Service Manual

Fuller Medium Heavy Transmissions TRSM0201

October 2007

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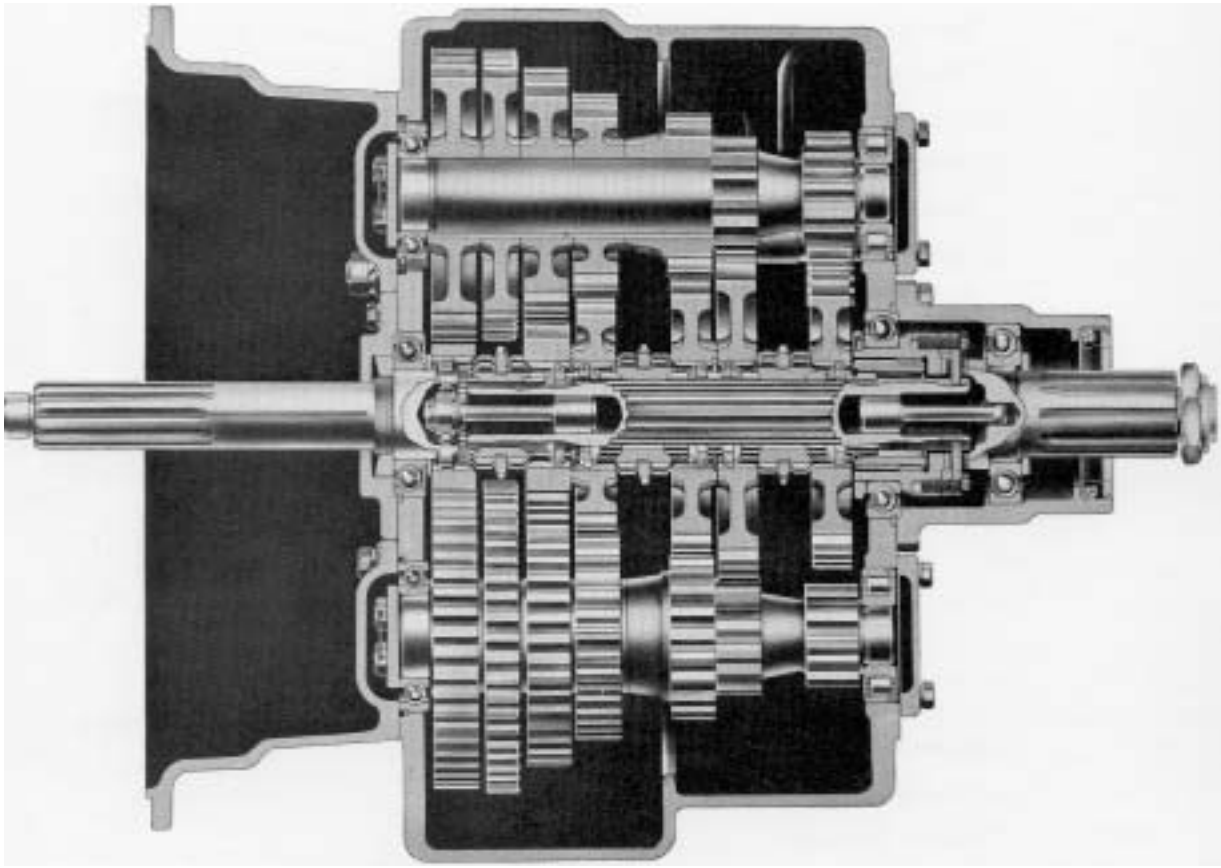
DESCRIPTION



CUTAWAY OF FIVE SPEED
TWIN-COUNTERSHAFT TRANSMISSION

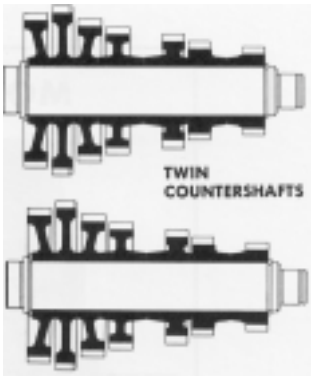
MODEL DESIGNATIONS

MODEL DESIGNATIONS		
T	=	Twin Countershaft Type
O	=	Used as a letter, denotes overdrive model
09	=	900 lbs. ft. capacity rating
05	=	Five speeds
“A”, “B”. etc.	=	Following numbers indicates a specific set of ratios

Since the models in the T-905 series are identical in construction, references in this manual apply to all models unless stated otherwise. This includes models not listed above which may have other ration combinations, designated by letters following the numerals.

PART NUMBERS SHOWN IN THIS MANUAL ARE SUBJECT TO CHANGE AND APPLY ONLY AT TIME OF PRINTING.

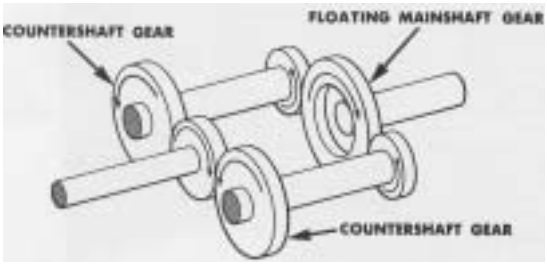
DESCRIPTION



The T-905 model transmissions have five forward speeds and one reverse speed, and are designed for heavy duty vehicles. These models are of twin countershaft design which divides the torque equally between shafts and gears, providing a high capacity to weight ratio.

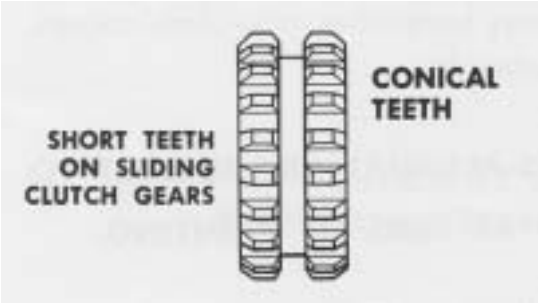
The countershafts, identical except for the PTO gears, are short and bearings are of a relative low capacity due to the split torque principle. All gears have spur type teeth.

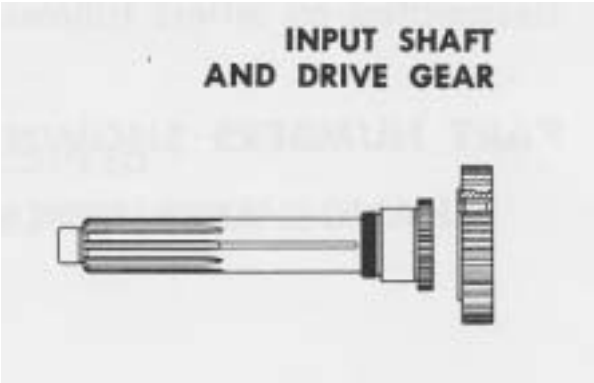
The mainshaft floats free, receiving only minor radial loads. Mainshaft vertical displacement to conform to clutched gear position is allowed by rod-like springs which resist float to right or left.



The mainshaft gears are not jounalled to the mainshaft, but are located axially by washers and held in position by rotation of the countershaft gears; this eliminates the need for bushings and sleeves. Because of equal tooth loading on each side of gear, pressure is reduced and gear face width can be narrowed. Gears are clutched by internal splines in hubs of gears. The sliding clutch gears with short, conical clutching teeth provide shorter and easier shifts.

The input shaft and drive gear are not integral, thus they can be changed individually.





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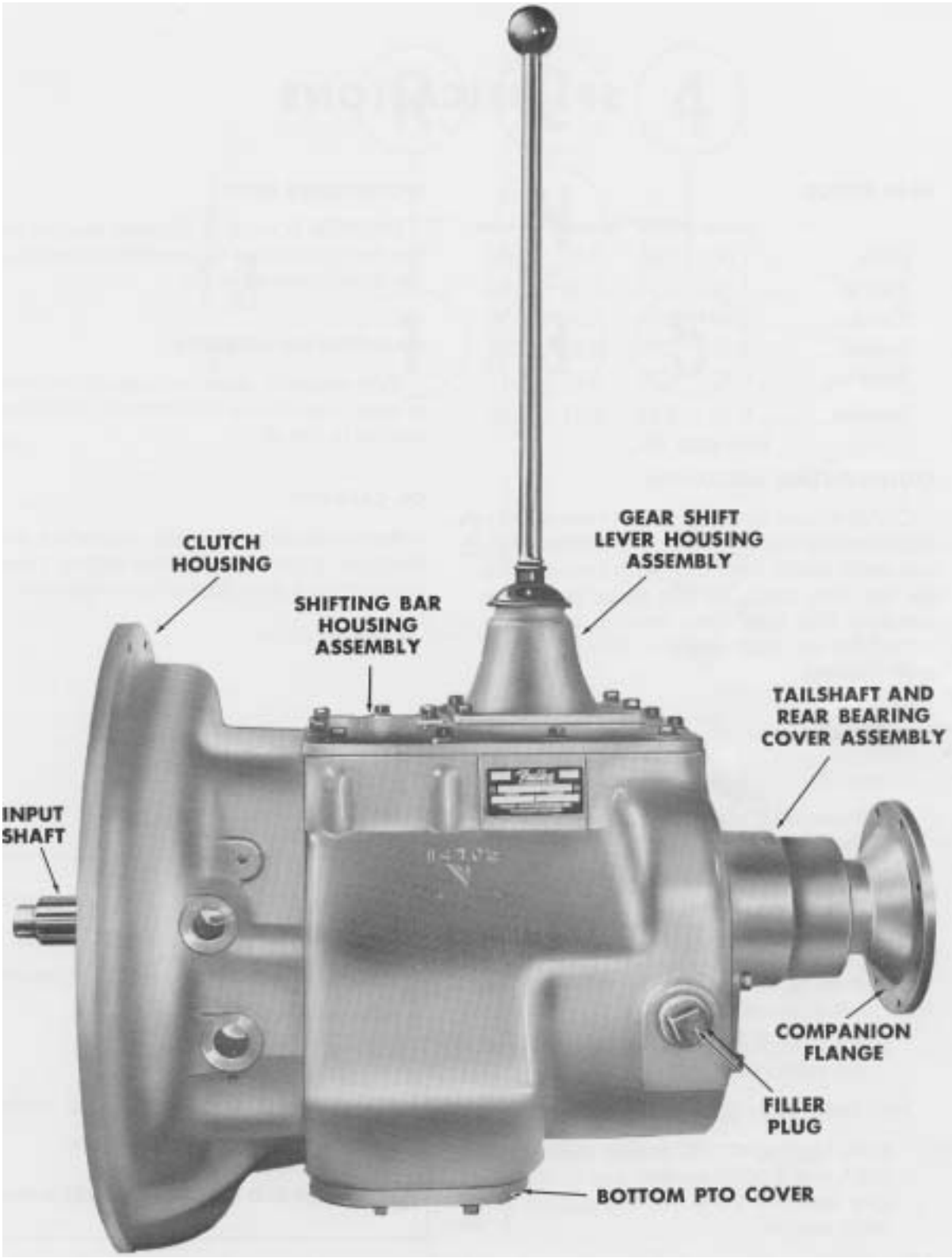


SPECIFICATIONS

GEAR RATIOS

	T-905A	T-905B	TO-905A	TO-905B
Fifth	1.00	1.00	0.65	0.86
Fourth	1.54	1.16	1.00	1.00
Third	2.38	2.04	1.54	1.76
Second	3.75	3.75	2.44	3.23
First	6.35	6.35	4.12	5.47
Reverse	6.48	6.48	4.21	5.58

SEE PAGE 68

Clutch Release Mechanism

Clutch release bearing carrier, release bearing, extended front bearing cover, release yoke and pedal shafts furnished with transmission for use with single or two plate, push type clutches. Flat type front bearing cover furnished for use with single or two plate, pull type clutches.

Power Take-Off

Openings

Bottom: SAE standard heavy-duty type, short length.

Right Side: SAE standard regular-duty type, short length.

PTO Drive Gear

Bottom: A 47-Tooth, 6/8 pitch gear on the left counterhshaft.

Right Side: A 45-Tooth, 6/8 pitch gear on the right countershaft.

PTO Drive Gear Speeds

Both turning at .533 engine speed on T-905A and T-905B models; and at .820 engine speed on TO-905A, and .619 on TO-905B models.

SPEEDOMETER DRIVE

Provision is made in the rear bearing cover for the installation of speedometer gears and the attachment of cable.

MAGNETIC OIL CLEANERS

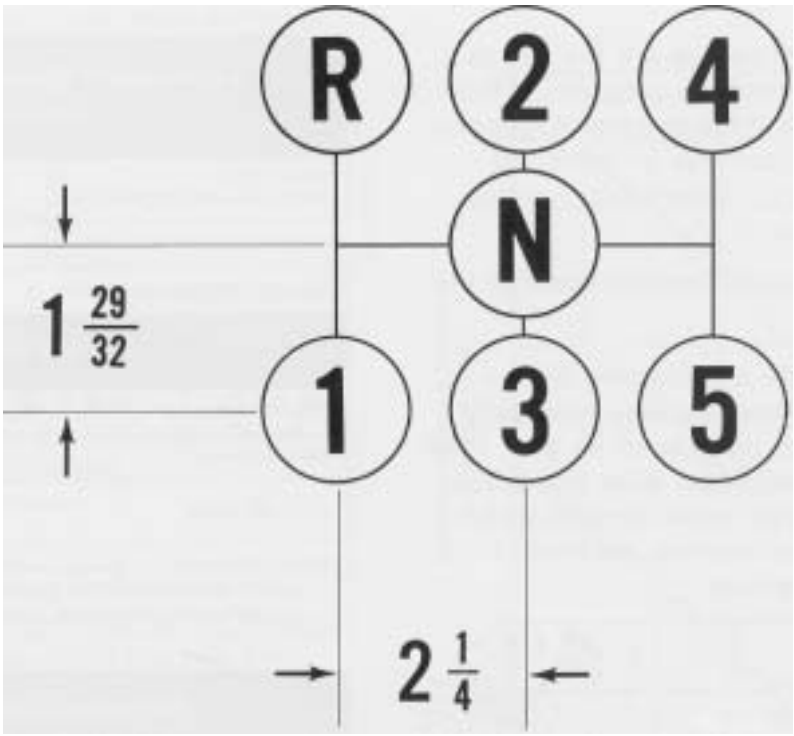
Two magnetic discs are installed in bottom of case to catch and hold metallic particles deposited in the oil.

OIL CAPACITY

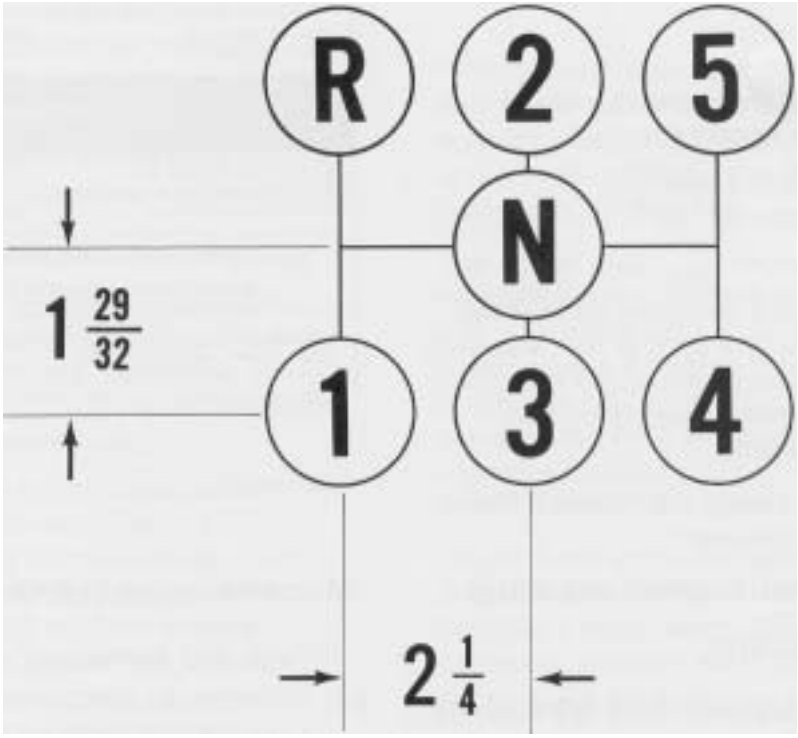
Approximately 22 pints, depending on inclination of transmission and engine. Twenty-two pints is a zero degree measurement.

Nominal torque rating	900 foot-pounds
Clutch housing size	SAE No. 1 or 2
Weight, with grey iron case	478 pounds
Length	
From face of clutch housing to rear shoulder of mainshaft	27-19/32 inches
From face of clutch housing to front of companion flange hub	24-23/32 inches

SPECIFICATIONS (SHIFTING DIAGRAMS)



Shifting Diagram for T-905 Model Transmissions



Shifting Diagram for TO-905 Model Transmissions

LUBRICATION

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

Oil is important, because here are some of the things it must do:

- Provide a protective film - to protect surface of heavily loaded parts such as gear teeth and bearings, thus preventing metal to metal contact which causes scoring, scuffing and seizure.
- Act as a coolant - to dissipate heat.
- Have sufficient fluidity - to follow, coat and cushion all loaded surfaces.
- Be chemically stable - to withstand heat and agitation without separation, gumming-up, oxidizing or corroding.
- Be non-foaming - to prevent excessive foam and increased volume under severe conditions.
- Be free of sediment and water - to prevent sludge and rust.

Fuller Transmissions are designed so that the internal parts operate in a bath of oil circulated by the motion of gears and shafts. Grey iron parts have built-in channels where needed, to help lubricate bearings and shafts.

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

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

LUBRICATION CHANGE AND INSPECTION HIGHWAY USE	
First 3,000-5,000 miles (4827 - 8045 Km)	Change transmission oil on new units.
Every 5,000 miles (8045 Km)	Inspect oil level. Check for leaks.
Every 50,000 miles (80,450 Km)	Change transmission oil.
OFF-HIGHWAY	
First 30 hours	Change transmission oil on new units.
First 40 hours	Inspect oil level. Check for leaks.
Every 500 hours	Change transmission oil where severe dirt conditions exist.
Every 1,000 hours	Change transmission oil (Normal off-highway use).
Change Oil Filter Element, If So Equipped, At Each Oil Change.	

RECOMMENDED LUBRICANTS ON-HIGHWAY VEHICLES		
TYPE	GRADE	TEMPERATURE
Heavy Duty Engine Oil MIL-L-2104C, or MIL-L-46152, or API-SE, or API-CC	SAE 50 or SAE 40 SAE 30	Above + 10°F. (-12.5°C.) Below + 10°F.
Mineral Gear Oil	SAE 90 SAE 80W	Above + 10°F. Below + 10°F.
OFF-HIGHWAY		
Heavy Duty Engine Oil MIL-L-2104C, or MIL-L-46152, or API-SE, or API-CC	SAE 50 or SAE 40 SAE 30	Above + 10°F. Below + 10°F.
Special Recommendation - For extreme cold weather where temperature is consistently below 0°F.		
Heavy Duty Engine Oil MIL-L-2104C, or MIL-L-46152, or API-SE, or API-CC	SAE 20W	Below 0°F. (-18°C.)

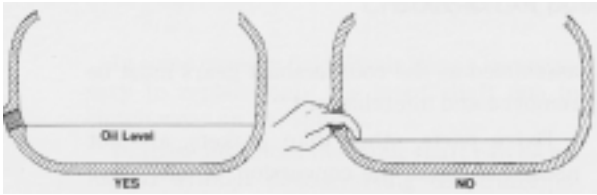
Miscellaneous Lubricants

O-Rings and Surfaces - Dowing Corning #200 Silicone, 30,000 Centistokes. Union Carbide L-45 Silicone, 30,000 Centistokes.

Lubrication

Proper Oil Level

Make sure oil is level with filler opening. Because you can reach oil with your finger does not mean oil is at proper level.



Draining Oil

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

Refilling

Clean area around filler plug and remove plug from side of case. Fill transmission to the level of the filler opening. If transmission has two filler openings, fill to level of rear opening on single countershaft models; fell to level of both openings on twin countershaft models.

The exact amount of oil will depend on the transmission inclination and model. *In every instance, fill to the level of the filler opening.*

Do not over fill. This will cause oil to be forced out of the case through mainshaft openings.

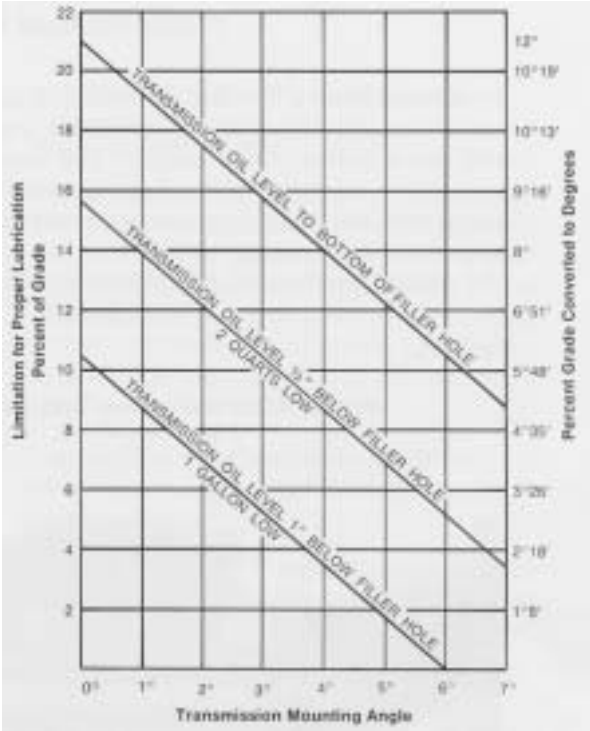
Adding Oil

It is recommended that types and brands of oil should not be intermixed because of possible incompatibility.

Operating Temperature

It is important that the transmission operating temperature does not exceed 250°F. (120°C.) for an extended period of time. Operating temperatures above 250°F. will cause breakdown of the oil and shorten transmission life.

The following conditions in any combination can cause operating temperatures of over 250°F: (1) Operating consistently at roadspeeds under 20 MPH, (2) High engine RPM, (3) High ambient temperature, (4) Restricted air flow around transmission, (5) Exhaust system too close to transmission, (6) high horsepower, over-drive operation. High operating temperatures may require more frequent oil changes.



External cooler kits are available to keep the transmission operating temperature under 250°F. when the conditions described above are encountered.

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

The above chart illustrates the safe percent of upgrade on which the transmission can be used with various chassis mounting angles. For example: If you have a 4 degree transmission mounting angel, then 8 degrees (or 14 percent of grade) is equal to the limit of 12 degrees. If you have a 0 degree mounting angle, the transmission can be operated on a 12 degree (21 percent) grade.

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

Note on the chart the effect low oil levels can have on safe operating angles. Allowing the oil level to fall ½" below the filler plug hole reduces the degree of grade by approximately 3 degrees (5.5)

PROPER LUBRICATION LEVELS ARE IMPORTANT!

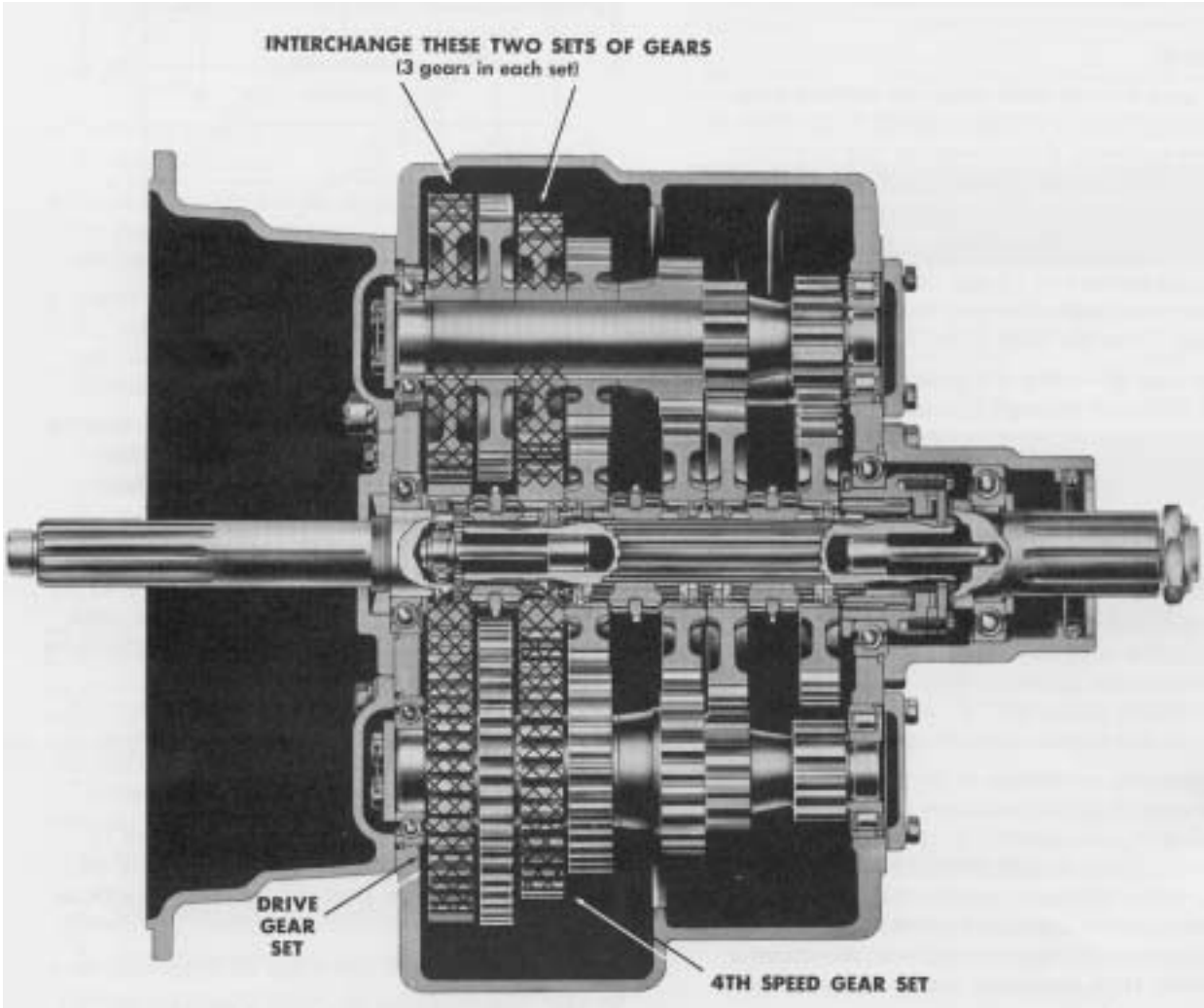
CONVERSION TO OVERDRIVE

TO CONVERT FROM T-905A To TO-905A, or T-905B to TO-905B

To convert from a T-905A or T-905B to an overdrive model TO-905A or TO-905B the 4th speed gear on the mainshaft and mating gears, one on each countershaft, are interchanged with the main drive gear and mating countershaft drive gears.

