

## GENERAL

See [Figure 6-45](#). The transmission is a five-speed constant-mesh type housed in an extension of the crankcase. The transmission permits the rider to vary the ratio of engine speed-to-rear driving wheel speed in order to meet the varying conditions of operation.

The transmission is foot-operated by the gear shifter lever, which transmits the force through a gear shifter shaft. The shifter shaft actuates a pawl and a shifter fork drum. The shifter fork drum moves shifter forks, which slide a series of shifter dogs on the mainshaft and countershaft, into and out of mesh with the other gears.

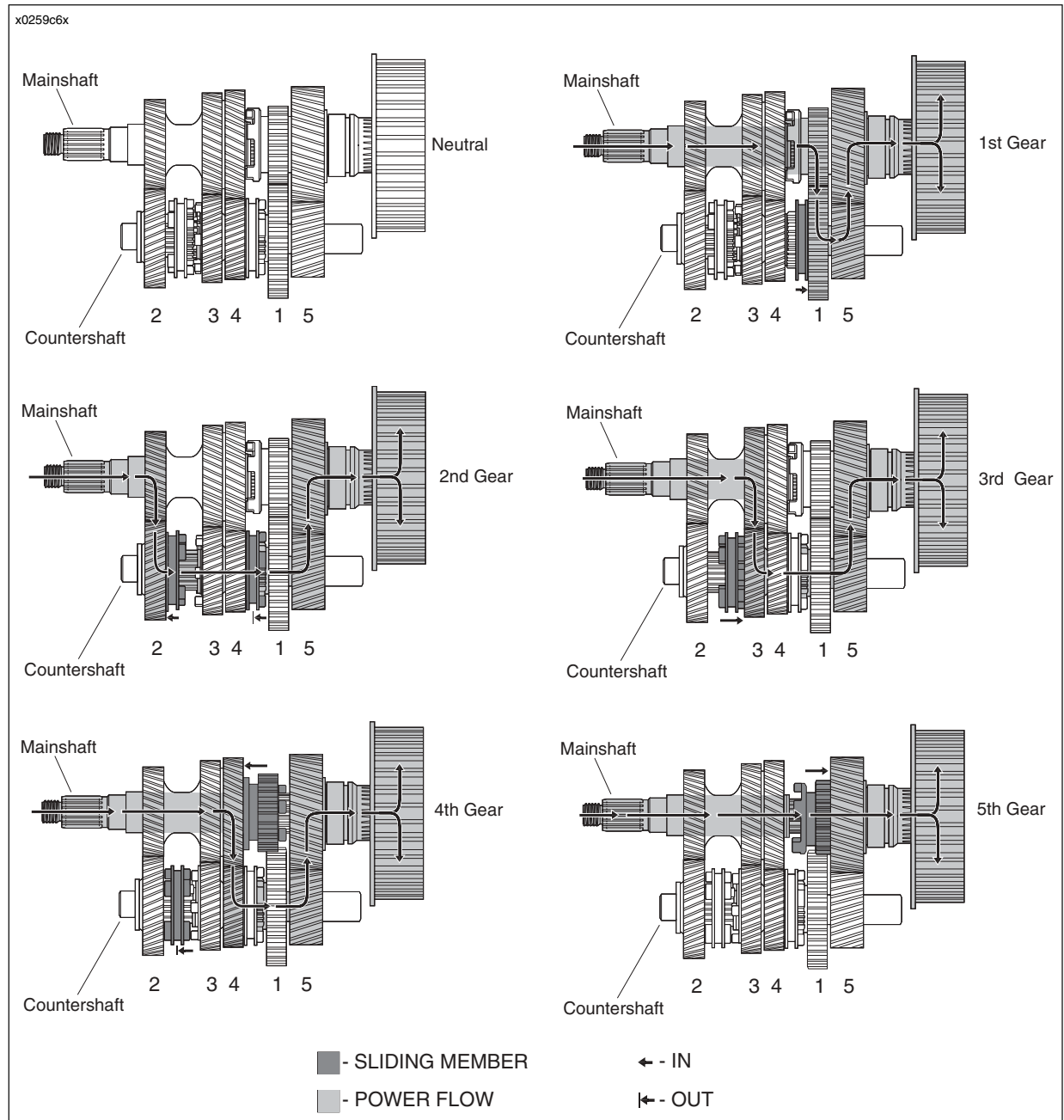


Figure 6-45. Transmission Power Flow

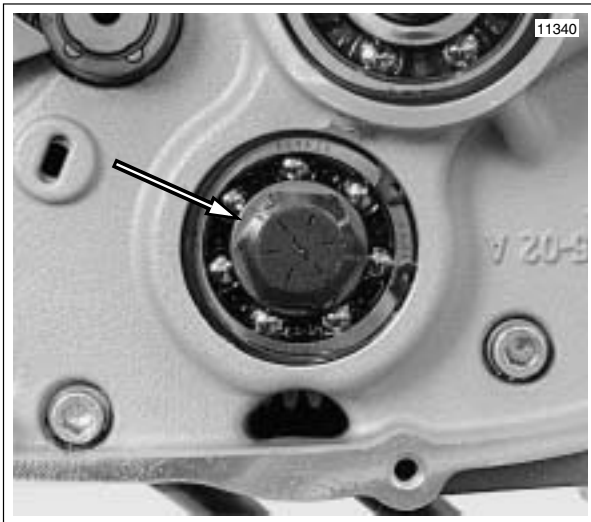
# CASE DISASSEMBLY FOR TRANSMISSION REMOVAL 6.8

## 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.

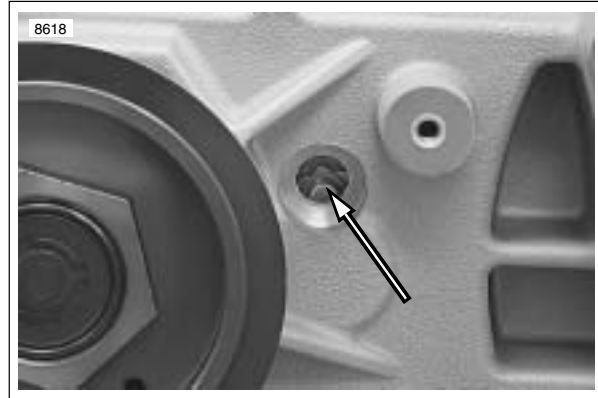
## RIGHT CRANKCASE REMOVAL

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 [3.18 GEARCASE COVER AND CAM GEARS](#).
6. Remove primary cover. See [6.2 PRIMARY COVER](#).
7. Remove clutch assembly, primary chain and engine sprocket. See [6.5 PRIMARY CHAIN](#).



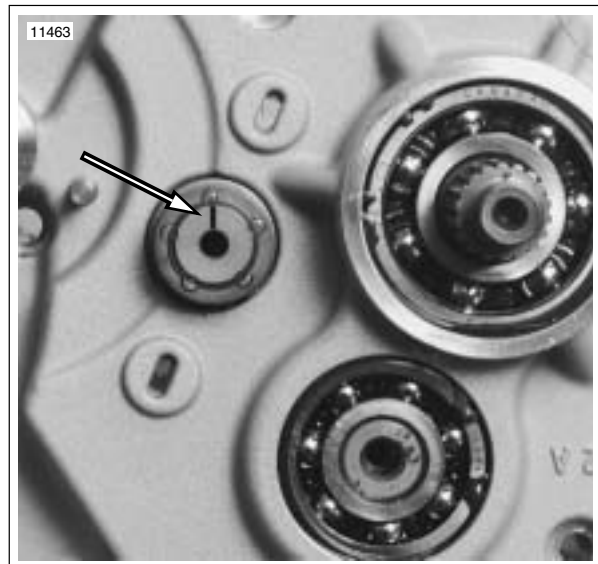
**Figure 6-46. Hex Fastener Countershaft Retainer**

8. See [Figure 6-46](#). Place transmission in 1st gear. Remove hex fastener.



**Figure 6-47. Shifter Drum Neutral Detent**

9. See [Figure 6-47](#). Place transmission in neutral. Remove neutral switch to ensure shifter drum detent is visible indicating transmission is in correct location.



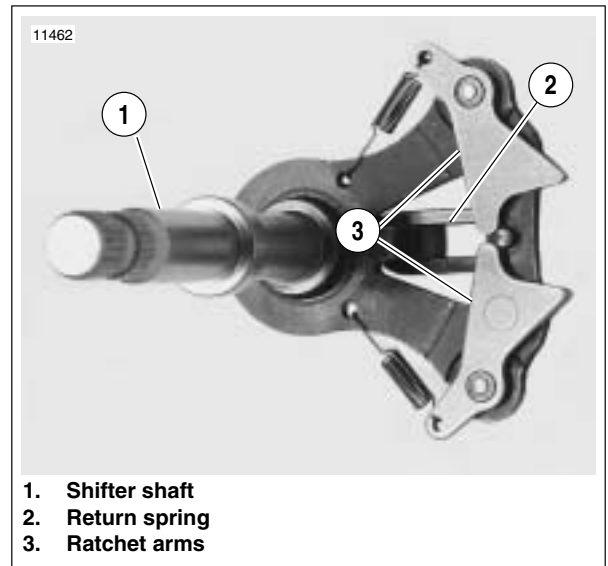
**Figure 6-48. Shifter Drum and Mainshaft (Transmission in Neutral)**

10. See [Figure 6-48](#). With transmission still in neutral, scribe a line on the end of the shifter drum at the 12 o'clock position for later reference.



**Figure 6-49. Removing Shifter Shaft Assembly**

11. See [Figure 6-49](#). Remove shifter shaft assembly.



**Figure 6-50. Shifter Shaft Assembly**

12. See [Figure 6-50](#). Depress ratchet arms (3) in order to clear the shifter drum and remove shifter shaft assembly from left crankcase half.
13. Remove starter. See [5.7 STARTER](#).



**Figure 6-51. Rear Isolator Assembly**

14. See [Figure 6-51](#). Remove rear isolator assembly by removing the forward two fasteners first and then the two rear fasteners (re-install with **new** fasteners).

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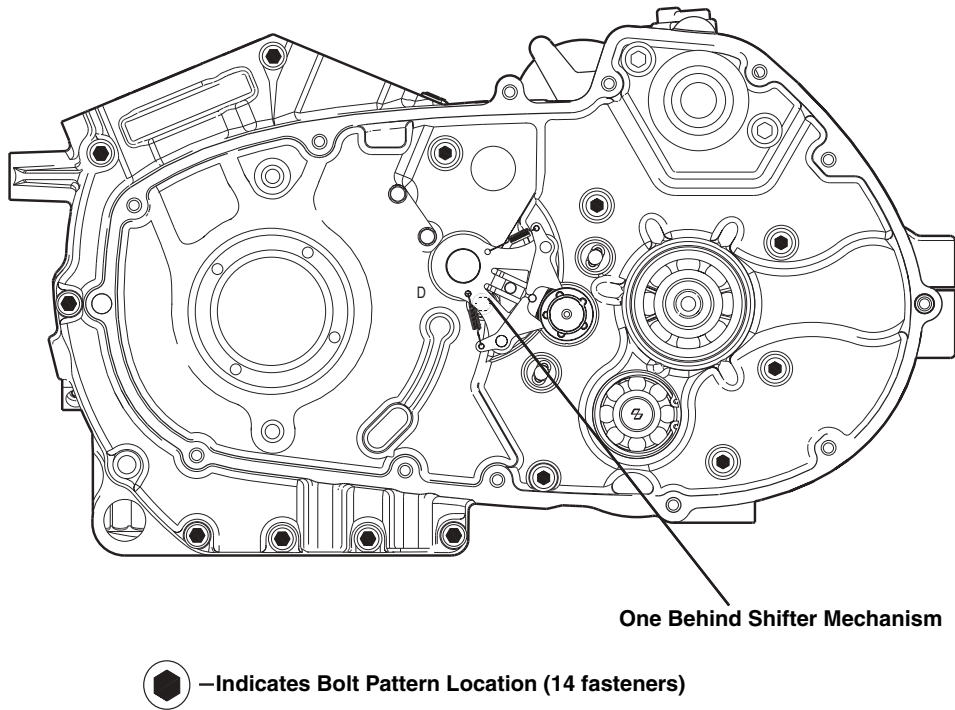


Figure 6-52. Crankcase Fasteners

15. See [Figure 6-52](#). 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.*

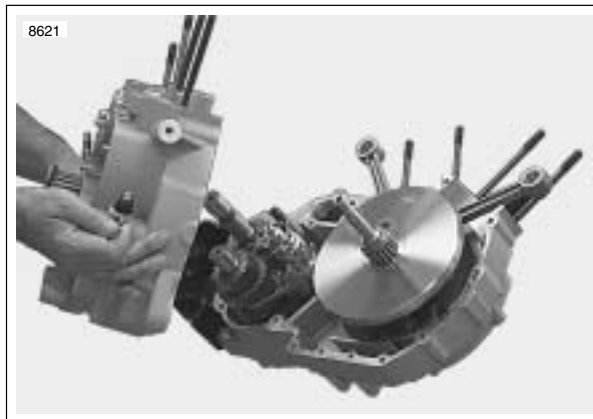


Figure 6-53. Separating Crankcase Halves

16. See [Figure 6-53](#). Separate crankcase halves.



Figure 6-54. Removing Flywheels from Left Case Half

17. See [Figure 6-54](#). Remove the flywheel assembly from left crankcase half.

## GENERAL

PART NO.	SPECIALTY TOOL
B-43985-1	Transmission remover
J-5586-A	Retaining ring pliers

## TRANSMISSION REMOVAL FROM LEFT CRANKCASE

## NOTE

See [Figure 6-55](#). Shifter design allows for one common part number for both countershaft 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.

