



Mack Transmission T2070A (T2070 Long Compound) Manual

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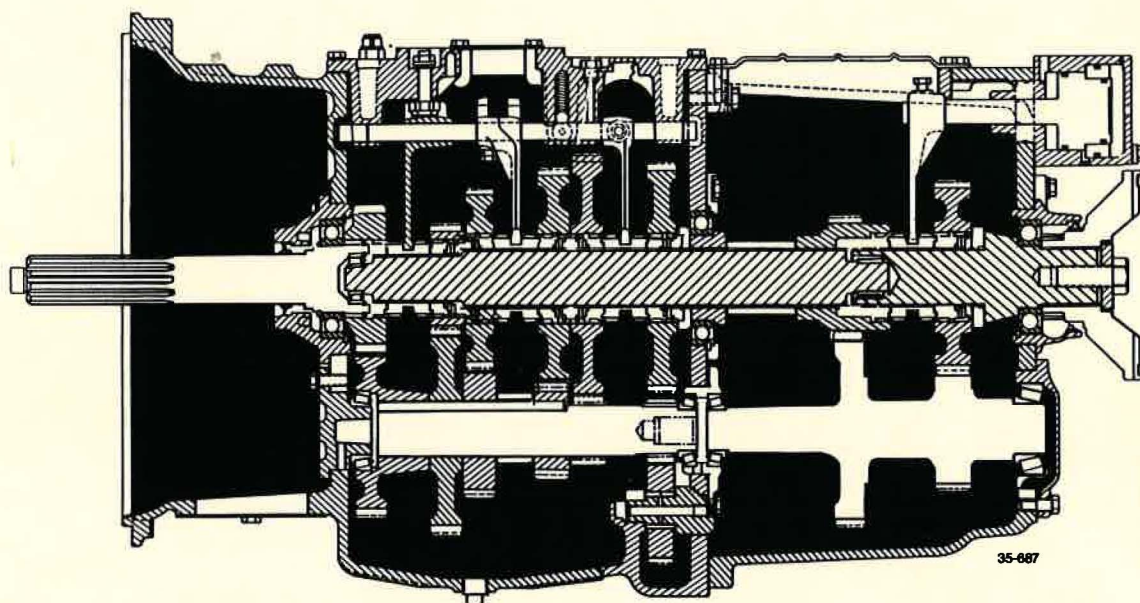
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T2070A

(T2070 LONG COMPOUND)



SERVICE MANUAL

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The information in this manual is not all-inclusive, and cannot take into account all unique situations.

The information and specifications in this publication are based on information that was current at the time of publication. Some photographs may not be exact, and are used for general guidance rather than showing exact features.

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INTRODUCTION

EXPLANATION OF ADVISORY LABELS

Correctly performed service procedures are critical for the safety of the technician, as well as the safe, reliable operation of the vehicle.

Cautionary "Signal Words" (Danger - Warning - Caution) may appear in various locations throughout this manual. Information accented by one of these "signal words" must be observed to minimize the risk of personal injury to service personnel, or the possibility of improper service methods which may damage the vehicle or render it unsafe. Additional Notes and Service Hints are utilized to emphasize areas of procedural importance and provide suggestions for ease of repair. The following definitions indicate the use of these advisory words as they appear throughout the manual.

DANGER

Directs attention to unsafe practices and/or existing hazards which will result in personal injury or death if proper precautions are not taken.

WARNING

Directs attention to unsafe practices which could result in personal injury or death if proper precautions are not taken.

CAUTION

Directs attention to unsafe practices which could result in damage to equipment and possible subsequent personal injury or death if proper precautions are not taken.

NOTE

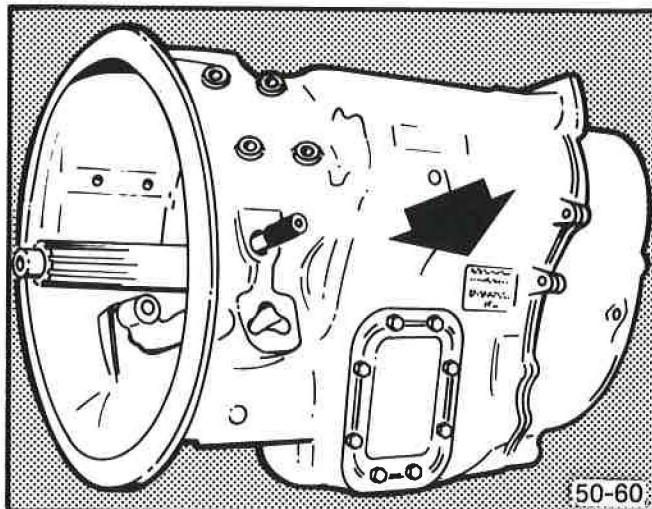
An operating procedure, practice, condition, etc. which is essential to emphasize.

SERVICE HINT

A helpful suggestion which will make the servicing being performed a little easier and/or faster.

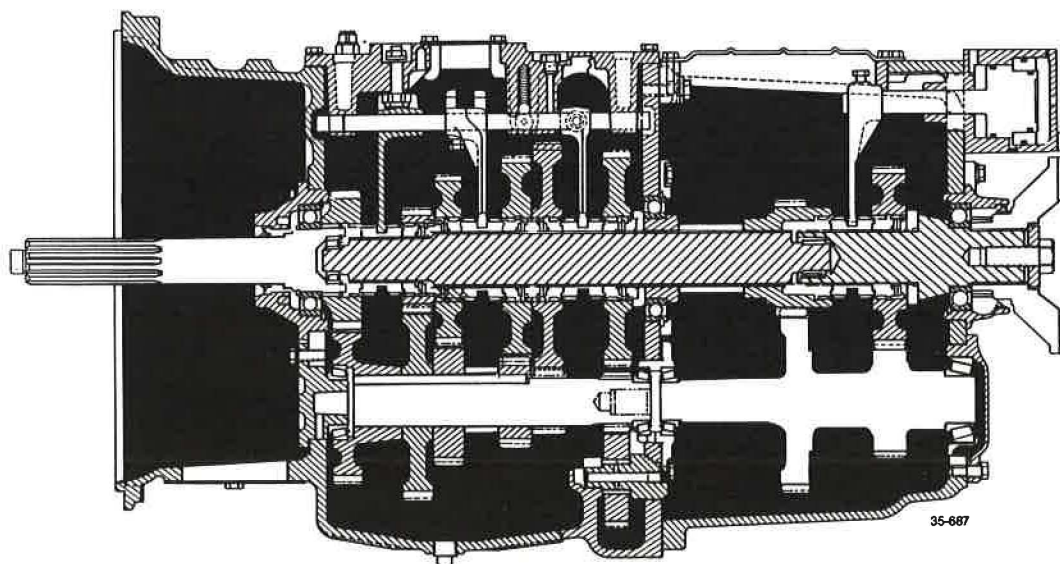
INTRODUCTION

TRANSMISSION IDENTIFICATION



Location Of Identification Stamping On Left Side Of Main Case

CUT-AWAY VIEW OF TRANSMISSION



Cutaway View Of T2070A Transmission

INTRODUCTION

DESCRIPTION

The T2070A transmission is a triple countershaft, non-synchronized unit. It consists of a compact main box which houses the five forward speeds plus a reverse gear set, and a rear compound (auxiliary) which houses the Lo-range and Hi-range gear sets.

The rear compound case in the T2070A is longer than the original T2070. This allows the addition of Power Take-Off (PTO) openings in the rear compound. Because the speed of the gears in the rear compound is dependent not only on engine speed, but also on the gear selected in the main box, this allows multiple speeds to be available at the rear compound PTO openings.

The main case and the bell housing (clutch housing) are a one piece casting, made from aluminum, and heat treated for strength.

The bearings are housed in cast iron bearing retainers. Tapered roller bearings are used at both ends of the three countershafts.

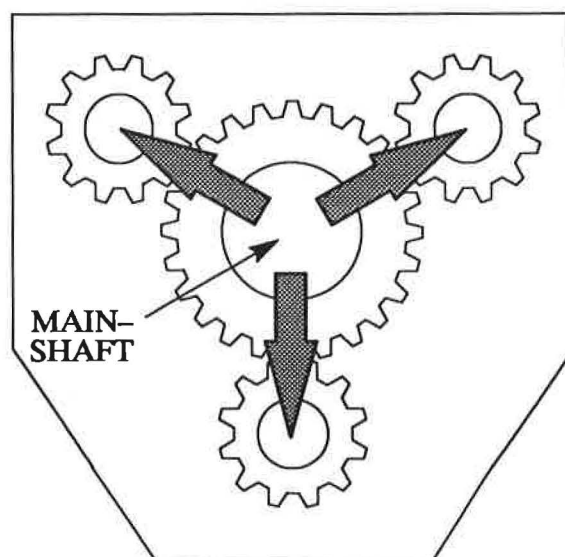
All gears are of the spur type design and are in constant mesh with their mating gears. All shifting is done by forks and sliding clutches. The shift rails and forks are integral with the shift cover.

A single gear shift lever is provided, and the standard "H" shift pattern is used. An air control flipper, mounted on the gear shift lever, is

also used. It directs air pressure to the rear compound air shift cylinder, causing a shift to occur between Hi-range and Lo-range, or Neutral in the rear compound to be selected.

The T2070A has seven forward speeds and two reverse speeds. Lo-range is used in both first and second, thus giving two low-hole gears, called Lo-Lo and Lo. Then the rear compound is shifted to Hi-range, and the main box is shifted through its five speeds. Reverse may be used in either Lo-range or Hi-range.

The three countershafts are equally spaced around the mainshaft. This design distributes the load equally among the three countershafts, thus keeping normal deflection and gear tooth loading to a minimum.



EQUAL TORQUE DISTRIBUTION

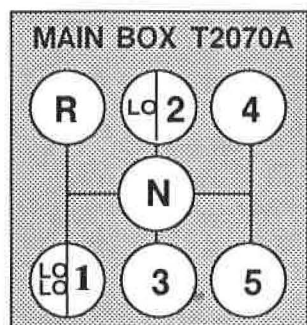
SPECIFICATIONS

SPECIFICATIONS

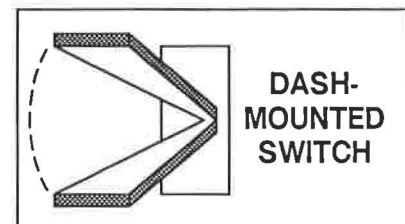
Make	Mack Trucks, Inc.
Type	Overdrive, Triple Countershaft
Controls	Selective, One Lever, Manual with Air Shifter Rear Compound
Speeds	Seven Forward, Two Reverse
Bell Housing	SAE #1, Integral With Main Case
Cases	Cast Aluminum, Heat Treated
Gears	Spur Type
Shaft Splines	Fine Pitch, Rolled Involute
Lubrication	Splash Lubrication
Oil Filter	Integral, Magnetic
Drain Plug	Magnetic
P.T.O. Openings	
Left Side	Std. SAE 8-Hole (Main Case & Rear Case)
Right Side	Std. SAE 6-Hole (Main Case & Rear Case)
Oil Capacity	Approx. 24 pints
Oil Type	Mack GO-H/GO-HS Gear Oil: 80W-90, 80W-140, 85W-140 (also 140 only if ambient temperature is above 32 degrees F.)

SHIFT PATTERNS AND GEAR RATIOS

SHIFT PATTERNS AND GEAR RATIOS



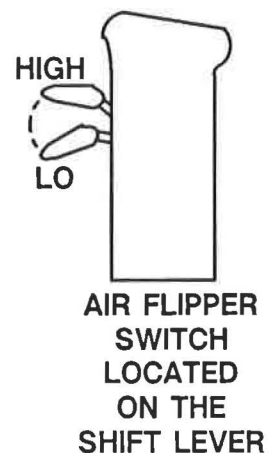
T2070A



GEAR (Main Box)	RATIOS		T2070A
	LO	HI	
1	14.16	5.24	
2	8.25	3.05	
3	(4.67)	1.73	
4	(2.70)	1.00	
5	(1.62)	.60	
R	14.53	5.38	

EH13

(The ratios in parentheses are not practical to use)



SHIFTING INSTRUCTIONS

SHIFTING INSTRUCTIONS

The T2070A is a non-synchronized transmission. There is a Lo and Hi auxiliary section controlled by an air shift flipper located on the shift lever. There is also a rear compound neutral valve switch located on the dash. In Lo range you get two low ratios. In Hi range there are five forward gears which can be shifted in the standard manner, but remember to double-clutch whether moving up or down through the gears. For normal highway usage, start in Hi range, first gear and shift through second, third, fourth and fifth. The two gears in Lo range are designed for off-highway use and in slow moving (curb pouring, material spreading, heavy load/steep grade) operations. Reverse can be used in Lo and Hi range.

CAUTION

Do NOT preselect the air shift flipper on the T2070A. Shift the rear compound only with the clutch pedal depressed and the gear shift lever in neutral.

UPSHIFTING THE T2070A

To upshift the T2070A, begin in first gear, Lo range (commonly referred to as LO-LO, as shown on the shift pattern diagram). Upshift to second gear, Lo range (commonly referred to as LO) in the normal manner (double-clutch). When you are ready to upshift again, depress the clutch pedal and release the accelerator pedal. Move the gear shift lever to neutral. Flip the air shift switch up to Hi, double-clutch and move the gear shift lever back to first gear. You are now in first gear, Hi range (which is the next highest ratio). Release the clutch pedal and apply the accelerator pedal. Shift through the normal second, third, fourth and fifth procedures, double-clutching as you go.

DOWNSHIFTING THE T2070A

To downshift the T2070A, downshift as normal from fifth to fourth, third, second to first in Hi range (double-clutch between them all). The next lowest shift will be to second gear, Lo range (commonly referred to as LO). When you are ready for this gear, depress the clutch pedal and release the accelerator pedal. Move the gear shift lever to neutral and move the air shift switch to Lo. Double-clutch and move the gear shift lever to second gear (LO). You are now in second gear, Lo range. Your next lower gear (and lowest ratio in the T2070A) is first gear, Lo range (LO-LO). Double-clutch down to first, Lo range, at the proper time.

SHIFTING INSTRUCTIONS

CAUTION

Do NOT overspeed the engine during downshifting. Damage to the drive train components may be the result.

OBTAINING NEUTRAL IN REAR (COMPOUND) CASE

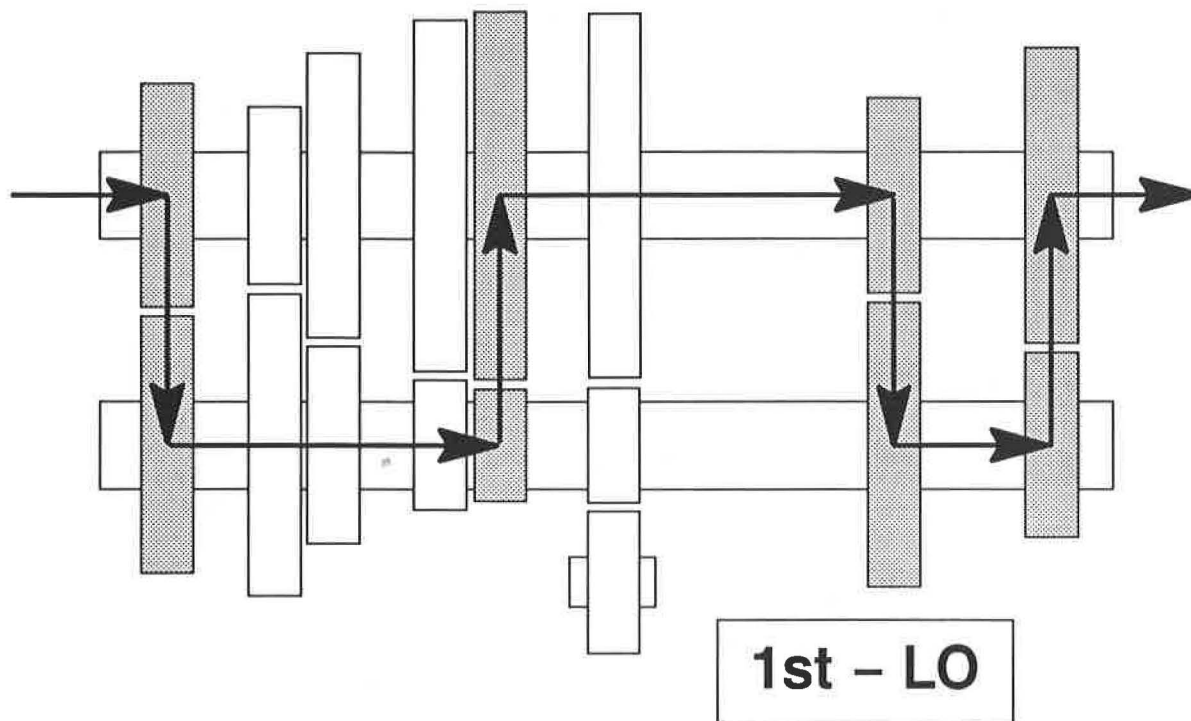
The T2070A has a two position switch mounted on the dashboard which controls air flow to the rear compound. This allows the operator to obtain Neutral in the rear case if he wants it. When you switch to Neutral in the rear (compound) case, it allows you to operate the PTO with the vehicle stationary. In order to get into Neutral in the rear (compound) case, follow the procedure listed below.

1. Disengage the clutch.
2. Move the main box shift lever to Neutral.
3. Select Neutral on the dash mounted two position switch.
4. Select and engage the required main box ration for the PTO operation.
5. Engage the clutch.

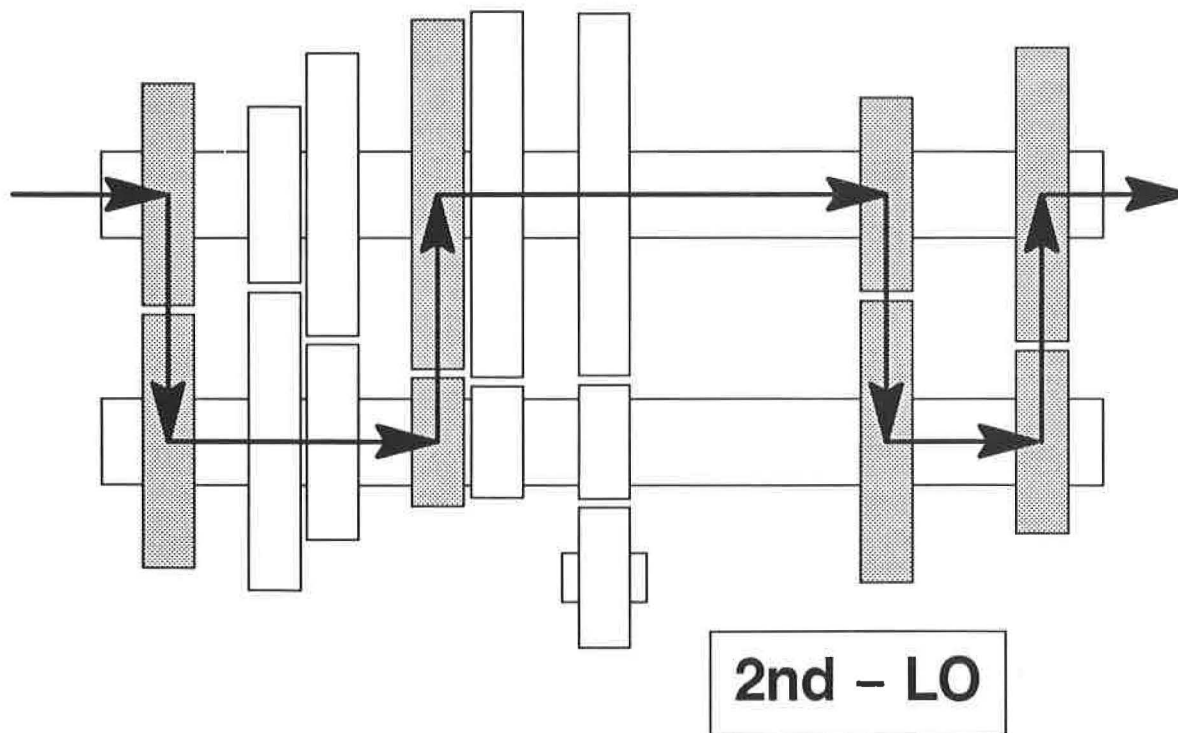
POWER FLOW DIAGRAMS

POWER FLOW DIAGRAMS

1ST - LO

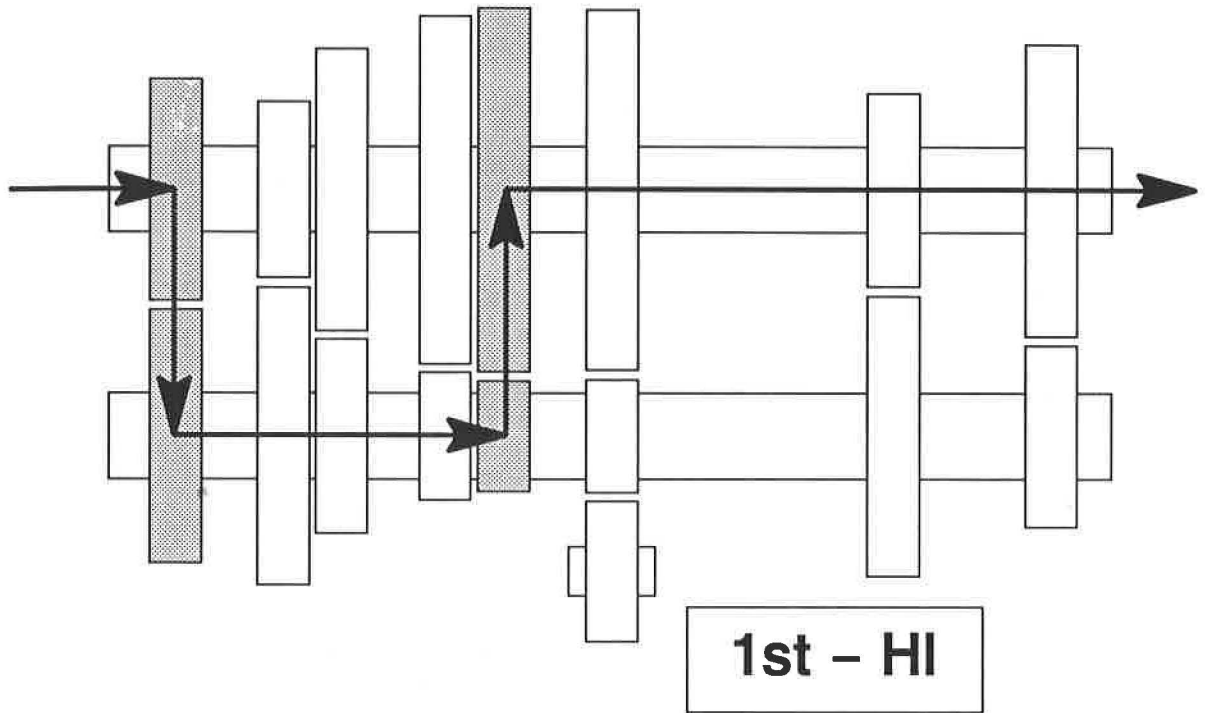


2ND - LO

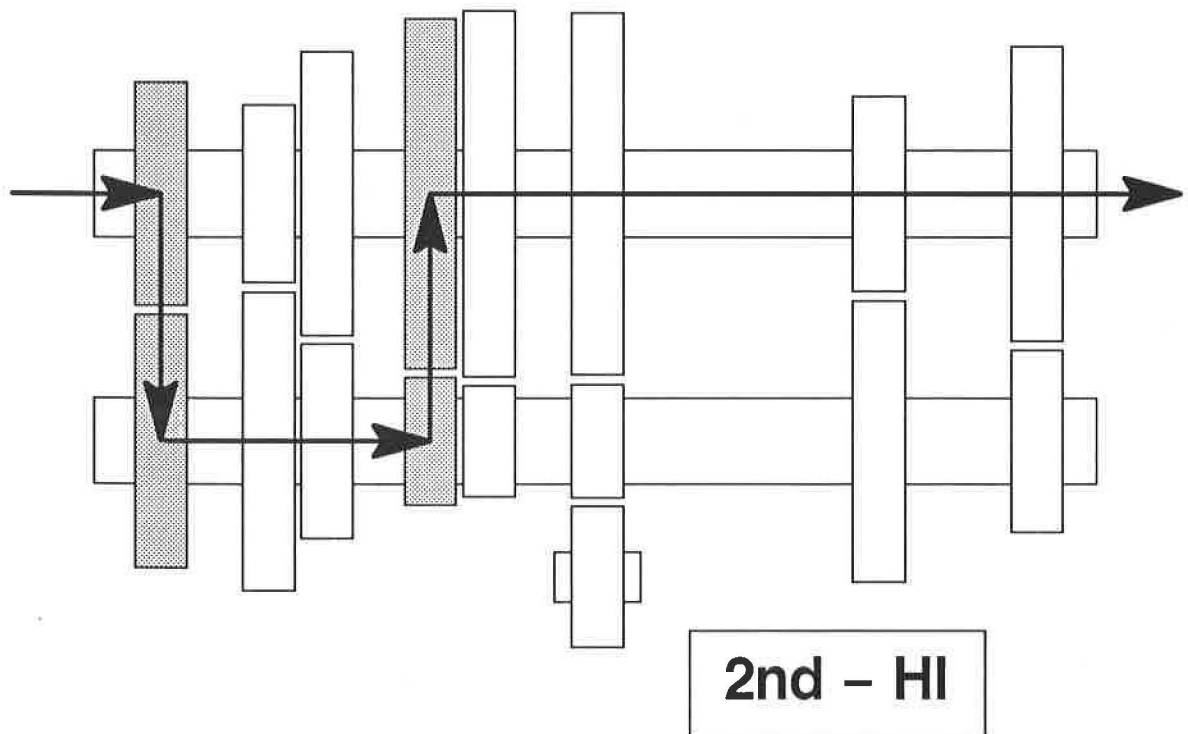


POWER FLOW DIAGRAMS

1ST - HI

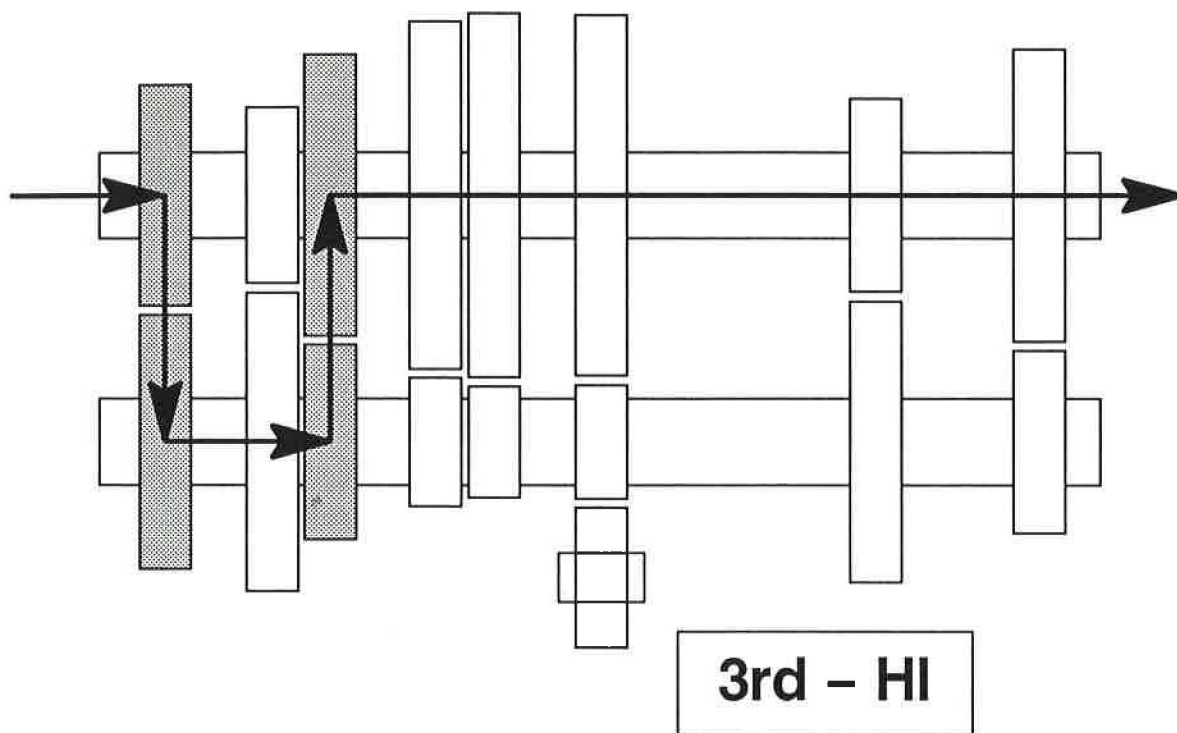


2ND - HI

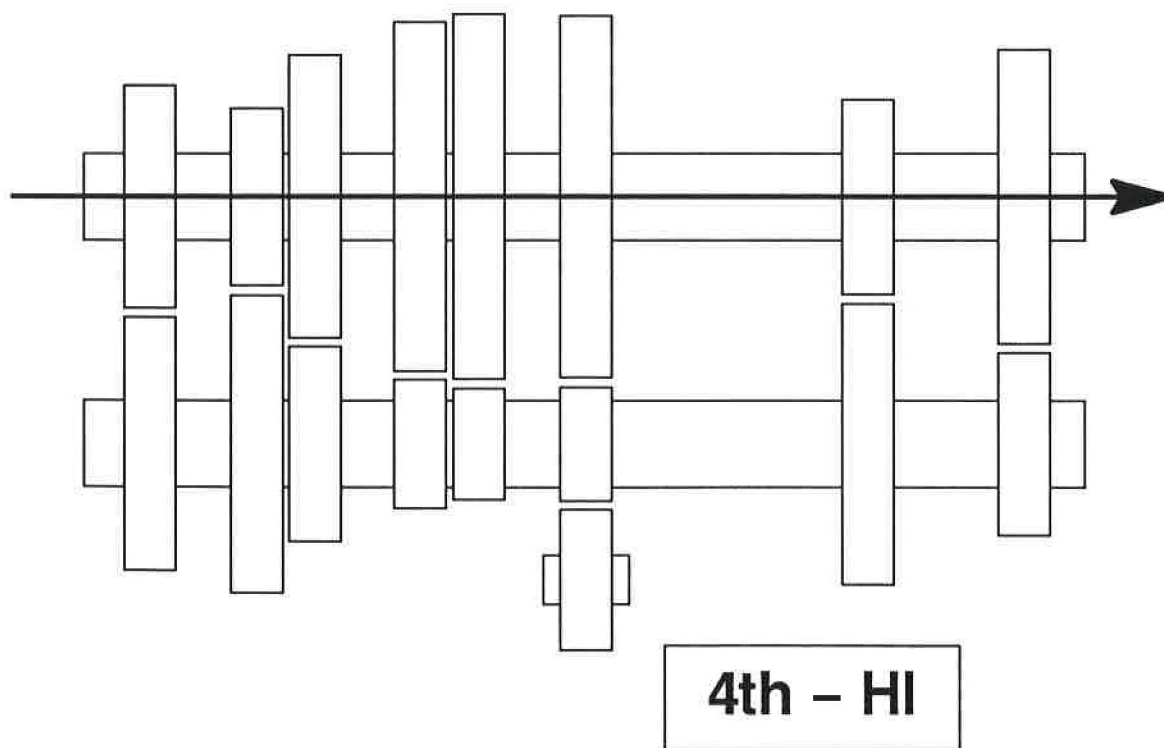


POWER FLOW DIAGRAMS

3RD - HI

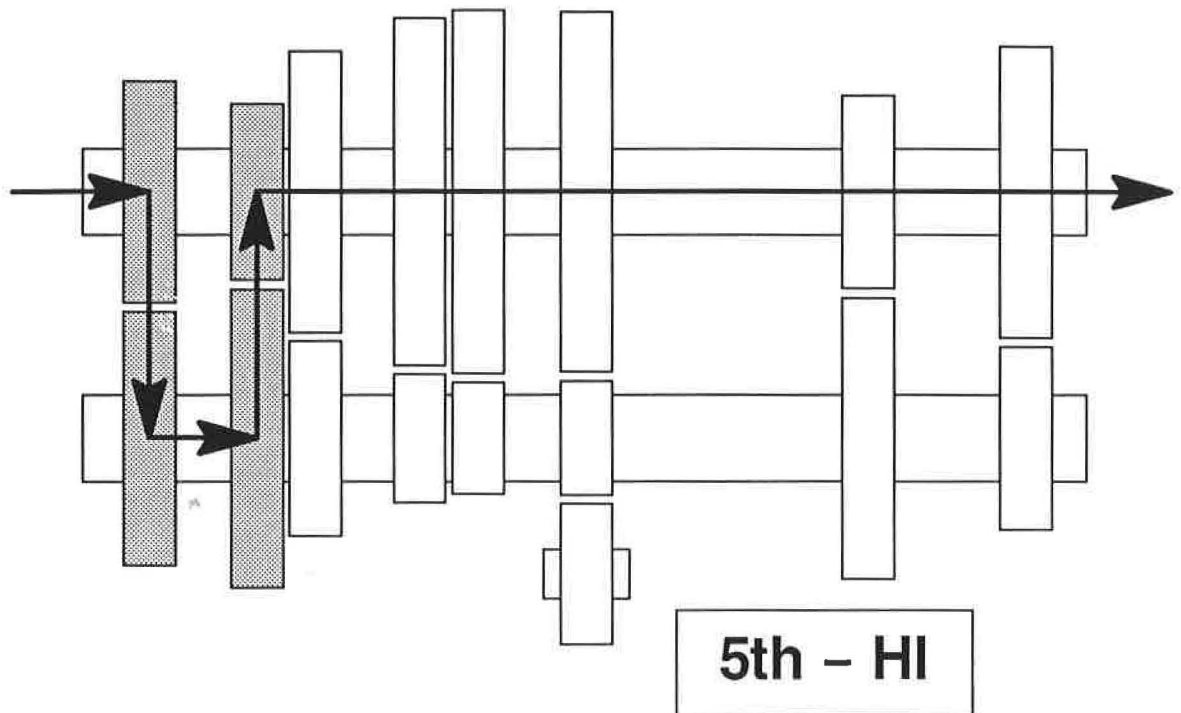


4TH - HI



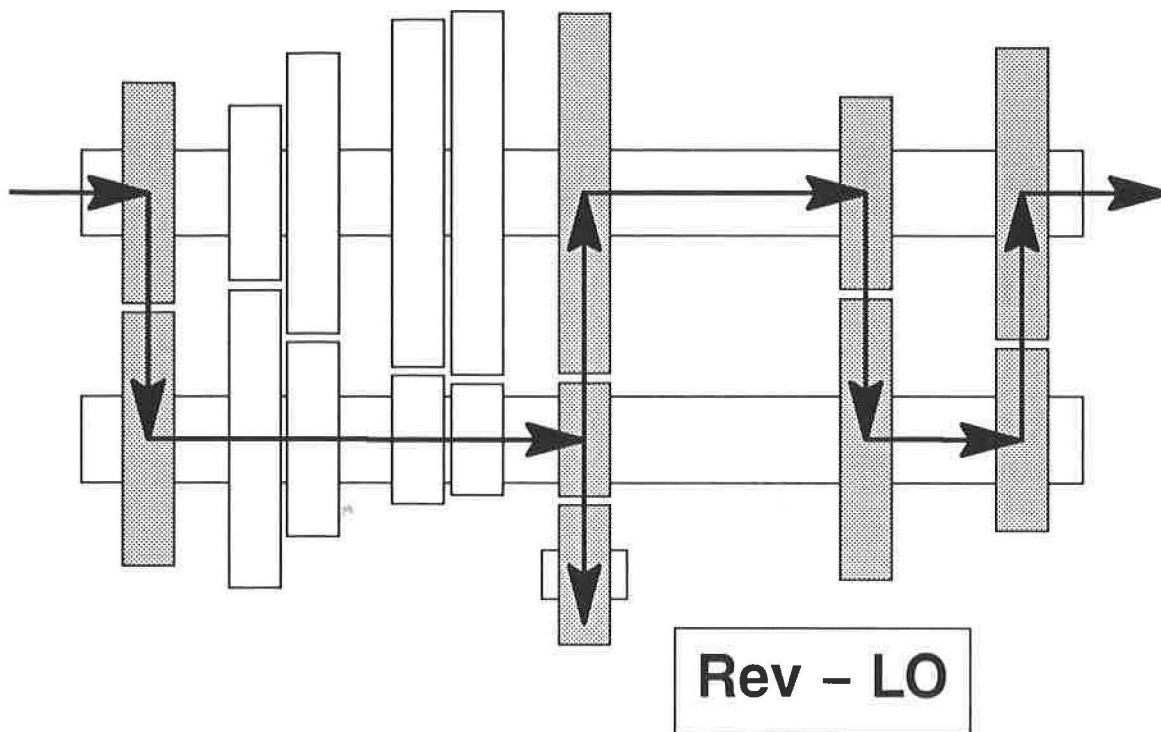
POWER FLOW DIAGRAMS

5TH - HI

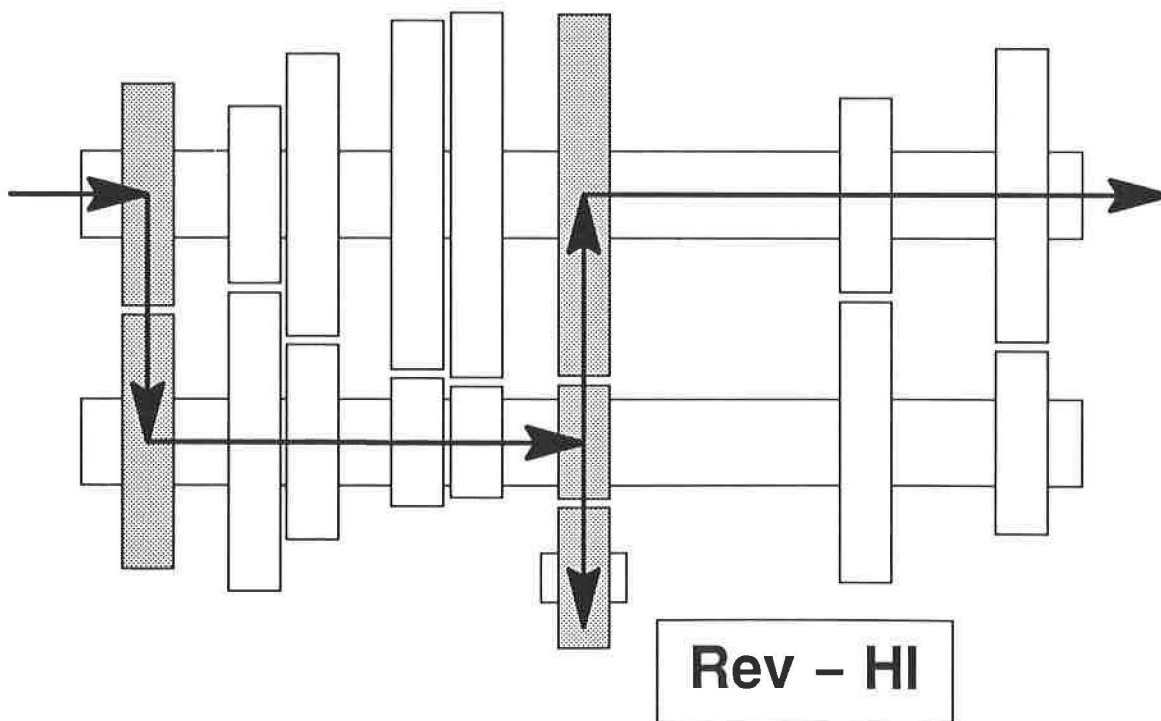


POWER FLOW DIAGRAMS

REV - LO



REV - HI

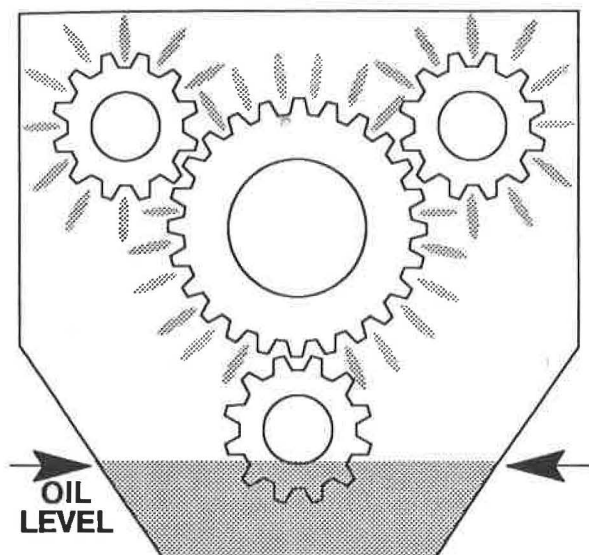


LUBRICATION / MAINTENANCE

LUBRICATION

SPLASH LUBRICATION

All parts inside the transmission are lubricated by a splash system. Only the lower countershaft dips into the lubricating oil. As the gears on the countershaft spin, a constant spray of oil is directed to all internal parts of the transmission. Troughs and passages are cast into the inside of the cases, to capture and direct the oil to the bearings.



