Service Manual

Fuller Heavy Duty Transmissions TRSM0415

October 2007

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Before starting a vehicle always be seated in the drivers seat, place the transmission in neutral, set the parking brakes and disengage the clutch.

Before working on a vehicle place the transmission in neutral, set the parking brakes and block the wheels.

Before towing the vehicle place the transmission in neutral, and lift the rear wheels off the ground or disconnect the driveline to avoid damage to the transmission during towing.

TABLE OF CONTENTS

FOREWORD
MODEL DESIGNATIONS AN D SPECIFICATIONS
LUBRICATION
OPERATION
POWER FLOW
TIMING
TORQUE RECOMMENDATIONS
TOOL REFERENCE
PREVENTIVE MAINTENANCE
PRECAUTIONS
DISASSEMBLY
INSPECTION
REASSEMBLY
CHANGING INPUT SHAFT
AIR SYSTEM
RANGE SHIFT AIR SYSTEM
AIR SYSTEM SCHEMATICS
DISASSEMBLY AND REASSEMBLY SHIFTING CONTROLS
REMOVAL–REAR YOKE, CLUTCH HOUSING AND AUXILIARY SECTION
DISASSEMBLY – AUXILIARY SECTION
REASSEMBLY – AUXILIARY SECTION
DISASSEMBLY – FRONT SECTION
REASSEMBLY – FRONT SECTION
INSTALLATION—AUXILIARY SECTION REAR YOKE AND CLUTCH HOUSING
INSTALLATION – SHIFTING CONTROLS

FOREWORD

This manual is designed to provide detailed information necessary to service and repair the Fuller® Transmission listed on the cover.

As outlined in the Table of Contents, the manual is divided into 3 main sections:

a. Technical information and reference
b. Removal, disassembly, reassembly and installation
c. Options

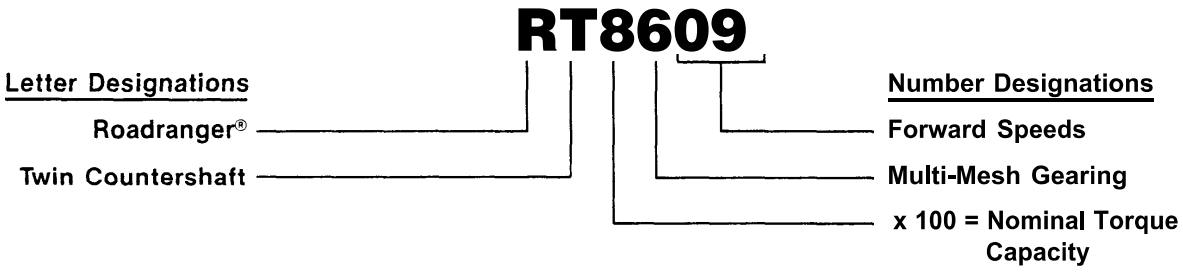
The format of the manual is designed to be followed in its entirety if complete disassembly and reassembly of the transmission is necessary. But if only one component of the transmission needs to be repaired, refer to the Table of Contents for the page numbers showing that component. For example, if you need to work on the Shifting Controls, you will find instructions for removal, disassembly and reassembly on page 26. Instructions for installation are on page 88. Service Manuals, Illustrated Parts Lists, Drivers Instructions, and other forms of product service information for these and other Fuller Transmissions are available upon request. A Technical Literature Order Form may be found in the back of this manual*. You may also obtain Service Bulletins, detailing information on product improvements, repair procedures and other service-related subjects by writing to the following address:

EATON CORPORATION
TRANSMISSION DIVISION
Technical Service Department
P.O. Box 4013
Kalamazoo, Michigan 49003
(61 6) 342-3344

Every effort has been made to ensure the accuracy of all information in this brochure. **However, Eaton Transmission Division makes no expressed or implied warranty or representation based on the enclosed information.** Any errors or omissions may be reported to Training and Publications, Eaton Transmission Division, P.O. Box 4013, Kalamazoo, MI 49003.

MODEL DESIGNATIONS AND SPECIFICATIONS

Nomenclature:



IMPORTANT: All Fuller Transmissions are identified by model and serial number. This information is stamped on the transmission identification tag and affixed to the case.
DO NOT REMOVE OR DESTROY THE TRANSMISSION IDENTIFICATION TAG.

Models	Spds.	LO	1 St	2nd	3rd	4th	5th	6th	7th	8th	Reverse Low/High	Relative Speed PTO Gear To Input RPM		1 Length In. (mm)	2 Weight Lbs. (Kg)	3 011 Cap Pints (Liters)
												Right	Bottom			
8609	9	12.66	8.48	6.24	4.64	3.42	2.48	1.82	1.36	1.00	12.03/3.52	.720	.720	284 (721.9)	460 (209)	15 (7)

CHART NOTES:

1. Lengths measured from face of clutch housing to front bottoming surface of companion flange or yoke.
2. **Weight** — Listed weights are ***without*** clutch housing* and include standard controls, which consist of gear shift lever housing and gear shift lever. Weight of standard controls is approximately 10 lbs. (4.5 kg.). All weights are approximate.
3. Oil Capacities are approximate, depending on inclination of engine and transmission. Always fill transmission with proper grade and type of lubricant to level of filler opening. See LUBRICATION.

* For information on available clutch housings refer to Publication FUL-140.—."Clutch Housing Chart".

LUBRICATION

Proper Lubrication . . . the Key to long transmission life

Proper lubrication procedures are the key to a good all-around maintenance program. If the oil is not doing its job, or if the oil level is ignored, all the maintenance procedures in the world are not going to keep the transmission running or assure long transmission life.

Eaton® Fuller® Transmissions are designed so that the internal parts operate in a bath of oil circulated by the motion of gears and shafts.

Thus, all parts will be amply lubricated if these procedures are closely followed:

1. **Maintain oil level. Inspect regularly.**
2. **Change oil regularly.**
3. **Use the correct grade and type of oil.**
4. **Buy from a reputable dealer.**

Lubrication Change and Inspection

Eaton® Roadranger® CD50 Transmission Fluid	
HIGHWAY USE—Heavy Duty and Mid-Range	
First 3,000 to 5.000 miles (4827 to 8045 Km)	Factory fill initial drain,
Every 10,000 miles (16090 Km)	Check fluid level. Check for leaks,
Heavy Duty Highway Change Interval	
Every 250,000 miles (402336 Km)	Change transmission fluid
Mid-Range Highway Change Interval	
Every 100,000 miles (160,000 Km) or every 3 years whichever occurs first.	Change transmission fluid,
OFF-HIGHWAY USE	
First 30 hours	Factory fill Initial drain
Every 40 hours	Inspect fluid level, Check for leaks
Every 500 hours	Change transmlssion fluid where severe dirt conditions exist.
Every 1,000 hours	Change transmlssion fluid (Normal off-highway use).
Heavy Duty Engine Lubricant or Mineral Gear Lubricant	
HIGHWAY USE	
First 3,000 to 5,000 miles (4827 to 8045 Km)	Factory fill Initlal drain.
Every 10,000 miles (16090 Km)	Inspect lubricant level, Check for leaks.
Every 50,000 miles (80450 Km)	Change transmlssion lubricant.
OFF-HIGHWAY USE	
First 30 hours	Change transmission lubricant on new units.
Every 40 hours	Inspect lubricant level Check for leaks
Every 500 hours	Change transmission lubricant where severe dirt conditions exist
Every 1,000 hours	Change transmission lubricant (Normal off-highway use),

Change the oil filter when fluid or lubricant is changed.

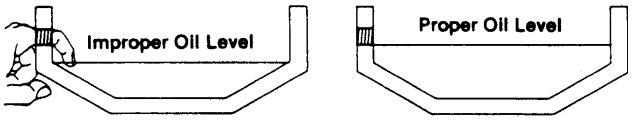
Recommended Lubricants

Type	Grade (SAE)	Fahrenheit (Celsius) Ambient Temperature
Eaton® Roadranger® CD50 Transmission Fluid	**50**	**All**
Heavy Duty Engine 011 MIL-L.2104B C or D or API-SF or API-CD (Previous API designations acceptable)	*50*	Above 10°F(-12°C)
	40	Above 10°F(-12°C)
	30	Below 10°F(-12°C)
Mineral Gear 011 with rust and oxidatlon inhibitor API-GL1	**90**	Above 10°F(-12°C)
	80W	Below 10°F(-12°C)

The use of mild EP gear oil or multi-purpose gear oil is not recommended, but if these gear oils are used, be sure to adhere to the following limitations:

Do not use mild EP gear oil or multi-purpose gear oil when operating temperatures are above 230° F (110°C). Many of these gear oils, particularly 85W140, break down above 230° F and coat seals, bearings and gears with deposits that may cause premature failures. If these deposits are observed (especially a coating on seal areas causing oil leakage), change to Eaton Roadranger CD50 transmission fluid, heavy duty engine oil or mineral gear oil to assure maximum component life and to maintain your warranty with Eaton. (Also see "Operating Temperatures".)

Additives and friction modifiers are not recommended for use in Eaton Fuller transmissions.



Proper Oil Level

Make sure oil is level with filler opening. Because you can reach oil with your finger does not mean oil is at proper level. One inch of oil level is about one gallon of oil.

Draining Oil

Drain transmission while oil is warm. To drain oil remove the drain plug at bottom of case. Clean the drain plug before re-installing.

Refilling

Clean case around filler plug and remove plug from side of case. Fill transmission to the level of the filler opening. If transmission has two filler openings, fill to level of both openings.

The exact amount of oil will depend on the transmission inclination and model. Do not over fill—this will cause oil to be forced out of the transmission.

When adding oil, types and brands of oil should not be mixed because of possible incompatibility.

LUBRICATION

Operating Temperatures —With Eaton® Roadranger® CD50 Transmission Fluid Heavy Duty Engine Oil and Mineral Oil

The transmission should not be operated consistently at temperatures above 250°F (120°C). However, intermittent operating temperatures to 300°F (149°C) will not harm the transmission. Operating temperatures above 250°F increase the lubricant's rate of oxidation and shorten its effective life. When the average operating temperature is above 250" F, the transmission may require more frequent oil changes or external cooling.

The following conditions in any combination can cause operating temperatures of over 250°F: (1) operating consistently at slow speeds, (2) high ambient temperatures, (3) restricted air flow around transmission, (4) exhaust system too close to transmission, (5) high horsepower, overdrive operation.

External oil coolers are available to reduce operating temperatures when the above conditions are encountered.

Transmission Oil Coolers are:

Recommended

— With engines of 350 H.P. and above with overdrive transmissions

Required

— With engines 399 H.P. and above with overdrive transmissions and GCW'S over 90,000 lbs.

— With engines 399 H.P. and above and 1400 Lbs.-Ft. or greater torque

— With engines 450 H.P. and above

— With EP or Multipurpose Gear Oil

Mild EP gear oil and multipurpose gear oil are not recommended when lubricant operating temperatures are above 230°F (110°). In addition, transmission oil coolers are not recommended with these gear oils since the oil cooler materials may be attacked by these gear oils. **The lower temperature limit and oil cooler restriction with these gear oils generally limit their success to milder applications.**

Proper Lubrication Levels as Related to Transmission Installation Angles

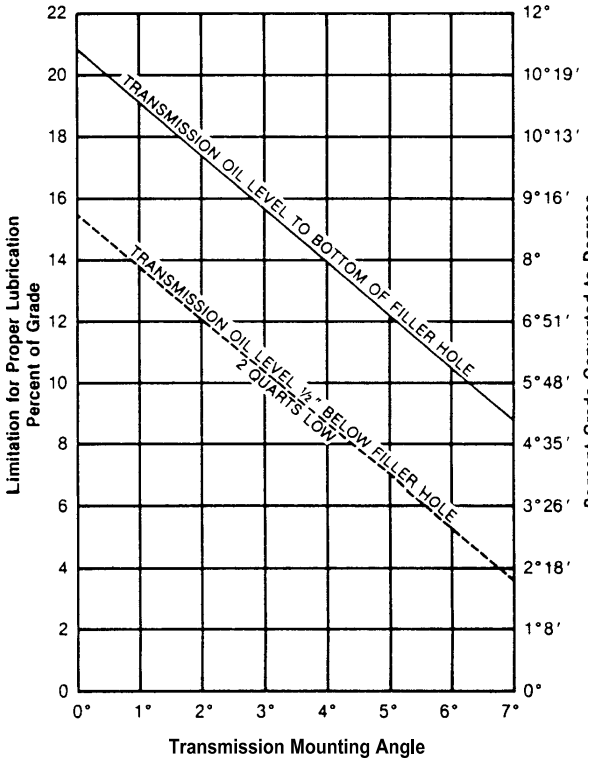
If the transmission operating angle is more than 12 degrees, improper lubrication can occur. The operating angle is the transmission mounting angle in the chassis plus the percent of upgrade (expressed in degrees).

The chart below illustrates the safe percent of upgrade on which the transmission can be used with various chassis mounting angles. For example: if you have a 4 degree transmission mounting angle, then 8 degrees (or 14 percent of grade) is equal to the limit of 12 degrees. If you have a O degree mounting angle, the transmission can be operated on a 12 degree (21 percent) grade.

Anytime the transmission operating angle of 12 degrees is exceeded for an extended period of time the transmission should be equipped with an oil pump or cooler kit to insure proper lubrication.

Note on the chart the effect low oil levels can have on safe operating angles. Allowing the oil level to fall 1/2" below the filler plug hole reduces the degree of grade by approximately 3 degrees (5.5 percent).

Proper Lubrication Levels are Essential!

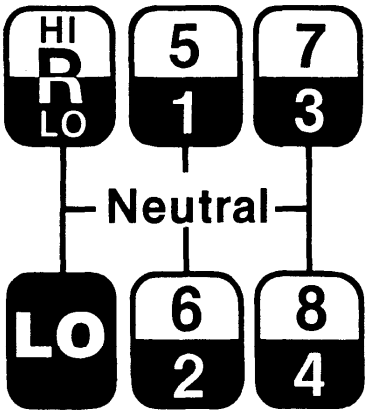


Dotted line showing "2 Charts Low" is for reference only. Not recommended.

OPERATION

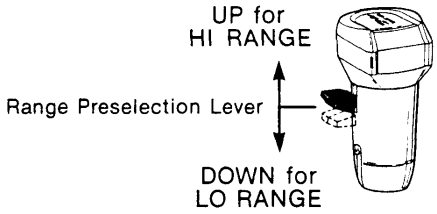
9-Speed Transmissions

Shift Lever Patterns and Shifting Controls



Shift LO-1-2-3-4 in LO Range. Range Shift . . . And shift 5-6-7-8 in HI Range.

Master Control Valve (A-5010)



Driving Tips

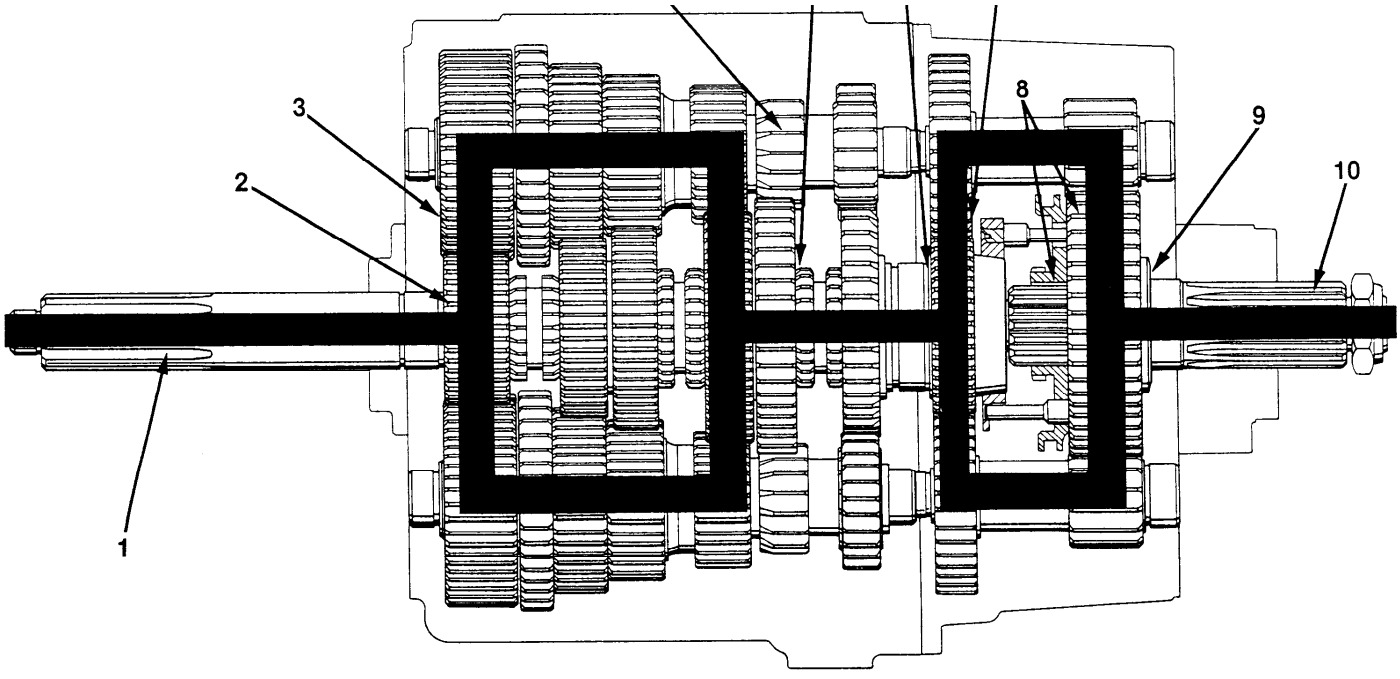
- For a smooth start, always select an initial starting gear that will provide sufficient reduction for the load and terrain.
- Always use normal double-clutching procedures when making lever shifts.
- Never slam or jerk the shift lever to complete gear engagement.
- Never coast with the gear shift lever in the neutral position.
- Never move the Range Control Knob/Range Preelection Lever with the gear shift lever in the neutral position while the vehicle is moving.
- Never make a range shift while operating in reverse.
- Never downshift at too high of a road speed.
- When slowing down, the proficient vehicle operator can downshift through all the individual gear speeds to prolong the life of chassis and trailer.

POWER FLOW

The transmission must efficiently transfer the engine's power, in terms of torque, to the vehicle's rear wheels. Knowledge of what takes place in the transmission during torque transfer is essential when trouble-shooting and making repairs.

Front Section Power Flow (All Models)

1. Power (torque) from the vehicle's engine is transferred to the transmission's input shaft.
2. Splines of input shaft engage internal splines in hub of main drive gear.
3. Torque is split between the two countershaft drive gears.
4. Torque is delivered along both countershaft to mating countershaft gears of "engaged" mainshaft gear. The following cross section views (Figures 1-3) illustrate a 1st/5th speed gear engagement.
5. Internal clutching teeth in hub of engaged mainshaft gear transfers torque to mainshaft through sliding clutch.
6. Mainshaft transfers torque directly to auxiliary drive gear.
7. The auxiliary drive gear splits torque between the two auxiliary countershaft drive gears.
8. Torque is delivered along both auxiliary countershaft to the mating "engaged" gear on output shaft.
9. Torque is transferred to output shaft through sliding clutch.
10. Output shaft delivers torque to driveline.



POWER FLOW

Auxiliary Section Power Flow: LO RANGE (All Models]

7. The auxiliary drive gear splits torque between the two auxiliary countershaft drive gears.
8. Torque is delivered along both countershaft to "engaged" LO RANGE gear on range mainshaft or output shaft.
9. Torque is transferred to range mainshaft or output shaft through sliding clutch.
10. Torque is delivered to driveline as LO RANGE 1st.

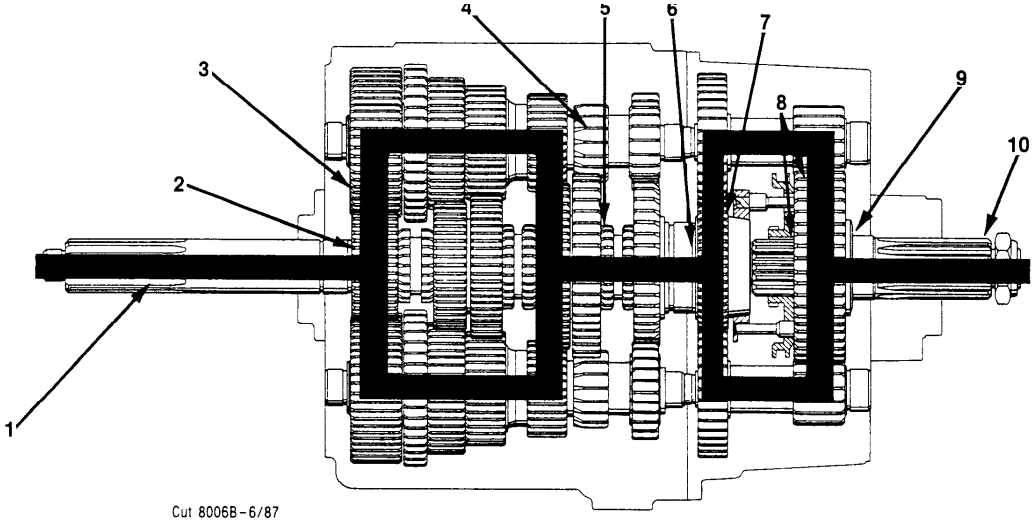


Figure 2.

LO RANGE POWER FLOW

Auxiliary Section Power Flow: HI RANGE (All Models)

7. The auxiliary drive gear transfers torque directly to the range mainshaft or output shaft through "engaged" sliding clutch.
8. Torque is delivered through range mainshaft and/or output shaft to driveline as HI RANGE 5th.

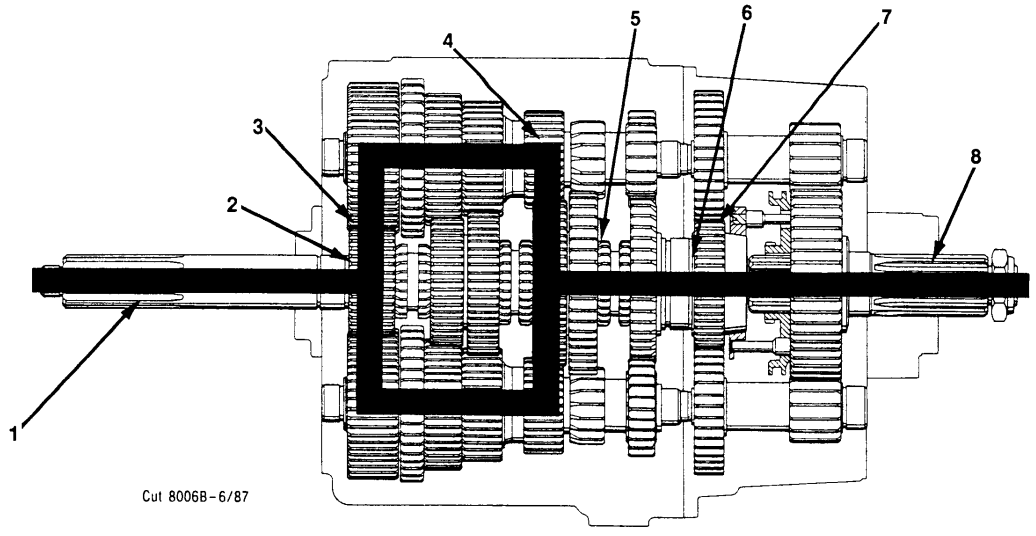


Figure 3.

HI RANGE POWER FLOW

TIMING

Timing Procedures: All Models

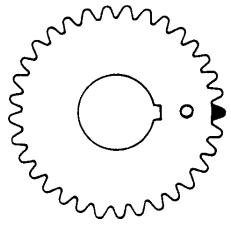
It is essential that both countershaft assemblies of the front and auxiliary sections are "timed. " This assures proper tooth contact is made between mainshaft gears seeking to center on the mainshaft during torque transfer and mating countershaft gears that distribute the load evenly. If not properly timed, serious damage to the transmission is likely to result from unequal tooth contact causing the mainshaft gears to climb out of equilibrium.

Timing is a simple procedure of marking the appropriate teeth of a gear set prior to installation and placing them in proper mesh while in the transmission. In the front section, it is necessary to time only the drive gear set. And depending on the model, only the LO range, deep reduction, or splitter gear set is timed in the auxiliary section.

Front Section

A. Marking countershaft drive gear teeth.

1. Prior to placing each countershaft assembly into case, clearly mark the tooth located directly over the keyway of drive gear as shown. This tooth is stamped with an "O" to aid identification.

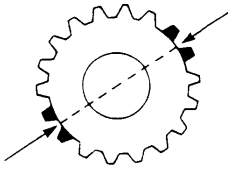


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Tooth on Countershaft directly over Keyway marked for timing

B. Marking main drive gear teeth.

1. Mark any two adjacent teeth on the main drive gear.
2. Mark the two adjacent teeth located directly opposite the first set marked on the main drive gear. As shown below, there should be an equal number of unmarked gear teeth on each side between the marked sets.

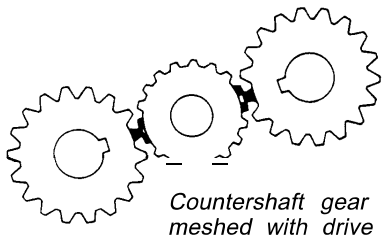


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Drive gear teeth correct/y marked for timing.

C. Meshing marked countershaft drive gear teeth with marked main drive gear teeth.
(After placing the mainshaft assembly into case, the countershaft bearings are installed to complete installation of the countershaft assemblies.)

1. When installing the bearings on left counter: shaft, mesh the marked tooth of countershaft drive gear with either set or two marked teeth on the main drive gear.
2. Repeat the procedure when installing the bearings on right countershaft, making u-se of the remaining set of two marked teeth on the main drive gear to time assembly.



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Countershaft gear teeth meshed with drive gear teeth for correct timing.

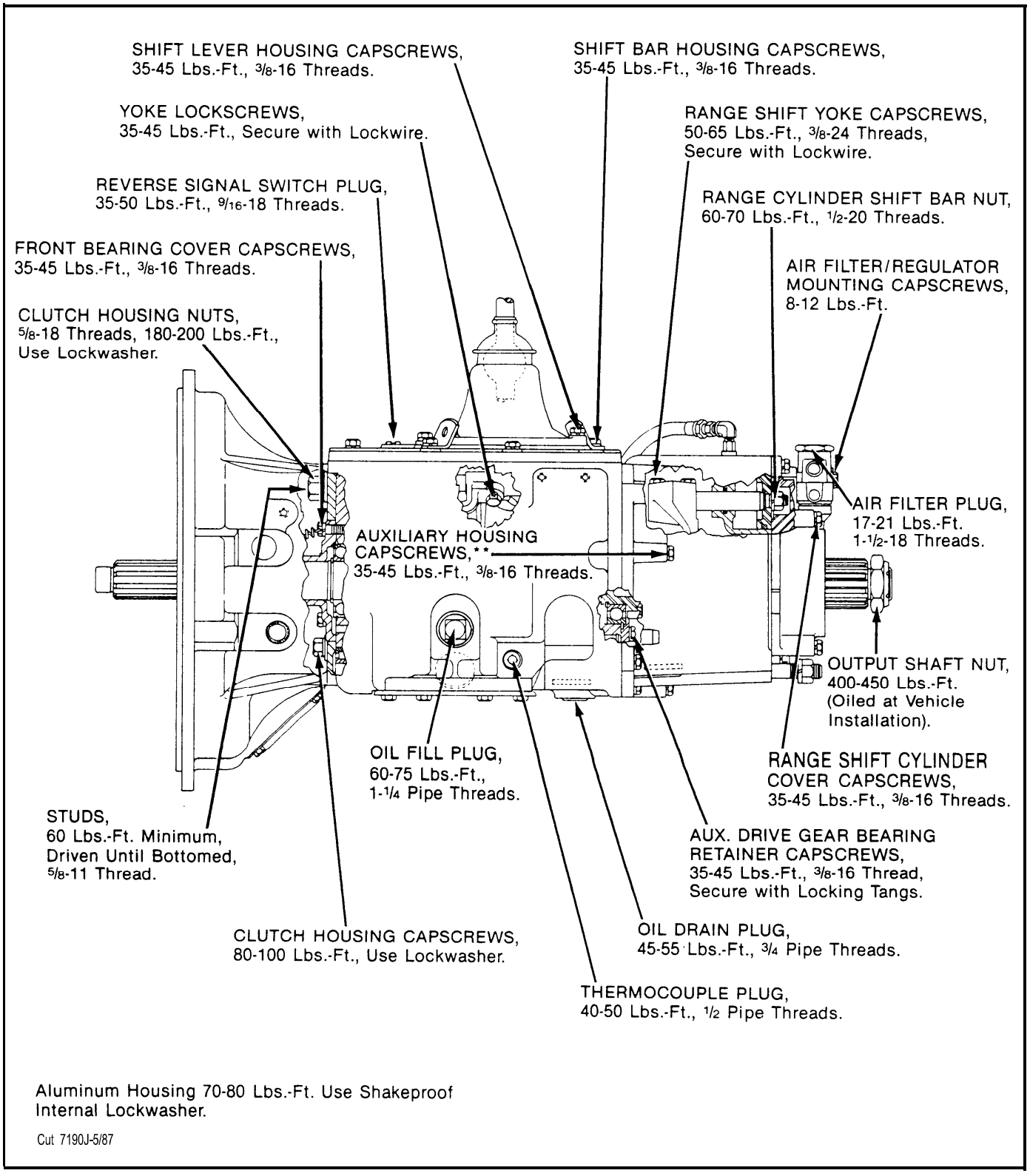
Auxiliary Section

A. Timing the auxiliary countershaft and LO range gear.

1. Mark any two adjacent teeth on the LO range gear of set to be timed. Then mark the two adjacent teeth located directly opposite the first set marked as shown in Illustration B.
2. Prior to placing each auxiliary countershaft assembly into housing, mark the tooth stamped with an "O" on gear to mate with timed mainshaft gear as shown in Illustration A.
3. Install the LO range gear on the out put shaft and into the auxiliary case.
4. Seat the auxiliary countershaft bearings.
5. Install the rear bearing cover and tighten to recommended torque.
6. Place the auxiliary countershaft assemblies into position and mesh the marked teeth of the mating countershaft gears with the marked teeth of the LO range gear as shown in illustration C.

TORQUE RECOMMENDATIONS

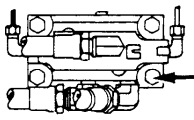
Correct torque application is extremely important to assure long transmission life and dependable performance. Over-tightening or under-tightening can result in a loose installation and, in many instances, eventually cause damage to transmission gears, shafts, and/or bearings. Use a torque wrench whenever possible to attain recommended lbs./ft. ratings. Do not torque capscrews dry.



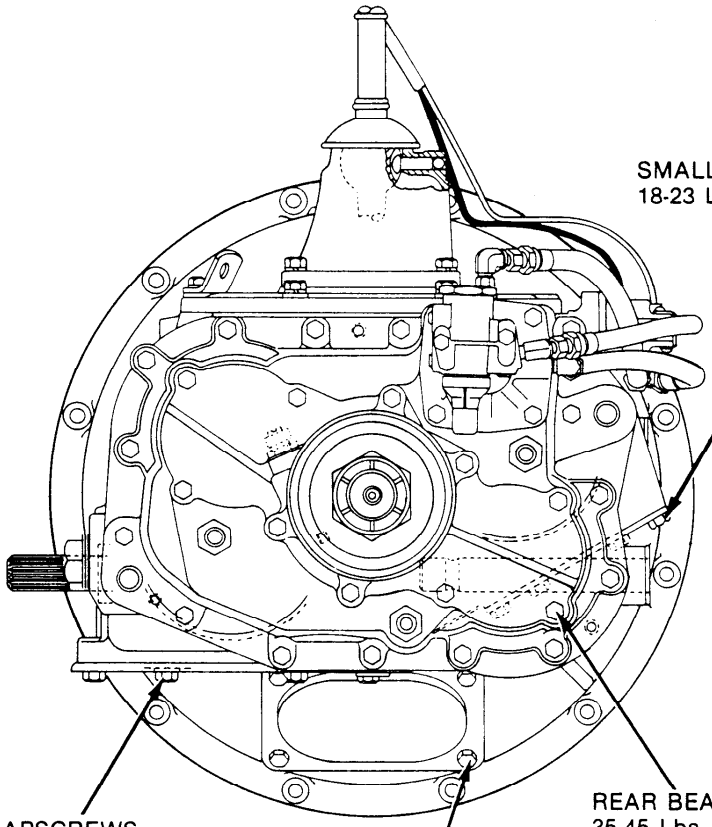
Aluminum Housing 70-80 Lbs.-Ft. Use Shakeproof Internal Lockwasher.

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TORQUE RECOMMENDATIONS



SLAVE VALVE CAPSCREWS,
8-12 Lbs.-Ft., 1/4-20 Threads.
Use Lockwashers.



SMALL P.T.O. COVER CAPSCREWS,
18-23 Lbs.-Ft., 3/8-16 Threads.

LARGE P.T.O. COVER CAPSCREWS,
50-65 Lbs.-Ft., 7/16-14 Threads.

REAR BEARING COVER CAPSCREWS,
35-45 Lbs.-Ft., 3/8-16 Threads.

HAND HOLE COVER CAPSCREWS,
20-25 Lbs.-Ft., 5/16-18 Threads.

THREAD SEALING INSTRUCTIONS

- CAPSCREWS — Apply Loctite 242
- CLUTCH HOUSING STUDS AND SUPPORT STUDS — Apply Thread Sealant (Fuller Part No. 71204)
- TAPERED THREADS (PIPE THREADS) AND AIR LINE FITTINGS — Apply Hydraulic Sealant (Fuller Part No. 71205)

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TOOL REFERENCE

Some repair procedures pictured in this manual show the use of specialized tools. Their actual use is recommended as they make transmission repair easier, faster, and prevent costly damage to critical parts.

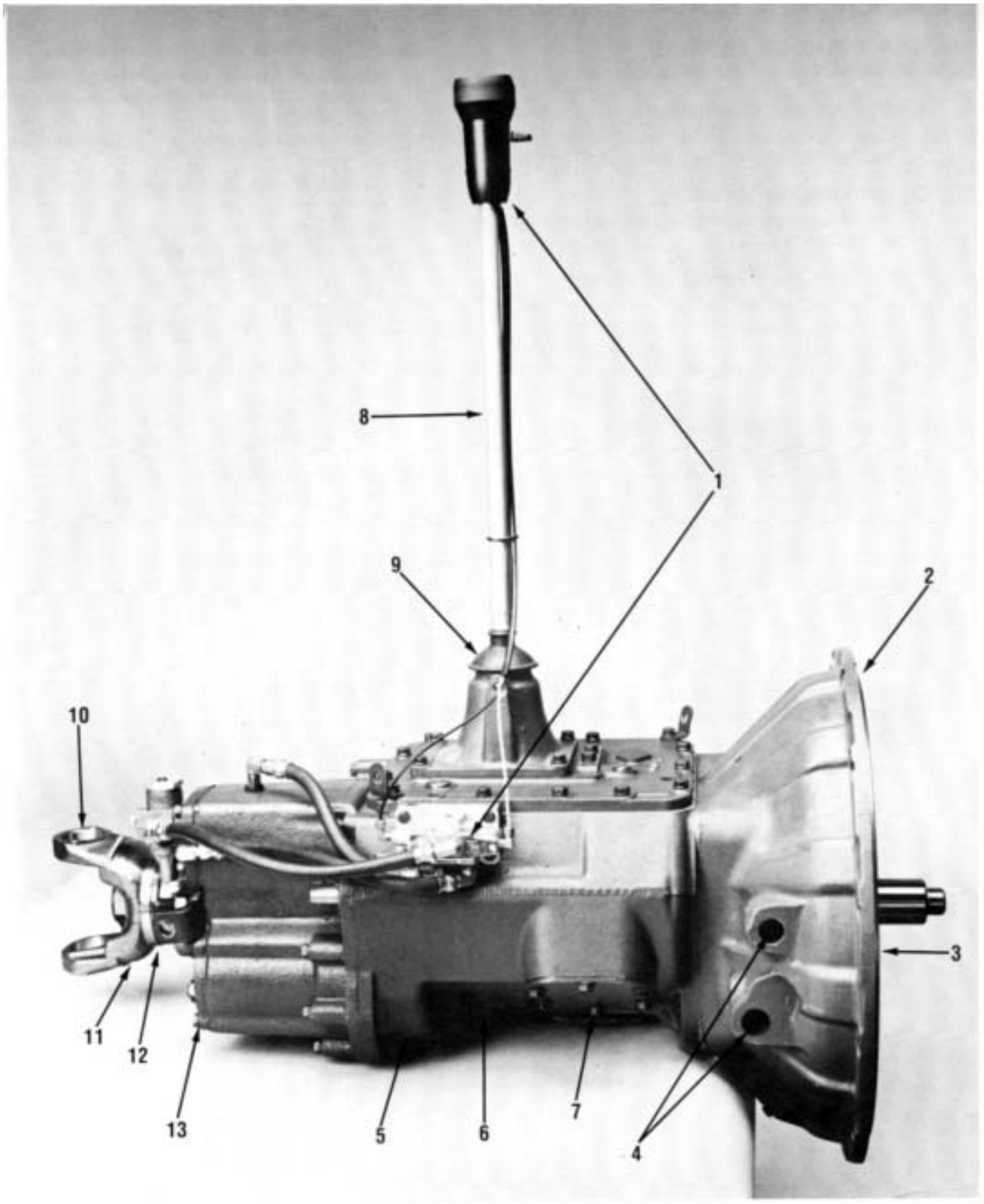
But for the most part, ordinary mechanic's tools such as socket wrenches, screwdrivers, etc., and other standard shop items such as a press, mauls and soft bars are all that is needed to successfully disassemble and reassemble any Fuller Transmission.

The specialized tools listed below can be obtained from a tool supplier or made from dimensions as required by the individual user. Detailed Fuller Transmission Tool Prints are available upon request by writing.

Eaton Corporation
Transmission Division
Technical Service Dept.
P.O. Box 4013
Kalamazoo, Michigan 49003

PAGE	T O O L	HOW OBTAINED
40	Auxiliary Section Hanger Bracket	Made from Fuller Transmission Print T-22823
43	C l a m p	Tool Supplier
32	Tension Spring Driver	Made from Fuller Transmission Print T=-11938
56	Snap Ring Pliers	Tool Supplier
43	Bearing Pullers (Jaw-Type)	Tool Supplier
42	Bearing Puller w/Set Screw	Made from Fuller Transmission Print T-10325
62	Impact Puller (1/2-13 Threaded End)	Tool Supplier
71	Bearing Drivers (Flanged-End)	Made from Fuller Transmission Print Series T-10842
55	Oil Seal Driver	Made from Fuller Transmission Print T-18088-23
71	Countershaft Support Tool	Made from Fuller Transmission Print T-22247
87	Torque Wrench, 1000 Lbs./Ft. Capacity	Tool Supplier

PREVENTIVE MAINTENANCE



PREVENTIVE MAINTENANCE

PREVENTIVE MAINTENANCE CHECK CHART

CHECKS WITHOUT PARTIAL DISASSEMBLY OF CHASSIS OR CAB

1. Air System and Connections

a. Check for leaks, worn air lines, loose connections and capscrews. See AIR SYSTEM.

2. Clutch Housing Mounting

a. Check all capscrews of clutch housing for looseness.

3. Clutch Release Bearing (Not Shown)

a. Remove hand hole cover and check radial and axial clearance in release bearing.

b. Check relative position of thrust surface of release bearing with thrust sleeve on push-type clutches.

4. Clutch Pedal Shaft and Bores

a. Pry upward on shafts to check wear.

b. If excessive movement is found, remove clutch release mechanism and check bushings in bores and wear on shafts.

5. Lubricant

a. Change at specified service intervals.

b. Use only the types and grades as recommended. See LUBRICATION.

6. Filler and Drain Plugs

a. Remove filler plugs and check level of lubricant at specified intervals. Tighten filler and drain plugs securely.

7. Capscrews and Gaskets

a. Check all capscrews, especially those on PTO covers and rear bearing covers for looseness which would cause oil leakage. See TORQUE RECOMMENDATIONS.

b. Check PTO opening and rear bearing covers for oil leakage due to faulty gasket.

8. Gear Shift Lever

a. Check for looseness and free play in housing. If lever is loose in housing, proceed with Check No. 9.

9. Gear Shift Lever Housing Assembly

a. Remove air lines at slave valve and remove the gear shift lever housing assembly from transmission.

b. Check tension spring and washer for set and wear.

c. Check the gear shift lever spade pin and slot for wear.

d. Check bottom end of gear shift lever for wear and check slot of yokes and blocks in shift bar housing for wear at contact points with shift lever.

CHECKS WITH DRIVE LINE DROPPED

10. Universal Joint Companion Flange or Yoke Nut

a. Check for tightness. Tighten to recommended torque.

11. Output Shaft (Not Shown)

a. Pry upward against output shaft to check radial clearance in mainshaft rear bearing.

CHECKS WITH UNIVERSAL JOINT COMPANION FLANGE OR YOKE REMOVED

NOTE: If necessary, use solvent and shop rag to clean sealing surface of companion flange or yoke. DO NOT USE CROCUS CLOTH, EMERY PAPER OR OTHER ABRASIVE MATERIALS THAT WILL MAR SURFACE FINISH.

12. Splines on Output Shaft (Not Shown)

a. Check for wear from movement and chucking action of the universal joint companion flange or yoke.

13. Mainshaft Rear Bearing Cover

a. Check oil seal for wear.

PRECAUTIONS

Disassembly

It is assumed in the detailed disassembly instructions that the lubricant has been drained from transmission, the necessary linkage and air lines disconnected and the transmission has been removed from vehicle chassis. Removal of the gear shift lever housing assembly (or remote control assembly) is included in the detailed instructions (Disassembly and Reassembly—Shifting Controls); however, this assembly MUST be detached from shift bar housing before transmission can be removed.

FOLLOW CLOSELY EACH PROCEDURE IN THE DETAILED INSTRUCTIONS, MAKING USE OF THE TEXT, iLLUSTRATIONS AND PHOTOGRAPHS PROVIDED.

1. BEARINGS—Carefully wash and relubricate all reusable bearings as removed and protectively wrap until ready for use. Remove bearings planned to be reused with pullers designed for this purpose.
2. ASSEMBLIES—When disassembling the various assemblies, such as the mainshaft, countershaft, and shift bar housing, lay all parts on a clean bench in the same sequence as removed. This procedure will simplify reassembly and reduce the possibility of losing parts.
3. SNAP RINGS—Remove snap rings with pliers designed for this purpose. Snap rings removed in this manner can be reused, if they are not sprung or loose.
4. INPUT SHAFT—The input shaft can be removed from transmission without removing the countershafts, mainshaft, or main drive gear. Special procedures are required and provided in this manual.
5. CLEANLINESS—Provide a clean place to work. It is important that no dirt or foreign material enters the unit during repairs. Dirt is an abrasive and can damage bearings. It is always good practice to clean the outside of the unit before starting the planned disassembly.
6. WHEN USING TOOLS TO MOVE PARTS — Alwavs apply force to shafts, housings, etc, with restraint. Movement of some parts is restricted. Never apply force to the part being driven after it stops solidly. The use of soft hammers, bars and mauls for all disassembly work is recommended.

Inspection

Before reassembling the transmission, check each part carefully for abnormal or excessive wear and damage to determine reuse or replacement. When replacement is necessary, use only genuine Fuller Transmission parts to assure continued performance and extended life from your unit.

Since the cost of a new part is generally a small fraction of the total cost of downtime and labor, avoid reusing a questionable part which could lead to additional repairs and expense soon after initial reassembly. To aid in determining the reuse or replacement of any transmission part, consideration should also be given to the unit's history, mileage, application, etc.

Recommended inspection procedures are provided in the following checklist.

A. BEARINGS

1. Wash all bearings in clean solvent. Check balls, rollers and raceways for pitting, discoloration, and spalled areas. Replace bearings that are pitted, discolored, or spalled.
2. Lubricate bearings that are not pitted, discolored, or spalled and check for axial and radial clearances.
3. Replace bearings with excessive clearances.
4. Check bearing fits. Bearing inner races should be tight to shaft; outer races slightly tight to slightly loose in case bore. If bearing spins freely in bore, however, case should be replaced.