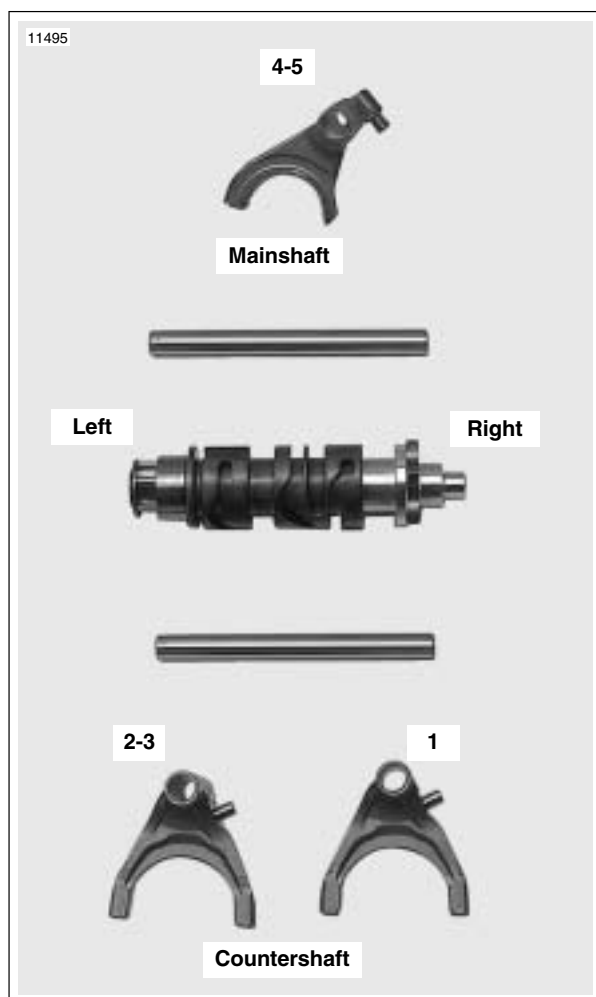


Figure 6-55. Shifter Forks, Drum and Shafts

1. See [Figure 6-56](#). Remove shifter fork shafts by inserting a small flat punch in the slots and tapping on the end of each shaft until it falls free.

## NOTE

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

2. See [Figure 6-57](#). Remove shifter drum (1) and shifter forks (2). Mark each shifter fork as it is removed, so it can be reinstalled in the same location.

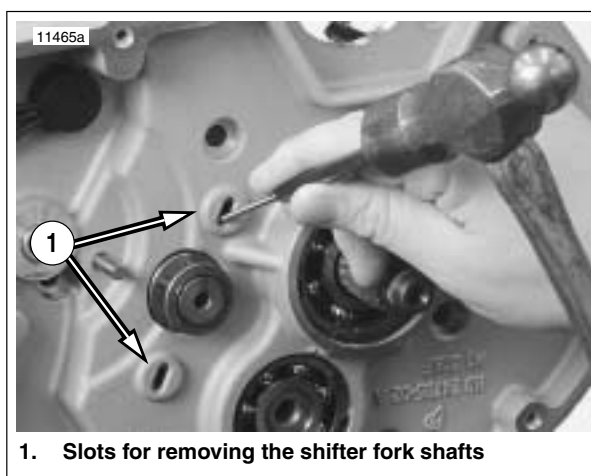


Figure 6-56. Removing Shifter Fork Shafts

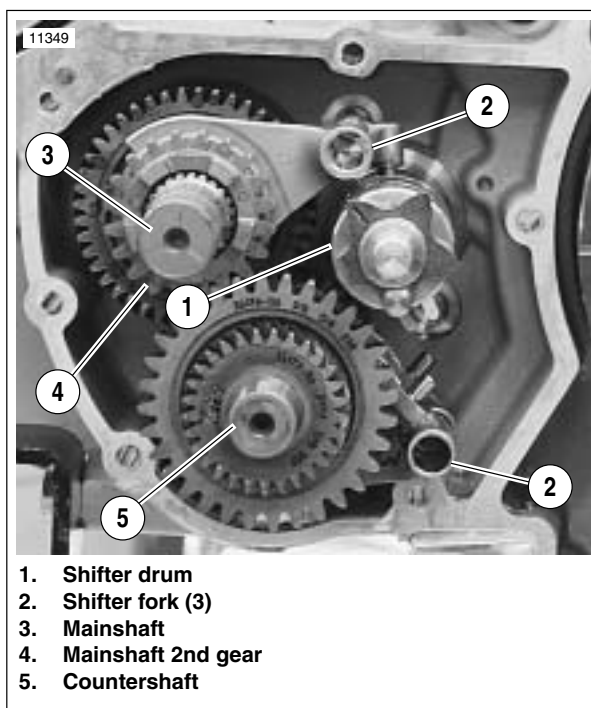
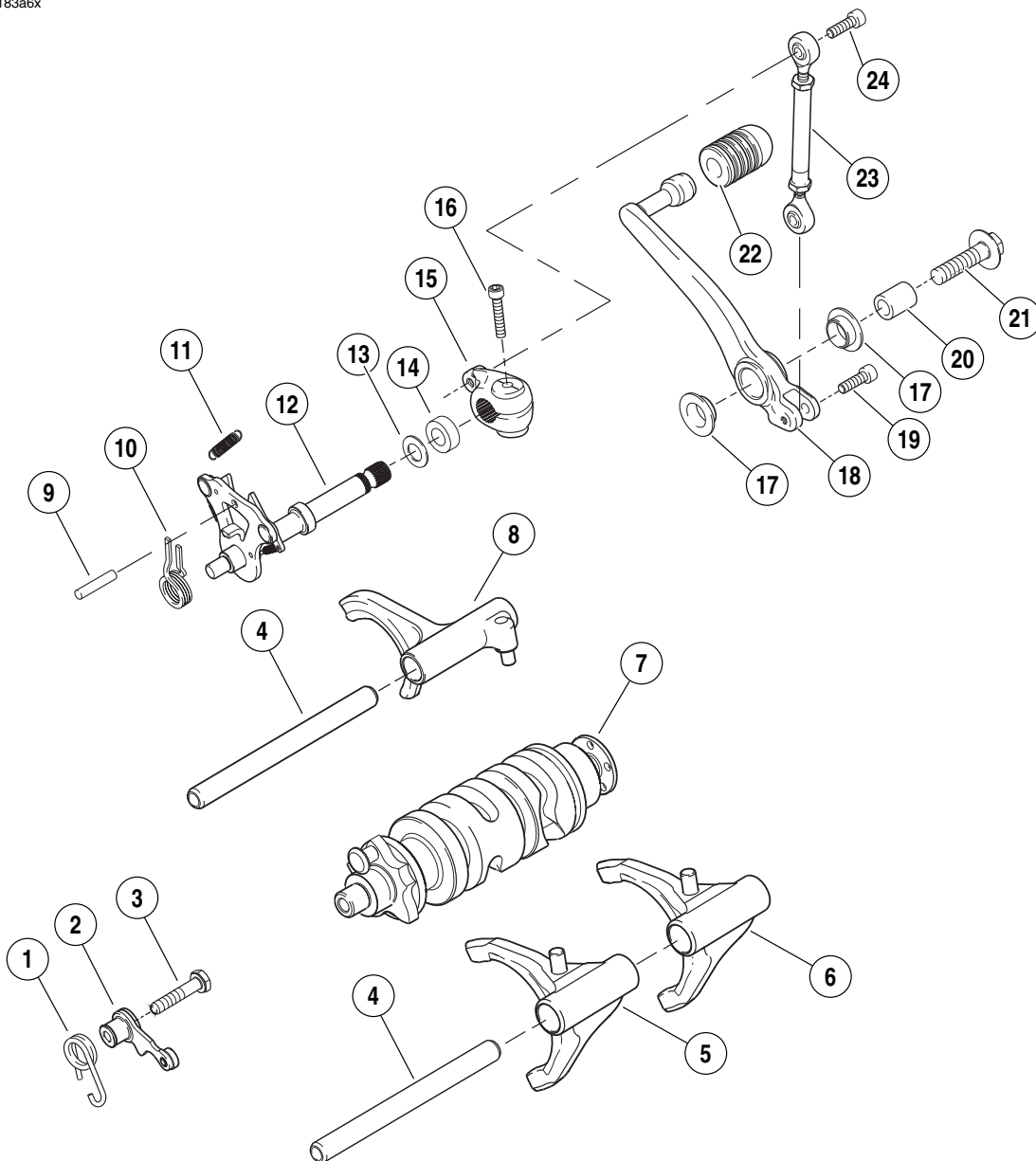


Figure 6-57. Transmission Assembly

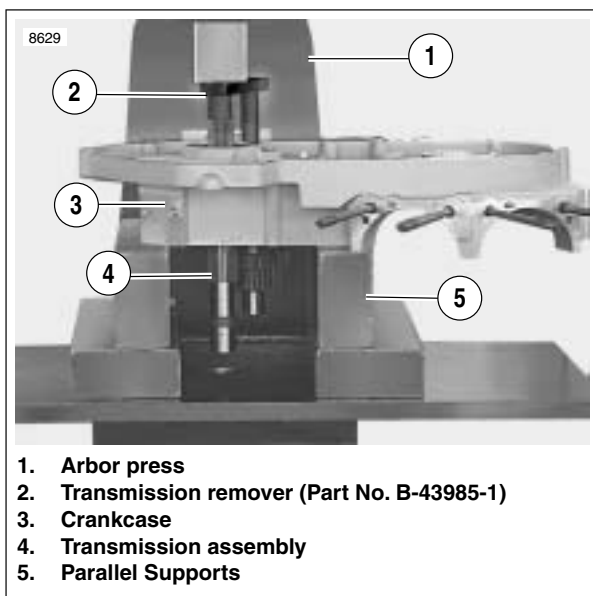
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- |                                     |                                       |
|-------------------------------------|---------------------------------------|
| 1. Spring, detent                   | 13. Oil seal                          |
| 2. Detent spring sleeve assembly    | 14. Rubber washer                     |
| 3. Screw, detent assembly           | 15. Lever, engine                     |
| 4. Shaft, shifter forks (2)         | 16. Bolt, engine lever                |
| 5. Fork assembly, shifter (2nd-3rd) | 17. Bearing, shift lever assembly (2) |
| 6. Fork assembly, shifter (1st)     | 18. Shift lever                       |
| 7. Shifter cam assembly             | 19. Bolt, linkage assembly            |
| 8. Fork assembly, shifter (4th-5th) | 20. Sleeve, shift/brake lever         |
| 9. Pin, shifter stop                | 21. Bolt, shift lever                 |
| 10. Spring, shifter return          | 22. Pad, rubber, shift lever          |
| 11. Spring, extension               | 23. Linkage assembly, shifter         |
| 12. Shifter lever assembly          | 24. Bolt, linkage assembly            |

Figure 6-58. Shifter Mechanism





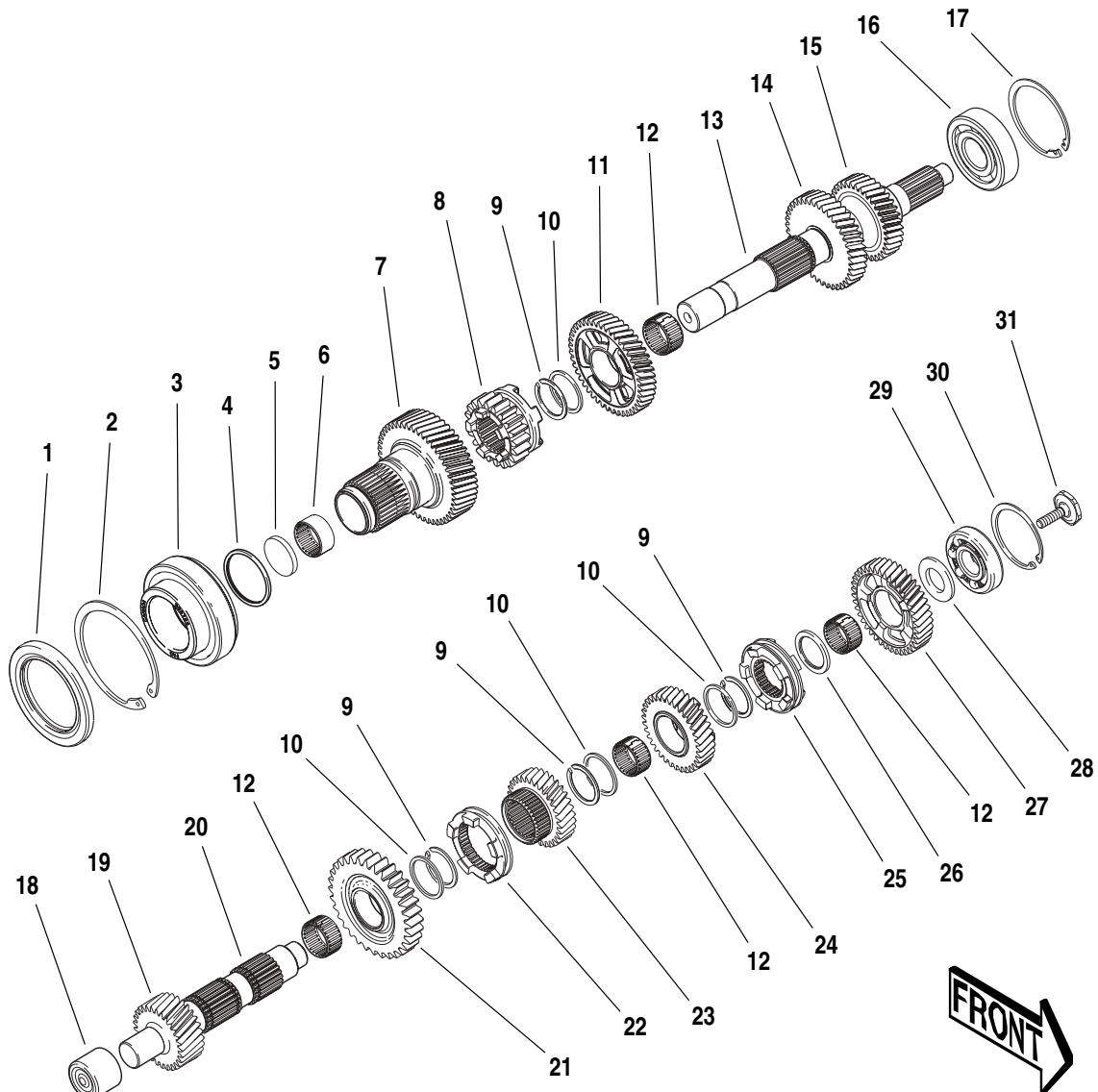
**Figure 6-59. Removing Transmission Assembly from Left Case Half**

**⚠ WARNING**

**Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)**

3. See [Figure 6-59](#). 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.

x0572a6x



- |                         |                                  |
|-------------------------|----------------------------------|
| 1. Oil seal             | 17. Retaining ring               |
| 2. Retaining ring       | 18. Closed end bearing           |
| 3. Ball bearing         | 19. Countershaft 5th gear**      |
| 4. O-ring               | 20. Countershaft                 |
| 5. Oil seal             | 21. Countershaft 1st gear        |
| 6. Needle bearing (2)   | 22. Dog ring                     |
| 7. Mainshaft 5th gear   | 23. Countershaft 4th gear        |
| 8. Mainshaft 1st gear   | 24. Countershaft 3rd gear        |
| 9. Retaining ring (4)   | 25. Dog ring                     |
| 10. Thrust washer (4)   | 26. Thrust washer                |
| 11. Mainshaft 4th gear  | 27. Countershaft 2nd gear        |
| 12. Split bearing (4)   | 28. Spacer                       |
| 13. Mainshaft           | 29. Countershaft bearing         |
| 14. Mainshaft 3rd gear* | 30. Retaining ring               |
| 15. Mainshaft 2nd gear* | 31. Countershaft retaining screw |
| 16. Mainshaft bearing   |                                  |

\* Mainshaft 2nd and 3rd gears are integral to the shaft.

