4. **FIVE-SPEED TRANSMISSION**

The following is a complete disassembly of the transmission. However, in most cases it is not necessary to disassemble the entire transmission to repair or replace components.

The double clutch five speed transmission, Figure 11, utilizes a separate input shaft to drive the P.T.O. countershaft gear. The single clutch transmission does not have a separate P.T.O. input shaft. Instead, the transmission input shaft incorporates a gear which drives the P.T.O. countershaft gear. Any difference in procedure between the single and double clutch transmission will be noted in the text.

**A. Disassembly**

Reference to right and left side are made facing the rear of the transmission.

1. Remove the shift lever retaining nut and flat washer, then remove the shift lever. Remove the Woodruff key and spring.
2. Remove the transmission cover assembly and gasket, Figure 12.
   **NOTE:** To replace a defective starter button, remove the nut, washer, and lock washer from the underneath side of the cover.
3. Remove the reverse idler gear and housing assembly from the right side of the transmission case.
4. Pry the clutch release bearing fork spring to one side to release it from the transmission case. Turn the fork forward and remove the clutch release bearing.
5. Remove the bolt and lock nut from the fork and withdraw the clutch release shaft to remove the fork and spring.

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Figure 11—Five Speed Transmission—Double Clutch
6. Remove the input shaft, oil seal retainer, and gasket, Figure 13, as an assembly.

Double Clutch Transmission: Remove the retainer, gasket, transmission input shaft, and P.T.O. input shaft as an assembly.
7. Remove the main cluster gear front bearing retainer and gasket.
8. Remove the six cluster gear rear bearing retainer attaching bolts and lock washers, then remove the retainer and shim pack. Keep the shim pack intact for reassembly purposes.
9. Lift the main cluster gear up and forward to clear the countershaft second gear, and remove the assembly from the case, rear end first.
10. Remove the six bolts and lock washers that secure the P.T.O. support, Figure 11, to the rear of the transmission and remove the support. Keep the shims intact and with the support to facilitate assembly.
11. Remove the three shift rail spring seats and gaskets from the left side of the transmission case and remove the springs and plungers, Figure 12.
12. Remove the top expansion plug from the rear of the transmission case behind the shift rail. Drive the plug from the case with a punch and hammer.
13. Loosen the lock nuts and remove the two set
screws from the 3rd and reverse shifter fork and gate on the top shift rail. Remove the rail through the expansion plug hole. Remove the shifter fork and gate, tag them for identification and place them with their rail.

NOTE: It may be necessary to lift or jiggle the countershaft to prevent it from binding on the rail.

14. Remove the transmission output gear, Figure 13, and remove the remaining expansion plugs.

15. Loosen the lock nuts and remove the set screws from the shifter fork on the middle rail. Remove the middle rail and the 1st and 2nd gear shifter fork and gate. Tag the shifter fork and gate for identification.

16. Loosen the lock nut and remove the set screw from the combination 4th and 5th gear shifter fork and gate on the bottom rail. Remove the bottom rail and shifter fork and tag them for identification.

17. Remove the interlock and hinge rod, Figure 12, by moving the rod up through the hole in the top of the transmission case. If this hole does not line up with the rod, remove the socket head plug from the bottom of the case and move the rod out through that opening.

18. Remove the detent seat, gasket, spring, and plunger for the shifter shaft, Figure 12, from the left side of the transmission case, then remove the shifter shaft.

19. Working from the rear of the case, remove the P.T.O. countershaft from the countershaft assembly, Figure 13. Remove the four front counter-shaft bearing retainer attaching bolts and lock washers, Figure 11. Remove the retainer and "O" ring seal from the case. Move the countershaft as far to the rear as possible and then lift it out of the case, front end first.

