Service Manual

Fuller Heavy Duty Transmissions TRSM0505

October 2007

RT-7608LL

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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 drive wheels off the ground or disconnect the driveline to avoid damage to the transmission during towing.

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FOREWORD

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

As outlined in the Table of Contents, the manual is divided into 2 main sections:

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

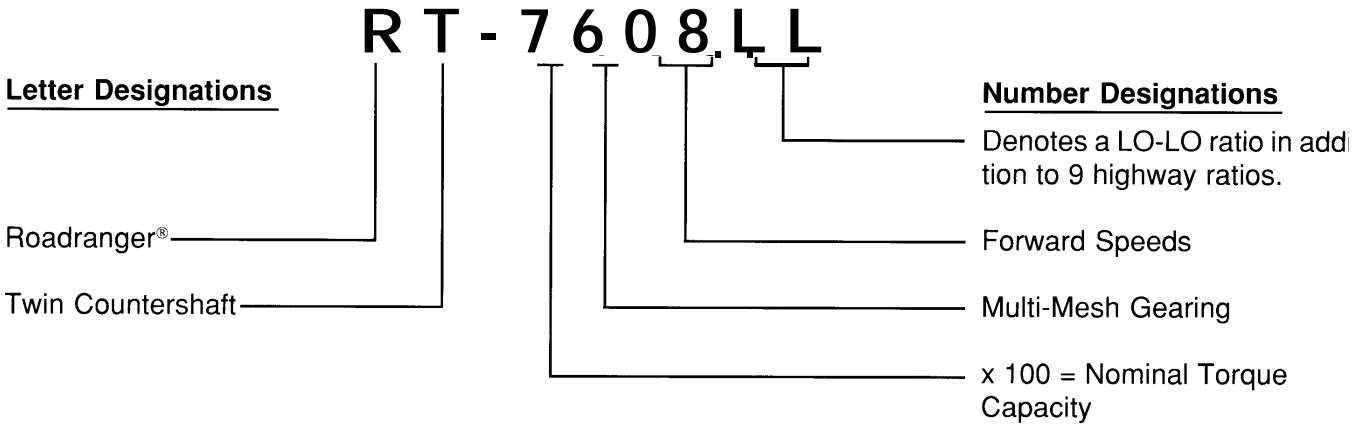
The format of the manual is designed to be followed in its entirety if complete disassembly and reassembly of the transmission is necessary. But if only one component of the transmission needs to be repaired, see the Table of Contents for the page numbers showing that component. For example, if you need to work on the Shifting Controls, you will find instructions for removal, disassembly, and reassembly on page 30. Instructions for installation are on page 102. Service Manuals, Illustrated Parts Lists, Drivers Instructions, and other forms of product service information for these and other Eaton Fuller Transmissions are available upon request. A Product Literature Order Form, Service Bulletins (detailing information on product improvements), repair procedures and other service-related subjects can be obtained by writing to the following address:

EATON CORPORATION
TRANSMISSION DIVISION
Technical Service Department
P.O. Box 4013
Kalamazoo, Michigan 49003

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 enclose 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 Eaton Fuller Transmissions are identified by the 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.

RT-7608LL

Model	No. Spds	Gear Ratios													Relative Speed PTO Gear To Input RPM		Note 1 Length in. (rim)	Note 2 Weight Lbs (Kg)	Note 3 Oil Capacity Pints (Liters)
		Deep Red.	Low Range					High Range				Reverse							
		LOLO	LO	1st	2nd	3rd	4th	5th	6th	7th	8th	LOLO	LO	HI	Right	Bottom			
RT-7608LL	10	18.81	12.31	8.24	6.17	4.51	3.32	2.48	1.83	1.36	1.00	17.87	11.69	3.52	.720	.720	32.8 833.1	597 270.8	19.5 9.2

CHART NOTE:

1. Lengths measured from clutch housing face to companion flange or yoke front bottoming surface.

2. **Weights** - Listed weights are *without* a 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.

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 an oil circulating bath by the motion of the gears and shafts.

Thus, all parts are 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	
Initial Fill with Eaton® Roadranger® CD50 Transmission Fluid	
Every 10,000 miles (16090 Km)	Check fluid level. Check for leaks.
Every 250,000 miles (402336 Km).	Change transmission fluid.
OFF-HIGHWAY USE	
First 30 hours	Inspect fluid level. Check for leaks.
Every 500 hours	Change transmisslon fluid where severe dirt conditions exist
Every 1,000 hours	Change transmission fluid (Normal off-highway use.)
HIGHWAY USE — Heavy Duty and Mid-Range	
Initial Fill with Other Recommended Oil	
First 3,000 to 5,000 miles (4827 to 8045 Km)	Factory fill initlal dram. Refill with Eaton® Roadranger® CD50 Transmission fluid; thereafter follow maintenance intervals above.
HIGHWAY USE	
First 3,000 to 5,000 miles (4827 to 8045 Km)	Factory fill initial
Every 10,000 miles (1 6090 Km)	Inspect lubicant level Check for leaks.
Every 50,000 miles (80450)	Change transmission lubricant
OFF-HIGHWAY USE	
Fiirst 30 hours	Change transmission lubricant on new units.
Every 40 hours	Inspect lubrliant level. Check for leaks.
Every 500 hours	Change transmission lubicant where severe dirt conditions exist.
Every 1,000 hours	Change transmission lubricant (Normal off-highway use.)

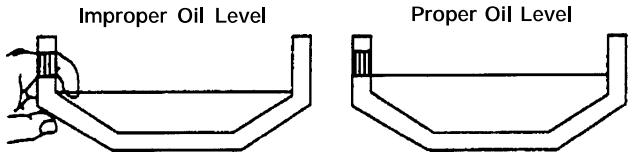
Change the oil filter when fluid or lubricant is changed.

Recommended Lubricant		
Type	Grade (SAE)	Fahrenheit (Celsius) Ambient Temperature
Eaton ®Road ranger' CD50 Transmission	5 0	All
Heavy Duty Engine 011 MIL-L-2104B, C or D or API-SF or API-CD (Previous API designatlons)	50 40 30	Above 10°F (-12°C) Above 10°F (-12°C) Below 10°F (-12°C)
Mineral Gear 011 with rus and oxldation Inhibitor API-GL-1	90 80W	Above 10°F (-12°C) 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 can 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 the 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 case bottom. Clean the drain plug before re-installing.

Refilling

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

The exact amount of oil depends on the transmission inclination and model. Do not over fill—this causes oil to be forced out of the case through the front bearing cover.

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) does not harm the transmission. Operating temperatures above 250°F increases the lubricant's oxidation rate and shortens its effective life. When the average operating temperature is above 250°F, the transmission can 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°C). In addition, transmission oil coolers are not recommended with these gear oils since the oil cooler materials can 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 Operating Angles

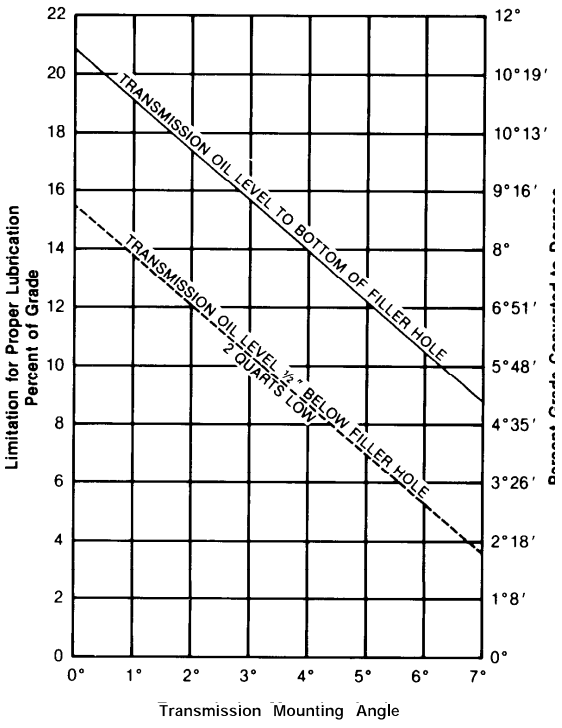
If the transmission operating angle is more than 12 degrees, improper lubrication can occur. The operating angle is the transmission mounting angle in the chassis plus the percent of upgrade (expressed in degrees).

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 or 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 1/2" below the filler plug hole reduces the degree of grade by approximately 3 degrees (5.5 percent).

Proper Lubrication Levels are Essential!



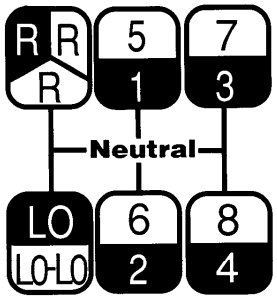
Dotted line showing "2 Quarts Low" is for reference only. Not recommended.

OPERATION

RT-7608LL Transmission

Shift Lever Patterns and Shifting Controls

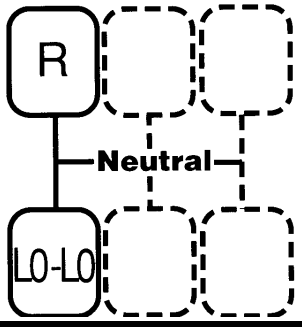
RT Models



A-5015



With Deep Reduction Button
in the Rearward position. . .
Shift LO-1-2-3-4 in LO Range
Shift 5-6-7-8 in HI Range.



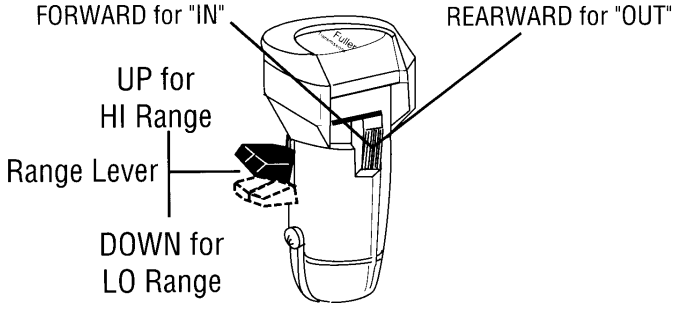
A-5015



While in LO Range ONLY and
with lever in LO. . .
LO-LO can be obtained by
moving Deep Reduction Button

Roadranger Valve
(A-5015)

DEEP REDUCTION BUTTON



Driving Tips

- For a smooth start, always select an initial starting gear that will provide sufficient reduction for the load and
- 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 Deep Reduction Lever/Button or 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.

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 troubleshooting and making repairs.

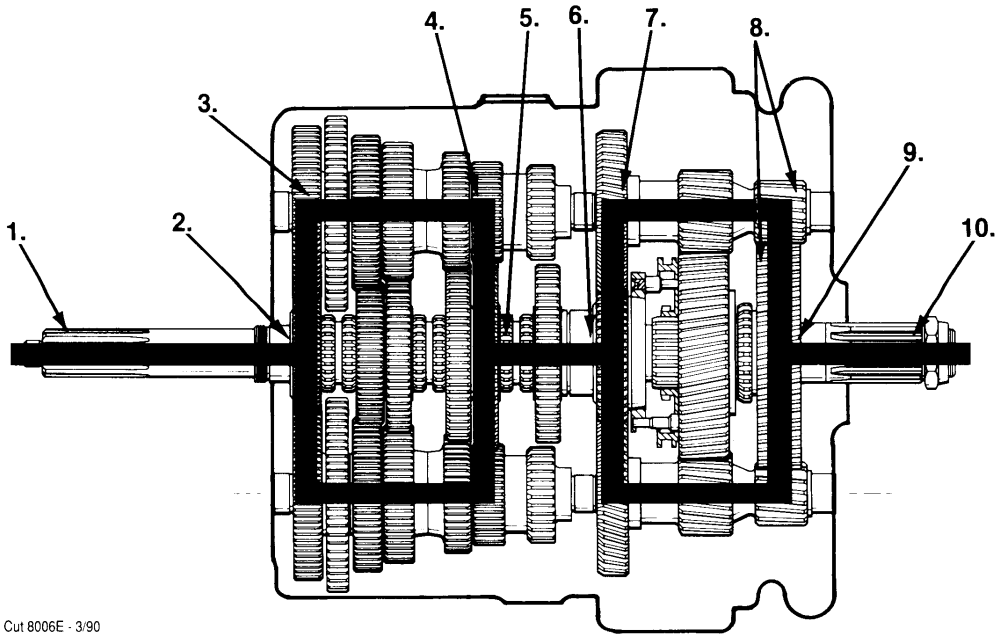
Front Section Power Flow
ALL MODELS

1. Power (torque) from the vehicle's engine is transferred to the transmission's input shaft.
2. Input shaft splines engage with the main drive gear internal splines.
3. Torque is split between the two countershaft drive gears.
4. Torque is delivered along both countershaft to their mating countershaft gears of the "engaged" mainshaft gear. The following cross section views illustrate a LO speed gear engagement.
5. Internal clutching teeth in engaged mainshaft gear hub transfers torque to mainshaft through the sliding clutch.
6. Mainshaft transfers torque directly to the auxiliary drive gear.

Auxiliary Section Power Flow:
DEEP REDUCTION

7. The auxiliary drive gear splits torque between the two auxiliary countershaft drive gears.
8. Torque is delivered along both auxiliary countershafts to their mating "engaged" gear on the output shaft.
9. Torque is transferred to the output shaft through the sliding clutch.
10. Output shaft delivers torque to driveline as DEEP REDUCTION or LO LO.

POWER FLOW IN DEEP REDUCTION

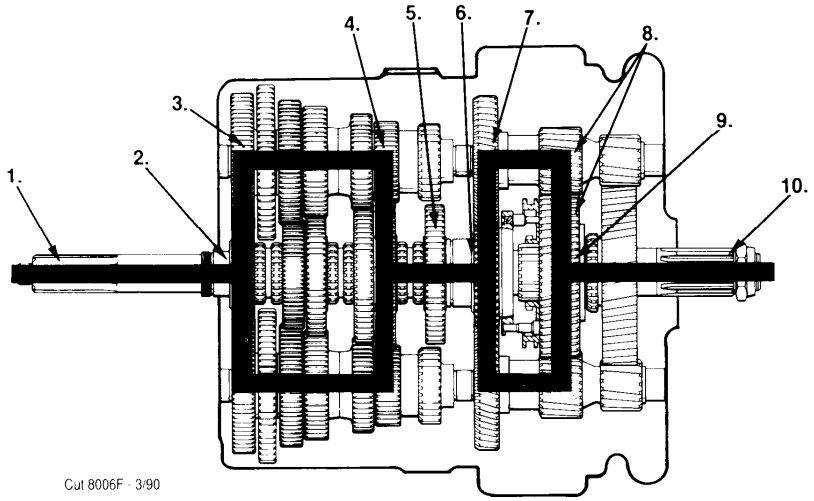


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POWER FLOW

Auxiliary Section Power Flow:
LO RANGE

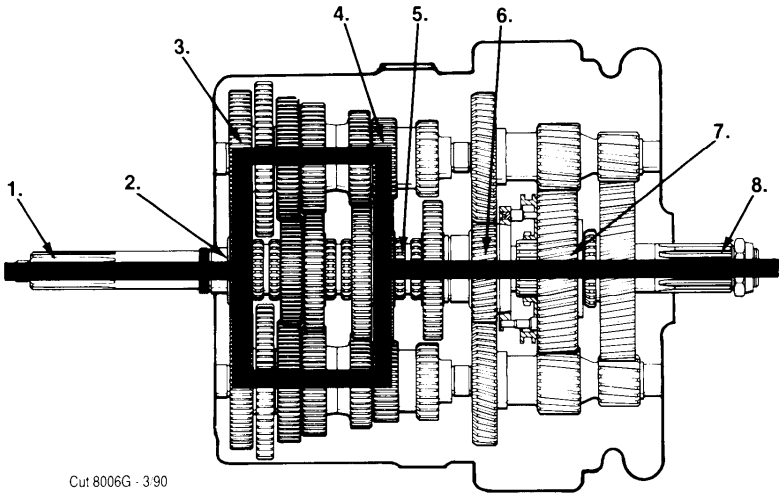
7. The auxiliary drive gear splits torque between the two auxiliary countershaft drive gears.
8. Torque is delivered along both countershaft to "engaged" LO RANGE gear on the range mainshaft or output shaft.
9. Torque is transferred to the range mainshaft or output shaft through the sliding clutch.
10.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



LO RANGE POWER FLOW

Auxiliary Section Power Flow:
HI RANGE

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



HI RANGE POWER FLOW

TIMING

Timing Procedures:

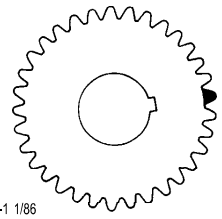
It is essential that both countershaft assemblies of the front and auxiliary sections are "timed." This assures proper tooth contact is made between mainshaft gears seeking to center on the mainshaft during torque transfer and mating countershaft gears that distribute the load evenly. If not properly 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 the case, clearly mark the tooth located directly over the drive gear keyway as shown. This tooth is stamp with an "0" to aid identification.

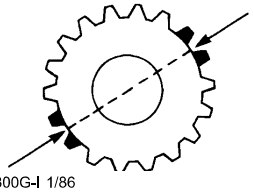


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Tooth on Countershaft directly over keyway marked for timing'.

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.

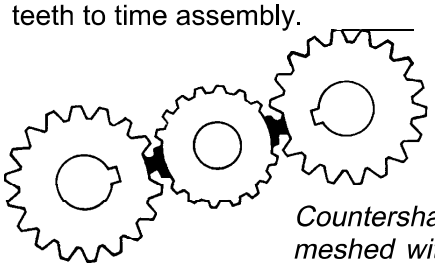


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Drive gear teeth correctly marked for timing.

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

1. When installing the bearings on the left countershaft, mesh the countershaft drive gear marked tooth with either set of main drive gear two marked teeth.
2. Repeat the procedure when installing the bearings on the right countershaft, make use of the remaining set of main drive gear two marked teeth to time assembly.



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

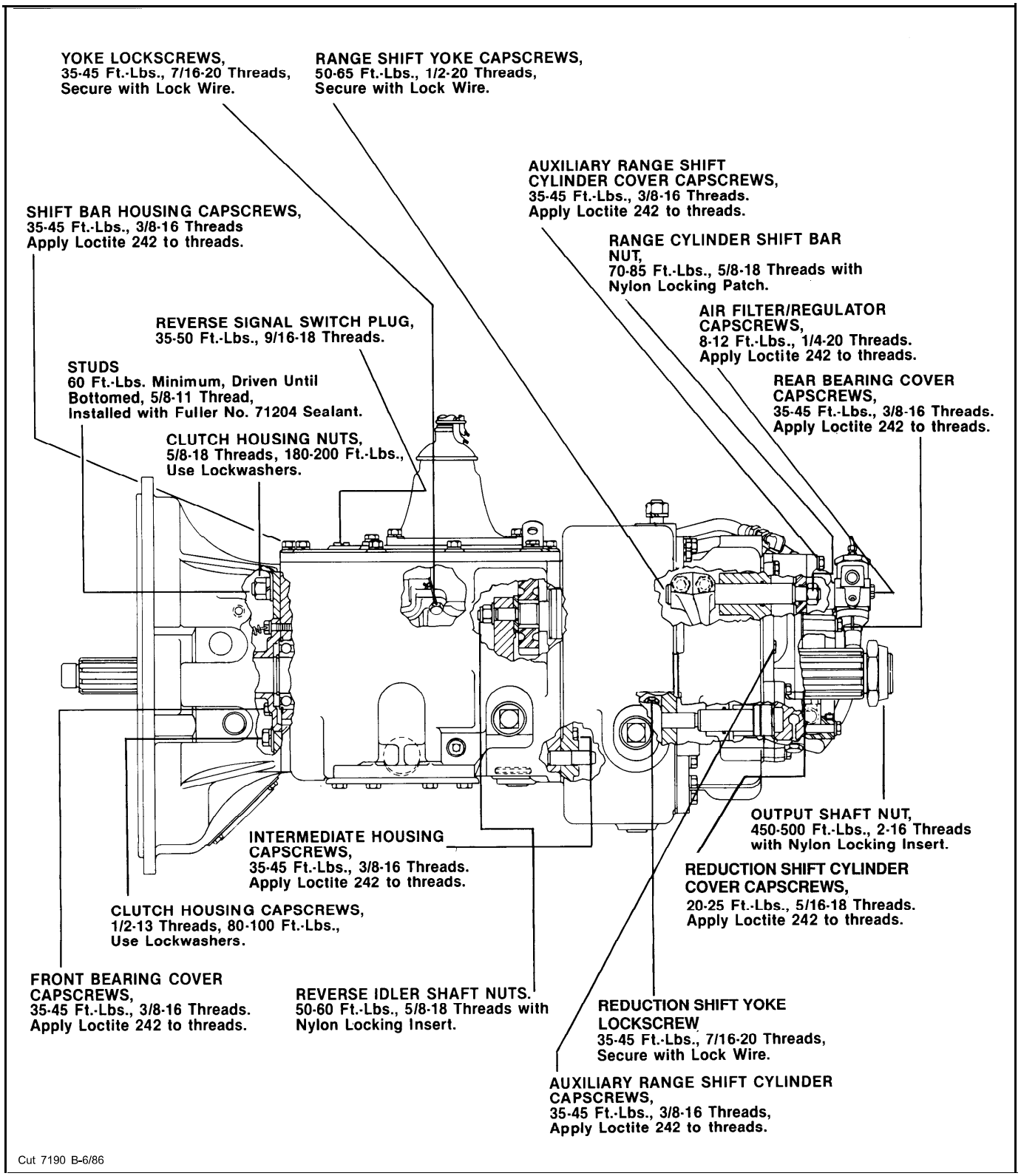
Auxiliary Section

A. Timing the Deep Reduction Gears Set of the "L" Model

1. Mark *any* two adjacent teeth on the mainshaft 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, make the tooth stamped with an "O" on gear to mate with timed mainshaft gear as shown in illustration A.
3. Install the mainshaft gear in position on range mainshaft OR output shaft.
4. Place the auxiliary countershaft assemblies into position and mesh the marked teeth of mating countershaft gears with the marked teeth of mainshaft gear as shown in illustration C.
5. Fully seat the rear bearings on each countershaft to complete installation.

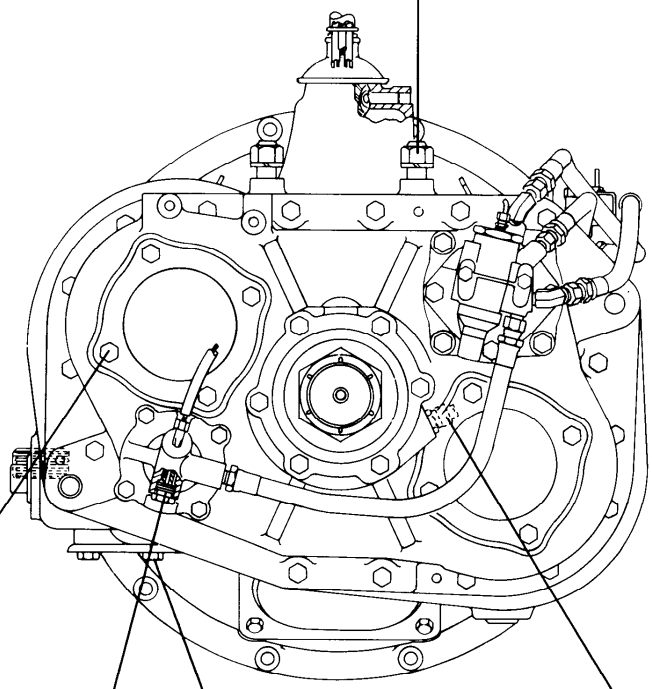
TORQUE RECOMMENDATIONS

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.



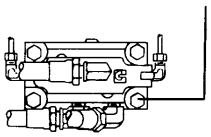
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TORQUE RECOMMENDATIONS



SUPPORT STUD NUTS,
170-185 Ft.-Lbs., 5/8 Threads, Use Lockwashers.

SLAVE VALVE CAPSCREWS,
8-12 Ft.-Lbs., 1/4-20 Threads.
Apply Loctite 242 to threads.



AUXILIARY COUNTERSHAFT BEARING COVER CAPSCREWS,
35-45 Ft.-Lbs., 3/8-16 Threads
Apply Loctite 242 to threads.

SPEEDMETER HOUSING PLUG,
35-75 Ft.-Lbs., 13/16-20 Threads, Use Fuller No. 71205 Sealant

REDUCTION CYLINDER PLUG,
40-50 Ft.-Lbs., 5/8-18 Threads.

LARGE P.T.O. COVER CAPSCREWS,
50-65 Ft.-Lbs., 7/16-14 Threads
Use Lockwashers. Apply Loctite 242 to threads.

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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.

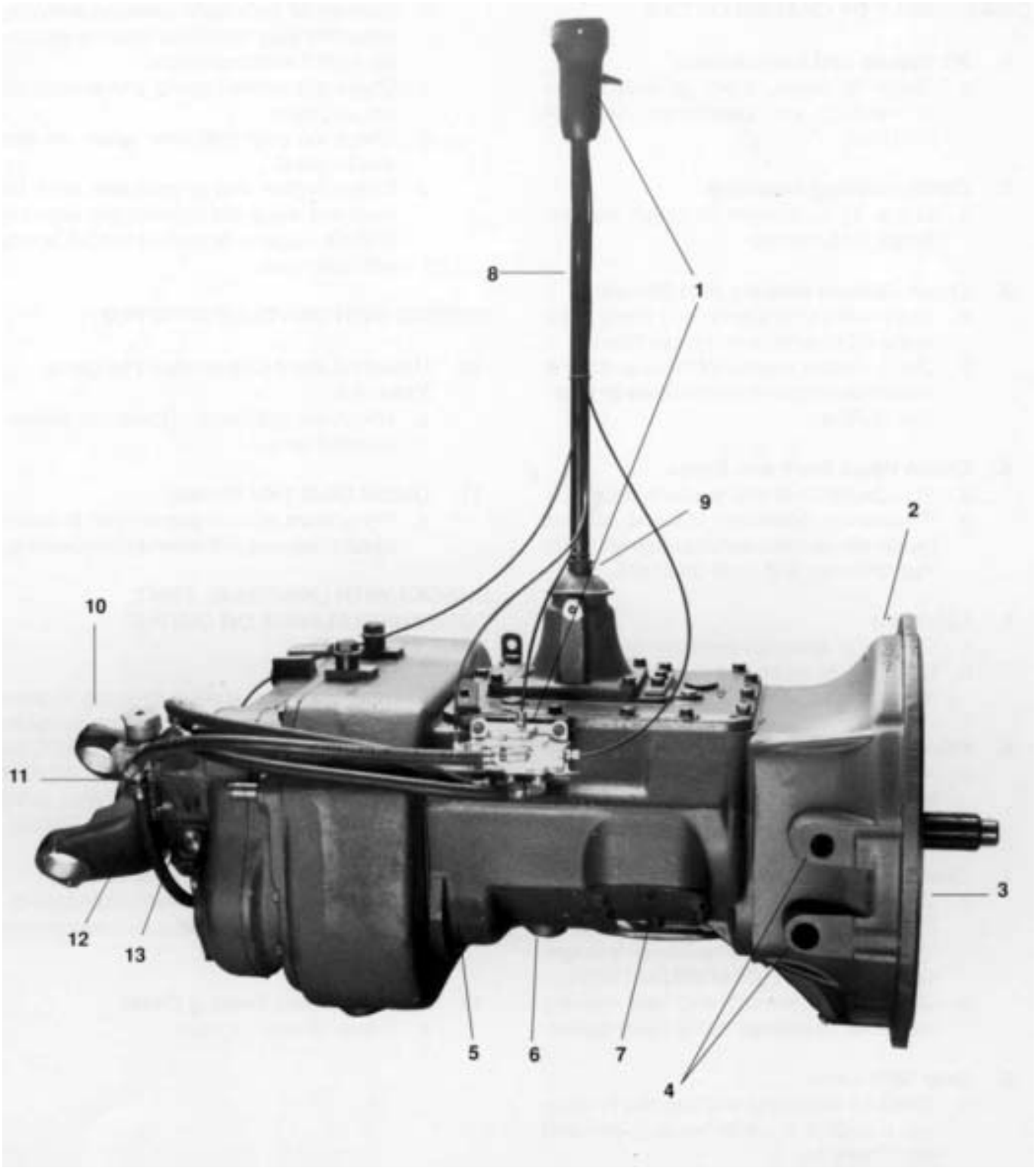
But for the most part, ordinary mechanic's tools such as socket wrenches, screwdrivers, etc., and other standard shop items such as a press, mauls and soft bars are all that is needed to successfully disassemble and reassemble any Fuller Transmission.

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 to:

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

PAGE	TOOL	HOW OBTAINED
35	Tension Spring Driver	Made from Fuller Transmission Print T-1 1938
43	Auxiliary Section Hanger Bracket	Made from Fuller Transmission Print T-22823
46	Snap Ring Pliers	Tool Supplier
47	Bearing Pullers (Jaw-Type)	Tool Supplier
57	Oil Seal Driver	From Fuller Transmission K-2091
72	Impact Puller (1/2-1 3 Threated End)	Tool Supplier
79	Bearing Drivers (Flanged-End)	Tool Supplier
82	Countershaft Support Tool	Made from Fuller Transmission Print T-22247
100	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 flange 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 on 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 the slave valve and remove the gear shift lever housing assembly from the transmission.
   b. Check the 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 DRIVELINE 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 OUTPUT YOKE REMOVED

NOTE: If necessary, use a clean shop rag to clean the sealing surface of companion flange or output yoke. DO NOT USE CROCUS CLOTH, EMERY PAPER, OR OTHER ABRASIVE MATERIALS THAT WILL MAR THE REAR SEALING 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 assembly instructions that the lubricant has been drained from the 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 the shift bar housing before transmission can be removed.

FOLLOW CLOSELY EACH PROCEDURE IN THE DETAILED INSTRUCTIONS, MAKE 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 the transmission without removing the countershaft, 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** Always 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, bar, 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 Eaton 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 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, spalled, or damaged during disassembly.
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 fit. Bearing inner races should be tight to shaft; outer races slightly tight to slightly loose in case bore. If bearing spins freely in bore, case should be replaced.

B. GEARS

1. Check gear teeth for frosting and pitting. Frosting of gear teeth faces present no threat of transmission failure. Often in continued operation of the unit, frosted gears "heal" and do not progress to the pitting stage. 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.)

3. Check axial clearance of gears. Where excessive clearance is found, check gear snap ring, split washer, clutch hub, and gear hub for excessive wear.

C. SPLINES

1. Check splines on all shafts for abnormal wear. If sliding clutch gears, companion flange, or clutch hub has worn marks in the spline sides, replace the specific shaft affected.

D. WASHERS

1. Check surfaces of all washers. Washer 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 any parts found to be damaged.

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 lockscrews in yoke 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.

I. GEAR SHIFT LEVER HOUSING ASSEMBLY

1. Check spring tension on shift lever. Replace tension spring if lever moves too freely.
2. If housing is disassembled, check gear shift lever bottom end and shift finger assembly for wear. Replace both 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 cover bores for wear. Replace those worn oversized.

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 synchronizer cups for wear.

N. O-RINGS

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

PRECAUTIONS

Reassembly

Make sure that case interiors and housings are clean. It is important that dirt and other foreign materials are 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 and loosening, use Loctite #242 thread sealant on all capscrews. For torque ratings, see TORQUE RECOMMENDATIONS.

3. **O-RINGs —** Lubricate all O-rings with silicon lubricant.

4. **ASSEMBLY —** See the illustrations provided in the detailed reassembly instructions as a guide.

5. **INITIAL LUBRICATION —** Coat all limit washers, the deep reduction gear splined spacer hub face, and the shaft splines 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 a flange-end bearing driver for bearing installation. 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 OUTPUT YOKE -** Pull the companion flange or output yoke tightly into place with the output shaft nut, using 450-500 lbs./ft. 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 can result in damage to the mainshaft rear bearing.

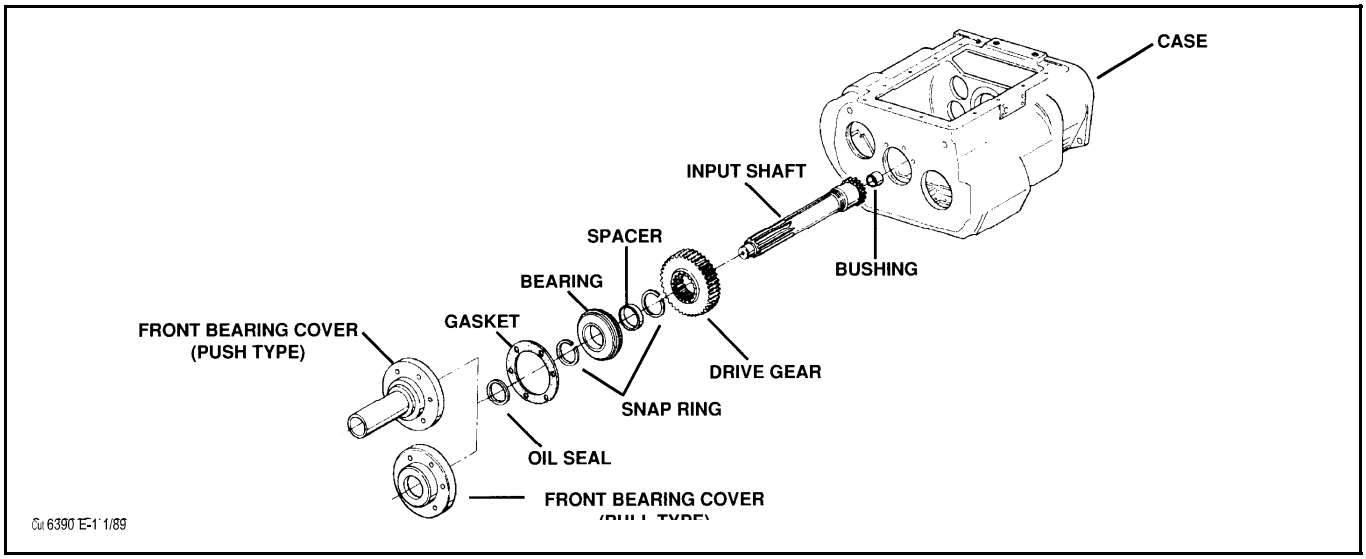
IMPORTANT: SEE THE APPROPRIATE ILLUSTRATED PARTS LIST (SPECIFIED BY MODEL SERIES) TO ENSURE THAT PROPER PARTS ARE USED DURING REASSEMBLY OF THE TRANSMISSION.

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, 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 the transmission case.

2. Remove the front bearing cover and gasket. If necessary, service the oil seal of model covers so equipped.

3. Remove the bearing retaining snap ring from the shaft groove.

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

5. Use pry bars or screwdrivers to complete removing the bearing.

6. Remove the drive gear spacer and the snap ring.

7. Pull the input shaft forward and out of the drive gear and case.

Reassembly

1. If necessary, replace the bushing in the input shaft pocket.

2. Install the snap ring in the snap ring groove inside the drive gear.

3. Install the drive gear spacer bearing on the input shaft.

4. Install the drive gear bearing on the input shaft.

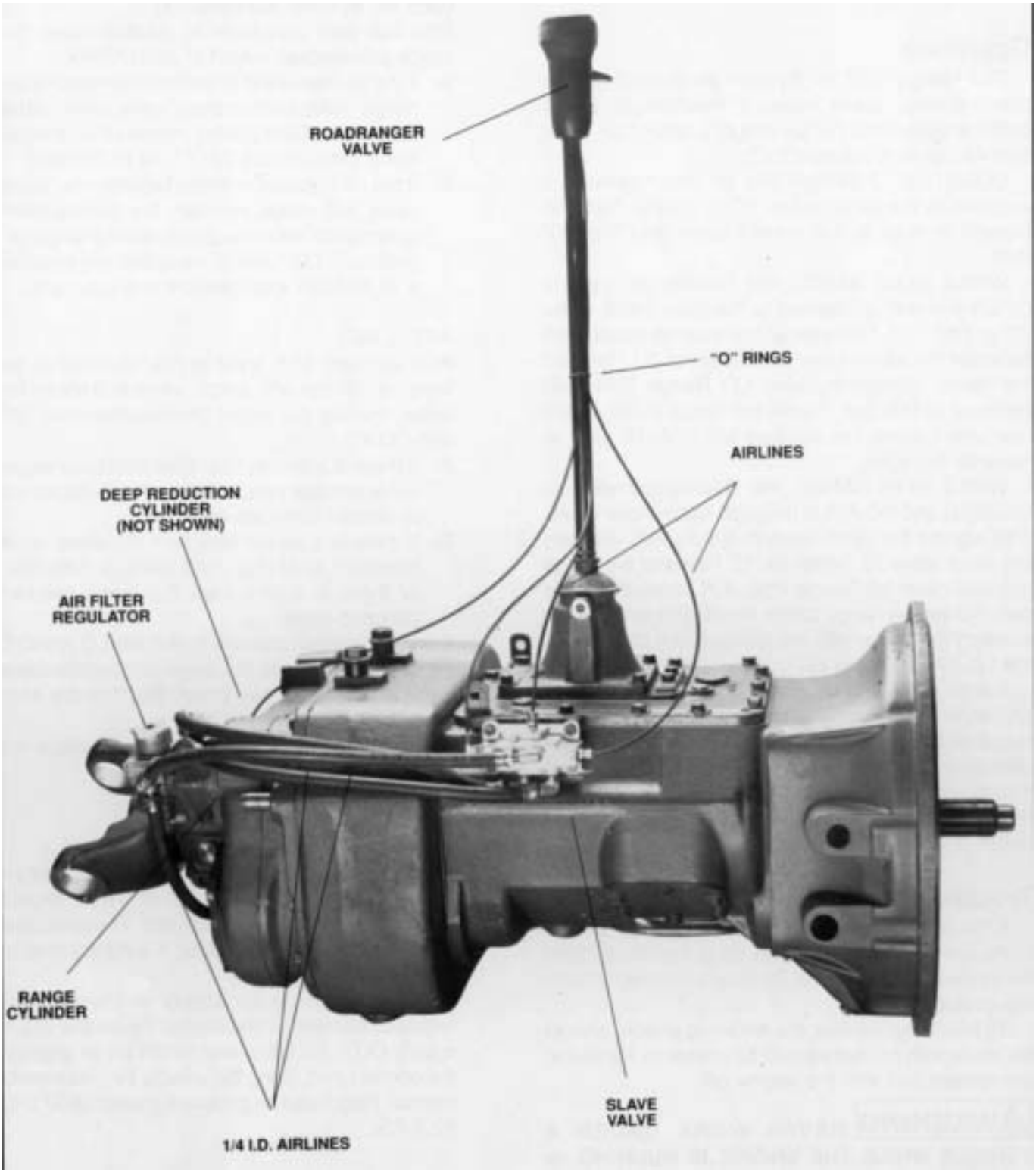
5. Install the bearing retainer snap ring.

6. Install the front bearing cover and gasket. Make sure to align the oil return hole in the case with the hole in the cover.

7. To ease proper reinstallation of the shift bar housing assembly on the case, make sure the 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, make sure to replace the used gaskets.

AIR SYSTEM


ROADRANGER VALVE
"O" RINGS
AIRLINES
DEEP REDUCTION CYLINDER (NOT SHOWN)
AIR FILTER REGULATOR
RANGE CYLINDER
SLAVE VALVE
1/4 I.D. AIRLINES

AIR SYSTEM

RANGE SHIFT AIR SYSTEM

Operation

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

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

WHILE IN LO RANGE, the Roadranger valve is OPEN and AIR is returned to the slave valve at the "P" or End Port. This signals the valve to supply AIR between the slave valve LO Range or "L" Port and the range cylinder housing LO Range Port. 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 Roadranger valve is CLOSED and NO AIR is returned to the slave valve. This signals the slave valve to supply AIR between the slave valve HI Range or "H" Port and the range cylinder cover HI Range Port. AIR received at this port moves the range piston forward to engage the auxiliary drive gear with the 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 should 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.

Troubleshooting

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

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

⚠WARNING **NEVER WORK UNDER A VEHICLE WHILE THE ENGINE IS RUNNING as personal injury may result from the sudden and unintended movement of the 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 range preelection lever UP and DOWN.
   - **A.** If the airlines are crossed between the Roadranger valve and the slave valve, there will be CONSTANT AIR flowing from the Roadranger valve exhaust port 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 range preelection lever UP and DOWN.
   - **A.** If there is a steady leak from the Roadranger valve exhaust port, control valve O-rings and/or related parts are defective.
   - **B.** If there is a steady leak from the slave valve – breather: an O-ring in the valve is defective, or there is a leak past the range cylinder piston O-rings.
   - **C.** If the 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 the defective O-rings and parts.

3. **AIR FILTER/REGULATOR**
   (See illustration, Page 25.)
   With the gear shift lever in neutral, check the air filter/regulator assembly breather. 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 the supply OUTLET fitting and install an air gage in the 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 filter element replacement or cleaning does nothing to correct the air pressure readings, replace the complete assembly, as the air regulator is non-serviceable.

4. RANGE VALVE (See Page 26.)

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

A. When LO RANGE is selected, a steady air blast flows from the opened port. Select HI RANGE to shutoff airflow. This indicates the Roadranger valve is operating properly. Reconnect the air line.

B. If the Roadranger 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 range cylinder cover port. Make sure this line leads from the slave valve HI Range or "H" Port.

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

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

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

IMPORTANT: RANGE PRESELECTION

The plunger pin, located in case bore between the slave valve and the shift bar housing actuating plunger, 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 range cylinder housing fitting. Make sure this line leads from the slave valve LO Range or "L" Port.

A. When LO RANGE is selected, a steady air blast should flow from the 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 the disconnected line. Return the gear shift lever to the neutral position. There should now be steady airflow from the disconnected line. Select HI RANGE to shut off air flow and reconnect the air line.

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

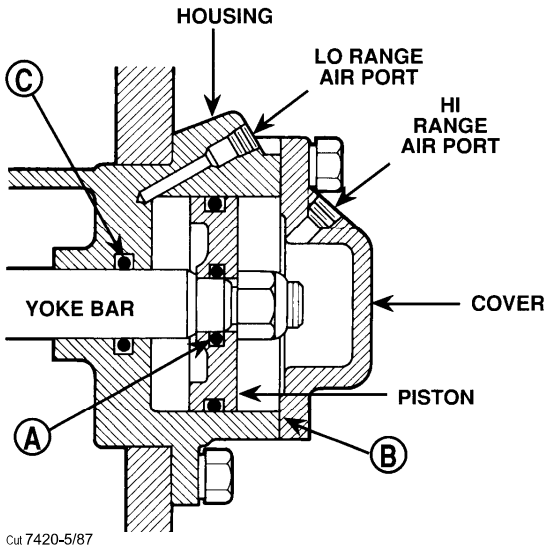
7. RANGE CYLINDER (See the following illustration.)

If any 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 air flow from the slave valve breather in both ranges.

B. Leak at gasket B results in a steady air flow to atmosphere while in H I RANGE.

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



Range Cylinder Assembly

AIR SYSTEM

DEEP REDUCTION AIR SYSTEM

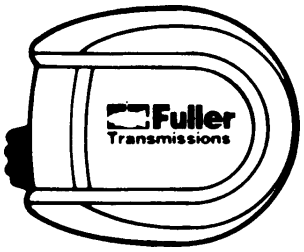
Operation

In addition to the various components of the Range Shift Air System, the Deep Reduction air System utilizes a reduction cylinder and a Roadranger Control Valve A-501 5.

CONSTANT AIR from the air filter/regulator assembly is supplied to the reduction cylinder at the port on the cylinder cover right side. See the Air System Schematics.