B. GEARS

1. Check gear teeth for frosting and pitting. Frosting of gear tooth faces present no threat of transmission failure. Often in continued operation of the unit, frosted gears will "heal" and not progress to the pitting stage. And in most cases, gears with light to moderate pitted teeth have considerable gear life remaining and can be reused. But gears with advanced stage pitting should be replaced.
2. Check for gears with clutching teeth abnormally worn, tapered, or reduced in length from clashing in shifting. Replace gears found in any of these conditions.

PRECAUTIONS

Inspection (cont'd.)

3. Check axial clearance of gears. Where excessive clearance is found, check gear snap ring, washer, spacer, and gear hub for excessive wear. Maintain .005" to .012" axial clearance between mainshaft gears.

C. SPLINES

1. Check splines on all shafts for abnormal wear. If sliding clutch gears, companion flange, or clutch hub have worn into the sides of the splines, replace the specific shaft affected.

TOLERANCE WASHERS

1. Check surfaces of all tolerance washers. Washers scored or reduced in thickness should be replaced.

E. REVERSE IDLER GEAR ASSEMBLIES

1. Check for excessive wear from action of roller bearings.

F. GRAY IRON PARTS

1. Check all gray iron parts for cracks and breaks. Replace or repair parts found to be damaged. Heavy castings may be welded or brazed provided the cracks do not extend into bearing bores or bolting surfaces. When welding, however, never place the ground so as to allow current to pass through the transmission.

G. CLUTCH RELEASE PARTS

1. Check clutch release parts. Replace yokes worn at cam surfaces and bearing carrier worn at contact pads.
2. Check pedal shafts. Replace those worn at bushing surfaces.

H. SHIFT BAR HOUSING ASSEMBLY

1. Check for wear on shift yokes and blocks at pads and lever slot. Replace excessively worn parts.
2. Check yokes for correct alignment. Replace sprung yokes.
3. Check lockscews in yokes and blocks. Tighten and rewire those found loose.
4. If housing has been disassembled, check neutral notches of shift bars for wear from interlock balls.

1. GEAR SHIFT LEVER HOUSING ASSEMBLY

1. Check spring tension on shift lever. Replace tension spring and washer if lever moves too freely.
2. If housing is disassembled, check spade pin and corresponding slot in lever for wear. Replace both parts if excessively worn.

J. BEARING COVERS

1. Check covers for wear from thrust of adjacent bearing. Replace covers damaged from thrust of bearing outer race.
2. Check bores of covers for wear. Replace those worn oversize.

K. OIL RETURN THREADS AND SEALS

1. Check oil return threads in front bearing cover. If sealing action of threads has been destroyed by contact with input shaft, replace bearing cover.
2. Check oil seal in rear bearing cover. If sealing action of lip has been destroyed, replace seal.

L. SLIDING CLUTCHES

1. Check all shift yokes and yoke slots in sliding clutches for extreme wear or discoloration from heat.
2. Check engaging teeth of sliding clutches for partial engagement pattern.

M. SYNCHRONIZER ASSEMBLY

1. Check synchronizer for burrs, uneven and excessive wear at contact surface, and metal particles.
2. Check blocker pins for excessive wear or looseness.
3. Check synchronizer contact surfaces on the auxiliary drive and low range gears for excessive wear.

N. O-RINGS

1. Check all O-rings for cracks or distortion. Replace if worn.

PRECAUTIONS

Reassembly

Make sure that interiors of case and housings are clean. It is important that dirt and other foreign materials be kept out of the transmission during reassembly. Dirt is an abrasive and can damage polished surfaces of bearings and washers. Use certain precautions, as listed below, during reassembly.

1. **GASKETS** — Use new gaskets throughout the transmission as it is being rebuilt. Make sure all gaskets are installed. An omission of any gasket can result in oil leakage or misalignment of bearing covers.
2. **CAPSCREWS** — TO prevent oil leakage, use Loctite 242 thread sealant on all capscrews. For torque ratings, see TORQUE RECOMMENDATIONS.
3. **O-RINGS** — Lubricate all O-rings with silicone lubricant.
4. **ASSEMBLY** — Refer to the illustrations provided in the detailed disassembly instructions as a guide to reassembly.
5. **INITIAL LUBRICATION** — Coat all limit washers and splines of shafts with Lubriplate during reassembly to prevent scoring and galling of such parts.
6. **AXIAL CLEARANCES** — Maintain original axial clearances of .005" to .012" for mainshaft gears.
7. **BEARINGS** — Use of flanged-end bearing drivers is recommended for the installation of bearings. These special drivers apply equal force to both bearing races, preventing damage to balls/rollers and races while maintaining correct bearing alignment with bore and shaft. Avoid using a tubular or sleeve-type driver, whenever possible, as force is applied to only one of the bearing races. See TOOL REFERENCE.
8. **UNIVERSAL JOINT COMPANION FLANGE OR YOKE** — Pull the companion flange or yoke tightly into place with the output shaft nut, using 450-500 foot-pounds of torque. Make sure the speedometer drive gear or a replacement spacer of the same width has been installed. Failure to pull the companion flange or yoke tightly into place will permit the output shaft to move axially with resultant damage to the rear bearing.

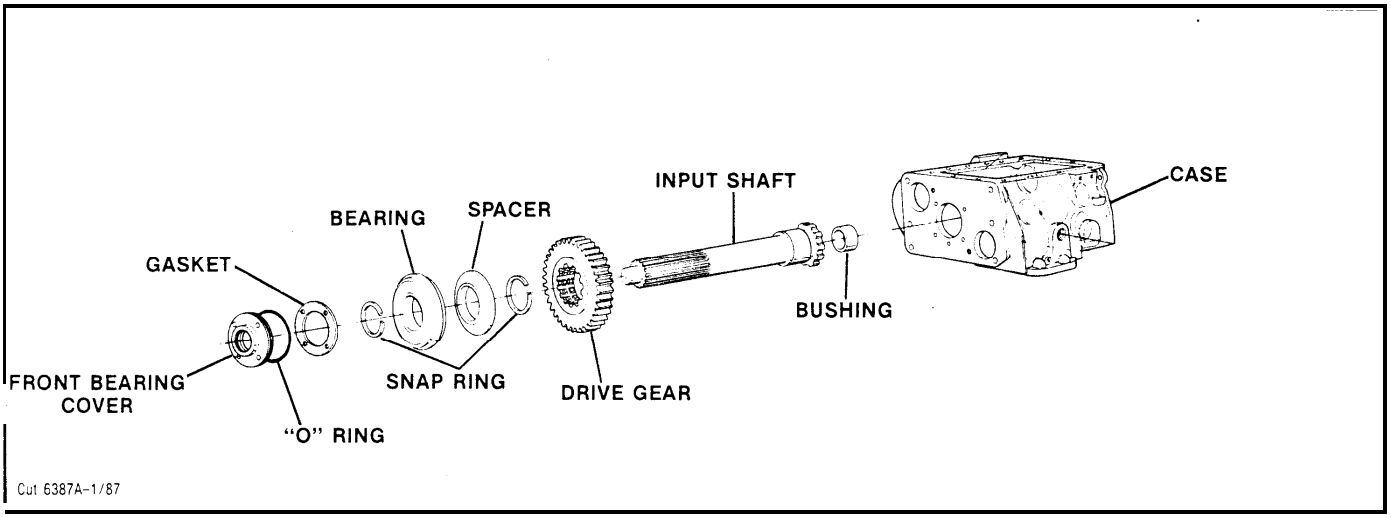
IMPORTANT: REFER TO THE APPROPRIATE ILLUSTRATED PARTS LIST (SPECIFIED BY MODEL SERIES) TO ENSURE THAT PROPER PARTS ARE USED DURING REASSEMBLY OF THE TRANSMISSION.

CHANGING INPUT SHAFT

Special Procedure

In some cases, it may become necessary to replace the input shaft due to excessive clutch wear on the splines. Except for removal of the shift bar housing assembly, the input shaft can be removed without further disassembly of the transmission. Removal of the clutch housing is optional.

NOTE: The following illustration and instructions pertain to changing the input shaft ONLY. To change the main drive gear, complete disassembly of the front section is required.



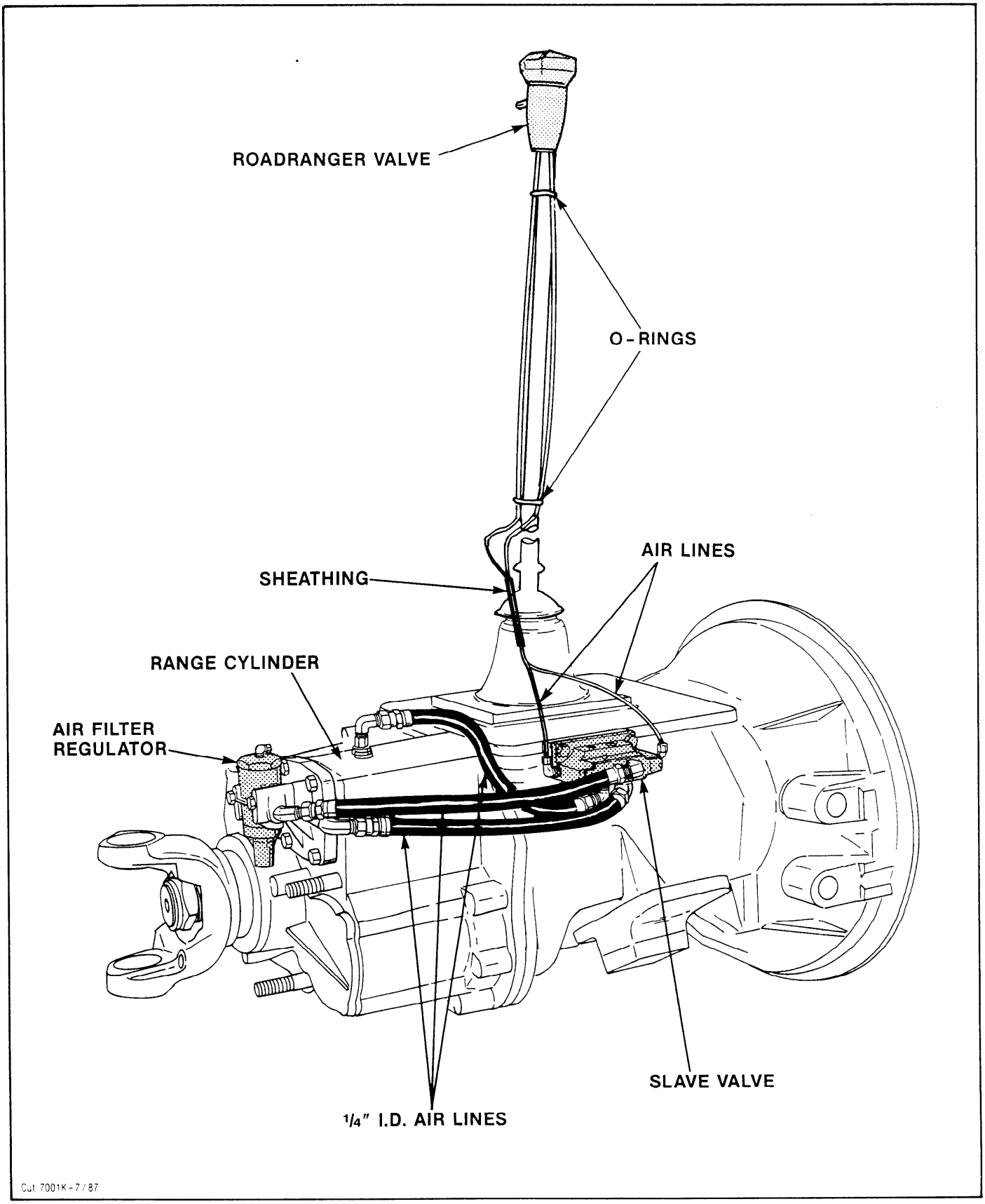
Disassembly

1. Remove the gear shift lever housing assembly (or remote control assembly) from shift bar housing, and the shift bar housing assembly from transmission case.
2. Remove the front bearing cover and gasket. If necessary, remove the O-ring from cover of models so equipped.
3. Remove the bearing retaining snap ring from groove in shaft.
4. Push down on input shaft to cock bearing in bore. Drive input shaft toward rear of transmission, through bearing as far as possible. Pull input shaft forward to expose snap ring of bearing.
5. Use pry bars to complete removal of bearing.
6. Remove drive gear spacer and snap ring.
7. Pull input shaft forward and out of drive gear and case.

Reassembly

1. If necessary, install bushing in pocket of input shaft.
2. Install snap ring in snap ring groove inside drive gear.
3. Install drive gear spacer on input shaft.
4. Install drive gear bearing on input shaft and into case bore.
5. Install bearing retainer snap ring.
6. Install front bearing cover and gasket. Make sure to align oil return hole in the case with hole in cover.
7. To facilitate proper reinstallation of the shift bar housing assembly on case, make sure mainshaft sliding clutches are placed in the neutral position.
8. Reinstall the shift bar housing assembly, the front bearing cover and all other parts and assemblies previously removed, making sure to replace the gaskets used.

AIR SYSTEM



Cut 7001K-7/87

AIR SYSTEM

RANGE SHIFT AIR SYSTEM—ALL MODELS

Operation

The Range Shift Air System consists of the air filter/regulator, slave valve, a Range Control Valve or Master Control Valve, range cylinder, fittings and connecting air lines. See Air System Schematics.

CONSTANT AIR from the air filter/regulator is supplied to the "S" or Supply Port of slave valve and passed through to the INLET or "S" Port of control valve.

WHILE IN LO RANGE, the control valve is OPEN and AIR is returned to slave valve at the "P" or End Port. This signals the valve to supply AIR in line between the Lo Range or "L" Port of slave valve and the Lo Range Port of range cylinder housing. AIR received at this port moves the range piston to the rear and causes the auxiliary LO RANGE gear to become engaged.

WHILE IN HI RANGE, the control valve is CLOSED and NO AIR is returned to the slave valve. This signals the slave valve to supply AIR in line between the HI Range or "H" Port of valve and the HI Range Port of range cylinder cover. AIR received at this port moves the range piston forward to engage the auxiliary drive gear with sliding clutch and bypass the LO RANGE gear set.

Range shifts can be made ONLY when the gear shift lever is in, or passing through, neutral. Thus, the range desired can be PRESELECTED while the shift lever is in a gear position. As the lever is moved through neutral, the actuating plunger in the shift bar housing releases the slave valve, allowing it to move to the selected range position.

Trouble Shooting

If the transmission fails to make a range shift or shifts too slowly, the fault may be in the Range Shift Air System or actuating components of the shift bar housing assembly.

To locate the trouble, the following checks should be made with normal vehicle air pressure applied to the system, but with the engine off.

⚠CAUTION **CAUTION: NEVER WORK UNDER A VEHICLE WHILE ENGINE IS RUNNING as personal injury may result from the sudden and unintended movement of vehicle under power. Always place transmission in the neutral position.**

1. INCORRECT AIR LINE HOOK-UPS (See Air System Schematics)

With the gear shift lever in neutral, move the control that provides range selection UP and DOWN.

A. If the air lines are crossed between control valve and slave valve, there will be CONSTANT AIR flowing from the exhaust port of control valve WHILE IN HI RANGE.

B. If the air lines are crossed between the slave valve and range cylinder, the transmission gearing will not correspond with the range selection. A LO RANGE selection will result in a HI RANGE engagement and vice versa.

2. AIR LEAKS

With the gear shift lever in neutral, coat all air lines and fittings with soapy water and check for leaks, moving the control that provides range selection UP and DOWN.

A. If there is a steady leak from the exhaust port of control valve, O-rings and/or related parts of the control valve are defective.

B. If there is a steady leak from breather of slave valve: an O-ring in valve is defective, or there is a leak past O-rings of range cylinder piston.

C. If transmission fails to shift into LO RANGE or is slow to make the range shift and the case is pressurized, see Check No. 7 of this section.

D. Tighten all loose connections and replace defective O-rings and parts.

3. AIR FILTER/REGULATOR

(See illustration, Page 22.)

With the gear shift lever in neutral, check the breather of air filter/regulator assembly. There should be NO AIR leaking from this port. The complete assembly should be replaced if a steady leak is found.

Cut off the vehicle air supply to the air filter/regulator assembly, disconnect the air line at fitting in Supply OUTLET and install an air gage in opened port. Bring the vehicle air pressure to normal. Regulated air pressure should be 57.5 to 62.5 Psi.

DO NOT ADJUST SCREW AT BOTTOM OF REGULATOR TO OBTAIN CORRECT READINGS. The air regulator has been PREADJUSTED within the correct operating limits. Any deviation from these limits, especially with regulators that have been in operation for some time, is likely to be caused by dirt or worn parts. If replacement or cleaning of the filter element does nothing to correct the air pressure readings, replace the complete assembly, as the air regulator is nonserviceable.

4. RANGE VALVE (See Page 23.)

With the gear shift lever in neutral, select HI RANGE and disconnect the air line at the OUTLET or "P" Port of control valve.

A. When LO RANGE is selected, a steady blast of air will flow from opened port. Select HI RANGE to shut off air flow. This indicates the control valve is operating properly. Reconnect air line.

B. If control valve does not operate properly, check for restrictions and air leaks. Leaks indicate defective or worn O-rings.

5. HI RANGE OPERATION

With the gear shift lever in neutral, select LO RANGE and disconnect the 1/4" I.D. air line at the port of range cylinder cover. Make sure this line leads from the HI Range or "H" Port of slave valve.

A. When HI RANGE is selected, a steady blast of air should flow from disconnected line. Select LO RANGE to shut off air flow.

B. Move the shift lever to a gear position and select HI RANGE. There should be NO AIR flowing from disconnected line. Return the gear shift lever to the neutral position. There should now be a steady flow of air from disconnected line. Select LO RANGE to shut off air flow and reconnect air line.

C. If the air system does not operate accordingly, the slave valve or actuating components of the shift bar housing assembly are defective.

IMPORTANT: RANGE PRESELECTION

The plunger pin, located in case bore between the slave valve and actuating plunger of shift bar housing, prevents the slave valve from operating while the shift lever is in a gear position. When the lever is moved to or through the neutral position, the pin is released and the slave valve becomes operational.

6. LO RANGE OPERATION

With the gear shift lever in neutral, select HI RANGE and disconnect the 1/4" I.D. air line at the fitting on range cylinder housing. Make sure this line leads from the Lo Range or "L" Port of slave valve.

A. When LO RANGE is selected, a steady blast of air should flow from disconnected line. Select HI RANGE to shut off air flow.

B. Move the shift lever to a gear position and select LO RANGE. There should be NO AIR flowing from disconnected line. Return the gear shift lever to the neutral position. There should now be a steady flow of air from disconnected line. Select HI RANGE to shut off air flow and reconnect air line.

C. If the air system does not operate accordingly, the slave valve or actuating components of the shift bar housing assembly are defective.

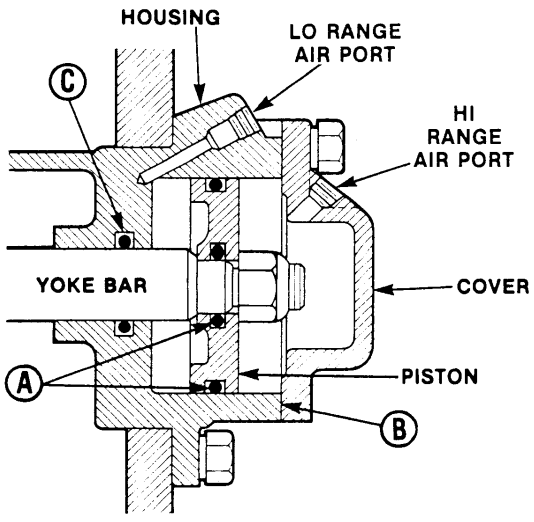
7. RANGE CYLINDER (Refer to the following illustration.)

If any of the seals in the range cylinder assembly are defective, the range shift will be affected.

A. Leak at either O-ring A results in complete failure to make a range shift; steady flow of air from breather of slave valve in both ranges.

B. Leak at gasket B results in a steady flow of air to atmosphere while in HI RANGE.

C. Leak at O-ring C results in a slow shift to LO RANGE; pressurizing of transmission case.

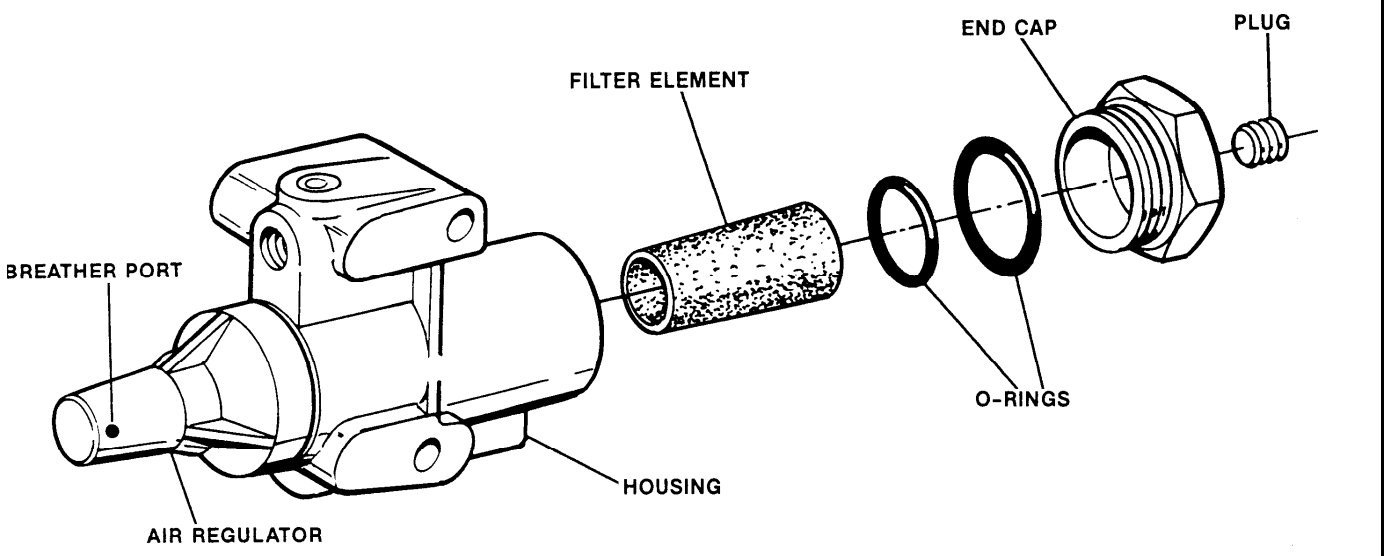


Cut **7420-5/87**

Range Cylinder Assembly—All Models

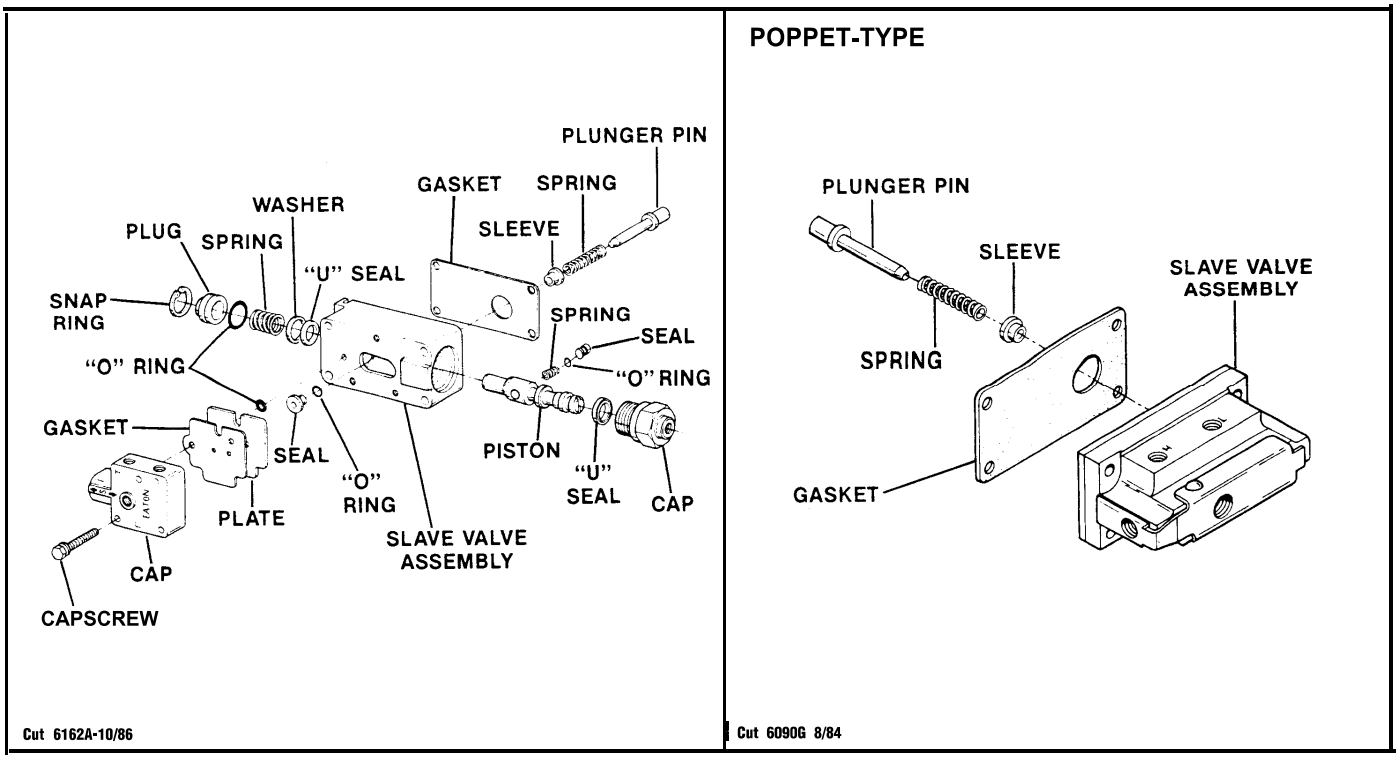
AIR SYSTEM

AIR FILTER/REGULATOR ASSEMBLY



The air filter contains a replaceable filter element which can be removed by turning out the end cap. This element should be cleaned at each oil change, or more often under high humidity conditions. Replace if necessary.

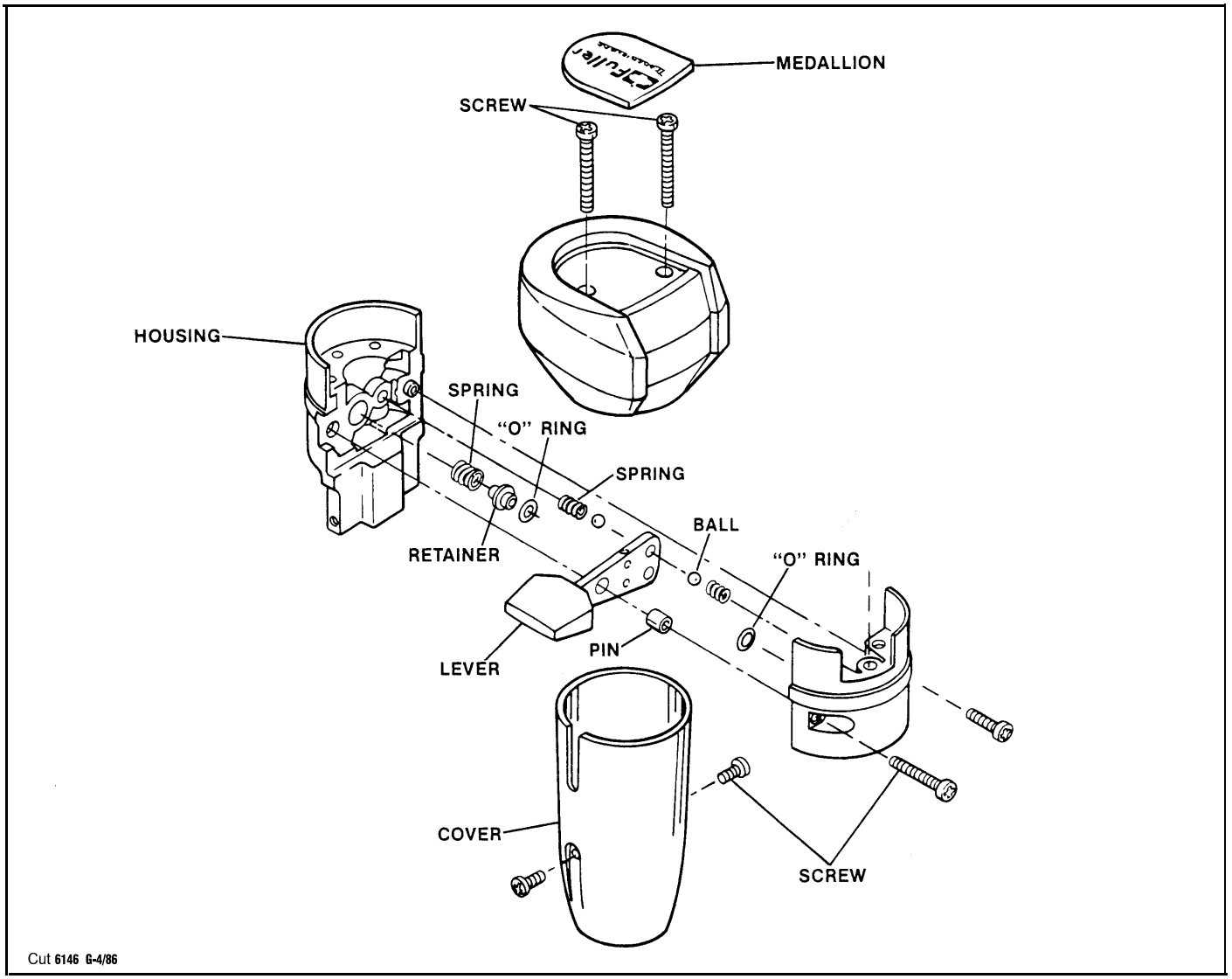
SLAVE VALVES



Refer to the drawing for disassembly and reassembly of the piston-type slave valve assemblies. **Should the poppet-type slave valve assembly prove to be defective, replace the complete assembly, as it is non-serviceable.** The actuating components used with these valve assemblies are non-interchangeable. Failure to use the correct plunger pin, spring, and alignment sleeve during installation on the transmission will cause hard shifting in Lo

AIR SYSTEM

ROADRANGER VALVE A-5010



Cut 6146 G-4/86

Removal and Disassembly

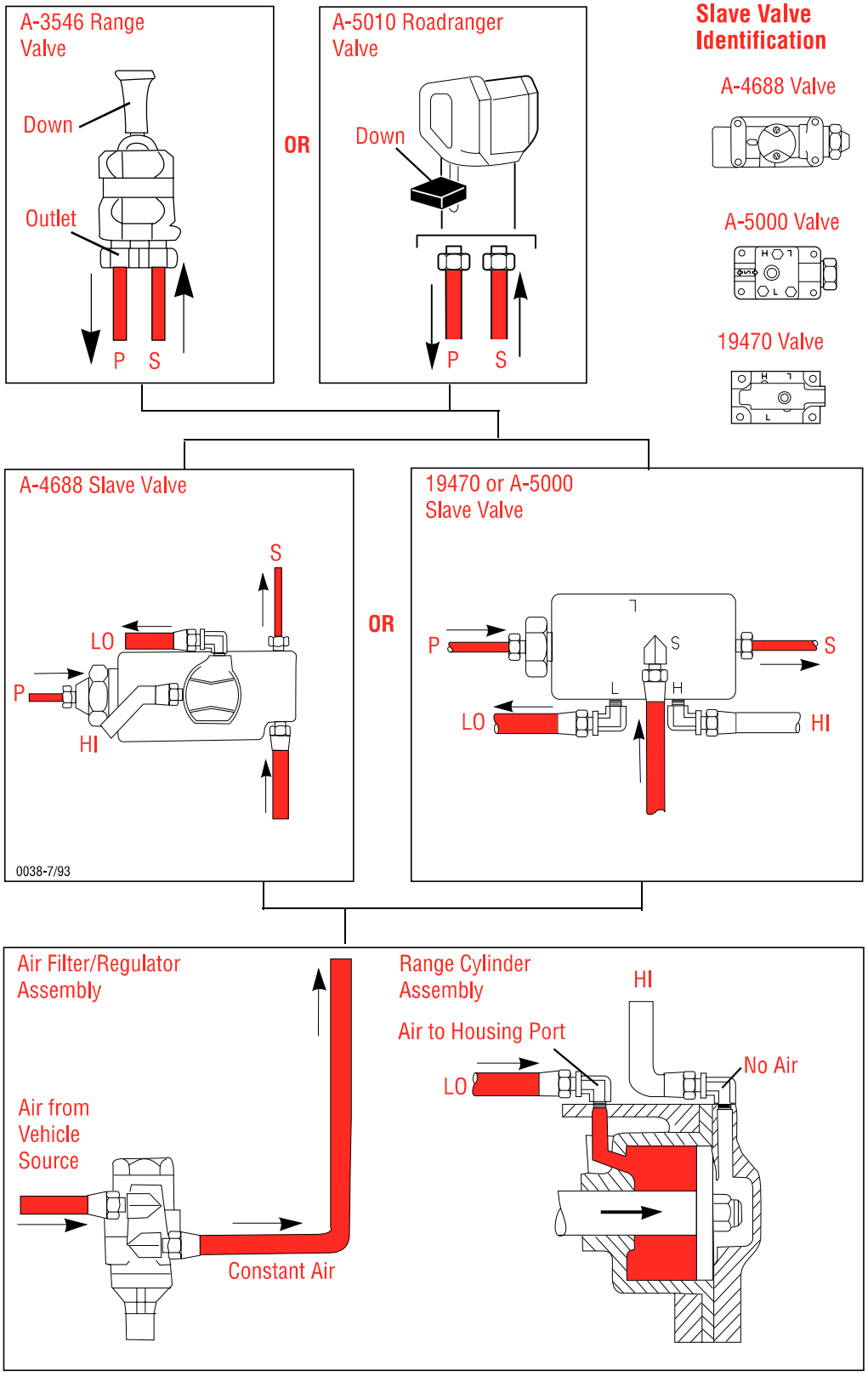
1. Remove two screws holding bottom cover to valve and slide cover down gearshift lever to expose air line fittings. Disconnect air lines.
2. Loosen jam nut and turn control valve from gear shift lever.
3. Pry medallion from recess in top cover.
4. Turn out the two screws to remove the top cover from valve housing.
5. Turn out the two screws in side of valve housing to separate the housing.
6. Remove the Range Preelection Lever from left housing and the position balls and guide from lever.
7. If necessary, remove spring and O-ring from bores in left housing.
8. If necessary, remove springs, O-ring and sleeve from bores in right housing.

Reassembly and Installation

1. Refer to the drawing for proper reassembly. Use a VERY SMALL amount of silicone lubricant on the O-rings to avoid clogging ports. A small amount of grease on the position springs and balls will help to hold them in place during reassembly.
2. Reinstall control valve on gear shift lever and tighten jam nut.
3. Attach the air lines and reinstall bottom cover.

RT & RTO 610: 6610: 6609: 8609 Models

Range—LO



Schematic

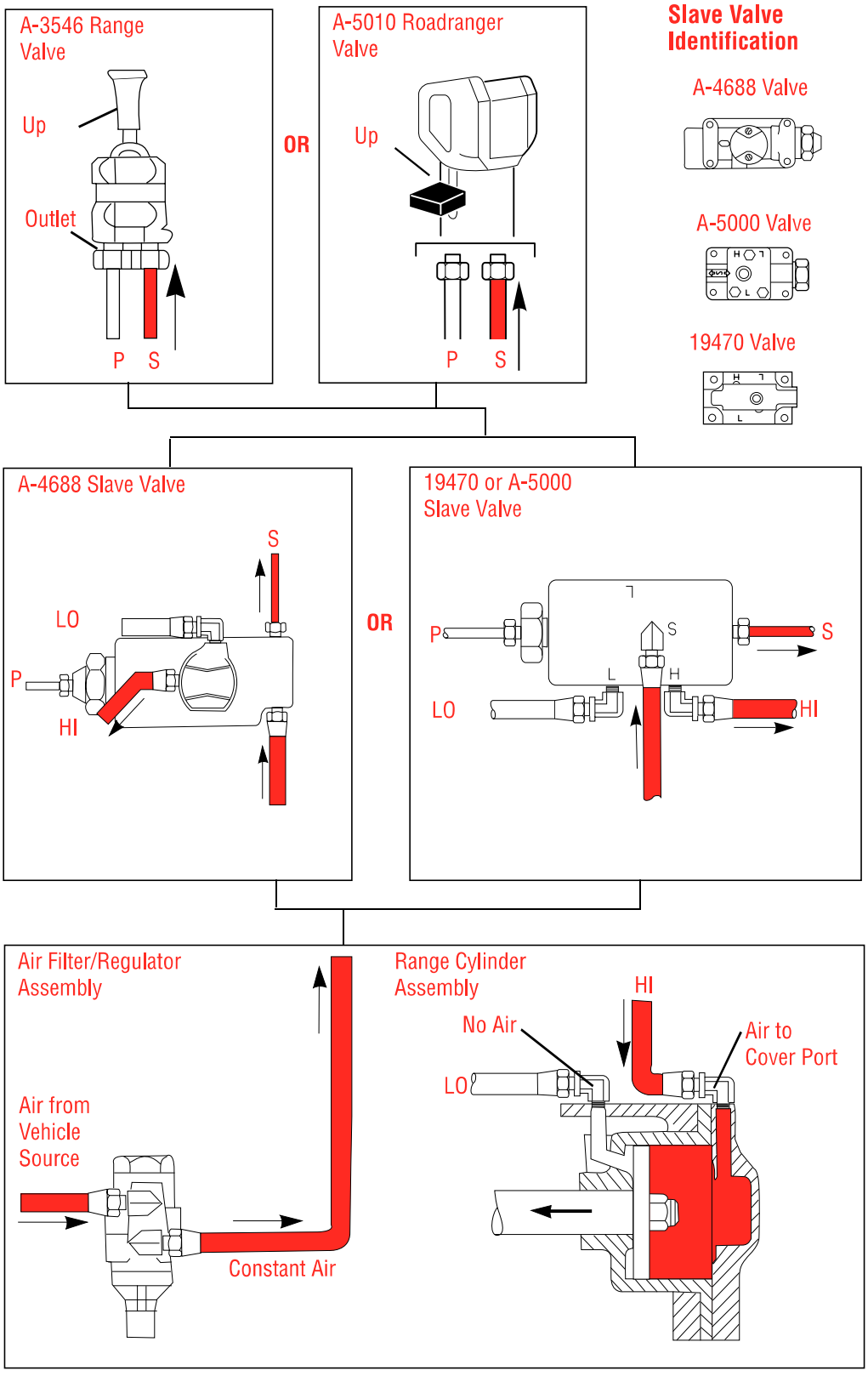
For all questions concerning removal and replacement, refer to Eaton Service and Parts Literature.

Schematic

For all questions concerning removal and replacement, refer to Eaton Service and Parts Literature.

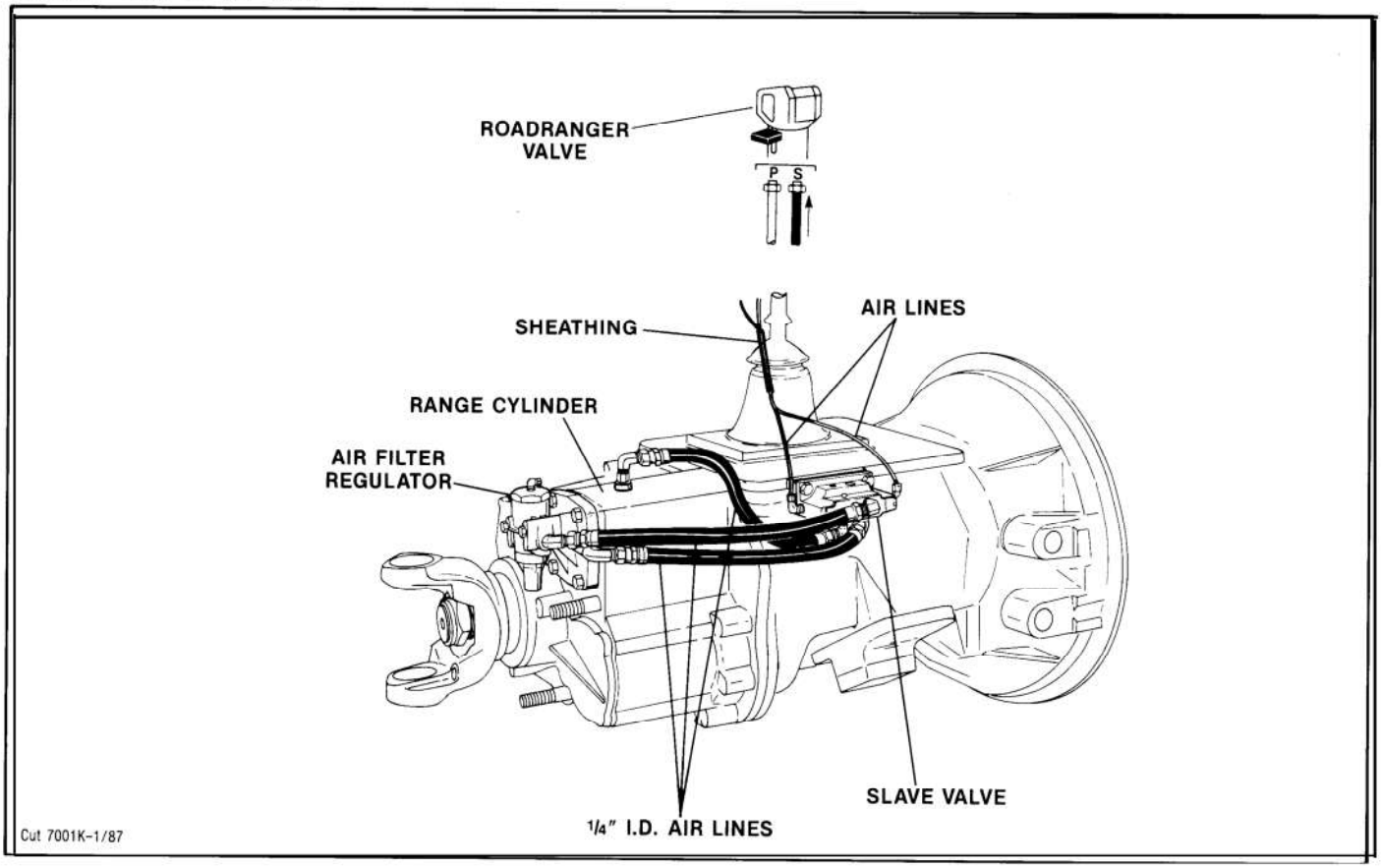
RT & RTO 610: 6610: 6609: 8609 Models

Range—HI

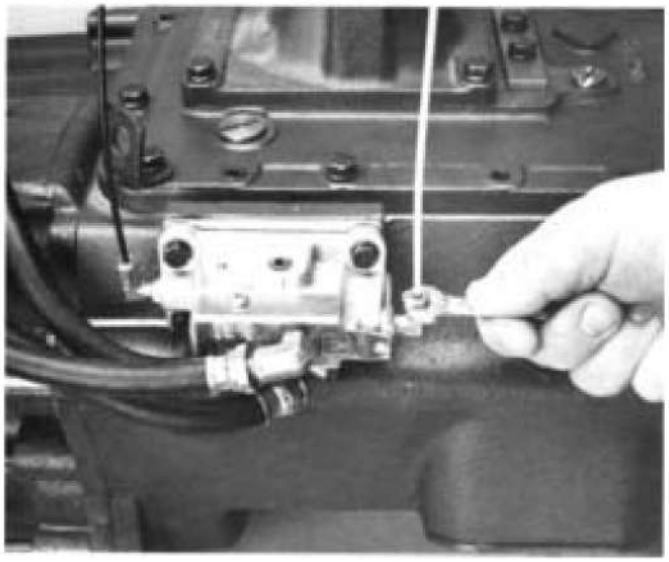


DISASSEMBLY AND REASSEMBLY SHIFTING CONTROLS

AIR SYSTEM

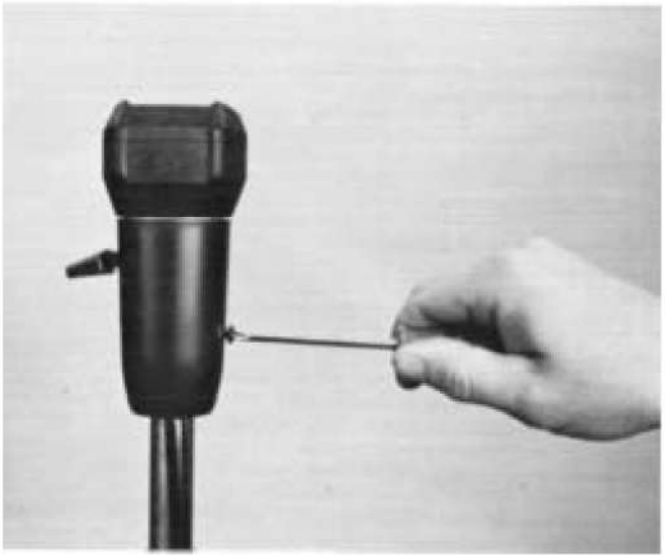


A. Removal of Air Controls



1. Disconnect the two air lines at the "S" or Supply Port and the "P" or End Port of the slave valve on the transmission case.

