

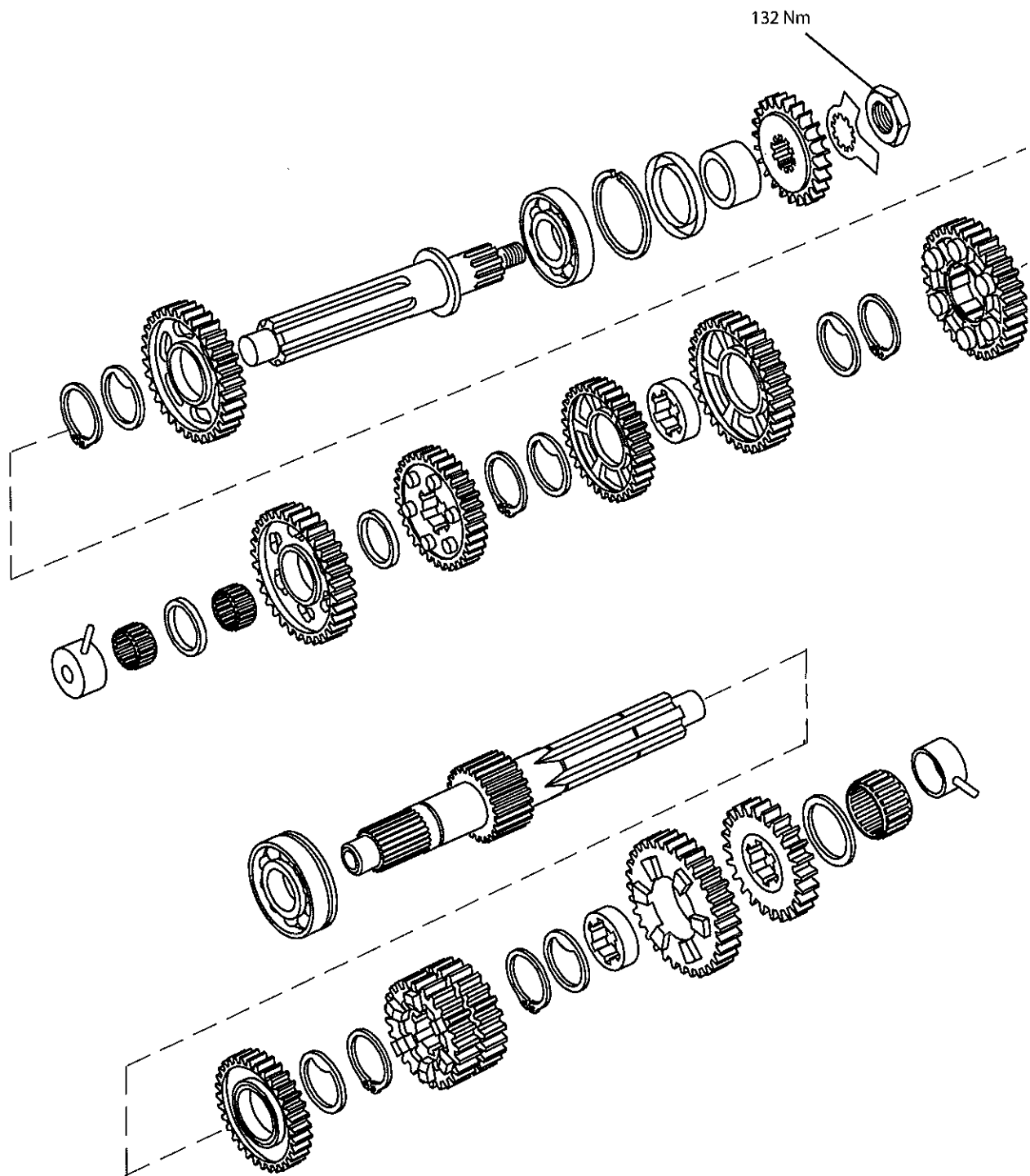
7 Transmission

Table of Contents

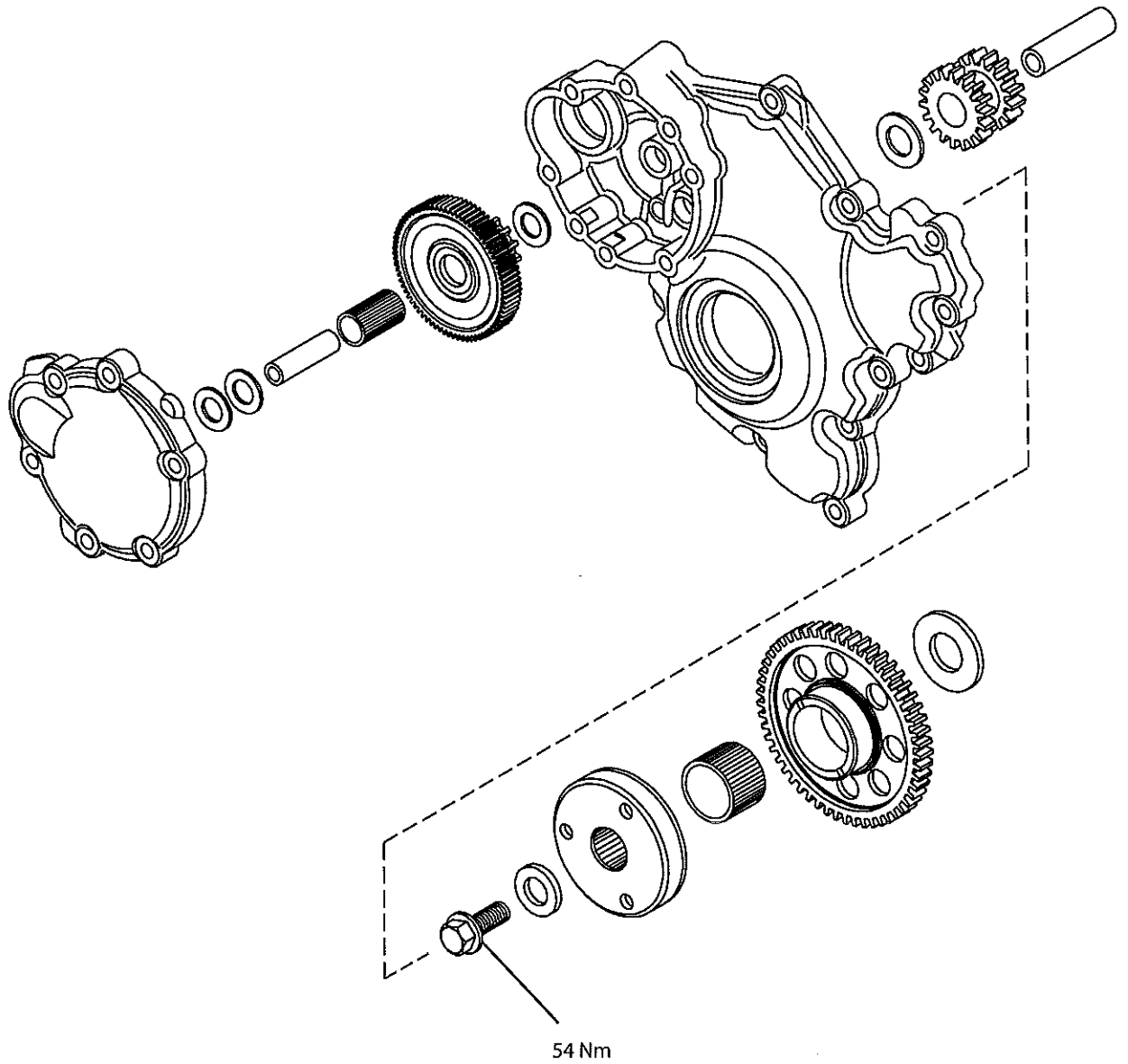
Exploded View, Input and Output Shafts	7.2
Exploded View, Sprag Clutch and Starter Gears	7.3
Exploded View, Gear Selectors and Drum	7.4
Exploded View, Gear Change Mechanism	7.5
Selector Shaft, Selector Forks and Drum	7.6
Removal	7.6
Inspection	7.8
Installation	7.8
Input and Output Shafts Assemblies.	7.11
Removal	7.11
Installation.	7.11
Input Shaft	7.12
Disassembly	7.12
Assembly	7.14
Pressing On the Input Shaft Bearing	7.14
Output Shaft	7.16
Disassembly	7.16
Assembly	7.18
Starter Drive Gears/Sprag Clutch	7.20
Removal	7.20
Inspection	7.21
Installation	7.22

