ring is backed out enough so that the driven plate is free after the clutch assembly is attached to the flywheel:*

- c. Make certain that the lubricating hoses and seal drain hose in the clutch housing are in good condition. Lower the clutch housing and the torque converter assembly into position at the rear of the clutch. Start the torque converter input shaft into the shifting sleeve and start the clutch shifting fork in position on the shifting sleeve blocks. Move the clutch housing and torque converter assembly forward so that the shifting sleeve bearing lubricating hose (Fig. 11) can be connected to the shifting sleeve. Connect the lubricating hose to the shifting sleeve then move the clutch housing and torque converter assembly into position against the flywheel housing. **NOTE:** *Keep the assembly straight when installing. If the splines of the torque converter input shaft fail to align with the splines in the clutch driven plate, insert the universal joint front yoke into the rear of the torque*

*converter and turn the front yoke counterclockwise to align the splines.* Install the capscrews and lockwashers attaching the clutch housing to the flywheel housing and tighten securely. Remove the lifting eye from the clutch housing and install the thread protecting plug.

- d. Install and tighten the torque converter drain plug. Using new gaskets secure the heat exchanger-to-torque converter fluid return line to the heat exchanger and torque converter. Using a new gasket secure the discharge line elbow to the torque converter.
  - e. Install the shifting lock lever bracket (Fig. 10) assembly on the torque converter and secure with capscrews and lockwashers. Secure the shifting lock plunger rod to the shifting lock plunger with a flat washer and cotter pin. Position the shifting lock lever on the clutch shift-fork shaft and secure with a capscrew and lockwasher as shown in Fig. 10.
  - f. Position the shifting fork shaft lever on the shifting fork shaft and secure with a capscrew and lockwasher (Fig. 10). Secure the front end of the clutch operating control rod to the shifting fork shaft lever with the yoke pin and cotter pin.
  - g. Insert the upper end of the shifter sleeve bearing, and the torque converter front and rear bearing lubricating hoses into the holes provided in the cowl and secure with jam nuts.
3. Install the drive shaft universal joint (refer to Section X, Topic 4).
  4. Install the right brake pedal shaft with its components in position and using the original amount of brake pedal shaft bracket shims install the capscrews, nuts, and lockwashers securing the right brake pedal shaft bracket to the main frame. Connect



the right front brake rod to the right pedal shaft outer lever.

5. Install the steering clutch lower cross shaft bracket, with levers, in position on the engine clutch or torque converter housing and secure with capscrews and lockwashers. Install and connect the steering clutch lower front and lower rear control rods. Adjust the steering linkage (refer to Section XI, Topic 2).
6. Adjust the engine clutch (refer to Paragraph C. in this Topic). Install the clutch inspection plate.
7. Install the floor plate supporting channels and the floor plates. Open the fuel tank shut-off valve. Install the tool box and the seat frame.
8. Insert the upper end of the steering clutch lubricating hoses into the holes provided in the tool box supporting bracket and secure each hose with a lockwasher and a jam nut. Insert the steering clutch lubricating pipes into the upper end of the lubricating hoses and tighten. Install the seat cushions.
9. On tractors without a torque converter, lubricate the clutch shifting sleeve bearing and the clutch shaft rear bearing. On tractors with a torque converter, lubricate the clutch shifting sleeve bearing and the torque converter front and rear bearings.
10. On tractors prior to Serial No. 4001, with a torque converter, start the engine and operate it at approximately one-half throttle (with engine clutch disengaged) until the torque converter fluid system is filled, which will be indicated when the fuel pressure gage registers normal (30 to 60 pounds) pressure.
11. On tractors Serial No. 4001 and above, with a torque converter, fill the torque converter fluid system as follows:
  - a. Fill the fuel tank with fuel. *NOTE: The*

*fuel tank should be filled to within approximately 2 inches of the top.*

- b. Close the fuel tank shut-off valve, located at the lower left front corner of the fuel tank.
- c. Thoroughly clean the exterior of the fuel transfer pump and the surrounding area. Remove the fuel transfer pump pressure relief valve plug and gasket, then remove the pressure relief valve spring, spring guide pin, and plunger. Reinstall the plug and plug gasket in position in the fuel transfer pump. *CAUTION: Use care to prevent scratching or damaging the pressure relief valve plunger when removing.*
- d. Disconnect the heat exchanger-to-fuel return line filter tube at the filter.
- e. Open the fuel tank shut-off valve and gravity will force the fuel through the first stage fuel filter, fuel transfer pump, second stage fuel filter, and the torque converter fluid supply line hose to the torque converter. When fuel, free of bubbles, flows from the disconnected tube, the torque converter and fluid heat exchanger are filled. Close the fuel tank shut-off valve.
- f. Connect the fluid heat exchanger-to-fuel return line filter tube.
- g. Remove the pressure relief valve plug and gasket from the fuel transfer pump. Rinse the pressure relief valve components in clean fuel and install in position in the pump body. Install the pressure relief valve plug and plug gasket and tighten the plug securely.
- h. Open the fuel tank shut-off valve. Start the engine and run it at part throttle until the proper fuel pressure (30 to 60 pounds) is indicated by the fuel pressure gage.

## 2. TORQUE CONVERTER

### A. General Description

The torque converter consists of three principal parts: the impeller wheel, connected to the engine clutch and driven by the engine; the turbine wheel, connected to the transmission top shaft (input shaft) by means of the universal joint; and the housing, which encloses the turbine and impeller wheels. The impeller wheel, driven by the engine, causes a flow of fluid in the torque converter. This fluid, striking the blades on the turbine wheel, causes the turbine wheel to rotate. Any load, including the tractor and whatever may be attached to it, is connected through the gear train and transmission top shaft to the turbine wheel. Therefore, any increase in the load will have a tendency to slow down the turbine wheel which will require an increase in torque (or turning effort) in order to keep the load moving. This increase in torque is automatically provided by the converter. Conversely, any decrease in the load diminishes the torque necessary to move it; again the torque converter automatically meets the requirements and speeds up the movement of the load.

An over-running clutch is incorporated in the torque converter. This clutch operates freely except when the load pushes the tractor as when descending steep grades, or when the tractor is being towed or pushed to start the engine, then this clutch engages and effects a direct connection between the transmission and the engine.

The torque converter and the engine clutch housing are bolted to the flywheel housing of the engine. A drive shaft universal joint assembly connects the torque converter to the top shaft of the transmission.

Two large fluid lines lead from the torque converter to a torque converter fluid heat exchanger, mounted on the right side of the engine. The fluid used in the converter is cooled by its circulation through these lines and through the heat exchanger.

On tractors prior to Serial No. 4001, the engine fuel transfer pump supplies more fuel to the fuel injection pump than is needed for operation of the engine. The fuel not required for operation of

the engine is forced, by the fuel transfer pump, from the fuel sump of the fuel injection pump through a fluid supply line to the upper right side of the torque converter.

On tractors Serial No. 4001 and above, the engine fuel transfer pump forces fuel through the second stage fuel filter and into the fuel filter head. A restricted fitting in the front of the filter head allows a pre-determined amount of fuel to be supplied to the fuel sump of the fuel injection pump; the remaining amount of fuel from the fuel filter head passes through a fitting in the rear of the filter head and through the torque converter fluid supply hose to the torque converter.

This fuel supplied by the fuel transfer pump keeps the torque converter full of fuel at all times. The fuel is circulated under pressure through the torque converter and the torque converter fluid heat exchanger. Surplus fuel supplied to the torque converter passes through a fuel return line filter assembly, located at the rear end of the fluid heat exchanger, and is returned to the fuel tank through a fuel return line. A pressure of 30 to 60 P.S.I. is maintained in the fuel and torque converter system by a restricted plug located in the fuel return line filter assembly.