20. Remove the P.T.O. countershaft gear from the transmission case, Figure 11.

B. Repair of Sub-Assemblies

The following information provides procedures for disassembly, and assembly of the transmission components. Where possible, illustrations are used to show the special tools that are required.
Input Shaft Oil Seal Retainer:
1. Pull the oil seal with Puller 943 and a slide hammer as shown in Figure 14.
2. Coat the wiping surface of a new seal with Lubriplate or equivalent and install it in the input shaft seal retainer with Step Plate 630-11 as shown in Figure 15. Make certain that the lip of the seal faces toward the rear of the retainer.

Cluster Gear Front Bearing Retainer:
1. Remove the bearing cup with Puller 956-2 and a slide hammer as shown in Figure 16.
2. Install the bearing cup in the bearing support with Step Plate 630-12 or a wood block and hammer, Figure 17.

P.T.O. Input Shaft (Double Clutch Transmission):
1. Remove the oil seal, needle bearing, and bushing with Puller 956-2 and a slide hammer as shown in Figure 18.
2. Pack wheel bearing grease in the shaft area behind the needle bearing. Press the stamped end of the bearing to a 0.76" depth from the front end of the shaft and pack grease in front of the bearing.
3. Coat the wiping surface of a new oil seal with Lubriplate or equivalent and press it in the shaft, using Step Plate 630-4. See Figure 19.
4. Drive a new bushing in the retainer using Bushing Driver Set 818. Ream the bushing so there is 0.003" to 0.005" clearance for the shaft.

Main Cluster Gear:
1. Remove the front and rear bearings with Pullers 951 and 1002 as shown in Figure 20.
2. Press the rear bearing onto the main cluster gear with Step Plate 630-7 as shown in Figure 21. Install the front bearing in the same manner with a 1½" I.D. sleeve.

Output Gear:
1. Use the access holes behind the inner bearing race in the transmission output gear and drive the bearing off the gear with a hammer and punch.
2. Press a new bearing onto the rear side of the transmission output gear using a 2½" I.D. sleeve.
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Output Shaft Bearing Retainer:
1. Remove the roller bearing using a punch and hammer, Figure 22.
2. Drive out the oil seal and bearing cup.
3. Coat the wiping surface of the new oil seal with Lubriplate or equivalent and press the seal into the retainer with Step Plate 630-9, Figure 23.
4. Drive or press the bearing into place with Step Plate 630-16. Install the bearing cup with a press or hammer and wood block.

Countershaft Front Bearing Retainer:
1. Remove the bearing cup from the countershaft front bearing retainer with Puller 956 and a slide hammer. Remove the bushing with a hammer and chisel.
2. Install a new bushing in the countershaft front bearing retainer with Bushing Driver Set T-818, Figure 24. Ream the bushing so there is a 0.003” to 0.005” clearance for the shaft portion of the P.T.O. countershaft gear.

Figure 19—Installing Seal in P.T.O. Input Shaft

Figure 20—Removing Main Cluster Gear Bearings
3. Install the bearing cup in the retainer with Step Plate 630-15 or a wood block and hammer, Figure 25.

Countershaft P.T.O. Gear:
1. Remove the bearing from the front of the P.T.O. countershaft gear with a punch and hammer through the holes in the gear, Figure 26. Remove the bearing cup with Puller 943 and a slide hammer.

2. Install the bearing cup in the P.T.O. countershaft gear with Step Plate 630-15 or a wood block, Figure 27. Install the bearing on the front of the gear with a 1½" I.D. sleeve and press.

Countershaft: Refer to Figure 28 while working on the countershaft.
1. Work from the rear of the countershaft and remove the bearing with Puller 1002, Bearing Pulling Attachment 951, and Step Plate 630-4. Remove the snap ring, retainer, thrust washer, and 3rd gear. Remove the sliding coupling, connector, and the countershaft reverse gear. Re-
move the thrust washer which is keyed to the countershaft spline and remove the snap ring, 4th gear, and sliding coupling.

2. Work from the front of the countershaft and pull the countershaft 1st gear (which removes the
bearing and thrust washer) with Puller 1003 and Step Plate 630-4. Remove the thrust washer, sliding coupling, connector and 2nd gear. Remove the keyed thrust washer and 5th gear.