NOTE: If desired, the gear shift lever housing assembly can now be removed from shift bar housing by removing the four capscrews from the



2. Turn out the two mounting screws in the Roadranger valve cover.

DISASSEMBLY AND REASSEMBLY SHIFTING CONTROLS

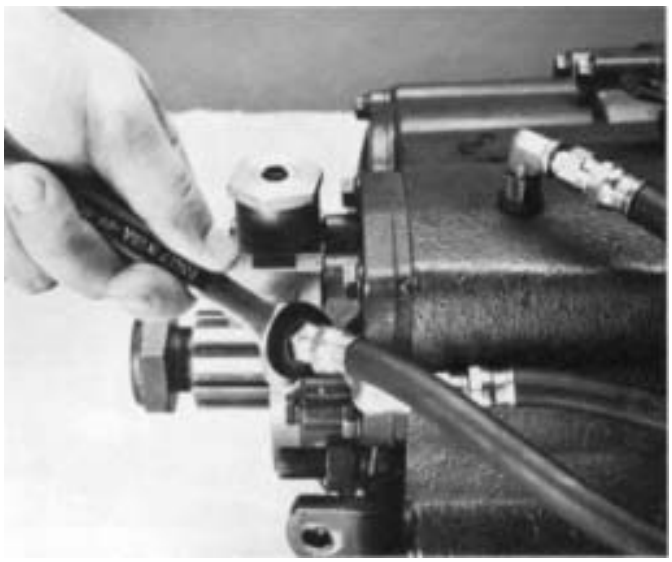


3. Slide the cover down to expose valve ports and disconnect the two air lines.

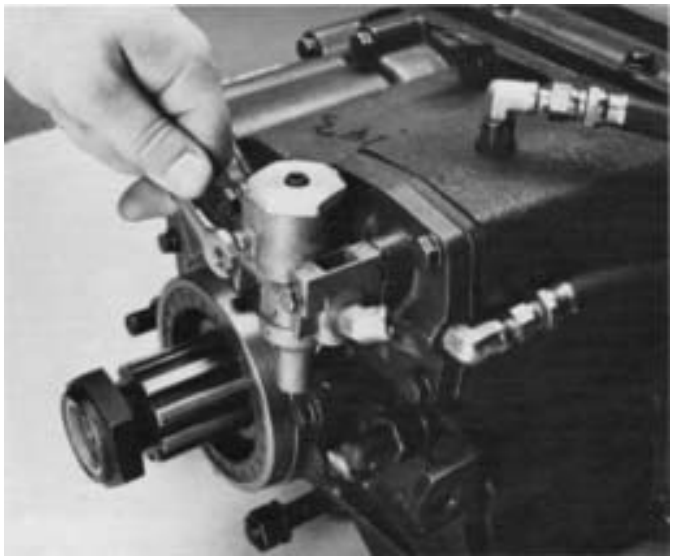


4. Loosen the jam nut and turn the valve and nut from gear shift lever. Remove the valve cover, air lines, sheathing and O-rings from lever.

B. Removal of Air Filter Regulator Assembly.



1. Disconnect and remove the 1/4" I.D. air hose between the slave valve and air filter/regulator assembly.

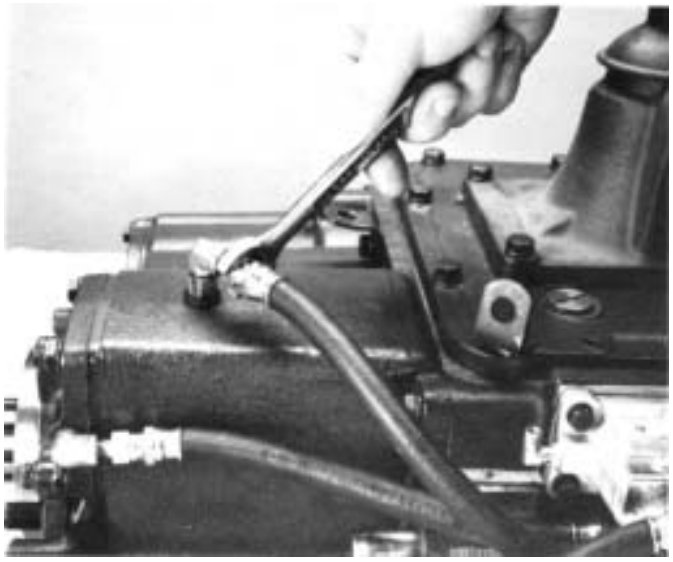


2. Turn out the two capscrews and remove the air filter/regulator assembly.

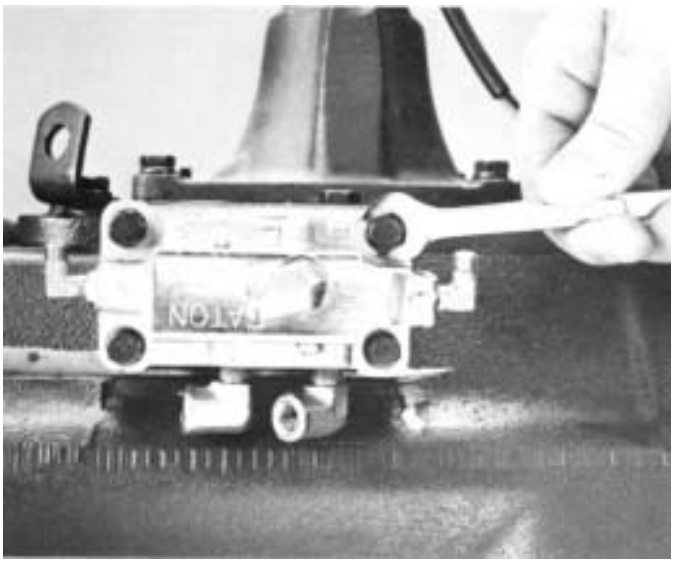
NOTE: For disassembly and reassembly of Air Filter/Regulator, see Page 22.

DISASSEMBLY AND REASSEMBLY SHIFTING CONTROLS

C. Removal of Slave Valve



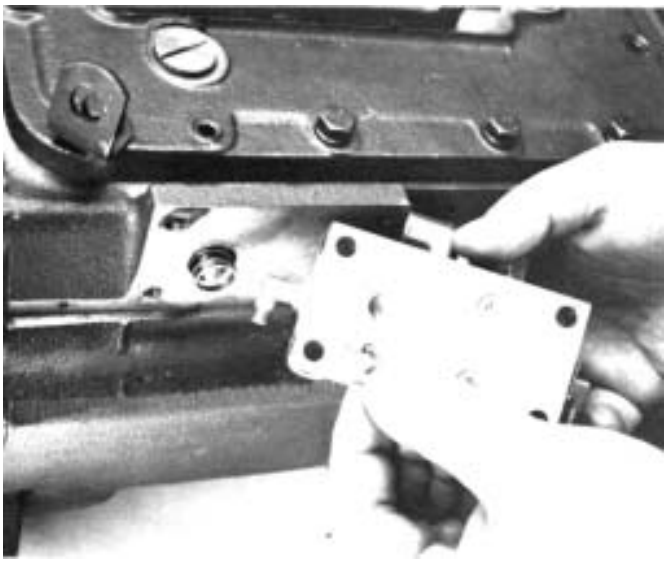
1. Disconnect and remove 1/4" I.D. air hose between the slave valve and Lo Range Port in housing of range cylinder.



3. Turn out the four retaining cap screws and remove slave valve from transmission case.



2. Disconnect and remove the 1/4" I.D. air hose between the slave valve and Hi Range Port in cover of range cylinder.

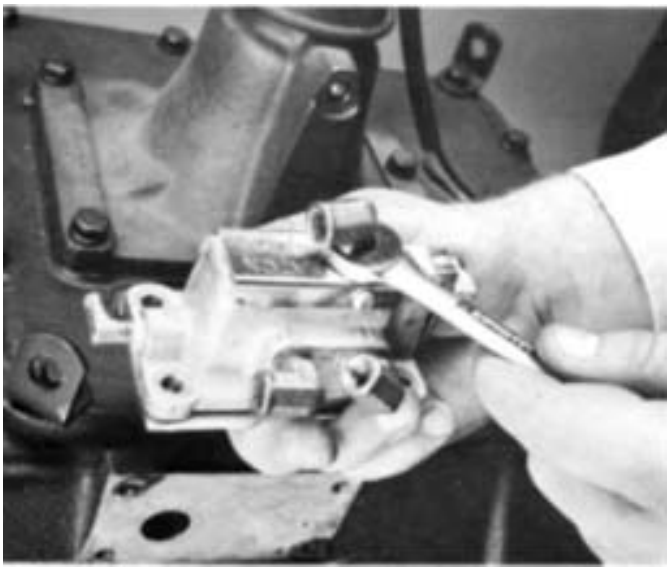


4. Remove the hat-type alignment sleeve from bore in slave valve.

DISASSEMBLY AND REASSEMBLY SHIFTING CONTROLS



5. Remove the spring and plunger pin from bore in transmission case. Remove slave valve gasket.

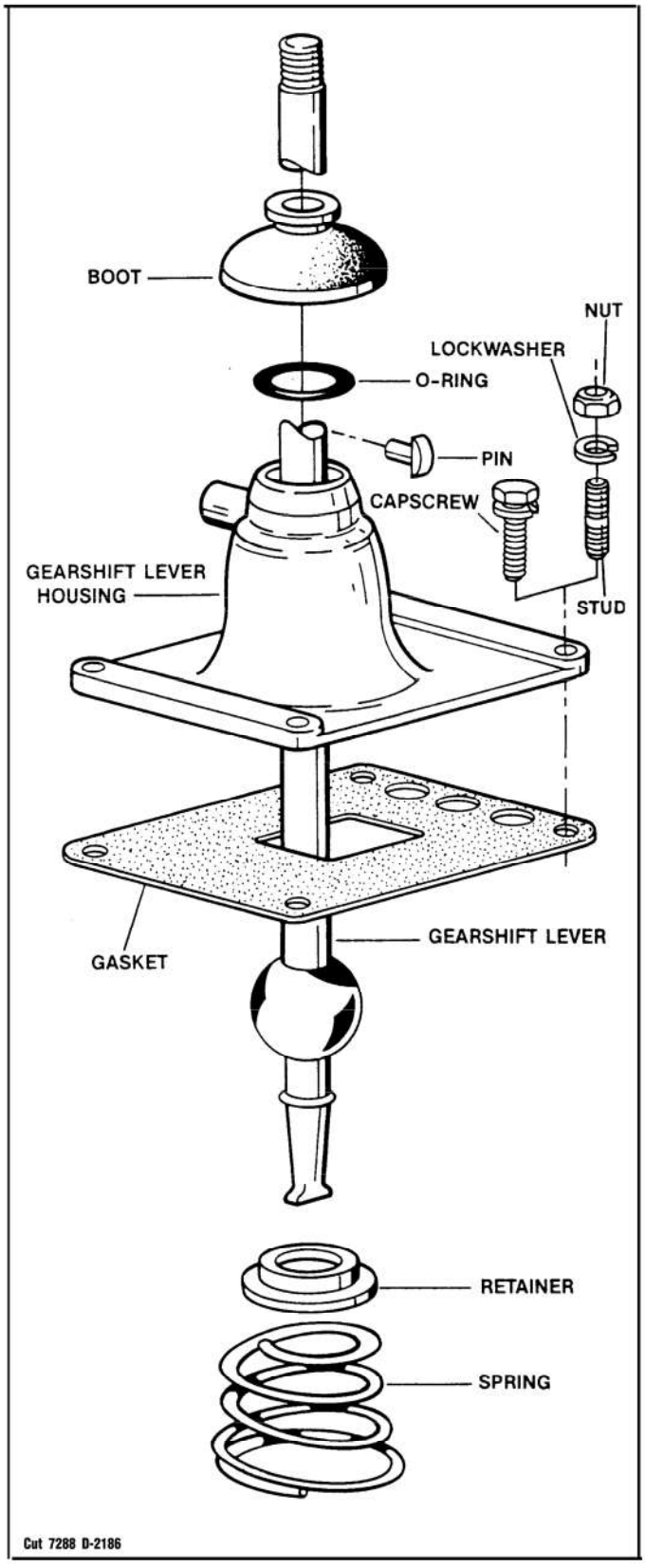


6. If necessary, remove the air line fittings from slave valve.

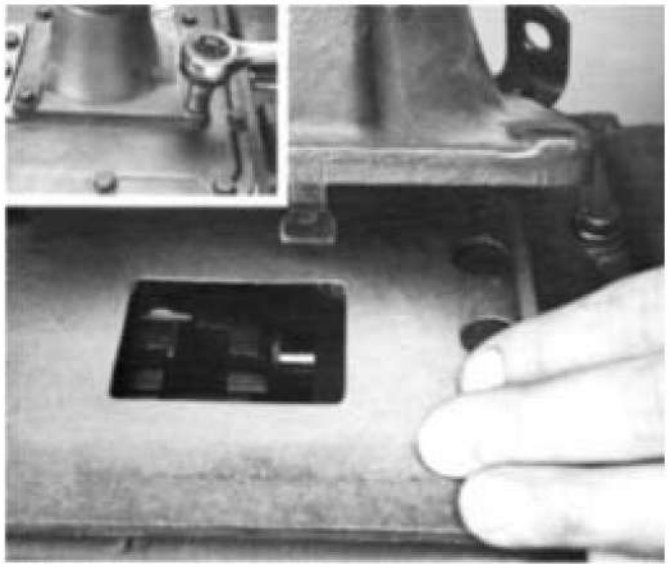
NOTE: For disassembly and reassembly of piston-type Slave Valve Assembly ONLY, see Page 22.

DISASSEMBLY AND REASSEMBLY SHIFTING CONTROLS

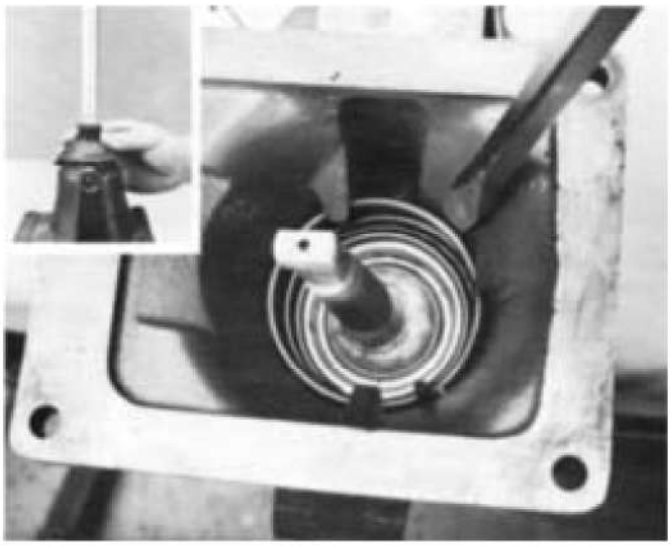
GEAR SHIFT LEVER HOUSING ASSEMBLY



A. Removal and Disassembly Gear Shift Lever Housing



1. Turn out the four retaining capscrews (inset), jar lightly to break gasket seal and remove the gear shift lever housing and gasket from shift bar housing.
   NOTE: Remote control housings are removed from shift bar housing in the same manner. For disassembly and reassembly of LRC Assemblies, see 11-Illustrated Parts List No. P-541. For disassembly and reassembly of SRC Assemblies, see illustrated Parts List No. P-515.

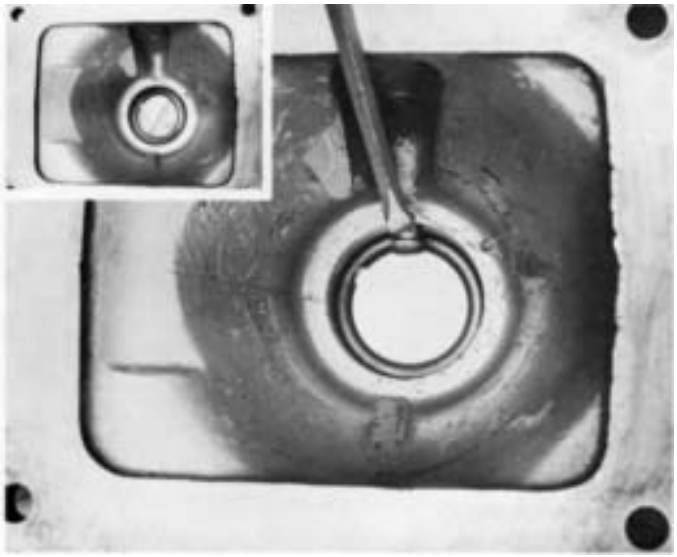


2. Remove the boot from gear shift lever and secure assembly in vise with bottom of housing facing up. Use a larger screwdriver to twist between the spring and housing, forcing the spring from under the lugs in housing. Do one coil at a time.

DISASSEMBLY AND REASSEMBLY SHIFTING CONTROLS

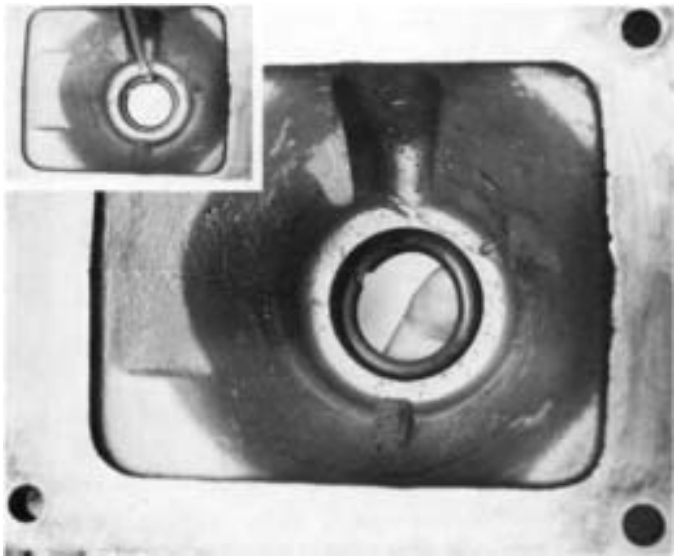


3. Remove the tension spring, washer and gear shift lever from housing.

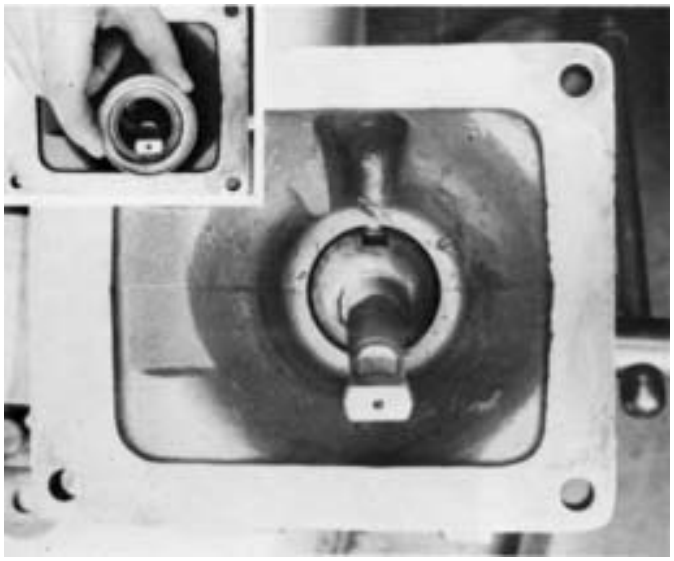


4. Remove the spade pin from bore in housing tower. If necessary, remove the O-ring from groove inside tower (inset.)

B. Reassembly of Gear Shift Lever Assembly

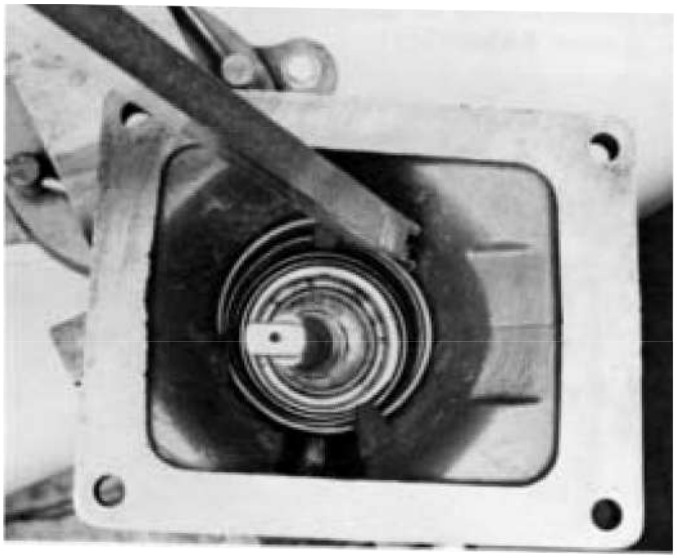


1. With the gear shift lever housing secured in vise as during disassembly, install the spade pin in bore of housing tower (inset). If previously removed, install the O-ring in tower groove.



2. Position the gear shift lever in housing with spade pin in lever slot and install the tension spring washer over ball, dished-side up, (inset.)

DISASSEMBLY AND REASSEMBLY SHIFTING CONTROLS



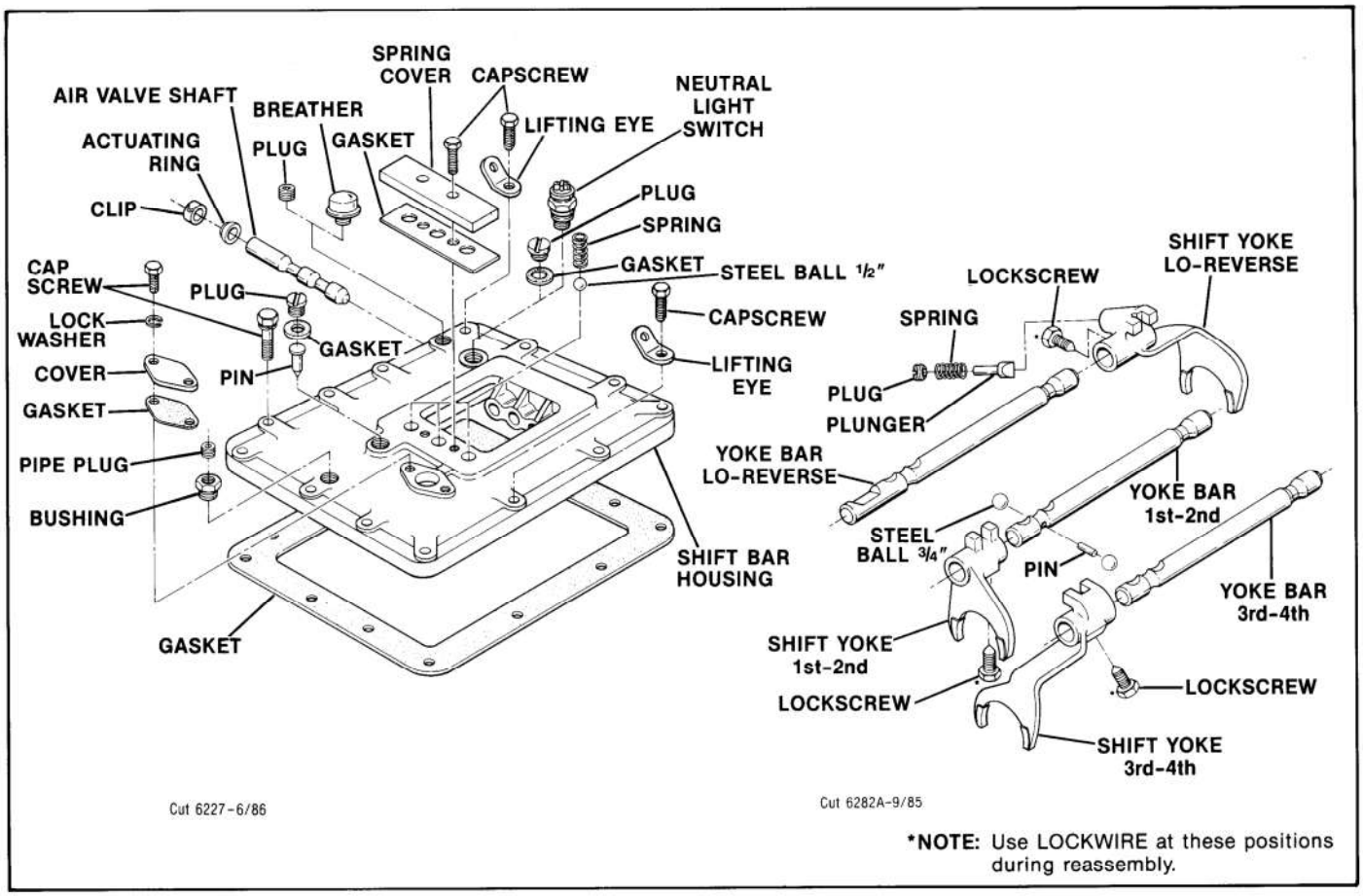
3. Install the tension spring under lugs in housing, seating one coil at a time. Use of a spring driving tool is recommended.



4. Remove the assembly from vise and install the rubber boot over gear shift lever and against housing.

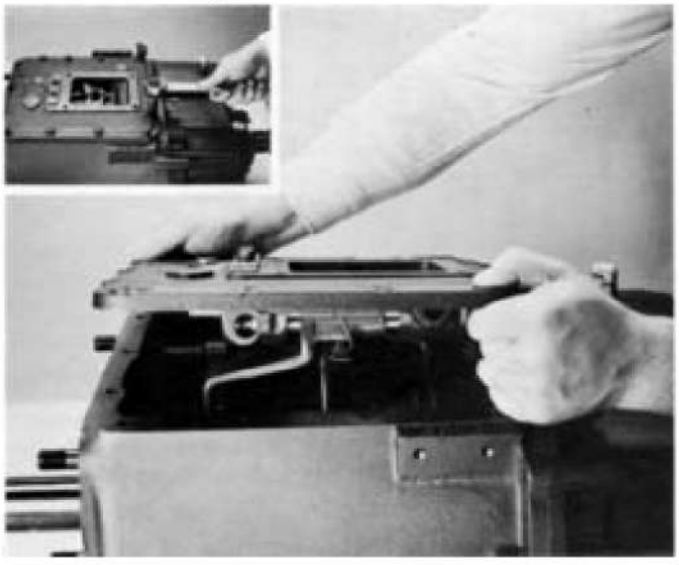
DISASSEMBLY AND REASSEMBLY
SHIFTING CONTROLS

SHIFT BAR HOUSING ASSEMBLY

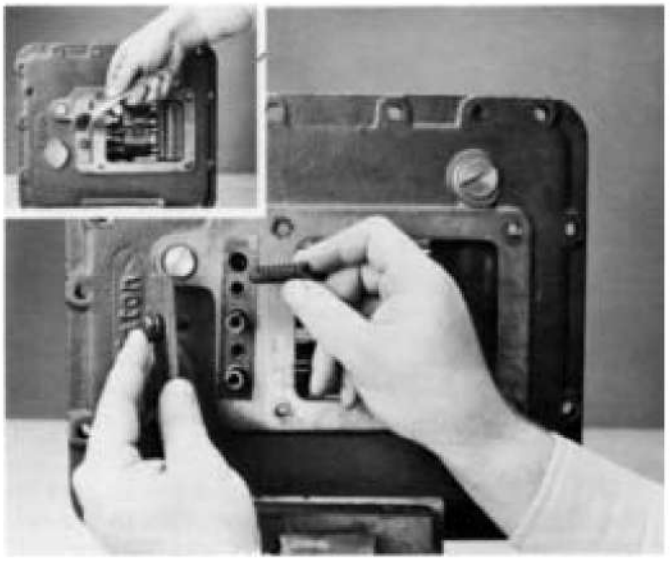


***NOTE:** Use LOCKWIRE at these positions during reassembly.

A. Removal and Disassembly of the Shift Bar Housing



1. Turn out the thirteen capscrews (inset,) jar to break gasket seal, and lift the shift bar housing from transmission.

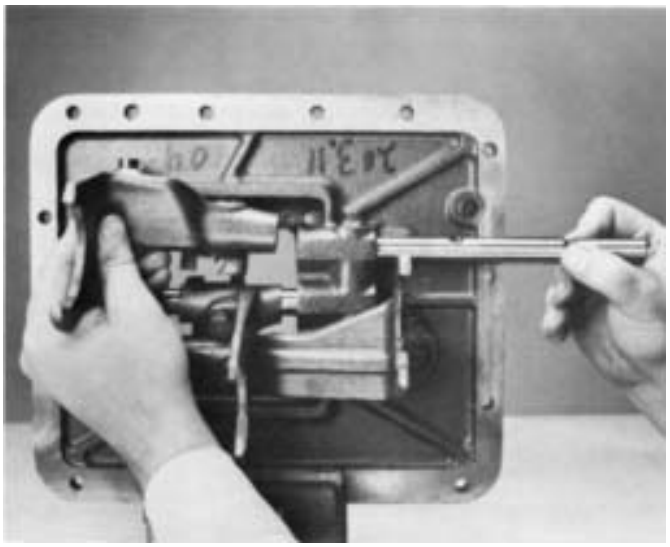


2. Turn out the two capscrews and remove the tension spring cover from top of housing (inset.) Remove the three tension springs installed under cover.

DISASSEMBLY AND REASSEMBLY SHIFTING CONTROLS

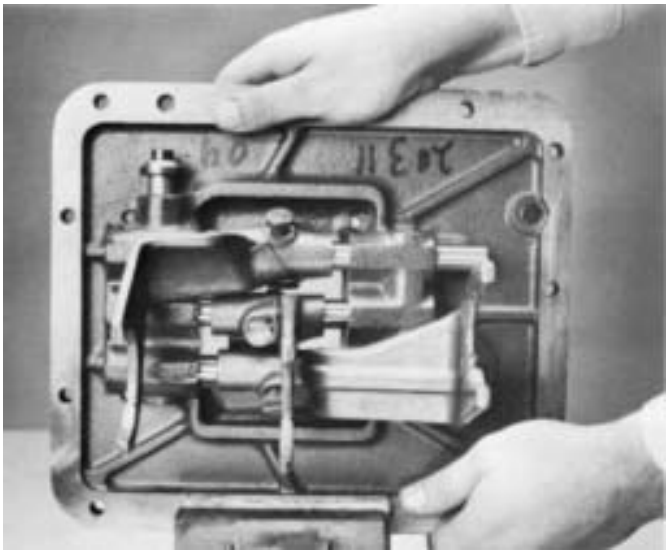


3. Tilt housing and remove the three tension balls installed under springs.



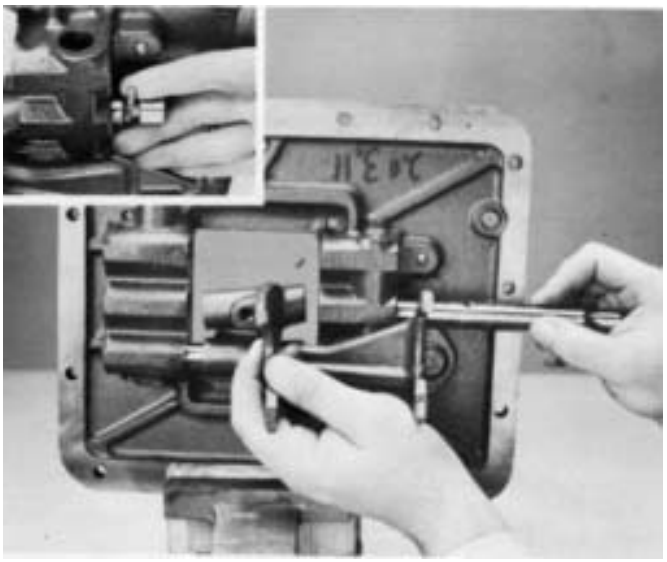
5. Move Lo-Reverse bar to the right and out of housing, removing shift yoke from bar.

NOTE: During disassembly, lay all parts on a clean bench in the order of removal to facilitate reassembly. Bars not being removed must be kept in the neutral position or interlock parts will lock bars.



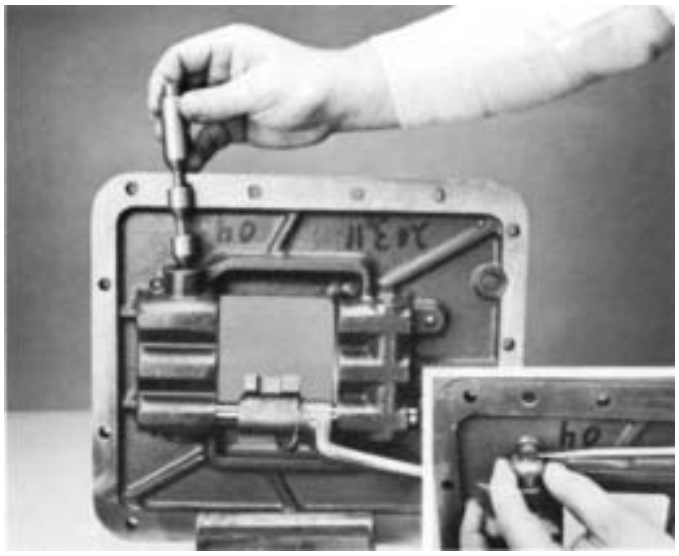
4. Place the housing in a vise with Plunger side up and secure on housing flange; (front of housing will be to right).

NOTE: Starting with the upper bar, move all bars to the right and out of housing as detailed in the following instructions. Cut lockwire and remove lock screws from each bar just prior to its removal.

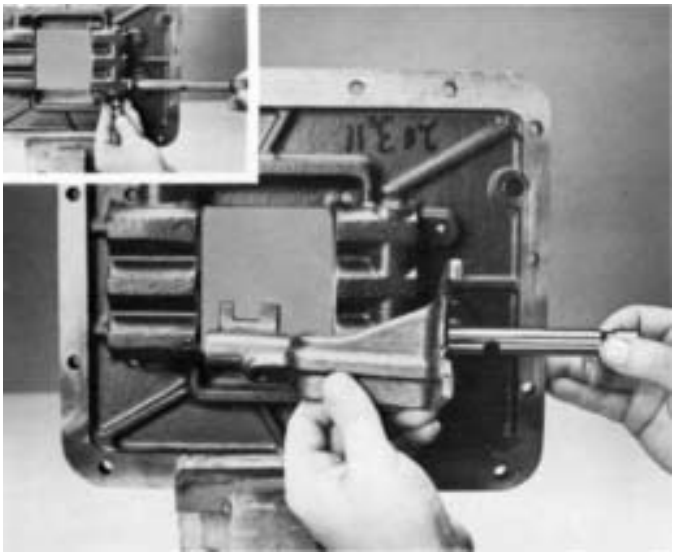


6. Move the 1st-2nd yoke bar to right and out of housing, removing shift yoke from bar. As the neutral notch in bar clears the front web, remove the interlock pin from bore in neutral notch (inset.)

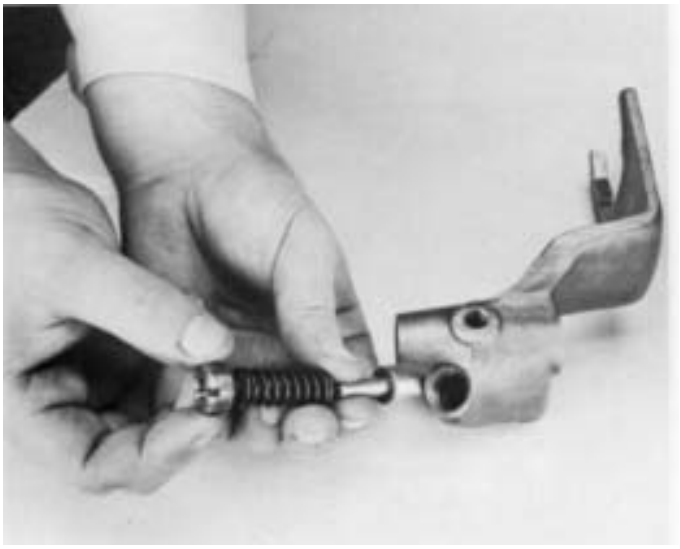
DISASSEMBLY AND REASSEMBLY SHIFTING CONTROLS



7. Remove clip and actuating ring from air valve shaft (inset.) Remove the air valve shaft from rear web.



8. Move the 3rd-4th yoke bar to the right and out of housing, removing shift yoke from bar, as yoke is removed, remove the two interlock balls from front web (inset.)



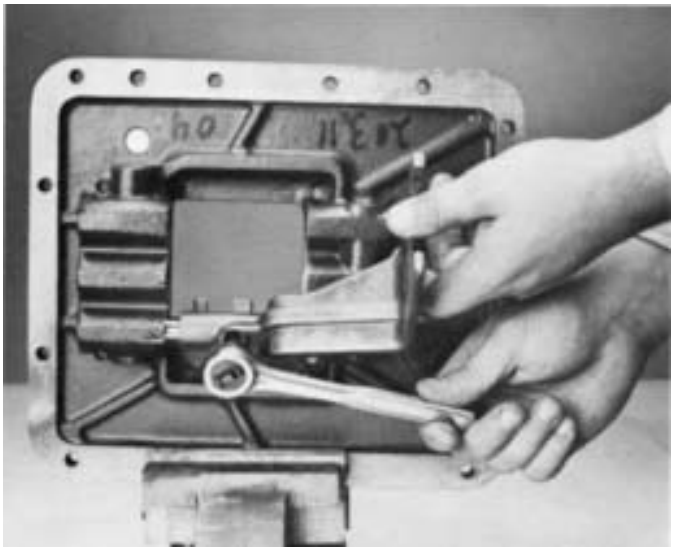
9. If necessary, remove the plug spring and reverse plunger stop from bore in Lo-reverse speed shift yoke.

A. Reassembly of Shift Bar Housing Assembly



1. If previously removed, place plunger stop in Lo-reverse shift yoke block, install spring in bore of yoke and onto shank of plunger. Install the plug and tighten to compress spring. Back the plug out 1-11/2 turns and stake plug through the small hole in yoke (inset.)

DISASSEMBLY AND REASSEMBLY SHIFTING CONTROLS

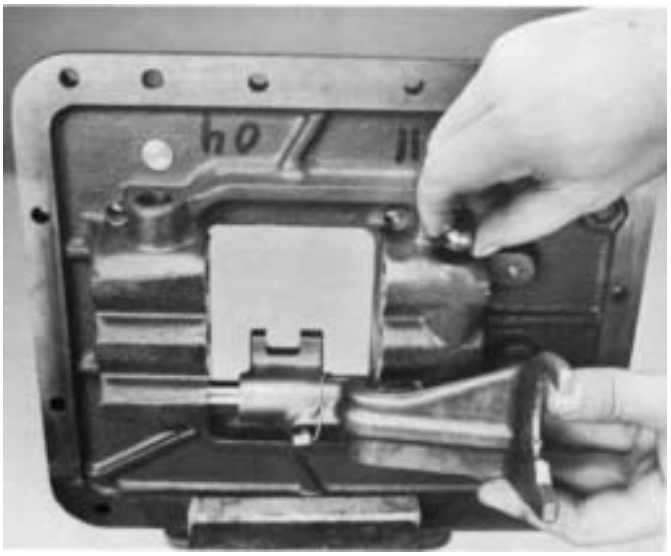


2. Place the housing in a vise with the front of housing to the right as shown. Install the 3rd-4th speed shift bar in bottom bore with detent notches to the front, installing yoke, lockscrew, and safety wire.

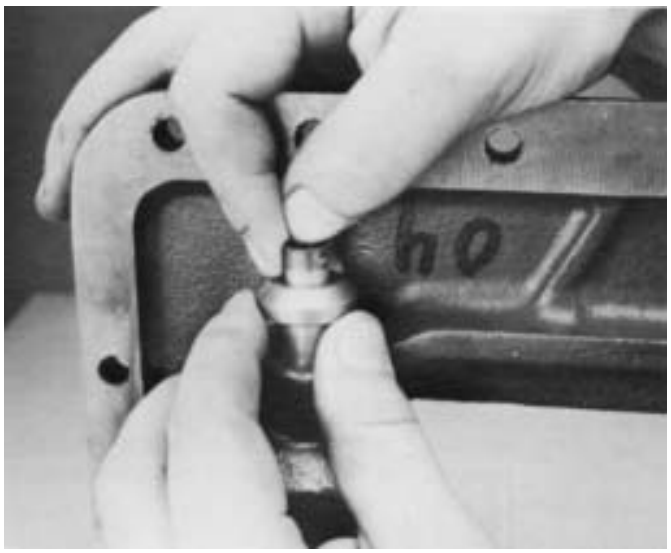
NOTE: Keep bar in neutral position during installation. Do not exceed the recommended torque rating for yoke lockscrews as over tightening may distort shift bars.