SPLASH LUBRICATION

MAGNETIC OIL FILTER

A magnetic oil filter assembly is built into the right side of the main case. It consists of a trough arrangement cast into the inside wall of the main case, and a removable cover plate. The trough is open at the top to collect oil. The oil is then channeled past a magnet, which removes ferrous metallic particles from the passing oil. After passing the magnet, the oil is channeled slightly upward to an outlet, where it falls back down into the transmission case. The magnet is mounted on a plug which is re-

movable from the outside of the transmission. The drain plug at the bottom of the case is also a magnetic plug.



MAINTENANCE

CHECKING OIL

To check the oil level in the transmission, remove the filler plug on the right side of the main case. The oil should be level with the bottom of the filler plug hole.

NOTE

The oil should be checked when it is at normal operating temperature. The vehicle should be in a level position, both front-to-rear as well as side-to-side.

LUBRICATION / MAINTENANCE

Check the level of the oil at the intervals specified in the Maintenance and Lubrication Manual (TS494). Add oil, if needed, until the oil is level with the bottom of the filler plug hole. Use oil of the proper specification (see Specifications page).

CAUTION

Be sure to add oil to the transmission through the filler hole, NOT the magnetic filter plug hole. Severe damage due to low oil level may occur, because the baffles of the magnetic filter may prevent proper filling.

CHANGING OIL

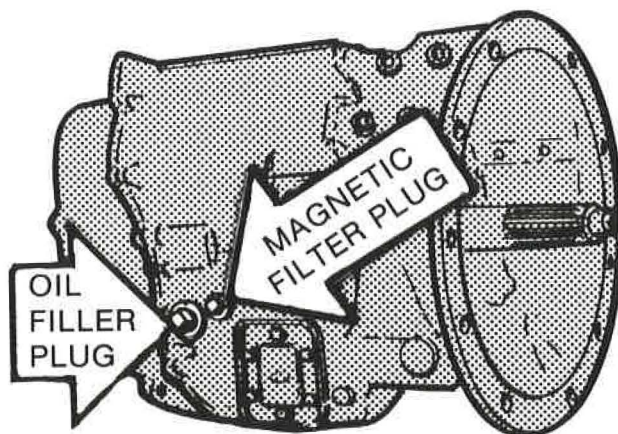
To change the oil in the transmission, the oil should be at normal operating temperature. Remove the magnetic drain plug from the bottom of the transmission case, and drain the hot oil from the unit. Clean and replace the magnetic drain plug, and tighten it to 25 to 30 lb. ft. torque.

Reinstall and hand tighten the filler plug. Then wrench tighten the plug an additional 3/4 to 1 turn, not exceeding 55 lb. ft. torque. Change the oil at the intervals specified in the Maintenance and Lubrication Manual (TS494).

Remove the filler plug and fill the transmission with oil of the proper specification, to the level of the bottom of the filler plug hole (see Specifications page).

MAGNETIC OIL FILTER

The magnetic oil filter plug should be removed, and the magnet in the plug cleaned, every time the oil is changed. Also clean the trough inside, and then reinstall the magnetic plug. Tighten the magnetic plug to 25 to 30 lb. ft. torque.



35-347

Plug Locations

AIR BREATHER

There is one air breather located on top of the main case top cover. It should be removed every time the oil is changed, and cleaned with a suitable solvent. Also check to be sure that the air flow through the breather is unobstructed.

TROUBLE SHOOTING CHART

TROUBLE SHOOTING CHART

NOISY TRANSMISSION	
PROBABLE CAUSE	REMEDY
a. Low oil level	a. Fill to correct level
b. Wrong oil used	b. Drain and refill with correct oil
c. Mismatched carrier ratios	c. Install correct, matched gearing
d. Resonating (ringing) driveshaft	d. Install suitable dampening material, then high-speed balance the driveshaft
e. Side mounted PTO mounted too loose or too tight	e. Reinstall PTO correctly
f. Loose bell housing to flywheel housing capscrews	f. Install new capscrews using Locktite
g. Incorrect clutch driven disks used	g. Install correct clutch driven disks
h. Gears worn, chipped, rough, cracked	h. Replace gears
i. Bearings worn, cracked, corroded, galled, etc.	i. Replace bearings

HARD SHIFTING	
PROBABLE CAUSE	REMEDY
a. Incorrect driving practices	a. Train driver in correct driving practices
b. Low oil level	b. Fill to correct level
c. Improperly adjusted clutch, clutch linkage, clutch brake, or shift linkage	c. Adjust properly
d. Wrong oil used	d. Drain and refill with correct oil
e. Remote shift linkage not lubricated	e. Clean and lubricate
f. Shift lever binding or interference	f. Relieve binding or interference
g. Poppet balls binding in their holes	g. Clean holes and balls
h. Loose setscrews in shifters or shift forks	h. Tighten to correct torque
i. Worn spigot bearing	i. Replace bearing
j. Clutch brake tangs broken	j. Replace clutch brake
k. Clutch disks worn into main drive pinion shaft splines	k. Replace clutch disks and main drive pinion
l. Mainshaft snap ring or thrust washer failure	l. Replace snap rings or thrust washers

TROUBLE SHOOTING CHART

GEAR DISENGAGEMENT (JUMPING OUT OF GEAR)

PROBABLE CAUSE	REMEDY
a. Excessive weight and/or length of gear shift lever and/or knob	a. Replace with standard lever and/or knob
b. Shift lever interference	b. Remove interference
c. Improperly adjusted remote control linkage	c. Adjust properly
d. Worn or loose mounting insulators	d. Replace insulators
e. Loose, broken or missing capscrews between clutch housing and flywheel housing	e. Replace capscrews, check threads in case
f. Weak or broken shifter rail poppet springs	f. Replace springs
g. Bent or worn shifter forks	g. Replace forks
h. Broken snap rings	h. Replace snap rings
i. Shift rail bent or poppet notches worn	i. Replace shift rail
j. Worn taper or chipped teeth on sliding clutch teeth	j. Replace sliding clutch, and mating gear if its clutch teeth are damaged
k. Worn or damaged spigot bearing	k. Replace bearing
l. Engine flywheel housing misalignment	l. Realign properly
m. Chassis resonant ride	m. Correct resonance

RANGE SHIFT MALFUNCTIONS

PROBABLE CAUSE	REMEDY
a. Low system air pressure	a. Wait for pressure to build back up to normal
b. Restricted air line (bent, squeezed, twisted, etc.)	b. Re-route and/or replace air lines
c. Air lines too small	c. Replace with correct size air lines
d. Defective O-rings in air shift cylinder	d. Replace O-rings
e. Scored air shift cylinders or pistons	e. Repair or replace cylinders or pistons
f. Defective range selector valve	f. Repair or replace as needed



TROUBLE SHOOTING CHART

OIL LEAKS

PROBABLE CAUSE	REMEDY
a. Oil level too high	a. Drain to correct level
b. Drain plug, fill plug, or magnetic filter plug loose	b. Tighten plugs
c. Loose or missing capscrews	c. Tighten or replace
d. Improper lubricant used	d. Drain and refill with correct oil
e. Clogged air breather	e. Clean or replace
f. Gaskets or O-rings broken, shifted, or squeezed out of position	f. Replace gaskets or O-rings
g. Worn oil seals	g. Replace seals
h. O-rings in air shift cylinder leaking air pressure into transmission	h. Replace O-rings
i. Porous case or housing	i. Replace case or housing

BEARING FAILURE

PROBABLE CAUSE	REMEDY
a. Dirt in system	a. Clean system, replace bearings as needed, flush and refill with clean lubricant
b. Wrong grade of oil, or contaminated oil	b. Clean system, replace bearings as needed, flush and refill with clean lubricant
c. Excessive vibrations	c. Eliminate vibrations, replace bearings
d. Binding or seized propeller shaft slip yoke	d. Clean and replace as needed
e. Improper bearing clamping	e. Replace bearings and re-clamp using correct procedures
f. Improper bearing installation (pre-loads, etc.)	f. Replace using correct procedures

MAIN COMPONENTS DISASSEMBLY

DISASSEMBLY

MAIN COMPONENTS DISASSEMBLY

NOTE

Unless a complete overhaul is necessary, remove only those parts required to gain access to the faulty parts. Do not disturb parts having heavy press fits (interference fits) unless replacement is necessary. In that case, use proper press set-ups and pullers, so that usable parts are not damaged.

NOTE

External inspection of the unit, before cleaning and disassembly, can often reveal information about the operating conditions that have existed, and may help you in diagnosing problems.

SERVICE HINT

As parts are removed from the transmission, remember the sequence in which they are removed. It is a good practice to keep groups of related parts together. Small parts such as shims, spacers, etc. can be wired to the larger piece they go with. Groups of parts can be put in boxes to keep them together.

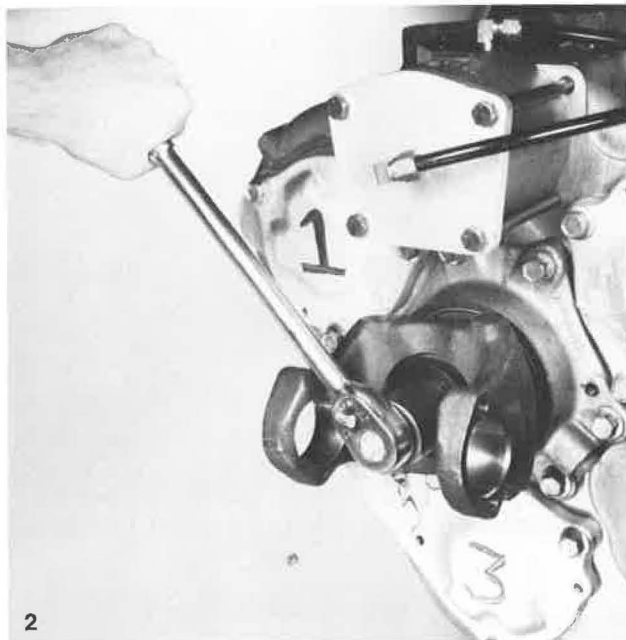
SERVICE HINT

Parts from each countershaft should be kept together, such as shim packs, bearings, bearing retainers, bearing races, gears, etc. It is good practice to mark the upper left countershaft (as viewed from the rear) as #1, the upper right as #2, and the bottom center as #3.

1. Clean the transmission externally, and mount it in an overhaul stand. Drain the lubricant. Plug the air line openings so that dirt cannot enter. Label air lines so that you can reinstall them correctly. During disassembly, plug openings with clean shop rags to prevent dirt from entering the transmission.
2. The transmission should be lifted and moved by using the two lifting brackets provided, and a hoist.
3. Remove the clutch release bearing assembly, shafts, yoke, and clutch brake.
4. Remove the main case top cover.

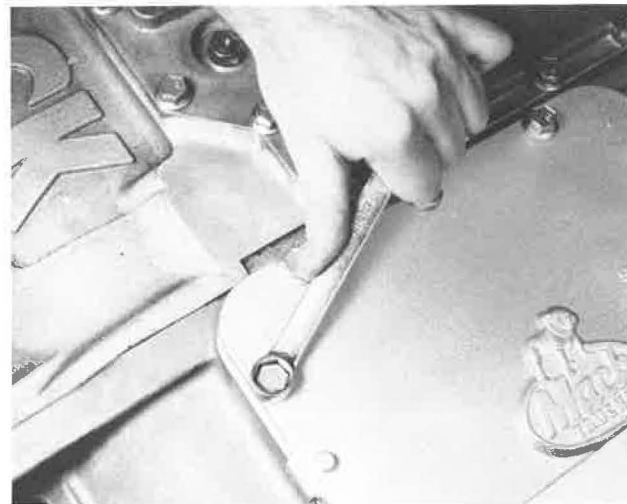
MAIN COMPONENTS DISASSEMBLY

5. Remove the drive yoke (or flange).



Removing Clamp Plate And Capscrew

6. Remove the capscrews from the rear case top cover, and remove the cover.



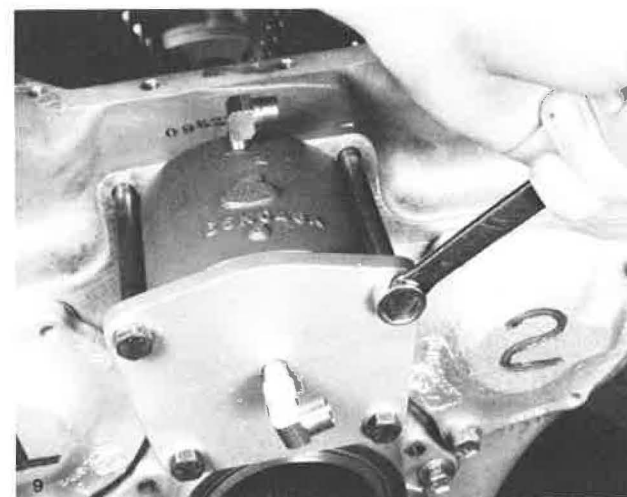
Removing Rear Case Top Cover Capscrew

7. Remove the rear compound shift fork set-screw, and then remove the shift fork from the rear case.



Removing Drive Yoke

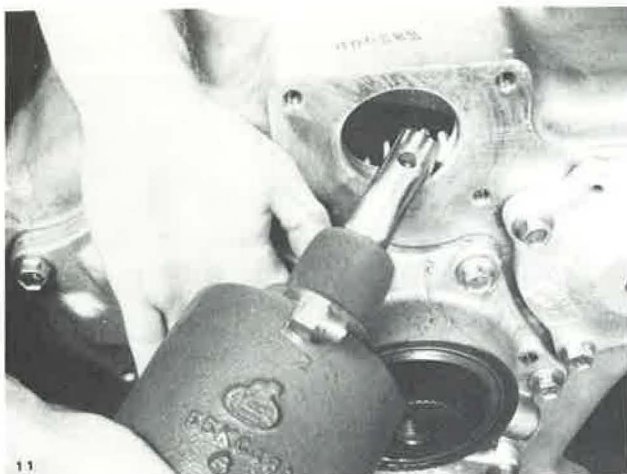
8. Remove the capscrews holding the shift cylinder onto the rear case.



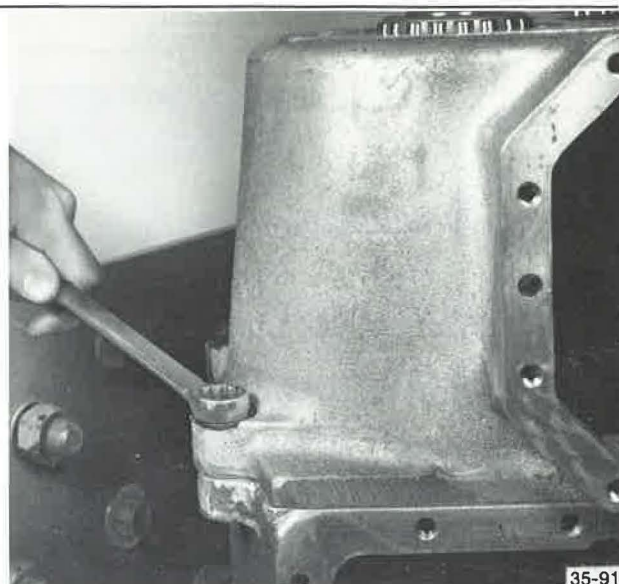
Removing Shift Cylinder Capscrews

MAIN COMPONENTS DISASSEMBLY

9. Remove the shift cylinder from the rear of the transmission case.

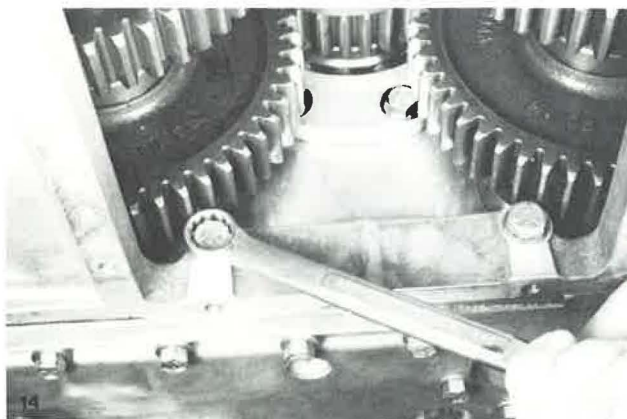


Removing Shift Cylinder



Removing Rear Case To Main Case
Capscrew

10. Position the transmission in a vertical position (rear case upward), and remove the two capscrews located inside the rear case.



Removing Rear Case To Main Case
Capscrews

11. Remove all the remaining capscrews and dowel bolts that hold the rear case to the main case.

NOTE

Be sure unit is vertical, so that the countershafts will not fall out when the case is removed.

12. Using a hoist and a chain, remove the rear case from the front case. Only the rear case should be lifted, not the output assembly. If necessary, tap on the end of the output shaft to loosen it from the rear case.

NOTE

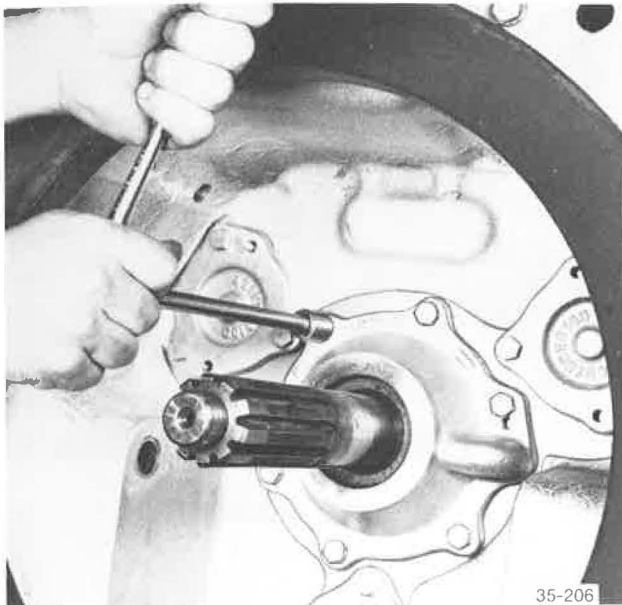
Remember to mark the countershafts, so they can be reinstalled in the same positions.

13. Remove the rear mainshaft assembly and the three rear countershafts from the rear of the transmission.

MAIN COMPONENTS DISASSEMBLY

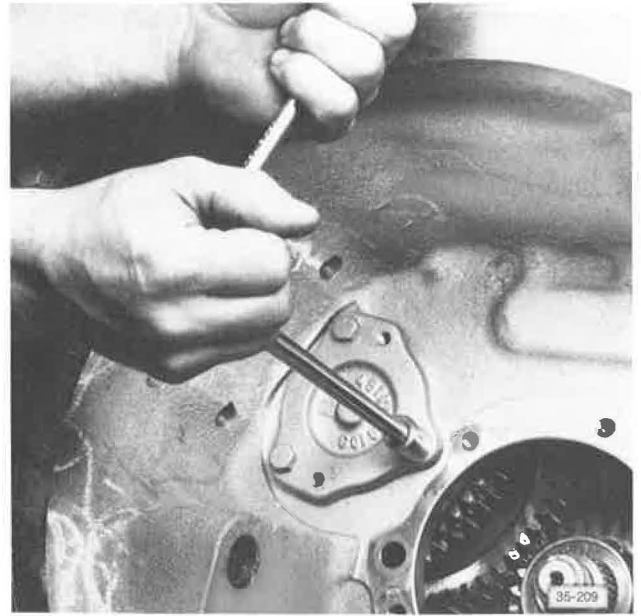
14. Remove the snap ring, the rear compound main drive gear, and the spacer.

15. Position the case horizontally, and remove the main drive pinion bearing cover, and remove the pinion/cover assembly.



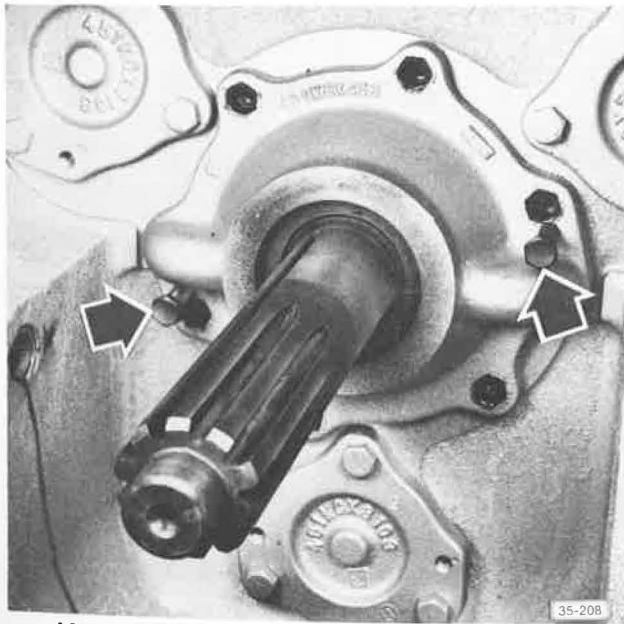
Removing Capscrew From Main Drive Pinion Bearing Cover

17. Remove the front countershaft front bearing covers.



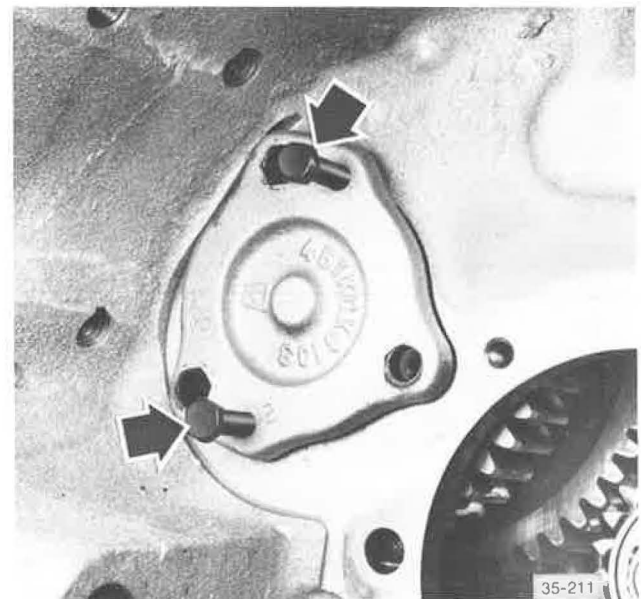
Removing Bearing Cover Capscrews

16. Jackscrew holes are provided to assist in the removal of the cover.



Using Jackscrews To Remove Cover

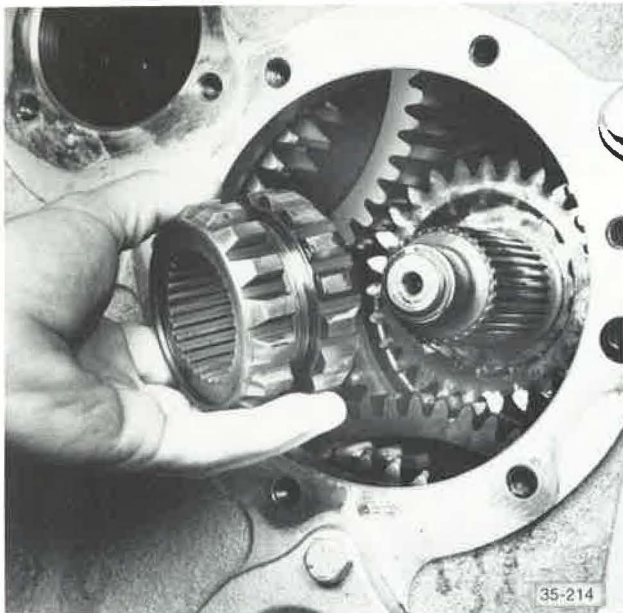
18. Jackscrew holes are provided to assist in the removal of the cover.



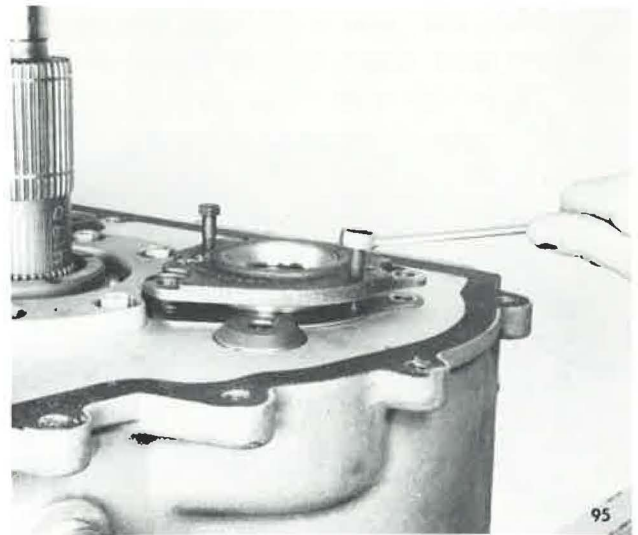
Using Jackscrews To Remove Cover

MAIN COMPONENTS DISASSEMBLY

19. Remove the sliding clutch from the front of the mainshaft.



Removing Sliding Clutch

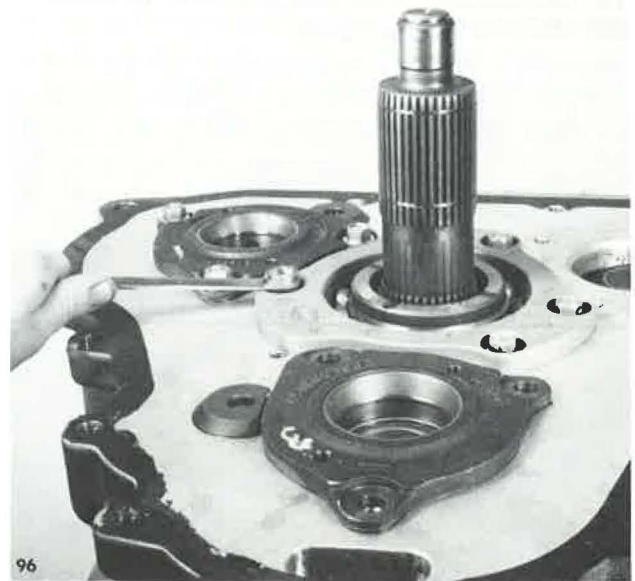


Using Jackscrews To Remove Cover

SERVICE HINT

If you remove the mainshaft rear bearing cover first, the countershaft rear bearing covers can be rotated as they are removed, and may come out easier. This may mean you will not have to use the jackscrews.

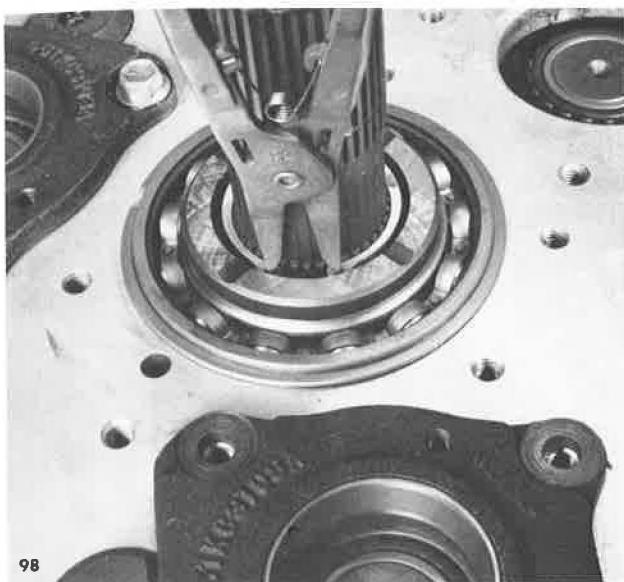
20. Remove the capscrews from the upper right front countershaft rear bearing cover, and remove the cover. Jackscrew holes are provided to assist in the removal of the cover.



Removing Capscrews From Mainshaft Rear Bearing Cover

MAIN COMPONENTS DISASSEMBLY

22. Remove the snap ring that holds the mainshaft rear bearing in place.



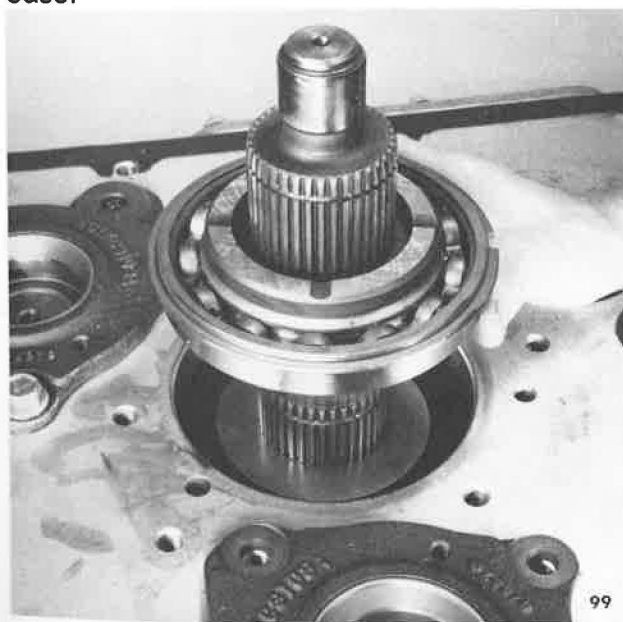
Removing Snap Ring

24. Press the sleeve out of the mainshaft rear bearing.



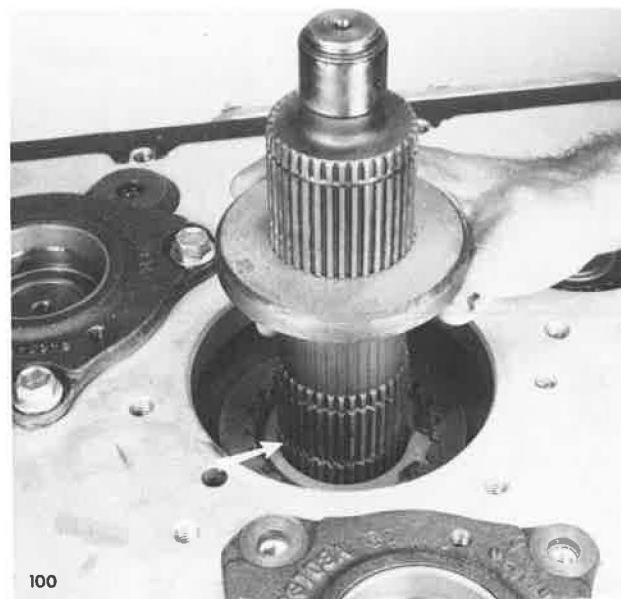
Pressing Sleeve Out Of Bearing

23. Remove the mainshaft rear bearing from the case.



Removing Mainshaft Rear Bearing

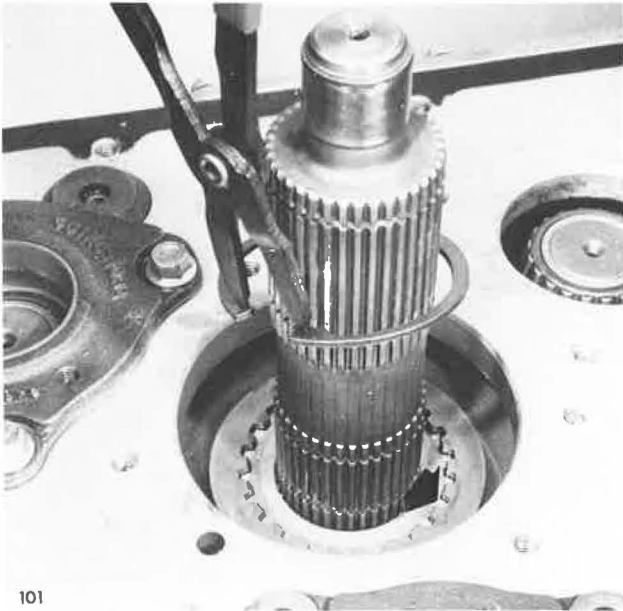
25. Remove the special thrust washer from behind the mainshaft reverse gear, and also remove the snap ring from the groove the arrow points to.