The transmission must be completely disassembled as the countershaft gears must be removed and interchanged.

Extra parts, other than gaskets are not needed to make the conversion. A new drive gear bearing nut may be needed as this part may be damaged during removal.



SPECIAL PROCEDURE FOR CHANGING THE CLUTCH (INPUT) SHAFT

In some case it may be necessary to remove only the input shaft due to clutch wear on the splines. In these cases, the input shaft can be removed without disassembling the transmission other than removing the shift bar housing. Removal of the clutch housing is optional. The following is the detailed procedure:

Disassembly

1. Remove the gear shift lever housing and shift bar housing from transmission.

2. Remove the front bearing cover.

3. Remove the drive gear bearing nut.

4. Move the drive gear assembly as far forward as possible and remove the drive gear bearing.

5. Remove the spacer from input shaft.

6. From the front, remove the snap ring from ID of drive gear.

7. Pull the input shaft forward and from splines of drive gear.

Reassembly

1. Install new input shaft into splines of drive gear just far enough to expose snap ring groove in ID of drive gear.

2. Install snap ring in ID of drive gear.

3. Install spacer on shaft.

4. IMPORTANT - To prevent damaging the front quill when installing bearing, move the 4th & 5th speed sliding clutch gear forward to contact end of input shaft in hub of drive gear. Block between rear of sliding clutch and front of the 4th speed gear. When installing bearing this will hold input shaft away from quill.

5. Install drive gear bearing on shaft and into case bore, making sure blocking remains in place.

6. Remove blocking from mainshaft and install the drive gear bearing nut, left-hand thread. Use Loctite sealant on threads of nut and shaft.

7. Peen nut into milled slot in shaft.

8. Re-install front bearing cover, shifting bar housing and gear shift lever housing.

NOTE: The above instructions are for changing the input shaft only. To change the drive gear, removal of the mainshaft and countershaft bearings is necessary.

GENERAL PRECAUTIONS FOR DISASSEMBLY

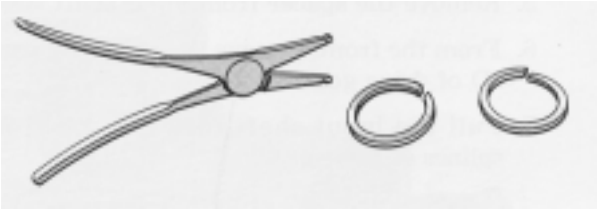
Important: Read this section before starting the detailed disassembly procedures.

It is assumed in the detailed disassembly instructions that the transmission lubricant has been drained and the transmission has been removed from the chassis.

Removal of the gear shift lever housing assembly is included in the detailed instructions; however, this assembly must also be removed from transmission before removing unit from vehicle.

Follow each procedure closely in each section, making use of both the text and pictures.

1. BEARINGS - Carefully wash and relubricate all bearings as removed and protectively wrap until ready for use. Remove bearings with pullers designed for this purpose.



2. SNAP RINGS - Remove snap rings with pliers designed for this purpose. Rings removed in this manner can be reused.

3. INPUT SHAFT - The clutch or input shaft can be removed without removing the countershafts or mainshaft (Refer to Page 11).

4. CLEANLINESS - Provide a clean place to work. It is important that no dirt or foreign material enters the unit during repairs. The outside of the unit should be carefully cleaned before starting the disassembly. Dirt is abrasive and can damage bearings.

5. WHEN DRIVING - Apply force to shafts, housings, etc., with restraint. Movement of some parts is restricted. Do not apply force after the part being driven stops solidly. Use soft hammers and bars for all disassembly work.

DETAILED DISASSEMBLY INSTRUCTIONS

A. To Remove and Disassemble the Gear Shift Lever Housing Assembly

1. Turn out the four capscrews and lift the gear shift lever housing, or remote control housing, from the shifting bar housing (See Illustration 1).

2. Remove the ball grip and rubber dust cover from the gear shift lever.'

3. Mount the assembly in a vise with the large bottom opening upwards.

4. Free the tension spring by twisting a heavy screwdriver between spring and housing, forcing spring from its seat in housing (See Illustration 2).

5. Remove the tension spring from housing.

6. Withdraw the tension spring washer and gear shift lever out through bottom housing (See Illustration 3).

7. Remove nut and lockwasher from pivot pin.

8. Remove pivot pin by forcing it inward and through wall of housing.

#1 - Lifting gear shift lever housing from shifting bar housing.

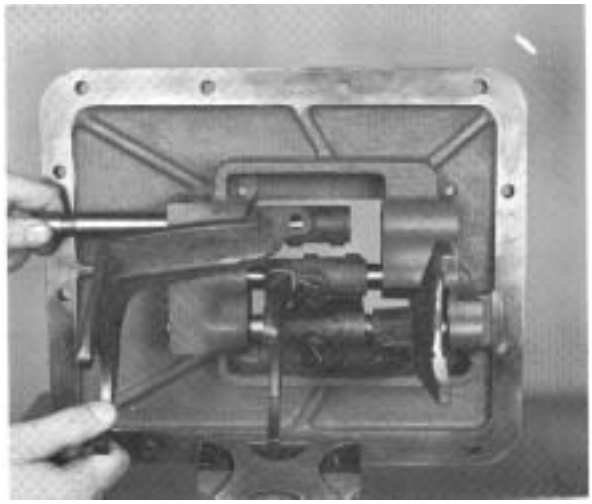
#2 - Removing the gear shift lever tension spring from under lugs cast in housing.

#3 - Removing washer and gear shift lever from housing.

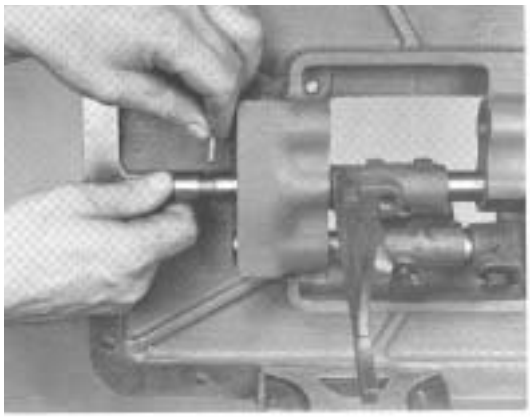
DISASSEMBLY

#4 - Lifting the shifting bar housing from transmission.

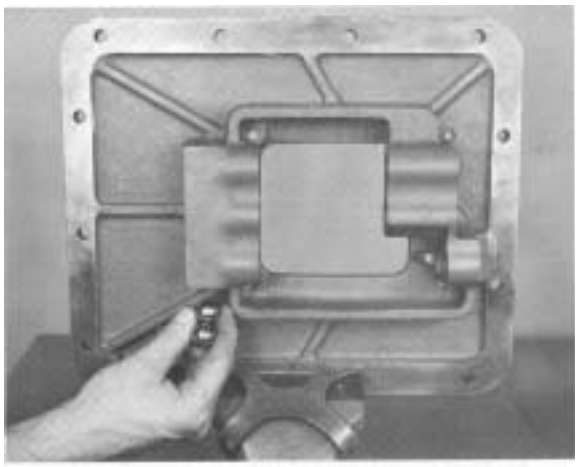
#5 - Removing shifting bar tension springs.



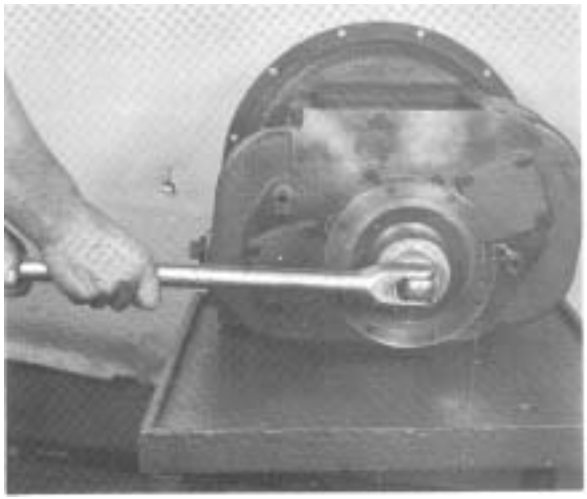
I#6 - Pulling the 4th-5th speed shifting bar from housing.



#7 - Removing interlock pin from neutral notch in the 2nd & 3rd speed shifting bar.



#8 - Two interlock balls are located in front boss, one between each bar.



#9 - Turning companion flange nut from output shaft.

DISASSEMBLY

B. To Remove the Shifting Bar Housing Assembly

1. Turn out the attaching capscrews.

2. Jar to break the gasket seal and lift the shifting bar housing from transmission (See Illustration #4).

C. To Disassemble the Shifting Bar Housing Assembly

NOTE: Lay all parts on a clean bench in the order in which they are removed to facilitate reassembly. Keep bars not being removed in the neutral position or interlock parts will lock bars.

1. Turn out the two capscrews and remove the tension spring cover from top of housing.

2. Remove the three tension springs from bores in housing (See Illustration #5).

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

4. Place the housing in a vise with the left side up; the long bar will be at the bottom.

5. Cut lockwire and remove lockscrews from each bar just prior to its removal.

6. Move the top, 4th-5th speed shifting bar to the front and out of housing, removing shifting yoke from bar (See Illustration #6).

7. Move the center, 2nd-3rd speed shifting bar to the front and out of housing, removing the shifting yoke from bar. As the neutral notch in bar clears housing boss, remove the small interlock pin from bore in neutral notch (See Illustration #7).

8. Move the bottom, 1st-Reverse speed shifting bar to the front and out of housing, removing the shifting yoke and block from bar.

9. Two interlock balls will fall from interlock ball opening in front boss as the last bar is removed (See Illustration #8).

D. To Remove the Companion Flange or Yoke

1. Lock the mainshaft by engaging two speeds with the mainshaft sliding clutch gears.

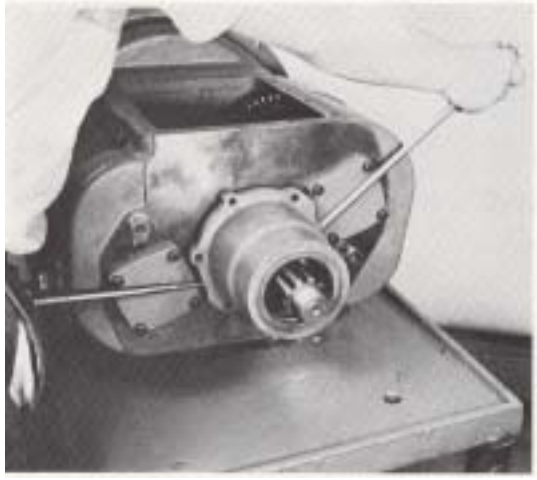
2. Turn the elastic stop nut from the output shaft (See Illustration #9).

3. Pull the flange or yoke from splines of the tailshaft.

E. To Remove and Disassemble the Rear Bearing Cover Assembly

1. Turn out the attaching capscrews from the rear bearing cover.

2. Pry the bearing cover evenly to the rear to unseat from tailshaft bearing (See Illustration #10).



#10 - Prying rear bearing cover evenly to rear.

3. Remove the bearing cover from tailshaft (See Illustration #11).

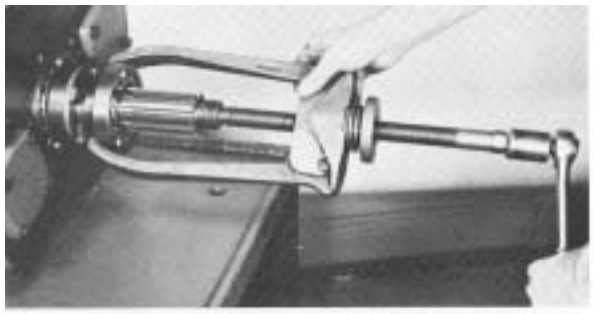
4. Remove the speedometer gear, or replacement spacer, and the bearing washer from tailshaft or from cover.

5. Pull the outer bearing from tailshaft. (This bearing may remain in cover; in this case, move the bearing evenly forward and from cover) See Illustration #12.

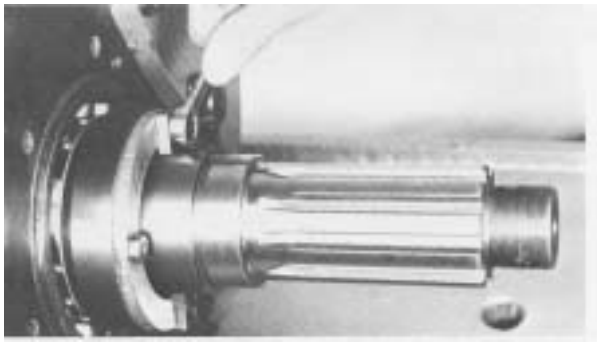
6. Remove the oil seal from cover if necessary.

DISASSEMBLY

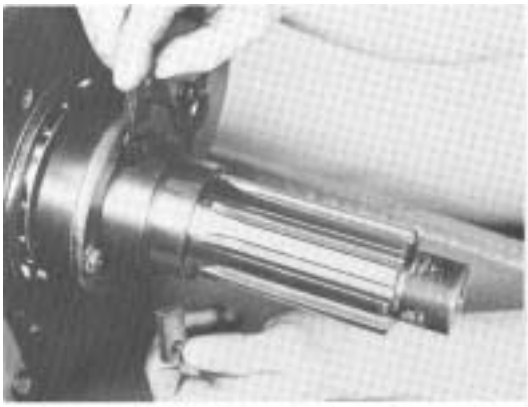
#11 - Removing rear bearing cover from tailshaft.



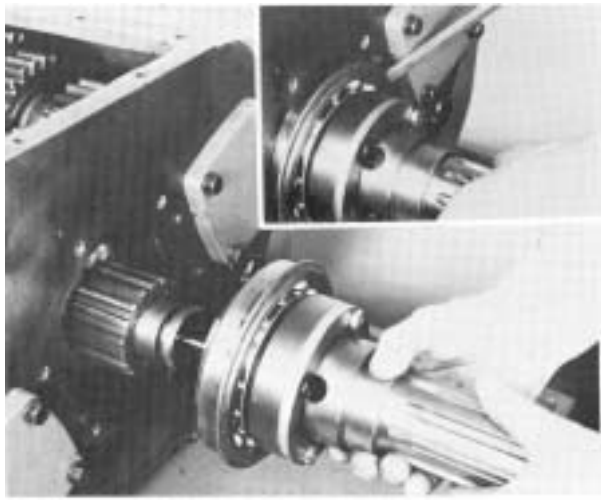
#12 - Pulling the tailshaft outer bearing.



#13 - Removing capscrews from flat keys.



#14 - Removing flat keys from tailshaft. These keys maintain relative position of mainshaft to tailshaft.



#15 - Removing tailshaft from case bore. Start assembly to the rear by prying evenly against bearing snap ring.

#16 - Removing key spacer ring from tailshaft.

#17 - Turning bearing nut from tailshaft, left-hand thread.

DISASSEMBLY

F. To Remove and Disassemble the Tailshaft Assembly

1. Cut lockwire and turn out the two 5/16” capscrews from the two flat keys (See Illustration #13).

2. Remove the two flat keys from bores in tailshaft. These keys maintain the position of the mainshaft in relation to tailshaft (See Illustration #14).

3. Move the tailshaft evenly to the rear and from case bore. Moving the mainshaft assembly to the rear will start moving tailshaft from bore (See Illustration #15).

4. Remove the splined coupling gear from mainshaft, or from pocket in tailshaft.

5. Turn out the 5/16” capscrews and remove the key spacer ring from tailshaft (See Illustration #16).

6. Remove the bearing nut from tailshaft, left-hand thread (Illustration #17).

7. Press the front bearing from tailshaft.

G. To Remove the Clutch Housing

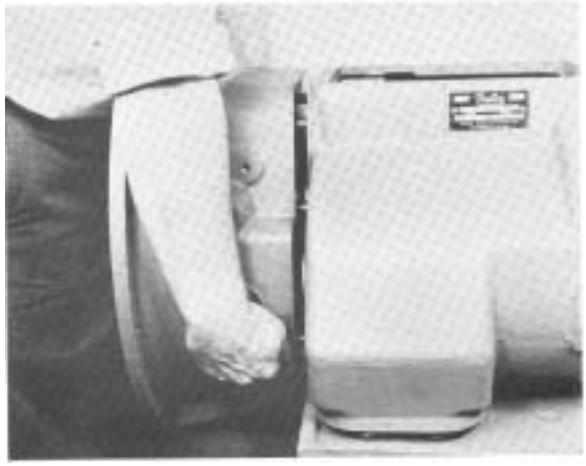
NOTE: The clutch housing can be removed at any time during transmission disassembly. However, it must be removed BEFORE the two countershafts can be removed.

1. Remove the clutch release mechanism if the transmission is so equipped.

2. Turn out the four bolts and remove the six nuts and lockwashers from studs at front of case (See Illustration #18).

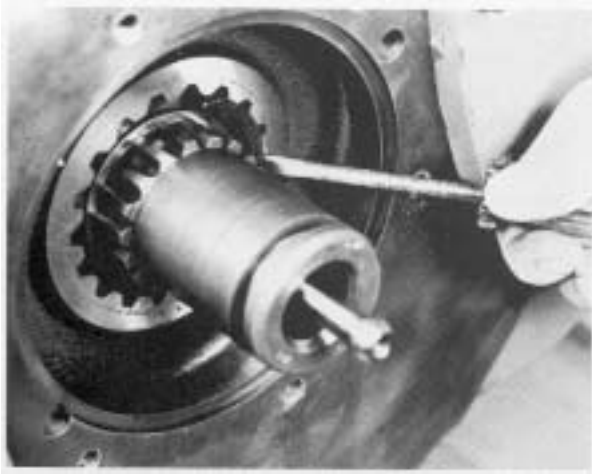
3. Break gasket seal and pull clutch housing from case (See Illustration #19).

#18 - Turning attaching bolts from clutch housing.



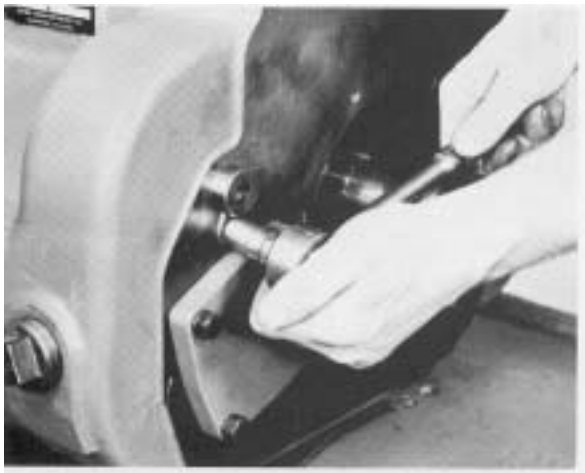
#19 - Removing clutch housing from case.

DISASSEMBLY

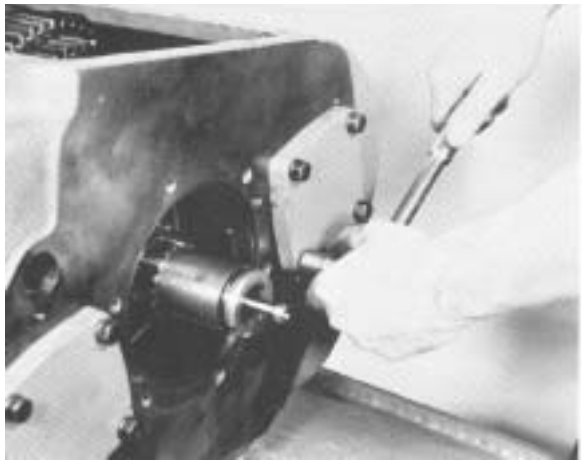


#20 - Removing snap ring from ID of the mainshaft reverse gear.

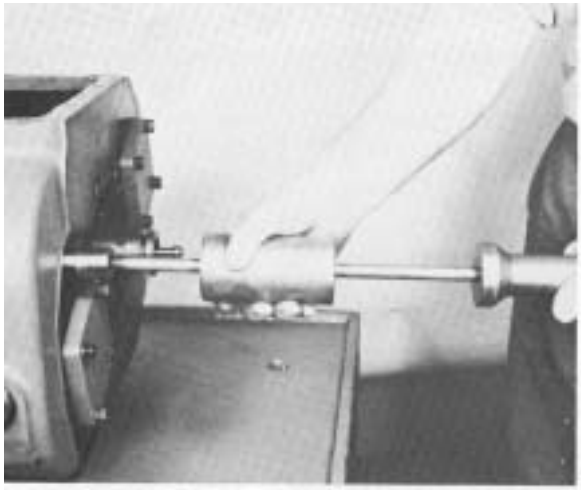
#23 - Removing left reverse idler gear and the two thrust washers from case.



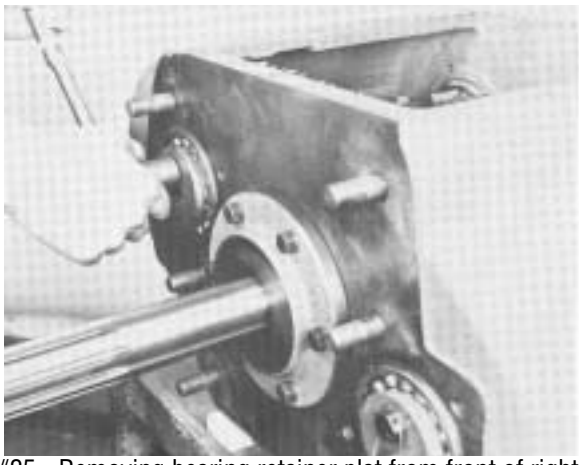
#21 - Removing lockplate from left reverse idler shaft.



#24 - Removing rear bearing cover from right counter-shaft.



#22 - Removing left reverse idler shaft with impact puller.



#25 - Removing bearing retainer plat from front of right countershaft.

DISASSEMBLY

H. To Remove the Left Reverse Idler Gear

NOTE: The left reverse idler gear must be removed in order to remove the mainshaft assembly.

1. Move the mainshaft assembly forward as far as possible and the mainshaft reverse gear to the rear against case.

2. Remove the snap ring from ID of the mainshaft reverse gear (See Illustration #20).

3. Move the 1st-Reverse sliding clutch gear and the reverse gear as far forward as possible on the mainshaft.

4. Turn out capscrew at rear of transmission and remove the lock plate from slot in the idler shaft (See Illustration #21).

5. Use impact puller to withdraw the idler shaft from case (See Illustration #22).

6. Remove the reverse idler gear and the two thrust washers from case (See Illustration #23).

7. Remove inner race of bearing from gear bore.

8. Press needle bearing from gear bore.

9. Remove plug from idler shaft if necessary.

I. To Remove Bearings from Right Countershaft

NOTE: In order to remove the mainshaft assembly it will be necessary to move the right countershaft by removing bearings.

1. Turn out capscrews and remove rear bearing cover from right countershaft (See Illustration #24).

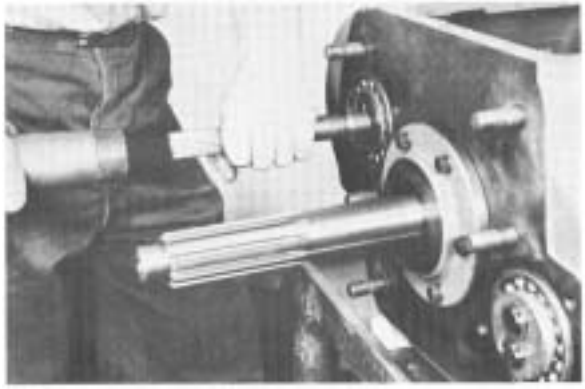
2. Cut lockwire, turn out the two capscrews and remove bearing retainer plate from front of right countershaft (See Illustration #25).

3. Use soft bar and mall to move the right countershaft to the rear until snap ring groove in rear bearing is exposed. Do not unseat shaft from front bearing (See Illustration #26).

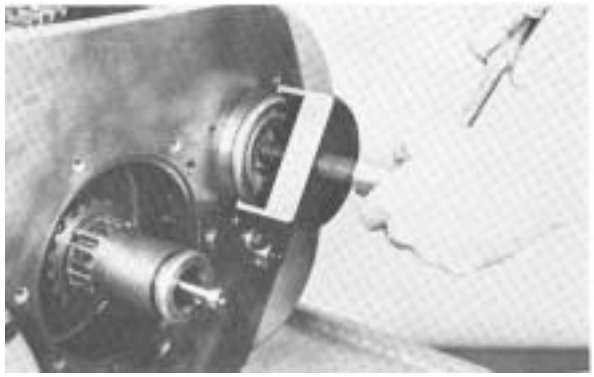
4. Use puller to remove rear bearing from shaft. A snap ring can be installed in rear bearing groove to facilitate pulling if groove type puller is not available (See Illustration #27).

5. Use soft bar and mall to move right countershaft forward to partially unseat front bearing (See Illustration #28).

6. Remove front bearing from countershaft (See Illustration #29).

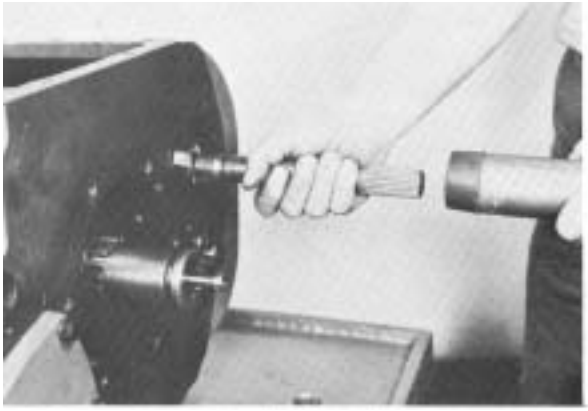


#26 - Moving right countershaft to the rear to expose rear bearing. DO NOT UNSEAT FRONT BEARING FROM SHAFT.

