

## SECTION XI — STEERING CLUTCHES AND CONTROLS

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### 1. GENERAL DESCRIPTION

Two multiple disc steering clutch assemblies, one located at each end of the bevel gear shaft, are provided for steering the tractor. Each steering clutch assembly is enclosed in a brake drum; each drum is bolted to a brake drum hub which is connected to the corresponding final drive pinion. The brake drums serve in conjunction with the steering clutches by stopping the rotation of the final drives when the clutches are disengaged and

the brakes are applied.

The steering clutches are actuated (disengaged) "hydraulically." The steering hydraulic system consists basically of an engine driven hydraulic pump, steering oil reservoir, steering clutch hydraulic control valve assembly, and hydraulic lines. The two spool valves of the hydraulic control valve assembly are controlled manually by means of two steering levers and the necessary linkage.

### 2. STEERING CLUTCHES AND CONTROLS

#### A. Description

Two multiple disc steering clutch assemblies, one located at each end of the bevel gear shaft, are provided for steering the tractor. Each steering clutch assembly is enclosed in a brake drum; each drum is bolted to a brake drum hub which is connected to the corresponding final drive pinion. The brake drums serve in conjunction with the steering clutches by stopping the rotation of the final drives when the clutches are disengaged and the steering brakes are applied. Each clutch assembly contains 14 friction discs and 14 steel discs assembled alternately, with pressure springs holding the steel and friction discs tightly together. Effective with tractor Serial No. 2700, two tapered friction discs were used in each clutch assembly. The purpose of the tapered discs is to produce a wobble action of the discs when the clutch is disengaged, which in turn accelerates disengagement and engagement of the clutch. These tapered friction discs can be identified by an omitted tooth at the thickest point.

The gear driven hydraulic pump, mounted on the front left side of the engine, supplies oil under pressure to the steering clutch hydraulic control valve assembly. Pulling back on a steering lever actuates the corresponding spool valve and control piston in the steering clutch hydraulic control valve assembly, and the piston in turn (through linkage) forces a throwout sleeve against a throwout plate in the steering clutch assembly, further compressing the steering clutch springs which disengages the corresponding steering clutch. Compressing the steering clutch springs, allows the discs of the clutch to separate, therefore no power is delivered to the corresponding final drive and track drive sprocket.

#### B. Service of Steering Clutches

Specified time intervals between control linkage adjustments can not be established because of the variable operating conditions which determine the amount of steering clutch disc wear.

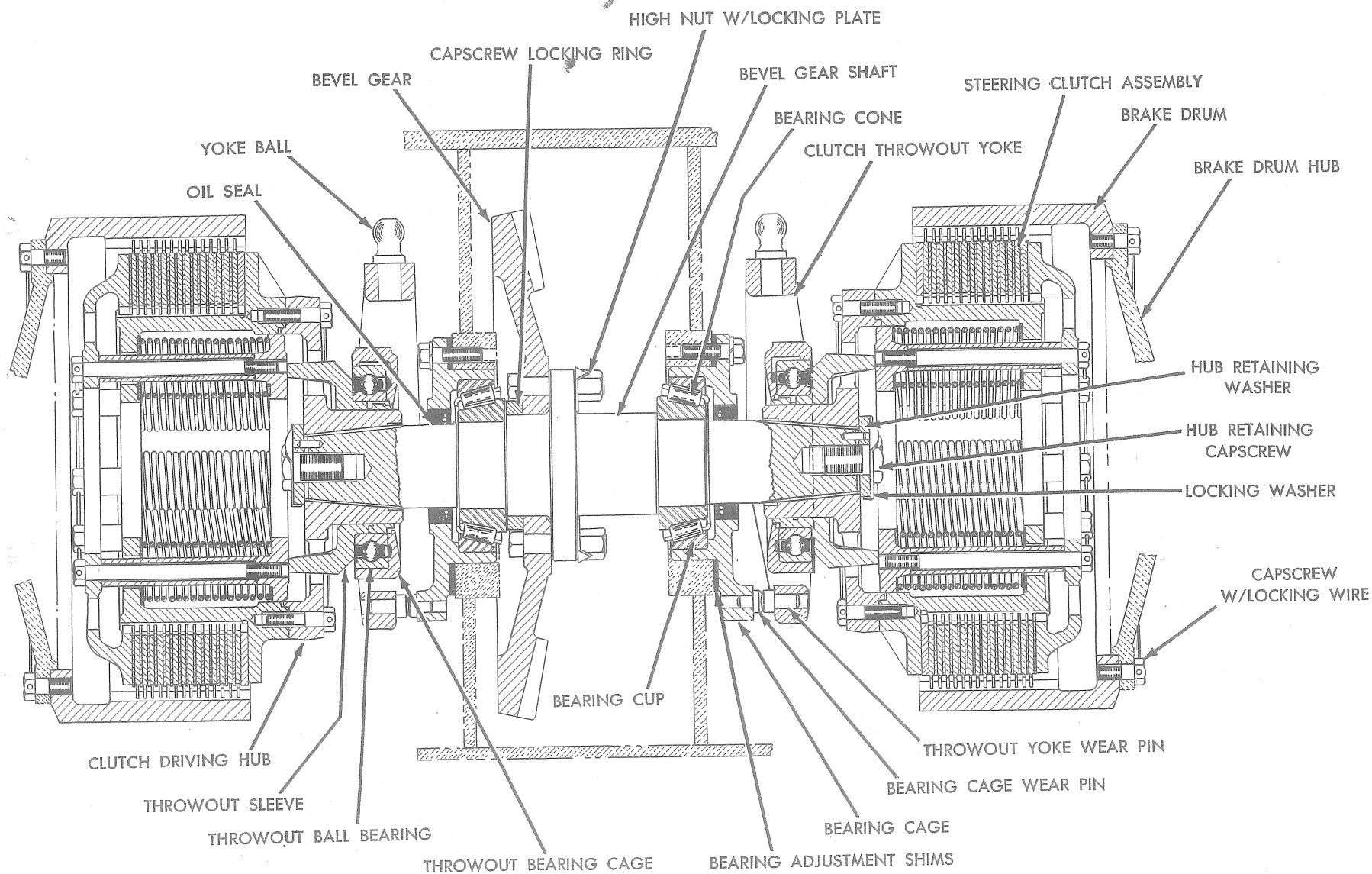
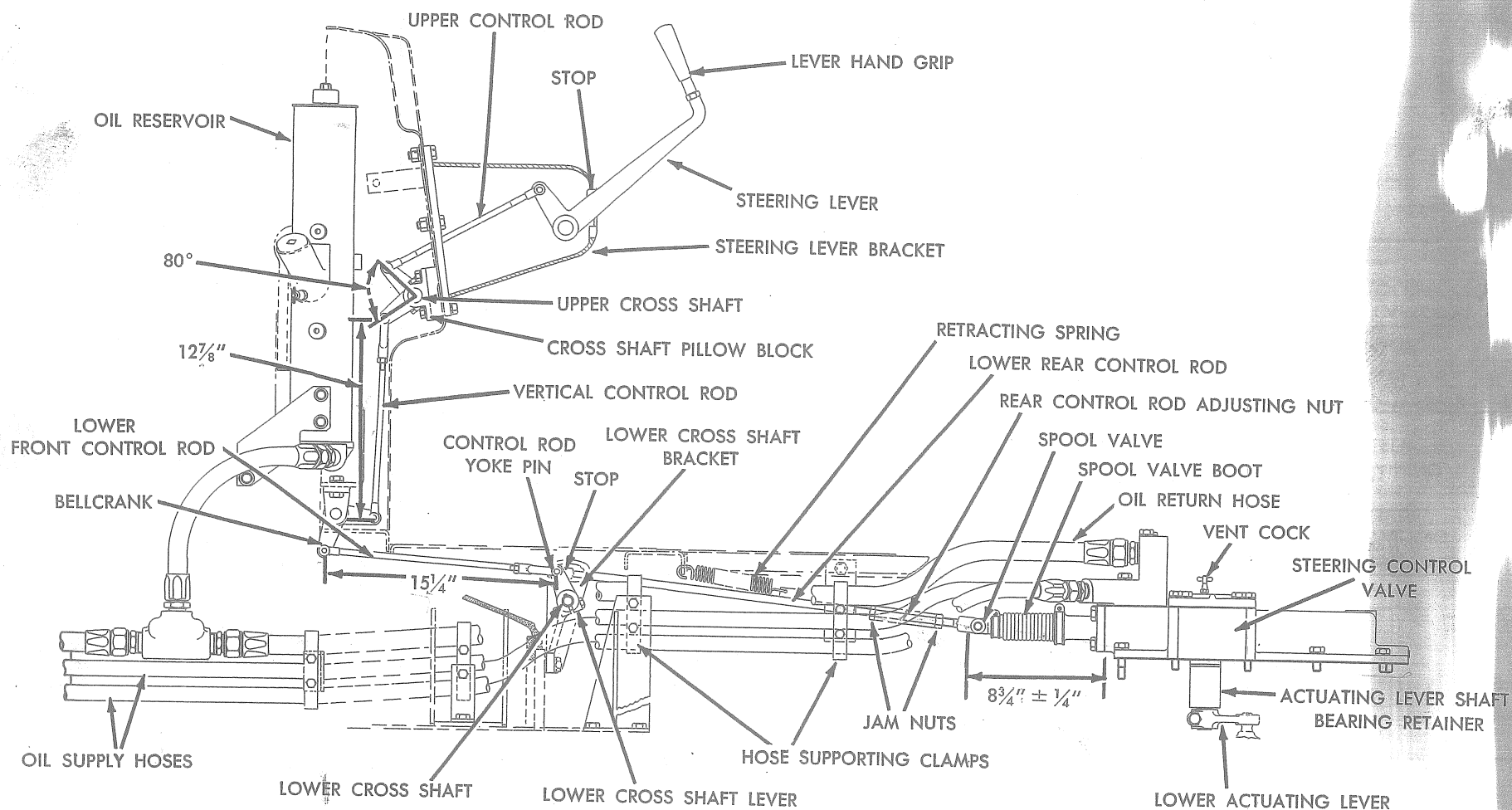
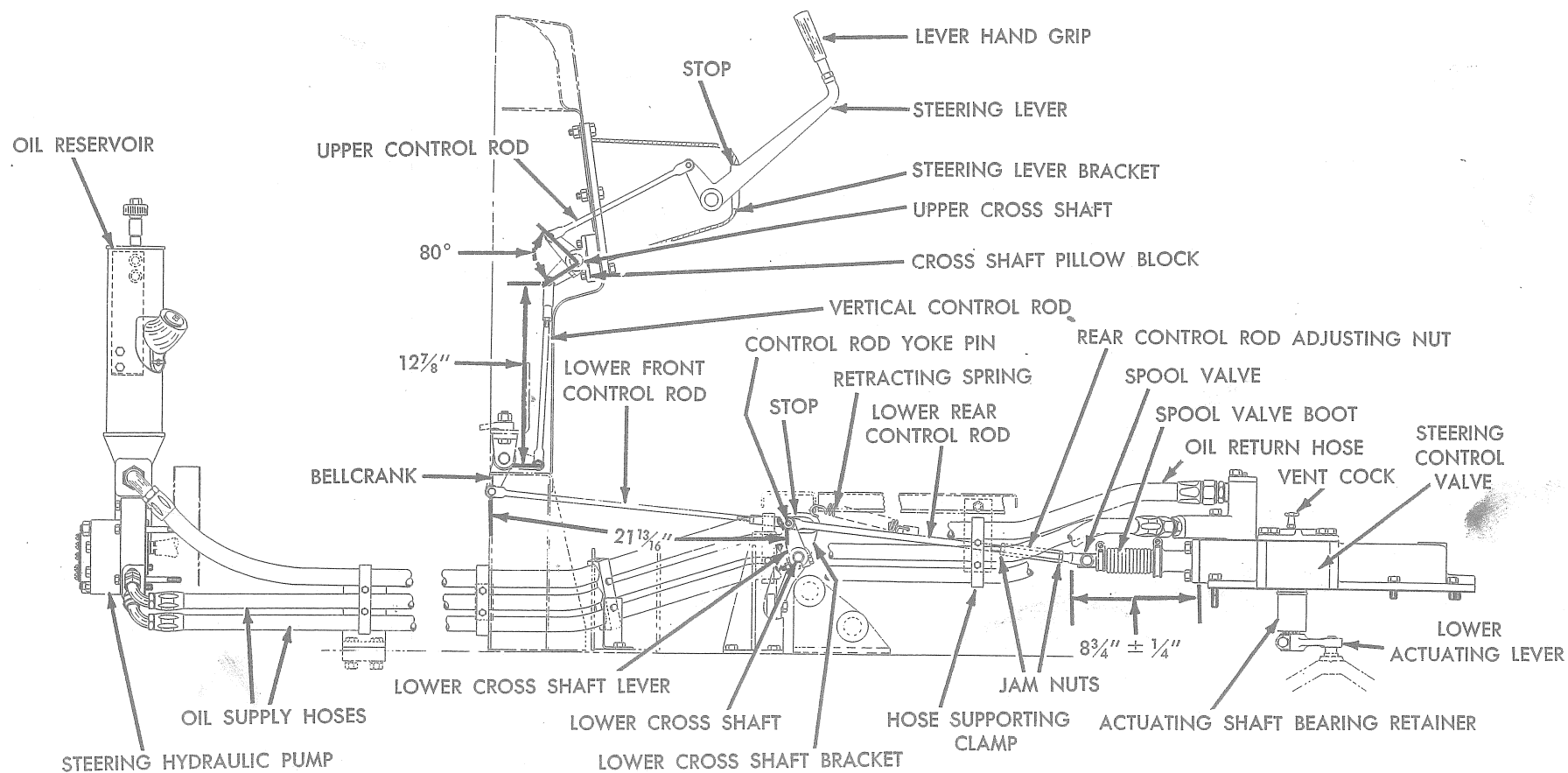


Fig. 1 — Steering Clutches and Bevel Gear Assembly





**Fig. 2 — Steering Clutch Controls — Tractors Without Torque Converter (Tractors Prior to Serial No. 4001 Shown — Tractors Serial No. 4001 and Above Similar)**



**Fig. 3 — Steering Clutch Controls — Tractors with Torque Converter (Tractors Serial No. 4001 and Above Shown — Tractors Prior to Serial No. 4001 Similar)**

The steering clutch control linkage is properly adjusted when the steering levers each have  $2\frac{3}{4}$ " of free travel, measured at the tops of the levers. As the clutch discs wear, this free travel decreases. When the free travel has decreased to  $1\frac{3}{4}$ ", an adjustment of the clutch control linkage is required. Free travel of each steering lever is necessary to assure proper clearance between the clutch throw-out sleeve and the clutch throwout plate and to assure full engagement of each clutch.

### C. Measuring and Adjusting Free Travel of Steering Levers

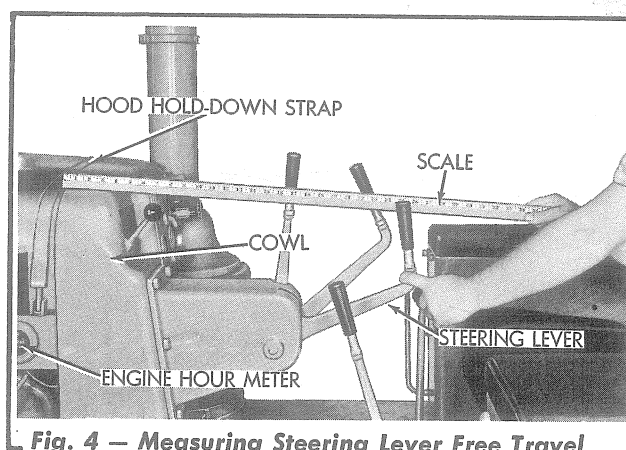
1. Before measuring or adjusting the free travel of the steering levers, the control linkage should be checked as follows:  
*NOTE: The following procedure applies to either steering lever.*

- a. Remove the center front floor plate, the right hand seat cushion, and the rear floor plate.
- b. Make certain that the two control levers, located on the upper cross shaft lever tube, are positioned  $80^\circ$  from each other as shown in Figs. 2 and 3.

- c. Remove the yoke pin connecting the lower front control rod to the lower cross shaft lever (Figs. 2 and 3), then raise the steering lever up against its stop in the steering lever bracket and block the steering lever in this position. Move the lower rear control rod forward until the lower rear control rod yoke pin is against the front end of the stop in the lever cross shaft bracket. With the steering lever and the lower rear control rod in this position, adjust the lower front control rod yoke until the yoke pin can be installed in the yoke and the lower cross shaft lever. Install the yoke pin and cotter pin, then tighten the jam nut. Remove the block from the steering lever and actuate the lever. When the lower front control rod is properly adjusted, the steering lever and the lower rear control rod yoke pin should strike their respective stops simultaneously (Figs. 2 and 3).

2. To measure the free travel of either steering lever, proceed as follows:

- a. With the engine stopped, place one end of a ruler or scale against the hood hold-down rear strap so that the ruler or scale projects horizontally past the top of the steering lever (Fig. 4).
- b. With the steering lever forward, measure the distance from the hood hold-down rear strap to the top of the lever.
- c. Pull the steering lever back until pressure is felt, which is the point where disengagement of the clutch begins. Note the distance between the hood hold-down rear strap and the top of the lever. The difference between the two measurements is the free travel of the lever. If this distance is less than  $1\frac{3}{4}$ " or more than  $2\frac{3}{4}$ ", adjustment of the steering control linkage is necessary.



3. To adjust the free travel of either steering lever, proceed as follows:

- a. Remove the right hand seat cushion and the rear floor plate.
- b. Loosen the front and rear jam nuts from the adjusting nut (Fig. 5), located at the rear end of the lower rear control rod. **CAUTION:** Hold the control rod yoke stationary to prevent the spool valve from turning and damaging the spool valve boot. Adjust the length of the lower rear control rod so that  $2\frac{3}{4}$ " of free travel is obtained at the top of

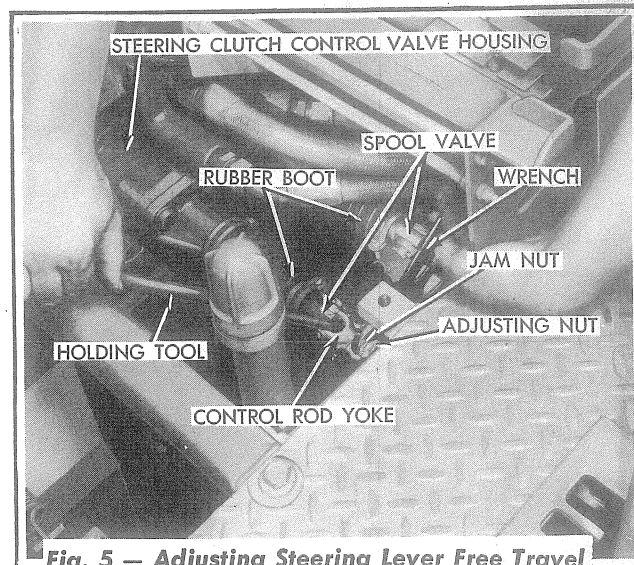
the steering lever. This adjustment is made by turning the adjusting nut to lengthen or shorten the control rod. As the adjusting nut has both right and left hand threads, it is not necessary to disconnect the control rod yoke from the end of the spool valve, when making an adjustment.

- c. Tighten the jam nuts when the correct adjustment has been made. Install the rear floor plate and the seat cushion.

## D. Washing Steering Clutches

If the steering clutches slip due to oil or grease on the clutch discs as a result of oil leaking into the steering clutch compartments, or from overlubricating the throwout bearings, wash the clutches with cleaning solvent in the following manner:

1. Install a drain plug in the drain hole in the bottom of each steering clutch compartment.
2. Remove the brake band adjuster access covers from the top of the housing and pour about two gallons of solvent into each clutch compartment; a suitable funnel or trough is needed to do this. Drive the tractor back and forth in a straight line for five minutes, leaving the steering clutches engaged. The oil on the exterior of the clutches and brakes will be washed off in this operation.
3. Drain the compartments and refill with the same amount of clean solvent, then drive the tractor back and forth for another five minutes, disengaging one clutch and then the other continually during this period. Disengaging the clutches allows the clutch discs to separate and the solvent will wash the oil from their friction surfaces.
4. Drain the compartments and allow the clutches to dry for a short time. Install the brake band adjuster access covers and gaskets. Operate the tractor with a light load in low gear until the clutches become thoroughly dry, otherwise they may slip due to the presence of solvent on the clutches.



**Fig. 5 — Adjusting Steering Lever Free Travel**

**IMPORTANT:** Lubricate the steering clutch throwout bearing (or bearings) with the specified pressure gun lubricant as the lubricant may have been washed out of the bearing (or bearings) during the washing process.

## E. Removal of Steering Clutches

**NOTE:** The following removal procedure applies to either steering clutch.

1. Remove the seat cushions. Remove the two steering clutch throwout bearing lubricating pipes, located at the right side of the tool box, from the lubricating hoses. Remove the jam nuts and lockwashers from the upper end of the lubricating hoses and disconnect the hoses from the tool box supporting bracket. Remove the seat frame and tool box. Remove the capscrew attaching the battery cable clips to the rear floor plate and remove the center and rear floor plates. **NOTE:** On tractors prior to Serial No. 1002, the steering clutch throwout bearings were lubricated by means of oiling wicks, therefore the lubricating pipes were not used.
2. Remove the fuel tank (refer to Section II, Topic 3, Paragraph B).
3. Remove the capscrews attaching the front and rear fuel tank supporting channels to the rear fenders and remove the supporting channels.

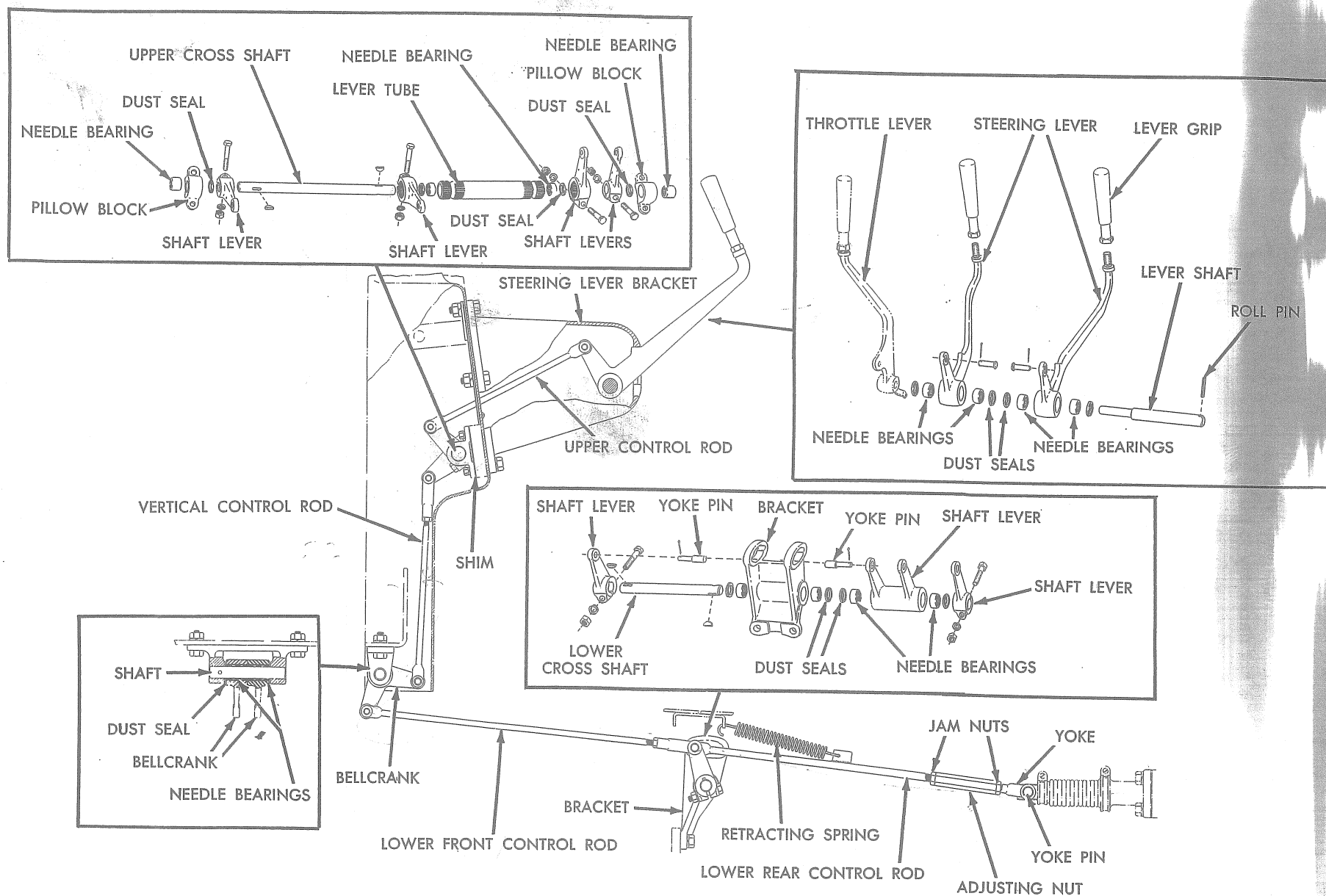


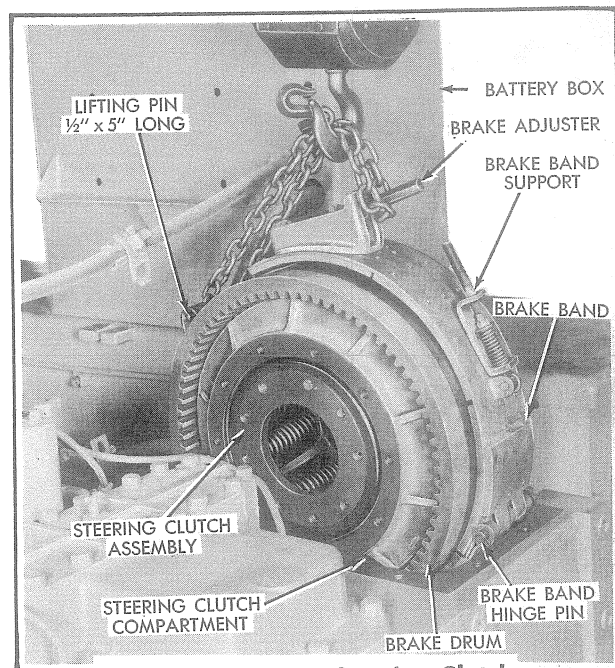
Fig. 6 — Steering Levers and Linkage Details

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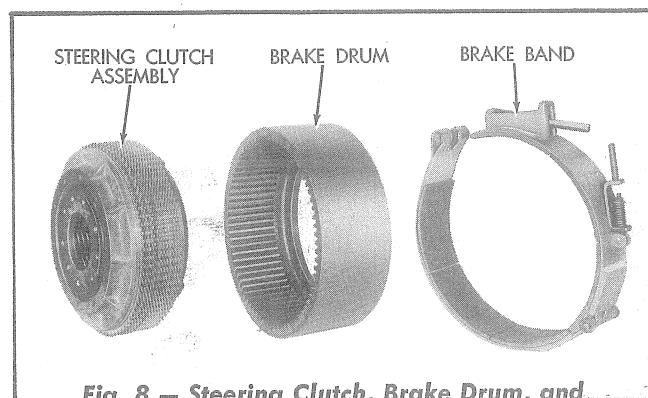
4. Remove the jam nut and the brake band support nut. Disconnect the brake pedal retracting spring from the clip on the rear rod. Remove the steering clutch compartment cover.
5. Turn the brake adjuster counterclockwise until it is loosened from the brake band adjusting fork. Remove the yoke pin connecting the rear rod to the top of the brake band lever.
6. Remove the pipe plug, located in the side of the steering clutch housing in line with the brake band end pin, and using a long  $\frac{3}{8}$ " NC capscrew inserted through the hole, turn it into the tapped hole in the end of the brake band end pin (refer to Fig. 6, Section XII). Pull the brake band end pin out and remove the brake band adjusting fork. Lift up on the brake band lever until the end pin, attaching the bottom section of the band to the lever, can be removed. Push the pin towards the bevel gear compartment and remove. Do not remove the brake band assembly at this time as it will be used to lift the steering clutch and brake drum assembly from the steering clutch compartment.
7. Remove the locking wires and capscrews attaching the steering clutch assembly to the steering clutch driving hub. Remove the locking wires and capscrews attaching the brake drum hub to the brake drum. This will necessitate turning the clutch assembly and brake drum which can be accomplished by using a jack under a track shoe grouser and moving the tractor.
8. Install a  $\frac{1}{2}$ " diameter pin approximately 5" long in the bottom section of the brake band and attach a chain to the brake band as shown in Fig. 7. Lift and remove the steering clutch and brake drum assembly from the steering clutch compartment.