Removing Thrust Washer And Snap Ring From Mainshaft

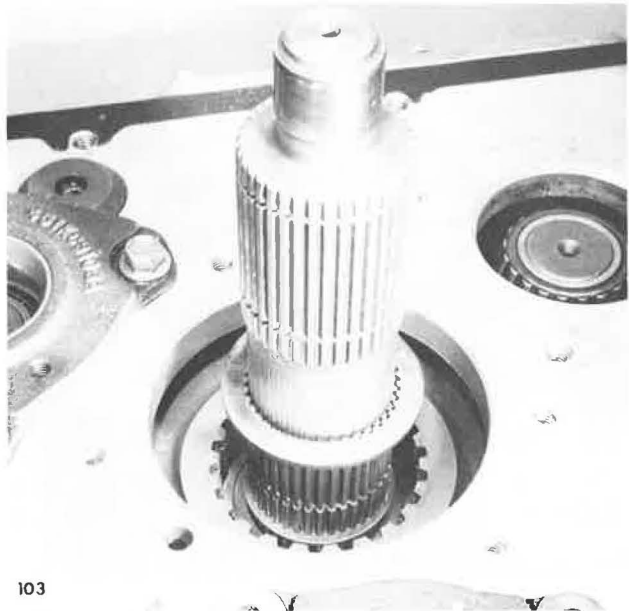
MAIN COMPONENTS DISASSEMBLY

26. Remove the snap ring from inside the mainshaft reverse gear.



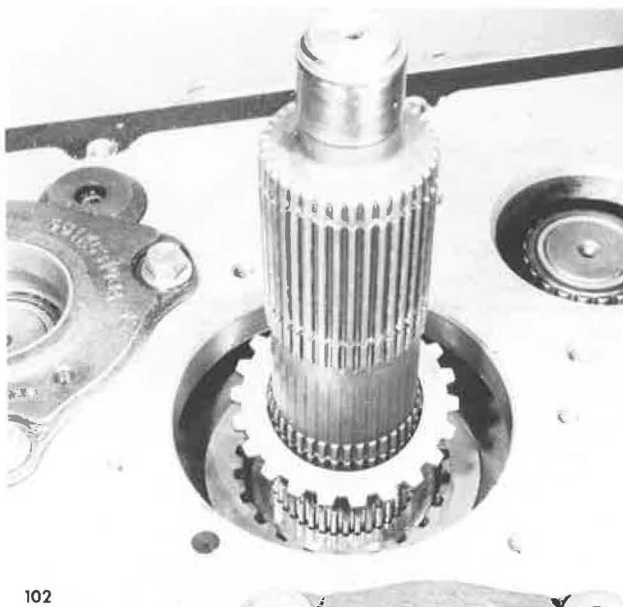
Removing Reverse Gear Snap Ring

28. Remove the internal tooth thrust washer from inside the reverse gear.



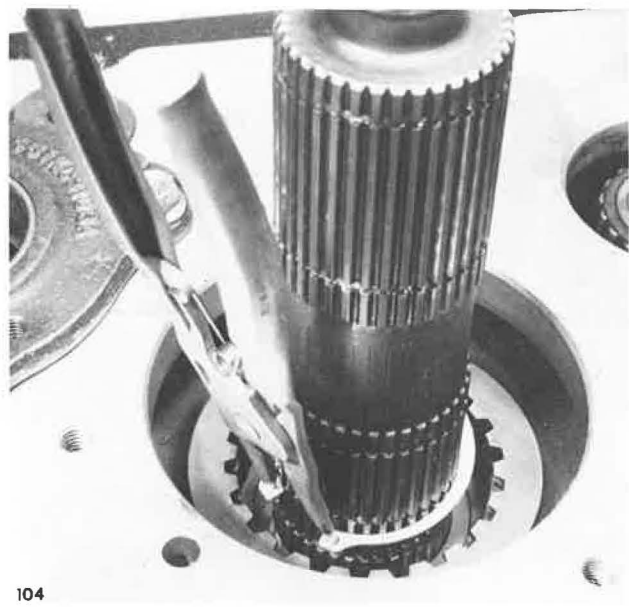
Removing Internal Tooth Thrust Washer From Reverse Gear

27. Remove the external tooth thrust washer from inside the reverse gear.



Removing External Tooth Thrust Washer From Reverse Gear

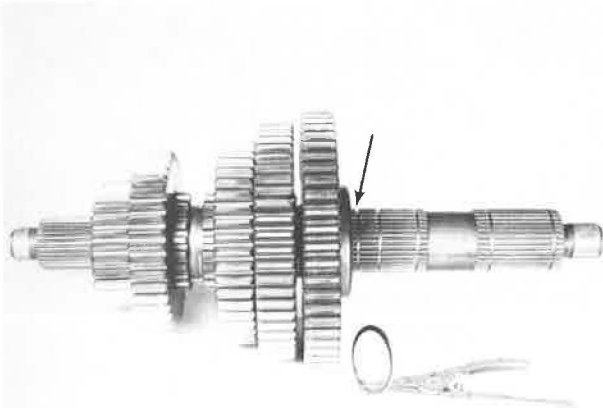
29. Remove the mainshaft snap ring from inside the reverse gear.



Removing Mainshaft Snap Ring From Inside Reverse Gear

MAIN COMPONENTS DISASSEMBLY

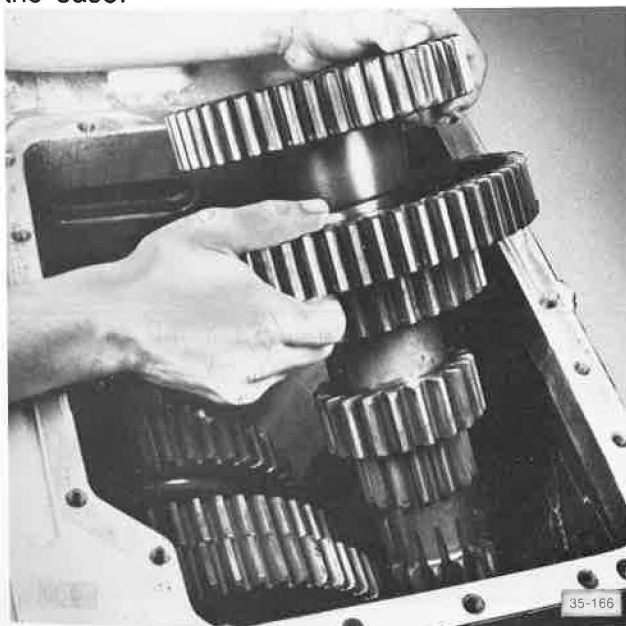
30. To aid in the removal of the mainshaft assembly from the case, it is recommended that the reverse gear be moved as far forward as possible. Slide the first/reverse sliding clutch forward until it fully engages the first speed gear. Then slide the reverse gear forward until it fully engages the sliding clutch also. Temporarily install thrust washer 31KD2136 and then install the mainshaft snap ring into the groove just behind the reverse gear, to hold the reverse gear forward.



108

**Reverse Gear In Fully Forward Position,
And Snap Ring Location**

31. Remove the upper right countershaft from the case.



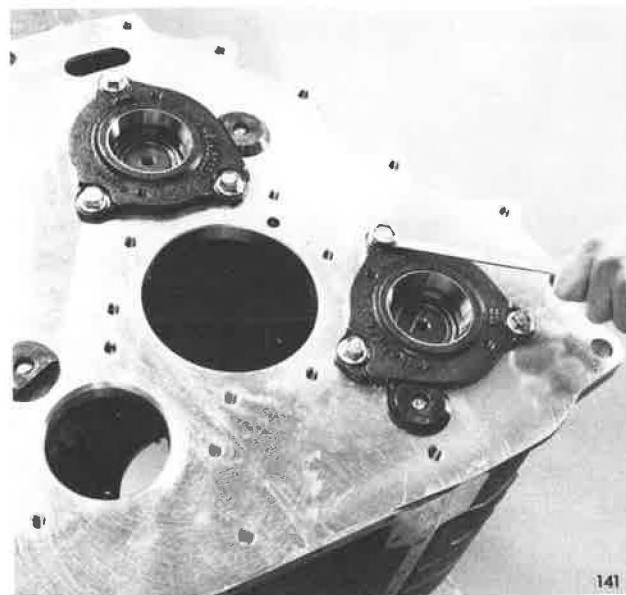
Removing Upper Right Countershaft

32. Fasten a chain around the mainshaft assembly between the second and third speed gears. Using a hoist, lift the mainshaft assembly out of the case.



Removing Mainshaft Assembly From Case

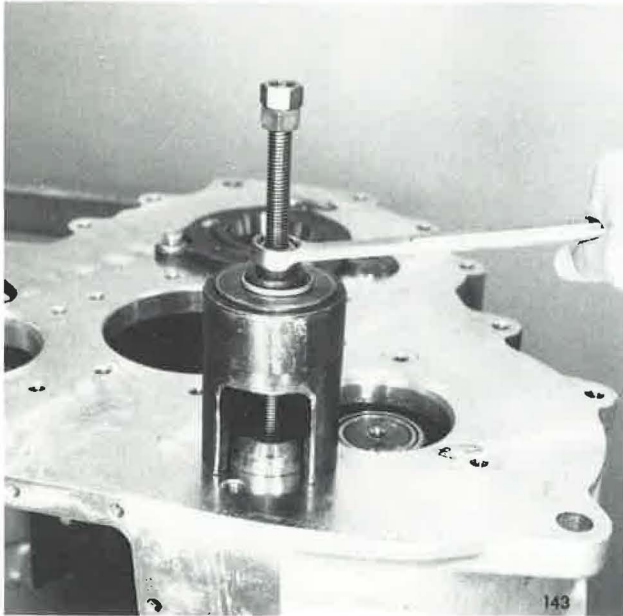
33. Remove the upper left countershaft rear bearing cover. Jackscrews are provided if needed.



**Removing Capscrews From Rear Bearing
Cover**

MAIN COMPONENTS DISASSEMBLY

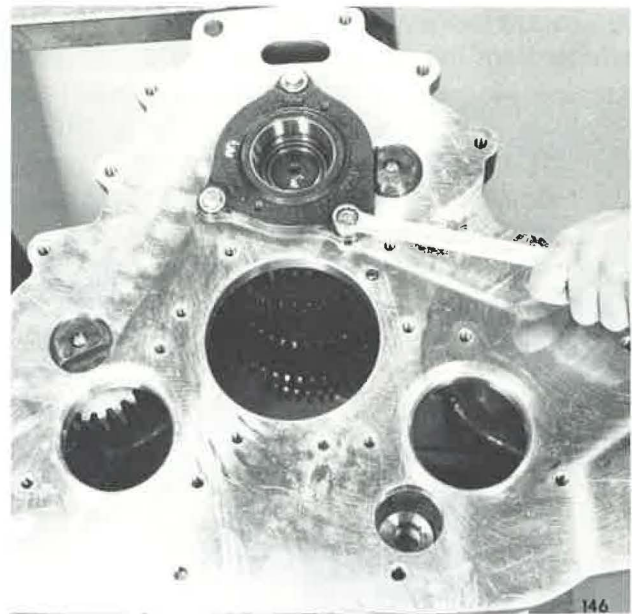
34. Remove the upper left reverse idler gear shaft, using an appropriate puller. Then also remove the reverse idler gear, bearing, and thrust washers.



Removing Reverse Idler Shaft

35. Move the upper left countershaft rearward until the front end of the shaft assembly can be angled out of the case, and then remove the countershaft from the case.

36. Remove the lower center countershaft rear bearing cover. Jackscrew holes are provided if needed.



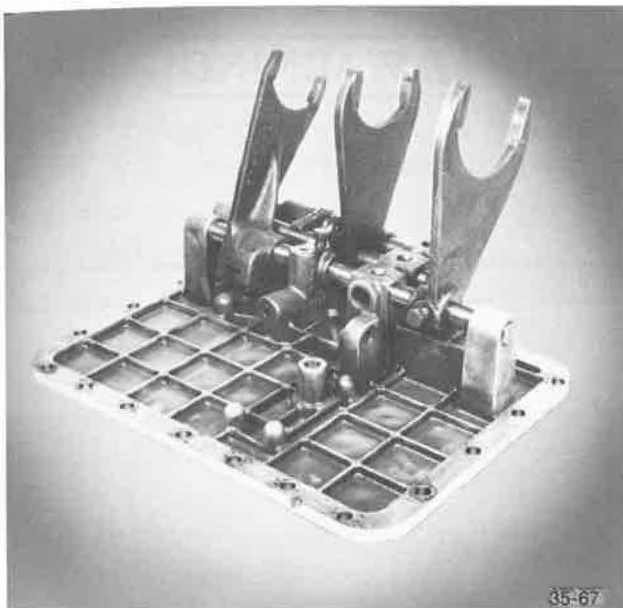
Removing Capscrews From Rear Bearing Cover

37. Move the lower center countershaft rearward until the front end of the shaft assembly can be angled out of the case, and then remove the countershaft from the main case.

38. Remove the remaining reverse idler gears, using an appropriate puller.

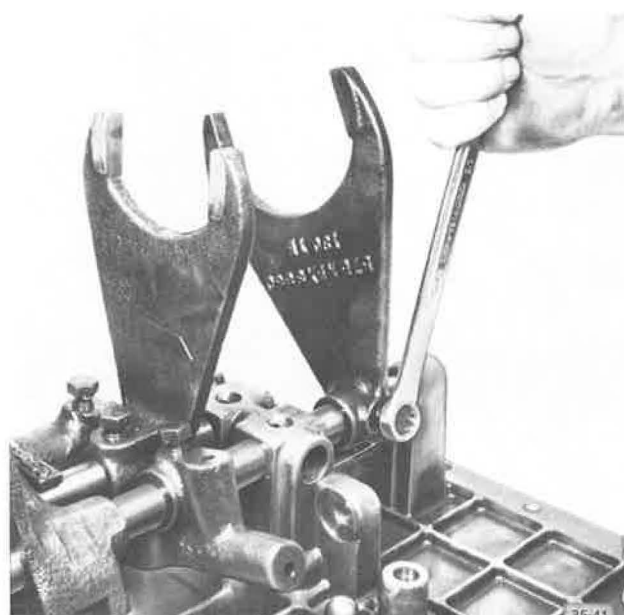
MAIN SHIFT COVER DISASSEMBLY

MAIN CASE SHIFT COVER DISASSEMBLY



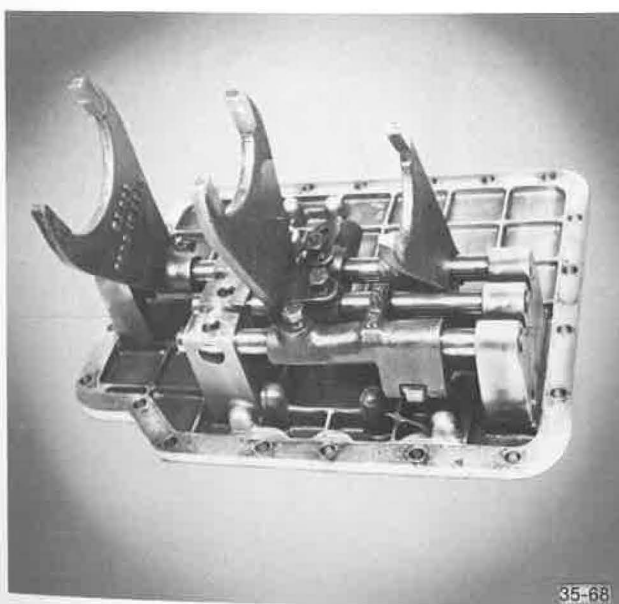
Shift Cover Assembly

1. Remove the setscrew from the first/reverse shift fork.

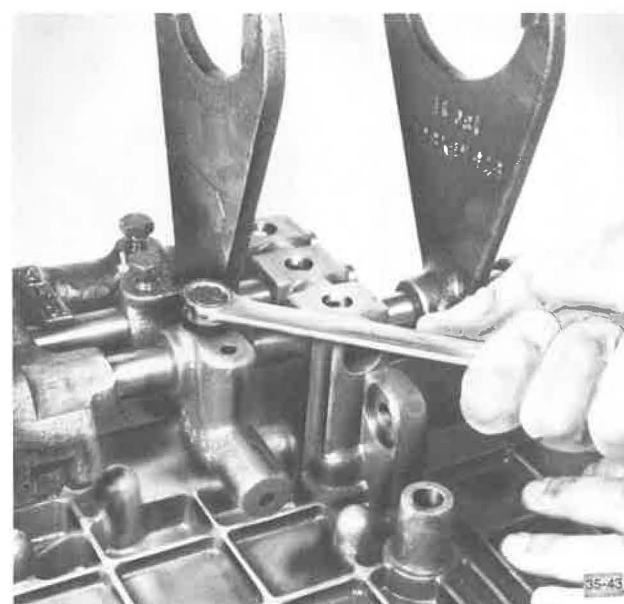


Removing Setscrew From First/Reverse Shift Fork

2. Remove the setscrew from the first/reverse shifter.



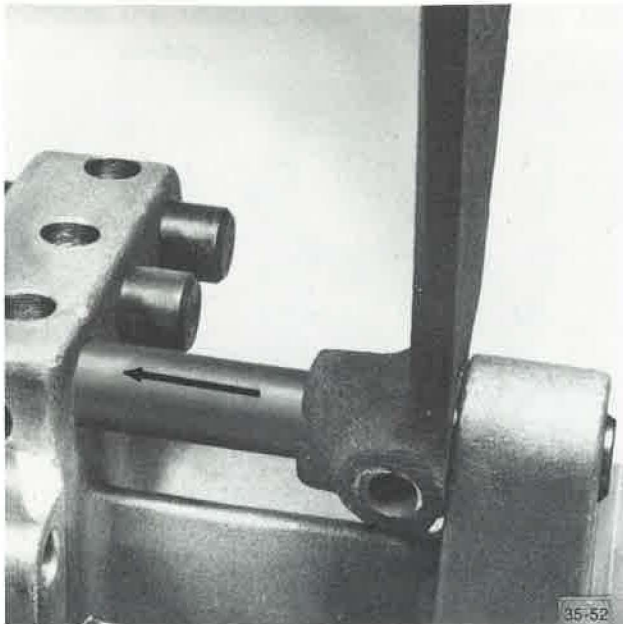
Shift Cover Assembly



Removing Setscrew From First/Reverse Shifter

MAIN SHIFT COVER DISASSEMBLY

3. Slide the first/reverse shift rail to the left as shown below.

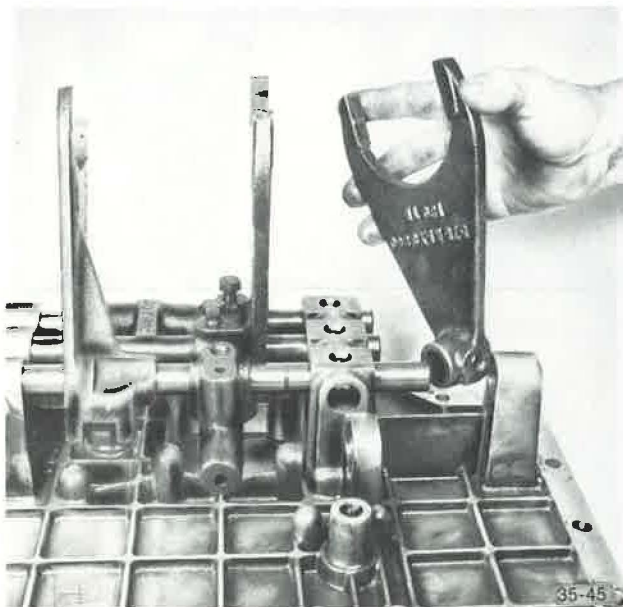


Sliding First/Reverse Shift Rail

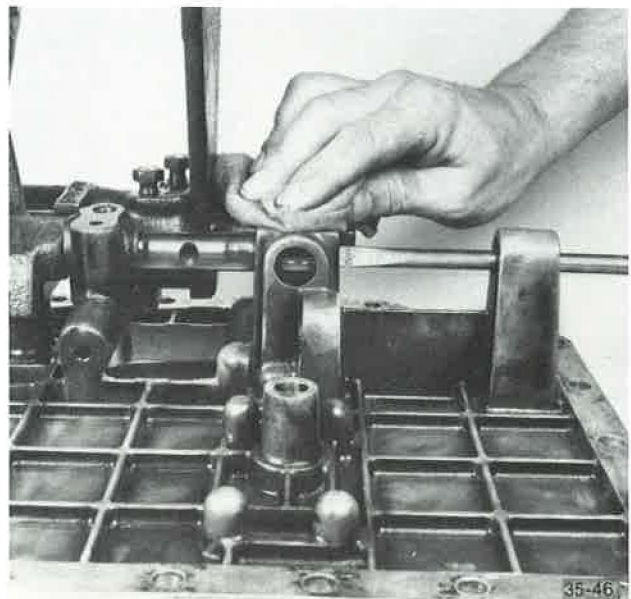
⚠ WARNING

Poppet balls are spring loaded, and could cause injury when they are released.

4. Remove the first/reverse shift fork from the cover.



Removing First/Reverse Shift Fork



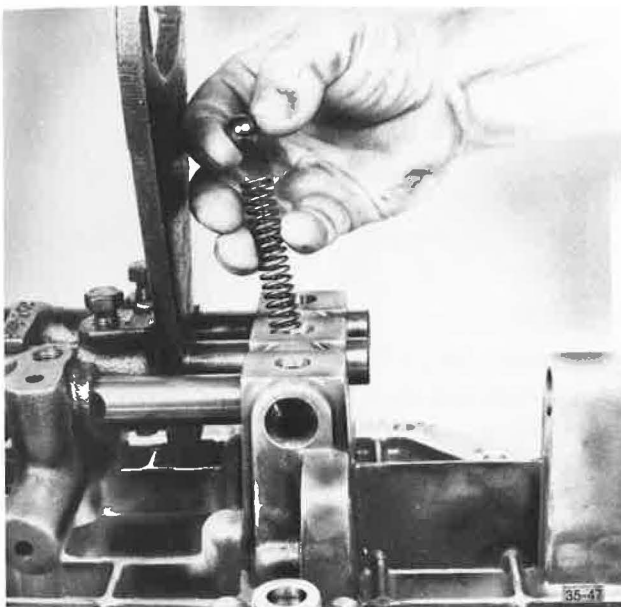
Pushing First/Reverse Rail Forward

MAIN SHIFT COVER DISASSEMBLY

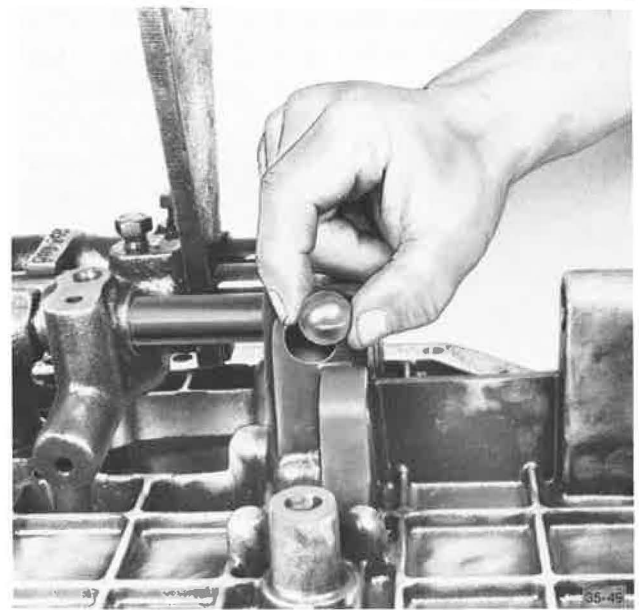
6. Remove the poppet ball and spring from under the first/reverse shift rail.

SERVICE HINT

A magnet is helpful in removing the poppet ball and spring.



Removing Poppet Ball And Spring



Removing Interlock Ball

8. Continue sliding the first/reverse shift rail forward, and remove the first/reverse shifter.

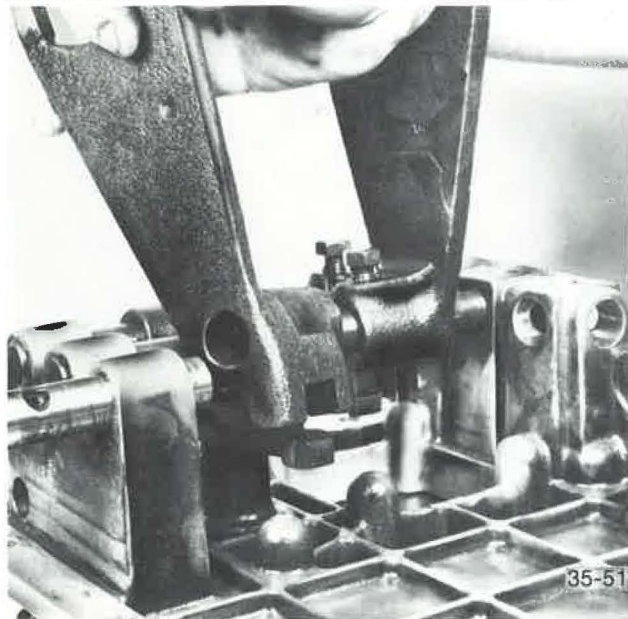


Removing First/Reverse Shifter

7. Remove the interlock ball from between the first/reverse shift rail and the second/third shift rail.

MAIN SHIFT COVER DISASSEMBLY

9. Slide the first/reverse shift rail the rest of the way forward, out of the shift cover, and at the same time, remove the fourth/fifth shift fork.



Removing Fourth/Fifth Shift Fork

10. Remove the setscrew from the second/third shift fork.

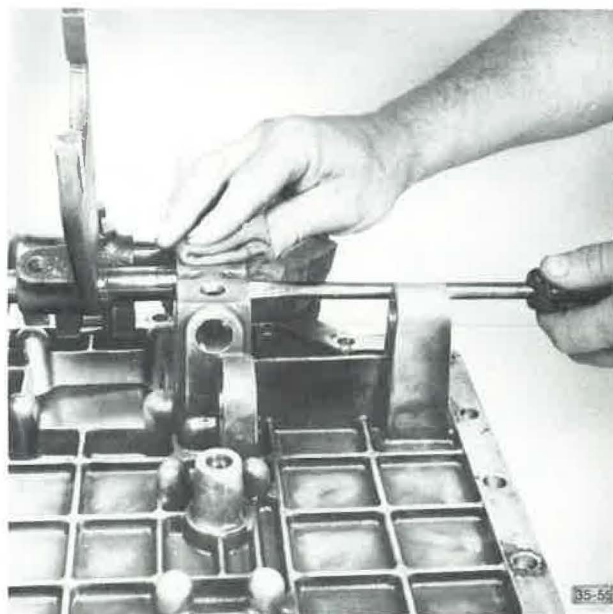


Removing Setscrew From Second/Third Shift Fork

⚠ WARNING

Poppet balls are spring loaded, and could cause injury when they are released.

11. Push the second/third shift rail forward, using a metal bar, while holding a shop rag over the top opening as shown. The rag will prevent the spring and ball, that are under the rail, from popping out and causing injury or becoming lost.



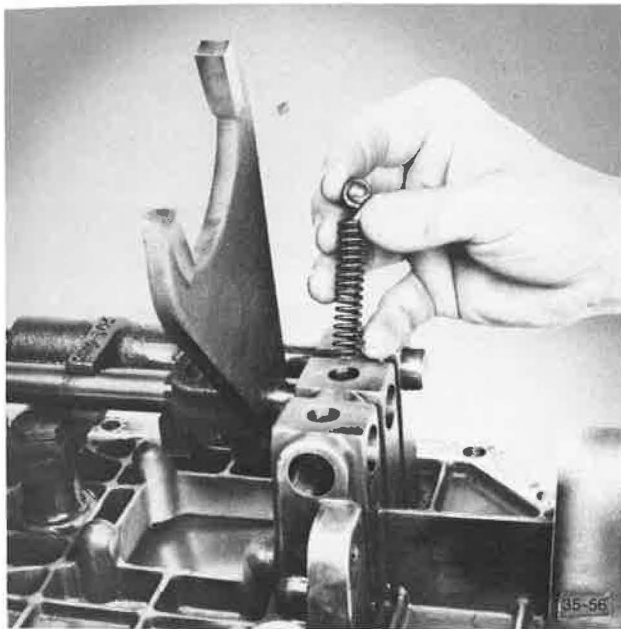
Pushing Second/Third Rail Forward

MAIN SHIFT COVER DISASSEMBLY

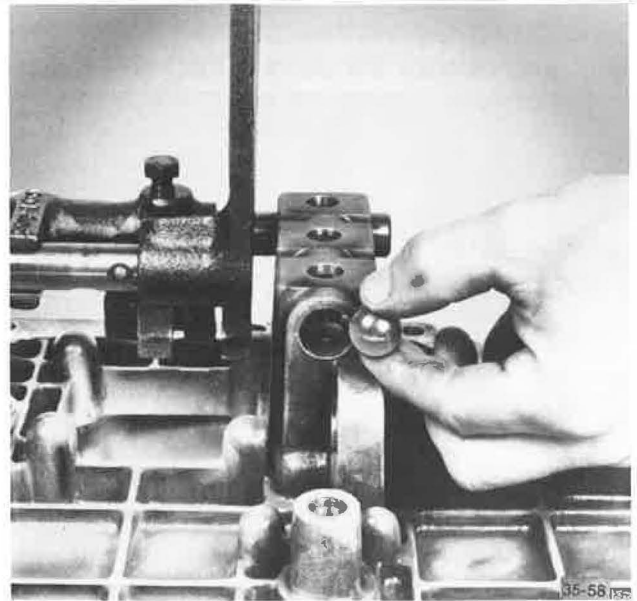
12. Remove the poppet ball and spring from under the second/third shift rail.

SERVICE HINT

A magnet is helpful in removing the poppet ball and spring.

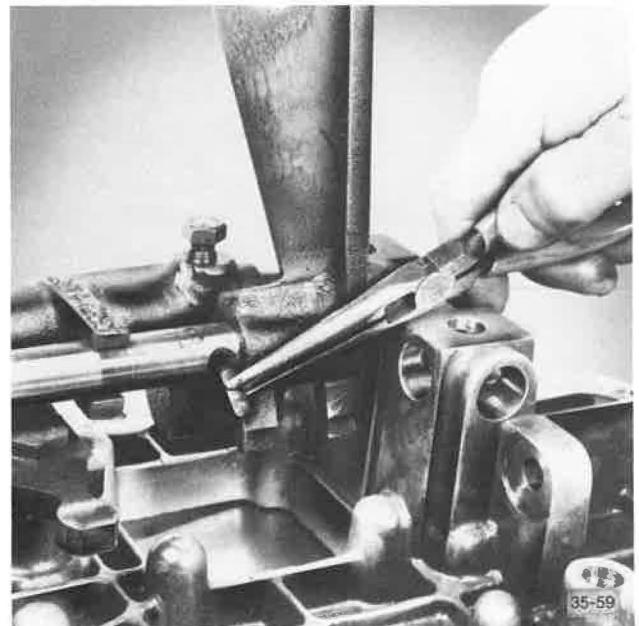


Removing Poppet Ball And Spring



Removing Interlock Ball

14. Remove the interlock pin from the second/third shift rail.

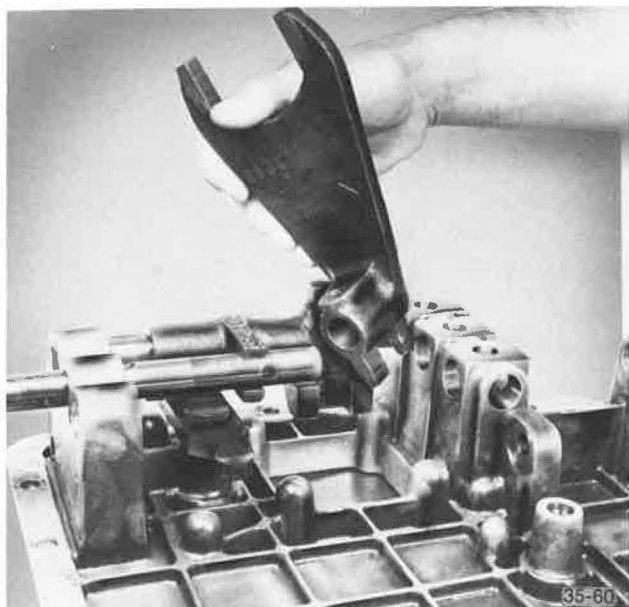


Removing Pin From Second/Third Rail

13. Remove the interlock ball from between the second/third shift rail and the fourth/fifth shift rail.

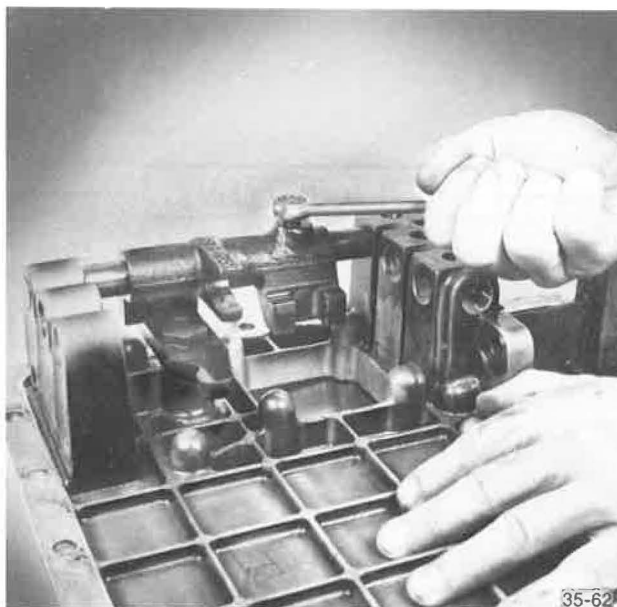
MAIN SHIFT COVER DISASSEMBLY

15. Slide the second/third shift rail further forward, and remove the second/third shift fork.



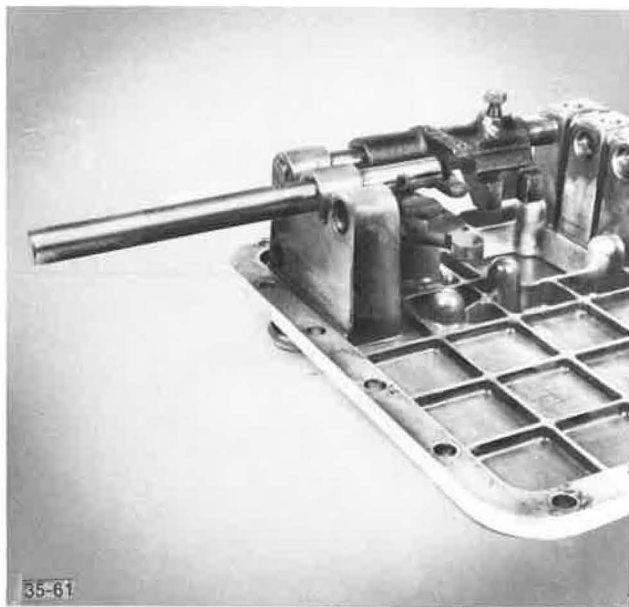
Removing Second/Third Shift Fork

17. Remove the setscrew from the fourth/fifth shifter.



Removing Setscrew From Fourth/Fifth Shifter

16. Continue sliding the second/third shift rail forward, and remove it from the shift cover.



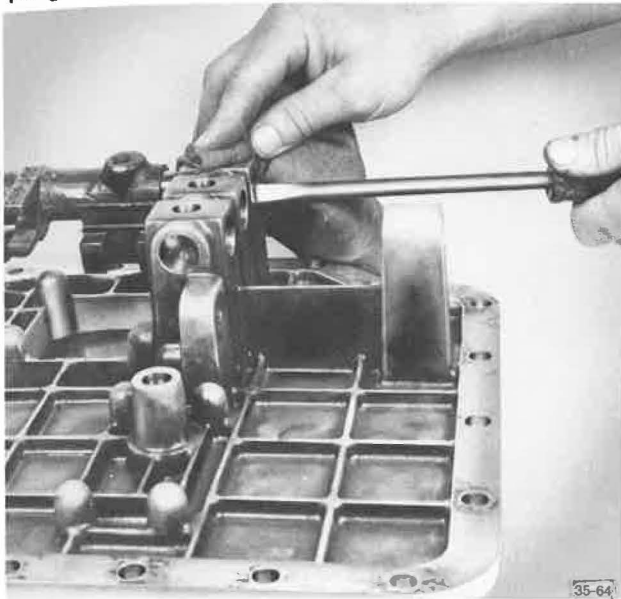
Removing Second/Third Shift Rail

⚠ WARNING

Poppet balls are spring loaded, and could cause injury when they are released.

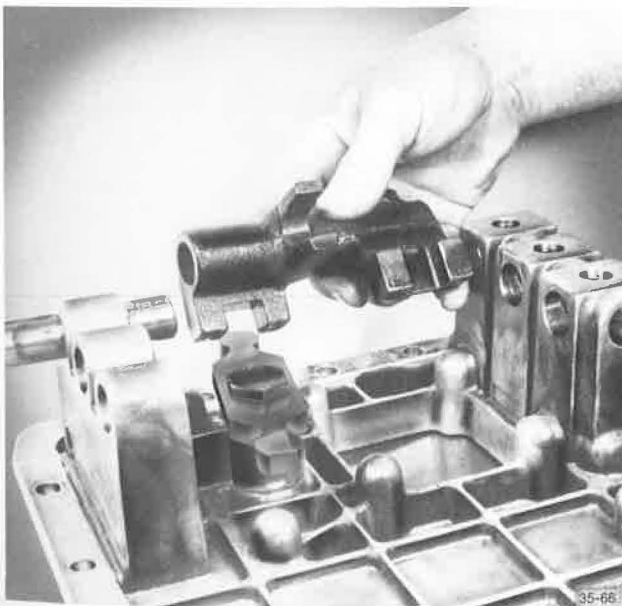
MAIN SHIFT COVER DISASSEMBLY

18. Push the fourth/fifth shift rail forward, using a metal bar, while holding a shop rag over the top opening as shown. The rag will prevent the spring and ball, that are under the rail, from popping out and causing injury or becoming lost.