Transmission

Exploded View, Input and Output Shafts

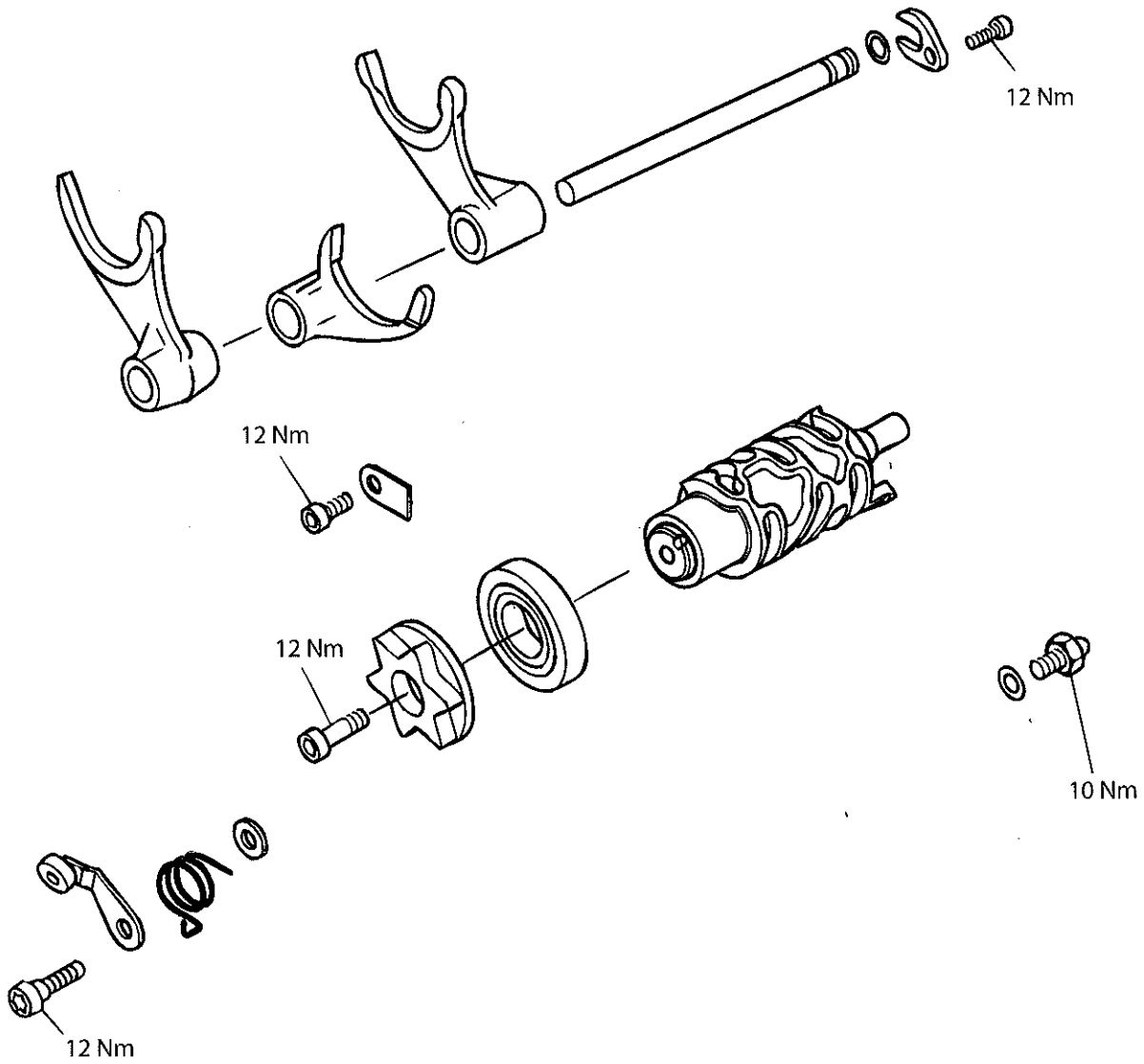


Exploded View, Sprag Clutch and Starter Gears



Transmission

Exploded View, Gear Selectors and Drum

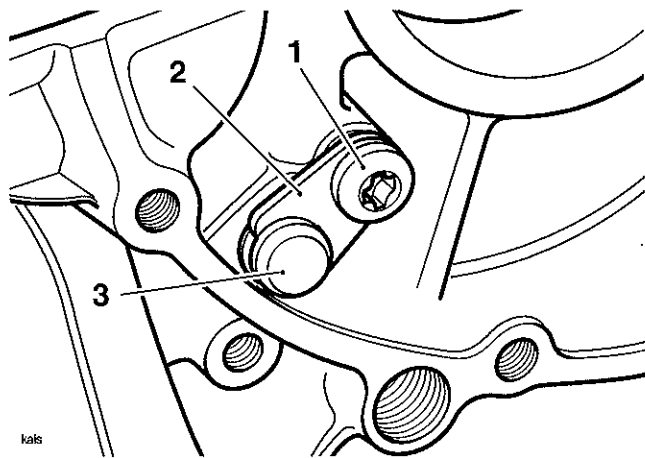


Transmission

Selector Shaft, Selector Forks and Drum

Removal

1. Remove the engine from the frame (see page 9-2).
2. Separate the two halves of the crankcase (see page 5-4).
3. Remove the input and output shafts from the crankcase (see page 7-11).
4. Remove the fixing and take out the 'U' shaped keeper plate from the selector shaft. Discard the fixing.



1. Fixing
2. Keeper plate
3. Selector shaft

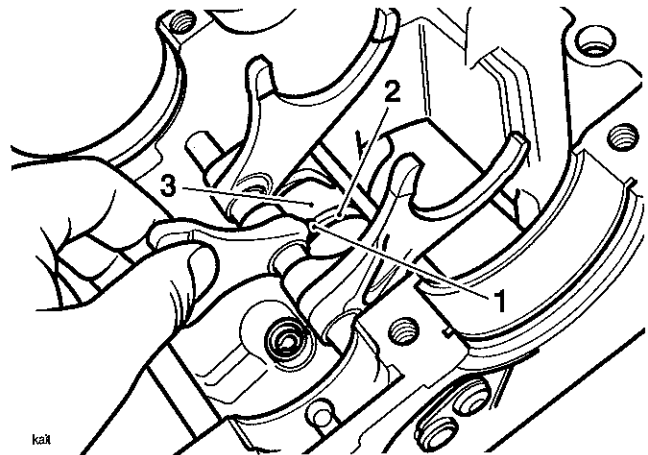


Caution

The selector forks can be fitted incorrectly. Ensure the position and orientation of the selector forks are marked prior to removal. Incorrect fitting of the selector forks will cause gearbox damage.

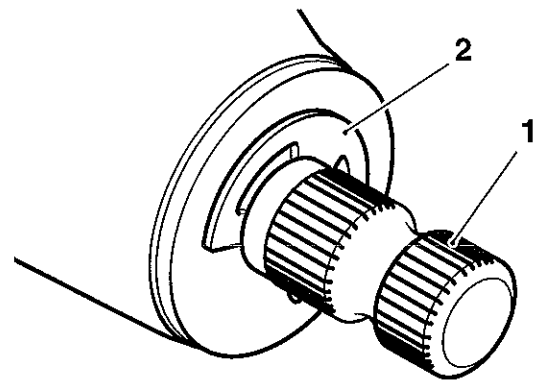
Note:

- The centre selector fork locates in the selector drum as shown below:



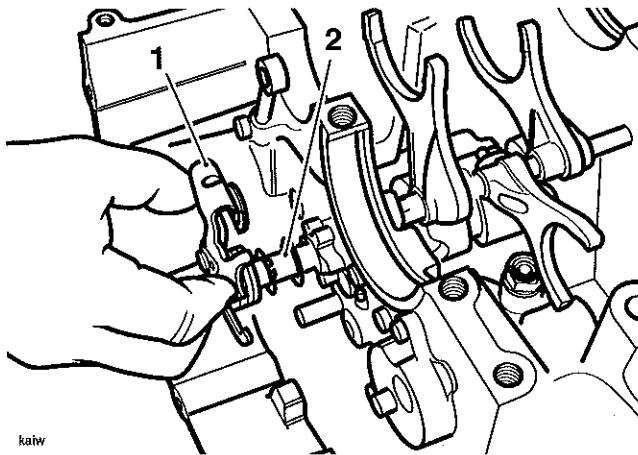
1. Selector fork stop
2. Selector fork guide
3. Selector drum

5. Using a suitable tool, push the selector shaft out from the crankcase in the direction of the keeper plate. Collect each selector fork as they are released by the selector shaft.
6. If not already removed, note the position and orientation of the gear pedal crank in relation to the shaft, then remove the pedal.
7. Remove the e-clip and washer from the gear pedal end of the gear change shaft.



1. Gear change shaft
2. E-clip

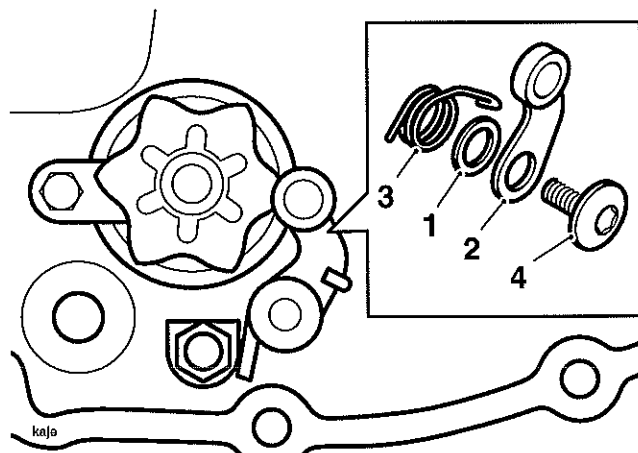
8. Withdraw the gear change shaft from the clutch end of the crankcase and collect the washer from inside the crankcase.



