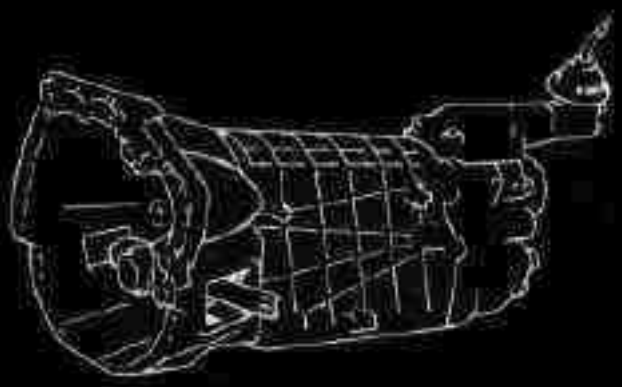
124 Spider
Spider 2000



click on transmission to continue

Five - Speed Transmission

Fiat Motors of North America, Inc.

124 Spider
Spider 2000

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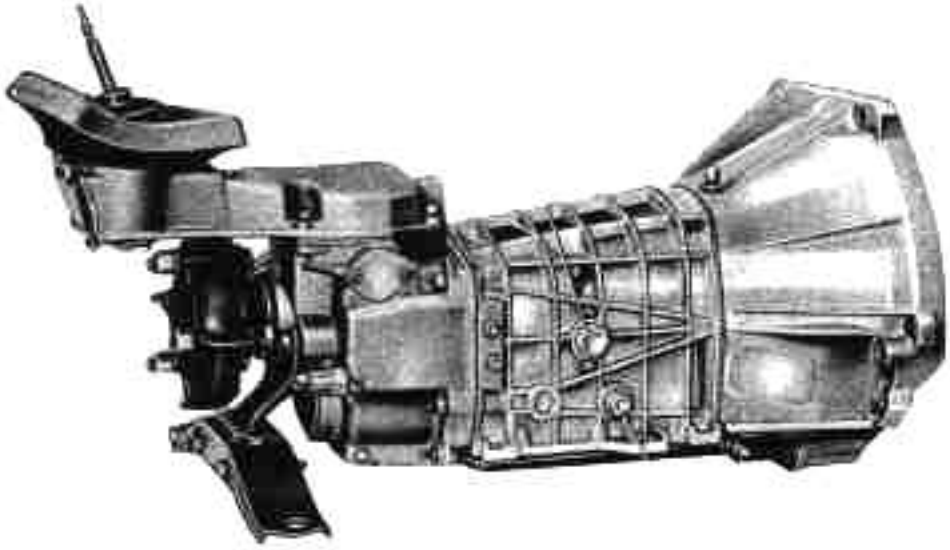
INTRODUCTION

This manual contains information on the 5-speed transmission as used in the Fiat 124 Spider and Spider 2000. The manual has physical description, operation, disassembly, inspection and repair, and reassembly procedures required for transmission maintenance.

Much of the art used (exploded views) is similar to the art used in the parts catalog. This will aid the reader when ordering replacement parts.



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DIMENSIONAL DATA

Speeds .....five forward and reverse

Synchronizers: slip ring, inverted cone type .....1 st - 2nd - 3rd - 4 th gear
snap ring
..... 5 th gear

Geartype: forward .....constant mesh, helical toothed
reverse
.....straight toothed

Gear ratios: first .....3.667 to 1
second .....2.100 to 1
third .....1.361 to 1
fourth .....1 to 1
fifth .....0.881 to 1
reverse .....3.626 to 1

Gear lash - inch - (mm)
.....0.004 (0.10)

Ball bearing radial play, max. limit - inch (mm)
.....0.002 (0.06)

Ball beating end play, max. limit - inch (mm)

.....0.0020 (0.60)

Max. allowable shaft misalignment - inch (mm) 0.002 (O.06)

Clearance between 1st gear and bushing and between 2nd-3rd gears and seats on mainshaft - inch (mm) ..... 0.002 to 0.004 (0.05 to 0. 10)

0.002 to 0.004

Clearance between reverse shaft and gear bushing - inch (mm).....(0.06 to 0. 10)

FILL-UP DATA

LUBRICANT	QUANTITY dm3	Kq	
U.S. units			
SAE 90 (not EP) containing antiwear additives	1.6	1.50	1 3/4qts

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TORQUE SPECIFICATIONS

DESCRIPTION	Thread (metric)	Material	Torque N m	Torque Ib ft
Detent spring cover bolt	M 8	R 80 Znt	25	18
Transmission case-to-bellhousing nut	M 10 x 1.25	R 80 Znt	49	36
Transmission case-to-bellhousing nut	M 8	R 50 Znt (Stud R 80 Znt)	25	18
Rear housing nut	M 8	R 50 Znt (Stud R 80 Znt)	25	18
Countershaft rear bearing nut	M 18 x 1.5	C 40 Rct R 60 + 70 (Shaft 20 Ncd 2 Fosf Lub)	118	87
Propeller shaft yoke-to-mainshaft nut	M 20 x 1	R 50 Znt (Shaft 20 Ncd 2 Fosf Lub or 19 U5 Fosf Lub)	147	108
Countershaft front bearing bolt	M 12 x 1.25	R 80 Znt	93	69
Shift fork bolt M 6	M 6	R 100	18	14
Dog-to-selector shaft bolt	M 6	R 100	18	14
Gear lever support bolt	M 8	R 80 Cdt	20	14
Inner cup-to-gear lever lower self -locking nut, type S	M 8	R 50 Cdt (Stem 12 Nc 3)	13	11

TOOL EQUIPMENT

The following is a list of tools used to service the transmission. Although only the * tools are required, all will aid to lessen work time.

Tool No. Description

A.50113 Wrench, transmission oil draining plug
A.55087 Wrench, transmission casing oil level plug
A.55130 Adapter, flexible joint yoke tightening - use with torque wrench
A.57051 Wrench, rear cover oil drain plug
A.70159* Remover and installer, snap ring on main shaft
A.70166* Installer, 5th-speed synchronizer snap ring
A.70350* Remover and installer, spring washer on input shaft
A.71001/19 Support for fixing transmission to stand Ar. 22204, during overhaul
A.74140/1 Pliers for staking countershaft nut
A.74140/4 Staking heads (pair), (use with A.74140/1) countershaft nut

PHYSICAL

(See cutaway view)

The transmission is conventional (mainshaft meshed with countershaft), with five forward and one reverse gear. The constant-mesh, helical type forward gears are silent and synchronized for quick engagement. Reverse is a spur gear. The transmission is in four parts: the bellhousing, main case, rear housing, and shift tower.

The bellhousing is attached to the main case, is used to attach the transmission to the engine, and contains the clutch and throwout bearing.

The main case contains:

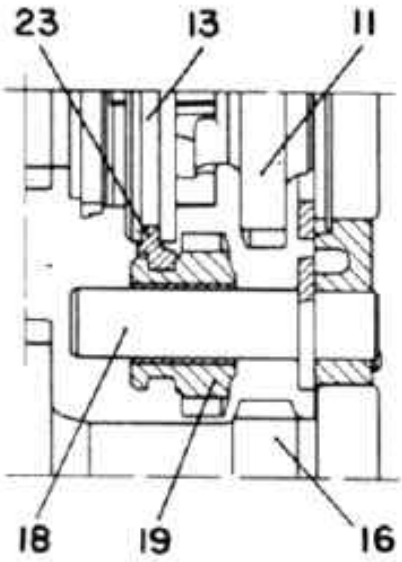
- the input shaft assembly.
- the main shaft assembly.
- the countershaft (sometimes called cluster gear or laygear).
- the first and second shift fork, third and fourth shift fork, and fork shafts for all speeds.
- the detent balls, dowels, and springs.
- the reverse switch.
- oil fill and drain plugs.
- inspection cover (oil removed).- two ball bearings for the main shaft, one double row ball bearing, and one roller bearing for the countershaft.

The rear housing contains the fifth and reverse gears, reverse shaft, fifth and reverse shift fork, main shaft rear bearing, and engaging lever. It is attached to the main case, and serves as the mounting for the shift tower. A rear supporting cross strut is also attached to the rear housing.

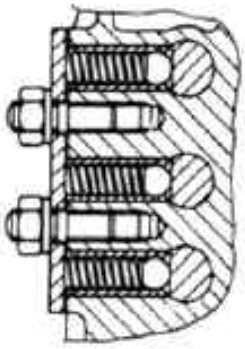
The shift tower contains a sliding shaft. At the front end is a dog that engages the engaging lever in the rear housing. At the rear end of the shaft is mounted a spherical bearing. Through the spherical bearing is mounted the shift lever.

MANUAL 5 - SPEED GEARBOX

Reverse-cone free-ring synchro-mesh on first-second-third and fourth gears and spring ring on fifth gear

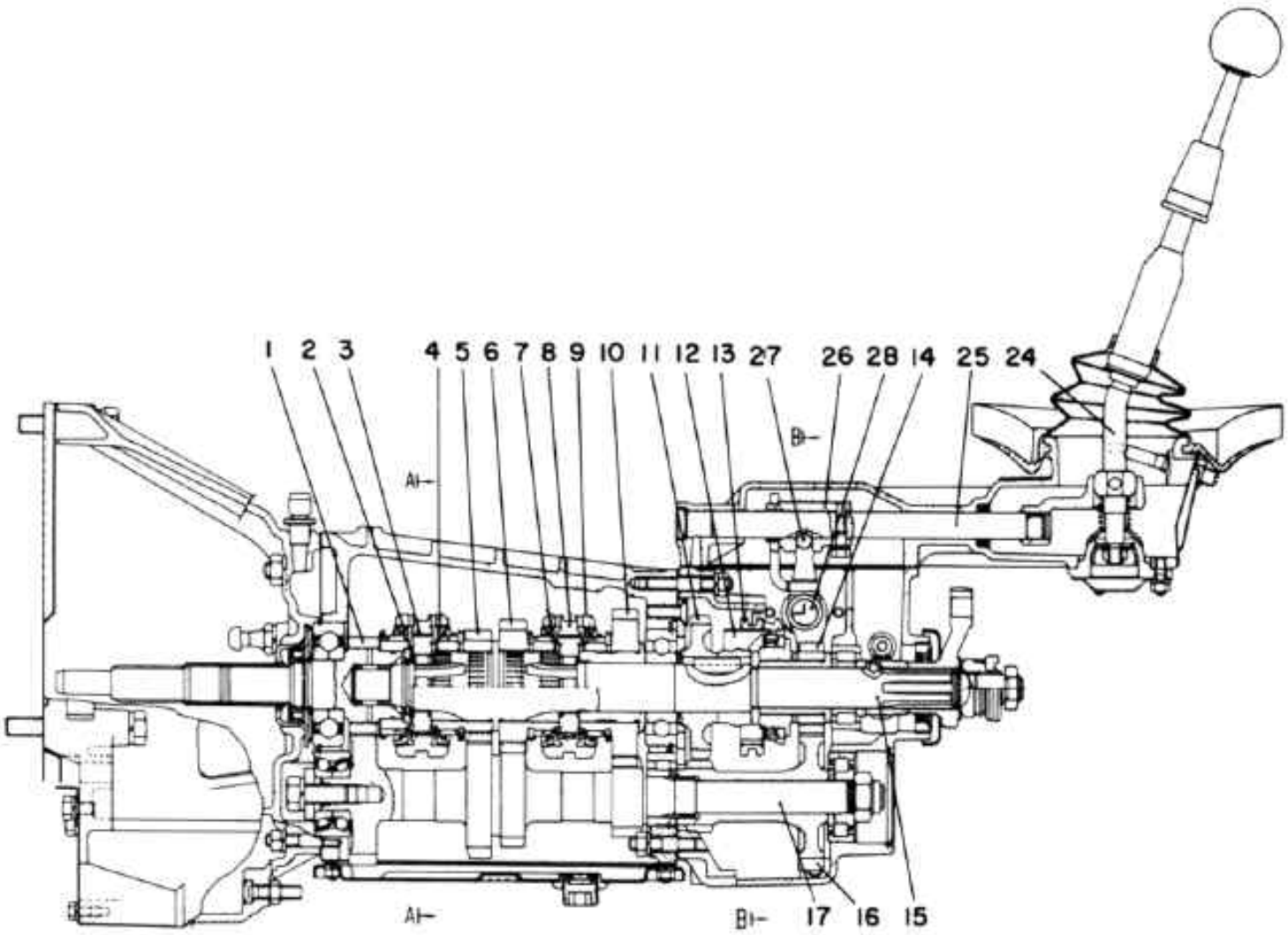


Section through the gear locking springs



Section facing reverse gearshaft and cogs

Section through the gear locking springs



Longitudinal section through the 5-speed gearbox

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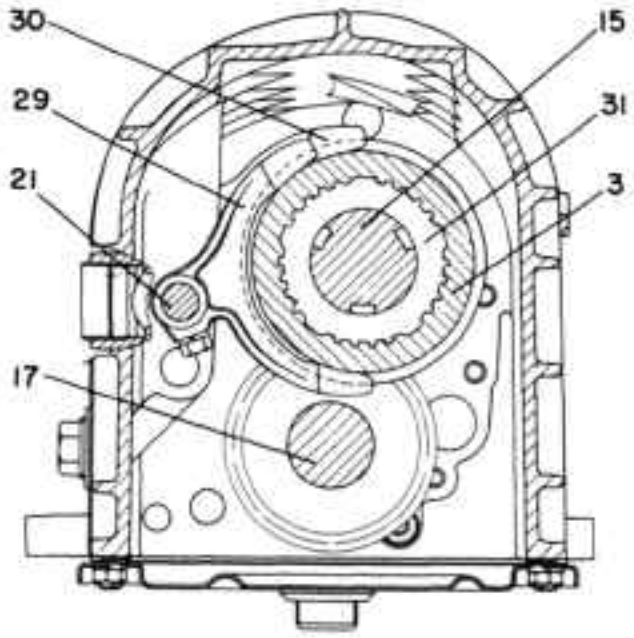
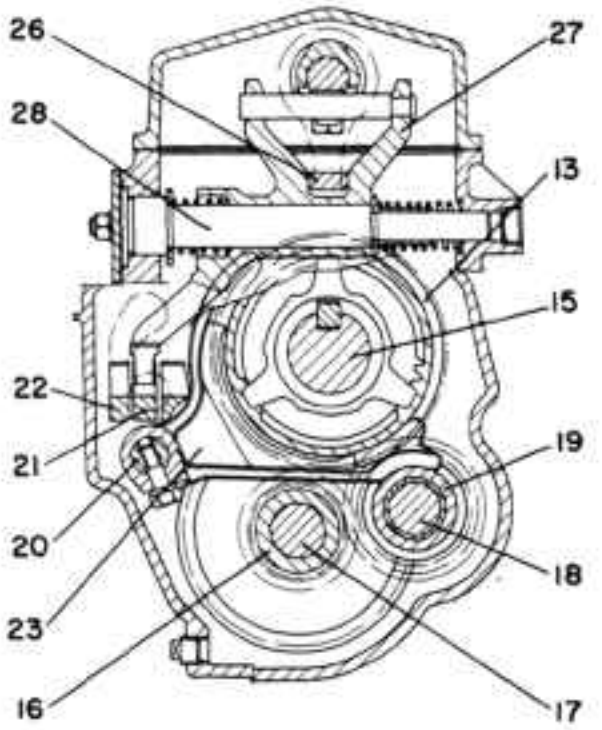
Description



Cross-section A-A - Transversal section through third and fourth gear sliding sleeve



Cross-section B-B - Transversal section through fifth gear control and gear lever support

1 . Input shaft (with fourth gear cogs)
2. Fourth gear synchro
3. Third/fourth sleeve
4. Third gear syncro
5. Third gear
6. Second gear
7. Second gear synchro
8. First/second sleeve
9. First gear synchro
10. First gear
11. Reverse gear
12. Hub
13. Fifth gear sleeve
17. Countershaft
18. Reverse sliding gear shaft
19. Reverse sliding gear
20. Fifth and reverse fork shaft
21. Third and fourth fork shaft
22. First and second fork shaft
23. Fifth and reverse shift fork
24. Shift lever
25. Skiing shaft
26. Dog
27. Gear selection and engaging lever
28. Engaging lever rod
29. Third and fourth shift fork

14. Fifth gear assernbly
15. Main shaft
16. Fifth and reverse gear
30. First and second shift fork
31. Hub

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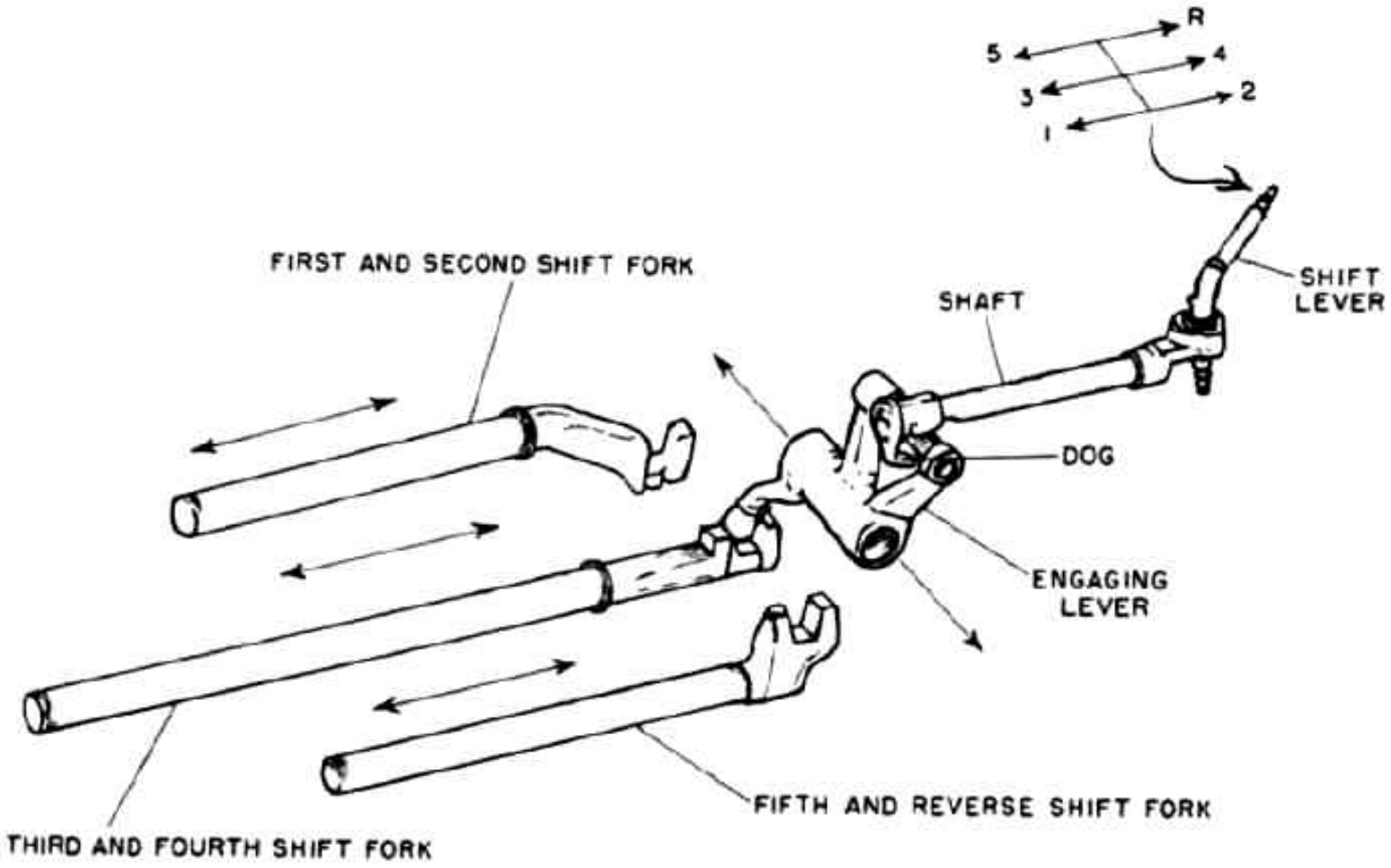
OPERATION

Shift Mechanism (See Shift Mechanism Figure)

When the driver moves the shift lever from side to side, the shaft in the shift tower is rotated about its axis. The dog at the front end of the shaft contacts the engaging lever and moves it from side to side. The knob on the engaging lever is then moved to one of the three shift forks. Once the shift fork is selected, the shift lever is moved either forward or backward, causing the fork shaft to move forward or backward.

Attached to the fork shaft are the shift forks which are used to engage the gears.

