



TRANSMISSION GROUP INDEX

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| | |
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TRANSMISSION SPECIFICATIONS

| TRANSMISSION MODELS (IH) | HDS | T-87-D | H-41-B | T-98 | F-51 | F-51-C | F-52 | F-52-C | F-54 | F-54-B |
|--------------------------------------|------------------|------------------|------------------|------------------|----------------|------------------|----------------|------------------|----------------|------------------|
| Transmission (make) | IH | Warner | Warner | Warner | Fuller | Fuller | Fuller | Fuller | Fuller | Fuller |
| Manufacturer's model | ----- | AS-4-T-87D | AS-74-T-9 | ASA T-98 | 5-A-330 | 5-A-33 | 5-A-430 | 5-A-43 | 5-A-620 | 5-A-62 |
| Type | Synchro- mesh | Synchro- mesh | Direct in 4th | Synchro- mesh | O.D. in 5th | Direct in 5th | O.D. in 5th | Direct in 5th | O.D. in 5th | Direct in 5th |
| Overdrive | No | No | No | No | Yes | No | Yes | No | Yes | No |
| Number of forward speeds | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 |
| Reductions: | | | | | | | | | | |
| First (low) | 3.058-1 | 3.714-1 | 6.40-1 | 6.398-1 | 6.36-1 | 7.35-1 | 6.98-1 | 8.03-1 | 7.07-1 | 8.08-1 |
| Second | 1.481-1 | 1.871-1 | 3.09-1 | 3.092-1 | 3.725-1 | 4.30-1 | 3.57-1 | 4.61-1 | 3.50-1 | 4.67-1 |
| Third | 1.000-1 | 1.000-1 | 1.69-1 | 1.686-1 | 1.92-1 | 2.52-1 | 1.89-1 | 2.46-1 | 1.72-1 | 2.62-1 |
| Fourth | ----- | ----- | 1.00-1 | 1.00-1 | 1.000-1 | 1.42-1 | 1.00-1 | 1.41-1 | 1.00-1 | 1.38-1 |
| Fifth | ----- | ----- | ----- | ----- | .823-1 | 1.000-1 | .825-1 | 1.000-1 | .776-1 | 1.00-1 |
| High reverse | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 8.12-1 |
| Low reverse | 3.707-1 | 4.588-1 | 7.82-1 | 7.820-1 | 6.39-1 | 7.20-1 | 6.95-1 | 8.00-1 | 7.11-1 | 4.74-1 |
| Number of P. T. O. opening | None | None | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 |
| Lubricant capacity (pints) | 3 | 6 | 5 | 8 | 12 | 12 | 19 | 19 | 24 | 24 |

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AUXILIARY TRANSMISSION SPECIFICATIONS

| MODEL | 2-A-45 | 5531 | 6231 | 6231-A | 8031-C | 8031-G |
|------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| Make | Fuller | Brown-Lipe | Brown-Lipe | Brown-Lipe | Brown-Lipe | Brown-Lipe |
| Number of speeds | 2 | 3 | 3 | 3 | 3 | 3 |
| Number of bearings | 7 | 6 | 7 | 7 | 6 | 6 |
| Type of bearings | 6-Ball, 1-Roller | 2-Ball, 4-Roller | 1-Ball, 6-Roller | 1-Ball, 6-Roller | 3-Ball, 3-Roller | 3-Ball, 3-Roller |
| Ratios: | | | | | | |
| Direct | 1.00 to 1 | 1.00 - 1 | 1.00 - 1 | 1.00 - 1 | 1.00 - 1 | 1.00 - 1 |
| Underdrive | 1.30 - 1 | 2.00 - 1 | 2.14 - 1 | 1.24 - 1 | 2.59 - 1 | 1.29 - 1 |
| Overdrive | ----- | .72 - 1 | .69 - 1 | .86 - 1 | .75 - 1 | .84 - 1 |
| Lubricant capacity: | | | | | | |
| Summer (pints) | 10 | 6 | 8 | 8 | 12 | 12 |
| Winter (pints) | 10 | 6 | 8 | 8 | 12 | 12 |



TRANSMISSIONS

Driving Downhill

A safety rule to follow by all good drivers is to use the same or next lower transmission gear when going downhill as would be used in climbing the same hill. If necessary, the vehicle speed can then be easily controlled to the maximum road speeds for that particular gear by "snubbing down" with the brakes. This practice will not only prevent damage to the engine, but will also effect a saving on the brakes.

CAUTION: Do not coast down hill, even for a very short distance, with the clutch disengaged. If the clutch is engaged while the truck is coasting, the sudden acceleration of the engine's speed will result in a shock to the gears, an excessive strain and ultimate failure of the driving parts.

Overdrive

Some transmissions have an over-drive speed. This gearing is for maintaining increased road speed with reduced engine speed. Overdrive should be used only when conditions are favorable to high road speeds. Overdrive should never be used at low road speeds or for lugging. Usually, for overland hauling, the minimum road speed for overdrive is 30 m.p.h.

Overload

The transmissions installed in International trucks are engineered to the rated capacity of the trucks. An ample safety factor well above normal requirements has been provided, but neither the transmission nor any other part of the truck will give maximum performance and long wear if continued to load it beyond its rated capacity.

Shifting

Probably one of the most distinguishing characteristics of a good driver is his ability to shift gears from a high to a lower transmission speed.

A knowledge of the maximum obtainable road speeds in the various gears is helpful in determining the maximum road speed at which a shift from a high to a lower gear can be made.

For example, in shifting fourth speed to third speed, the maximum road speed at which this change can be made is at approximately

thirty-three miles per hour since that is the maximum available road speed for this truck in third gear.

Gear changes from a higher to lower gear speeds should be made as follows:

1. Ease off on accelerator and disengage clutch.
2. Move gear shift lever to neutral position and engage clutch. At same time, accelerate engine to governed speed.
3. Disengage clutch, ease off on accelerator, and move gear shift lever to next lower transmission gear position.
4. Engage clutch and depress accelerator sufficiently to pick up load.

The above procedure, known as "double-clutching," is necessary to bring about an equalization or synchronization of engine speed and transmission gear speed, and thereby prevent clashing of gears.

When the truck is equipped with a governor the maximum engine speed is controlled. If, however, it is desired to shift at lower road speeds than those shown, the shifts should be made at correspondingly lower engine speeds. Since the governor does not operate at the lower engine speeds, determination of the proper lower engine speed at which to shift is a matter of judgment that comes with practice.

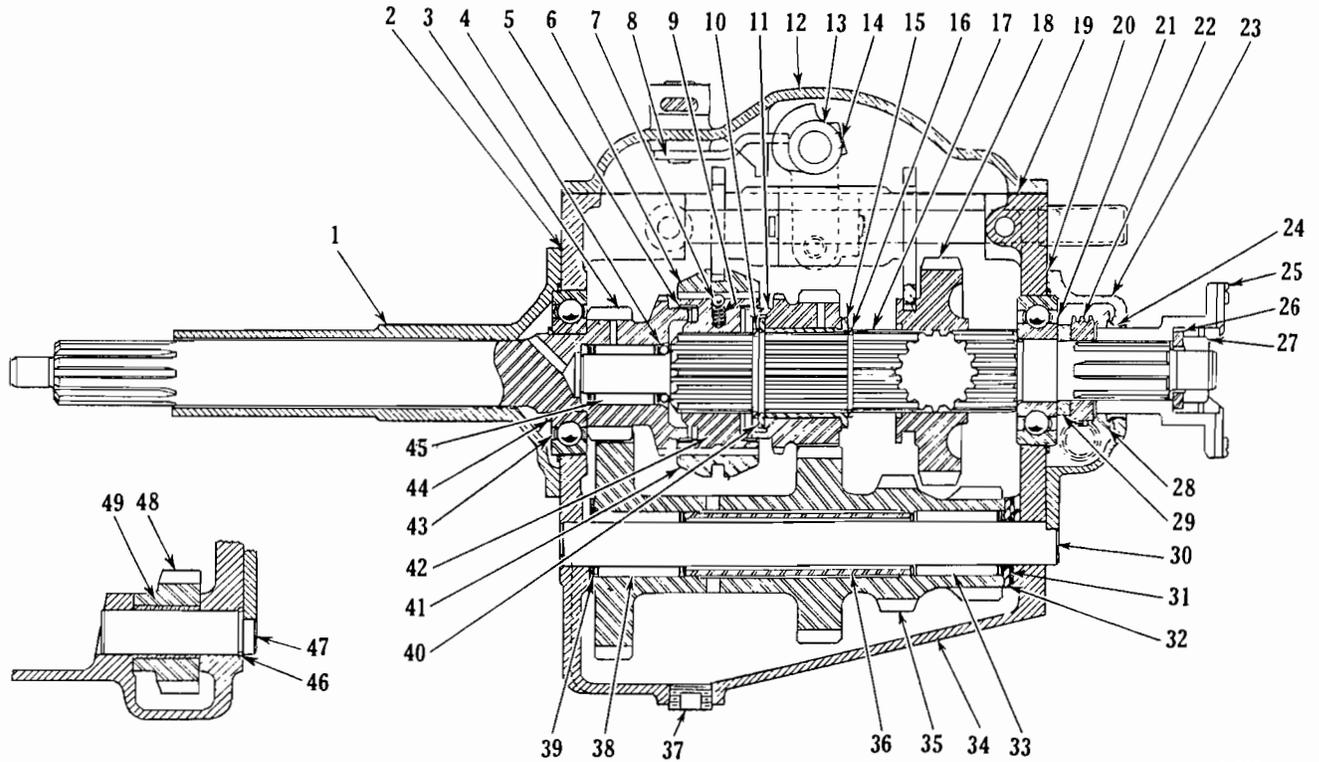
When the operator becomes accustomed to the sound of the engine at various engine speeds and has become experienced at "double-clutching" he should be able to shift from a high to a lower gear very rapidly--and without clashing the gears. **CAUTION:** When shifting, avoid injury to the gear teeth by making it a practice to shift gears with as little clashing as possible.

Starting

When starting a new unit or one which has been exposed to cold weather, allow sufficient time for the lubricant to circulate and coat all contacting surfaces. Do not stay in any one gear for any length of time. The metal-to-metal contact between some of the working parts, due to insufficient lubrication, will result in damage which may not appear immediately but will eventually develop into serious trouble.



TRANSMISSION (HDS)



A-21744

Fig. 1 - (HDS)

| No. | Description | No. | Description |
|-----|---|-----|--------------------------------------|
| 1. | Main drive gear bearing retainer. | 25. | Flange. |
| 2. | Retainer gasket. | 26. | Lockwasher. |
| 3. | Main drive gear. | 27. | Nut. |
| 4. | Mainshaft pilot bearing spacer. | 28. | Oil slinger. |
| 5. | Sliding clutch synchronizer ring. | 29. | Speedometer gear spacer. |
| 6. | Mainshaft clutch sleeve. | 30. | Countershaft. |
| 7. | Clutch poppet ball. | 31. | Countershaft thrust washer (bronze). |
| 8. | Selector lever assembly. | 32. | Countershaft thrust washer (steel). |
| 9. | Clutch poppet spring. | 33. | Countershaft roller bearing. |
| 10. | Second speed gear lock ring. | 34. | Transmission case. |
| 11. | Second speed gear. | 35. | Countershaft gear cluster. |
| 12. | Transmission cover. | 36. | Countershaft bearing spacer. |
| 13. | Shift lever assembly. | 37. | Drain plug. |
| 14. | Shift lever setscrew. | 38. | Countershaft roller bearing. |
| 15. | Mainshaft adapter. | 39. | Countershaft thrust washer. |
| 16. | Second speed gear lock ring. | 40. | Second speed gear thrust washer. |
| 17. | Mainshaft. | 41. | Clutch sleeve (second and high). |
| 18. | Mainshaft sliding gear (low and reverse). | 42. | Clutch hub (second and high). |
| 19. | Transmission cover gasket. | 43. | Main drive gear ball bearing. |
| 20. | Rear bearing retainer gasket. | 44. | Bearing lock ring. |
| 21. | Mainshaft rear bearing. | 45. | Mainshaft pilot bearing. |
| 22. | Speedometer drive gear. | 46. | Idler shaft snap ring. |
| 23. | Mainshaft rear bearing retainer. | 47. | Reverse idler shaft. |
| 24. | Oil seal. | 48. | Reverse idler gear. |
| | | 49. | Reverse idler gear bushing. |



TRANSMISSION (MODEL HDS)

The Model HDS transmission is of synchromesh type with remote control having three speeds forward and one reverse. Fig. 2 illustrates the shift diagram.

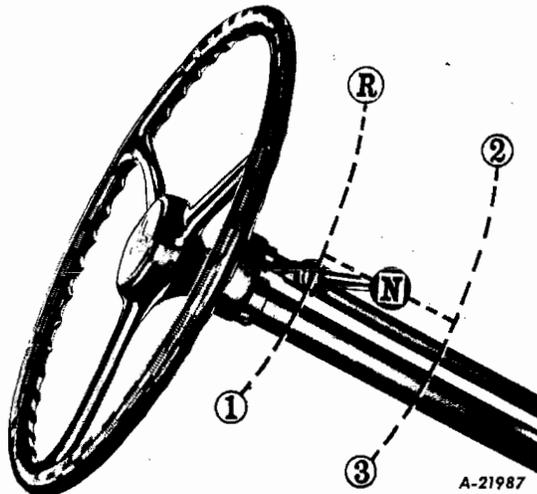


Fig. 2 - Shifting Diagram (HDS)

DISASSEMBLING AND REASSEMBLING

With a few minor exceptions, the assembly is simply the reverse of disassembling. Therefore the following disassembly instructions will also serve as reference for assembling.

Fig. 1 illustrates construction details of this transmission and figure numbers in parentheses throughout this section will refer to this illustration.

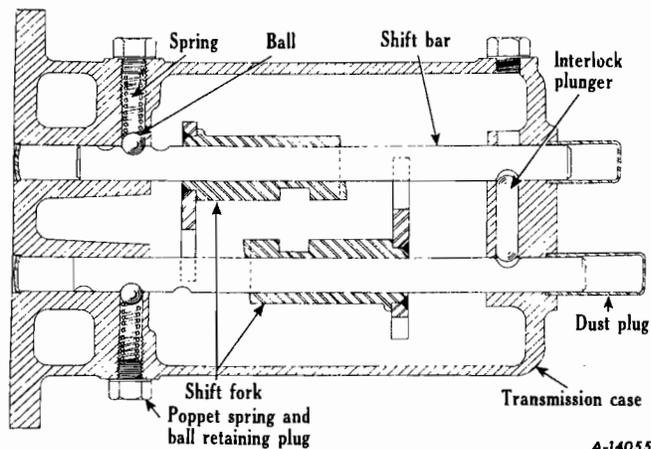
1. Clean outside of transmission, particularly around the control and bearing covers (1, 12, 23).
2. Shift selector lever (8) and shift lever (13) to neutral position. Remove cotter pin and breather cap from hold-down bolt. Remove four capscrews and lockwashers from control cover (12) and lift off control cover assembly.
3. To disassemble the control cover assembly:
 - (a) Remove outer selector lever setscrew releasing both outer and inner levers (8).
 - (b) Remove shift lever setscrew (14) and this will release the shaft, spring and shift lever (13).
4. Disassembling shift forks and shafts:
 - (a) Remove poppet ball and spring retainer plugs releasing balls and springs.
 - (b) Remove setscrews from shift forks and slide shift bar toward rear of case.

Use shift bar to tap out bar thimbles (dust plugs). With the removal of shift bar, the shift fork is lifted out through top of case.

- (c) Remove interlock plunger retainer capscrew to release interlock plunger from case.

CAUTION: In reassembling transmission, be sure to insert interlock plunger, poppet springs and balls.

- (d) Remove low and reverse shift bar and fork, in the same manner as described in paragraph (b).



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Fig. 3 - Sectional View of Shifting Bars, Poppet Springs and Balls and Shifting Forks.

5. Removing main drive gear assembly:
 - (a) Lock transmission and remove companion flange (25). Remove capscrews - three in number - from mainshaft rear bearing retainer (23). Lift off retainer and gasket (20) revealing oil deflector (28), speedometer drive gear (22) and spacer (29).
 - (b) Drive out countershaft (30) toward rear of case permitting countershaft gear cluster (35) to drop down in case, allowing clearance for removal of main drive gear.
 - (c) Remove capscrews - four in number - from the main drive gear bearing retainer (1). Remove retainer (1) revealing main bearing (43) and retaining ring (44).
- NOTE:** When reassembling, see that oil drain in retainer (1) is located at bottom.
- (d) Main drive gear (3) and bearing (43) can now be removed from case (34) by driving toward front of case. **CAUTION:** Exercise care not to damage bearing (43) when driving from case.

