

# FUEL PUMPS

ing the cover. Do this with the flexing tool shown in Fig. 41.

25. Push on the rocker arm until the diaphragm is level with the flange on which it rests. Hold the rocker arm at this point. Slip the hook of the flexing tool in between the rocker arm and the body casting. Release the rocker arm against leveling tool and the diaphragm will remain level, Fig. 42.
26. Install circular spring seat on center of diaphragm retainer (over pull rod end).
27. Place the diaphragm spring on the seat. Then, Fig. 43, drop the vacuum cover over the spring. Do not try to press cover all the way down. Be sure spring seat stays down in place against diaphragm protector.
28. Line up the file marks, Fig. 44, which were made before the pump was taken apart. Insert two long (1½") screws in two opposite holes in the cover flange. Turn down these two screws as far as they will go without forcing. This will draw the lower cover toward the body far enough to allow the short screws to take hold.
29. Install screws with lock washers. Tighten screws only enough so that they press lightly against lock washers. Remove the two long screws and install short ones.
30. Remove the diaphragm leveling tool. The diaphragm will then flex the correct amount because of the pressure of the heavy spring. Tighten all cover screws. Do this alternately, first a screw on one side, then a screw on the opposite side, repeating the procedure until all screws are tightened securely.

## Installing Pump, All Series

1. Insert the rocker arm through the opening in the engine. Make sure that the "pad", which is always the flat surface, rests against the cam on the engine camshaft.
2. Holding the pump in position against the engine, gasket in place, insert the bolts with lock washers in the mounting holes. Start the bolts with your fingers to prevent damage to the threads.
3. Tighten all bolts securely with a suitable wrench.
4. First check the fuel line to be sure it is properly aligned with the opening on the pump. Then start the nuts of both lines with the fingers before tightening them securely with a wrench.
5. On combination pumps, connect both vacuum lines.

## CARTER FUEL PUMP

This pump, Fig. 45, operates in the same manner described for AC mechanical fuel pumps.

Referring to Fig. 45, the service procedure for this pump is as follows:

1. Mark pump body and valve housing to assure correct reassembly.
2. Remove cam lever return spring.
3. Remove rivet plug, and cam lever pin plug and washer.
4. Remove cam lever pin, and take out cam lever and spring retainer.
5. Remove vent retainer ring and packing, and take off bowl cover, gasket and strainer.
6. Remove bowl retaining screw, bowl and outlet air dome diaphragm.
7. Remove pump valve housing by inserting a screw driver at opposite

sides between the valve housing and body at flats of diaphragm. By twisting the screw drivers in opposite directions, the valve housing will come off.

8. Lift out the diaphragm assembly, and remove both valve cages.

Clean all parts in gasoline or solvent and dry with compressed air. Replace all worn or damaged parts. To reassemble, proceed as follows:

1. Install new intake valve cage assembly, using tool T-109-191. With the same tool, install new discharge valve cage assembly.
2. Install diaphragm with flats toward ports. Then install pump valve housing, starting all screws but do not tighten. Be sure marks previously made on body and valve housing are aligned.
3. Install cam lever and spring retainer, cam lever pin, cam lever pin plug and washer, and a new rivet plug, using tool T109-43 for the plug.
4. Flex the diaphragm to full downward position and hold in place while tightening valve housing attaching screws. Tool T109-192 may be used to flex diaphragm and hold in position.
5. Install outlet air dome diaphragm, bowl, and bowl retaining screw and washer.
6. Insert cap screw through gasket and bowl cover and install felt packing on screw. Then install strainer, bowl cover and ring gasket.
7. Install vent packing and retainer, and complete the assembly by installing the cam lever return spring.

**NOTE**—When installing pump on engine, be sure slot and stud holes in gasket are aligned with those in face of pump body.

# STOCK TRANSMISSIONS

## CLARK

Model	Speeds	Oil, Pts.	Page
185F	4	4	71
202V, VO	5	12	72
204V, VO	5	12	72
205V, VO	5	12	72
207V, VO	5	12	72
230F	4	10	72
231F	4	10	72
265V, VO	5	12	74
267V, VO	5	12	74
270V, VO	5	20	76
276V, VO	5	20	76
290V, VO	5	18	76
291V, VO	5	18	76
292V, VO	5	18	76
300V	5	12	74

## FULLER

Model	Speeds	Oil, Pts.	Page
2-A-45	2 Aux.	10	90
5-A-33, 330	5	11	86
5-B-33, 330	5	11	86
5-F-33	5	11	86
5-A-43, 430	5	16	86
5-A-62, 620	5	18	86
5-A-65, 650	5	24	86
5-C-65, 650	5	24	86
5-C-72, 720	5	24	86
10-B-1120	10	35	88
R-45 ①	8	19	78
R-46 ①	8	17	78
R-95-C ①	10	32	78
R-950-C ①	10	32	78
R-96 ①	10	36	78

①—Road Ranger transmission.

## NEW PROCESS

Model	Speeds	Oil, Pts.	Page
245	5	12	91
275	5	12	91
420	4	5½	92
540	5	9½	93
541G	5	10	93
875	5	8	97
895	5	8	97
5401	5	10	93
5402	5	10	93
5403	5	10	93
5404	5	10	93
90845	5	12	95
90930	5	12	95

SPICER

WARNER

Model	Speeds	Oil, Pts.	Page
752	5	9	97
753	5	9	97
4452	5	14	97
4453	5	14	97
4952	5	14	97
4953	5	14	97
5531	3 Aux.	7	103
5552	5	9	97
5553	5	9	97
5831	3 Aux.	4	105
6031	3 Aux.	10	108
6041	4 Aux.	8	106
6231	3 Aux.	8	108
6252	5	23	97
6253	5	23	97
6452	5	17	97
6453	5	17	97

Model	Speeds	Oil, Pts.	Page
6852	5	17	97
6853	5	17	97
7231	3 Aux.	8	108
7751	5	①	101
7851	5	①	101
8031	3 Aux.	12	109
8035	3 Aux.	12	109
8041	4	16	101
8045	4	16	101
9051	5	24	103
8055	5	24	105
8245	4	16	101
8251	5	24	105
8255	5	25	105
8341	4 Aux.	12	112
8445	4	16	101

Model	Speeds	Oil, Pts.	Page
T9	4	6	112
T9A	4	6	112
T87D	3	6	113
T89B	3	2 3/4	113
T97	4	7	112
T98	4	8	114

①—Fill to bottom of filler plug hole

# Clark Transmission Section

## MODEL 185F

### Disassemble, Fig. 1

1. With transmission on bench or repair stand, remove hand brake assembly.
2. Disconnect flexible oil line from clutch release sleeve.
3. Remove clutch release pull back spring.
4. Remove clutch release bearing and sleeve assembly.
5. Remove clutch release levers and shaft.
6. Lock mainshaft by putting gears in two speeds and unscrew companion flange nut.
7. Use suitable puller to remove flange and brake drum.
8. Remove speedometer sleeve and driven gear.
9. Remove mainshaft rear bearing cover.
10. Remove speedometer drive gear.
11. Remove countershaft rear bearing cover.
12. With mainshaft still locked, remove countershaft rear bearing retainer.
13. Remove reverse idler gear shaft lock from rear of case.
14. Remove main drive gear bearing cap.
15. Pull main drive gear out through front of case.
16. Remove mainshaft pilot bearing from pocket of main drive gear.
17. Remove gear main drive gear bearing retaining nut and press off bearing.
18. Drive mainshaft back until rear bearing is clear of case.
19. Remove clutch hub from front of shaft.
20. Use suitable puller to remove rear bearing from mainshaft.
21. Tilt forward end of mainshaft upward and lift assembly through top of case.
22. Lift loose sliding gear from case.

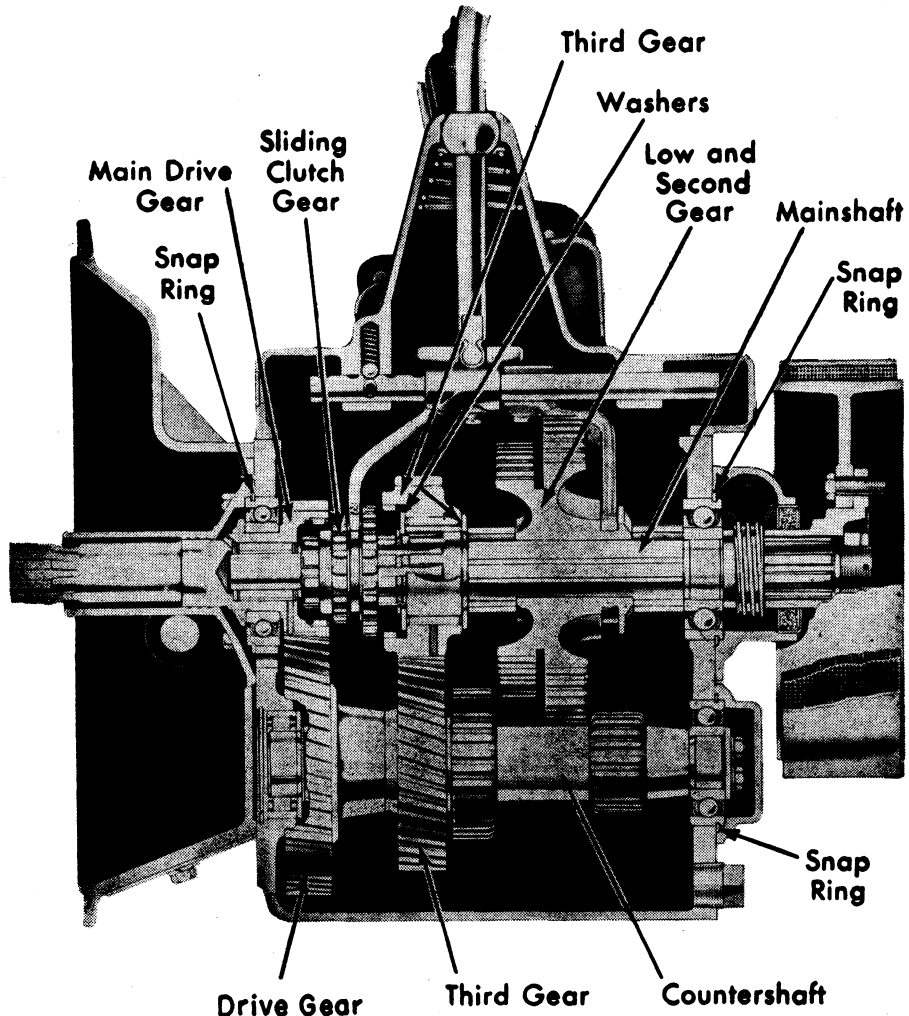


Fig. 1 Clark 185F four speed transmission

23. Remove reverse idler gear shaft from rear of case and lift out gear.
24. Move countershaft assembly toward rear until rear bearing is free of case. Then pull off bearing.
25. Tilt forward end of countershaft upward and lift assembly from case. Remove front bearing spacer, which was freed by removal of assembly.
26. Remove countershaft front bearing from inside of case. Do not disturb snap ring and Welch plug at front end of counterbore.
27. To remove drive and 3rd speed countershaft gears, remove snap ring and press off gears.
28. To disassemble mainshaft, fasten in vise with forward end up. Then remove snap ring, splined washer and 3rd speed gear, using care not to lose rollers. Remove bearing sleeve, lock pin, and locating washer.

**NOTE**—Do not remove bell housing from transmission case unless a new one is required. Assemble main drive gear and bearing cap in transmission case and tighten cap screws. Use bearing cap for centering bell housing and bolt housing in place.

### Reassemble

Reassembly procedure is accomplished by reversing the order of disassembly. However, observe the following:

1. When installing drive and 3rd speed gears on countershaft, press them on shaft with long hubs of gears facing each other and install snap ring.
2. After installing countershaft assembly, check its operation to see that no binding or end play exists.
3. Install reverse idler gear with slot for shifter fork toward front of case.
4. To assemble mainshaft, place it in vise with forward end up. Then slide 3rd speed locating washer over shaft. Install bearing sleeve with lock pin in place toward front of shaft.
5. Install 3rd speed gear on mainshaft with internal teeth of hub upward. Apply grease to rollers and insert them between shaft and gear.
6. Place splined thrust washer over shaft and install new snap ring in shaft groove. It may be necessary to use a shim or two under snap ring due to matching tolerances.
7. Install clutch hub on mainshaft with small end of hub forward.
8. Place 1st and 2nd speed sliding gears in transmission with shift fork slot facing rear. Then tilt rear end of mainshaft downward and lower into transmission case and slide loose gears on shaft.
9. When installing main drive gear bearing cap, be sure to line up oil holes in cap with holes in case, after first seeing that holes are clean and open.
10. Mainshaft rear oil seal should be installed with open end facing in.
11. When installing clutch release bearing and sleeve, adjust clutch release fingers so that .003" clearance is provided between sleeve and each finger or a total of .006" between sleeve and both fingers.
12. Install transmission cover by placing

gears and shift forks in 2nd speed position.

## MODELS 202, 204, 205, 207

### Disassemble, Fig. 2

1. Take off cover.
2. Remove hand brake assembly.
3. Lock mainshaft by placing gears in two positions at the same time. Then remove companion flange nut.
4. Remove brake drum.
5. Remove speedometer sleeve and driven gear.
6. Remove mainshaft rear bearing retainer; then remove speedometer drive gear.
7. Remove low and reverse rocker arm pivot bolt and take rocker arm from case.
8. Remove low and reverse fork bar through rear of case and lift out shifting fork.
9. Remove main drive gear bearing retainer cap.
10. Take main drive gear assembly out through front of case.
11. Slide direct and overdrive clutch hub forward and withdraw through front of case.
12. Remove mainshaft rear bearing snap ring. Then drive mainshaft back until rear bearing is free of case.
13. Pull rear bearing off mainshaft with suitable puller.
14. Tilt forward end of mainshaft upward and lift assembly out through top.
15. Remove countershaft rear bearing retainer.
16. Remove bearing retainer washer from rear of countershaft.
17. Remove countershaft rear bearing snap ring. Then move shaft back until rear bearing is out of case so it can be removed with a puller.
18. Tilt forward end of countershaft upward and remove. Then remove front bearing and spacer.
19. Remove reverse idler lock from rear of case.
20. Remove reverse idler gear shaft from rear of case, lift out gear and remove two roller bearings and spacer.
21. Remove sliding gears from mainshaft.
22. Hold splines of mainshaft in vise with soft jaws and spread snap ring, holding 4th speed (or overdrive) gear so it can be slid over splines and off end of shaft.
23. Turn forward steel thrust washer to align internal splines of washer with splineway on shaft and remove 4th speed (or overdrive) gear, bearing bushing, locating washer, 3rd speed roller bearing and gear, and locating washer, in that order.
24. Remove mainshaft pilot bearing.
25. To disassemble countershaft, remove front snap ring and press off gears.

### Reassembly Notes

Reassembly of the transmission is accomplished in the reverse order in which it was disassembled. However, observe the following:

1. When assembling mainshaft, clamp it in a vise with front end up. Place 3rd speed gear rear thrust washer on shaft and slip on 3rd speed gear. Apply heavy grease to rollers to hold them in position and insert them between gear and shaft.
2. Place 4th speed (or overdrive) gear rear thrust washer in position. Slide bearing sleeve over shaft, being sure inner race locating pin is in position and engaging splineway in shaft. Place 4th speed (or overdrive) gear in position and then the front splined thrust washer, pushing it down so that a new snap ring can be installed.
3. Install 3rd speed sliding gear on mainshaft with internal teeth toward front end and install low and reverse sliding gear with slot for shifter fork toward front end of shaft. Install sliding clutch hub on mainshaft.
4. When installing main drive gear front bearing cap, place oil return hole at bottom to line up with hole in case. Be sure these holes are clear of any obstruction.

## MODELS 230F, 231F

### Disassemble, Fig. 3

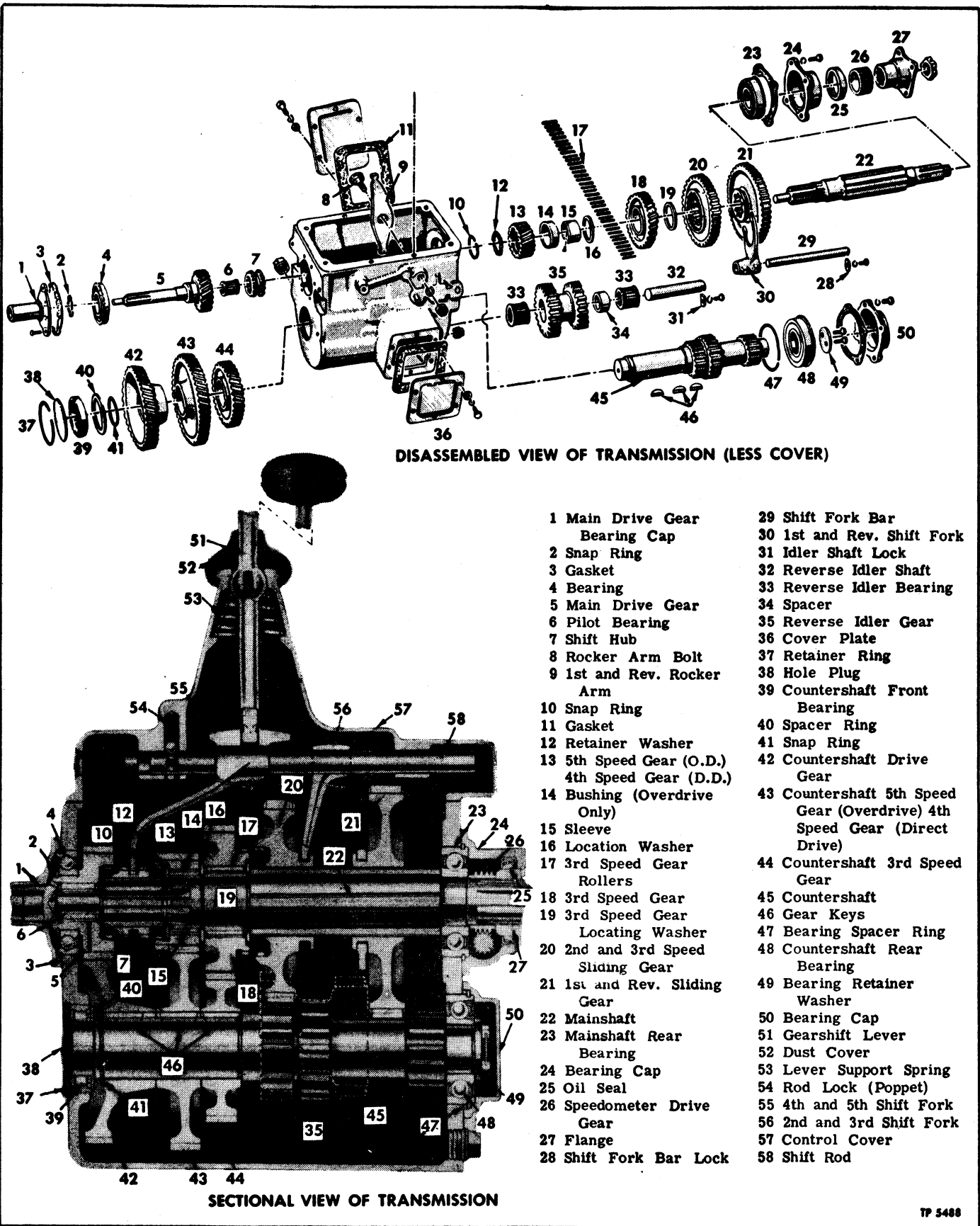
Shift the transmission into second speed and take off the cover and shifter assembly. Remove the speedometer driven gear. Disconnect the hand brake band and linkage from the transmission. Lock the transmission in two gears to prevent the mainshaft from turning and unscrew the nut from the rear of the mainshaft. Pull off the universal flange and brake drum.

Remove the bell housing and the main drive gear bearing retainer, then pull the gear assembly out through the front. Slip the sliding clutch gear off the mainshaft and withdraw it through the front. Disconnect the mainshaft rear bearing retainer and push the shaft to the rear far enough to permit the removal of the rear bearing and speedometer drive gear. Tilt the front end of the mainshaft upward and lift the assembly out through the top.

Take off the countershaft rear bearing cap and remove the two screws and washer from the rear bearing. Push the countershaft far enough to the rear to permit the rear bearing to be removed. Tilt the front end of the countershaft upward and lift the assembly out of the transmission case. Remove the lock, tap the reverse idler shaft out rearward and lift out the gear.

To disassemble the mainshaft, slip the sliding gear from the shaft. Remove the snap ring from the front of the third speed gear. Rotate the front thrust washer until its teeth align with the mainshaft splines and take off the gears, together with the roller bearings, inner race, and washers.

To assemble, clamp the shaft in a vise with the front end up and slip on the second speed gear rear thrust washer. Assemble the second speed gear over the shaft and insert the rollers between the gear and the shaft, using grease to hold them in place. Install the third speed gear rear thrust washer and the inner race with the locating pin engaging



DISASSEMBLED VIEW OF TRANSMISSION (LESS COVER)

SECTIONAL VIEW OF TRANSMISSION

- |  |  |
|--|--|
| 1 Main Drive Gear Bearing Cap                  | 29 Shift Fork Bar  |
| 2 Snap Ring                                    | 30 1st and Rev. Shift Fork   |
| 3 Gasket                                       | 31 Idler Shaft Lock  |
| 4 Bearing                                      | 32 Reverse Idler Shaft   |
| 5 Main Drive Gear                              | 33 Reverse Idler Bearing   |
| 6 Pilot Bearing                                | 34 Spacer  |
| 7 Shift Hub                                    | 35 Reverse Idler Gear  |
| 8 Rocker Arm Bolt                              | 36 Cover Plate   |
| 9 1st and Rev. Rocker Arm                      | 37 Retainer Ring   |
| 10 Snap Ring                                   | 38 Hole Plug   |
| 11 Gasket                                      | 39 Countershaft Front Bearing  |
| 12 Retainer Washer                             | 40 Spacer Ring   |
| 13 5th Speed Gear (O.D.) 4th Speed Gear (D.D.) | 41 Snap Ring   |
| 14 Bushing (Overdrive Only)                    | 42 Countershaft Drive Gear   |
| 15 Sleeve                                      | 43 Countershaft 5th Speed Gear (Overdrive) 4th Speed Gear (Direct Drive) |
| 16 Location Washer                             | 44 Countershaft 3rd Speed Gear   |
| 17 3rd Speed Gear Rollers                      | 45 Countershaft  |
| 18 3rd Speed Gear                              | 46 Gear Keys   |
| 19 3rd Speed Gear Locating Washer              | 47 Bearing Spacer Ring   |
| 20 2nd and 3rd Speed Sliding Gear              | 48 Countershaft Rear Bearing   |
| 21 1st and Rev. Sliding Gear                   | 49 Bearing Retainer Washer   |
| 22 Mainshaft                                   | 50 Bearing Cap   |
| 23 Mainshaft Rear Bearing                      | 51 Gearshift Lever   |
| 24 Bearing Cap                                 | 52 Dust Cover  |
| 25 Oil Seal                                    | 53 Lever Support Spring  |
| 26 Speedometer Drive Gear                      | 54 Rod Lock (Poppet)   |
| 27 Flange                                      | 55 4th and 5th Shift Fork  |
| 28 Shift Fork Bar Lock                         | 56 2nd and 3rd Shift Fork  |
|  | 57 Control Cover   |
|  | 58 Shift Rod   |

TP 5488

Fig. 2 Clark five speed transmission. Models 202, 204, 205, 207



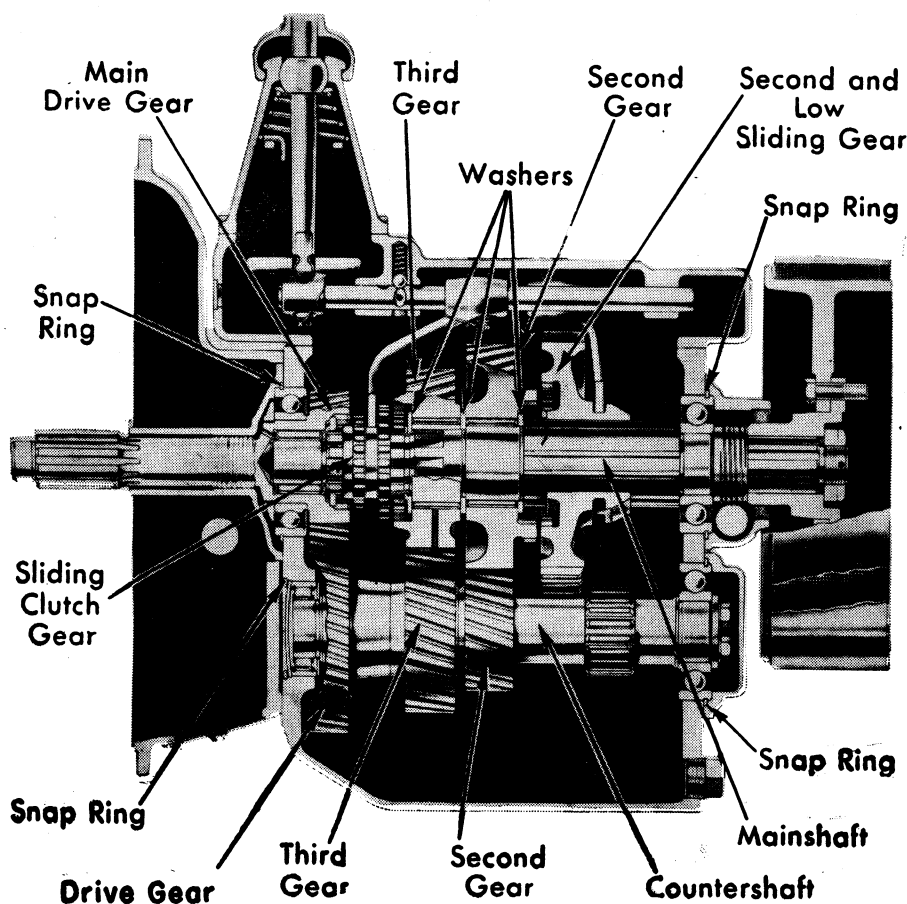


Fig. 3 Clark four speed transmission. Models 230F, 231F

mainshaft spline. Assemble the third speed gear over the race and insert the rollers, using grease to hold them in place. Slip on the front thrust washer and hold it down in order to install the snap ring. Lubricate the mainshaft splines and slip the sliding gear on the shaft with its internal teeth facing the front. Assemble the sliding clutch gear on the front of the shaft with the larger gear to the rear.

If necessary to disassemble the cover, drive the expansion plugs out of the cover. With all rails in the neutral position, remove the set screws from the shift forks and push the rails out toward the front, holding a hand over the lock ball holes to prevent them from flying out. As each rail is removed, tag it to be sure that assembly is made correctly. Remove the expansion plug from the side of the cover and tilt the cover on its side to allow the interlock plungers to drop out. Disassemble the reverse shifter fork assembly.

Assemble in the reverse order after lubricating all balls, springs and interlock plungers. When assembling the reverse shifter lug plunger, be sure it works freely and turn the adjusting nut until the plunger is flush with the face of the slot for the end of the shift lever.

### Assemble

Insert the reverse idler with the larger gear toward the rear and tap in the

shaft. Assemble the countershaft front bearing, its retainer and snap ring. Place the countershaft assembly in the case and install the rear bearing, the two retaining screws, washer and the retainer cap.

Position the mainshaft assembly in the case and replace the rear bearing, speedometer drive gear and rear bearing retainer. Lubricate the mainshaft pilot bearing, place it in position in the main drive gear and install the drive gear assembly through the front. Fasten the drive gear bearing retainer securely in position and replace the bell housing.

Complete the assembly by replacing the universal flange, brake drum, hand brake mechanism, transmission cover and speedometer driven gear.

## MODELS 265, 267, 300

### Disassemble, Fig. 4

1. Drain lubricant from case.
2. Remove control cover.
3. Remove 2nd speed gear oil scraper which is bolted to case.
4. Lock transmission in two gears so mainshaft cannot be turned and remove nut and flange from rear of mainshaft.
5. Remove bearing caps from rear of case, and bearing retaining nut from rear of countershaft.
6. Remove drive gear bearing cap and

pull drive gear and bearing through bore in front of case. If drive gear is to be disassembled, remove lock nut and press bearing off shaft.

7. Remove mainshaft pilot bearing.
8. Remove speedometer drive gear and spacer.
9. Push mainshaft toward rear far enough to permit use of puller to remove rear bearing.
10. Tilt front of mainshaft upward and lift assembly through top of case.
11. Remove reverse idler shaft lock plate.
12. Use puller in tapped hole in shaft to remove reverse idler shaft.
13. Remove reverse idler gear and bearings from inside of case.
14. Force countershaft rearward so that rear bearing can be removed with a puller. If countershaft is to be stripped, remove snap ring at front of shaft and press off gears.

### Mainshaft, Disassemble

1. Remove 4th and 5th speed synchronizer and place balance of mainshaft assembly in vise with front end up.
2. Remove snap ring holding 4th and 5th speed gear.
3. Remove forward thrust washer and slide off 4th and 5th speed gear.
4. Remove assembly from vise and, with front end pointing downward, pound lightly on block of wood, allowing weight of 3rd speed gear to force fluted bushing off shaft. After bushing has loosened, remove it from shaft together with 3rd speed gear locating washer. Use care not to lose the bushing locating pin.
5. Strip mainshaft of remaining parts.

### Mainshaft, Assemble

1. Place 2nd speed gear on shaft with spur teeth toward front.
2. Place 2nd speed gear retaining washer on shaft at gear and install snap ring.
3. Set rear synchronizer in place, noting that one side of synchronizer hub has counterbore to provide clearance for snap ring. This side must face 2nd speed gear.
4. Install 3rd speed gear with spur teeth toward synchronizer and install locating washer at gear.
5. Insert sleeve locating pin in mainshaft gear bushing and press sleeve on mainshaft. Pin must be toward front end of mainshaft.
6. The 4th and 5th speed gear retaining washer in furnished in three thicknesses for use in service. To determine proper washer to use, install snap ring in mainshaft groove. Measure space between edge of snap ring and edge of bushing and select the washer that will fill this space. Then remove snap ring.
7. Install gear on shaft, slide retaining washer into place at gear hub and reinstall snap ring.
8. Install synchronizer on front of shaft with extended side of hub toward front.

### Transmission, Assemble

1. Install countershaft front bearing.
2. Install countershaft front bearing spacer.

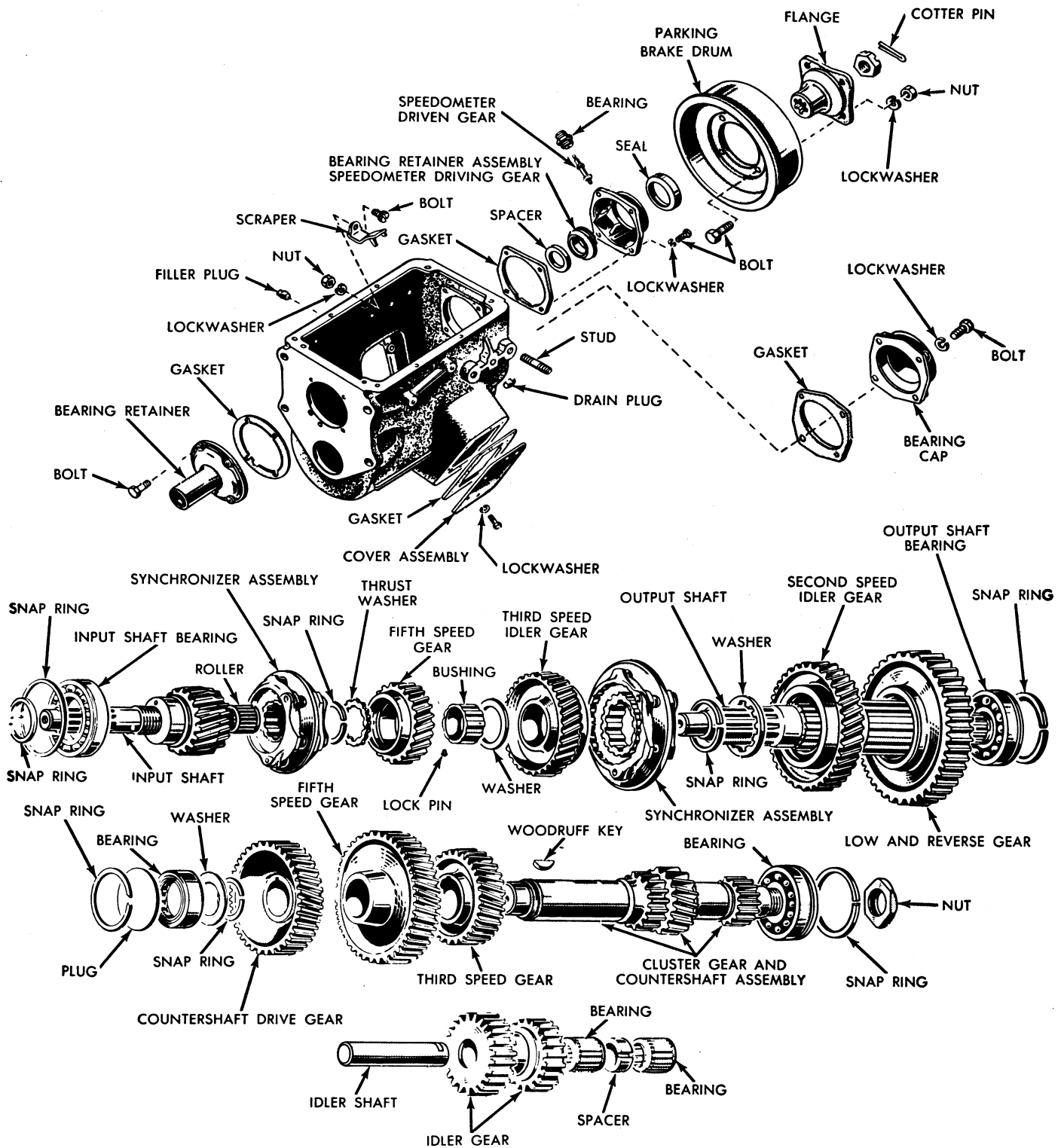


Fig. 4 Clark five speed transmission. Models 265, 267, 300

3. Install countershaft assembly.
4. Install countershaft rear bearing. Be sure snap ring is in groove of outer race and press bearing into position with snap ring toward rear.
5. Insert two roller bearings separated by spacer into hub of reverse idler

6. Drive reverse idler shaft in until forward face of slot in shaft is flush with rear face of case and slot lined up to permit installation of locking

7. Set mainshaft 1st and reverse gear in case and slip mainshaft through this gear and out through rear bore of case.
8. Move mainshaft forward and install rear bearing with snap ring in outer

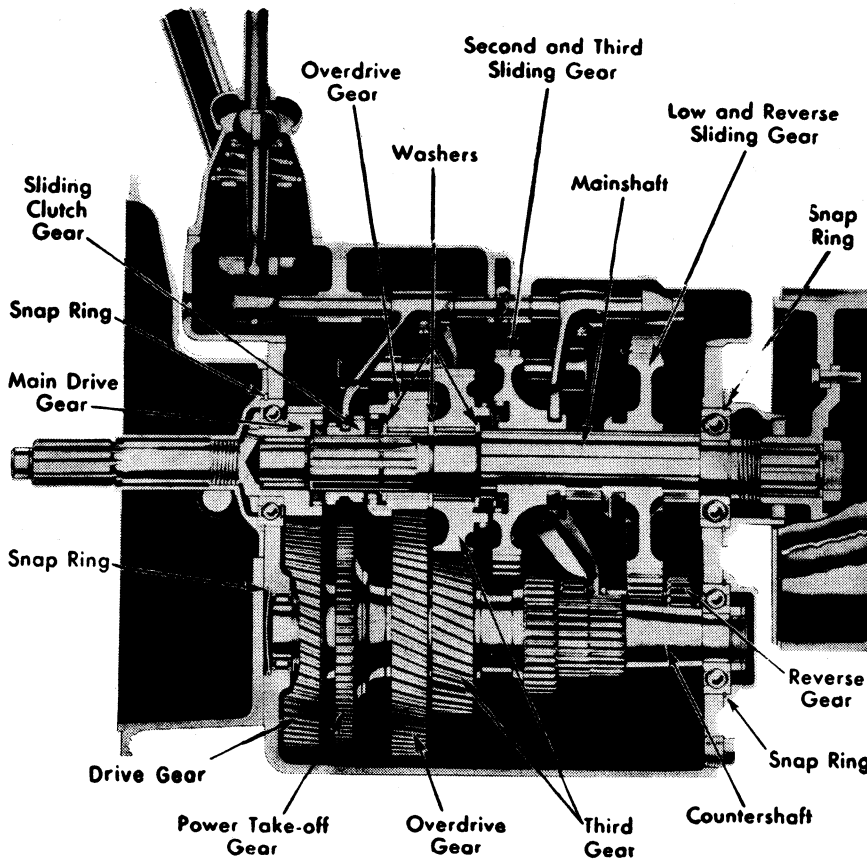


Fig. 5 Clark five speed transmission. Models 270, 276

race toward rear.