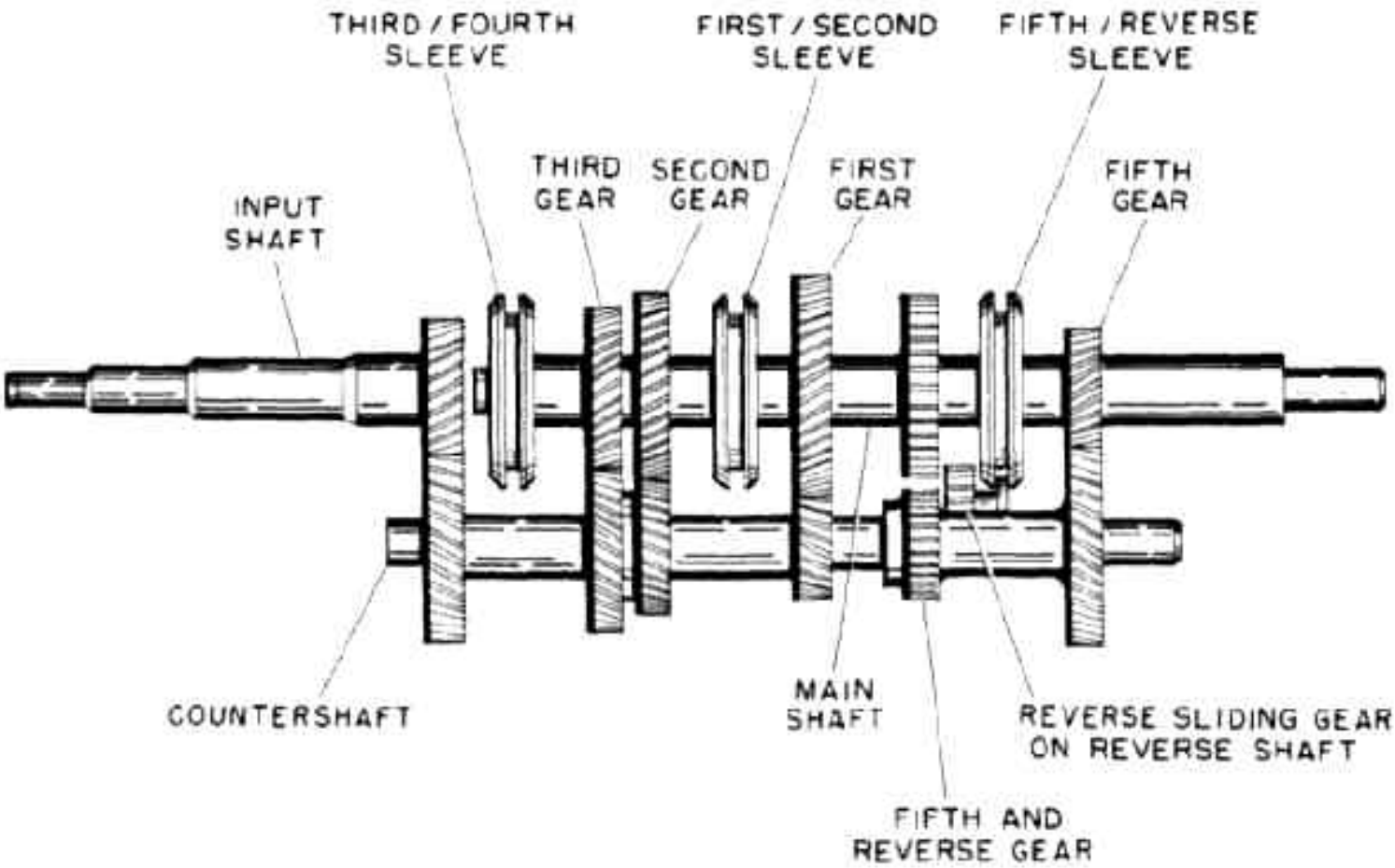


Shift Mechanism

Neutral (See Transmission Gear Identification, Neutral Position Figure)

The referenced figure is a schematic view of the 5-speed transmission in neutral position. Motion from the engine is transferred through the clutch, to the input shaft. The gear on the input shaft transfers the motion to the countershaft. Each gear on the countershaft transfers motion to its mating gear on the main shaft.

Each pair of mating gears (first/second and third/fourth) on the main shaft share a sleeve that is keyed to and turns with the main shaft. Between the sleeve and each gear is a synchro used to synchronize sleeve and gear speeds for easy engagement. Each sleeve has inner teeth that engage with crown teeth machined on the forward gears. In neutral position, all three sleeves are disengaged from the forward or reverse gears. With no sleeves engaged, all gears are free wheeling. Only the reverse sliding gear does not turn.



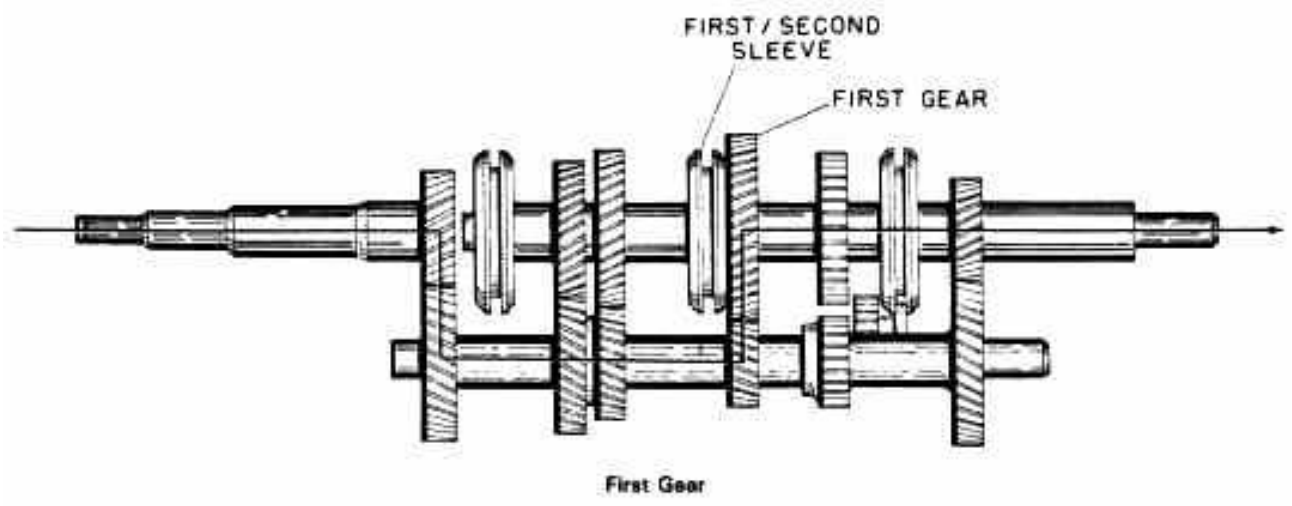
Transmission Gear Identification, Neutral Position

First Gear (See First Gear Figure)

When the shift lever is placed in first position, the first/second sleeve is moved rearward on the main shaft. In between and perpendicular to the fork shafts are detent dowels and pin which prevent two gears from being engaged at the same time. The sleeve contacts the synchro, which is normally kept out of contact with the first gear by the spring between the synchro and first gear.

As the synchro contacts the sleeve, friction between the synchro and the conical surface forces the sleeve (keyed to main shaft), synchro, and first gear (being turned by the countershaft) to approach the same speed. Drive is finally achieved when the crown teeth inside the sleeve engage the crown teeth on first gear.

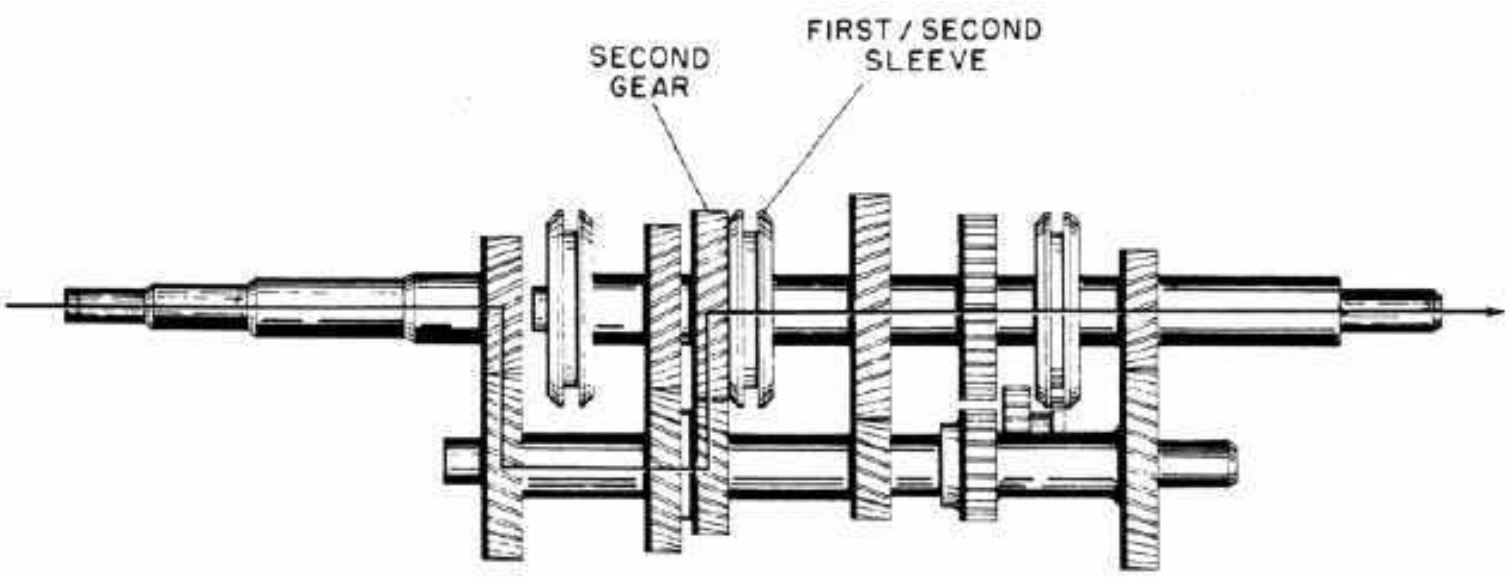
Once fully engaged, the spring between the gear and synchro, would return the sleeve to neutral. This is prevented by the spring loaded detent balls engaging notches in the fork shafts.



First Gear

Second Gear (See Second Gear Figure)

When the shift lever is placed in second position, the first/second sleeve is disengaged from first gear, then engaged with second gear. Synchronizing is the same as for first gear.



Second Gear

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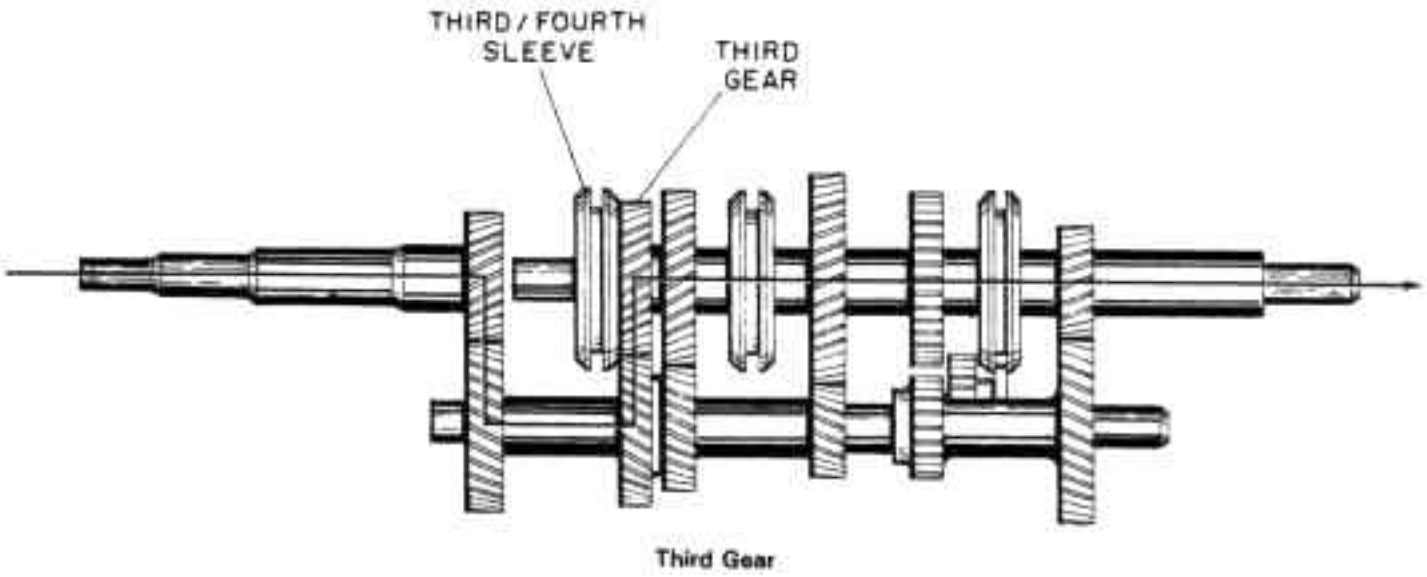
Third Gear (See Third Gear Figure)

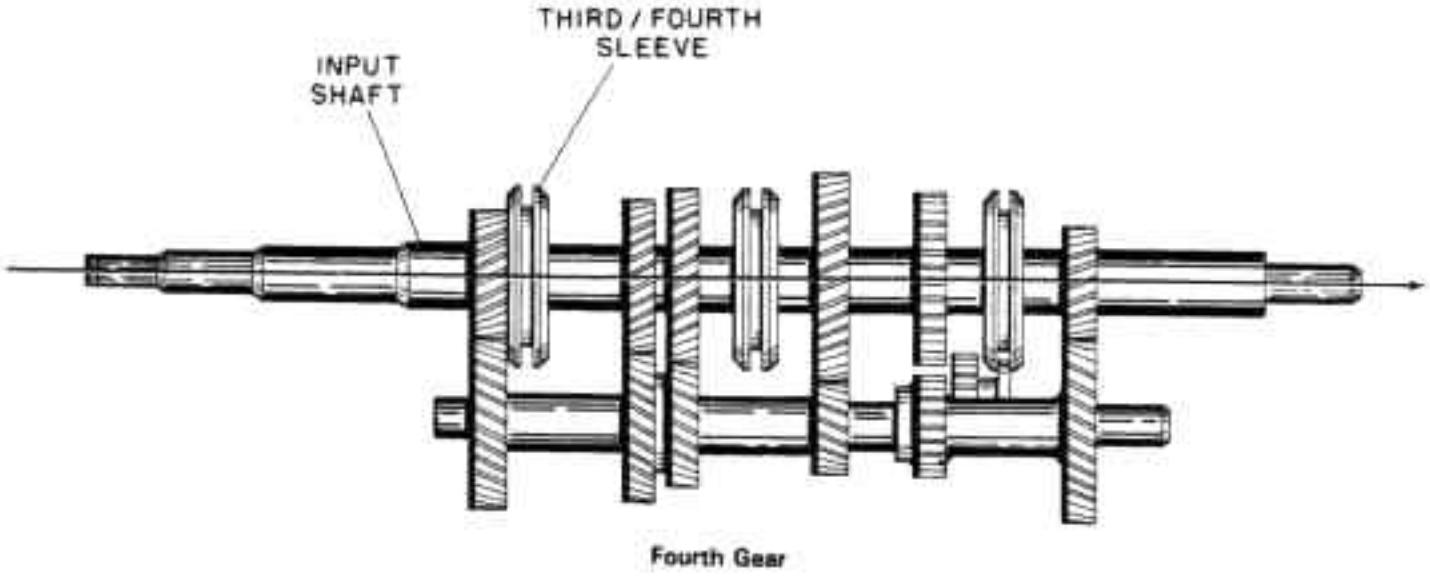
To go from second to third gear, the shift lever is returned to neutral to disengage the first/second sleeve from second gear. It is then moved to third position. The third/fourth sleeve engages the third gear.



Third Gear

Fourth Gear (See Fourth Gear Figure)

When the shift lever is placed in fourth position, the third/f ourth sleeve is disengaged from third gear, then engaged with the crown teeth on the input shaft. As a result, there is a direct drive from the input shaft to the main shaft, giving a 1 : 1 ratio. The countershaft continues to be driven, but does not transfer power.



Fourth Gear

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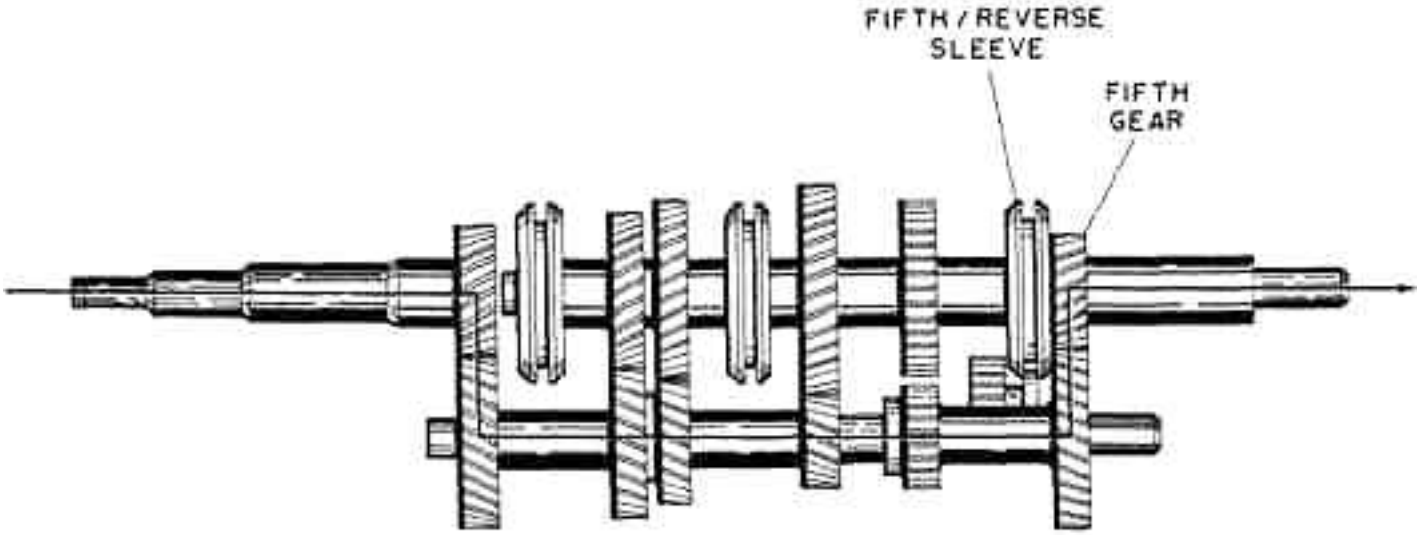
Fifth Gear (See Fifth Gear Figure)

To go from fourth to fifth gear, the shift lover is returned to neutral to disengage the third/fourth sleeve from the input shaft. It is then moved to fifth position. The fifth/reverse position sleeve engages the fifth gear.

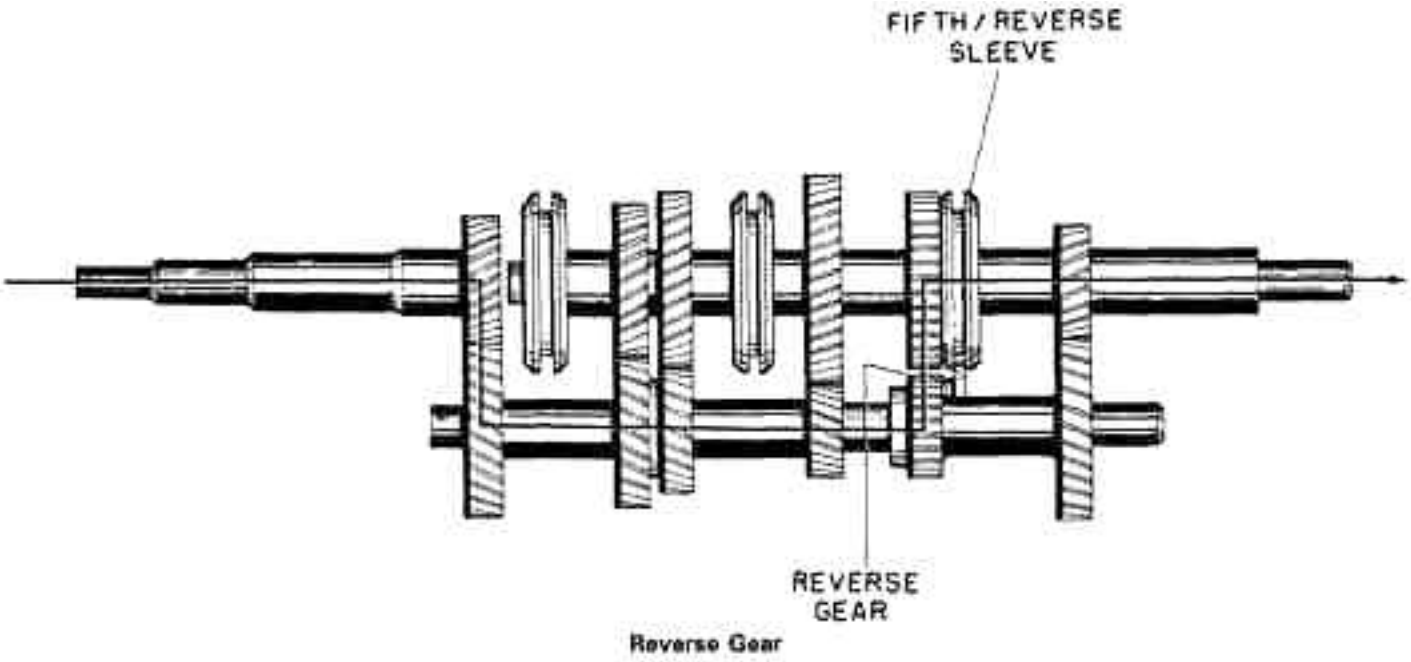


Fifth Gear

Reverse Gear (See Reverse Gear Figure)

Reverse gear is a nonsynchro spur gear. As a result, the vehicle must be stopped before reverse can be engaged. Otherwise, damage may result. To engage reverse, the shift lever is first moved to the neutral position. The shift lever must then be pushed down and back to clear the reverse lockout screw. This lockout screw prevents accidental engagement of reverse gear when the car is moving.