6. Removal of mainshaft assembly:

- (a) With companion flange (25) and mainshaft bearing retainer (23) removed, slip off oil deflector (28) speedometer drive gear (22) and spacer (29) from mainshaft assembly.
- (b) Remove mainshaft rear bearing (21). **CAUTION:** Exercise care in driving off bearing to prevent its being damaged.
- (c) Mainshaft assembly can then be lifted out through top of case.

NOTE: Main drive gear assembly (3) must be removed first as outlined in paragraph 5.

7. Removal of countershaft cluster gear:

- (a) As countershaft (30) has already been removed for disassembly of main drive gear (3), the countershaft gear cluster (35) is merely lifted out through top of case. Be sure to remove the bronze washer (39) at front and bronze washer (31) and steel thrust washer (32) at rear in bottom of case.
- (b) Countershaft bearings (38) and spacer (36) can also be removed from gear cluster.

8. Removal of reverse idler gear and shaft:

- (a) Reverse idler shaft (47) can now be removed by driving shaft toward rear of case and this will permit lifting idler gear (48) out through top of case. **NOTE:** When reassembling, be sure to position shaft so that recess will take rear bearing retainer properly.

9. Disassembly of mainshaft clutch assembly:

- (a) Mainshaft clutch and sleeve are held together by poppet springs (9) and balls (7). Mainshaft clutch can be removed from sleeve by supporting outer diameter of sleeve and pressing on clutch. Use care when disassembling as poppet balls are under spring tension and may fly out when sleeve is removed. It is suggested that a cloth be wrapped around the assembly to guard against this.

A special tool, SE-920, is available which if used, will facilitate disassembly and reassembly. If you do not have this tool on hand, follow instructions outlined in paragraph (b).

- (b) To reassemble, insert clutch partially in sleeve and install springs and balls. Then insert cotter pins (1/8 x 2") having the ends spread slightly as shown in Fig. 4. The cotter pins, when pressed between the splines, force the balls into the clutch and after clutch is pressed into sleeve, cotter pins can be removed.

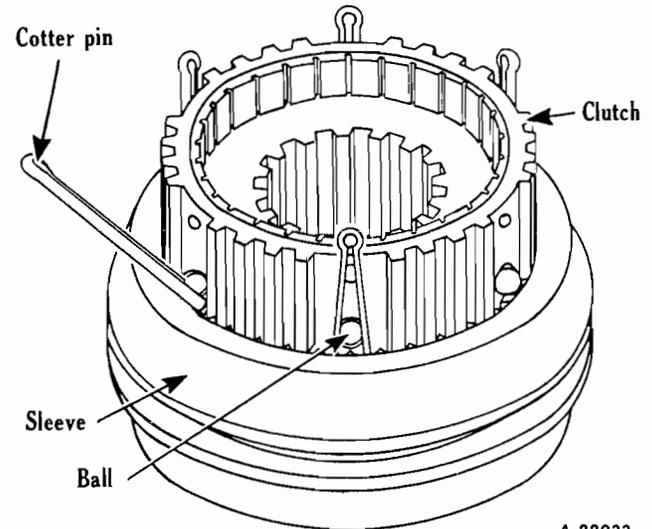


Fig. 4

TRANSMISSION (T-87-D)

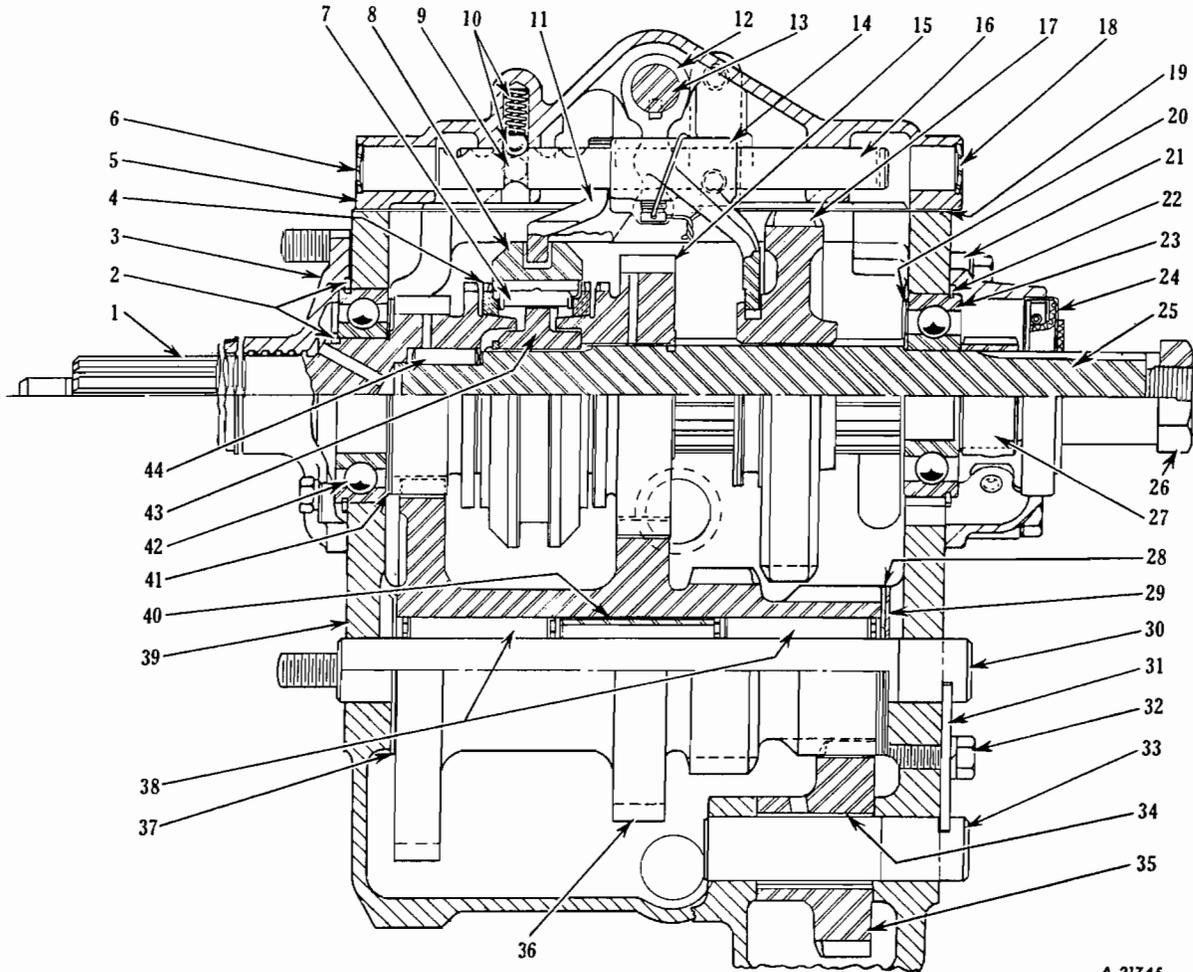


Fig. 1 - (T-87-D)

A-21745

| No. | Description | No. | Description |
|-----|------------------------------------|-----|-------------------------------------|
| 1. | Main drive gear. | 23. | Mainshaft rear bearing. |
| 2. | Bearing snap rings. | 24. | Oil seal. |
| 3. | Main drive gear bearing retainer. | 25. | Mainshaft. |
| 4. | Synchronizer blocking ring. | 26. | Mainshaft flange nut. |
| 5. | Transmission cover. | 27. | Speedometer drive gear. |
| 6. | Expansion plug. | 28. | Countershaft thrust washer (inner). |
| 7. | Shifting plate. | 29. | Countershaft thrust washer (outer). |
| 8. | Clutch sleeve (second and direct). | 30. | Countershaft. |
| 9. | Interlock plunger. | 31. | Lock plate. |
| 10. | Poppet ball and spring. | 32. | Lock plate capscrew. |
| 11. | Shift fork (second and third). | 33. | Reverse idler shaft. |
| 12. | Shift lever. | 34. | Reverse idler gear bushing. |
| 13. | Shifting shaft. | 35. | Reverse idler gear. |
| 14. | Shift fork (low and reverse). | 36. | Countershaft gear cluster. |
| 15. | Mainshaft second speed gear. | 37. | Countershaft thrust washer (front). |
| 16. | Shift rail. | 38. | Countershaft roller bearing. |
| 17. | Mainshaft low and reverse gear. | 39. | Transmission case. |
| 18. | Expansion plug. | 40. | Countershaft bearing spacer. |
| 19. | Transmission cover gasket. | 41. | Oil retainer washer. |
| 20. | Oil retainer washer. | 42. | Main drive gear bearing. |
| 21. | Mainshaft rear bearing retainer. | 43. | Clutch hub (second and direct). |
| 22. | Mainshaft bearing snap ring. | 44. | Mainshaft pilot bearing. |



TRANSMISSIONS (MODEL T-87-D)

The Model T-87-D transmission is of synchro-mesh type, with remote controls, having three speeds forward and one reverse. Fig. 2 illustrates the shift diagram.

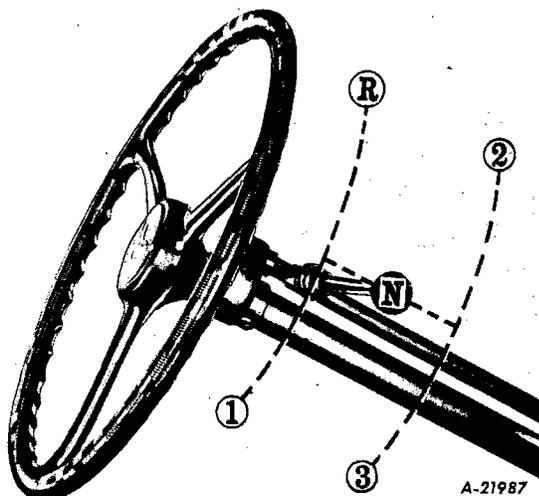


Fig. 2 - Shifting Diagram (T-87-D)

DISASSEMBLING AND REASSEMBLING

The assembly is simply the reverse of disassembling with the exception of a few minor details. Therefore the following disassembly instructions will also serve as reference for assembling.

Figure numbers in parantheses throughout this section will refer to Fig. 1 which illustrates construction details of this transmission.

1. Clean outside of transmission especially around the control and bearing covers (3; 5, 21).
 2. Shift selector lever (12) into neutral position. Remove capscrews and lockwashers holding cover assembly (5) to case (39) and lift off the cover assembly.
 3. To disassemble the control cover assembly:
 - (a) Clip lockwire and remove lockscrew from low and reverse speed shift fork (14). Tap shift rail (16) toward rear of cover driving out expansion plug (18). Pull out shift rail (16) releasing poppet spring and ball (10) and shift fork (14). CAUTION: Do not lose poppet springs and balls.
 - (b) To remove second and third speed shift fork (11), rail, expansion plug, poppet spring and balls (10), follow the same procedure as in step (a).
 - (c) Remove snap rings from shifting shaft (13) located on each side of shift lever (12) thus releasing shaft assembly (13), spring, shift lever (12) and key.
 - (d) Interlock plunger (9) may be removed by pulling 3/8" tapered plug located on left side transmission cover (5) directly below poppet spring and ball.
- NOTE: When reassembling the top cover assembly (5) to case, make sure that shift forks (11, 14) are not sprung and engaged properly with sliding gears.
4. To disassemble the mainshaft assembly.
 - (a) Lock transmission and remove companion flange nut (26). Remove capscrews - four in number - holding main drive gear bearing retainer (3) to case (39) and five capscrews holding mainshaft assembly rear bearing retainer (21).
 - (b) Lift off main drive gear retainer (3) revealing snap rings (2) and bearing (42). Remove mainshaft rear retainer (21) revealing speedometer drive gear (27) snap ring (22) and bearing (23). NOTE: When reassembling the front bearing retainer (3) see that oil drain in retainer is located at bottom.
 - (c) With the mainshaft rear bearing retainer (21) removed, slip speedometer drive gear (27) from mainshaft (25). Remove mainshaft rear bearing (23) and oil retainer washer (20). CAUTION: Exercise care in driving off bearing to prevent damage.
 - (d) Pull main drive gear (1) and bearing (42) out through front of case until drive gear contacts countershaft gear. Slide mainshaft assembly through rear bore of case as far as necessary to clear main drive gear (1) and lift out through top of case. CAUTION: Be sure to catch pilot needle bearings (14) - sixteen in number - when removing mainshaft assembly. A helpful suggestion in reassembling pilot needle bearing (44), use a rubber band to hold the sixteen needle bearings in place until the assembly is started in the main drive gear and then the rubber band is removed before completing the assembly.
 - (e) To disassemble mainshaft assembly, remove retainer snap ring and use sliding gear (17) to tap synchronizer assembly and bushed gear (15) from mainshaft.



5. To disassemble main drive gear:
 - (a) Remove snap ring (2) holding bearing (42) on main drive gear (1). Push the drive gear and bearing assembly back into case until outside snap ring seats snugly against case. Using a soft hammer, tap the mainshaft gently toward inside of case until bearing is freed and the mainshaft can then be lifted out through top of case. CAUTION: Do not damage bearing during this operation.
6. To disassemble countershaft assembly:
 - (a) Remove capscrew (32) and lock plate (31) releasing countershaft (30) and reverse idler shaft (33). Drive countershaft (30) out through rear of case using a brass drift. With the countershaft removed, the gear cluster (36) can be lifted out through top of case. Be sure to pick up the bronze thrust washer (37) at front and bronze washer (28) and steel washer (29) at rear in bottom of case.
 - (b) Countershaft bearings (38) and spacer (40) can also be removed from gear cluster.
7. Removal of reverse idler gear and shaft:
 - (a) Reverse idler shaft (33) can be removed by driving out through rear of case. May also be removed by placing a pinch bar in lock plate slot and pulling out shaft. With the idler shaft (33) removed, the idler gear (35) can be lifted out of case. NOTE: When reassembling, be sure to position properly slots in countershaft (30) and idler shaft (33) to take lock plate (31).
8. To disassemble mainshaft clutch assembly:
 - (a) The mainshaft clutch hub and sleeve are held together by two retaining springs located on each side of clutch hub. The clutch sleeve (8) can be removed from clutch hub (43) by removing the retaining springs and supporting the outside diameter of sleeve (8) and pressing on hub (43). Use care when disassembling not to lose the three shifting plates (7). The blocker rings (4) are supported by the main drive gear hub and second speed gear hub and are disassembled with the removal of the mainshaft assembly.

CAUTION: In reassembling the clutch, 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 (7). Also index etched marking on hub and sleeve.

