

## GENERAL

See [Figure 6-43](#). The transmission is a five-speed constant-mesh type housed in an extension of the crankcase.

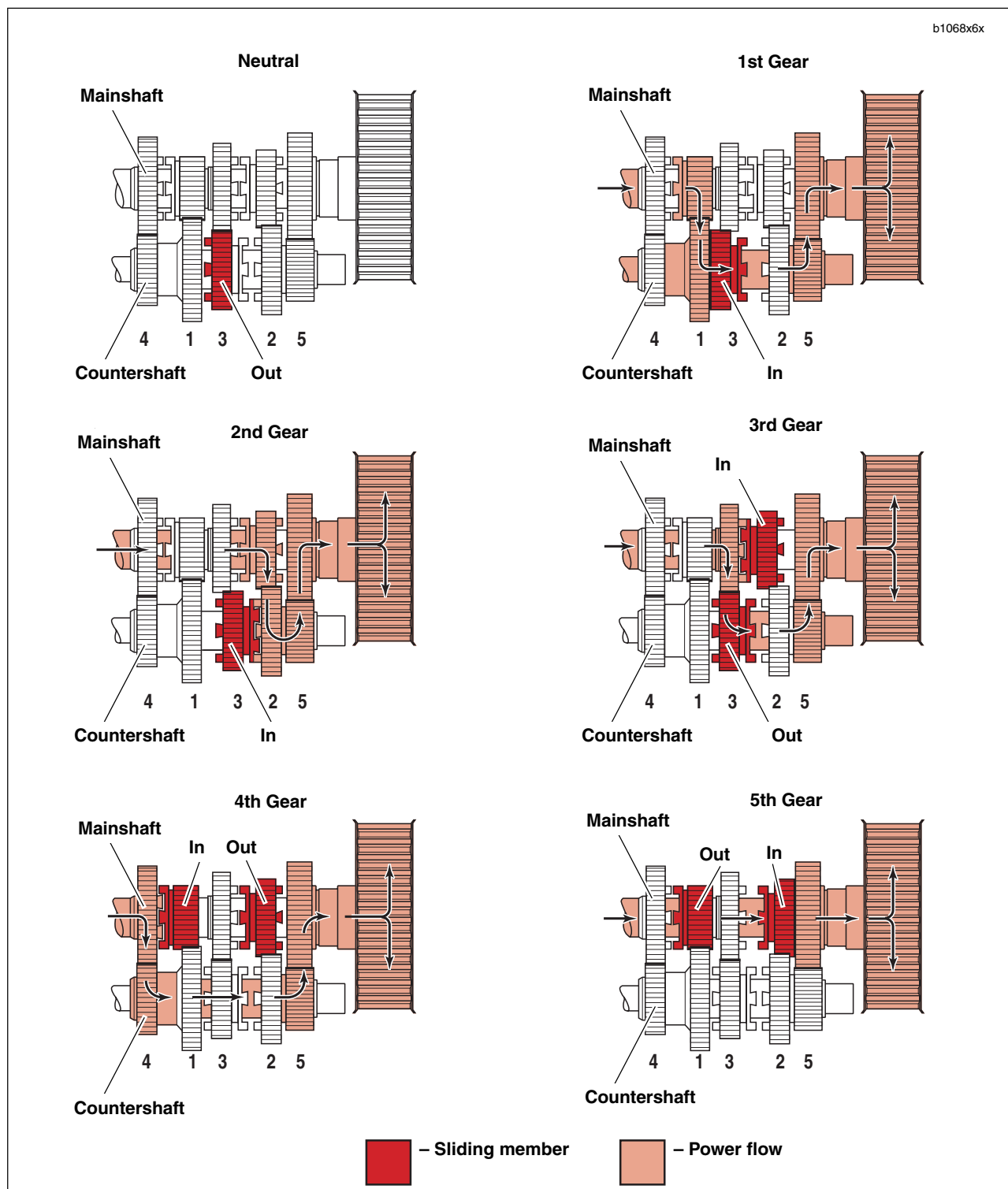


Figure 6-43. Transmission Power Flow

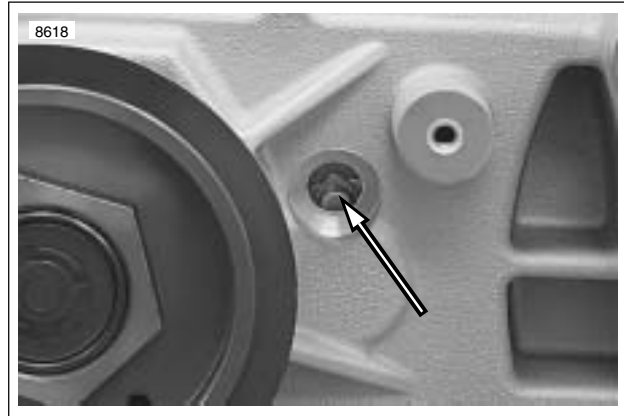
# CASE DISASSEMBLY FOR TRANSMISSION REMOVAL 6.8

## GENERAL

The rear compartment of the left and right crankcase halves form the transmission case. Servicing of transmission components requires removing the engine and disassembling (splitting) the crankcase.

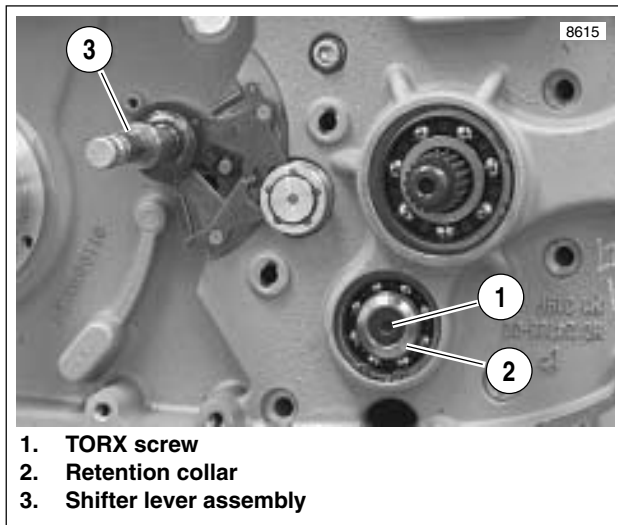
## RIGHT CRANKCASE REMOVAL

1. Remove transmission sprocket. See [6.16 TRANSMISSION SPROCKET](#).
2. Remove engine from chassis. See [3.4 STRIPPING MOTORCYCLE FOR ENGINE SERVICE](#).
3. Support engine using ENGINE SUPPORT STAND (Part No. HD-42310/HD-43646 or HD-43682).
4. Disassemble top end. See [3.6 CYLINDER HEAD](#).
5. Disassemble gearcase. See [3.16 GEARCASE COVER AND CAM GEARS](#).
6. Remove primary cover. See [6.2 PRIMARY COVER](#).
7. Remove clutch assembly, primary chain and engine sprocket. See [6.4 CLUTCH](#).



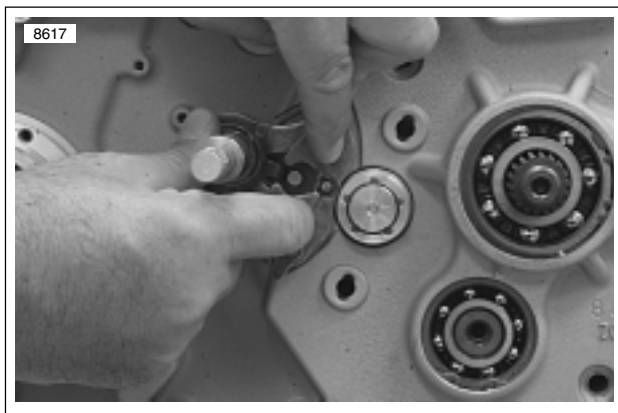
**Figure 6-45. Shifter Drum Neutral Detent**

9. See [Figure 6-45](#). Place transmission in neutral. Remove neutral switch to ensure shifter drum detent is visible indicating transmission is in correct location.



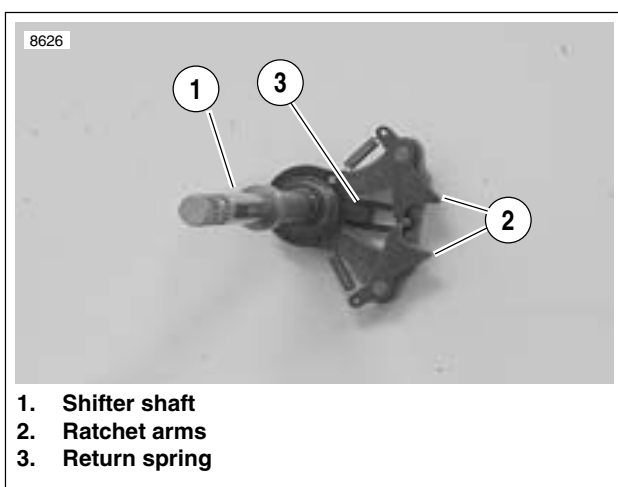
**Figure 6-44. Countershaft Retainer**

8. See [Figure 6-44](#). Place transmission in 1st gear. Remove countershaft TORX screw (1) and retention collar (2).



**Figure 6-46. Removing Shifter Shaft Assembly**

10. See [Figure 6-47](#). Remove shifter shaft assembly.



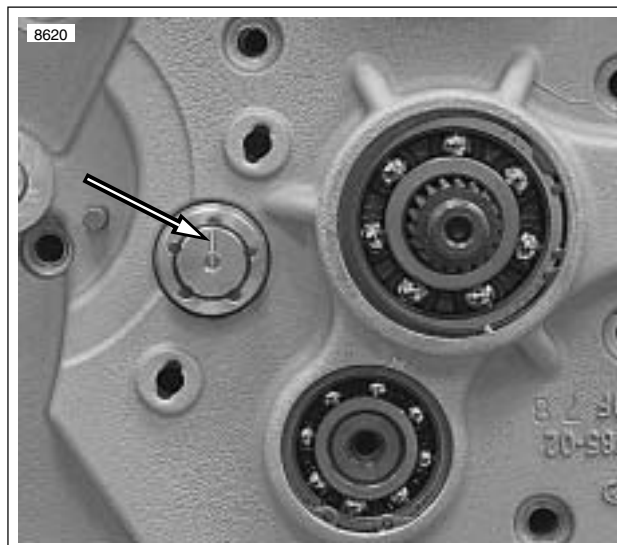
**Figure 6-47. Shifter Shaft Assembly**

11. See [Figure 6-46](#). Depress ratchet arms in order to clear the shifter drum and remove shifter shaft assembly from left crankcase half.  
12. Remove starter. See [5.7 STARTER](#).



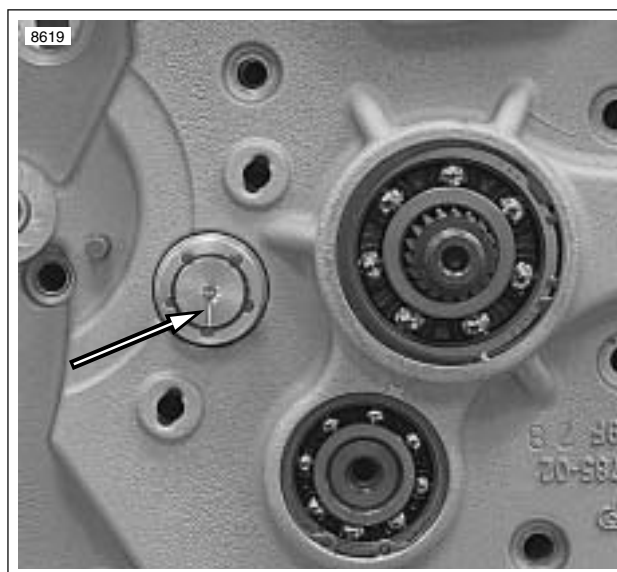
**Figure 6-48. Rear Isolator Assembly**

13. See [Figure 6-48](#). Remove rear isolator assembly by removing the forward two fasteners first and then the two rear fasteners (re-install with **new** fasteners).



**Figure 6-49. Scribed Line on Shifter Drum at 12 o'clock (Transmission in Neutral)**

14. See [Figure 6-49](#). Scribe a line on the end of the shifter drum at the 12 o'clock position for later reference.



**Figure 6-50. Scribed Line on Shifter Drum at 6 O'clock (Transmission in 4th Gear)**

15. See [Figure 6-50](#). Place transmission in 4th gear. The scribed line should now be at the 6 o'clock position.

**NOTE**

*Transmission can be easily shifted by rotating the mainshaft and shifter drum at the same time by hand.*

b1016x3x

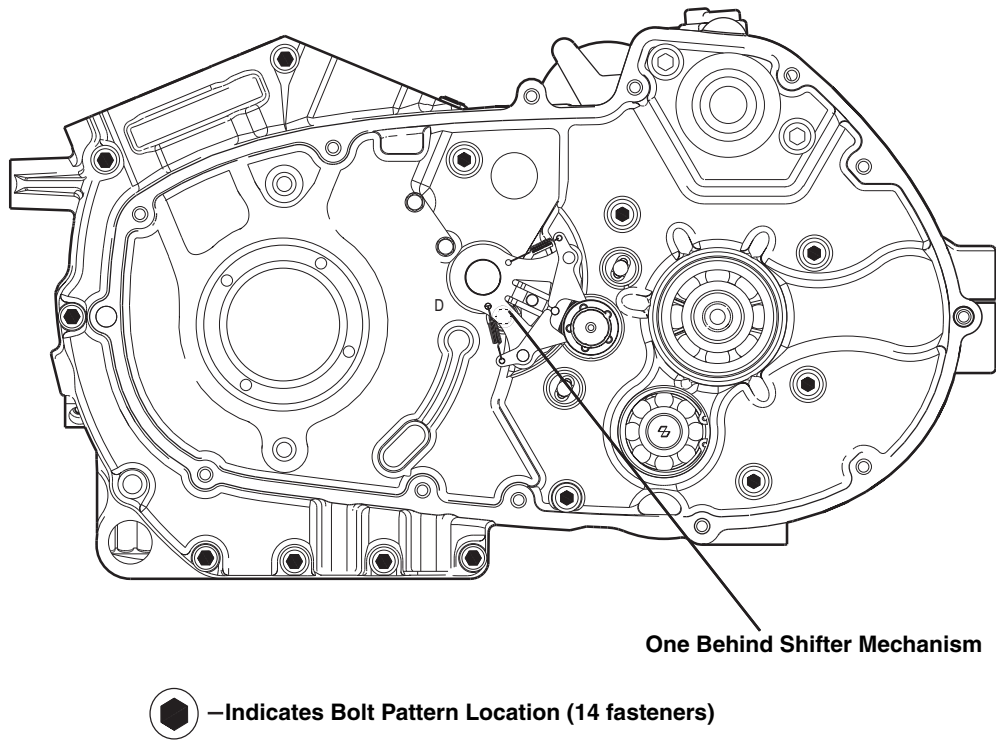


Figure 6-51. Crankcase Fasteners

16. See Figure 6-51. Remove crankcase bolt set (14 fasteners).

**NOTE**

*Flywheel assembly slides out of the left main bearing by hand. No tools are required for this operation.*