4. Install air valve shaft in vertical bore in rear web, as shown.

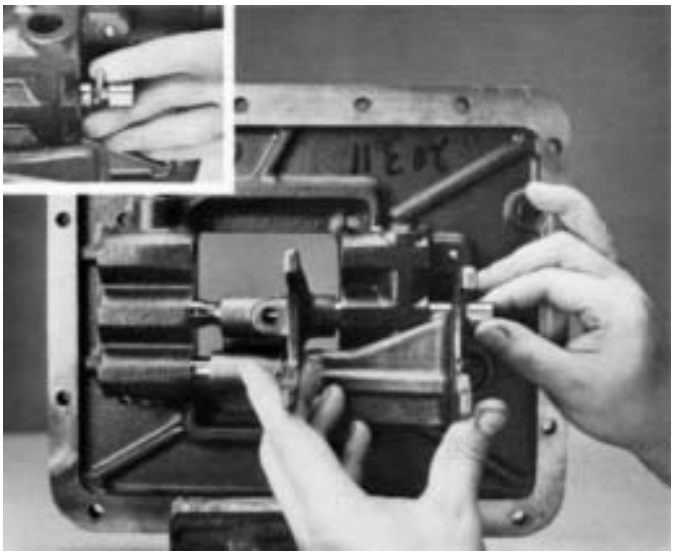


3. Install interlock ball in vertical bore of front web.

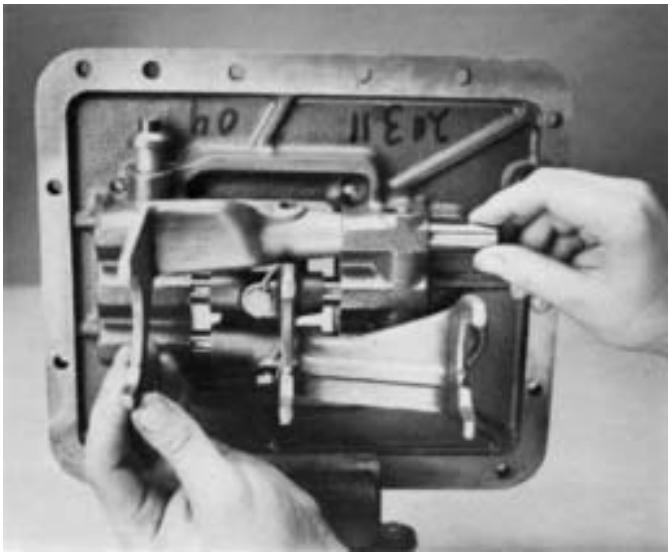


5. Install actuating ring and clip on air valve shaft.

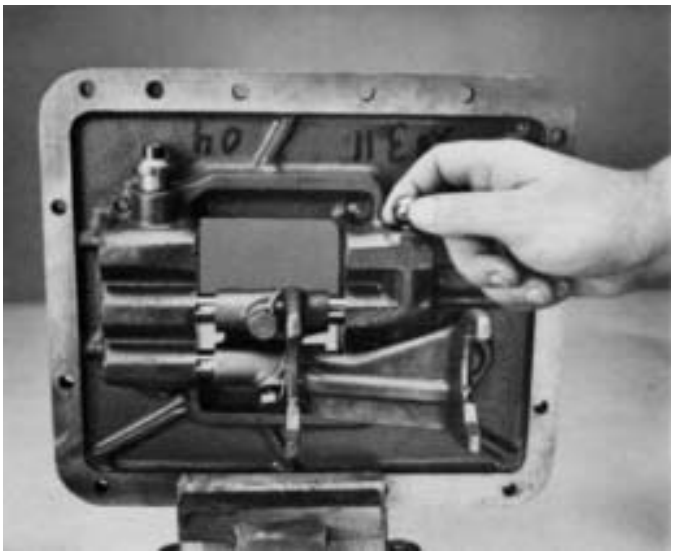
DISASSEMBLY AND REASSEMBLY SHIFTING CONTROLS



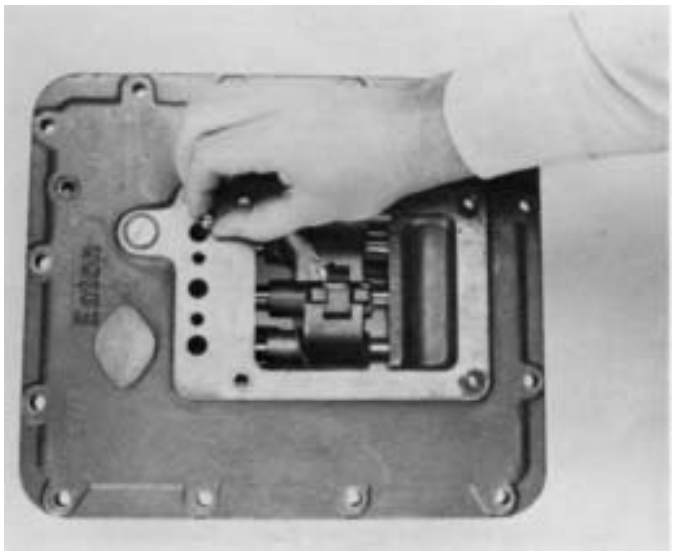
6. Install the 1st-2nd speed shift bar in center bore, and install shift yoke on bar; insert interlock pin in detent notch (inset.) Install lockscrew and safety wire.



8. Install Lo-reverse shift bar in upper bore, detent notches to the front, install yoke on bar, fork to the rear, install lockscrew and safety wire.

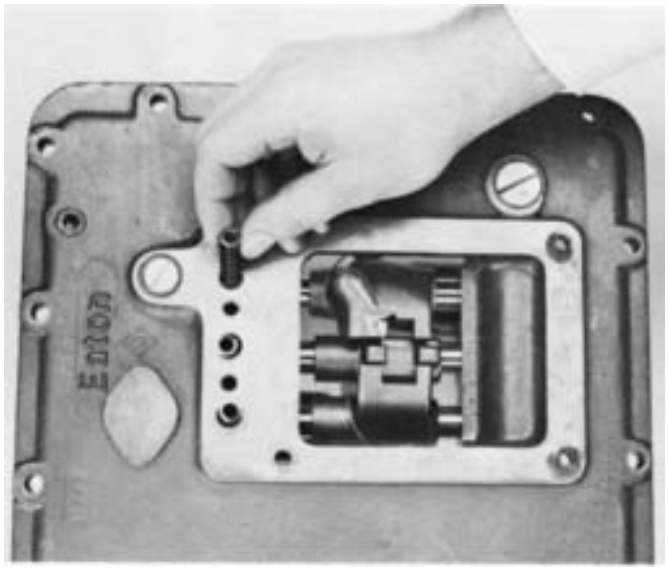


7. Install interlock ball in vertical bore of front web.

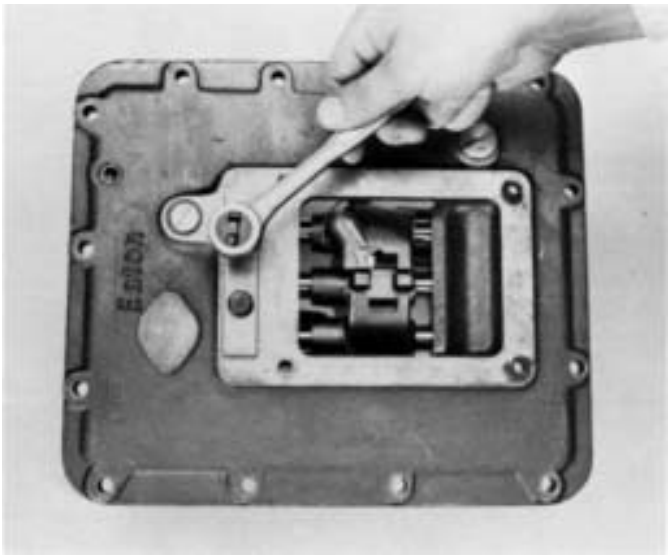


9. Remove assembly from vise and install the three tension balls, one in each bore in top of housing. Keep yokes in neutral.

DISASSEMBLY AND REASSEMBLY
SHIFTING CONTROLS

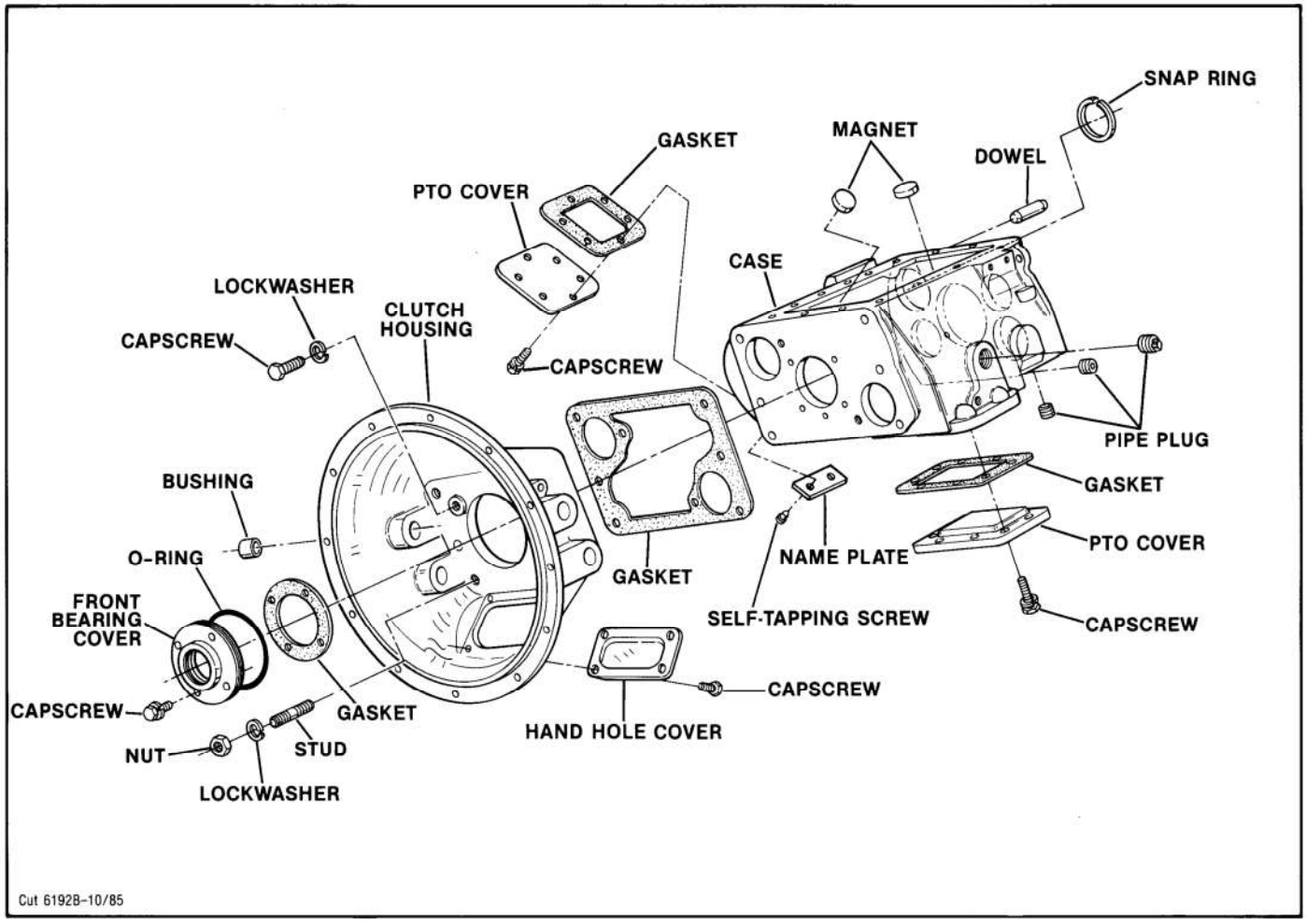


10. Install the three tension springs, one in each bore, in top of housing.

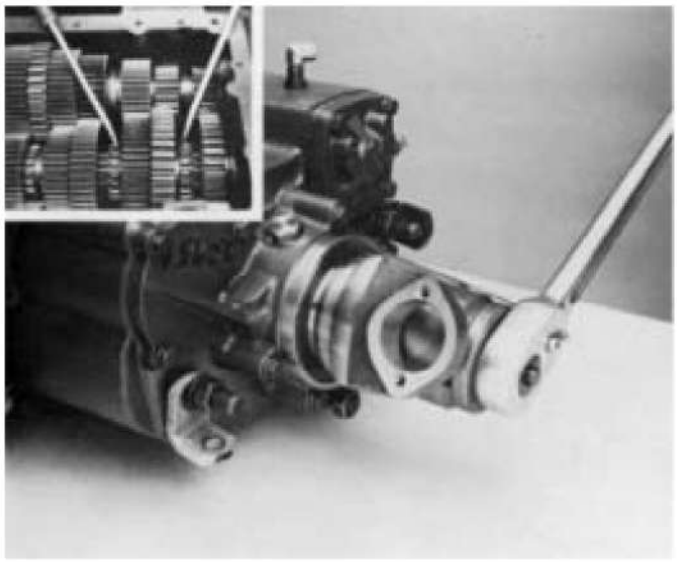


11. Install the tension spring cover. Tighten two cap-screws to recommended torque.

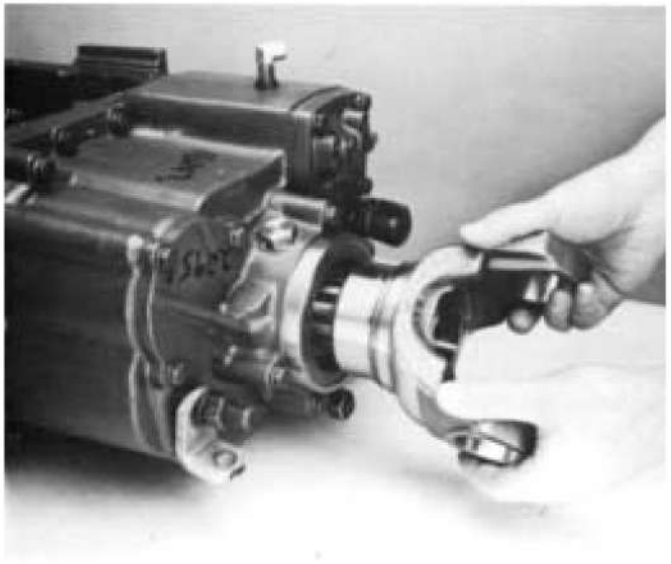
REMOVAL-REAR YOKE, CLUTCH HOUSING AND AUXILIARY SECTION



A. Removal of Rear Yoke



1. Lock transmission by engaging two mainshaft gears with the mainshaft sliding clutches, (inset.) Use a large breaker bar to turn the output shaft nut from the output shaft.

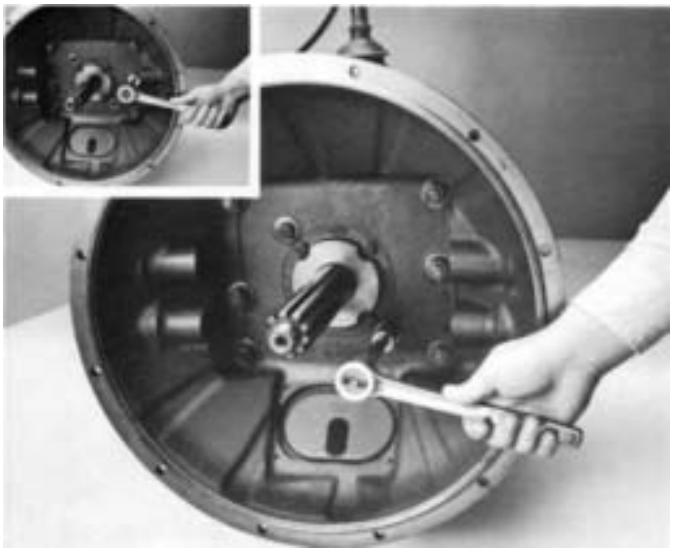


2. Pull yoke straight to the rear and off output shaft.

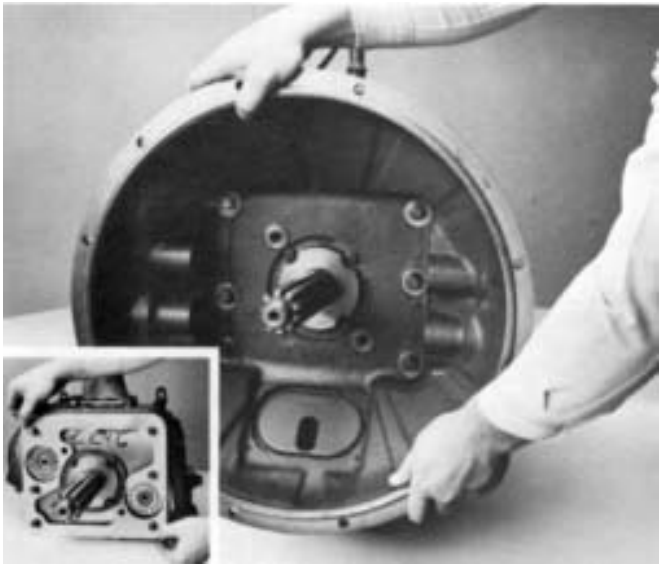
REMOVAL-REAR **YOKE, CLUTCH HOUSING AND AUXILIARY SECTION**

B. Removal Clutch Housing

NOTE: For models so equipped remove the clutch release mechanism and/or clutch brake assembly. See OPTIONS,



1. Remove the two capscrews, six nuts, and six lockwashers from studs that secure the clutch housing to transmission case (inset).



2. Jar clutch housing with rubber mallet to break gasket seal and pull from transmission case, remove gasket (inset.)

C. Removal of Auxiliary Section

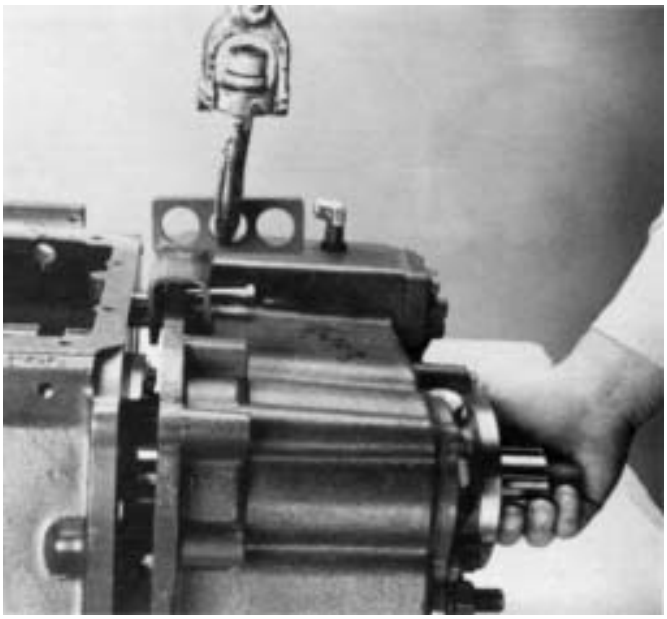


1. Turn out the fifteen capscrews that attach the two sections.

NOTE: There are two lengths of capscrews, note their location.



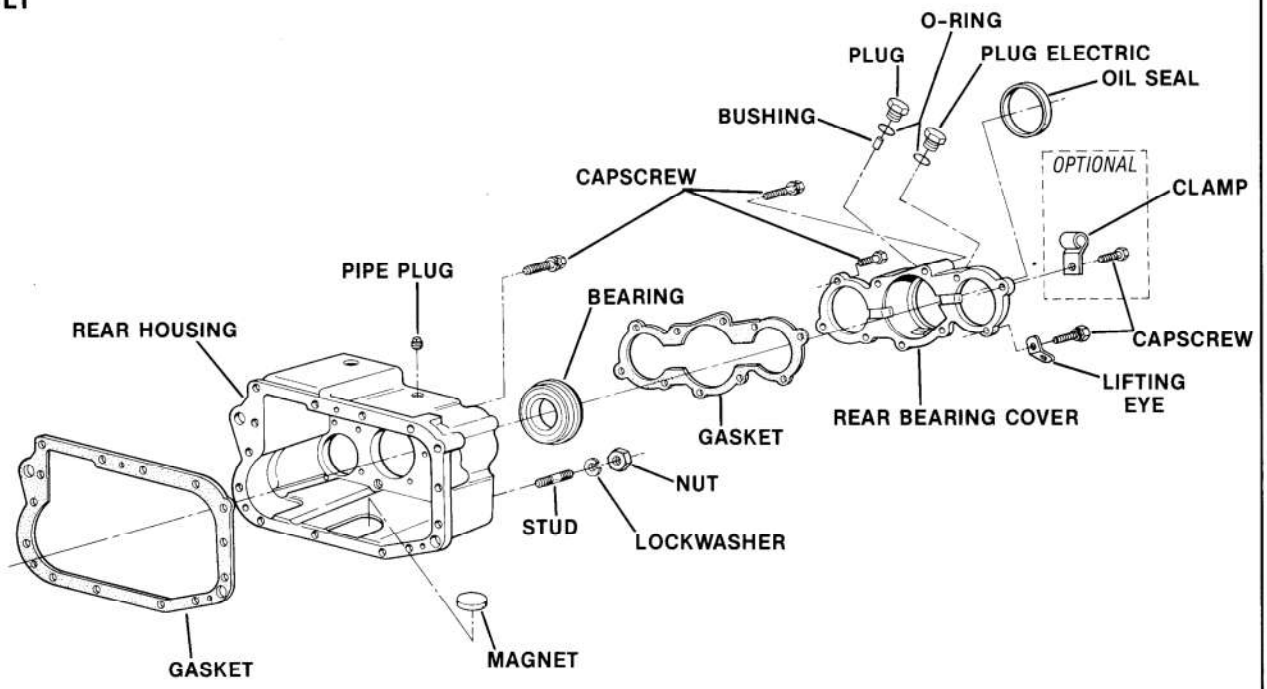
2. Insert three capscrews in the tapped holes of housing flange. Tighten evenly to move auxiliary section to the rear and just far enough from front section to break gasket seal.



3. Remove capscrews and attach a chain hoist to auxiliary section. Move the assembly to the rear until free of front section and remove gasket.

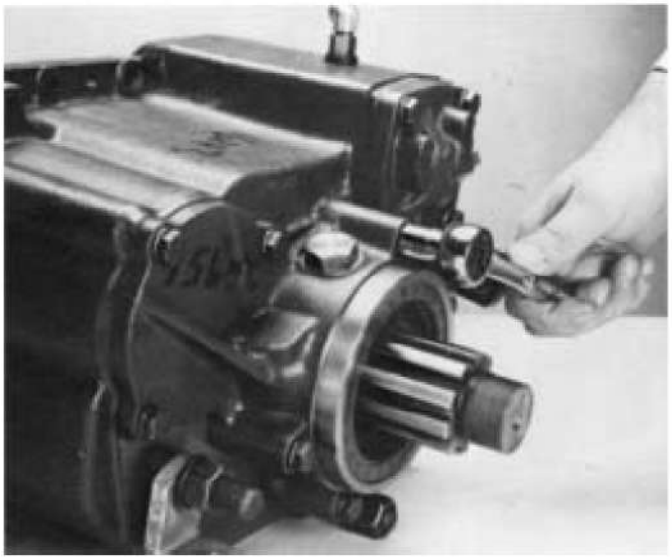
DISASSEMBLY-AUXILIARY SECTION

AUXILIARY HOUSING ASSEMBLY



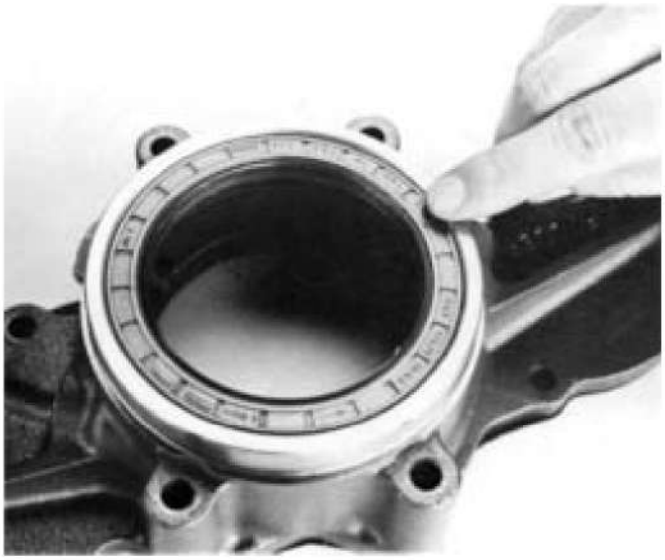
Cut 6523A-9/85

A. Removal and Disassembly Output Shaft and Rear Bearing



1. Turn out twelve capscrews and remove the rear bearing cover, and gasket.

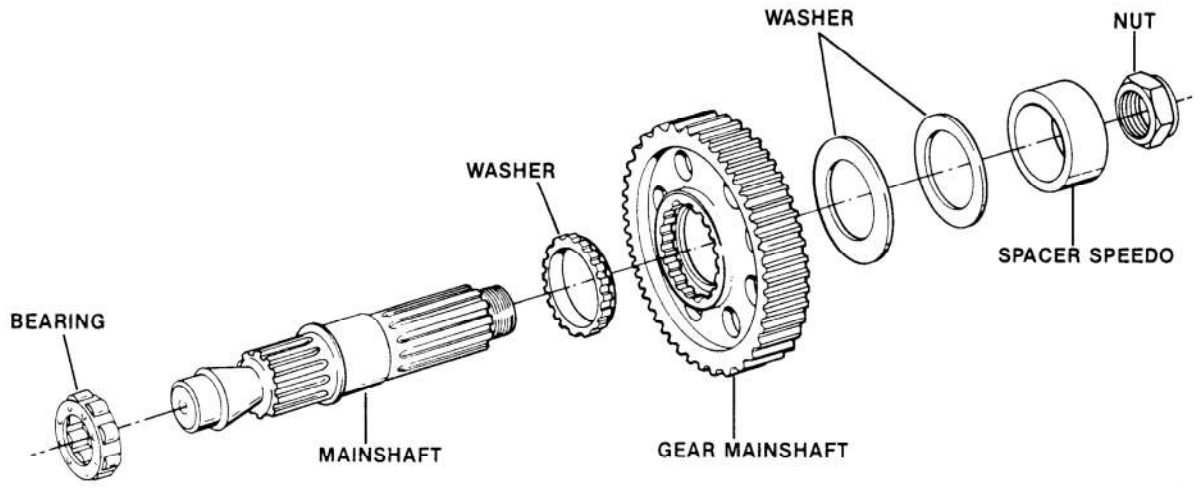
NOTE: There are two lengths of capscrews, note their locations.



2. If necessary remove the oil seal from the rear bearing cover.

DISASSEMBLY-AUXILIARY SECTION

AUXILIARY MAINSHAFT ASSEMBLY



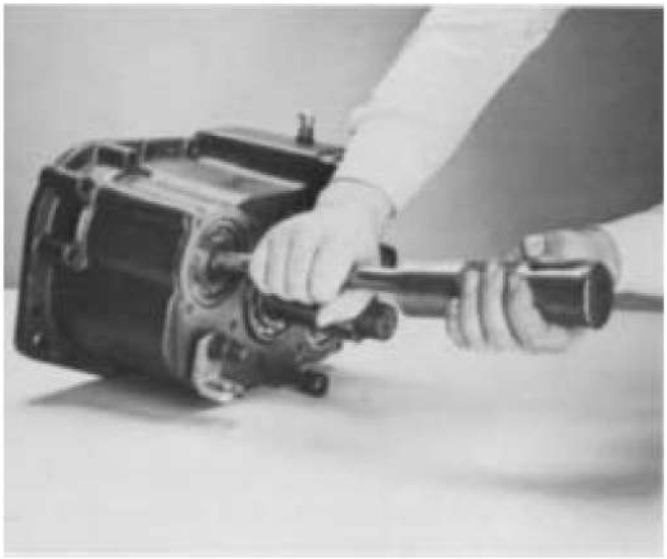
Cut 6549-9/85



3. Remove the speedometer drive gear or replacement spacer, and washer from output shaft.

A. Removal and Disassembly Auxiliary Countershafts

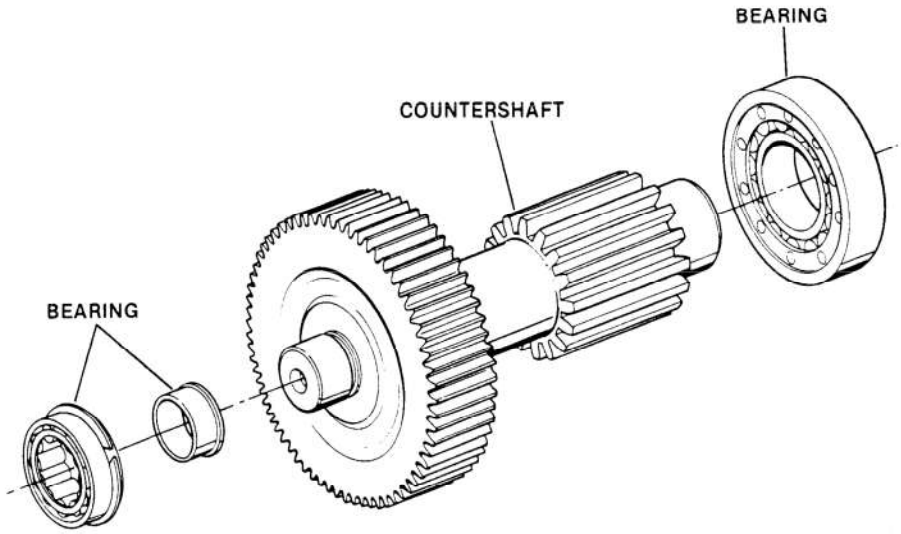
NOTE: Place synchronizer in HI range before removal of countershaft.



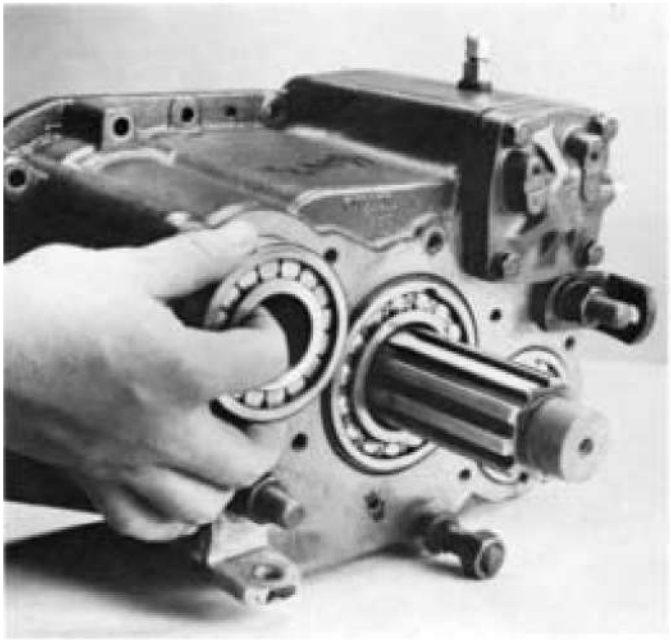
1. Using a soft bar and maul drive the countershaft forward through the countershaft bearings and remove them from the auxiliary housing.

DISASSEMBLY-AUXILIARY SECTION

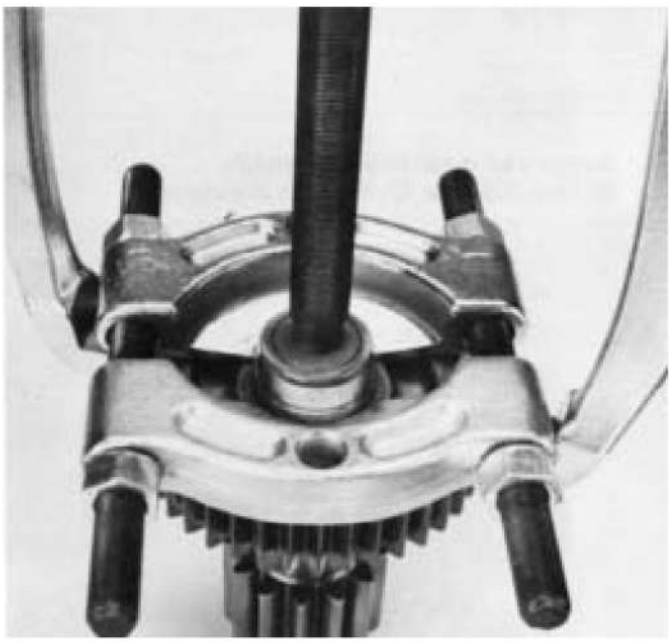
AUXILIARY COUNTERSHAFT ASSEMBLY



Cut 6482 A-1 2/83



2. Remove the countershaft bearings from the auxiliary case bearing bores.

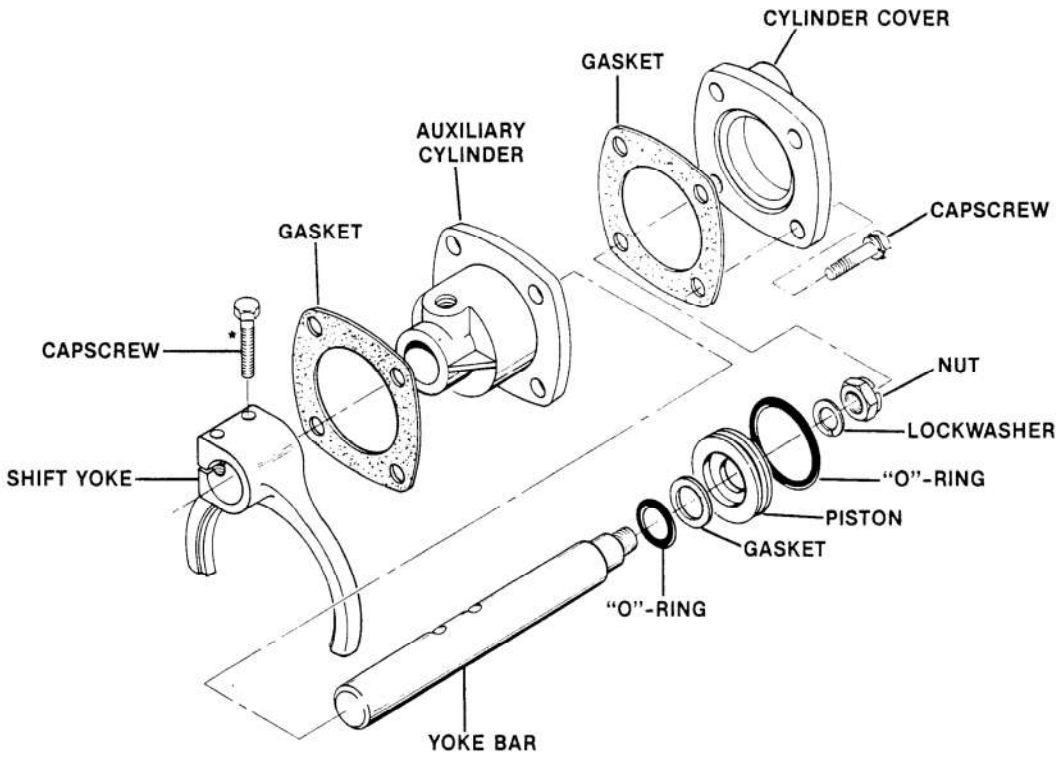


3. If necessary, secure assembly in vice and remove the auxiliary countershaft front bearing race from countershaft with jaw puller, and clamp.

NOTE: The vise should be equipped with soft jaws or wood blocks to prevent damage to the countershaft.

DISASSEMBLY-AUXILIARY SECTION

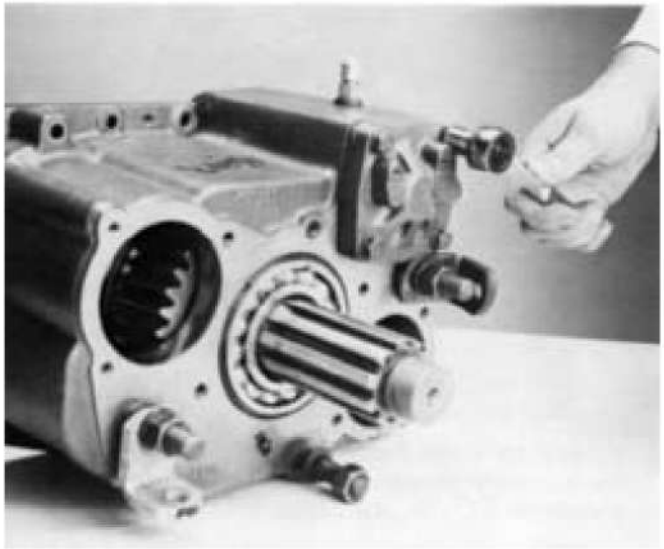
RANGE CYLINDER ASSEMBLY



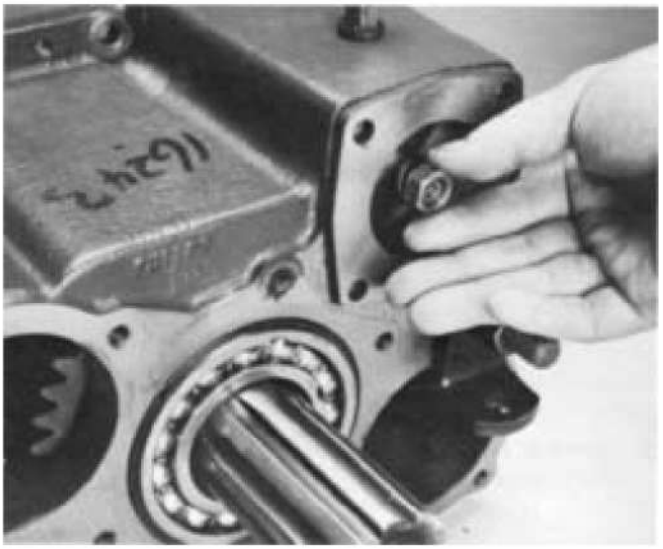
*NOTE: Use Lockwire at this position.

Cut 6422-2184

C. Removal and Disassembly of the Range Cylinder Assembly



1. Turn out four capscrews and remove the Range cylinder cover and gasket.



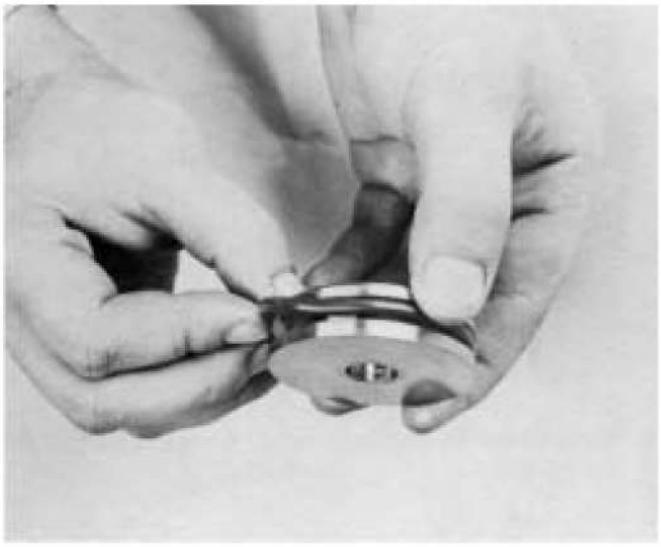
2. Remove the nut and lockwasher from end of yoke bar.

DISASSEMBLY-AUXILIARY SECTION



3. Use air to remove piston.

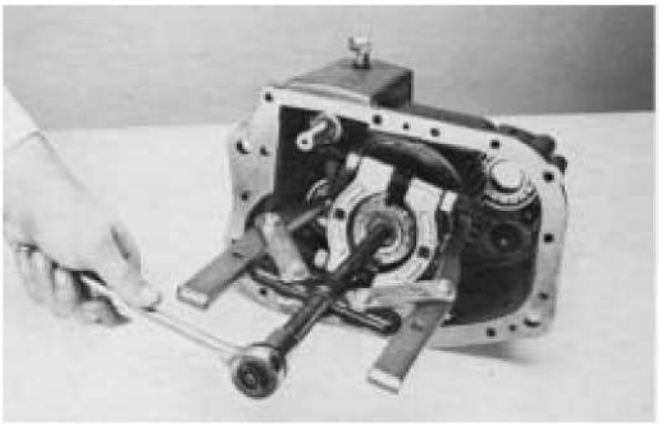
⚠CAUTION DO NOT STAND IN FRONT OF CYLINDER OPENING.



4. If necessary remove O-ring from O.D. of piston.

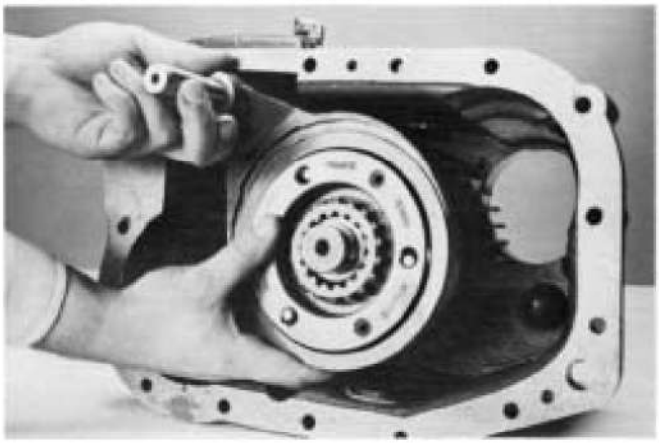


5. Remove the copper gasket from yoke bar.



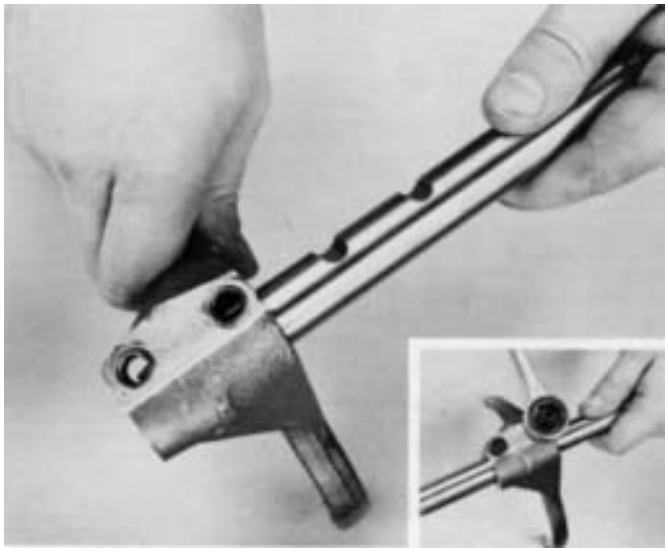
6. Use pullers and a clamp to remove the bearing from front of output shaft.

NOTE: This procedure will damage the bearing and should not be attempted unless a replacement of bearing is planned.

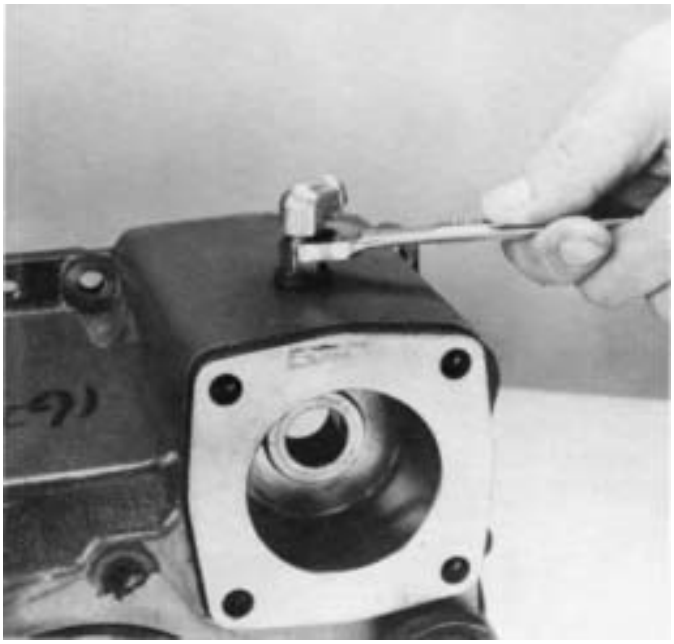


7. Move the synchronizer assembly, shift yoke, and yoke bar, forward and out of housing as complete assembly.

DISASSEMBLY-AUXILIARY SECTION



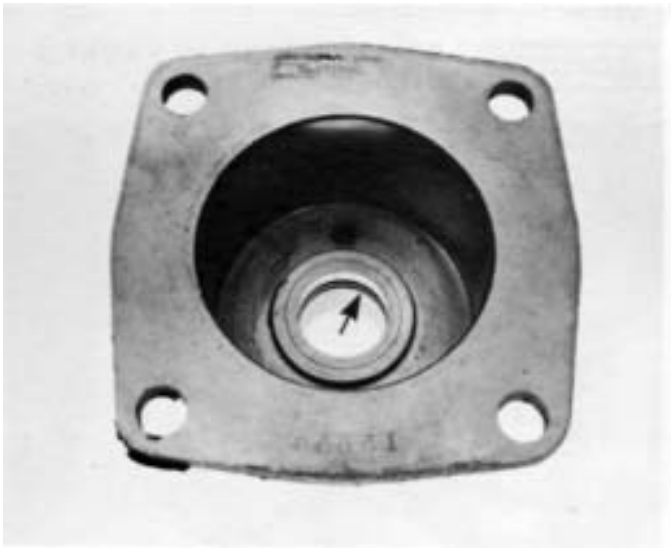
8. Remove the yoke bar and shift yoke from the synchronizer assembly. Cut the lockwire and remove the two lockscrews (inset,) remove the shift yoke from the yoke bar.