## F. Disassembly of Steering Clutches

**NOTE:** The following disassembly procedure applies to either steering clutch.



**Fig. 7 — Removing Steering Clutch**



**Fig. 8 — Steering Clutch, Brake Drum, and Brake Band**

1. Remove the brake drum from the steering clutch assembly, using care to prevent damage to the clutch disc teeth.
2. Before disassembling the steering clutch assembly, center punch or mark the pressure plate, steering clutch hub, and throw-out plate so that they may be reassembled in the same relative position.
3. Remove the locking wires from the throwout plate capscrews used in holding the steering clutch assembly together. Compress the steering clutch pressure springs using special tools similar to the ones shown in Figs. 11 and 12 and remove the throwout plate capscrews. Slowly release the pressure from the hydraulic ram, allowing the assembly to separate until all tension is taken off of the steering clutch pressure springs.



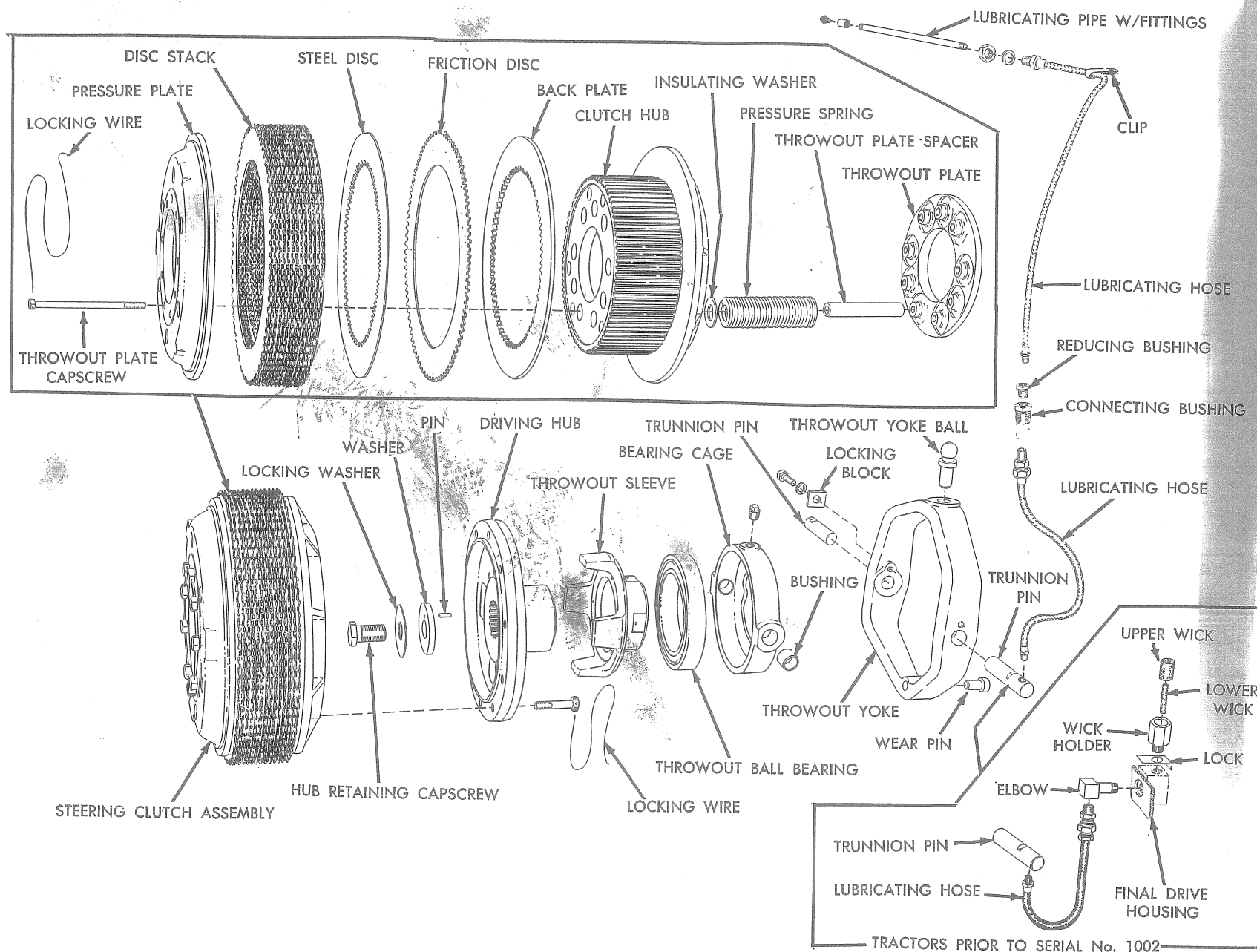
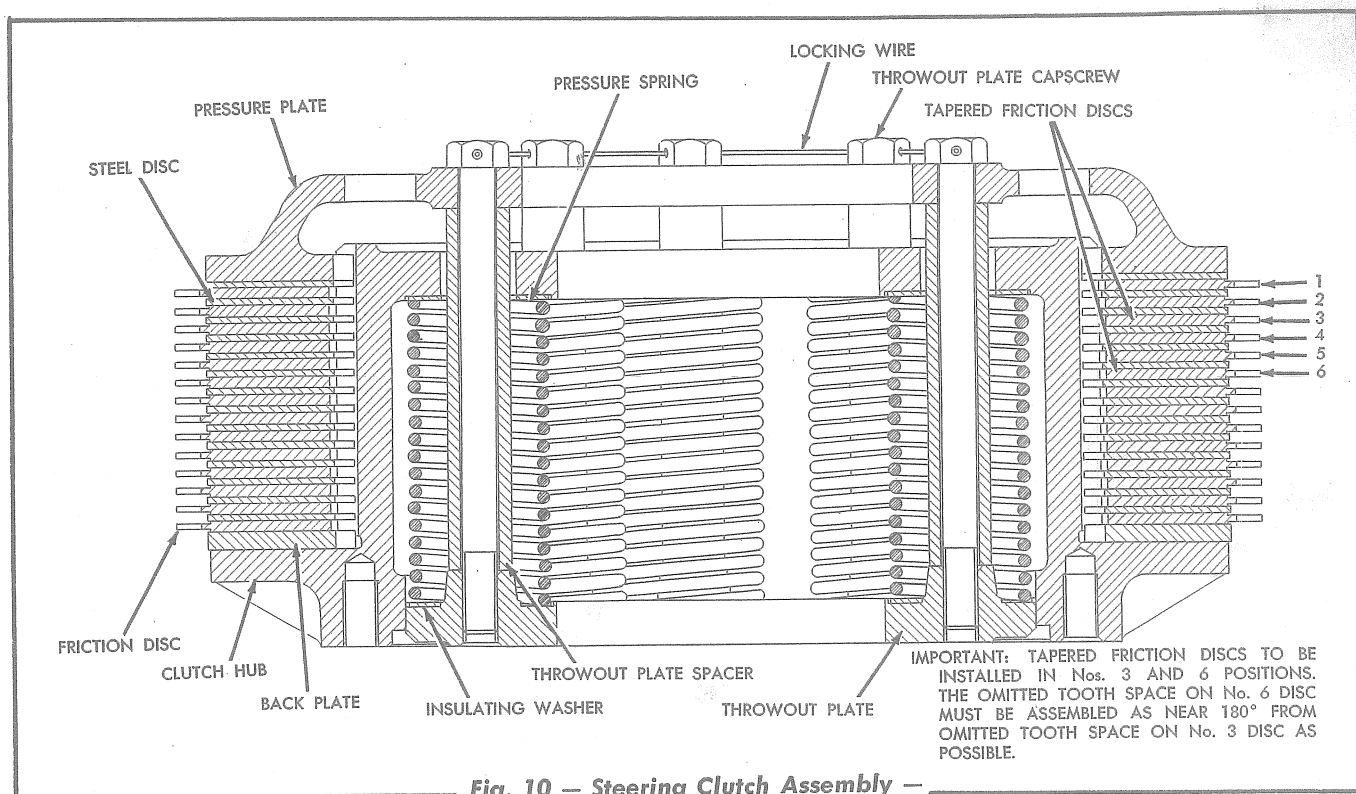
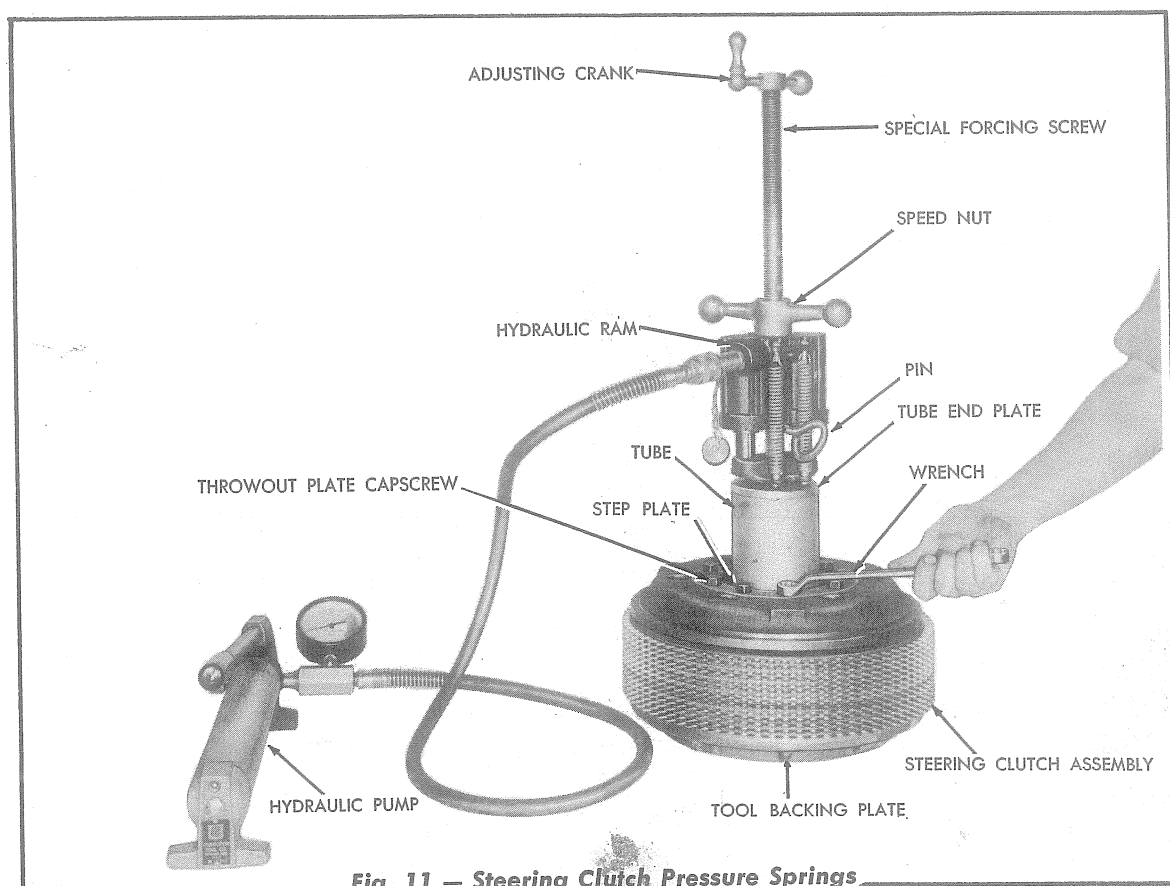


Fig. 9 — Steering Clutch and Throwout Yoke Details



**Fig. 10 — Steering Clutch Assembly — Sectional View**



**Fig. 11 — Steering Clutch Pressure Springs Compressed to Remove Throwout Plate Capscrews**

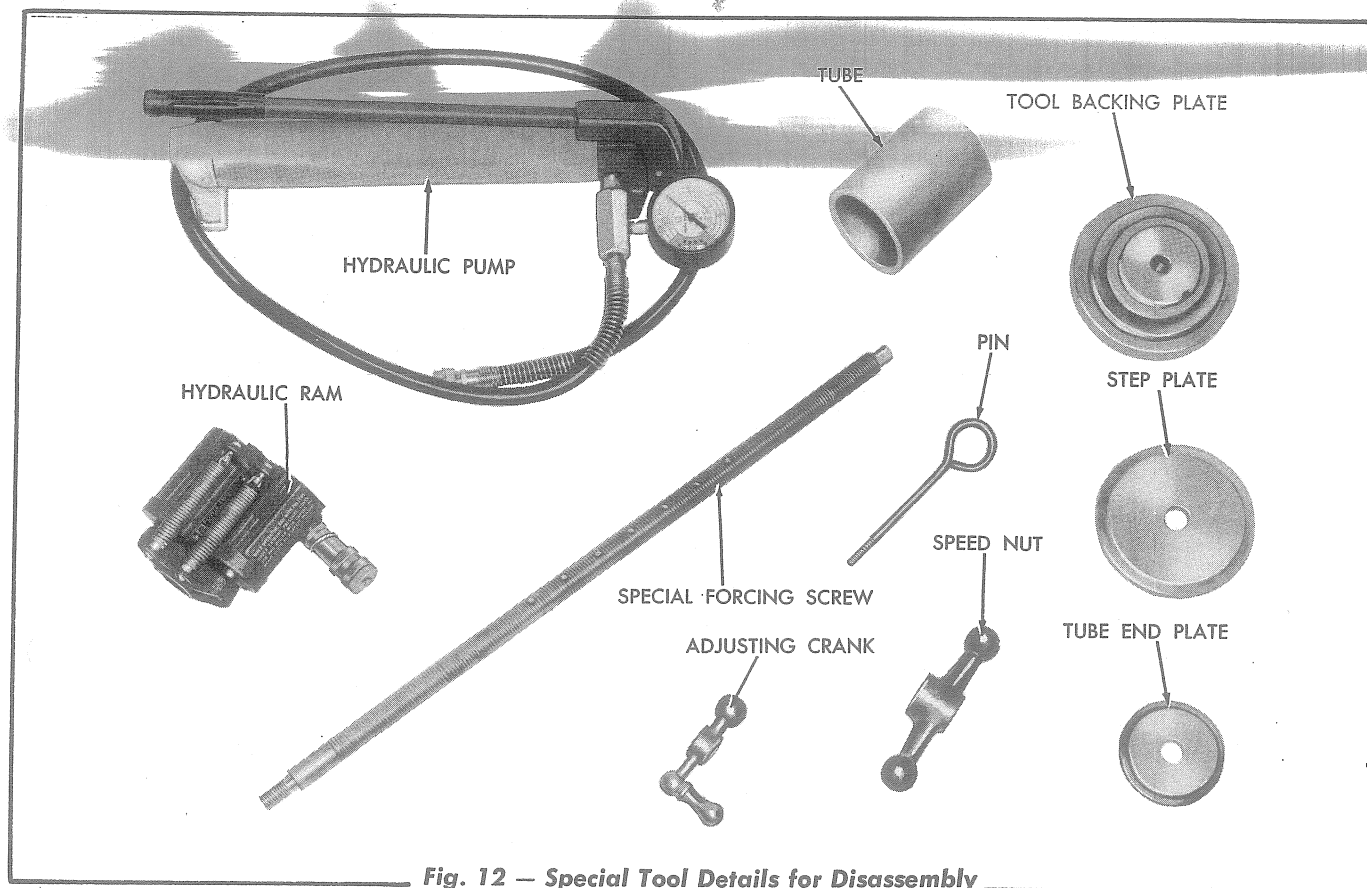


Fig. 12 — Special Tool Details for Disassembly and Assembly of Steering Clutch

4. Remove the pressure plate, steel and friction discs, and back plate from the clutch hub. Remove the clutch hub, insulating washers, pressure springs, and throwout plate spacers from the throwout plate.

## G. Inspection and Repair of Steering Clutch

When the steering clutch has been disassembled, inspect the following:

### 1. Steel Discs

The specified thickness for a new steel disc is .084" to .096". Inspect the discs for wear and scoring. The discs must be flat within .015".

### 2. Friction Discs

- a. **Flat Discs** (14 discs per clutch prior to tractor Serial No. 2700 and 12 discs per clutch effective with tractor Serial No. 2700) — The specified thickness for a new friction disc is .152" to .157". Inspect the discs for wear, condition of teeth, and con-

dition of friction material. If the thickness of the disc is less than .125", or if the friction material or teeth are in bad condition, a new disc must be installed.

- b. **Tapered Discs** (2 discs per clutch effective with tractor Serial No. 2700) — The specified thickness for a new disc when measured at the thickest part (at omitted tooth location) is .172" to .177" and when measured at the thinnest part (180° from the omitted tooth location) is .142" to .147". If the thickness of the disc is less than .145" at the thickest part and .115" at the thinnest part, or if the friction material or teeth are in bad condition, a new disc must be installed.

### 3. Pressure Springs

Each pressure spring, when new, exerts a pressure of 456 to 504 lbs., when compressed to  $4\frac{17}{64}$ ". If a spring does not check reasonably close to this tolerance, it is an indication that it has lost its tension and a new spring should be installed.

#### 4. Steering Clutch Hub

Inspect the steering clutch hub splines for wear as heavy grooving may cause binding with the teeth of the steel discs.

#### 5. Back Plate

The specified thickness for a new back plate is .245" to .255". Inspect the plate for wear and scoring. The plate must be straight and flat within .015".

#### H. Assembly of Steering Clutch

Effective with tractor Serial No. 2700, two tapered friction discs were used in each clutch assembly. The purpose of the tapered discs is to produce a wobble action of the discs when the clutch is disengaged which in turn accelerates disengagement and engagement of the clutch. It is recommended that two tapered friction discs be installed in each clutch when new clutch discs are installed in tractors prior to Serial No. 2700. When assembling a steering clutch, refer to Fig. 10 showing the component parts in their relative positions.

1. Place the clutch hub on a work bench, with the flanged side of the hub down. Install the clutch back plate in position on the hub.
2. Stack the discs (12 flat friction discs, 2 tapered friction discs, and 14 steel discs) alternately on the clutch hub, beginning with a flat friction disc next to the clutch back plate. **IMPORTANT:** When stacking the discs, be sure to install the two tapered friction discs in the Nos. 3 and 6 friction disc position (refer to Fig. 10) with the omitted tooth space on the No. 6 friction disc as near 180° from the omitted tooth space on the No. 3 friction disc as possible. Measure the stack height of the discs as shown in Fig. 13. If the distance from the top disc to the top of the clutch hub is more than  $\frac{29}{64}$ ", add another steel disc, or discs, as required to the top of the stack to obtain a measurement of  $\frac{29}{64}$  (+ or -  $\frac{1}{16}$ ) inch. **NOTE:** When assembling a clutch using new discs, 14 steel discs are usually required. After checking the clutch disc

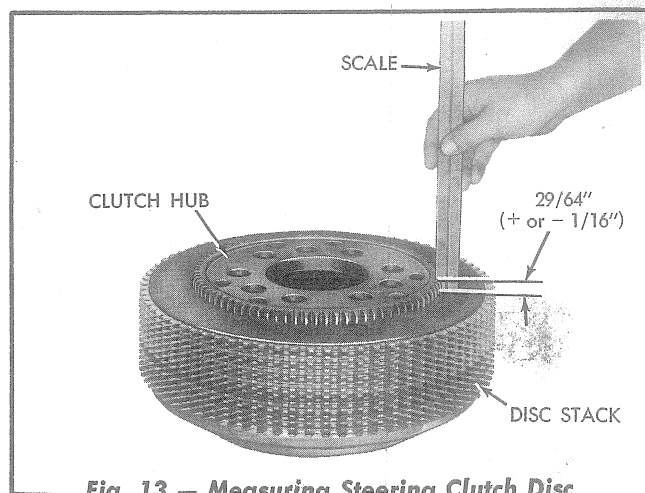


Fig. 13 — Measuring Steering Clutch Disc Stack Height

stack height, remove the discs and back plate from the clutch hub, keeping the discs in their proper positions.

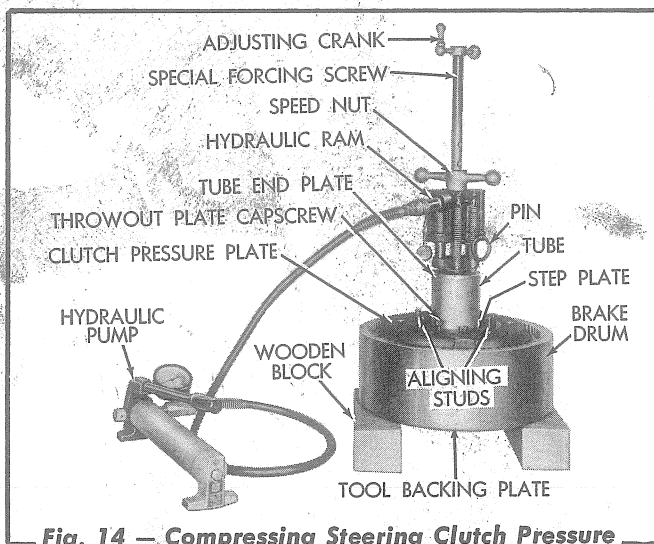
3. Place the special tool backing plate (shown in Figs. 11 and 12) on a work bench and place the clutch throwout plate, with the pressure spring boss side up, in position on the tool backing plate.
4. Place the brake drum, with the brake drum hub bolting side down, over the throwout plate. Keep the brake drum raised even with the throwout plate by using wooden blocks between the brake drum and the work bench.
5. Place one pressure spring over each pressure spring boss of the throwout plate and insert a throwout plate spacer into each spring.
6. Place an insulating washer on the top of each pressure spring.
7. Install the clutch hub in position over the pressure springs and insulating washers, making certain the locating punch marks on the clutch hub and throwout plate are aligned.
8. Install two aligning studs (Fig. 14) through two of the throwout plate spacers and screw the studs into the throwout plate.
9. Install the clutch back plate in position on the clutch hub.

10. Lubricate the teeth of the steering clutch hub and the outer circumference of the steering clutch throwout plate sparingly with a graphite base lubricant.

11. Install the clutch discs on the clutch hub in the positions as in Step 2 above, making certain that the tapered friction discs are in their proper position and that the omitted tooth spaces are as near to 180° apart as possible.

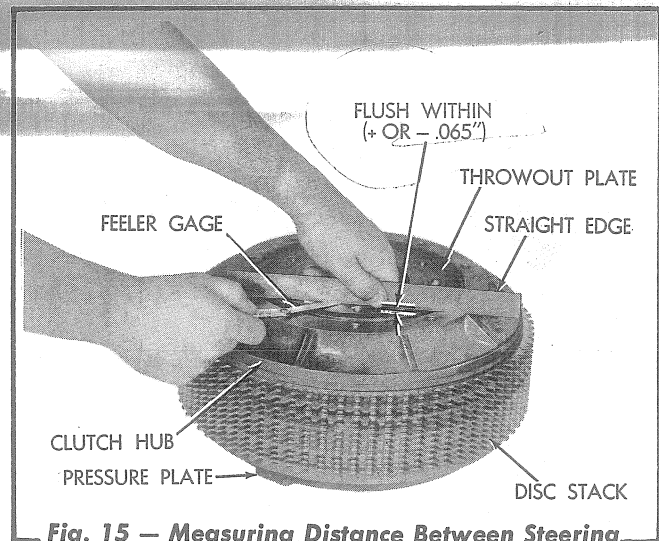
12. Place the clutch pressure plate in position, making certain the locating punch marks are aligned. Place the special tool step plate in position on the clutch hub, and place the tool compressing tube through the center of the pressure plate and down on the step plate (Fig. 14).

13. Insert the tool forcing screw through the clutch hub and turn the screw into the tool backing plate.



**Fig. 14 — Compressing Steering Clutch Pressure Springs to Install Throwout Plate Capscrews**

14. Install the tube end plate, hydraulic ram, and the speed nut (Fig. 14), and compress the pressure springs. Install seven throwout plate capscrews and tighten the capscrews evenly. **NOTE:** The drilled head, 1/2" NF x 6 1/2" throwout plate capscrews are special capscrews designed for this particular application. Standard 1/2" NF x 6 1/2" capscrews should never be substituted.



**Fig. 15 — Measuring Distance Between Steering Clutch Hub and Throwout Plate**

15. Remove the two aligning studs and install the two remaining throwout plate cap-screws. Tighten all capscrews evenly to a torque of 90 lbs. ft.

16. Release the pressure from the hydraulic ram and remove the special tools.

17. Remove the steering clutch assembly from the brake drum.

18. Using a suitable straight edge and feeler gage, measure the distance between the machined end of the clutch hub and the machined face of the throwout plate as shown in Fig. 15; these surfaces **MUST** be flush within + or - .065". If the throwout plate extends out from the face of the hub more than .065", add steel disc(s) as required to obtain the specified dimension above, placing the disc(s) next to the pressure plate. If the throwout plate is more than .065" below the face of the clutch hub, remove steel disc(s) as required from next to the pressure plate. **NOTE:** At least one steel disc must be used next to the pressure plate. If only one steel disc remains next to the pressure plate and the clutch throw-out plate is still more than .065" below the face of the clutch hub, remove one steel disc from either the No. 3 or 4 steel disc positions from the pressure plate side of the clutch.



19. Install the locking wires in the clutch throwout plate capscrews, and wire in groups of three.
20. Install the steering clutch in position in the brake drum, using care to prevent damage to the teeth of the friction discs.

### I. Installation of Steering Clutches

The installation of either steering clutch may be

made by a direct reversal of the removal procedure outlined in Paragraph E in this Topic.

Tighten the steering clutch driving hub and brake drum hub attaching capscrews (90 to 100 lbs. ft. torque) and secure with locking wires. Before installing the fuel tank, refer to Topic 4, Paragraph B in this Section and adjust the hydraulic control valve linkage.

Refer to Section XII, Topic 2, Paragraph A and adjust the steering brakes.

## 3. STEERING CLUTCH THROWOUT BEARING ASSEMBLIES

### A. Description

Each steering clutch throwout bearing assembly consists of the following parts: throwout ball bearing, throwout bearing cage, throwout sleeve, throwout yoke assembly, and a throwout bearing lubricating hose assembly. On tractors prior to Serial No. 1002, both steering clutch throwout ball bearings and the throwout sleeves are lubricated from the bevel gear compartment by means of a lubricating wick assembly. On tractors Serial No. 1002 and above, each steering clutch throwout ball bearing is pressure lubricated by means of a grease tube and fitting located beneath the operator's seat. The throwout ball bearing is a press fit in the throwout bearing cage and on the hub of the throwout sleeve. The assembly of the throwout sleeve and throwout ball bearing is carried by the steering clutch driving hub. The bore in the throwout sleeve is machined to provide a sliding fit of the throwout sleeve on the driving hub. The clutch throwout yoke is attached to the throwout bearing cage with two trunnion pins.

### B. Removal of Steering Clutch Throwout Bearing Assemblies

The steering clutch throwout bearing assemblies should be removed and the parts inspected whenever the steering clutches are removed. *NOTE: The following removal procedure applies to either throwout bearing assembly. Refer to Fig. 9 showing the components in their relative positions.*

1. Remove the steering clutch (refer to Topic 2, Paragraph E, in this Section).

2. Disconnect the upper end of the lower lubricating hose for the clutch throwout ball bearing.
3. Unlock the clutch driving hub retaining capscrew. Loosen and turn the hub retaining capscrew out approximately  $\frac{1}{8}$ "; do not remove it at this time. Using puller tools similar to the ones shown in Fig. 16, pull the steering clutch driving hub loose from the bevel gear shaft. Remove the puller tools from the steering clutch driving hub. Remove the hub retaining capscrew, locking washer, and the hub retaining washer.
4. Remove the steering clutch driving hub, throwout sleeve, throwout sleeve ball bearing, throwout bearing cage, and throwout yoke as an assembly.

### C. Disassembly of Steering Clutch Throwout Bearing Assemblies

1. Remove the steering clutch driving hub from the throwout sleeve.
2. Remove the lubricating hose from the trunnion pin.
3. Remove the capscrews, lockwashers, locking blocks, and the throwout yoke trunnion pins and remove the throwout yoke.
4. Place the throwout bearing cage assembly in a press and remove the throwout sleeve and throwout ball bearing from the bearing cage.