1. Gear change shaft
2. Washer

Note:

- The detent arm is held in position under spring pressure. Prior to removal, note the orientation of the detent arm, fixing, spring and washer. The same orientation must be retained on assembly.

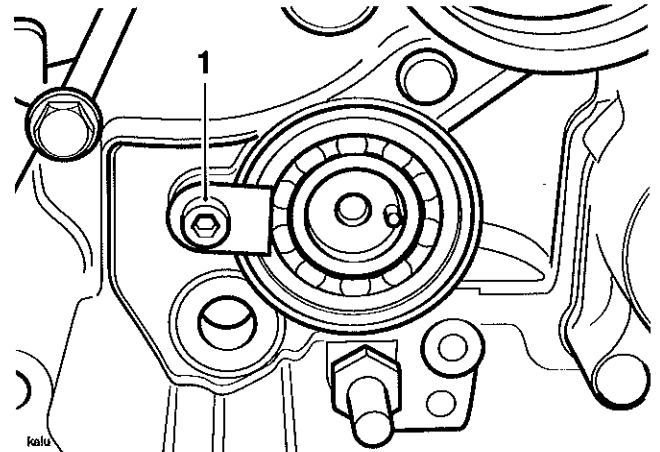


1. Washer
2. Detent arm
3. Spring
4. Fixing

9. Release and remove the fixing securing the detent arm.
10. Withdraw the detent arm complete with its spring and washer. Discard the fixing.
11. Remove the fixing from the centre of the detent wheel (discard the fixing) and withdraw the wheel.

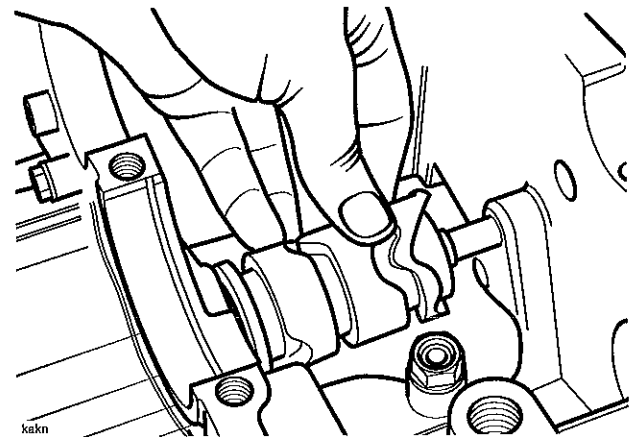
Note:

- To prevent drum rotation, use a stout rod through one of the through-holes in the drum. Care must be taken not to damage the oil pressure relief valve.
12. Release and remove the bolt securing the selector drum bearing to the crankcase. Discard the bolt.



1. Bolt

13. Ease the selector drum backwards and forwards to push the drum bearing out of the crankcase.
14. Withdraw the drum from within the crankcase.



Selector drum removal

Transmission

Inspection

1. Examine all components for damage and/or wear, paying particular attention to the selector forks and selector drum. Replace any parts that are damaged and/or worn.

Gear selector fork thickness

Standard	5.80 - 5.90 mm
Service limit	5.70 mm

Gear selector groove width

Standard	6.00 - 6.10 mm
Service limit	6.25 mm

Selector fork to groove clearance

0.55 mm max.

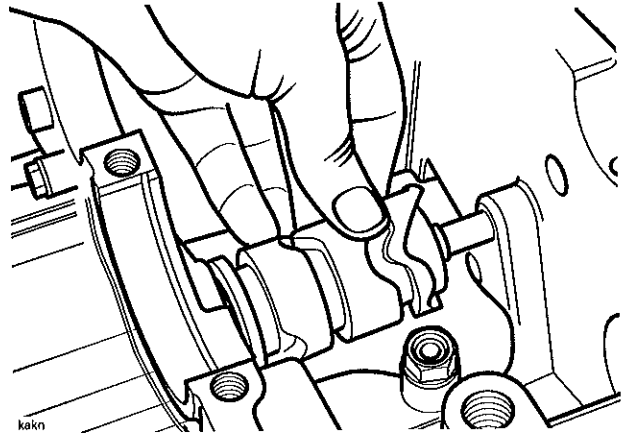
2. Examine the gear change shaft seal for damage and/or wear. Replace the seal if damaged and/or worn.

Installation

Note:

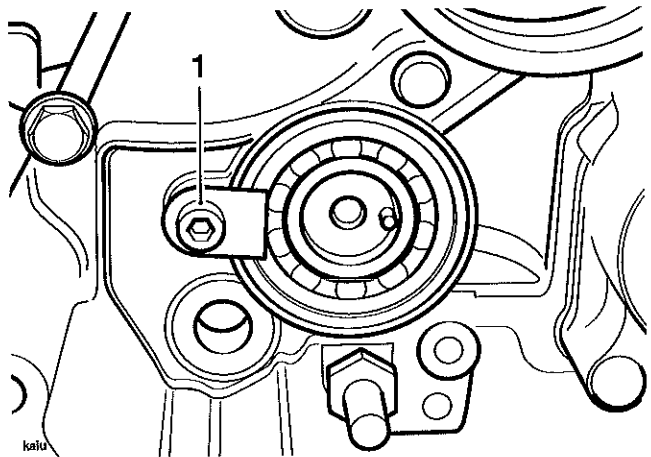
- The detent wheel is keyed to the selector drum

1. Position the selector drum into the crankcase.



Locating the selector drum

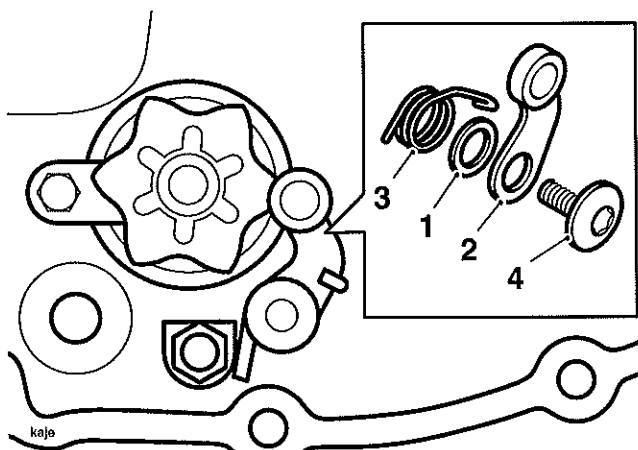
2. Using clean engine oil, lubricate the selector drum bearing.
3. Position the bearing into the crankcase recess and engage with the selector drum.
4. Refit the bearing retainer. Secure with a new bolt and tighten to **12 Nm**.



1. Bearing Retaining Bolt

5. Fit the detent wheel engaging the wheel with the locator pin in the selector drum. Tighten a new fixing to **12 Nm**.

6. Assemble the detent arm as noted on removal and place up to the crankcase.



- 1. Washer
- 2. Detent arm
- 3. Spring
- 4. Fixing

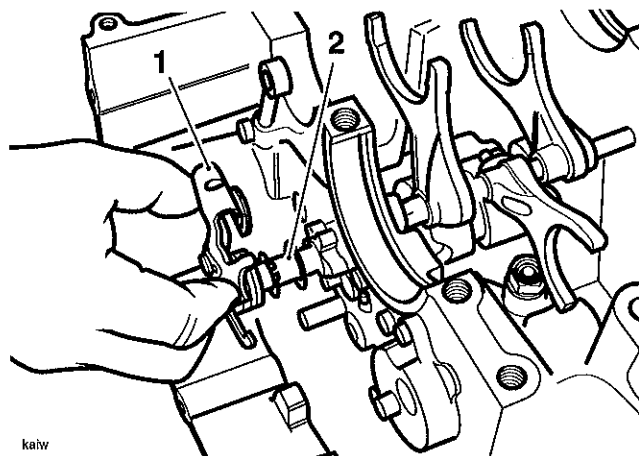
7. Hold the detent arm assembly in position and fit a new fixing. Start the thread and push the detent arm, using finger pressure, to locate on the detent wheel. Ensure the detent arm remains correctly located on the detent wheel. Tighten the capscrew to **12 Nm**.
8. Rotate the selector drum and ensure a smooth movement. Rectify as necessary.
9. Using clean engine oil, lubricate the lip of the seal on the gear change shaft.
10. Lubricate, with a 50/50 solution of engine oil and molybdenum disulphide grease, both sides of the fingers of the selector mechanism on the gear change shaft.



Caution

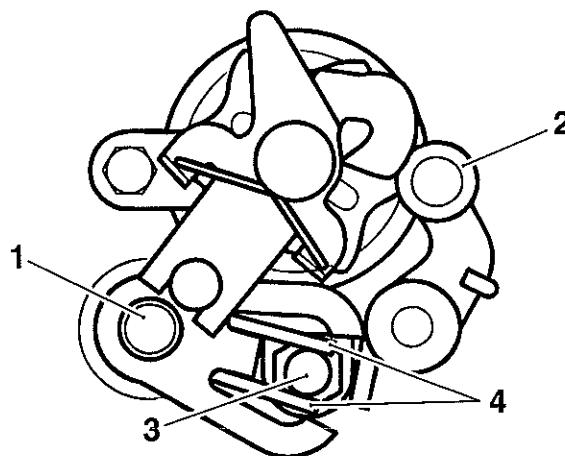
Take care to avoid damaging the lip of the seal when inserting the gear change shaft into the crankcase. A damaged seal will lead to oil loss and could result in engine damage.