The fifth/reverse sleeve now moves the reverse sliding gear forward to engage the reverse gear on the countershaft and the reverse gear on the main shaft. With this third gear introduced into the system, output direction is reversed.



Reverse Gear

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TRANSMISSION ASSEMBLY

Mount Transmission and Drain Oil

a. Mount transmission on support (2) A.71001/19, part of rotating stand (1).

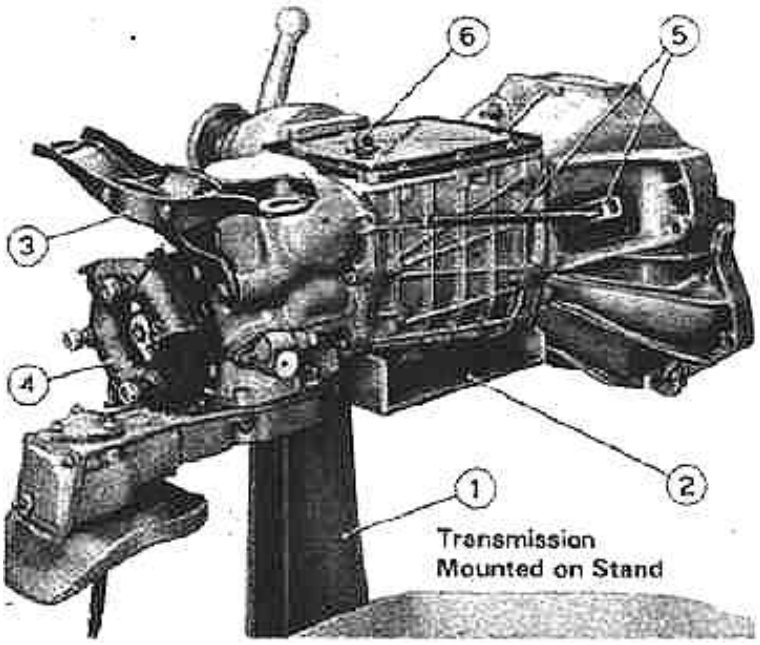
b. Using tools A.50113, A.55087, and A.57051, remove oil drain plug (6), oil level plug, and rear housing oil drain plug.

c. Remove three sell-locking nuts and bolts attaching flexible joint (4).

d. Remove two nuts and washers attaching rear supporting cross strut (3) to rear housing.

e. Remove return spring and rubber boot (5).

1. Rotating stand
2. Support
3. Rear supporting cross strut
4. Flexible joint
5. Spring and rubber boot
6. Oil drain plug



Transmission Mounted on Stand

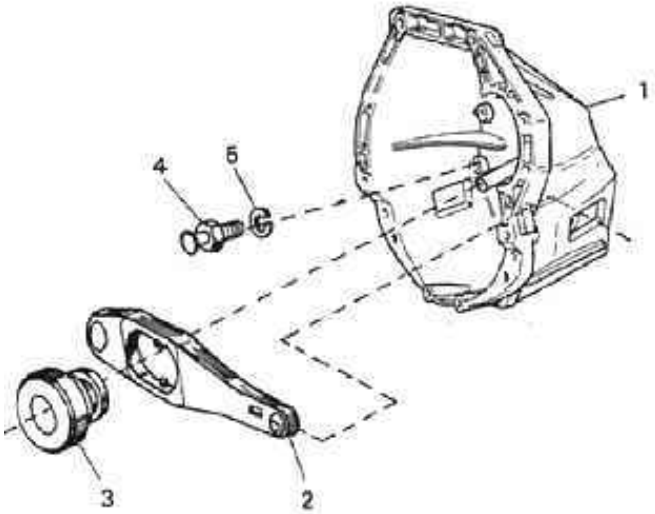
Remove Yoke and Throwout Bearing

a. Unhook yoke (2) from pivot (4) by sliding yoke toward return spring end.

b. When unhooked, guide yoke and throwout bearing (3) off input shaft.

c. Remove pivot (4) and lockwasher (5) from bellhousing (1) only if damaged.

1. Bellhousing
2. Yoke
3. Throwout bearing
4. Pivot
5. Lockwasher

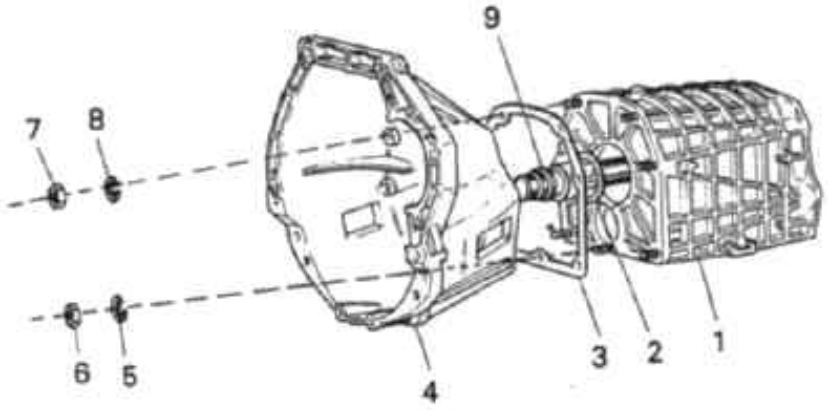


Throwout Bearing and Yoke, Removal

Remove Bellhousing

a. Remove six nuts (7), lockwashers (8), and one nut (6) and lockwasher (5) attaching bellhousing (4) to case (1).

b. Remove gasket (3) and spring washer (2). Remove seal (9) from the bellhousing (4) only if the seal will be replaced.



Bellhousing, Removal

1. Case
2. Spring washer
3. Gasket
4. Bellhousing
5. Lockwasher
6. Nut
7. Nut
8. Lockwasher
9. Seal

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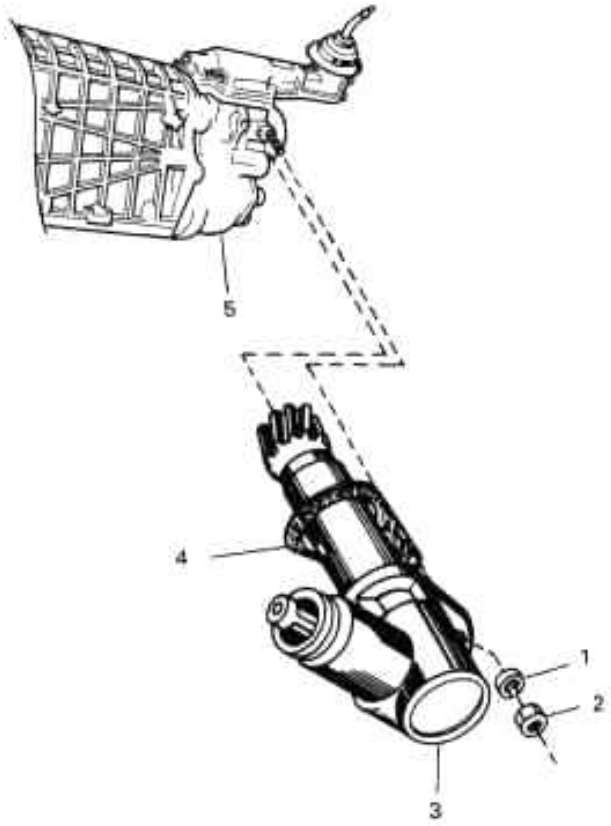
Remove Speedometer Drive

a. Remove nut (2) and lockwasher (1) attaching
speedometer drive (3) to rear housing (5).

b. Remove speedometer drive (3) and gasket (4).

1. Lockwasher
2. Nut
3. Speedometer drive
4. Gasket
5. Rear housing



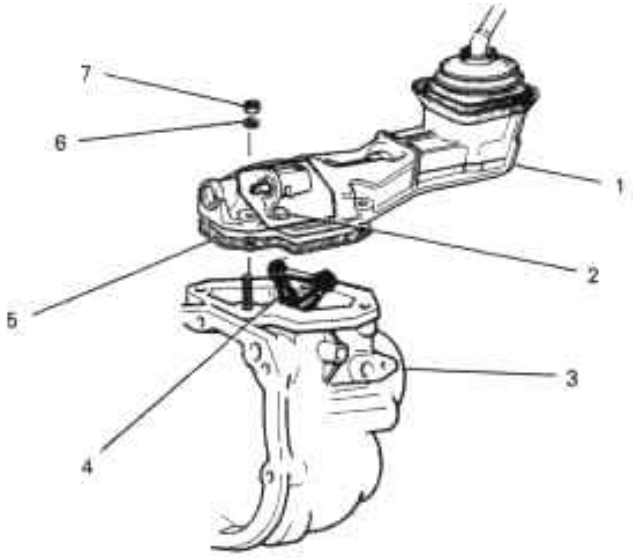
Speedometer Drive, Removal

Remove Shift Tower

a. Remove four nuts (7) and lockwashers (6).

b. Remove entire. shift tower assembly (1) by lifting then pushing shift lever forward until tab
on dog (2) clears engaging lever (4) in rear housing (3). Remove gasket (5).

1. Shift tower assembly
2. Dog
3. Rear housing
4. Engaging lever
5. Gasket
6. Lockwasher
7. Nut



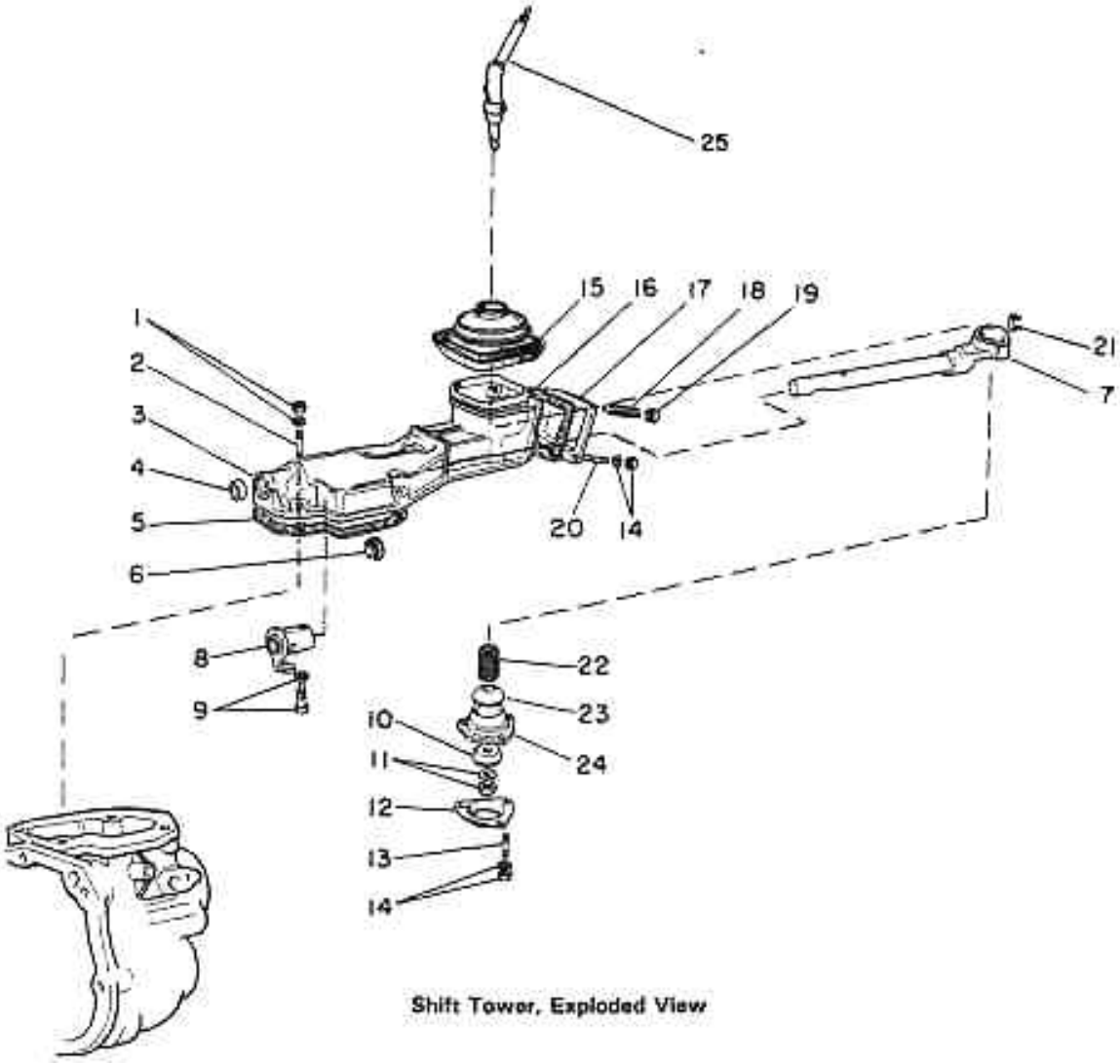
Shift Tower, Removal

Disassemble Shift Tower

NOTE: Disassemble shift tower assembly only to the extent to replace defective components.

a. Remove boot (15).
b. Remove four nuts and lockwashers (14), cover (17), and gasket (16). Do not remove reverse lockout
screw (18) and locknut (19) unless damaged.c. Remove three nuts and lockwashers (14), and cover (112).
d. Remove nut and washer (11), bearings (10), socket (24), cover (23), and spring (22).
e. Lift shift lever (25) from shift tower. Remove spring clip (21).
f. Remove bolt and lockwasher (9). Slide shaft out shift tower rear, then remove dog (8).
g. Remove cap (4), bearing (6), and studs (2, 13, and 20) only if damaged.

1. Nut and lockwasher
2. Stud
3. Shift tower
4. Cap
5. Gasket
6. Bearing
7. Shaft
8. Dog
9. Bolt and lockwasher
10. Bearing
11. Nut and washer
12. Cover
13. Stud
14. Nut and lockwasher
15. Boot
16. Gasket
17. Cover
18. Reverse lockout screw
19. Locknut
20. Stud
21. Spring
22. Spring
23. Cover
24. Socket
25. Shift lever



Shift Tower, Exploded View

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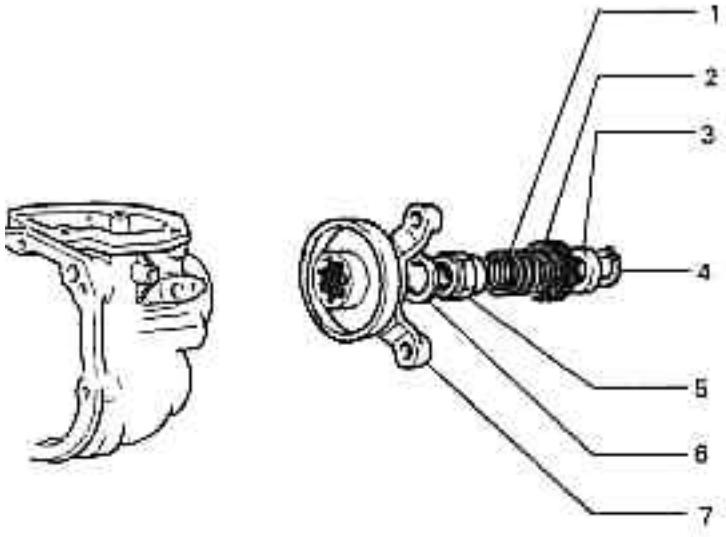
Remove Yoke

a. Remove snap ring (4), spacer (3), seal (2), and spring (1) from output shaft.

b. Using adapter A-55130 on yoke (7), remove nut (5) and washer (6).

c. Using a puller, remove yoke (7).

1. Spring
2. Seal
3. Spacer
4. Snap ring
5. Nut
6. Washer
7. Yoke

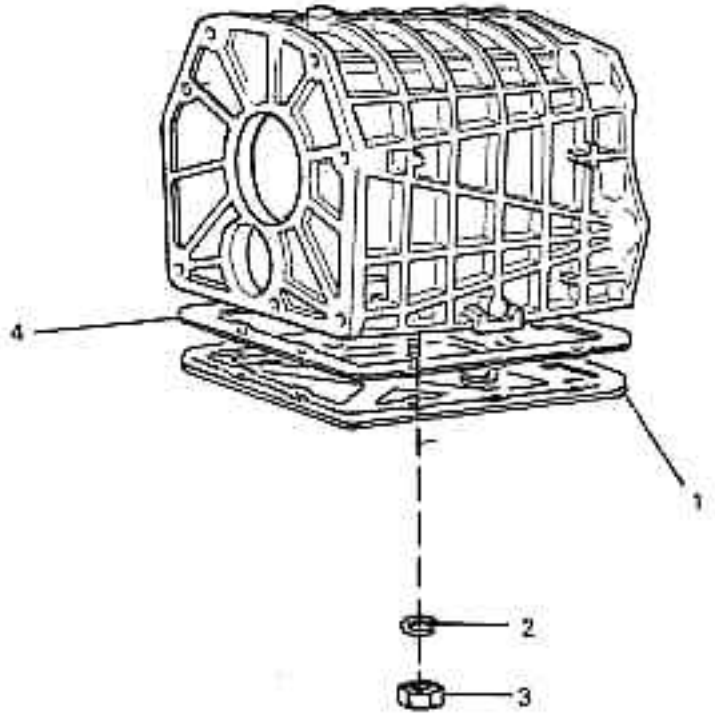


Drive Yoke, Removal

Remove Case Cover

a. Remove ten nut (3) and lockwasher (2). b. Remove cover (1) and gasket (4).

1. Cover
2. Lockwasher
3. Nut
4. Gasket



Case Cover, Removal

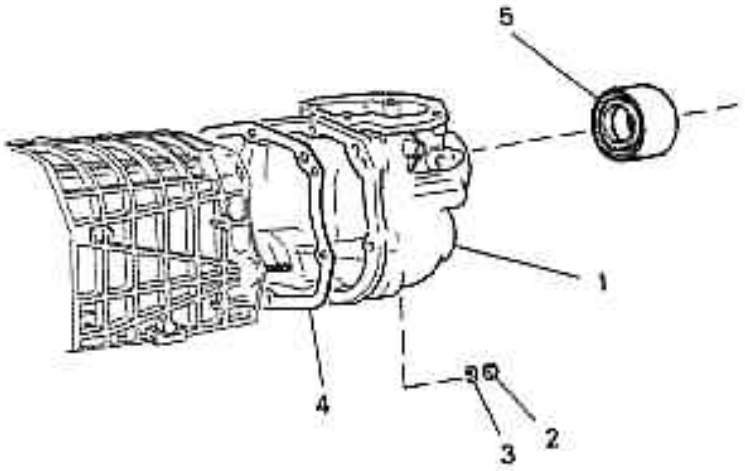
Remove Rear Housing

a. Remove six nuts (2) and lockwashers (3) attaching rear housing (1) to case. (One nut is located inside the case.)

b. Carefully remove rear housing (1) from case. As housing is removed, guide the gear selection and engaging lever out of the fork shafts.

c. Remove gasket (4).

d. Remove seal (5) from rear housing (1) only if the seal will be replaced.



