

## SECTION X — TRANSMISSION AND BEVEL GEAR

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### 1. GENERAL DESCRIPTION

Power from the engine is transmitted through the engine clutch and the universal joint assembly to the transmission. From the transmission, power is transmitted to the bevel gear, and from the bevel gear through the steering clutches, to the final drives and the track sprockets.

The transmission case is attached to the front of the steering clutch and final drive housing with capscrews. The transmission case is piloted into the

steering clutch and final drive housing by a boss, located on the rear of the transmission case. This boss also serves as a bearing retainer for the bevel pinion shaft rear ball bearing.

A fixed gear reduction is made between the bevel pinion shaft and the bevel gear to the final drive gears; further reduction for power or speed change is obtained by shifting the transmission gears.

### 2. TRANSMISSION

#### A. Description

The transmission is, in effect, a speed reduction unit to provide the proper ratio for the required speed or power for operation of the tractor. The transmission in the Standard Model HD-6A and HD-6B Tractors provides one reverse and five forward speeds. The transmission in the Model HD-6G Tractor (optional for the HD-6A and HD-6B) provides two reverse and four forward speeds. The speed changes of the transmission are obtained by the use of sliding gears on the bevel pinion shaft. Reversal of direction is accomplished by meshing the low speed and reverse gear on the bevel pinion shaft with the reverse gear on the reverse gear shaft.

The sliding gears on the bevel pinion shaft are shifted into mesh by shifting forks actuated by the gear shift lever. They are located for proper mesh by detent notches in the gear shifting shafts and detent balls (steel balls) in the transmission case.

The sliding gears are locked in mesh by a locking mechanism consisting of a plunger attached to, and actuated by a lever located on the engine clutch shifting yoke shaft. The gears are locked in mesh when the engine clutch is fully engaged and cannot be shifted out of mesh until the engine clutch is disengaged.

The transmission top shaft is supported by a ball bearing at the front end and a roller bearing at the rear end. The front end of the bevel pinion shaft is supported by a roller bearing, located inside the transmission input shaft, and is supported at the rear end by a double row ball bearing.

The transmission input shaft is supported by two ball bearings, one located in the gear shift lever housing attached to the front of the transmission case, and the other retained in the rear bore of the transmission case. The transmission input shaft is connected to the engine clutch shaft by a universal joint assembly.

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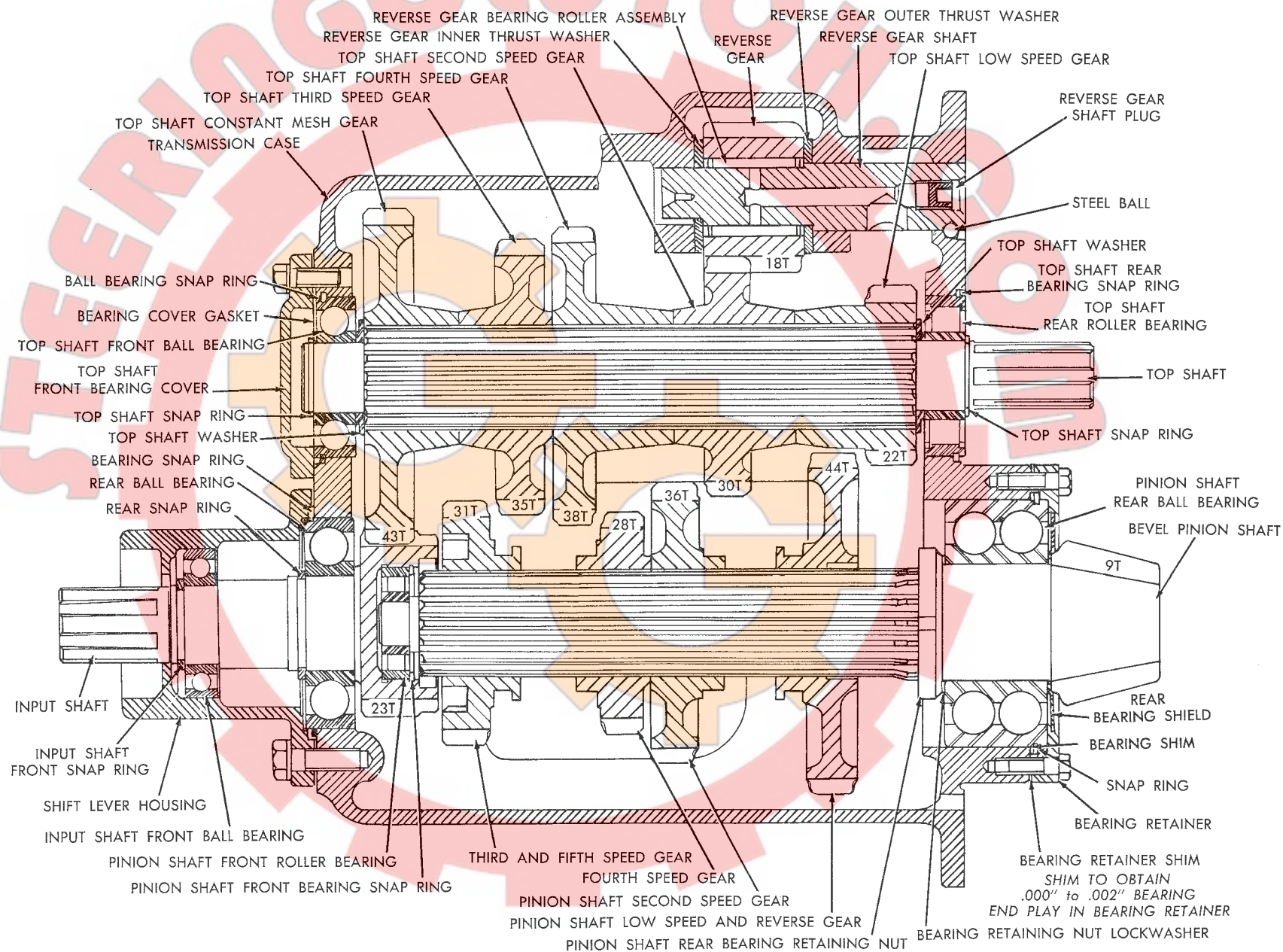