9. Install mainshaft pilot bearing.
10. Install main drive gear and bearing through bore in front of case. Install bearing cap with new gasket, using care to align cut-out in gasket with oil return passage in cap and transmission case.
11. Install countershaft rear bearing retaining nut and stake in place.
12. Complete the assembly by installing countershaft rear bearing cap and gasket, speedometer drive gear and spacer, mainshaft rear bearing cap and gasket, brake drum and companion flange, and control cover.

## MODELS 270, 276

### Disassemble, Fig. 5

1. Take off transmission cover.
2. Lock mainshaft in two gears and unscrew universal flange nut.
3. Pull off flange.
4. Remove bell housing and main drive gear bearing retainer.
5. Pull main drive gear out through front.
6. Slip sliding clutch gear and mainshaft pilot bearing from shaft.
7. Remove speedometer driven gear and mainshaft rear bearing retainer.
8. Push mainshaft far enough to rear to permit removal of speedometer drive gear and rear bearing.
9. Tilt front of mainshaft upward and

lift assembly out through top of case.

10. Take off countershaft rear bearing retainer.
11. Push countershaft far enough to rear to permit removal of rear bearing.
12. Lift countershaft assembly out of case.
13. Remove lock and take reverse idler shaft out through rear and lift out gear.
14. If countershaft front bearing is to be removed, remove snap ring and push bearing and expansion plug out through front.
15. To disassemble mainshaft, slip off sliding gears. Then remove snap ring from front of fourth speed gear. Rotate front thrust washer until its teeth align with spline groove and strip shaft of all parts.

### Reassemble

1. To assemble the mainshaft, clamp it in a vise with its front end up and install the third speed gear rear thrust washer. Place the third speed gear on the shaft and insert the bearing rollers, using grease to hold them in place. Install the intermediate thrust washer and the fourth speed gear inner bearing race, engaging the pin with the mainshaft spline.
2. On units having direct drive on fifth, install the fourth speed gear and bearing rollers in the same manner

as for the third speed gear. On units having direct on fourth, before installing the fifth speed gear and bushing, make sure the oil holes are clear and the bushing lubricated.

3. To continue assembling the mainshaft, place the front thrust washer in position and use a new snap ring to lock the assembly in place. Lubricate the mainshaft splines and slip on the sliding gears, with the larger gear to the rear and the shift fork channels facing each other. Slip the sliding clutch gear on the front end of the shaft. Lay the mainshaft assembly carefully aside for the time being.
4. Assemble the spacer and bearings in the reverse idler gear and place the assembly in the case with the smaller gear toward the rear. Push the reverse idler shaft in through the rear and engage the slot in the locking plate and fasten it securely.
5. The countershaft gears, including the power take-off gear but not the low speed gear, can be replaced by pressing them from the shaft. And when installed, be sure the five keys are a tight fit and staked in place. Assemble the front countershaft bearing in the case, install the expansion plug and use a new snap ring to lock it in place. Place the countershaft assembly in position and install the rear bearing and its retainer.
6. Assemble the mainshaft and gears in position and install the rear bearing, using a new snap ring. Install the speedometer drive gear and rear bearing retainer.
7. Lubricate the mainshaft pilot bearing and place it in the main drive gear pocket. Install the drive gear through the front, using a new snap ring to lock the bearing in place. Then fasten the front bearing retainer securely.
8. Complete the assembly by installing the universal flange, fastening the nut securely to the end of the mainshaft. Install the bell housing speedometer driven gear and transmission cover.

## MODELS 290, 291, 292

### Disassemble, Fig. 6

1. Remove cover and gasket.
2. Remove hand brake.
3. Lock mainshaft by engaging gears in two speeds at the same time. Then use a suitable puller to remove brake drum and companion flange.
4. Remove speedometer sleeve and driven gear.
5. Remove mainshaft and countershaft rear bearing covers.
6. Remove speedometer drive gear.
7. With transmission shafts in locked position, unscrew countershaft rear bearing retaining nut.
8. Disconnect flexible oil line at clutch release sleeve.
9. Remove clutch release bearing pull-back spring.
10. Remove release bearing and sleeve.
11. Remove lock wire and binder bolts from clutch release fingers.
12. Slide clutch release fingers on shaft

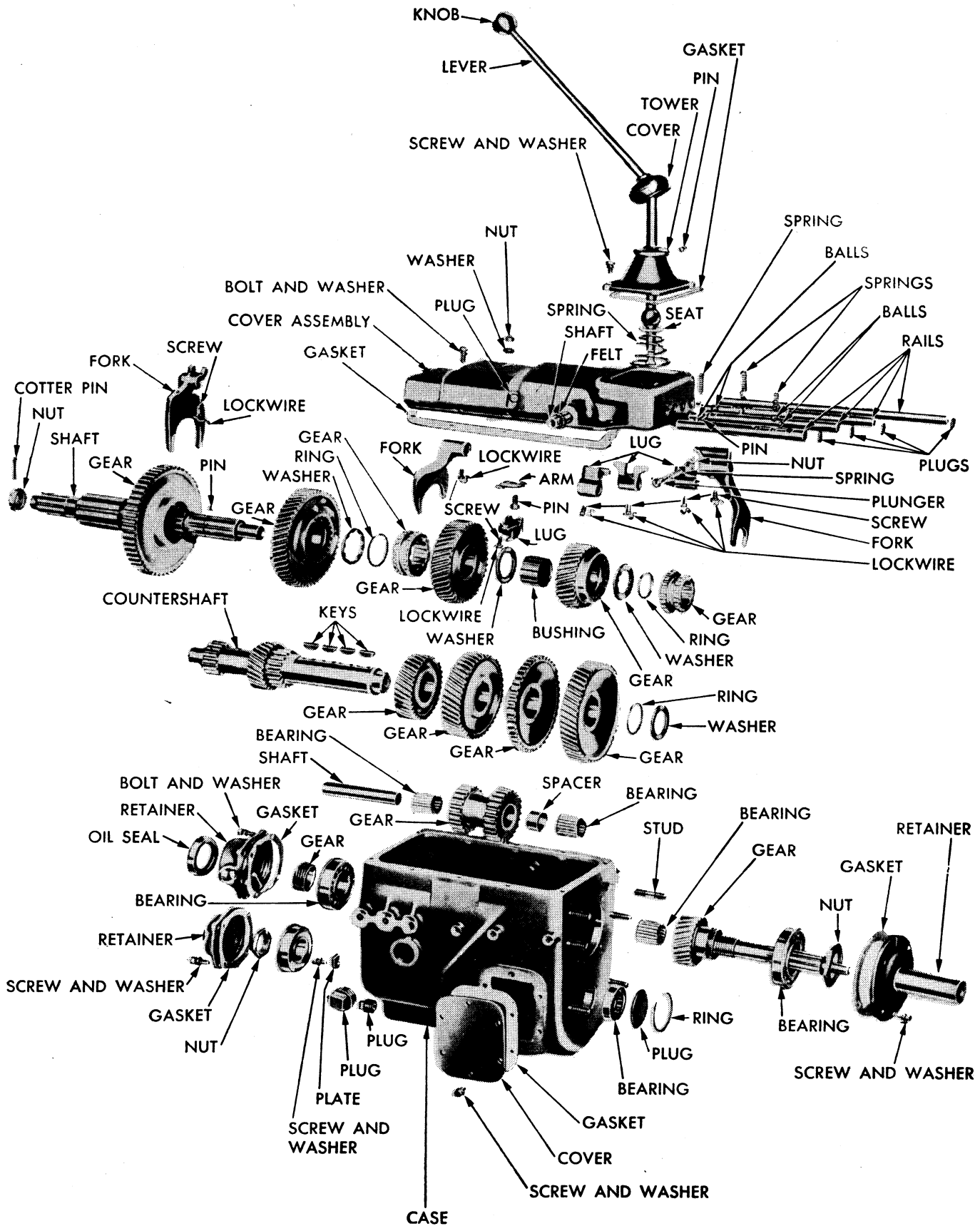


Fig. 6 Clark five speed transmission. Models 290, 291, 292

- far enough to expose Woodruff keys.
13. Remove Woodruff keys. Then pull shaft from bell housing and remove clutch release fingers.
  14. Remove main drive gear bearing retainer. Tap it off with a soft hammer if necessary.
  15. Pull main drive gear out through front, being careful not to drop pilot bearing which may be in pocket of drive gear.
  16. Using a brass drift, drive mainshaft back until rear bearing is out of transmission case.
  17. Use a suitable puller to remove rear bearing from mainshaft.
  18. Tilt front end of mainshaft upward and remove through top of case, leaving first and reverse sliding gear inside.
  19. Remove loose sliding gear from case.
  20. Remove reverse idler gear shaft from rear of case. Lift out reverse idler gear and remove two roller bearings and spacer from bore of idler gear.
  21. Move countershaft rearward until rear bearing is out of transmission case.
  22. Use a suitable puller to remove rear bearing from countershaft.
  23. Tilt front end of countershaft assembly upward and lift out of case. Remove countershaft front bearing spacer which was freed by removal of assembly.
  24. Remove countershaft front roller bearing from inside of case by inserting an offset screwdriver and prying lightly around outer race. Do not disturb snap ring and welch plug at front end of counterbore.
  25. If mainshaft pilot bearing did not come out with main drive gear, remove it from mainshaft.

## Mainshaft, Disassemble

1. Remove 4th and 5th gear shift hub.
2. Place mainshaft in vise with soft jaws with forward end up. Then remove snap ring, splined washer and 4th speed gear (on 290VO transmission this is overdrive gear).
3. Remove fluted bushing, locating washer and 3rd speed gear by taking assembly out of vise and jarring forward end of shaft against a block of wood. Weight of gear will force bushing off mainshaft. Use care not to lose pin.
4. Remove 2nd and 3rd sliding shift hub.
5. Remove 2nd speed gear by taking off snap ring, retaining washer and sliding gear off shaft.

## Countershaft, Disassemble

Remove snap ring from forward end of shaft and press off countershaft drive gear, power take-off drive gear, 4th and 3rd speed gear. Remove Woodruff keys from shaft.

## Main Drive Gear, Disassemble

Place gear in vise with soft jaws and remove retaining nut. Use an arbor press or puller to remove bearing.

**NOTE**—Bell housing should not be removed from transmission case unless absolutely necessary. If it has been removed for any reason or a new one is to be used, assemble the main drive gear and bearing cap in transmission case and tighten cap screws. Use bearing cap for centering bell housing and bolt housing in place.

## Reassembly Notes

Reassembly of sub-assemblies and their installation in the transmission is accomplished in the reverse order of the foregoing instructions. However, give special attention to the following:

1. Install 2nd speed gear on mainshaft with oil catchers up.
2. Install sliding 2nd and 3rd shift hub with undercut toward 2nd speed gear.
3. Install 3rd speed gear on mainshaft with toothed hub downward.
4. After installing fluted bushing and pin on mainshaft, lock pin toward upper end.
5. Install 4th speed gear on mainshaft with toothed hub upward. On VO transmission, this is the overdrive gear.
6. Install 4th and 5th speed hub with large end downward.
7. Install 1st and reverse gear on mainshaft with fork slot toward front.
8. Install countershaft rear bearing with snap ring toward rear.
9. Install mainshaft rear bearing with snap ring toward rear.
10. When installing main drive gear bearing retainer, be sure oil holes in case and retainer are aligned.
11. Install mainshaft rear oil seal with open end facing in.
12. If new bushings are installed in clutch release shaft, ream them to size.
13. When clutch release bearing and sleeve assembly is installed, adjust release fingers so that .003" clearance is provided between sleeve and each finger, or a total of .006" between sleeve and both fingers.

# Fuller Transmission Section

## ROAD RANGER

### 8 and 10 Speed Units

These transmissions combine a four- or five-speed main section with a two-speed auxiliary section at the rear to provide a total of eight or ten speeds forward and two reverse speeds. When equipped with an oil filter, as shown in Figs. 1 and 2, it is attached to either the right or left-hand power take-off opening. Fig. 3 illustrates the gear train of the eight-speed unit whereas Fig. 4 shows a cross section of the ten-speed unit.

## LUBRICATION

These transmissions should always be filled through the auxiliary section filler plug opening. Openings between the front and rear sections allow the lubricant to seek its proper level in both sections. *Overfilling will slow the action of the auxiliary synchronizing clutches, Fig. 3, and the extra drag caused may result in damage to the synchronizer discs.*

## TROUBLE SHOOTING

**NOTE**—Before removing the transmission from the truck for inspection, always check for possible trouble in the clutch, drive shaft, universal joints or rear axle.

### Noisy Transmission

Excessive noise may be caused by misalignment due to loose mounting bolts, paint on the clutch housing or transmission faces, flywheel housing misalignment, loose parts, dirt or metal chips in the lubricant, or insufficient lubricant.

Transmission noise may also be caused by worn or damaged parts, which requires the removal of the transmission to replace worn parts.

### Transmission Shifts Hard

Check the clutch pedal free travel adjustment and clutch parts. Inspect the transmission linkage for binding caused by bent or worn parts. Hard shifting may also be caused by improper lubricant in the transmission.

### Transmission Jumps Out of Gear

Improper shifting may cause the transmission to jump out of gear. Be sure the gears are completely engaged before releasing the clutch pedal.

Check the transmission linkage adjustment and make necessary corrections. Check for excessive end play caused by wear in the shift forks, sliding gear fork grooves, thrust washers, output shaft or countershaft bearings, or clutch pilot bearing or bushing.

Inspect the detent springs in the gear shift housing and replace any that are broken or damaged. Check clutch housing alignment with the engine.

### Oil Leakage

Oil leaks may be caused by overfilling the transmission or by using a lubricant that expands and foams while the truck is in operation.

Loose gear shift housing cover screws may allow the lubricant to escape between the housing and transmission case. Check the condition of the bearing retainers and gaskets. See that the transmission vent is open.

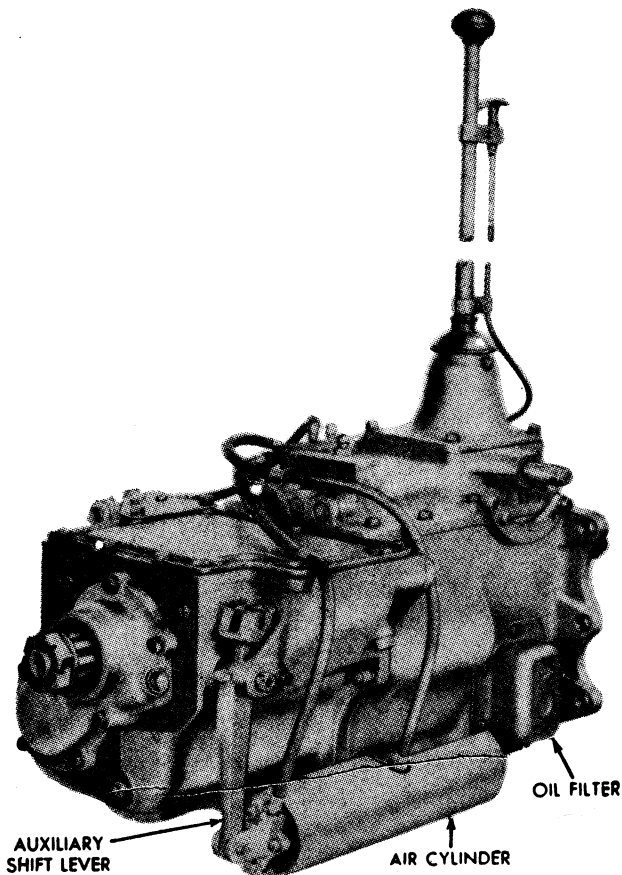


Fig. 1 Road Ranger eight-speed transmission (right side and rear view)

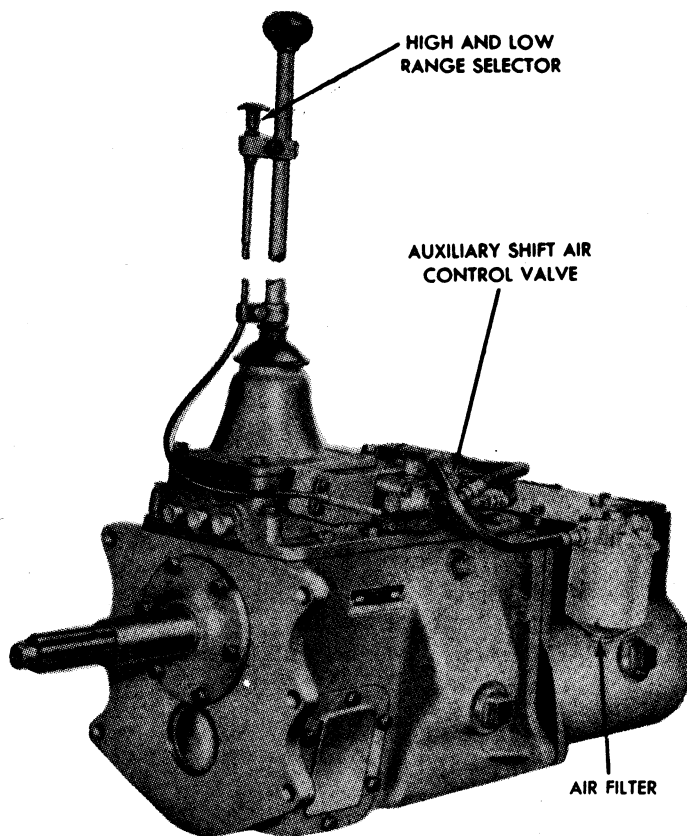


Fig. 2 Road Ranger eight-speed transmission (left side and front view)

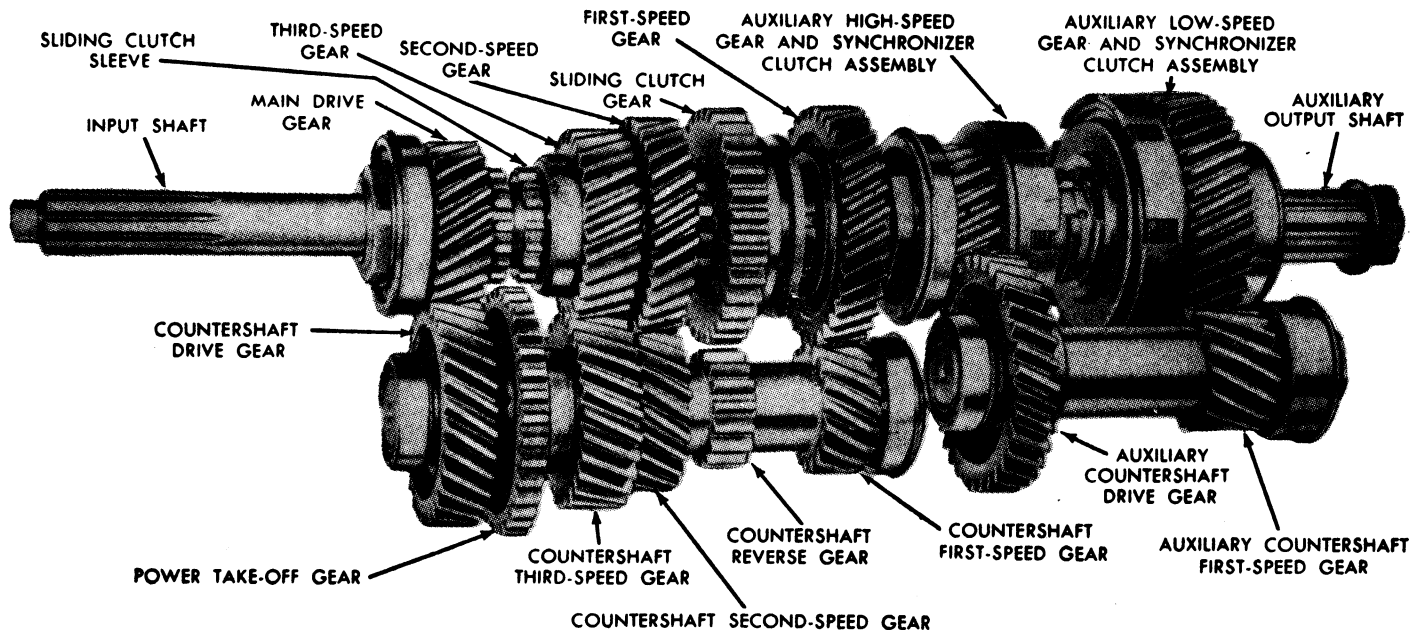


Fig. 3 Road Ranger eight-speed transmission gear train



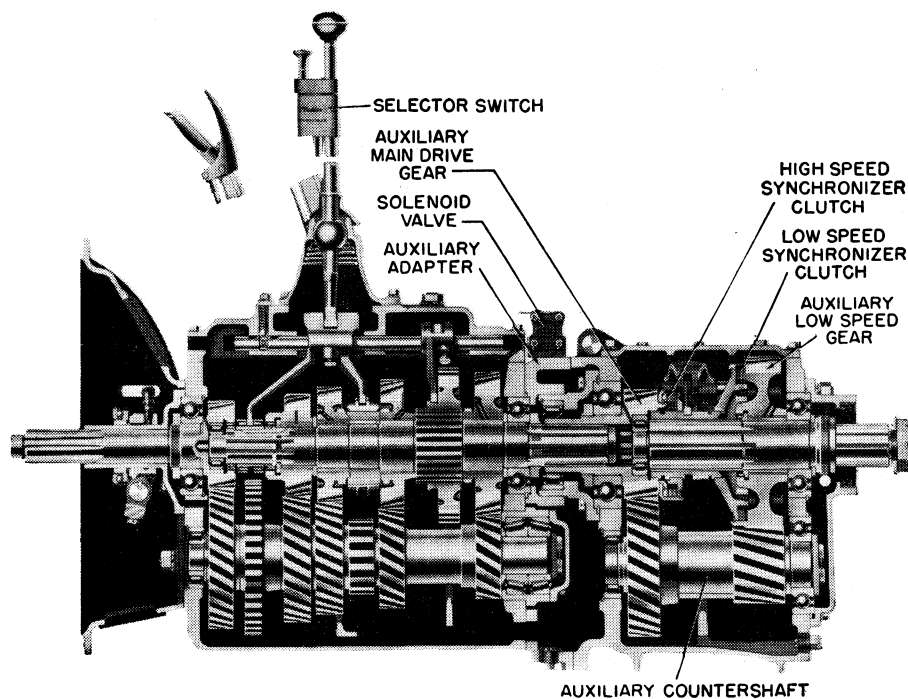


Fig. 4 Road Ranger ten-speed transmission

### Bind in Air Cylinder or Connecting Linkage

With the auxiliary section in high range, relieve the pressure in the air system and disconnect the piston rod of the air cylinder. Slowly move the piston several times through the complete stroke cycle. If either bind or drag is evident, disassemble the cylinder to find the cause. When connecting the piston, check the entire linkage for bind resulting from misalignment.

### Leak in Air Lines

Raise the air pressure in the lines to normal and coat all connections in the system with soapy water to locate leaks. Disassemble the leaky connections, coat them with sealing compound and reassemble. Replace worn, leaky air hose, and repair or replace connectors, lines and hoses which continue to leak.

### Leak in Air Cylinder

With the air system at normal line pressure and shift lever in neutral, disconnect the hose at the air cylinder which is not under pressure. Check the open port in the cylinder for a leak past the piston leathers. If no leak is found, connect the hose.

Move the shift lever to neutral and move the range selector handle to its opposite position. At the air cylinder, disconnect the air hose which is *not* now under pressure. Check the open port for a leak past the piston leathers; if no leak is found, connect the hose.

Check for a leak at the seal in the cylinder cap where the piston rod enters the cylinder.

If the above procedures disclose a leak, disassemble the cylinder and check the

leathers, barrel, seal and piston rod. Replace any defective parts.

### Defective Air Valve

Disconnect air hoses at the cylinder and cap each hose securely. After raising the air pressure to normal, move the shift lever to neutral and raise and lower the range selector handle. With each movement of the handle a short, fast blast of air should be heard at the breather valve. If the air exhaust is not as described, the valve is defective and the "O" rings should be replaced.

With the gear shift lever in neutral and selector handle in low-range position, check the breather valve for an escape of air past the pressure (outside) "O" ring. Move the selector handle to the opposite position and recheck the breather valve for a leak past the pressure "O" ring.

With the engine not running and with normal line pressure, move the shift lever in a geared position and then move the range selector handle to its opposite position. With movement of the selector handle a short, fast blast or air should be heard at the breather valve. After the initial exhaust, check the breather valve for continued escape of air past the pre-exhaust (inside) "O" ring.

Move the shift lever to neutral to allow the air valve to complete the shift. Again move the shift lever to a geared position and move the selector handle to its opposite position. After the initial exhaust, check the breather valve for continued escape of air past the pre-exhaust "O" ring.

If a leak is found at the breather valve after either a complete range shift or pre-exhaust of the air valve, replace both "O" rings.

### Block In Air System

Raise the air pressure to normal and move the shift lever to neutral. At the air cylinder, disconnect the hose which is not under pressure and move the range selector handle to its opposite position. If no air block exists, a loud, continuous air blast will escape from the disconnected hose. Move the range selector handle to its opposite position and reconnect the loose hose to the cylinder.

Move the range selector handle to its opposite position and proceed as above with the other hose. If this check reveals an air block, it can be located by inspection of the air valve and/or by inspection of the air lines.

## TRANSMISSION REMOVAL

The procedure for removing the transmission varies somewhat depending upon the truck in which it is used. In general, however, it is accomplished as follows:

1. Bleed air reservoirs.
2. Drain transmission.
3. Disconnect drive shaft.
4. Set parking brake and remove companion flange nut.
5. Remove parking brake assembly.
6. Disconnect speedometer cable at transmission.
7. Remove parking brake lever.
8. Move selector control cable to high range position and remove cable retaining clamps.
9. Disconnect cable at connector joint and remove cable and cable tube.
10. Remove gear shift lever housing.
11. Disconnect air line from air filter.
12. Disconnect air lines from air cylinder and remove cylinder from transmission.

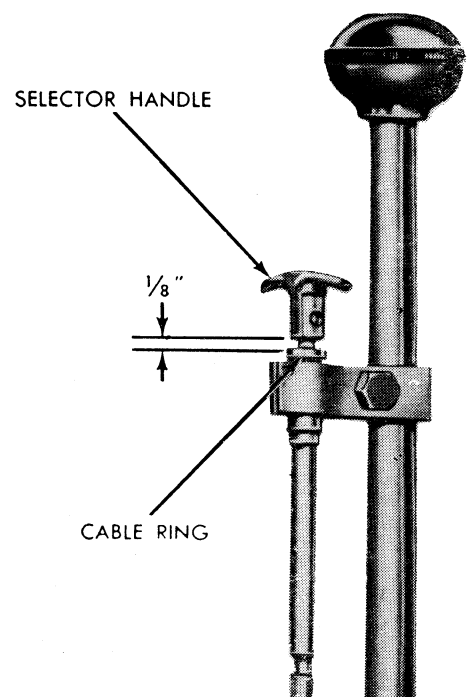


Fig. 5 Selector handle adjustment



13. Remove four lower transmission mounting bolts and install guide studs in the two lower holes.
14. Raise front axle on blocks and position jack under transmission.
15. Install safety chain.
16. Remove transmission support.
17. Remove two upper attaching bolts and remove transmission from truck.

**TRANSMISSION INSTALL**

Installation of the transmission is the reverse of the removal procedure. However, observe the following:

1. Torque the transmission-to-clutch housing bolts to 120-130 lbs. ft.
2. Torque the brake shoe support bolts to 180-220 lbs. ft.
3. Torque the companion flange nut to 275-350 lbs. ft.
4. Torque the gearshift housing attaching bolts to 35-40 lbs ft.
5. During installation of the selector cable, eliminate unnecessary bends, and do not bend the cable on a radius of less than 4 inches.
6. On tilt-cab models, route the connector end of the cable along the frame before attempting to adjust the cable. Position the frame clamps on the cable but do not attach the clamps to the frame.
7. Push the selector handle all the way down to the cable ring and shift the air valve into high range position.
8. Partially fill the cable tube with Lubriplate and slide it over the end of the long cable.
9. Attach the connector ends of the two cables and move the cable rearward into its bore in the valve housing.
10. Push the cable casing into the connector tube until it contacts the cable joint. *The selector handle must be held up in the high range position during this operation.*
11. With the cable casing in position against the joint, install the cable clamp and spacer on the adapter. *Tighten the bolts finger-tight.*
12. Position the control cable and clamps on the gear shift lever and tighten the clamp bolts securely. On tilt-cab models do not attach the clamps to the frame at this time.
13. Loosen bolts that attach cable clamp and spacer to adapter.
14. Push selector handle down until there is 1/8" clearance between bottom fo selector handle and cable

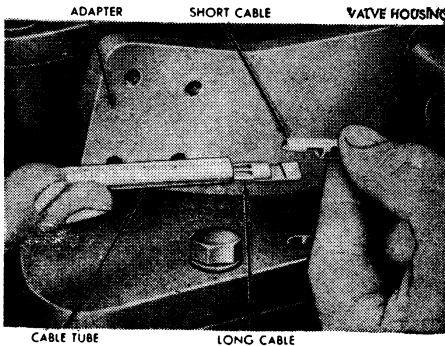


Fig. 6 Long and short shift cable connection

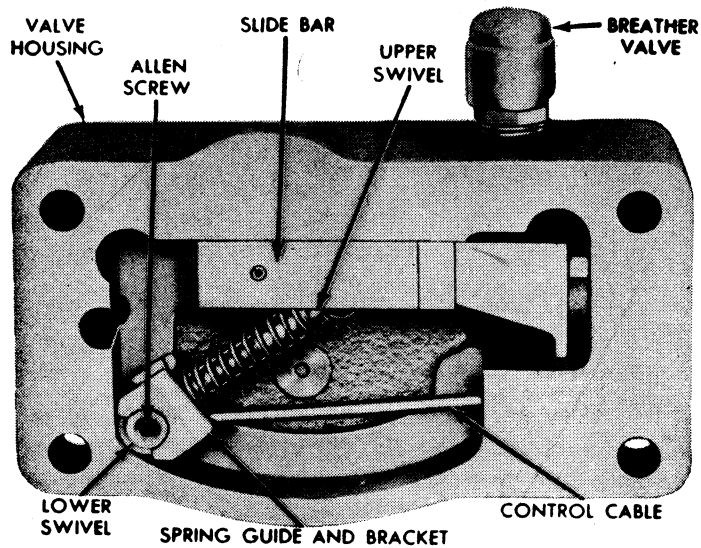


Fig. 8 Air valve

- ring, Fig. 5. *This clearance should not exceed 1/8".*
15. Tighten cable clamp bolts to adapter 10-15 lbs. ft., being careful not to pinch cable casing.
  16. Check operation of control cable, making certain that air valve shifts freely into both high and low range positions.
  17. On tilt-cab models, install frame clamps.
  18. Install transmission cover plate and close air reservoir valves.
  19. Fill transmission with lubricant, start engine and check for air leaks.

**AIR VALVE SERVICE**

**Removal**

1. Remove floor mat and plate.
2. Move selector control cable to high range position and remove cable clamp and spacer from adapter.
3. Disconnect long and short shift cables at connector joint, Fig. 6.
4. Disconnect 3 hoses at air valve and remove valve housing mounting bolts.
5. Remove air valve and plate, Fig. 7.
6. Remove Allen set screw which holds adapter to gearshift housing and remove adapter.
7. Remove lockout spring and pin from bore in gearshift housing.

**Disassembly**

1. Remove 3 air line fittings from valve housing.
2. Remove breather valve, Fig. 8.
3. Remove Allen head pipe plug from center opening in side of valve housing.
4. *Remove short control cable only for replacement.* Remove Allen set screw from end of lower swivel and pull cable from swivel through opening in front end of valve housing, Fig. 8.
5. Remove upper and lower swivels and spring by prying outward at lower

- swivel. Spring tension will free both swivels as lower swivel clears side of housing.
6. Lift out slide bar, spacer and shift fork.
7. Remove welch plug from front end of housing by carefully forcing plug outward with small punch. *Inserts in housing must not be moved or damaged as plug is removed.*
8. Remove valve through welch plug opening by pushing with small screwdriver at shift fork slot.
9. Remove "O" rings from valve.

**Inspection**

1. Clean and inspect all parts, replacing as necessary.
2. Check tension of actuator and swivel springs, and examine the upper and lower swivels for wear or damage.
3. Check the slide bar, spacer and shift fork for wear or rust, and replace the 4 "O" rings if one or more show wear or damage.
4. Coat the slide bar, spacer, shift fork, lower swivel and contact points with Automatic Transmission Fluid.

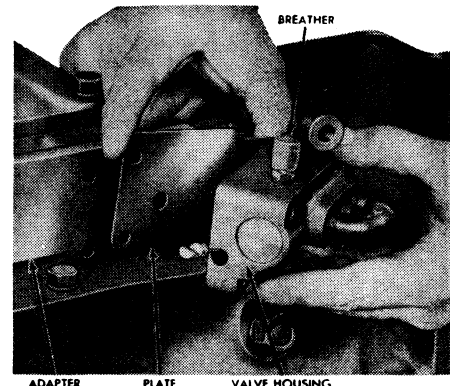


Fig. 7 Air valve and plate

## Assemble

1. Install "O" rings on valve.
2. Position valve in housing with shift fork slot toward front of housing, and install welch plug.
3. Position slide bar, spacer and shift fork in housing. *Shift fork must engage groove in valve and spacer must be positioned between slide bar and shift fork, Fig. 8.*
4. If short cable was removed from lower swivel, pass new cable completely through swivel. Stake cable securely through set screw hole in swivel. Install set screw.
5. Push connector end of cable through its opening in front of valve housing.
6. Position upper swivel and spring guide and bracket in ends of spring, and position lower swivel in yoke of spring guide.
7. Compress spring until upper swivel enters its depression in slide bar and lower swivel rides on lower track in housing.
8. To provide maximum projection of cable, move slide bar to rear of housing.
9. Install Allen head pipe plug in center opening in side of housing.
10. Install breather valve and 3 air hose fittings.

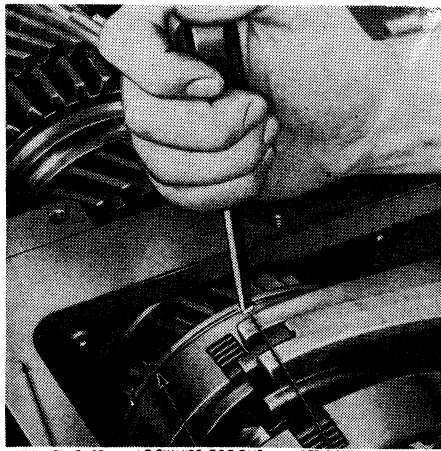
## Installation

1. Install lockout spring and pin in gearshift housing bore.
2. Position adapter and install retaining screw.
3. Position valve plate and air valve, install 4 mounting bolts and connect 3 hoses. Torque bolts to 10-15 lbs. ft.
4. Connect long and short shift cables and pull cable tube toward rear until it bottoms in valve housing.
5. Install cable retaining clamp and spacer on adapter and adjust cable as outlined under *Transmission, Install.*

## AUXILIARY SECTION SERVICE

### Separation Of Main And Auxiliary Transmissions

1. Disconnect 3 air hoses at air control valve and remove the 2 valves-to-

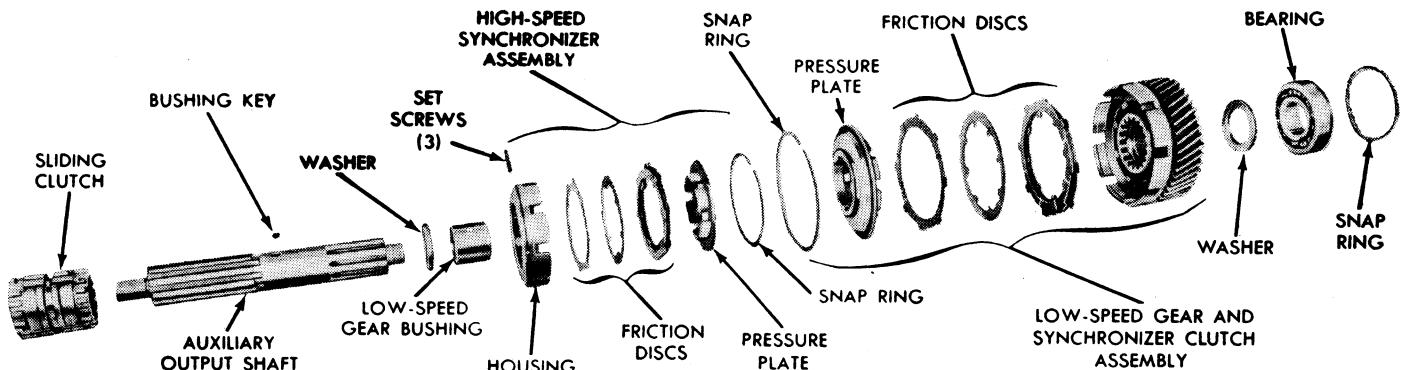


**Fig. 9 Removal of one screw from high-speed synchronizer clutch housing**

1. Disconnect cylinder hoses from transmission.
2. Remove air filter and air hose.
3. Remove air valve and plate from air valve adapter. *Do not lose small horseshoe spacer in air valve.*
4. With assembly shifted into neutral, remove main transmission gear shift housing assembly and auxiliary cover.
5. Remove auxiliary rear bearing cover and speedometer drive gear.
6. With a small punch, relieve the auxiliary countershaft rear bearing nut where it is staked to shaft. Shift main transmission into two gears and remove countershaft rear bearing nut. *This nut has a right-hand thread.*
7. Shift main transmission into neutral and auxiliary unit into low range. Remove lock wire from groove at front end of auxiliary high speed synchronizer clutch housing. Remove 3 set screws (in lock wire groove) which secure high speed synchronizer clutch housing to auxiliary drive gear, Fig. 9. Move clutch housing to rear against auxiliary shifting yoke.
8. Remove upper front nuts from two studs inside auxiliary case.
9. Remove 6 nuts retaining auxiliary case to main case.
10. Remove auxiliary case from main case by tapping with a soft mallet.

