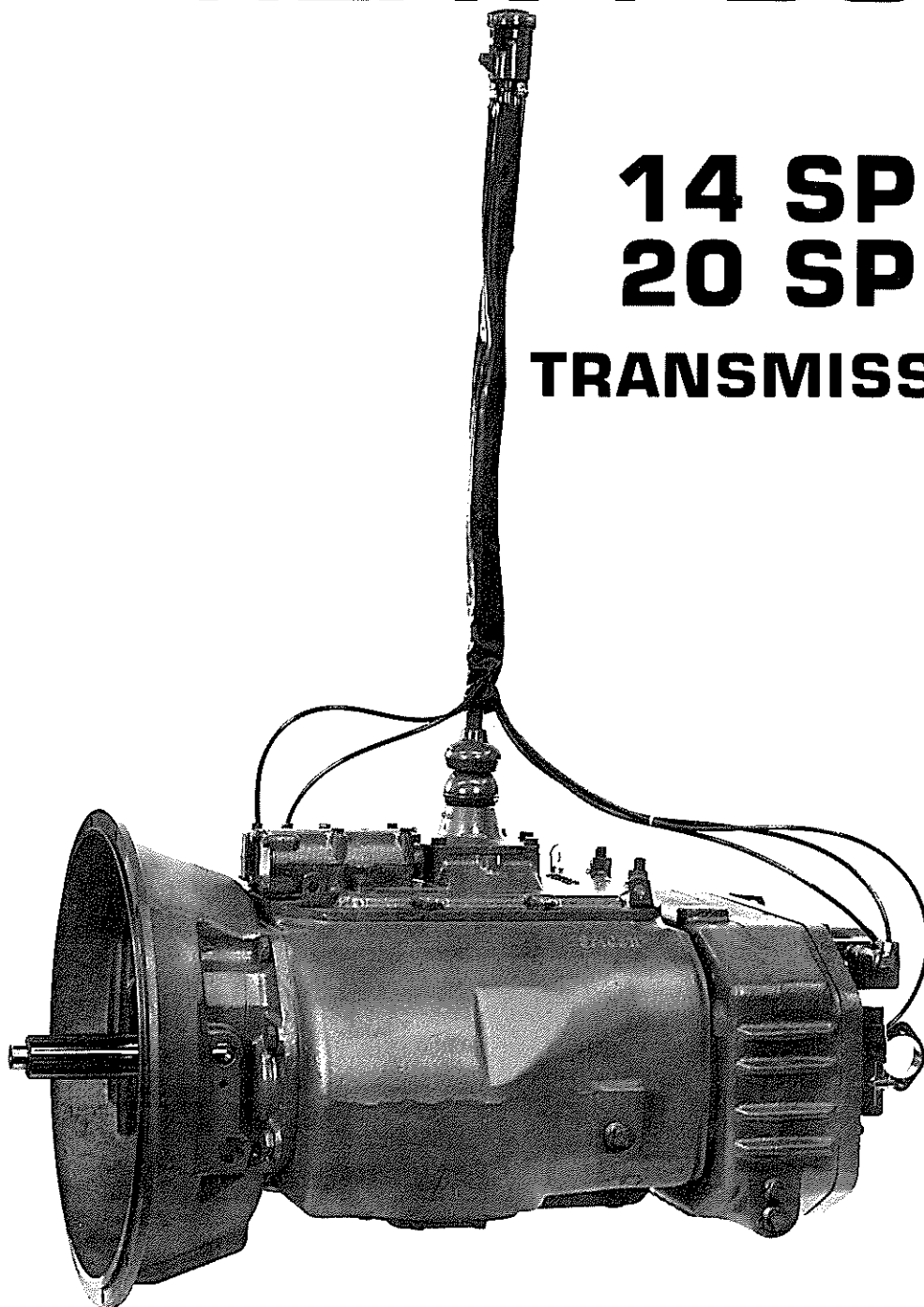


SERVICE MANUAL
SPICER®
HEAVY DUTY

14 SPEED
20 SPEED
TRANSMISSIONS



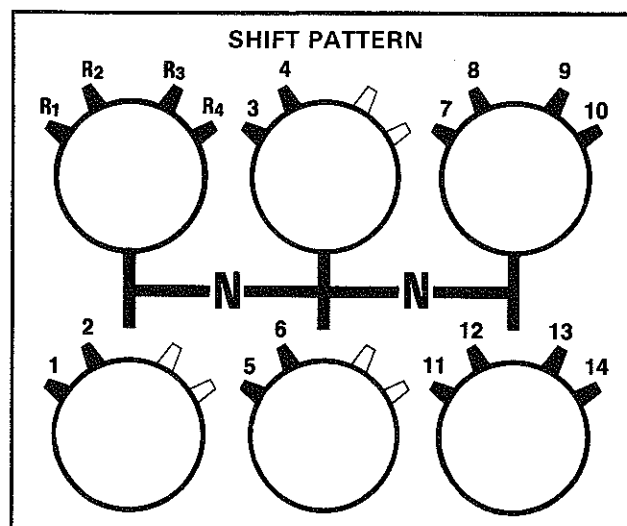
MODELS 1214 & 1420

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SPECIFICATIONS MODEL 1214

Model 1214-2A (DIRECT)				Model 1214-3A (OVERDRIVE)			
Stick Position	Gear	Ratio	% Step	Gear	Ratio	% Step	
1	1	12.59	19	1	12.59	19	
	2	10.60	38	2	10.60	47	
2	3	7.67	19	3	7.18	19	
	4	6.46	36	4	6.05	42	
3	5	4.76	19	5	4.25	19	
	6	4.01	20	6	3.57	28	
4	7	3.35	19	7	2.80	19	
	8	2.82	19	8	2.36	20	
	9	2.36	19	9	1.97	19	
	10	1.99	18	10	1.66	17	
5	11	1.69	19	11	1.42	18	
	12	1.42	19	12	1.20	20	
	13	1.19	19	13	1.00	19	
	14	1.00		14	.84		
	Rev.	12.59		Rev.	12.59		
		10.60			10.60		
		8.86			8.86		
		7.47			7.47		

Torque Rating: 950-1300 lbs. ft. (1292-1768 Nm.)
Length: 34-13/16 in. (884.2 mm.)
Weight: 760 lbs. (345 Kg.)
Yoke or Flange: 1710, 1760, 1810, or 1880 Series
Clutch: 14 in. or 15½ in., 2-Plate
Clutch Housing: SAE No's. 1 or 2
 Both available with Nodal Mount
***Oil Capacity:** 43 pts. (20.3 Lit.) at 0° Installation
Power Take Off: Right Side: SAE Std. H.D. 6 Bolt
 Bottom Left: SAE Std. H.D. 8 Bolt



How to Shift the Spicer Model 1214

Your vehicle has been equipped with the Spicer Model 1214 transmission. The Model 1214 has 20 possible forward ratios with 14 progressive forward speeds, and four useable reverse speeds. It also has only four shift lever movements from first to fourteenth with an air-shifted splitter and range making all other gear changes. Here's how this transmission is designed to work for you in the driver's seat.

Starting

With the engine idling, depress the clutch, move the air control to position (1), and then move the stick into first hand position. Gradually engage the clutch and accelerate to governed engine speed (2100 RPM).

NOTE

A clutch brake is used to stop gear rotation to complete a shift into first or reverse when the vehicle is stationary. If a butt-toothed condition exists between the clutching teeth, a momentary re-engagement of the main clutch will allow the gear train to move into a smooth engagement.

NOTE

The clutch brake on this transmission is actuated by depressing the clutch pedal all the way to the floor. For normal upshifts and downshifts, only a partial disengagement of the clutch is necessary to break engine torque.

Upshifting

Once governed engine speed has been attained in first gear move the air control to position (2) and immediately depress the clutch. Allow engine RPM to drop approximately 350 (RPM drop may vary with engines of different governed speeds)*, and re-engage the clutch with stick remaining in the first hand position, air control in position (2) for second gear. Again at governed speed, depress the clutch and move the stick to neutral. Move the air control back to position (1), engage the clutch, allow engine speed to drop approximately 350 RPM, depress the clutch and move the stick into second hand position, or third gear, re-engaging the clutch.

The procedure, just described, is repeated for the first three hand positions until the fourth hand position, air control position (1) (seventh gear) is reached. In seventh gear and governed speed, move the air control to position (2) (eighth gear) and immediately depress the clutch.

Allow the RPM to drop approximately 350 RPM* and re-engage the clutch, leaving stick in fourth hand position. To shift from eighth to ninth, move the air control valve to position (3) and immediately depress the clutch, allowing engine RPM to drop approximately 350. Re-engage the clutch and accelerate to governed speed. To shift from ninth to tenth, move the air control to position (4) and immediately depress the clutch. Allow engine RPM to drop 350 and re-engage the clutch. The stick remains in fourth hand position for these last two shifts. To shift into fifth hand position, depress the clutch and move the stick to neutral. Move the air control back to position (1) from position (4) and re-engage the clutch. Allow the engine speed to drop approximately 350 RPM, then depress the clutch and move the stick into fifth hand position, re-engaging the clutch. Fifth hand, air position (1) is eleventh gear. To upshift through fourteenth gear, repeat the same procedure used in the fourth hand position, splitting with the air control three times.

NOTE

The only time double-clutching is required on upshifting is when the gear stick changes position.

Downshifting

Driving in fourteenth gear, (fifth hand, air control position (4)), allow the RPM to drop approximately 350, move the air control back to position (3) and immediately dip the throttle to break torque, then accelerate to governed speed to complete the airshift to thirteenth gear. It is not necessary to use the clutch on splitter only downshifts (positions (4) to (3) or positions (2) to (1)). To shift from thirteenth to twelfth (from position (3) to position (2)), a range and splitter air shift is made. Allow the RPM to drop approximately 350*, move the air control back to position (2) and immediately depress the clutch to break torque and then re-engage. Pause momentarily to allow the engine to drop 200 RPM further to complete the splitter air shift, and then accelerate to governed speed to complete the range airshift. To downshift from twelfth to eleventh, allow the RPM to drop approximately 350*, move the air control back to position (1) and immediately dip the throttle to break torque, then accelerate to governed speed to complete the air shift.

To shift from fifth hand to fourth hand, disengage the clutch, move the stick to neutral and the air control forward to position (4). Engage the clutch, accelerate to governed speed, disengage the clutch and move the stick into fourth hand position, re-engaging the clutch. The shifts from tenth through seventh follow the same procedure described above for those in the fifth hand position. Three more downshifts are made before the stick is moved again. Note that the airshift from position (3) to position (2) is both a range and splitter shift, and requires an extra pause as described above in the fifth hand position.

Downshifting continued

To downshift into third hand position, allow the engine to drop approximately 350 RPM. Disengage the clutch and move the stick to neutral and air control from position (1) to position (2). Engage the clutch, accelerate to governed speed, disengage the clutch and move the stick into third hand position, re-engaging the clutch.

A second downshift is made in third hand position by allowing the engine speed to drop approximately 350 RPM, moving the air control back to position (1), and immediately dipping the throttle to break torque, then accelerating the engine to governed speed.

Downshifts in the second and first hand positions are performed the same as those described above for the third hand position.

NOTE

Characteristic ratcheting noise heard during range and splitter shifts is normal, and not harmful to proper operation of the transmission. This noise normally can be minimized by proper use of the clutch during shifts as described above.

*All RPM drops are based on engines set at 2100 RPM. These drops will vary with engines of different governed speeds.

OPERATION

Clutches

A clutch brake is required for use with this transmission. It is recommended that the torque limiting clutch brake be used instead of the three-piece type. Attention is called to the fact that Spicer 14" and 15½" 2-plate clutch service manuals (Bulletins 1308 and 1309) are available for the asking, and contain complete information on all Spicer Heavy Duty Clutches.

Replacement Parts

The exploded views of sub-assemblies which are incorporated here are for the mechanic's convenience and show the latest material. The parts are arranged in their correct order and may also be used as a reference for assembly or disassembly of this unit.

No special precautions are necessary during removal or installation of the bell housing. The bell housing is piloted on the input drive shaft bearing cap and the large flat case mounting face insures correct alignment of bores, face and pilot with bell housing.

Power Flow

The Spicer split torque transmission is designed for medium and heavy duty, on and off highway applications.

The two countershaft design allows the engine torque to be equally divided between the two countershafts. This provides a high ratio of torque capacity to transmission weight. This also allows a reduction in the face width of each gear involved in the transmission. All the gears are in constant mesh through spur teeth.

SPECIFICATIONS MODEL 1420

1420-3A RATIOS						
Stick Position	Gear	Off-Highway Range	% Step	Gear	On-Highway Range	% Step
1	1	14.88	30	1	8.86	30
	2	11.47	35	2	6.83	36
2	3	8.47	30	3	5.04	30
	4	6.54	30	4	3.89	31
3	5	5.01	30	5	2.98	30
	6	3.86	32	6	2.30	32
4	7	2.92	30	7	1.74	30
	8	2.25	34	8	1.34	34
5	9	1.68	30	9	1.00	30
	10	1.29		10	.77	
	Rev.	14.88		Rev.	8.86	
		11.47			6.83	

Speeds: Forward—10 off-highway, 10 on-highway, 12 progressive, 4 reverse

Torque Capacity*: 950-1400 lbs. ft. (1292-1904 Nm.)

Length: 34-13/16 in. (884.2 mm)

Weight:** 800 lbs. (363 kg)

PTO POSITIONS: SAE standard 6 bolt—right side—54 tooth 6 pitch. SAE standard 8 bolt—left side—54 tooth, 6 pitch. Countershaft—standard on right, optional on left.

Clutch Housing: SAE Nos. 1 or 2 cast iron—both available w/nodal mount

Clutch: 14" or 15½"—2 plate

Yoke or Flange: 1710-1760-1810-1880 Series

Oil Capacity: 43 pts. (20.3 Lit.) at 0° installation

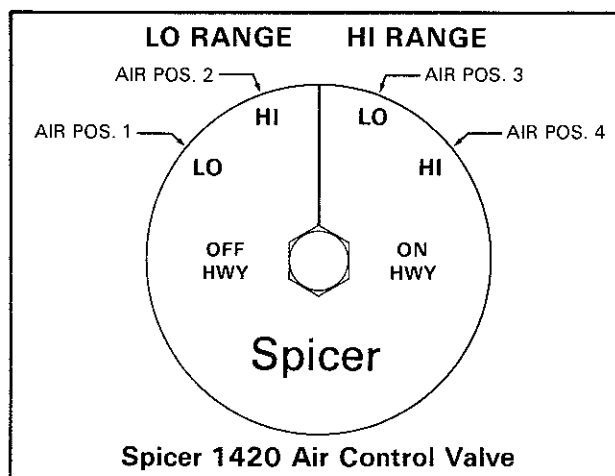
Countershaft PTO can be operated in two ways: 1) while truck is in motion, with auxiliary section in low range, 2) while truck is stationary, with auxiliary section in neutral.

PTO Drive Speeds 6 and 8 bolt: Low Split—481 RPM, Hi Split—625 RPM

(Per 1000 RPM of Engine Speed)

Countershaft PTO:		Gear	Speed (RPM)	Gear	Speed (RPM)
		1	160	2	210
		3	280	4	370
		5	480	6	620
		7	820	8	1070
		9	1430	10	1860
		R ¹ -R ³	160	R ² -R ⁴	210

*Torque rating dependent on duty cycle for on- and off-highway operation. Consult Spicer engineering for specific off-highway rating.
**Iron case & cl. housing.

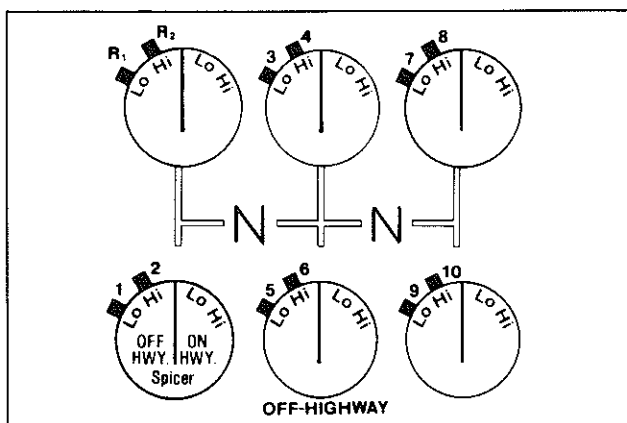


How to Shift the Spicer Model 1420

Your vehicle has been equipped with the Spicer Model 1420 transmission. The 1420 is a compound transmission with a 10-speed main box and a 2-speed range section. An air operated splitter in the main box divides each of the five gear sets, providing 10 forward speeds. In combination with the 2-speed range section, this gives you 20 forward speeds—10 in each range.

For extra heavy loads, on highway, where a deep starting gear is needed the first two air positions in the off-highway range can be used. The pattern then progresses to the on-highway range while still in the first hand position. This method of shifting provides 12 progressive forward speeds.

OFF HIGHWAY



Starting and Upshifting

With engine idling, shift lever in neutral:

- 1st gear
- Declutch and select air position 1
 - Move lever to first hand position
 - Engage clutch and accelerate to governed speed
- 2nd gear
- Select air position 2 and declutch
 - Allow engine speed to drop approximately 500 RPM*
 - Engage clutch and accelerate to governed speed (Shift will be automatically completed by air operated splitter)
- 3rd gear
- Declutch and move lever to neutral while selecting air position 1
 - Engage clutch and allow engine speed to drop approximately 500 RPM*
 - Declutch and move lever to 2nd hand position
 - Engage clutch and accelerate to governed speed.

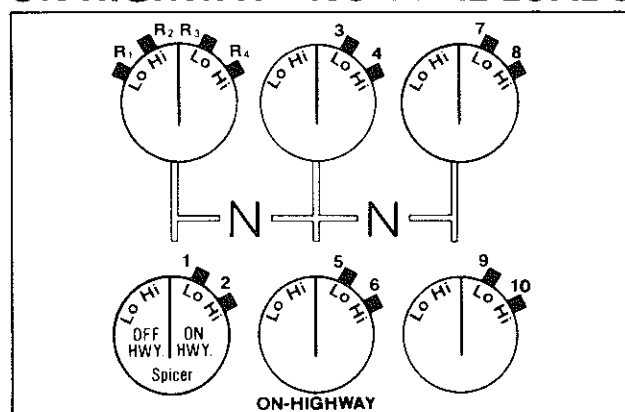
Continue shifting in this manner through the remaining gears, double clutching each time the lever is moved to a new hand position.

Downshifting

- 10 - 9 Gear
- Drop engine speed approximately 500 RPM*
 - Select air position 1
 - Declutch and accelerate to governed speed
- 9 - 8 Gear
- Drop engine speed approximately 500 RPM*
 - Declutch and move lever to neutral while selecting air position 2
 - Engage clutch and accelerate to governed speed
 - Declutch and move lever to next lower hand position
 - Engage clutch and accelerate to governed speed

Continue downshifting in this manner through the remaining gears, double clutching each time the lever is moved to a new hand position.

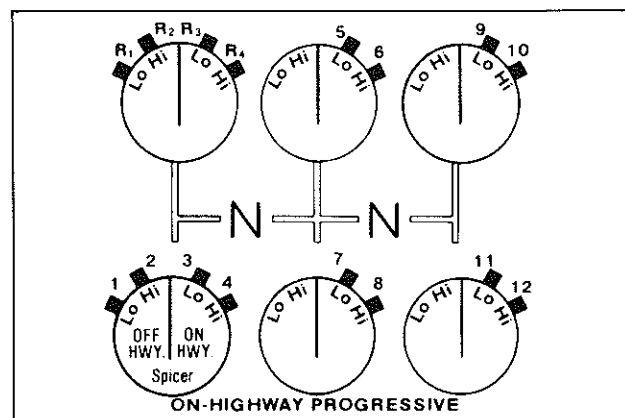
ON HIGHWAY - NORMAL LOADS



Upshifting and Downshifting

Use same procedure described for off-highway, but using air positions 3 and 4.

ON HIGHWAY - HEAVY LOADS



Upshifting

Use normal on-highway procedure except vehicle is started in air position 1 and progresses through all four air positions while lever is still in hand position 1. For balance of shift pattern use air positions 3 and 4 only.

Downshifting

Use normal on-highway procedure except when shifting from 3rd to 2nd gear (first hand position). To shift from 3rd to 2nd gear, move air valve from position 3 to position 2, declutch and *pause* before raising engine speed to complete shift.

CAUTION

To prevent possible damage to the transmission, do not use air positions 3 or 4 when off-highway. To go from on-to off-highway with vehicle in motion (lever in any hand position), move air valve from position 3 to position 2, declutch and *pause* before raising engine speed to complete shift. *Use only air positions 1 and 2 while off-highway.* The transition from off-to on-highway is accomplished by moving air valve from position 2 to position 3 (lever in any hand position), declutch, drop engine speed approximately 500 RPM* and engage clutch.

REVERSE

Use *only* air positions 1 and 2 while in reverse off-highway. All four reverse positions can be used on-highway.

CLUTCH BRAKE

The clutch brake on this transmission is actuated by depressing the clutch pedal to the floor. For normal upshifts and downshifts, only partial disengagement is necessary to break engine torque.

To shift a stationary vehicle into first or reverse, complete disengagement is required. If a butt-toothed condition exists between clutching teeth, a momentary re-engagement of the clutch will allow the gear train to move into smooth engagement.

**All RPM drops are based on engines governed at 2100 RPM. This drop will vary with engines of different governed speeds.*

OPERATION

Clutches

A clutch brake is required for use with this transmission. It is recommended that the torque limiting clutch brake be used instead of the three-piece type. Attention is called to the fact that Spicer 14" and 15½" 2-plate clutch service manuals (Bulletins 1308 and 1309) are available for the asking, and contain complete information on all Spicer Heavy Duty Clutches.

Replacement Parts

The exploded views of sub-assemblies which are incorporated here are for the mechanic's convenience and show the latest material. The parts are arranged in their correct order and may also be used as a reference for assembly or disassembly of this unit.

No special precautions are necessary during removal or installation of the bell housing. The bell housing is piloted on the input drive shaft bearing cap and the large flat case mounting face insures correct alignment of bores, face and pilot with bell housing.

Power Flow

The Spicer split torque transmission is designed for medium and heavy duty, on and off highway applications.

The two countershaft design allows the engine torque to be equally divided between the two countershafts. This provides a high ratio of torque capacity to transmission weight. This also allows a reduction in the face width of each gear involved in the transmission. All the gears are in constant mesh through spur teeth.

Spicer® Transmission Lubrication

To insure proper lubrication and operating temperatures in these units it is most important that the proper lubricants be used and that correct oil levels be maintained.

Recommended Lubricants

The lubricants listed below are recommended, in order of preference, for use in all Spicer mechanical transmissions, auxiliaries and transfer cases.

DO NOT USE EXTREME PRESSURE ADDITIVES, such as found in multi-purpose or rear axle type lubricants. These additives are not required in Spicer transmissions, and may in some cases create transmission problems. Multi-purpose oils, as a group, have relatively poor oxidation stability, a high rate of sludge formation and a greater tendency to react on or corrode the steel and bronze parts.

Oil Changes

We recommend an initial oil change and flush after the transmission is placed in *actual* service. This change should be made any time following 3000 miles (4827 km), but *never exceed 5000 miles (8045 km)*, of over-the-road service. In off-highway use, the change should be made after 24 and before 100 hours of service have elapsed. There are many factors that influence the following oil change periods and we have not specified a definite mileage interval.

In general, it is suggested that a drain and flush period be scheduled every 50,000 miles (80,450 km) for normal over-the-highway operations. Off-highway usually requires oil change every 1000 hours. The oil level in the transmission should be checked every 5,000 miles (8,045 km) on-highway, or every 40 hours in off-highway operation. When it is necessary to add oil we recommend that types or brands of oil should not be mixed. The correct oil level in *all* Spicer transmissions is established by the filler plug opening.

Refill

First, remove all dirt around the filler plug. Then refill with new oil of grade recommended for the existing season and prevailing service. Fill to the bottom of the level testing plug positioned on the side of the transmission.

Overfilling

Do not overfill the transmission. Overfilling usually results in oil breakdown due to excessive heat and aeration from the churning action of the gears. Early breakdown of the oil will result in heavy varnish and sludge deposits that plug up oil ports and build up on splines and bearings. Overflow of oil escapes onto clutch or parking brakes causing additional trouble.

TEMPERATURE	GRADE	TYPE
Above 0° F.	SAE 30, 40, or 50	Heavy Duty Engine Oil Meeting MIL-L-2104C or MIL-L-46152
Below 0° F.	SAE 30	NOTE: Oils Meeting MIL-L-2104B or MIL-L-45199 Are Also Acceptable
Above 0° F.	SAE 90	Straight Mineral Gear Oil - R & O Type
Below 0° F.	SAE 80	

CAUTION

Do not tow vehicles equipped with Spicer transmissions at high speeds or for long distances without first pulling the axles or disconnecting the drive shaft. Lubrication of the internal gear train is inadequate when the vehicle is towed.

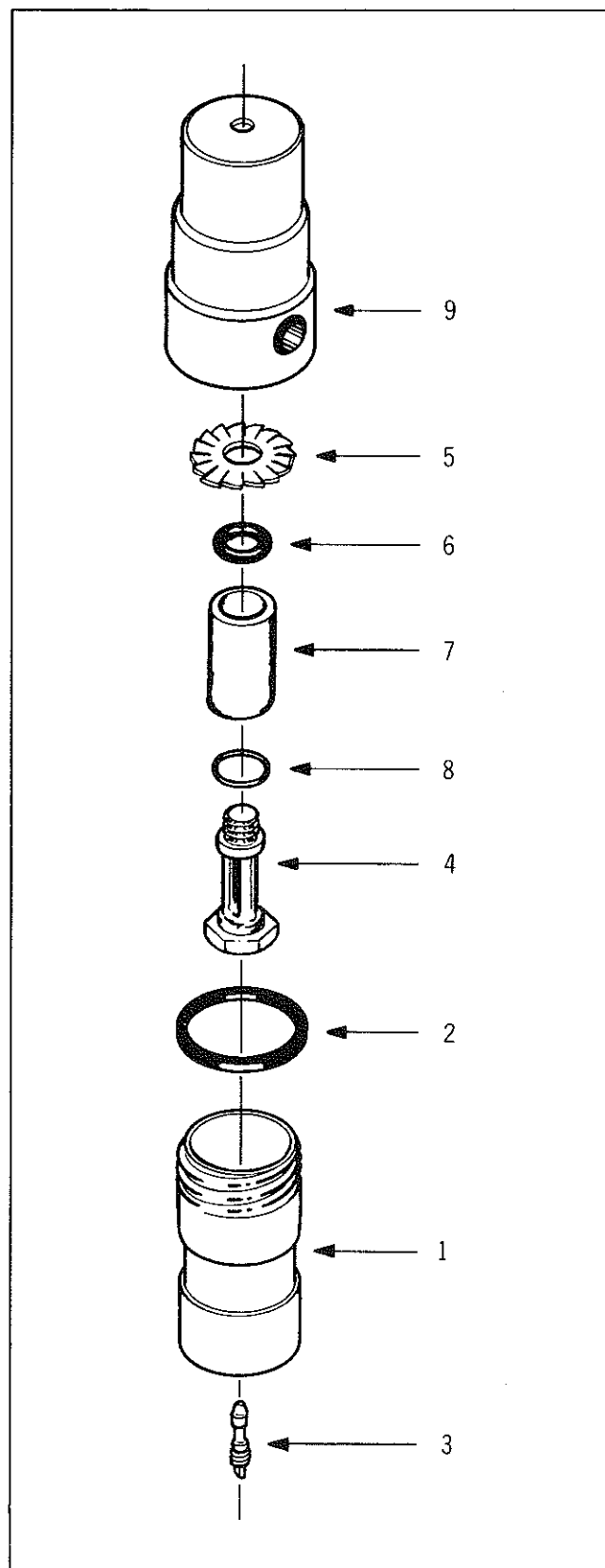
Disassembly and Reassembly of Filter-Regulator

NOTE

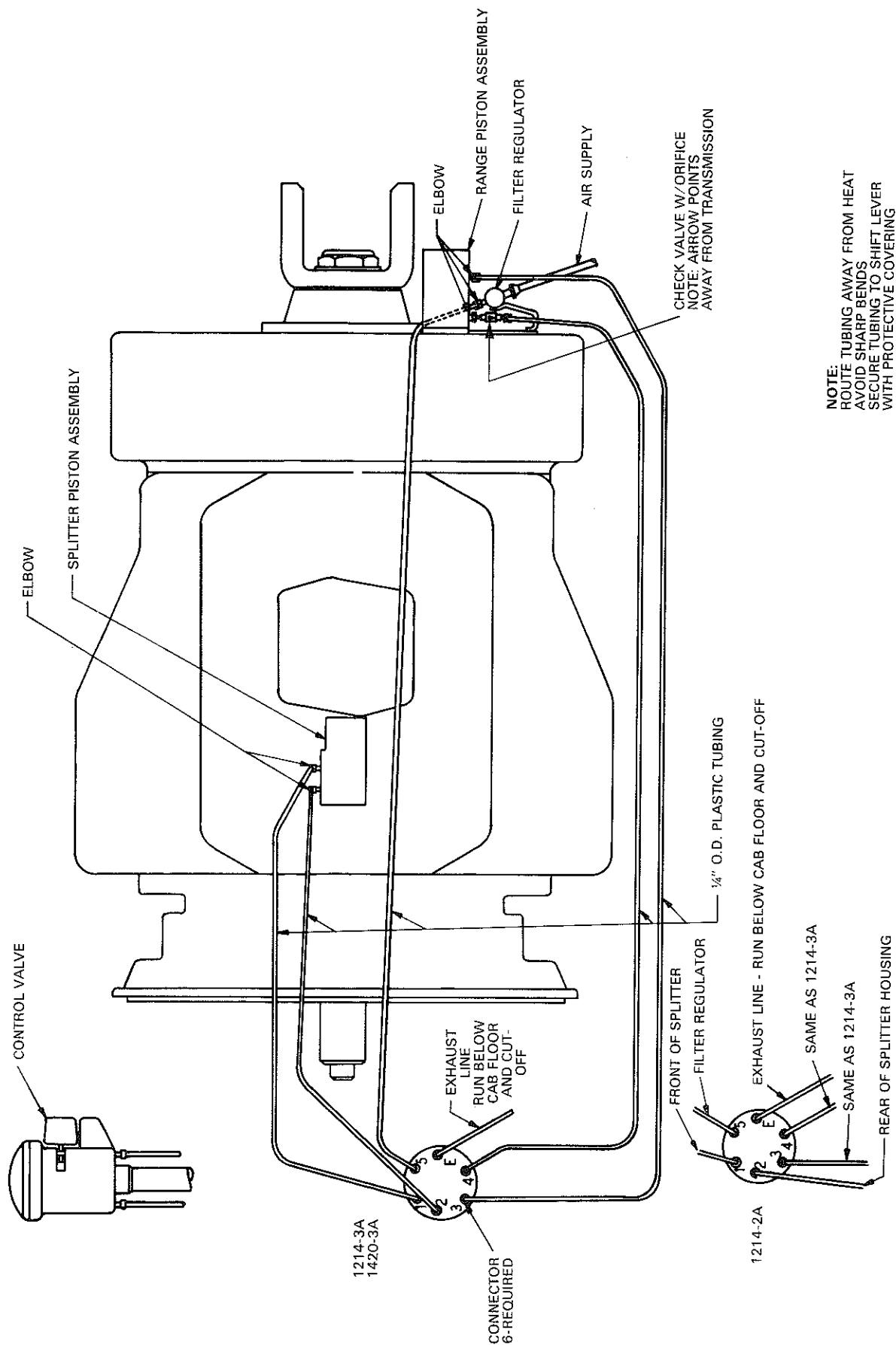
The SST-1214 and 1420 use a filter-regulator pre-set at 50-55 P.S.I. Maximum setting 60 P.S.I. Use only petroleum base solvent to clean parts. Blow air through filter (inside to outside) to dislodge surface contaminants. Do not disassemble regulator section (9), as it is not field repairable.

MAINTENANCE

1. Clean or replace filter element (7) every six months to one year to whenever slow shifting is encountered. Element should be replaced after three cleanings. If regulator malfunction is indicated, replace entire unit.
2. To service filter section, shut off air pressure. Unscrew bowl (1) and remove O-Ring (2). Unscrew stud (4). Remove louver (5), upper gasket (6), element (7), and lower gasket (8) from stud. Do not disassemble regulator section (9).
3. After cleaning, inspect parts carefully; replace any damaged parts.
4. Reassemble by installing element (7) on stud (4) so that large end of internal taper (thinnest wall section) is toward hex on stud. Torque stud to 5-10 lbs. inch.
5. Apply a wipe coat of Dow Corning DC7 Silicone Grease (or equivalent) to O-Ring (2) seating surfaces on regulator (9) and bowl (1). Apply a light, even coat of Molykote "G" (or equivalent) to bowl threads. Torque bowl to 5-10 lbs. inch. If drain valve (3) was removed, reinstall and torque to 10-15 lbs. inch.



DIRECT AIR CONTROL PIPING DIAGRAM



General Precautions for Disassembly

IMPORTANT

Read this section before starting the detailed disassembly procedure.

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

Rebuild Facilities

A suitable holding fixture or overhaul stand is desirable but not necessary to rebuild this unit. The flat bottom of the transmission case provides a suitable working platform when the unit is placed on a sturdy shop table.

For easier working conditions, table height should be 28-30 inches. A light chain hoist should be used to handle the mainshaft and countershafts during removal and reassembly procedures.

Cleanliness

Transmissions should be steam cleaned prior to disassembly. Seal all openings before steam cleaning to prevent entry of dirt and water which can damage serviceable parts.

Dirt is abrasive and will cause premature wear of bearings and other parts. We suggest that mechanics have a small wash tank to clean parts just prior to reassembly.

Bearings

When a transmission is removed at relatively low mileage, bearings should be removed with pullers designed for this purpose. Wrap the bearings to keep out dirt. Clean, inspect and lubricate all bearings just prior to reassembly. If accumulated mileage is over 150,000 miles, we suggest that all bearings be replaced.

End Yokes & Flanges

Hammering on end yokes and flanges, to remove or install them is not only destructive to the yoke or flange itself, but can also cause serious internal damage. Hammering destroys or mutilates the pilot diameters and warps or bends the flange. Hammering on end yokes will close-in the bearing bores or misalign yoke lugs and result in early failures of journal needle bearings, etc.

Serious damage can be done internally to bearings, thrust faces and washers, pilot bearings, etc., by hammering on external parts.

In most designs when the yoke/flange locknuts are tightened and secure, the internal bearings and gears are in proper location. When the yoke/flange is driven on the shaft, two conditions can exist.

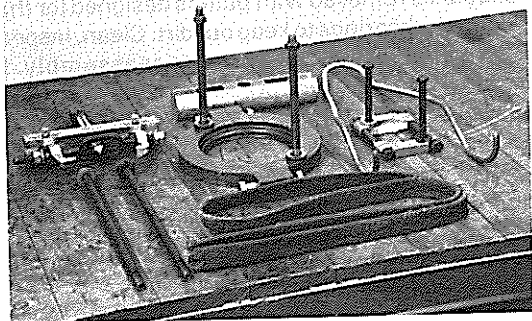
- (a) If the bearing fit is *tight* on the shaft, then usually the bearings will brinell as they must absorb the pounding forces.
- (b) If the bearing is *loose*, the shaft will keep moving inward until it is stopped by the internal parts such as pilot bearing thrust washers, etc.