TRANSMISSION (H-41-B)

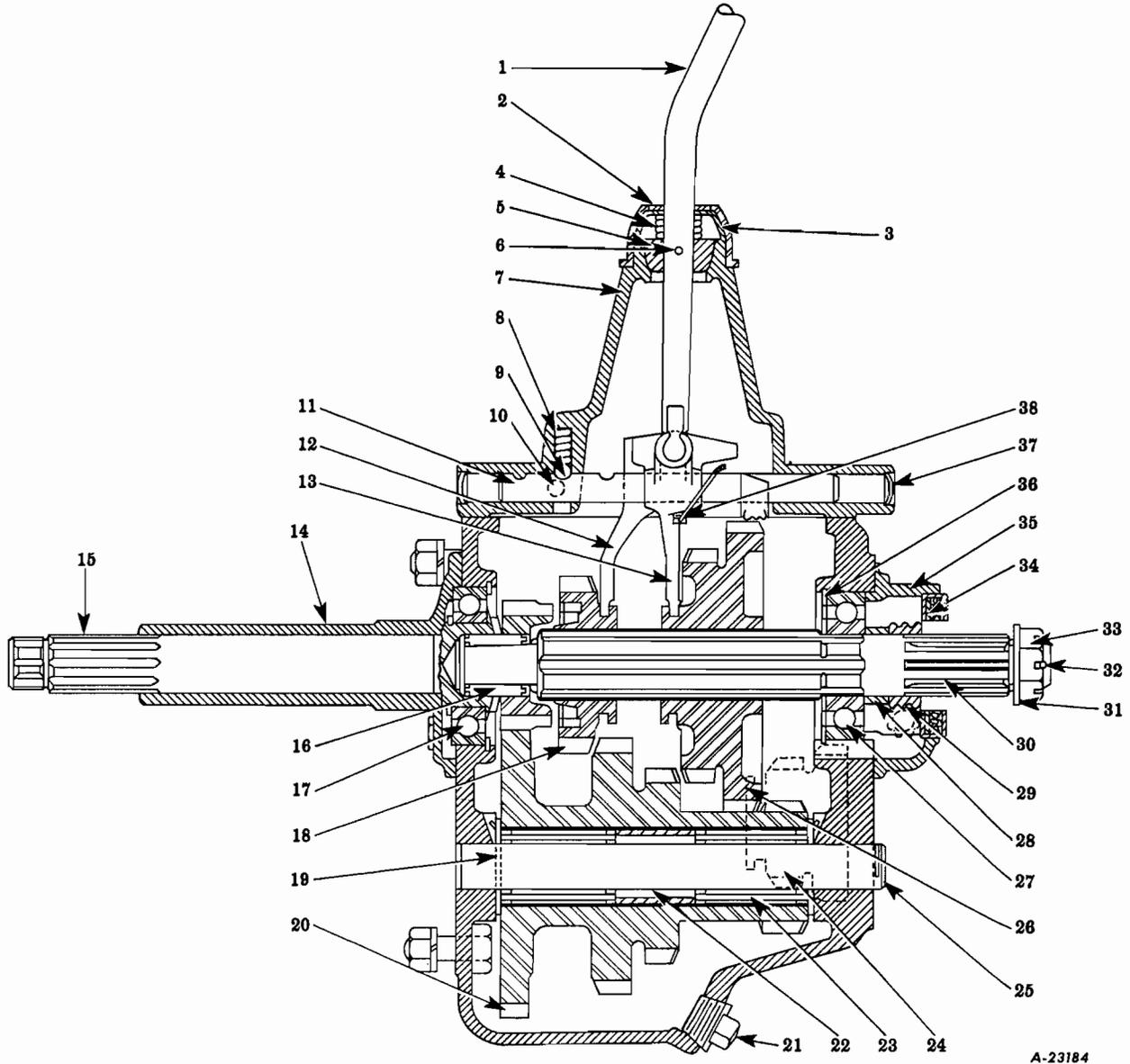


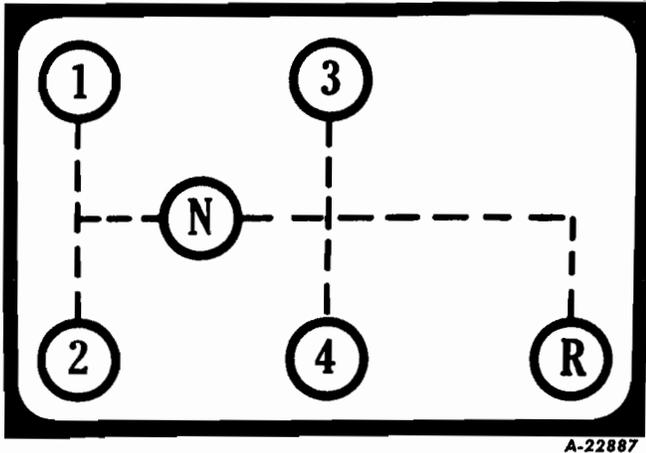
Fig. 1 - (H-41-B)

| No. | Description | No. | Description | No. | Description |
|-----|------------------------------|-----|----------------------------------|-----|----------------------------------|
| 1. | Shift lever. | 15. | Main drive gear. | 26. | Mainshaft gear (low and second). |
| 2. | Retainer. | 16. | Main drive gear. | 27. | Mainshaft rear bearing. |
| 3. | Retainer washer. | 17. | Main drive gear bearing. | 28. | Spacer. |
| 4. | Spring. | 18. | Mainshaft gear (3rd and direct). | 29. | Speedometer drive gear. |
| 5. | Fulcrum ball. | 19. | Countershaft thrust washer. | 30. | Mainshaft. |
| 6. | Pin. | 20. | Countershaft gear cluster. | 31. | Washer. |
| 7. | Control cover. | 21. | Drain plug. | 32. | Cotter pin. |
| 8. | Poppet spring. | 22. | Bearing spacer. | 33. | Nut. |
| 9. | Poppet ball. | 23. | Countershaft bearing. | 34. | Grease seal. |
| 10. | Interlock pin. | 24. | Reverse idle gear. | 35. | Rear bearing retainer. |
| 11. | Shifter shaft. | 25. | Countershaft. | 36. | Grease slinger. |
| 12. | Shift fork (3rd and direct). | | | 37. | Expansion plug. |
| 13. | Shift fork (1st and 2nd). | | | 38. | Shifter fork lock screw. |
| 14. | M. drive gear brg. retainer. | | | | |



TRANSMISSIONS (MODEL H-41B)

The Model H-41-B transmission is of sliding gear type, having four speeds forward and one reverse. Fig. 2 illustrates the shift diagram.



A-22887

Fig. 2 - Shifting Diagram (H-41-B)

DISASSEMBLING AND REASSEMBLING

With a few minor exceptions, the assembling is simply the reverse of disassembling. Therefore the following disassembly instructions will also serve as reference for assembling.

Fig. 2 illustrates construction details of this transmission and figure numbers in parentheses throughout this section will refer to this illustration.

1. Clean the outside of the transmission, particularly around the control and bearing covers (7, 14, 35).
2. Place shift lever (1) in neutral position. Remove the six holding capscrews and lift off the control assembly (7).
CAUTION: Do not force the control cover off the transmission. Forcing may spring the yokes of alignment and cause partial engagement or gear interference. If binding occurs, a slight manipulation will free it.
3. To disassemble the control cover assembly:
 - (a) Remove control lever retainer (2) from top of cover (7). Lift out control lever (1), retainer (2), washer (3), and spring (4) and fulcrum ball (5). Fulcrum ball (5) can be removed from control lever (1) by driving out pin (6) with a suitable punch.
 - (b) Clip lockwire from first and second speed shift fork (38) and remove lock-screw (38). Drive shift rail (11) toward rear of cover driving out expansion plug (37). With the expansion plug removed, pull shift rail (11) out and lift shift fork (13) out of cover.
CAUTION: Do not lose poppet spring (8) and ball (9).
 - (c) Continue disassembly operation removing third and direct shift fork (12), reverse shift block, stop pin, spring, rails, poppet balls and springs and interlock pins and stops. CAUTION: In reassembling the control cover, care should be exercised to see that all parts are replaced in their correct positions and none of the small interlocking parts are lost or omitted.
4. To remove mainshaft assembly:
 - (a) Lock transmission by engaging two speeds and remove flange nut (32).
 - (b) Remove five capscrews holding mainshaft rear bearing retainer (35) to case. Lift bearing retainer off mainshaft revealing gasket, speedometer drive gear (29), spacer (28), and mainshaft rear bearing (27).
 - (c) Hold mainshaft sliding gears (18, 26) in position. Mainshaft (30) and bearing (27) can now be removed through rear of case. If necessary, use a brass drift against washer (31) and nut (32).
 - (d) Lift out mainshaft third and direct gear (18) and low and second gear (26) through top of case.



L-LINE MOTOR TRUCK SERVICE MANUAL

5. To disassemble the mainshaft:
 - (a) Remove nut (32), companion flange, then remove rear bearing retainer (35), speedometer drive gear (29), spacer (28), and bearing (27).
 - (b) Remove cotter pin from reverse idler gear shifter fork shaft. Drive shaft toward rear of case with a brass drift and remove idler shifter fork.
 - (c) Lift countershaft gear cluster (20) with bearings (23) and spacer (22), through top opening of case. Tilt gear cluster slightly through rear bore in case to facilitate removal.
 - (d) Remove roller bearings (23) and spacer (22) from cluster (20). Be sure to pick up countershaft thrust washers, one each end, from bottom of case.
6. Remove main drive gear:
 - (a) Remove four capscrews holding main drive gear bearing retainer (14) to case.
 - (b) Remove retainer (14) revealing gasket and bearing (17). NOTE: When re-assembling, be sure to locate oil drain at bottom.
 - (c) Main drive gear (15) and bearing (17) can now be removed from front of case. If necessary, use babbit or rawhide hammer to tap main drive gear (15).
7. Removing the countershaft assembly:
 - (a) Remove countershaft and reverse idler shaft lock screw and plate. Drive out countershaft (25) toward rear of case, using a brass drift.
8. Removing the reverse idler gear and shaft assembly:
 - (a) Insert screwdriver or pinch bar in lock plate groove and pry out shaft. Reverse idler gear can then be lifted out through top of case. NOTE: When reassembling, be sure to position slot in shaft properly to take lock plate.
9. When reassembling the top cover assembly, make sure that the shifter forks are not sprung, and engaged properly with sliding gears.



TRANSMISSION (T-98)

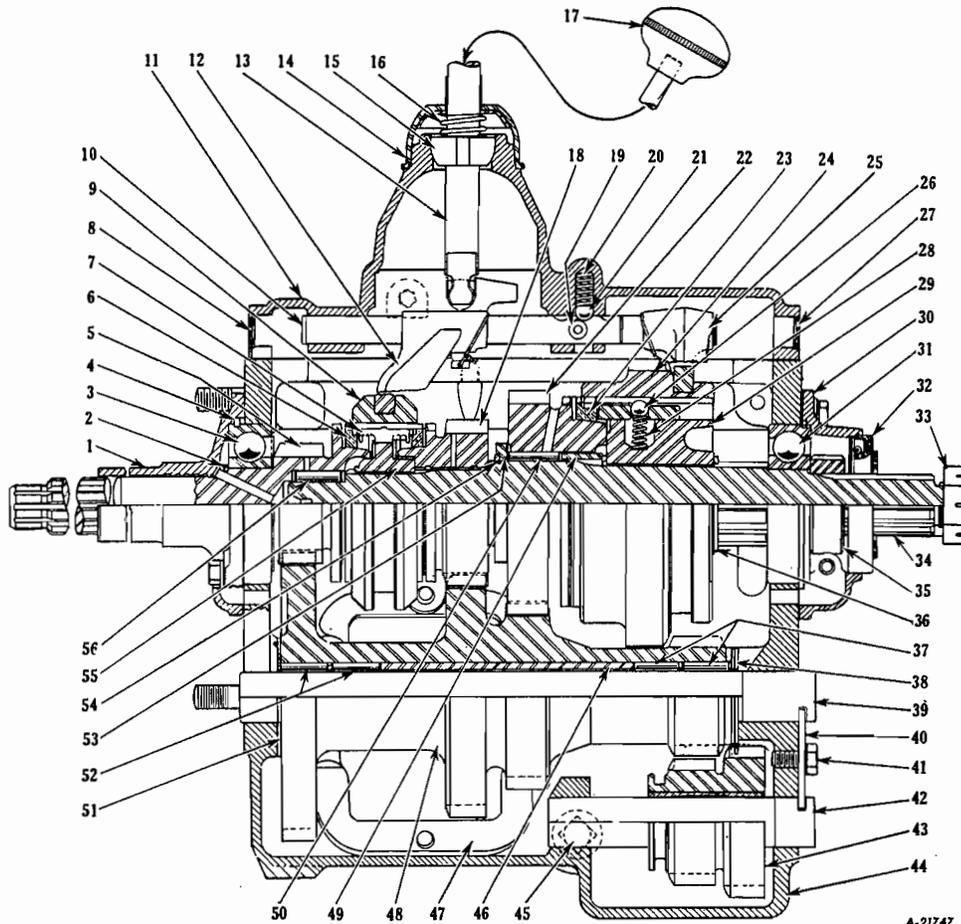


Fig. 1 - (T-98)

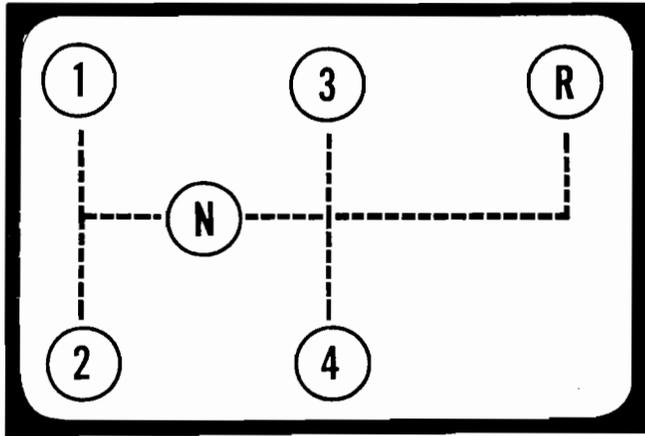
A-21747

| No. | Description | No. | Description | No. | Description |
|-----|-----------------------------------|-----|-----------------------------------|-----|------------------------------------|
| 1. | Main drive gear bearing retainer. | 23. | Synchronizer blocking ring. | 40. | Lock plate. |
| 2. | Snap ring. | 24. | Mainshaft 1st and 2nd speed gear. | 41. | Lock plate capscrew. |
| 3. | Main drive gear bearing. | 25. | Shift fork, 1st and 2nd speed. | 42. | Reverse idler shaft. |
| 4. | Snap ring. | 26. | Poppet ball. | 43. | Reverse idler gear. |
| 5. | Main drive gear. | 27. | Expansion plug. | 44. | Transmission case. |
| 6. | Synchronizer blocking ring. | 28. | Poppet spring. | 45. | Drain plug. |
| 7. | Shifting plate. | 29. | Clutch hub, 1st and 2nd speed. | 46. | Countershaft bearing spacer. |
| 8. | Expansion plug. | 30. | Mainshaft rear bearing retainer. | 47. | P.T.O. opening. |
| 9. | Sleeve (3rd and direct). | 31. | Mainshaft rear bearing. | 48. | Countershaft gear cluster. |
| 10. | Shift rail. | 32. | Rear bearing retainer seal. | 49. | 2nd speed gear bearing spacer. |
| 11. | Transmission cover. | 33. | Mainshaft flange nut. | 50. | 2nd speed gear roller bearing. |
| 12. | Shift fork, (3rd and direct). | 34. | Mainshaft. | 51. | Countershaft thrust washer, front. |
| 13. | Control lever. | 35. | Speedometer drive gear. | 52. | Countershaft roller bearing. |
| 14. | Control housing cap. | 36. | Snap ring. | 53. | 2nd speed gear thrust washer. |
| 15. | Fulcrum ball. | 37. | Countershaft roller bearing. | 54. | Snap ring. |
| 16. | Control lever spring. | 38. | Countershaft thrust washer, rear. | 55. | Clutch hub, 3rd and direct. |
| 17. | Control lever ball. | 39. | Countershaft. | 56. | Mainshaft pilot bearing. |
| 18. | Mainshaft 3rd speed gear. | | | | |
| 19. | Interlock plunger. | | | | |
| 20. | Poppet spring. | | | | |
| 21. | Poppet ball. | | | | |
| 22. | Mainshaft 2nd speed gear. | | | | |



TRANSMISSION (MODEL T-98)

The Model T-98 transmission is of synchromesh type having four speeds forward and one reverse. Fig. 2 illustrates the shift diagram.



A-22937

Fig. 2 - Shifting Diagram (T-98)

DISASSEMBLING AND REASSEMBLING

With a few minor exceptions, the assembling is simply the reverse of disassembling. Therefore the following disassembly instructions will also serve as reference for assembling.

Fig. 1 illustrates construction details of this transmission and figure numbers in parentheses throughout this section will refer to this illustration.

1. Clean outside of transmission particularly around the control and bearing covers (1, 11, 30).
2. Place control lever (13) into neutral position. Remove capscrews and lockwashers holding cover (11) to case (44) and lift control cover assembly off transmission.

CAUTION: Do not force the control cover assembly off the transmission. Forcing may spring the yokes and cause partial engagement or gear interference. A slight manipulation will free the cover.

3. To disassemble the control cover assembly:
 - (a) Cut lock wire on reverse shift block and remove shift block lockscrew. Drive shift rail (10) out toward rear of cover driving out expansion plug (27) and remove shift block.
 - (b) Pull tapered plug located on left outside of cover directly below poppet spring and ball and remove interlock plunger (19) and third and direct speed shift rail interlock pin.

- (c) Continue disassembly operation in the same manner as described in paragraph (a), removing third and direct speed shift fork (12) and first and second speed shift fork (25), rails, expansion plugs, poppet springs, balls and interlock plunger.

CAUTION: In reassembling the control cover assembly, care should be exercised to see that all parts are replaced in their correct positions and none of the small interlocking parts are lost or omitted.

- (d) To remove control lever (13) from cover (11), turn off the housing cap (14) releasing retainer washer, spring (16) and fulcrum ball (15). With the fulcrum ball and control lever assembly removed, the control lever pivot pin can be removed from cover.

4. To remove the mainshaft assembly:

- (a) Lock transmission by engaging two speeds and remove flange nut (33).
- (b) Remove capscrews, five in number, and lift off mainshaft rear bearing retainer (30) revealing speedometer gear (35), bearing (31), and snap rings. Slide speedometer gear (35) off of mainshaft (34). Disassemble main drive gear bearing retainer (1) by removing capscrews and lockwashers, revealing main drive gear bearing (3) and snap rings (2) and (4).
- (c) Remove main drive gear bearing snap ring (2) and pull main drive gear (5) and bearing (3) out through front of case sufficiently to expose bearing snap ring (4). Apply bearing puller and remove bearing (3) from main drive gear (5). Tap mainshaft assembly toward rear of case and pull mainshaft rear bearing (31). Push mainshaft assembly through rear bore in case to clear main drive gear (5) and tilt front end upward and lift out through top of case.