Pushing Fourth/Fifth Rail Forward

19. Continue sliding the fourth/fifth shift rail forward out of the shift cover. At the same time, remove the fourth/fifth shifter.

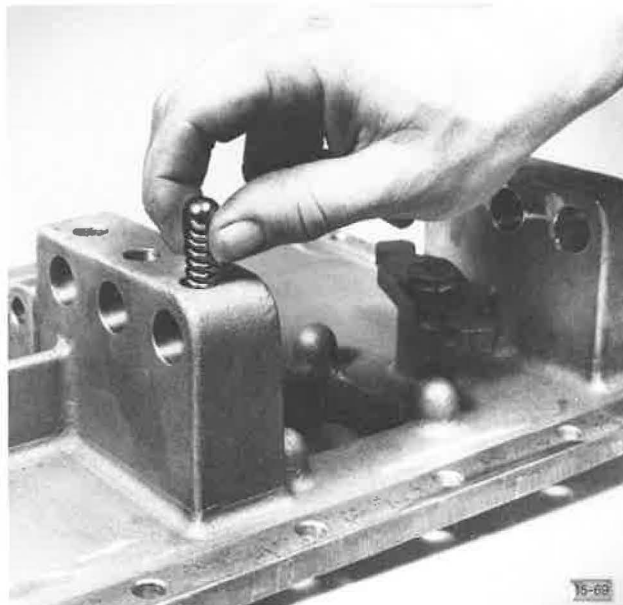


Removing Fourth/Fifth Shifter

20. Remove the poppet ball and spring from under the fourth/fifth shift rail.

SERVICE HINT

A magnet is helpful in removing the poppet ball and spring.



Removing Poppet Ball And Spring

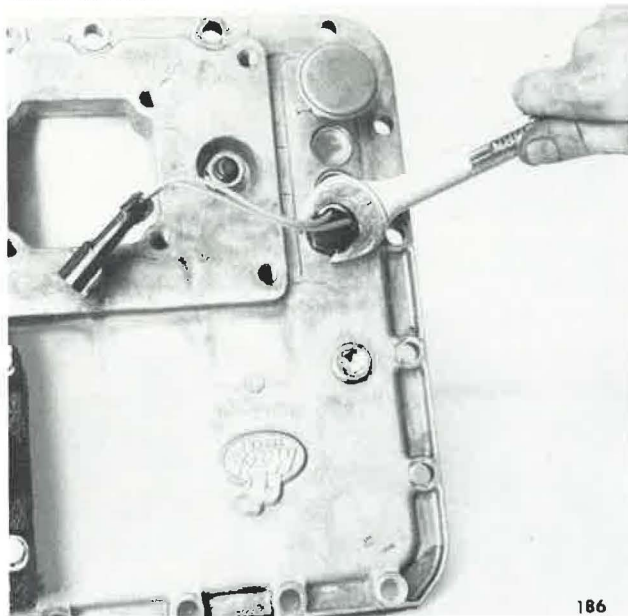
21. Remove the poppet ball and spring, and the interlock plunger and spring, from the first/reverse shifter.



Disassembly Of First/Reverse Shifter

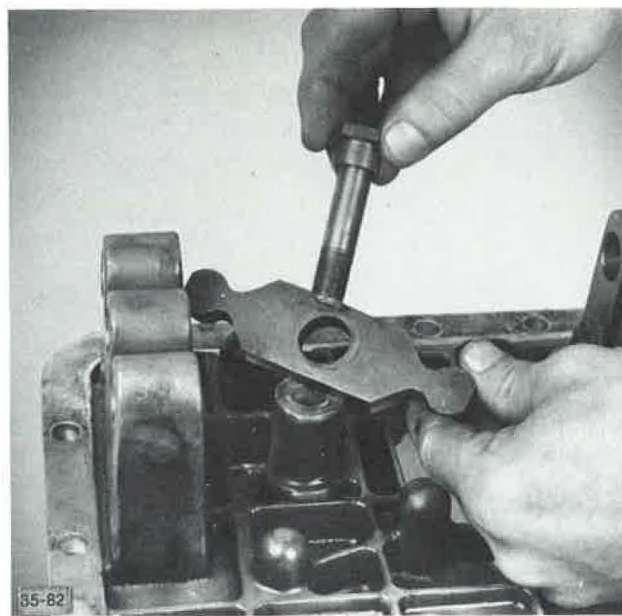
MAIN SHIFT COVER DISASSEMBLY

22. Remove the reverse light switch from the shift cover.



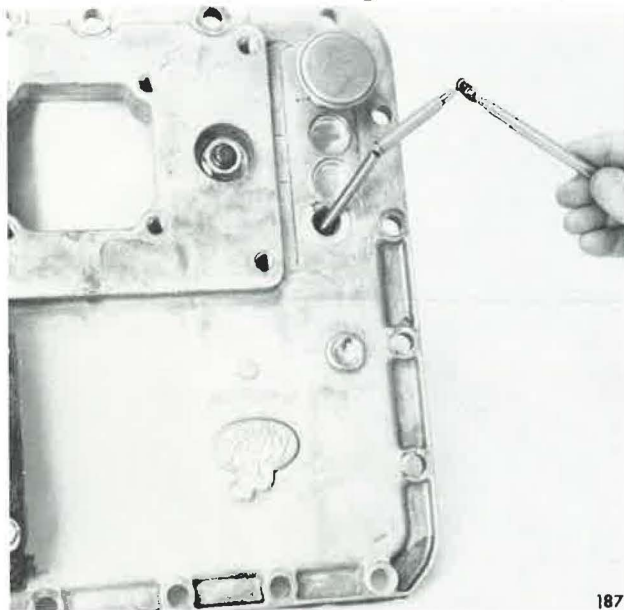
Removing Reverse Light Switch

24. Remove the rocker pivot pin and rocker arm.



Removing Rocker Pivot Pin And Rocker Arm

23. Remove the reverse light switch rod.



Removing Reverse Light Switch Rod

25. Remove the shift cover breather.



Removing Breather Vent

AIR SHIFT CYLINDER DISASSEMBLY

AIR SHIFT CYLINDER DISASSEMBLY

1. Slide the piston assembly partially out of the shift cylinder.



Piston Assembly Partially Removed

3. Remove the piston from the shift cylinder.



Removing Piston From Cylinder

2. Remove the sleeve from the shift piston.



Removing Sleeve From Piston

4. Remove the O-ring from the rear end of the shift cylinder.



Removing O-Ring From Cylinder

AIR SHIFT CYLINDER DISASSEMBLY

5. Remove the O-ring from the front end of the shift cylinder.



Removing O-Ring From Cylinder

75

7. Remove the O-ring from the middle of the shift piston.



Removing O-Ring From Middle Of Piston

77

6. Remove the O-ring from the end of the shift piston.



Removing O-Ring From Rear Of Piston

76

8. Remove the O-ring from the piston shift rail.



Removing O-Ring From Piston Shift Rail

172

AIR SHIFT CYLINDER DISASSEMBLY

9. Remove the O-ring from the shift sleeve.



Removing O-Ring From Sleeve

10. The breather vent, shown installed (#2) and removed (#1) in the photo below, should be cleaned and checked that air can flow through it freely. Replace if needed.



Shift Cylinder Breather Vent

FRONT MAINSHAFT DISASSEMBLY

FRONT MAINSHAFT DISASSEMBLY

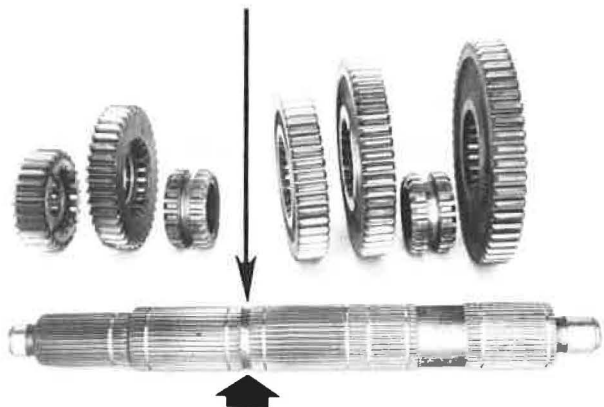
1. Remove the snap ring that was temporarily installed to hold the reverse gear forward during removal from the main case.



108

Removing Snap Ring Behind Reverse Gear

2. The splines on the mainshaft are usually not aligned for the whole length of the shaft. As a result, the parts to the left of the arrows will come off the front of the shaft (left side in the photo), and the parts to the right of the arrows will come off the rear of the shaft (right side in the photo).



148

View Of Mainshaft And Gears

3. Remove the reverse gear from the shaft.



109

Removing Reverse Gear From Mainshaft

4. Remove the first/reverse sliding clutch from the mainshaft.

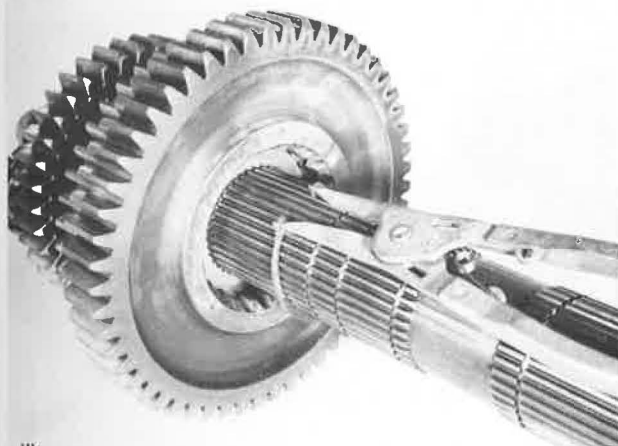


110

Removing First/Reverse Sliding Clutch

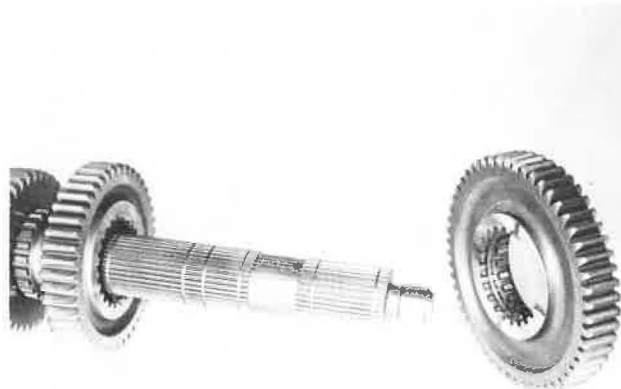
FRONT MAINSHAFT DISASSEMBLY

5. Remove the mainshaft snap ring from underneath the first speed gear.



111
Removing Mainshaft Snap Ring From Inside First Speed Gear

7. Remove the first speed gear from the mainshaft.



113
Removing First Speed Gear

6. Remove the internal tooth and the external tooth thrust washers from inside the first speed gear.



112
Removing Internal And External Tooth Thrust Washers

8. Remove the snap ring from inside the first speed gear.



114
Removing Snap Ring From First Speed Gear

FRONT MAINSHAFT DISASSEMBLY

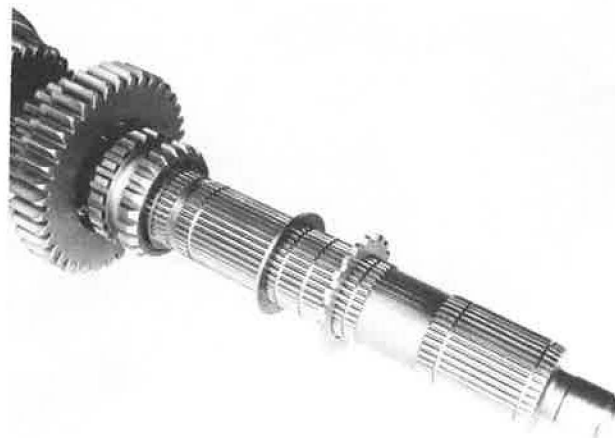
9. Remove the second speed gear from the mainshaft.



115

Removing Second Speed Gear

11. Remove the second speed gear external tooth and internal tooth thrust washers from the mainshaft.



117

Removing External And Internal Tooth Thrust Washers

10. Remove the snap ring from inside the second speed gear.



116

Removing Snap Ring From Second Speed Gear

12. Remove the mainshaft snap ring from inside the fifth speed gear.



118

Removing Mainshaft Snap Ring From Inside Fifth Speed Gear

FRONT MAINSHAFT DISASSEMBLY

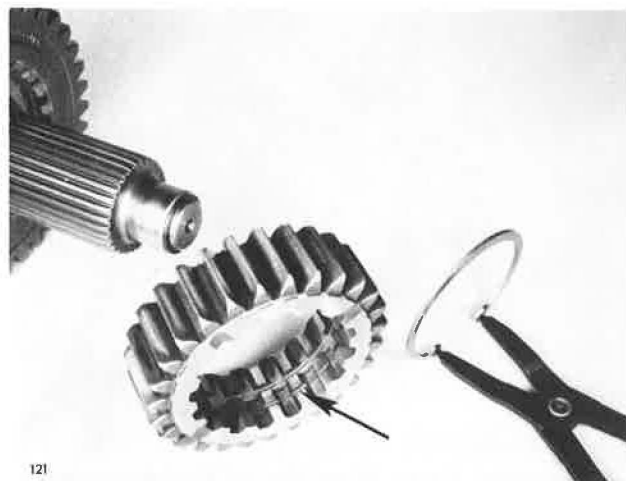
13. Remove the fifth speed gear internal tooth and external tooth thrust washers from the mainshaft.



119

Removing Internal And External Tooth Thrust Washers

15. Remove the snap ring from inside the fifth speed gear.



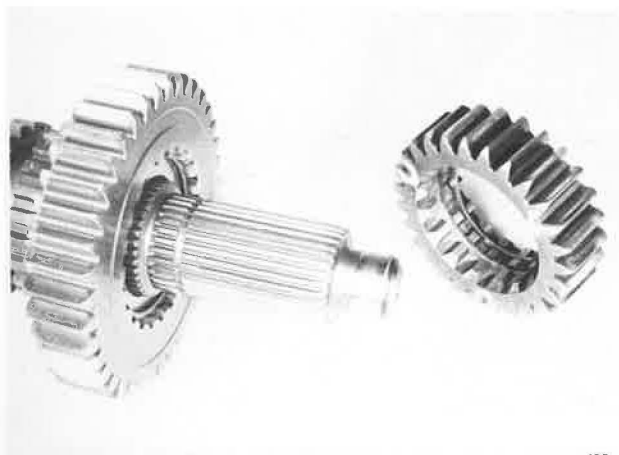
121

Removing Snap Ring From Inside Fifth Speed Gear

14. Remove the fifth speed gear from the mainshaft.

NOTE

Note that the clutch teeth in this gear face forward (right in photo).



120

Removing Fifth Speed Gear

16. Remove the third speed gear from the mainshaft.



122

Removing Third Speed Gear

FRONT MAINSHAFT DISASSEMBLY

17. Remove the snap ring from inside the third speed gear.



123
Removing Snap Ring From Third Speed Gear

19. Remove the mainshaft third speed gear snap ring.



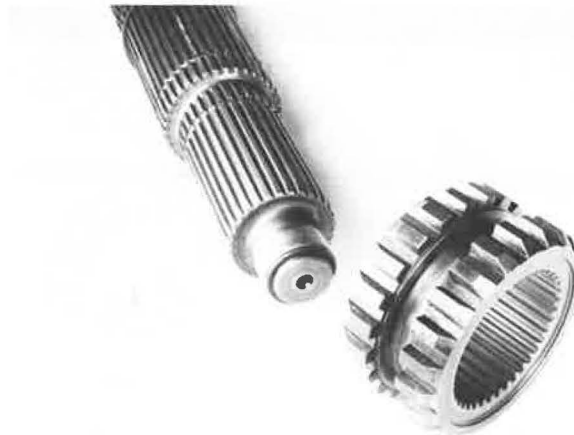
125
Removing Mainshaft Third Speed Gear Snap Ring

18. Remove the third speed gear external tooth and internal tooth thrust washers from the mainshaft.



124
Removing External And Internal Tooth Thrust Washers

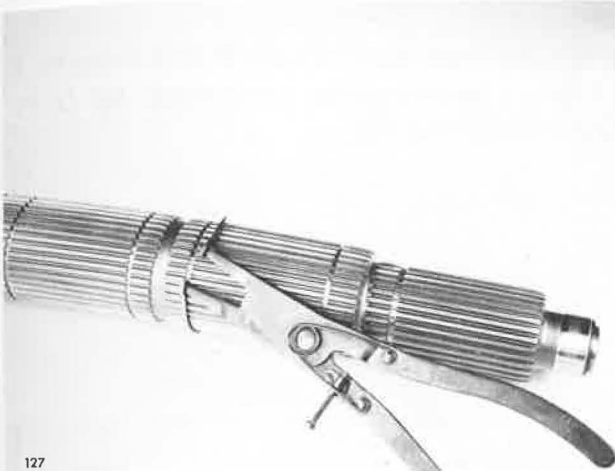
20. Remove the second/third speed gear sliding clutch from the mainshaft.



126
Removing Second/Third Speed Sliding Clutch

FRONT MAINSHAFT DISASSEMBLY

21. Remove the mainshaft second speed gear snap ring from the mainshaft.



Removing Mainshaft Second Speed Gear Snap Ring

22. Remove the mainshaft front bearing race retaining snap ring.



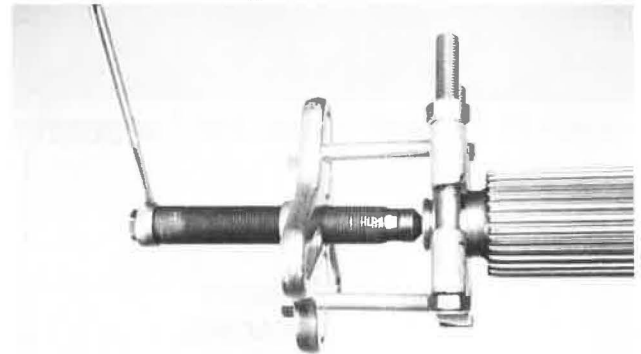
Removing Front Bearing Race Snap Ring

23. Remove the mainshaft rear bearing race retaining snap ring.



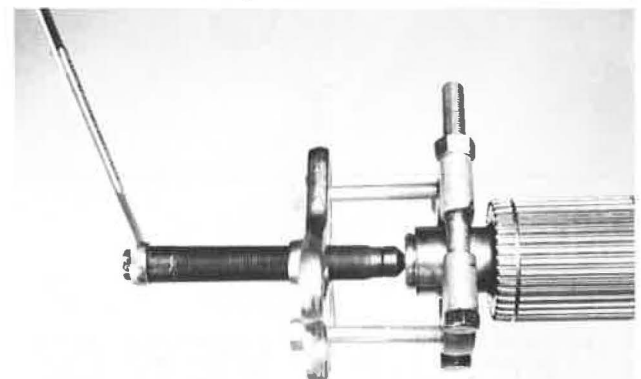
Removing Rear Bearing Race Snap Ring

24. Using a bearing puller, remove the mainshaft front bearing race.



Removing Mainshaft Front Bearing Race

25. Using a bearing puller, remove the mainshaft rear bearing race.



Removing Mainshaft Rear Bearing Race

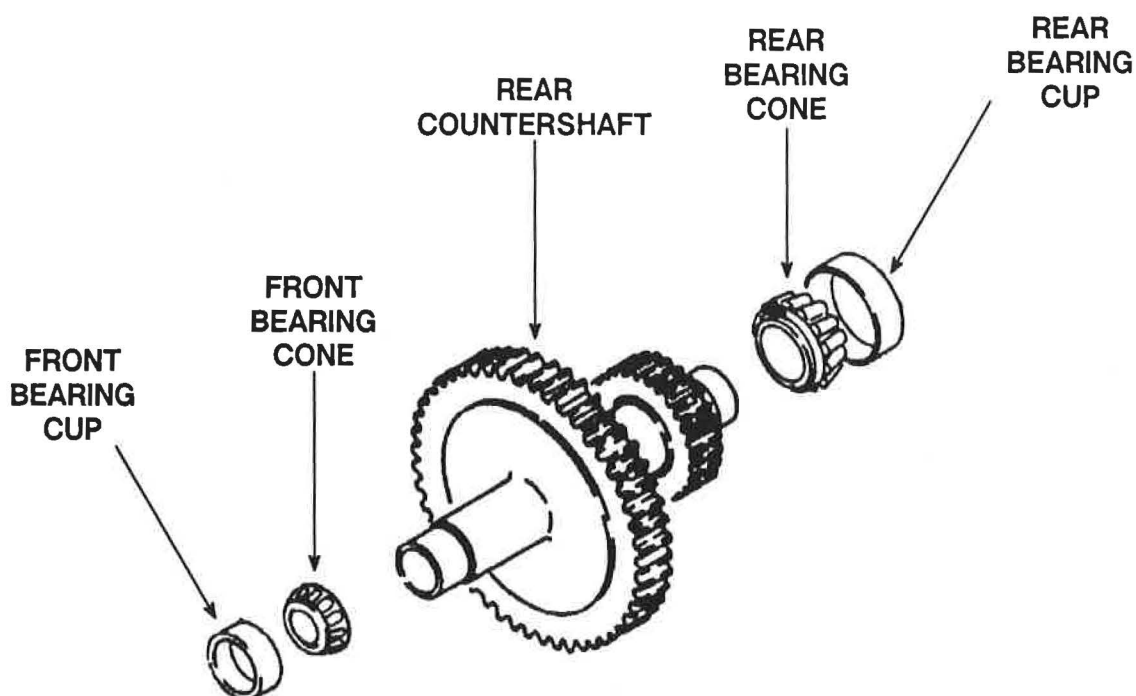
REAR COUNTERSHAFT DISASSEMBLY

REAR COUNTERSHAFT DISASSEMBLY

1. Because the rear countershaft in the T2070A is one piece (shaft and gears), the only disassembly possible is to remove the bearings.

2. Using a bearing puller, remove the rear countershaft front bearing.

3. Using a bearing puller, remove the rear countershaft rear bearing.



EXPLODED VIEW OF REAR COUNTERSHAFT

FRONT COUNTERSHAFT DISASSEMBLY

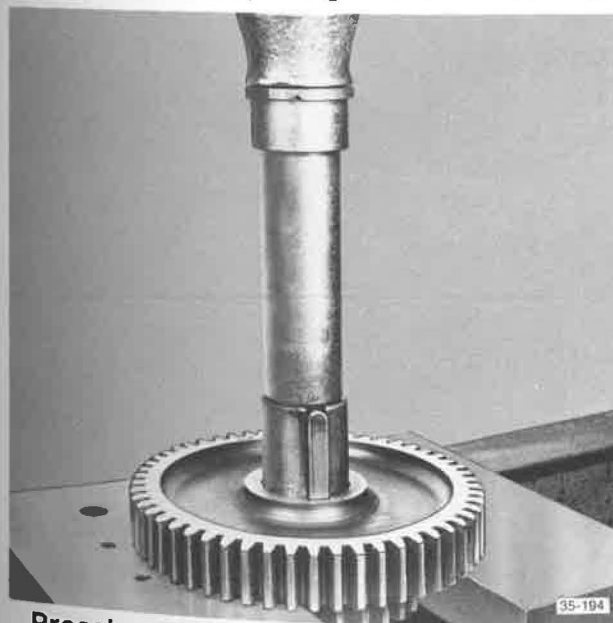
FRONT COUNTERSHAFT DISASSEMBLY

1. Press the front countershaft main drive gear off of the shaft.



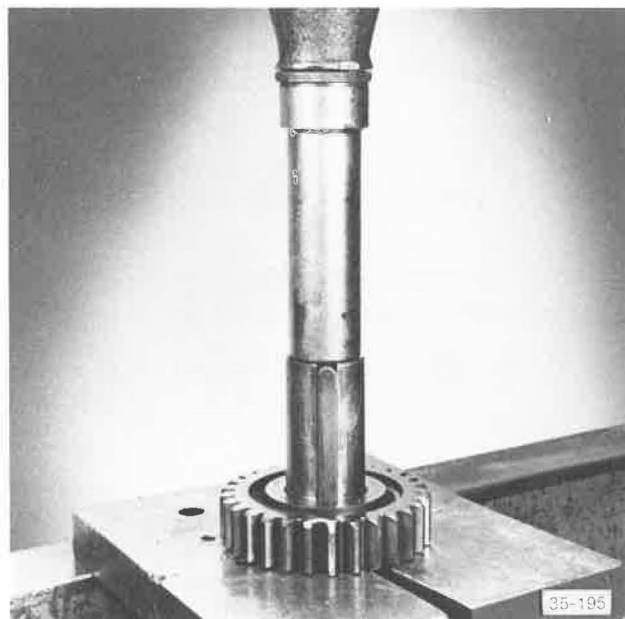
Pressing Main Drive Gear Off Of Shaft

2. Press the fifth speed gear off of the shaft.



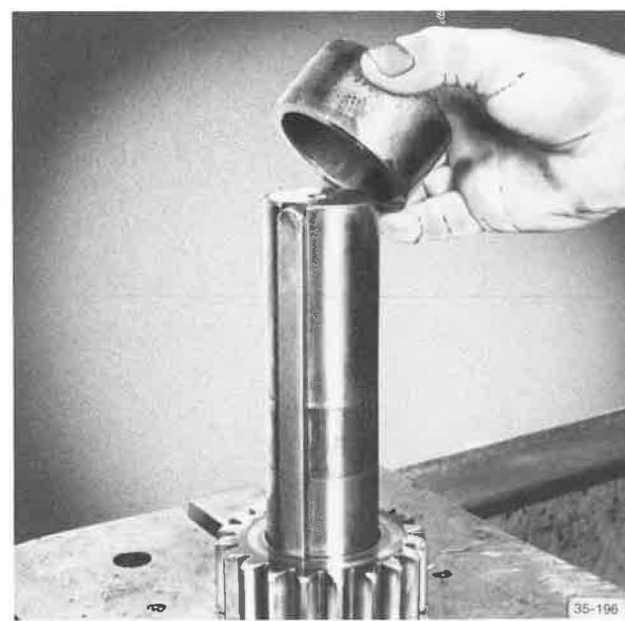
Pressing Fifth Speed Gear Off Of Shaft

3. Press the front countershaft third speed gear off of the shaft.



Pressing Third Speed Gear Off Of Shaft

4. Remove the spacer between the third and second speed gears from the shaft.



Removing Spacer

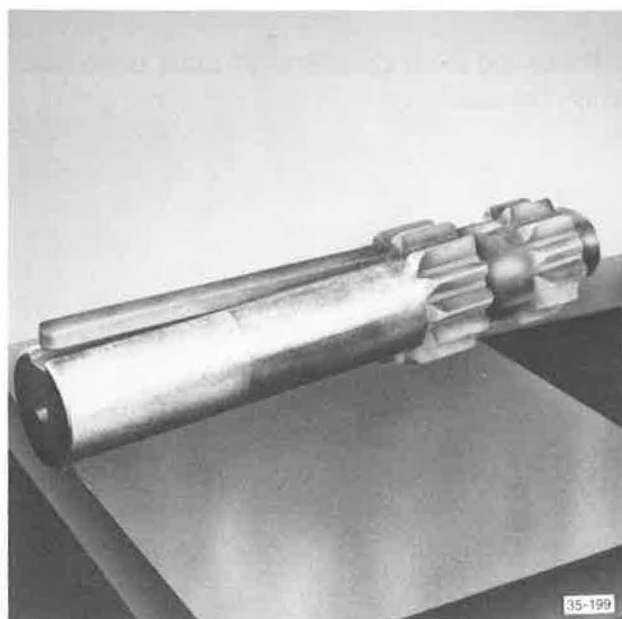
FRONT COUNTERSHAFT DISASSEMBLY

5. Press off the second speed gear from the shaft.



Pressing Second Speed Gear Off Of Shaft

7. Remove the key from the keyway of the front countershaft.



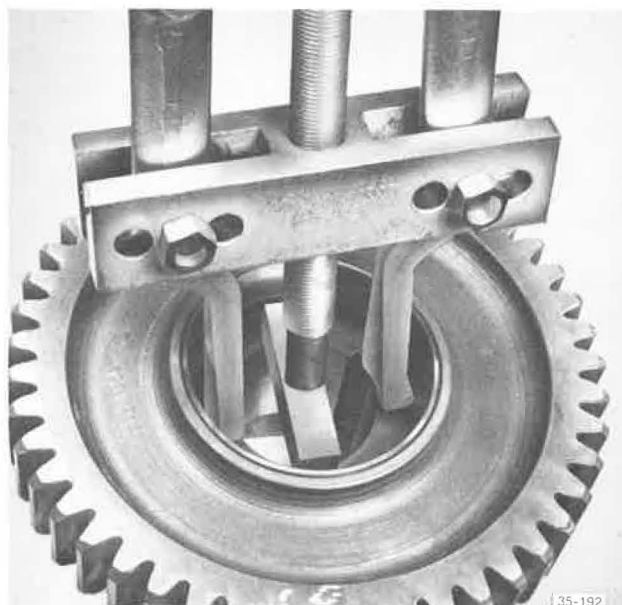
Removing Key

6. Press the bearing off of the rear end of the shaft.



Pressing Off Rear Bearing

8. Remove the bearing race from inside the front countershaft main drive gear, using an appropriate puller.

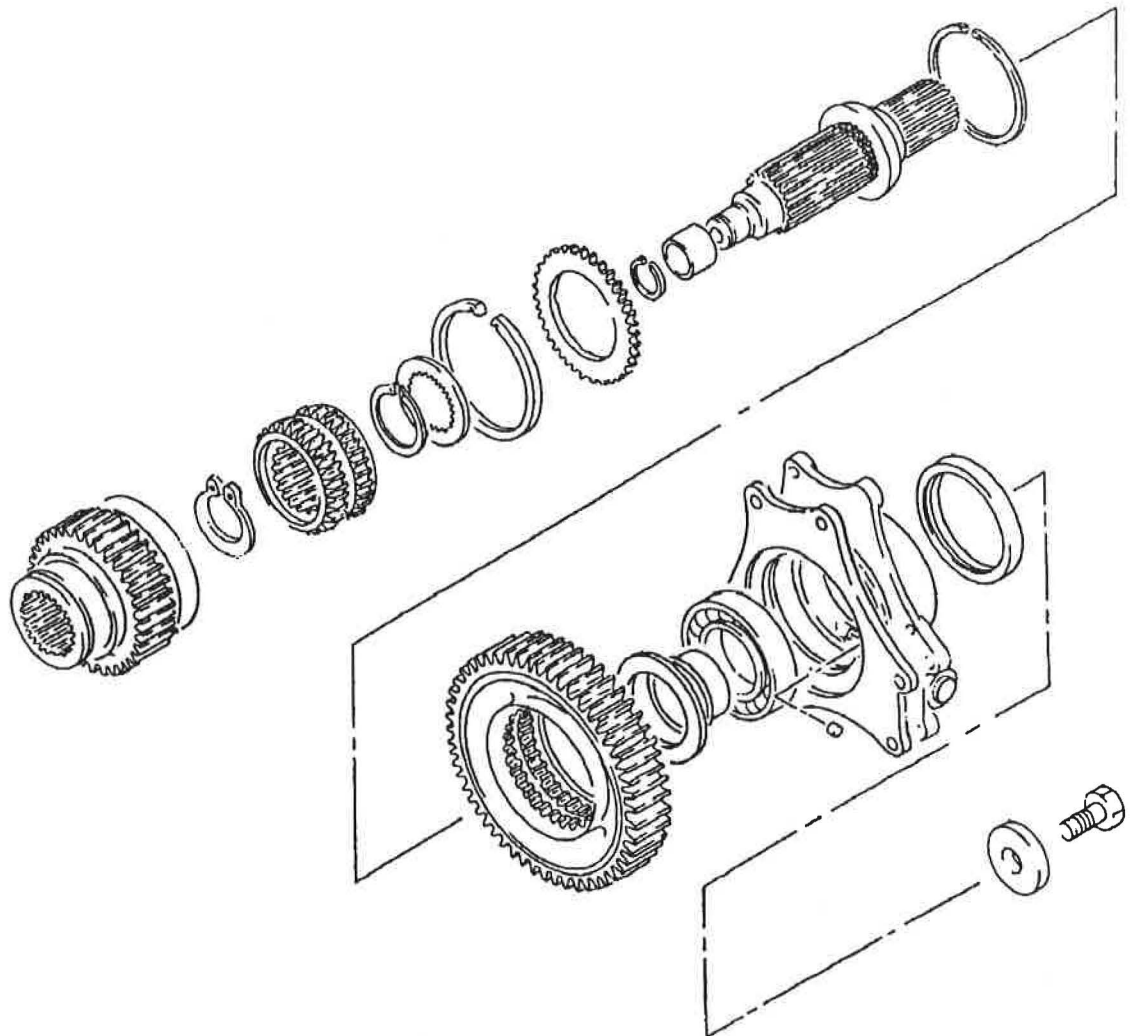


Removing Bearing Race

REAR MAINSHAFT DISASSEMBLY

REAR MAINSHAFT DISASSEMBLY

1. Remove the rear compound sliding clutch from the rear mainshaft.
2. Remove the snap ring from the mainshaft, inside the lo-range gear.
3. Remove the internal tooth thrust washer from the mainshaft.
4. Remove the external tooth thrust washer from the mainshaft.
5. Remove the lo-range gear from the mainshaft.
6. Remove the snap ring from inside the lo-range gear.
7. Remove the spacer from the rear mainshaft.
8. Remove the snap ring holding in the needle bearing at the front of the rear mainshaft.
9. Remove the needle bearing from the front of the rear mainshaft.
10. Press the bearing off of the rear of the rear mainshaft.



MAIN DRIVE PINION DISASSEMBLY

MAIN DRIVE PINION DISASSEMBLY

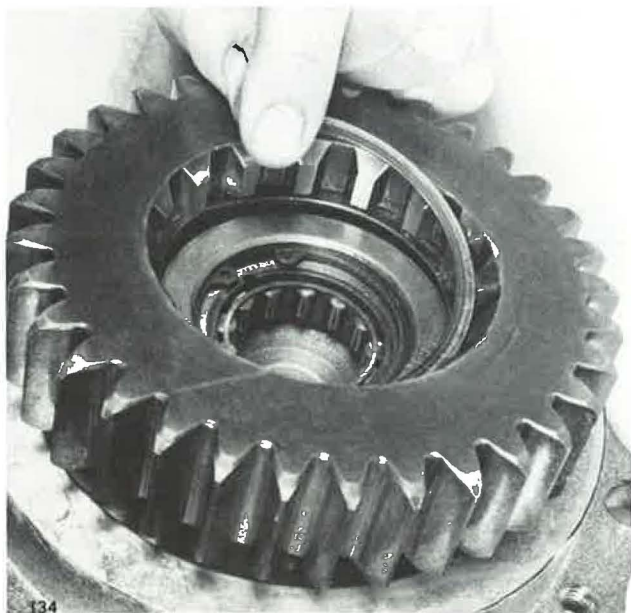
1. Remove the gasket from the main drive pinion assembly.



149

Removing Gasket From Main Drive Pinion Assembly

2. Remove the spiral snap ring that holds the main drive pinion gear onto the main drive pinion shaft.



134

Removing Spiral Snap Ring

3. Remove the main drive pinion gear from the main drive pinion shaft.



135

Removing Main Drive Pinion Gear From Shaft

⚠ WARNING

The large snap ring is very difficult to compress and remove, and may fly off the snap ring pliers, causing injury.

4. Remove the large retaining snap ring from inside the cover.



136

Removing Snap Ring From Cover

5. Press the main drive pinion shaft and bearing out of the cover.

MAIN DRIVE PINION DISASSEMBLY

6. Remove the oil seal from the front of the main drive pinion cover.



Removing Oil Seal From Cover

8. Press the main drive pinion bearing off of the shaft.



Pressing Bearing Off Of Shaft

7. Remove the spiral snap ring that holds on the main drive pinion bearing.



Removing Spiral Snap Ring

9. Remove the snap ring that holds the spigot bearing in place.



Removing Spigot Bearing Snap Ring

MAIN DRIVE PINION DISASSEMBLY

10. Using a bearing puller, remove the spigot bearing from the main drive pinion shaft.



Removing Spigot Bearing

MAINSHAFT REAR COVER DISASSEMBLY

REAR MAINSHAFT REAR BEARING COVER DISASSEMBLY

NOTE

The oil slinger built into the bearing shown in these photos is not used in the T2070A transmission.