Tool Reference

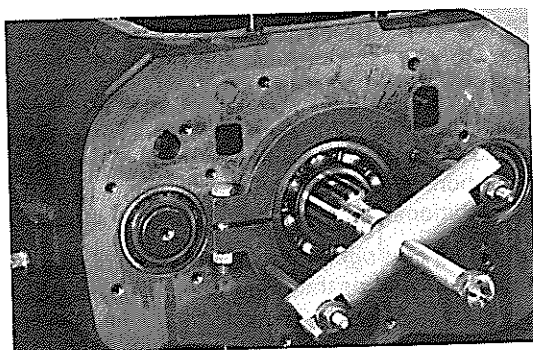
Tools

Spicer Transmissions can be repaired with ordinary mechanic's hand tools, however this procedure is not only time consuming but could damage otherwise reusable

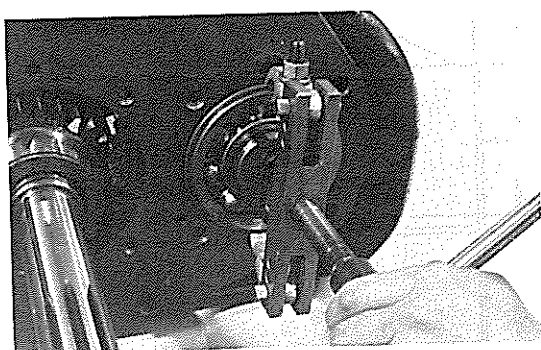
parts. To reduce maintenance costs and vehicle down-time, we recommend using the special tools shown in this section.



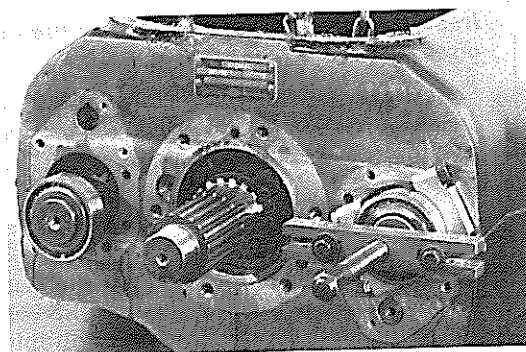
Suggested pullers and alignment tools.



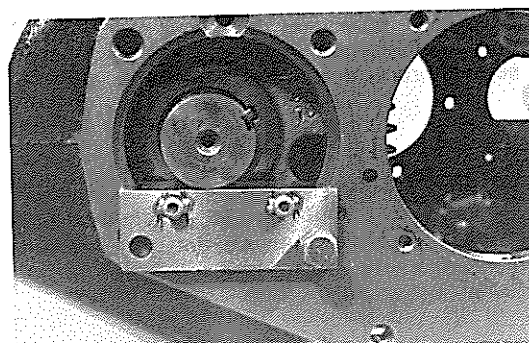
Reversible input and output bearing puller — (Kent Moore J 24348). Used with end yoke remover (J 7804-01).



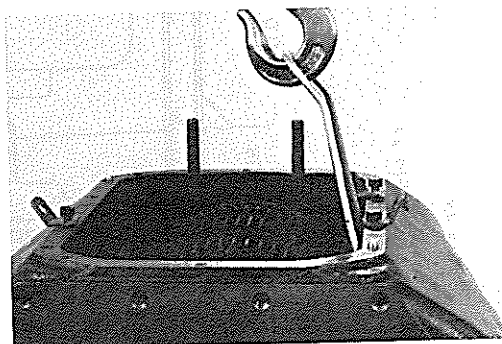
Countershaft front bearing puller (Snap on — CJ 80).



Countershaft rear bearing puller (Snap on — CJ 950).



Countershaft alignment blocks — Kent Moore (J 28720-1 & 2). Provides maximum clearance for mainshaft assembly installation. Allows countershafts to be rotated for timing purposes.



Countershaft lift hook — (Kent Moore J 23667). Holds countershaft in time while centering the countershaft in the case bore for easier bearing installation.

Tools may be purchased thru:

Kent-Moore Corporation
1501 S. Jackson St.
Jackson, Michigan 49203
Phone: 517-784-8561 Telex: 22-3413

Overhead Control

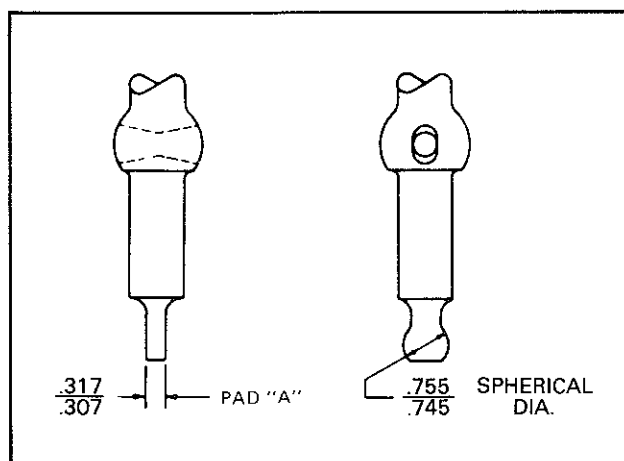
Disassembly

1. Remove the six retaining capscrews and lockwashers. Separate the dome from the shifter housing and gasket and lift straight up.
2. Position shift lever dome on edge in vise.
3. Pull up grommet. Depress collar against spring and remove lock pin.
4. Slide the compression cup up shift lever and remove rock shaft snap ring.
5. Tap rock shaft free of dome and remove shift lever. Remove seal and discard.
6. Remove shift lever handle and slide grommet, collar, spring and cup off lever.

4. Assemble rock shaft snap ring to groove of dome and lock rock shaft in place.
5. Grease lightly and assemble new seal to shift dome. Grease inner wall of cup and slide over lever into position on dome.
6. Assemble spring, collar and grommet over shift lever. Depress collar and insert lock pin through hole in lever.
7. Assemble shift lever handle.
8. Place shift lever and dome assembly on shifter housing with gasket, noting that finger enters the neutral position notches.
9. Secure with six capscrews and lockwashers.

Inspection

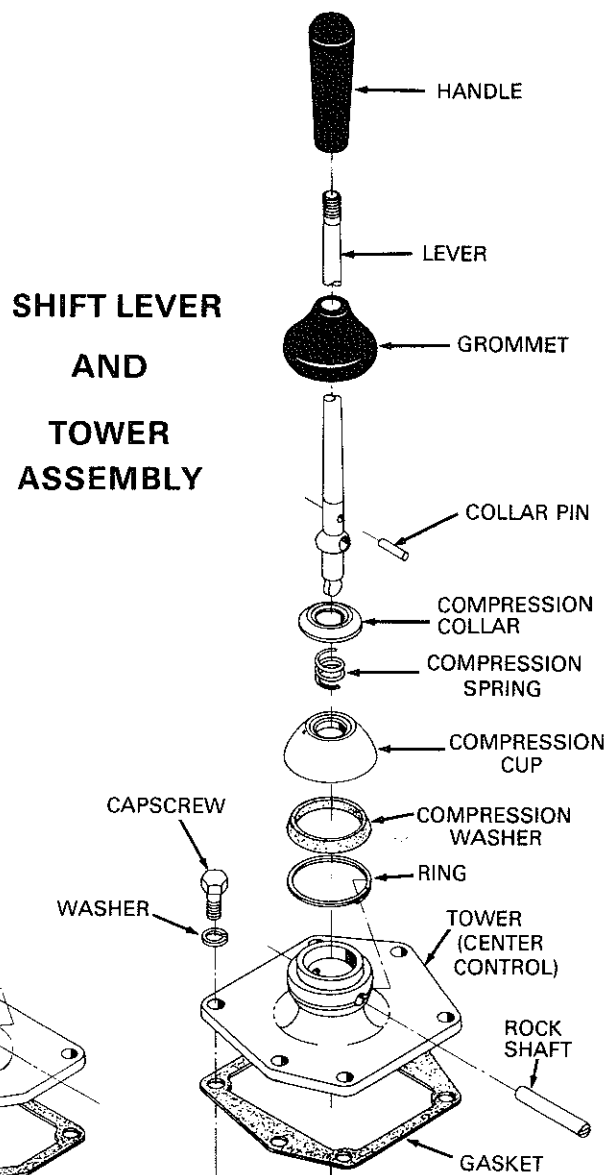
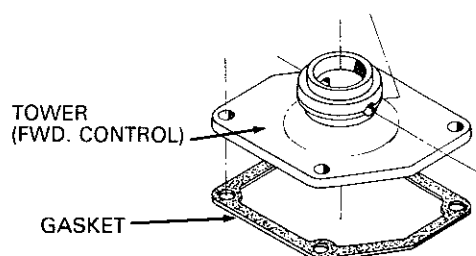
Wash all parts thoroughly and inspect for excessive wear at cross hole in lever and rock shaft. Inspect finger end of lever for excessive wear.



Check spring tension by comparing to a new part.

Reassembly

1. Position shift lever dome on edge in vise.
2. Hold shift lever so that cross hole in lever aligns with rock shaft cross holes in dome.
3. Insert rock shaft through hole in dome and cross hole of shift lever.



Remote Control Assembly

Disassembly

Remove six capscrews and lockwashers and separate the remote control from the shifter housing.

1. Remove set screw from universal joint assembly and pull universal joint from the rod.
2. Remove four capscrews and lockwashers holding end cover and gasket in place.
3. Remove set screw from joint shift rod finger and tap rod through cross holes in housing.
4. Remove finger from housing.
5. Remove set screw from inner shift finger.
6. Slide rod and bracket assembly from inner shift finger.
7. Be careful not to lose key from rod or shift finger.
8. Remove seals from cross holes in housing.

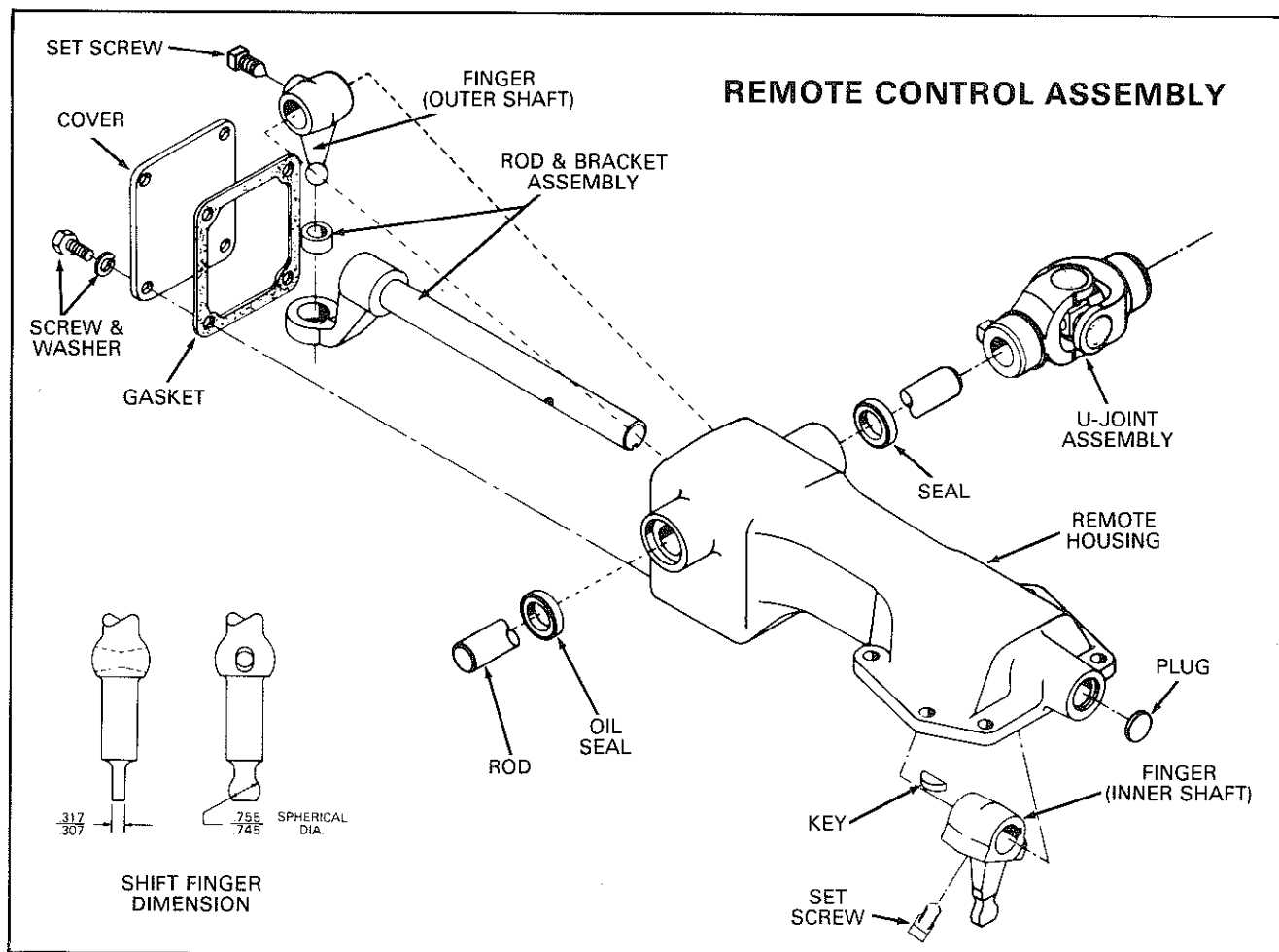
Inspection

Check shift fingers for excessive wear. Check all bores and rods for excessive wear or scuffing.

Clean parts thoroughly and apply light coat of grease to pivot points when reassembling.

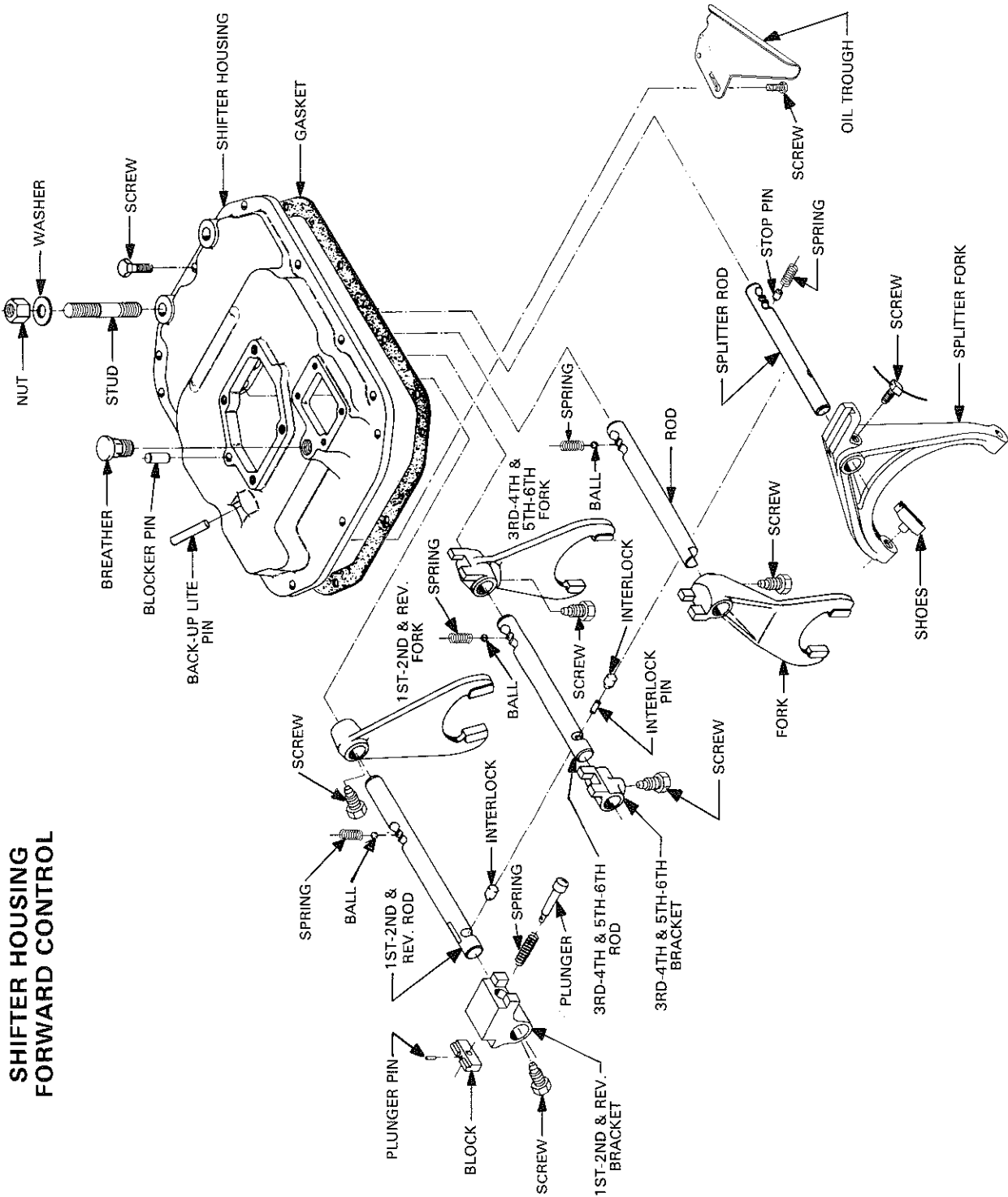
Assembly

1. Install new key in rod and bracket assembly and install into remote housing, sliding shift finger (inner) on end of rod.
2. Line up set screw hole and install set screw, and torque 40 to 50 lbs. ft.
3. Install joint shift rod through cross holes and through outer finger, making sure finger is inserted into bracket.
4. Align set screw hole and install same, and torque 40 to 50 lbs. ft.
5. Install end cover and secure with four capscrews and lockwashers.
6. Install two new oil seals in joint shift rod bores.
7. Install joint assembly and secure with set screw.



SHIFTER HOUSING FORWARD CONTROL

SECTION IV

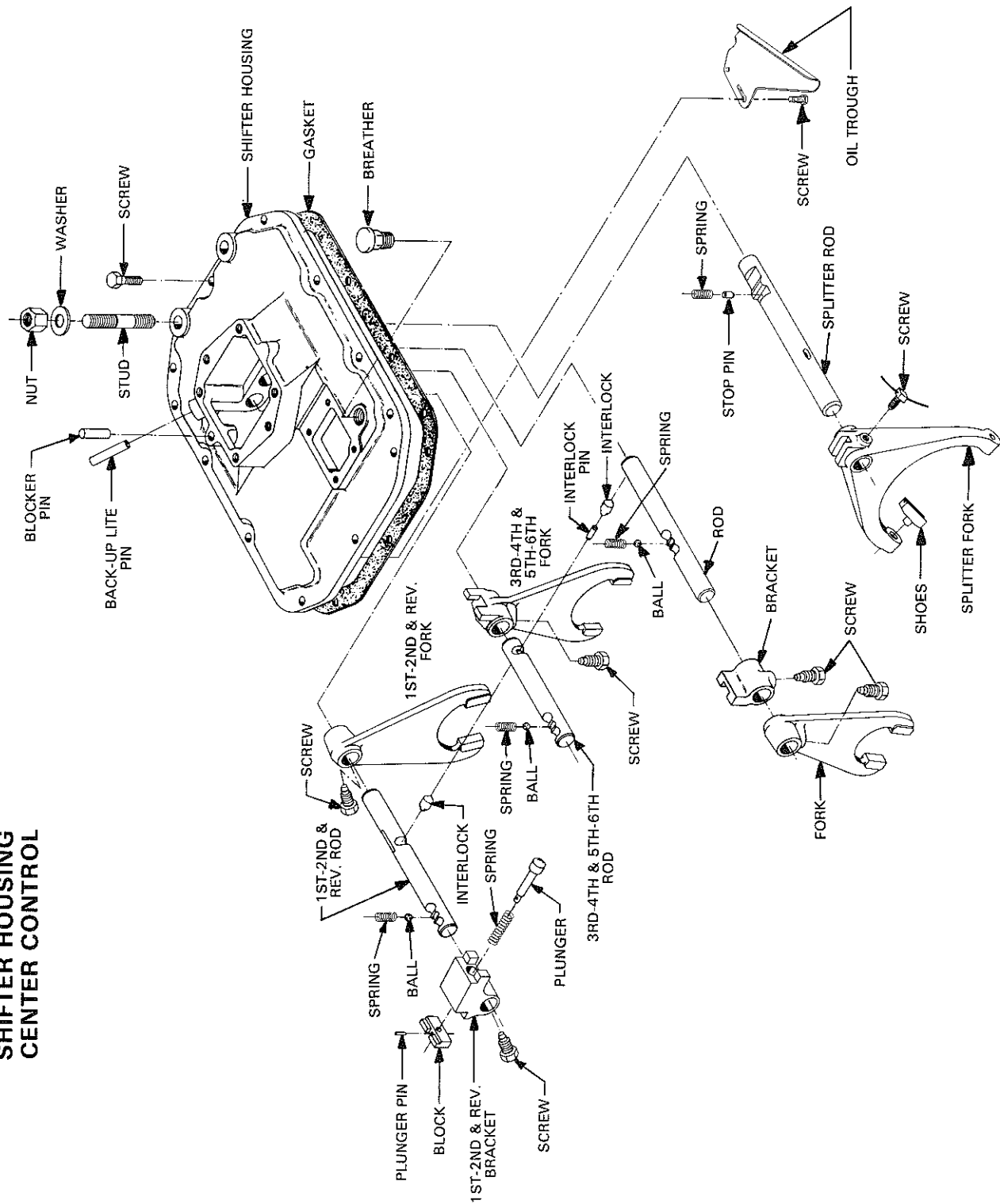


SHIFTER HOUSING
FORWARD CONTROL

SHIFTER HOUSING CENTER CONTROL

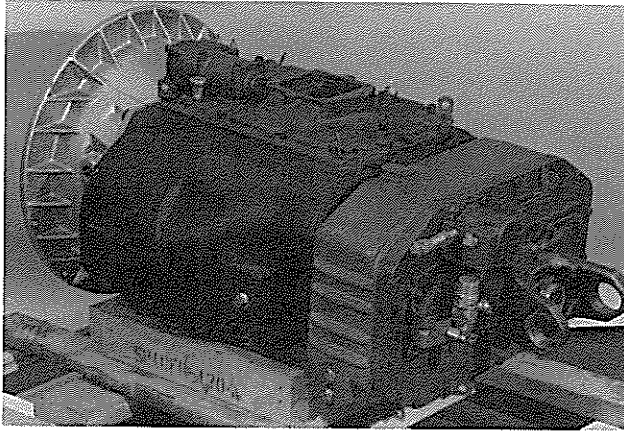
SECTION IV

SHIFTER HOUSING CENTER CONTROL

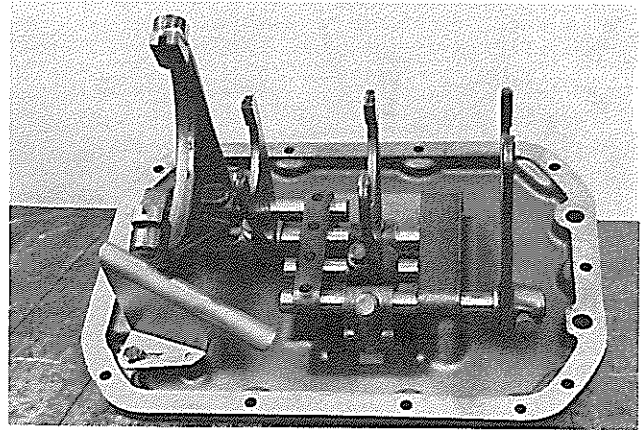


SHIFTER HOUSING DISASSEMBLY

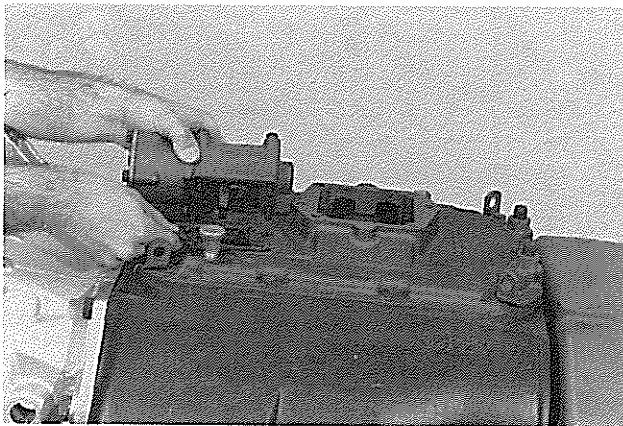
SECTION IV-A



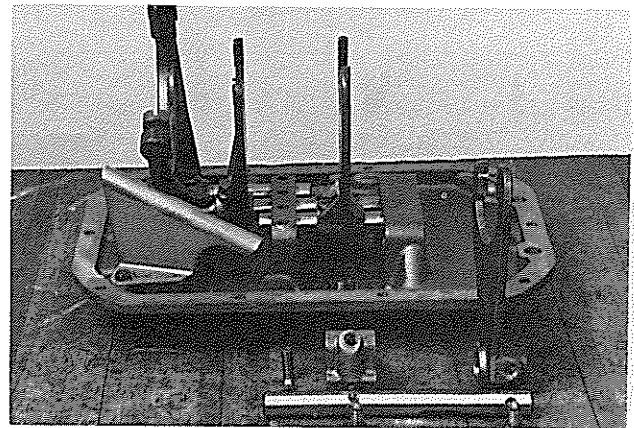
1. The 1214 & 1420 Transmissions are identical in appearance. Both utilize two air-actuated piston assemblies. Major difference being gear ratios & shift pattern.



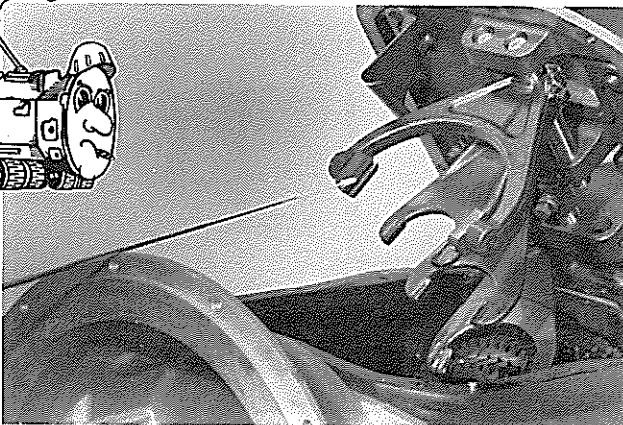
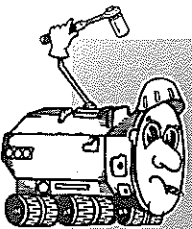
4. If further disassembly of the shifter housing is required, these steps should be followed. Place cover on a bench with the forks up and in neutral position.



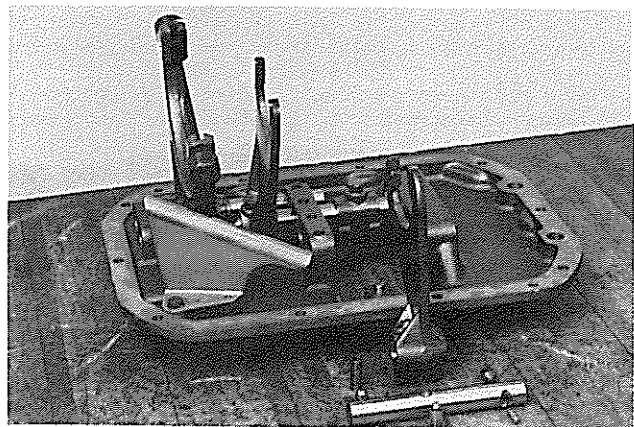
2. Remove (4) cap screws from the air splitter housing. Lift housing and gasket from cover.



5. Remove 1st-2nd-Rev. fork and bracket set screws. Tap rod to rear for removal being careful not to lose poppet ball and spring.



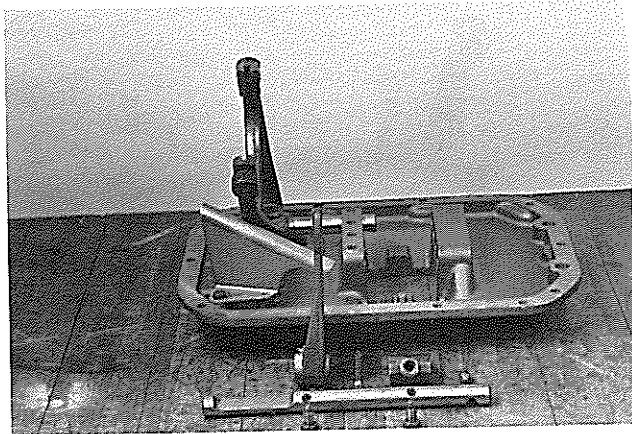
3. After removal of cap screws and stud mounting nuts, the shifter housing can be removed. Care should be taken so that the splitter shoes do not fall from the fork into the unit.



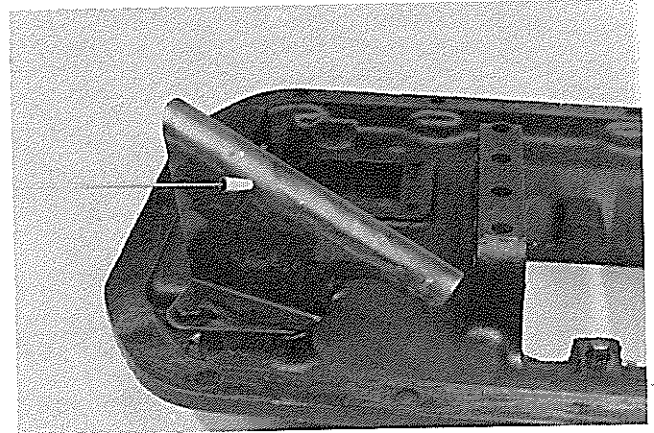
6. Remove set screw from 3rd-4th and 5th-6th shift fork and tap rod rearward. Remove poppet ball and spring. Do not lose small interlock pin in rod. Remove interlock ball from rear boss.

SHIFTER HOUSING DISASSEMBLY

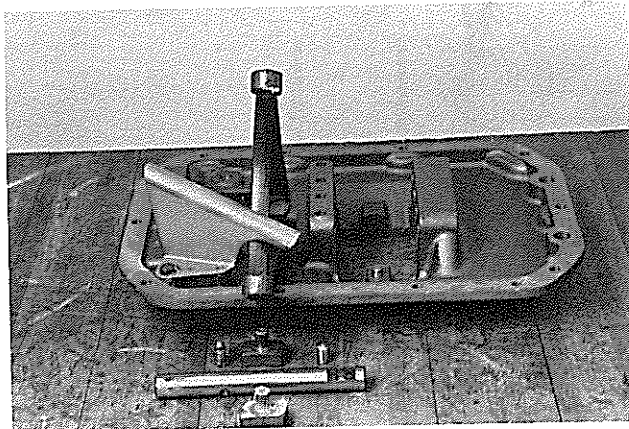
SECTION IV-A



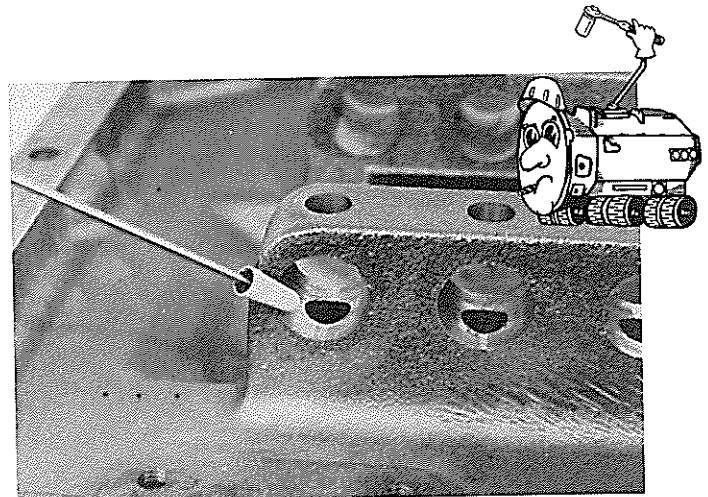
7. Remove set screws in remaining fork and bracket. Tap rod to the rear. Recover poppet ball and spring.



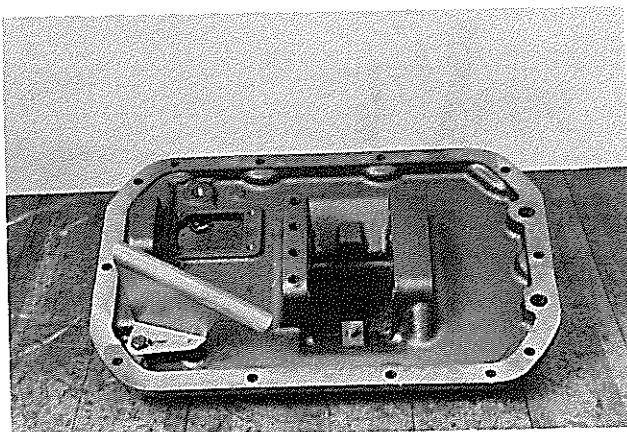
10. All shifter housings are equipped with an oil trough. This trough provides lubrication to the input bearing.



8. Cut lockwire, remove set screw from splitter fork and tap rearward to remove.



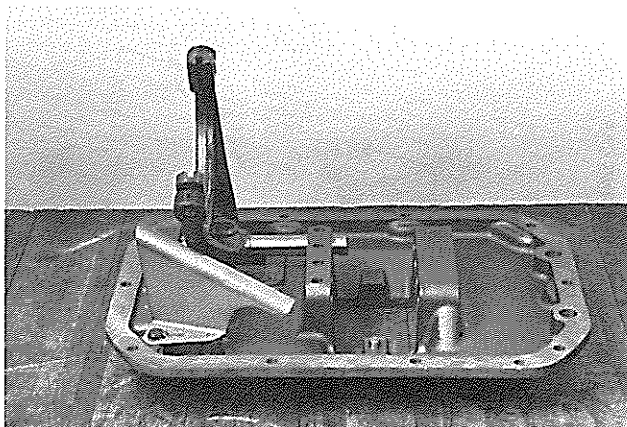
11. Check poppet holes for sharp corners. Rounded or chipped edges will allow the transmission to hang in gear.



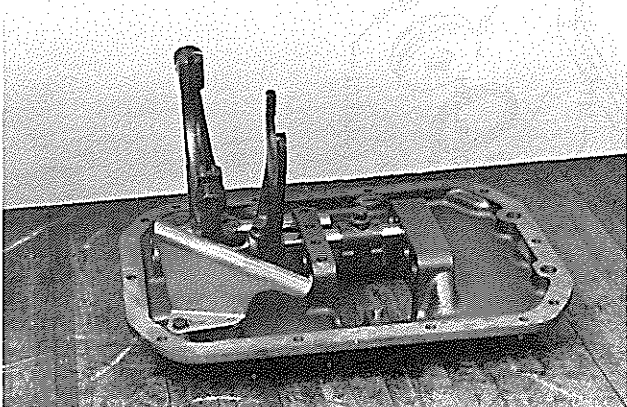
9. This completes the disassembly of the shifter housing. Examine all forks and rods for excessive wear.

