Service Manual

Fuller Mid Range Transmissions TRSM0194

October 2007

Powering Business Worldwide

BACKED BY Roadranger SUPPORT

Caution -

Before towing the vehicle, be sure to lift the rear wheels off the ground or disconnect the driveline to avoid damage to the transmission during towing.

FOREWARD

This manual has been prepared to provide the customer and the maintenance personnel with information and instructions on the maintenance and repair of the CLARK® Transmission.
Extreme care has been exercised in the design, selection of materials and manufacturing of these units. The slight outlay in personal attention and cost required to provide regular and proper lubrication, inspection at stated intervals, and such adjustments as may be indicated will be reimbursed many times in low cost operation and trouble free service.
In order to become familiar with the various parts of the transmission, its principle of operation, troubleshooting and adjustments, it is urged that the service person study the instructions in this manual carefully and use it as a reference when performing maintenance and repair operations.
Whenever repair or replacement of components parts is required, only Clark-approved parts as listed in the applicable parts manual should be used. Use of “will-fit” or non-approved parts may endanger proper operation and performance of the equipment. The Clark Equipment Company does not warrant repair or replacement parts, nor failures resulting from the use thereof, which are not supplied by or approved by the Clark Equipment Company.

IMPORTANT: Always furnish the Distributor with the transmission serial and model number when ordering parts.

THE CLARK SYNCHRONIZER AND HOW IT WORKS FOR YOU

The Clark split-pin synchronizer prevents the clashing of the gears and increase the speed of shifting.

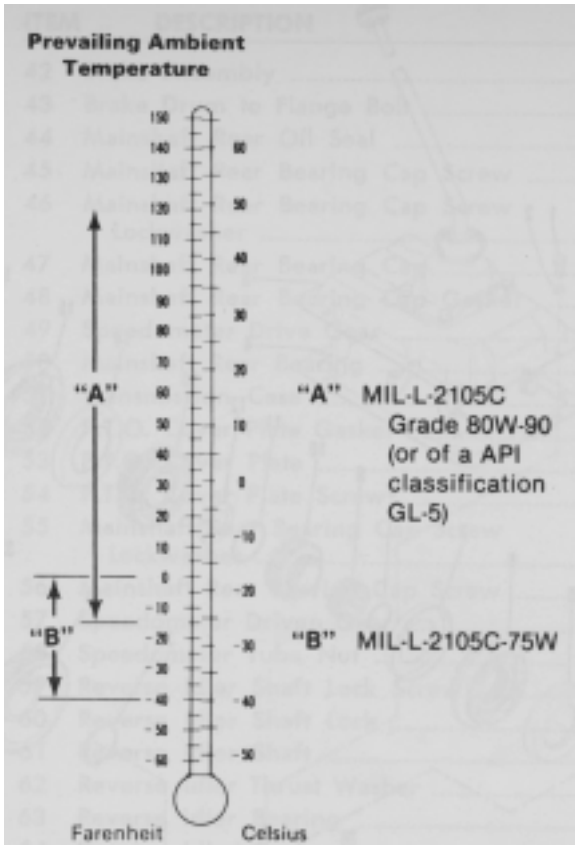
In a conventional transmission which does not have synchronizers the absence of gear clashing is dependent entirely on the skill of the truck driver. By double-clutching and split second timing of engine speeds with the gear shifting movement, a driver can synchronize the speeds of the engaging gears and thereby prevent the damage to gears by clashing when a fast shift. The splint-pin sychronzier performs the same function with or without the “double-clutching” operating even though the driver does not accurately time his gear shifting movements. It also mechanically prevents the driver from completing the shift to the point of gear engagement until the engaging gears have reached the same or synchronous speeds. This is known as the blocking action of the synchronizer and it is this action that makes the operation of shifting a transmission having synchronizers different from one which does not have synchronizers.

Upon shifting gears in these synchronized transmissions the first part of the gear shift lever movement brings the blockers into contact. The blockers momentarily prevent further movement of the shift lever and the pressure exerted by the driver to complete the movement, is transferred by the blockers to the synchronizer providing the force necessary to synchronize the gears being engaged. When the engaging gears have reached the same speed, the blockers automatically disengage, permitting the gear shift lever movement to be completed. Therefore, to properly shift a synchronized transmission a steady and continuous pressure must be applied by the driver to the shift lever until the shift is completed. Under normal conditions this action is instantaneous.

Sometimes difficulty is experienced in shifting a synchronizer when the vehicle is standing still. This is caused by the fact that the disengagement of the blockers requires relative rotation and with the vehicle at rest and with the engine clutch released, there may be at times, no relative rotation of the engaging gears. Under these conditions, the same continuous pressure should be applied to the shift lever and at the same time, the clutch should be engaged slightly. This will give sufficient rotation to unblock the synchronizer and allow the shift to be completed without difficulty.

RECOMMENDED LUBRICANTS FOR CLARK MANUALLY SHIFTED TRANSMISSIONS

*Mil-L-2105C Extreme Pressure Lubricant (or API classification GL-5) of the SAE viscosity recommended in the chart at the right is preferred. All lubricants should be backed by the reputation of a well-know supplier. It is important to specify EP lubricants of the MIL-L-2105C type only, or of a API classification GL-5.



***Do not use extreme pressure lubricants other than MIL-L-2105C or of a API classification GL-5.**

Many EP lubricants contain highly-active chemical compounds that have been formulated to perform satisfactorily in specific types of applications. Severe corrosion, residual deposits, and inadequate lubrication may result from improper application. Use of EP lubricants other that MIL-L-2105C or of a API classification GL-5 may result in failure and/or impaired operation.

DRAINING ECONOMY - The object in draining the transmission oil periodically is to eliminate possible bearing surface abrasion and attendant wear. Minute particles of metal, the product of normal wear in service, are deposited in and circulate with the transmission oil. The oil changes chemically, due to its repeated heating and cooling, also the terrific churning it undergoes in the presence of air. It is desirable to drain out this used oil after the first 1,000 miles (1609,0 Km) of service (regardless of type of service). Subsequent drains should be made every 24,000 miles (38616,0 Km) or six (6) months (whichever comes first) for highway service, and every 8,000 to 10,000 miles [12872,0-16090,0 Km] or six (6) months (whichever comes first) “on-off” highway and “pick-up and delivery” types of service. Do this only when the transmission is thoroughly warm.

FLUSHING - After draining, flushing is desirable. Replace the drain plug and fill the transmission to the proper level with a light flushing oil. Drive the transmission for a short period at fast idle in such a manner that the gears in the transmission are rotating without load. This washes out the old oil clinging to the interior of the gear case, covers and shifter rails. BE SURE TO DRAIN OUT ALL of the flushing oil before attempting to refill with new oil. This flushing procedure is most important after first drain.

REFILL - First, removal all dirt around the filler plug, Then refill with new oil of a grade recommended for the existing season and prevailing service. Fill to the bottom of the level testing plug positioned on the side of the transmission. DO NOT OVERFILL, as the excess quantity will serve no useful purpose. If the oil level is too high, it will cause excessive oil churning and high oil temperature and possible leakage.

INSPECTION - Oil level inspection should be made every 6,000 miles [9654,0 Km] which usually coincides with the vehicle manufacturers chassis lube procedure. Always clean around filler plug before inspection. Add sufficient oil to maintain correct level.

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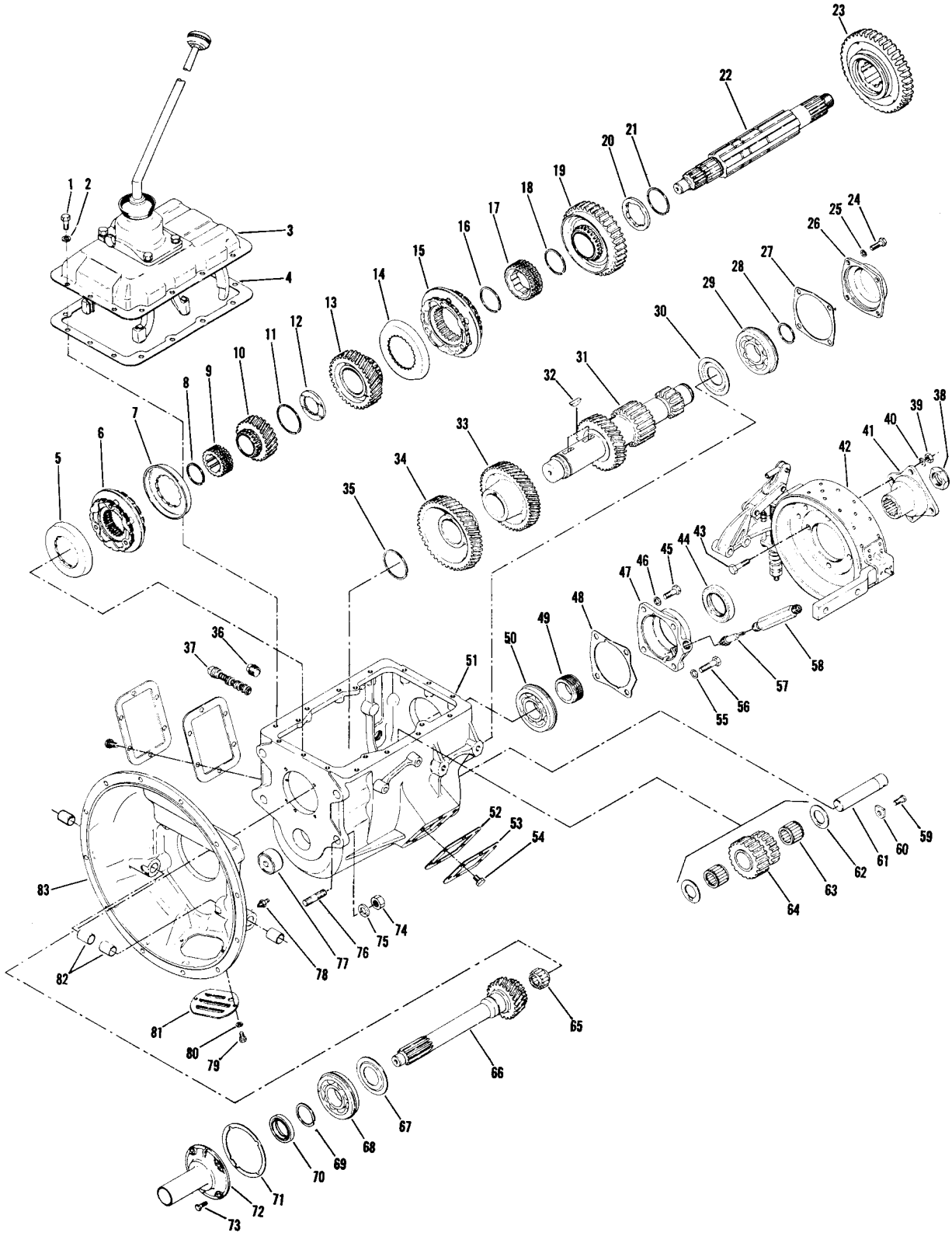
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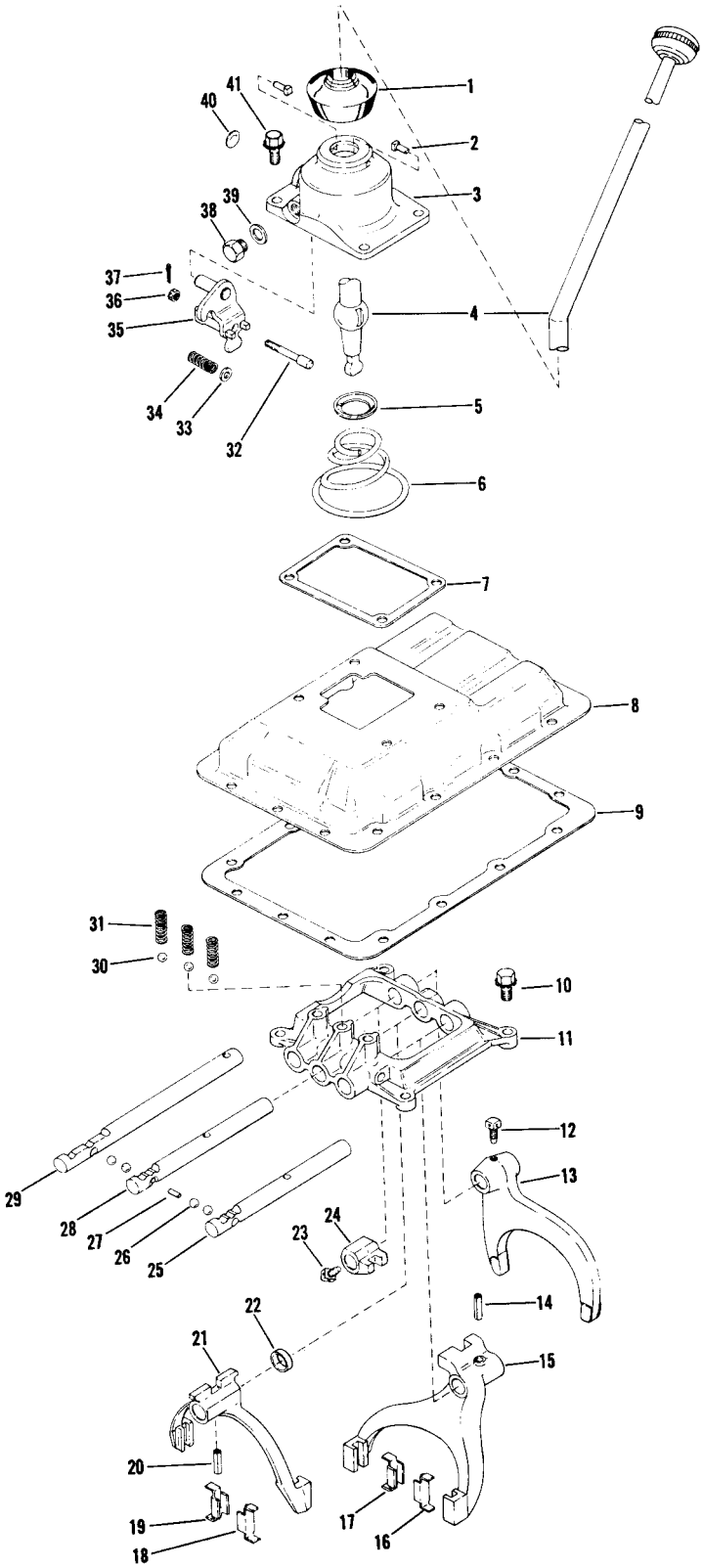
280V-Series Transmission

Item	Description	QTY
1	Shift Rod Cover Screw	14
2	Shift Rod Cover Screw Lockwasher	14
3	Control Cover (Stamped version)	1
4	Control Cover Gasket	1
5	Mainshaft 5th Speed Synchronizer Cup	1
6	Mainshaft 4th & 5th Synchronizer Assembly	1
7	Mainshaft 4th Speed Synchronizer Cup	1
8	Mainshaft 4th & 5th Shift Hub Sleeve Retainer Ring	1
9	Mainshaft 4th & 5th Shift Hub Sleeve	1
10	Mainshaft 4th Speed Gear	1
11	Mainshaft 3rd Gear Retainer Ring	1
12	Mainshaft 3rd Gear Locating Washer	1
13	Mainshaft 3rd Speed Gear	1
14	Mainshaft 3rd Speed Synchronizer Cup	1
15	Mainshaft 2nd & 3rd Synchronizer Assembly	1
16	Mainshaft 2nd & 3rd Shift Hub Sleeve Retainer Ring	1
17	Mainshaft 2nd & 3rd Shift Hub Sleeve	1
18	Mainshaft 2nd & 3rd Shift Hub Sleeve Retainer Ring	1
19	Mainshaft 2nd Speed Gear	1
20	Mainshaft 2nd Speed Gear Locating Washer	1
21	Mainshaft 2nd Speed Gear Retainer Ring	1
22	Mainshaft	1
23	Mainshaft 1st & Reverse Gear	1
24	Countershaft Rear Bearing capscrew	4
25	Countershaft Rear Bearing Cap Lockwasher	4
26	Countershaft Rear Bearing Cap	1
27	Countershaft Rear Bearing Cap Gasket	1
28	Countershaft Rear Bearing Cap Retainer Ring	1
29	Countershaft Rear Bearing	1
30	Countershaft Rear Bearing Oil Slinger	1
31	Countershaft	1
32	Countershaft Gear Key	1
33	Countershaft 4th Speed Gear	2
34	Countershaft Drive Gear	1
35	Countershaft Drive Gear Retainer Ring	1
36	Filler Plug	1
37	Magnetic Drain Plug	1
38	Flange Nut	1
39	Flange to Drum Bolt Nut	4
40	Flange to Drum Bolt Lockwasher	4
41	Companion Flange	1
42	Brake Assembly	1
43	Brake Drum to Flange Bolt	4
44	Mainshaft Rear Oil Seal	1
45	Mainshaft Rear Bearing capscrew	3
46	Mainshaft Rear Bearing capscrew Lockwasher	3
47	Mainshaft Rear Bearing Cap	1
48	Mainshaft Rear Bearing Cap Gasket	2
49	Speedometer Drive Gear	1
50	Mainshaft Rear Bearing	1
51	Transmission Case	1
52	P.T.O. Cover Plate Gasket	2
53	P.T.O. Cover Plate	2
54	P.T.O. Cover Plate Screw	12
55	Mainshaft Rear Bearing capscrew Lockwasher	1
56	Mainshaft Rear Bearing capscrew	1
57	Speedometer Driven Gear	1
58	Speedometer Tube Nut	1
59	Reverse Idler Shaft Lock Screw	1
60	Reverse Idler Shaft Lock	1
61	Reverse Idler Shaft	1
62	Reverse Idler Thrust Washer	2
63	Reverse Idler Bearing	2
64	Reverse Idler Gear	1
65	Mainshaft Spigot Bearing	1
66	Main Drive Gear	1
67	Main Drive Gear Bearing Oil Slinger	1
68	Main Drive Gear Bearing	1
69	Main Drive Gear Bearing Retainer Ring	1
70	Main Drive Gear Bearing Cap Oil Seal	1
71	Main Drive Gear Bearing Cap Gasket	1
72	Main Drive Gear Bearing Cap	1
73	Main Drive Gear Bearing capscrew	4
74	Clutch Housing Stud Nut	4
75	Clutch Housing Stud Nut Lockwasher	4
76	Clutch Housing Stud	4
77	Countershaft Pilot Bearing	1
78	Pedal Shaft Grease Fitting	2
79	Clutch Housing Inspection Plate Bolt	2
80	Clutch Housing Inspection Plate Lockwasher	2
81	Clutch Housing Inspection Plate	1
82	Clutch Pedal Shaft Bushing	4
83	Clutch Housing	1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280V-SERIES CONTROL PARTS GROUP (Stamped Cover)

ITEM	Description	QTY
1	Gear Shift Lever Dust Cover	1
2	Gear Shift Lever Pivot Pin	2
3	Control Top	1
4	Gear Shift Lever	1
5	Gear Shift Lever Support Washer	1
6	Support Spring	1
7	Control Top Gasket	1
8	Shift Rod Cover	1
9	Shift Rod Cover Gasket	1
10	Shift Rod Support Screw and Lockwasher	4
11	Shift Rod Support	1
12	1st & Reverse Shift Fork Lockscrew	1
13	1st & Reverse Shift Fork	1
14	Shift Fork Lock Pin	1
15	4th & 5th Shift Fork Assembly (Inc. Items 16 & 17)	1
16	Shift Fork Bushing	2
17	Shift Fork Bushing	2
18	Shift Fork Bushing	2
19	Shift Fork Bushing	2
20	Shift Fork Lock Pin	1
21	2nd & 3rd Fork Assembly (Inc. Items 18 & 19)	1
22	2nd Speed Overshift Spacer	1
23	Reverse Shift Lug Lock Screw	1
24	Reverse Shift Lug	1
25	4th & 5th Shift Rod	1
26	Mesh Lock Ball	4
27	Interlock Cross Pin	1
28	2nd & 3rd Shift Rod	1
29	1st & Reverse Shift Rod	1
30	Mesh Lock Spring	3
31	Mesh Lock Spring	3
32	Reverse Latch Plunger	1
33	Reverse Latch Plunger Retainer Washer	1
34	Reverse Latch Plunger Spring	1
35	1st & Reverse Rocker	1
36	Reverse Latch Plunger Nut	1
37	Reverse Latch Plunger Nut Cotter	1
38	Backup Switch Hole Plug	1
39	Backup Switch Hole Plug Gasket	1
40	Welch Plug	1
41	Control Top Screw & Lockwasher	4

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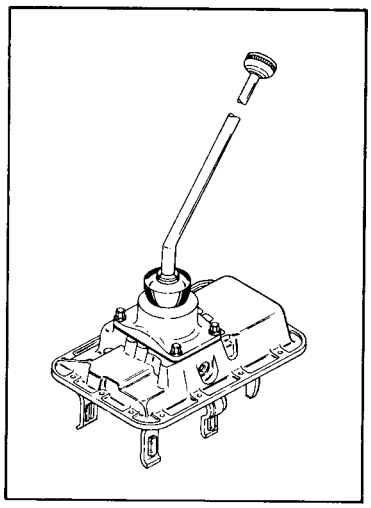