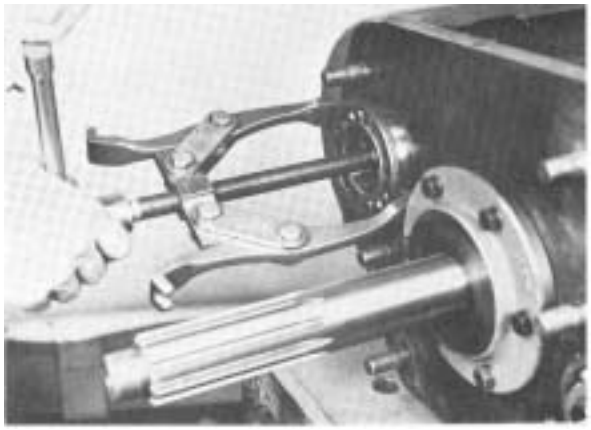


#27 - Pulling rear bearing from right countershaft.

DISASSEMBLY

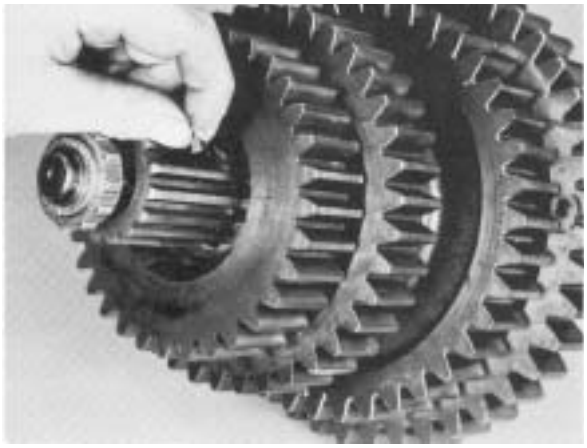


#28 - Moving right countershaft forward to expose front bearing.

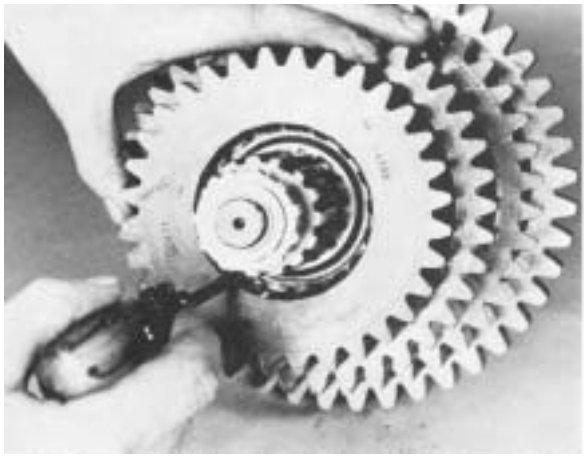


#29 - Pulling from bearing from right countershaft.

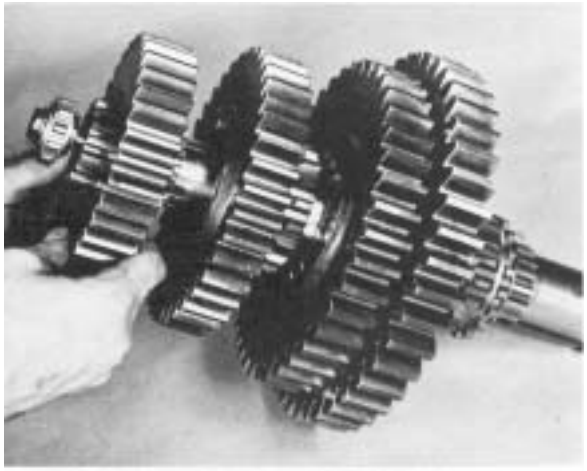
#30 - Removing mainshaft assembly from case.



#31 - Removing short key from keyway in mainshaft.



#32 - Turning the 4th-speed gear washer to align with mainshaft splines.



#33 - Removing 4th-speed gear, spacer and washer from shaft.

DISASSEMBLY

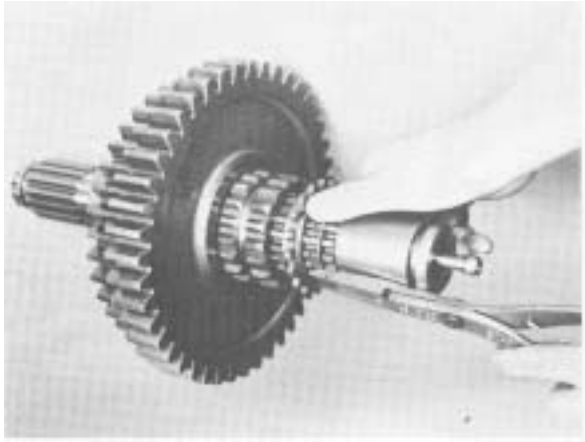
J. To Remove the Mainshaft Assembly

1. With right countershaft moved toward wall of case, pull the mainshaft to the rear, life front of shaft and remove assembly from case (See Illustration #30).

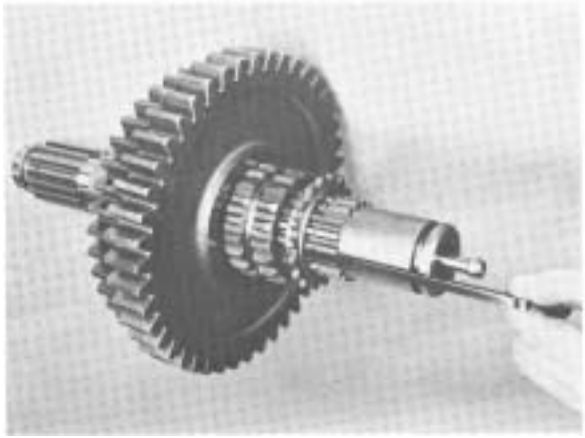
K. To Disassemble the Mainshaft Assembly

NOTE: When removing washers, spacers and gears, note their location to facilitate reassembly. Keep washers and spacers with the gear from which they were removed; there is one spacer and one washer for each gear. The spacers have external splines to engage gear splines; the washers have internal splines to engage mainshaft splines.

1. Remove the Reverse gear from mainshaft.
2. Remove the 4th-5th speed sliding clutch from front of shaft.
3. Remove the short key from keyway near front of shaft. This key locks the 4th speed gear washer in position (See Illustration #31).
4. Turn the 4th speed gear washer, located in hub of 4th speed gear, to align with splines in mainshaft (See Illustration #32).
5. Pull gear forward to remove the washer, spacer and gear from shaft (See Illustration #33).
6. Remove the 3rd speed gear, washer and spacer from shaft.
7. Remove the 2nd-3rd speed sliding clutch gear from shaft.
8. Remove the key retaining snap ring from slot near rear of mainshaft (See Illustration #34).
9. Pull the long key from mainshaft (See Illustration #35).
10. Remove the Reverse gear spacer, washer and the 1st-Reverse sliding clutch gear from shaft (See Illustration #36).
11. Remove the 1st and 2nd speed gears with washers and spacers from mainshaft (See Illustration #37).
12. Remove the quill bearing snap ring.
13. Pull the quill bearing from quill. Do not move quill as relative position of quill and mainshaft must be retained (See Illustration #38).

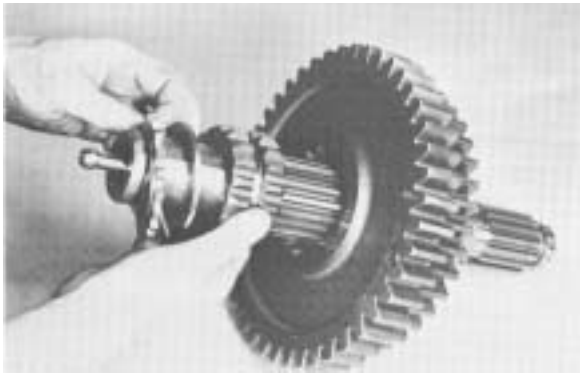


#34 - Removing key-retaining snap ring from mainshaft.

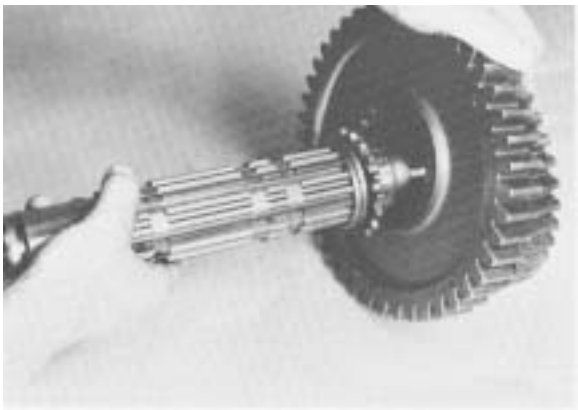


#35 - Pulling the long key from mainshaft.

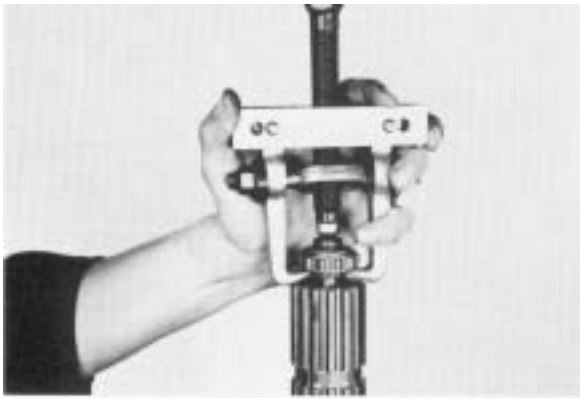
DISASSEMBLY



#36 - Removing spacer, washer and sliding clutch from mainshaft.

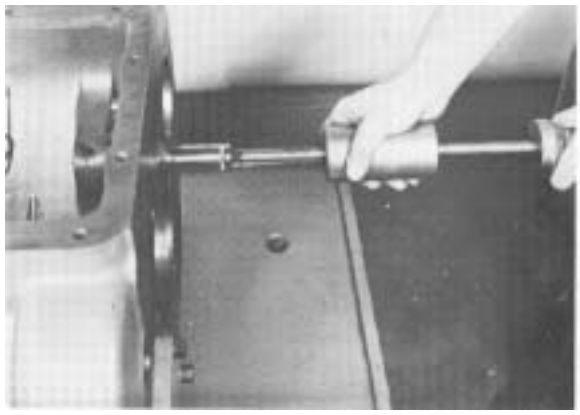


#37 - Removing remaining gears, spacers, and washers from mainshaft.



#38 - Pulling the quill bearing.

#39 - Lifting the right countershaft from case.



#40 - Removing the right reverse idler shaft with impact puller.

#41 - Removing the right reverse idler gear and two thrust washers from case.

DISASSEMBLY

L. To Remove the Right Countershaft Assembly

1. Move the countershaft to the rear, move front of shaft toward center of case and lift the assembly from case (See Illustration #39)

M. To Remove the Right Reverse Idler Gear

1. Turn out capscrews at rear of transmission and remove the lock plate from slot in the idler shaft.
2. Use impact puller to withdraw the idler shaft from case (See Illustration #40).
3. Remove the reverse idler gear and the two thrust washers from case (See Illustration #41).
4. Remove inner race of bearing from gear bore.
5. Press the needle bearing from gear bore.

N. To Remove the Left Countershaft Assembly

1. Turn out capscrews and remove the rear bearing cover from left countershaft (See Illustration #42).
2. Cut lockwire, turn out the two capscrews and remove the bearing retaining plate from front of left countershaft (See Illustration #43).
3. Use soft bar and mall to move the countershaft far enough to the rear to expose the snap ring groove in rear bearing.
4. Use puller to remove rear bearing from shaft. A snap ring can be installed in rear bearing groove to facilitate pulling if groove type puller is not available (See Illustration #44).
5. Use soft bar and mall to move countershaft forward to partially unseat front bearing. Keep rear of shaft centered in bore with block (See Illustration #45).
6. Remove front bearing from countershaft and case bore.
7. Move the countershaft to the rear, lift front of shaft to the center and up to remove from case (See Illustration #46).

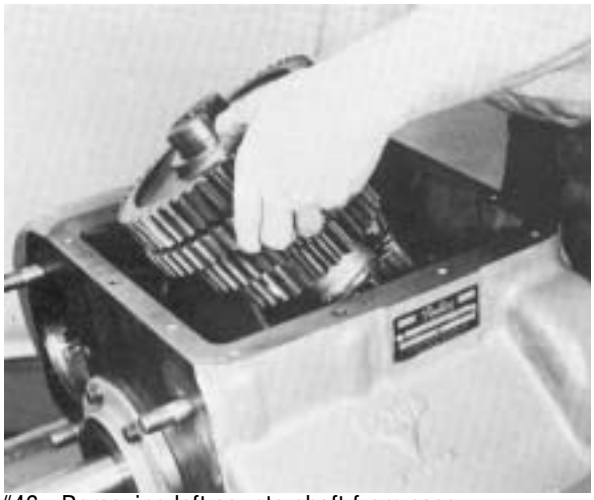
#42 - Removing rear bearing cover from left countershaft.

#43 - Removing bearing retainer plate from front of left countershaft.

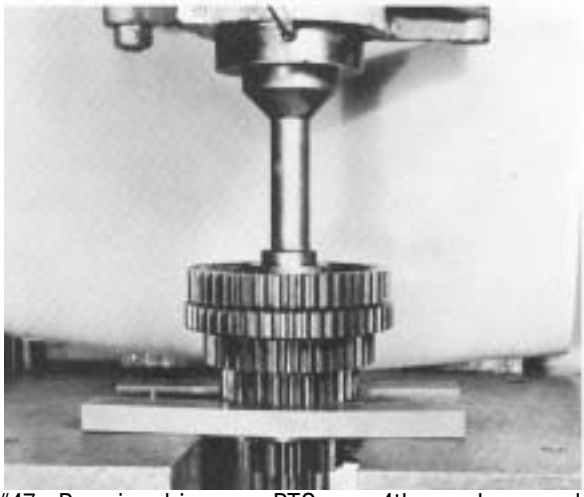
DISASSEMBLY

#44 - Pulling rear bearing from left countershaft.

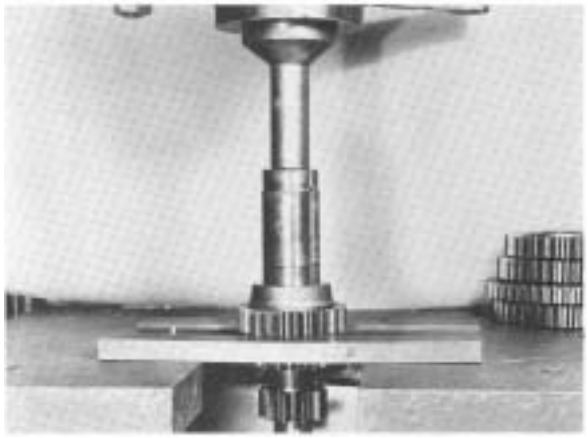
#45 - Moving left countershaft forward to unseat from bearing.



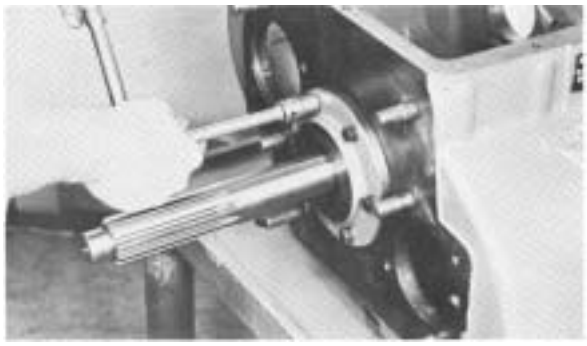
#46 - Removing left countershaft from case.



#47 - Pressing drive gear, PTO gear, 4th speed gear and 3rd speed gear from countershaft.



#48 - Pressing 2nd speed gear from countershaft.



#49 - Turning capscrews from front bearing cover.

DISASSEMBLY

O. To Disassemble the Countershaft Assemblies

NOTE: Both countershafts are disassembled in the same manner.

1. Press the drive gear, PTO gear, 4th speed gear and 3rd speed gear from countershaft. Use caution when pressing gears as it is necessary to press these gears off in a cluster of four (See Illustration #47).

2. Press the 2nd speed gear from countershaft (See Illustration #48).

3. Remove the two keys from countershaft if necessary.

4. Remove the roll pin from countershaft if necessary.

P. To Remove the Drive Gear Assembly

1. Turn out capscrews from the front bearing cover (See Illustration #49).

2. Use soft bar and mall from inside case to move the drive gear assembly forward as far as possible and remove the bearing cover.

3. Remove the snap ring from bearing (See Illustration #50).

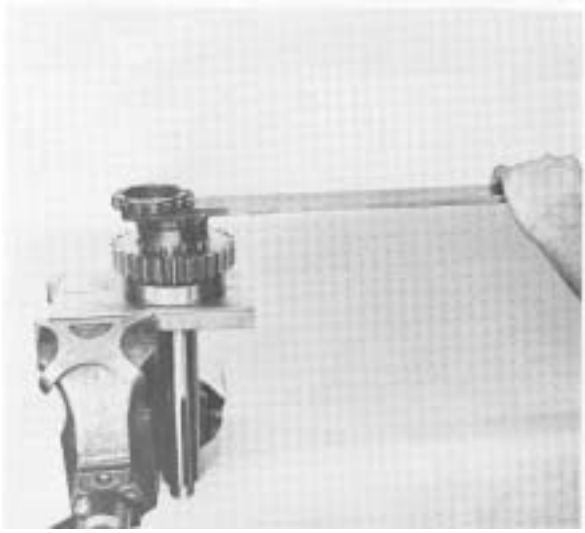
4. Move the assembly to the inside of case and lift through top of case (See Illustration #51).

#50 - Removing snap ring from drive gear bearing.

#51 - Lifting gear assembly out through top of case.

DISASSEMBLY

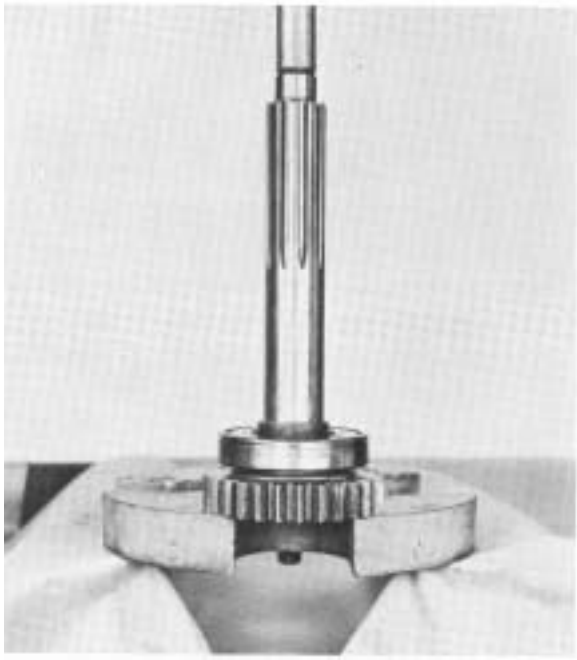
#52 - Relieving bearing nut where peened into shaft.



#53 - Turning drive gear bearing nut from shaft, left-hand thread.

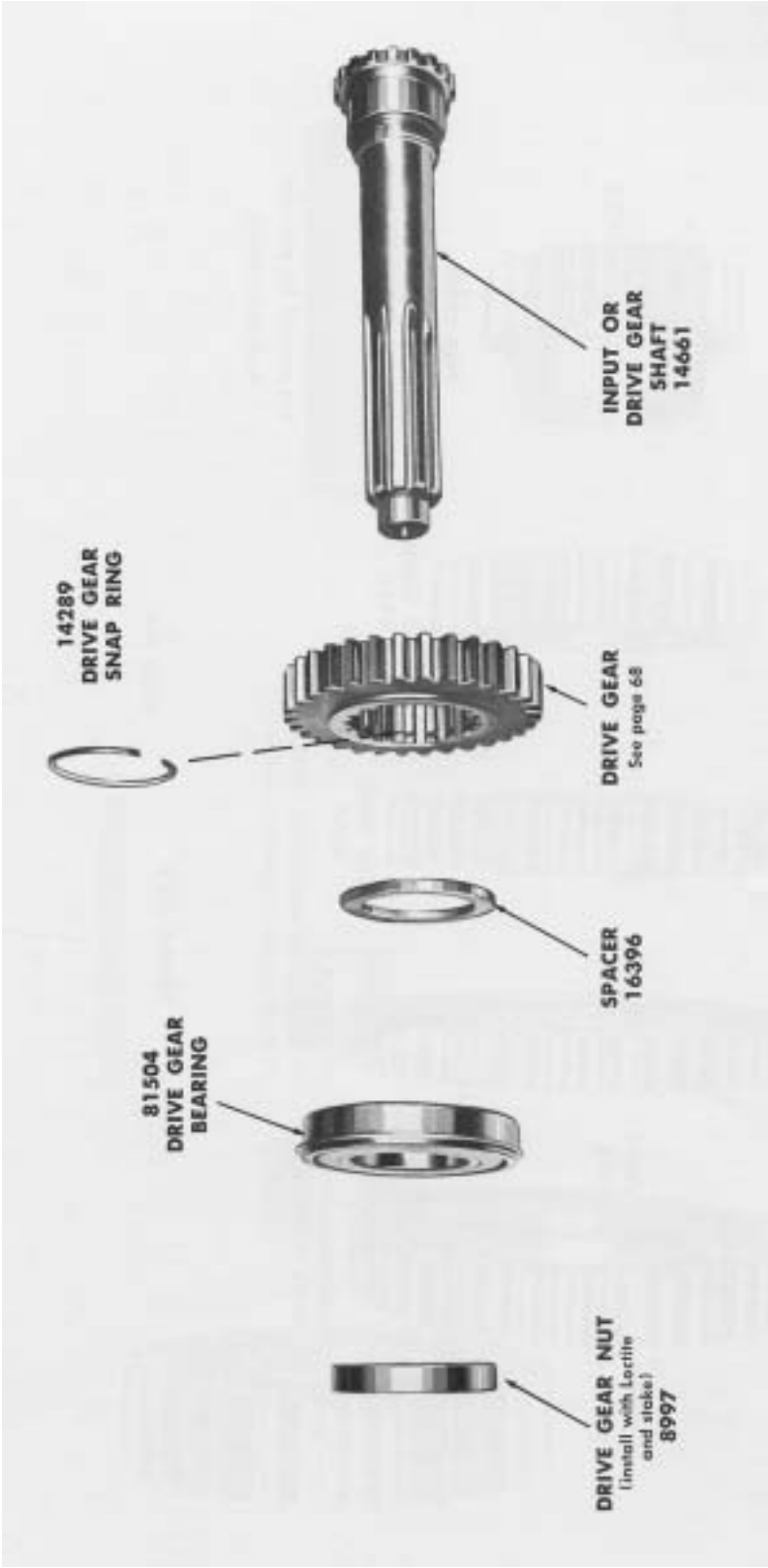
Q. To Disassemble the Drive Gear Assembly

1. Place the assembly in a vise, pilot end up.
2. Relieve the bearing nut where peened into shaft (See Illustration #52).
3. Turn the bearing nut from shaft, left-hand thread (See Illustration #53).
4. Using the rear face of the drive gear as a base, mount the assembly in a press, and press the shaft through the gear to unseat bearing from shaft. This will free the bearing, spacer and gear form shaft (See Illustration #54).
5. Remove snap ring from ID of drive gear if necessary.

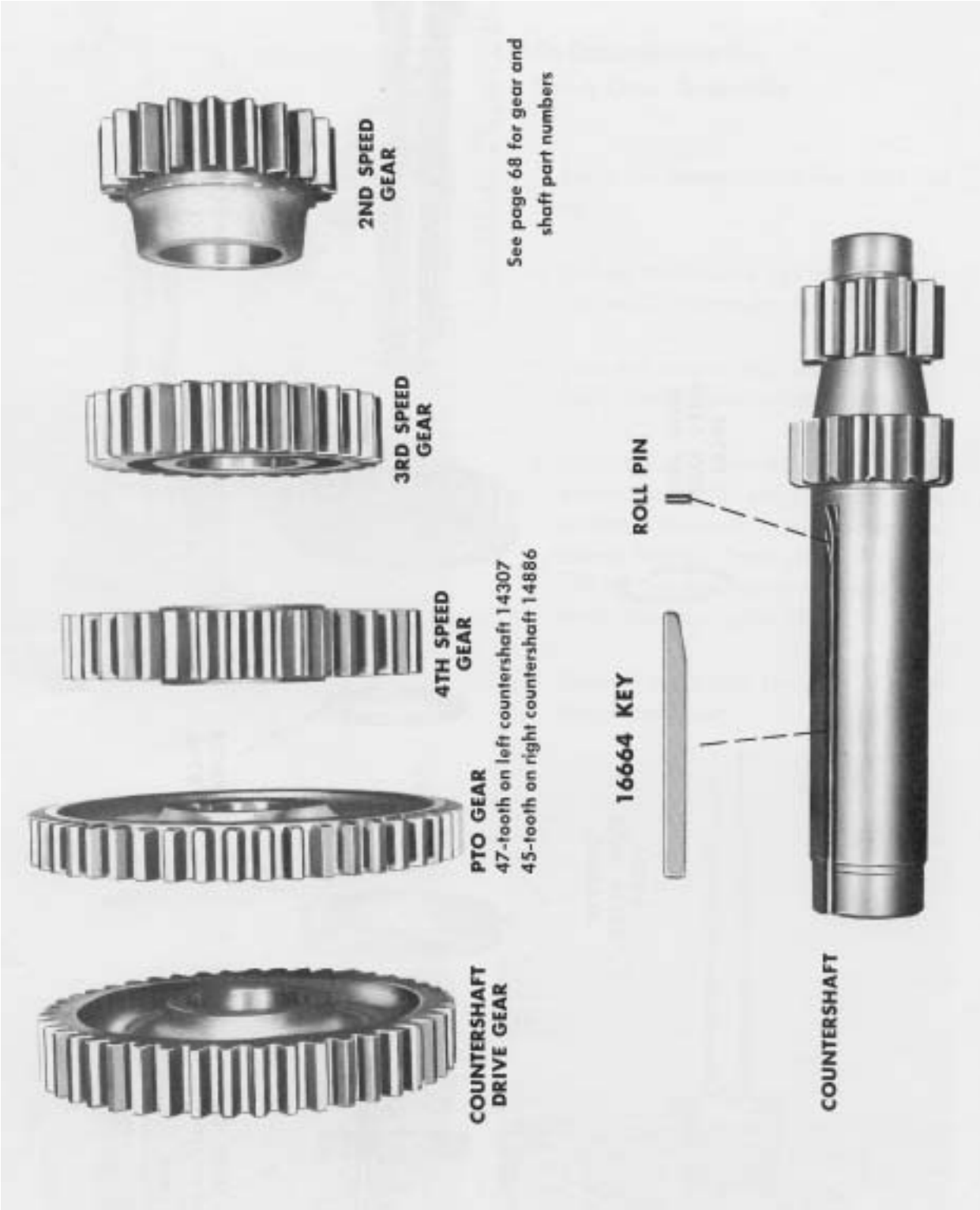


#54 - Pressing shaft through drive gear and bearing.