11. Feed the washer onto the shaft and insert the gear change shaft into the crankcase. Gently push the gear pedal end of the shaft through the bearing and seal located, at the gear pedal end, in the crankcase.



- 1. Gear change shaft
- 2. Washer

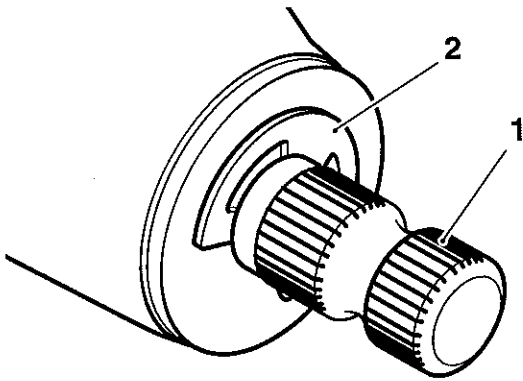
12. Ensure that the gear change shaft locates in the detent wheel/arm and that the spring fits over the abutment bolt.



- 1. Gear change shaft
- 2. Detent Arm
- 3. Abutment bolt
- 4. Spring

Transmission

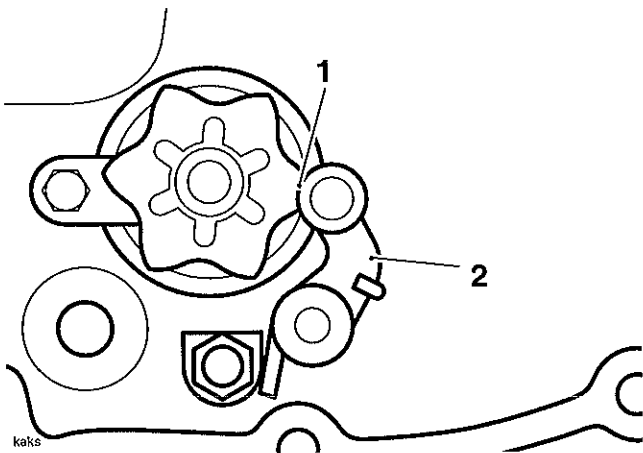
13. Fit the large washer and e-clip to the gear pedal end of the gear change shaft.



kakh

1. Gear change shaft
2. E-clip
3. Washer

14. Fit the gear pedal crank to the shaft in the same orientation as noted prior to removal. Tighten the fixing to **9 Nm**.
15. Position the selector drum in the neutral position.
16. Check that the detent arm locates in the raised profile in the detent wheel (neutral position).



kaks

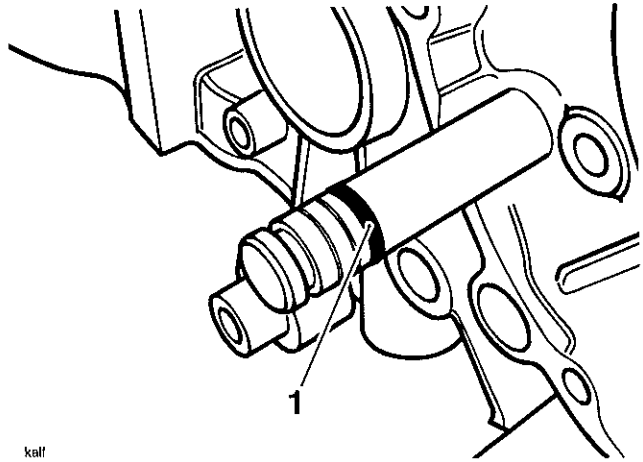
1. Raised profile
2. Detent arm



Caution

The selector forks can be fitted incorrectly. Ensure the position and orientation of the selector forks are the same as noted during removal. Incorrect fitting of the selector forks will cause gearbox damage when changing gear.

(O-ring located at the keeper plate end). Ensure the forks are fitted in the positions noted during removal.

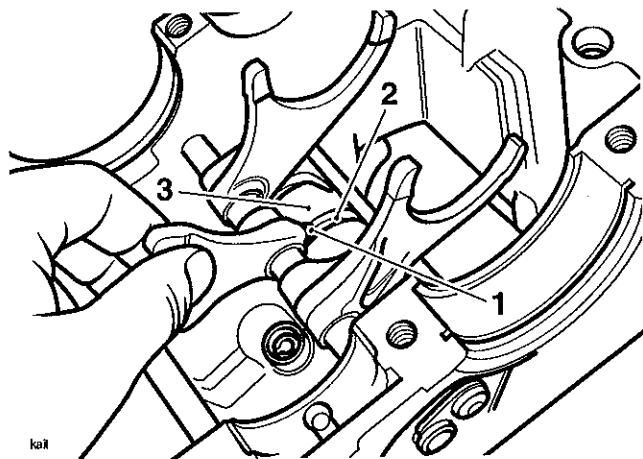


kell

1. O-ring

Note:

- The centre selector fork locates in the selector drum as shown below:



kall

1. Selector fork stop
2. Selector fork drum guide
3. Selector drum

18. Fit the 'U' shaped keeper plate.
19. Fit a new capscrew, and tighten to **12 Nm**.
20. Fit the input and output shafts (see page 7-11).

17. Push the selector shaft into the crankcase from the keeper plate end. As the shaft is inserted locate the selector forks and also fit a new O-ring

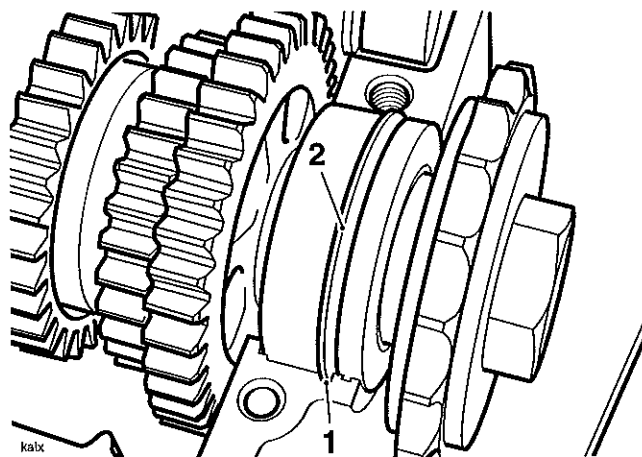
Input and Output Shafts Assemblies

Removal

1. Remove the engine from the frame (see page 9-2).
2. Separate the two halves of the crank case (see page 5-4).
3. Lift the input and output shaft assemblies out of the upper crankcase.

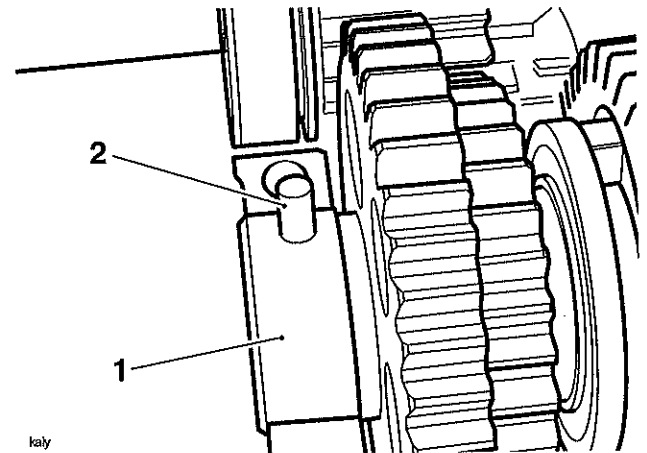
Installation

1. Place the output shaft in position in the crankcase.
2. Ensure the retaining ring on the bearing locates in the groove provided in the crankcase.
3. Ensure the output shaft seal aligns with its recess in the crankcase.



1. Groove in crankcase
2. Retaining ring
3. Seal

4. Ensure the dowel in the output shaft needle roller bearing is positioned to locate in the hole provided in the upper crankcase.



1. Roller bearing
2. Dowel

5. Ensure the output shaft seal aligns with its recess in the crankcase.
6. Repeat steps 1 to 3 for the input shaft and ensure that both sets of gear mesh correctly and that the half-circlip is correctly located and is not accidentally omitted.

Transmission

Input Shaft

Disassembly

Working from the opposite end to where the clutch assembly is fitted, dismantle the input shaft as follows:

1. Remove the pegged bearing sleeve (1) from the end of the shaft.
2. Slide off the needle bearing (3) and thrust washer (4).
3. Remove second gear (5).
4. Remove sixth gear (6), complete with the splined bush (7) which runs inside the gear.
5. Remove the thrust washer (8) from in front of the circlip between sixth and third/fourth gear.
6. Remove the circlip (9) from the shaft.
7. Slide off the combined third/fourth gear (10).
8. Remove the circlip (11) from in front of fifth gear.