3. Work from the front of the countershaft and slide the 5th speed gear on the countershaft making certain that the spur teeth face toward the rear of the shaft. Install the 2nd gear thrust washer with the locking tab on the shaft next to the 5th speed gear. Slide the 2nd speed gear onto the shaft with the spur teeth facing toward the front. Install the connector then the thrust washer that seats in the connector. Install a sliding coupling on the connector. Install the 1st speed gear and retaining washer. Carefully install the tapered roller bearing on the shaft with Step Plate 630-11.

4. Work from the rear of the shaft and install a sliding coupling on the 5th speed gear. Slip the 4th speed gear onto the shaft with the spur teeth toward the sliding coupling and secure with the snap ring, Figure 28. Install the thrust washer with the locking tab on the shaft next to the snap ring. Slip the reverse gear onto the shaft with the spur teeth facing toward the rear, then install a connector and the sliding coupling (the small notches machined in one end of the connector crown must be positioned next to the 3rd gear).

Slip the 3rd speed gear onto the shaft making sure that the spur teeth are toward the front. Install the 3rd gear thrust washer, retainer, and snap ring on the shaft. Install the rear bearing with Step Plate 630-11.
P.T.O. Support:
1. Remove the bearing cup from the P.T.O. support, Figure 28, with Puller 943 and a slide hammer. Remove the P.T.O. shifter stop, shifter rail, detent ball, and spring. Remove the P.T.O. shifter sleeve from the rear of the support. Work from the rear of the support and drive out the retainer and oil seal.
2. Install the retainer in the P.T.O. support with a punch and hammer. Coat a new seal with Lubriplate or equivalent and drive it into the front of the support with Step Plate 630-9. Make sure the lip of the seal faces toward the front of the support. Drive the bearing cup into place with Step Plate 630-15.
3. Slide the P.T.O. sleeve into place, Figure 28. Place the spring and detent ball in the support. Hold the ball down with a screwdriver and slide the shifter rail in far enough to cover the detent ball. Place the stop in position in the sleeve groove, then slide the rail forward into the hole in the stop. Secure the rail and stop with a lock washer and nut, Figure 28.

Reverse Idler Gear:
1. Loosen the lock nut and remove the set screw that holds the shaft in the reverse idler gear housing, Figure 29. Remove the shaft, the gear, and the two washers. Remove the bushing from the gear with a hammer and punch.
2. Install a new bushing in the reverse idler gear with Bushing Driver Set 818. Ream the bushing so there is 0.003" to 0.005" clearance for the shaft.
3. Position the two thrust washers, thick washers next to gear, on the front (short hub) side of the idler gear. Hold the gear and washers in place in the housing, and install the shaft, Figure 29. Secure the shaft with a set screw and lock nut.

C. Assembly
Always use new gaskets and "O" rings when assembling a transmission. Also make certain that all gears, bearings, and moving parts are lubricated with transmission lubricant.
1. Position the P.T.O. countershaft front bearing retainer and "O" ring seal on the transmission, Figure 28, and tighten the bolts to 20-25 ft. lbs. torque.
2. Position the P.T.O. countershaft gear assembly into the front bearing retainer.
3. Place the assembled countershaft in the transmission case, rear end first. Move the countershaft forward to seat the front countershaft bearing in the P.T.O. countershaft gear bearing cup, Figure 28.
NOTE: Do not insert the P.T.O. countershaft through the rear of the transmission and countershaft until the countershaft preload is established.
4. Install the P.T.O. countershaft rear support with the original shim pack and torque the bolts to 25-30 ft. lbs. Rap the support a few times with a "soft head" hammer to seat the countershaft bearings.
5. Wrap a piece of cord around the countershaft final drive, Figure 11. Attach the other end of the cord to Pull Scale 3600-E. Pull the scale and at the same time note the reading. The scale should read 6-8 pounds pull. If necessary, remove shims to increase the preload or add shims to decrease the preload. Shims are available in 0.003", 0.005", and 0.012" thicknesses.
NOTE: If the countershaft has all new bearings establish a preload of 14-16 pounds pull.
6. Install the shifter shaft, seat, gasket, spring, and plunger. Place the interlock in position, flat side of the hinge toward the case, and install the hinge rod, Figure 12.
7. Position the shifter fork and gate on the 4th and 5th gear coupling, then install the bottom rail.