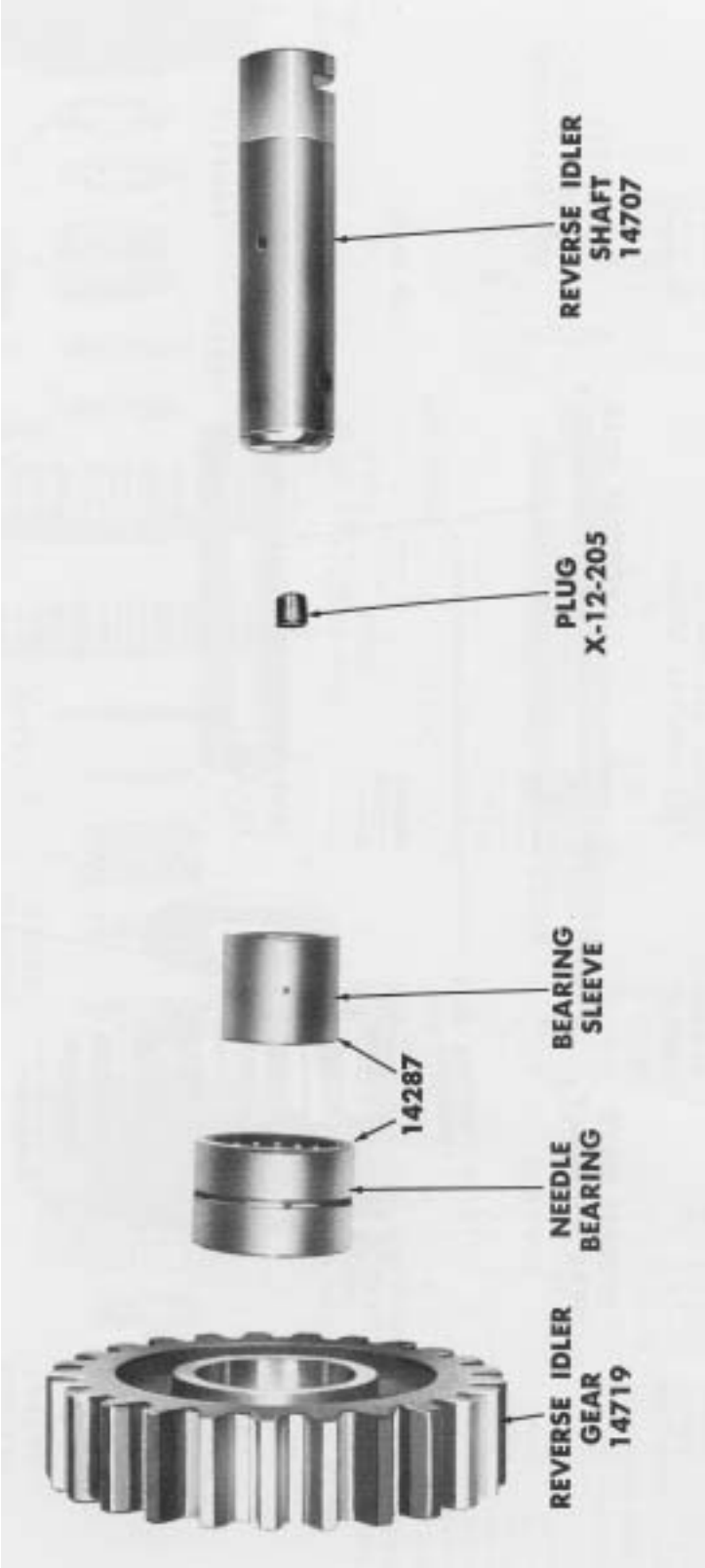
DRIVE GEAR ASSEMBLY



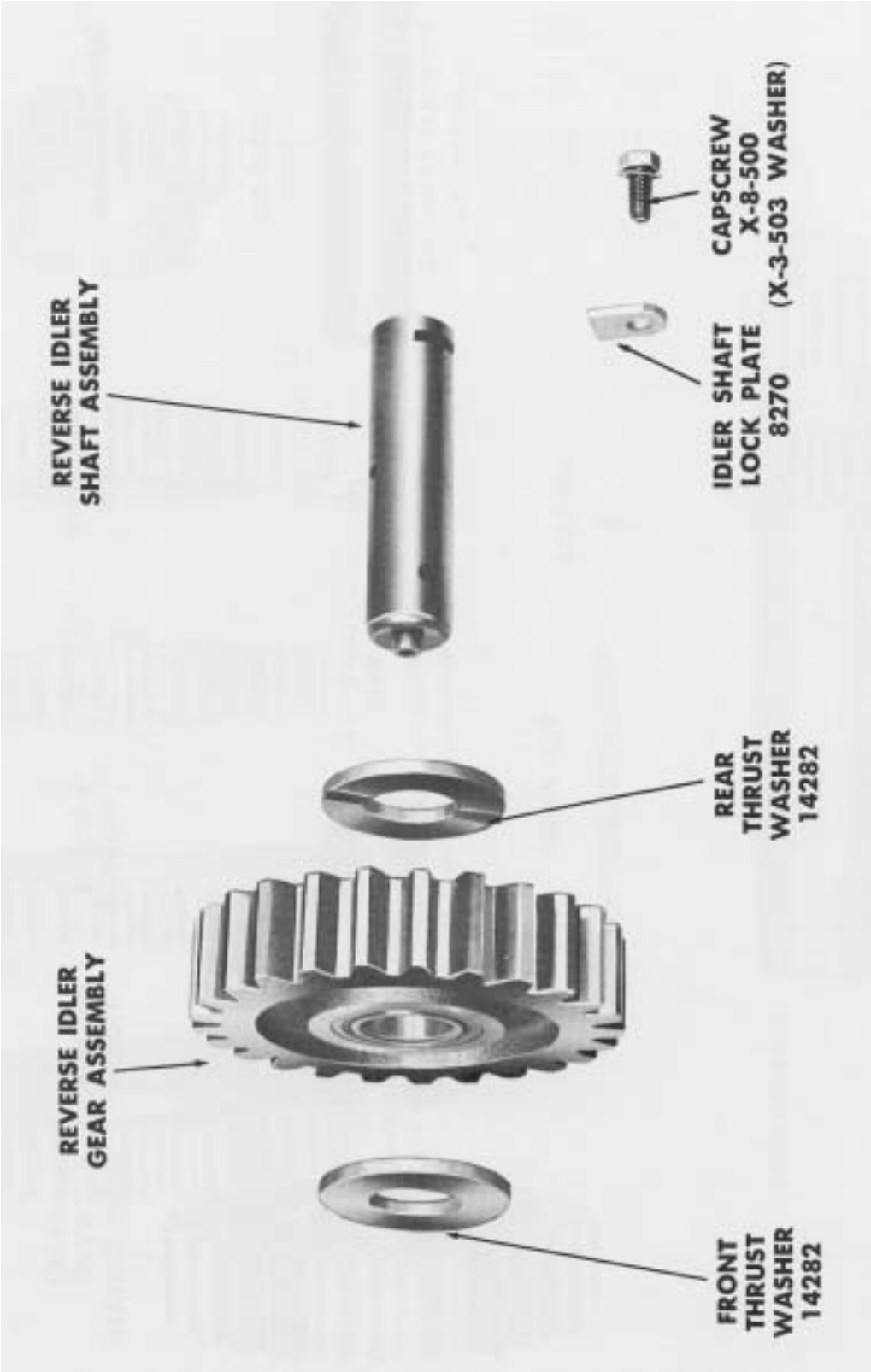
COUNTERSHAFT ASSEMBLY



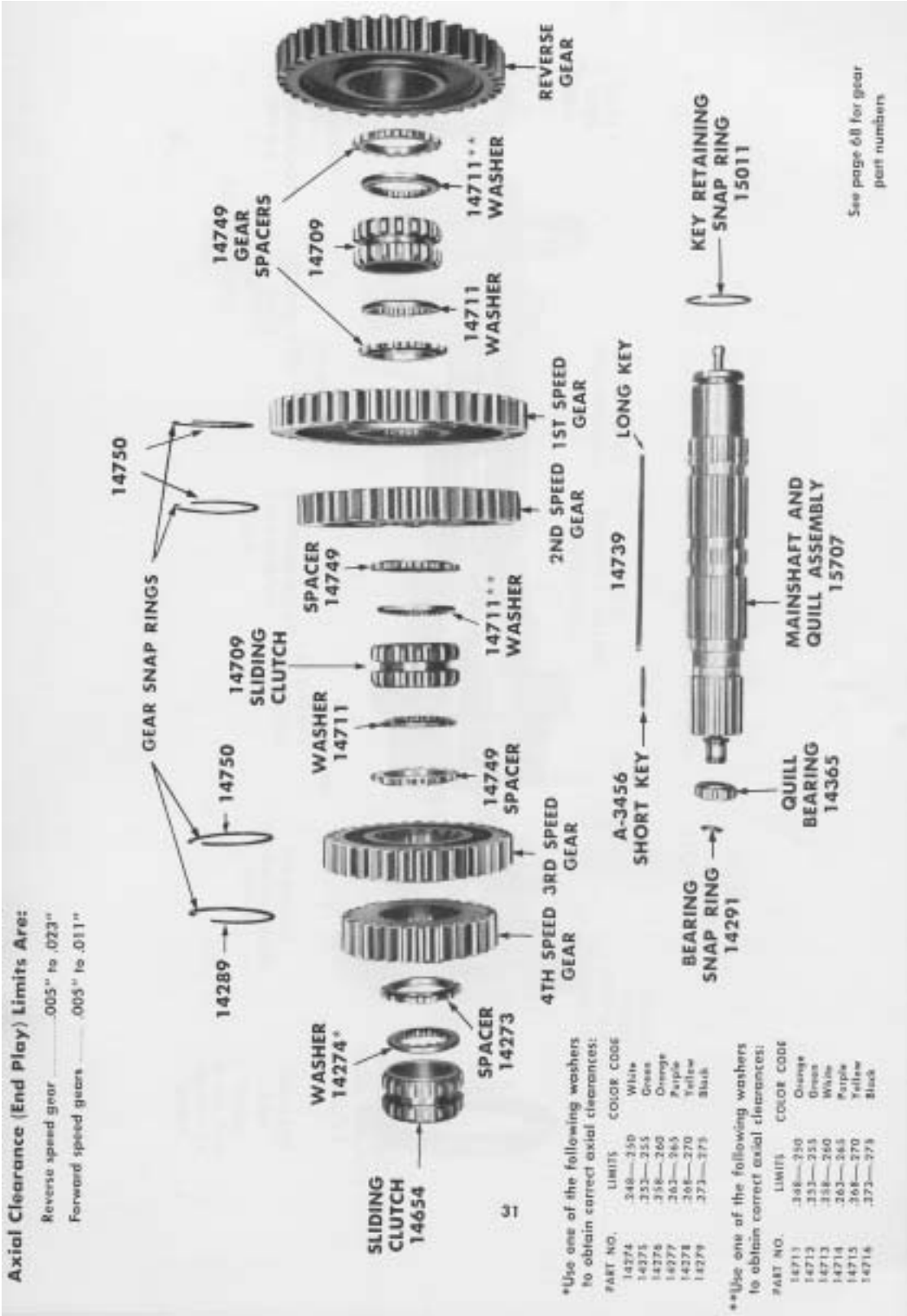
REVERSE IDLER SHAFT AND GEAR ASSEMBLY GRAPHICS



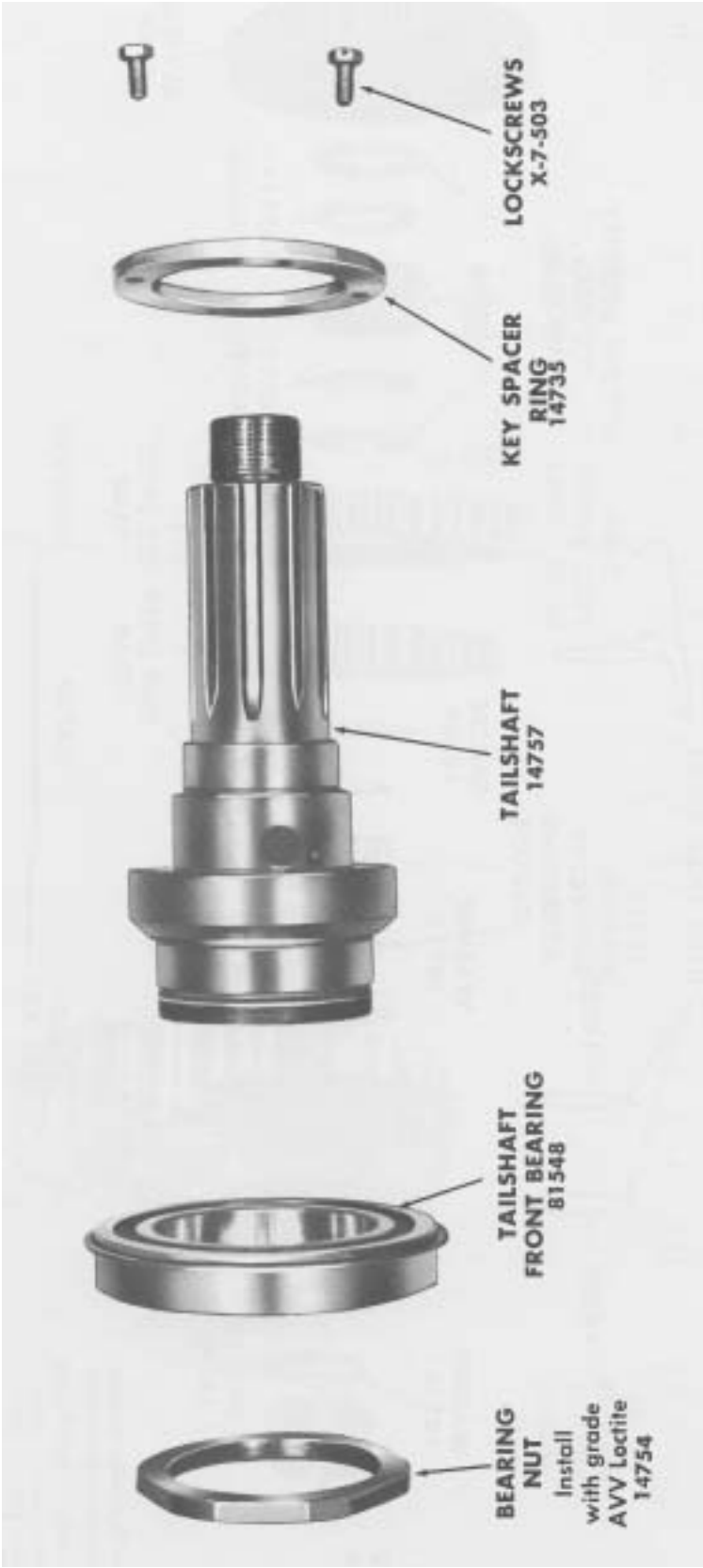
REVERSE IDLER GEAR AS ASSEMBLED IN CASE



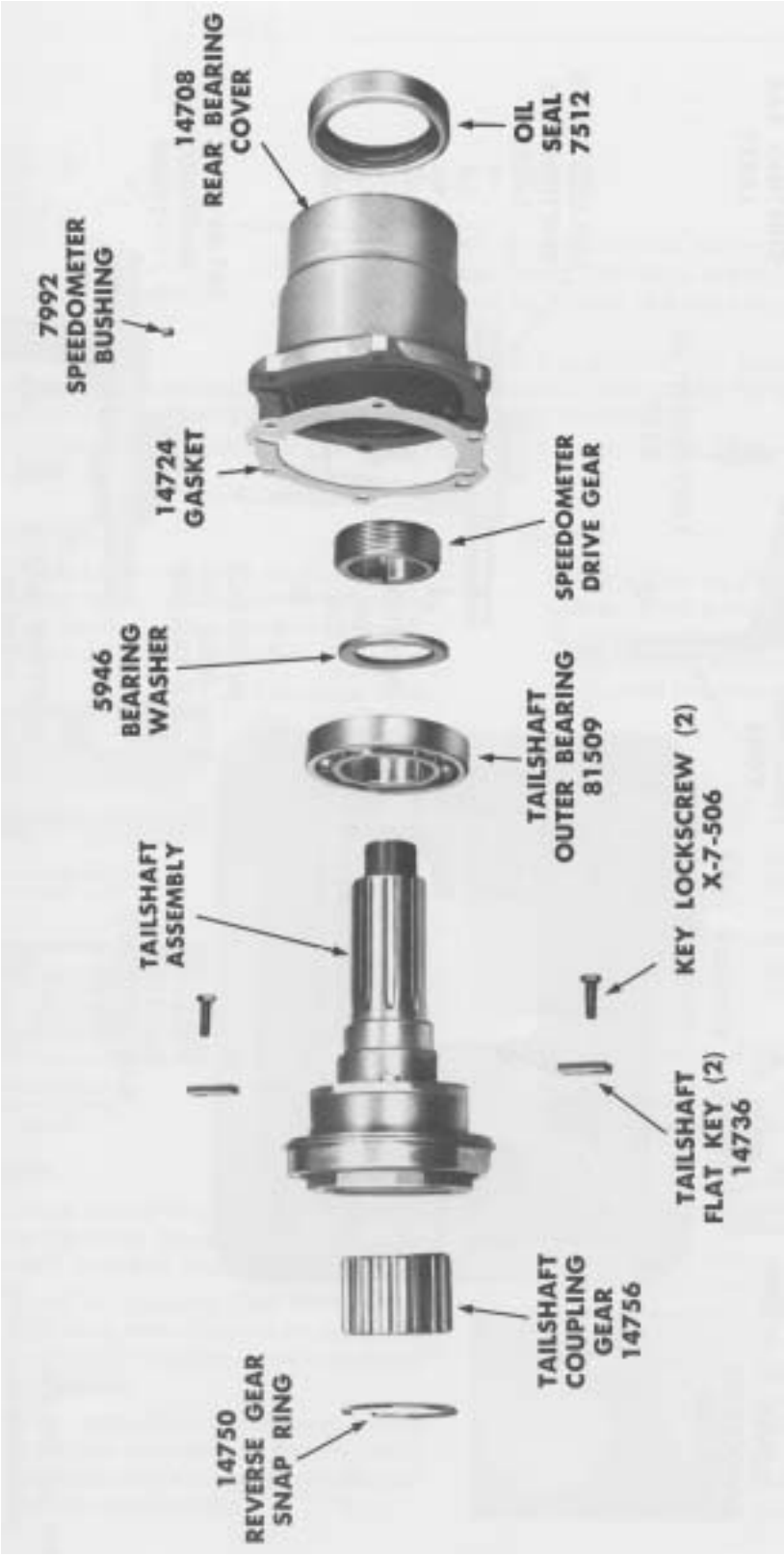
MAINSHAFT ASSEMBLY



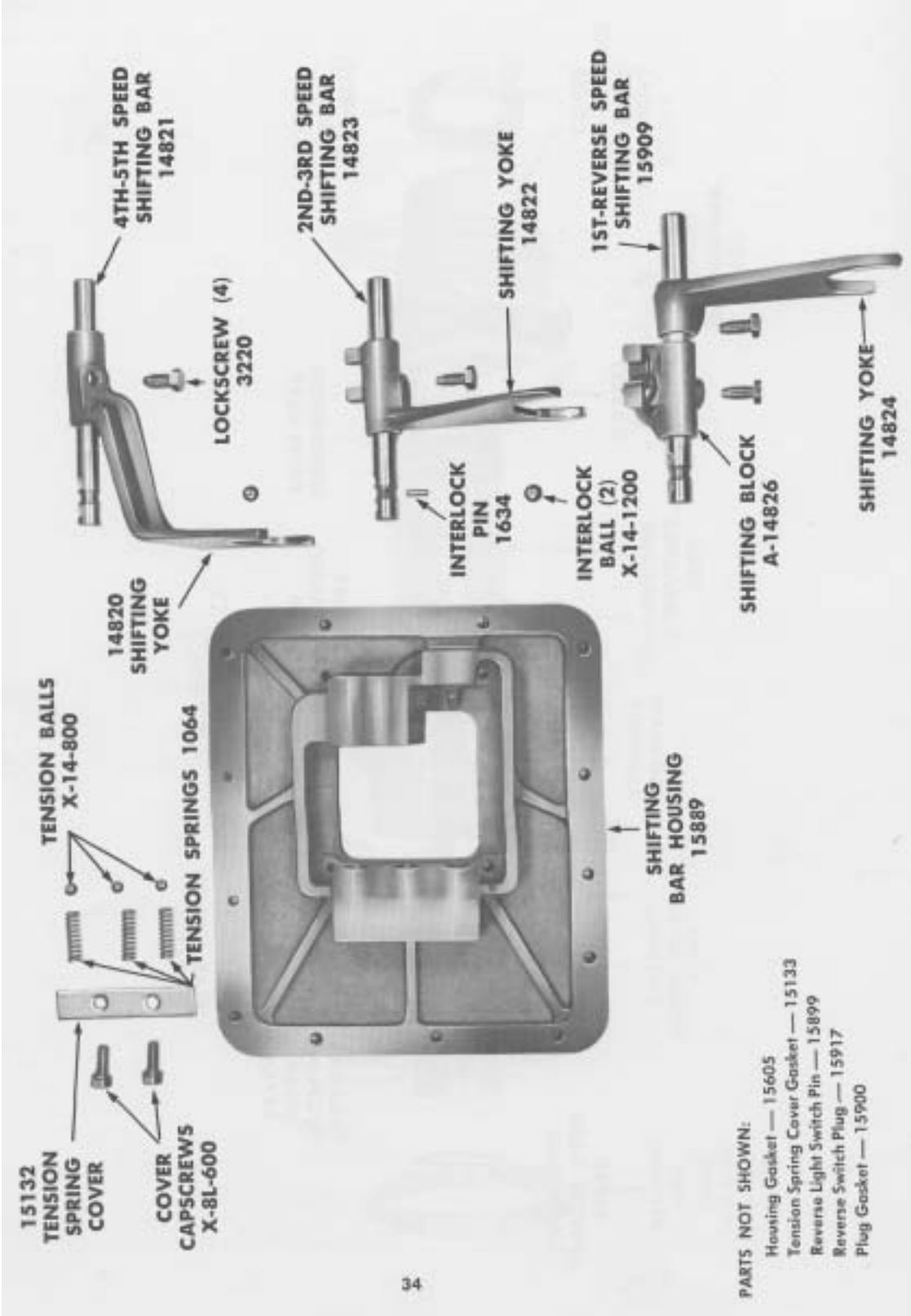
TAILSHAFT ASSEMBLY



TAILSHAFT AND REAR BEARING COVER ASSEMBLY



SHIFTING BAR HOUSING ASSEMBLY



Inspection

Before reassembling the transmission, the individual parts should be carefully checked to eliminate those damaged from previous service. This inspection procedure should be carefully followed to insure the maximum of wear life from the rebuilt unit.

The cost of a new part is generally a small fraction of the total cost of downtime and labor, should the use of a questionable part make additional repairs necessary before the next regularly scheduled overhaul.

Recommended inspection procedures are set forth in the following checklist:

A. Bearings

1. Wash all bearings in clean solvent. Check balls, rollers and races for pits and spalled areas. Replace bearings which are pitted or spalled.

2. Lubricate bearings which are not spalled or pitted and check for axial and radial clearances. Replace bearings with excessive clearances.
3. Check fits of bearings in case bores. If outer races turn freely in the bores, the case should be replaced.

B. Gears

1. Check operating gear teeth for pitting on the tooth faces. Gears with pitted teeth should be replaced.
2. Check all engaging gear teeth. Gears with teeth worn, tapered or reduced in length from clashing in shifting should be replaced.
3. Check axial clearances of gears. Where excessive clearance is found, check gear snap ring, washer, spacer and gear hub for excessive wear. Maintain .005 - .012 axial clearance of mainshaft forward speed gears, .005 minimum on reverse gear.

C. Splines

1. Check splines on all shafts for wear. If sliding clutch gears, companion flange or clutch hubs have worn into the sides of the splines, the shafts in this condition should be replaced.

D. Thrust Washers

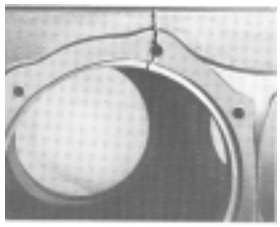
1. Check surfaces of all thrust washers. Washers scored or reduced in thickness should be replaced.

E. Reverse Gear and Shaft

1. Check bearing sleeve for wear from action of roller bearings.

F. Gray Iron Parts

1. Check all gray iron parts for cracks and breaks. Replace or repair parts found to be damaged. Heavy casting may be welded or brazed providing the cracks do not extend into bearing bores or bolting surfaces.



G. Clutch Release Parts

1. Check clutch release parts. Replace yokes worn at cam surfaces and bearing carrier worn at contact pads.

2. Check pedal shafts. Replace those worn at bearing surfaces.

H. Shifting Bar Housing Assembly

1. Check yokes and blocks for wear at pads and lever slot. Replace worn parts.
2. Check yokes for alignment.

3. Check yokes for excessive wear; replace worn yokes.
4. Check lock-screws in yokes and blocks. Tighten and rewire those found loose

TORQUE RATINGS

Recommended torque ratings, location and thread sizes of capscrews and nuts are listed below. Capscrew length are given for reference purposes as a guide to installation at proper locations.

Correct torque application is extremely important to assure long transmission life and dependable performance. Over-tightening or under-tightening can result in a loose installation and, in many instances, eventually causing damage to transmission gear, shafts or bearings. Do not torque capscrews dry.