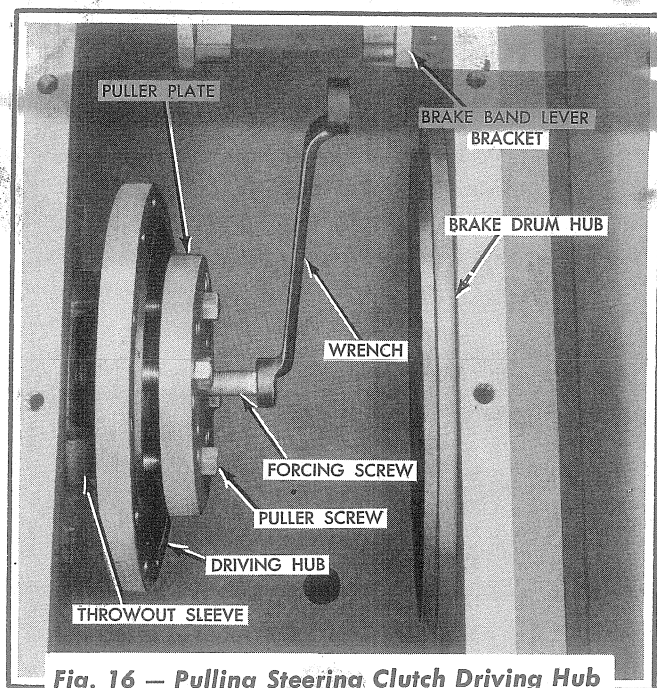


Fig. 16 — Pulling Steering Clutch Driving Hub

#### D. Inspection and Repair of Steering Clutch Throwout Bearing Assemblies

1. Check the steering clutch throwout ball bearing for wear, indicated by looseness.
2. Check the components for wear and the lubricating hose for leakage; replace the necessary parts.
3. On tractors prior to Serial No. 1002, two oiling wicks and holder assemblies, located in the bevel gear compartment, are provided to feed oil through the throwout bearing lubricating hoses to the steering clutch throwout ball bearings and the throwout sleeves.

A  $\frac{25}{32}$ " diameter oiling wick is inserted in the upper end of the wick holder and about  $\frac{1}{2}$  of this wick is exposed above the wick holder. This wick accumulates oil from the bevel gear compartment and feeds oil to the smaller oiling wick, located in the lower end of the wick holder. When repairs are being made to the tractor, it is recommended that the condition of the oiling wicks be checked and replaced if they have become hard. Replace the oiling wicks as follows:

- a. Unlock and remove the oiling wick holder. Remove the oiling wicks from the holder.
- b. Soak new wicks in light oil until they are completely saturated; heat the oil if necessary.
- c. Work the lower wick into the wick holder until  $\frac{5}{16}$ " of the wick protrudes from the lower end of the holder. **CAUTION:** If the lower wick is inserted into the holder by twisting, be sure to untwist after the wick has been inserted.
- d. Start the upper wick into the wick holder and push the wick down until the lower end bottoms in the wick holder.
- e. Install the wick holder assembly, with wick holder lock, in position in the bevel gear compartment. Tighten the holder and lock in position with the wick holder lock.

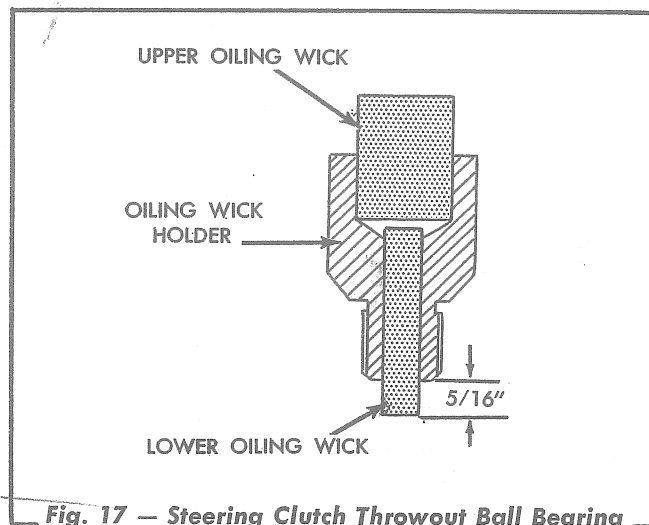


Fig. 17 — Steering Clutch Throwout Ball Bearing Oiling Wicks and Wick Holder

#### E. Assembly of Steering Clutch Throwout Bearing Assemblies

The throwout ball bearing and throwout sleeve assembly may be assembled by a direct reversal of the disassembly procedure. However, the throwout ball bearing and the hub portion of the clutch driving hub, where the throwout sleeve fits, must be lubricated before assembly.

## F. Installation of Steering Clutch Throwout Bearing Assemblies

Install the steering clutch throwout yoke, throwout bearing cage, throwout ball bearing, throwout sleeve, and driving hub as an assembly on the bevel gear shaft.

When installing, insert the throwout yoke ball (in the top of the throwout yoke) into position in the lower actuating lever assembly. Install the hub retaining washer, locking washer, and the hub retaining capscrew. Tighten the hub retaining capscrew to a torque of 300 lbs. ft. Lock the capscrew in position with the locking washer. Connect the upper end of the throwout bearing lubricating hose.

## 4. STEERING CLUTCH HYDRAULIC CONTROL VALVE

### A. Description

The steering clutch hydraulic control valve assembly is mounted on top of the steering clutch and final drive housing. The control valve mechanism is enclosed in a control valve housing and consists of a control piston, connecting rod, upper and lower actuating levers, and an actuating lever shaft for each steering clutch. One spool valve for each clutch is mounted in each spool valve bracket, which is secured to the housing with capscrews. The spool valve oil seals are protected from dirt by a rubber boot which is attached to each spool valve and spool valve bracket.

A steering hydraulic pump, driven by the engine accessory drive upper shaft, discharges oil to the control valve housing through passages to the front of the control piston bore. The oil then passes through an opening in the center of the control piston and into the main body of the control valve housing where it is returned to the pump inlet through an oil return hose. When the spool valve is actuated by the steering lever, the spool valve moves back and closes the hole in the control piston.

The free flow of oil is then cut off and the oil under pressure moves the piston back, thus disengaging the steering clutch through the linkage attached to the control piston. It is necessary that the spool valve follow the control piston back to fully disengage the steering clutch; this is accomplished manually by operating the steering levers.

The clutch actuating lever shafts are mounted on needle bearings. The needle bearings and the lip type oil seals are mounted in bearing retainers installed in the control valve housing and secured with capscrews and lockwashers. A gasket is used between the flange on the bearing retainer and the

control valve housing and a sealing ring is used in the groove in the outer diameter of the retainer to prevent oil from leaking into the steering clutch compartment.

### B. Adjustment of Steering Clutch Hydraulic Control Valve Linkage

In order to assure sufficient travel of each steering clutch throwout sleeve for proper disengagement of each steering clutch, the front end of each spool valve must be  $8\frac{3}{4}"$  (+ or  $-\frac{1}{4}"$ ) from the front machined surface of the hydraulic control mechanism housing when the spool valve is pushed back as far as it will go (with engine stopped) as shown in Fig. 19.

The lower actuating lever of the hydraulic control mechanism must be properly positioned on the serrations of the actuating lever shaft (Figs. 2 and 3) to obtain the  $8\frac{3}{4}"$  (+ or  $-\frac{1}{4}"$ ) dimension described above when any of the following operations have been performed:

1. A new or rebuilt steering clutch is installed.
2. The hydraulic control mechanism housing is removed and reinstalled, or any of its components are removed or replaced.
3. A steering clutch throwout yoke and components are removed or replaced.

### 1. Measuring Stand-Out of Spool Valve

**NOTE:** The engine must be stopped when checking the stand-out of the spool valve.

- a. Remove the steering clutch compartment cover from the side on which the linkage is to be adjusted.

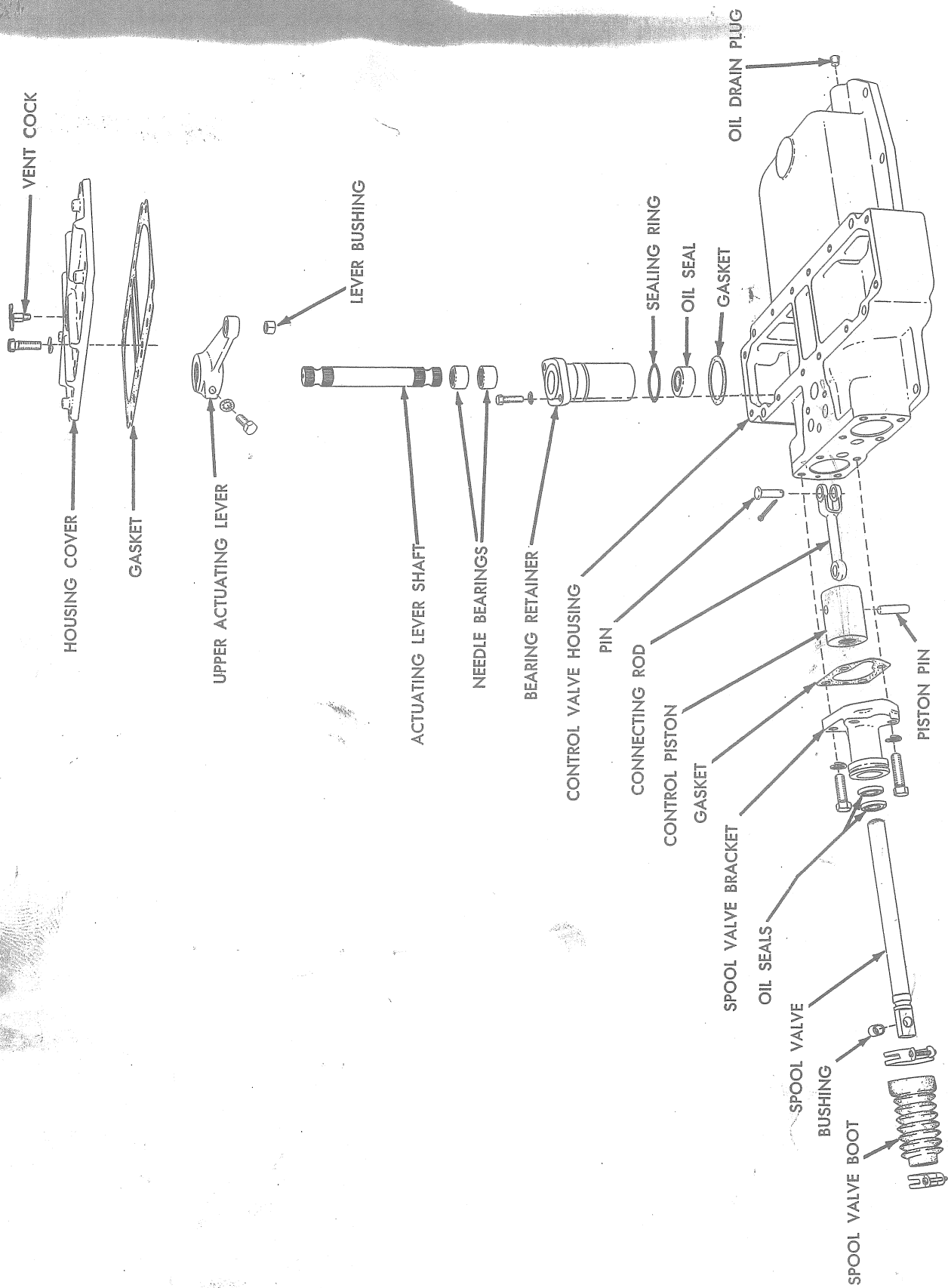
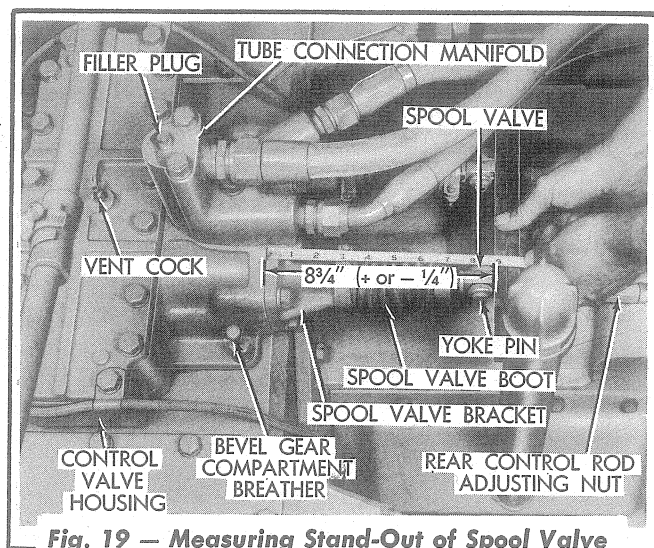


Fig. 18 — Steering Clutch Hydraulic Control Valve Details



**Fig. 19 — Measuring Stand-Out of Spool Valve**

- b. Remove the yoke pin connecting the lower rear control rod to the spool valve (Fig. 19). Push the spool valve back by hand as far as it will go, then looking into the steering clutch compartment, check and make certain that the clutch throwout sleeve is contacting the clutch throwout plate. With the spool valve pushed back by hand as far as it will go, measure the distance from the front surface of the spool valve to the front machined surface of the hydraulic control valve housing as shown in Fig. 19. This measurement must be  $8\frac{3}{4}" (+ \text{ or } - \frac{1}{4}')$ .

## 2. Positioning Lower Actuating Lever on Shaft to Obtain Proper Spool Valve Stand-Out (Fuel Tank Removed)

- a. Remove the drain plug from the hydraulic control valve housing and drain the oil.
- b. Remove the capscrews and lockwashers attaching the housing cover to the control valve housing and remove the cover and gasket.
- c. Remove the yoke pin connecting the lower rear control rod to the spool valve and measure the stand-out of the spool valve as described in Step 1 above.
- d. Refer to Fig. 18 and remove the connecting rod pin attaching the connecting rod to the upper actuating lever. Remove the bolt, clamping the lower actuating lever to the actuating lever shaft.

- e. Raise the upper actuating lever and shaft just high enough to free the lower actuating lever from the shaft. Move the upper end of the clutch throwout yoke toward the clutch as far as it will go so that the clutch throwout sleeve is contacting the clutch throwout plate, then install the lower actuating lever on the actuating lever shaft. Install the connecting rod pin to attach the upper actuating lever to the connecting rod and measure the stand-out of the spool valve as described in Step 1 above. This measurement **MUST** be  $8\frac{3}{4}" (+ \text{ or } - \frac{1}{4}')$ . If the measurement does not fall within the specified limits, it will be necessary to repeat the above procedure and reposition the lower actuating lever on the actuating lever shaft until the specified measurement is obtained. Install the bolt, clamping the lower actuating lever to the actuating lever shaft.
- f. Install the cotter pin in the connecting rod pin. Install the yoke pin and cotter pin to connect the lower rear control rod to the spool valve. Install the control valve housing cover and gasket and the oil drain plug.
- g. Adjust for proper free travel of the steering lever(s), refer to Topic 2, Paragraph C, in this Section.
- h. Install the steering clutch compartment cover, inserting the brake band support through the hole in the cover. With the brake pedal free (pedal all the way back), turn the brake band support nut down on the support until the nut contacts the seat in the cover, then turn the nut an additional  $\frac{1}{4}$  turn and lock the nut in position with the jam nut; this centers the brake band on the brake drum.
- i. Install the fuel tank. Fill the hydraulic system with the specified oil as described in the following paragraph.

## C. Service of Hydraulic Control Valve

After each 1000 hours of operation, the oil in the hydraulic system should be drained and the system



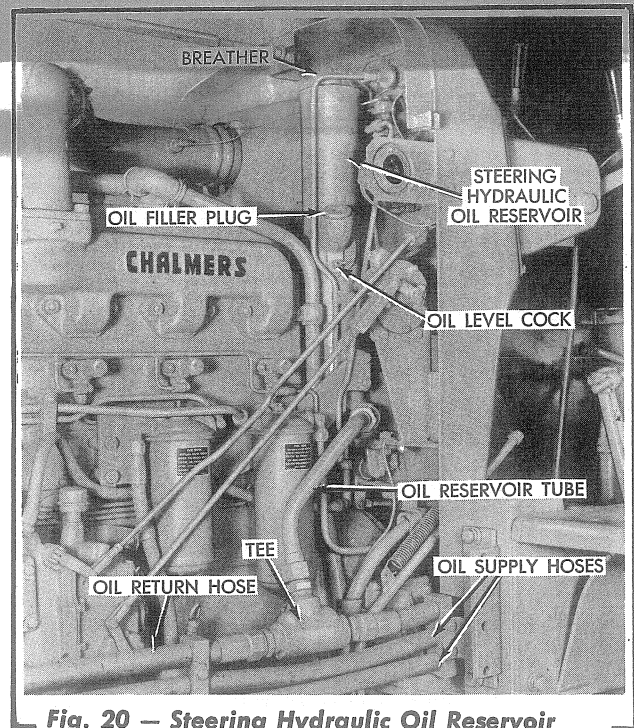
refilled. Use a good quality engine oil of the same viscosity as is used in the engine. Diesel engine oil may be used provided it does not foam. The viscosity of the oil is to be determined by the prevailing atmospheric temperature (refer to Section I, Topic 3).

Drain the hydraulic system by removing the drain plug located at the rear of the control valve housing. Refill with new oil as follows:

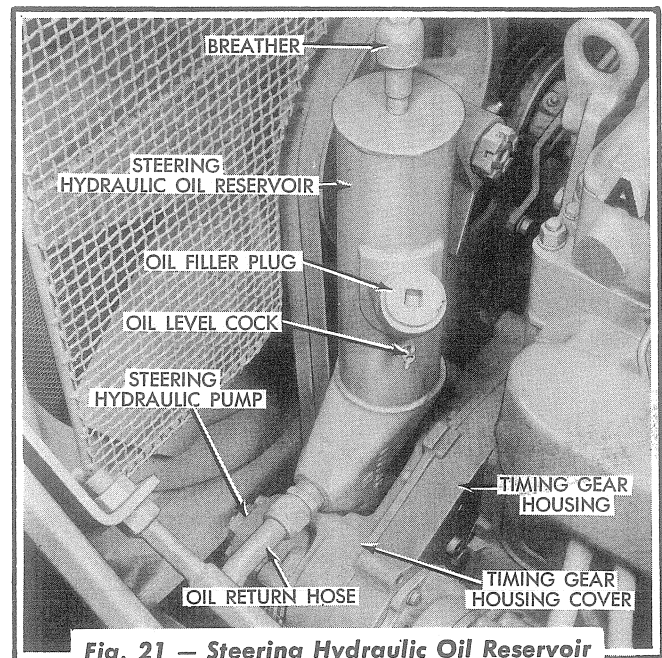
1. Install the oil drain plug and open the control valve housing air vent cock (Fig. 19).
2. Remove the oil filler plug and gasket from the hydraulic oil reservoir (Fig. 20 or 21) and open the oil level cock located just below the filler neck. Fill the oil reservoir with the specified oil until oil, free from bubbles, flows from the control valve housing air vent cock (Fig. 19), then close the air vent cock. Continue to fill the oil reservoir until oil flows from the oil level cock. Close the oil level cock and install the filler plug and gasket. *NOTE: On tractors not equipped with an oil level cock; fill the reservoir until oil is visible in the filler neck.*
3. Operate the engine at low idle speed and open the air vent cock on the control valve housing to allow any air trapped in the system to escape. Open the vent cock intermittently until all the air has been vented from the hydraulic system, then close the air vent cock.
4. Stop the engine and add oil to the oil reservoir as necessary to obtain the proper level.
5. Repeat Steps 3 and 4 until further operation does not lower the oil level in the oil reservoir.

#### D. Removal of Hydraulic Control Valve

1. Remove the seat cushions and seat back cushions. Remove the seat adjusting frame. Remove the rear floor plate.
2. Remove the fuel tank, refer to Section II, Topic 3, Paragraph B.



**Fig. 20 — Steering Hydraulic Oil Reservoir Location (Tractors Prior to Serial No. 4001)**



**Fig. 21 — Steering Hydraulic Oil Reservoir Location (Tractors Serial No. 4001 and Above)**

3. Remove the drain plug in the hydraulic control valve housing and drain the oil.
4. Remove the capscrews attaching the steering hydraulic tube connection manifold (Fig. 19) to the control valve housing. Remove the yoke pins connecting the lower rear control rods to the spool valves. Remove the capscrews attaching the control valve housing to the steering clutch and

final drive housing. **NOTE:** *Four of the attaching capscrews extend through the housing cover and into the steering clutch housing and are located at the side of each steering clutch actuating lever shaft.*

5. Remove the steering clutch compartment covers. Remove the two bolts (one in each steering clutch compartment) clamping the lower steering clutch actuating levers to the actuating lever shafts.
6. Raise the control valve housing and free the lower actuating levers from the shafts. Remove the control valve housing.

### **E. Disassembly of Hydraulic Control Valve**

1. Place the control valve housing on a clean work bench and use suitable blocking under the control valve housing so that the lower ends of the actuating lever shafts will clear the bench.
2. Remove the remaining capscrews attaching the housing cover to the control valve housing, then remove the cover and gasket.
3. Loosen the hose clamps (two on each spool valve) clamping the boots to the spool valves and the spool valve brackets, then remove the spool valves and the valve boots.
4. Remove the capscrews attaching the spool valve brackets to the control valve housing, then remove the two spool valve brackets and gaskets. If the spool valve seals are to be replaced, drive the seals out of the spool valve bracket towards the front. The spool valve brackets are counterbored deep enough to accommodate two lip type oil seals. One seal is used as a dirt seal and the other as an oil seal.
5. Remove the cotter pins from the connecting rod pins located inside the control valve housing and remove the connecting rod pins. Remove the control pistons and the connecting rods by pushing them out toward the front of the control valve housing. Remove the connecting rod from the

control piston by driving the piston pin out of the connecting rod. **IMPORTANT:** *Protect the surface of the piston while driving the piston pin out.*

6. Remove the upper actuating levers and the actuating lever shafts by raising them up and out of the control valve housing. Place the upper control lever in a vise, remove the clamping capscrew used to clamp the upper actuating lever to the shaft, then remove the shaft from the actuating lever.
7. To remove the actuating lever shaft bearing retainers, remove the bearing retainer sealing ring from the bearing retainer and remove the capscrews and lockwashers securing the bearing retainer to the control valve housing. The bearing retainer, gaskets, bearing, and the seals may now be removed by pushing them up through the control valve housing.
8. If the actuating lever shaft seals and needle bearings are to be replaced, use a suitable punch and drive the lower needle bearing and the seal out of the retainer towards the lower end of the retainer. Drive the upper needle bearing out of the retainer towards the top.

### **F. Inspection and Repair of Hydraulic Control Valve**

1. Clean all parts thoroughly in clean solvent or fuel oil.
2. Inspect the spool valves, control pistons, the bores for the pistons, and the bores for the spool valves. If the parts show excessive wear or scoring, replace the necessary parts.

### **G. Assembly of Hydraulic Control Valve**

Make certain that the control valve housing is thoroughly clean. Place the housing on a clean work bench and use suitable blocking under the housing so that the lower ends of the actuating shafts will clear the bench when they are installed.

1. If the needle bearings and the seals were



- removed from the actuating lever shaft bearing retainers, lubricate and start one of the needle bearings into the bore at the top end of the retainer (flange end). Press the bearing into the bore to a depth of  $\frac{1}{4}$ ", measured from the top surface of the retainer to the top surface of the bearing. Turn the retainer over, lubricate and start one of the needle bearings into the bore from the lower end (end with counterbore for seal assembly). Press the bearing into the bore until the face of the bearing is even with the bottom of the counterbore of the bearing retainer. Press a new double lip oil seal into the counterbore at the lower end of the retainer, with the sealing lips of the seal directed toward the bearing.
2. Using a new bearing retainer gasket under the flange of each bearing retainer, install each bearing retainer into position from the top side of the control valve housing and secure with capscrews and lockwashers. Install the seal ring in the groove in the outer diameter of the retainer.
  3. Install the upper actuating levers on the actuating lever shafts. Install the clamping capscrews and lockwashers and tighten securely. *NOTE: Install the actuating levers on the shafts so that the heads of the clamping capscrews are toward the rear of the control valve housing when installed.*
  4. Lubricate the actuating lever shafts and the oil seals. Insert the actuating lever shafts into position from the top side of the control valve housing. Use care and do not damage the oil seals when installing the shafts.
  5. Place the connecting rod in position in the control piston and drive the piston pin into place to connect the piston and connecting rod. Protect the surface of the piston while installing the piston pin. The piston pin should be centered in the connecting rod, this can be determined by moving the connecting rod over against each piston boss and checking each end of the pin to make certain it does not protrude out past the piston.
  6. Lubricate the control pistons, then install them into position from the front end of the control valve housing. Place the connecting rod yokes in position on the upper actuating levers and install the connecting pins. Do not install the cotter pins at this time.
  7. Install new seals in the spool valve brackets, lubricate the seals and install the first seal in each bracket with the sealing lip of the seal directed toward the control valve housing. Install the second seal in each bracket with the sealing lip of the seal directed away from the control valve housing. Coat new spool valve bracket gaskets with gasket cement and place the gaskets in position on the spool valve brackets. Install the spool valve brackets in position on the control housing, then install the attaching capscrews and lockwashers and tighten securely.
  8. Place the hose clamps on the small end of the spool valve boots and install the boots in position on the spool valves, with the vent hole in the boots down. Tighten the clamps securely.
  9. Place the hose clamps on the large end of the boots. Lubricate the spool valves, then install them in position in the spool valve brackets, being careful not to damage the oil seals. Push the large ends of the boots into position on the spool valve brackets and tighten the clamps securely.

## H. Installation of Hydraulic Control Valve

1. Inspect the gasket, used between the bottom of the control valve housing and the top of the steering clutch and final drive housing, and replace if necessary. Coat the gasket with gasket cement, then install the control valve housing and gasket on the steering clutch and final drive housing and tighten the attaching capscrews securely. *NOTE: Tractors Serial No. 2727 and above have a drilled capscrew located at the right front side of the control valve housing, for installation of the bevel gear compartment breather. This capscrew must be tightened to a torque of 50 to 60 lbs. ft. (Fig. 19).*

2. Use new gaskets coated with gasket cement and secure the steering hydraulic tube connection manifold to the control valve housing with the attaching capscrews and lock-washers. Tighten the capscrews securely.
3. Remove the two connecting rod pins located in the control housing. Place each lower steering clutch actuating lever in position on the ball in the upper end of each clutch throwout yoke. *NOTE: When installing a lower actuating lever, make certain that the chamfered edge around the hole for the actuating shaft is up.*
4. Raise the actuating shafts only far enough to start the shafts into the lower actuating levers. Install the clamping bolt in each lower lever and hold each lever up, when tightening, so that the lower end of the shaft is flush with the bottom of the lever.
5. The control valve linkage must now be adjusted in order to assure proper disengagement of the steering clutches. Refer to Paragraph B in this Topic and adjust for the proper stand-out of the spool valves.
6. Fill the hydraulic system with the specified oil as described in Paragraph C in this Topic.

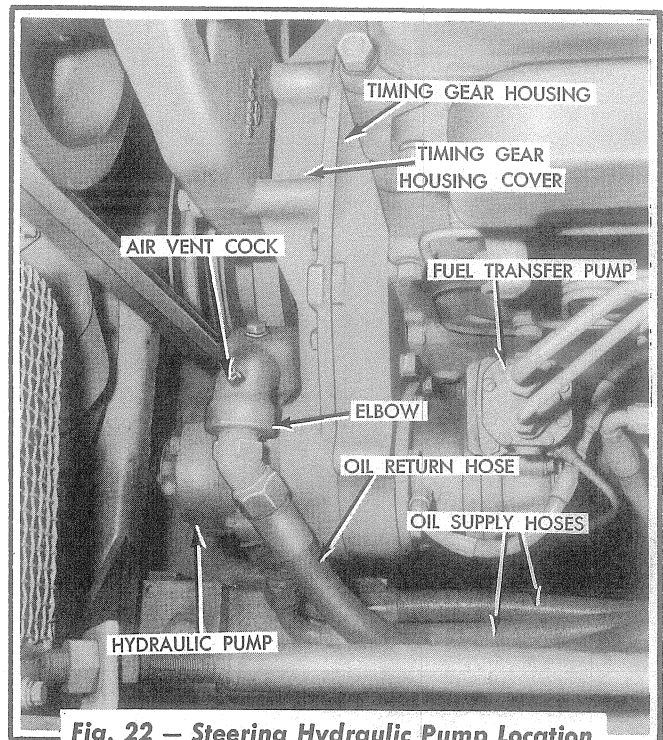
## 5. STEERING HYDRAULIC PUMP

### A. Description

The tractor is equipped with a "ROPER" gear type, hydraulic pump. The hydraulic pump assembly is attached to the engine timing gear housing cover and is driven by the accessory drive upper shaft through a driving shaft coupling. The pump assembly consists of two sets of pump gears separated by a spacing plate. Oil is supplied to both sets of pump gears from the oil return hose through one inlet passage. The oil is discharged from the pump gears through two separate outlets which are connected to the hydraulic steering control valve housing by a tube connection manifold and two oil supply hoses.

