

## G.M. Corporation SM420 4 Speed

### Description

The model SM420 synchromesh has four forward speeds and one reverse. Fourth speed is direct drive. All speeds except first and reverse use helicalgears.

### General Data

Type	4-Speed Synchromesh
Model	SM420
Gear Tooth Design	

1st and Reserve  
2nd and Third

Spur  
Helical

### Gear ratios

1st Speed	7.05 to 1
2nd Speed	3.58 to 1
3rd Speed	1.71 to 1
4th Speed	1 to 1
Reverse	6.78 to 1

### Disassembly of Transmission

See exploded view of transmission.

### Shift Control Cover Removal

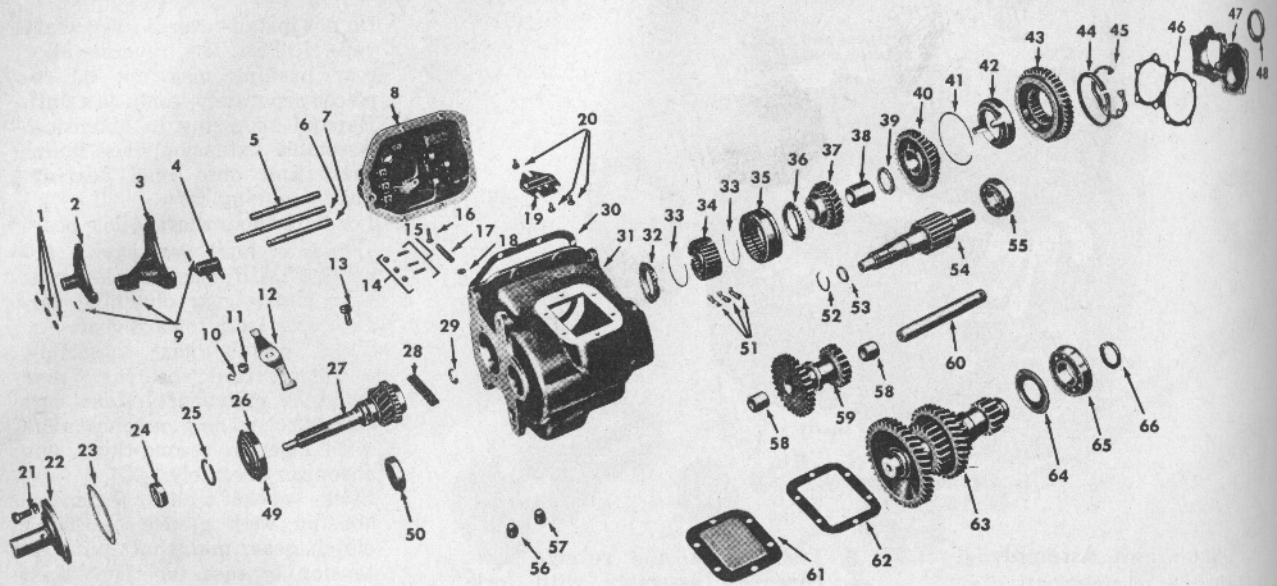
1. Remove gearshift lever from

transmission cover using re-  
mover and replacer tool.

2. Remove transmission cover.
3. Remove nut lock and nut from reverse shifter lever eccentric. Drive eccentric out of transmission case and remove reverse shifter lever.

### Clutch Drive Gear Removal

1. Remove drive gear bearing re-  
tainer and gasket.
2. Using a plastic hammer, remove  
the clutch drive gear from trans-