Figure 30—Input Shafts and Retainer for Double Clutch Transmission
through the bottom expansion plug hole. Slide the rail through the fork. Turn the set screw all the way in and tighten the lock nut. All sliding couplings should be in the neutral position; then the plunger hole in the rail should line up with the plunger seat hole in the side of the case. Install the plunger, spring, gasket, and plug for the bottom rail.

8. Position the shifter fork on the coupling for the 1st and 2nd gears. Position the middle rail gate in the interlock and slide the middle rail through the gate and fork. Install the two set screws, tighten them securely, and install the lock nuts. Install the middle rail shift detent plunger, spring, gasket, and seat.

9. Remove the P.T.O. support so the countershaft assembly will lower slightly.

10. Install the transmission output gear, Figure 13.

11. Install the shifter fork on the 3rd and reverse gear coupling. Slide the top rail through the fork and the gate, then position the gate in the interlock, Figure 12, and install the set screws with locking nuts. Install the shift rail detent plunger, spring, gasket, and seat. Be sure the plunger enters the middle hole in the rail.

12. Install new expansion plugs at the end of each shift rail. Install the P.T.O. support (leave the countershaft out) and tighten the bolts to 25-30 ft. lbs. torque.

13. Install the main cluster gear, front end first.

14. Install the output shaft bearing retainer.

15. Install the main cluster gear front bearing retainer and gasket.

16. Install the transmission input shaft and thrust washer.

**Double Clutch Transmission:** Install three input shaft thrust washers, the P.T.O. input shaft, and two P.T.O. shaft thrust washers, Figure 30. Position the two outside input shaft washers so their oil grooves are against the middle washer. The middle washer has oil grooves on both sides.

17. Install the oil seal retainer and gasket. Tighten the nuts to 25-30 ft. lbs. torque.

18. Check to see that all gears move freely and that the shifter forks can be moved forward and backward with a large screwdriver.

19. Install the reverse idler gear housing assembly and "O" ring on the right side of the transmission case. Tighten the attaching nuts to 40-50 ft. lbs. torque.

20. Position the forks in neutral and check the main cluster gear preload as shown in Figure 31. With the cord wrapped around the main cluster gear (between gears), establish a pull of 8-10 lbs. on the double clutch transmission. Preload can be adjusted by varying the quantity or thickness of shims used on the rear bearing retainer. Shims are available in 0.003”, 0.005”, and 0.012” thicknesses.

**NOTE:** The input shaft in single clutch transmissions turns the P.T.O. gear, which was pre-loaded with the countershaft. To obtain an equivalent main cluster gear preload on single clutch transmissions, the pull scale must read 10-12 lbs.

21. Install the P.T.O. countershaft and the transmission cover assembly.

22. Install the Woodruff key and spring at the top of the shifter shaft. Install the shift lever, making sure the slot on the shift lever engages the Woodruff key. Install the flat washer, lock washer, and retaining nut and tighten the nut securely.

23. Inspect the clutch release shaft bushings, and on some model tractors, the brake shaft bushings. If necessary, remove the bushings and install new ones using Bushing Driver Set 818. Ream the bushings so there is a 0.003” to 0.005” clearance on the shaft.

24. Install the clutch release shaft, fork, spring, bolt, and lock nut. Make sure the offset end of the spring is positioned toward the transmission case.

25. Install the clutch throwout bearing and hub assembly. The word "top" is cast in the hub for proper positioning. Seat the spring in the bearing hub and on the stop in the transmission case.

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**Figure 31—Checking the Main Shaft Preload**