CAUTION: Be sure to catch pilot needle bearing, sixteen in number, when removing mainshaft assembly. When reassembling front bearing retainer (1), be sure to locate oil drain hole at bottom.

5. To disassemble main drive gear:
 - (a) With the main drive gear bearing (3) removed from drive gear (5), it is lifted out through top of case.



6. To disassemble the mainshaft assembly:
- Remove snap ring holding third and direct speed clutch assembly and mainshaft third speed gear (18) and slide clutch assembly and bushed gear from mainshaft.
 - Remove first and second speed hub retainer snap ring (36) and slide off synchronizer assembly.
 - Remove mainshaft second speed gear snap ring (54) releasing thrust washer (53) needle bearing (50), thirty-four in number, second speed gear (22) and spacer (49).
7. To disassemble the countershaft assembly:
- Remove capscrew (41) and lock plate (40) locking countershaft (39) and reverse idler shaft (42).
 - Using a brass drift, drive countershaft out through rear of case and lift the gear cluster (48) out through top of case. NOTE: The countershaft gear cluster turns on four sets of roller bearings (37, 52) which are loose in the bore of the countershaft gear. There are twenty-two rollers in each bearing set, totaling eighty-eight bearings, separated by spacer washers and spacer (46). These rollers will probably intermingle with the main drive gear pilot bearing rollers (56) in bottom of case when the countershaft gear is removed. Countershaft rollers (37, 52) are slightly smaller than pilot bearing rollers (56). Be sure to pick up front thrust washer (51), rear thrust washer (38) and spacing washer from bottom of case.
8. To disassemble the reverse idler gear assembly:
- Remove reverse shifting arm and drive reverse idler shaft (42) out through rear of case and lift idler gear (43) out through top of case. NOTE: When reassembling, be sure to position slot in shaft properly to take lock plate.
9. To disassemble the third and direct speed clutch assembly:
- The mainshaft clutch hub and sleeve are held together by two retaining springs located on each side of clutch hub. The clutch sleeve can be removed from clutch hub by removing the retaining springs and supporting the outside diameter of sleeve and pressing on hub. Use care when disassembling not to loose the three shifting plates (7). The blocker rings are supported by the main drive gear hub and third speed gear hub and are disassembled with the removal of the mainshaft assembly.
- CAUTION: In reassembling the clutch assembly, be sure to place end of each retaining spring in the same shifting plate (7) with the loose ends located in same position on both sides to equalize the tension on all three shifting plates (7), and also index etched marking on hub and sleeve.
10. To disassemble first and second speed synchronizer unit:
- The mainshaft first and second speed clutch hub (29) and sleeve gear (24) are held together by poppet springs (28) and balls (26). The clutch hub (29) can be removed from sleeve (24) by supporting the outside diameter and pressing on the hub. Use care when disassembling as poppet springs and balls are under spring tension and may fly out when sleeve is removed. It is suggested that a cloth be wrapped around the assembly to guard against this.

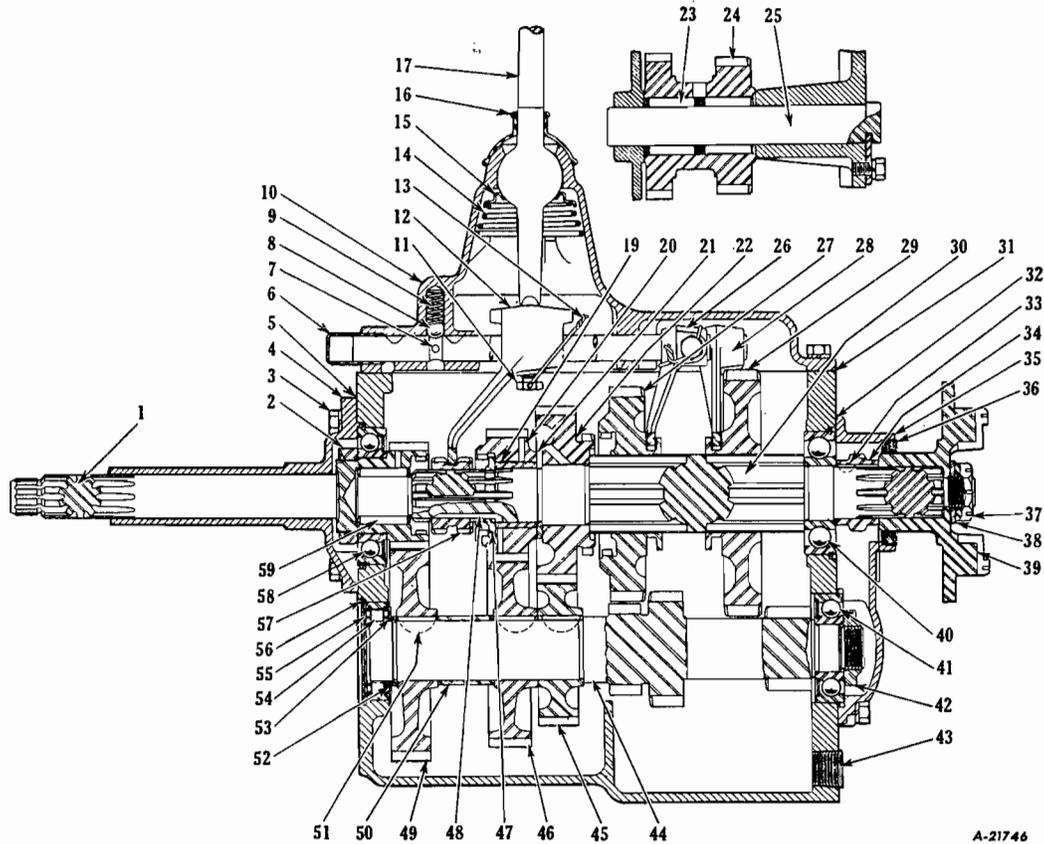
TRANSMISSION REMOVAL (L-160 SERIES)

When it becomes necessary to remove the transmission on the above series trucks, it is necessary to disconnect and move to one side the front propeller shaft. This will permit removal of the transmission. Proceed as follows.

- Remove the bolts from the front end of the front propeller shaft at the joint flange (Spicer joints used.)
- Remove the brake drum retainer bolts and slide the brake drum out of the brake band onto the propeller shaft. (This will provide maximum clearance for the end of the propeller shaft to permit its being moved to one side.)
- Carefully pry the shaft end towards the rear and over the transmission mainshaft flange and nut to permit the shaft to clear the flange.
- Securely wire the shaft to one side to keep it out of the way while proceeding with transmission removal.



TRANSMISSIONS (F-51 AND F-51-C)



A-21746

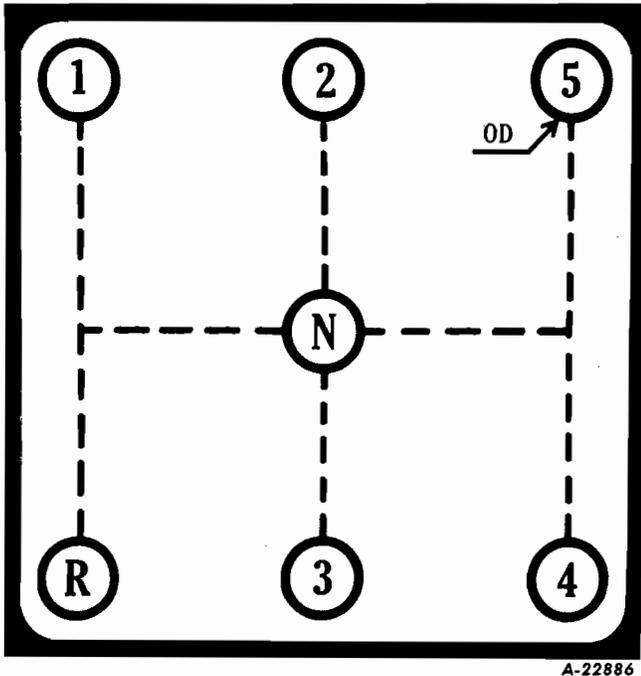
Fig. 1 - (F-51 and F-51-C)

| No. | Description | No. | Description | No. | Description |
|-----|-----------------------------------|-----|-------------------------------------|-----|--|
| 1. | Main drive gear. | 23. | Reverse idler roller bearing. | 42. | Countershaft rear bearing lock nut. |
| 2. | Drive gear bearing nut. | 24. | Reverse idler gear. | 43. | Drain plug. |
| 3. | Front bearing retainer capscrew. | 25. | Reverse idler shaft. | 44. | Countershaft gear, 1st, 2nd & reverse. |
| 4. | Main drive gear bearing retainer. | 26. | Shifter fork, 2nd & 3rd speed. | 45. | Countershaft 3rd speed gear. |
| 5. | Retainer gasket. | 27. | Mainshaft 2nd & 3rd speed gear. | 46. | Countershaft 5th speed gear. |
| 6. | Shift rail thimble. | 28. | Shifter fork (low & reverse). | 47. | Mainshaft 5th gear washer. |
| 7. | Interlock pin. | 29. | Mainshaft low & reverse gear. | 48. | Mainshaft 5th speed gear key. |
| 8. | Poppet ball. | 30. | Mainshaft. | 49. | Countershaft drive gear. |
| 9. | Poppet spring. | 31. | Control cover gasket. | 50. | Spacer. |
| 10. | Control cover. | 32. | Rear bearing cover gasket. | 51. | Key. |
| 11. | Shifter fork lockscrew. | 33. | Speedometer drive gear key. | 52. | Countershaft snap ring. |
| 12. | Shifter fork, 4th & 5th speed. | 34. | Speedometer drive gear. | 53. | Countershaft front bearing washer. |
| 13. | Shifter fork lockwire. | 35. | Rear bearing retainer. | 54. | Countershaft front bearing. |
| 14. | Spring. | 36. | Mainshaft rear bearing grease seal. | 55. | Countershaft front bearing retainer. |
| 15. | Retainer. | 37. | Flange nut. | 56. | Expansion plug snap ring. |
| 16. | Dust cover. | 38. | Flange lockwasher. | 57. | Mainshaft sliding clutch. |
| 17. | Shift lever, and ball. | 39. | Flange. | 58. | Main drive gear bearing. |
| 19. | Mainshaft sleeve, 5th gear. | 40. | Mainshaft rear bearing. | 59. | Mainshaft pilot bearing. |
| 20. | Mainshaft 5th gear. | 41. | Countershaft rear bearing. | | |
| 21. | Mainshaft 3rd speed washer. | | | | |
| 22. | 3rd speed constant mesh gear. | | | | |



TRANSMISSIONS (MODELS F-51 and F-51C)

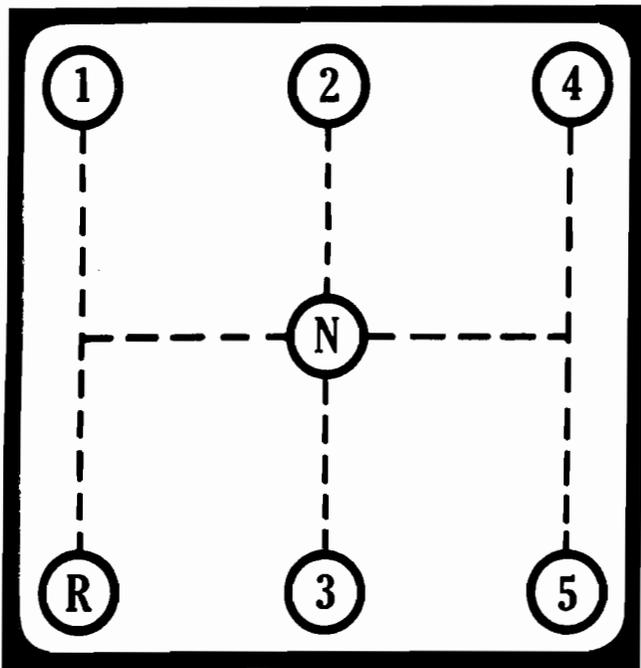
The Model F-51 transmission (5-A-330) has five speeds forward and one reverse. Fifth speed is overdrive. Fig. 2 illustrates the shift diagram.



A-22886

Fig. 2 - Shifting Diagram (F-51)

The Model F-51-C transmission (5-A-33) is constructed having five forward speeds and one reverse speed. Fifth speed is direct. Fig. 3 illustrates the shift diagram.



A-22882

Fig. 3 - Shifting Diagram (F-51-C)

Fig. 1 illustrates construction details of the F-51 and F-51-C transmissions and figure numbers in parentheses throughout this section will refer to this illustration. Item (20) on Fig. 1 will be referred to as Mainshaft Fifth Speed Gear although due to change in diameter on F-51-C, direct in fifth transmission, it is used as fourth speed gear.

DISASSEMBLING AND REASSEMBLING

With a few exceptions, the assembling is simply the reverse of disassembling. Therefore the following disassembly instructions will also serve as reference for assembling.

1. Clean the outside of the transmission, particularly around the control and bearing covers (4, 10, 35).
2. Place shift lever (17) to neutral position. Remove nine capscrews and lockwashers from control cover (10) and lift cover assembly and gasket (31) from top of case.
3. To disassemble the control cover assembly:
 - (a) Cut lockwire (13) at fourth and fifth speed shift fork (12) and remove shift fork lockscrew (11). Drive shift rail out toward front of cover driving out shift rail thimble (6) and remove shift fork (12). Do not lose poppet ball (8) and spring (9).
 - (b) Remove interlock ball and pin retainer plug located on left outside of cover directly below the poppet spring and ball housing, releasing interlock ball and pin (7).
 - (c) Continue disassembly operation removing low and reverse and second and third speed shift forks (26, 28), shift block, step pin, spring and rails. Do not lose shift rail poppet balls (8) and springs (9) or interlock pin (7) and balls.
 - (d) Remove shift lever ball (18) from shift lever (17). Remove lever dust cover (16) and also nut and lockwasher from control lever pivot pin. Place cover (10) in a vise, grasp lower end of control lever spring (14) with a large pliers and twist it from its retaining lugs. Spring may also be removed by use of a pinch bar and forcing spring over the retaining lugs. The shift lever (17) may now be lowered through the control cover (10). Control lever pivot pin can also be removed from cover. **CAUTION:** In reassembling the controls, care should be exercised that all parts are replaced in their respective positions.



4. Disassembling main drive gear and mainshaft assembly:
 - (a) Lock transmission and disassemble flange nut (37), washer (38) and flange (39). Remove six capscrews and lockwashers from mainshaft rear bearing retainer (35). Lift retainer and gasket (32) from case. Slide speedometer drive gear (34) from mainshaft (30) and remove speedometer gear drive key (33).
 - (b) Drive mainshaft assembly toward rear of case sufficiently to expose rear bearing (40) snap ring. Install suitable puller and pull bearing (40) from mainshaft (30).
 - (c) Remove six capscrews (3) and lockwashers from main drive gear bearing retainer (4) and lift off retainer (4) and gasket (5). Remove main drive gear (1) and bearing (58) and also mainshaft pilot bearing (59) out through front of case.
 - (d) Lift mainshaft (30) and gears out through top of case, tilting front end upward and leaving low and reverse speed gear (29) in case. With the mainshaft assembly removed, lift out low and reverse speed gear (29) out of case.

5. To disassemble mainshaft assembly:

- (a) Slide mainshaft second and third speed gear (27) from mainshaft and also the mainshaft sliding clutch (57) from opposite end of mainshaft.

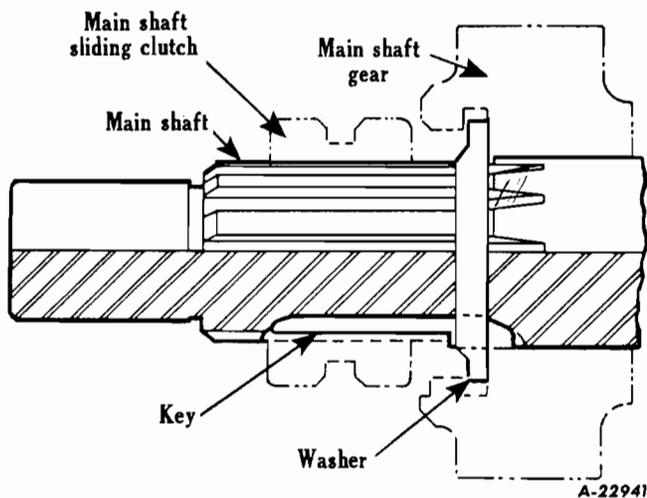


Fig. 4

- (b) Remove fifth speed gear key (48) from groove in mainshaft (30). Rotate fifth

speed gear washer (47) on mainshaft to index lugs with splines of shaft and then remove (Figure 4). Slide mainshaft fifth speed gear (20) sleeve (19) and washer (21) from shaft.

6. To disassemble main drive gear:

- (a) Remove peened over material from slots in main drive gear and turn off drive gear bearing nut (2). NOTE: Nut is left-hand threaded. Press bearing (58) from main drive gear (1).