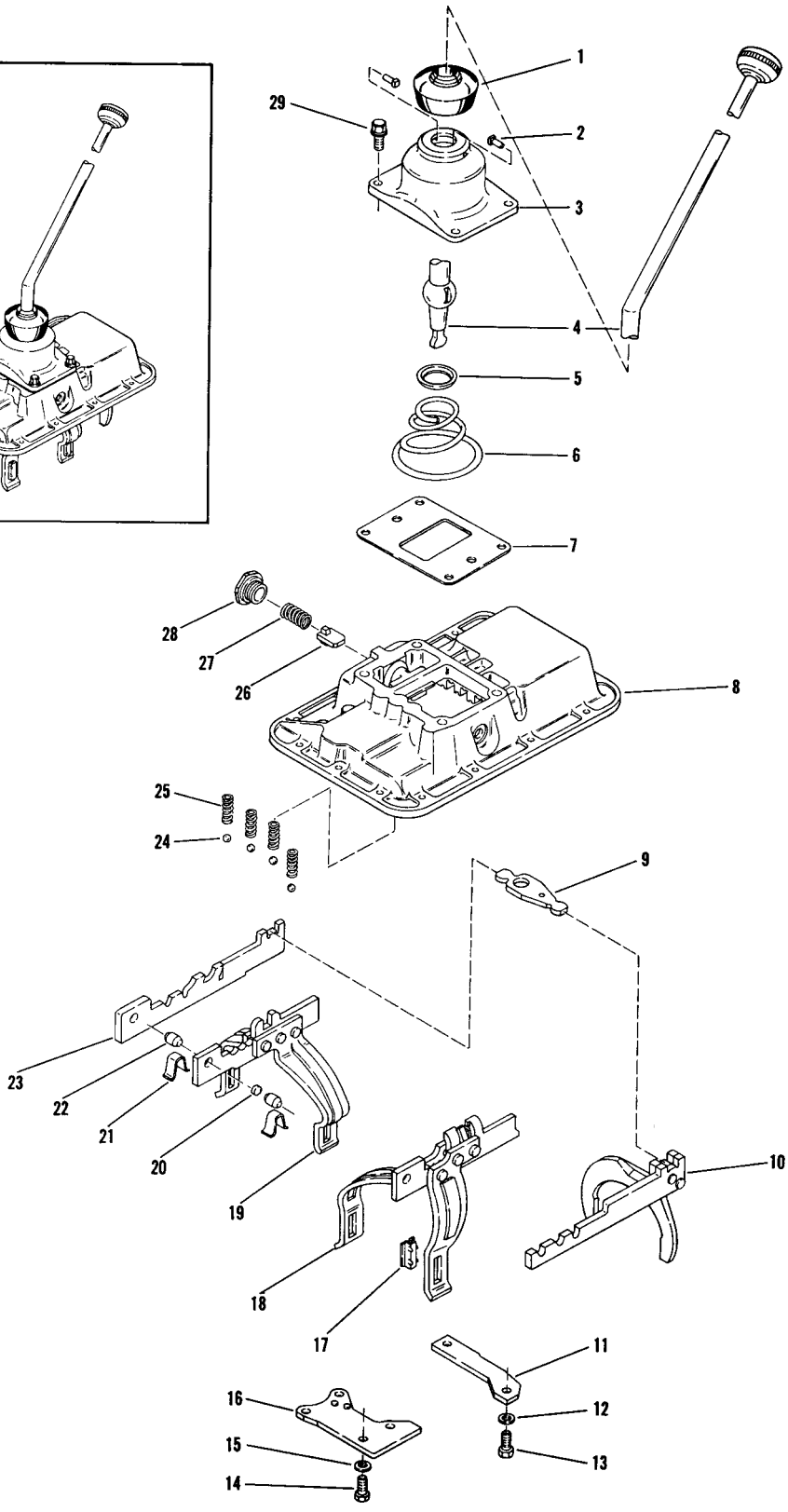

280V-SERIES CONTROL PARTS GROUP (Diecast Cover - Fabricate Rails)

ITEM	Description	QTY
1	Gear Shift Lever Dust Cover	1
2	Gear Shift Lever Pivot Pin	2
3	Control Top	1
4	Gear Shift Lever	1
5	Gear Shift Lever Support Washer	1
6	Support Spring	1
7	Control Top or Remote Control Gasket	1
8	Control Cover	1
9	1st & Reverse Rocker Arm	1
10	1st & Reverse Shift Fork & Rail Assembly	1
11	Rear Rail Support	1
12	Rear Rail Support Capscrew Lockwasher	2
13	Rear Rail Support Capscrew	4
14	Front Rail Support Capscrew	4
15	Front Rail Support Capscrew Lockwasher	4
16	Front Rail Support	1
17	2nd & 3rd, 4th & 5th Shift Fork Bushing	4
18	4th & 5th Shift Fork & Rail Ass'y (Includes Item #17)	1
19	2nd & 3rd Shift Fork & Rail Ass'y (Includes Item #17)	1
20	Interlock Cross Pin	1
21	Interlock Tapered Pin Support	2
22	Interlock Tapered Pin	2
23	1st & Reverse Shift Rail	1
24	Mesh Lock Poppet Rails	4
25	Poppet Springs	4
26	Reverse Latch Plunger	1
27	Plunger Spring	1
28	Plunger Spring Retaining Plug	1
	Control Top or Remote Control Capscrew	4

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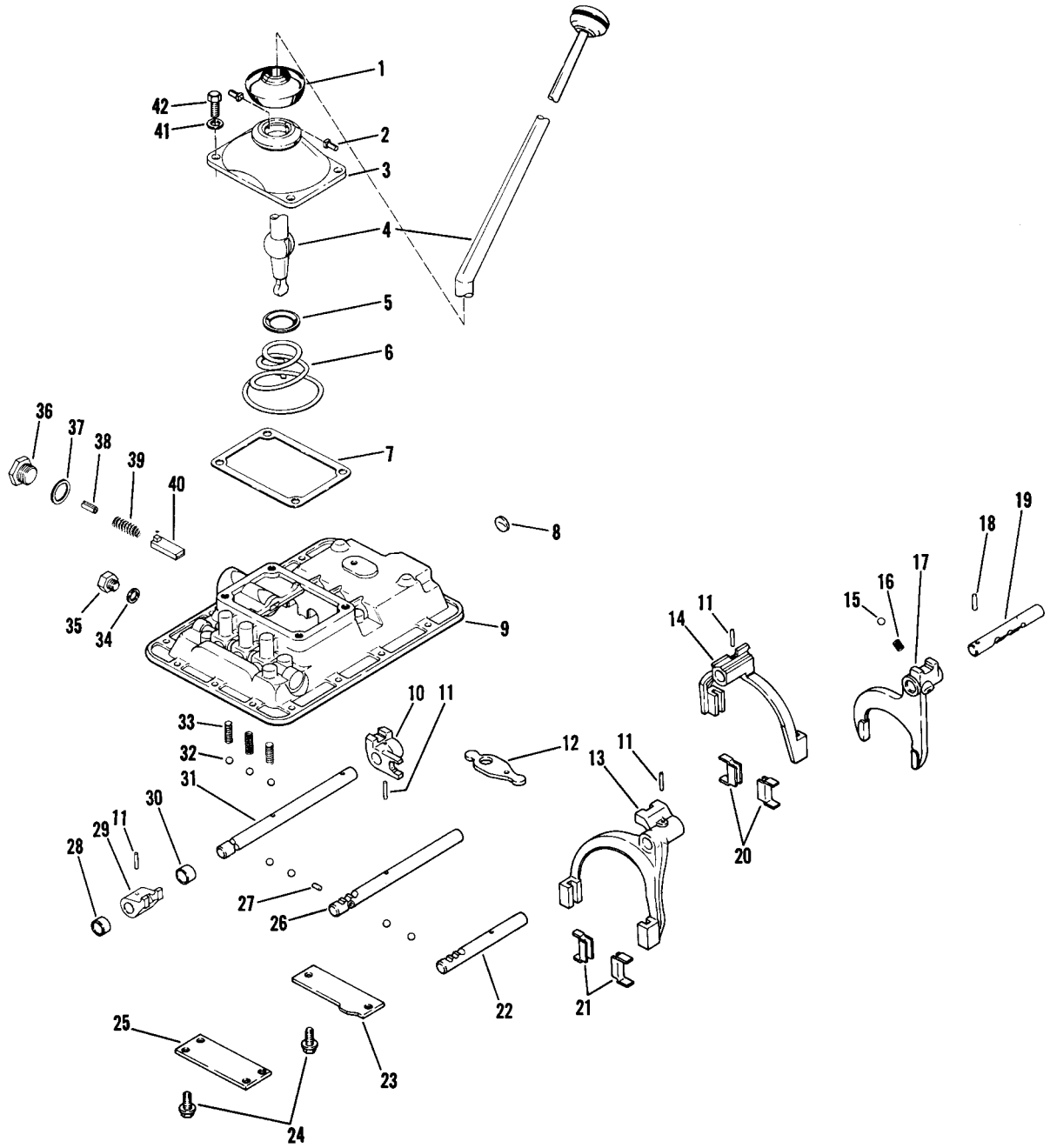
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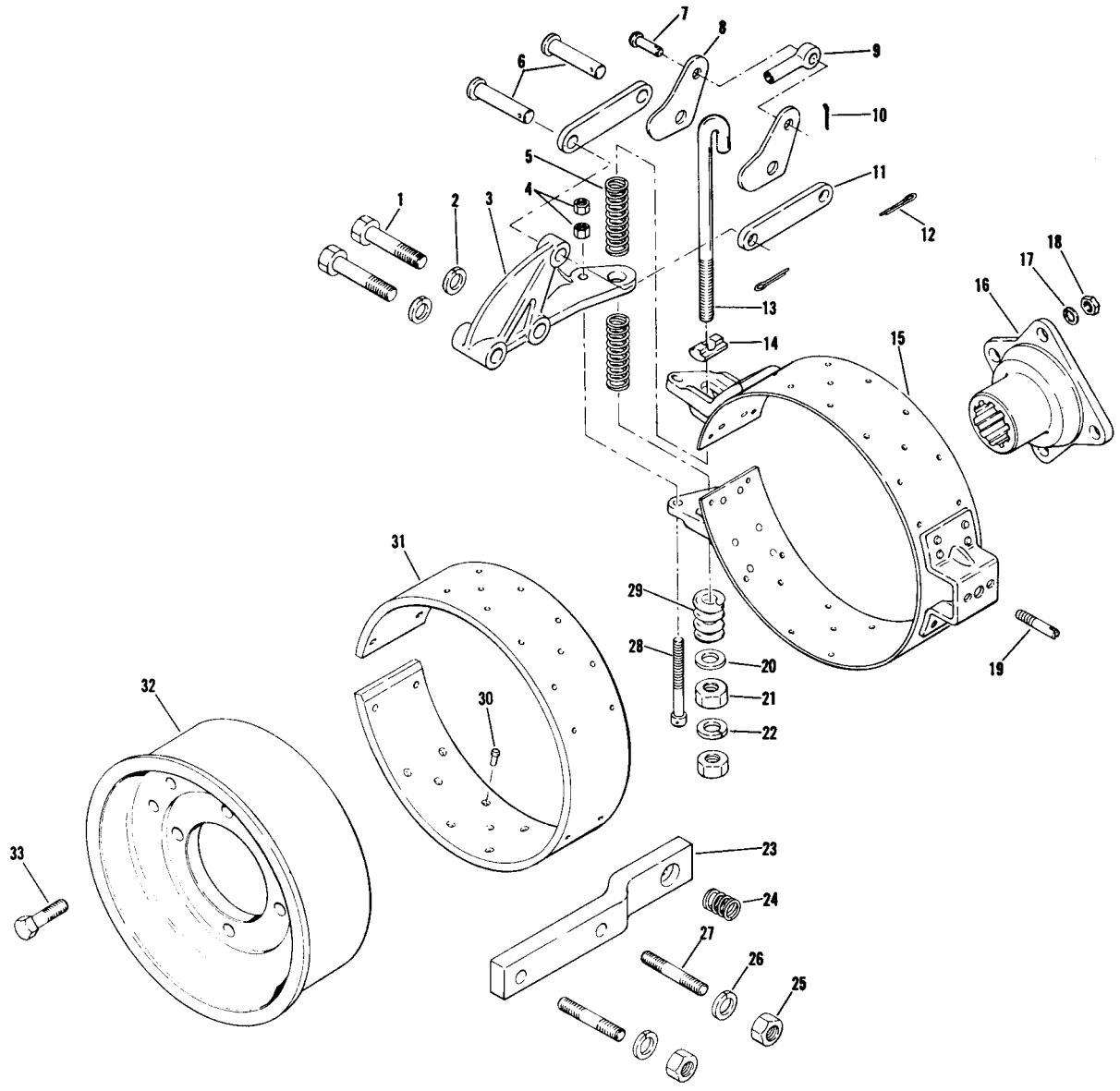
280V-SERIES CONTROL PARTS GROUP (Diecast Cover - Round Rails)

ITEM	Description	QTY
1	Gear Shift Lever Dust Cover	1
2	Gear Shift Lever Pivot Pin	2
3	Control Top	1
4	Gear Shift Lever	1
5	Gear Shift Lever Support Washer	1
6	Support Spring	1
7	Control Top or Remote Control Gasket	1
8	Welch Plug	1
9	Shift Rail Housing	1
10	1st & Reverse Rocker Lug	1
11	Shift Fork Lock Pin	4
12	1st & Reverse Rocker Arm	1
13	4th & 5th Shift Fork	1
14	2nd & 3rd Shift Fork	1
15	Mesh Lock Ball	1
16	1st & Reverse Mesh Lock Spring	1
17	1st & Reverse Shift Fork	1
18	1st & Reverse Shift Fork Rail Lock Pin	1
19	1st & Reverse Shift Fork Rail	1
20	Shift Fork Bushing	2
21	Shift Fork Bushing	2
22	4th & 5th Shift Rail	1
23	Rear Rail Support	1
24	Rail Support Screw	6
25	Front Rail Support	1
26	2nd & 3rd Shift Rail	1
27	Inter-Lock Cross Pin	1
28	1st Gear Shift Stop Space (wide)	1
29	1st & Gear Shift Lug	1
30	1st & Gear Shift Stop Spacer (narrow)	1
31	1st & Reverse Shift Rail	1
32	Mesh & Inter-Lock Ball	7
33	Mesh Lock Spring	3
34	Back-up Switch Hole Plug Gasket	1
35	Back-up Switch Hole Plug	1
36	1st & Reverse Latch Plunger Springer Plug	1
37	1st & Reverse Latch Plunger Plug Gasket	1
38	1st & Reverse Latch Plunger Stop	1
39	1st & Reverse Latch Plunger Spring	1
40	1st & Reverse Latch Plunger	1
41	Control Top Lockwasher	4
42	Control Top Screw	4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280V-SERIES BRAKE PARTS GROUP

ITEM	Description	QTY
1	Brake Support Capscrew	2
2	Brake Support Capscrew	2
3	Brake Locating Bracket	1
4	Brake Band Locating Screw Nut	2
5	Brake Release Spring	2
6	Brake Spacer Link Clevis Pin	2
7	Brake Draw Rod Clevis Pin	1
8	Brake Cam Lever	2
9	Brake Adjusting End	1
10	Brake Draw Rod Clevis Pin Cotter	1
11	Brake Spacer Link	2
12	Spacer Link Clevis Pin Cotter	2
13	Adjusting Bolt	1
14	Brake Cam Lever Shoe	1
15	Brake Band & Facing Assembly (Inc. items 30 & 31)	1
16	Companion Flange	1
17	Companion Flange to Brake Drum Lock-washer	4
18	Companion Flange to Brake Drum Bolt Nut	4
19	Anchor Clip Screw	1
20	Brake Compression Spring Washer	1
21	Brake Adjusting Bolt Nut	2
22	Brake Adjusting Bolt Nut Lockwasher	1
23	Brake Anchor Support Bar	1
24	Brake Anchor Clip Spring	1
25	Brake Support Stud Nut	2
26	Brake Support Stud Nut Lockwasher	2
27	Brake Support Stud	1
28	Brake Band Locating Screw	1
29	Compression Spring	1
30	Brake Band Facing Rivet	26
31	Brake Band Facing	1Brake Drum1
32	Brake Drum to Flange Bolt	4

280V-SERIES

ASSEMBLY INSTRUCTIONS

When screws with pre-applied thread locking compound are removed after initial assembly, clean thread locking compound are removed after initial assembly, clean threads thoroughly and apply Loctite 262 Thread Lock before re-installation.

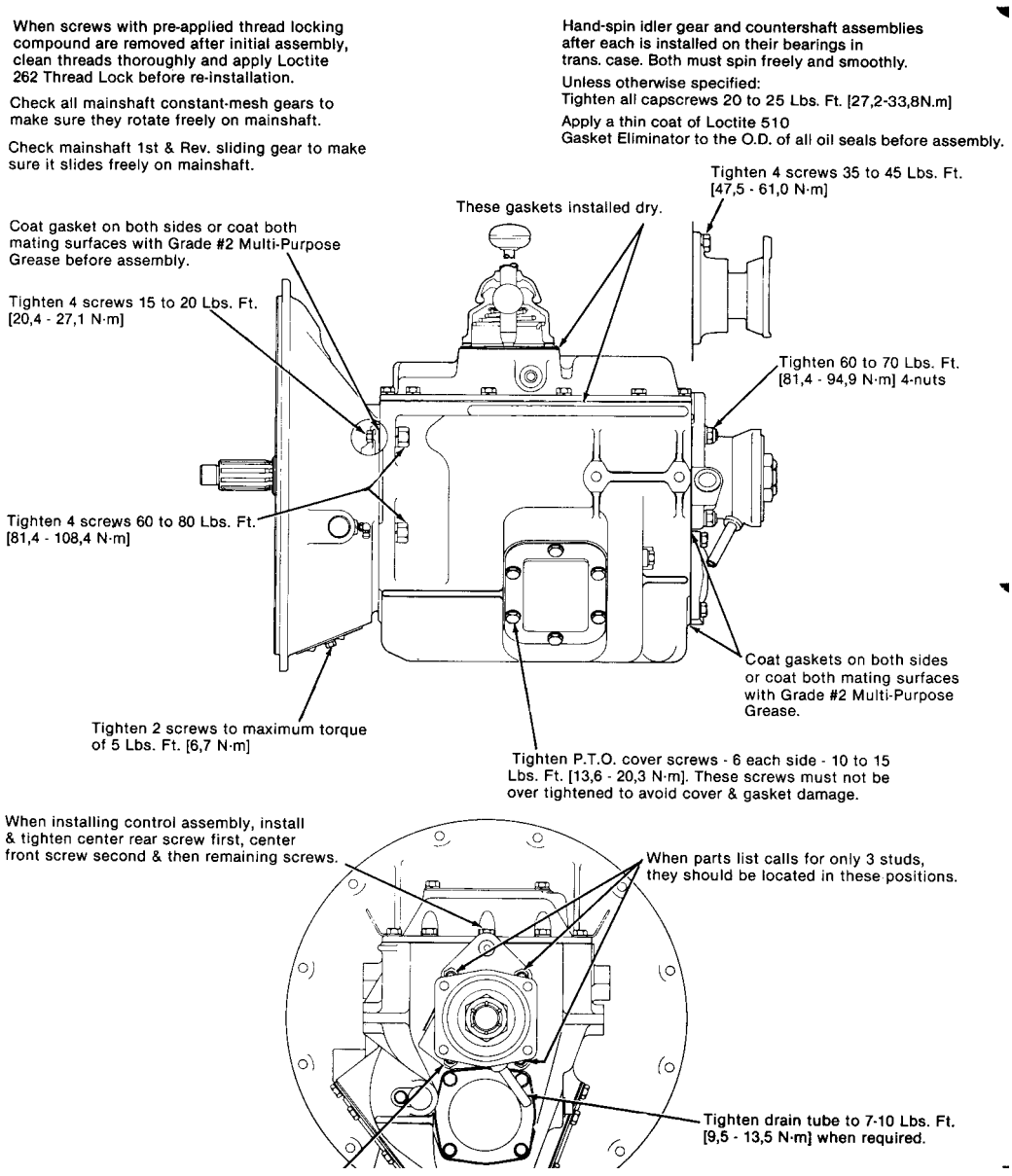
Check all mainshaft constant-mesh gears to make sure they rotate freely on mainshaft.

Check mainshaft 1st & Reverse sliding gear to make sure it slides freely on mainshaft.

Hand-spin idler gear and countershaft assemblies after each is installed on their bearings in trans. case. Both must spin freely and smoothly.

Unless otherwise specified:
Tighten all capscrews 20-25 Lbs. Ft. [27,2-33,8N.m]

Apply a thin coat of Loctite 510
Gasket Eliminator to the O.D. of all oil seals before assembly.



OVERHAUL OF TRANSMISSION ASSEMBLY

The instructions contained herein cover the disassembly and reassembly of the transmission in a sequence that would normally be followed after the unit has been removed from the machine and is to be completely overhauled.

CAUTION: Cleanliness is of extreme importance and an absolute must in the repair and overhaul of this unit. Before attempting any repairs, the exterior of the unit must be thoroughly cleaned to prevent the possibility of dirt and foreign matter entering the mechanism.

DISASSEMBLY OF THE TRANSMISSION:

Figure 1-Remove control top or remote control assembly.

Figure 2-Remove shift rod cover capscrews.
NOTE: See Page 23 for Diecast Cover Disassembly

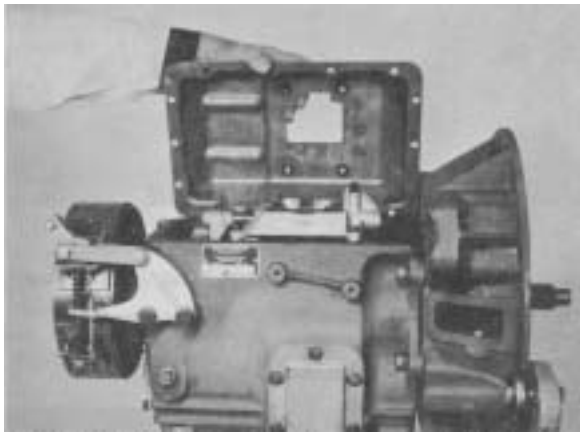


Figure 3-Remove shift rod cover.