9. IMPORTANT: Remove the dust seal and air port extension from top of range cylinder housing.



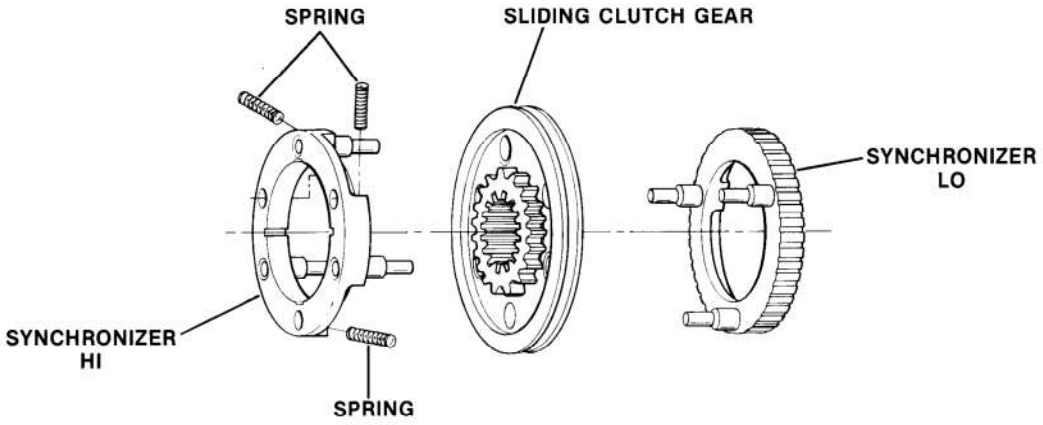
10. Remove cylinder from housing.



11. Remove the O-ring from small bore in cylinder, if necessary.

DISASSEMBLY-AUXILIARY SECTION

SYNCHRONIZER ASSEMBLY



Cut 6479-6/81

D. Synchronizer Disassembly

NOTE: Cover synchronizer assembly with a shop rag to prevent losing the three springs released from HI range synchronizer at pin locations.



1. Place the larger LO range synchronizer ring on a bench and pull the high range synchronizer ring from blocker pins.



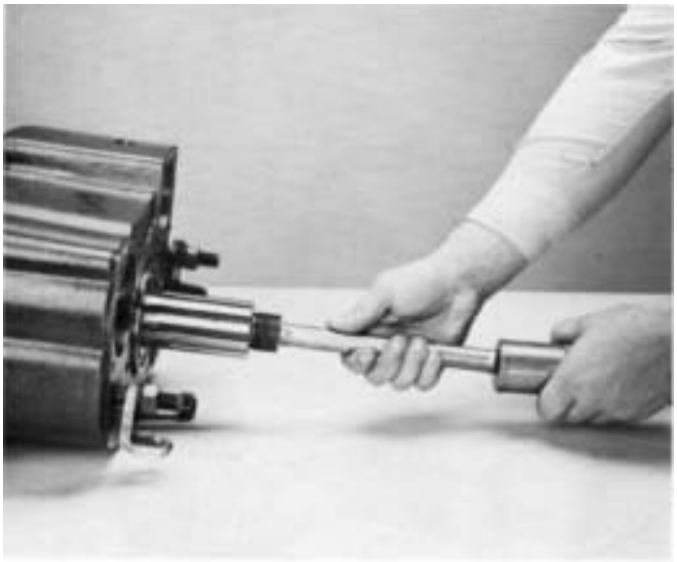
2. Remove synchronizer springs.

DISASSEMBLY-AUXILIARY SECTION



3. Remove the sliding clutch from LO range synchronizer pins.

E. Disassembly of Lo Range Speed Gear and Output Shaft.



1. Using a soft bar and maul, drive or press against rear of output shaft to move assembly forward and from rear bearing.

   NOTE: When applying force to rear of output shaft, DO NOT DAMAGE THREADS.



2. Remove the rear washer and Lo Range speed gear from rear of shaft. Remove spline washer from-hub of reduction gear (inset.)

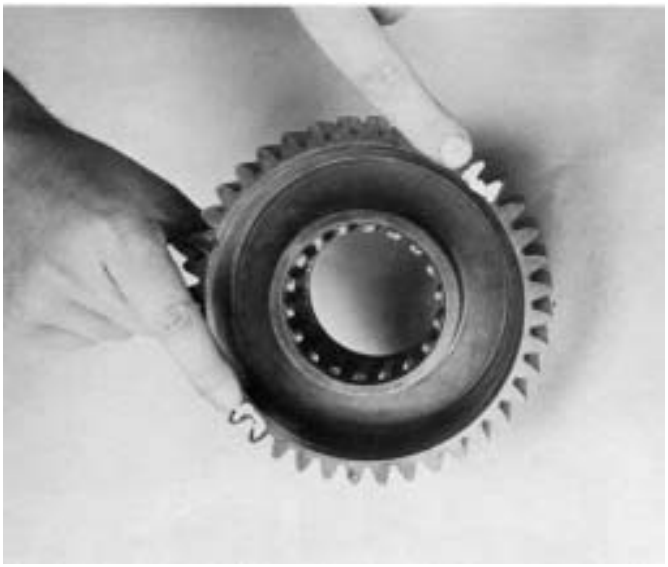


3. Move the output shaft rear bearing to the rear and out of housing.

REASSEMBLY-AUXILIARY SECTION

A. Reassembly and Installation of Lo Range Speed Gear and Output Shaft.

NOTE: Make sure magnetic plugs are installed in auxiliary housing.



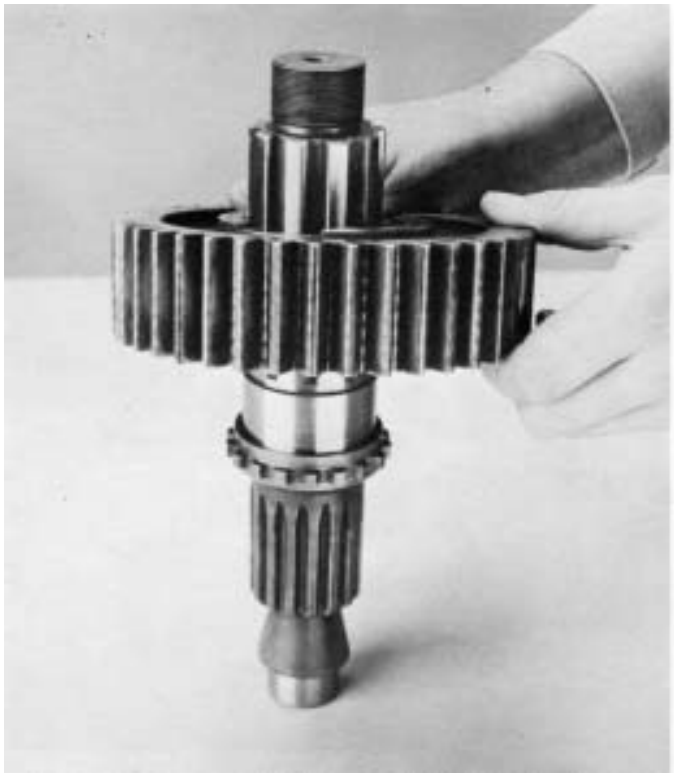
1. IMPORTANT: Mark timing teeth on the Lo Range (reduction) gear. A highly visible color of tool-maker's dye is recommended.

a. Mark any two adjacent gear teeth on Lo Range gear, front side.

b. Then mark the two adjacent teeth which are directly opposite the first set marked. There should be the same number of teeth between the markings on each side of the gear.



2. Placed splined washer on output shaft shoulder facing up as shown.



3. Install the Lo Range gear over rear of output shaft and against shoulder.

REASSEMBLY-AUXILIARY SECTION



4. Install the LO Range gear rear washer on output shaft and against gear, with chamfer side facing up.



5. Stand the output shaft on end with the rear of shaft facing up. Place auxiliary housing over shaft so that output shaft extends through rear bore.



6. Using a heat lamp or hot plate and oil heat the output shaft rear bearing and install on output shaft. Seat the bearing securely on shaft and in bore. Bearing can also be installed using the appropriate driver.

NOTE: DO NOT HEAT BEARING ABOVE 275°F (136°C).

B. Reassembly Range Cylinder Assembly

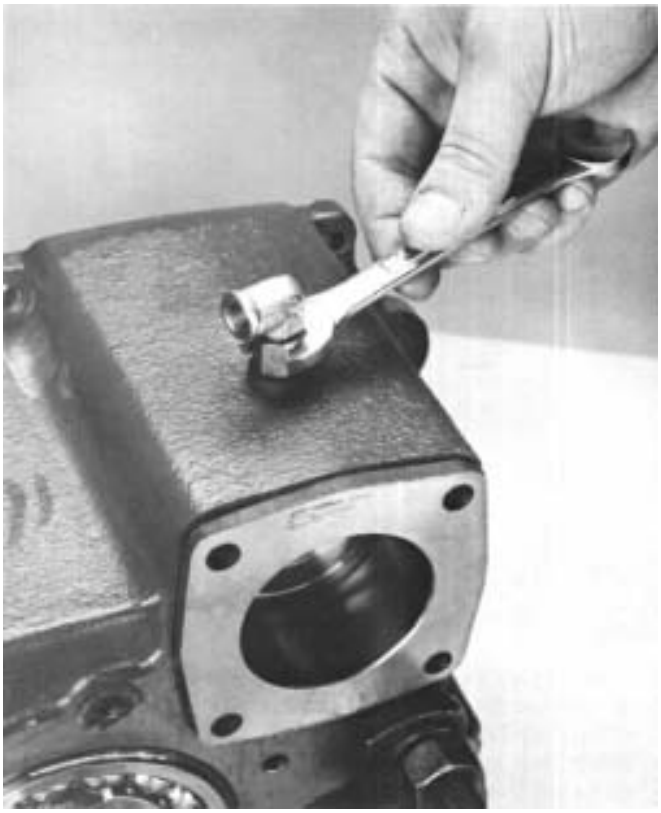


1. Install O-ring in slot of small bore in cylinder. Lubricate O-ring with silicone lubricant.

REASSEMBLY-AUXILIARY SECTION

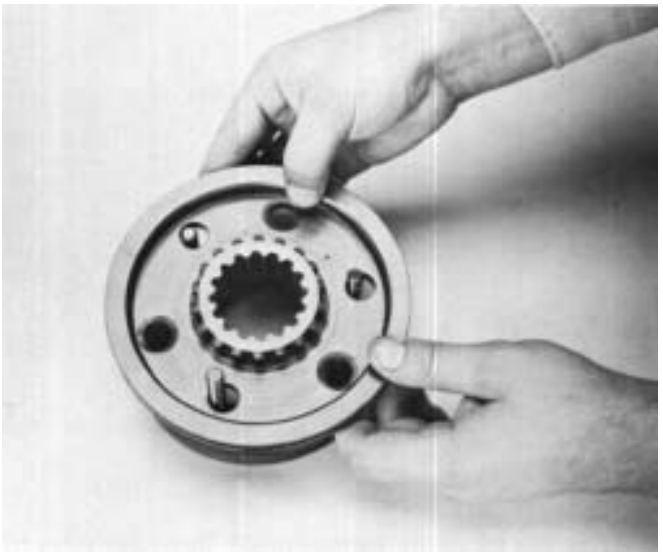


2. Install range cylinder in housing with air port in cylinder aligned with air port in top of auxiliary housing.



3. Install dust cover and air port extension through housing and into bore of air cylinder.

C. Reassembly Synchronizer Assembly



1. Place the larger LO range synchronizer ring face down on bench with pins up.
   Place the sliding clutch, recessed side up, on pins of LO range synchronizer.

   NOTE: Pins on LO Range synchronizer must line up with chamfered holes on bottom of sliding clutch.



2. Install the three springs in bores in HI range synchronizer ring.

REASSEMBLY-AUXILIARY SECTION

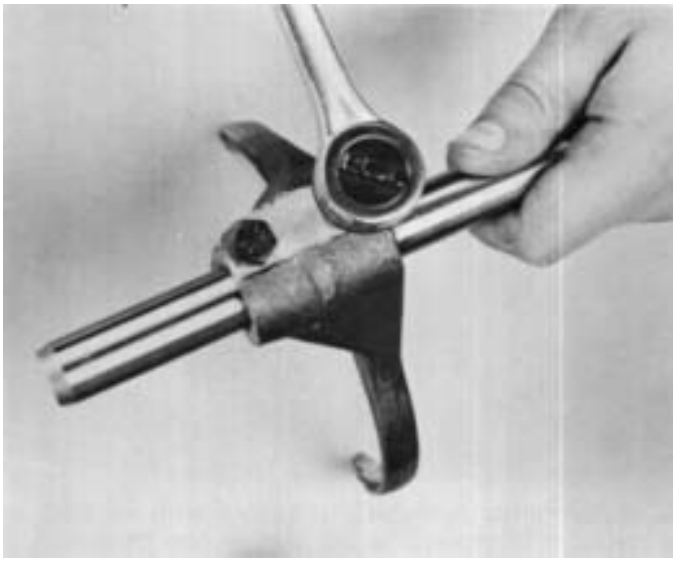


3. Place the HI range synchronizer ring over pins of LO speed synchronizer ring, seating springs against pins.

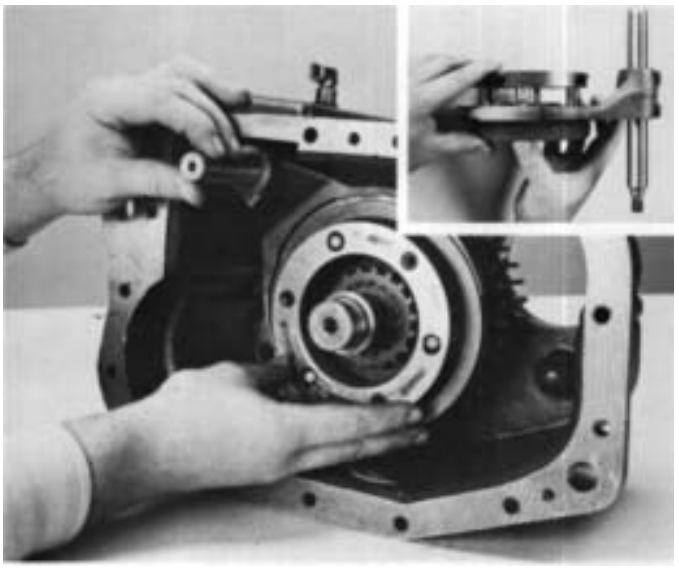


4. Apply downward pressure to the HI range synchronizer ring WHILE TWISTING COUNTER-CLOCKWISE to compress the springs and fully seat ring on blocker pins of LO range synchronizer.

D. Installation of Synchronizer and Range Cylinder Assemblies.



1. Place the shifting yoke on yoke bar, long hub towards the front of bar. Align slots in yoke bar and install the two lockscrews, secure with safety wire.



2. Place yoke in slot of sliding clutch; threaded end of piston bar towards the larger LO ranger synchronizer (inset.)
Place the entire assembly into auxiliary housing, engaging splines of sliding clutch with output shaft and inserting yoke bar through cylinder bore.

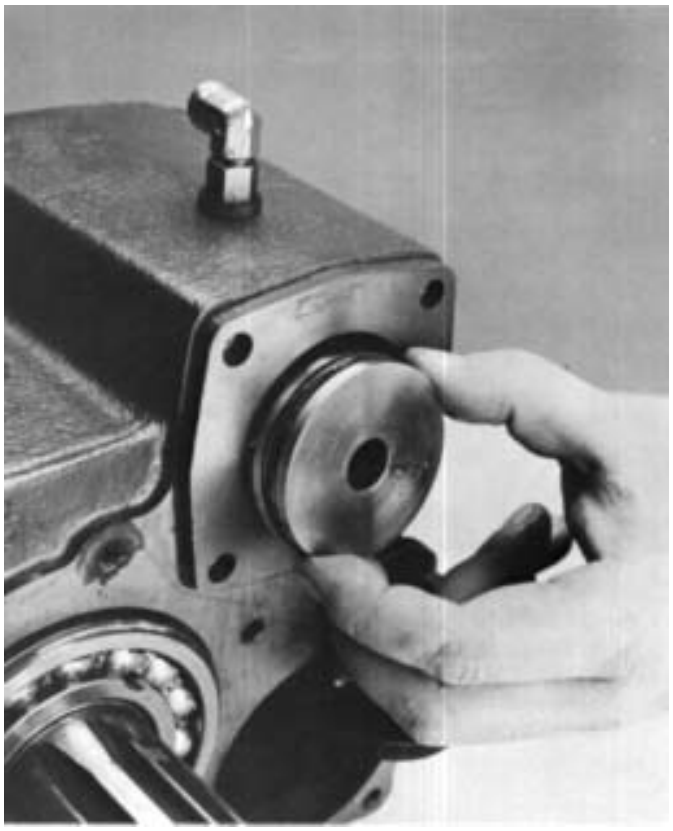
REASSEMBLY-AUXILIARY SECTION



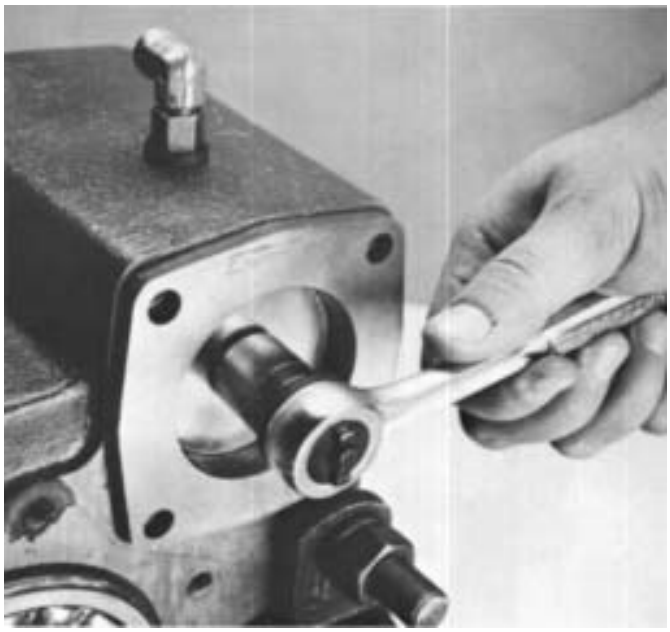
3. Install copper gasket on threaded end of yoke bar.



4. Install O-ring on O.D. of piston. Apply light coat of silicone lubricant to O-ring.

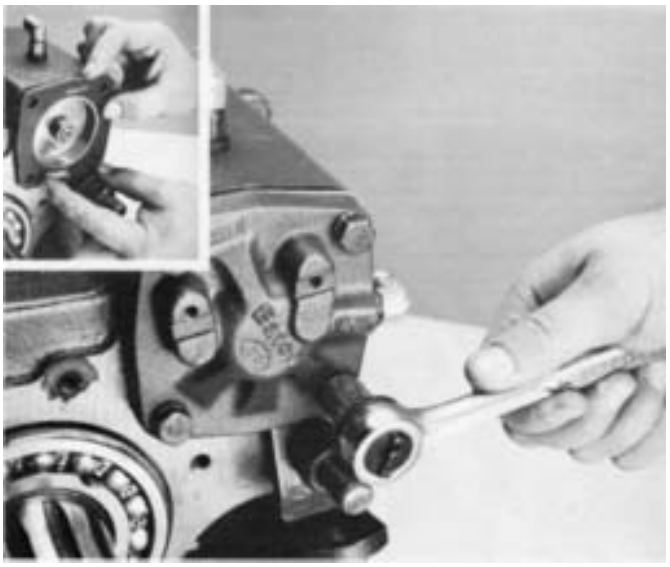


5. Install piston on yoke bar and against copper gasket, flat side of piston out.



6. Install lockwasher and nut on yoke bar to secure piston. Tighten nut to recommended torque.

REASSEMBLY-AUXILIARY SECTION



7. Install gasket, (inset), and cylinder cover with HI range port to right. Tighten the four capscrews to recommended torque.

E. Countershafts



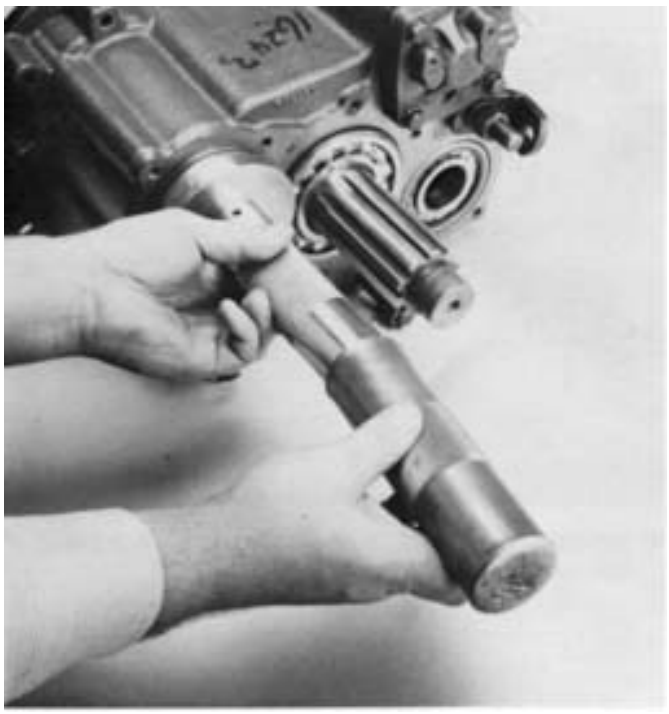
1. Install bearing inner race on front of countershaft.



2. Mark the tooth on the countershaft gear which is stamped with an "0".

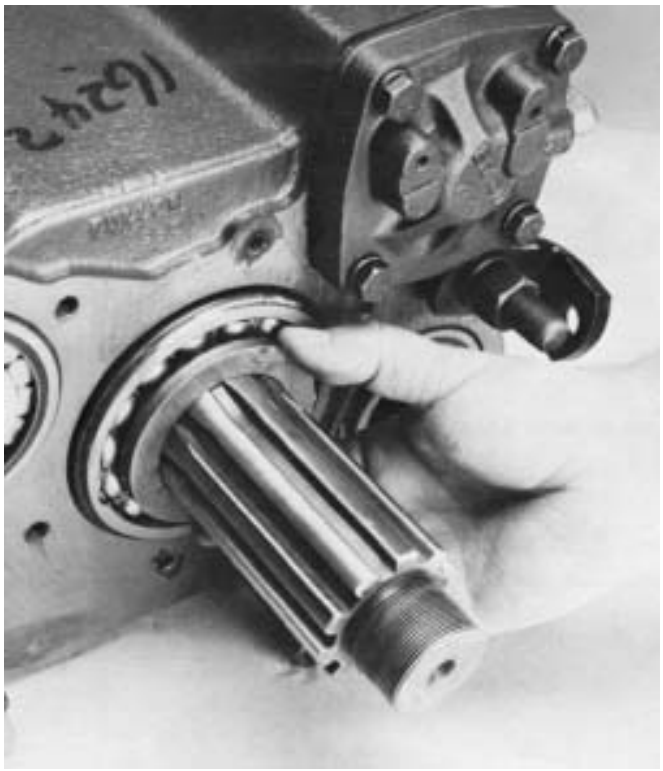
NOTE: Countershaft gear teeth must be marked for timing auxiliary section. Mark with a highly visible color of toolmaker's dye.

F. Installation Auxiliary

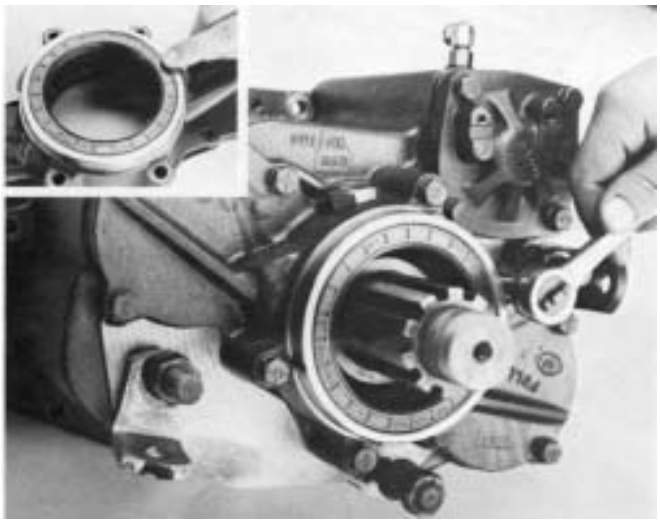


1. Seat the countershaft rear bearings in auxiliary housing, snap ring toward rear.

REASSEMBLY-AUXILIARY SECTION

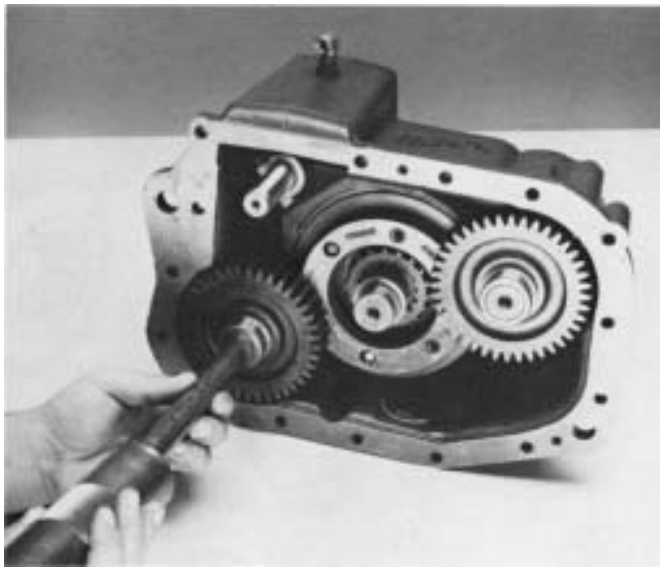


2. Install speedometer gear washer, with flat side to rear, and speedometer gear or replacement spacer on output shaft, and against washer.



3. If previously removed install oil seal in bearing cover, lip of seal to rear (inset). Install gasket and rear bearing cover with mechanical speedometer bore up to left. Position capscrews in proper location and tighten to recommended torque.

NOTE: Use proper seal driver to install seal. Install gasket and rear bearing cover with mechanical speedometer bore up to left, position capscrews in proper location and tighten to recommended torque.

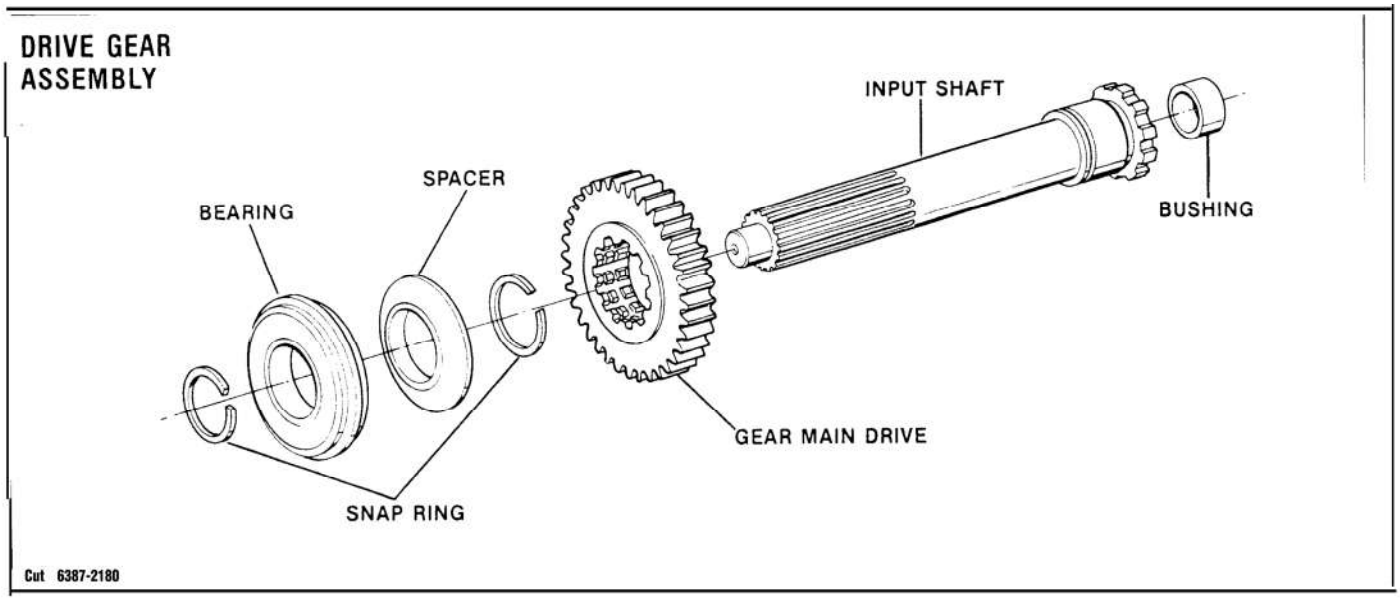


4. As the countershafts are installed mesh the marked reduction gear tooth on each counterhsaft set of gear of gear teeth marked. With countershafts positioned and timed drive countershafts into bearings, seat securely.



5. Install bearing on front of output shaft, chamfered side of race to rear.

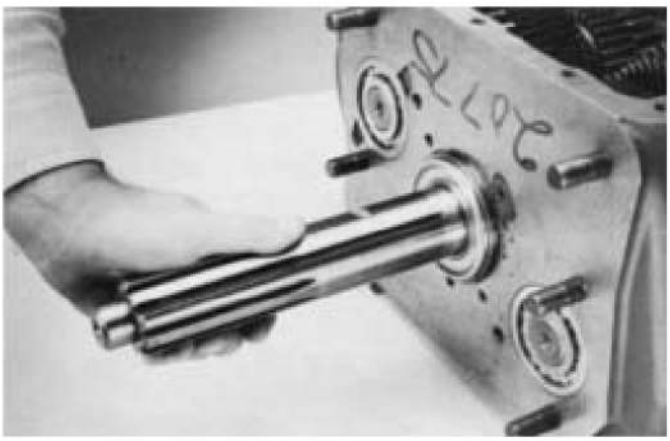
DISASSEMBLY-FRONT **SECTION**



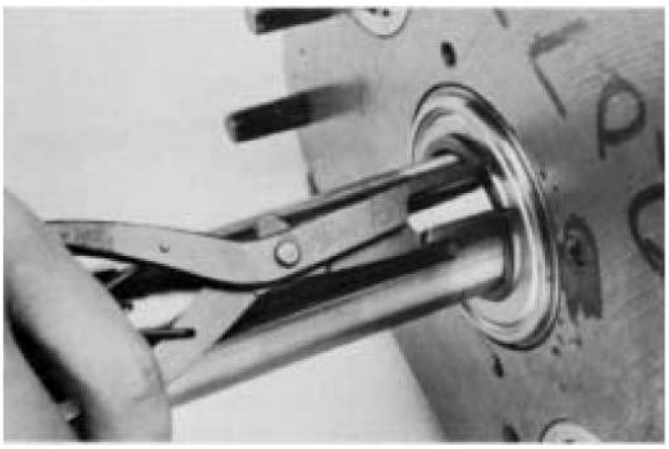
A. Input Shaft Removal



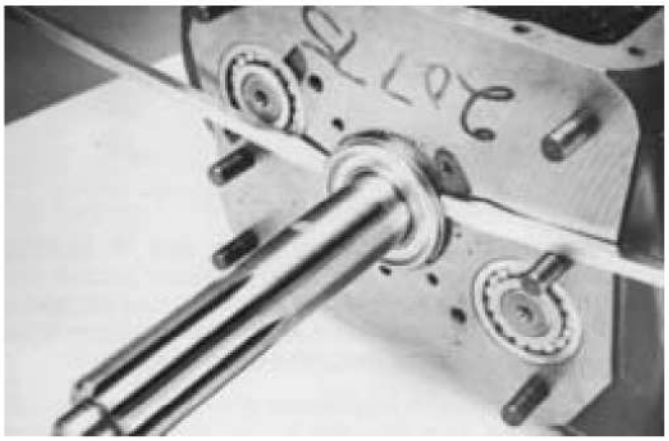
1. Remove four capscrews retaining front bearing cover (inset.) Remove bearing cap, gasket and O-ring.



3. Push down on input shaft to cock bearing in bore. Drive input shaft toward rear of transmission, through bearing as far as possible. Pull input shaft forward to expose snap ring of bearing.

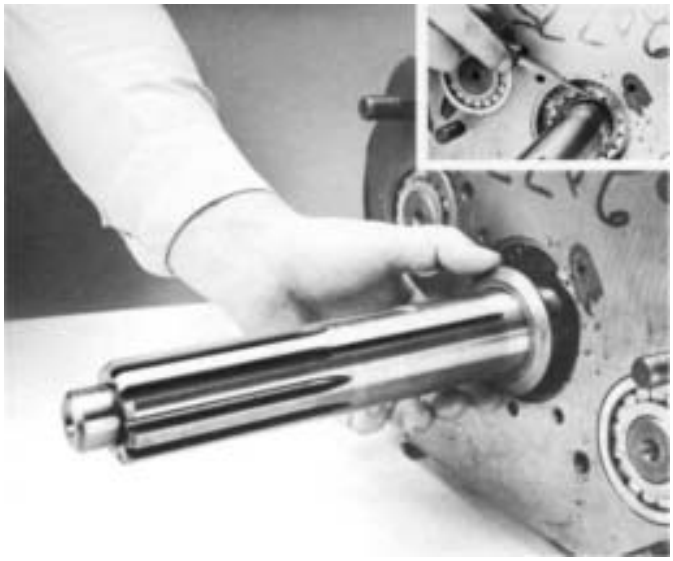


2. Remove the bearing retaining snap ring from groove in shaft.



4. Use pry bars to complete removal of bearings.

DISASSEMBLY-FRONT SECTION



5. Remove drive gear spacer, and snap ring (inset.)

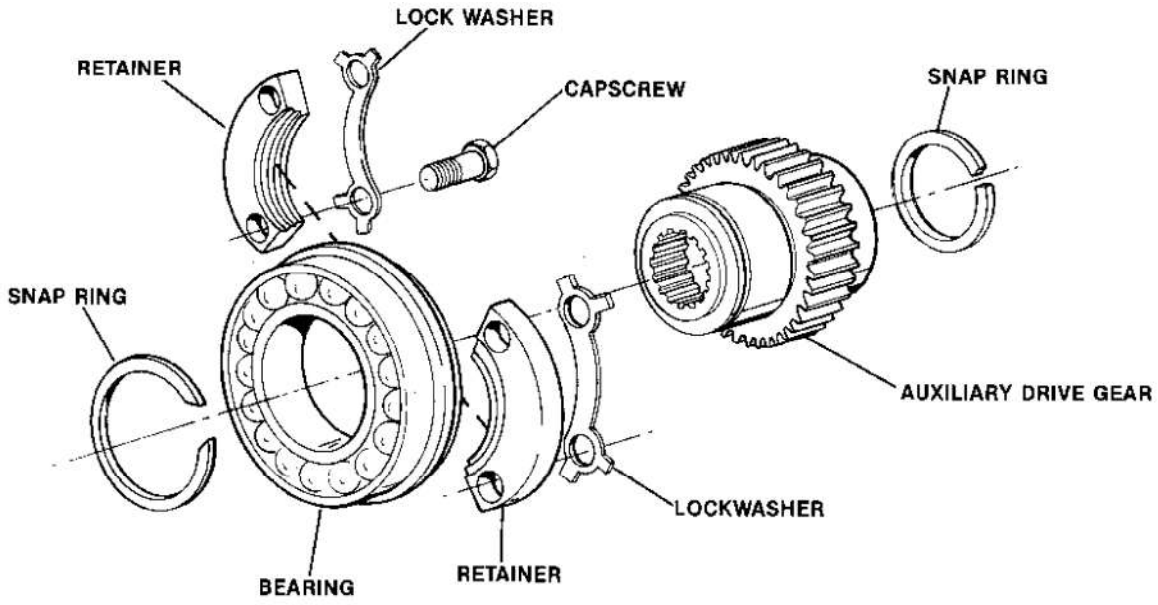


6. Pull input shaft forward and out of drive gear and case.

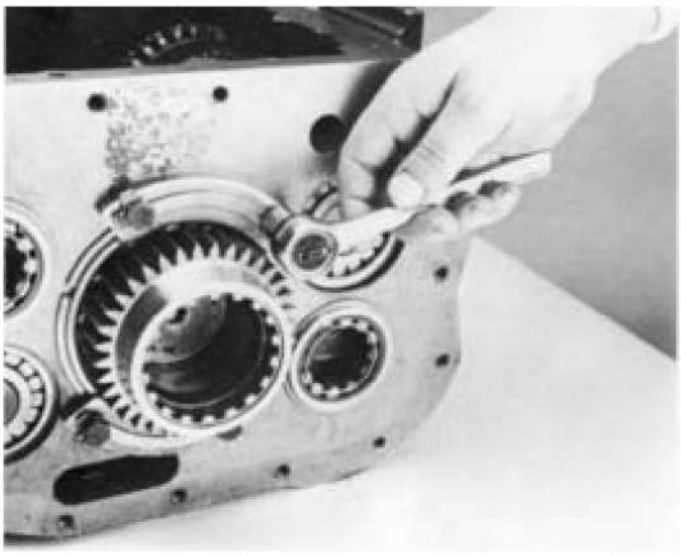


7. Check the bushing in pocket of input shaft, replace if worn.

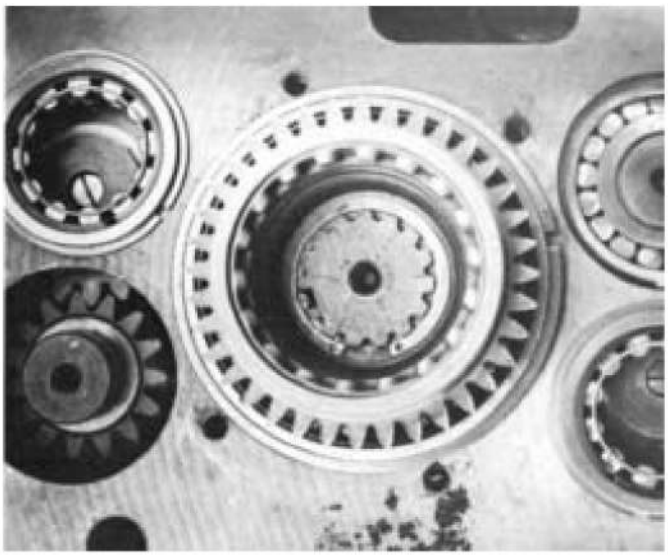
DISASSEMBLY-FRONT SECTION



B. Removal and Disassembly Auxiliary Drive Gear

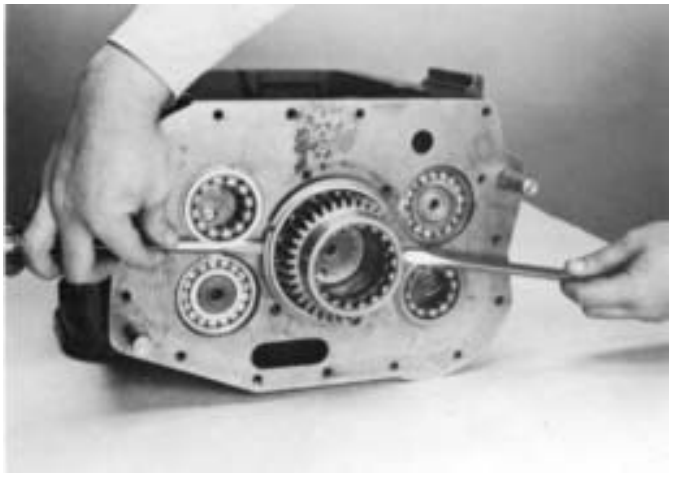


1. Straighten lock tangs,remove four capscrews and two bearing retainers from case.



2. Remove snap ring from rear of mainshaft, located in auxiliary drive gear bore.

DISASSEMBLY-FRONT SECTION



3. With two screwdrivers pry auxiliary gear off mainshaft.



4. Remove snap ring from auxiliary drive gear.



5. Press or use a driver to remove bearing from auxiliary drive gear.

DISASSEMBLY-FRONT SECTION

C. Removal of Right Countershaft Bearings



1. Remove the right countershaft snap ring, in rear bearing bore of case.

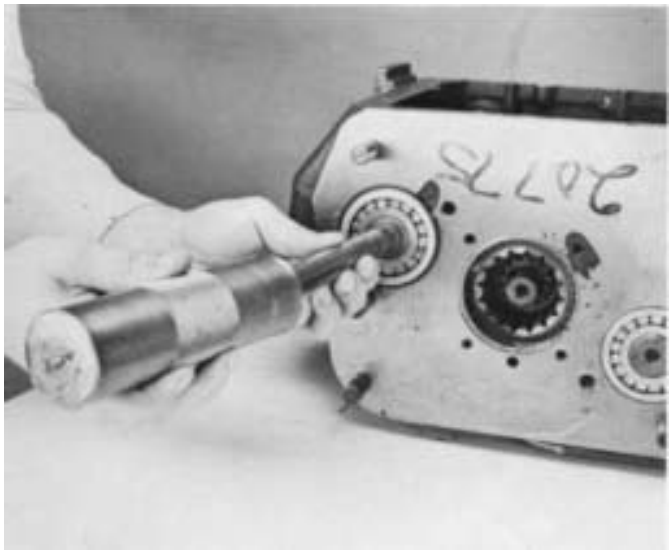


2. Using soft bar and maul against rear of countershaft, move the assembly forward as far as possible until snap ring groove in front bearing is exposed.

NOTE: If front bearing snap ring groove can not be exposed (due to variances in thickness of case), use punch between hub of countershaft drive gear and inner race of bearing to move the bearing forward on shaft.



3. Install the snap ring that was removed from the rear bearing bore in exposed snap ring groove.



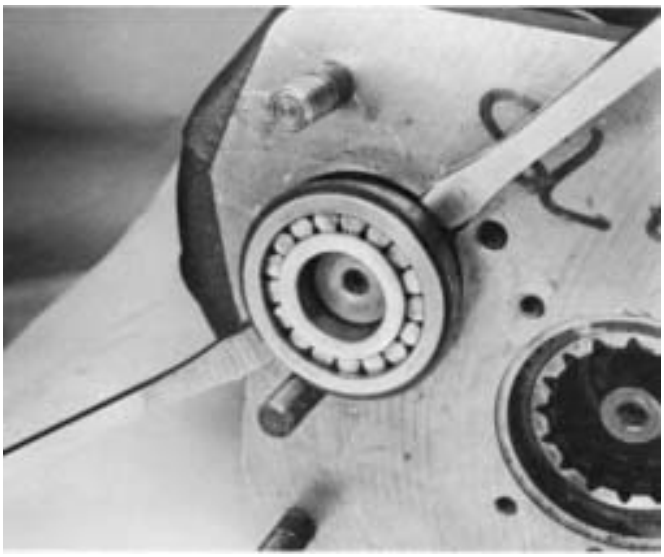
4. Using a soft bar and maul drive the countershaft assembly to the rear as far as possible. This will move the front bearing forward on countershaft.

DISASSEMBLY-FRONT SECTION

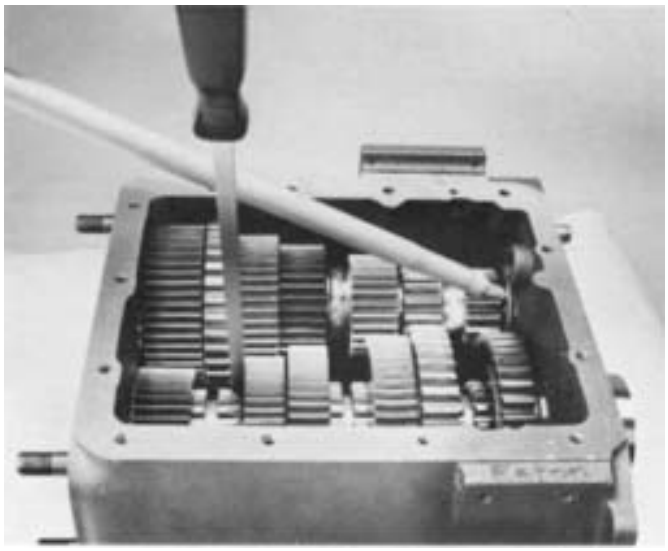


5. From the rear of case use a soft bar and maul to drive the countershaft forward to unseat the front bearing from case bore.

NOTE: This procedure may have to be repeated several times to unseat the front bearing.