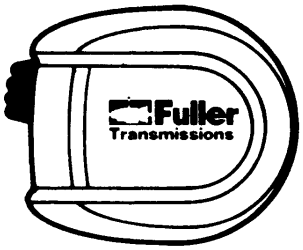
AIR is supplied to the built-in deep reduction valve ONLY WHILE IN LO RANGE from the fitting at the LO Range or slave valve "L" port. The insert valve (see page 24) must be installed in the cylinder cover to provide the proper air flow needed to move the reduction piston in the cylinder. See the schematic provided on page 27.

With the Deep Reduction Button in the REARWARD position, the control valve "SP" port is CLOSED and NO AIR is supplied to the cylinder cover center port.



Button REARWARD ("SP" Port CLOSED)

WHILE IN THE LO SPEED GEAR POSITION, the button can be moved FORWARD to operate in LO-LO. The slave valve "SP" Port is OPENED when deep reduction selection is made, supplying AIR to the cylinder cover center port.



Button FORWARD ("SP" Port OPENED)

NOTE: WHILE IN HI RANGE, the mechanical interlock of the Roadranger Valve prevents movement of the Deep Reduction Button to the FORWARD position.

Troubleshooting

If the transmission fails to shift or shifts too slowly to or from LO-LO, the fault may be in the Deep Reduction Air System or related components of the Range Shift Air System.

To locate the trouble, the following checks should be made with normal vehicle air pressure supplied to the system, but with the engine off. See the WARNING on the inside front cover.

NOTE: It is assumed that correct PSI readings were obtained from the air filter/regulator and all air lines have been checked for leaks.

1. **Air Supply (See schematic.)**
   With the gear shift lever in neutral, select LO RANGE and loosen the connection at the Roadranger valve "H" Port until it can be determined that AIR is supplied to the valve. Reconnect the air line.
   If there is NO AIR, check for a restriction in the air line between the Roadranger valve and the slave valve, make sure this line is connected to a tee fitting at the slave valve LO Range or "L" Port.

2. **Roadranger Valve (See Page 26 and schematic on preceding page.)**
   With the gear shift lever in neutral, disconnect the air line at the reduction cylinder cover center port, make sure this line leads from the Roadranger valve "SP" Port.
   A. WHILE IN LO RANGE, move the Deep Reduction Button FORWARD. There should be AIR flowing from the disconnected line. Move the button REARWARD to shut off air flow and reconnect the air line.
   B. If the preceding conditions did not exist, the Roadranger valve is defective, or there is a restriction in the air lines.

AIR SYSTEM

DEEP REDUCTION AIR SYSTEM

3. Reduction Cylinder (See the following illustration.)

If any seals in the reduction cylinder assembly are defective, the deep reduction shift will be affected. The degree of air lost will govern the degree of failure, from slow shifting to complete shift failure.

A. Leak at O-ring A results in a slow shift to the engage deep reduction gearing; pressurizing of transmission case; deep reduction gearing can be disengaged.

B. Leak at O-ring B results in slow shifting or complete failure to exhaust and disengage deep reduction gearing; steady air flow from the Roadranger valve exhause port and/or cylinder cover when the Deep Reduction Button is in the FORWARD position.

C. Leak at gasket C results in a slow shift to disengage deep reduction gearing, steady air flow to atmosphere.

4. Insert Valve (See next Page.)

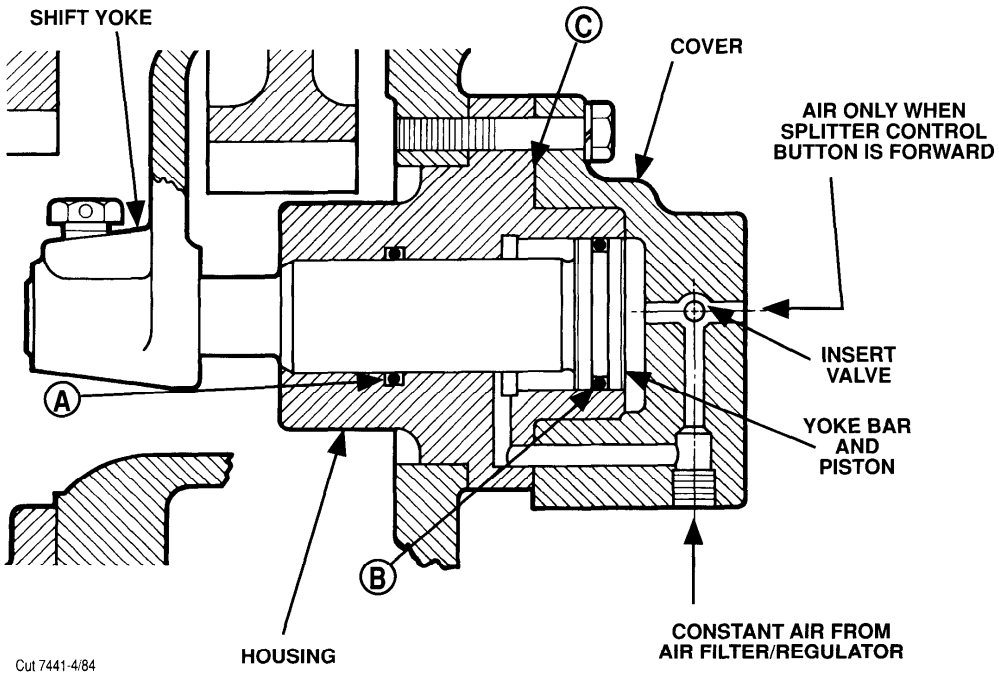
Any constant air flow from the cylinder cover exhause port usually indicates a faulty insert valve. Exhaust should occur ONLY BRIEFLY when Deep Reduction Button is moved FORWARD WHILE IN LOW RANGE.

A faulty insert valve, leaking at the valve O.D. O-rings or from the inner seals will result in shift failure. Two indications or defective O-rings or seals are:

A. CONSTANT AIR flowing from the cylinder cover exhaust port.

B. CONSTANT AIR flowing from the Roadranger valve exhaust or "E" Port WHILE DEEP REDUCTION BUTTON IS REARWARD (providing the Roadranger valve is operating properly.)

The three O-rings in position on valve O.D. can be replaced. However, if an inner seal is damaged, the complete assembly MUST be replaced.

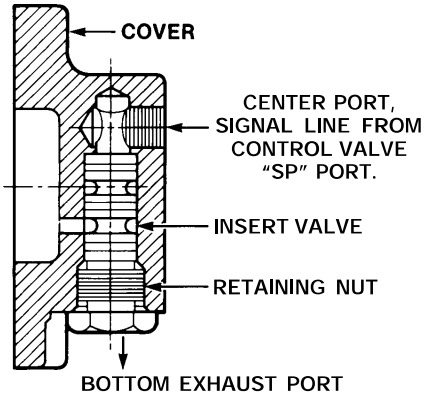


REDUCTION CYLINDER ASSEMBLY

AIR SYSTEM

Insert Valve

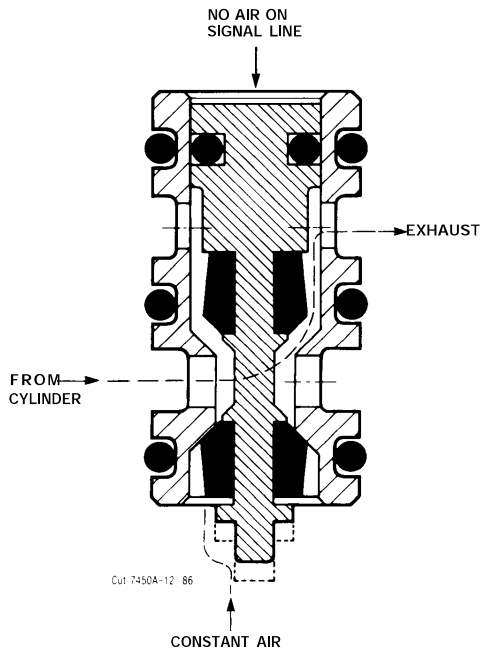
The insert valve is a self-contained valve assembly located in the reduction cylinder cover. It CANNOT be disassemble except for the three O-rings on the outer diameter. The O-rings provide a stationary seal and do not move in the cylinder.



Cut 7450-4/84

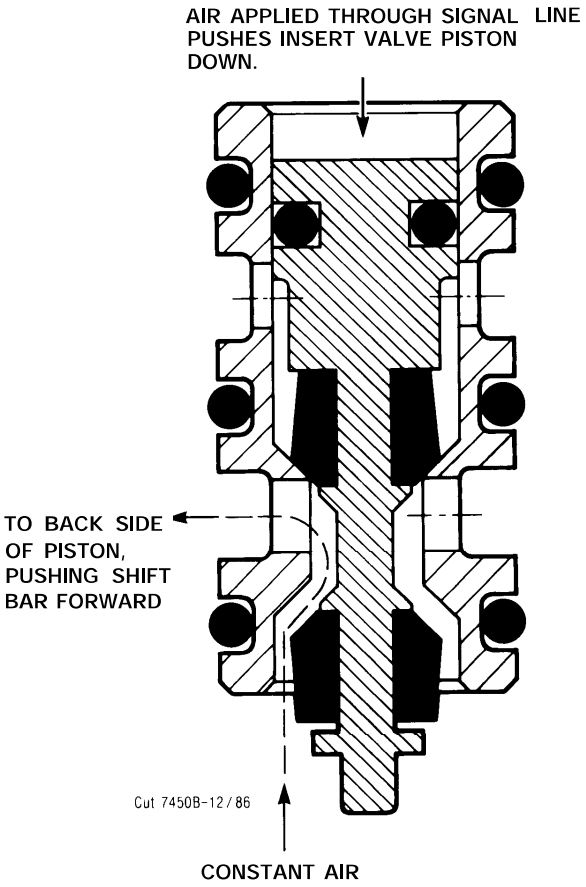
When installing the insert valve in the cover bottom bore, apply Fuller transmission #71 206 silicone lubricant or its equivalent to the O-rings and cylinder walls. Install valve in bore with the flat surface to the inside. When installing the special valve retaining nut, apply Fuller Transmission #71 204 adhesive/sealant or its equivalent to threads and tighten. See TORQUE RECOMMENDATIONS.

LO RANGE AND HI RANGE



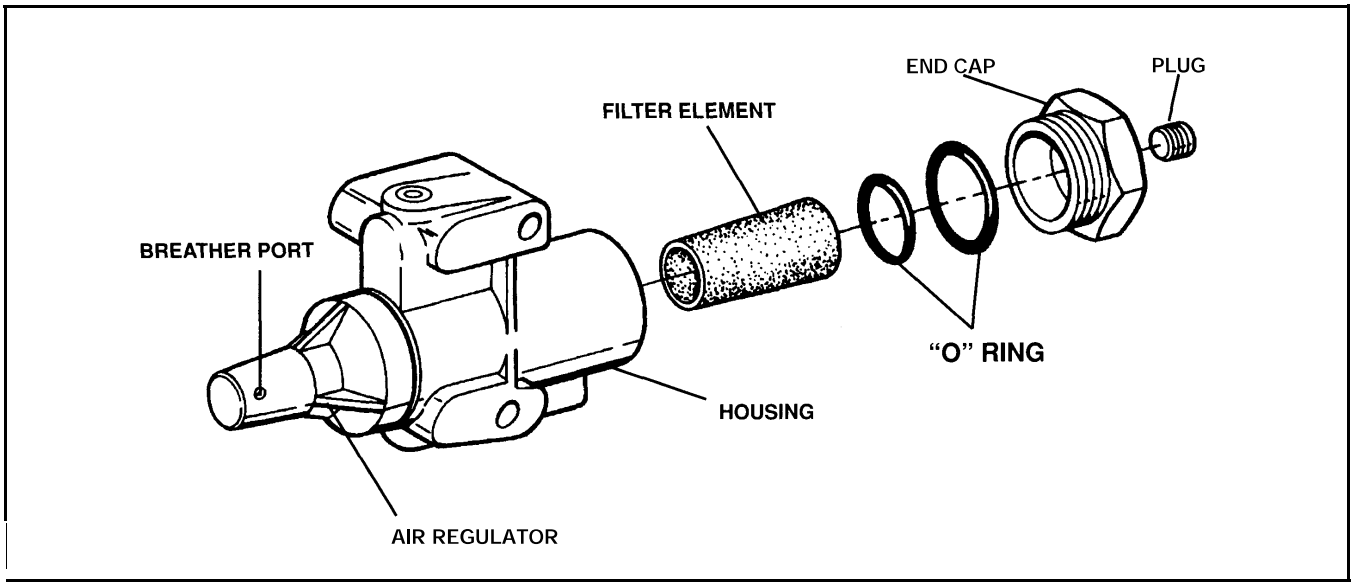
Travel of the small insert valve piston is only 1/32". As shown in the illustrations below, when NO AIR is applied to the valve piston topside, CONSTANT AIR supplied from the regulator passes freely through the insert valve and to the backside of the cylinder piston, moving the yoke bar forward to disengage deep reduction gearing (LO RANGE AND HI RANGE) When AIR is applied to the valve piston top side through the signal line, the piston moves down to cut off the air supplied to the cylinder piston backside. This air is exhausted out the cover bottom port when CONSTANT AIR supplied from the regulator is directed to the cylinder piston frontside, moving the yoke bar rearward to engage deep reduction gearing

DEEP REDUCTION



AIR SYSTEM

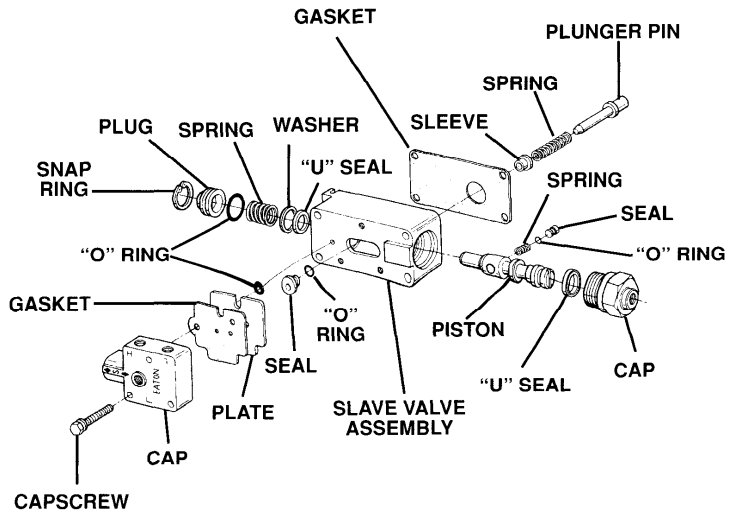
AIR FILTER/REGULATOR ASSEMBLY



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 humid conditions. Replace if necessary.

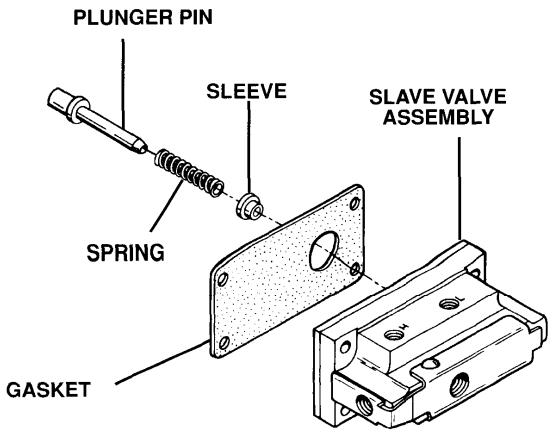
SLAVE VALVES

Piston-Type



Cut 6161-6/84

Poppet-Type

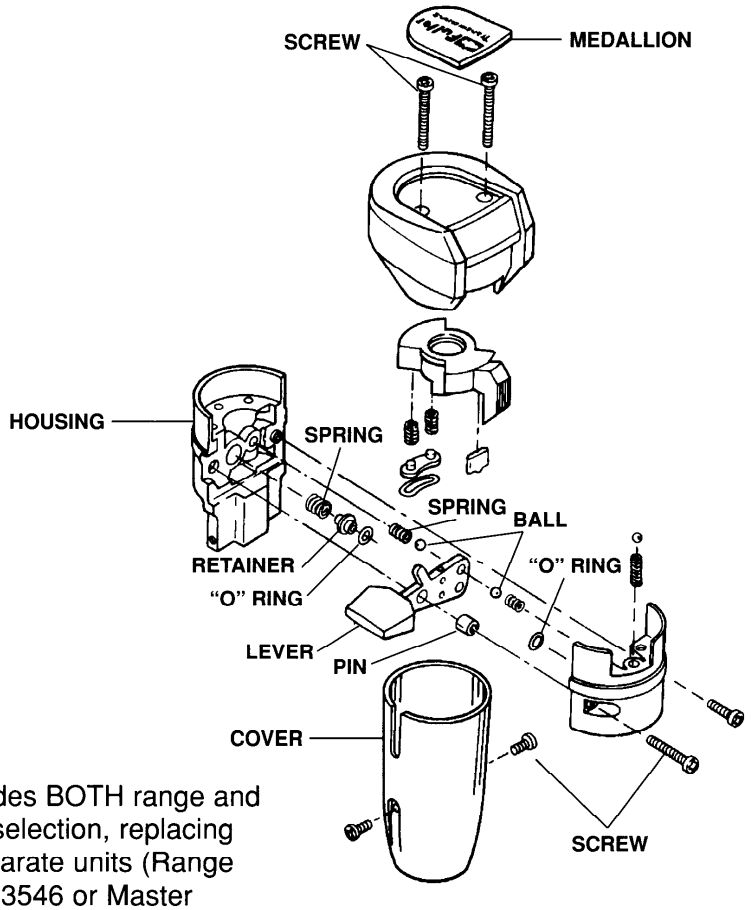


Cut 6090 G-8/84

See 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 the transmission will cause hard shifting in LO Range gear.

AIR SYSTEM

ROADRANGER VALVE -5015



NOTE: This valve provides BOTH range and deep reduction selection, replacing the need for separate units (Range Control Valve A-3546 or Master Control Valve A-5010 with Dash-mounted Deep Reduction Valve).

Cut 6147A - 11/83

Removal and Disassembly

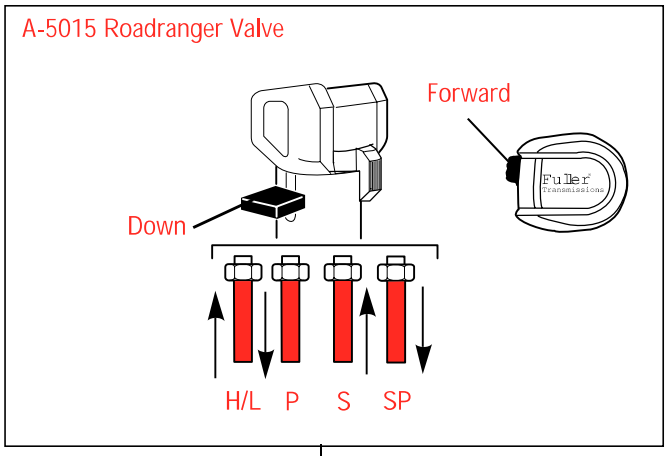
1. Remove two screws holding the bottom cover to the valve and slide the cover down the gearshift lever to expose the air line fittings.
2. Loosen the jam nut and turn the control valve from the gear shift lever.
3. Pry the medallion from the recess in the top cover.
4. Remove the two screws to remove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

Reassembly and Installation

1. See 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 the control valve on the gear shift lever and tighten the jam nut.
3. Attach the air lines and reinstall the bottom cover.

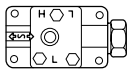
7608LL Models

Deep Reduction

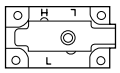


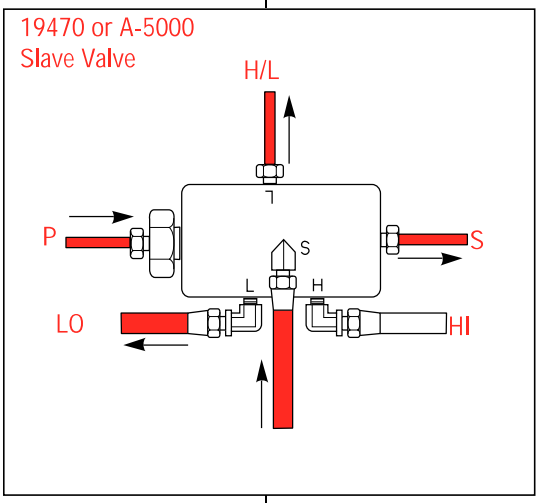
Slave Valve Identification

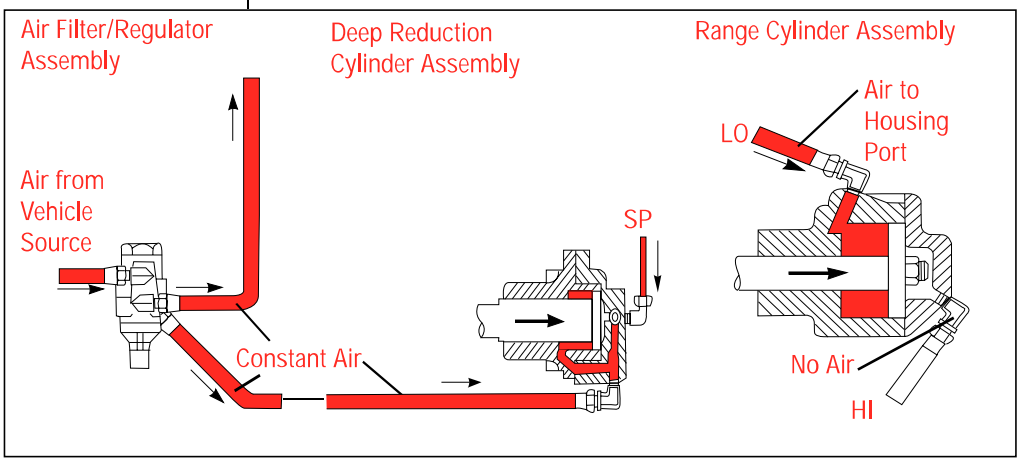
A-5000 Valve



19470 Valve





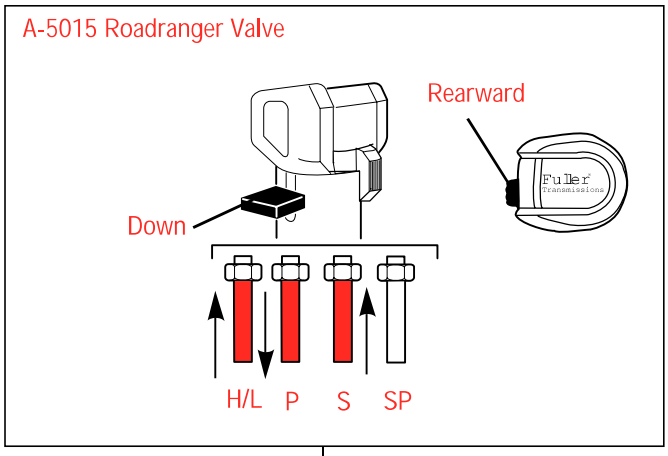


Schematic

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

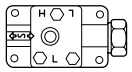
7608LL Models

Range—LO

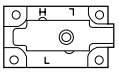


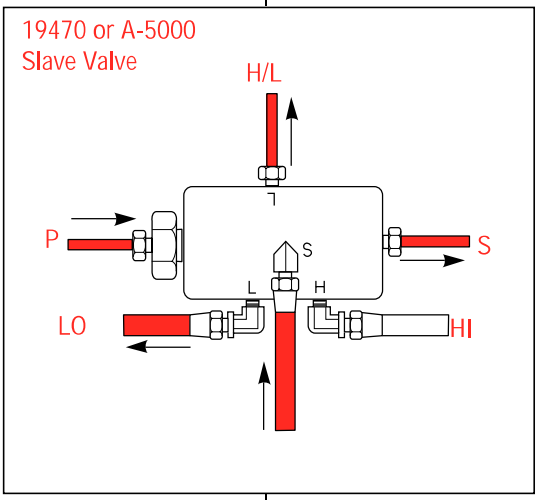
Slave Valve Identification

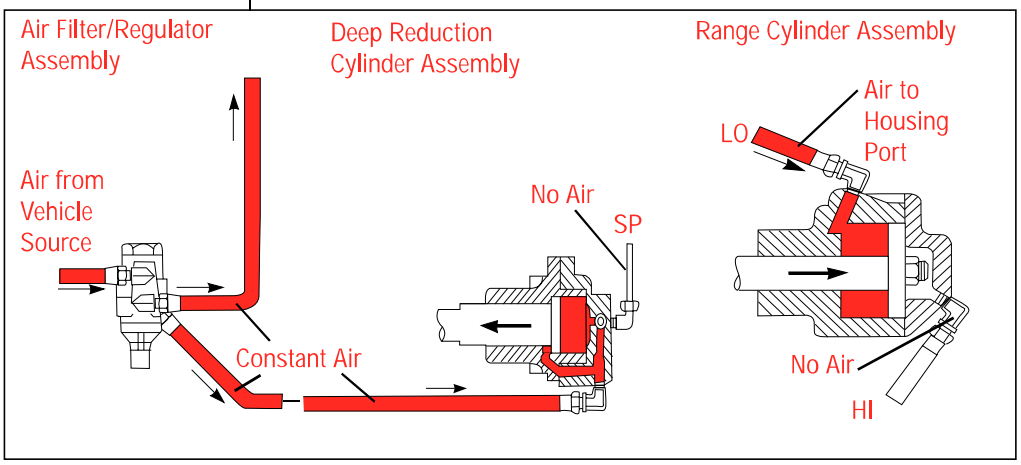
A-5000 Valve



19470 Valve





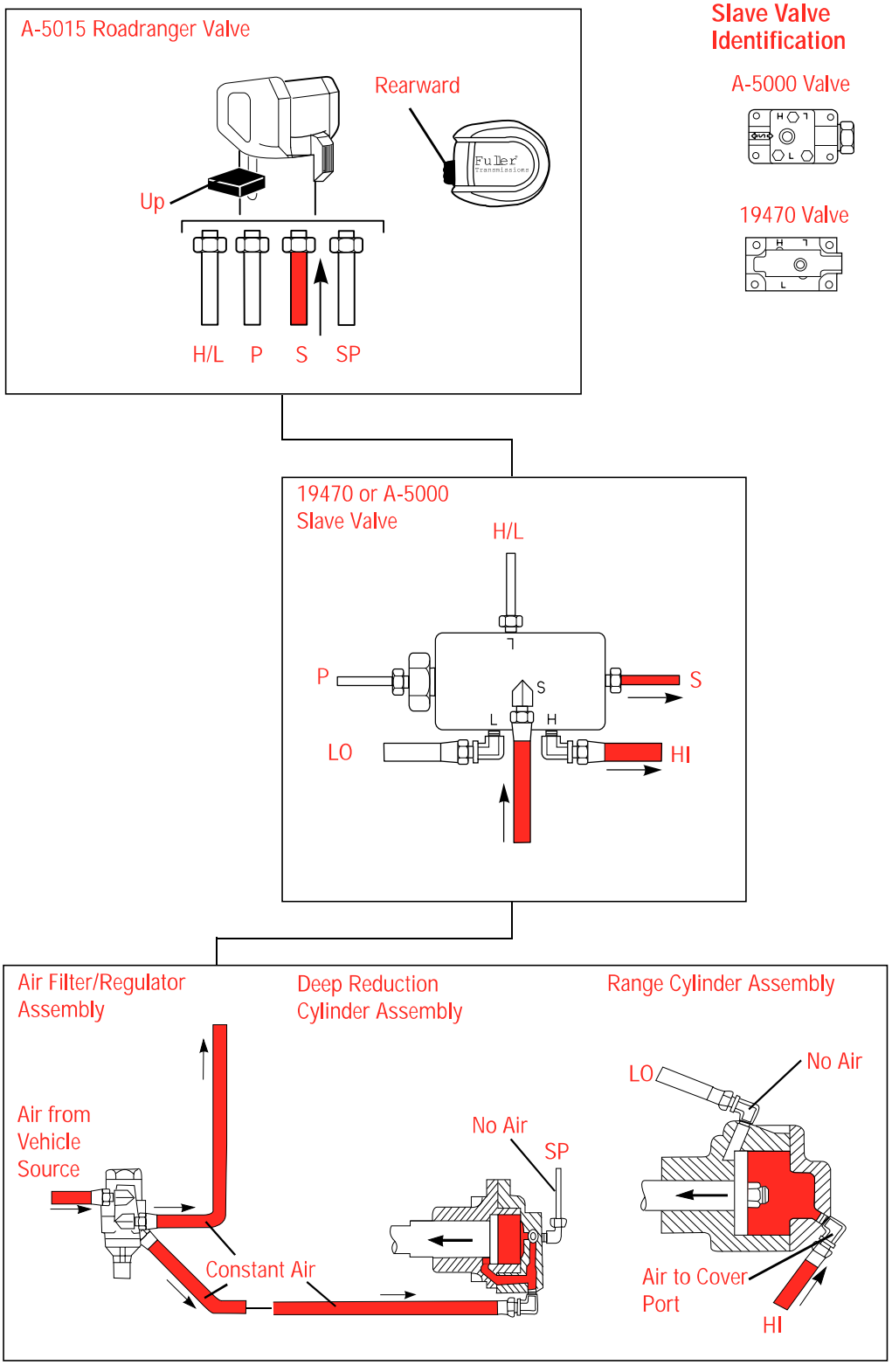


Schematic

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

7608LL Models

Range—HI

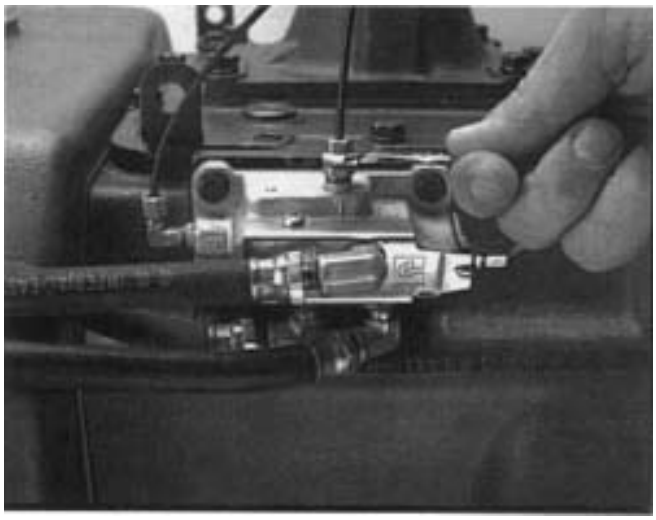


Schematic

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

REMOVAL - SHIFTING CONTROLS

A. Removal of the Air Hoses Roadranger valve, and Air Filter Regulator.



2. Disconnect the air line from the deep reduction cylinder cover.



2. Disconnect the air line from the deep reduction cylinder cover.



3. Remove the 2 Roadranger valve cover mounting screws and slide down the cover to expose 4 valve fittings for disconnection.



4. Disconnect the air lines from the roadranger valve.

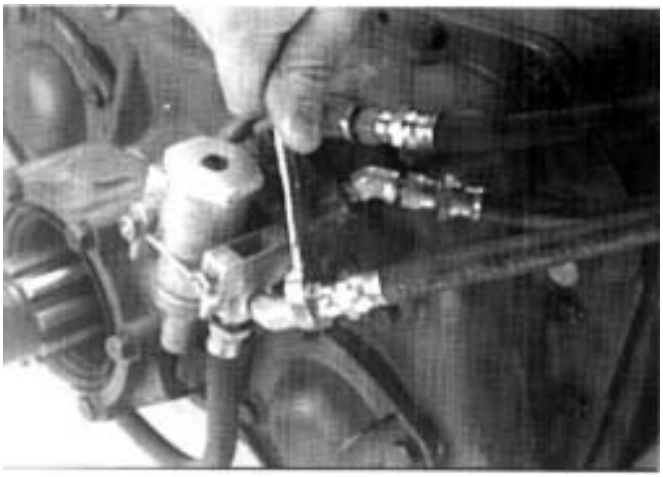


5. Loosen the jam nut and turn the Roadranger valve and nut from the gearshift lever. Remove the valve cover, air lines, sheathing, and O-rings from the gearshift lever..

REMOVAL - SHIFTING CONTROLS



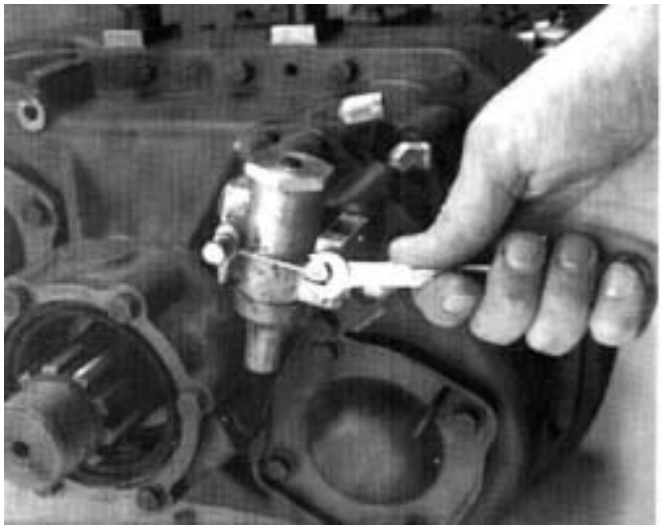
6. Disconnect and remove the salve valve 1/4" I.D. air supply base.



7. Disconnect and remove the air filter/regulator assembly 1/4" I.D. air supply base.



8. Disconnect the 1/4" I.D. air hose between the air filter/regulator assembly and the deep reduction cylinder.



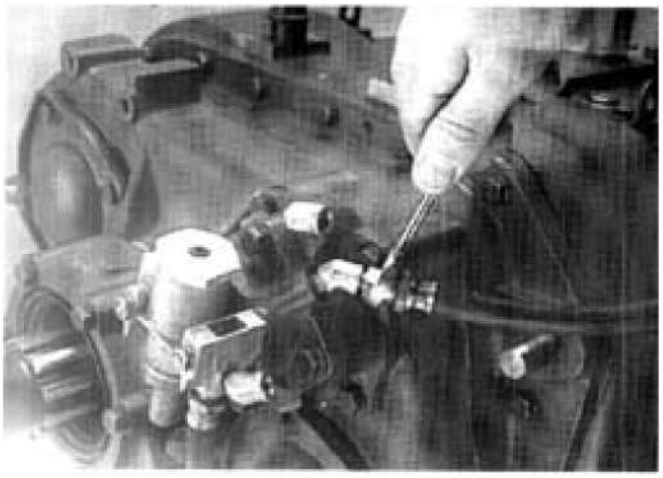
9. Remove the 2 capscrews and remove the air filter/regulator assembly.

NOTE: For disassembly and reassembly of the Air Filter/Regulator Assembly, see Page 25.



10. Disconnect and remove the slave valve "H" 1/4" I.D. air hose.

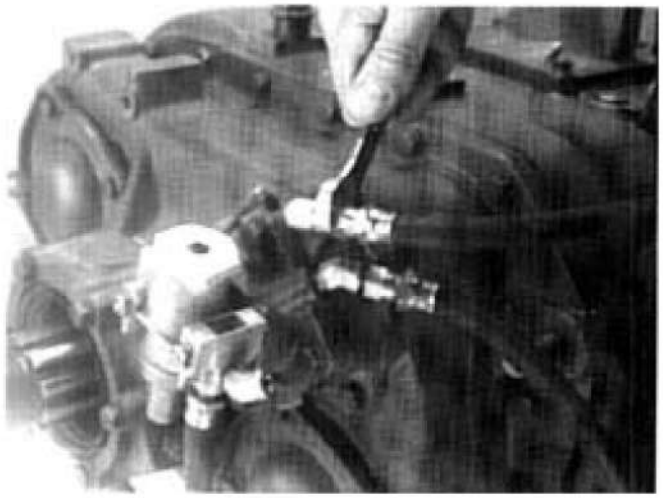
REMOVAL - SHIFTING CONTROLS



11. Disconnect and remove the HI Range Port 1/4" I.D. air hose.

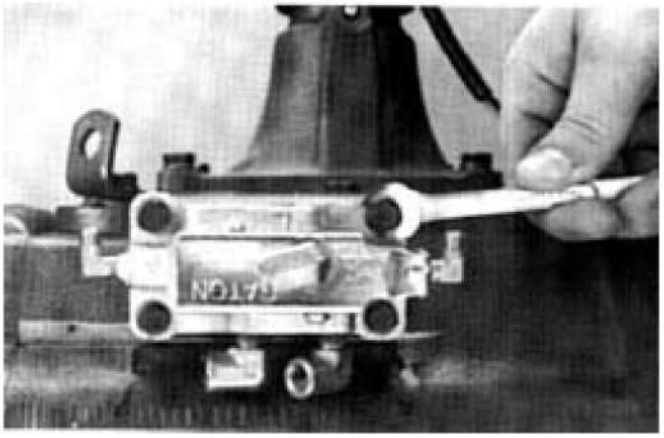


12. Disconnect and remove the slave valve "L" 1/4" I.D. air hose.

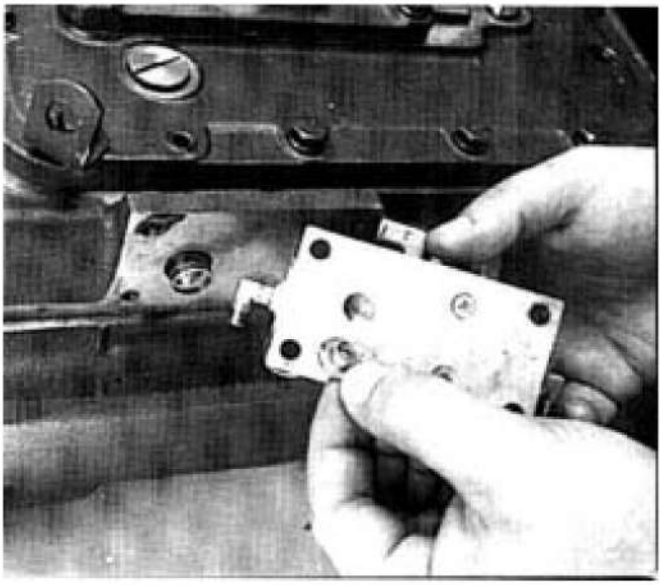


13. Disconnect and remove the LO Range Port 1/4" I.D. air hose located in the range cylinder cover.

B. Removal of the Slave Valve



1. Remove the 4 capscrews, and remove the slave valve and gasket from the transmission case.

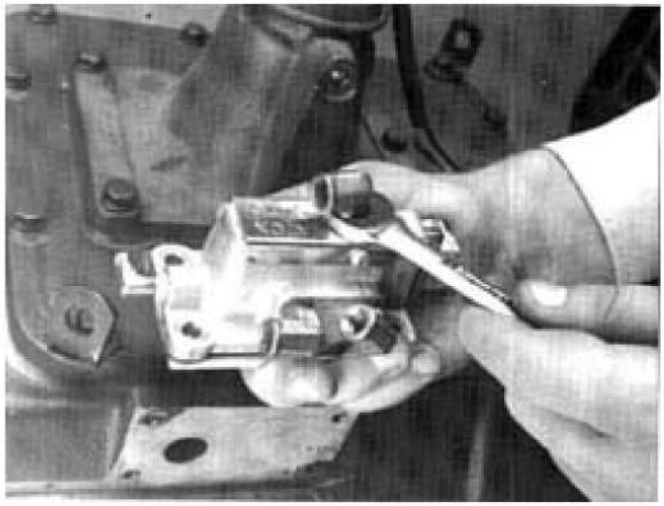


2. Remove the hat-type alignment sleeve from the slave bore.

REMOVAL - SHIFTING CONTROLS



3. Remove the spring and plunger pin from the transmission case bore.



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

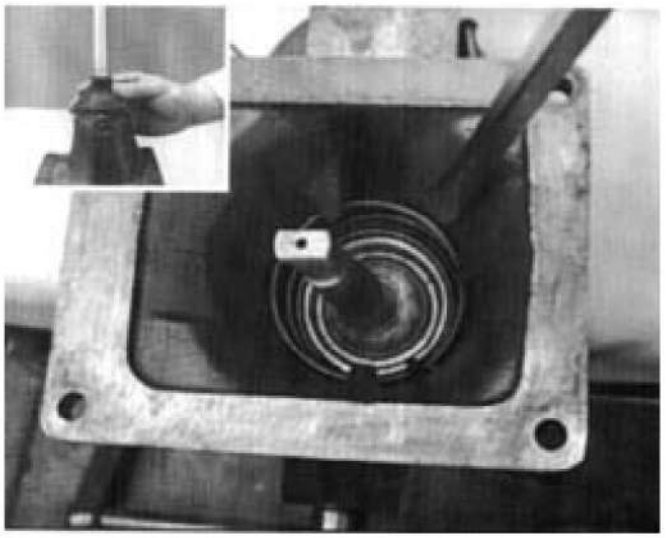
NOTE: For disassembly and reassembly of the A-5000 Slave Valve see page 25, 19470 Slave Valve is non-serviceable.

C. Removal and Disassembly of the Gear Shift Lever



1. Remove the 4 retaining capscrews, jar the top to break the gasket seal. Remove the gear shift lever housing and gasket.

NOTE: Remote control housings are removed from the shift bar housing in the same manner. For disassembly and reassembly of LRC, and SRC see Illustrated Parts List P-599.

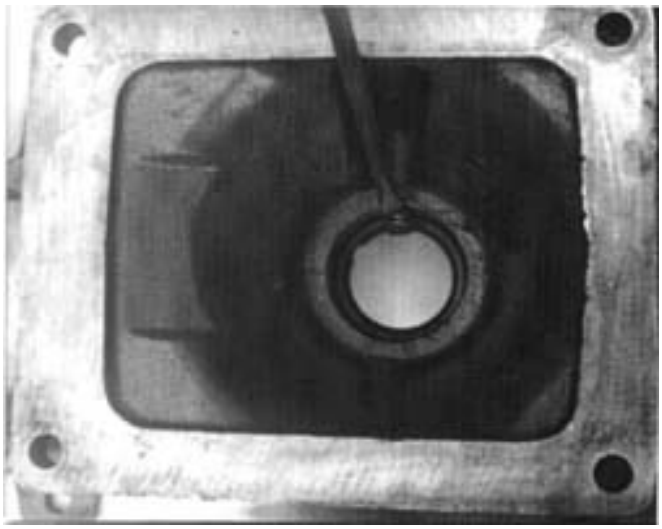


2. Remove the boot from the gear shift lever (inset) and secure assembly in a vise with the housing bottom up. Use a large screwdriver to twist between the spring and housing, forcing the spring from under the lugs in the housing. Do one coil at a time.