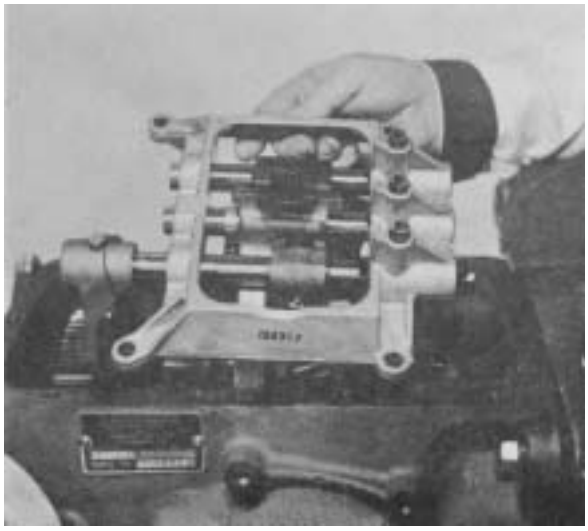


Figure 4-Remove shift rod support assembly.

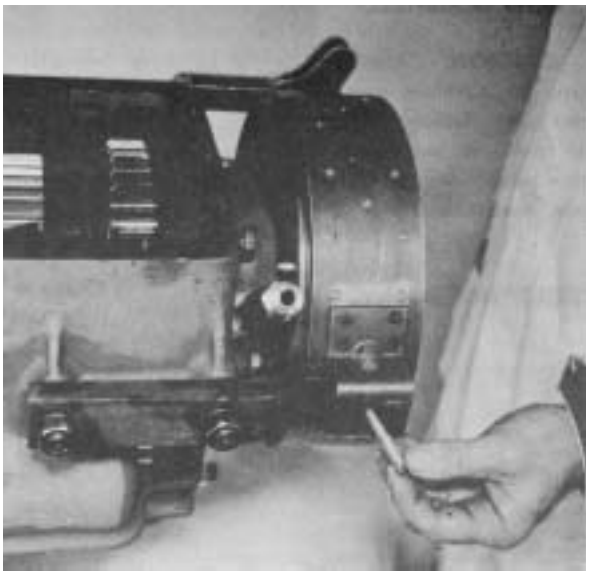


Figure 5-Remove anchor clip screw lockwire and clip screw.

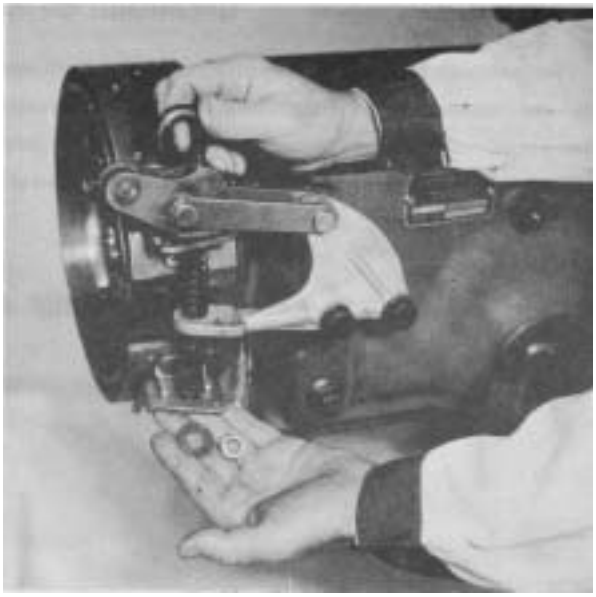


Figure 7-Remove adjusting bolt, nuts, and washer. Remove adjusting bolt.

Figure 6-Remove jam nuts and brake band locating screw.

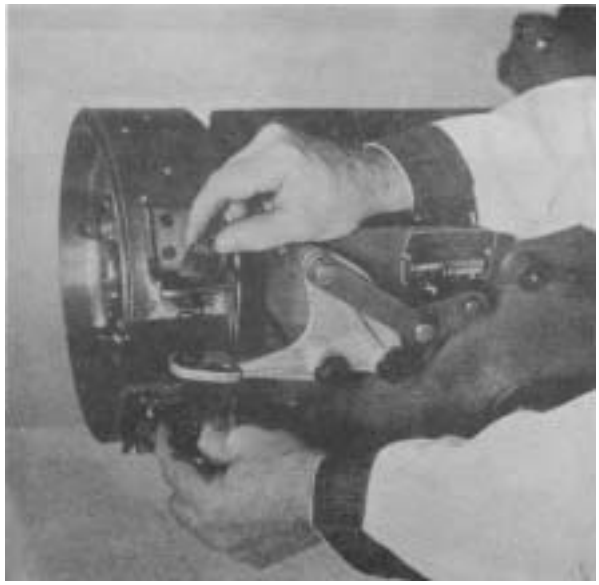


Figure 8-Remove brake release springs and cam lever shoe.

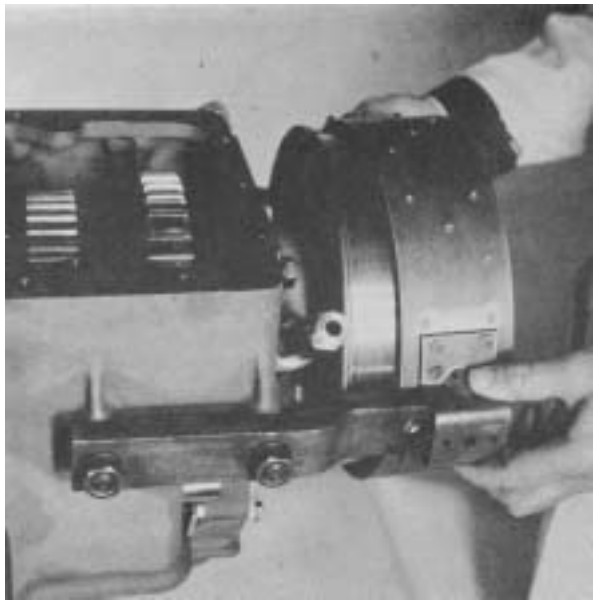


Figure 9-Remove brake band and anchor clip spring.

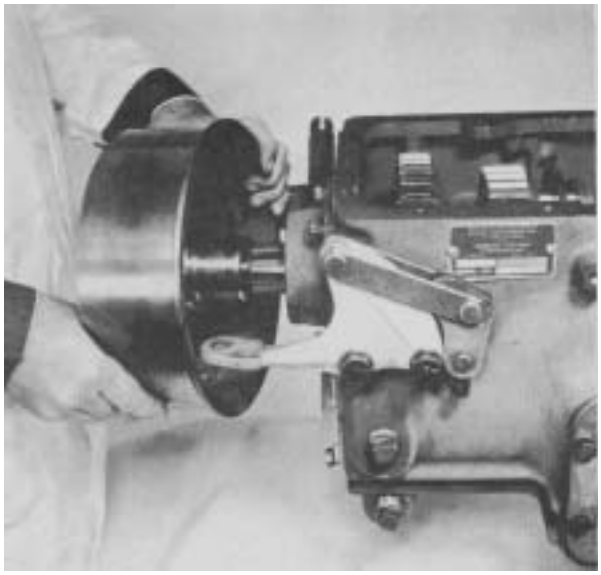


Figure 11-Remove brake drum.

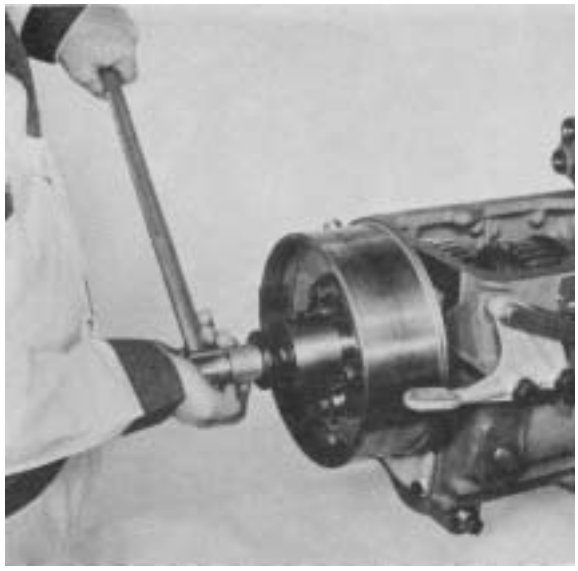


Figure 10-Lock transmission in two gears and remove brake drum.

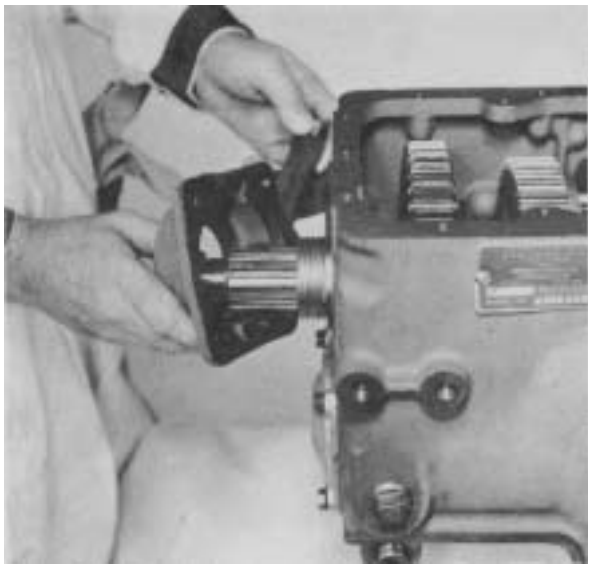


Figure 12-Remove mainshaft rear bearing cap and speedometer drive gear.

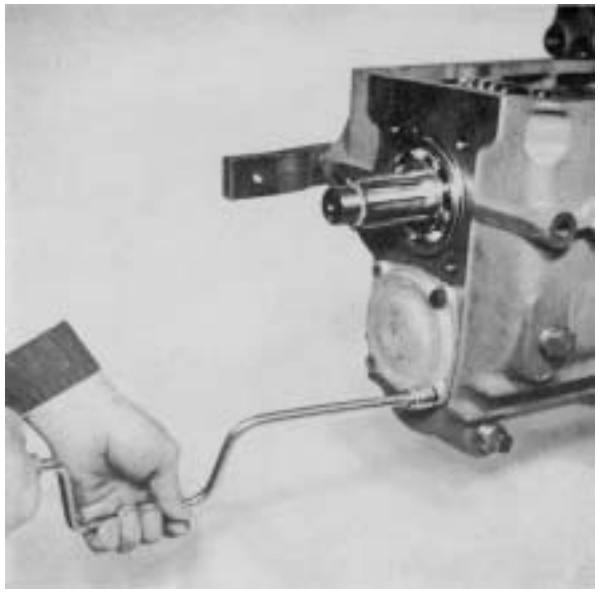


Figure 13-Remove countershaft rear bearing cap.

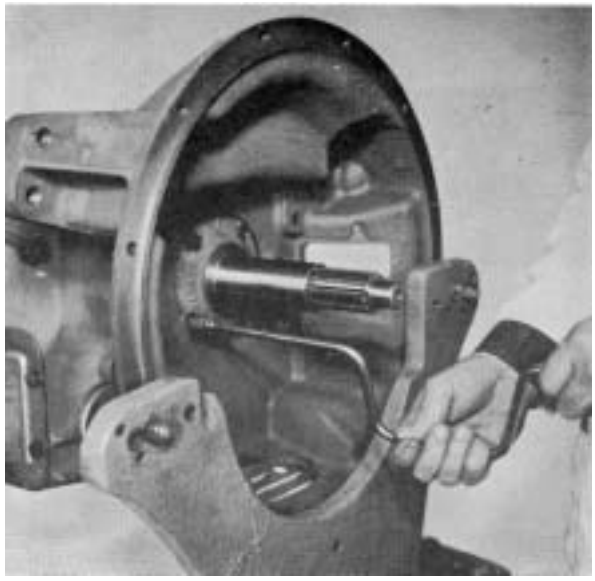


Figure 15-Remove main drive gear bearing cap.

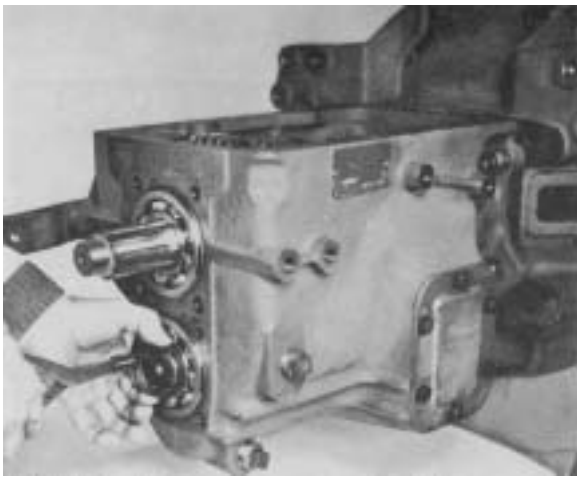


Figure 14-Remove countershaft rear bearing retainer ring.

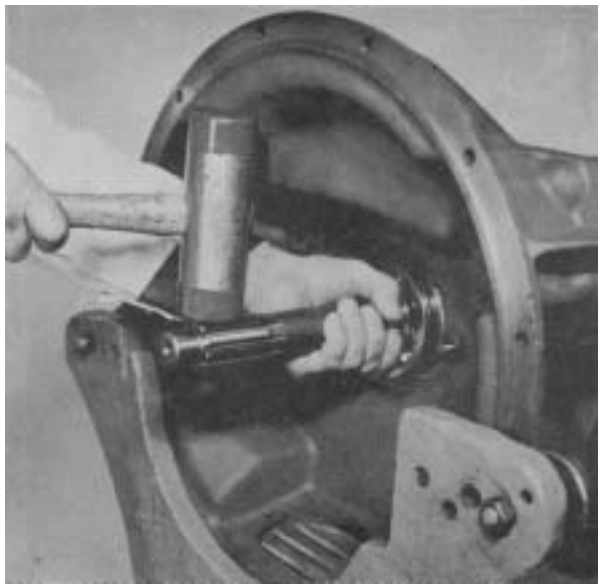


Figure 16-Remove main drive gear. Use caution as not to drop mainshaft spigot bearing rollers in transmission case.

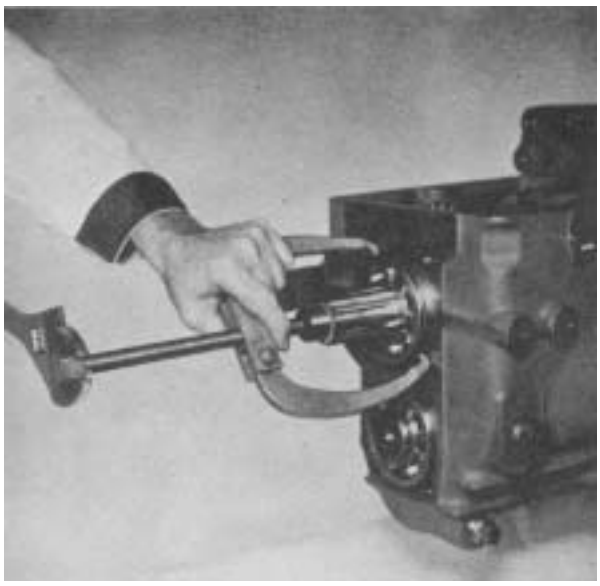


Figure 17-Pry mainshaft to the rear to expose rear bearing. Remove bearing.

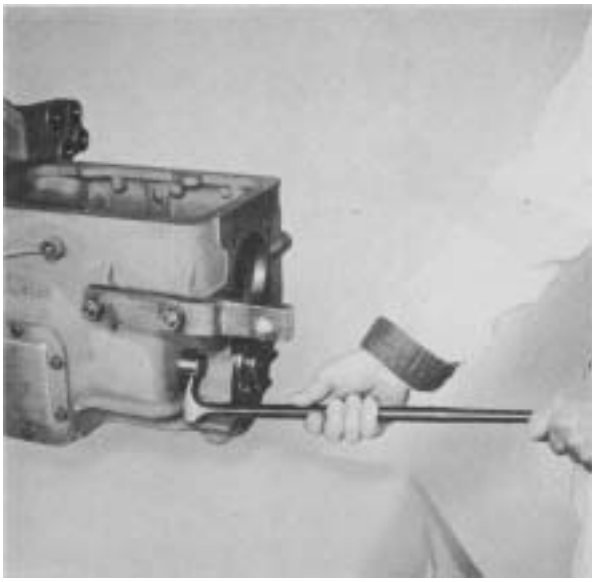


Figure 19-Remove reverse idler shaft lockscrew and lock. Using a suitable puller remove reverse idler shaft.

Figure 18-Remove mainshaft assembly

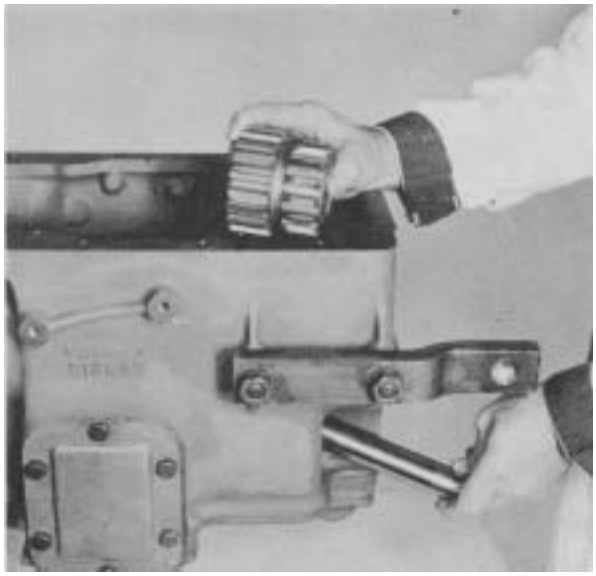


Figure 20-Remove reverse idler gear, bearings, and two thrust washers.

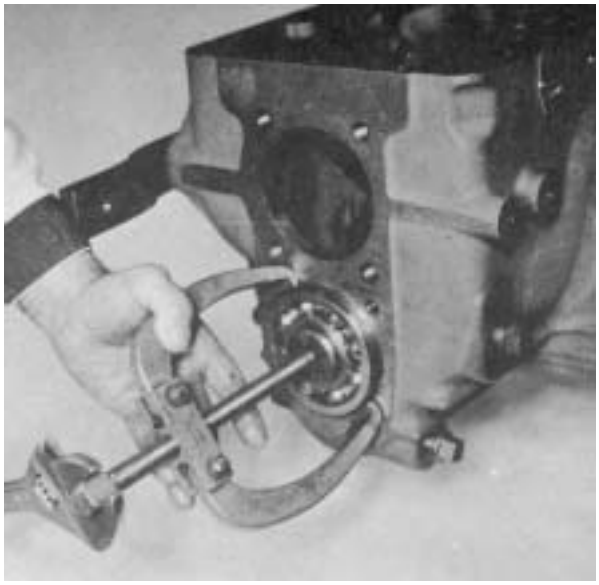


Figure 21-Pry countershaft to the rear to expose rear bearing.

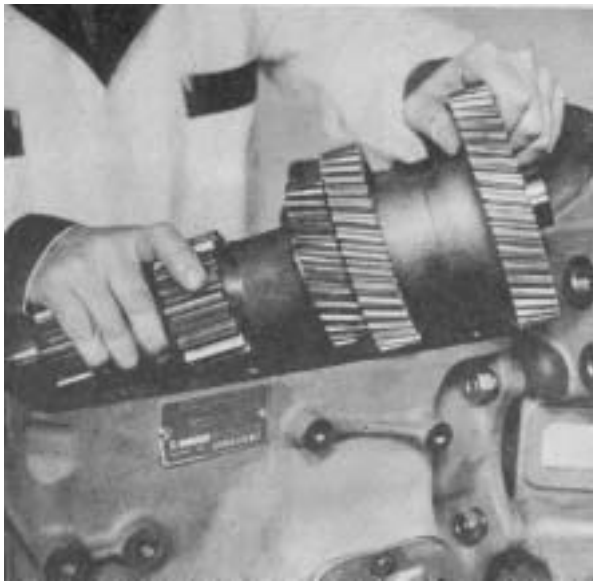


Figure 23-Remove countershaft assembly.

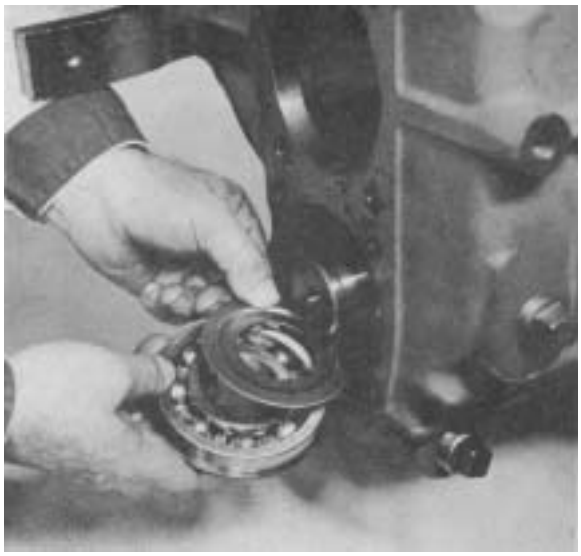


Figure 22-Remove countershaft rear bearing and oil slinger.

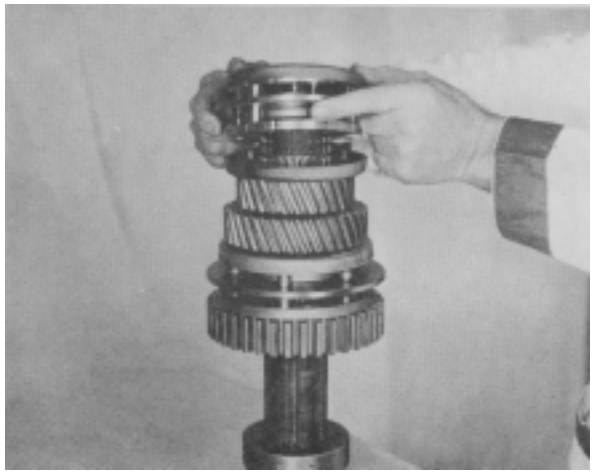


Figure 24-Remove mainshaft 1st & reverse sliding gear. Set mainshaft up as shown and remove 4th & 5th synchronizer assembly. NOTE: Bottom synchronizer cup may stay on mainshaft.