SHIFTER HOUSING REASSEMBLY

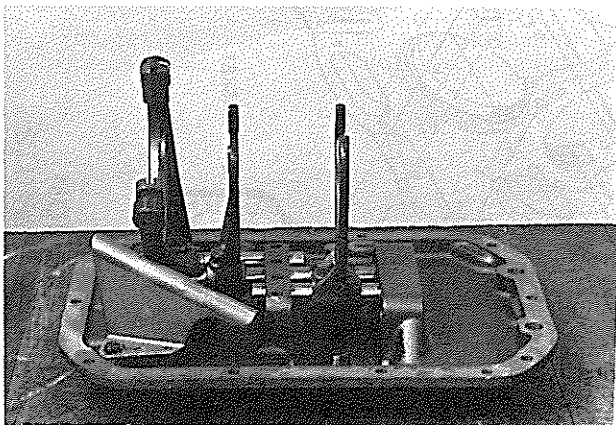
SECTION IV-B



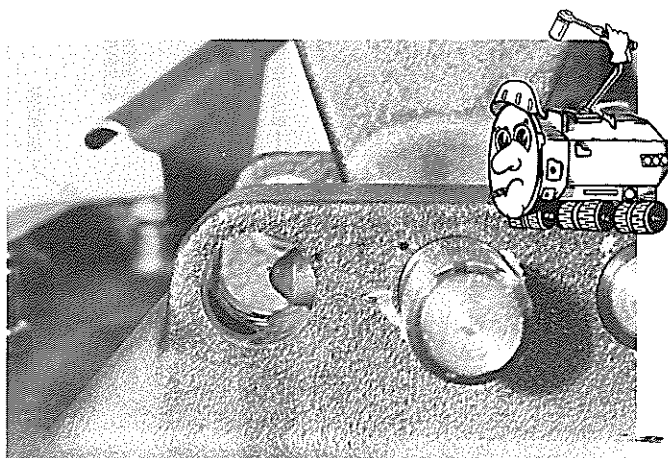
1. Shifter housing reassembly begins with installation of the splitter fork.



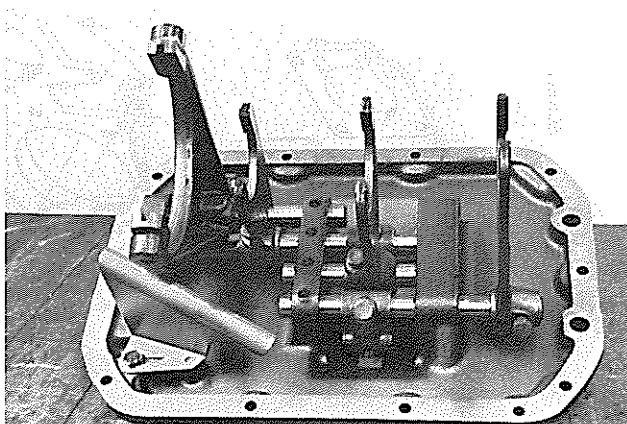
2. Install fork with long hub forward. Remember to place poppet balls and springs in their proper location.



3. The 3rd-4th & 5th-6th fork should be assembled with the long hub forward.



4. Careful attention should be paid to insure proper installation of interlock balls. These interlocks prevent the transmission from being shifted into (2) gears at the same time.

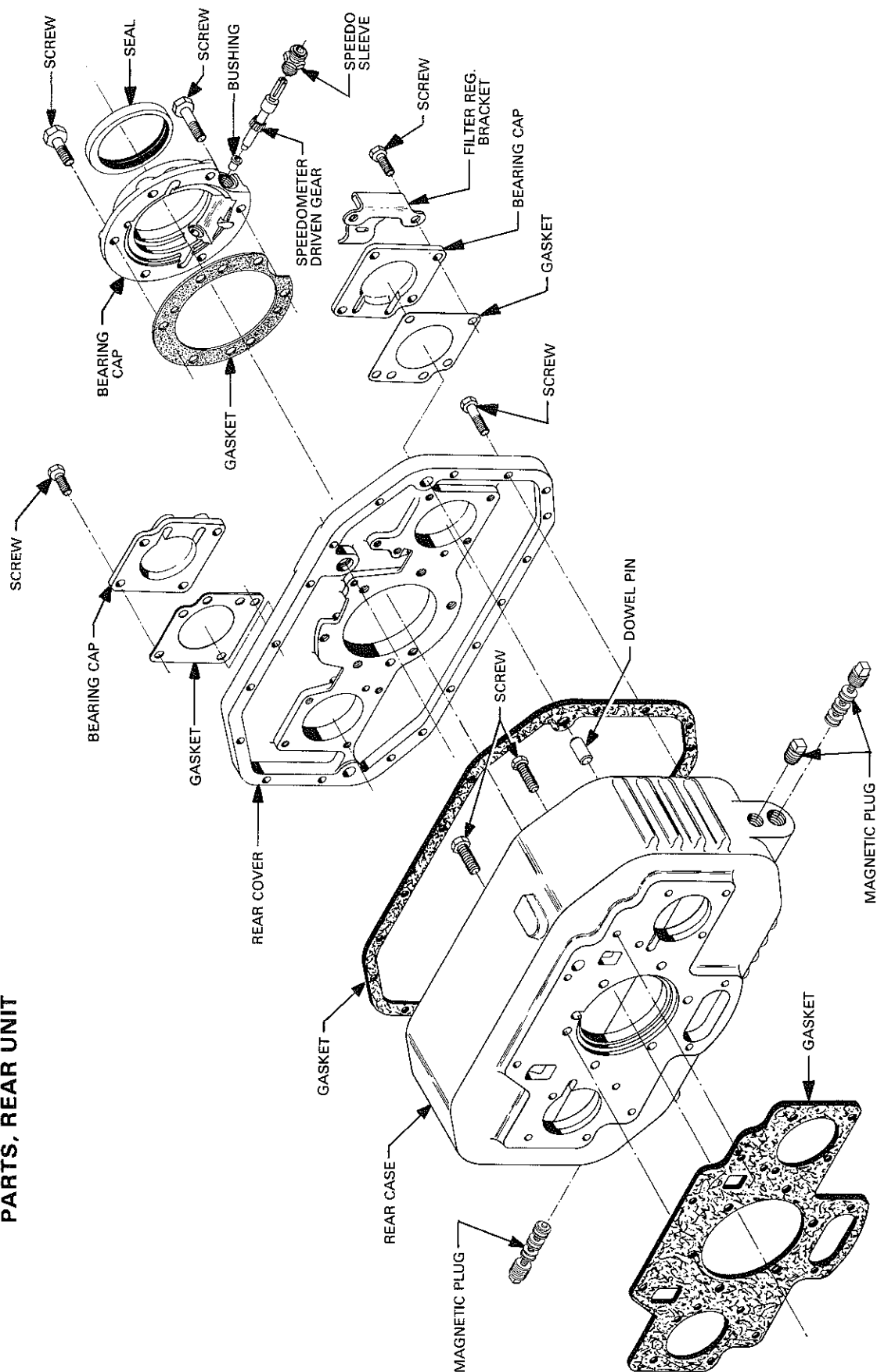


5. With the shifter housing reassembly completed, it is advisable to check for proper functioning of interlocks. Shift (1) fork into gear if all interlocks were installed correctly none of the other forks will shift into gear.

REAR SECTION SUB-ASSEMBLY

SECTION V

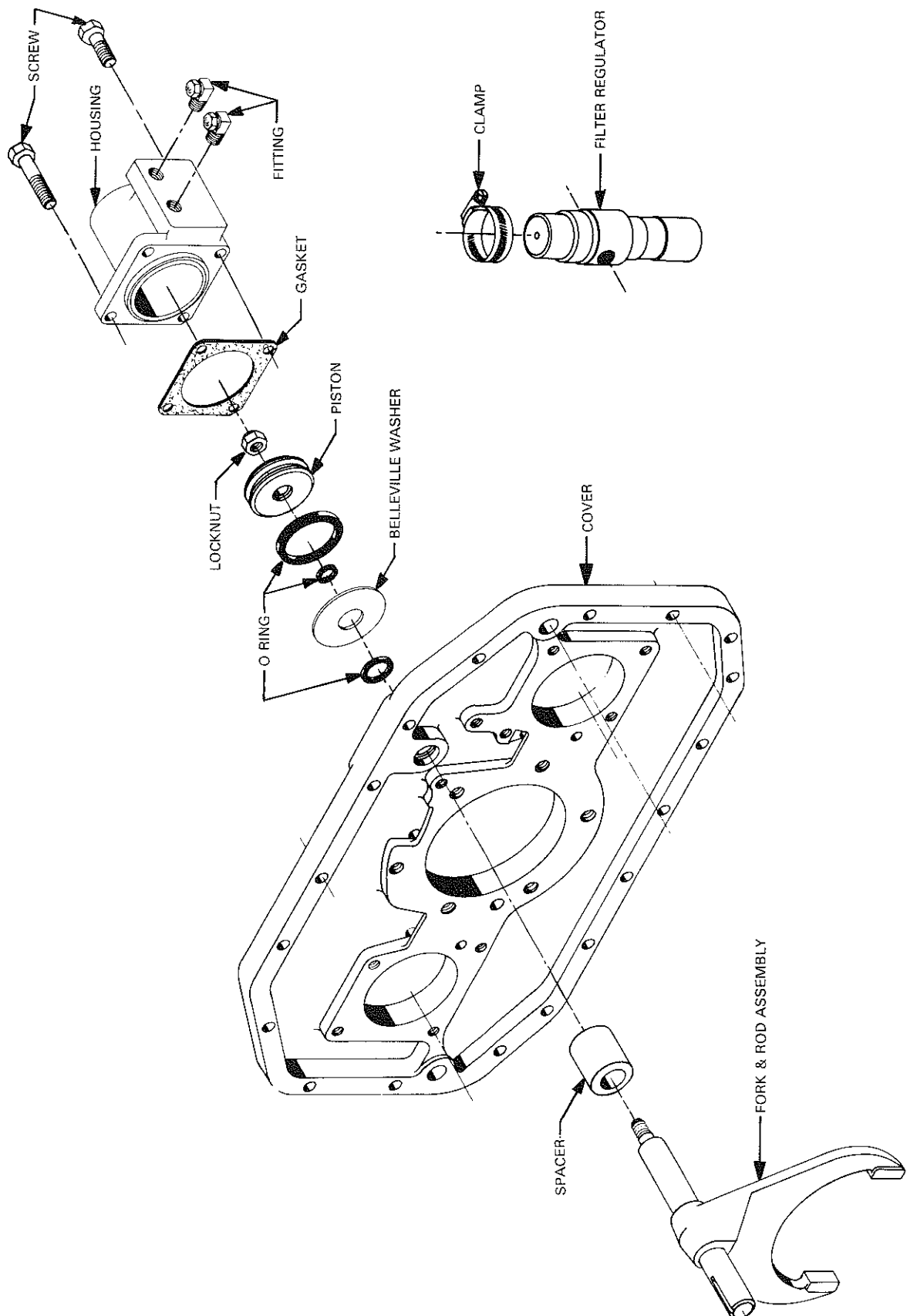
CASE, BEARING CAPS & RELATED
PARTS, REAR UNIT



REAR COVER SUB-ASSEMBLY

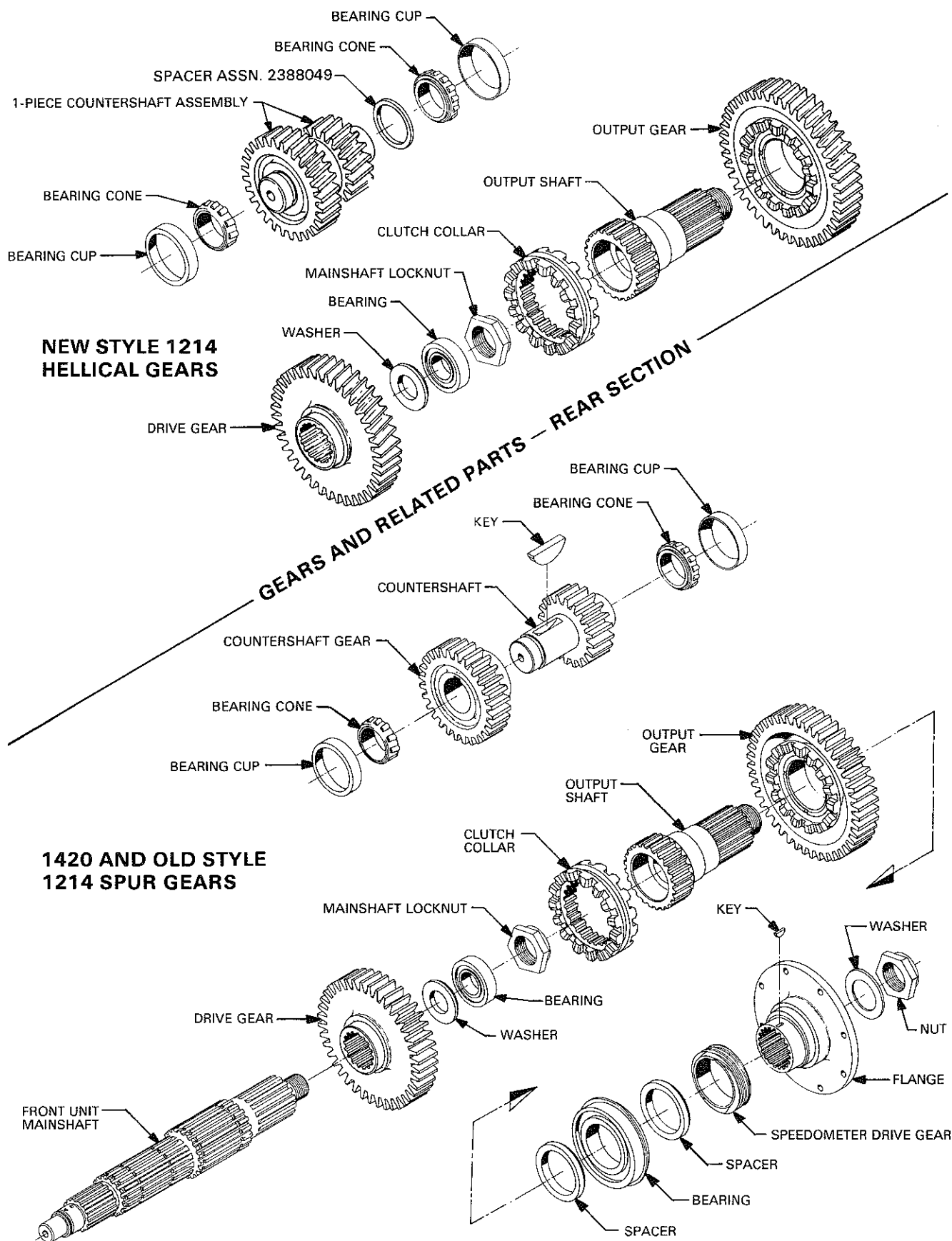
SECTION V

AIR CONTROL PARTS
REAR SECTION



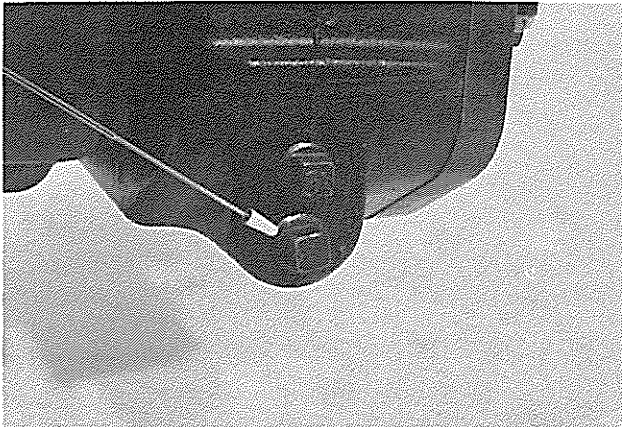
REAR SECTION SUB-ASSEMBLY

SECTION V

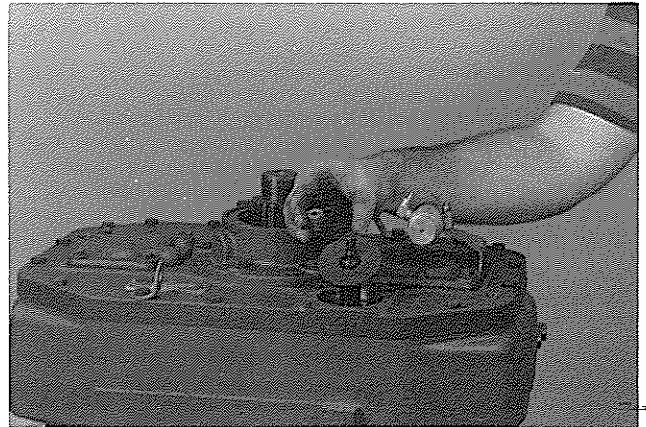


REAR CASE DISASSEMBLY

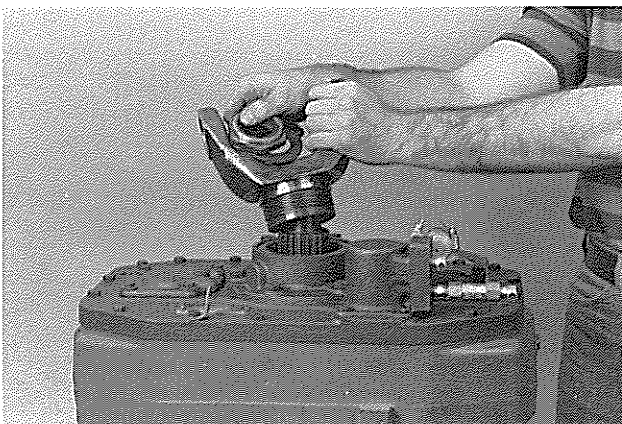
SECTION V-A



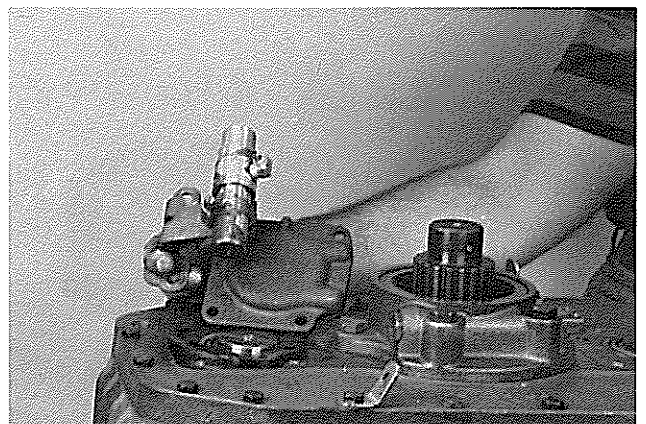
1. Before starting the teardown, the exterior of the unit should be cleaned and the lube drained.



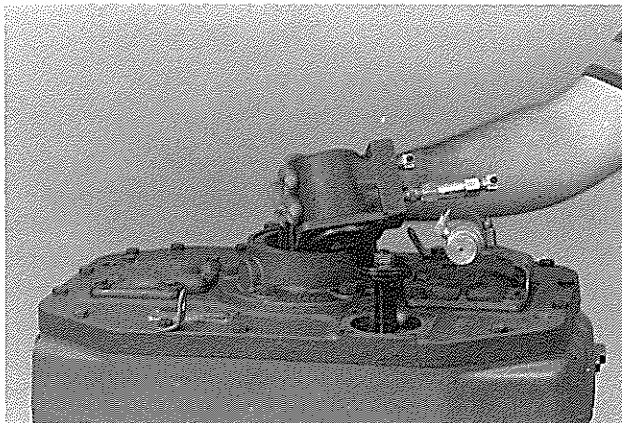
4. The piston locknut may be removed complete with piston and washer. This Belleville washer secures an O-ring in the rear cover.



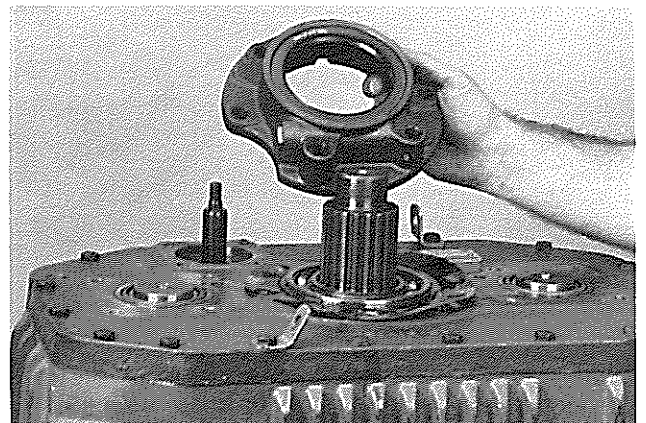
2. Place unit upright. Remove output nut, washer and end yoke. (Note that the end yoke contains a speedometer drive gear and a spacer).



5. Remove countershaft bearing cover capscrews. The filter regulator is pre-set at the factory and must provide 50-55 PSI to function properly.



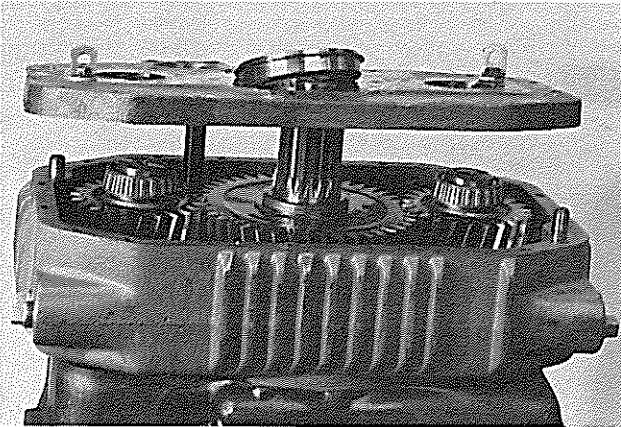
3. Remove range housing capscrews, housing and gasket.



6. Using a 3/4" socket remove capscrews from output bearing cap, bearing cap and gasket.

REAR CASE DISASSEMBLY

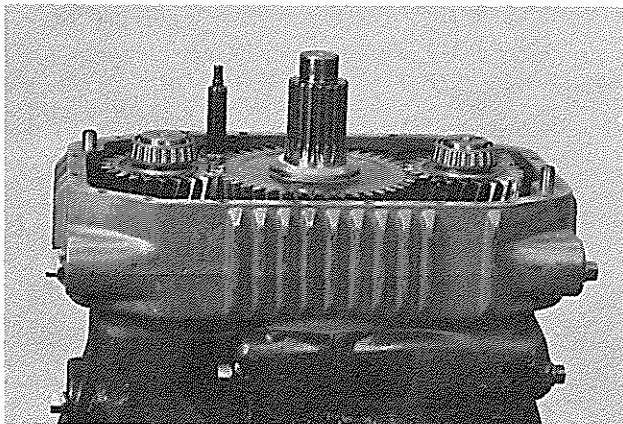
SECTION V-A



7. Remove the remaining capscrews from the rear cover. Notice the (2) Dowel pins holding the cover in the correct location.



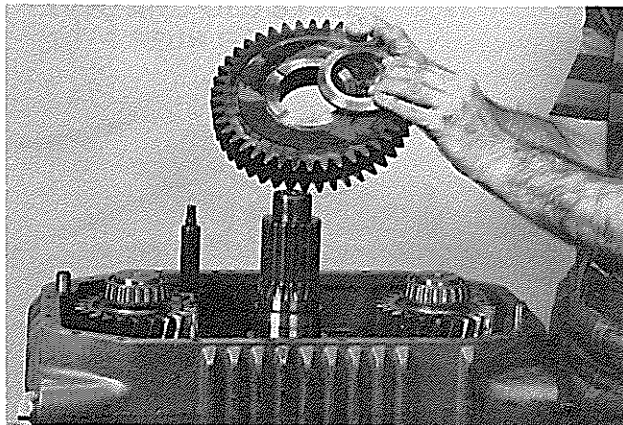
10. Lift output shaft out of case.



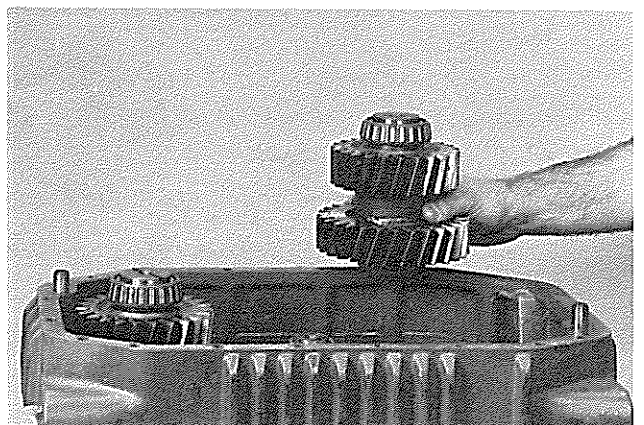
8. While removing the cover, tap on the end of the output shaft with a mallet. This will loosen the shaft from the bearing allowing it to remain in the case.



11. Remove fork and rod assembly, spacer and clutch collar.



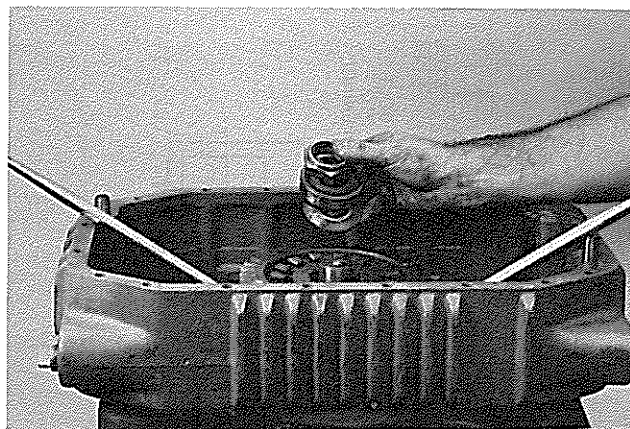
9. Remove washer and low range gear.



12. The countershafts may now be removed.

REAR CASE DISASSEMBLY

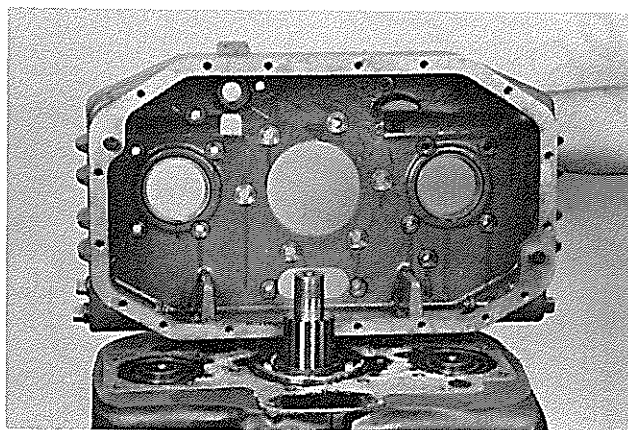
SECTION V-A



13. Remove mainshaft nut, with (2) prybars under the hi-range gear remove the pocket bearing, washer and gear from the mainshaft.



16. Remove gasket. This completes the disassembly of the rear section. Place the transmission on a bench for front section disassembly.



14. Remove capscrews from rear case. Separate the rear section from the front.

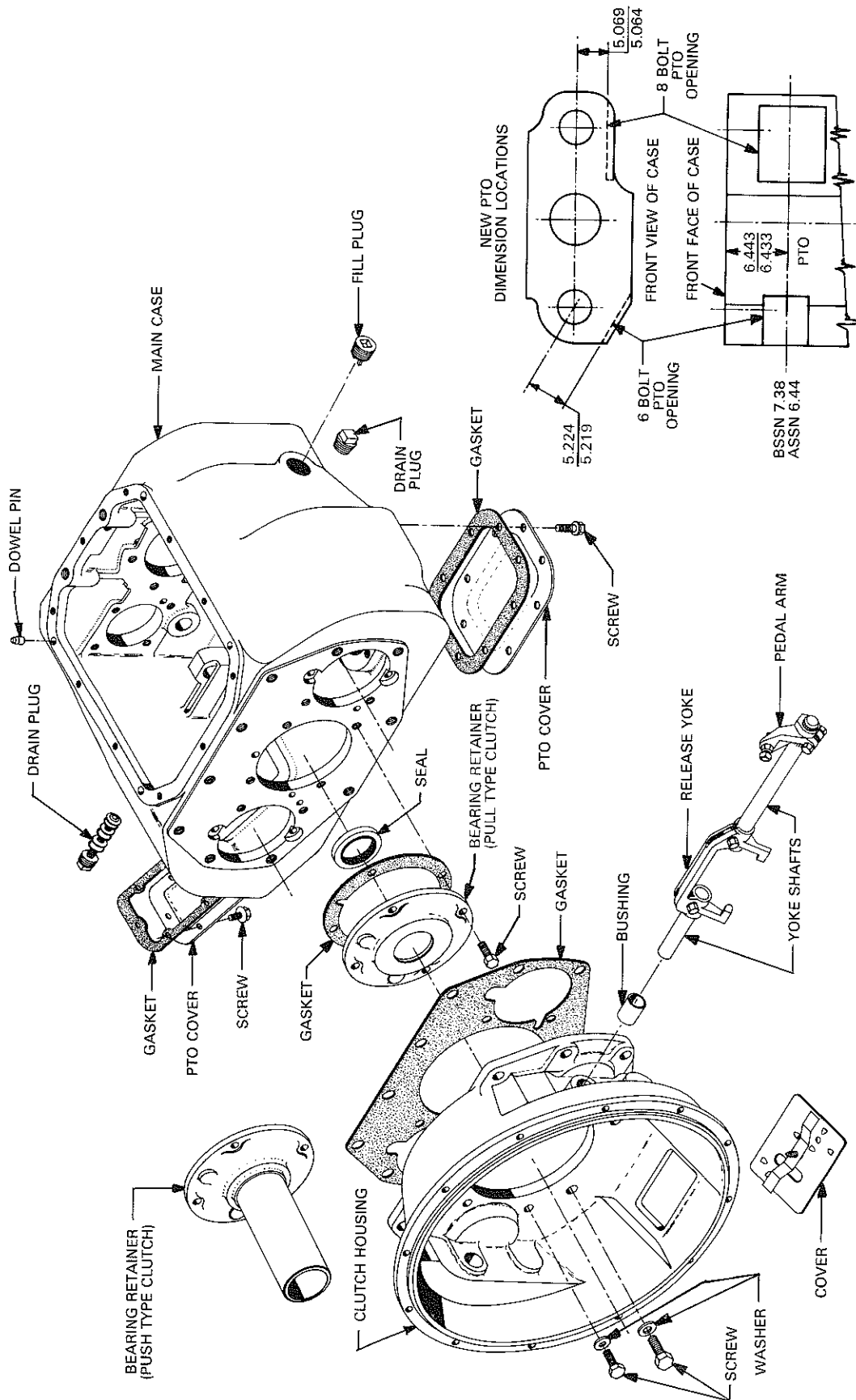


15. Tap bearing cups from rear case.

FRONT CASE SUB-ASSEMBLY

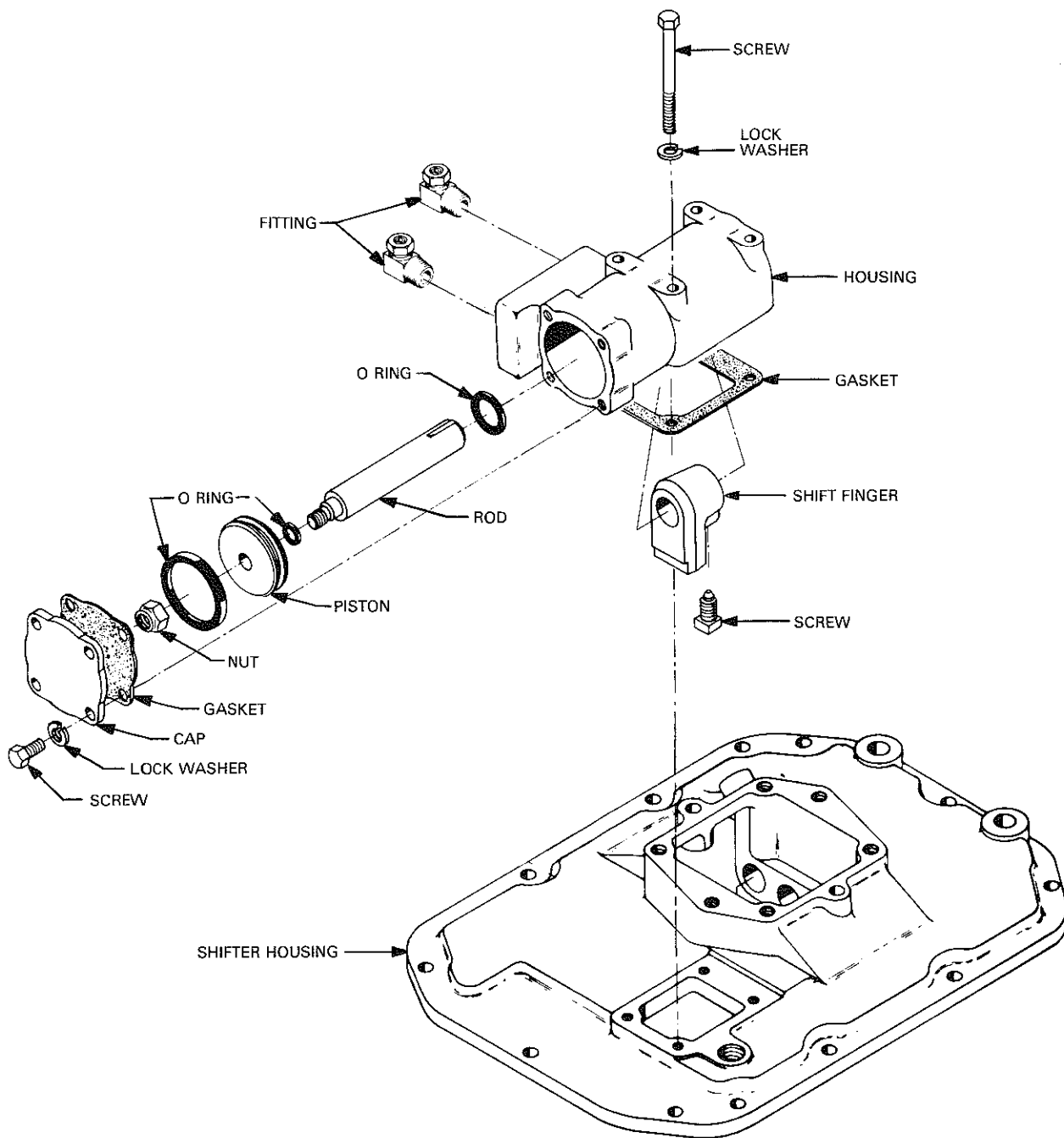
SECTION V-B

MAIN CASE



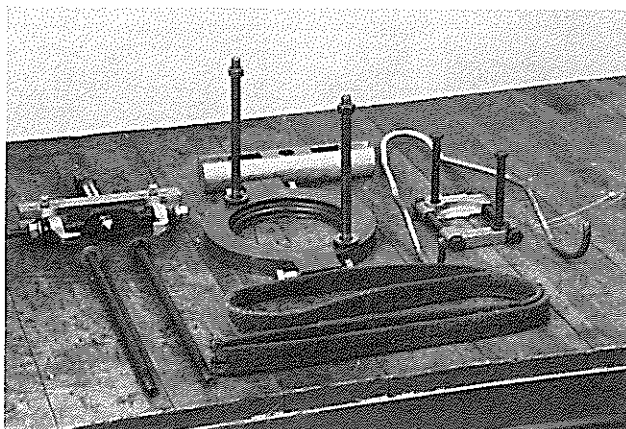
AIR CONTROL PARTS FRONT SECTION

SECTION V-B

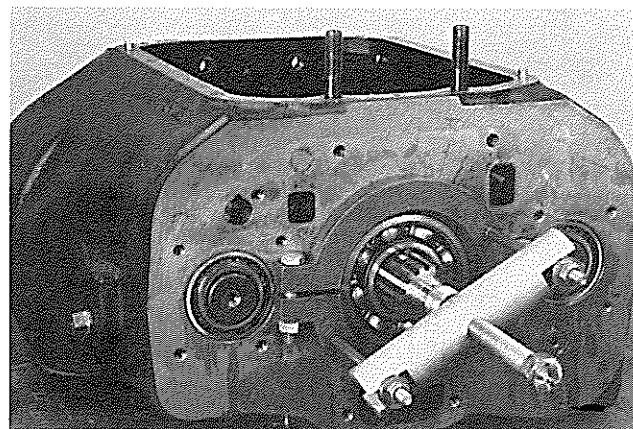


FRONT CASE DISASSEMBLY

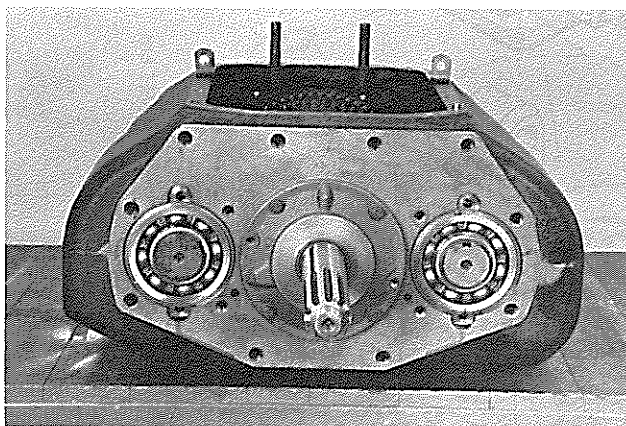
SECTION V-B



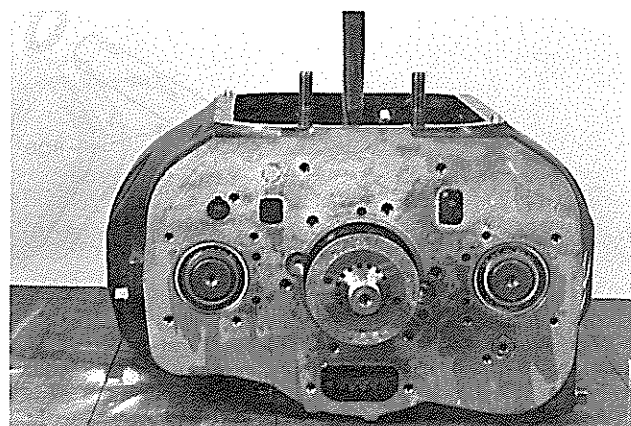
1. Ordinary hand tools can be used for disassembly. However, there are some special pullers and alignment tools that may be used to ease this procedure.