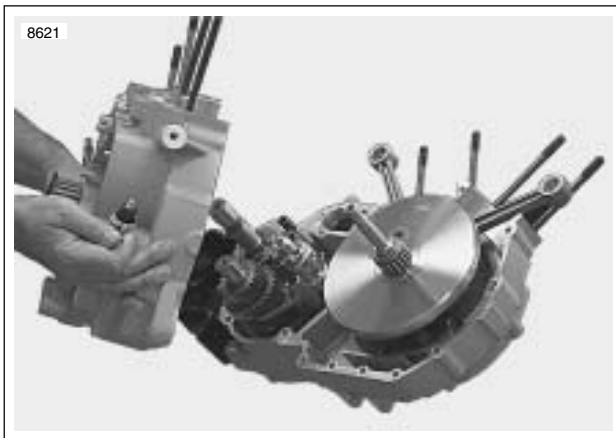


Figure 6-52. Separating Crankcase Halves

17. See Figure 6-52. Separate crankcase halves.



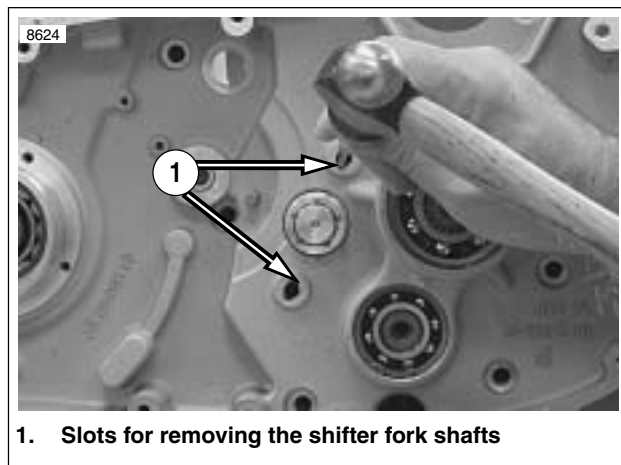
Figure 6-53. Removing Flywheels from Left Case Half

18. See Figure 6-53. Remove the flywheel assembly from left crankcase half.

## TRANSMISSION REMOVAL FROM LEFT CRANKCASE

### NOTE

See [Figure 6-56](#). Shifter design allows for one common part number for all three shifter forks. As the transmission runs, each shifter fork develops a certain wear pattern with its mating parts. For this reason, it is important that each shifter fork be reinstalled in its original location.

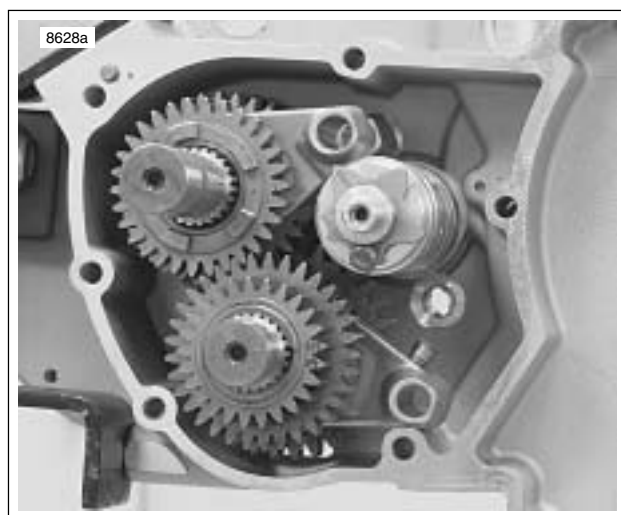


**Figure 6-54. Removing Shifter Fork Shafts**

1. See [Figure 6-54](#). Remove shifter fork shafts.

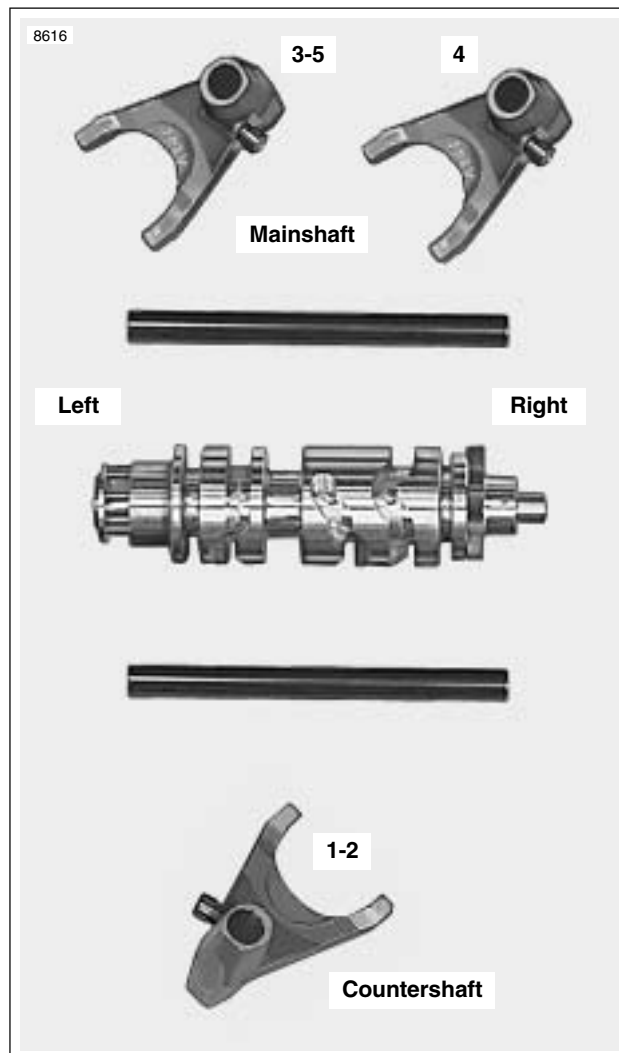
### NOTE

Carefully tap on alternate sides of the shaft using the provided slots.



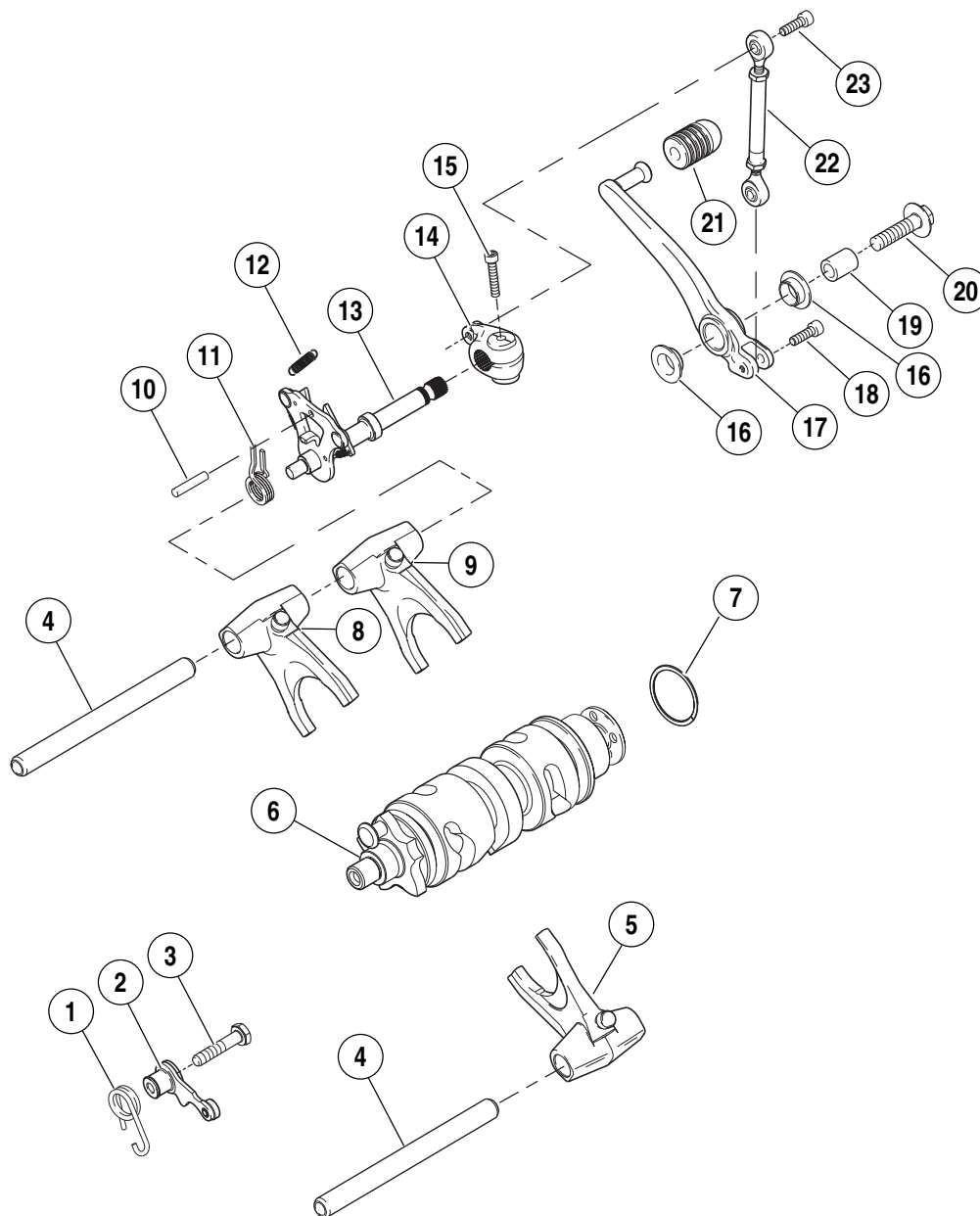
**Figure 6-55. Transmission Assembly**

2. See [Figure 6-55](#). Remove shifter drum and shifter forks.
3. Remove mainshaft 2nd gear from mainshaft.



**Figure 6-56. Shifter Forks, Drum and Shafts**

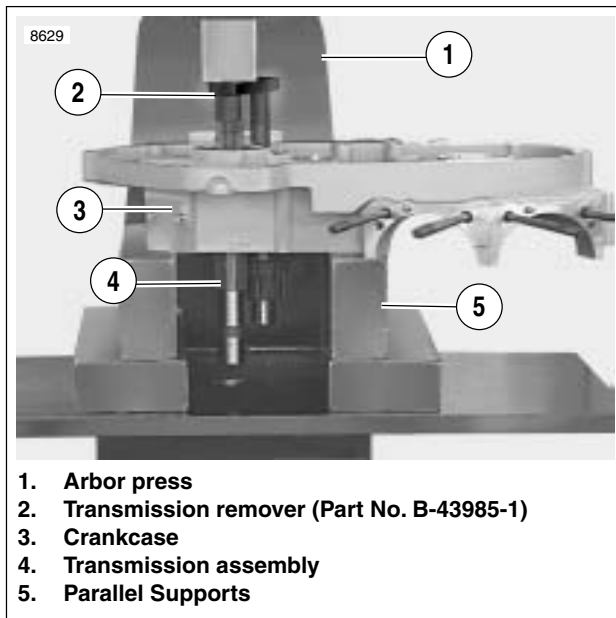
b1015x6x



- |                                     |                                       |
|-------------------------------------|---------------------------------------|
| 1. Spring, detent                   | 13. Shifter lever assembly            |
| 2. Detent spring sleeve assembly    | 14. Lever, engine                     |
| 3. Screw, detent assembly           | 15. Bolt, engine lever                |
| 4. Shaft, shifter forks (2)         | 16. Bearing, shift lever assembly (2) |
| 5. Fork assembly, shifter (1st-2nd) | 17. Shift lever                       |
| 6. Shifter cam assembly             | 18. Bolt, linkage assembly            |
| 7. Retaining ring                   | 19. Sleeve, shift/brake lever         |
| 8. Fork assembly, shifter (3rd-5th) | 20. Bolt, shift lever                 |
| 9. Fork assembly, shifter (4th)     | 21. Pad, rubber, shift lever          |
| 10. Pin, shifter stop               | 22. Linkage assembly, shifter         |
| 11. Spring, shifter return          | 23. Bolt, linkage assembly            |
| 12. Spring, extension               |                                       |

Figure 6-57. Shifter Mechanism





**Figure 6-58. Removing Transmission Assembly from Left Case Half**

**⚠ WARNING**

Always wear proper eye protection when installing retaining rings. Use the correct retaining ring pliers. Verify that the tips of the pliers are not damaged or excessively worn. Slippage may propel the ring with enough force to cause eye injury.

4. See [Figure 6-58](#). Remove left crankcase half and transmission assembly (4) from engine stand.
  - a. Place crankcase half (3) and transmission assembly (4) on arbor press (1) and support transmission assembly on parallel supports (5).
  - b. Press transmission assembly using TRANSMISSION REMOVER (2) (Part No. B-43895-1) to remove transmission assembly from crankcase half.
  - c. Remove crankcase from press.

## MAINSHAFT/COUNTERSHAFT

### NOTE

- As the transmission runs, each part develops a certain wear pattern and a kind of “set” with its mating parts. For this reason, it is important that each component be reinstalled in its original location and facing its original direction.
- See [Figure 6-59](#). As each component is removed, place it on a clean surface in the exact order of removal.