Figure 25 - Remove 4th & 5th shift hub sleeve retainer ring.

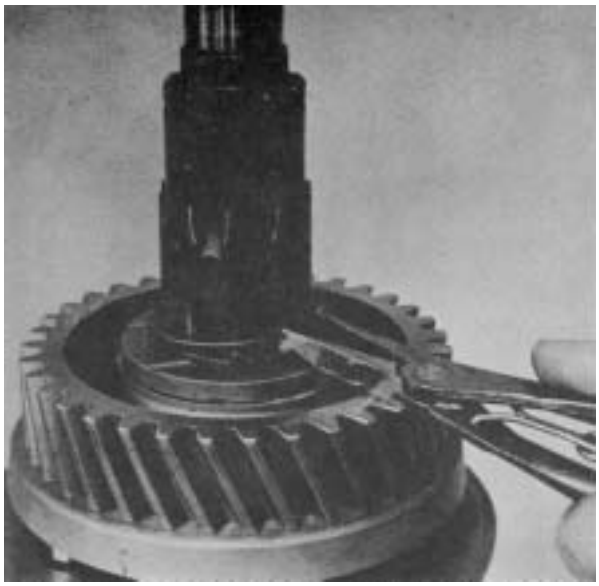


Figure 27 - Remove 3rd speed gear retainer ring.

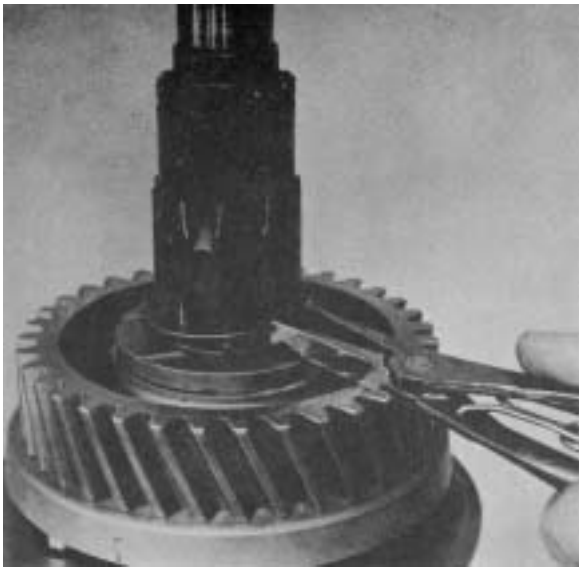


Figure 26 - Remove 4th & 5th shift hub sleeve and 4th speed gear.

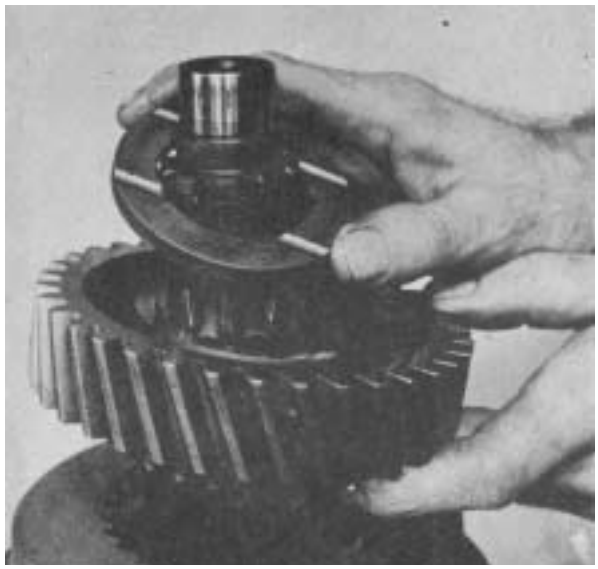


Figure 28 - Remove 3rd speed gear and locating washer.

Figure 29 - Remove 2nd & 3rd synchronizer assembly.

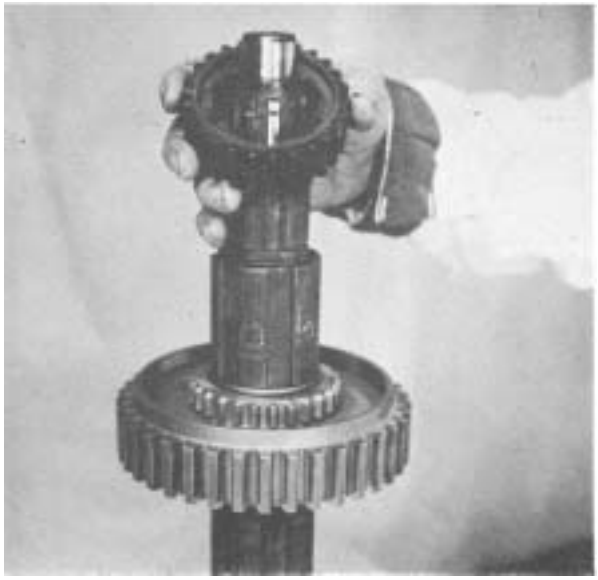


Figure 31 - Remove 2nd & 3rd shift hub sleeve.

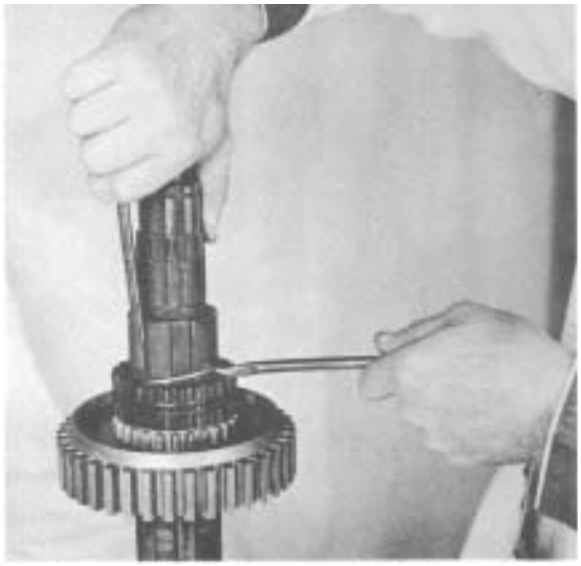


Figure 30 - Remove 2nd & 3rd shift hub sleeve retainer ring.

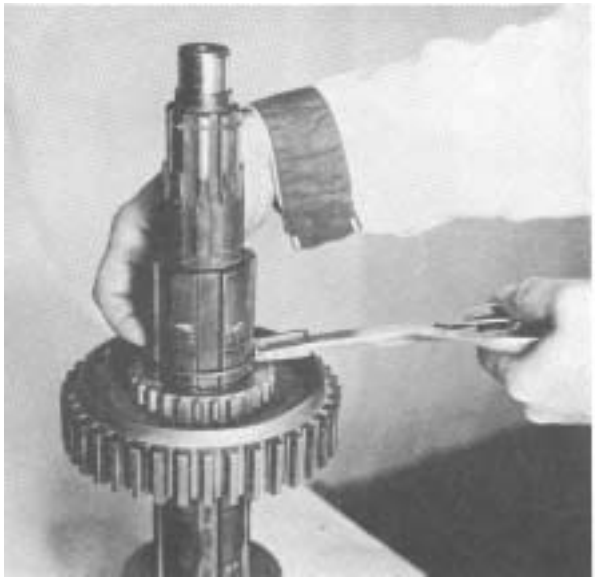


Figure 32 - Remove 2nd gear retainer ring.

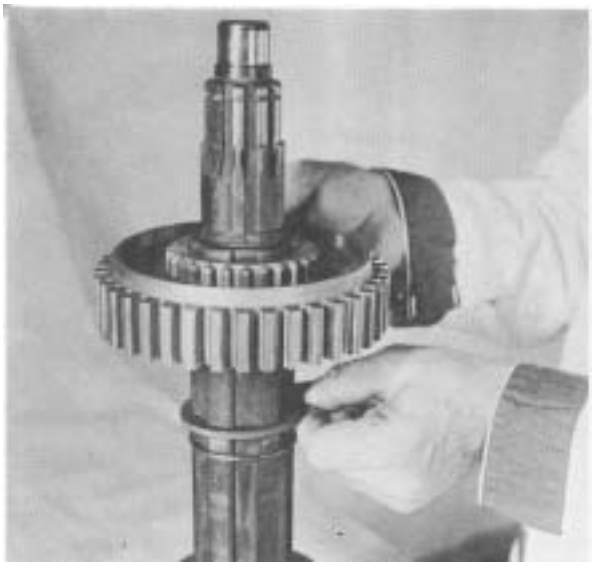


Figure 33 - Remove 2nd gear and locating washer.

Figure 35 - Remove 1st & Reverse shift fork, rod and lug from shift rod support.

STAMPED CONTROL DISASSEMBLY
See Page 23 for Diecast Cover - Fabricated Rails
See Page 31 for Diecast Cover - Round Rails

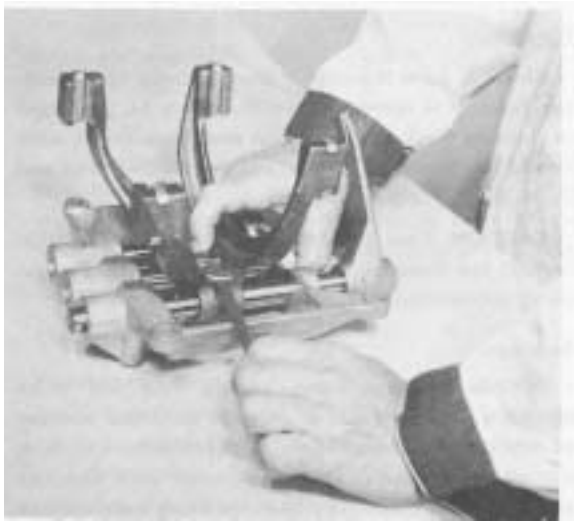


Figure 34 - Remove 1st & Reverse shift lug lockscrew.

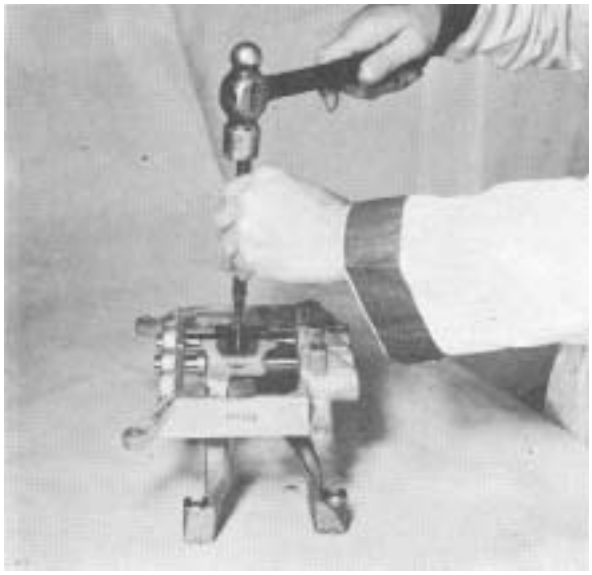


Figure 36 - Using a small pin or drift, remove 2nd & 3rd shift fork roll pin.

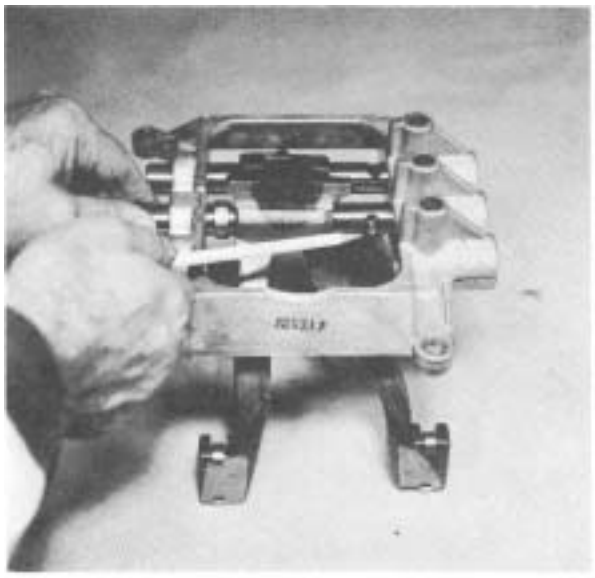


Figure 37 - Remove 2nd & 3rd shift rod. CAUTION: Do not lose interlock cross pin or 2nd speed overdrive spacer.

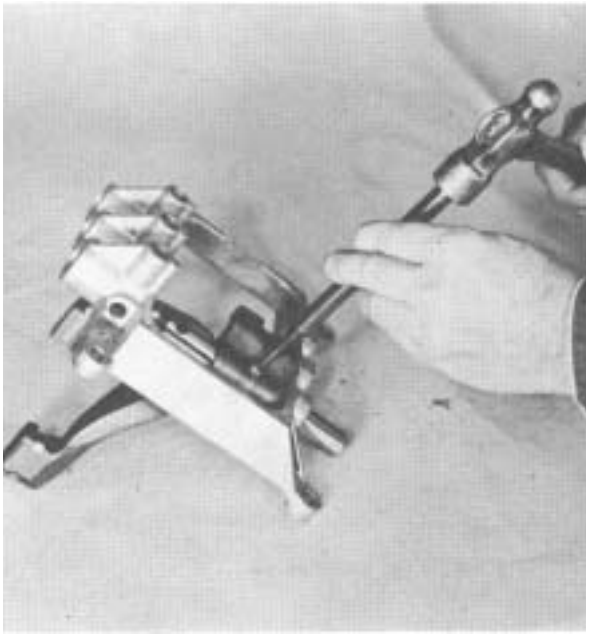


Figure 34 - Remove 4th & 5th shift fork roll pin.

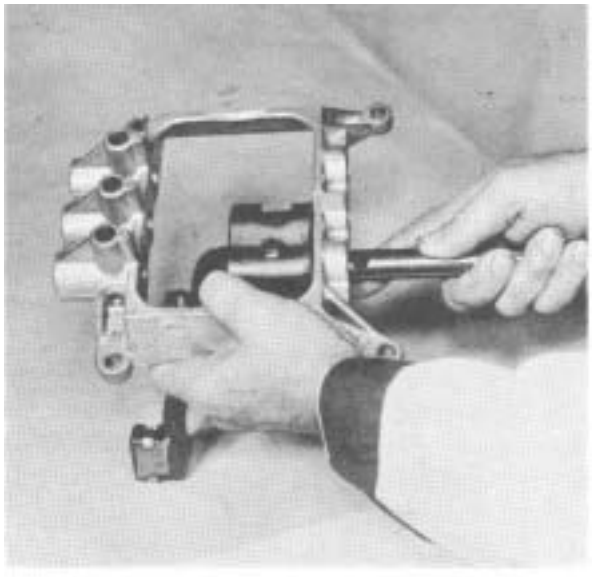


Figure 39 - Remove 4th & 5th shift rod and fork.

CLEANING AND INSPECTION

CLEANING

Cleaning all parts thoroughly using solvent type cleaning fluid. It is recommended that parts be immersed in cleaning fluid and moved up and down slowly until all old lubricant and foreign material is dissolved and parts are thoroughly cleaned.

CAUTION: Care should be exercised to avoid skin rashes, fire hazards, and inhalation of vapors when using solvent type cleaners.

Bearings:

Remove bearings from cleaning fluid and strike against a block of wood to dislodge solidified particles of lubricant. Immerse again in cleaning fluid to flush out particles. Repeat above operation until bearings are thoroughly clean. Dry bearings using moisture-free compressed air. Be careful to direct air stream across bearing to avoid spinning. Do not spin bearings when drying. Bearing say be rotated slowly by hand to facilitate drying process.

Housings:
Clean interior and exterior of housings, bearing caps, etc. thoroughly. Cast parts may be cleaned in hot solution tanks with mild alkali solutions providing these parts do not have ground or polished surfaces. Parts should remain in solution long enough to be thoroughly cleaned and heated. This will aid the evaporation of the cleaning solution and rinse water. Parts cleaned in solution tanks must be thoroughly rinsed with clean water to remove all traces of alkali. Cast parts may also be cleaned with steam cleaner.

CAUTION: Care should be exercised to avoid inhalation of vapors and skin rashes when using alkali cleaners.

All parts cleaned must be thoroughly dried immediately by using moisture-free compressed air or soft, lintless absorbent wiping rages free of abrasive materials such as metal filings, contaminated oil or lapping compound.

INSPECTION

The importance of careful and thorough inspection of all parts cannot be overstressed. Replacement of all parts showing indication of wear or stress will eliminate costly and avoidable failures at a later date.

Bearings:
Carefully inspect all rollers and balls for wear, chipping or nicks to determine fitness of bearings for further use. After inspection, dip bearings in clean oil and wrap in clean lintless cloth or paper to protect them until installed.

Oil Seals, Gaskets, Etc.:
Replacement of spring load oil seals, gaskets and snap rings is more economical when unit is disassembled that premature overhaul to replace these parts at a future time. Further, loss of lubricant through a worn seal may result in failure of other more expensive parts of the assembly. Sealing members should be handled carefully, particularly when being installed. Cutting, scratching, or curling under of lip of seal seriously impairs its efficiency.

Gears and Shafts:
If magno-flux process is available, use process to check parts. Examine teeth on all gears carefully for wear, pitting, chipping, nicks, cracks, or scores. If gear teeth show spots where case hardening is worn through or cracked, replace with new gear. Small nicks may be removed with suitable hone. Inspect shafts to make certain they are not sprung, bent, or splines twisted, and that shaft are true.

Housing, Covers, Etc.:
Inspect housings, covers, and bearing caps to be certain they are thoroughly cleaned and that mating surfaces, bearing bores, etc., are free from nicks or burrs. Check all parts carefully for evidence of cracks or condition which would cause subsequent oil leaks or failures.

MAIN DRIVE GEAR DISASSEMBLY AND REASSEMBLY

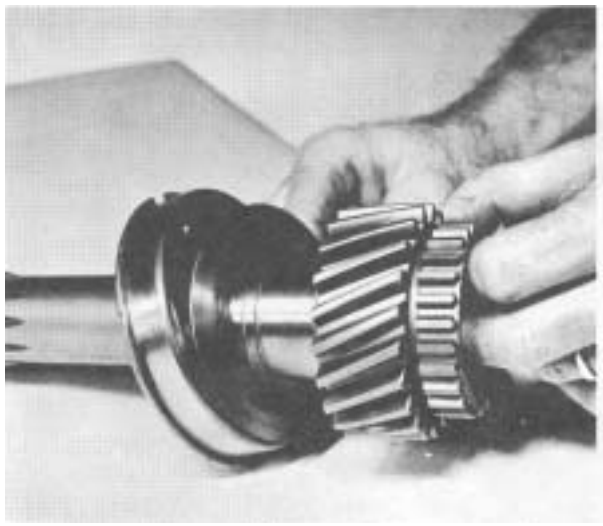


Figure 40 - Remove main drive gear bearing retainer ring. Press bearing and oil slinger from main drive gear. Replace gear or bearing and install as shown. Install retainer ring.

CLUTCH HOUSING OR COUNTERSHAFT FRONT BEARING REPLACEMENT

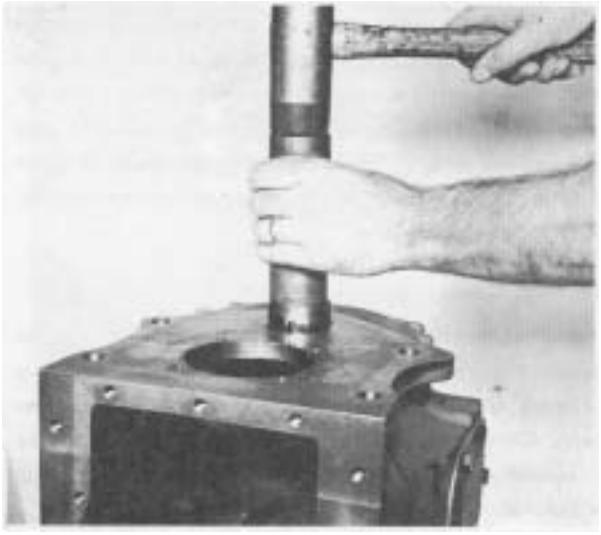


Figure 41 - If countershaft front bearing is to be replaced, remove clutch housing and drive front bearing from transmission case. Apply a light coat of permatex No. 2 on the outher diameter of the new bearing. Install in transmission case as shown with end of bearing .001 to .007 below the face of case. Install main drive gear andearing assembly in transmission case. Install main drive gear bearing cap on drive gear.

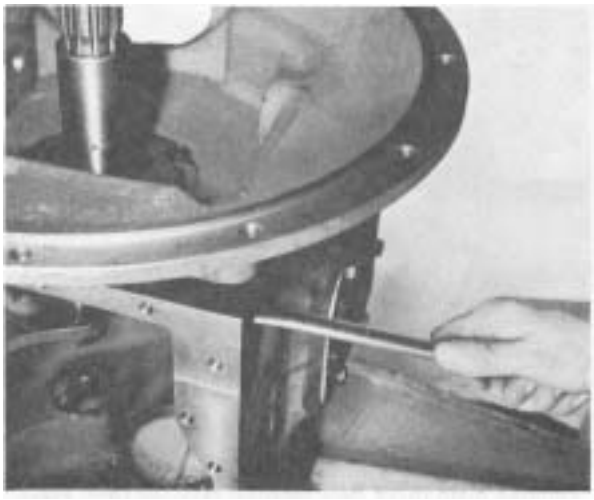


Figure 42 - Install clutch housing and tighten stud nuts 60 to 80 ft. lbs. torque. Remove drive gear bearing cap and main drive gear.