7. To disassemble countershaft and reverse idler gear:

- (a) Remove peened over material from slots and remove countershaft rear bearing nut (42) from countershaft (44).
- (b) Remove capscrew and lockwasher from reverse idler shaft lock plate and remove from slot in idler shaft (25). Drive idler shaft (25) toward rear of case and lift idler gear (24) and roller bearings (23) from case.
- (c) Drive countershaft assembly (44) toward rear of case sufficiently to expose rear bearing (41), attach puller, and remove rear bearing from countershaft. Lift countershaft assembly through top of case, lifting front end upward and tilting assembly. Also remove front bearing thrust (53). The countershaft front bearing is disassembled by removing snap ring (56) from groove and drive retainer (55) from case. The countershaft front bearing (54) may now be removed from case.
- (d) To disassemble the countershaft assembly, remove snap ring (52) from countershaft. Using adapter plates, press countershaft drive gear (49) spacer (50) fifth speed gear (46) and third speed gear (45) from countershaft (44) and remove gear keys (51).

CAUTION: In reassembling, NEW snap rings should be used throughout the unit.



TRANSMISSIONS (F-52 AND F-52-C)

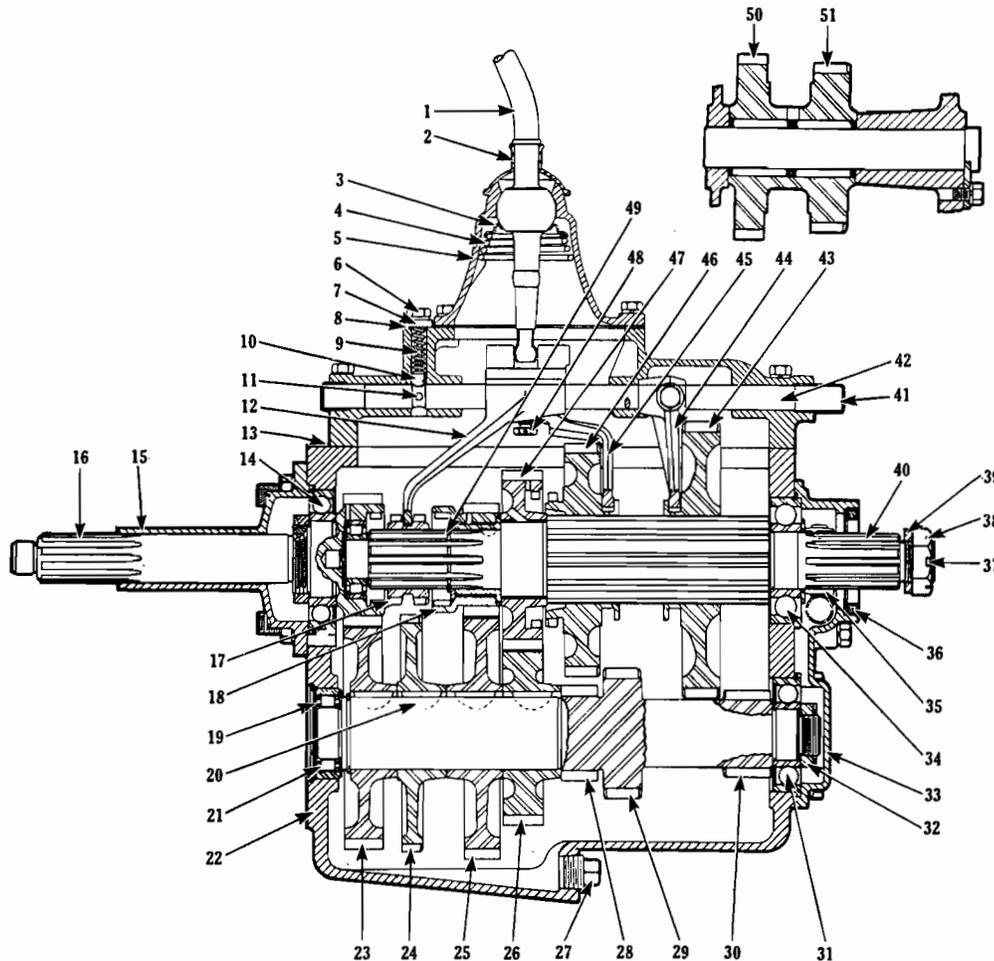


Fig. 1 - (F-52 and F-52C)

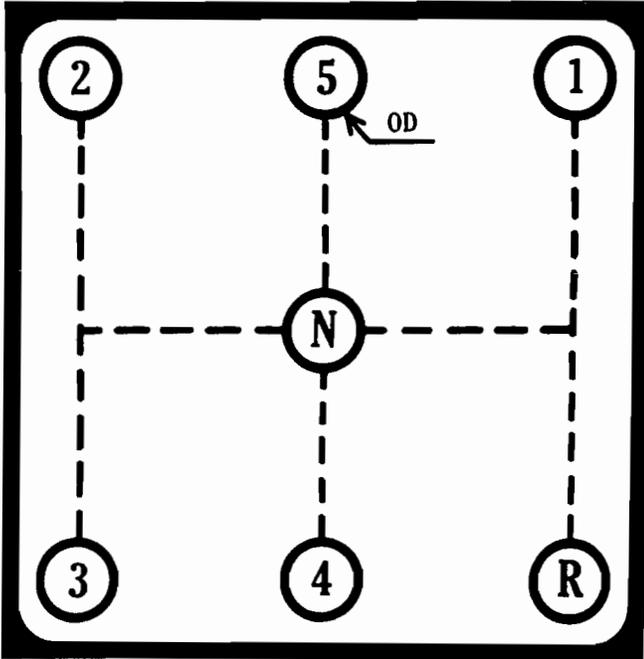
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| No. | Description | No. | Description | No. | Description |
|-----|--------------------------------------|-----|---|-----|---|
| 1. | Shift lever. | 20. | Countershaft gear key. | 36. | Mainshaft rear grease seal. |
| 2. | Dust cover. | 21. | Countershaft front bearing. | 37. | Cotter pin. |
| 3. | Spring retainer. | 22. | Transmission case. | 38. | Nut. |
| 4. | Spring. | 23. | Countershaft drive gear. | 39. | Washer. |
| 5. | Shift lever cover. | 24. | Power take-off drive gear (right side). | 40. | Mainshaft. |
| 6. | Capscrew. | 25. | Countershaft overdrive gear. | 41. | Shifter shaft rear cover. |
| 7. | Poppet spring cover. | 26. | Countershaft 3rd speed drive gear. | 42. | Shifter shafts. |
| 8. | Control cover. | 27. | Drain plug. | 43. | Mainshaft low and reverse sliding gear. |
| 9. | Poppet spring. | 28. | Reverse drive gear. | 44. | Shifter fork (low and reverse). |
| 10. | Poppet ball. | 29. | Countershaft 2nd speed drive gear. | 45. | Shifter fork (2nd and 3rd speed). |
| 11. | Interlock pin. | 30. | Countershaft low speed drive gear. | 46. | Mainshaft 2nd and 3rd speed sliding gear. |
| 12. | Shifter fork (direct and overdrive). | 31. | Countershaft rear bearing. | 47. | Mainshaft 3rd speed constant mesh gear. |
| 13. | Retainer gasket. | 32. | Countershaft rear bearing lock nut. | 48. | Shifter shaft lock screw. |
| 14. | Main drive gear bearing. | 33. | Rear bearing retainer. | 49. | Mainshaft gear lock washer. |
| 15. | Main drive gear bearing retainer. | 34. | Mainshaft rear bearing. | 50. | Constant mesh reverse idle gear. |
| 16. | Main drive gear. | 35. | Speedometer drive gear. | 51. | Reverse drive gear. |



TRANSMISSIONS (MODELS F-52 and F-52-C)

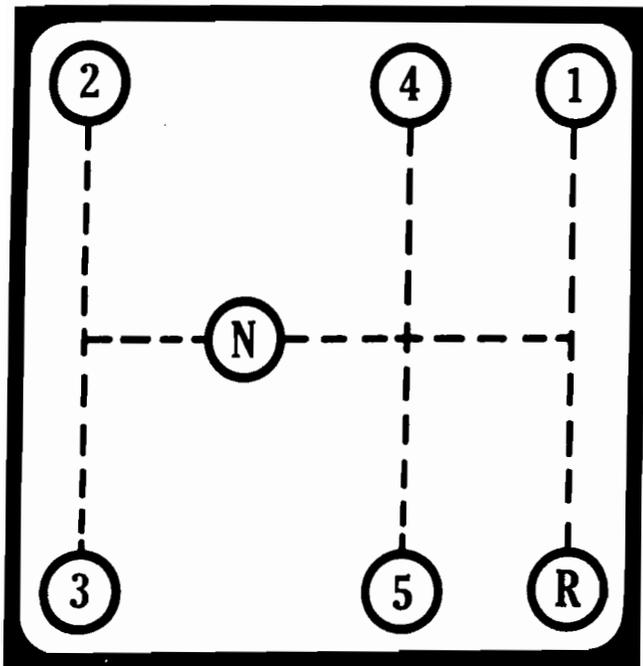
The Model F-52 transmission (S-A-430) is constructed having five forward speeds and one reverse. Fifth speed is overdrive. Fig. 3 illustrates the shift diagram.



A-22881

Fig. 2 - Shifting Diagram (F-52)

The Model F-52-C transmission (5-A-43) is constructed having five speeds forward and one reverse. Fifth speed is direct. Fig. 4 illustrates the shift diagram.



A-22883

Fig. 3 - Shifting Diagram (F-52-C)

Fig. 1 illustrates construction details of the F-52 and F-52-C transmissions and figure numbers in parentheses throughout this section will refer to this illustration. Item (18) on Fig. 1 will be referred to as mainshaft fifth speed gear although due to change in diameter on F-52-C, direct in fifth transmission, it is used as fourth speed gear.

DISASSEMBLING AND REASSEMBLING

With a few exceptions, the assembly is simply the reverse of disassembly. Therefore, the following disassembly instructions will also serve as reference for assembly.

1. Clean the outside of transmission, particularly around the control and bearing covers (15, 8, 5, 33).
2. Place shift lever (1) to neutral position, then remove the holding capscrews and lift off the control cover assembly. CAUTION: Do not try to force the cover off, as it may spring the shifting yokes and cause gear interference. A slight manipulation will free it.
3. Disassembling the control cover assembly:
 - (a) Remove four capscrews and lift shift lever cover assembly (5) from control cover assembly (8).
 - (b) Remove shift lever ball from shift lever (1) and also dust cover (2). Remove nut and lockwasher from pivot pin. Place cover in vise, grasp lower end of control lever spring (4) with a large pliers and twist it from its lugs. Spring may also be removed by use of a pinch bar and forcing spring over the retaining lugs. With the spring removed, releasing spring retainer (3), the lever (1) can be lowered through shift lever cover (5).
 - (c) Remove capscrews (6) and poppet spring and ball cover plate (7) releasing poppet springs (9) and balls (10). Cut lockwire at reverse shift block and remove lockscrew. Drive shift rail (42) toward rear of cover driving out shift rail cover (41). Pull shift rail out releasing reverse shift block on inside of cover. CAUTION: Do not lose poppet spring (9) and ball (10).
 - (d) Remove interlock ball retainer cap located on left outside of cover directly below poppet spring and ball housing, releasing the interlock ball and pin (11).

- (e) Continue disassembly operation in the same manner as described in paragraph (c) removing the balance of shift rails (42), covers (41), shift forks (12, 44), poppet springs and balls and interlock ball.

CAUTION: In reassembling the control cover assembly, care must be exercised to see that all parts are replaced in their correct positions and none of the small interlocking parts are lost or omitted.

4. Disassemble mainshaft assembly:

- (a) After locking gears by engaging two speeds, the countershaft rear bearing nut (32) is removed from end of countershaft. Remove rear bearing retainer (33). Slide off speedometer gear (35) and remove key.
- (b) Drive mainshaft assembly toward rear of case sufficiently to expose rear bearing (34) snap ring. Install suitable puller and pull bearing (34) from mainshaft (40). By tilting the mainshaft assembly front end upward, the entire unit comes out easily leaving sliding gears (46, 43) inside case. After shaft assembly is removed, the sliding gears may then be lifted out of case.
- (c) To disassemble the mainshaft, slide the sliding clutch (17) from front end of shaft. Remove gear retaining washer key (Fig. 5).

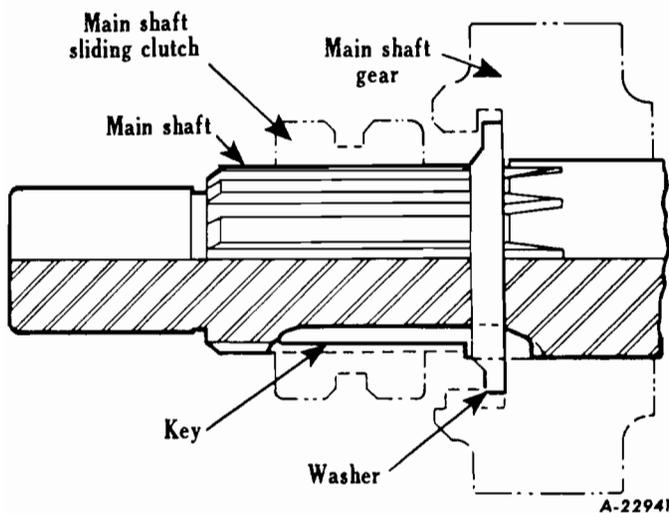


Fig. 4

After removing key, rotate gear retainer washer until its inside lugs line up with grooves in the shaft and then

remove. The bushed gears (18) (47) and sleeve are removed by using rear gear (47) to start the sleeve. Also remove the sleeve key from shaft.

5. To disassemble main drive gear:

- (a) Remove four capscrews from main drive gear bearing retainer (15). The main drive gear (16), bearing (14) and lock nut assembly can then be withdrawn through front of case.
- (b) Remove peened over material from slots in drive gear shaft (16) and turn off drive gear bearing lock nut. **NOTE** Nut is left-hand threaded. Press bearing (14) from main drive gear (16).

6. To disassemble countershaft and reverse idler gear:

- (a) To disassemble reverse idler gear, remove capscrew and lock plate from groove in idler. A simple method of pulling idler shaft, use a short piece of pipe, a long bolt having threads the same size as those tapped in end of shaft. Using a flat piece of steel with a hole in the center sufficiently large to permit passage of bolt. The nut is turned on the bolt close up to the head. The bolt is then passed through plate and pipe in order named and screwed into idler shaft. The nut is then tightened against the plate with the result that the pulling action is exerted against the shaft with the case acting as a base through the pipe and plate. After withdrawing reverse idler shaft, the gears (50, 51) are lifted from case and bearings removed from idler gear.
- (b) With the countershaft rear bearing lock nut (32) removed, drive countershaft assembly toward rear of case sufficiently to install suitable puller to remove rear bearing (31). By tilting the front end upward, the countershaft assembly is easily removed through top of case. Also remove front bearing thrust washer.
- (c) To disassemble countershaft, remove retaining snap ring from countershaft. Countershaft gears (23, 24, 25, 26) should be pressed off, one at a time, and keys (20) removed from shaft.

CAUTION: In reassembling, new snap rings should be used throughout the unit. When reassembling mainshaft assembly, always replace lock key and washer and make sure the gears are neither tight nor loose after they are assembled. Make sure that all gears in the unit are replaced in their proper position.