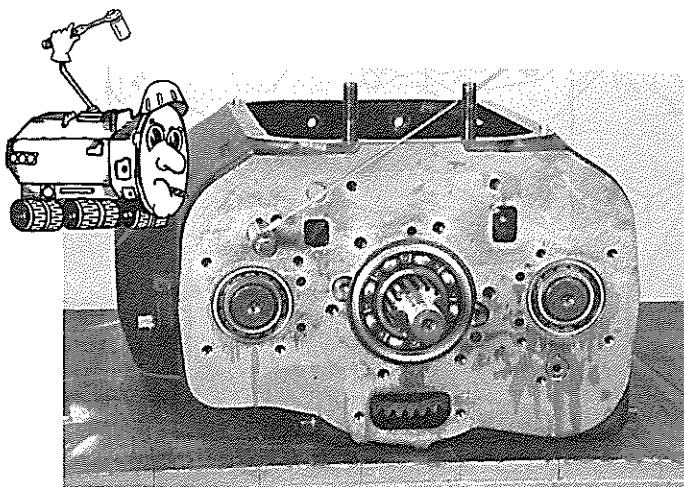
4. Move mainshaft rearward to expose the rear bearing, with the aid of a puller remove the bearing.



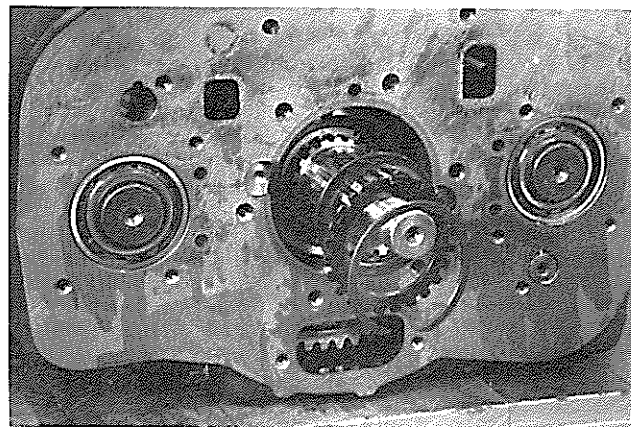
2. Remove clutch housing bolts, housing and gasket.



5. Place a sling around the 3rd-4th/5th-6th mainshaft clutch collar for support and to aid in bearing removal. Remove reverse gear washer.



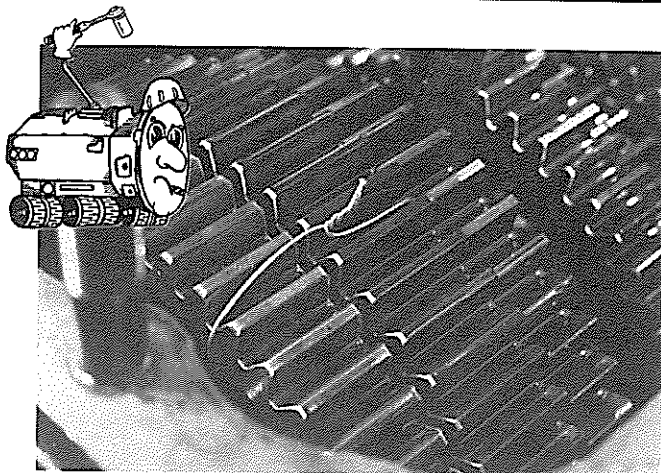
3. Remove upper reverse idler shaft. Do not lose the lockball in the shaft. This ball prevents the idler shaft from turning in the case. Roll upper reverse idler gear toward the side of the case.



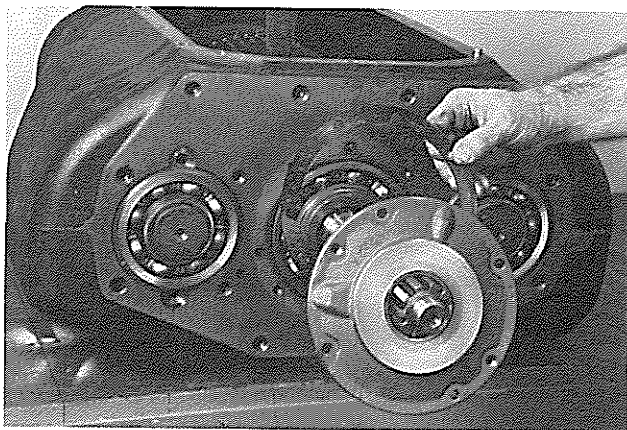
6. Use a long, thin tipped screwdriver to remove the snap ring from within the bore of reverse gear. The externally and internally splined thrust washers may also be removed at this time.

FRONT CASE DISASSEMBLY

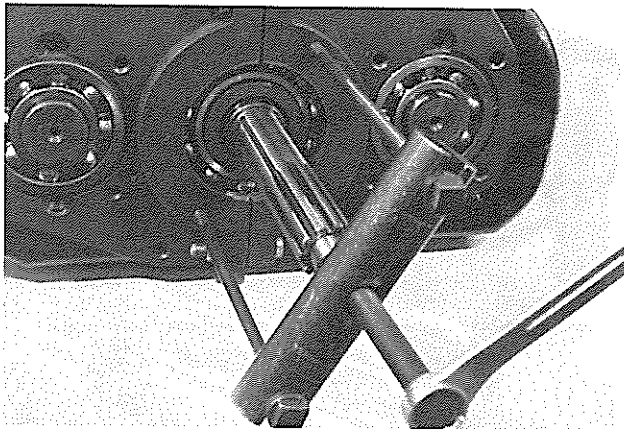
SECTION V-B



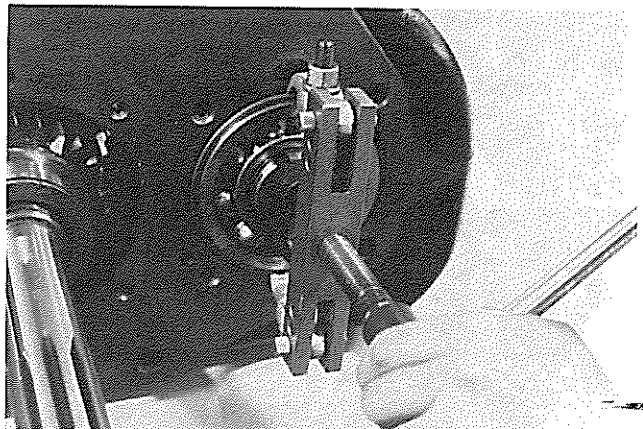
7. Slide reverse gear onto 1st-2nd/reverse mainshaft collar and engage collar into 1st-2nd gear so both gears butt together. Lockwire these gears. This is necessary to provide adequate clearance when the mainshaft is removed from the case.



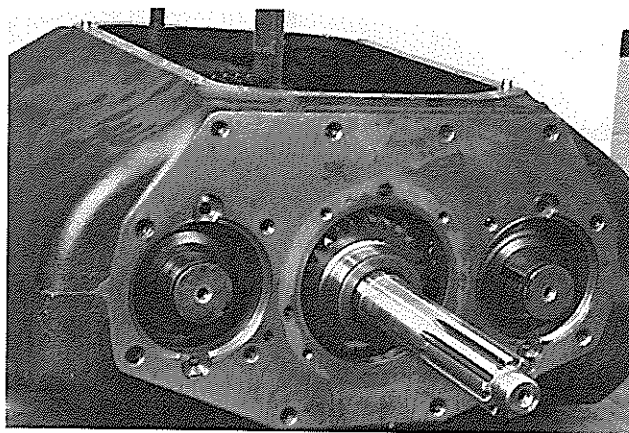
8. Remove (4) capscrews from the input bearing cap. Remove bearing cap and gasket.



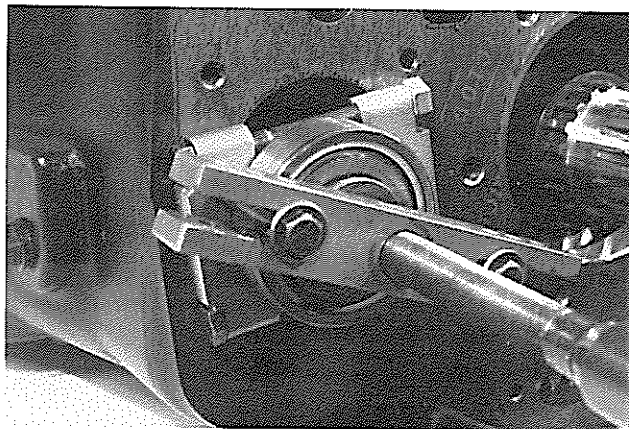
9. After removing the bearing snap ring, attach a puller to this bearing for removal.



10. Remove countershaft snap ring. Install a 2-jawed puller behind the bearing snap ring for removal. It may be necessary to tap on the rear of the countershaft to move it forward so the puller jaws will fit behind the bearing snap ring.



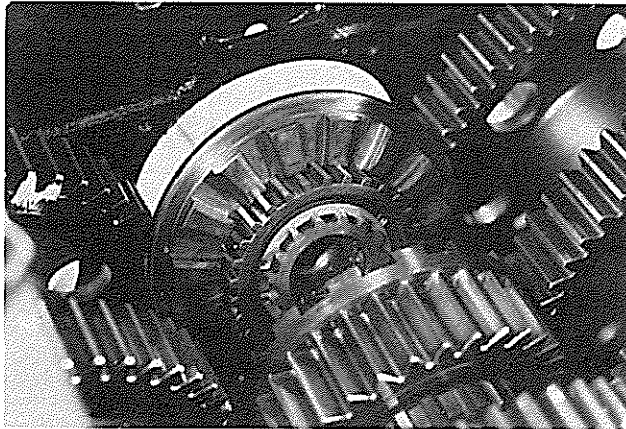
11. Repeat procedure for remaining countershaft.



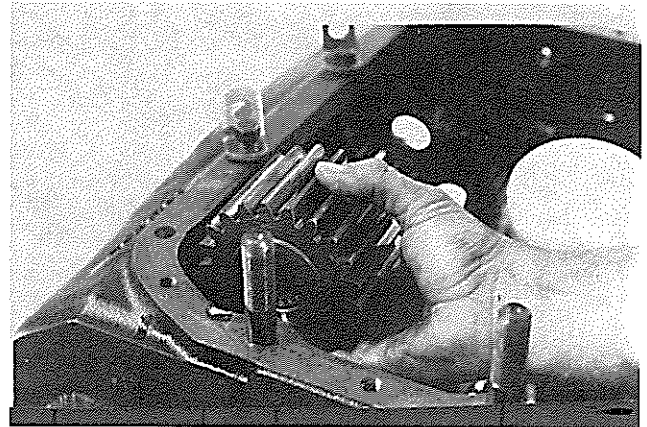
12. To remove rear bearings force countershafts as far rearward as possible. Install a split puller behind the inner race of the bearing.

FRONT CASE DISASSEMBLY

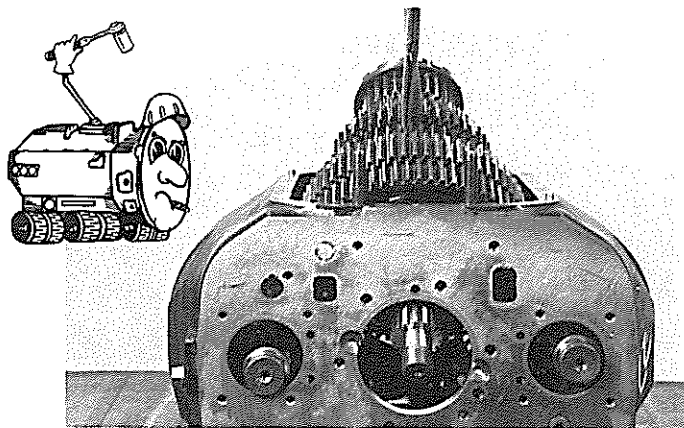
SECTION V-B



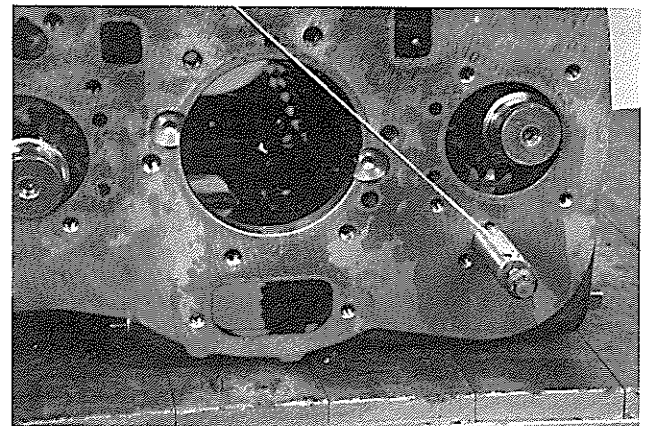
13. Pull input gear from pilot end of mainshaft so that it drops down and away from the mainshaft.



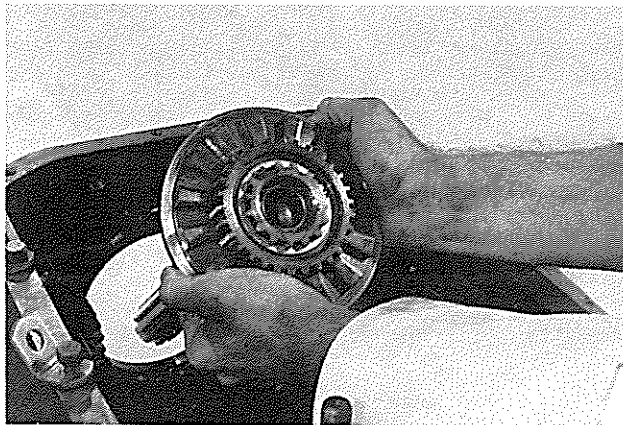
16. Remove upper reverse idler gear.



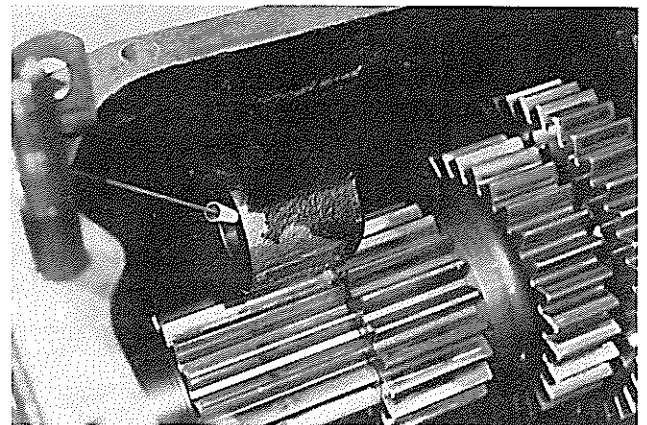
14. In order to remove the mainshaft, it is necessary to spread the countershafts outward and move to the front of the case to provide proper clearance. Lift mainshaft up and out of the case.



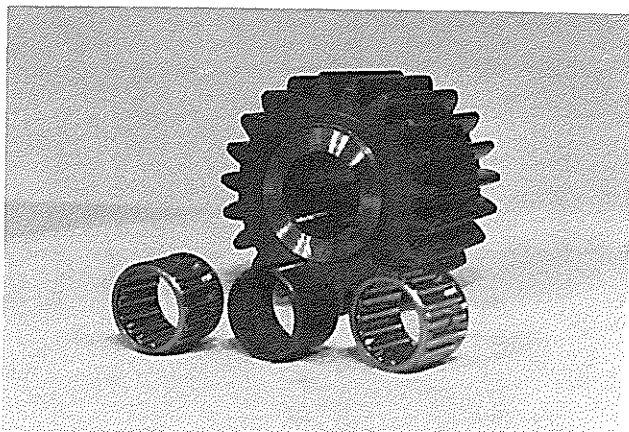
17. When removing the lower reverse idler shaft, be careful not to lose the lockball.



15. Lift input gear and splitter collar from the case.



18. The upper reverse idler boss prevents removal of the left countershaft first, so remove the right side, then the left.

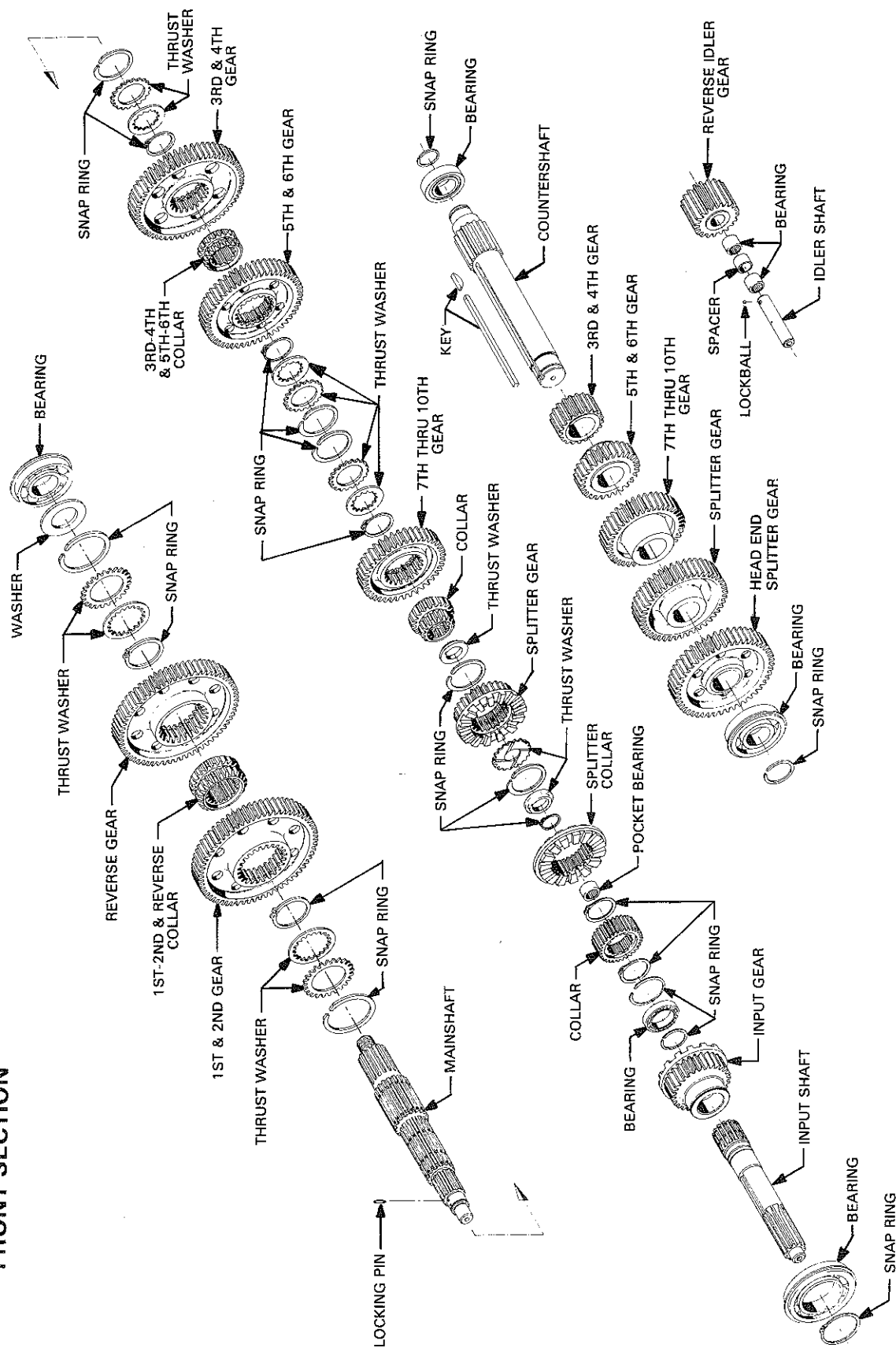


19. Remove lower reverse idler gear from case. Check both the upper and lower gear bearings and inside gear diameter for excessive wear.

GEARS & RELATED PARTS FRONT SECTION

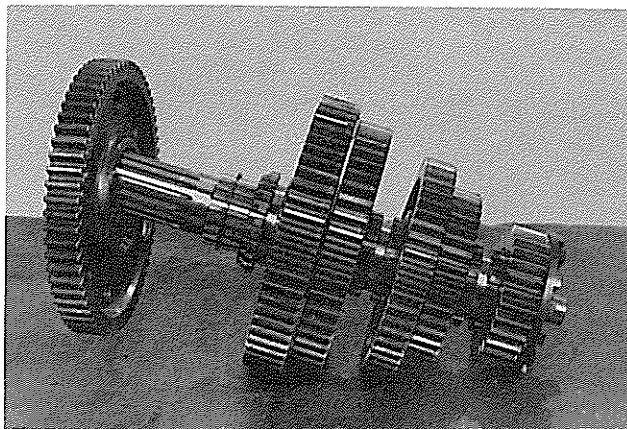
SECTION VI

GEARS & RELATED PARTS FRONT SECTION

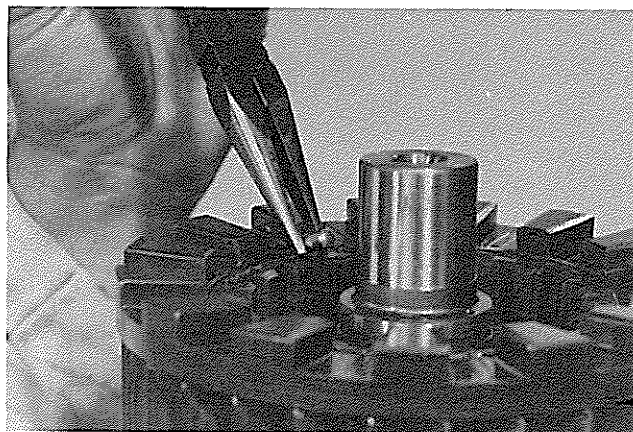


MAINSHAFT DISASSEMBLY

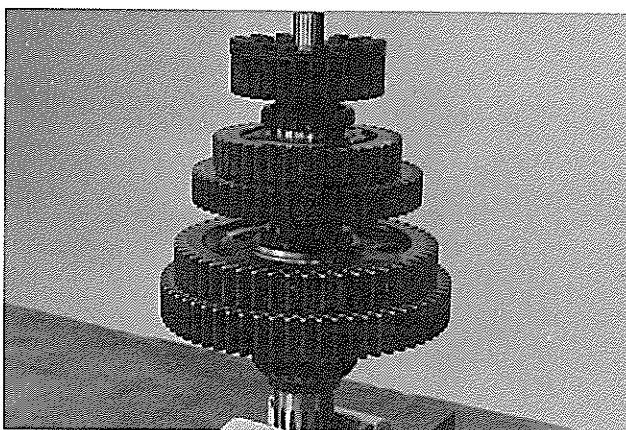
SECTION VI-A



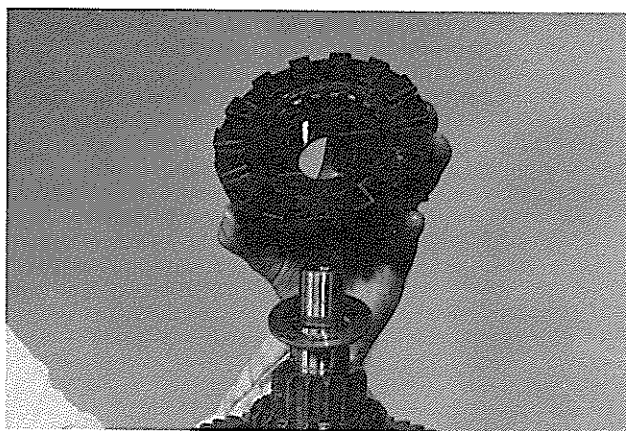
1. To begin disassembly of the mainshaft, place it on a bench, cut lockwire and remove reverse gear.



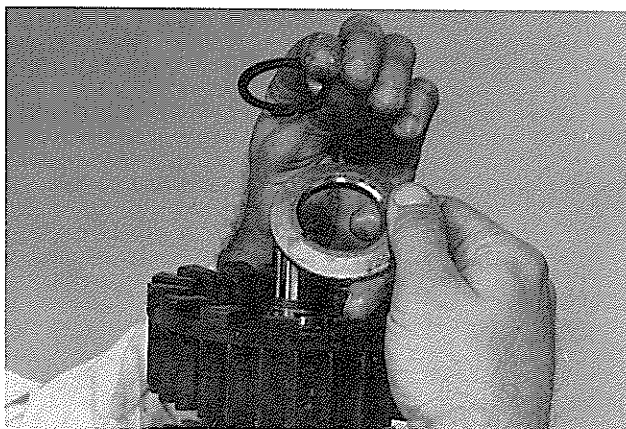
4. Remove upper thrust washer locking pin from mainshaft.



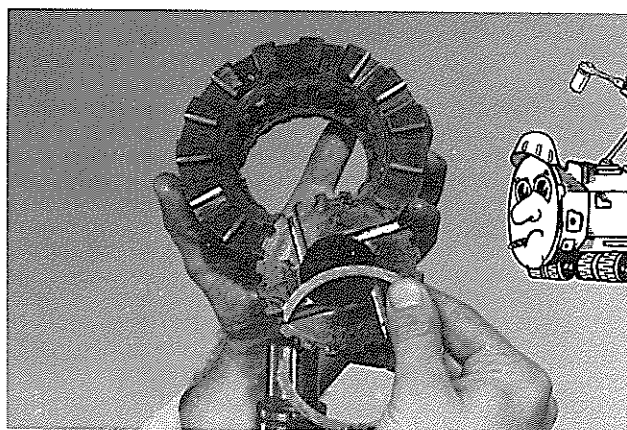
2. Place the mainshaft upright in a vise.



5. Hi-splitter gear Sub-Assembly may now be removed.



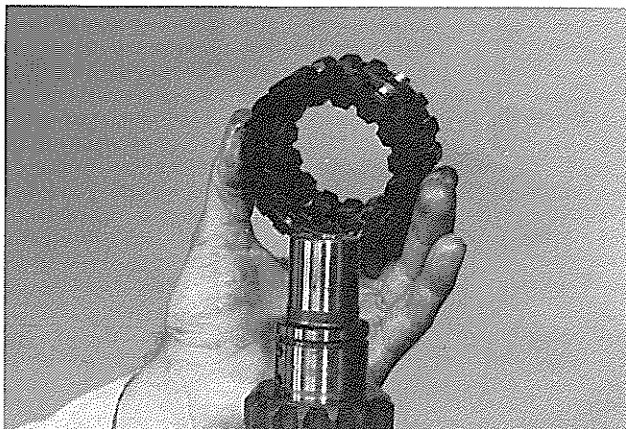
3. Remove snap ring and bronze thrust washer.



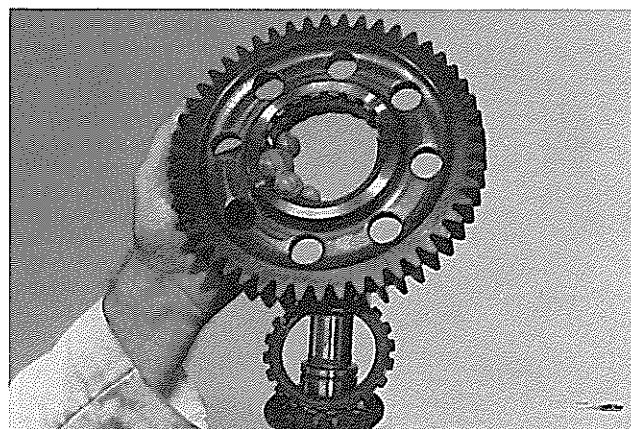
6. The externally splined thrust washer may be removed. This washer should be installed one way only. A dab of paint applied at the factory marks the side which should face the curvic teeth side of the gear.

MAINSHAFT DISASSEMBLY

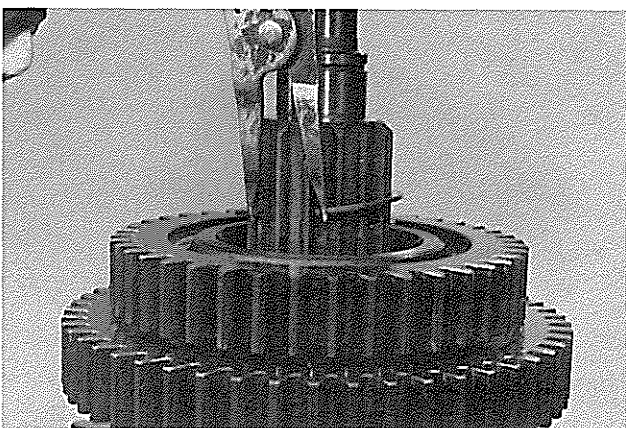
SECTION VI-A



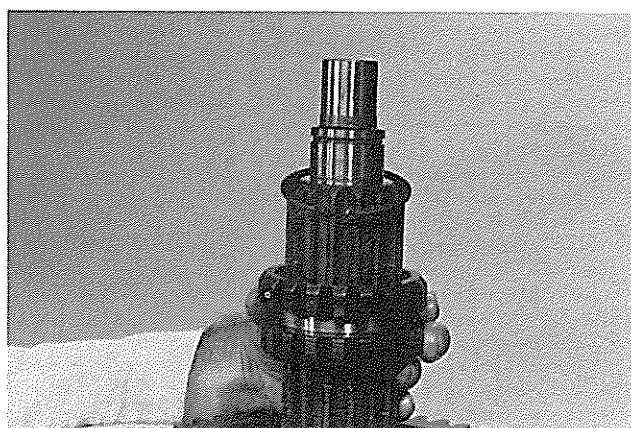
7. After removing the lower bronze washer and pin, you may now remove the clutch collar.



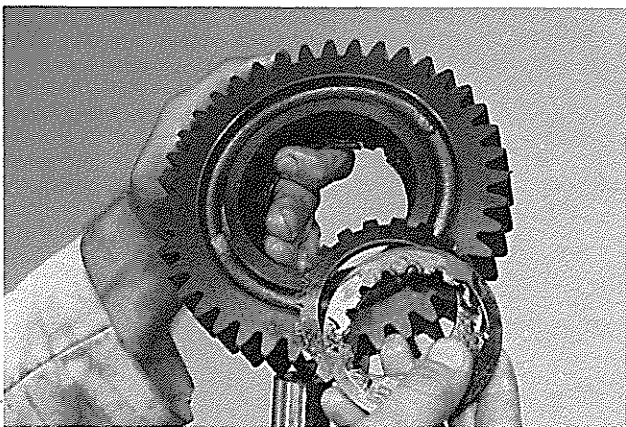
10. The 5th-6th gear can now be taken from the mainshaft complete with thrust washers.



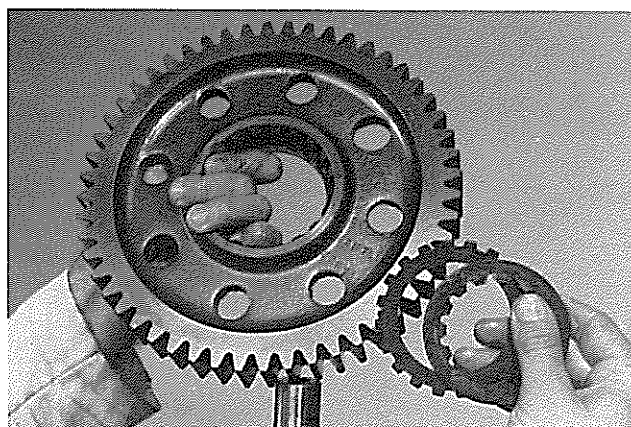
8. Remove mainshaft snap ring.



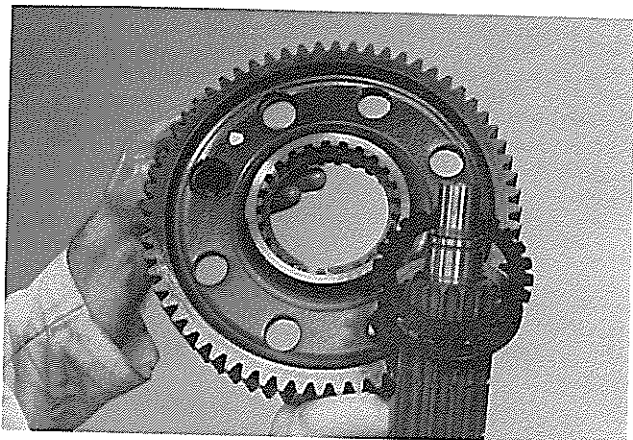
11. Remove snap ring and clutch collar.