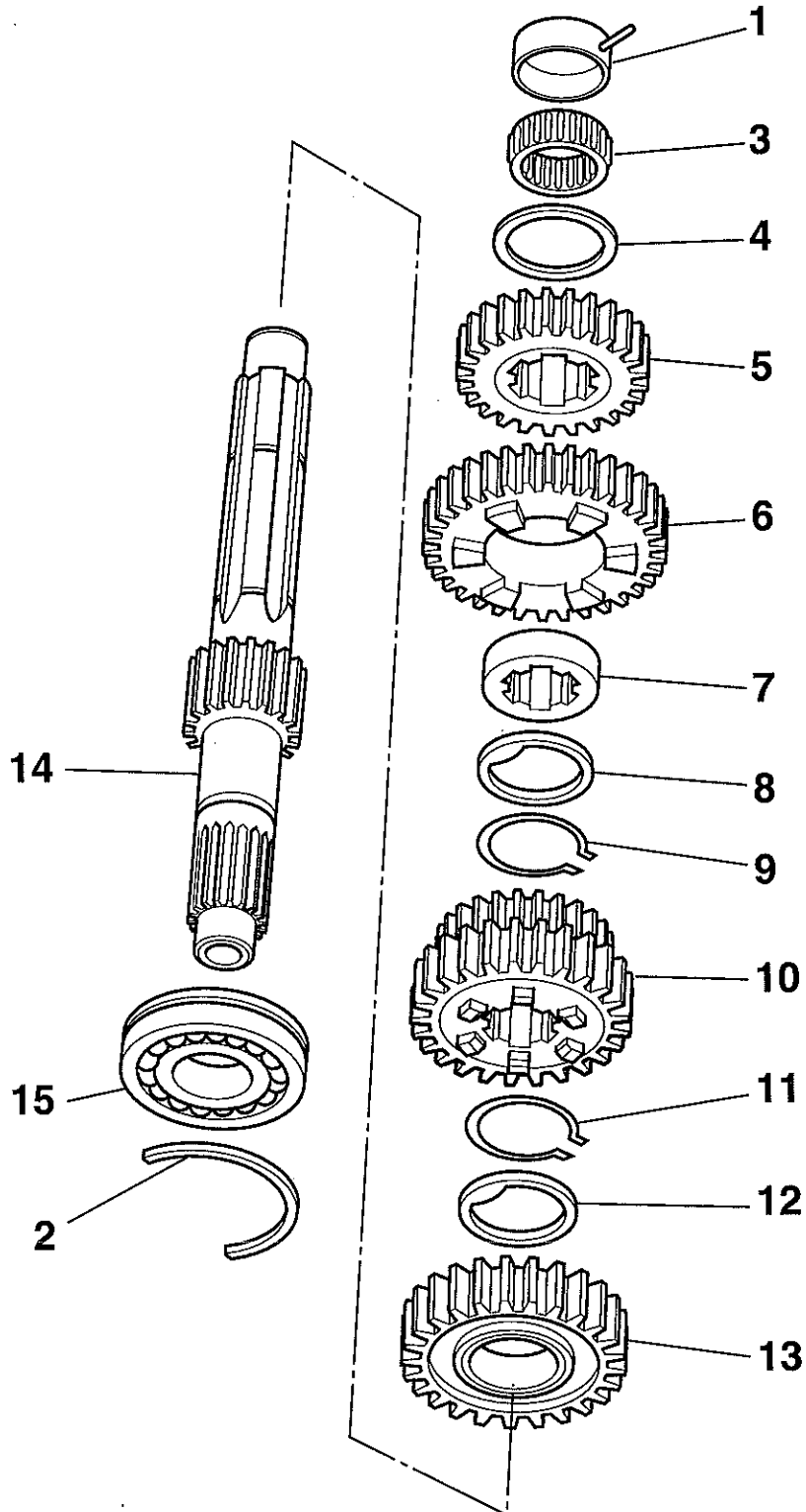
9. Remove the thrust washer (12) adjacent to fifth gear.
10. Remove fifth gear (13).
11. Place the shaft in a press with the input shaft bearing supported on press bars and the clutch end of the shaft facing the press ram. Protect the shaft thread with a thread protector or similar and press the shaft through the bearing.



Warning

When using a press, always wear overalls, eye, face and hand protection. Objects such as bearings frequently break-up under load and the debris caused during break-up may cause damage and injury to unprotected parts of the body.

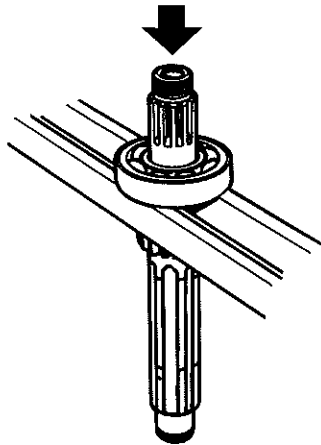
Never wear loose clothing which could become trapped in the press and cause crushing injury to the hand, arms or other parts of the anatomy.



ccsa

- 1. Bearing Sleeve
- 2. Half Circlip
- 3. Needle Roller Bearing
- 4. Thrust Washer
- 5. Second Gear
- 6. Sixth Gear
- 7. Splined Bush
- 8. Thrust Washer

- 9. Circlip
- 10. Third/Fourth Gear
- 11. Circlip
- 12. Thrust Washer
- 13. Fifth Gear
- 14. Input Shaft
- 15. Input Shaft Bearing



ccsh

1. Pressing Off The Input Shaft Bearing

Assembly

Note:

- Lubricate each gear and bush with clean engine oil during assembly.
- Examine all gears, bearings and sleeves for damage, chipped teeth and wear beyond the service limits. Replace all suspect components and always use new circlips to assemble the shaft.

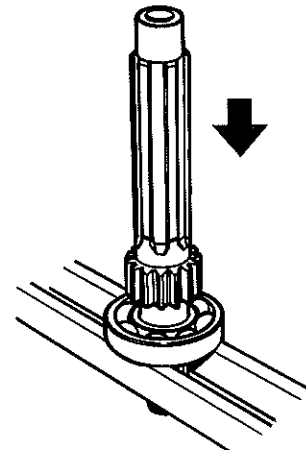
1. Place the input shaft bearing on press bars ensuring the inner race of the bearing is supported by the bars and the circlip groove is pointing upwards. Position the mainshaft to the bearing with the clutch end pointing downwards through the bearing. Press the shaft through the bearing until the bearing comes into contact with the fixed gear on the shaft.



Warning

When using a press, always wear overalls, eye, face and hand protection. Objects such as bearings frequently break-up under load and the debris caused during break-up may cause damage and injury to unprotected parts of the body.

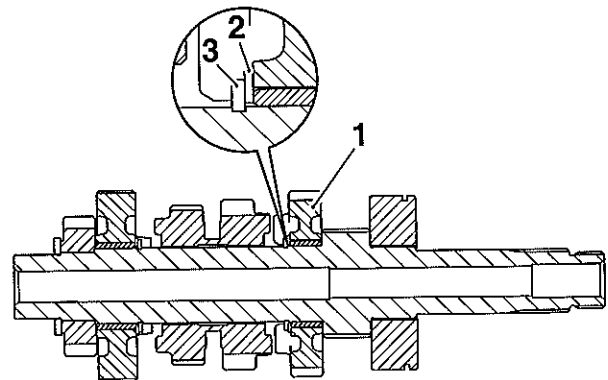
Never wear loose clothing which could become trapped in the press and cause crushing injury to the hand, arms or other parts of the anatomy.



ccsl

Pressing On the Input Shaft Bearing

2. Fit fifth gear (13) to the input shaft with the dog teeth pointing away from the input shaft bearing.
3. Slide on the thrust washer (12).
4. Fit a new circlip (11) to the input shaft ensuring that the clip is located in the circlip groove.



ccwb

1. Fifth gear

2. Thrust washer

3. Circlip

5. Fit the combined third/fourth gear (10) with the larger gear facing toward fifth gear. Ensure that the oil hole in the input shaft DOES NOT align with the oil hole in the gear.

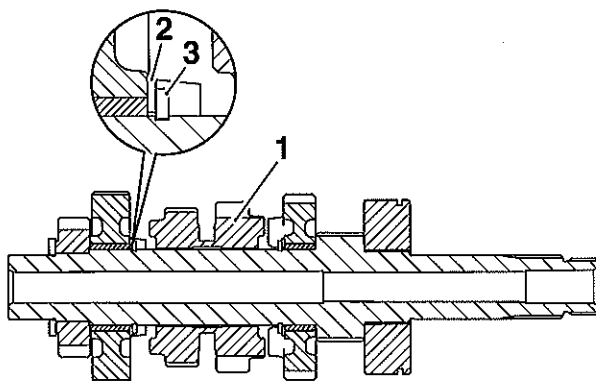


Warning

If the oil hole in the third/fourth gear is aligned with the corresponding hole in the input shaft, engine oil pressure and gear lubrication will be reduced.