Front and rear seal drain tubes are provided for draining any fuel that might seep past the front and the rear fluid seals of the torque converter. The front seal drain tube is located at the lower left side of the converter housing and the rear seal drain tube is located at the rear of the converter housing, just below the front end of the drive shaft universal joint assembly. A slight discharge of fuel (a few drops per minute) through the seal drain tubes is normal when the converter is in operation; if a steady stream of fuel is observed, a worn or damaged fluid seal is indicated and the torque converter should be removed and repaired, or replaced. It is important that the discharge end of the seal drain tubes be kept open at all times.

### B. Service of Torque Converter

The only service required on the torque converter is the periodic lubrication of the converter bearings and inspection of the seal drain tubes. The torque



converter bearings require lubrication daily (after each 10 hours of operation) with a good grade of ball or roller bearing lubricant, having a minimum melting point of 300° F. This lubricant should have a viscosity range so as to permit easy handling in the lubricating gun at the prevailing atmospheric temperature. In cold weather it may be necessary to use a lubricant of No. 1 consistency to obtain satisfactory pumpability; in warmer weather either a No. 2 or No. 3 lubricant may be used.

The amount of lubricant required daily will depend on operating conditions. Over lubrication will not harm the bearings or the seals, however, if lubricant is allowed to accumulate in the engine clutch housing, difficulty with the engine clutch may result. Inspect the clutch housing periodically and remove any accumulation of lubricant (refer to Topic 1, Paragraph F. in this Section). Inspect the converter seal drain tubes, making certain the discharge ends of the tubes are open. Due to the close fitting parts of the converter, it is important that the fuel used in the tractor be kept clean and the fuel filters properly serviced so that no dirt enters the torque converter.

If for any reason it becomes necessary to drain the torque converter, close the fuel tank shut-off valve, then remove the drain plug from the bottom of the converter housing and allow the converter to drain. Install the converter drain plug and open the fuel tank shut-off valve. Fill the torque converter fluid system (refer to Topic 1, Paragraph P., Steps 10 and 11 in this Section). **CAUTION:** *The engine clutch should never be engaged with the engine running and the tractor not in motion, as this will cause extreme heat to generate in the torque converter and damage to the seals may result.*

### C. Removal of Torque Converter

Remove the clutch housing and the torque converter assembly from the tractor as outlined in Topic 1, Paragraph G. in this Section.

### D. Disassembly of Torque Converter

Before starting to disassemble the torque converter, thoroughly clean the outside of the converter housing. *Cleanliness is very important when repairing the converter.*

When a torque converter is moved or shipped from one location to another, always make certain that all fluid openings are covered. The splines of the shaft must also be protected from damage. Rain or foreign material entering the converter while in transit will cause serious damage and improper handling may damage the splines of the input shaft.

1. Remove the clutch inspection plate and remove all but one of the nuts and lockwashers attaching the turbine housing to the clutch housing, leaving the one nut by the inspection hole in the clutch housing to hold the turbine housing and clutch housing together. **NOTE:** *On tractors prior to Serial Number 2236, it will be necessary to remove the seal drain tube, connecting the rear seal to the connection on the left side of the clutch housing, then remove the seal drain tube and its breather attached to the turbine wheel rear bearing retainer.*
2. Position the assembly on a stand with the turbine housing up as shown in Fig. 22 and remove the remaining nut and lockwasher through the opening in the clutch housing. If a stand is not available, use suitable blocks under the clutch housing so that the input shaft will clear the bench.
3. Using a short chain or lifting bracket as shown in Fig. 22, attached to the turbine housing with two of the bearing retainer capscrews, the turbine housing assembly may now be removed with a suitable hoist. **CAUTION:** *Use care and raise the housing assembly straight up so as not to damage the turbine or the impeller wheels and the over running clutch and roller assembly. Care must also be taken so as not to lose any of the clutch rollers which will fall free from the clutch roller cage as the turbine housing is raised.*
4. Remove the capscrews attaching the turbine wheel bearing retainer to the rear of the turbine housing. Install  $\frac{3}{8}$ " NC pusher screws in the tapped holes in the retainer. Turn the screws in and remove the bearing retainer and gasket.





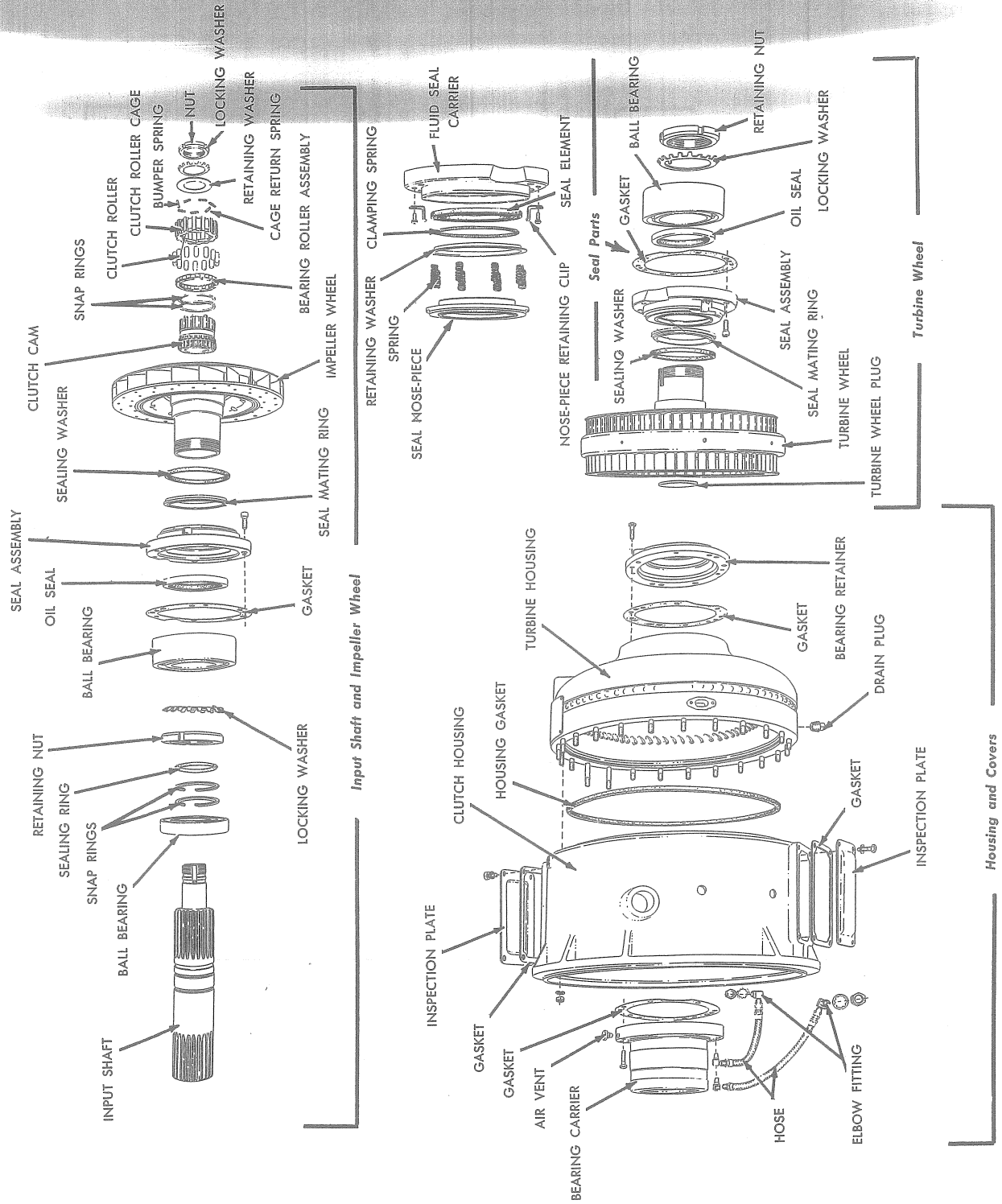
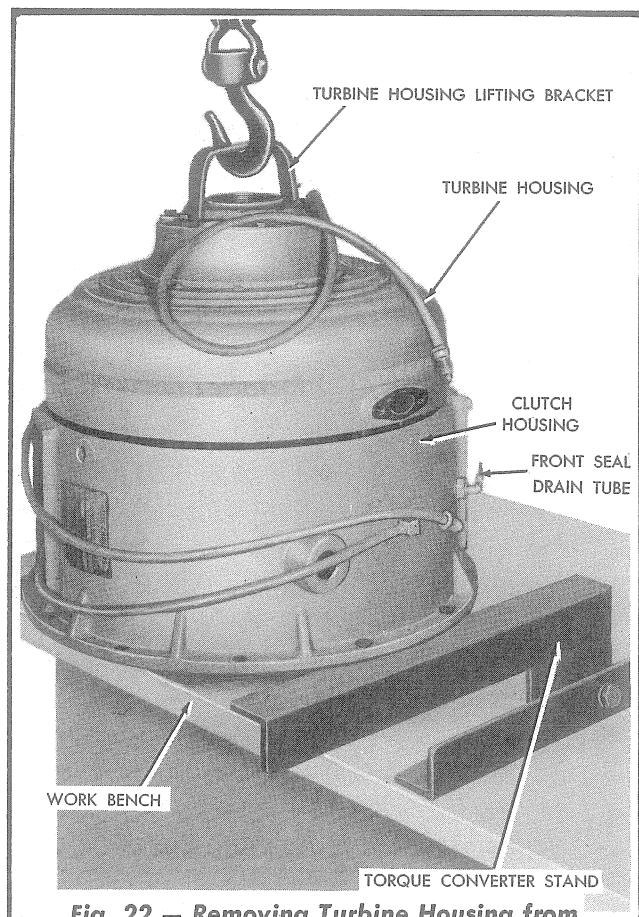