## Disassemble

1. Remove auxiliary detent spring cap from boss under shift fork shaft, and remove spring and ball.
2. Remove shift lever fulcrum pin lock plate and withdraw pin, using a slide hammer.
3. Remove shift lever.
4. Remove swivel pin from shift shaft.
5. To remove shift fork, cut lock wire and remove shift fork lock screws. Withdraw shift shaft and remove fork and fork shoe.
6. Remove oil seal from shift shaft bore in rear of case.
7. Remove auxiliary output shaft pilot bearing.
8. Using a soft mallet, tap auxiliary output shaft forward out of rear bearing. Remove shaft by forcing it forward out of case through front bearing bore.
9. Remove low speed gear, high speed synchronizer clutch and low speed thrust washer from case.
10. Remove output shaft rear bearing from case by lightly tapping bearing outer race with soft drift.
11. To remove countershaft, tap shaft to rear until rear bearing is out of case. Remove rear bearing from shaft, using a suitable puller.
12. Tilt countershaft and remove it from top of case.
13. Remove front countershaft bearing by tapping lightly on outer race with a soft mallet. If countershaft drive gear is to be replaced, press it off the shaft.
14. To dismantle the output shaft assembly, Fig. 10, first remove the sliding clutch gear.
15. Press the output shaft  $\frac{5}{8}$ " through low speed gear front thrust washer and bushing. *Pressing the shaft more than  $\frac{5}{8}$ " will damage the small Woodruff key and thrust washer.* Move thrust washer forward against shoulder of shaft and press shaft through bushing until key is completely exposed. Remove key and press washer and bushing off shaft.
16. Disassembly of the two clutches is the same. At the rim of the clutch, remove the wire stop for the pressure plate retaining snap ring. Remove snap ring, pressure plate and discs from housing.



**Fig. 10 Auxiliary section output shaft**

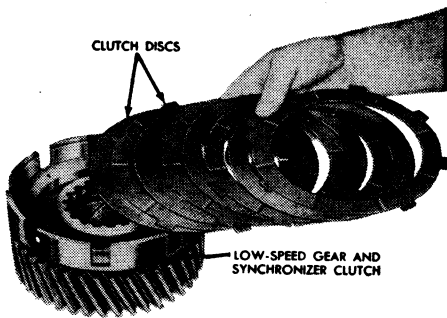


Fig. 11 Positioning synchronizer discs

### Inspection

Check the surfaces of all thrust washers. Washers scored and/or reduced in thickness should be replaced. Synchronizer discs scored, burned or warped should be replaced. Bearing covers grooved or showing wear from thrust of adjacent bearings should be replaced. Check oil return threads in bearing covers. If the sealing action of the threads has been destroyed by contact from the input and output shafts, replace the covers.

### Assemble

- Both synchronizer clutches are assembled the same way. Start with an inner disc (projections at inside diameter) and alternately place one inner and one outer disc in housing until 8 discs have been installed, Fig. 11.
- Install pressure plate and snap ring. Lock wire hole in rim of gear must be between open ends of snap ring.
- Install lock wire in housing rim and bend wire up internally and down externally. Internal end must not extend above housing.
- Press countershaft drive gear on shaft, Fig. 12.
- To assemble output shaft, refer to Fig. 10 and proceed as follows:
- Install low speed gear front thrust washer on rear of shaft with beveled edge toward front of shaft.
- Install Woodruff key and press low speed gear bushing onto shaft until thrust washer is firmly seated against spline shoulder.
- Install new oil seal in shift shaft bore.
- Position snap ring on countershaft front bearing and install bearing in case. Tap lightly with soft mallet if necessary.
- Position countershaft front bearing thrust washer on countershaft and install it in case.
- Position snap ring on countershaft rear bearing and install bearing, using a suitable bearing driver.
- Place low speed gear and high speed clutch in case, making sure low gear teeth engage those of low countershaft gear.
- Install output shaft through front of case, threading it through high speed clutch and low gear until low gear is fully seated on sleeve.
- Position low gear rear thrust washer on output shaft with beveled edge toward low gear.

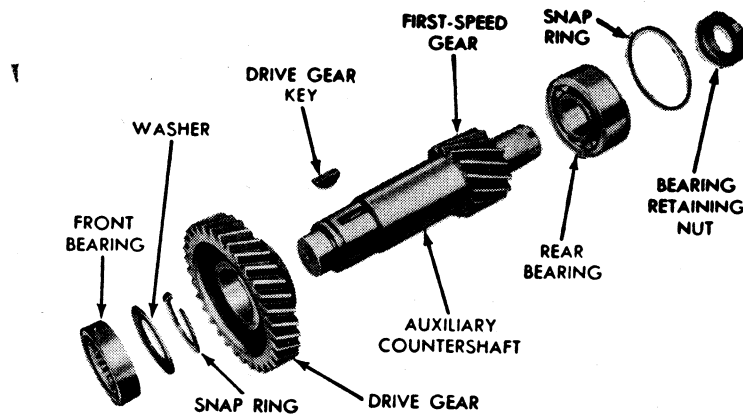


Fig. 12 Auxiliary section countershaft and related parts

- Install snap ring on output shaft rear bearing.
- Block front of output shaft and install bearing in case, using suitable bearing driver.
- Install sliding clutch on output shaft through front bearing bore with word "front" toward front end of shaft. Thread sliding clutch through both synchronizer clutches until it engages pocket in low gear. *Interference can be eliminated during installation of sliding clutch by turning synchronizer clutches until lugs on inside diameters line up with grooves in sliding clutch.*
- Install shoe in shift fork. *Counter-sunk holes in fork must be up and rib in shoe must face the rear.*
- Install shoe and fork in sliding clutch.
- Insert shift shaft in case through fork. End of shaft with milled flats should be to rear. Make sure notches in shaft line up with holes in fork but do not install lock screws.
- Shift sliding clutch into low speed position and install auxiliary detent spring, ball and cap. Torque cap to 25-35 lbs. ft.
- Install swivel pin on outer end of shift shaft.
- Position shift lever on swivel pin. Insert fulcrum pin in case and through shift lever, lining up milled slot in pin with lock screw hole. Drive fulcrum pin into case until slot is flush with case.
- Install fulcrum pin lock, capscrew and lockwasher, and torque to 20-25 lbs. ft.
- Install shift fork lock screws and torque to 50-60 lbs. ft.
- Install safety wires in shift fork screws.

### Joining Main and Auxiliary Transmissions

- Shift auxiliary section into low range. Move high speed clutch to rear against auxiliary shift fork.
- Install auxiliary output shaft pilot bearing in bore of auxiliary drive gear.
- Install new gasket between two transmission cases.
- Attach main and auxiliary cases by

fitting auxiliary section over gear which projects from end of mainshaft of main transmission. At the same time, fit auxiliary case over studs which project from rear of main case. The mainshaft rear bearing must be seated in shallow bore in rear of main case before two sections are joined.

- Install retaining nuts holding two cases together and torque to 65-70 lbs. ft. *Do not overlook the nuts on the two upper studs on the inside of the auxiliary case.*
- Shift main transmission into two gears and torque auxiliary countershaft rear bearing nut to 250-300 lbs. ft. *This nut has a right-hand thread. Stake nut at milled slots, and shift transmission into neutral.*
- Move high speed synchronizer clutch forward against auxiliary drive gear.
- Line up three holes in outside diameter of high speed synchronizer housing with holes in projections on drive gear.
- Fit high speed clutch on projections of drive gear and move it forward until flush against shoulder of gear, at the same time keeping holes in line.
- Install three set screws which retain clutch to drive gear. Tighten screws securely and then back them off until the slots are parallel with lock wire grooves in synchronizer housing.
- Install lock wire in groove at front end of synchronizer housing and through slotted heads of set screws.
- Install speedometer drive gear.
- Install auxiliary rear bearing cover with new gasket and torque bolts to 25-35 lbs. ft.
- Install auxiliary transmission cover

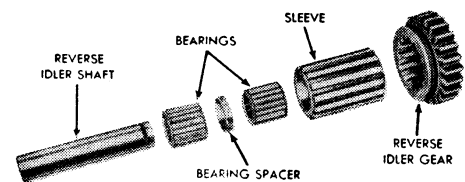
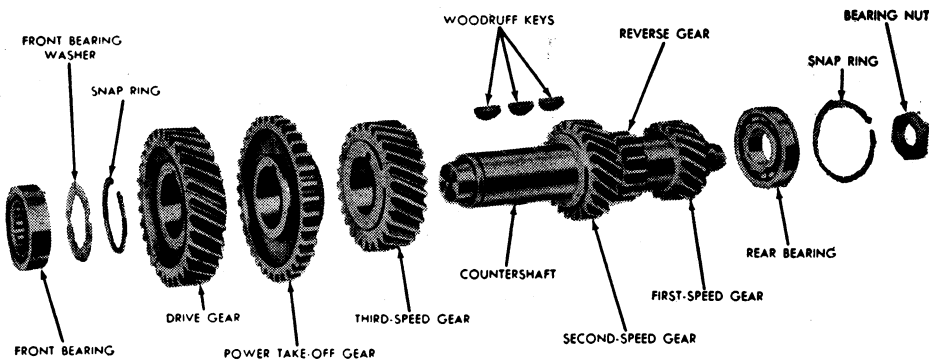


Fig. 13 Reverse idler shaft and related parts



**Fig. 14 Countershaft and related parts**

- and gasket and torque bolts to 35-40 lbs. ft.
- Shift gear shift housing in neutral and install with new gasket. Shift forks must enter grooves in mainshaft sliding gears and reverse shift lever must engage reverse shift gate. Torque gear shift housing bolts to 35-40 lbs. ft.
  - Install air filter.
  - Install air valve and plate on air valve adapter. Torque bolts to 10-15 lbs. ft. Make sure small horseshoe spacer is installed between slide bar and shift fork.
  - Connect air hose to front of air filter and top fitting of air valve.
  - Install two air cylinder hoses and clamps on transmission and connect hoses to air control valve.

## 4 SPEED MAIN SECTION

**NOTE**—Separate the main and auxiliary transmissions as outlined previously. Then disassemble the main section as follows:

### Disassemble

- Using a small punch, unstake coun-

tershaft rear bearing nut. Shift transmission into two gears and remove nut, which has a right-hand thread.

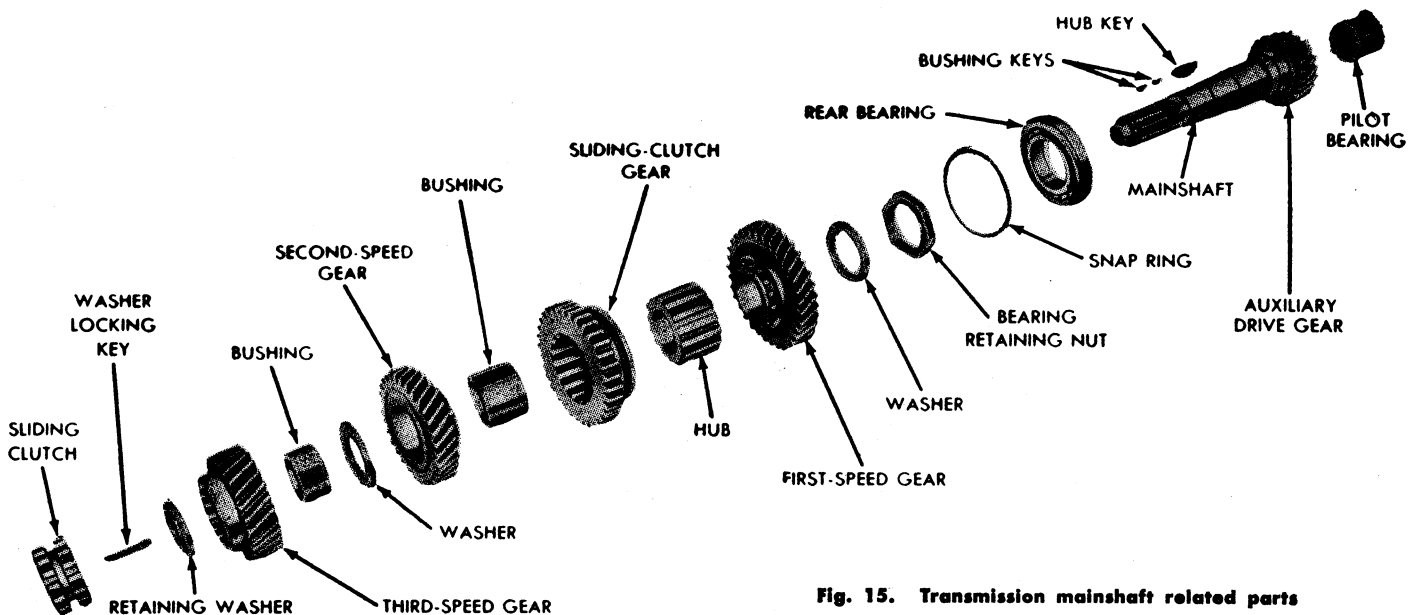
- Remove input shaft bearing retainer and pull shaft and bearing out of front of case as an assembly.
- If input shaft bearing is to be removed, unstake retaining nut and remove the nut, which has a left-hand thread. Shift transmission into neutral.
- To remove mainshaft, shift reverse gear into mesh with countershaft, and shift sliding gear forward into second speed position. Then lift mainshaft from case.
- Remove nut from reverse shift lever pivot pin on left side of transmission case. Force pin out of case and remove lever and pin.
- Remove reverse idler shaft retainer through opening in rear of case.
- Remove shaft by threading a cap-screw into the shaft and use a slide hammer to pull shaft from case.
- Remove splined reverse sleeve with reverse gear, bearings and spacer.
- Remove reverse idler gear from sleeve.
- Remove caged bearings and spacer

from sleeve, Fig. 13.

- To remove countershaft, pry it to rear until rear bearing is out of case.
- Using a suitable bearing puller, remove bearing from countershaft.
- Lift countershaft out of case.
- To remove countershaft front bearing, rap front of case sharply with a mallet to jar bearing backward, and remove it from case.
- To disassemble input shaft, remove bearing nut and press bearing from shaft.
- If countershaft gears are to be removed, remove snap ring and press gears off shaft one at a time, Fig. 14. Remove Woodruff keys from shaft.

### Mainshaft Disassemble

- Secure mainshaft assembly in a soft-jawed vise.
- Remove pilot bearing.
- Tap sliding clutch off shaft.
- At pilot end of shaft and between the splines, pry out third speed gear washer locking key. Remove washer and gear, Fig. 15.
- Position mainshaft in a press, using sliding clutch gear as a base and press mainshaft  $\frac{1}{8}$ " through third speed gear bushing and thrust washer. If a press is not available, pry bushing upward. Travel of mainshaft is limited to  $\frac{1}{8}$ " by the small Woodruff key installed under the sleeve. Pressing the shaft more than  $\frac{1}{8}$ " will shear the key and damage the washer.
- Pry third gear bushing upward on shaft to expose Woodruff key, Fig. 16, and remove key.
- Using weight of sliding clutch gear, jar second speed gear, third gear bushing and thrust washer off shaft.
- Remove sliding gear.
- Position mainshaft in press. Then press shaft out of first speed gear, sliding gear hub and second gear bushing.



**Fig. 15. Transmission mainshaft related parts**

10. Remove Woodruff keys from shaft and remove first gear thrust washer.
11. Unstake and remove mainshaft rear bearing nut, which has a left-hand thread.
12. Press rear bearing from mainshaft.

### Mainshaft Assemble

1. Press mainshaft rear bearing on shaft with snap ring groove toward front and install snap ring.
2. Install rear bearing retaining nut and torque to 300-350 lbs. ft. Stake nut at slots milled into shaft.
3. Install first gear rear thrust washer with beveled edge on the I.D. toward rear of shaft.
4. Install first gear with clutching teeth toward front of shaft, Fig. 15.
5. Install large Woodruff key which prevents movement of sliding clutch gear hub.
6. Position sliding clutch gear hub on shaft with beveled edge at the I.D. toward rear of shaft. Line up keyway with key and press shaft through hub until hub is tight against shoulder of shaft. *When pressing shaft through hub hold first gear against its rear thrust washer.*
7. Install sliding clutch gear on its hub with fork slot to rear.
8. Install small Woodruff key which prevents movement of second gear bushing.
9. Position second gear bushing on shaft, making sure keyway is lined up with Woodruff key.
10. Press or tap bushing into position, making sure it fits tightly against hub.
11. Install second gear with clutching teeth toward rear.
12. Install third gear rear thrust washer with beveled edge at the I.D. to rear.
13. Install Woodruff key which prevents movement of third gear sleeve.
14. Line up keyway in third gear bushing with the key, and press or tap bushing into position. Bushing must fit tightly against rear thrust washer.
15. Install third speed gear with internal clutching teeth toward front of shaft.
16. Install third gear retaining washer with beveled edge of lugs at the I. D. to rear. Turn washer in its groove until lugs are under splines on shaft. The thick end of this key must enter slot in washer. Check end clearance between third gear and its thrust washer, which must be .006" to .012". Adjust to specified clearance by selecting a third gear retaining washer of the proper thickness. These washers are available in thicknesses of .253-.255", .258-.260" and .263-.265".
17. Install sliding clutch with word "front" toward front of shaft.
18. Install mainshaft pilot bearing on mainshaft with roller retaining snap ring to rear of shaft.

### Main Transmission Assemble

1. Install countershaft front bearing in its bore.
2. Lower countershaft into case and

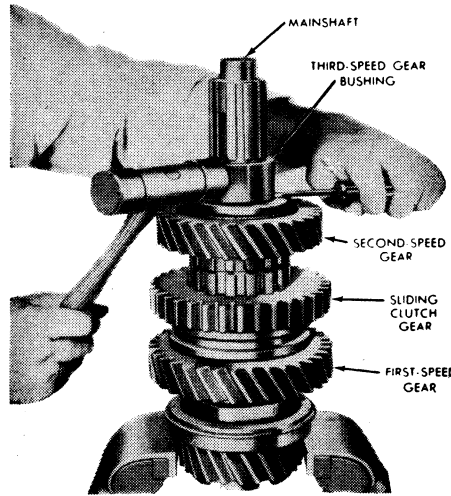


Fig. 16 Gaining access to third speed gear bushing key

- position front of shaft into front bearing.
3. Install countershaft rear bearing, using a suitable bearing driver.
4. Install countershaft rear bearing retaining nut finger-tight. This nut has a right-hand thread.
5. Install bearings and spacer in splined reverse gear sleeve, Fig. 13.
6. Install reverse gear in splined sleeve. Position gear and sleeve in case with shift fork groove in gear toward front of transmission.
7. Insert reverse idler shaft in case and through bearings and spacer. Line up slot in shaft with lock screw hole in case.
8. Drive shaft into case until front edge of milled slot in shaft is flush with case wall.
9. Install reverse idler shaft retainer and torque capscrew to 20-25 lbs. ft.
10. Install reverse shifting lug in bottom or gear end of reverse lever. Insert lug in lever from side opposite bosses. Install snap ring on grooved end of lug.
11. Position reverse shifting lever in case, and guide lug into groove in reverse sliding gear.
12. Line up hole in lever with hole in case and install pivot pin through lever and case. Install washer and nut on pivot pin and torque nut to 100-115 lbs. ft.
13. Shift reverse idler shaft into mesh with countershaft and move mainshaft sliding gear into mesh with second speed gear clutching teeth.
14. Lower mainshaft assembly into case, making sure all mainshaft and countershaft gears properly engage, and that the rear bearing is seated in its shallow bore in rear face of case.
15. Install input shaft, making sure mainshaft pilot bearing enters bore in input shaft. Block against rear of mainshaft as input shaft is installed.
16. Shift transmission into two gears and torque countershaft rear bearing nut to 225-275 lbs. ft. Stake nut in place.
17. If input shaft bearing was removed, install retaining nut and torque to

- 250-300 lbs. ft. Stake nut in place.
18. Shift transmission into neutral. Install input shaft bearing cover and gasket, making sure oil return hole in cover lines up with hole in case. Torque bolts to 25-35 lbs. ft.

## 5 SPEED MAIN SECTION

Service on the five-speed main section is quite similar to that described for the four-speed main section. However, due to the fact that the mainshaft has more parts and is, therefore, more complex than its four-speed counterpart, herewith is given the procedure for disassembling and assembling the five-speed unit mainshaft. For the balance of the assembly, refer to the procedures outlined for the four-speed unit.

### Mainshaft Disassemble

1. With mainshaft assembly removed from case, mount assembly in a vise with soft jaws.
2. At pilot end of mainshaft and between splines, locate and pry washer retaining key from keyway.
3. Turn washer in its groove until lugs on the O.D. line up with spline grooves in shaft.
4. Remove upper bushed gear and front washer over pilot end of shaft.
5. Remove assembly from vise and jar pilot end of shaft against block placed on floor. The weight of third speed gear in Model R-95-C or second gear in Model R-950-C will jar sleeve and washer from shaft. Catch gear and clutch collar as they clear sleeve seat.
6. On Model R-95-C only, mount assembly in press, using rear face of second speed gear as a base. Press shaft through gear. This operation will also remove sleeve assembled in front of gear.
7. On Model R-950-C only, mount shaft in press, using rear face of first speed gear as a base. Press shaft through gear and front sleeve. Using front face of overdrive gear as a base, press shaft and gear through gear and rear sleeve approximately  $\frac{3}{4}$ ". *Travel of gear and sleeve is limited to  $\frac{3}{4}$ " by Woodruff key installed under sleeve; do not press shaft further.* Move mainshaft overdrive gear to its original position against shoulder on shaft. Using front face of sleeve as a base, press shaft through sleeve. Remove shaft from Woodruff key which prevents radial movement of sleeve. Then remove overdrive gear from shaft.

### Mainshaft Assemble

1. Install all parts on mainshaft including sliding gears, bushed gears and rear thrust washers. *Install high speed sliding clutch with counterbore to rear. Install splined sleeve for sliding clutch collar with counterbore to front.*
2. On Model R-95-C only, over rear bearing seat and against first speed gear rear washer, install spacer approximately  $1\frac{3}{4}$ " to 2" long. Turn mainshaft rear bearing nut against spacer. Nut and spacer will hold sliding gear, rear bushed gear and

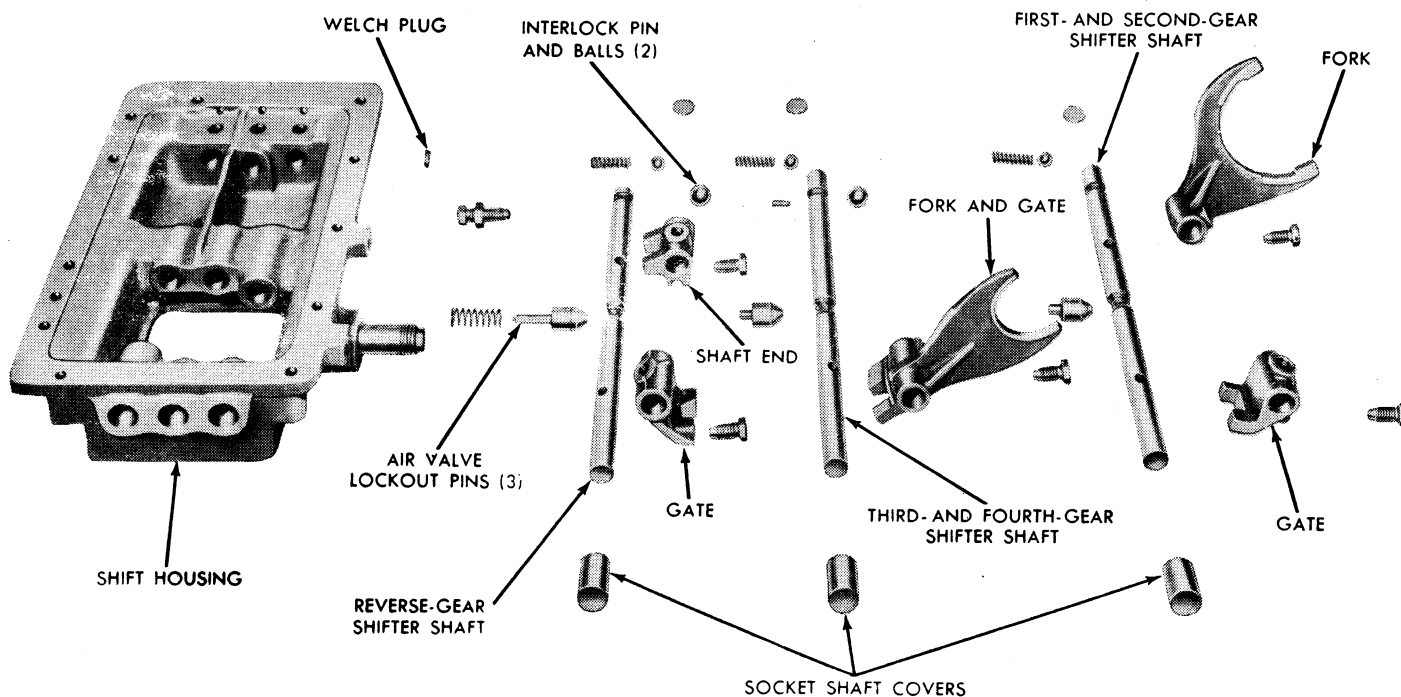


Fig. 17 Eight-speed transmission gearshift mechanism

washer in place as shaft assembly is placed in case.

3. Install mainshaft assembly in case. On Model R-95-C, remove spacer and nut mentioned above.
4. Install rear bearing, install and tighten nut securely, and stake nut in place.

## GEARSHIFT MECHANISM

Fig. 17 shows a layout of the parts comprising the eight-speed transmission gearshift mechanism. A similar arrangement is used for the ten-speed unit.

### Gearshift Housing Disassemble

1. Remove the air valve adapter plate and lock pin and spring from the bore in the air valve mounting surface.
2. Remove the welch plug from the interlock bore on the left side of the shift housing and, with air valve mounting face down, mount housing in a soft-jawed vise.
3. Make sure all shifter shafts are in neutral. Then remove lock wires and lock screws from shifting forks and gates, Fig. 17.
4. Remove welch plugs from rear of shift housing.
5. Remove shifter shafts, top one first, by driving them out front of housing. The detent springs and balls, interlock pin and balls, and intermediate air valve lockout pins must not be lost as shafts are removed. A detent spring and steel ball are depressed by each shaft and will be released from the bore as the shaft clears the hole in the rear hub.

### Inspection

Shift forks and gates should be checked for wear. Check forks for alignment. Check lock screws in forks and gates. Replace parts showing wear or misalignment. Retighten and rewire lock screws. Check neutral notches in shafts for wear from interlock balls. Shafts indented at points adjacent to neutral notches should be replaced. Check spring tension on shift lever. Replace tension spring and washer if lever moves too freely. Check shift lever pivot pin and slot in lever for wear. Check auxiliary shift fork and shoe for wear. Replace if necessary.

### Assemble

Reverse the order of disassembly to assemble the shift housing. Be sure the interlock pin is in the shaft. Torque shift gate and fork lock screws to 50-60 lbs. ft.

## FIVE-SPEED UNITS

### Figs. 18, 19, 20

Before dismantling a transmission, carefully clean the outside of the case to avoid the possibility of introducing dirt or other foreign material into the unit. This is important because dirt, being abrasive, is highly detrimental to highly polished parts such as bearings, sleeves and bushings. These, as well as other parts, should be cleaned as removed and protectively wrapped until ready for use.

In removing the control cover, do not force it off the transmission. Forcing may spring the yokes out of alignment and cause partial engagement or gear interference. Follow the directions relative to shifting and the cover can easily

be removed. If binding occurs, a slight manipulation or movement to one side or the other will free it.

When disassembling the control cover, all parts should be laid on a clean bench in the same sequence as removed. This procedure will not only simplify reassembling the yokes and bars in their proper places but will also reduce the possibility of omitting the small yoke bar interlock parts. If these parts are left out, the unit will shift into two speeds at the same time.

Unless absolutely necessary, the clutch housing should not be detached from the case. If it is detached, extreme care should be taken when reassembling the housing to maintain the alignment between its machined face and the mainshaft bores in the case; also the concentricity of the mainshaft bores and the flange pilot.

**NOTE**—The disassembly procedure which follows is based on the assumption that the transmission has been taken from the chassis and that all supplementary equipment such as universal joint companion flanges and brake assemblies have been removed.

### Control Cover, Disassemble

1. Shift transmission into 1st speed.
2. Remove hand brake lever.
3. Detach and lift off cover.
4. Place control lever in neutral.
5. Remove shift yoke lock screws.
6. Start with upper bar and drive shift bars from housing. Use care to see that none of the small yoke bar locking parts are lost as bars are removed.
7. To remove shift lever, take off rubber grip, and latch spoon if lever is equipped with latch rod.



8. Force dust cover up and off lever after removing lock screw from those so equipped.
9. Remove tension spring and washer from inside lever housing, and withdraw shift lever.

### Mainshaft, Disassemble

1. Remove rear bearing covers from mainshaft and countershaft.
2. Lock gears and remove bearing lock nut from end of countershaft.
3. Pull mainshaft and countershaft assemblies to the rear.
4. Remove mainshaft rear bearing.
5. Tilt mainshaft and remove through top of case, leaving sliding gears inside case.
6. Remove loose sliding gears from case.
7. To remove gears and sleeve from mainshaft, remove pilot bearing and sliding clutch, using the latter to free bearing.
8. Remove mainshaft gear retaining washer key.
9. Rotate mainshaft gear retaining washer until its inside lugs line up with grooves in shaft.
10. Remove mainshaft bushed gears, sleeve and washers, using the rear bushed gear to start the sleeves.

### Main Drive Gear, Disassemble

1. Remove clutch release mechanism.
2. Remove drive gear bearing cover.
3. Withdraw gear.

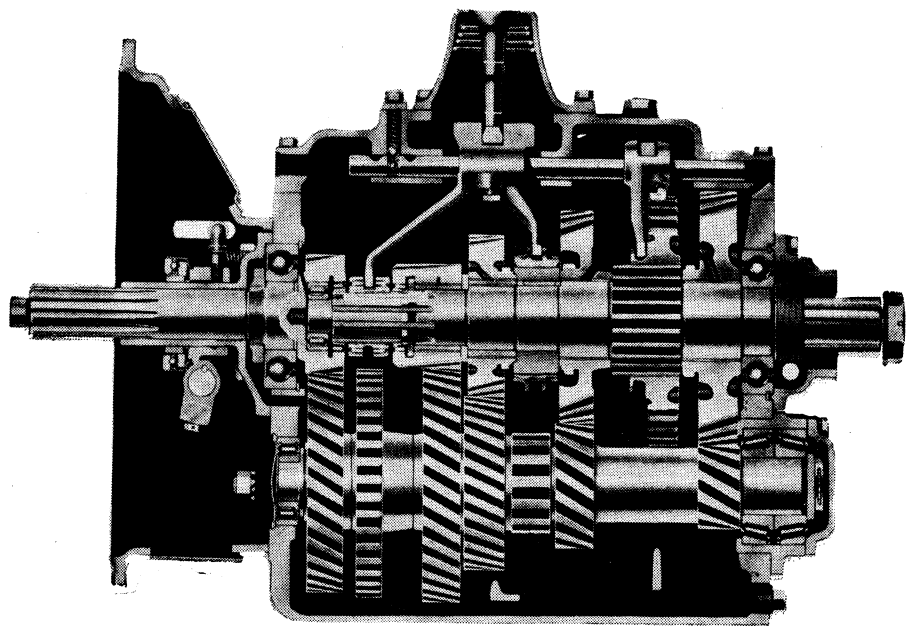


Fig. 19 Fuller five speed transmission. Models 5-A-62, 620, 5-A-65, 650

### Reverse Gears, Disassemble

1. Remove high speed reverse shifting bar and yoke from inside the case (Models 62, 620, 65, 650, 72, 720).
2. Withdraw shaft or shafts and re-

move gear or gears from case.

### Countershaft, Disassemble

1. Remove countershaft rear bearing.
2. Tilt countershaft and remove through top of case.
3. To disassemble countershaft, remove gear retaining snap ring.
4. Press gears from shaft one at a time.

### Reassembly Instructions

With the exception of a few specific points, the general instructions for reassembly are merely the reversal of those for disassembly. The exceptions are as follows and should be given careful attention.

### Clearances

1. On mainshaft helical bushed gears, replace worn washers to assist in maintaining original fit.
2. Hold end play of both gears to a minimum of .006". Check with dial indicator or feeler gauge.
3. Replace bushings in gears having excessive radial clearance.

### Assembling Bushed Gears

When assembling either new or re-bushed gears on the mainshaft or countershaft, be sure that they move freely after having been assembled in their proper places. Clean all mounting parts and coat with clean oil before replacing gears.

### Installing Bushings in Mainshaft Helical Gears

1. Remove old bushing.
2. Clean bore of gear carefully and remove all burrs.
3. Lubricate outside diameter of bushing and inside diameter of gear.

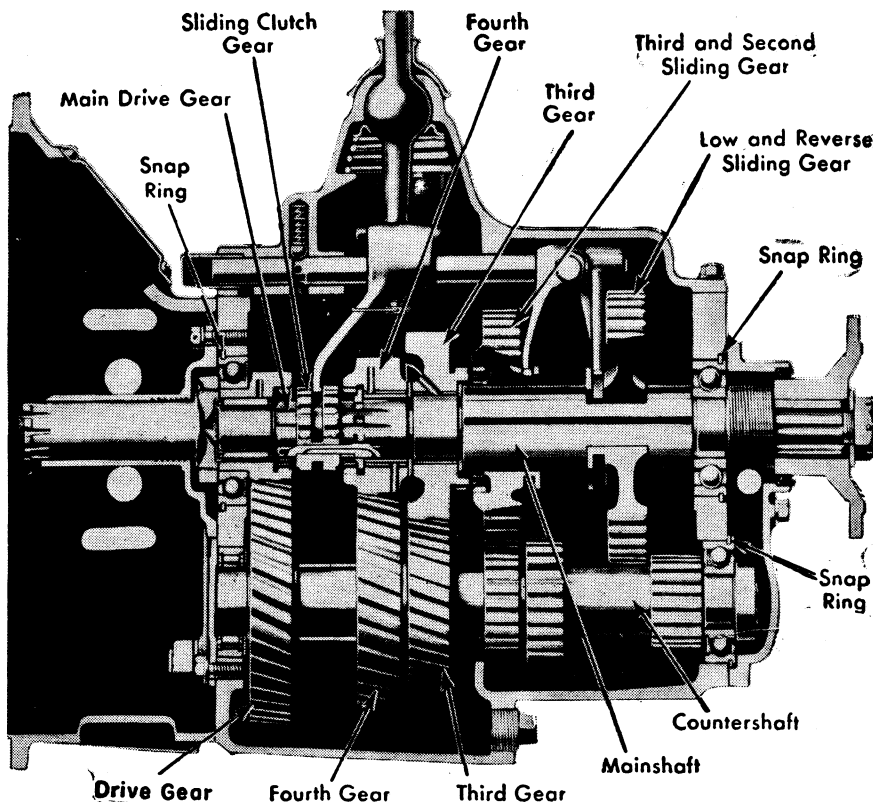
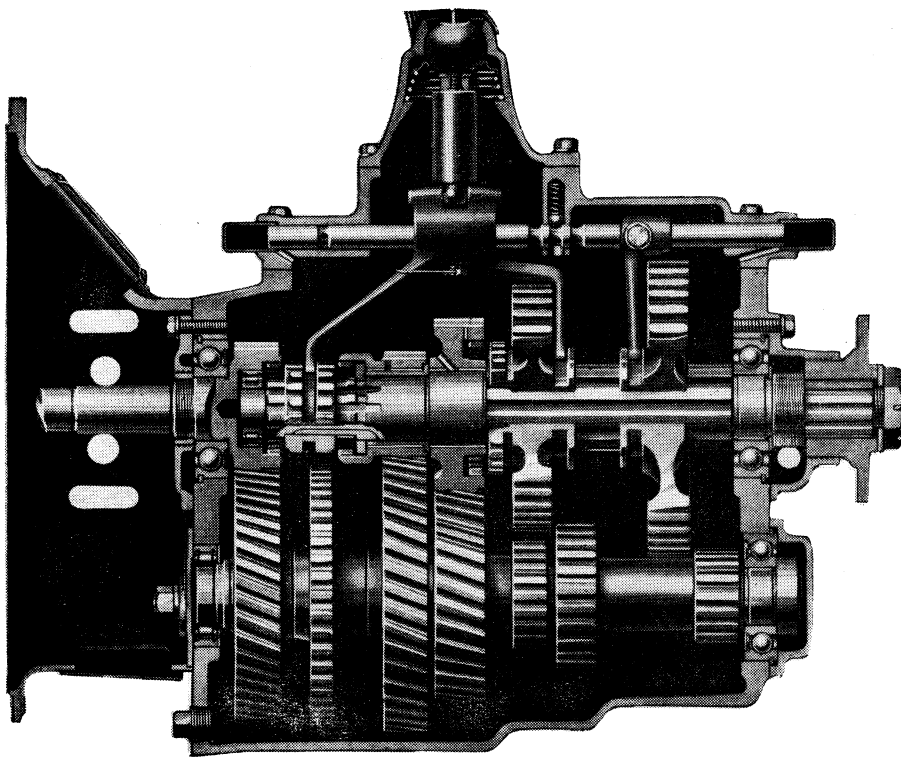


Fig. 18 Fuller five speed transmission. Models 5-A-33, 330, 5-A-43, 430, 5-F-43, 430





**Fig. 20 Fuller five speed transmission. Models 5-C-72, 720**

4. Carefully press bushing fully into gear.
5. Face off any projecting end of bushing.
6. Drill oil holes in bushing through holes in gear, making sure all holes are open.
7. Remove all burrs resulting from drilling and break all sharp edges on ends of bushing.

