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Service Manual

Eaton® Fuller® Heavy-Duty Transmissions

TRSM0410 EN-US

December 1989

6609 Series

Powering Business Worldwide

BACKED BY Roadranger SUPPORT

For parts or service call us
Pro Gear & Transmission, Inc.

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Orlando, FL 32805



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General Information



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.

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 26. Instructions for installation are on page 81. 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

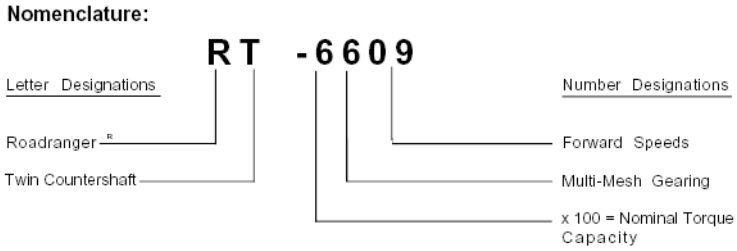
Kalamazoo, Michigan 49003

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Model Designations and Specifications

Nomenclature



CAUTION: 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.

Model	No. Speeds	GEAR RATIOS										
		LOW RANGE					HIGH RANGE				REVERSE	
		LO	1st	2nd	3rd	4th	5th	6th	7th	8th	LO	HI
RT-6609	9	12.72	8.61	6.27	4.66	3.42	2.52	1.83	1.36	1.00	12.08	3.53

Relative Speed PTO Gear to Input R.P.M.		Note 1 Length	Note 2 Weight	Note 3 Oil capacity
Right	Bottom	28.4 in	440 Lbs.	12 Pints
.720	.720	721.9 mm	199 Kgs	5.81 liters

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.

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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 (402,336 Km)	Change transmission fluid
OFF-HIGHWAY USE	
Every 30 hours	Inspect lubricant level, Check for leaks
Every 500 hours	Change transmission 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	Factory fill initial drain
(4827 to 8045 Km)	Refill with Eaton® Roadranger® CD50 Transmission oil;
	thereafter follow maintenance intervals above
HIGHWAY USE	
First 3,000 to 5,000 miles (4827 to 8045 Km)	Factory fill initial drain.
Every 10,000 miles (16090 Km)	Inspect lubricant level, Check for leaks
Every 50,000 miles (80,450 Km)	Change transmission lubricant.
OFF-HIGHWAY USE	
First 30 hours	Change transmission lubricant on new units
Every 40 hours	Inspect lubricant level. Check for leaks
Every 500 hours	Change transmission lubricant where severe dirt conditions exist
Every 1,000 hours	Change transmission lubricant (Normal off-highway use.)

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Change the oil filter when fluid or lubricant is changed.

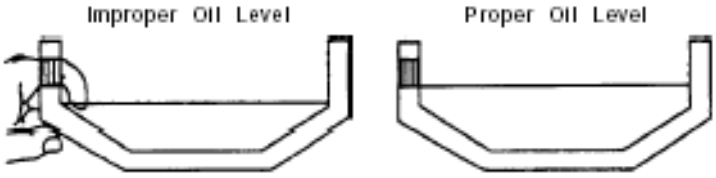
Type	Grade (SAE)	Fahrenheit (Celsius) Ambient Temperature
Eaton® Roadranger® CD50 Transmission Fluid	50	All
Heavy Duty Engine Oil MIL-L-2104B, C, or D or API-SF or API-CD (Previous API designations acceptable)	50	Above 10°F (-12°C)
	40	Above 10°F (-12°C)
	30	Below 10°F (-12°C)
Mineral Gear Oil with rust and oxidation inhibitor API-GL-1	90	Above 10°F (-12°C)
	80W	Below 10°F (-12°C)

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

Do not use mild EP gear oil or multi-purpose gear 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.

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.
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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.

1. Transmission Oil Coolers are: Recommended:
   -With engines of 350 H. P. and above with overdrive transmissions
2. Required:
   -With engines 399 H. P. and above with over drive transmissions and GCW'S over 90,000 lbs.
   -With engines 399 H. P. and above and 1400 lb-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.

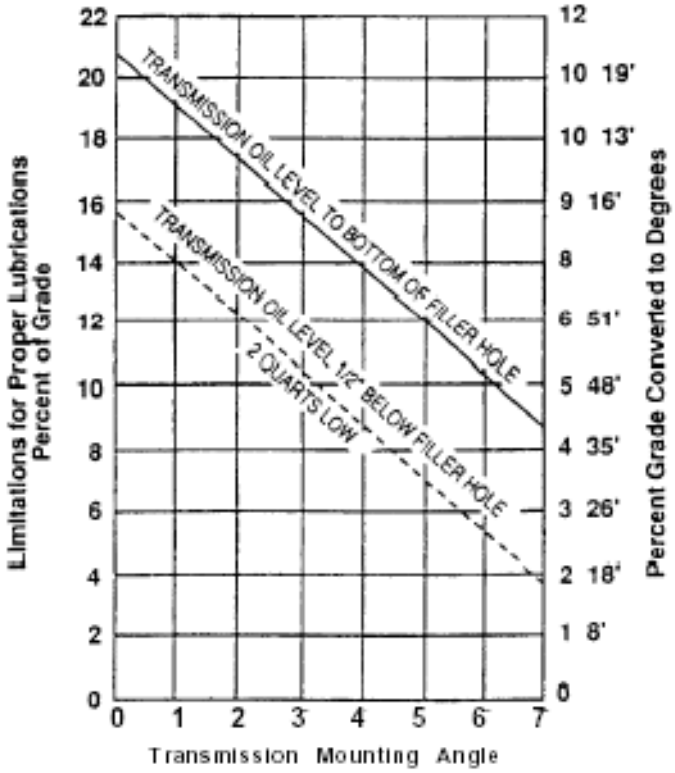
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Proper Lubrication Levels as Related to Transmission Operating Angles
If the transmission operating angle is more than 12 degrees, improper lubrication can occur. The operating angle is the transmission mounting angle in the chassis plus the percent 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 0 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).

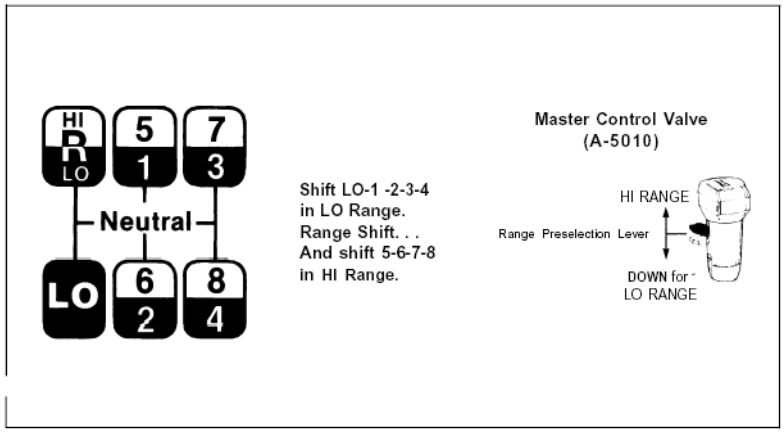


Dotted line showing "'2 Quarts Low" is for reference only. Not recommended

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Operation

RT-6609 Transmission Shift Lever Patterns and Shifting Controls



Driving Tips:

- For a smooth start, always select an initial starting gear that will provide sufficient reduction for the load and terrain.
- Always use normal double-clutching procedures when making lever shifts. (See back cover.)
- 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.

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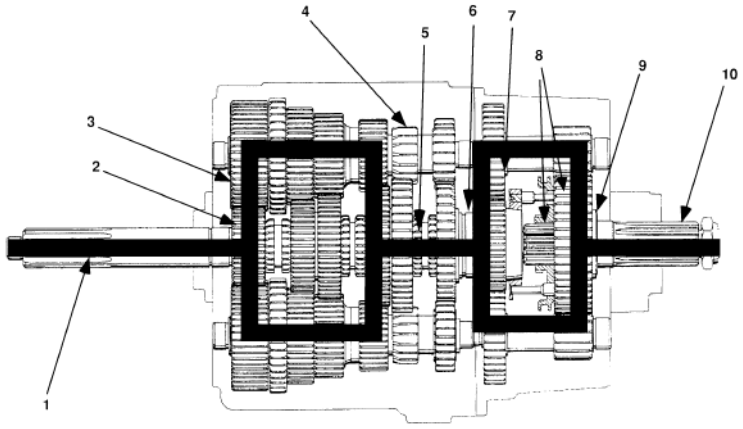
Power Flow

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 (LO Range Direct)

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

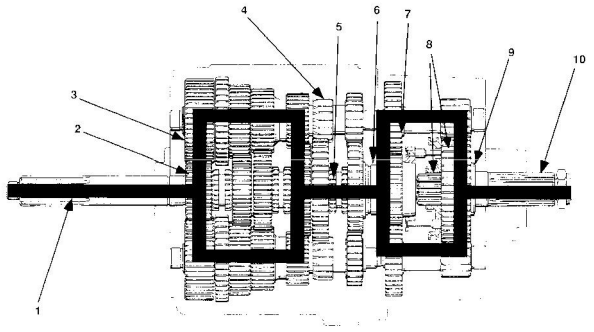


Auxiliary Section Power Flow

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

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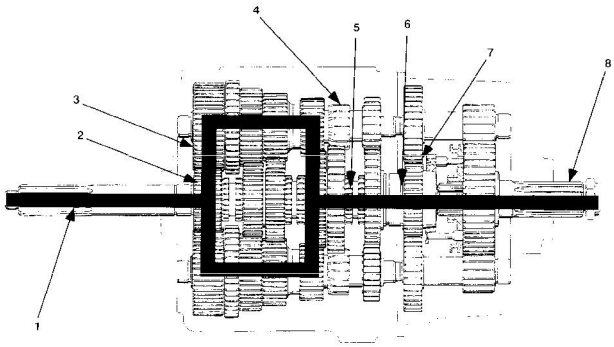
Auxiliary Section Power Flow: LO RANGE



LO RANGE POWER FLOW

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

Auxiliary Section Power Flow: HI RANGE



HI RANGE POWER FLOW

- The auxiliary drive gear transfers torque directly to the range mainshaft or output shaft through the "engaged" sliding clutch.**(7)**
- Torque is delivered through the range mainshaft and/or output shaft to the driveline as HI RANGE 6th gear.**(8)**

Timing

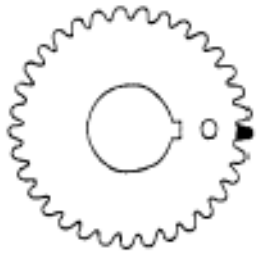
Timing Procedures

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 simply 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

Marking countershaft drive gear teeth.



Tooth on Countershaft directly over keyway marked for timing.

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.

Marking main drive gear teeth.

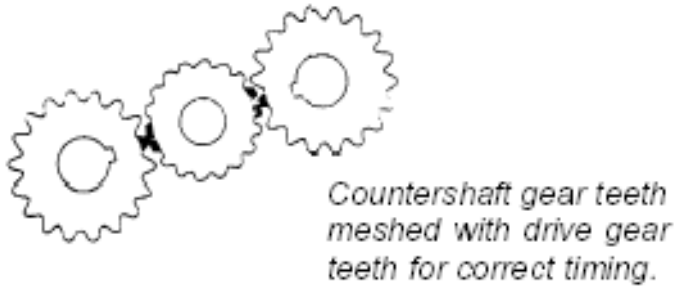


Drive gear teeth correctly marked for timing.

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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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.

Auxiliary Section

Timing the auxiliary countershaft.
The auxiliary section is different from the standard because of the helical gear design; therefore, review this procedure before reassembly.

1. Mark any tooth on the LO range gear. Then mark a tooth located directly opposite the first marked.
2. Mark any tooth on the reduction gear. Then mark a tooth located directly opposite the first marked
3. Prior to placing each auxiliary countershaft assembly into housing, mark the two teeth on each auxiliary countershaft assembly LO range gear stamped with the two 0's. Repeat the procedure on each auxiliary countershaft reduction gear.
4. Install the auxiliary countershaft in the auxiliary housing lining the timing marks on the countershaft with the LO range gear and the reduction gear.
5. Seat the auxiliary countershaft bearings.
6. Install an auxiliary countershaft retaining strap in each countershaft.

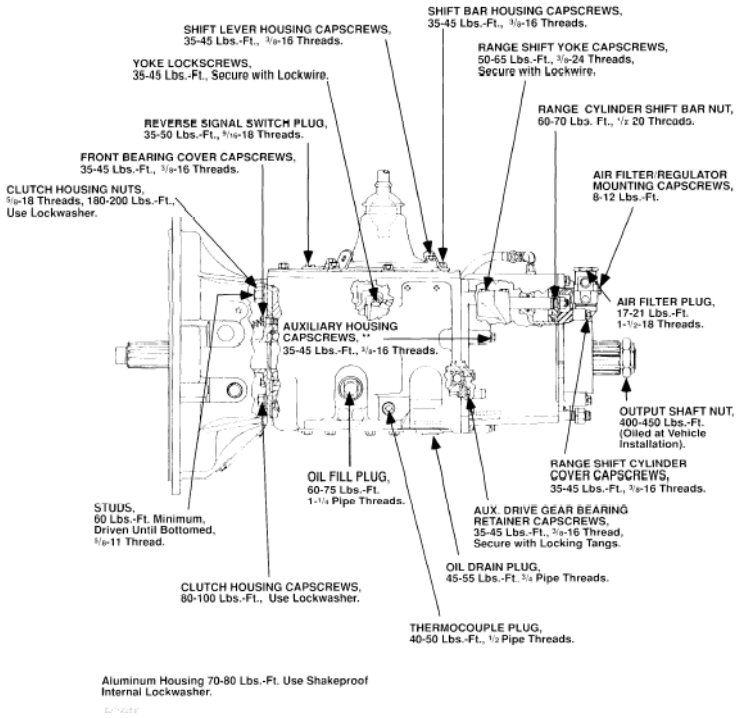
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Torque Recommendations

Correct torque application is extremely important to assure long transmission life and dependable performance. Overtightening 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.

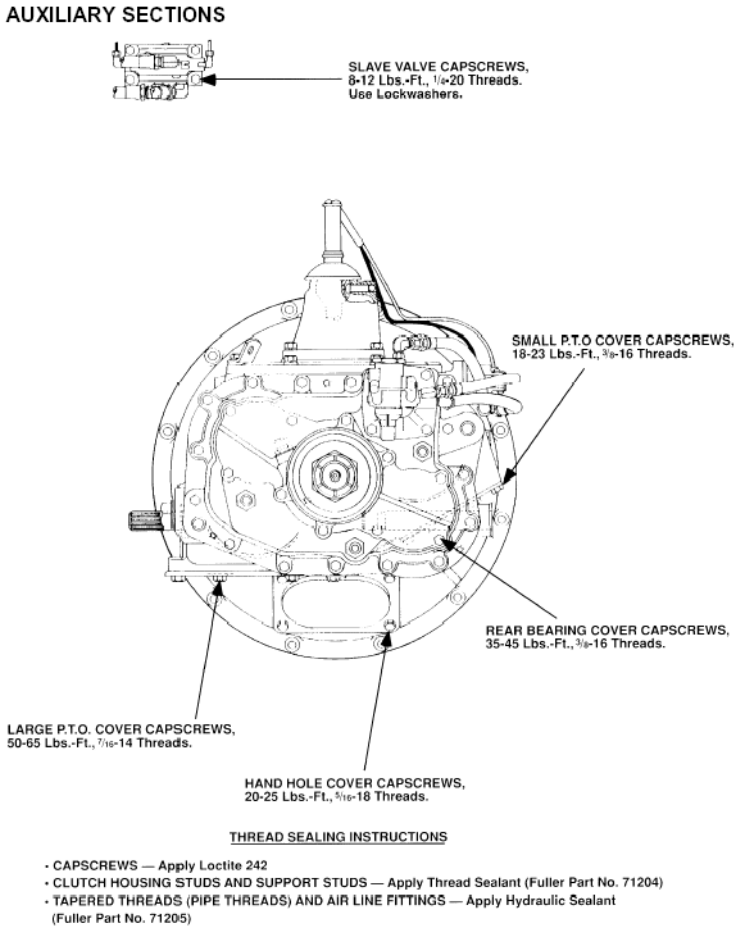
FRONT SECTION

FRONT SECTION



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AUXILIARY SECTIONS



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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 mechanics 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

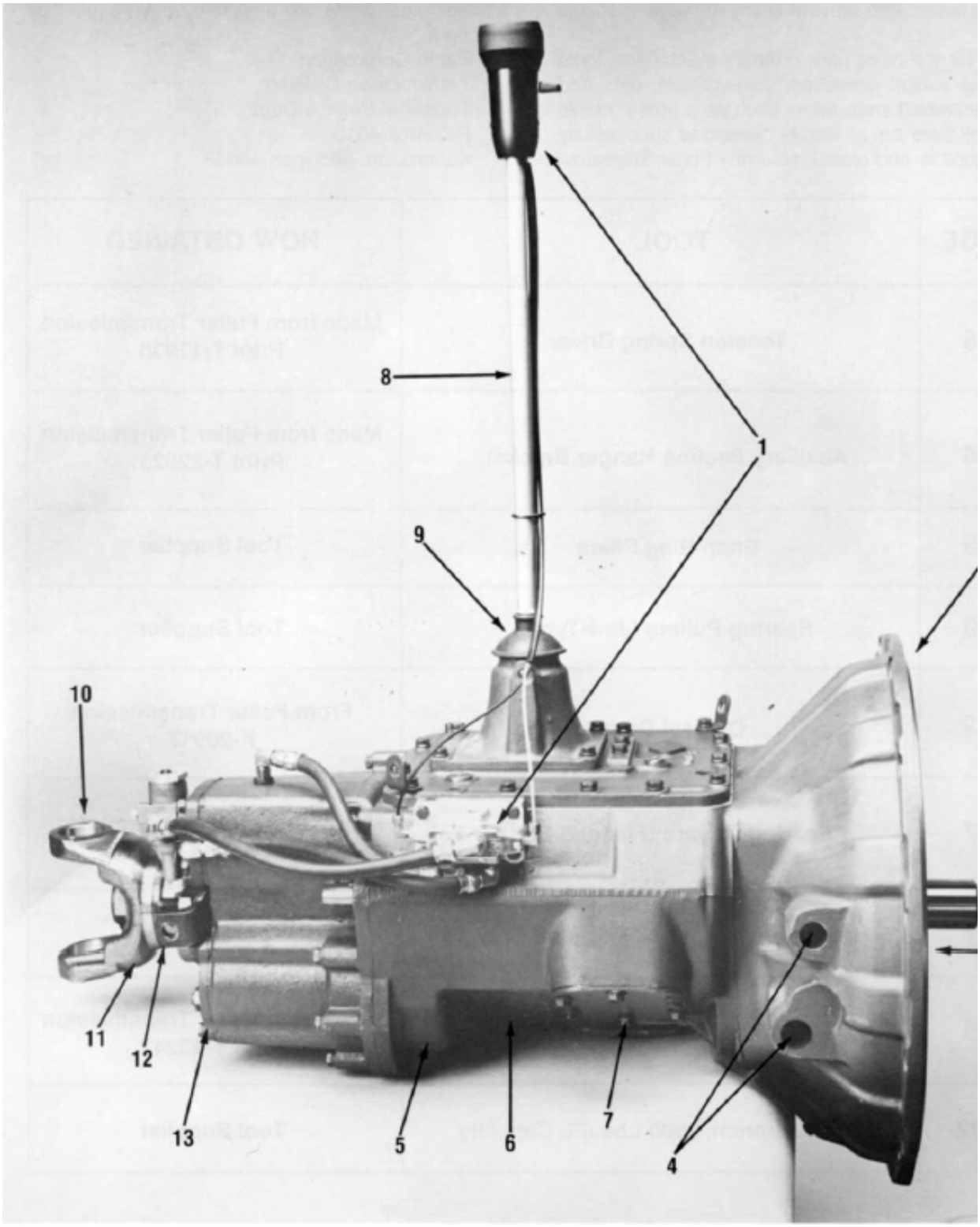
Kalamazoo, Michigan 49003

TOOL	HOW OBTAINED
Tension Spring Driver	Made from Fuller Transmission Print T-11938
Auxiliary Section Hanger Bracket	Made from Fuller Transmission Print T-22823
Snap Ring Pliers	Tool Supplier
Bearing Pullers (Jaw - Type)	Tool Supplier
Oil Seal Driver	From Fuller Transmission K-20917
Bearing Drivers (Flanged - End)	Made from Fuller Transmission Print Series T18042
Impact Puller (1/2-13 Threaded End)	Tool Supplier
Countershaft Support Tool	Made from Fuller Transmission Print T-22247
Torque Wrench, 1,000 Lbs./Ft. Capacity	Tool Supplier

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Preventive Maintenance

Preventive Maintenance



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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

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 DRIVEIINE 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

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

13. Mainshaft Rear Bearing Cover a.

a. Check oil seal for wear

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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 lubricate 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.

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.

GEARS

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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.
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.

SPLINES

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

Washers

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

REVERSE IDLER GEAR ASSEMBLIES

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

GRAY IRON PARTS

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

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.

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.

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 gears if excessively worn.

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.

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

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

SYNCHRONIZER ASSEMBLY

1. Check synchronizer for burrs, uneven and excessive wear at contact surface, and metal particles.
2. Check blacker pins for excessive wear or looseness.
3. Check synchronizer contact surfaces on the synchronizer cups for wear.

O-RINGS

1. Check all 0-rings for cracks or distortion. Replace if worn.

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.

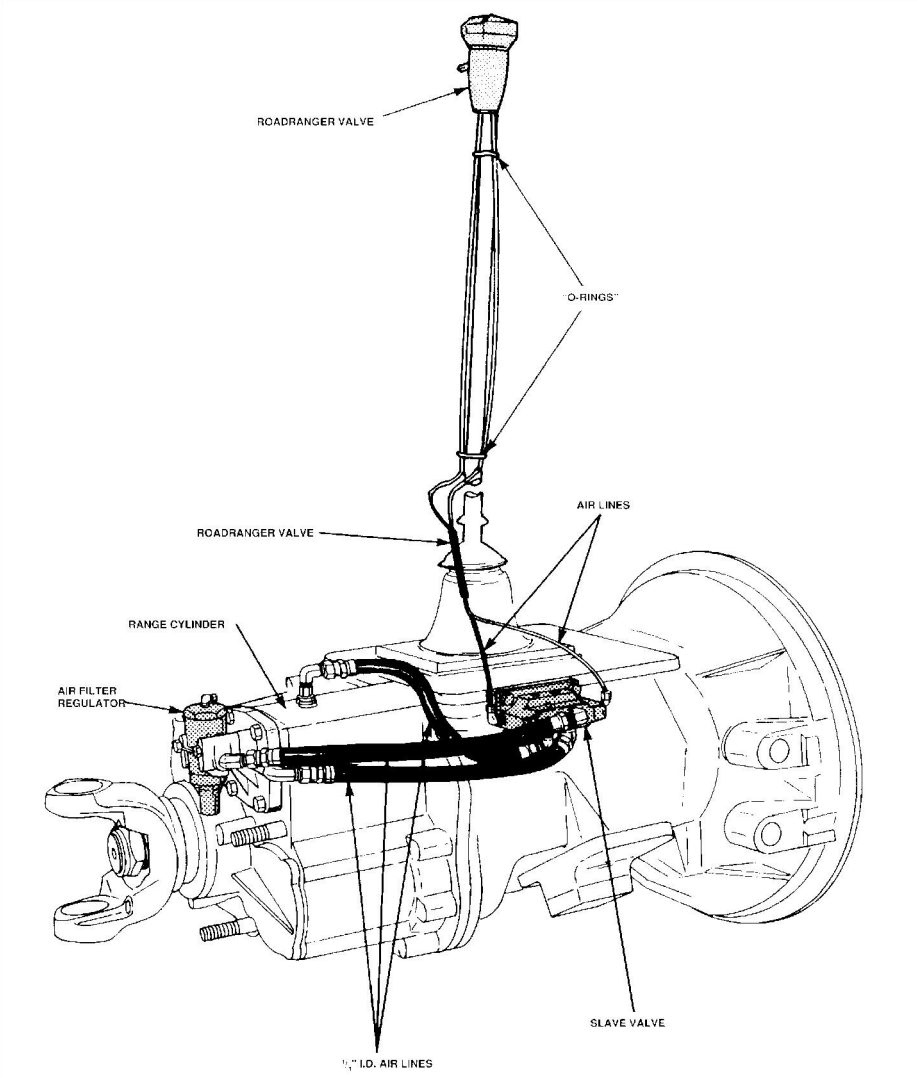
1. GASKETS - Use new gaskets throughout the transmission as it is being rebuilt. Make sure all gaskets are installed. An omission of any gasket can result in oil leakage or misalignment of bearing covers.
2. CAPSCREWS - TO prevent oil leakage and loosening, use Loctite #242 thread sealant on all cap screws. For torque ratings, see TORQUE RECOMMENDATIONS.
3. O-RINGS - Lubricate all 0-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, pre venting 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.

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

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Air System

Range Shift Air System



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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.

INCORRECT AIR LINE HOOKUPS (See Air System Schematics)
With the gear shift lever in neutral, move the range preelection lever UP and DOWN.

a. If the air lines 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.

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.

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AIR FILTER/REGULATOR
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.

RANGE VALVE
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 shut off air flow. 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.

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.

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.

RANGE CYLINDER (See the following illustration.)
If any seals in the range cylinder assembly are defective, the range shift will be affected.

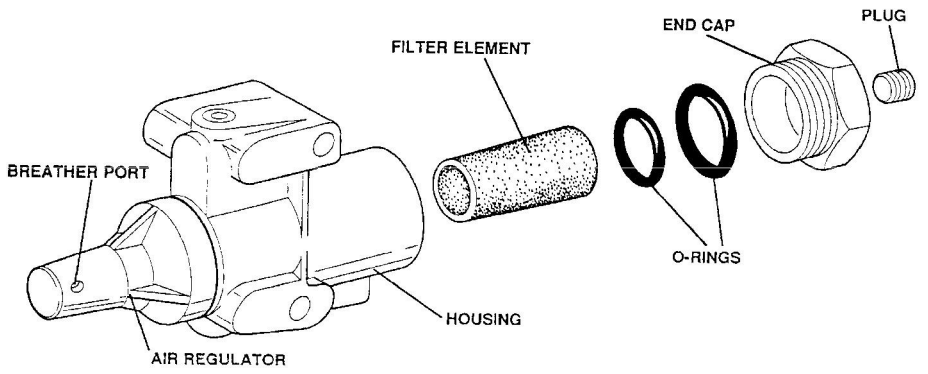
a. Leak at either O-ring A results in complete failure to make a range shift; steady air flow from the slave valve breather in both ranges.

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

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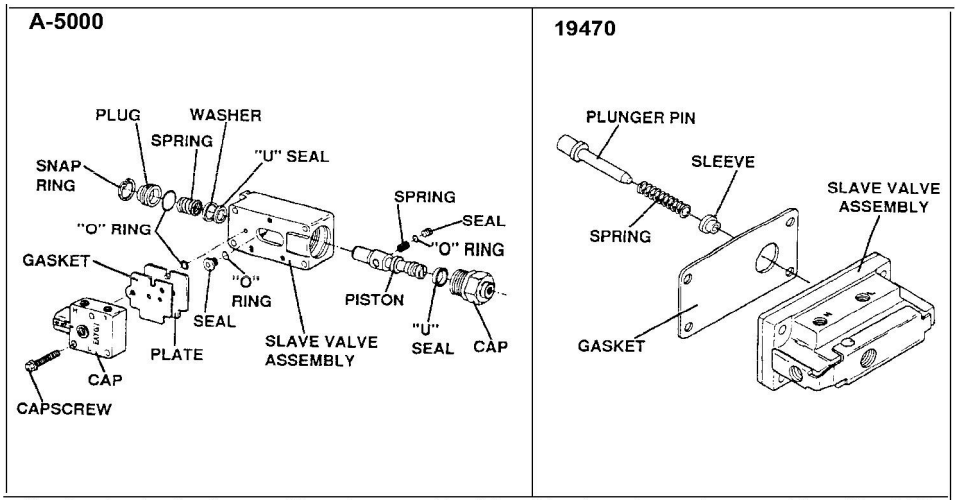
c. Leak at O-ring C results in a slow shift to LO RANGE; pressuring of transmission case.

AIR FILTER/REGULATOR ASSEMBLY



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

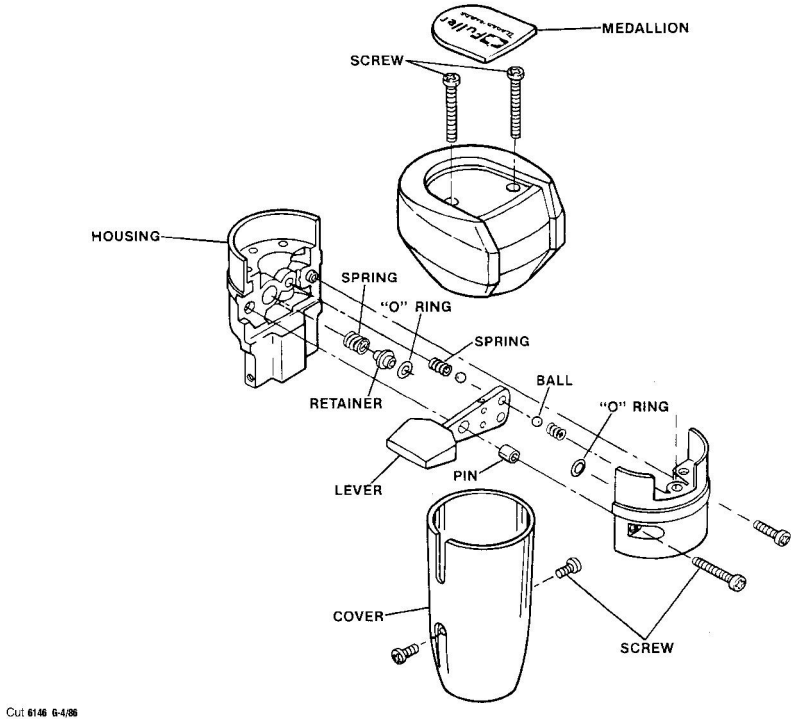
SLAVE VALVES



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.

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Roadranger Valve A-5010



Removal and Disassembly

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

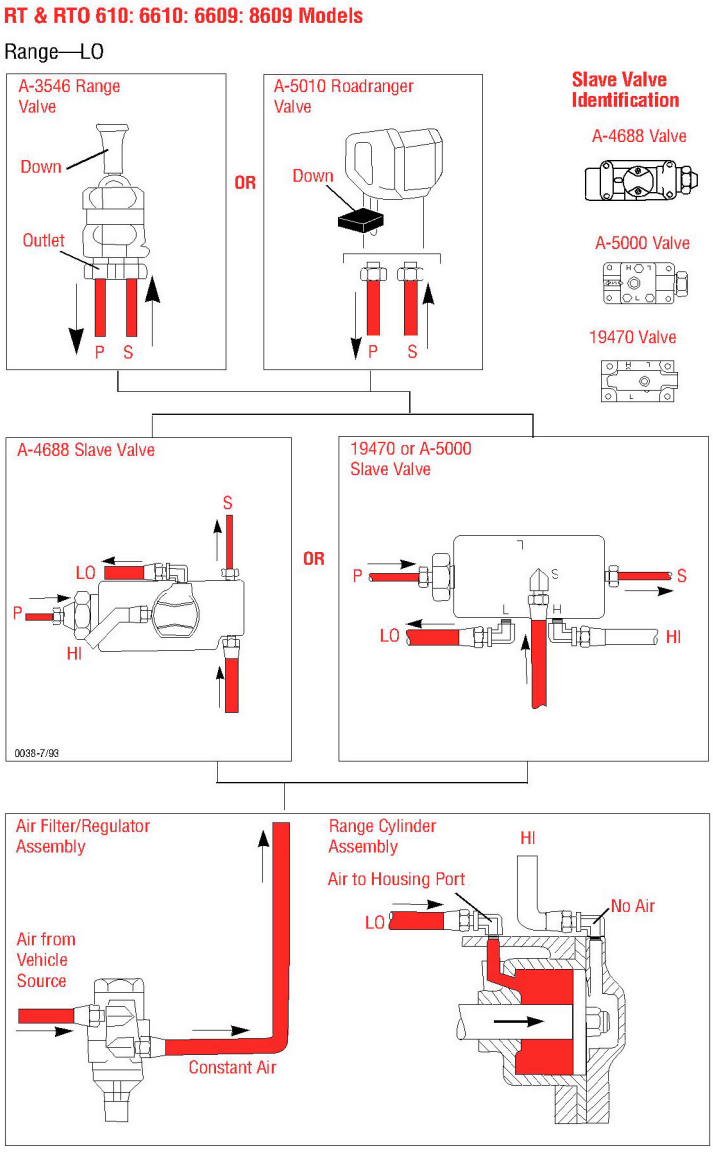
Reassembly and Installation

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

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Air System Schematics RT-6609 (with A-5010 Roadranger Valve)

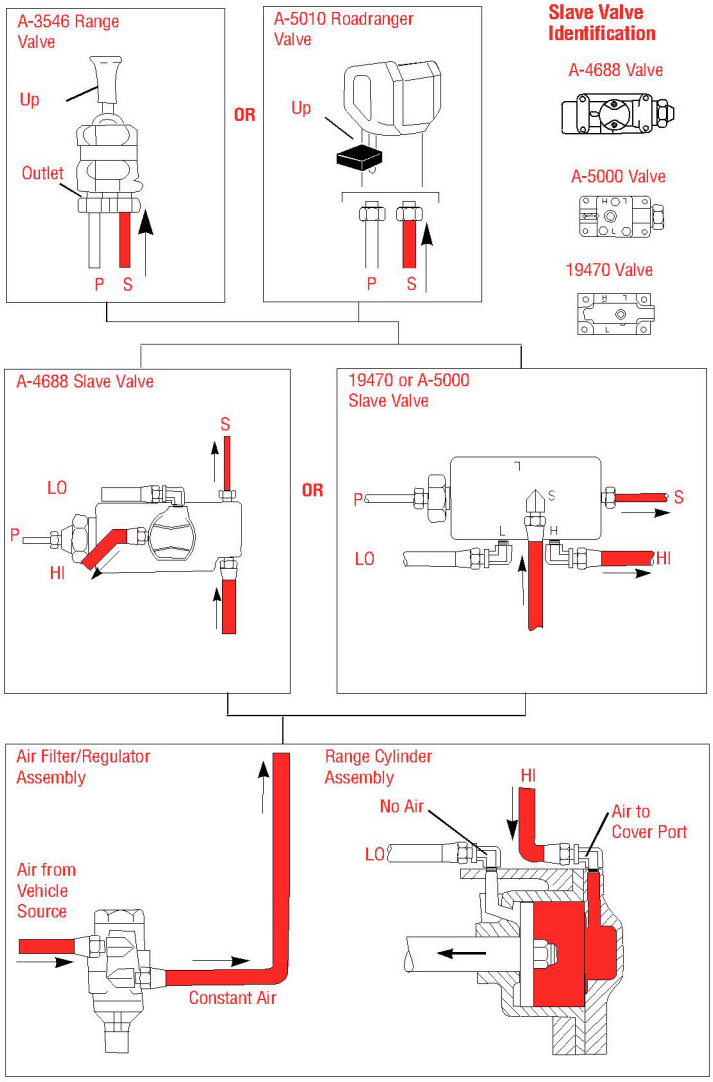


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Schematic - For all questions concerning removal and replacement, refer to Eaton Service and Parts Literature.

RT & RTO 610: 6610: 6609: 8609 Models

Range—HI



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Removal of the Air Hoses, Roadranger Valve, and Air Filter/Regulator

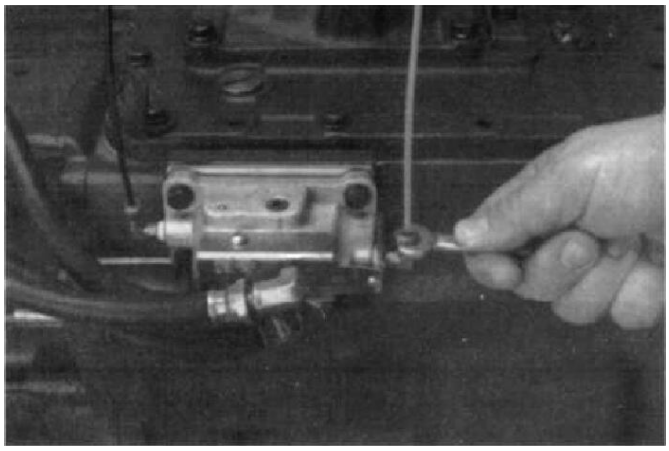
Special Instructions

Note: If desired, the gear shift lever housing assembly can now be removed from the shift bar housing by removing the four cap-screws from the tower.