Reduced oil pressure and gear lubrication will cause engine damage and could also lead to engine seizure resulting in loss of motorcycle control and an accident.

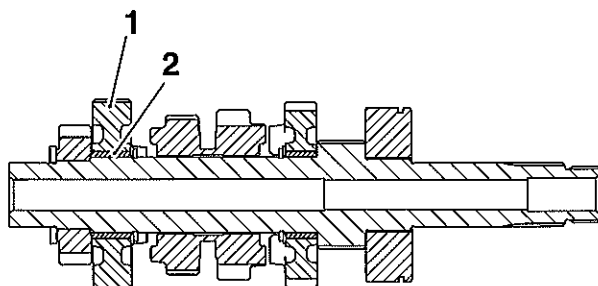
6. Fit a new circlip (9) to the input shaft ensuring that the circlip is located in the circlip groove.



ccwa

- 1. Third/forth gear**
2. Thrust washer
3. Circlip

7. Fit the thrust washer (8) to the input shaft and slide up the shaft until in contact with the circlip.
 8. Fit the splined bush (7) from sixth gear taking care that the oil hole in the shaft aligns with the hole in the bush.
 9. Fit sixth gear (6) with the dog teeth facing third/ fourth gear.

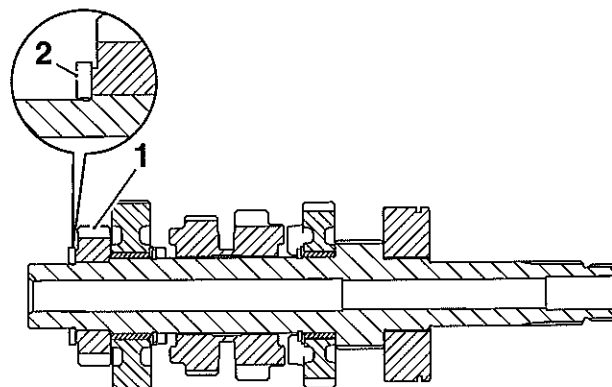


ccvz

- 1. Sixth gear**
2. Splined bush

10. Fit second gear (5) with the stepped side facing away from the clutch end of the input shaft.

11. Fit the thrust washer (4) adjacent to second gear and slide on the needle roller bearing (3).



ccvq

- 1. Second gear**
2. Thrust washer

12. Finally, fit the bearing sleeve (1) to the needle roller bearing.

Transmission

Output Shaft

Working from the opposite end to the drive sprocket, dismantle the output shaft as follows.

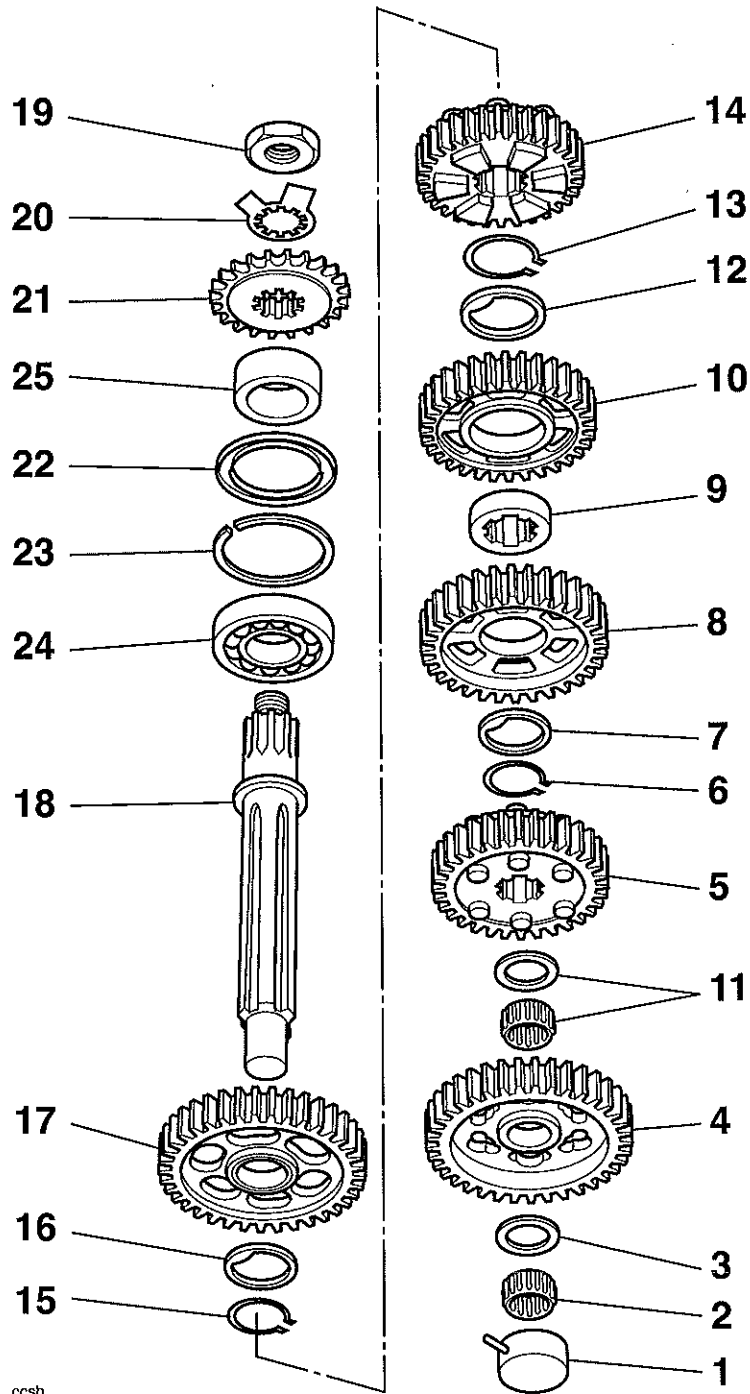
Disassembly

1. Remove the output bearing sleeve (1), needle roller bearing (2) and hardened thrust washer (3).
2. Mark one side of first gear to denote its correct orientation. Remove first gear (4) from the shaft.
3. Remove the first gear bearing and thrust washer (11).
4. Slide fifth gear (5) from the shaft.
5. Remove the circlip (6) from in front of the third gear.
6. Remove the splined thrust washer (7) from the shaft.
7. Remove the third gear (8).
8. Slide fourth gear (10) off the shaft and also remove the splined bush (9) and thrust washer (12).
9. Remove the circlip (13) from in front of sixth gear.
10. Remove sixth gear (14) from the shaft.
11. Remove the circlip (15) from in front of second gear.
12. Remove thrust washer (16) and slide off second gear (17).
13. Position the output shaft (18) in a vice with soft jaws fitted. Tighten the vice to prevent the shaft from turning and release the lock tab (20) from the output sprocket nut (19), then release the nut.
14. Remove the transmission sprocket nut (19), locktab (20) and sprocket (21).
15. Collect the oil seal (22) and retaining ring (23).
16. If it is found necessary to replace the large bearing (24) at the end of the shaft, use a press to remove both the bearing and output sprocket sleeve together.



Warning

When removing the output shaft bearing, always wear overalls, eye, face and hand protection. The bearing races are hardened and are liable to splinter if broken. Debris from broken bearings could cause injury to eyes, face and any unprotected parts of the body.



ccsb

- 1. Bearing Sleeve
- 2. Needle Roller Bearing
- 3. Thrust Washer
- 4. First Gear
- 5. Fifth Gear
- 6. Circlip
- 7. Thrust Washer
- 8. Third Gear
- 9. Third Gear Bush
- 10. Fourth Gear
- 11. First gear bearing & washer
- 12. Thrust Washer
- 13. Circlip

- 14. Sixth Gear
- 15. Circlip
- 16. Thrust washer
- 17. Second Gear
- 18. Output Shaft
- 19. Nut
- 20. Locktab
- 21. Output Sprocket
- 22. Oil Seal
- 23. Retaining Ring
- 24. Bearing
- 25. Sleeve

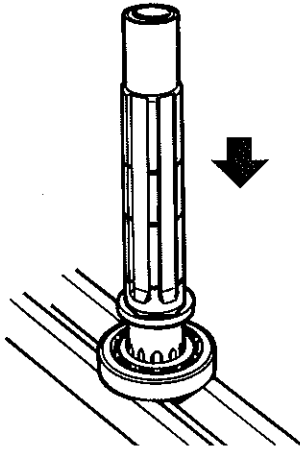
Transmission

Assembly

Note:

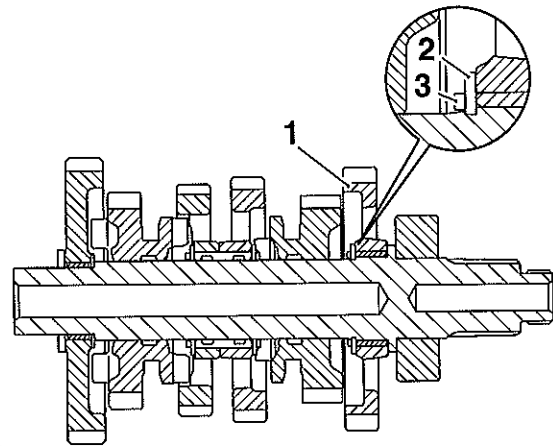
- Lubricate each gear and bush with clean engine oil during assembly.
- Examine all gears, bearings and sleeves for damage, chipped teeth and wear beyond the service limits. Replace all suspect components and always use new circlips to assemble the shaft

1. Working from the output sprocket end of the shaft, fit a new bearing (24) and new sleeve (25) to the shaft using a press and press bars. Fit the sleeve with the large chamfer facing outwards.
2. Fit the retaining ring (23) to the shaft. Lubricate and fit a new oil seal (22).