### Installing Bushings in Reverse & Countershaft Gears

1. Remove old bushing, clean bore of gear and remove all burrs.
2. Press bushing fully into gear.
3. Spin over the projecting ends of the bushing.
4. Open the ends of the oil grooves with a file.
5. Drill oil holes in bushing through holes in gear, making sure all holes are open.
6. Remove all ridges and burrs resulting from drilling and spinning operations.

### U-Joint Flange

The mainshaft is held in its proper place by the universal joint companion flange. The omission of parts between the flange and bearing, or failure to pull the flange tightly into place will allow the mainshaft to move endwise with resultant damage to the pilot bearing, mainshaft and main drive gear.

### Sliding Clutches

All sliding clutches should be assembled to the shaft with the counterbore toward the bushed gears. An exception

is the sliding clutches in 43 and 430 series, which have no counterbore. They are marked, however, on one end with the word "front," and must be assembled with the marked end toward the front of the transmission.

### Power Take-Off

When attaching a power take-off, be sure sufficient filler blocks and gaskets are used to prevent the gears from meshing too deeply. If the gears bottom, they will damage not only themselves but also the transmission case.

## MODEL 10B-1120

### Separating Front & Gear Boxes, Fig. 21

1. Disconnect auxiliary control rod from shifting bar.
2. Detach front case from rear case and separate two units. Start rear section by rapping bulges on either side of case. Complete the separation by prying in the opening between the two cases.

### Auxiliary Section, Disassemble

1. Shift unit into direct drive.
2. Remove flat top cover.
3. To disassemble drive gear, remove capscrews and withdraw drive gear, bearings and cover as a unit.
4. Force drive gear through front roller bearing to separate gear and cover.
5. Remove nut from drive gear (left-hand thread).
6. Jar bearing from drive gear.

### Auxiliary Mainshaft, Remove

1. Remove rear bearing cover from case.
2. Turn shaft so that key under sliding clutch is uppermost.
3. Force pilot bearing and sliding clutch from shaft.
4. Remove key from its keyway.
5. Turn mainshaft gear washer radially in its grooves until lugs on washer line up with grooves in mainshaft.
6. Withdraw mainshaft, leaving bushed gear and splined washer inside of case.
7. Remove bearing and rear thrust washer.
8. Press sleeve from mainshaft.
9. Remove loose parts freed by removal of shaft.

### Auxiliary Shifting Yoke & Bar, Remove

1. Remove screw from yoke.
2. Withdraw bar and lift yoke from case.
3. Remove pipe plug over bar and lift out spring and ball.

### Auxiliary Countershaft, Remove

1. Lock countershaft so it can't turn.
2. Remove rear bearing retainer plate.
3. Remove snap ring from countershaft front bearing bore.
4. From the rear, force countershaft from its seat in rear bearing through gears and spacer and out through front of case. The bearing washer will be driven from front bearing bore as countershaft emerges.
5. Press countershaft from front roller bearing.
6. Remove bearing from rear bore of case.
7. Lift two gears and spacer from case.

### Five-Speed Section, Disassemble

1. Shift transmission into 2nd speed.
2. Detach and remove shift lever housing.
3. Detach and remove shifting bar housing.

### Overdrive Gearing, Remove

1. Remove lock screw from overdrive shifting yoke.
2. Drive overdrive yoke bar to rear and out of case.
3. Remove overdrive shifting yoke.
4. Unlock nut from mainshaft splines and remove from shaft.
5. Remove overdrive mainshaft gear and front thrust washer.
6. Remove countershaft sliding clutch.
7. Pry countershaft overdrive washer key from its keyway.
8. Turn countershaft gear retaining washer in its groove until its lugs line up with grooves in shaft.
9. Pull countershaft bushed gear to rear, which will also remove the washer.

### Clutch Shaft & Drive Gear, Remove

1. Remove clutch release mechanism.
2. Remove drive gear bearing cover.
3. Remove drive gear and bearing.

4. Mount gear in vise and remove drive gear retaining nut (left-hand thread).
5. Jar or press bearing from gear.

### Mainshaft Assembly, Remove

1. Remove countershaft front bearing cover.
2. Drive countershaft forward as far as possible ( $\frac{1}{8}$ ").
3. Remove mainshaft pilot bearing and sliding clutch by driving against clutch with a soft bar.
4. Mark the four tapped holes in the rear bearing retainer which have no capscrews assembled into them.
5. Remove all  $\frac{3}{8}$ " capscrews from rear bearing retainer.
6. Install four of the  $\frac{3}{8}$ " capscrews in the marked holes and, using as a puller, evenly tighten them to pull the mainshaft rear bearing to the rear and from the shaft. If the bearing does not clear the shaft after the full length of the puller screws is utilized, rap the rear end of the shaft sharply to drive it through the bearing.
7. Attach a small "C" clamp to the 3rd speed gear. Attach a chain hoist or block and tackle to the "C" clamp and lift the mainshaft assembly from the case, leaving the sliding gear inside the case.
8. Remove bushed gear and sliding gear from case.

### Mainshaft, Disassemble

1. Mount assembly in a vise and pry 3rd speed gear washer key from between splines.
2. Turn 3rd speed gear retaining washer in its groove until its lugs line up with grooves in shaft.
3. Withdraw washer and 3rd speed gear over pilot end of shaft.
4. Jar pilot end of mainshaft against a wood block until weight of 3rd speed gear moves sleeve and washer not more than  $\frac{1}{4}$ " to front.
5. Insert on shaft end between washer and sleeve a C-shaped spacer made from strap iron, making sure that keyway in sleeve falls under opening in spacer.
6. Jar pilot end of shaft until woodruff key is completely exposed between open end of C-shaped spacer. Use a second C-shaped spacer wider than the original to completely expose the key.
7. Remove woodruff key and jar sleeve, washer and 3rd speed gear completely off shaft, catching gear as it clears sleeve seat.

### Reverse Gearing, Remove & Disassemble

1. Remove reverse idler shaft lock.
2. Attach puller at opening in rear end of case and withdraw reverse idler gear shaft.
3. Lift both sections of reverse gearing from case.
4. Remove two roller bearings and spacer from gear sleeve.
5. Remove thrust washers and buttons from case.
6. Remove bushed reverse gear from idler assembly.

7. Remove snap ring from sleeve.
8. Press reverse idler gear driver from sleeve.

### Countershaft, Remove & Disassemble

1. Remove front bearing retainer plate.
2. Install two  $\frac{3}{8}$ " x 2" capscrews in tapped holes in front flange of countershaft front bearing housing.
3. Pull front bearing housing and bearings from shaft by evenly tightening the two "puller" screws.
4. Pull countershaft rear bearing, sleeve and washer to rear until bearing completely clears its seat on shaft.
5. Insert a C-shaped spacer on shaft between washer and sleeve, making sure keyway in sleeve falls between open ends of spacer.
6. Pull countershaft rear bearing backward until woodruff key is exposed between open ends of spacer.
7. Remove key and pull rear bearing, sleeve and washer from shaft.
8. Remove snap ring from front end of shaft.
9. Press drive gear from shaft.
10. Remove woodruff key and press remaining gears off one at a time.

### Main Transmission, Assemble Reassembly Precautions

When reassembling mainshaft bushed gears, make sure they move freely. All parts should be carefully cleaned and lubricated. The end play of all helical gears should be held to a minimum of .006" and a maximum of .014". Check carefully with either a feeler gauge or a dial indicator. Of the two limits shown in connection with end play, the minimum of .006" is by far the more important. To go below this figure is to invite trouble. The bushed gears may freeze to the shaft or sleeve as a result of insufficient endwise clearance.

All bushed and sliding gears should be replaced on the mainshaft before it is reinstalled in the case. This is necessary because of the difficulty of threading the rear end of the mainshaft through the 1st and 2nd speed sliding gear and the bushed 1st speed gear. Hold these gears in their proper positions as the mainshaft assembly is reinstalled.

### Countershaft, Assemble & Install

1. Press individual gears on shaft one at a time in their proper position.
2. Install gear retaining snap ring.
3. Lower assembly into case.
4. Install front bearing adapter.
5. Install rear bearing cup in adapter.
6. Holding countershaft as straight as possible, install rear bearing.
7. Install front bearing rear cone, spacer, front cone and cup in that order.
8. Install front bearing retaining plate.
9. Install front bearing cover.

### Reverse Gearing, Assemble & Install

1. Install splined drive gear on sleeve with chamfered teeth to rear, and with snap ring on each side.
2. Clean and oil sleeve and install bushed gear so internal clutching teeth will engage external teeth of sleeve.
3. Clean and oil bearings and install in sleeve with spacer between bearings.
4. Install buttons in thrust washers.
5. Insert idler shaft in rear boss until it protrudes inside case about  $\frac{3}{16}$ ". Install rear washer on shaft.
6. Using a short bar slightly smaller in diameter than idler shaft, insert it in front boss to hold front thrust washer in place.
7. Lower idler assembly in place, being careful not to dislodge washers.
8. Install idler shaft. *Be sure to remove bar tool.*
9. Install idler shaft lock.

### Mainshaft, Assemble & Install

1. Mount mainshaft in vise with companion flange end down.
2. Clean and oil 2nd speed gear seat and install gear with clutch teeth to rear.

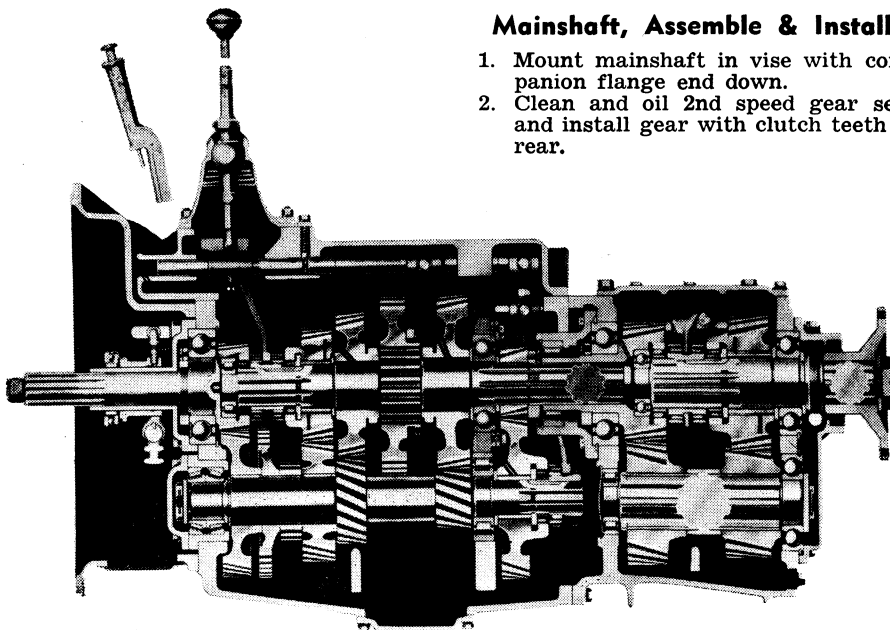


Fig. 21 Fuller ten speed transmission, Model 10-B-1120

3. Install 3rd speed gear rear thrust washer.
4. Install woodruff key in mainshaft.
5. Install 3rd speed gear sleeve, making sure key in shaft lines up with keyway in shaft.
6. Clean and oil 3rd speed sleeve and install 3rd speed gear with clutch teeth to front.
7. Install 3rd speed gear splined thrust washer with flat machined surface toward gear.
8. Turn washer until its lugs line up with mainshaft splines.
9. Install key in keyway between splines.
10. Remove mainshaft from vise and install first and reverse speed sliding gear with chamfered teeth to rear.
11. Clean and oil first speed gear seat and install gear with clutch teeth to front.
12. Lower mainshaft in case.
13. Install first speed gear rear thrust washer.
14. Install rear bearing with combination bearing puller and retainer assembled to it.
15. Install bearing retainer capscrews and wire.

## Clutch Shaft & Gear, Assemble & Install

1. Press gear into bearing.
2. Install andpeen bearing retaining nut into milled notches of gear.
3. Install mainshaft 3rd and 4th speed sliding clutch with counterbore to rear.
4. Install mainshaft pilot bearing with snap ring to rear.
5. Install clutch shaft and drive gear.
6. Install front bearing cover.

## Overdrive Gear, Install

1. Install countershaft overdrive gear front thrust washer.
2. Install key in countershaft.
3. Install countershaft overdrive gear sleeve.
4. Clean and oil sleeve and install overdrive gear with clutch teeth to rear.
5. Install splined rear thrust washer in its groove until its lugs line up with countershaft splines.
6. Install countershaft washer retaining key.
7. Install countershaft overdrive sliding clutch.
8. Install mainshaft overdrive gear front washer.
9. Install mainshaft overdrive gear with long hub to rear.
10. Install overdrive gear retaining nut and peen into mainshaft splines.
11. Install overdrive yoke and yoke bar.

## Shift Bar Housing, Install

1. Shift transmission into 2nd speed.
2. Shift bar housing into 2nd speed.
3. Install shift bar housing, making sure yokes enter slots of gears.
4. Install attaching screws and tighten evenly and securely.

## Auxiliary Section, Assemble

**Countershaft**—Place countershaft gears and spacer in case with long gear hubs to rear. Thread countershaft through gears. Install front and rear bearings.

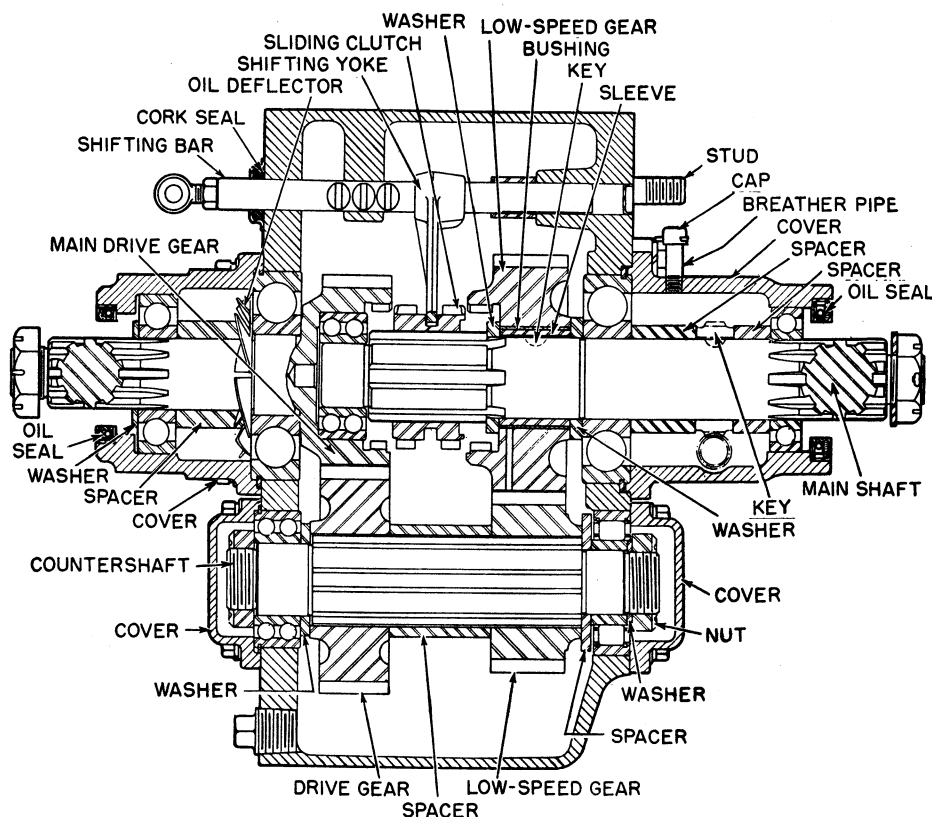


Fig. 22 Fuller two speed auxiliary transmission. Model 2-A-45

Install countershaft front bearing washer and snap ring in case bore.

**Yoke**—Install shifting yoke with attaching capscrews to rear. Tighten and lace screws with wire.

**Mainshaft**—Press low speed gear sleeve on shaft. Do not press it all the way to washer groove. Place low speed gear in case. Thread mainshaft through low speed gear from rear, at the same time thread shaft through splined thrust washer and sliding clutch. Turn splined washer in its groove until its lugs line up with mainshaft splines. Install key in mainshaft keyway. Install low speed gear rear thrust washer and rear bearing. Install mainshaft pilot bearing.

**Main Drive Gear**—Install drive gear in case bore. Install roller bearing in cover. Install snap ring in groove in cover. Install front bearing cover. Insert attaching screws and wire.

**Final Assembly**—Install countershaft rear bearing retaining plate. Install one-piece rear bearing cover. Install yoke bar, poppet ball and spring. Install auxiliary section cover. Install auxiliary section to front section and tighten attaching screws securely.

## MODEL 2-A-45

### Disassemble, Fig. 22

1. Remove side cover or power take-off unit.
2. Remove shift bar and fork.

3. Remove countershaft front and rear bearing covers.
4. Remove countershaft front bearing lock nut.
5. Remove main drive gear, bearings and cover as a unit.
6. Press main drive gear from cover and bearing.
7. Remove mainshaft rear bearing cover, bearing, spacer, speedometer gear and key, and inner spacer.
8. Force mainshaft out of rear bearing through main drive gear bearing bore in front of case, removing mainshaft underdrive bushed gear and washer as shaft emerges.
9. Remove mainshaft pilot bearing.
10. Remove mainshaft sliding clutch gear.
11. Remove mainshaft underdrive gear sleeve washer from shaft.
12. Remove mainshaft underdrive gear sleeve and key from shaft.
13. Force countershaft toward rear and out of case, removing front bearing spacer, washer, drive gear, spacer and countershaft underdrive gear as shaft emerges.
14. Remove countershaft rear bearing lock nut and washer.
15. Press off countershaft rear bearing.
16. Remove countershaft rear bearing washer.
17. Remove countershaft front bearing.

### Assemble

1. Install countershaft front bearing in case.
2. Install countershaft rear bearing washer on shaft.

3. Press on countershaft rear bearing.
4. Install countershaft rear bearing lock nut and washer.
5. Insert countershaft through rear bore in case.
6. Install countershaft underdrive gear, gear spacer, countershaft drive gear, and front bearing spacer washer as shaft progresses through case.
7. Install mainshaft underdrive gear sleeve and key on shaft.
8. Install mainshaft underdrive gear sleeve washer on shaft.
9. Install mainshaft sliding clutch gear.
10. Press mainshaft pilot bearing into position.
11. Install mainshaft rear bearing in case.
12. Insert mainshaft assembly, previously prepared, through front bore in case and move toward rear. Install rear bearing washer and mainshaft underdrive bushed gear as shaft progresses in case.
13. Install main drive gear bearing on gear.
14. Install main drive gear bearing spacer.
15. Install main drive gear outer bearing.
16. Install main drive gear and bearing in case.
17. Install main drive gear bearing cover and gasket.
18. Install mainshaft rear bearing spacer, speedometer drive gear and key, rear bearing spacer, rear bearing, rear bearing cover and gasket.
19. Install shifter bar through fork with hub of fork toward rear.
20. Install poppet spring and ball.
21. Push shifter fork in position.
22. Install poppet spring retainer screw.
23. Install shifter fork lock screw.
24. Install side cover or power take-off unit.
25. Fill transmission with lubricant to proper level.

## New Process Transmission Section

### MODELS 245, 275

#### Disassemble, Fig. 1

1. Remove nut from output shaft.
2. Remove parking brake, universal joint spline flange and parking brake drum.
3. Remove gearshift housing.
4. Remove power take-off covers and gaskets.
5. Remove speedometer driven gear and bearing from output shaft bearing retainer.
6. Remove output shaft bearing retainer and slide speedometer drive gear and spacer from output shaft.
7. Remove input shaft bearing retainer and pull shaft and bearing out through front of case.
8. Slide synchronizer assembly off output shaft and lift shaft out of case.
9. Pull reverse idler gear shaft out of case and lift out gear.
10. Remove countershaft front bearing retainer, unfasten retainer washer and remove washer.
11. Remove bolts from countershaft rear bearing cap. Tap countershaft toward rear of case until bearing cap and bearing is forced out of case.
12. Lift countershaft front bearing from case.

#### Disassemble Sub-Assemblies

**Input Shaft**—Remove lock nut from end of shaft and remove bearing. Remove snap ring from shaft bore and remove output shaft pilot bearings. Remove snap ring from output shaft bearing.

**Output Shaft**—Slide low and reverse gear and 2nd speed gear from shaft. Remove snap ring and remove 4th and 5th gear synchronizer hub. Slide 4th speed gear (5th gear on overdrive units) and thrust washer from shaft. Remove bushing from gear and lock pin from bushing.

Slide off 3rd speed gear and thrust washer and remove bearing rollers from

gear. Separate synchronizer parts and inspect for wear or damage. Reassemble with new parts as necessary.

**Countershaft**—Remove thrust washer from front end of countershaft. Press gear cluster off shaft and drive key from shaft slot.

**Reverse Idler Gear**—Remove thrust washer from bore of gear and remove bearing rollers and spacer.

#### Assemble Sub-Assemblies

**Reverse Idler Gear**—Install spacer in gear. Coat bearing rollers with grease and install 31 rollers in each end of gear. Install washer at each end of gear next to rollers.

**Countershaft**—Install spacer on shaft and key in slot. Press gear cluster on shaft until gear is seated against spacer. Position thrust washer on forward end of shaft.

**Output Shaft**—Coat 3rd speed gear rollers with lubricant and install rollers in bore of gear. Place thrust washer on shaft and slide gear on shaft with spur gear teeth toward rear.

Install lock pin in 4th speed gear bushing (5th speed gear on overdrive units). Place thrust washer on shaft and install bushing. Install gear on bushing with shorter teeth toward front.

Position clutch gear on shaft and install snap ring in shaft groove. Check 3rd speed gear end play. If not within .006-.008", replace snap ring with one of the proper thickness to give correct end play.

Position 2nd speed gear on shaft with shift fork groove toward rear. Install low and reverse gear on shaft with shift fork groove toward front of shaft. Assemble synchronizer as shown in Fig. 1.

**Input Shaft**—Install bearing on shaft. Install lock nut and tighten until bearing is firmly seated against gear shoulder. Install snap ring in shaft bearing groove.

Coat pilot bearing rollers with grease.

and install in bore of input shaft. Secure bearings with snap ring.

#### Installation in Case

1. Install snap ring on countershaft front bearing and tap bearing into case.
2. Position countershaft in case and insert forward end in front bearing.
3. Tap countershaft rear bearing and cap into case and onto countershaft. Install bolts and lockwashers.
4. Install countershaft front bearing retaining washer and retainer.
5. Position reverse idler gear in case and tap idler shaft into case until notch in shaft is flush with rear face of case. Install shaft retainer.
6. Place output shaft in case and slip on synchronizer.
7. Install input shaft through front of case. Tap assembly into case until bearing snap ring is seated in recess in case. Install and tighten bearing retainer.
8. Position output shaft into pilot bearing, then install shims on rear of output shaft. Install snap ring on output shaft bearing and tap bearing into case bore until snap ring is seated against rear face of case. Install spacer and speedometer drive gear on output shaft.
9. Install output shaft bearing retainer and tighten securely.
10. Check end play of synchronizer. If not within .040-.060", change shims at rear of output shaft until correct end play is obtained.
11. Install speedometer driven gear and bearing. Install power take-off covers.
12. Place gears in neutral and install gearshift housing, tightening bolts to 30-40 lb. ft. torque.
13. Slide parking brake drum onto output shaft and place band and lever on drum. Install bolts to case and torque them to 30-40 lb. ft.
14. Install parking brake band anchor spring and adjusting screw, then adjust brake.

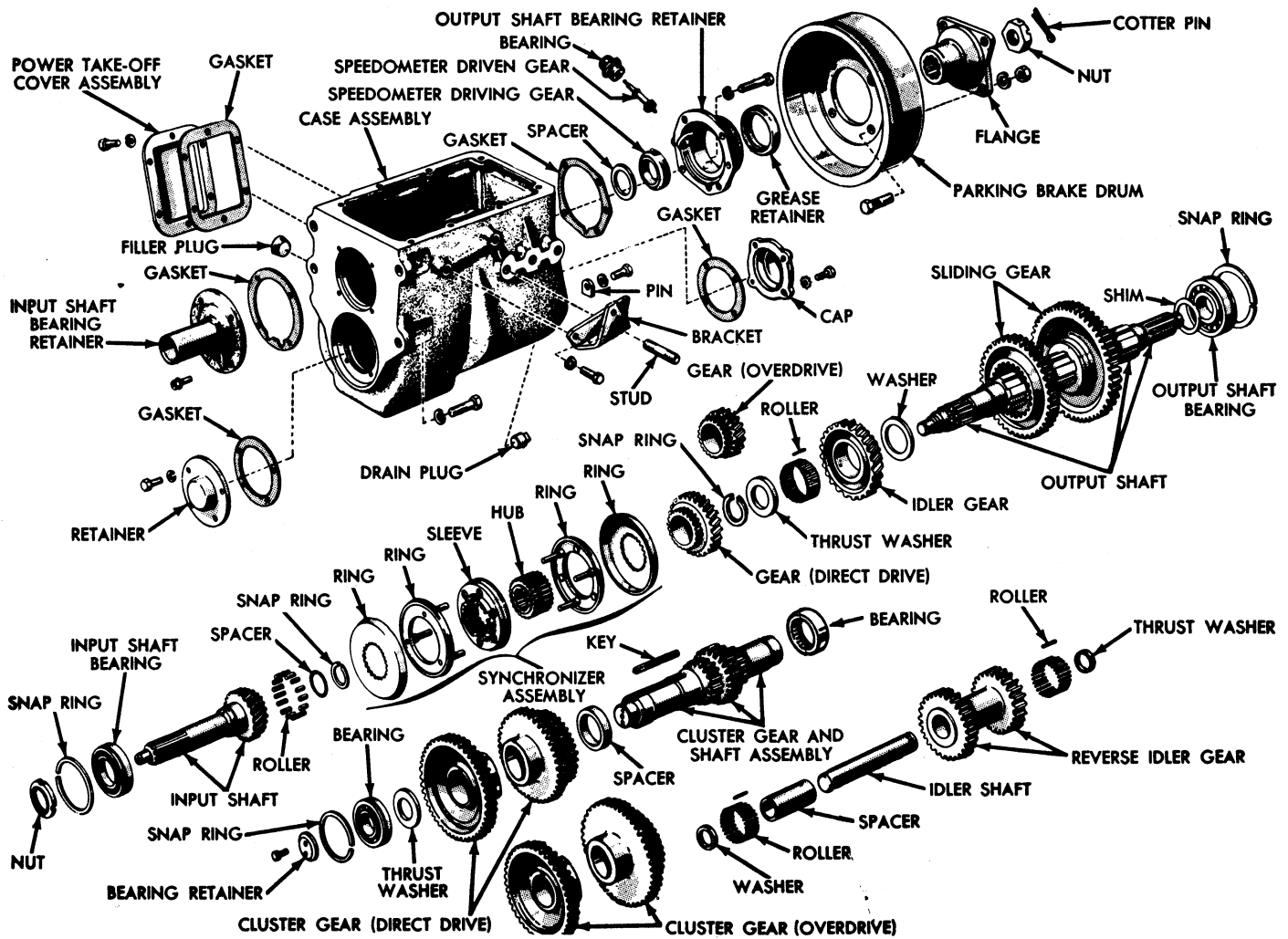


Fig. 1 New Process five speed transmission. Models 245, 275

## MODEL 420

### Disassemble, Fig. 2

1. Remove nut from companion yoke.
2. Remove hand brake linkage and band.
3. Pull off brake drum and companion yoke.
4. Remove transmission cover.
5. Remove rear bearing retainer and seal assembly, and speedometer drive gear.
6. Remove main drive gear bearing retainer, gear and bearing.
7. Remove snap ring and pull rear bearing from case. Remove shim pack and tie shims together for reassembly.
8. Remove synchronizer snap ring and slide synchronizer gear forward. Then slide synchronizer from mainshaft.
9. Lift mainshaft assembly out of case through sliding gears. Then remove sliding gears from case.
10. Remove reverse idler shaft lock plate, pull out shaft and lift gear from case.
11. Remove rear countershaft bearing

retainer and bearing. Then remove front countershaft retainer, cap screws and lock plate, and remove bearing.

12. Lift countershaft assembly from case.

### Reassembly

**Reverse Idler Gear**—Install spacer in gear. Coat roller bearings with grease and install a complete set of 31 rollers in each end of the gear. Install a thrust washer in each end of the gear.

**Countershaft**—Install spacer and drive key in shaft keyway. Remove all burrs from key and shaft and press gear cluster onto shaft until gears bottom on spacer. Then install thrust washer on forward end of shaft.

**Mainshaft**—Coat third speed gear roller bearings with grease and place in third speed gear. Install thrust washer on mainshaft. Position third speed gear with spur teeth toward rear of shaft and slide gear on shaft.

Install lock pin in fourth speed gear (fifth on overdrive units). Place thrust washer on shaft and install bushing on

shaft. Position fourth (or fifth) speed gear with shortest teeth toward front end of shaft. Install gear on bushing.

Install mainshaft synchronizer gear on mainshaft and secure with snap ring in shaft groove. Check snap ring for proper thickness by testing third speed gear end play. Snap rings are available in .002" steps each to obtain desired end play of .006 to .008".

Position second speed gear with shift fork groove toward rear of shaft and slide gear on shaft.

**Main Drive Gear**—Install bearing on shaft. Install lock nut and tighten securely to seat bearing against gear shoulder. Install snap ring in bearing groove. Lubricate mainshaft pilot bearing and place it in main drive gear bore.

### Installation in Case

**Countershaft**—Install snap ring on countershaft front bearing and tap bearing into case. Lower countershaft in case and insert shaft into front bearing. Install new gasket on rear bearing retainer and tap rear bearing and retainer assembly into case and on countershaft. Install retainer cap screws and lock washers and

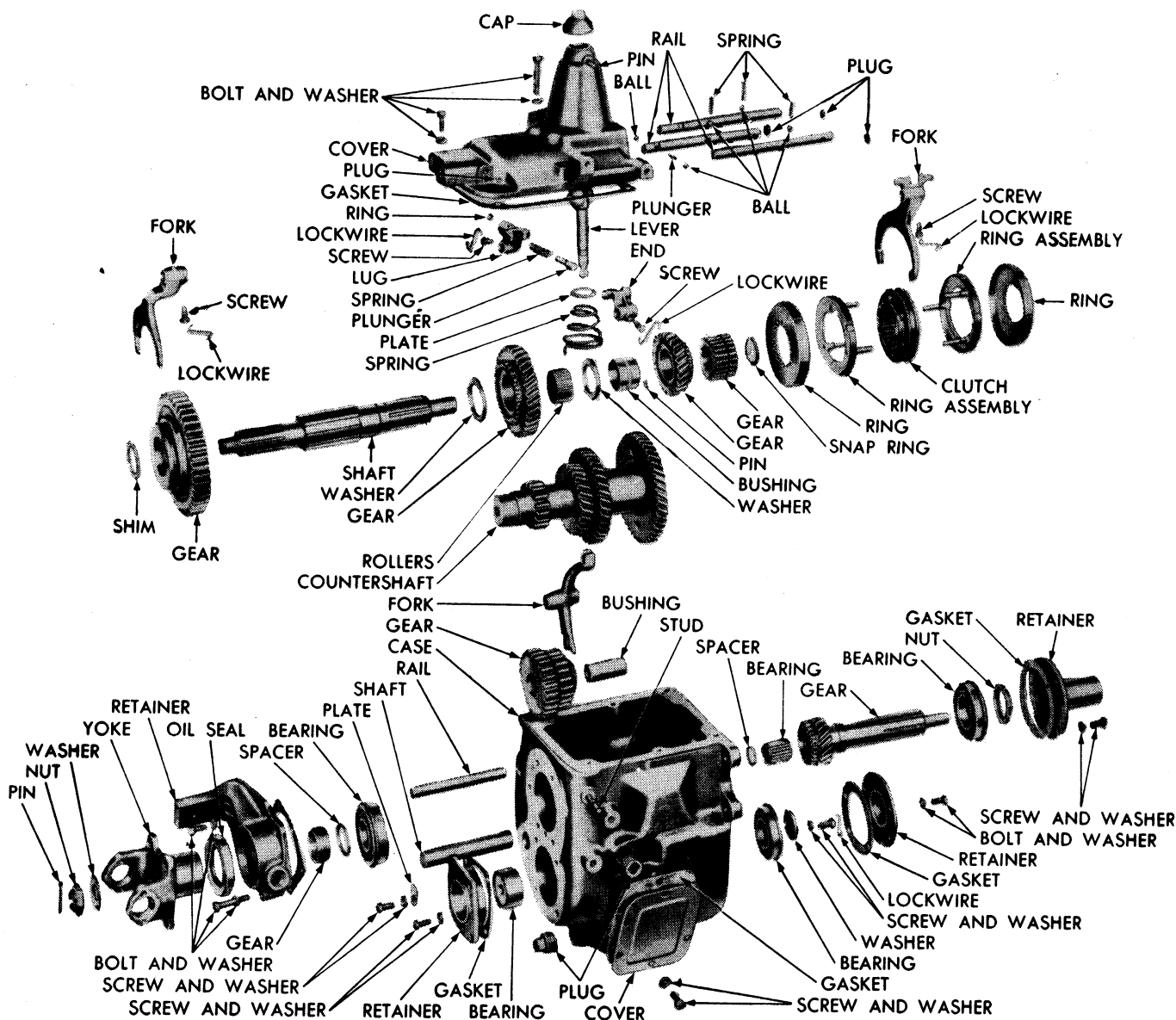


Fig. 2 New Process four speed transmission. Model 420

tighten securely. Install countershaft front bearing lock plate and secure screws with lock wire. Install front bearing retainer, using a new gasket, and tighten securely.

**Reverse Idler Gear**—Place gear in position and tap shaft through case and gear until notch in shaft is flush with rear face of transmission case. Install shaft lock plate.

**Mainshaft & Main Drive Gear**—Place low and reverse gear in case. Lower mainshaft into case, passing it through low and reverse gear. Then insert shaft through rear of case far enough to install synchronizer parts one at a time on front end of shaft.

Insert main drive gear in case, tapping it with a soft hammer until the bearing snap ring is seated against case. Install main drive gear bearing retainer, using a new gasket, and tighten securely.

Place synchronizer outer stop ring on main drive gear and position front end of mainshaft into pilot bearing. Then install shim pack (as removed) on rear end of mainshaft.

Install snap ring on mainshaft rear bearing. Tap bearing into case until retainer seats against case. Install speedometer gear on mainshaft. Install mainshaft rear bearing retainer, using new gaskets, and tighten securely.