REMOVAL - SHIFTING CONTROLS



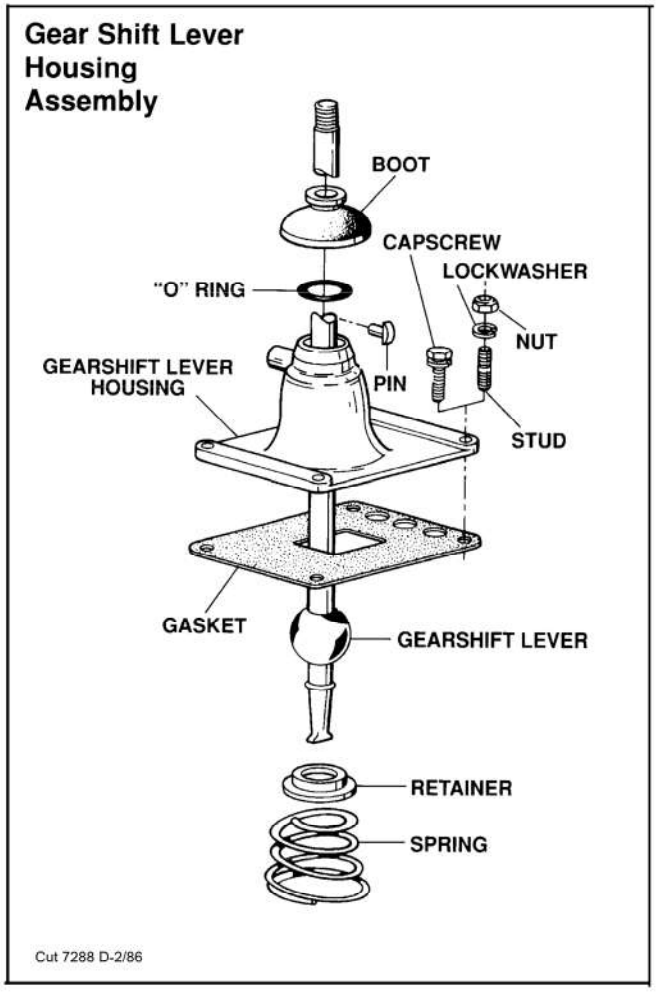
3. Remove the tension spring, washer, and gear shift lever from the housing.

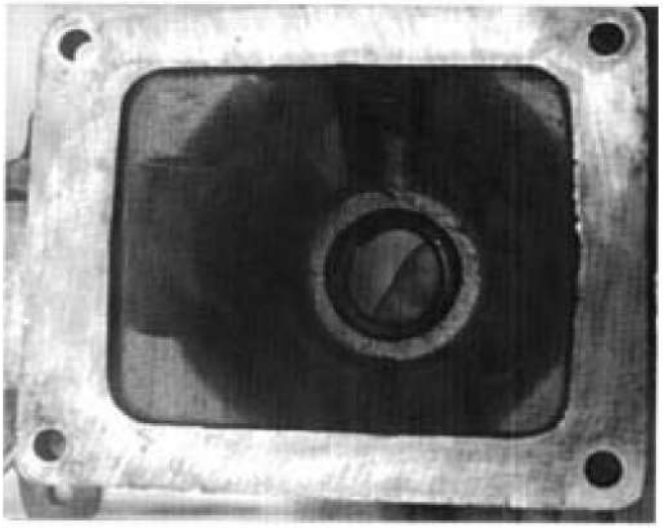


4. Remove the spade pin from the housing bore tower. If necessary, remove the O-ring from the tower groove.

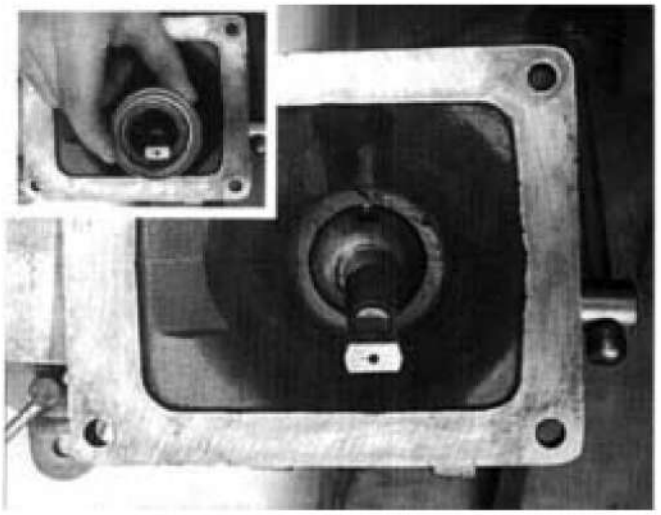
REASSEMBLY - SHIFTING CONTROLS

D. Reassembly of the Gear Shift Lever

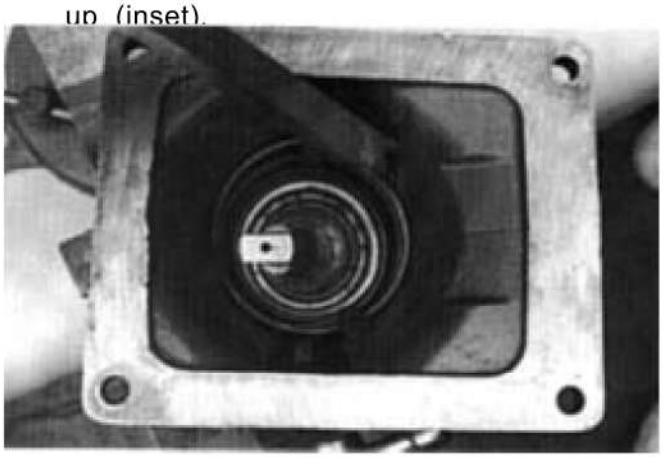




1. Secure the gear shift lever housing in a vise. Install the spade pin in the housing tower bore. If previously removed, install the O-ring in the tower groove.



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



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

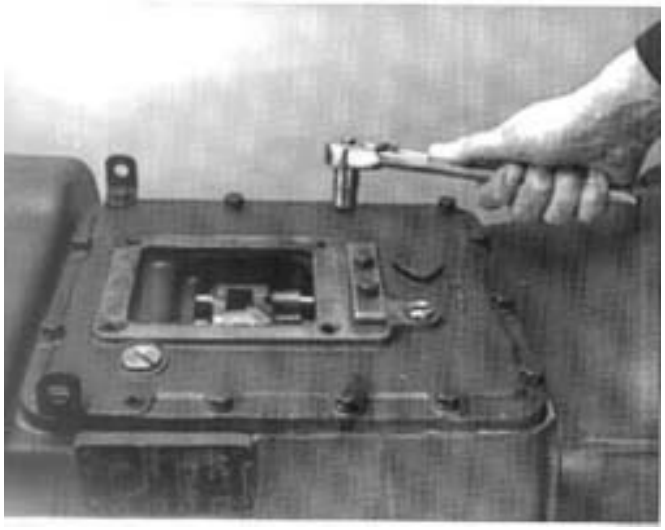


4. Remove the assembly from the vise. Install the rubber boot over the gear shift lever and against the housing.

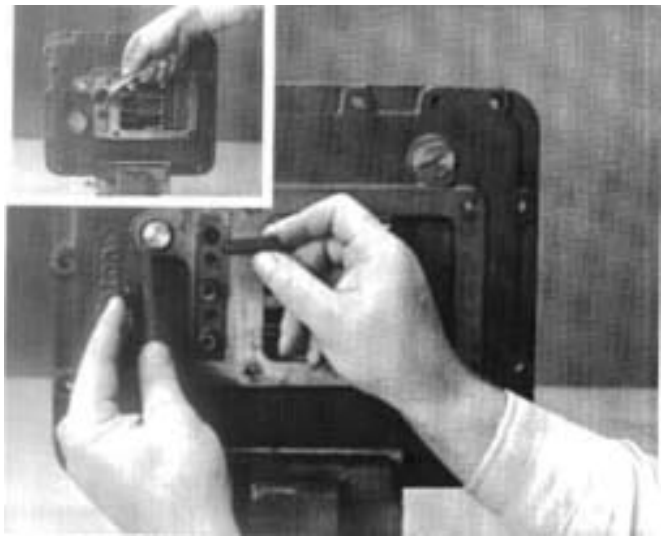
DISASSEMBLY - SHIFT BAR HOUSING

A. Removal and Disassembly of the Shift Bar Housing

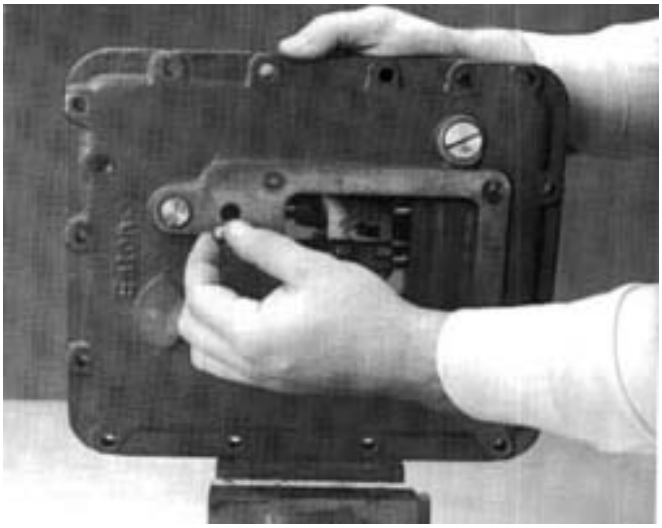
NOTE: During disassembly, lay all parts on a clean bench in the order they are removed. This makes reassembly easier. Shift bars not being removed MUST be kept in the neutral position or the interlock parts will lock the bars. For disassembly and reassembly of "X" and "F" model assemblies, see the Illustrated Parts List.



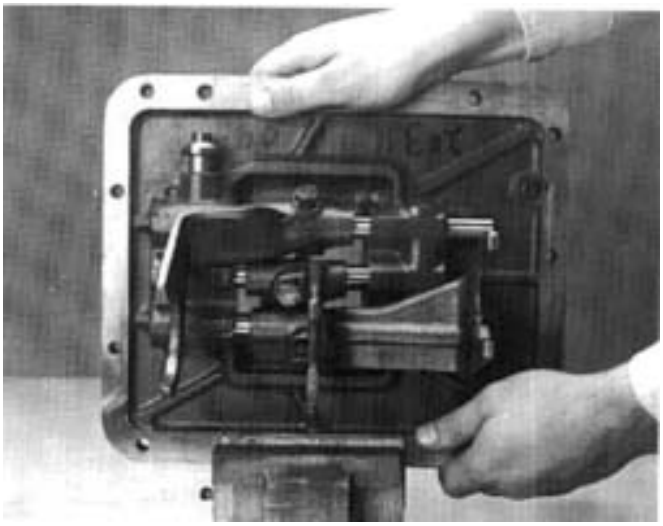
1. Remove the retaining capscrews. Jar the top to break the gasket seal and lift the shift bar housing from the transmission case. Remove the gasket.



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



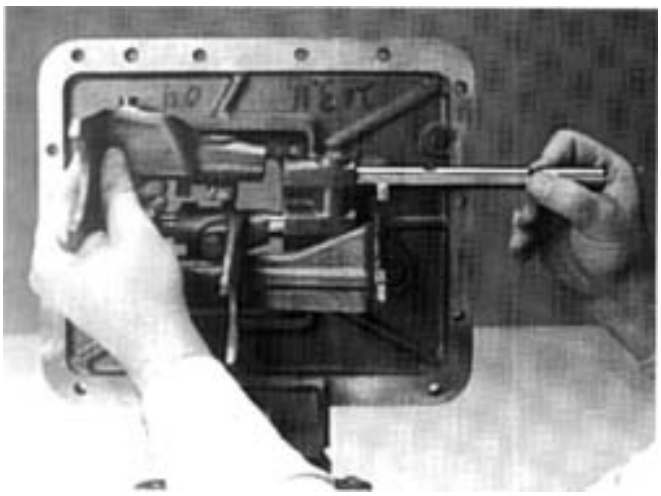
3. Tilt the assembly and remove the *3* detent balls from the housing bores.



4. Secure the assembly in a vise with the plunger-side up. (The housing front will be to the right.) For models so equipped, cut the lockwire and remove the retaining capscrews to remove the oil trough from the shift bar housing.

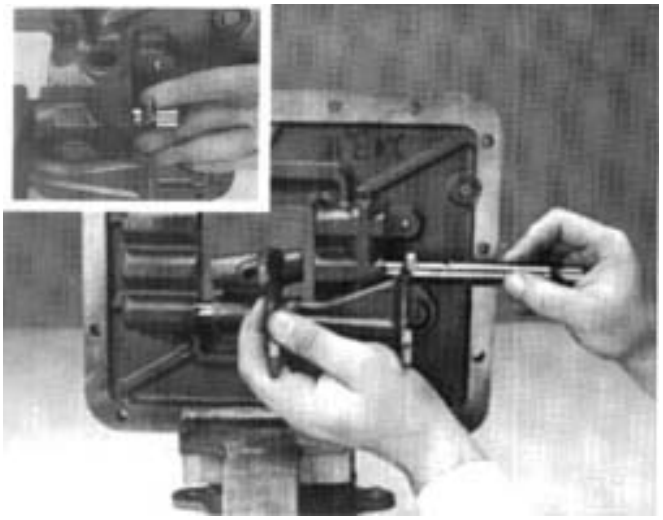
NOTE: When removing the shift bars, start with the upper shift bar, move all the bars to the right and out the rear boss bore. Cut the lockwire and remove the lockscrews from each bar just before their removal.

DISASSEMBLY - SHIFT BAR HOUSING

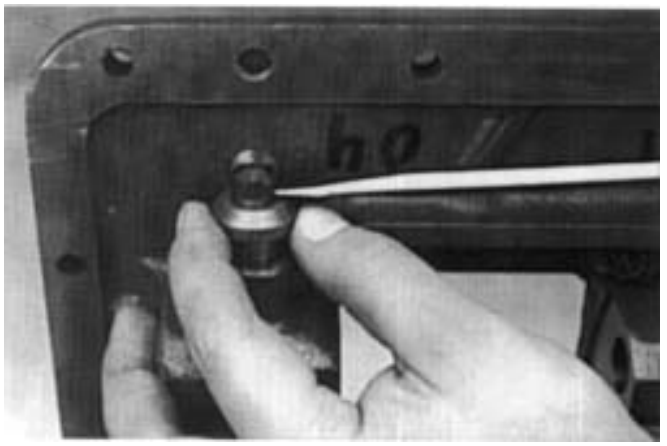


5. Move Lo-Reverse bar to the right and out of housing, removing the shift yoke bar.

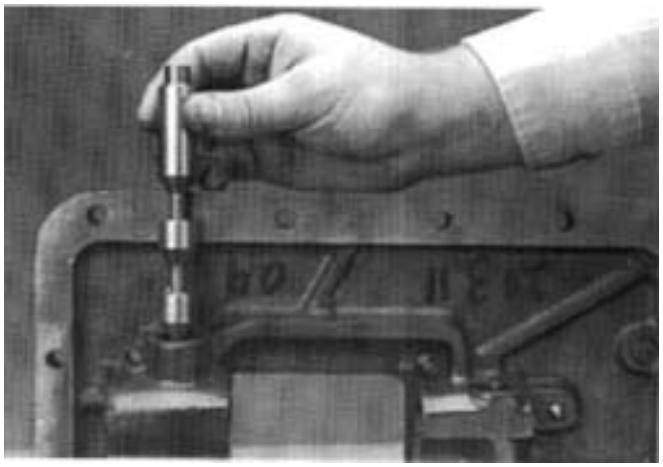
NOTE: During disassembly, lay all parts on a clean bench in the order of removal to facilitate reassembly. Bars not being removed must be kept in the neutral position or interlock parts will lock bars.



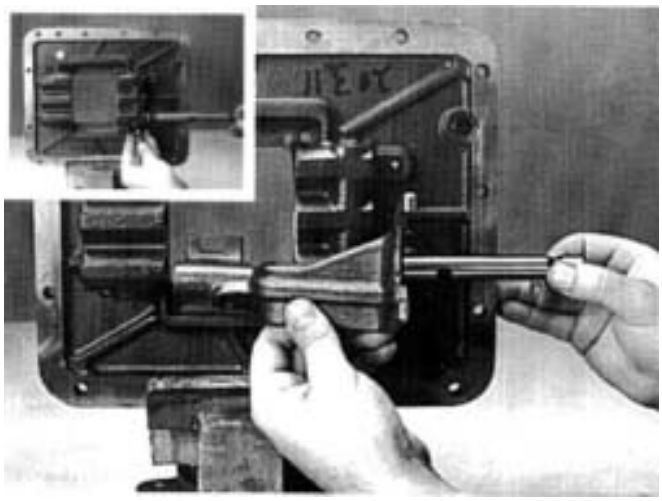
6. Move the 1st-2nd yoke bar to right and out of housing, removing shift yoke from bar. As the neutral notch in bar clears the front web, remove the interlock pin from bore in neutral notch (inset).



7. Remove clip and actuating ring from air valve shaft.



8. Remove the air valve shaft from rear web.



9. 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).

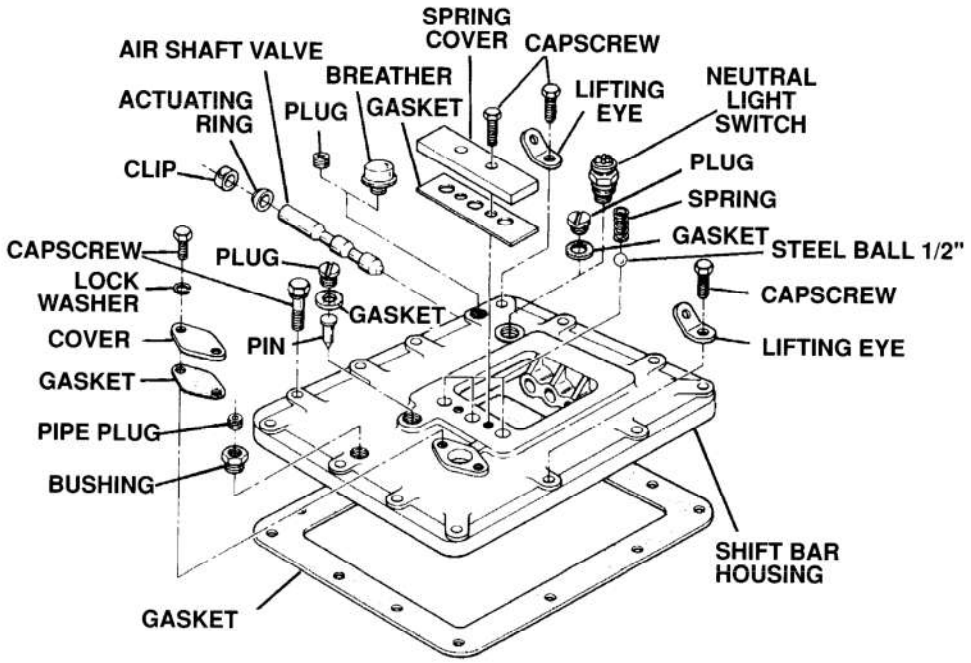
DISASSEMBLY - SHIM BAR HOUSING



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

REASSEMBLY - SHIFT BAR HOUSING

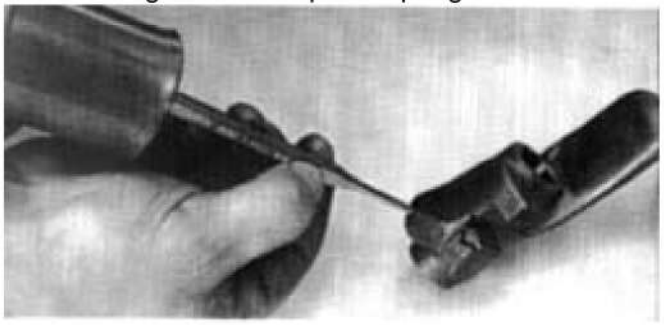
B. Reassembly of the Shift Bar Housing



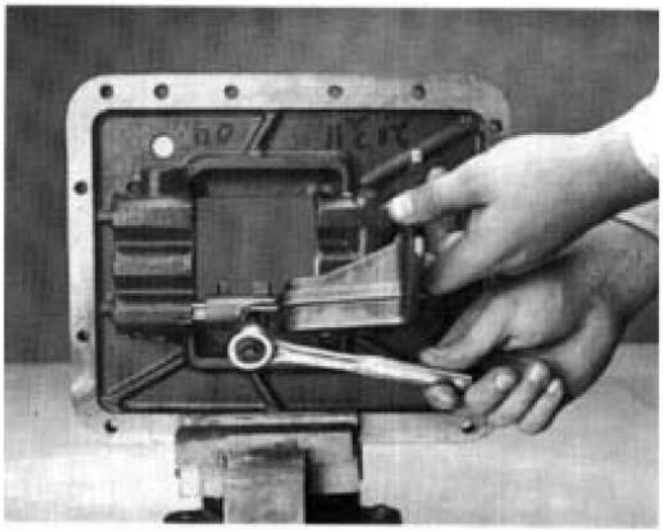
Cût 6227-1/88



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.



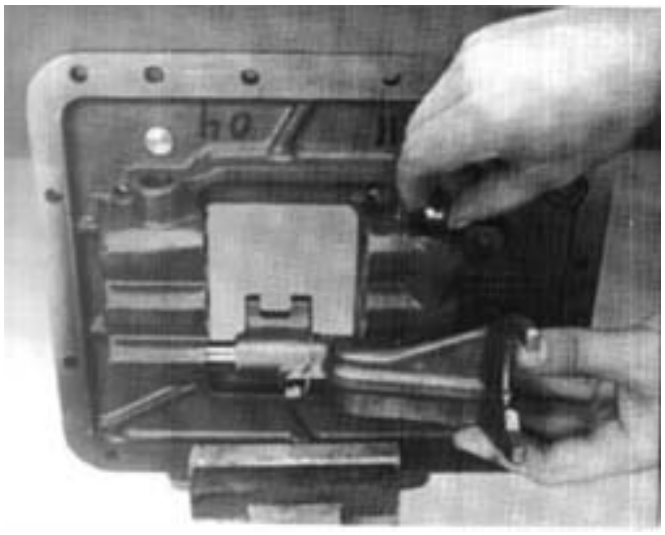
2. Back the plug out 1-1/2 turns and stake plug through the small hole in yoke.



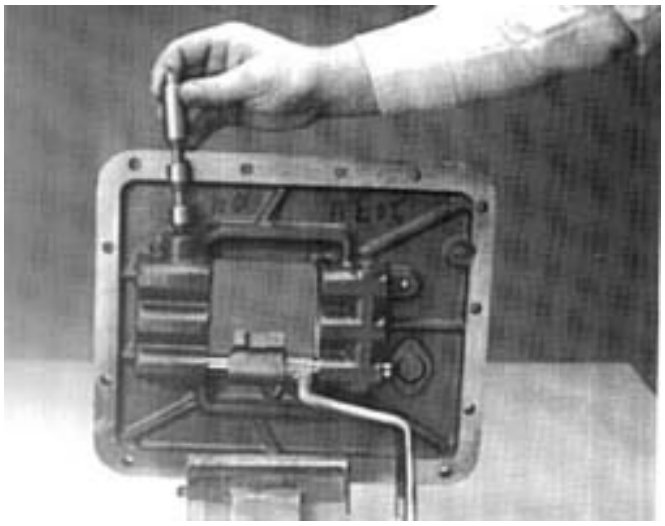
3. Place the housing in a vise with the front of housing to the right as shown. Install the 3rd-4th speed shift bar in bottom bore with detent notches to the front, installing yoke, lockscrew, and safety wire.

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.

REASSEMBLY - SHIFT BAR HOUSING



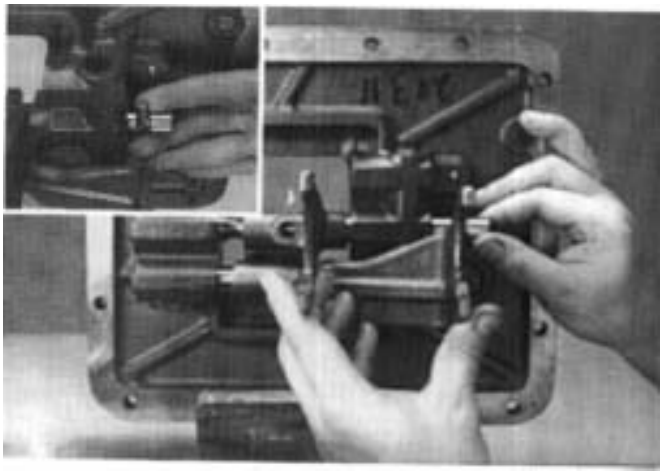
4. Install interlock ball in front web vertical bore.



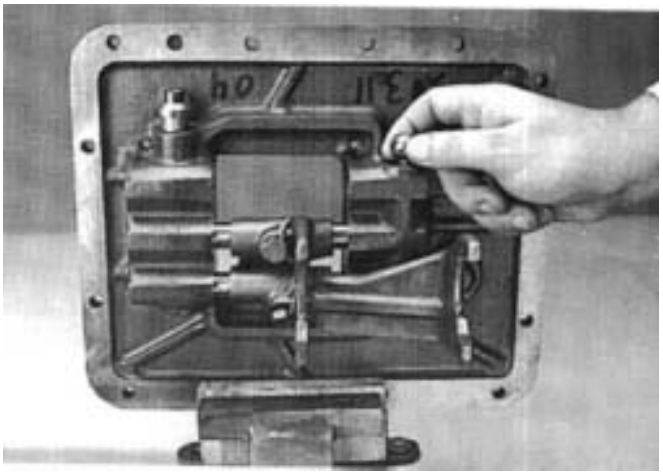
5. Install air valve shaft in rear web vertical bore.



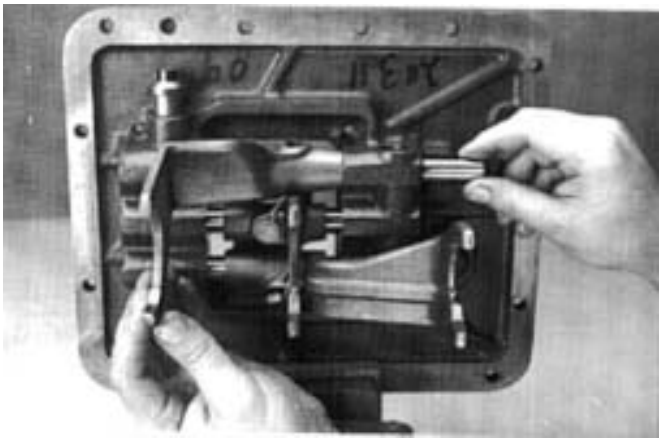
6. Install actuating ring clip in air valve shaft.



7. 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.

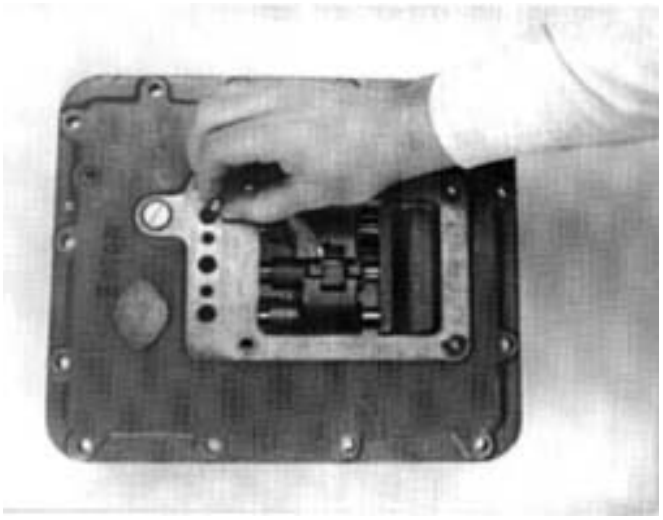


8. Install interlock ball in front web vertical bore.

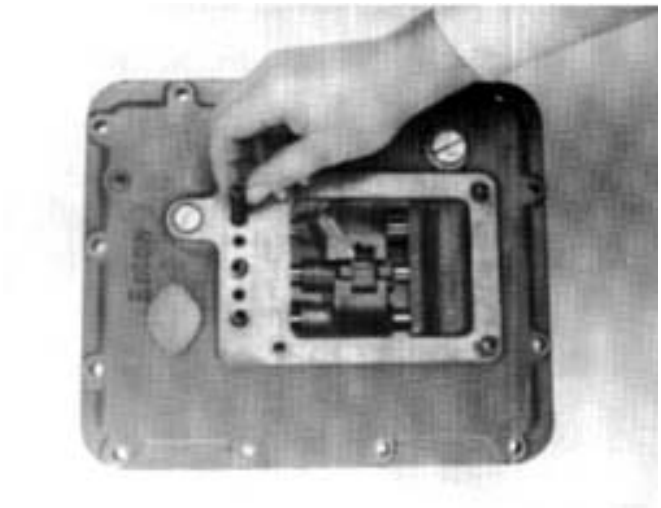


9. Install Lo-reverse shift bar in upper bore, detent notches of the front, install yoke on bar, fork to the rear, install lockscrew and safety wire.

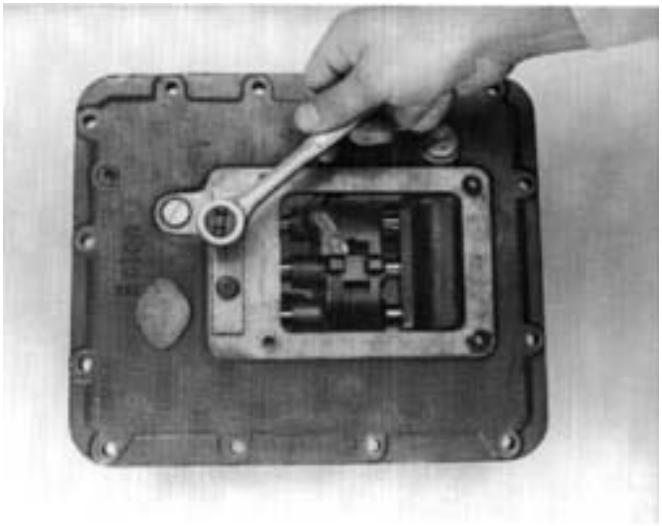
REASSEMBLY - SHIFT BAR HOUSING



10. Remove assembly from vise and install the 3 detent balls, one in each bore in top of housing. Keep yokes in neutral.



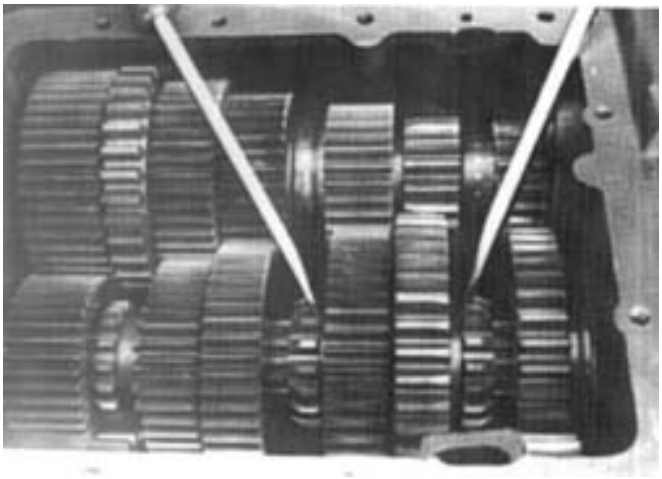
11. Install the 3 tension springs, one in each bore, in housing top.



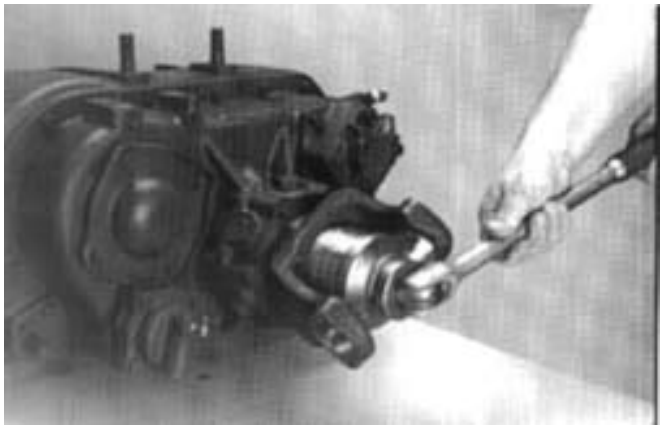
12. Install the tension spring cover. Tighten the 2 capscrews to recommended torque.

REMOVAL - OUTPUT YOKE

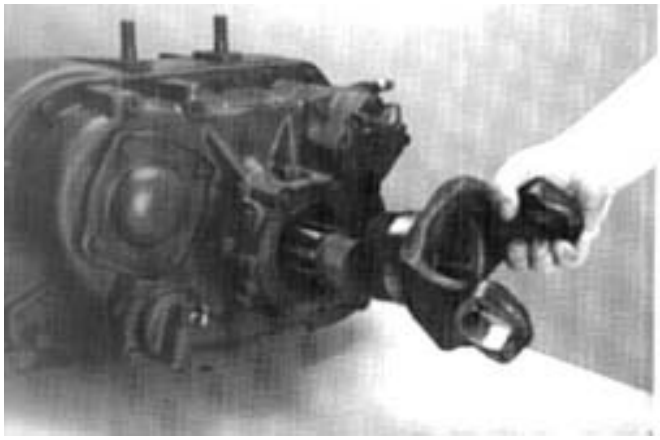
A. Removal of the Output Yoke



1. Lock the transmission by engaging the two mainshaft gears with the mainshaft sliding clutches.



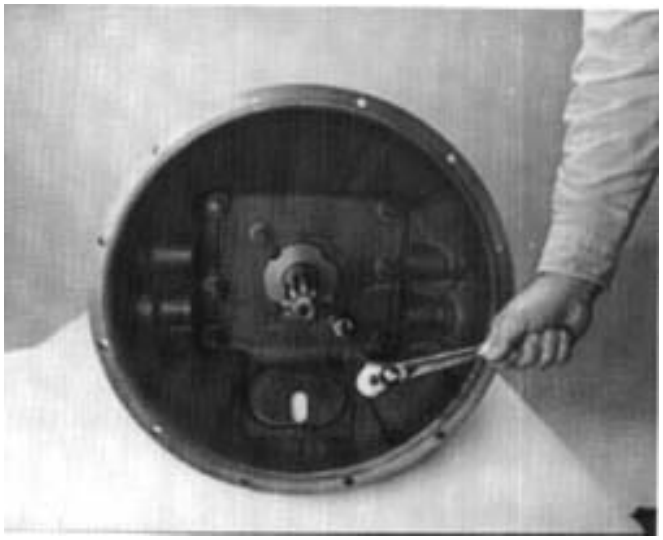
2. Use a large breaker bar to turn the output shaft nut from the output shaft.



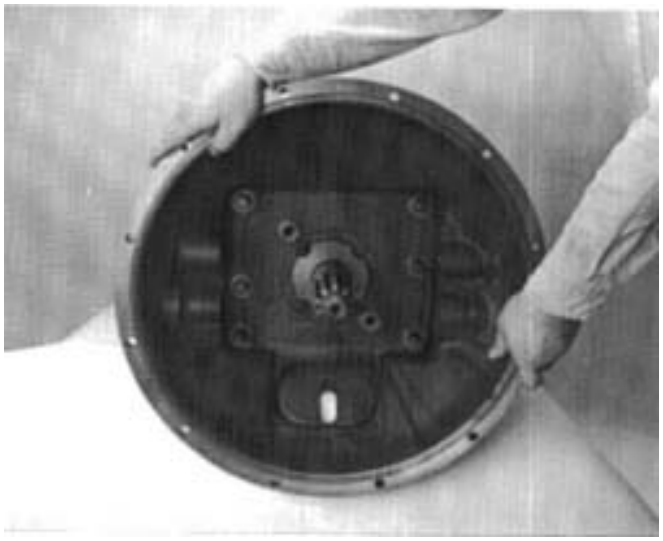
3. Pull the yoke straight to the rear and off the output shaft.

B. Removal of the Clutch Housing

NOTE: From models so equipped remove the clutch release mechanism and/or the clutch brake assembly.



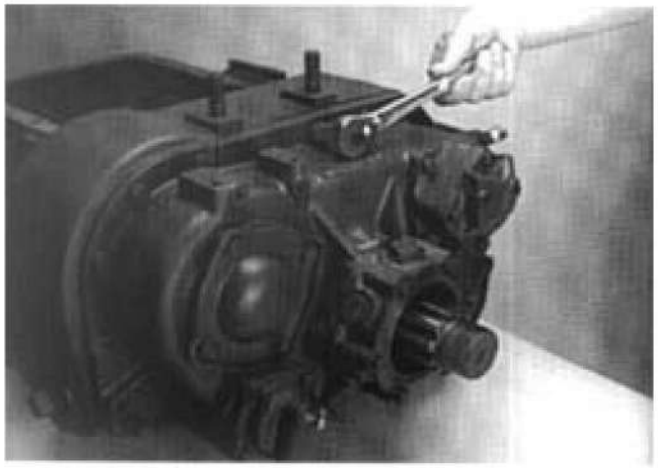
1. Remove the 2 capscrews and the 6 nuts with lockwashers that hold the clutch housing to the transmission case.



2. Jar the clutch housing with a rubber mallet to break the gasket seal. Pull the clutch housing from the transmission case.

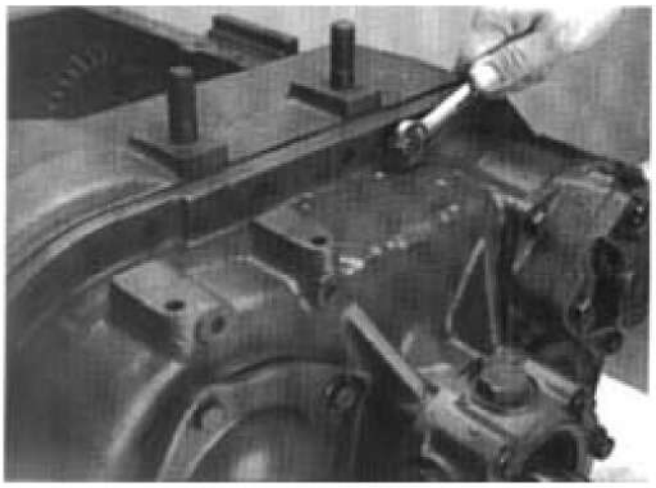
REMOVAL - AUXILIARY SECTION

C. Removal of the Auxiliary Section

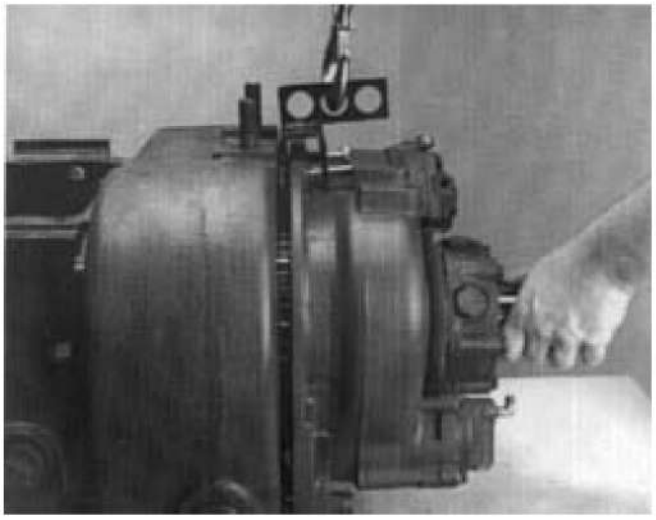


1. Remove the 15 capscrews that hold the auxiliary section to the transmission case.

NOTE: There are 3 capscrew lengths. Note their locations.

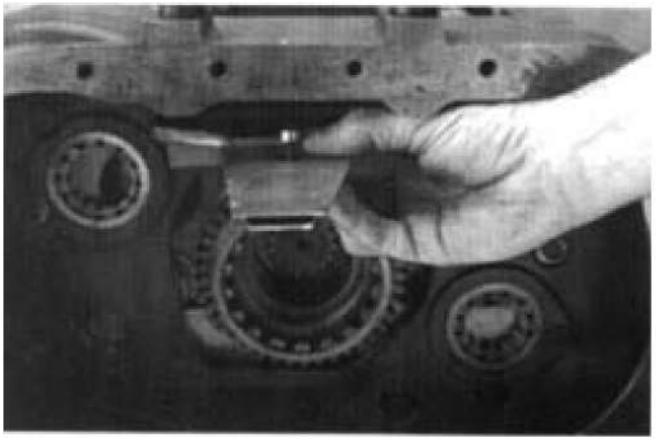


2. Insert 3 capscrews in the housing flange tapped holes. Tighten evenly to move the auxiliary section back; leave a space wide enough to attach auxiliary section hanger bracket.



3. Remove the puller screws and attach a chain hoist to the auxiliary section. Pull the auxiliary section off and remove the gasket.

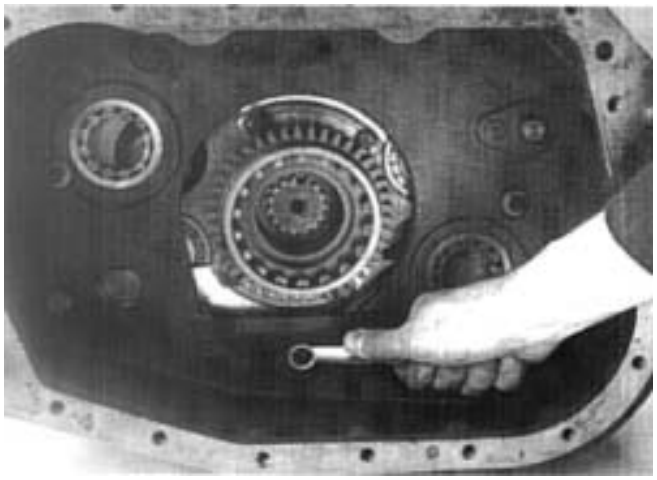
D. Removal of the Intermediate Housing



1. Remove the 3 capscrews and remove the oil trough from the intermediate housing.

NOTE: There is a spacer on the 7/16 capscrew, note its location for reassembly.

REMOVAL - AUXILIARY SECTION



2. Remove the remaining 12 capscrews and remove the intermediate housing from the transmission.

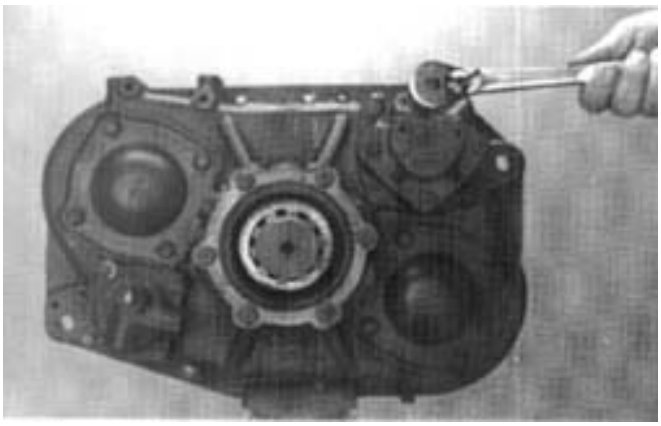


3. Locate and save the 2 inner auxiliary countershaft bearing spacers for reassembly the countershaft bearings may be removed for replacement at this time.

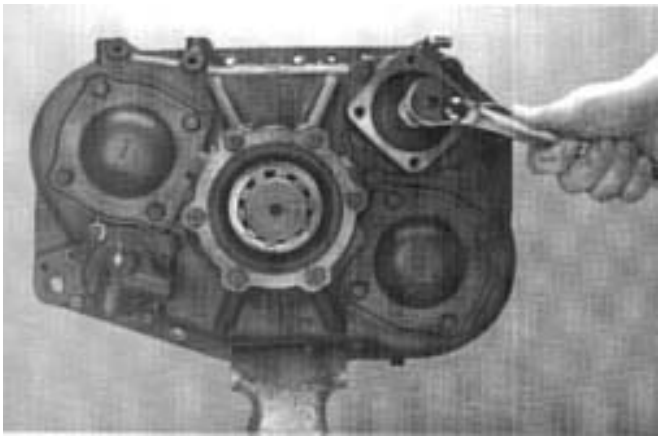
NOTE: These are spacers only and must be installed at time of reassembly.