STAMPED CONTROL REASSEMBLY

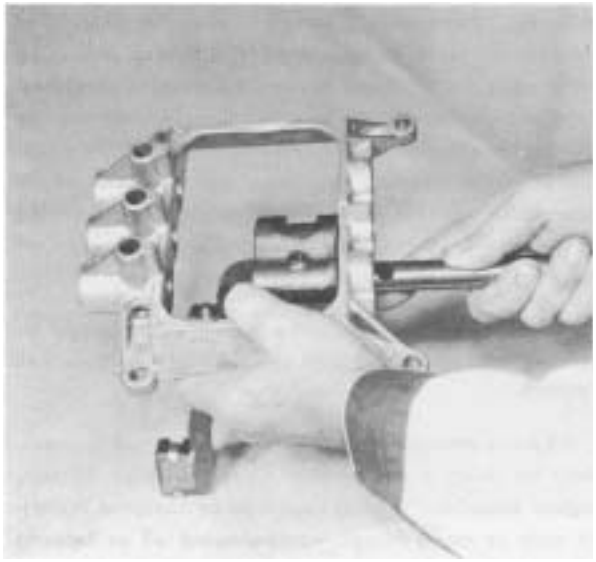


Figure 43 - Install 4th & 5th shift rod through support and into 4th & 5th shift fork.

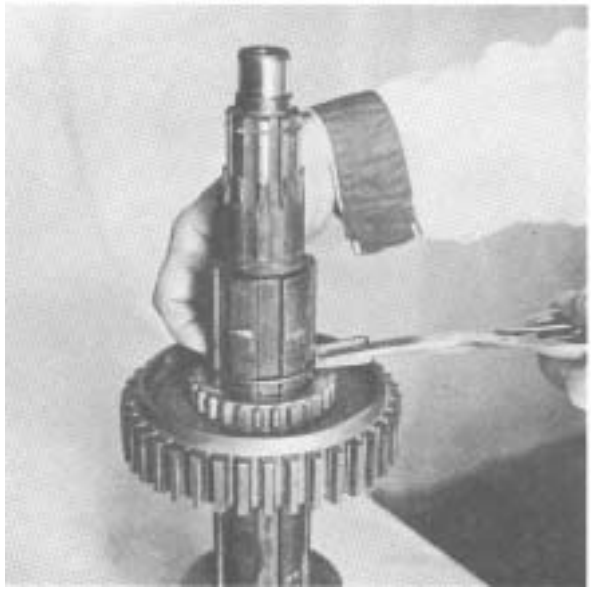


Figure 44 - Install 4th & 5th shift fork to shift rod roll pin, move rod to neutral.

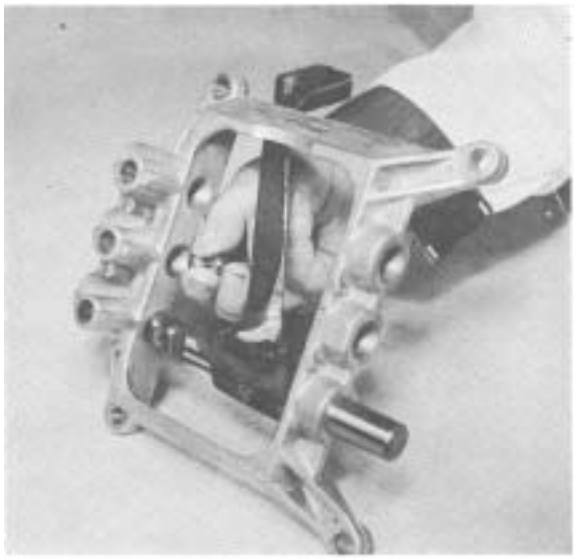


Figure 45 - Install two interlock balls between 4th & 5th, and 2nd & 3rd shift rods.

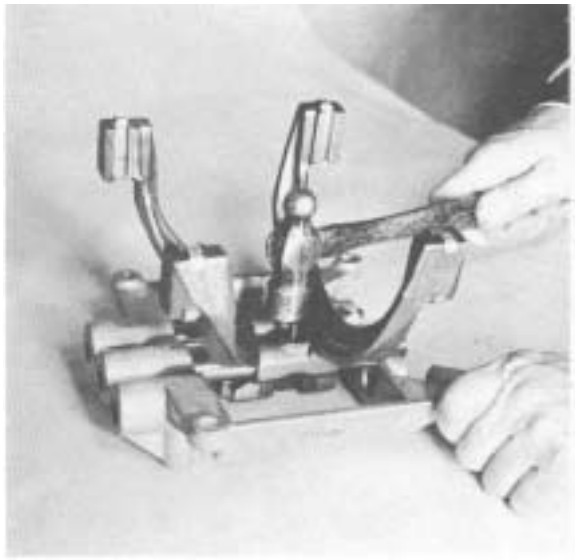


Figure 47 - Install 2nd & 3rd shift fork to shift rod roll pin. Move rod to neutral.

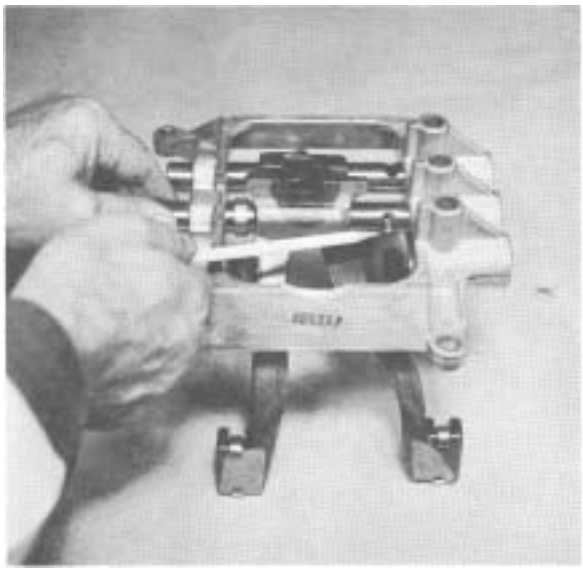


Figure 46 - Install 2nd & 3rd shift rod through shift support. Install over shift spacer, shift fork and interlock cross pin.

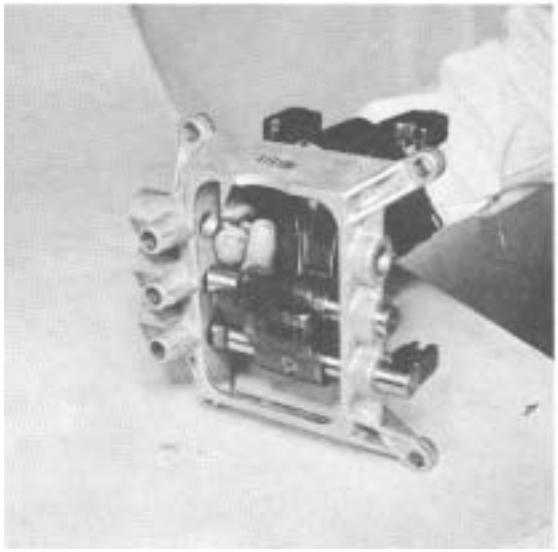


Figure 48 - Install two interlock balls between the 2nd & 3rd, and 1st & Reverse shift rods.

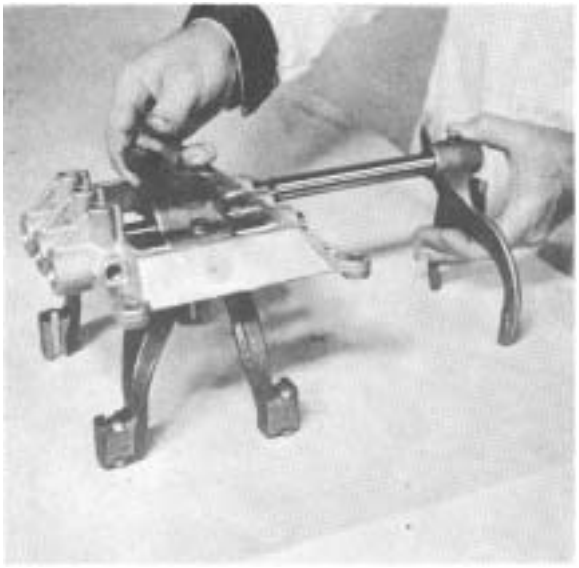


Figure 49 - Install 1st & reverse rod through support and into lug

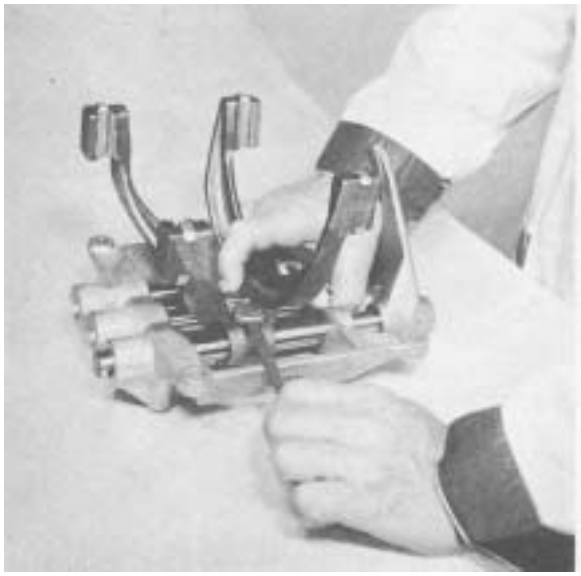


Figure 50 - Install 1st & reverse lug lockscrew and lockwire to prevent loosening.

MAINSHAFT REASSEMBLY

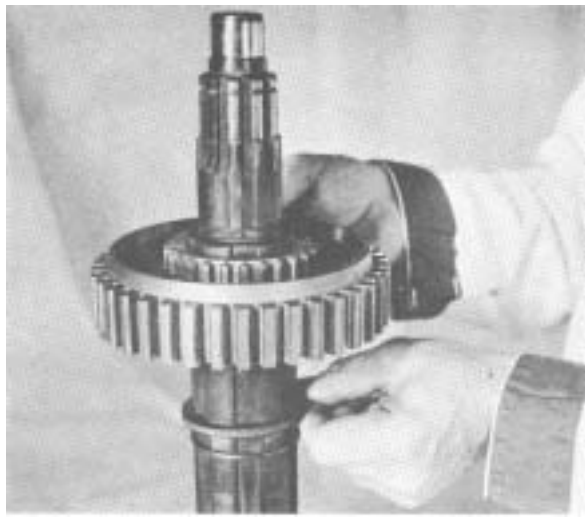


Figure 51 - Install 2nd speed gear retainer ring, locating washer, and 2nd speed gear on mainshaft. (NOTE: clutching teeth are up.)

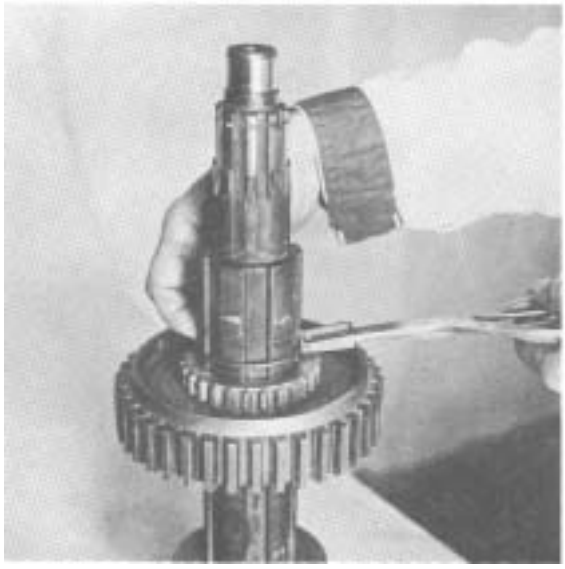


Figure 52 - Install 2nd gear retainer ring.

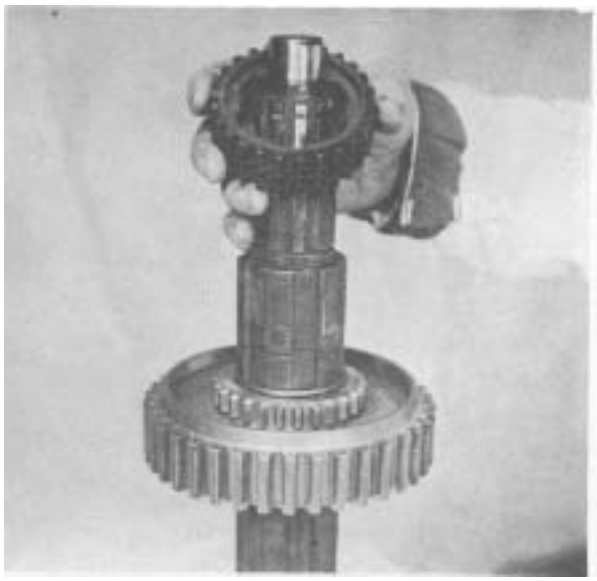


Figure 53 - Install 2nd & 3rd shift hub sleeve and sleeve retainer ring.

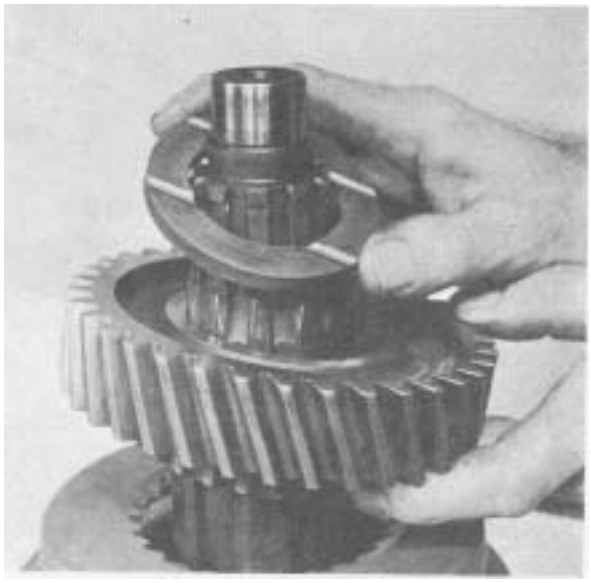


Figure 55 - Install 3rd speed gear with clutching teeth down. Install 3rd gear locating washer.

Figure 54 - Install 2nd & 3rd synchronizer assembly.

Figure 52 - Install 3rd gear retainer ring.

Figure 57 - Install 4th gear with clutching teeth up. Note chamfer on 4th & 5th shift hub sleeve. Chamfer must go down. Install bottom cup of 4th & 5th synchronizer on 4th speed gear clutching teeth before installing 4th & 5th shift hub sleeve. Install sleeve retainer ring.

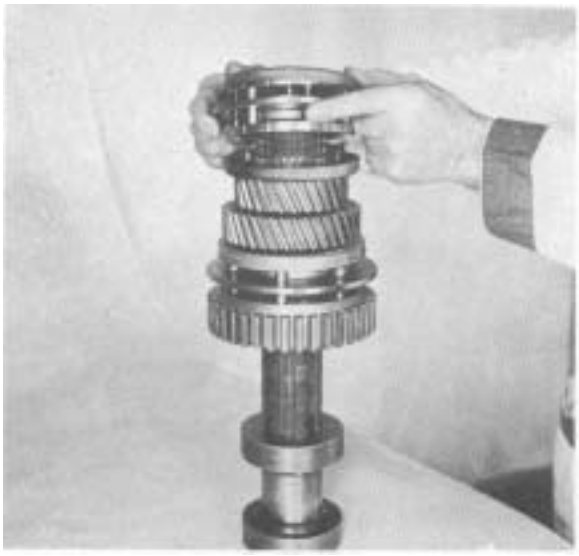


Figure 58 - Install 4th & 5th synchronizer on shift hub sleeve.

Figure 59 - Turn mainshaft assembly over and install 1st & reverse sliding gear with shift fork slot down.

REASSEMBLY OF TRANSMISSION

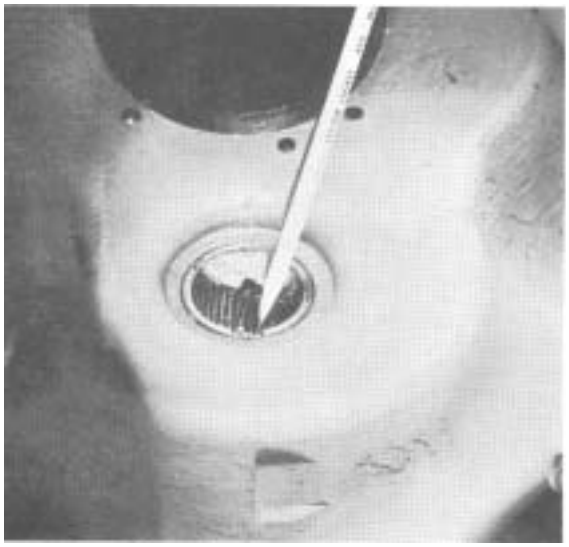


Figure 60 - Coat countershaft pilot bearing needles with heavy grease to hold in place until countershaft is installed.

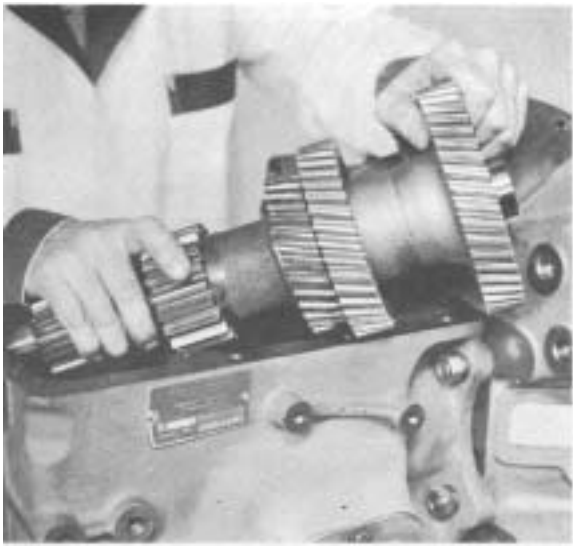


Figure 61 - Tip rear of countershaft down and into transmission case. Feed rear of countershaft through rear countershaft bearing bore. Move countershaft forward and into pilot bearing. CAUTION: Do not disrupt countershaft needle bearing.

Figure 63 - Drive rear bearing on countershaft and rear bearing bore. NOTE: Countershaft drive gear must be supported on each side with a ¼" flat bar to prevent damage to countershaft pilot bearing.

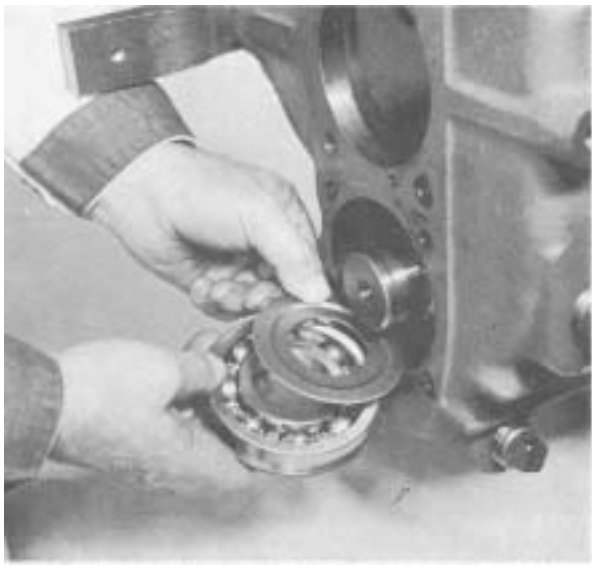


Figure 62 - Position rear bearing oil slinger as shown and start rear bearing.

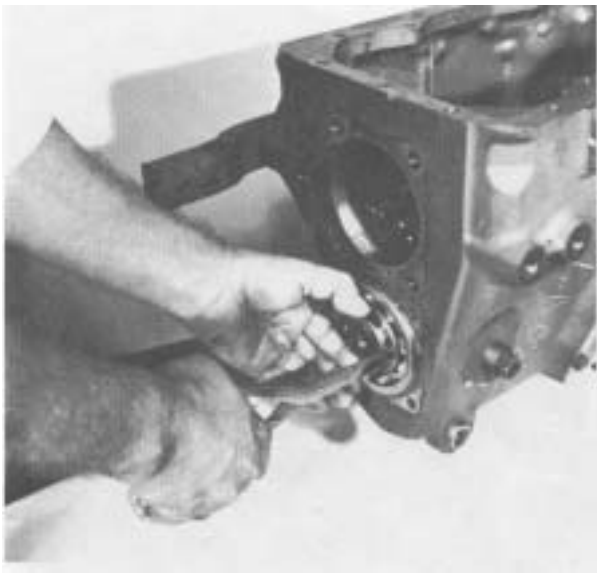


Figure 64 - Install countershaft rear bearing retainer ring.

Figure 65 - Coat a new gasket on both sides with a grade #2 multi-purpose grease. Position

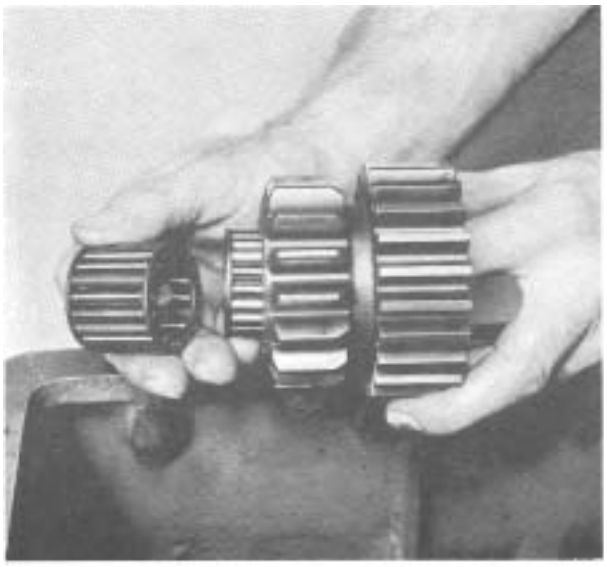


Figure 67 - Insert two reverse idler gear bearings in idler gear.