Rear Housing, Removal

1. Rear housing
2. Nut
3. Lockwasher
4. Gasket
5. Seal

Disassemble Engaging Lever

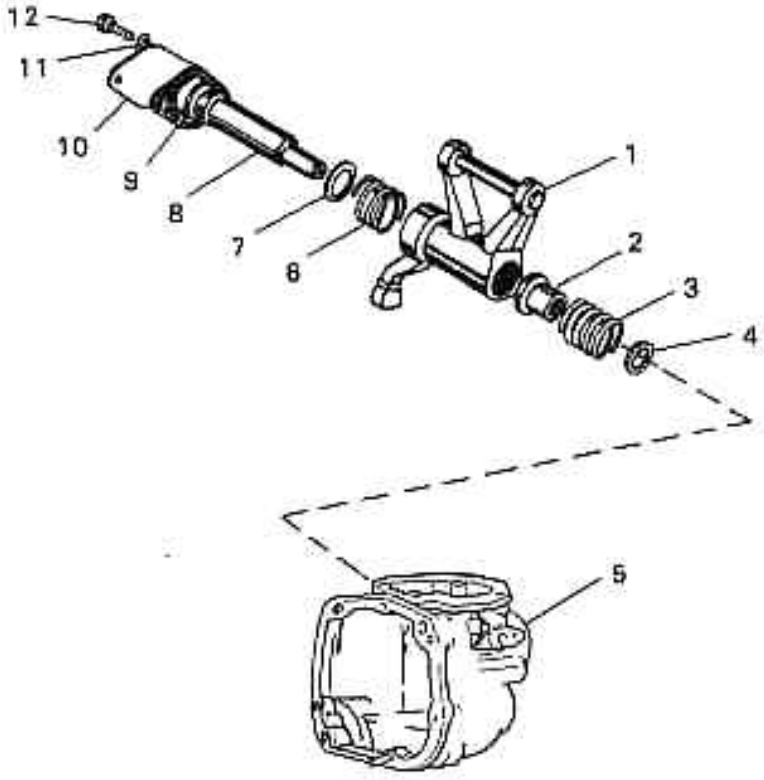
NOTE: Disassemble gear selection and engaging lever only if damaged.

a. Remove two bolts (12) and two lockwashers (11) attaching cover (10) to rear housing (5).

b. Remove cover (10) and gasket (9).

c. Slowly slide gear selection and engaging lever rod (8) out side of rear housing (5). As rod is withdrawn, remove spring (3), spring retainer (2), gear selection and engaging lever (1), spring (6), and thrust washer (7).

d. Remove thrust washer (4) from rear housing (5).



Engaging Lever, Removal

1. Engaging lever
2. Spring retainer
3. Spring
4. Thrust washer
5. Rear housing
6. Spring
7. Thrust washer
8. Engaging lever rod
9. Gasket
10. Cover
11. Lockwasher
12. Bolt

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Remove Fork Shafts

a . Remove bolt (3) and lockwasher (2) attaching f ifth and reverse shift fork to fifth and reverse fork shaf t

b. Slowly remove fork shaft. As fork shaft is removed, detent ball (8) will release.

c. Engage two gears to lock the transmission.

d. Loosen, but do not remove, 27-mm nut (4) and 19-mm bolt (7) on ends of countershaft. Disengage the two gears.

e. Remove two bolts (12) attaching cover (11) to case.

f. Remove gasket (10), three springs (9), three detent balls (8), and short detent dowel (6).

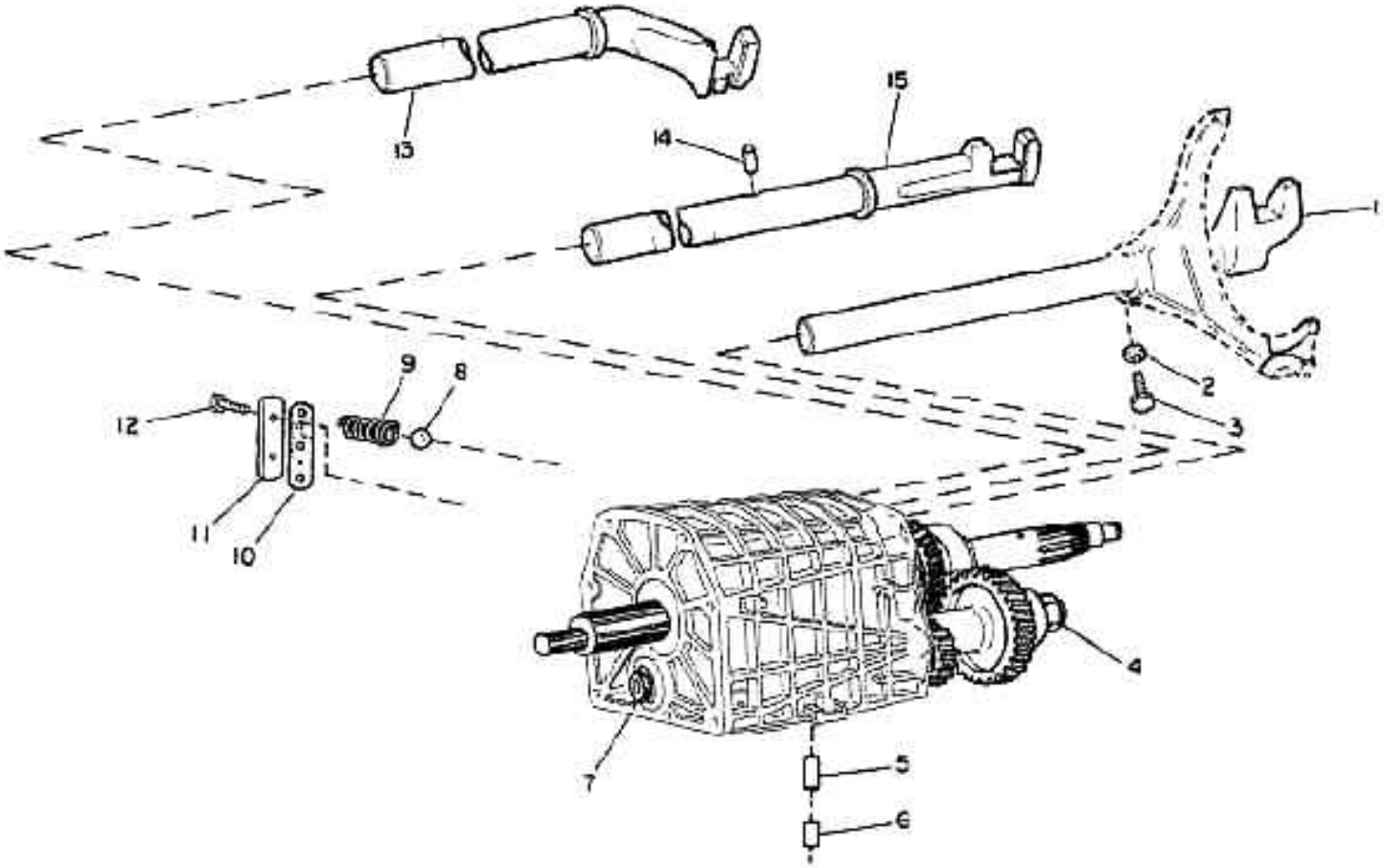
g. Remove second bolt (3) and lockwasher (2) attaching third and fourth shift fork to third and fourth fork shaft (15).

h. Slowly remove third and fourth fork shaft. While removing fork shaft, remove detent pin (14) from fork shaft.

i. Using a magnet, remove long detent dowel (5).

j. Remove third bolt (3) and lockwasher (2) attaching first and second shift fork to first and second fork shaft (13). Remove fork shaft.

1 - Fifth and reverse fork shaft
2. Lockwasher
3. Bolt
4. 27-mm nut
5. Long detent dowel
6. Short detent dowel
7. 19-mm bolt
8. Detent ball
9. Spring
10. Gasket
11. Cover
12. Bolt
13 First and second fork shaft
14. Detent pin
15. Third and fourth fork shaft



Fork Shafts, Removal

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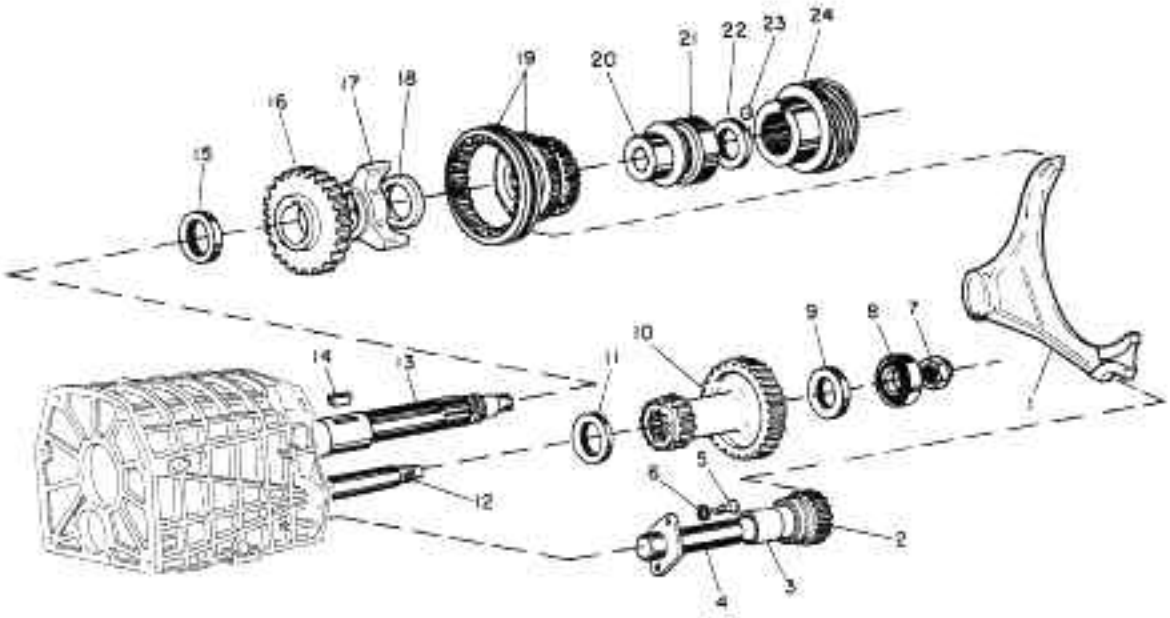
Remove Fifth and Reverse Gears

a. Remove speedometer drive gear (24), ball (23), spacer (22), and bearing (21).
b. Remove 27-mm nut (7), bearing (8), and spacer (9).
c. Carefully tap fifth and reverse gear 0 0) off until its internal splines are disengaged.
d. As fifth and reverse gear is removed from countershaft (12), remove reverse sliding gear (2), fifth and reverse gear (10), spacer (11), bushing (20), fifth and reverse gear shift fork (1), and fifth gear assembly (19). Disassemble fifth gear assembly as specified in Fifth Gear Assembly.
e. Remove spacer (18), hub (17), and reverse gear (16).
f. Remove key (14) and spacer (15) from main shaft (13).
g. Remove bushing (3) and shaft (4) attached with screws (5) and lockwasher (6) only if damaged.

1. Fifth and reverse shift fork
2. Reverse sliding gear
3. Bushing
4. Shaft
5. Screw
6. Lockwasher
7. 27-mm nut
8. Bearing
9. Spacer
10. Fifth and reverse gear
11. Spacer
12. Countershaft
13. Main shaft
14. Key
15. Spacer
16. Reverse gear
17. Hub
18. Spacer
19. Fifth gear assembly
20. Bushing
21. Bearing
22. Spacer
23. Ball
24. Speedometer drive gear



Fifth and Reverse Gears, Removal

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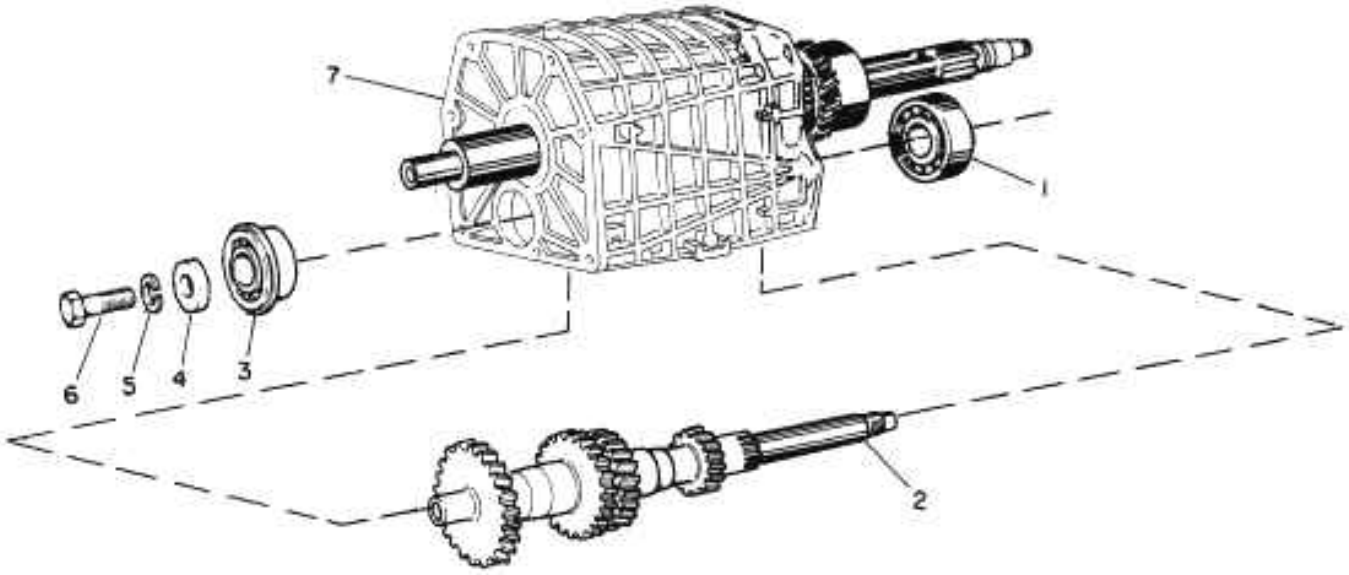
Remove Countershaft

a. Remove bolt (6), lockwasher (5), and washer (4).
b. Using a soft mallet, tap on output end of countershaft (2) until bearing (3) can be removed from case (7).
c. Carefully tap on bearing (1) outer race to remove from case (7).
d. Remove countershaft (2) from case.

1. Bearing
2. Countershaft
3. Bearing
4. Washer
5. Lockwasher
6. Bolt
7. Case



Countershaft, Removal

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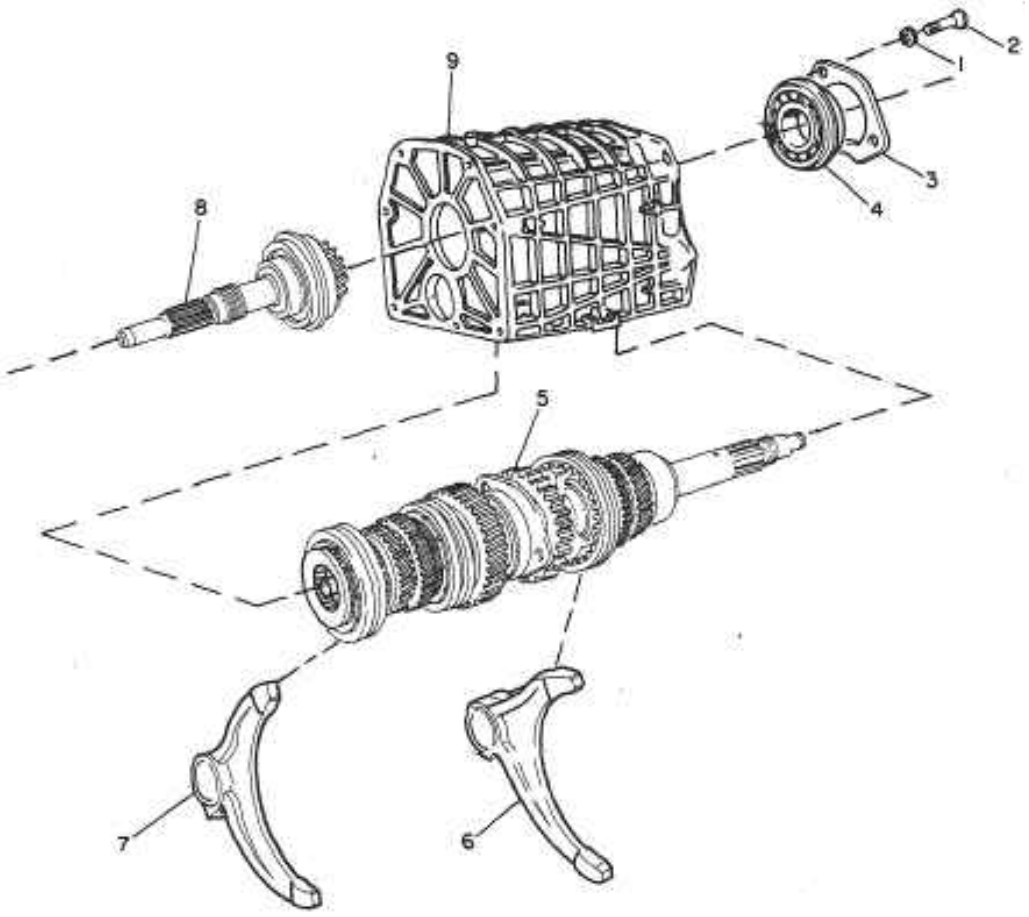
Remove Input and Main Shaft Assemblies

a. Remove third and fourth shift fork (7), first and second shift fork (6). Although both forks are the same, do not mix to maintain wear.
b. Using an impact driver, remove three screws (2) and lockwashers (1).
c. Remove bearing retainer (3) and bearing (4).
d. Carefully work to slip input shaft assembly (8) out of case (9).
e. Disassemble as specified in Input Shaft Assembly.
f. Carefully move main shaft assembly (5) rearward, then remove from case (9).
g. Disassemble as specified in Main Shaft Assembly.

1. Lockwasher
2. Screw
3. Bearing retainer
4, Bearing
5. Main shaft assembly
6. First and second shift fork
7. Third and fourth shift fork
8. Input shaft assembly
9. Case



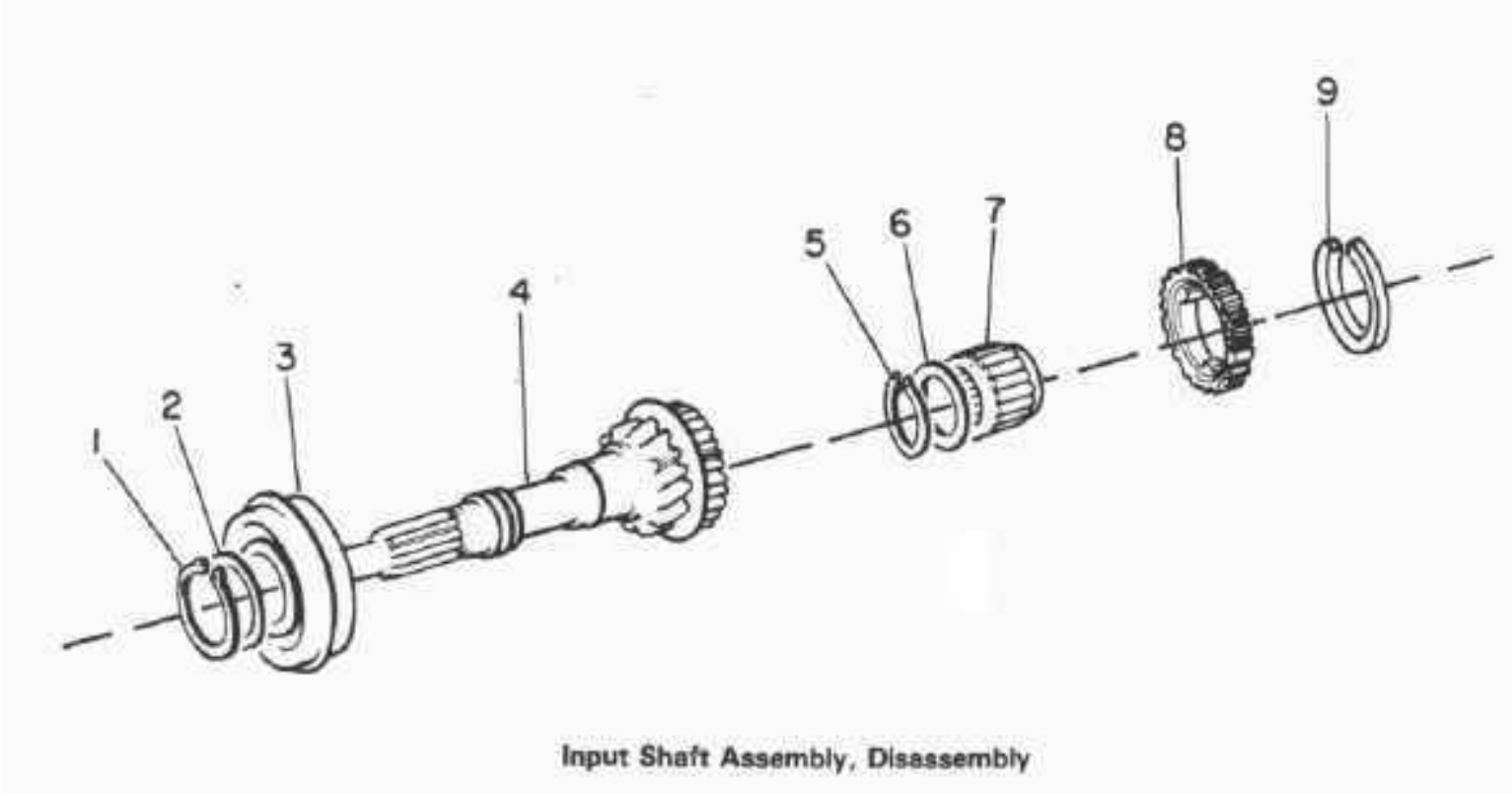
Input and Main Shaft Assemblies, Removal

INPUT SHAFT ASSEMBLY

Disassemble Input Shaft Assembly

a. Use a press and tool A.70350 to compress spring washer (2).
b. Unsnap snap ring (1) from its groove, then remove from press.
c. Remove snap ring (1), spring washer (2), and bearing (3) from input shaft (4).
d. Remove snap ring (9) and synchro (8).
e. Remove bearing (7), washer (6), and snap ring (5).