DISASSEMBLY - AUXILIARY SECTION

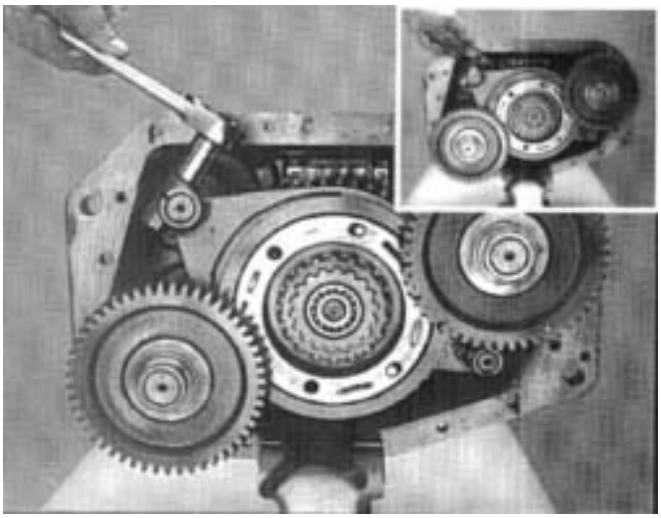
A. Removal and Disassembly of the Range Cylinder Assembly



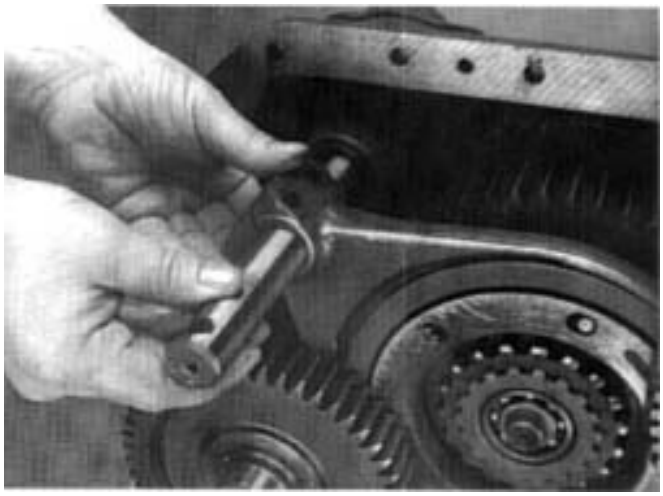
1. Secure the auxiliary housing in a vise. Remove the capscrews and the range cylinder cover and gasket.



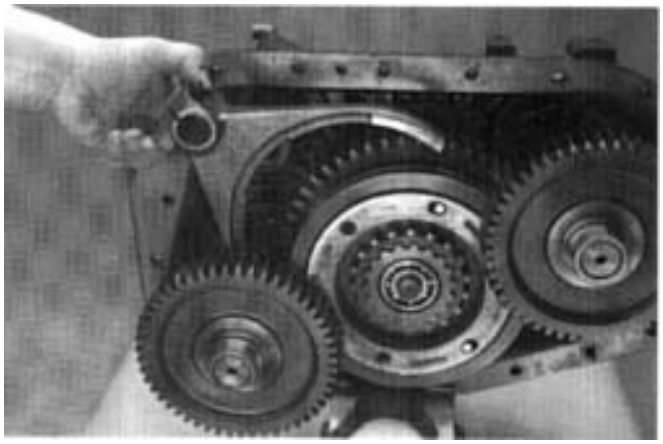
2. Remove the yoke bar nut and washer.



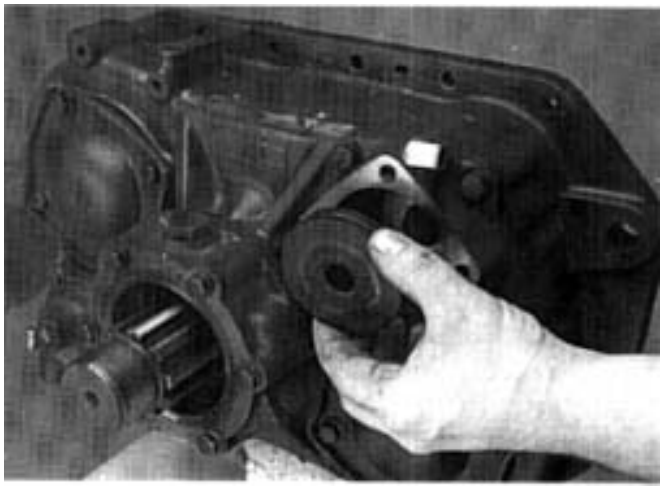
3. Cut the lockwire (inset) and remove the 2 yoke locksrews.



4. Remove the yoke bar from the cylinder housing bore.

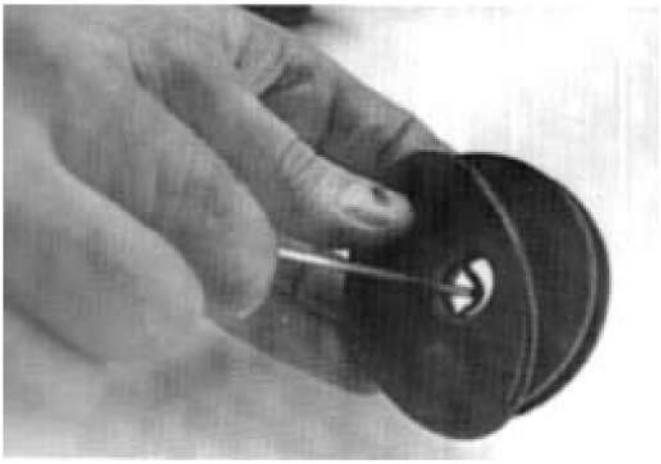


5. Remove the range yoke from the synchronizer assembly sliding clutch.

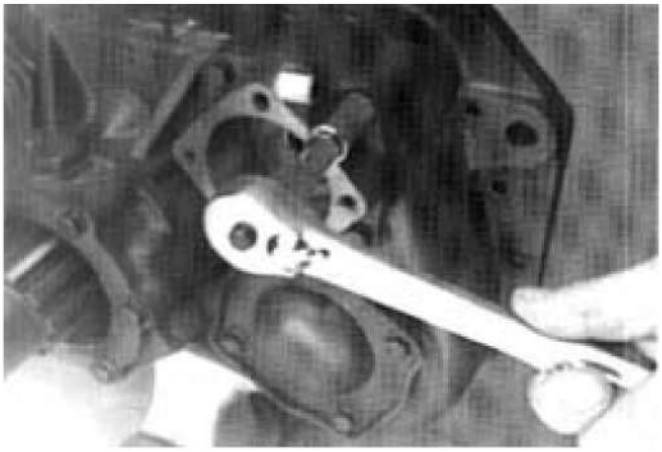


6. Remove the range piston from the cylinder bore.

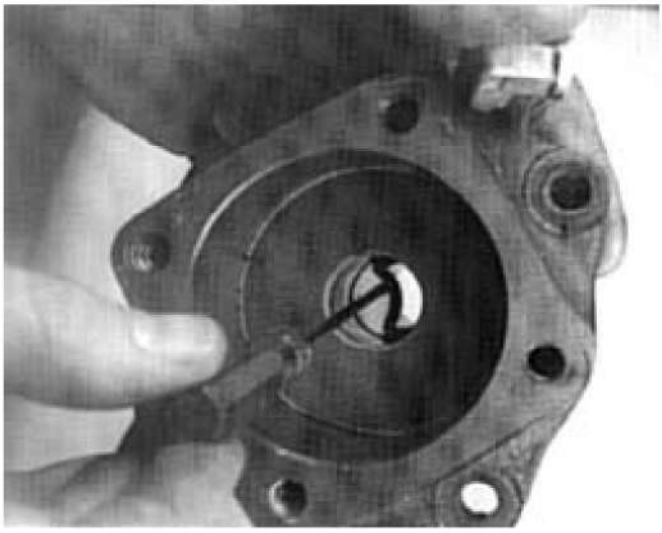
DISASSEMBLY - AUXILIARY SECTION



7. If necessary, remove the O-rings from the piston I.D. and O.D.

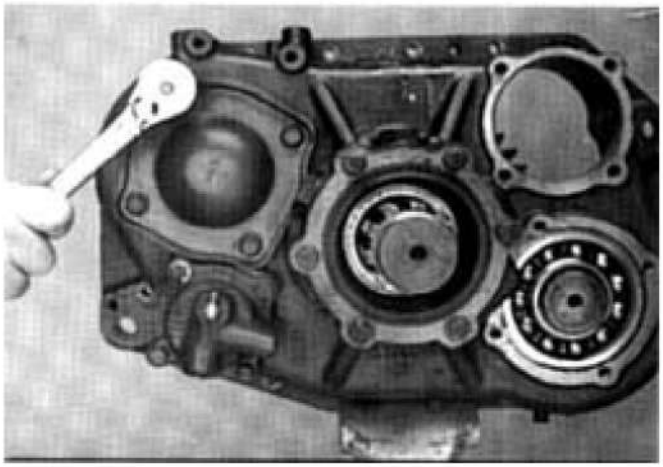


8. Remove the capscrews and range cylinder housing and gasket.



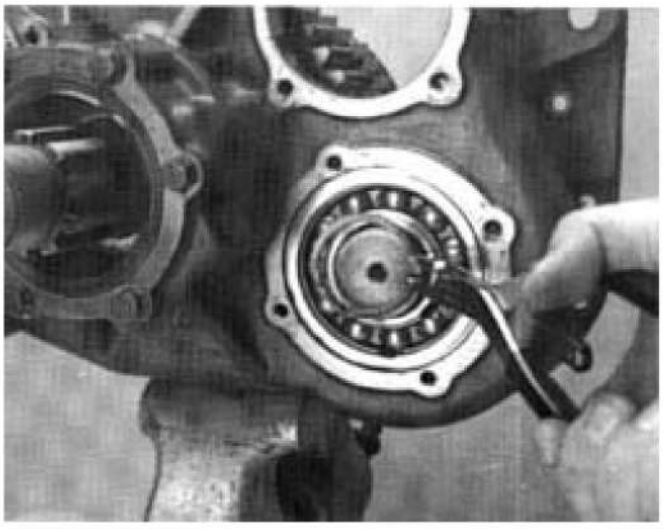
9. If necessary, remove the small O-ring from the housing bore groove.

B. Removal of the Auxiliary Countershaft Assemblies



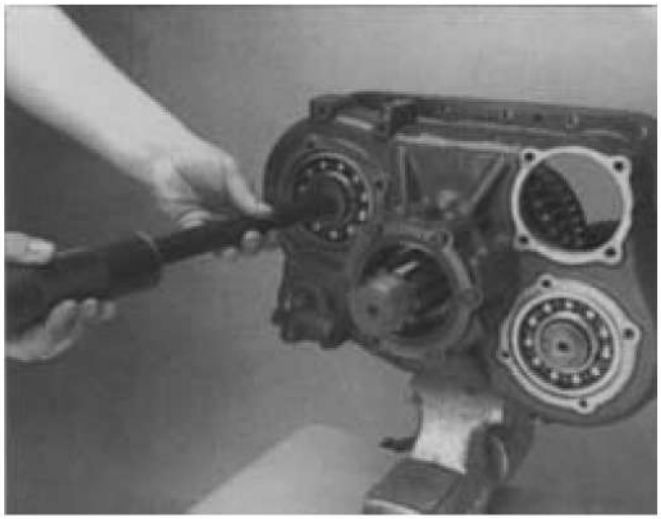
1. Remove the capscrews and both countershaft rear bearing covers.

NOTE: For removal and disassembly of models equipped with an Auxiliary Oil Pump Assembly on countershaft rear, see EATON® FULLER® Cooling & Lubrication Illustrated Parts List P-528.

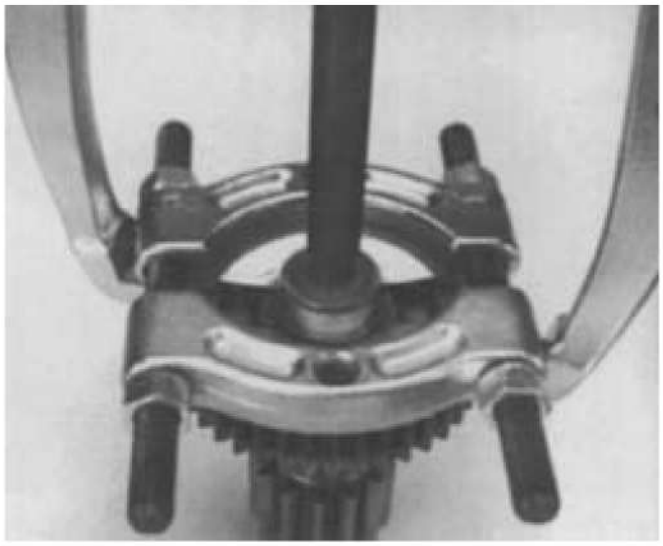


2. Remove the snap ring from each countershaft rear groove.

DISASSEMBLY - AUXILIARY SECTION



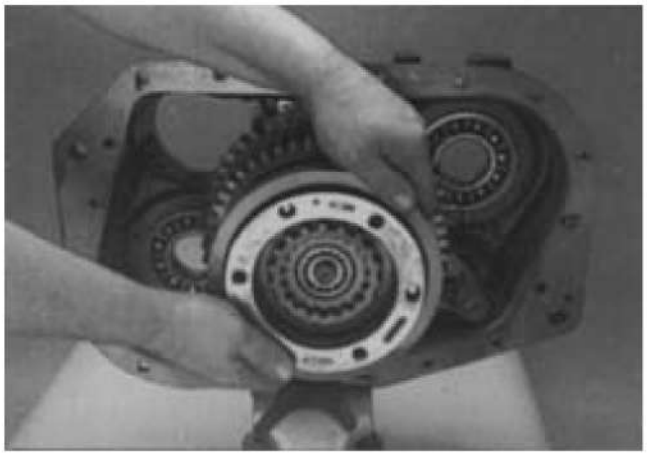
3. Using a soft bar and maul drive the countershaft forward through the countershaft bearings and remove them from the auxiliary housing.



4. If necessary, secure the countershaft assemblies in a vise and remove the bearing inner race from each countershaft front with jaw pullers.

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

C. Removal and Disassembly of the Synchronizer



1. Pull the synchronizer assembly off the range mainshaft splnes.



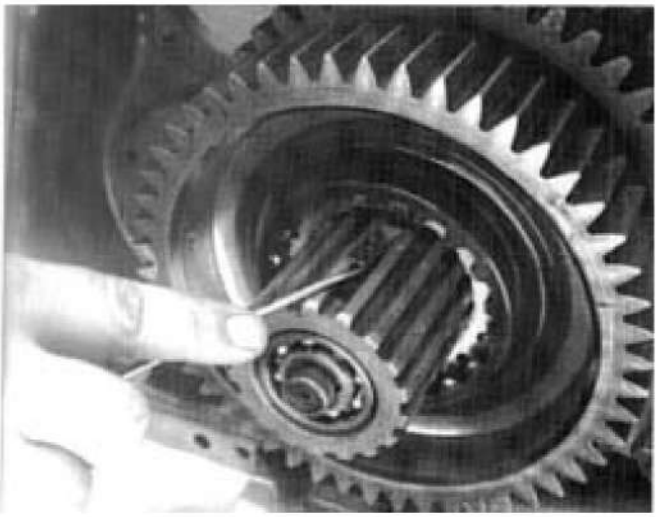
2. Place the larger LO Range synchronizer ring on the bench. Cover the assembly with a shop rag to prevent losing the three springs released from the HI Range synchronizer at the pin locations. Pull the HI Range synchronizer from the blocker pins.



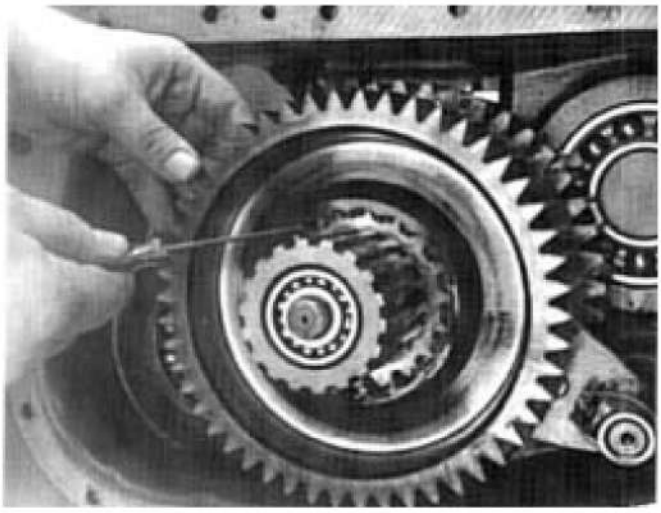
3. Remove the sliding clutch from the synchronizer LO Range pins.

DISASSEMBLY - AUXILIARY SECTION

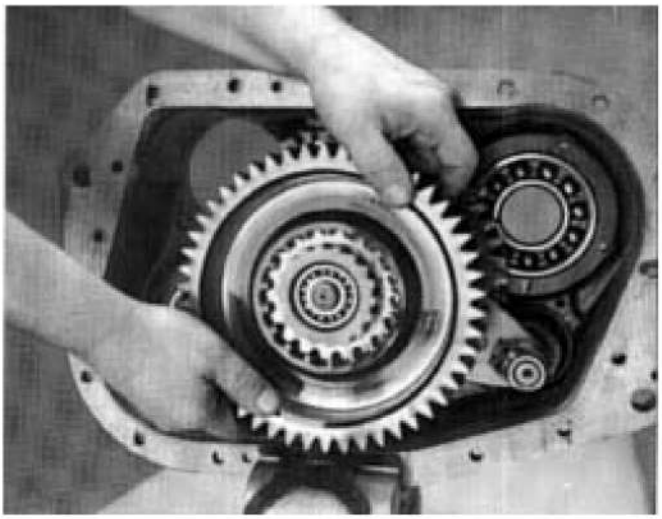
D. Removal of the LO Range Gear



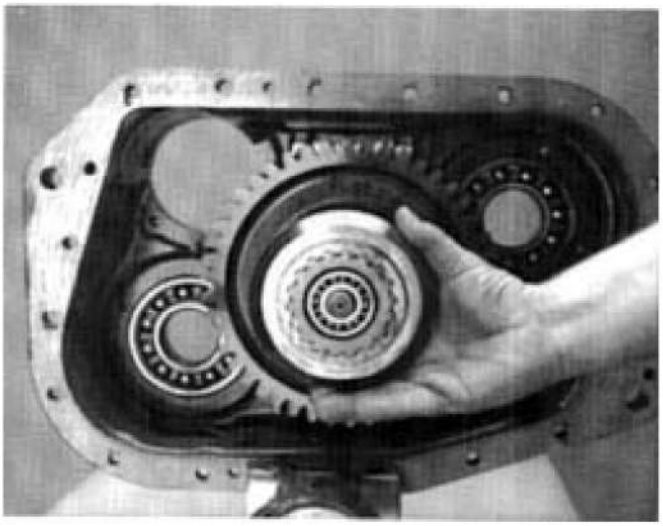
1. Remove the key from the range mainshaft keyway.



2. Turn the washer located in the LO range gear hub so the washer splines align with the mainshaft splines.



3. Pull the Lo range gear and washer from the range mainshaft splines.



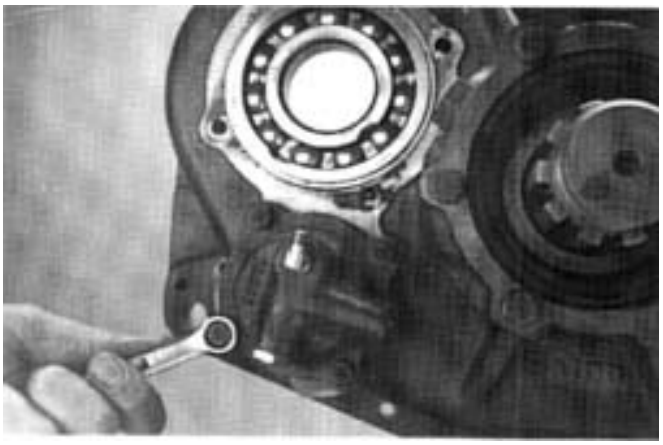
4. Remove the coupler from the range mainshaft splines.

DISASSEMBLY - AUXILIARY SECTION

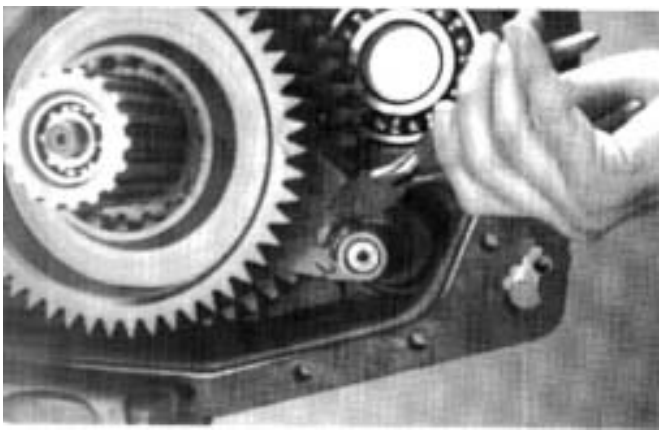
E. Removal and Disassembly of the Deep Reduction Cylinder Assembly.



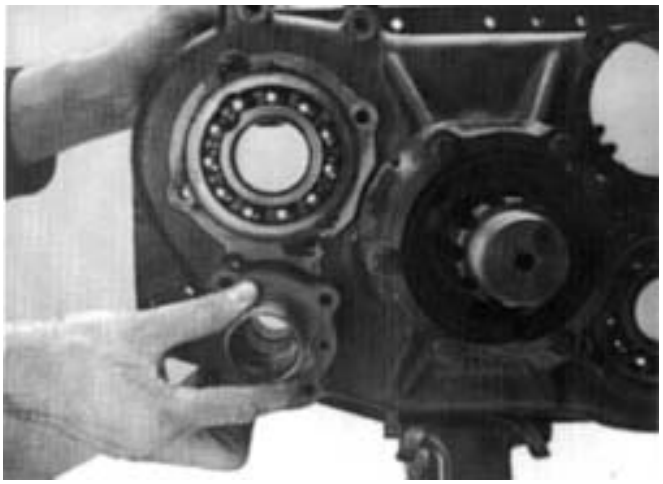
1. If necessary, remove the insert valve retaining cover nut and remove the insert valve from the bore.



2. Remove the capscrews and the deep reduction cylinder cover and gasket.



3. Cut the lockwire and remove the lockscrew from the shift yoke.



4. Pull the yoke bar from the cylinder housing and remove the shift yoke.



5. If necessary, remove the O-ring from the piston O.D.



6. Remove the deep reduction cylinder housing and gasket from the auxiliary housing. If necessary, remove the small O-ring from the cylinder housing bore.

DISASSEMBLY - AUXILIARY SECTION

F. Removal and Disassembly of the Range Mainshaft Assembly



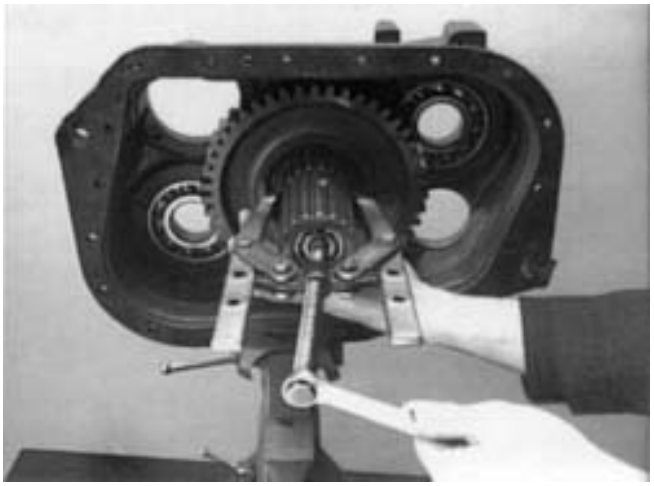
1. Remove the snap ring from the range mainshaft.



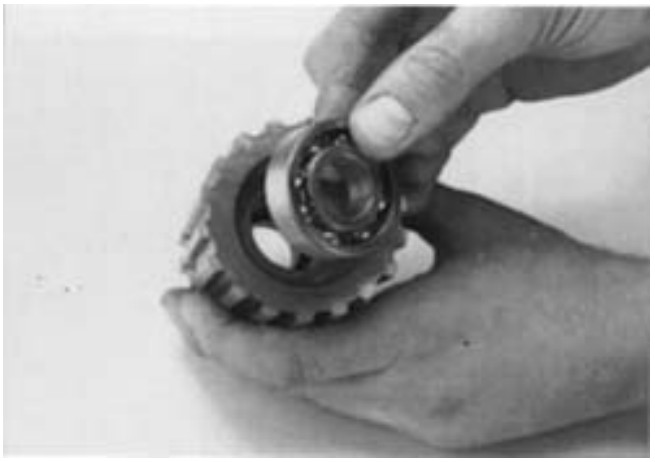
2. Remove the deep reduction sliding clutch.



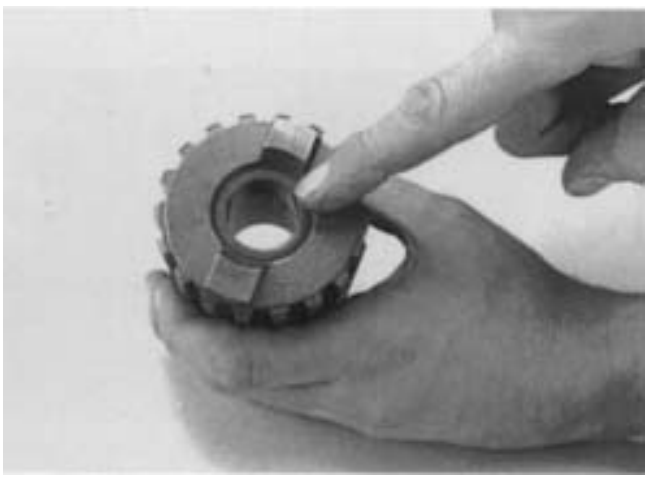
3. Remove the "O" ring from the mainshaft quill front groove.



4. Insert the puller jaws behind the range mainshaft and pull off the quill.



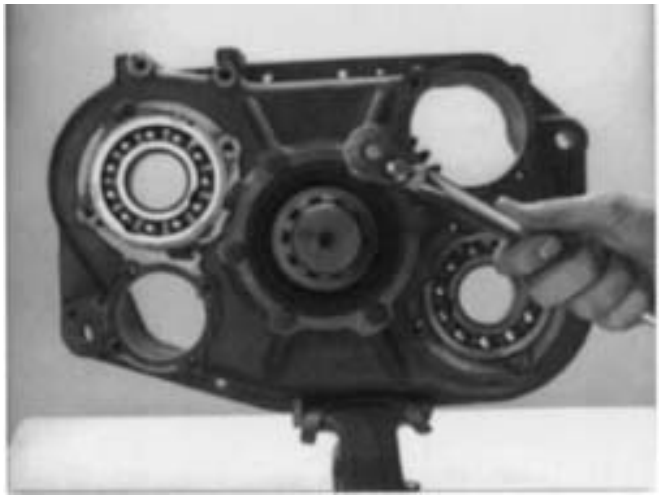
5. Remove the front bearing from the range mainshaft bore.



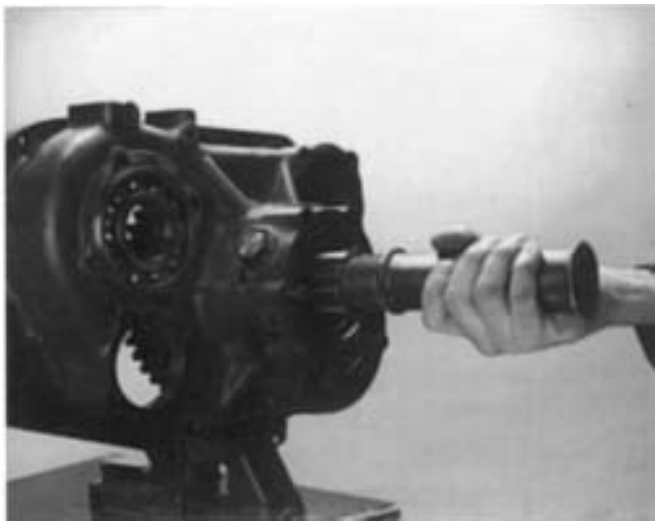
6. If necessary, press the bushing from the mainshaft bore.

DISASSEMBLY - AUXILIARY SECTION

G. Removal and Disassembly of the Output Shaft and Rear Bearing Assemblies



1. Remove the capscrews and the rear bearing cover and gasket. If necessary, remove the oil seal from the cover.



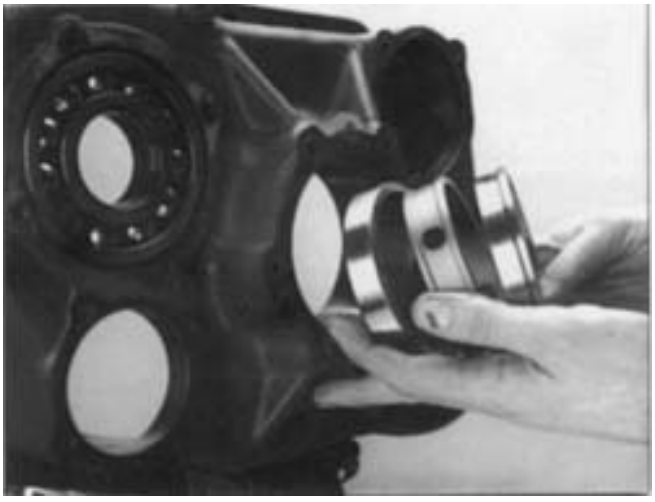
2. Temporarily reinstall the rear bearing cover in position on the housing. The cover will catch the rear bearing cone during the next step. Use a soft bar and maul to drive the output shaft forward and through the rear bearing assembly.

NOTE: When applying force to the output shaft rear, DO NOT DAMAGE THE THREADS. Support the shaft front to avoid damaging the mainshaft quill once the output shaft is free of the bearing.



3. Remove the rear bearing cover and outer output shaft bearing.

NOTE: When removing cover remove it slowly as the rear output shaft bearing will be loose in the cover.

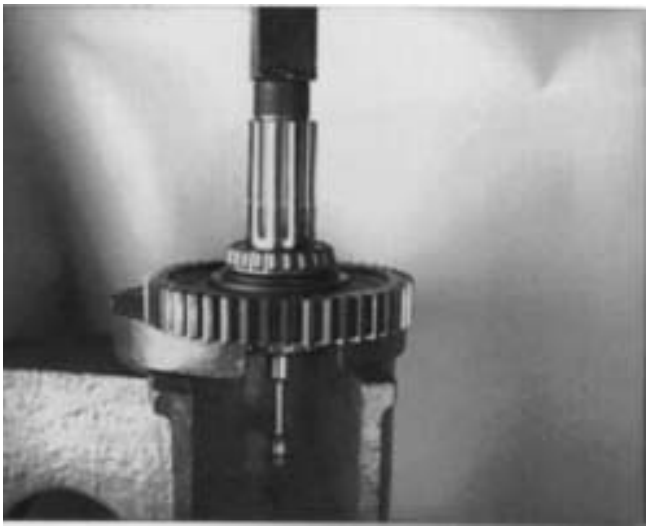


4. Remove the 2 bearing cups and outer spacer from the auxiliary housing bore.

DISASSEMBLY - AUXILIARY SECTION



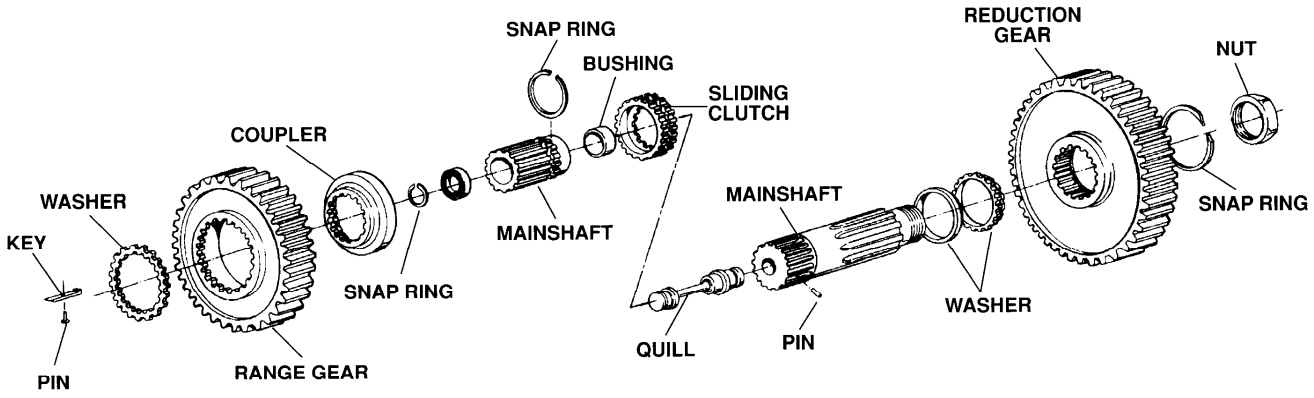
5. Remove the bearing inner spacer from the output shaft.



6. Use the deep reduction gear front face as a base, press the output shaft through the bearing and gear. This will free the bearing, gear, washer, and, for models so equipped, the spacer or oil retention ring. DO NOT DAMAGE THE MAINSHAFT QUILL.

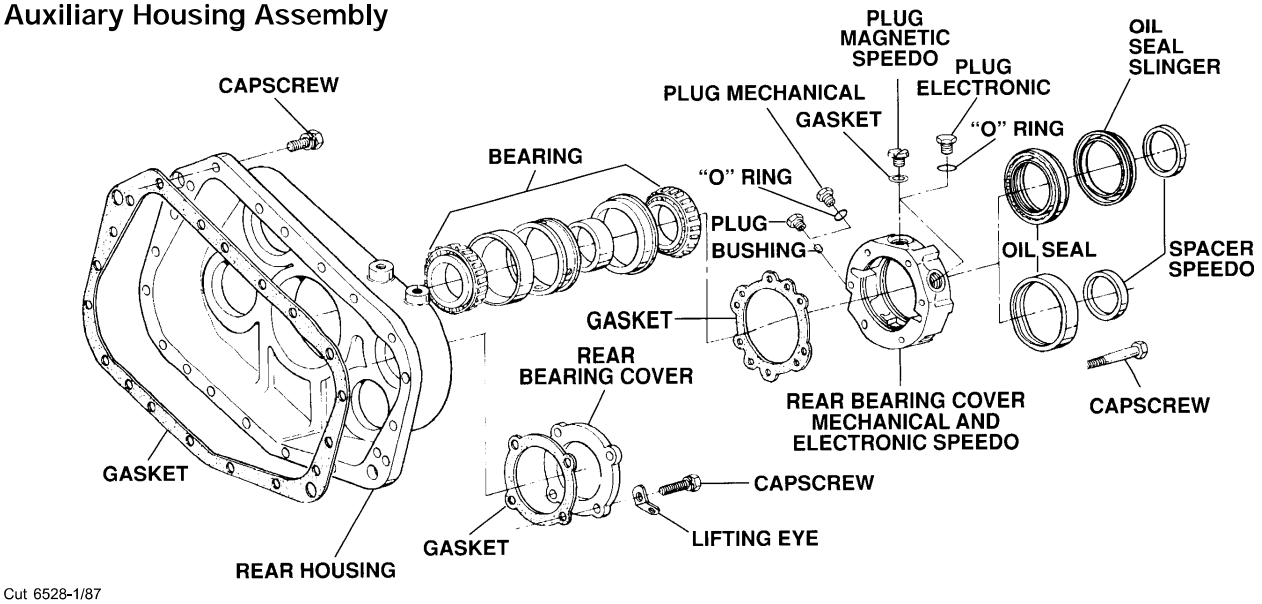
REASSEMBLY - AUXILIARY SECTION

Auxiliary Mainshaft Assembly



Cut 6591 1/81

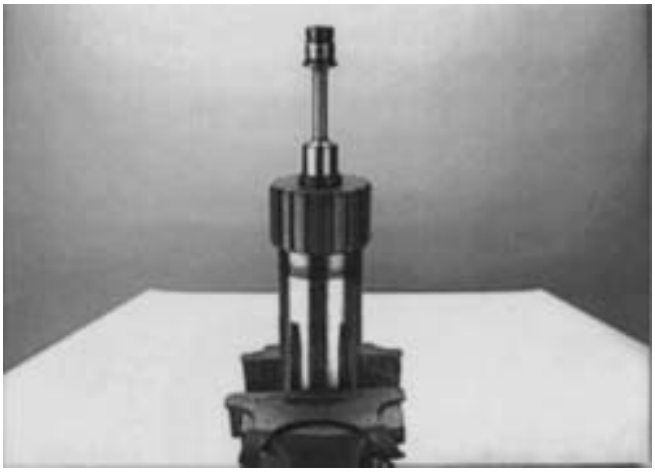
Auxiliary Housing Assembly



Cut 6528-1/87

REASSEMBLY - AUXILIARY SECTION

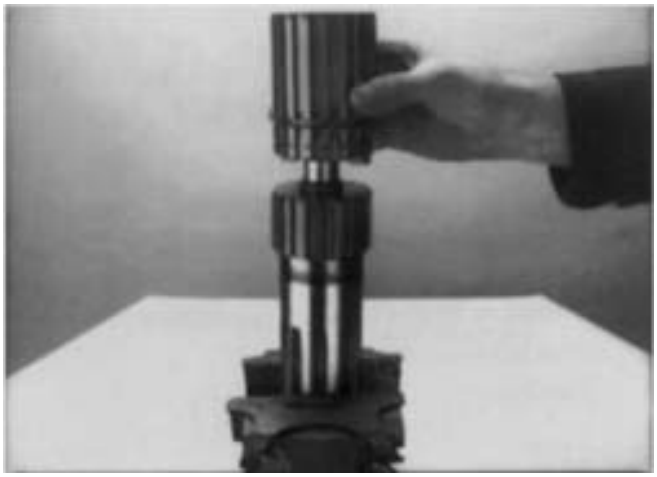
A. Reassembly of the Range Mainshaft Assembly



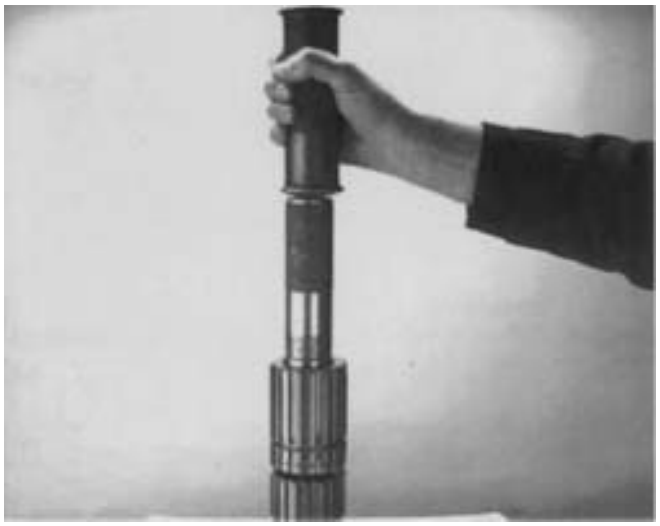
1. Secure the output shaft in a vise with the main shaft quill up.



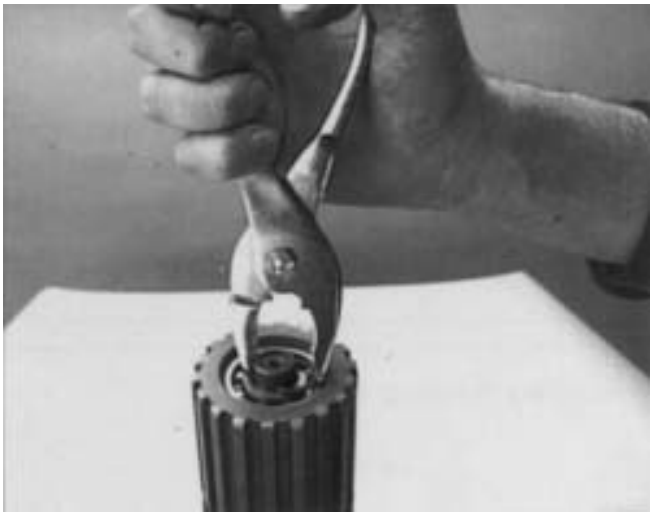
2. If necessary, press the bushing in the range mainshaft rear bore.



3. Install the mainshaft in position on the quill.



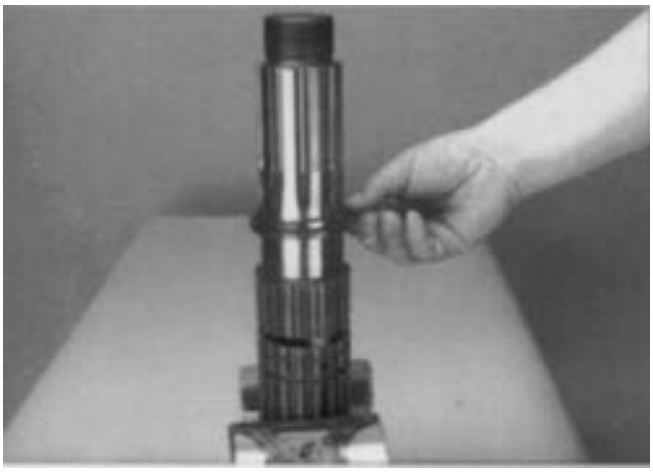
4. Install the bearings in the range mainshaft front bore. Use a small flanged-end driver to properly seat the bearing in the mainshaft quill bore.



5. Install the "O" ring in the mainshaft quill groove to retain the bearing.

REASSEMBLY - AUXILIARY SECTION

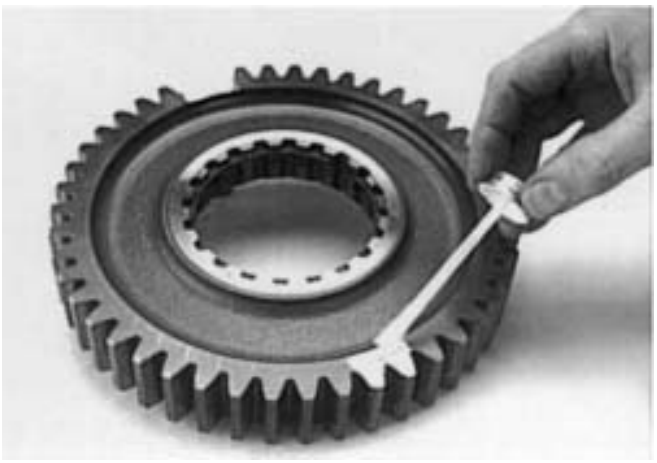
B. Reassembly and Installation of the Reduction Gear and the Output Shaft Assembly



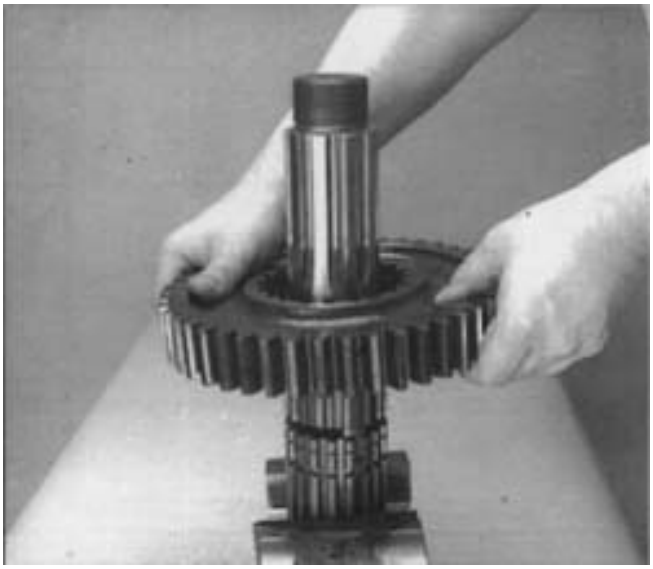
1. Remount the output shaft in the vise with the thread-end up. Install the stepped washer on the shaft, larger diameter step down.