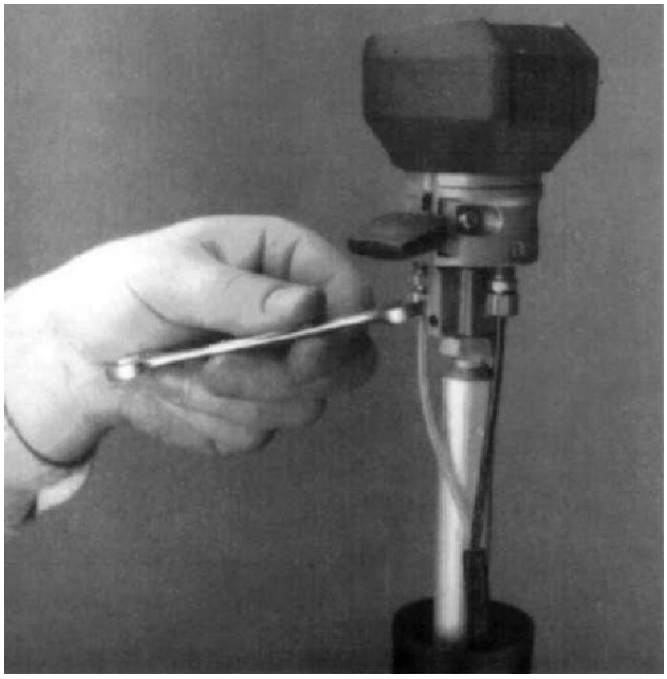
Special Tools

- Typical Service Tools

Procedure -



1. Disconnect the slave valve "P" or End Port on the transmission case. Disconnect the air line at the slave valve "S" or Supply Port.

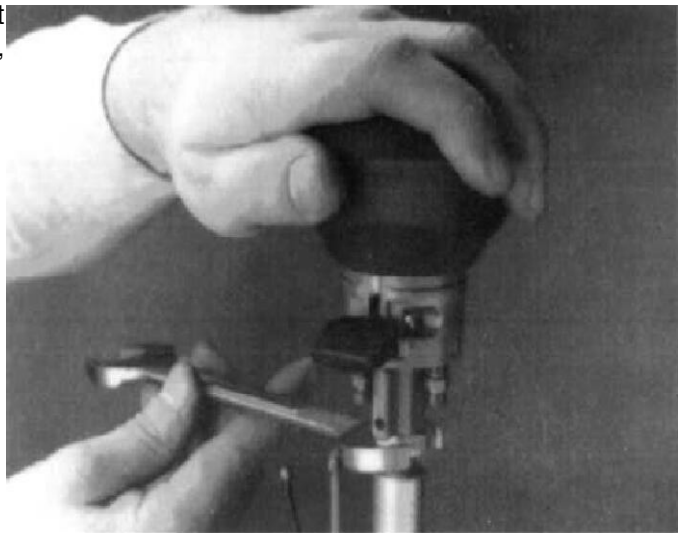


2. Remove the two Roadranger valve cover mounting screws.

3. Slide the cover down the shift lever to expose the valve ports and disconnect the 2 air lines.

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4. 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.



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



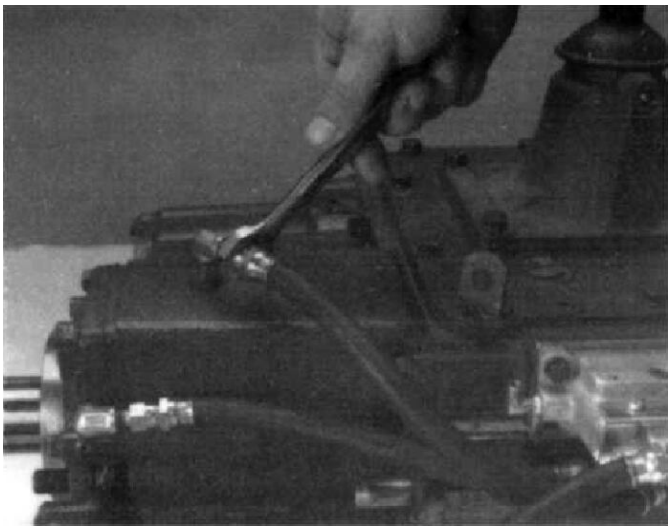
6. Remove the 2 cap screws and remove the air filter/regulator assembly.

   Note: For disassembly and reassembly of the Air Filter/Regulator Assembly, see Page 22.

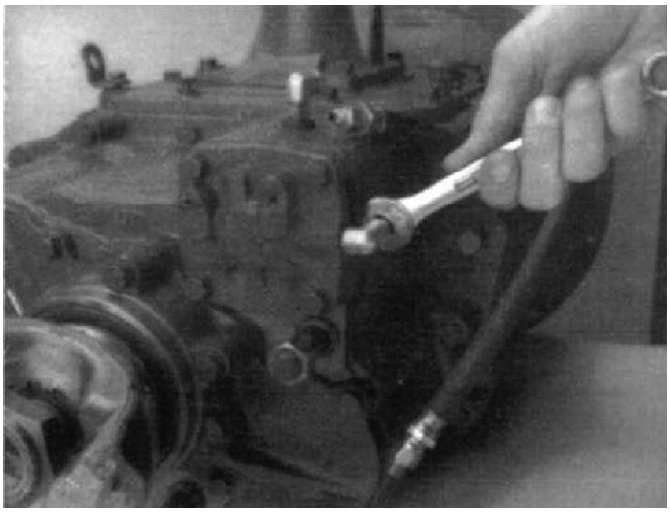


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Removal - Shifting Controls



7. Disconnect and remove the air line between the slave valve "L" or LO Range Port and the range cylinder LO Range Port.



8. Disconnect and remove the air line between the slave valve "H" or HI Range Port and the range cylinder HI Range Port.

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Removal of the Slave Valve

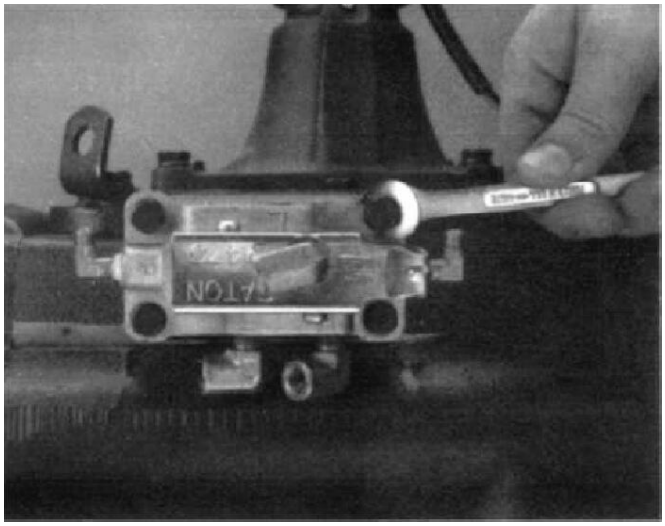
Special Instructions

None

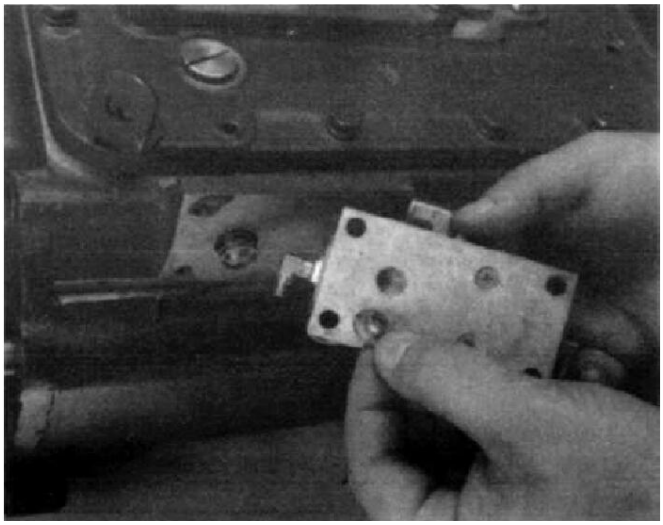
Special Tools

- Typical Service Tools

Procedure -



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



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

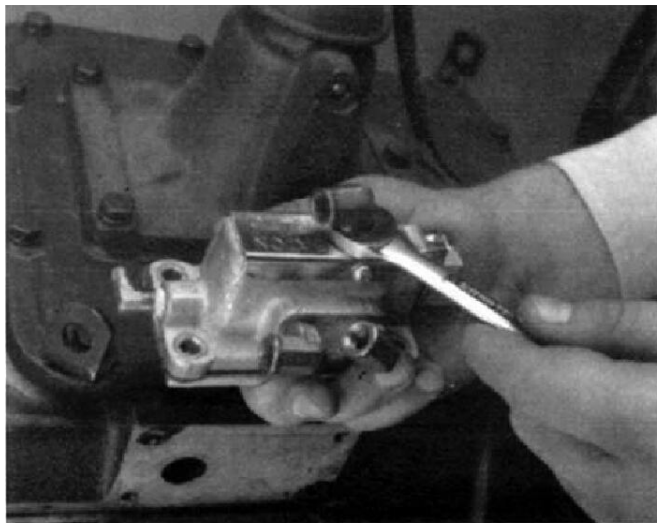
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3. Remove the spring and plunger pin from the transmission case bore.



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 22. The 19470 Slave Valve shown is a non serviceable valve.



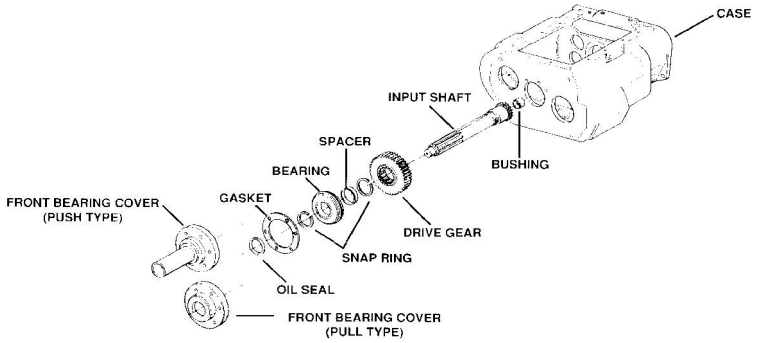
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Changing Input Shaft

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 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.

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Removal and Disassembly of the Gear Shift Lever

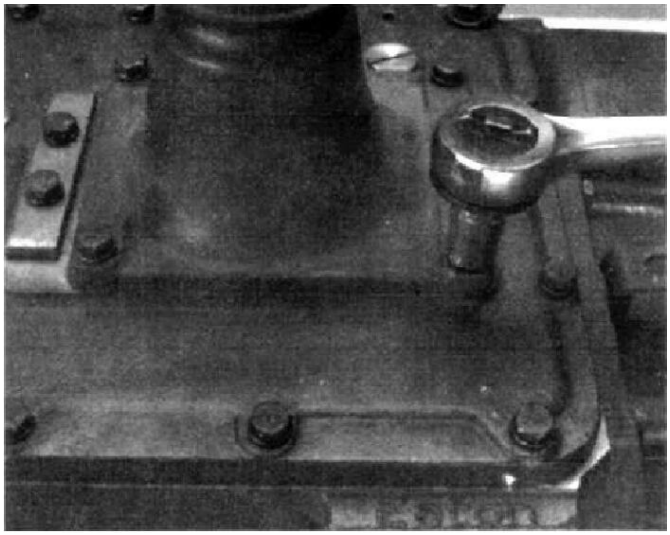
Special Instructions

Note: Remote control housings are removed from the shift bar housing in the same manner. For disassembly and reassembly of LRC Assemblies. See the Illustrated Part List No. P-541. For disassembly and reassembly of SRC Assemblies, see Illustrated Part List No. P-541.

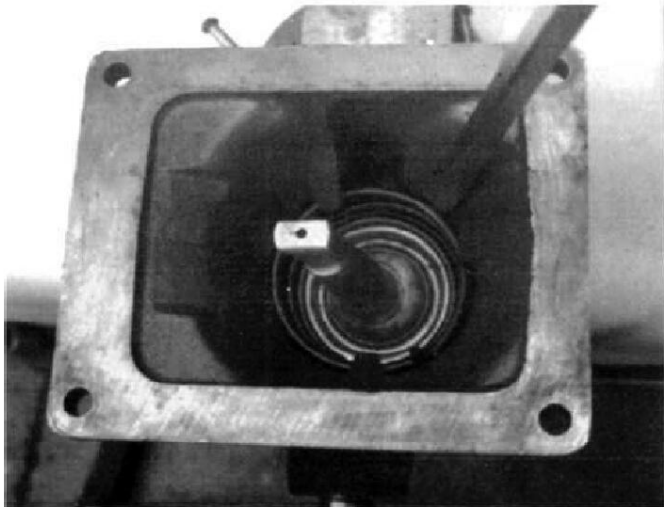
Special Tools

- Typical Service Tools

Procedure -



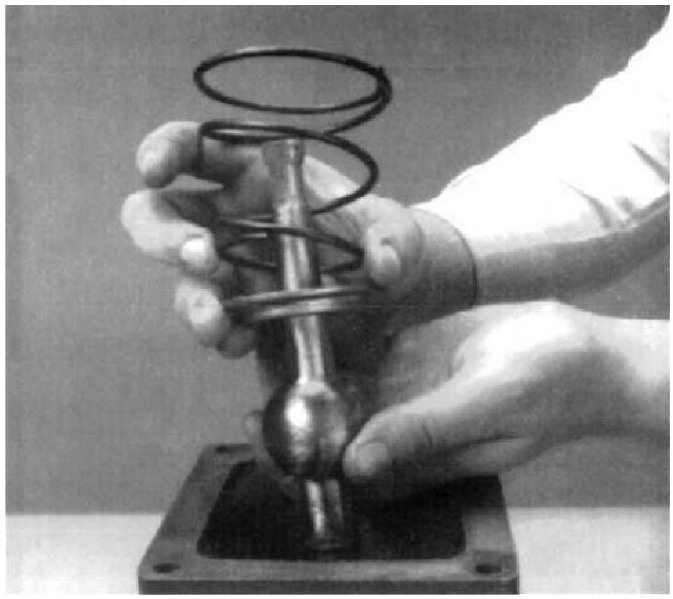
1. Remove the 4 retaining cap screws. jar the top to break the gasket seal. Remove the gear shift lever housing and gasket.



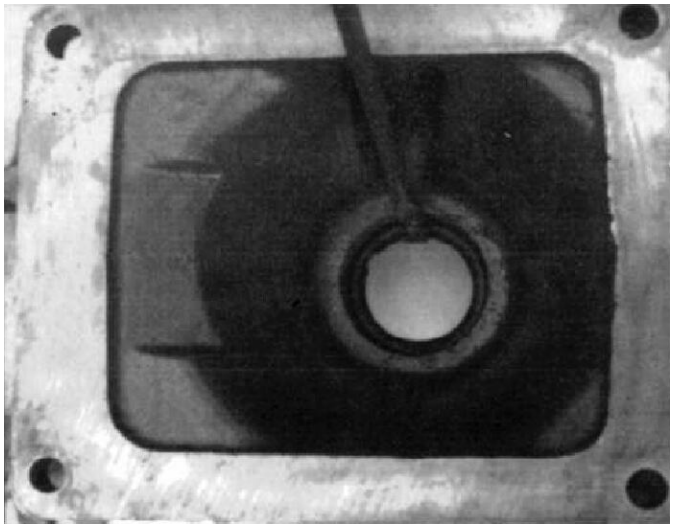
2. Remove the boot from the gear shift lever and secure assembly in a vise with the housing bottom up. Use a large screwdriver to twist between the spring and housing, forcing the spring from under the lugs in the housing. Do one coil at a time.

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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.



Removal - Shifting Controls

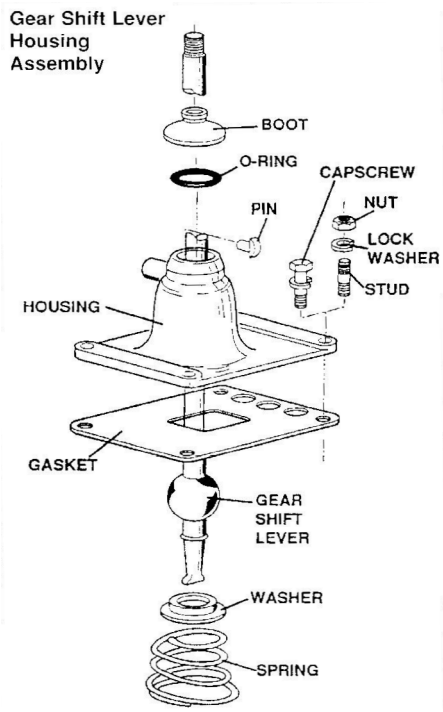
Reassembly of the Gear Shift Lever

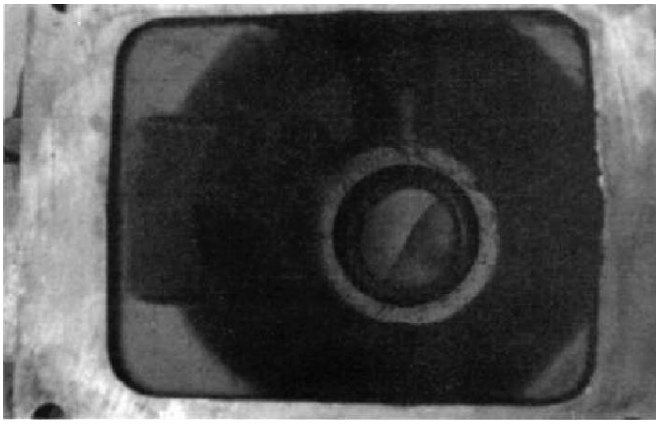
Special Instructions

None

Special Tools

- Typical Service Tools



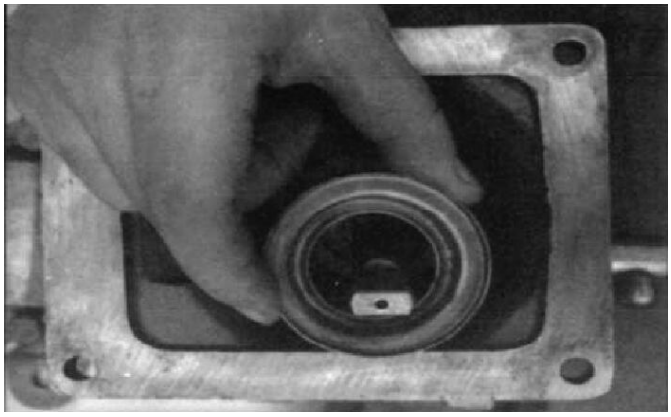


Procedure -

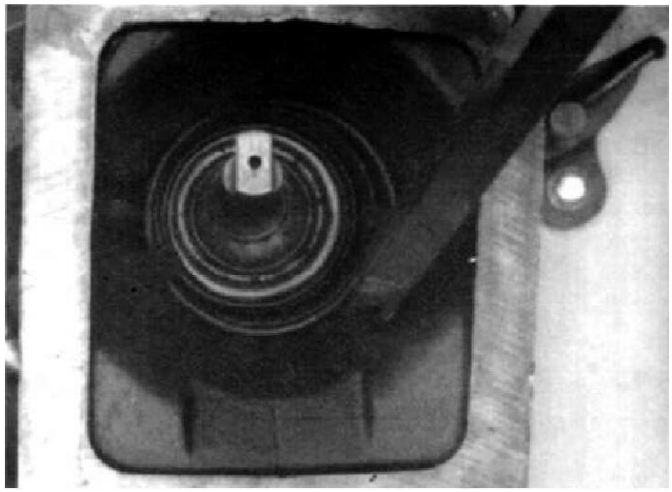
1. Secure the gear shift lever housing in a vise. Install the spade pin in the housing tower bore. If previously removed, install the O-ring in the tower groove.

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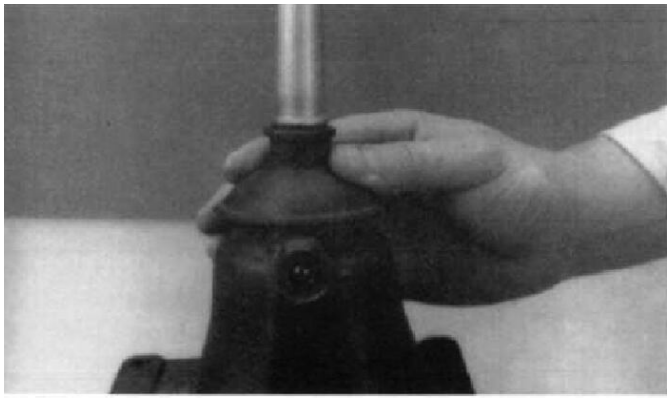
2. Position the gear shift lever in the housing with the spade pin in the lever ball slot. Install the tension spring washer over the ball, dished side



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



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



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Removal and Disassembly of the Shift Bar Housing

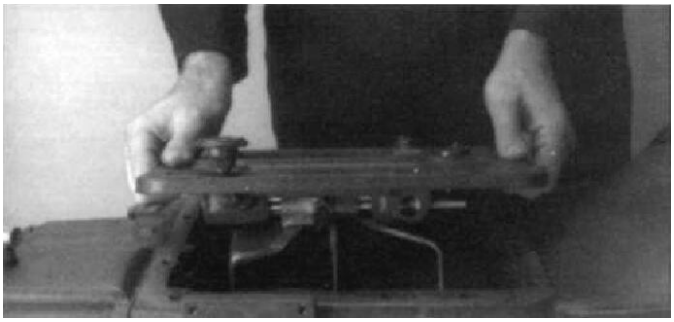
Special Instructions

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.

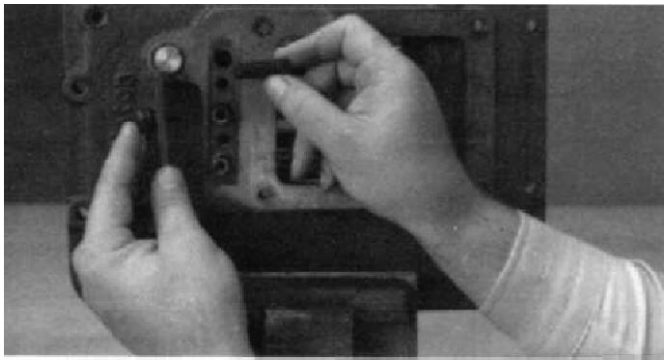
Special Tools

- Typical Service Tools

Procedure -



1. Remove the retaining cap screws. Hit the top to break the gasket seal and lift the shift bar housing from the transmission case. Remove the gasket.



2. Remove the 2 cap screws and remove the tension spring cover from housing top. Remove the three tension springs installed under the cover.

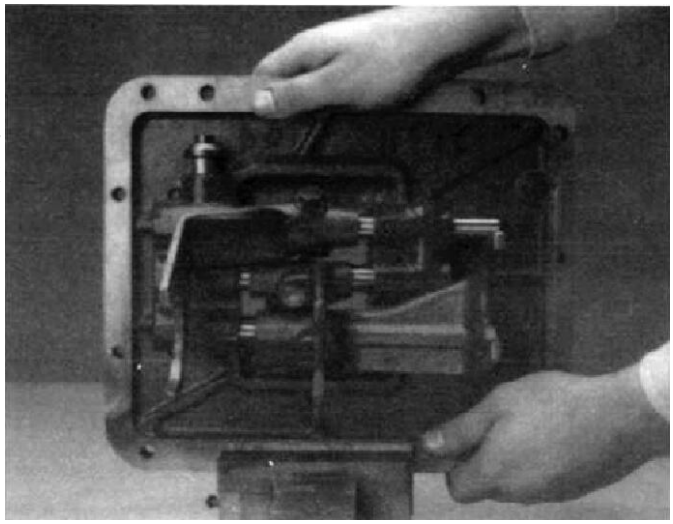


3. Tilt the assembly and remove the 3 detent balls from the housing bores.

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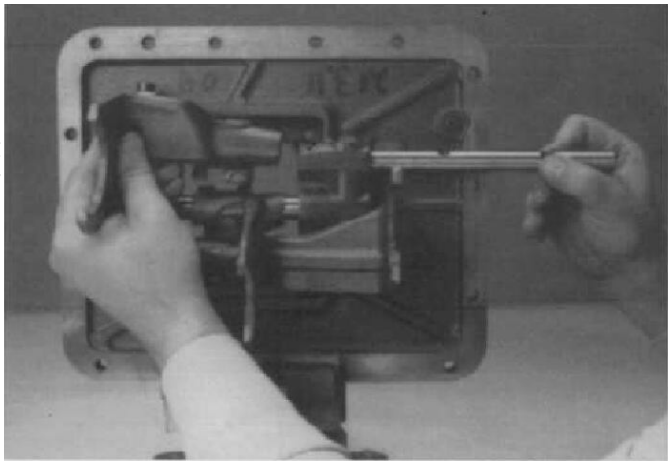
4. Secure the assembly in a vise with the plunger side up. (The housing front will be to the right.).

   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 lock-wire and remove the lock screws from each bar just before their removal.

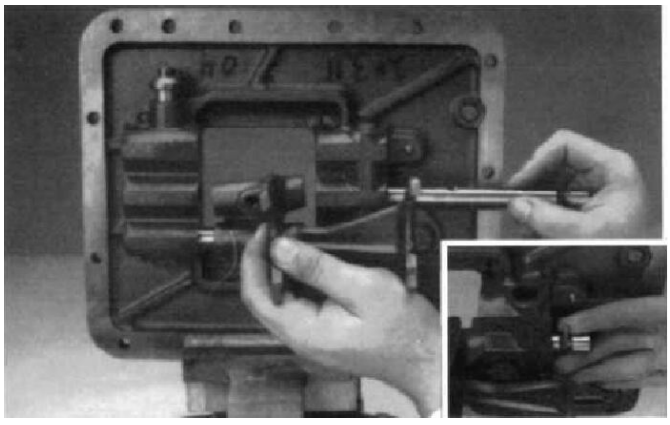


5. Move the upper bar to the right and out of housing, removing the shift yoke bar.

   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.

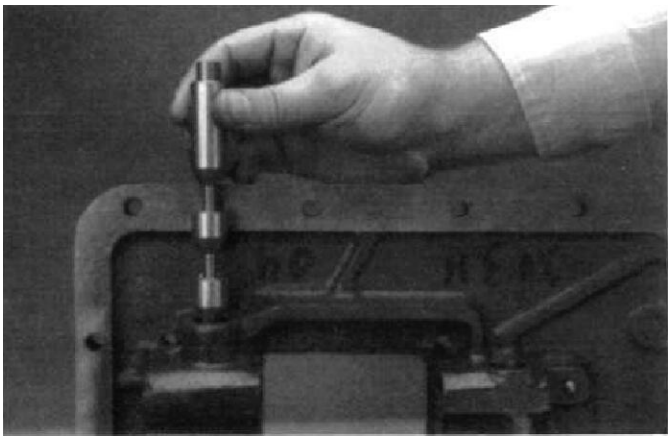


6. Move the middle yoke bar to right and out of housing, removing shift yoke from bar. As the neutral notch in bar clears the front web, remove the interlock pin from the neutral notch bore (inset.).

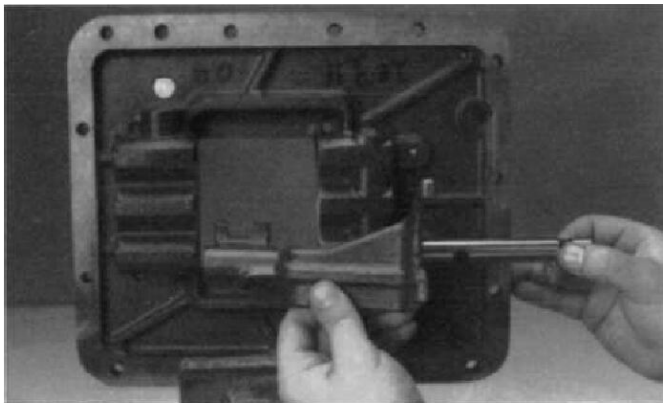


https://truckmanualshub.com/

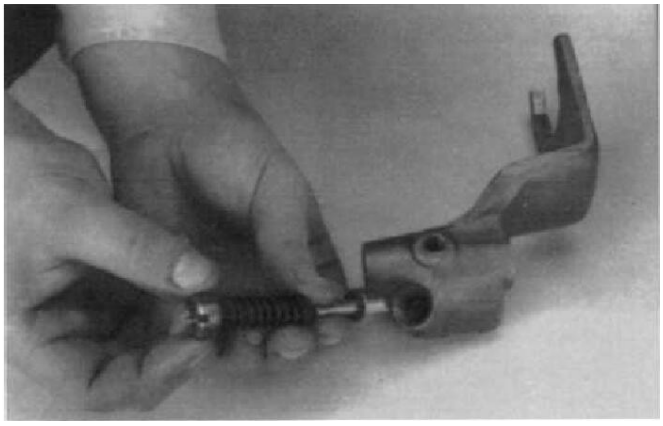
Disassembly - Shift Bar Housing



7. Remove the air valve shaft from rear web.



8. Move the lower 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.



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

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Reassembly - Shift Bar Housing

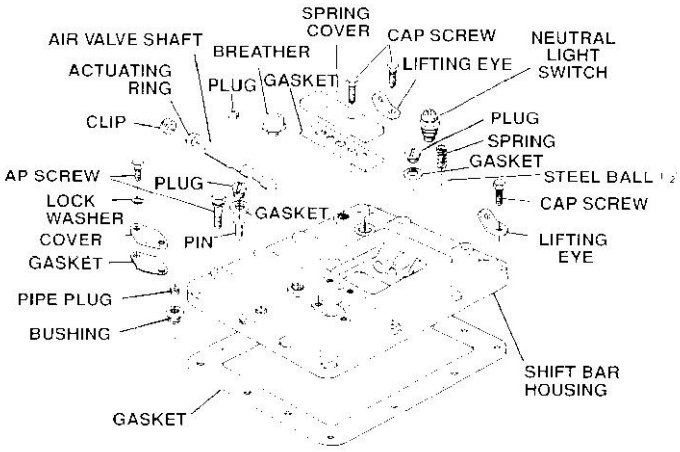
Reassembly of the Shift Bar Housing

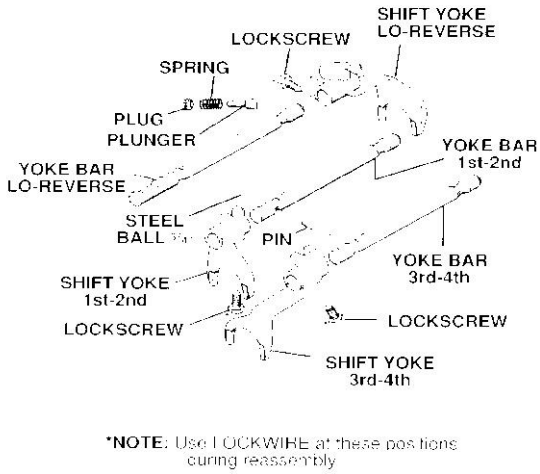
Special Instructions

None

Special Tools

- Typical Service Tools





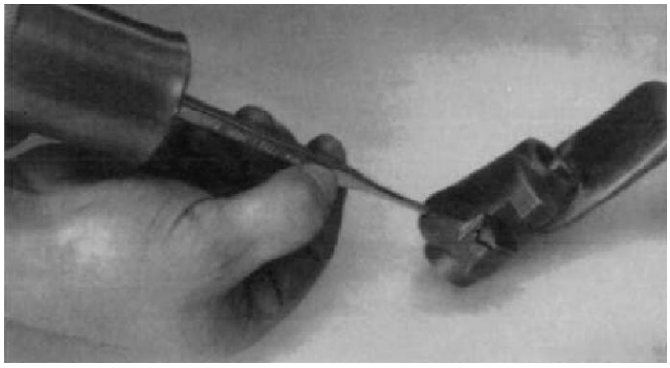
Procedure -



1. If previously removed, place plunger stop in 1st-reverse shift yoke block, install spring in bore of yoke and onto shank of plunger. Install the plug an tighten to compress the spring.

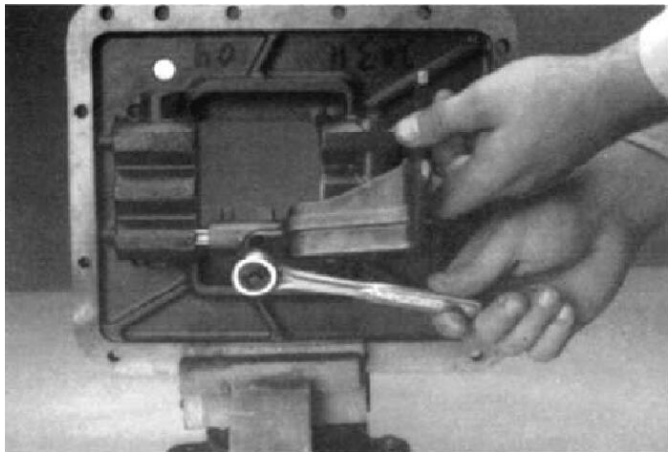
https://truckmanualshub.com/

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

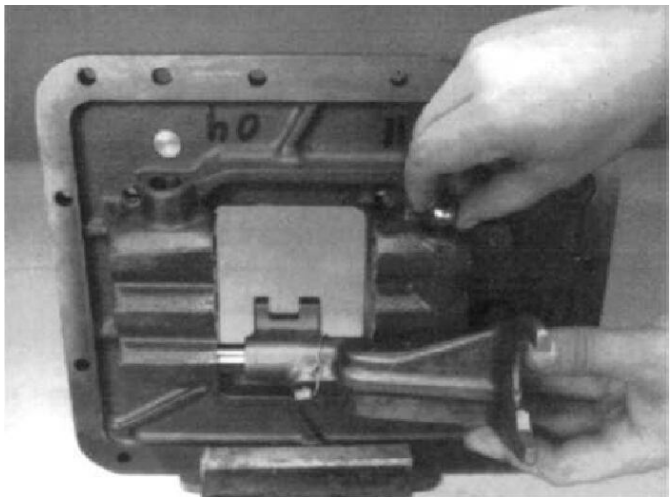


3. Place the housing in a vise with the front of housing to the right as shown. Install the 4th-5th speed shift bar in bottom bore with detent notches to the front, installing yoke, lock-screw, and safety wire.

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

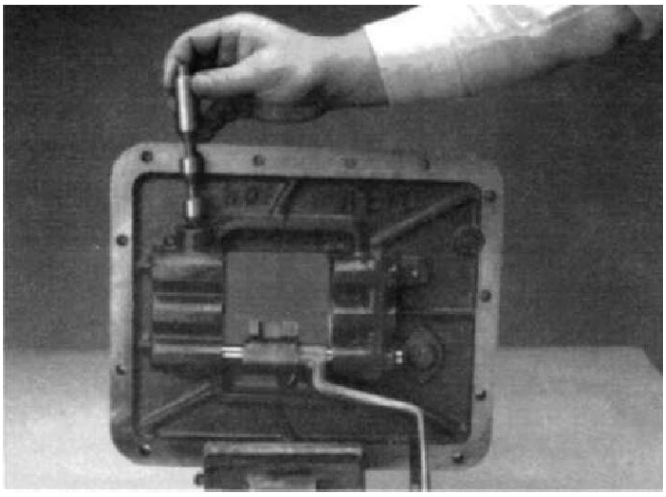


4. Install interlock ball in front web vertical bore.

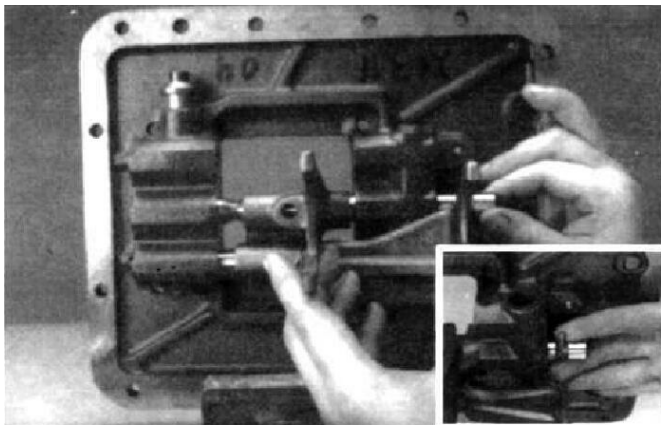


https://truckmanualshub.com/

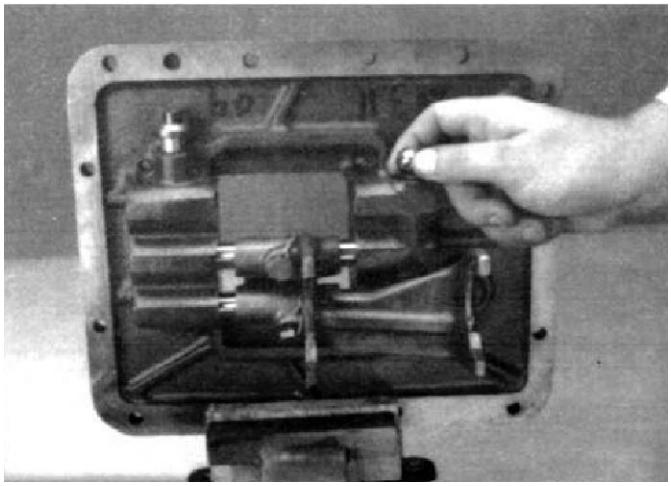
Reassembly - Shift Bar Housing



5. Install air shaft in rear web vertical bore.



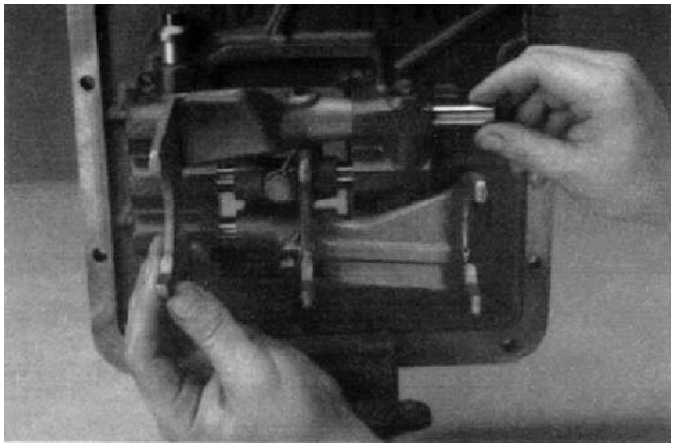
6. Install the 2nd-3rd speed shift bar in center bore, and install shift yoke on bar; insert interlock pin in detent notch (inset). Install lock screw and safety wire.