\*\* Countershaft 5th gear is integral to the shaft.

Figure 6-60. Transmission Assembly



## 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 6-61. As each component is removed, place it on a clean surface in the exact order of removal.

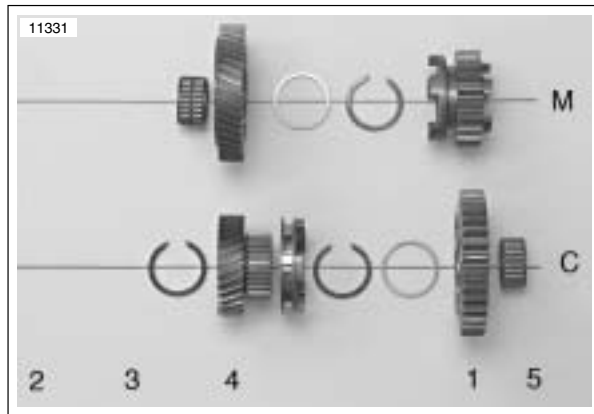


Figure 6-61. Transmission Parts Identification

## MAINSHAFT DISASSEMBLY

### NOTES

- Mainshaft 2nd and 3rd gears are integral to the shaft.
- Mainshaft 1st gear is directional. Mark gear when removed for correct installation.
- 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. This transmission requires no shimming.

### WARNING

**Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)**

### NOTE

Use correct retaining ring pliers and correct tips. Verify that tips are not excessively worn or damaged.

- See Figure 6-62. Remove 1st gear (1).
- Use RETAINING RING PLIERS (Part No. J-5586-A) to expand and remove retaining ring (2). Discard retaining ring.
- Slide thrust washer (3) off end of mainshaft.
- Remove 4th gear (4) and split bearing (5). Discard bearing.

## Cleaning And Inspection

### WARNING

**Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)**

- Clean all parts 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.

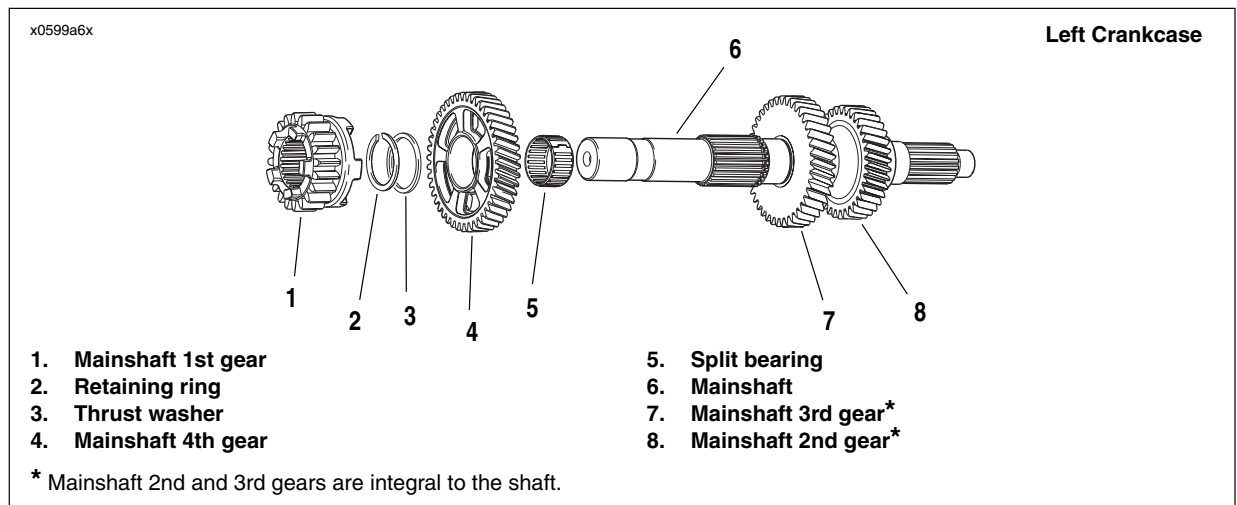


Figure 6-62. Transmission Mainshaft Assembly Once Removed from Left Crankcase/Disassembly

## COUNTERSHAFT DISASSEMBLY

### NOTES

- Countershaft 5th gear is integral to the shaft.
- 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. This transmission requires no shimming.
- Use correct retaining ring pliers with correct tips. Verify that tips are not excessively worn or damaged.

### ⚠ WARNING

Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)

- See Figure 6-63. Remove spacer (19) and 2nd gear (18) from the end of the of the countershaft (2). Remove and discard split bearing (17).
- Remove spacer (16).

### NOTE

When removing the dog ring (15), it is important to mark the direction of the ring on the shaft as parts establish wear patterns.

- Remove dog ring (15).

- Using RETAINING RING PLIERS (Part No. J-5586-A), expand and remove retaining ring (14). Discard retaining ring.
- Remove thrust washer (13), 3rd gear (12), and split bearing (11). Discard bearing.
- Remove thrust washer (10).
- Expand, remove and discard retaining ring (9).
- Remove 4th gear (8) and dog ring (7).
- Expand, remove and discard retaining ring (6).
- Remove thrust washer (5), 1st gear (4) and split bearing (3). Discard bearing.

## Cleaning And Inspection

### ⚠ WARNING

Compressed air can pierce the skin and flying debris from compressed air could cause serious eye injury. Wear safety glasses when working with compressed air. Never use your hand to check for air leaks or to determine air flow rates. (00061a)

- 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.

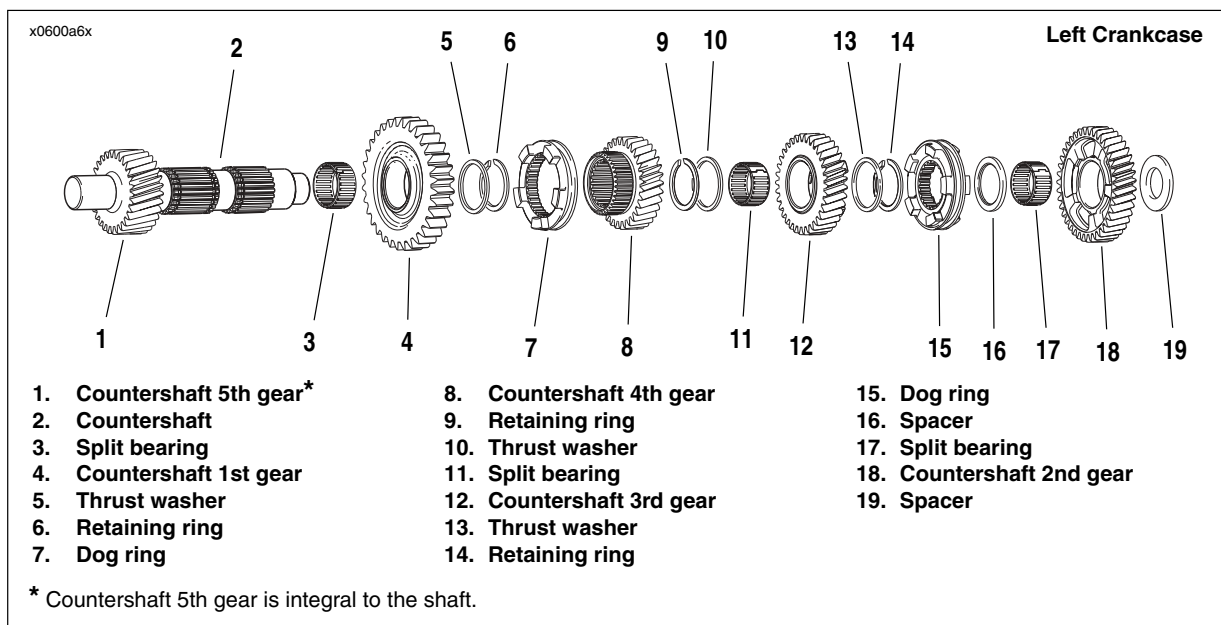


Figure 6-63. Transmission Countershaft Assembly Once Removed from Left Crankcase/Disassembly

## GENERAL

PART NO.	SPECIALTY TOOL
J-5586-A	Retaining ring pliers

## MAINSHAFT ASSEMBLY

**WARNING**

Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)

## NOTES

- Use correct retaining ring pliers and correct tips. Verify that tips are not excessively worn or damaged.
  - During assembly, the split bearings and the internal bores of the gears must be lubricated with Harley-Davidson FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT prior to assembly. Leaving these parts dry could accelerate wear at start-up.
1. See Figure 6-64. Install **new** split bearing (5) in 4th gear position on mainshaft.
  2. Install 4th gear (4) and thrust washer (3).
  3. Using RETAINING RING PLIERS (Part No. J-5586), expand and install **new** retaining ring (2).
  4. Install 1st gear (1).

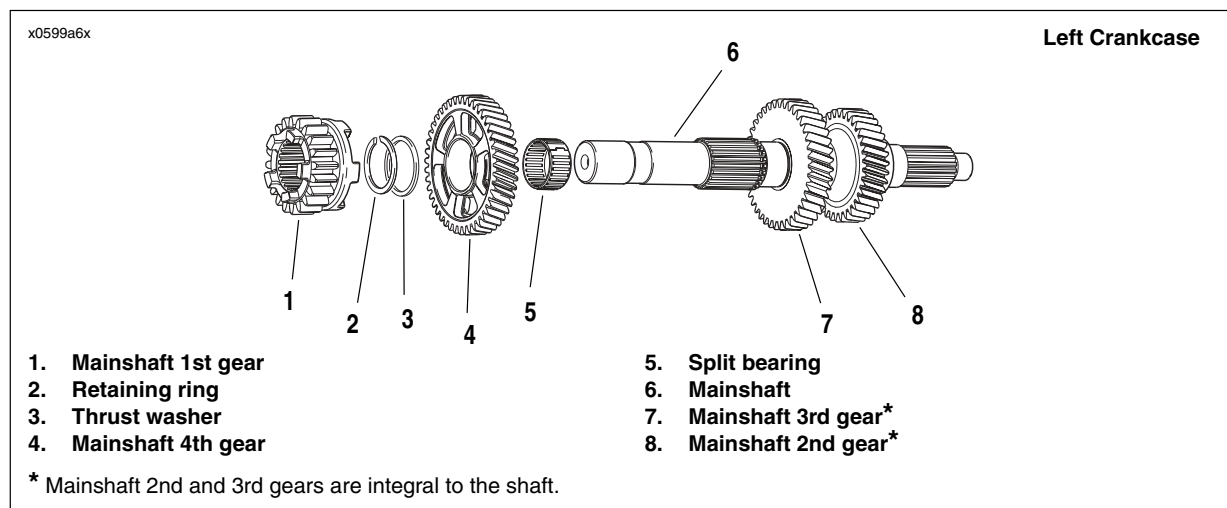


Figure 6-64. Transmission Mainshaft Assembly/Reassembly

## COUNTERSHAFT ASSEMBLY

### ⚠ WARNING

Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)

#### NOTES

- Use correct retaining ring pliers and correct tips. Verify that tips are not excessively worn or damaged.
  - During assembly, the split bearings and the internal bores of the gears must be lubricated with Harley-Davidson FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT prior to assembly. Leaving these parts dry could accelerate wear at start-up.
1. See Figure 6-65. Install **new** split bearing (3) in 1st gear position on mainshaft.
  2. Install 1st gear (4) and thrust washer (5).

3. Using RETAINING RING PLIERS (Part No. J-5586-A), expand and install **new** retaining ring (6).
4. Install dog ring (7) onto 4th gear (8). Now install dog ring and gear assembly onto countershaft.
5. Expand and install **new** retaining ring (9).
6. Install thrust washer (10).
7. Install **new** split bearing (11) in 3rd gear position on mainshaft.
8. Install 3rd gear (12) and thrust washer (13).
9. Expand and install **new** retaining ring (14).
10. Install dog ring (15). Make sure to install with dog ring facing same direction as when it was removed.
11. Install spacer (16).
12. Install **new** split bearing (17) in 2nd gear position on shaft.
13. Install 2nd gear (18) and spacer (19).