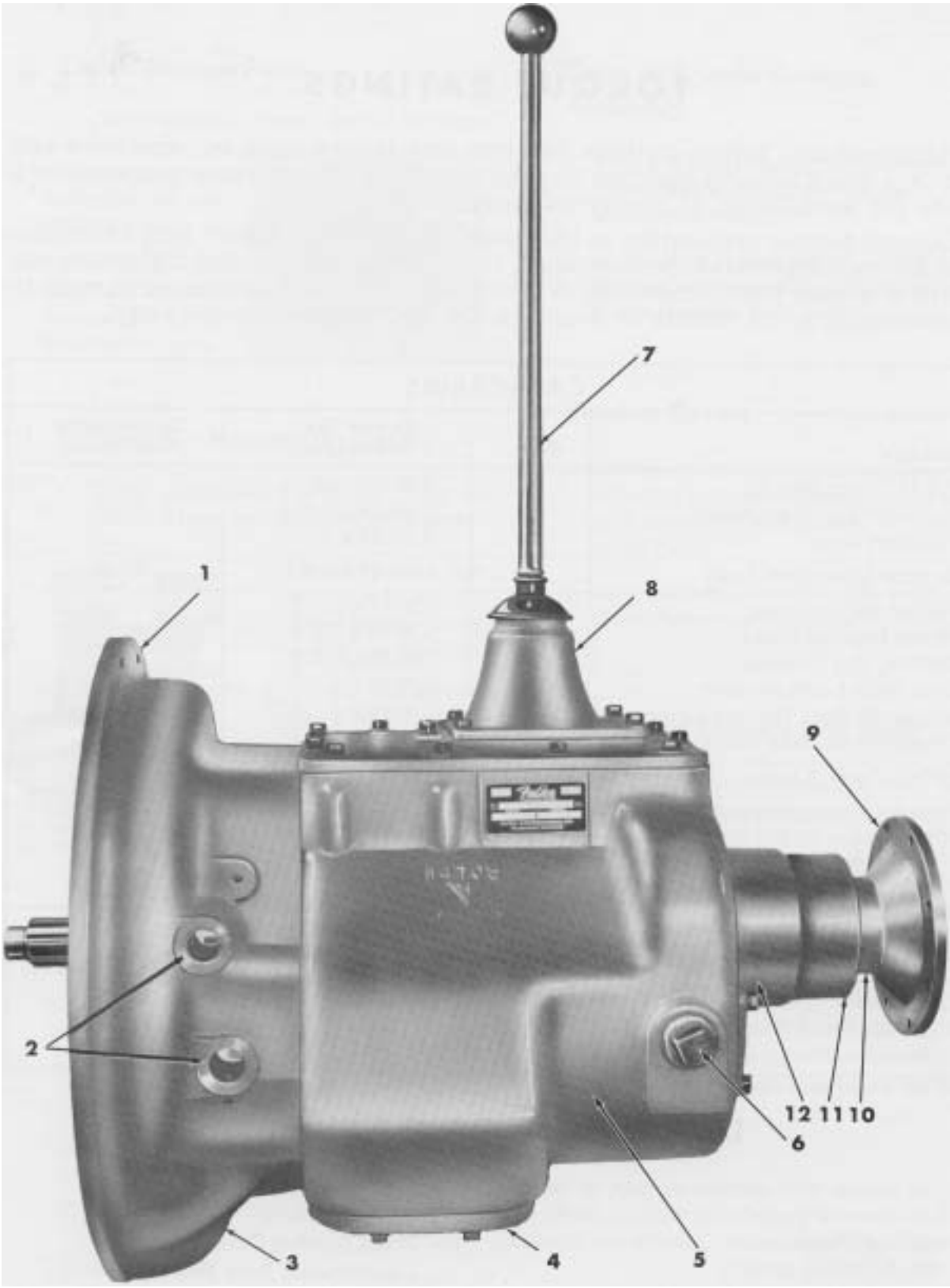
CAPSCREWS			
Location	Qty.	Thread Size and Length	Torque Rating Foot-Pound
P.T.O. Cover, Small Tailshaft Key Spacer Ring Tailshaft Key	6 2 2	3/8-16 x ¾ 5/16-24 x 5/8 5/16-24 x 1	20-25
Reverse Idler Shaft Lock	2	5/16-18 x ¾	25-35
Poppet Spring Cover Front Bearing Cover Shifting Bar Housing Gear Shift Lever Housing Mainshaft Rear Bearing Cover Countershaft Rear Bearing Cover	2 6 13 4 6 8	3/8 -16 x 1 3/8-16 x1-¼ 3/8-16 x1-¼ 3/8-16 x1-¼ 3/8-16 x1-¼ 3/8-16 x1-¼	35-45
P.T.O. Cover, Large	8	7/16-14 x 1-¼	50-65
Clutch Housing to Case	2 2	½-13 x 1-¼ ½-13 x 3-¼	90-100 (70-75)*
Countershaft Front Bearing Retainer	4	½-20 x1	100-115
NUTS			
Clutch Housing to Case Drive Gear Tailshaft Front Bearing Companion Flange or Yoke	6 1 1 1	5/8-18 2-1/8-16 3-17/32-16 1-½-18	180-190 (170-175)* 250-300 250-300 400-450

LOCATION OF GASKETS

Seat gaskets with shellac on part to be installed. Use new gaskets throughout when reassembling transmission. Gaskets are located on the following parts:

- P.T.O. Cover, Small
- P.T.O. Cover, Large
- Gear Shift Lever Housing
- Clutch Housing
- Front Bearing Cover
- Countershaft Rear Bearing Covers
- Shifting Bar Housing
- Mainshaft Rear Bearing Cover

PREVENTATIVE MAINTENANCE CHECK CHART



PREVENTATIVE MAINTENANCE CHECK CHART

CHECKS WITHOUT PARTIAL DISASSEMBLY OF CHASSIS OR CAB

1. Clutch Housing Mounting

   a. Check all capscrews in bolt circle of clutch housing for looseness.

2. Clutch Pedal Shaft and Bores

   a. Pry upward on shaft to check wear.

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

3. Clutch Release Bearing

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

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

4. Capscrews and Gaskets

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

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

5. Gear Lubricant

   a. Change at specified service intervals.

   b. Use only gear oils as recommended (See Lubrication Section).

6. Filler and Drain Plugs

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

7. Gear Shift Lever

   a. Check for looseness and free play in housing. If lever is loose in housing, proceed with Check #8.

8. Gear Shift Lever Housing Assembly

   a. Remove the gear shift lever housing assembly from transmission.

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

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

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

CHECKS WITH DRIVE LINE DROPPED

9. Universal Joint Companion Flange Nut

   a. Check for tightness. Tighten to recommended torque.

CHECKS WITH UNIVERSAL JOINT COMPANION FLANGE REMOVED

10. Splines on Output Shaft

    a. Check for wear from movement and chucking action of the universal join companion flange.

11. Mainshaft Rear Bearing Cover

    a. Check oil seal for wear.

12. Output Shaft

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

GENERAL PRECAUTIONS FOR REASSEMBLY

IMPORTANT: Read this section before starting the detailed reassembly procedures.

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

1.GASKETS - Use new gaskets throughout the transmission as it is being rebuilt. Make sure all gaskets are installed, as omission of gasket can result in oil leakage or misalignment of bearing covers (See “Location of Gaskets” heading).

2. CAPSCREWS - To prevent oil leakage, use shellac on all capscrews. See torque rating chart for recommended torque.

3. ASSEMBLY - Refer to the assembly illustration, pages 27-34, as a guide to reassembly.

4. INITIAL LUBRICATION - Coat all thrust washers and splines of shafts with Lubriplate during installation to provide initial lubrication, preventing scoring and galling.

5. AXIAL CLEARANCES - Maintain the following axial clearances:

Mainshaft Forward Speed Gears .....005”-.011

Mainshaft Reverse Speed Gear ..... .005-.023

Reverse Idler Gear ..... .011-.032

Mainshaft ..... .002-.008

6.BEARINGS - Use of flanged-end bearing drivers is recommended for the installation of bearings. These drivers apply equal force to both races of bearing, preventing damage to balls and races and maintaining correct bearing alignment with shaft and bore. If tubular or sleeve type driver is used, apply force only to inner race.

7. UNIVERSAL JOINT COMPANION FLANGE - Pull the companion flange tightly into place with the mainshaft nut, using 450-500 ft. lbs. of torque. Make sure the speedometer gear is not used, a replacement

spacer of the same width must be used. Failure to pull the yoke or flange tightly into place will permit the shaft to move axially with resultant damage to rear bearing.

DETAILED REASSEMBLY INSTRUCTIONS

A. To Reassemble the Drive Gear Assembly

1. Install snap ring in ID of drive gear (See Illustration #55).

2. Install the drive gear on shaft, engaging internal splines of gear with teeth on shaft, snap ring of gear towards the front (See Illustration #56).

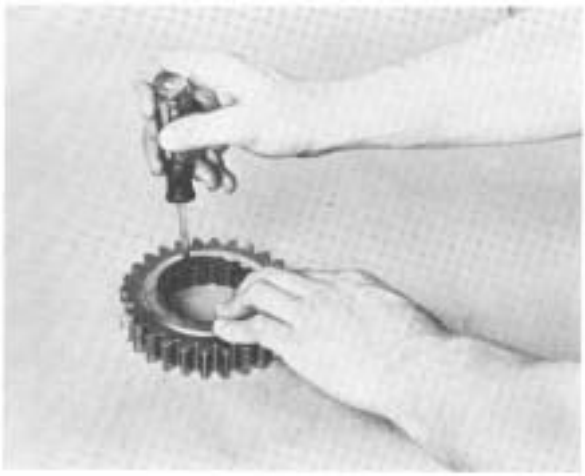
3. Install drive gear spacer on shaft and against gear (See Illustration #57).

4. Press the drive gear bearing on shaft, shield to the front (See Illustration #58).

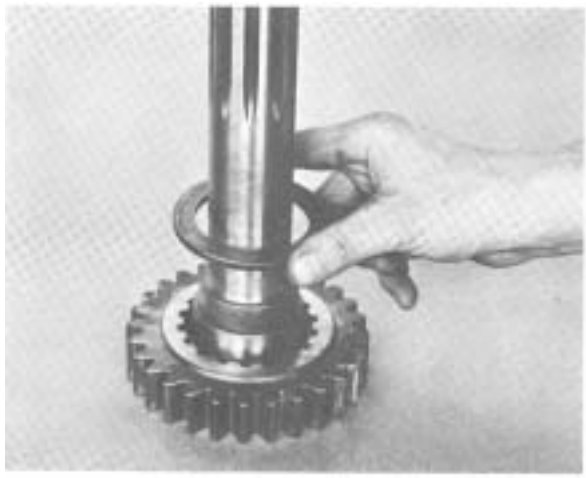
5. Clean threads of drive gear and nut and apply grade AVV Loctite (See Illustration #59).

6. Install the bearing nut on shaft, left-hand thread, with 250-300 ft. lbs of torque (See Illustration #60).

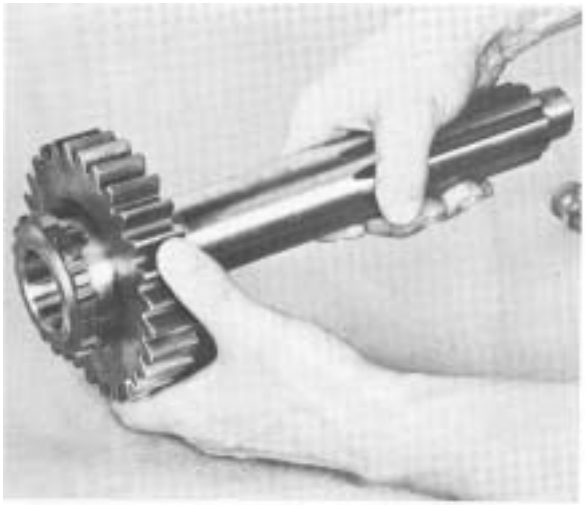
NOTE: If torque wrench is not available, torque can be approximated by multiplying the pounds of pull time the length of wrench handle. For example: If there are 150 pounds of pull on a wrench with a two-foot handle, multiply 150 x 2, which equals 300 ft. lbs. of torque. Ordinary pull scales can be used to measure pounds of pull.



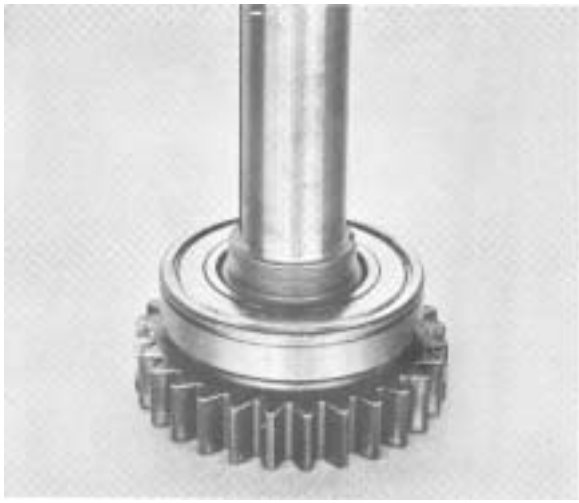
#55 - Installing snap ring in ID of drive gear.



#57 - Installing spacer on shaft.



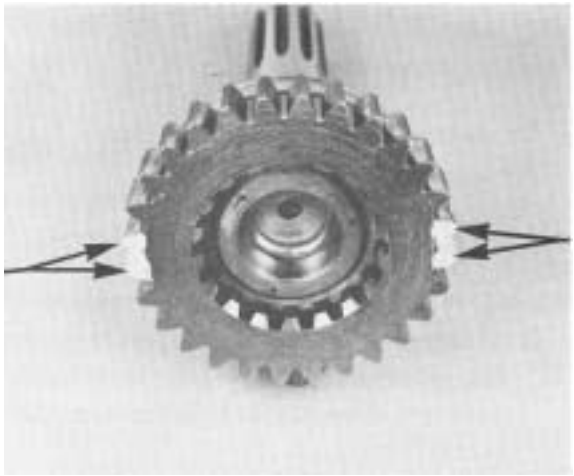
#56 - Installing drive gear on input shaft, engaging gear splines with shaft splines.



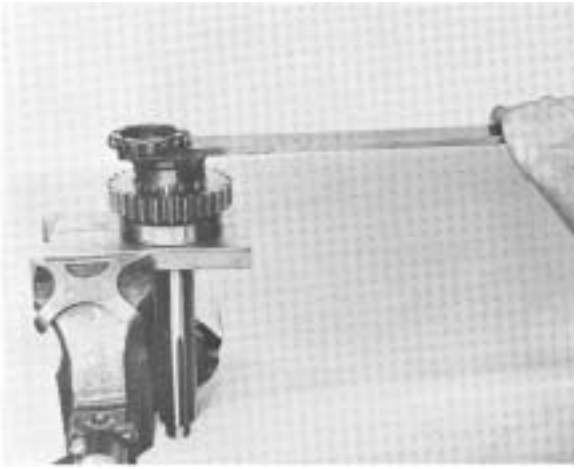
#58 - Drive gear bearing installed on shaft.

REASSEMBLY

#59 - Applying Loctite sealant to threads of drive gear nut.



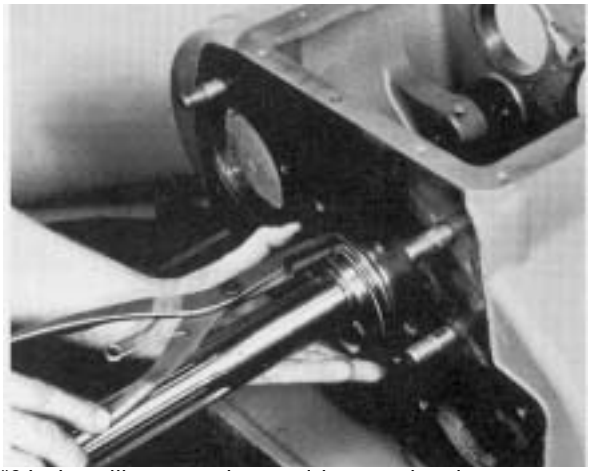
#62 - Drive gear teeth marked for timing, two adjacent teeth plus two adjacent teeth directly opposite.



#60 - Installing drive gear bearing nut, left-hand thread.

#63 - Installing the drive gear assembly through top of case.

#61 - Peening nut into the two milled slots of shaft.



#64 - Installing snap ring on drive gear bearing.

1. Clean threads of drive gear and nut and apply grade AVV Loctite (See Illustration #59).

2. Install the bearing nut on shaft, left-hand thread, with 250-300 ft. lbs of torque (See Illustration #60).

NOTE: If torque wrench is not available, torque can be approximated by multiplying the pounds of pull time the length of wrench handle. For example: If there are 150 pounds of pull on a wrench with a two-foot handle, multiply 150 x 2, which equals 300 ft. lbs. of torque. Ordinary pull scales can be used to measure pounds of pull.

3. Peen the nut into the two milled slots of shaft (See Illustration #61).

4. IMPORTANT: Mark the drive gear for timing. Mark any two adjacent teeth on the drive gear, then mark two adjacent teeth which are directly opposite the first set marked (See Illustration #62).

A. To Install the Drive Gear Assembly

1. Remove the snap ring from drive gear bearing.

2. Insert the drive shaft from inside case through front bore. Seat the drive gear bearing in case bore and move assembly forward until snap ring groove in bearing is exposed (See Illustration #63).

3. Install snap ring in bearing groove (See Illustration #64).

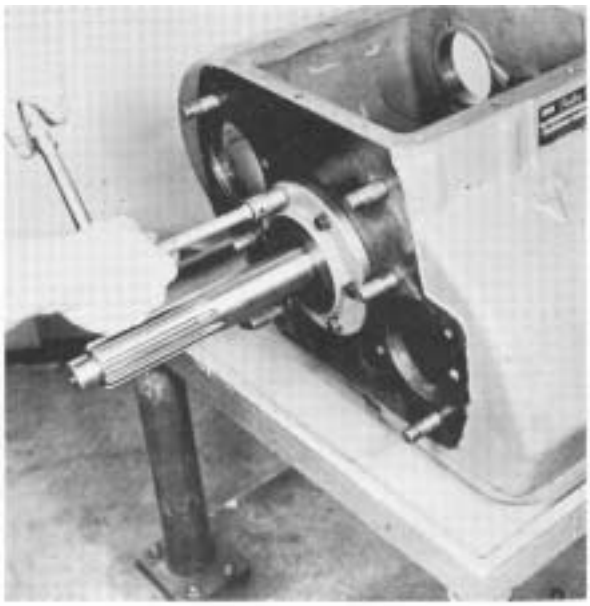
4. Seat bearing in case bore.

5. Install the drive gear bearing cover, aligning oil return slot in cover with oil return bore in case. Tighten capscrews securely (See Illustration #65).

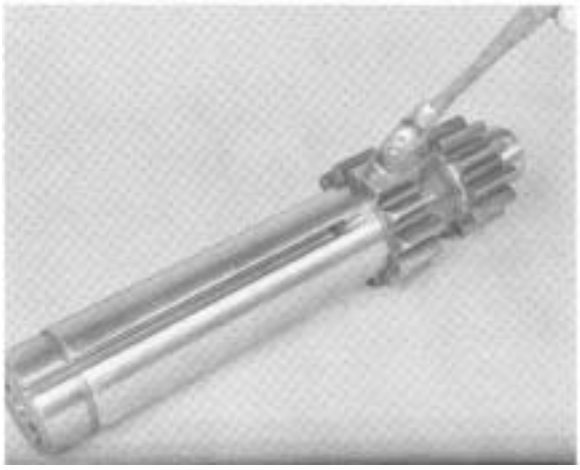
B. To Reassemble the Countershaft Assemblies

NOTE: Except for the power take-off gears, the countershafts are identical.

1. Install roll pin in bore located in keyway of countershaft (See Illustration #66).

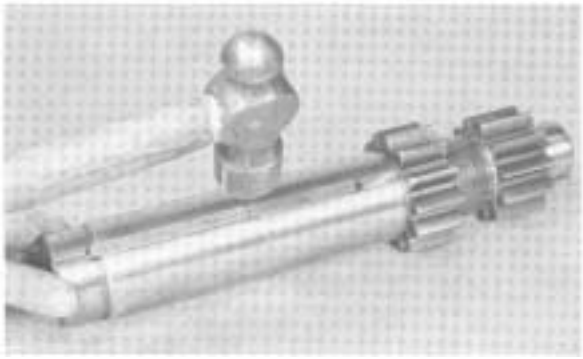


#65 - Installing the drive gear bearing cover.

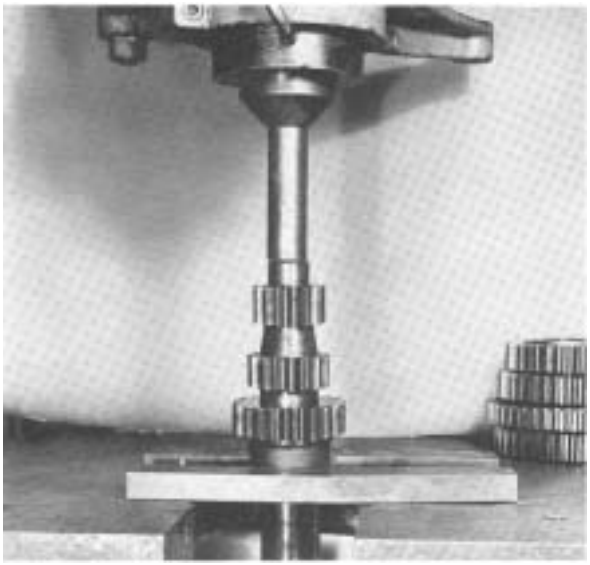


#66 - Installing roll pin in countershaft.

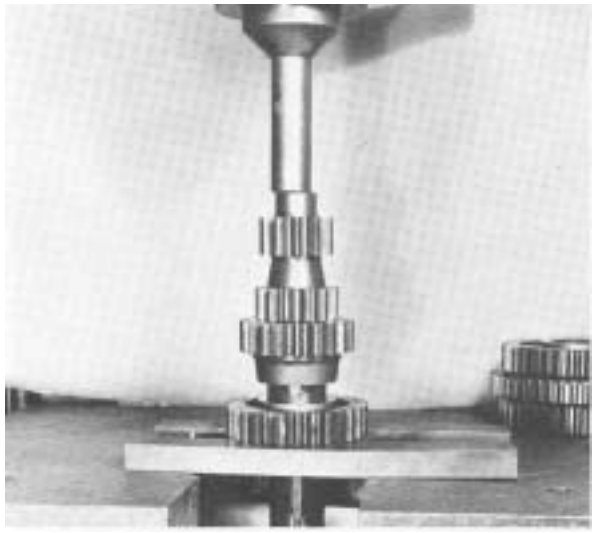
REASSEMBLY



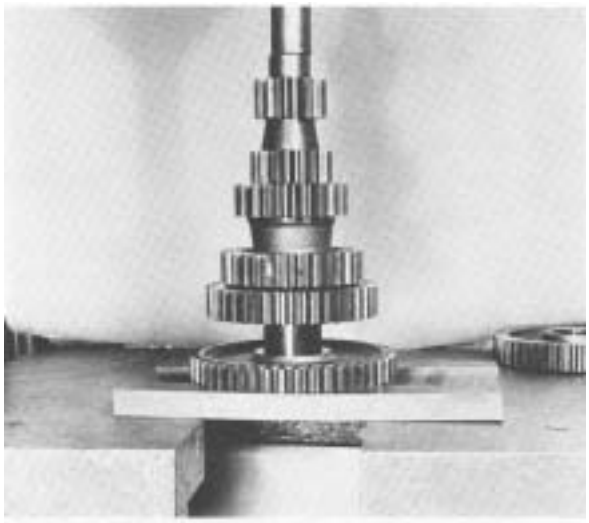
#67 - Installing keys in countershaft.



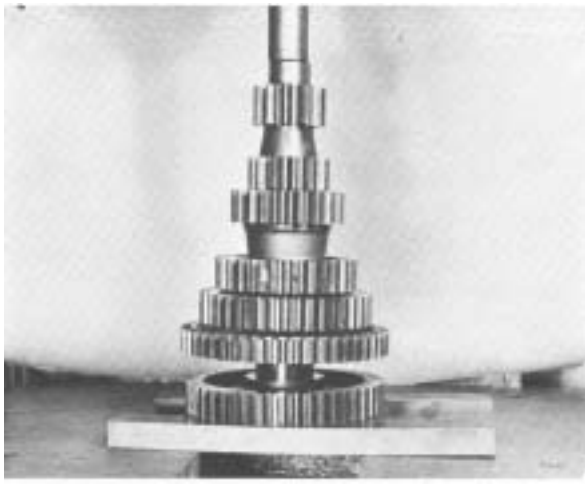
#68 - Pressing the 2nd speed gear on countershaft.



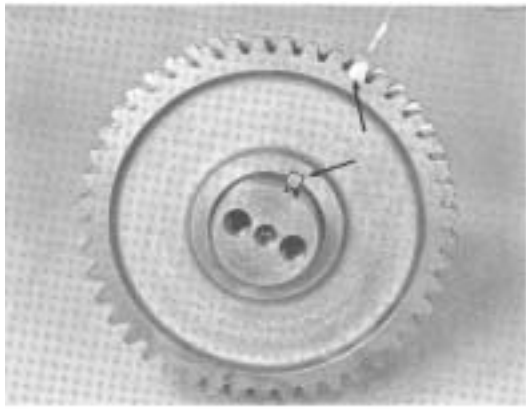
#69 - Pressing the 3rd speed gear on countershaft



#70 - Pressing the power take-off gear on countershaft.



#71 - Pressing the drive gear on countershaft.



#72 - Marking timing tooth on countershaft drive gear. Tooth is aligned with keyway and is stamped with an “O”.

REASSEMBLY

2. Install the short key in countershaft, tapered end against roll pin.

3. Install the long key in keyway in countershaft (See Illustration #67).

4. Align keyway in gear with keys in shaft and press the 2nd speed gear on shaft, long hub towards front of shaft (See Illustration #68).

5. Press the 3rd speed gear on countershaft, long hub towards 2nd speed gear (See Illustration #69).

6. Press the 4th speed gear on countershaft.

7. Press the power take-off gear on countershaft, bullet nose teeth towards rear of shaft (See Illustration #70).

NOTE: The left countershaft assembly has a 47-tooth PTO gear; the right assembly has a 45-tooth gear. Mark each assembly as "right" and "left".

8. Press the drive gear on countershaft (See Illustration #71).

9. IMPORTANT: Mark countershaft drive gears for timing. On the drive gear of each countershaft, mark tooth that is aligned with keyway in gear; this tooth will be stamped with an "O" (See Illustration #72).

C. To Time and Install the Left Countershaft Assembly

1. Place the left countershaft assembly with the 47-foot PTO gear into position in case (See Illustration #73).

2. Center front of left countershaft in bore (See Illustration #74).

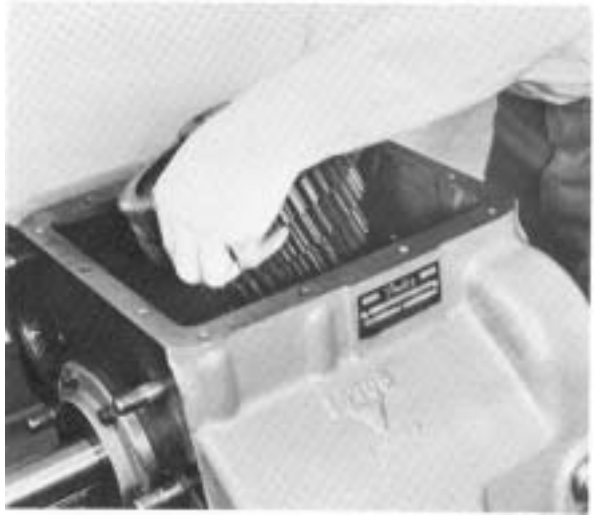


Illustration #73 - Placing left countershaft into position in case.