Fig. 21 — Torque Converter Details (Tractors  
Serial No. 1879 and Above)

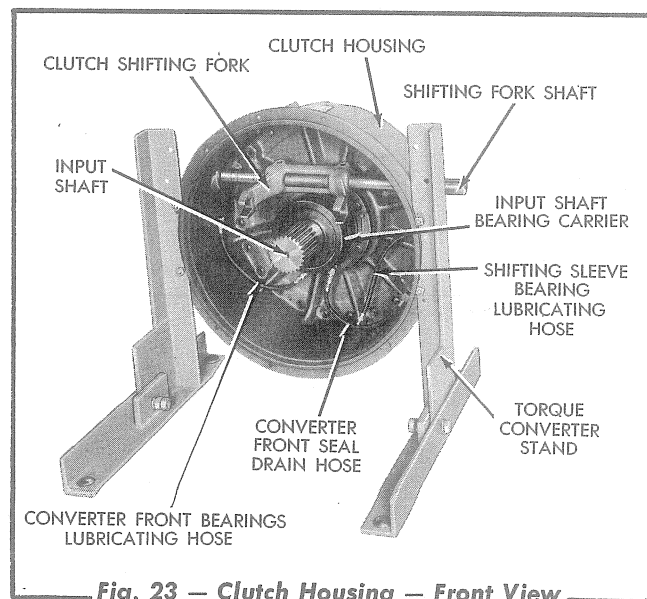


**Fig. 22 — Removing Turbine Housing from Clutch Housing**

5. Unlock and remove the turbine wheel retaining nut (spanner nut) from the hub of the turbine wheel, using tools similar to the ones shown in Figs. 25 and 26. **CAUTION:** Do not attempt to hold the turbine wheel from turning by inserting anything in the blades of the turbine wheel. The blades of the turbine wheel are accurately located and any disturbance of their location or damage to them will affect the efficiency of the torque converter.
6. Support the turbine housing, large end down, and press the turbine wheel assembly out of the bearing by pressing on the end of the turbine wheel hub. **CAUTION:** Do not press on the turbine wheel plug located inside of the turbine wheel hub.
7. Remove the socket head capscrews attaching the seal assembly to the turbine housing and remove the seal assembly. Place the turbine housing with the large end down

in a suitable press and press the ball bearing from the turbine housing; when removing the bearing, press or drive on the outer race of the bearing.

8. Refer to Fig. 20 or 21 and remove the seal mating ring and sealing washer from the hub of the turbine wheel assembly. **NOTE:** Be careful and do not break the seal mating ring (carbon) when removing it from the hub and do not scratch or damage the sealing surface of the ring.
9. Disassemble the seal assembly by removing the two slotted head capscrews from the nose piece retaining clips.
10. Unlock the input shaft nut located on the rear of the input shaft. Using tools similar to the ones shown in Figs. 25 and 29 remove the input shaft nut. **CAUTION:** When removing the input shaft nut, do not attempt to hold the impeller wheel from turning by inserting anything in the blades of the wheel, as to do so will damage the blades.
11. Remove the locking washer, retaining washer, and the over-running clutch cam and clutch components from the input shaft.



**Fig. 23 — Clutch Housing — Front View (Turbine Housing Removed)**

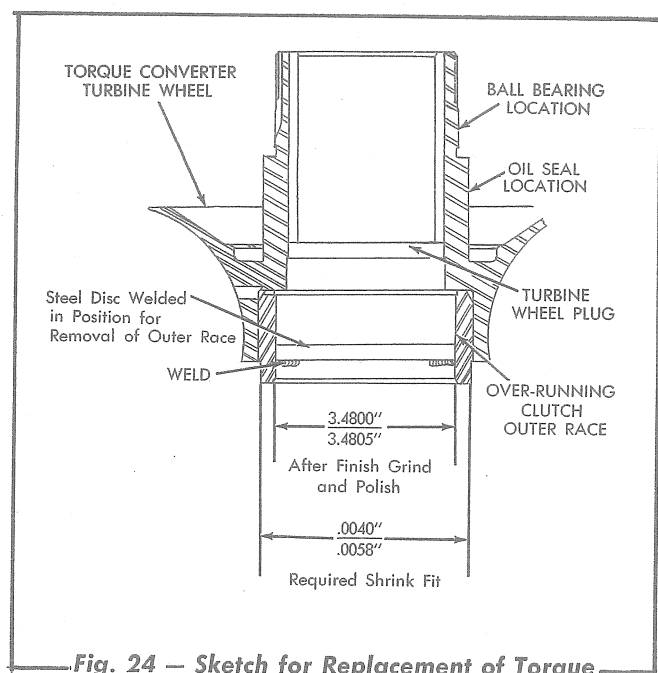
12. Refer to Fig. 23 and disconnect the lubricating hose and the seal drain hose from the input shaft bearing carrier. Remove the clutch shifting fork shaft and the shifting

fork (refer to Topic 1, Paragraph M. in this Section). Remove the capscrews attaching the input shaft bearing carrier to the clutch housing. Using a soft hammer, drive on the rear end of the input shaft and remove the shaft and bearing carrier from the clutch housing. Bump the front end of the input shaft on a block of wood and remove the carrier from the input shaft. Remove the input shaft ball bearing from the input shaft, or if the bearing remains in the carrier, remove the bearing from the carrier.