#### NOTE

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

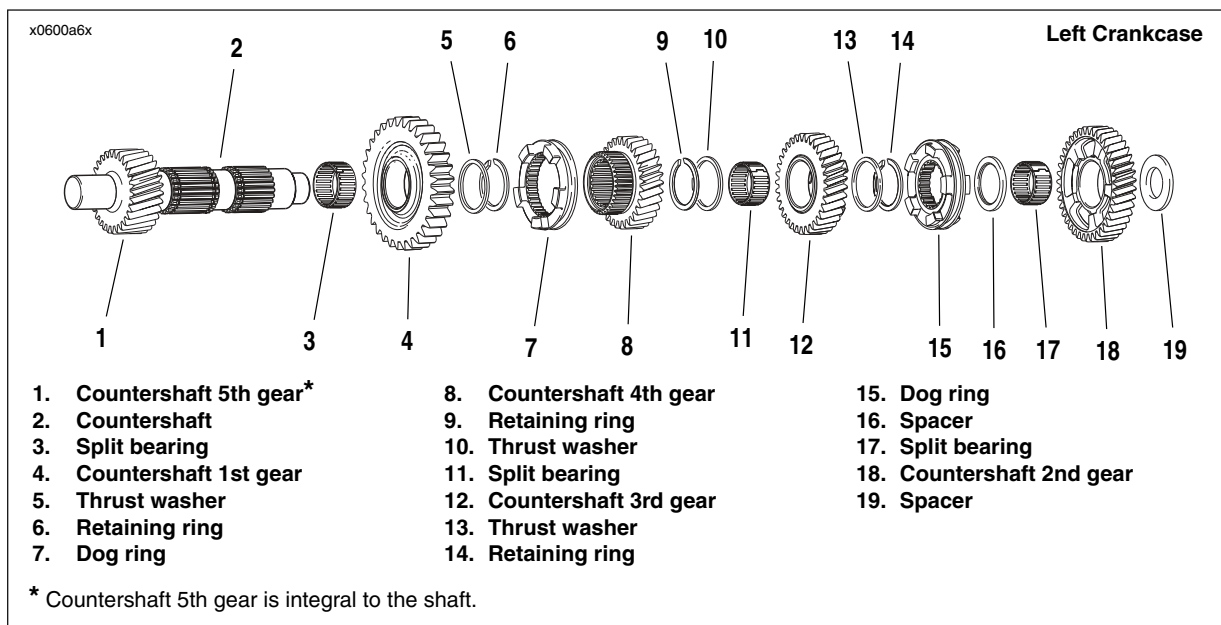


Figure 6-65. Transmission Countershaft Assembly Once Removed from Left Crankcase/Disassembly

# MAIN DRIVE GEAR AND BEARING

6.11

## GENERAL

PART NO.	SPECIALTY TOOL
HD-35316-C	Main drive gear remover and installer
B-45847	Cross plate
HD-47855	Inner/outer main drive gear needle bearing installation tool
HD-95637-46A	Bearing race puller
HD-47856	Seal driver

### NOTE

When removing the main drive gear, the gear is pressed out against the resistance of the ball 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 must also be replaced.

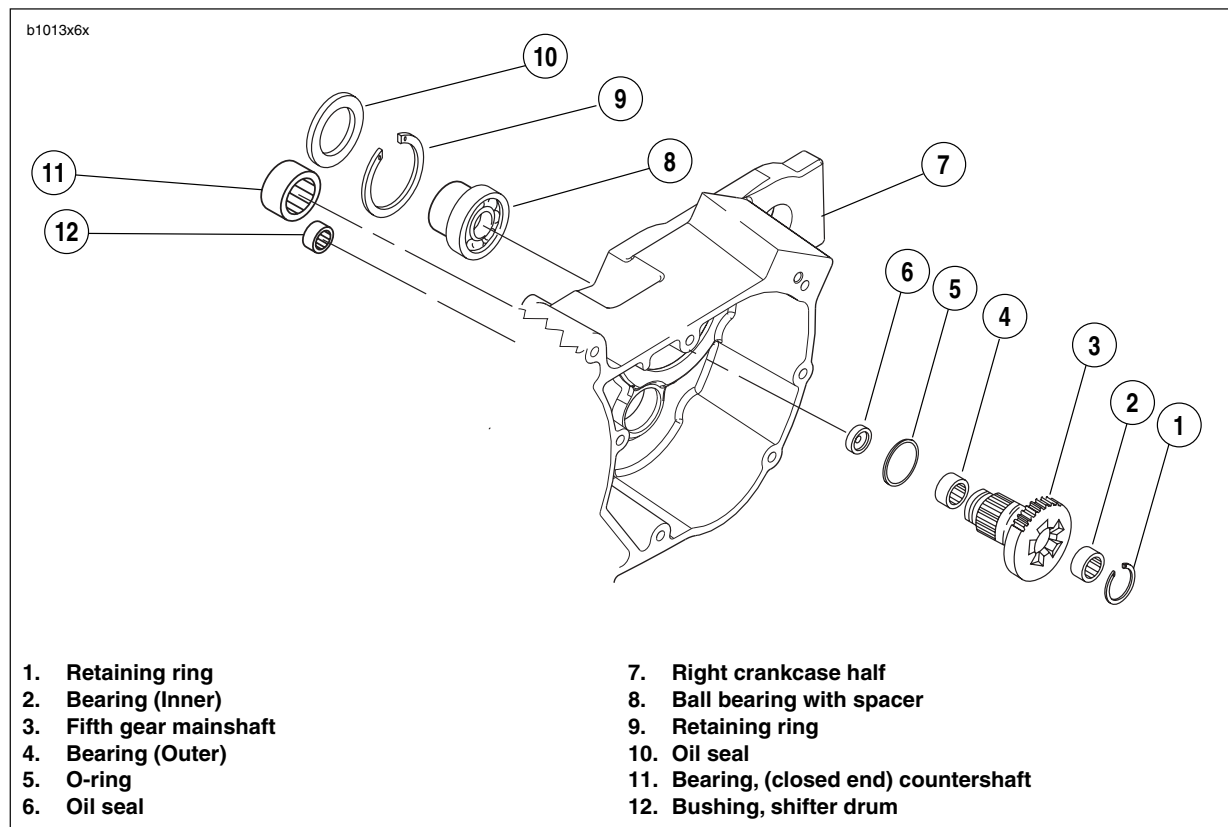


Figure 6-66. Transmission Assembly-Right Crankcase Half

## 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](#).
3. See [Figure 6-67](#). From inside case tap out seal (3) at end of mainshaft 5th gear. Discard seal.
4. Obtain MAIN DRIVE GEAR REMOVER AND INSTALLER SET. See [Figure 6-68](#). Place CROSS PLATE on right crankcase as shown. Position cross plate so that roll pins fit into crankcase mating screw holes and bolt hole in cross plate is centered over main drive gear.

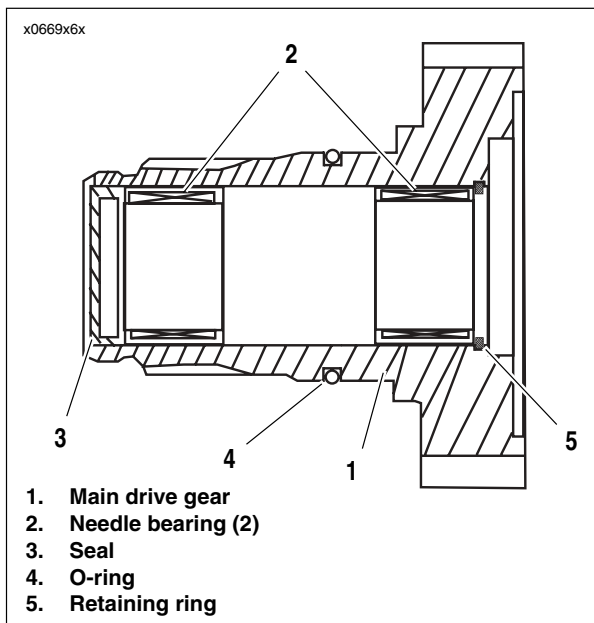


Figure 6-67. Main Drive Gear Assembly

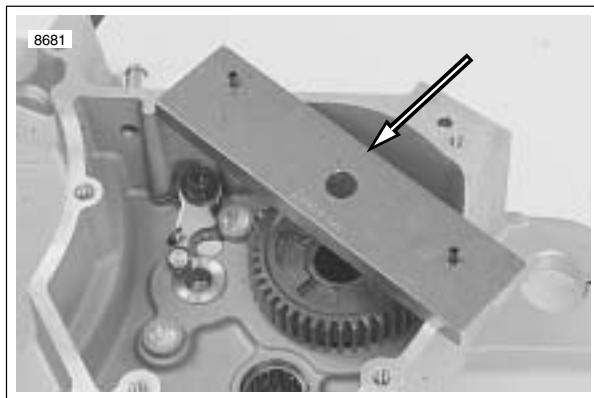
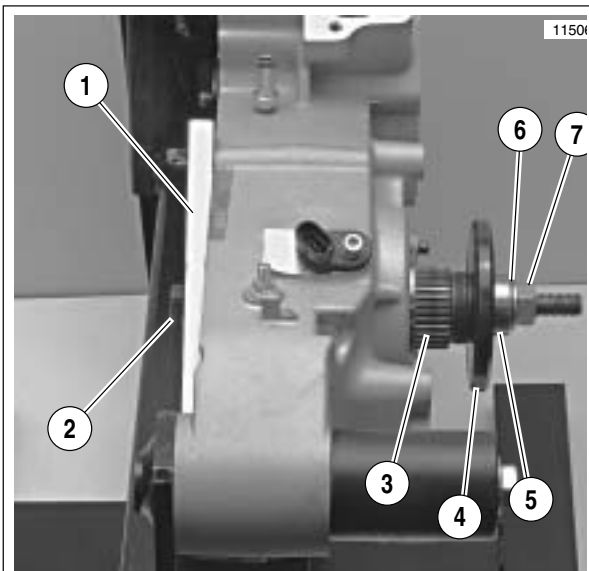


Figure 6-68. Bearing Remover Cross Plate Mounting (Part No. B-45847)



1. Cross plate (Part No. B-45847)
2. 8 in. bolt (Part No. HD-35316-4A)
3. Main drive gear
4. Washer (Part No. HD-35316-7)
5. Nice bearing
6. Washer
7. Nut

Figure 6-69. Removing Main Drive Gear Bearing (Typical)

5. See [Figure 6-69](#). Insert bolt (2) through cross plate (1) and 5th gear (3).

### NOTE

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.

6. At outside of case, place WASHER (Part No. HD-35316-7) (4), NICE BEARING (5), FLAT WASHER (6) and NUT (7) over end of bolt. Tighten nut until main drive gear is free.



## Main Drive Gear Bearing

### ⚠ WARNING

**Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)**

#### NOTE

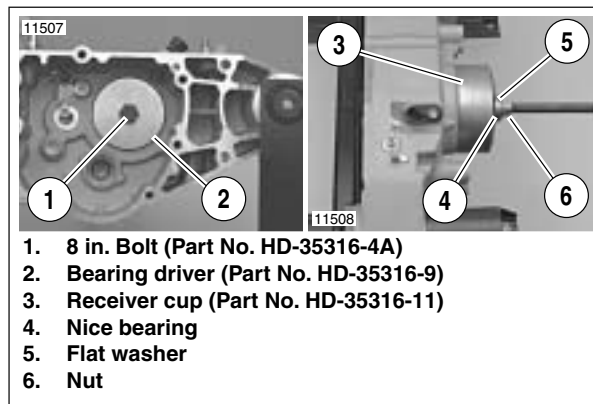
*Use correct retaining ring pliers and correct tips. Verify that tips are not excessively worn or damaged.*

1. See [Figure 6-66](#). At outside of case remove and discard oil seal (10). Remove and discard main drive gear bearing retaining ring (9).
2. See [Figure 6-68](#). From inside crankcase, position BEARING DRIVER (Part No. HD-035316-9) (2) over main drive gear bearing.
3. Insert 8 IN. BOLT (Part No. HD-35316-4A) (1) through bearing driver and bearing.
4. See [Figure 6-70](#). At outside of case, slide RECEIVER CUP (Part No. HD-35316-11) (3) onto bolt and over bearing. Install NICE BEARING (4), FLAT WASHER (5) and NUT (6) over end of bolt.

#### NOTE

*Support bearing remover assembly as you remove bearing in the following step. Entire assembly will fall out of crankcase when bearing comes free.*

5. Tighten nut until main drive gear bearing is free.
6. Discard main drive gear bearing.



**Figure 6-70. Removing Main Drive Gear Bearing (Typical)**

## DISASSEMBLY

1. See [Figure 6-67](#). Remove and discard retaining ring (5).
2. Drive out needle bearings (2) from inside bore of main drive gear (1) using appropriate bearing and bushing puller. Discard bearings. Do not reuse bearings after removal.
3. Remove o-ring (4) from outside of main drive gear and discard. Do not reuse o-ring after removal.

#### NOTE

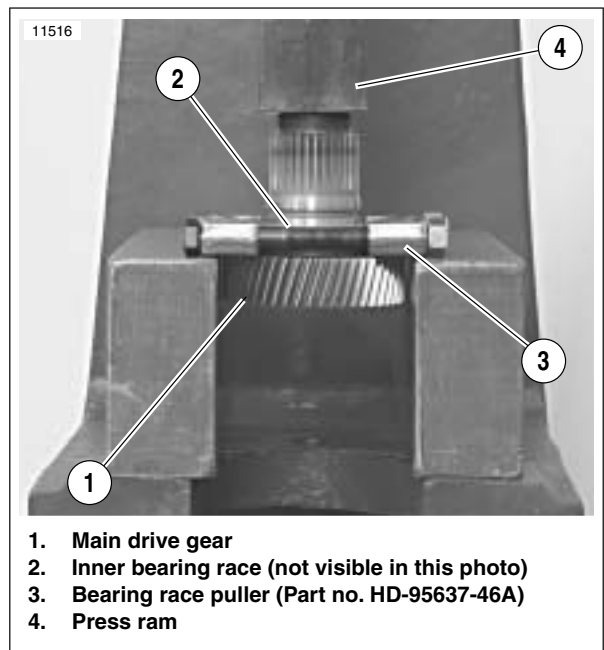
*When the main drive gear is removed, a portion of the bearing inner race remains attached to the main drive gear. This inner race must be removed before the main drive gear can be re-installed.*

4. See [Figure 6-71](#). Attach BEARING RACE PULLER (Part No. 95637-46A) (3) to inner race (2) on main drive gear (1).
5. Place main drive gear with bearing race puller assembly onto press bed as shown in the photo.