2. Install the splinted spacer on the output shaft with the large diameter splines down.



3. **IMPORTANT:** Mark any 2 adjacent teeth on the deep reduction gear and repeat the procedure for the two adjacent teeth directly opposite the first set marked. A highly visible color of toolmakers' dye is recommended for making the timing marks.



4. If previously removed, install the snap ring in deep reduction gear. Install the gear on the output shaft, clutching teeth down and engaged with spacer splines.

REASSEMBLY - AUXILIARY SECTION

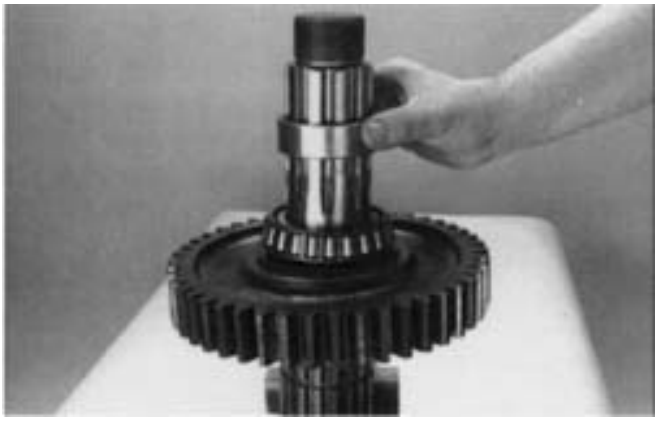


5. Install the washer on the shaft against the deep reduction gear, small diameter step down. (inset)



6. Heat the front bearing cone and install it on the washer, taper side up.

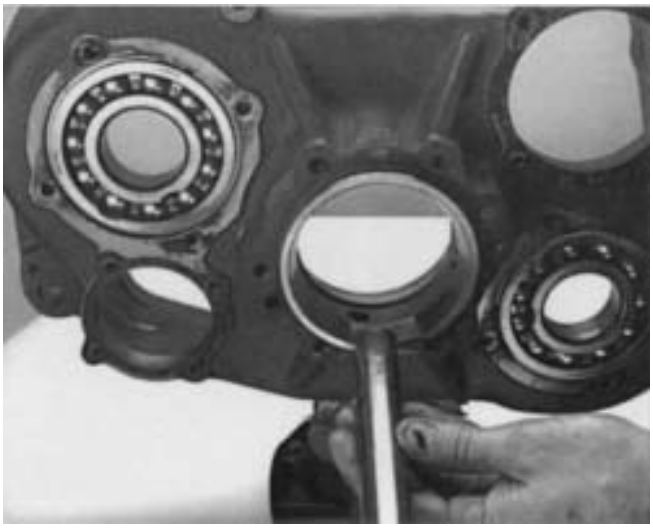
NOTE: Do not heat the bearing above 275°F (136°C)



7. Install the bearing inner spacer on the output shaft against the front bearing cone.



8. Place the front bearing cup in the housing bore, taper to the inside, and use a soft bar to start cup into the bore.



9. Stack the bearing outer spacer and rear bearing cup on the front bearing cup top in the proper sequence. Use a soft bar or a flanged driver to move all three parts evenly into the housing bore until the rear bearing cup lip seats on the housing.

REASSEMBLY - AUXILIARY SECTION



10. Install the auxiliary housing over the output shaft assembly. (inset) Heat the rear bearing cone and install on the shaft, taper down and inside the bearing cup.

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



11. Secure the assembly upright in a vise. Install the deep reduction sliding clutch on the output shaft, internal splines toward the gear and engaged with the shaft splines.

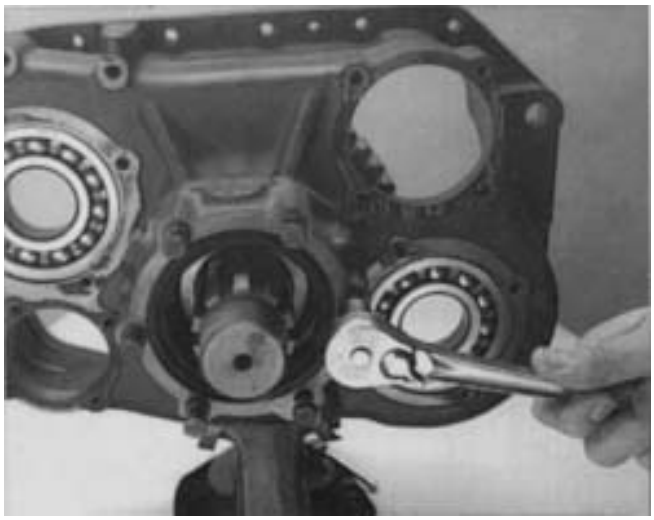


12. Install the snap ring in the range mainshaft groove.



13. If previously removed, install the oil seal in the rear bearing cover.

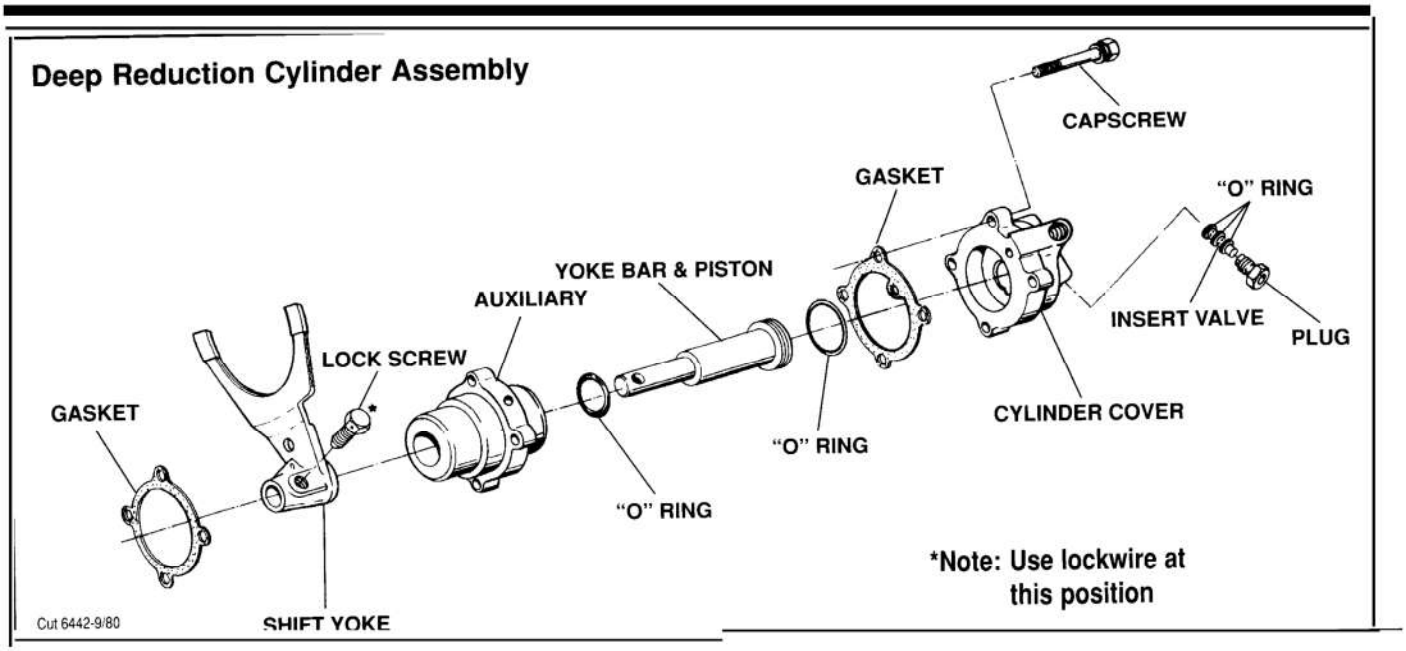
NOTE: Seal should be installed so the spring is to the cover front.



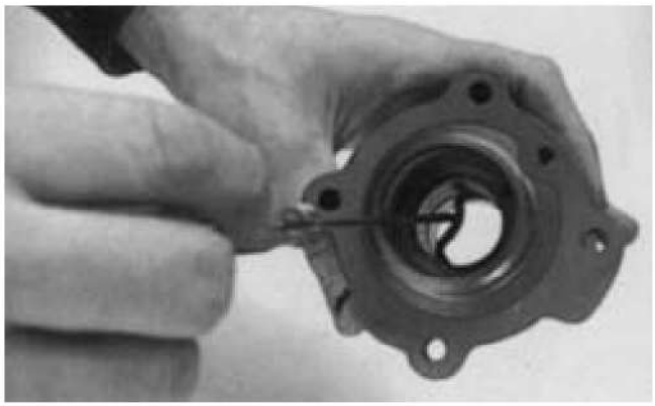
14. Position the gasket on the cover mounting surface and install the rear bearing cover on the auxiliary housing. Tighten capscrews to secure the housing cover.

NOTE: Use a new nylon collar and brass washer with the capscrew at the chamfered hole which intersects the speedometer bore. DO NOT REUSE AN OLD NYLON COLLAR.

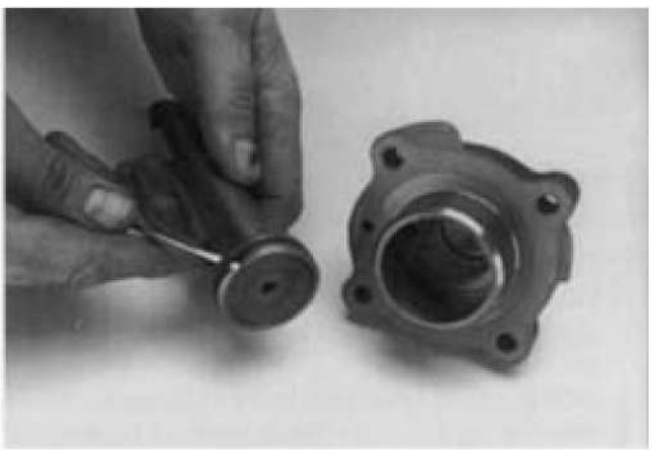
REASSEMBLY - AUXILIARY SECTION



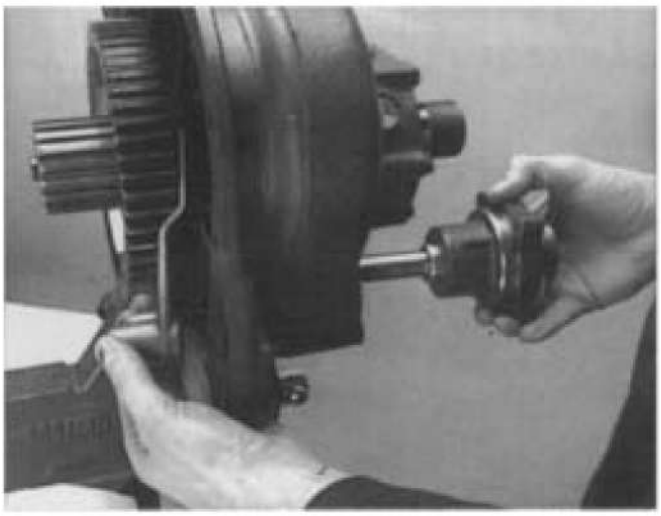
C. Reassembly and Installation of the Deep Reduction Cylinder Assembly



1. If previously removed, install the small O-ring in the cylinder housing bore.

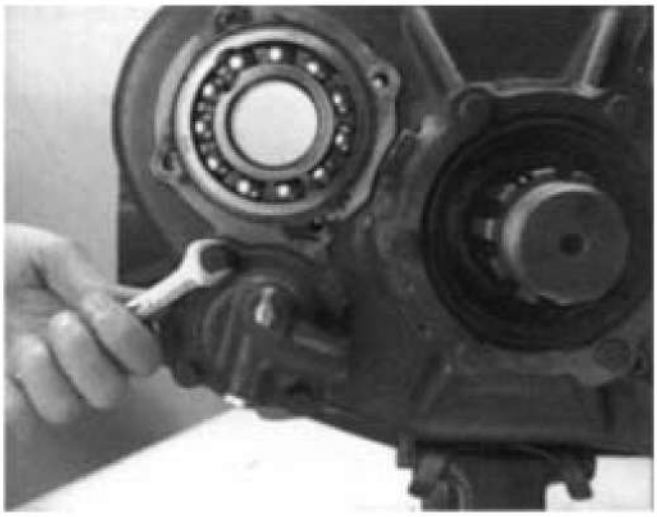


2. If previously removed, install the O-ring in the yoke bar piston groove.

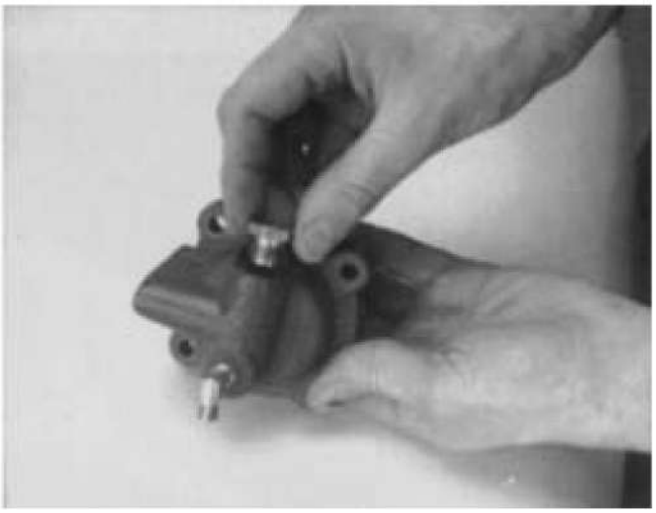


3. Position the corresponding new gasket on the housing mounting surface. Place the reduction yoke into position with the sliding clutch, lockscrew hole to the front. From the auxiliary housing rear, insert the deep reduction cylinder and yoke bar through cylinder bore and into the yoke, aligning the notch in the bar with the yoke lockscrew hole.

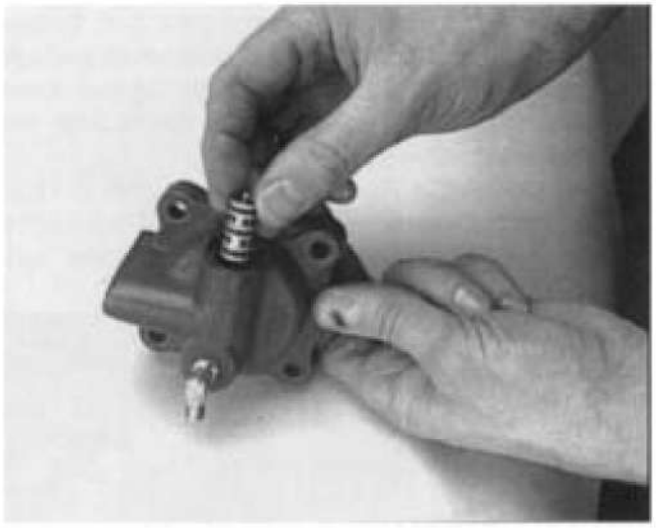
REASSEMBLY - AUXILIARY SECTION



4 . Install the yoke lockscrew, tighten and wire securely.

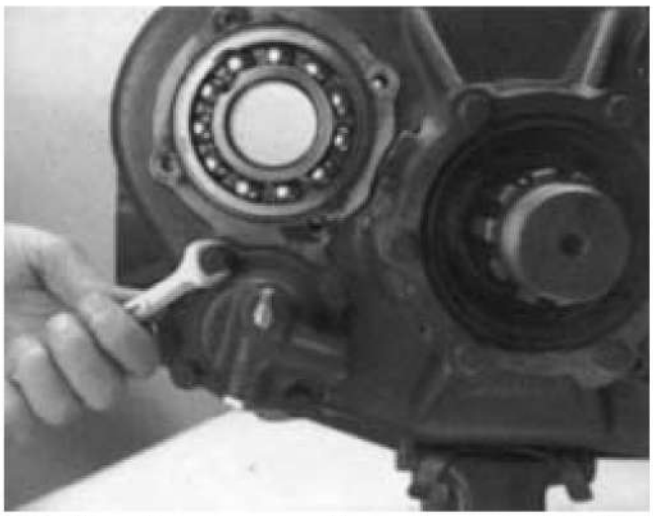


6. Install the valve retaining nut in cover exhaust port and tighten to the recommended torque.



5 . Install the insert valve in cylinder cover exhaust port.

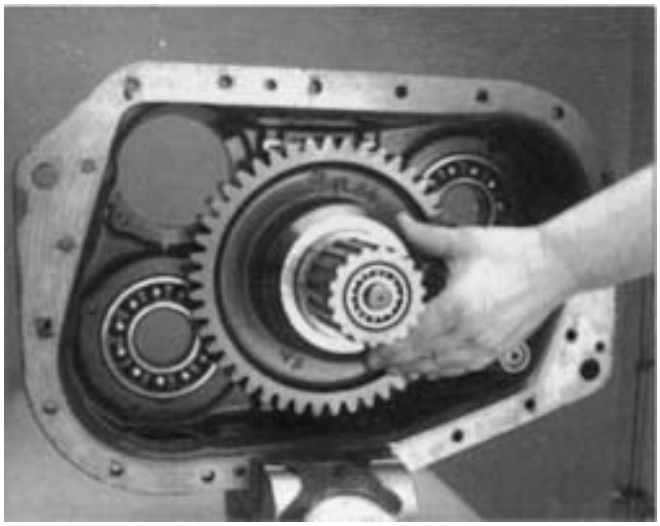
NOTE: Prior to installation of insert valve, apply a small amount of silicone lubricant to the O-rings on the valve O.D.



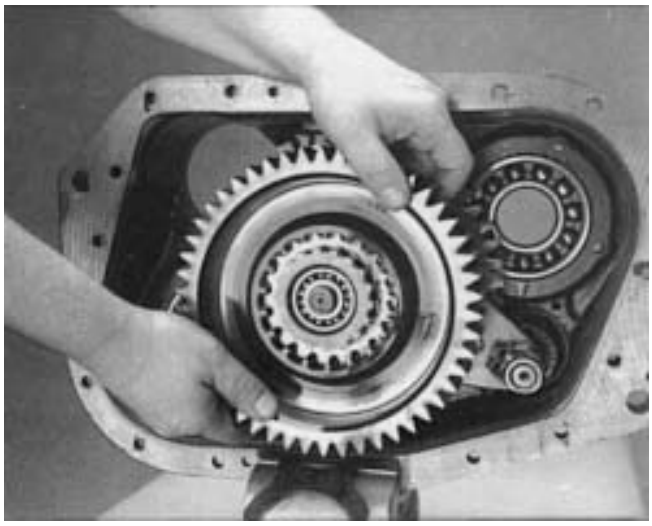
7. Position the corresponding new gasket on the cover mounting surface and install the deep reduction cylinder cover, align the air channel with cylinder housing channel. Tighten the capscrews to secure cover to the cylinder housing.

REASSEMBLY - AUXILIARY SECTION

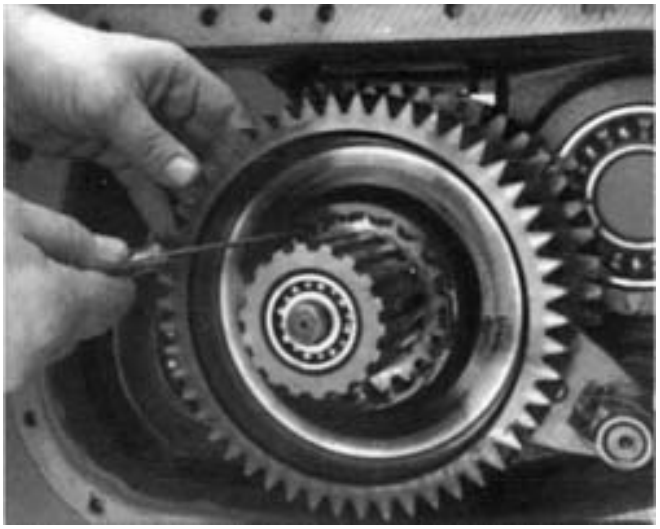
D. Installation of the LO Range Gear



1. Install the coupler on the range mainshaft, clutching teeth to the rear.



2. Install the LO range gear on the mainshaft against the coupler, clutching teeth to the front.



3. Install the splined tolerance washer on the mainshaft and in the LO range gear hub. Rotate the washer in the mainshaft groove to engage the external splines with the clutching gear teeth and align the square internal spline with the mainshaft keyway.

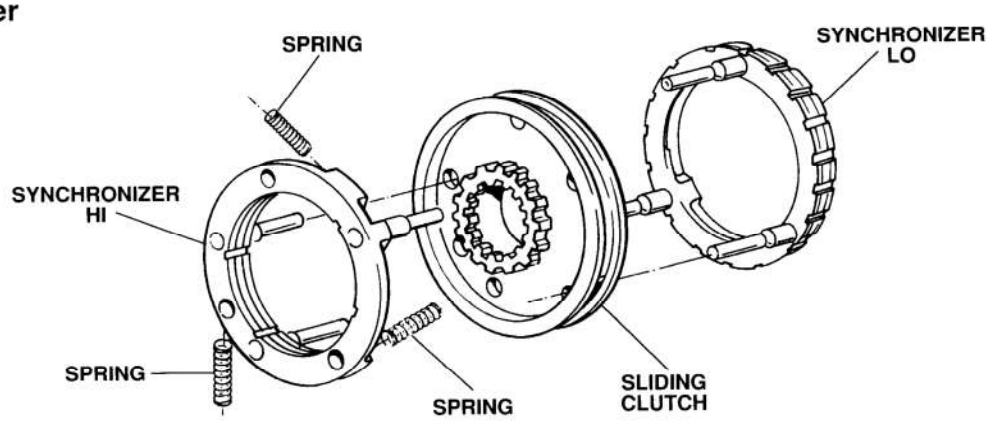
IMPORTANT: This washer is available in varying thicknesses. Use the splined tolerance washer that provides a snug fit in the gear hub.



4. Install the key in the range mainshaft keyway, inserting the key thick end into the tolerance washer square internal spline to lock the LO range gear to the shaft.

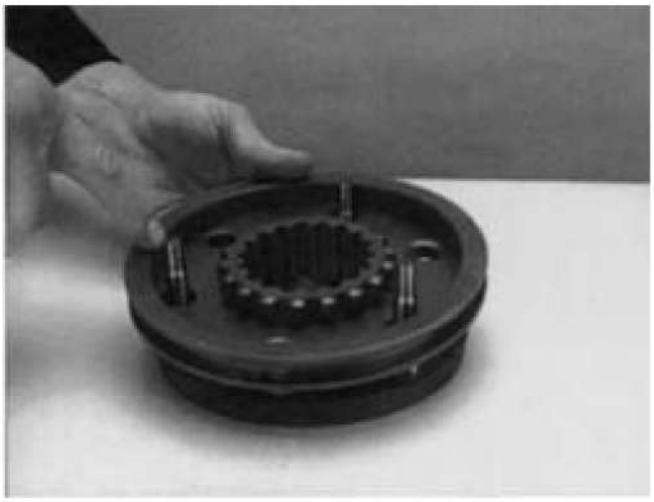
REASSEMBLY - AUXILIARY SECTION

Synchronizer



Cut 480-4/79

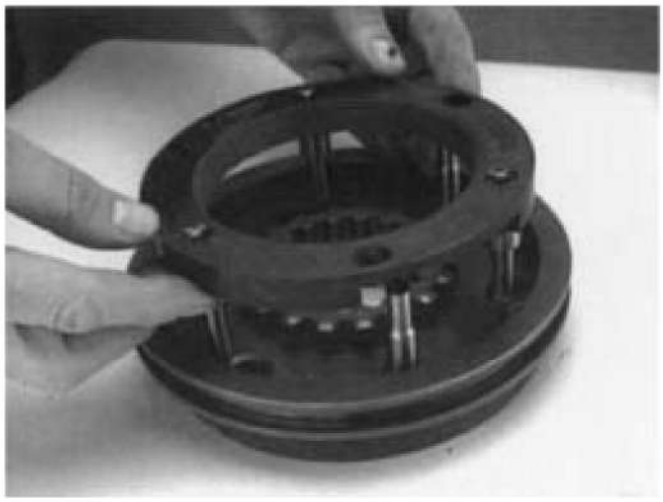
E. Reassembly and Installation of the Synchronizer Assembly



1. Place the larger LO Range synchronize ring on the bench. Place the sliding clutch, recessed side up, on the LO Range synchronizer pins.



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



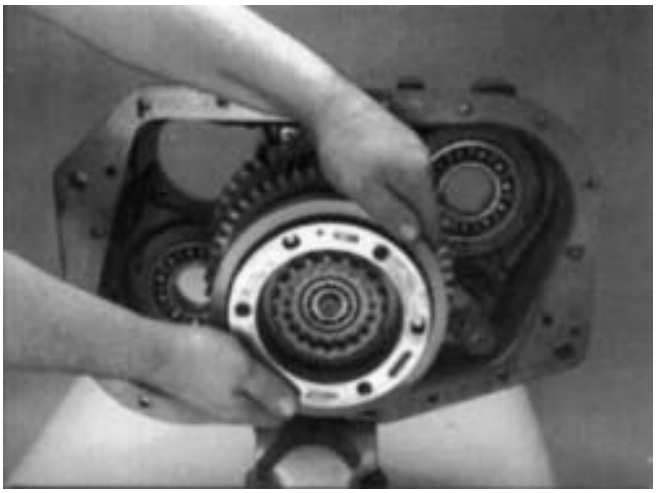
3. Place the HI Range synchronizer ring over the LO Range synchronizer ring pins.



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

NOTE: Place a shop towel over the assembly to prevent injury to hands.

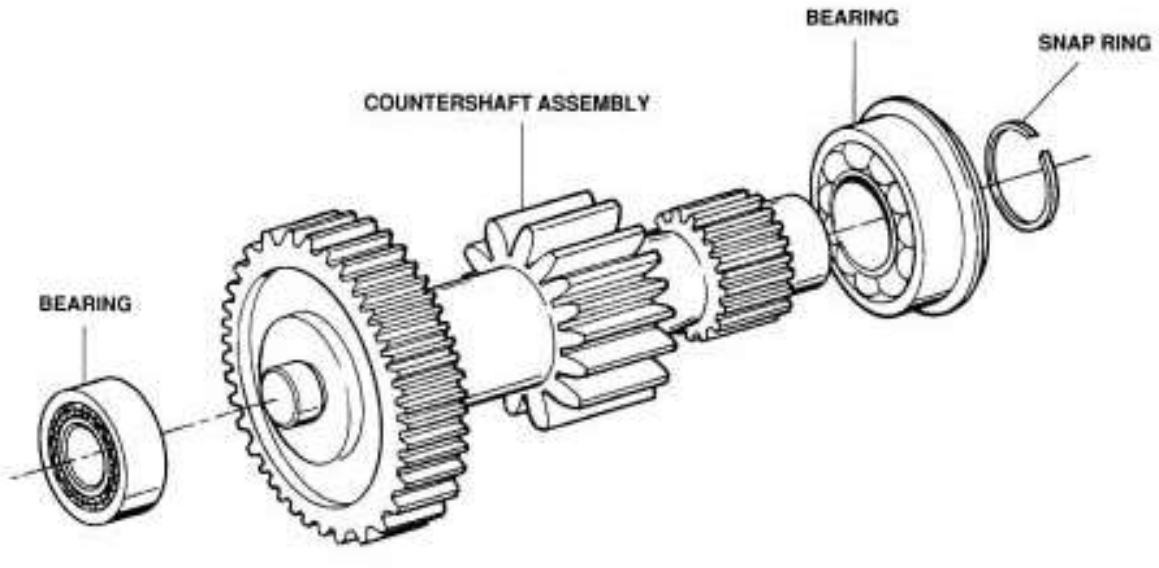
REASSEMBLY - AUXILIARY SECTION



5. Install the synchronizer on the output shaft with the LO range synchronizer ring in.

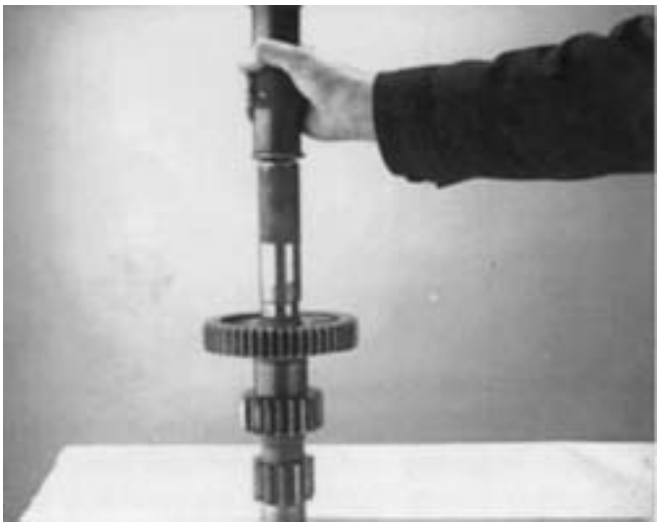
REASSEMBLY - AUXILIARY SECTION

Auxiliary Countershaft Assembly

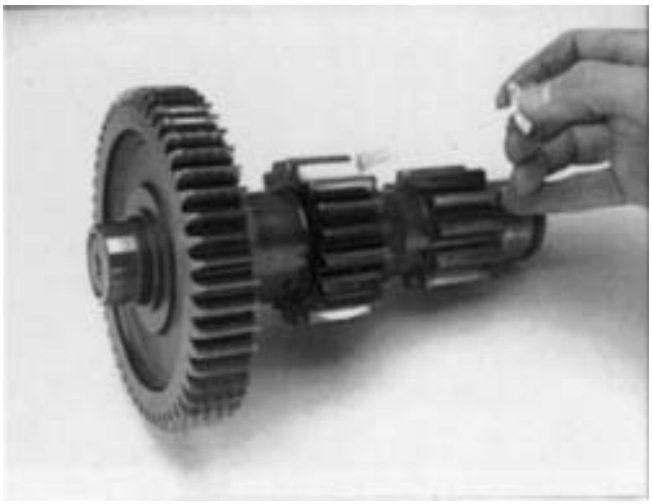


Cut 6502A - 6/88

F. Timing and Installation of the Auxiliary Countershaft Assemblies

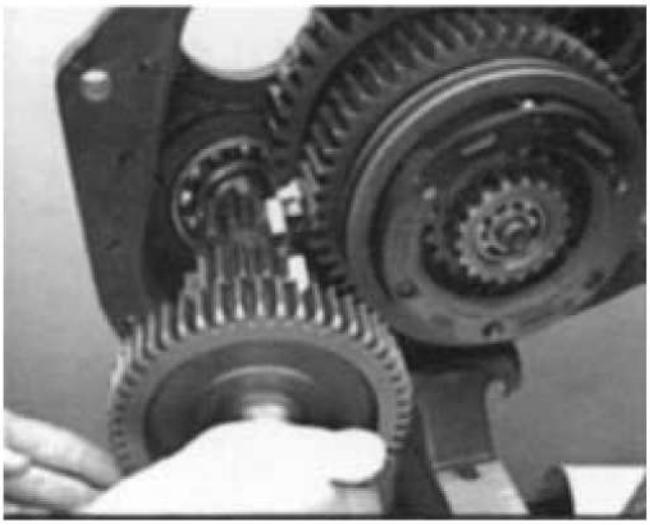


1. If previously removed, install the bearing inner race on each countershaft front.

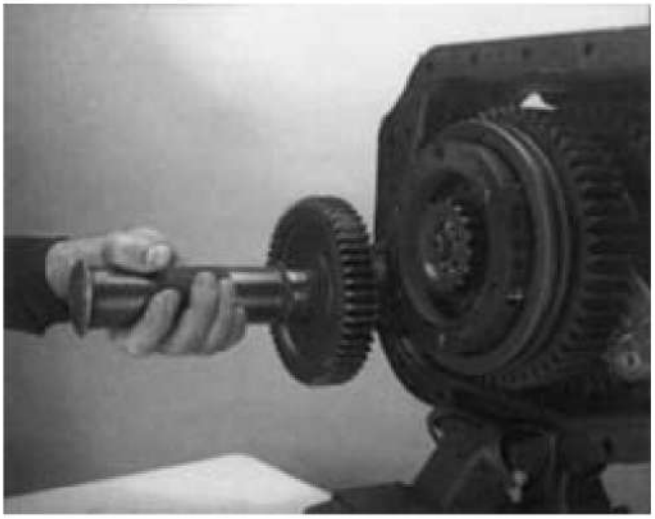


IMPORTANT: On each auxiliary countershaft assembly LO Range gear locate the "O" stamped on one tooth. Mark tooth with highly visible color of toolmaker's dye. Repeat the procedure on each auxiliary countershaft deep reduction gear. **NOTE**: Temporarily install the auxiliary countershaft bearing covers for countershaft installa-

REASSEMBLY - AUXILIARY SECTION

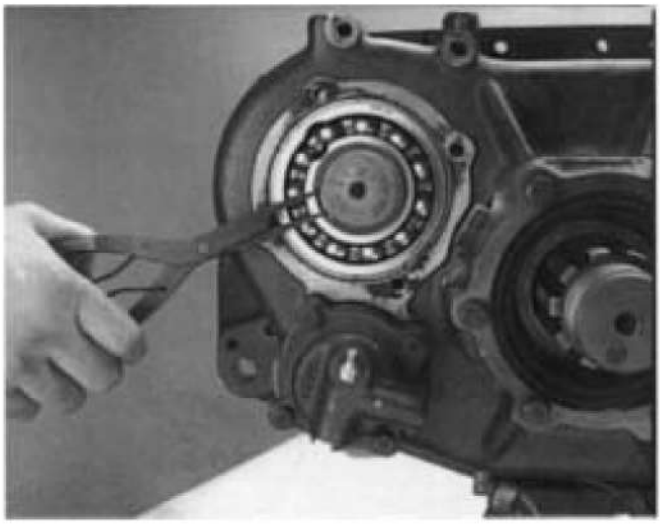


3. Place one countershaft into position in the housing, meshing the countershaft gear marked tooth with either set of the mainshaft deep reduction gear two marked teeth.

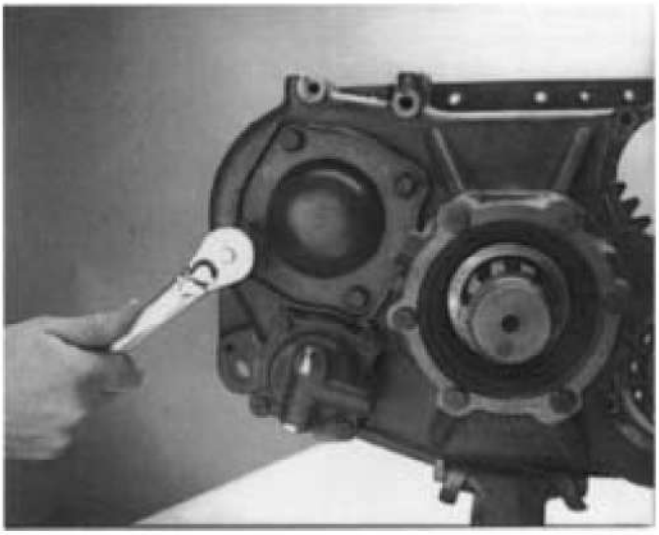


4. Center the countershaft rear in bearing bore, start the rear bearing in the bore and complete installation with a soft bar and maul. Repeat the procedure with the other auxiliary countershaft assembly, make sure the deep reduction gear set remains in time during bearing installation.

NOTE: Check synchronizer assembly for springs that may be released during bearing installation.



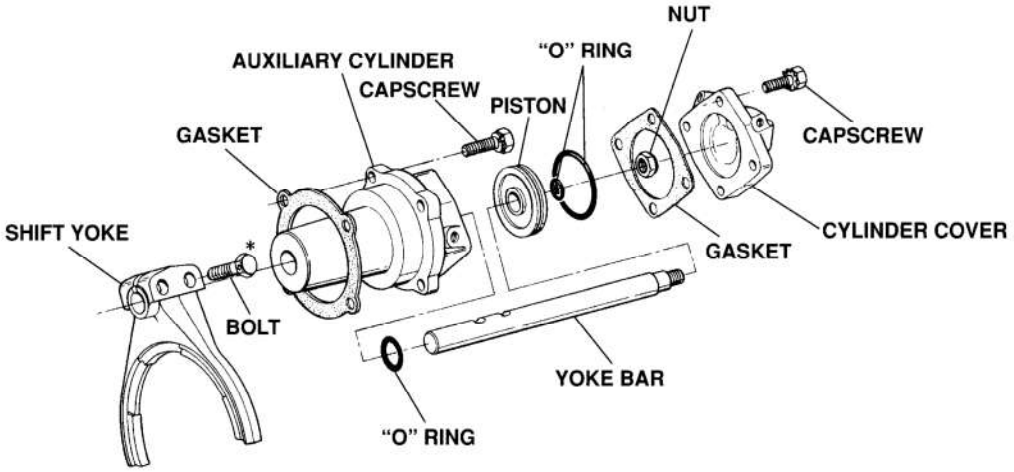
5. Remove the rear bearing covers and install the snap ring in each countershaft rear groove.



6. Position the corresponding new gasket on the cover mounting surface and install both rear bearing covers. Tighten the capscrews to secure the covers to the auxiliary housing.

REASSEMBLY - AUXILIARY SECTION

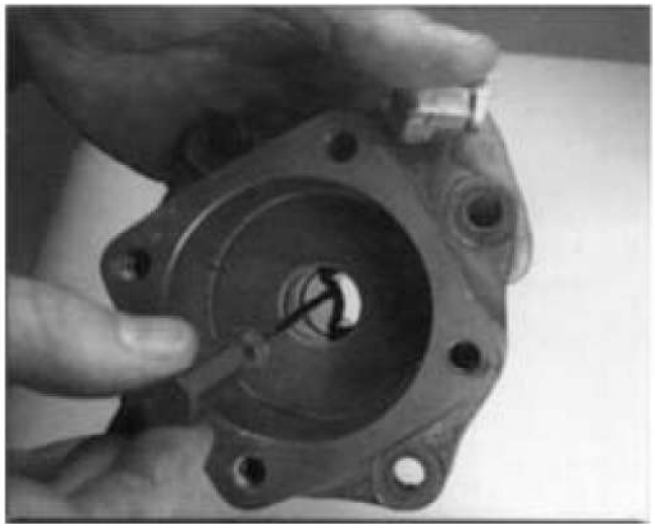
Range Cylinder Assembly



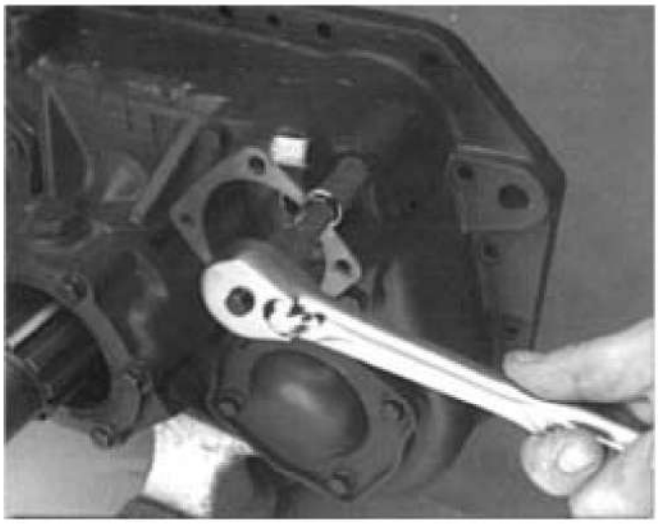
*Note: Use lockwire at this position

Cut 6426-10/80

G. Installation of the Range Cylinder Assembly



1. If previously removed, install the O-ring in the range cylinder housing bore.

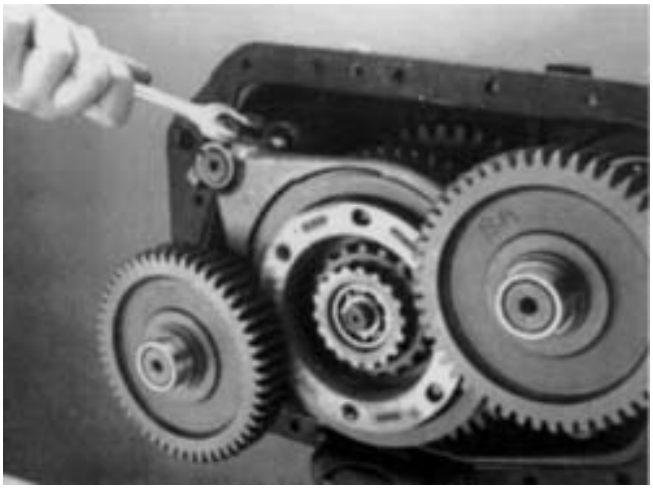


2. IMPORTANT: On each auxiliary countershaft assembly LO Range gear locate the "O" stamped on one tooth. Mark tooth with highly visible color of toolmaker's dye. Repeat the procedure on each auxiliary countershaft deep reduction gear.

REASSEMBLY - AUXILIARY SECTION



3. Place the range yoke into position with the synchronizer assembly sliding clutch, yoke long hub to the rear (inset). Insert the yoke bar threaded-end throught the yoke and into the range cylinder housing bore, aligning the bar notches with the lockscrew holes.



4. Install the 2 yoke lockscrews, tighten and lockwire securely.

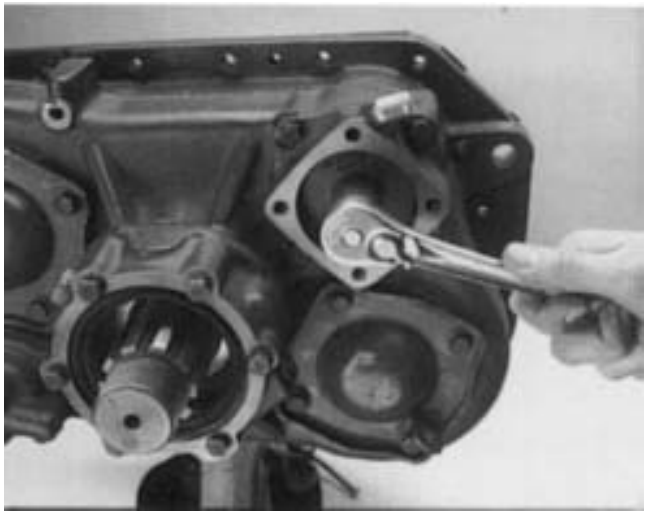


5. If previously removed, install the O-rings in the range piston I.D. and O.D.

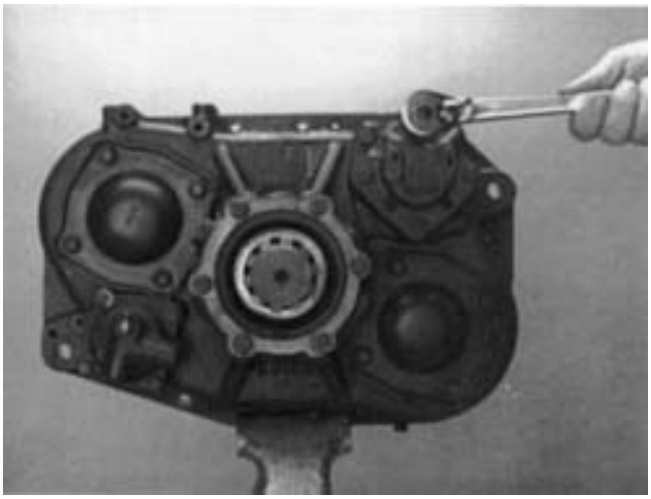


6. Install the range piston on the yoke bar, in the cylinder housing bore, flat side to the rear.

REASSEMBLY - AUXILIARY SECTION



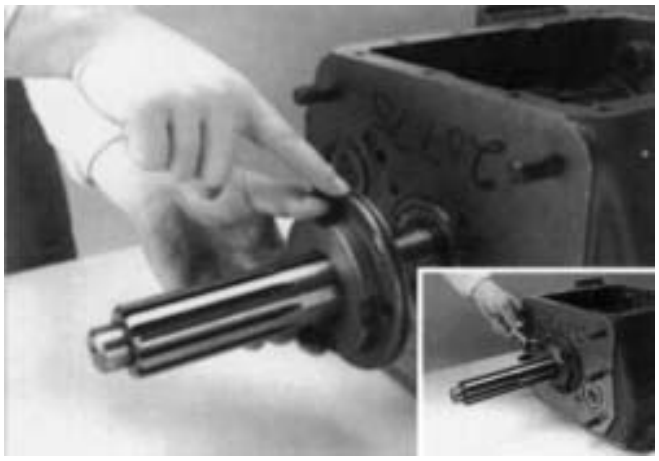
7. Secure with the nut and tighten to the recommended torque.