Fig. 1 — Transmission — Sectional View  
 (Standard — One Speed Reverse)



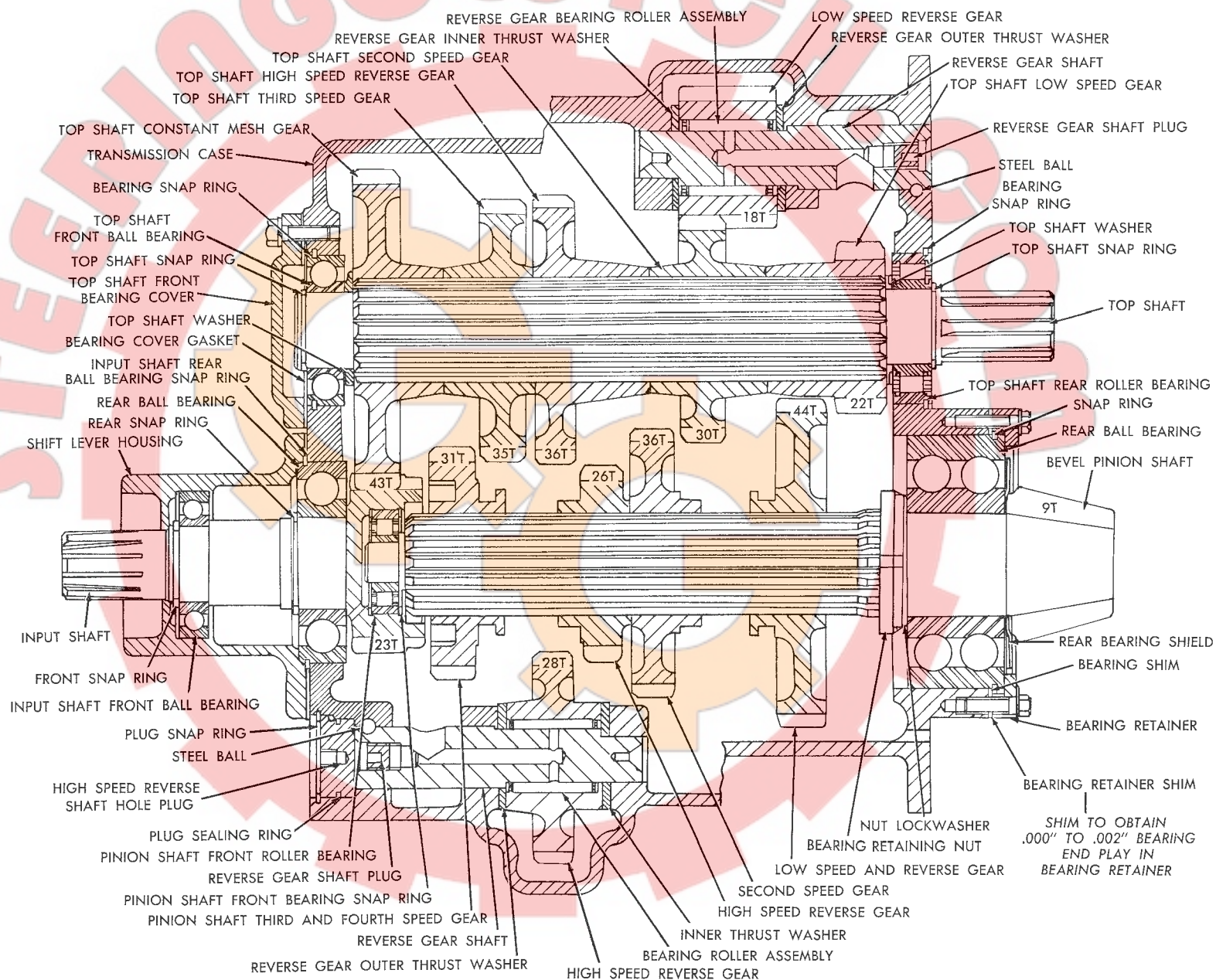
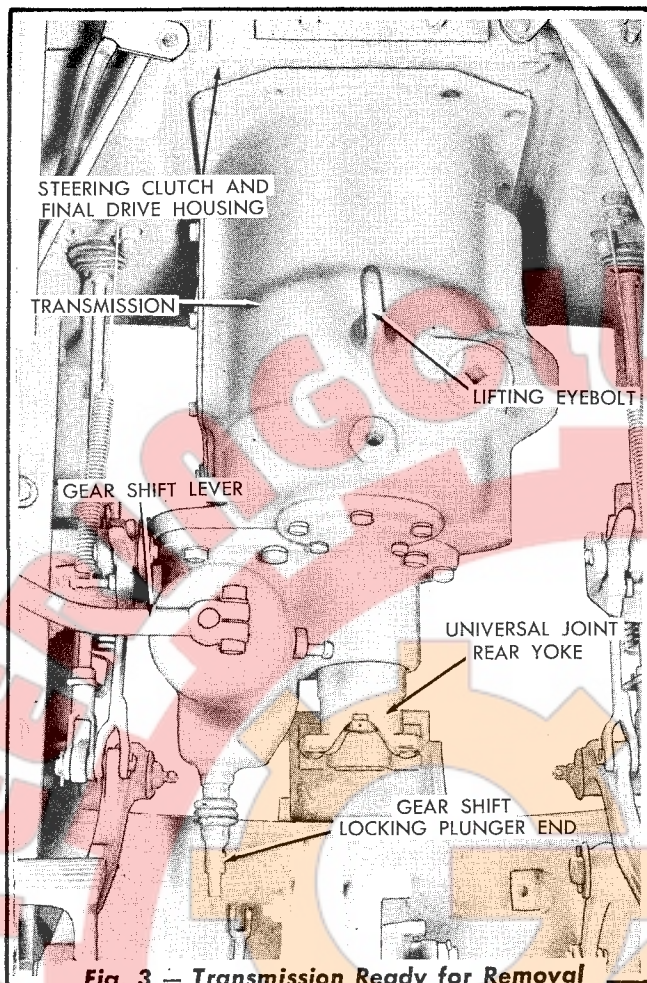