1. Snap ring
2. Spring washer
3. Bearing
4. Input shaft
5. Snap ring
6. Washer
7. Bearing
8. Synchro
9. Snap ring



Input Shaft Assembly, Disassembly

MAIN SHAFT ASSEMBLY

Disassemble Main Shaft Assembly

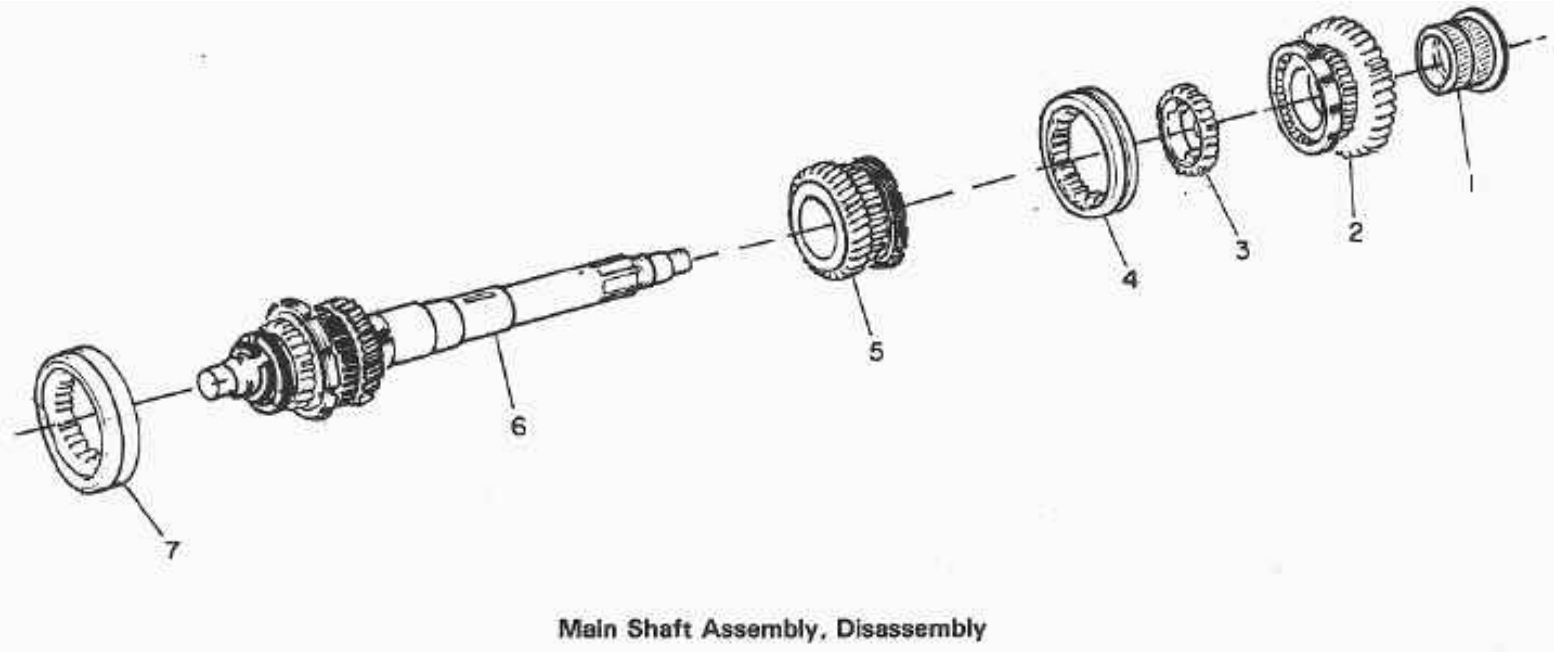
a. Remove sleeve (7).

b. Remove bushing (1), first gear assembly (2), hub (3), sleeve (4) and second gear assembly (5) from main shaft and third gear subassembly (6).

c. Disassemble main shaft and third gear subassembly (6) as specified in Main Shaft and Third Gear Subassembly.

d. Disassemble first and second gear assemblies (2 and 5) as specified in First, Second, and Third Gear Assemblies.

1. Bushing
2. First gear assembly
3. Hub
4. Sleeve
5. Second gear assembly
6. Main shaft and third gear subassembly
7. Sleeve



Main Shaft Assembly, Disassembly

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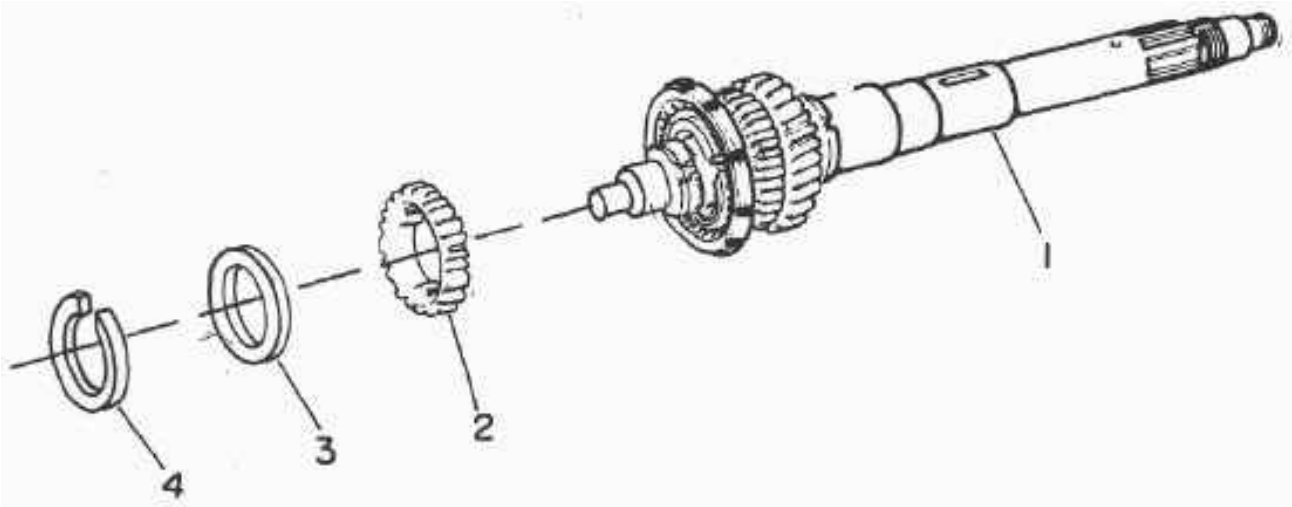
MAIN SHAFT AND THIRD GEAR SUBASSEMBLY

Disassemble Main Shaft and Third Gear Subassembly

a. Place subassembly in press. Do not support subassembly on gear, but on shoulder of main shaft.
b. Use press and tool A.701 59 to compress spring washer (3).
c. Unsnap snap ring (4) from its groove, then remove from press.
d. Remove snap ring (4), spring washer (3) and hub (2) from main shaft and third gear (1).
e. Disassemble main shaft and third gear (1) as specified in First, Second, and Third Gear Assemblies.

1 . Main shaft and third gear
2. Hub
3. Spring washer
4. Snap ring



Main Shaft and Third Gear Subassembly, Disassembly

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FIRST, SECOND, AND THIRD GEAR ASSEMBLIES

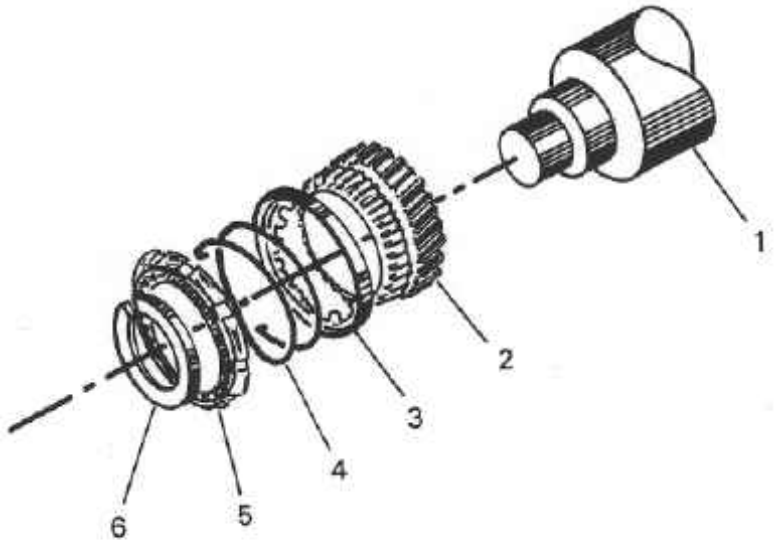
Disassemble First, Second, and Third Gear Assemblies

NOTE: Although different in size, the first, second, and third gear assemblies are similar in assembly. Also, the third gear assembly is assembled on the main shaft.

a. Using tool A.701 59, remove snap ring (6).

b. Remove synchro (5), spring (4) and spring retainer (3) from gear (2).

c. Remove third gear assembly from main shaft (1).



First, Second, and Third Gear Assemblies, Disassembly

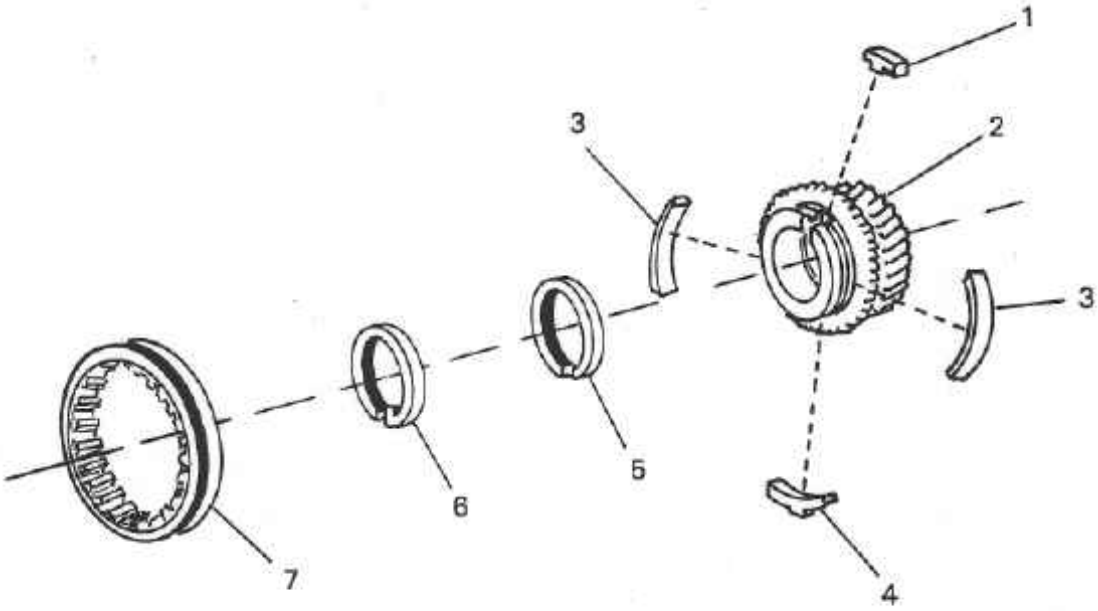
1 . Main shaft (third gear only)
2. First, second, or third gear
3. Spring retainer
4. Spring
5. Synchro
6. Snap ring

FIFTH GEAR ASSEMBLY

Disassemble Fifth Gear Assembly

a. Remove sleeve (7).
b. Remove synchromesh parts snap ring (6). Discard snap ring.
c. Using tool A.701 66, remove synchromesh ring (5).
d. Remove spring (3), lock (1), and stop (4) from fifth gear (2).

1. Lock
2. Gear
3. Spring
4. Stop
5. Synchromesh ring
6. Synchromesh parts snap ring
7. Sleeve



Fifth Gear Assembly, Disassembly

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CLEANING

Before inspecting:

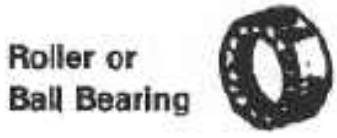
a. Clean all parts with a suitable cleaning solvent to remove oil traces.
b. Carefully scrape or brush away deposits from holes and grooves.
c. Carefully remove gaskets from mating surfaces.
d. Dry with compressed air. Do not spin dry bearings as damage may result.

INSPECTION AND REPAIR

Inspect and repair each part as described. If there is doubt as to a part's serviceability, replace the part.

Bearings
a. Roller or ball

1 . Check that bearing rollers and balls are free to turn in their cages, or that there is no galling, scratches, or cracks. Replace bearing if damaged.
2. Check that surfaces of inner and outer races are free from galling, scratches, or cracks. Replace bearing if damaged.
3. Check that radial play is not greater than 0.002 inch and end play is not greater than 0.020 inch. Replace worn bearings.
b. Throwout bearing. Check throwout bearing for wear. Replace if worn.
c. Nonroller bearings. Check for wear. For minor scratches, clean with fine emery or stone. Replace if worn, cracked, or broken.



Hubs and Sleeves

a. Check that bearing surfaces are free from burrs, nicks,
or galling. For nicks or burrs, use a fine stone or emery.
Replace if galled.

b. Check that there is no excessive play between a hub or
sleeve and its mating surface.

c. Check that teeth are not chipped,. broken, galled, or worn. Replace if damaged.

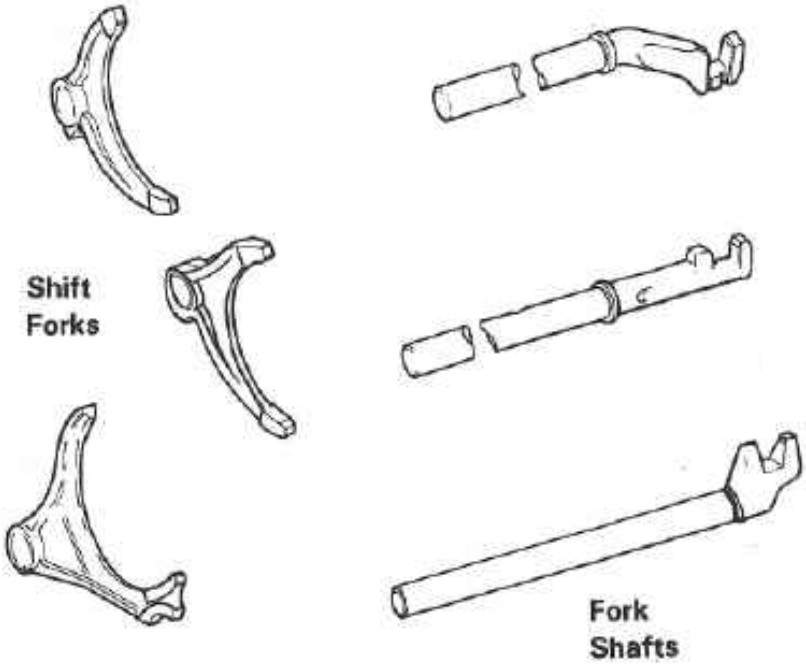
Shift Forks and Fork Shafts.

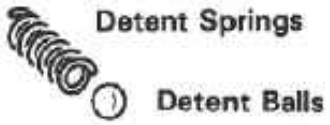
Although the first and second shift fork is the same as the third and fourth shift fork, do not mix.

a. Check that threads in bolt holes are clean and free from damaged threads. Use a tap to clean holes. Replace
shaft if threads are stripped.

b. Check sliding surfaces for excessive wear. Replace if worn.

c. Check that fork shafts are not bent, and that grooves for detent balls are not scored. Replace if bent or worn.





Detent Balls, Dowels, and Pin

a. Check for free travel of detent pin in third and fourth fork shaft. Replace pin if worn. Use fine emery for minor scratches.

b. Check detent ball and dowels for galling. Replace if damaged.

c. Check detent springs for tension. Replace if weak.

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Input Shaft, Main Shaft, Countershaft, Reverse Sliding Gear Shaft, and Engaging Lever Rod

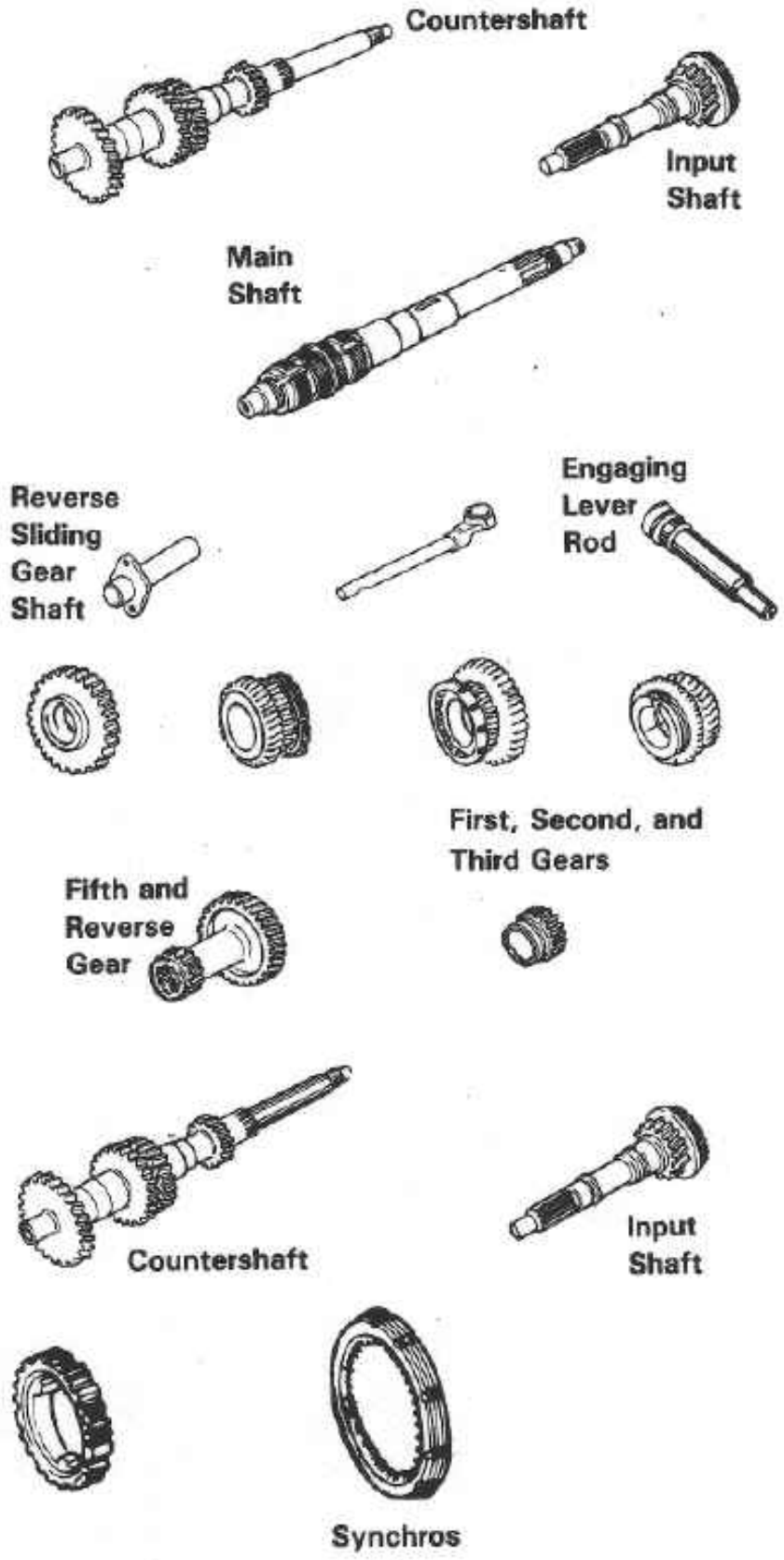
a. Check all shafts for straightness by placing between points. Maximum runout shall be not greater than 0.002 inch. Some shafts can be straightened with a press. I If not, replace.
b. Check splines for damage. Use a fine file, emery, or stone to remove burrs or nicks.
c. Check that threads on main shaft and countershaft are not damaged. Replace shaft if threads are stripped.
d. Check that bearing surfaces are free from burrs, nicks or galling. Use a fine stone or emery to clean.
e. Check engaging lever rod for straightness and wear. Replace if worn or bent.