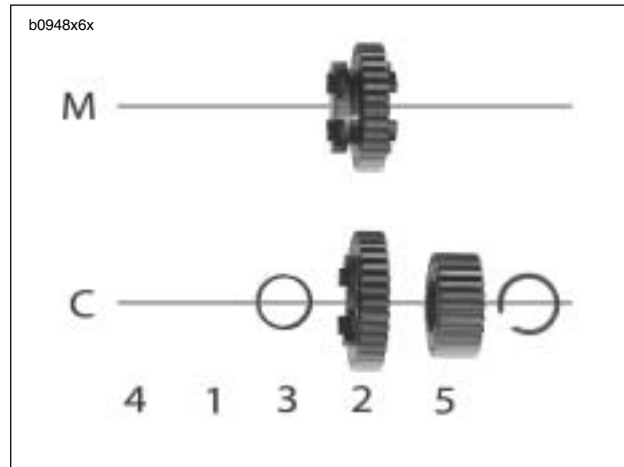


Figure 6-59. Transmission Parts Identification

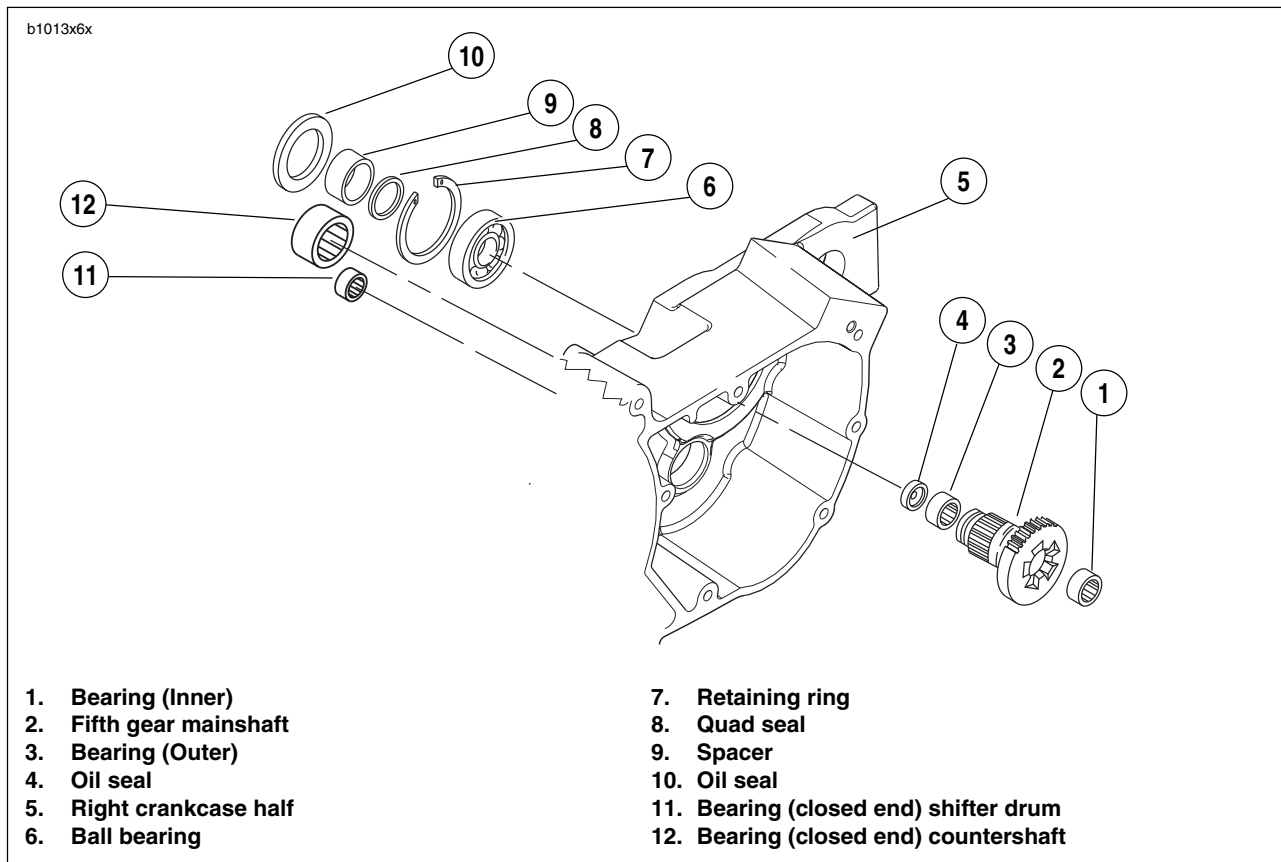


Figure 6-60. Transmission Assembly-Right Crankcase Half



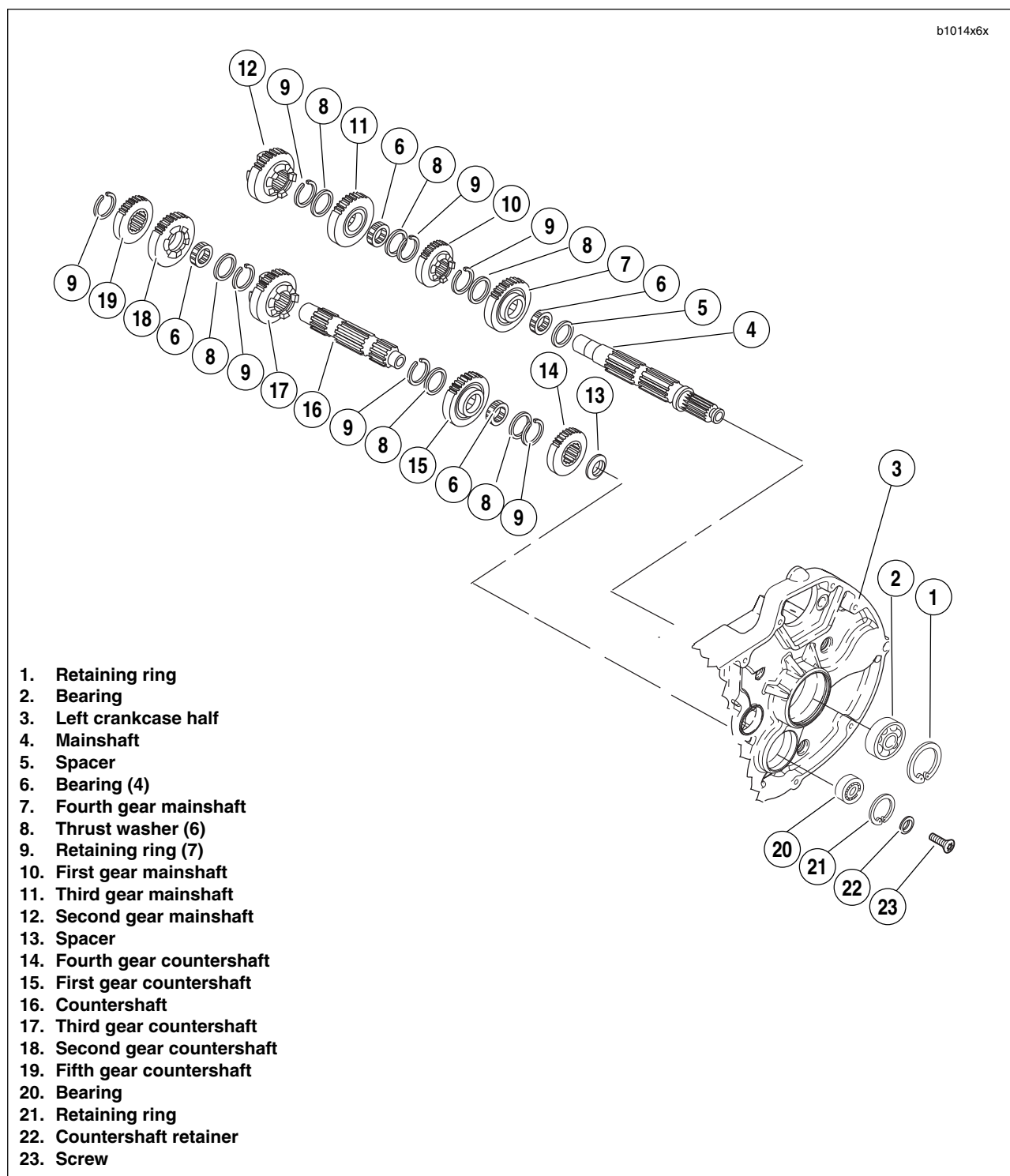


Figure 6-61. Transmission Assembly-Left Crankcase Half

## MAINSHAFT DISASSEMBLY

### NOTES

- Once the transmission assembly has been pressed out of the left crankcase half, the mainshaft and countershaft assemblies can be serviced separately.
- All thrust washers are one common part number. There is no shimming required with this transmission.

### ⚠ WARNING

Always wear proper eye protection when removing retaining rings. Use the correct retaining ring pliers. Verify that the tips of the pliers are not damaged or excessively worn. Slippage could propel the ring with enough force to cause death or serious injury.

- See Figure 6-62. Remove spacer (1), mainshaft 4th gear (3), split bearing (2) and thrust washer (4) from the threaded end of the mainshaft.
- On the mainshaft, between mainshaft 1st gear (6) and mainshaft 3rd gear (10), use RETAINING RING PLIERS (Part No. J-5586) to expand retaining ring (7) and move next to mainshaft 1st gear along with thrust washer (8).
  - Move mainshaft 3rd gear (10) as far as possible toward mainshaft 1st gear (6).
  - Expand retaining ring (12) at opposite side of mainshaft 3rd gear (10) and slide off end of mainshaft with thrust washer (11).
  - Remove mainshaft 3rd gear (10) and its split bearing (9).

- Slide thrust washer (8) off end of mainshaft.
- Expand retaining ring (7), which is next to mainshaft 1st gear (6), and slide off end of shaft.
- Remove mainshaft 1st gear (6).
- Expand retaining ring (5) and remove.

## Cleaning And Inspection

### ⚠ WARNING

Never use compressed air to “spin-dry” bearings. Spinning bearings with compressed air can also cause a bearing to fly apart, which could result in death or serious injury.

Low pressure compressed air can blow debris into your face and eyes. Always wear eye protection or a face shield when using pressurized air. Failure to take adequate safety precautions could result in death or serious injury.

- Clean all parts (except bearings) in cleaning solvent and blow dry with compressed air.
- Check gear teeth for damage. If gears are pitted, scored, rounded, cracked or chipped, they should be replaced.
- Inspect the engaging dogs on the gears. Replace the gears if dogs are rounded, cracked, battered, chipped or dimpled.
- Discard all retaining rings that were removed.

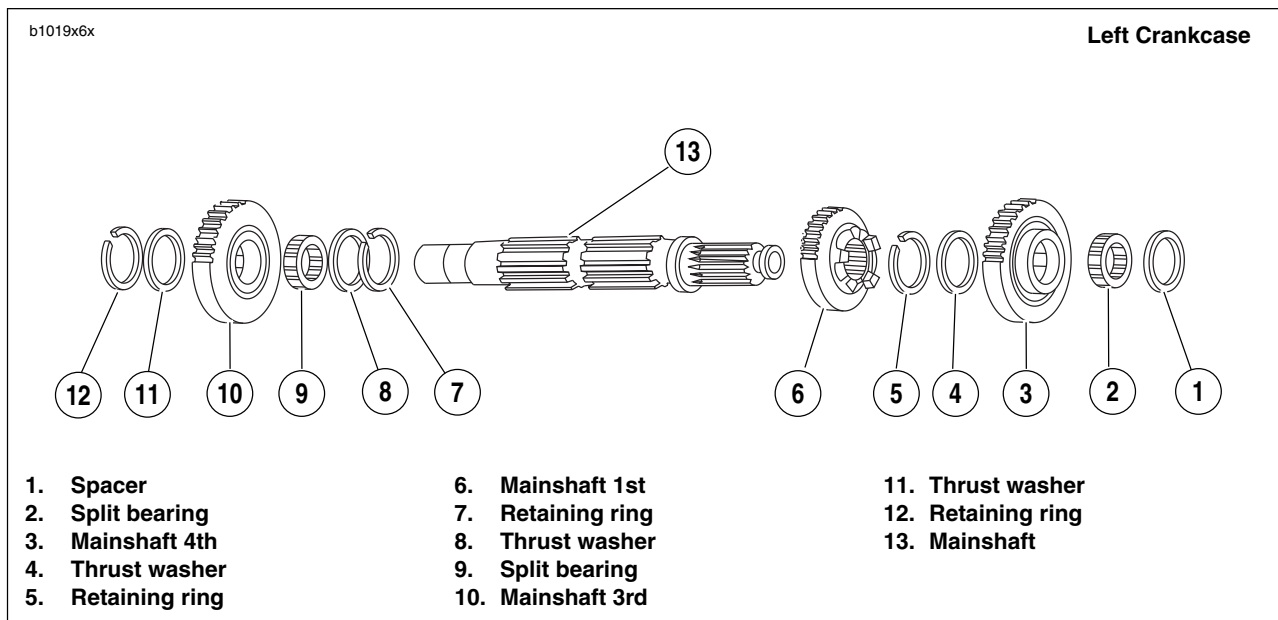


Figure 6-62. Transmission Mainshaft Assembly Once Removed from Left Crankcase/Disassembly

## COUNTERSHAFT DISASSEMBLY

### NOTES

- Once the transmission assembly has been pressed out of the left crankcase half, the mainshaft and countershaft assemblies can be serviced separately.
- All thrust washers are one common part number. There is no shimming required with this transmission.

### ⚠ WARNING

Always wear proper eye protection when removing retaining rings. Use the correct retaining ring pliers. Verify that the tips of the pliers are not damaged or excessively worn. Slippage could propel the ring with enough force to cause death or serious injury.

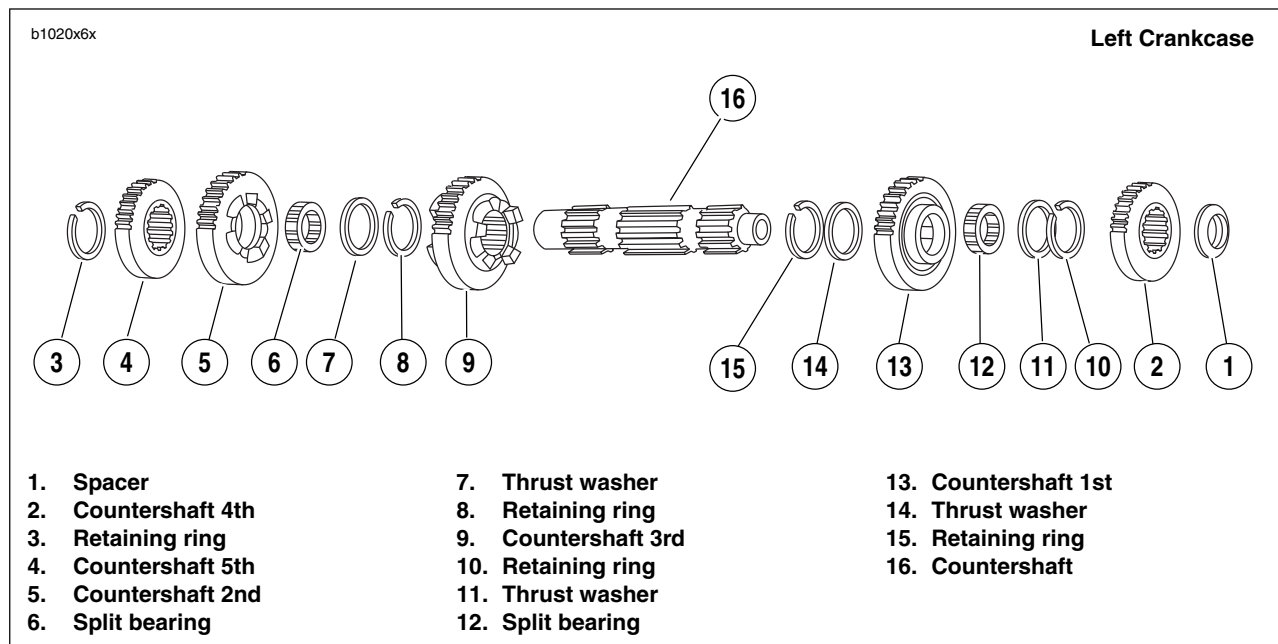


Figure 6-63. Transmission Countershaft Assembly Once Removed from Left Crankcase/Disassembly

- See Figure 6-63. Remove spacer (1) and countershaft 4th gear (2) from the end of the of the countershaft with internal threads.
- Using RETAINING RING PLIERS (Part No. J-5586), remove and discard retaining ring (3) next to countershaft 5th gear (4).
  - Slide countershaft 5th (4), and countershaft 2nd (5) off end of countershaft.
  - Remove split bearing (6) that was under countershaft 2nd gear (5) and thrust washer (7).
  - Remove retaining ring (8) on the countershaft and slide countershaft 3rd gear (9) off free end of countershaft.
- Expand retaining ring (10) located next to countershaft 1st gear (11). Remove retaining ring (10) and thrust washer (11).
  - Slide countershaft 1st gear (13) off end of shaft.
  - Remove split bearing (12).
- Remove thrust washer (14). Expand remaining retaining ring (15) and slide off countershaft.