13. Unlock the bearing retaining nut and using tools similar to the ones shown in Figs. 25 and 27, remove the impeller wheel retaining nut from the hub of the impeller wheel, being careful not to damage the impeller wheel while performing this operation. NOTE: On tractors prior to Serial No. 1879, remove the spacer from the impeller hub.
14. Remove the turbine housing-to-clutch housing gasket from the rear flange of the clutch housing. Support the rear face of the clutch housing in a press and press the impeller wheel out of the ball bearing, being careful not to damage the impeller wheel.
15. Remove the socket head capscrews attaching the seal assembly to the clutch housing and remove the seal assembly. Place the clutch housing in a suitable press and press the ball bearing from the clutch housing; when removing the bearing press or drive on the outer race of the bearing.
16. Remove the seal mating ring and the sealing washer from the hub of the impeller wheel. NOTE: Be careful and do not break the seal mating ring (carbon) when removing it from the hub and do not scratch or damage the sealing surface of the ring.
17. Disassemble the seal assembly by removing the two slotted head capscrews from the nose piece retaining clips.

## E. Inspection of Torque Converter

1. Inspect the turbine wheel for loose or damaged blades or blade rings. Slight burrs may be removed with a mill file. Refer to Fig. 24 and inspect the turbine wheel hub at the rear ball bearing location. The outside diameter of the hub at this point should be 3.5428" to 3.5435" and the turbine wheel must be replaced if the diameter is less than 3.5425". Inspect the hub at the oil seal location, a groove not more than .015" deep is permissible at this location. Refer to Fig. 24 and inspect the outer bearing race for the over-running clutch. If the outer race is damaged, worn, or is loose in the bore of the turbine wheel, and the turbine wheel is in good condition except for the outer race, the outer race may be replaced. Outer races are available in two oversizes, .020" oversize, (O.D. - 4.225" to 4.228"); and .060" oversize, (O.D. - 4.265" to 4.268"). The outer race is a .0040" to .0058" shrink fit in the bore of the turbine wheel. To replace the over-running clutch outer race proceed as follows:
  - a. Drive or press the turbine wheel plug Fig. 24 out of the bore of the turbine wheel.
  - b. In order to press the outer race from its bore in the turbine wheel, it is necessary to weld a steel disc to the inside diameter of the race as shown in Fig. 24. The disc should be made from round bar stock or mild steel plate at least  $\frac{3}{8}$ " thick and should have an outside diameter approximately  $\frac{1}{32}$ " smaller than the inside diameter of the race.
  - c. Weld the disc to the inside diameter of the outer race, as shown in Fig. 24. Use a heavy bead and weld at three equally spaced points at the circumference of the disc, for a distance of approximately one inch.
  - d. Allow sufficient time for the welded disc to cool then place the turbine wheel in



**Fig. 24 — Sketch for Replacement of Torque Converter Over-Running Clutch Outer Race**

a suitable press. Support the front end (outer race end) of the turbine wheel on a heavy sleeve or tube having an inside diameter slightly larger than the outside diameter of the race. Use a heavy step plate approximately 2½" in diameter inserted into the splined end of the turbine wheel and next to the welded steel plate and press the over-running clutch outer race from the turbine wheel.

- e. Machine the bore in the turbine wheel for the outer race sufficiently to remove all scoring. Using a micrometer, measure the cleaned up bore in the turbine wheel and using either the .020" or the .060" oversize race, grind the outside diameter of the race so that the O.D. of the race is .0040" to .0058" larger than the measured bore I.D. in the turbine wheel. EXAMPLE: Cleaned up I.D. of the bore in the turbine wheel is 4.210"; O.D. of race after grinding should be 4.2140" to 4.2158".
- f. Heat the hub of the turbine wheel at the outer race bore location to a temperature of 500° F. (260° C.) and at the same time, chill the outer race (after machining) in a cold box or by packing

in dry ice. When the turbine wheel hub reaches the proper temperature and the outer race is thoroughly chilled, drop the COLD race into the bore with the chamfered side of the race down (facing the splines in the hub).

- g. Place the turbine wheel in a fixture and locate from the machined surface for the rear ball bearing and from the turbine wheel; refer to Fig. 24, and rough grind the inside diameter of the outer race to within .001" of the specified finished diameter. Using a No. 120 grit stone, finish grind and polish the inside diameter of the race to the specified 3.4800" to 3.4805" dimension.
  - h. Install a new turbine wheel plug Fig. 24 into position in the bore of the turbine wheel. Coat the outer edge of the plug with a good non-hardening sealing compound before pressing the plug into position. NOTE: This plug must be tight to prevent fluid from leaking at the universal joint front yoke location.
2. Inspect the sealing edges of the lip type seals to make certain that they are in good condition. Replace any seals that are worn or damaged.
  3. Inspect the carbon mating rings, the mating ring rubber sealing washers, and the nose pieces of the seals for wear or scratches on the sealing surfaces. Replace any worn or damaged parts. NOTE: The nose pieces and fluid seal carriers are not serviced separately. If either of these parts are to be replaced, a new fluid seal assembly, mating ring, and sealing washer must be used.
  4. Inspect the springs in each seal assembly to make certain that they are not broken or have lost their tension. Replace any broken or weak springs.
  5. Make certain that the seal drain and grease passages in the seal carriers, rear bearing retainer, input shaft bearing carrier, and the clutch housing are open.

6. Inspect and thoroughly clean all tubes and piping removed when removing the converter.
7. Inspect the blades on the turbine wheel and the impeller wheel for burrs and remove any slight roughness with a mill file.
8. Inspect all ball bearings for wear or damage. Replace worn or damaged bearings.

## F. Assembly of Torque Converter

The torque converter on tractors prior to Serial No. 1879 are equipped with a single row ball bearing on the turbine wheel and a single row ball bearing and a bearing spacer on the impeller wheel. On these tractors a bearing spacer is also used with the input shaft ball bearing (refer to Fig. 20). Effective with tractor Serial No. 1879, the single row turbine wheel and impeller wheel ball bearings were replaced with double row ball bearings and all bearing spacers were eliminated (refer to Fig. 21). The single row and double row ball bearings are not interchangeable.

Refer to Figs. 19, 20, and 21 and assemble the turbine wheel in the turbine housing first, then assemble the impeller wheel in the clutch housing and bolt the two complete assemblies together. Before assembling, make certain that all parts are in good condition and clean.

### 1. Assembly of Turbine Wheel and Turbine Housing (Fig. 20 or 21)

- a. Support the turbine housing in a press, large side up, then lubricate one of the ball bearings and press it into the bore of the housing so that the bearing protrudes approximately  $\frac{1}{8}$ " from the inner face (front face) of the housing.
- b. If the seal assembly has been disassembled, refer to Fig. 20 or 21 and assemble it as follows:
  - (1) Install the lip type oil seal in the large bore of the seal carrier with the sealing lip of the seal directed toward the flat machined side of the carrier.

- (2) Place the nose piece of the seal on a clean cloth, with the sealing edge down.
- (3) Insert the springs in the counterbores of the nose piece.
- (4) Place the clamping spring in its groove in the rubber seal element. Place the assembly of the spring and element on the shoulder of the retaining washer, with the retaining spring next to the flange of the retaining washer.
- (5) Install the assembly of the washer, spring, and element on the shoulder of the nose piece, with the retaining washer against the springs. **CAUTION:** *Make certain that the lip of the element does not turn under when it is assembled to the nose piece.*
- (6) Compress the assembly on the nose piece and install it in the bore of the seal carrier, with the clip notches of the nose piece and seal carrier in line.
- (7) Secure the seal to the seal carrier with two nose piece clips and slotted head capscrews with lockwashers.

