Chapter 2 Gearbox, clutch and torque converter

Contents

Specifications

V-1000 I-Convert

Gearbox

Type	Three shaft, constant mesh
No. of ratios	Two
Ratios:	
1st gear	1.333 : 1
2nd gear	1.000 : 1
Primary ratio	1.570 : 1
Mainshaft endfloat	0.15 - 0.20 mm (0.006 - 0.008 in)
Layshaft/bush clearance	0.040 - 0.106 mm (0.0015 - 0.0041 in)
Bush/pinion clearance	0.000 - 0.390 mm(Zero - 0.0153 in)

Clutch

Type	Dry, multi-plate
No. of plates	
Plain	5
Friction	6
Friction plate thickness	3.15 - 3.35 mm (0.124 - 0.131 in)
Wear limit	2.65 mm (0.104 in)
No. of springs	6
Free length	27.970 - 28.000 mm (1.101 - 1.102 in)

Torque converter

Type	Hydraulic turbine
Maximum converting ratio	1.6 : 1
Working clearances:	
Converter housing/flanged shaft	0.010 - 0.059 mm (0.0004 - 0.0020 in)
Flanged shaft/converter spigot	0.070 - 0.104 mm (0.0027 - 0.004 in)
Flanged shaft/ bush outer diameter	0.058 - 0.149 mm (0.0022 - 0.006 in)
Clutch shaft/bush inner diameter	0.006 - 0.035 mm (0.0002 - 0.0013 in)
Converter boss/crankshaft spigot	0.016 - 0.043 mm (0.0006 - 0.0016 in)

Specifications

Converter oil pump

Type	Trochoid
Working pressure	25 - 30 psi
Gearbox oil capacity	0.6 itr (16.9 Imp oz)
Torque converter system oil capacity	1.5 - 1.7 ltr (42.9 - 47.8 Imp oz)

750-S3, 850T-3 and Le Mans models

Gearbox

Ratios:	
1st gear	11.643 : 1
2nd gear	8.080 : 1
3rd gear	6.095 : 1
4th gear	5.059 : 1
5th gear	4.366 : 1
Primary ratio	1.235 : 1

750S and 850T models

	750S	850T
Ratios		
1st gear	10.806 : 1	11.424 : 1
2nd gear	7.499 : 1	7.928 : 1
3rd gear	5.657 : 1	5.980 : 1
4th gear	4.695 : 1	4.963 : 1
5th gear	4.052 : 1	4.284 : 1
Primary ratio	1.235 : 1	1.235 : 1
Working clearances:		
Mainshaft bearing/cover bearing	167.1 - 167.2 mm (6.578 - 6.582 in)	
Layshaft adjusted length	144.7 - 145.2 mm (5.692 - 5.715 in)	
Gearbox oil capacity	0.75 ltr (1.75/1.33 US/Imp pints)	

Clutch

Type	Two plate, diaphragm
Friction plate:	
standard thickness	8 mm (0.3149 in)
wear limit	7.5 mm (0.2953 in)

Torque wrench settings

Oil level plug	2 kg m (14 lb ft)
Cover screw	1 kg m (7 lb ft)
Layshaft nut	16 - 18 kg m (115 - 129 lb ft)

1 General description

All the models covered in this manual, with the exception of the V-1000 automatic, utilise a 5-speed constant mesh gearbox driven from the engine via a two-plate flywheel mounted clutch. The gearbox incorporates three shafts, of which the input shaft combines a single reduction gear pinion and a spring-loaded cam-type shock absorber. The intermediate or layshaft has one free running gear pinion only, the remaining four being integral with the shaft. The mainshaft or output comprises five gear pinions and two sliding dog clutches by which means the constantly meshed pinions are engaged. With the exception of the mainshaft 5th gear pinion, which runs directly on the shaft, all pinions are supported on caged needle roller bearings, with independent inner races. The gear shafts themselves run in journal ball or caged needle roller bearings. The clutch consists of two friction plates, one placed either side of an intermediate plate, the complete assembly being secured under pressure from eight coil springs by the starter ring gear bolted to the flywheel.

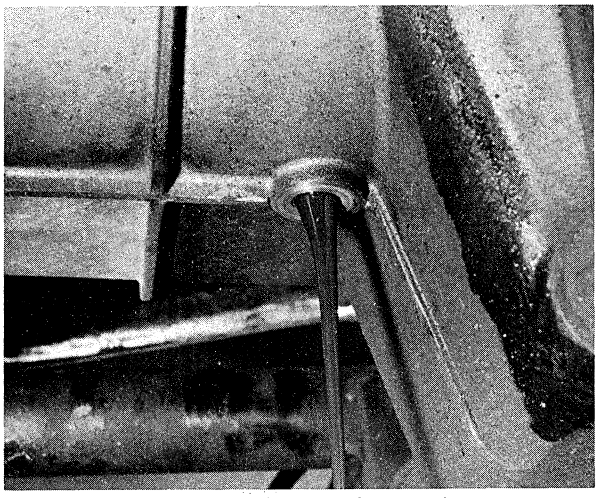
The V-1000 model is fitted with an unusual transmission system which virtually eliminates the need for gear selection whilst on the move. An hydraulic torque converter transmits the engine power through a traditional multi-plate clutch to a two-speed gearbox. The torque converter, which is oil filled to provide the drive medium, is fitted with a circulatory cooling system comprising an engine driven oil pump and an oil cooler, the latter of which prevents heat build-up in the torque converter from becoming excessive. The gearbox, in common with the 5-speed unit, incorporates three shafts, of which the output or mainshaft carries the selector, dog and free running gears. The gear pinions run on plain bronze bushes.

On all models, helically cut gear pinions are utilised to improve wear characteristics and to reduce gear noise. A selection of straight-cut gears, however, is available for fitting to the Le Mans model, for production racing purposes.

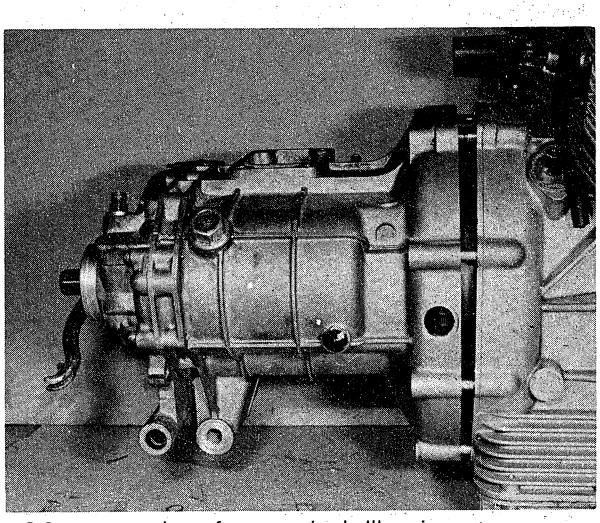
2 Gearbox: removal from the frame

1 The gearbox can be removed from the frame only as an integral part of the engine. Separation of the engine from the gearbox is possible only after the frame has been lifted clear. Gearbox removal therefore follows substantially the same procedure as that described for engine/gearbox removal in Chapter 1, Section 4.