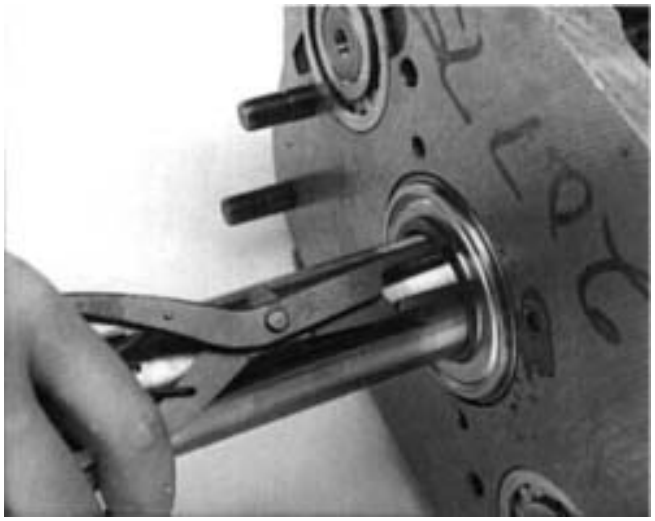
8. Position the corresponding new gasket on the cover mounting surface and install the range cylinder cover on the housing, open port to the upper left. Tighten the capscrews to secure the cover to the housing.

DISASSEMBLY - FRONT SECTION

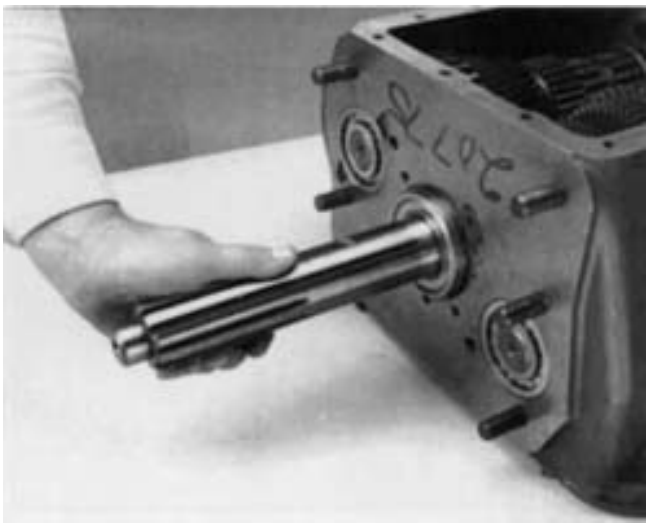
A. Remove of the Input Shaft



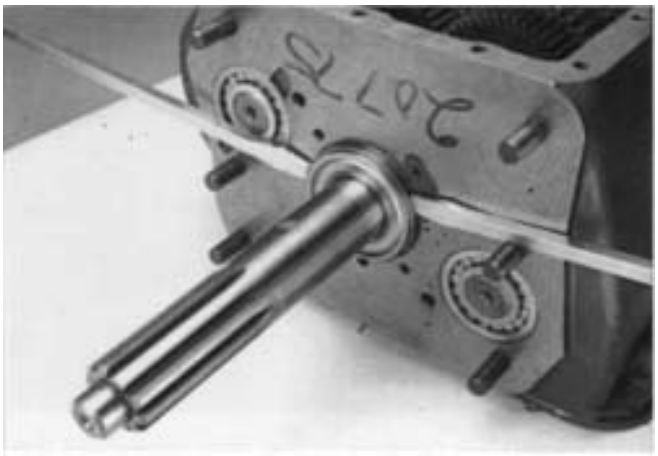
1. Remove the 4 capscrews from the front bearing cover (inset). Remove the bearing cap, gasket, and O-ring.



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

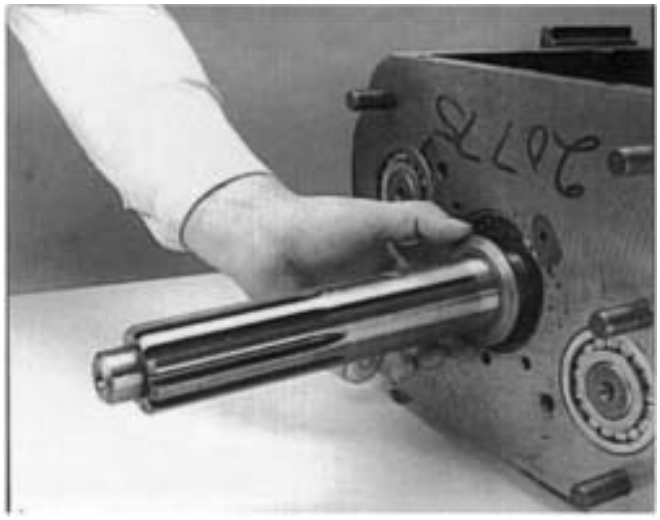


3. Push down on the input shaft to cock the bearing in the bore. Drive the input shaft toward the transmission rear, through the bearing as far as possible. Pull the input shaft forward to expose the bearing snap ring.



4. Use pry bars to complete the bearing removal.

DISASSEMBLY - FRONT SECTION



5. Remove the drive gear spacer.



6. Remove the drive gear snap ring.



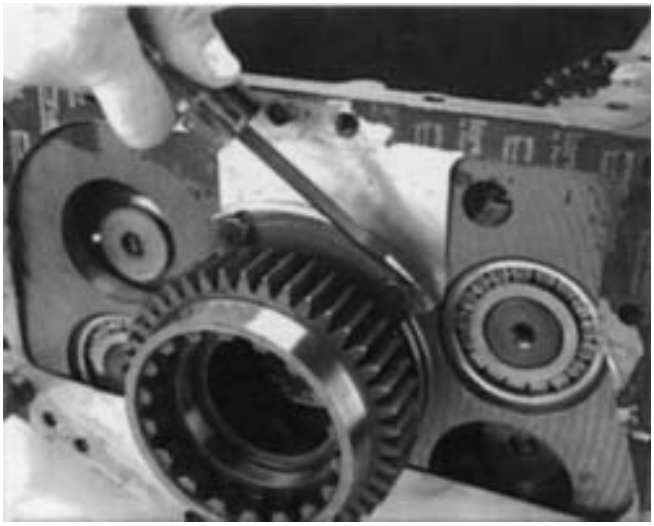
7. Pull the input shaft forward and out of the drive



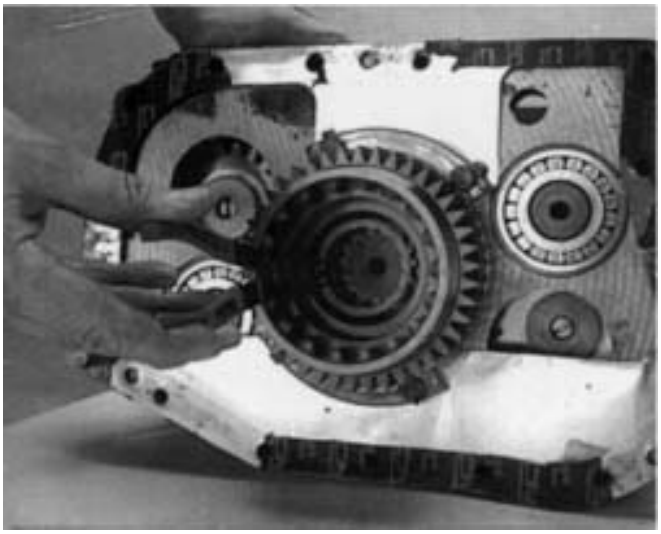
8. Check the bushing in the input shaft pocket, replace if worn.

DISASSEMBLY - FRONT SECTION

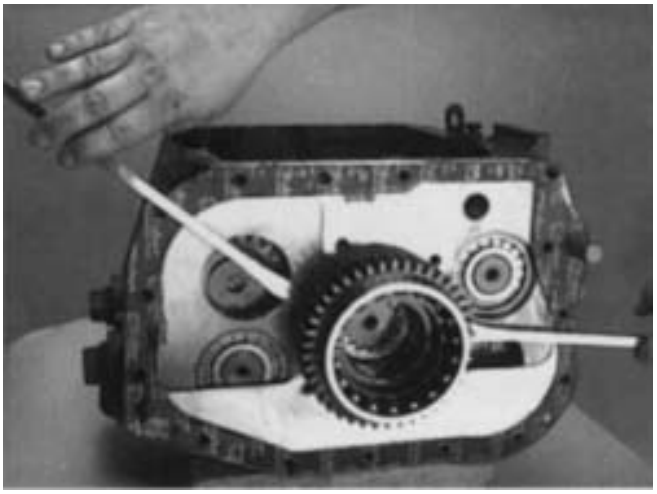
B. Removal and Disassembly of the Auxiliary Drive Gear



1. Straighten the lock tangs, loosen the 4 cap-screws and 2 bearing retainers from the case.



2. Remove the snap ring from the mainshaft rear, located inside the auxiliary drive gear bore.



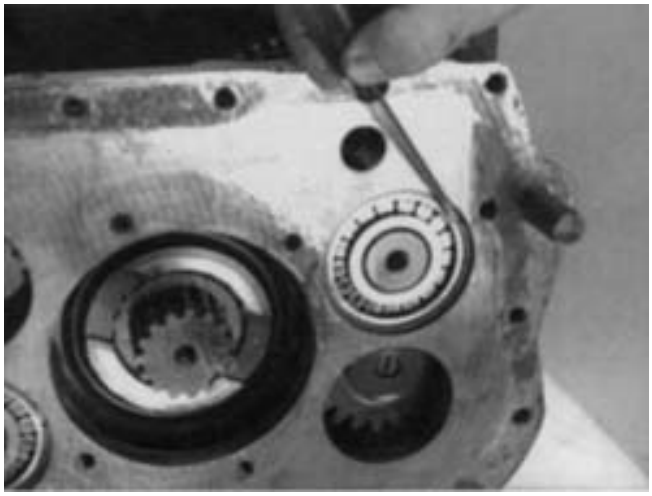
3. With 2 screwdrivers pry the auxiliary drive gear out to complete the removal of the bearing retainers then remove the auxiliary drive gear.



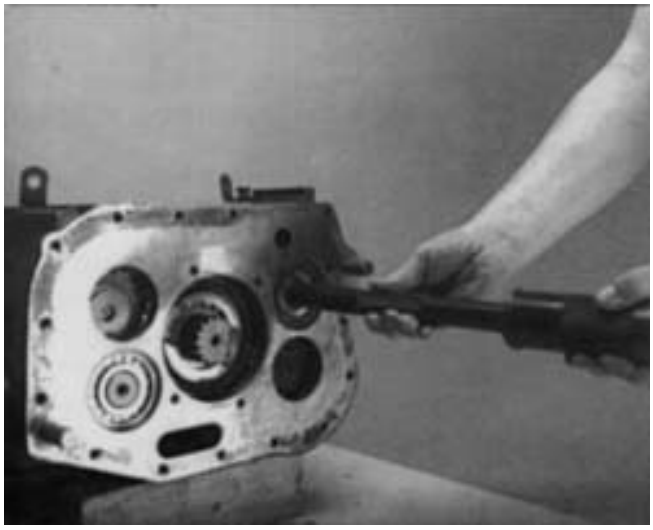
4. Remove the snap ring from the auxiliary drive gear. Press or use a driver to remove the bearing from the auxiliary drive gear.

DISASSEMBLY - FRONT SECTION

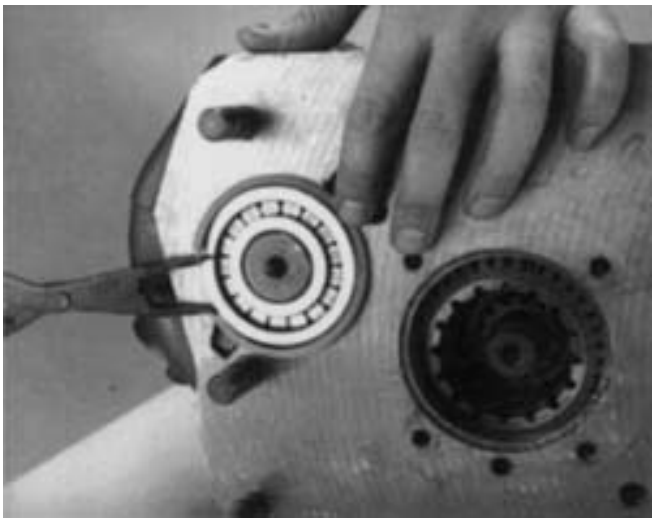
C. Removal of the Upper Countershaft Bearings



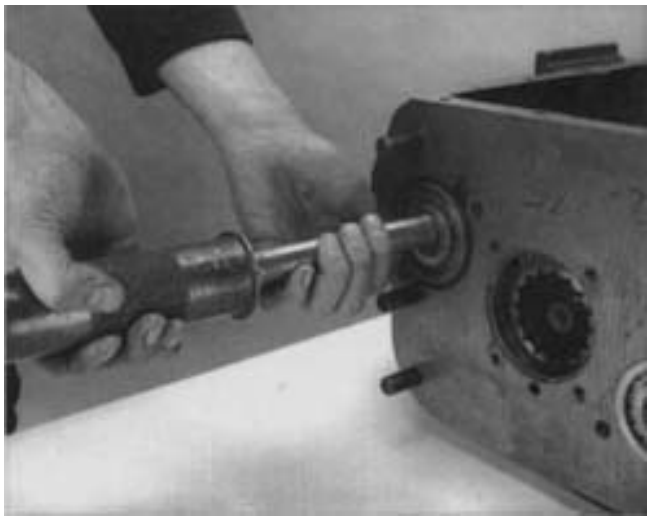
1. Remove the upper countershaft snap ring from the case rear bearing bore.



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

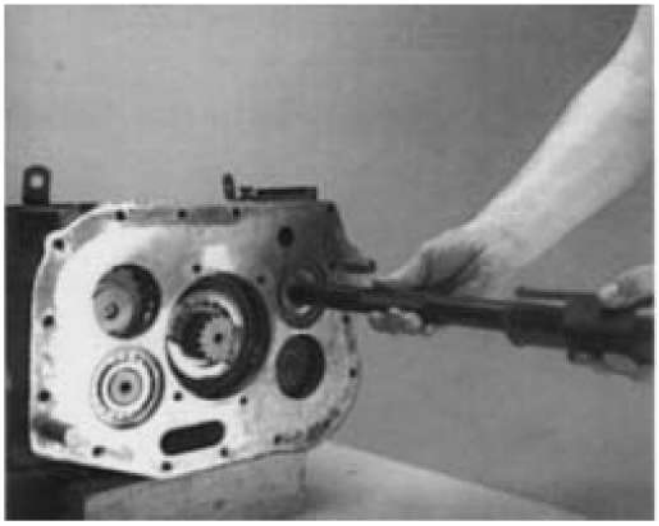


3. Install a snap ring in the exposed snap ring groove. Use the snap ring removed from the rear bearing bore.



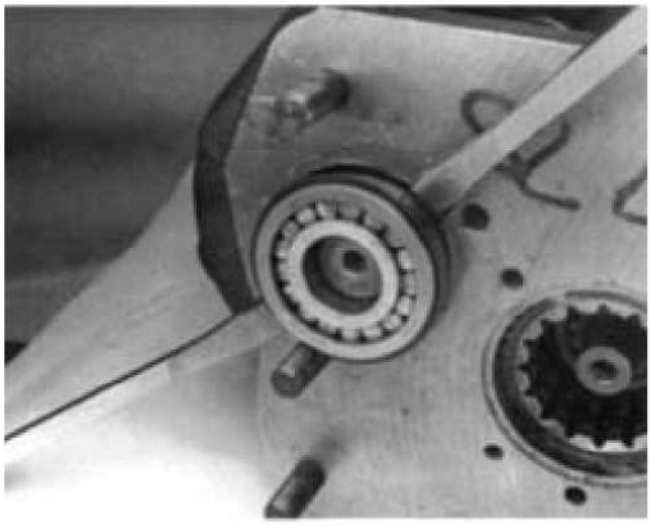
4. Use a soft bar and maul to drive the countershaft assembly to the rear as far as possible. This will move the front bearing forward on the countershaft.

DISASSEMBLY - AUXILIARY SECTION

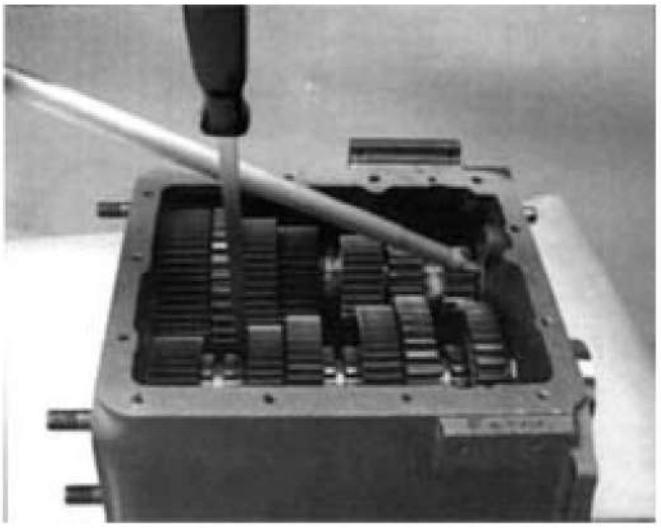


5. From the case rear use a soft bar and maul to drive the countershaft forward to unseat the front bearing from the case bore.

NOTE: Steps 4 and 5 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.

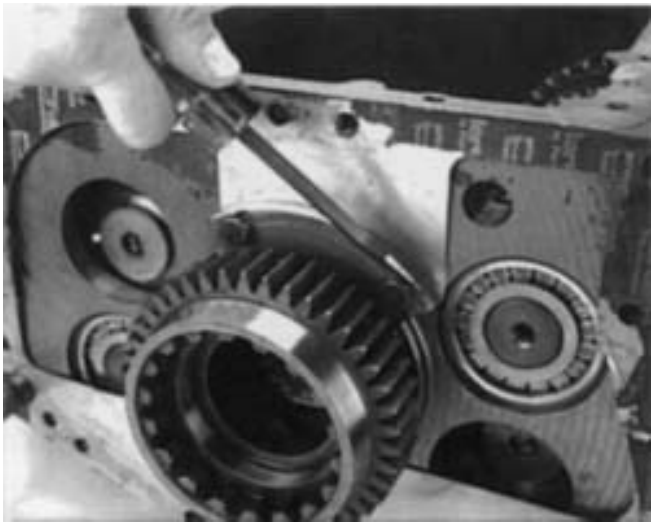
NOTE: Removal procedure damages the bearing. Removal should not be attempted unless bearing replacement is planned.

D. Removal and Disassembly of the Left Reverse Idler Gear Assembly

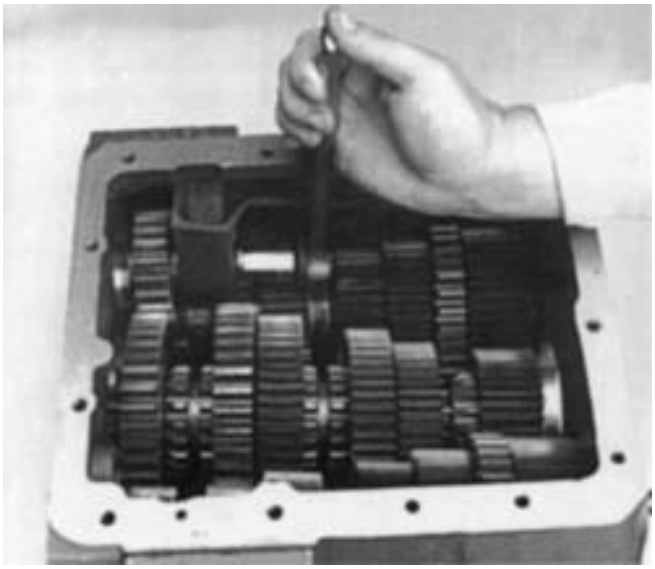


1. Use inside jaw pullers or an impact puller and remove the auxiliary countershaft front bearing from the left reverse idler gear bore.

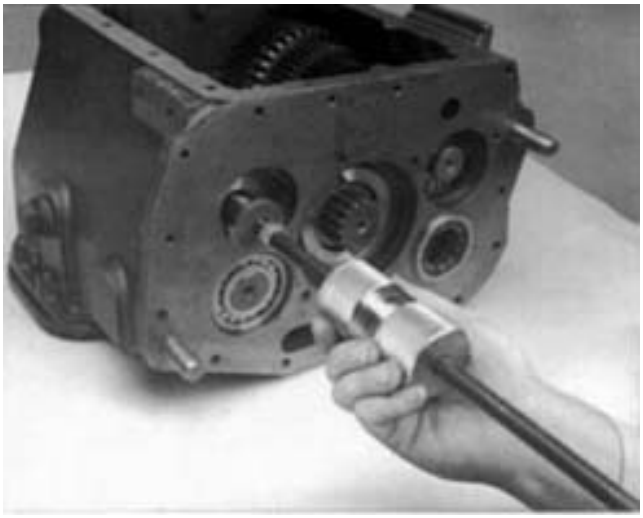
DISASSEMBLY - FRONT SECTION



2. Remove the plug from the idler shaft rear.



3. Use a socket wrench and remove the stop nut from the idler shaft front. Remove the washer.



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



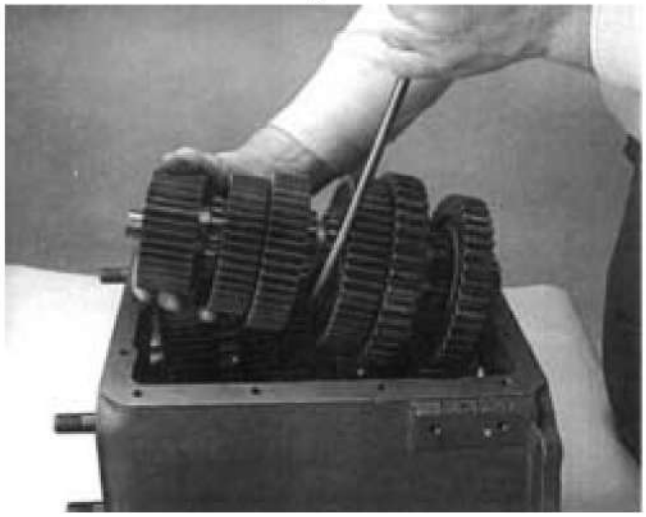
5. As the idler shaft is moved to the rear, remove the thrust washer and gear from the case.



6. If necessary, remove the bearing from the reverse idler gear bore.

DISASSEMBLY - FRONT SECTION

E. Removal and Disassembly of the Mainshaft Assembly

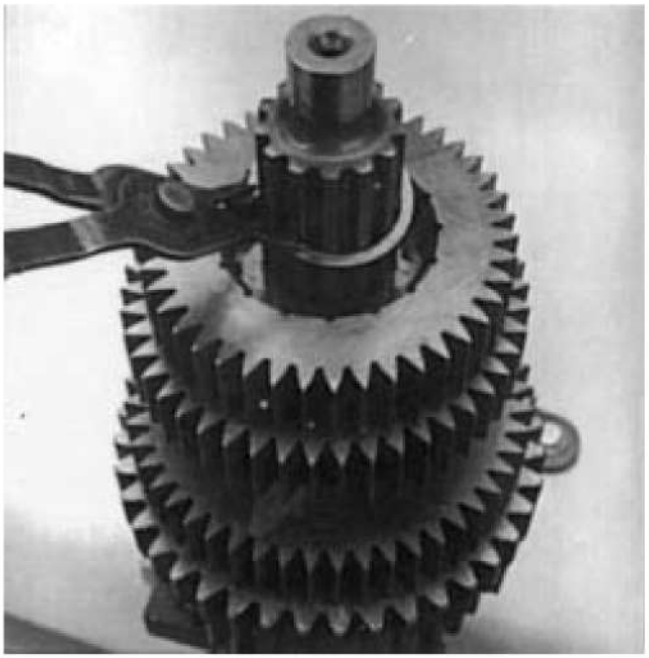


1. Block the right countershaft assembly against the case wall. Slide the drive gear to the rear and engage with the sliding clutch splines. Use a hook around 1st-2nd sliding clutch, tilt the mainshaft front up and lift the assembly from the case.

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



2. Secure the mainshaft, drive gear up, in a vise. Remove the drive gear and the 3rd-4th speed sliding clutch.



3. Remove 3rd speed gear hub snap ring from the mainshaft groove.



4. Remove 3rd speed gear and tolerance washer.

DISASSEMBLY - FRONT SECTION



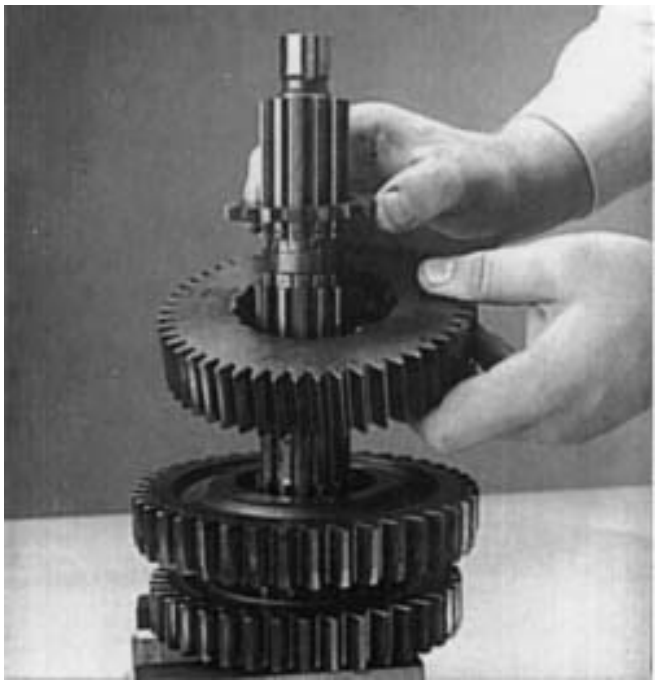
5. Remove 2nd speed gear and tolerance washer.



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



7. Remove mainshaft key from mainshaft key way.

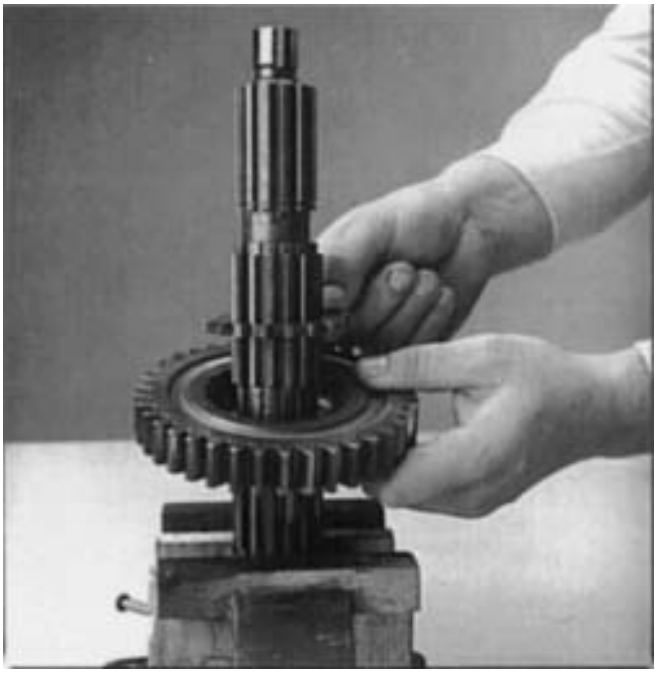


8. Remove 1st speed gear and tolerance washer.

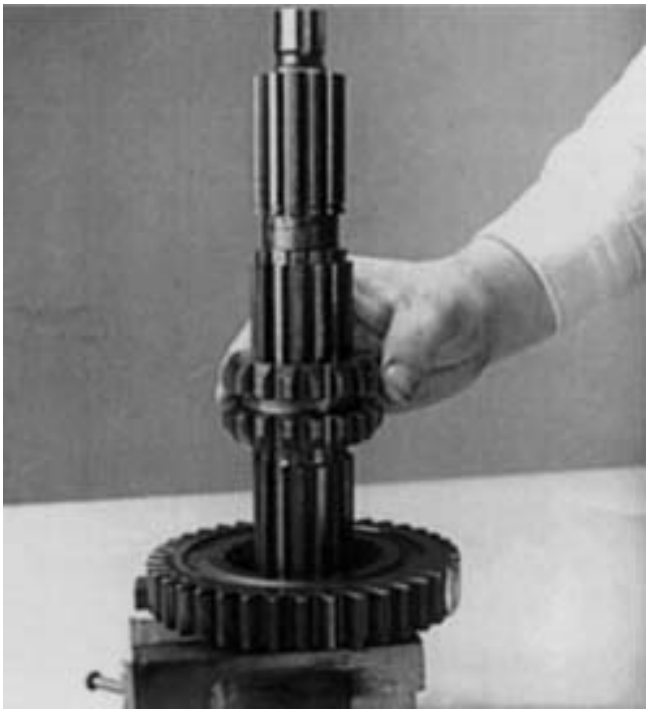
DISASSEMBLY - FRONT SECTION



9. Remove LO speed gear and tolerance washer.



11. Remove the reverse gear and tolerance washer. _



10. Remove LO and reverse speed sliding clutch.

DISASSEMBLY - FRONT SECTION

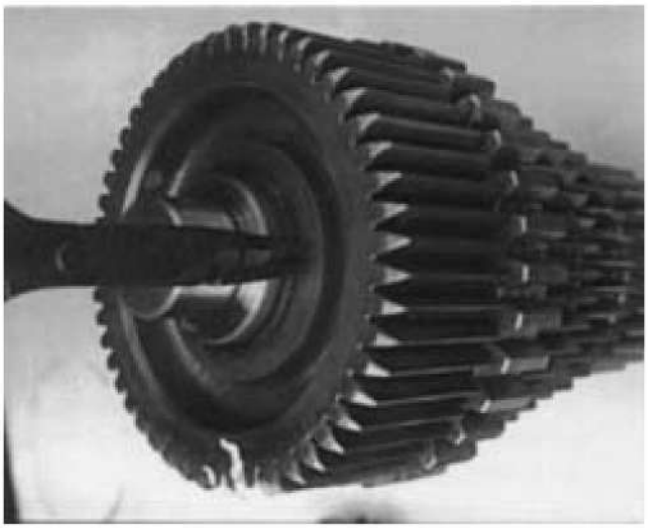
F. Removal and Disassembly of the Countershaft Assemblies

NOTE: Both countershaft disassemble and re-assemble in the same manner.



1. Remove the upper countershaft from the case.

NOTE: Remove the bearings from the lower countershaft in the same manner as was done for the upper countershaft. There is enough clearance on the rear countershaft bearing to remove it with a puller. Remove the lower reverse idler assembly in the same manner as the upper reverse idler was removed.



2. Remove the snap ring from the countershaft front.



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

WARNING DO NOT PRESS ON THE COUNTERSHAFT PTO GEAR.

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

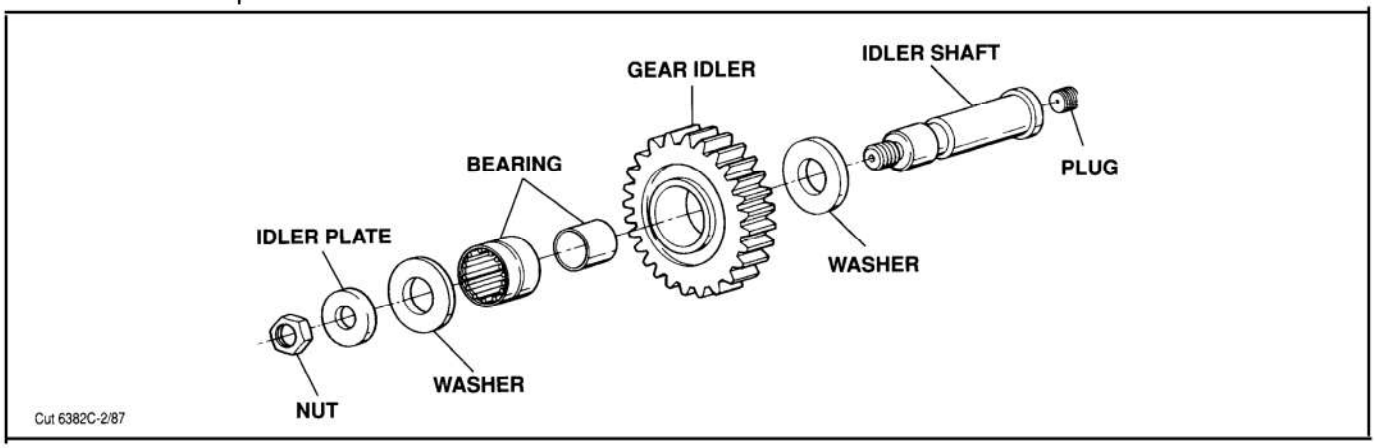


4. If necessary, remove the countershaft key.

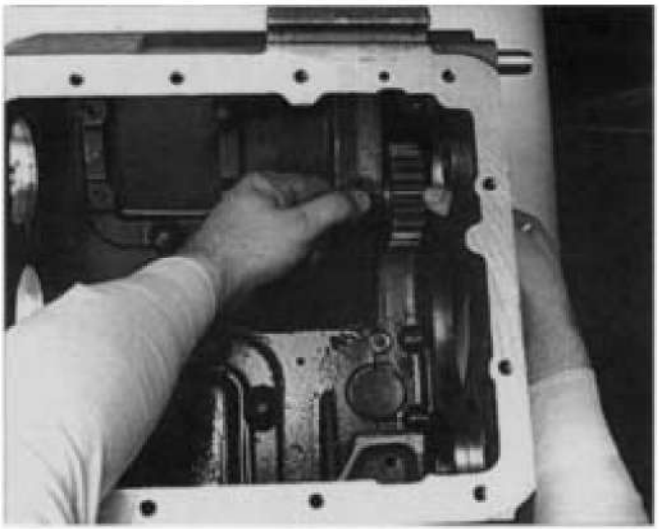
REASSEMBLY - FRONT SECTION

CASE ASSEMBLIES

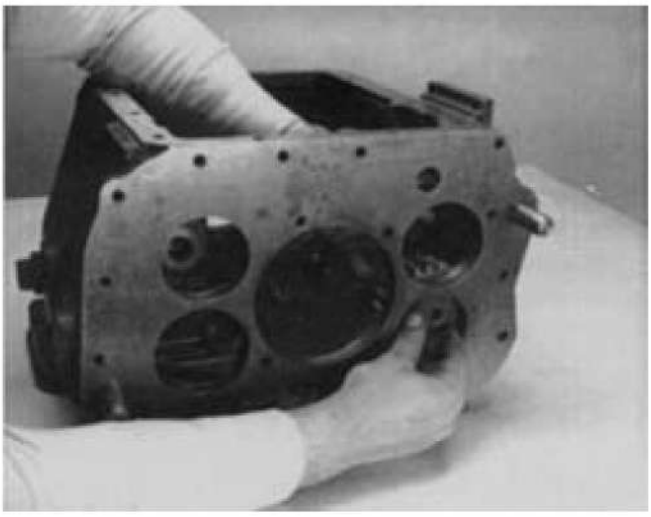
NOTE: Before starting reassembly, make sure the three magnetic discs are solidly in place at the bottom of the transmission case. These can be secured to the disc mounting surfaces with Scotch Grip Rubber Adhesive or equivalent adhesive.



A. Reassembly an Installation of the Lower Reverse Idler Gear Assembly

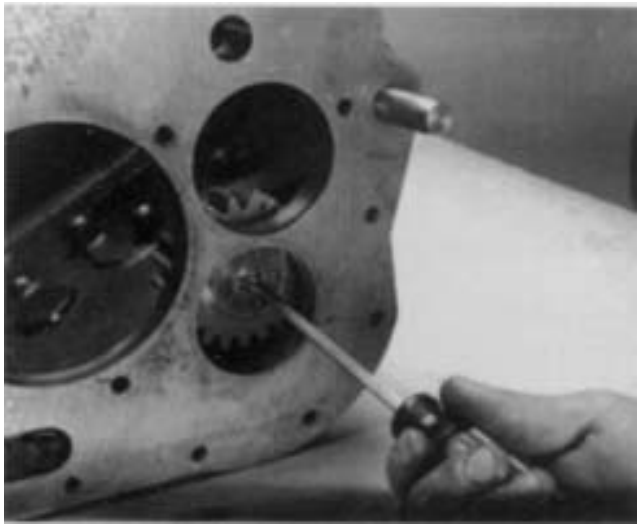


1. Position the reverse idler bearing, gear, and washer in the transmission case, washer to the case front.

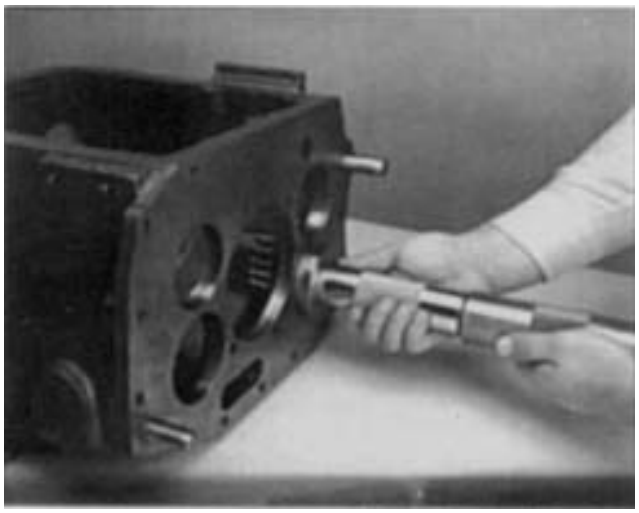


2. Install the idler shaft through the idler gear and into the transmission case bore. Make sure the idler shaft is seated in the support boss bore as far forward as possible. Install the washer and the stop nut on the idler shaft front. Tighten the nut to the recommended torque.

REASSEMBLY - FRONT SECTION

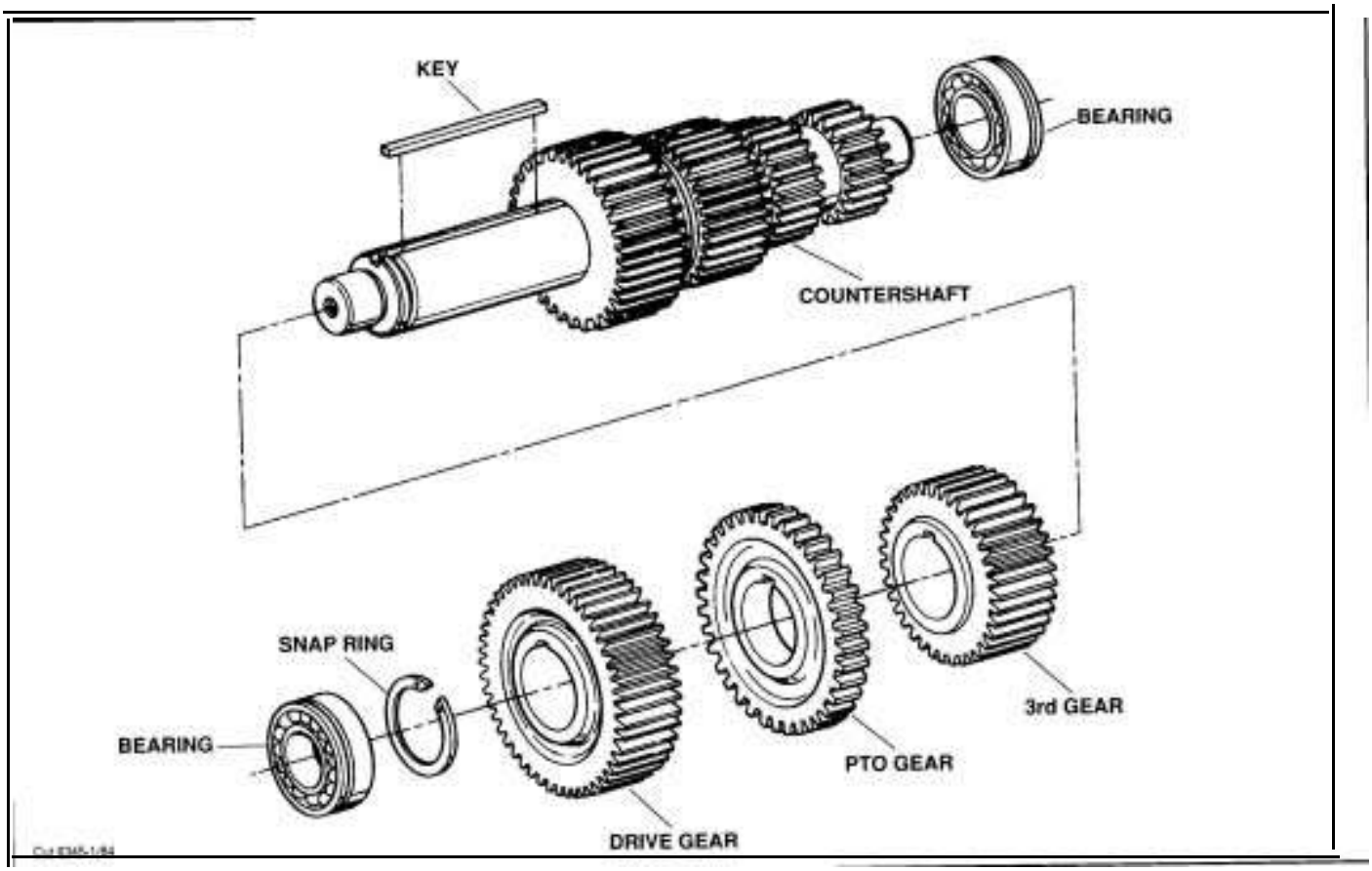


3. Install the reverse idler shaft plug.



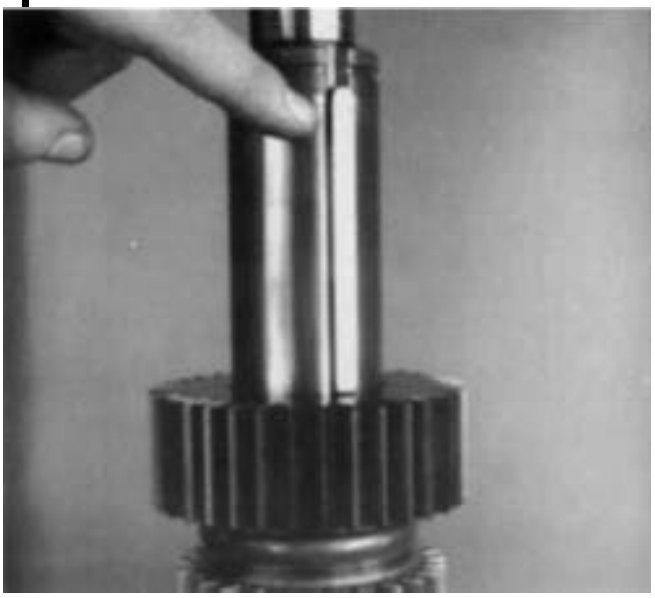
4. Install the auxiliary countershaft front bearing into the reverse idler gear case bore.