Gears

a. Check that teeth on all gears are not chipped, broken, or galled. Replace if damaged.
b. Check that synchro crown teeth are flat and not rounded. Rounded teeth indicates worn gear. Replace. Also replace mating gear.
c. Check that wear pattern is even. Replace if worn.d. Check that bearing surfaces are free from burrs, nicks or galling. Use fine emery to clean.e. Check that clearance between reverse sliding gear bushing and reverse shaft is 0.002 to 0.004 inch. Replace bushing if worn.
f. Check that clearance between first gear and its bushing is 0.002 to 0.004 inch. Replace if worn.
g. Check that clearance between second and third gears and seats on main shaft is 0.002 to 0.004 inch. Replace if worn.

Synchros

a. Check that synchro is not cracked. Replace if cracked.
b. Check that teeth are not broken. Replace if broken.
c. Check bearing surfaces for excessive wear. Replace if worn.



Springs

Springs

a. Check all springs for tension. Replace weak springs.
b. Check detent springs for wear on axial surface. Replace if worn.

Snap Rings. Check that snap rings are not deformed and maintain a good grip in their grooves. Replace if worn. Discard the synchromesh parts snap ring used on fifth gear assembly.

Snap Ring

Spring Washers

Spacers, Thrust and Spring Washers

a. Check all thrust washers for wear. Replace if worn.
b. Check that spacer and spring washers are not deformed. Replace if deformed.

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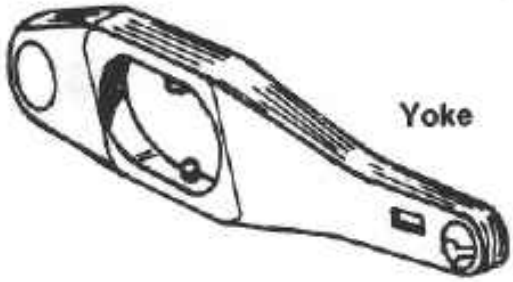
Pivot and Yoke

a. Check that pivot and yoke for throwout bearing are not worn. Replace if worn.

b. Check that hole for return spring on yoke is not worn. A steel washer can be welded to restore hole.

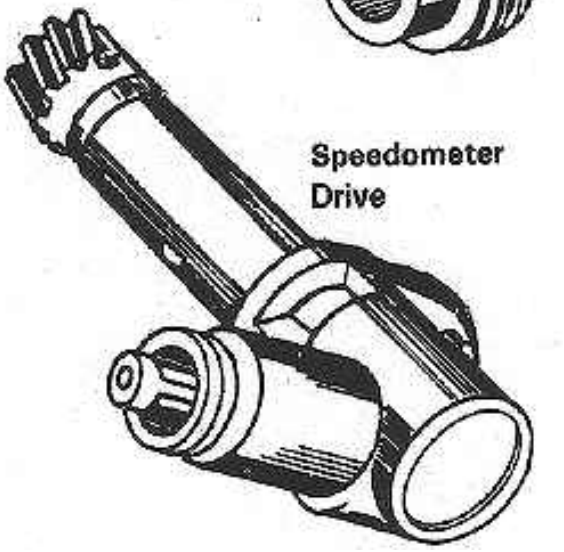
c. Check that yoke is not bent. Replace if bent.



Speedometer Drive

a. Check that teeth on speedometer drive are not chipped, broken or galled. Replace if damaged. Also replace speedometer drive gear.

b. Check that shafts turn easily without excessive play. Replace if worn.



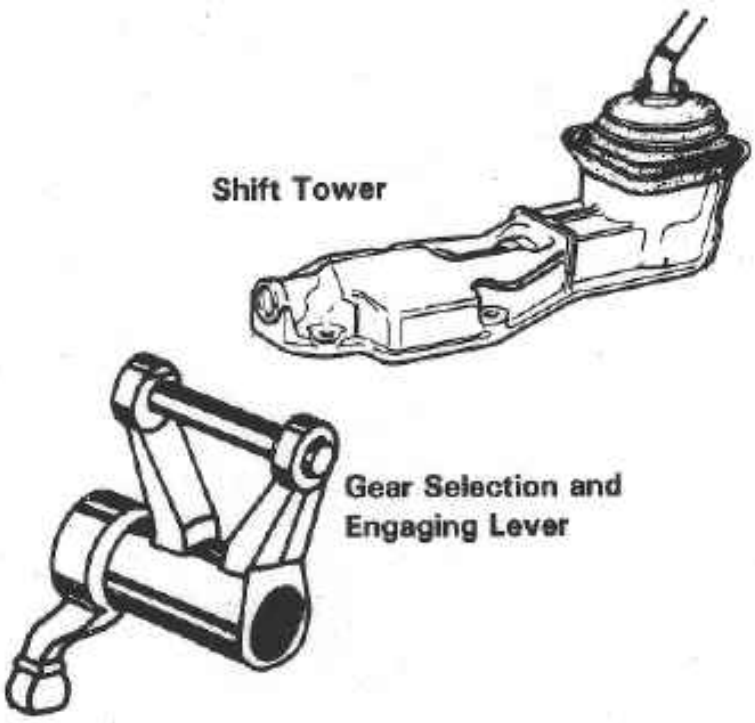
Shift Tower and Gear Selection and Engaging Lever

a. If not disassembled, check for free movement without binding or excessive play. Disassemble for binding

b. If disassembled, check that all bearing surfaces are free from excessive wear. Replace worn parts.

c. Check that shafts are not bent. Replace bent parts.

d. Check that dog is not damaged. Replace if damaged.



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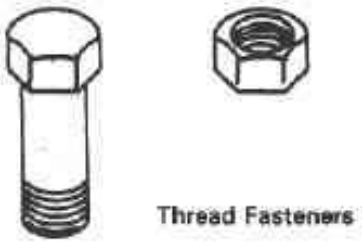
Thread Fasteners


Thread Fasteners

a. Check that threads on all threaded fasteners are not stripped or cross-threaded. Replace if damaged.

b. Replace all self-locking nuts.

Case, Rearhousing, Bell Housing, Covers

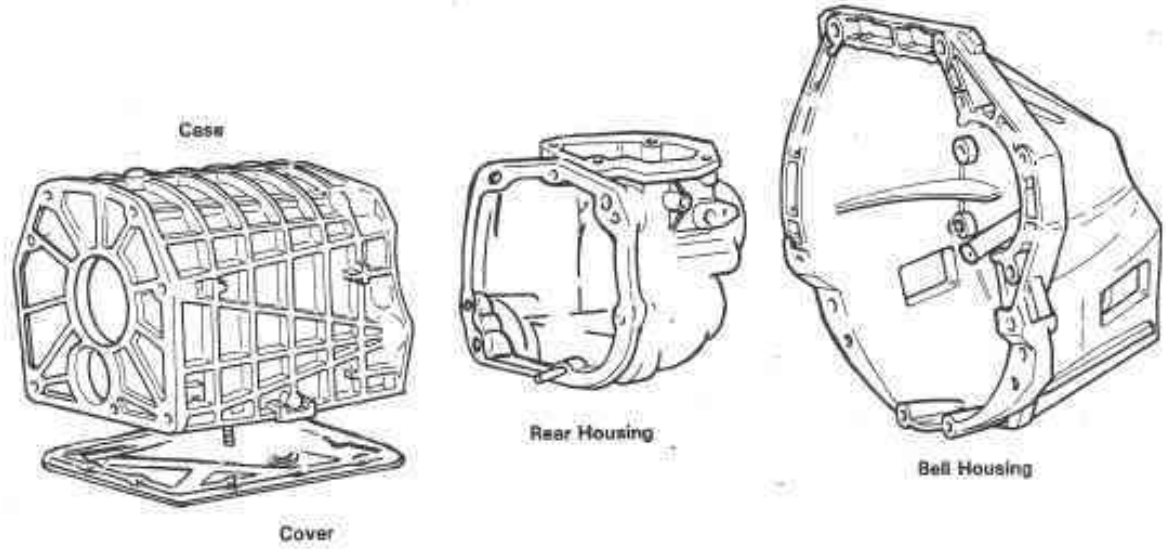
a. Check that all structured parts are not cracked, broken, or damaged. Replace if damage is in a bearing or structural area. Cracks or holes in any nondimensional or structural area may be repaired by welding.

b. Check that all threaded holes are not stripped or cross-threaded. Repair by retreading oversize or using helical inserts.

c. Check that covers are not bent or cracked. Repair by straightening or welding.

d. Check that bores for detent balls and dowels are not worn. Replace steel sleeve if worn.

e. Check gasket surfaces for nicks, scratches, or breaks that may cause leaks. Clean with fine emery. Gasket surface can be repaired by welding and machining. Otherwise replace part.



Oil Seals

a. Check that oil seals are not worn, chipped, torn, brittle, or cracked. Replace if damaged.

b. Check that seal springs are not deformed and in place. Restore spring to its position if seal is not otherwise damaged.

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Reassembly is basically the reverse of disassembly and observing the following instructions.

FIFTH GEAR ASSEMBLY

Reassemble Fifth Gear Assembly

a. Lightly coat parts with oil.

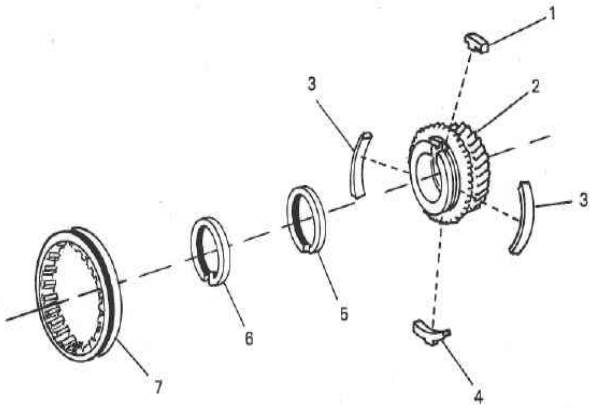
b. With gear (2) laying flat (gear side down), assemble lock (1) into slot of gear (2).

c. Assemble stop (4) and two springs (3).

d. Carefully spread synchro ring (5) and place around assembled parts (1, 3, and 4) so open end is over stop (4).

e. Using tool A.701 66, assemble new synchromesh parts snap ring (6) with dog end in slot on gear (2).

f. Assemble sleeve (7).



Fifth Gear Assembly, Disassembly

1. Lock
2. Gear
3. Spring
4. Stop
5. Synchromesh ring
6. Synchromesh parts snap ring
7. Sleeve

FIRST, SECOND, AND THIRD GEAR ASSEMBLIES

Reassemble First, Second, and Third Gear Assemblies

a. Lightly coat parts with oil.

b. For third gear only, assemble third gear (2) on main shaft (1).

c. With cup side away from gear (2), assemble spring retainer (3) on gear (2).

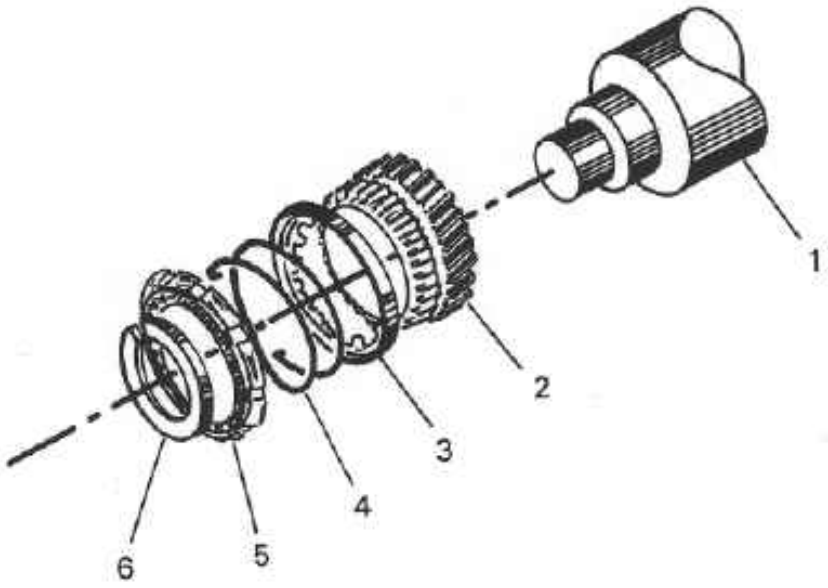
d. Assemble spring (4).

e. With small end of synchro (5) away from gear (2), assemble synchro (5) and snap ring (6) on gear

(2). Use tool A.701 59 to assemble snap ring (6).

f. When assembled, check that synchro (5) can be moved along gear (2), and springs back when released.

1 . Main shaft (third gear only)
2. First, second, or third gear
3. Spring retainer
4. Spring.
5. Synchro
6. Snap ring



First, Second, and Third Gear Assemblies, Disassembly

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MAIN SHAFT AND THIRD GEAR SUBASSEMBLY

Reassemble Main Shaft and Third Gear Subassembly

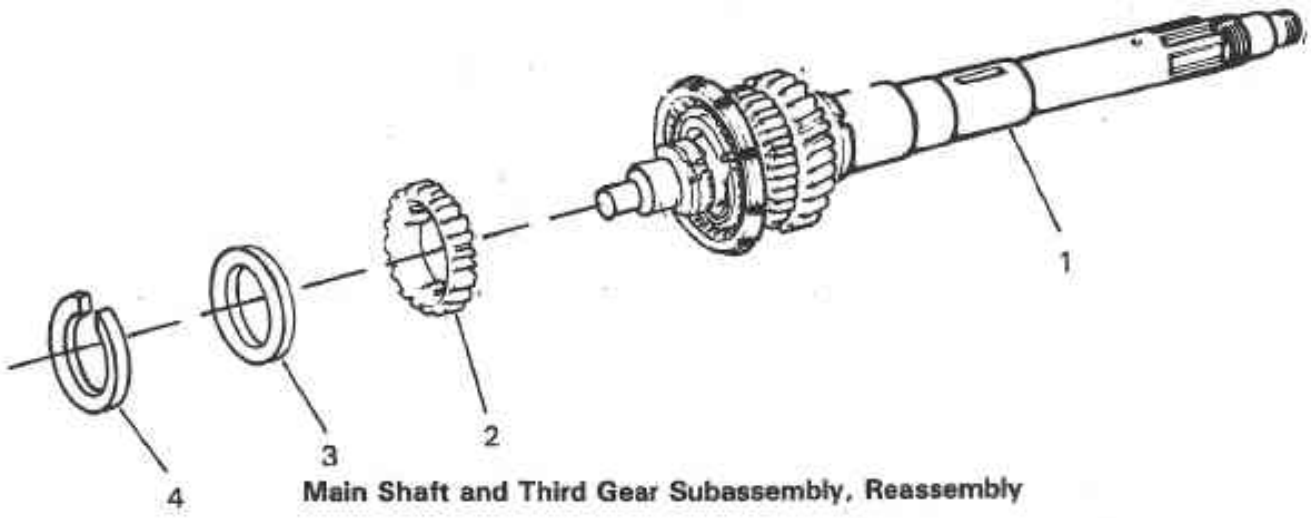
a. Lightly coat parts with oil, then place main shaft and third gear (1) in a press. Do not support on third gear, but on shoulder of main shaft.

b. Onto main shaft and third gear (1) input end, assemble hub (2), spring washer (3), snap ring (4), and tool A.701 59.

c. Use press to compress spring washer (3), then seat snap ring (4) in its groove.

d. Remove subassembly from press.

1. Main shaft and third gear
2. Hub
3. Spring washer
4. Snap ring



Main Shaft and Third Gear Subassembly, Reassembly

MAIN SHAFT ASSEMBLY

Reassemble Main Shaft Assembly

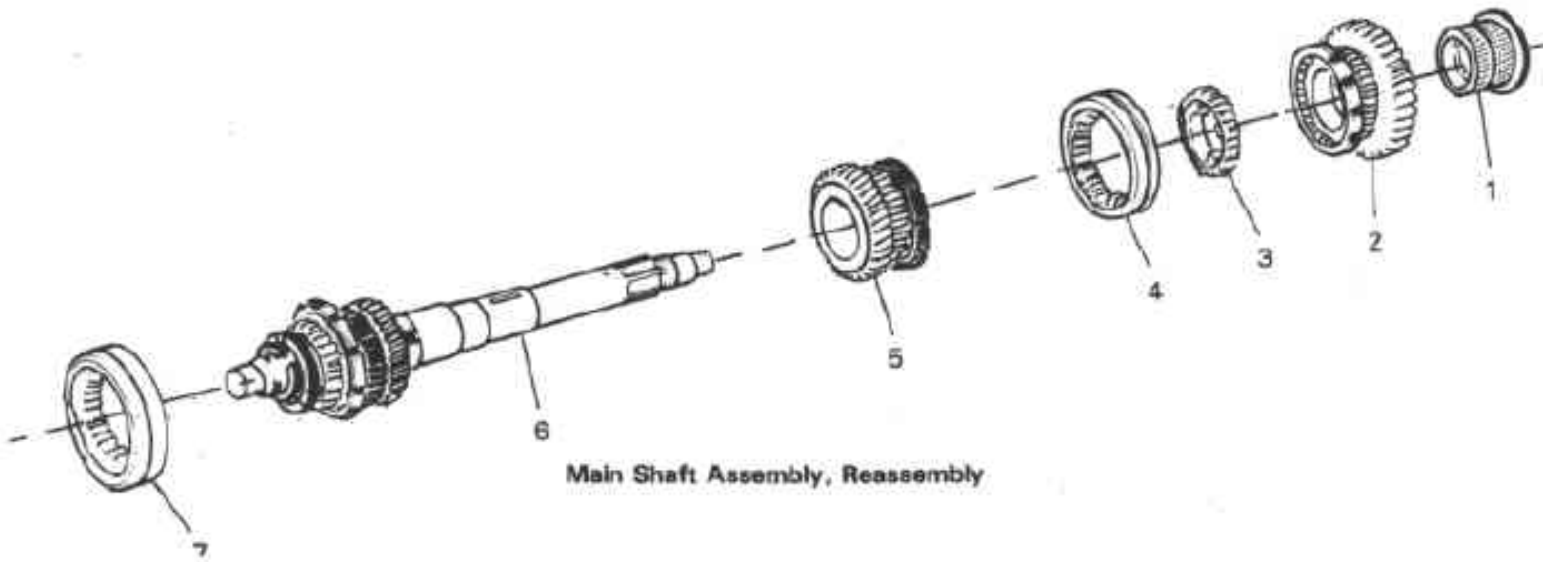
a. Lightly coat parts with oil.

b.Onto output end of main shaft and third assembly (6), assemble second gear assembly (5), sleeve (4), hub (3), first gear assembly (2), and bushing (1).

c. Carefully mate all parts. When assembled, sleeve (4) should straddle the synchros on second and first gear assemblies, and the gears should go from small to large, input end to output end.

d. Assemble sleeve (7) on input end.

1. Bushing
2. First gear assembly'
3. Hub
4. Sleeve
5. Second gear assembly
6. Main shaft and third gear subassembly
7. Sleeve



Main Shaft Assembly, Reassembly

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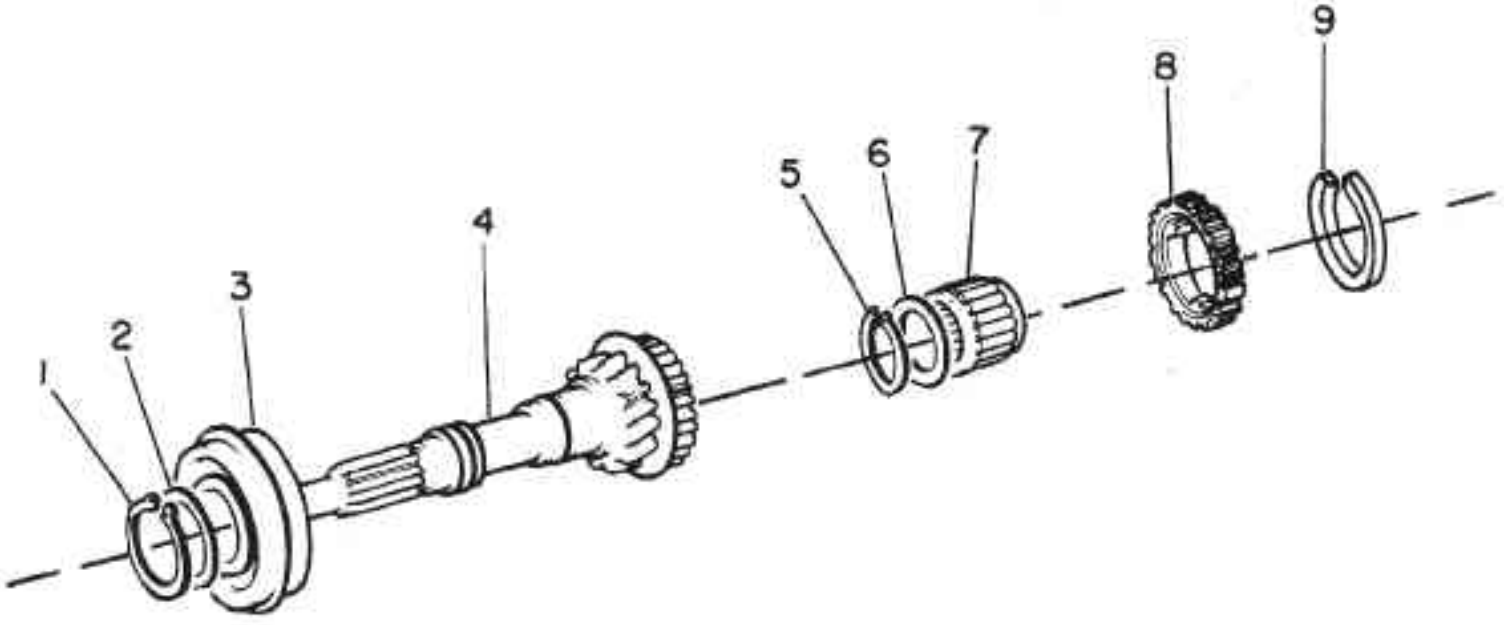
INPUT SHAFT ASSEMBLY

Reassemble Input Shaft Assembly

a. Lightly coat parts with oil.
b. Place input shaft (4) in press. Support on gear end.
c. Onto input shaft (4) input end, assemble bearing (3) with retaining ring away from gear, spring washer
(2), snap ring (1), and tool A.70350.

d. Use press to compress spring washer (2), then seat snap ring (1) in its groove. Remove from press.
e. Onto input shaft (4) output end, assemble synchro (8) with small end away from gear.
f. Assemble snap ring (9) in its groove.
g. Assemble snap ring (5) and washer (6), and bearing (7).
h. Coat bearing (7) with heavy grease, then insert in input shaft (4).
i Lay input shaft assembly on its side so bearing (7) does not come out.