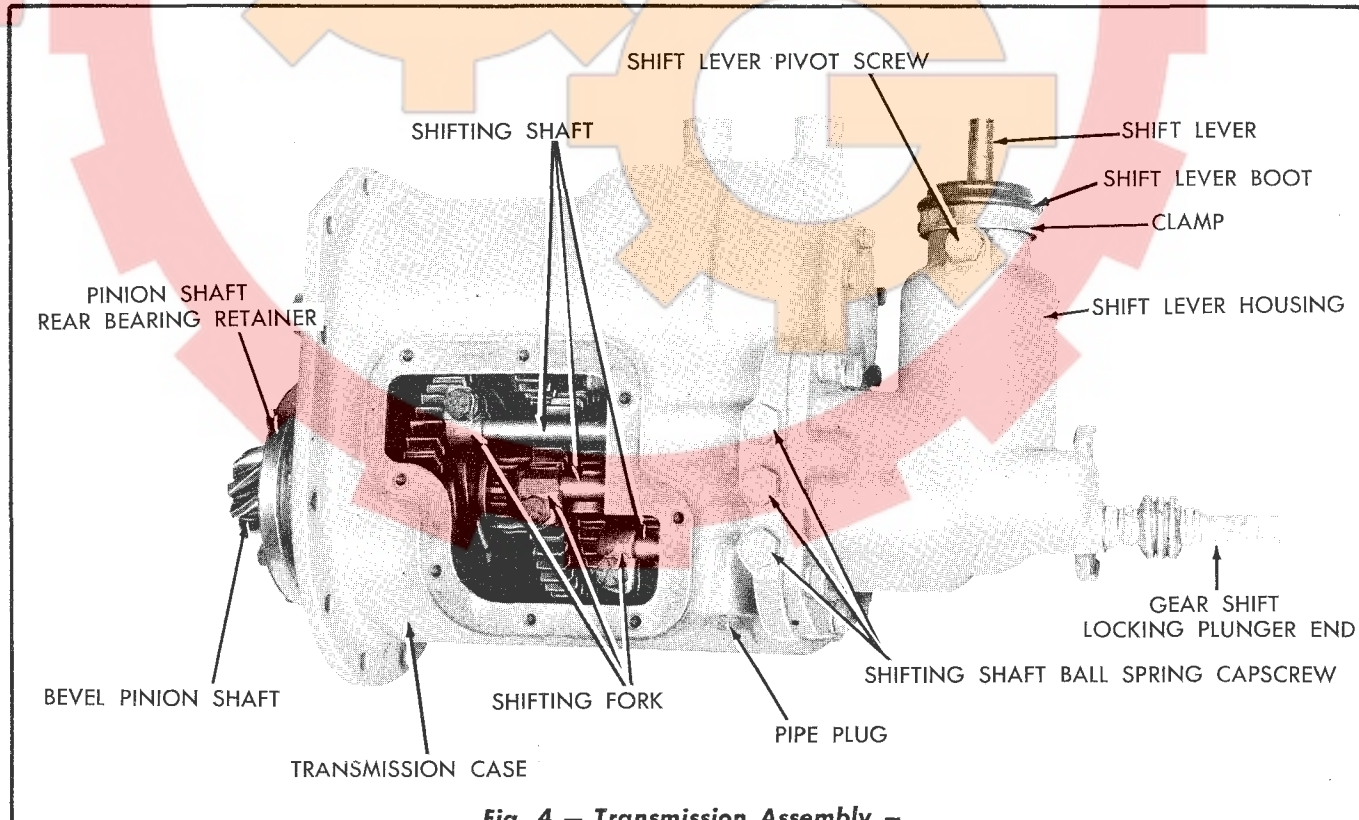
Fig. 2 — Transmission — Sectional View (Optional Two Speed Reverse — Standard on HD-6G Only)



**Fig. 3 — Transmission Ready for Removal**

## B. Transmission Removal

1. Remove the oil drain plug from the bottom of the bevel gear compartment of the steering clutch and final drive housing and allow the oil to drain.
2. Remove the floor plates, seat cushion, back cushion, and seat cushion support. Remove the main frame closure plate located below the transmission.
3. Remove the yoke pins connecting the steering clutch control rod yokes to the steering clutch operating levers, then move the rods over to each side as far as possible.
4. Remove the capscrews attaching the steering clutch operating lever bracket to the top of the transmission case and remove the bracket and levers as an assembly.
5. Unlock and remove the capscrews and locks attaching the front and rear yokes to the universal joint assembly and remove the universal joint.
6. Remove the yoke pin connecting the gear



**Fig. 4 — Transmission Assembly — Side Cover Removed**



shift locking plunger rod to the locking plunger end.