- |                                   |                                 |                                   |                                |
|-----------------------------------|---------------------------------|-----------------------------------|--------------------------------|
| 1 Hole plugs                      | 17 Compression spring           | 35 Clutch sleeve                  | 52 Clutch hub retainer ring    |
| 2 3rd and 4th shift fork          | 18 Plug                         | 36 Synchronizer cone (3rd spd.)   | 53 Bearing spacer              |
| 3 1st and 2nd shift fork          | 19 Interlock Plate Assy.        | 37 Mainshaft 3rd speed gear       | 54 Mainshaft                   |
| 4 Reverse shifter head            | 20 Interlock Plate Pin          | 38 3rd speed gear bushing         | 55 Mainshaft rear bearing      |
| 5 3rd and 4th speed shifter shaft | 21 Retainer bolt                | 39 Thrust washer                  | 56 Drain plug                  |
| 6 1st and 2nd speed shifter shaft | 22 Drive gear bearing retainer  | 40 Mainshaft 2nd speed gear       | 57 Filler plug                 |
| 7 Reverse shifter shaft           | 23 Retainer gasket              | 41 Synchronizer ring retainer     | 58 Bushing                     |
| 8 Transmission cover              | 24 Seal                         | 42 Synchronizer ring (2nd spd.)   | 59 Reverse idler gear assy.    |
| 9 Taper pins                      | 25 Bearing retainer ring        | 43 Mainshaft 1st and reverse gear | 60 Idler gear shaft            |
| 10 Nut Lock                       | 26 Drive gear bearing           | 44 Friction ring rubber strip     | 61 P.T.O. opening cover        |
| 11 Nut                            | 27 Clutch drive gear            | 45 Friction ring (steel)          | 62 Cover gasket                |
| 12 Reverse shifter lever          | 28 Mainshaft bearing rollers    | 46 Rear bearing retainer gasket   | 63 Countershaft and gear assy. |
| 13 Lever eccentric                | 29 Roller retainer              | 47 Rear bearing retainer          | 64 Oil deflector               |
| 14 Shifter shaft detent ball      | 30 Cover gasket                 | 48 Oil seal                       | 65 Countershaft rear bearing   |
| 15 Detent ball spring             | 31 Transmission case            | 49 Drive gear bearing snap ring   | 66 Bearing retainer ring       |
| 16 Compression pin                | 32 Synchronizer cone (4th spd.) | 50 Countershaft front bearing     |                                |
|                                   | 33 Clutch key spring            | 51 Clutch key                     |                                |
|                                   | 34 Clutch hub                   |                                   |                                |

Third and fourth speed synchronizing components (© G.M.C.)

mission. NOTE: Index cut-out section of clutch drive gear with countershaft driven gear to obtain clearance necessary for removal.

3. Remove drive gear synchronizer cone and mainshaft pilot bearing roller spacer from end of mainshaft.

**Mainshaft Removal**

1. Remove speedometer driven gear from rear bearing retainer.
2. Lock transmission into two gears at the same time.
3. Remove bolt, lock washer, and special washer or retaining nut; then remove universal joint

front flange or yoke from mainshaft.

4. Remove rear bearing retainer and gasket.
5. Push mainshaft assembly to the rear and remove retaining ring from outer race of mainshaft rear bearing. Using bearing puller, pull bearing assembly from end of mainshaft.
6. With 1st and reverse sliding gear pushed forward, raise front of mainshaft and remove shaft from transmission.

**Reverse Idler Gear Removal**

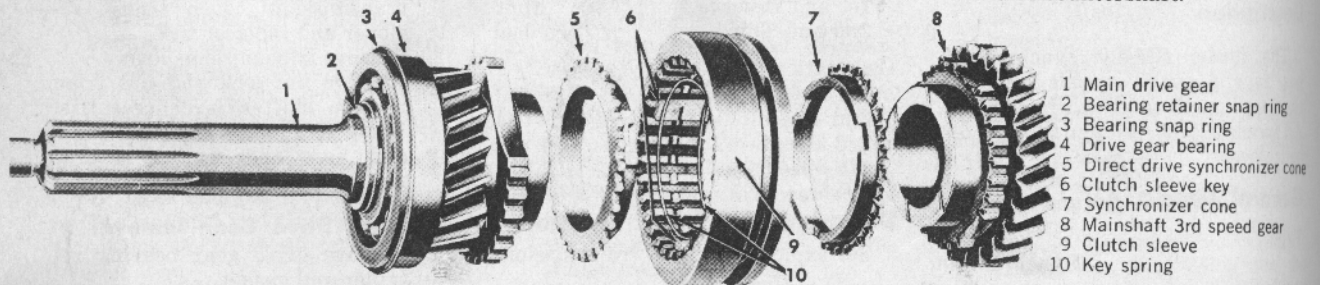
1. Drive reverse idler gear shaft lock pin into the shaft. After pin

has been driven into hole in shaft, shaft may be driven out of transmission case from front to rear with a brass drift and hammer.

2. Remove reverse idler gear assembly from case.

**Countershaft Removal**

1. Remove retainer ring from countershaft rear bearing.
2. Remove rear bearing snap-ring.
3. Engage grab edges of puller tool plate in ring grooves of countershaft rear bearing.
4. Using bearing puller, remove rear bearing assembly from rear end of countershaft.