2 Separation of the gearbox from the engine should be carried out as described in Chapter 1, Section 6. Drain the oil from the gearbox before commencing the dismantling operations.



2.1 Remove filler plug and drain plug from gearbox



2.2 Separate gearbox after removing bellhousing nuts

3 Gearbox: dismantling, 5-speed gearbox only

1 Place the gearbox on the workbench so that the rear end is facing upwards. Remove the clutch operating arm after detaching the clevis pin, which is secured by a split pin. Lift the return spring from position. Withdraw the clutch pushrod thrust components from the gearbox end casing, noting carefully the sequence of the five individual parts. Push the clutch pushrod out and note and displace the small rubber bush from the centre of the input shaft. Remove the gear selector arm, which is retained by a pinch bolt.

2 Invert the gearbox and place it on the workbench, supported on a number of wooden blocks. The splined boss on the end of the input shaft is retained by a special ring nut, secured by a tab washer. The nut must be loosened by means of a peg spanner. This may be fabricated from a length of thick walled tube of suitable dimensions, one end of which has been relieved to form four short pegs. To prevent the shaft rotating when loosening the nut, a small metal sprag must be made which will engage with the splined boss and bear against a block of wood in the casing. A small amount of experimentation will elicit the ideal shape for the sprag. The splined boss is a tight fit on the splines of the input shaft and may require drawing from position. A two or three legged sprocket puller may be used to extract the boss. Alternatively, levers may be used, if care is taken.

3 Invert the gearbox again so that the end cover is once more uppermost. Unscrew the speedometer driveshaft housing and withdraw it from the casing, together with the driveshaft. A small endfloat shim is fitted to the lower end of the driveshaft; this is easily overlooked.

4 Using a box spanner, loosen and remove the shouldered nut from the output shaft. The shaft may be prevented from rotating by fitting temporarily the internally splined sleeve which interconnects the final driveshaft with the rear wheel bevel box input shaft. A strap or chain wrench should be employed with which to hold the sleeve. After removal of the nut, access is made to the speedometer drive worm gear. The gear is driven by the output shaft, drive being given through a single steel ball which engages on the shaft splines and the gear. Remove the steel ball and store it in a safe place.

5 Remove the gearbox end cover retaining socket screws. Separate the cover from the gasket, using a rawhide mallet, and lift it clear of the shafts.

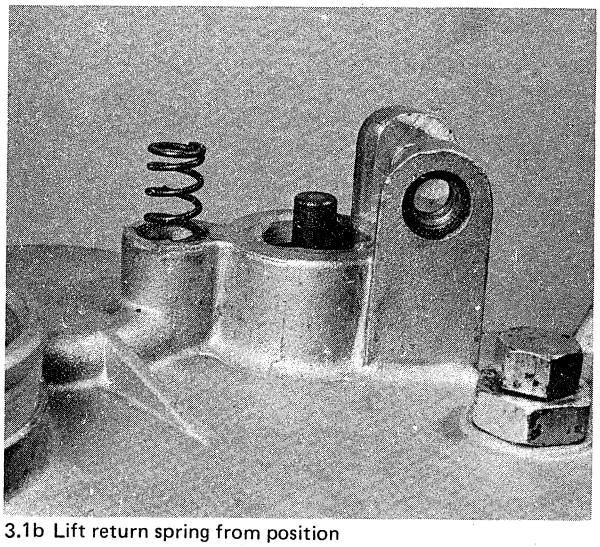
6 Lift the shims and washers off the end of the gear selector drum, noting their number and sequence. Unscrew the gearbox breather union from the left-hand wall and withdraw the spring and detent plunger from the tunnel. The breather union serves also as the plunger housing bolt. Remove the neutral indicator switch as a complete unit by unscrewing the two outer screws which pass through the switch flange.

7 Push the top of the selector drum across slightly towards the casing wall, so that the uppermost selector fork and dog clutch may be lifted off the layshaft end. Pull out the rod upon which the selector drum pivots and move the drum to one side to clear the remaining two selector forks. Lift the drum out of the casing, followed by the endfloat shim(s). Note the number of shims. Lift the selector fork rod up so that the rod lower end leaves the casing and lift the rod, complete with the selector forks, out of the gearbox.

8 Grasp the end of the layshaft and also that of the output shaft. The two shafts may be withdrawn from the gearbox simultaneously, complete with the gear pinions. Note the needle thrust bearing, washers and shim which lie between the layshaft lower end and the gearbox wall. Lift the thrust assembly from position.

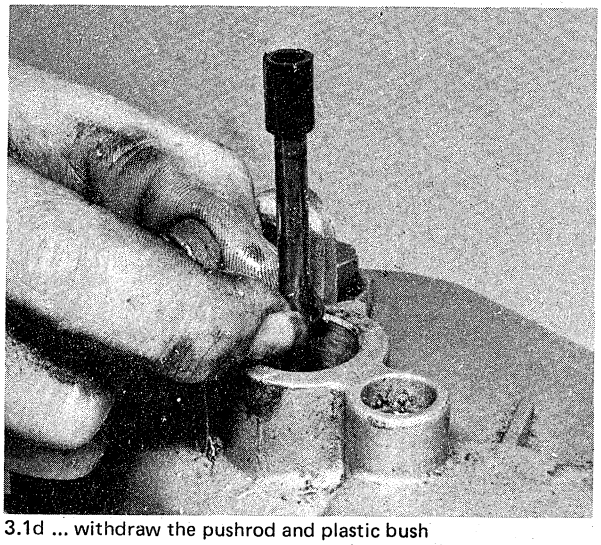
9 The remaining components within the gearbox, which form the input or reduction shaft, can be driven from position in the casing using a rawhide mallet.