#### NOTE

*Provide a soft surface to catch the main drive gear when it falls free in the next step.*

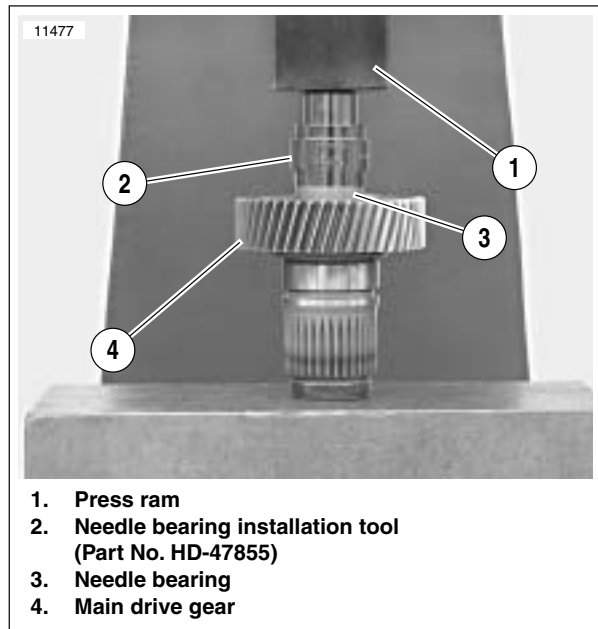
6. Press main drive gear out of inner bearing race. Discard inner bearing race.



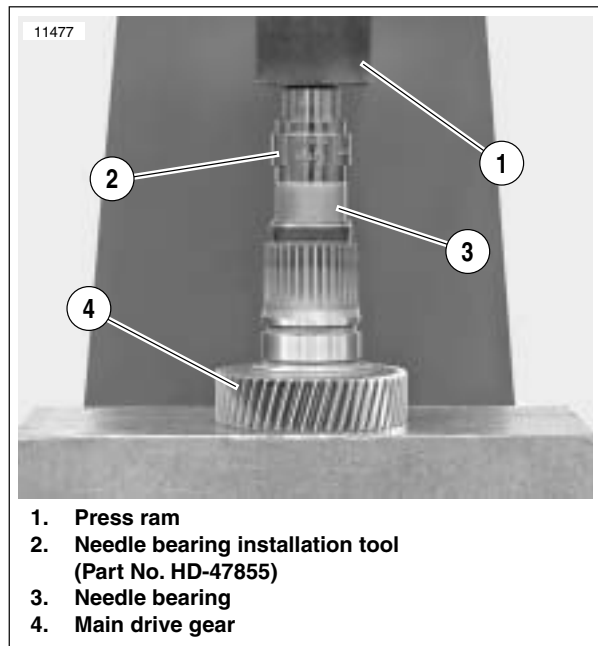
**Figure 6-71. Removing Inner Bearing Race From Main Drive Gear**

## ASSEMBLY

1. Use INNER/OUTER MAIN DRIVE GEAR NEEDLE BEARING INSTALLATION TOOL (Part No. HD-47855) for assembly. Assemble parts. The installation tool will automatically bottom on the gear when the correct depth is reached.
2. See [Figure 6-72](#). Place main drive gear (4) on press bed with gear end facing up.
3. Place needle bearing (3) squarely into end of drive gear. Insert installation tool (2) with end stamped "INNER" facing needle bearing.
4. Press in the inner bearing until the installation tool bottoms on the main drive gear. The surface of the needle bearing will be at a depth of 0.418in. (10.6 mm) from the face of the shifter dogs on the main drive gear.
5. Install **new** retaining ring.
6. See [Figure 6-73](#). Place main drive gear (4) on press bed with gear end facing down.
7. Place needle bearing (3) squarely into end of drive gear. Insert installation tool (2) with end stamped "OUTER" facing needle bearing.
8. Press in the outer bearing until the installation tool bottoms on the main drive gear. The surface of the needle bearing will be at a depth of 0.285 in. (7.2 mm) from the end of the main drive gear.



**Figure 6-72. Pressing Inner Needle Bearing Assembly into Main Drive Gear**



**Figure 6-73. Pressing Outer Needle Bearing Assembly into Main Drive Gear**

## INSTALLATION

### Main Drive Gear Ball Bearing

1. See [Figure 6-74](#). Place CROSS PLATE (Part No. B-45847) (1) on right crankcase as shown. Position cross plate so that roll pins (2) fit into crankcase mating screw holes and bolt hole (3) in cross plate is centered over crankcase bearing bore (4).
2. See [Figure 6-75](#). Insert 8 IN. BOLT (Part No. HD-35316-4A) (2) through cross plate (1) and main drive gear bearing bore.
3. At outside of case, place main drive gear ball bearing (3), BEARING DRIVER (Part No. HD-35316-8) (4), NICE BEARING (5), FLAT WASHER (6) and NUT (7) over end of bolt.

#### CAUTION

**Do not continue to tighten nut after ball bearing bottoms against lip in crankcase bearing bore. Tightening nut too much can break lip in bearing bore casting.**

4. Tighten nut until main drive gear ball bearing bottoms against lip cast into crankcase bearing bore.
5. Remove main drive gear bearing installer tool.

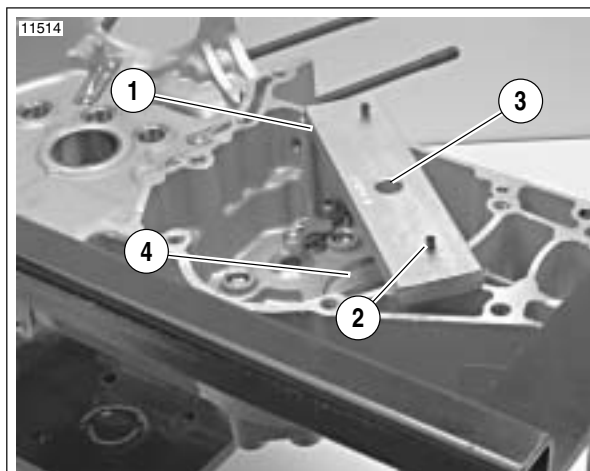
#### WARNING

**Wear safety glasses or goggles when removing or installing retaining rings. Retaining rings can slip from the pliers and could be propelled with enough force to cause serious eye injury. (00312a)**

#### NOTE

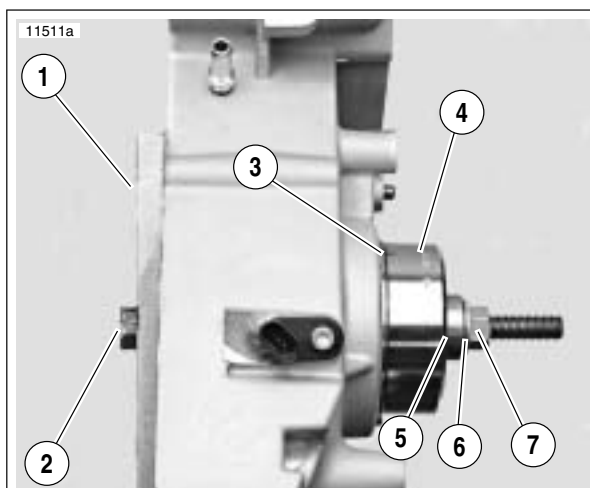
*Use correct retaining ring pliers and correct tips. Verify that tips are not excessively worn or damaged.*

6. See [Figure 6-66](#). At outside of case install **new** beveled retaining ring (9) in groove inside bearing bore with beveled side facing outside of case.
7. Lubricate main drive gear ball bearing with GENUINE HARLEY-DAVIDSON FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT.



1. Cross plate (Part No. B-45847)
2. Roll pin (2)
3. Bolt hole
4. Crankcase bearing bore

Figure 6-74. Positioning Cross Plate (Typical)



1. Cross plate (Part No. B-45847)
2. 8 in. bolt (Part No. HD-35316-4A)
3. Main drive gear bearing
4. Bearing driver (Part No. HD-35316-8)
5. Nice bearing
6. Flat washer
7. Nut

Figure 6-75. Installing Main Drive Gear Bearing

## Main Drive Gear

1. See [Figure 6-76](#). Lubricate both main drive gear needle bearing assemblies and the mating surface of the main-shaft with HARLEY-DAVIDSON SPECIAL PURPOSE GREASE (Part No. 99857-97).
2. See [Figure 6-84](#). Install **new** o-ring (4) into groove in main drive gear (2). Lubricate o-ring with GENUINE HARLEY-DAVIDSON FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT.

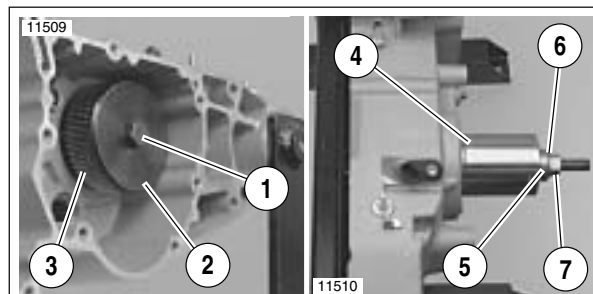
### NOTE

See [Figure 6-84](#). Make sure to install **new** o-ring (6) onto main drive gear before installing main drive gear into crank-case.

3. See [Figure 6-77](#). Insert 8 IN. BOLT (Part No. HD-35316-4A) (1) through WASHER (Part No. HD-35316-7) (2) and main drive gear (3). From inside of case insert bolt with washer and main drive gear through inner race of main drive gear bearing.
4. At outside of case, place INSTALLER CUP (Part No. HD-35316-12) (4), NICE BEARING (5), FLAT WASHER (6) and NUT (7) over end of bolt. Tighten nut until main drive gear bottoms against main drive gear bearing.
5. Remove MAIN DRIVE GEAR REMOVER AND INSTALLER set.
6. See [Figure 6-84](#). Tap in **new** oil seal (6) at threaded end of main drive gear to a depth of 0.060-0.030 in. (1.524-0.762 mm).



Figure 6-76. Lubricating Main Drive Gear Needle Bearings



1. 8 in. bolt (Part No. HD-35316-4A)
2. Washer (Part No. HD-35316-7)
3. Main drive gear
4. Installer cup (Part No. HD-35316-12)
5. Nice bearing
6. Flat washer
7. Nut

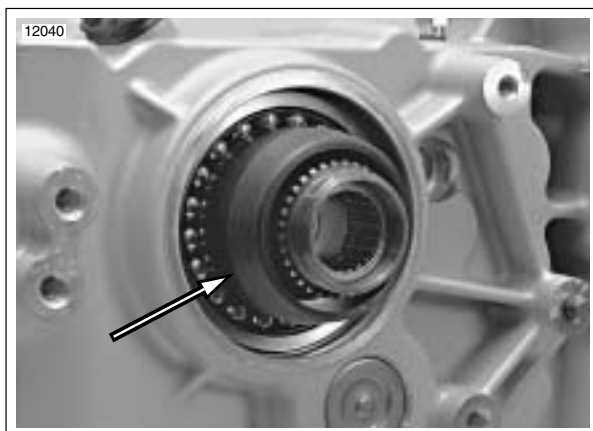
Figure 6-77. Installing Main Drive Gear (Typical)

## Main Drive Gear Seal

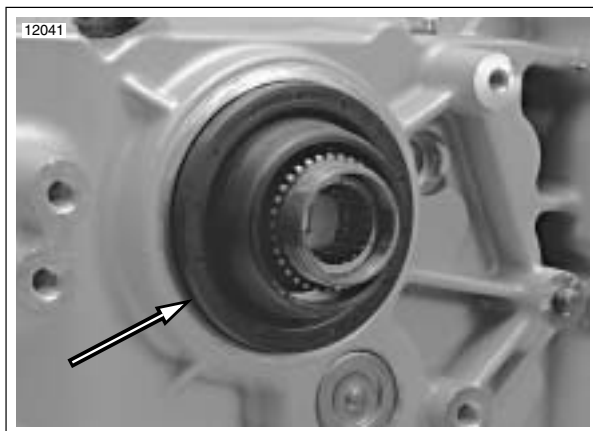
1. See [Figure 6-78](#). From outside of crankcase, install PILOT (Part No. HD-47856-2) over end of main drive gear bearing inner race.
2. Coat lips of **new** main drive gear seal with GENUINE HARLEY-DAVIDSON FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT.

### NOTE

Adapter (Part No. HD-47856-4) and main drive gear have left-hand threads.

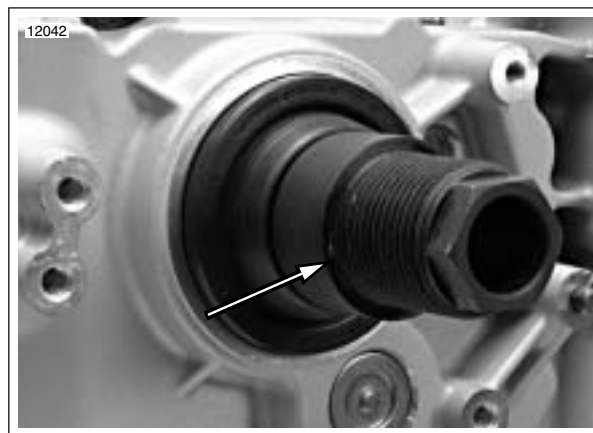


**Figure 6-78. Install Pilot (Part No. HD-47856-2) (Typical)**



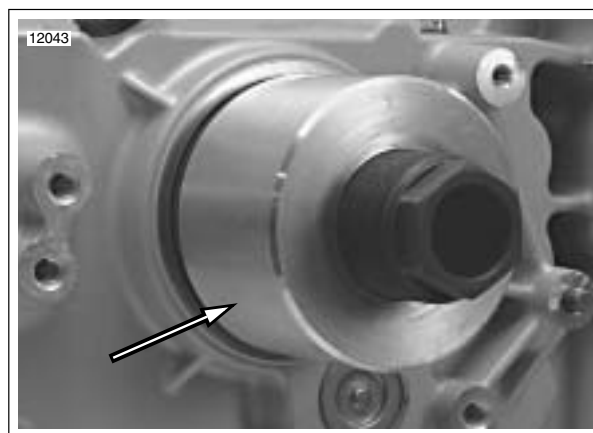
**Figure 6-79. Install Main Drive Gear Seal (Typical)**

3. See [Figure 6-79](#). Place seal over pilot and position seal squarely in end of crankcase bore.



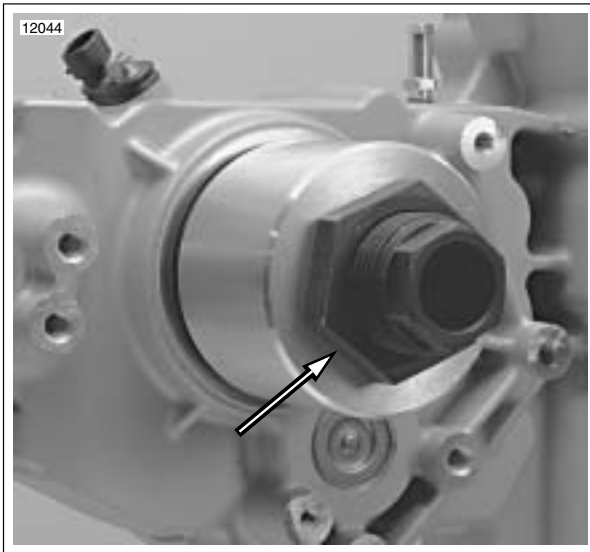
**Figure 6-80. Install Adapter (Part No. HD-47856-4) (Typical)**

4. See [Figure 6-80](#). Thread ADAPTER (Part No. HD-47856-4) onto end of main drive gear several turns. Do NOT tighten. Doing so could make it difficult to remove adapter after seal has been installed.