1. Remove the gasket from the bearing cover.



170

Removing Gasket From Bearing Cover

⚠ WARNING

The large snap ring is very difficult to compress and remove, and may fly off the snap ring pliers, causing injury,

2. Remove the bearing retaining snap ring from the cover.



169

Removing Bearing Retaining Snap Ring

3. Press the bearing from inside the cover.



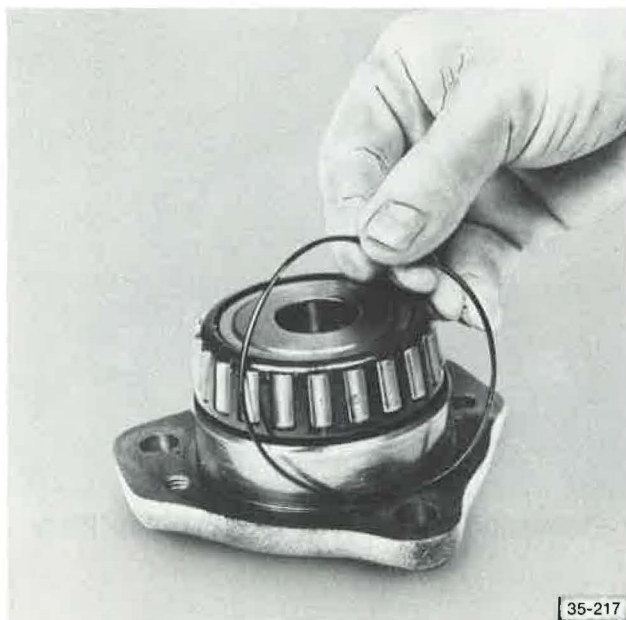
167

Pressing Bearing From Cover

FRT. C'SHAFT FRT. COVER DISASSEMBLY

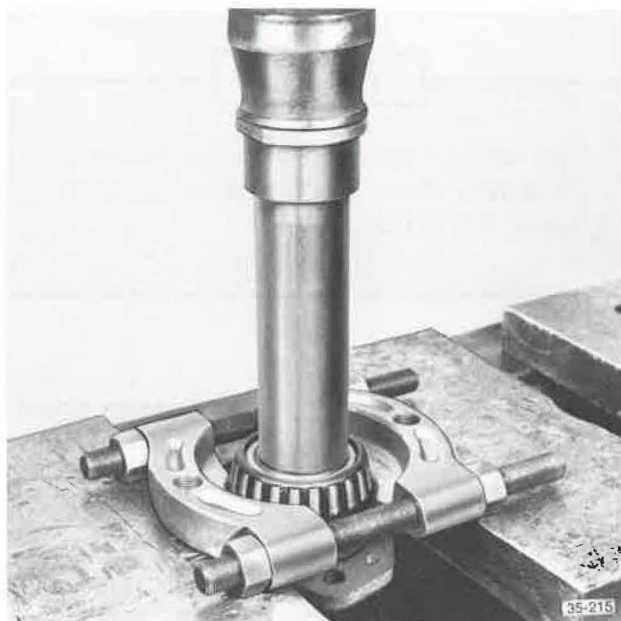
FRONT COUNTERSHAFT FRONT BEARING COVER DISASSEMBLY

1. Remove the large O-ring from the front countershaft front bearing cover.



Removing O-Ring From Front Cover

2. Press the bearing off of the front bearing cover.



Pressing Bearing Off Of Cover

FRT. C'SHAFT REAR COVER DISASSEMBLY

FRONT COUNTERSHAFT REAR BEARING COVER DISASSEMBLY

1. Remove the front bearing race from the bearing cover.



Removing Front Bearing Race

2. Remove the rear bearing race from the bearing cover.



Removing Rear Bearing Race

REAR C'SHAFT REAR COVER DISASSEMBLY

REAR COUNTERSHAFT REAR BEARING COVER DISASSEMBLY

1. Remove the O-ring from the rear countershaft rear bearing cover.



Removing O-Ring From Cover

174

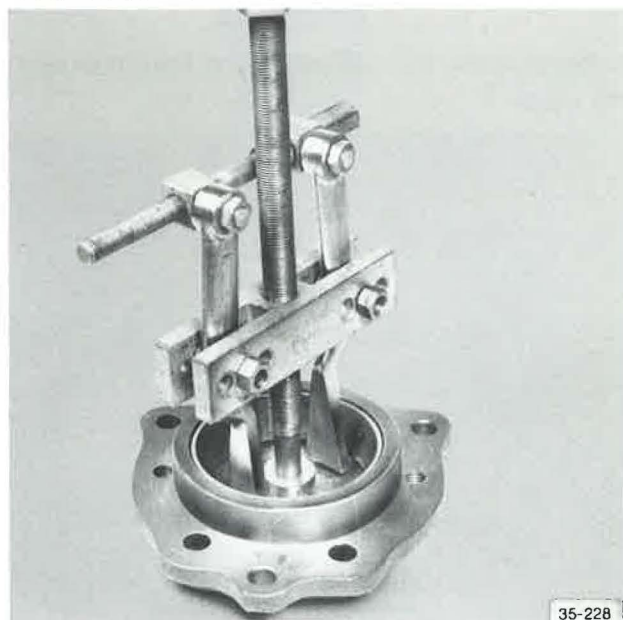
2. Remove the shim pack from the rear countershaft rear bearing cover.



Removing Shim Pack From Cover

173

3. Using a bearing puller, remove the bearing outer race from the cover.



Removing Bearing Outer Race

REVERSE IDLER GEAR DISASSEMBLY

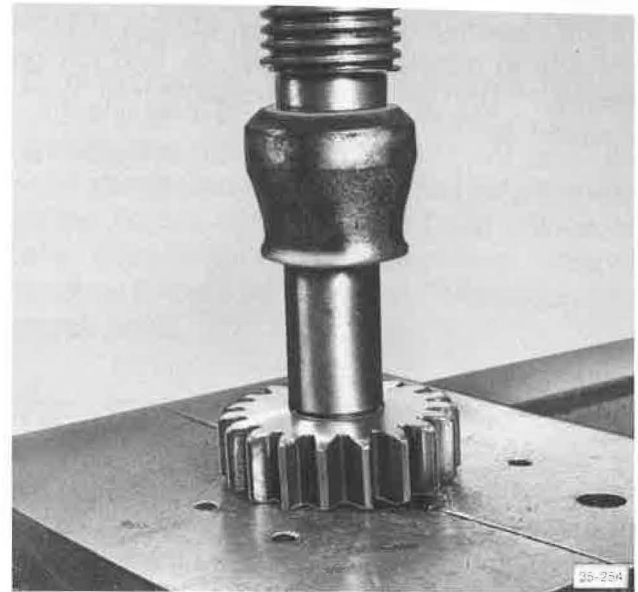
REVERSE IDLER GEAR DISASSEMBLY

1. Using a sharp pointed punch, drive a hole in the expansion plug and remove it.



Removing Expansion Plug

2. Using a driver of suitable size, press the reverse idler bearing out of the reverse idler gear.



Pressing Bearing Out Of Reverse Idler
Gear

INSPECTION AND CLEANING

INSPECTION AND CLEANING

Clean the case, covers, and all the other parts of the transmission thoroughly, using a suitable solvent, to remove all grease, oil, and foreign matter. Dry parts with moisture-free compressed air.

BEARINGS

Soak bearings in fresh, clean solvent to loosen all hardened grease and foreign matter, until the bearings are clean, and then blow them dry with filtered, moisture-free compressed air.

CAUTION

Do not spin the bearings with compressed air, because damage to the bearings may occur.

Inspect bearings for flaking, cracks, fractures, cavities, indentations, measurable wear, brinelling, fretting, corrosion, nicking, and cage failures. If any of these conditions are present, the bearing should be replaced.

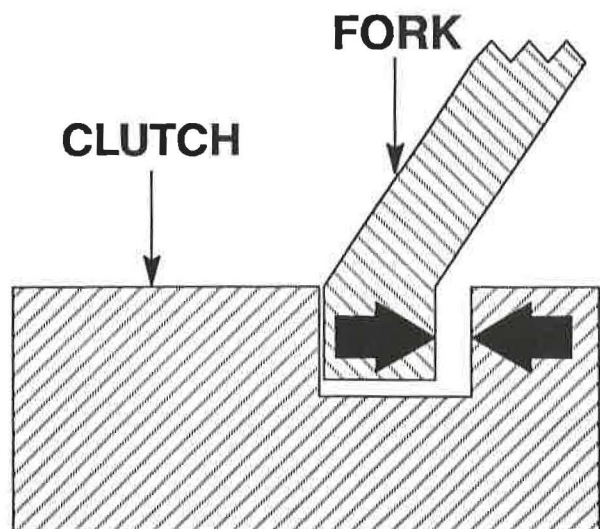
Apply a light coat of clean, fresh gear oil (GO-H) to the bearings. Turn the races slowly by hand, to be sure they move freely and smoothly. If they do not, replace the bearings.

GEARS

Replace the gears if the teeth show any signs of abrasive wear, scratching (except for normal manufacturing tool marks), ridging, scoring, surface fatigue, pitting, spalling, corrosive wear, digging in, or cracking. Gears should also be inspected by Magnaflux or a similar system for cracks which would not otherwise be detected.

SHIFTER FORKS, SLIDING CLUTCHES, AND SHIFT RAILS

Replace forks and/or clutches if side clearance between the fork and the groove in the sliding clutch is in excess of the specified limits, as shown in the Torque and Tolerance Table.



CLUTCH FORK CLEARANCE

INSPECTION AND CLEANING

Replace shift rails if they are cracked in either the poppet or setscrew holes. In the case of wear, if the clearance between the shift rail and the mating housing bore exceeds 0.010 inch maximum, check to determine which member is worn before replacing. Shaft wear may be checked by measuring shaft diameter at a point on the rail that is not subject to wear, as compared to the wear area.

OIL SEALS

When an overhaul is required, replace all the oil seals. Care must be taken to be sure that the sealing surface of the seal is not damaged, turned back, or cut. A nick on the shaft surface may cut the seal. Remove sharp edges that could damage the seal (chamfer edges if possible). Press seals into their housings with smooth, uniform pressure, to prevent cocking the seal.

Be careful when using any abrasive polishing methods such as emery or crocus cloth on a sealing surface. It is possible for you to leave almost invisible grooves on the surface, which could conduct the lubricating oil out past the sealing lip(s) of the oil seal. If this happens, a new seal will not stop the leak.

Be careful when installing a shaft through a new seal (or a new seal over a shaft). The shaft should be lubricated before inserting through a seal. Splines, keyways, and holes in a shaft can damage seals unless care is taken. The sealing surfaces of seals should be manually lubricated to provide lubrication during the "start-up" period before normal lubrication occurs. Be careful that anti-seize and sealing compounds used in reassembly are kept away from the sealing surfaces.

If an oil seal does not have a pre-applied sealant on its outer diameter, install an appropriate sealer around the outside diameter to prevent leaks.

GENERAL INSPECTION

Replace cases found to be cracked. Check all other parts for wear and damage. Replace all parts as required. Replace all gaskets, O-rings, and any part that shows mutilation. Test all springs and replace any that do not meet the load specification at the specified height. Refer to the Torque and Tolerance Table. Clean up any threads that show mutilation. Repair stripped threads by using Heli-Coil or equivalent repair parts.

GENERAL INSTRUCTIONS FOR REASSEMBLY

Refer to the Torque and Tolerance Table for fits and limits.

As moving parts are assembled, check frequently to be sure that they move freely.

When pressing parts together, always oil the surfaces being pressed.

LUBRICATION DURING REASSEMBLY

All working metal parts, especially the bearings, should be coated with gear oil while the transmission is being reassembled. This will insure immediate lubrication when first starting, and will prevent seizing of these parts due to running without lubrication at start-up.

INSTALLING BEARINGS

When installing bearings, use proper bearing drivers. When pressing a bearing onto a shaft, apply force only to the bearing inner race. When pressing a bearing into a housing, apply force only to the bearing outer race. Do not apply force which is transmitted through the balls or rollers, because bearing damage can result (even though not evident at the time) which will cause premature bearing failure. Apply pressure evenly to prevent cocking the bearing.

REVERSE IDLER GEAR REASSEMBLY

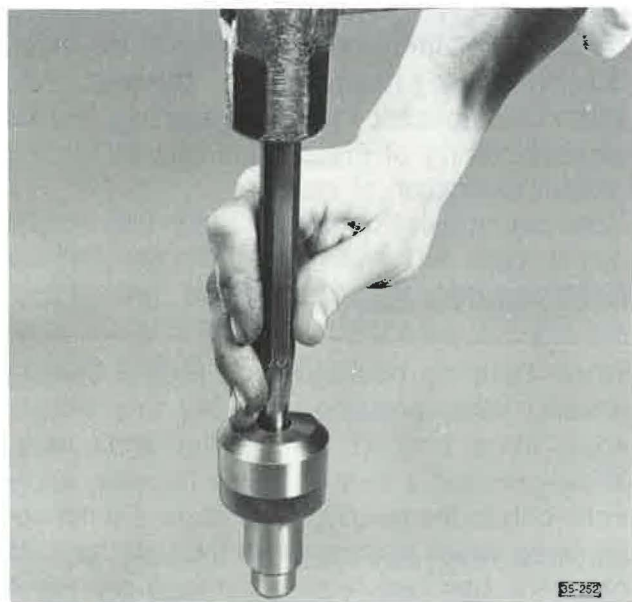
REASSEMBLY

REVERSE IDLER GEAR REASSEMBLY

NOTE

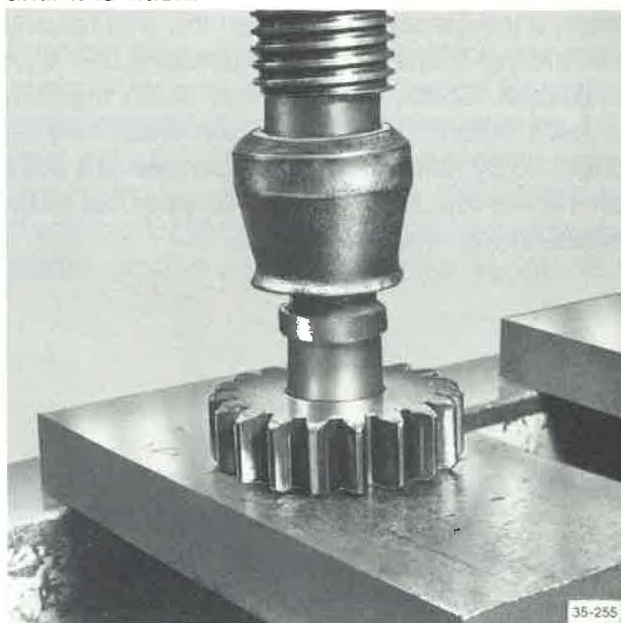
Remember to apply oil to the surfaces before pressing parts together.

1. Install the expansion plug into the reverse idler shaft, rounded side up. Seat it by driving it downward with a driver. The driver should be solid (not tubular), cylindrical in shape, with an end diameter the same as the expansion plug, and a flat (not rounded) end.



Seating Expansion Plug In Reverse Idler Shaft

2. Press the bearing into the reverse idler gear, until it is flush.



Pressing Bearing Into Reverse Idler Gear

REAR C'SHAFT REAR COVER REASSEMBLY

REAR COUNTERSHAFT REAR BEARING COVER REASSEMBLY

NOTE

Remember to apply oil to the surfaces before pressing parts together.

1. Using a properly sized driver, press the bearing outer race into the cover.



Pressing Outer Race Into Cover

NOTE

Be sure that the shim pack is installed first, followed by the O-ring last, or proper sealing will not occur, and leaks may develop.

2. Install the shim pack onto the cover.



Installing Shim Pack Onto Cover

173

3. Install the O-ring onto the cover.



Installing O-Ring Onto Cover

174

FRT. C'SHAFT REAR COVER REASSEMBLY

FRONT COUNTERSHAFT REAR BEARING COVER REASSEMBLY

NOTE

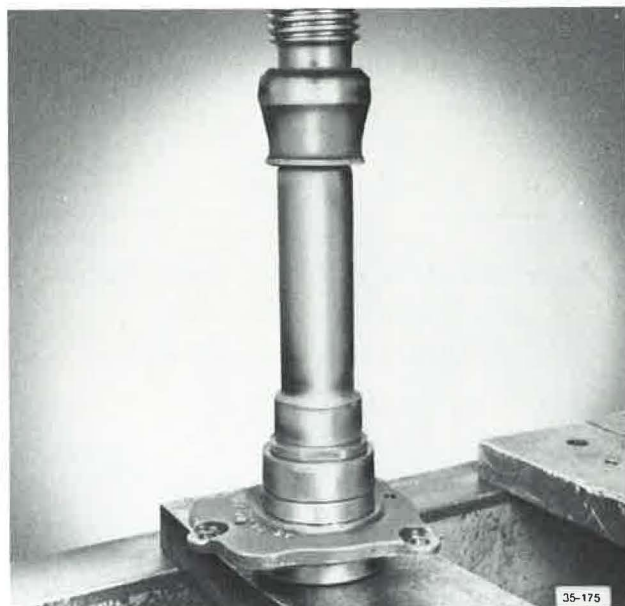
Remember to apply oil to the surfaces before pressing parts together.

1. Using a suitably sized driver, press the front bearing outer race into the bearing cover.



Pressing Front Bearing Outer Race Into Cover

2. Using a suitably sized driver, press the rear bearing outer race into the bearing cover.



Pressing Rear Bearing Outer Race Into Cover

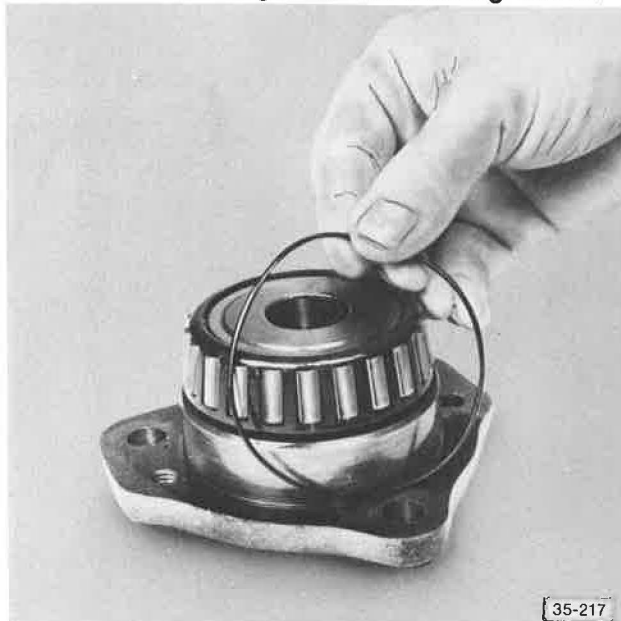
FRT. C'SHAFT FRT. COVER REASSEMBLY

FRONT COUNTERSHAFT FRONT BEARING COVER REASSEMBLY

NOTE

Remember to apply oil to the surfaces before pressing parts together.

2. Install the O-ring onto the bearing cover.



Installing O-Ring Onto Bearing Cover

1. Press the bearing onto the front countershaft front bearing cover, being careful to apply force to the inner race only.

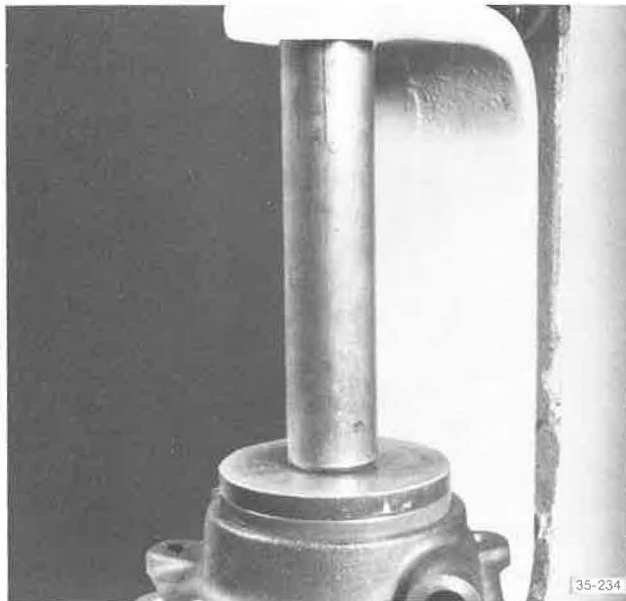


Pressing Bearing Onto Front Cover

MAINSHAFT REAR COVER REASSEMBLY

REAR MAINSHAFT REAR BEARING COVER REASSEMBLY

1. Press the seal into the rear bearing cover.



Pressing Seal Into Cover

NOTE

The oil slinger built into the bearing shown in these photos is not used in the T2070A transmission.

2. Press the bearing into the cover, using a driver that applies force to the outer race only.



Pressing Bearing Into Cover

3. Install the bearing snap ring into the cover.



Installing Snap Ring Into Cover

4. Install the gasket onto the bearing cover.



Installing Gasket Onto Cover

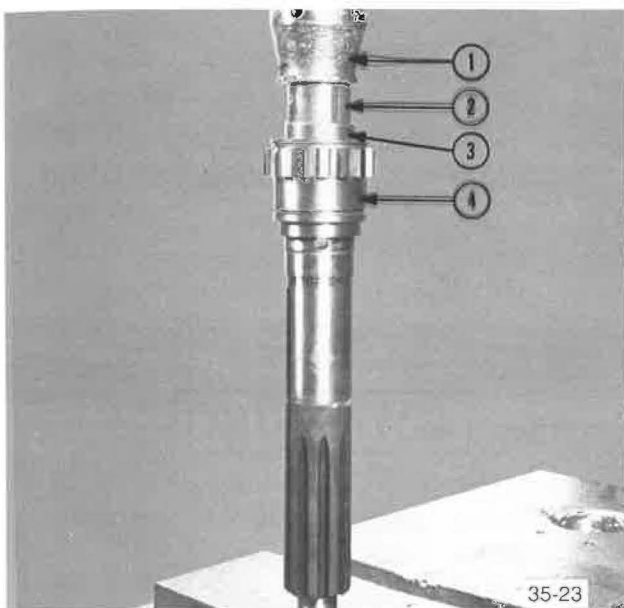
MAIN DRIVE PINION REASSEMBLY

MAIN DRIVE PINION REASSEMBLY

NOTE

Remember to apply oil to the surfaces before pressing parts together.

1. Press the spigot bearing into the end of the main drive pinion shaft.



1.Press 2.Driver 3.Bearing 4.Shaft
Pressing Spigot Bearing Into Main Drive Pinion Shaft

2. Install the bearing retaining snap ring into the end of the shaft.



Installing Snap Ring Into Main Drive Pinion Shaft

3. Press the bearing onto the main drive pinion shaft.



Pressing Bearing Onto Main Drive Pinion Shaft

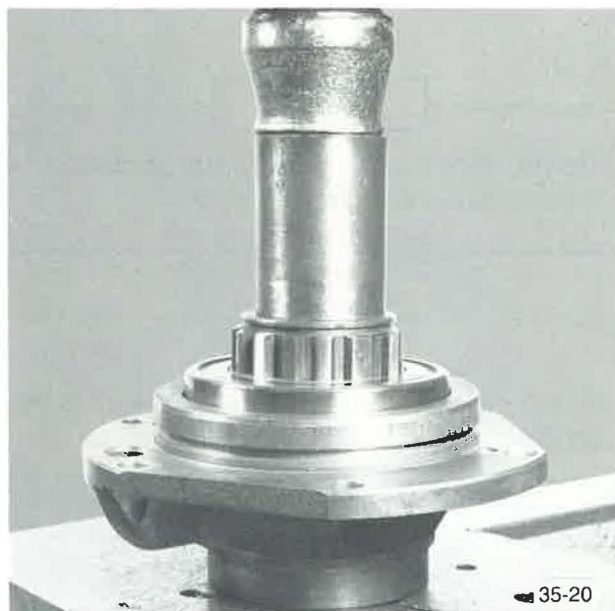
MAIN DRIVE PINION REASSEMBLY

4. Install the spiral snap ring that retains the bearing on the main drive pinion shaft.



Installing Snap Ring Onto Main Drive Pinion Shaft

6. Press the main drive pinion shaft and bearing assembly into the cover.



Pressing Shaft And Bearing Into Cover

5. Install the oil seal into the front of the main drive pinion cover.



Installing Oil Seal Into Cover

WARNING

The large snap ring is very difficult to compress, and may fly off the snap ring pliers, causing injury.

NOTE

One side of the large snap ring is beveled and faces out. The flat side of the snap ring goes against the bearing.

MAIN DRIVE PINION REASSEMBLY

7. Install the large bearing retaining snap ring into the cover.



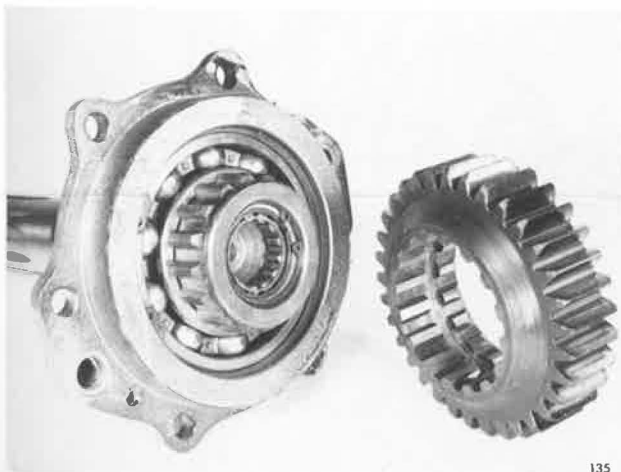
Installing Snap Ring Into Cover

9. Install the spiral snap ring that holds the main drive pinion gear onto the main drive pinion shaft.



Installing Spiral Snap Ring

8. Install the main drive pinion gear onto the main drive pinion shaft.

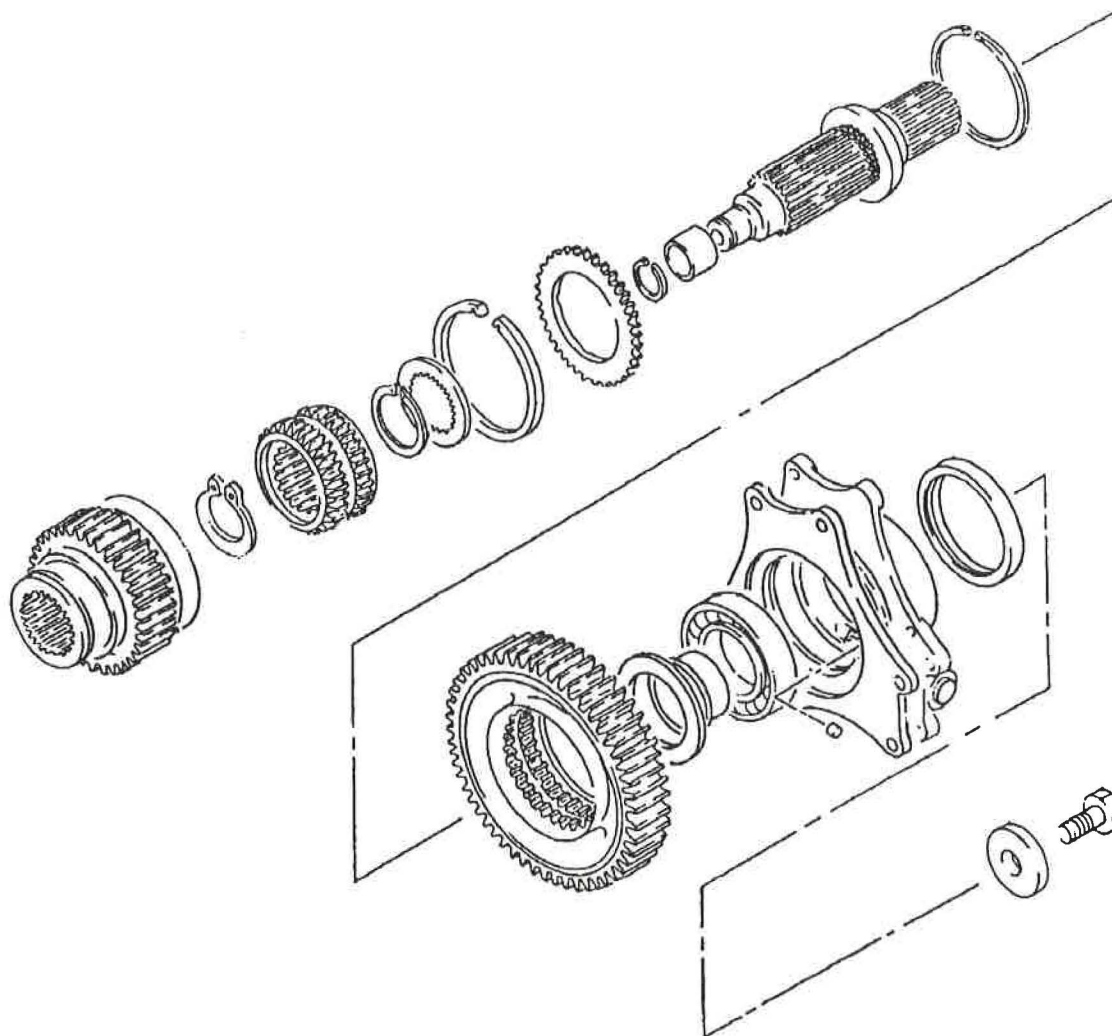


Installing Main Drive Pinion Gear Onto Shaft

REAR MAINSHAFT REASSEMBLY

REAR MAINSHAFT REASSEMBLY

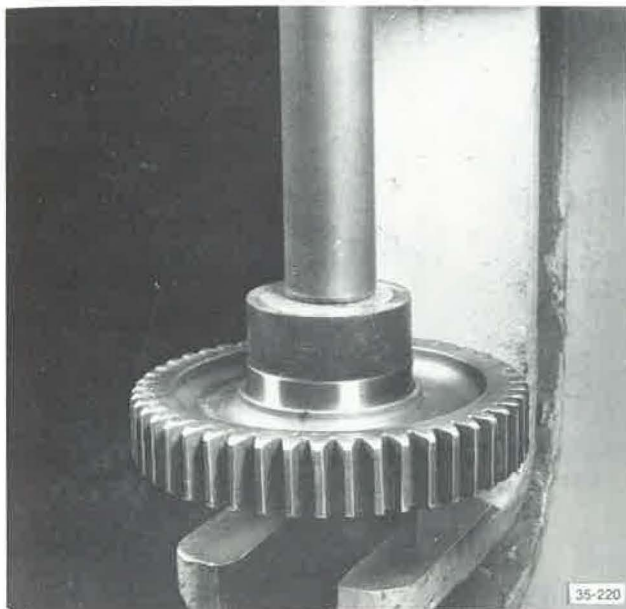
1. Press the bearing onto the rear of the rear mainshaft.
2. Press the needle bearing into the front of the rear mainshaft.
3. Install the snap ring that holds the needle bearing in place at the front of the rear mainshaft.
4. Install the spacer onto the rear mainshaft.
5. Install the snap ring inside the lo-range gear.
6. Install the lo-range gear onto the mainshaft, with the the beveled clutch teeth facing front.
7. Install the external tooth thrust washer onto the mainshaft, and inside the lo-range gear.
8. Install the internal tooth thrust washer onto the mainshaft, and inside the lo-range gear.
9. Install the snap ring onto the mainshaft, and slide it rearward until it is inside the lo-range gear, holding the two thrust washers just installed in place.
10. Install the rear compound sliding clutch onto the rear mainshaft.



FRONT COUNTERSHAFT REASSEMBLY

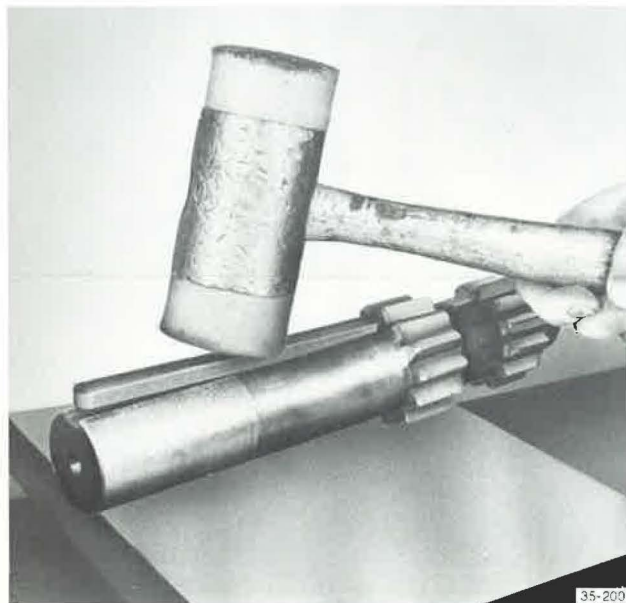
FRONT COUNTERSHAFT REASSEMBLY

1. Press the bearing outer race into the front countershaft main drive gear.



Pressing Race Into Gear

2. Install the key into the keyway of the front countershaft. A soft mallet should be used.



Installing Key Into Keyway

3. Press the bearing onto the rear end of the shaft, being careful to apply force to the inner race only.



Pressing Rear Bearing Onto Shaft

NOTE

Some second speed gears have a recess in one side. This recess must face rearward (up in picture).

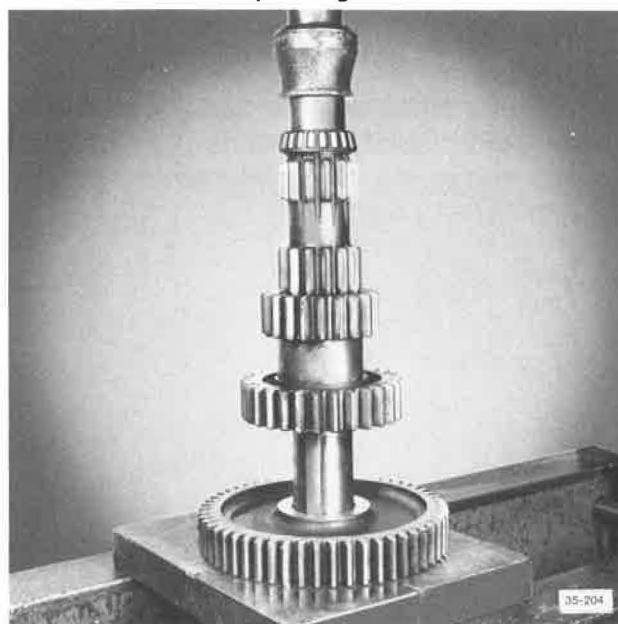
FRONT COUNTERSHAFT REASSEMBLY

4. Press the second speed gear onto the shaft.



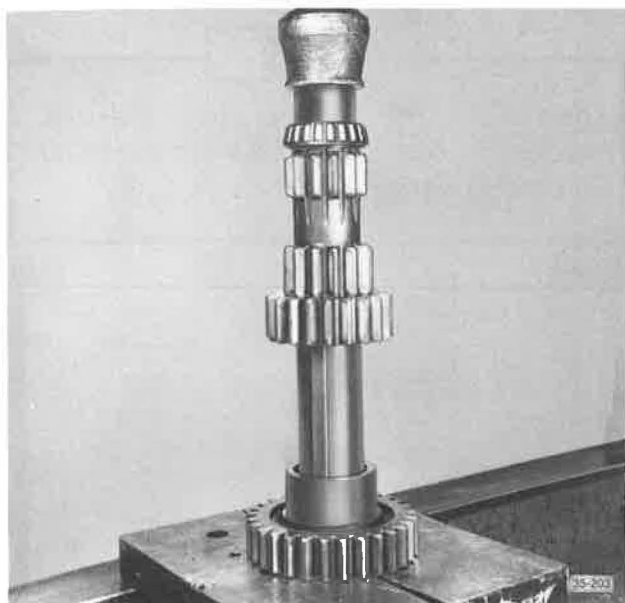
Pressing Second Speed Gear Onto Shaft

6. Press the fifth speed gear onto the shaft.



Pressing Fifth Speed Gear Onto Shaft

5. Install the second/third spacer, and then press on the third speed gear.



Pressing Third Speed Gear Onto Shaft

7. Press the main drive gear onto the shaft, with the gear hub rearward, next to the fifth speed gear.



Pressing Main Drive Gear Onto Shaft

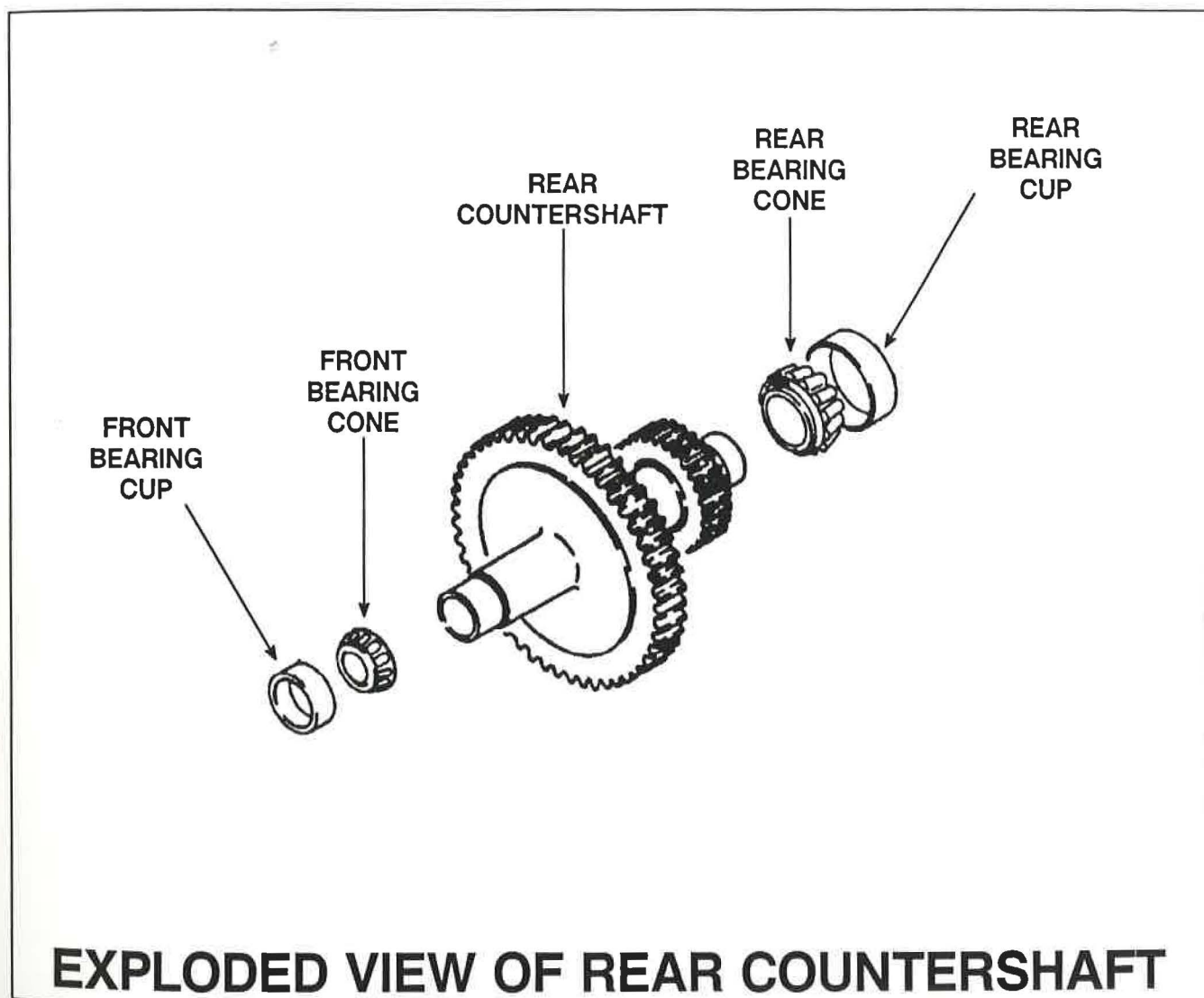
REAR COUNTERSHAFT REASSEMBLY

REAR COUNTERSHAFT REASSEMBLY

1. Because the rear countershaft on the T2070A is one piece (shaft and gears), the only reassembly possible is to install the bearings.