Install companion yoke and nut, tightening nut from 95-135 lbs. ft. torque. Check gears in neutral and in all speeds for free rotation.

Check synchronizer end play by placing feeler gauges diametrically opposite each other. End play should be .040 to .060"; if not within these limits, adjust by removing or adding shims at the rear of the case to obtain the desired result.

With gears in neutral, install a new gasket and install the transmission cover.

Tighten cover screws to 30-40 lbs. ft. torque.

Install hand brake and fill transmission with correct amount of lubricant.

## MODELS 540, 541G, 5101-2-3-4

### Disassemble, Fig. 3

1. Remove nut from output shaft.
2. Remove parking brake, universal joint spline flange and parking brake drum.
3. Remove gearshift housing.
4. Remove power take-off covers and gaskets.
5. Remove speedometer driven gear and bearing from output shaft bearing retainer.
6. Remove output shaft bearing retainer and slide speedometer drive



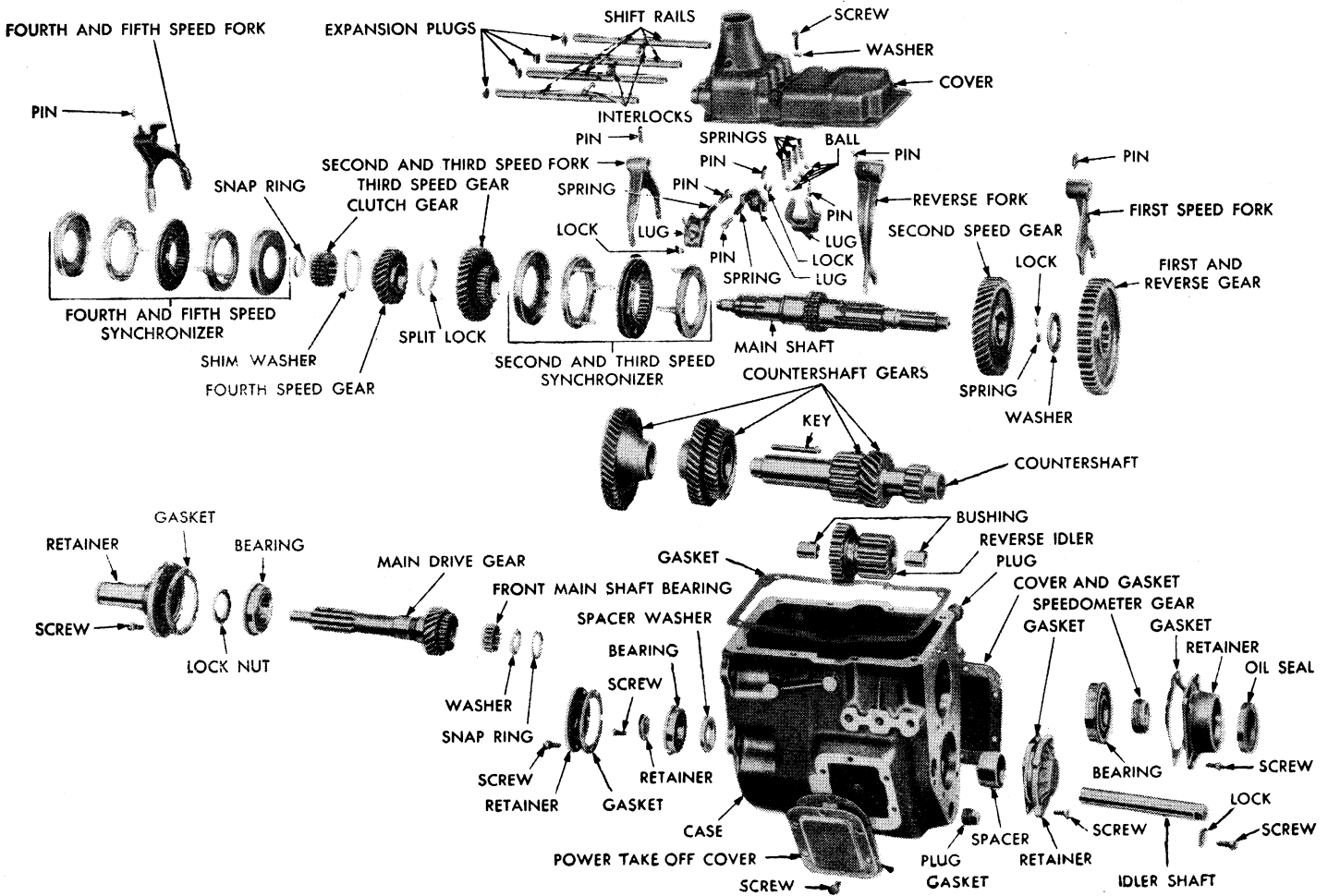


Fig. 3 New Process five speed transmission. Model 540. Typical of 541G, 5101, 5102, 5103, 5104

7. Remove input shaft bearing retainer and pull shaft and bearing out through front of case.
8. Slide synchronizer assembly off output shaft and lift shaft out of case.
9. Pull reverse idler gear shaft out of case and lift out gear.
10. Remove countershaft front bearing retainer, unfasten retainer washer and remove washer.
11. Remove bolts from countershaft rear bearing cap. Tap countershaft toward rear of case until bearing cap and bearing is forced out of case.

### Disassemble Sub-Assemblies

**Input Shaft**—Remove lock nut from end of shaft and remove bearing. Remove snap ring from shaft bore and remove output shaft pilot bearings. Remove snap ring from output shaft bearing.

**Output Shaft**—Slide low and reverse gear and 2nd speed gear from shaft. Remove snap ring and remove 4th and 5th gear synchronizer hub. Slide 4th speed gear (5th gear on overdrive units) and thrust washer from shaft. Remove bushing from gear and lock pin from bushing.

Slide off 3rd speed gear and thrust

gear and spacer from output shaft. washer and remove bearing rollers from gear. Separate synchronizer parts and inspect for wear or damage. Reassemble with new parts as necessary.

**Countershaft**—Remove thrust washer from front end of countershaft. Press gear cluster off shaft and drive key from shaft slot.

**Reverse Idler Gear**—Remove thrust washers from bore of gear and remove bearing rollers and spacer.

### Assemble Sub-Assemblies

**Reverse Idler Gear**—Install spacer in gear. Coat bearing rollers with grease and install 31 rollers in each end of gear. Install washer at each end of gear next to rollers.

**Countershaft**—Install spacer on shaft and key in slot. Press gear cluster on shaft until gear is seated against spacer. Position thrust washer on forward end of shaft.

**Output Shaft**—Coat 3rd speed gear rollers with lubricant and install rollers in bore of gear. Place thrust washer on shaft and slide gear on shaft with spur gear teeth toward rear.

Install lock pin in 4th speed gear

bushing (5th speed gear on overdrive units). Place thrust washer on shaft and install bushing. Install gear on bushing with shorter teeth toward front.

Position clutch gear on shaft and install snap ring in shaft groove. Check 3rd speed gear end play. If not within .006-.008", replace snap ring with one of the proper thickness to give correct end play.

Position 2nd speed gear on shaft with shift fork groove toward rear. Install low and reverse gear on shaft with shift fork groove toward front of shaft. Assemble synchronizer as shown in Fig. 3.

**Input Shaft**—Install bearing on shaft. Install lock nut and tighten until bearing is firmly seated against gear shoulder. Install snap ring in shaft bearing groove.

Coat pilot bearing rollers with grease and install in bore of input shaft. Secure bearings with snap ring.

### Installation in Case

1. Install snap ring on countershaft front bearing and tap bearing into case.
2. Position countershaft in case and insert forward end in front bearing.
3. Tap countershaft rear bearing and cap into case and onto countershaft.



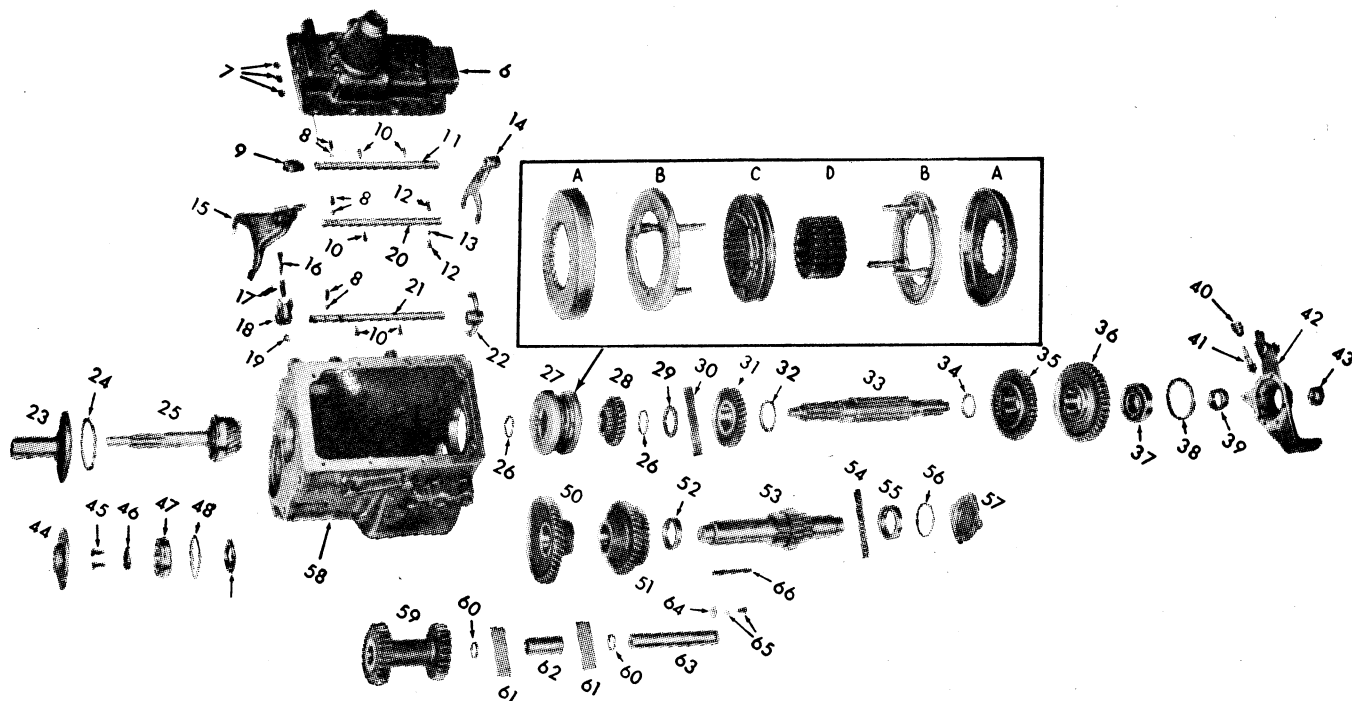


Fig. 4 New Process five speed transmission. Models 90845, 90930

- 6. Gearshift base
- 7. Expansion plugs
- 8. Rod interlock spring and ball
- 9. 2nd-3rd shift rod end
- 10. Lock screws
- 11. 2nd-3rd shift rod
- 12. Interlock balls
- 13. Interlock pin
- 14. 2nd-3rd shift fork
- 15. 4th-5th shift fork
- 16. Reverse rod end plunger
- 17. Plunger spring
- 18. Reverse rod end
- 19. C washer
- 20. 4th-5th shift rod
- 21. Low and reverse shift rod
- 22. Low and reverse shift fork
- 23. Front bearing cover
- 24. Snap ring
- 25. Main drive pinion
- 26. Snap ring

- 27. Synchronizer assembly
  - A. Outer ring
  - B. Stop ring and pins
  - C. Sleeve
  - D. Gear
- 28. 4th speed gear
- 29. Thrust washer
- 30. Bearing rollers
- 31. 3rd speed gear
- 32. Thrust washer
- 33. Mainshaft
- 34. Shim
- 35. 2nd-3rd sliding gear
- 36. Low & reverse sliding gear
- 37. Bearing
- 38. Snap ring
- 39. Speedometer drive gear
- 40. Pinion adapter
- 41. Speedometer drive pinion
- 42. Case rear flange
- 43. Companion flange retaining nut
- 44. Front bearing retainer
- 45. Retaining washer screw

- 46. Retaining washer
- 47. Bearing
- 48. Snap ring
- 49. Thrust washer
- 50. Countershaft drive gear
- 51. Countershaft 3rd-4th gear
- 52. Spacer
- 53. Countershaft
- 54. Bearings
- 55. Bearing cup
- 56. Snap ring
- 57. Retainer (rear bearing)
- 58. Case
- 59. Reverse idler gear
- 60. Bearing end spacer
- 61. Bearings
- 62. Center spacer
- 63. Reverse idler gear shaft
- 64. Lock plate
- 65. Lock plate screw & lock washer
- 66. Key

- 4. Install bolts and lockwashers.
- 5. Install countershaft front bearing retaining washer and retainer.
- 6. Position reverse idler gear in case and tap idler shaft into case until notch in shaft is flush with rear face of case. Install shaft retainer.
- 7. Place output shaft in case and slip on synchronizer.
- 8. Install input shaft through front of case. Tap assembly into case until bearing snap ring is seated in recess in case. Install and tighten bearing retainer.
- 9. Position output shaft into pilot bearing, then install shims on rear of output shaft. Install snap ring on output shaft bearing and tap bearing into case bore until snap ring is seated against rear face of case. Install spacer and speedometer drive

- gear on output shaft.
- 9. Install output shaft bearing retainer and tighten securely.
- 10. Check end play of synchronizer. If not within .040-.060", change shims at rear of output shaft until correct end play is obtained.
- 11. Install speedometer driven gear and bearing. Install power take-off covers.
- 12. Place gears in neutral and install gearshift housing, tightening bolts to 30-40 lb. ft. torque.
- 13. Slide parking brake drum onto output shaft and place band and lever on drum. Install bolts to case and torque them to 30-40 lb. ft.
- 14. Install parking brake band anchor spring and adjusting screw, then adjust brake.

**MODELS 90845, 90930**

**Disassemble, Fig. 4**

- 1. Remove transmission cover.
- 2. Remove main drive gear bearing retainer. Pull main drive gear from case and remove snap ring from bearing outer race. If bearing is to be removed, unscrew retainer nut and remove bearing from main drive gear.
- 3. Remove snap ring from bore of main drive gear and remove mainshaft pilot bearing rollers.
- 4. Remove universal joint flange.
- 5. Remove mainshaft rear bearing retainer and take off speedometer drive gear.
- 6. Remove snap ring from outer race of mainshaft rear bearing.

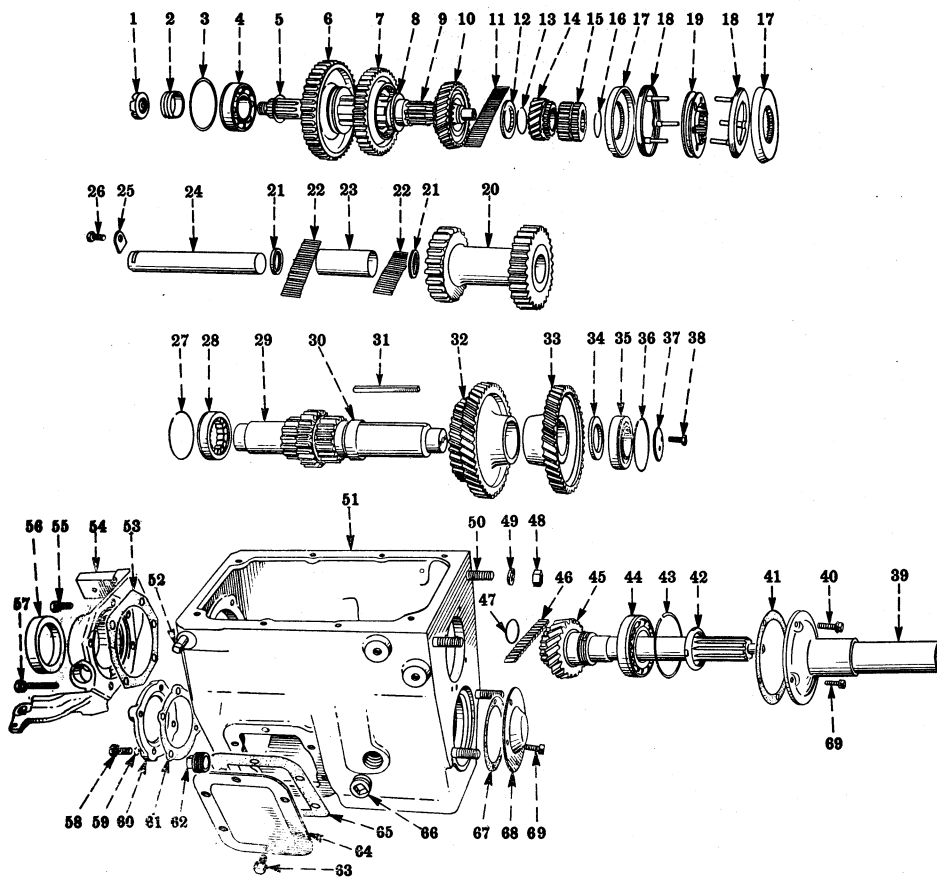


Fig. 5 New Process five speed transmission. Models 875, 895

- |                              |                           |
|------------------------------|---------------------------|
| 1. Mainshaft nut             | 30. Spacer                |
| 2. Speedometer drive gear    | 31. Key                   |
| 3. Snap ring                 | 32. Third and fourth gear |
| 4. Bearing                   | 33. Drive gear            |
| 5. Shim                      | 34. Thrust washer         |
| 6. Low and reverse gear      | 35. Bearing               |
| 7. Second and third gear     | 36. Snap ring             |
| 8. Thrust washer             | 37. Plate                 |
| 9. Mainshaft                 | 39. Retainer              |
| 10. Third speed gear         | 41. Gasket                |
| 11. Bearing                  | 43. Snap ring             |
| 12. Thrust washer            | 44. Bearing               |
| 13. Snap ring                | 45. Main drive gear       |
| 14. Overdrive gear           | 46. Bearing               |
| 15. Synchronizer clutch gear | 47. Spacer                |
| 16. Snap ring                | 51. Case                  |
| 17. Synchronizer ring        | 53. Gasket                |
| 18. Synchronizer ring        | 54. Retainer              |
| 19. Synchronizer clutch      | 56. Seal                  |
| 20. Reverse idler gear       | 60. Bearing cover         |
| 21. Spacer                   | 61. Gasket                |
| 22. Bearing                  | 62. Drain plug            |
| 23. Spacer                   | 64. Cover                 |
| 24. Reverse idler shaft      | 65. Gasket                |
| 25. Lock                     | 66. Plug                  |
| 27. Snap ring                | 67. Gasket                |
| 28. Bearing                  | 68. Cover                 |
| 29. Countershaft             |                           |

7. Remove countershaft rear bearing retainer.
8. Use a suitable puller to pull rear bearing from mainshaft. Remove shims from mainshaft and tie them together.
9. Slide synchronizer off mainshaft.
10. Lift mainshaft assembly from case.
11. Slide loose gears off mainshaft.
12. Remove snap ring and slide synchronizer gear from mainshaft.
13. Remove 4th speed idler gear.
14. Remove snap ring in front of 3rd speed idler gear.
15. Remove front thrust washer.
16. Slide 3rd speed idler gear from mainshaft, being sure to account for all 51 bearing rollers.
17. Remove rear thrust washer.
18. Separate parts of synchronizer assembly. Inspect stop ring and pin assemblies for worn or damaged pins, and for wear on the outer diameter of rings. Check outer stop rings for wear, and the sliding sleeve for wear or damaged teeth.
19. Remove reverse idler shaft lock plate. Drive out or use a suitable puller to remove reverse idler shaft. Lift reverse idler gear out of case, being sure not to lose any of the bearing rollers or space washers.
20. Remove countershaft front bearing cover, and bearing retainer plate.
21. Tap countershaft toward rear of case until countershaft rear bearing has been forced out of case.
22. Tilt front end of countershaft gear assembly up and lift out of case.
23. Remove thrust washer from front end of countershaft and tap countershaft front bearing out of case.
24. The three larger gears on the countershaft are removable. The largest gear can be removed alone but the other two are integral and must be removed together.

## Reassemble

**Countershaft**—Lower rear end of countershaft into case and pass it through rear bearing opening. Install rear bearing on shaft. Slide countershaft and rear bearing forward and tap rear bearing into case. Install thrust washer and front bearing. Install front bearing retainer plate and capscrews. Install safety wire. Install a new gasket on the front bearing cover and install cover. Use a new gasket and install rear bearing retainer cover.

**Reverse Idler**—Coat each end of the reverse idler gear bore with cup grease. Place a set of 31 rollers in each end. After rollers are in place, coat exposed surfaces with grease to keep them in place when installing gear. Coat spacer washers with grease and install one in each end. Lubricate idler shaft with engine oil and start it into case. Install gear in case with large gear forward. Enter shaft into gear with lock groove horizontal. Drive shaft into case until inner edge of lock plate groove is flush with case. Install lock plate, tightening retainer capscrew securely.

**Mainshaft**—Install inner thrust washer on mainshaft. Coat bore of 3rd speed gear with cup grease and install on mainshaft. Slip 51 rollers in bore of 3rd speed gear. Align teeth of outer thrust washer with

mainshaft splines and install thrust washer and snap ring.

Check clearance between outer thrust washer and face of 3rd speed gear. If clearance is greater than .006", use a thicker snap ring.

Lubricate bore of 4th speed gear and install on mainshaft. Install synchronizer gear and secure with snap ring. Install the two sliding gears on mainshaft, after lubricating splines on mainshaft with engine oil so gears move freely.

Assemble synchronizer parts. To aid in handling, tape the assembly together with masking tape, being sure end of tape does not extend beyond curved portion of outer stop ring. Place synchronizer on mainshaft.

Spread sliding gears apart and start mainshaft assembly into case. When installed, install shim or shims on mainshaft. Install snap ring in outer race of rear bearing. Drive bearing on mainshaft and into case. Install speedometer drive gear with wide shoulder toward bearing.

Inspect grease seal in rear bearing retainer and install a new one if necessary. Lubricate the seal with clean engine oil. Use a new gasket and install the rear bearing retainer.

**Main Drive Gear**—Install the roller bearing on the main drive gear shaft and install snap ring in its outer race. Install bearing retainer nut and tighten securely. Stake retainer to prevent it becoming loose. Coat bore of main drive gear with cup grease and install the 15 rollers, securing them in place with the snap ring.

Insert main drive gear in case, being sure teeth on drive gear and teeth on synchronizer outer stop ring match. Tap drive gear into case until snap ring on bearing seats against case.

Use a new gasket and install mainshaft front bearing retainer, tightening cap screws progressively to prevent distorting retainer. Remove masking tape from synchronizer assembly.

Install universal joint flange and retaining nut, tightening nut to 300 lb. ft. torque.

Place all gears in neutral and test to see that the mainshaft turns freely while holding main drive gear. Push synchronizer assembly toward front and measure the clearance between synchronizer outer stop ring and 4th speed gear. This clearance or "float" should be .040-.060". If not within these limits, add or remove the number of shims required between

the mainshaft shoulder and rear bearing.

With gears and shifter fork in neutral, install the transmission cover assembly, using a new gasket. Then test shifting operation in all positions.

## NEW PROCESS 875, 895

### Disassemble, Fig. 5

1. Drain transmission.
2. Remove hand brake band and drum.
3. Remove transmission control housing.
4. Remove mainshaft rear bearing retainer, noting the number of gaskets present.
5. Remove oil seal and speedometer drive gear.
6. Remove main drive gear bearing retainer, noting the number of gaskets used.
7. Remove main drive gear.
8. Tap mainshaft to rear until rear bearing is free of case.
9. Remove synchronizer.
10. Use puller to remove bearing from rear of mainshaft. Remove shims and note number used as they control floating clearance of synchronizer.
11. Lift mainshaft assembly from case.
12. Remove reverse idler gear shaft from rear of case and lift out reverse idler gear.
13. Remove front and rear countershaft bearing covers, and bearing retainer plate from end of countershaft.
14. Tap front end of countershaft toward rear of case until rear bearing is free of case. Then lift countershaft and gear assembly out of case.

### Reassembly

1. Install reverse idler gear assembly in case before installing countershaft gear assembly. This will permit clearance for removal of pilot shaft used to assemble bearings in idler gear.
2. A wood pilot shaft or a discarded idler gear shaft cut to a length of five inches may be used to facilitate assembling bearings in reverse idler gear. Diameter of wood pilot shaft should be  $1\frac{1}{16}$ ".
3. A bench assembly of the reverse idler gear and bearings should be made before installing in case. Position pilot shaft and long spacer in

idler gear. Insert 31 needle bearings and short spacer between pilot shaft and idler gear. Insert 31 needle bearings and short spacer in same manner at opposite end of idler gear. Position gear and bearing assembly in case. Push shaft flush against pilot shaft, permitting pilot to be removed from gear. Remove pilot shaft from inside of case.

4. The mainshaft third speed gear bearing consists of 50 individual needle bearings. To assemble bearings, position thrust washer and third speed gear on mainshaft. Insert each needle bearing between gear and mainshaft.
5. Select a snap ring of correct thickness that will provide proper running clearance of mainshaft third speed gear. Snap rings are available in three thicknesses (.090", .093", .096") for this purpose.
6. Select a snap ring for securing the clutch gear that will hold the gear tight against the shoulder on mainshaft. Four thicknesses (.087", .090", .093", .096") are available for this purpose. To check for the thickness required temporarily install the synchronizer clutch gear on the mainshaft before installing the overdrive gear and third speed gear. Insert snap ring in groove on mainshaft and check the gear for tightness.
7. The main drive gear bearing lock nut should be tightened sufficiently to seat bearing against gear shoulder.
8. Like parts of the synchronizer assembly are interchangeable. Pre-assembly of this unit before installing on the mainshaft is not required since parts may be installed individually.
9. Check and replace all thrust washers showing signs of excessive wear.
10. The mainshaft front and rear bearing retainers fit or end play for their respective bearing is controlled by gaskets. Install bearing retainers and cap screw, check clearance between each retainer and case with a feeler gauge. Then select a gasket or gaskets about .005" thicker than the clearance between retainer and case. Remove retainer, install selected gasket or gaskets and retainer. This will give a satisfactory condition as to bearing end play and sealing of transmission.

## Spicer Transmission Section

**MODELS 752, 753, 4452, 4453, 4952, 4953, 5552, 5553, 6252, 6253, 6452, 6453, 6852, 6853**

In these transmissions, two synchronizer assemblies are used, one for 2nd and 3rd speeds and another for 4th and 5th speeds. All mainshaft and countershaft gears which are constantly meshed are helical type.

In some models the mainshaft constant mesh gear bearings are pressure lubri-

cated by a transmission oil pump which forces gear lubricant through passages to bearing surfaces.

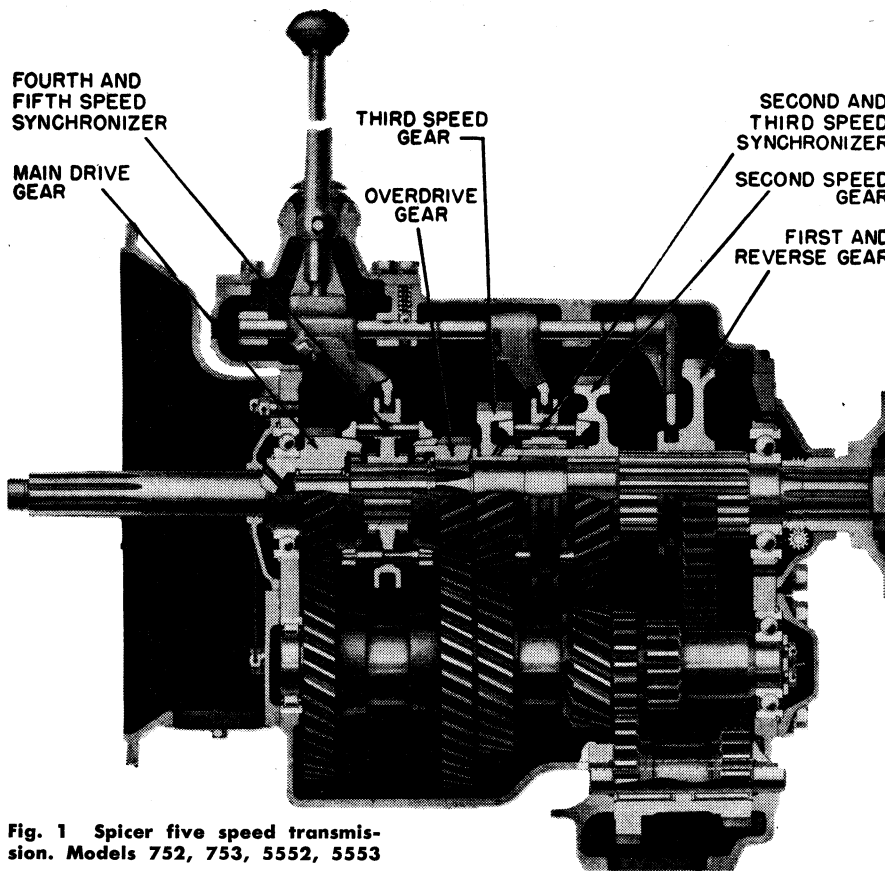
The mainshaft pilot bearing on some models is a double-row ball bearing assembly, while the pilot bearing on other models is a roller bearing assembly.

### Disassemble, Figs. 1, 2, 3, 4

1. Take off transmission cover and shift lever and then remove shift lever housing.
2. Unscrew flange nut and use a puller to remove companion flange.
3. Remove mainshaft and main drive gear bearing caps.
4. Remove main drive gear bearing re-

taining nut and plate.

5. Push mainshaft to rear far enough to permit removal of speedometer drive gear and rear bearing.
6. Tilt front end of mainshaft up slightly to permit main drive gear to clear countershaft drive gear. Then pull main drive gear out through front of case.
7. Lift mainshaft assembly out of case and at the same time slip low and reverse gear from the shaft.
8. Take off countershaft rear bearing cap and remove capscrews from rear end of shaft.
9. Push countershaft to rear far



**Fig. 1 Spicer five speed transmission. Models 752, 753, 5552, 5553**

enough to permit removal of rear bearing.

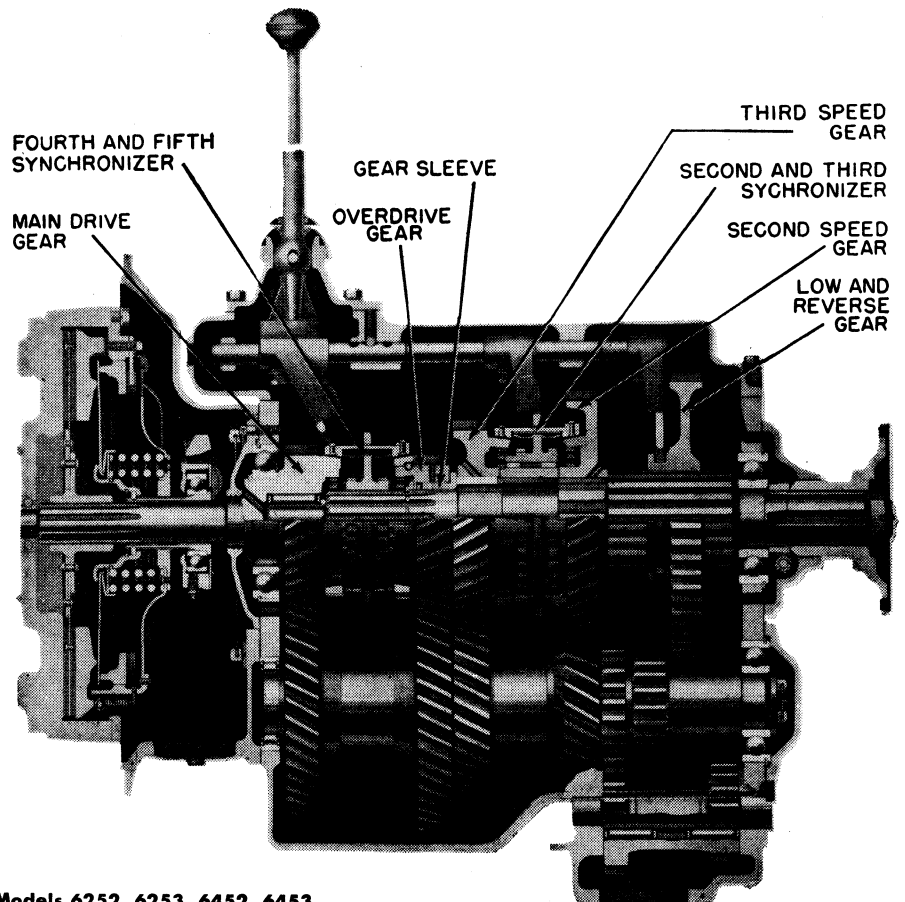
10. Lift countershaft out of case.
11. The reverse idler gear shaft is tapped to rear for use of a puller when necessary to remove these parts.

### Mainshaft, Disassemble

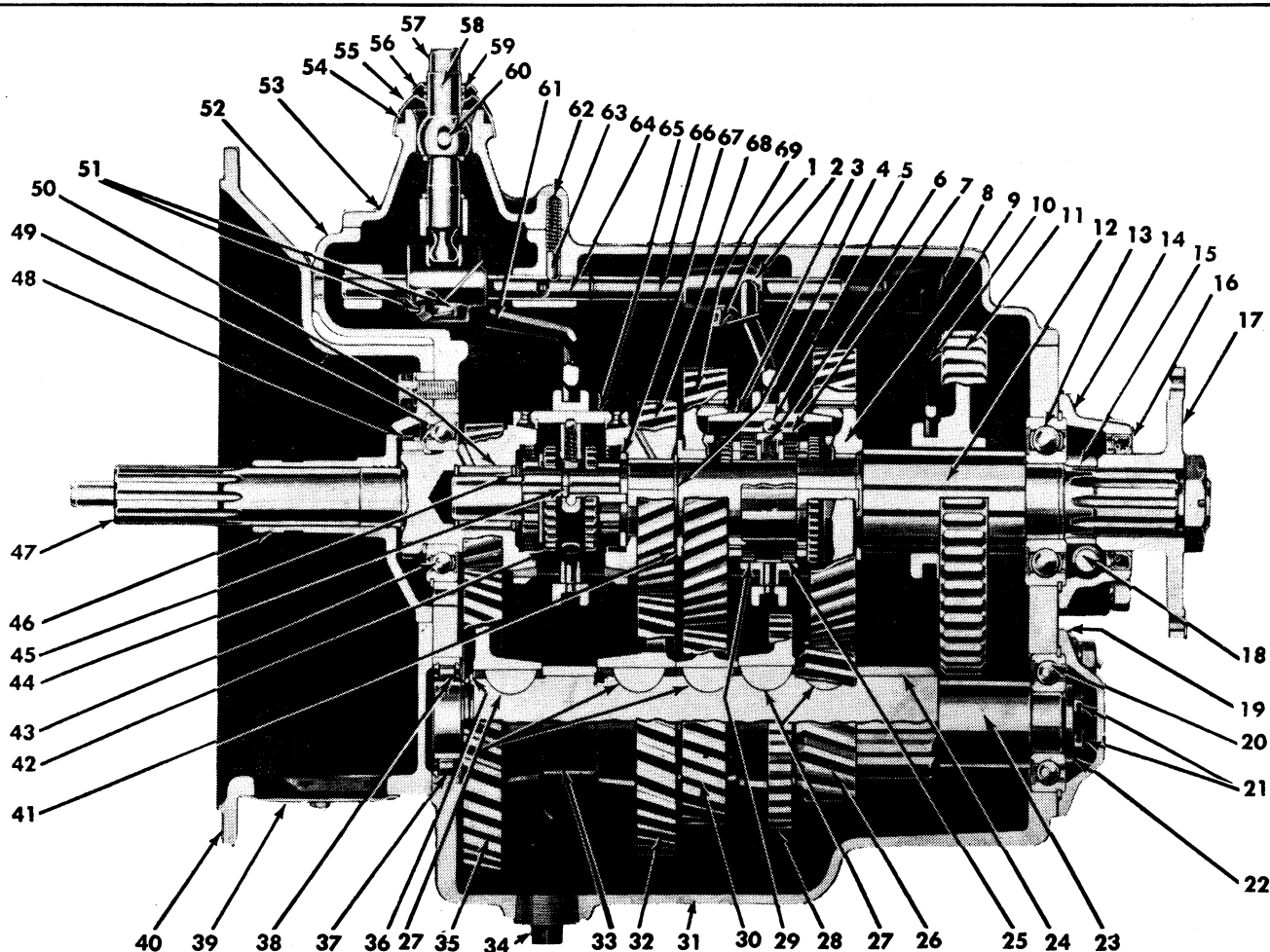
1. Clamp rear end of mainshaft in vise.
2. Remove pilot bearing and snap ring and take off high speed synchronizer.
3. Remove snap ring or T-shaped key from slot in shaft.
4. Rotate thrust washer to align its lugs with shaft splineways and slide it off shaft.
5. Lift off fourth speed (or overdrive) gear, bearings, rollers and spacer; also sleeve on models so equipped.
6. Remove snap ring (if equipped) from third speed gear sleeve.
7. Take off third speed gear with rollers and spacer. The sleeve used on some models will come off with the gear and bearings, whereas on other models the sleeve is removed after the gear and bearings.
8. Lift off the rear synchronizer. Care should be exercised on models with spring and ball type synchronizer to prevent the loss of springs, retainers and balls. This may be accomplished by wrapping a piece of wire around the poppet spring retainers after partially removing the unit.
9. Use a puller to remove rear synchronizer clutch gear, if necessary.