3.1a Displace clevis pin to free clutch arm

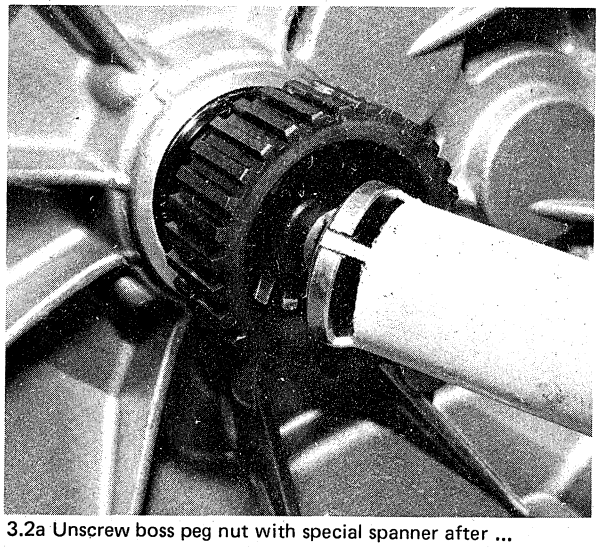


3.1b Lift return spring from position

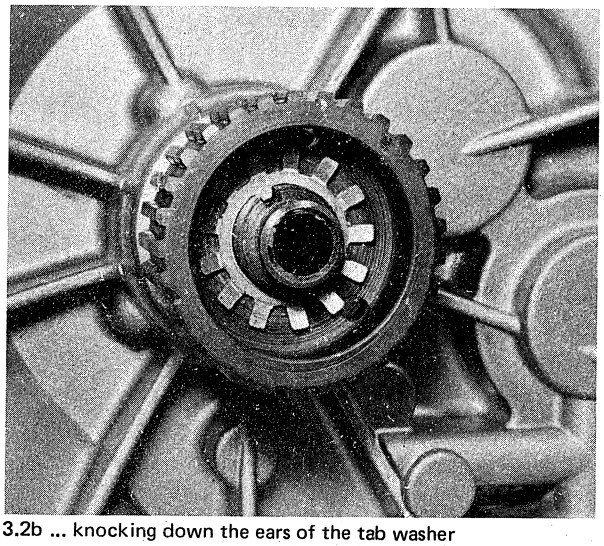
3.1c Remove the pushrod thrust components and ...



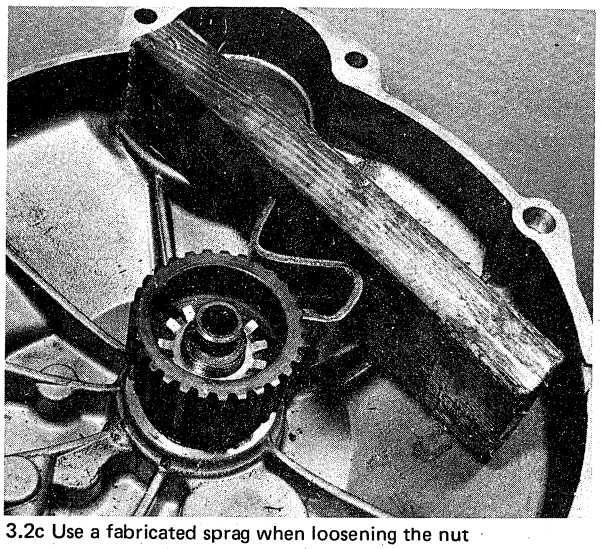
3.1d ... withdraw the pushrod and plastic bush



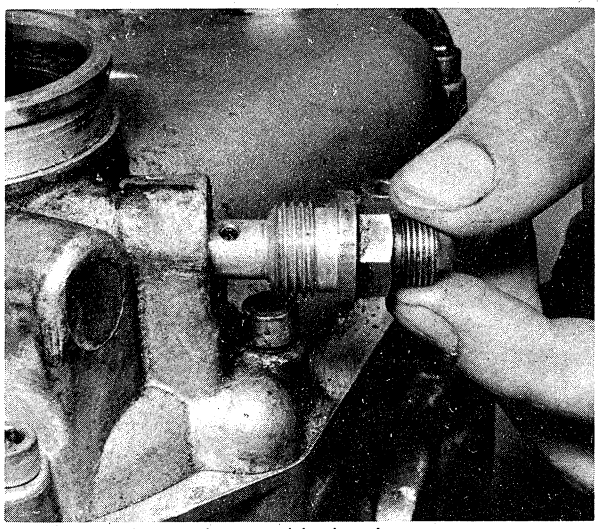
3.2a Unscrew boss peg nut with special spanner after ...



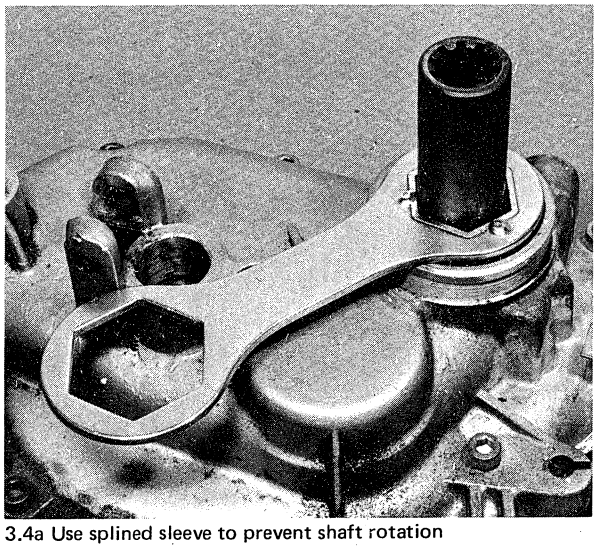
3.2b ... knocking down the ears of the tab washer



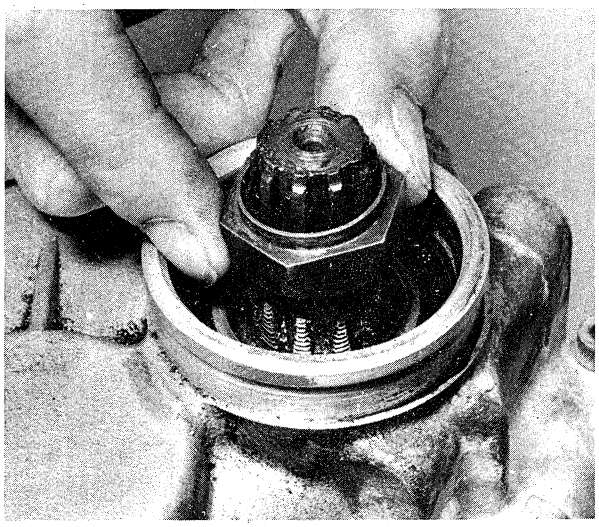
3.2c Use a fabricated sprag when loosening the nut



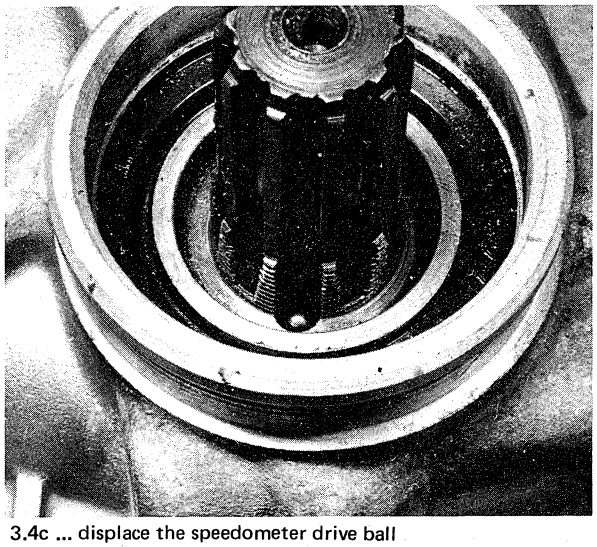
3.3 Unscrew the speedometer drive housing