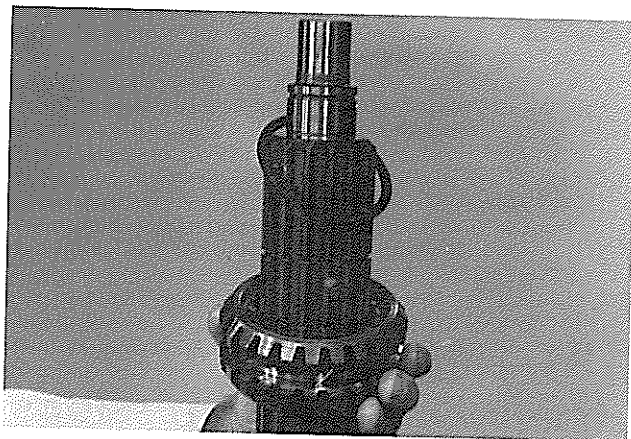
9. Remove 7-8-9-10 gear with its thrust washers. An externally splined washer which seats against the snap ring in the gear bore and an internally splined washer which seats against the snap ring on the mainshaft.



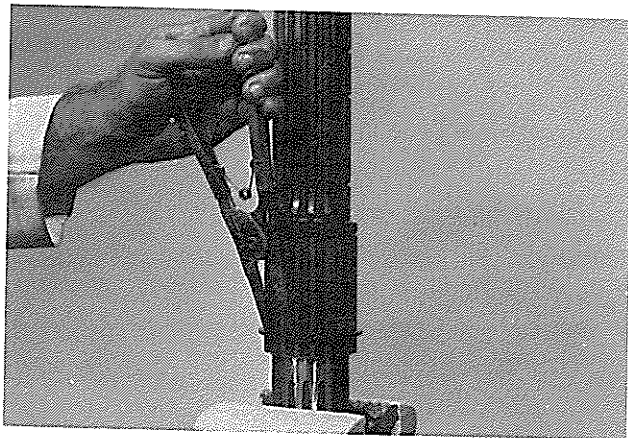
12. After removing the snap ring, the 3rd-4th gear may now be removed complete with thrust washers.



13. First-second gear may be removed.



14. Remove snap ring and clutch collar.



15. All that remains is the reverse gear snap ring. This completes the disassembly of the mainshaft.

INSPECTION PROCEDURES & TORQUE SPECIFICATIONS

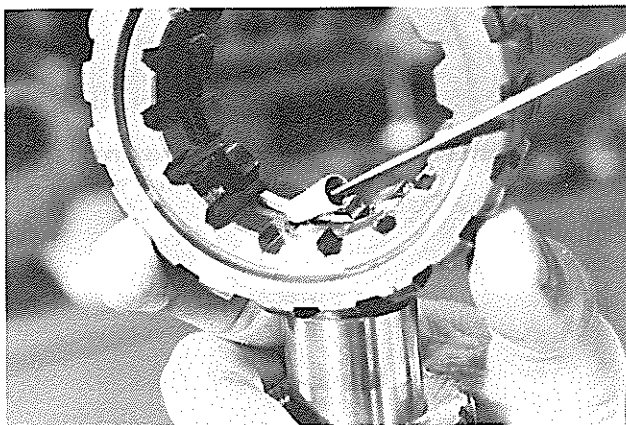
SECTION VI-B

Inspection

Prior to reassembling the mainshaft, certain individual parts should be examined. Parts damaged from previous service should be eliminated to insure maximum rebuild life.

These suggested inspection procedures should be followed:

Clutch Collars: Both the internal and external teeth must have sharp edges. Rounded corners or excessive chipping will cause gear jumping. Also, examine fork slots for wear.

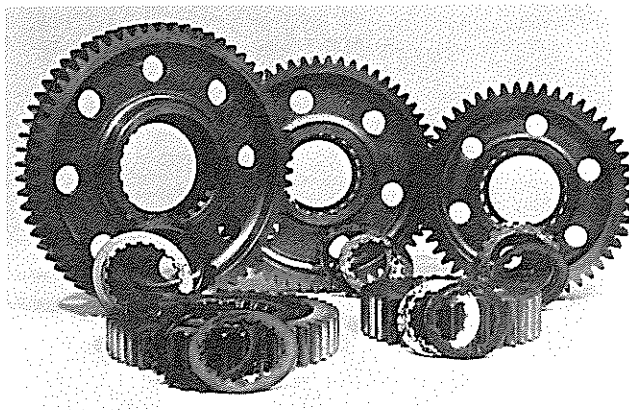


Gears: Examine for broken or cracked operating teeth. Also, check for any unusual wear patterns. Clutching teeth must not show excessive wear.

Thrust Washers: Check for flatness or excessive face wear (cracks, scoring, etc.)

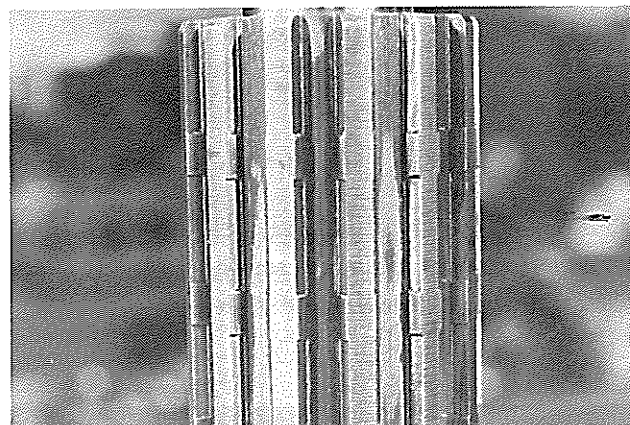
NOTE:

All thrust washers should be coated with SAE 30 wt. oil prior to reassembly to provide proper lubrication.



Snap Rings: Examine for distortion or loss of tension. New snap rings are recommended with every rebuild.

Mainshaft: Check spline gearlocks for sharp corners. Worn or ironed out gearlocks will produce gear jumping. Also, check for chipped splines at snap ring grooves.

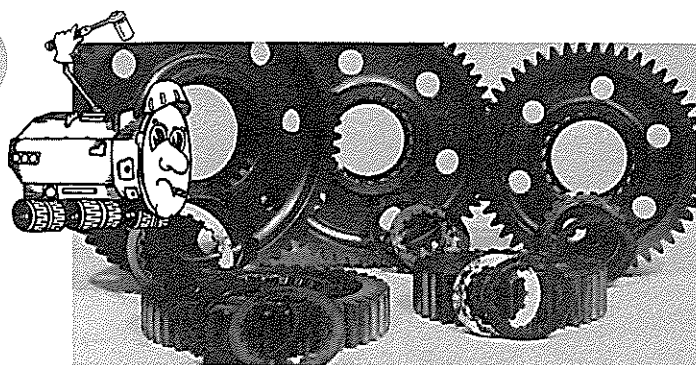


Torque Specification Guide 1214 and 1420 Heavy Duty Transmissions

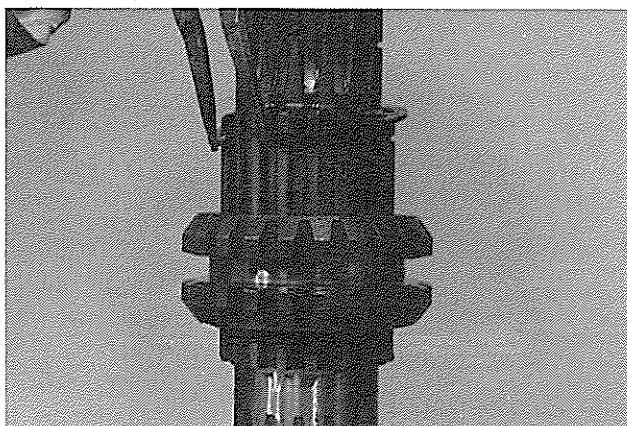
PART NAME	LBS. FT. TORQUE
Mainshaft Flange/Yoke Locknut	550-600
Rear Section Input Locknut	550-600
Clutch Housing Locknuts	1/2" dia. 60-80, 5/8" dia. 120-150
Piston Shift Rod Locknut	40-50
Mainshaft Front Bearing Capscrews	25-32
Mainshaft Rear Bearing Capscrews	60-80
Countershaft Rear Bearing Capscrews	25-32
Shifter Housing Capscrews	25-32
All Set Screws (Shift Forks, Brackets, and Fingers)	40-50

MAINSHAFT REASSEMBLY

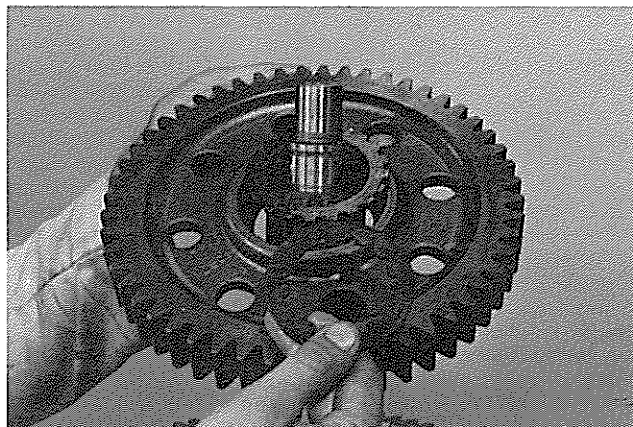
SECTION VI-C



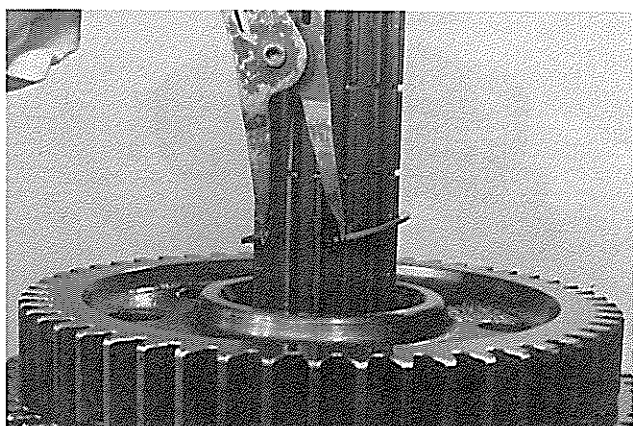
1. Reassembly of the mainshaft may now begin by placing a light coat of oil on all thrust washer and gear faces. All mainshaft gears contain a set of thrust washers. Externally splined against the snap ring in the gear bore and a thinner, internally splined washer against the snap ring on the mainshaft. Washers are the same thickness and need only be placed according to internal diameter size for reassembly.



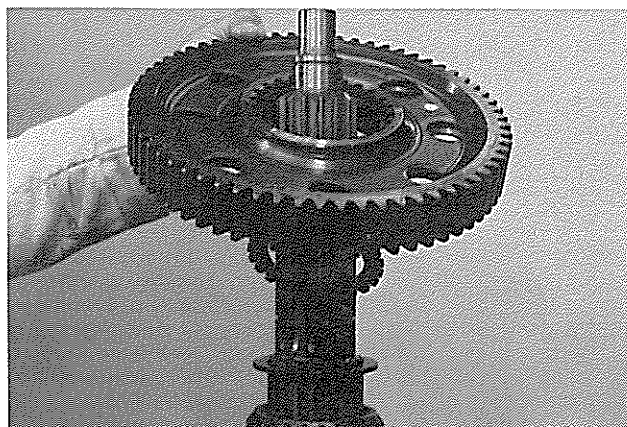
2. Place mainshaft in a vise. Install 1st-2nd/Rev. clutch collar between (2) mainshaft snap rings. This collar will assemble in either direction.



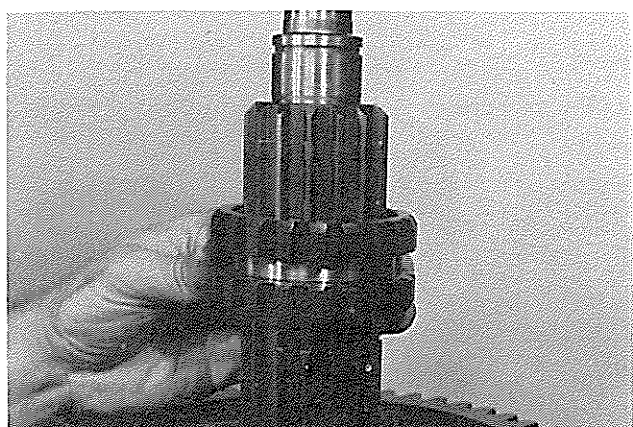
4. Third-fourth gear should be assembled with the clutching teeth-up complete with externally and internally splined thrust washers in their proper position.



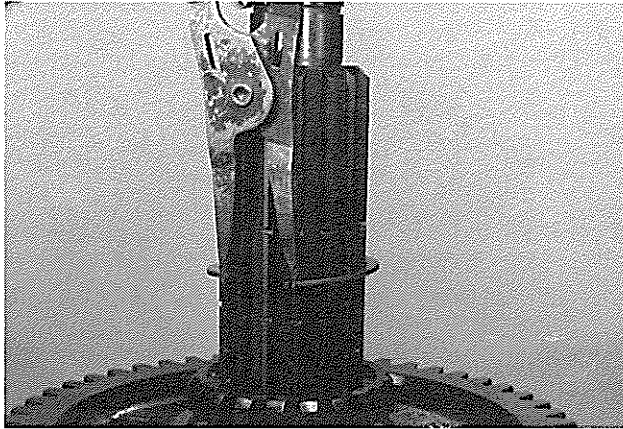
5. Secure with mainshaft snap ring.



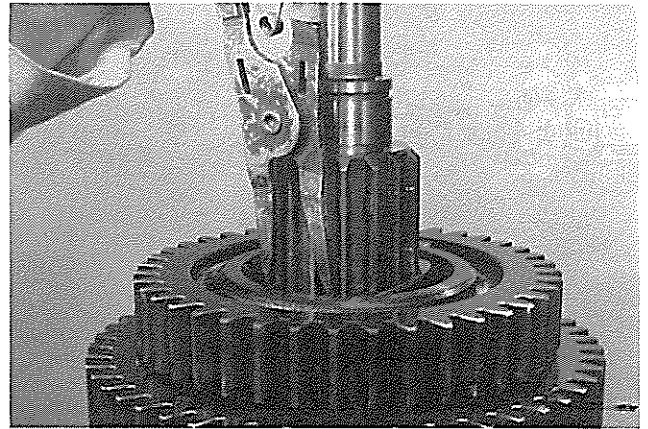
3. Place 1st-2nd gear on the mainshaft with the ground hub facing up complete with thrust washers.



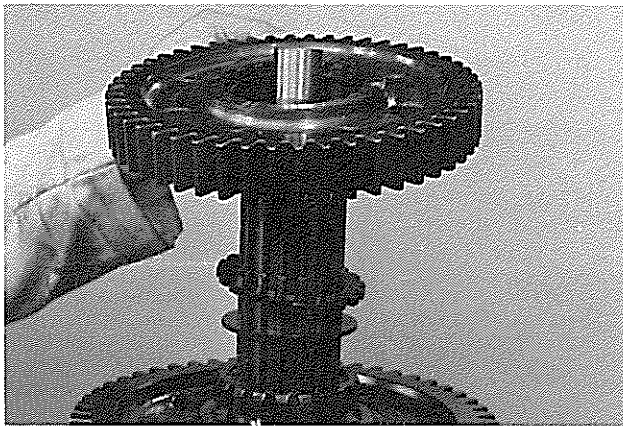
6. Slide clutch collar on the mainshaft. This collar will assemble either way. Check for free movement on mainshaft splines.



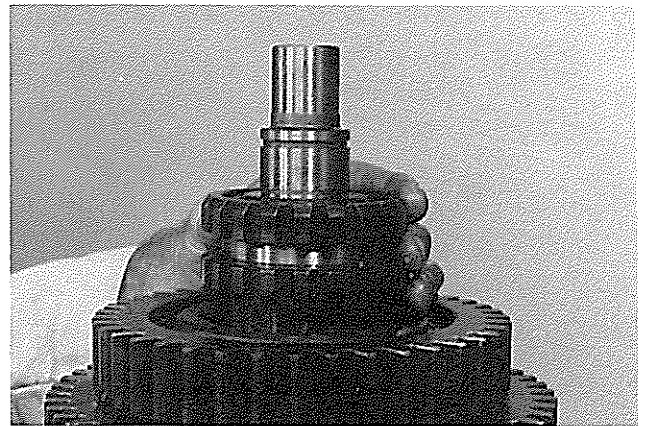
7. Install 5th-6th gear snap ring on mainshaft.



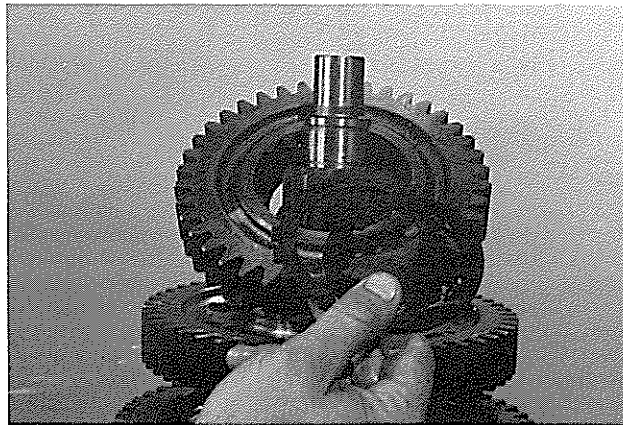
10. Secure with snap ring.



8. Install thrust washers and 5th-6th gear with the ground hub facing up.



11. Install remaining clutch collar on the mainshaft. Larger diameter down or to the rear.



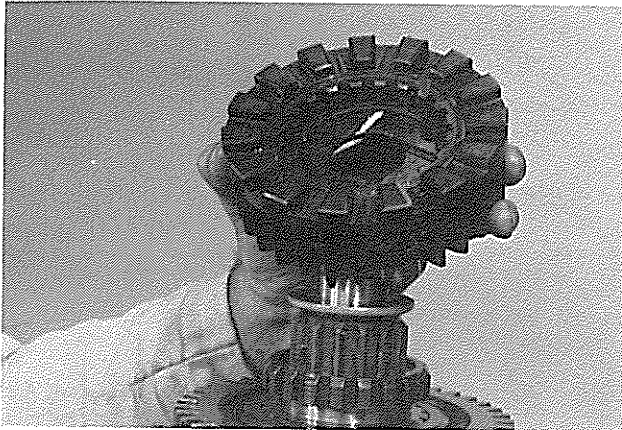
9. Place 7-8-9-10 gear on the mainshaft complete with thrust washers.



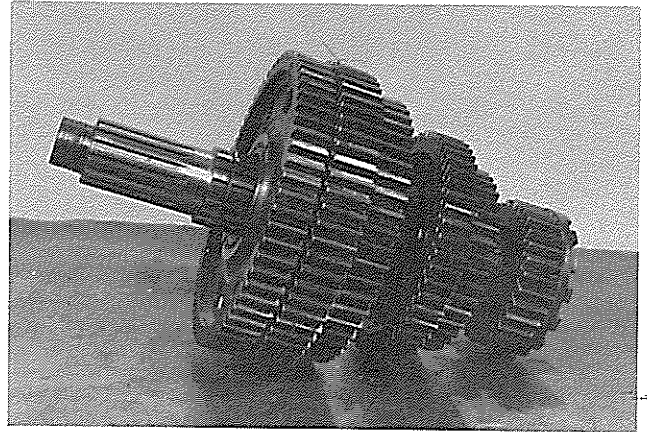
12. Assemble locking pin and lower bronze thrust washer with the flat side up.

MAINSHAFT REASSEMBLY

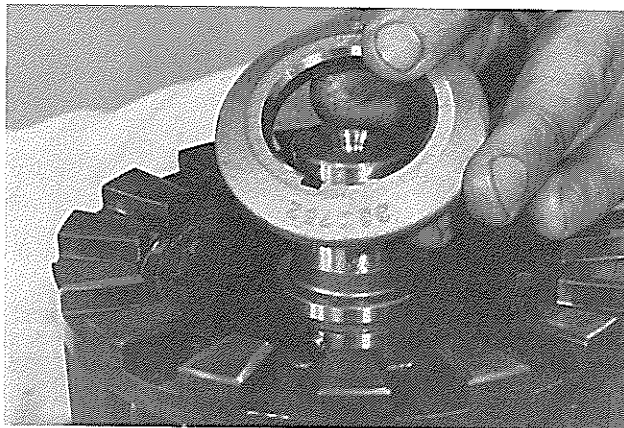
SECTION VI-C



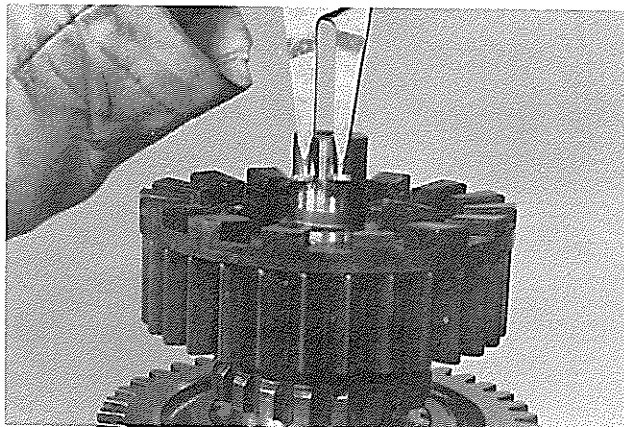
13. Place hi-splitter gear Sub-Assembly on the mainshaft with curvic clutch teeth up.



16. Remove mainshaft from vise and place on a bench. Assemble reverse gear and butt it against 1st-2nd gear lockwire together.



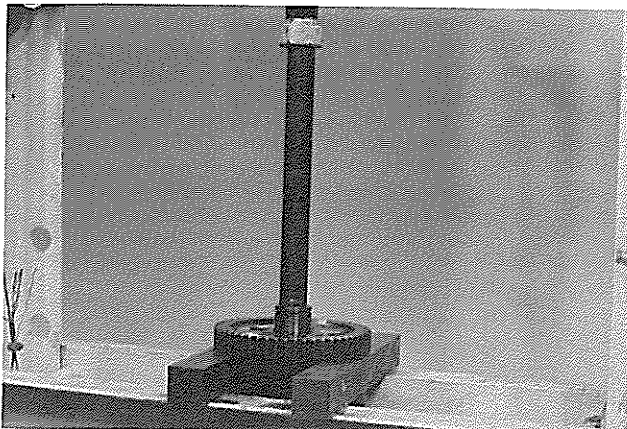
14. Install locking pin and upper bronze washer on the mainshaft.



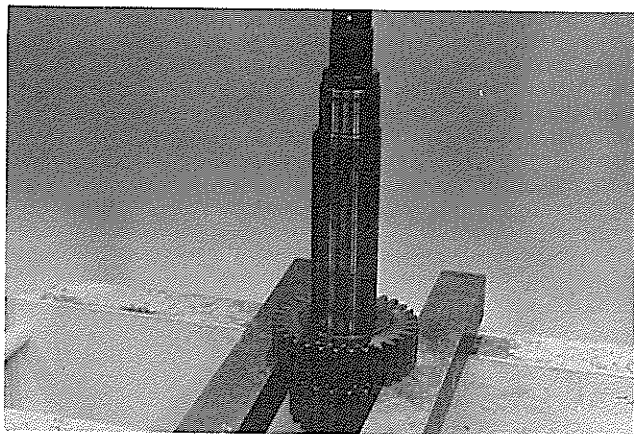
15. Secure with snap ring.

COUNTERSHAFT DISASSEMBLY

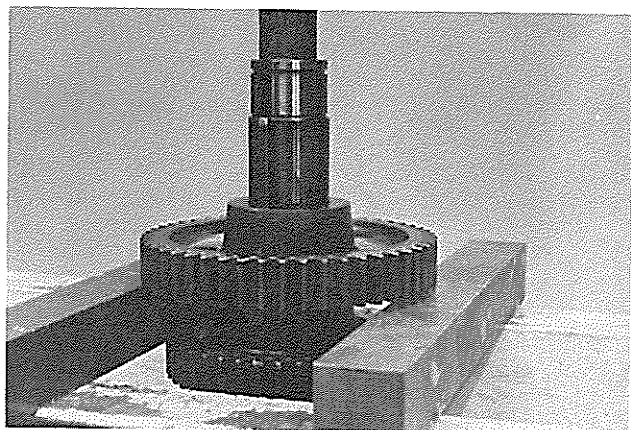
SECTION VII-A



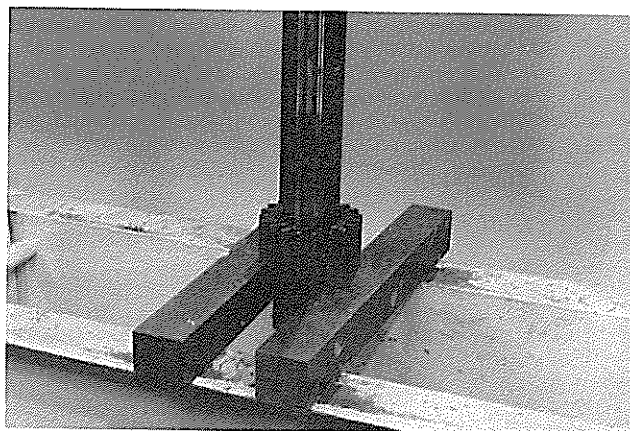
1. If there has been countershaft damage, it is necessary to follow these procedures for disassembly. Support the head end gear as close to the hub as possible and press the shaft thru this gear.



4. Press one gear at a time.



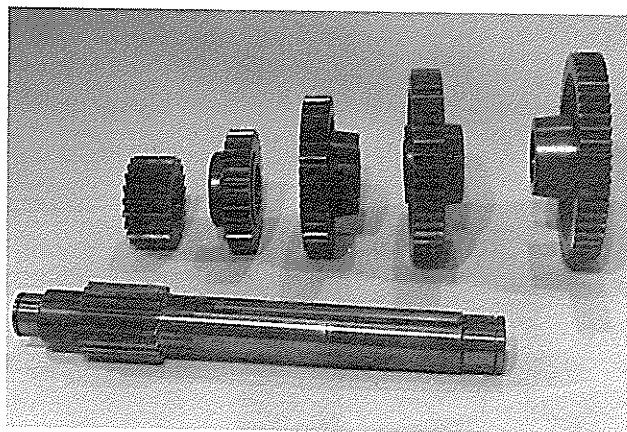
2. Repeat procedure for remaining gears.



5. Remove remaining gear.



3. Support each gear as close to the hub as possible.

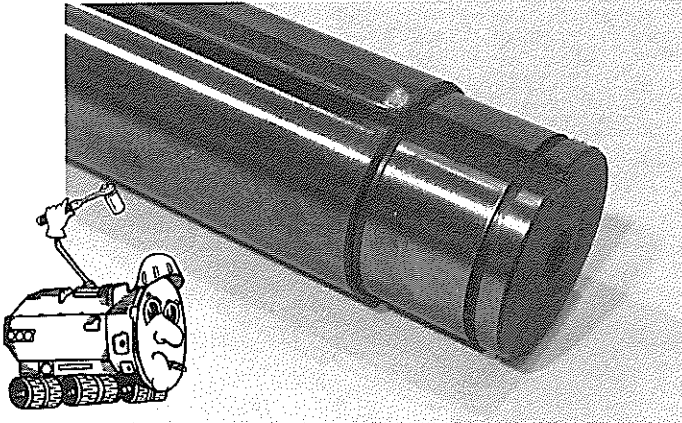


6. This view shows hub direction for reassembly.

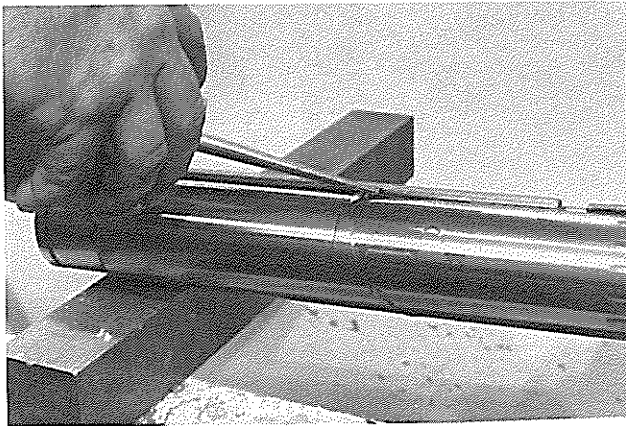
NOTE: Page 40 is a blank page.

COUNTERSHAFT REASSEMBLY

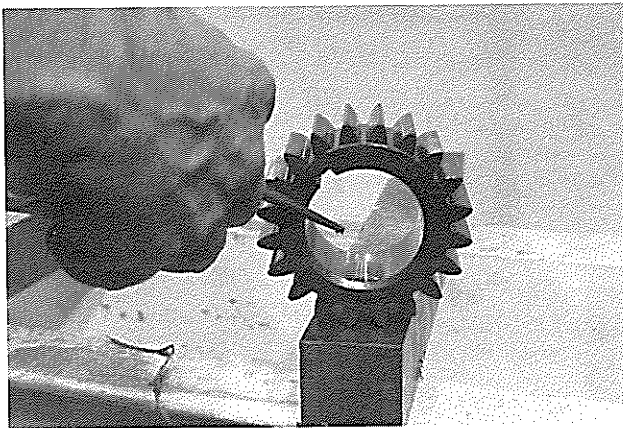
SECTION VII-B



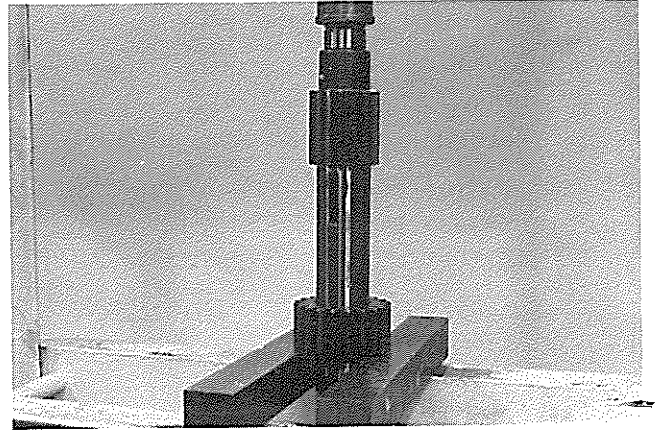
1. Make sure when installing the long key that it does not extend beyond the countershaft shoulder which will prevent the countershaft front bearing from seating properly.



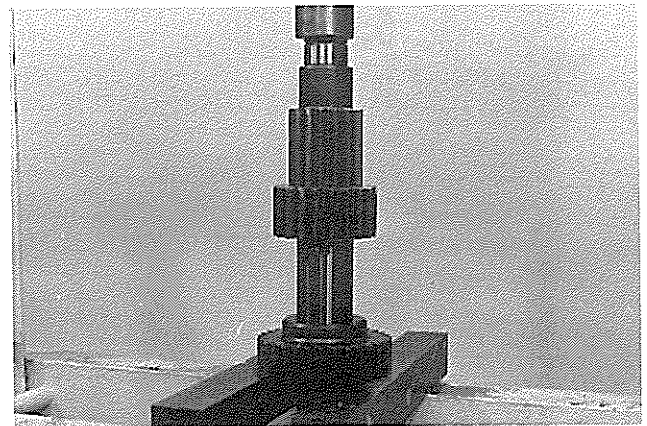
2. Begin by coating the shaft with oil.



3. Coat gears with oil. Support each gear and press the shaft thru the gears as follows:



4. 3rd-4th gear can be assembled either way.



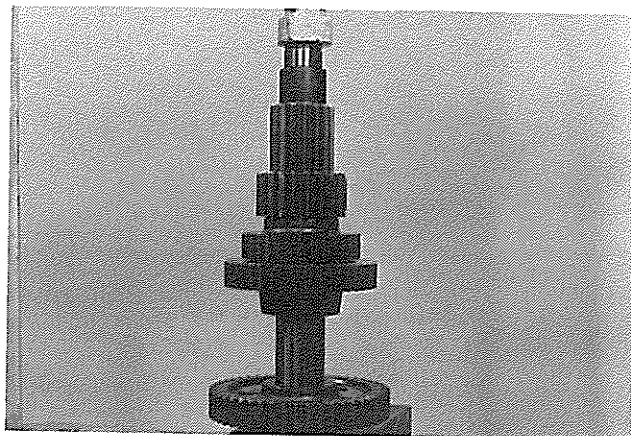
5. 5th-6th gear — long hub up.



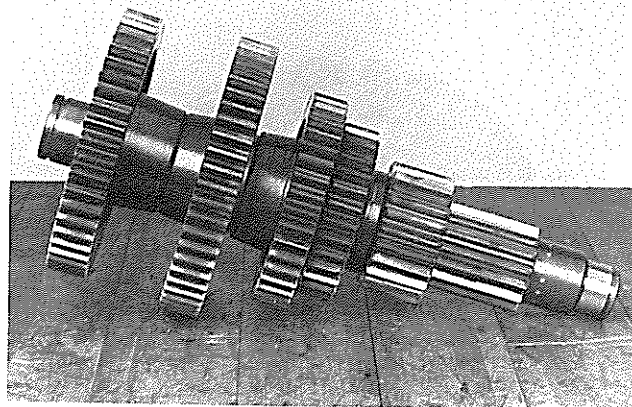
6. 7-8-9-10 gear — long hub down.

COUNTERSHAFT REASSEMBLY

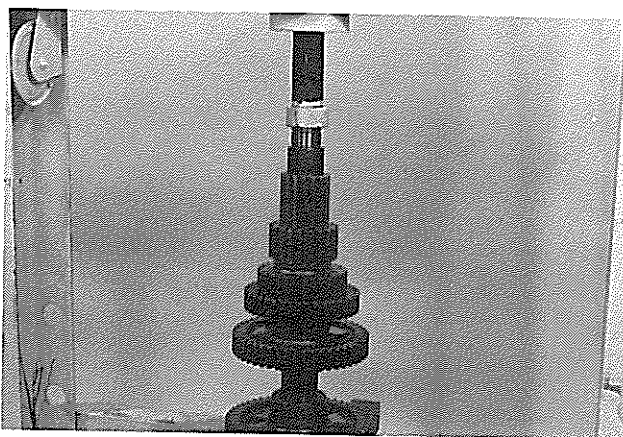
SECTION VII-B



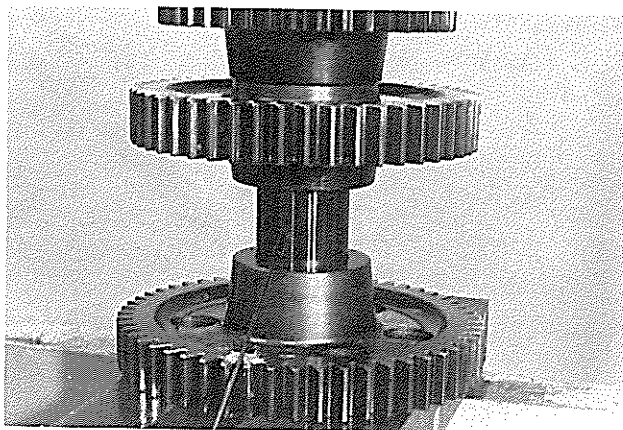
7. 11-12-13-14 gear — long hub down.



10. Countershaft for an overdrive model. Notice smaller head end gear.



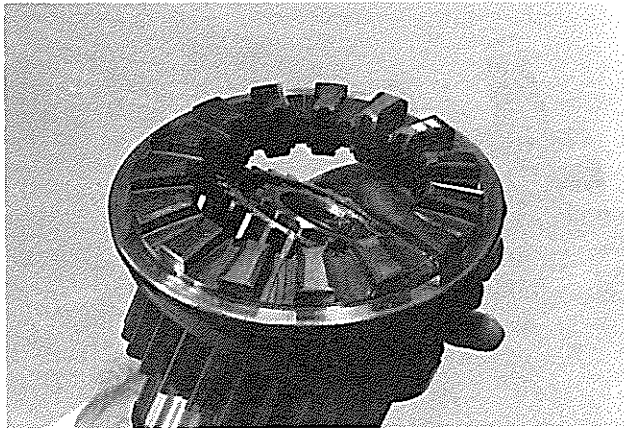
8. Head end gear — long hub up.