6. Use a puller or pry bars to remove the front countershaft bearing.

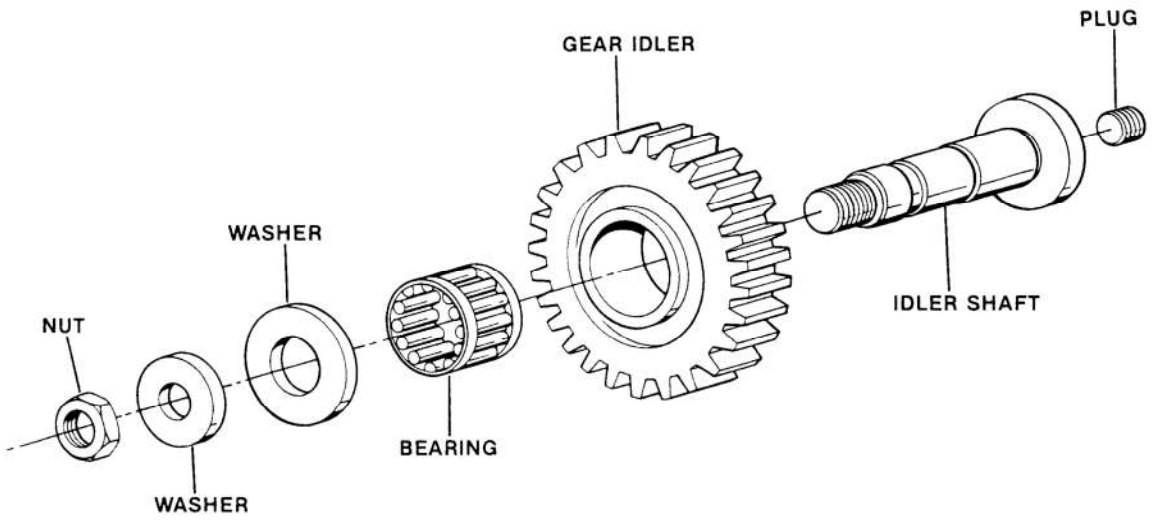


7. Block the countershaft and use a maul and punch from inside the case, to drive the rear countershaft bearing from the case bore and countershaft.

NOTE: Removal procedures will damage the bearings. Removal should not be attempted unless replacement of the bearings is planned.

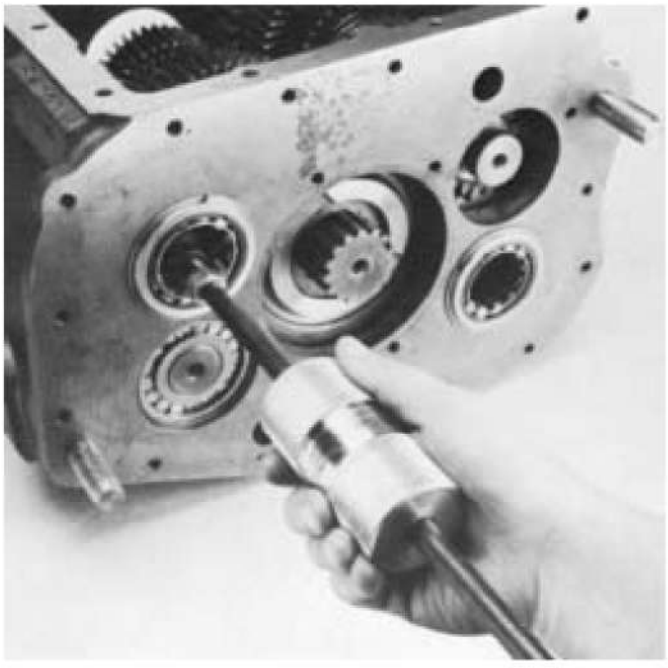
DISASSEMBLY-FRONT SECTION

REVERSE IDLER GEAR ASSEMBLY

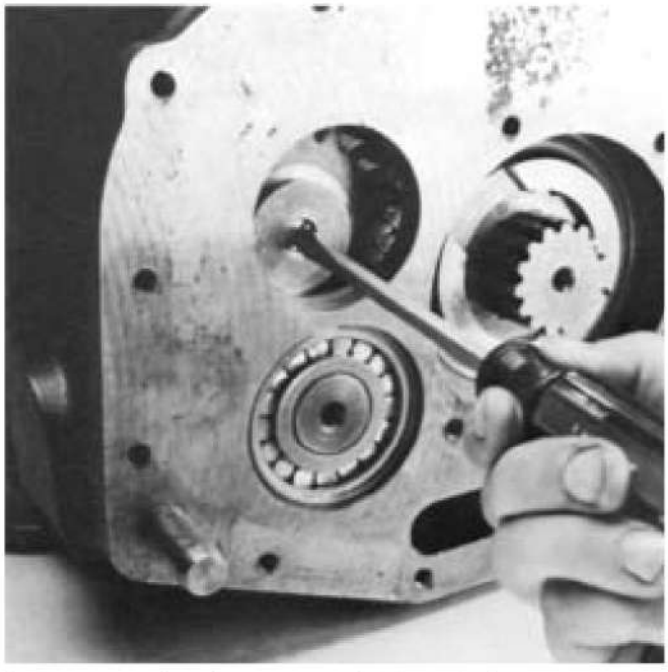


Cut 6382 B-12/83

D. Removal and Disassembly of Left Reverse Idler Gear Assembly



1. Using inside jaw pullers or impact puller, remove the auxiliary countershaft front bearing from left reverse idler gear bore.

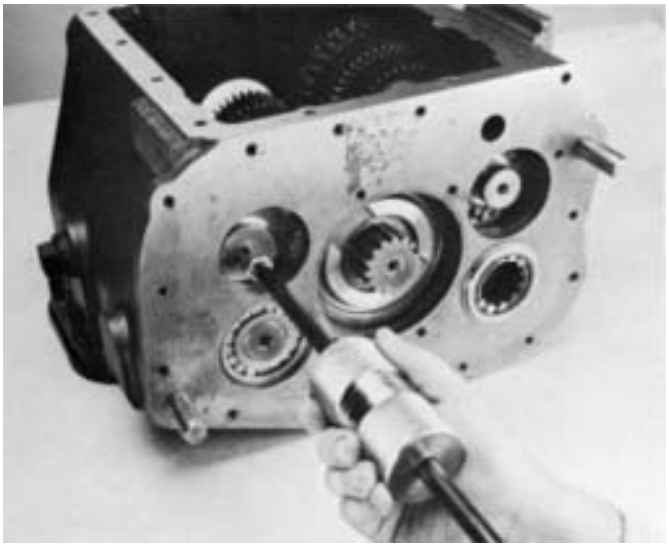


2. Remove plug from rear of idler shaft.

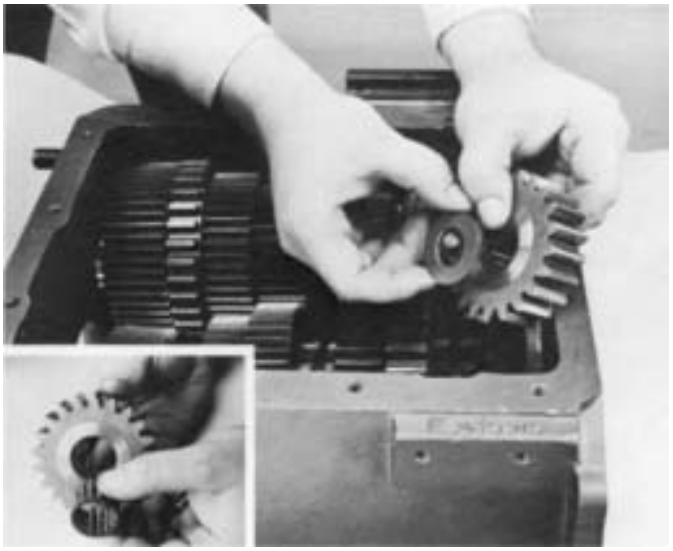
DISASSEMBLY-FRONT SECTION



3. With a 15/16" socket remove the stop nut from front of idler shaft and remove washer.



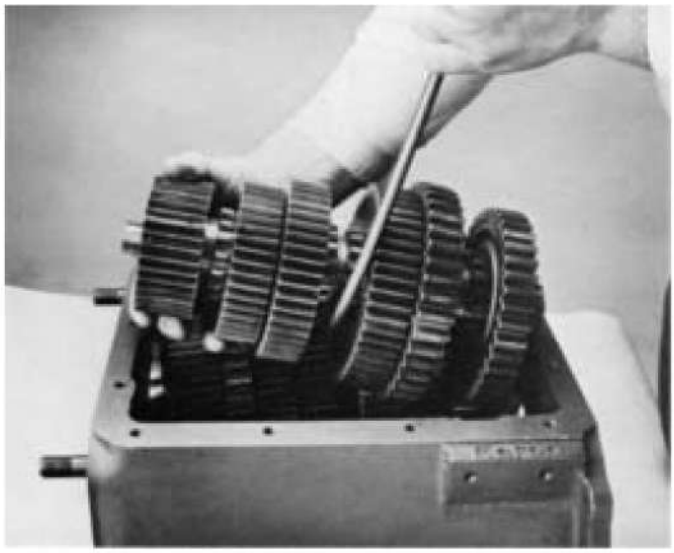
4. Use an impact puller, 1/2"-13 threaded end, to remove idler shaft from case bore.



5. As idler shaft is moved to the rear, remove the thrust washer and gear from case. If necessary, remove the bearing from bore of reverse idler gear (inset.)

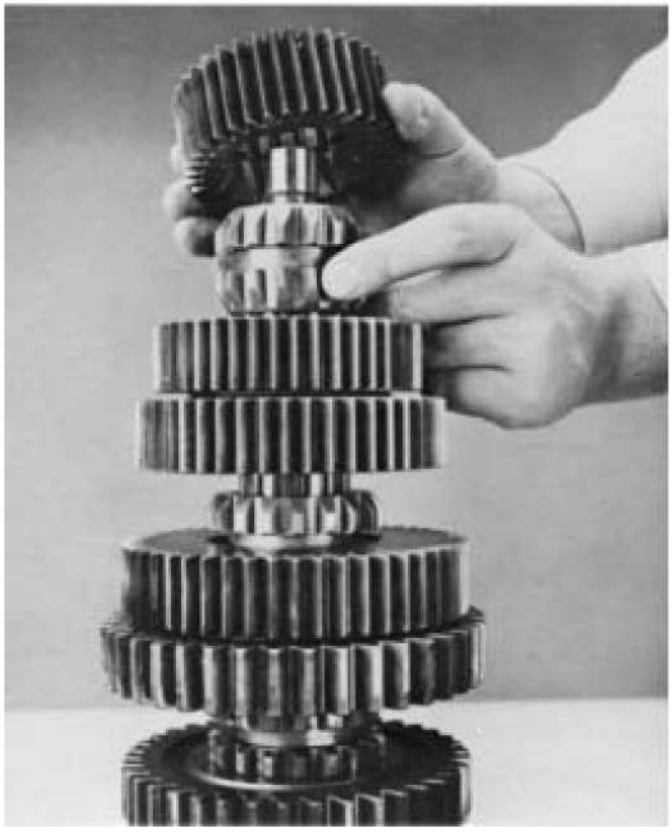
DISASSEMBLY-FRONT SECTION

E. Removal and Disassembly of Mainshaft Assembly



1. Block the right countershaft assembly against case wall. Slide drive gear to the rear and engage with sliding clutch splines. Using a hook around the 1st-2nd sliding clutch, tilt front of mainshaft up and lift the assembly from case.

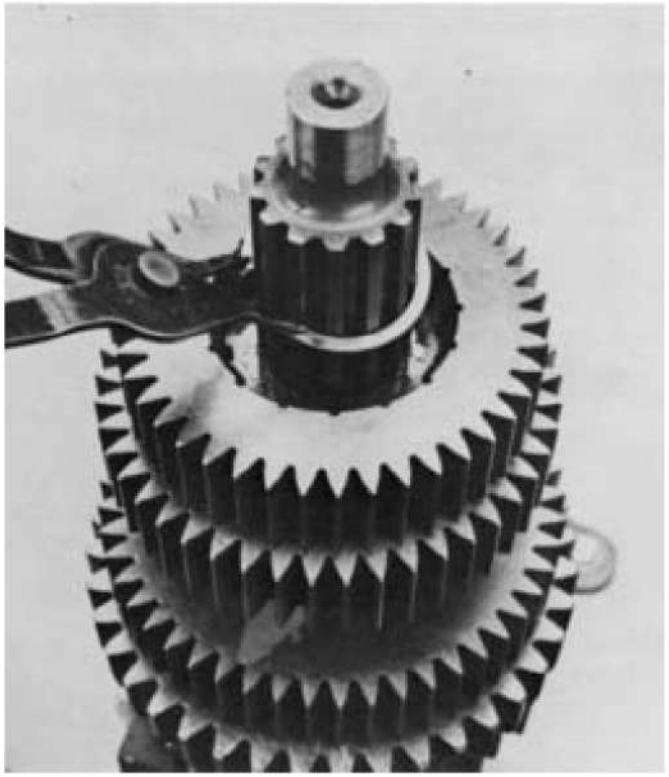
⚠CAUTION THE DRIVE GEAR IS FREE AND CAN FALL FROM SHAFT.



2. Remove the drive gear and the 3rd-4th speed sliding clutch.



3. Install mainshaft assembly in a vice ewuipped with

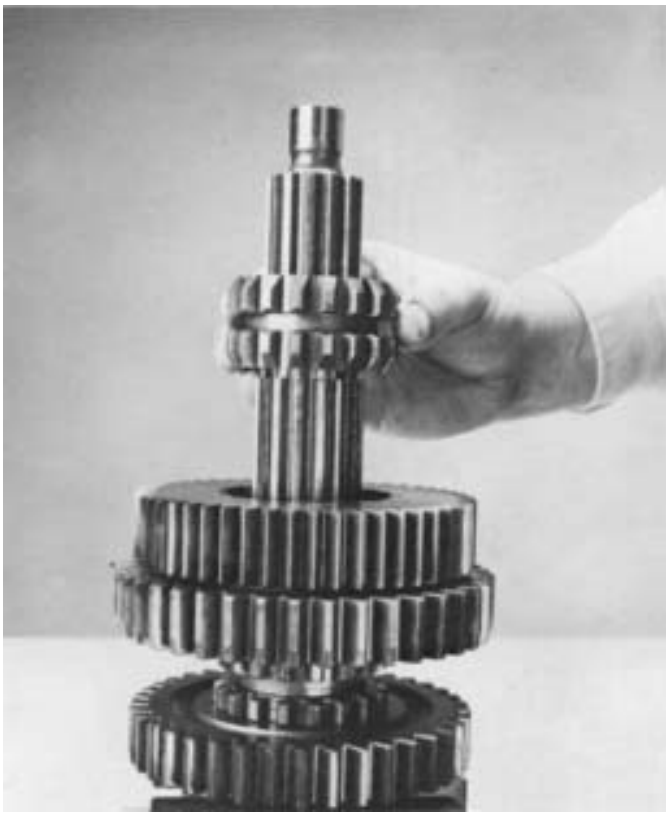


4. Remove snap ring from mainshaft groove, inside of 3rd speed gear hub.

DISASSEMBLY-FRONT SECTION



5. Remove 3rd speed gear and tolerance washer.



7. Remove 1st-2nd speed sliding clutch.

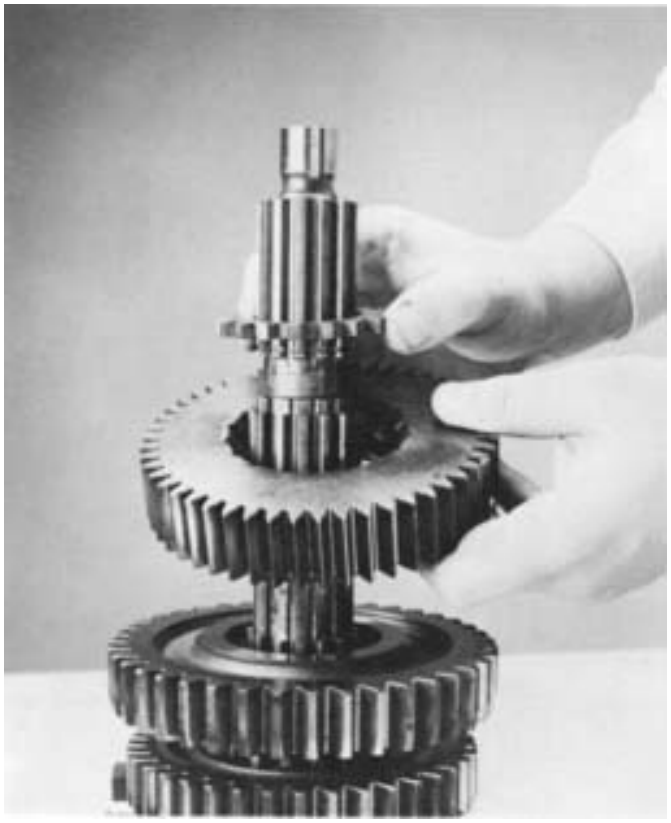


6. Remove the 2nd speed gear and tolerance washer.



8. Remove the mainshaft key from keyway in mainshaft.

DISASSEMBLY-FRONT SECTION



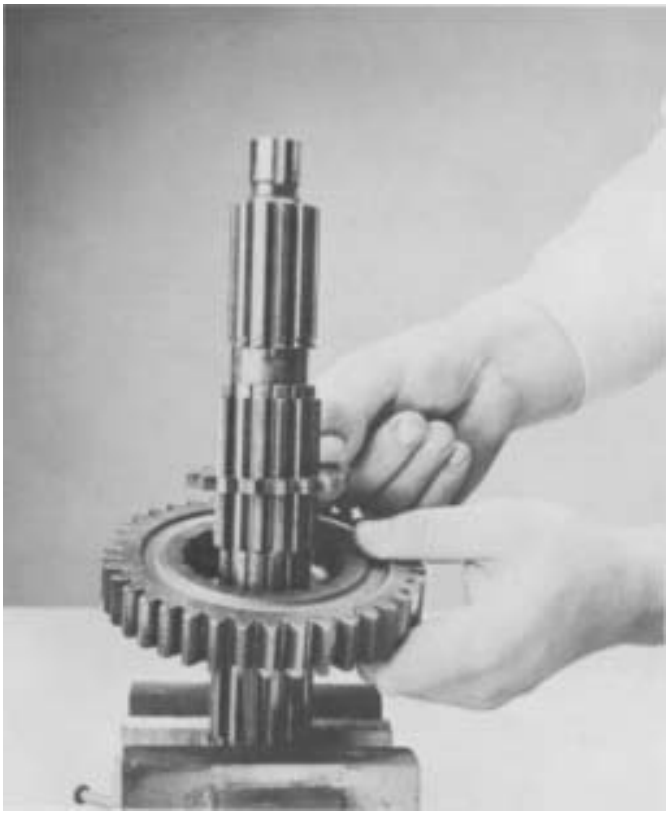
9. Remove 1st speed gear and tolerance washer.



11. Remove Lo and reverse speed sliding clutch.



10. Remove Lo speed gear and tolerance washer.

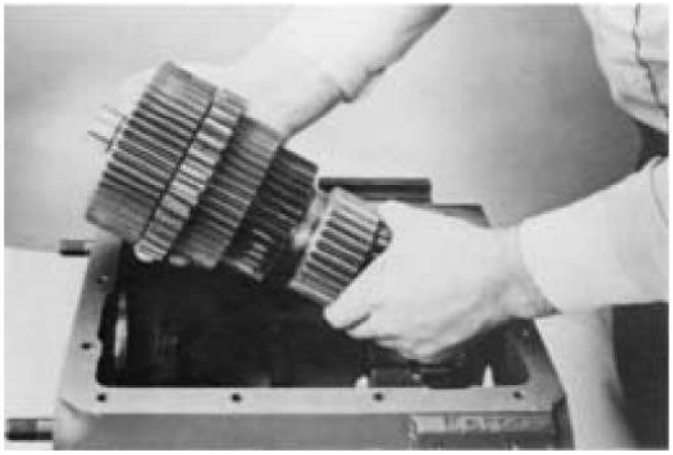


12. Remove the reverse gear and tolerance washer.

DISASSEMBLY-FRONT SECTION

F. Removal and Disassembly of Countershaft Assemblies

NOTE: Both countershaft are identical and are disassembled and reassembled in the same manner.

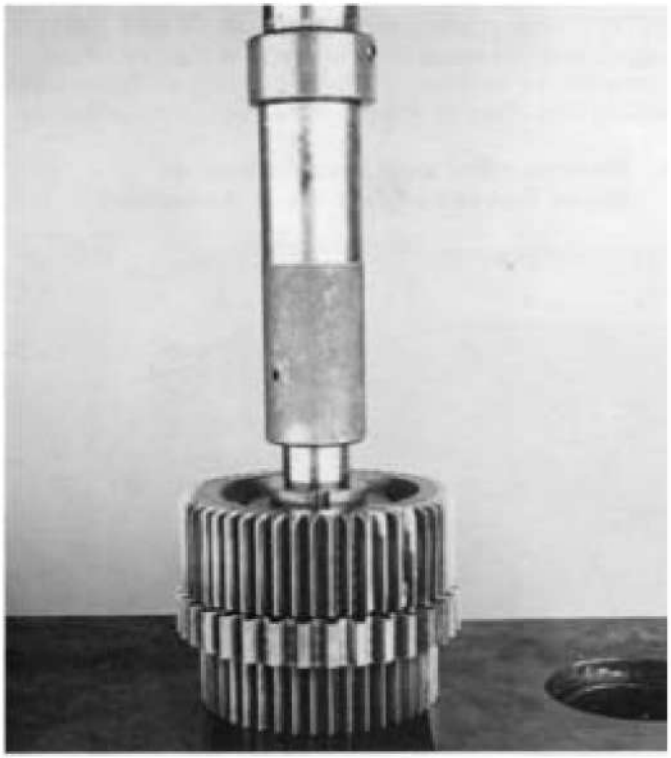


1. Remove the right countershaft from case.

NOTE: Remove bearings from the left countershaft in the same manner in which bearings were removed from right countershaft. There is enough clearance on the rear countershaft bearing to remove it with puller.
(See pages 62 and 63.) Remove the right reverse idler assembly in the same manner as the left reverse idler was removed.



2. Remove snap ring from front of countershaft.



3. Remove the countershaft drive gear, countershaft PTO gear and the countershaft 3rd gear by pressing on bottom face of countershaft 3rd gear.

⚠CAUTION DO NOT PRESS ON COUNTER. SHAFT PTO GEAR.

NOTE: You can not remove any more gears from the countershaft.

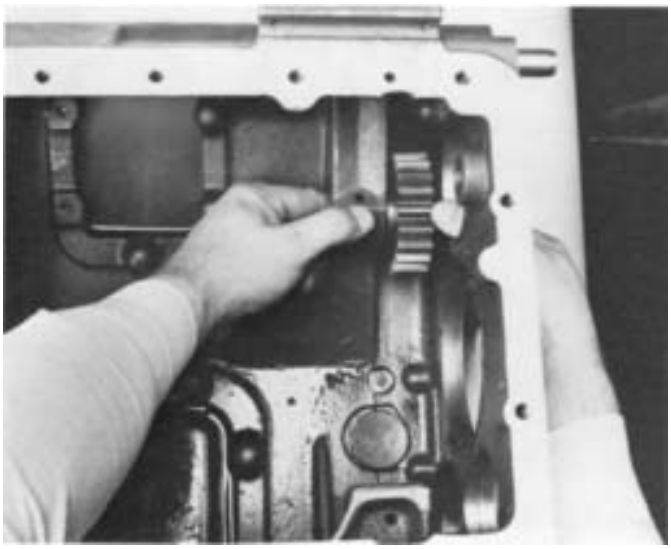


4. If necessary remove key from countershaft.

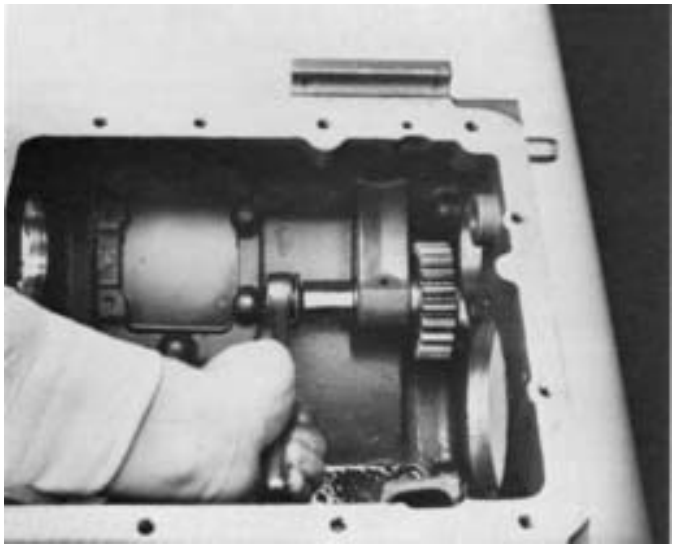
REASSEMBLY-FRONT SECTION

NOTE: Before starting reassembly, make sure the two magnetic discs are solidly in place at bottom of case. These can be secured to disc mounting surfaces with Scotch Grip Rubber Adhesive or equivalent adhesive.

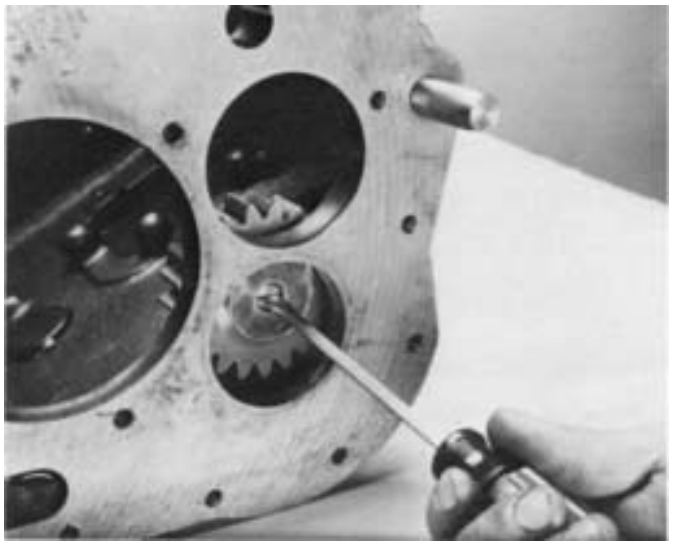
A. Reassembly and Installation of Right Reverse Idler Gear Assembly



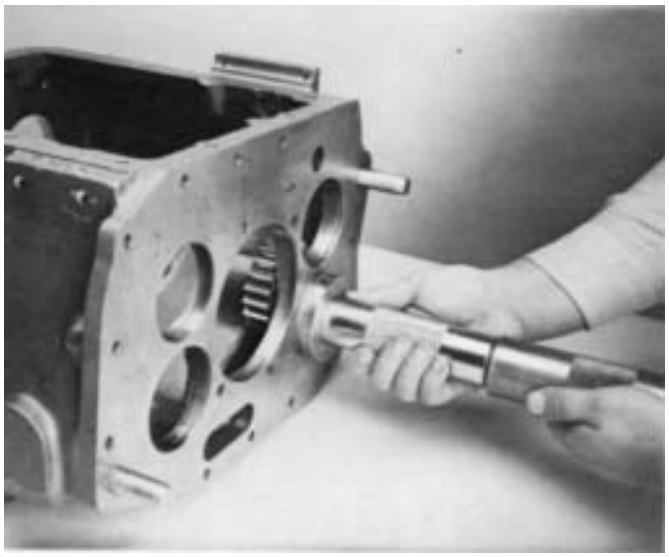
1. Position reverse idler bearing, gear, and washer in case, washer to the front of case.



2. Install idler shaft through idler gear and into case bore and washer making sure the reverse idler shaft is seated in bore of support boss as far forward as possible. Install the washer and stop nut on front of shaft. Tighten nut to recommended torque setting.



3. Install plug in reverse idler shaft.

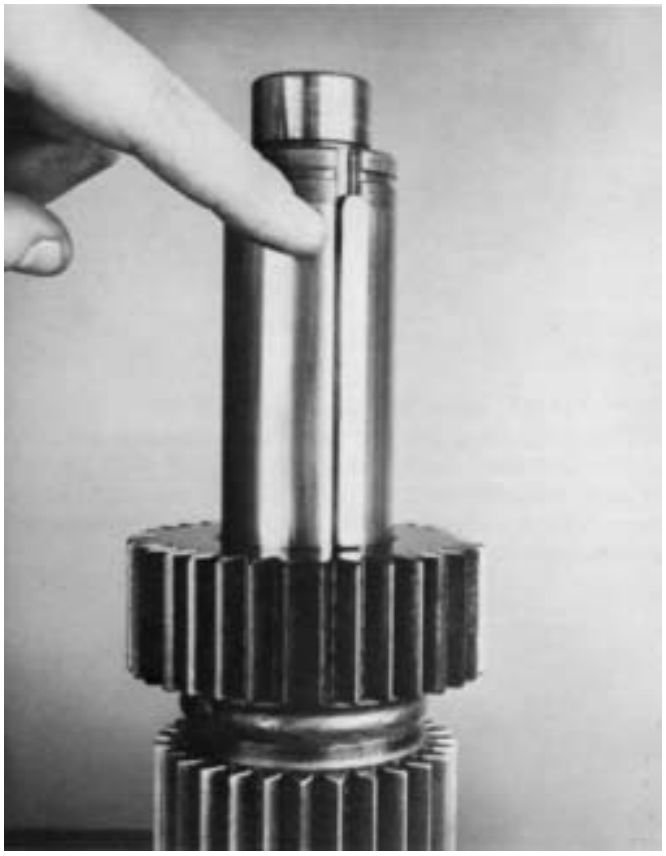


4. Install the auxiliary countershaft front bearing into the reverse idler gear case bore.

REASSEMBLY-FRONT SECTION

B. Reassembly of Countershaft Assemblies

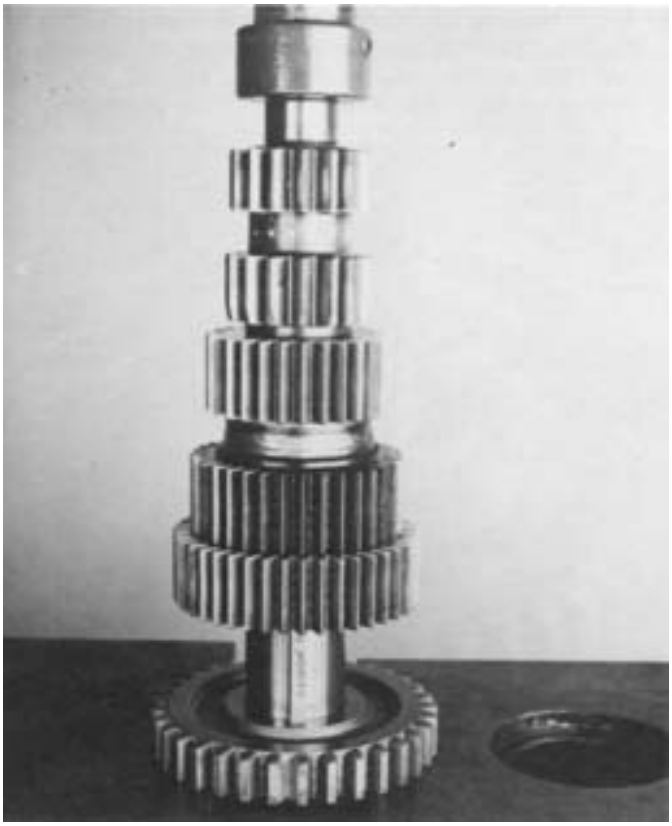
NOTE: The left and right countershaft assemblies are identical and are reassembled in the same manner.



1. If previously removed, install key in countershaft keyway.



2. Align ke yway of 3rd gear with key in countershaft, press 3rd gear onto countershaft with timing tooth, marked with an ÒOÓ, facing the rear of countershaft.

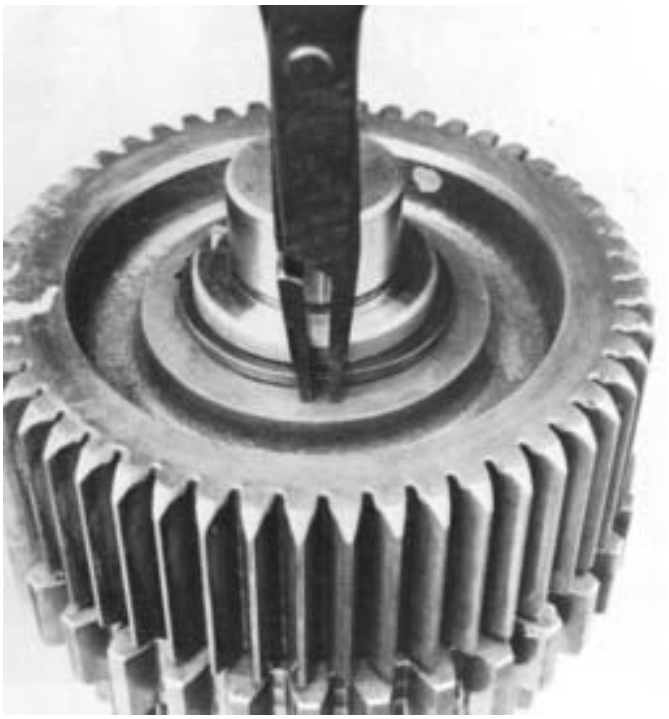


3. Align keyway of PTO gear with keyway in countershaft, press the PTO gear onto the countershaft with long hub of gear to the front.

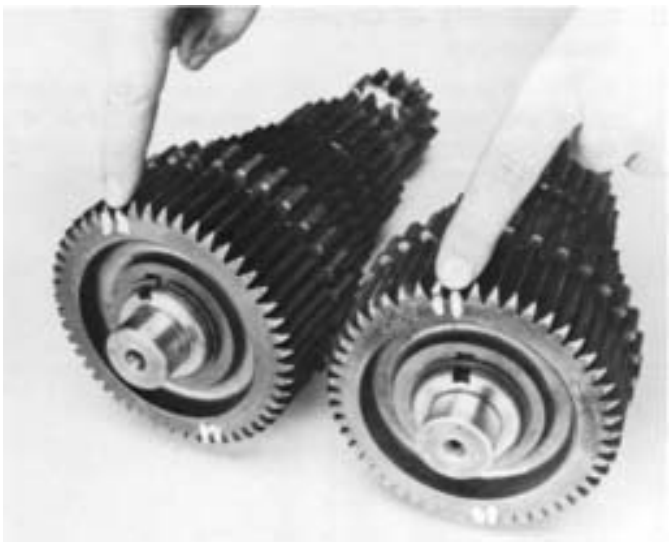
REASSEMBLY-FRONT SECTION



4. Align keyway of countershaft drive gear with key on countershaft, press the countershaft drive gear onto the countershaft with long hub to the rear, timing tooth, marked with an "0" to the front.



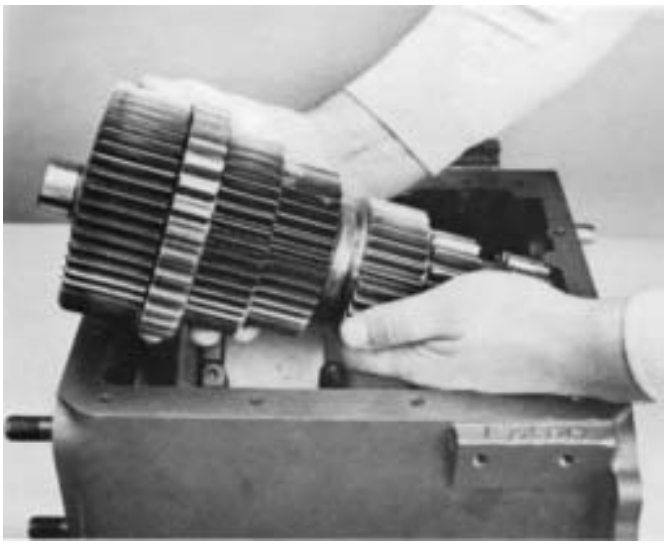
5. Install the snap ring in groove on the front of each countershaft.



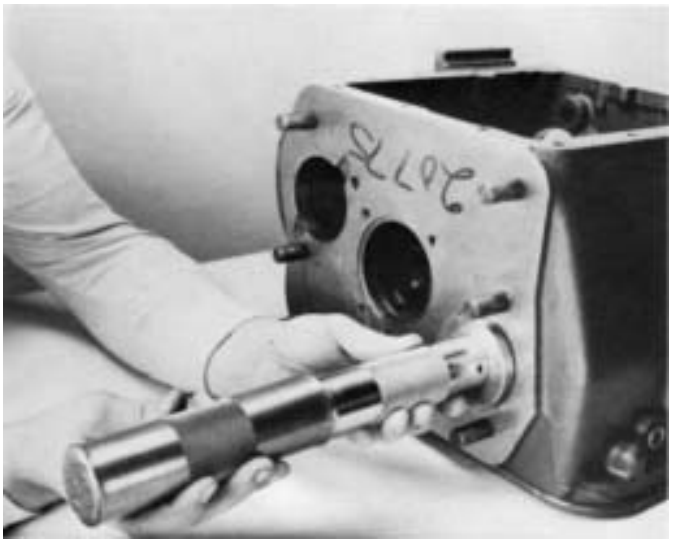
IMPORTANT: Mark the countershaft drive gear for timing purposes. On the drive gear of each countershaft assembly, mark the tooth aligned with keyway of gear and stamped with an "O" for easy identification. A highly visible color of toolmakers" dye is recommended for making timing marks.

REASSEMBLY-FRONT SECTION

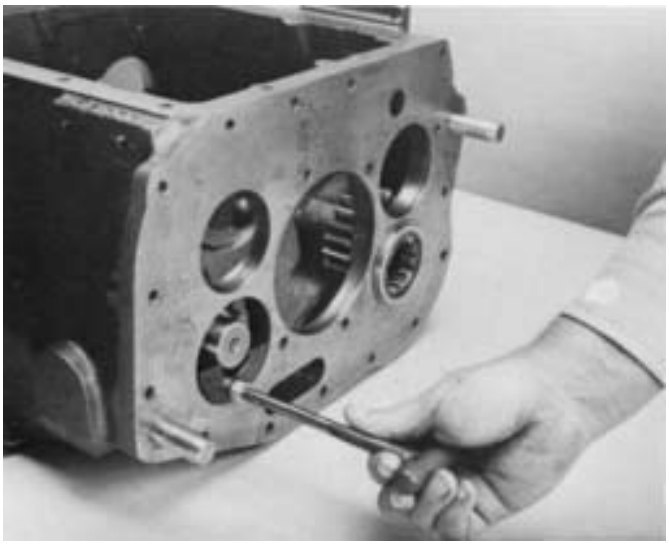
C. Installation Left Countershaft Assembly



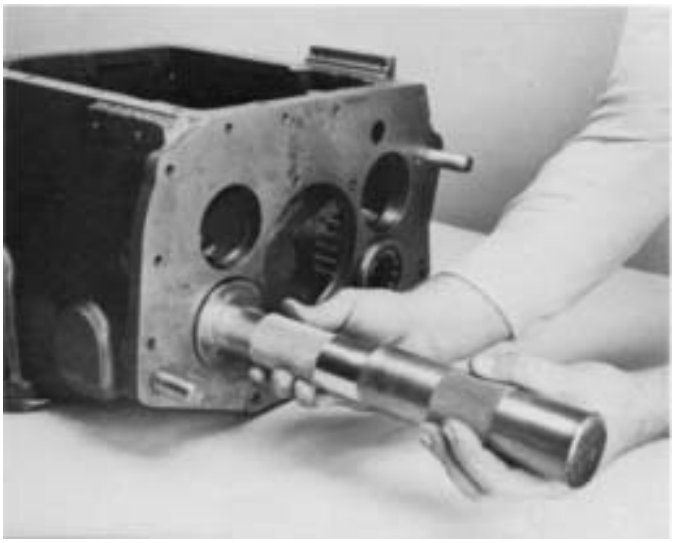
1. Place left countershaft into position in case.



3. Install front bearing on countershaft and in case bore, with flanged driver.

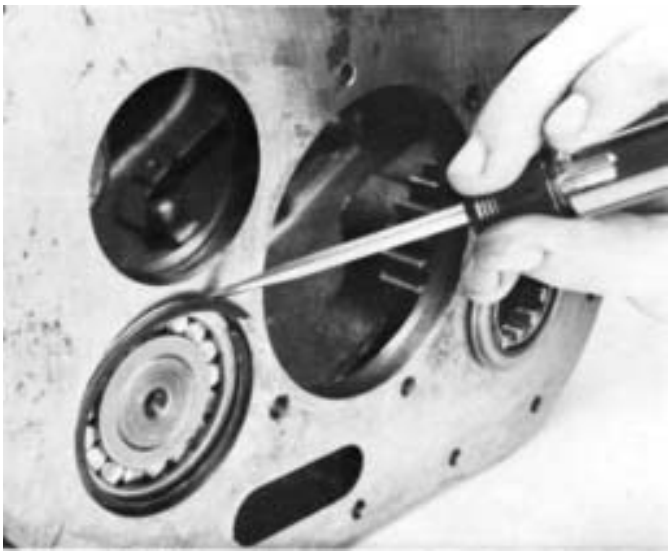


2. Move the left countershaft assembly to the rear and insert countershaft support tool, or block, to center shaft in rear case bore.



4. Install rear bearing on countershaft and in case bore, with flanged driver.

REASSEMBLY-FRONT SECTION

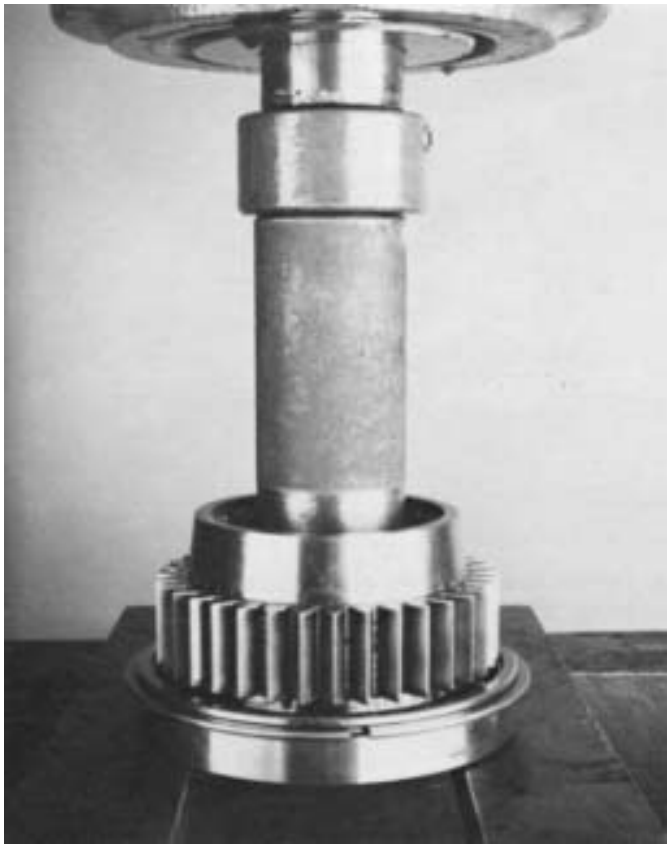


5. Install snap ring in groove in rear bore of case.



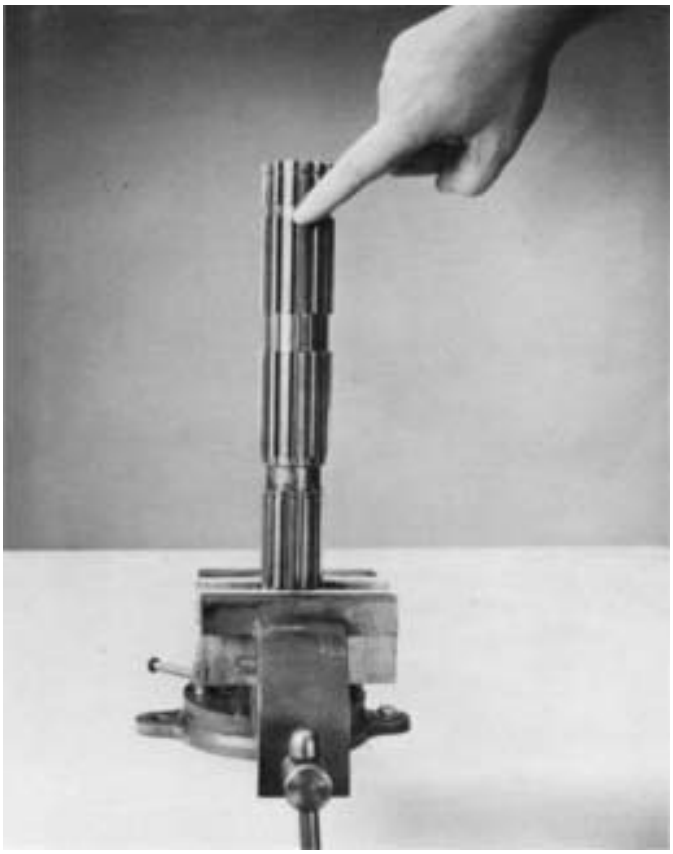
2. Install bearing retaining snap ring in groove of auxiliary drive gear shoulder.