## Cleaning And Inspection

### ⚠ WARNING

Never use compressed air to “spin-dry” bearings. Spinning bearings with compressed air can also cause a bearing to fly apart, which could result in death or serious injury.

- Clean all parts (except bearings) in cleaning solvent and blow dry with compressed air.
- Check gear teeth for damage. If gears are pitted, scored, rounded, cracked or chipped, they should be replaced.
- Inspect the engaging dogs on the gears. Replace the gears if dogs are rounded, cracked, battered, chipped or dimpled.
- Discard all retaining rings that were removed.

## MAINSHAFT ASSEMBLY

### WARNING

Always wear proper eye protection when removing retaining rings. Use the correct retaining ring pliers. Verify that the tips of the pliers are not damaged or excessively worn. Slippage could propel the ring with enough force to cause death or serious injury.

### CAUTION

During assembly, the split bearings and the internal bores of the gears must be lubricated with SPORT-TRANS FLUID prior to assembly. Leaving these parts dry could accelerate wear at start-up.

1. See Figure 6-65. Install **new** retaining ring (1) onto mainshaft in the first ring groove from the threaded end of the mainshaft.
2. Slide mainshaft 1st gear (2), identified by two grooves in gear teeth, onto mainshaft with the fork groove facing mainshaft 4th gear (11).

### NOTE

See Figure 6-64. The shifting fork groove on mainshaft 1st gear has been made 0.020 in. (0.5 mm) wider than existing mainshaft first gear (Part No. 35762-89A) to accommodate the new style shifting fork and has a new part number.

3. See Figure 6-65. Install **new** retaining ring (3).
  - a. Install thrust washer (4) onto mainshaft.
  - b. Install split bearing (5) onto mainshaft.
  - c. Install mainshaft 3rd gear (6) onto shaft over bearing (5). 3rd gear is installed with shifting lugs away from 1st gear mainshaft.

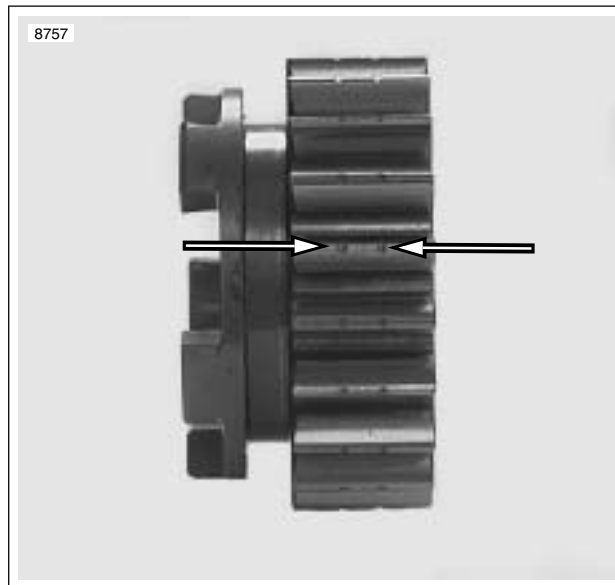


Figure 6-64. New Mainshaft 1st Gear with Identification Grooves

4. Install thrust washer (7) and **new** retaining ring (8) next to mainshaft 3rd gear (6).
5. Install thrust washer (9) on threaded end of mainshaft next to retaining ring (1).
6. Install split bearing (10) onto mainshaft next to thrust washer (9).
7. Install mainshaft 4th gear (11), which can be identified by the two radial grooves on one side, onto mainshaft over split bearing (10) and against thrust washer (9).
8. Install spacer (12) onto end of mainshaft.

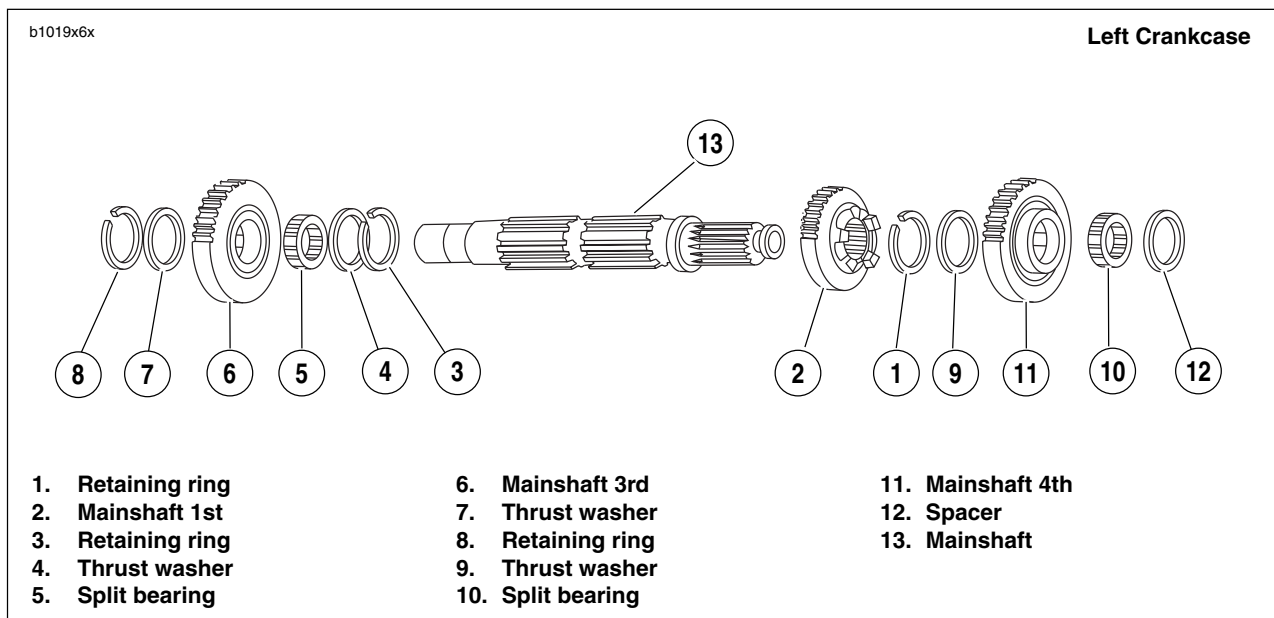


Figure 6-65. Transmission Mainshaft Assembly/Reassembly

## COUNTERSHAFT ASSEMBLY

### WARNING

Always wear proper eye protection when removing retaining rings. Use the correct retaining ring pliers. Verify that the tips of the pliers are not damaged or excessively worn. Slippage could propel the ring with enough force to cause death or serious injury.

### CAUTION

During assembly, the split bearings and the internal bores of the gears must be lubricated with **SPORT-TRANS FLUID** prior to assembly. Leaving these parts dry could accelerate wear at start-up.

1. See Figure 6-66. Install **new** retaining ring (1) and thrust washer (2) onto countershaft in the second ring groove from the end with internal threads.
2. Install split bearing (4) onto countershaft.
3. Locate countershaft 1st gear (3), identified by one radial groove at one side, and slide gear onto shaft. Position gear over bearing (4).

4. Install thrust washer (5) and **new** retaining ring (6) next to countershaft 1st gear (3).
5. Install countershaft 3rd gear (7) on countershaft with fork groove facing away from countershaft 1st gear (3).
6. Install **new** retaining ring (8) on countershaft. Position **new** retaining ring in the second ring groove from the end. Install thrust washer (9) next to retaining ring (8). Install split bearing (10) in seat next to washer (9).
5. Install countershaft 2nd gear (11) with the locking dogs facing countershaft 3rd gear (7).
6. Install countershaft 5th gear (12) on countershaft.
7. Install **new** retaining ring (13) on countershaft.
8. Locate countershaft 4th gear (14). This flat, shoulder less gear is splined and has a single radial groove at one side. Position gear next to retaining ring (6) on countershaft. Place beveled spacer (15) over end of shaft with beveled side away from countershaft 4th gear (14).

### NOTE

*At this point both mainshaft and countershaft sub-assemblies are ready to be pressed into the left crankcase half.*

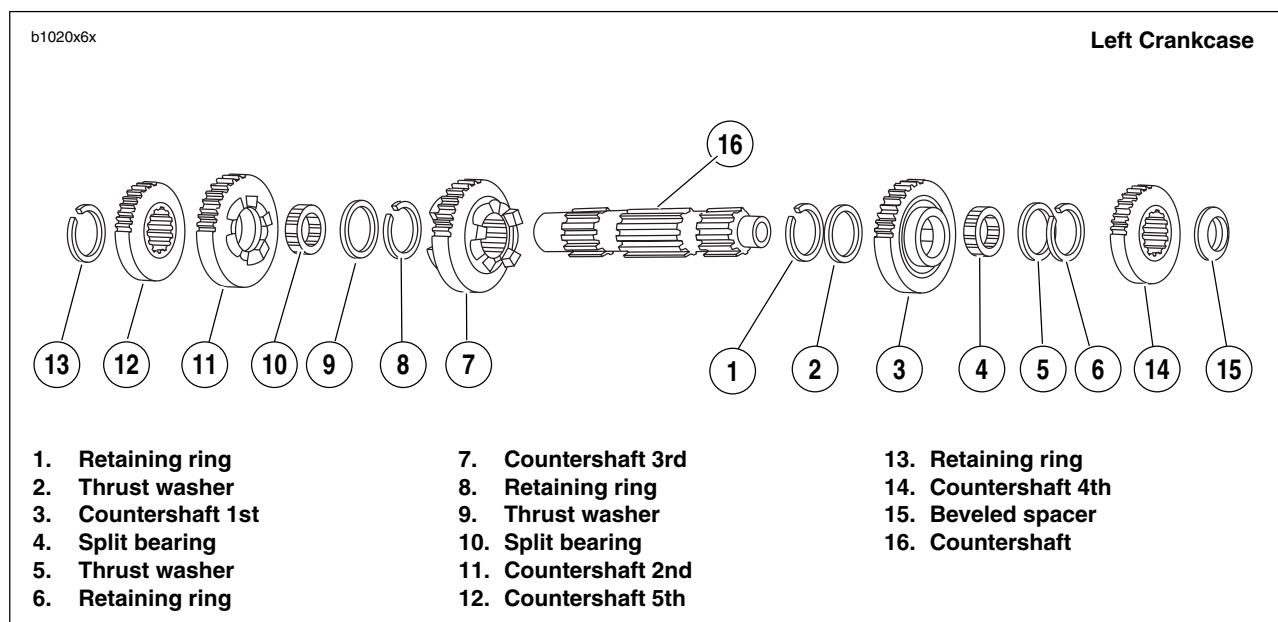


Figure 6-66. Transmission Countershaft Assembly/Reassembly

## REMOVAL

1. Split crankcases in half. See [6.8 CASE DISASSEMBLY FOR TRANSMISSION REMOVAL](#).
2. Remove transmission as an assembly. See [6.9 TRANSMISSION DISASSEMBLY](#).

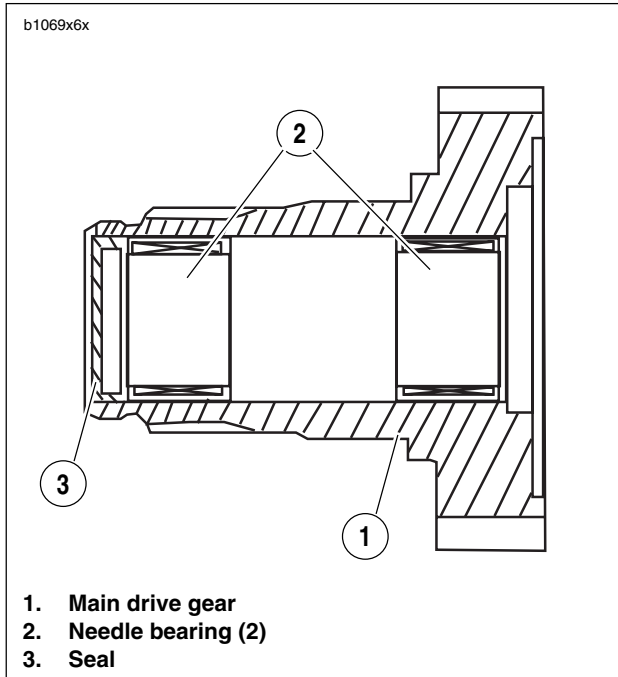


Figure 6-67. Main Drive Gear Assembly

3. See [Figure 6-67](#). From inside case tap out seal at end of mainshaft 5th gear. Discard seal.

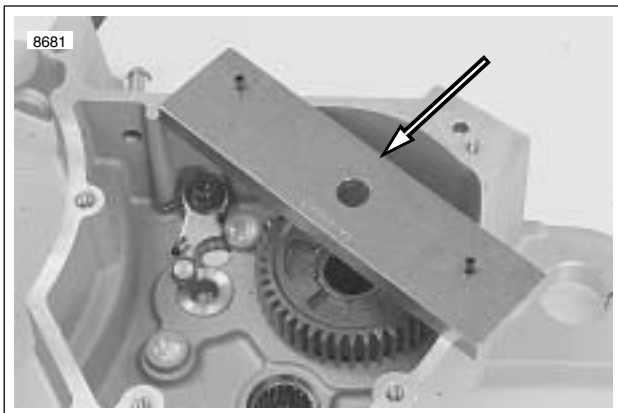


Figure 6-68. Bearing Remover Cross Plate Mounting (Part No. B-45847)

4. See [Figure 6-68](#). Place cross plate on crankcase as shown.

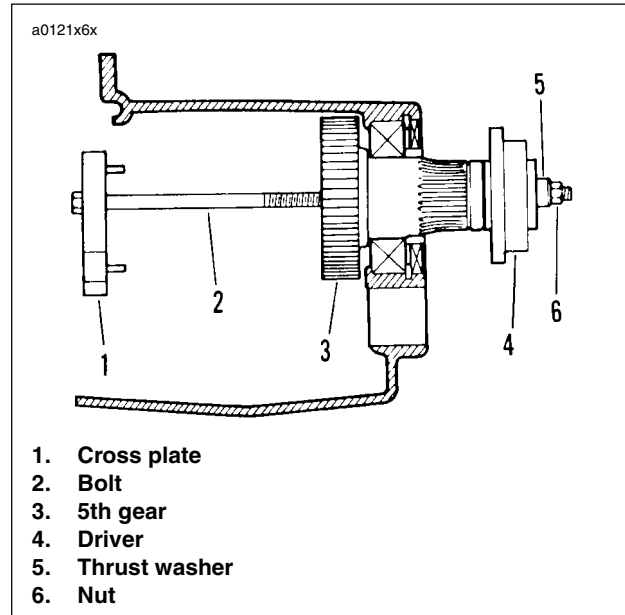


Figure 6-69. Removing Main Drive Gear

5. See [Figure 6-69](#). Assemble MAIN DRIVE GEAR REMOVER AND INSTALLER (Part No. HD-35316-A) with CROSS PLATE (Part No. B-45847).
6. Insert bolt (2) through cross plate (1) and 5th gear (3).