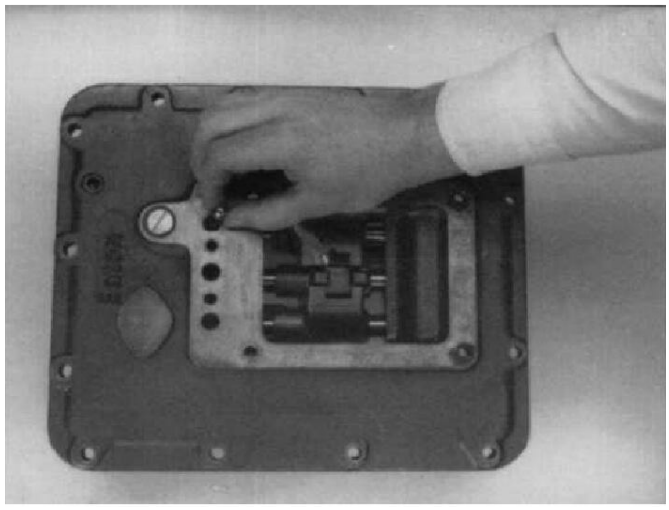
7. Install interlock ball in front web vertical bore.

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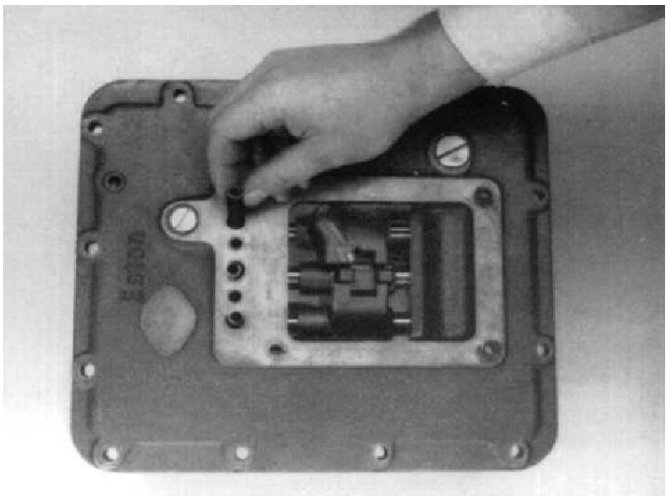
8. Install 1st-reverse shift bar in upper bore, detent notches to the front, install yoke on bar, fork to the rear, install lock screw and safety wire.



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

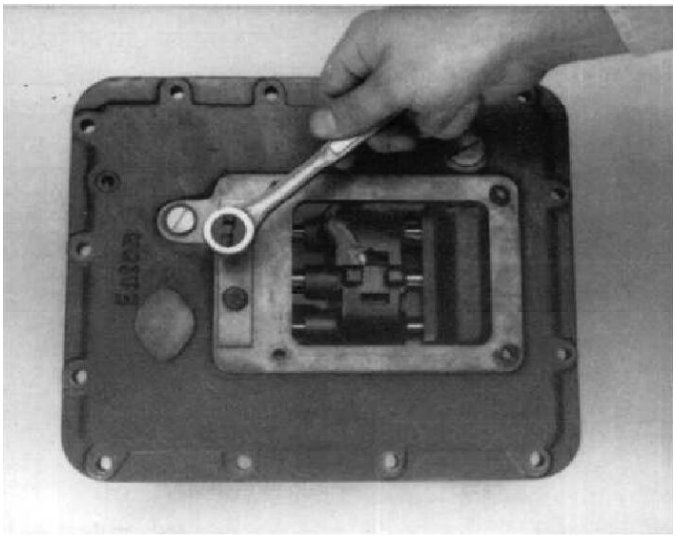


10. Install the 3 tension springs, one in each bore, in housing top.



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Reassembly - Shift Bar Housing



11. Install the tension spring cover. Tighten the 2 cap screws to recommended torque.

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Removal - Output Yoke

Removal of the Output Yoke

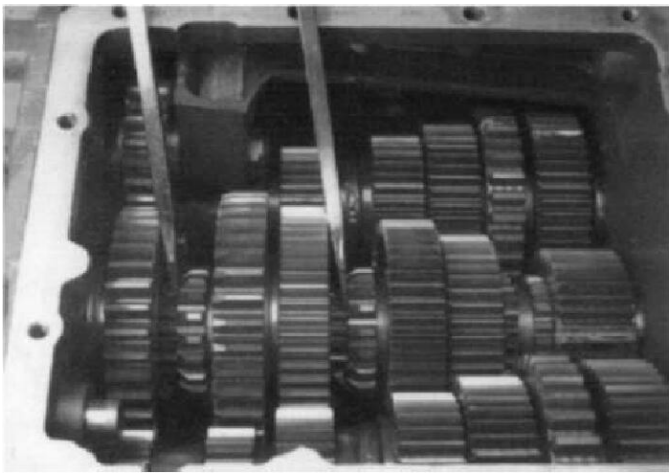
Special Instructions

None

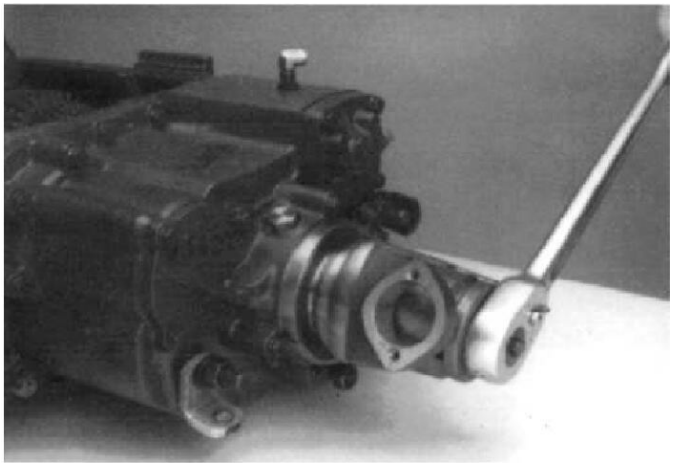
Special Tools

- Typical Service Tools

Procedure -



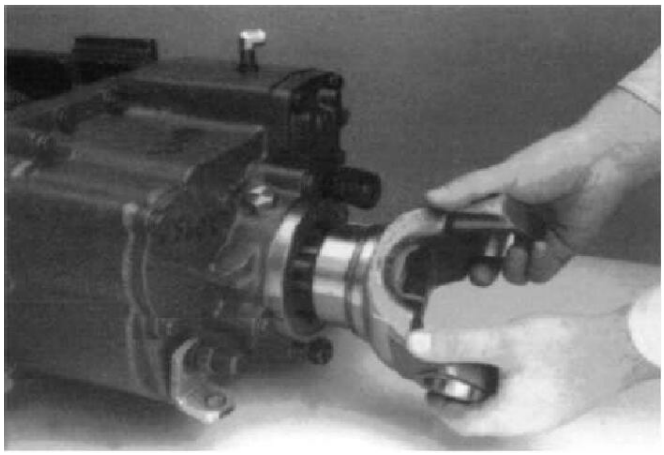
1. Lock the transmission by engaging the two mainshaft gears with the mainshaft sliding clutches.



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

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



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Removal of the Clutch Housing

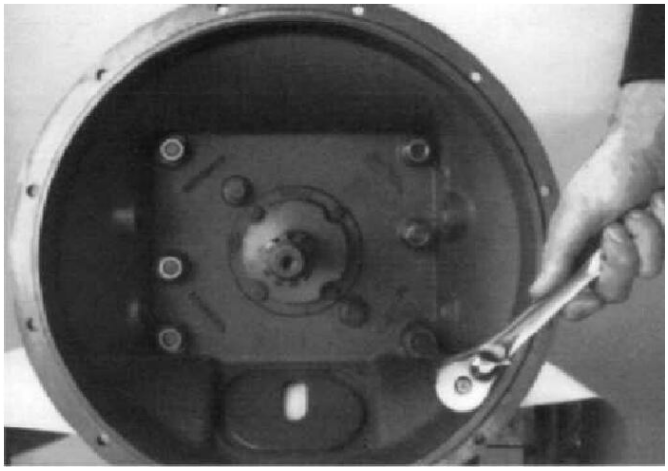
Special Instructions

None

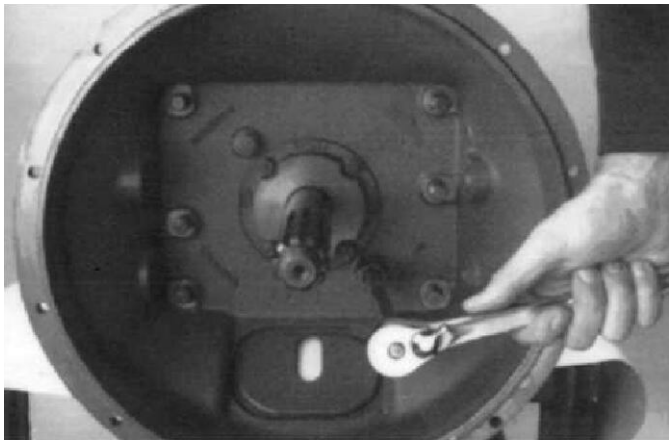
Special Tools

- Typical Service Tools

Procedure -



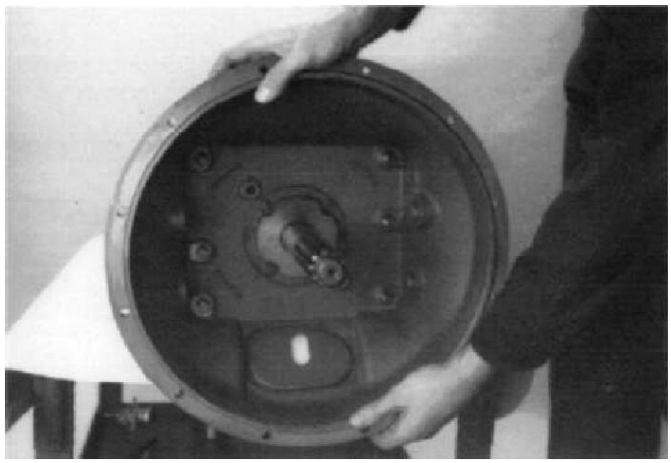
1. Remove the 6 nuts with lock washers that hold the clutch housing to the transmission case.



2. Remove the 2 cap screws with lock washers that hold the clutch housing to the transmission case.

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



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Removal of the Auxiliary Section

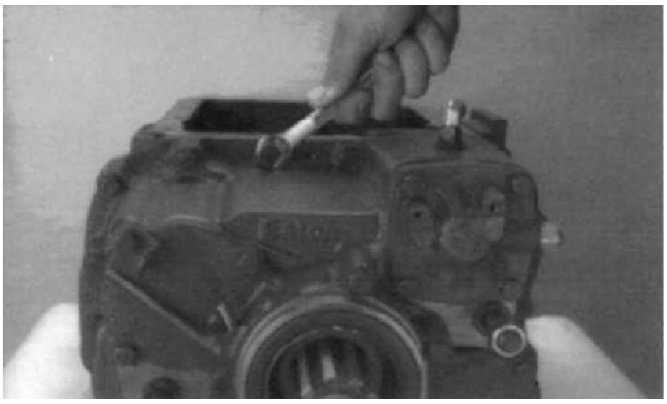
Special Instructions

Note: There are 3 cap screw lengths. Note their locations.

Special Tools

- Typical Service Tools

Procedure - Removal of the Auxiliary Section



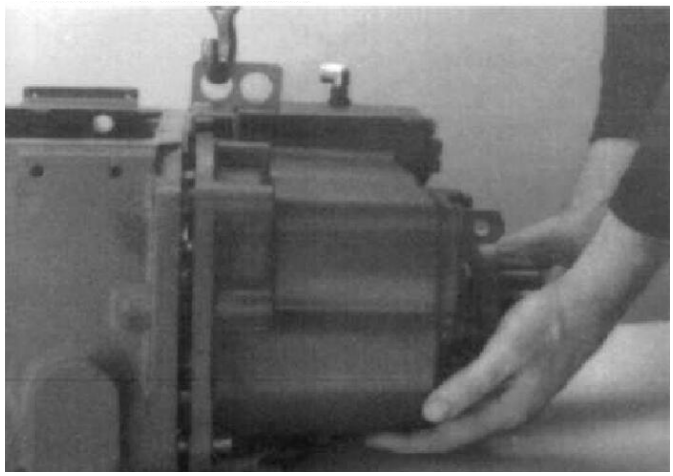
1. Remove the 15 cap screws that hold the auxiliary section to the transmission case.



2. Insert 3 cap screws in the housing flange tapped holes. Tighten evenly to move the auxiliary section back: leave a space wide enough to attach a chain hoist.

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



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Removal and Disassembly of the Output Shaft and Rear Bearing Cover

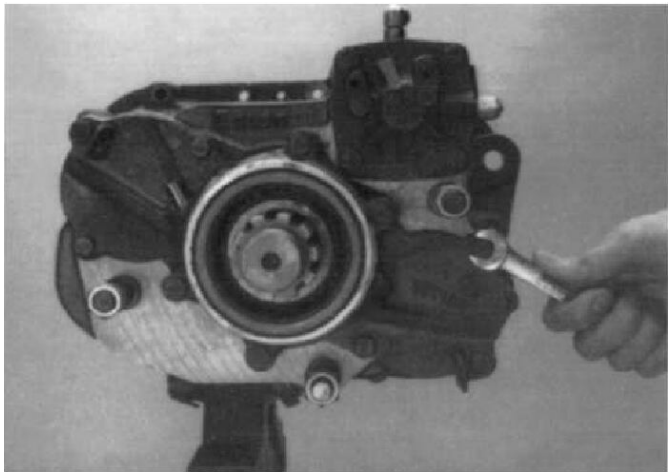
Special Instructions

None

Special Tools

- Typical Service Tools

Procedure -



1. Remove the 12 cap screws and the rear bearing cover and gasket.



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

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



4. Remove the washer from the output shaft.



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Removal and Disassembly of the Auxiliary Countershaft

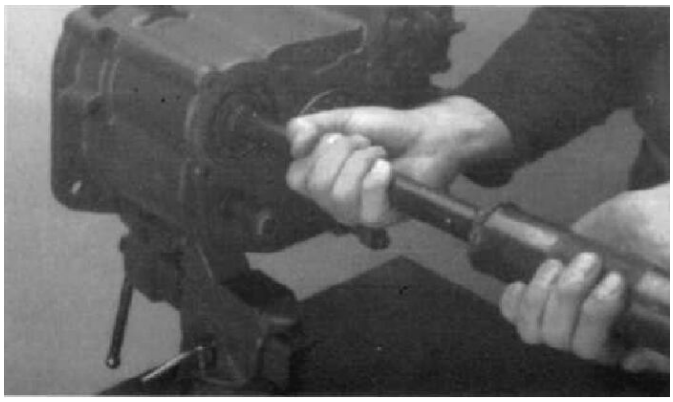
Special Instructions

None

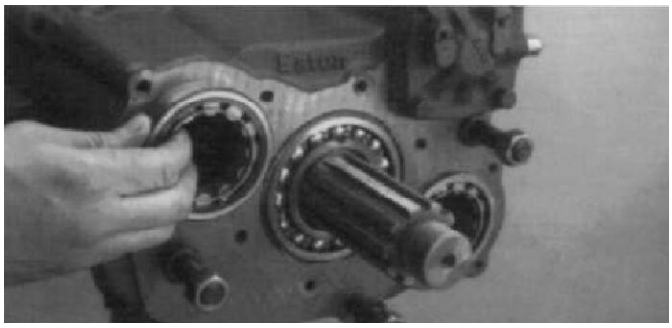
Special Tools

- Typical Service Tools
- Bearing Splitter
- Bearing Puller

Procedure -



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

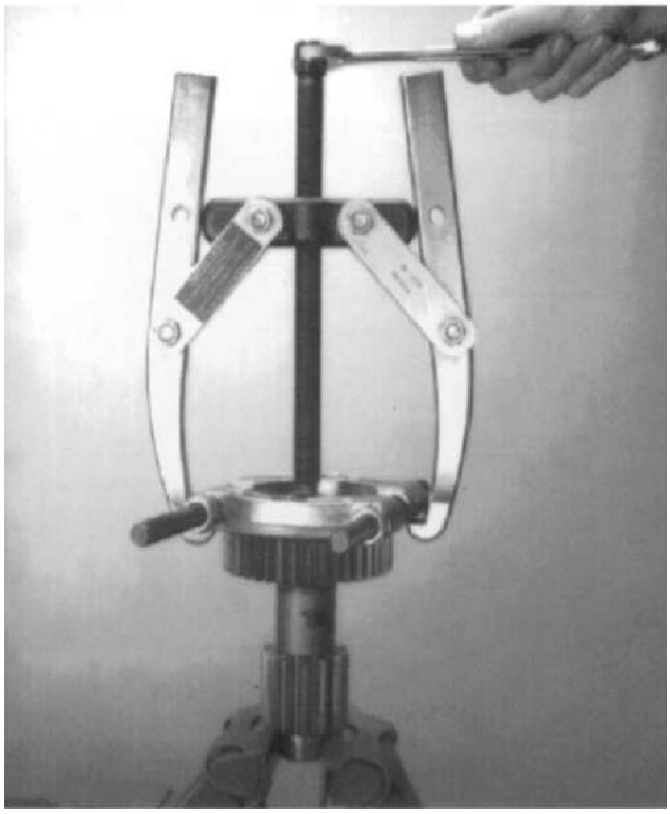


2. Remove the countershaft bearings from the auxiliary case bearing bores.

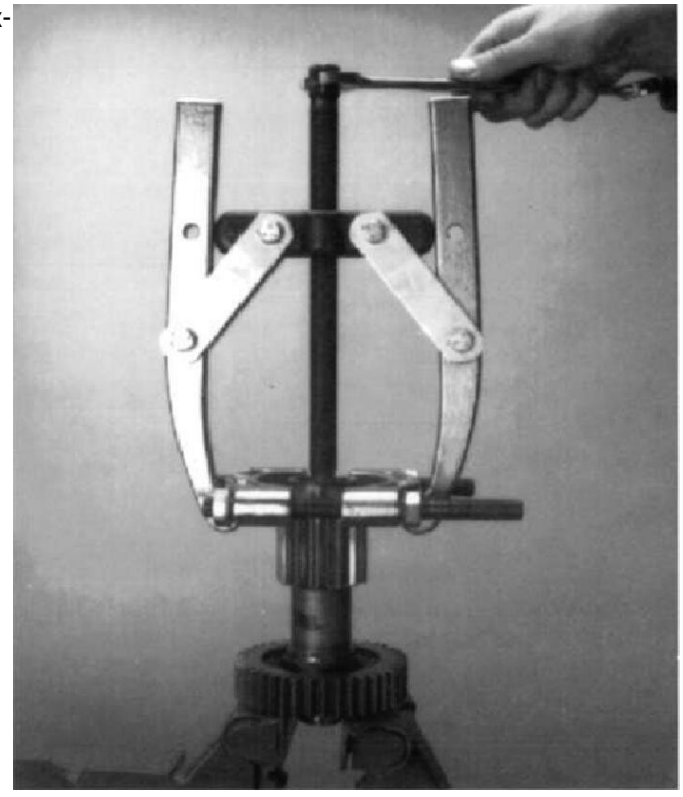
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3. If necessary, secure assembly in a vice and remove the auxiliary countershaft front bearing race from the countershaft with a puller and bearing separator.

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



4. If necessary, secure assembly in a vice and remove the auxiliary countershaft rear bearing.



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Removal and Disassembly of the Range Cylinder Assembly

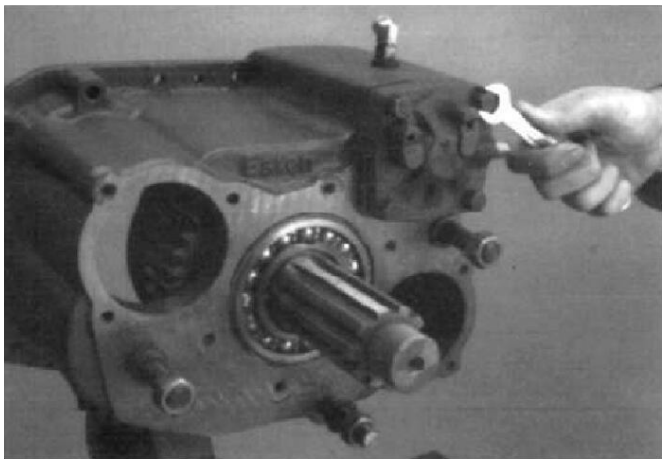
Special Instructions

None

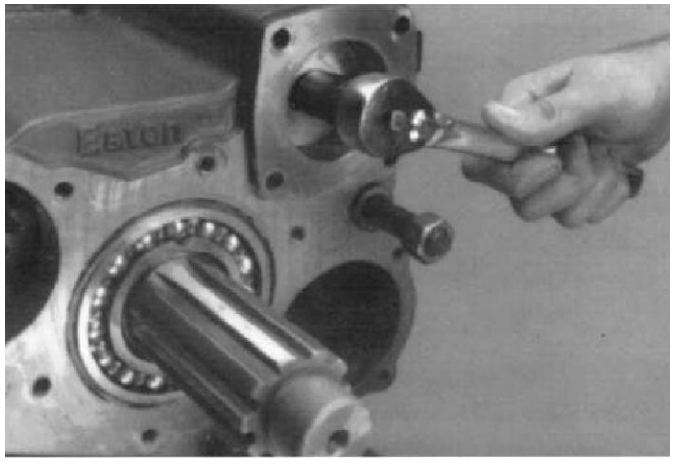
Special Tools

- Typical Service Tools
- Bearing Splitter
- Bearing Puller

Procedure -



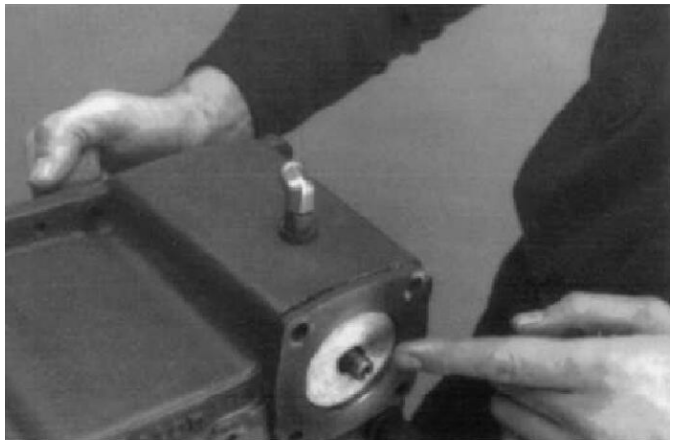
1. Secure the auxiliary housing in a vise. Remove the cap-screws and the range cylinder cover and gasket.



2. Remove the yoke bar nut and washer.

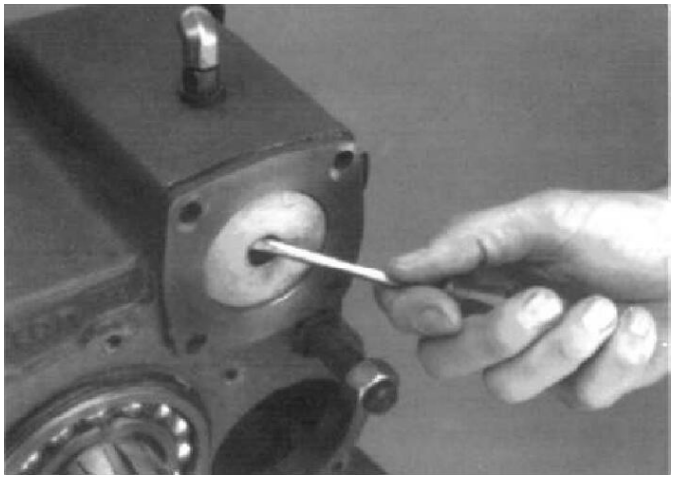
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3. Push range yoke bar to the transmission rear.

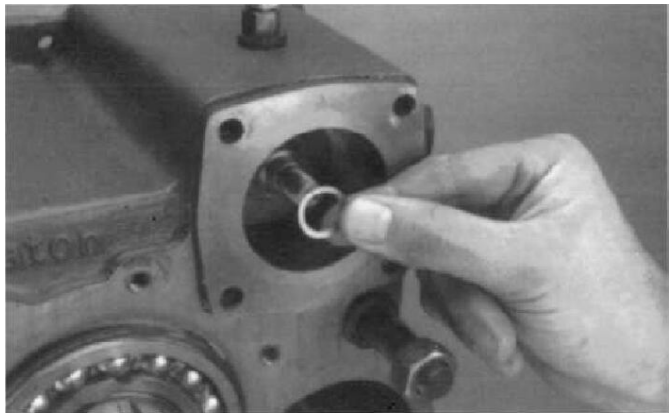


4. Use a screwdriver to remove the piston.

   Note: Do not damage the piston.

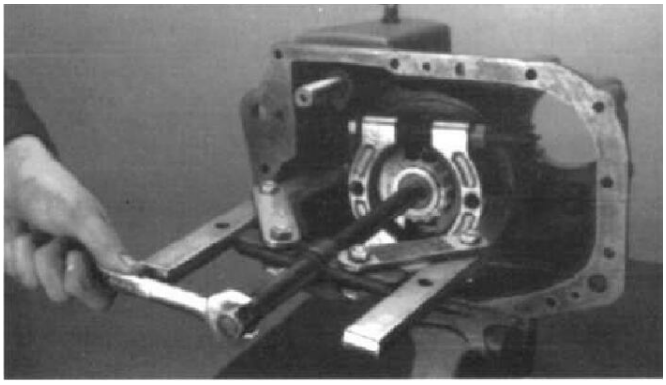


5. Remove the copper gasket from the yoke bar.



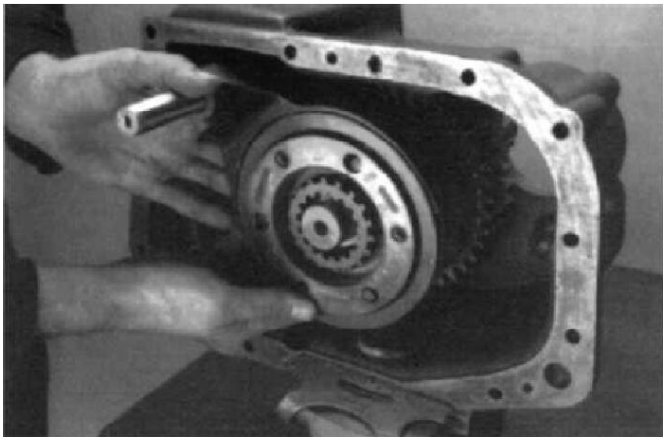
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Disassembly - Auxiliary Section

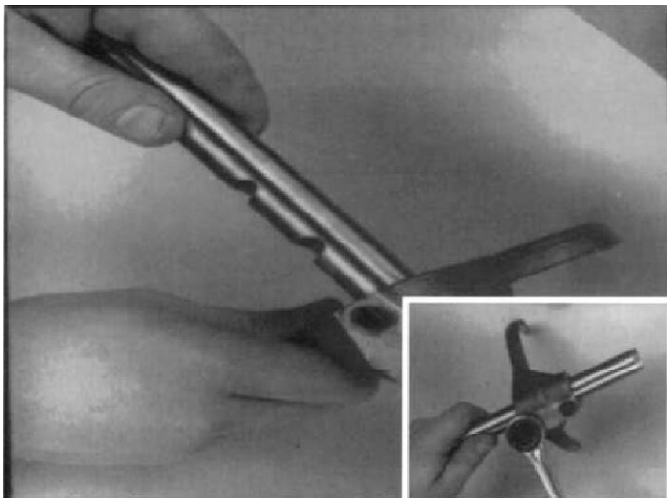


6. Use a puller and bearing separator to remove the bearing from the output shaft front.

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



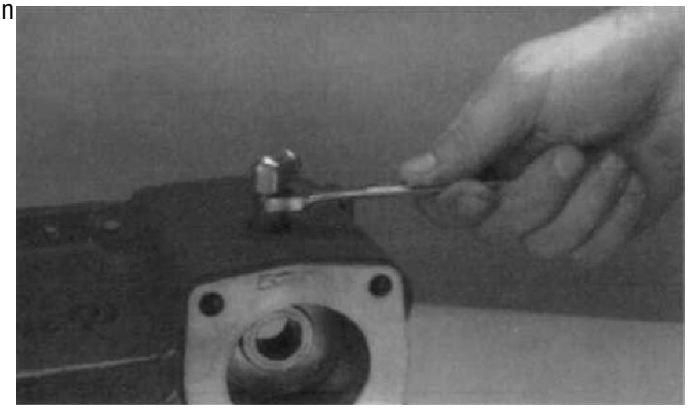
7. Move the synchronizer assembly, shift yoke, and yoke bar forward and out of the housing assembly.



8. Remove the yoke bar and shift yoke from the synchronizer assembly. Cut the lock-wire and remove the2 lock screws (inset,) remove the shift yoke from the yoke bar.

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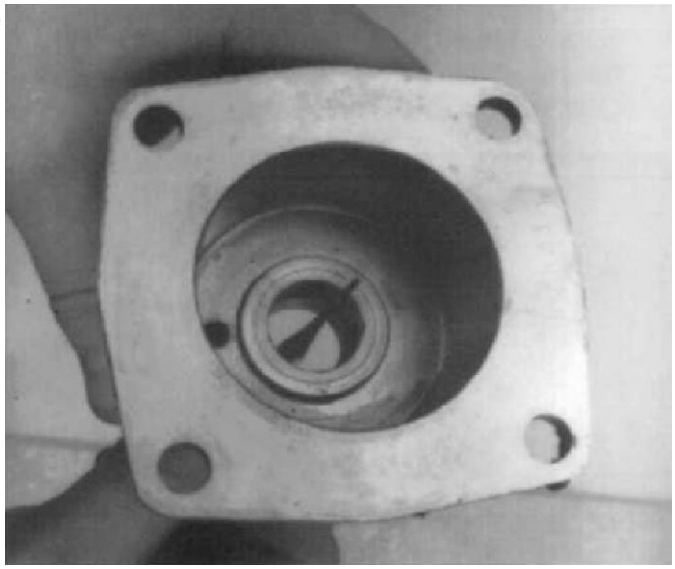
9. IMPORTANT: Remove the dust seal and airport extension from the range cylinder housing top.



10. Remove the cylinder housing.



11. If necessary, remove the O-ring from the small bore in the cylinder.



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Removal and Disassembly of the Synchronizer

Special Instructions

None

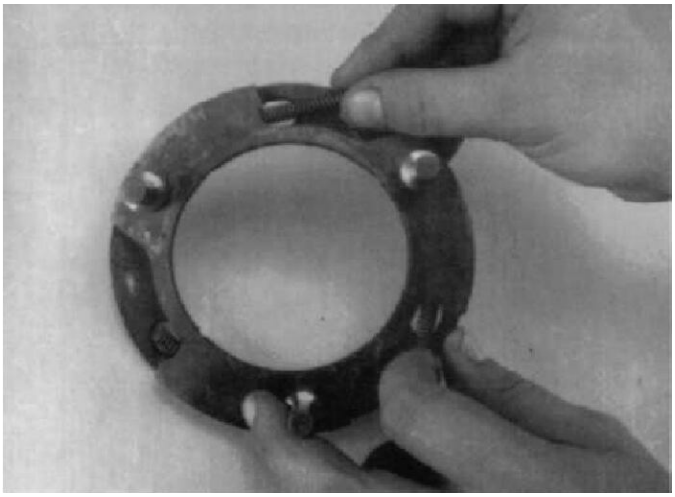
Special Tools

- Shop Rag

Procedure -



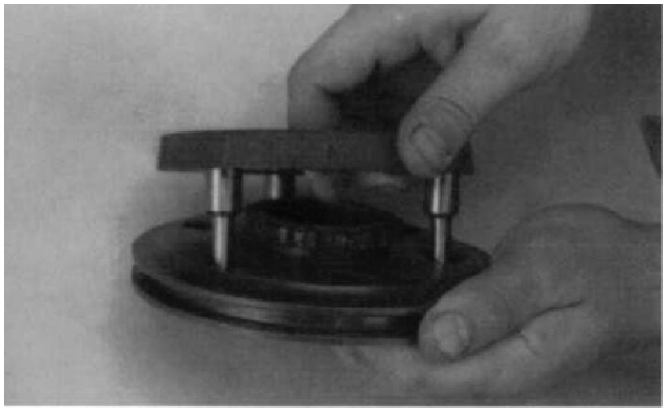
1. Place the larger LO Range synchronizer ring on the bench. Cover the assembly with a shop rag to prevent losing the three springs released from the Hi Range synchronizer at the pin locations. Pull the HI Range synchronizer from the blocker pins.



2. Remove the synchronizer springs.

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



Disassembly - Auxiliary Section

Removal of the LO Range Gear and Output Shaft

Special Instructions

Note: When applying force to the output shaft rear, DO NOT DAMAGE THREADS.

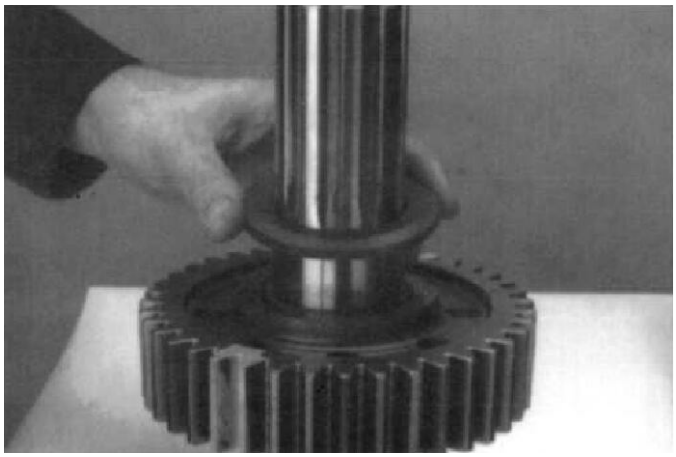
Special Tools

- Typical Service Tools

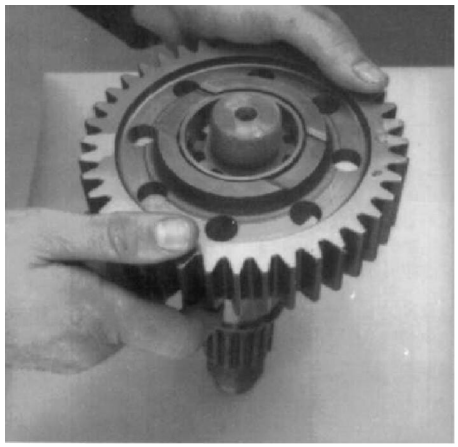
Procedure -



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



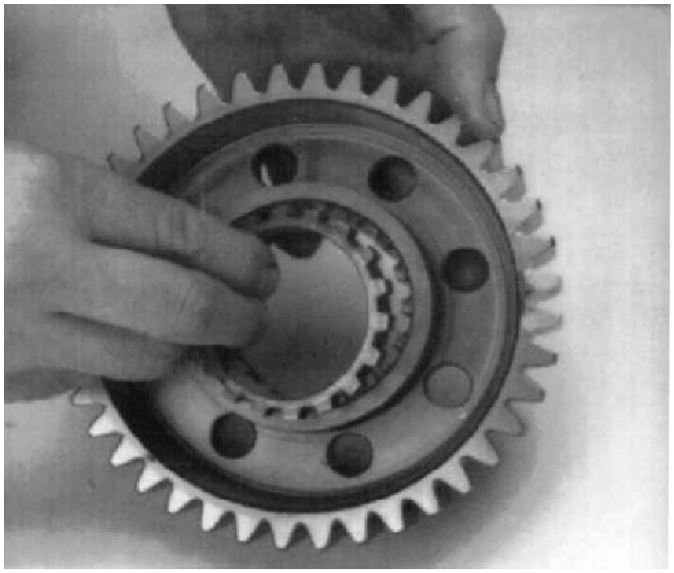
2. Remove the rear washer.



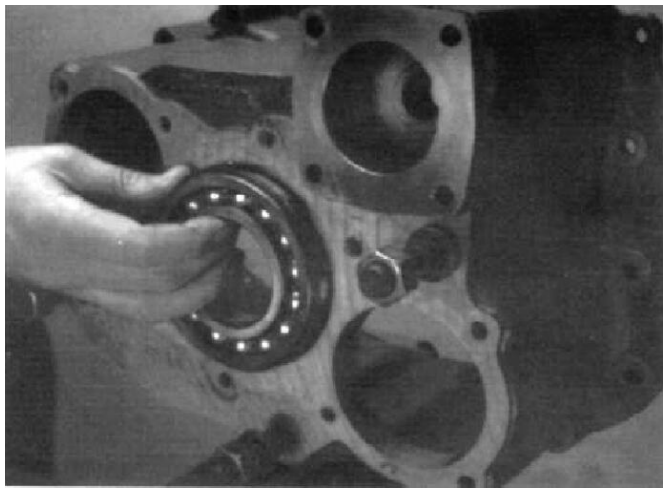
3. Remove LO Range speed gear from the shaft rear.