1. Snap ring
2. Spring washer
3. Bearing
4. Input shaft
5. Snap ring
6. Washer
7. Bearing
8. Synchro
9. Snap ring



Input Shaft Assembly, Reassembly

TRANSMISSION ASSEMBLY

Reassemble Transmission Assembly - Install Input and Main Shaft Assemblies

a. Lightly coat all bearing bores, bores for fork shafts, and bores for detent balls and dowels. Also coat each part as it is installed.

b. While keeping main shaft assembly (5) fully compressed, carefully insert output end into its bore in case (9), then insert input end.

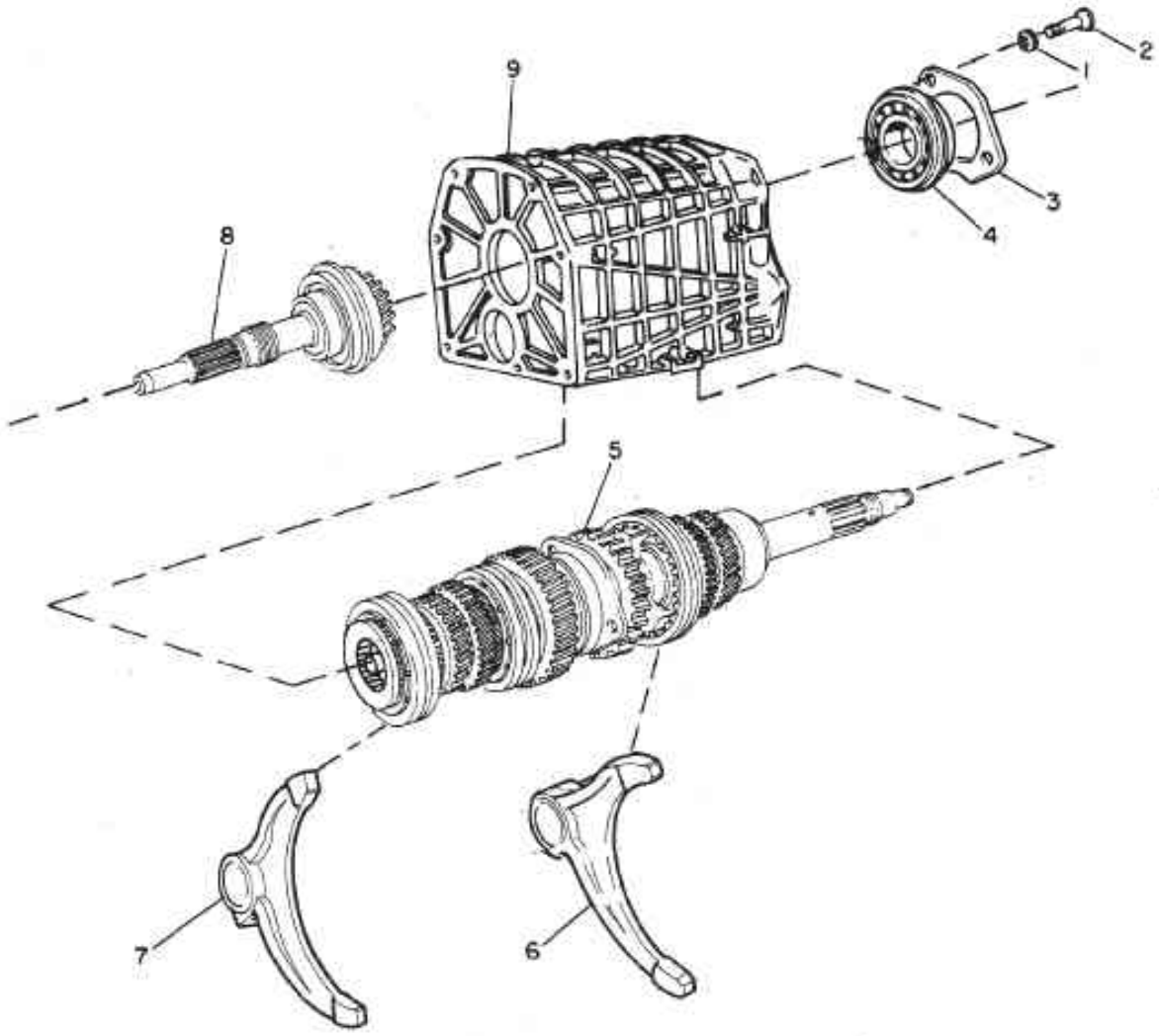
c. Check for bearing in input shaft assembly (8), then carefully work input shaft assembly into its bore in case (9).

d. Assemble bearing (4), bearing retainer (3), washers (1) and screws (2). Tighten screws with an im-pact driver.

e. Check that input and main shaft assemblies (8 and 5) are easily turned. Check that sleeves on main shaft assembly can be moved axially.

f. Install first and second shift fork (6) and third and fourth shift fork (7) in their respective sleeves on main shaft assembly (5). Make sure thread holes face cover end of case (9).

1. Lockwasher
2. Screw
3. Bearing retainer
4. Bearing
5. Main shaft assembly
6. First and second shift fork
7. Third and fourth shift fork
8. Input shaft assembly
9. Case



Input and Main Shaft Assemblies, Reassemblies

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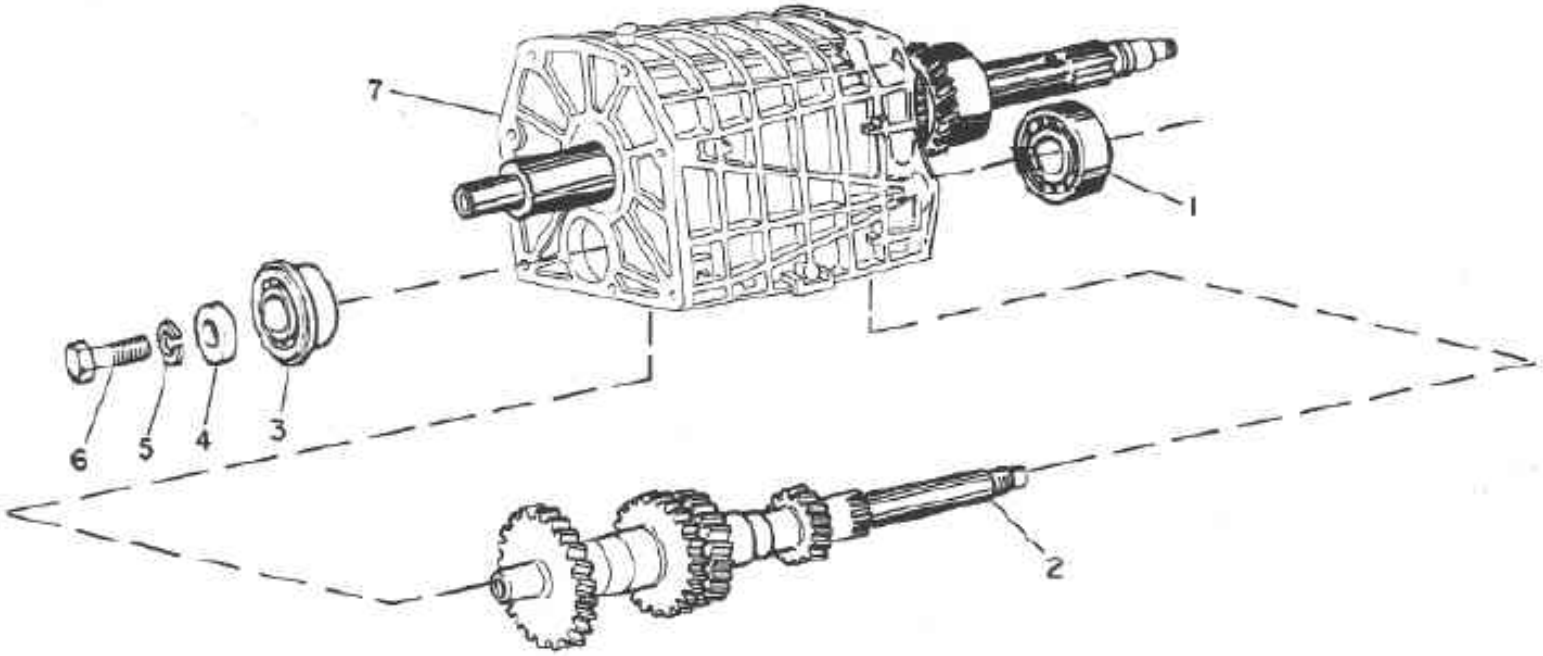
Install Countershaft

a. Insert output end of countershaft (2) into its bore in case (7), then insert input end.

b. Assemble bearing (3) with retaining ring away from case (7), washer (4), lockwasher (5), and bolt (6). Finger tighten bolt.

c. Install bearing (1) with inner race going on first. Carefully tap on outer race to install.

1. Bearing
2. Countershaft
3. Bearing
4. Washer
5. Lockwasher
6. Bolt
7. Case



Countershaft, Installation

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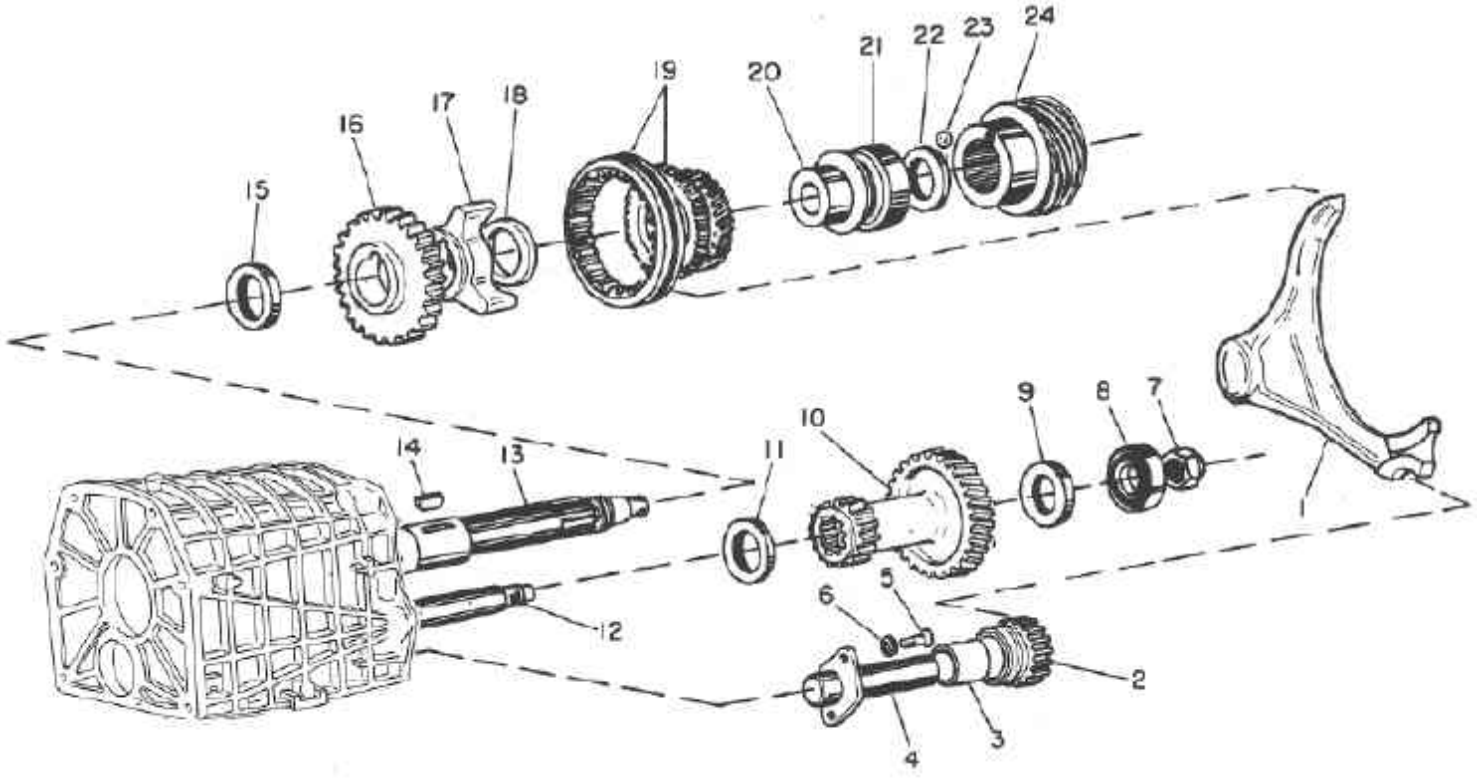
Install Fifth and Reverse Gears

a. If removed, install bushing (3) in reverse sliding gear (2). Attach shaft (4), iockwasher (6), and screws (5). Tighten screws with impact driver.
b. Assemble spacer (15) and key (14) on main shaft (13).
c. Assemble reverse gear (16), hub 0 7), and spacer (18).
d. Assemble spacer (11) on countershaft (12).
e. Partially assemble fifth and reverse gear (10) on countershaft (12), and fifth gear assembly (19) on main shaft (13).
f. Assemble fifth and reverse shift fork (1) on reverse sliding gear (2) and fifth gear assembly (19). Carefully slide partially assembled parts on their respective shafts until they can be released.
g. Carefully tap on fifth and reverse gear (10) until it is fully seated on countershaft (12).
h. Assemble spacer (9), bearing (8), and nut (7). Finger tighten nut.
i. Assemble bushing (20), bearing (21), spacer (22), ball (23), and speedometer drive gear (24).

1 . Fifth and reverse shift fork
2. Reverse sliding gear
3. Bushing
4. Shaft
5. Screw
6. Lockwasher
7. 27-mm nut
8. Bearing
9. Spacer
10. Fifth and reverse gear
11. Spaper
12. Countershaft
13. Main shaft
14. Key
15. Spacer
16. Reverse gear
17. Hub
18. Spacer
19. Fifth gear assembly
20. Bushing
21. Bearing
22. Spacer
23. Ball
24. Speedometer drive gear

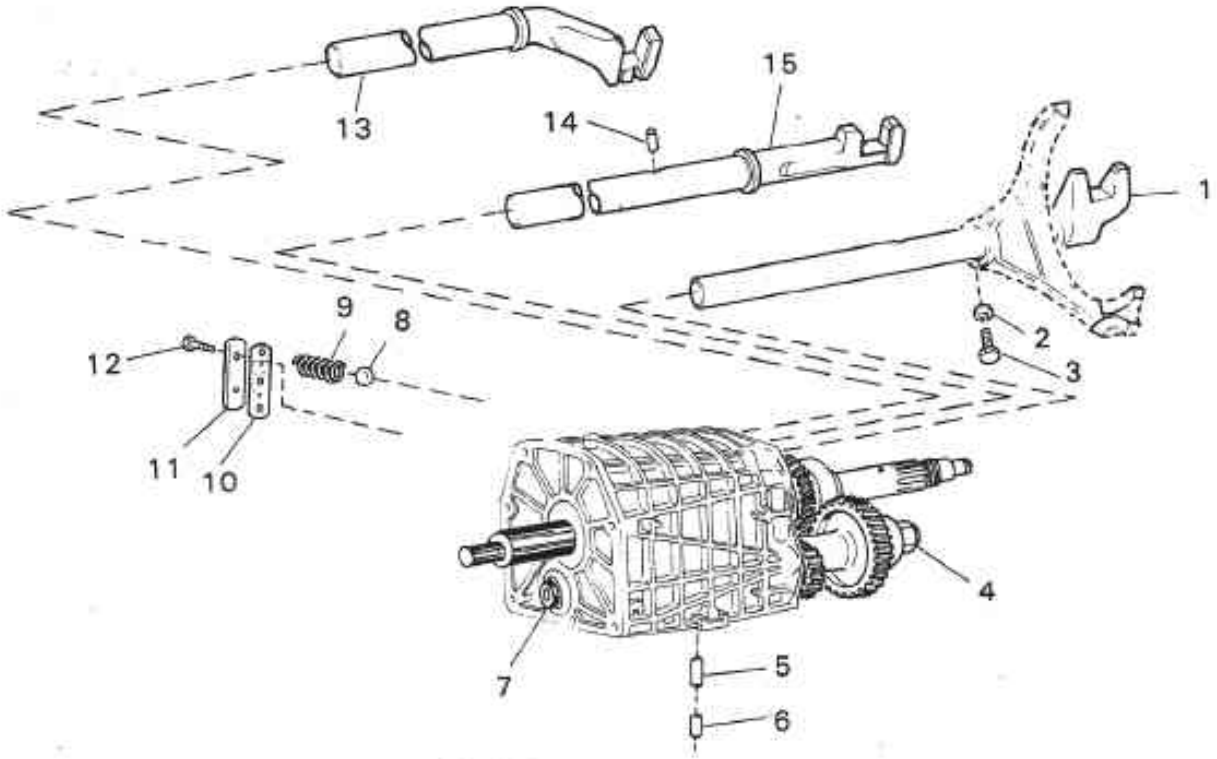


Fifth and Reverse Gears, Installation

Install Fork Shafts

a. Install first and second fork shaft (13) in fork shaft hole furthest away from case cover. As fork shaft is
installed, insert into first and second shift fork.
b. Assemble washer (2) and bolt (3). Tighten to 14 lb ft torque.
c. Install long detent dowel (5).
d. Install third and fourth fork shaft (15) in center fork shaft holes. As fork shaft is installed, insert into third and fourth shift fork. Also install detent pin (14) into fork shaft (15).
e. Assemble washer (2) and bolt (3). Tighten to 14 lb ft torque.
f. Temporarily install two detent balls (8) and two springs (9) for installed fork shafts. Assemble cover (11)
and two bolts (12).
g. Engage two gear's to lock the transmission.
h. Tighten 27-mm nut (4) to 87 ib ft, and 19-mm bolt to 69 lb ft torque. Disengage two gears.
i. Check that both countershaft and main shaft can be easily turned. If countershaft cannot be turned, its
rear bearing may be installed backwards. Also engage each gear and check for free turning.
j. Using staking pliers A.74140/1 and staking heads A.74140/4, stake nut (4).
k. Install short detent dowel (6).
l. Install fifth and reverse fork shaft (1) into fifth and reverse shift fork, and into remaining fork shaft hole.
m. Assemble washer (2) and bolt (3). Tighten to 14 lb ft torque.
n. Remove bolt (12) and cover (11). Install third detent ball (8) and spring (9).
o. Install new gasket (10) (sealant is not recommended), cover (11), and two bolts (12). Tighten bolts to
18 lb ft torque.
p. Engage a gear. Check that a second gear cannot be engaged at the same time.