2. Press the rear countershaft rear bearing onto the shaft, being sure to apply force to the inner race only.

3. Press the rear countershaft front bearing onto the shaft, being sure to apply force to the inner race only.



FRONT MAINSHAFT REASSEMBLY

FRONT MAINSHAFT REASSEMBLY

1. Press the bearing race onto the mainshaft.



Pressing Bearing Inner Race Onto Front Of Mainshaft

2. Press the rear bearing inner race onto the mainshaft.



Pressing Bearing Inner Race Onto Rear Of Mainshaft

3. Install the mainshaft rear bearing inner race retaining snap ring.



Installing Rear Bearing Inner Race Snap Ring

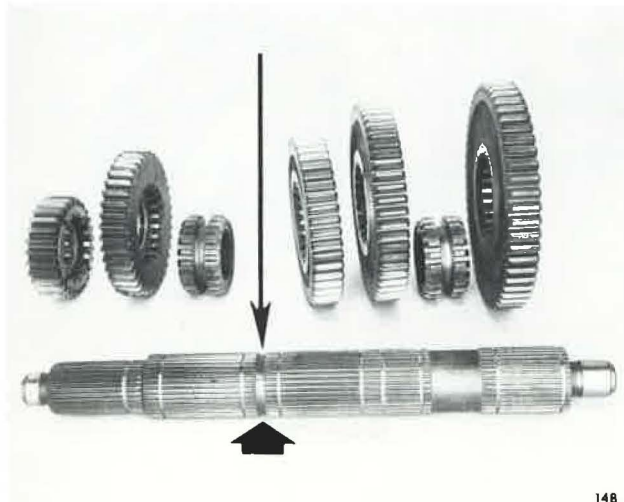
4. Install the mainshaft front bearing inner race retaining snap ring.



Installing Front Bearing Inner Race Snap Ring

FRONT MAINSHAFT REASSEMBLY

5. The splines on the mainshaft are usually not aligned for the whole length of the shaft. As a result, the parts to the left of the arrows will be installed from the front of the shaft (left side in photo), and the parts to the right of the arrows will be installed from the rear of the shaft (right side in photo).



View Of Mainshaft And Gears

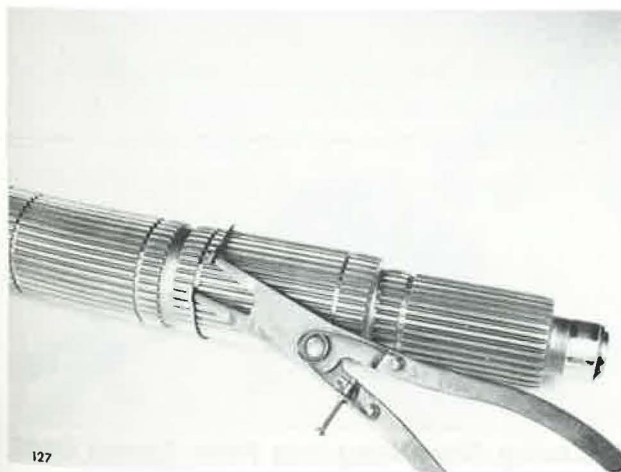
7. Install the second/third speed sliding clutch onto the mainshaft.



126

Installing Second/Third Speed Sliding Clutch

6. We will start from the front of the shaft. Install the second speed gear snap ring onto the mainshaft.



127

Installing Second Speed Gear Snap Ring

8. Install the third speed gear snap ring onto the mainshaft.



125

Installing Third Speed Gear Snap Ring

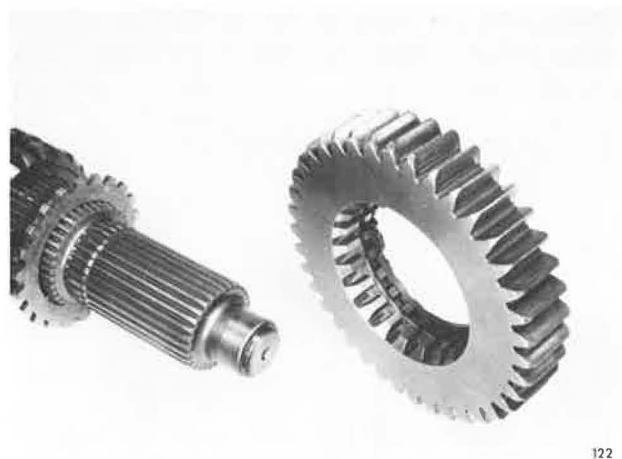
FRONT MAINSHAFT REASSEMBLY

9. Install the third speed gear internal tooth and external tooth thrust washers onto the mainshaft.



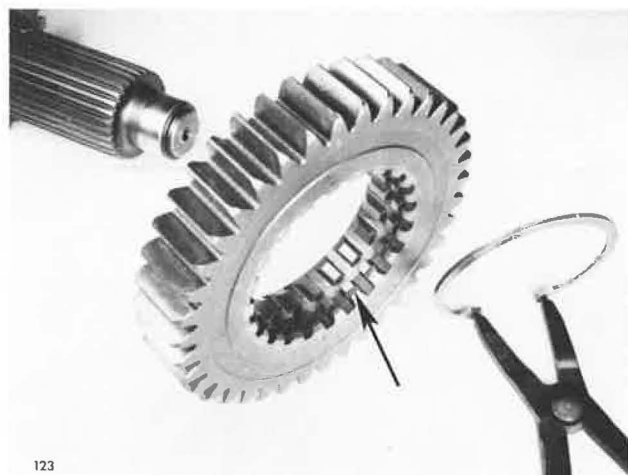
Installing Internal And External Tooth Thrust Washers

11. Install the third speed gear onto the mainshaft, with the clutch teeth facing rearward (left in photo), and the internal snap ring toward the front of the shaft.



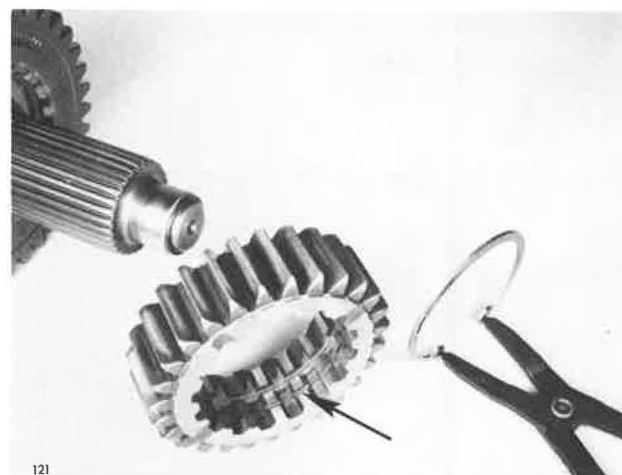
Installing Third Speed Gear Onto Mainshaft

10. Install the snap ring into the inside of the third speed gear, into the groove shown by the arrow in the photo.



Installing Snap Ring Into Third Speed Gear

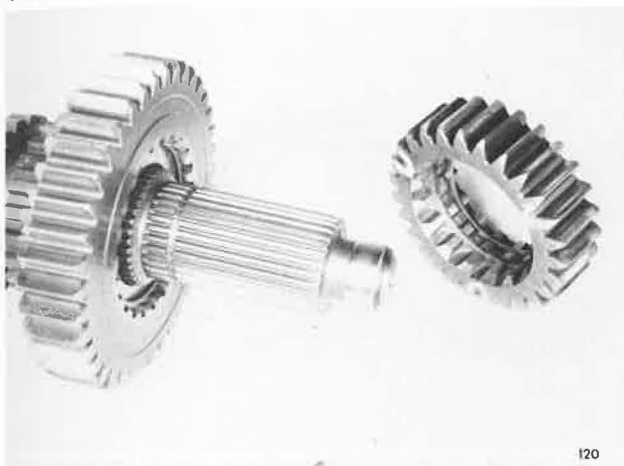
12. Install the snap ring into the inside of the fifth speed gear, into the groove shown in the photo.



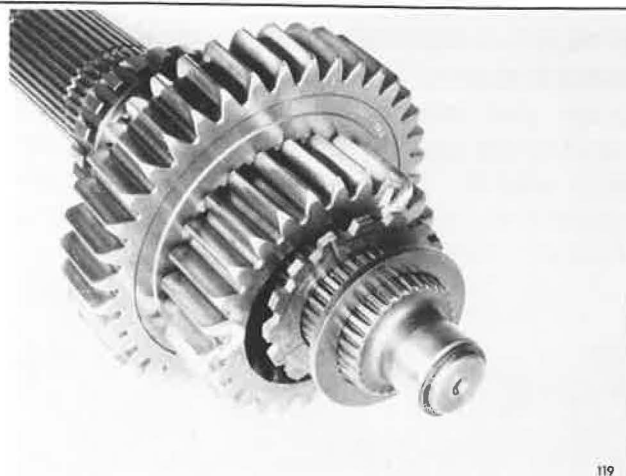
Installing Snap Ring Into Fifth Speed Gear

FRONT MAINSHAFT REASSEMBLY

13. Install the fifth speed gear onto the mainshaft, with the clutch teeth facing forward (right in photo), and the internal snap ring toward the rear of the shaft.



Installing Fifth Speed Gear Onto Mainshaft



Installing External And Internal Tooth Thrust Washers

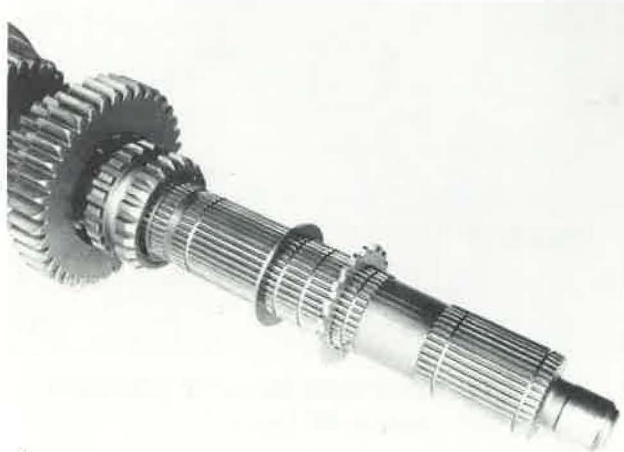
14. Install the fifth speed gear external tooth and internal tooth thrust washers, as shown in the photo. Note that the grooves in the external tooth thrust washer are facing forward (right in photo).



Installing Mainshaft Fifth Speed Gear Snap Ring

FRONT MAINSHAFT REASSEMBLY

16. Now turn the shaft around, and we will work from the rear of the shaft. Install the second speed gear internal tooth thrust washer, followed by the second speed gear external tooth thrust washer. Slide them all the way forward against the second speed mainshaft snap ring previously installed.



117

Installing Internal And External Tooth Thrust Washers

18. Install the second speed gear onto the mainshaft, with the clutch teeth facing the front of the shaft (left in photo).



115

Installing Second Speed Gear Onto Mainshaft

17. Install the snap ring into the second speed gear, into the groove shown in the photo.



116

Installing Snap Ring Into Second Speed Gear

19. Install the snap ring into the first speed gear, into the groove shown in the photo.

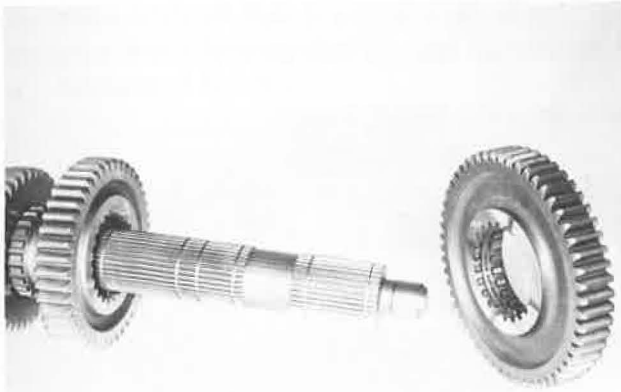


114

Installing Snap Ring Into First Speed Gear

FRONT MAINSHAFT REASSEMBLY

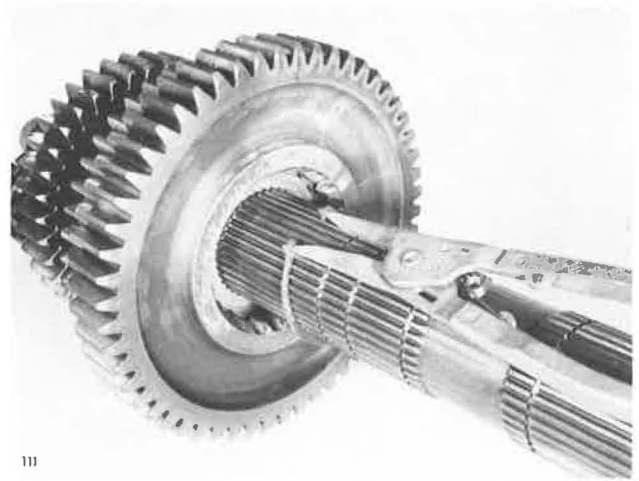
20. Install the first speed gear onto the mainshaft, with the clutch teeth facing the rear of the shaft (right in photo).



113

Installing First Speed Gear Onto Mainshaft

22. Install the mainshaft first speed gear snap ring onto the mainshaft, inside the first speed gear.



111

Installing Mainshaft First Speed Gear Snap Ring

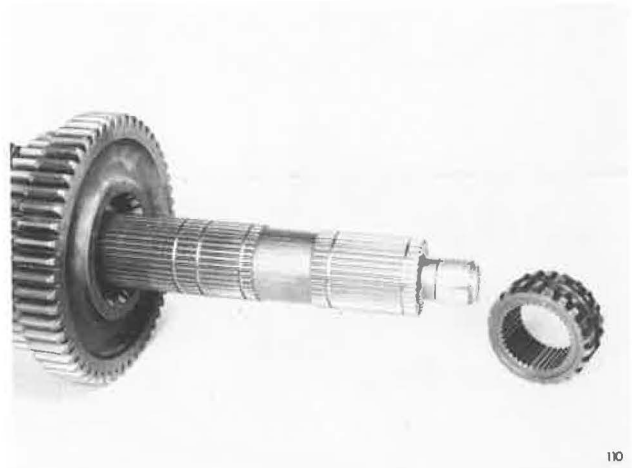
21. Install the first speed gear external tooth and internal tooth thrust washers onto the mainshaft, as shown in the photo. Note that the grooves in the external tooth thrust washer are facing rearward (right in photo).



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Installing External And Internal Tooth Thrust Washers

23. Install the first/reverse sliding clutch onto the mainshaft.

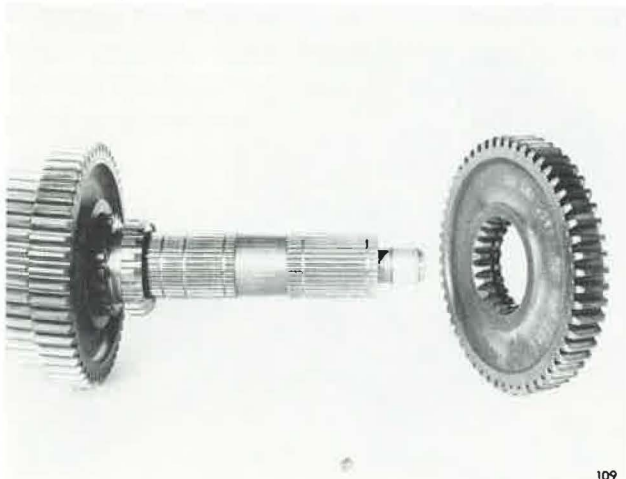


110

Installing First/Reverse Sliding Clutch

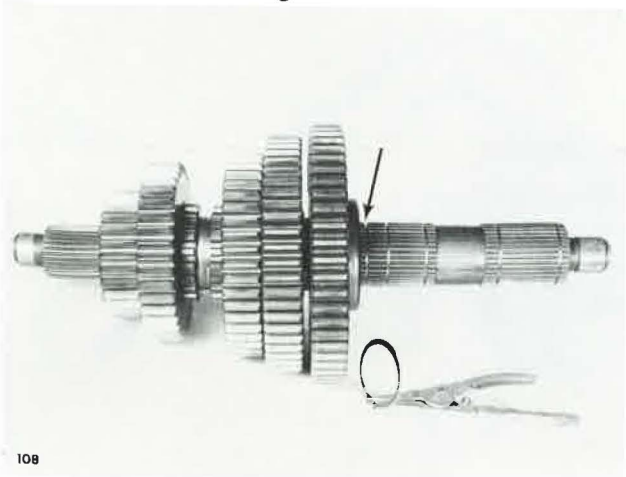
FRONT MAINSHAFT REASSEMBLY

24. Install the reverse gear onto the mainshaft. Note that the clutch teeth are facing forward (left in photo).



Installing Reverse Gear Onto Mainshaft

25. To aid in the installation of the mainshaft assembly into the case, it is recommended that the following step be taken. Slide the first/reverse sliding clutch forward until it fully engages the first speed gear. Then slide the reverse gear forward until it fully engages the sliding clutch also. Temporarily install thrust washer 31KD2136 and then install the mainshaft snap ring into the groove just behind the reverse gear, to hold the reverse gear forward.



Reverse Gear In Fully Forward Position,
And Snap Ring Location

AIR SHIFT CYLINDER REASSEMBLY

AIR SHIFT CYLINDER REASSEMBLY

1. The breather vent, shown removed (#1) and installed (#2) in the photo below, should be cleaned and checked that air can flow through it. Replace if needed.



Shift Cylinder Breather Vent

2. Install the O-ring onto the shift sleeve.



Installing O-Ring Onto Shift Sleeve

NOTE

Lubricate all O-rings with a multi-purpose grease meeting Mack specification MG-C before installation.

3. Install the O-ring onto the piston shift rail.



Installing O-Ring Onto Shift Rail

AIR SHIFT CYLINDER REASSEMBLY

4. Install the O-ring onto the middle of the shift piston.



Installing O-Ring Onto Middle Of Piston

6. Install the O-ring onto the front end of the shift cylinder.



Installing O-Ring Onto Cylinder

5. Install the O-ring onto the rear end of the shift piston.



Installing O-Ring Onto Rear Of Piston

7. Install the O-ring into the rear end of the shift cylinder.



Installing O-Ring Into Cylinder

AIR SHIFT CYLINDER REASSEMBLY

8. Install the piston into the shift cylinder.



Installing Piston Into Cylinder

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10. Push the piston assembly into the cylinder.



Installing Piston Assembly Into Cylinder

71

9. Install the sleeve onto the shift piston.



Installing Sleeve Onto Piston

72

MAIN SHIFT COVER REASSEMBLY

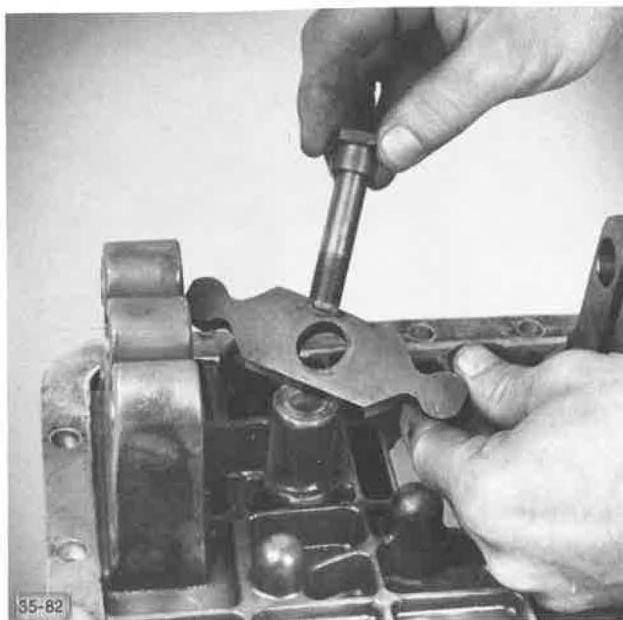
MAIN CASE SHIFT COVER REASSEMBLY

1. Install the shift cover breather vent into the shift cover.



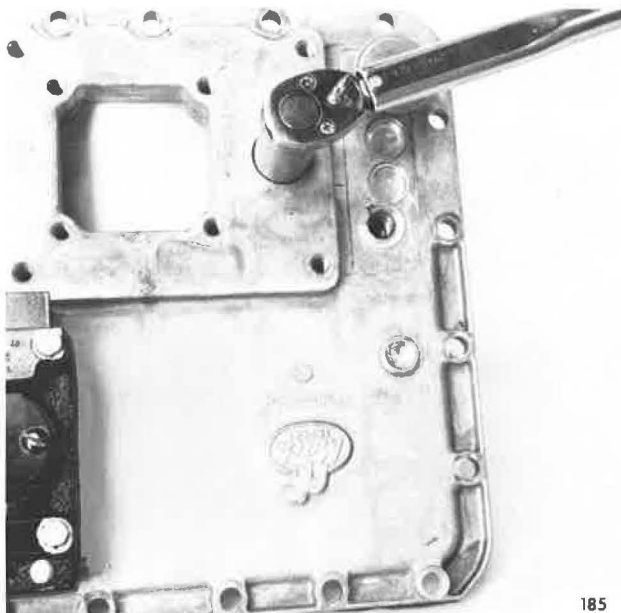
Installing Breather Vent

2. Install the rocker pivot pin and rocker arm.



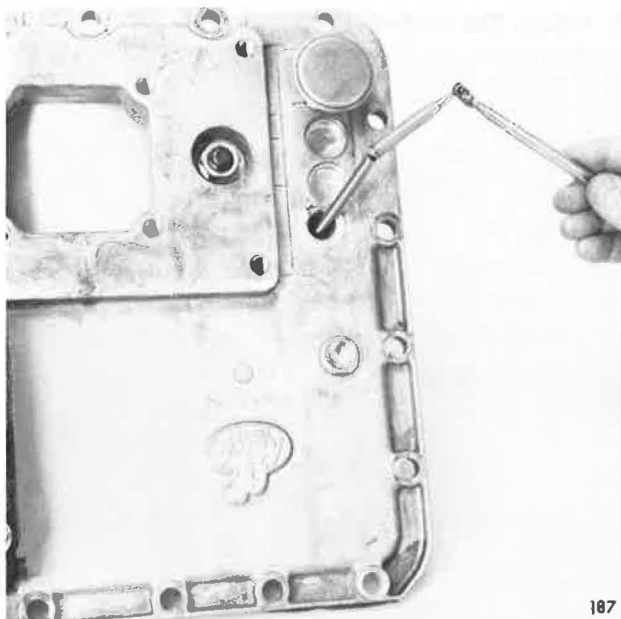
Installing Rocker Pivot Pin And Rocker Arm

3. Install the rocker pivot pin washers and nut, and tighten the nut to 50-60 lb. ft. torque.



Tightening Rocker Pivot Pin Nut

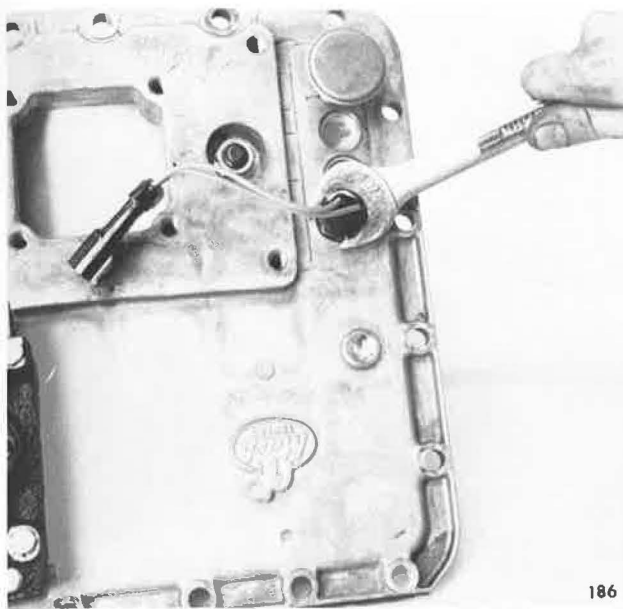
4. Install the reverse light switch rod into the shift cover.



Installing Reverse Light Switch Rod

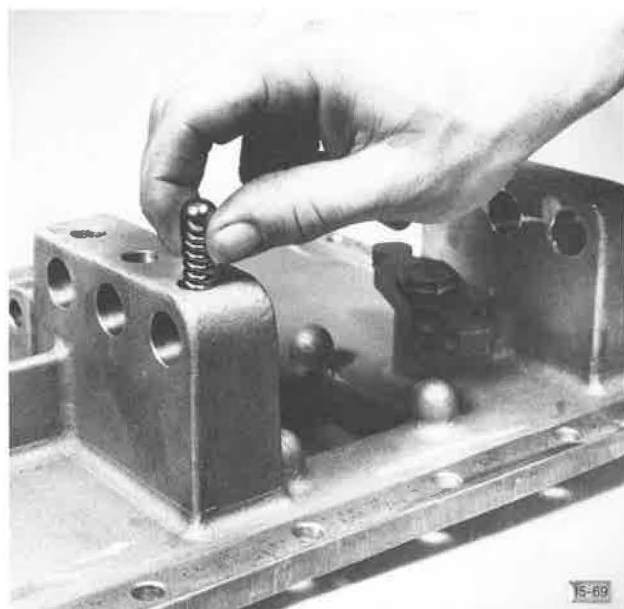
MAIN SHIFT COVER REASSEMBLY

5. Install the reverse light switch into the shift cover.



Installing Reverse Light Switch

7. Install the poppet ball and spring for the fourth/fifth shift rail.



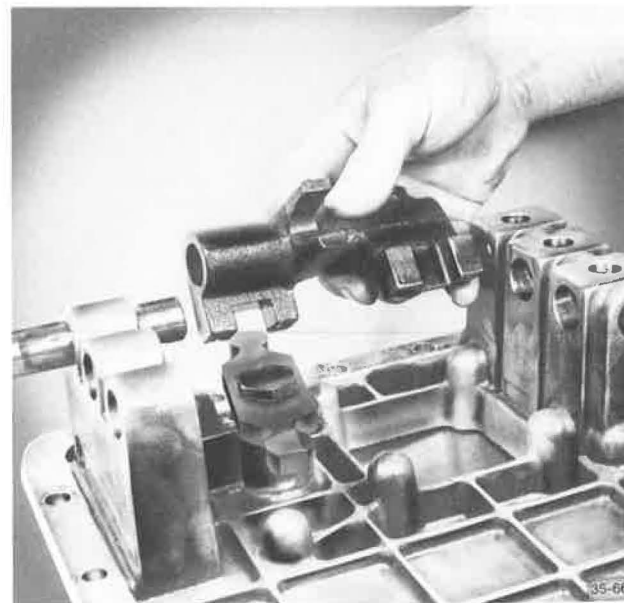
Installing Poppet Ball And Spring

6. Install the poppet ball and spring into the first/reverse shifter, followed by the spring and plunger. Depress the poppet ball to allow the spring and plunger to pass.



Reassembly Of First/Reverse Shifter

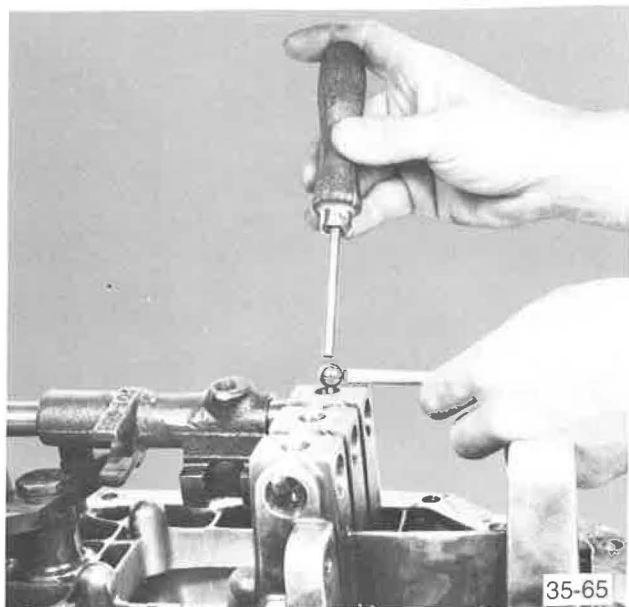
8. Start sliding the fourth/fifth shift rail into the cover, and at the same time, install the fourth/fifth shifter.



Installing Fourth/Fifth Shift Rail And Shifter

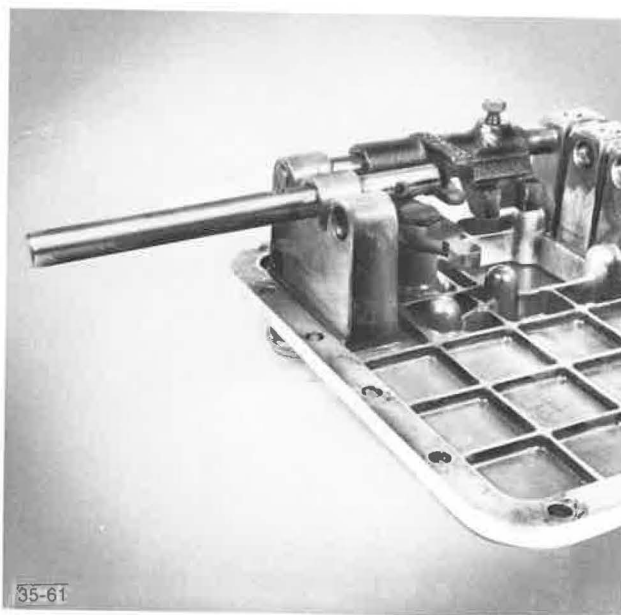
MAIN SHIFT COVER REASSEMBLY

9. Using an appropriate tool, such as the hollow tube shown below, press the poppet ball down, and slide the fourth/fifth shift rail over the ball.



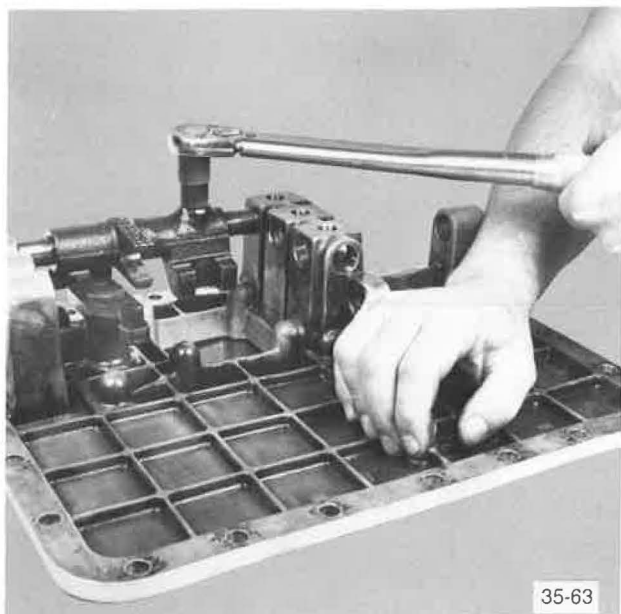
Installing Shift Rail Over Poppet Ball

11. Start sliding the second/third shift rail into the shift cover.



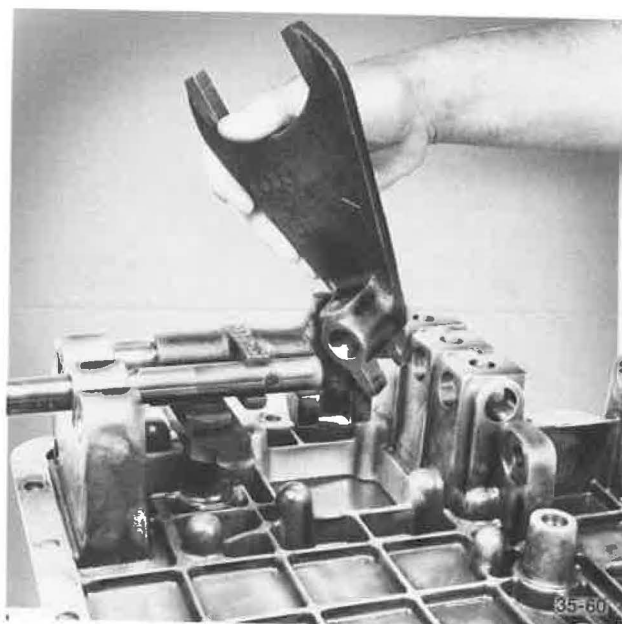
Installing Second/Third Shift Rail

10. Align the setscrew in the fourth/fifth shifter with the notch in the shift rail, and tighten the setscrew to 35-45 lb. ft. torque.



Tightening Shifter Setscrew

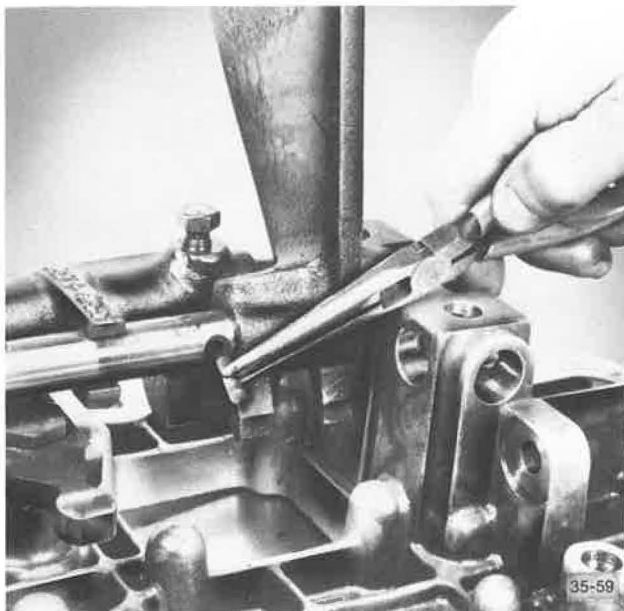
12. Install the second/third shift fork onto the shift rail.