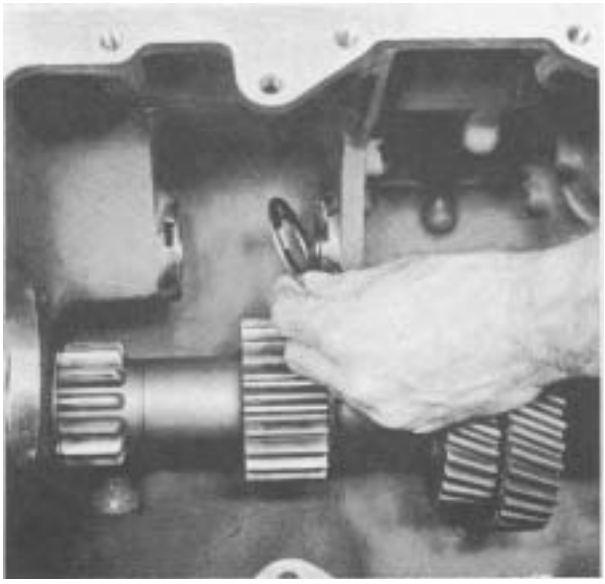


Figure 66 - Use heavy grease on reverse idler thrust washers to hold in place.

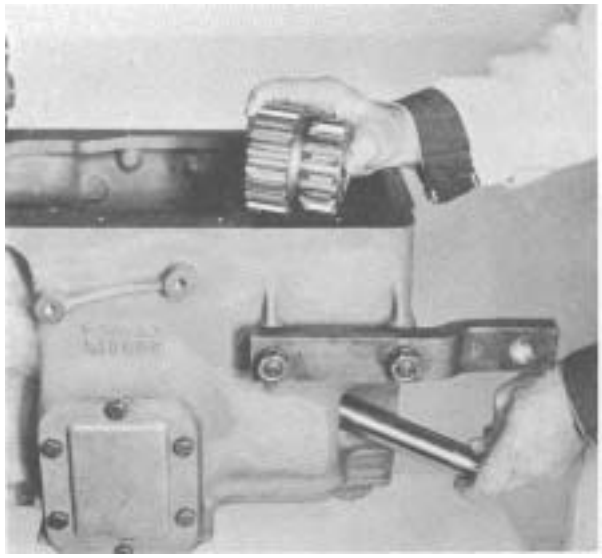


Figure 68 - Install reverse idler gear as shown. Insert idler shaft through case and idler gear. **NOTE**: Idler shaft lock groove must line up with lock bolt hole. Drive shaft into position. Install shaft lock and bolt. Tighten bolt 20 to 25 ft. lbs. torque [27,2 - 33,8 N.m].

Figure 69 - Install mainshaft assembly into transmission case as shown.

Figure 70 - Assemble the pilot bearing in the main drive gear as follows:

1. If a new pilot bearing is used it comes from the factory with a plastic sleeve. Stand drive gear on end. Set bearing and sleeve over bearing pocket in drive gear. Slide bearing rollers and cage from plastic sleeve into bearing pocket.
2. If old pilot bearing is used, set rollers in bearing cage and hold in place with a rubber band. Slide bearing rollers and cage from rubber band into bearing pocket.

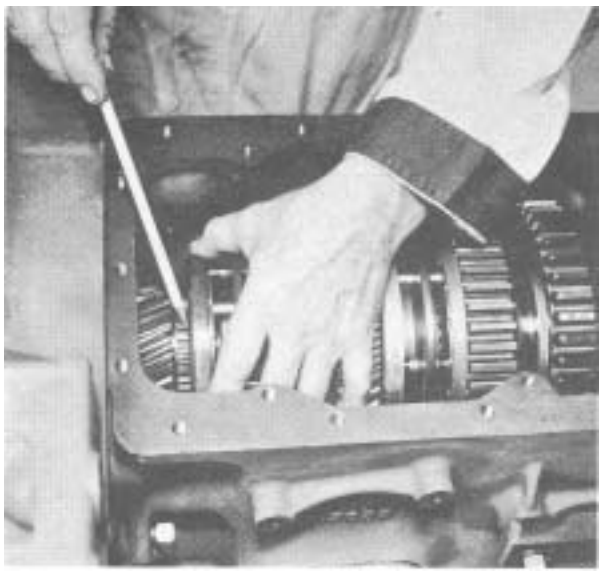


Figure 71 - Install main drive gear assembly in transmission case. Clutching teeth on main drive gear must enter 5th speed synchronizer cup without binding.

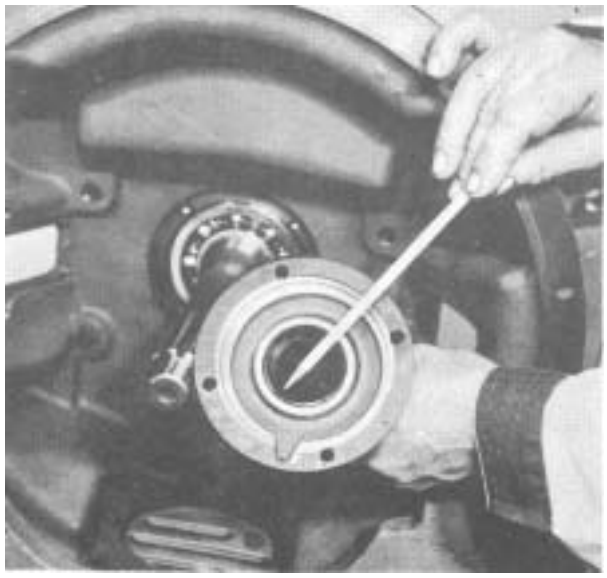


Figure 72- Press oil seal into drive gear bearing cap with lip of seal up. Coat a new gasket on both sides with a grade #2 multi-purpose grease. Position gasket on drive gear bearing cap. Use caution as not to cover oil return groove in bearing cap.

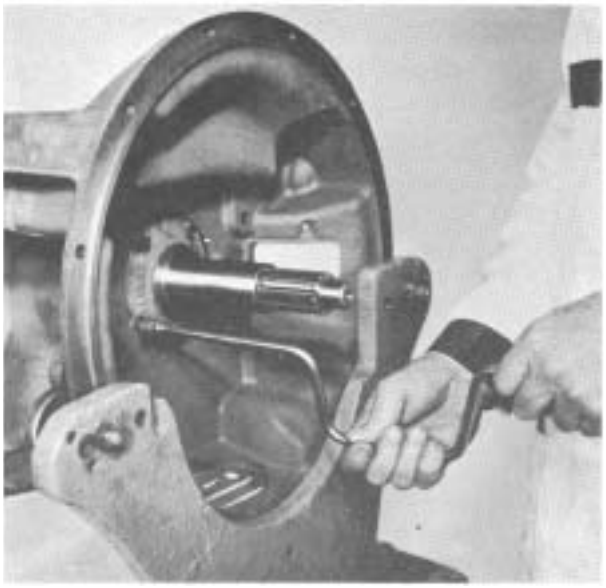


Figure 73 - With bearing cap oil return groove lined up with oil hole in transmission case, install bearing cap and bolts. Tighten bolts 15 to 20 ft. lbs. torque [20,4 - 27,1 N,m]

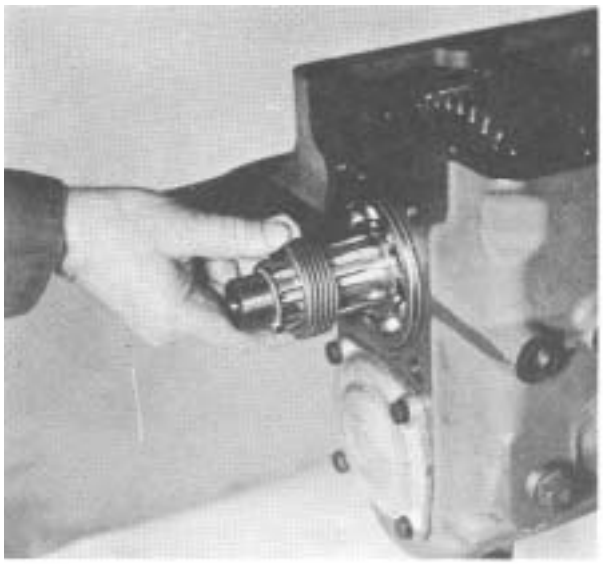


Figure 75 - Install speedometer drive gear.

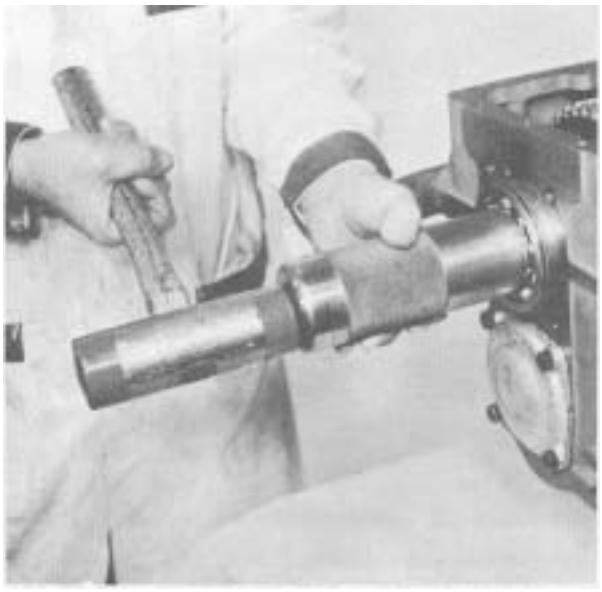


Figure 74 - Install mainshaft rear bearing.

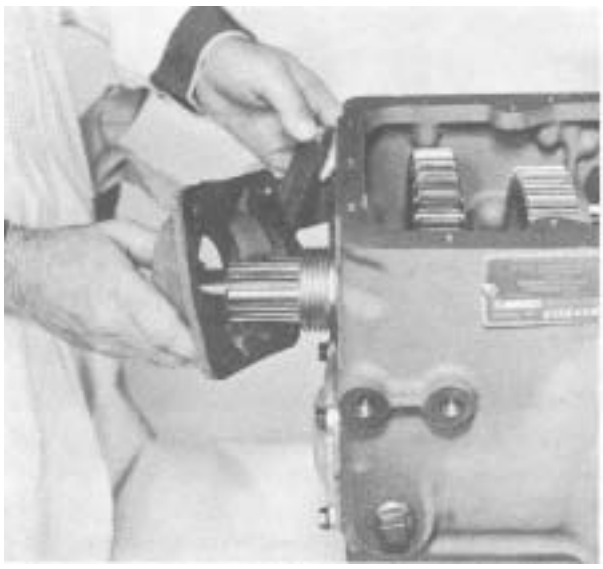


Figure 76 - Press a new oil seal in mainshaft rear bearing cap with lip of seal down. Coat a new gasket on both sides with a grade #2 multi-purpose grease. Position gasket on mainshaft rear bearing cap, use caution as not to cover oil return grooves in bearing cap. Install bearing cap with oil grooves lined up with oil holes in case. Tighten bolts 35 to 45 ft. lbs. torque [47,5 - 61,0 N,m].

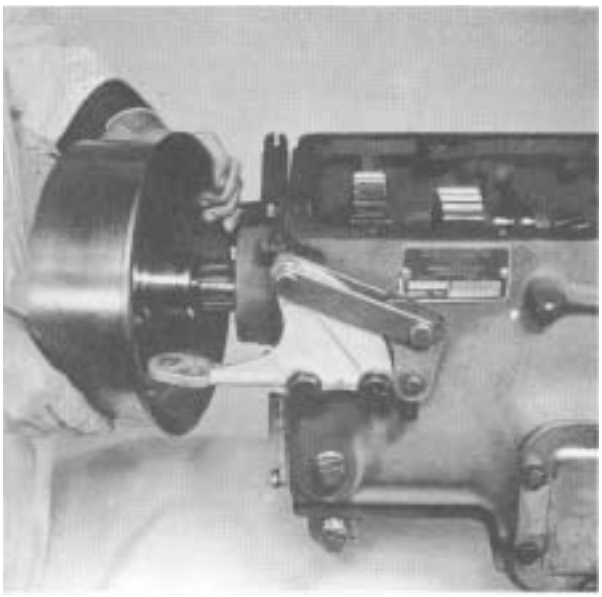


Figure 77 - Install drum and flange assembly, brake locating bracket, and anchor support bar.

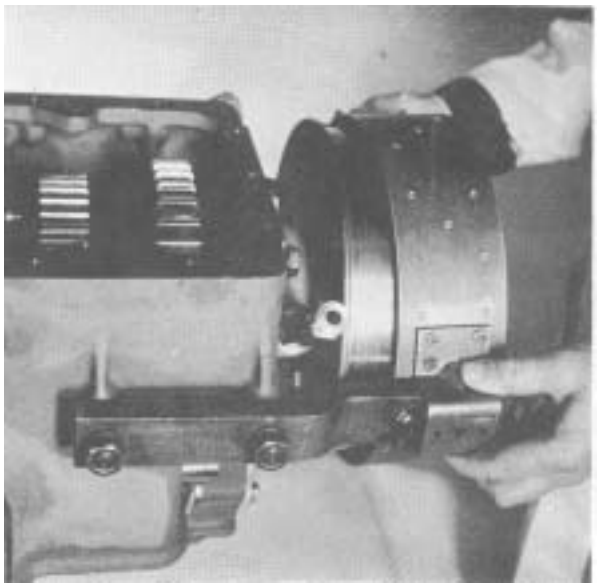


Figure 79 - Install anchor clip spring and brake band on anchor support bar.

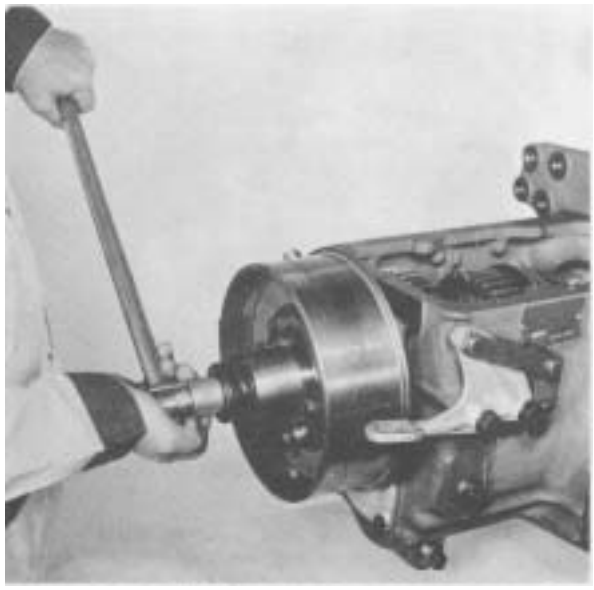


Figure 78 - Install companion flange nut and tighten 400 to 500 ft. lbs. torque [542,3 - 610,0 N,m].

Figure 80 - Install brake release springs and cam lever shoe as shown.

Figure 81 - With spacer link and cam lever in position, install adjusting bolt washer and nut.

Figure Install band locating screw as shown with threaded end up; install nut.

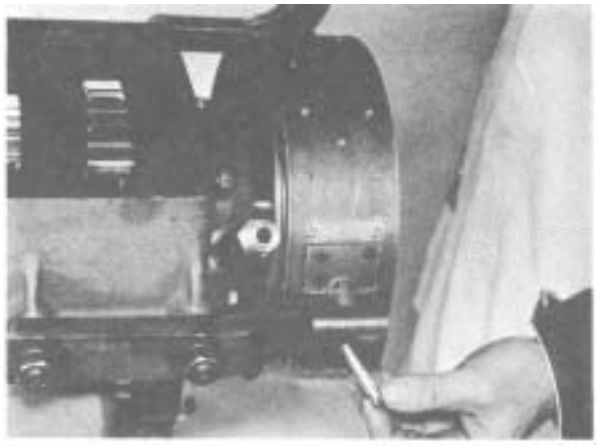


Figure 83 - Install anchor clip screw.

BRAKE BAND ADJUSTMENT

Adjust brake band anchor screw to give clearance of.010 between brake drum and band. Adjust brake band locating screw and adjusting bolt to give a .010 clearance around the entire drum. After adjustment, lockwire anchor clip screw.

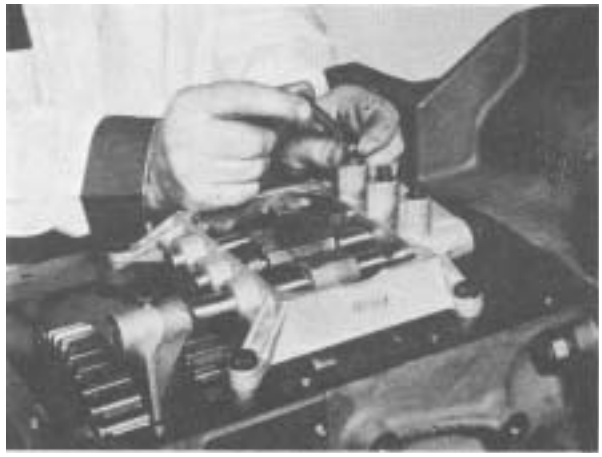


Figure 84 - With transmission shifted into neutral, install shift control assembly. 2nd & 3rd and 4th & 5th shift forks set over shift hubs, 1st & reverse fork enters slot on 1st & reverse gear. Tighten bolts 20 to 25 ft. lbs. torque [27,2 - 33,8 N.m]. Position three mesh lock balls and springs in support housing.

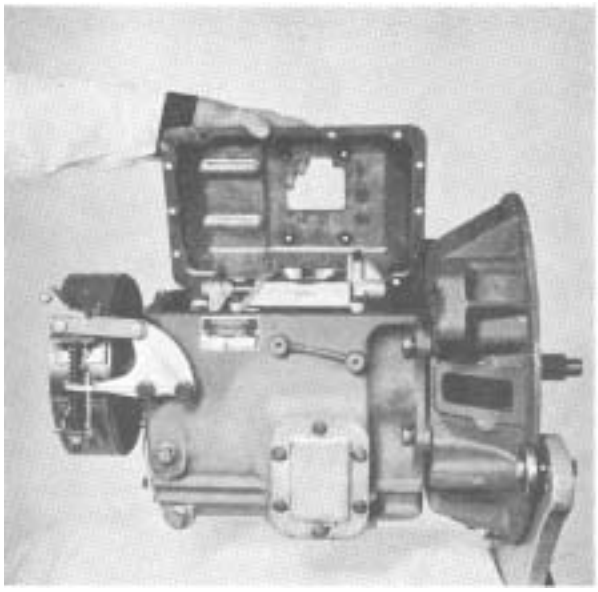


Figure 85 - Install shift support cover.

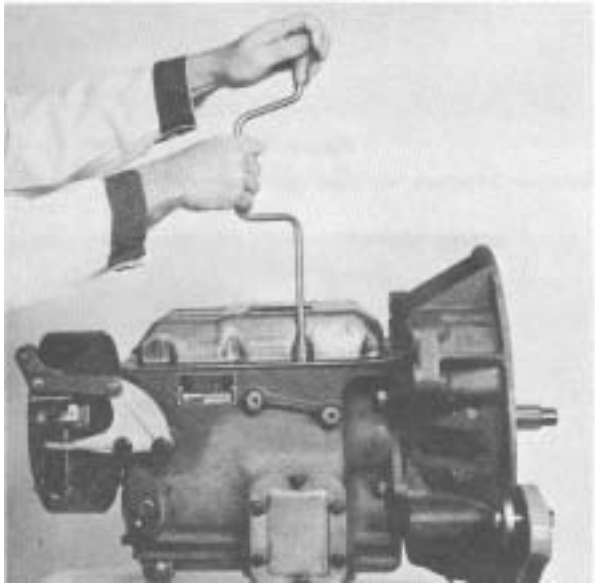


Figure 86 - Tighten shift support cover bolts 20 to 25 ft. lbs. torque [27,3 - 33,8 N.m.].

Figure 87 - Install remove control or shift control top, tighten bolts 20 to 25 ft. lbs. torque [27,2 - 33,8 N.m.].

USE FOLLOWING PROCEDURE FOR DIECAST COVER DISASSEMBLY AND REASSEMBLY (Fabricated Rails)

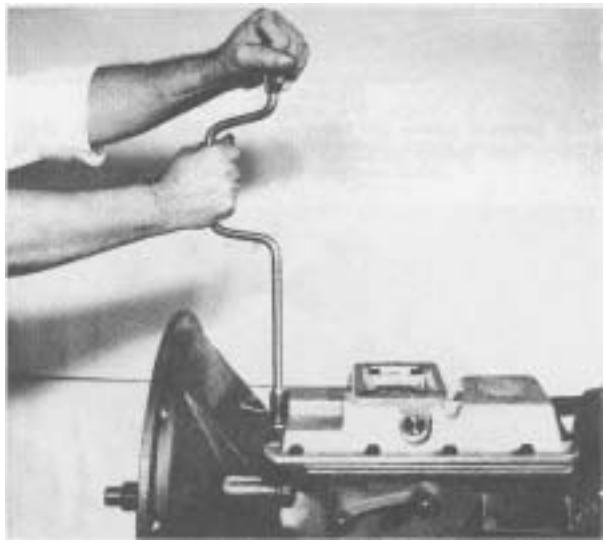


Figure 88 - Remove remote control or shift tower from control cover. Remove control cover capscrew and lockwashers.