**CAUTION**

When removing the main drive gear, the gear is pressed out against the resistance of the bearing inner race. Without any support at the inner race, the bearing is destroyed. Whenever the main drive gear is removed the main drive gear bearing will also have to be replaced.

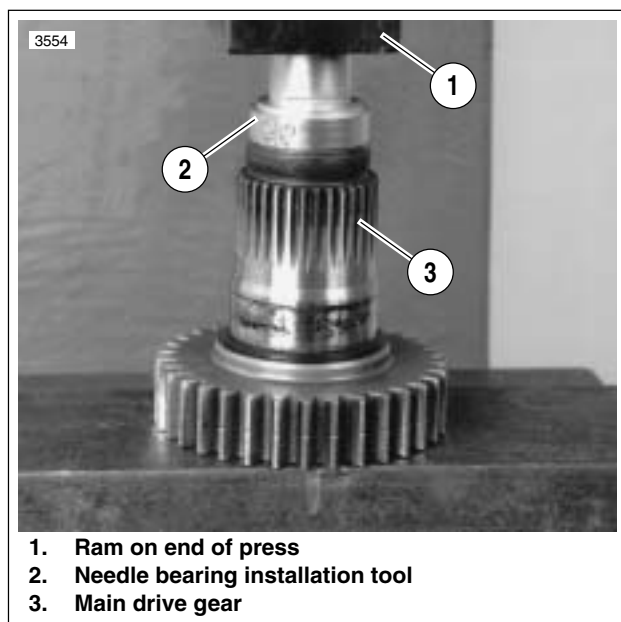
7. At outside of case, place driver (4) and thrust washer (5) over end of bolt (2). Install and tighten nut (6) until 5th gear (3) is free.

## DISASSEMBLY

Drive out needle bearings from inside bore of main drive gear. Do not reuse bearings after removal.

## ASSEMBLY

1. See [Figure 6-70](#). Use INNER/OUTER MAIN DRIVE GEAR NEEDLE BEARING INSTALLATION TOOL (Part No. HD-37842-A) for assembly. Select which end of tool to use.
  - a. The end stamped 0.080 in. (2.032 mm) is for driving the bearing into the inner end.
  - b. The end stamped 0.315 in. (8.001 mm) is for the outer end bearing.

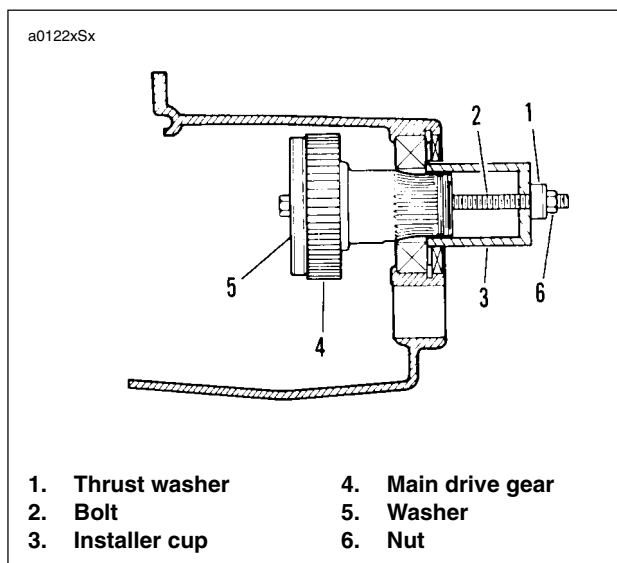


**Figure 6-70. Needle Bearing Installation Tool**

2. Assemble parts. The installation tool will automatically bottom on the gear when the correct depth is reached.
  - a. Place main drive gear on a press.
  - b. Press in the outer bearing to a depth of 0.315-0.285 in. (8.001-7.239 mm).
  - c. Press in the inner bearing to a depth of 0.080 in. (2.032 mm).

## INSTALLATION

1. Replace main drive gear bearing.



**Figure 6-71. Main Drive Gear Installation**

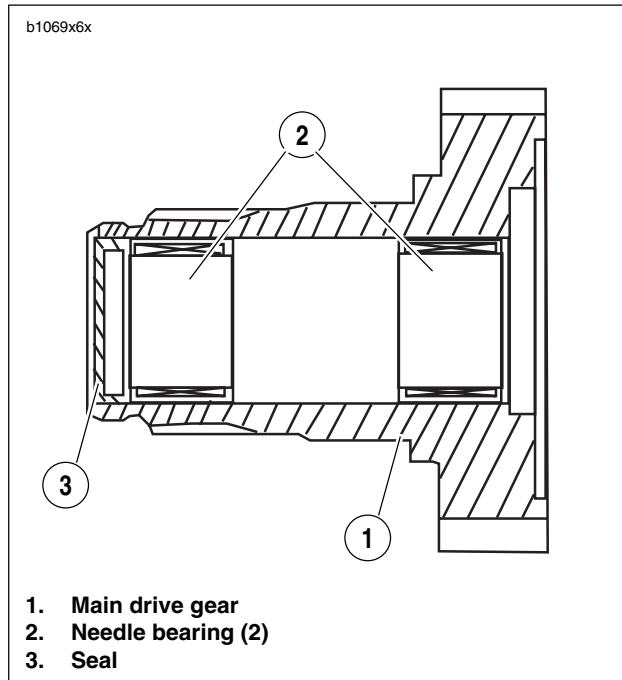
2. See [Figure 6-71](#). Use MAIN DRIVE GEAR REMOVER AND INSTALLER (Part No. HD-35316-A) for assembly.
  - a. Take bolt (2) and place washer (5) followed by main drive gear (4) over end of bolt.
  - b. From inside of case insert bolt and main drive gear through inner race of ball bearing.
  - c. Insert threaded end of bolt (2) through installer cup (3) and thrust washer (1).
  - d. Thread nut (6) onto end of bolt (2). Tighten nut (6) until shoulder on gear (4) bottoms against inner race of bearing.



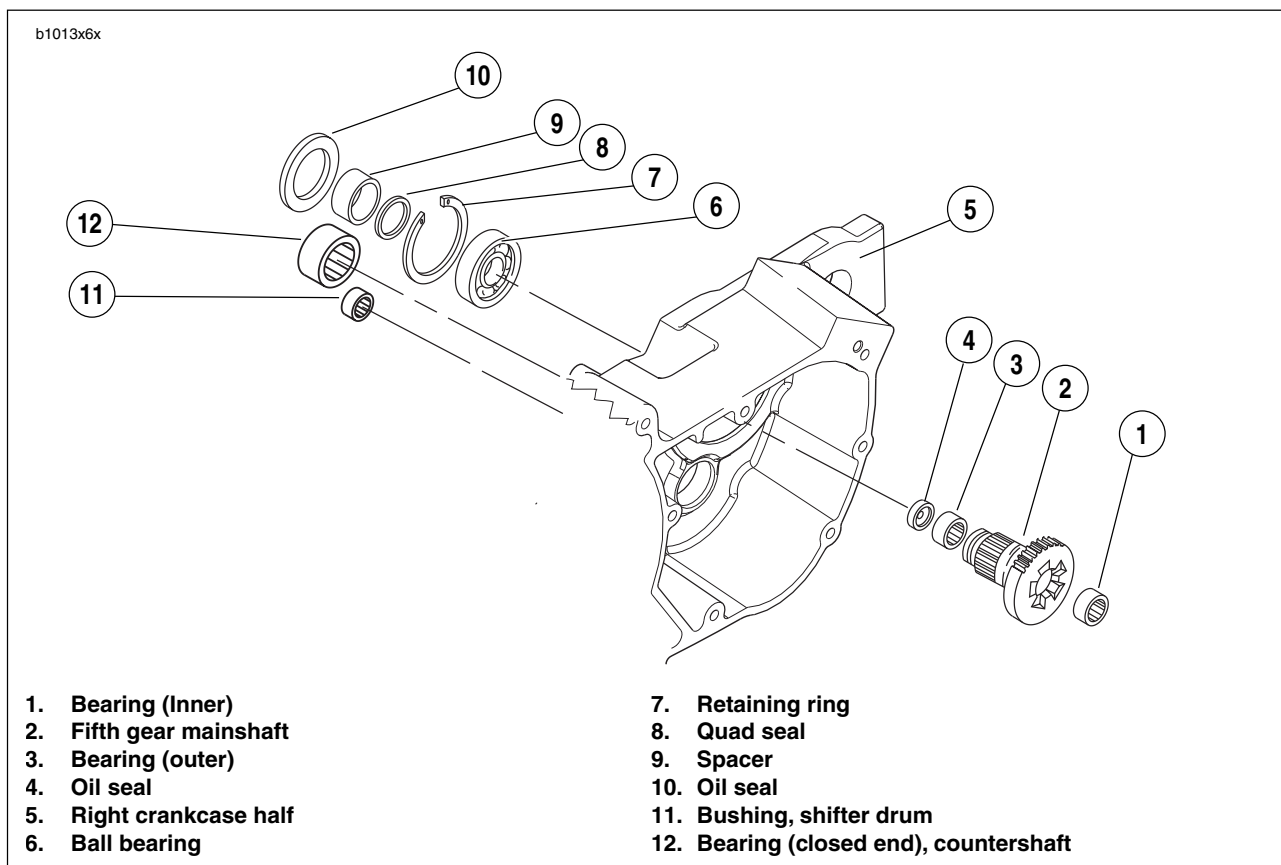
3. See [Figure 6-72](#). Tap in **new** seal (3) at threaded end of 5th gear to a depth of 0.060-0.030 in. (1.524-0.762 mm).
4. See [Figure 6-73](#). Place **new** quad ring over threaded end of fifth gear, and position next to the gear taper. Install spacer over threaded end of fifth gear with chamfered end toward quad ring. Slide spacer up against bearing.
5. Install large seal.
  - a. Coat lips of seal with SPORT-TRANS FLUID.
  - b. Position seal over spacer with lips of seal toward case.
  - c. Use MAIN DRIVE GEAR SEAL INSTALLER (Part No. HD-41496) to gently tap seal into bore of case until the outside of seal is flush with outer edge of bore.

**NOTE**

*It is acceptable to recess seal to about 0.030 in. (0.762 mm) below outer edge of bore. Seal will be controlled by tool.*



**Figure 6-72. Main Drive Gear Assembly**



**Figure 6-73. Transmission Assembly Right Crankcase Half**

## REMOVAL

### NOTE

See [Figure 6-73](#). Refer to *Transmission assembly right crankcase half*, for location of items discussed on this page.

1. Remove transmission assembly. See [6.9 TRANSMISSION DISASSEMBLY](#).
2. See [Figure 6-73](#). Remove main drive 5th gear. Use MAIN DRIVE GEAR REMOVER AND INSTALLER (Part No. HD-35316A). See [6.11 MAIN DRIVE GEAR](#).
3. At outside of case remove seal next to 5th gear bearing retainer. Remove retaining ring.
4. From inside transmission case drive bearings (5th gear, countershaft or shifter shaft) out of bores. Carefully tap bearings free by working around bearing diameter to keep bearing from skewing.

## INSTALLATION

### Mainshaft 5th Gear Ball Bearing

1. See [Figure 6-74](#). Locate MAIN DRIVE GEAR REMOVER AND INSTALLER (Part No. HD-35316-A). Place cross-plate pins in appropriate holes in transmission case.
2. See [Figure 6-75](#). Insert bolt (2) through cross plate (1), **new** bearing (3), driver (4) and thrust bearing (5). Thread nut (6) on end of bolt. Tighten nut carefully until bearing is started in bore squarely. Tighten nut (6) until bearing is seated against shoulder in bore.
3. At outside of case install beveled retaining ring in groove inside bearing bore with beveled side facing outside of case.
4. Lubricate bearing with SPORT-TRANS FLUID.

### Countershaft Needle Bearing

1. Find a suitable bearing driver 1-1/4 in. (31.75 mm) in diameter.
2. See [Figure 6-73](#). From the outside of the case place the needle bearing open end first next to the bearing bore. Hold the driver squarely against the closed end of the bearing and tap the bearing into place. The bearing is properly positioned when it is driven inward flush or 0.030 in. (0.762 mm) below the outside surface of the case.
3. Lubricate bearing with SPORT-TRANS FLUID.

### Shifter Drum Bushing

1. See [Figure 6-73](#). The shifter drum bushing (11) is a press fit in the right crankcase half. Inspect the bushing against the corresponding end of the shifter drum for proper fit and wear.
2. If bushing is to be replaced, use a BUSHING AND BEARING PULLER (Part No. HD-95760-69A) with a 1/2 in. collet (Part No. HD-95765-69A) to remove bushing from right crankcase half.

3. To install new bushing, use SNAP-ON BUSHING DRIVER SET (Part No. A-157C) with a 1/2 inch adapter (Part No. A157-8).
4. Lubricate bushing with SPORT-TRANS FLUID.