Exploded view of transmission (© G.M.C.)

5. Raise front end of countershaft and remove from case.

NOTE: If transmission is equipped with power take-off, remove cover and gasket.

### Disassembly of Subassemblies

See exploded view of transmission.

#### Shift Control Cover Disassembly

1. Remove reverse shifter head from shaft.
2. Remove shifter shafts and shift forks. NOTE: Remove shafts carefully so as not to lose detent balls and springs. There should be three of each.
3. Should it be necessary to remove the interlock plate assembly, cut the three attaching pins and remove assembly from transmission.
4. Remove expansion plug (caution—plug is under spring tension), compression spring, and reverse shifter compression pin from transmission cover.

#### Clutch Drive Gear Disassembly

1. Remove roller retainer and eighteen mainshaft pilot bearing rollers from rear end of clutch drive gear.
2. Remove bearing retaining snap-ring from clutch drive gear.
3. Position clutch drive gear in an arbor press and, using special tools, press drive gear assembly out of drive gear bearing.

#### Mainshaft Disassembly

1. Remove 3rd and 4th speed clutch hub retainer ring from pilot end of mainshaft.
2. Using an arbor press, press mainshaft out of gear cluster.
3. Remove 3rd and 4th speed clutch hub. Remove two clutch key springs from 3rd and 4th speed clutch hub. Remove 3rd and 4th speed clutch sleeve. Remove three clutch keys.
4. Remove 3rd speed gear synchronizer cone, 3rd speed gear and thrust washer.
5. Remove mainshaft 2nd speed

gear, synchronizing ring retainer and synchronizer ring from mainshaft 1st and reverse gear.

6. Remove steel friction ring and rubber strip from splines of 1st and reverse gear.

#### Countershaft Disassembly

1. Remove snap-ring from front end of countershaft.
2. Using an arbor press, press countershaft out of stack of gears.

NOTE: Countershaft 1st speed gear is part of the countershaft.

#### Mainshaft Rear Bearing Retainer

##### Oil Seal Replacement

1. Using a suitable sleeve, press or drive oil seal out of mainshaft rear bearing retainer.
2. Press or drive new oil seal into retainer until it bottoms. NOTE: Lightly coat outer diameter of oil seal with sealing cement. Wipe off excess cement. Lip of oil seal goes toward front of retainer.

#### Drive Gear Bearing Retainer

##### Oil Seal Replacement

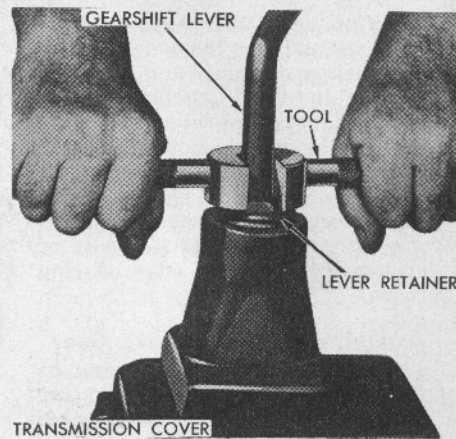
1. Pry old oil seal out of retainer.
2. Insert new oil seal on special tool with lip of seal toward flange on tool.
3. Support front surface of retainer in press and press seal into retainer until flange of tool bottoms on retainer.

#### Countershaft Front Bearing Replacement

1. If countershaft front bearing needs replacing, drive bearing out of transmission case.
2. Apply sealing cement to outer surface of new bearing and drive into case.

#### Reverse Idler Gear Bushing Replacement

1. If reverse idler gear bushings are scored or worn, use a suitable sleeve and press bushings out of gear.
2. Using installer tool, press new bushings into bore of idler gear.



Removing gearshift lever  
(© G.M.C.)

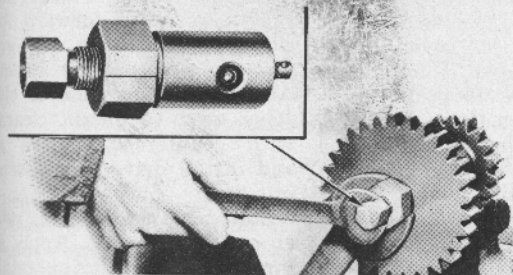
Press bushings into gear until 1 1/16-inch clearance is obtained between bushings and ends of gear.