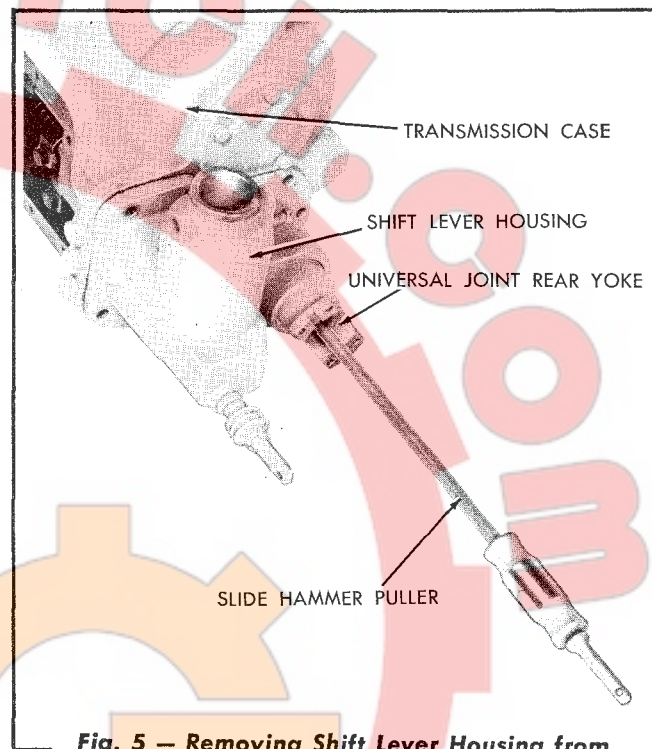
7. Install a  $\frac{5}{8}$ " NC eyebolt in the tapped hole of the transmission case as shown in Fig. 3 and remove the capscrews attaching the transmission case to the steering clutch and final drive housing.
8. Using a suitable hoist, move the transmission forward until the rear boss of the transmission case is free of its bore in the steering clutch and final drive housing, then raise and remove the transmission. **NOTE:** Keep the transmission in alignment (straight), when removing, to prevent the boss of the transmission case from binding in the bore of the steering clutch and final drive housing.

### C. Transmission Disassembly

1. Thoroughly clean the transmission case before disassembly.
2. Place the transmission assembly on a clean work bench (top side up). Remove the transmission case side cover and gasket.
3. Remove the capscrew clamping the gear shift lever to the shift lever and remove the gear shift lever.
4. Loosen the clamp holding the shift lever boot in position on the shift lever housing and remove the clamp and boot.
5. Remove the two shift lever pivot screws and lift the shift lever out of the shift lever housing.
6. Remove the locking wire, universal joint yoke retaining capscrew, washer, and seal from the transmission input shaft.
7. Remove the capscrews attaching the shift lever housing to the transmission case. Use a slide hammer puller, with an adapter having  $\frac{5}{8}$ " NF threads, inserted in the end of the input shaft as shown in Fig. 5, and pull the shift lever housing assembly from the transmission case. Remove the universal

joint rear yoke from the input shaft.

8. Press or drive on the front end of the input shaft to remove the assembly from the shift lever housing. **NOTE:** The input shaft rear seal ring, seal spring assembly, and boot will remain in the shift lever housing as they are cemented in place in the housing. **CAUTION: USE CARE AND DO NOT DAMAGE THE SEAL RINGS.**

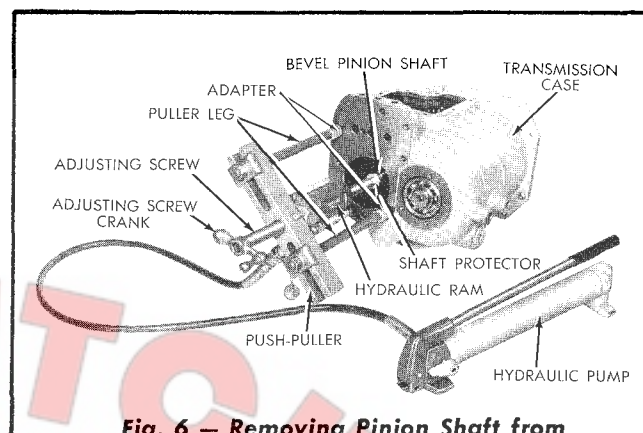


**Fig. 5 — Removing Shift Lever Housing from Transmission Case**

9. Unlock and loosen the capscrews clamping the shifting forks to the shifting shafts.
10. Remove the three shifting shaft ball spring capscrews (Fig. 4), located in the right front side of the transmission case, and remove the three shifting shaft ball springs. Tilt the case and allow the three steel balls to fall out of the holes.
11. Remove the pipe plug (Fig. 4), located under the right front corner of the transmission case. Hold the lower shaft shifting fork and pull the lower shifting shaft out of the fork and the transmission case. Catch the two steel balls (detent balls) when removing the shaft and also the shifting shaft interlock pin if it falls out of the intermediate shifting shaft.

12. Hold the intermediate shaft shifting fork and pull the shifting shaft out of the fork and the transmission case. Catch the two steel balls when removing the intermediate shifting shaft.
13. Hold the upper shaft shifting fork and pull the shifting shaft out of the fork and the transmission case. Remove and keep the shifting forks with the shafts from which they were removed.
14. Unlock and remove the capscrews attaching the pinion shaft rear bearing retainer to the transmission case. Remove the bearing retainer and the bearing retainer shims. Tie the shims to the retainer to prevent loss.
15. Using tools similar to those shown in Fig. 6, press the bevel pinion shaft out of the case (towards the rear). Remove the gears as they are freed from the shaft.
16. Remove the top shaft front bearing cover. Remove the snap ring from the front end of the top shaft. Drive the shaft out of the case (towards the rear). Remove the gears as they are freed from the shaft.
17. Remove the reverse gear shaft plug and using a slide hammer puller with an adapter having  $\frac{5}{8}$ " NC threads, insert the puller into the end of the shaft and pull the shaft out of the transmission case. Catch the steel locking ball used in the shaft, as the shaft is removed. Remove the reverse gear, bearing roller assembly, and the thrust washers.