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4. Remove the spline washer from the reduction gear hub.



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



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Reassembly and Installation of the LO Range Gear and Output Shaft

Special Instructions

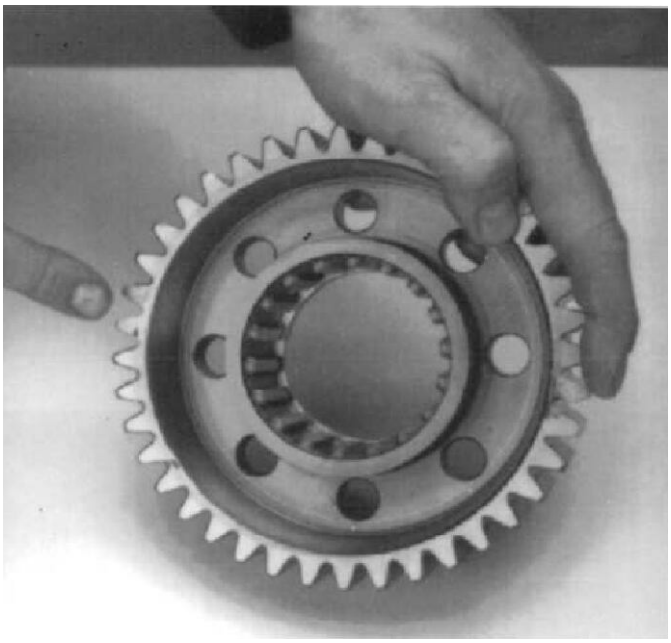
Note: Make sure the magnetic discs are installed in the auxiliary housing.

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

Special Tools

- Bearing Heater
- Bearing Driver

Procedure -



1. IMPORTANT: Mark timing teeth on the LO Range gear. A highly visible color of toolmaker's dye is recommended. Mark any 2 adjacent gear teeth which are directly opposite the first set marked. There should be the same number of teeth between the markings on each gear side.



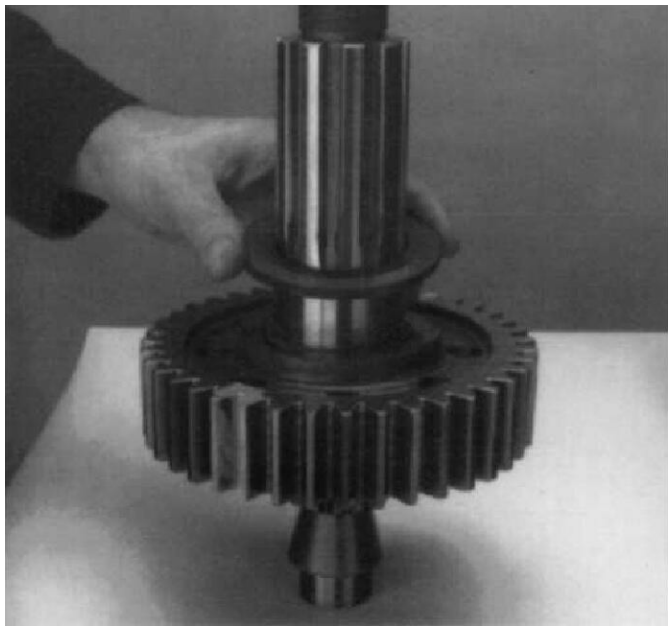
2. Place splined washer on the output shaft shoulder facing up as shown.

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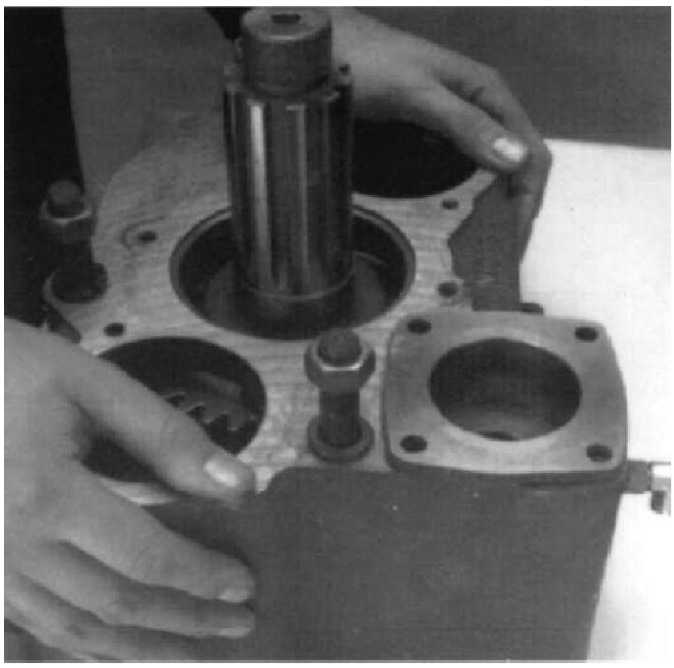
3. Install the LO Range gear over the output shaft rear and against the shoulder.



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

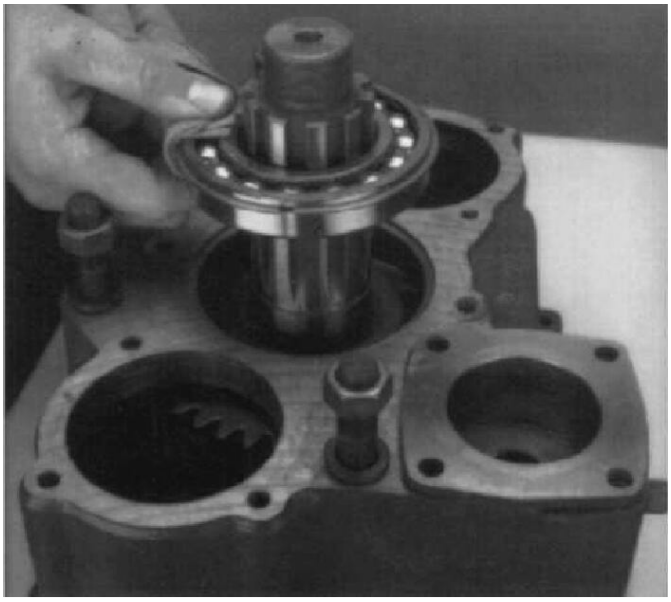


5. Stand the output shaft on end with the shaft rear facing up. Place the auxiliary housing over the shaft so the output shaft extends through the rear bore.



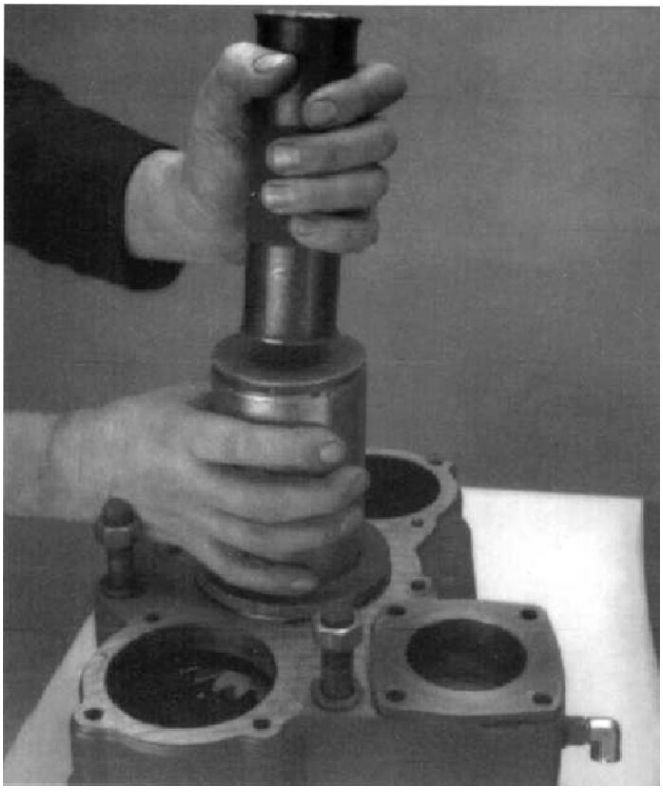
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Reassembly - Auxiliary Section



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

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



7. Install the bearing in the housing bore.

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Reassembly of the Range Cylinder

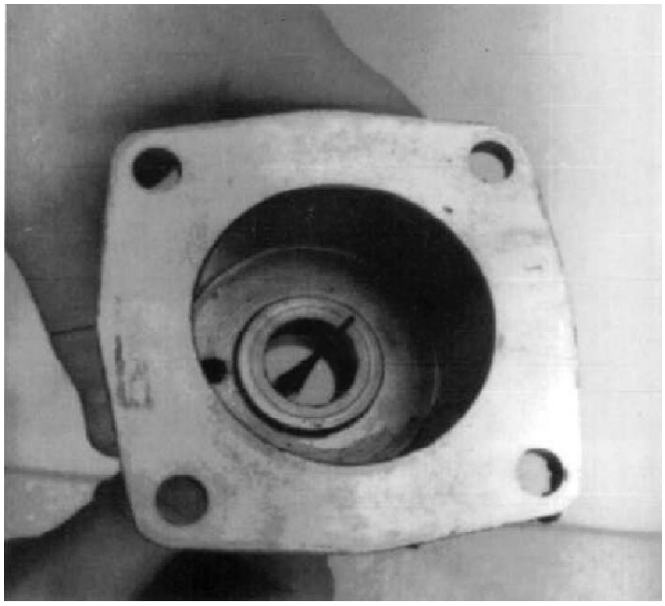
Special Instructions

None

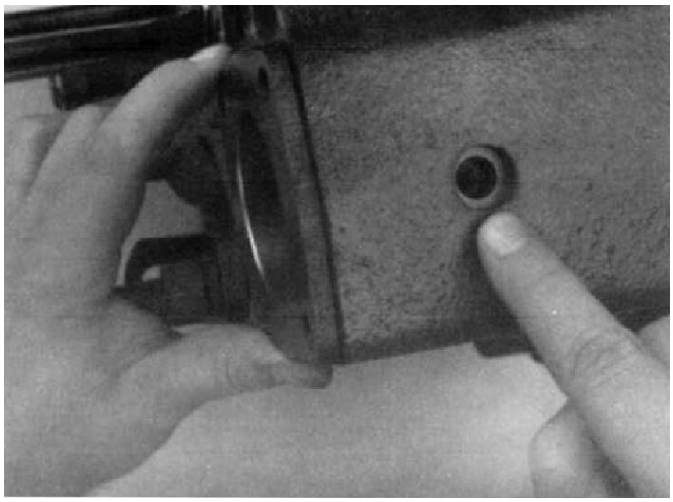
Special Tools

- Typical Service Tools

Procedure -



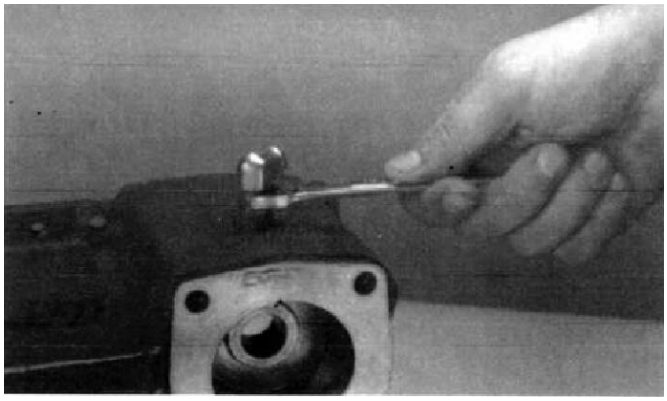
1. If removed, install the O-ring in the cylinder small bore slot. Lubricate the O-ring with silicone lubricant.



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

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



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Reassembly of the Synchronizer Assembly

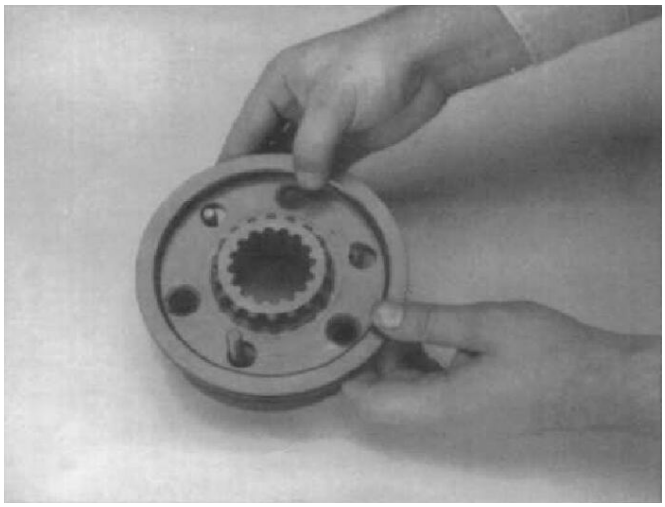
Special Instructions

Note: Pins on the LO Range synchronizer must be lined up with the chamfered holes on the sliding clutch bottom.

Special Tools

- None

Procedure -



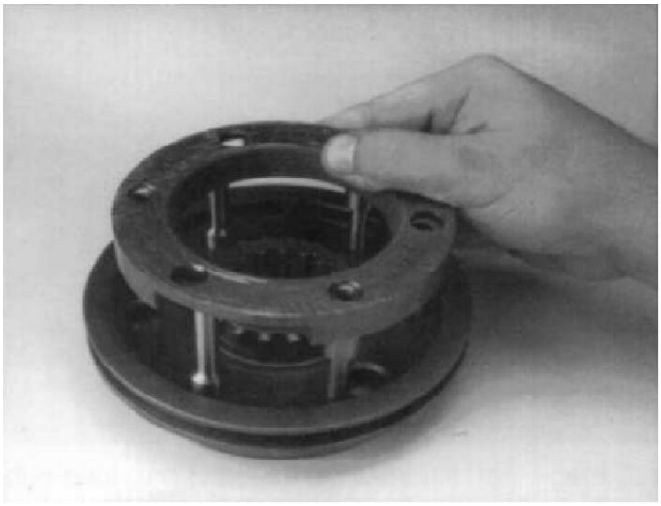
1. Place the larger LO Range synchronizer ring race down on the bench with the pins up. Place the sliding clutch, recessed side up, on the pins of the LO Range synchronizer.



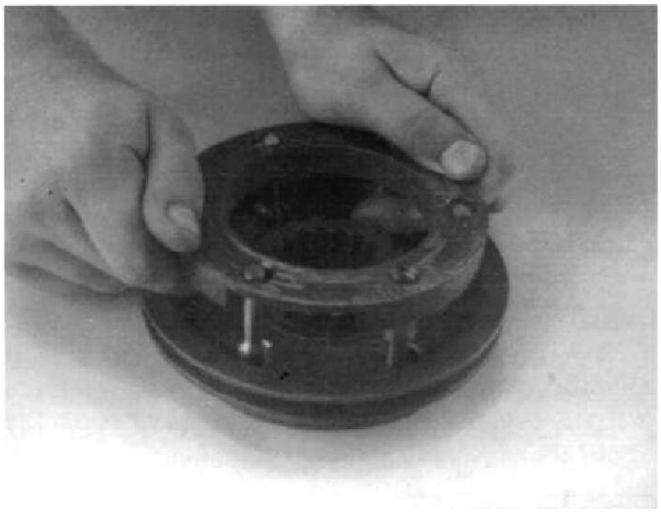
2. Install the 3 springs in the HI Range synchronizer ring bore.

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3. Place the HI Range synchronizer ring, seating springs against the pins.



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



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Installation of the Synchronizer and Range Cylinder Assemblies

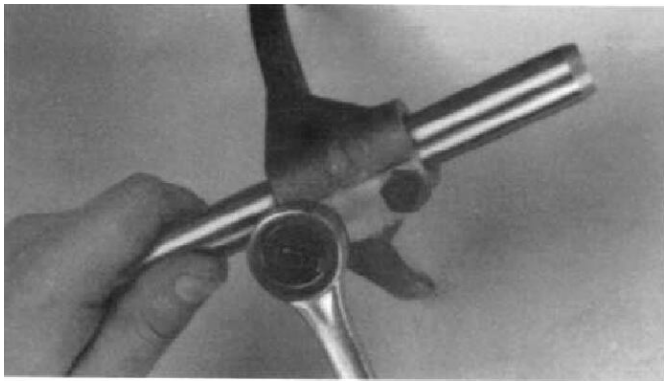
Special Instructions

None

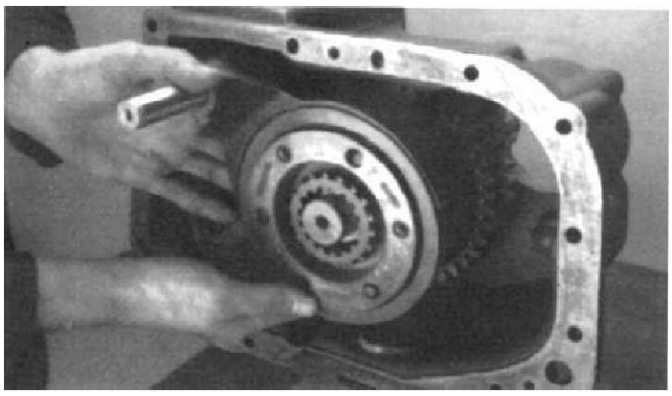
Special Tools

- Typical Service Tools
- Silicone Lubricant

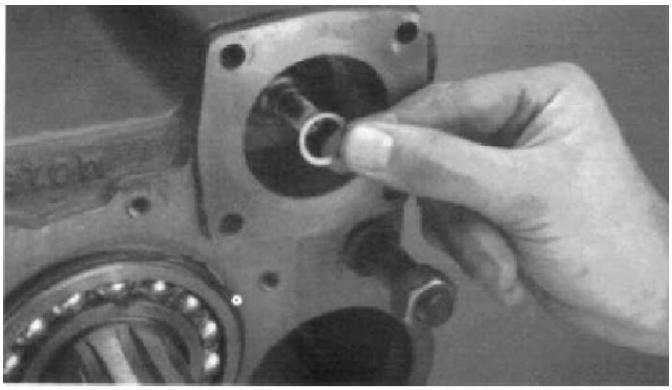
Procedure -



1. Place the shift yoke on the yoke bar, long hub toward the bar front. Align slots in the yoke bar and install the 2 lockscrews, secure with safety wire.



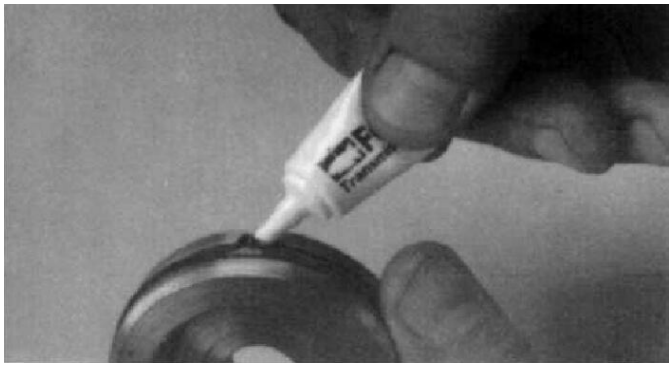
2. Place the yoke in the sliding clutch slot; threaded end of the piston bar towards the larger LO Range synchronizer. Place the entire assembly in the auxiliary housing, engaging the sliding clutch splines with the output shaft and inserting the yoke bar though the cylinder bore.



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

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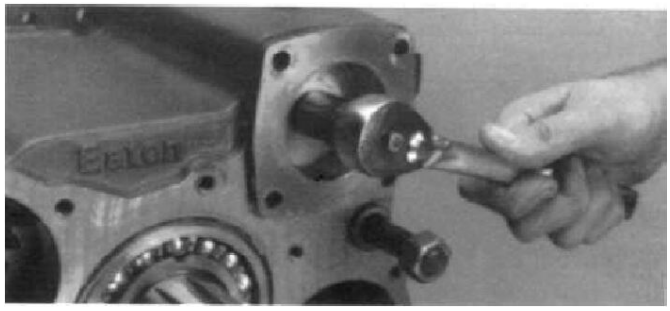
4. Install the O-ring on the piston O.D. Apply a light coat of silicone lubricant to the O-ring.



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



6. Install the lock washer and nut on the yoke bar to secure the piston. Tighten the nut to the recommended torque.



7. Install the gasket and cylinder cover with the HI Range port to the right. Tighten the 4 capscrews to the recommended torque.



Reassembly - Auxiliary Section

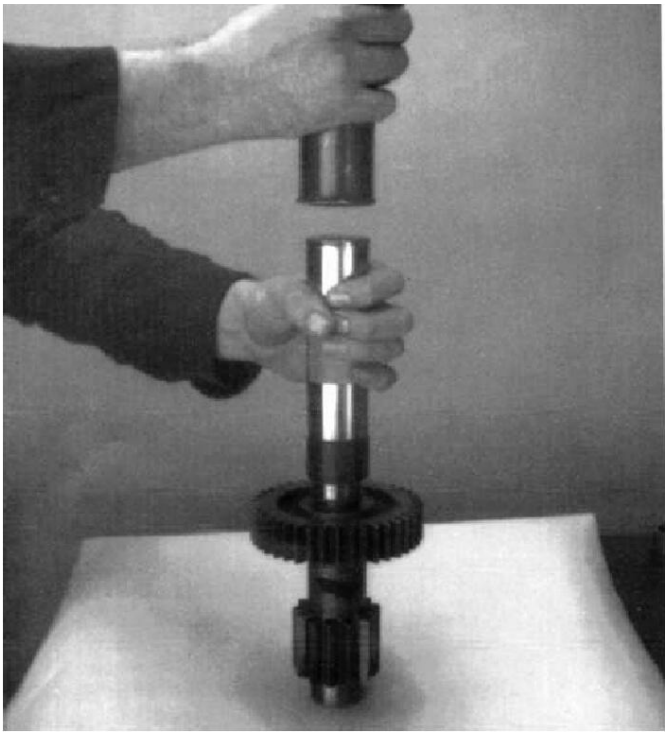
Reassembly of the Auxiliary Countershafts

Special Instructions

Note: Countershaft gear teeth must be marked for timing the auxiliary section. Mark with a highly visible color of toolmakers' dye.

Special Tools

- Bearing Driver
- Toolmakers Dye
- Typical Service Tools

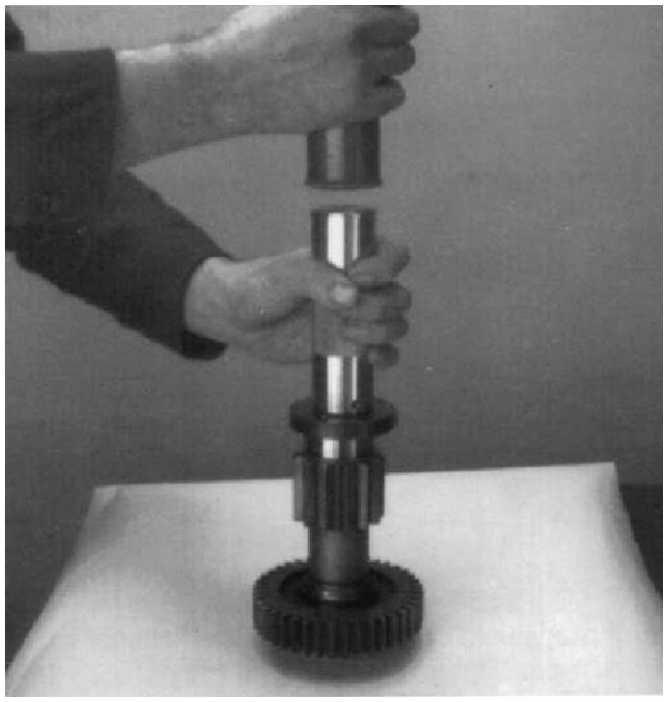


Procedure -

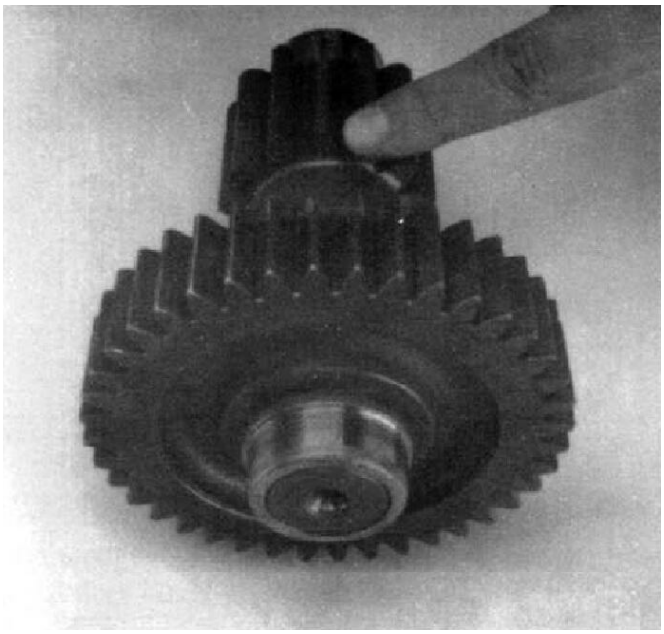
1. Install the bearing inner race on the countershaft front.

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2. Install the bearing inner race on the countershaft rear.



3. Mark the tooth on the countershaft gear which is stamped with an "O".



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Installation of the Auxiliary Countershaft Assemblies

Special Instructions

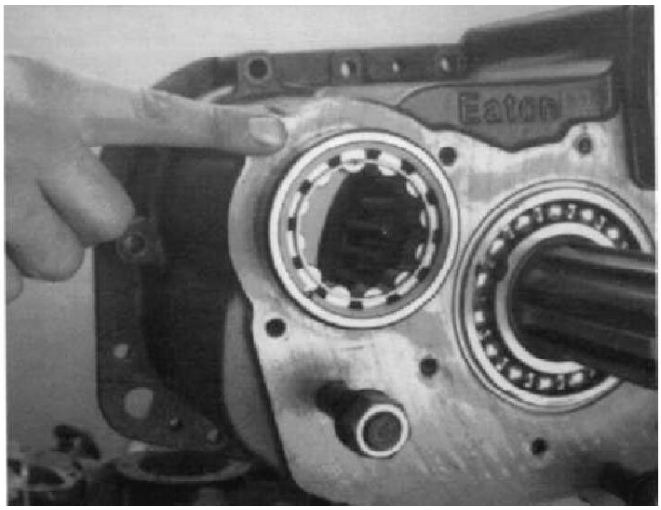
Note: Time the countershaft gear with the LO speed gear. As the countershaft is installed. mesh the marked LO speed gear tooth on each countershaft between each set of marked gear teeth on the LO speed gear.

Note: Use the proper seal driver to install the seal.

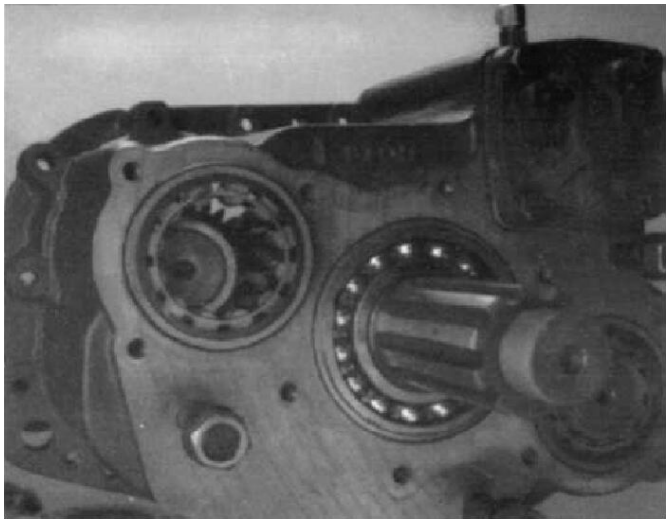
Special Tools

- Typical Service Tools
- Bearing Driver
- Seal Driver

Procedure -



1. Seat the outer races of the countershaft rear bearing only partially in the housing bores, just far enough to stay in place.



2. Place the countershaft into position in the auxiliary housing, inserting the inner race into the partially installed rear countershaft bearing.

   Note: Time the countershaft gear with the LO speed gear. As the countershaft is installed. mesh the marked LO speed gear tooth on each countershaft between each set of marked gear teeth on the LO speed gear.

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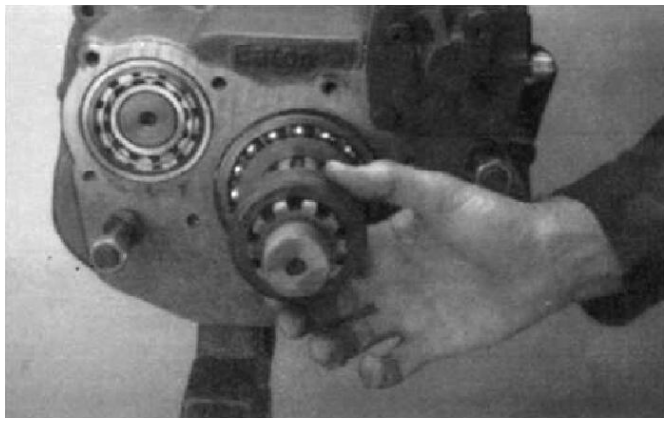
3. With the countershaft in position, complete the installation of the countershaft rear bearings on the shaft and into the case bore. Seat securely.



4. Install the speedometer gear washer, flat side to the rear, on the output shaft and against the bearing.



5. Install the speedometer gear or replacement spacer on the output shaft.



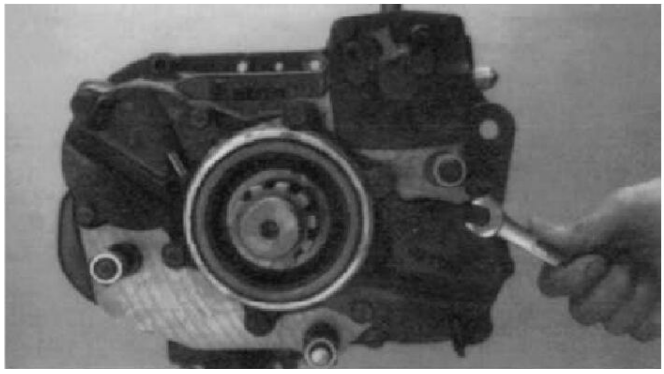
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Reassembly - Auxiliary Section

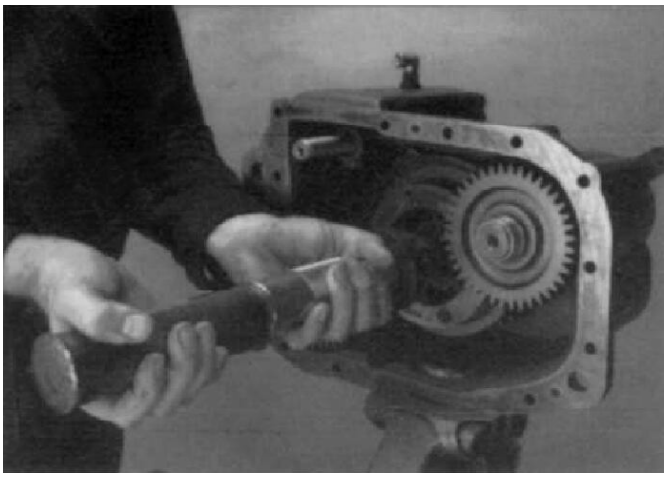


6. If previously removed, install the oil seal in the rear bearing cover, seal lip to the rear.

   Note: Use the proper seal driver to install the seal.



7. Install the rear bearing cover with the speedometer bore up and to the left, tighten the capscrews to the recommended torque.,



8. Install the bearing on the output shaft front, large chamfered side to rear.

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Removal of the Input Shaft

Special Instructions

None

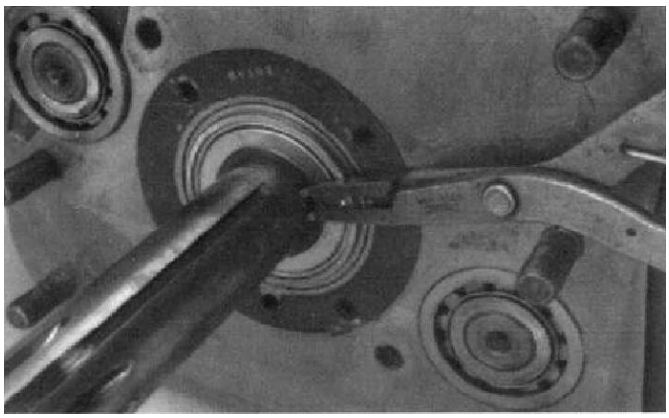
Special Tools

- Typical Service Tools

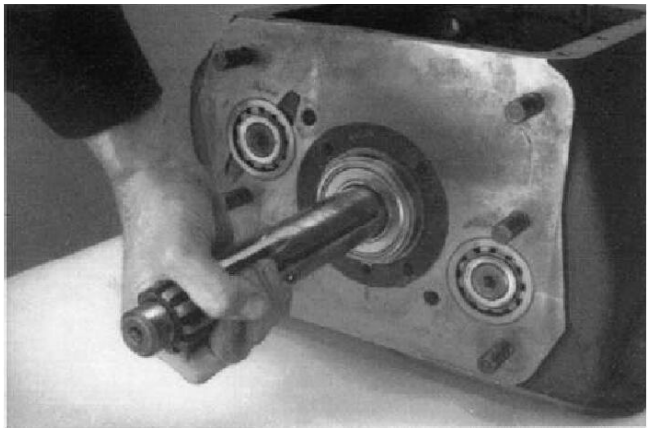
Procedure -



1. Remove the 4 capscrews retaining the front bearing cover. Remove the bearing cover and gasket.



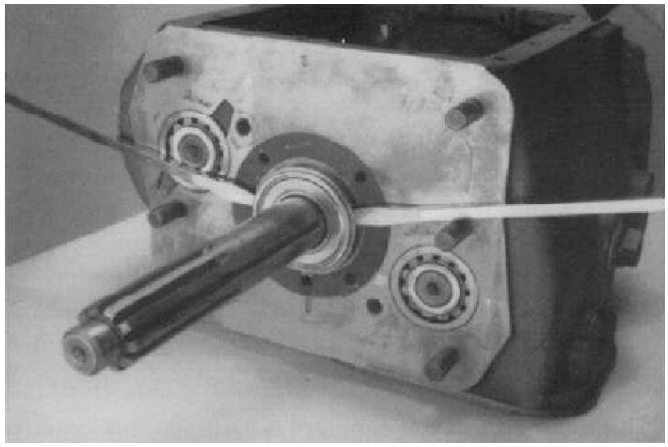
2. Remove the bearing retaining snap ring from the shaft groove.



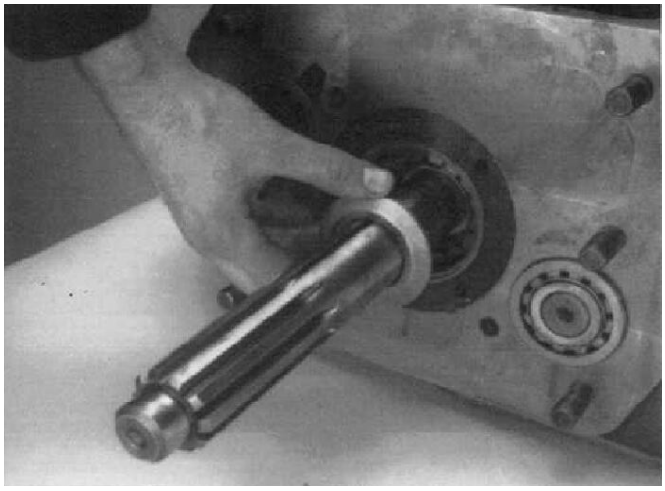
3. Push down on the input shaft to cock the bearing in the bore. Drive the input shaft toward the transmission rear, through the bearing as far as possible. Pull the input shaft forward to expose the bearing snap ring.

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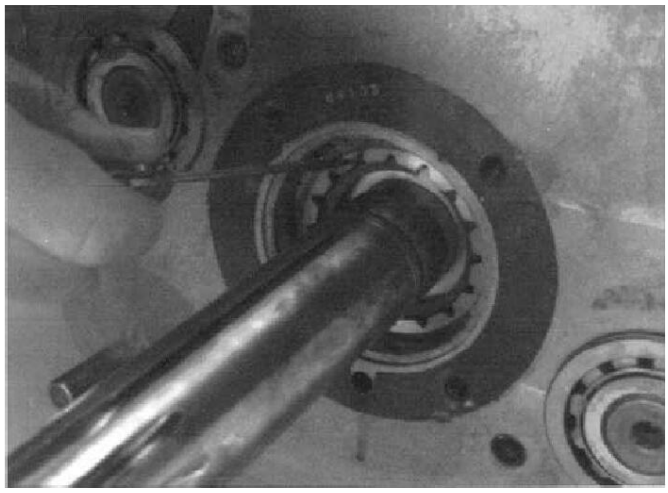
4. Use pry bars to complete the bearing removal.