- c. Cement a new gasket, to the seal assembly and attach the seal assembly to the inside of the turbine housing with the socket head capscrews. **NOTE:** *The seal assembly must be installed with the part marked "TOP" toward the top of the housing. Tighten the attaching capscrews securely.*
- d. Turn the turbine housing over, lay it on its large face, and attach the bearing retainer to the housing with two capscrews, using a new gasket cemented to the retainer. **NOTE:** *The retainer is installed to hold the ball bearing in position until the hub of the turbine wheel is pressed through the bearing.*
- e. Place the mating ring sealing washer on the seal mating ring (carbon) with the flat side of the sealing washer against the shoulder of the mating ring.



- f. Lubricate the seal mating ring (carbon) with clean oil and install the mating ring and the sealing washer (rubber) on the hub of the turbine wheel, with the sealing washer next to the turbine wheel. **CAUTION:** Make certain that the sealing surface of both the seal nose piece and the mating ring are clean and smooth.
- g. Lubricate the sealing surface on the nose piece of the seal and insert the turbine wheel in the turbine housing. Press the hub of the turbine wheel through the ball bearing in the housing. **CAUTION:** Do not press or drive on the plug inside the bore of the turbine wheel hub, and do not allow the turbine wheel to drop on the seal face, as to do so may crack the carbon mating ring.
- h. After the turbine wheel is in position, remove the bearing retainer and install the locking washer and retaining nut on the turbine wheel hub. Using tools similar to the ones shown in Fig. 26 tighten the turbine wheel retaining nut to a torque of 900 lbs. ft. and secure with the locking washer.

To tighten the retaining nut to a torque of 900 lbs. ft., the following pull is required on the spring scale when using a sliding tee and extension as shown in Fig. 26:

WRENCH-FEET*	POUNDS PULL
6	150
8	112
10	90

\*NOTE: Distance from center of turbine wheel turning tool to point on wrench extension to which spring scale is attached.

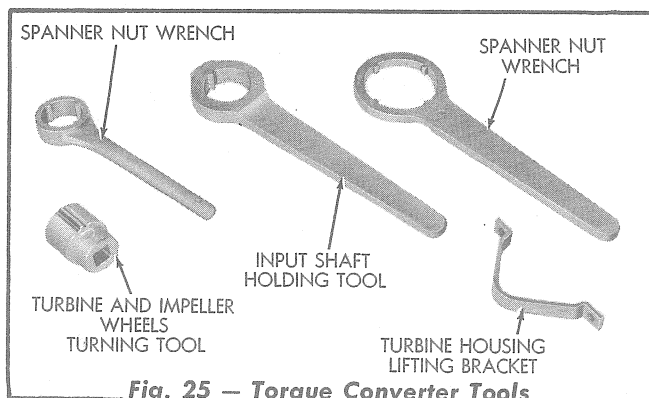


Fig. 25 — Torque Converter Tools

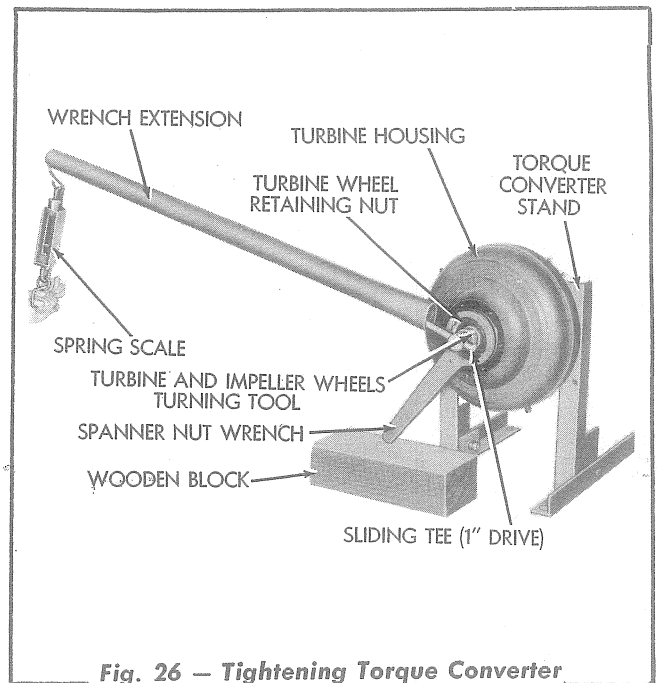


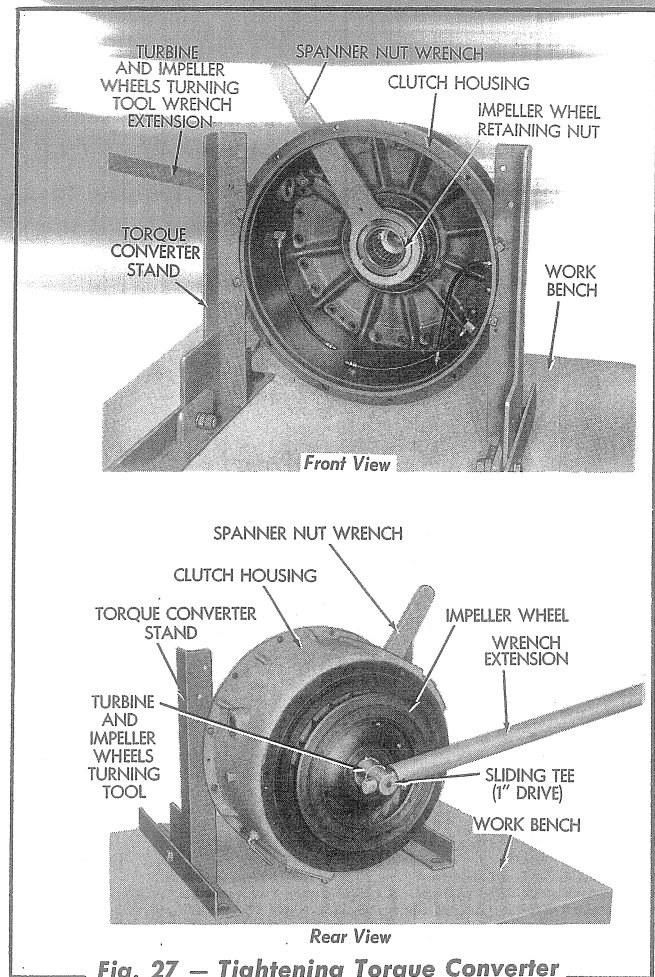
Fig. 26 — Tightening Torque Converter Turbine Wheel Retaining Nut

- i. Install the bearing retainer on the turbine housing and tighten securely with the attaching capscrew.
- j. Rotate the turbine wheel in the housing by hand to make certain it is free and does not drag or bind.

## 2. Assembly of Impeller Wheel and Clutch Housing (Fig. 20 or 21)

- a. Support the clutch housing in a press, with the mounting flange side down. Lubricate the remaining ball bearing and press it into the bearing bore in the clutch housing so that the bearing protrudes approximately  $\frac{1}{8}$ " from the face of the counter-bore in the front of the housing.
- b. If the seal assembly was disassembled, reassemble as outlined in Step 1, b. above.
- c. Cement a new gasket to the seal assembly and attach the seal assembly to the clutch housing with socket head capscrews. **NOTE:** The seal assembly must be installed with the part marked "TOP" toward the top of the housing. Tighten the attaching capscrews securely.