3. Stake bushings in position using staking tool. NOTE: It is important that bushings be properly staked as they are of split type and may have a tendency to creep. Stake bushings approximately 1/4-inch from split.
4. After bushings are installed they must be line reamed to size.

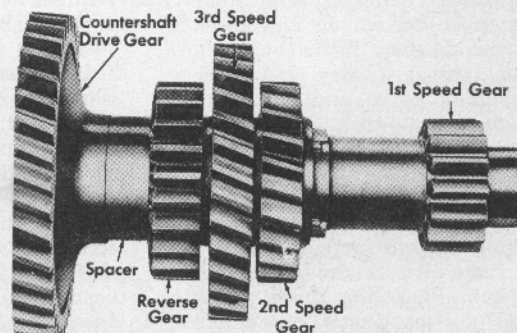
### Assembly of Subassemblies

#### Assembly of Countershaft

1. Use new drive keys when assembling the countershaft. Position one new drive key in slot of countershaft. Using an arbor press install gears in the following order:
2. Using a suitable sleeve, press 2nd speed against shoulder on countershaft.
3. Press 3rd speed gear on the countershaft. Both sides of gear are identical so gear can be installed either way.
4. Press reverse gear on the countershaft so chamfered end of teeth face countershaft drive gear. Install spacer on countershaft.
5. Press drive gear on the countershaft.
6. After gears are pressed into po-



Staking reverse idler gear  
(© G.M.C.)



Countershaft and gear assembly  
(© G.M.C.)

sition on countershaft, drive in the remaining three drive keys. Use a small punch to drive each key in 0.30" maximum past front surface of drive gear.

7. Install snap-ring in groove of countershaft.

NOTE: Snap-ring is a selective type. Select a ring wide enough to completely fill space between edge of drive gear and front edge of ring groove.

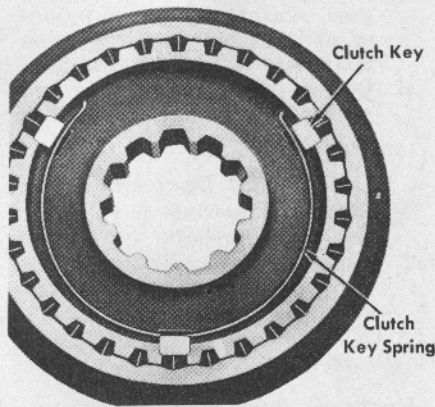
#### Assembly of Clutch Drive Gear

1. Position drive gear bearing on drive gear shaft; then using press plate, press bearing onto drive gear.
2. Install retaining snap-ring on drive gear shaft.
3. Install snap-ring in drive gear bearing outer race.
4. Apply a small amount of grease to bearing surface in cavity at rear end of drive shaft. Install eighteen mainshaft pilot bearing rollers; then install bearing roller retainer.

NOTE: Purpose of installing roller retainer is to hold rollers in position when mainshaft is installed later. Mainshaft will force retainer forward from rollers into cavity at rear end of drive gear.

#### Assembly of Mainshaft

1. Assemble new friction ring rubber strip and then steel friction ring in groove in first and reverse sliding gear.
2. Assemble 2nd speed synchronizer ring to 1st and reverse sliding gear. Install retainer ring in groove of sliding gear. Retainer ring must be well seated in groove of gear.
3. Position 1st and reverse sliding gear assembly on splines of the mainshaft with synchronizer ring facing the front. NOTE: It may be necessary to pry against friction ring to engage all four spline engaging lugs.
4. Install 2nd speed gear on mainshaft with synchronizer springs toward synchronizer ring in 1st and reverse gear.
5. Install 2nd speed gear thrust washer.
6. Install 3rd speed gear bushing on mainshaft using special tool. Bushing must bottom on 2nd speed gear thrust washer. With the bushing tight against washer, 2nd speed gear should have end play of 0.012-inch  $\pm$  0.003 inch.
7. Install 3rd speed gear over bushing and install synchronizer cone on tapered surface of 3rd speed gear.
8. Install clutch sleeve over clutch hub so long tapered surface on sleeve faces in same direction as long shoulder on hub. Place the three clutch keys into position. Install one clutch key spring on each side of clutch hub. Both clutch key springs must be in-



Clutch keys and spring location  
(© G.M.C.)

stalled in the same relative position to provide even tension on clutch keys.