When operating the tractor with the steering clutches in the engaged position, the oil from the pump supply hoses flows through the passages in the tube connection manifold, control valve housing, and the spool valve brackets to the front of the right and left control piston bores. The oil then passes through the valve port in the center of the control pistons and to the main body of the control valve housing. The oil is then returned through the oil return hose back to the hydraulic pump.

Steering of the tractor is accomplished "hydraulically" by operating the steering levers. When either of the steering levers is pulled back, the lever linkage moves the corresponding spool valve back in the control valve housing, thus closing the valve port in the control piston. The oil flow from the



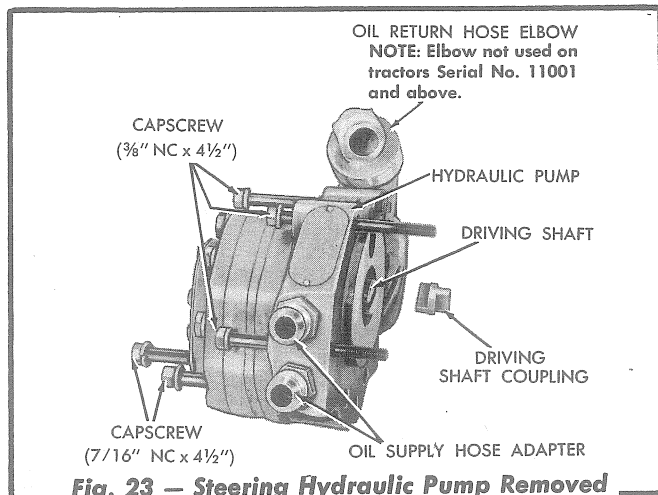
**Fig. 22 — Steering Hydraulic Pump Location**  
(Tractors Prior to Serial No. 4001 Shown —  
Tractors Serial No. 4001 and Above Similar)

pump then moves the piston back and actuates the clutch throwout yoke assembly to disengage that steering clutch. The steering hydraulic pump consists of two sets of pump gears; one set of pump gears actuates the right control piston, and the other set of pump gears actuates the left control piston.

The steering lever linkage, when properly adjusted, controls the travel of the spool valve, thus releasing

the hydraulic pressure through the valve port in the control piston at the end of the spool valve travel.

The hydraulic system is provided with a breather, mounted at the top of the steering hydraulic oil reservoir.



**Fig. 23 — Steering Hydraulic Pump Removed from Engine**

## B. Removal of Steering Hydraulic Pump

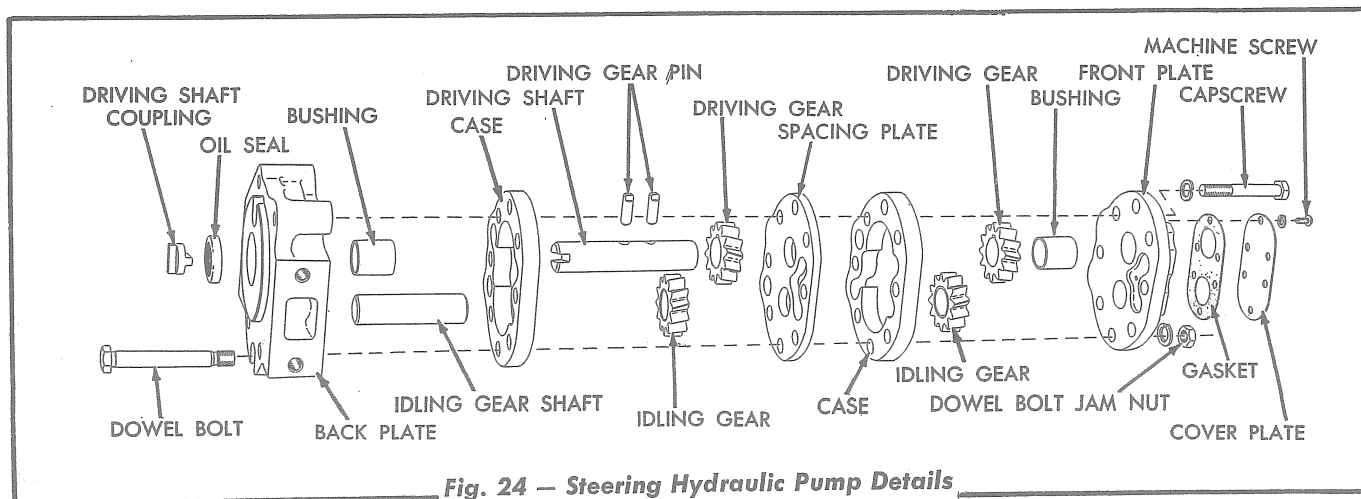
1. On tractors prior to Serial No. 4001 disconnect the oil return hose from the oil return elbow of the hydraulic pump and allow the oil to drain. On tractors Serial No. 4001 and above, disconnect the oil return hose from the steering hydraulic oil reservoir and allow the oil to drain.
2. Disconnect the two oil supply hoses from the hydraulic pump assembly.
3. On tractors Serial No. 4001 and above,

remove the capscrews and lockwashers attaching the steering hydraulic oil reservoir to the steering hydraulic pump.

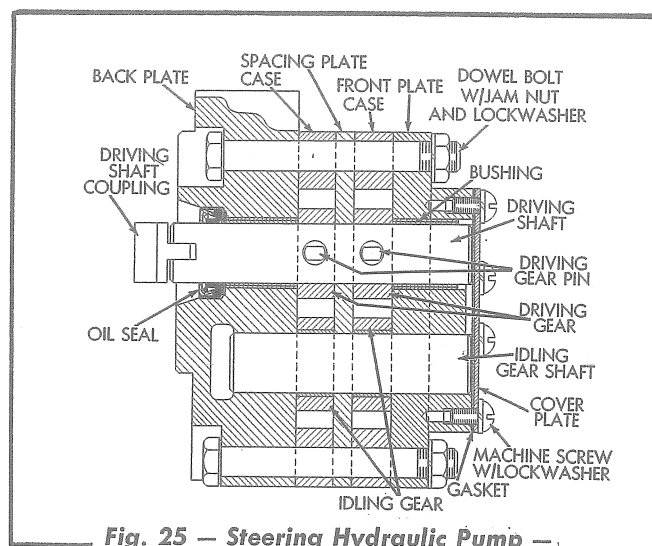
4. Loosen the two  $\frac{7}{16}$ " NC x  $4\frac{1}{2}$ " capscrews and lockwashers located on the bottom of the pump and the three  $\frac{3}{8}$ " NC x  $4\frac{1}{2}$ " capscrews and lockwashers located at the top of the pump (refer to Fig. 23) and remove the pump with the attaching capscrews from the timing gear housing cover. As the pump is removed, also remove the driving shaft coupling.

## C. Disassembly of Steering Hydraulic Pump

1. Thoroughly wash the pump assembly. Place the pump in a vise using care not to damage the machined surface of the back plate.
2. Before disassembly of the pump, mark the plates and cases by scribing a line the entire length of the pump, or center punching each case and plate in a line, as an index to facilitate reassembly of the pump.
3. Remove the two dowel bolt jam nuts and lockwashers located at the front of the pump and using a hammer and a suitable punch, drive the dowel bolts out of the pump assembly.
4. Remove the capscrews and lockwashers from the front end of the pump assembly. Remove the front plate and front case. Remove the front driving gear, the front



**Fig. 24 — Steering Hydraulic Pump Details**



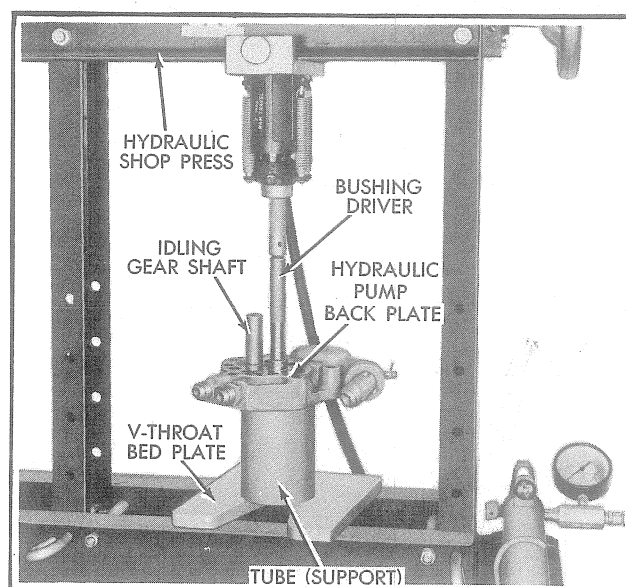
**Fig. 25 — Steering Hydraulic Pump — Sectional View**

idling gear, and remove the front driving gear pin from the driving shaft. Remove the spacing plate and rear case, then remove the rear driving gear, the rear idling gear, and the rear pin from the driving shaft. Remove the driving shaft from the back plate.

5. If the idling gear shaft is to be replaced, it can be removed from the back plate by clamping the shaft in a vise and driving or pulling the back plate from the shaft using care not to damage the machined faces of the back plate.
6. If the driving shaft bushings are to be replaced, remove the machine screws attaching the cover plate to the front plate and remove the cover plate and gasket. The old bushings may be pressed out and new bushings pressed in with tools similar to the ones shown in Fig. 26.
7. If the driving shaft oil seal is to be replaced, the old seal may be driven out of the back plate toward the rear.

#### **D. Cleaning and Inspection of Steering Hydraulic Pump Parts**

Wash all the parts in clean diesel fuel or solvent, being careful not to scratch or damage the sealing surface of the plates and cases. These sealing surfaces are precision ground and no gasket is necessary for sealing. Inspect all parts carefully. The



**Fig. 26 — Removing Driving Shaft Bushing from Steering Hydraulic Pump Back Plate**

parts subject to the most wear are the gears. If the oil has been kept clean, the wear on these parts will be slight. If the oil in the hydraulic system has not been changed as recommended, and cleanliness was not observed while servicing the pump, wear may be pronounced in a comparatively short time. Prior to assembling the pump, examine the gear teeth, inside of both gear cases, spacing plate, shaft bushings, and the shafts for wear. If the gear teeth are scored, or excessively worn, the gears must be replaced. Replace worn or scored gear cases, pump plates, or spacing plate. Inspect the driving shaft oil seal for damage or wear and replace if necessary.

#### **E. Assembly of Steering Hydraulic Pump**

1. **NOTE:** One end of each driving shaft bushing is slightly undercut on the outside diameter; the bushings should be installed with the under cut end facing away from the driving gear side of each end plate. Press a driving shaft bushing into the pump back plate so that the end of the bushing is flush with the inner face (front face — face next to gear) of the back plate. Press a driving shaft bushing into the pump front plate so that the end of the bushing is flush with the inner face (rear face — face next to gear) of the front plate. Install the cover plate and gasket on the front plate and

secure with machine screws and lockwashers. The specified inside diameter of the bushings, when installed, is 1.0015" to 1.0030" and the specified diameter of a new driving shaft is .9995" to 1.0000".

2. Using a suitable press, press the idling gear shaft into the back plate so that the front end of the shaft protrudes  $2\frac{7}{8}$ " from the inner machined face (front face) of the back plate. The diameter of a new idling gear shaft is .9995" to 1.0000". Press a new driving shaft oil seal into the counter-bore in the back plate, making certain that the sealing lip of the oil seal is directed toward the accessory drive.
3. Install the dowel bolts into position in the back plate. Clamp the back plate in a vise with the dowel bolts up. Insert the driving shaft in position in the back plate, with the slotted end of the shaft (driving end) down. Insert a driving gear pin into the rear hole in the driving shaft and install a driving gear on the shaft so that the flat end of the driving gear pin engages with the slot in the driving gear. Install an idling gear on the idling gear shaft. The inside diameter of the bushing in a new idling gear is 1.0020" to 1.0025"; the bushing is not serviced separately. Install a case, making certain the scribe or punch marks placed on the components when the pump was disassembled, are aligned. Lubricate the shafts and gears and install the spacing plate in position over the dowel bolts. Install the second set of gears in the same manner as described above. Install the

second case, then lubricate the gears and install the front plate. Install the dowel bolt lockwashers and jam nuts and the four  $\frac{7}{16}$ " NC x 3" capscrews and lockwashers. Tighten the capscrews to a torque of 25 to 35 lbs. ft. and the dowel bolt jam nuts to a torque of 35 to 45 lbs. ft.

## F. Installation of Steering Hydraulic Pump

1. The steering hydraulic pump may be installed on the engine by a direct reversal

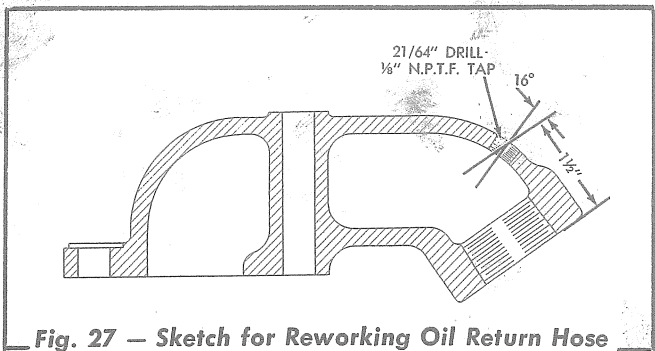
of the removal procedure. Make certain that the driving shaft coupling is in position between the pump driving shaft and the accessory drive upper shaft when the pump is installed. NOTE: Heavy grease, or gasket cement, may be used to hold the driving shaft coupling in position while installing the pump.

2. After the pump is installed, the steering hydraulic system must be filled to the proper level with the specified oil. Use a good quality engine oil of the same viscosity as is used in the engine; diesel engine oil may be used provided it does not foam. The viscosity of the oil is to be determined by the prevailing atmospheric temperature (refer to Section I, Topic 3).

An air vent cock (Fig. 22) is provided in the oil return hose elbow of the hydraulic pump on tractors Serial No. 2727 to 4001. The purpose of the vent cock is to facilitate the venting of any air trapped in the hydraulic pump when the hydraulic system is refilled with oil. On tractors Serial No. 4001 and above the steering hydraulic oil reservoir is mounted on the steering hydraulic pump and an oil return hose elbow is not used. This location of the oil reservoir makes the hydraulic pump self venting and no air vent cock is required.

On tractors prior to Serial No. 2727, it is recommended that whenever the hydraulic pump or any of the hydraulic tubes or hoses are removed or replaced, the oil return hose elbow be reworked so that an air vent cock may be installed as shown in Fig. 22. The elbow should be removed from the hydraulic pump when reworking so that metal chips or other foreign material do not enter the hydraulic system. To rework the oil return hose elbow, refer to Fig. 27 and proceed as follows:

- a. Remove the capscrews and lockwashers attaching the oil return hose elbow to the hydraulic pump and remove the elbow and gasket.



**Fig. 27 — Sketch for Reworking Oil Return Hose Elbow for Installation of Air Vent Cock**

- b. Drill a  $\frac{21}{64}$ " hole in the elbow at the location shown in Fig. 27 and tap with a  $\frac{1}{8}$ " N. P. T. F. tap. Install a vent cock or a  $\frac{1}{8}$ " pipe plug in the tapped hole.
  - c. Reinstall the oil return hose elbow and gasket on the hydraulic pump. Install the attaching capscrews and lockwashers and tighten securely. Connect the oil return hose to the elbow.
3. Fill the steering hydraulic system with oil as follows: *NOTE: On tractors Serial No. 4001 and above the steering hydraulic oil reservoir is mounted on the steering hydraulic pump, and an oil return hose elbow is not used. This location of the oil reservoir makes the hydraulic pump self venting and no air vent cock is required. In all other respects, filling of the steering hydraulic system is identical to the following:*
  - a. Open the air vent cock in the oil return

hose elbow and in the hydraulic control valve housing.

- b. Remove the oil filler plug and gasket from the hydraulic oil reservoir and open the oil level cock located just below the filler neck. Fill the oil reservoir with the specified oil until oil, free from bubbles, flows from the air vent cock in the oil return hose elbow and the hydraulic control valve housing, then close the air vent cock. Continue to fill the oil reservoir until oil flows from the oil level cock. Close the oil level cock and install the filler plug and gasket. *NOTE: On tractors not equipped with an oil level cock, fill the oil reservoir until oil is visible in the filler neck.*
  - c. Operate the engine at low idle speed and open the air vent cock in the hydraulic control valve housing to allow any air trapped in the system to escape. Open the vent cock intermittently until all the air has been vented from the hydraulic system, then close the air vent cock.
  - d. Stop the engine and add oil to the oil reservoir as necessary to obtain the proper level.
  - e. Repeat steps c and d until further operation does not lower the oil level in the oil reservoir.



## 6. STEERING HYDRAULIC SYSTEM PIPING AND OIL RESERVOIR

### A. Description

The first type steering hydraulic system piping, used on tractors prior to Serial No. 1275, consists of two oil supply tubes and one oil return tube along with the necessary fittings, supporting clamps and brackets. The second type of piping, on tractors Serial No. 1275 to 4001, consists of hoses instead of tubes and the necessary changes in the fittings, supporting clamps and brackets. The third type of piping, used on tractors Serial No. 4001 and above, consists of hoses. The location of the steering hydraulic oil reservoir is changed from the left rear to the left front of the engine and a new oil return hose is used. One oil supply hose extends from the lower outlet in the steering hydraulic pump to the right control piston of the steering hydraulic control valve; the other supply hose extends from the upper outlet in the pump to the left control piston of the control valve. On tractors prior to Serial No. 4001, the oil return hose consists of two sections; the rear section extends from the hydraulic control valve to a tee located just below the oil reservoir and connected to the reservoir by an oil reservoir tube. The oil return hose front section extends from the tee to an oil return hose elbow

located on the inlet side of the steering hydraulic pump. On tractors Serial No. 4001 and above, the oil return hose extends from the hydraulic control valve to the oil reservoir.

On tractors prior to Serial No. 4001, the steering hydraulic oil reservoir is attached to the left rear of the engine by means of a bracket and a bracing plate. On tractors Serial No. 4001 and above, the steering hydraulic oil reservoir is mounted on the steering hydraulic pump. The reservoir is equipped with a breather, an oil filler plug and gasket, and an oil level cock. With the oil in the oil reservoir maintained at the proper level, a full supply of oil is supplied to the intake side of the steering hydraulic pump at all times.

### B. Service and Inspection of Steering Hydraulic System Piping

The oil supply and return hose supporting clamps and brackets should be kept tight to prevent damage to the hoses and fittings. In the event of failure of the hydraulic system and metal chips or cuttings are noted within the system, the oil hoses and/or tubes should be removed and thoroughly cleaned.

## SECTION XII—STEERING BRAKES

Topic Title	Topic No.	Page No.
General Description .....	1	297
Service of Steering Brakes .....	2	300

NOTE: This supplement section is provided to include the 7" wide brake bands which became effective with tractor S/N 4560.

### 1. GENERAL DESCRIPTION

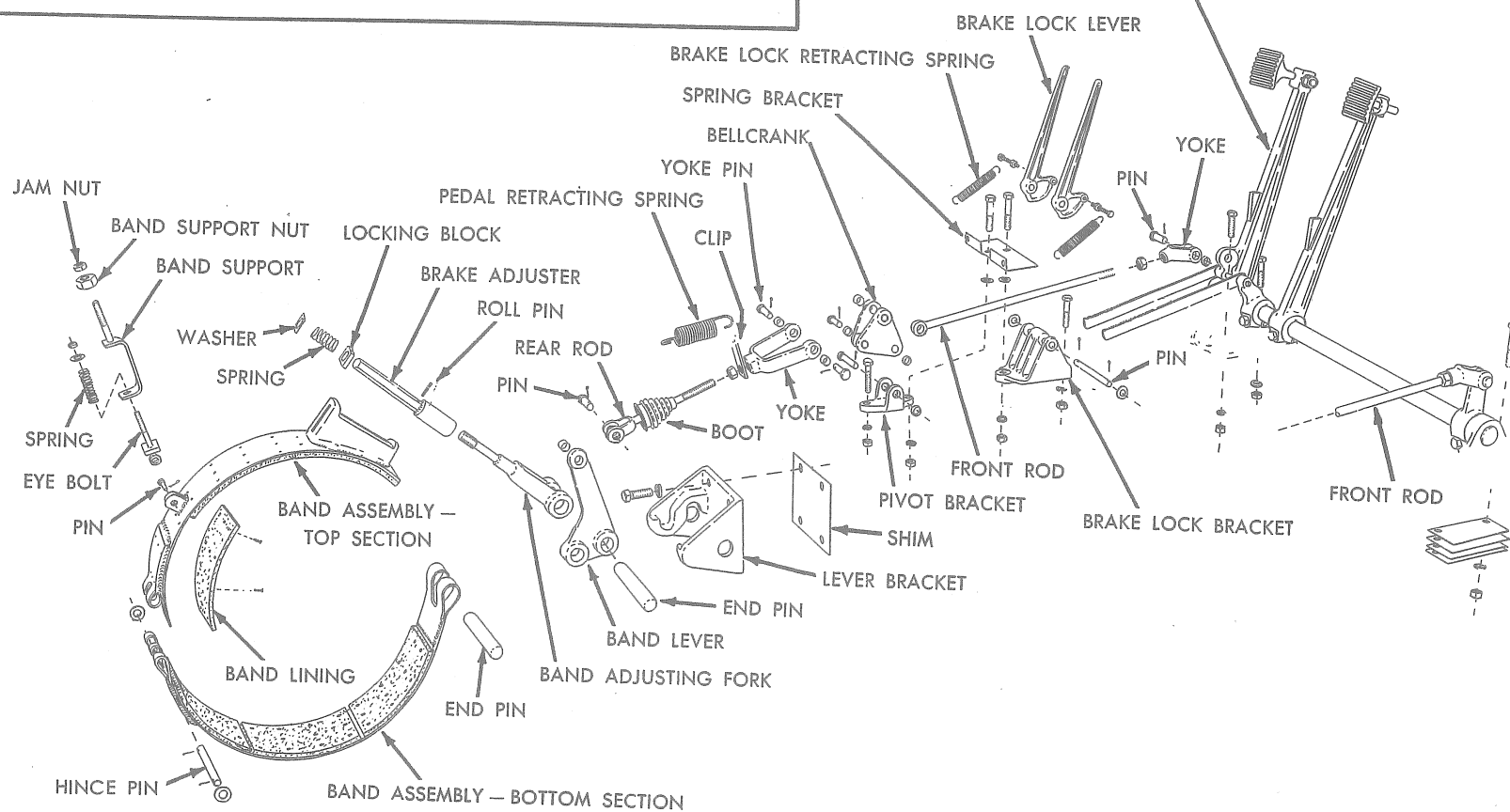
The two steering brakes are of the foot operated, mechanically controlled, self-energizing type. On tractors prior to S/N 4560 the brake band assemblies are wrap around, two-piece type with replaceable linings and the brake bands are 4½" wide. Effective with tractor S/N 4560 the brake band assemblies are wrap around, three-piece type with replaceable linings and the brake bands are 7" wide. The brake band assemblies operate on brake drums which enclose the steering clutches. Effective with tractor S/N 4560 wider brake drums are used to accommodate the 7" wide brake bands.

Pressure applied on the brake pedal levers is transmitted through linkage and a bellcrank to the brake band lever assemblies. Action of the brake band lever assemblies pulls the ends of the brake band assembly together, causing the brake band assembly to tighten around the brake drum.

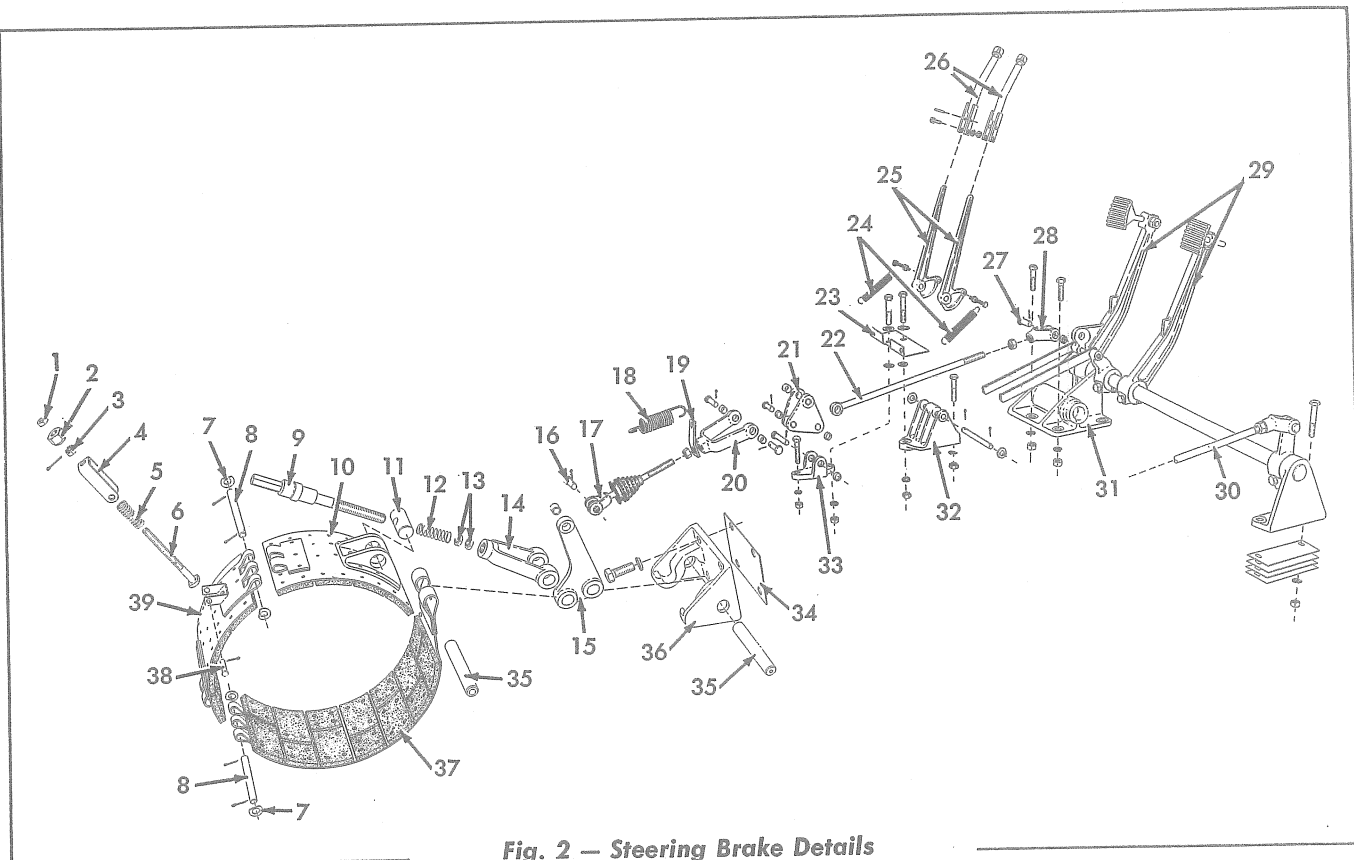
The steering brakes are used as an aid in steering when use of the steering clutches alone is not adequate. Do not attempt to use a steering brake for steering without first disengaging the corresponding steering clutch.

The steering brakes may be used singly or together as service brakes to slow or stop the tractor. Each steering brake is provided with a parking brake lock, to hold each brake pedal lever in the applied position when parking.