**NOTE:** On tractors having (optional) two speed reverse transmission, refer to Fig. 2. Remove the reverse shaft hole plug snap ring, reverse shaft hole plug, and plug sealing ring. Remove the reverse gear shaft plug and using a slide hammer puller with an adapter having  $\frac{5}{8}$ " NC threads, insert the puller into the end of the shaft and pull the shaft out of the case. Catch the steel locking ball, used in the shaft, as the shaft is removed. Remove the high speed reverse gear bearing roller assembly and the thrust washers.



**Fig. 6 — Removing Pinion Shaft from Transmission Case**

18. The bearings that remain in the transmission case or on the shafts, and the snap rings that remain on the input shaft and on the rear of the top shaft should now be removed, cleaned, inspected, and replaced if necessary.

#### **D. Cleaning and Inspection of Parts**

Clean and inspect all the transmission parts thoroughly as described in pertinent pages of "GENERAL MAINTENANCE INSTRUCTIONS," Section XX. Replace or recondition the worn or damaged parts.

#### **E. Assembly of Transmission**

1. **Installation of Low Speed Reverse Shaft Assembly** (Figs. 1 and 7)
  - a. Stand the transmission case on its front end, place the bearing roller assembly in the low speed reverse gear and place the reverse gear and the inner and outer thrust washers in position in the case. The inner thrust washer can be distinguished from the outer thrust washer by having the smaller hole. **IMPORTANT:** Install the reverse gear so that the chamfered ends of the teeth are towards the rear of the transmission case.
  - b. Turn the thrust washers so that the flat surfaces, in the inside diameter of the washers, are to the top of the transmission case and in line.



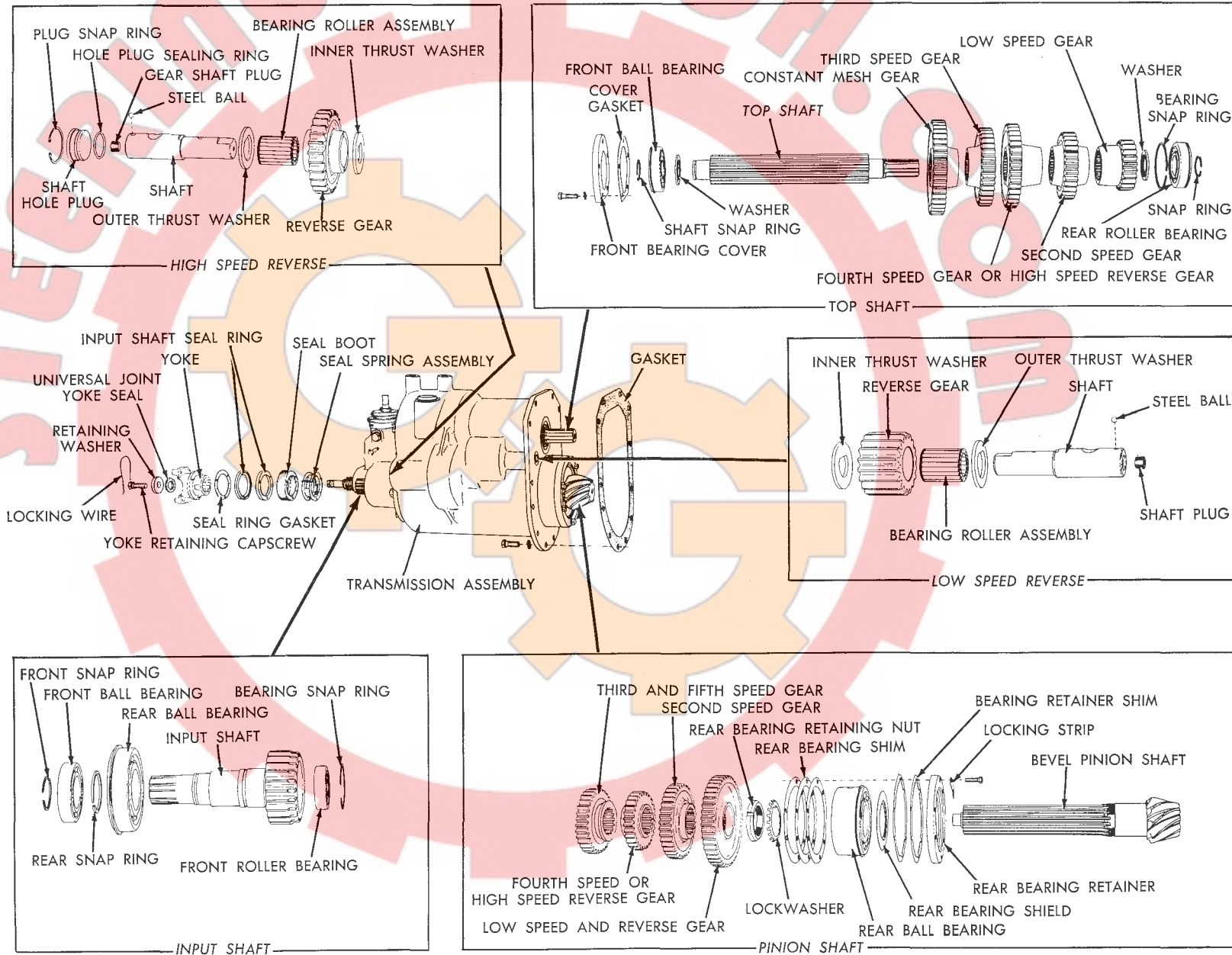


Fig. 7 — Transmission Details

- c. Position the reverse gear shaft so that the hole for the steel ball is in line with the notch in the transmission case. Start the shaft in the transmission case, install the steel ball in the shaft, then drive the shaft into position. Install the reverse gear shaft plug in the end of the reverse gear shaft.
- d. Use a feeler gage and check the clearance between the reverse gear and one of the thrust washers; the specified clearance is .008" to .025". If the clearance is not within the specified limits, remove the shaft and replace the necessary parts.