REASSEMBLY - FRONT SECTION

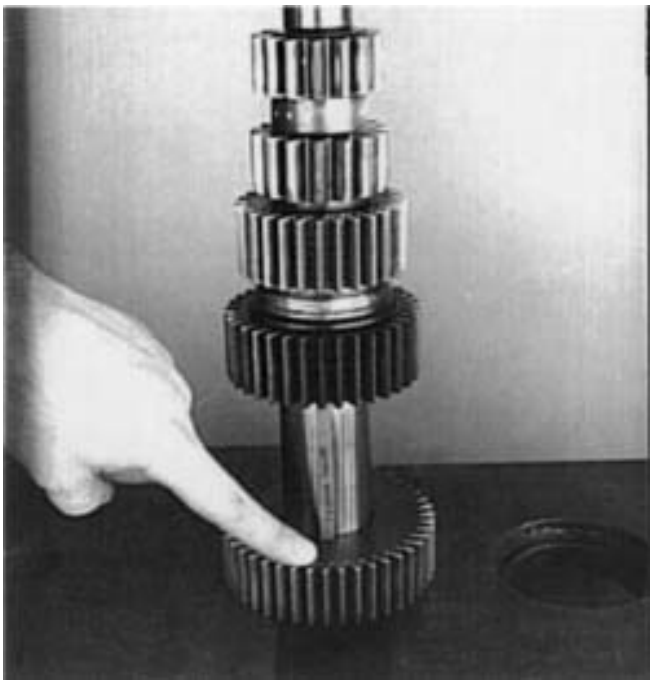


B. Reassembly of the Countershaft Assemblies

NOTE: Except for the PTO gears, the upper and lower countershaft assemblies are identical and reassemble in the same manner.

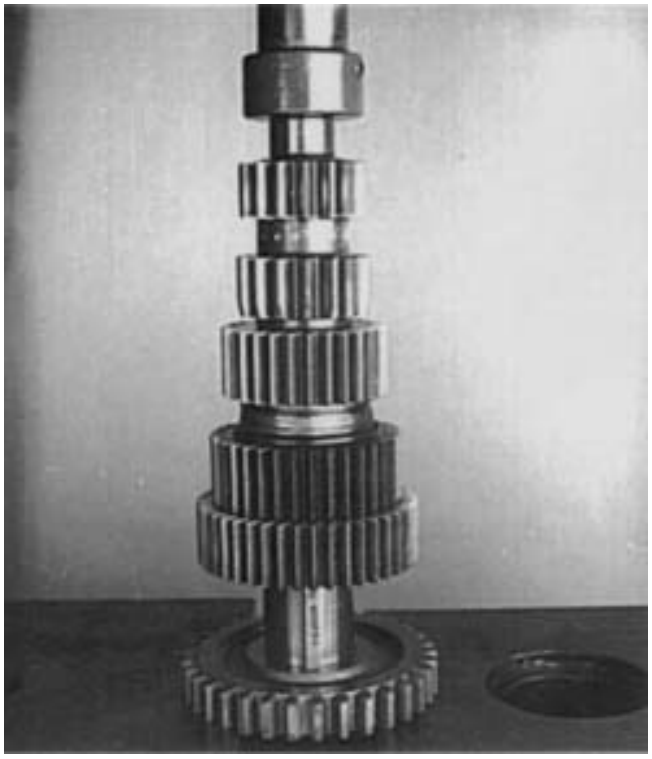


1. If previously removed, install the key in the countershaft keyway.



2. Align 3rd gear keyway with the countershaft key. Press 3rd speed gear on the countershaft, timing tooth, marked with an "O", facing the countershaft rear.

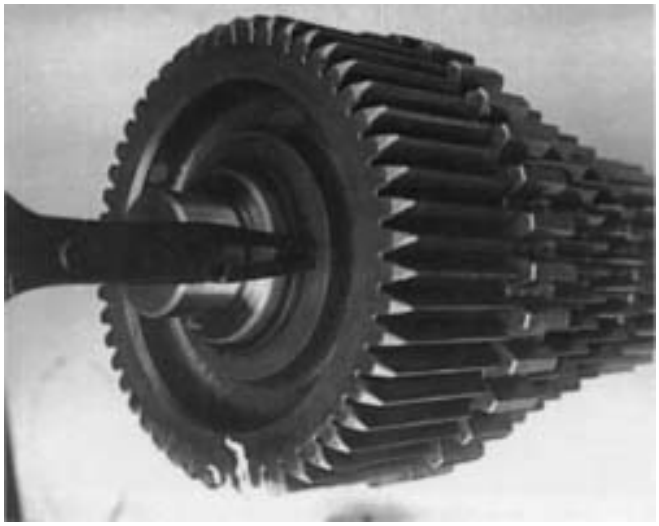
REASSEMBLY - FRONT SECTION



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



4. Align the countershaft drive gear keyway with countershaft key, press the countershaft drive gear onto the countershaft with gear long to the rear, (marked timing tooth to the front.)



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



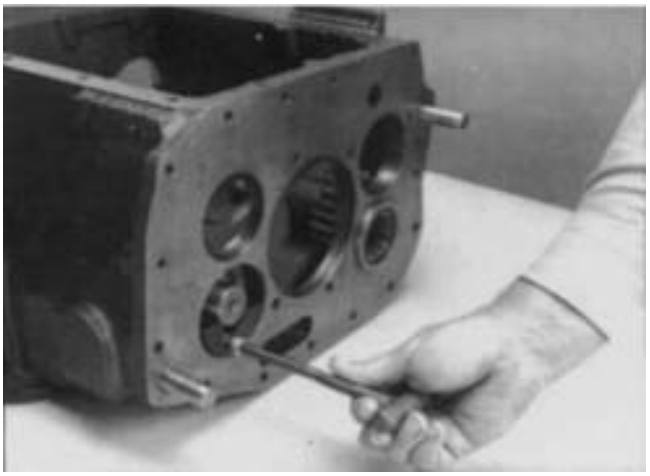
6. **IMPORTANT:** Mark each countershaft drive gear for timing purposes. Mark the tooth aligned with the gear keyway and stamped with an "O". A highly visible color of toolmakers' dye is recommended for making timing marks.

REASSEMBLY - FRONT SECTION

C. Installation of the Lower Countershaft Assembly



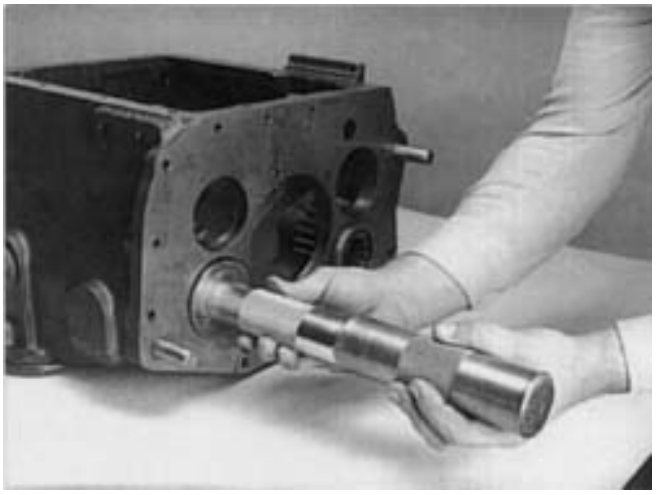
1. Place the lower countershaft into position in the case.



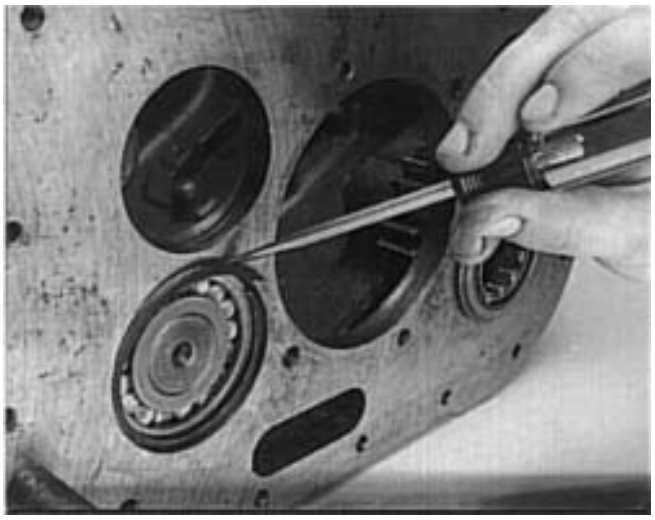
2. Move the lower countershaft assembly to the rear and insert the countershaft support tool, or block, to center shaft in the rear case bore.



3. Install the countershaft front bearing with a flanged driver.



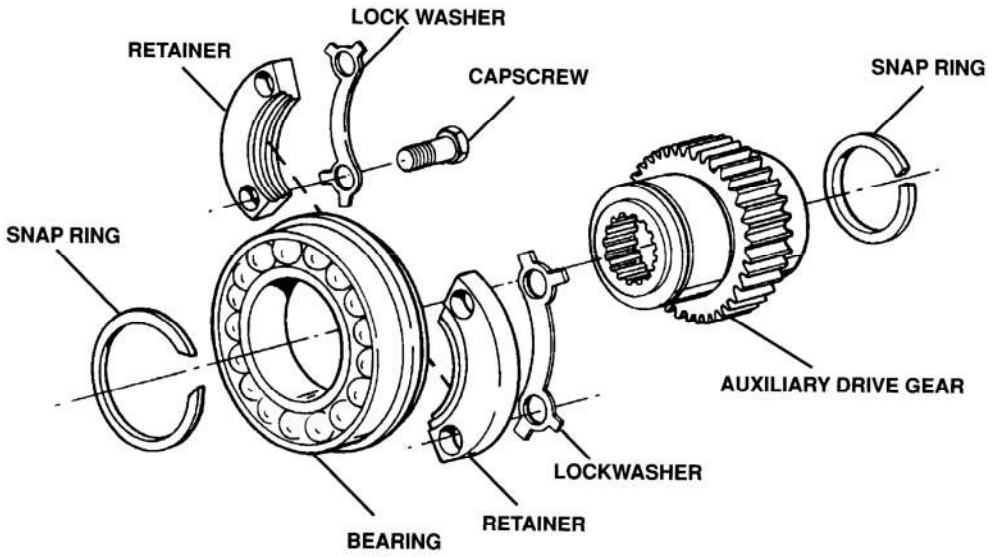
4. Install the countershaft rear bearing with a flanged driver.



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

REASSEMBLY - FRONT SECTION

Auxiliary Drive Gear

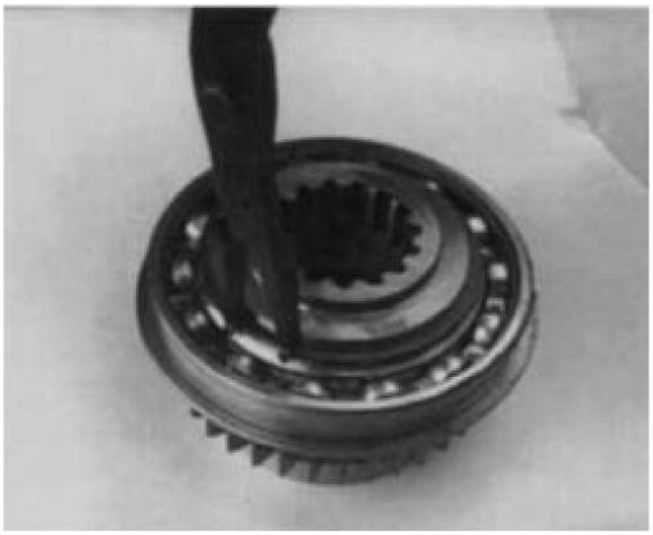


Cut 6421-2/80

D. Reassembly of the Auxiliary Drive Gear



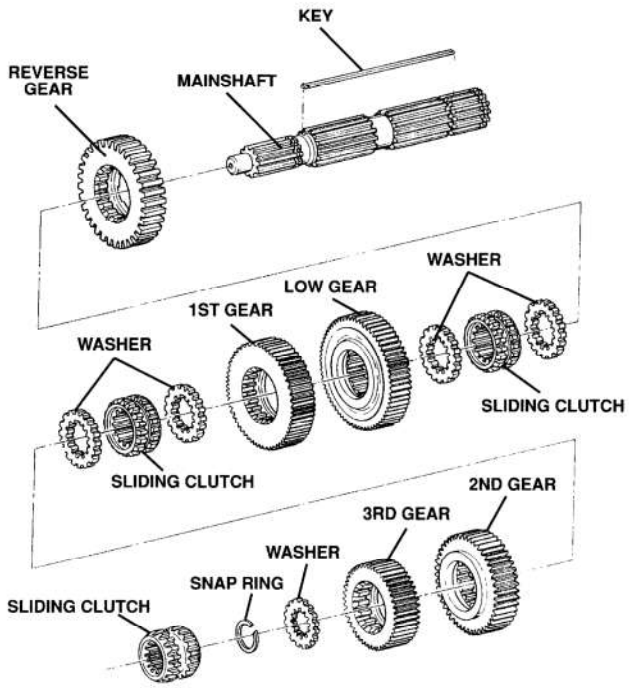
1 . Press the bearing on the auxiliary drive gear.



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

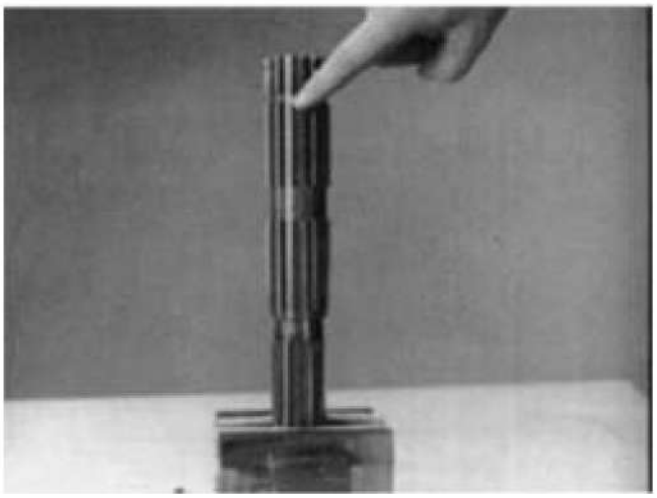
REASSEMBLY - FRONT SECTION

Mainshaft Assembly



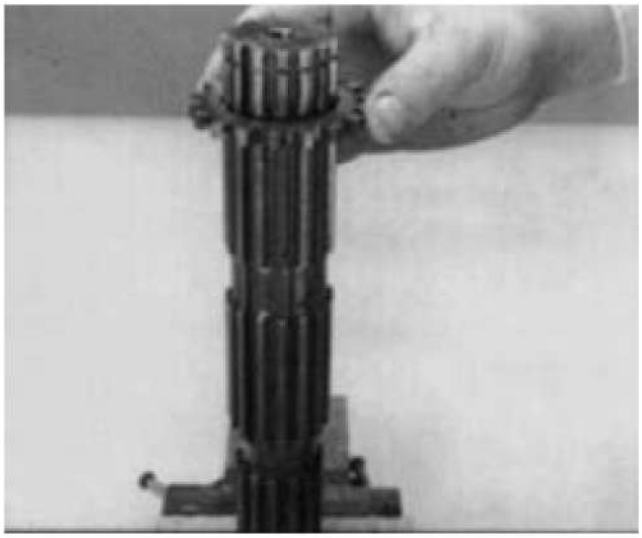
Cut 6334A-12/83

E. Reassembly and Partial Installation of the Mainshaft Assembly



1. Secure the mainshaft in a vise equipped with brass jaws or wood blocks, shaft-pilot-end down. If previously removed, install the roll pin in the keyway.

NOTE: If previously removed, install the corresponding snap rings in the I.D. of the mainshaft gears.



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

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, 10, 1st and 2nd speed gears are the same diameter, the 3rd speed tolerance washer is a smaller diameter..

REASSEMBLY - FRONT SECTION

SETTING CORRECT AXIAL CLEARANCES FOR THE MAINSHAFT GEARS

Axial Clearance (End Play) Limits Are:

.005" ¯.01 2" for all mainshaft gears

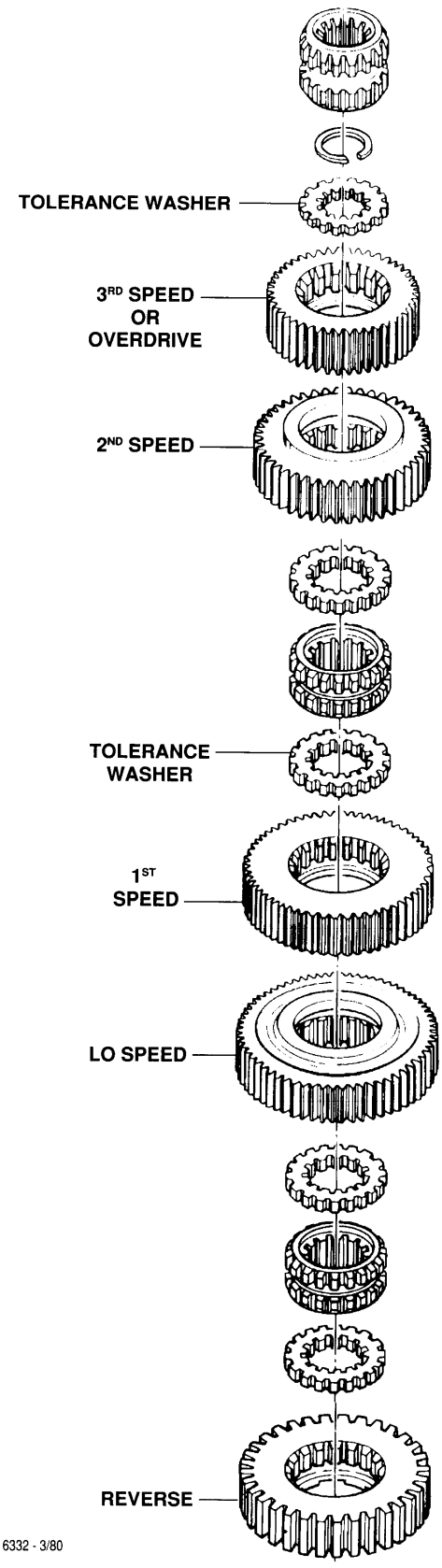
Washers are used to obtain the correct limits; six thicknesses are available as follows:

LIMITS (INCH)	COLOR CODE
.258 - .261	ORANGE
.263 - .265	PURPLE
.268 - .270	YELLOW
.273 - .275	BLACK
.278 - .280	RED

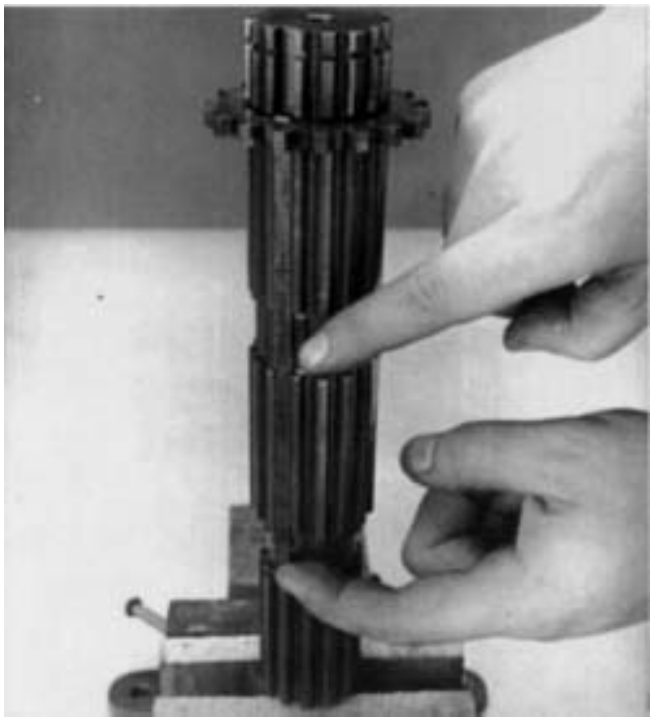
*NOTE: New style limit washers come in a full range of tolerances as corresponding colors listed above "plus red".

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.



REASSEMBLY - FRONT SECTION

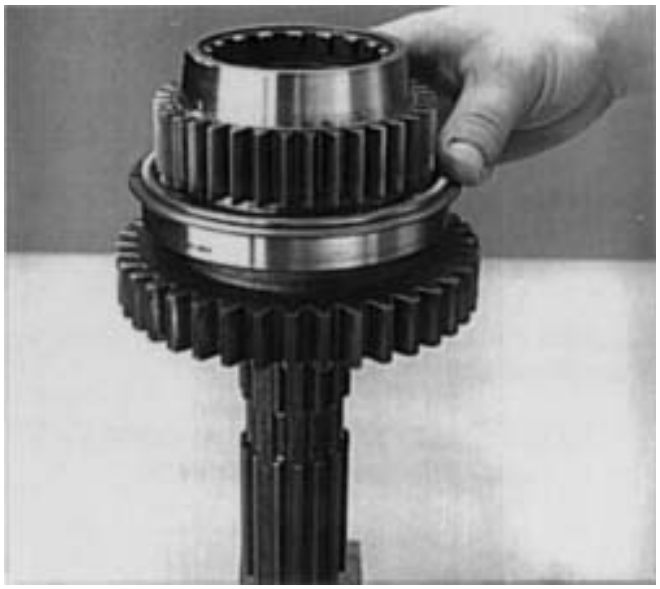


3. Rotate the tolerance washer in the mainshaft groove to align the washer splines with the mainshaft splines. Install the mainshaft key in keyway to lock the washer in place.

NOTE: Make sure the mainshaft key is positioned with the word "TOP" to the outside.



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

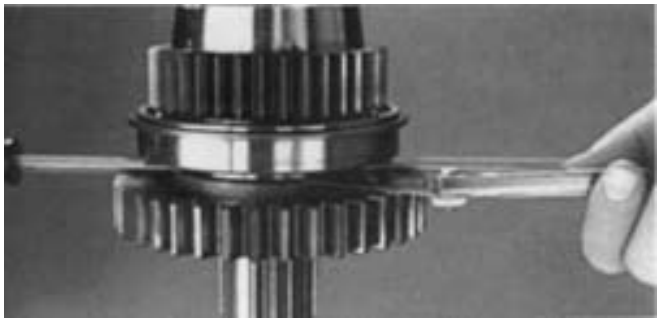


5. Install the auxiliary drive gear on the mainshaft with clutching teeth facing up.

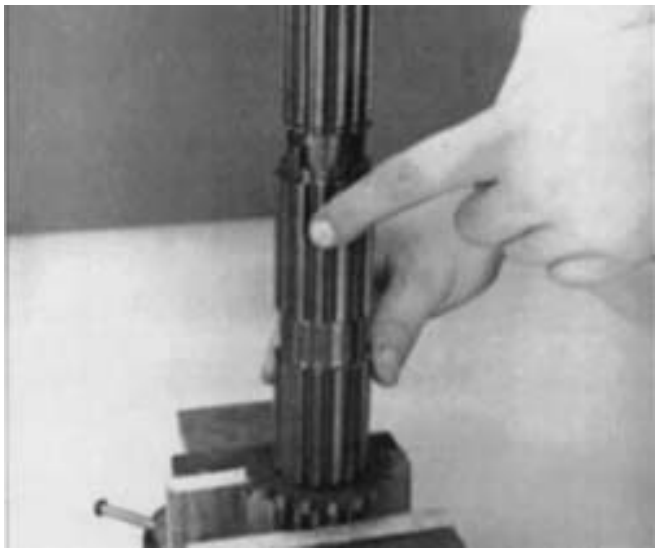


6. Install the snap ring in the mainshaft rear groove.

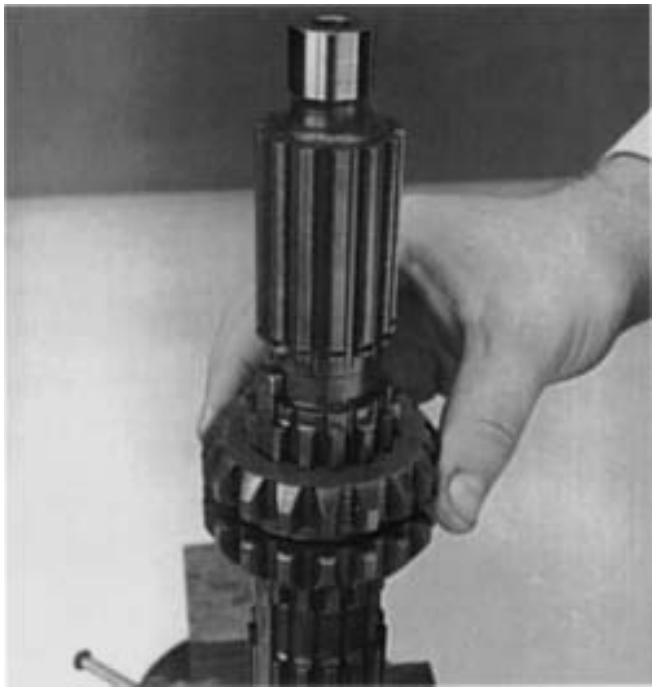
REASSEMBLY - FRONT SECTION



7. Insert two screwdrivers between the reverse gear hub and the auxiliary drive gear. Apply slight downward pressure on the screwdriver handles to spread the gears evenly apart. Make sure the gear hubs are parallel, insert a feeler gage between the hubs. Correct axial clearance should be from .005" to .01 2". If the clearance is less than the minimum .005" tolerance, the tolerance washer in the reverse gear should be replaced by a thinner tolerance washer. This increases the axial clearance between gears. If the clearance checked is greater than the maximum .012" tolerance, a thicker tolerance washer should be installed in the 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 the mainshaft rear, remove the auxiliary drive gear and the reverse gear from the mainshaft. The tolerance washer and key remain on the mainshaft. Reposition the mainshaft in the vise as shown, pilot end up, with the keyway accessible.



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



10. Remove the mainshaft key. Install LO speed gear toleranc washer on the mainshaft (inset). Install the key to lock the tolerance washer to the shaft.

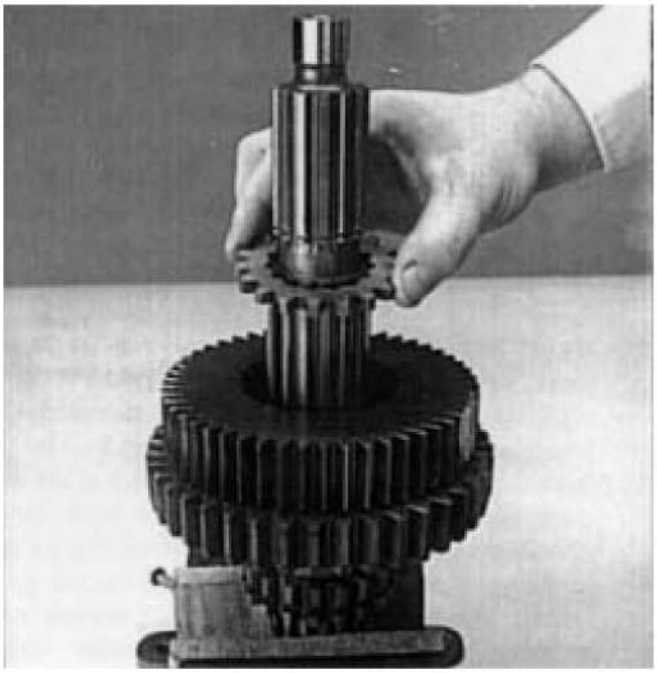
REASSEMBLY - FRONT SECTION



11. install LO speed gear on the mainshaft, clutching teeth down and engaged with the washer external splines.

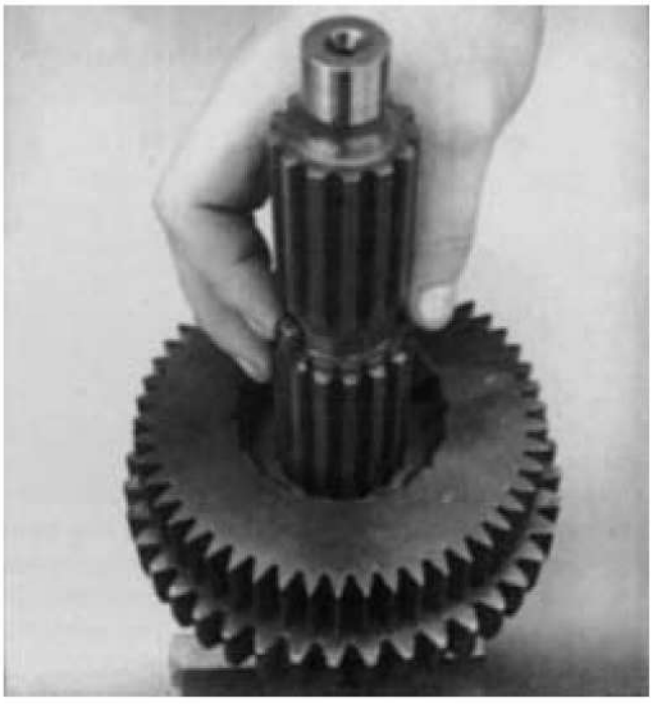


12. Install 1st speed gear on the mainshaft, clutching teeth up.



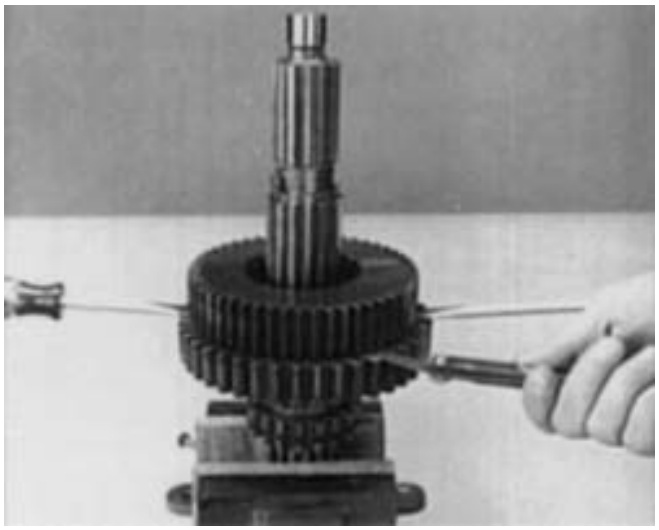
13. Remove the mainshaft key from the keyway. Install 1st speed gear tolerance washer on the mainshaft and into 1st speed gear hub.

⚠WARNING WHEN THE KEY IS REMOVED THE MAINSHAFT GEARS CAN DROP TO THE BOTTOM.

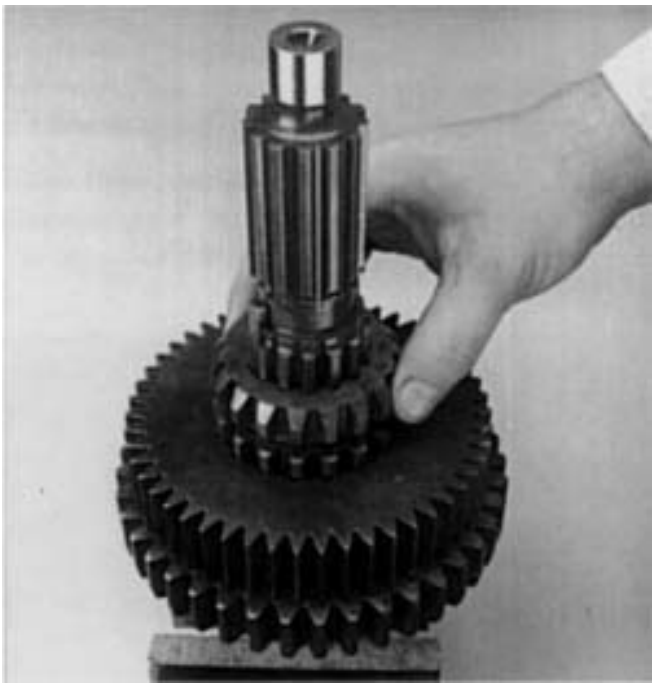


14. Install the mainshaft key to lock the tolerance washer to the shaft.

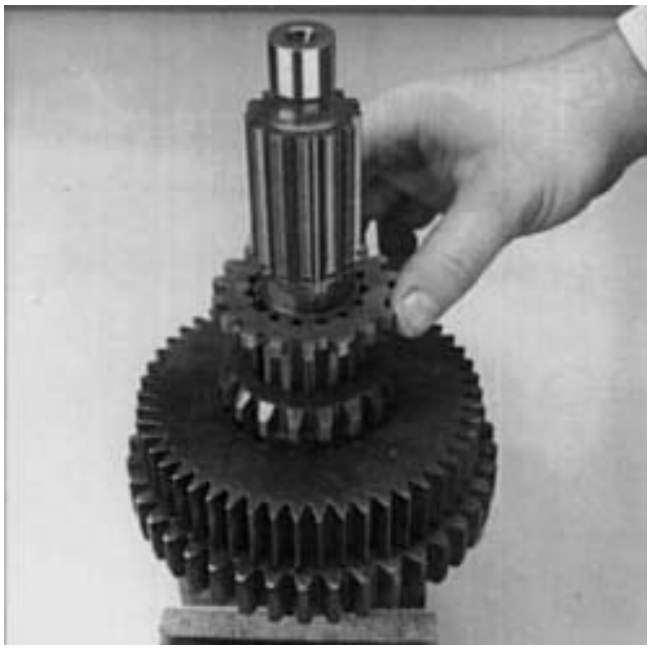
REASSEMBLY - FRONT SECTION



15. Check axial clearances and make adjustments if necessary.

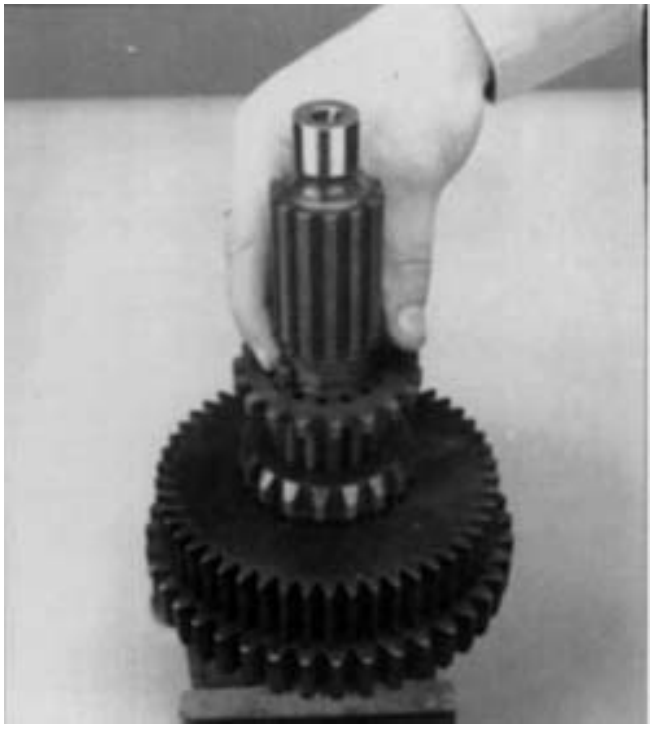


16. Install the 1st-2nd speed sliding clutch, aligning sliding clutch slot with key; engage with first speed gear.



17. Remove the mainshaft key and install 2nd gear tolerance washer. Install mainshaft key.

NOTE: It will be necessary to pull the mainshaft key up slightly to fit in keyway.

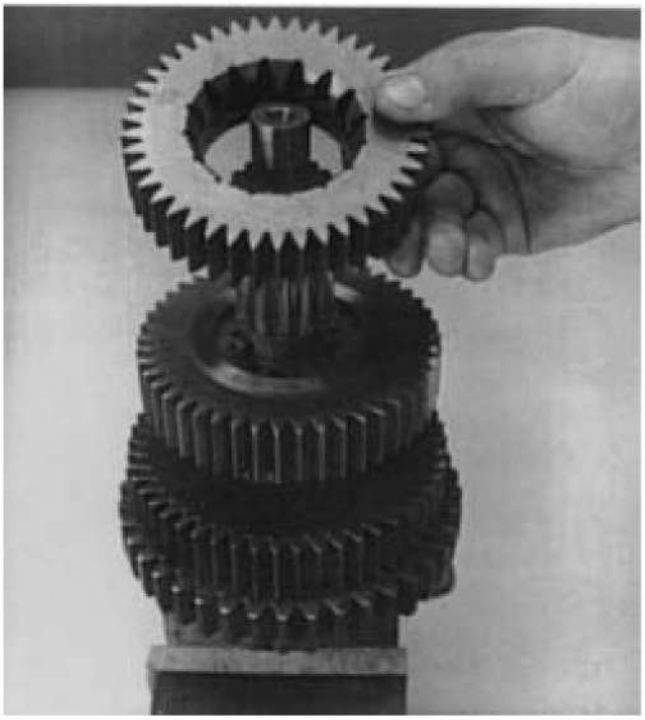


18. Reposition the key so it rests on the mainshaft grooved shoulder.

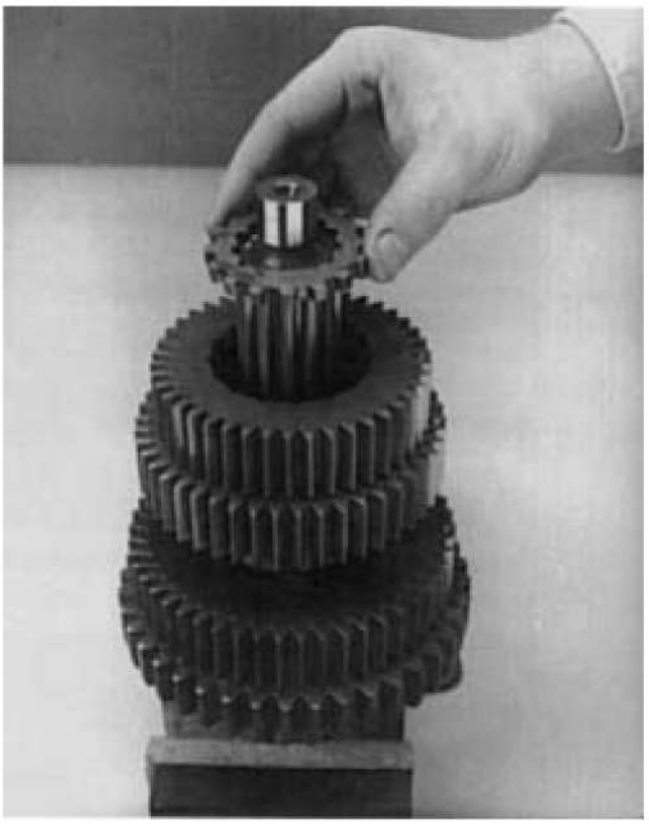
REASSEMBLY - FRONT SECTION



19. Install the 2nd speed gear on the mainshaft with clutching teeth down. Engage gear with the tolerance washer external splines.



20. Install the 3rd speed gear on the mainshaft with clutching teeth up.

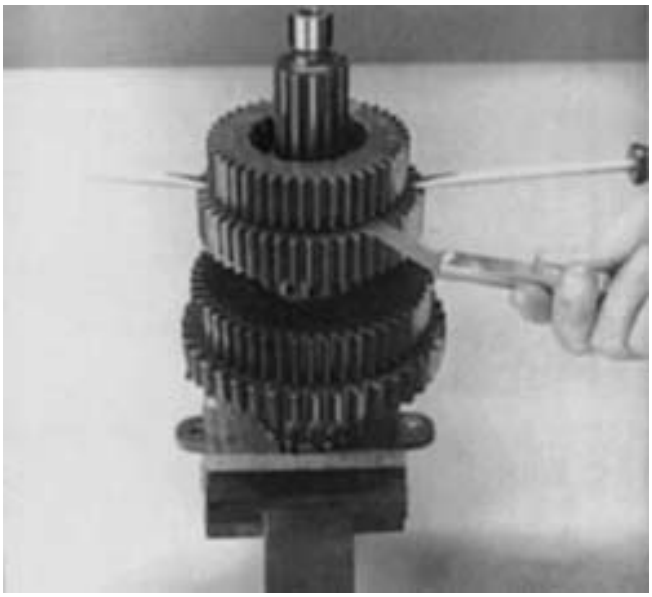


21. Install a tolerance washer in the 3rd speed gear bore.

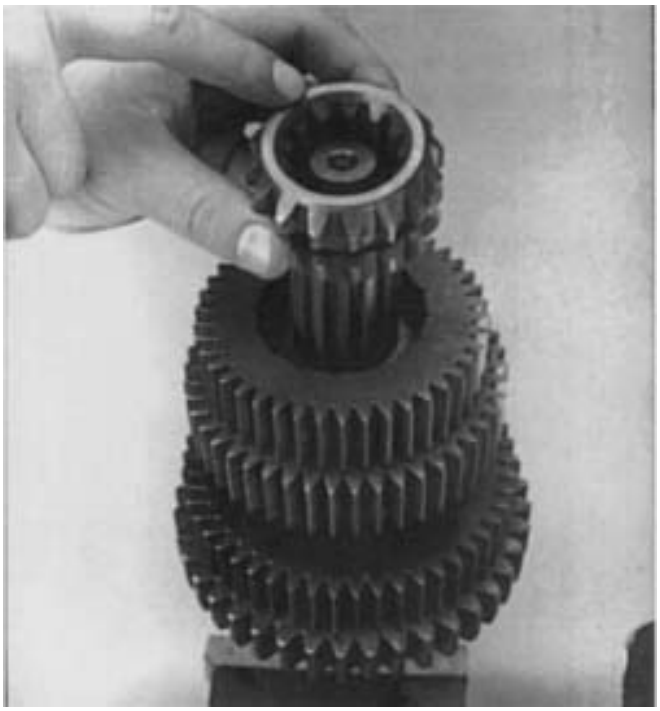


22. Install the snap ring in the snap ring groove.

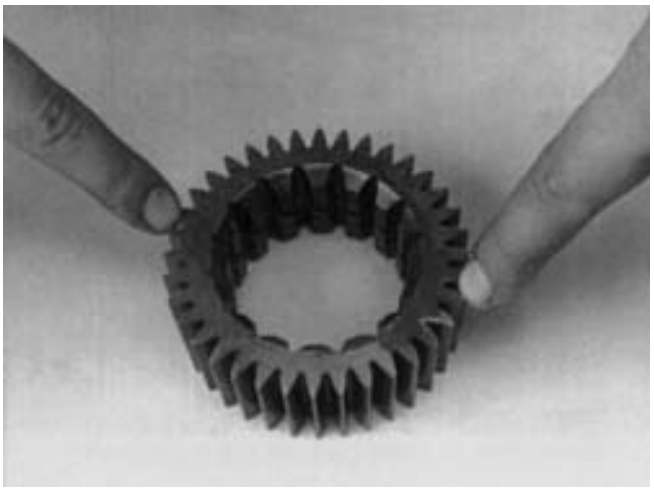
REASSEMBLY - FRONT SECTION



23. Check axial clearance and make adjustments if necessary.



24. Install the 3rd-4th speed sliding clutch to the mainshaft with "FRONT" up. Align sliding clutch slot with key and engage clutch with 3rd speed gear.