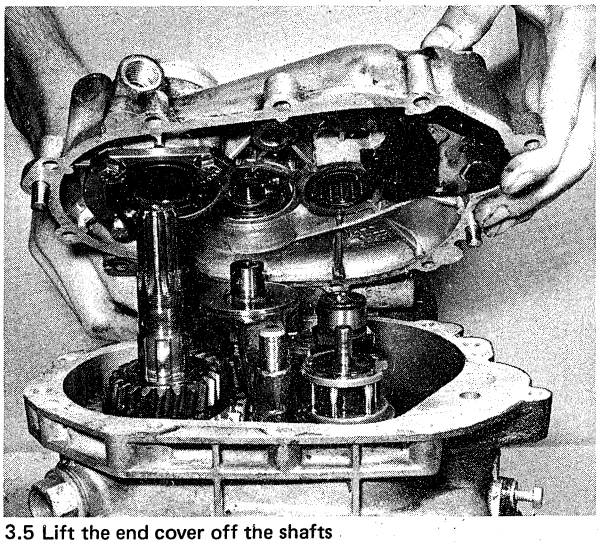
3.4a Use splined sleeve to prevent shaft rotation



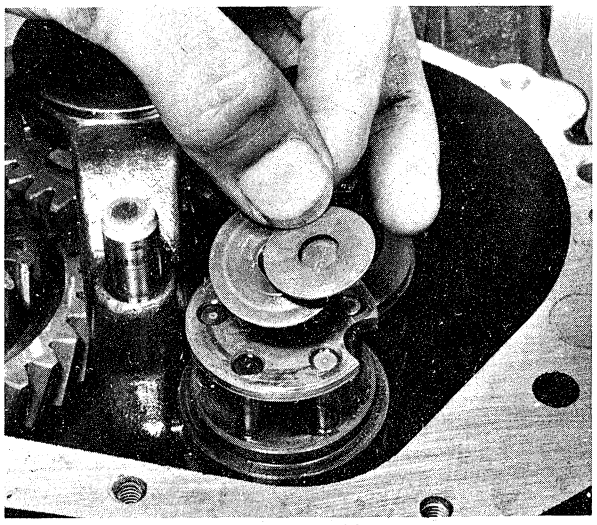
3.4b Unscrew the shouldered nut and ...



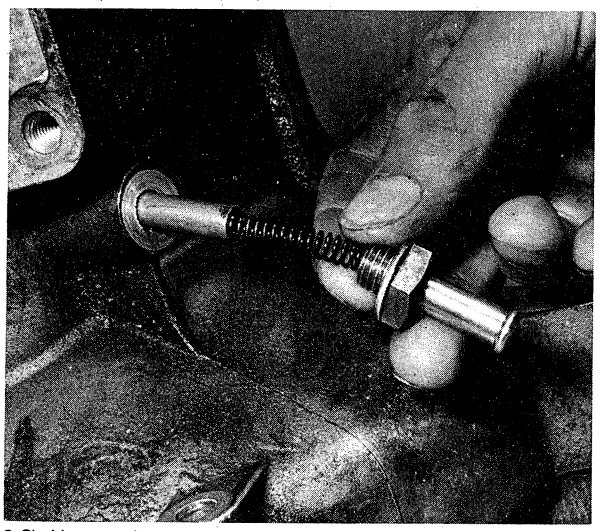
3.4c ... displace the speedometer drive ball



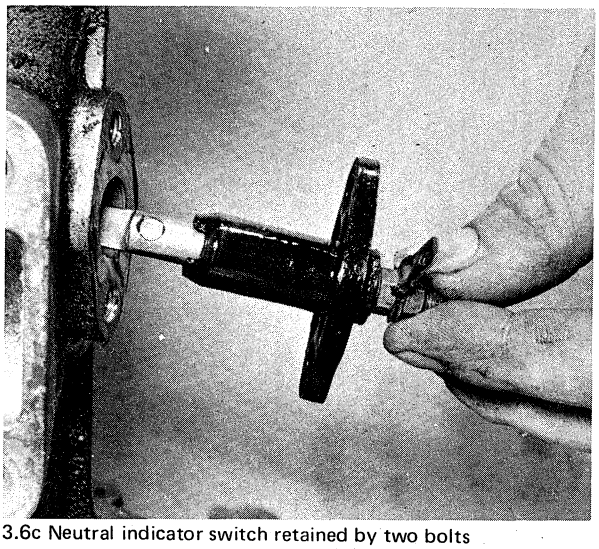
3.5 Lift the end cover off the shafts



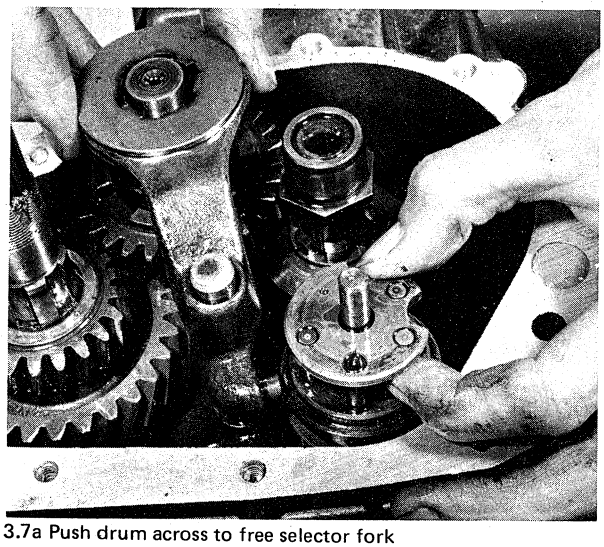
3.6a Note and remove change drum shims



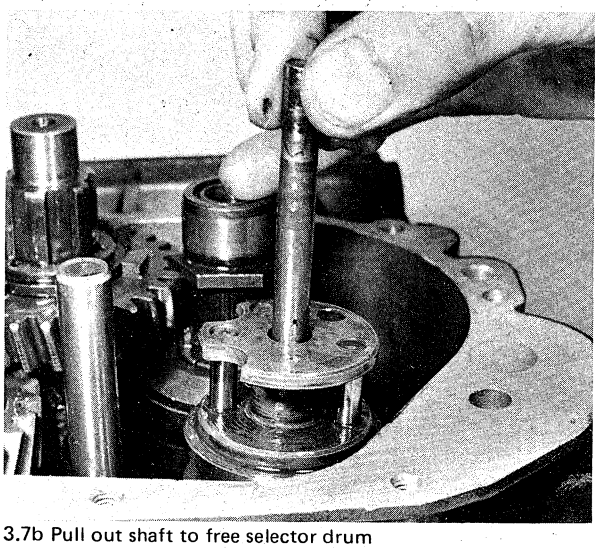
3.6b Unscrew breather and withdraw spring and plunger