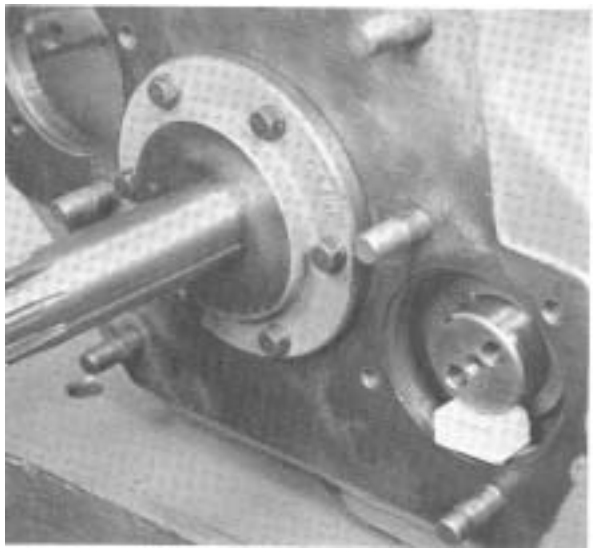
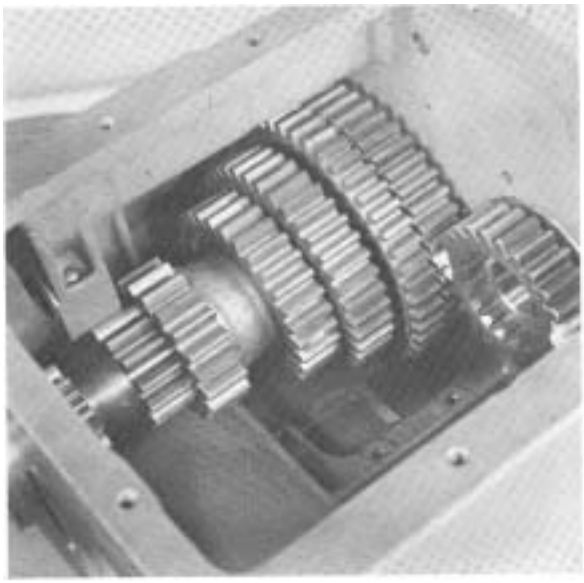


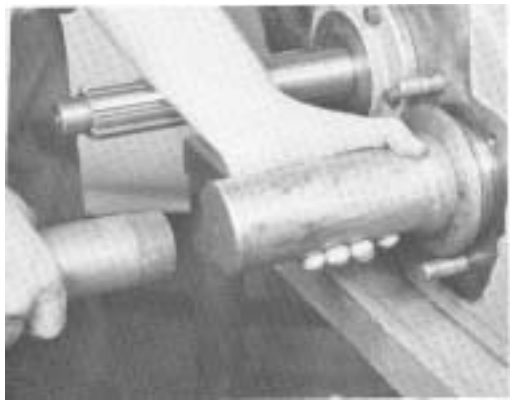
Illustration #74 - Centering left countershaft in front bore with wood block.

REASSEMBLY

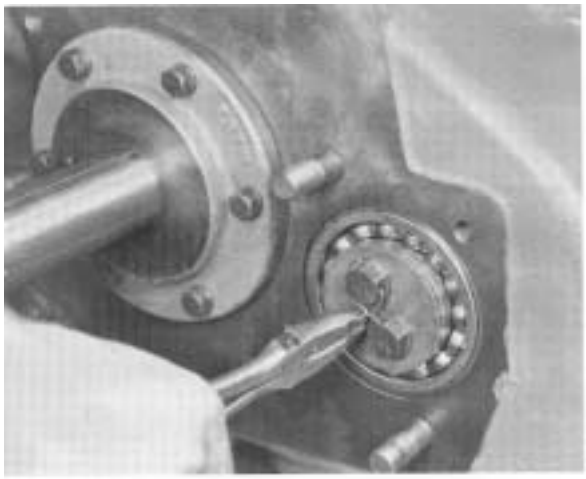


#75 - Timing tooth on countershaft meshed with timing teeth on drive gear.

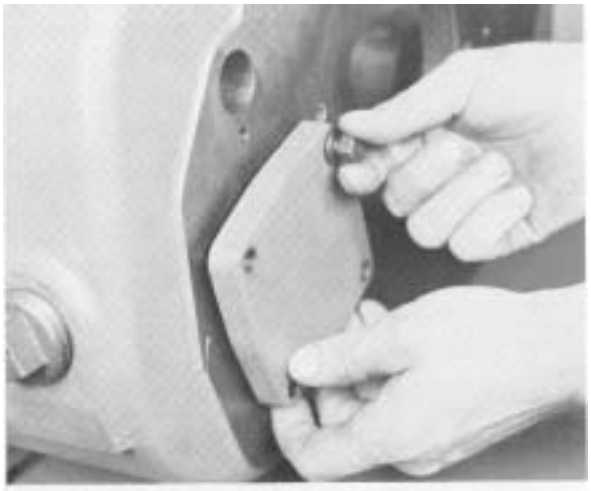
#76 - Installing rear bearing on left countershaft.



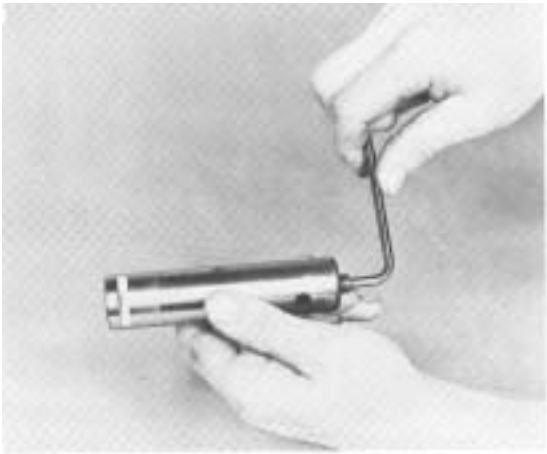
#77 - Installing front bearing on left countershaft.



#78 - Installing bearing retainer plate on front of left countershaft.



#79 - Installing rear bearing cover.



#80 - Installing plug in reverse idler shaft.

REASSEMBLY

3. Mesh the marked tooth on countershaft drive gear with two teeth marked on the main drive gear (See Illustration #75).

4. Center countershaft in rear bore and install the rear bearing on shaft and into case bore. Bearing can be started by installing partially on shaft before seating in bore (See Illustration #76).

5. Install front bearing on countershaft and into case bore (See Illustration #77).

6. Install the bearing retainer plate on front of countershaft, tighten and wire capscrews securely (See Illustration #78).

7. Install the rear bearing cover, tighten capscrews securely (Illustration #79).

D. To Install the Right Reverse Idler Gear

1. Install plug in oil channel in idler shaft (See Illustration #80).

2. Press needle bearing into bore of reverse gear idler gear.

3. Place inner race of bearing in gear.

4. Place a thrust washer on each side of gear, oil slots to gear.

5. Place the reverse gear and the two thrust washers into position in case.

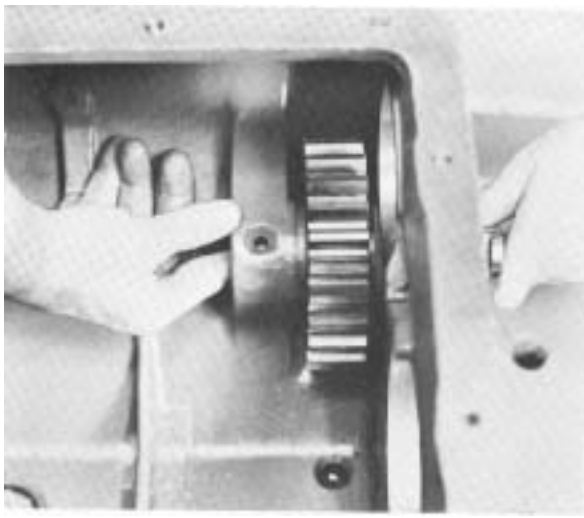
6. Thread the idler shaft through bore in rear of case, washers and gear. Make sure slot in idler shaft is aligned with lockplate capscrew bore in case (See Illustration #81).

7. Install the lockplate in slot in idler shaft. Tighten capscrew securely.

E. To Place Right Countershaft in Position

1. Lower the countershaft assembly through top of case, small end through the rear countershaft bore in case (See Illustration #82).

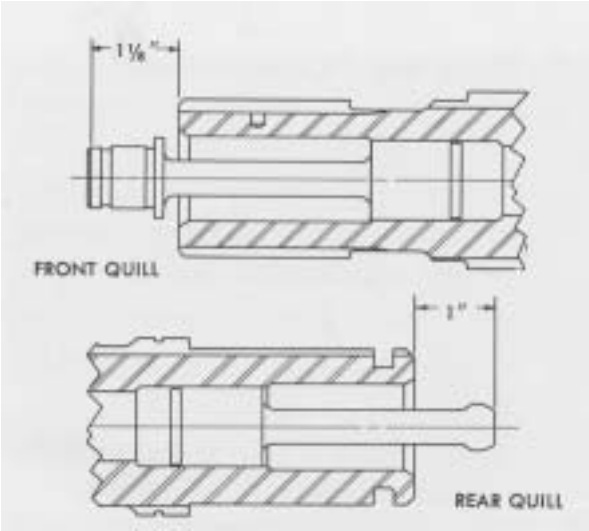
2. Move countershaft forward and into correct position, aligning timing tooth on countershaft with those on main drive gear. Do not install bearings.



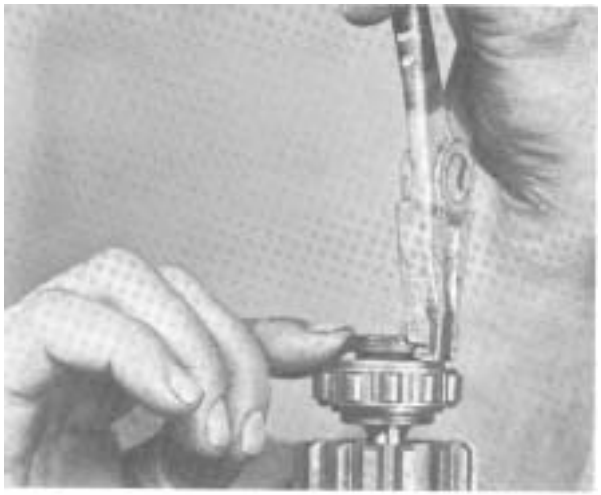
#81 - Threading the right reverse idler shaft through reverse idler gear and the two thrust washers.

#82 - Placing the right countershaft into position in case. Do not install bearings.

REASSEMBLY

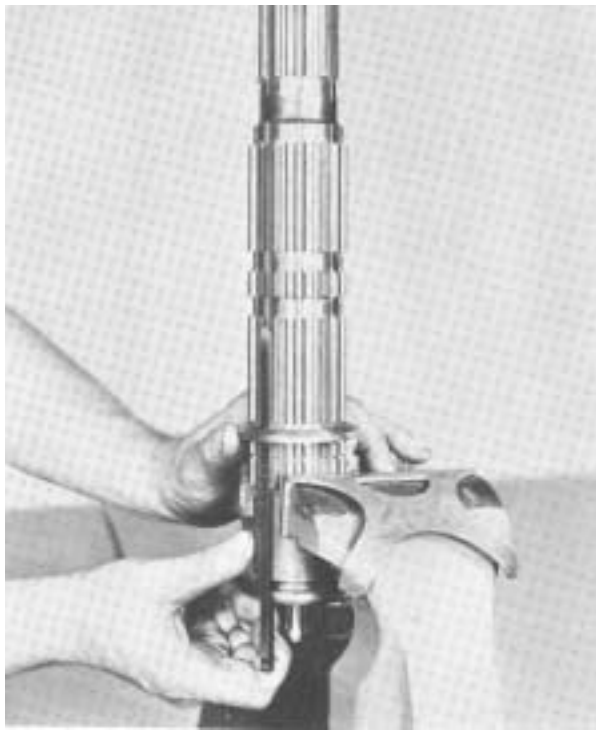


#83 - Drawing showing correct dimensions for mainshaft quills.



#84 - Installing quill bearing snap ring.

#85 - Installing snap ring in ID of mainshaft gear.



#86 - Installing reverse gear washer on shaft and inserting key through keyway and washer.

#87 - Installing the 1st-Reverse sliding clutch gear on shaft.

REASSEMBLE

F. To Reassemble the Mainshaft Assembly

NOTE: Mainshaft should have quills assembled, one in each end. In case it is necessary to install quills, exact dimensions must be held between end of shaft and end of quill (See Illustration #83)

1. Place the mainshaft in a vise, pilot end up, so that keyway in shaft is exposed for insertion of key.

2. Install quill bearing on front quill. Do not move quill.

3. Install bearing snap ring on quill (See Illustration #84).

4. Install snap rings in ID of all mainshaft gears except the reverse gear (See Illustration #85).

5. Install the reverse gear washer in the lowest radial groove in mainshaft, aligning keyway in washer with keyway in shaft. Flat side of washer is down.

NOTE: Gear WASHERS are internally splined and contain a square keyway which locks washers to mainshaft. Gear SPACERS are externally splined to engage splines in gear hubs. There is one washer and one spacer for each gear.

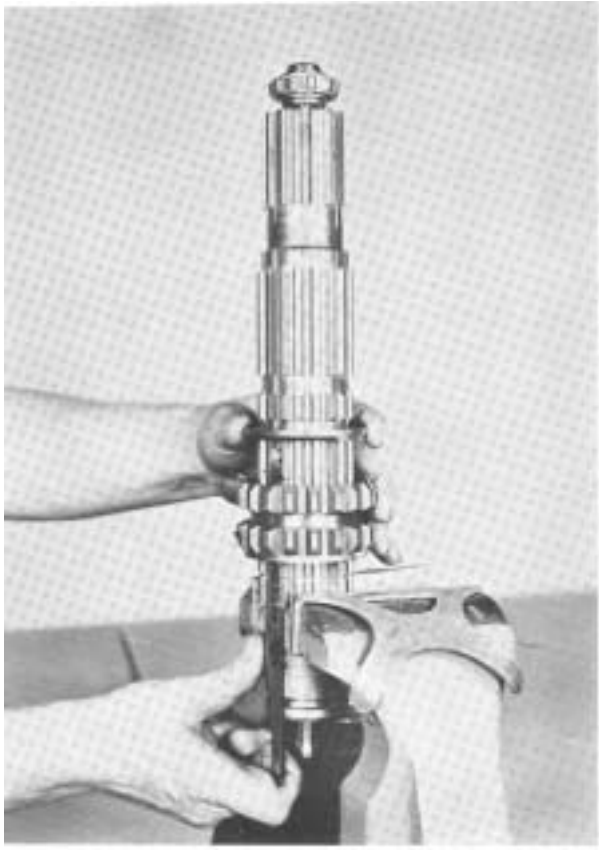
6. Install the long key from the bottom in mainshaft keyway and through keyway in washer, snap ring groove in key to the rear and outside (See Illustration #86).

NOTE: The long key is moved upward to engage each washer as it is placed on mainshaft.

7. Install the 1st-Reverse sliding clutching gear on mainshaft, aligning large keyway in gear with key in shaft (See Illustration #87).

8. Install the 1st speed gear washer, flat side up, in the third radial groove from top of shaft, aligning keyway in washer with keyway in shaft (See Illustration #88).

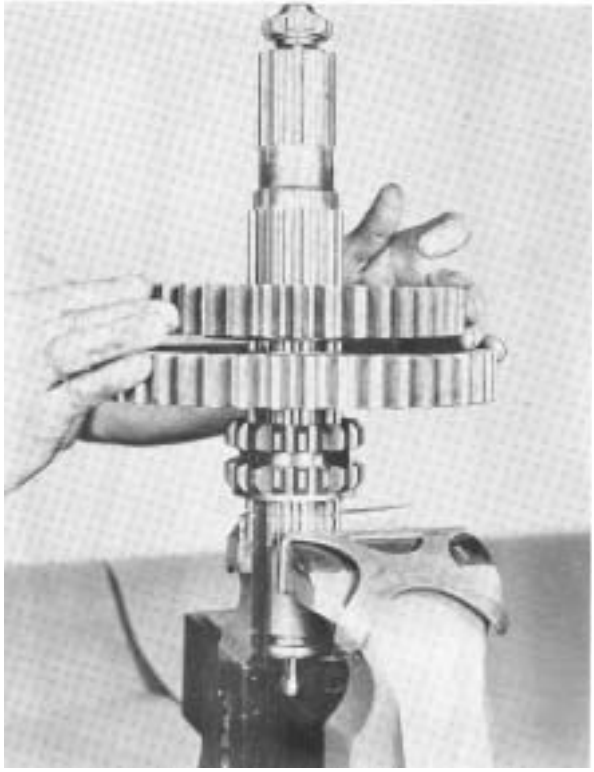
9. Move the long key up to engage the 1st speed gear washer.



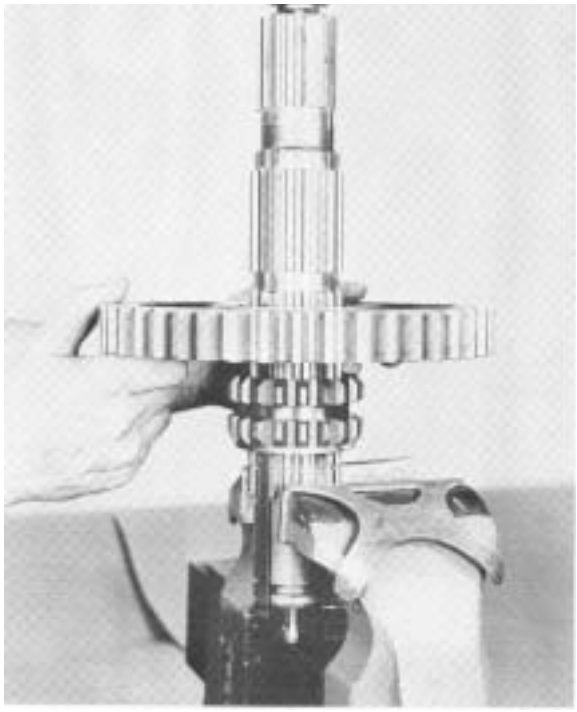
#88 - Installing the 1st speed gear washer, flat side up, engaging keyway with key.

REASSEMBLY

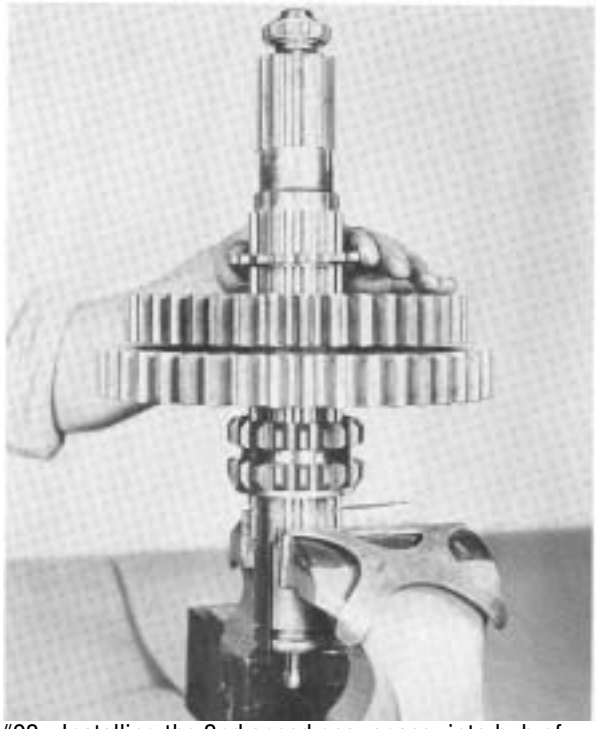
#89 - Installing the 1st speed gear spacer, flat side to washer.



#91 - Installing the 2nd speed gear.



#90 - Installing the 1st speed gear on shaft and splines of spacer.



#92 - Installing the 2nd speed gear spacer into hub of gear, flat side up.

REASSEMBLY

10. Install the 1st speed gear spacer on shaft, flat side to washer (See Illustration #89).

11. Install the 1st speed gear, snap ring up, on shaft, engaging splines of gear with splines of spacer (See Illustration #90)

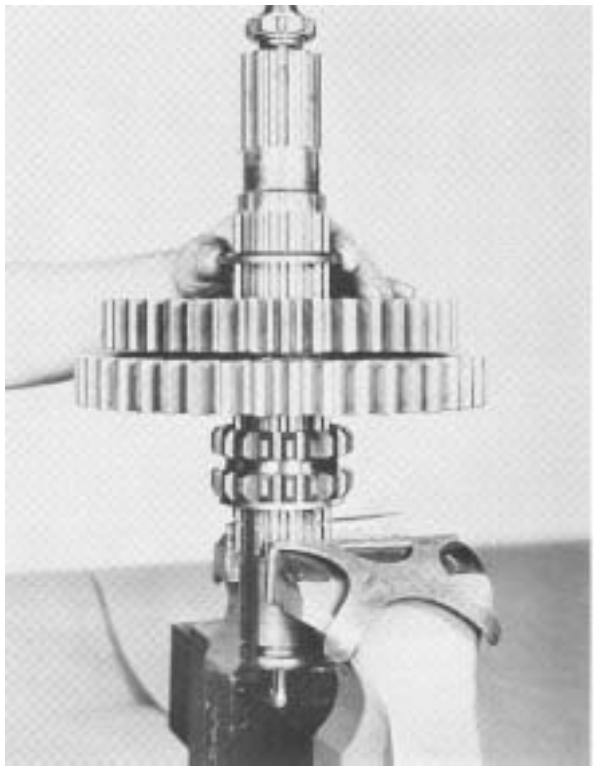
12. Install the 2nd speed gear, snap ring down, on shaft and against the 1st speed gear (See Illustration #91).

13. Install the 2nd speed gear spacer on shaft and into hub of gear, flat side up, engaging splines of gear with splines of spacer (See Illustration #92).

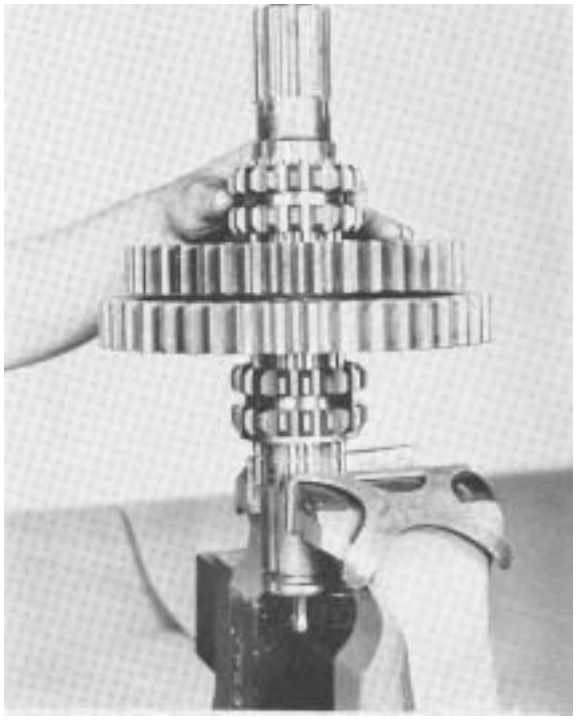
14. Install the 2nd speed gear washer, flat side against spacer, aligning keyway in washer with keyway in shaft (See Illustration #93).

15. Move key upward to engage the 2nd speed gear washer.

16. Install the 2nd-3rd speed sliding clutch gear on mainshaft, aligning large keyway in gear with key in shaft (See Illustration #94).

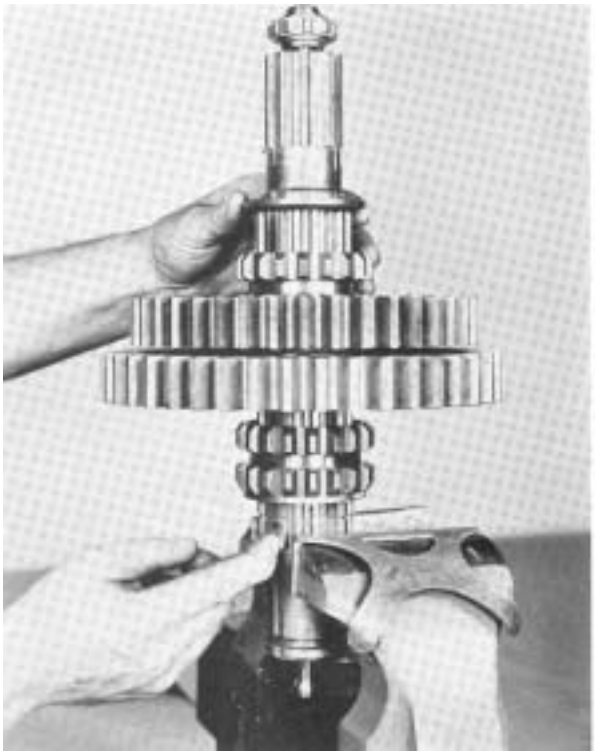


#93 - Installing the 2nd speed gear washer, engaging keyway with key.

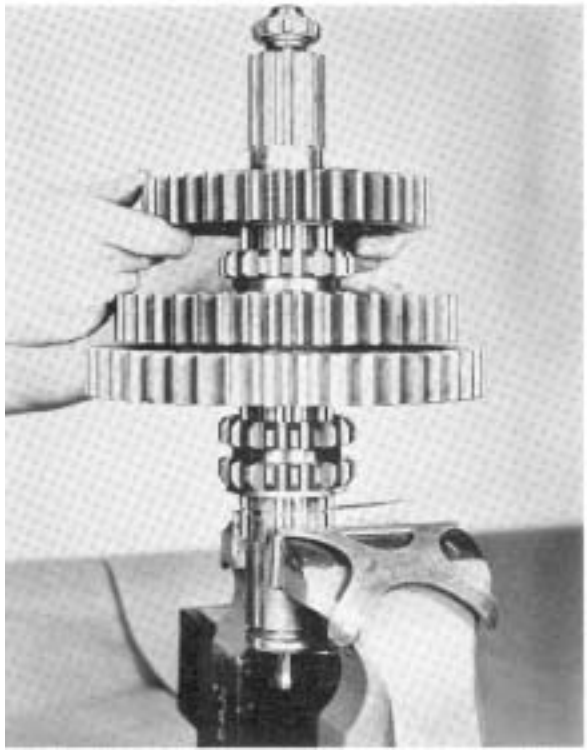


#94 - Installing the 2nd-3rd speed sliding clutch on shaft.