*NOTE: When assembling transmissions having two speed reverse, the assembly procedure is the same as that of the one speed reverse explained above, with the exception that the high speed reverse gear shaft (Figs. 2 and 7) is installed from the front end of the transmission case. After the high speed reverse gear shaft plug is installed, install the reverse shaft hole plug, seal ring, and the snap ring.*

## **2. Installation of Top Shaft and Gears**

If the inner race of the top shaft rear roller bearing has not been removed from the shaft, stand the shaft on end and install one of the gears on the shaft. Using the gear as a slide hammer, drive against the top shaft washer to remove the bearing race.

- a. Install the top shaft washer on the front end of the top shaft, with the flat side of the washer against the shaft splines. Install the top shaft front ball bearing on the shaft, then install the top shaft snap ring.
- b. Turn the transmission case on its side (side cover opening up).
- c. Insert the rear end of the top shaft through the front bore of the transmission case. Refer to Figs. 1 and 7 and install the top shaft gears in order and

with the hubs in the direction shown. After the gears are installed on the shaft, hold the shaft in position and install the top shaft front ball bearing in the bore of the transmission case.

- d. Install the top shaft front bearing cover and gasket.
- e. Install the top shaft washer on the rear of the top shaft, with the flat side of the washer against the shaft splines. Install the inner race of the top shaft rear ball bearing on the shaft (chamfered end next to the washer), then install the rear roller bearing. Install the top shaft snap ring on the rear of the top shaft.
- f. The specified clearance (total clearance) between the gear hubs is .020" to .025"; check the clearance and if it is not within the specified limits remove the top shaft and replace or rework the necessary parts.

## **3. Installation of Bevel Pinion Shaft and Gears**

- a. Install the rear bearing shield on the bevel pinion shaft with the large diameter of the shield toward the rear. Install the pinion shaft rear ball bearing on the shaft, then install the bearing retaining nut lockwasher and retaining nut. Tighten the retaining nut securely and lock with the lockwasher.
- b. Install the inner race of the pinion shaft front roller bearing on the pinion shaft (chamfered end next to the shaft splines).
- c. Refer to Figs. 1 and 7 and place the pinion shaft gears in the transmission case in order and with the hubs in the direction shown. Insert the bevel pinion shaft through the rear bore of the case and into the gears. Hold the bevel pinion shaft in place and install the rear bearing in position in the bore of the case. Drive the bevel pinion shaft in



until the snap ring on the rear bearing is against the case. **NOTE:** On tractors equipped with the two speed reverse transmission, refer to Figs. 2 and 7 and see that the proper gears are installed on the shaft in the proper order.

- d. Using a depth gage, measure the depth of the recess in the rear bearing retainer and lock the depth gage. Place the depth gage against the rear face of the rear bearing, then, using a feeler gage measure the clearance between the depth gage and the rear face of the transmission case. Make up a shim pack of pinion shaft bearing retainer shims .002" thicker than the feeler gage measurement; this will provide .000" to .002" bearing end play when the rear bearing retainer is installed. Keep the shim pack with the bearing retainer.
- e. Drive the bevel pinion shaft back approximately  $1/16$ " and remove the snap ring from the pinion shaft rear ball bearing. Install a .054" shim pack of rear bearing shims in place on the bearing. Reinstall the snap ring and drive the bevel pinion shaft forward until the bearing snap ring is tight against the shims.

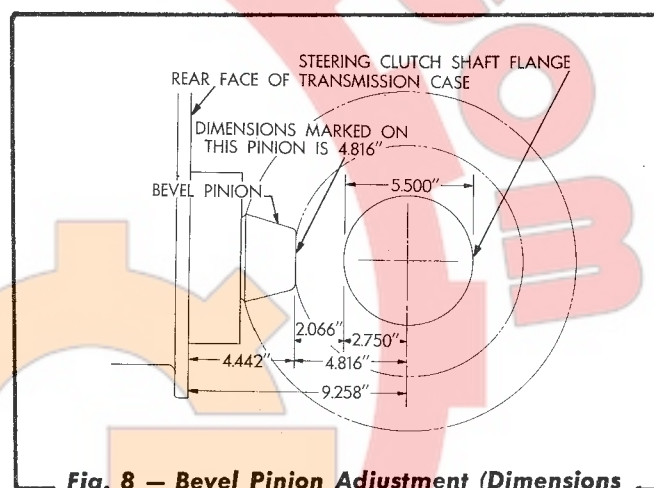
Reinstall the rear bearing retainer with the correct amount of bearing retainer shims as determined in Step "d." Tighten the attaching capscrews securely.

- f. If the bevel pinion has a mounting distance dimension marked on the toe end, subtract this dimension from 9.258" which is the specified dimension from the rear face of the transmission case to the center of the bevel gear hub. The difference between these two dimensions, is the distance the toe end of the bevel pinion teeth should extend from the rear face of the transmission case. **EXAMPLE:** Dimension marked on the toe end of pinion 4.816" from 9.258" equals 4.442", the distance the toe end should extend from the rear face of the

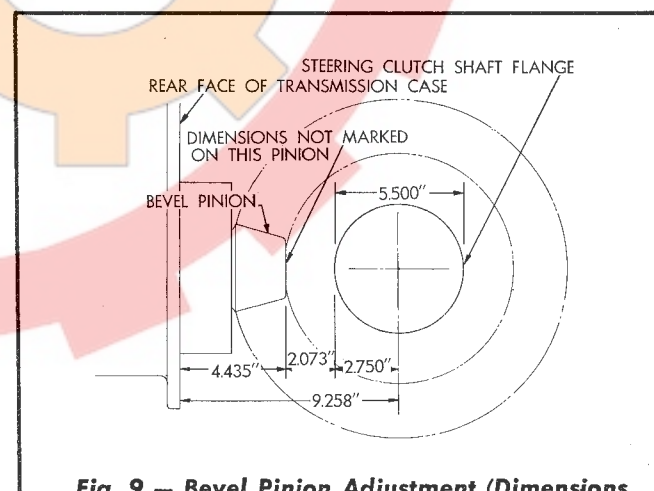
transmission case.