3. Transfer the shaft to the vice and secure between soft jaws. Fit the sprocket (21), locktab (20) and nut (19). Tighten the nut to **132 Nm**. Close the lock tab.
4. Withdraw the shaft from the vice and continue to assemble from the opposite end to the output sprocket.

5. Locate the second gear (17) to the shaft with the large step side facing away from the output sprocket end. Fit the thrust washer (16) and retain with a new circlip (15).



1. Second gear
2. Thrust washer
3. Circlip

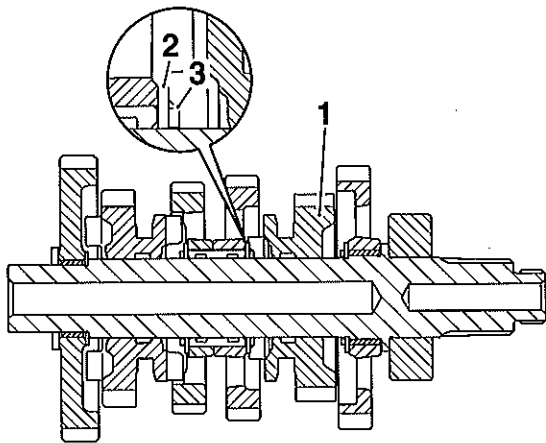
6. Fit sixth gear (14) with the selector fork groove facing away from the output sprocket end. Ensure that the oil holes in the gear DO NOT align with the corresponding oil hole in the output shaft.



Warning

If the oil holes in the sixth gear are aligned with the corresponding hole in the output shaft, engine oil pressure and gear lubrication will be reduced. Reduced oil pressure and gear lubrication will cause engine damage and could also lead to engine seizure resulting in loss of motorcycle control and an accident.

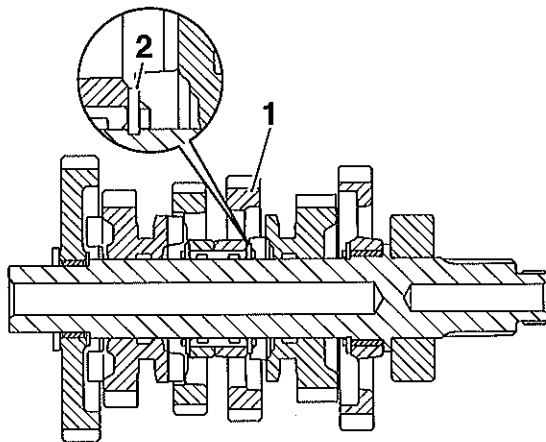
7. Fit a new circlip (13) to retain sixth gear.



ccvp

- 1. Sixth gear
- 2. Thrust washer
- 3. Circlip

8. Fit the thrust washer (12) to the rear of fourth gear. Fit the splined sleeve (9) for fourth gear, taking care to align the oil hole in the shaft with the corresponding hole in the bush. Fit fourth gear (10) to the shaft with the large step side facing towards the output sprocket.

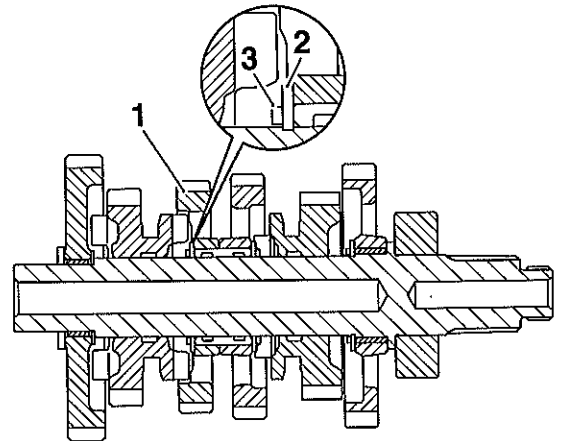


ccwd

- 1. Fourth gear
- 2. Thrust washer

9. Fit third gear (8) with the larger step side facing away from the output sprocket.

10. Fit the thrust washer (7) and retain with a new circlip (6).



ccwe

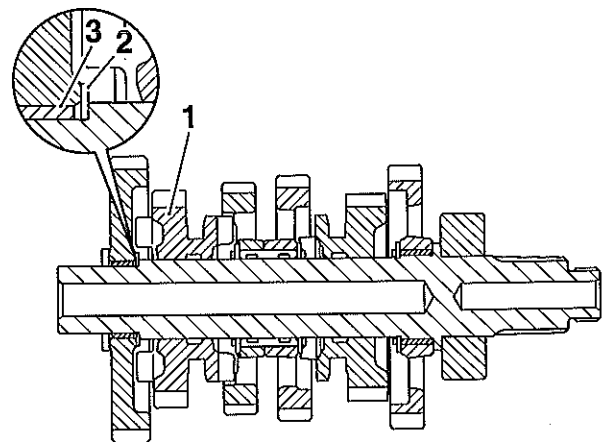
- 1. Third gear
- 2. Thrust washer
- 3. Circlip

11. Fit the fifth gear (5) to the shaft with the groove facing towards the output sprocket. Ensure that the oil holes in the gear DO NOT align with the corresponding oil hole in the output shaft.

Warning

If the oil holes in the fifth gear are aligned with the corresponding hole in the input shaft, engine oil pressure and gear lubrication will be reduced. Reduced oil pressure and gear lubrication will cause engine damage and could also lead to engine seizure resulting in loss of motorcycle control and an accident.

12. Fit the first gear thrust washer and bearing (11).

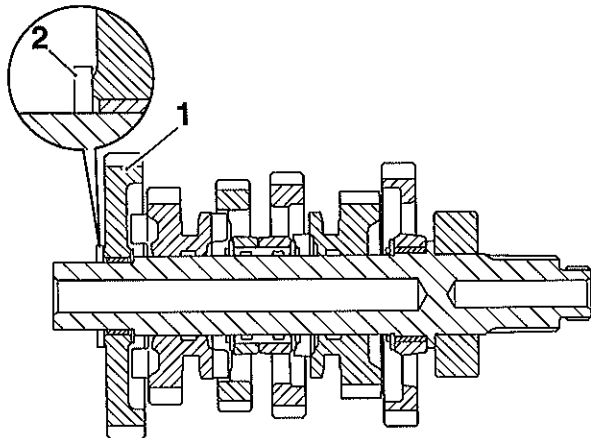


ccwf

- 1. Fifth gear
- 2. Thrust washer
- 3. Bearing

Transmission

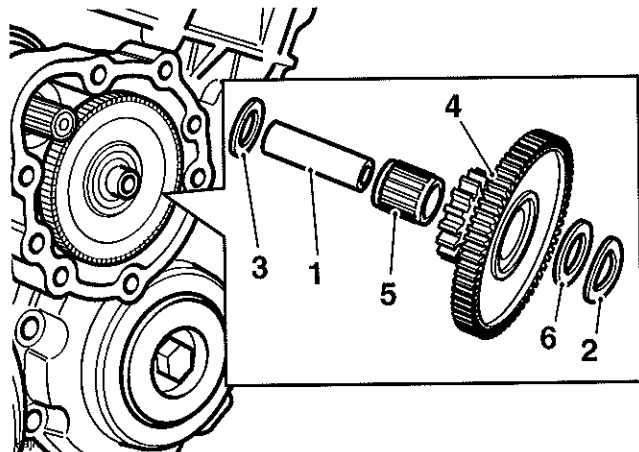
13. Fit first gear (4) to the shaft as marked during disassembly.



1. First gear
2. Thrust washer

14. Finally fit the thrust washer (3), needle roller bearing (2) and bearing cap (1) to the end of the shaft.

4. Withdraw the large starter idler gear noting the fitted position of all components.



1. Idler shaft
2. Wave washer
3. Flat washer
4. Idler gear
5. Bearing
6. Flat washer

5. Remove the bolts securing the right hand crank cover noting the position of the aluminium washer under the head of one of the upper bolts.