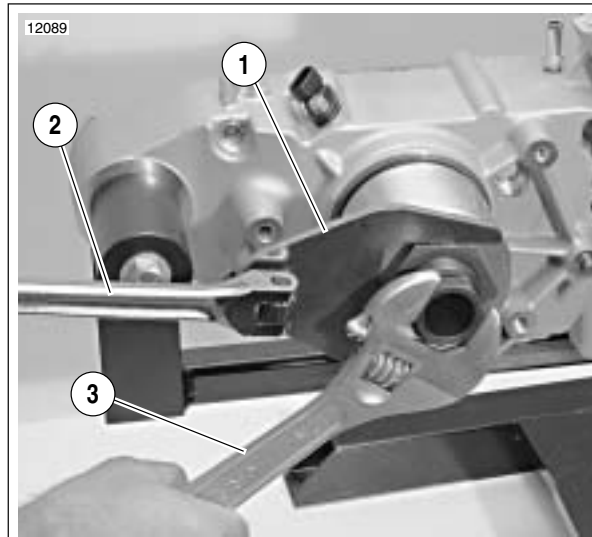
**Figure 6-81. Place Installer (Part No. HD-47856-1) over Adapter (Typical)**

5. See [Figure 6-81](#). Slide INSTALLER (Part No. HD-47856-1) over adapter until cupped end of installer is flat against seal.



**Figure 6-82. Install Nut (Part No. HD-47856-5) (Typical)**

6. See [Figure 6-82](#). Thread nut (Part No. HD-47856-5) onto end of adapter, until it tightens against installer.



1. Crowfoot wrench
2. 1/2 inch breaker bar
3. Adjustable wrench

**Figure 6-83. Press Seal Into Crankcase**

7. See [Figure 6-83](#). Place crowfoot wrench (Part No. HD-47856-7) (1) with 1/2 inch drive breaker bar (2) on large nut. Place an adjustable wrench (3) on flats of hex head cast into end of adapter.
8. Holding smaller wrench, tighten nut with larger wrench until outer face of seal is flush with outer edge of crankcase 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.*

9. Remove nut, installer, adapter and pilot.



## GENERAL

PART NO.	SPECIALTY TOOL
HD-95760-69A	Bushing and bearing puller
HD-95765-69A	1/2 in. collet

## REMOVAL

1. Split crankcases. See [6.8 CASE DISASSEMBLY FOR TRANSMISSION REMOVAL](#).

## Countershaft Needle Bearing

1. See [Figure 6-84](#). From inside transmission case use a suitable BEARING DRIVER/PULLER to remove countershaft bearing (11) from crankcase bore.

## Shifter Drum Bushing

1. The shifter drum bushing (12) 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 BUSHING AND BEARING PULLER (Part No. HD-95760-69A) with 1/2 IN.

COLLET (Part No. HD-95765-69A) to remove bushing from crankcase bore.

## INSTALLATION

## Countershaft Needle Bearing

1. Find a suitable bearing driver 1-1/4 in. (31.75 mm) in diameter.
2. See [Figure 6-84](#). From the outside of the case place the closed end needle bearing (11) 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 flush or 0.030 in. (0.762 mm) below the outside surface of the case.
3. Lubricate bearing with GENUINE HARLEY-DAVIDSON FORMULA+ TRANSMISSION AND PRIMARY CHAIN-CASE LUBRICANT.

## Shifter Drum Bushing

1. See [Figure 6-84](#). Using SNAP-ON BUSHING DRIVER SET (Part No. A-157C) with a 1/2 inch adapter (Part No. A157-8), install **new** bushing (12).
2. Lubricate bushing with GENUINE HARLEY-DAVIDSON FORMULA+ TRANSMISSION AND PRIMARY CHAIN-CASE LUBRICANT.

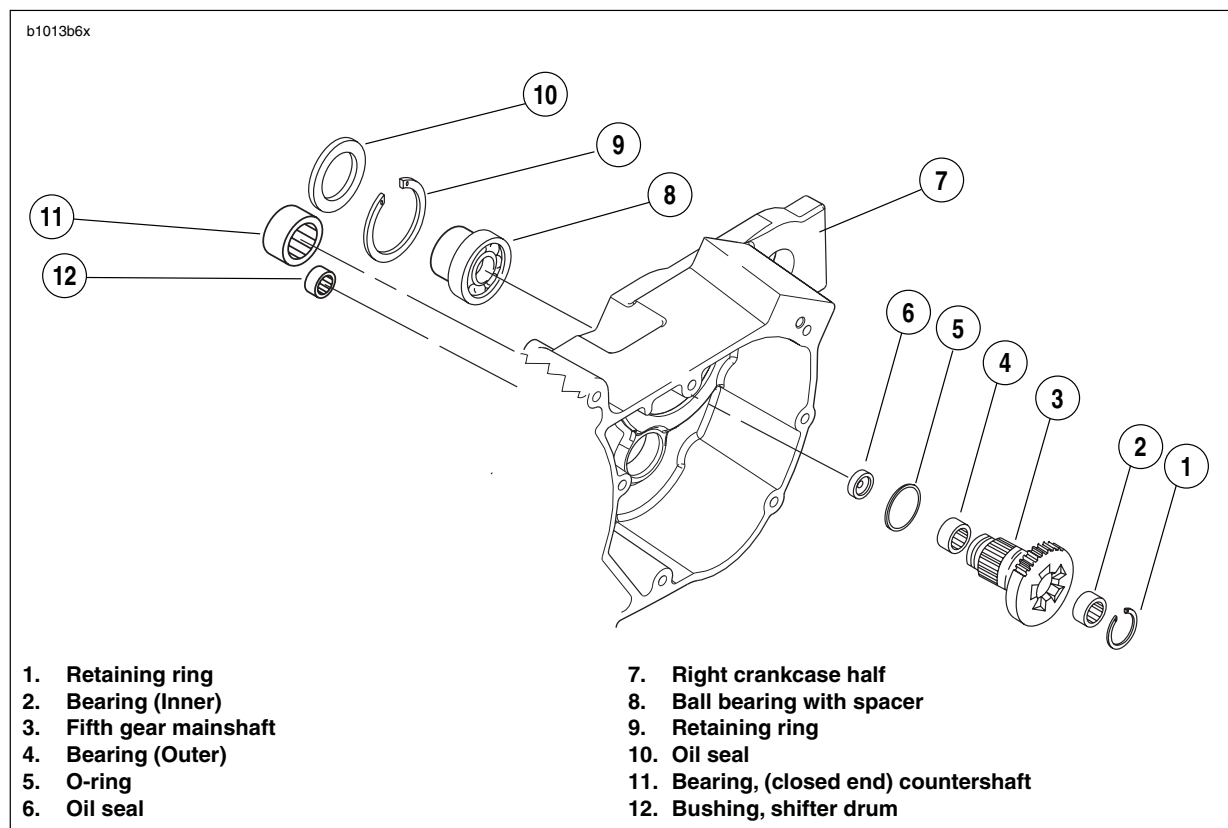


Figure 6-84. Transmission Assembly-Right Crankcase Half

## REMOVAL

### Mainshaft and Countershaft Bearings

1. Split crankcases in half. See [6.8 CASE DISASSEMBLY FOR TRANSMISSION REMOVAL](#).
2. Remove shifter forks and drum. See [6.9 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 6-85](#). 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.

### 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 6-86](#). 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.

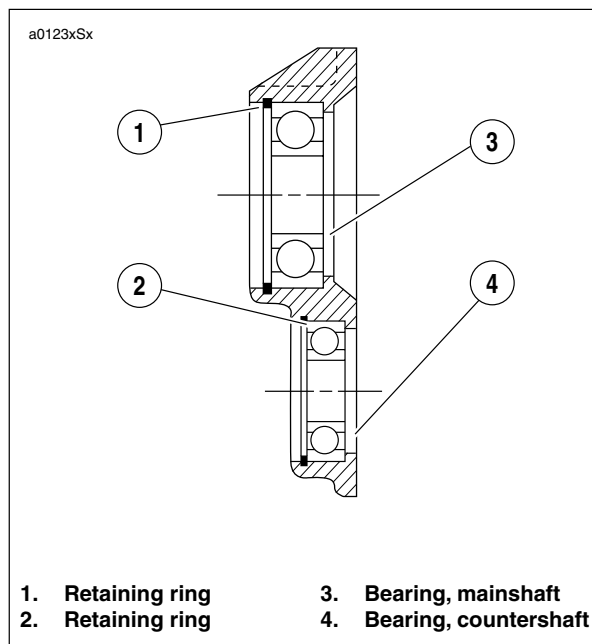


Figure 6-85. Ball Bearing Assembly

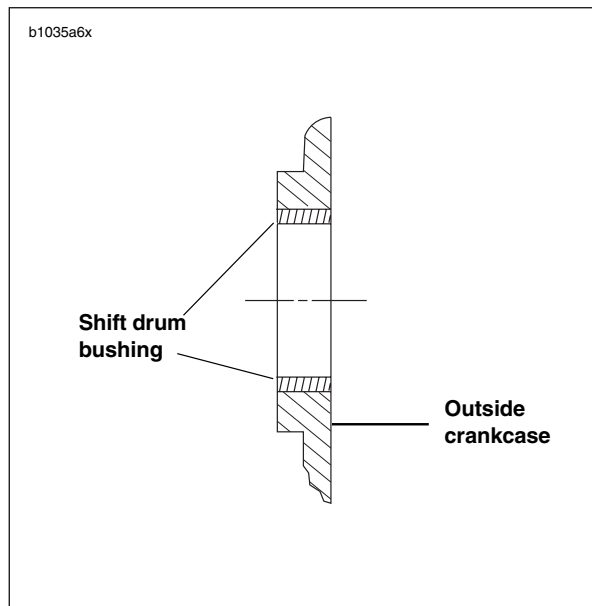


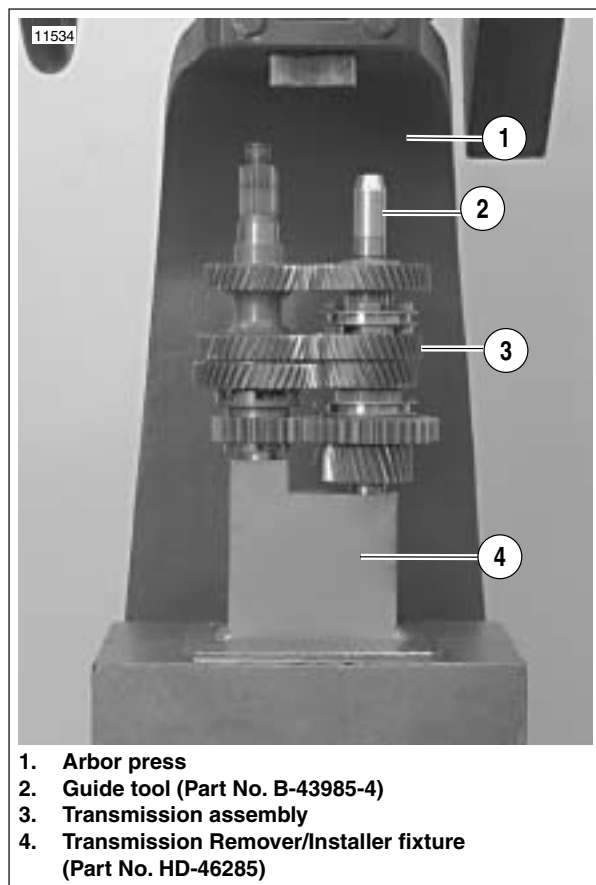
Figure 6-86. Shift Drum Bushing Assembly

## INSTALLATION

### NOTES

After re-installing the transmission assembly, verify that all parts have been properly installed. See:

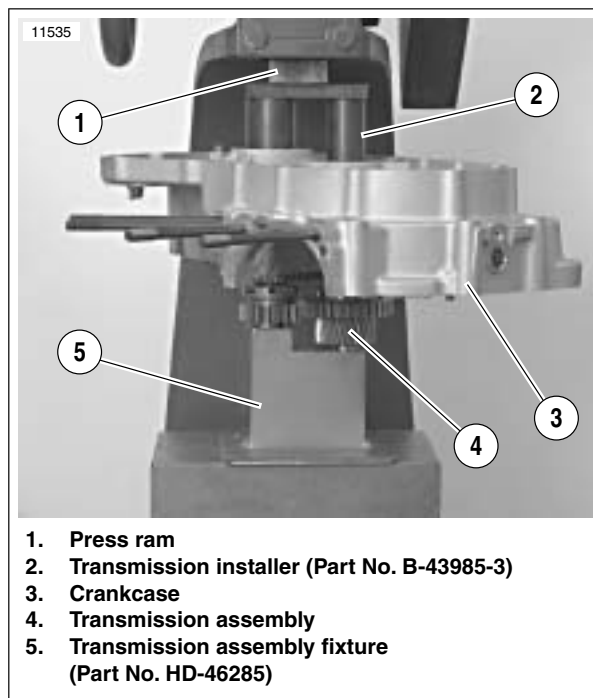
- 6.11 MAIN DRIVE GEAR AND BEARING
- 6.10 TRANSMISSION ASSEMBLY
- 6.13 TRANSMISSION LEFT CASE BEARINGS
- 6.12 TRANSMISSION RIGHT CASE BEARINGS
- Make sure crankcase does not begin to tilt when pressed onto transmission assembly. It may be necessary to place press ram on transmission installer closer to mainshaft to keep the crankcase level.
- When removing crankcase and transmission assembly from fixture, make sure mainshaft 1st gear does not fall off shaft. Gear could be damaged if it strikes a hard surface.