D. Reassembly Auxiliary Drive Gear



1. Press bearing on auxiliary drive gear.

E. Reassembly and Partial Installation of Mainshaft Assembly



1. Place mainshaft in a vise, equipped with brass jaws or wood blocks, pilot end down. Keep keyway in mainshaft clear for insertion of mainshaft key.

REASSEMBLY-FRONT SECTION

Setting Correct Axial Clearances For Mainshaft Gears

Axial Clearance (End-Play) Limits Are:
.005" -.012" for all mainshaft gears

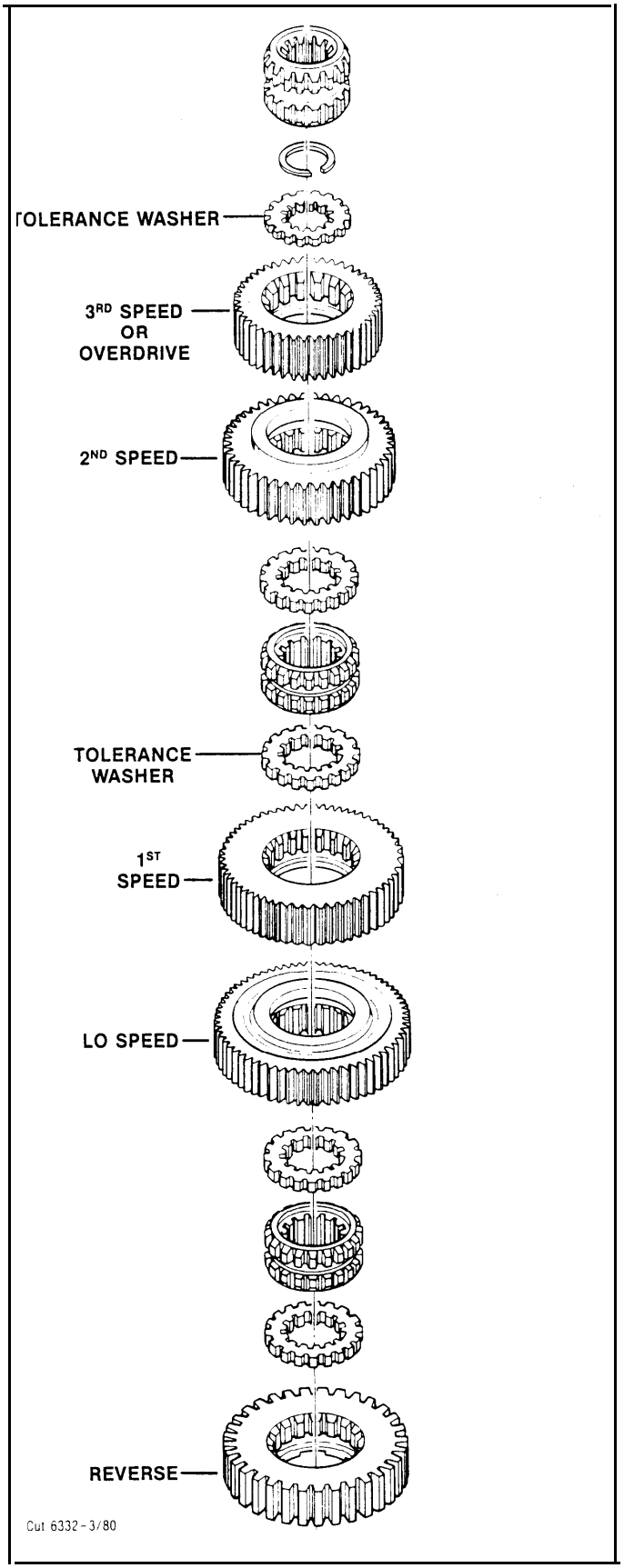
Washers are used to obtain the correct limits; six thicknesses are available as follows:

LIMITS	COLOR CODE
.259 -.261	ORANGE
.263 -.265	PURPLE
.268 -.270	YELLOW
.273 -.275	BLACK
.278 -.280	RED

NOTE: New style limit washers come in a full range of tolerances as corresponding colors listed above "plus red."

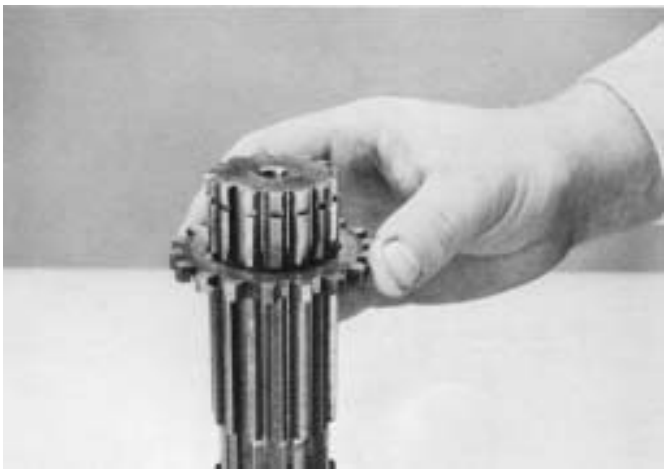
Refer to Illustrated Parts Lists for washer part numbers.

IMPORTANT: REFER TO THE APPROPRIATE ILLUSTRATED PARTS LIST (SPECIFIED BY MODEL SERIES) TO ENSURE THAT PROPER PARTS ARE USED DURING REASSEMBLY OF THE TRANSMISSION.

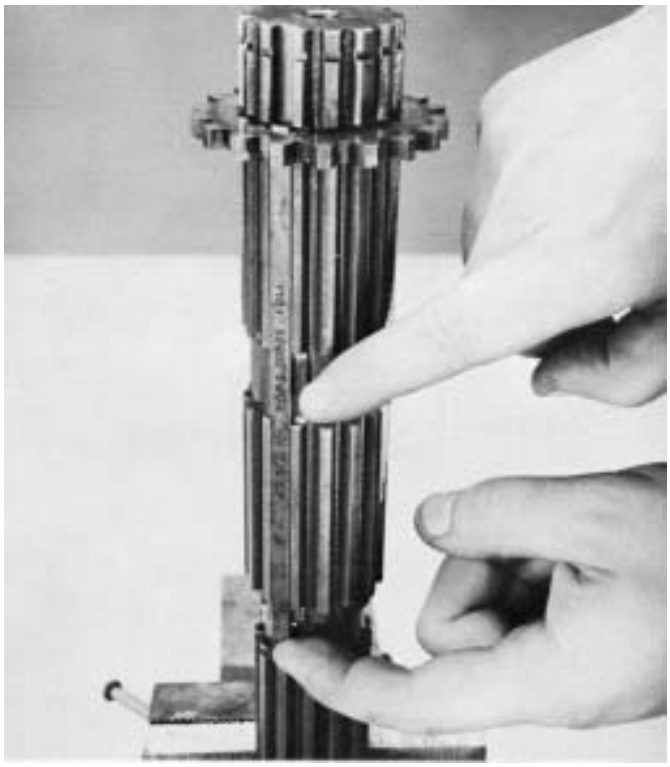


REASSEMBLY-FRONT SECTION

NOTE: Each mainshaft gear is held in position by locking a tolerance washer to the mainshaft with a mainshaft key. There is one tolerance washer for each gear. Tolerance washers for reverse, Lo, 1st, and 2nd speed gears are the same diameter, the 3rd speed tolerance washer is a smaller diameter.

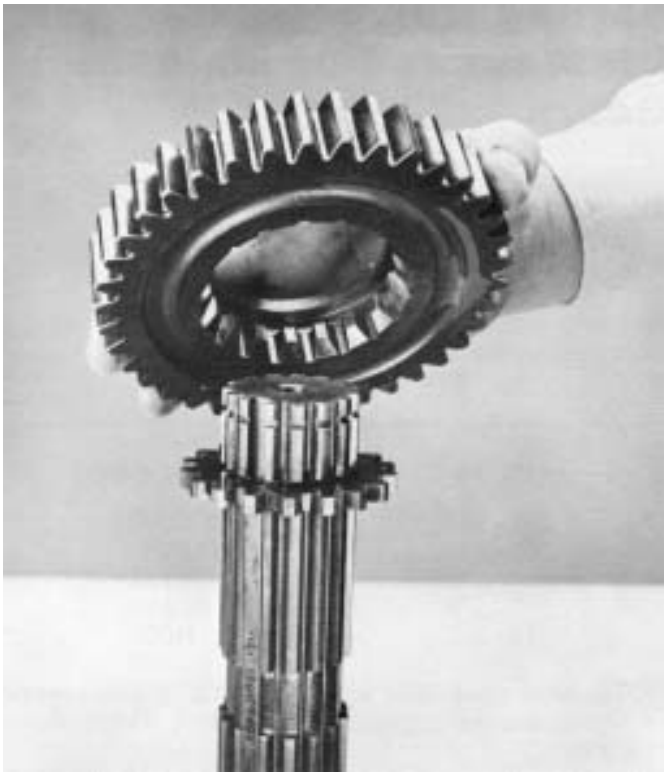


2. Install reverse gear tolerance washer in groove near the rear of mainshaft.



3. Rotate the tolerance washer in groove of mainshaft to align the splines of washer with splines of mainshaft. Install mainshaft key in keyway to lock washer in place.

NOTE: Make sure mainshaft key is positioned with the word "TOP" to the outside. Procedure of rotating tolerance washer will be followed each time a tolerance washer is installed on mainshaft.



4. Install reverse gear on the tolerance washer with clutching teeth facing down.

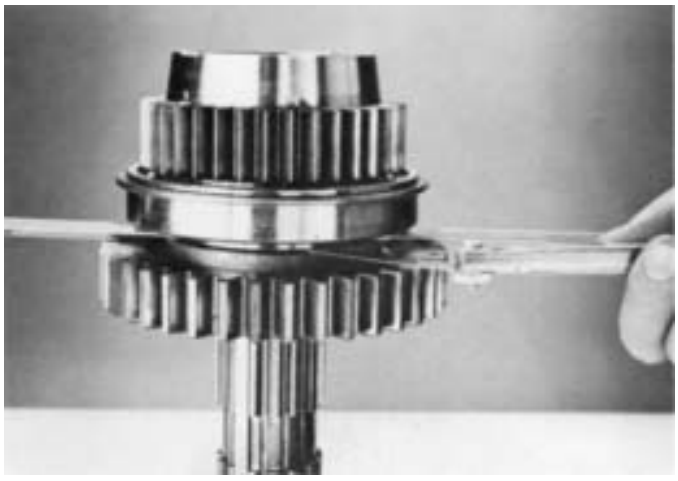


5. Install auxiliary drive gear on mainshaft with clutching teeth facing up.

REASSEMBLY-FRONT SECTION



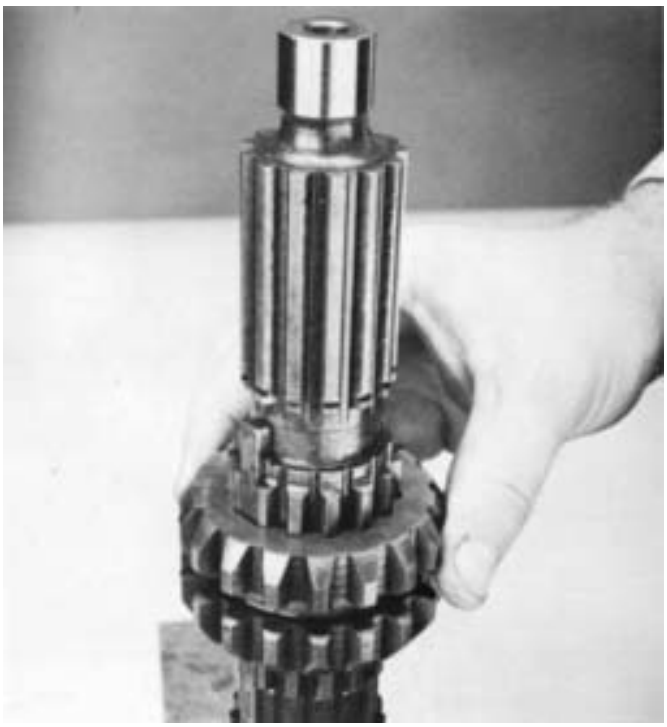
6. Install snap ring in groove at rear of mainshaft.



7. Insert two screwdrivers between the hub of reverse gear and the auxiliary drive gear. Apply slight downward pressure on screwdriver handles to spread gears evenly apart. Making sure the gear hubs are parallel, insert a feeler gage between hubs. Correct axial clearance should be from, 005" to .012". If the clearance is less than the minimum .005" tolerance, the tolerance washer in reverse gear should be replaced by a thinner tolerance washer. This will increase the axial clearance between gears. If the clearance checked is greater than the maximum .012" tolerance, a thicker tolerance washer should be installed in reverse gear. This would decrease the axial clearance between the gears.



8. After proper reverse gear clearance has been set, remove the snap ring from rear of mainshaft, remove auxiliary drive gear and the reverse gear from mainshaft. The tolerance washer and key remain on the mainshaft.
Reposition mainshaft in a vise as shown, pilot end up, so that the keyway is accessible.

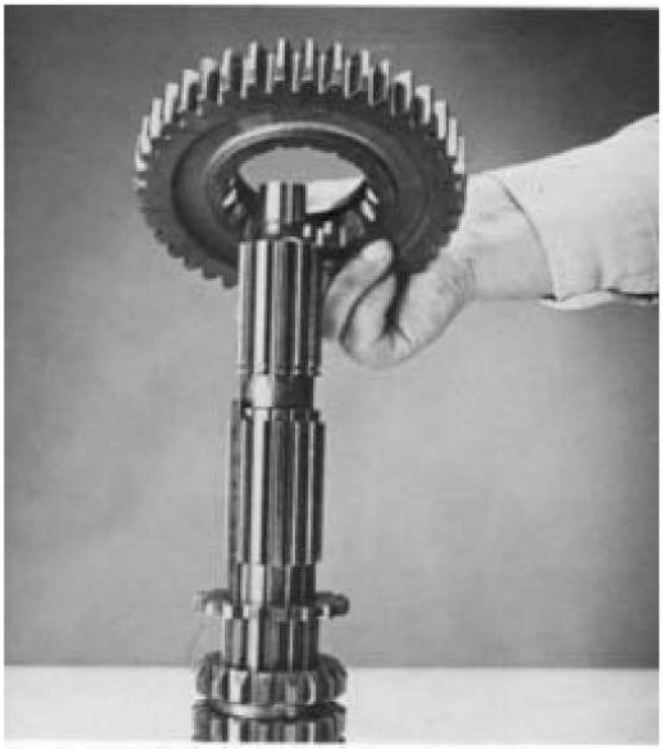


9. Install the Lo-reverse speed clutch on mainshaft, against reverse gear tolerance washer. Align slot in sliding clutch with key on mainshaft.

REASSEMBLY-FRONT SECTION



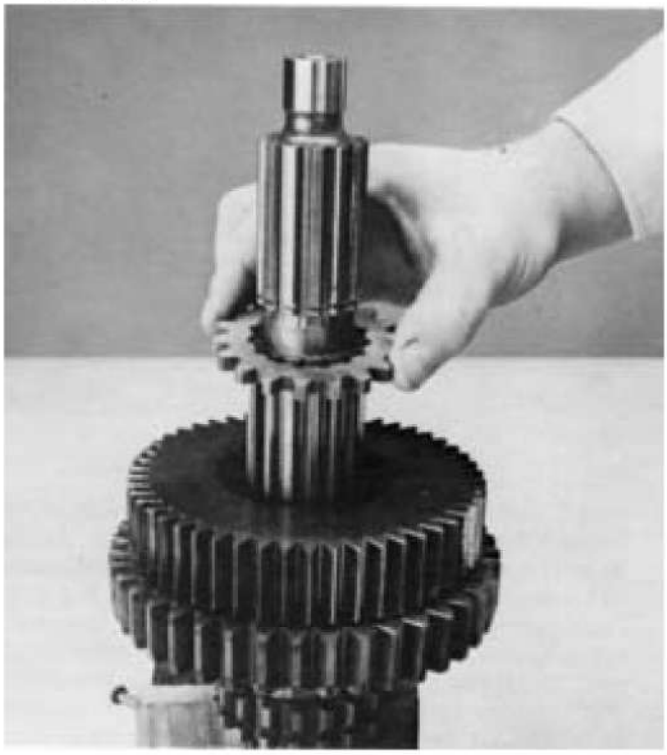
10. Remove mainshaft key from mainshaft. Install Lo speed gear tolerance washer on mainshaft Lo speed gear location and reinstall the mainshaft key to lock tolerance washer to shaft.



11. Install Lo speed gear on mainshaft, clutching teeth down, and engage with external splines of spacer.



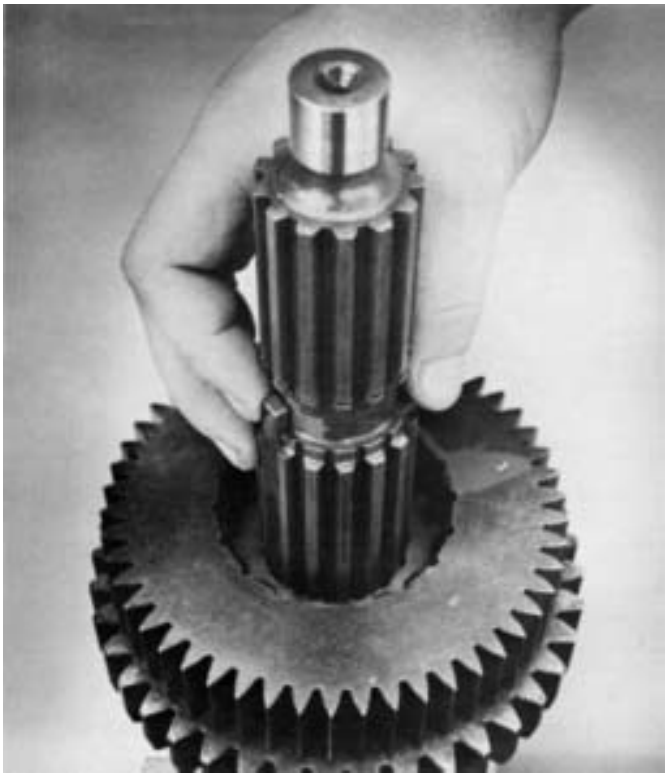
12. Install first speed gear on mainshaft, clutching teeth up.



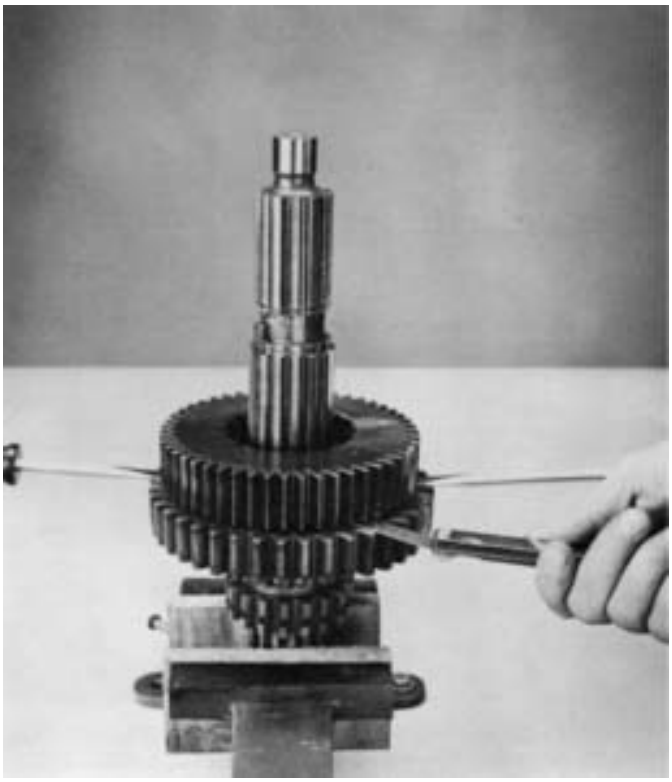
13. Remove the mainshaft key from keyway. Install first speed gear tolerance washer on mainshaft and into hub of first speed gear.

⚠CAUTION CAUTION SHOULD BE USED TO PREVENT THE MAINSHAFT GEARS FROM DROPPING TO THE BOTTOM OF THE MAINSHAFT

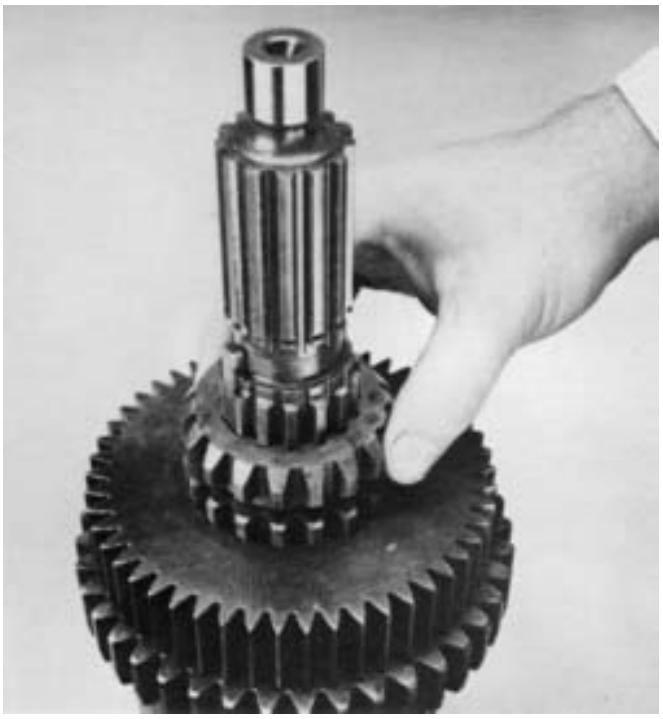
REASSEMBLY-FRONT SECTION



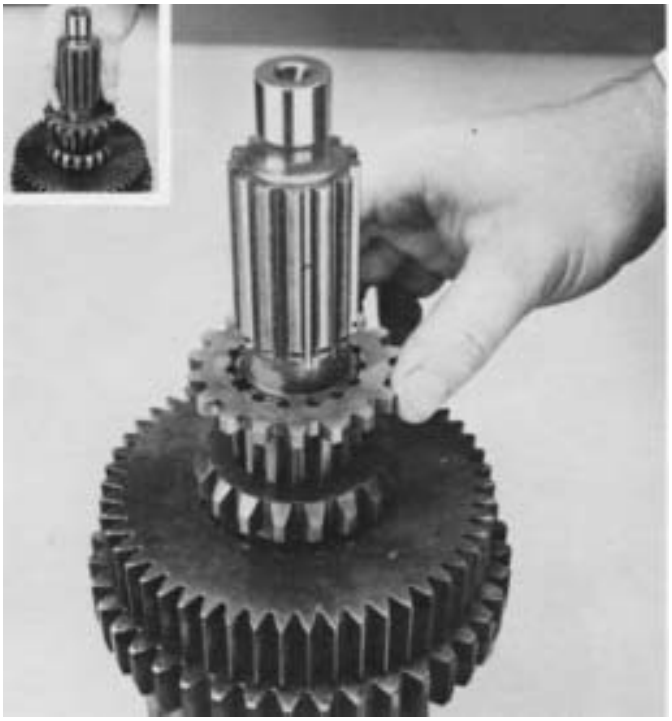
14. Install mainshaft key in keyway to lock tolerance washer to shaft.



15. Check axial clearances and make adjustments, if necessary, between the Lo and first speed gears, as described in No. 7 of this section.



16. Install the 1st-2nd speed sliding clutch, aligning slot in sliding clutch with key: engage with first speed gear.

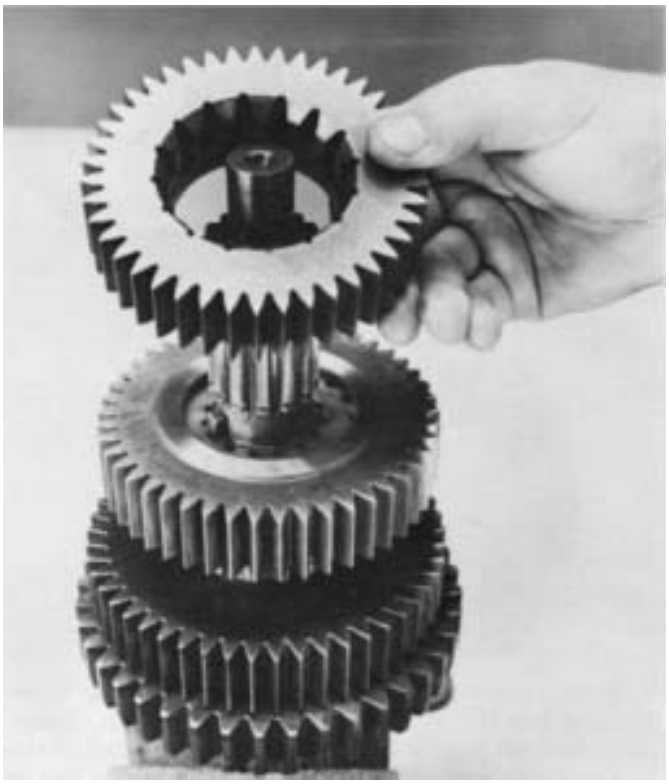


17. Remove mainshaft key and install 2nd gear tolerance washer at 2nd speed gear location. Install mainshaft key. It will be necessary to pull mainshaft key upward slightly in order to fit key in keyway. Reposition key so that it rests on mainshaft groove shoulder, (inset.)

REASSEMBLY-FRONT SECTION



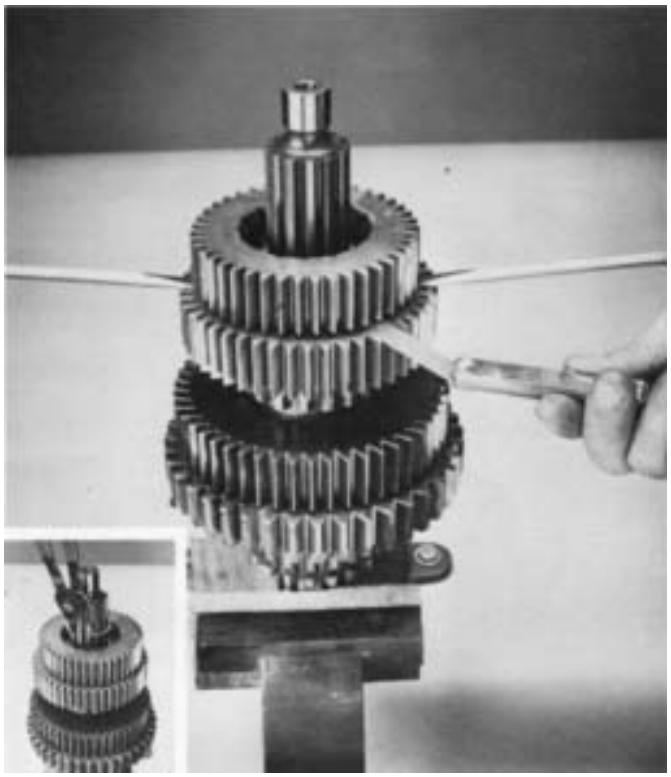
18. Install the 2nd speed gear on mainshaft, clutch-engage with external splines of tolerance washer, clutching teeth down.



19. Install the 3rd speed gear on mainshaft, clutching teeth up.

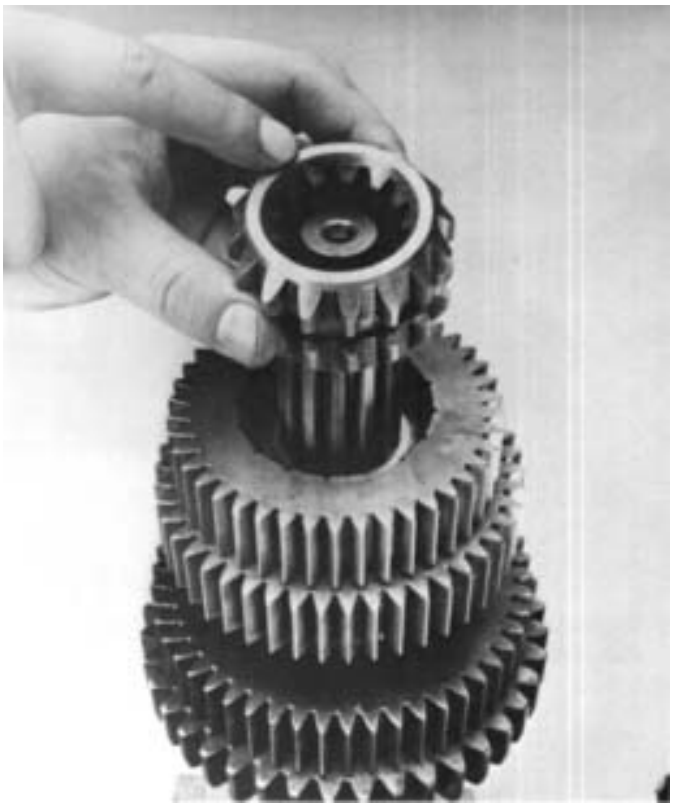


20. Install a tolerance washer in the bore of 3rd speed gear.



21. Install snap ring (inset) in snap ring groove. This will hold 3rd speed gear in position on mainshaft. Check axial clearance and make adjustments, if necessary, between 2nd and 3rd speed gears, as described in No. 7 of this section.

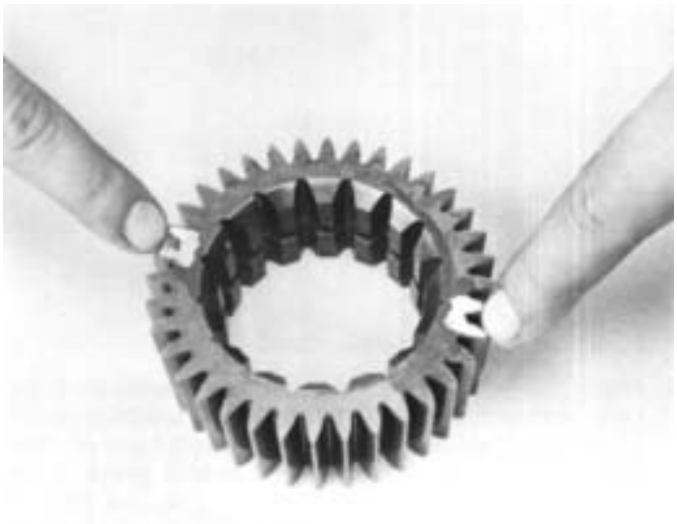
REASSEMBLY-FRONT SECTION



22. Install the 3rd-4th speed sliding clutch on mainshaft with "FRONT" UP. Align slot in sliding clutch with key, and engage clutch with 3rd speed gear.

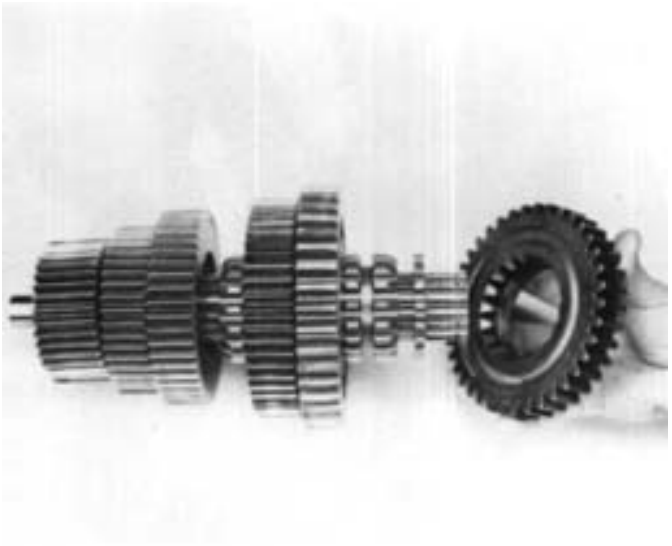


24. Install the drive gear (4th gear) on mainshaft clutching teeth facing down.



23. IMPORTANT:Mark timing teeth on drive gear (4th speed gear,)with a highly visible color of toolmakers" dye.

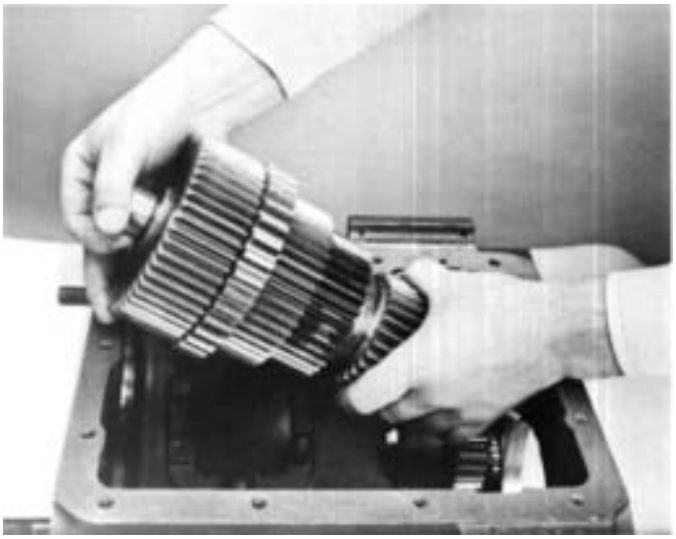
a. Mark two adjacent teeth on drive gear.
b. Mark two adjacent teeth on drive-gear which are directly opposite the first set marked. There should be the same number of teeth between markings on each side of gear.



25. Remove mainshaft assembly from vise, and install the reverse gear on mainshaft.

REASSEMBLY-FRONT SECTION

F. Partial Installation of Right Countershaft Assembly

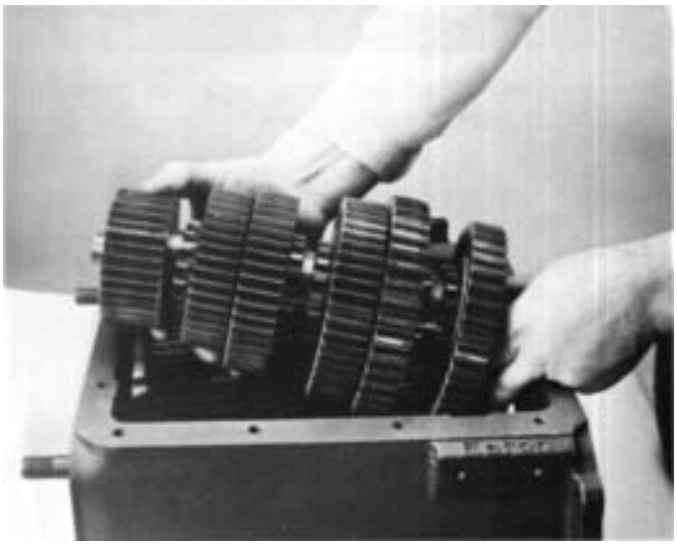


1. Place right countershaft assembly into position in case, support countershaft assembly against case wall as far as possible.

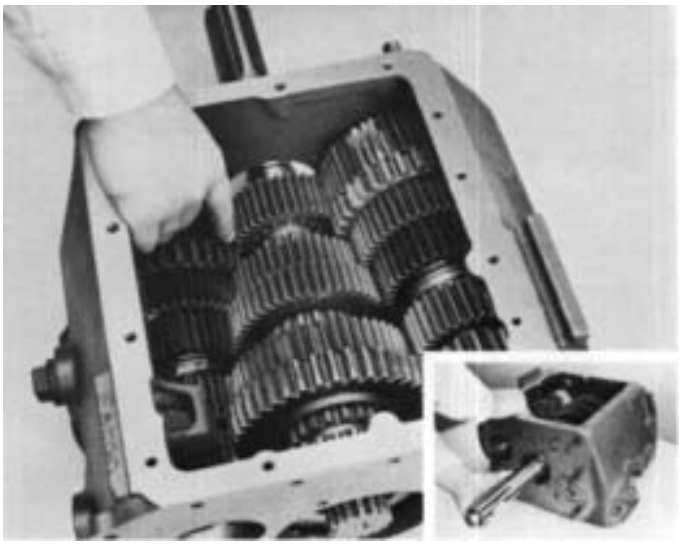


2. If previously removed, install bushing in pocket of input shaft as shown.

G. Installation Mainshaft Assembly

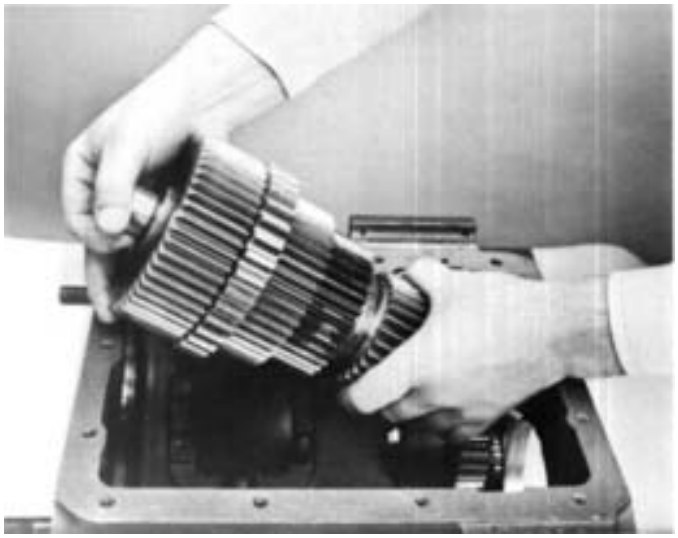


1. Place the mainshaft assembly into position in case.

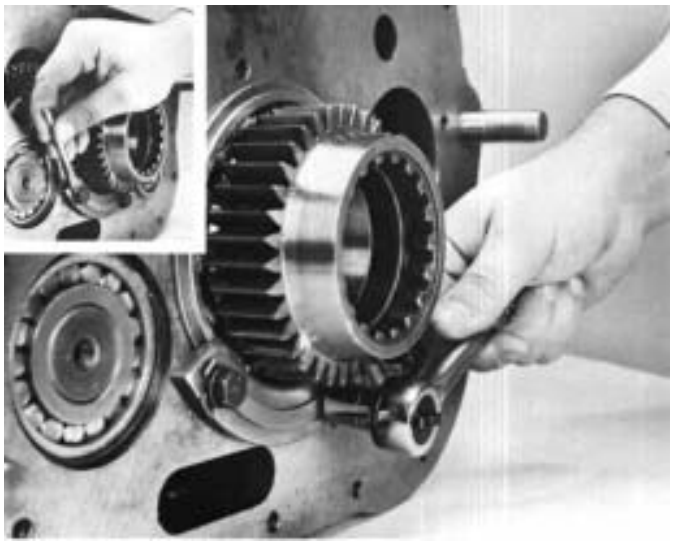


3. Mesh the marked tooth of left countershaft drive gear with either set of two marked teeth on main drive gear. Install input shaft through bore of case and onto mainshaft (inset). This will prevent the mainshaft assembly from dropping to the bottom of the case. Install the input shaft in the splines of drive gear by moving drive gear forward against inside wall of case.

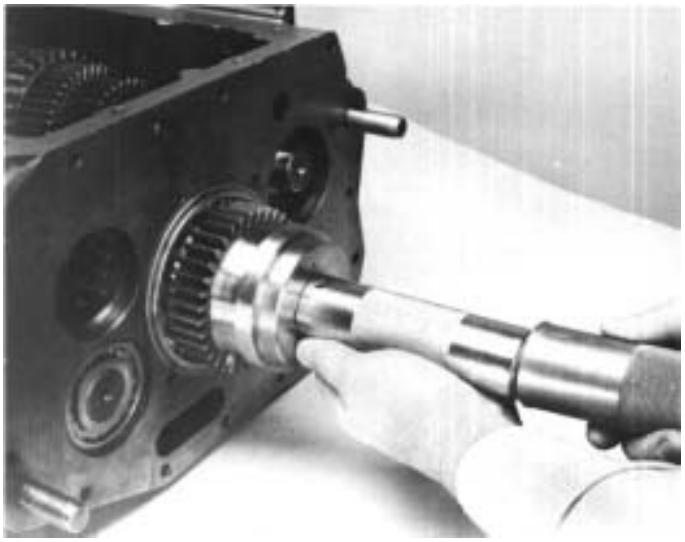
REASSEMBLY-FRONT SECTION



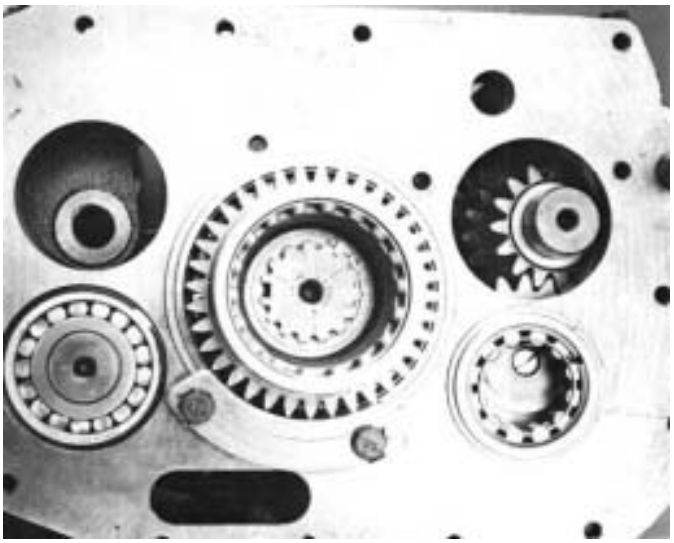
4. Center mainshaft in rear bore of case and install auxiliary drive gear on splines of mainshaft.