TRANSMISSIONS (F-54 AND F-54-B)

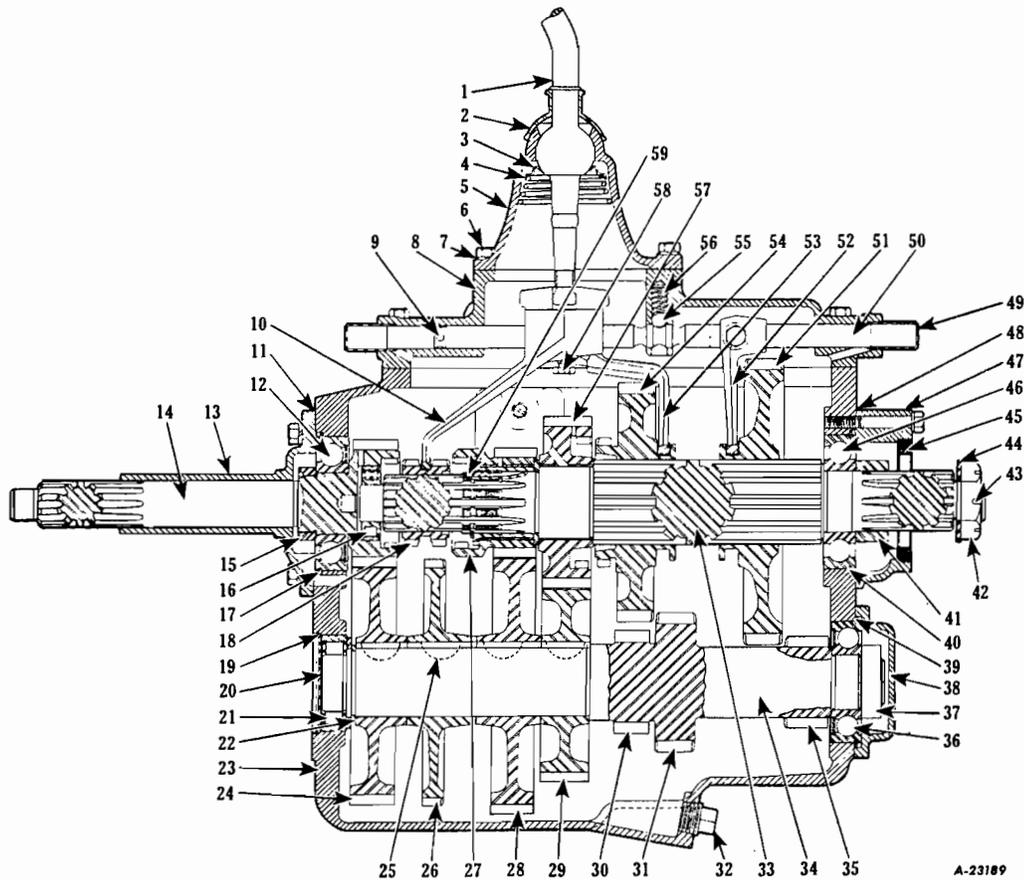


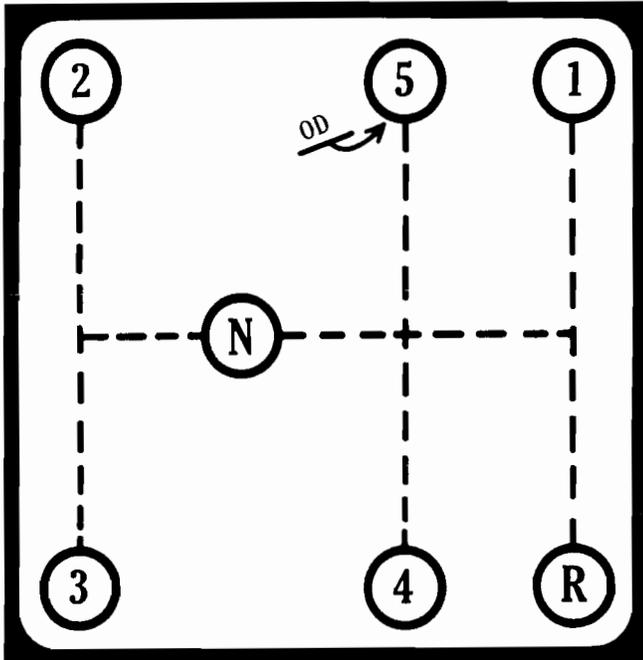
Fig. 1 - (F-54 and F-54-B)

| No. | Description | No. | Description | No. | Description |
|-----|--|-----|-------------------------------------|-----|---|
| 1. | Shift lever. | 23. | Transmission case. | 42. | Nut |
| 2. | Dust cover. | 24. | Countershaft drive gear. | 43. | Cotter pin. |
| 3. | Spring retainer. | 25. | Key. | 44. | Washer. |
| 4. | Spring. | 26. | Power take-off drive gear. | 45. | Mainshaft rear grease seal. |
| 5. | Shift lever cover. | 27. | Mainshaft overdrive gear. | 46. | Mainshaft rear bearing. |
| 6. | Capscrew. | 28. | Countershaft overdrive gear. | 47. | Rear bearing cover and speedometer housing. |
| 7. | Lockwasher. | 29. | Countershaft 3rd speed drive gear. | 48. | Gasket. |
| 8. | Control cover. | 30. | Reverse drive gear. | 49. | Shifter shaft rear cover. |
| 9. | Interlock pin. | 31. | Countershaft 2nd speed drive gear. | 50. | Shifter shafts. |
| 10. | Shifter fork (direct and overdrive). | 32. | Drain plug. | 51. | Mainshaft low and reverse sliding gear. |
| 11. | Retainer gasket. | 33. | Mainshaft. | 52. | Shifter fork (low and reverse). |
| 12. | Main drive gear bearing. | 34. | Countershaft. | 53. | Shifter fork (2nd and 3rd speed). |
| 13. | Main drive gear bearing retainer. | 35. | Countershaft low speed drive gear. | 54. | Mainshaft 2nd and 3rd speed sliding gear. |
| 14. | Main drive gear. | 36. | Countershaft rear bearing. | 55. | Poppet ball. |
| 15. | Main drive gear bearing retaining nut. | 37. | Countershaft rear bearing lock nut. | 56. | Poppet spring. |
| 16. | Mainshaft front bearing. | 38. | Countershaft rear bearing retainer. | 57. | Mainshaft 3rd speed constant mesh gear. |
| 17. | Snap ring. | 39. | Snap ring. | 58. | Shifter shaft lock screw. |
| 18. | Mainshaft sliding clutch. | 40. | Snap ring. | 59. | Mainshaft gear lock key. |
| 19. | Snap ring. | 41. | Speedometer drive gear. | | |
| 20. | Expansion plug. | | | | |
| 21. | Countershaft front bearing. | | | | |
| 22. | Spacer. | | | | |



TRANSMISSION (MODELS F-54 and F-54-B)

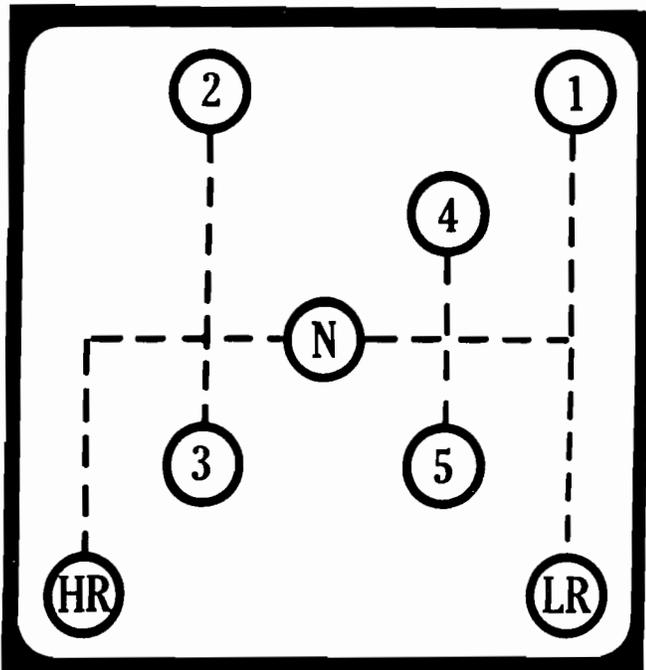
The Model F-54 transmission (5-A-620) is constructed having five forward speeds and one reverse. Fifth speed is overdrive. Fig. 2 illustrates the shift diagram.



A-22884

Fig. 2 - Shifting Diagram (F-54)

The Model F-54-B transmission (5-A-62) is constructed having five speeds forward and two reverse. Fifth speed is direct. Fig. 3 illustrates the shift diagram.



A-22885

Fig. 3 - Shifting Diagram (F-54-B)

Fig. 1 illustrates construction details of the F-54 and F-54-B transmissions and figure numbers in parentheses throughout this section will refer to this illustration. Item (27) on Fig. 1 will be referred to as mainshaft fifth speed gear although due to change in diameter on F-54-B, direct in fifth transmission, it is used as fourth speed gear.

DISASSEMBLING AND REASSEMBLING

With a few minor exceptions, the assembling is simply the reverse of disassembling. Therefore, the following disassembling instructions will also serve as reference for assembling.

1. Clean the outside of transmission, particularly around the control and bearing covers (5, 13, 8, 47, 38).
2. Place shift lever to neutral position and remove the holding capscrews and lift off control cover assembly (8). **CAUTION:** Do not try to force the cover off, as you may spring the shifting yoke and cause gear interference.
3. To disassemble control cover assembly:
 - (a) Remove four capscrews (6) and lift shift lever assembly (5) from control cover assembly (8).
 - (b) Remove shift lever ball from shift lever (1) and also dust cover (2). Remove nut and lockwasher from pivot pin. Place cover in a vise, grasp lower end of control lever spring (4) with a large pliers and twist it from its lugs. Spring may also be removed by use of a pinch bar and forcing over the retainer lugs. With the spring removed, releasing spring retainer (3), the lever (1) can be lowered through shift lever cover (5).
 - (c) Cut lockwire and remove shift fork lockscrew (58), starting with upper shift rail (50). Drive shift rail (50) out toward rear of cover driving out shift rail cover (thimble) (49). Shift fork can be lifted out of cover. **CAUTION:** Do not loose poppet springs (56) and balls (55).
 - (d) Continue disassembly operation removing the balance of shift rails (50) interlock pin (9) shifter forks (52, 53, 10) interlock balls, shift blocks and stop pins.

CAUTION: In reassembling the control cover, care should be exercised to see that all parts are replaced in their correct positions and none of the small interlocking parts are lost or omitted.



4. To remove mainshaft assembly:
- Remove mainshaft rear bearing retainer (47) and countershaft rear bearing (38). Slide off speedometer drive gear (41) and remove key. After locking gears by engaging two speeds, the countershaft rear bearing lock nut (37) is removed from end of countershaft.
 - Drive mainshaft assembly toward rear of case sufficiently to expose rear bearing snap ring (40). Install suitable puller and remove bearing (46) from mainshaft (33). By tilting the mainshaft assembly, front end upward, the entire unit comes out easily leaving sliding gears (51, 54) inside case. After shaft assembly is removed, the sliding gears may then be lifted out of case.
 - To disassemble the mainshaft, remove the pilot bearing (16) and sliding clutch (18) using the latter part to free the bearing. After removing key (59) (Fig. 4) rotate gear retainer washer until its inside lugs line up with grooves in shaft and then remove.
- (b) Remove peened over material from slot in drive gear shaft (14) and turn off drive gear bearing lock nut (17). NOTE: Nut is left hand threaded. Press bearing (12) from main drive gear (14).
6. To disassemble countershaft and reverse idler gears:
- To disassemble reverse idler gear or gears, remove capscrews and lock plates from groove in idler shafts. A simple method of pulling shaft, or shafts, use a short piece of pipe, a long bolt having threads the same size as those tapped in end of shaft. Using a flat steel plate with a hole in the center sufficiently large to permit passage of bolt. The nut is turned on the bolt close up to the head. The bolt is then passed through plate and pipe in order named and screwed into idler shaft. The nut is then tightened against the plate with the result that the pulling action is exerted against the shaft with the case acting as a base through pipe and plate. After withdrawing the idler shaft or shafts from case, the idler gears are lifted out through top of case and bearings removed from idler gears.

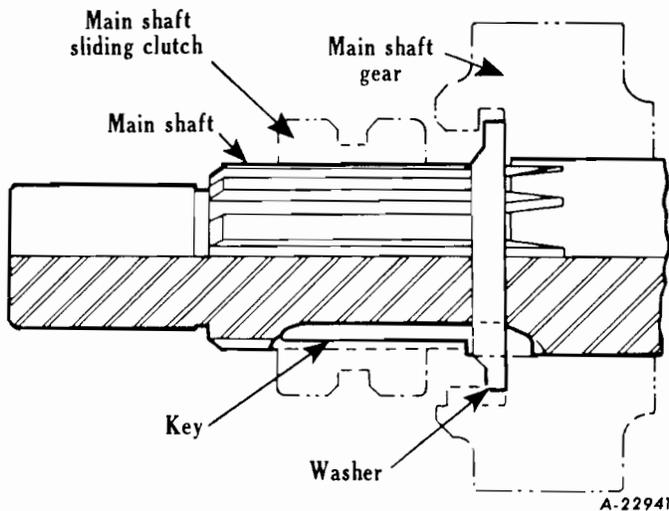


Fig. 4

The bushed gears (27) (57) and sleeve are removed by using rear gear (57) to start the sleeve. Also remove sleeve key from shaft.

5. To disassemble main drive gear:

- Remove four capscrews from main drive gear retainer (13), and lift off retainer. The main drive gear (14), bearing (12) and lock nut (15) can then be withdrawn through front of case.

- With the countershaft rear bearing lock nut (37) removed, drive countershaft assembly toward rear of case sufficiently to install suitable puller to remove rear bearing (36). By tilting the front end upward, the countershaft assembly is easily removed through top of case. Also remove front bearing thrust washer (22).
- To disassemble countershaft, remove retaining snap ring from countershaft. Gears (24) (26) (28) (29) should be pressed off, one at a time and keys (25) removed from shaft.

CAUTION: In reassembling, NEW snap rings should be used throughout the unit. When reassembling mainshaft assembly, always replace lock key and washer and make sure the gears are neither tight nor loose after they are assembled. Make sure that all gears in the unit are replaced in their proper position.



FULLER AUXILIARY TRANSMISSION — MODEL 2-A-45

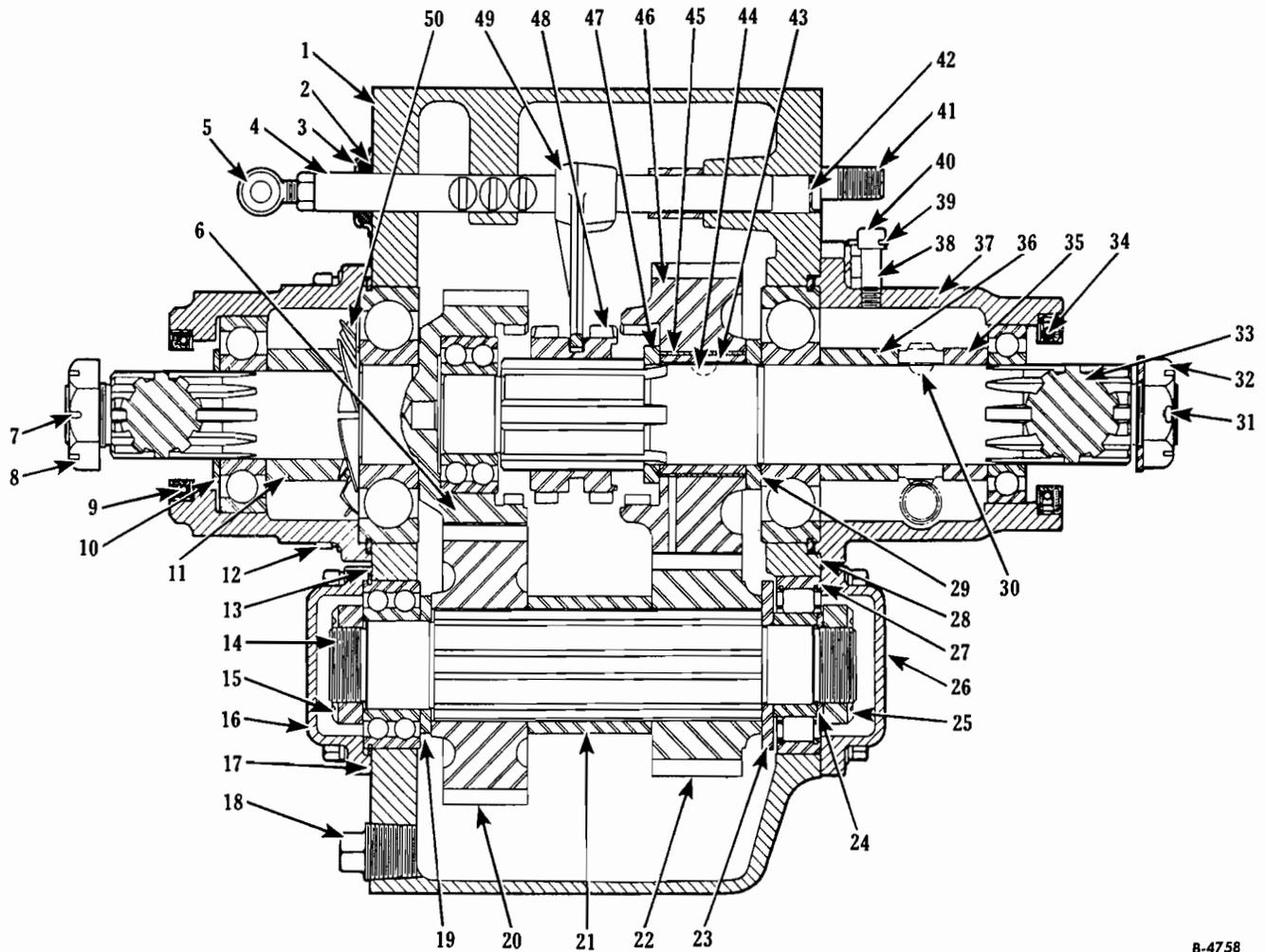


Fig. 1

B-4758

| No. | Description | No. | Description | No. | Description |
|-----|-----------------------------------|-----|-----------------------------------|-----|---|
| 1. | Transmission case. | 20. | washer. | 35. | Mainshaft. |
| 2. | Cork seal. | 21. | Countershaft drive gear. | 36. | Speedometer gear spacer. |
| 3. | Cork seal retainer. | 22. | Countershaft low-speed gear. | 37. | Rear bearing cover and speedometer housing. |
| 4. | Shifting bar. | 23. | Countershaft rear bearing spacer. | 38. | Breather pipe. |
| 5. | Shifting bar eyebolt. | 24. | Countershaft rear bearing washer. | 39. | Cotter pin. |
| 6. | Main drive gear. | 25. | Countershaft bearing nut. | 40. | Breather pipe cap. |
| 7. | Cotter pin. | 26. | Countershaft rear bearing cover. | 41. | Rear support stud. |
| 8. | Nut. | 27. | Gasket. | 42. | Oil retainer thimble. |
| 9. | Oil seal. | 28. | Gasket. | 43. | Mainshaft low-speed gear sleeve. |
| 10. | Mainshaft bearing washer. | 29. | Mainshaft washer. | 44. | Key. |
| 11. | Front bearing spacer. | 30. | Key. | 45. | Mainshaft low-speed gear bushing. |
| 12. | Front bearing cover. | 31. | Cotter pin. | 46. | Mainshaft low-speed gear. |
| 13. | Gasket. | 32. | Nut. | 47. | Mainshaft low-speed gear washer. |
| 14. | Countershaft. | 33. | Mainshaft. | 48. | Shifting yoke. |
| 15. | Countershaft bearing nut. | 34. | Oil seal. | 49. | Shifting yoke. |
| 16. | Countershaft front bearing cover. | | | 50. | Oil deflector. |
| 17. | Gasket. | | | | |
| 18. | Drain plug. | | | | |
| 19. | Countershaft front bearing | | | | |