9. Support mainshaft assembly in an arbor press; then install clutch hub assembly with tapered surface of clutch sleeve and long shoulder of clutch hub toward pilot on mainshaft. Press clutch hub assembly onto shaft until it bottoms. IMPORTANT: Make sure that slots in third speed gear synchronizer cone align with three clutch keys in clutch hub assembly.

10. 3rd speed gear end play of 0.012 inch  $\pm$  0.002 inch should exist when clutch hub is firmly seated against bushing.

11. Install clutch hub retainer ring.

NOTE: The retainer ring is a selective lock ring and should be checked carefully for proper thickness at assembly. There are four thicknesses available—0.083", 0.087", 0.091" and 0.095". Be sure to select a proper ring that will assemble to obtain 0.007-inch maximum end clearance.

To make ring selection, lay retainer ring outer edge in groove at forward side of clutch hub and check clearance.

#### Assembly of Shift Control Cover

NOTE: See picture of shifter shafts for proper installation.

1. Place shifter shaft detent ball springs and detent balls in position in transmission cover.
2. Depress detent ball and push 3rd and 4th shifter shaft into cover so that it passes over ball. Hold 3rd and 4th shift fork in position and push shaft on through fork until retainer pin hole in fork aligns with hole in shifter shaft. Install tapered pin.
3. Follow the above procedure and install 1st and 2nd speed shift shaft and shift fork and reverse shift shaft and reverse shifter head in transmission cover.
4. Install and stake shifter shaft hole expansion plugs in transmission cover.

5. Install new reverse shifter compression pin, spring, and expansion plug. Support cover in a vise and hold plug while staking.
- NOTE: For initial lubrication and rust prevention, lubricate each moving part during assembly.

#### Installation of Countershaft

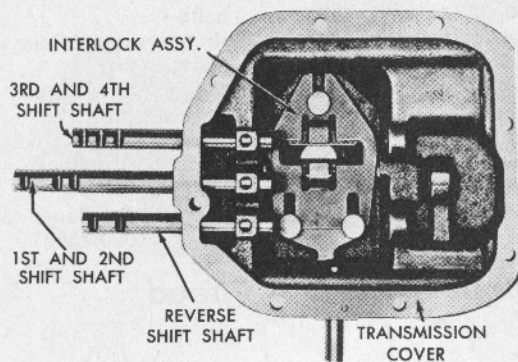
1. If countershaft front bearing was previously removed, apply sealing cement to outer surface of bearing; then drive in bearing until flush with front face of case.
2. Position countershaft assembly in transmission case with rear end of shaft extending through rear bearing hole.
3. Install oil deflector and rear bearing on countershaft assembly. Install bearing retainer ring in countershaft making sure it is well seated in groove of shaft.
4. Guide front end of shaft into front bearing. Rear bearing retainer snap-ring limits forward movement of countershaft.

#### Installation of Reverse Idler Gear

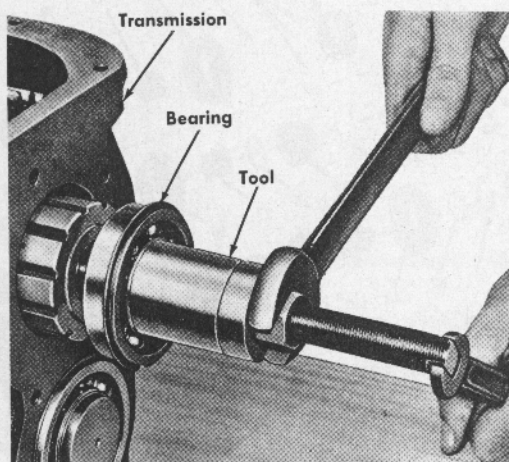
1. Position reverse idler gear assembly in transmission case; then install idler gear shaft into idler gear and transmission case from the rear. Be sure slot in rear end of shaft is in horizontal position.
2. Drive reverse idler gear shaft in until hole in shaft aligns with lock pin hole in transmission case. Drive new lock pin into shaft and case until pin is flush with case.