Installing Second/Third Shift Fork

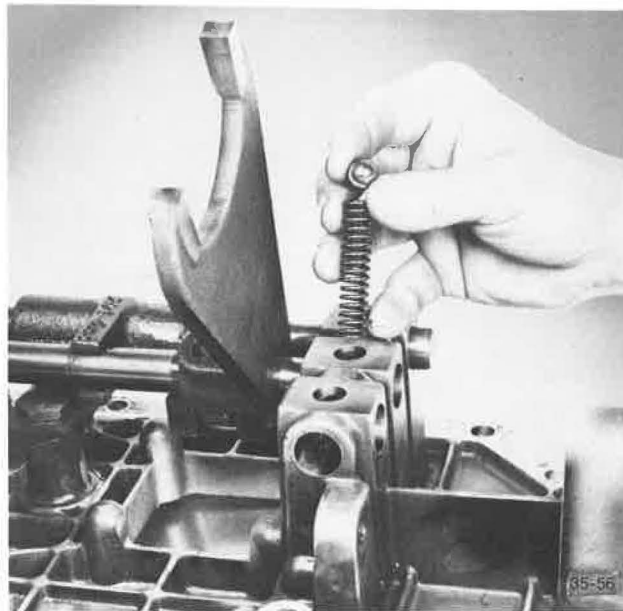
MAIN SHIFT COVER REASSEMBLY

13. Install the interlock pin into the second/third shift rail.



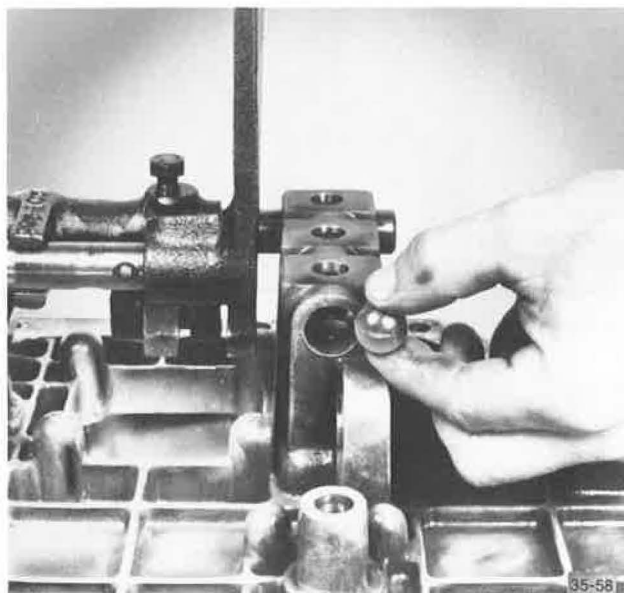
Installing Pin Into Second/Third Shift Rail

15. Install the poppet ball and spring for the second/third shift rail.



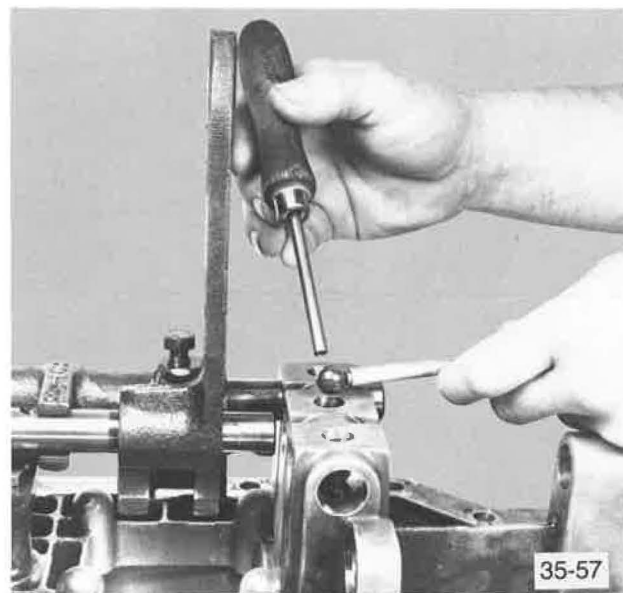
Installing Poppet Ball And Spring

14. Install the interlock ball between the second/third shift rail and the fourth/fifth shift rail.



Installing Interlock Ball

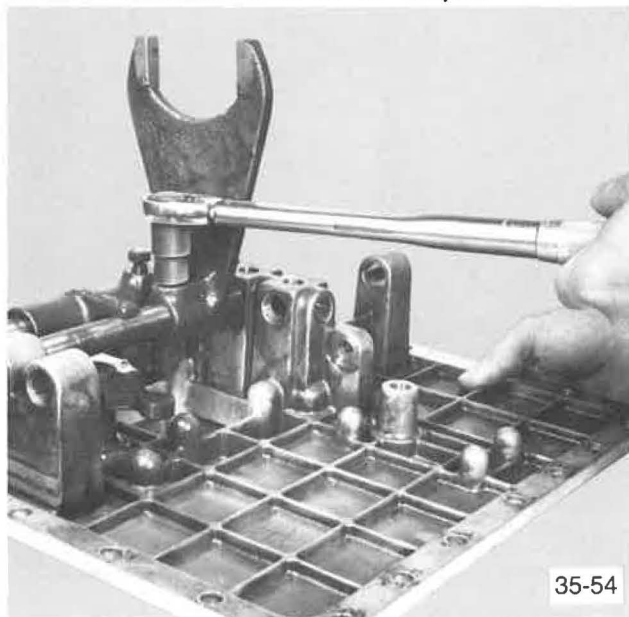
16. Using an appropriate tool, such as the hollow tube shown below, press the poppet ball down, and slide the second/third shift rail over the ball.



Installing Shift Rail Over Poppet Ball

MAIN SHIFT COVER REASSEMBLY

17. Align the setscrew in the second/third shift fork with the notch in the shift rail, and tighten the setscrew to 35-45 lb. ft. torque.



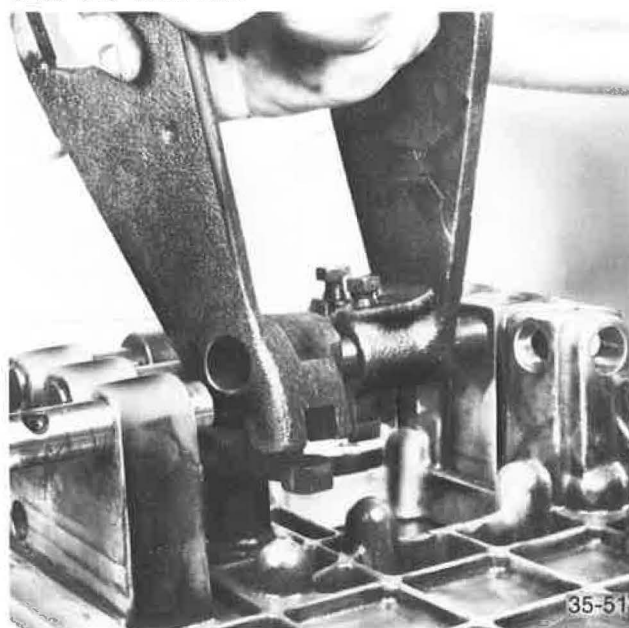
Tightening Shift Fork Setscrew

19. Continue sliding the first/reverse shift rail into the shift cover, and install the first/reverse shifter.



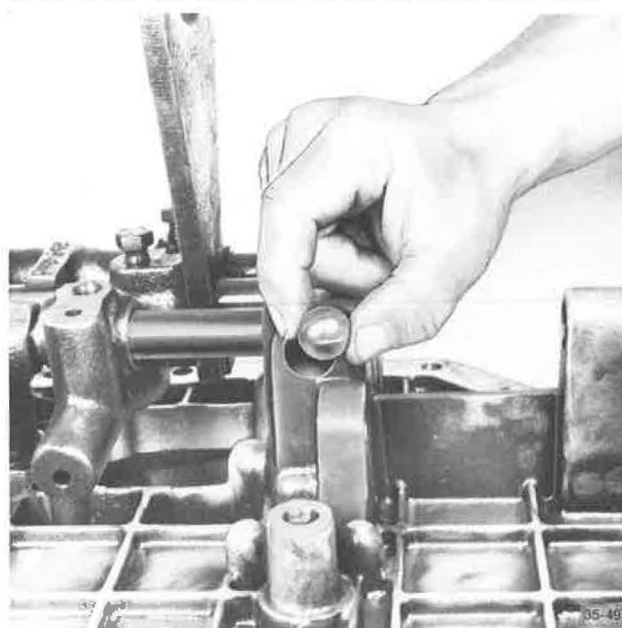
Installing First/Reverse Shifter

18. Start sliding the first/reverse shift rail into the shift cover, and install the fourth/fifth shift fork onto the shift rail.



Installing Fourth/Fifth Shift Fork

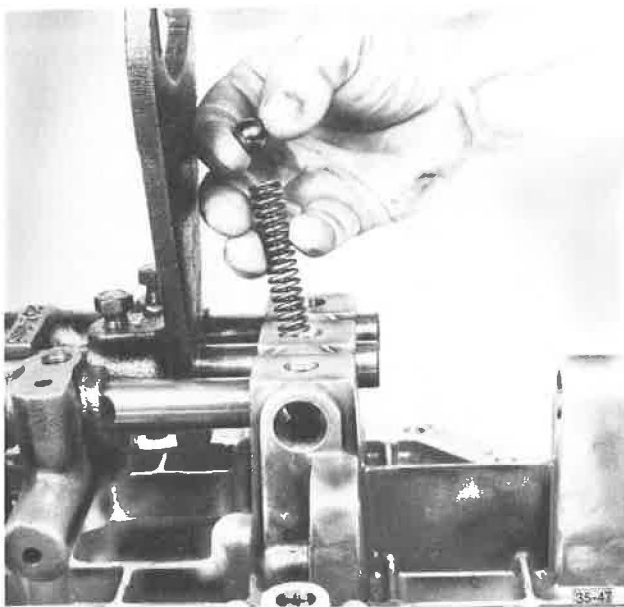
20. Install the interlock ball between the first/reverse shift rail and the second/third shift rail.



Installing Interlock Ball

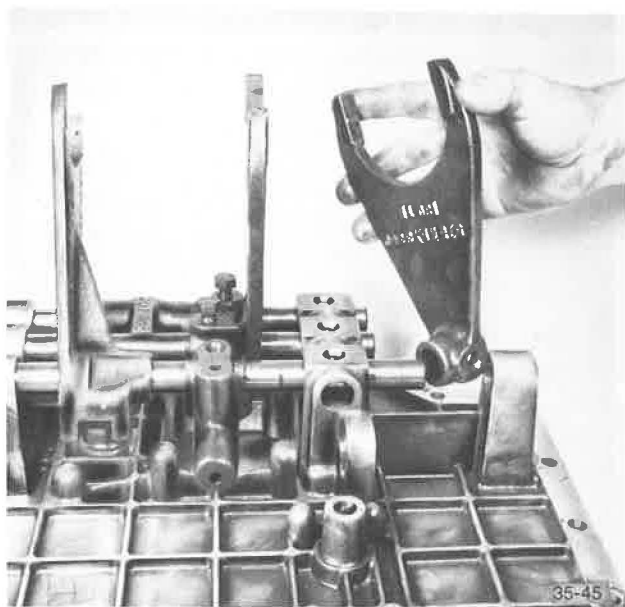
MAIN SHIFT COVER REASSEMBLY

21. Install the poppet ball and spring for the first/reverse shift rail.



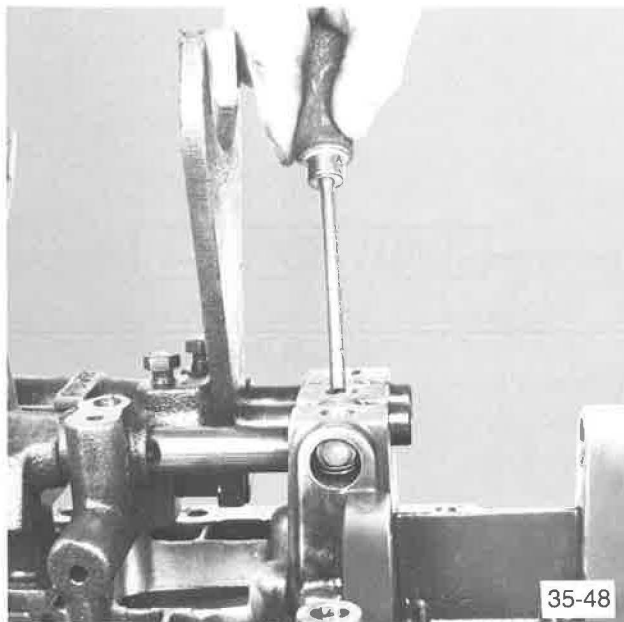
Installing Poppet Ball And Spring

23. Install the first reverse shift fork onto the shift rail.



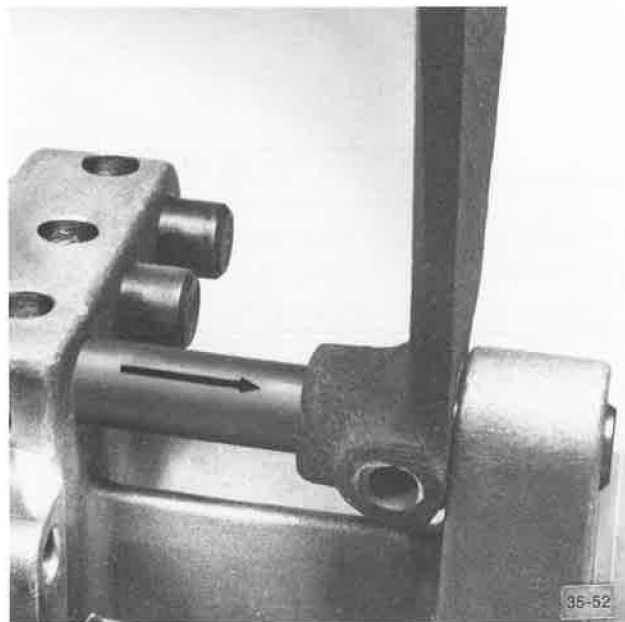
Installing First/Reverse Shift Fork

22. Using an appropriate tool, such as the hollow tube shown in the photo, press the poppet ball down, and slide the first/reverse shift rail over the ball.



Installing Shift Rail Over Poppet Ball

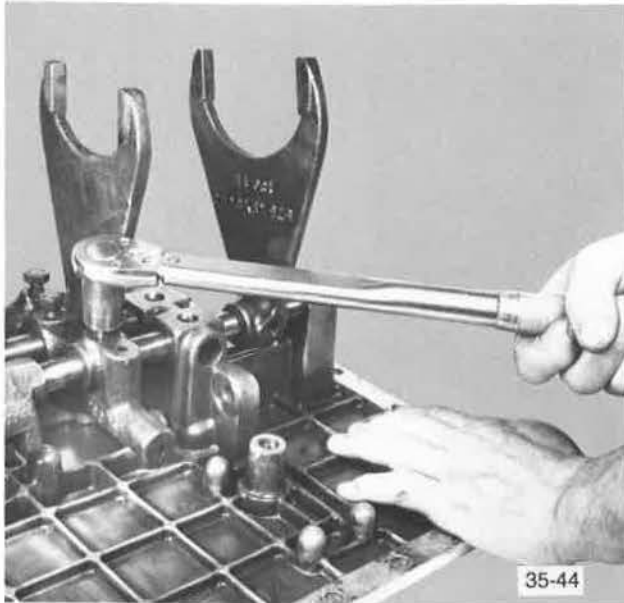
24. Install the interlock pin into the first/reverse shift rail, and slide the shift rail into position.



Sliding First/Reverse Shift Rail Into Position

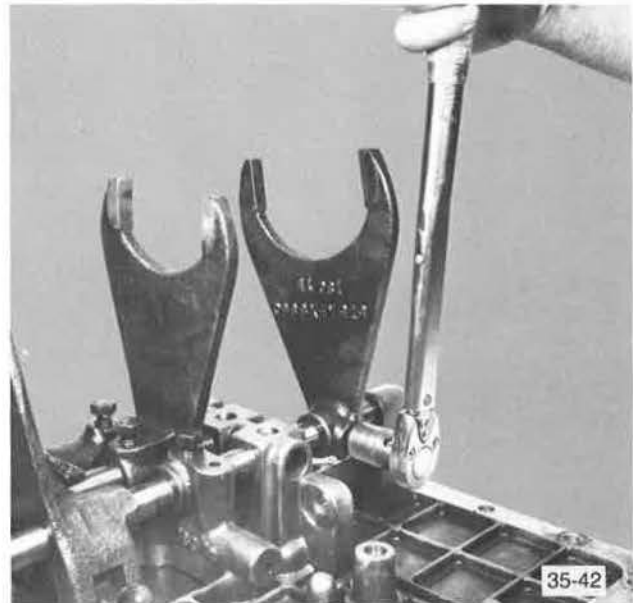
MAIN SHIFT COVER REASSEMBLY

25. Align the setscrew in the first/reverse shifter with the notch in the shift rail, and tighten the setscrew to 35-45 lb. ft. torque.



Tightening Shifter Setscrew

26. Align the setscrew in the first/reverse shift fork with the notch in the shift rail, and tighten the setscrew to 35-45 lb. ft. torque.



Tightening Shift Fork Setscrew

MAIN COMPONENTS REASSEMBLY

MAIN COMPONENTS REASSEMBLY

1. Install the upper right and lower center reverse idler gears into the case.



Installing Reverse Idler Gear

2. Install the reverse idler shafts for the gears just installed, aligning the flat on the end of the shaft so that the countershaft bearing cover will hold the shaft in place. Drive the idler shaft in until the flat is flush with the case.



Installing Reverse Idler Shaft

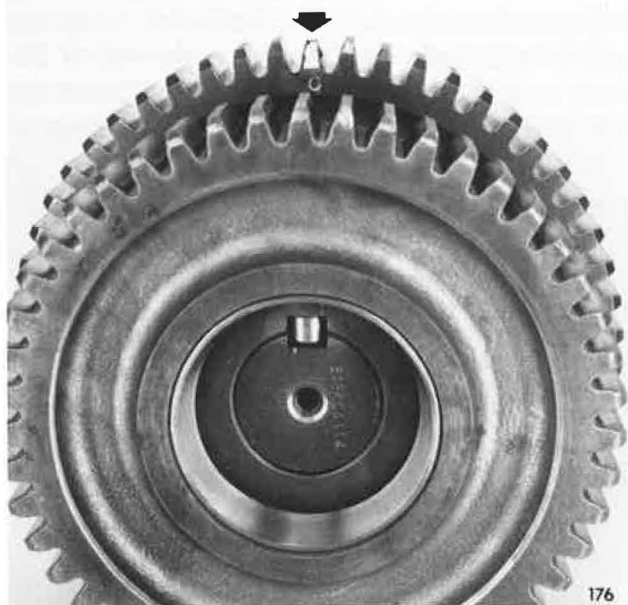
SERVICE HINT

To properly align the reverse idler shaft, first install each of the three rear bearing covers temporarily, and draw marks on the case to show where the cover will be installed over the idler shaft.

SERVICE HINT

Locate the gear tooth on the countershaft fifth speed gear that aligns with the keyway. This tooth should already be stamped with the letter "O". Paint the front of that tooth with white paint for greater visibility when timing the countershafts later. Do this for each of the three front countershafts.

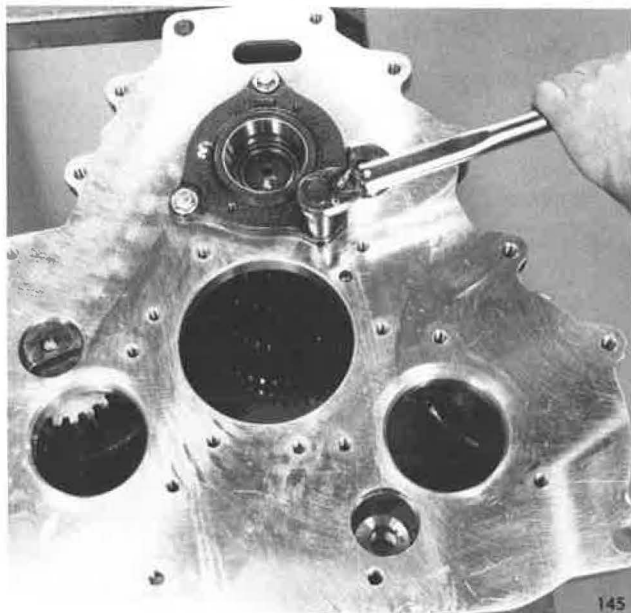
MAIN COMPONENTS REASSEMBLY



Gear Tooth Marked For Timing

3. Install the lower center countershaft into the case.

4. Temporarily install the lower center rear bearing cover, to hold the countershaft in place and to protect the bearing. This cover will have to be removed later, to determine end play and proper bearing shim pack.

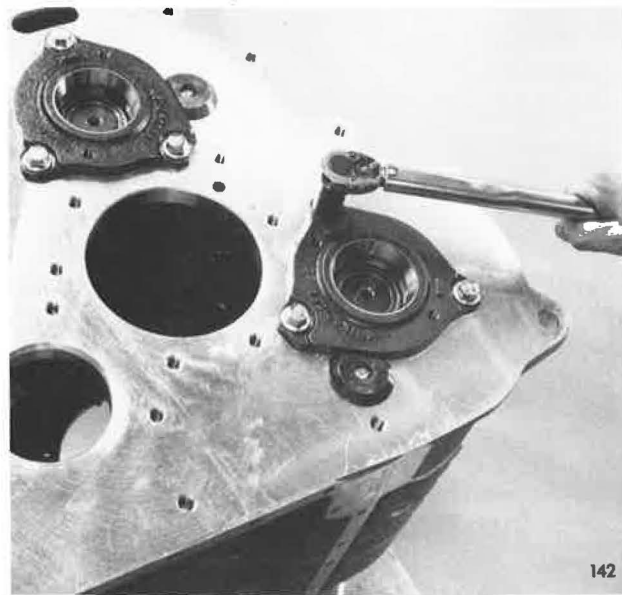


Temporarily Installing Rear Bearing Cover

5. Install the upper left countershaft into the case.

6. Install the upper left reverse idler shaft and gear.

7. Temporarily install the upper left rear bearing cover, to hold the countershaft in place and to protect the bearing. This cover will have to be removed later, to determine end play and proper bearing shim pack.

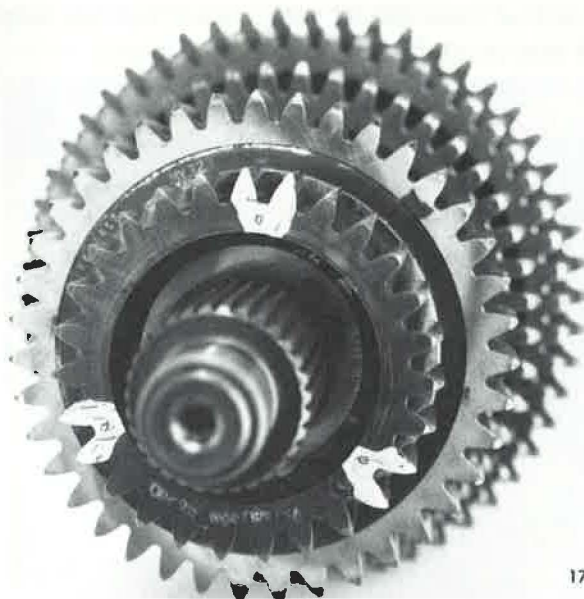


Temporarily Installing Rear Bearing Cover

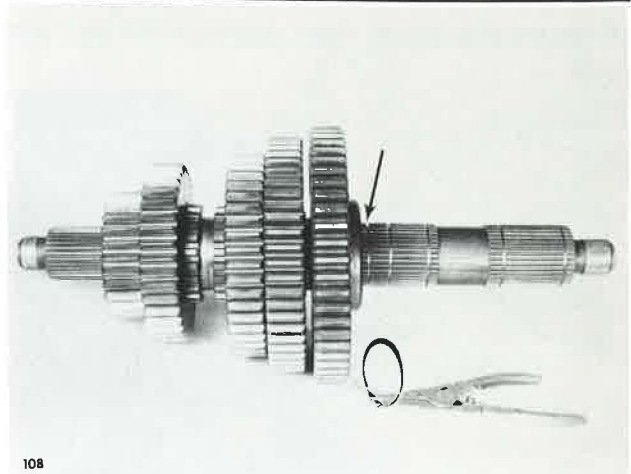
SERVICE HINT

Locate the three gear tooth spaces on the mainshaft fifth speed gear that are stamped with the letter "O". Paint the front of each tooth space with white paint for greater visibility when timing the countershafts later. If there are no stamped letters, count the number of gear teeth, and divide the total by three (should divide evenly, with no remainder). Place a white paint mark on any tooth space. Then count around one-third of the total spaces and place the second white paint mark. Finally, count around one-third of the total spaces again, and place the third white paint mark. These marks should now be evenly spaced from each other.

MAIN COMPONENTS REASSEMBLY



Gear Tooth Spaces Marked



View Of Reverse Gear Forward And Snap Ring To Be Installed

8. To aid in the installation of the mainshaft assembly into the case, it is recommended that the following steps be taken. Slide the first/reverse sliding clutch forward until it fully engages the first speed gear. Then slide the reverse gear forward until it fully engages the sliding clutch also. Temporarily install thrust washer 31KD2136 and then install the mainshaft snap ring into the groove just behind the reverse gear, to hold the reverse gear forward.

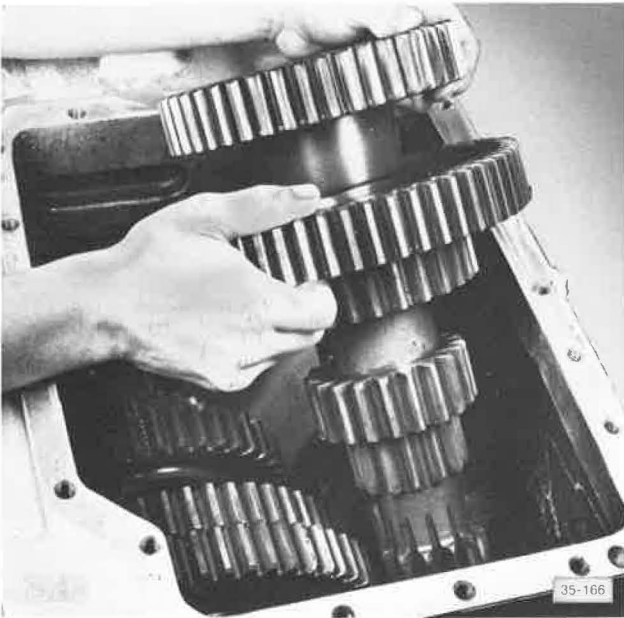
9. Fasten a chain around the mainshaft assembly between the second and third speed gears. Using a hoist, install the mainshaft assembly into the case, and align the timing marks on the mainshaft with the marks on the countershaft gears.

SERVICE HINT

Installing and timing the mainshaft will be easier if the transmission is horizontal, and rotated 15 degrees counter-clockwise as viewed from the rear of the transmission.

MAIN COMPONENTS REASSEMBLY

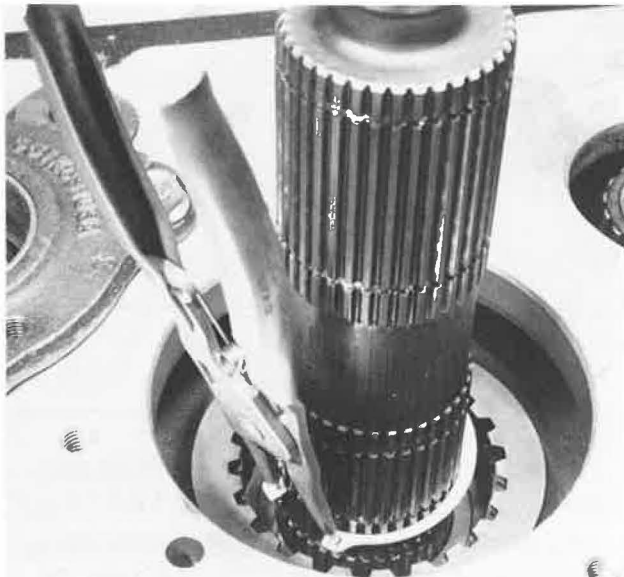
10. Install the upper right countershaft into the case.



Installing Upper Right Countershaft

11. Remove the snap ring and thrust washer that were temporarily installed behind the reverse gear. Move the reverse gear and the first/rev-erse sliding clutch into their normal positions.

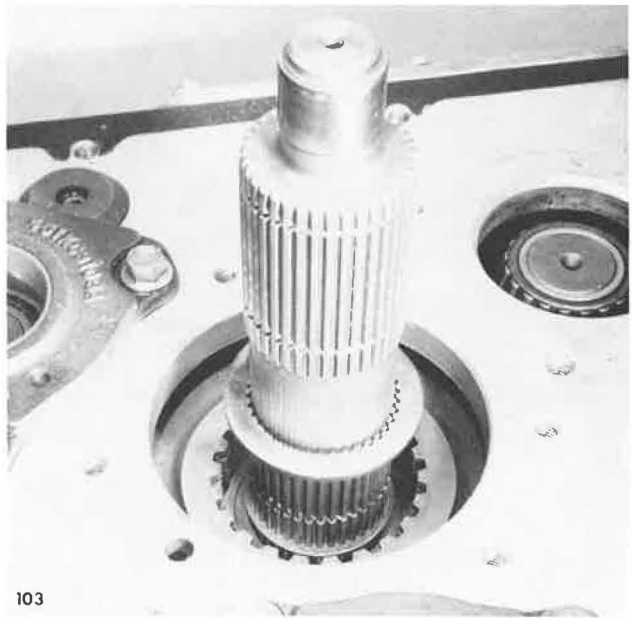
12. Install the mainshaft snap ring onto the mainshaft inside the reverse gear.



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Installing Snap Ring Onto Mainshaft

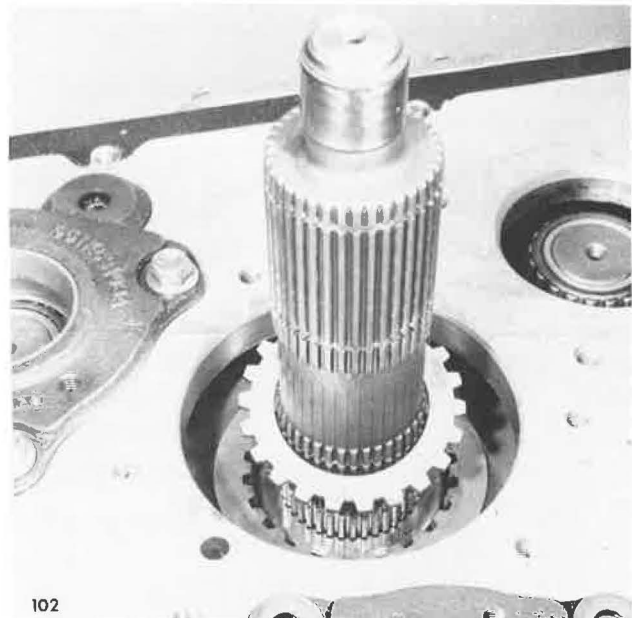
13. Install the internal tooth thrust washer onto the mainshaft inside the reverse gear.



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Installing Internal Tooth Thrust Washer Inside Reverse Gear

14. Install the external tooth thrust washer onto the mainshaft inside the reverse gear. Note that the oil grooves on this washer face forward (down in the photo).

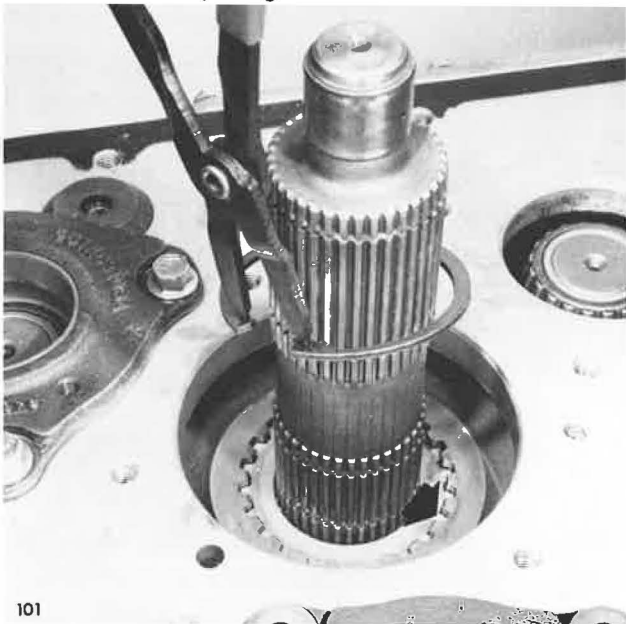


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Installing External Tooth Thrust Washer Inside Reverse Gear

MAIN COMPONENTS REASSEMBLY

15. Install the snap ring inside the mainshaft reverse gear. Note the arrow in the photo pointing to the snap ring groove in the reverse gear where the snap ring is to be installed.

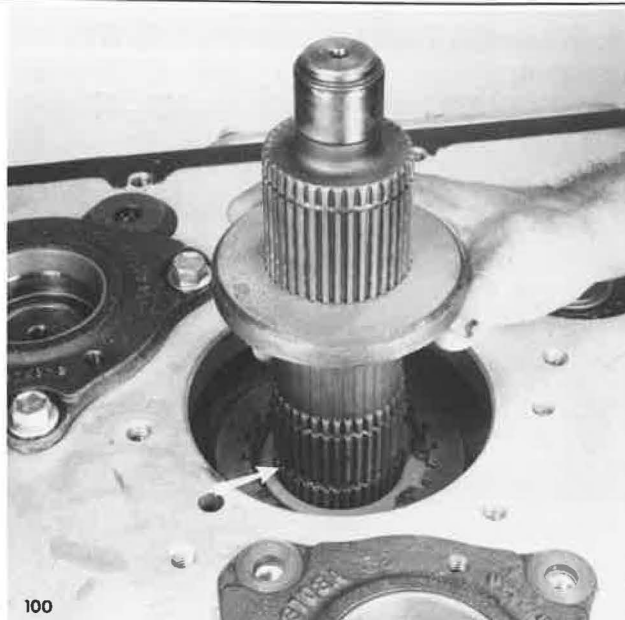


Installing Snap Ring Into Reverse Gear

16. Install the snap ring onto the mainshaft, followed by the special thrust washer behind the reverse gear.

NOTE

The arrow in the photo points to the groove where the snap ring is to be installed. The snap ring is not shown, so the groove could be seen better.



Installing Snap Ring And Thrust Washer

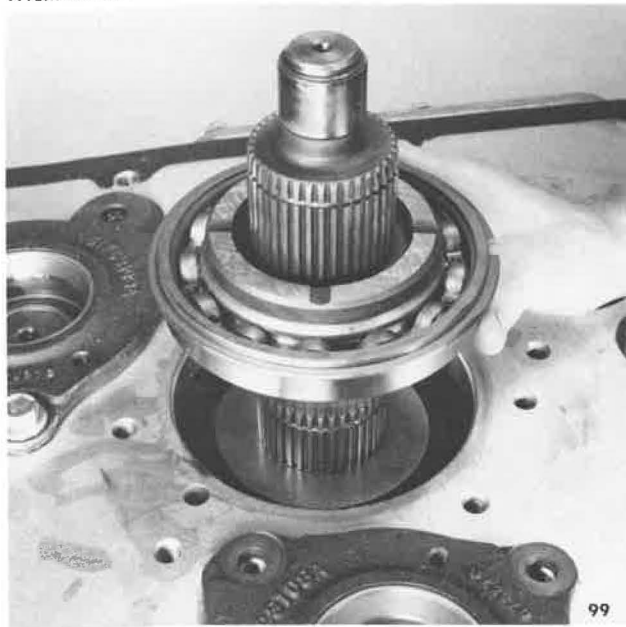
17. Press the sleeve into the mainshaft rear bearing, being careful to support the bearing on its inner race to prevent damage.