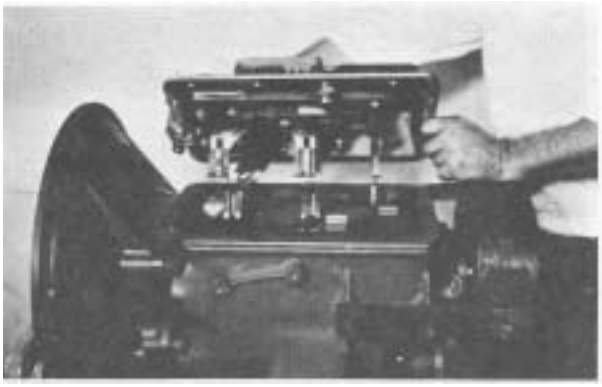


Figure 89 - Remove control cover assembly from transmission. Remove backup switch.

Figure 90 - With control cover in neutral, pry 4th & 5th shift fork to 4th speed position (toward the rear of cover).

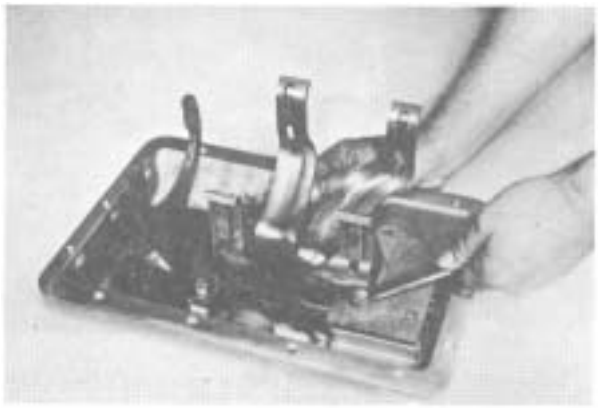


Figure 91 - Remove front rail support capscrews.

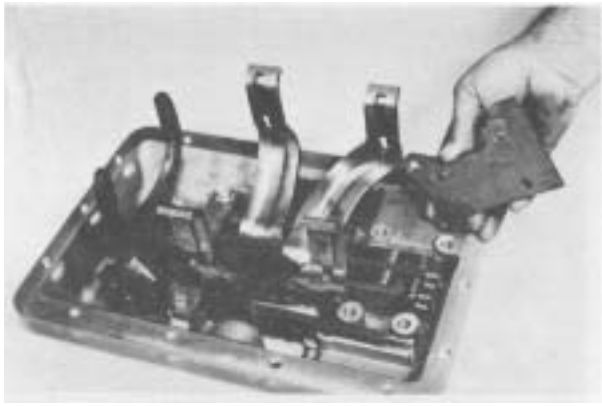


Figure 92 - Remove front rail support.

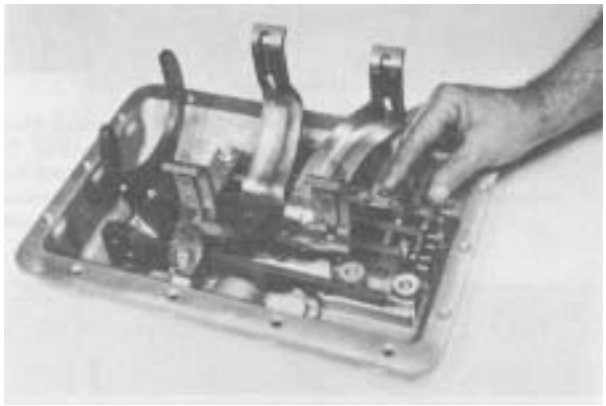


Figure 93 - Remove interlock tapered pin supports

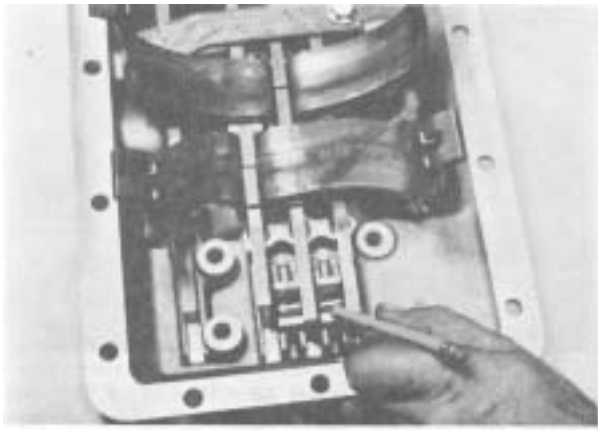


Figure 94 - Note position of interlock tapered pins for reassembly.

Figure 95 - Remove rear rail support capscrews.

Figure 96 - Remove rear rail support

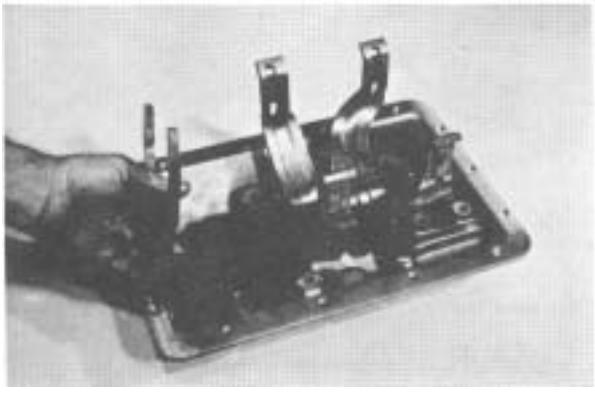


Figure 97 - Remove 1st & reverse shift fork and rail assembly.

Figure 98 - Remover 4th, 5th 2nd & 3rd shift fork and rail assembly. (See Caution in Figure 99).

Figure 99 - Use caution as not to lose interlock cross pin, interlock tapered pins or mesh lock poppet balls.

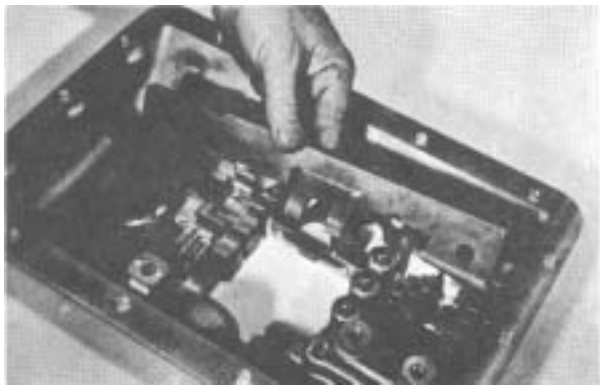


Figure 100 - Remove 1st & reverse shift rail.

Figure 101 - Remove mesh lock poppet balls, quantity 4.

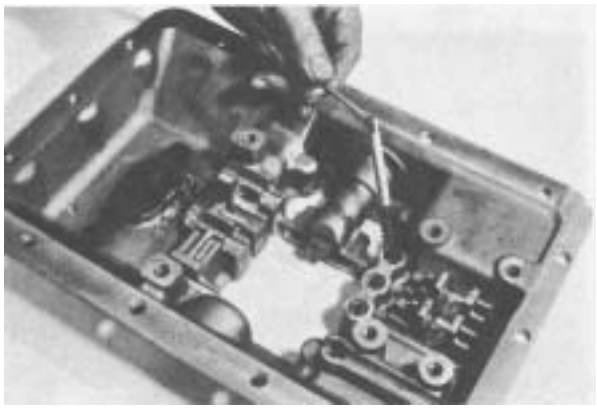


Figure 102 - Remove poppet springs, quantity 4.

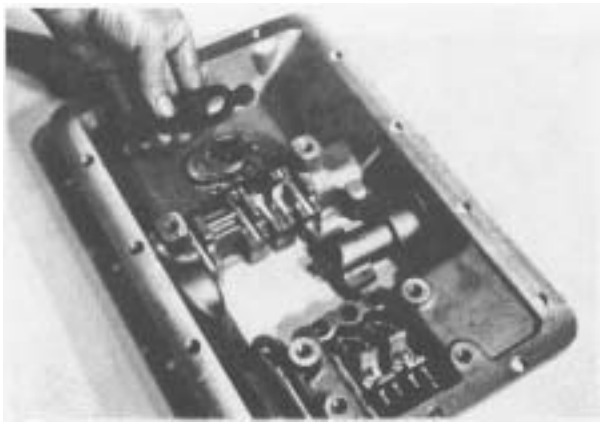


Figure 103 - Remove 1st & reverse rocker arm.

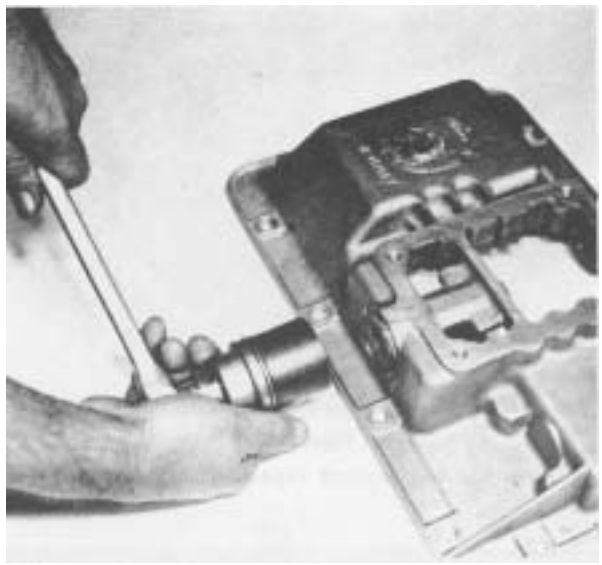


Figure 104 - Remove reverse latch plunger spring retaining plug.

Figure 105 - Remove reverse latch plunger spring and plunger.

SEE CLEANING AND INSPECTION PROCEDURE, PAGES 10-11.

DIECAST CONTROL REASSEMBLY

Figure - 106 - If fork bushings are worn, secure fork in a vise equipped with soft jaws and remove worn bushings with a drift. Install new bushings in fork. Turn fork over on anvil of vise and secure bushing in fork using a prick punch and upsetting bushing metal on outside of fork.

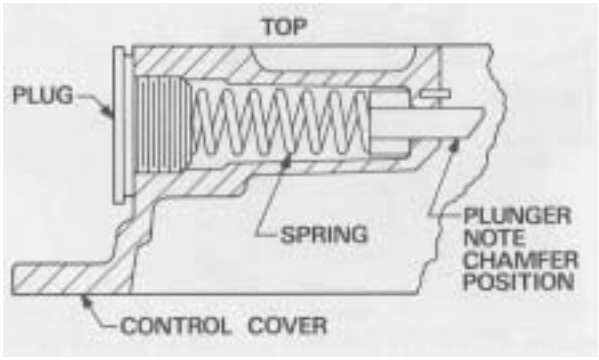


Figure 107 - Install reverse latch plunger, spring and retaining plug. Tighten plug securely.

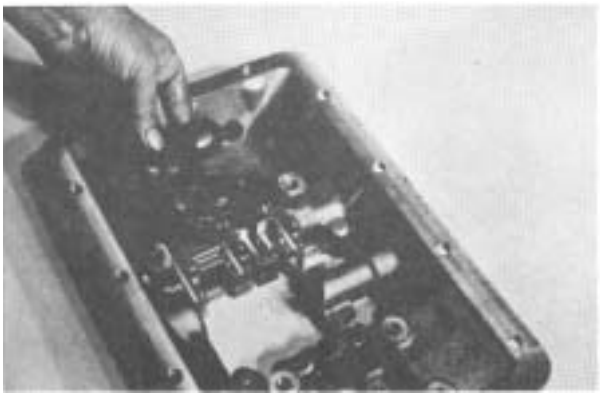


Figure 108 - Position 1st & reverse rocker arm on pivot pin as shown.

Figure 109 - Install poppet springs, quantity 4.

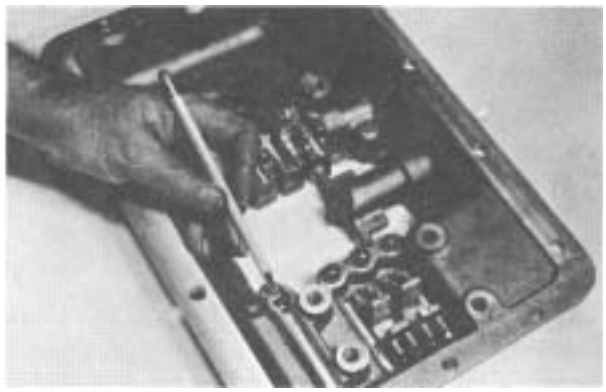


Figure 110 - Install mesh lock poppet balls, quantity 4. Note 1st & reverse shift fork rail poppet ball in pocket.

Figure 111 - Align one tapered interlock cross pin with hole in 1st & reverse shift rail. Position rail on poppet ball with rail in neutral position.

Figure 112 - Note position of tapered interlock cross pin in relation to rail.

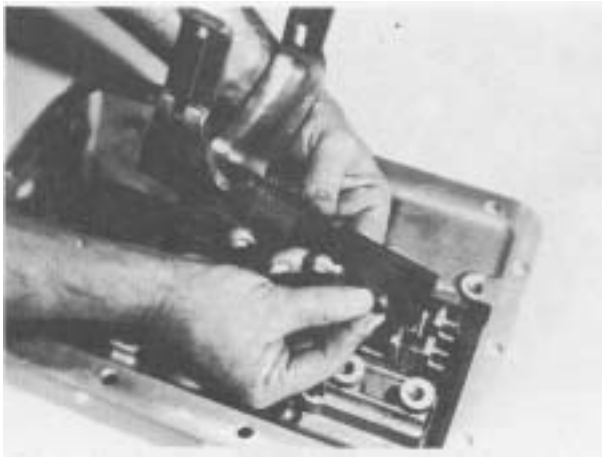


Figure 113 - Install interlock cross pin in 2nd & 3rd shift rail.

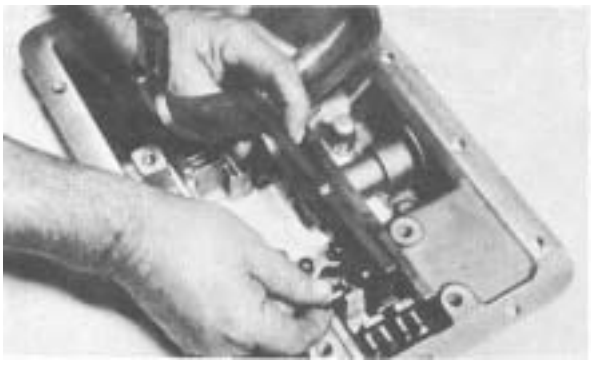


Figure 114 - Position 2nd & 3rd shift rail on poppet ball in neutral position with interlock pin aligned with 1st interlock tapered pin.

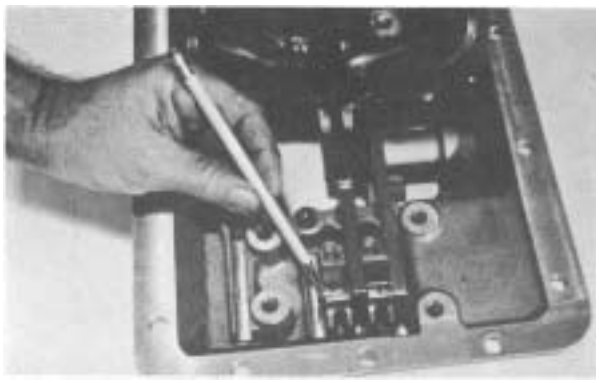


Figure 115 - Install 2nd interlock tapered pin. Align pin with interlock cross pin hole.

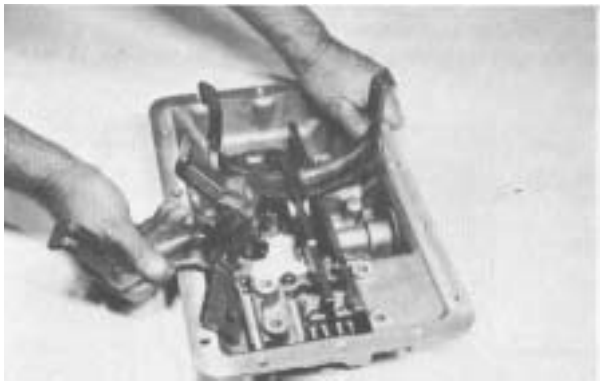


Figure 116 - Position 4th & 5th shift fork and rail on poppet ball in neutral.

Figure 117 - Slightly raise rear of 4th & 5th shift rail and align 2nd interlock tapered pin with cross hole in 4th & 5th shift rail.

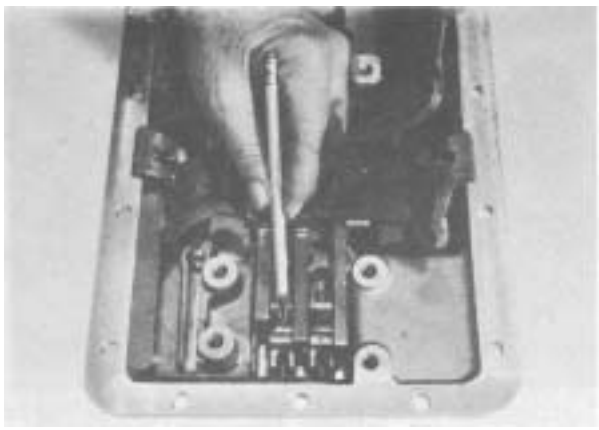


Figure 118 - Note position of tapered interlock pins and shift rails.

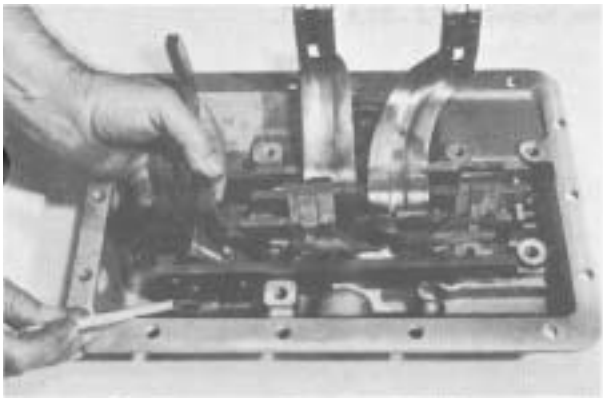


Figure 119 - Install 1st & reverse shift fork and rail assembly on poppet ball in a neutral position. Align 1st & reverse rocker arm in notch at rear of rail as shown.

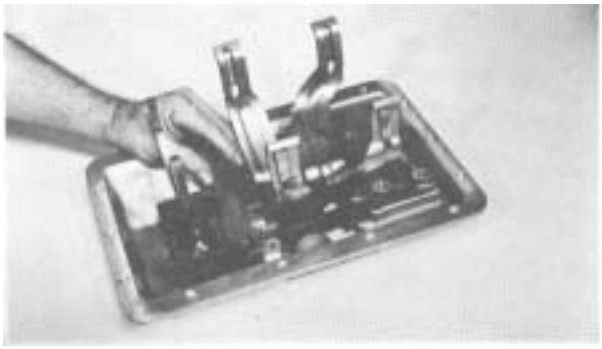


Figure 120 - Position rear rail support

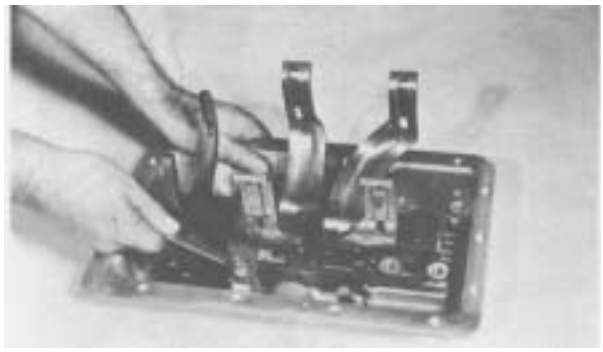


Figure 121 - Install rail support capscrews and washers. Tighten capscrews slightly.

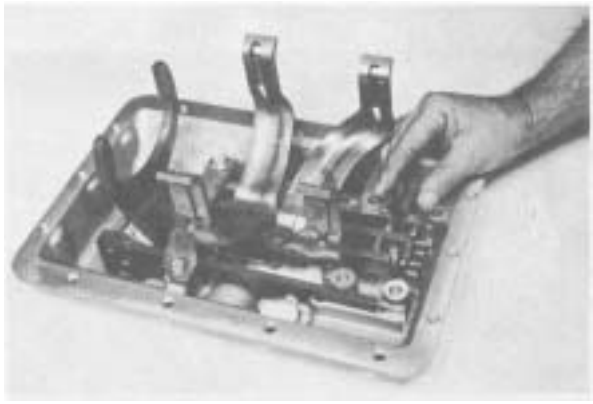


Figure 122 - Install interlock tapered pin supports. Tap 4th & 5th shift fork to the rear. (4th speed position).

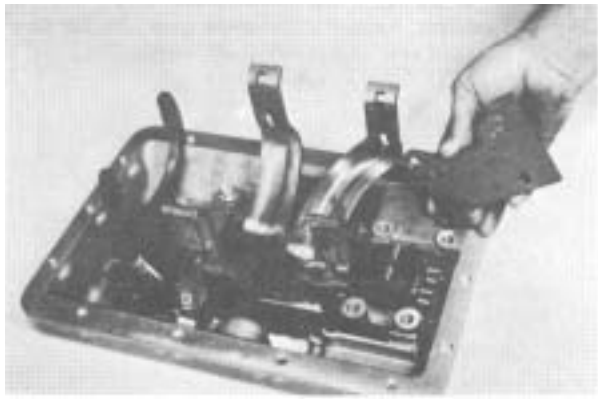


Figure 123 - Position front rail support and install capscrews and washers.