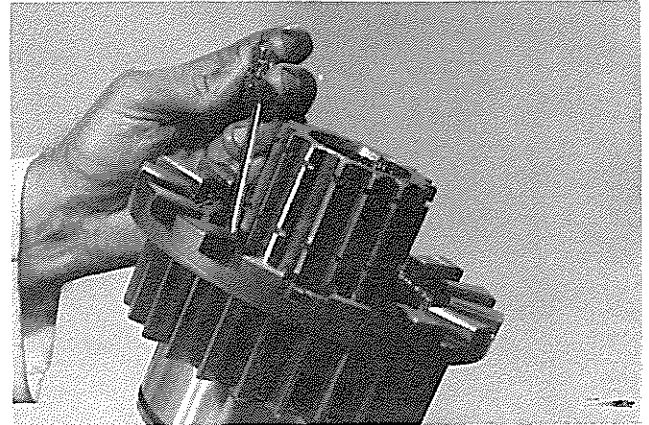
9. This view illustrates how the timing tooth or mark on the head end gear should line up with the keyway in the shaft.

INPUT GEAR DISASSEMBLY

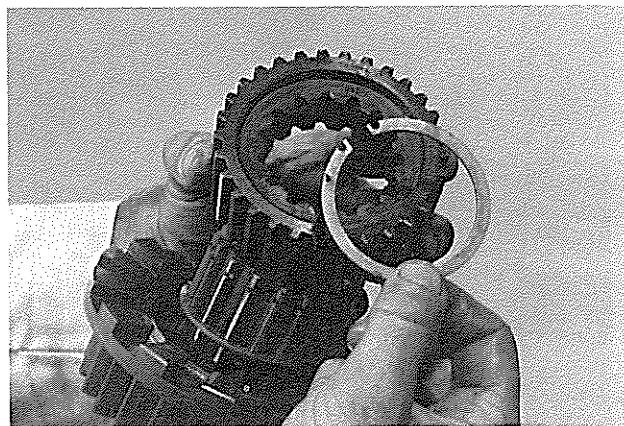
SECTION VIII-A



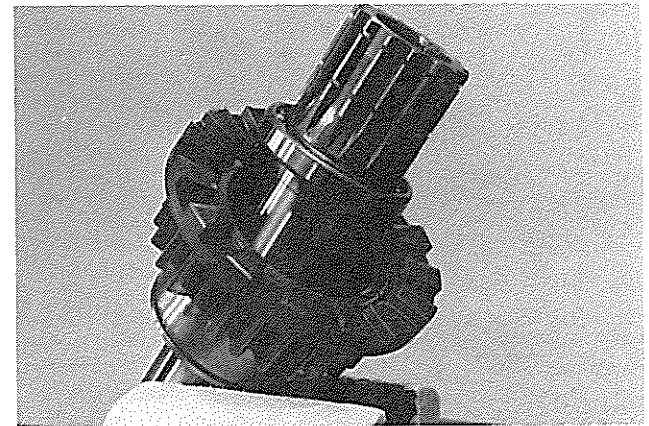
1. Disassembly of the input gear begins by removing the splitter collar. It is advisable to examine this collar for excessive tooth wear, due to clash shifting.



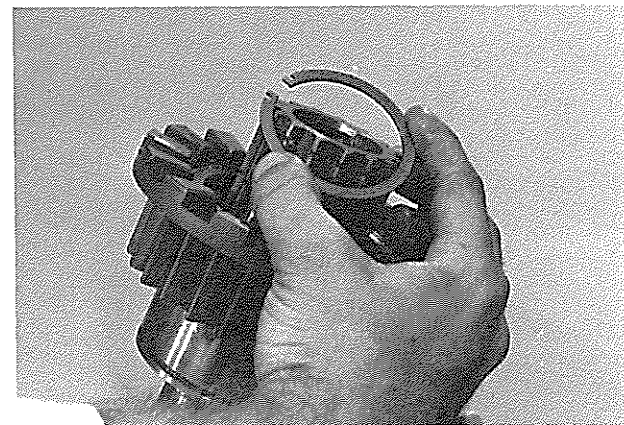
4. With a small screwdriver remove the internal snap ring in the input gear.



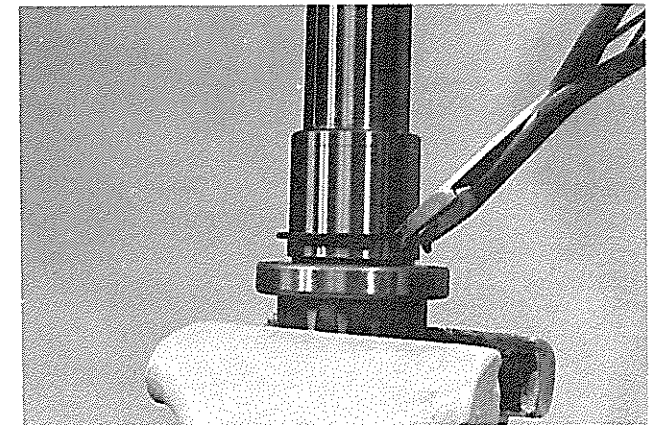
2. Remove snap ring and collar.



5. By tapping down on the input gear Sub-Assembly with a soft mallet, the input gear will drop down exposing the internal drive gear bearing.



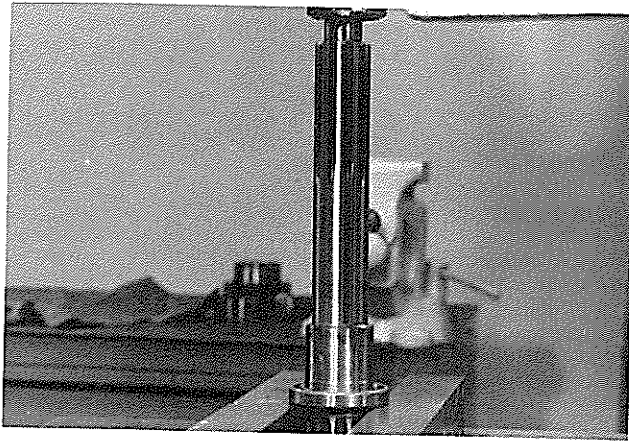
3. Remove remaining snap ring.



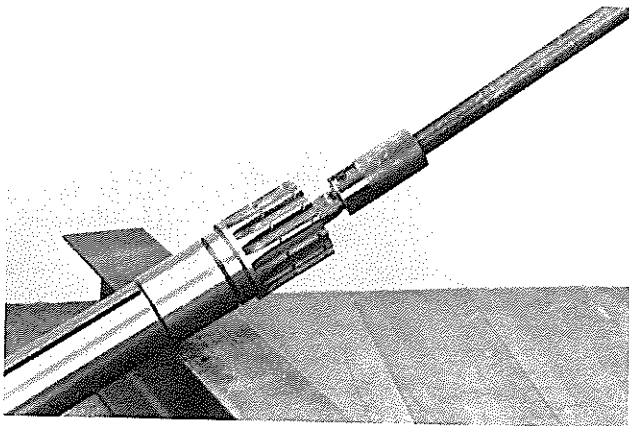
6. Remove snap ring.

INPUT GEAR DISASSEMBLY

SECTION VIII-A



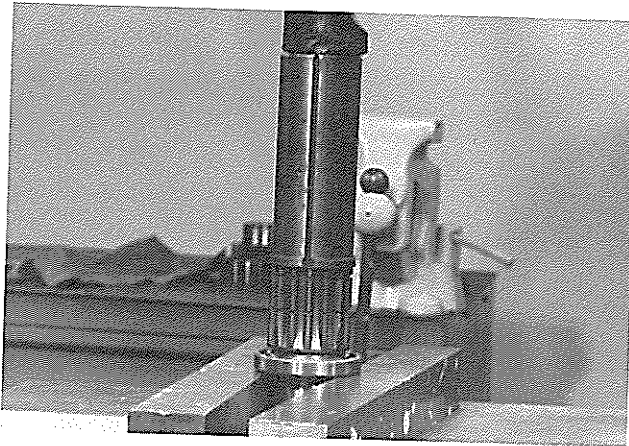
7. Remove bearing.



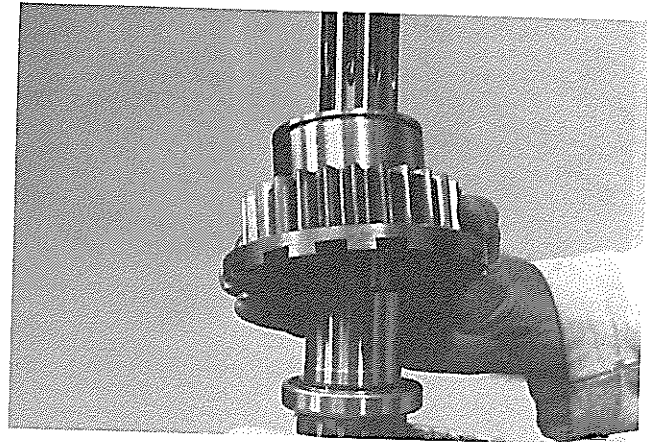
8. Using a pocket bearing tool, remove this bearing.

INPUT GEAR REASSEMBLY

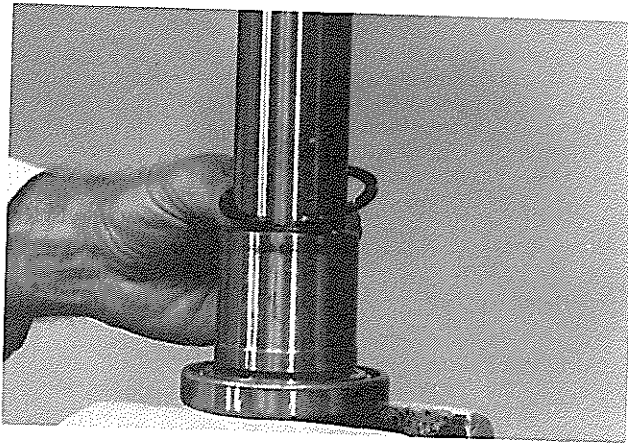
SECTION VIII-B



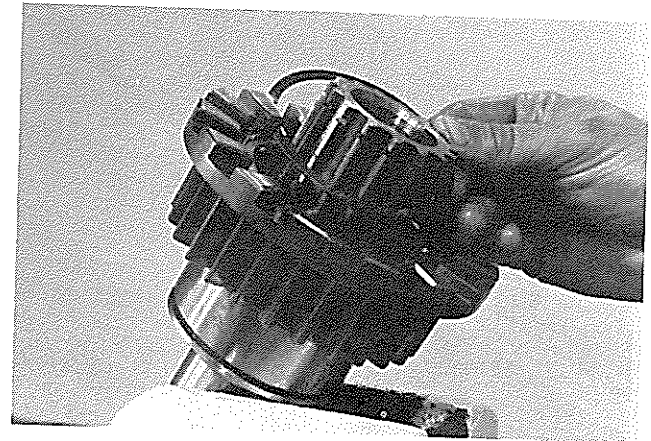
1. Begin reassembly by pressing the input shaft thru the inner bearing.



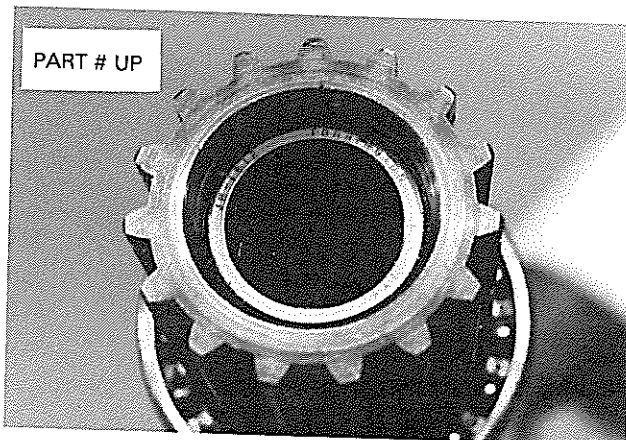
4. Assemble input gear Sub-Assembly, tapping on the gear until the inner bearing is seated in its proper location.



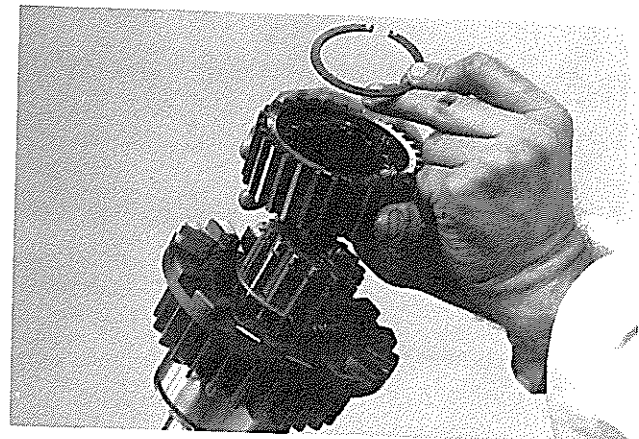
2. Secure with snap ring.



5. Place snap ring in input gear assembly.



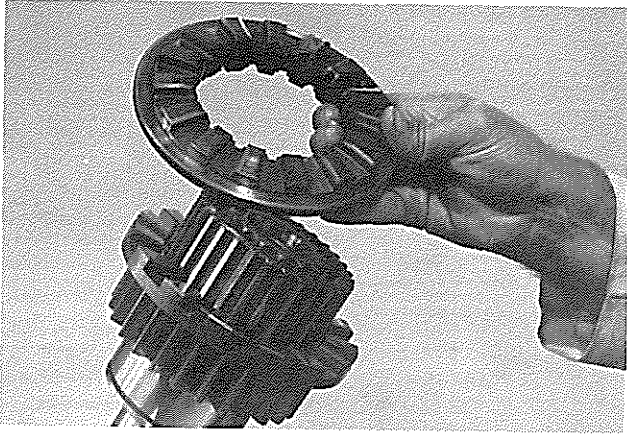
3. Install pocket bearing with part number side of bearing facing outward.



6. After securing lower snap ring to shaft, install clutch gear and secure with upper snap ring.

INPUT GEAR REASSEMBLY

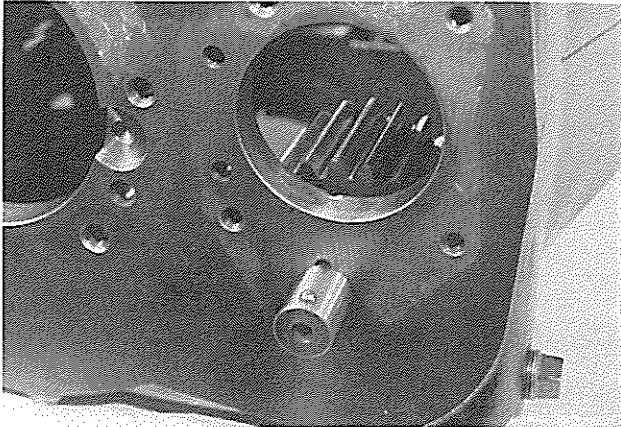
SECTION VIII-B



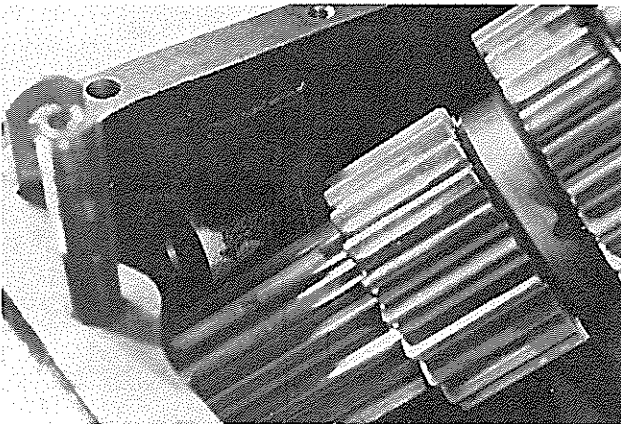
7. Install splitter collar on input gear and set aside for installation later. This collar is reversible.

FRONT CASE REASSEMBLY

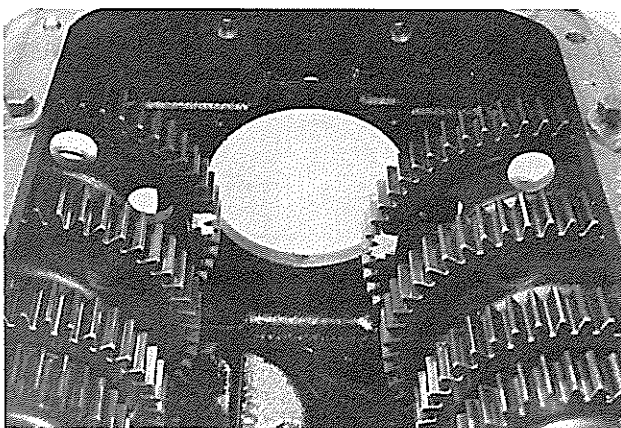
SECTION IX-A



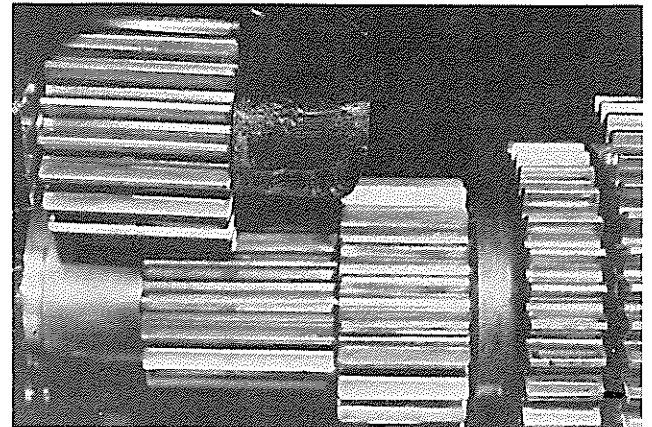
1. Reassembly of the unit begins by placing the lower reverse idler gear (complete with bearings & spacer) in case. It's recommended to apply a coat of lightweight lubricant to these bearings. Install lower reverse idler shaft with lockball.



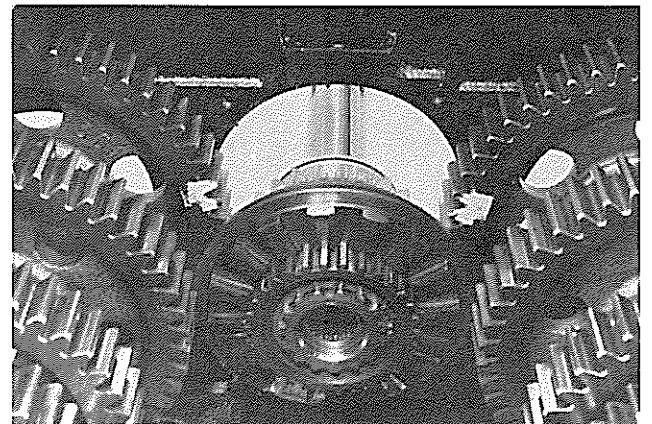
2. Place left side countershaft into the case first, due to the interference caused by the upper idler boss once the right side countershaft is in the case.



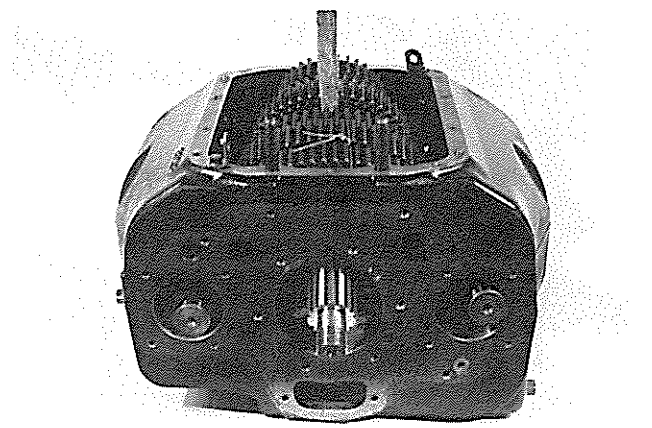
3. Move countershafts as far forward as possible with timing marks towards the center.



4. Place upper reverse idler gear with bearings and spacer in its proper location and roll against case wall. Do not install idler shaft at this time.



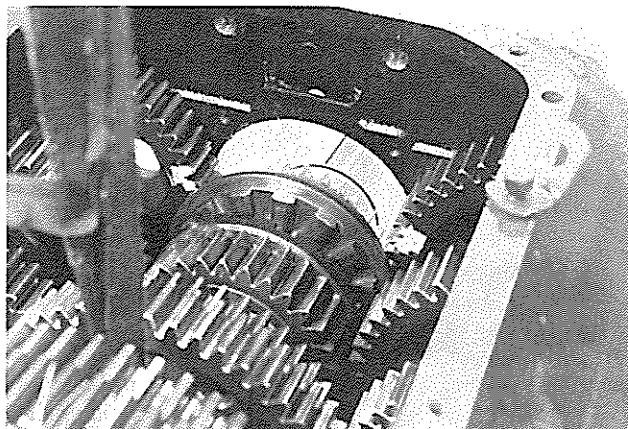
5. Place input shaft into the case complete with splitter collar.



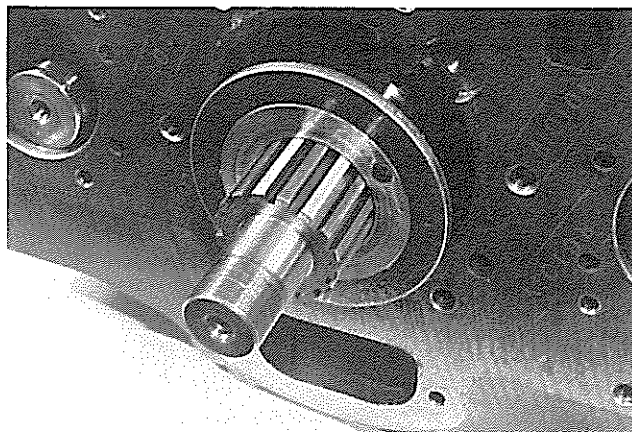
6. With the use of a sling lower the mainshaft assembly into the case. Insert the mainshaft pilot into the input gear pocket bearing.

FRONT CASE REASSEMBLY

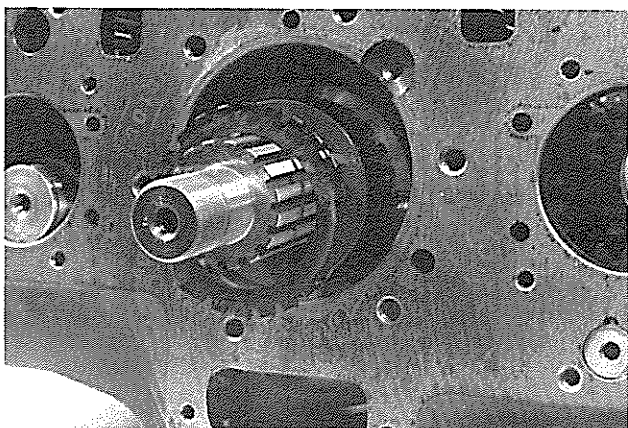
SECTION IX-A



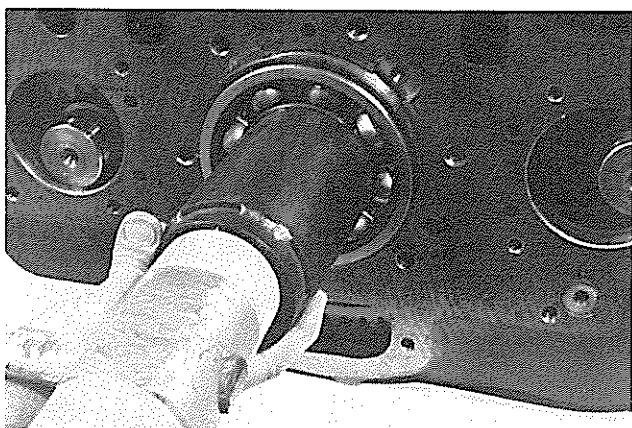
7. Leave sling attached to the mainshaft for centering purposes. Cut lockwire and slide reverse gear rearward.



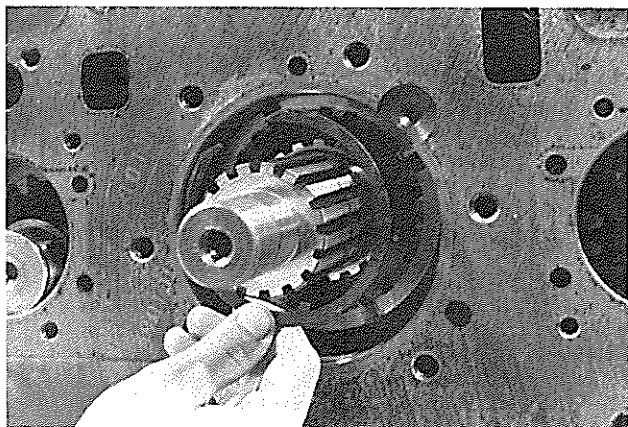
10. Slide reverse gear washer onto mainshaft with the flat side towards reverse gear.



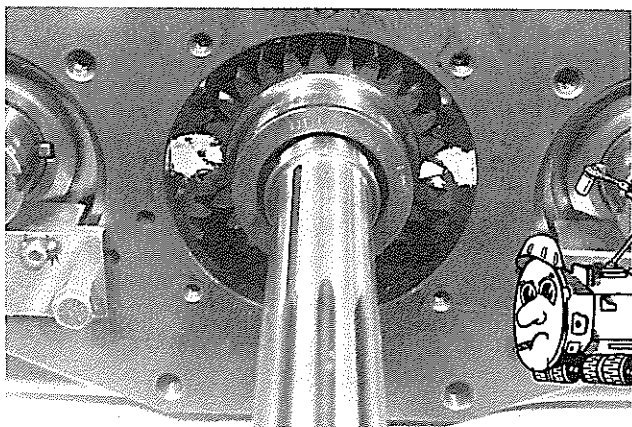
8. Place thrust washers on mainshaft and into reverse gear bore.



11. Place output bearing on shaft and with suitable driver, install until snap ring seats against the case.



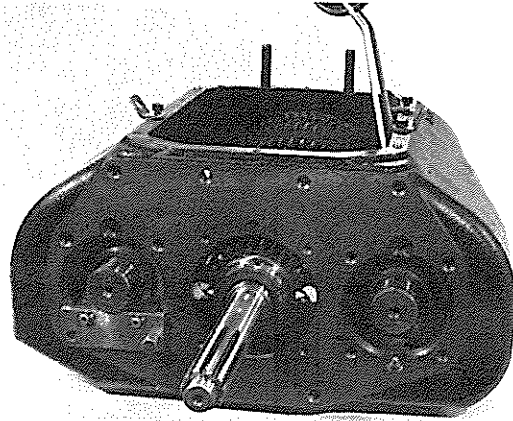
9. Install snap ring in reverse gear bore.



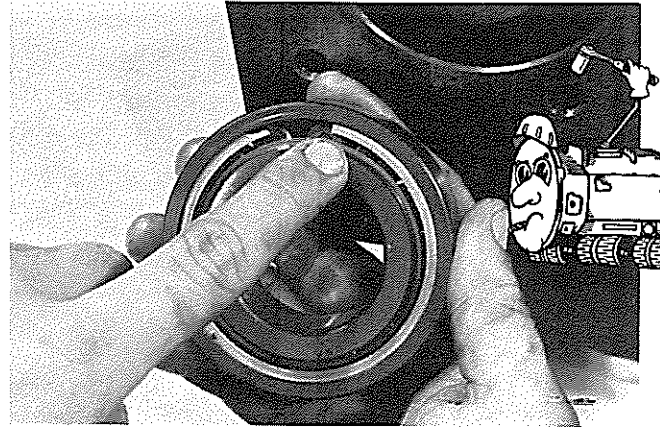
12. Align timing marks.

FRONT CASE REASSEMBLY

SECTION IX-A



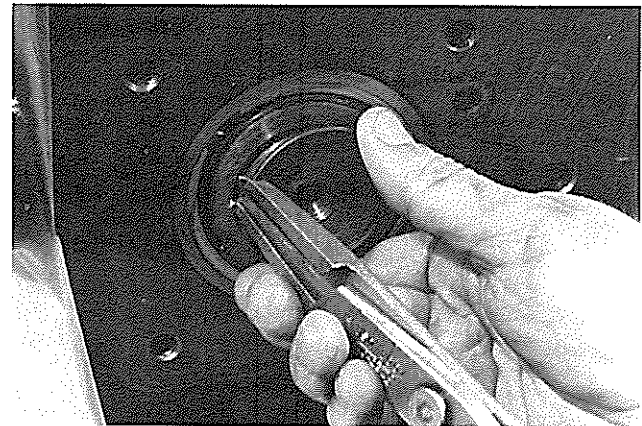
13. With the aid of a countershaft lift hook, set countershaft in time with input gear.



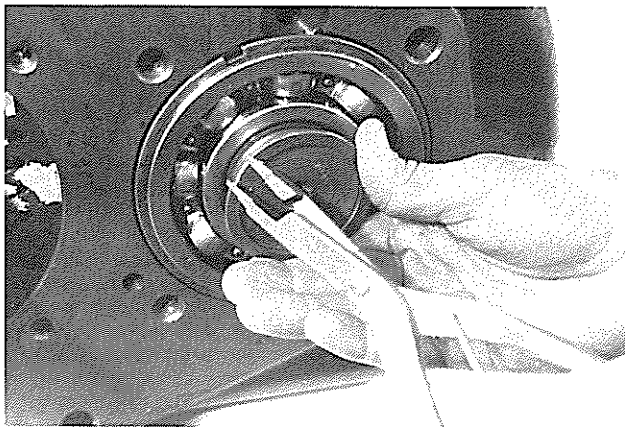
16. *The countershaft rear bearing must be installed with the bearing snap ring facing rearward.*



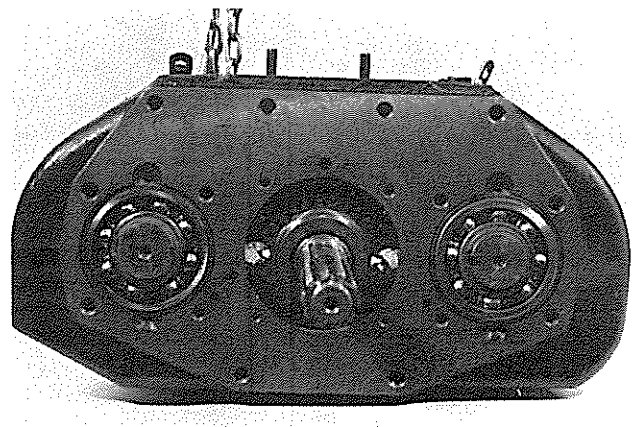
14. Install countershaft front bearing.



17. Install rear bearing and secure with snap ring.



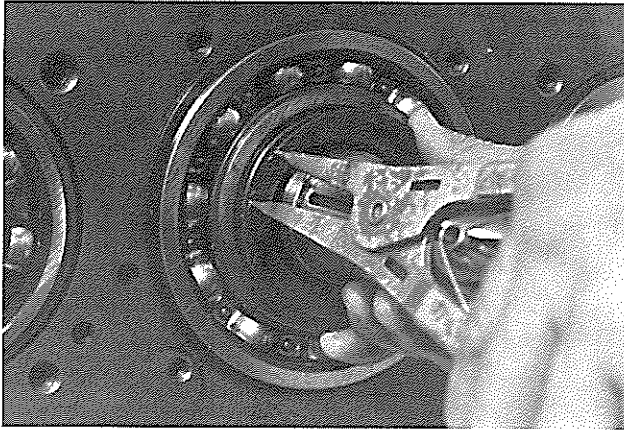
15. Secure with snap ring.



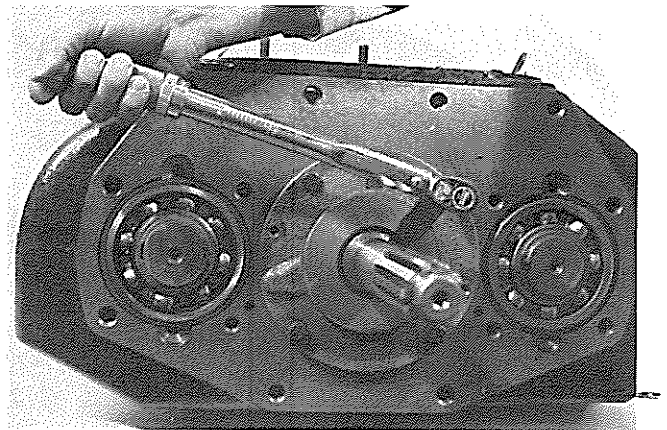
18. Repeat procedure for remaining countershaft paying close attention to timing mark match.

FRONT CASE REASSEMBLY

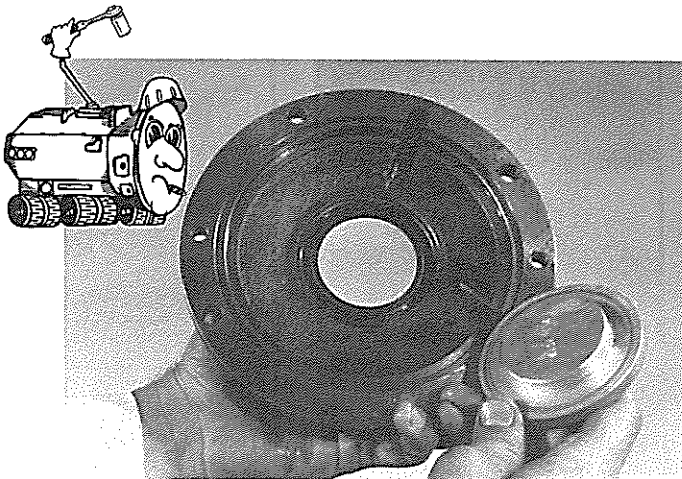
SECTION IX-A



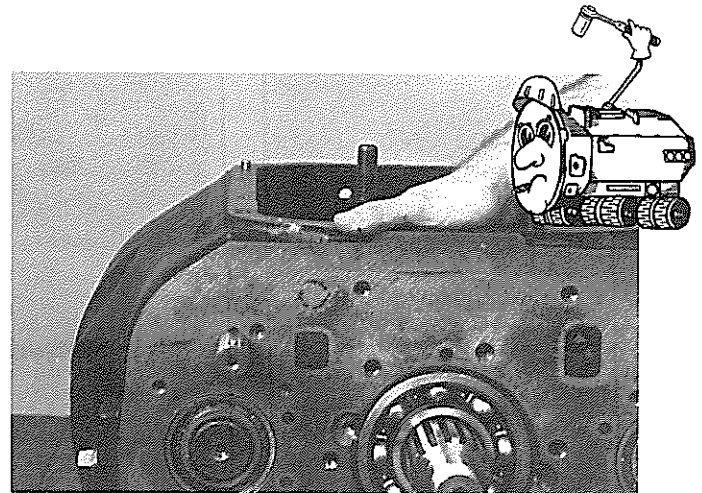
19. Install input bearing and secure with snap ring.