Brake pedals, clamped to the brake pedal levers with eyebolts, are adjustable within limits. The brake pedal shafts are supported by needle bearings that are grease packed and sealed for life at the time of assembly. Adjustable type brake control front rods connect the brake pedal levers to the bellcrank assemblies and adjustable type rear rods connect the bellcrank assemblies to the brake band lever assemblies. Each brake band lever assembly is attached to both ends of the brake band. A brake pedal retracting spring is attached to the rear rod to return the brake pedal lever to the normal (released) position. Each brake band assembly is made in sections to permit easy removal and installation. Each section of the brake band is serviced separately with lining attached, or the lining alone may be replaced.



**Fig. 1 — Steering Brake Details  
(Tractors with Brake Bands 4½" Wide)**



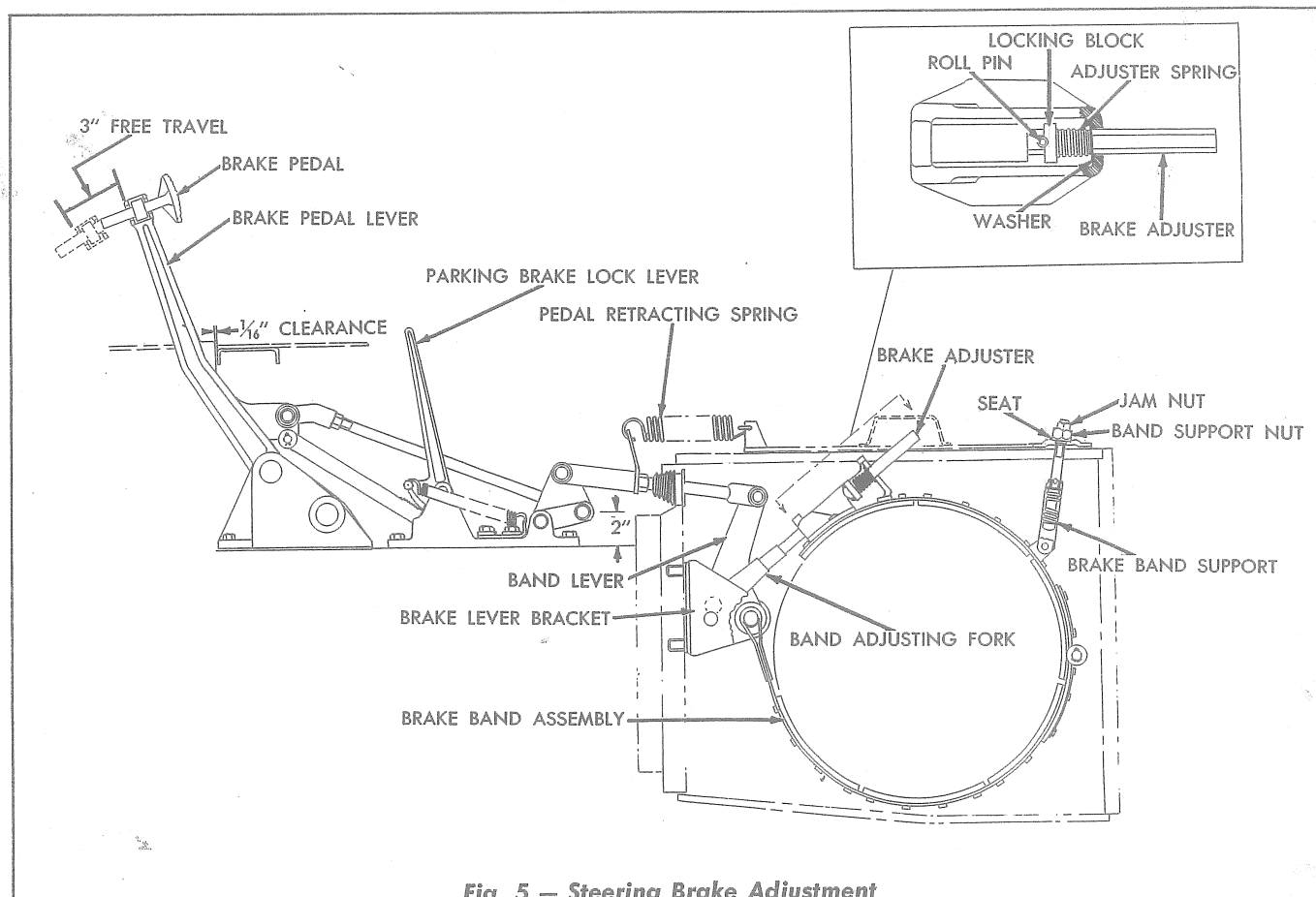
**Fig. 2 — Steering Brake Details**  
(Tractors with Brake Bands 7" Wide)

1. Jam Nut
2. Band Supporting Nut
3. Slotted Nut
4. Band Supporting Yoke
5. Band Supporting Spring
6. Band Supporting Bolt
7. Plain Washer
8. Hinge Pin
9. Brake Adjuster
10. Brake Band — Top Section
11. Band Adjusting Screw Pin
12. Spring
13. Jam Nuts
14. Band Adjusting Yoke
15. Brake Band Lever
16. Pin
17. Rear Rod
18. Pedal Retracting Spring
19. Clip
20. Yoke

21. Bellcrank
22. Front Rod
23. Spring Bracket
24. Brake Lock Retracting Springs
25. Brake Lock Levers
26. Brake Lock Extensions (HD 16GC Tractors Only)
27. Pin
28. Yoke
29. Brake Pedal Lever
30. Front Rod
31. Left Pedal Shaft Bracket
32. Brake Lock Bracket
33. Pivot Bracket
34. Shim
35. End Pin
36. Lever Bracket
37. Brake Band — Bottom Section
38. Pin
39. Brake Band — Intermediate Section







**Fig. 5 — Steering Brake Adjustment**  
(Tractors with Brake Bands 4½" Wide)

brake wear, and loss of power. When brakes are too loose, they will not hold properly and will wear rapidly because of excessive slipping. To adjust each of the steering brakes, refer to Figs. 5 or 6 and proceed as follows:

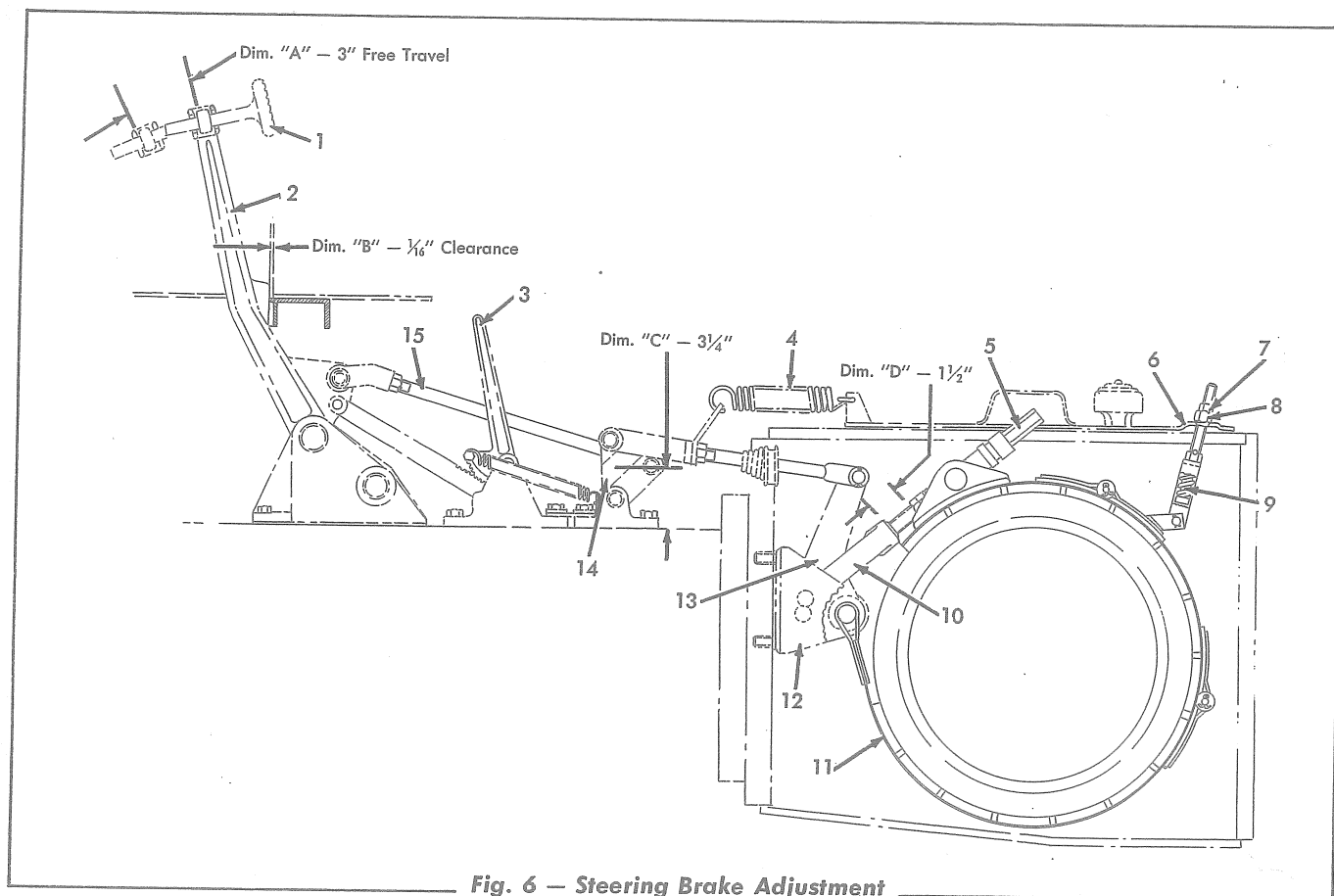
1. Remove the brake band adjuster access cover from the steering clutch compartment cover.
2. Turn the brake adjuster clockwise until the brake pedal has 3" free travel. **NOTE:** When adjusting the brakes, it is necessary to turn the brake adjuster in ½ turn increments to engage the adjuster lock.
3. With the brake pedal free (pedal all the way back), loosen the jam nut on the brake band support, then back off the band support nut from its seat in the cover. Turn the band support nut back down until it contacts the seat in the cover and give the nut an additional ¼ turn, then lock the band

support nut in position with the jam nut; this centers the brake band around the brake drum.

4. Install the brake band adjuster access cover and gasket on the steering clutch compartment cover.

## **B. Adjustment of Steering Brake Linkage**

1. Remove the seat cushions, seat frame, and the tool box. Remove the center and rear floor plates.
2. Disconnect the brake pedal retracting spring from the clip on the rear rod and remove the steering clutch compartment cover.
3. Adjust the rear rod, connecting the brake band lever to the bellcrank, so that the distance from the center of the front rod rear pin (located in the bellcrank) to the



**Fig. 6 — Steering Brake Adjustment**  
(Tractors with Brake Bands 7" Wide)

1. Brake Pedal
2. Brake Pedal Lever
3. Parking Brake Lock Lever
4. Pedal Retracting Spring
5. Brake Adjuster
6. Seat
7. Jam Nut
8. Band Support Nut

9. Brake Band Support (Second Type — Effective with Tractor S/N 3041)
10. Band Adjusting Yoke
11. Brake Band Assembly
12. Brake Lever Bracket
13. Brake Band Lever
14. Bellcrank
15. Front Rod

top surface of the main frame is 2" on tractors with brake bands 4½" wide (Fig. 5) and 3¼" on tractors with brake bands 7" wide (Fig. 6).

4. Hold the brake band lever back (toward the rear) as far as it will go and adjust the front rod, connecting the bellcrank to the brake pedal shaft lever, to provide 1/16" clearance between the stop on the pedal lever and the floor plate when the pedal lever is all the way back.
5. Install the steering clutch compartment cover and connect the brake pedal retracting spring. Install the center and rear floor

plates, tool box, seat frame and seat cushions. Adjust the brakes as described in Paragraph A in this Topic.

**NOTE:** Shims are provided between each brake band lever bracket and the steering clutch housing. When installing a brake band lever bracket, use shims as necessary between the brake band lever bracket and the steering clutch housing so that the hole for the brake band bottom section end pin in the brake band lever is 1⅛" from the brake drum as shown in Fig. 7.

### C. Washing Steering Brakes

When the steering brakes are properly adjusted,

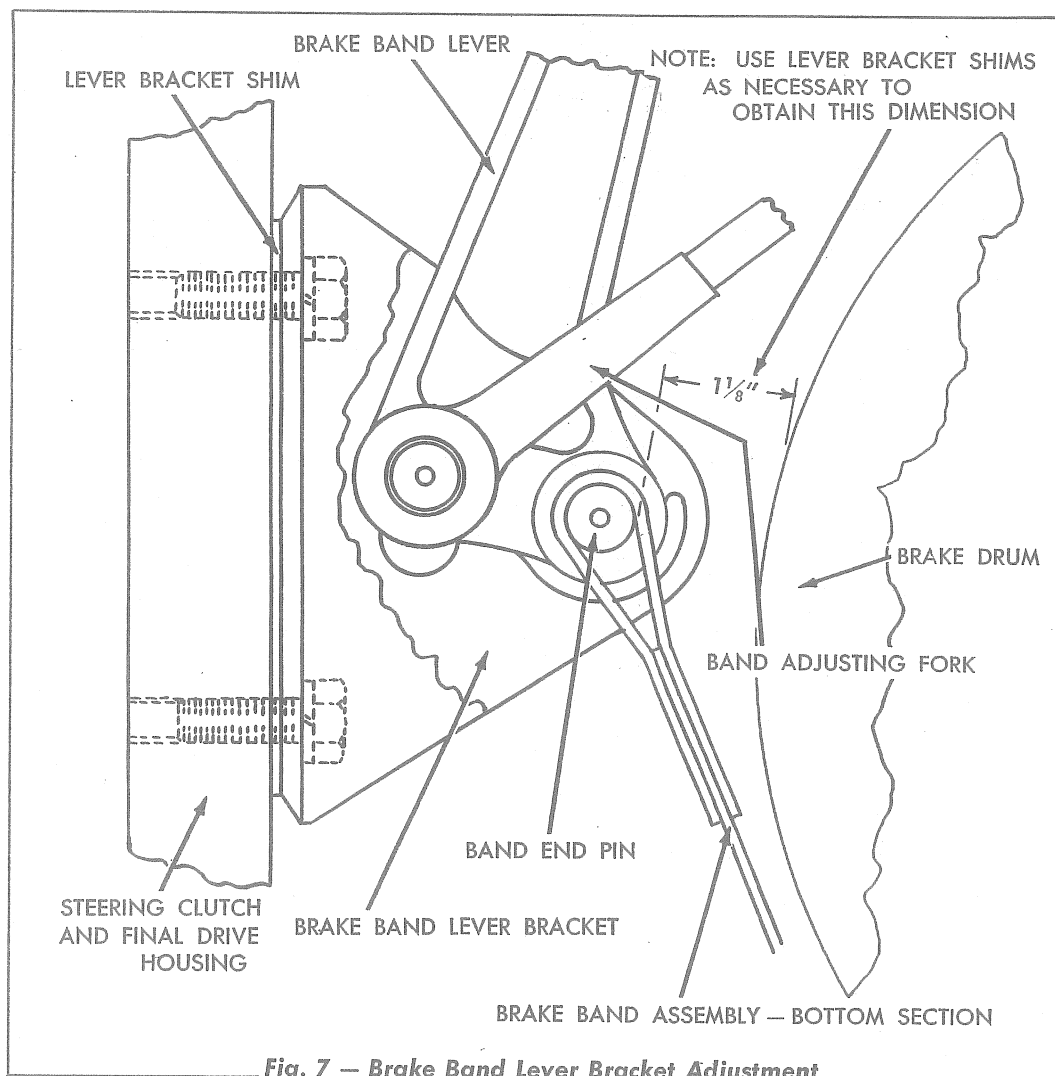


Fig. 7 — Brake Band Lever Bracket Adjustment

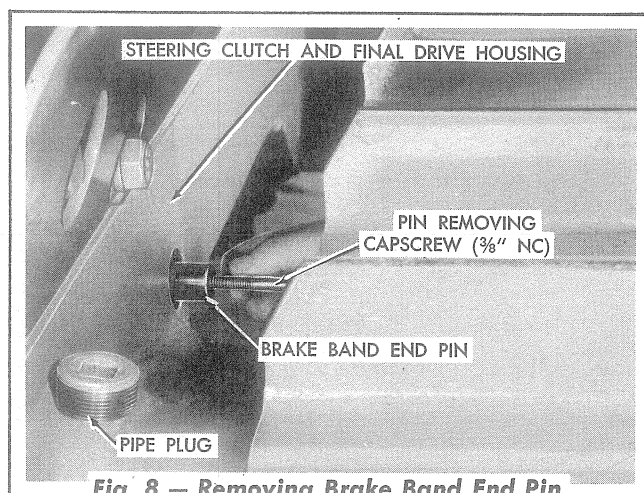


Fig. 8 — Removing Brake Band End Pin

yet fail to hold because of oil or grease on the linings, they may be washed in the same manner as the steering clutches, refer to "WASHING STEERING CLUTCHES" Section XI.

#### D. Removal of Steering Brake Bands (Tractors with Brake Bands 4½" Wide)

NOTE: The following removal procedure applies to either brake band (refer to Figs. 1 and 9 when removing).

1. Remove the seat cushions, seat frame, and the tool box. Remove the rear floor plate.
2. Remove the jam nut and the brake band support nut. Disconnect the brake pedal retracting spring from the clip on the rear rod and remove the steering clutch compartment cover.
3. Turn the brake adjuster counterclockwise until it is loosened from the band adjusting fork and remove the brake band adjuster from the brake band assembly.

4. Remove the pin attaching the brake band support assembly to the brake band and remove the brake band support.
5. Remove the yoke pin connecting the rear rod to the top of the brake band lever.
6. Remove the pipe plug located in the side of the steering clutch and final drive housing, in line with the brake band end pin, and using a long  $\frac{3}{8}$ " NC capscrew inserted through the hole, turn it into the tapped hole in the end of the band end pin (Fig. 8). Pull the brake band end pin out of the brake band lever bracket and the band adjusting fork. Remove the brake band adjusting fork. Lift up on the brake band lever until the end pin attaching the bottom section of the band to the lever can be removed. Push the pin toward the bevel gear compartment and remove the pin then remove the brake band lever.
7. Move the brake band toward the bevel gear compartment and remove the band as shown in Fig. 9.

#### E. Removal of Steering Brake Bands (Tractors with Brake Bands 7" Wide)

When replacement of the brake bands becomes necessary, replacement may be accomplished without the removal of the fuel tank or the rear floor plates. *NOTE: The following removal procedure applies to either brake band (refer to Figs. 2, 10, and 11 when removing).*

1. Remove the brake band support nut, brake retracting spring, and the steering clutch compartment cover.
2. Turn the brake band adjuster counterclockwise until it is free of the brake band adjusting yoke.
3. Remove the pipe plug located in the side of the steering clutch and final drive housing, in line with the brake band end pin, and using a long  $\frac{3}{8}$ " NC capscrew inserted through the hole, turn it into the tapped hole in the end of the band end pin (Fig.

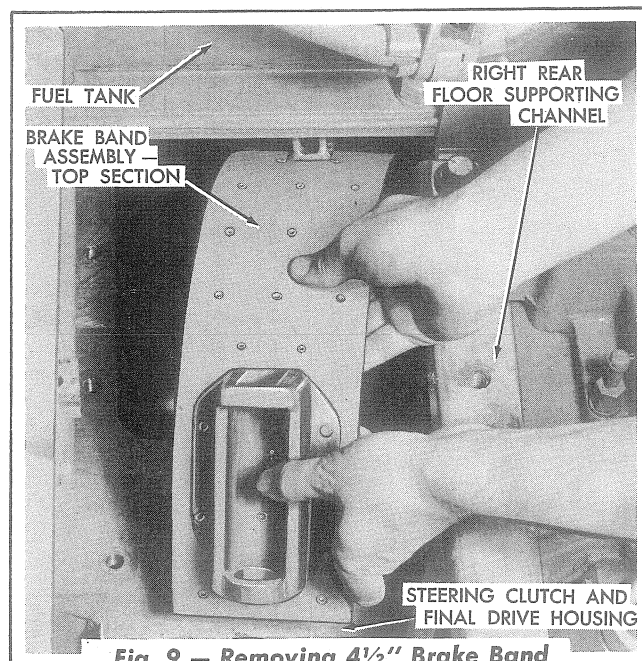
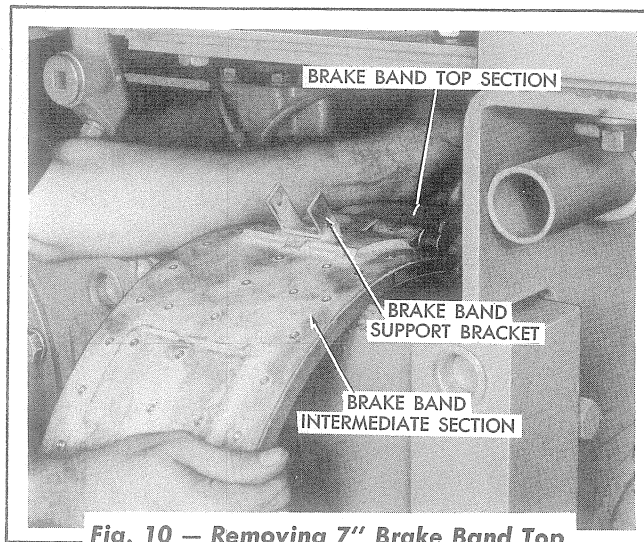


Fig. 9 — Removing 4½" Brake Band

- 8). Pull the brake band end pin out of the brake band lever bracket and the band adjusting yoke. Remove the brake band adjusting yoke. Lift up on the brake band lever until the end pin attaching the bottom section of the band to the lever can be removed. Push the pin toward the bevel gear compartment and remove the pin and the brake band lever.
4. Remove the yoke pin connecting the brake rear rod to the brake band lever. Pull upward on the brake band lever until the remaining band end pin is free of the brake lever bracket and remove the band end pin and the brake band lever.
5. Lift the top section of the brake band and move the brake assembly forward (sliding it on the brake drum) until the brake band hinge pin, connecting the brake band intermediate section and the bottom section, is accessible for removal. Remove the cotter pin and washer from the outer end of the hinge pin and remove the hinge pin.
6. Remove the brake band top and intermediate sections as shown in Fig. 10.
7. Move the brake band bottom section toward the bevel gear compartment as far



**Fig. 10 — Removing 7" Brake Band Top and Intermediate Sections**

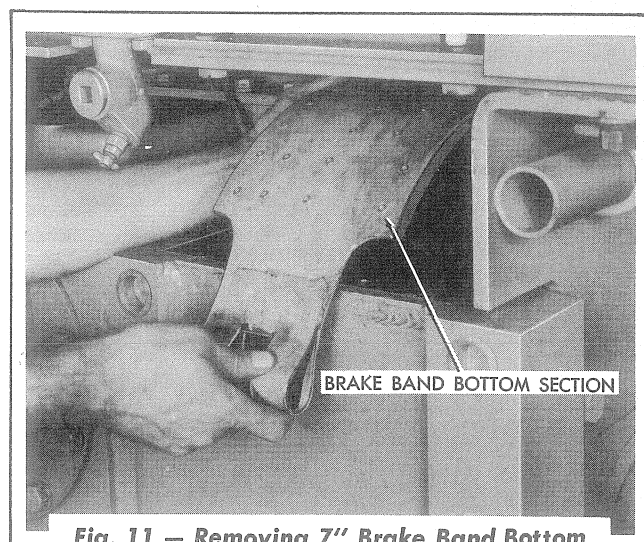
as it will go. Pull upward on the rear of the band bottom section (sliding it up and over the brake drum) until the anchor end can be reached, then remove the band section as shown in Fig. 11.

#### **F. Inspection and Repair of Steering Brakes**

1. The brake band linings must be replaced, or new bands installed, before the linings are worn to a point where the lining retaining rivets will contact and score the brake drums.
2. If the steering brake drum is worn, scored, or grooved excessively, it must be removed and replaced.
3. Inspect the brake band end pins, yokes, yoke pins, and brake band lever bushings for wear. Replace the necessary parts.
4. Actuate each brake pedal to make certain that the pedal bracket needle bearings are in good condition.
5. All pins and bushings should be lubricated sparingly when reinstalled.

#### **G. Installation of Steering Brake Bands (Tractors with Brake Bands 4½" Wide)**

The steering brake bands may be installed by a



**Fig. 11 — Removing 7" Brake Band Bottom Section**

direct reversal of the steering brake band removal procedure and must be properly adjusted (refer to Paragraphs A and B in this Topic).

#### **H. Installation of Steering Brake Bands (Tractors with Brake Bands 7" Wide)**

The steering brakes may be installed by a direct reversal of the steering brake removal procedure and must be properly adjusted (refer to Paragraphs A and B in this Topic).

If the brake bands have been relined or new bands installed, it is very important that the 1½" clearance between the band adjusting yoke and the bottom jam nut (Fig. 6) be maintained to prevent eventual scoring of the brake drums. After new brake bands or relined bands have been installed and the brake linkage is connected, tighten the brake adjusting screw until the band assembly is tight around the brake drum. Turn the jam nuts until a clearance of 1½" is obtained between the lower jam nut and the band adjusting screw yoke as shown in Fig. 6, then tighten the jam nuts to lock them. Loosen the brake adjuster until the brake pedal has approximately 3" of free travel (Fig. 6) and proceed to adjust the steering brakes and the steering brake linkage as described in Paragraphs A and B in this Topic.

The 1½" adjustment between the jam nuts and the band adjusting screw yoke (Fig. 6) must never be changed to compensate for normal wear after the original installation and adjustments have been



made. As the brake linings wear, the jam nuts move closer to the band adjusting screw yoke and eventually the lower jam nut will contact the yoke and further adjustment is impossible. The  $1\frac{1}{2}$ " dimen-

sion is a predetermined distance that limits the amount of adjustment so that the brake bands cannot be adjusted too far thus allowing the lining retaining rivets to score the brake drum.



## SECTION XIII — FINAL DRIVES

Topic Title	Topic No.	Page No.
General Description .....	1	304
Disassembly .....	2	306
Cleaning and Inspection .....	3	311
Assembly .....	4	312

### 1. GENERAL DESCRIPTION

The final drives are of the double reduction type, each consisting of a drive pinion, intermediate pinion and intermediate gear, sprocket shaft and driving gear, and component parts. The final drives are assembled in a combination "one-piece" steering clutch and final drive housing. Since the final drive housings are an integral part of the steering clutch housing, they are line bored, thus eliminating misalignment of the bearing bores.

The final drive pinions, final drive intermediate pinions, and track sprocket shafts are mounted on tapered roller bearings which are adjustable by means of shims. The drive pinion bearings and the intermediate pinion bearings are splash lubricated by oil thrown by the gears.

The outboard bearings of the sprocket shafts are located in bearing cages which attach to the truck frames. The outboard bearings absorb thrust in both directions.