### Mainshaft, Assemble

1. Fasten rear end of shaft in a vise and slip on second speed gear thrust washer (if unit has one).
2. On models so equipped, assemble bearing rollers and spacer in second speed gear, using grease to hold them in position.
3. Place second speed gear on shaft with clutch teeth facing front.
4. Install rear synchronizer clutch gear.
5. On models having poppet ball and spring type synchronizers, position poppet springs on clutch gear and insert balls. Use a piece of wire to compress plungers in order to slip on synchronizer sleeve, pulling wire out gradually as sleeve is being installed.
6. Slip synchronizer over clutch gear and slide sleeve in place. If sleeve has an oil hole be sure to line it up with oil hole in mainshaft.
7. On models so equipped, assemble roller bearings and spacer in third speed gear in same manner outlined for second speed gear. Then place this assembly on mainshaft, facing clutch gear teeth to rear. On some models the sleeve has lugs which must register with keyways of clutch gear. After sleeve is installed in these units, lock in place with a snap ring.
8. On models so equipped, slide fourth speed (or overdrive) gear sleeve and dowel in place, being sure oil hole in sleeve lines up with oil hole in mainshaft.

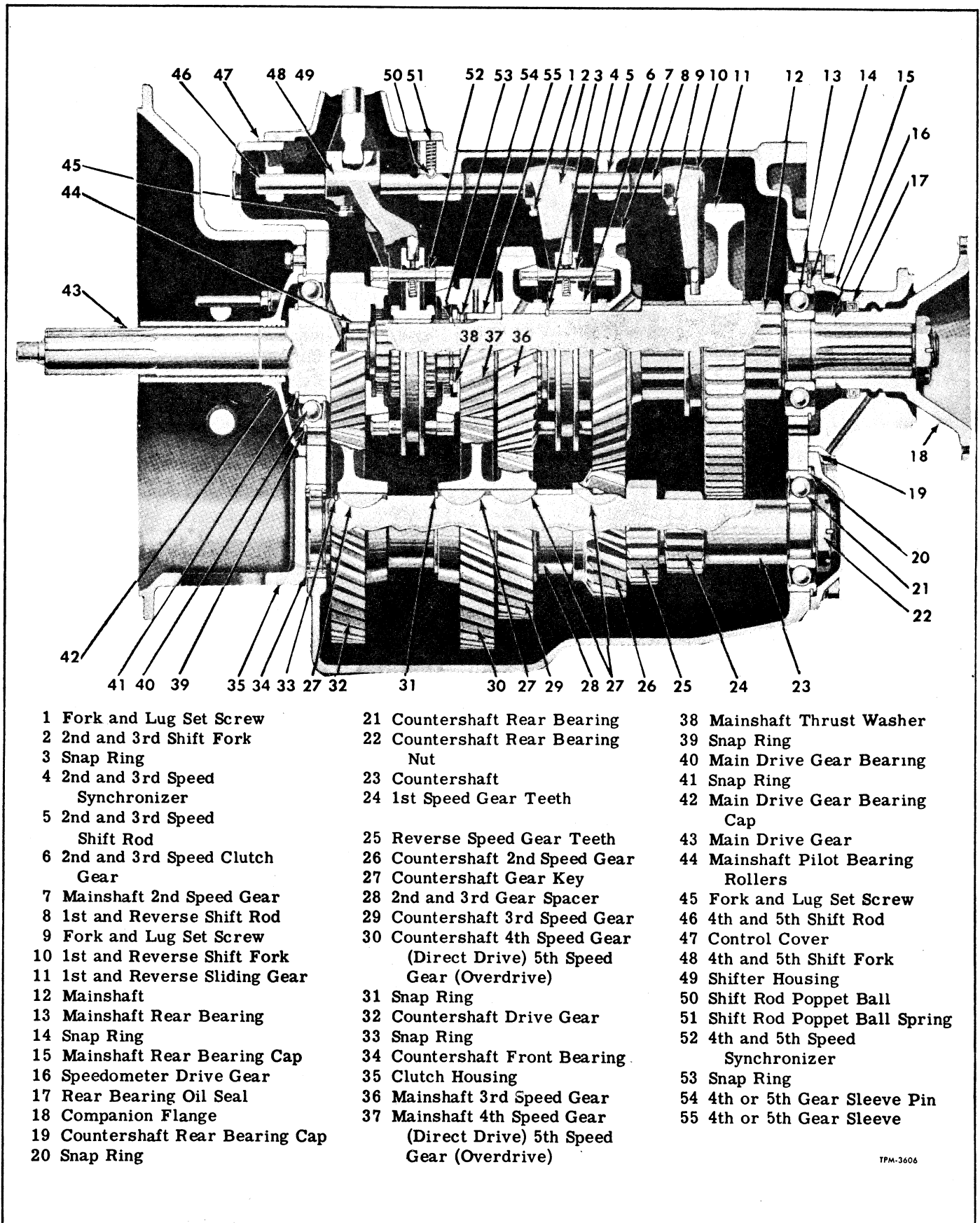


**Fig. 3 Spicer five speed transmission. Models 6252, 6253, 6452, 6453**



- |                                  |   |  |
|----------------------------------|---|--|
| 1 Fork and Lug Set Screw         | 24 1st and Reverse Gear Teeth                 | 48 Bearing Lock Nut                        |
| 2 2nd and 3rd Shift Fork         | 25 Clutch Gear                                | 49 Nut Lock                                |
| 3 2nd and 3rd Speed Synchronizer | 26 Countershaft 2nd Speed Gear                | 50 Mainshaft Pilot Bearing                 |
| 4 Snap Ring                      | 27 Countershaft Gear Key                      | 51 Fork and Lug Set Screw                  |
| 5 Synchronizer Ball              | 28 Power Take-off Gear                        | 52 Control Cover                           |
| 6 Plunger Spring                 | 29 Synchronizer Clutch                        | 53 Shifter Housing                         |
| 7 Synchronizer Plunger           | 30 Countershaft 3rd Speed Gear                | 54 Seal Washer                             |
| 8 1st and Reverse Shift Rod      | 31 Transmission Case                          | 55 Compression Cup                         |
| 9 Mainshaft 2nd Speed Gear       | 32 Countershaft 4th Speed Gear (Direct Drive) | 56 Compression Collar                      |
| 10 1st and Reverse Shift Fork    | 33 Gear Spacer                                | 57 Gearshift Lever                         |
| 11 1st and Reverse Sliding Gear  | 34 Drain Plug                                 | 58 Compression Pin                         |
| 12 Mainshaft                     | 35 Countershaft Drive Gear                    | 59 Compression Collar Spring               |
| 13 Mainshaft Rear Bearing        | 36 Snap Ring                                  | 60 Rock Shaft                              |
| 14 Bearing Cap                   | 37 Countershaft Front Bearing                 | 61 4th and 5th Shift Fork                  |
| 15 Speedometer Drive Gear        | 38 Front Bearing Spacer Washer                | 62 Mesh Lock Spring                        |
| 16 Oil Seal                      | 39 Clutch Hand Hole Cover                     | 63 Mesh Lock Plunger                       |
| 17 Companion Flange              | 40 Clutch Housing                             | 64 4th and 5th Shift Rod                   |
| 18 Speedometer Driven Gear       | 41 Gear Sleeve                                | 65 4th and 5th Speed Synchronizer          |
| 19 Countershaft Rear Bearing Cap | 42 Synchronizer Clutch                        | 66 2nd and 3rd Shift Rod                   |
| 20 Countershaft Rear Bearing     | 43 Main Drive Gear Bearing                    | 67 Thrust Washer                           |
| 21 Retaining Washer Screw        | 44 Thrust Washer Lock Key                     | 68 Mainshaft 4th Speed Gear (Direct Drive) |
| 22 Bearing Retainer Washer       | 45 Bearing Spacer Ring                        | 69 Mainshaft 3rd Speed Gear                |
| 23 Countershaft                  | 46 Drive Gear Bearing Cap                     |  |
|                                  | 47 Main Drive Gear                            |  |

Fig. 2 Spicer five speed transmission. Models 4452, 4453, 4952, 4953



- |                                  |  |                                    |
|----------------------------------|--|------------------------------------|
| 1 Fork and Lug Set Screw         | 21 Countershaft Rear Bearing   | 38 Mainshaft Thrust Washer         |
| 2 2nd and 3rd Shift Fork         | 22 Countershaft Rear Bearing Nut   | 39 Snap Ring                       |
| 3 Snap Ring                      | 23 Countershaft  | 40 Main Drive Gear Bearing         |
| 4 2nd and 3rd Speed Synchronizer | 24 1st Speed Gear Teeth  | 41 Snap Ring                       |
| 5 2nd and 3rd Speed Shift Rod    | 25 Reverse Speed Gear Teeth  | 42 Main Drive Gear Bearing Cap     |
| 6 2nd and 3rd Speed Clutch Gear  | 26 Countershaft 2nd Speed Gear   | 43 Main Drive Gear                 |
| 7 Mainshaft 2nd Speed Gear       | 27 Countershaft Gear Key   | 44 Mainshaft Pilot Bearing Rollers |
| 8 1st and Reverse Shift Rod      | 28 2nd and 3rd Gear Spacer   | 45 Fork and Lug Set Screw          |
| 9 Fork and Lug Set Screw         | 29 Countershaft 3rd Speed Gear   | 46 4th and 5th Shift Rod           |
| 10 1st and Reverse Shift Fork    | 30 Countershaft 4th Speed Gear (Direct Drive) 5th Speed Gear (Overdrive) | 47 Control Cover                   |
| 11 1st and Reverse Sliding Gear  | 31 Snap Ring   | 48 4th and 5th Shift Fork          |
| 12 Mainshaft                     | 32 Countershaft Drive Gear   | 49 Shifter Housing                 |
| 13 Mainshaft Rear Bearing        | 33 Snap Ring   | 50 Shift Rod Poppet Ball           |
| 14 Snap Ring                     | 34 Countershaft Front Bearing  | 51 Shift Rod Poppet Ball Spring    |
| 15 Mainshaft Rear Bearing Cap    | 35 Clutch Housing  | 52 4th and 5th Speed Synchronizer  |
| 16 Speedometer Drive Gear        | 36 Mainshaft 3rd Speed Gear  | 53 Snap Ring                       |
| 17 Rear Bearing Oil Seal         | 37 Mainshaft 4th Speed Gear (Direct Drive) 5th Speed Gear (Overdrive)    | 54 4th or 5th Gear Sleeve Pin      |
| 18 Companion Flange              |  | 55 4th or 5th Gear Sleeve          |
| 19 Countershaft Rear Bearing Cap |  |                                    |
| 20 Snap Ring                     |  |                                    |

TPM-3606

Fig. 4 Spicer five speed transmission. Models 6852, 6853



9. Assemble bearing rollers and spacer in fourth speed (or overdrive) gear in same manner as already set forth and slide assembly in place with clutch gear teeth facing front.
10. Slip on thrust washer and lock it in place with T-shaped key or snap ring, whichever is used.
11. Install front synchronizer.
12. Install pilot bearing spacer ring on shaft to complete the assembly.

**Mainshaft, Install**

1. Hold low and reverse gear in case at an angle and pass rear end of shaft through gear and out through rear of case; then forward to a position where mainshaft and countershaft line up.
2. Lubricate pilot bearing and slip it on mainshaft.
3. Raise front of mainshaft slightly and, at the same time, install main drive gear.
4. Install main drive gear bearing and snap ring, locking bearing with nut and lock plate.
5. Tap mainshaft rear bearing in place with its snap ring to rear.
6. Slip bearing cap over main drive gear and bolt it in place. The oil holes in bearing cap and gasket must line up. The leather oil seals on models with an oil pump should be installed with the aid of a piece of shim stock covering the splines to prevent cutting the leather.

**Oil Pump**

The oil pump (most models) is bolted to the inner side of the clutch housing. The pump is fitted with a non-adjustable pressure relief valve consisting of a ball and spring held in place by a pipe plug in the side of the oil pump housing.

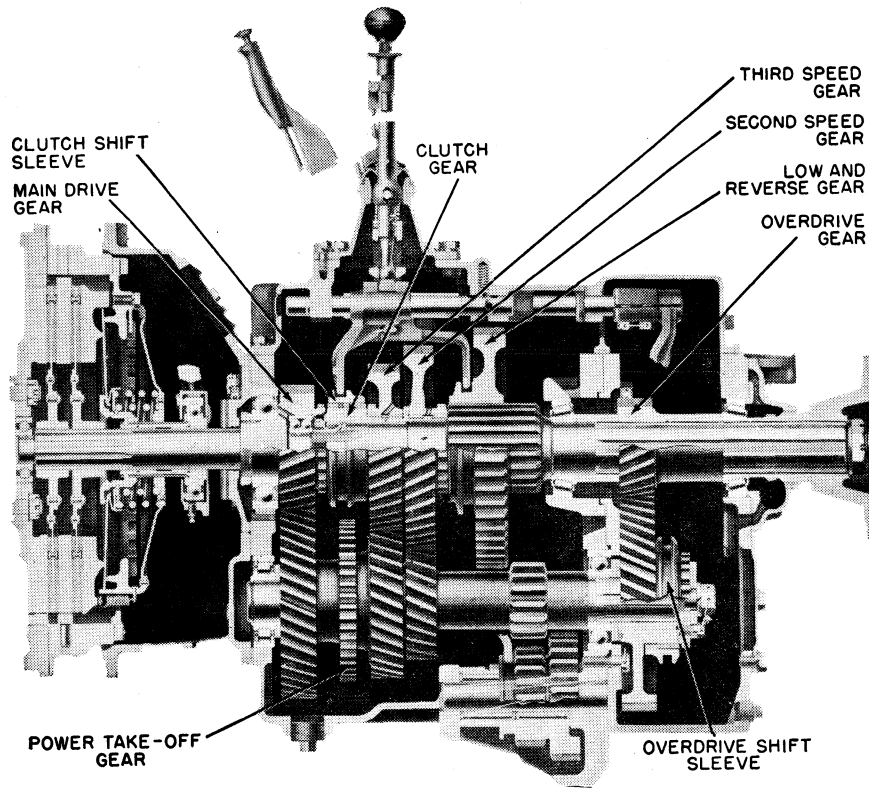
When assembling the pump, press the drive gear on the shaft so that the distance from the front end of the shaft to the front side of the gear measures  $\frac{1}{4}$ ". This dimension should be maintained to prevent excessive wear on the side of the gear.

Assemble the oil pump driving gear and shaft in the housing. Press the driven gear shaft in the housing and then on the shaft. Assemble the relief valve and spring and install the pipe plug. Position the housing gasket, being sure the oil holes in the case are not covered by the gasket. Fill the oil pump with gear oil and fasten the assembly in place, being sure the oil holes line up.

**MODELS 7751, 7851**

**Fig. 5**

1. Remove transmission cover.
2. Remove universal flange.
3. Unfasten retainer cap from rear of transmission case and remove speedometer drive gear and rear bearing retainer.
4. Pull overdrive shift shaft out through rear and lift out fork.
5. Remove overdrive housing countershaft cover and unscrew lock bolts that retain overdrive gears to countershaft.
6. Reach into overdrive housing and



**Fig. 5 Spicer five speed transmission. Models 7751, 7851**

7. Pull overdrive housing and gears to rear and force rear bearing from mainshaft.
8. Push mainshaft to rear until intermediate bearing is free of case.
9. Tilt mainshaft and lift assembly out through top.
10. Remove bell housing and main drive gear bearing cap.
11. Unscrew nut from main drive gear shaft and push drive gear into case and lift it out.
12. Remove snap ring from front end of countershaft.
13. Push countershaft to rear until bearing is free of case, then lift countershaft out through top.
14. Push out reverse idler shaft and lift out gear.
15. To disassemble the mainshaft, slip off sliding gear and clutch sleeve. Unscrew clutch gear retaining nut and strip mainshaft, being careful not to lose any of the bearing rollers.
16. Reverse the above procedure to assemble the transmission.
3. Remove mainshaft rear bearing cap and take off speedometer drive gear, spacer and thrust washer.
4. Slide mainshaft to rear far enough to free rear bearing from case and use a suitable puller to remove bearing.
5. Remove clutch release yoke and shafts.
6. Remove cap screws from main drive gear bearing cap and, using a suitable puller, remove bearing cap and main drive gear.
7. Remove mainshaft pilot bearing from drive gear pocket.
8. Lift mainshaft assembly out of case by its front end.
9. Remove countershaft rear bearing cap and the bearing retainer washer from rear end of countershaft.
10. Pull reverse idler gear shaft out with a puller.
11. Remove reverse idler gear, sleeve and bearing assembly.
12. Move countershaft to rear far enough to free rear bearing from case. Then use puller to remove bearing.
13. Slide countershaft to rear until front bearing is out of case and lift out assembly.

**MODELS 8041, 8045, 8245, 8445,**

**Disassemble, Fig. 6**

1. Shift transmission into reverse gear, remove cover screws and lift off shift cover.
2. Remove nut and pull off companion flange.

**Main Drive Gear, Disassemble**

1. Remove snap ring from inside of bearing cap.
2. Place bearing cap in arbor press and push bearing and main drive gear out of bearing cap.
3. Remove nut and press bearing off main drive gear.



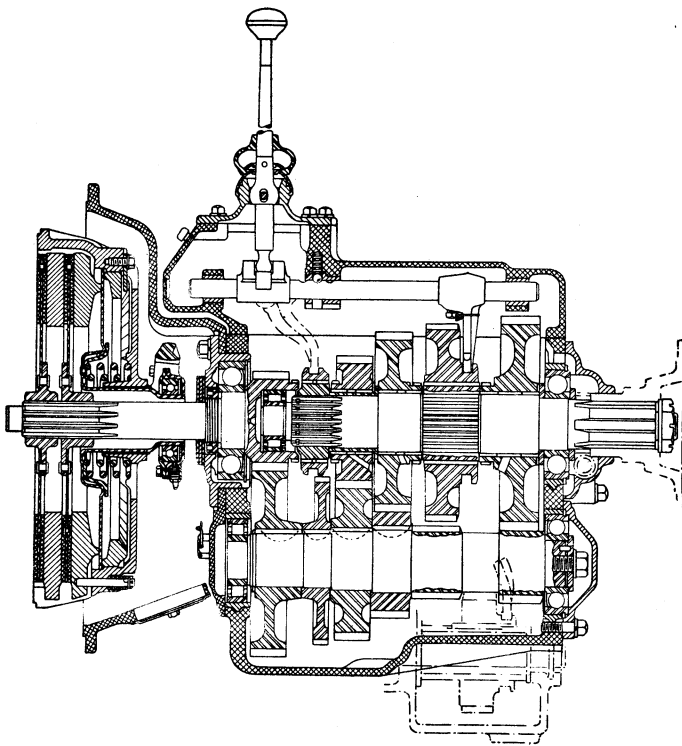


Fig. 6 Spicer four speed transmission. Models 8041, 8045, 8245, 8445

### Mainshaft, Disassemble

1. Remove 3rd and 4th speed clutch collar.
2. Remove low speed gear, being careful not to lose any of the needle bearings.
3. Remove low and 2nd speed clutch gear.
4. Remove 3rd and 4th speed clutch gear snap ring.
5. Place mainshaft assembly in arbor press with rear end down and press mainshaft through gears. Use care to see that none of the needle bearings and 3rd speed gear lock balls are lost as they fall out.

### Countershaft, Disassemble

1. Use puller to remove front bearing.
2. Remove countershaft drive gear snap ring.
3. Place assembly in arbor press and press countershaft through gears.

### Mainshaft, Disassemble

1. Coat inside bore of low speed gear with heavy grease. Then place two rows of needle bearings (72 per row) on inside of low speed gear with spacer between rows.
2. Assemble needle bearings in 2nd and 3rd speed gears in same manner.
3. Place mainshaft in vise with rear end down.
4. Place 2nd speed gear on mainshaft with clutch teeth to rear.
5. Place 3rd speed gear sleeve on mainshaft with flanged end of sleeve toward rear. Line up two notches on inside of sleeve with mainshaft splines. Place two sleeve lock balls in notches of sleeve and press sleeve on mainshaft.
6. Place 3rd speed gear on mainshaft with clutch teeth to front.
7. Place 3rd and 4th speed clutch gear on mainshaft with hub of gear toward front and press in place. Then lock assembly with a new snap ring.
8. Place 3rd and 4th speed clutch collar on clutch gear with longer hub to rear.
9. Take mainshaft from vise and place low and 2nd speed clutch gear with shift fork collar to rear.
10. Place low speed gear on mainshaft with clutch teeth to front.
11. Grease one side of low speed gear thrust washer and place its greased side against low speed gear.

### Transmission, Assemble

Reassembly of the transmission is largely the reverse of the disassembly procedure. However, the following should be noted:

1. Place reverse idler gear and sleeve in case with shift fork collar to rear of case.
2. Make sure flat on rear end of reverse idler shaft is lined up so countershaft rear bearing cap will lock shaft in place.
3. Main drive gear bearing cap is marked "Top" and should be so installed.
4. Be sure mainshaft rear bearing cap and gasket are installed with oil drain holes lined up.

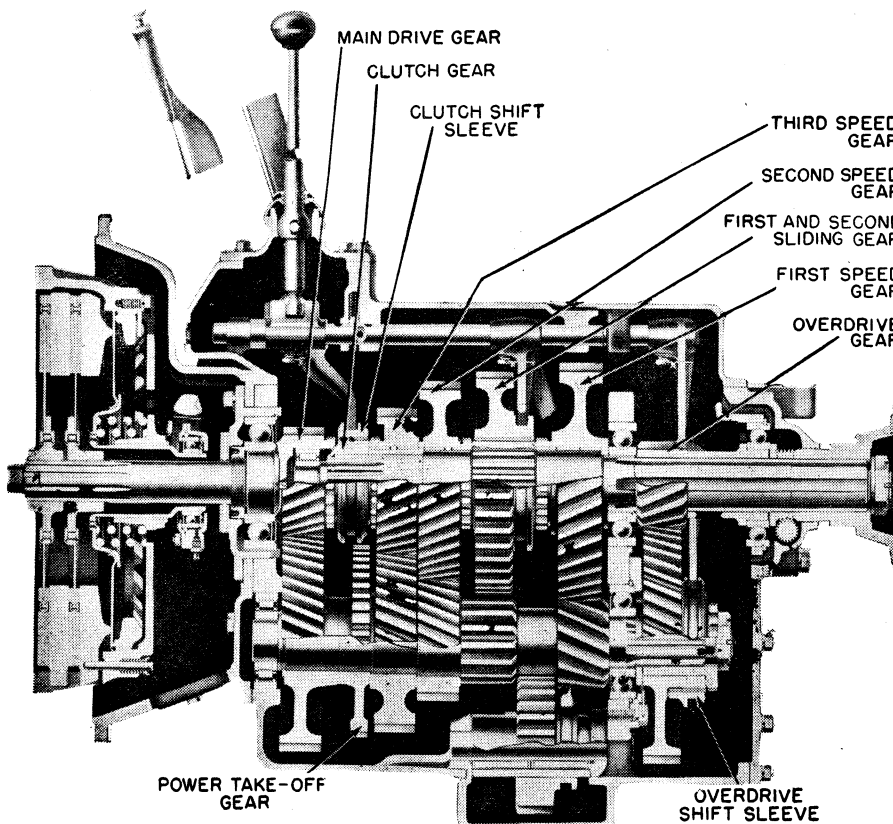


Fig. 7 Spicer five speed transmission. Models 8051, 8251, 8055, 8255 (Models 8055 and 8255 have double row ball bearing at rear of mainshaft)

## MODELS 8051, 8251, 8055, 8255

### Disassemble, Fig. 7

1. Shift transmission into reverse.
2. After removing cap screws, lift cover and shift forks off transmission.
3. Remove nut and pull off companion flange.
4. Remove mainshaft rear bearing cap.
5. Remove speedometer drive gear or spacer from mainshaft.
6. Slide mainshaft to rear until rear bearing is free of case. Then use a suitable puller to remove bearing.
7. Remove overdrive gear lower shift fork guide shaft and remove shift fork.
8. Remove transmission rear end cover.
9. Remove overdrive gear and bearing spacer from mainshaft.
10. Remove nut from rear end of countershaft and use a suitable puller to remove overdrive sleeve.
11. Remove countershaft overdrive gear and shift collar.
12. Slide mainshaft toward rear to bring center roller bearing out of case far enough to get a puller or "C" clamp on the outside diameter of the bearing. Then tap rear end of mainshaft toward front which will move bearing off shaft.
13. Loosen bearing puller or "C" clamp and slide mainshaft back and get another hold on center mainshaft roller bearing and again tap mainshaft forward as far as possible.
14. Repeat this procedure until center roller bearing is out of case and off mainshaft.
15. Remove clutch release yoke and shafts.
16. Remove cap screws from main drive gear bearing cap and with a suitable puller remove cap and main drive gear out of case, using the two puller screw holes provided.
17. Remove main drive gear pilot bearing from mainshaft.
18. Tilt front end of mainshaft upward and lift assembly out of case.
19. Remove cap screws and take off countershaft rear bearing retainer and thrust washer.
20. Place a suitable puller in threaded hole in reverse idler gear shaft and pull out shaft.
21. Remove reverse idler gear and sleeve and bearing assembly.
22. Move countershaft to the rear until rear bearing is out of case. Then use a puller to remove rear bearing.
23. Slide countershaft toward rear until front end is out of case. Then lift assembly out by its front end.

### Main Drive Gear, Disassemble

1. Remove snap ring on inside of bearing cap.
2. Place bearing cap in press and push bearing and main drive gear out of cap.
3. Remove bearing nut and press bearing from main drive gear.

### Mainshaft, Disassemble

1. Remove 3rd and 4th speed clutch collar.
2. Remove low speed gear and needle

roller bearings, being careful not to lose any of the rollers.

3. Remove low and 2nd speed clutch gear.
4. Remove snap ring from front end of mainshaft and press gears off shaft. Use care to see that needle bearings and 3rd speed gear sleeve lock balls are not lost during the pressing operation.

### Countershaft, Disassemble

1. Use puller to remove front bearing.
2. Remove countershaft drive gear snap ring.
3. Press off countershaft gears one at a time by placing gears on bed of press and pushing countershaft out of gears.

### Mainshaft, Assemble

1. Coat inside bore of low speed gear with heavy grease.
2. Place two rows of needle bearings (72 per row) on inside of low speed gear with spacer between rows.
3. Assemble needle bearings in 2nd and 3rd speed gears in same manner.
4. Place mainshaft in vise with rear end down.
5. Place 2nd speed gear on mainshaft with clutch teeth to rear of shaft.
6. Place 3rd speed gear sleeve on shaft with flanged end toward rear. Line up the two notches on inside of sleeve with mainshaft spline and place two sleeve lock balls in notches of sleeve. Then press sleeve on mainshaft.
7. Place 3rd speed gear on mainshaft sleeve with clutch teeth to front.
8. Press 3rd and 4th speed clutch gear on mainshaft with its hub to front. Then install snap ring in front of clutch gear.
9. Place 3rd and 4th speed clutch collar on clutch gear with longer hub to rear.
10. Remove mainshaft from vise and place low and 2nd speed clutch gear on mainshaft with shift fork collar to rear.
11. Place low speed gear on rear of mainshaft with clutch teeth to front.
12. Grease one side of mainshaft low speed gear thrust washer and place on mainshaft with greased side against low gear.

### Transmission, Assemble

Reassembly of the transmission is largely a matter of reversing the disassembly procedure. However, the following should be noted:

1. Shift fork collar of reverse idler gear should be to rear of case.
2. When installing reverse idler gear shaft, make sure flat on rear of shaft is lined up so countershaft rear bearing retainer will lock reverse idler shaft in place.
3. Mainshaft pilot bearing must be assembled on shaft with snap ring in outer race to rear.
4. Main drive gear bearing cap is marked "Top" and it should be so installed.
5. Make sure countershaft overdrive gear clutch collar is installed with hub of collar toward gear. Make

sure collar is a free slide fit on spline hub of gear.

6. When installing overdrive shift fork and shaft, place shift fork guide shaft in hole provided in rear of case. Tap it through case and line up shift fork and tap shaft on through hole in center support in main case.

## MODEL 5531

### 3 Speed Auxiliary Disassemble, Fig. 8

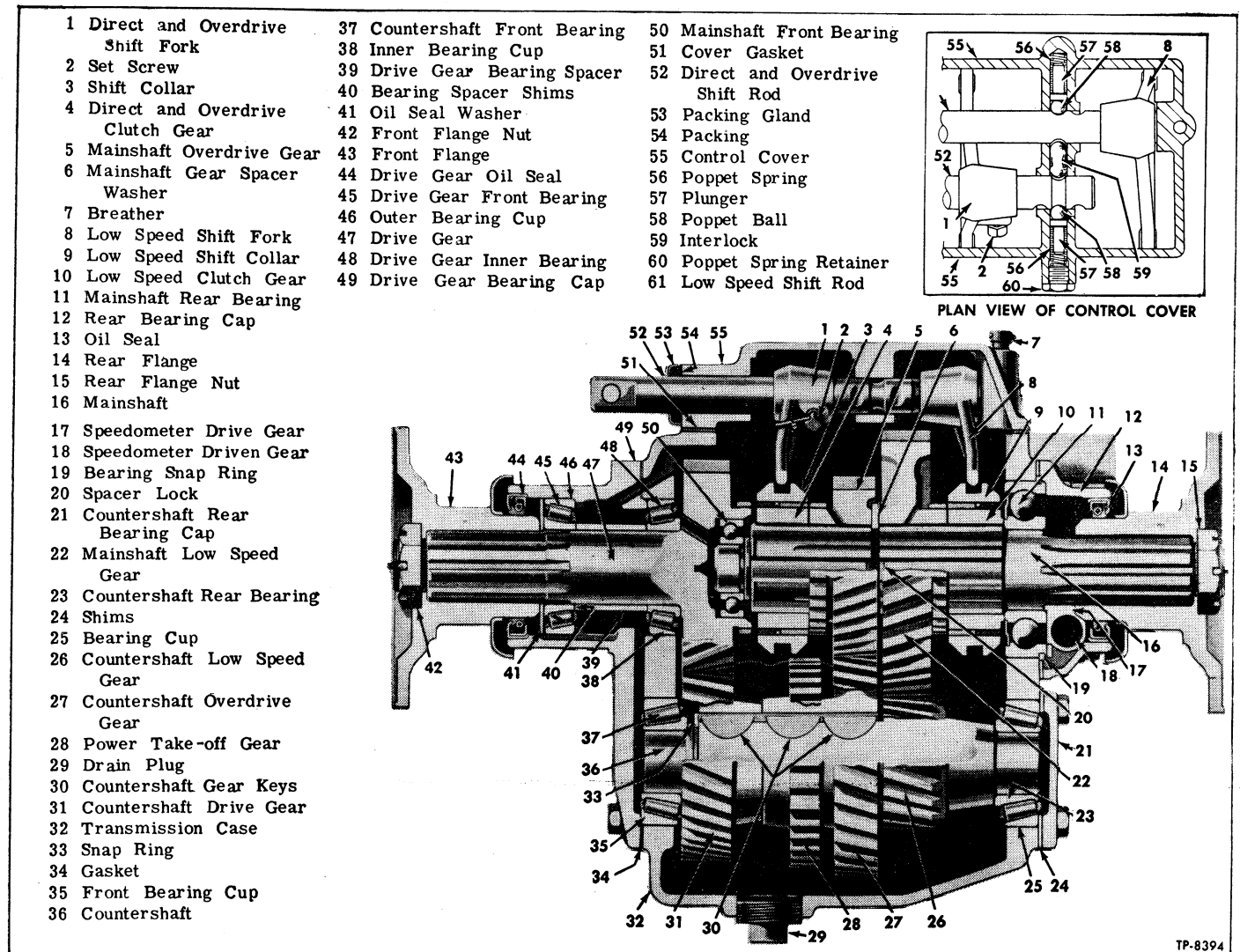
1. Remove transmission cover.
2. Remove both propeller shaft flanges.
3. Remove front support from main drive gear bearing cap.
4. Remove countershaft rear bearing cap, noting number of shims under cap.
5. Remove mainshaft rear bearing cap and snap ring from bearing.
6. Use puller to remove rear bearing.
7. Remove mainshaft assembly from case.
8. Remove drive gear bearing cap, pulling bearing and washer with cap.
9. Lift drive gear from case.
10. Force countershaft toward rear to remove bearing cap from case.
11. Lift countershaft from case.

### Disassemble Sub-Assemblies

1. Slide spacer and shims off main drive gear. Then use press or bearing puller to remove bearing from gear.
2. Remove oil seal from bearing cap and tip cap to allow washer and bearing to fall out.
3. If bearing cup requires replacing, drive out old cup and press new part squarely in until cup bottoms in counterbore.
4. To disassemble mainshaft, first mark shift sleeves and clutch gears so they may be assembled in the same position when rebuilding transmission. Remove shift sleeves from clutch gears.
5. Support mainshaft at low speed gear and remove clutch gear by pressing mainshaft out of gears.
6. Remove spacer lock from between splines and remove gear and spacer from shaft.
7. Press clutch gear off mainshaft.
8. The countershaft low speed gear is integral with the shaft, whereas the other three gears are retained by a snap ring and each gear located by a key. Mark each countershaft gear so correct position will be known when assembling.
9. If necessary to remove countershaft bearings, use puller which will apply pressure on bearing race.
10. Remove snap ring from front end of countershaft.
11. Support gears one at a time and with arbor press, press countershaft out of gears.

### Sub-Assembly Build-Up

1. Drive countershaft keys in place and press gears on countershaft, using marks previously made before gears were removed.



**Fig. 8 Spicer three speed auxiliary. Model 5531**

- |   |  |   |
|---|--|---|
| <ol style="list-style-type: none"> <li>2. Install new snap ring in groove at forward end of countershaft drive gear.</li> <li>3. Press bearing cone on each end of countershaft, being sure that cone seats firmly against shoulder on countershaft.</li> <li>4. Press direct and overdrive clutch gear on mainshaft, referring to marks made at disassembly.</li> <li>5. Install overdrive gear on mainshaft with spur teeth toward clutch gear.</li> <li>6. Slide spacer washer over splines and into place at overdrive gear hub. Turn washer in groove to align internal teeth with mainshaft splines so washer cannot be moved endwise. Insert lock in place between splines to hold washer in place.</li> <li>7. Install low speed gear on mainshaft with spur teeth toward rear end of mainshaft.</li> <li>8. Install low speed clutch gear with flat side of gear toward low speed gear.</li> <li>9. Install shift sleeves on clutch gears.</li> <li>10. Install drive gear bearing cup in case. Use new gasket and bolt bearing cap in place.</li> </ol> | <ol style="list-style-type: none"> <li>11. Press bearing on drive gear and slide sleeve into place against bearing.</li> <li>12. Place original quantity of shims at outer end of sleeve. Then from inside of case, move drive gear and bearing in place in bearing cap.</li> <li>13. Install drive gear front bearing and washer over outer end of drive gear. Then install flange and nut. While tightening flange nut, check bearing adjustment by turning drive gear by hand. If any binding or tightness is noted, it indicates an insufficient number of shims. Install sufficient number of shims to permit drive gear to be turned easily by hand but not so loose as to be able to spin.</li> <li>14. If no tightness is evident with original shim pack in place, tighten flange nut to a minimum torque of 240 lb. ft. Recheck bearing adjustment by rotating drive gear. Shims are available in three sizes (.003", .010" and .030") to establish proper bearing adjustment.</li> <li>15. When proper shim pack has been selected, remove drive gear from bearing cap and lay shim pack aside</li> </ol> | <p>for use when reassembling transmission.</p> <p style="text-align: center;"><b>Transmission, Assemble</b></p> <ol style="list-style-type: none"> <li>1. If drive gear bearing cap is removed, bolt cap in place, using new gasket with oil passages aligned with passages in cap and case.</li> <li>2. Install mainshaft inner bearing cup and countershaft front bearing cup.</li> <li>3. Install countershaft assembly in case.</li> <li>4. Install countershaft rear bearing cup, using same thickness of shims removed during disassembly. Install cap and tighten bolts, meanwhile turning countershaft by hand. If any binding is noted, remove bearing cap and add sufficient shims to provide a free turning countershaft with no end play. Three sizes of shims (.003", .010" and .030") are available for use in obtaining proper adjustment of countershaft bearings.</li> <li>5. Install drive gear and bearing in bearing cap, using shim pack previously selected.</li> <li>6. Before installing propeller shaft</li> </ol> |
|---|--|---|

**MODEL 5831**

**3 Speed Auxiliary**

**Disassemble, Fig. 9**

- flange, be sure washer is in place and install new oil seal with seal lip pointing inward.
7. Install front support bracket on trunnion at bearing cap. Tighten flange nut 240 lb. ft. minimum and install cotter pin.
  8. Install mainshaft front bearing on pilot at front of mainshaft.
  9. Lower mainshaft in case. Install rear bearing with shielded side toward front.
  10. Install speedometer drive gear.
  11. Install new oil seal in mainshaft rear bearing cap with lip of seal pointing inward. Also assemble speedometer driven gear in cap if this part has been removed.
  12. Be sure snap ring is in groove in bearing, then install bearing cap, using new gasket.
  13. Install flange and nut, tightening nut to 240 lb. ft. minimum.
  14. Move shift forks to neutral and install cover with new gasket, being sure shift forks enter grooves in shift or collars.
  15. Install breather in cover.