5. Remove the drive gear spacer.

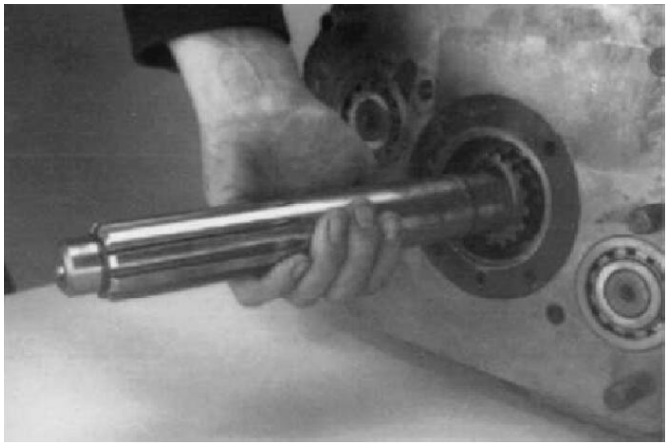


6. Remove the drive gear snap ring.

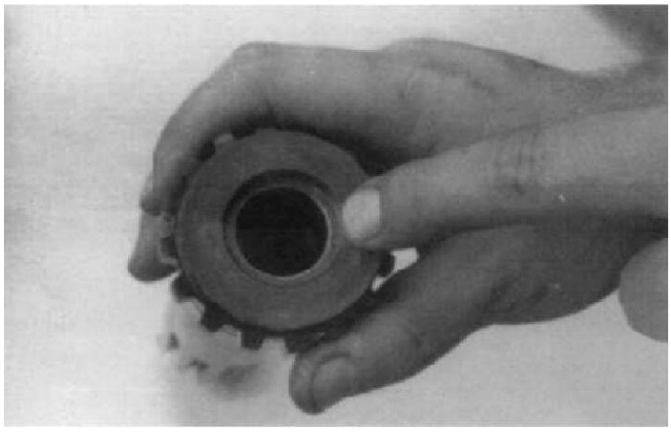


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Disassembly - Front Section



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



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

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Removal and Disassembly of the Auxiliary Drive Gear

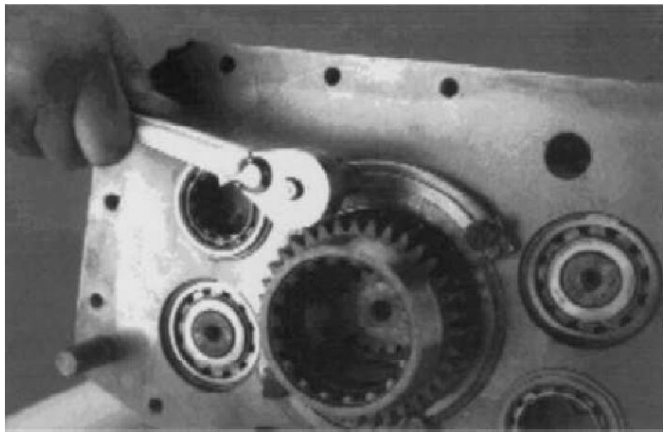
Special Instructions

None

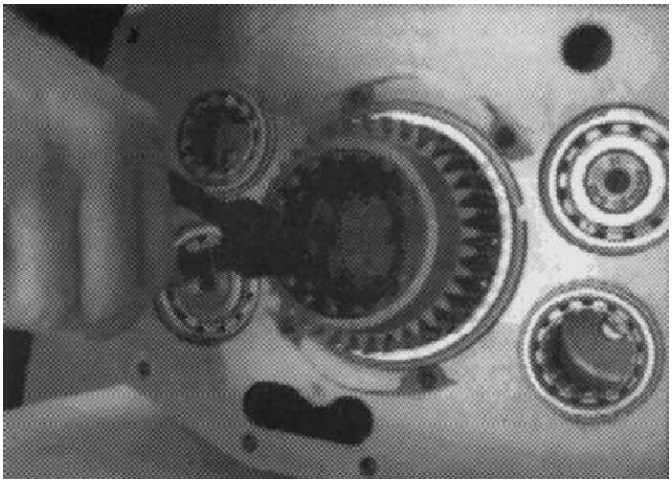
Special Tools

- Typical Service Tools

Procedure -



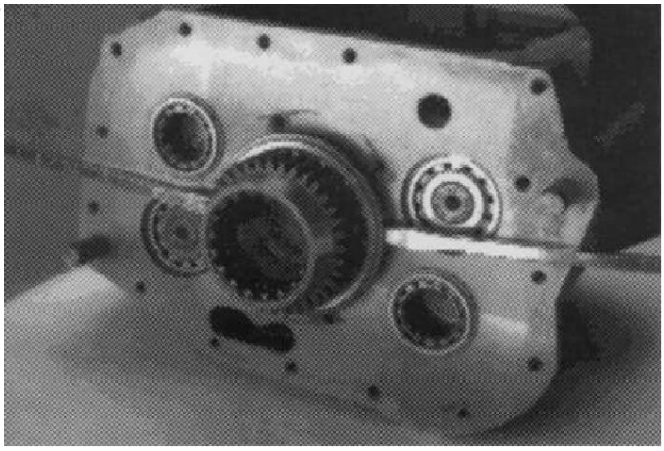
1. Straighten the lock tangs, remove the 4 capscrews and 2 bearing retainers from the case.



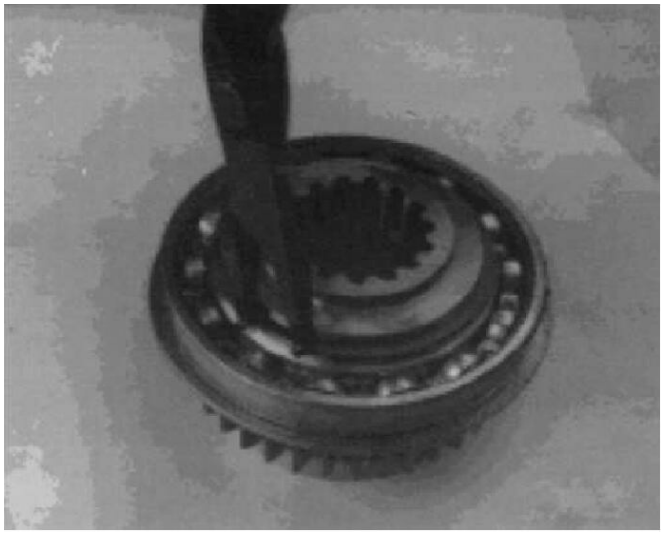
2. Remove the snap ring from the mainshaft rear, located inside the auxiliary drive gear bore.

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3. With 2 screwdrivers pry the auxiliary drive gear off the mainshaft.



4. Remove the snap ring from the auxiliary drive gear.



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



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Removal of the Upper Countershaft Bearings

Special Instructions

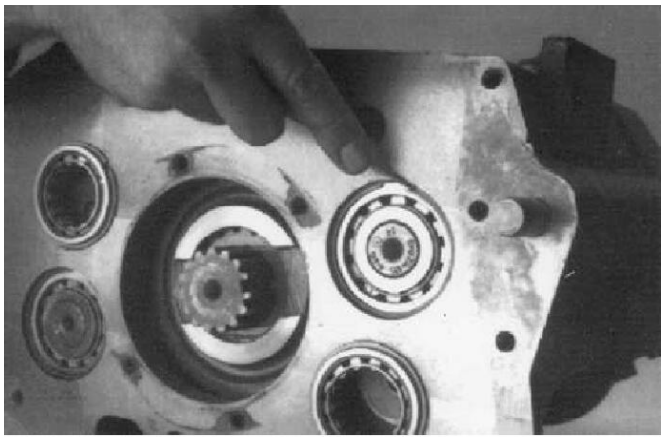
Note: Steps 4 and 5 may have to be repeated several times to unseat the front bearing.

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

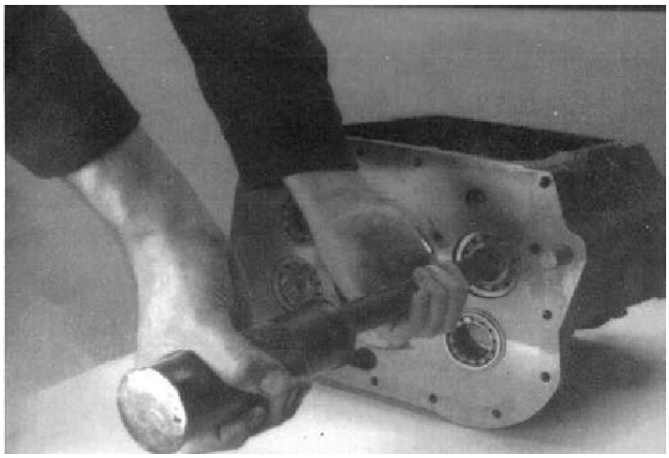
Special Tools

- Typical Service Tools

Procedure -



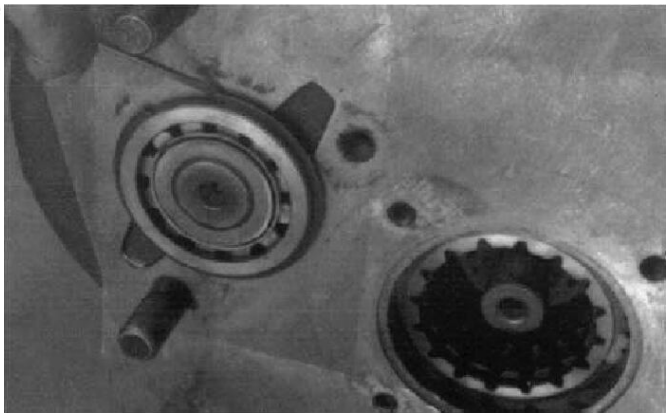
1. Remove the upper countershaft snap ring from the case rear bearing bore.



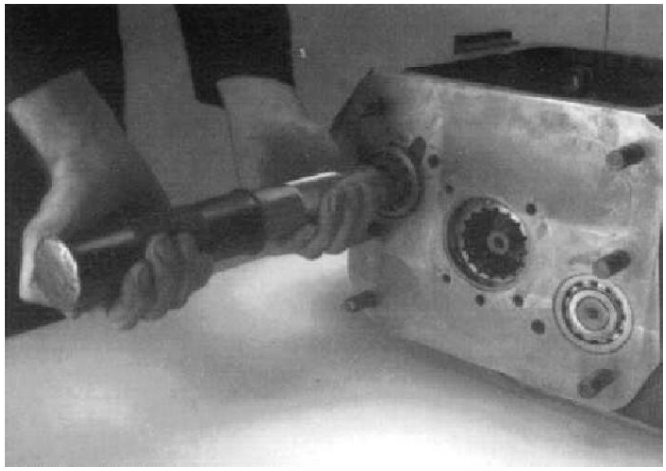
2. Use a soft bar and maul against the countershaft rear and move the countershaft assembly forward as far as possible until the snap ring groove in the front bearing is exposed.

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

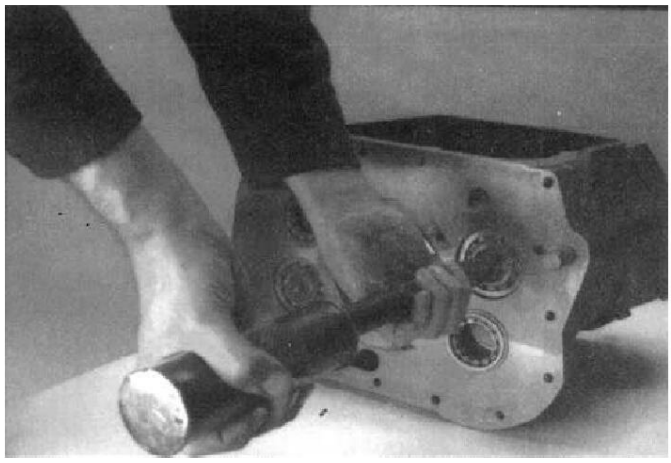


4. Use a soft bar and maul to drive the countershaft assembly to the rear as far as possible. This will move the front bearing forward on the countershaft.



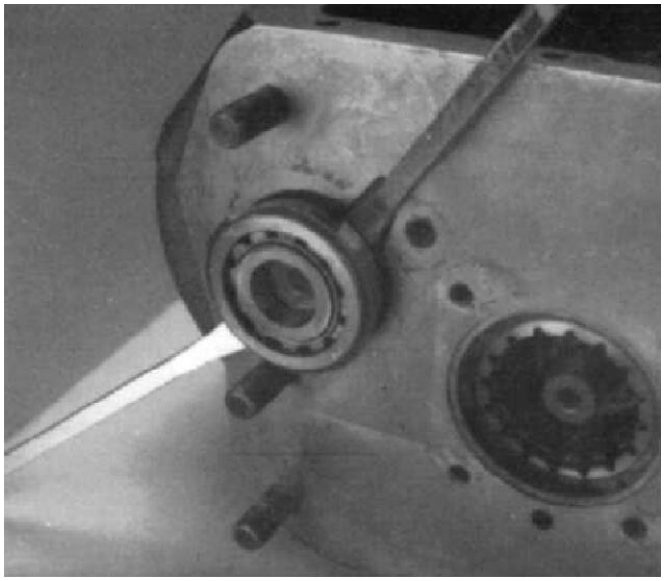
5. From the case rear use a soft bar and maul to drive the countershaft forward to unseat the front bearing from the case bore.

   Note: Steps 4 and 5 may have to be repeated several times to unseat the front bearing.

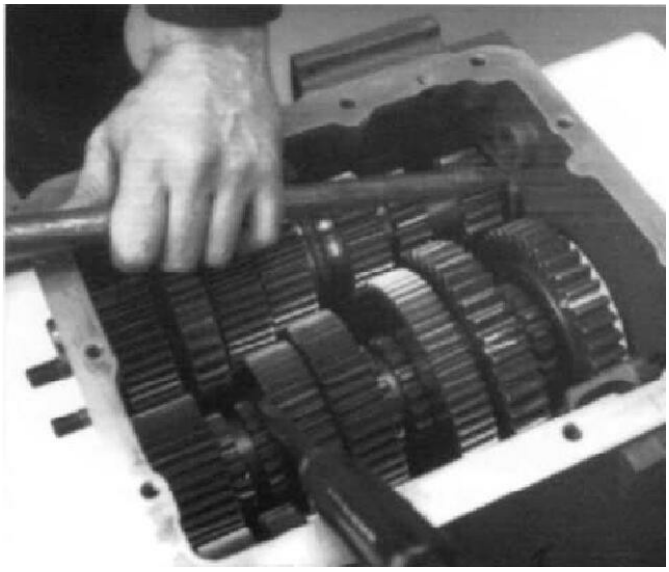


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Disassembly - Front Section



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 bearings. Removal should not be attempted unless bearing replacement is planned.

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Removal and Disassembly of the Reverse Idler Gear Assembly

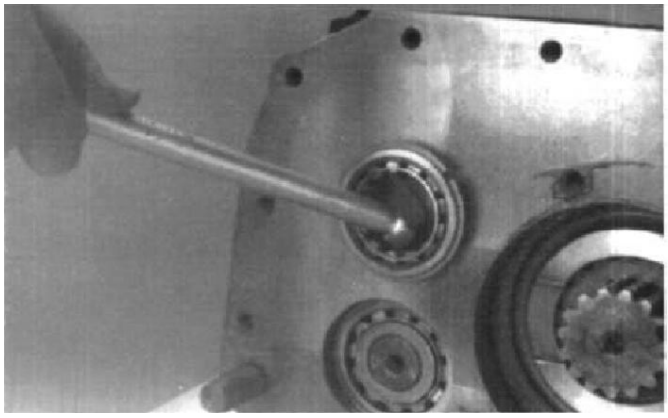
Special Instructions

Note: The lower and upper reverse idler gear assemblies disassemble the same.

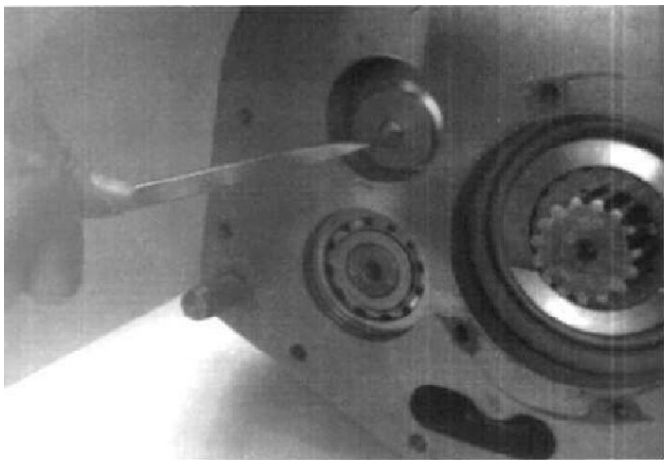
Special Tools

- Typical Service Tools
- Slide Hammer

Procedure -



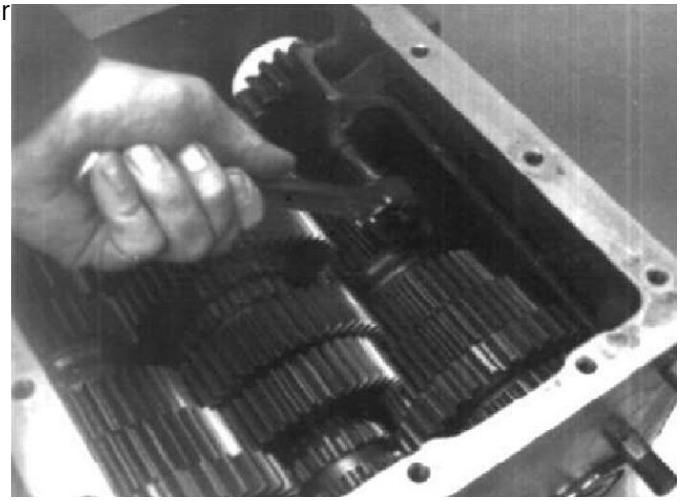
1. Use a rolling head pry barer an impact puller and remove the auxiliary countershaft front bearing from the left reverse idler gear bore.



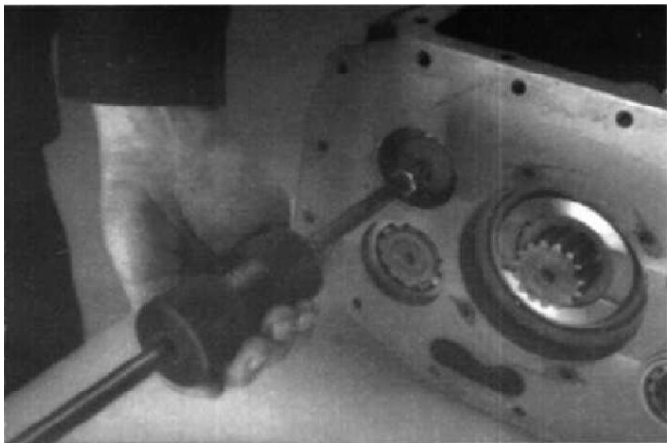
2. Remove the plug from the idler shaft rear.

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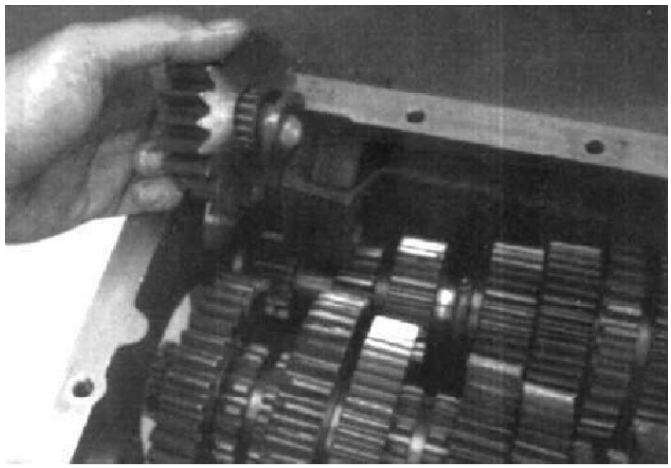
3. Use a socket wrench and remove the lock nut from the idler shaft front. Remove the washer.



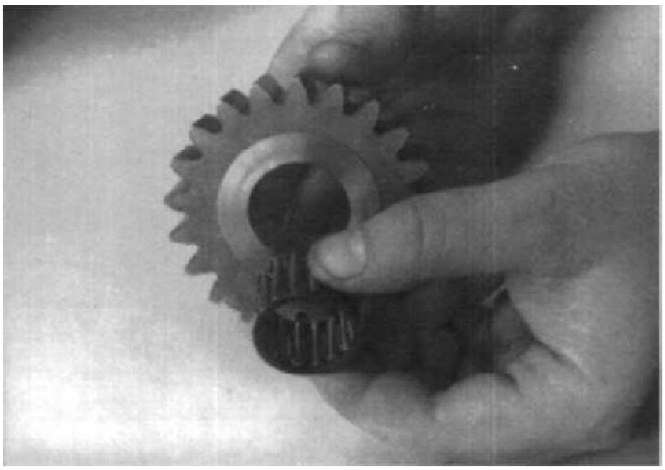
4. Use an impact puller, 1/2-13 threaded end, to remove the idler shaft from the case bore.



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



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

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Removal and Disassembly of the Mainshaft Assembly

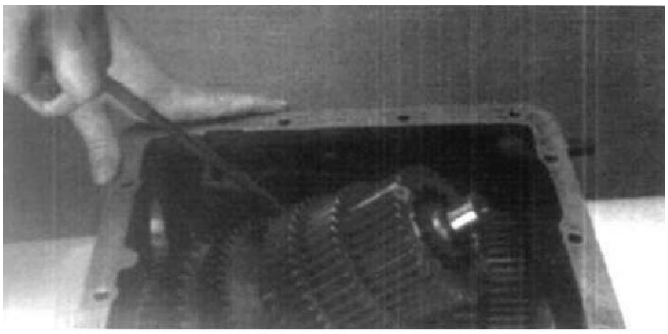
Special Instructions

WARNING: The drive gear is free and can fall from the mainshaft.

Special Tools

- Mainshaft Hook
- Vise with Jaw Protectors

Procedure -



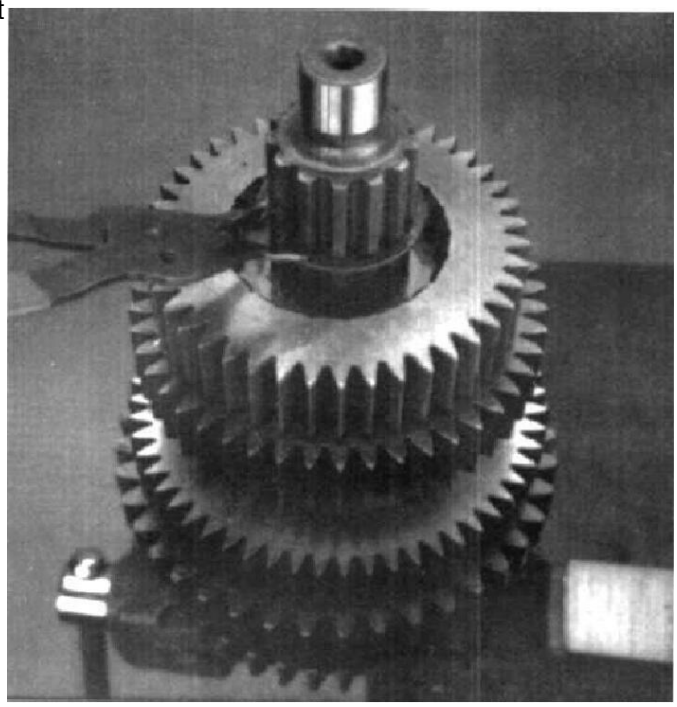
1. Block the right countershaft assembly against the case wall. Slide the drive gear to the rear and engage with the sliding clutch splines. Use a hook around 1st-2nd sliding clutch, tilt the mainshaft front up and lift the assembly from the case.



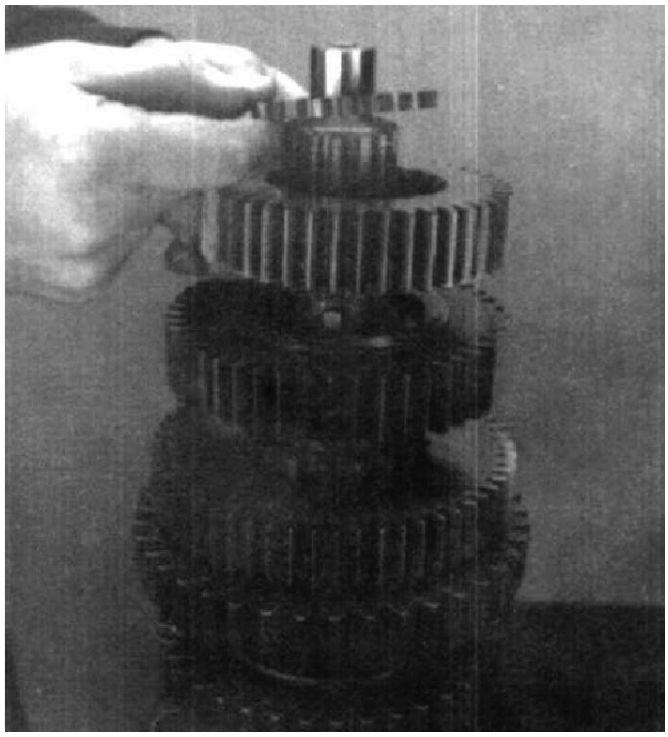
2. Secure the mainshaft, drive gear up, in a vise. Remove the drive gear and the 3rd-4th speed sliding clutch.

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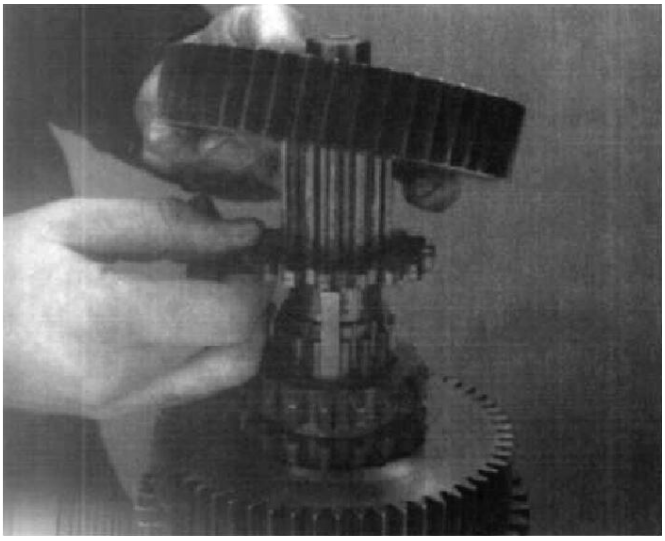
3. Remove 3rd speed gear hub snap ring from the mainshaft groove.



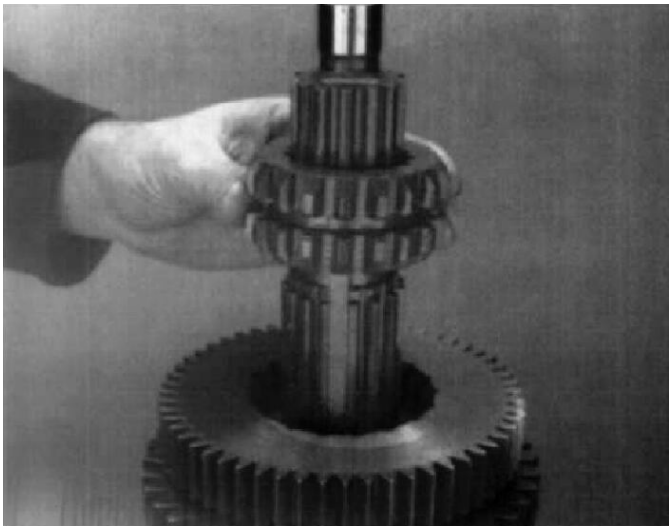
4. Remove 3rd speed gear and tolerance washer.



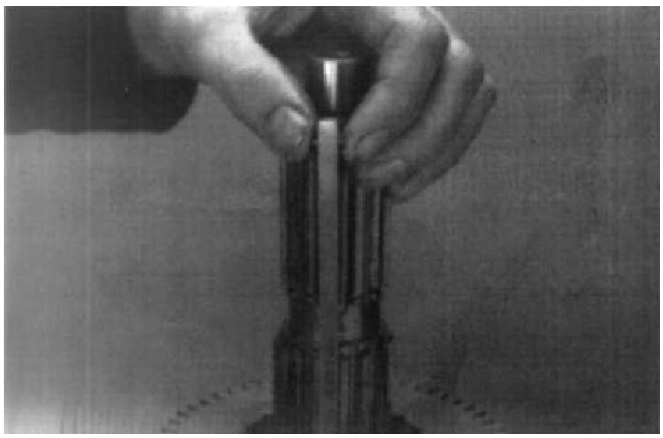
Disassembly - Front Section



5. Remove 2nd speed gear and tolerance washer.



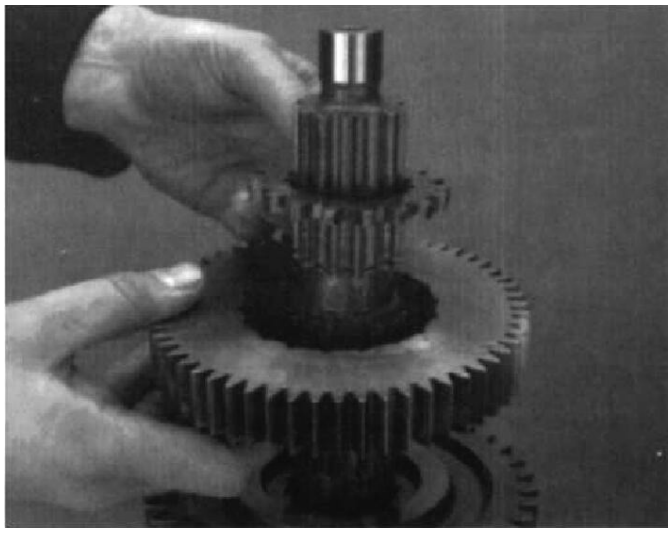
6. Remove 1st-2nd speed sliding clutch.



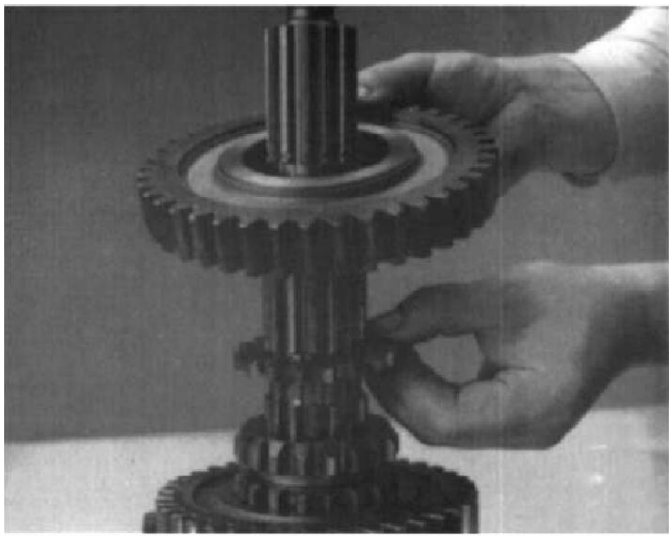
7. Remove mainshaft key from mainshaft keyway.

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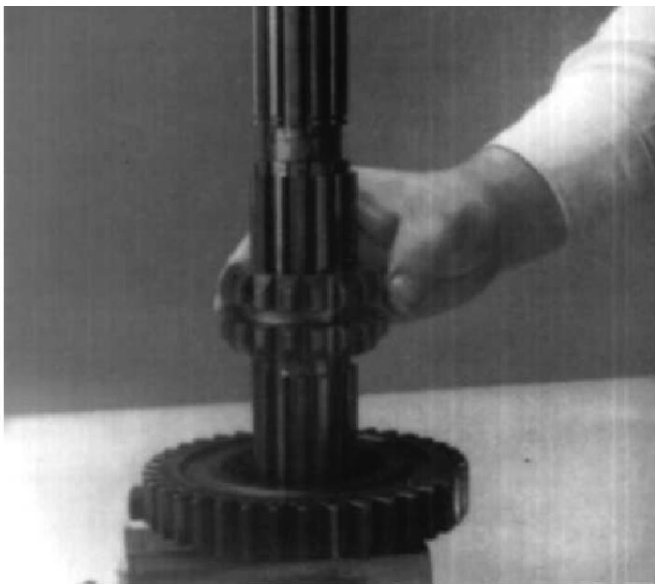
8. Remove 1st speed gear and tolerance washer.



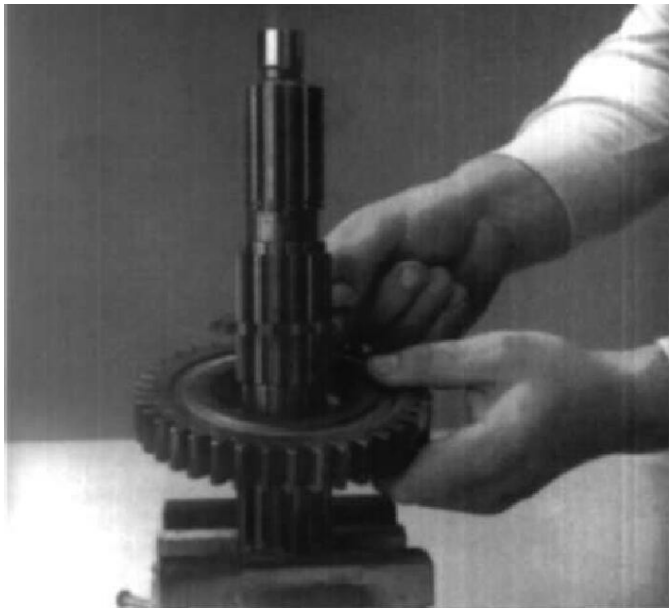
9. Remove LO speed gear and tolerance washer.



10. Remove LO and reverse speed sliding clutch.



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11. Remove the reverse gear and tolerance washer.

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Removal and Disassembly of the Countershaft Assemblies

Special Instructions

WARNING: Do not press on the countershaft PTO gear.

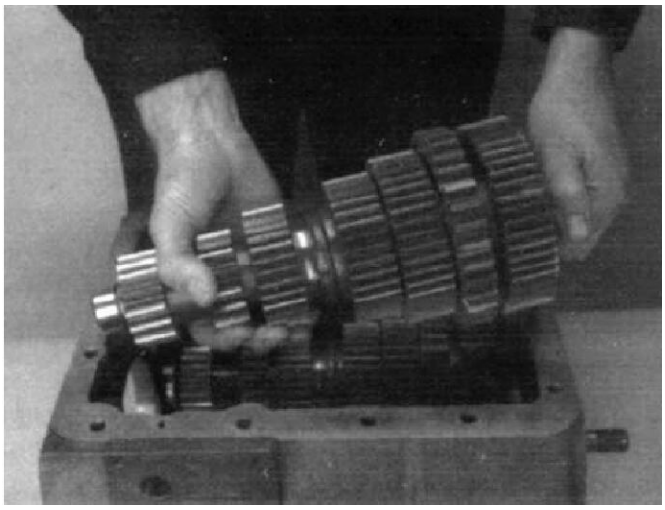
Note: Both countershafts disassemble and reassemble in the same manner.

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.

Special Tools

- Press
- Typical Service Tools

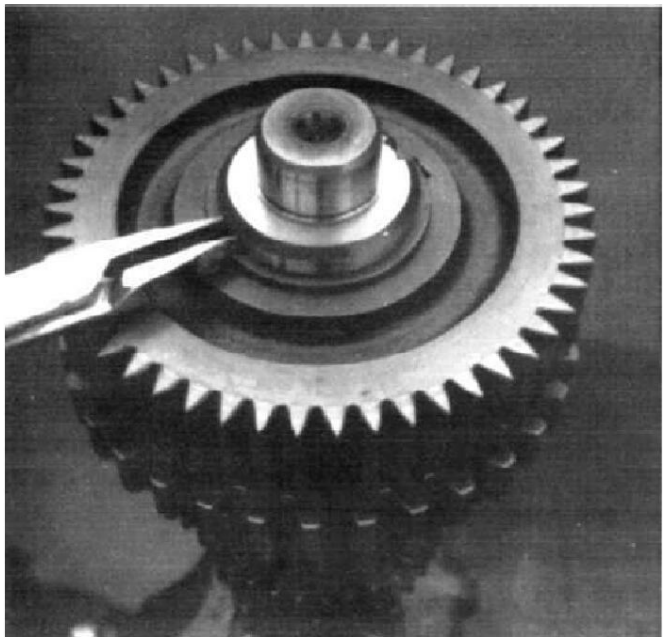
Procedure -



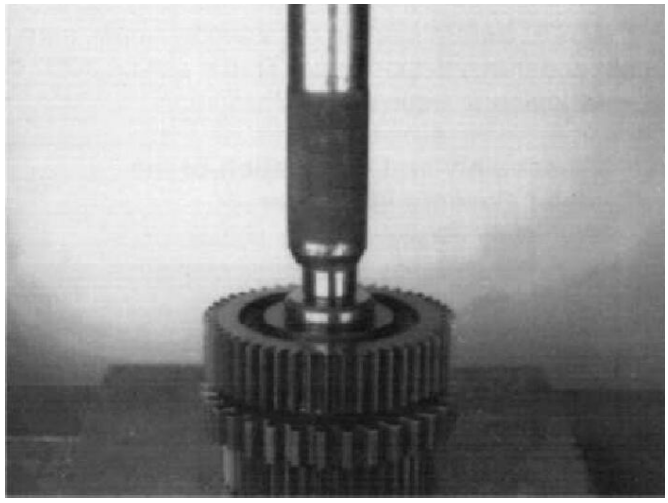
1. Remove the upper countershaft from the case.

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2. Remove the snap ring from the countershaft front.