Pressing Sleeve Into Bearing

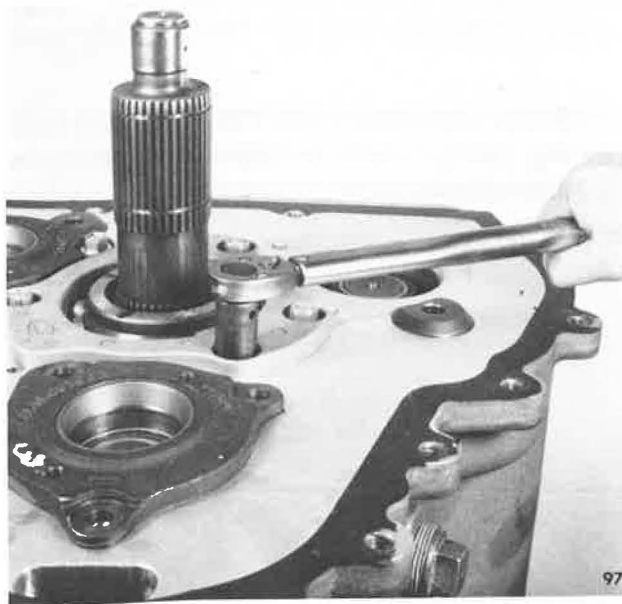
MAIN COMPONENTS REASSEMBLY

18. Install the mainshaft rear bearing onto the mainshaft.



Installing Mainshaft Rear Bearing

19. Install the mainshaft rear bearing cover, and tighten the capscrews to 40-50 lb. ft. torque.

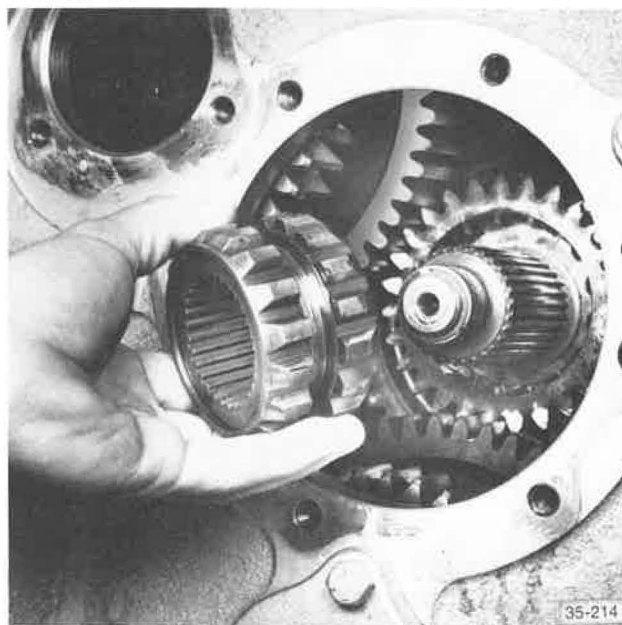


Tightening Capscrews In Mainshaft Rear Bearing Cover

20. Temporarily install the upper right rear bearing cover, to hold the countershaft in place and to protect the bearing. This cover will have to

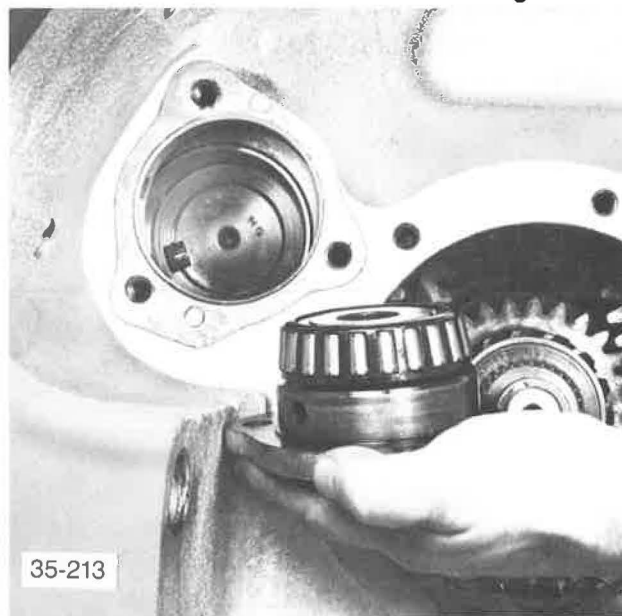
be removed later, to determine end play and proper bearing shim pack.

21. Install the sliding clutch onto the front of the mainshaft.



Installing Sliding Clutch Onto Mainshaft

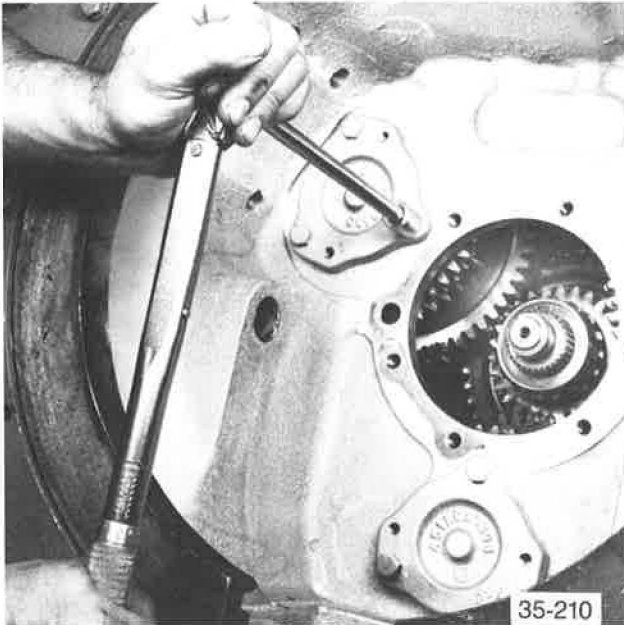
22. Install the countershaft front bearing covers.



Installing Front Bearing Covers

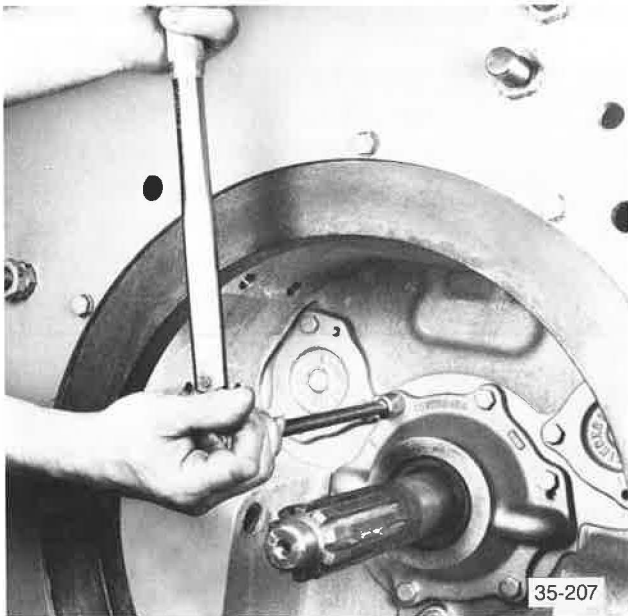
MAIN COMPONENTS REASSEMBLY

23. Tighten the bearing cover capscrews to 40-50 lb. ft. torque.



Tightening Countershaft Front Bearing Cover Capscrew

24. Install the main drive pinion assembly into the front of the main case (using a new gasket), and tighten the capscrews to 40-50 lb. ft. torque.



Tightening Main Drive Pinion Capscrews

SETTING FRONT COUNTERSHAFT BEARING PRE-LOAD

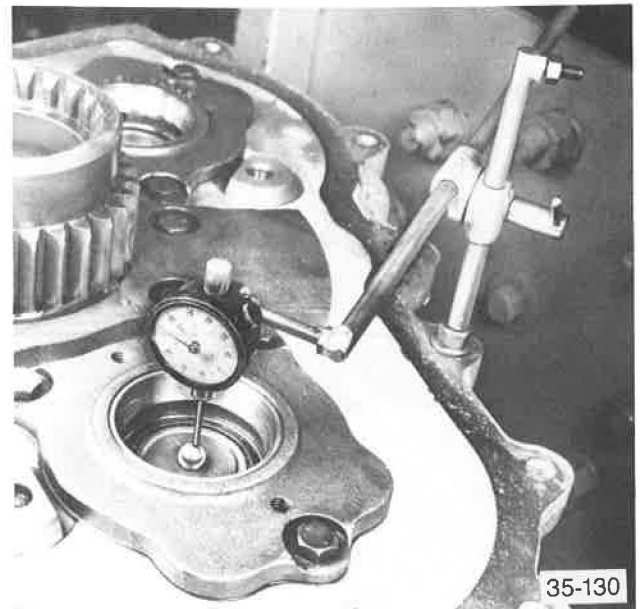
25. Install enough shims under the countershaft rear bearing covers to be sure that the shafts have end-play. Then install the covers and tighten the capscrews to 40-50 lb. ft. torque. Measure the end-play using a dial indicator.

NOTE

A more accurate end-play reading will be obtained if the transmission is vertical, front end down, and a pry-bar is used to move the countershaft assemblies up and down.

NOTE

The next photo is not of a T2070A transmission, and is used only to illustrate the proper procedure to be used when measuring end-play.



Measuring Countershaft End-Play

MAIN COMPONENTS REASSEMBLY

26. Calculate the thickness of shims that must be removed from the shim pack to get zero end-play. Then subtract enough more shims to get the required 0.003 to 0.007 inch pre-load.

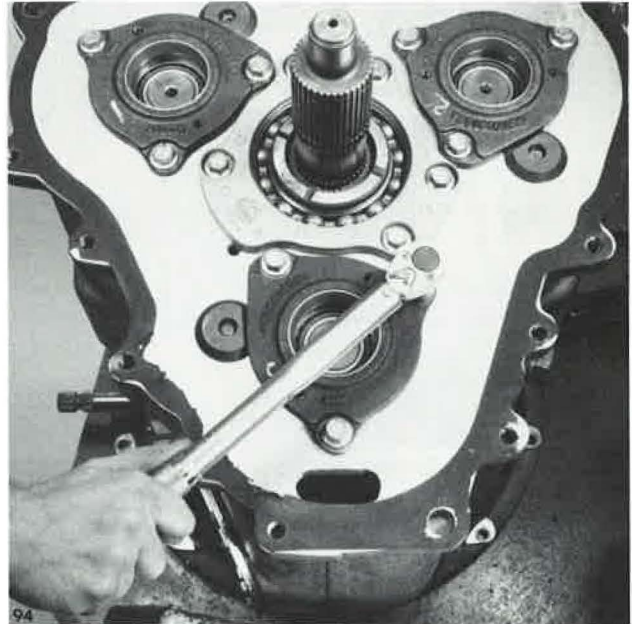
EXAMPLE

Measured End-Play: 0.100 inches

Shims to be removed to get 0.003 to 0.007 inch pre-load:

0.103 to 0.107 inches

27. Remove the countershaft rear bearing covers, and measure the thickness of the shim pack. Remove shims as needed, and install the shims and cover. Tighten the capscrews to 40-50 lb. ft. torque. Repeat this procedure for each of the three countershafts and rear bearing covers.



Tightening Countershaft Rear Bearing Cover Capscrew

NOTE

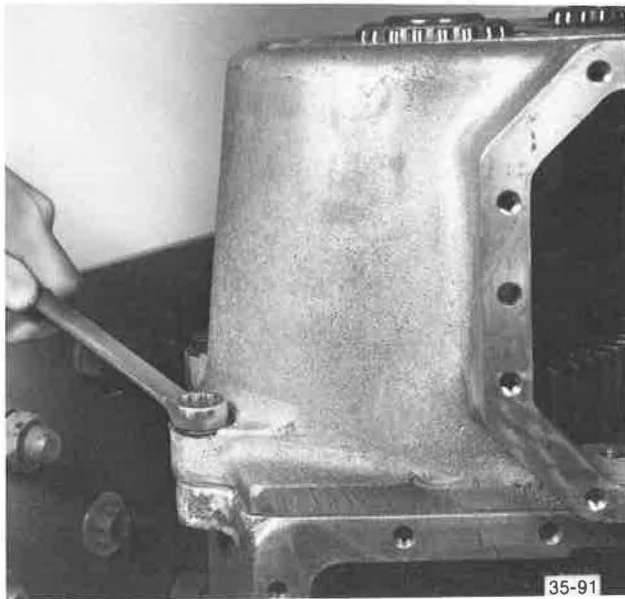
Because "pre-load" is "negative end-play" or "crush", it cannot be measured directly. The above measurements and calculations must be done carefully to get the correct pre-load.

28. Install the rear mainshaft assembly and the three rear countershafts onto the rear of the transmission, being careful to align the timing marks on the countershafts and the rear mainshaft.

29. Install a new front case to rear case gasket. Using a hoist and a chain, lower the rear case onto the front case.

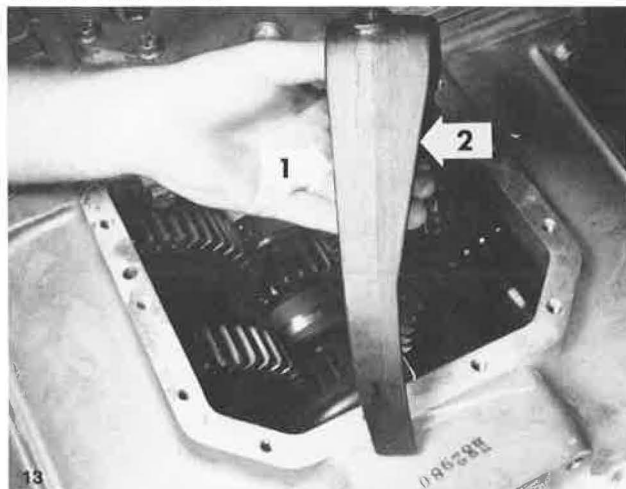
MAIN COMPONENTS REASSEMBLY

30. Install the dowel bolts and nuts, and tighten them to 66-80 lb. ft. torque. Install the case-to-case capscrews (including the two locator inside the rear case), and tighten them to 62-78 lb. ft. torque.



Tightening Case-To-Case Capscrews

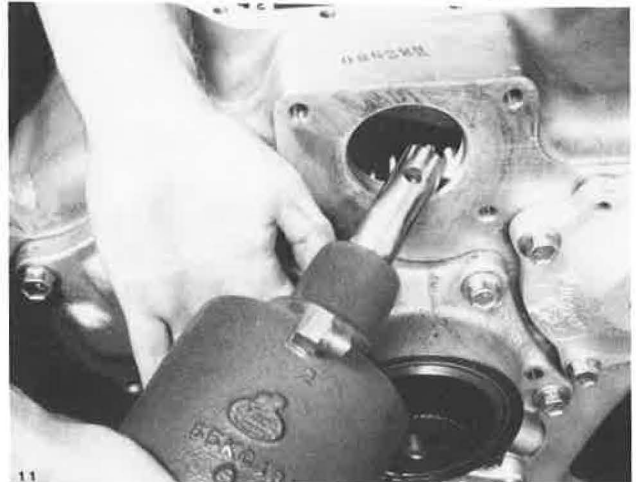
31. Install the rear compound shift fork into the rear case. Notice the orientation of the fork. The straight side (number 1 in photo) faces forward, and the angled side (number 2 in photo) faces rearward.



Installing Shift Fork

32. Install the shift cylinder into the rear of the rear case, sliding the piston rod into the shift fork

just installed. The air breather must be installed facing down, and the air port facing up.



Installing Shift Cylinder

33. Be sure the O-ring is properly in position, and install the range shift rear cover and capscrews. Tighten the capscrews to 27-33 lb. ft. torque.

⚠ CAUTION

Do not over-tighten the four long capscrews that hold the shift cylinder to the rear case. It is possible to bend the rear cover if tightened too much.



Tightening Shift Cylinder Capscrews

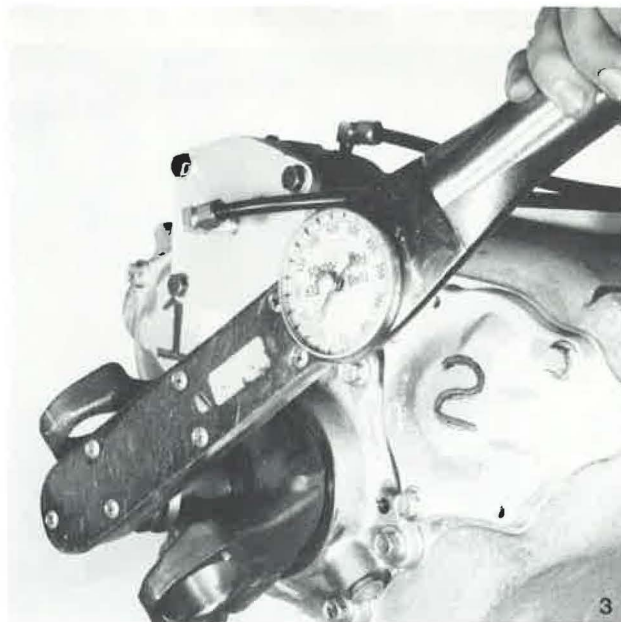
MAIN COMPONENTS REASSEMBLY

34. Align the setscrew in the shift fork with the setscrew hole in the shaft of the piston rod, and tighten the setscrew to 35-45 lb. ft. torque.

CAUTION

Premature bearing failure may occur if the drive flange (or yoke) is driven on by hitting it with a hammer or similar instrument. Install it only by pulling it onto the shaft using an appropriate puller, or the clamp plate and cap-screw.

stall the drive flange (or yoke), and tighten the clamp plate capscrew to 494-600 lb/ ft. torque. Return all clutches to their normal, neutral positions.



Tightening Clamp Plate Capscrew

35. Place two gears in the main box into engagement, and place the sliding clutch in the rear case into engagement also. This will lock up the gearing and prevent it from turning. In-

36. Install a new gasket, and then install the rear case top cover. Tighten the capscrews to 27-33 lb. ft. torque.

MAIN COMPONENTS REASSEMBLY

SETTING REAR COUNTERSHAFT BEARING PRE-LOAD

37. Install the rear countershaft rear bearing covers, leaving the capscrews loose. No shims or O-rings should be used now.

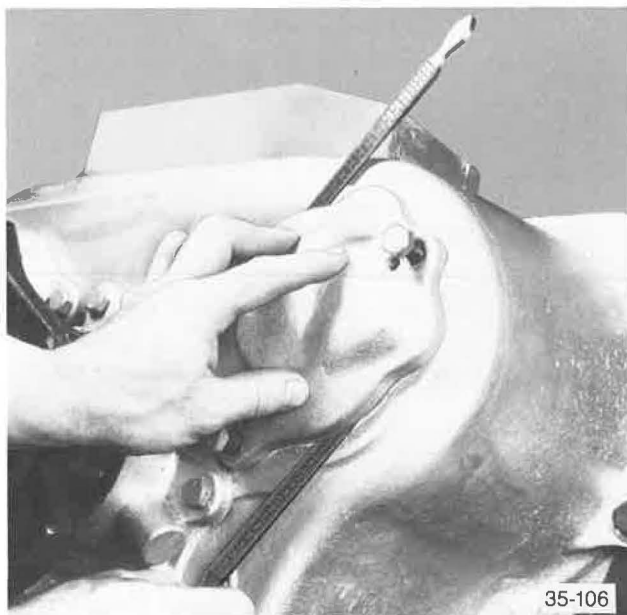
38. Measure the space between the rear bearing covers and the case. Two or more measurements for each cover should be taken. For each cover, average the results.



Measuring With Standard Feeler Gauges

NOTE

A more accurate measurement will be obtained if the transmission is vertical, front end down, and the covers are hand-held firmly against the rear countershaft bearings.



Measuring With Tapered Feeler Gauges

39. For each countershaft, remove the cover, and add enough shims to bring the space under the bearing cover down to zero. Then subtract (take away) enough shims to get the required 0.002 to 0.006 inch pre-load.

EXAMPLE

Measured Space Under Cover:
0.100 inches

Shims to be added to get 0.002 to 0.006 inch pre-load:

0.094 to 0.098 inches

MAIN COMPONENTS REASSEMBLY

NOTE

Because "pre-load" is "negative end-play" or "crush", it cannot be measured directly. The above measurements and calculations must be done carefully to get the correct pre-load.

40. Place the correct shim pack onto the rear bearing cover.



173

Installing Shim Pack Onto Rear Bearing Cover

41. Install the O-ring onto the rear bearing cover.



174

Installing O-Ring Onto Rear Bearing Cover

42. Reinstall the rear bearing cover, and tighten the capscrews to 40-50 lb. ft. torque.



35-104

Tightening Capscrews In Rear Bearing Cover

MAIN COMPONENTS REASSEMBLY

43. Using a new gasket, install the main case top cover, and tighten the capscrews to 27-33 lb. ft. torque.



Tightening Top Cover Capscrews

44. Using a new gasket, install the rear case top cover, and tighten the capscrews to 27 to 33 lb. ft. torque.

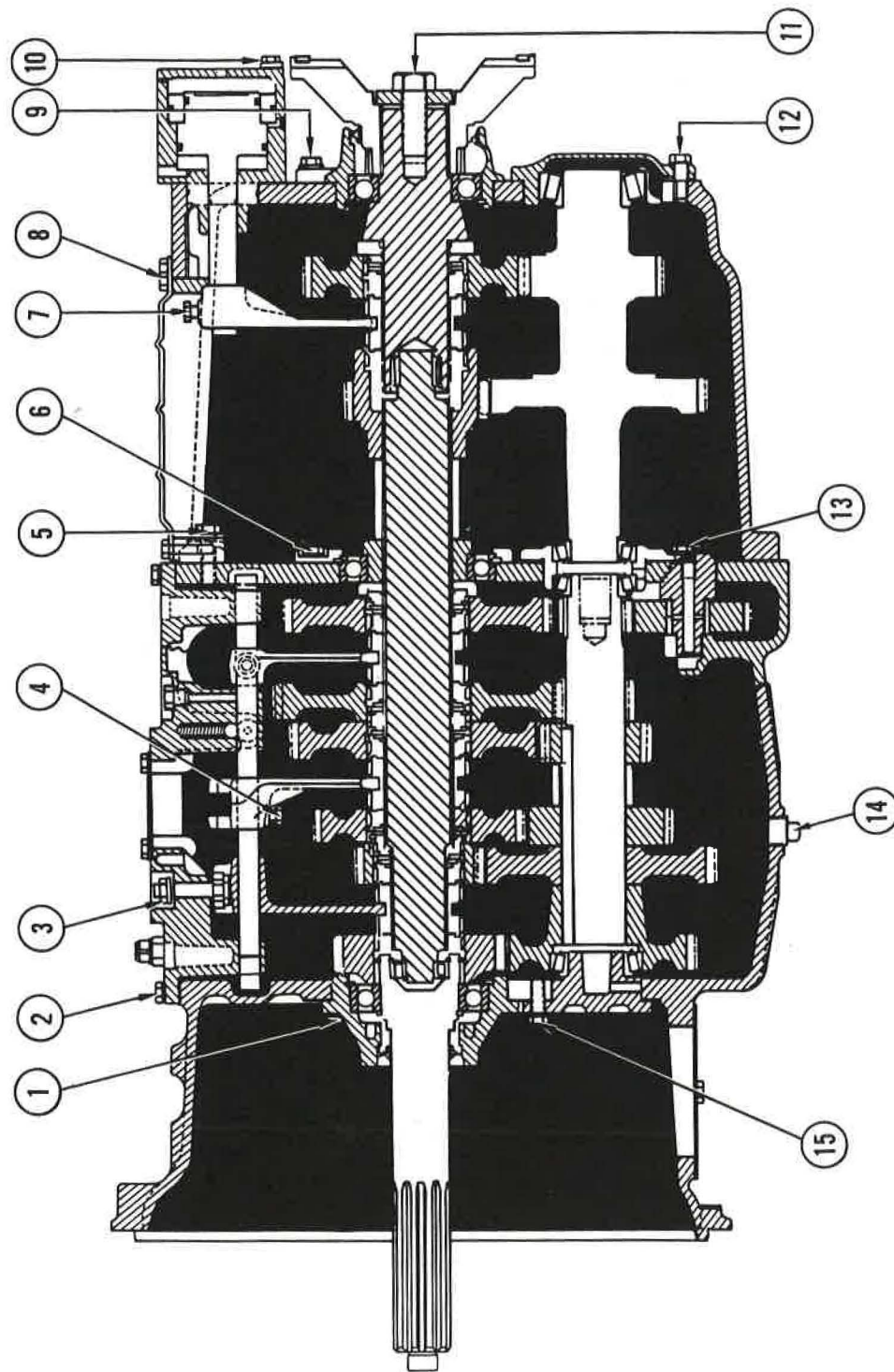
TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS

TORQUE SPECIFICATIONS TABLE		
ITEM NO.	LOCATION ON TRANSMISSION	TORQUE IN LB. FT.
1	Main Drive Pinion Bearing Cover Capscrews	40-50
2	Main Case Top Cover Capscrews	27-33
3	4th/5th Pivot Pin Nut	50-60
4	Shifter And Shift Fork Setscrews	35-45
5	Front Case To Rear Case Capscrews	62-78
5	Front Case To Rear Case Dowel Bolts	66-80
6	Mainshaft Rear Bearing Cover Capscrews	40-50
7	Range Shift Fork Setscrew	35-45
8	Rear Case Top Cover Capscrews	27-33
9	Rear Mainshaft Rear Bearing Cover Capscrews	40-50
10	Air Shift Cylinder Capscrews	27-33
11	Drive Flange (Or Yoke) Clamp Plate Capscrew	494-600
12	Rear Countershaft Rear Bearing Cover Capscrews	40-50
13	Front Countershaft Rear Bearing Cover Capscrews	40-50
14	Drain Plug	25-30
15	Front Countershaft Front Bearing Cover Capscrews	40-50
--	Oil Filler Plug	55 Max.
--	Magnetic Oil Filter Plug	25-30

TORQUE SPECIFICATIONS

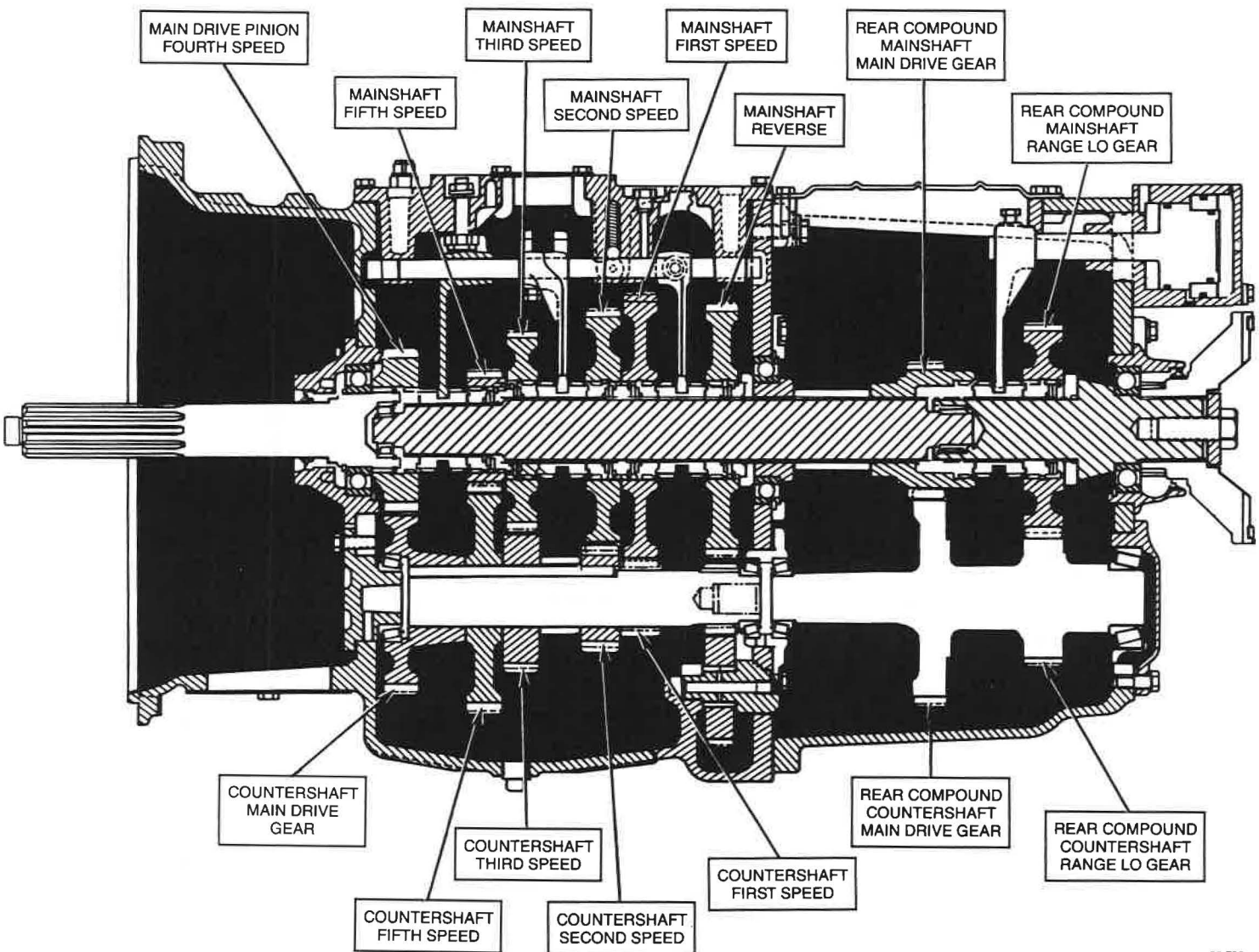
CUT-AWAY VIEW WITH CALL-OUTS FOR TORQUE VALUES



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GEAR NAMES

CUT-AWAY VIEW WITH GEAR NAMES

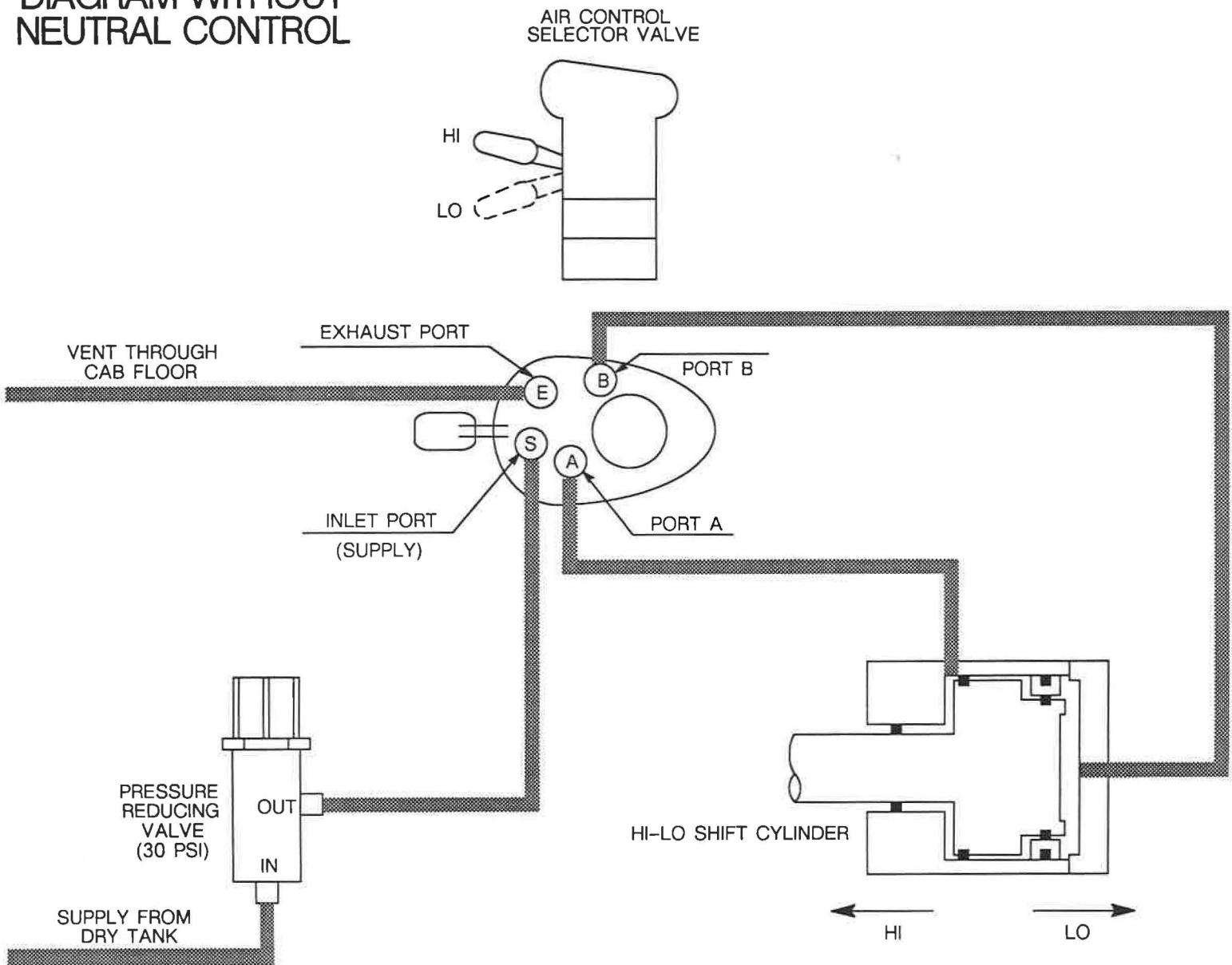


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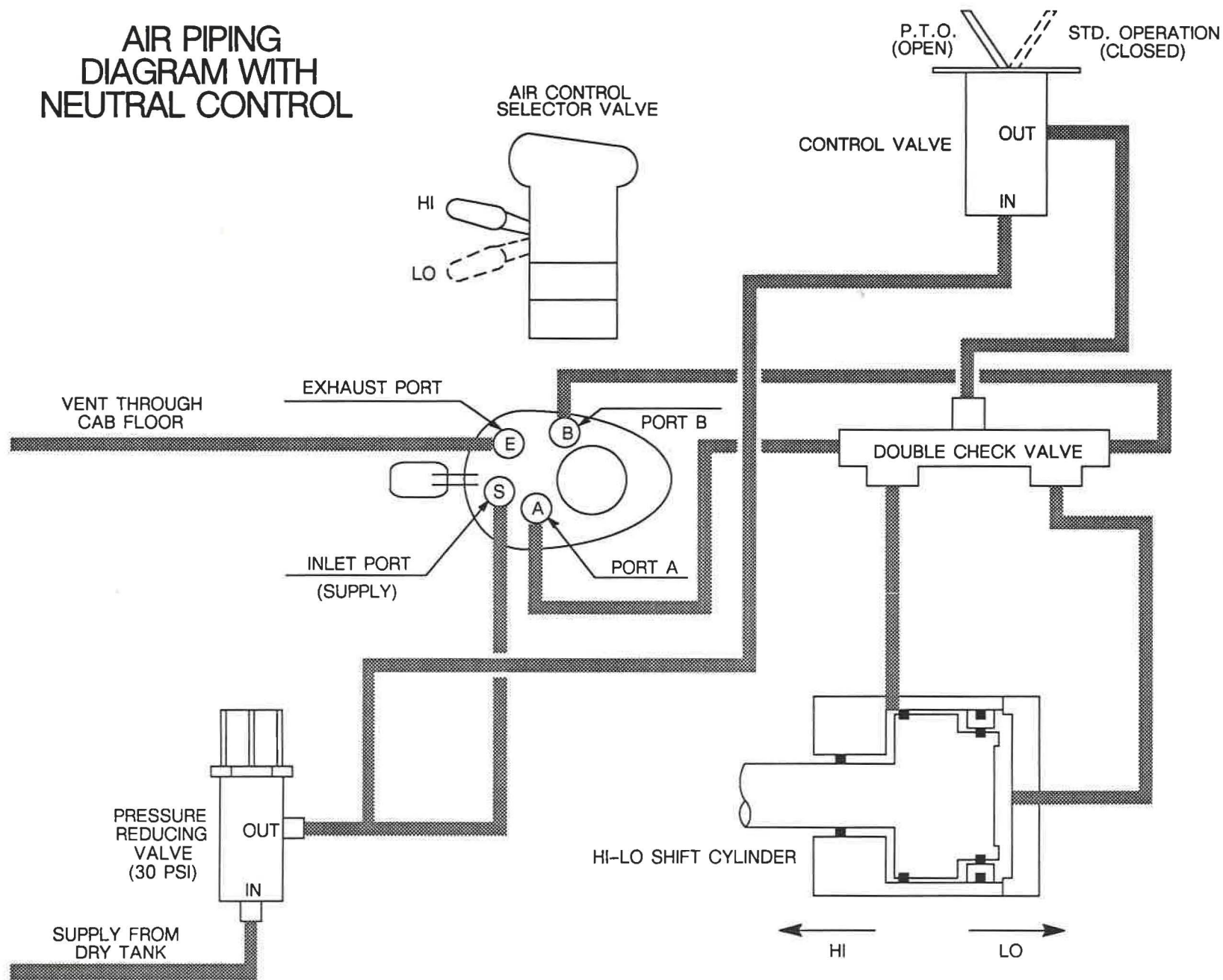
AIR PIPING WITHOUT NEUTRAL CONTROL

AIR PIPING DIAGRAM WITHOUT NEUTRAL CONTROL





AIR PIPING DIAGRAM WITH NEUTRAL CONTROL



AIR PIPING WITH NEUTRAL CONTROL

AIR PIPING DIAGRAM

TOLERANCE SPECIFICATIONS

TOLERANCE SPECIFICATIONS

SHIFT FORKS IN CLUTCHES			
	Minimum New	Maximum New	Maximum Wear
Clearance between fork pad and clutch groove	0.005 in.	0.020 in	0.050 in. *
* If unit has experienced disengagement, clearance must not exceed 0.030 inch maximum			

SPRING SPECIFICATIONS			
	Free Length In Inches	Load In Pounds	Length Under Load
First/Reverse Shifter Ball Spring	1.562	41.8 +/- 5	0.875 in.
First/Reverse Shifter Plunger Spring	1.500	22 +/- 2	0.625 in.
Shift Rail Poppet Ball Springs (3)	2.251	42.4 +/- 3	1.539 in.

GENERAL TOLERANCES	
Shift Rails To Mating Housing Bore	0.010 inch maximum
Reverse Idler Gear End-Play	0.003 - 0.020 inch
Front Countershaft Bearing Pre-Load	0.003 - 0.007 inch
Rear Countershaft Bearing Pre-Load	0.002 - 0.006 inch
Mainshaft Reverse Gear To Reverse Gear Spacer End-Play	0.028 - 0.078 inch
Mainshaft First Speed Gear To Mainshaft Second Speed Gear	0.020 - 0.079 inch
Mainshaft Third Speed Gear To Mainshaft Fifth Speed Gear	0.024 - 0.085 inch

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