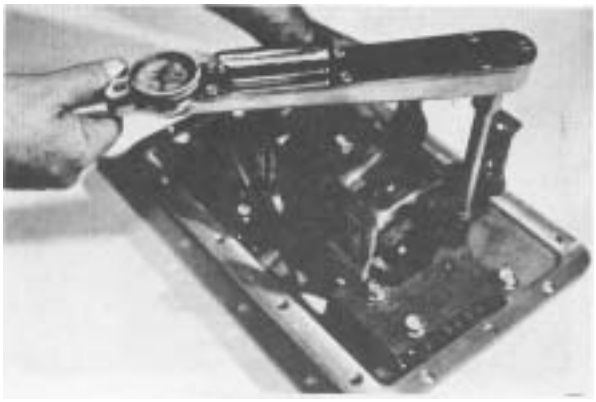


Figure 124 - Tighten front and rear support capscrews 20 to 25 ft. lbs. torque [27,2 - 33,8 N,m]. Tap 4th & 5th shift fork and rail assembly forward to a neutral position.

Figure 125 - With transmission in neutral, position control cover over gears aligning shift forks in shift cover with gear shift hubs. If control cover is in neutral and transmission is in neutral, transmission drive gear should turn without brake drum or output shaft turning.

Figure 126 - Install center rear capscrews first and tighten 20 to 25 ft. lbs. torque [27,2 - 33,8 N,m]. Install center front screw second and tighten 20 to 25 ft. lbs torque [27,2 - 33,8 N,m]. Tighten remaining capscrews 20 to 25 ft. lbs torque [27,2 - 33,8 N,m].

SHIFT CONTROL DISASSEMBLY (Round Rails)

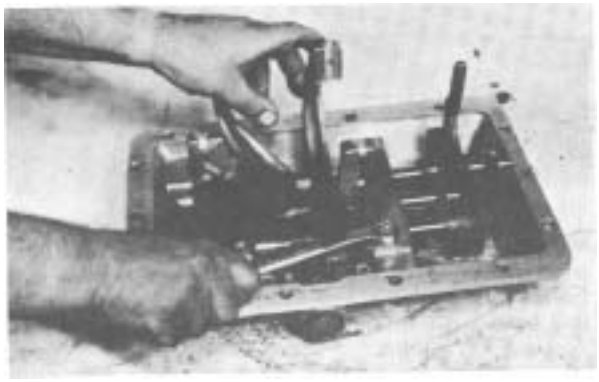


Figure 1- Remove front and rear rail support capscrews.

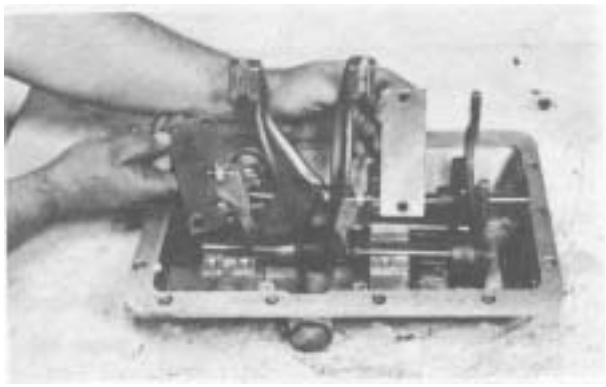


Figure 2 - Remove front and rear rail supports

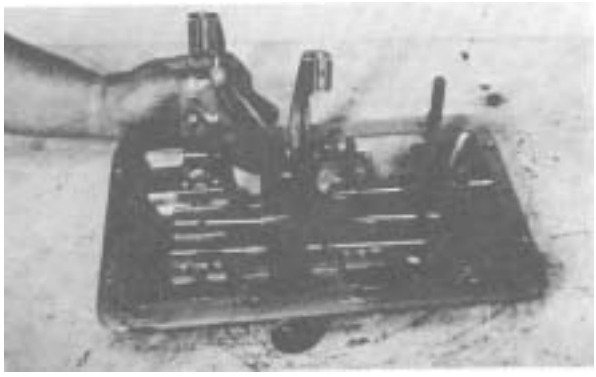


Figure 3 - Remove the 4th and 5th shift fork and rail assembly.

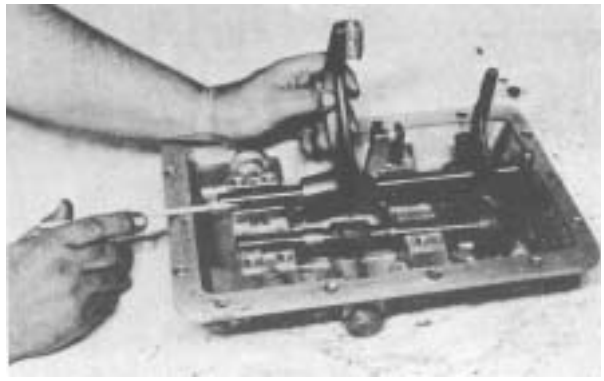


Figure 4 - Remove 2nd & 3rd shift fork and rail assembly. CAUTION: Do not loss interlock cross pin.

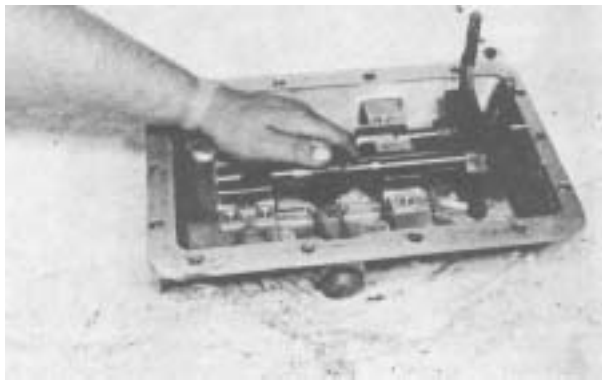


Figure 5 - Remove 1st & reverse shift fork, rail and lug assembly.

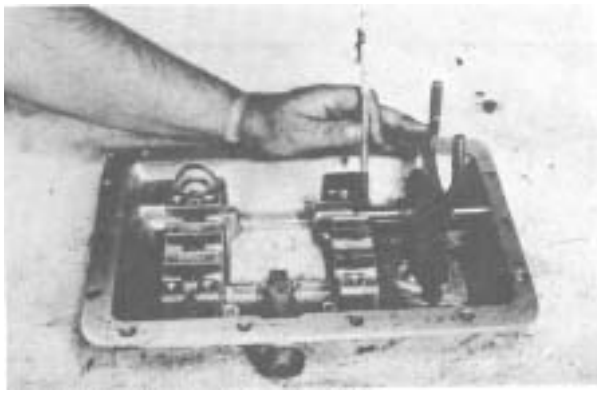


Figure 6 - Using a small magnet remove the 1st and reverse shift fork rod lock pin.

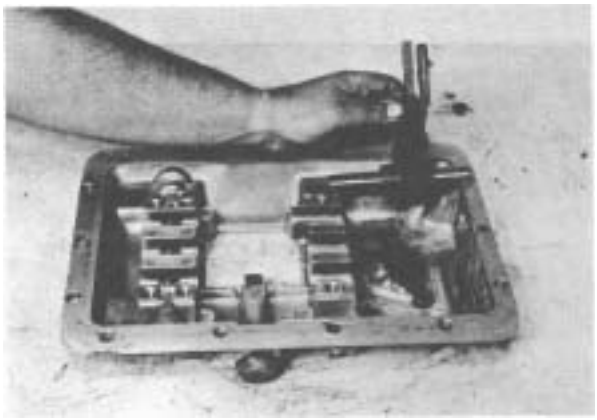


Figure 7 - Remove first & reverse shift fork and rail assembly.

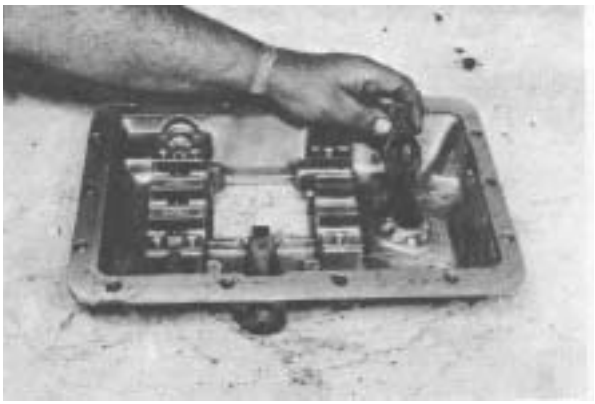


Figure 8 - Remove 1st & reverse rocker arm.

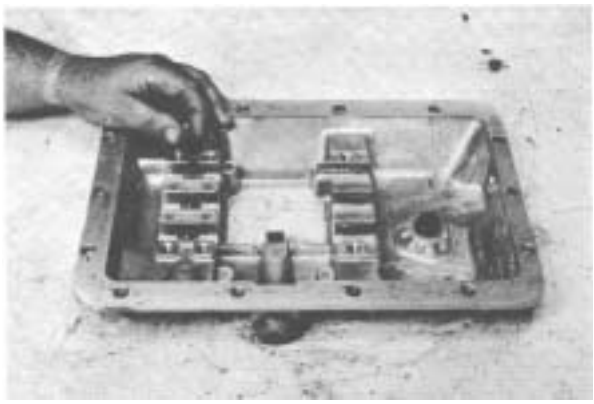


Figure 9 - Remove mesh lock spring and lock ball - 3 each. Remove crossover interlock balls - 4 each.

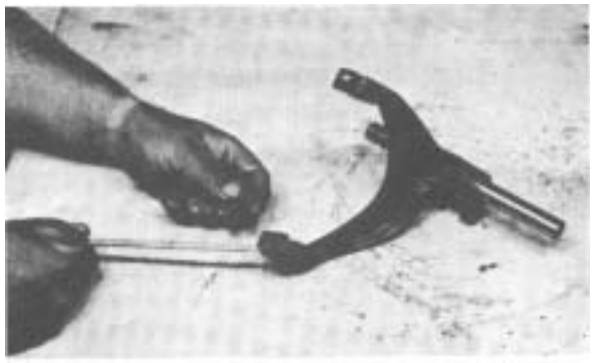


Figure 10 - If the second, third, fourth or fifth shift fork bushing is to be replaced, remove worn bushings from fork. Install new bushing and bend bushings tab over top and bottom of fork.

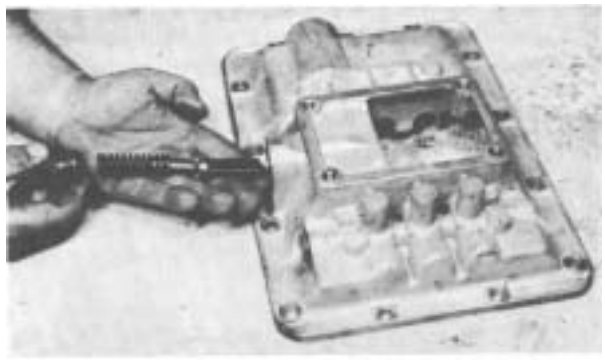


Figure 11 - Remove reverse latch plunger, pin and spring.

See Cleaning and Inspection Section, Page 10.

REASSEMBLY

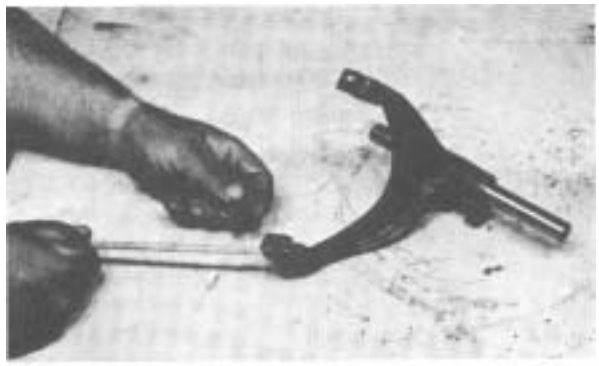


Figure 12 - Install reverse latch plunger, spring, pin and plunger spring plug.

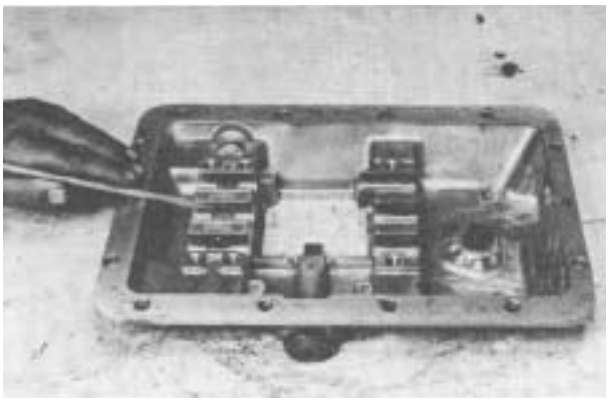


Figure 13 - Position crossover interlock balls in cover cross bores. Two balls in cover cross bore between 1st & reverse rail groove, and 2nd & 3rd rail groove and two balls in cover cross bore between 2nd & 3rd rail groove, and 4th & 5th rail groove. (See cross-section illustration Figure 13-A).

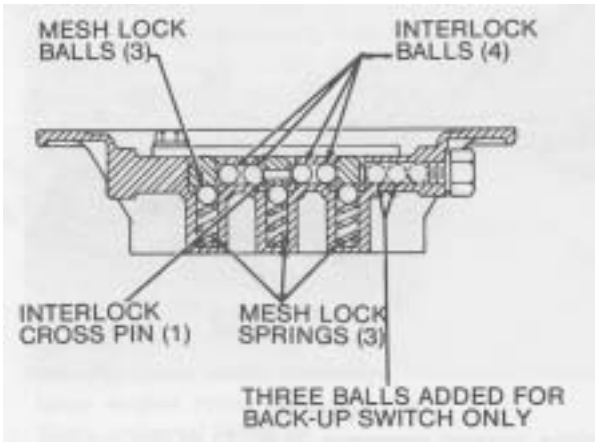


Figure 13-A

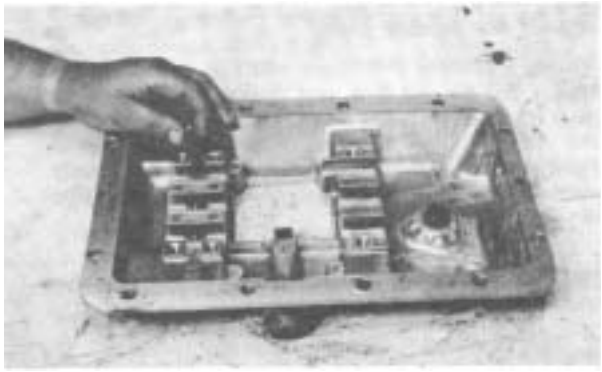


Figure 14 - Position the mesh lock spring and ball, three each, in spring pockets. (See cross-section illustration Figure 13-A).

Figure 15 - Position 1st & reverse rocker arm on pivot pin.

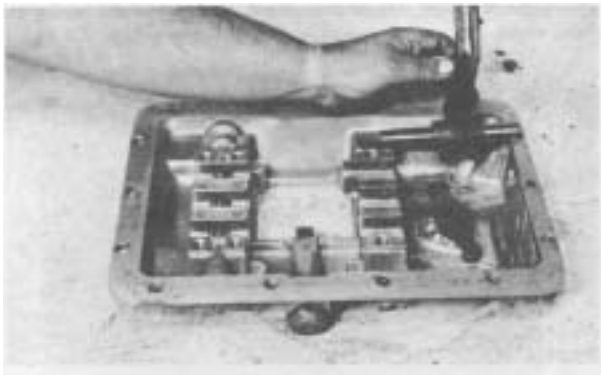


Figure 16 - Install 1st & reverse shift fork and rail assembly in control housing. Install shift rail lock pin to position rail in control housing.

Figure 17 - Install 1st & reverse shift lug, rocker lug, shift rail and spacers in rail groove over mesh lock ball and spring. NOTE: Position widest spacer between shift lug and front support. The narrower spacer between the shift lug and center support.

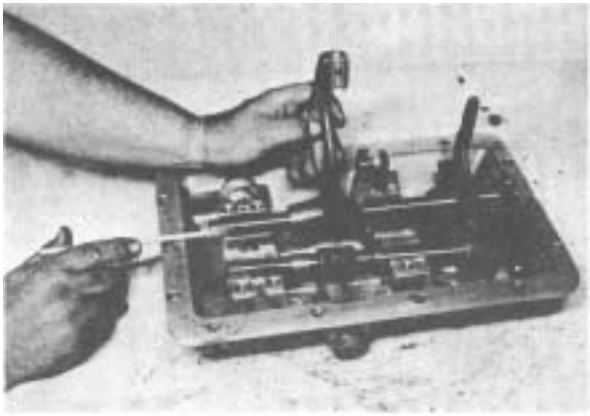


Figure 18 - Install interlock cross pin in 2nd & 3rd shift rail. Position 2nd & 3rd shift rail and fork assembly in rail groove over mesh lock ball and spring. Make certain cross pin is in position in rail. (See Figure 13-A).

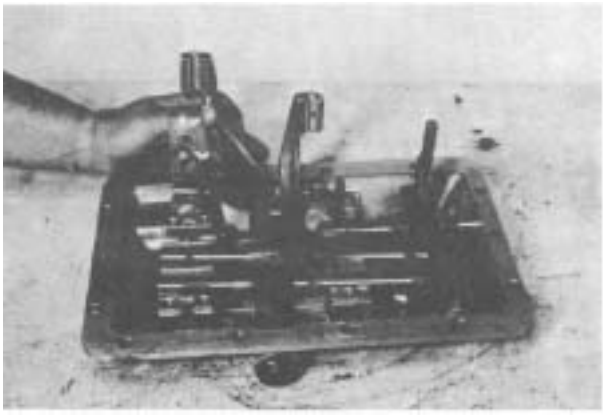


Figure 19 - Position 4th & 5th shift rail and fork assembly in rail groove over mesh lock ball and spring.

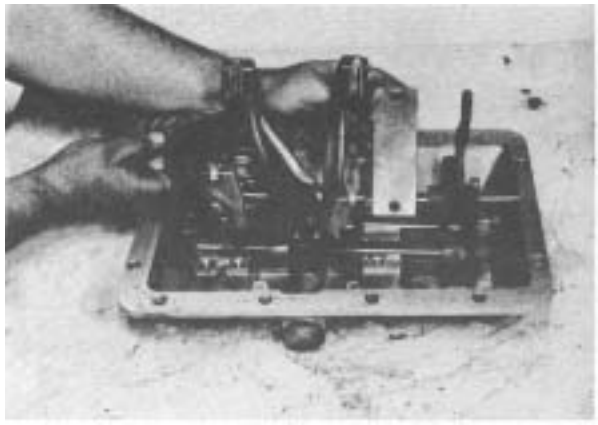


Figure 20 - Position front rail support shift rails and install capscrews. Position rear support over rails and install capscrews.

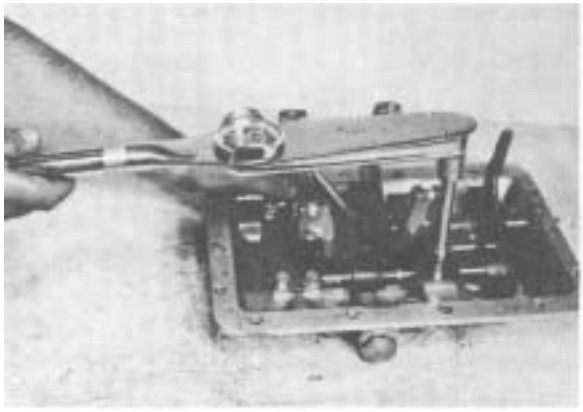


Figure 21 - Tighten support capscrews 20 to 25 ft. lbs. torque [27,2 - 33,8 N.m].

Test Cover for Double Shift:
Pry 4th & 5th shift fork and rail out of neutral position. Try to pry 1st & reverse shift fork and rail out neutral positoin. 1st & reverse fork should not shift. If it does, interlock cross pin or interlock cross over balls were not assembled correctly. Disassemble cover and correct cross over. (See illustration Figure 13-A).

NOTE: Install control cover capscrews in sequence explained in Figure 126.

TROUBLESHOOTER'S TRANSMISSION CHECKLIST

1. NOISE ARISING IN NEUTRAL
Misalignment of transmission
Worn transmission bearings
Scuffed gear tooth contact surfaces on gears
Worn mainshaft gear bushings
Worn or rough reverse idler gear
Sprung or work countershaft
Excessive backlash in constant mesh gear
Work mainshaft pilot bearing
Incorrect lubricant
Low lubricant level
Noisy main drive gear bearing

2. NOISE ARISING IN GEAR
Worn or rough mainshaft rear bearing
Sliding gear teeth rough, chipped, tapered
Excessive end play on mainshaft gears
Noisy speedometer gears
(See Conditions under #1)

3. NOISE ARISING OUTSIDE
Out-of-balance fan
Defective torsional dampener
Out-of-balance crankshaft
Out-of-balance flywheel
Out-of-balance clutch assembly
Loose engine mountings
Worn universal joints
U-joints improperly installed
Misaligned or sprung driveshaft
Incorrect driveshaft assembly
Out-of-balance driveshaft

4. DIFFICULT SHIFTING
Improperly operating clutch
Sliding gear or shift hubs tight on mainshaft splines
Damaged chamfer on sliding gear teeth
Burred mainshaft splines
Misaligned mainshaft
Damaged or worn synchronizer assembly
Improper linkage adjustment
Worn or sprung shift fork

5. STICKING IN GEAR
Improperly operating clutch
Sliding gear or shift hubs tight on mainshaft splines
Misaligned mainshaft
Improper linkage adjustment

6. SLIPPING OUT OF DIRECT
Misaligned of transmission on engine
Worn pinion gear teeth
Worn clutching teeth on shift hub
Insufficient tension on detent balls
Improper linkage adjustment
Excessive shift lever whip action

7. SLIPPING OUT OF FIRST OR REVERSE
First or reverse sliding gear splines worn
Sliding gear teeth worn or tapered
Worn mainshaft splines
Worn countershaft first speed gear
Partial engagement
Improper linkage adjustment

8. SLIPPING OUT OF OTHER SPEEDS
Excessive clearance between mainshaft gear and mainshaft
Excessive end play of mainshaft gear on mainshaft
Worn clutching teeth
Weak detent ball springs
Improper linkage adjustment

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