1. Arbor press
2. Guide tool (Part No. B-43985-4)
3. Transmission assembly
4. Transmission Remover/Installer fixture (Part No. HD-46285)

Figure 6-87. Transmission Assembly in Fixture (Typical)

1. See Figure 6-87. 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).



1. Press ram
2. Transmission installer (Part No. B-43985-3)
3. Crankcase
4. Transmission assembly
5. Transmission assembly fixture (Part No. HD-46285)

Figure 6-88. Pressing Transmission Into Left Crankcase (Typical)

3. See Figure 6-88. Place left case half over transmission assembly and install TRANSMISSION INSTALLER (Part No. B-43985-3) into crankcase.
4. 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.

## SHIFTER FORKS AND DRUM ASSEMBLY

### NOTES

- See [Figure 6-89](#). Shifter design allows for one common part number for both countershaft 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 GENUINE HARLEY-DAVIDSON FORMULA+ TRANSMISSION AND PRIMARY CHAINCASE LUBRICANT before assembly.

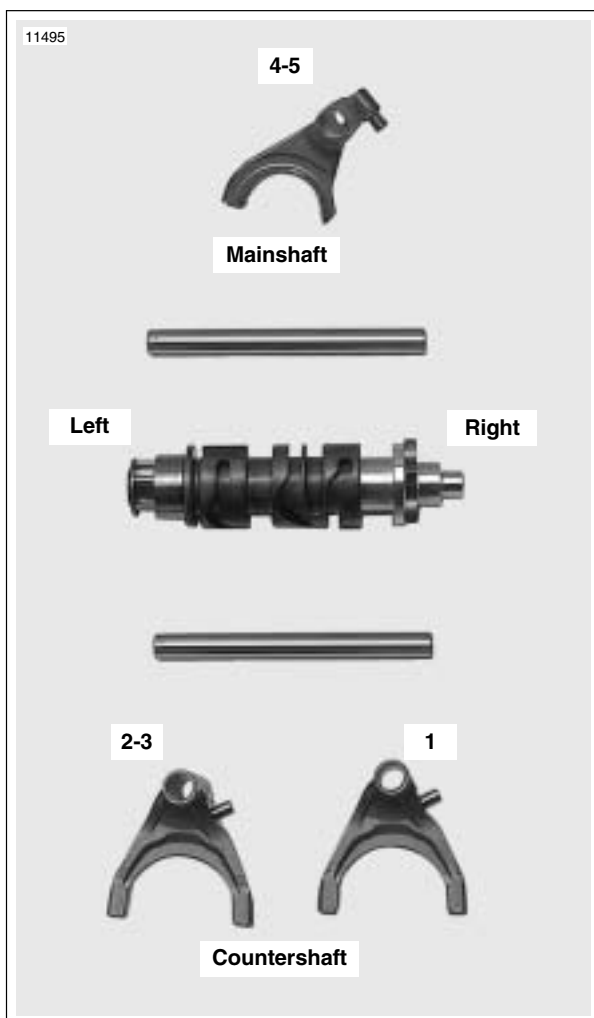


Figure 6-89. Shifter Forks, Drum and Shafts

1. Place 2nd/3rd gear shifter fork onto dog ring between countershaft 2nd and 3rd gears.
2. Install shifter drum into left case half with previously scribed line at 12 o'clock position. This will place shifter drum in neutral position.

### NOTE

See [Figure 6-90](#). Install shifter fork shafts in the left case half by lightly tapping on the end of the shaft with a brass or hard plastic hammer until shaft is seated in bore.

3. Place 1st gear shifter fork onto dog ring between countershaft 1st and 4th gear gears. Install shifter fork shaft through two installed shifter forks and into left crankcase half.
4. Install 4th/5th gear shifter fork onto sliding gear with dogs located on mainshaft. Install remaining shifter fork shaft through last installed shifter fork and into left crankcase half.

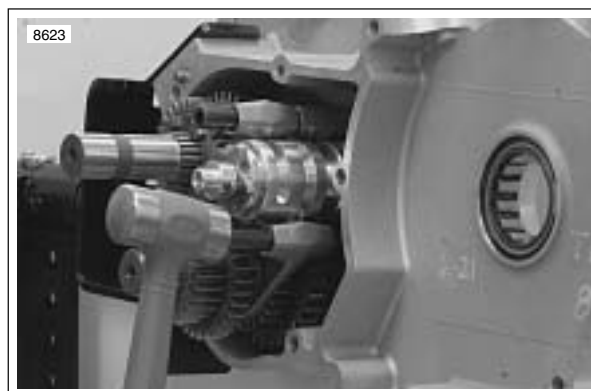


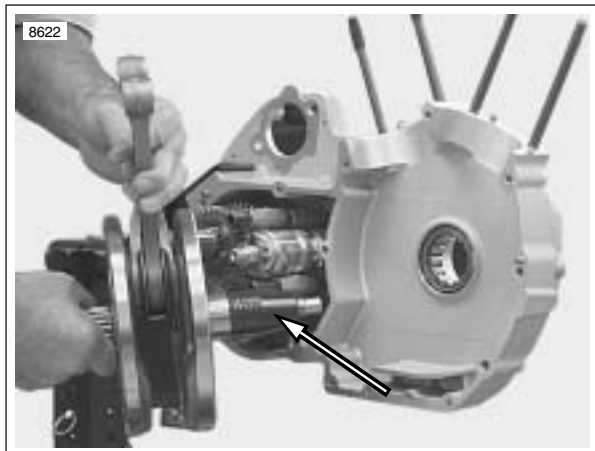
Figure 6-90. Installing Shift Fork Shafts

### NOTE

See [Figure 6-90](#). Install shifter fork shafts in the left case half by lightly tapping on the end with a brass hammer until seated in bore.

## INSTALLING RIGHT CRANKCASE

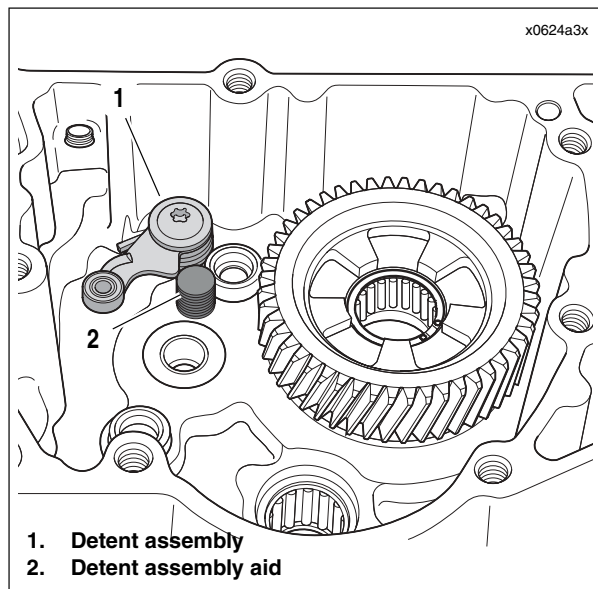
1. See [Figure 6-91](#). Install the flywheel assembly into the left crankcase half using CRANKSHAFT GUIDE TOOL Part No. HD-42326.



**Figure 6-91. Installing Flywheel Assembly Using Crankshaft Guide Tool (Part No. HD-42326)**

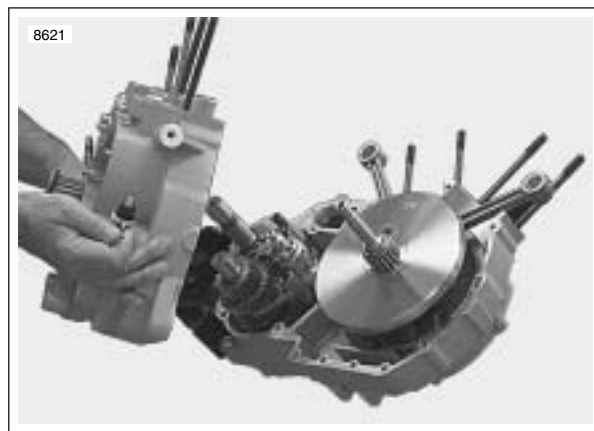
### NOTE

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



**Figure 6-92. Using Gear Detent Assembly Aid (Part No. B-45520)**

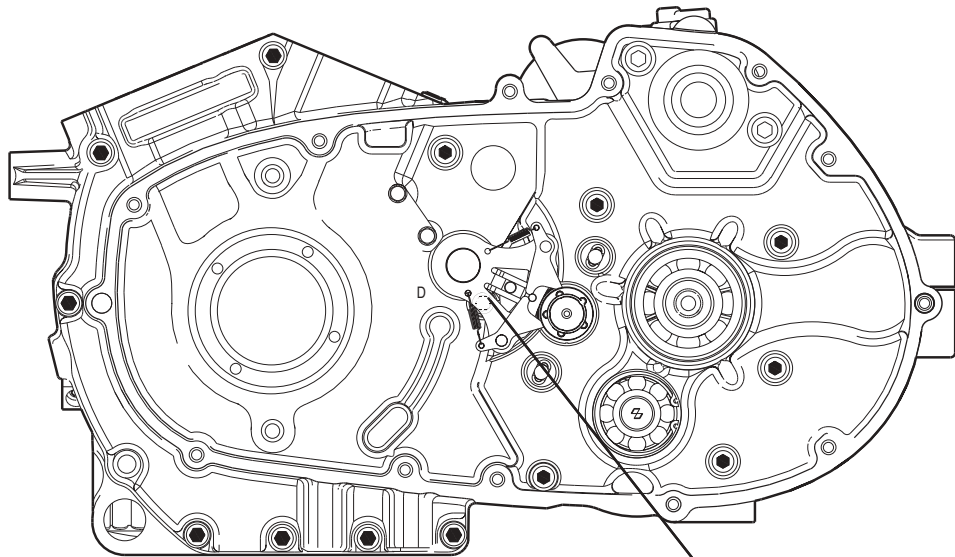
2. See [Figure 6-92](#). Retract detent assembly in right case half and install GEAR DETENT ASSEMBLY AID (Part No. B-45520) until it has bottomed in right case half.
3. Place Transmission in the 1st gear position.
4. Lubricate main drive gear needle bearing assemblies, the mating surface of the mainshaft and countershaft with HARLEY-DAVIDSON SPECIAL PURPOSE GREASE (Part No. 99857-97).



**Figure 6-93. Crankcase Halves**

5. See [Figure 6-93](#). Assemble crankcase halves together.
  - a. Apply a thin coat of GRAY HIGH-PERFORMANCE SEALANT (Part No. 99650-02) to crankcase joint faces.
  - b. See [Figure 6-94](#). Apply several drops of LOCTITE 271 (red) to last few threads and tighten 5/16-in. fasteners to 15-19 ft-lbs (20.3-25 Nm).
  - c. Remove GEAR DETENT ASSEMBLY AID and install neutral indicator switch and washer. Apply LOCTITE 242 and tighten to 60-84 **in-lbs** (6.7-9.5 Nm).

b1016x3x



One Behind Shifter Mechanism



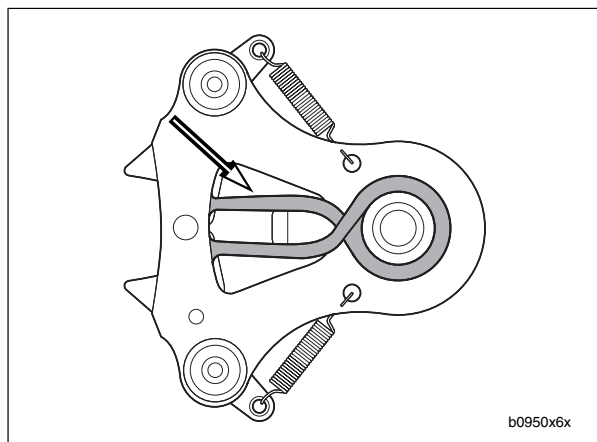
—Indicates Bolt Pattern Location

**Figure 6-94. Crankcase Fasteners**



## INSTALLATION

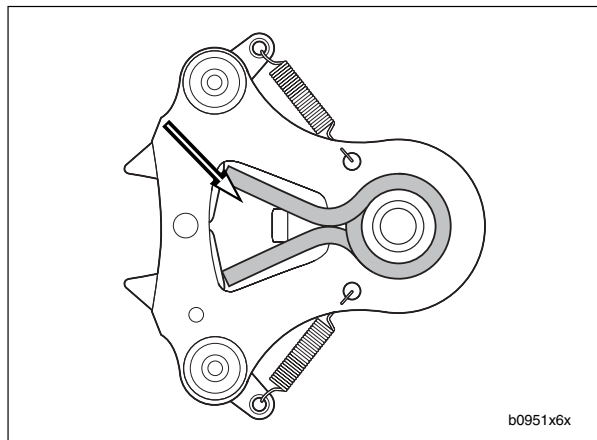
1. See [Figure 6-95](#). Correctly install shifter return spring onto the reverse side of the shifter shaft assembly before placing shaft in left crankcase half.