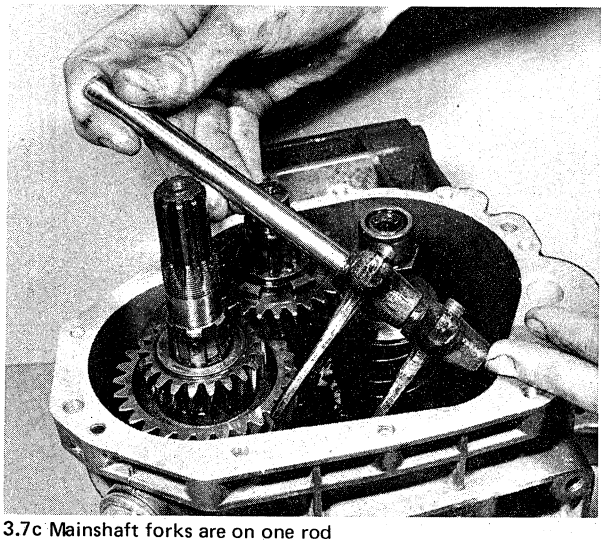
3.6c Neutral indicator switch retained by two bolts



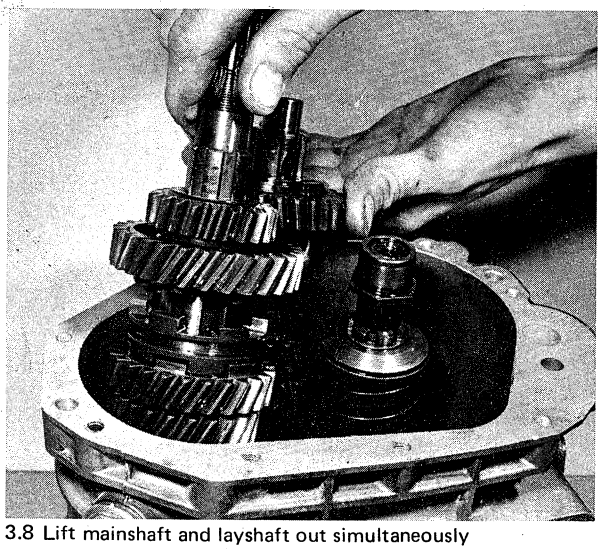
3.7a Push drum across to free selector fork



3.7b Pull out shaft to free selector drum



3.7c Mainshaft forks are on one rod



3.8 Lift mainshaft and layshaft out simultaneously

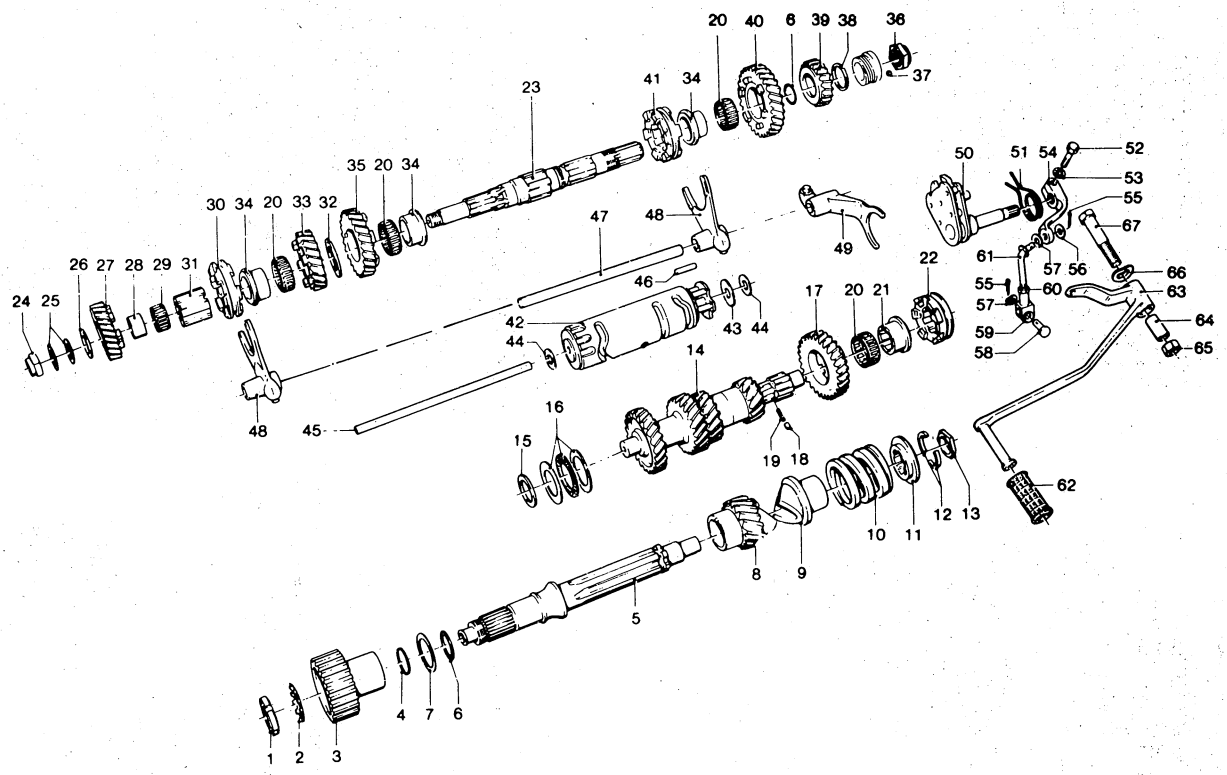


Fig. 2.1. Gearbox components - 5-speed models

1 *Peg nut*
2 *Tab washer*
3 *Splined input boss*
4 *'O' ring*
5 *Input shaft*
6 *'O' ring*
7 *Washer*
8 *Input reduction gear*
9 *Shock absorber cam*
10 *Shock absorber spring*
11 *Spring seat*
12 *Collet - 2 off*
13 *Spacer*
14 *Layshaft*
15 *Shim*
16 *Thrust bearing*
17 *Layshaft 5th gear pinion*
18 *Bush locating pin*
19 *Spring*
20 *Needle roller bearing*
21 *Inner race*
22 *Sliding dog clutch*
23 *Mainshaft*
24 *Shouldered nut - LH thread*
25 *Shim - as required*
26 *Washer*
27 *Mainshaft 4th gear pinion*
28 *Inner race*
29 *Needle roller bearing*
30 *Sliding dog clutch*
31 *Splined sleeve*
32 *Washer*
33 *Mainshaft 3rd gear pinion*
34 *Inner race - 3 off*
35 *Mainshaft 2nd gear pinion*
36 *Shouldered nut*
37 *Speedometer gear drive ball*
38 *Washer*
39 *Mainshaft 5th gear pinion*
40 *Mainshaft 1st gear pinion*
41 *Sliding dog clutch*
42 *Gearchange drum*
43 *Washer*
44 *Shim - as required*
45 *Change drum spindle*
46 *Change drum pin - 4 off*
47 *Selector fork rod*
48 *Selector fork*
49 *Selector fork*
50 *Gearchange selector*
51 *Centraliser spring*
52 *Pinch bolt*
53 *Star washer*
54 *Gearchange arm*
55 *Split pin - 2 off*
56 *Washer*
57 *Washer - 2 off*
58 *Clevis pin*
59 *Clevis fork*
60 *Nut*
61 *Link rod*
62 *Rubber*
63 *Gear lever*
64 *Nylon bush*
65 *Nut*
66 *Wave washer*
67 *Bolt*