- g. If the bevel pinion does not have a mounting distance dimension marked on the toe end, measure the distance (with pinion installed as outlined in step "e" above), from the toe end of the pinion to the rear face of the transmission case. This distance should be 4.435". Add or remove rear bearing shims as necessary to obtain this measurement (refer to Fig. 9).

**NOTE:** The above specified dimensions in steps "f" and "g" allow for the thickness of the gasket used between the transmission case and steering clutch housing when assembled.



**Fig. 8 — Bevel Pinion Adjustment (Dimensions Marked on End of Pinion)**



**Fig. 9 — Bevel Pinion Adjustment (Dimensions Not Marked on End of Pinion)**

- h. Install the rear bearing retainer and the correct amount of bearing retainer shims as determined in step "d." Install

the attaching capscrews and locking strips. Tighten the capscrews securely and lock in position with the locking strips.

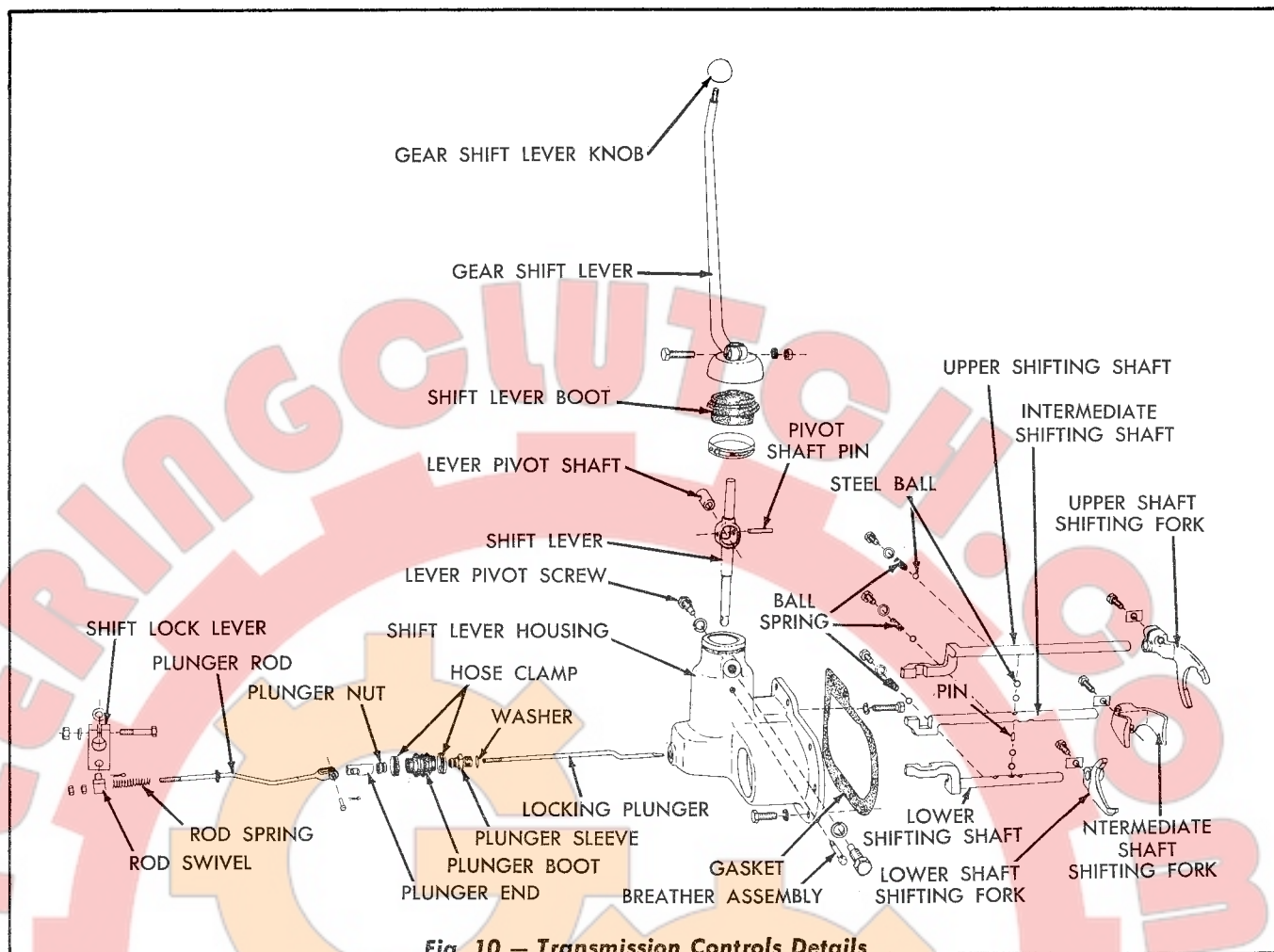
#### 4. Assembly of Input Shaft

- a. Install the input shaft rear ball bearing on the input shaft and install the rear snap ring on the shaft.
- b. Install the input shaft front ball bearing on the input shaft and install the front snap ring on the shaft.
- c. Install the pinion shaft front roller bearing in the input shaft and install the snap ring.
- d. Place the shift lever housing on a clean bench with the machined face of the housing down. Make certain the input shaft seal spring assembly, boot, and rear seal ring (bronze) are clean and dry. Install the boot on the spring assembly. Hold each lip of the boot away from the spring assembly and coat the inside of the lips and the sides of the spring assembly with "NEOPRENE" cement. Press the lips back in place against the spring assembly.
- e. Coat the outer face of one lip of the boot and coat the machined face in the bottom of the counterbore in the shift lever housing with "NEOPRENE" cement. Immediately place the boot and spring assembly in the housing, inserting the ends of the pins into the corresponding holes in the housing.
- f. Coat the outer lip of the boot and the back face of the rear seal ring (bronze) with "NEOPRENE" cement. Immediately place the seal ring on the boot assembly, inserting the ends of the pins into the holes in the seal ring. Place a weight on the seal ring, using a clean cloth between the weight and the seal ring, and allow the "NEOPRENE" cement to dry and set thoroughly.
- g. Cement the input shaft seal ring gasket to the universal joint rear yoke with "NEOPRENE" cement, then cement the front seal ring (steel) to the gasket. Place a weight on the seal ring, using a clean cloth between the weight and the seal ring. 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 used for thinning can be purchased from your "Allis-Chalmers" Construction Machinery Dealer.
- h. After the "NEOPRENE" cement has dried and set thoroughly, install the input shaft in the shift lever housing. Lubricate the front and rear seal rings with clean oil and install the universal joint rear yoke on the input shaft.
- i. Place the universal joint yoke seal and the yoke retaining washer in position, then install the retaining capscrew. Tighten the capscrew to a torque of 168 to 178 lbs. ft. and lock with locking wire.

#### 5. Installation of Input Shaft and Gear Shift Controls

- a. Turn the transmission case on the bench so that the top of the case is up.
- b. Refer to Fig. 10, insert the lower shifting shaft into position in the transmission case. Insert two of the steel balls in place in the transmission case and on top of the lower shifting shaft. Make certain the shaft is positioned so that the lower steel ball is in the center notch of the three notches in the shaft.
- c. Refer to Fig. 10, install the shifting shaft interlock pin in the hole in the intermediate shifting shaft, then insert the shaft into position in the transmission case. Position the shaft so that the interlock pin in the shaft is located in line with the steel balls. Insert two of the





**Fig. 10 — Transmission Controls Details**

steel balls in place in the transmission case and on top of the intermediate shifting shaft.

- d. Refer to Fig. 10, insert the upper shifting shaft into position in the transmission case. Position the shaft so that the upper steel ball is in the center notch of the three notches in the shaft.