- d. Place the mating ring sealing washer on the seal mating ring (carbon) with the flat side of the sealing washer against the shoulder of the mating ring.
- e. Lubricate the seal mating ring (carbon) with clean oil and install the mating ring and sealing washer (rubber) on the hub of the impeller wheel, with the sealing washer next to the impeller wheel. **CAUTION:** Make certain that the sealing surface of both the seal nose piece and the carbon mating ring are clean and smooth.
- f. Set the clutch housing up and install the input shaft bearing carrier with two cap-screws. **NOTE:** The carrier will hold the ball bearing in position while the impeller wheel hub is pressed through the bearing.
- g. Lubricate the sealing surface on the nose piece of the seal and insert the hub of the impeller wheel through the seal assembly and into the ball bearing in the clutch housing. Press the impeller wheel hub into place in the bearing. **CAUTION:** Do not allow the impeller wheel to drop on the seal face, as to do so may crack the carbon mating ring.
- h. Remove the bearing carrier and install the lockwasher and impeller wheel retaining nut. **NOTE:** On tractors prior to Serial No. 1879, the converter contained single row ball bearings and the bearing spacer (Fig. 20) must be installed before the locking washer and nut are installed. Using tools similar to the ones shown in Fig. 27, tighten the nut to a torque of 900 lbs. ft. (refer to Step 1., h. above) and secure with the locking washer.
- i. On tractors prior to Serial No. 1879, refer to Fig. 20 and install the snap ring in the front groove of the input shaft. Lubricate and press the input shaft ball bearing into position on the input shaft (from the rear) so that the bearing is tight against the snap ring. Install the bearing spacer in position on the shaft, then install the sealing ring in the sealing ring groove of the shaft. Lubri-



**Fig. 27 — Tightening Torque Converter Impeller Wheel Retaining Nut**

cate the O.D. of the sealing ring with clean oil and insert the input shaft into position in the impeller wheel.

On tractors Serial No. 1879 and above, refer to Fig. 21 and install the two snap rings in position in the snap ring grooves of the input shaft. Lubricate and press the input shaft ball bearing into position on the input shaft (from the front) so that the bearing is tight against the front snap ring. Install the sealing ring in the sealing ring groove of the shaft. Lubricate the O.D. of the sealing ring with clean oil and insert the input shaft into position in the impeller wheel.

- j. Coat a new bearing carrier gasket with gasket cement and place the gasket in position in the clutch housing, making certain that the holes in the gasket are properly aligned with the holes in the clutch

housing. Start the bearing carrier on the input shaft and ball bearing and using a soft hammer, tap the carrier into position. Make certain the lubricating hose and seal drain hose fittings in the carrier are toward the bottom as shown in Fig. 23, then secure the carrier to the clutch housing with the attaching capscrews. Connect the lubricating hose and the seal drain hose to the bearing carrier as shown in Fig. 23.

- k. Position the clutch housing on a stand with the impeller wheel up. If no stand is available, use suitable blocks so that the front end of the input shaft will clear the work bench.

### 3. Assembly of Over-Running Clutch (Fig. 20 or 21)

- a. If the two snap rings in the grooves in the over-running clutch cam were removed, install them at this time, then place the over-running clutch cam over the input shaft, with the splined end down and engage with the splines in the impeller wheel.
- b. Install the bearing roller assembly over the clutch cam. *NOTE: One side of the bearing roller is etched to read "REAR SIDE." This surface must be installed up, or toward the rear of the input shaft.*
- c. Install the two cage return springs in position on their guiding pins in the clutch roller cage assembly, then install the cage on the clutch cam, compressing the return springs, and placing the free ends of the springs against the stops on the cam. Install the five bumper springs in position in the roller cage (refer to Fig. 28). Oscillate the roller cage on the cam against the springs; the springs should return the cam to its normal position. The roller cage must operate freely after it is installed.
- d. Place a rubber band around the clutch roller cage, then insert the 14 clutch rollers in their proper locations in the cage. The rubber band will hold the rollers in position for assembly when installing the tur-

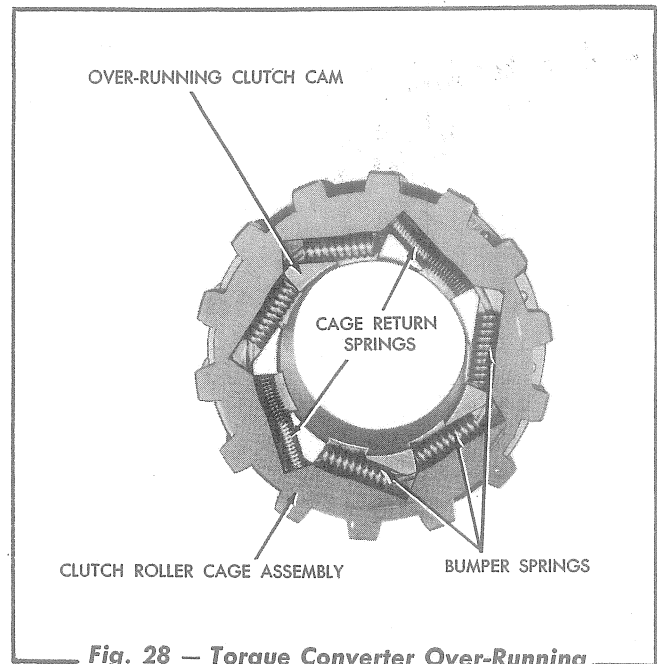


Fig. 28 — Torque Converter Over-Running Clutch Springs — Installed

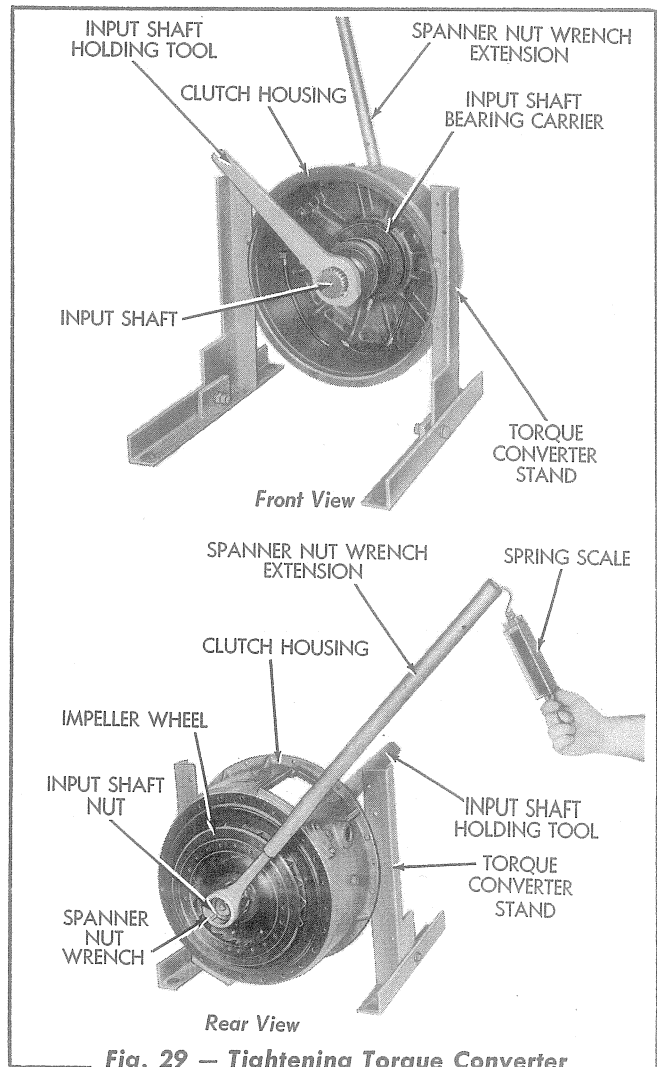


Fig. 29 — Tightening Torque Converter Input Shaft Nut

bine housing; the rubber band need not be removed as it will disintegrate when the converter is placed in operation.

- e. Place the over-running clutch retaining washer on the input shaft, then install the locking washer and the input shaft nut. Using special tools as shown in Fig. 29, tighten the input shaft nut to a torque of 200 lbs. ft. and secure with the locking washer.

To tighten the input shaft nut to a torque of 200 lbs. ft., the following pull is required on the spring scale when using the spanner nut wrench and extension as shown in Fig. 29.