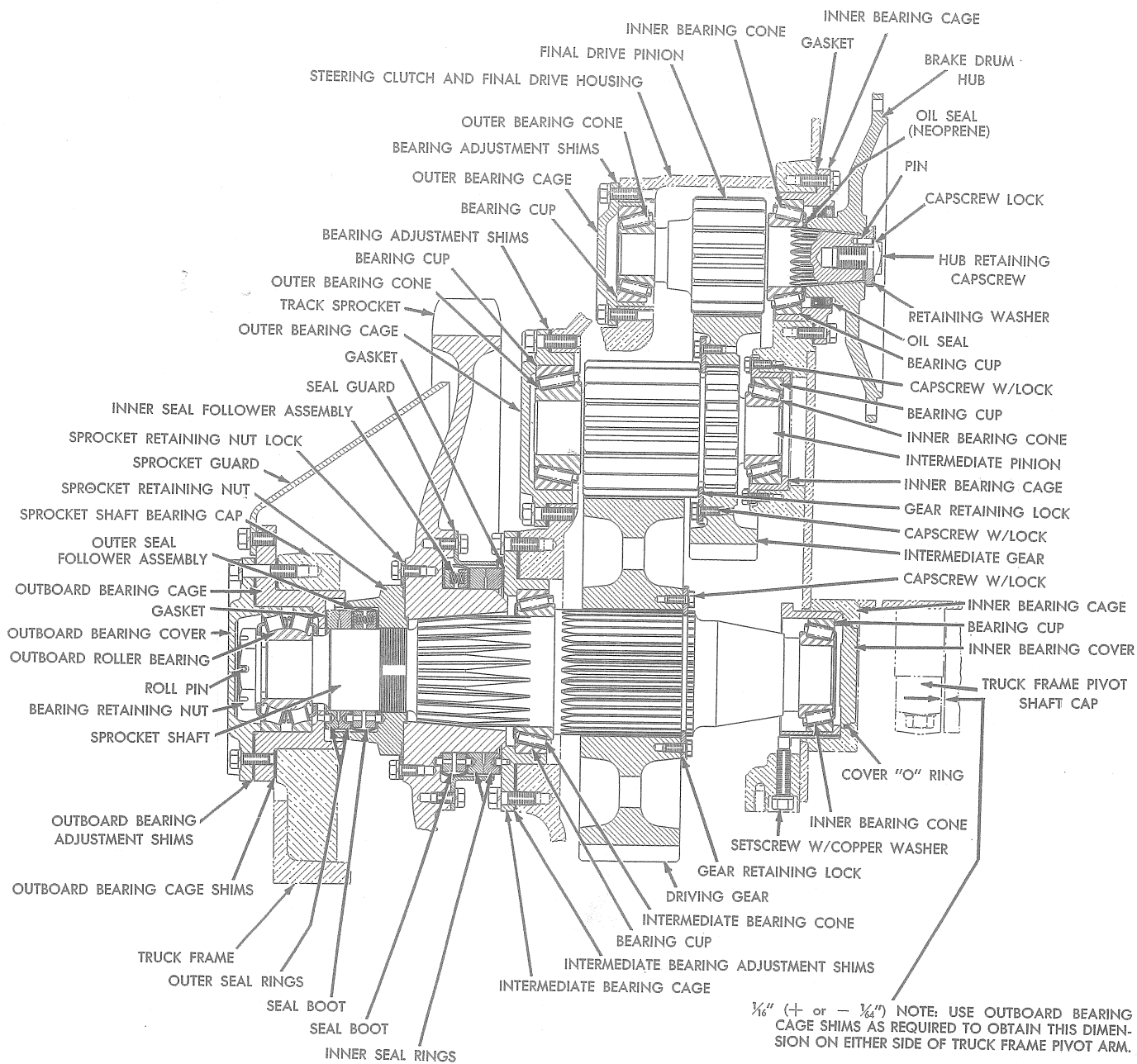
The oil seal assemblies (inner and outer) installed in each final drive assembly on the track sprocket and sprocket shaft are of the positive type. A lip type oil seal is used on the brake drum hub.

Each drive pinion is driven by the bevel gear through the steering clutches; each drive pinion drives the intermediate gear and pinion; the intermediate pinion drives the corresponding sprocket shaft driving gear, which in turn drives the sprocket shaft and track sprocket.









**Fig. 1 — Final Drive Assembly —  
Sectional View**

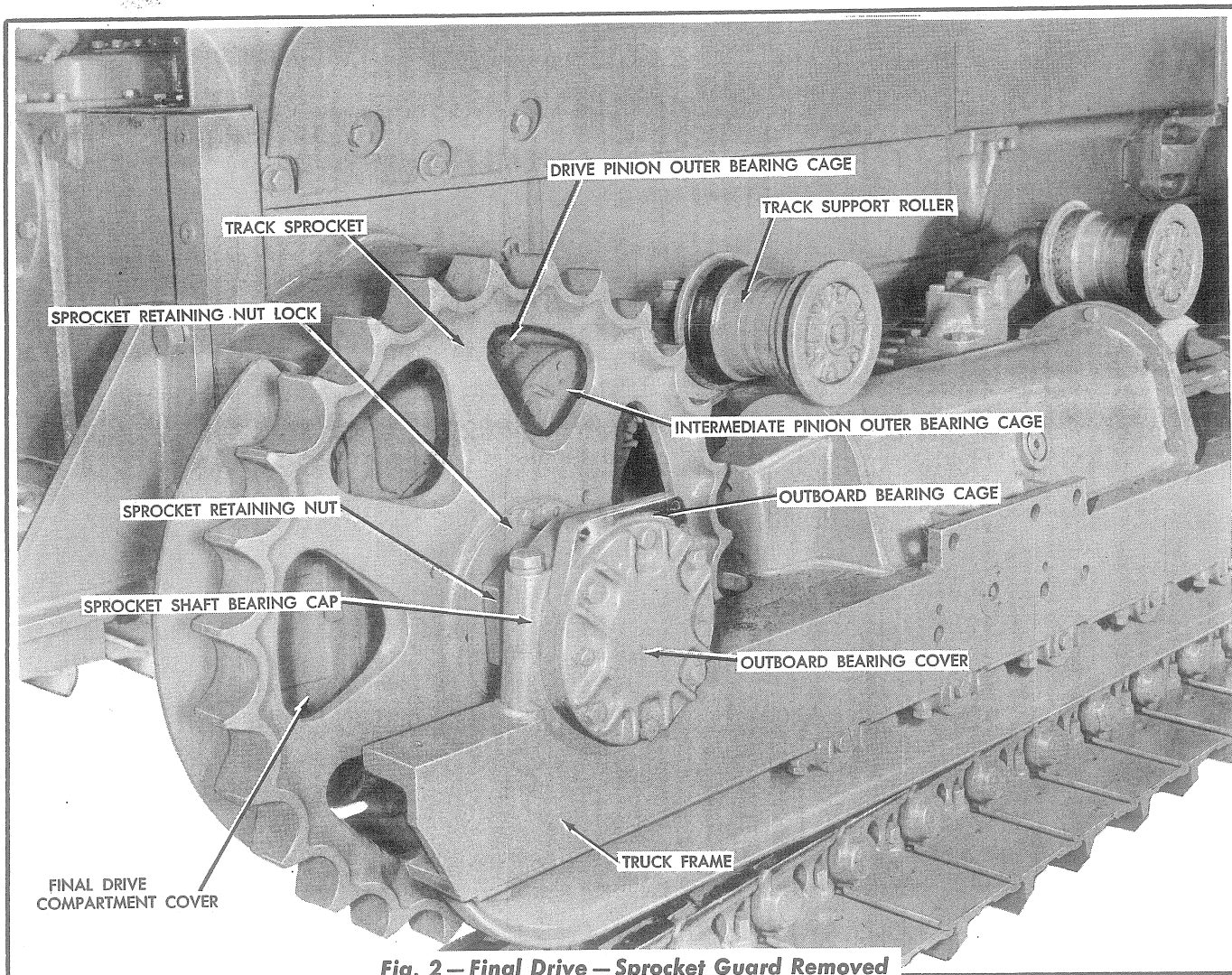


Fig. 2 — Final Drive — Sprocket Guard Removed

## 2. DISASSEMBLY OF FINAL DRIVES

**NOTE:** The disassembly procedure for each final drive is the same.

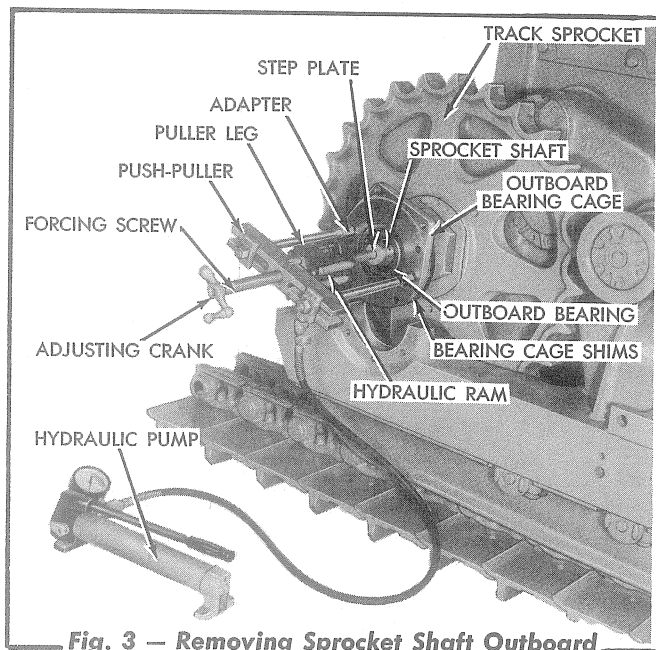
### A. Removal of Track Sprocket and Shaft

1. Uncouple the track by removing the track master pin (refer to Section XVI, Topic 2, Paragraph B). Move the tractor backward until the top of the track is off of the track sprocket.
2. Drain the oil from the final drive compartment.
3. Remove the truck frame pivot shaft caps, located directly under the steering clutch compartment. Remove the track sprocket guard. Remove the capscrews attaching the outboard bearing cover and remove the

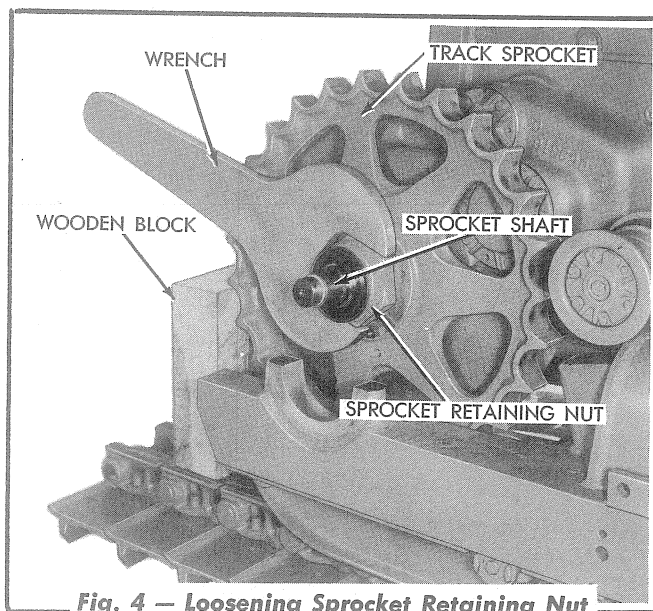
cover and bearing adjustment shims, tie the shims to the cover to prevent loss. Remove the two capscrews and lockwashers attaching the sprocket shaft bearing cap to the truck frame and remove the cap. Remove the two capscrews attaching the equalizing spring seat to the truck frame.

4. Using a suitable jack or hoist, raise the tractor off the truck frame and place suitable cribbing under the drawbar supporting plate and the front of the tractor. It will be necessary to raise the tractor high enough so that the track sprocket can be tipped to clear the truck frame when removing. Roll the truck frame forward on the track until the track release housing contacts the equalizing spring.

5. Remove the roll pin then remove the outboard bearing retaining nut using a wrench similar to the one shown in Fig. 27:
6. Using puller tools similar to the ones shown in Fig. 3, pull the sprocket shaft outboard bearing cage and bearing from the sprocket shaft. Use care in handling and prevent damage to the oil seal ring. Tie the outboard bearing cage shims to the outboard bearing cage to prevent loss.



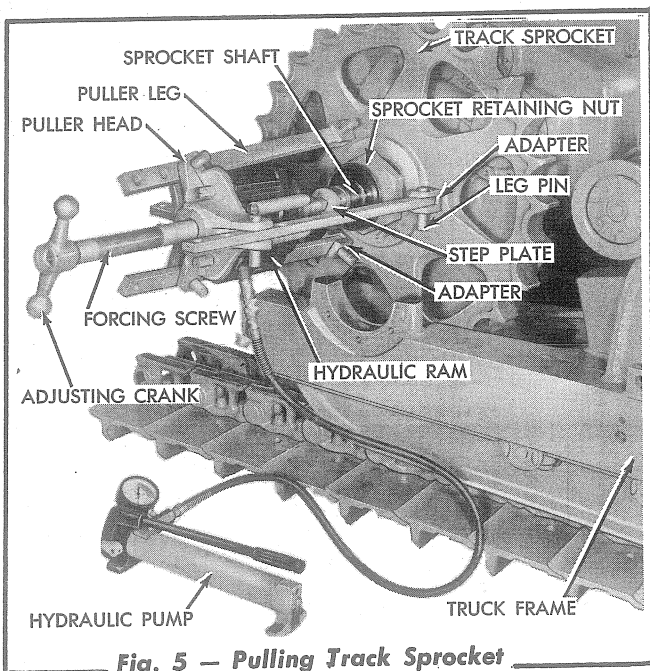
**Fig. 3 — Removing Sprocket Shaft Outboard Bearing Cage**



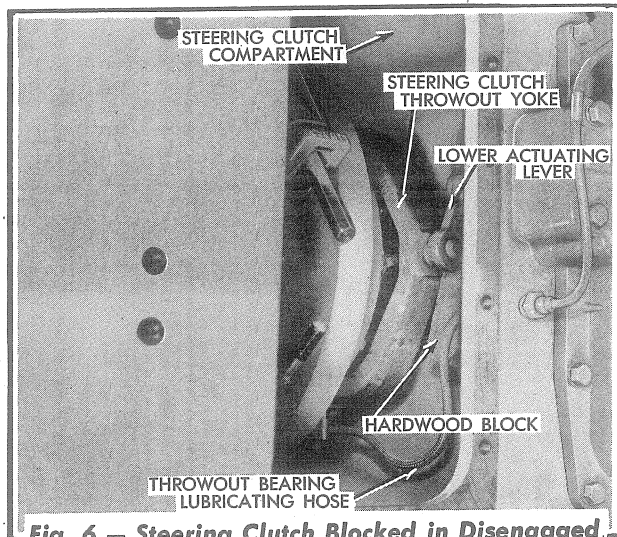
**Fig. 4 — Loosening Sprocket Retaining Nut**

7. Remove the two capscrews attaching the sprocket retaining nut lock and remove the lock. Place a wooden block between the sprocket and track to keep the sprocket shaft from turning and using a suitable wrench on the sprocket retaining nut (Fig. 4) strike the end of the wrench with a sledge hammer to loosen the sprocket retaining nut. Back the sprocket retaining nut off approximately  $\frac{1}{2}$ ", but do not remove it at this time. Using puller tools similar to the ones shown in Fig. 5, pull the track sprocket until it is loose on the shaft. Leaving the loosened sprocket retaining nut on the shaft prevents damage to the threads on the sprocket shaft and also serves as a safety factor when pulling the sprocket. Remove the puller tools and the sprocket retaining nut using care to prevent damage to the outer seal components cemented in the sprocket retaining nut. Tilt and remove the track sprocket using care to prevent damage to the inner seal ring components.
8. Remove the capscrews attaching the final drive compartment cover to the steering clutch and final drive housing and remove the cover. Unlock and remove the capscrews from the sprocket shaft driving gear retaining locks and remove the capscrew locks and the gear retaining locks. **NOTE:** To rotate the sprocket shaft to the correct position for removal of the gear retaining locks, it is necessary to block the opposite steering clutch throwout yoke assembly in the disengaged position. This may be accomplished by placing a hardwood block in back of the opposite steering clutch throwout yoke as shown in Fig. 6. With the steering clutch compartment covers removed, start the engine, disengage the steering clutch, and place the hardwood block between the lower actuating lever and the inner wall of the steering clutch compartment as shown. This will hold the clutch in the disengaged position and the final drive gears may then be rotated to the proper position (with transmission in neutral) for removal of the gear retaining locks.





**Fig. 5 — Pulling Track Sprocket**

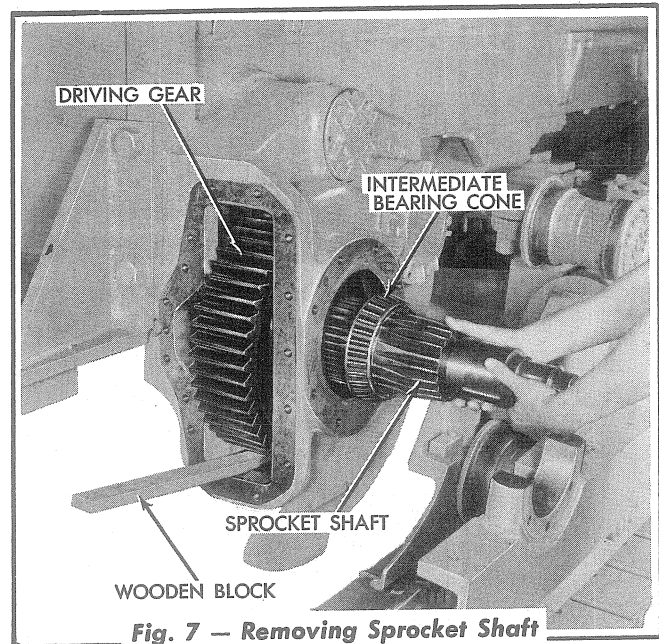


**Fig. 6 — Steering Clutch Blocked in Disengaged Position — Fuel Tank Removed**

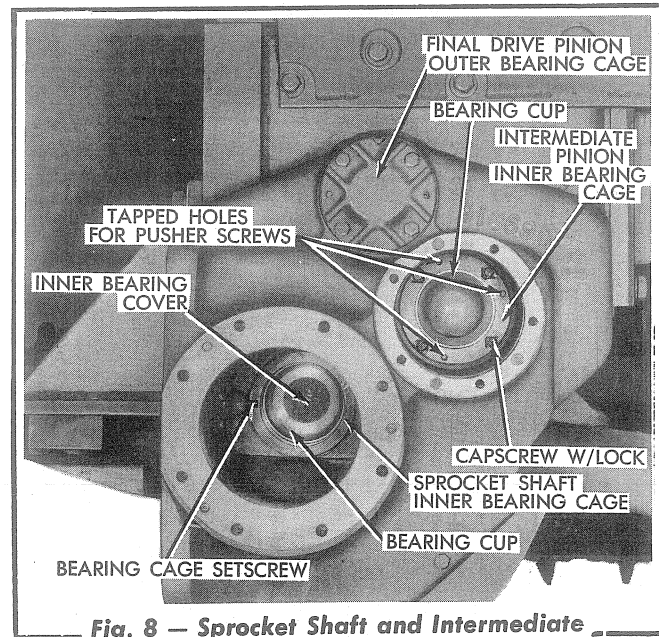
9. Place a wooden block under the sprocket shaft driving gear, as shown in Fig. 7, to prevent the gear from dropping when the sprocket shaft is removed.

10. Remove the capscrews securing the sprocket shaft intermediate bearing cage assembly to the final drive housing. Using three  $\frac{5}{8}$ " NC pusher screws in the tapped holes in the bearing cage, remove the intermediate bearing cage assembly, bearing adjustment shims, and intermediate bearing cup. Use care and prevent damage to the seal ring cemented to the intermediate bearing cage assembly when removing. Tie the bearing adjustment shims to the cage to prevent

loss. Remove the sprocket shaft from the driving gear and remove the driving gear from the steering clutch and final drive housing.



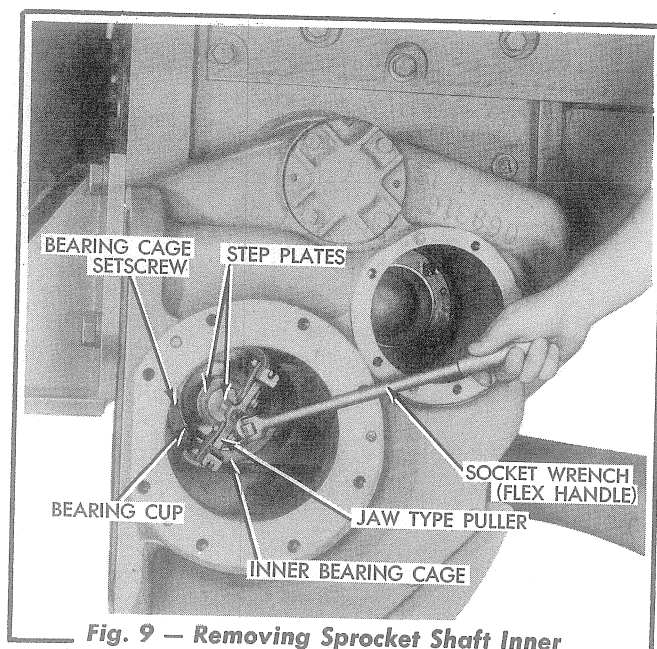
**Fig. 7 — Removing Sprocket Shaft**



**Fig. 8 — Sprocket Shaft and Intermediate Pinion Inner Bearing Cages — Installed**

11. If it is necessary to remove the sprocket shaft inner bearing cage, the inner bearing cage and bearing cup may be removed as a unit, using tools similar to the one shown in Fig. 9. Using a suitable press or puller type tools, remove the inner bearing cup from the inner bearing cage. The inner bearing cover and cover sealing ring may

be removed from the housing, if necessary, by driving the bearing cover in toward the final drive compartment after the inner bearing cage has been removed.



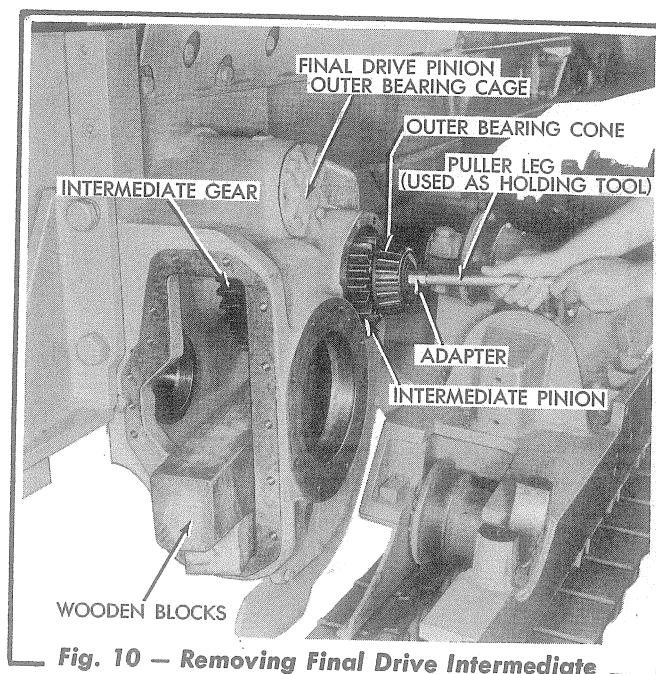
**Fig. 9 — Removing Sprocket Shaft Inner Bearing Cage**

## B. Removal of Final Drive Intermediate Pinion and Gear

To remove the intermediate gear retaining lock capscrews, it will be necessary to turn the intermediate gear; this is accomplished by blocking the opposite steering clutch throwout yoke in the disengaged position as outlined in Paragraph A, Step 8 above.

1. Remove the capscrews attaching the intermediate pinion outer bearing cage to the final drive housing. Using  $\frac{5}{8}$ " NC pusher screws in the tapped holes provided in the bearing cage, pull the bearing cage out approximately 1 inch. Unlock and remove the capscrews from the intermediate gear retaining locks. Move the pinion out against the intermediate outer bearing cage and remove the gear retaining locks.
2. Remove the intermediate pinion outer bearing cage, using care to prevent the intermediate pinion from falling and damaging the outer bearing cage bore in the final drive housing. Tie the bearing adjustment shims to the cage to prevent loss.

3. Hold or block the intermediate gear to prevent the gear from falling when the pinion is removed. Using a suitable bar having  $\frac{5}{8}$ " NC threads on one end, turn the bar into the tapped hole in the outer end of the intermediate pinion (Fig. 10) and using the bar as a holding tool, pull the pinion from the intermediate gear. Remove the holding blocks from the final drive compartment and remove the intermediate gear.



**Fig. 10 — Removing Final Drive Intermediate Pinion**

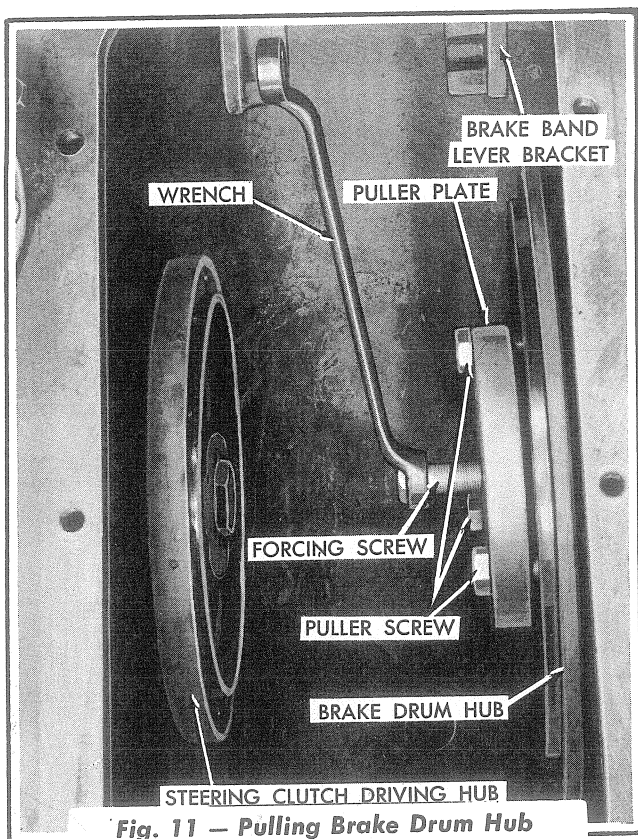
4. If it is necessary to remove the inner bearing cup from the inner bearing cage, remove the capscrews and locks attaching the inner bearing cage to the final drive housing. Using three  $\frac{3}{8}$ " NC pusher screws in the tapped holes (Fig. 8) of the bearing cage, remove the inner bearing cage. Using a suitable press or puller type tools, remove the inner bearing cup from the inner bearing cage.

## C. Removal of Final Drive Pinion

With the sprocket shaft and driving gear, and the intermediate pinion and intermediate gear removed, the final drive pinion may be removed as follows:

1. Remove the steering clutch from the side



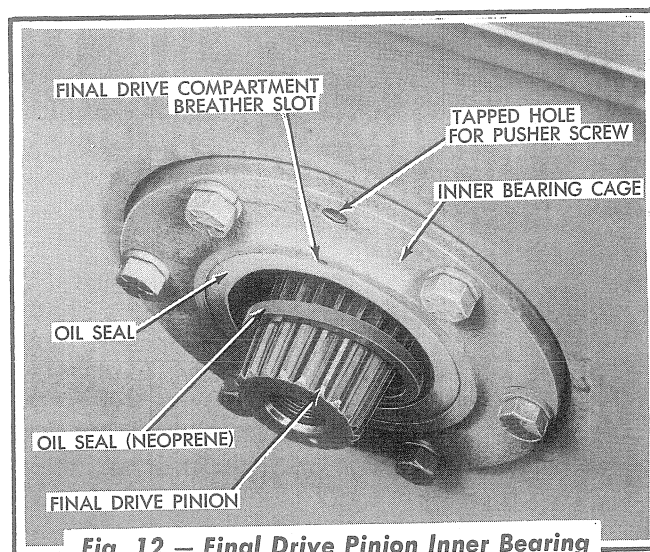


**Fig. 11 — Pulling Brake Drum Hub**

on which the final drive is being disassembled (refer to Section XI, Topic 2, Paragraph E).

2. Remove the final drive pinion as follows:

- a. Unlock the brake drum hub retaining capscrew. Loosen the hub retaining capscrew and back it out approximately  $\frac{1}{8}$ ", but do not remove it at this time. Using tools similar to the ones shown in Fig. 11, pull the brake drum hub until it is loose on the final drive pinion. Remove the puller tools, the retaining capscrew, capscrew lock, hub retaining washer, and the brake drum hub from the steering clutch compartment.



**Fig. 12 — Final Drive Pinion Inner Bearing Cage — Installed**

- b. Remove the capscrews attaching the final drive pinion inner bearing cage to the steering clutch and final drive housing. Using three  $\frac{1}{2}$ " NC pusher screws in the tapped holes in the bearing cage, pull the bearing cage, oil seal, and inner bearing cup from the housing as an assembly.
- c. Using two  $\frac{1}{2}$ " NC pusher screws in the tapped holes in the final drive pinion outer bearing cage (Fig. 8), remove the outer bearing cup, bearing adjustment shims, and the drive pinion outer bearing cage as an assembly. Tie the adjustment shims to the outer bearing cage to prevent loss.
- d. Pull the final drive pinion into the steering clutch compartment and remove.

### 3. CLEANING AND INSPECTION OF FINAL DRIVES

Clean and inspect all the parts thoroughly as described in pertinent pages in Section XX. Replace or recondition any damaged parts before assembling the final drive. **IMPORTANT:** When installing the final drive bearings on their respective shafts, make certain the bearings are pressed tightly against the shoulders on the shafts.

If replacement of the sprocket shaft outboard bearing is necessary, use tools similar to the ones shown in Fig. 13 to pull the bearing from the bearing cage.