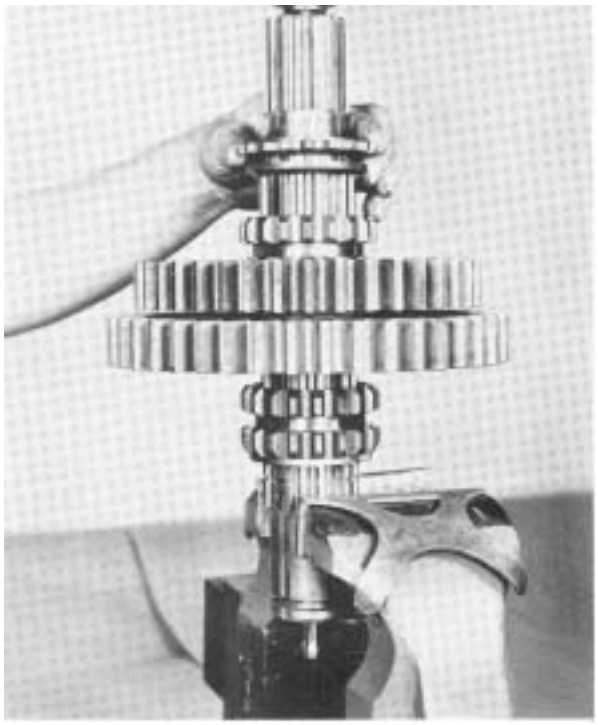
REASSEMBLY



#95 - Installing the 3rd speed gear washer, flat side up, engaging keyway with key.



#97 - Installing the 3rd speed gear on shaft and splines of spacer.



#96 - Installing the 3rd speed gear spacer, flat side next to washer.

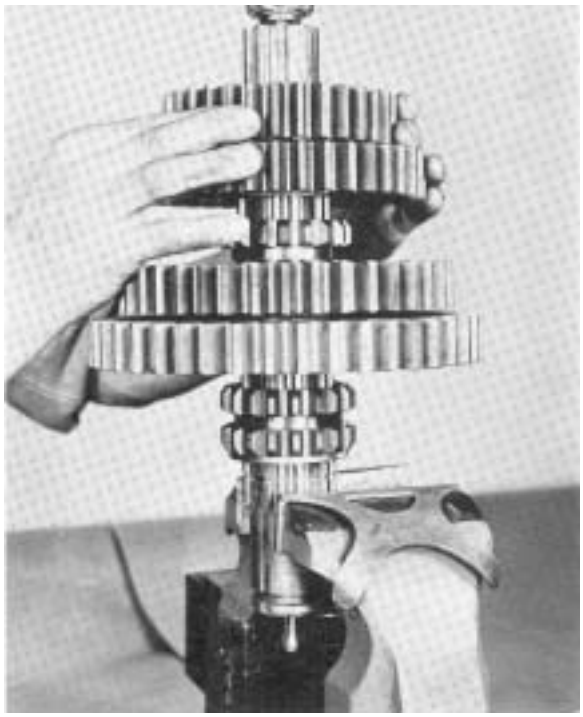


Illustration #98 - Installing the 4th speed gear on shaft.

REASSEMBLY

17. Install the 3rd speed gear washer, flat side up, on mainshaft, aligning keyway in washer in shaft (See Illustration #95).

18. Move the key upwards to engage the 3rd speed gear washer. Align snap ring slot at rear of key with snap ring groove in mainshaft.

19. Install the 3rd speed gear spacer, flat side against washer (See Illustration #96).

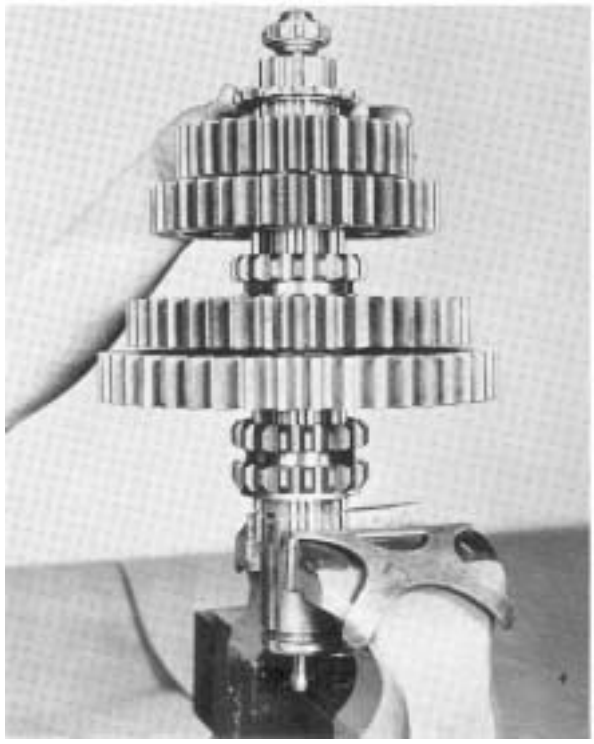
20. Install the 3rd speed gear on shaft, snap ring up, engaging gear splines with splines of spacer (See Illustration #97).

21. Install the 4th speed gear on shaft, snap ring down (See Illustration #98).

22. Install the 4th speed gear spacer, flat side up (See Illustration #99).

23. Install the 4th speed gear washer on shaft, flat side against spacer, aligning keyway in washer with keyway in shaft (See Illustration #100).

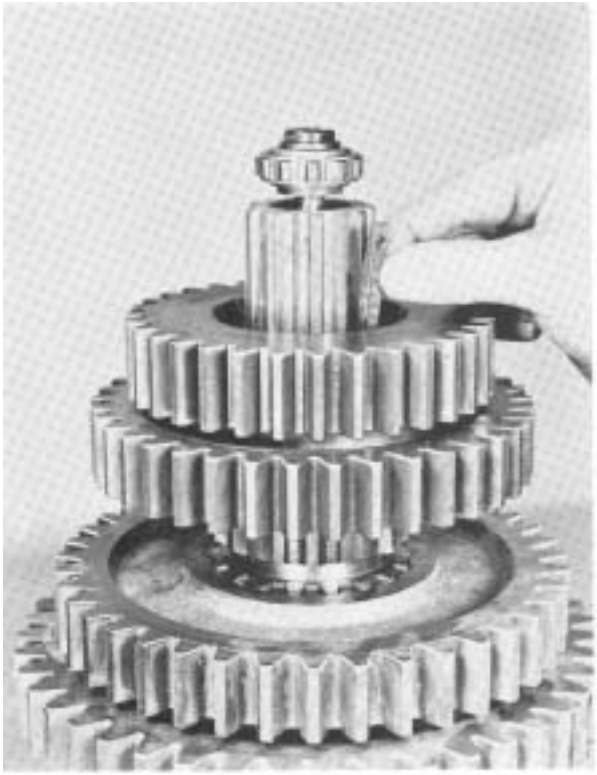
24. Make sure pin is installed in the short 4th speed gear mainshaft key.



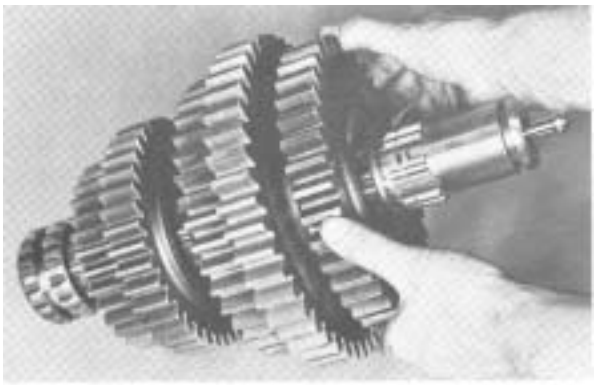
#99 - Installing the 4th speed gear spacer, flat side up.

#100 - Installing the 4th speed gear washer on shaft and aligning keyway in washer with keyway in shaft.

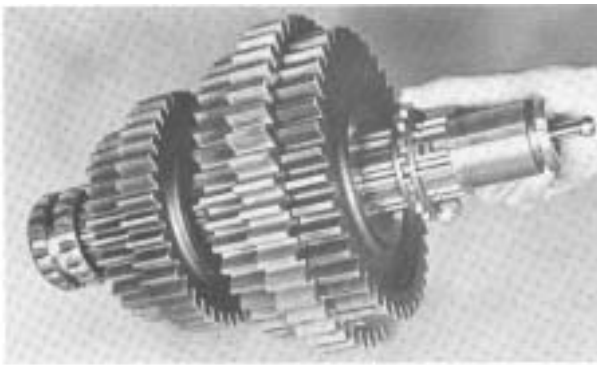
REASSEMBLY



#101 - Installing the short key in keyway in mainshaft to lock the 4th speed gear washer.

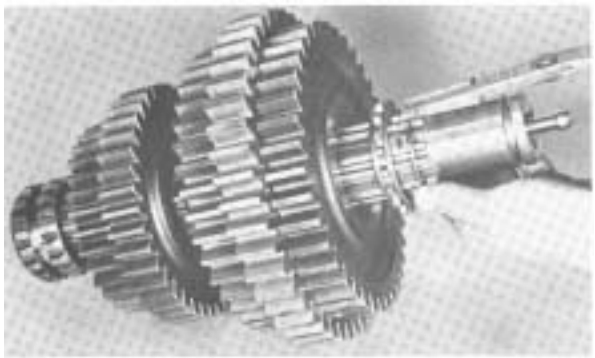


#103 - Installing the reverse gear on mainshaft.

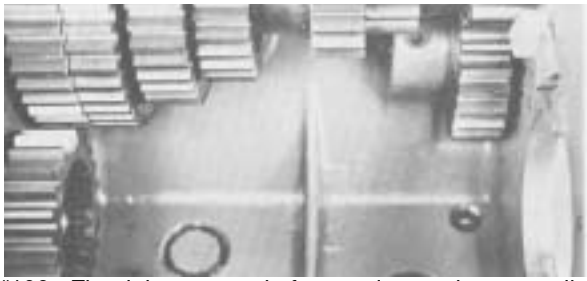


#104 - Installing the reverse gear spacer on shaft.

#102 - Installing the 4th-5th speed sliding clutch gear.



#105 - Installing key retaining snap ring on mainshaft.



#106 - The right countershaft moved towards case wall.

REASSEMBLY

25. Install the short key in keyway in mainshaft to lock the 4th speed gear washer in position (See Illustration #101).

26. Install the 4th-5th speed sliding clutch gear on shaft, aligning large keyway in gear with key in shaft (See Illustration #102).

27. Remove the assembly from vise and install the reverse gear on rear of shaft, snap ring groove in ID to the rear (See Illustration #103).

28. Move the reverse gear as far forward on shaft as possible, against the first speed gear.

29. Install the reverse gear spacer on shaft, flat side against washer (See Illustration #104).

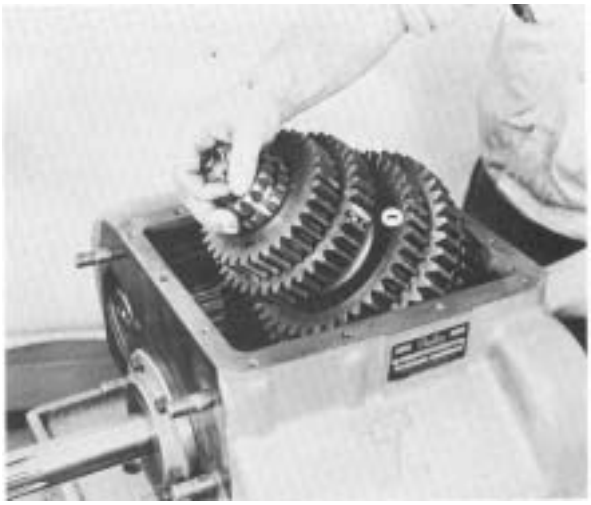
30. Lock the long key in position by installing snap ring in mainshaft groove and key slot (See Illustration #105).

G. To Install the Mainshaft Assembly

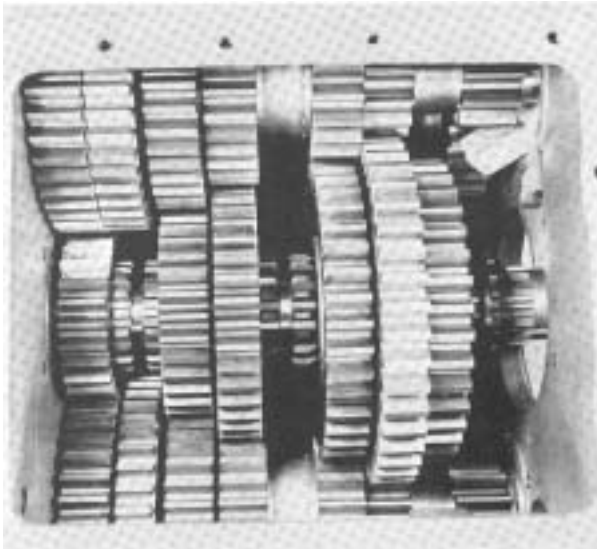
1. Move the right countershaft assembly as far as possible towards case wall (See Illustration #106).

2. With the reverse gear as far forward as possible, install the mainshaft into position in case, meshing corresponding gears on left countershaft with those on mainshaft (See Illustration #107).

3. Block under rear of mainshaft to exactly center shaft in rear bore. Front quill bearing should be seated in pocket of drive gear (See Illustration #108).



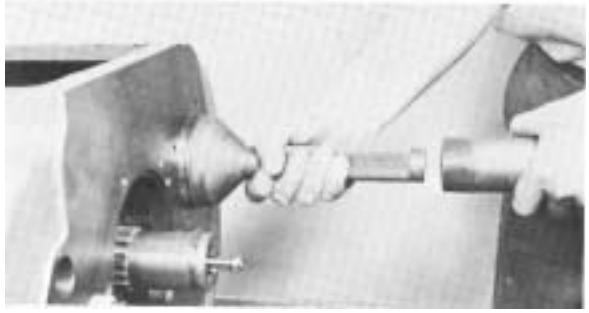
#107 - Lowering mainshaft in position in case; mesh corresponding gears on left countershaft with those on mainshaft.



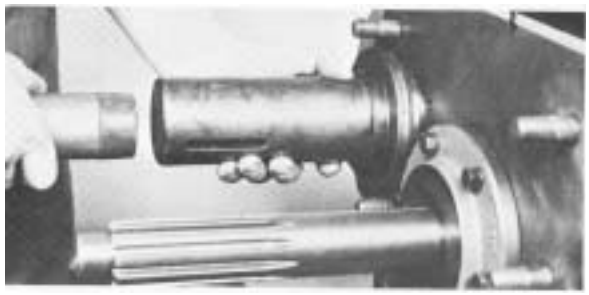
#108 - Mainshaft assembly in correct position in case.

REASSEMBLY

#109 right countershaft moved into position to mesh with gears of mainshaft. Timing tooth on drive gear must mesh with tining teeth on main drive gear.

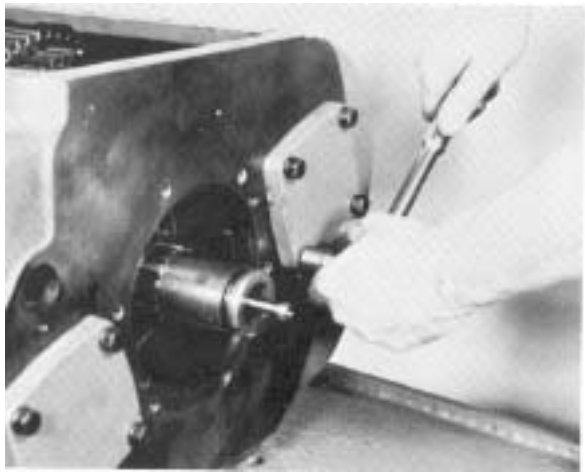


#110 Installing rear bearing on right countershaft.

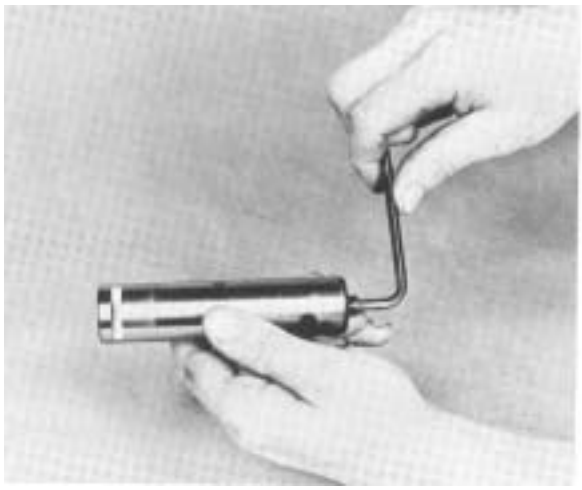


#111 Installing front bearing on right countershaft.

#112 Installing bearing retainer plate on front of right countershaft.



#113 Installing rear bearing cover on right countershaft.



#114 Installing plug in left rererse idler gear shaft.

#115 Place the two thust washers and reverse idler gear into position in case.

REASSEMBLY

H. To Time Right Countershaft and Complete Installation

1. Center front of right countershaft in front bore with wood block and move the right countershaft into mesh with the mainshaft gears. At the same time engage timing tooth on countershaft drive gear with timing teeth on main drive gear.

2. Center countershaft in rear bore and install the rear bearing on shaft and in case bore. Bearing can be started by installing partially on shaft before seating in bore (See Illustration #110).

3. Install front bearing on countershaft and into case bore (See Illustration #111).

4. Install the bearing retainer plate on front of countershaft. Tighten and wire capscrews securely (See Illustration #112).

5. Install rear bearing cover on countershaft (See Illustration #113).

I. To Install the Left Reverse Idler Gear

1. Install plug in oil channel in idler shaft (See Illustration #114).

2. Press needle bearing into bore of reverse idler gear.

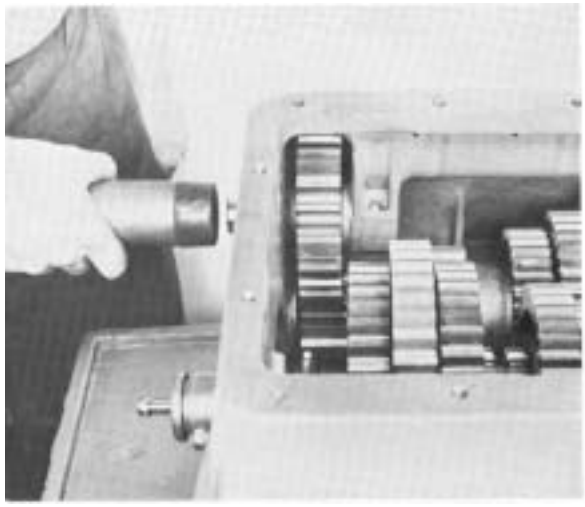
3. Place inner race of bearing in gear.

4. Place a thrust washer on each side of gear, oil slots to gear (See Illustration #115).

5. Place the reverse gear and the two thrust washers into position in case.

6. Thread the idler shaft through bore in rear of case, washers and gear. Make sure slot in idler shaft is aligned with lockplate capscrew bore in case (See Illustration #116).

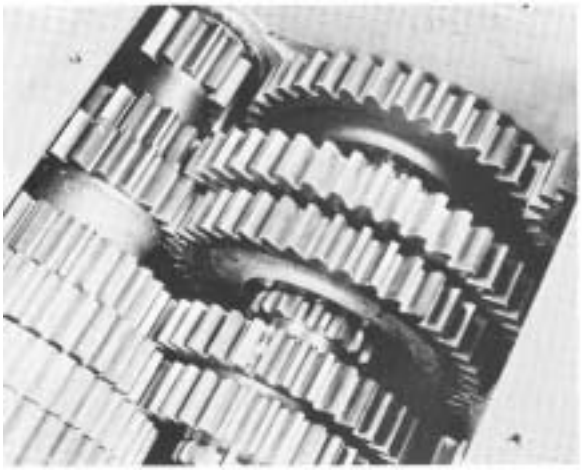
7. Install the lockplate in slot in idler shaft. Tighten capscrew securely (See Illustration #117).



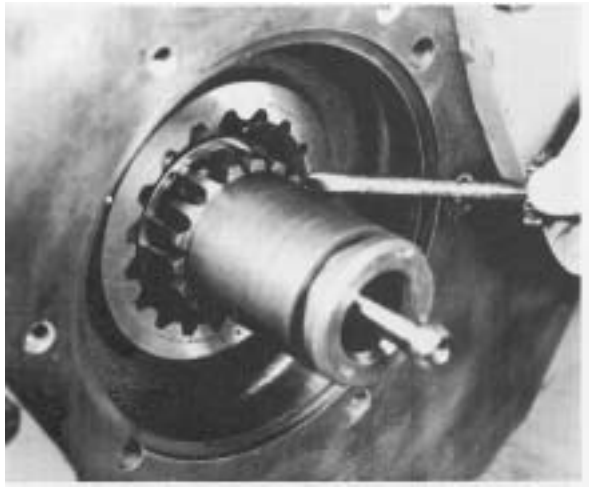
#116 - Threading reverse idler shaft through reverse idler gear and the two thrust washers.

#117 - Installing lockplate in reverse idler shaft.

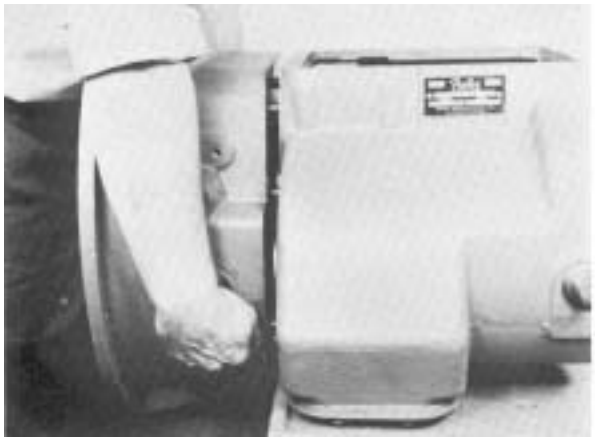
REASSEMBLY



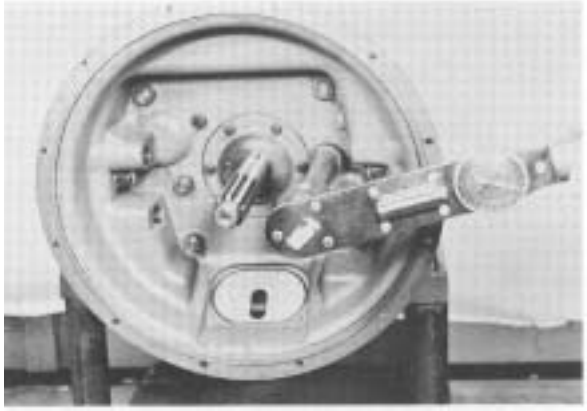
#118 - The mainshaft reverse gear moved to the rear to mesh with the two reverse idler gears.



#119 - Installing snap ring in ID of mainshaft reverse gear.



#120 - Installing clutch housing on front of transmission.



#121 - Installing nuts on case studs with 180-190 ft.lbs of torque.

#122 - Installing bolts in clutch housing with 90-100 ft.lbs. of torque

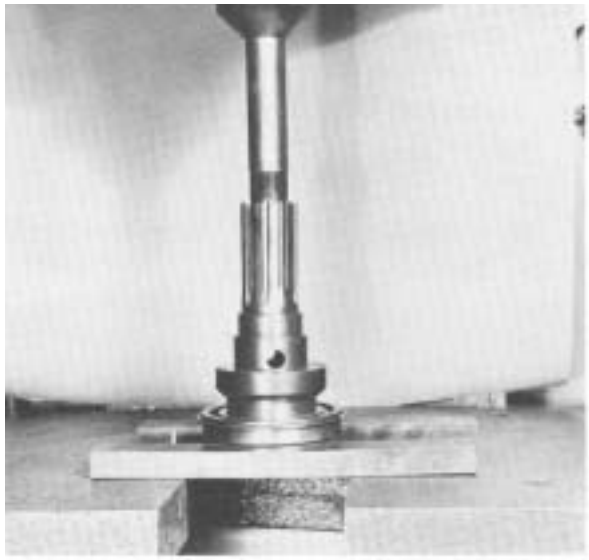


Illustration #123 - Pressing bearing on tailshaft.

REASSEMBLY

J. To Complete Installation of Mainshaft Assembly

1. Move the reverse gear to the rear on mainshaft as far as possible, meshing teeth of gear with teeth of the two reverse idler gears (See Illustration #118).

2. With mainshaft forward and reverse gear to the rear, seat the reverse gear spacer previously installed on shaft in hub of gear, and install the snap ring in ID of reverse gear (See Illustration #119).

K. To Install Clutch Housing

1. Place clutch housing in position on the six studs in front case, piloting on drive gear cover (See Illustration #120).

2. Install the six nuts with 180-190 ft.lbs. of torque (See Illustration #121).

3. Install the four bolts in clutch housing with 90-100 ft. lbs. of torque (See Illustration #122).

4. Install the clutch release mechanism if transmission is so equipped.

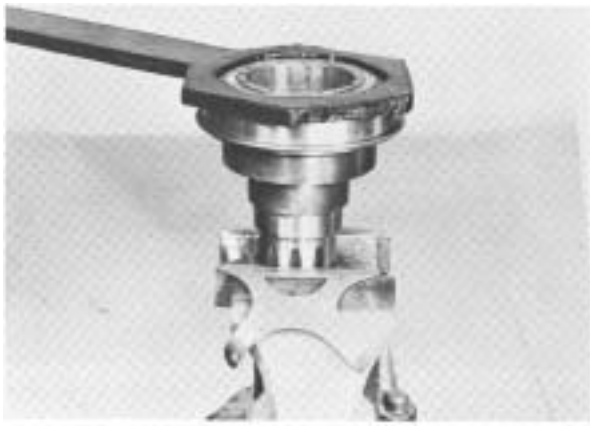
L. To Reassemble the Tailshaft Assembly

1. Press the front bearing on tailshaft, snap ring to the rear (See Illustration #123).

2. Clean threads of tailshaft and bearing nut and apply grade AVV Loctite (See Illustration #124).

3. Install the bearing nut on tailshaft with 250-300 ft.lbs. of torque (See Illustration #125).

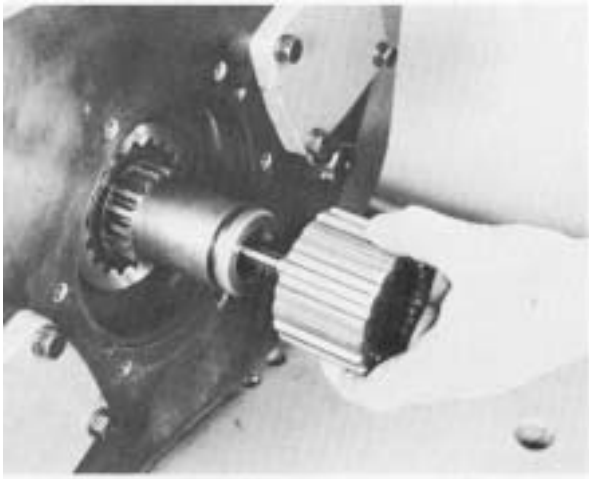
#124 - Applying Loctite to threads of bearing nut.