4 Gearshafts and pinions: examination and renovation, 5-speed gearbox only

1 Examine the gear pinions to ensure that there are no chipped or broken teeth and that the dogs on the pinion faces are not rounded. Inspect also the condition of the sliding dogs which are operated by the selector forks. If damage to any of these components is evident, the faulty part must be renewed. Renewal of pinions and further inspection of the shafts, splines and bearings require that the pinions be removed from the shafts. Each shaft should be dismantled separately and the relative positions of the components noted very carefully, to aid refitting.

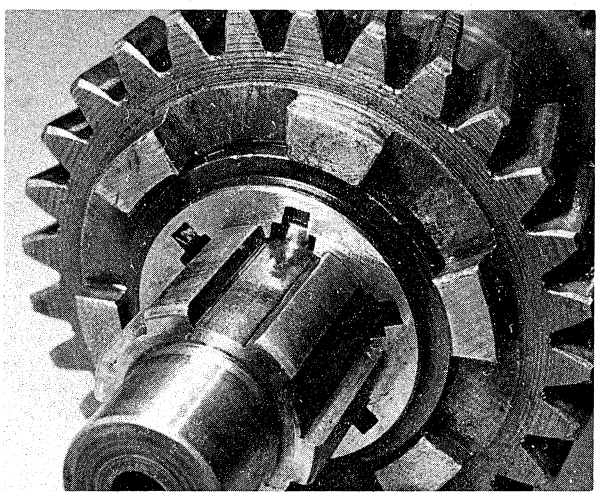
2 Of the five layshaft gears only the 5th gear pinion is floating; the remainder are an integral part of the shaft. The 5th gear pinion is secured on the shaft by a sping-loaded pin resting in a drilling in one of the shaft splineways. Using a pointed instrument, depress the pin against the spring pressure. Rotate the bush either to the right or left and draw the pinion, caged needle roller bearing and inner bush from position. Care should be taken not to allow the pin and spring to fly from place as the inner bush is drawn off.

3 Unscrew the shouldered nut from the end of the mainshaft. Note that this nut has a left-hand thread and must therefore be undone in a **clockwise** direction. The roller bearing cage and inner race is a tight fit on the shaft and will require pulling from position, using a standard two or three-legged sprocket puller. The puller feet may be located behind the 4th gear pinion, which will be drawn off with the bearing. After pulling the bearing from position, note the adjusting shims which lie between the bearing and 4th gear pinion face. Remove the needle roller bearing and inner bush. Remove the selector dog, noting that it can be fitted only one way round, with the relieved dogs facing inwards. The 3rd gear pinion and bearing can now be removed, followed by the thick washer and the 2nd gear pinion and bearing.

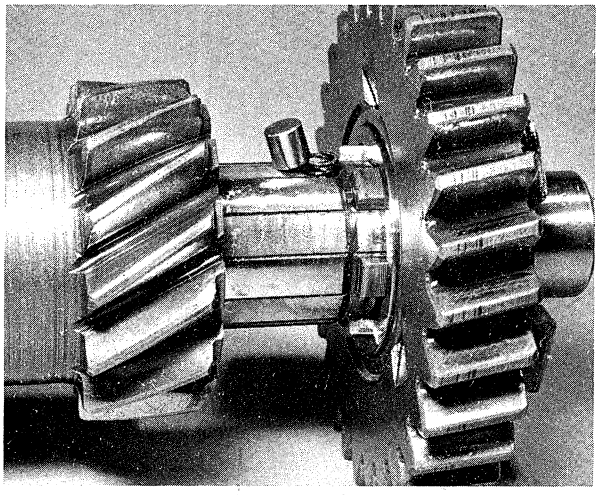
Working from the other end of the shaft, remove the 5th gear pinion, the 'O' ring and the 1st gear pinion and bearing. Finally slide off the dog clutch.

4 With the exception of the mainshaft 5th gear pinion, all pinions run on caged needle roller bearings supported on separate inner bushes or races. If up and down play can be detected on any bearing, or the rollers or tracks are pitted, the matched components should be renewed.

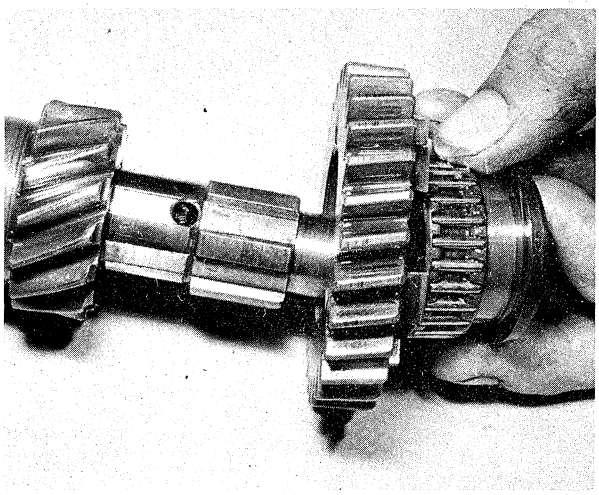
5 The gearbox input shaft, on which the primary reduction gear is mounted, incorporates a cam type shock absorber unit. The shock absorber unit is unlikely to give trouble until an extended mileage has been covered, when wear on the cam faces or weakening of the coil spring will necessitate renewal. In order to dismantle the shaft assembly, the heavy square section coil spring must be compressed to allow removal of the spring seat and the split retaining collets. A special compressor must be used to carry out this operation safely. Most motorcycle repair agents have a tool of the correct type, which is used also for compressing rear suspension unit springs. If the cam faces have worn through the hardened layer, or if heavy chattering marks are apparent, both cam pieces should be renewed. Check the spring length against that of a new component. A marked shortening in the free state will indicate the need for renewal.