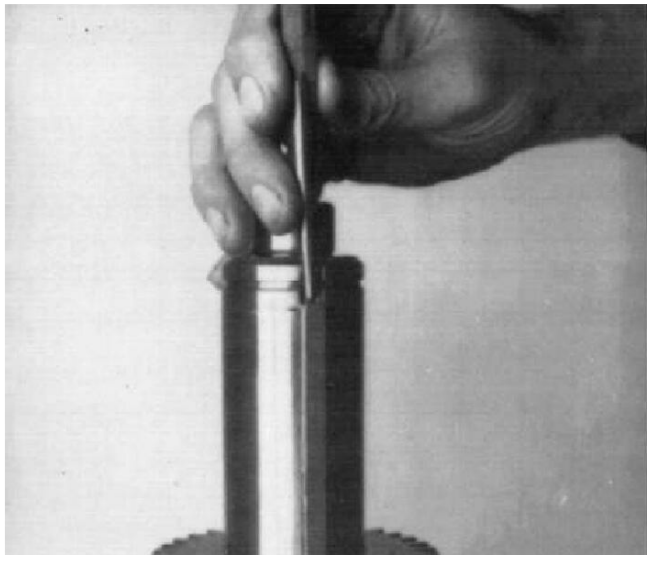


3. Remove countershaft drive gear, countershaft PTO gear, and countershaft 3rd speed gear together by pressing on the countershaft 3rd speed pear bottom face.



4. If necessary, remove the countershaft key.

   Note: You cannot remove any more gears from the countershaft.



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Reassembly and Installation of the Lower Reverse Idler Gear Assembly

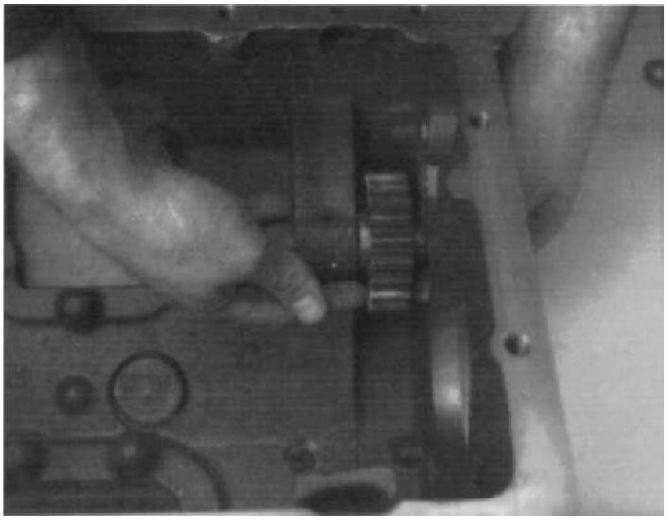
Special Instructions

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.

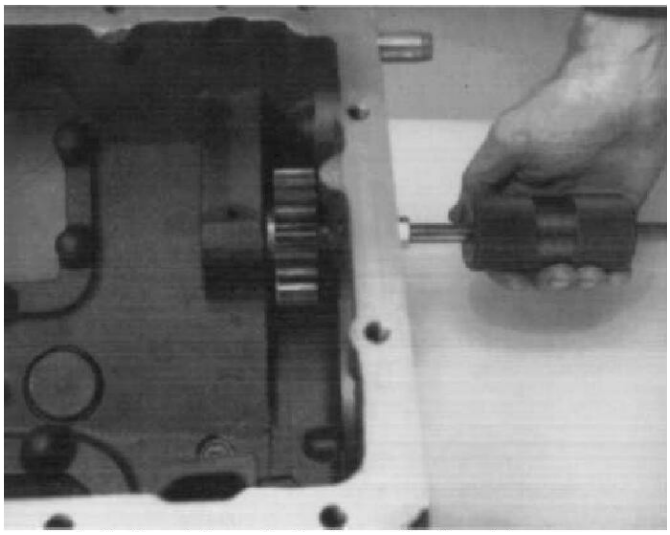
Special Tools

- Bearing Driver
- Typical Service Tools

Procedure -



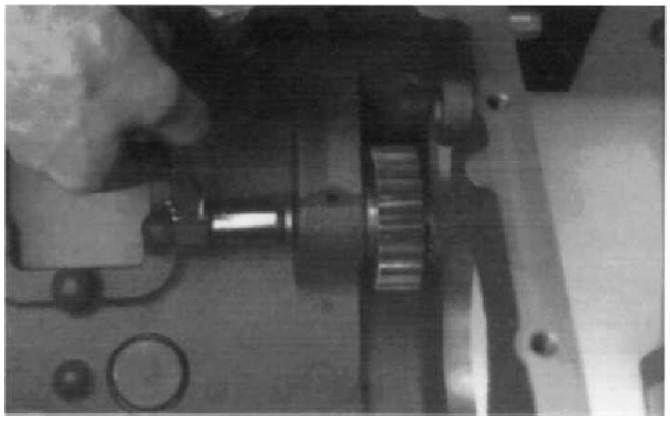
1. Position the reverse idler bearing, gear, and washer in the transmission case, washer to the case front.



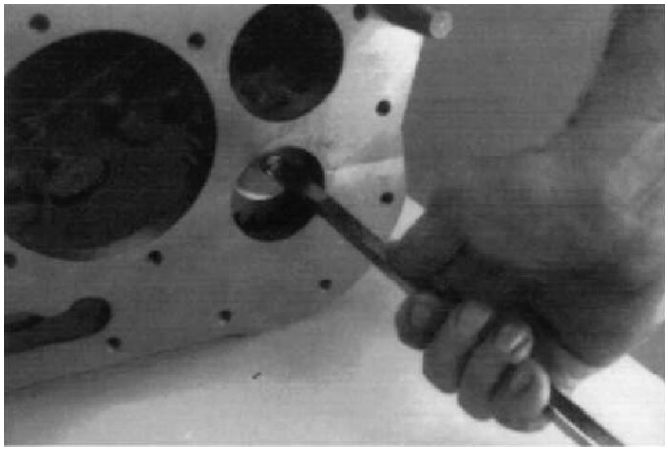
2. Install the idler shaft through the idler gear and into the transmission case bore. Make sure the idler shaft is seated in the support boss bore as far forward as possible.

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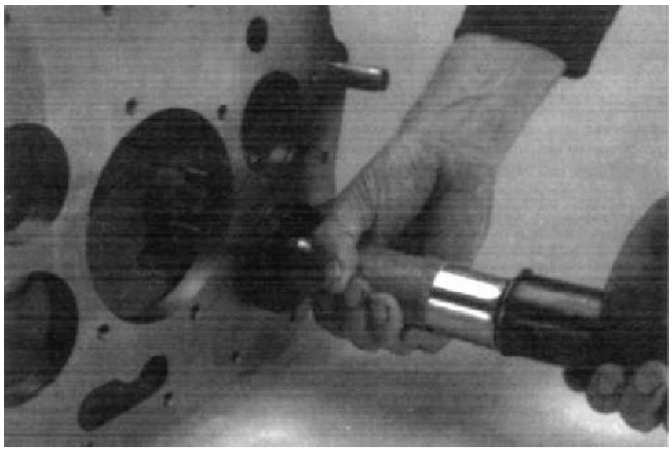
3. Install the washer and the lock nut on the idler shaft front. Tighten the nut to the recommended torque.



4. Install the reverse idler shaft plug.



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



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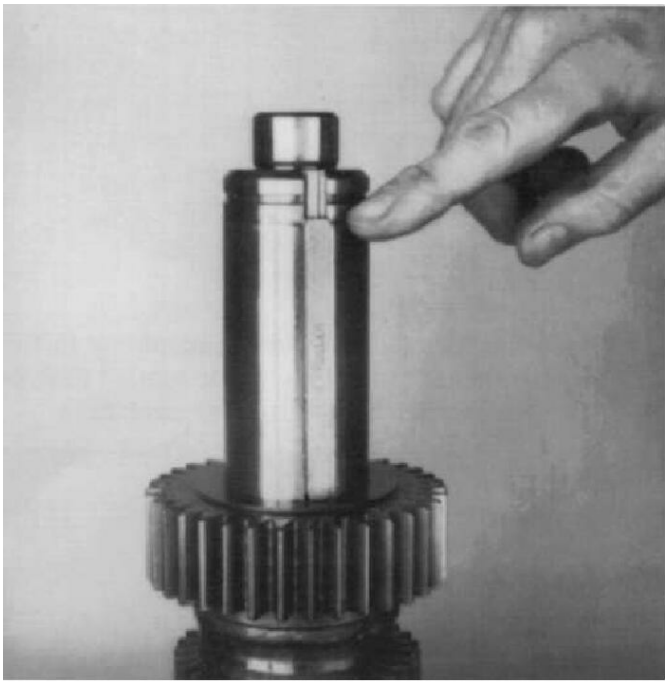
Reassembly of the Countershaft Assemblies

Special Instructions

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

Special Tools

- Press
- Typical Service Tools
- Toolmakers Dye

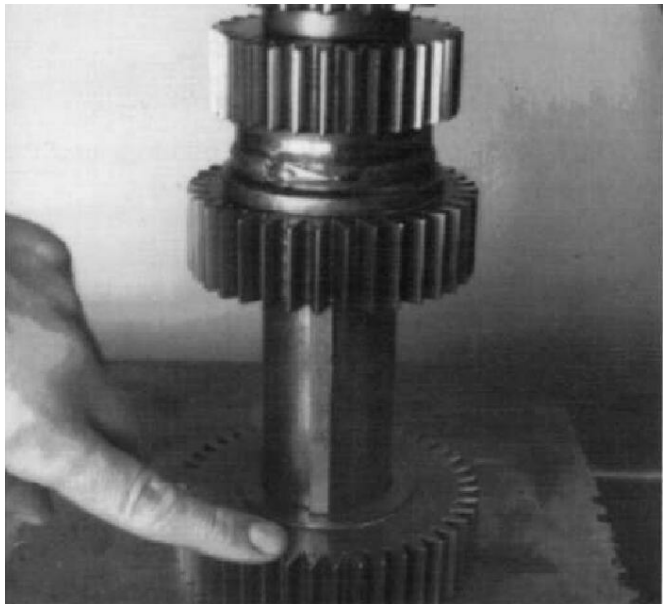


Procedure -

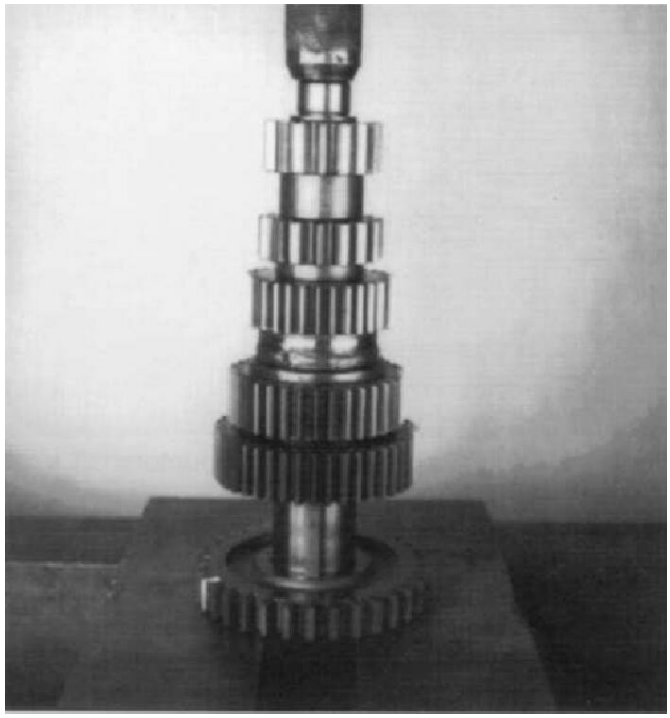
1. If previously removed, install the key in the countershaft keyway.

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2. Align 3rd gear keyway with the countershaft key. Press 3rd speed gear on the countershaft, timing tooth, marked with an "0", facing the countershaft rear.

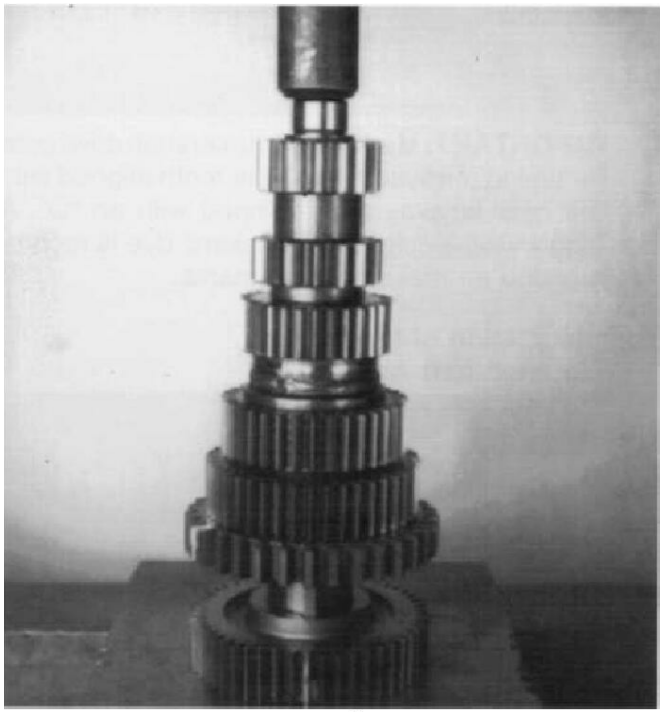


3. Align PTO gear keyway with the countershaft keyway, press the PTO gear onto the countershaft with gear long hub to the front.

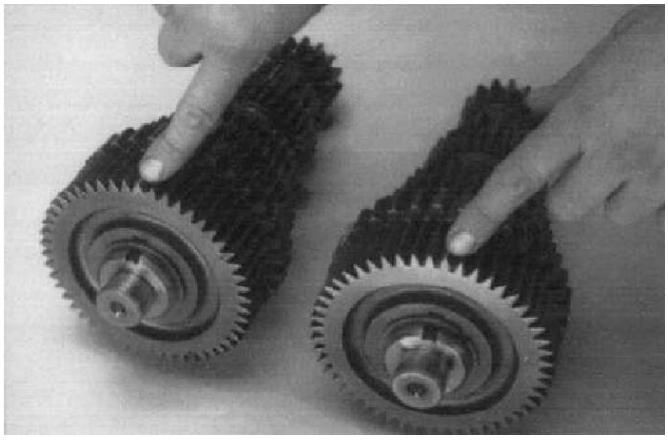


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REASSEMBLY - FRONT SECTION



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



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

   Note: 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.

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Installation of the Lower Countershaft Assembly

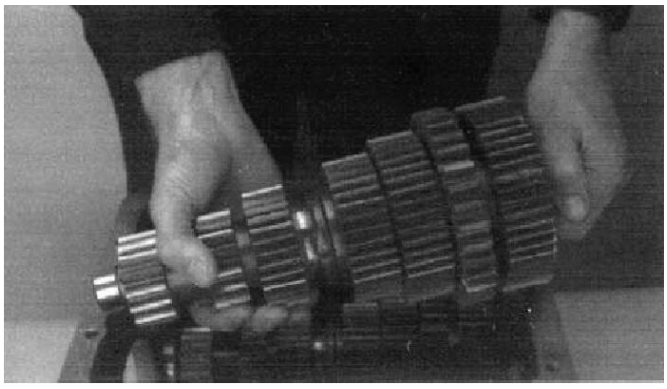
Special Instructions

None

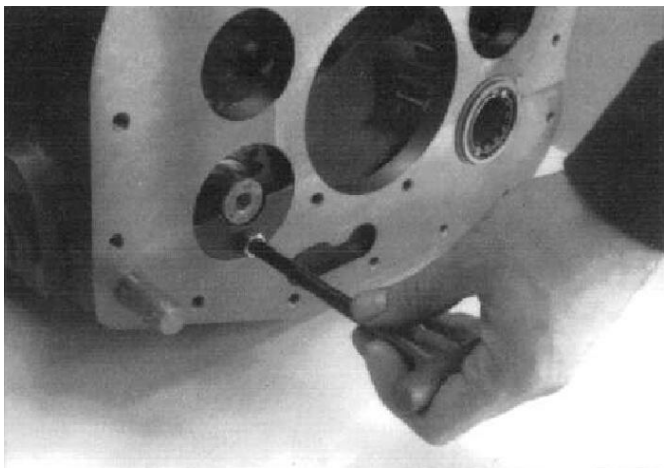
Special Tools

- Bearing Driver
- Typical Service Tools

Procedure -



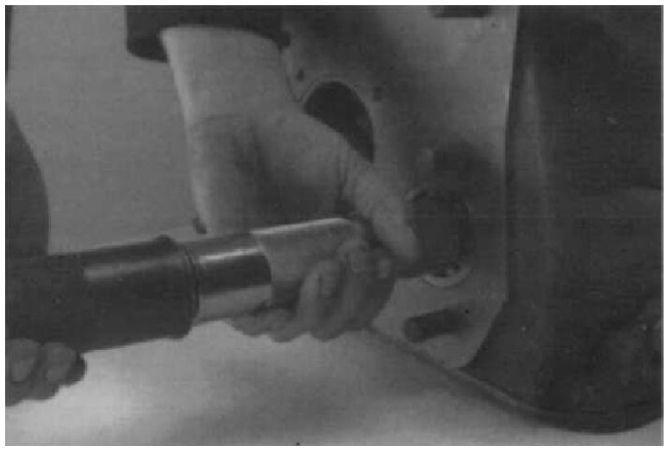
1. Place the lower countershaft into position in the case.



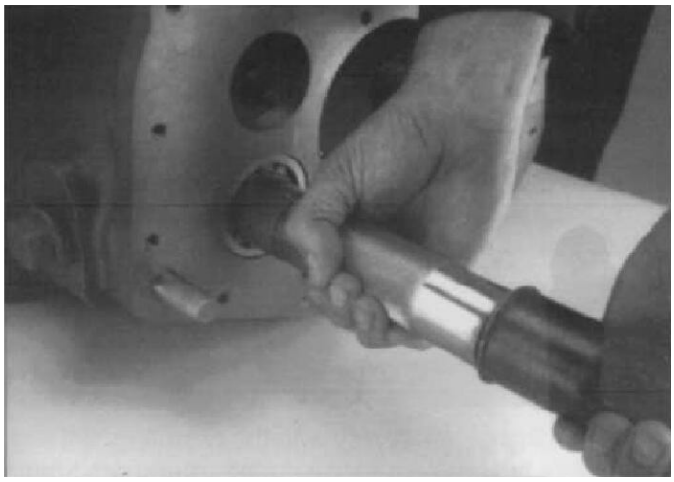
2. Move the lower countershaft assembly to the rear and insert the countershaft support tool, or block, to center shaft in the rear case bore.

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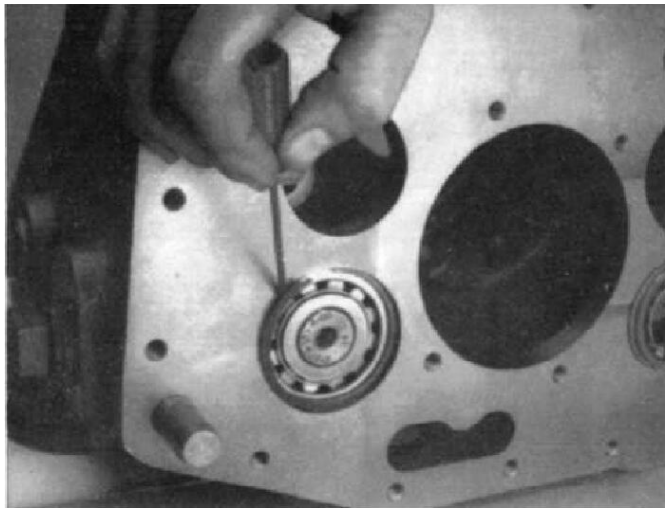
3. Install the countershaft front bearing.



4. Install the countershaft rear bearing pass the snap ring groove.



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



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Reassembly of the Auxiliary Drive Gear

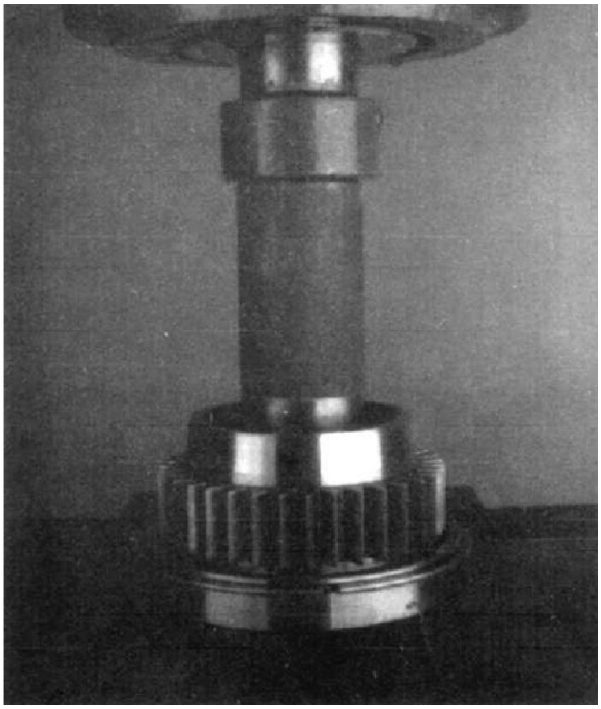
Special Instructions

None

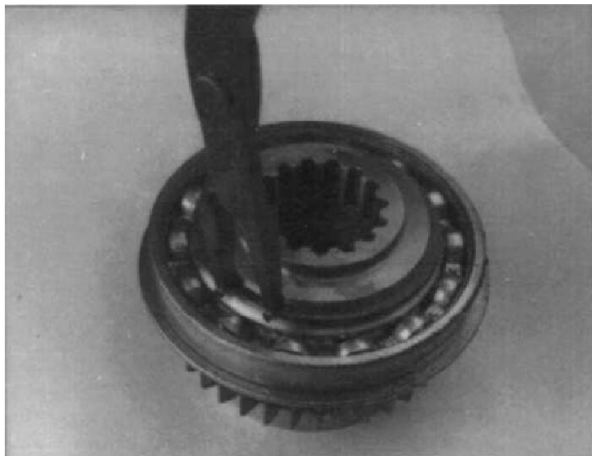
Special Tools

- Press
- Typical Service Tools

Procedure -



1. Press the bearing on the auxiliary drive gear.



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

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Reassembly and Partial Instalation of the Mainshaft Assembly

Special Instructions

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

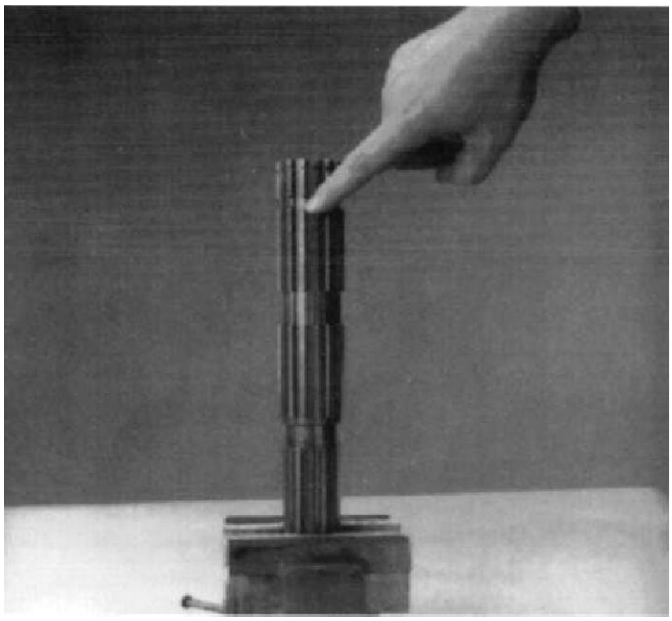
Note: Gear tolerance washers are internally splined and locked to the mainshaft by the key. Gear spacers are externally splined to engage with clutching teeth in the gear hubs. There is one tolerance washer and one spacer for each gear in the mainshaft assembly.

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

Special Tools

- Vise with Jaw Protectors
- Typical Service Tools

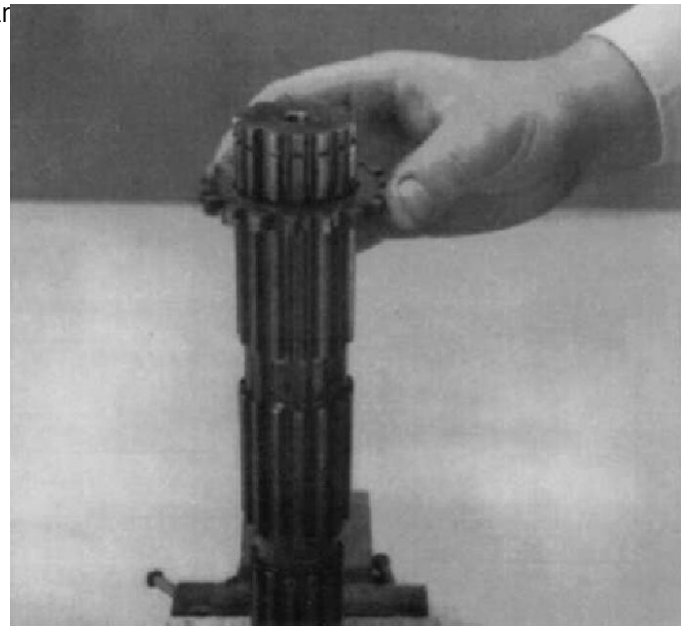
Procedure -



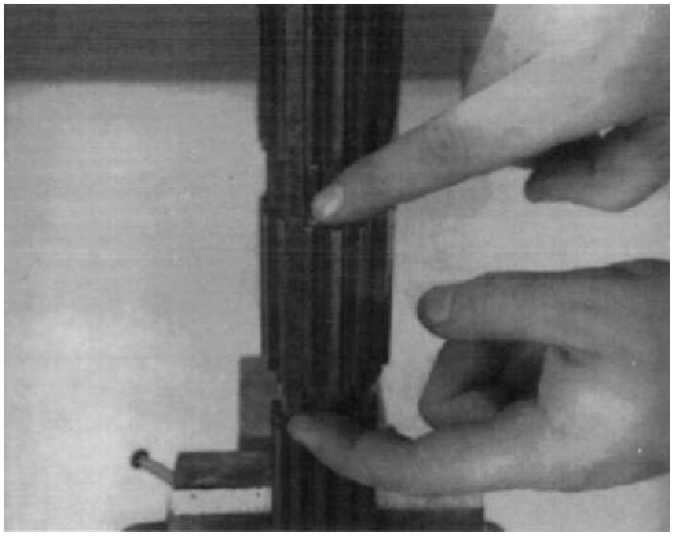
1. Secure the mainshaft in a vise equipped with brass jaws or wood blocks, shaft pilot-end down. If previously removed, install the roll pin in the keyway.

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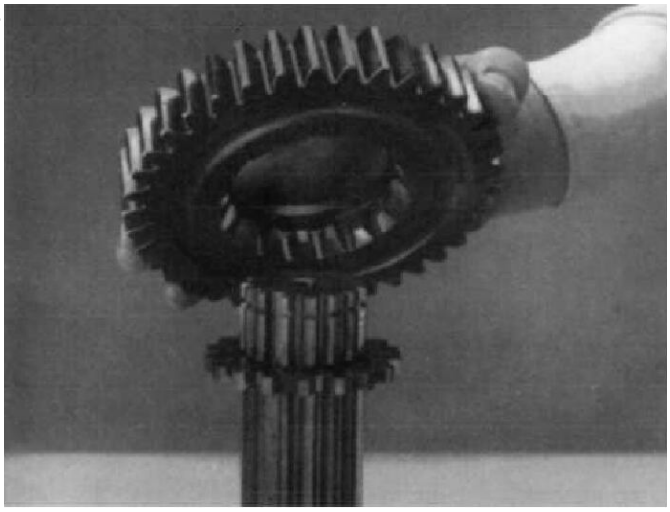
2. Install the reverse gear tolerance washer in the groove near the mainshaft rear.



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.

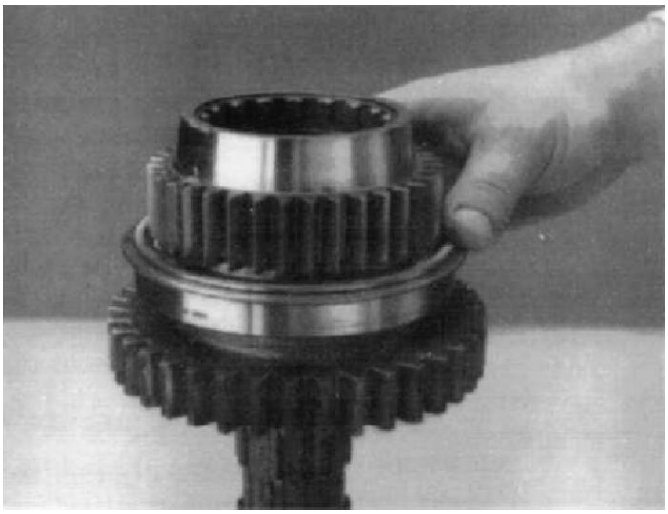


4. Install the reverse gear on the tolerance washer with clutching teeth facing down.

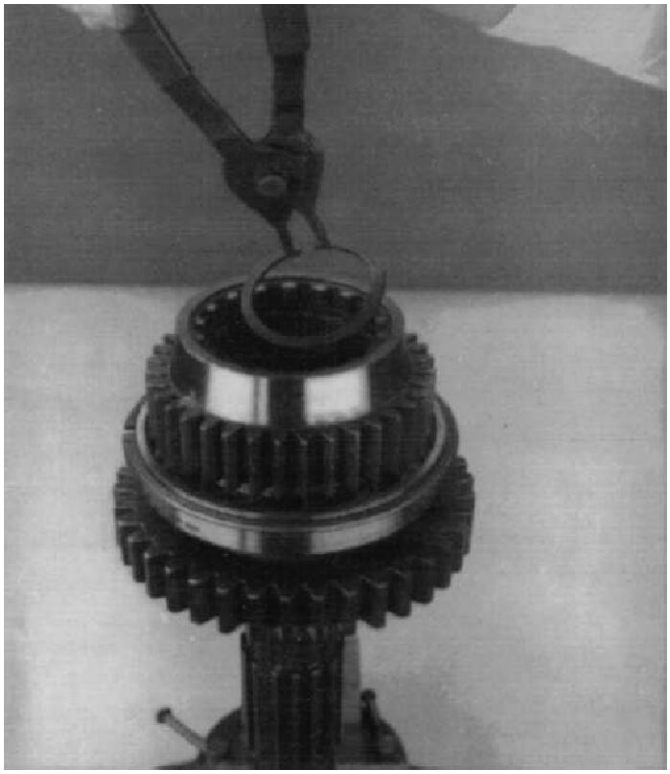


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Reassembly - Front Section



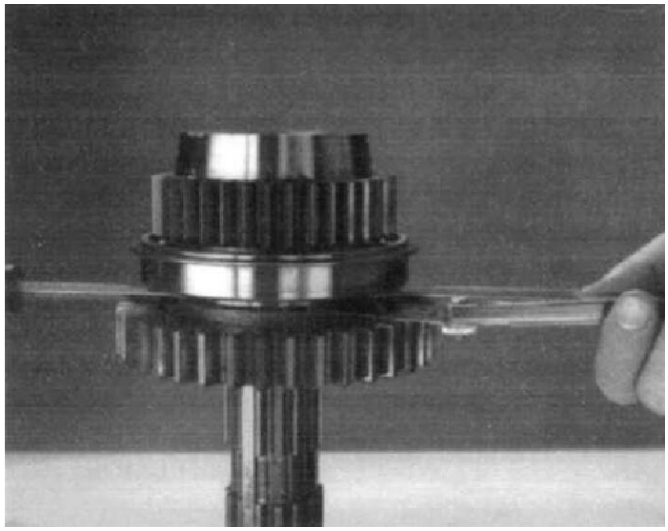
5. Install the auxiliary drive gear on the mainshaft with clutching teeth facing up.



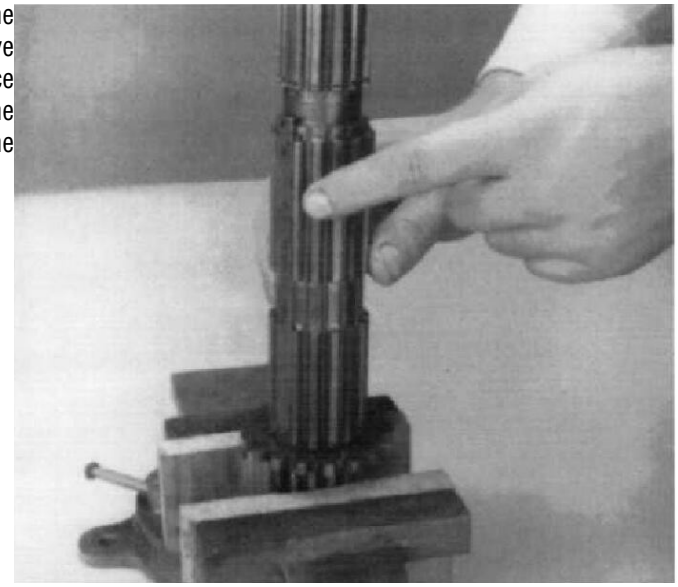
6. Install the snap ring in the mainshaft rear groove.

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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. 012". 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.

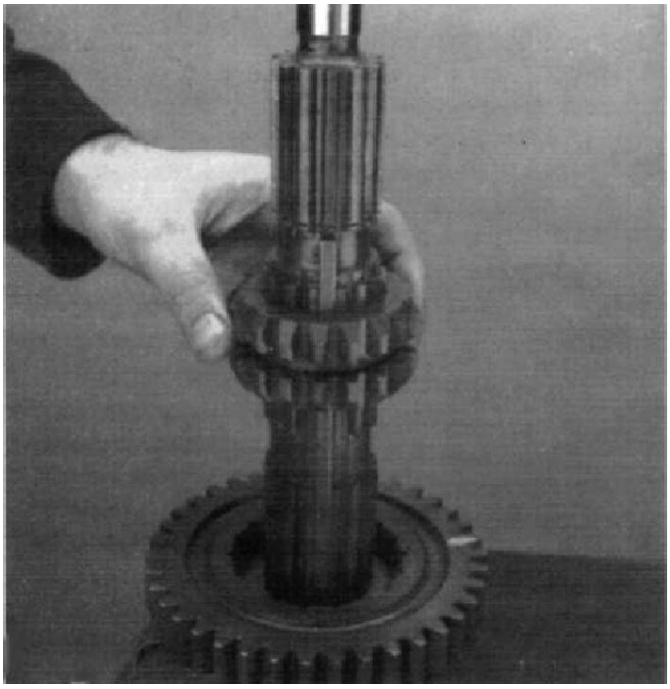


8. After proper reverse gear clearance has been set, remove the snap ring from the mainshaft rear, remove the auxiliary drive gear and the reverse gear from the mainshaft. The tolerance washer and key remain on the mainshaft. Reposition the mainshaft with the reverse gear minus its snap ring in the vise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

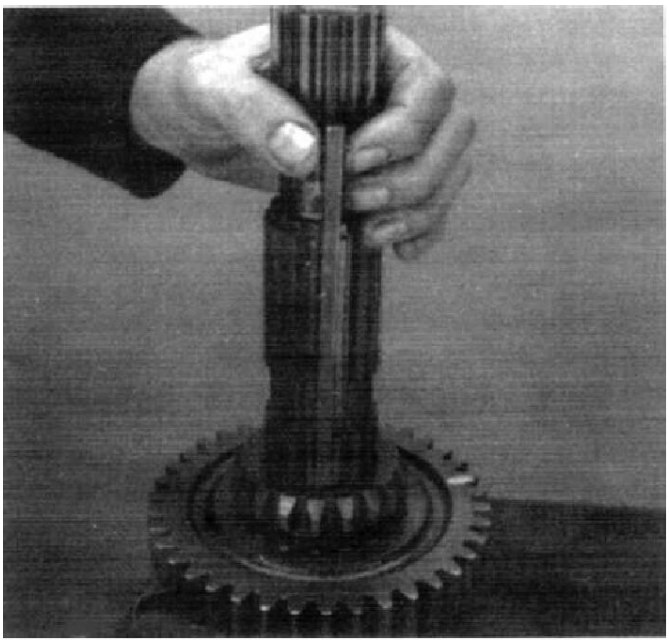


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Reassembly - Front Section



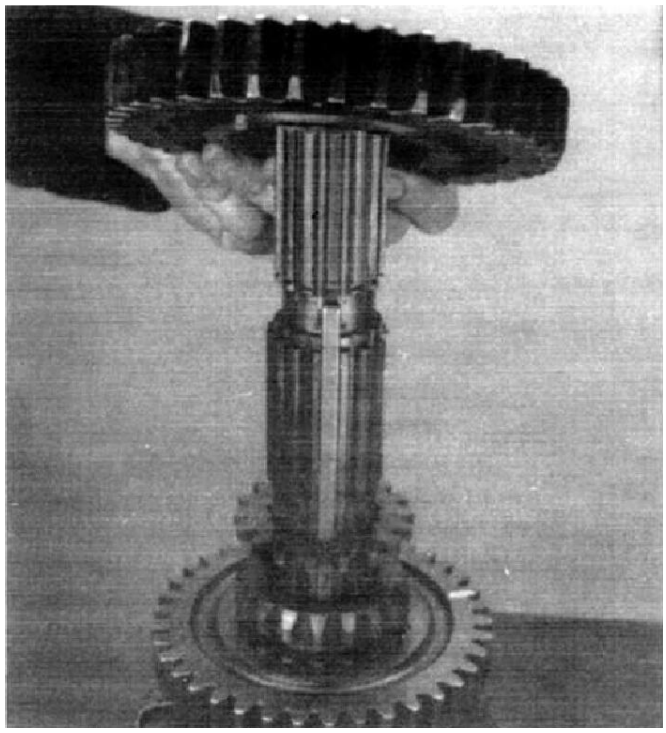
9. Install the LO-reverse speed clutch on the mainshaft, against the reverse gear tolerance washer. Align sliding clutch slot with mainshaft key.