6. Install the lower bearing retainer plates. Tighten capscrews to recommended torque, bend lock tangs, (inset.)

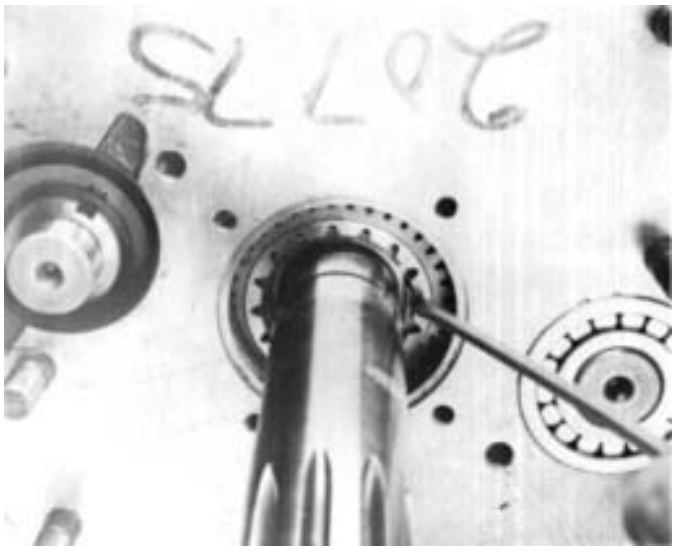


5. Seat auxiliary drive gear bearing in rear bore of case.

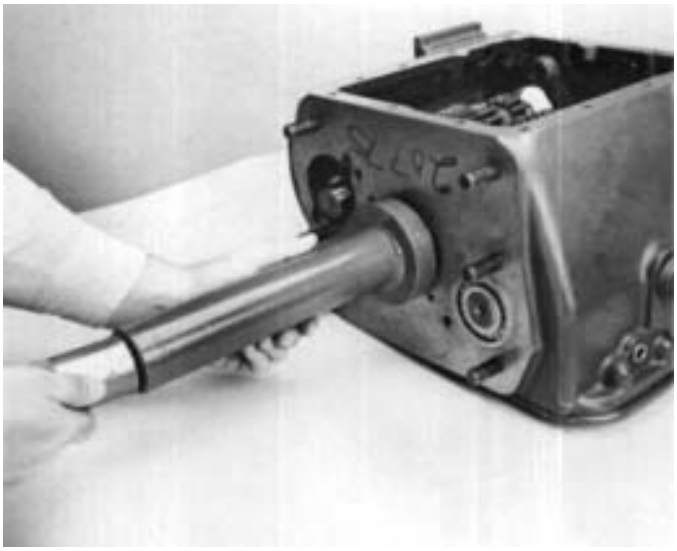


7. Move mainshaft assembly to the rear to expose snap ring groove on rear of mainshaft and install snap ring.

REASSEMBLY-FRONT SECTION



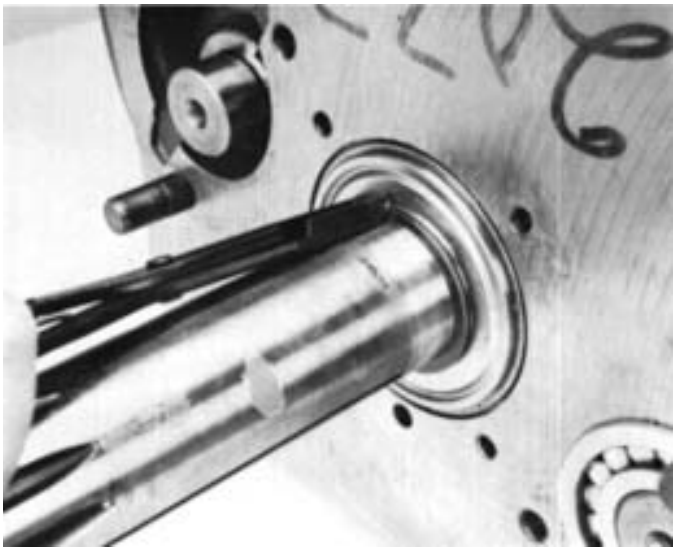
8. Install snap ring in snap ring groove inside drive gear.



10. Install drive gear bearing on input shaft and into case bore.



9. Install drive gear spacer on input shaft, chamfered side to front.

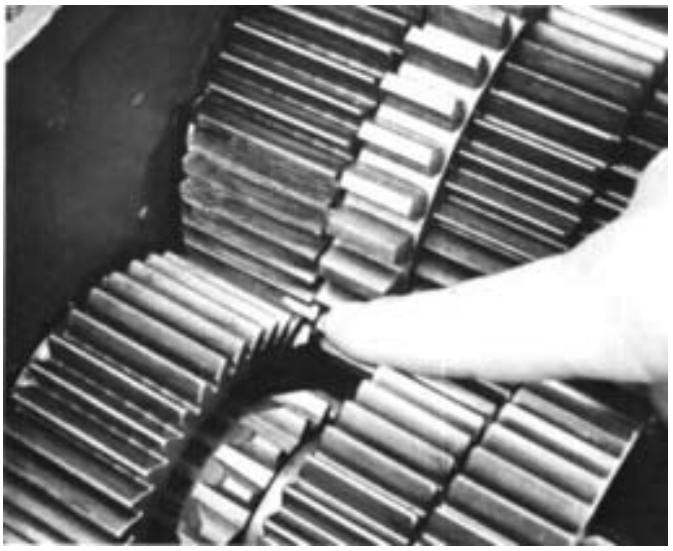


11. Install the bearing retainer snap ring.

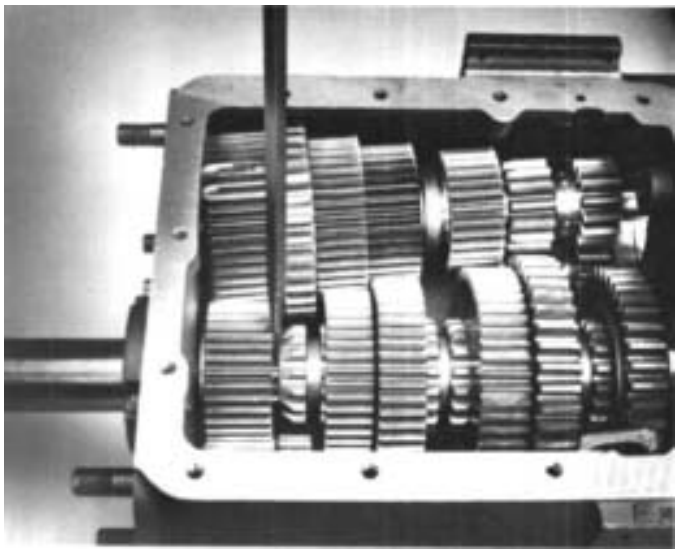
REASSEMBLY-FRONT SECTION



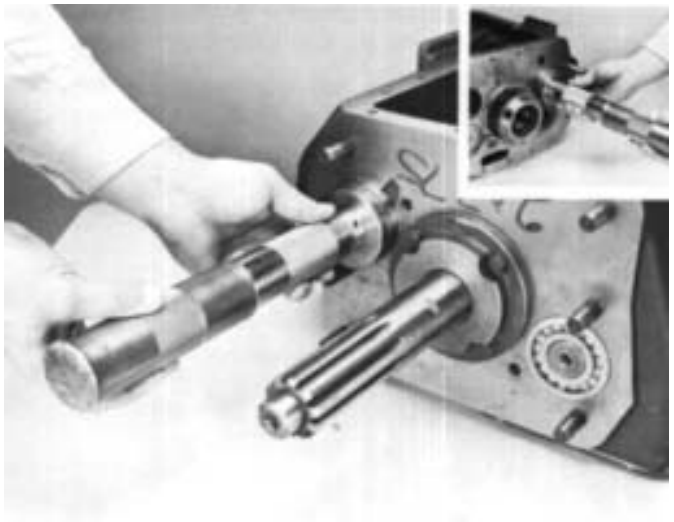
12. Install the front bearing cover and gasket, making sure to align oil return hole in the case with hole in cover. Secure the bearing cover on case with four capscrews, tighten to recommended torque.



14. Mesh the marked timing tooth of the right countershaft drive gear with the two marked timing teeth of the main drive gear, making sure the left countershaft remains in time.

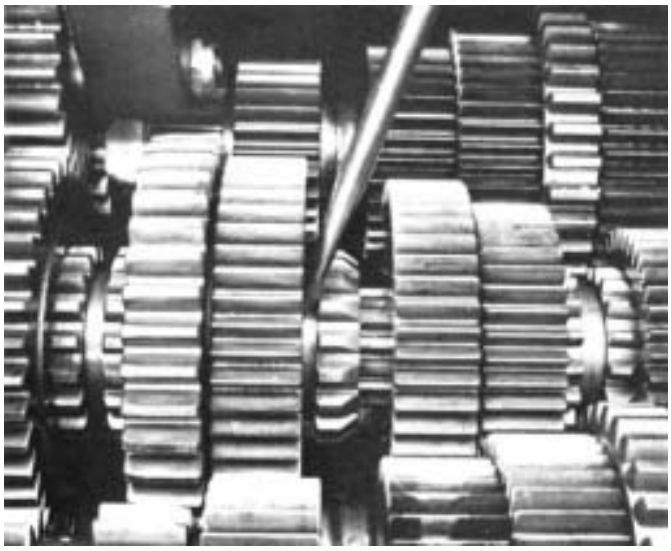


13. Engage the 3rd-4th speed sliding clutch into 3rd speed mainshaft gear. This will prevent the 4th speed gear from dropping far enough to cause a possible timing error.



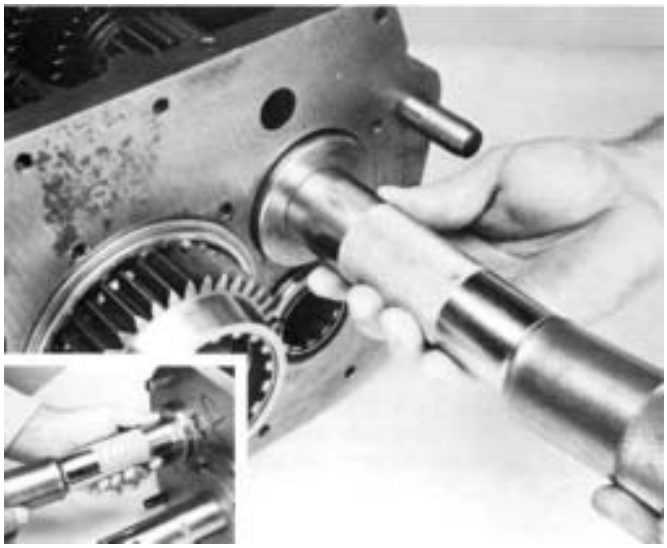
15. Hold the countershaft in position and partially install the front and rear countershaft bearings (inset) in case bores and on countershaft.

REASSEMBLY-FRONT SECTION

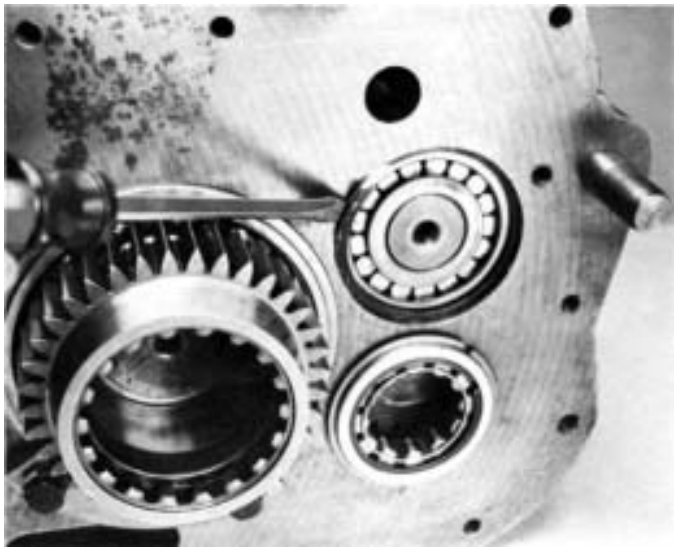


16. Shift the mainshaft sliding clutches into all the gear positions with a screwdriver. If a clutch cannot be shifted into a gear it indicates that the gear set is out of time. The right countershaft bearings would then need to be removed and the countershaft retimed with the mainshaft. The front box is properly timed if the sliding clutches can be shifted into all the mainshaft gears.

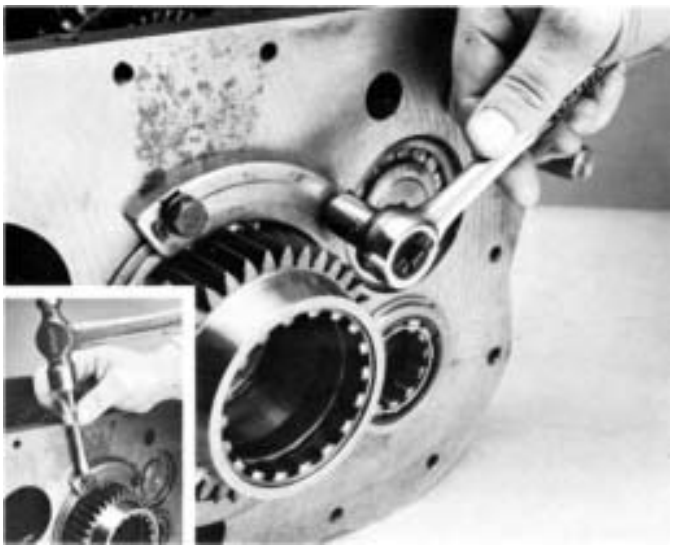
NOTE: Do not shift the transmission into two gears at the same time. This will prevent the transmission from rotating.



17. Use a flanged bearing driver to complete seating both front (inset) and rear countershaft bearings.



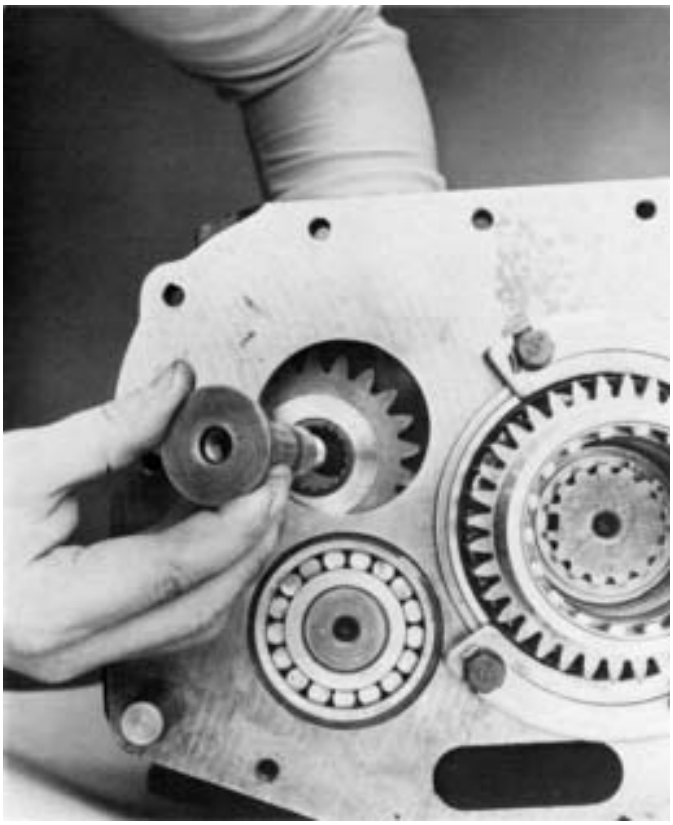
18. Install snap ring into groove into rear bore of case.



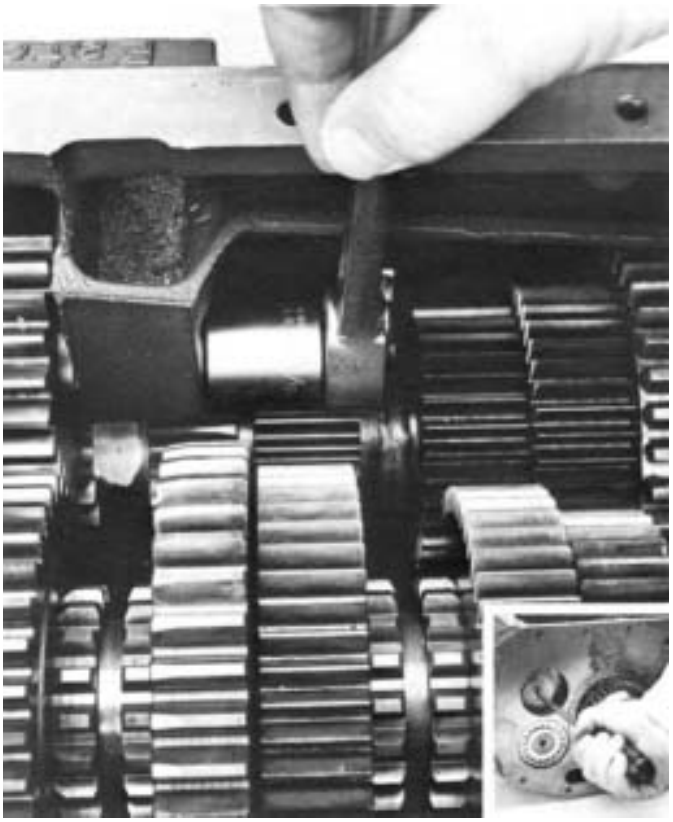
19. Install the upper bearing retainer plate on the auxiliary drive gear. Tighten the two capscrews to the recommended torque, secure by bending lock tangs (inset.)

REASSEMBLY-FRONT SECTION

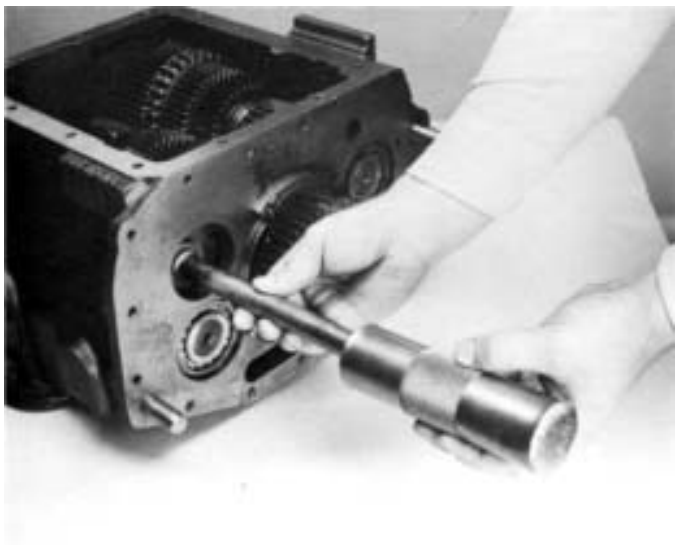
G. Installation Left Reverse Idler Gear Assembly



1. Position reverse idler bearing gear and washer in case, washer to front of reverse idler gear case.

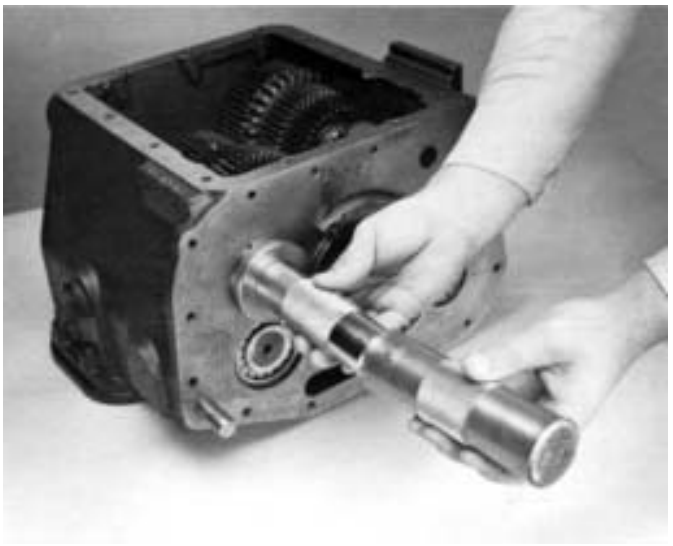


3. Making sure that the reverse idler shaft is seated in bore of support boss and forward as far as possible, install the washer and stop nut on front of shaft. Tighten nut to recommended torque rating. Install plug in reverse idler shaft (inset.)



2. Install idler shaft through idler gear and washer and into case bore.

NOTE: Reverse idler gear must be in mesh, before idler shaft can be inserted.

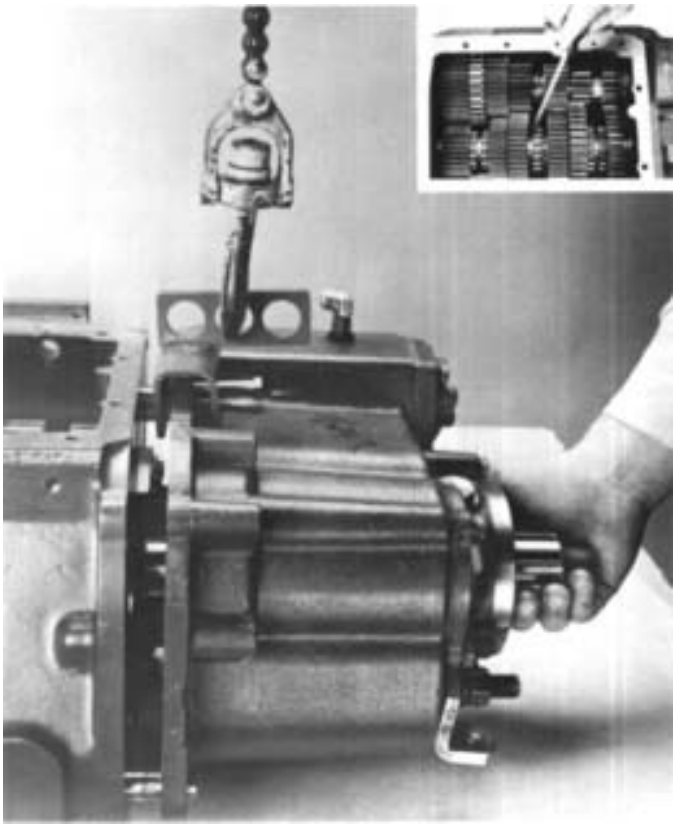


4. Install the auxiliary countershaft front bearing into the reverse idler gear case bore.

INSTALLATION-AUXILIARY SECTION, REAR YOKE AND CLUTCH HOUSING

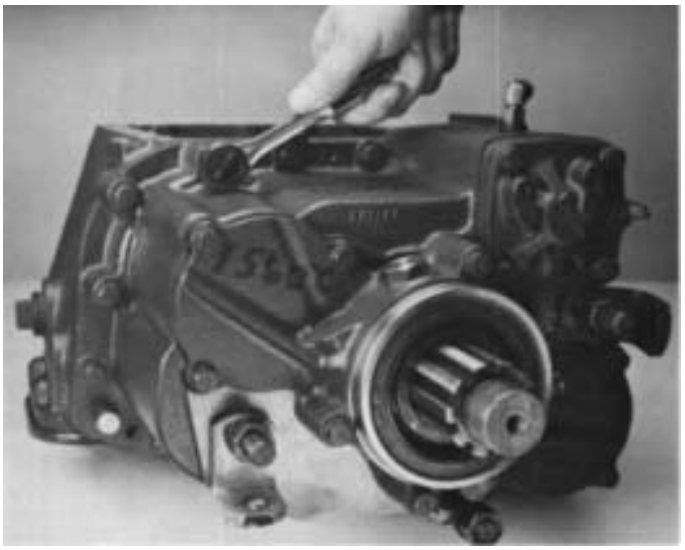
A. Installation Auxiliary Section

NOTE: Make sure the synchronizer is in neutral, and that auxiliary front countershaft bearings are installed in front case.



1. Postion gasket on auxiliary housing. Attach a chain hoist to auxiliary. Move the assembly evenly into rear of front case, piloting it on the dowel pins. As assembly is moved forward, the countershaft drive gears will mesh with the auxiliary drive gear.

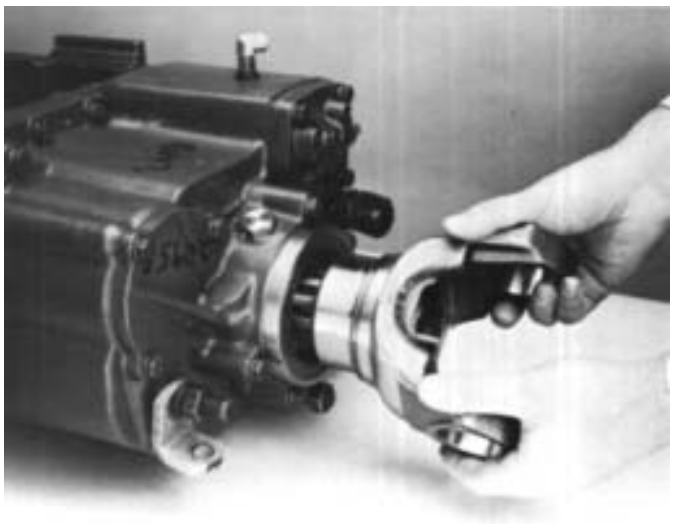
   NOTE: Engage front section in gear and rotate input shaft to help mesh auxiliary drive gear and countershaft drive sears (inset.)



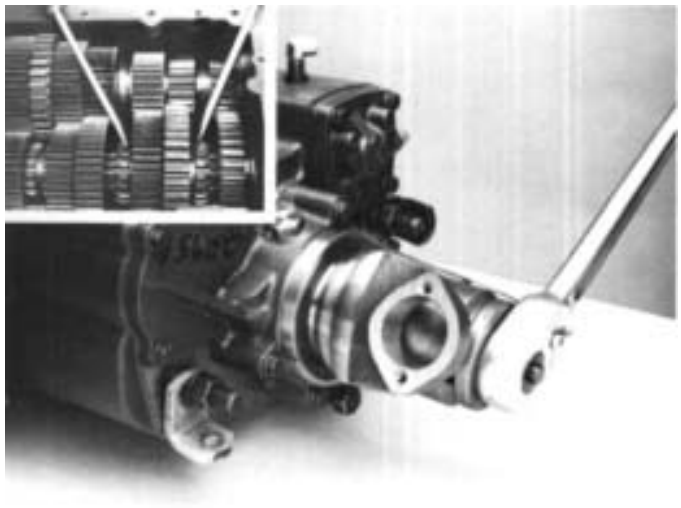
2. Install fifteen capscrews in flange of auxiliary housing, and tighten to secure auxiliary section with front section. Tighten to recommended torque specification. Make sure capscrews are in their proper position.

INSTALLATION-AUXILIARY SECTION, REAR YOKE AND CLUTCH HOUSING

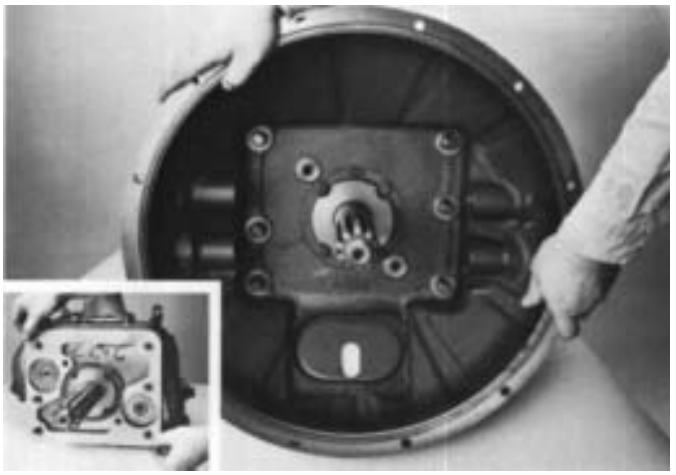
B. Installation Rear Yoke



1. Install the rear yoke on splines of output shaft and move into rear bearing cover.



2. Lock the transmission by engaging two mainshaft gears with sliding clutches (inset.) Install the washer and nut on output shaft and tighten nut using 450-500 lbs./ft. torque.



1. Position gasket on housing mounting surface (inset) and install clutch housing on front case, piloting on the six studs and drive gear bearing cover.



2. Install six nuts and lockwashers and tighten to recommended torque.

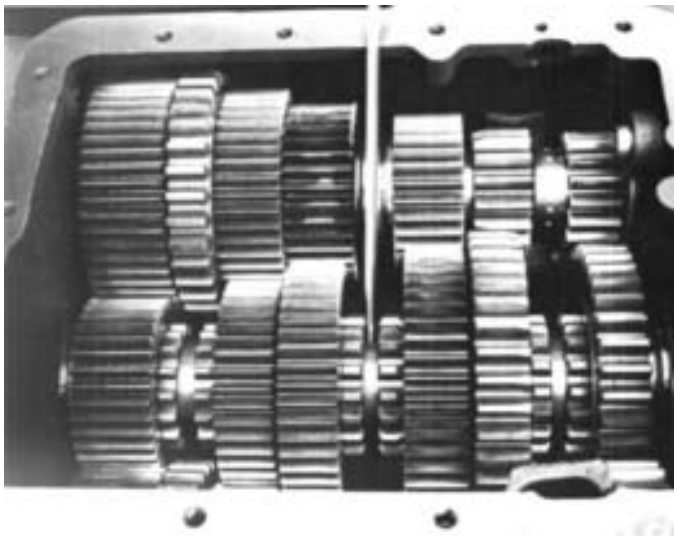


3. Install two capscrews and lockwashers and tighten to recommended torque.

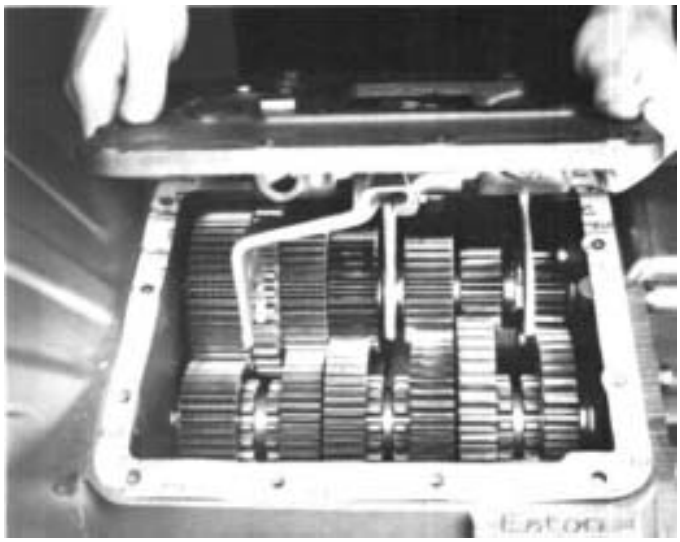
NOTE: For models so equipped install the clutch release mechanism and/or clutch brake assembly. See OPTIONS.

INSTALLATION-
SHIFTING CONTROLS

A. Installation Shift Bar



1. Place all three mainshaft sliding clutches in the neutral position. Install shift bar housing gasket in position.



2. With all three shift yokes in the neutral position, install the shift bar housing assembly on case, fitting the shift yokes into the slots of the corresponding sliding clutches.

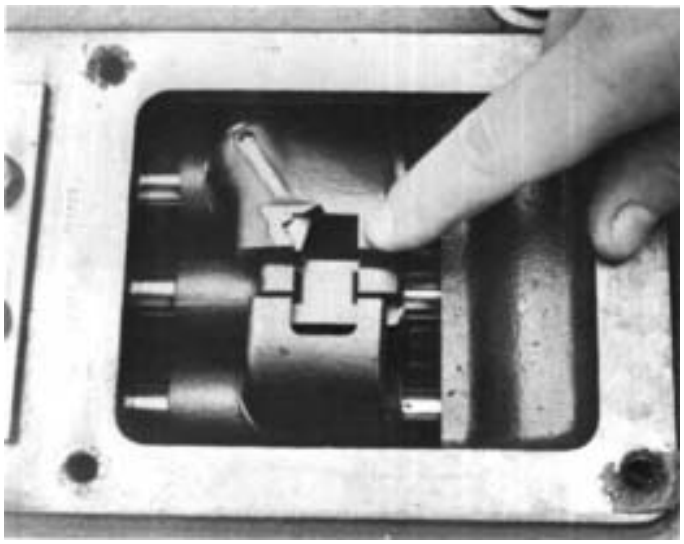


3. Install the thirteen capscrews in shift bar housing and tighten to recommended torque.

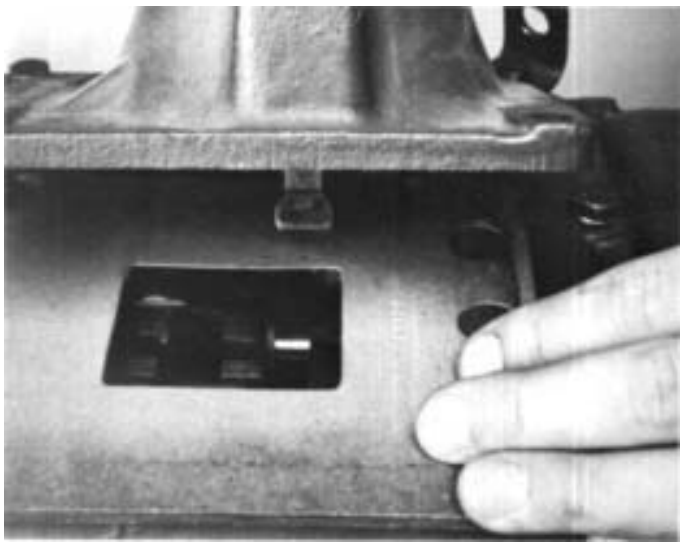
NOTE: There are two sizes of capscrews. The 1-1/2Ócapscrews are used with lifting eyes. Their position on the shift bar housing is illustrated on page No. 33.

INSTALLATION-
SHIFTING CONTROLS

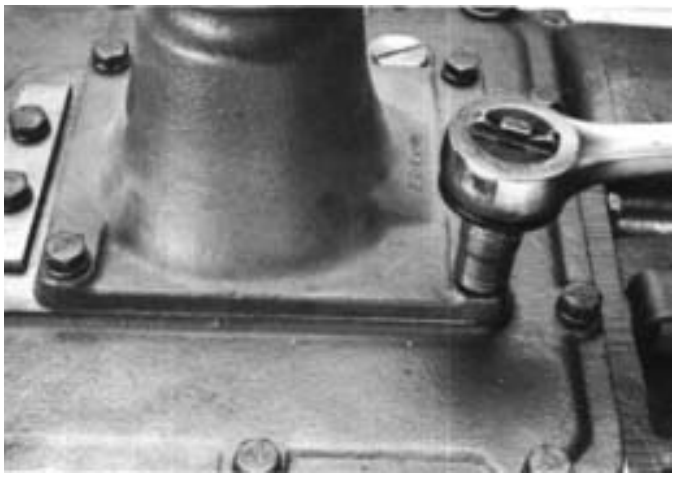
B. Installation Gear Shift Lever Housing Assembly



1. Make sure shift bar housing assembly shift blocks and yoke notches are aligned in the neutral position.



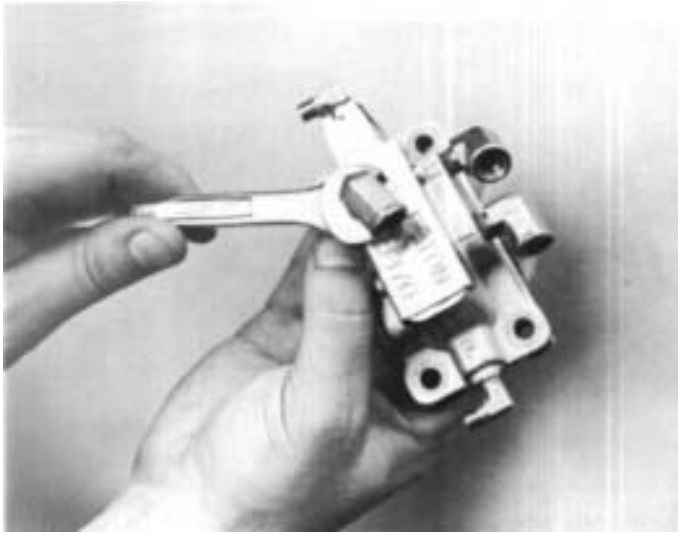
2. Install gasket and gear shift lever housing assembly on shift bar housing, fitting the lever into shift block and yoke notches.



3. Install the four retaining capscrews in housing flange and tighten to recommended torque to secure the assembly to shift bar housing.

INSTALLATION-
SHIFTING CONTROLS

C. Installation of Slave Valve



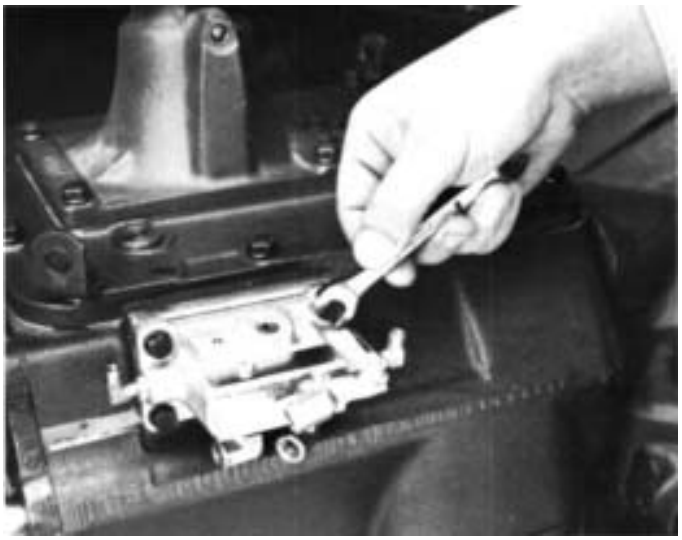
1. If previously removed, install the air line fittings on slave valve.



2. Install the spring on shank of actuating pin and insert in bore of transmission case.



3. Install the hat-type alignment sleeve in bore of slave valve.



4. Position gasket on valve mounting surface and install the slave valve on case, inserting the end of actuating pin into alignment sleeve. Secure the valve to case with four capscrews tighten evenly to recommended torque.

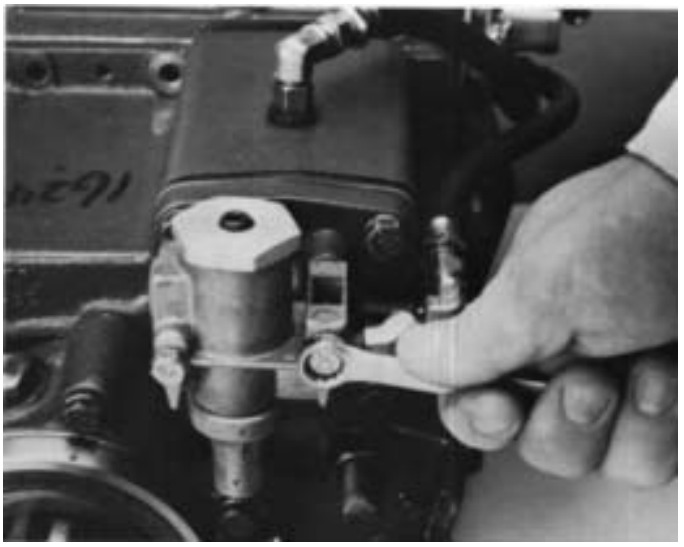
INSTALLATION-
SHIFTING CONTROLS

D. Installation of Air Lines and Air Filter Regulator

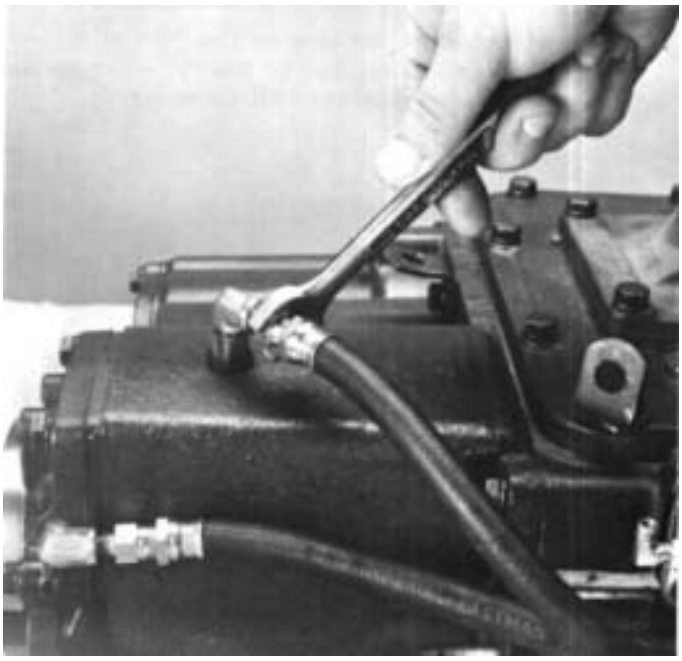
NOTE: Recommended sealant for fittings is Fuller Sealant 71205.



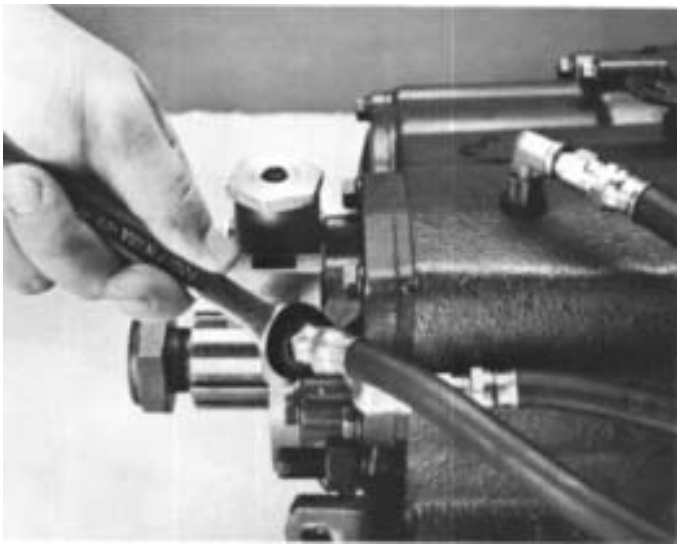
1. Connect the 1/4" I.D. air hose between the slave valve and the HI Range Port of the range cylinder. Tighten fittings securely.



3. Postion the air filter/regulator on the rear of the auxiliary housing and install the two retaining cap-screws. Tighten to recommended torque.



2. Connect the 1/4" I.D. air hose between the slave valve and the LO Range Port of the range cylinder. Tighten fittings securely.



4. Connect the 1/4" I.D. air hose between the slave valve and the air filter/regulator. Tighten fittings securely.

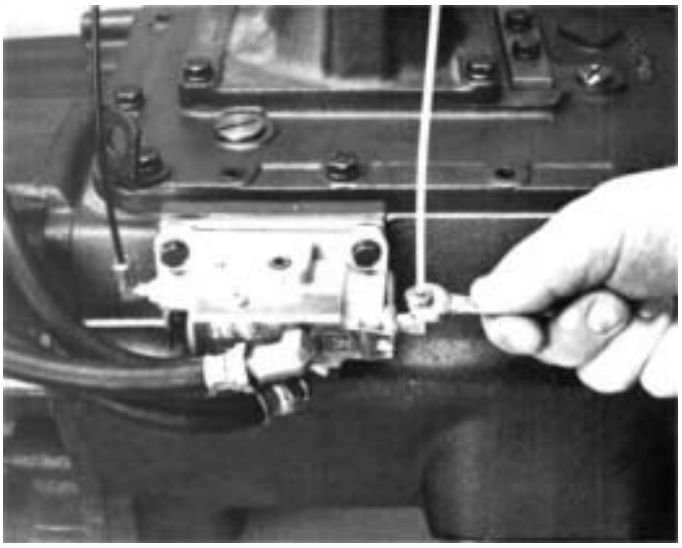
INSTALLATION-
SHIFTING CONTROLS



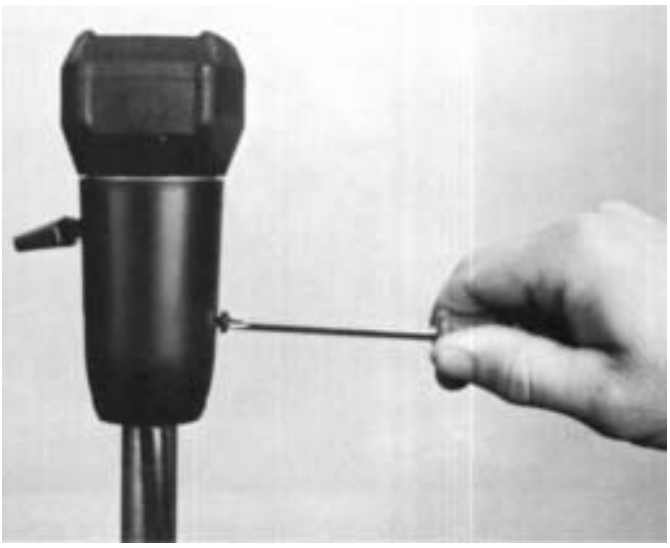
5. Position air lines, valve cover and jam nut on shift lever. Thread the Roadranger valve on shift lever and secure by tightening jam nut against valve.



7. Connect the white air line to the "S" or Supply Port and the black air line to the "P" Port on the Roadranger valve. Tighten fittings securely.



6. Connect the white air line to the "S" or Supply Port, and the black air line to the "P" or End Port of the slave valve. Tighten fittings securely.



8. Position valve cover on Roadranger valve and secure by tightening the two mounting screws in cover.

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