WRENCH-FEET*	POUNDS PULL
4	50
5	40
6	33

\*NOTE: Distance from center of input shaft to point on wrench extension to which spring scale is attached.

#### 4. Assembly of Turbine Housing to the Clutch Housing

- a. Position the clutch housing, flanged end down, as shown in Fig. 30. If no stand is available, use suitable blocking so that the end of the input shaft will clear the work bench and the shaft will be accessible for rotating.
- b. Install a new turbine wheel housing-to-clutch housing gasket on the shoulder of the clutch housing. Make certain all parts of both assemblies are clean.
- c. Raise the turbine assembly with a suitable hoist and position it over the clutch housing so that the two long studs in the turbine housing will enter the holes on each side of the fluid return tube opening in the clutch housing (Fig. 30).
- d. Lower the turbine housing assembly enough so that the clutch outer race in the turbine wheel just contacts the over-running clutch rollers, then rotate the input shaft clockwise

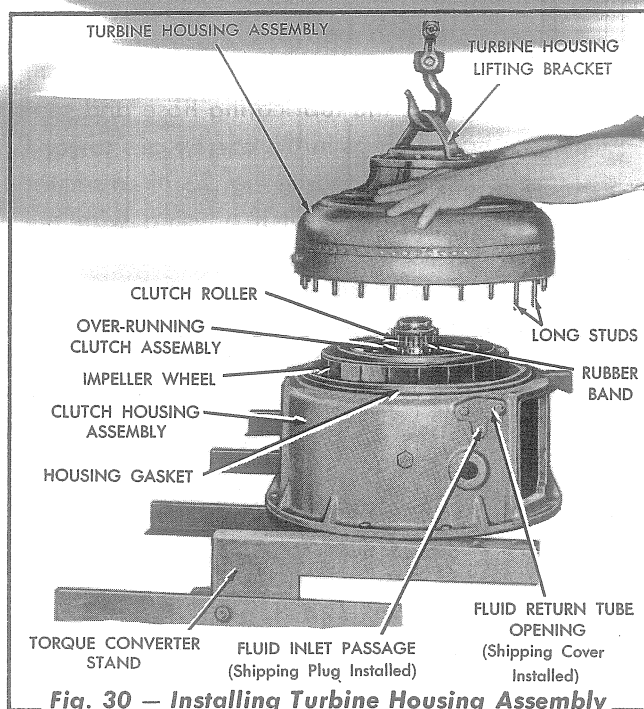


Fig. 30 — Installing Turbine Housing Assembly Onto Clutch Housing Assembly

(viewed from the front) and lower the turbine housing assembly while turning the input shaft. This will rotate the clutch roller cage to the low point on the cam, or the freewheel position. Do not force the two housings together, as to do so may damage the over-running clutch assembly. The weight of the turbine housing assembly should be sufficient to assemble the two housings to the point where the pilot on the clutch housing contacts the turbine housing assembly. At this point, it is permissible to tap the turbine housing lightly with a soft hammer until the pilot enters the bore in the turbine housing.

- e. Secure the two housings together with the 24 nuts and lockwashers. Tighten the nuts securely.
- f. After the assembly is completed, test the converter for leaks as follows:
  - (1) Cover all openings in the converter with suitable covers and gaskets except the seal drain openings, the grease passages, and the fluid inlet passage.
  - (2) Fill the converter approximately  $\frac{3}{4}$  full with clean fuel, then cover the fluid

inlet passage, and apply from 25 to 80 pounds of air pressure in the converter. *NOTE: An air valve from an old inner tube welded to a fuel tube nut is a suggested means of introducing air into the converter. Screw the nut onto the fluid inlet fitting in the clutch housing. Do not use more than 80 pounds of air pressure as to do so may damage the fluid seals. A slight seepage of fluid from the fluid seal drain passages is permissible. This seepage, from each seal, must not exceed 6 drops per minute. If considerable fluid is seen emerging from the openings, rotate the turbine and pump wheels by hand several times to seat the seals. If any fluid at all leaks through the gaskets or housings, or if the seals continue to leak excessively after the seals are seated, it will be necessary to disassem-*

ble the converter and determine the reason for the leakage. When the converter has been assembled in accordance with the instructions, it is unlikely that any leakage will occur.

- (3) After the converter has been tested for leakage, drain the converter and prepare it for installation.

### 5. Installation of Torque Converter

Install the clutch shifting fork and shifting fork shaft (refer to Topic 1, Paragraph M. in this Section). Make certain that the engine clutch is in the disengaged position and install the torque converter by the direct reversal of the removal procedure (refer to Topic 1, Paragraph P., Step 2 in this Section). Thoroughly lubricate the torque converter front ball bearing and the rear ball bearing with the specified lubricant.

## 3. TORQUE CONVERTER PIPING

### A. General Description

The torque converter piping consists of two large tubes or hoses (Fig. 31 or 32) leading from the torque converter to the torque converter fluid heat exchanger, mounted on the right side of the engine. The fluid used in the converter is cooled by its circulation through these lines and the heat exchanger. The engine fuel transfer pump keeps the torque converter housing completely filled with fuel. Fluid is returned from the torque converter to the fuel tank through a fuel return line extending from the fuel return line filter (Fig. 31 or 32) to the fuel tank. A pressure of 30 to 60 pounds is maintained in the converter system by a restrictor plug located in the fuel return line filter assembly.

Erratic fuel pressure is an indication of a plugged fuel return line filter screen or restrictor. Clean the filter screen and the restrictor plug in the fuel re-

turn line filter if plugging should occur.

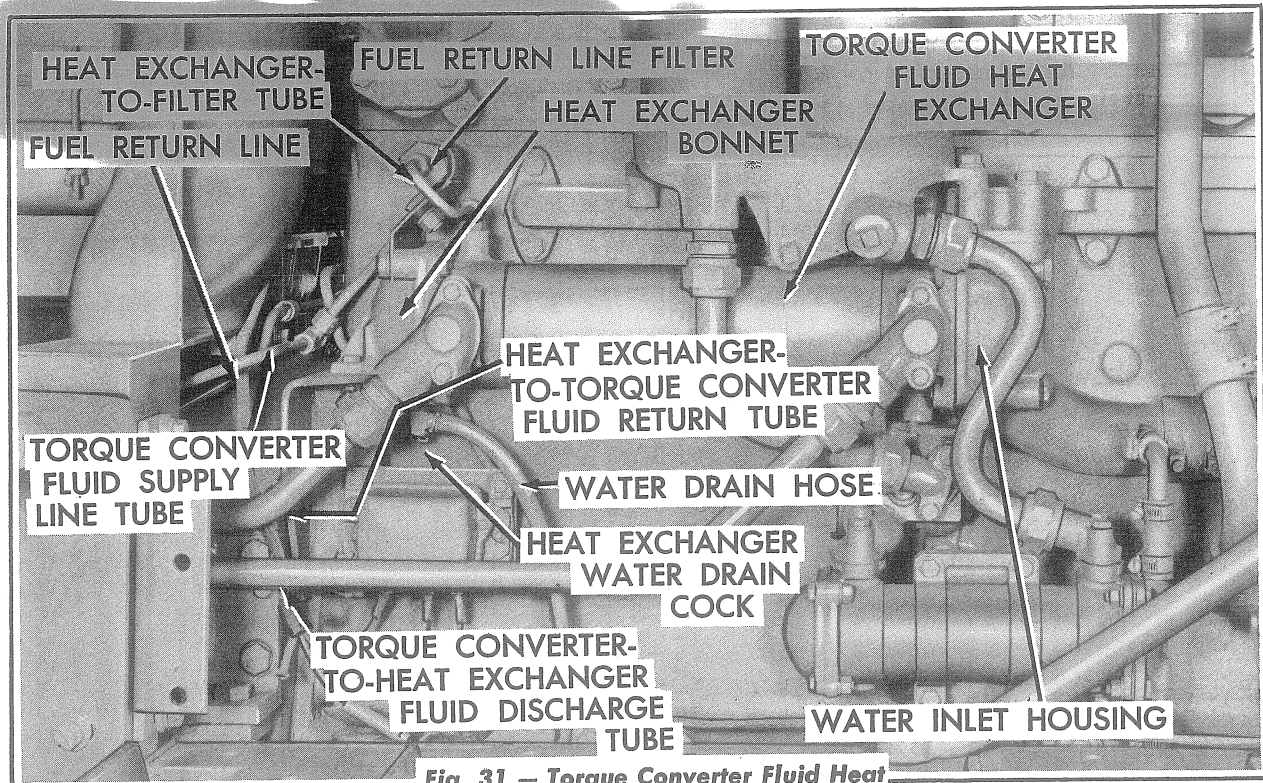
Front and rear seal drain tubes are provided for draining any fuel that might seep through the front and rear fluid seals of the torque converter. The front seal drain tube is located at the lower left side of the converter housing and the rear seal drain tube is located at the rear of the converter housing, just below the front end of the drive shaft universal joint assembly.