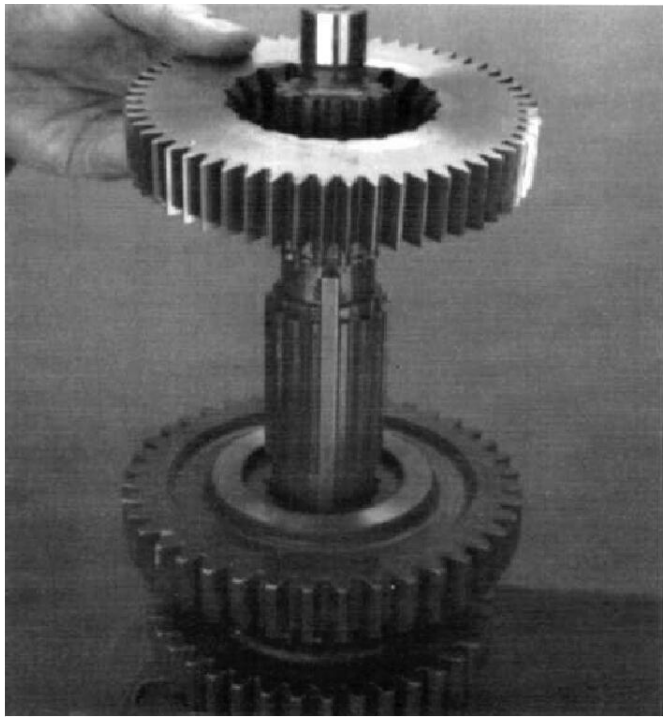
10. Remove the mainshaft key. Install LO speed gear tolerance washer on the mainshaft. Install the key to lock the tolerance washer to the shaft.

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

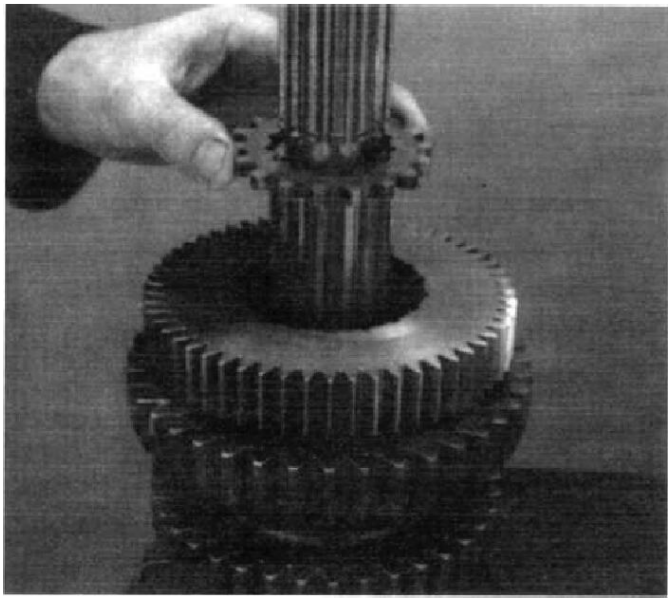


12. Install 1st speed gear on the mainshaft, clutching teeth up.



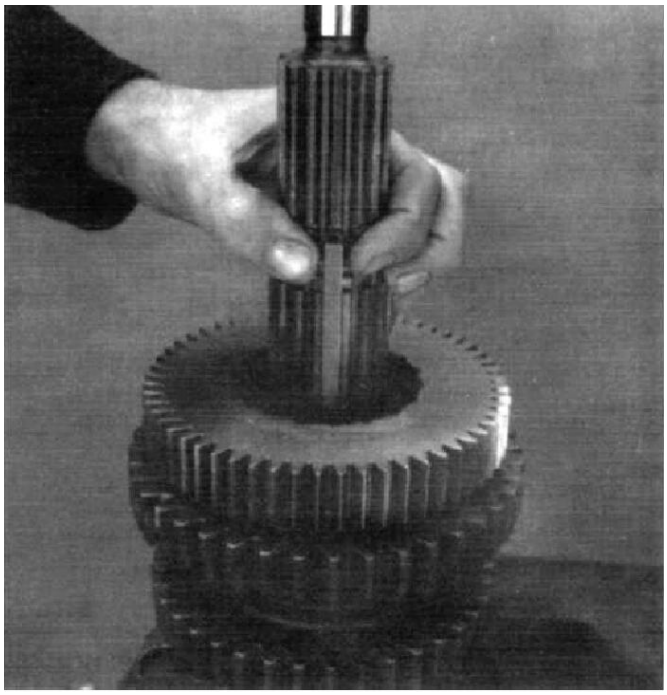
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Reassembly - Front Section



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

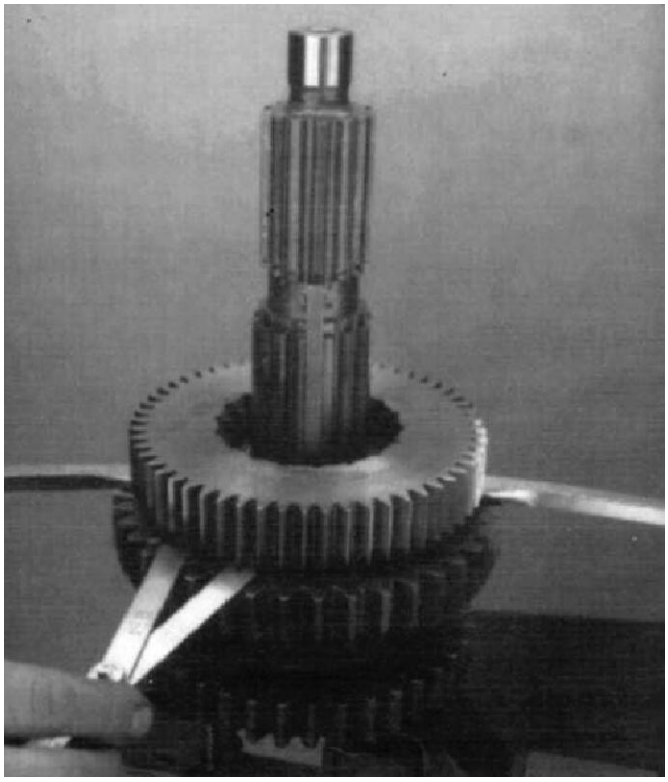
    WARNING: WHEN THE KEY IS REMOVED THE MAINSHAFT GEARS CAN DROP TO THE BOTTOM.



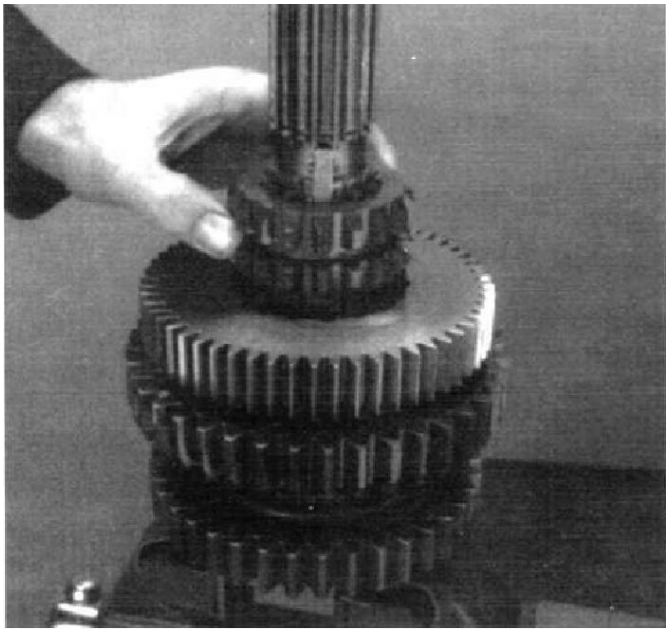
14. Install the mainshaft key to lock the tolerance washer to the shaft.

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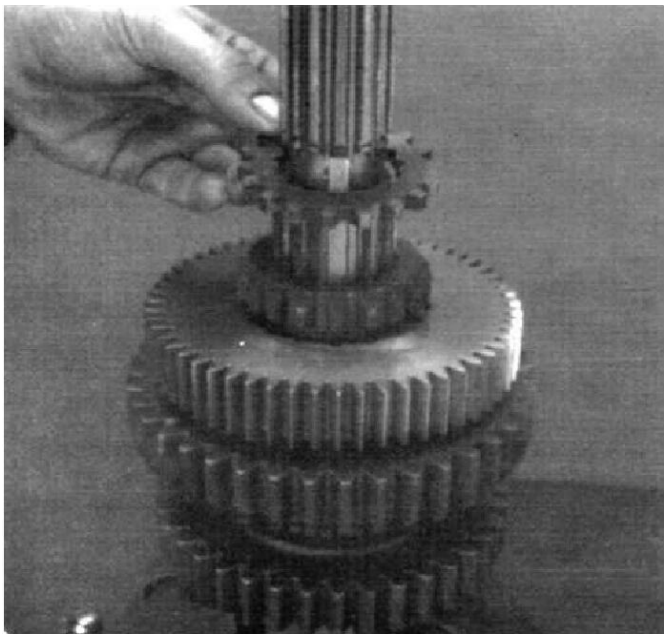
15. Check axial clearances and make adjustments if necessary.



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

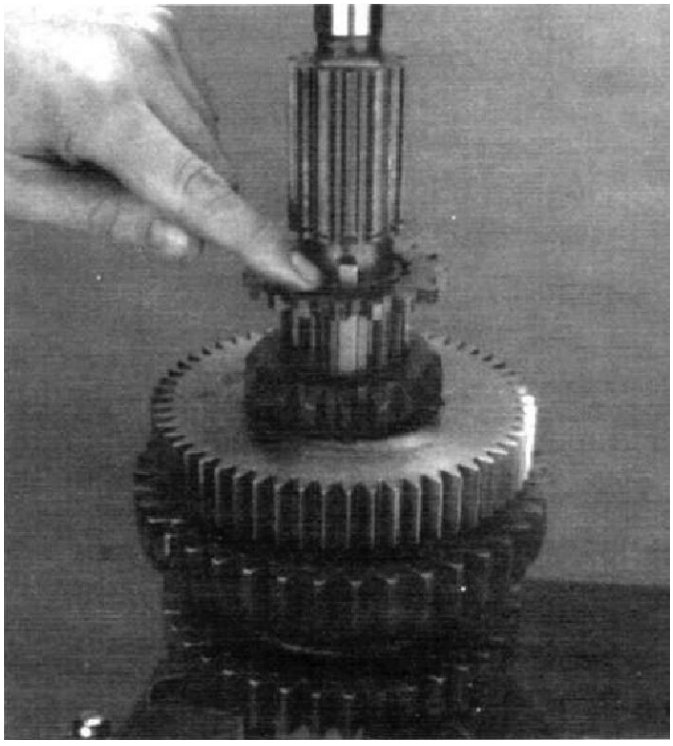


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17. Move the mainshaft key upward and install 2nd gear tolerance washer. Install mainshaft key.

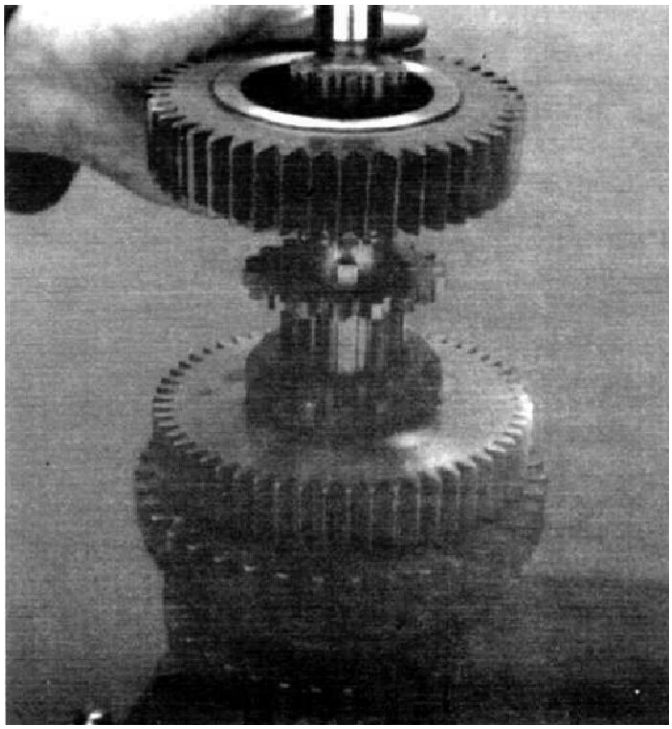
    Note: It will be necessary to pull the mainshaft key up slightly to fit in keyway.



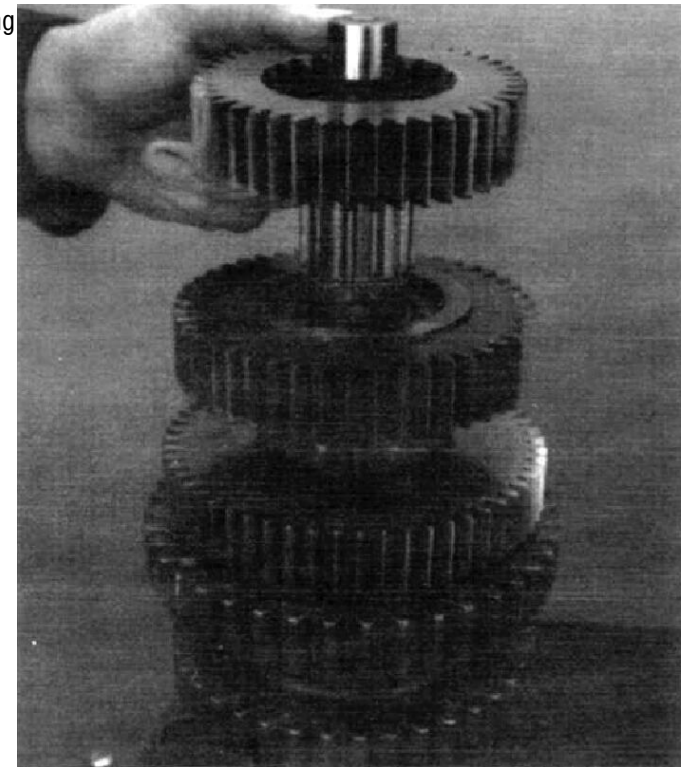
18. Reposition the key so it rests on the mainshaft grooved shoulder.

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

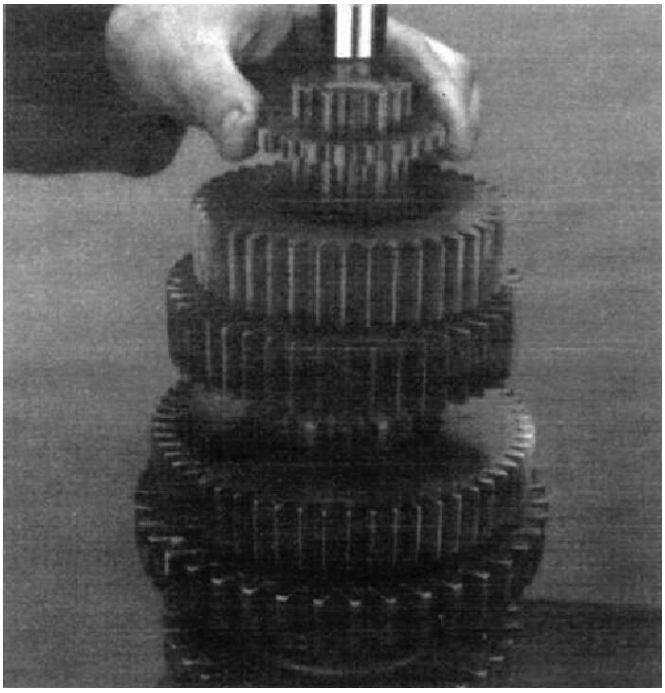


20. Install the 3rd speed gear on the mainshaft with clutching teeth up.

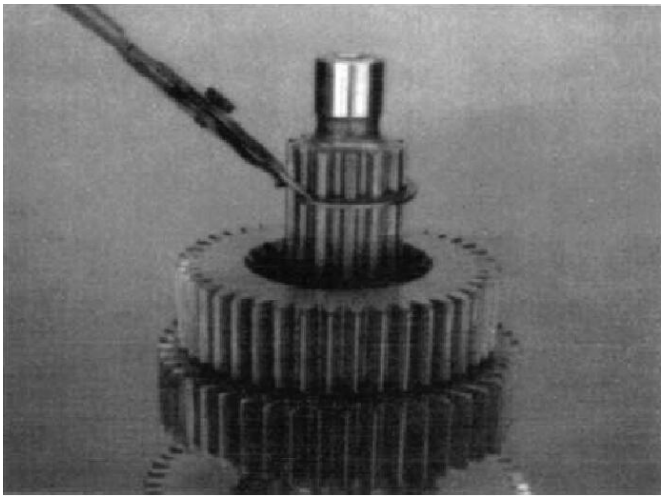


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Reassembly - Front Section



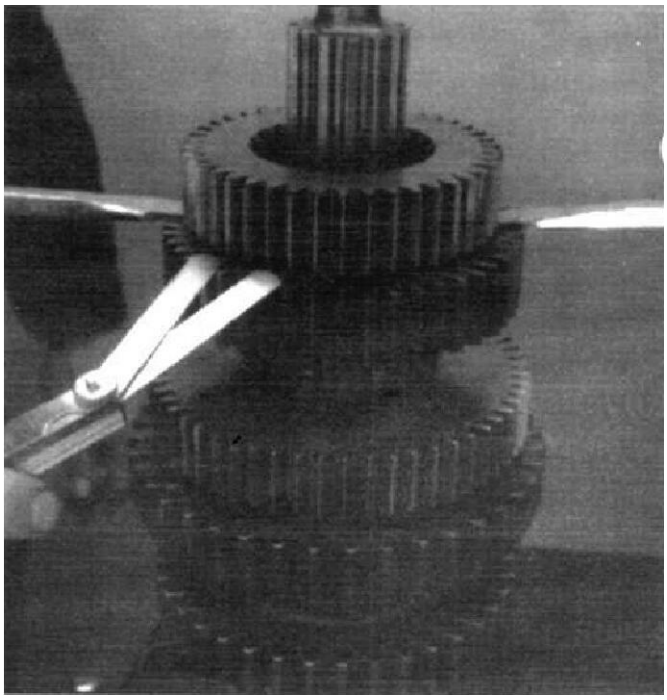
21. Install a tolerance washer in the 3rd speed gear bore.



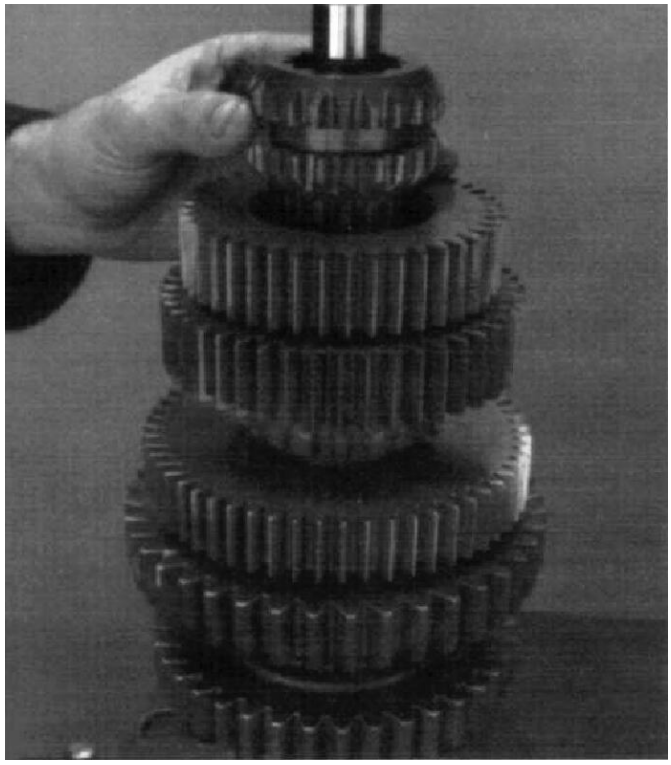
22. Install the snap ring in the snap ring groove.

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23. Check axial clearance and make adjustments if necessary.

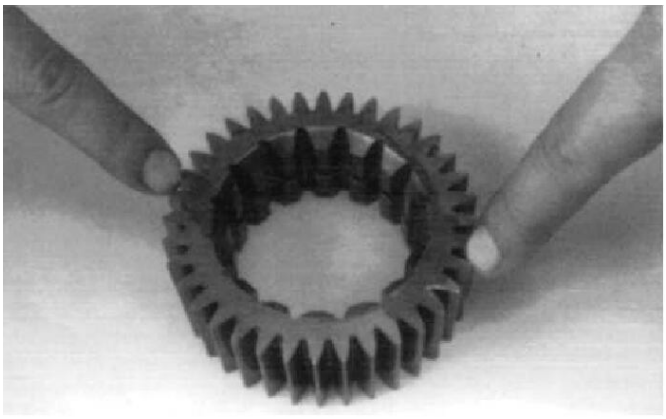


24. Install the 3rd-4th speed sliding clutch on the mainshaft. Align sliding clutch slot with key and engage clutch with 3rd speed gear.

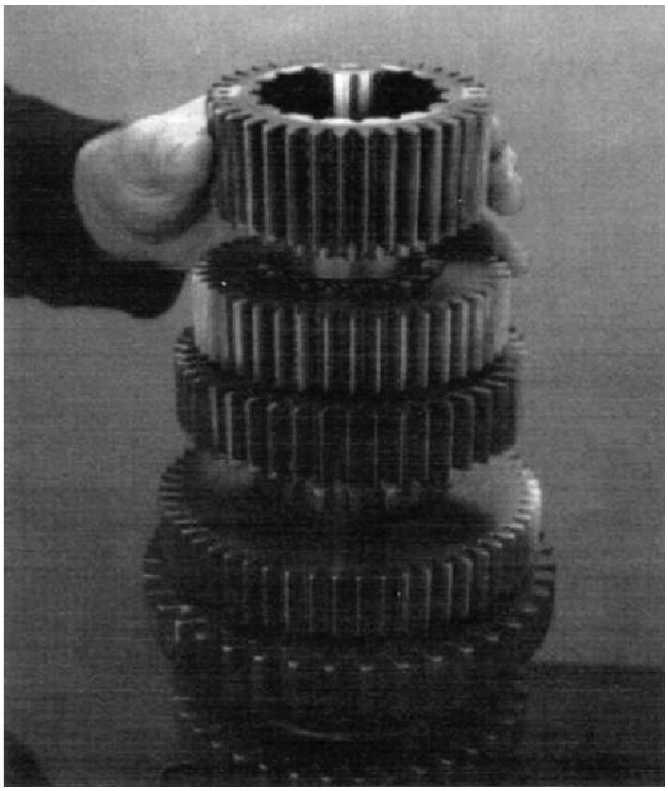


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Reassembly - Front Section



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. Remove the mainshaft assembly from the vise.

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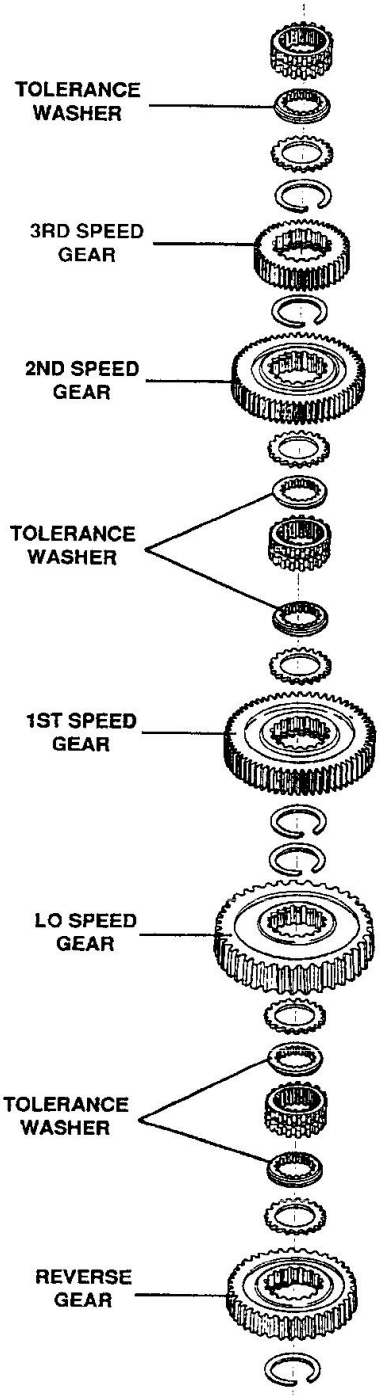
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Setting Correct Axial Clearances for the Mainshaft Gears

Note: Axial Clearance (End Play) Limits Are: 0.005”-0.012” for all mainshaft gears.

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

Note: New style tolerance washers come in a full range of tolerances as corresponding colors "plus red" (Example: "Orange plus red" tolerance washer has an inch tolerance thickness of 0.258-0.260).



Procedure -

1. See the illustrated Parts List for washer part numbers.

Table 1: Washer Thickness

LIMITS (INCH)	COLOR CODE
0.248-0.250	White
0.253-0.255	Green
0.258-0.260	Orange
0.263-0.265	Purple
0.268-0.270	Yellow
0.273-0.275	Black

Note: Always use the 0.2488-0.250" low tolerance washer ("white" or "white plus red") in the 3rd, 1st, and Reverse speed gear positions as shown.

Note: On overdrive models, the 4th speed gear becomes 5th speed.

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

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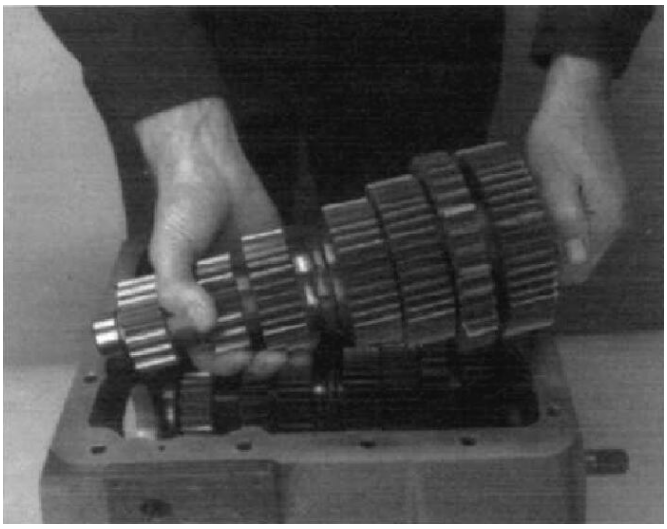
Partial Installation of the Upper Countershaft Assembly

Special Instructions

None

Special Tools

- None



Procedure -

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

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Reassembly - Front Section

Installation Mainshaft Assembly and Drive Gear Assembly

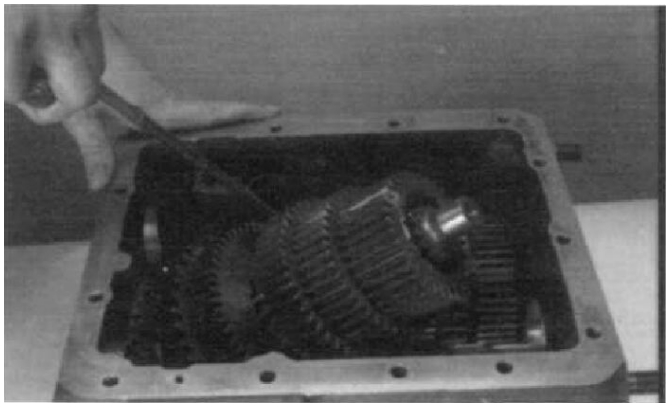
Special Instructions

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

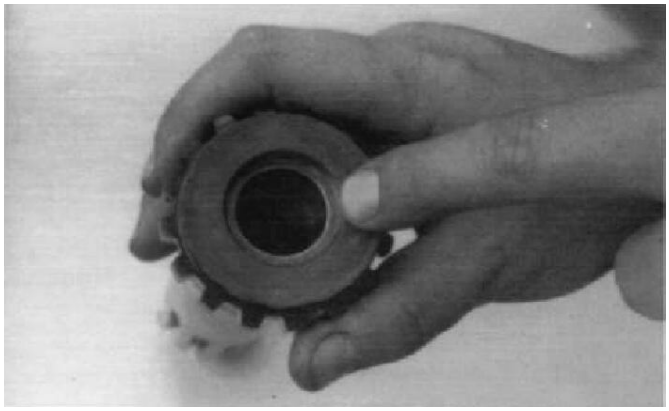
Special Tools

- Bearing Driver
- Typical Service Tools

Procedure -



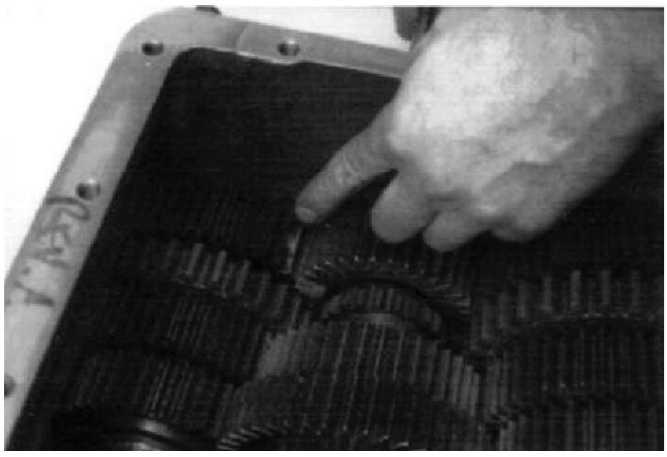
1. Place the mainshaft assembly into position in the case.



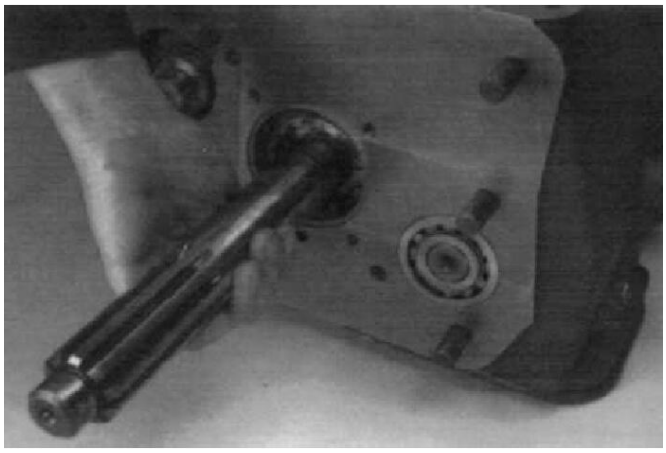
2. If previously removed, install the input shaft bushing.

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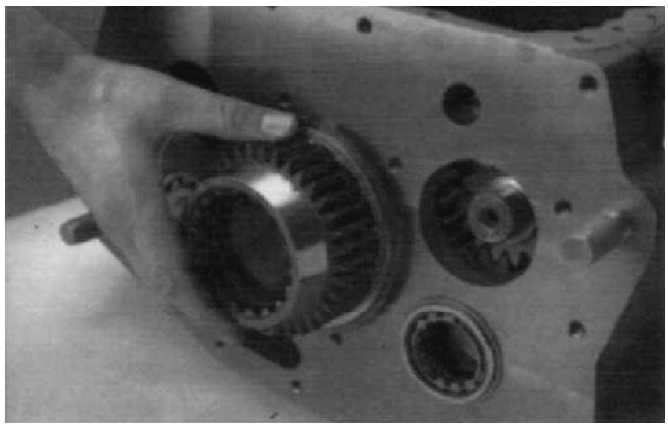
3. Mesh the lower countershaft marked tooth with either of the two marked teeth on the main drive gear.



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.

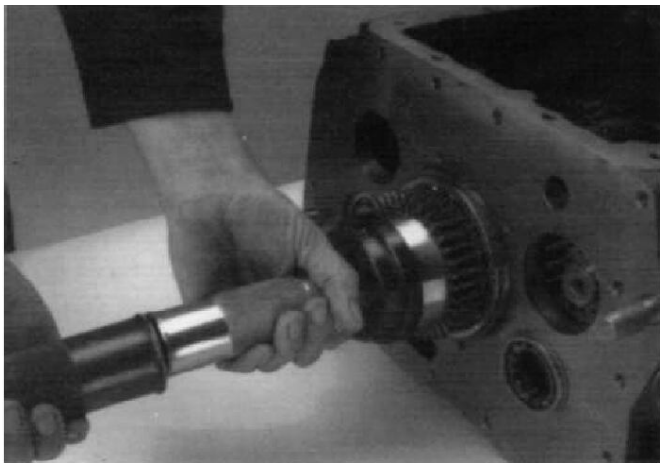


5. Center the mainshaft in the case rear bore and install the auxiliary drive gear.

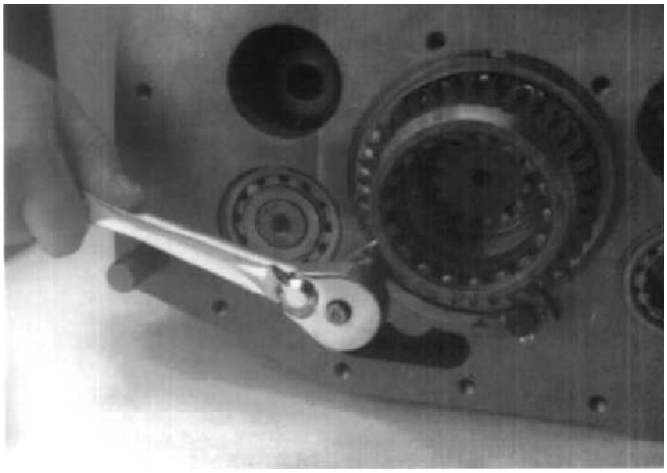


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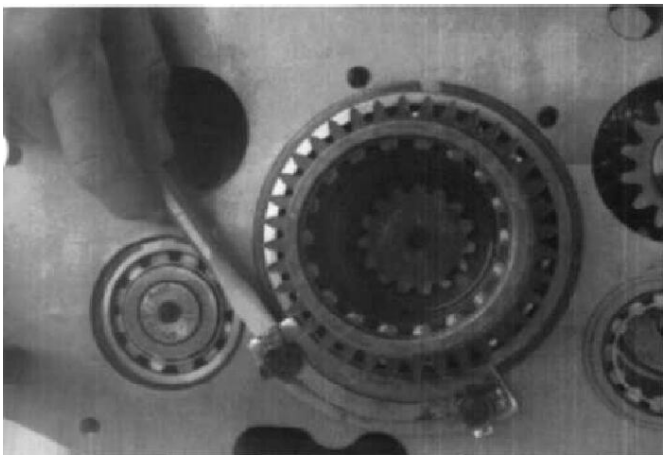
Reassembly - Front Section



6. Seat the auxiliary drive gear bearing in the case rear bore.



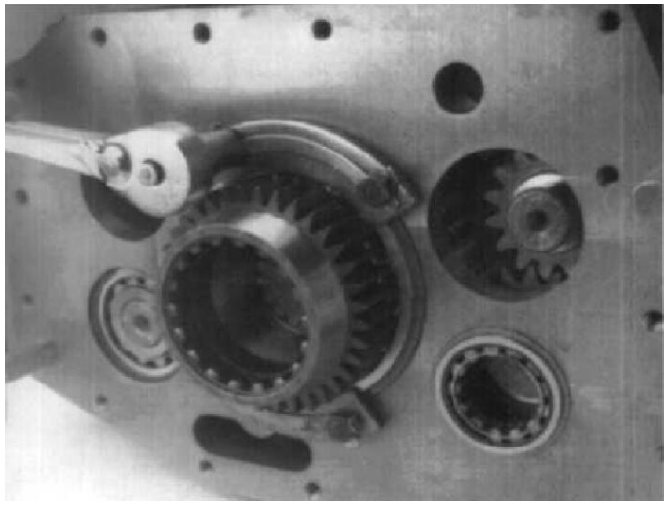
7. Install the bearing lower retainer plates. Tighten cap screws to the recommended torque.



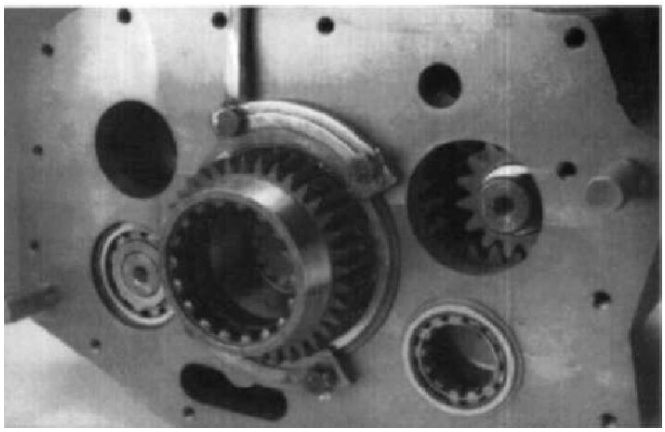
8. Bend the lock tangs.