#### Installation of Mainshaft and Mainshaft Drive Gear

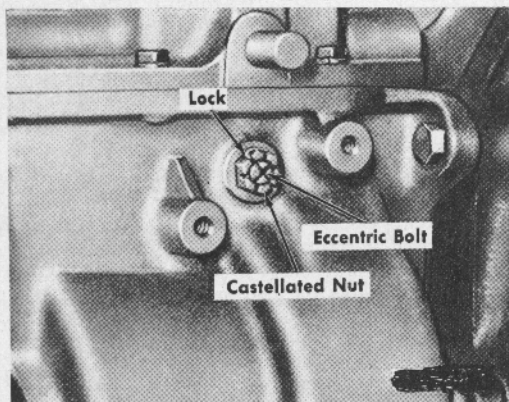
1. Position mainshaft assembly in case with rear of shaft extending out through rear bearing bore.
2. Using special tool, install mainshaft rear bearing assembly on rear end of mainshaft.
3. Install pilot bearing roller spacer on front end of mainshaft. Install drive gear synchronizer cone and move mainshaft assembly forward until clutch sleeve clears 3rd speed gear on countershaft assembly.
4. Align cut-out portion of clutch drive gear to obtain clearance with countershaft drive gear and install drive gear assembly into case.
5. Install drive gear bearing retainer and new gasket. Apply sealing cement to bearing retainer bolt threads and install with lock washers at 15-18 foot-pounds torque.
6. Enter mainshaft pilot end into bearing rollers in clutch drive



Shifter shaft positions  
(© G.M.C.)



Installing rear bearing on mainshaft  
(© G.M.C.)



Reverse idler gear adjustment location  
(© G.M.C.)

- gear.
7. Attach puller tool to rear of case and press in mainshaft and bearing assembly. NOTE: Be sure the three cut-out sections of drive gear synchronizer cone align with the three clutch keys.
  8. Install rear bearing retainer and gasket using a sealing cement on

the bolts. Tighten bolts to 20-25 foot-pounds torque.

9. Position reverse shifter lever in transmission case with lower end engaged with groove in reverse idler gear.
10. Install lever eccentric at outer side of transmission case and torque nut to a minimum of 40

foot-pounds. NOTE: Nut-lock should not be installed until after reverse shifter lever is adjusted as described later.

11. On some transmissions, install output flange or yoke with attached speedometer drive gear, on the mainshaft. Lock transmission into two gears at one time and install special washer, lock washer, and bolt at a torque of 60-65 foot-pounds.
12. On other transmissions, install output flange or yoke on the mainshaft. Lock transmission into two gears at once and torque retaining nut to 95-120 foot-pounds.
13. If used, install parking brake parts, and adjust parking brake.
14. Install speedometer driven gear and adapter in rear bearing retainer. Tighten adapter firmly.

#### Installation of Shift Control Cover

1. Make sure all transmission gears are in "Neutral" position; then install transmission cover assembly and new gasket on transmission case. Be sure shift forks engage respective gears. Install attaching bolts and lock washers and torque to 20-25 foot-pounds.
2. On transmissions having a conventional gearshift lever, use special tool and install lever. Engage lugs of tool in open slot of retainer. Press down on tool and turn to the right to engage lugs on retainer. On transmissions having remote controls, install control linkage.
3. Use procedures described in the following text to make proper adjustment of reverse shifter lever:
  - a. Position transmission in "Neutral." Loosen eccentric nut. Using a screwdriver in slot at outer end of eccentric, turn eccentric so that small round (dot) marks on slotted end of eccentric are toward rear of the transmission. This places reverse idler gear in its extreme rear position and will provide maximum engagement when transmission is shifted into reverse.
  - b. Shift transmission into 2nd speed; then through the power take-off opening, check for interference between reverse idler gear and first and reverse gear. If interference exists, rotate eccentric counterclockwise to provide approximately 1/32-inch running clearance between gears.
  - c. Shift transmission into reverse; then check for clearance between reverse idler gear and transmission case at the rear. If

necessary, rotate the eccentric an additional amount in a counterclockwise direction to obtain running clearance at this point.

d. Lock adjustment by tightening lock nut to 40 foot-pounds torque. Install nut lock.

4. Check operation of transmission by shifting into each gear and make sure drive gear can be rotated without binding in each

position.

5. Install drain plug, filler plug, PTO cover (or unit, if used) and new gasket. Fill transmission with lubricant.

## Torque Wrench Specifications

	<i>Foot-Pounds</i>
Drain plug	30 to 35
Drive gear bearing retainer bolts	15 to 18

Power take-off cover

bolts 15 to 20

Rear bearing retainer

bolts 20 to 25

Reverse shifter lever

eccentric nut 40 ft.-lbs.

Transmission cover bolts 20 to 25

Universal joint flange nut  
(3500-4000)

95 to 120

Universal joint flange cap  
screw (1000-2500)

60 to 65

From Chilton's Truck Repair Manual 1971