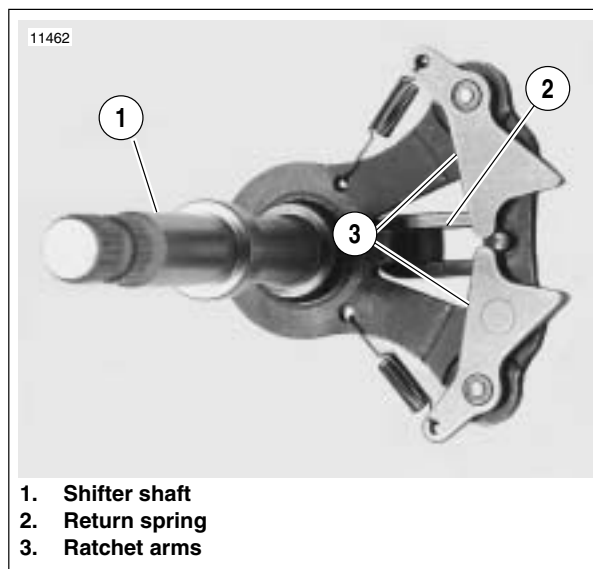
**Figure 6-95. Shifter Shaft Return Spring  
(Correctly Installed)**

### NOTE

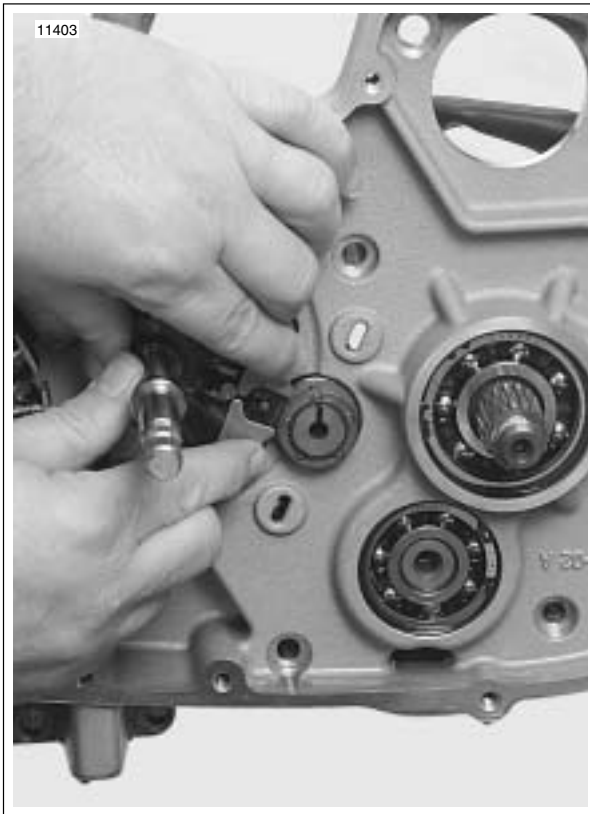
See [Figure 6-96](#). The shifter shaft return spring can be installed incorrectly and then assembled in the left crankcase half. Failure to install the spring properly will result in improper shifting.



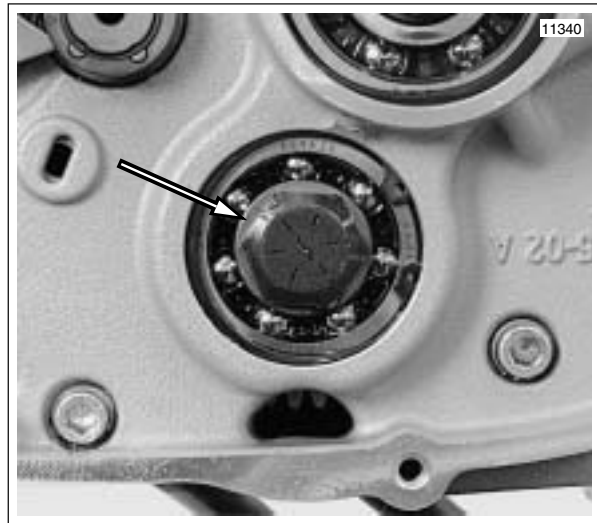
**Figure 6-96. Shifter Shaft Return Spring  
(Incorrectly Installed)**



**Figure 6-97. Shifter Shaft Assembly**



**Figure 6-98. Installing Shifter Shaft Assembly**



**Figure 6-99. Hex Fastener Countershaft Retainer**

2. See [Figure 6-98](#). 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.
3. See [Figure 6-99](#). Apply several drops of LOCTITE 271 (red) to last few threads of countershaft retaining screw. Thread screw into end of shaft.
4. Place transmission in gear and tighten screw to 33-37 ft-lbs (44.8-50 Nm).
5. Install transmission sprocket. See [6.16 TRANSMISSION SPROCKET](#).
6. Continue assembling engine. See appropriate sections of [3.19 CRANKCASE/ ASSEMBLY](#) and [3.6 CYLINDER HEAD/3.7 CYLINDER AND PISTON/ ASSEMBLY/ INSTALLATION](#).
7. Install primary chain and engine sprocket, clutch assembly and primary cover. See [6.5 PRIMARY CHAIN](#).
8. Install engine in chassis. See [3.5 ENGINE INSTALLATION](#).

## REMOVAL

## NOTE

Use spacer and fastener from B-45659 to install sprocket locking tool.

PART NO.	SPECIALTY TOOL
B-43982	Transmission sprocket locking tool
HD-94660-37B or HD-46288	Mainshaft locknut wrench

1. Loosen rear axle pinch fastener. See [IDLER PULLEY REMOVAL/6.6 DRIVE BELT SYSTEM](#).
2. Unthread axle approximately 15 threads to release tension from drive belt.
3. Remove front sprocket cover. See [2.30 SPROCKET COVER](#).

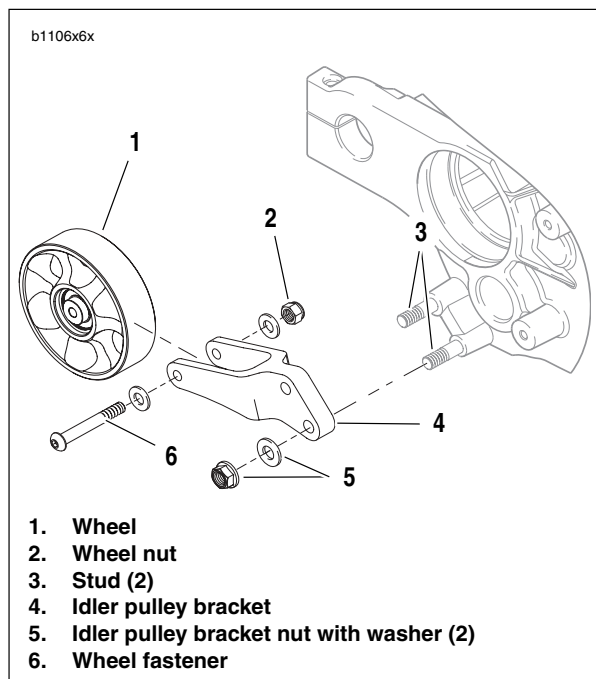


Figure 6-100. Idler Pulley Assembly

4. See [Figure 6-100](#). 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. See [INSPECTION/1.10 DRIVE BELT](#).
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.

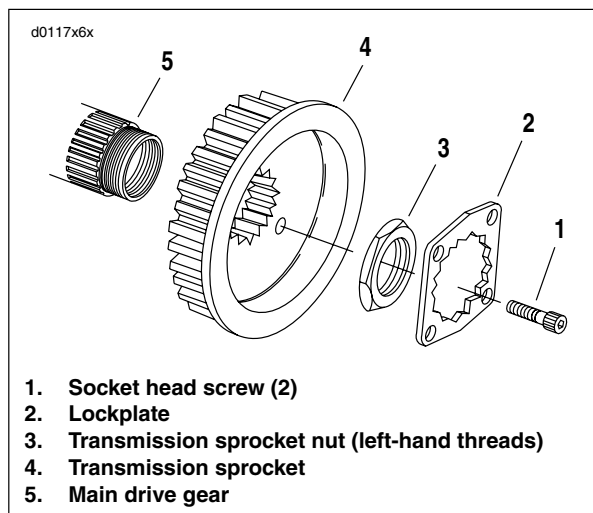


Figure 6-101. Transmission Sprocket

8. See [Figure 6-101](#). Place transmission in first gear. Remove two socket head screws (1) and lockplate (2).

## NOTES

- Transmission sprocket nut has left-hand threads. Turn nut clockwise to loosen and remove from main drive gear shaft.
  - Use the P3/Blast SPROCKET HOLDING TOOL (Part No. B-43982) with the spacer and fastener from the Firebolt SPROCKET LOCKING TOOL (Part No. B-45659) to hold the sprocket.
9. See [Figure 6-102](#). Place transmission in neutral. Install the P3/Blast SPROCKET HOLDING TOOL (Part No. B-43982) to hold the sprocket.
  10. Remove transmission sprocket nut (3) from main drive gear (5) using MAINSHAFT LOCKNUT WRENCH (Part No. HD-94660-37B or HD-46288) and a breaker bar.
  11. Remove secondary drive belt from transmission sprocket. Remove transmission sprocket (4) from main drive gear (5).

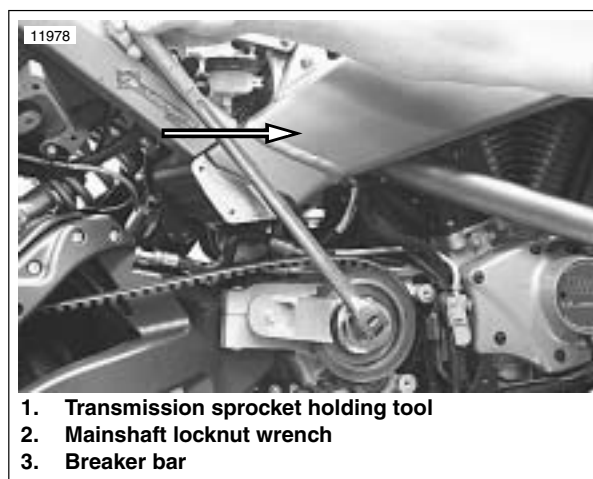


Figure 6-102. Removing Transmission Sprocket Locknut

## INSTALLATION

1. See [Figure 6-101](#). 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 271 (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

Use the P3/Blast SPROCKET HOLDING TOOL (Part No. B-43982) with the spacer and fastener from the 2003 Firebolt SPROCKET LOCKING TOOL (B-45659) to hold the sprocket.

5. See [Figure 6-103](#). Install SPROCKET HOLDING TOOL (Part No. B-43982) as shown.
6. Using MAINSHAFT LOCKNUT WRENCH (Part No. HD-94660-37B or H-D-46288) and a torque wrench, apply LOCTITE 271 (red) and tighten sprocket nut to 50 ft-lbs (67.8 Nm) INITIAL TORQUE ONLY.
7. See [Figure 6-104](#). 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°.

### NOTE

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. 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 lockplate and sprocket screw holes, nut may be additionally tightened to 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. NEVER LOOSEN nut to align the screw holes.

9. See [Figure 6-101](#). Install lockplate over nut so that two of lockplate's four drilled holes (diagonally opposite) align with sprocket's two tapped holes.
10. See [Figure 6-101](#). 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

See [Figure 6-101](#). 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.

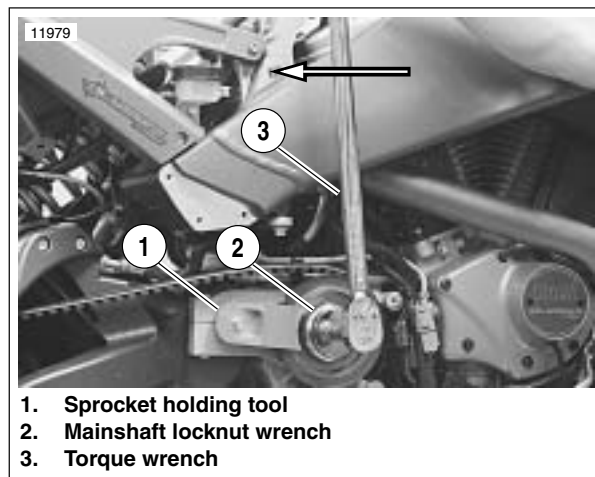


Figure 6-103. Transmission Sprocket Tightening (Typical)

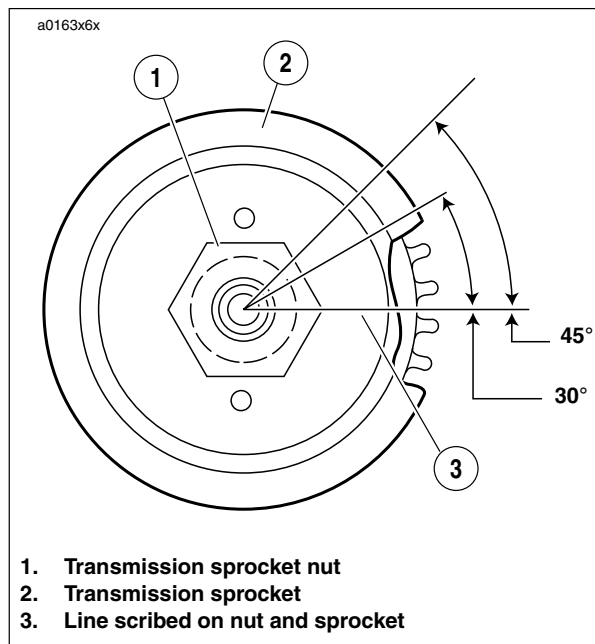
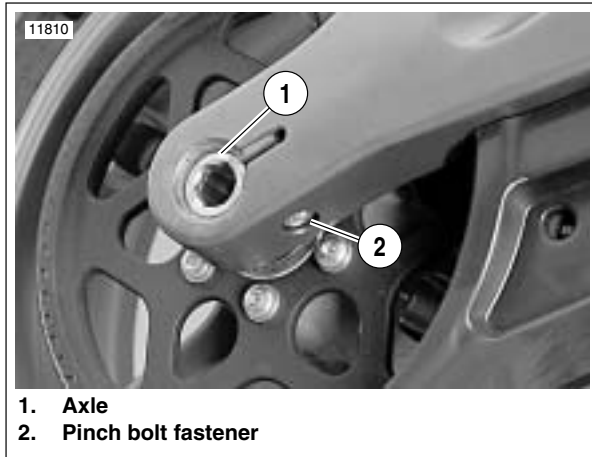


Figure 6-104. Aligning Transmission Sprocket

11. Install idler pulley. See [IDLER PULLEY INSTALLATION](#) under 6.6 DRIVE BELT SYSTEM.

**NOTE**

*Never tighten rear axle with swingarm brace removed.*



**Figure 6-105. Rear Wheel Mounting, Right Side**

12. See [Figure 6-105](#). 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).
13. Tighten pinch fastener (2) on right side of swingarm to 40-45 ft-lbs (54-61 Nm).

# NOTES

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