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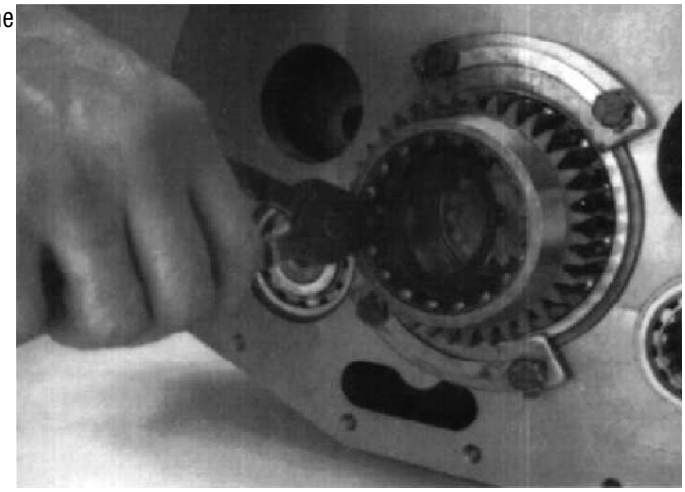
9. Install the top retainer plates.



10. Bend the lock tangs.

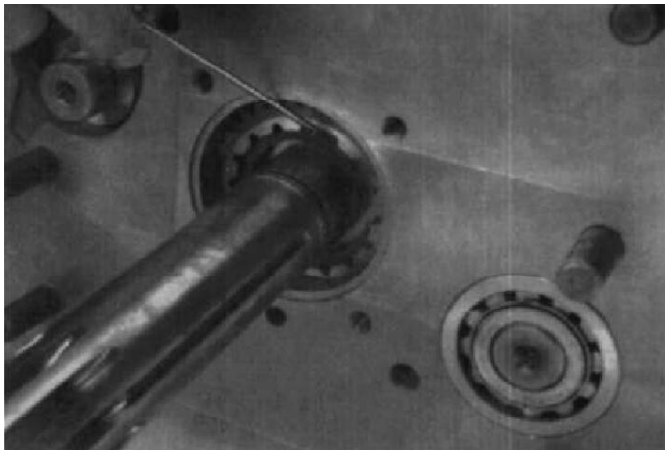


11. Move the mainshaft assembly to the rear to expose the mainshaft snap ring groove. Install the snap ring.

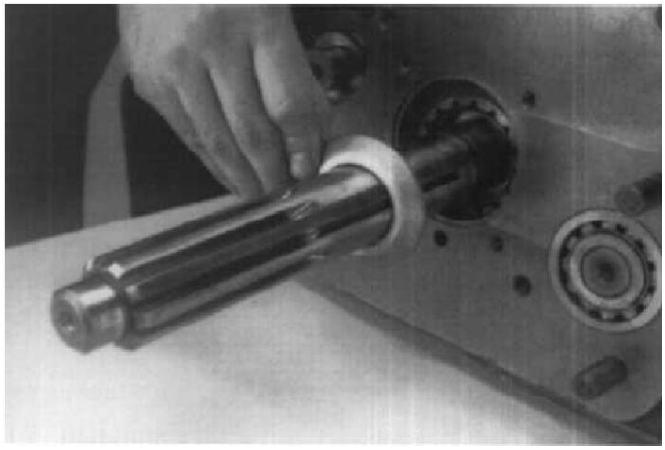


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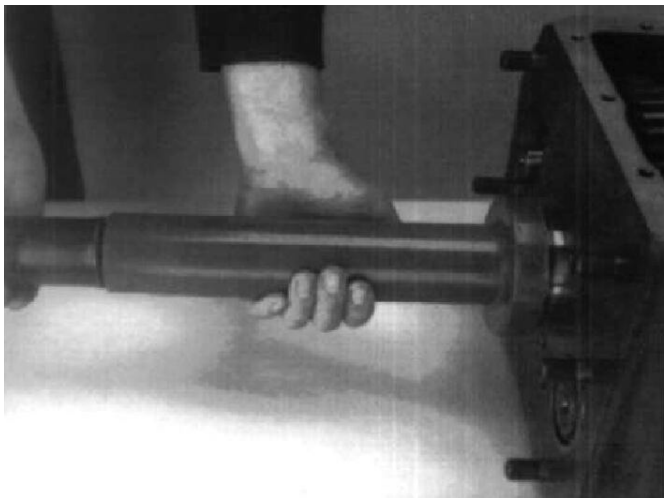
Reassembly - Front Section



12. Install the drive gear snap ring.



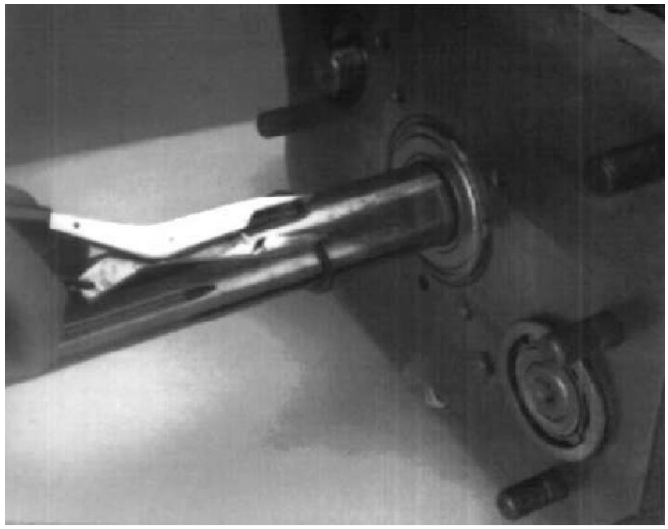
13. Install the drive gear spacer on the input shaft, small chamfered side to the front.



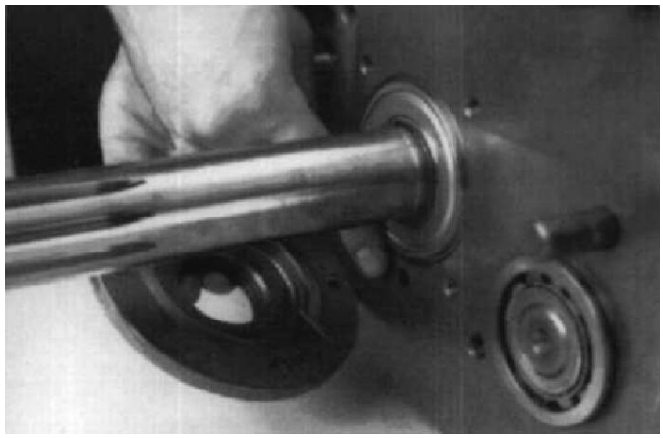
14. Install the drive gear bearing.

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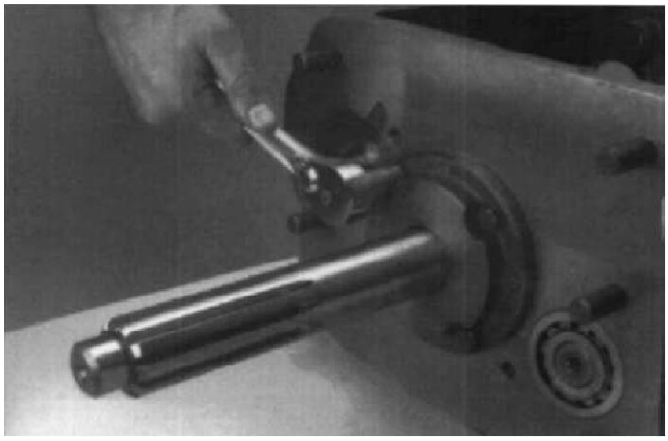
15. Install the bearing retainer snap ring.



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

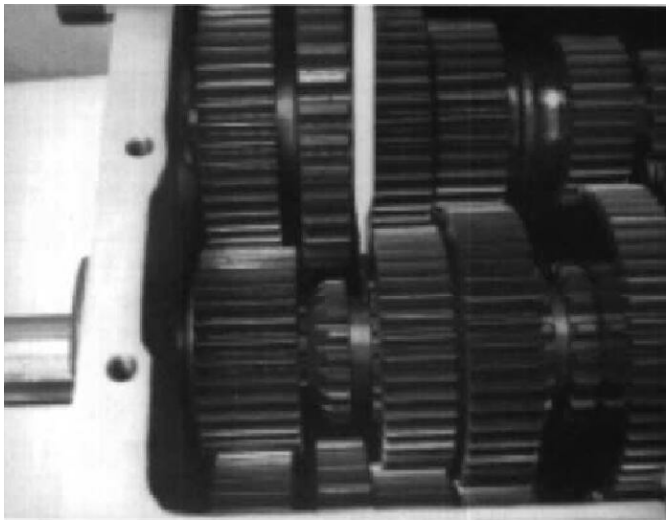


17. Install the bearing cover cap screws, tighten to the recommended torque.

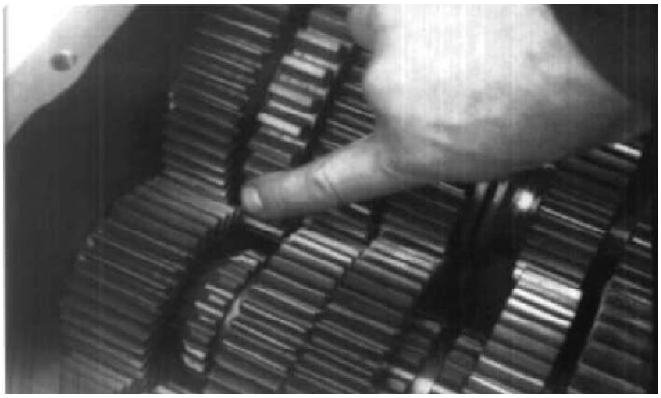


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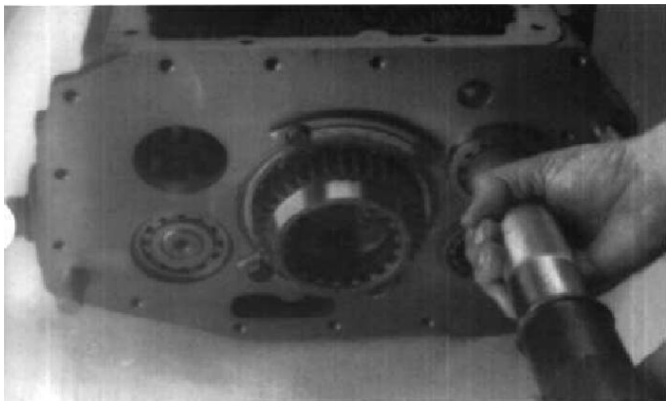
Reassembly - Front Section



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



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

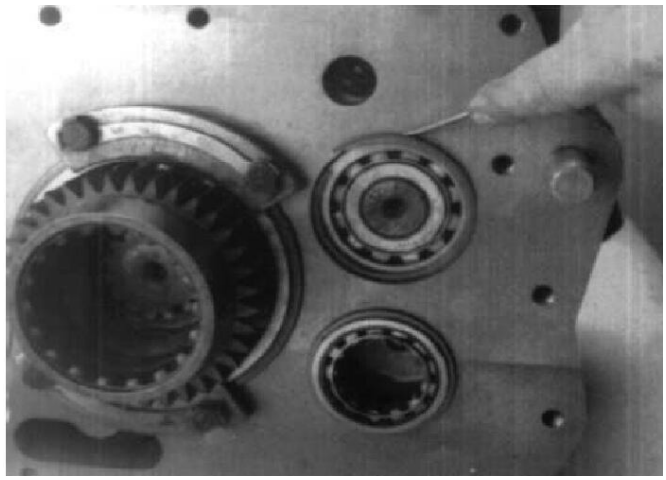


20. Hold the countershaft in position and partially install the rear countershaft bearing.

    Note: Use a large screwdriver or bar to block the countershaft from moving.

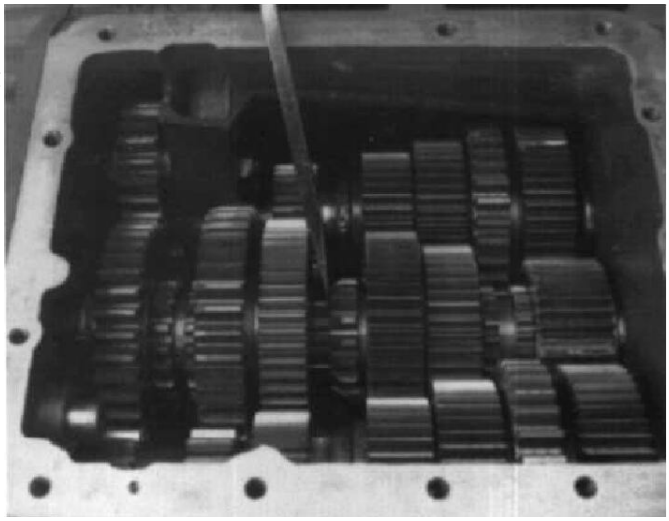
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21. Install the case rear bore snap ring into the groove.



22. 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.



23. Use a flanged driver to complete installation of the front countershaft bearing.



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Installation of the Auxiliary Section

Special Instructions

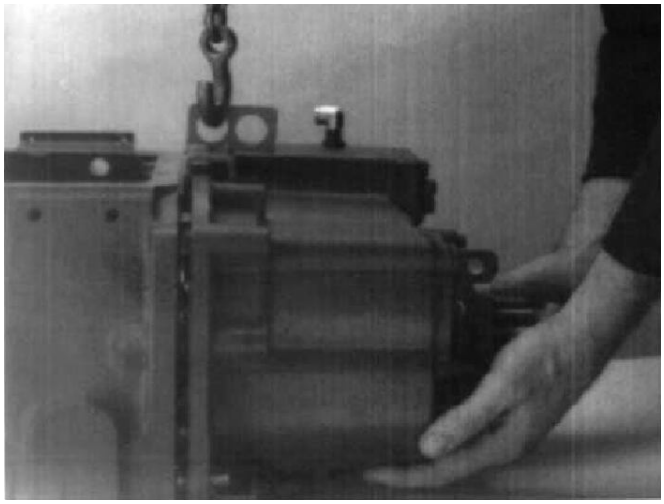
Note: Make sure the synchronizer is in neutral, and the auxiliary front countershaft bearings are installed in the front case.

Note: There are 3 capscrew lengths. Make sure the cap screws are in their proper location.

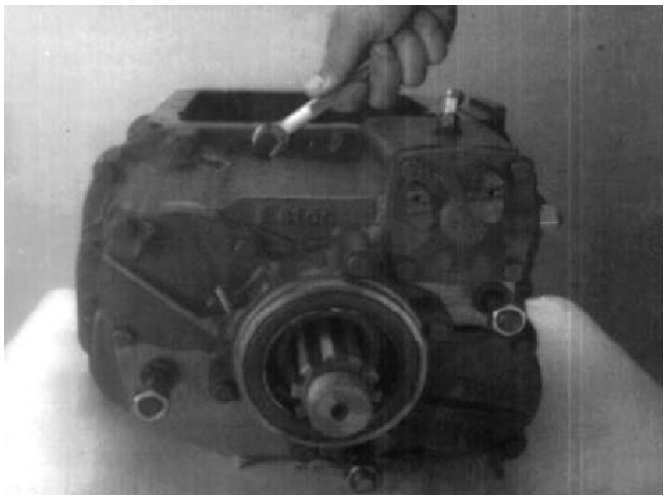
Special Tools

- Typical Service Tools

Procedure -



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 gear.



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

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Installation of the Clutch Housing

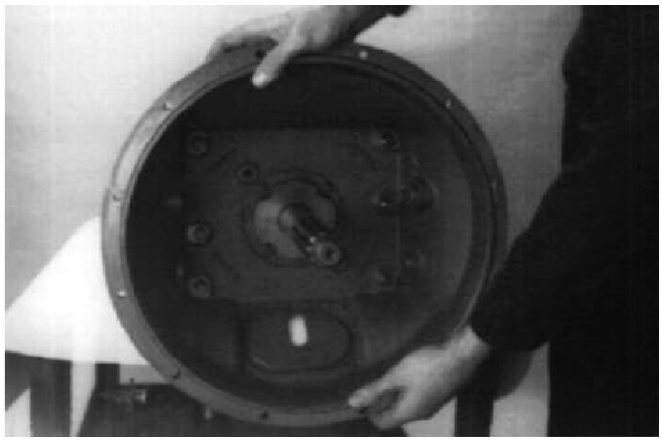
Special Instructions

None

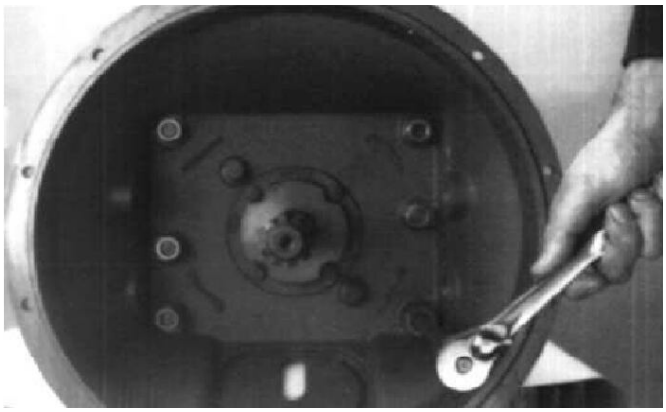
Special Tools

- Typical Service Tools

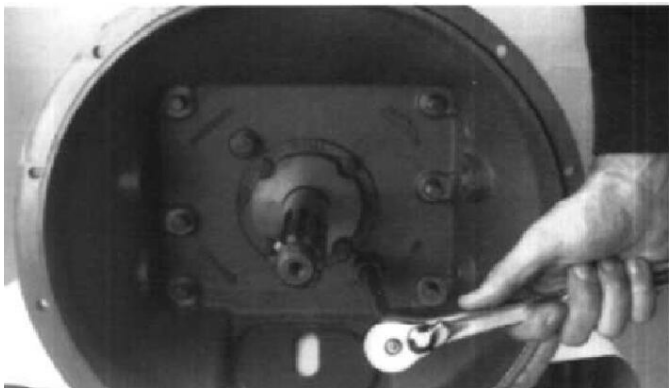
Procedure -



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. Tighten to the recommended torque.



3. Install the 2 capscrews with washers. Tighten to the recommended torque.
4. For the models so equipped, install the clutch release mechanism and/or clutch brake assembly.

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Installation - Output Yoke

Installation of the Output Yoke

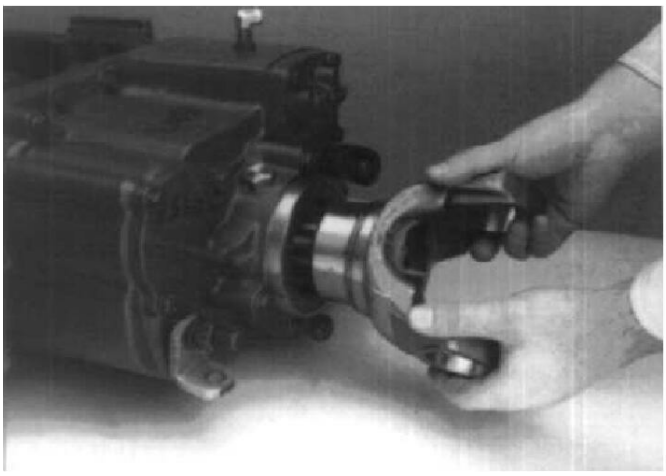
Special Instructions

None

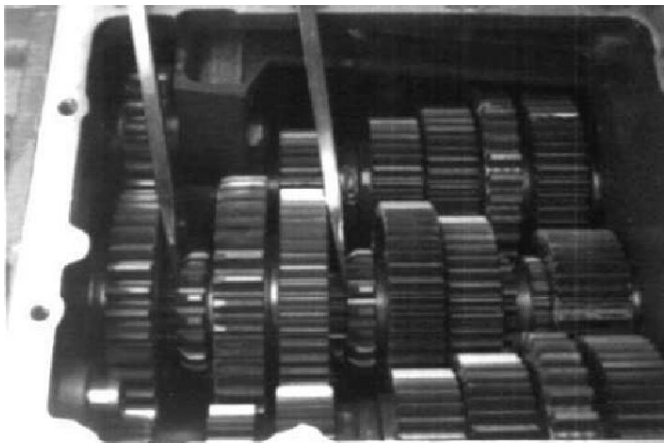
Special Tools

- Typical Service Tools

Procedure -



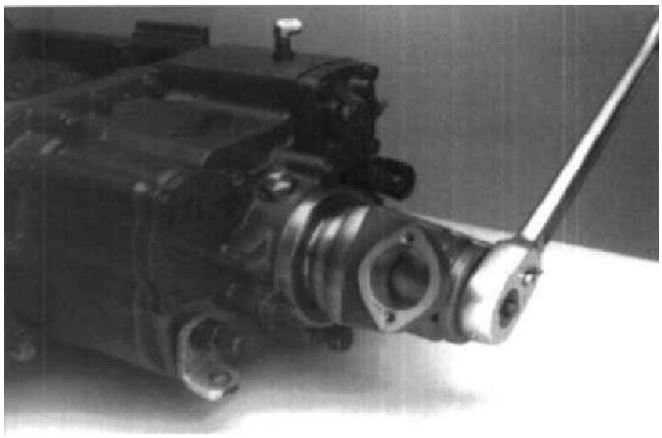
1. Install the output yoke on the output shaft splines and move it into the rear bearing cover.



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

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



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Installation of the Shift Bar Housing

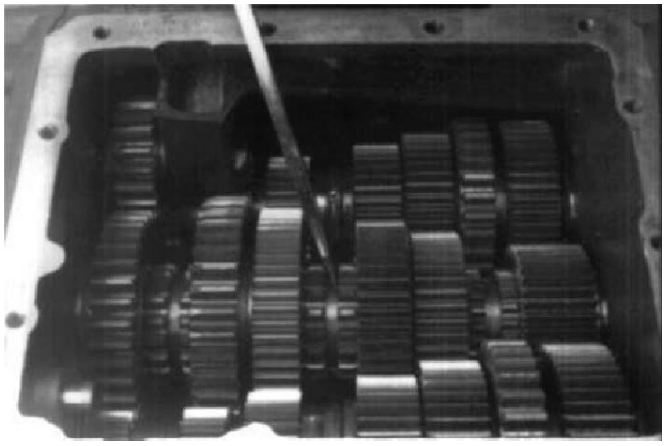
Special Instructions

None

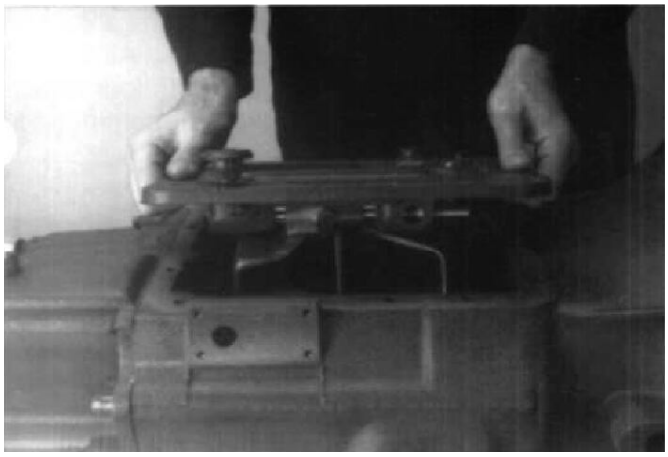
Special Tools

- Typical Service Tools

Procedure -



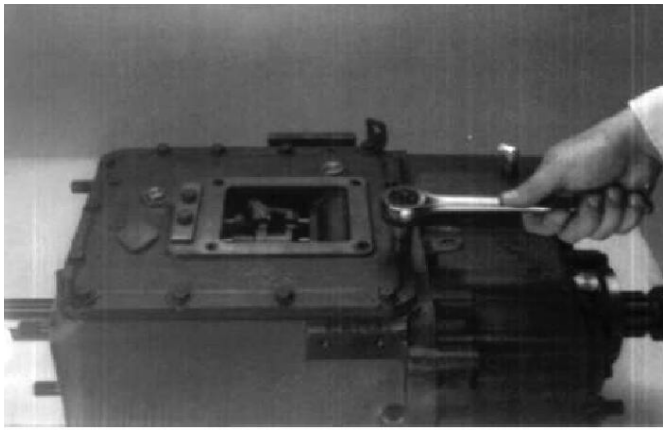
1. Place all three mainshaft sliding clutches in the neutral position. Position the shift bar housing gasket.



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

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



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Installation of the Gear Shift Lever Housing Assembly

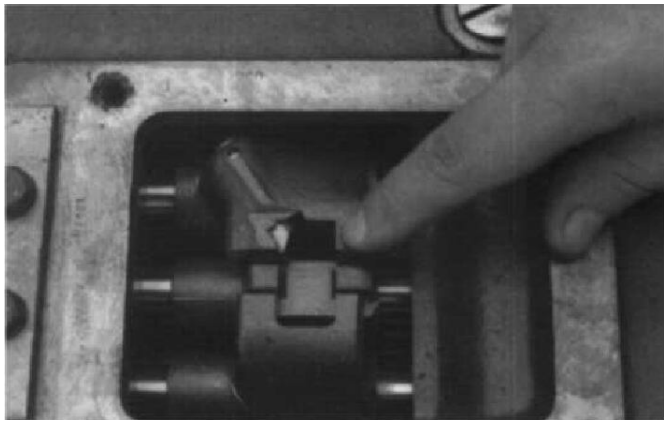
Special Instructions

None

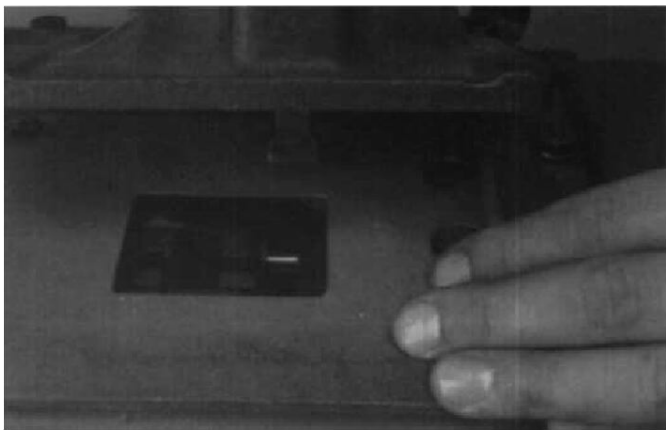
Special Tools

- Typical Service Tools

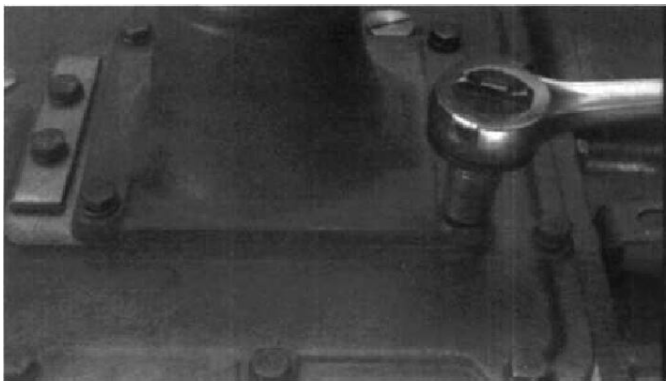
Procedure -



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.

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Installation of the Slave Valve

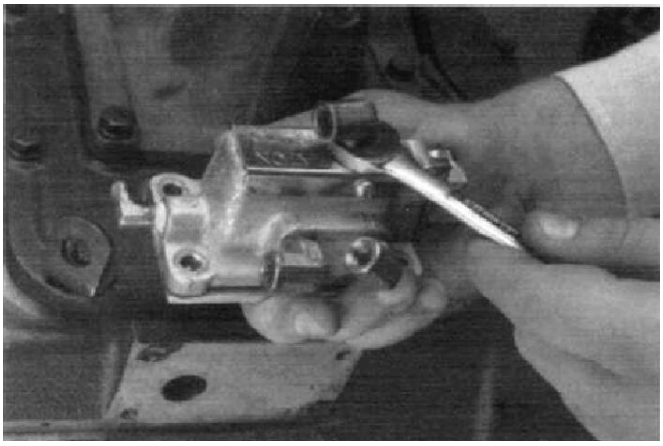
Special Instructions

None

Special Tools

- Typical Service Tools

Procedure -



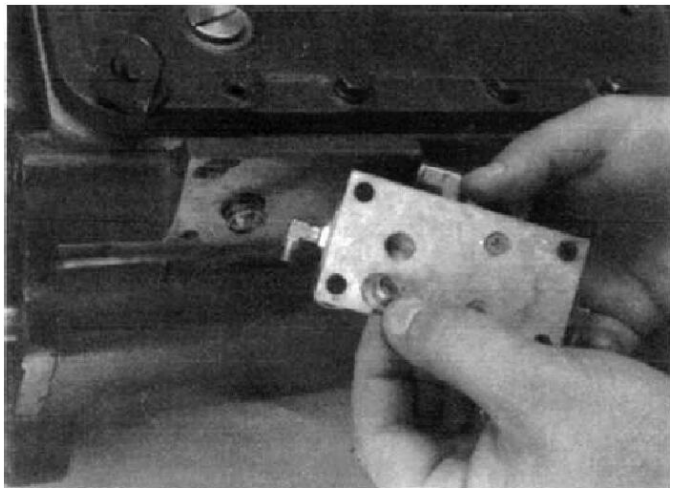
1. Install the spring on the actuating pin shank. Insert the shank in the transmission case bore.



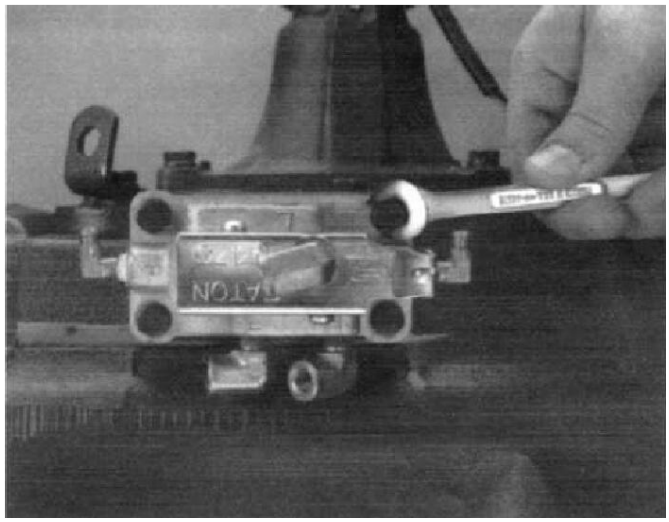
2. Install the hat-type alignment sleeve in the slave valve bore.

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3. Position the slave valve.



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 cap screws tightened evenly to recommended torque.



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

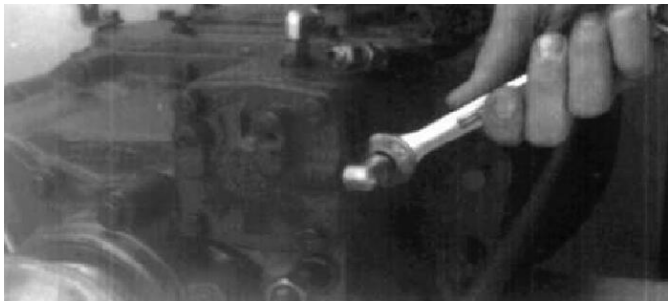
Special Instructions

Note: We recommend using Fuller Sealant 71205 for sealing the fittings

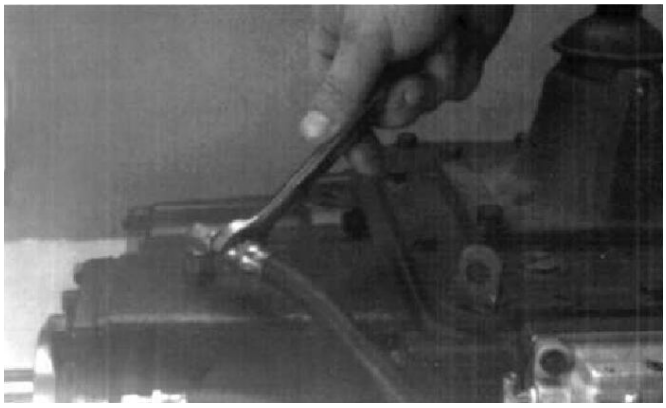
Special Tools

- Typical Service Tools

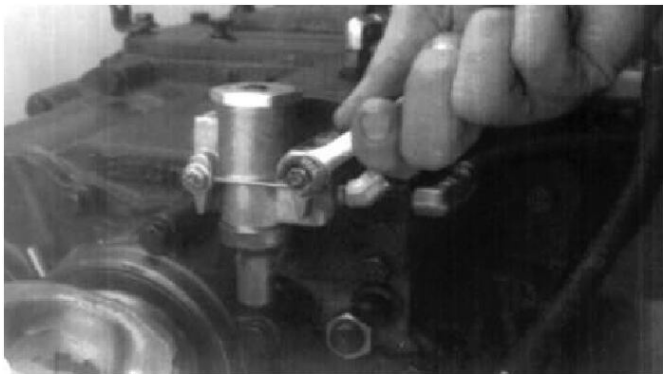
Procedure -



1. 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.



2. 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.



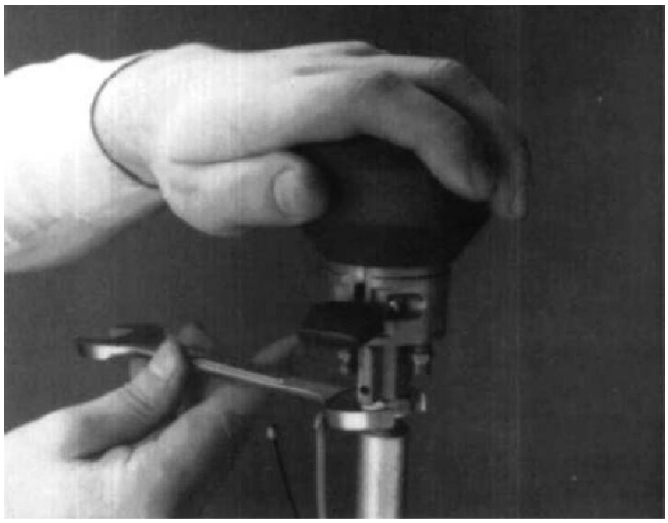
3. Position the air filter/regulator on the auxiliary housing rear. Install the two retaining capscrews tighten both connections to the recommended torque.

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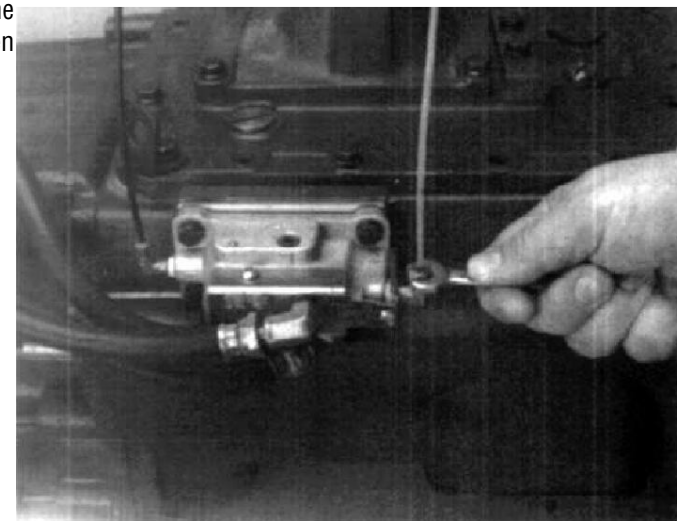
4. Connect the 1/4" I.D. air hose between the slave valve "S" Port and the air filter/regulator. Tighten both connections to the recommended torque.



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

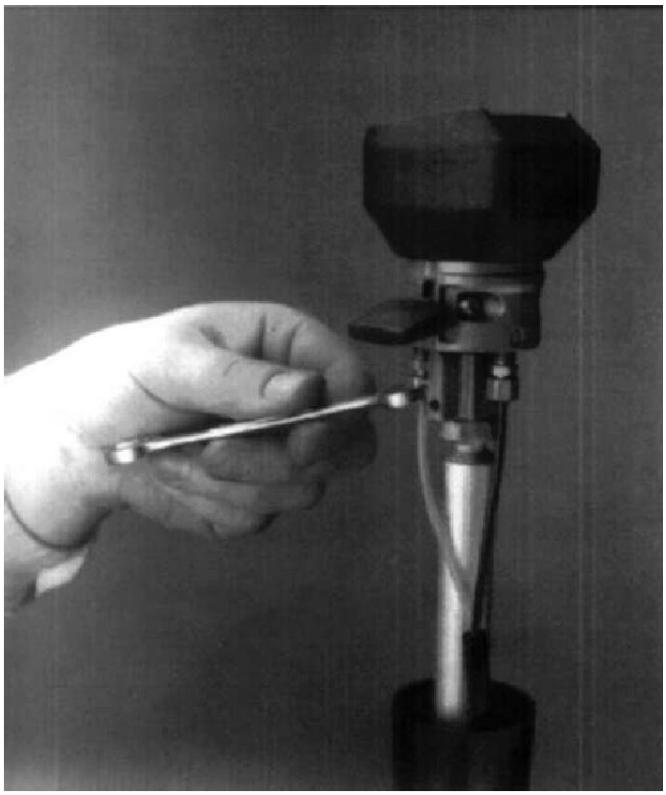


6. Connect the white air line to the "S" or Supply Port and the black air line to the "P" or End Port of the slave valve. Tighten fittings securely.



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Installation - Shifting Controls



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

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

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