POWER TAKE-OFF FOR FULLER MODEL 2-A-45 TRANSMISSION

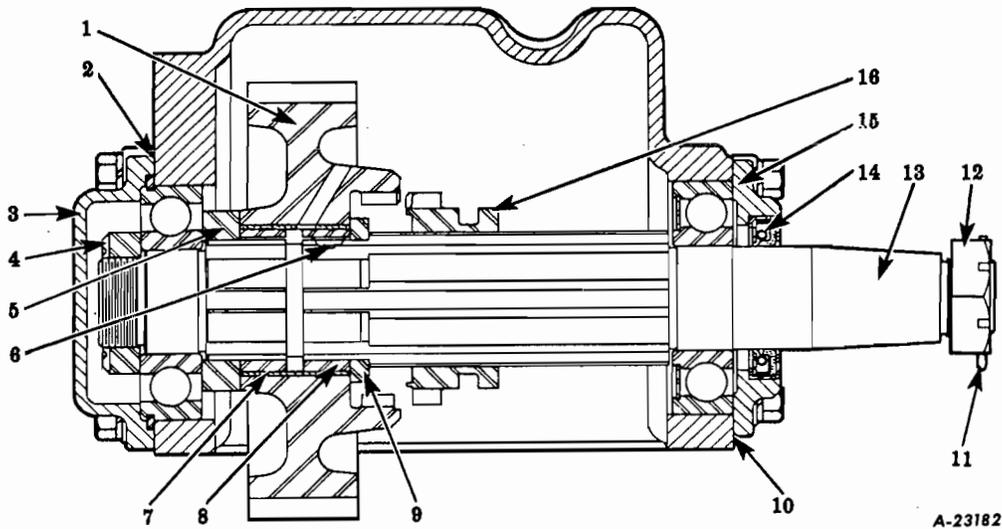


Fig. 2

| No. | Description |
|-----|---------------------------|
| 1. | Gear. |
| 2. | Gasket. |
| 3. | Front bearing cover. |
| 4. | Countershaft bearing nut. |
| 5. | Bearing spacer. |
| 6. | Key. |
| 7. | Bushing. |
| 8. | Gear sleeve. |
| 9. | Gear washer. |
| 10. | Gasket. |
| 11. | Cotter pin. |
| 12. | Nut. |
| 13. | Mainshaft. |
| 14. | Oil seal. |
| 15. | Rear bearing cover. |
| 16. | Mainshaft sliding clutch. |



The Fuller Model 2-A-45 Auxiliary Transmission is designed to be used in conjunction with regular transmissions.

The gear ratios of the two-speed Model 2-A-45 Auxiliary Transmission are as follows:

Direct-----1.00 to 1
Underdrive----1.3 to 1

The following procedure will be found helpful in servicing the unit:

(A) Dismantle Transmission

1. Remove capscrews holding side cover or power take-off.
2. Remove cover or power take-off, and gasket.
3. Remove poppet spring retainer screw.
4. Remove shifter fork lock screw.
5. Withdraw shifter bar.
CAUTION: Do not lose poppet spring and ball as shifter bar emerges.
6. Remove shifter fork.
7. Remove capscrews from countershaft front bearing cover.
8. Remove countershaft front bearing cover and gasket.
9. Remove countershaft rear bearing cover capscrews.
10. Remove countershaft rear bearing cover and gasket.
11. Lock transmission gears.
12. Remove countershaft front bearing lock nut.
13. Remove capscrews from main drive gear cover.
14. Remove main drive gear, bearings, and cover as a unit.
15. Press main drive gear from cover and bearing assembly.
16. Remove capscrews from main shaft rear bearing cover.
17. Remove rear bearing cover and gasket.
18. Remove main shaft rear bearing.
19. Remove rear bearing spacer.

20. Remove speedometer gear and key.
21. Remove inner bearing spacer.
22. Force main shaft out of rear bearing through main drive gear bearing bore in front of case, removing main shaft underdrive bushed gear and washer as shaft emerges.
23. Remove main shaft pilot bearing from shaft.
24. Remove main shaft sliding clutch gear.
25. Remove main shaft underdrive gear sleeve washer from shaft.
26. Remove main shaft underdrive gear sleeve and key from shaft.
27. Force countershaft toward rear and out of case, removing countershaft front bearing spacer washer, countershaft drive gear, gear spacer, and countershaft underdrive gear as shaft emerges.
28. Remove countershaft rear bearing lock nut and washer.
29. Press off countershaft rear bearing.
30. Remove countershaft rear bearing washer.
31. Remove countershaft front bearing from case.

(B) Assemble Transmission

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. Install countershaft in position by inserting through rear bore in case.
6. Install countershaft underdrive gear, gear spacer, countershaft drive gear, and front bearing spacer washer as shaft progresses.
7. Install main shaft underdrive gear sleeve and key on shaft.
8. Install main shaft underdrive gear sleeve washer on shaft.

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9. Install main shaft sliding clutch gear in position.
10. Press main shaft pilot bearing into position on shaft.
11. Install main shaft rear bearing in position in rear bore in case.
12. Insert main shaft assembly, previously prepared, through front bore in case and move toward the rear. Install rear bearing washer and main shaft underdrive bushed gear as shaft progresses.
13. Install main drive gear bearing in position on main drive gear.
14. Install main drive gear bearing spacer.
15. Install main drive gear outer bearing.
16. Install main drive gear and bearing assembly in position in case.
17. Install main drive gear and bearing cover and gasket.
18. Install capscrews in main drive gear bearing cover.
19. Install main shaft rear bearing spacer.
20. Install speedometer drive gear and key.
21. Install main shaft rear bearing spacer.
22. Install main shaft rear bearing.
23. Install rear bearing cover and gasket.
24. Install rear cover capscrews.
25. Install shifter bar through shifter fork, hub of shifter fork toward the rear.
26. Insert poppet spring and ball in position.
27. Push shifter fork into position.
28. Install poppet spring retainer screw.
29. Install shifter fork lock screw.
30. Install side cover or power take-off and gasket.
31. Install capscrews holding cover or power take-off.
32. Fill transmission with lubricant (10 pints).

BROWN-LIPE AUXILIARY TRANSMISSION — MODEL 5531

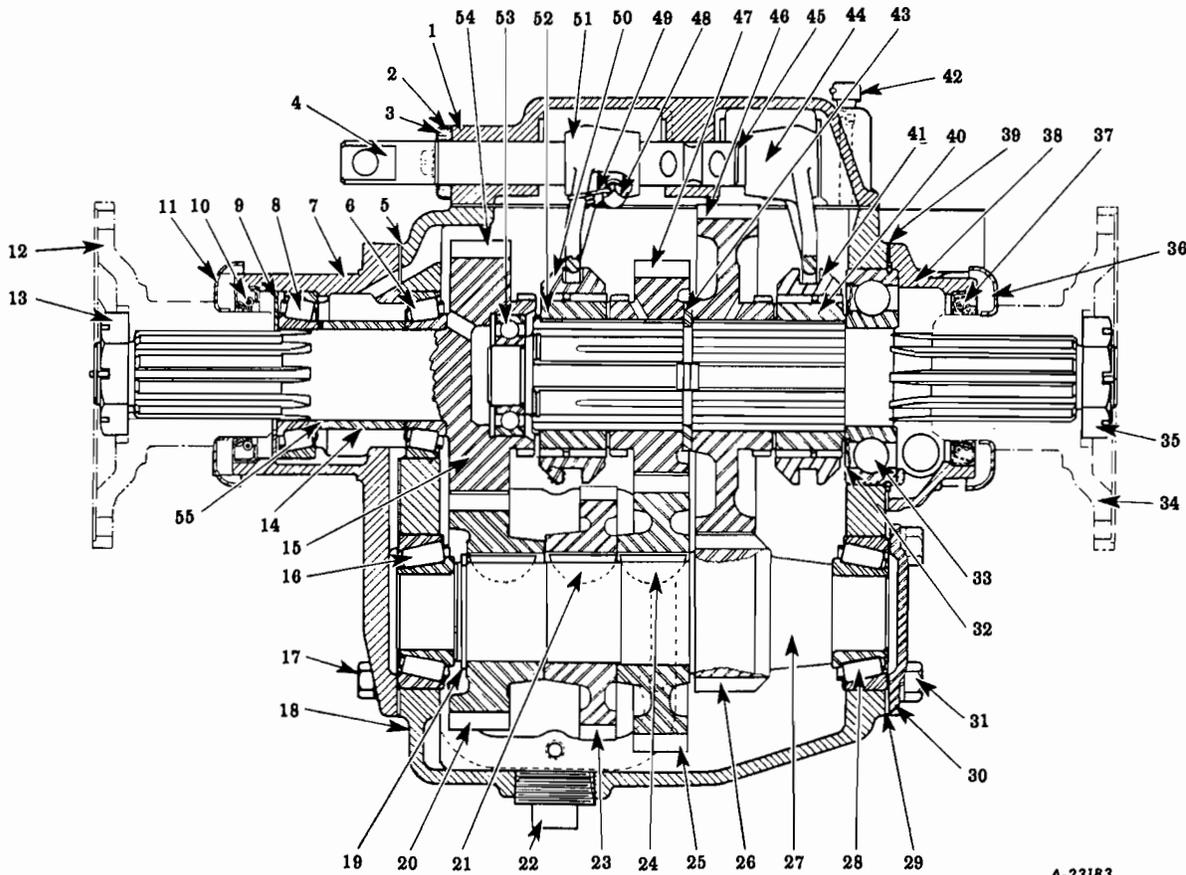


Fig. 1

| No. | Description | No. | Description | No. | Description |
|-----|--|-----|--|-----|---|
| 1. | Shifter housing. | 20. | Countershaft drive gear. | 37. | Mainshaft rear oil seal. |
| 2. | Shifter rod gland cover. | 21. | Woodruff key. | 38. | Mainshaft rear bearing retainer. |
| 3. | Shifter rod packing gland. | 22. | Drain plug. | 39. | Mainshaft rear bearing retainer gasket. |
| 4. | Shifter rail - direct and overdrive. | 23. | Power take-off gear. | 40. | Mainshaft clutch gear. |
| 5. | Mainshaft front bearing cap gasket. | 24. | Woodruff key. | 41. | Mainshaft clutch collar. |
| 6. | Mainshaft inner bearing. | 25. | Countershaft overdrive gear. | 42. | Breather assembly. |
| 7. | Mainshaft front bearing cap. | 26. | Countershaft underdrive gear. | 43. | Overdrive and underdrive gear spacer. |
| 8. | Mainshaft outer bearing. | 27. | Countershaft. | 44. | Underdrive shifter fork. |
| 9. | Drive gear front bearing oil slinger. | 28. | Countershaft rear bearing. | 45. | Underdrive shifting rod. |
| 10. | Drive gear front bearing oil seal. | 29. | Countershaft rear bearing shims. | 46. | Mainshaft underdrive gear. |
| 11. | Drive gear oil seal cover. | 30. | Countershaft rear bearing cap. | 47. | Mainshaft overdrive gear. |
| 12. | Companion flange. | 31. | Countershaft rear bearing retainer capscrew. | 48. | Shifter fork lock screw. |
| 13. | Mainshaft nut. | 32. | Mainshaft rear bearing spacer washer. | 49. | Shifter fork lock screw lockwire. |
| 14. | Drive gear bearing spacer. | 33. | Mainshaft rear bearing. | 50. | Mainshaft clutch collar. |
| 15. | Mainshaft drive gear. | 34. | Companion flange. | 51. | Overdrive shifter fork. |
| 16. | Countershaft front bearing. | 35. | Mainshaft nut. | 52. | Mainshaft clutch gear. |
| 17. | Countershaft front bearing retainer cap. | 36. | Mainshaft rear oil seal cover. | 53. | Mainshaft pocket bearing. |
| 18. | Transmission housing. | | | 54. | Main gears. |
| 19. | Countershaft gear snapping. | | | 55. | Main gear front bearing spacer shims. |



The Brown - Lipe Model No. 5531 Auxiliary Transmission is constructed with three speeds forward, with Direct Drive on second speed and Overdrive on third speed. There are no speeds in Reverse.

As an Auxiliary Transmission it is designed to be used in conjunction with standard four or five-speed transmissions.

The Gear Ratios of the Brown-Lipe No. 5531 Auxiliary Transmission are:

Direct----- 1.00 to 1.00
Overdrive----- .72 to 1.00
Underdrive----- 2.00 to 1.00

The following instructions will be found helpful in servicing the unit; and it will be noted that the procedure is best handled in sections.

(A) Dismantle Transmission

1. Drain transmission.
2. Remove shifter housing capscrews and housing.
3. Remove companion flange nut -- front.
4. Remove companion flange nut -- rear.
5. Remove companion flange -- front.
6. Remove companion flange -- rear.
7. Remove power take-off covers and gaskets.
8. Remove countershaft rear bearing cover and shims.
9. Remove countershaft front bearing cover and shims.
10. Drive countershaft toward rear of housing, forcing rear bearing cup from position.
11. Drop countershaft assembly to bottom of case.
12. Remove main shaft rear bearing cover.
13. Force main shaft assembly toward rear of case.
14. Remove main shaft rear bearing.
15. Tilt main shaft assembly and lift out through top of case.
16. Remove drive gear and bearing from top of case.
17. Remove countershaft assembly.

(B) Dismantle Countershaft Assembly

1. Remove countershaft front bearing cone.
2. Remove countershaft rear bearing cone.
3. Remove snap ring from front of countershaft.
4. Press off countershaft drive gear and remove key.
5. Press off countershaft overdrive gear and remove key.
6. Press off countershaft power take-off gear and remove key.

(C) Dismantle Main Shaft Assembly

1. Remove underdrive clutch gear collar.
2. Remove underdrive clutch gear.
3. Remove main shaft underdrive gear.
4. Remove direct and overdrive clutch gear collar.
5. Remove direct and overdrive clutch gear.
6. Remove direct and overdrive gear.
7. Remove main shaft snap-ring.

(D) Dismantle Shifter Housing Assembly

1. Remove lockwires from shifter rail setscrews.
2. Remove shifter rail setscrews.
3. Remove poppet retaining plugs and springs.
4. Remove overdrive shifter rail, poppets and springs, and shifter fork.
5. Remove underdrive shifter rail, poppets and springs, and shifter fork.
6. Remove shifter rail packing glands and covers.

(E) Dismantle Main Drive Gear Assembly

1. Remove pocket bearing.
2. Press off main drive gear bearing.

**(F) Dismantle Main Shaft Front Bearing Cover Assembly**

1. Remove front bearing oil seal.
2. Remove front bearing oil slinger.
3. Remove inner bearing race.

(G) Assemble Countershaft Assembly

1. Press countershaft power take-off gear into place after installing holding key.
2. Press countershaft overdrive gear and key into place.
3. Press countershaft drive gear and key into place.
4. Install countershaft gear lock-ring.
5. Install countershaft front bearing cone.
6. Install countershaft rear bearing cone.