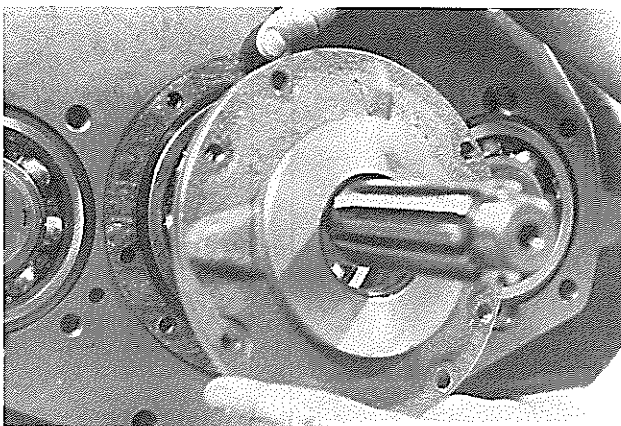
22. Secure with capscrews. Torque 25-32 lbs. ft.



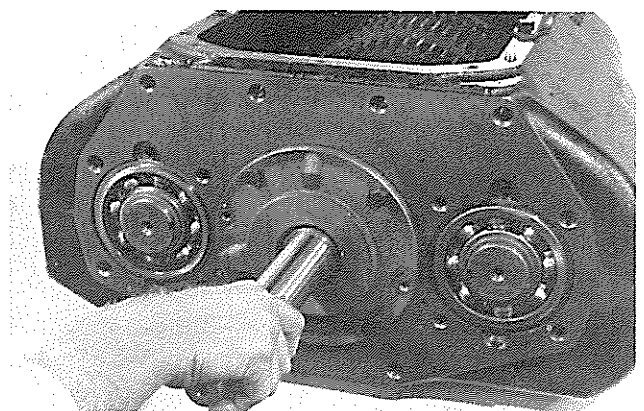
20. If the input bearing cap seal must be replaced, use of a proper seal driver is required to prevent seal distortion.



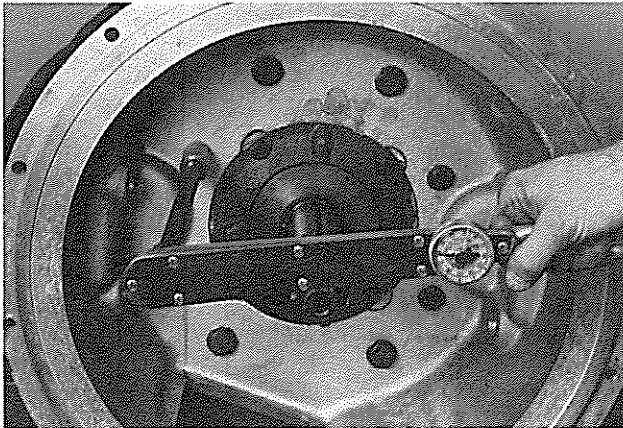
23. Install upper reverse idler shaft. Lift up on reverse gear to obtain proper alignment.



21. Place input bearing cap and gasket on case being careful to align oil return holes.



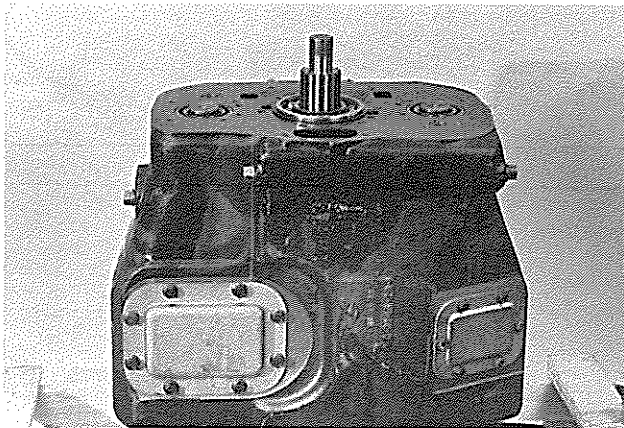
24. Turn input gear stem to roll gear train. If teeth timing marks are in their correct position, the entire gear train will roll freely. If the timing teeth have not been set correctly or have escaped their proper position, the gear train will lock-up after several turns of the input gear. If the unit locks-up, retiming is necessary.



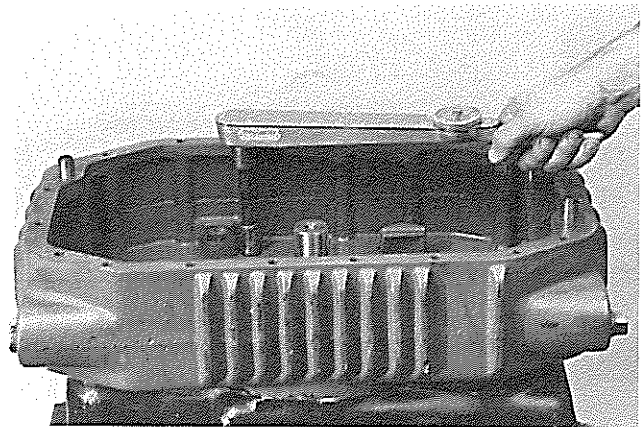
25. Place clutch housing gasket on front of case. Install clutch housing and secure with capscrews.

REAR CASE REASSEMBLY

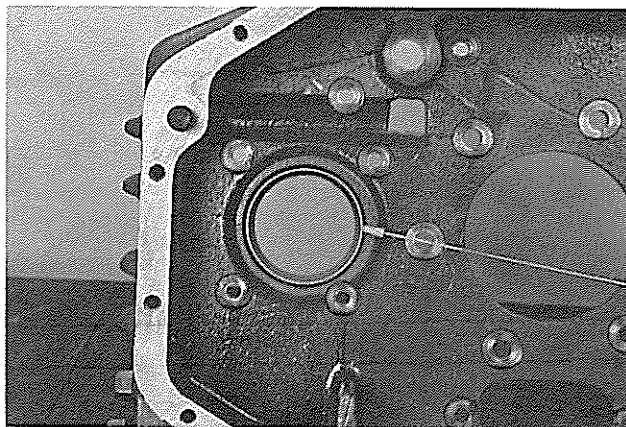
SECTION IX-B



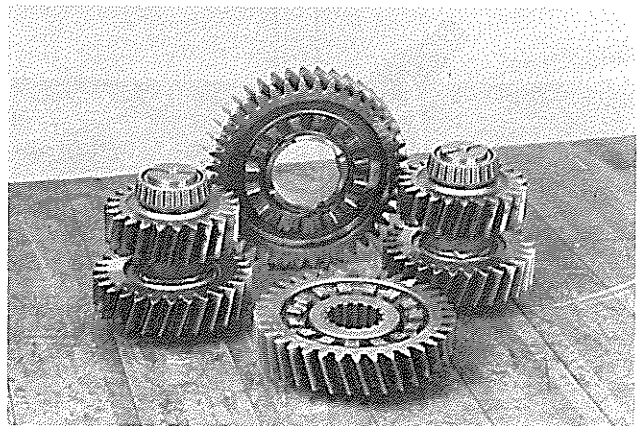
1. Stand transmission upright for rear section reassembly.



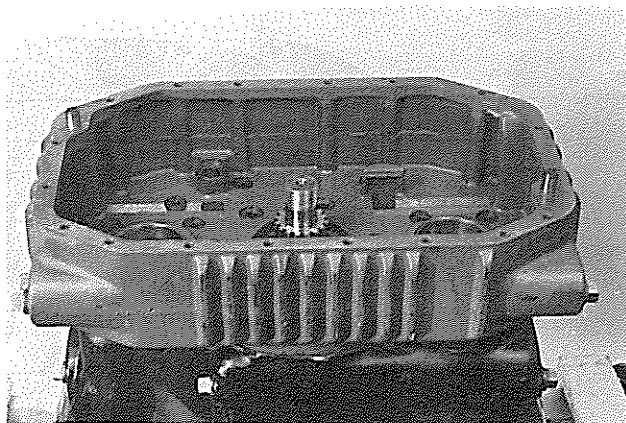
4. Secure with capscrews.



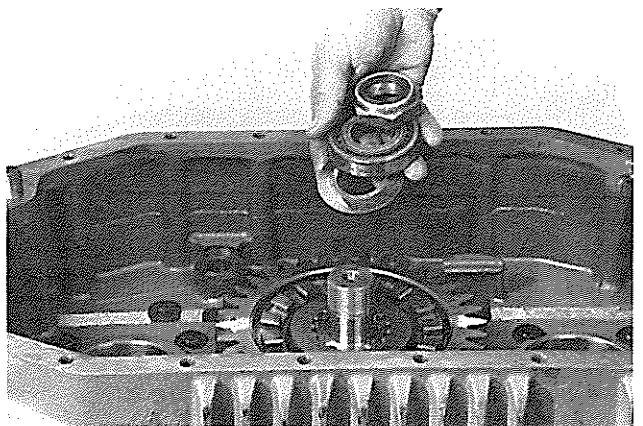
2. Replace bearing cups in rear case.



5. The 1214, unlike the 1420 transmission, may contain either spur or helical gears in the rear section.



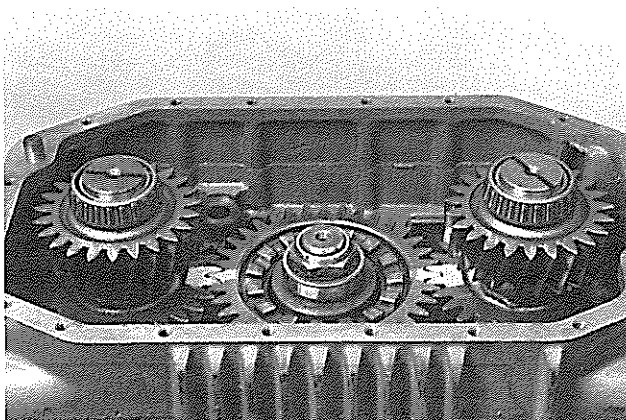
3. Place gasket and rear case on front section.



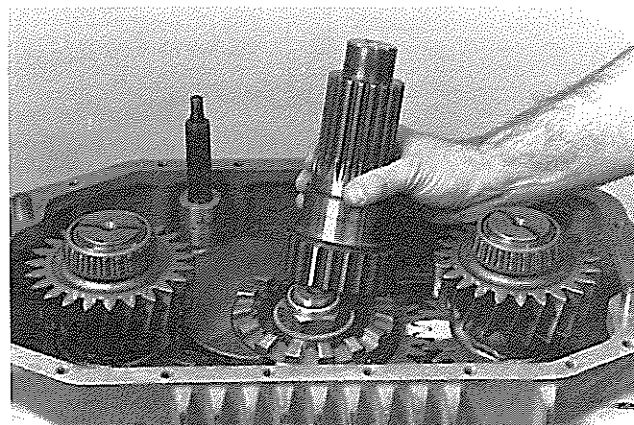
6. Install mainshaft drive gear onto shaft splines with timing marks 180° across. Assemble washer, bearing and secure with nut. Torque 550-600 lbs. ft.

REAR CASE REASSEMBLY

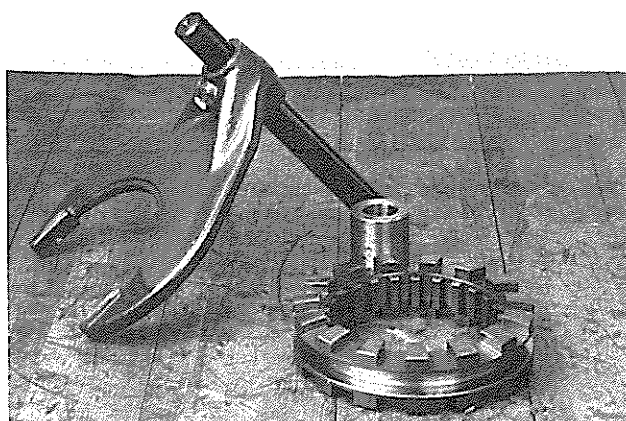
SECTION IX-B



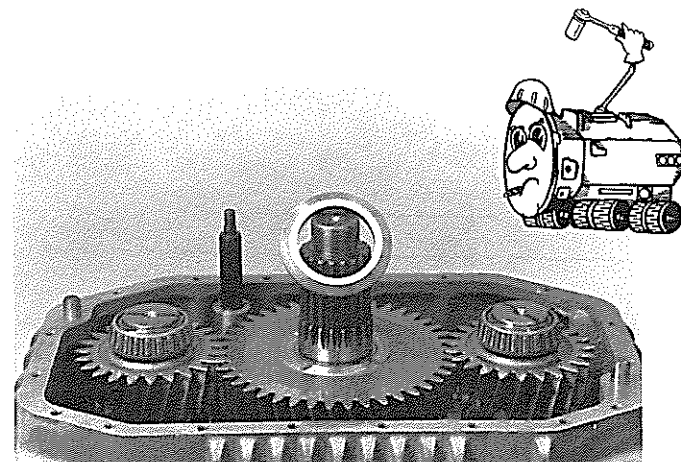
7. Install countershafts with larger diameter gear meshing with mainshaft drive gear. Care should be taken to insure proper alignment of timing marks.



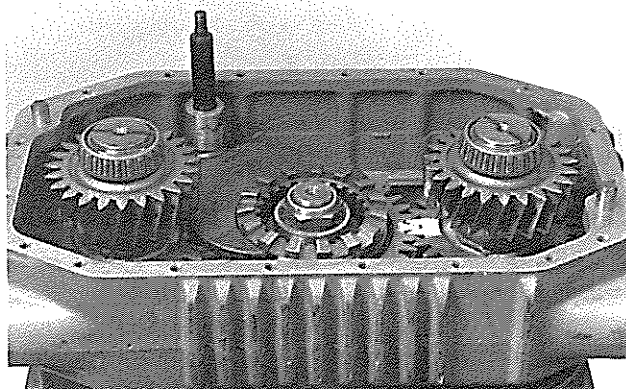
10. Place output shaft over pocket bearing and thru clutch collar splines.



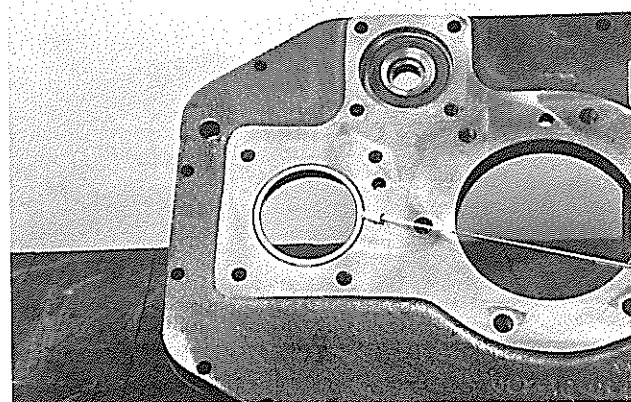
8. All range or rear section shifts are accomplished by this shift fork and rod assembly. Don't forget to place the stop spacer on the end of the shift rod.



11. Place low range gear and washer onto output shaft. The flat side of the washer faces the gear.



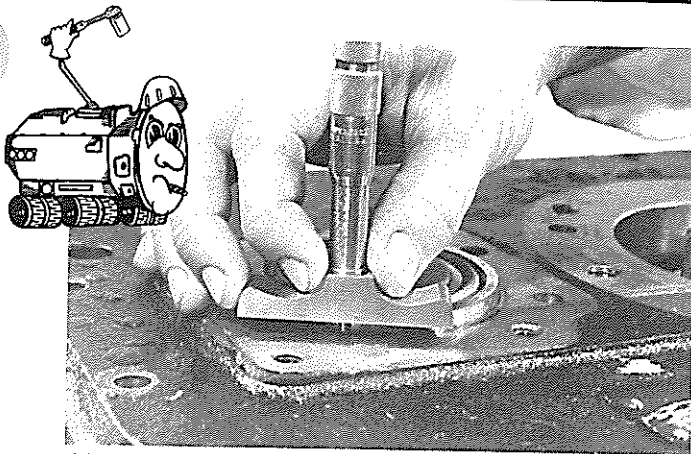
9. Assemble the shift fork and rod assembly complete with spacer and collar into the case. This collar is reversible.



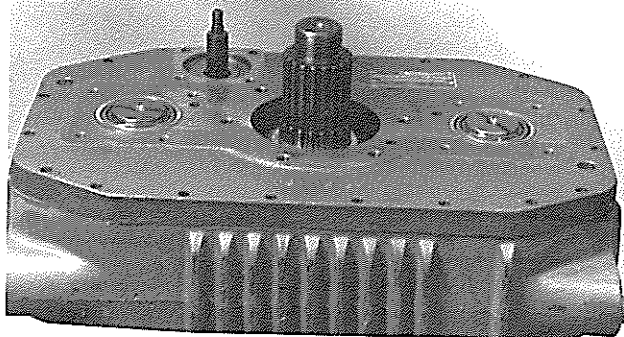
12. Drive tapered bearing cups into cover bores.

REAR CASE REASSEMBLY

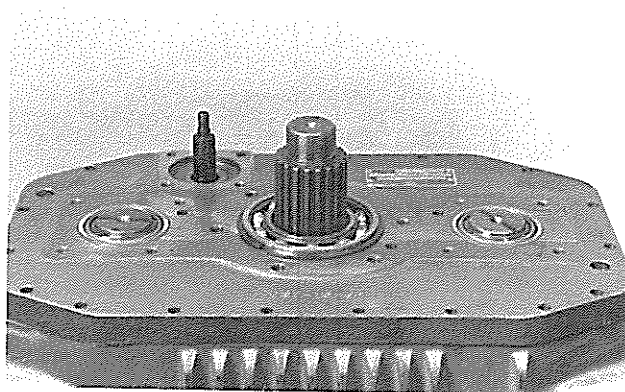
SECTION IX-B



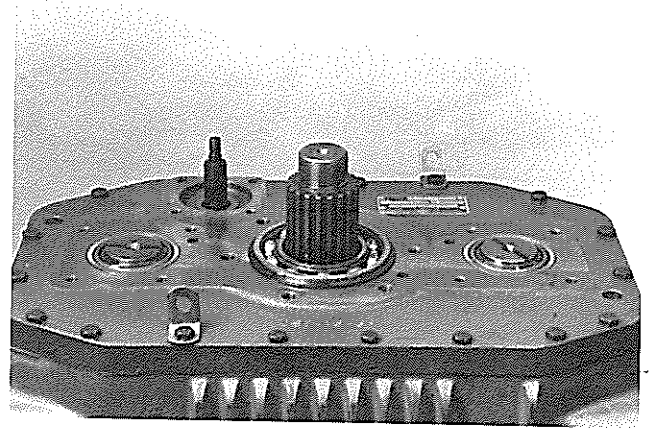
13. Cups for hellical gears (Model 1214, prior to starting serial #2388049) are installed flush with cover. Cups for spur gears (1420 and old stype 1214) as well as 1214 hellical gears starting with serial #2388049, must extend out of cover .205 to insure proper end play of tapered bearings.



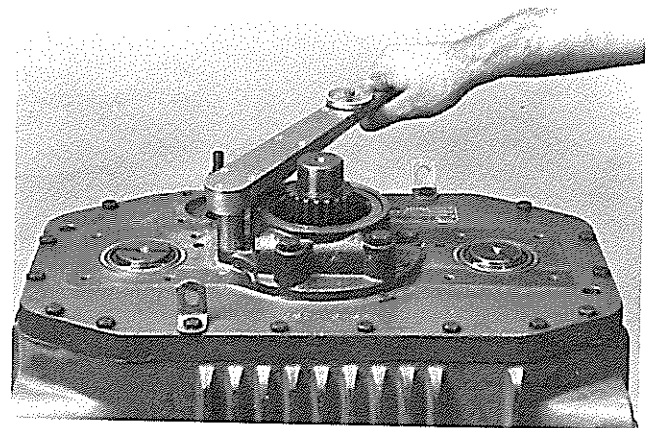
14. Assemble the rear cover over the pilot dowel pins and the piston rod onto the cover gasket.



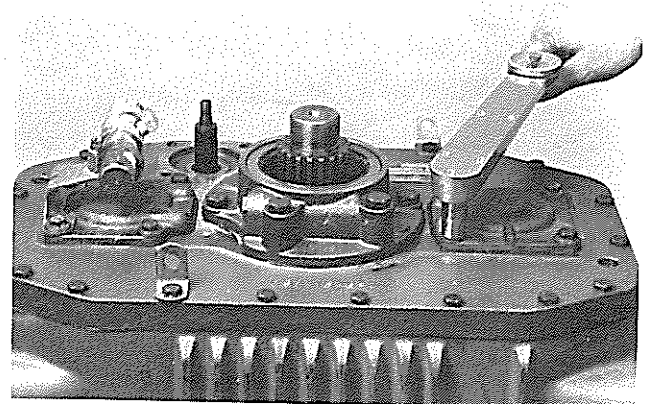
15. Install output bearing.



16. Secure rear cover with capscrews.



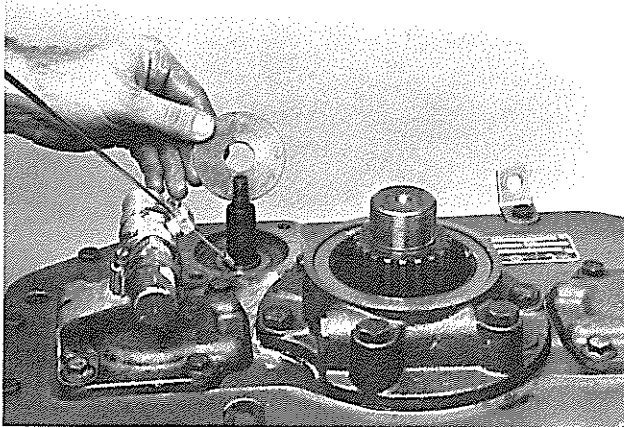
17. Assemble output bearing cap and gasket being careful to align oil return holes. Secure with capscrews. Torque 60-80 lbs. ft.



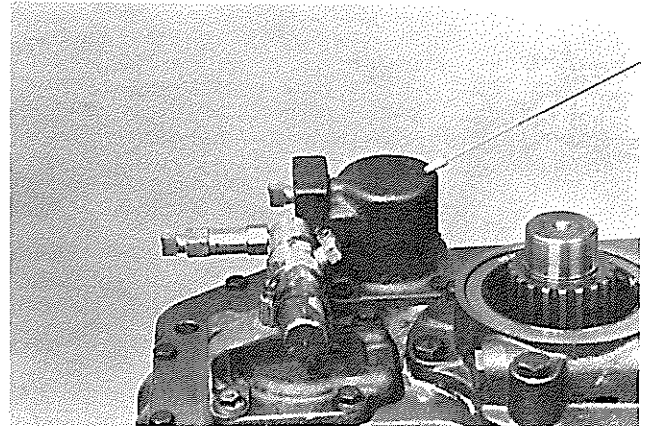
18. Install countershaft bearing caps and gaskets. The filter regulator may also be assembled to the left countershaft cap at this time. Torque 25-32 lbs. ft.

REAR CASE REASSEMBLY

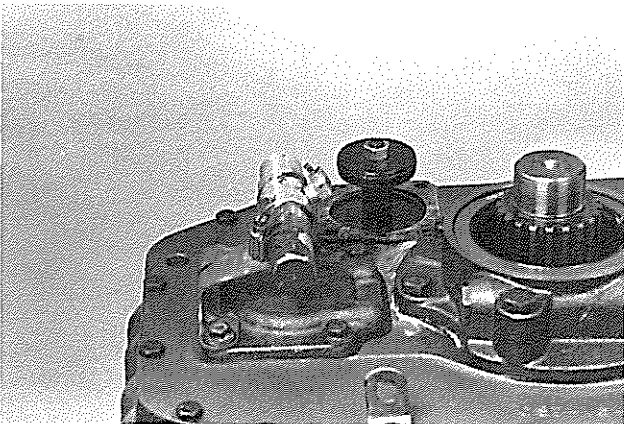
SECTION IX-B



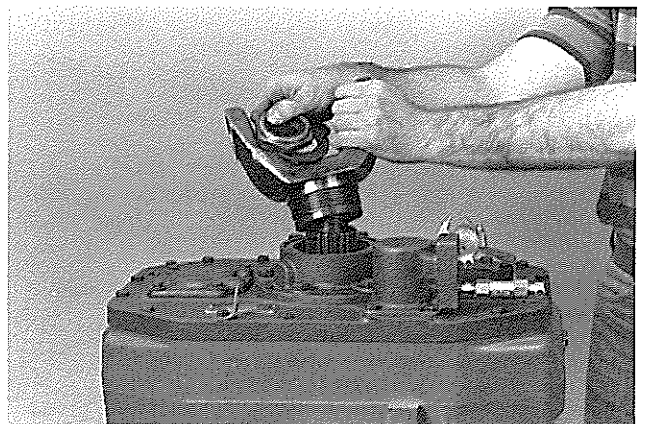
19. Place rear cover o-ring in the counterbore. The Belleville washer assembles with the part number to the rear and secures this o-ring in the cover.



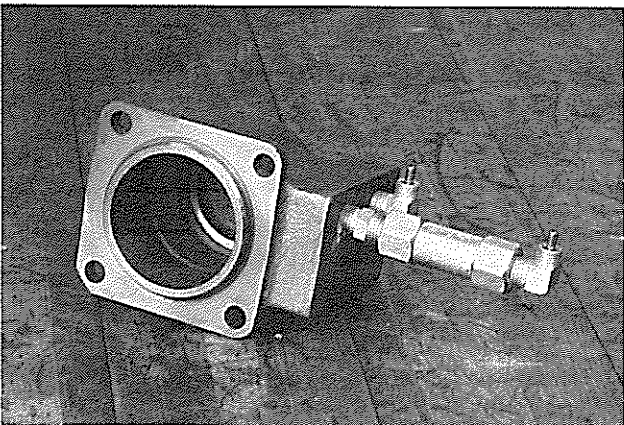
22. Assemble the piston housing and gasket to the cover. Secure with capscrews. Torque 25-32 lbs. ft.



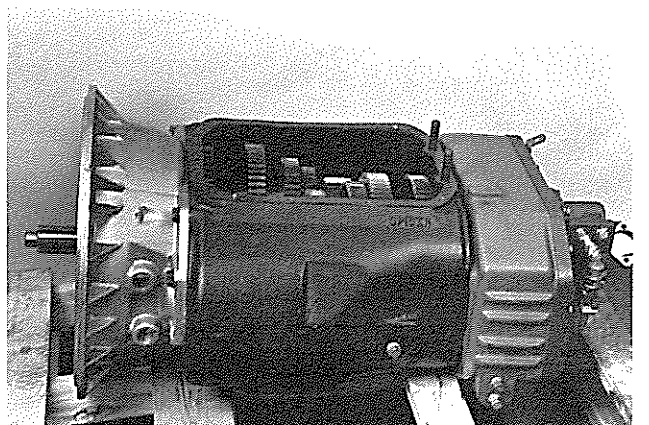
20. Assemble the piston to the shift rod with the piston counterbore facing towards the cover. Secure with locknut. Torque 40-50 lb. ft.



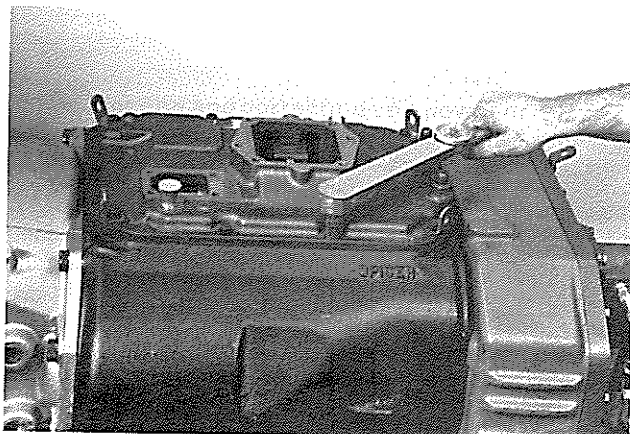
23. Install end yoke, washer and nut. Torque 550-600 lbs. ft.



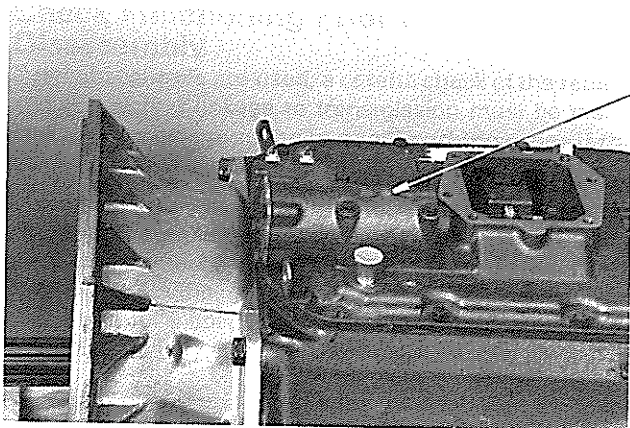
21. The piston or range housing contains an orifice which helps the 3-2 air downshift. This orifice must be assembled with the arrow pointing toward the truck frame rail.



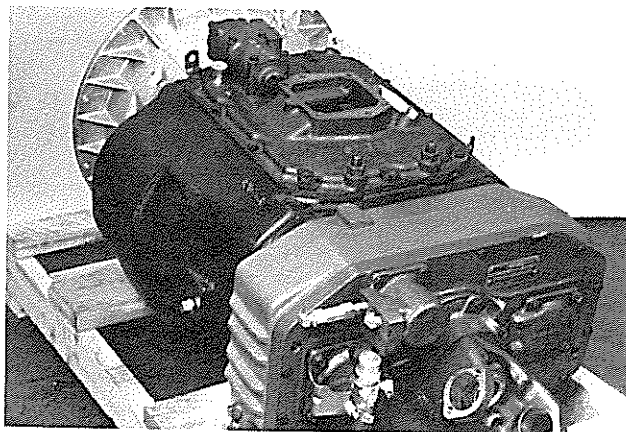
24. Place unit in a horizontal position for shifter housing reassembly.



25. Install gasket and shifter housing being careful to align splitter shoes over splitter collar. Secure with capscrews. Torque 25-32 lbs. ft.



26. Place splitter housing and gasket on shifter housing. Secure with capscrews.



27. This completes the rebuild procedure.

Important Procedure

When locating and correcting unit power or auxiliary transmission troubles, a systematic procedure should be followed.

Road test whenever possible. Mechanics usually get second or third hand reports of trouble experienced with the unit and these reports do not always accurately describe the actual conditions. Sometimes symptoms seem to indicate trouble in the transmission; while, actually the trouble may be caused by the axle, propeller shaft, universal joint, engine or clutch. This is especially true of complaints on noise. Therefore, before removing transmission or related components to locate trouble, always road test to check possibility that trouble may exist in other closely associated units. If the mechanic can drive, road testing will be more effective; however, just riding with the driver can be very informative.

Check Functioning Prior to Disassembly

If remote controls are used, a careful check of the remote and connecting linkage to transmission must be made. The remote unit must be in good working order if the transmission is expected to shift satisfactorily.

Many times the answer to the trouble is apparent when the unit is inspected prior to disassembly, but this evidence is often lost when the parts are separated. If possible, check the unit prior to disassembly. Bear in mind that a careful inspection of the unit should be made as each disassembly step is performed.

Inspect Thoroughly During Disassembly

It is poor practice to disassemble a unit or complete transmission as quickly as possible without bothering to examine the parts as they come down. It happens many times that a mechanic has completely disassembled a unit and failed to find the cause of the trouble because he did not bother to examine the parts as they came apart. After the transmission is disassembled, check the lubricant for foreign particles which often reveal sources of trouble that are overlooked during the disassembly.

Repair or Replace Worn Parts

Many times the parts or critical adjustments that have caused the trouble are not replaced or corrected because the mechanic will only inspect and replace parts that have failed completely. All pieces should be accurately examined because the broken parts are often just the result and not the cause of the trouble. All parts that are broken or worn and no longer meet specifications should be replaced. On large units, like a transmission, it is suggested that a mechanic replace parts that are worn to the extent that they do not have a long service life remaining. This avoids another teardown on the unit in the near future. It is also good practice, at this time, to make the changes or modifications recommended to bring the transmission up to date and increase the service life of the unit.

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Noisy Operation

Noise is usually very elusive and generally not the fault of the transmission; therefore, mechanics should road test to determine if the driver's complaint of noise is actually in the transmission.

In numerous instances, drivers have insisted that the noise was in the transmission, however, investigations revealed the noise to be caused by one of the following conditions:

- (a) Fan out of balance or blades were bent.
- (b) Defective vibration dampers.
- (c) Crankshafts out of balance.
- (d) Flywheels out of balance.
- (e) Flywheels mounting bolts loose.
- (f) Engine rough at idle producing rattle in gear train.
- (g) Clutch assembly out of balance.
- (h) Engine mounts loose or broken.
- (i) Power-take-off engaged.
- (j) Universal joints worn out.
- (k) Propeller shafts out of balance.
- (l) Universal joint angles out of plane or at excessive angle.
- (m) Center bearings in drive line dry, not mounted properly, etc.
- (n) Wheels out of balance.
- (o) Tire treads humming or vibrating at certain speeds.
- (p) Air leaks on suction side of induction system, especially with turbo-chargers.

Mechanics should try to locate and eliminate noise by means other than transmission removal, or overhaul. However, if the noise appears to be in the transmission try to break it down into the following classifications. If possible, determine what position the gear shift lever is in when the noise occurs. If the noise is evident in only one gear position, the cause of the noise is generally traceable to the gears in operation.

- (a) *Growl and humming* or, more serious, a grinding noise. These noises are caused by worn, chipped, rough or cracked gears. As gears continue to wear, the grinding noise will be noticeable, particularly in the gear position that throws the greatest load on the worn gear.
- (b) *Hissing* or, more serious, a thumping or bumping-type noise. Hissing noises can be caused by bad bearings. As bearings wear and retainers start to break up, etc., the noise could change to a thumping or bumping.

- (c) *Metallic rattles* within the transmission usually result from a variety of conditions. Engine torsional vibrations are transmitted to the transmission through the clutch. In heavy duty equipment, clutch discs with vibration dampers are not used, so a rattle, particularly in neutral, is common with diesel equipment. In general, engine speeds should be 600 RPM or above to eliminate objectionable rattles and vibration during the idle. A defective or faulty injector would cause a rough or lower idle speed and a rattle in the transmission. Rattle could also be caused by excessive backlash in P.T.O. unit mounting.
- (d) *Improper lubricants* or lack of lubricant can produce noises. Transmissions with low oil levels sometimes run hotter than normal, as there is insufficient lubricant to cool and cover the gears.

Improved highways permit sustained high speeds. The fact that engines and entire power trains can now cruise at a higher RPM can introduce vibration frequencies, that were not critical in the past. At slower speeds these items would get by or only pass through critical period while accelerating or decelerating through the gears.

In the past, drive line vibrations such as bent tubes, joints out of phase or alignment, bad angles to short couples, clutches out of balance, gears and shafts in transmission out of balance, were fairly obvious. These items will become more critical in vehicles running at sustained high speeds.

Critical vibrations associated with higher speeds are not the old thumping or bumping type but are high frequency vibrations which sting or tingle the soles of your feet, tickle the end of your fingers, etc. This type of vibration will cause gear seizures, broken synchronizer pins, bearing failure due to retainer rivet failures, promote brinelling, fretting corrosion, etc.

- (e) *Gear whine* is usually caused by lack of backlash between mating gears—improper shimming of P.T.O. units is the big offender here.

Noise in Neutral

Possible Causes:

- (a) Misalignment of transmission.
- (b) Worn flywheel pilot bearing.
- (c) Worn, or scored countershaft bearings.
- (d) Worn, or rough reverse idler gear.
- (e) Sprung, or worn countershaft.
- (f) Excessive backlash in gears.
- (g) Worn mainshaft pilot bearing.
- (h) Scuffed gear tooth contact surface.
- (i) Insufficient lubrication.
- (j) Use of incorrect grade of lubricant.