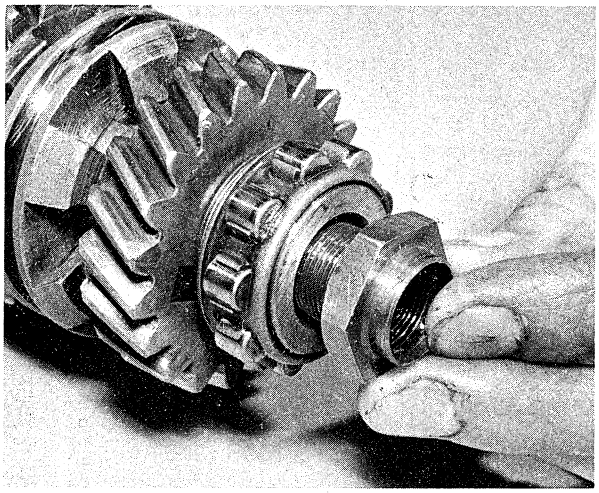
4.2a Depress pin and turn pinion to right or left



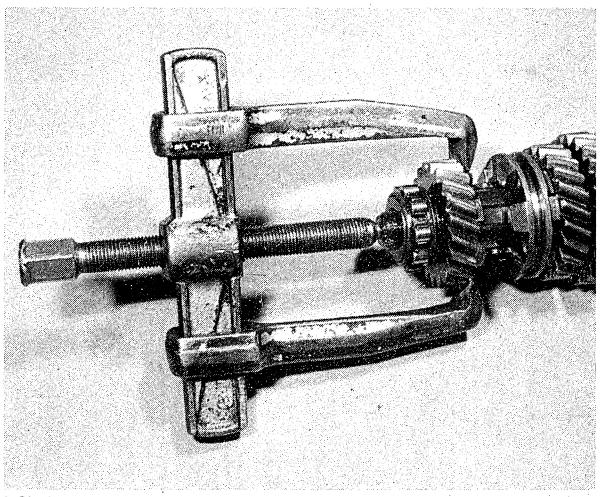
4.2b Do not allow pin and spring to fly out



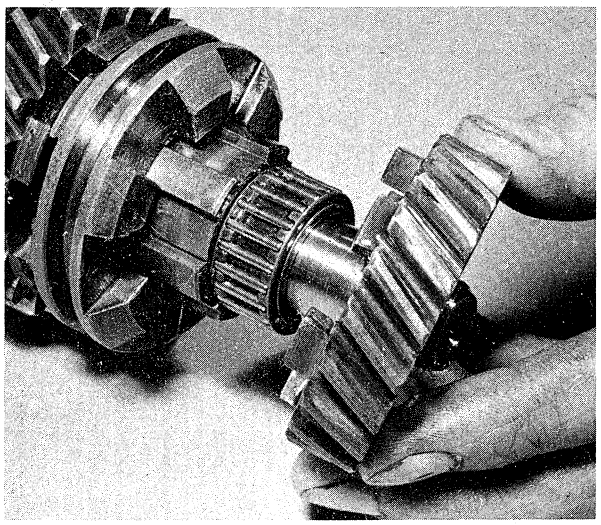
4.2c Pull off the layshaft pinion, caged bearing and race



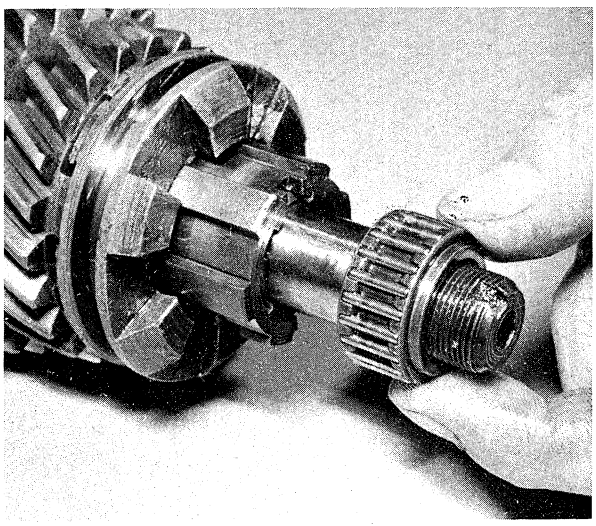
4.3a Shouldered end nut has LEFT-HAND thread



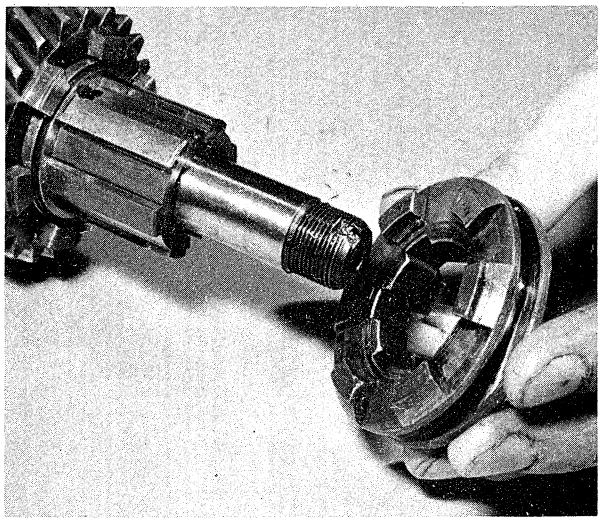
4.3b Use puller to draw off bearing together with ...



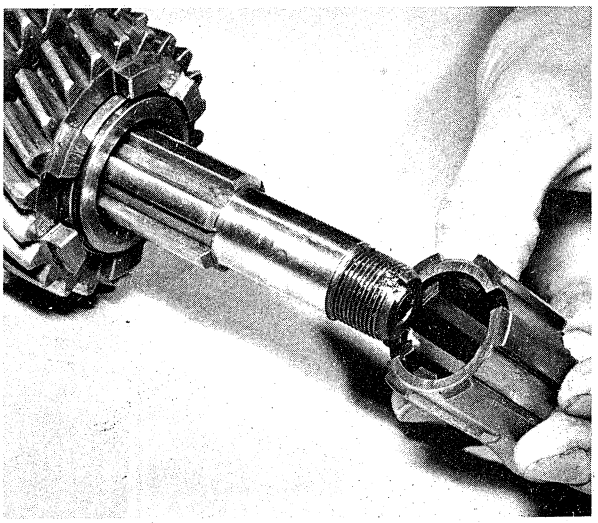
4.3c ... 4th gear pinion and ...