- e. Install a steel ball in each of the three holes in the right front side of the transmission case, then insert a shifting shaft ball spring in each hole. Start the three shifting shaft ball spring capscrews with copper washers (Fig. 4) in the case. Tighten the capscrews enough to compress the springs slightly.
- f. Refer to Fig. 10, install the upper shaft shifting fork in place on the low speed and reverse gear and on the upper shifting shaft. Install the lower shaft shifting fork in place on the 3rd and 5th speed gear and on the lower shifting shaft. Slide the 4th speed and the 2nd speed gears together, then install the intermediate shaft shifting fork in place on the gears and on the intermediate shifting shaft. **NOTE:** When assembling transmissions having two speed reverse, the lower shaft shifting fork will engage the 3rd and 4th speed gear and the intermediate fork will engage the 2nd speed gear and the high speed reverse gear. Move the shifting shafts as necessary to install the shifting forks. After moving the shifting shafts, return them to the neutral position (steel balls located in the center notch in the shafts).
- g. Position the shaft shifting forks so that the rear sides are flush with the ends of

the shifting shafts, then tighten the shifting fork capscrews slightly. Shift each shaft and check to see if the forks are located so that the sliding gears mesh properly with their mating gears. Reposition the forks on the shafts if necessary and tighten the shifting fork capscrews to a torque of 70 to 90 lbs. ft. Lock the capscrews with the capscrew locks. Tighten the three shifting shaft ball spring capscrews in the right front side of the case.

- h. Install the gear shift locking plunger sleeve with washer (Fig. 10) in the front of the shift lever housing, then insert the locking plunger through the rear of the shift lever housing and in place in the sleeve.
- i. Cement the shift lever housing gasket in place on the transmission case. Install the shift lever housing and input shaft assembly in place on the transmission case, inserting the locking plunger in position in the transmission case. Tighten the attaching capscrews securely.
- j. Coat the inside diameter (at each end) of the locking plunger boot with "NEOPRENE" cement and install it (with hose clamps) on the locking plunger sleeve. Install the locking plunger nut and turn it on the plunger to the end of the threads. Install the locking plunger end on the plunger and lock it in position with the plunger nut. Install the plunger boot in place on the plunger nut and tighten the hose clamps.
- k. Install the shift lever in position in the notches of the shifting shafts (shifting shafts in neutral position). Install the

two shift lever pivot screws.

- l. Place the clamp for the shift lever boot in place on the shift lever housing, then install the boot in place on the housing and shift lever. Position the clamp on the boot and tighten securely.
- m. Install the gear shift lever on the shift lever. Position the gear shift lever so that the machined surface of the shift lever protrudes through the clamping boss of the gear shift lever. Tighten the lever clamping capscrew securely.
- n. Install the transmission case side cover and gasket. Install the pipe plug in the lower right front corner of the transmission case.

## F. Transmission Installation

The transmission is now ready to be installed in the tractor. Use a new gasket between the transmission case and the steering clutch and final drive housing and install the transmission by a direct reversal of the removal procedure. After the transmission has been secured in position, check the backlash between the bevel gear and pinion teeth and the tooth contact pattern (refer to "INSTALLATION OF BEVEL GEAR" (Step 10) in this Section).

Adjust the nuts on the front end of the gear shift locking plunger rod (Fig. 10) so that the distance between the center of the locking plunger rod swivel and the center of the plunger rod yoke pin is approximately  $10\frac{3}{4}$ ".

Install the oil drain plug in the bevel gear compartment, then fill the transmission and bevel gear compartment to the proper level using the specified lubricant.