Noise in Gear

Possible Causes

- (a) Worn, or rough mainshaft rear bearing.
- (b) Rough, chipped, or tapered sliding gear teeth.
- (c) Noisy speedometer gears.
- (d) Excessive end play of mainshaft gears.
- (e) Refer to conditions listed under *Noise in Neutral*.

Oil Leaks

Possible Causes

- (a) Oil level too high.
- (b) Wrong lubricant in unit.
- (c) Non-shielded bearing used as front or rear bearing cap. (Where applicable.)
- (d) Seals (if used) defective or omitted from bearing cap, wrong type seal used, etc.
- (e) Transmission breather omitted, plugged internally, etc.
- (f) Capscrews loose, omitted or missing from remote control, shifter housing, bearing caps, P.T.O. or covers, etc.
- (g) Oil drain-back openings in bearing caps or case plugged with varnish, dirt, covered with gasket material, etc.
- (h) Broken gaskets, gaskets shifted or squeezed out of position, pieces still under bearing caps, clutch housing, P.T.O. and covers, etc.
- (i) Cracks or holes in castings.
- (j) Drain plug loose.
- (k) Also possibility that oil leakage could be from engine.
- (l) Speedometer adaptor or connections.

Walking or Jumping Out of Gear

If the units are walking out of gear it could be caused by:

- (a) Interference or resistance in the shift mechanism preventing full engagement of the sliding clutch gear or
- (b) If the gear has been shifted completely into position some other malfunction which could move the gear or the shift itself out of its proper location.

If remote controls are used, the mechanic must satisfy himself that the remote units are satisfactory and that transmission is actually at fault. One other point that should be noted is whether the unit walks out of gear under drive (while pulling a load) or on a coast load. Also, does the gear hop occur on smooth or only on rough roads. A number of items that would prevent full engagement of gears are:

- (a) Improperly positioned forward remote control which limits full travel forward and backward from the remote neutral position.
- (b) Improper length shift rods or linkage that limits travel of forward remote from neutral position.
- (c) Loose bell cranks, sloppy ball and socket joints.
- (d) Shift rods, cables, etc., too spongy, flexible, or not secured properly at both ends.
- (e) Worn or loose engine mounts if forward unit is mounted to frame.
- (f) Forward remote mount too flimsy, loose on frame, etc.
- (g) Set screws loose at remote control joints or on shift forks inside remote or even inside transmission unit.
- (h) Shift fork pads or groove in sliding gear or collar worn excessively.
- (i) Worn taper on gear clutch teeth.
- (j) Transmission and engine out of alignment either vertically or horizontally.

A few items which could move the gear or shaft out of proper position, particularly on rough roads are:

- (a) Use of heavy shift lever extensions.
- (b) Shift rod poppet springs broken.
- (c) Shift rod poppet notches worn.
- (d) Shift rod bent or sprung out of line.
- (e) Shift fork pads not square with shift rod bore.
- (f) Excessive end-play in drive gear, mainshaft or countershaft, caused by worn bearings, retainers, etc.
- (g) Thrust washers worn excessively or missing.

Hard Shifting

An improperly operating clutch will interfere with the proper shifting of gears in any transmission. It is important that the hydraulic, air or similar release mechanism (if used), also be used in proper working order. If the mechanic is sure that a full and complete clutch release is being made, the following could be a few of the possible causes for hard shifting complaints:

- (a) No lubricant in remote control units. Forward remote is isolated and is often overlooked. However, many remote controls used on transmissions and auxiliaries require separate lubrication.
- (b) No lubricant in (or grease fittings on) U-joints or swivels of remote controls.
- (c) Lack of lubricant or wrong lubricant used, causing buildup of sticky varnish and sludge deposits on splines of shaft and gears.
- (d) Badly worn or bent shift rods.
- (e) Improper adjustment on shifter linkage.
- (f) Sliding clutch gears tight on splines of shaft.
- (g) Clutch teeth burred over, chipped or badly mutilated due to improper shifting.
- (h) Binding or interference of shift lever with other objects or rods inside the cab or near the remote control island.
- (i) Driver not familiar with proper shifting procedure for this transmission. Also includes proper shifting if used with 2-speed axle, auxiliary, etc.
- (j) Clutch or drive gear pilot bearing seized, rough, or dragging.
- (k) Clutch brake engaging too soon when clutch pedal is depressed.
- (l) Wrong lubricant especially if E.P. type lubricant are added.
- (m) Free running gears, seized or galled on either the thrust face or diameters.

Sticking in Gear

- (a) Clutch not releasing—also check remote units such as hydraulic or air assist, etc. Note: On some units employing a full air control for clutch release, air pressure of approximately 60 lbs. or more must be secured before clutch can be released. *Do not leave these vehicles parked in gear.*
- (b) Sliding clutch gears tight on splines.
- (c) Chips wedged between or under splines of shaft and gear.
- (d) Improper adjustment excessive wear or lost motion in shifter linkage.
- (e) Clutch brake set too high on clutch pedal—locking gears behind hopping guard.

Bearing Failures

The service life of most transmissions either main or auxiliaries is governed by the life of the bearings. Majority of bearing failures can be attributed to vibration and dirt. Some of the more prominent reasons for unit removal with bearing failures are:

- (a) Worn out due to dirt.
- (b) Fatigue of raceways or balls.
- (c) Wrong type or grade of lubricant.
- (d) Lack of lubricant.
- (e) Vibrations—breakup of retainer & brinelling of races—fretting corrosion.
- (f) Bearings tied-up due to chips in bearings.
- (g) Bearings set-up too tight or too loose.
- (h) Improper assembly—brinelling bearing.
- (i) Improper fit of shafts or bore.
- (j) Acid etch of bearings due to water in lube.
- (k) Overloading of vehicle. Overload from engine or engine too large for transmissions used.

Dirt

More than 90% of all ball bearing failures are caused by dirt which is always abrasive.

Dirt may enter the bearings during assembly of the units or be carried into the bearing by the lubricant while in service. Dirt may enter through seals, breather or even dirty containers used for addition or change of lubricant.

Softer material such as dirt, dust, etc., usually forms abrasive paste or lapping compounds within the bearings themselves since the unit pressure between the balls and raceways makes a perfect pulverizer. The rolling motion tends to entrap and hold the abrasives. As the balls and raceways wear, the bearings become noisy. The lapping action tends to increase rapidly as the fine steel from the balls and rollway adds to the lapping material.

Hard coarse materials such as chips, etc., may enter the bearings during assembly from hammers, drifts, power chisels, etc., or be manufactured within the unit during service from raking teeth, etc. These chips produce small indentation in balls and races. Jamming of these hard particles between balls and races may cause the inner face to turn on shaft, or the outer race to turn in the housing.

Fatigue

All bearings are subject to fatigue and must be replaced eventually. Your own operating experience will dictate mileage replacement of bearings showing only normal wear.

Corrosion

Water, acid and corrosive materials formed by deterioration of lubricant, will produce reddish-brown coating and small etched holes over outer and exposed surfaces of race. Corrosive oxides also act as lapping agent.

Brinelling caused by improper assembly or removal—usually hammering with off-center blows. Use drivers, preferably under an arbor, or pullers.

Shaft Fits

Excessive looseness under load is very objectionable because it produces a creeping or slipping of the inner ring on the rotating shaft. This causes the surface metal of shafts to scrub or wear off.

Bearing fits on rotating shafts are usually specified as tight. When play or looseness, even .001", exists between the bearing and shaft, there is a very powerful force tending to rotate the inner race on the shaft; this force is caused by the looseness or lost motion between the parts and disappears when no looseness exists.

Removal of Bearings

It is far more difficult to remove bearings from a shaft than to put them on. In most cases it is necessary to remove the bearing by pulling on the outer-race which can damage the balls or races. Since such damage is seldom visible, it does not become known until after complete reassembly. It is good preventative maintenance to replace most ball bearings during the overhaul period. If a bearing is not going to be replaced, avoid removal during low mileage rebuild.

Interchangeability

All ball bearings (whether manufactured here or abroad) are interchangeable in regard to—standardized dimensions, tolerances and fits. However, for a given shaft size there are standard bearings for light, medium, and heavy-duty service.

Numbers and symbols stamped on inner and outer races of bearings designate size and type.

Numbering systems of different bearing manufacturers, however, have not been standardized. Consult interchangeable tables and use proper bearings for replacement parts.

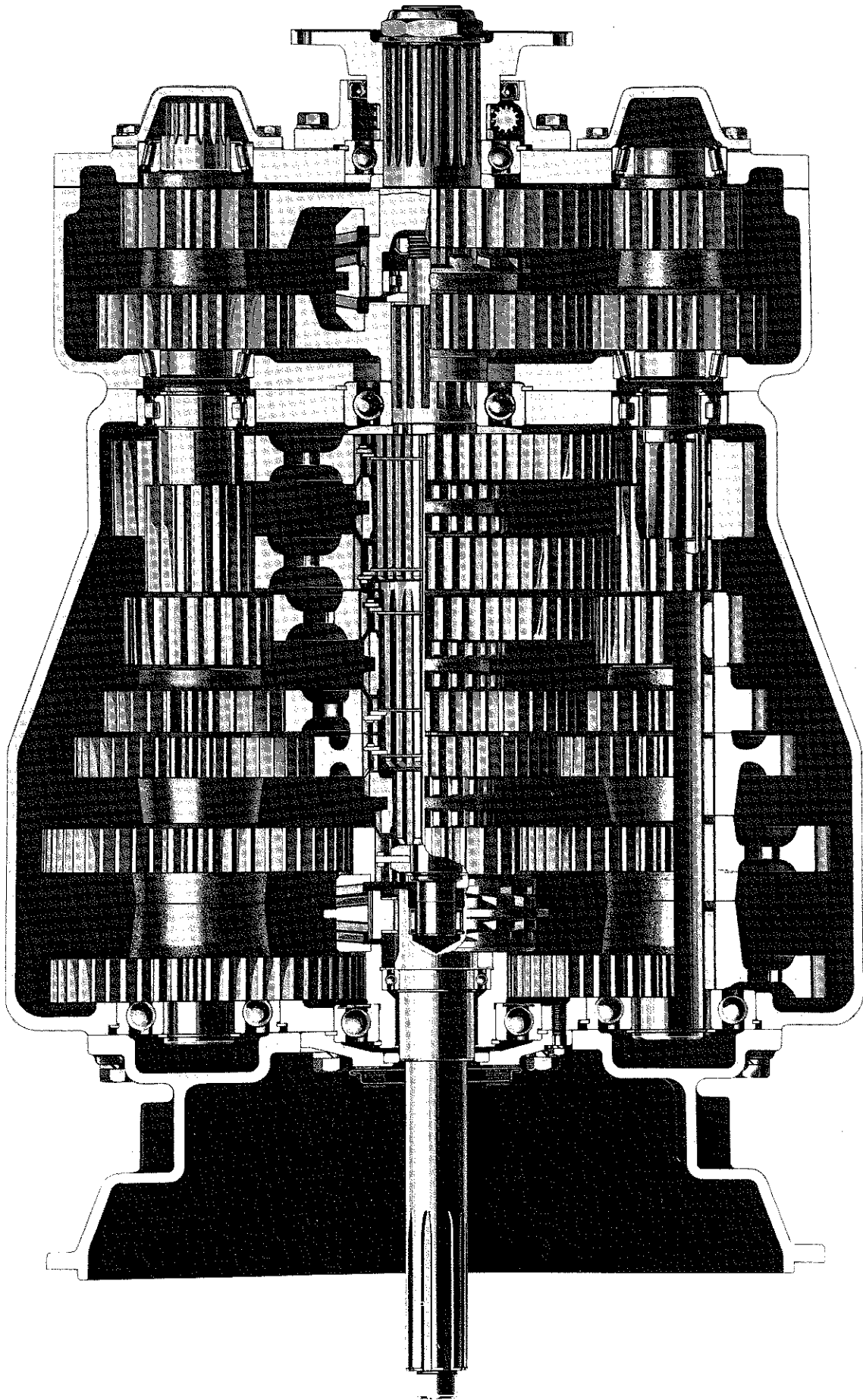
Clutch Trouble Shooting

Faulty clutch operation interferes with proper shifting of gears in any transmission. For complete information on Spicer Heavy Duty Clutches, refer to Bulletins No. 1302 and 1303. If a clutch other than a Spicer is used with this transmission, refer to the manufacturer's service manual for correct adjustment, maintenance, etc. The two following paragraphs describe the most common problems encountered with Spicer clutches.

- (a) If the clutch slips or does not engage properly, first check the internal clutch adjustment. If adjustment does not remedy the situation, check for weak pressure springs, no free pedal, worn or oily clutch facings and binding release mechanism.
- (b) If the clutch drags or does not release properly, check the internal clutch adjustment. Some other causes for clutch drag are: intermediate plate sticking on drive pins or drive lugs; pressure plate not retracting; driven disc distorted or warped; splines worn on main drive gear of transmission; clutch release bearing damaged; bushing in release sleeve dragging on transmission drive gear.

NOTE

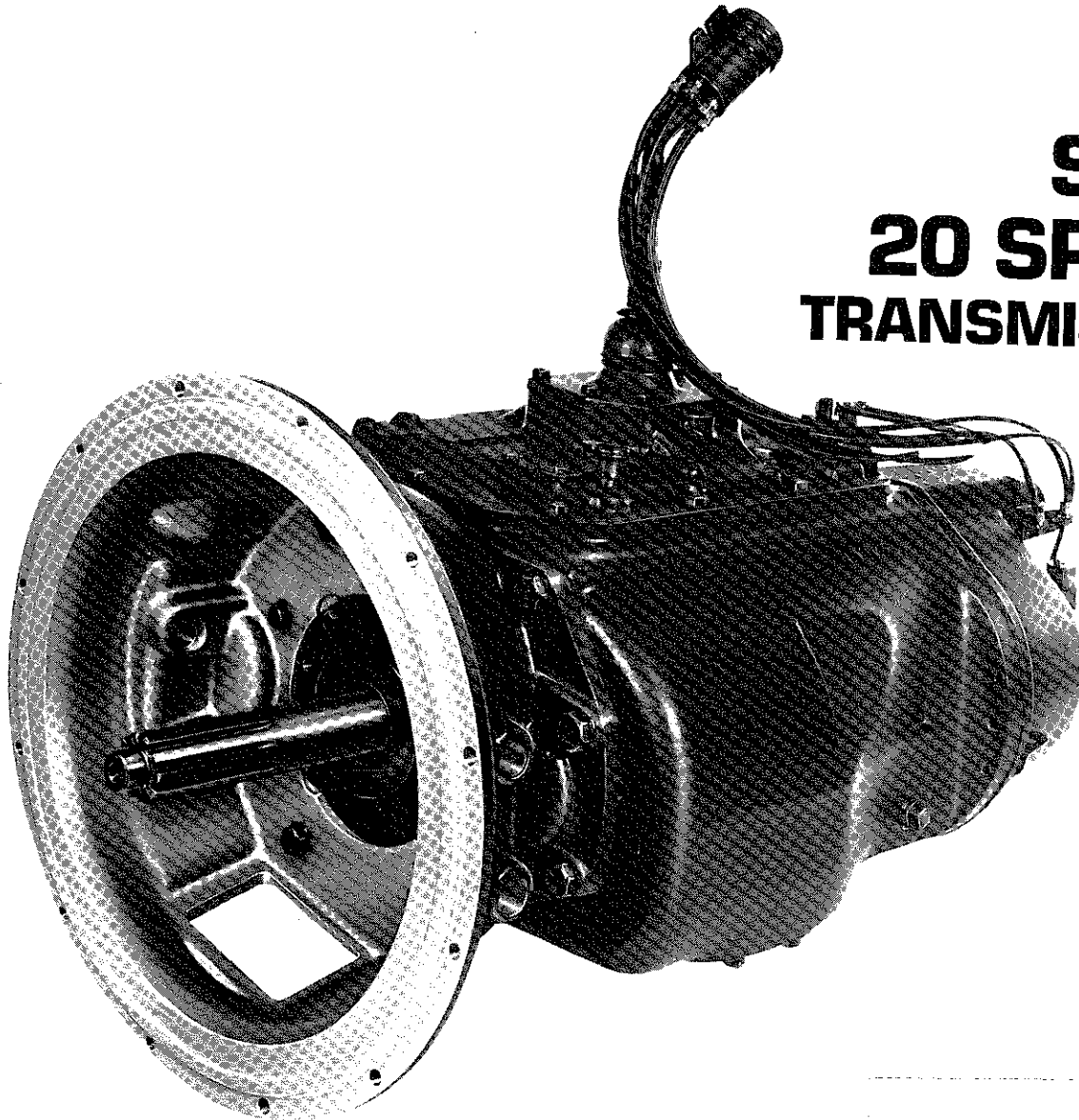
See Transmission Installation Section of clutch manual for information on making the internal clutch adjustment to Spicer Heavy Duty Clutches.



SPICER MODEL 1420

SERVICE MANUAL SUPPLEMENT
SPICER®
HEAVY DUTY

SST-2
20 SPEED
TRANSMISSION



**WHEN SERVICING A MODEL 1420-3B
TRANSMISSION, THIS SUPPLEMENT
SHOULD BE USED IN CONJUNCTION WITH
SPICER SERVICE MANUAL 2352**



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1-800-401-9866

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In October 1982 the 1412-3A transmission was replaced by the 1420-3B model. The major revision was the addition of a mainshaft gear and the mating countershaft gears. This supplement covers not only the internal changes, new gear ratios and recommended shift pattern, but also provides conversion kit information. For detailed tear-down/rebuild procedures refer to Spicer Service Manual 2352.

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SPECIFICATIONS

General Application Guidelines

GCW Range:	80,000 lbs. and above
HP Range:	300-475 HP
RPM Range:	1800-2100 RPM
Engine Types:	Conventional High Torque Rise

Top Geared MPH Chart

11.00R22.5 (499 rev/mile)				11.00R24.5 (477 rev/mile)		
Governed RPM			Axle Ratio	Governed RPM		
1800	1950	2100		1800	1950	2100
60.7	65.8	70.8	4.63	63.5	68.8	74.1
57.6	62.4	67.2	4.88	60.3	65.3	70.3
53.1	57.6	62.0	5.29	55.6	60.2	64.8
45.6	49.4	53.1	6.17	47.7	51.6	55.6

Specifications for Model 1420-3B

Speeds10 Off Highway/12 On-Highway/4 Reverse

Torque Capacity950-1400 lbs. ft. (1290-1896 nm)

Length*34-13/16" (884.2 mm)

Weight**734 lbs. (333 kg.)

Clutch HousingSAE No.'s 1 or 2 — both available with nodal amount

Clutch14" or 15-1/2" (356.6 or 393.7mm) — 2-plate

Yoke or Flange1710, 1760, 1810 series

Drive Gear2" standard

Oil Capacity30 pints (14.2 litres) at 0° installation

Power Take OffStandard 6 bolt right side and 8 bolt left side.
Chelsea® PTO application bulletin 1033.

Countershaft PTO provision standard on right side,
optional on left or on both countershafts.
Chelsea PTO application bulletin 1033.

For PTO speeds refer to Spicer Transmission
condensed specifications bulletin 2212.

* From bell housing facing to end of splines on output shaft.

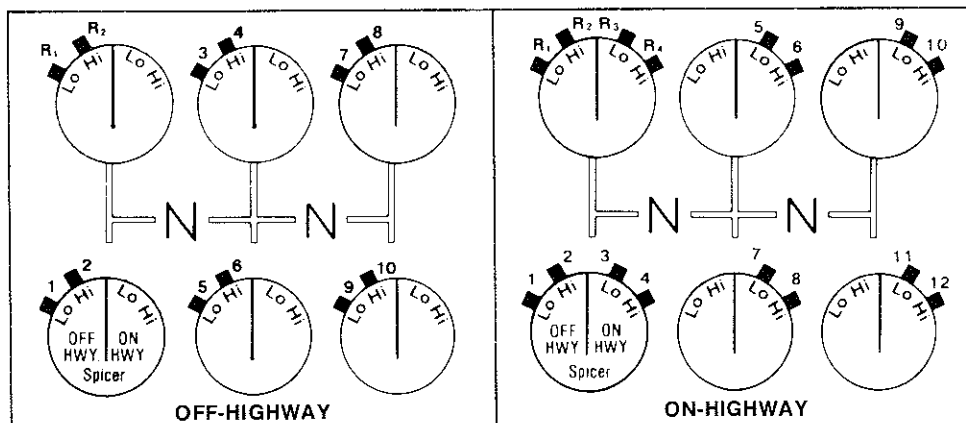
** Iron case, aluminum bell, aluminum center control shifter housing. Add 40 lbs. (18 kg) for iron clutch housing. Add 22 lbs. (10 kg) for iron forward control shifter housing.

Gear Ratios

Gear	Ratio	% Step
Off-Highway		
1	15.05	30
2	11.60	35
3	8.59	30
4	6.62	34
5	4.93	30
6	3.79	31
7	2.89	30
8	2.23	31
9	1.70	30
10	1.31	
On-Highway		
1	15.05	30
2	11.60	30
3	8.86	30
4	6.83	35
5	5.06	30
6	3.90	34
7	2.90	30
8	2.23	31
9	1.70	30
10	1.31	31
11	1.00	30
12	.77	

Reverse: 15.05, 11.60, 8.86,
6.83

Spicer Model 1420-3B Shift Pattern

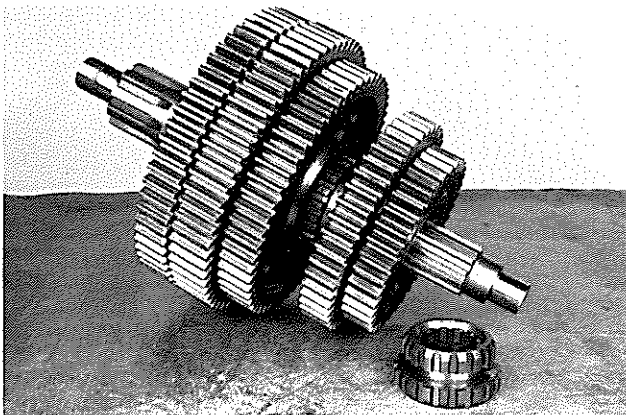


FRONT CASE GEARS

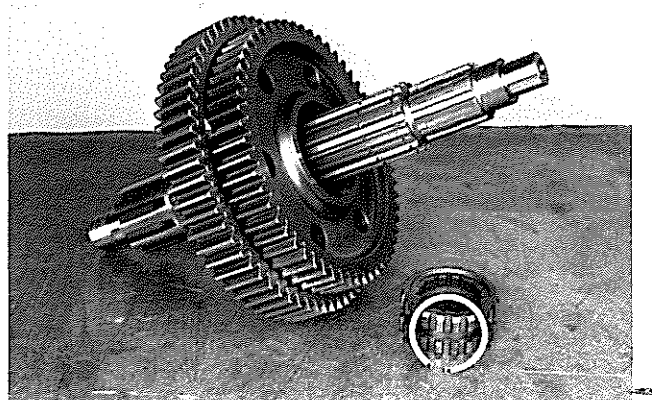


INTERNAL CHANGES

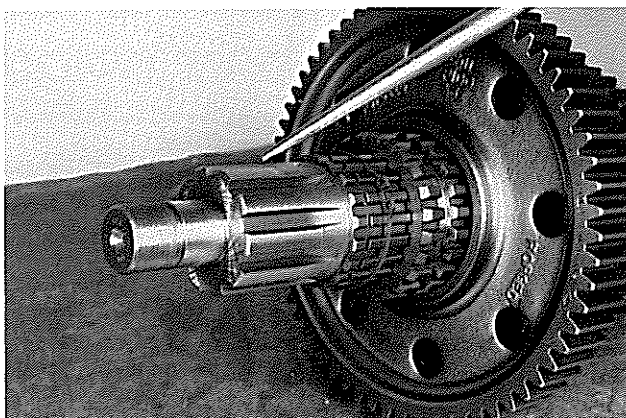
MAINSHAFT & COUNTERSHAFT



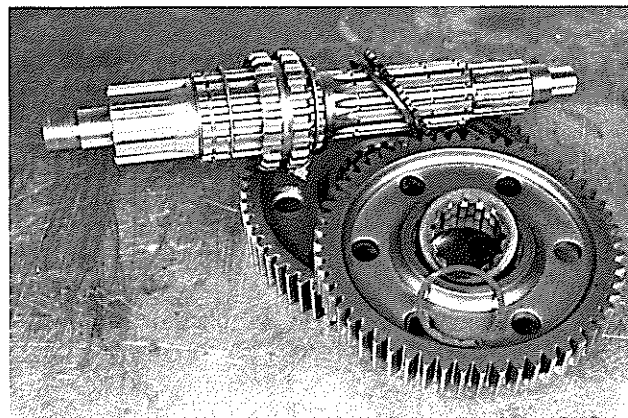
1. Begin the disassembly by removing the clutch collar.



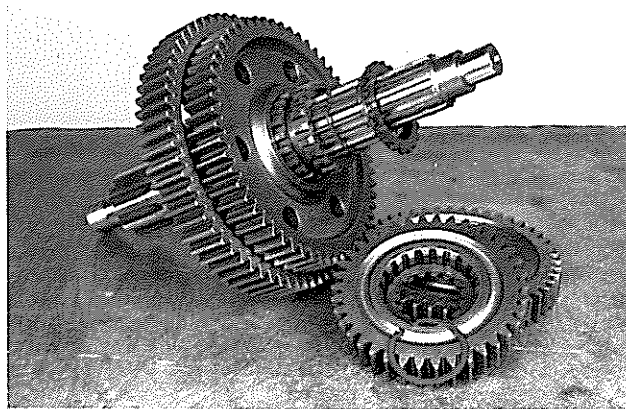
4. Remove the next mainshaft snap ring and the clutch collar.



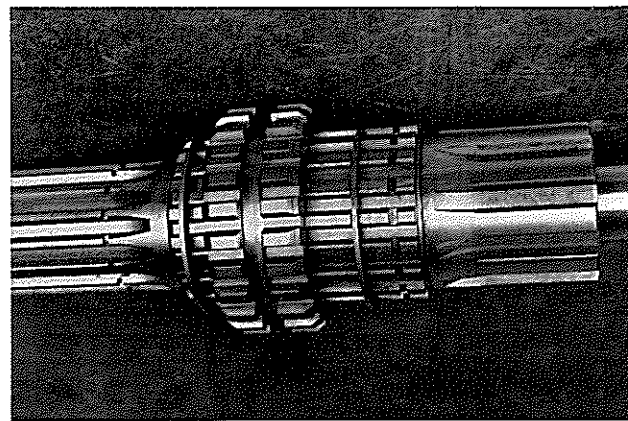
2. After removing the reverse gear, you'll notice that this section of the mainshaft is identical to the 1412. The clutch collar and 1st speed gear are different.



5. After removing another mainshaft snap ring both gears may be lifted from the shaft.

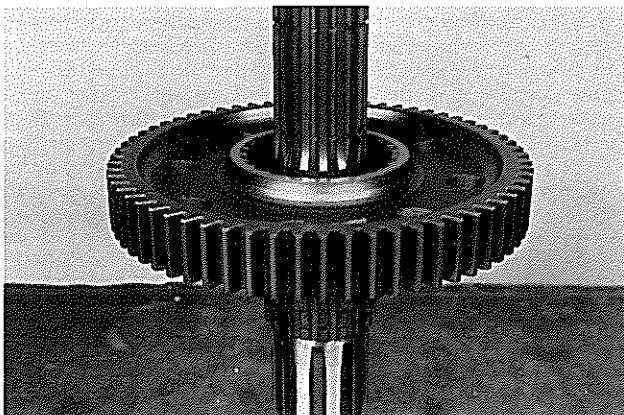


3. Remove the mainshaft snap ring. Lift both gears complete with thrust washers from the mainshaft.

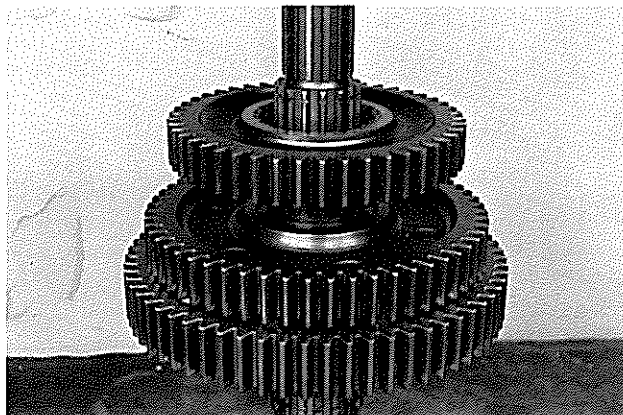


6. All that remains is the 1st-reverse clutch collar. This collar is a two-way collar unlike the one-way version of the 1412.

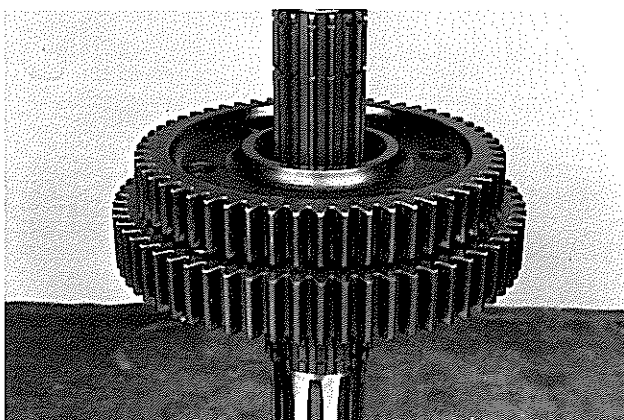
INTERNAL CHANGES MAINSHAFT & COUNTERSHAFT



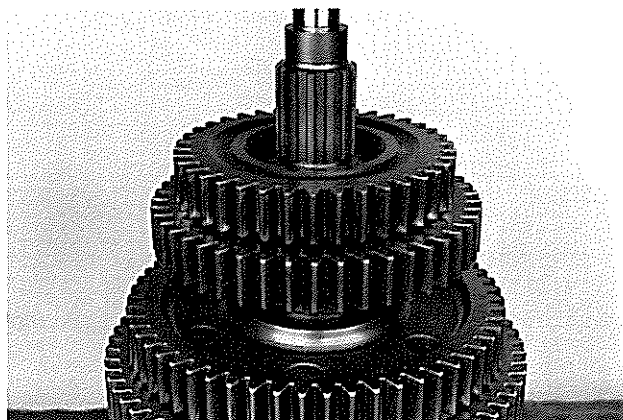
7. Reassembly begins by placing the 1st-2nd speed gear on the mainshaft, complete with thrust washers.



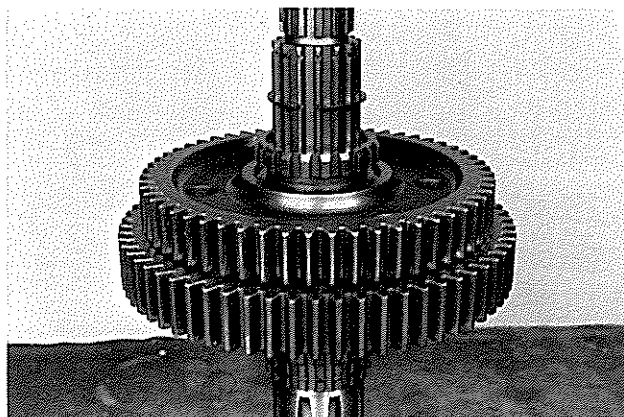
10. Install the 5th-6th speed gear.



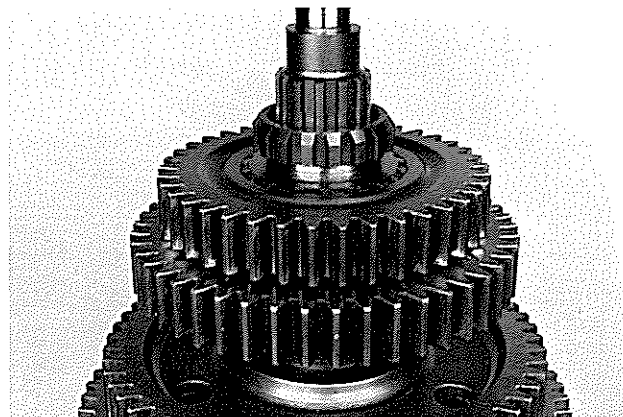
8. The 3rd-4th speed gear should be assembled with the ground hub down. Secure with a mainshaft snap ring.



11. Place the 7th-8th speed gear onto the mainshaft with the ground hub down and secure with a snap ring.

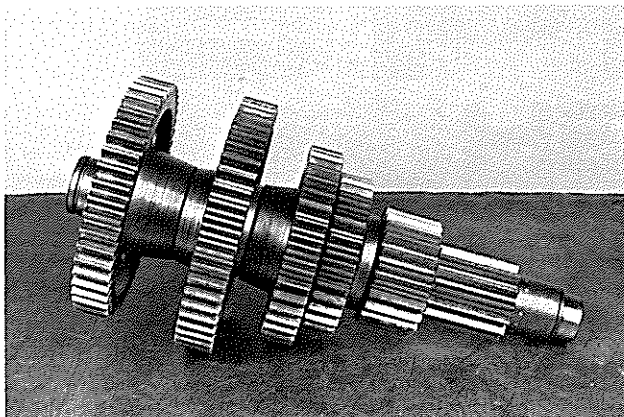


9. Slide the clutch collar onto the mainshaft and secure with a snap ring.

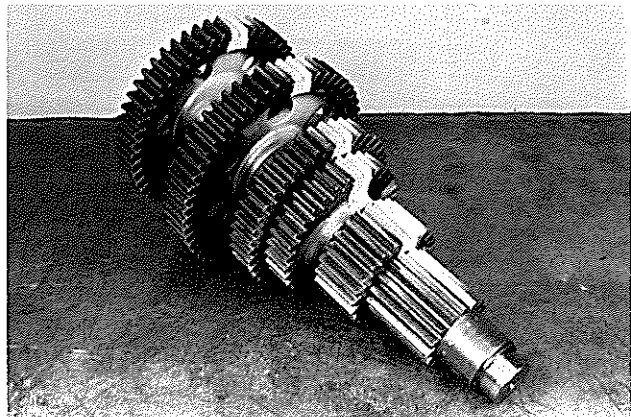


12. Install the remaining clutch collar.

INTERNAL CHANGES MAINSHAFT & COUNTERSHAFT



13. This view shows an additional gear when compared to the 1412 model.



14. As always, it is advisable to paint the teeth on each gear as it aligns with the timing mark on the head end gear. This procedure facilitates reassembly.

CONVERSION KIT

A kit to convert a 1412-3A into a 1420-3B has been released as Part Number 313490-1X. This kit consists of:

Quantity	Part Number	Description
1	2790	Air Ctl. diagram
1	312475-35X	Gasket Kit
1	313210X	O'Ring Kit
1	97-465-24	Clutch Collar (1 thru 4 & Reverse)
1	97-465-21	Clutch Collar (5 thru 8)
4	312526-2	Connector
4	500714-1	Reducer Bushing
1	SD-SST 10+2	Shift Decal
1	SD-SST 20	Shift Decal
4	545025-3	Elbow
1	97-8-113	Mainshaft 1st Gear
1	97-8-127	Mainshaft 5-6 gear
2	97-196-17	Countershaft 5-6 Gear
2	500010-8	Key
1	97-381-4	Snap Ring
1	97-381-1	Snap Ring
1	98-381-2	Snap Ring
1	94-420-5-1	Tubing
1	330730	Thrust Washer
1	330814	Thrust Washer



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