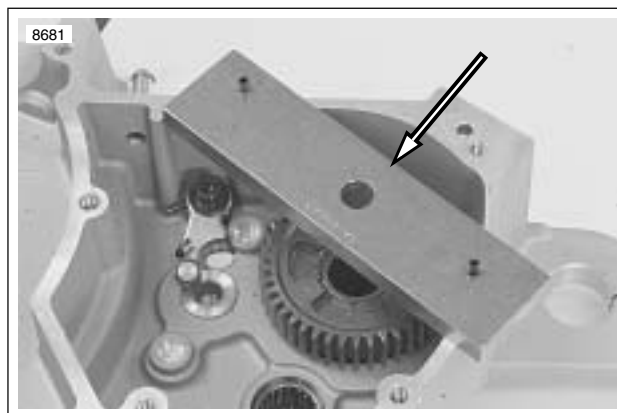


Figure 6-74. Bearing Remover Cross Plate Mounting (Part No. B-45847)

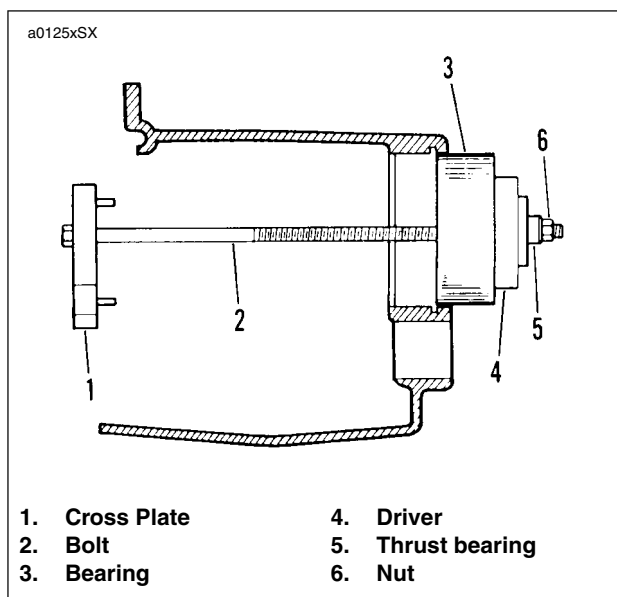


Figure 6-75. Installing Mainshaft 5th Gear Ball Bearing

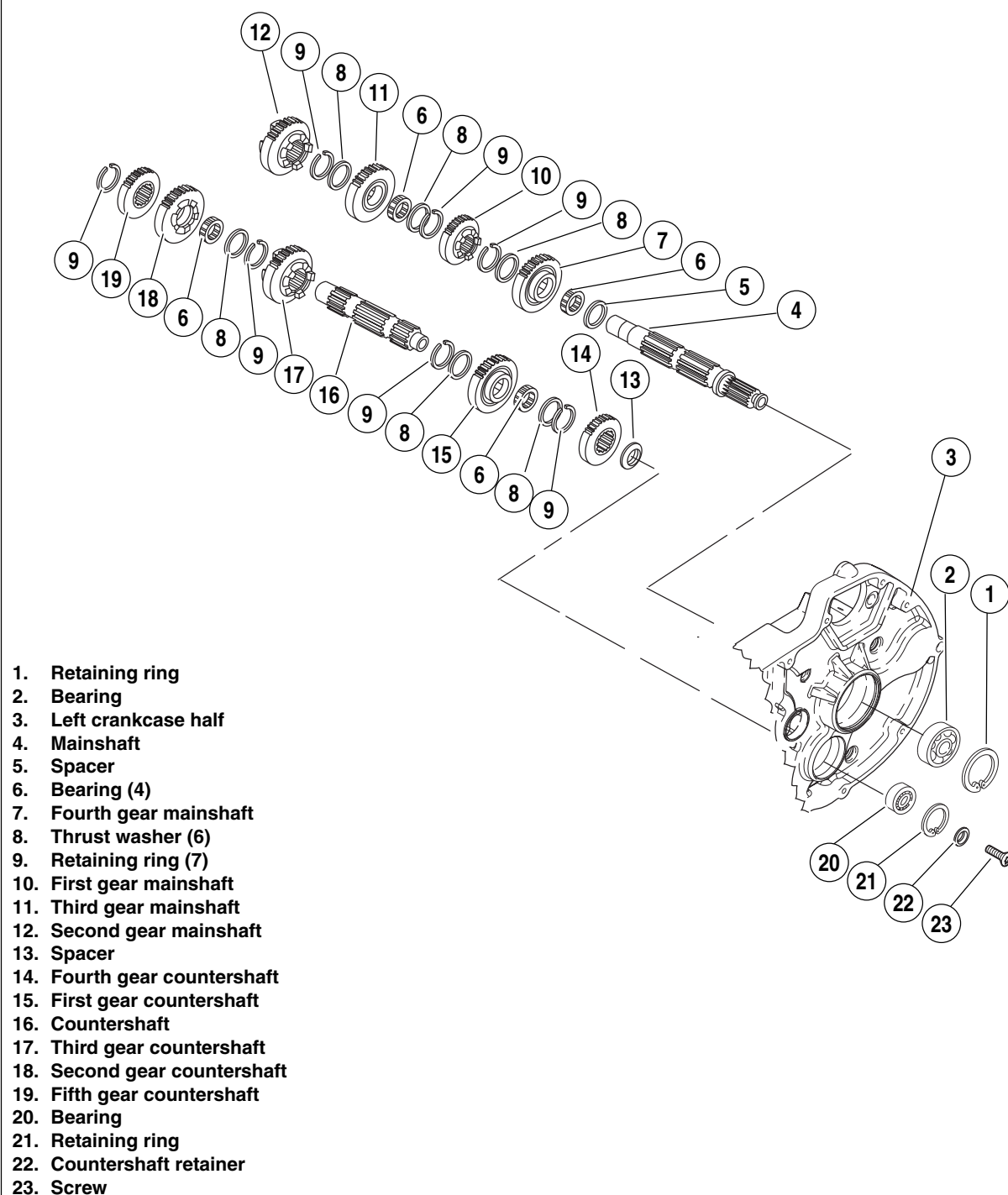


Figure 6-76. Transmission Assembly Left Crankcase Half

## REMOVAL

### NOTE

See [Figure 6-76](#). Refer to *Transmission assembly left crankcase half*, for location of items discussed on this page.

### Mainshaft and Countershaft Bearings

1. Split crankcases in half. See [6.8 CASE DISASSEMBLY FOR TRANSMISSION REMOVAL](#).
2. Remove shifter forks and drum. See [6.10 TRANSMISSION ASSEMBLY](#) under [6.9 TRANSMISSION DISASSEMBLY](#).
3. Remove countershaft and mainshaft. See [6.9 TRANSMISSION DISASSEMBLY](#).
4. Inspect the mainshaft and countershaft ball bearings for pitting, scoring, discoloration or other damage.
5. See [Figure 6-77](#). If bearing replacement is required, remove retaining rings (1, 2) using snap ring pliers (Snap-On Part No. PR-36). Press out bearings (3, 4) from the inside of the crankcase.

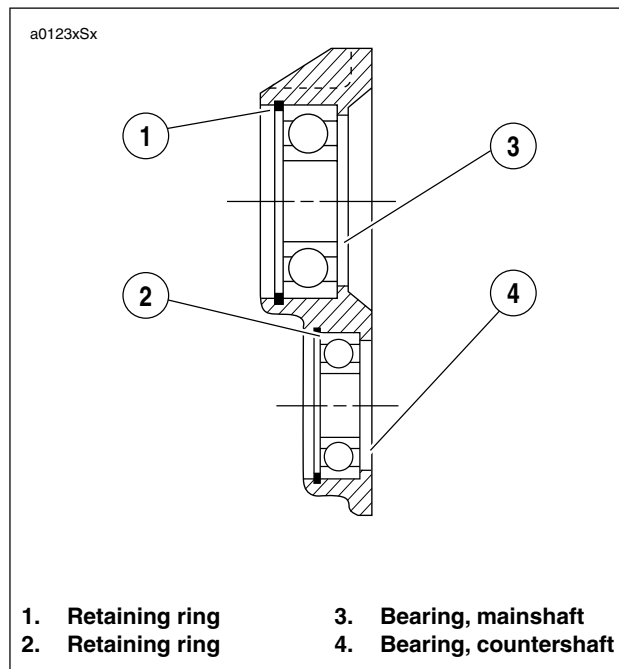


Figure 6-77. Ball Bearing Assembly

### Shift Drum Bushing

Inspect the shifter drum bushing for pitting, scoring, discoloration or excessive wear. If bushing requires replacement press bushing out of crankcase from either side.

## INSTALLATION

### Mainshaft and Countershaft Bearings

1. Place crankcase on press with inside surface of crankcase downward.
2. Lay bearing squarely over bore with printed side of bearing upward. Place a pressing tool (slightly smaller than outside diameter of bearing) against outer race. Press bearing into bore until bearing bottoms against shoulder.
3. Install **new** retaining ring with beveled side facing away from bearing.

### Shift Drum Bushing

1. Place crankcase on press with outside surface of crankcase downward.
2. See [Figure 6-78](#). Lay bushing squarely over bore. Using a pressing tool larger than diameter of bushing, press bushing into bore until bushing contacts shoulder in left crankcase half. If using a pressing tool larger than diameter of bushing, the pressing tool will bottom against crankcase when bushing is flush with top surface.

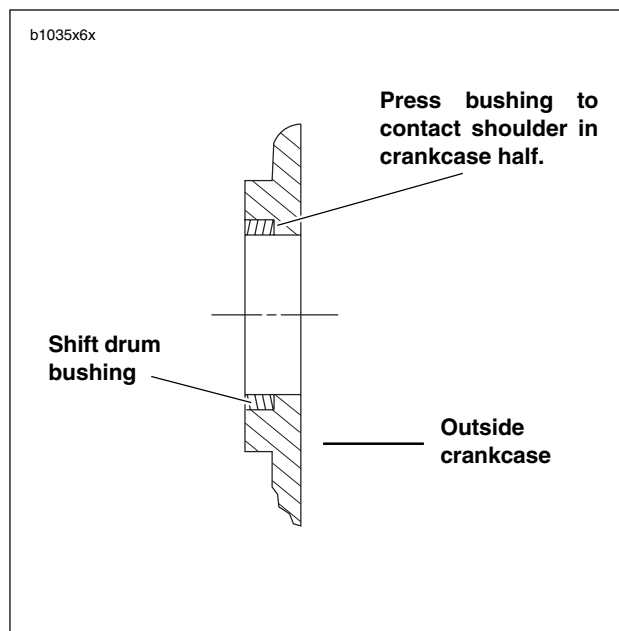


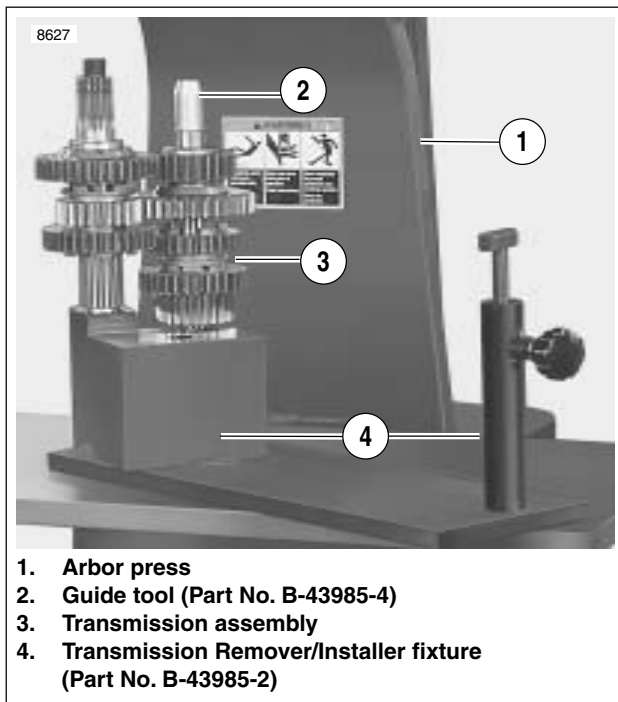
Figure 6-78. Shift Drum Bushing Assembly

## INSTALLATION

### NOTE

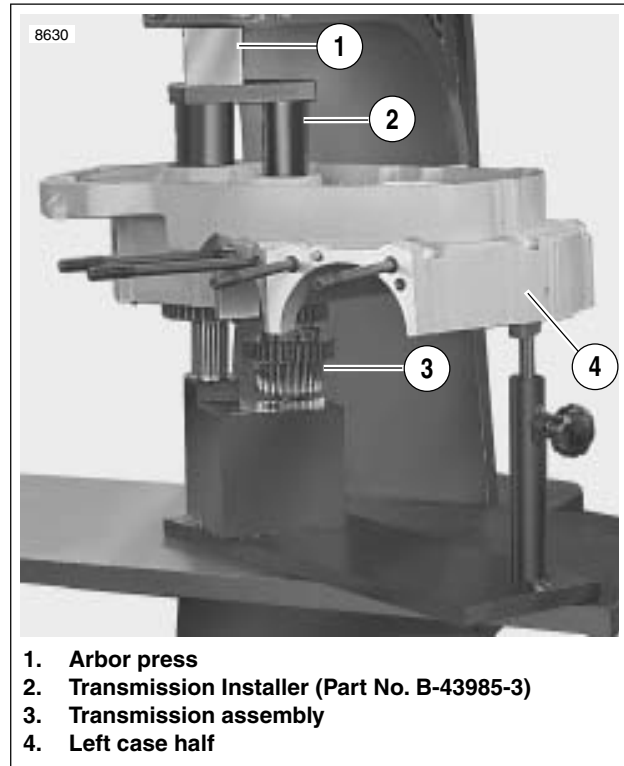
After re-installing the transmission assembly, verify that all parts have been properly installed. See [Figure 6-76](#).

- [6.11 MAIN DRIVE GEAR](#)
- [6.10 TRANSMISSION ASSEMBLY](#)
- [6.13 TRANSMISSION LEFT CASE BEARINGS](#)
- [6.12 TRANSMISSION RIGHT CASE BEARINGS](#)



**Figure 6-79. Transmission Assembly in Fixture**

1. See [Figure 6-79](#). Place transmission assembly onto TRANSMISSION REMOVER/INSTALLER FIXTURE (Part No. B-43985-2) on arbor press.
2. Install COUNTERSHAFT GUIDE ADAPTER (Part No. B-43985-4).



**Figure 6-80. Installing Transmission in Left Case Half**

3. See [Figure 6-80](#). Place left case half over transmission assembly and install TRANSMISSION INSTALLER (Part No. B-43985-3) into crankcase.
4. See [Figure 6-80](#). Press crankcase onto transmission assembly into until it bottoms out.
5. Remove COUNTERSHAFT GUIDE ADAPTER (Part No. B-43985-4).
6. Remove transmission assembly and left crankcase half from fixture.
7. Re-install transmission assembly and left crankcase half in engine stand.
8. Install mainshaft 2nd gear with shifter fork groove towards mainshaft 3rd gear.
9. Install shifter forks, shafts and shifter drum. See [6.10 TRANSMISSION ASSEMBLY](#).