### B. Cleaning and Inspection of Piping

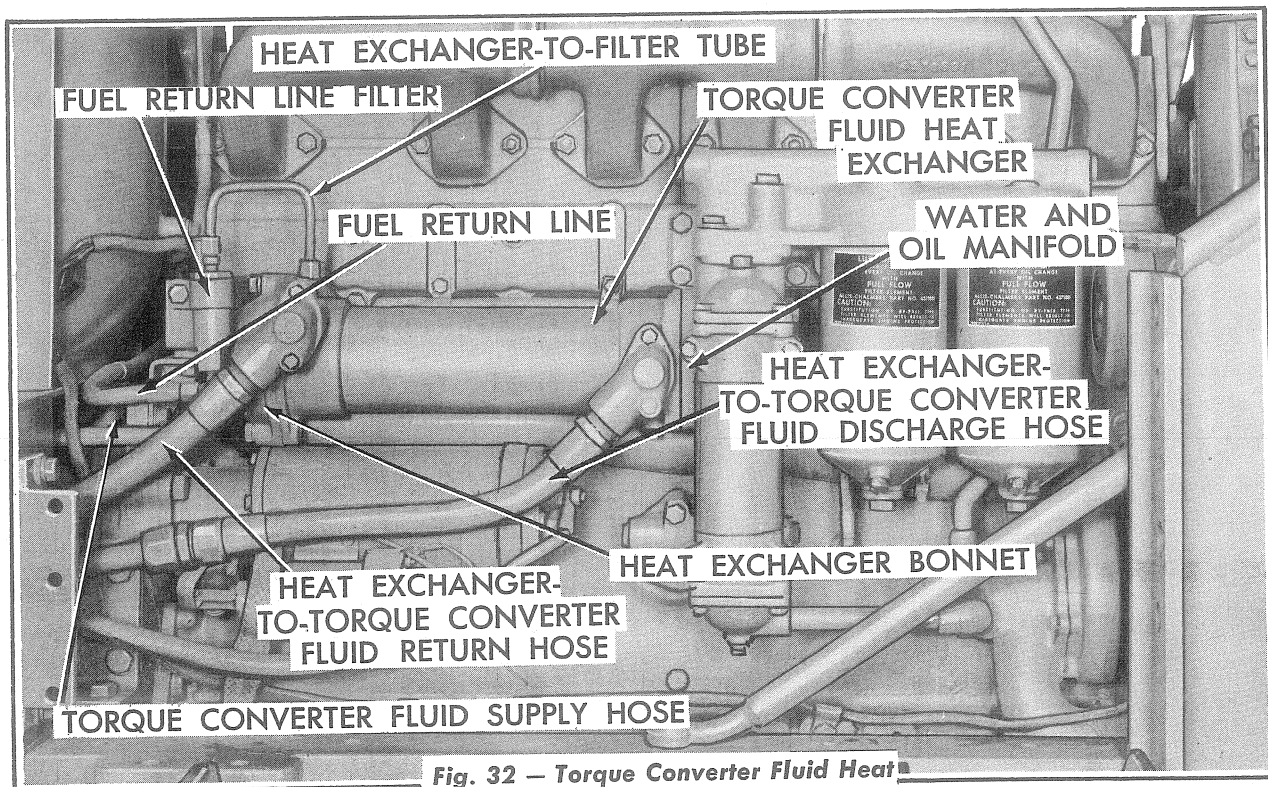
Whenever the torque converter is removed for repairs, ALL FLUID TUBES AND/OR HOSES AND SEAL DRAIN TUBES SHOULD BE REMOVED AND THOROUGHLY CLEANED. Make certain that the fluid seal drain holes in the fluid seal carriers, rear bearing retainer, input shaft bearing carrier, and the clutch housing are open and that the drain tubes are not plugged.



#### 4. TORQUE CONVERTER FLUID HEAT EXCHANGER



**Fig. 31 — Torque Converter Fluid Heat Exchanger — Installed (Tractors Prior to Serial No. 4001)**



**Fig. 32 — Torque Converter Fluid Heat Exchanger — Installed (Tractors Serial No. 4001 and Above)**

## **A. Description**

The torque converter fluid heat exchanger (Fig. 31 or 32) located on the right side of the engine, consists of a corrosion resistant cooling core and tank. The water pump circulates coolant through the cooling core tubes, and the fluid from the torque converter circulates through the tank, around the outside of the tubes of the cooling core, thereby controlling the fluid temperature.

## **B. Removal of Torque Converter Fluid Heat Exchanger**

In the event of a major failure in the torque converter where any metal particles from the failed converter may have entered the fluid tubes and the fluid heat exchanger, it is of the utmost importance that the fluid tubes and heat exchanger be removed, cleaned and thoroughly flushed.

Remove the heat exchanger as follows:

1. Drain the engine cooling system (refer to Section IV, Topic 3).
2. Refer to Fig. 31 or 32 and disconnect all lines or hoses necessary for the removal of the heat exchanger.
3. On tractors prior to Serial No. 4001, remove the capscrews and lockwashers, plain washers, and nuts securing the heat exchanger rear bonnet to the supporting bracket. Remove the capscrews and lockwashers securing the front of the heat exchanger to the water inlet housing and remove the heat exchanger and rear bonnet.

On tractors Serial No. 4001 and above, loosen the hose clamps attaching the heat exchanger water inlet pipe (integral with the heat exchanger rear bonnet) to the water pump. Remove the capscrews, lockwashers, plain washers, and nuts securing the heat exchanger rear bonnet to the supporting bracket. Loosen the capscrews securing the front of the heat exchanger to the water and oil manifold and remove the heat exchanger and rear bonnet as a unit.

4. Remove the heat exchanger rear bonnet from the heat exchanger.

## **C. Inspection of Torque Converter Fluid Heat Exchanger**

Thoroughly clean the inside of the torque converter fluid heat exchanger and remove any metal particles that may be found. The heat exchanger should be submerged in water and tested for leaks under air pressure of 100 P.S.I. If repair of the heat exchanger is necessary, the repair should be made by a reputable radiator repair shop.

## **D. Installation of Torque Converter Fluid Heat Exchanger**

Using a new gasket, install the heat exchanger rear bonnet in position on the rear of the heat exchanger. Using new gaskets, install the heat exchanger by a direct reversal of the removal procedure. Fill the engine cooling system (refer to Section IV, Topic 3).