(H) Assemble Main Shaft Assembly

1. Install main shaft snap-ring in place on shaft.
2. Install main shaft underdrive gear with clutch gear to rear of shaft.
3. Install main shaft underdrive clutch gear with flat face toward rear of shaft.
4. Install main shaft underdrive clutch gear collar with hub toward rear of shaft.
5. Install main shaft direct and overdrive gear with clutch gear to front of shaft.
6. Install main shaft direct and overdrive clutch gear with flat face toward front of shaft.
7. Install main shaft direct and overdrive gear clutch gear collar with clutch teeth toward the front.

(I) Assemble Transmission Shifter Housing Assembly

1. Install direct and overdrive shifter rail shifter fork, poppet ball and spring in place in housing cover. (Shifter fork must be installed with hub toward the rear.)
2. Install shifter rail interlock.
3. Install underdrive shifter rail, shifter fork, poppet ball, and spring in place in housing. (Shifter fork must be in-

stalled with hub toward the front.)

4. Lock underdrive shifter fork in place with setscrew.
5. Lock direct and overdrive shifter fork in place with setscrew.
6. Install lockwires through shifter fork setscrews.
7. Install poppet spring retaining plugs.
8. Install packing glands and covers for shifter rails.

(J) Assemble Transmission

1. Install countershaft front bearing cup in position in front of case.
2. Install countershaft front bearing cap and gasket.
3. Place countershaft and gear assembly in position in case.
4. Install countershaft rear bearing cup in place in bore of case.
5. Install countershaft rear bearing cap, gasket and shims.
6. There should be no perceptible bind or end play in the countershaft assembly. Make this assembly in such manner that there is a distinct drag felt and then add one .003" shim.
7. Remove front countershaft bearing cap.
8. Remove countershaft rear bearing cap gasket and shims.
9. Drive countershaft assembly toward rear of case, forcing rear bearing cup from position in bore of case.
10. Allow countershaft to lay in bottom of case.
11. Press bearing cone against shoulder of main drive gear.
12. Place front bearing cover over main drive gear shaft.
13. Install drive gear bearing spacer over shaft.
14. Install shims over spacer.
15. Install front bearing cone in cover.
16. Install companion flange.

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17. Install companion flange nut.
18. There should be no perceptible bind or end play in the main shaft assembly. Make this assembly in such manner that there is a distinct drag felt and then add one .003" shim.
19. Remove companion flange nut.
20. Remove companion flange.
21. Remove front cover, front bearing, and bearing spacer with shims.
22. Bolt front main shaft bearing cover in place to housing.
23. Install main drive gear and inner bearing in position through top of case.
24. Assemble drive gear bearing spacer, shims, and outer bearing as previously prepared.
25. Install oil slinger, oil seal, and dirt shield.
26. Install companion flange.
27. Install companion flange nut and cotter key.
28. Install main drive gear pocket bearing in hole in main drive gear.
29. Tilt main shaft gear assembly, previously prepared, and place in position in housing with pilot of shaft inside pocket bearing in main drive gear.
30. Using bar through power take-off opening, raise countershaft assembly into place.
31. Install countershaft rear bearing cup.
32. Bolt countershaft rear bearing cap, shims, and gasket into place.
33. Bolt countershaft front cover and gasket into place.
34. Using bar through power take-off opening, raise main shaft and gear assembly into place.
35. Install main shaft rear bearing.
36. Bolt main shaft rear bearing cap and gasket into place.
37. Install main shaft rear bearing oil slinger, oil seal, and dirt slinger in place.
38. Install companion flange.
39. Install companion flange nut and cotter key.
40. Install shifter housing and fork assembly in place with shifter forks in proper position.
41. Install shifter housing cover capscrews.
42. Install power take-off cover and gasket.
43. Fill with lubricant. (6 pints).

BROWN-LIPE AUXILIARY TRANSMISSION MODELS 6231 AND 6231-A

(FOR TEAR-DOWN ILLUSTRATIONS SEE SHOP TALK No. 38)

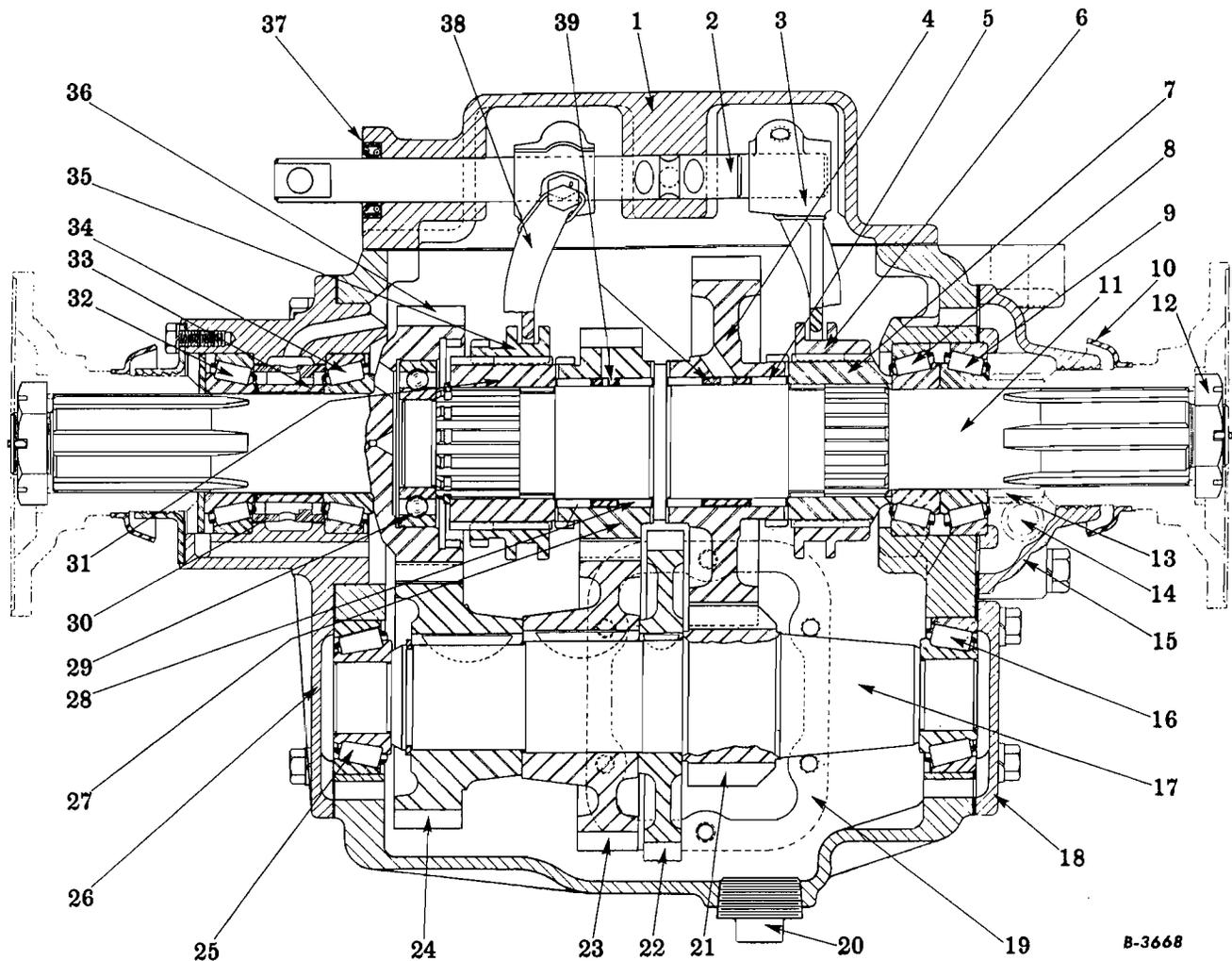


Fig. 1

B-3668

| No. | Description | No. | Description | No. | Description |
|-----|----------------------------|-----|--|-----|-------------------------------------|
| 1. | Cover. | | | 27. | Mainshaft overdrive gear. |
| 2. | Shift bar. | 16. | Countershaft rear bearing. | 28. | Needle bearings (47). |
| 3. | Shift fork. | 17. | Countershaft. | 29. | Mainshaft pilot bearing. |
| 4. | Underdrive gear. | 18. | Countershaft rear bearing retainer. | 30. | Sleeve (oil dam). |
| 5. | Needle bearings (47). | 19. | Power take-off opening. | 31. | Clutch gear. |
| 6. | Clutch collar. | 20. | Drain plug. | 32. | Mainshaft outer bearing (front). |
| 7. | Clutch gear. | 21. | Countershaft underdrive gear. | 33. | Sleeve. |
| 8. | Inner bearing (rear). | 22. | Power take-off gear. | 34. | Mainshaft inner bearing (front). |
| 9. | Outer bearing (rear). | 23. | Countershaft overdrive gear. | 35. | Clutch collar. |
| 10. | Slinger. | 24. | Countershaft drive gear. | 36. | Mainshaft drive gear. |
| 11. | Mainshaft. | 25. | Countershaft bearing front. | 37. | Seal. |
| 12. | Mainshaft flange nut. | 26. | Bearing retainer (front). | 38. | Shift fork. |
| 13. | Speedometer drive gear. | | | 39. | Spacers. |
| 14. | Speedometer driven gear. | | | | |
| 15. | Mainshaft rear bearing re- | | | | |



The Brown-Lipe Models No. 6231 and 6231-A auxiliary transmissions are constructed having three speeds forward. There are no speeds in reverse.

As an auxiliary transmission it is designed to be used in conjunction with a standard transmission.

The gear ratios of the Brown-Lipe No. 6231 auxiliary transmission are:

| | |
|------------|-----------|
| Direct | 1.00 to 1 |
| Overdrive | .69 to 1 |
| Underdrive | 2.14 to 1 |

The gear ratios of the Brown-Lipe No. 6231-A auxiliary transmission are:

| | |
|------------|-----------|
| Direct | 1.00 to 1 |
| Overdrive | .86 to 1 |
| Underdrive | 1.24 to 1 |

The following instructions will be found helpful in servicing the unit:

(A) Dismantle transmission:

1. Drain transmission.
2. Remove six cover retaining capscrews and lift off cover assembly and gasket.
3. Remove companion flange nut and flange - front.
4. Remove companion flange nut and flange - rear.
5. Remove power take-off covers and gaskets.
6. Remove countershaft rear bearing cover and shims.
7. Remove mainshaft rear bearing retainers, shims, gasket and speedometer drive gear.
8. Remove seven main drive gear and bearing retainer assembly capscrews and lockwashers.
9. Lift off main drive gear and retainer assembly, leaving pilot bearing in the drive gear.
10. Remove clutch collar from front of mainshaft.
11. Support mainshaft underdrive gear on blocks inside of front face of transmission case. Press mainshaft out of rear bearings, underdrive clutch gear,

collar and underdrive gear. NOTE: Do not lose any of the loose needle bearings located in the underdrive gear. There are 47 rollers in each row of bearings.

12. The mainshaft assembly can then be removed out through front of case and underdrive gear lifted out through top of case.
13. Press out mainshaft rear, outer bearing cup and use a brass drift and carefully drive out mainshaft front bearing cup.
14. Tap forward end of countershaft with soft hammer to drive out countershaft rear bearing cup.
15. Lift countershaft assembly out through top of case and then remove countershaft front bearing cup.

(B) Dismantle countershaft assembly:

1. Remove countershaft rear and front bearing cones.
2. Remove snap-ring from front end of countershaft.
3. Press off countershaft drive gear and remove key.
4. Press off countershaft overdrive gear and remove key.
5. Press off countershaft power take-off gear and remove key.

(C) Dismantle the mainshaft assembly:

1. Remove underdrive clutch gear and collar.
2. Remove mainshaft underdrive gear.
3. Remove snap ring from front end of mainshaft.
4. Remove direct and overdrive clutch gear and collar.
5. Remove overdrive gear and roller bearings. NOTE: There are 47 needle bearings in each of the two rows used, with a spacer sleeve between the rows.

(D) Dismantle shifter housing assembly:

1. Cut lockwires and remove shift fork lock screws.
2. Remove poppet retaining plugs releasing balls and springs.



3. Pull overdrive shift rail out through front of cover and remove shift fork.
4. Pull underdrive shift out through front of cover and remove shift fork.
5. Remove shift rails interlock pin and seals.

(E) Dismantle main drive gear assembly:

1. Remove four oil retainer capscrews and lockwashers and lift off oil retainer and gasket.
2. Lift out spacing washer.
3. Press on end of main drive gear shaft to remove shaft, spacer sleeve, shims and inner bearing cone from retainer. NOTE: Keep shim pack together.
4. Press inner and outer bearing cups out of retainer together with oil sleeve.
5. Remove pilot bearing from main drive gear.

(F) Assemble the main drive gear assembly:

1. Install inner bearing race in the retainer, then place the oil sleeve (or lubricant-dam sleeve) in the retainer with the ridge of the oil sleeve toward inside of the retainer casting. Be sure to locate oil sleeve holes in proper location. The sleeve permits building up a reservoir of oil to assure front bearing lubrication.
2. Press in outer bearing cup.
3. Press inner bearing cone on the main drive gear and install spacer and shims.
4. Slide main drive gear shaft through retainer assembly and install outer cone.
5. Place suitable tubing over end of main drive gear shaft and against outer bearing cone. Press against tubing to seat the bearings and shims. Approximately 30 tons pressure against sleeve will suffice to firmly seat the bearings. Bearing adjustment must be .000" to .002" tight.
6. Install spacing washer and oil retainer on outer end of drive gear shaft retainer.
7. Install companion flange and nut draw down tight.
8. Install mainshaft pilot bearing in main drive gear.

(G) Assemble countershaft assembly:

1. Press countershaft power take-off gear into place after installing holding key.
2. Press countershaft overdrive gear into place after installing holding key.
3. Press countershaft drive gear into place after installing holding key.
4. Install countershaft gear snap ring.
5. Install countershaft front and rear bearing cones.

(H) Assemble mainshaft assembly:

1. Place mainshaft underdrive gear on flat surface and insert a little non-soap, viscous type, low melting point grease in the bore of the gear. Insert one row of roller bearings (47 rollers), and turn gear over and insert spacer.
2. Insert second row of bearings (47 rollers). Note that when all bearings are in place there is a space wide enough for another roller. Do not place another roller in the bearing row. The space is left to provide rolling clearance for all the rollers in that particular row.
3. Repeat roller installation as outlined in paragraphs (1 & 2) with the mainshaft overdrive gear.
4. Slide overdrive gear on shaft being careful not to disturb the rollers.
5. Place clutch gear on mainshaft with flat face of gear toward front of shaft and install gear retaining snap ring.
6. Carefully place mainshaft underdrive gear, with bearings, on shaft with clutch teeth on gear toward rear and install clutch collar.

(I) Assemble transmission shifter housing assembly:

1. Install direct and overdrive shift rail, shift fork, poppet ball and spring, in place in housing cover. (Shift fork must be installed with hub toward rear.)
2. Install shift rail interlock pin.
3. Install underdrive shift rail, shift fork, poppet ball and spring in place in housing. (Shift fork must be installed with hub toward front.)



4. Lock shift forks in place with setscrews and install lockwires through setscrews.
5. Install poppet springs, balls and retainer plugs.
6. Install shift rail seals.
7. Holding the mainshaft and gear assembly together, with fingers in clutch collar groove, tilt the shaft, and install in case, being careful to hold underdrive gear and clutch collar in position.
8. With the mainshaft gears resting on the countershaft, slide the underdrive clutch gear through rear bore onto the mainshaft and into the underdrive clutch collar. NOTE: Beveled end of gear toward rear of case.

(J) Assemble transmission:

1. Install countershaft front bearing cup in position in front of case.
2. Install front bearing retainer and gasket.
3. Place countershaft and gear assembly in position in case and tap toward front of case until gear contacts inside face of case.
4. Install countershaft rear bearing cup in place in bore of case.
5. Install rear bearing cap, gasket and shims.

Add or remove shims at rear bearing retainer to provide an adjustment of .000" to .003" loose. Such an adjustment will allow the countershaft to revolve freely and with no perceptible end play or drag.
6. Remove front bearing retainer and proceed with the assembly.
9. Place overdrive clutch collar on direct and overdrive clutch gear with clutch collar teeth toward front.
10. Install main drive gear and retainer assembly previously assembled.
11. Install rear bearing cups, cones, speedometer drive gear, and bearing retainer with shims.
12. Adjust mainshaft assembly to obtain .000" to .003" loose bearing adjustment.
13. Install companion flange, nut and cotter key - tighten securely.
14. Install transmission cover assembly, being sure that the shifting forks engage clutch collars and tighten all capscrews securely.
15. Fill with specified lubricant per lubrication section - (Capacity 8 pints).