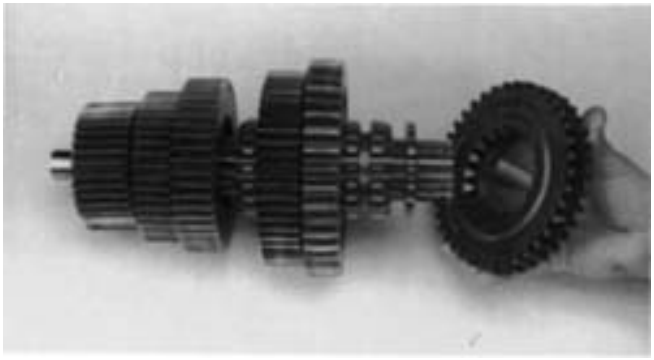


25. **IMPORTANT:** Mark timing teeth on drive gear (4th speed gear) with a highly visible color of toolmakers' dye.
    a. Mark 2 adjacent teeth on the drive gear.
    b. Mark 2 adjacent teeth on the drive gear which are directly opposite the first set marked. There should be the same number of teeth between the markings.



26. Install the drive gear (4th speed gear) on the mainshaft with clutching teeth down.

REASSEMBLY - FRONT SECTION



27. Remove the mainshaft assembly from the vise. Install the reverse gear on the mainshaft.

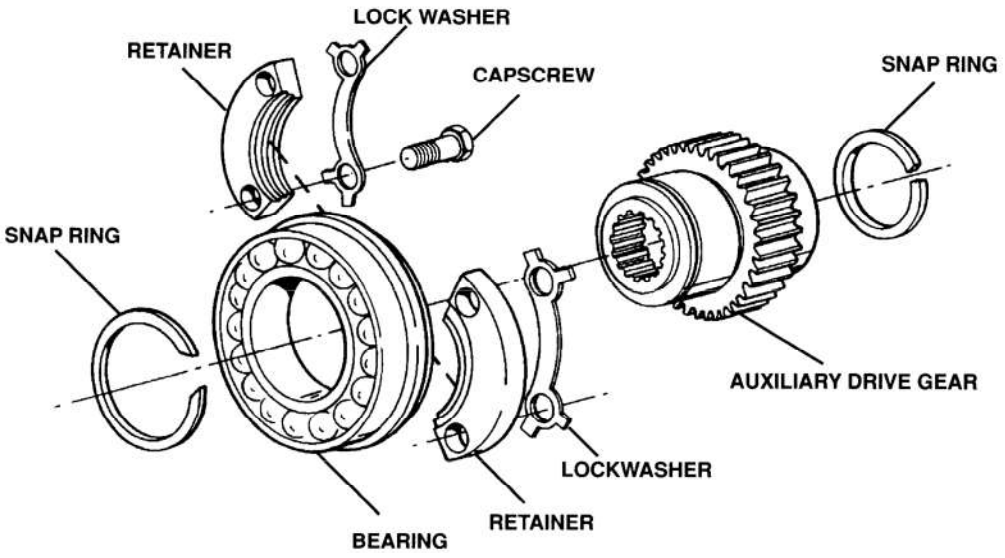
F. Partial Installation of the Upper Countershaft Assembly



1. Place the upper countershaft assembly into position the case. Support the countershaft assembly against the case wall as far as possible.

REASSEMBLY - FRONT SECTION

Drive Gear Assembly



Cut 6421-2/80

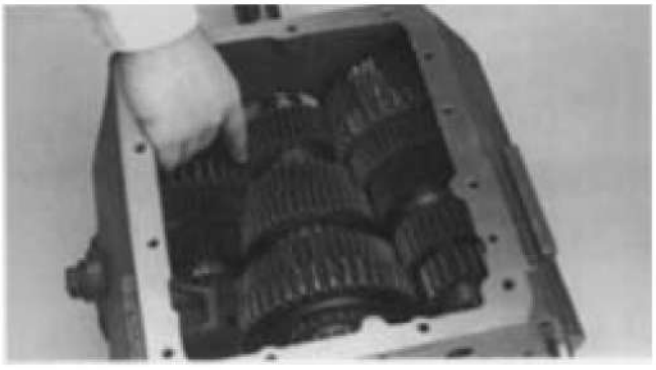
G. Installation Mainshaft Assembly and Drive Gear Assembly



1. Place the mainshaft assembly into position in the case.

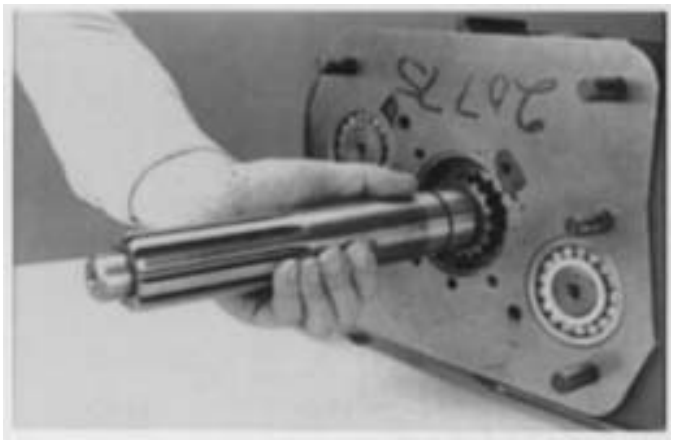


2. If previously removed, install the input shaft bushing.

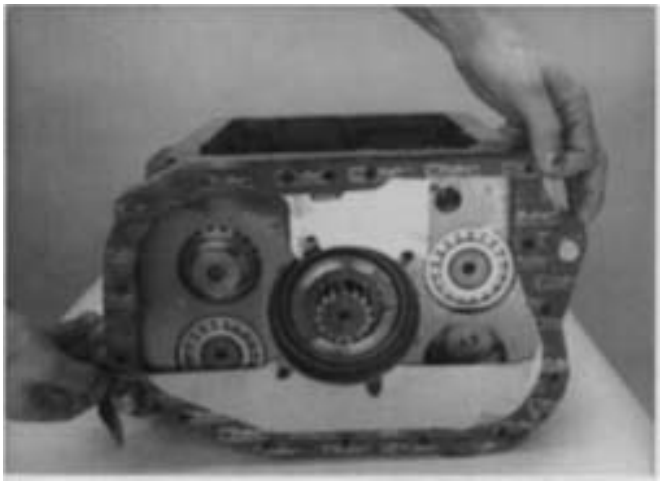


3. Mesh the lower countershaft marked tooth on the main drive gear.

REASSEMBLY - FRONT SECTION



4. Install input shaft through case bore and into the drive gear splines. Installation of the input shaft prevents the mainshaft from dropping to the case bottom.



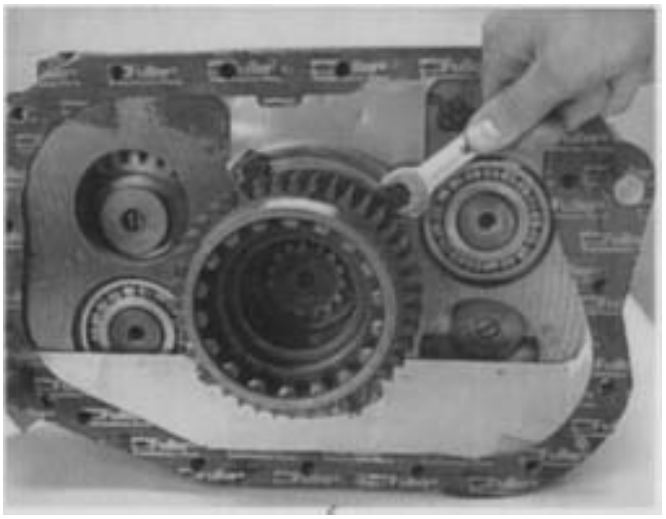
5. Align and install rear case gasket plate on alignment pins.



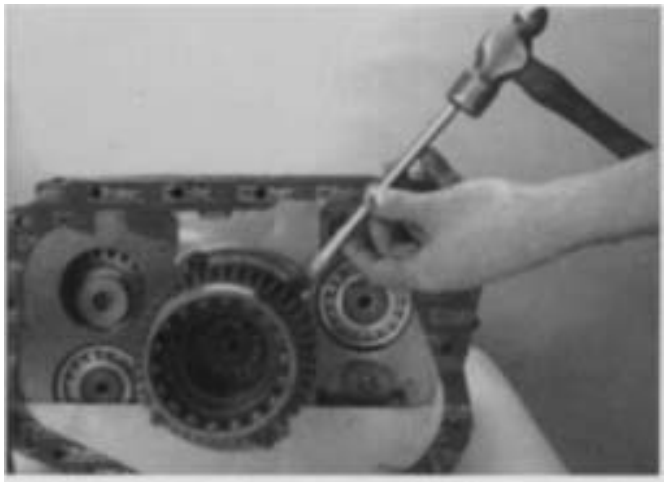
6. Partially install the auxiliary drive gear bearing in the case rear bore.



7. Install the bearing retainer plates. Tighten capscrews to recommended torque.

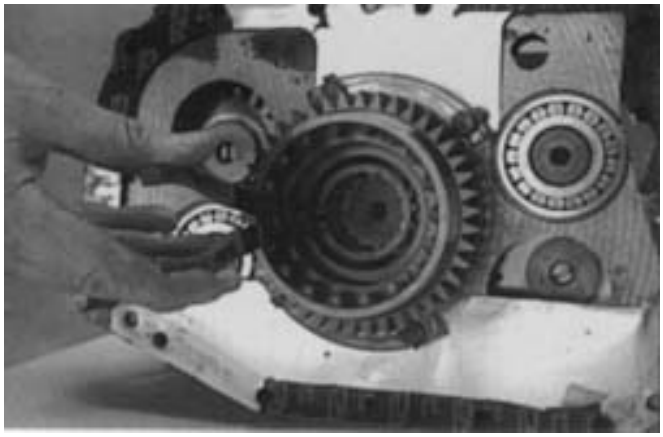


8. Completely seat auxiliary drive gear and tighten capscrews to recommended torque.



9. Bend the lock tangs on the retaining plates to secure capscrews.

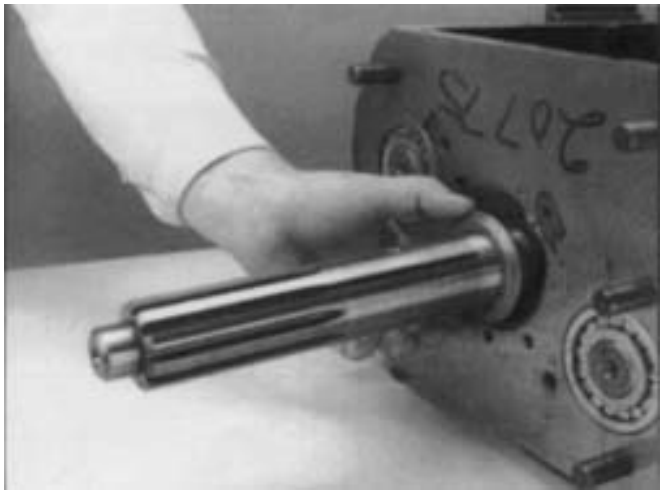
REASSEMBLY - FRONT SECTION



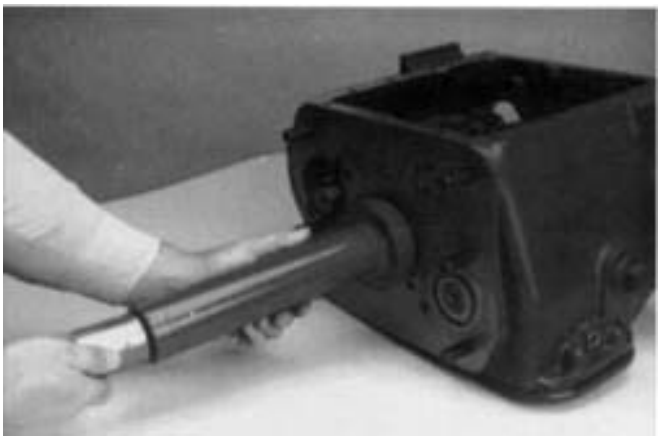
10. Move the mainshaft assembly to the rear to expose the mainshaft snap ring groove. Install the snap ring.



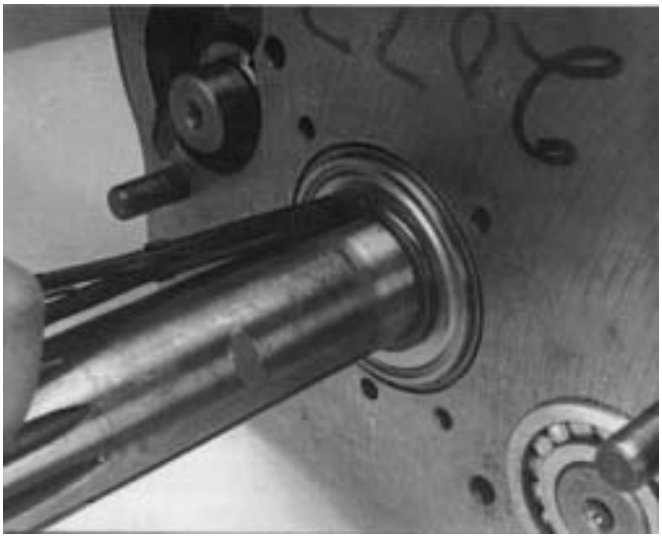
11. Install the drive gear snap ring.



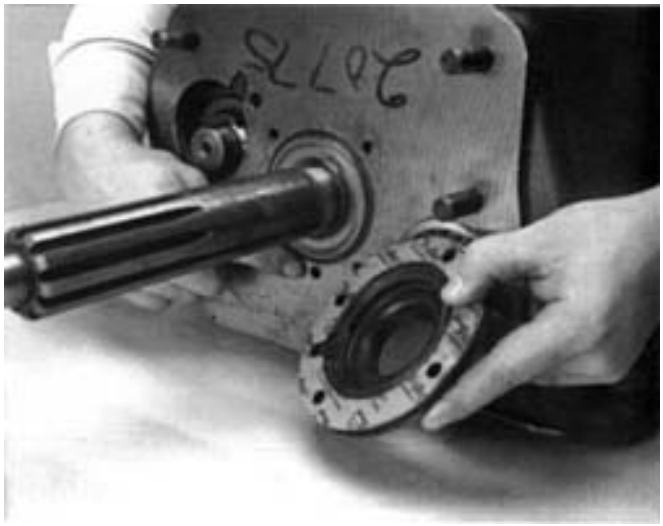
12. Install the drive gear spacer on the input shaft, chamfered side to the front.



13. Install the drive gear bearing.

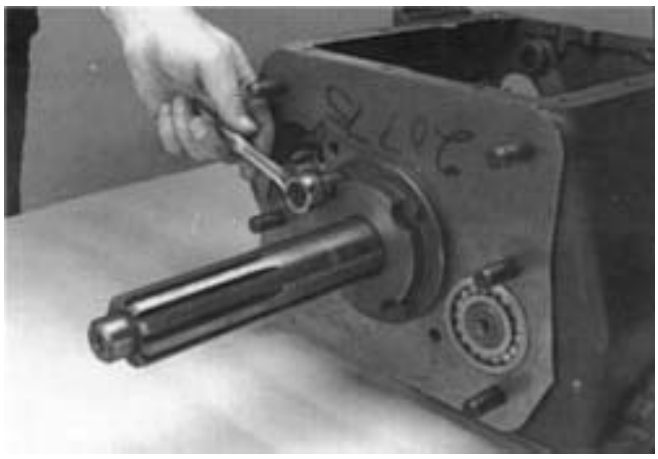


14. Install the bearing retainer snap ring.



15. Install the front bearing cover and gasket, make sure oil return hole aligns with cover hole.

REASSEMBLY - FRONT SECTION



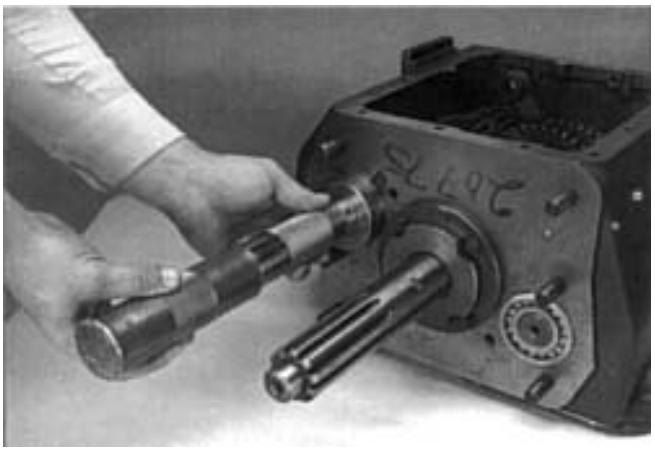
16. Install the bearing cover capscrews, tighten to the recommended torque.



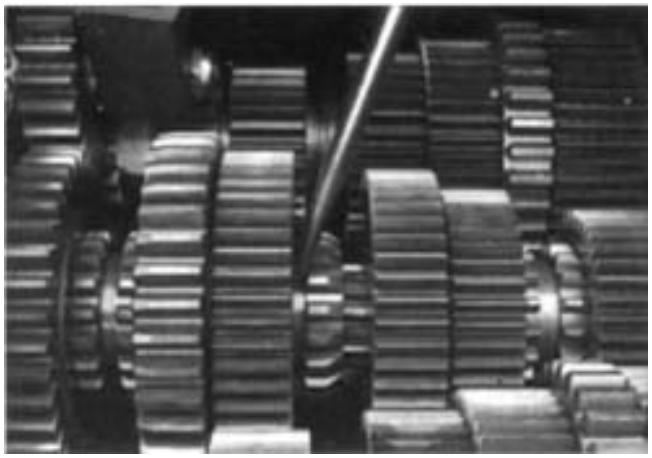
17. Engage the 3rd-4th speed clutch into 3rd speed mainshaft gear. This prevents 4th speed gear from dropping to cause a timing error.



18. Mesh the upper countershaft marked timing tooth with the main drive gear two marked timing teeth, make sure the lower countershaft remains in time.



19. Hold the countershaft in position and partially install the front and rear countershaft bearings.



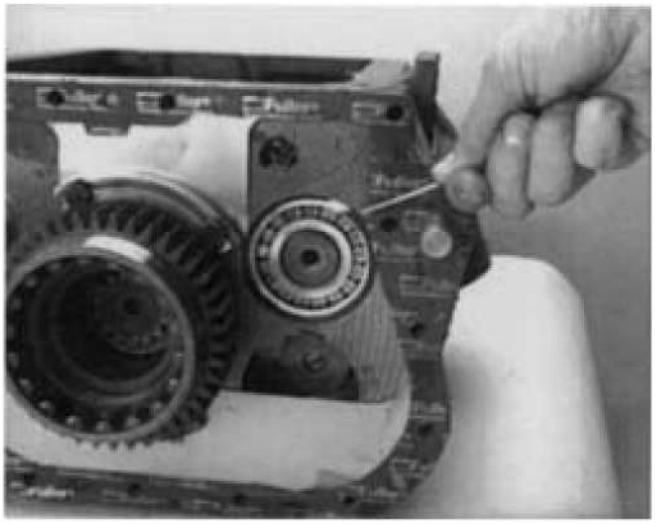
20. Shift the mainshaft sliding clutches into all the gear positions with a screwdriver. The front box is properly timed if the sliding clutches can be shifted into all the mainshaft gears.

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



21. Use a flanged driver to complete installation of the bearings, front and rear.

REASSEMBLY - FRONT SECTION

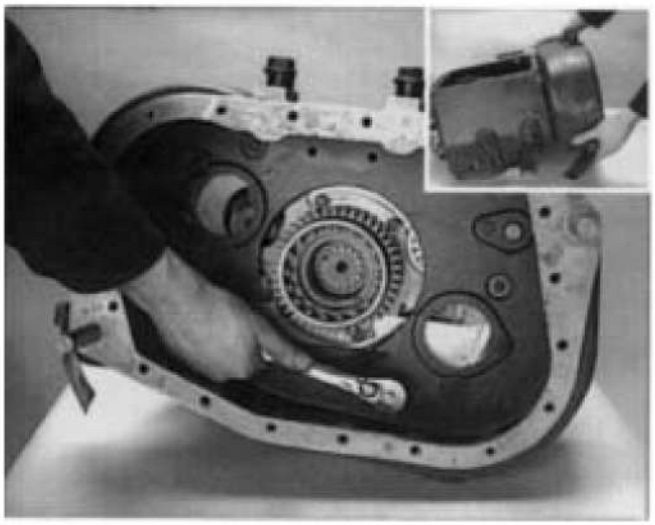


22. Install the case rear bore snap ring into the groove.

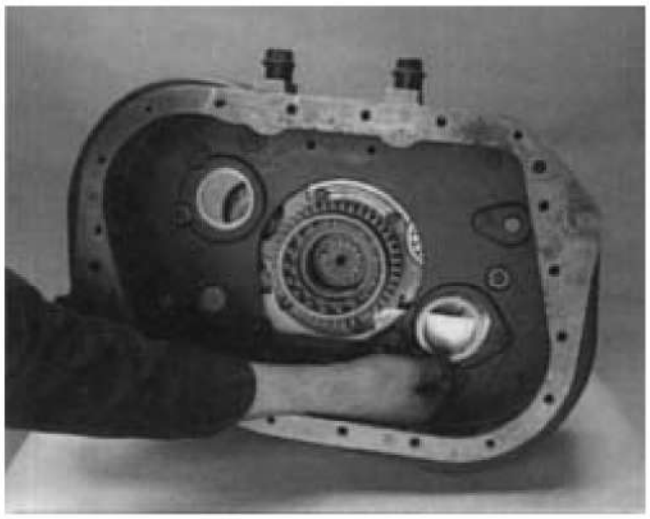
H. Installation of the Upper Reverse Idler Gear Assembly

NOTE: Since the upper and lower reverse idler gear assemblies are identical, reassembly and installation of the upper reverse idler gear assembly should be performed at this time as described in Part A of this section.

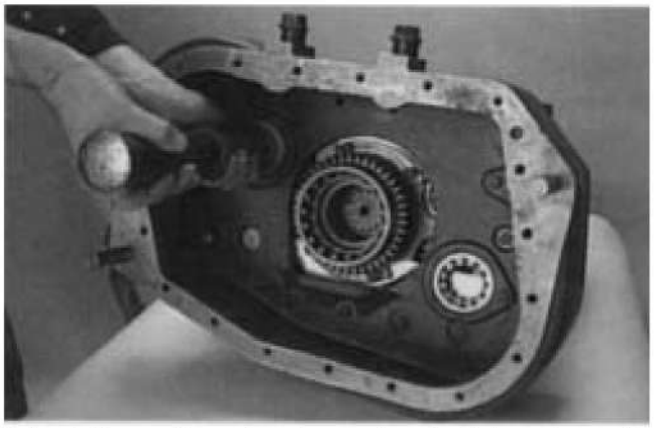
I. Installation of the Auxiliary Intermediate Housing



1. Align intermediate housing to rear of the front case (inset) then install retaining capscrews to recommended torque.



2. Install auxiliary front countershaft bearing spacers in bearing bores.



3. Install auxiliary front countershaft bearings. Be sure to completely set bearing against.

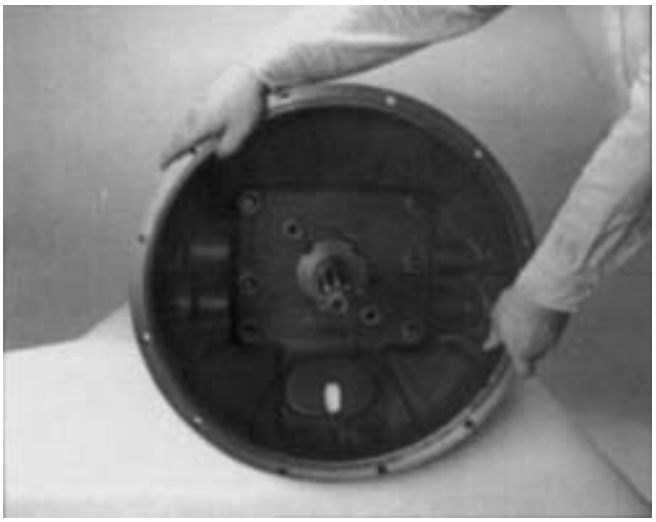


4. Align oil trough in intermediate section and install 3 retaining capscrews to recommended torque.

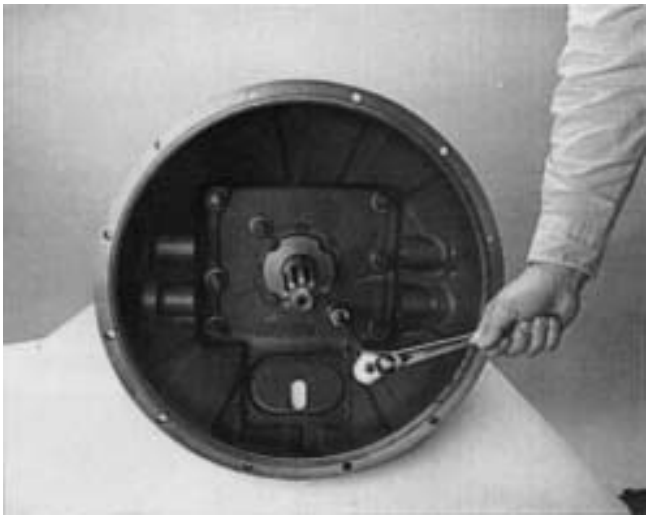
NOTE: Be sure spacer is in place on 7/16 capscrew of oil trough

INSTALLATION - CLUTCH HOUSING

A. Installation of the Clutch Housing



1 . Position the corresponding new gasket on the housing mounting surface. Install the clutch housing on the case front, piloting on the six studs and the drive gear bearing cover.

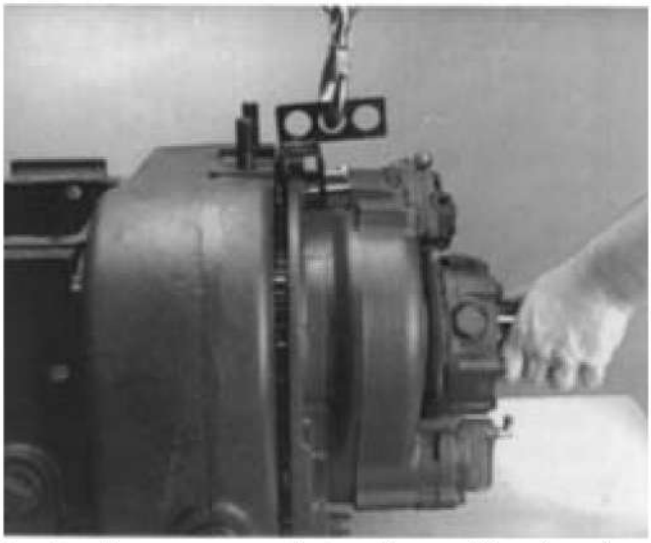


2. Install the 6 nuts with lockwashers and 2 cap-screws, tighten to the recommended torque.

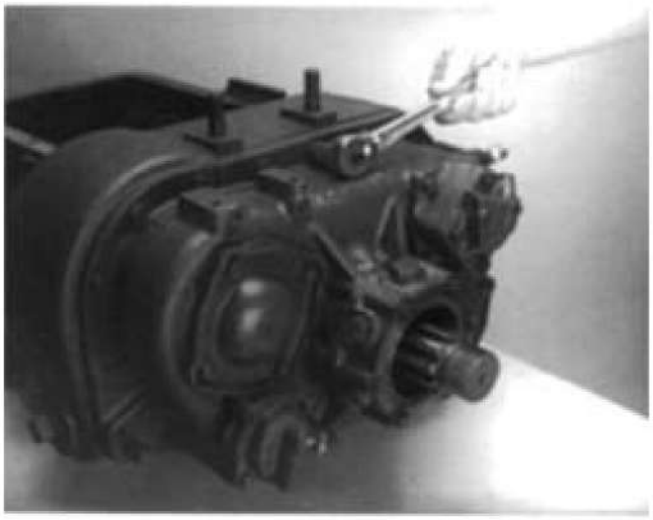
INSTALLATION - AUXILIARY SECTION

B. Installation of the Auxiliary Section

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



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

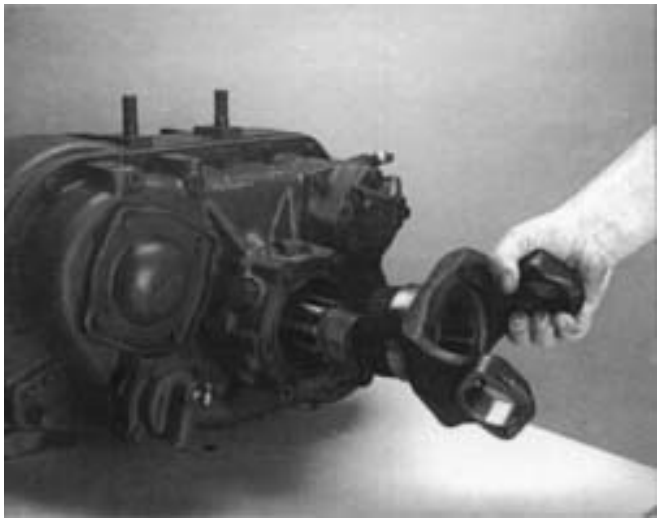


2. Install the 15 capscrews in the auxiliary housing flange and tighten to the recommended torque.

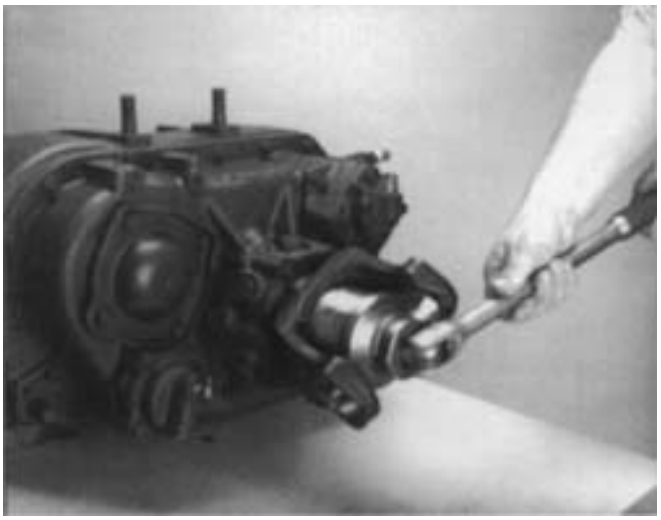
NOTE: There are 3 capscrew lengths. Make sure the capscrews are in their proper location.

INSTALLATION - OUTPUT YOKE

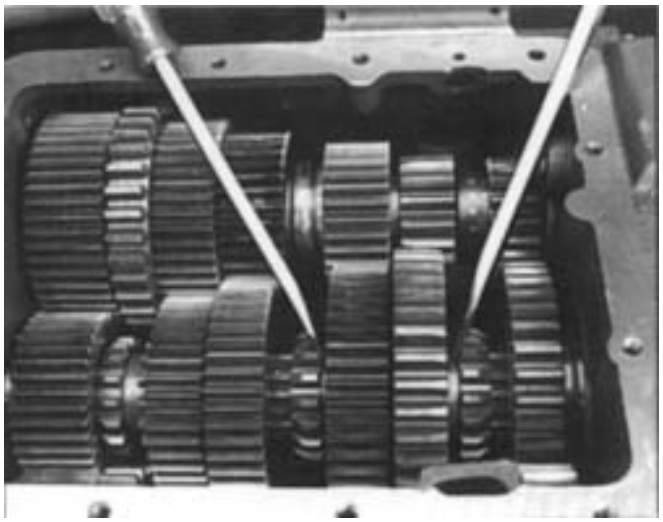
C. Installation of the Output Yoke



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



3. Install the washer and nut on the output shaft. Tighten the nut according to the recommended torque.



2. Lock the transmission by engaging two main-shaft gears with their slide clutches.

INSTALLATION - SHIFTING CONTROLS

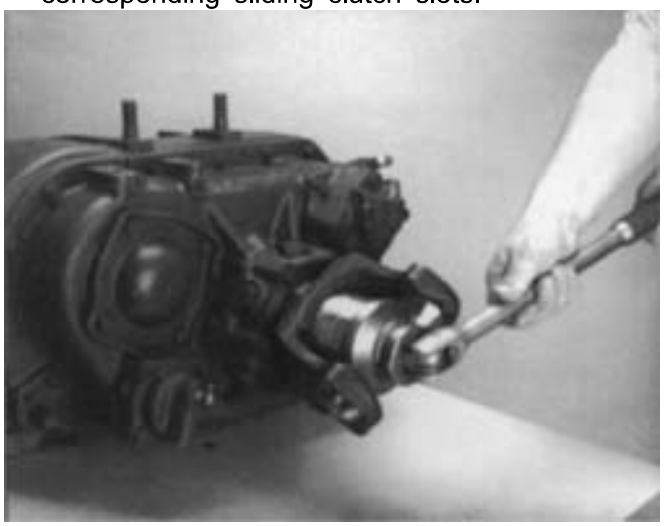
A. Installation of the Shift Bar Housing



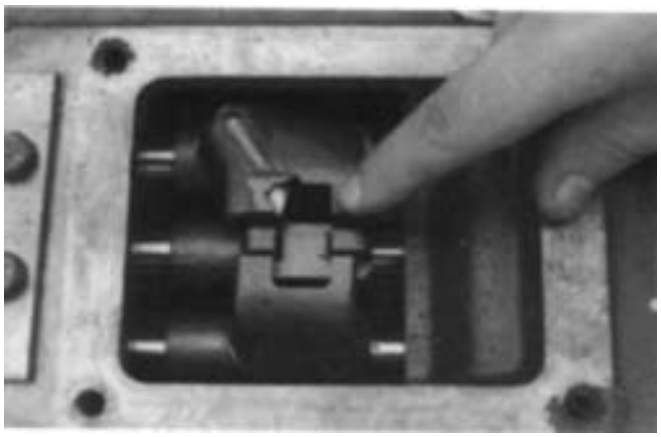
1. Place all three mainshaft sliding clutches in the neutral position. Position the shift bar housing gasket.



2. Install the shift bar housing assembly on the transmission case, fitting the shift yokes into the corresponding sliding clutch slots.



3. Install the capscrews in the housing. Tighten to secure the assembly to the transmission case.



1. Make sure the shift block and the yoke notches are aligned in the neutral position.



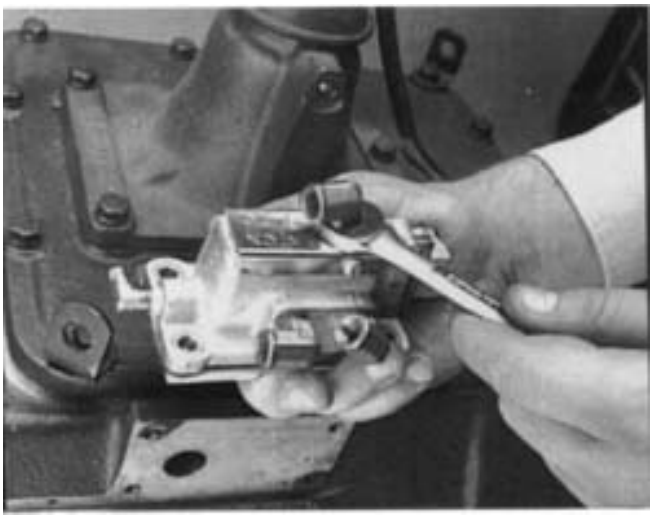
2. Install the new gear shift lever housing gasket in position on the shift bar housing. Install the gear shift lever housing assembly on the shift bar housing, fitting the lever into the shift block and yoke notches.



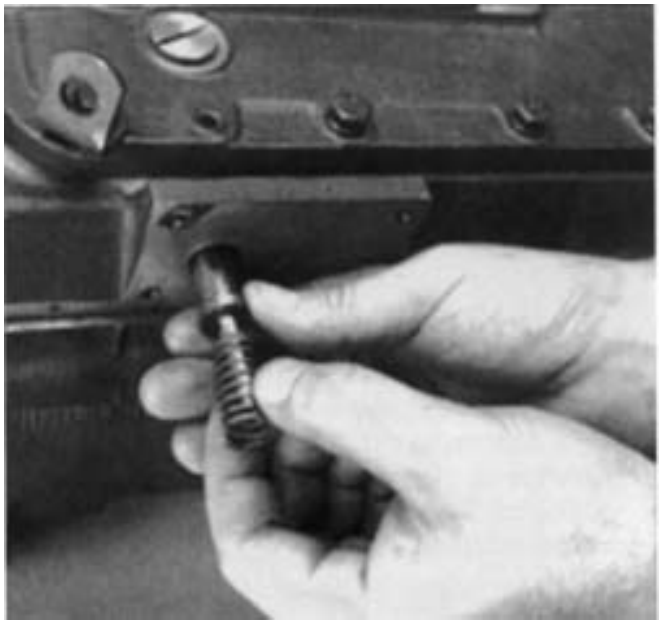
3. Install the retaining capscrews in the shift bar housing flange. Tighten to hold the assembly to the shift bar housing.

INSTALLATION - SHIFTING CONTROLS

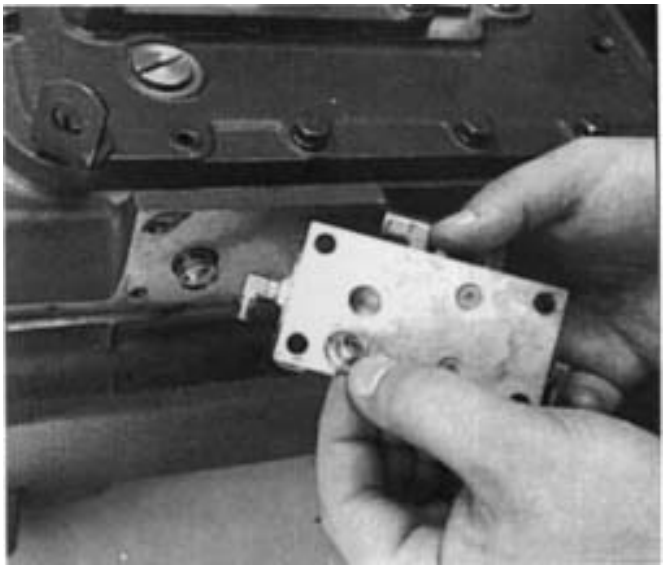
C. Installation of the Slave Valve



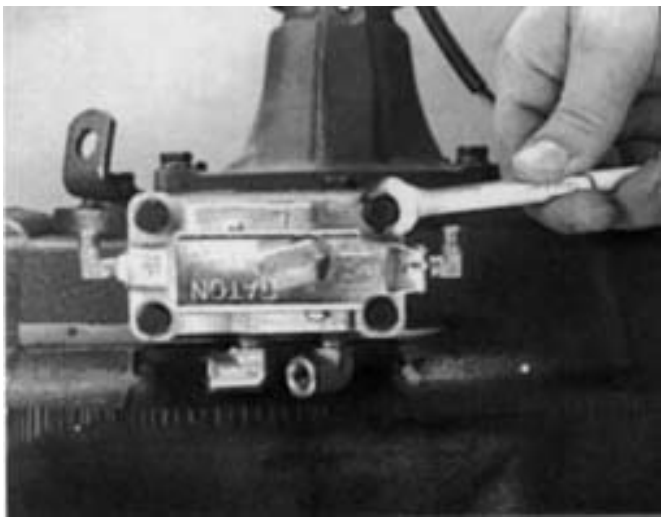
1. If previously removed, install the air line fittings on the slave valves.



2. Install the spring on the actuating pin shank. Insert the shank in the transmission case bore.



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



4. Position the corresponding new gasket on the valve mounting surface. Install the slave valve on the transmission case, inserting the actuating pin end into the alignment sleeve. Attach the valve to the transmission case with four retaining capscrews tightened evenly.

INSTALLATION - SHIFTING CONTROLS

D. Installation of the Air Hoses, Air Filter/Regulator, and Roadranger Valve

NOTE: We recommend using Fuller Sealant 71205 for sealing the fittings.



1. Connect the 1/4" I.D. air hose between the slave valve "L" port and the range cylinder "L" port. Tighten both connections to the recommended torque.



2. Connect the 1/4" I.D. air hose between the slave valve "H" port and the range cylinder "H" port. Tighten both connections to the recommended torque.

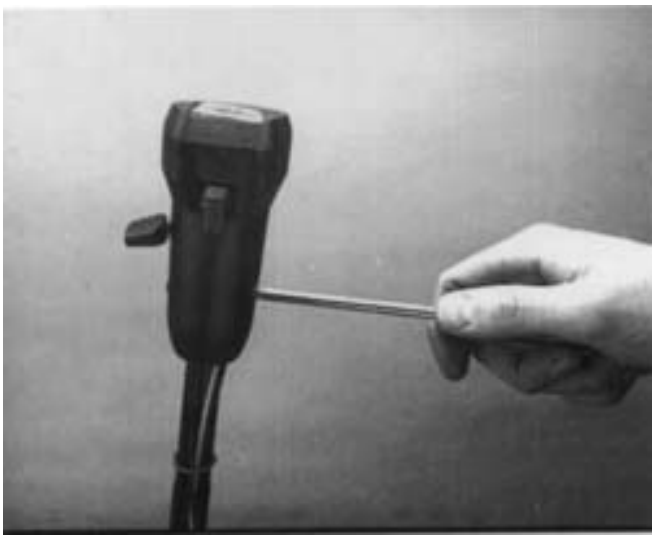


3. Position the air filter/regulator on the auxiliary housing rear. Install the two retaining capscrews, tighten both connections to the recommended torque.

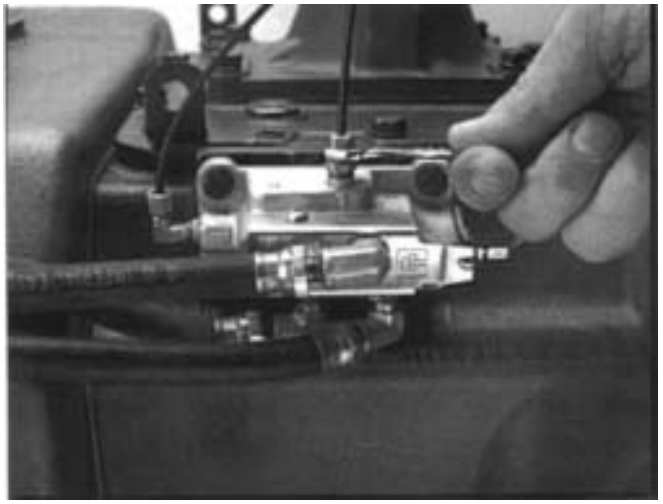


4. Connect the 1/4" I.D. air hose between the slave valve "S" Port and the air filter/regulator. Tighten both connections to the recommended torque.

INSTALLATION - SHIFTING CONTROLS



5. Thread the Roadranger valve on the shift lever and secure by tightening the jam nut against the Roadranger valve. Install the Roadranger valve cover over the 2 air lines and gear shift lever.



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

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