If replacement of the bearings on the final drive pinion, the intermediate pinion, or the sprocket shaft is necessary, use tools similar to the one shown in Figs. 14 and 15 to remove and install the bearings.

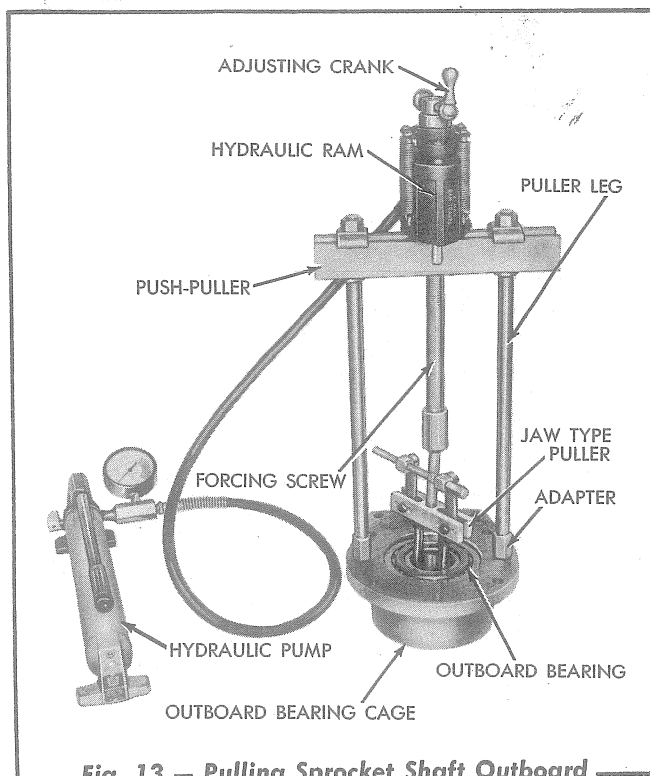


Fig. 13 — Pulling Sprocket Shaft Outboard Bearing from Bearing Cage

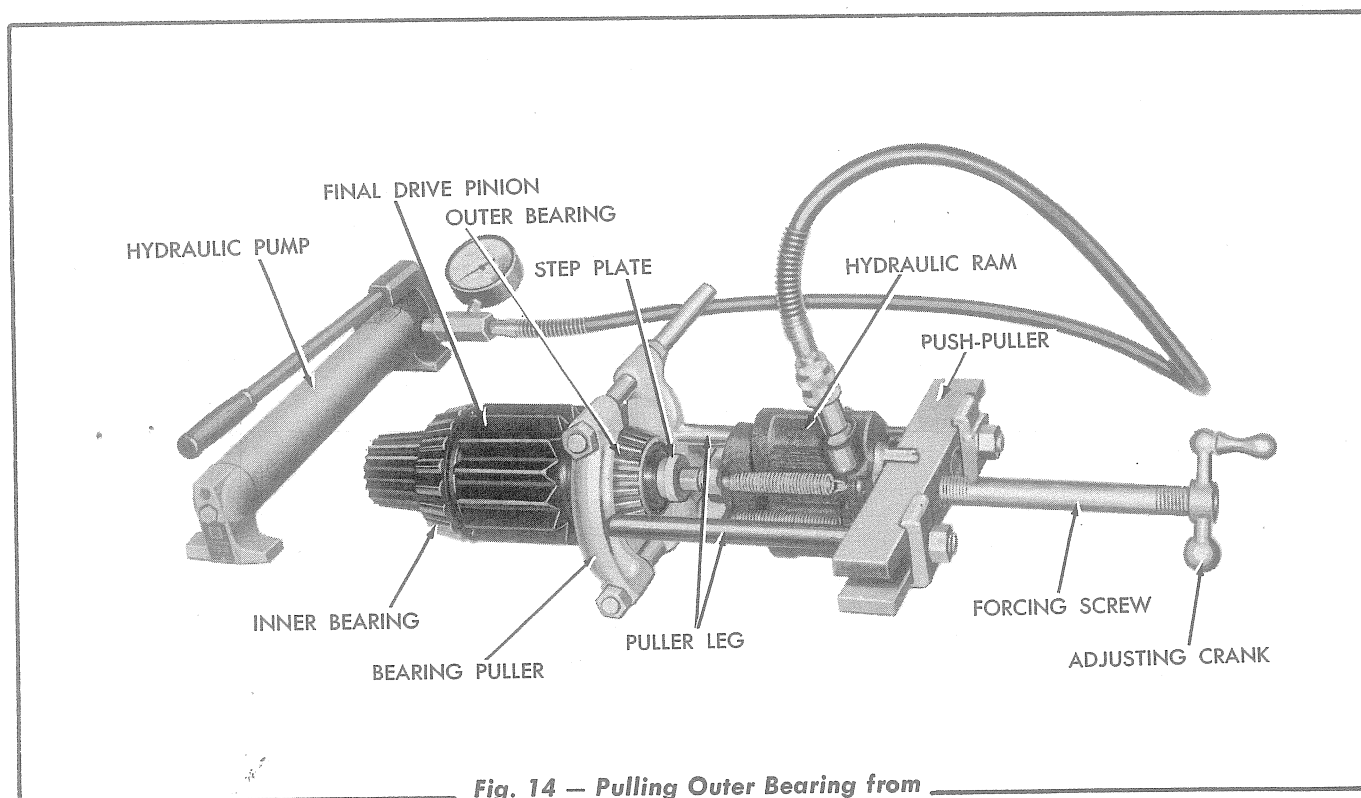
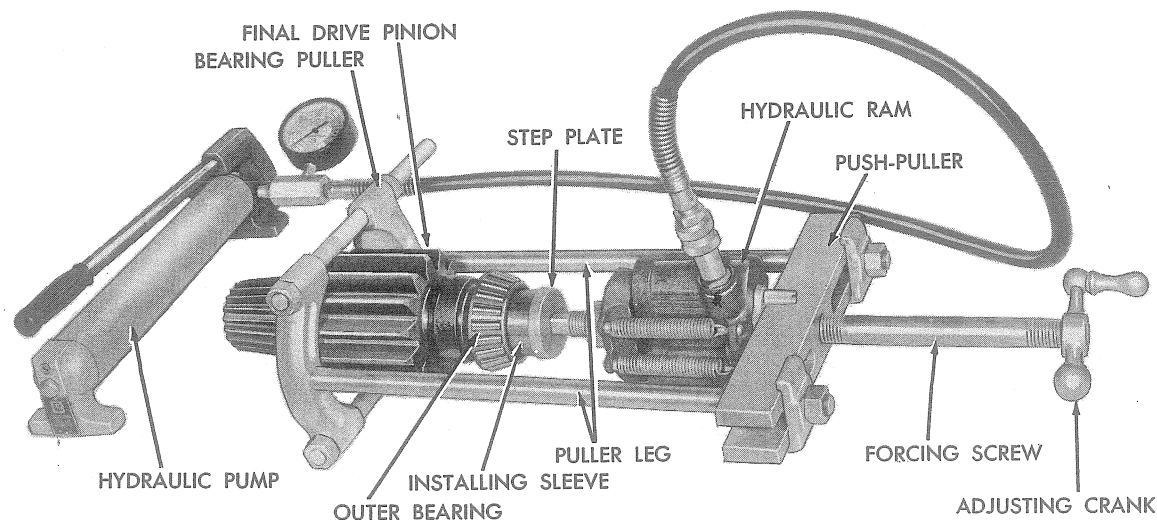


Fig. 14 — Pulling Outer Bearing from Final Drive Pinion



**Fig. 15 — Installing Outer Bearing On Final Drive Pinion**

## 4. ASSEMBLY OF FINAL DRIVES

If the seal assemblies for the sprocket shaft were removed, the seal assemblies (Figs. 1, 19, and 24) should be installed at this time so that the "Neoprene" cement, used for cementing the seal assemblies in place, will have sufficient time to dry.

### A. Installation of Sprocket Shaft Seal Assemblies

#### 1. Installation of Inner Seal Assembly

- a. Place the sprocket shaft intermediate bearing cage on a clean bench, with the flat face of the bearing cage up.
- b. Make certain the outer face of the intermediate bearing cage and the inner seal ring are clean and dry. Coat the outer machined surface of the intermediate bearing cage and one side of the seal ring gasket with "Neoprene" cement. Place the seal ring gasket onto the seal ring locating pins in the intermediate bearing cage. Cement the back face of an inner seal ring and the other face of the seal ring gasket and install the inner seal ring in position on the seal ring locating pins.

- c. Place a weight on the inner seal ring, using a clean cloth between the weight and the seal ring, and allow the "Neoprene" cement to dry and set thoroughly.
- d. Clean and dry the inner machined surface of the track sprocket, inner seal boot, inner seal follower assembly, and the other inner seal ring. Install the inner seal boot on the inner seal follower assembly, lining up the holes in the seal boot with the protruding pins of the follower assembly. Hold each lip of the seal boot out and coat the inside of the lips and the sides of the inner seal follower assembly with "Neoprene" cement. Press the boot lips back in place against the inner seal follower assembly.
- e. Coat the outer face of one lip of the inner seal boot and the inner machined surface of the track sprocket with "Neoprene" cement. Immediately place the inner seal boot and inner seal follower assembly over the hub of track sprocket and insert the protruding follower pins into the corresponding holes in the track sprocket.

- f. Coat the outer face of the inner seal ring and the other lip of the inner seal boot with "Neoprene" cement. Immediately place the inner seal ring on the inner seal boot and follower assembly, inserting the ends of the follower pins into the corresponding holes in the inner seal ring. Place a weight on the inner seal ring, using a clean cloth between the weight and the seal ring, and allow the "Neoprene" cement to dry and set thoroughly.

## 2. Installation of Outer Seal Assembly

- a. Place the sprocket retaining nut on a clean bench with the flat side down.
- b. Make certain the inner surface of the sprocket retaining nut, outer seal follower assembly, outer seal boot, and the outer seal rings are clean and dry. Install the outer seal boot on the outer seal follower assembly, lining up the holes in the boot with the protruding pins of the follower assembly. Hold each lip of the seal boot out and coat the inside of the lips and the sides of the outer seal follower assembly with "Neoprene" cement. Press the boot lips back in place against the outer seal follower assembly.
- c. Coat the outer face of one lip of the outer seal boot and the machined face in the bottom of the counterbore in the sprocket retaining nut with "Neoprene" cement.

Immediately place the seal boot and outer seal follower assembly into position in the sprocket retaining nut, inserting the ends of the follower pins into the corresponding holes in the sprocket retaining nut.

- d. Coat the face of the outer lip of the outer seal boot and the back face of an outer seal ring with "Neoprene" cement. Immediately place the outer seal ring on the seal boot and follower assembly, inserting the ends of the follower pins into the corresponding holes in the outer seal ring.
- e. Place a weight on the outer seal ring, using a clean cloth between the weight and the seal ring, and allow the "Neoprene" cement to dry and set thoroughly.
- f. Place the outboard bearing cage on a clean bench, with the cover attaching side down, and thoroughly clean and dry.
- g. Coat one side of the seal ring gasket and the machined face in the bottom of the counterbore in the outboard bearing cage with "Neoprene" cement. Immediately place the seal ring gasket in position on the seal ring locating pins in the outboard bearing cage, inserting the pins into the corresponding holes in the seal ring gasket. Coat the other side of the seal ring gasket and the back face of the other seal ring with "Neoprene" cement and immediately place the seal ring on the gasket, inserting

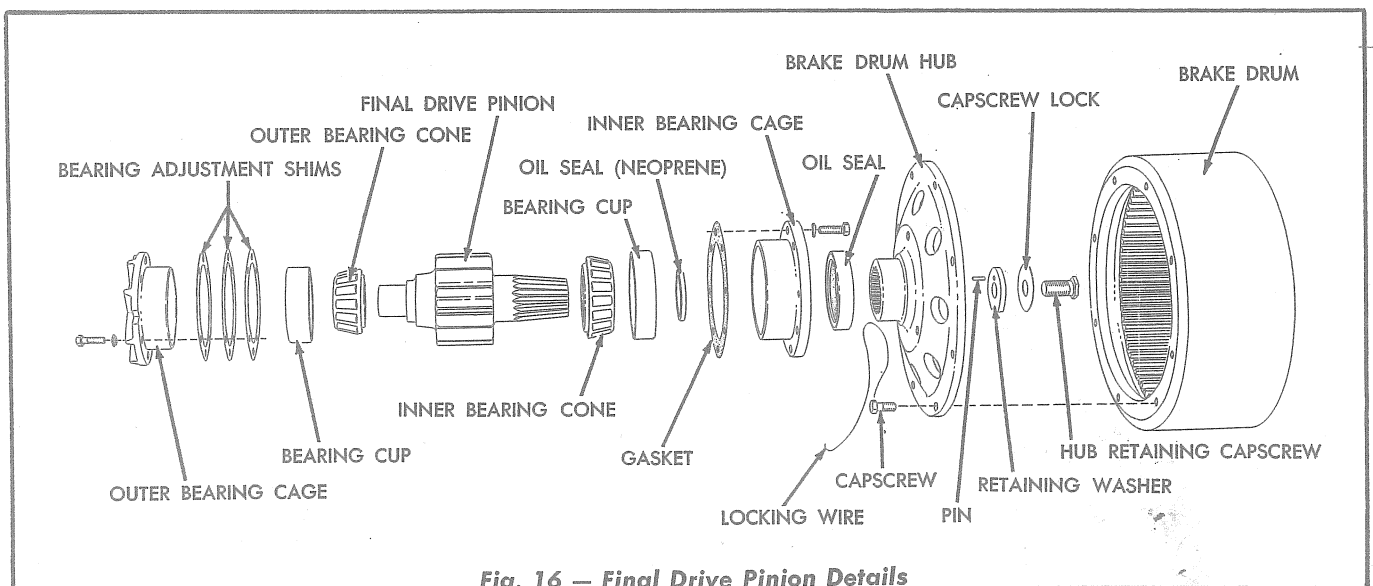


Fig. 16 — Final Drive Pinion Details

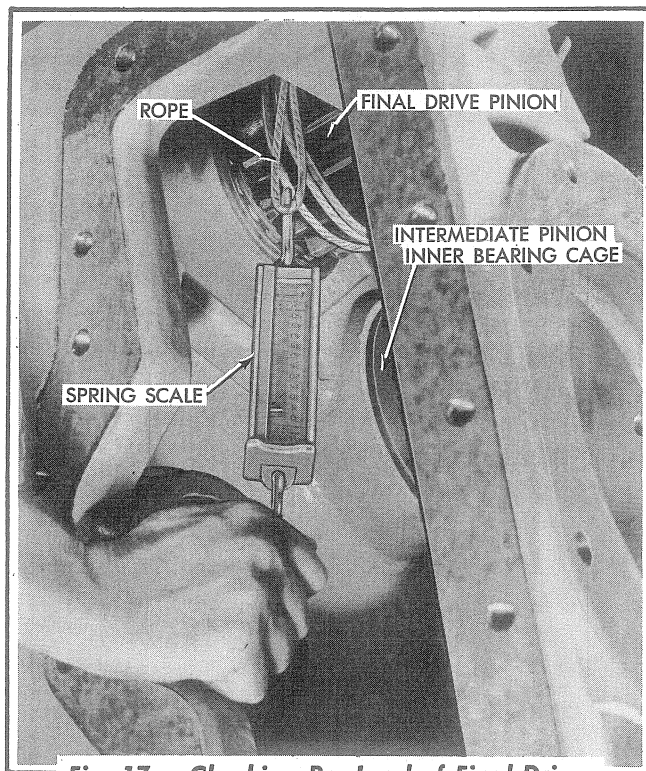
the ends of the pins into the corresponding holes in the seal ring. Place a weight on the outer seal ring, using a clean cloth between the weight and the seal ring, and allow the "Neoprene" cement to dry and set thoroughly.

**NOTE:** When coating the above parts with "Neoprene" cement, do not use an excessive amount. The "Neoprene" cement and solvent for thinning can be purchased from your "Allis-Chalmers" Construction Machinery Dealer.

## B. Installation and Bearing Adjustment of Final Drive Pinion

1. Install the drive pinion outer bearing cup in position in the outer bearing cage. Install the outer bearing cage in the bore of the housing, using the original amount of bearing adjustment shims between the bearing cage and the housing. Do not tighten the outer bearing cage retaining capscrews at this time. **NOTE:** It is very important that all adjustment shims be wiped clean and are free from burrs and nicks.
2. Lubricate the drive pinion bearings installed on the pinion, lower the pinion into the steering clutch compartment, and insert it into position in the final drive housing.
3. Install a new brake drum hub oil seal in position in the drive pinion inner bearing cage, with the sealing lip of the oil seal directed toward the drive pinion. Install the drive pinion inner bearing cup in position in the inner bearing cage.
4. Use a new gasket and install the drive pinion inner bearing cage in position in the housing and tighten the capscrews for both bearing cages to a torque of 70 to 90 lbs. ft. **NOTE:** The inner bearing cage contains a slot as shown in Fig. 12 which acts as a breather in the final drive housing. When the inner bearing cage is installed the slot is located at the top. Bump the outer bearing cage to make certain the

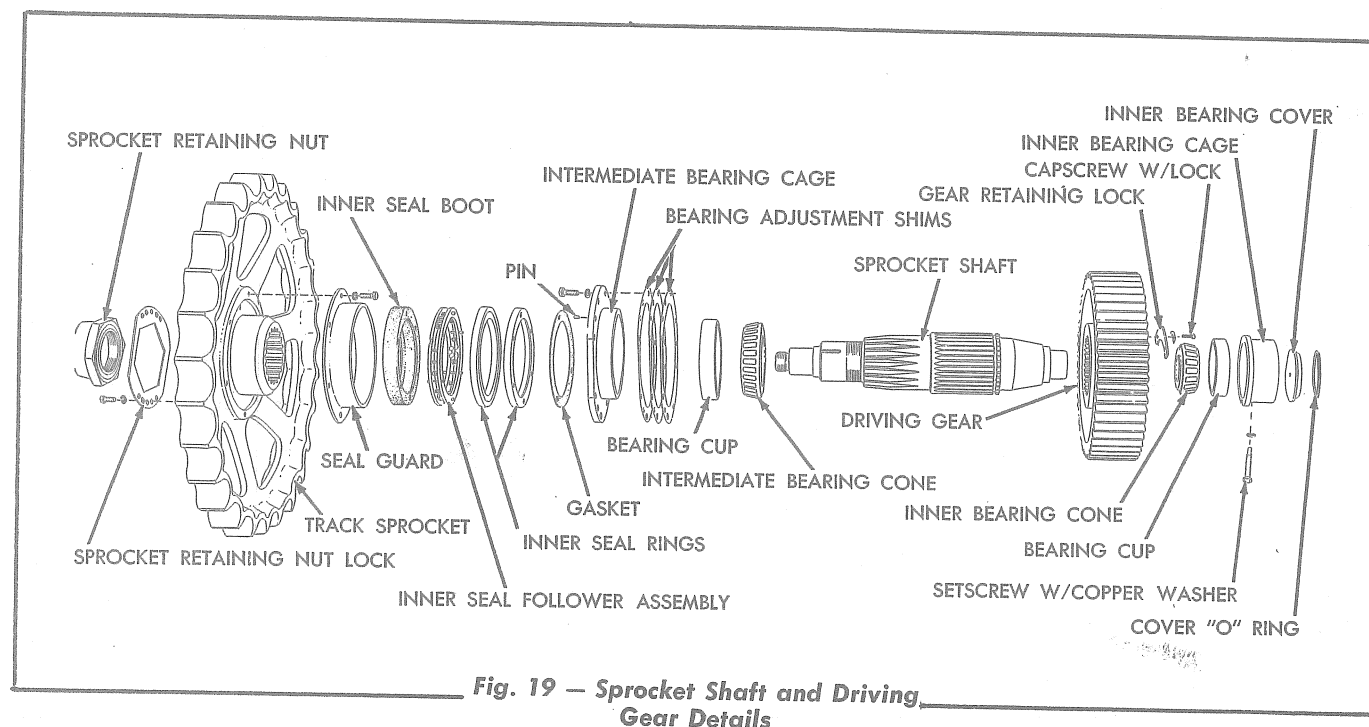
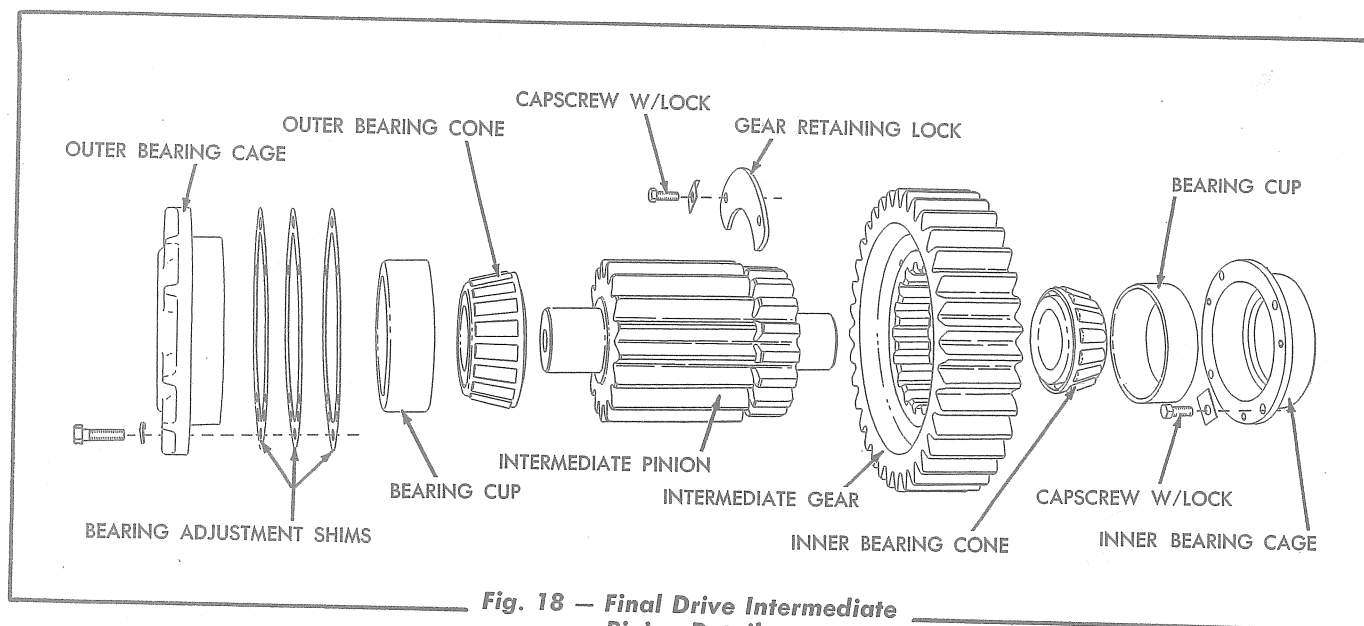
bearings are properly seated, then check the bearing pre-load.



**Fig. 17 — Checking Pre-Load of Final Drive Pinion Bearings**

5. The drive pinion bearings are properly adjusted when they have a pre-load of 10 to 20 lbs. in. or when they are adjusted .002" to .003" tight. A spring scale may be used to weigh the bearing pre-load as shown in Fig. 17.
6. To check the pre-load of the final drive pinion bearings, proceed as follows:
  - a. Use a length of heavy cord or light rope and wind the rope around the drive pinion several times at the pinion teeth location. Tie a loop in the free end of the rope and hook the spring scale in the loop. Pull on the spring scale and note the pounds pull required to revolve the final drive pinion. A pull of approximately 4 to 7 pounds shown on the spring scale is required to indicate that the bearings are adjusted to the specified 10 to 20 lbs. in. pre-load.
  - b. Add or remove bearing adjustment shims as necessary to obtain the speci-





fied pre-load. When adjusting, bump the outer bearing cage to make certain the bearings are properly seated.

7. Install a new pinion shaft oil seal "Neoprene" on the inner end of the pinion shaft. Install the brake drum hub, hub retaining washer, capscrew lock, and the hub retaining capscrew. Tighten the retaining capscrew to a torque of 300 lbs. ft. Lock the capscrew securely with the capscrew lock.

### C. Adjustment of Final Drive Intermediate Pinion and Sprocket Shaft Bearings

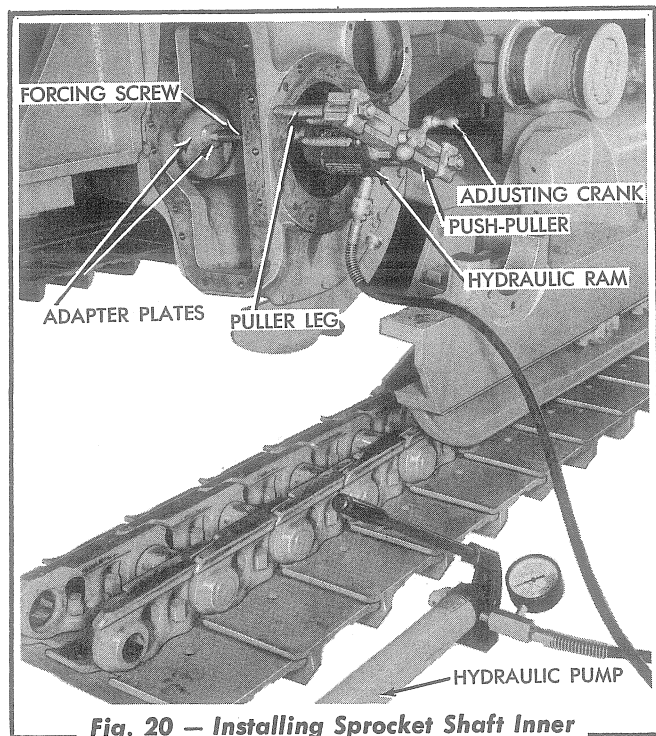
**NOTE:** Before installing the intermediate pinion and the sprocket shaft in the final drive housing, the intermediate pinion bearings and the sprocket shaft bearings **MUST** be adjusted to the specified bearing pre-load. It is very important that all adjustment shims be wiped clean and are free from burrs and nicks.

## 1. Adjustment of Final Drive Intermediate Pinion Bearings

- a. Install the intermediate pinion bearing cup in the inner bearing cage and install the cage in position in the housing. Secure the cage to the housing with capscrews and capscrew locks (Fig. 8). Install the bearings on the intermediate pinion using tools similar to those shown in Fig. 15.
- b. Lubricate the intermediate pinion bearings and insert the intermediate pinion (without the intermediate gear) into position in the housing. Install the bearing cup in the outer bearing cage. Install the outer bearing cage in the housing, using the original amount of bearing adjustment shims. Install and tighten the outer bearing cage attaching capscrews.
- c. The intermediate pinion bearings are properly adjusted when they have a pre-load of 10 to 20 lbs. in. or when they are adjusted .002" to .003" tight.
- d. To check the pre-load of the final drive intermediate pinion bearings, proceed as follows:
  - (1) Use a length of heavy cord or light rope (similar to that shown in Fig. 17) and wind the rope around the intermediate pinion several times at the pinion teeth location. Tie a loop in the free end of the rope and hook the spring scale in the loop. Pull on the spring scale and note the pounds pull required to revolve the intermediate pinion. A pull of approximately 3 to 6 pounds shown on the spring scale is required to indicate that the bearings are adjusted to the specified 10 to 20 lbs. in. pre-load.
  - (2) Add or remove bearing adjustment shims as necessary to obtain the specified pre-load. When adjusting, bump the outer bearing cage to make certain the bearings are properly seated.