1 . Fifth and reverse fork shaft
2. Lockwasher
3. Bolt
4. 27-mm nut
5. Long detent dowel
6. Short detent dowel
7. 19-mm bolt
8. Detent ball
9. Spring
10. Gasket
11. Cover
12. Bolt
13. First and second fork shaft
14. Detent pin
15. Third and fourth fork shaft



Fork Shafts, Installation

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Assemble Engaging Lever

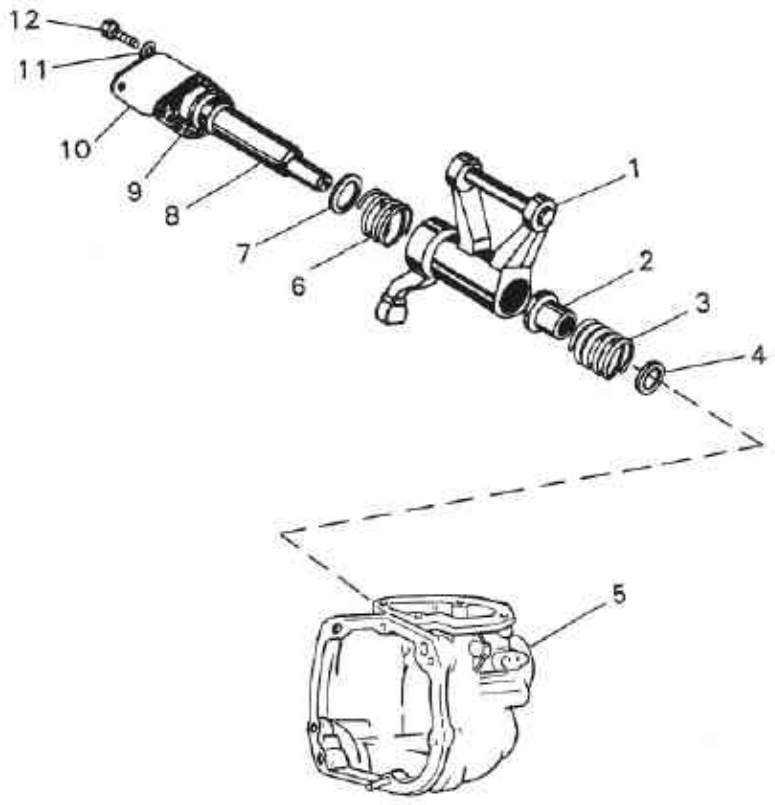
a. If disassembled, install thrust washer (4) in rear housing (5).

b. Slowly install engaging lever rod (8) into rear housing (5). As rod is installed, assemble thrust washer (7), spring (6), gear selection and engaging lever 0), spring retainer (2), and spring (3).

c. Install new gasket (9) (sealant is not recommended), cover 0 0), lockwasher 0 1), and bolt 0 2). Tighten bolt to 14 lb ft torque.

d. Check for free side-to-side travel of gear selection and engaging lever (1), and that it returns to center position when released.

1 . Engaging lever
2. Spring retainer
3. Spring
4. Thrust washer
5. Rear housing
6. Spring
7. Thrust washer
8. Engaging lever rod
9. Gasket
10. Cover
11. Lockwasher
12. Bolt



Engaging Lever, Installation

Install Rear Housing

a. If removed, install new seal (5).

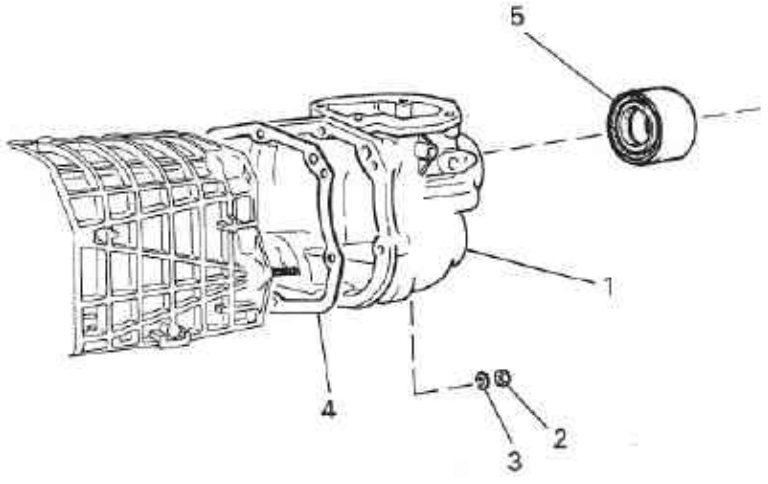
b. Assemble new gasket (4) on case (sealant is not recommended).

c. Move gear selection and engaging lever rearward. Slowly assemble rear housing (1) onto case. As rear housing is assembled, guide gear selection and engaging lever into fork shafts.

d, Assemble six nuts (2) and lockwashers (3). Tighten to 18 lb ft torque.

e. Check that gear selection and engaging lever can be operated through all gears.

1 . Rear housing
2. Nut
3. Lockwasher
4. Gasket
5. Seal

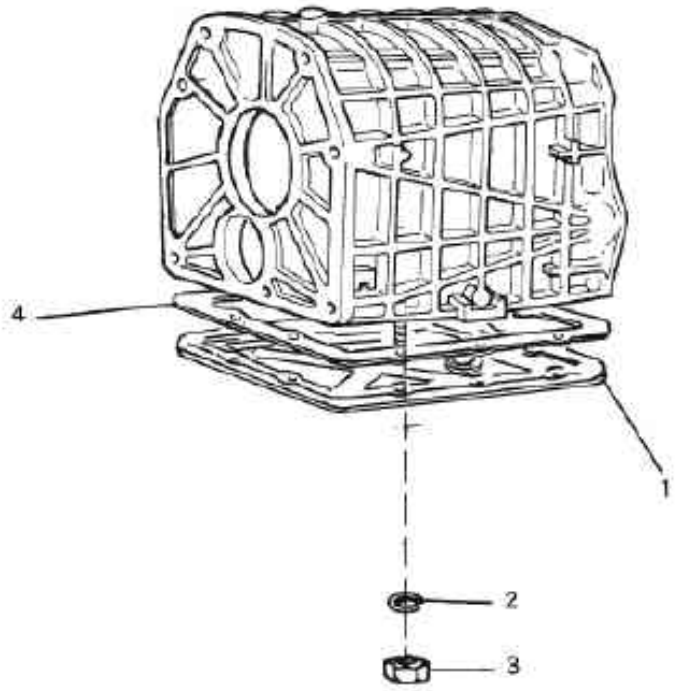


Rear Housing, Installation

Install Case Cover

a. Assembie new gasket (4) to case.
b. Assemble cover (1), ten lockwashers (2), and nuts (3).

1. Cover
2. Lockwasher
3. Nut
4. Gasket

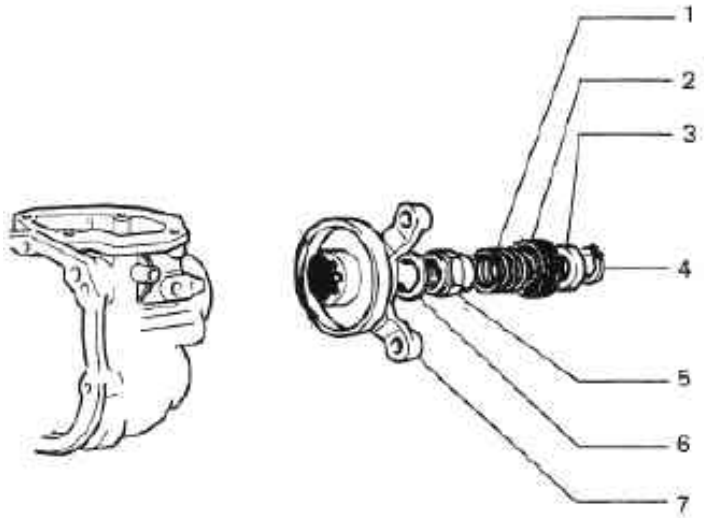


Case Cover, Installation

Install Yoke

a. Coat splines of yoke (7) with antiseize compound, then assemble to main shaft.
b. Assemble washer (6) and nut (5). Using adapter A-551 30 on yoke (7), tighten nut to 108 lb ft torque.
c. Assemble spring (1), seal (2), spacer (3), and snap ring (4).
d. Coat seal (2) with heavy grease.

1. Spring
2. Seal
3. Spacer
4. Snap ring
5. Nut
6. Washer
7. Yoke

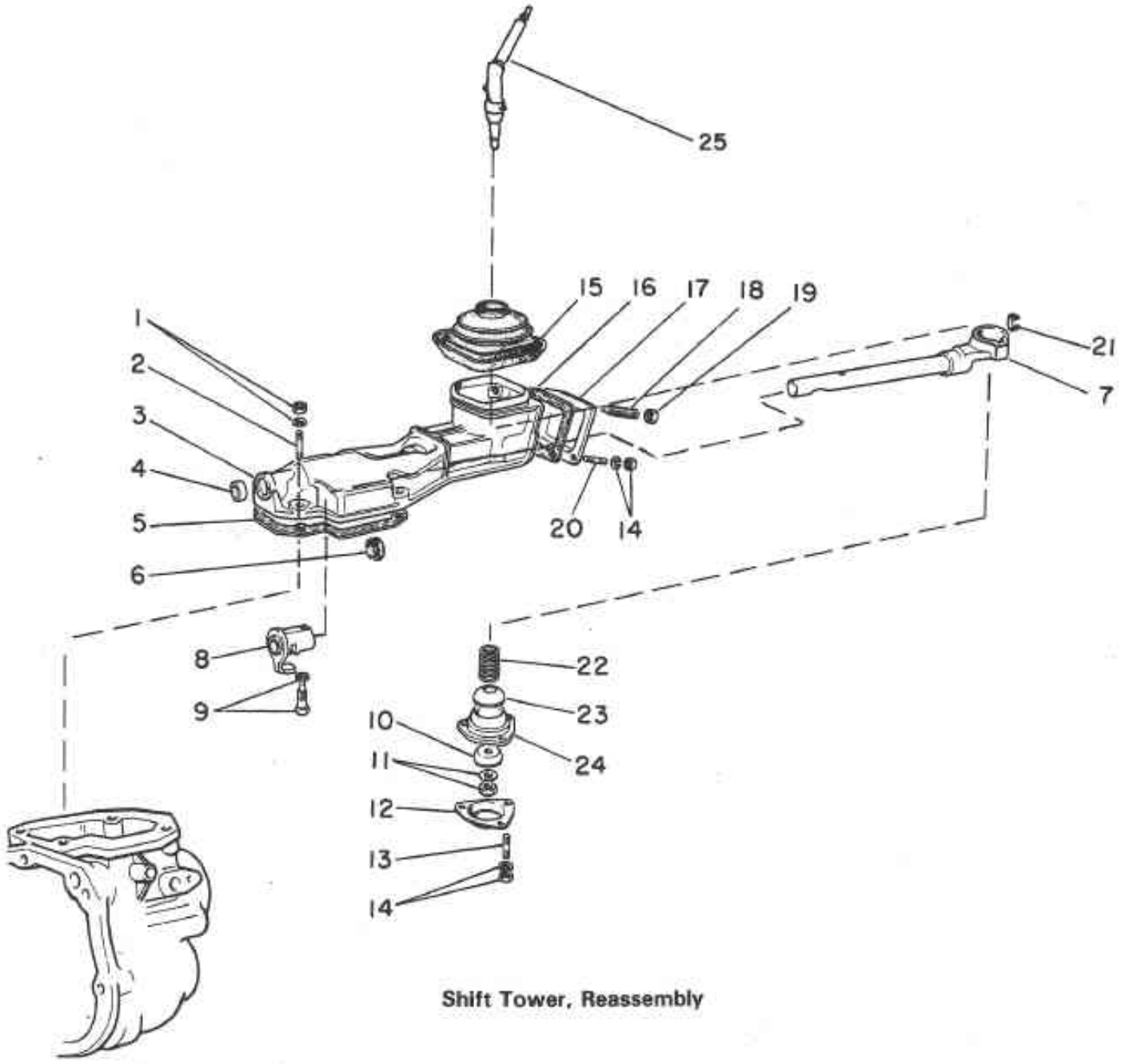


Yoke, Installation

Assemble Shift Tower

a. If disassembled, install shaft (7) in shift tower (3) and into dog (8). Assembie bolt and washer (9).
Tighten screw to 14 lb ft torque.
b. Assembie new gasket (16), cover (17), and washer and nut 0 4).
c. Place spring (21) in groove in shaft (7). Install shift lever (25).
d. To bottom of shift lever, assemble spring (22), cover (23), socket (24), bearing (10), and washer and
nut (11). Tighten nut to 11 lb ft torque.
e. Assemble cover 0 2) and three washers and nuts 0 4).
f. To adjust reverse lockout screw (18), place shift lever (25) in fifth/reverse gate. Screw reverse lockout screw (18) in until it contacts shift lever, then back out three turns. Tighten locknut 0 9).

1 . Nut and lockwasher
2. Stud
3. Shift tower
4. Cap
5. Gasket
6. Bearing
7. Shaft
8. Dog
9. Bolt and lockwasher
10. Bearing
11. Nut and washer
12. Cover
13. Stud
14. Nut and lockwasher
15. Boot
16. Gasket
17. Cover
18. Reverse lockout screw
19. Locknut
20. Stud
21. Spring
22. Spring
23. Cover
24. Socket
25. Shift lever



Shift Tower, Reassembly

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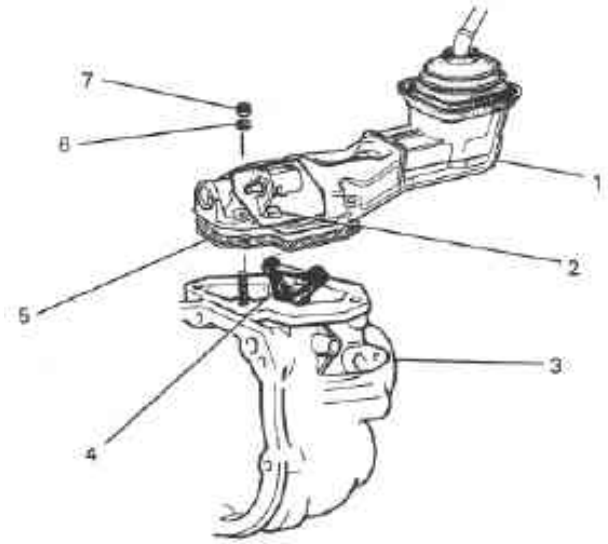
Install Shift Tower

a. Assemble new gasket (5) on rear housing (3).
b. Move shift lever forward, then place shift tower (1) on rear housing (3).
c. Carefully slide shift tower down, then move shift lever rearward to engage dog (2) on engaging lever (4).
d. Assemble four washers (6) and nuts (7).

1 . Shift tower assembly
2. Dog
3. Rear housing
4. Engaging lever
5. Gasket
6. Lockwasher
7. Nut

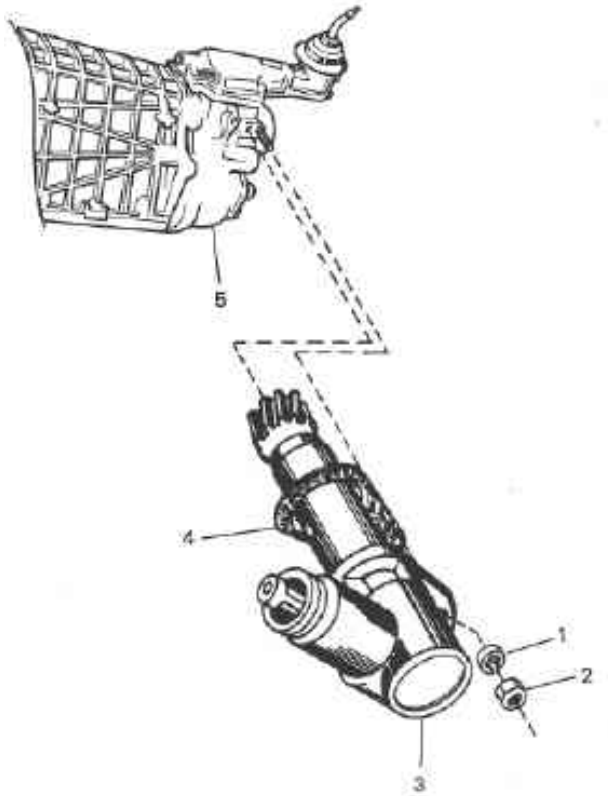


Shift Tower, Installation

Install Speedometer Drive

a. Assemble new gasket (4) and speedometer drive (3) on rear housing (5).
b. Assemble washer (1) and nut (2).

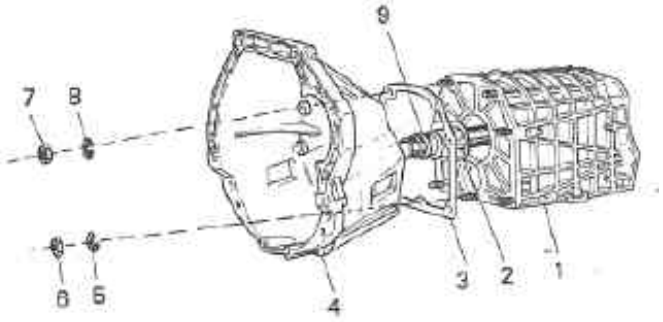
1. Lockwasher
2. Nut
3. Speedometer drive
4. Gasket
5. Rear housing



Speedometer Drive, Installation

Install Bellhousing

a. If removed, install new seal (9) in bellhousing (4).
b. Assembie new gasket (3) on. case (1).
c. Coat spring washer (2) with heavy grease. With cup end forward, place on seal in bellhousing.
d. Assemble bellh ousing (4), six lockwashers (8), nuts (7), and one lockwasher (5) and nut (6).
e. Tighten nuts (7) to 36 lb ft torque and nut (6) to 18 lb ft torque.

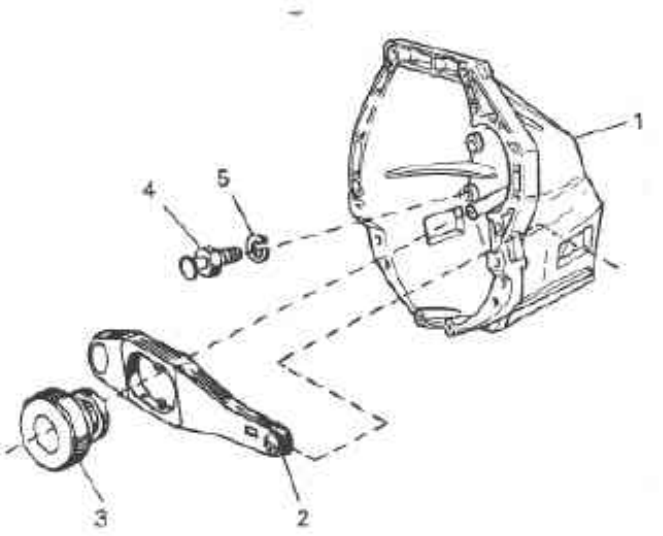


Bellhousing, Installation

1. Case
2. Spring washer
3. Gasket
4. Bellhousing
5. Lockwasher
6. Nut
7. Nut
S. Lockwasher
9. Seal

Install Yoke and Throwout Bearing

a. If removed, assemble lockwasher (5) and pivot (4) to bellhousing (1).
b. Insert throwout bearing (3) into yoke (2).
c. Insert return spring end of yoke (2) into opening in bellhousing (1) and throwout bearing (3) over input shaft.
d. Slide yoke (2) over pivot (4) until locked in place.

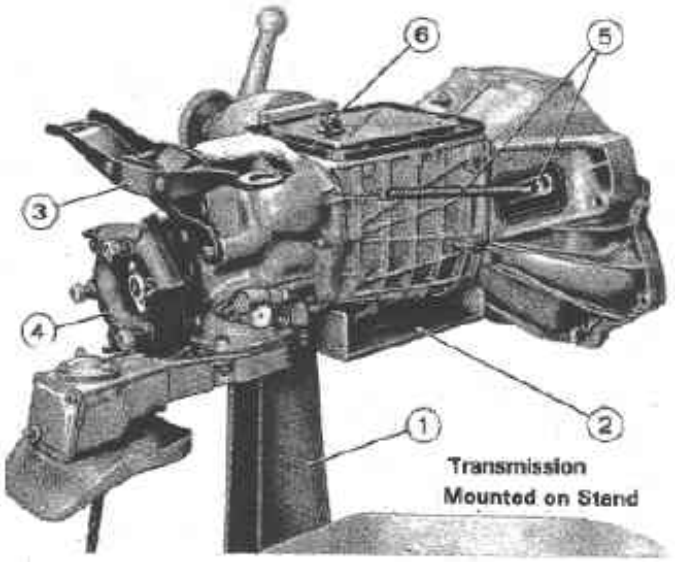


Throwout Bearing and Yoke, Installation

1. Bellhousing
2. Yoke
3. Throwout bearing
4. Pivot
5. Lockwasher

Install Oil Plugs

a. Assemble return spring and rubber boot (5).
b. Using two nuts and washers, attach rear supporting cross strut (3) to rear housing.
c. Using three self-locking nuts and bolts, attach flexible joint (4) to yoke.
d. Using tools A.5011 3 and A.55087, install oil drain plug (6) and rear housing oil drain plug. Loosely install oil level plugs until transmission is filled with oil.
e. After transmission is car installed, add 1 % quarts of SAE 90 oil containing antiwear additives. Do not use EP oil.



1. Rotating stand
2. Support
3. Rear supporting cross strut
4. Flexible joint
5. Spring and rubber boot
6. Oil drain plug