## SHIFTER FORKS AND DRUM ASSEMBLY

### NOTES

- See [Figure 6-81](#). Shifter fork design allows for one common part number for all three shifter forks. As the transmission runs, each shifter fork develops a certain wear pattern with its mating parts. For this reason, it is important that each shifter fork be reinstalled in its original location.
- Always lubricate the shaft bore in each shifting fork with Sport Transmission Lube before assembly.

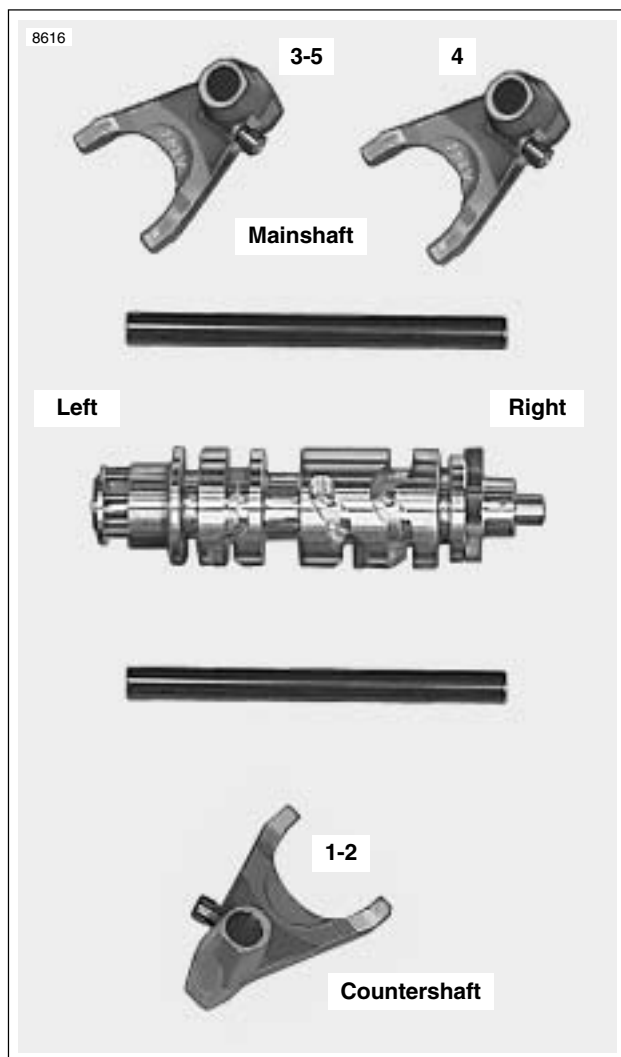


Figure 6-81. Shifter Forks, Drum and Shafts

1. Place the 4th gear shifter fork on the appropriate mainshaft sliding gear.
2. Install the shifter drum into the left case half with the previously scribed line at the 6 o'clock position. This will place the shifter drum in the 4th gear position.
3. See [Figure 6-82](#). Place the 3rd and 5th gear shifter fork on the appropriate mainshaft sliding gear and install the shifter fork shaft through the two installed shifter forks and into the left case half.
4. Install the 1st and 2nd gear shifter fork on the appropriate countershaft sliding gear and install the remaining shifter fork shaft through the last installed shifter fork and into the left case half.

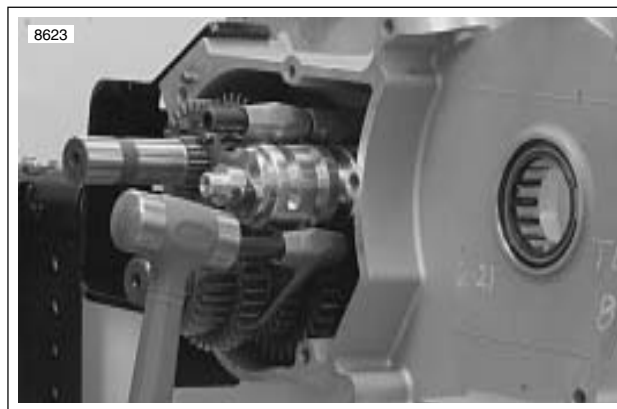
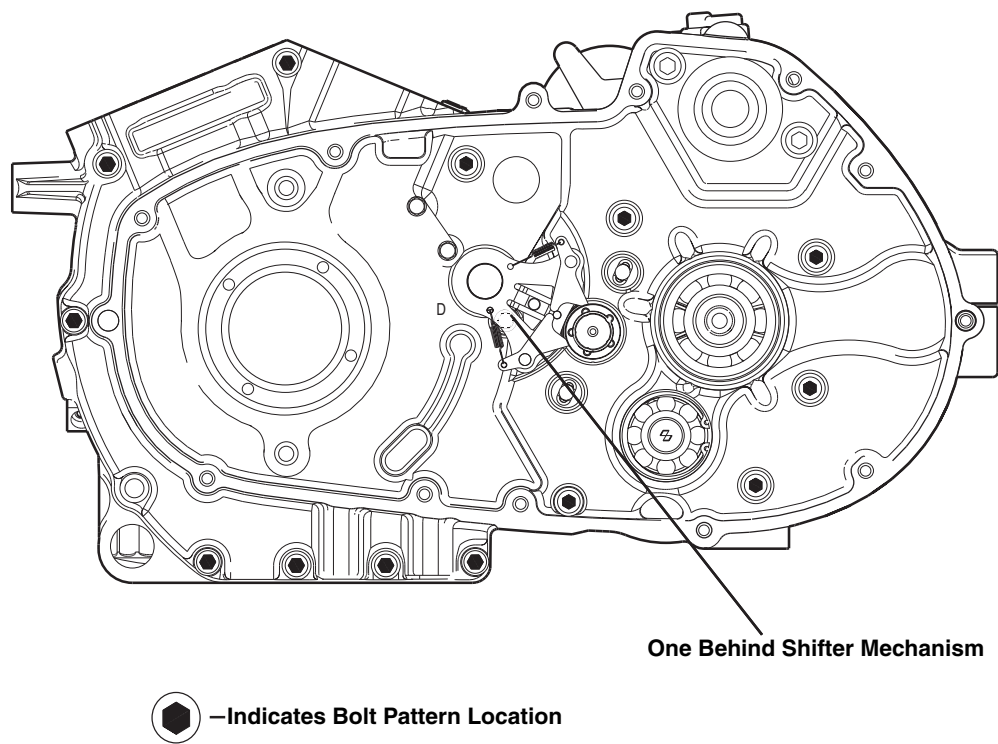


Figure 6-82. Installing Shift Fork Shafts

### NOTE

See [Figure 6-82](#). Install shifter fork shafts in the left case half by lightly tapping on the end with a brass hammer until seated in bore.

b1016x3x

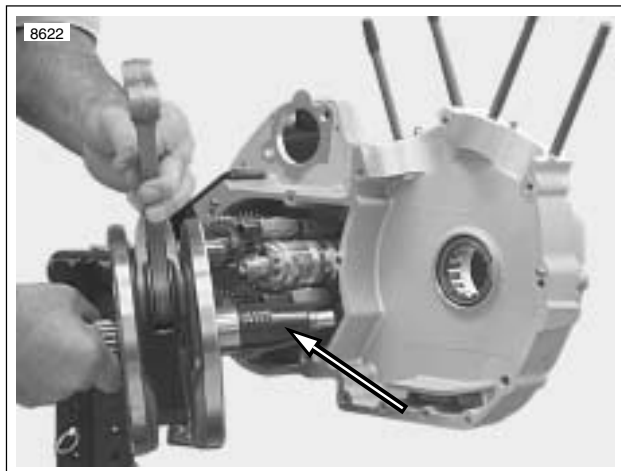


**Figure 6-83. Crankcase Fasteners**



## INSTALLING RIGHT CRANKCASE

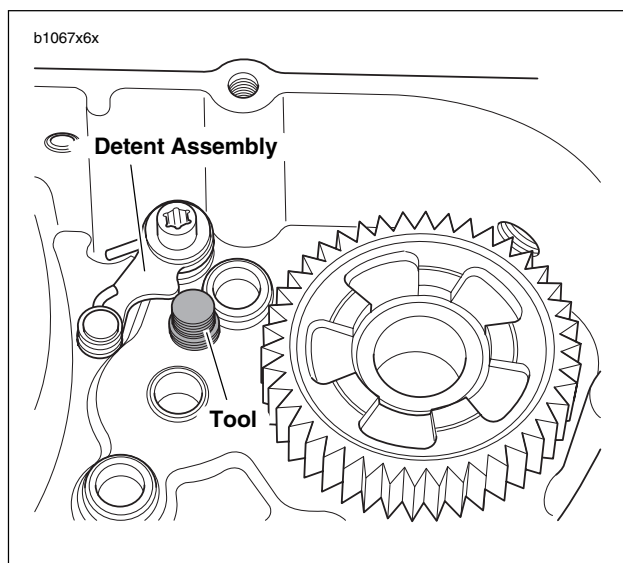
1. See [Figure 6-84](#). Install the flywheel assembly into the left crankcase half using CRANKSHAFT GUIDE TOOL Part No. HD-42326.



**Figure 6-84. Installing Flywheel Assembly Using Crankshaft Guide Tool (Part No. HD-42326)**

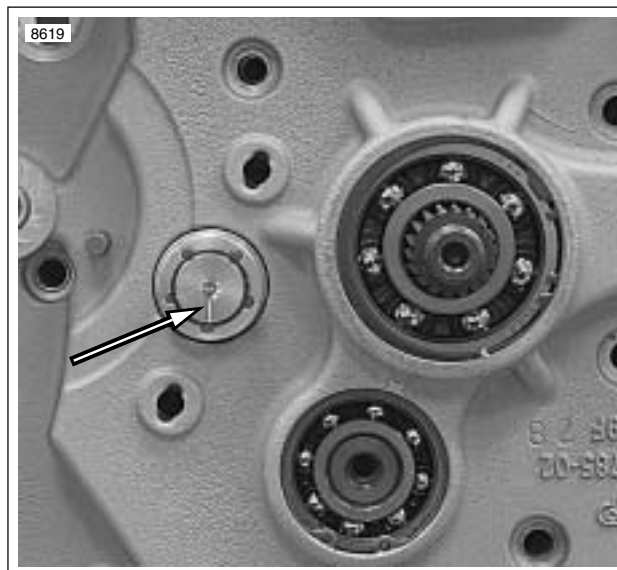
### NOTE

*The Gear Detent Assembly Aid is used to move the gear detent lever clear of the shifter drum for assembly purposes.*



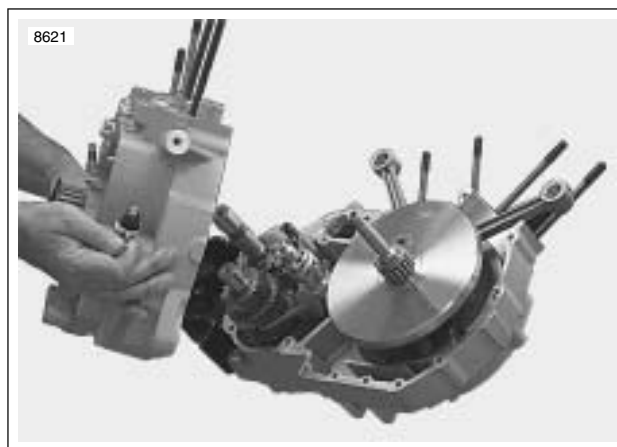
**Figure 6-85. Gear Detent Assembly Aid (Part No. B-45520)**

2. See [Figure 6-85](#). Retract detent assembly in right case half and install GEAR DETENT ASSEMBLY AID (Part No. B-45520) until it has bottomed in right case half.



**Figure 6-86. Scribed Line on Shifter Drum at 6 O'clock (Transmission in 4th Gear)**

3. See [Figure 6-86](#). Place Transmission in the 4th gear position. The scribed line on the shifting drum should be at 6 o'clock.

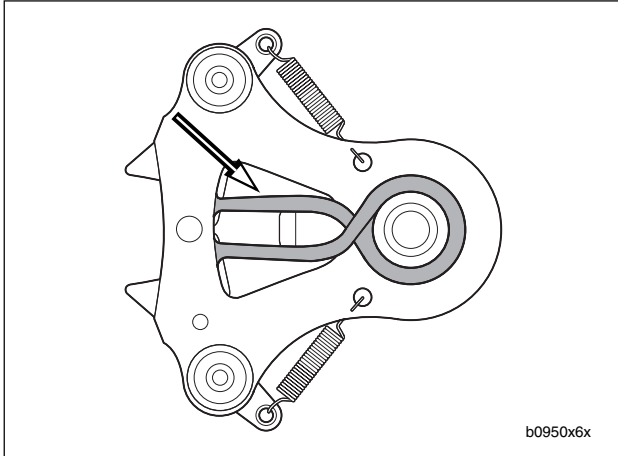


**Figure 6-87. Crankcase Halves**

4. See [Figure 6-87](#). Assemble crankcase halves together.
  - a. Apply a thin coat of DOW CORNING SILASTIC #732 clear sealant to crankcase joint faces.
  - b. Apply several drops of LOCTITE 262 (red) to last few threads.
  - c. See [Figure 6-83](#). Tighten 5/16-in. fasteners to 15-19 ft-lbs (20.3-25 Nm).

## INSTALLATION

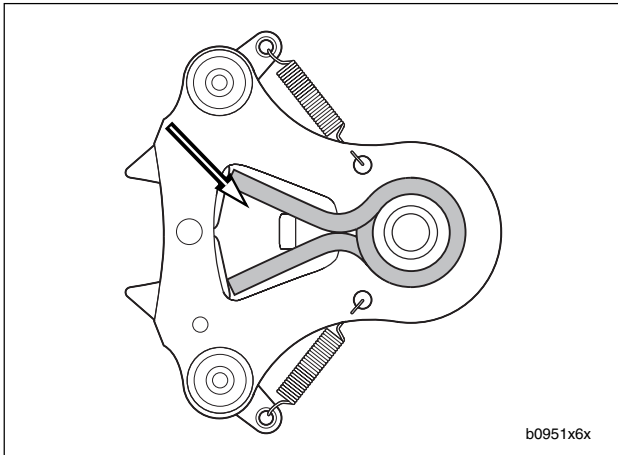
1. See [Figure 6-88](#). Correctly install shifter return spring onto the reverse side of the shifter shaft assembly before placing shaft in left crankcase half.