1. Remove gear shift housing.
2. Remove input shaft U-joint yoke.
3. Remove transmission front trunnion support from input shaft bearing retainer.
4. Remove nut from output shaft.
5. Remove transmission support, parking brake band support, band and brake drum as a unit.
6. Remove speedometer driven gear.
7. Remove output shaft rear bearing retainer and slip the speedometer drive gear from shaft.
8. Remove input shaft bearing retainer and bearing spacer.
9. Remove countershaft rear bearing cap and shims. Tie shim pack together for future use.
10. Tap underdrive gear toward rear of transmission until bearing is forced out of case. Pull bearing from shaft

and remove underdrive sleeve and hub from shaft through rear bearing bore.

11. Tilt output shaft upward and lift out of case.
12. Remove 13 pilot rollers from input shaft hub. Remove snap ring from input shaft bearing. Then remove input shaft by tapping into case.
13. Drive countershaft toward rear of case until rear bearing cup is out of case. Slide countershaft toward rear of case and lift out the assembly.

**Countershaft, Assemble**

1. Press rear bearing on shaft and install key.
2. Position rear end of shaft in a press plate. Place cluster gear on top of shaft with keyway in gear aligned with key in shaft. Press cluster gear on shaft and install snap ring.
3. Press on front bearing.
4. Lower rear end of assembly in case and slide assembly forward into position.
5. Position bearing cups in case bores. Temporarily install input shaft bearing retainer to properly locate front countershaft bearing cup.
6. Install countershaft rear bearing cup and shims with oil passage properly aligned on rear of case.
7. Install bolts and lockwashers and torque bolts to 40-45 lb. ft.
8. Countershaft should roll freely and have .001-.003" end play. Add or remove shims to obtain proper adjustment. When proper adjustment is

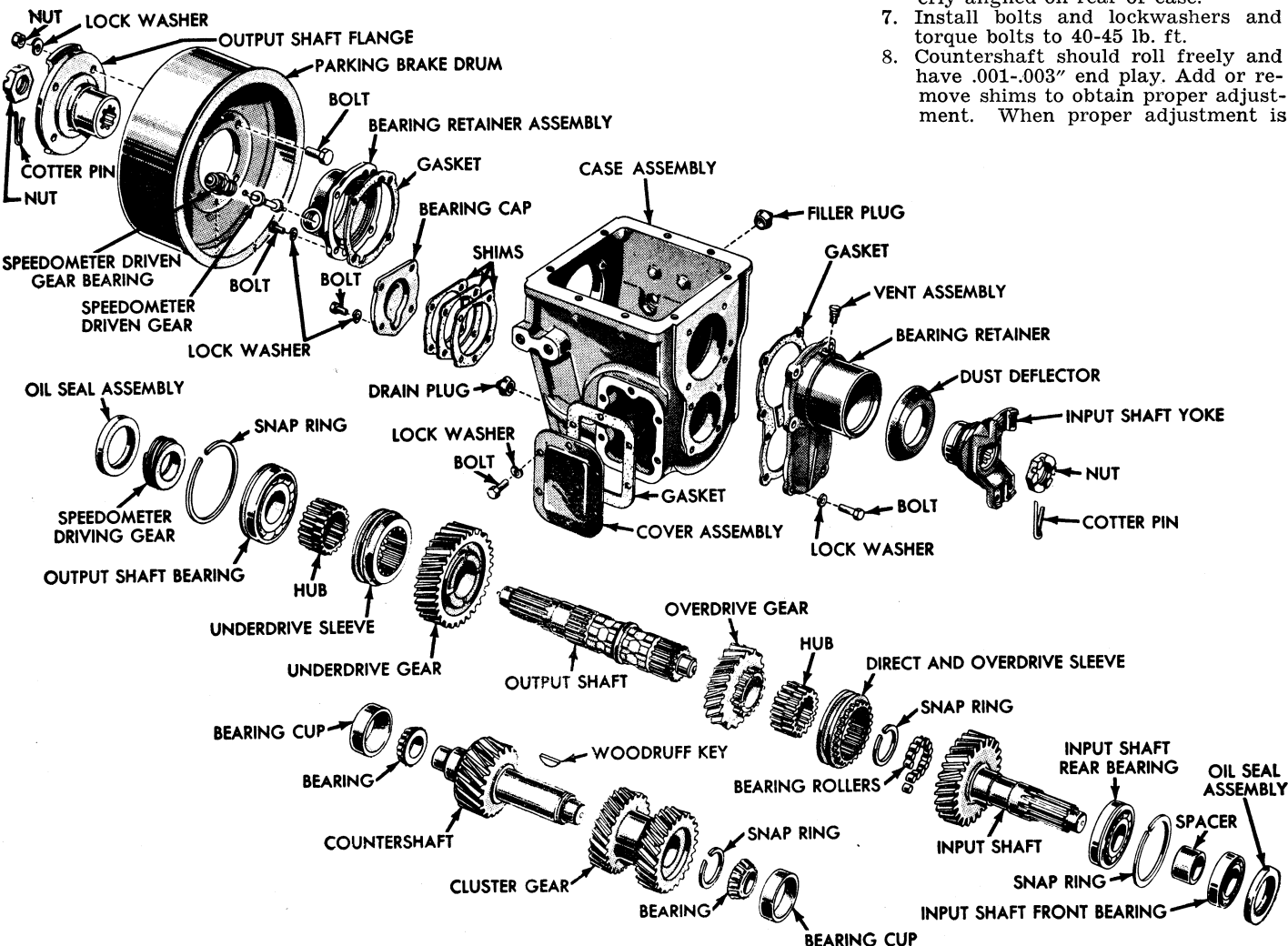


Fig. 9 Spicer three speed auxiliary. Model 5831

obtained, remove input shaft bearing retainer.

### Input Shaft, Assemble

1. Press bearing on shaft with snap ring groove toward splined end of shaft.
2. Insert shaft through inside of case.
3. After bearing is positioned in bore, install snap ring on bearing.
4. Coat pilot bearing recess with vaseline to hold pilot bearing rollers in place when assembly is completed, then install the 13 rollers in the recess.
5. Install bearing spacer over outer end of shaft and against inner bearing.
6. Install new bearing retainer gasket on case, being sure oil passage hole is properly aligned.
7. Install bearing retainer and tighten bolts solidly. Install transmission breather in top of bearing retainer.

### Output Shaft, Assemble

1. Install overdrive gear on front end of shaft with sleeve teeth toward front.
2. Install direct and overdrive hub on shaft with face of hub stamped "X" toward front. Install hub snap ring.
3. Install direct and overdrive sleeve on hub with external teeth on hub of sleeve toward front end of shaft with sleeve teeth toward rear end of shaft.
4. Insert rear end of shaft and gear assembly into rear bearing bore, then lower shaft in place.
5. Install underdrive hub with face stamped "X" toward rear of shaft and case. Insert hub through shaft bearing bore and against face of underdrive gear.
6. Install sleeve through rear bearing bore with long hub of sleeve facing underdrive gear.
7. Position rear bearing on shaft with snap ring groove toward rear of case. Drive bearing in place and install snap ring.
8. Install speedometer drive gear, seating gear against rear bearing.
9. Install speedometer driven gear bushing in rear bearing retainer and install retainer.
10. Install speedometer driven gear.
11. Install power take-off covers.
12. Install transmission drain plug.

## MODEL 6041

### 4 Speed Auxiliary

#### Disassemble, Fig. 10

1. Remove transmission cover.
2. Remove both propeller shaft flanges.
3. Remove support from main drive gear bearing cap.
4. Remove countershaft rear bearing cap, noting number of shims under cap.
5. Remove mainshaft rear bearing cap, oil seal, and speedometer driven gear in cap. Then remove oil seal and driven gear from cap and sleeve.
6. Remove main drive gear bearing cap with bearings, gear, seal and seal cap.

7. Remove speedometer drive gear.
8. With suitable puller, press mainshaft with front pilot bearing, overdrive gear snap ring, overdrive and direct clutch gear, collar and overdrive gear out through front of case, leaving first speed gear, first and second clutch gear and collar, and second speed gear and sleeve in case. Remove these items from case after removing mainshaft.
9. Remove mainshaft rear bearing.
10. Drive countershaft toward rear far enough to force rear bearing cup out of case. Using snap ring pliers, remove countershaft second speed gear snap ring from groove, slide second gear forward, then lift countershaft assembly out of case.
11. Remove countershaft front bearing cup from case.
12. Remove power take-off covers, and drain and filler plugs from case.
13. Disassemble sub-assemblies as required. If countershaft is to be disassembled, gears should be marked so that correct position will be known when installing.

### Countershaft Assemble

1. Drive gear keys in countershaft slots. Then using arbor press and suitable driver, press countershaft overdrive gear and drive gear into place.
2. Install new snap ring in groove at forward end of drive gear.
3. Press cone on front end of countershaft, making sure that cone seats firmly against countershaft.
4. Install second speed gear front snap ring over end of countershaft and position snap ring in groove in countershaft.
5. Install second gear on countershaft, then position rear snap ring in groove.
6. Press bearing cone on rear end of countershaft, making sure cone seats firmly against countershaft.

### Mainshaft Assemble

1. Place mainshaft in vise with front end up. Then apply heavy gear oil on bearing surfaces.
2. Install overdrive gear and overdrive and direct clutch gear with shoulder toward overdrive gear.
3. Install snap ring in groove at front end of mainshaft.
4. Install overdrive and direct clutch gear collar with external teeth toward front end of mainshaft.
5. Install mainshaft pilot bearing, using suitable bearing replacer.

### Main Drive Gear Assemble

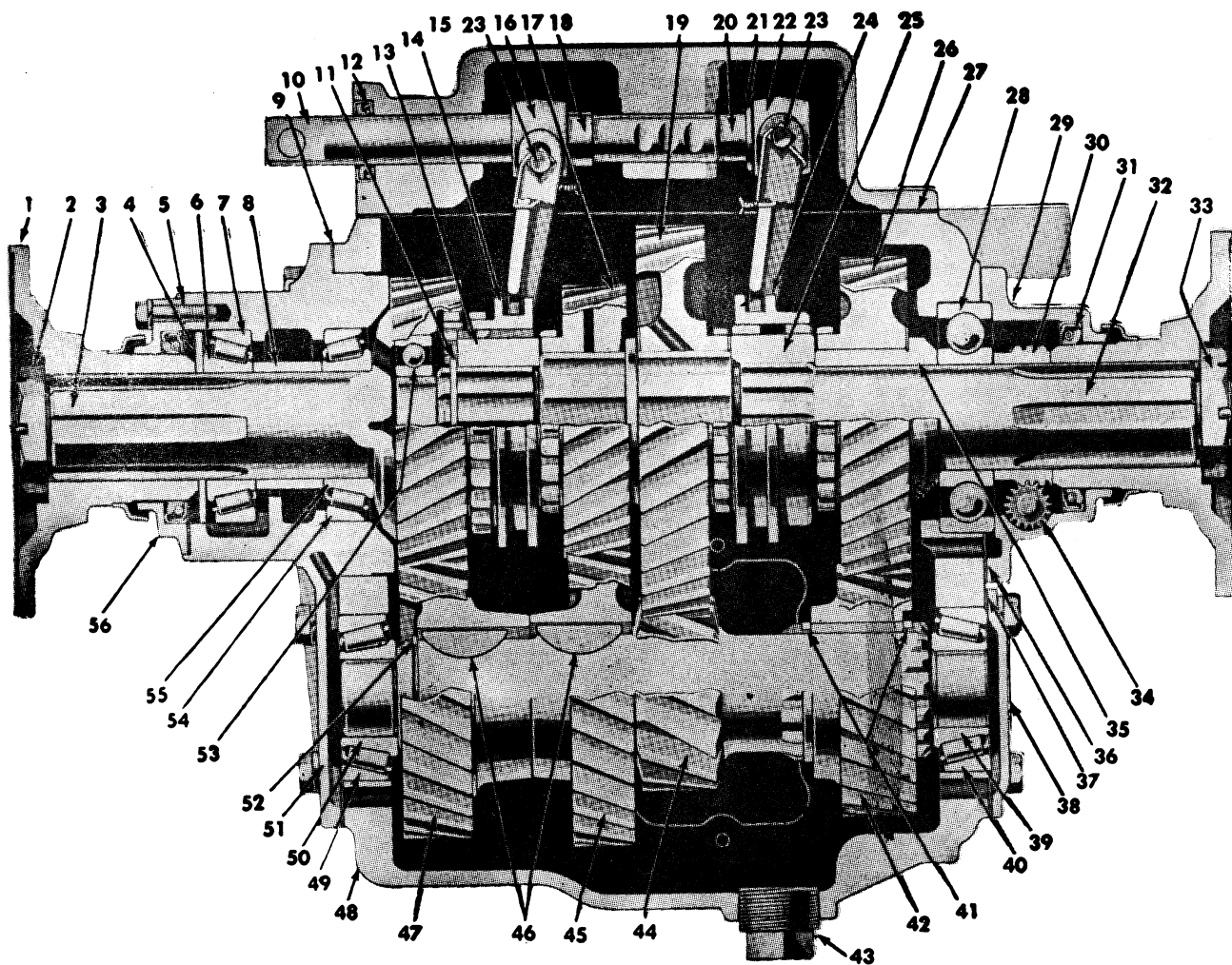
1. Apply transmission lubricant to bearings before installing.
2. Press bearing cups into cap and install inner bearing on drive gear. Then install bearing spacer on drive gear.
3. Place drive gear and bearing in arbor press with bearing spacer in place.
4. Apply pressure on front bearing inner race, using a piece of 2" diameter tubing about 4" long over end

of shaft. Bearing cup should turn readily but not spin on shaft with pressure applied. If bearing adjustment is too loose or too tight, select correct spacer (available in several sizes). After correct spacer has been installed, remove assembly from press.

5. If seal has been removed from seal cap, press new seal in cap.
6. Place washer in position against bearing cone. Then install seal cap with new gasket. Install cap bolts and tighten securely.

### Transmission, Assemble

1. Install countershaft front bearing cup in transmission case bore.
2. Lower countershaft assembly in case with rear end of shaft out through rear bearing bore. Then move assembly forward so that front bearing enters cup.
3. Install drive gear bearing cap temporarily with new gasket. Tighten cap screws evenly and firmly. Then slide countershaft second speed gear on shaft and install snap ring in groove ahead of second speed gear.
4. Install rear bearing cup. Using same thickness of shims as was removed at disassembly, install rear bearing cap temporarily. Tighten cap bolts, meanwhile turning countershaft by hand. If any binding of countershaft bearings is noted before cap bolts are fully tightened, remove cap and add shims. If cap bolts are tightened with a shim pack which is too thin, bearings will be damaged. Three sizes of shims (.003", .010" and .030") are available for use in adjusting countershaft bearings. Bearing adjustment is correct when countershaft can be turned without evidence of binding and without perceptible end play.
5. Remove main drive gear bearing cap. Lower mainshaft first speed gear, first and second clutch gear and collar, and second speed gear into case. Then guide mainshaft assembly through front of case and through gears. Slide second speed gear sleeve into hub of second gear through rear of case.
6. Using new gasket, install main drive gear bearing cap with main drive gear and bearings on front of case, guiding mainshaft pilot bearing into pocket of main drive gear. Tighten cap bolts securely.
7. Press mainshaft rear bearing onto mainshaft and into case, then place speedometer drive gear on shaft, with shoulder toward front of transmission.
8. Install mainshaft rear bearing cap and gasket and tighten capscrews securely.
9. Install propeller shaft flange on mainshaft and tighten nut to a torque of 350-400 lbs. ft.
10. Place transmission front support bracket on trunnion at bearing cap, install front flange and tighten nut to a torque of 350-400 lbs. ft.
11. Install cover, being sure that shift forks enter grooves in shift collars.
12. Install breather in cover, and drain plugs.



- |                                       |  |   |
|---------------------------------------|--|---|
| 1 Propeller Shaft Flange              | 20 1st and 2nd Shift Rod                                     | 38 Countershaft Rear Bearing Cap          |
| 2 Main Drive Gear Nut                 | 21 Shift Rod Spacer  | 39 Countershaft Rear Bearing Cone         |
| 3 Main Drive Gear                     | 22 1st and 2nd Shift Fork                                    | 40 Countershaft Rear Bearing Cup          |
| 4 Companion Flange Washer             | 23 Shift Fork Screw  | 41 Countershaft 2nd Speed Gear Snap Rings |
| 5 Seal Gasket                         | 24 1st and 2nd Speed Clutch Gear Collar                      | 42 Countershaft 2nd Speed Gear            |
| 6 Outer Bearing Cone                  | 25 1st and 2nd Speed Clutch Gear                             | 43 Drain Plug                             |
| 7 Outer Bearing Cup                   | 26 Mainshaft 2nd Speed Gear                                  | 44 Countershaft 1st Speed Gear            |
| 8 Drive Gear Bearing Spacer           | 27 Shifter Housing Gasket                                    | 45 Countershaft Overdrive Gear            |
| 9 Bearing Cap Gasket                  | 28 Mainshaft Rear Bearing Assembly                           | 46 Countershaft Keys                      |
| 10 Direct and Overdrive Shift Rod     | 29 Mainshaft Rear Retainer Cap Assembly                      | 47 Countershaft Drive Gear                |
| 11 Mainshaft Overdrive Gear Snap Ring | 30 Speedometer Drive Gear                                    | 48 Transmission Case                      |
| 12 Shift Rod Oil Seal                 | 31 Oil Seal  | 49 Countershaft Front Bearing Cup         |
| 13 Overdrive and Direct Clutch Gear   | 32 Mainshaft Nut   | 50 Countershaft Front Bearing Cone        |
| 14 Overdrive and Direct Clutch Collar | 33 Mainshaft 2nd Speed Gear Sleeve                           | 51 Main Drive Gear Bearing Cap            |
| 15 Shifter Housing (Cover)            | 34 Speedometer Driven Gear                                   | 52 Countershaft Drive Gear Snap Ring      |
| 16 Direct and Overdrive Shift Fork    | 35 Mainshaft 2nd Speed Gear Sleeve                           | 53 Mainshaft Front Bearing                |
| 17 Mainshaft Overdrive Gear           | 36 Retainer Cap Gasket                                       | 54 Bearing Cup                            |
| 18 Shift Rod Spacer                   | 37 Rear Bearing Cap Adjusting Shims (0.003, 0.010 and 0.030) | 55 Bearing Cone                           |
| 19 Mainshaft 1st Speed Gear           |  | 56 Seal Cap                               |

Fig. 10 Spicer four speed auxiliary. Model 6041



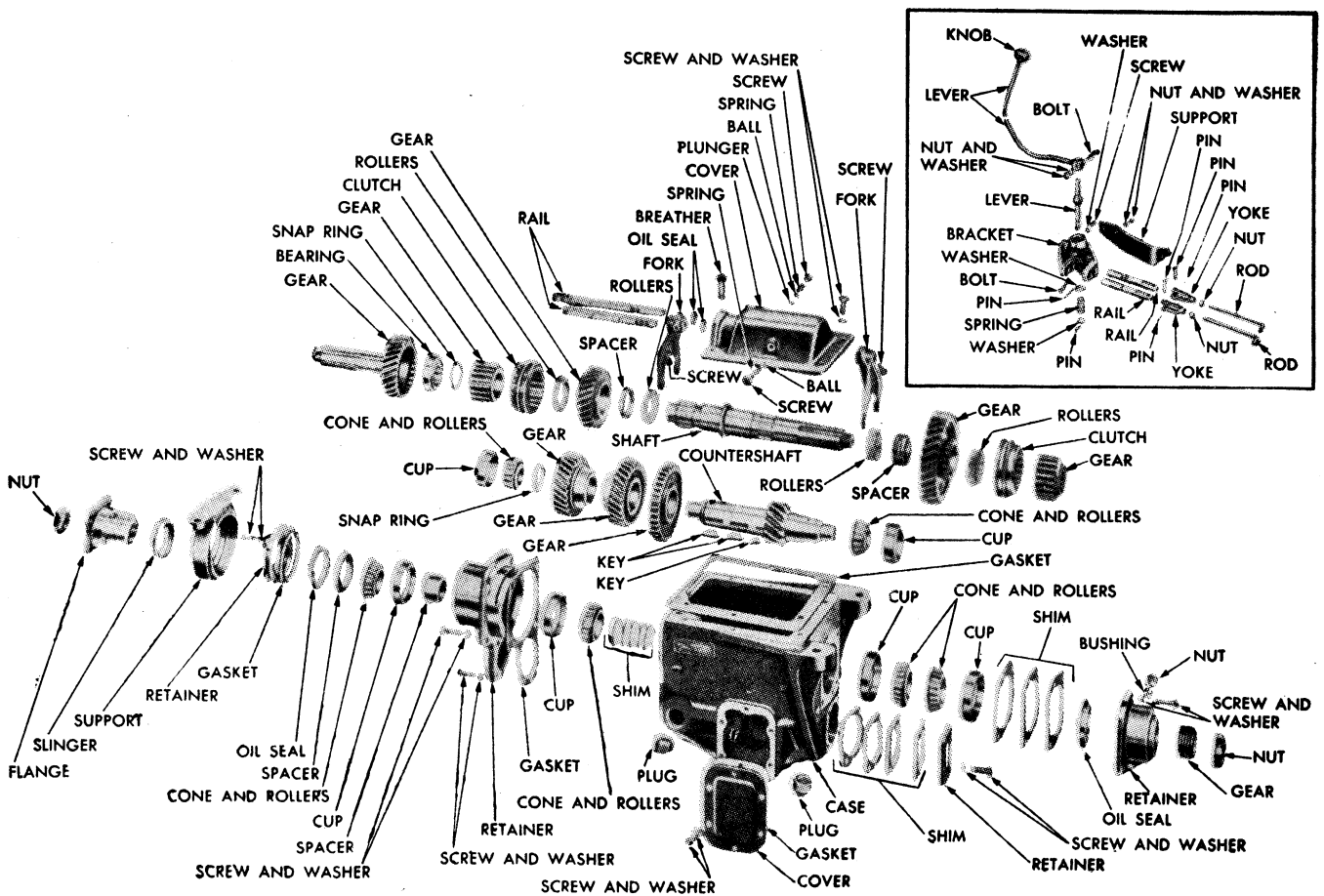


Fig. 11 Spicer three speed auxiliary. Models 6031, 6231

## MODELS 6031, 6231

### 3 Speed Auxiliaries

#### Disassemble, Fig. 11

1. Take off the transmission cover and hand brake mechanism.
2. Pull off both universal flanges and oil slingers.
3. Remove countershaft bearing caps, noting the number of shims behind rear bearing.
4. Remove mainshaft rear bearing cap and oil seal.
5. Use a puller to remove cage and bearing assembly, noting number of shims behind the cap.
6. Remove main drive gear bearing cage, together with bearing and oil seal, noting thickness of shims used at this point.
7. Use a puller to remove oil seal and bearing cup from cage.
8. Push countershaft to rear, moving mainshaft back at the same time until countershaft rear bearing is free of case.
9. Separate mainshaft from main drive gear, leaving pilot bearing in drive gear. Then shift countershaft forward again, and lift mainshaft out of the case.

10. Push main drive gear into case and lift out.
11. Use puller to remove drive gear spacer and bearing.
12. To disassemble mainshaft, make shift sleeves and clutch gears for re-assembly purposes and slip clutch sleeves from clutch gears. Remove retainer and snap ring from front end of shaft and use a puller, if necessary, to remove the clutch gear. If a puller is used, hold a cloth under the assembly to catch the rollers. This same precaution should be taken when removing the low speed gear.
13. Lift out the countershaft. If the countershaft gears are to be removed, release the snap ring from the front end and press the gears off one at a time (except low gear which is integral with the shaft.)

#### Reassemble

Reverse the order of the above procedure to assemble the transmission. When assembling the mainshaft, however, clamp it in a vise with its rear end up. Apply a liberal quantity of grease around the low speed gear bearing surface and assemble the rollers around the shaft.

Assemble the low speed gear over the rollers with the splined hub of the gear

facing up. Slip the bearing spacer into the bore of the gear, pushing it down against the rollers, then assemble the other rollers in the same manner.

Install the low speed clutch gear with the splined end up, and the collar with the conical end up, pressing the gear and collar tight against the low speed gear. Now fasten the rear end of the shaft in the vise and assemble the overdrive gear and bearings in the same manner, using the high speed clutch gear and snap ring to hold the gear in place. Install the clutch sleeves over the gears according to the marks made during disassembly.

## MODEL 7231

### 3 Speed Auxiliary

This transmission differs in several ways from the 5831 Spicer auxiliary. Service procedures not covered below are the same as for Model 5831 Spicer auxiliary, Fig. 9.

#### Input Shaft

The input shaft front and rear bearings are both installed in the front bearing retainer, Fig. 12. The input shaft may be removed with the bearing retainer after removal of the bolts which attach the retainer to the transmission case.

Use a suitable puller to remove the input shaft from the front bearing and retainer. Remove the bearing spacer and press the rear bearing off the shaft. Using a soft drift, tap the front bearing and oil seal out of the front of the bearing retainer.

Assemble the input shaft as suggested by Fig. 12.

**Output Shaft**

The output shaft is supported at the forward end by a roller bearing, Fig. 13. Use a suitable puller to remove the rear bearing. Using the direct and overdrive pilot sleeve, remove the pilot bearing from the front of the shaft.

When assembling the output shaft, install the direct and overdrive hub with the flat side of the hub toward the overdrive gear.

**Countershaft**

The countershaft drive gear and overdrive gear are separated by a spacer and are individually removed from the countershaft, Fig. 14.

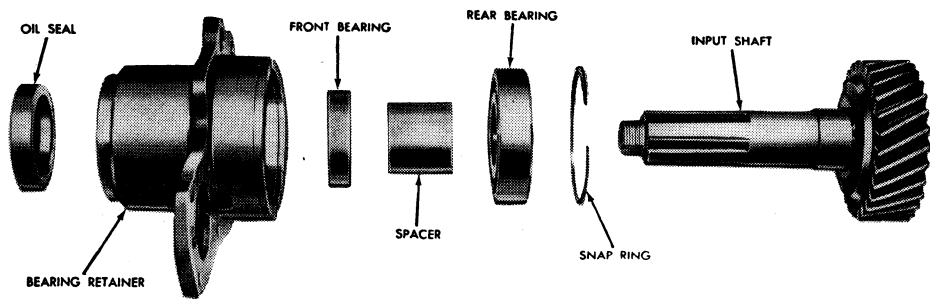


Fig. 12 Layout of input shaft parts. Model 7231

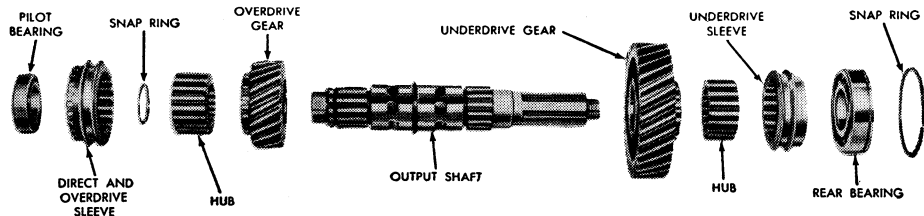


Fig. 13 Layout of output shaft parts. Model 7231

**MODELS 8031, 8035**

**3 Speed Auxiliaries**

**Disassemble, Fig. 15**

1. Remove transmission cover.
2. Lock mainshaft by placing gears in two speeds at same time, remove nuts and pull off both flanges.
3. Remove front bearing cap and bearing as a unit.
4. Remove washer from front end of countershaft.
5. Remove mainshaft rear bearing cap and pull speedometer drive gear and washer off mainshaft.
6. Move main drive gear forward as far as possible and force mainshaft and gears rearward, thereby forcing mainshaft rear bearing out of case.
7. Use a suitable puller to remove bearing from mainshaft.
8. Slide low speed shift collar off mainshaft and remove through rear of case.
9. Raise front end of mainshaft and lift from case, passing low speed gear teeth through power take-off gear teeth.
10. Move main drive gear rearward, forcing bearing out of bore. Then lift assembly out through top of case.
11. Remove countershaft rear bearing cap. Then push countershaft forward until front bearing is free of case, after which use puller to remove bearing.
12. Move countershaft rearward until rear bearing is out of case. Then remove snap ring and bearing from countershaft. The assembly may then be lifted out of the case by its front end.

**Mainshaft, Disassemble**

1. Support mainshaft assembly with front side of low speed gear on bed plate of arbor press.

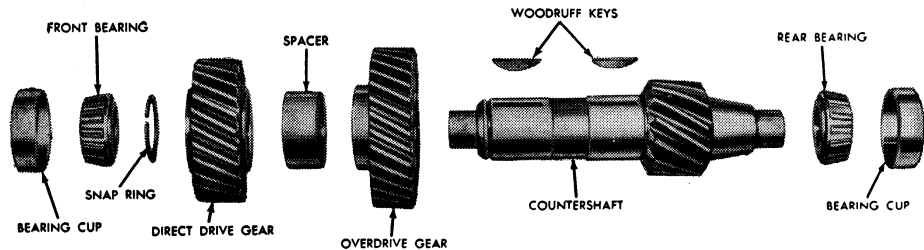


Fig. 14 Layout of countershaft parts. Model 7231

2. Apply pressure on rear of mainshaft to force low speed clutch gear off mainshaft. Use care to prevent loss of needle bearings as mainshaft is pressed out of gear.
3. Grip mainshaft in vise with front end up. Then remove mainshaft pilot bearing from shaft, and remove clutch gear lock nut.
4. Set mainshaft in arbor press with flange on sleeve resting on bed plate. Press on front end of mainshaft to force sleeve with mainshaft overdrive gear and bearings and clutch gear off sleeve.
5. Slide gear off sleeve, being careful not to lose bearings.

**Mainshaft, Assemble**

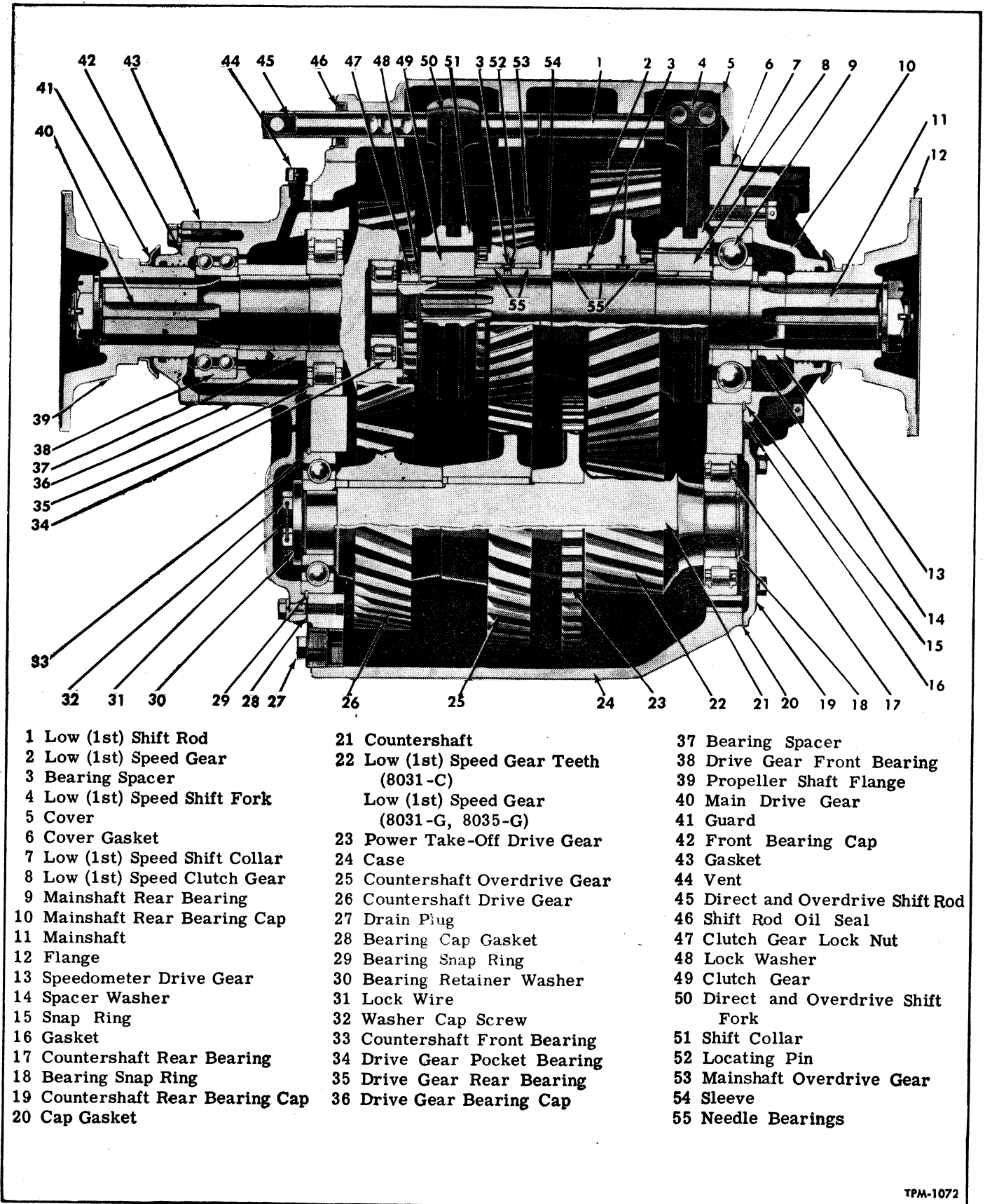
1. Place locating pin in hole in sleeve. Apply heavy grease on surface of sleeve to hold bearings in place. Then stand sleeve on end with flange down and arrange needle bearings and spacer around sleeve. Use 63 bearings in each row. Carefully lower overdrive gear over sleeve with spur teeth toward front of mainshaft.
2. Hold mainshaft in vise with front end up. Then lower overdrive gear and sleeve assembly over front end of mainshaft, carefully guiding head

- of locating pin into milled slot of mainshaft. Press sleeve flange tightly against mainshaft shoulder.
3. Press direct drive clutch gear on mainshaft up against sleeve. Then install lock washer and nut. Tighten nut securely and bend lock washer against flats on nut.
4. Grip mainshaft in vise with rear end up. Apply heavy transmission grease on mainshaft surface contacted by low speed gear rollers. Then arrange two rows of needle bearings separated by a spacer around mainshaft. Use 63 rollers in each row.
5. Set low speed gear over bearings with spur teeth upward. Drop other spacer over rearward end of mainshaft and insert remaining 63 rollers at gear hub.
6. Install clutch gear on splines at rear of gear with flat side of gear toward front.
7. Install pilot bearing on forward end of mainshaft and install shift collar.