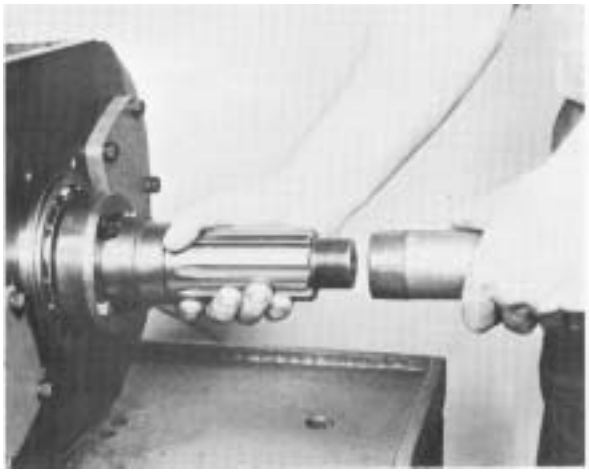
#125 - Installing bearing nut, left hand thread, with 250-300 ft.lbs. of torque.

#126 - Installing key-spacer ring on tailshaft.

REASSEMBLY

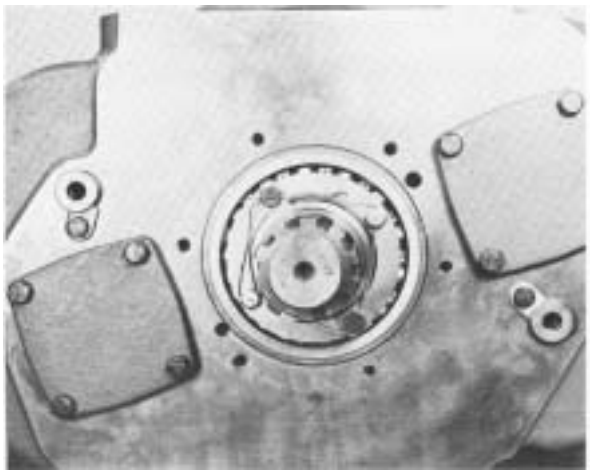


#127 - Installing coupling gear on mainshaft, counter-bore towards the front.

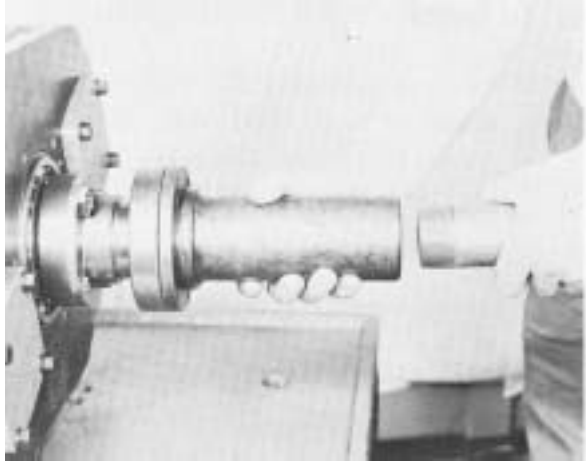


#128 - Installing tailshaft assembly over mainshaft and in case bore.

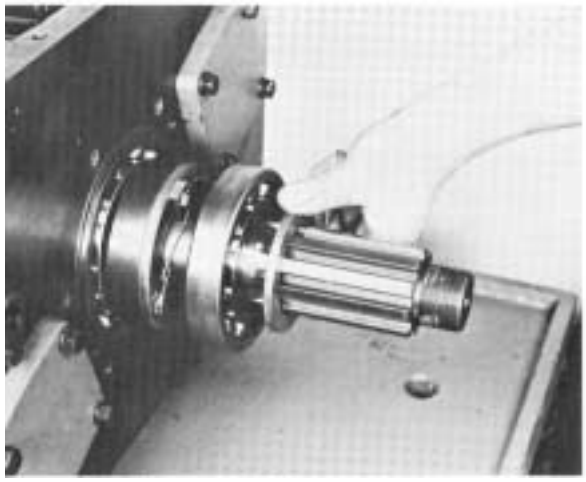
#129 - Installing flat keys in tailshaft to engage slot in mainshaft.



#130 - Flat keys secured to spacer ring and properly wired.



#131 - Installing outer bearing on tailshaft.



#132 - Installing bearing washer on tailshaft.

REASSEMBLY

M. To Install the Tailshaft Assembly

1. Install the coupling gear on splines of mainshaft with the counterbore towards the front and keyway aligned with key in shaft (See Illustration #127).

2. Install the tailshaft assembly over mainshaft, seating bearing in case bore. MAKE SURE SPLINES IN TAILSHAFT ENGAGE SPLINES OF COUPLING GEAR (See Illustration #128).

3. Install the flat keys in bores in tailshaft to engage slot in mainshaft (See Illustration #129)

4. Secure flat keys with 5/16” x 1” capscrews and tighten all capscrews in spacer ring evenly and securely. Install safety wire (See Illustration #130).

5. Install outer bearing on tailshaft, seating against shaft shoulder (See Illustration #131).

N. To Reassemble and Install the Rear Bearing Cover Assembly

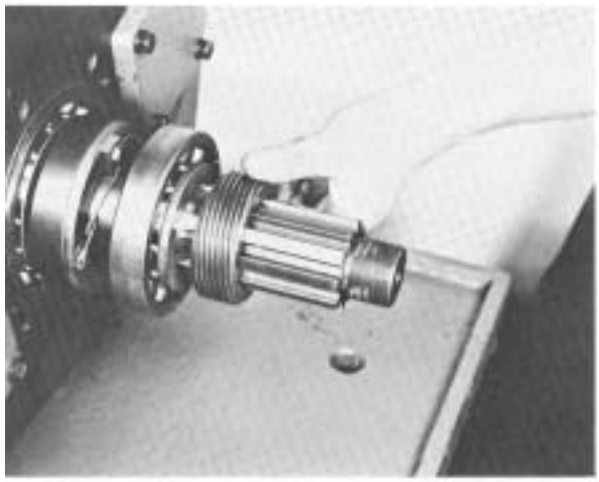
1. Install the tailshaft bearing washer on shaft and against bearing, chamfered ID to bearing (See Illustration #132).

2. Install the speedometer drive gear or replacement spacer on shaft and against washer (See Illustration #133).

3. Install speedometer bushing in rear bearing cover if required.

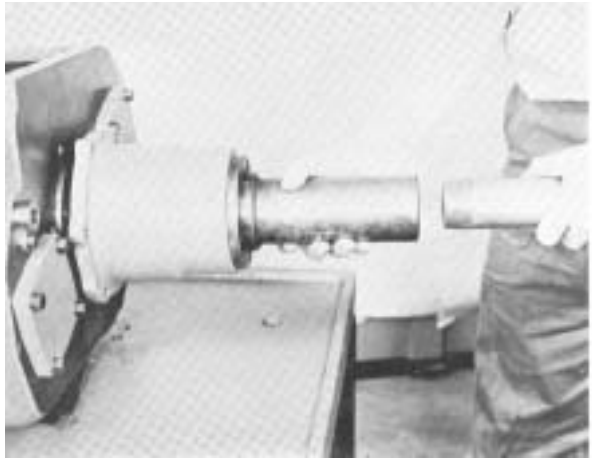
4. Install oil seal in rear bearing cover (See Illustration #134).

5. Install rear bearing cover evenly on tailshaft to seat tailshaft bearing in cover, aligning oil slot in cover with slot in case (See Illustration #135).



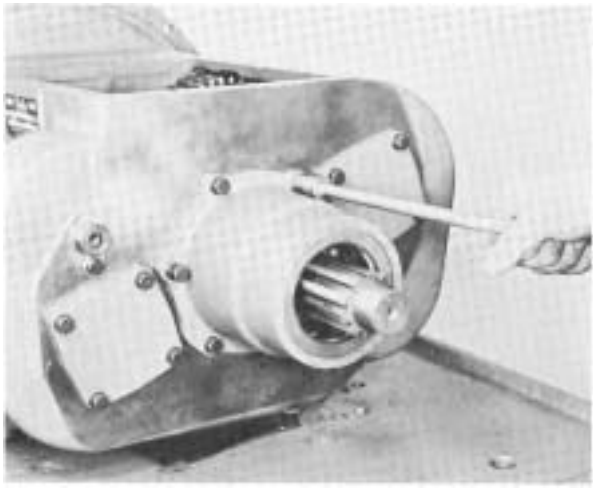
#133 - Installing speedometer drive gear on tailshaft.

#134 - Installing oil seal in rear bearing cover.

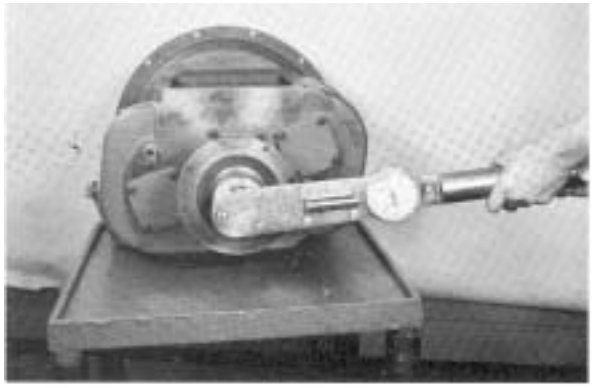


#135 - Installing rear bearing cover on tailshaft. Install evenly to properly seat outer bearing.

REASSEMBLY

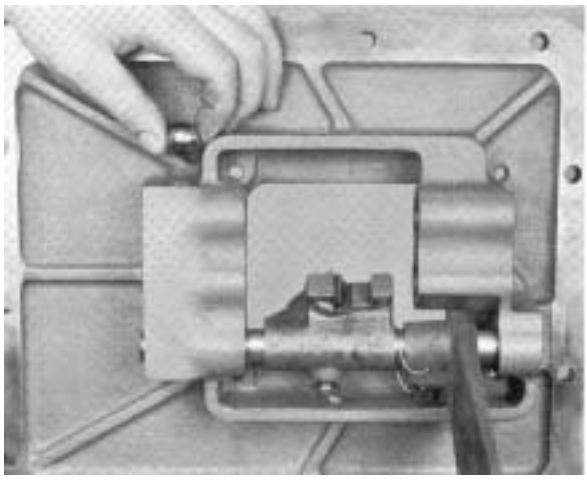


#136 - Securing rear bearing cover to transmission case.

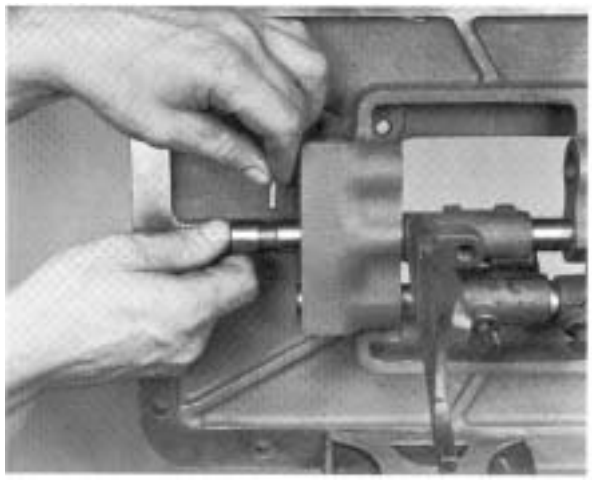


#137 - Installing companion flange nut with 400-500 ft.lbs. of torque.

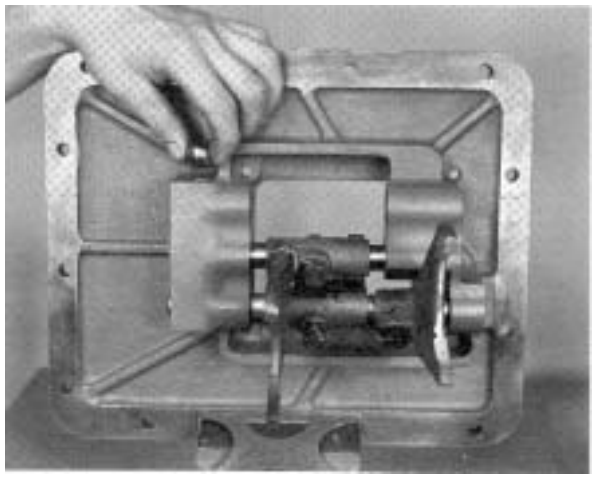
#138 - Installing the 1st-Reverse speed shift bar and shifting yoke and block.



#139 - Installing interlock ball in front boss.



#140 - Installing interlock pin in bore in neutral notch of 2nd-3rd speed shifting bar



#141 - Installing interlock ball in front boss.

REASSEMBLY

6. Install attaching capscrews, tighten evenly and securely (See Illustration #136).

O. To Install the Companion Flange or Yoke

1. Lock the mainshaft by engaging two speeds with the sliding clutch gears.

2. Install Flange or yoke on tailshaft splines and secure with tailshaft nut, using 400-450 ft. lbs. of torque (See Illustration #137).

P. To Reassemble the Shifting Bar Housing

1. Install the housing in a vise with the left side up.

NOTE: Shift bars should be installed from the front with neutral and shift notches to the front. Keep bars in the neutral position when installed.

2. Install the long 1st-Reverse shift bar in lowest bore in housing, installing the shifting yoke and block on bar, long hub of each to the front (See Illustration #139).

3. Install lockscrew in yoke and block, tighten and wire securely.

4. Install ¾" interlock ball in bore in front boss (See Illustration #139).

5. Install the 2nd-3rd speed shifting bar in center bore in housing and install shift yoke, long hub to the rear. At the same time install interlock pin bore in neutral notch of bar as notch enters front boss (See Illustration #140).

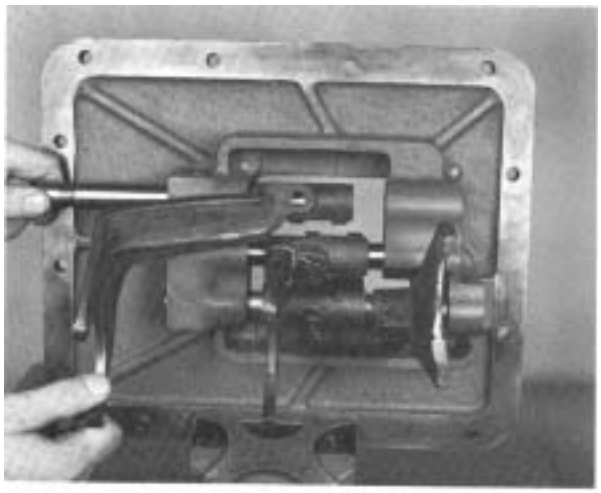
6. Install yoke lockscrew, tighten and wire securely.

7. Install ¾" interlock ball in bore in front boss (See Illustration #141).

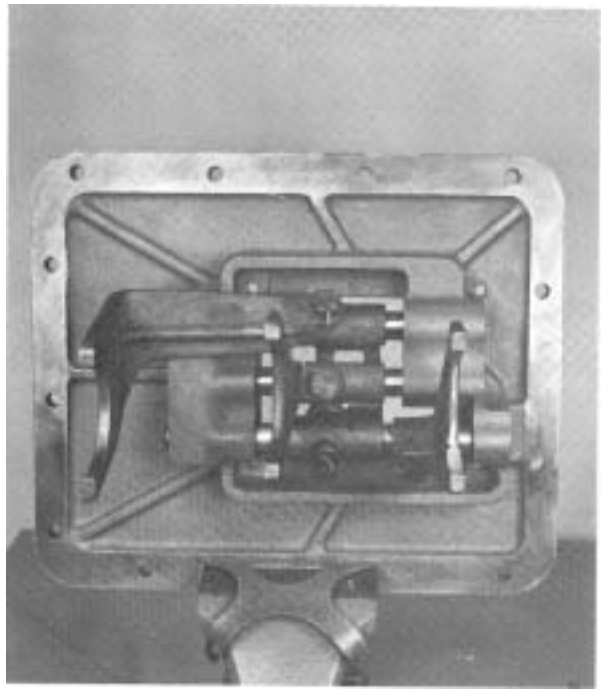
8. Install the 4th-5th speed shifting bar in upper bore in housing installing shift yoke on bar, fork to the front (See Illustration #142).

9. Install yoke lockscrew, tighten and wire securely (See Illustration #143).

10. Remove housing from vise.



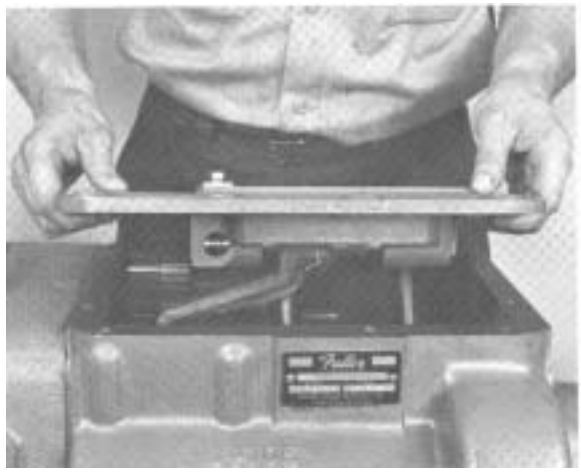
#142 - Installing the 4th-5th speed shifting bar and shifting yoke.



#143 - Shifting bar housing with yokes, blocks and bars correctly installed.

REASSEMBLY

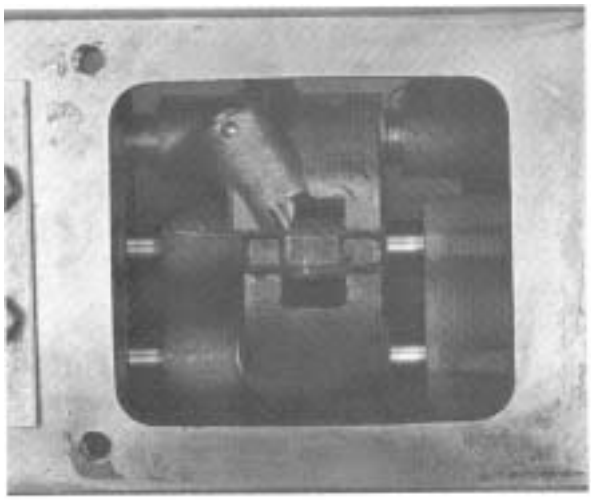
#144 - Installing tension balls in bores on top of housing.



#147 - Installing the shifting bar housing on transmission, fitting yokes in yoke slots of sliding gears.

#145 - Installing the three tension springs in bores.

#148 - Installing nut on gear shift lever pivot pin.



#146 - Shifting bars in the neutral position.

#149 - Installing the gear shift lever in housing.

REASSEMBLY

11. Install the three shift bar tension balls in bores in top of housing (See Illustration #144).

12. Install three tension springs in bores (See Illustration #145).

13. Install tension spring cover, tighten capscrews securely.

Q. To Install the Shifting Bar Housing Assembly

1. Place the sliding clutch gears in transmission in the neutral position.

2. Make sure shifting bars in housing are in the neutral position (See Illustration #146).

3. Install the shifting bar housing on transmission, fitting yokes into corresponding yoke slots of sliding gears, tighten capscrews securely (See Illustration #147).

R. To Reassemble and Install the Gear Shift Lever Housing Assembly

1. Install the pivot pin in bore in housing, thread end outward.

2. Install lockwasher and nut on pivot pin (See Illustration #148).

3. Mount the housing in a vise with the large bottom opening upwards.

4. Insert the gear shifts lever in housing, fitting slot in pivot ball of shift lever on pivot pin (See Illustration #149).

5. Install the tension spring washer in housing (See Illustration #150).

#150 - Installing the tension spring washer in housing.

REASSEMBLY

6. Install the tension spring in housing, seating spring under lugs cast inside the housing (See Illustration #151).

7. Remove assembly from vise and install the rubber protector over the gear shift lever and against neck of housing.

8. Install ball grip on shift lever

9. Make sure the shifting notches in the shifting bar housing are aligned in the neutral position.

10. Install the gear shift lever housing, fitting lever into notches in block and yokes; tighten capscrews securely (See Illustration #152).

#151 - Installing tension spring in housing, fitting spring under lugs cast inside the housing.

#152 - Installing the gear shift lever housing on shifting bar housing.

TOOL REFERENCE

Some illustrations in this manual show the use of specialized tools. These tools are recommended for transmission repair as they make repair easier, faster and prevent costly damage to critical parts.

Some of these tools can be obtained from a regular tool supplier, while others can be made either from prints or from dimensions as required by the individual user.

Listed below are illustrations which show these specialized tools, the tool name and how it can be obtained.

Prints are available for tools which have a Fuller tool number; send request to:

Service Department, Fuller Transmission Division,
EATON YALE & TOWNE, Inc., Kalamazoo, Michigan.

Also available upon request is a tool booklet which gives in detail the use and description of suggested specialized tools for rebuilding Fuller Transmissions.

Illustration	Tool	How Obtained
12	Jaw pullers, large	Tool Supplier
17-125	Hexagonal wrench	Make from 3/8” steel stock for 4 ½” hex. nut
22-40	Impact puller	Make from 18” steel rod, threaded ½”-13 one end, attach end block and sliding block
27-44	Bearing puller, ring type	Make from Fuller tool print T-22552
29	Jaw pullers, medium	Tool Supplier
34-84-105	Snap ring pliers, medium	Tool Supplier
38	Jaw puller, small	Tool Supplier
53-60	Special slotted plate and tool	Make from Fuller tool print T-15765, weld used sliding clutch to 3/8” steel lever
76-110	Flanged-end bearing driver	Make from Fuller tool print T-18042-50
77-11-131-134-135	Flanged-end bearing driver	Make from Fuller tool print T-10324
121-137	Torque wrench, 1,000 ft. lb. cap.	Tool Supplier
122	Torque wrench, 150 ft. lb. cap.	Tool Supplier
151	Tension spring driver	Make from Fuller tool print T-11938

GEAR CHART FOR T-905 SERIES TRANSMISSIONS

MODEL	Drive Gear	C.S. Drive Gear	M.S. 4th	C.S. 4th	M.S. 3rd	C.S. 3rd	M.S. 2nd	M.S. 2nd	M.S. 1st	C.S. with 1st & Rev.	Rev, M.S.
T-905A	24-T 14745	45-T 14747	32-T 14725	39-T 14746	38-T 14737	30-T 14741	40-T 14835	20-T 14836	44-T 14734	14720	38-T 14748
T-905B	24-T 14745	45-T 14747	26-T 14892	42-T 14891	36-T 14890	33-T 14889	40-T 14835	20-T 14836	44-T 14734	14720	38-T 14748
T-905C	24-T 15473	47-T 15478	26-T 15474	43-T 15479	32-T 15472	29-T 15477	38-T 15471	19-T 15476	48-T 15470	15475	40-T 15480
T905F	24-T 15473	47-T 15478	26-T 15585	35-T 15584	32-T 15472	29-T 15477	38-T 15471	19-T 15476	48-T 15470	15475	40-T 15480
TO-905A	32-T 14725	39-T 14746	24-T 14745	45-T 14747	38-T 14737	30-T 14741	40-T 14835	20-T 14836	44-T 14734	14720	38-T 14748
TO-905B	26-T 14892	42-T 14891	24-T 14745	45-T 14747	36-T 14890	33-T 14889	40-T 14835	20-T 14836	44-T 14734	14720	38-T 14748
TO-905C	26-T 15474	43-T 15479	24-T 15473	47-T 15478	32-T 15472	29-T 15477	38-T 15471	19-T 15476	48-T 15470	15475	40-T 15480
TO-905F	26-T 15585	35-T 15584	24-T 15473	47-T 15478	32-T 15472	29-T 15477	38-T 15471	19-T 15476	48-T 15470	15475	40-T 15480
T-905H	24-T 14745	45-T 14747	32-T 14725	39-T 14746	38-T 14737	30-T 14741	40-T 14835	20-T 14836	48-T 15470	15475	38-T 14748
T-905J	24-T 15473	47-T 15478	32-T 14725	39-T 14746	34-T 15464	26-T 15465	46-T 15466	22-T 15467	48-T 15470	15475	40-T 15480
T-905M	26-T 14892	42-T 14891	32-T 14725	39-T 14746	36-T 14890	33-T 14889	38- 16373	23-T 16372	44-T 14734	14720	38-T 14748

M.S. = Mainshaft
C.S. = Countershaft

RATIOS											
	T-905A	T-905B	T-905C	T-905F	T-905H	T-905J	T-905M	TO-905A	TO-905B	TO-905C	TO-905F
FIFTH	1.00	1.00	1.00	1.00	1.00	1.00	1.00	.65	.86	.84	.69
FOURTH	1.54	1.16	1.18	1.45	1.54	1.61	1.32	1.00	1.00	1.00	1.00
THIRD	2.38	2.04	2.16	2.16	2.37	2.56	1.76	1.54	1.76	1.82	1.48
SECOND	3.75	3.75	3.92	3.92	3.75	4.09	2.67	2.44	3.23	3.31	2.69
FIRST	6.35	6.35	7.23	7.23	6.92	7.23	5.47	4.12	5.47	6.11	4.97
REVERSE	6.48	6.48	7.12	7.12	6.48	7.12	5.58	4.21	5.58	6.01	4.90

Note: Features and specifications listed in this document are subject to change without notice and represent the maximum capabilities of the software and products with all options installed. Although every attempt has been made to ensure the accuracy of information contained within, Eaton makes no representation about the completeness, correctness or accuracy and assumes no responsibility for any errors or omissions. Features and functionality may vary depending on selected options.

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