## 2. Adjustment of Sprocket Shaft Bearings

- a. Install the inner bearing cover "O" ring ("Neoprene") in position on the sprocket shaft inner bearing cover. Start the inner bearing cover and "O" ring into position in the bore of the final drive housing by tapping with a hammer. Install the bearing cup into position in the inner bearing cage and, using tools similar to the ones shown in Fig. 20, press the inner bearing cage and inner bearing cover into position in the final drive housing. **NOTE: When installing the bearing cage, make certain the slot in the cage is aligned with the bearing cage setscrew (Fig. 8).**

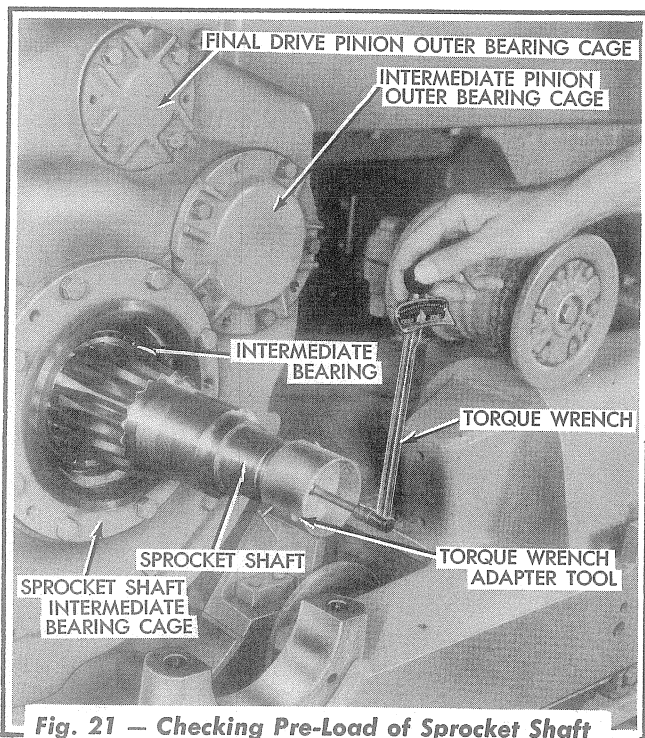


**Fig. 20 — Installing Sprocket Shaft Inner Bearing Cage**

- b. Install the intermediate and the inner bearing cones on the sprocket shaft using tools similar to those shown in Fig. 15. Lubricate the bearings and insert the sprocket shaft (without the driving gear) into position in the final drive housing. Install the bearing cup in the intermediate bearing cage. Install the intermediate bearing cage, with the bearing cup, using the original amount of bearing adjustment shims and install and tighten the attaching capscrews.



- c. A special torque wrench adapter tool and an inch pound torque indicating wrench, similar to the ones shown in Fig. 21, may be used to check the bearing pre-load. The sprocket shaft bearings (inner and intermediate) are properly adjusted when they have 10 to 20 lbs. in. pre-load, or when they are adjusted .002" to .003" tight. Add or remove bearing adjustment shims to obtain the proper pre-load. When adjusting, bump the intermediate bearing cage to make certain the bearings are properly seated.



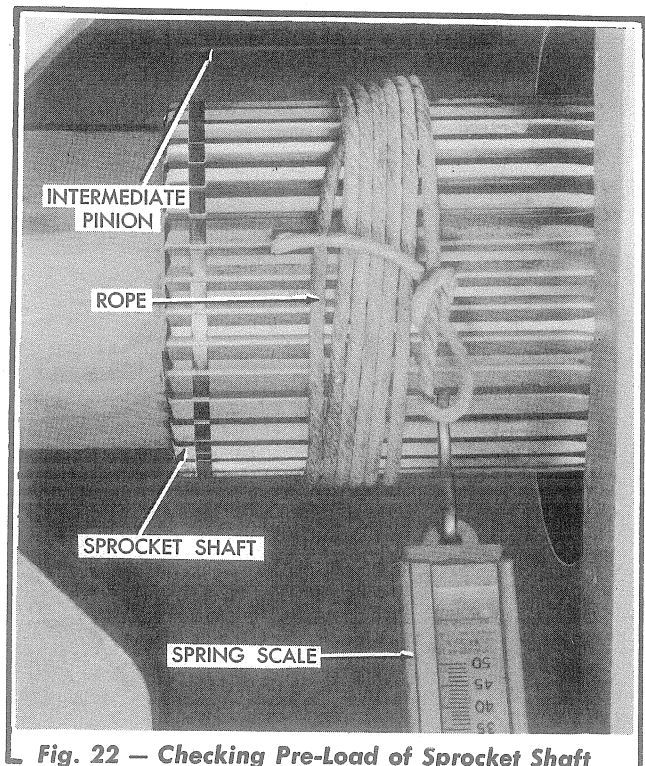
**Fig. 21 — Checking Pre-Load of Sprocket Shaft Bearings Using Torque Indicating Wrench**

- d. If a torque indicating wrench and torque wrench adapter tool are not available, a spring scale may be used to weigh the bearing pre-load as shown in Fig. 22. Proceed as follows:

- (1) Use a length of heavy cord or light rope and wind the rope around the sprocket shaft several times at the driving gear splines location. Tie a loop in the free end of the rope and hook the spring scale in the loop. Pull on the spring scale and note the pounds pull required to revolve the sprocket shaft. A pull of approximately 4 to 6 pounds shown on

the spring scale is required to indicate that the bearings are adjusted to the specified 10 to 20 lbs. in. pre-load.

- (2) Add or remove bearing adjustment shims as necessary to obtain the specified pre-load. When adjusting, bump the intermediate bearing cage to make certain the bearings are properly seated.



**Fig. 22 — Checking Pre-Load of Sprocket Shaft Bearings Using Spring Scale**

- e. Remove the sprocket shaft intermediate bearing cage and the bearing cup as an assembly. Keep the bearing adjustment shim pack with the intermediate bearing cage. Remove the sprocket shaft with bearings. **IMPORTANT: Keep the bearings clean.**

#### **D. Installation of Final Drive Intermediate Pinion and Gear**

1. Remove the final drive intermediate pinion outer bearing cage, as described in Topic 2, Paragraph B in this Section. Keep the bearing adjustment shims with the outer bearing cage. Remove the intermediate pinion using a tool similar to the one shown in Fig. 10. **IMPORTANT: Keep the bearings clean.**

2. Place the intermediate gear in the housing (with the lock side of the gear toward the outer side of the housing). Raise and block the gear in place with suitable blocking. Lubricate the intermediate pinion bearings and insert the intermediate pinion into position in the housing and the intermediate gear.

3. Working through the opening in the rear of the final drive housing, use a bar and raise the intermediate pinion and gear so that the outer bearing cage can be installed. Install the outer bearing cage in the housing, using the correct amount of

bearing adjustment shims as determined previously in Paragraph C, Step 1 above. When installing the outer bearing cage, install it in the housing just far enough to start the attaching capscrews. Use a bar and move the intermediate pinion out against the outer bearing cage. Insert the two gear retaining locks in place in the groove in the pinion, then move the pinion back until the locks are against the gear and install the capscrews and capscrew locks to secure the gear retaining locks to the gear. Tighten the capscrews securely and lock the capscrews with the capscrew locks.

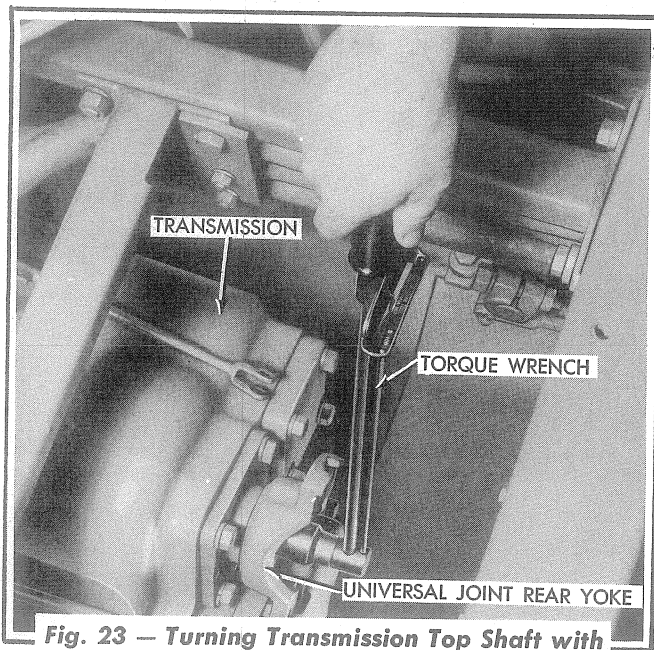
4. Tighten the outer bearing cage attaching capscrews to a torque of 70 to 90 lbs. ft. if the bearing cage has  $\frac{1}{2}$ " NF capscrews or 150 to 165 lbs. ft. if the bearing cage has  $\frac{5}{8}$ " NF capscrews.

### **E. Installation of Sprocket Shaft and Track Sprocket**

1. Install the sprocket shaft driving gear (with the lock side of the gear toward the inner bearing cup) in the housing and block the gear in position.
2. Lubricate the sprocket shaft bearings and insert the sprocket shaft into the bore in the housing and the driving gear. Push the sprocket shaft in so that the inner bearing is in position in the bearing cup. Install the

sprocket shaft intermediate bearing cage, with the seal assembly attached, using the correct amount of bearing adjustment shims as determined previously in Paragraph C, Step 2 above. Tighten the intermediate bearing cage attaching capscrews to a torque of 150 to 165 lbs. ft.

3. Position the driving gear on the shaft so that the gear retaining locks may be installed. Install the gear retaining locks, capscrews, and capscrew locks. Tighten the capscrews and secure with the capscrew locks. Install the final drive compartment cover gasket and cover; tighten the attaching capscrews securely.
4. Install the steering clutch and steering brake (refer to Section XI, Topic 2, Paragraph I).
5. Install the seal guard in position on the track sprocket. Lubricate the mating surfaces of the seal rings of the inner seal assembly, then install the track sprocket (with the seal ring in place) on the sprocket shaft. Coat the back face of the sprocket retaining nut (face which contacts the sprocket) with gasket cement or sealing compound. Make certain the oil grooves in the track sprocket retaining nut are not obstructed with the gasket cement or sealing compound, then install the nut. Tighten the sprocket retaining nut to a torque of 4500 to 5000 lbs. ft. This may be accomplished by using the reduction of the transmission and final drive when tightening. With the opposite steering clutch throwout yoke blocked in the disengaged position as outlined in Topic 2, Paragraph A, Step 8 in this Section, proceed as follows:
  - a. Remove the seat cushions, seat frame, and tool box.
  - b. Remove the center floor plate and the front center floor plate. Disconnect the retracting springs and the front and rear ends of the steering clutch lower rear control rods and remove the control rods. Remove the universal joint assembly.



**Fig. 23 — Turning Transmission Top Shaft with Torque Indicating Wrench to Tighten Track Sprocket Retaining Nut**

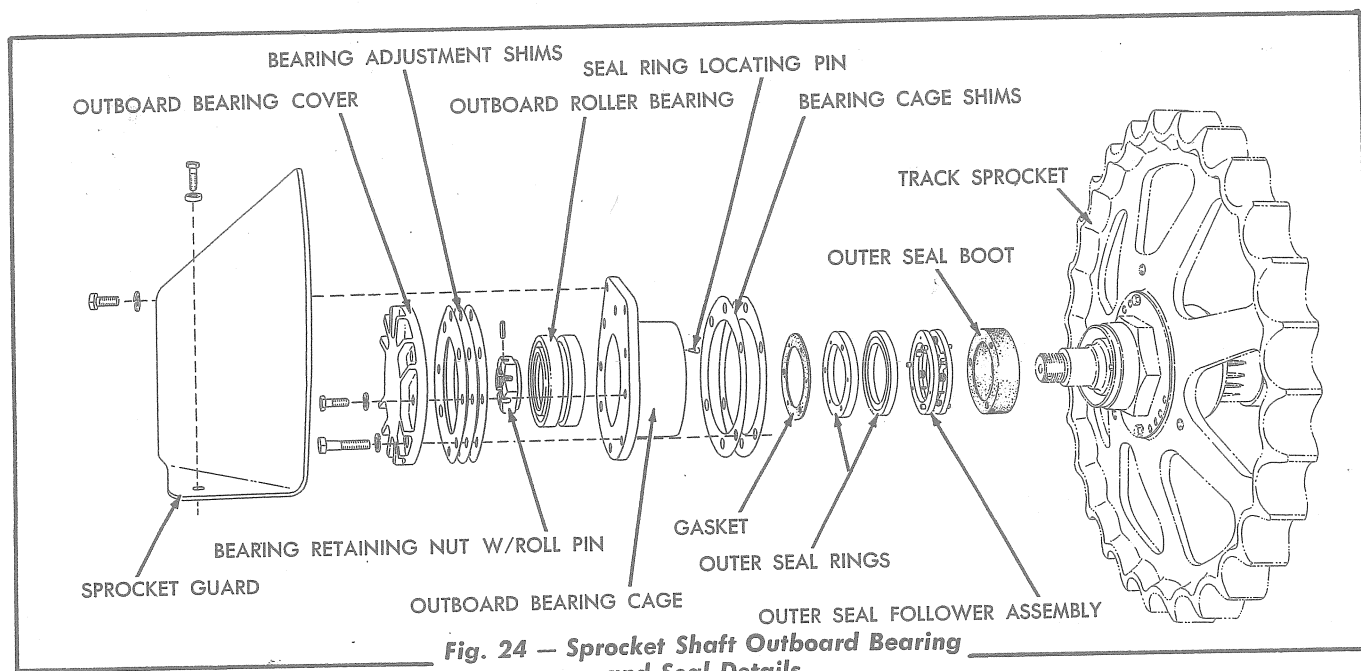
- c. When tightening the left track sprocket retaining nut, place a wrench on the retaining nut and place a block of wood between the wrench handle and the top of the truck frame to hold the wrench in position. When tightening the right track sprocket retaining nut, place a wrench on the nut and place a block of wood on the ground (in back of the tractor) so that the wrench handle will rest on the block.
- d. To tighten the left track sprocket retaining nut on tractors without a torque converter, move the transmission "HI-LO" shift lever forward to the low range position and move the transmission speed selection shift lever to its low range position. Using a pound foot torque indicating wrench on the universal joint rear yoke retaining cap-screw, turn the transmission top shaft counterclockwise (viewed from the seat) to a torque of 42 to 48 lbs. ft. This will impose a torque of 4500 to 5000 lbs. ft. on the sprocket retaining nut.
- e. To tighten the left track sprocket retaining nut on tractors with a torque converter, move the transmission speed selection shift lever to its low speed

position. Using a pound foot torque indicating wrench on the universal joint rear yoke retaining cap-screw, turn the transmission top shaft counterclockwise (viewed from the seat) to a torque of 76 to 86 lbs. ft. This will impose a torque of 4500 to 5000 lbs. ft. on the sprocket retaining nut.

- f. To tighten the right track sprocket retaining nut on tractors without a torque converter move the transmission "HI-LO" shift lever to either the high range or low range position and move the transmission speed selection shift lever to its low reverse range position. Using a pound foot torque indicating wrench on the universal joint rear yoke retaining cap-screw, turn the transmission top shaft counterclockwise (viewed from the seat) to a torque of 45 to 51 lbs. ft. This will impose a torque of 4500 to 5000 lbs. ft. on the sprocket retaining nut.
- g. To tighten the right track sprocket retaining nut on tractors with a torque converter, move the transmission speed selection shift lever to its low reverse range position. Using a pound foot torque indicating wrench on the universal joint rear yoke retaining cap-screw, turn the transmission top shaft counterclockwise (viewed from the seat) to a torque of 97 to 110 lbs. ft. This will impose a torque of 4500 to 5000 lbs. ft. on the sprocket retaining nut.

**IMPORTANT:** When tightening the track sprocket retaining nut, use a sledge hammer and strike the sprocket several times during the tightening procedure, as close to the hub as possible to make certain the sprocket is firmly seated on the shaft.

- h. Install the sprocket retaining nut lock and secure with the attaching cap-screws.
- i. Install the universal joint assembly,



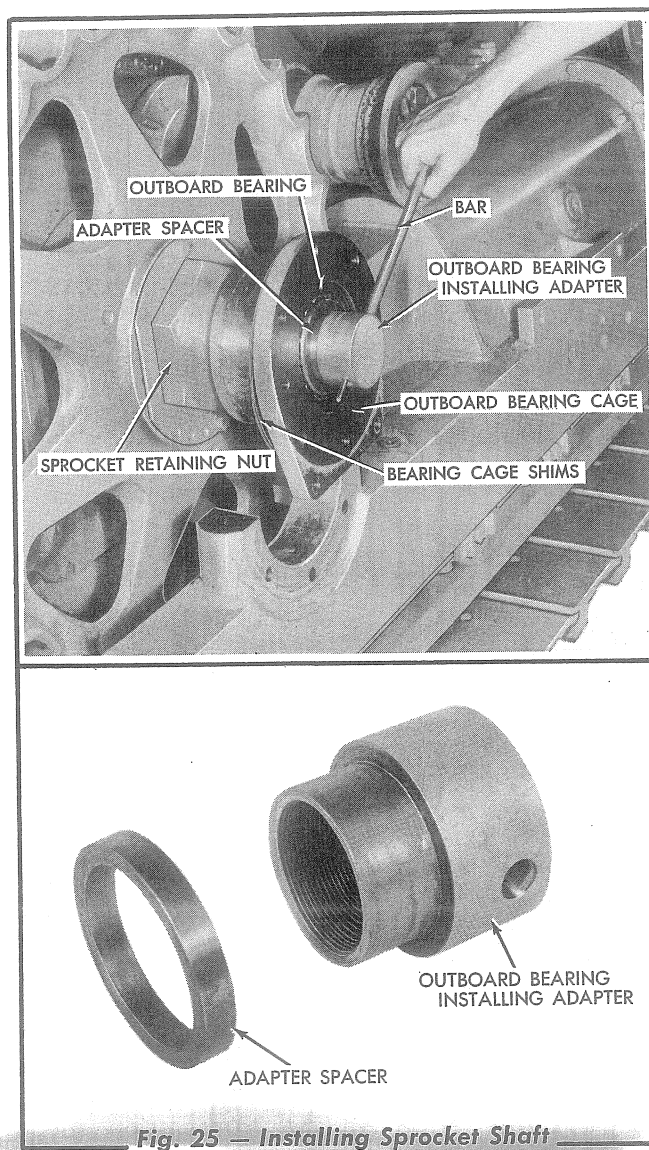
steering clutch lower control rods, and floor plates. Install the tool box, seat frame, and seat cushions.

- j. Remove the block used to hold the steering clutch in the disengaged position as described in Topic 2, Paragraph A, Step 8 in this Section.

## F. Installation of Sprocket Shaft Outboard Bearing

1. Roll the truck frame back into position under the tractor.
2. Place the original amount of bearing cage shims in position on the outboard bearing cage. With the outer seal assembly and the outboard bearing in place in the outboard bearing cage, use an outboard bearing installing adapter similar to the one shown in Fig. 25, and press the bearing and bearing cage onto the sprocket shaft to a position allowing approximately  $\frac{1}{4}$ " to  $\frac{3}{8}$ " clearance between the outer seal rings. Remove the installing adapter. Lubricate the outboard bearing with clean oil.

**IMPORTANT:** Do not press the outboard bearing and bearing cage onto the shaft to a position far enough to allow the outer



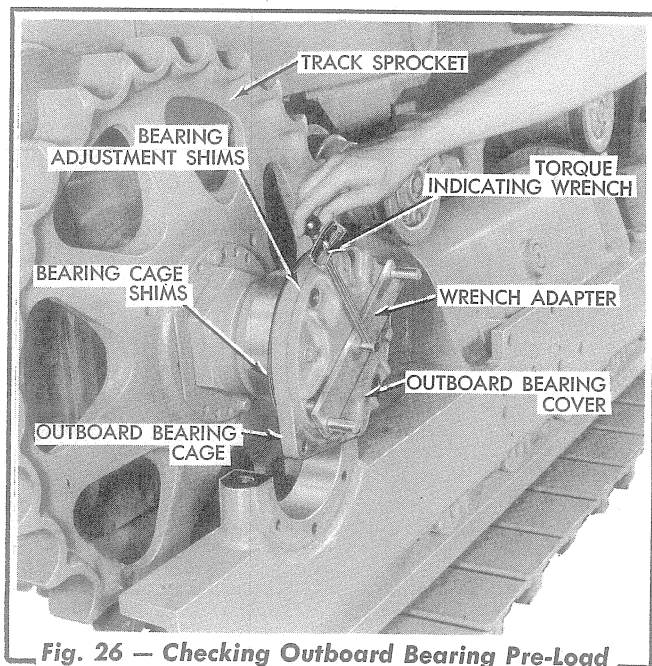


seal rings to contact each other, as this will cause a drag between the rings and a false reading will be obtained when adjusting for the proper pre-load of the bearing.

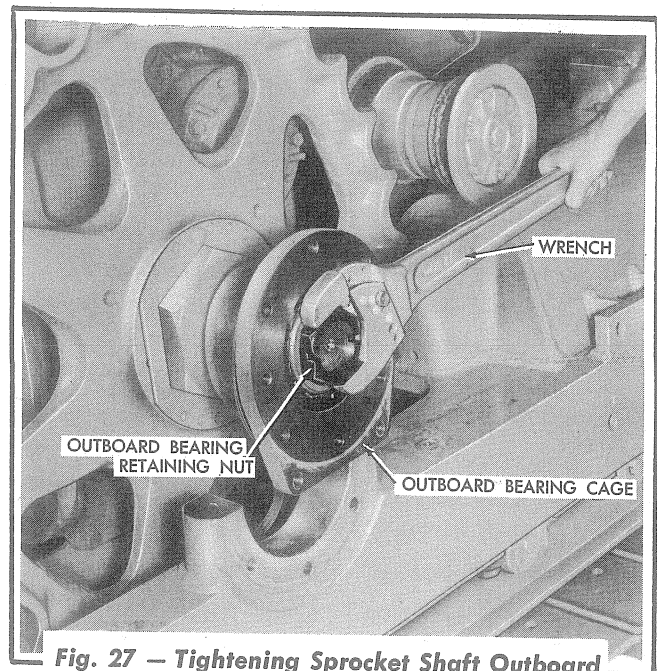
3. Install the sprocket shaft outboard bearing cover, using the original amount of outboard bearing adjustment shims.
4. The outboard bearing is correctly adjusted when it has 19 to 25 lbs. in. pre-load or is adjusted .001" to .002" tight. Using tools similar to those shown in Fig. 26, check the bearing pre-load as follows: Turn the outboard bearing cage so that the extended portion of the cage flange, used for attaching the track sprocket guard, is down. Install the outboard bearing cage torque wrench adapter in position on the outboard bearing cover. Using a pounds inch torque

indicating wrench, oscillate the outboard bearing cage approximately 30° in either direction and note the maximum reading indicated on the torque indicating wrench. Add or remove outboard bearing adjustment shims until the specified outboard bearing pre-load of 19 to 25 lbs. in. is obtained.

5. After the proper amount of bearing adjustment shims have been determined, remove the sprocket shaft outboard bearing cover



**Fig. 26 — Checking Outboard Bearing Pre-Load Using Torque Indicating Wrench**



**Fig. 27 — Tightening Sprocket Shaft Outboard Bearing Retaining Nut**

and the bearing adjustment shims. Lubricate the mating surfaces of the outer seal rings, then install the outboard bearing retaining nut. Tighten the nut securely using a wrench similar to the one shown in Fig. 27. When tightening the nut, the bearing and bearing cage will be pressed onto the shaft the remaining distance. Install the roll pin to lock the retaining nut.

6. Install the sprocket shaft outboard bearing cover and the proper amount of outboard bearing adjustment shims, determined in Step 4, above. Install and tighten the cover attaching capscrews.

## **G. Installation of Truck Frame and Track**

1. Remove the blocking and lower the tractor onto the truck frame, making certain that the truck frame is positioned correctly under the tractor so that the lower end of the lubricating wick for the truck frame pivot shaft enters the hole near the inner end of the pivot shaft. **CAUTION:** Each truck frame pivot shaft and bushing is lubricated by a wick assembly that also serves as a dowel pin for locating the pivot shaft to the steering clutch and final drive housing. When lowering the tractor onto the pivot shaft, care **MUST** be used to prevent damaging

the lower end of the lubricating wick assembly. Misalignment of the truck frame and abnormal wear of the pivot shaft and bushing will result from a damaged lubricating wick assembly.

2. Start the two 1" NF x 5 $\frac{1}{4}$ " capscrews to attach the sprocket shaft bearing cap (Fig. 28) to the truck frame but do not tighten at this time.
3. The truck frame pivot shaft caps and the pivot shaft brackets (welded to the steering clutch and final drive housing) are center-punched on the rear side for identification, as the caps *MUST* be installed in their original positions. Install each pivot shaft cap in its original position, and tighten the cap attaching capscrews to a torque of 475 to 495 lbs. ft.
4. Install and tighten the capscrews attaching the outboard bearing cover and cage to the truck frame. Install and tighten the capscrews attaching the outboard bearing cover and cage to the sprocket shaft bearing cap. Securely tighten the capscrews attaching the sprocket shaft bearing cap

to the truck frame.

5. Check the clearance between the truck frame pivot arm and the pivot shaft caps; a clearance of  $\frac{1}{16}$ " (+ or -  $\frac{1}{64}$ ") should be obtained between the pivot arm and either of the pivot shaft caps, refer to Fig. 1. If the proper clearance is not obtained at this point, add or remove outboard bearing cage shims between the outboard bearing cage and the truck frame to obtain the specified clearance.
6. Install the sprocket guard on the truck frame and outboard bearing cage.
7. Install the capscrews to attach the equalizing spring seat to the truck frame and tighten securely.
8. Install the oil drain plug in the final drive compartment and fill the final drive compartment to the proper level using the specified lubricant (refer to Section I, Topic 3).
9. Refer to Section XVI, Topic 2, Paragraph C and install the track.

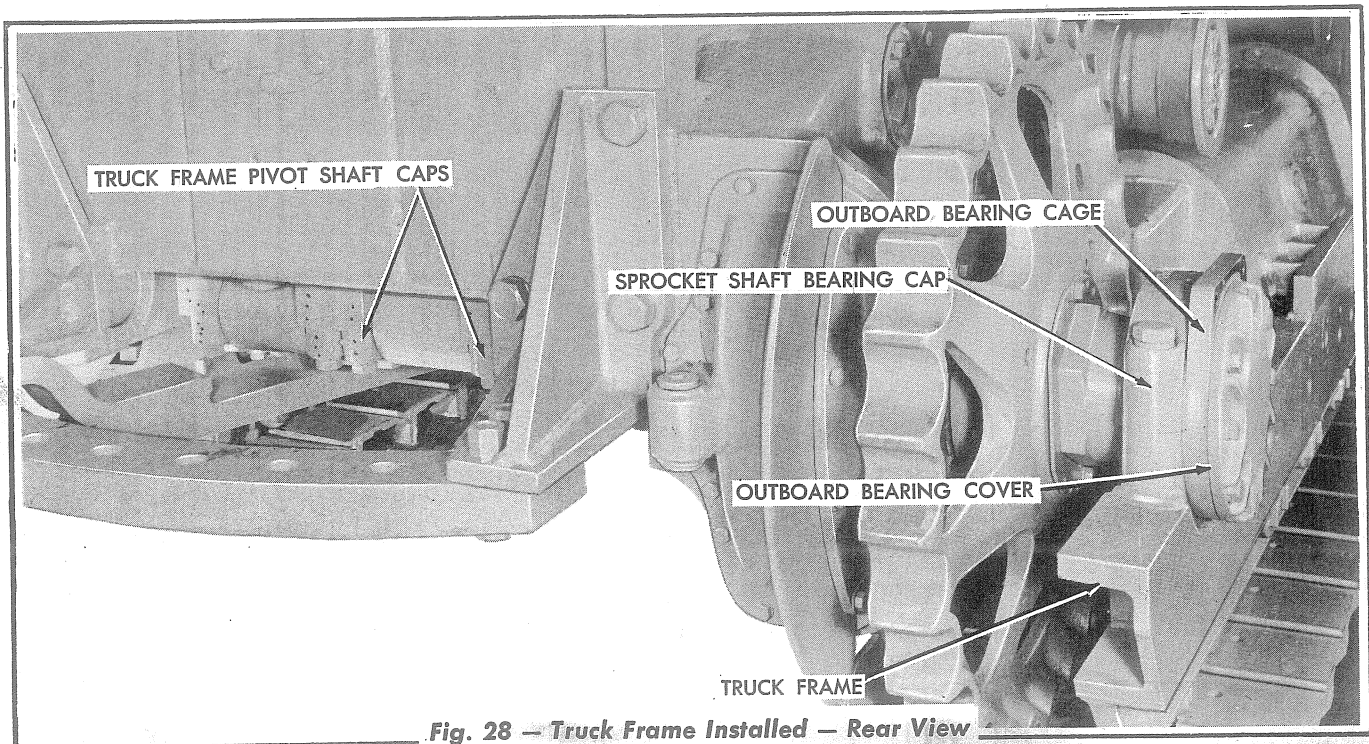


Fig. 28 — Truck Frame Installed — Rear View