**Transmission, Assemble**

Reassembly procedure is largely the reverse of disassembly procedure. However, the following should be noted:

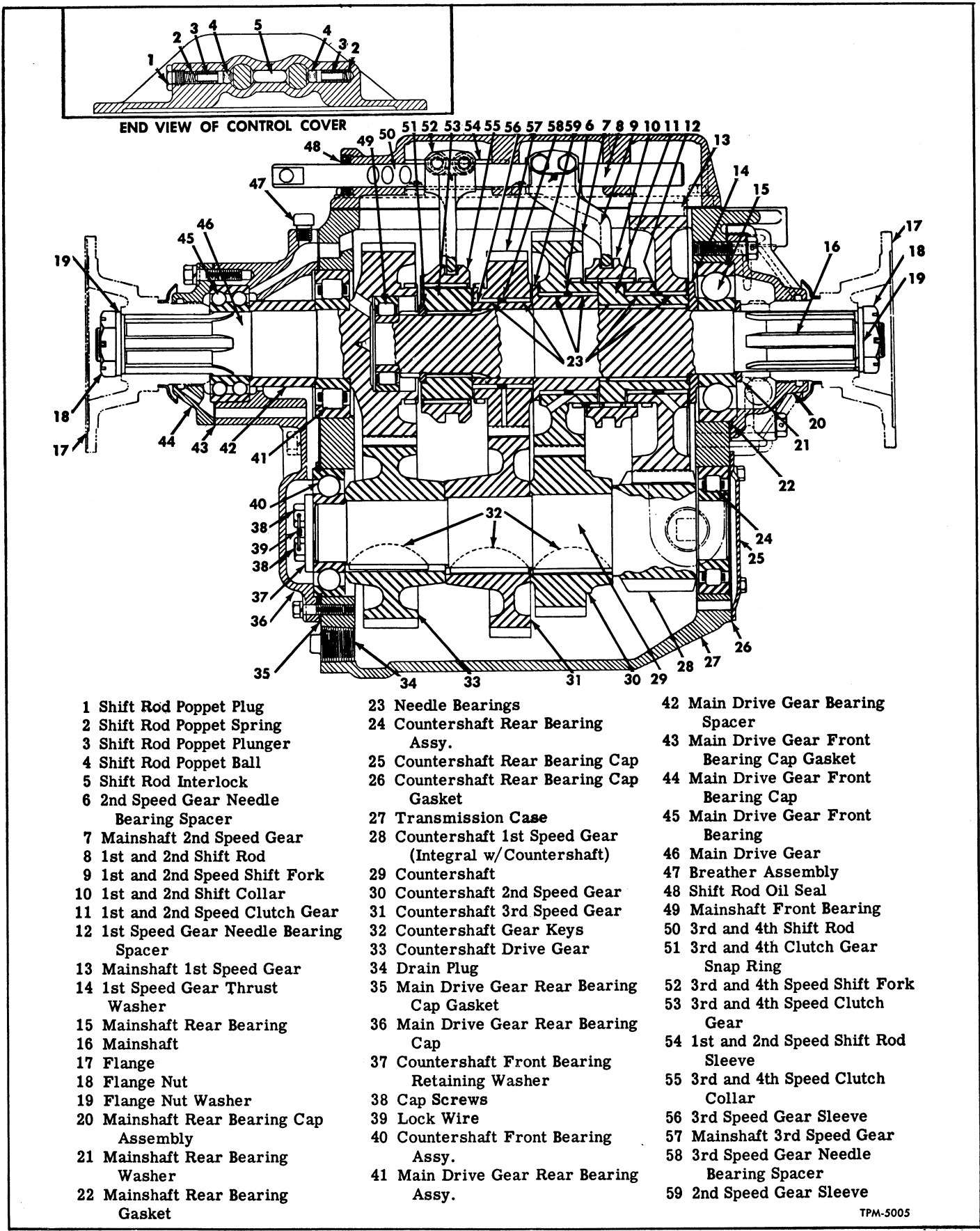
1. When installing main drive gear and mainshaft, place main drive gear in place from inside of case, moving



- |                                  |   |                                       |
|----------------------------------|---|---------------------------------------|
| 1 Low (1st) Shift Rod            | 21 Countershaft                           | 37 Bearing Spacer                     |
| 2 Low (1st) Speed Gear           | 22 Low (1st) Speed Gear Teeth<br>(8031-C) | 38 Drive Gear Front Bearing           |
| 3 Bearing Spacer                 | Low (1st) Speed Gear<br>(8031-G, 8035-G)  | 39 Propeller Shaft Flange             |
| 4 Low (1st) Speed Shift Fork     | 23 Power Take-Off Drive Gear              | 40 Main Drive Gear                    |
| 5 Cover                          | 24 Case                                   | 41 Guard                              |
| 6 Cover Gasket                   | 25 Countershaft Overdrive Gear            | 42 Front Bearing Cap                  |
| 7 Low (1st) Speed Shift Collar   | 26 Countershaft Drive Gear                | 43 Gasket                             |
| 8 Low (1st) Speed Clutch Gear    | 27 Drain Plug                             | 44 Vent                               |
| 9 Mainshaft Rear Bearing         | 28 Bearing Cap Gasket                     | 45 Direct and Overdrive Shift Rod     |
| 10 Mainshaft Rear Bearing Cap    | 29 Bearing Snap Ring                      | 46 Shift Rod Oil Seal                 |
| 11 Mainshaft                     | 30 Bearing Retainer Washer                | 47 Clutch Gear Lock Nut               |
| 12 Flange                        | 31 Lock Wire                              | 48 Lock Washer                        |
| 13 Speedometer Drive Gear        | 32 Washer Cap Screw                       | 49 Clutch Gear                        |
| 14 Spacer Washer                 | 33 Countershaft Front Bearing             | 50 Direct and Overdrive Shift<br>Fork |
| 15 Snap Ring                     | 34 Drive Gear Pocket Bearing              | 51 Shift Collar                       |
| 16 Gasket                        | 35 Drive Gear Rear Bearing                | 52 Locating Pin                       |
| 17 Countershaft Rear Bearing     | 36 Drive Gear Bearing Cap                 | 53 Mainshaft Overdrive Gear           |
| 18 Bearing Snap Ring             |   | 54 Sleeve                             |
| 19 Countershaft Rear Bearing Cap |   | 55 Needle Bearings                    |
| 20 Cap Gasket                    |   |                                       |

TPM-1072

Fig. 15 Spicer three speed auxiliary. Models 8031, 8035



- |   |  |   |
|---|--|---|
| 1 Shift Rod Poppet Plug                 | 23 Needle Bearings                                       | 42 Main Drive Gear Bearing Spacer           |
| 2 Shift Rod Poppet Spring               | 24 Countershaft Rear Bearing Assy.                       | 43 Main Drive Gear Front Bearing Cap Gasket |
| 3 Shift Rod Poppet Plunger              | 25 Countershaft Rear Bearing Cap                         | 44 Main Drive Gear Front Bearing Cap        |
| 4 Shift Rod Poppet Ball                 | 26 Countershaft Rear Bearing Cap Gasket                  | 45 Main Drive Gear Front Bearing            |
| 5 Shift Rod Interlock                   | 27 Transmission Case                                     | 46 Main Drive Gear                          |
| 6 2nd Speed Gear Needle Bearing Spacer  | 28 Countershaft 1st Speed Gear (Integral w/Countershaft) | 47 Breather Assembly                        |
| 7 Mainshaft 2nd Speed Gear              | 29 Countershaft  | 48 Shift Rod Oil Seal                       |
| 8 1st and 2nd Shift Rod                 | 30 Countershaft 2nd Speed Gear                           | 49 Mainshaft Front Bearing                  |
| 9 1st and 2nd Speed Shift Fork          | 31 Countershaft 3rd Speed Gear                           | 50 3rd and 4th Shift Rod                    |
| 10 1st and 2nd Shift Collar             | 32 Countershaft Gear Keys                                | 51 3rd and 4th Clutch Gear Snap Ring        |
| 11 1st and 2nd Speed Clutch Gear        | 33 Countershaft Drive Gear                               | 52 3rd and 4th Speed Shift Fork             |
| 12 1st Speed Gear Needle Bearing Spacer | 34 Drain Plug  | 53 3rd and 4th Speed Clutch Gear            |
| 13 Mainshaft 1st Speed Gear             | 35 Main Drive Gear Rear Bearing Cap Gasket               | 54 1st and 2nd Speed Shift Rod Sleeve       |
| 14 1st Speed Gear Thrust Washer         | 36 Main Drive Gear Rear Bearing Cap                      | 55 3rd and 4th Speed Clutch Collar          |
| 15 Mainshaft Rear Bearing               | 37 Countershaft Front Bearing Retaining Washer           | 56 3rd Speed Gear Sleeve                    |
| 16 Mainshaft                            | 38 Cap Screws  | 57 Mainshaft 3rd Speed Gear                 |
| 17 Flange                               | 39 Lock Wire   | 58 3rd Speed Gear Needle Bearing Spacer     |
| 18 Flange Nut                           | 40 Countershaft Front Bearing Assy.                      | 59 2nd Speed Gear Sleeve                    |
| 19 Flange Nut Washer                    | 41 Main Drive Gear Rear Bearing Assy.                    |   |
| 20 Mainshaft Rear Bearing Cap Assembly  |  |   |
| 21 Mainshaft Rear Bearing Washer        |  |   |
| 22 Mainshaft Rear Bearing Gasket        |  |   |

TPM-5005

Fig. 16 Spicer four speed auxiliary. Model 8341

the assembly forward as far as possible. Lower mainshaft and gears into case with rear end extending through rear bearing bore. Install low gear shift collar on clutch gear, inserting collar through bearing bore in case.

2. Move mainshaft forward so that mainshaft pilot bearing enters pocket of main drive gear. Then install rear mainshaft bearing, spacer washer and speedometer drive gear.
3. Be sure to install front bearing cap gasket so oil passage is not obstructed.
4. Companion flange nuts should be torque tightened to 240-310 lbs. ft.

## MODEL 8341

### 4 Speed Auxiliary

#### Disassemble, Fig. 16

1. Remove transmission cover.
2. Remove both propeller shaft flanges.
3. With a suitable puller, remove mainshaft and main drive gear bearing caps.
4. Remove capscrews from front end of countershaft.
5. Remove mainshaft rear bearing cap and pull speedometer drive gear and washer from mainshaft.
6. Move main drive gear forward as far as possible and force mainshaft and gears rearward. Then place a piece of hard wood  $\frac{1}{2}$ " thick between main drive gear and 3rd and 4th clutch gear. Drive mainshaft forward far enough to permit removing 3rd and 4th clutch gear snap ring. Remove block and then snap ring.
7. Using pry bar inserted between main drive gear and 3rd and 4th clutch gear, and engaging shoulder on mainshaft, force mainshaft toward rear of transmission. Remove mainshaft from case, stripping gears and sleeves off shaft as it is removed. Then remove loose mainshaft parts from case.
8. Remove rear bearing from mainshaft and also 1st speed gear thrust washer.
9. Remove spacer from end of main drive gear.
10. Move main drive gear rearward and lift out through top of case. Inner race of rear bearing will remain on drive gear; outer race and roller will remain in case.

11. Remove main drive gear rear bearing outer race and roller assembly from case.
12. Remove countershaft rear bearing cap.
13. Remove snap ring and use a suitable puller to remove countershaft front bearing.
14. Slide countershaft assembly toward rear until rear bearing is accessible. Then pull off rear bearing.
15. Remove countershaft by lifting assembly through top of case. Remove any loose needle bearings or other parts that may have dropped into the case.
16. If countershaft is to be disassembled, mark the gears so that the correct relative position will be known when installing.

#### Transmission Assemble

1. Lower countershaft into case with rearward end out through bearing bore in rear of case. Stand case on end, rear end up. Position countershaft rear bearing and press it onto shaft and into case, using a suitable tool to exert pressure on bearing inner and outer races.
2. Install countershaft rear bearing cap.
3. Install countershaft front bearing, using capscrews and washer to pull bearing onto shaft. Force bearing into bore in case until snap ring contacts case. This positions bearing in proper operating position.
4. Place main drive gear into place from inside case, moving assembly forward as far as possible.
5. Install outer bearing into main drive gear and into case.
6. Install mainshaft front bearing into drive gear pocket.
7. With 1st and 2nd clutch gear on bench with gear end down, apply heavy lubricant on needle bearing surface, then arrange needle bearings and spacer around gear hub. Use 72 needle bearings in each row. Carefully lower low speed gear over clutch gear hub with spur teeth downward facing clutch gear. Place 1st and 2nd shift collar over clutch gear, then carefully lower assembly into case in operating position.
8. With mainshaft 2nd speed gear sleeve on bench with shoulder down, apply heavy lubricant on needle

bearing surface, then arrange needle bearings and spacer around sleeve. Use 72 needle bearings in each row. Carefully lower 2nd speed gear over sleeve with spur teeth upward. Lower assembly into case in operating position.

9. With mainshaft 3rd speed sleeve on bench, apply heavy lubricant to needle bearing surface. Then arrange needle bearings and spacer around sleeve. Use 62 needle bearings in each row. Carefully lower mainshaft 3rd speed gear over sleeve. Lower assembly into case with spur teeth on 3rd speed gear toward front.
10. Place 3rd and 4th clutch collar over its clutch gear, then lower assembly into case with snap ring recess in clutch gear toward front.
11. Install mainshaft through rear of transmission, carefully guiding end of shaft through each gear and bearing assembly.
12. Place  $\frac{1}{2}$ " hard wood spacer block between 3rd and 4th clutch gear and main drive gear. Then, using a plastic hammer, drive mainshaft forward until snap ring groove is exposed. Remove block and install snap ring. Then slide 3rd and 4th clutch gear forward over snap ring. Slide all gears forward on mainshaft.
13. Install main drive gear rear bearing cap on case and tighten bolts. Install drive gear front bearing and bearing cap. Be careful to position gasket so lubricant passages are not obstructed.
14. Install mainshaft 1st speed gear thrust washer on rear end of shaft.
15. Install mainshaft rear bearing, making sure snap ring on bearing is flush with case.
16. Install mainshaft rear bearing washer and speedometer drive gear.
17. Install mainshaft rear bearing cap, with speedometer driven gear hole in cap toward bottom. Using copper washers on bearing cap retaining screws, tighten screws securely.
18. Install speedometer driven gear in bearing cap and install speedometer sleeve.
19. Move both shift collars into mesh. Install flanges and tighten nuts to a torque of 400-450 lbs. ft. torque.
20. Install breather in main drive gear rear bearing cap. Install filler and drain plugs.
21. Install transmission cover, making sure shift forks enter grooves in shift collars.

# Warner Transmission Section

## MODELS T9, T9A, T97

### Disassemble, Fig. 1

1. Take off the transmission cover.
2. Unscrew the nut from the universal flange.
3. Remove the hand brake mechanism.
4. Remove universal flange.
5. Remove main drive gear bearing retainer and pull drive gear out through front.

6. Take off mainshaft rear bearing retainer oil seal and speedometer drive gear.
7. Before removing the mainshaft, chalk-mark the relationship of the mainshaft splines with the mating splines in the sliding gears so that these parts may be assembled in the original position, as the gears are a selective fit on the mainshaft splines.

8. Grasp the mainshaft gears and pull the mainshaft and rear bearing out through the rear. Then lift out the loose gears.
9. Remove the counter shaft lock plate, push the shaft through the rear and lift out the cluster gear.
10. Drive out the reverse shift rail and lift out the fork.
11. Push the reverse idler shaft out through the rear and lift out the gear.

### Reassembly

Reverse the order of the above procedure to assemble the unit. And when installing the mainshaft, be sure to match the marked gear splines with the mainshaft splines.

## MODEL T87D

### Disassemble, Fig. 2

1. Remove transmission cover.
2. Unscrew companion flange nut.
3. Remove main drive gear and mainshaft rear bearing retainers from case.
4. Slip speedometer drive gear, rear bearing and oil washer from mainshaft.
5. Pull main drive gear and bearing out through front of case until it contacts countershaft gear.
6. Slide mainshaft assembly through rear of case until it clears main drive gear and then lift it out through top of case. Be sure to account for 16 pilot needle bearings when mainshaft is removed.
7. To disassemble mainshaft, remove retainer snap ring and use sliding gear to tap synchronizer and bushed gear from mainshaft.
8. To remove main drive gear, remove snap ring holding bearing on main drive gear. Push drive gear and bearing back into case until outside snap ring seats snugly against case. Then with a soft hammer, tap shaft gently toward inside of case until bearing is freed. Main drive gear can then be lifted out through top.
9. To remove countershaft assembly, remove capscrew and lock plate which holds countershaft and reverse idler shaft in position. Drive countershaft out through rear of case, and lift out cluster gear and thrust washers.
10. To remove reverse idler gear and shaft, drive shaft out through rear of case and lift out gear.
11. The synchronizer clutch hub and sleeve are held together by two retaining springs located on each side of the clutch hub. The clutch sleeve can be removed from the hub by removing the retaining springs and supporting the outside diameter of sleeve and pressing on hub. Use care when disassembling not to lose the three shifting plates.

### Reassembly

Reverse the order of the foregoing procedure to assemble the transmission, noting the following:

1. In reassembling the synchronizer, be sure to place end of each retaining spring in the same shifting plate with the loose ends located in same position on both sides to equalize the tension on all three shifting plates. Be sure to index etched marking on hub and sleeve.
2. When installing the countershaft, see that a bronze thrust washer is located at the front and a bronze and steel washer at the rear of the shaft with the steel washer placed next to the gear.

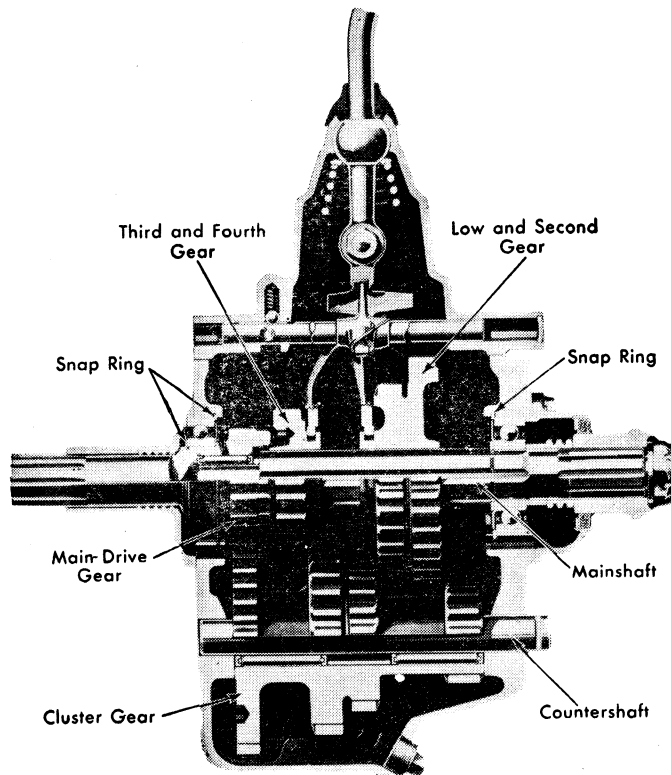


Fig. 1 Warner four speed spur gear transmission. Models T9, T9A, T97

3. A helpful suggestion in reassembling the mainshaft pilot bearings is to use a rubber band to hold them in place on the shaft until the assembly is started in the main drive gear. The rubber band can then be cut and removed.
4. When installing the main drive gear bearing retainer, see that the oil drain in the retainer is located on the bottom.
8. Remove washer and snap ring from main drive gear shaft and press the gear out of the bearing. Remove oil retaining washer from shaft. Be careful not to lose 14 roller bearings.
9. Remove snap ring from main drive gear bearing and tap bearing out through front of case.
10. Drive reverse idler shaft to rear of case and remove woodruff key, shaft and idler gear.
11. Raise cluster gear and related parts out of case.

## MODEL T89B

### Disassemble, Fig. 3

1. Remove side covers.
2. Remove universal yoke, speedometer driven gear and spacer from mainshaft.
3. Remove rear bearing support and oil seal from rear extension.
4. Remove main drive gear bearing retainer.
5. Unfasten rear extension from case, move extension away from case about  $\frac{1}{2}$ " and rotate retainer to expose countershaft.
6. With a suitable arbor the length of the cluster gear and thrust washers combined, drive countershaft toward the rear just far enough to permit removal of the woodruff key from the rear end of the countershaft. When key is removed, drive countershaft all the way out, leaving the dummy shaft in the cluster gear to hold the needle bearings in place.
7. Remove rear bearing retainer and mainshaft assembly from the case.

### Mainshaft, Disassemble

1. To disassemble the mainshaft, remove synchronizer cone and clutch hub retaining snap ring from end of mainshaft. Remove clutch sleeve from hub and hub from mainshaft. If not already marked, mark relation of hub and sleeve for assembly purpose.
2. Remove two clutch springs and three keys from clutch hub.
3. Remove second speed gear and sliding gear.
4. Remove snap ring from front of rear bearing retainer and tap mainshaft and bearing from retainer. Remove other snap ring from retainer and press the mainshaft from the rear bearing.

### Mainshaft, Assemble

1. Press rear bearing on mainshaft with outer raised section of oil retainer toward front of shaft.
2. Install rear snap ring in rear retainer and install mainshaft and



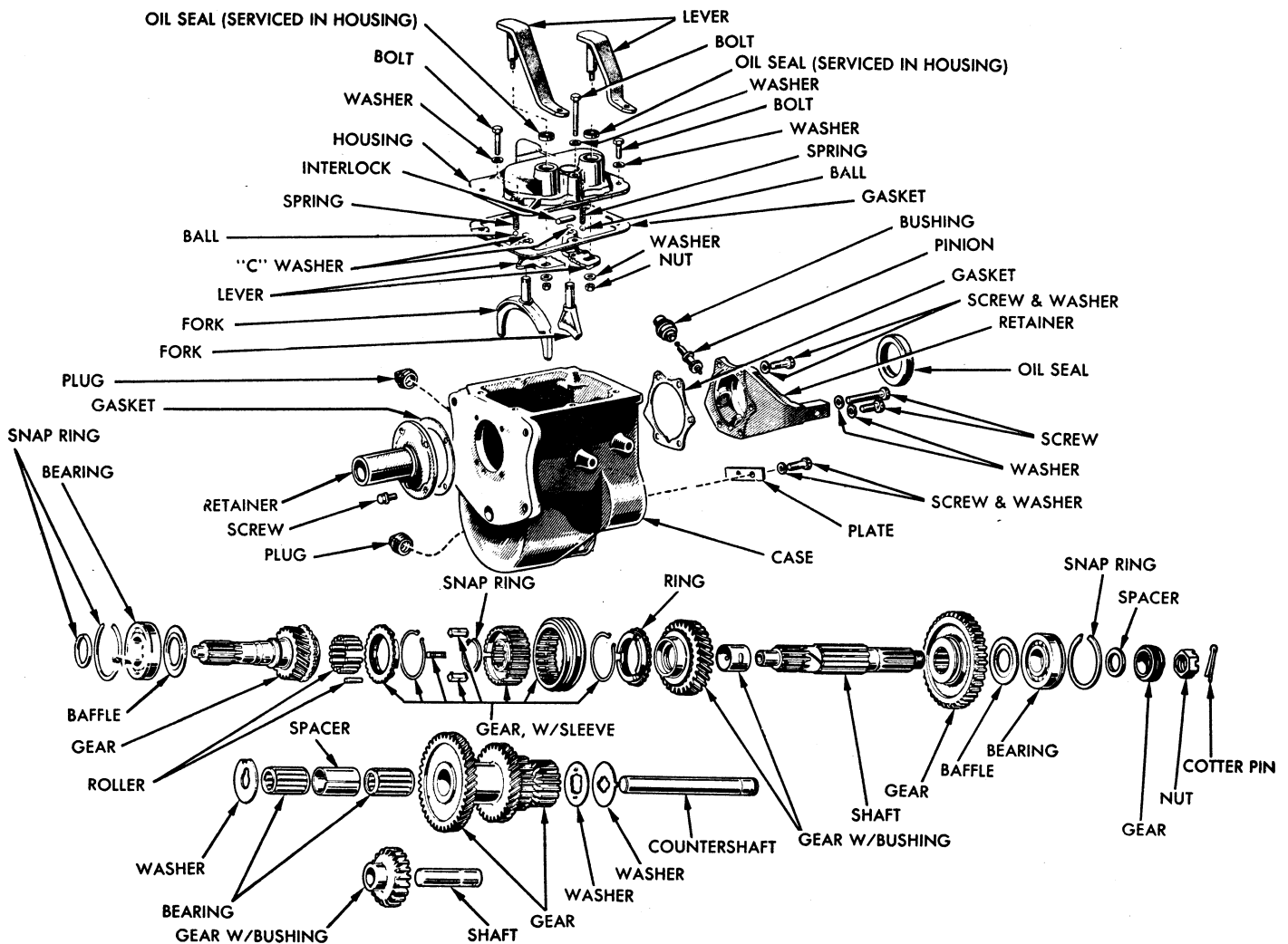


Fig. 2 Warner three speed transmission. Model T87D

3. Install mainshaft bearing front snap ring into rear retainer. Mainshaft bearing front snap rings are available in thicknesses of .088, .091, .094, .097 and .100". Select the proper one for the transmission.
4. Install speedometer gear spacer and driven gear.
5. Install oil seal to rear support and install bearing support to rear retainer. Oil slot in support goes toward bottom of retainer.
6. Install sliding gear and second speed gear on mainshaft.
7. Assemble key springs to clutch hub with one end of each spring in same slot and outer end free.
8. Install three clutch keys to hub.
9. Align marks made at disassembly on hub and sleeve and push sleeve over clutch hub.
10. Place synchronizer cones on assembly, making sure slots are in line with shifting plates.
11. Install synchronizer assembly on mainshaft, securing it with snap ring. After assembly, cones must turn freely.

### Assemble

1. Insert spacer and dummy shaft into cluster gear.
2. Install double row of 20 roller bearings and retainers at each end of the cluster gear.
3. Place front and rear tabbed washers (bronze) on cluster gear.
4. Install cluster gear assembly through gearshift housing opening (large gear in first).
5. Install tab steel thrust washer at rear of cluster gear between bronze thrust washer and case.
6. Install main drive gear bearing in case from the front and install snap ring.
7. Install 14 rollers in drive gear bore.
8. Install main drive gear with oil retaining washer in place.
9. Install washer and main drive gear snap ring on shaft. These snap rings are available in six sizes.
10. From rear of case, install idler gear, shaft and woodruff key.
11. Install assembled mainshaft into transmission case. Use care to see that one of the pilot bearings is not

forced into the lubrication hole in the main drive gear when installing the mainshaft pilot into the main drive gear.

12. Raise cluster gear and insert countershaft, being sure woodruff key is in place in notch in rear end of countershaft.
13. Install main drive gear retainer. Then check clearance between retainer and transmission case to determine thickness of gaskets required to seal this point. Gaskets are available in thicknesses of .010 and .015" and may be used in combination to obtain proper thickness.
14. Fasten rear extension to transmission case.
15. Install gearshift cover.

### MODEL T98

#### Disassembly, Fig. 4

1. Lock transmission by engaging two gears and remove flange nut.
2. Remove mainshaft rear bearing retainer and main drive gear bearing retainer.

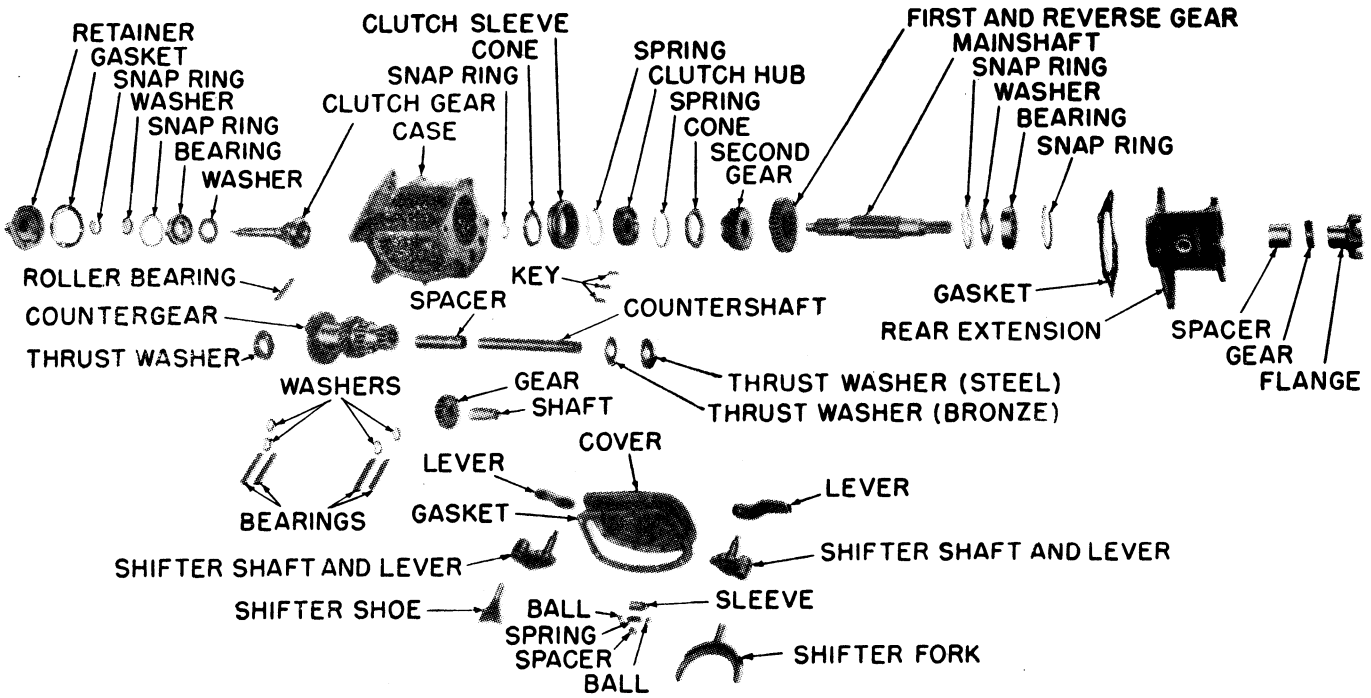


Fig. 3 Warner three speed transmission. Model T89B

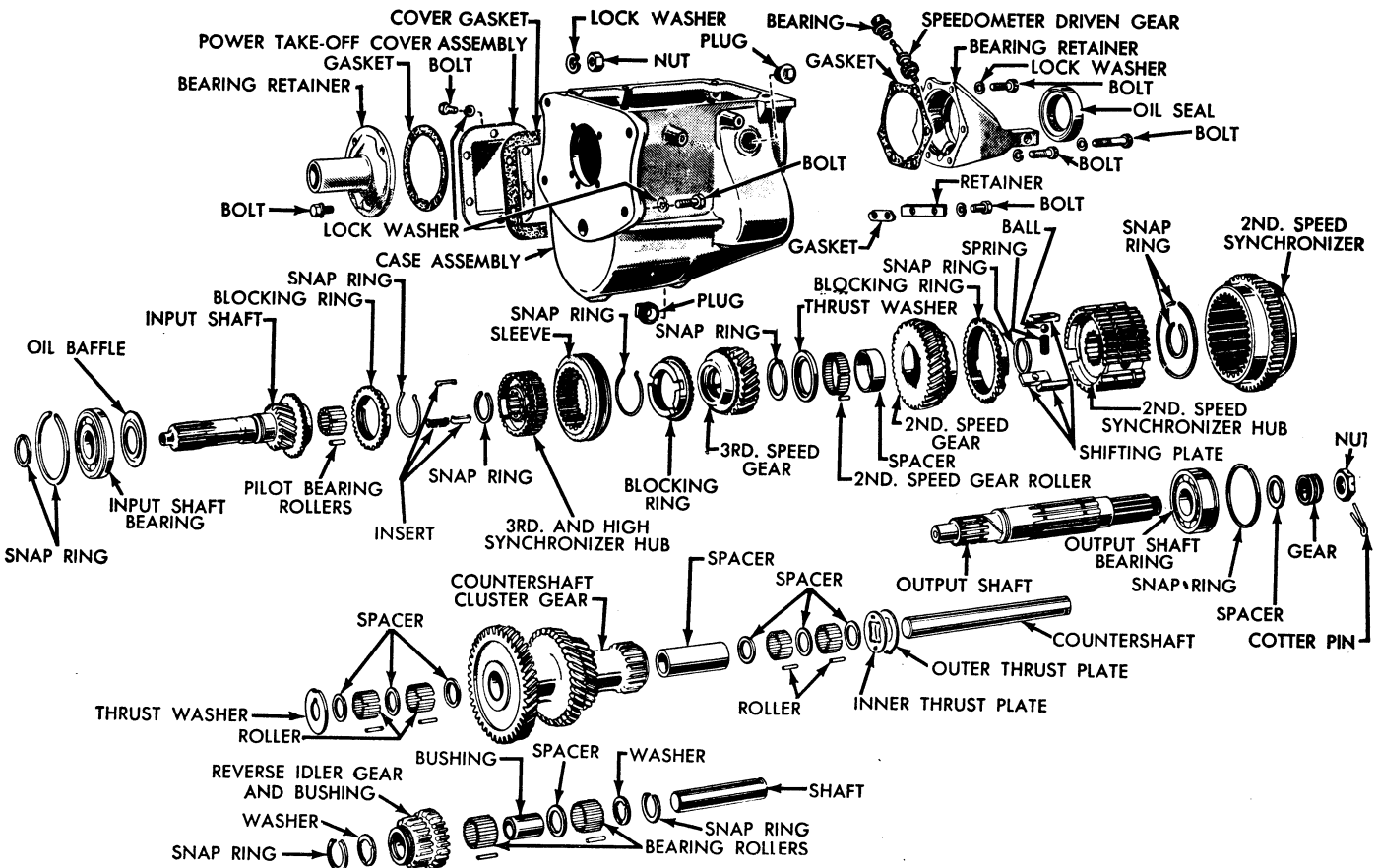


Fig. 4 Warner four speed transmission. Model T98

3. Remove main drive gear bearing snap ring and pull main drive gear and bearing out through front of case far enough to expose bearing snap ring.
4. Apply bearing puller and remove bearing from main drive gear.
5. Tap mainshaft assembly toward rear of case and pull off mainshaft rear bearing.
6. Push mainshaft through rear bore of case to clear main drive gear. Then tilt front end upward and lift out of case. Be sure to catch mainshaft pilot bearing rollers when removing assembly.
7. Lift main drive gear out through top of case.
8. To disassemble mainshaft, remove snap ring holding 3rd and 4th speed synchronizer and 3rd speed gear and slide these parts from mainshaft.
9. Remove 1st and 2nd speed hub retainer snap ring and slide off synchronizer.
10. Remove 2nd speed gear snap ring, and strip the mainshaft of the 2nd speed gear thrust washer, 34 needle bearings, 2nd speed gear and spacer.
11. To disassemble the countershaft, remove lock plate which holds countershaft and reverse idler gear shaft in position.
12. Using a brass drift, drive countershaft out through rear of case and lift gear cluster out through top. The countershaft gear cluster turns on four sets of roller bearings which are loose in the bore of the countershaft gear. There are 22 rollers in each bearing set, totalling 88 bearings, separated by spacer washers and spacer. In the event that these rollers become mixed with the main drive gear pilot bearing rollers, they may be identified by the fact that the countershaft rollers are slightly smaller than the pilot bearing rollers.
13. Be sure to pick up the front thrust washer, rear thrust washer and spacer washer from the bottom of the case.
14. To disassemble the reverse idler gear, remove reverse shifting arm and drive idler shaft out through rear of case and lift idler gear out through top.
15. To disassemble 3rd and 4th speed synchronizer, remove the two retaining springs located on each side of the clutch hub. The clutch sleeve can be removed from the hub by supporting the outside diameter of the sleeve and pressing on the hub. Use care not to lose the three shifting plates. The blocker rings are supported by the main drive gear hub and 3rd speed gear hub and are disassembled with the removal of the mainshaft.
16. To disassemble 1st and 2nd speed synchronizer, support the outside diameter of the clutch sleeve and press out the hub. Use care when disassembling as poppet springs and balls are under spring tension and may fly out when sleeve is removed. Wrap a cloth around the assembly to guard against this.

## Reassembly

Reverse the order of the above procedure to assemble the transmission. In reassembling the synchronizer, be sure to place end of each retaining spring in the same shifting plate with the loose ends located in the same position on both sides to equalize the tension on all three shifting plates, and also index etched marking on hub and sleeve.

# REAR AXLES

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# Axle Lubricant Capacities

Lubricant capacities are given as a guide only. The lubricant capacities of two similar axles in the same series may vary considerably due to design changes and the vehicle manufacturer's installation. The actual service capacity may be accurately determined by carefully measuring the amount of lubricant necessary to fill the assembly to the correct level and measuring the lubricant again as it is drained from the unit. The vehicle should be on a level floor when this inspection is made.

### EATON AXLES

Single Reduction Axles		Model	Oil, Pts.
		1615	17
		1715	22
Model	Oil, Pts.	1716	22
1350	13	1790	22
1614	17	1791	22

Model	Oil, Pts.
1795	24
1796	24
1862	22
1863	22
1890	21
1891	21
1892	21
1893	21
1895	24
1896	24
1900	20
1901	20
1911	24

Two Speed Axles	
Model	Oil, Pts.
13600	13
16500	20
16501	20
16600	20
16601	20

Model	Oil, Pts.
17500	22
17501	22
17700	24
17701	24
17800	22
17801	22
18500	22
18501	22
18502	22
18503	22
18700	24
18701	24
18800	22
18801	22
18802	22
18803	22
19500	24
19501	24
19503	24
20500	20
20501	20
22500	32

### Double Reduction Axles

Model	Oil, Pts.
2613	22
2614	22
2615	22
2616	22
2695	22
2696	22
2750	31

### Tandem Axles

Model	Oil, Pts.
22M	27 <sup>5</sup>
22MF	12
22M-P.D.U.	9
22MR	12
22R	11
28M	43 <sup>6</sup>
28MF	17
28M-P.D.U.	9