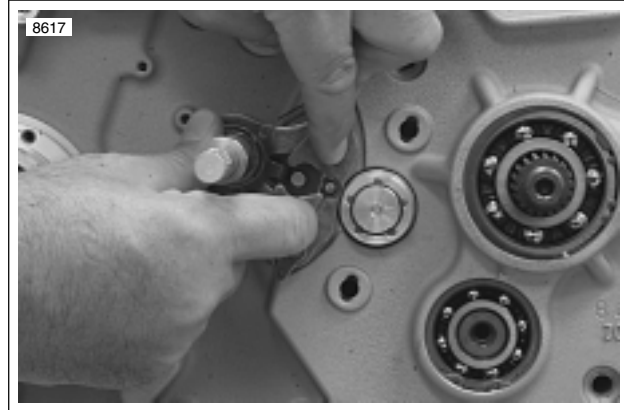
**Figure 6-88. Shifter Shaft Return Spring  
(Correctly Installed)**

### CAUTION

See [Figure 6-89](#). The shifter shaft return spring can be installed incorrectly and then assembled in the left crankcase half. Failure to install the spring properly will result in improper shifting.

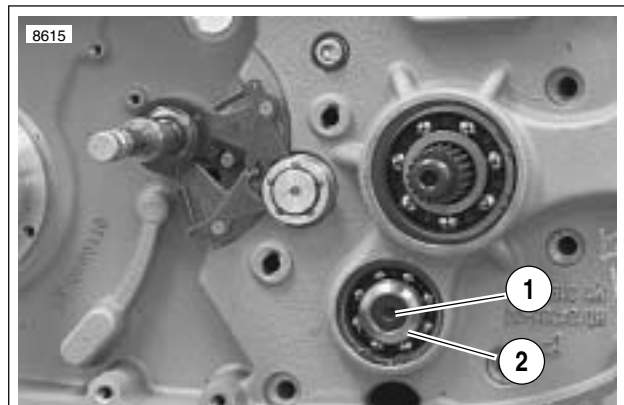


**Figure 6-89. Shifter Shaft Return Spring  
(Incorrectly Installed)**



**Figure 6-90. Installing Shifter Shaft Assembly**

2. See [Figure 6-90](#). Depress ratchet arms and insert shaft assembly into the bushing in the left case half and release. Ratchet arms should now be inside the end plate of the shifter drum contacting the shifter drum pins.



1. TORX screw
2. Retention collar

**Figure 6-91. Countershaft Retainer**

3. See [Figure 6-91](#). Position retention collar (2) next to end of countershaft with beveled side facing outward.
  - a. Apply several drops of LOCTITE 243 (blue) to last few threads.
  - b. Insert screw (1) through retention collar (2) and thread into end of shaft.
  - c. Place transmission in gear and tighten TORX screw (1) to 13-17 ft-lbs (18-23 Nm).

## REMOVAL

PART NO.	SPECIALTY TOOL
B-45659	Transmission sprocket locking tool
HD-94660-37B	Mainshaft locknut wrench

1. Loosen rear axle pinch fastener. See [IDLER PULLEY REMOVALS](#) [6.6 DRIVE BELT SYSTEM](#).
2. Unthread axle approximately 15 threads to release tension from drive belt.
3. Remove front sprocket cover. See [2.31 SPROCKET COVER](#).

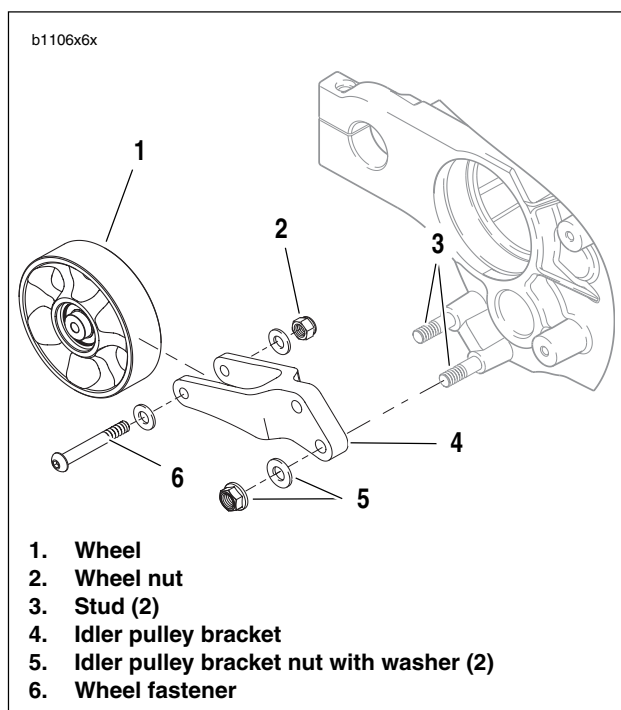


Figure 6-92. Idler Pulley Assembly

4. See [Figure 6-92](#). Remove both bracket nuts with washers (5) attaching idler pulley bracket (4) to studs (3).
5. Slide idler pulley assembly off studs.
6. Inspect pulley by spinning wheel (1) and checking for excessive wheel bearing wear.
7. If pulley wheel needs replacement, remove fastener (6) and nut (2) from idler pulley bracket (4) and discard. Replace with **new** pulley wheel (1).

## NOTE

The pulley wheel bearings can not be replaced separately. A new pulley wheel must be installed.

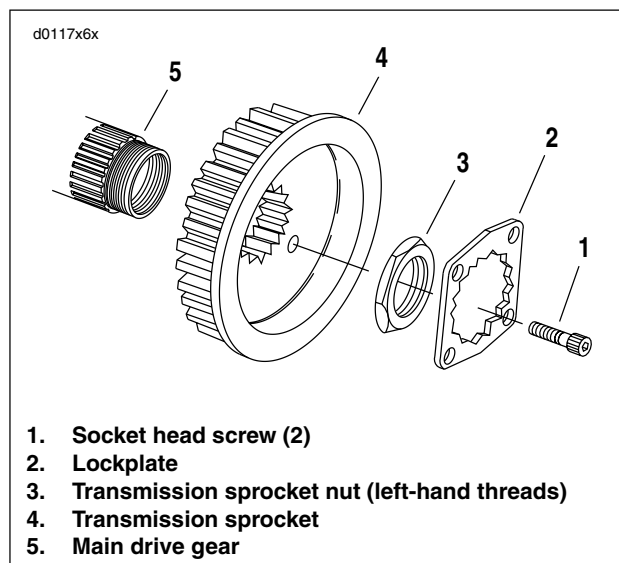


Figure 6-93. Transmission Sprocket

8. See [Figure 6-93](#). Place transmission in first gear. Remove two socket head screws (1) and lockplate (2).

## CAUTION

Transmission sprocket nut has left-hand threads. Turn nut clockwise to loosen and remove from main drive gear shaft.

9. Remove transmission sprocket nut (3) from main drive gear (5) using MAINSHAFT LOCKNUT WRENCH (Part No. HD-94660-37B). Use an air impact wrench for best results.
10. Remove secondary drive belt from transmission sprocket. Remove transmission sprocket (4) from main drive gear (5).

## INSTALLATION

1. See [Figure 6-93](#). Install transmission sprocket (4) with secondary drive belt onto main drive gear (5).
2. Place transmission in neutral.
3. Apply a few drops of LOCTITE 262 (red) to the **left-hand threads** of transmission sprocket nut (3) and lightly coat the washer-faced side with clean H-D 20W50 engine oil. Wipe off any excess oil.
4. Position nut with washer-faced side facing transmission sprocket. Turn the nut **counterclockwise** to install it onto main drive gear.

### NOTE

The drive on 2004 Lightning models is a 14mm belt. Use the P3/Blast SPROCKET HOLDING TOOL with the spacer and fastener from the 2003 Firebolt SPROCKET LOCKING TOOL to hold the sprocket.

5. See [Figure 6-94](#). Install SPROCKET HOLDING TOOL (Part No. B-43982) as shown.
6. Using MAINSHAFT LOCKNUT WRENCH (Part No. HD-94660-37B) and a torque wrench, tighten sprocket nut to 50 ft-lbs (67.8 Nm) INITIAL TORQUE ONLY.
7. See [Figure 6-95](#). Scribe a line on the transmission sprocket nut and continue the line on the transmission sprocket as shown.
8. Tighten the transmission sprocket nut an additional 30°-40°.

### CAUTION

Maximum allowable tightening of sprocket nut is 45° of counterclockwise rotation, after initially tightening to 50 ft-lbs. Do not loosen sprocket nut while attempting to align the screw holes. If you cannot align lockplate and sprocket screw holes, nut may be additionally tightened 45° as specified above. Tightening too much or too little may cause the nut to come loose during vehicle operation. If you cannot align lockplate and sprocket screw holes, nut may be additionally tightened until screw holes align.

9. See [Figure 6-93](#). Install lockplate over nut so that two of lockplate's four drilled holes (diagonally opposite) align with sprocket's two tapped holes.

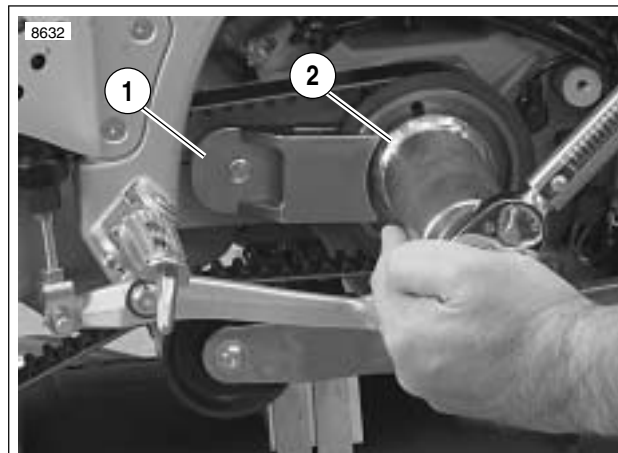
### NOTE

The lockplate has four screw holes and can be turned to either side, so you should be able to find a position without having to additionally tighten the nut. If you cannot align the screw holes properly, the nut may be additionally **TIGHTENED** until the screw holes line up, **but do not exceed 45°**. NEVER LOOSEN nut to align the screw holes.

10. See [Figure 6-93](#). Install two socket head screws through aligned holes of lockplate and into tapped holes of sprocket. Tighten to 90-110 in-lbs (10.2-12.4 Nm).

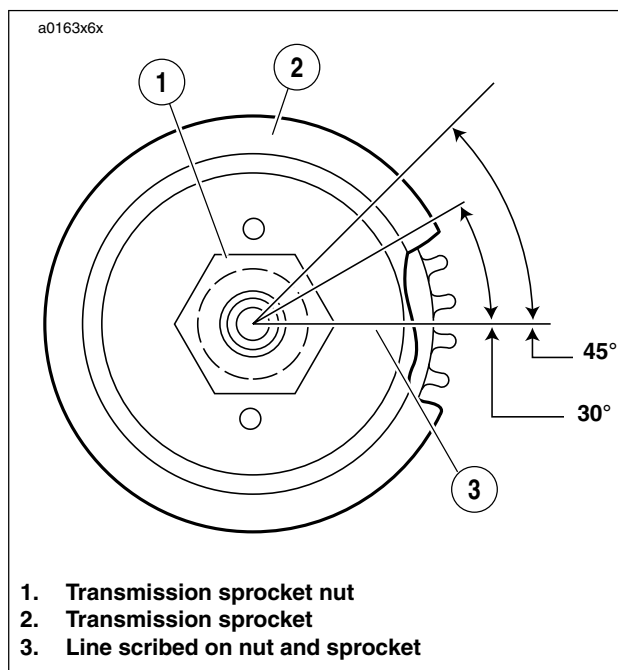
### NOTE

The original equipment socket head screws (1) have thread-locking compound applied to them. Since this compound remains effective for about three removal/installation cycles, the original screws may be reused up to three times. After the third removal/installation cycle, replace both screws with **new** screws identical to the original.



1. Sprocket holding tool (Part No. B-43982)
2. Mainshaft locknut wrench (Part No. HD-94660-37B)

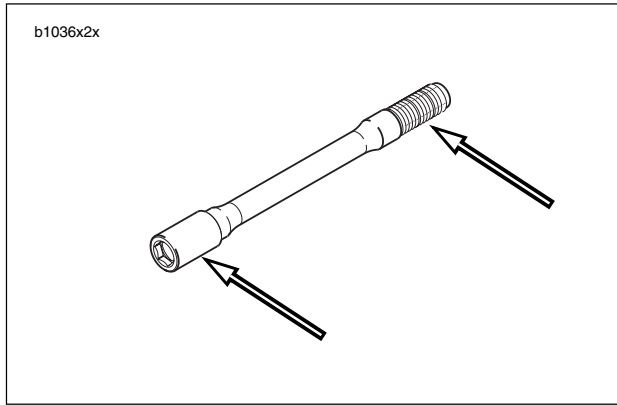
Figure 6-94. Transmission Sprocket Tightening



1. Transmission sprocket nut
2. Transmission sprocket
3. Line scribed on nut and sprocket

Figure 6-95. Aligning Transmission Sprocket

11. Center rear wheel in the swingarm at the same time sliding the drive belt onto the rear sprocket.
12. With wheel centered in swingarm, lower bike to align swingarm and wheel hub.
13. Apply ANTI-SEIZE LUBRICANT to hole in right side of swingarm where rear axle slides through.

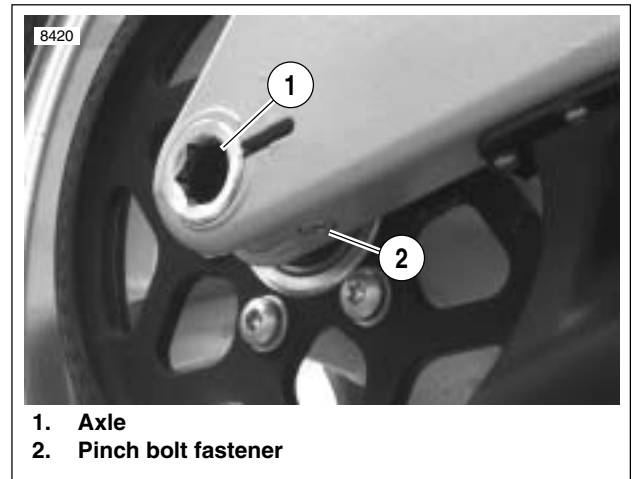


**Figure 2-96. Anti-Seize Lubricant Location**

14. See [Figure 2-96](#). Coat the axle with ANTI-SEIZE LUBRICANT.
15. Slide axle through right side of swing arm and wheel hub and thread partially into swingarm on left side.
16. Install idler pulley. See [IDLER PULLEY INSTALLATION](#)-under [6.6 DRIVE BELT SYSTEM](#).

**CAUTION**

Never tighten rear axle with swingarm brace removed.



**Figure 6-97. Rear Wheel Mounting, Right Side**

17. See [Figure 6-97](#). Tighten rear axle (1) to 23-27 ft-lbs (31.2-36.6 Nm), back off two full turns and then retighten to 48-52 ft-lbs (65.1-70.5 Nm).
18. Tighten pinch fastener (2) on right side of swingarm to 40-45 ft-lbs (54-61 Nm).

# NOTES

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