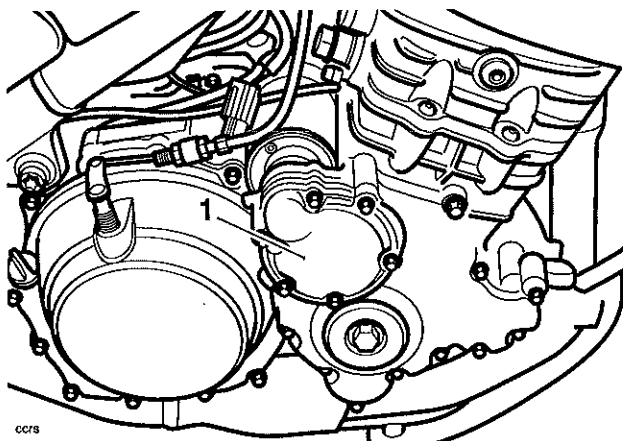
Starter Drive Gears/Sprag Clutch

Removal

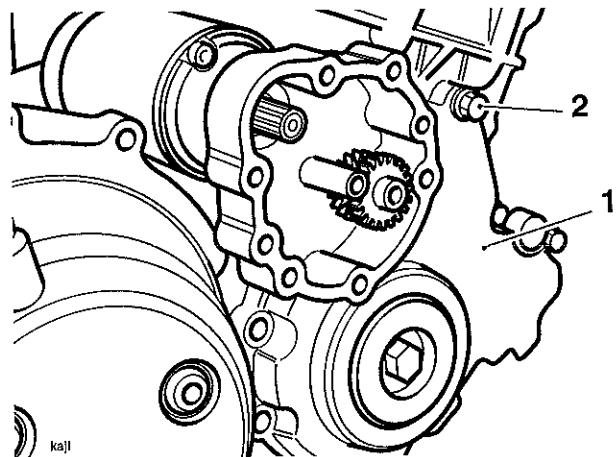
1. Disconnect the battery, negative (black) lead first (see page 17-8).
2. Remove the rear bodywork and the right hand lower fairing (see page 16-9).
3. Remove the starter cover.

Note:

- There are two bolts located inside the cover in the area behind the starter idler gear.

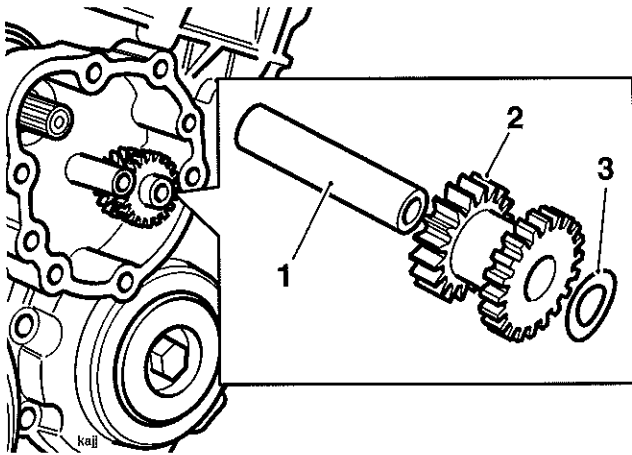


1. Starter cover



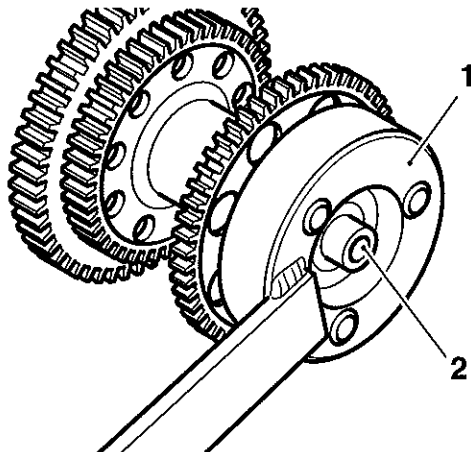
1. Right hand crank cover
2. Aluminium washer position

6. Ease the cover from the crankcase and collect the small starter idler gear again noting the position of all components.



1. Idler shaft
2. Gear
3. Wave washer

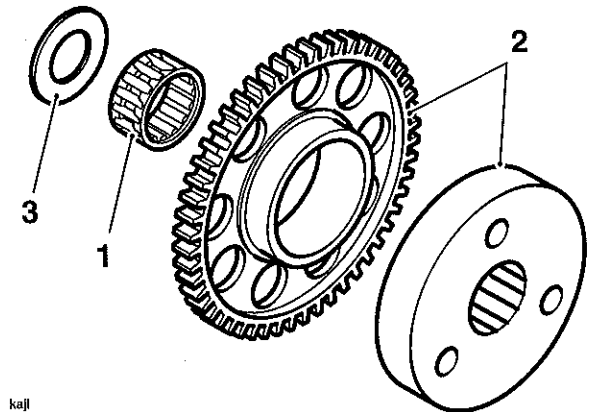
7. Using tool T3880017, prevent the sprag from turning and remove the sprag fixing and washer from the end of the crankshaft.



1. Tool T3880017
2. Sprag fixing

8. Slide the sprag clutch and gear from the crankshaft.

9. Separate the sprag clutch, bearing and gear from each other.



1. Needle roller bearing
2. Sprag clutch and gear
3. Plain washer

10. Recover the washer from the end of the crankshaft.

Inspection

1. Examine the sprag clutch for signs of slipping, overheating (going blue) and for any other damage.
2. Examine all gears for chipped teeth, overheating (going blue) and for any other damage.
3. Examine all bearings for chipped, broken or seized rollers, overheating (going blue) and for any other damage.
4. Examine the end of the crankshaft for damage.

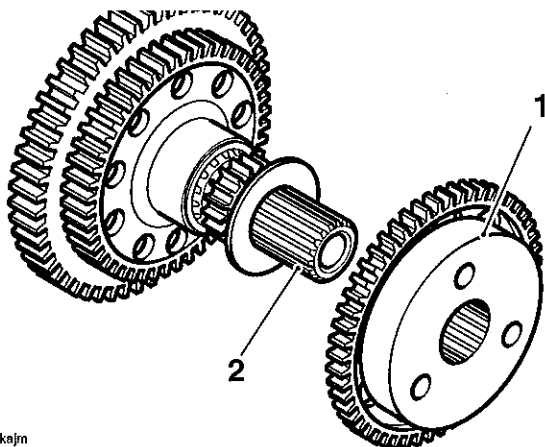
Transmission

Installation

1. Fit the sprag's washer to the crankshaft.
2. Assemble the needle roller bearing and sprag gear to the sprag clutch.
3. Locate the sprag clutch assembly to the crankshaft.

Note:

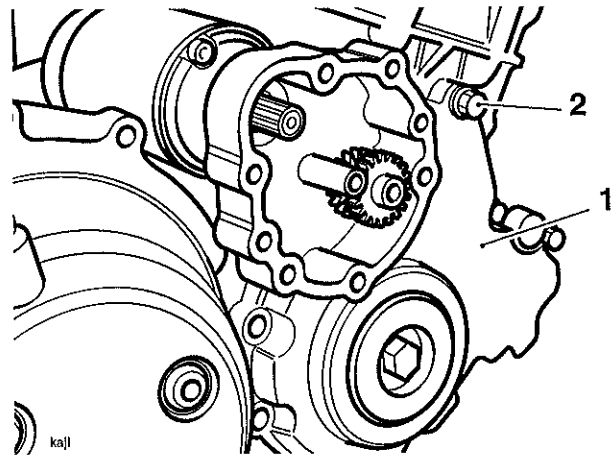
- The sprag clutch will only fit with the crankshaft when the master splines on both components are aligned.



1. Sprag clutch
2. Crankshaft end

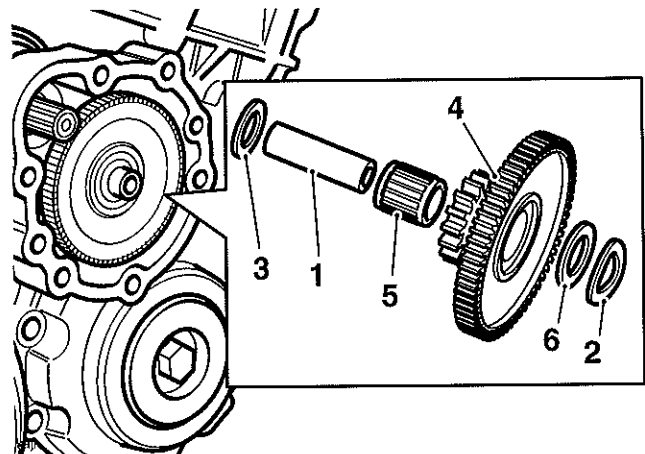
4. Prevent the sprag from turning using tool T3880017 then fit and tighten a new sprag fixing and washer to **54 Nm**.
5. Lubricate the idler gear shaft.
6. Fit the small idler gear, shaft and wave-washer (washer to the outside of the gear) to the crankcase.
7. Thoroughly clean the right hand crank cover.
8. Position a new gasket to the crankcase dowels then refit the right hand crank cover.

9. Ensure the bolt with the aluminium washer is correctly located then tighten the cover bolts to **9 Nm**.



1. Right hand crank cover
2. Aluminium washer position

10. Lubricate then refit the large starter idler gear ensuring that all components are located in the positions noted on removal.



1. Idler shaft
2. Wave washer
3. Flat washer
4. Gear
5. Bearing
6. Flat Washer

11. Thoroughly clean the starter cover.
12. Position a new gasket to the dowels then refit the starter cover.
13. Fit and tighten the cover bolts to **9 Nm**.
14. Refit any removed bodywork (see page 16-9).
15. Reconnect the battery positive (red) lead first.