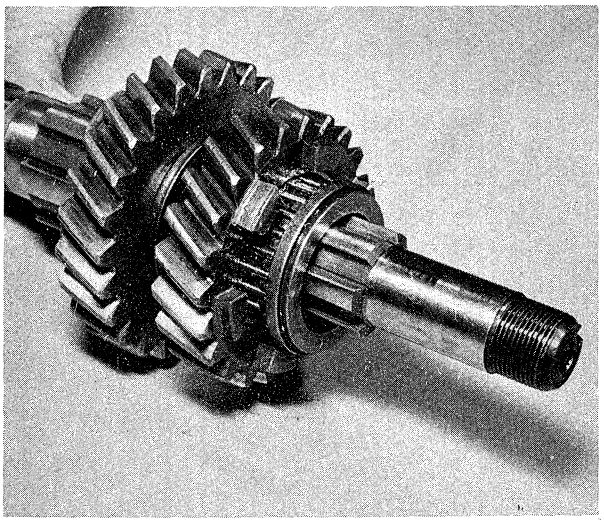
4.3d ... 4th gear pinion bearing



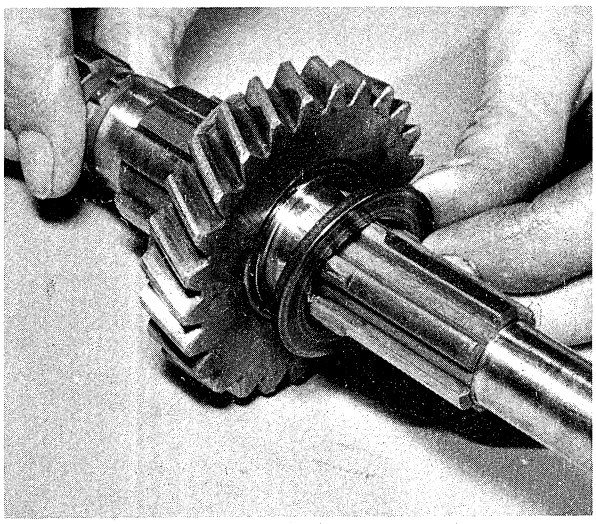
4.3e Remove the sliding dog and ...



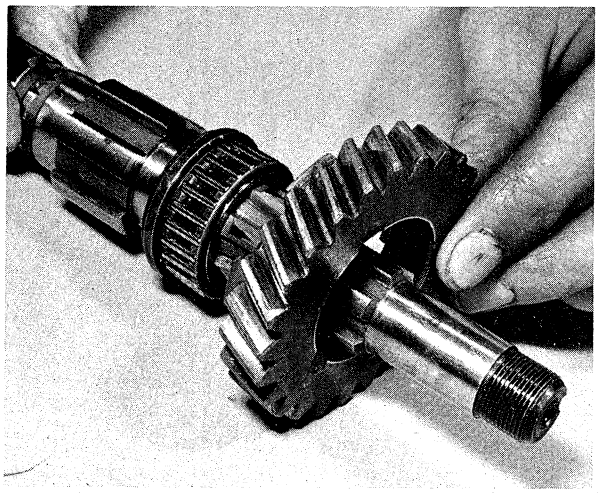
4.3f ... internally and externally splined sleeve



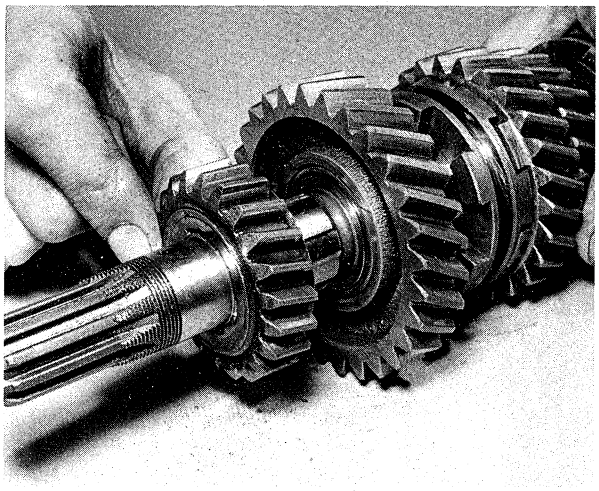
4.3g Displace 3rd gear pinion and bearing and ...



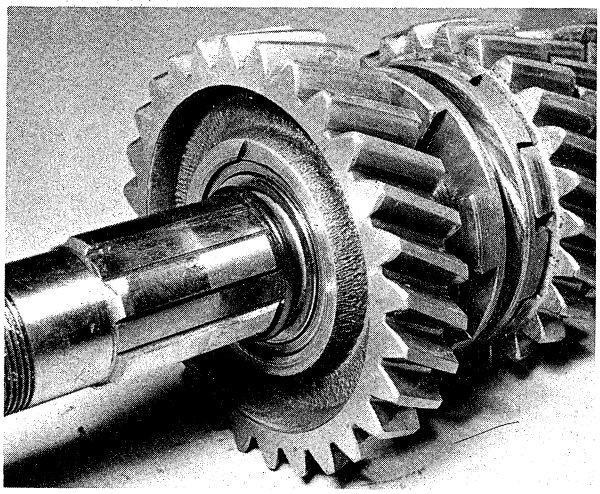
4.3f ... intermediate thick washer



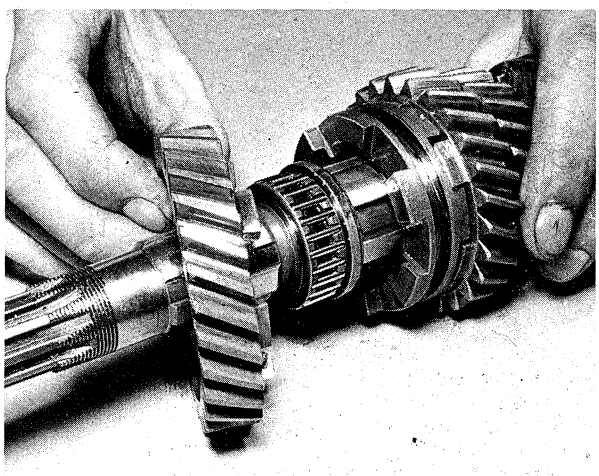
4.3i The 2nd gear pinion and bearing is now free



4.4a Pull the 5th gear pinion off the shaft



4.4b Displace the 'O' ring followed by the ...



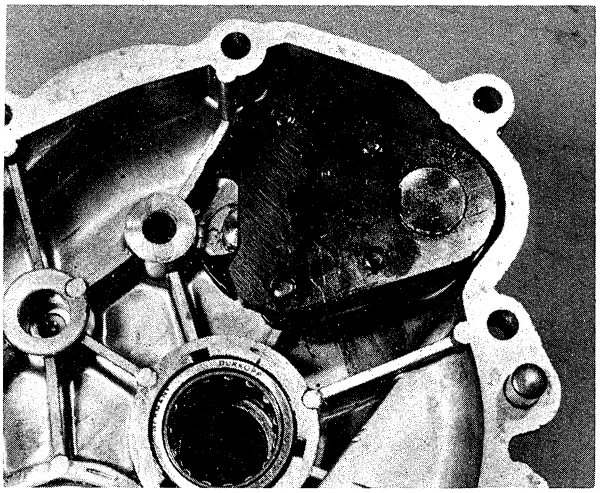
4.4c ... 1st gear pinion and bearing and sliding dog

5 Gearselector mechanism: examination and renovation, 5-speed gearbox only

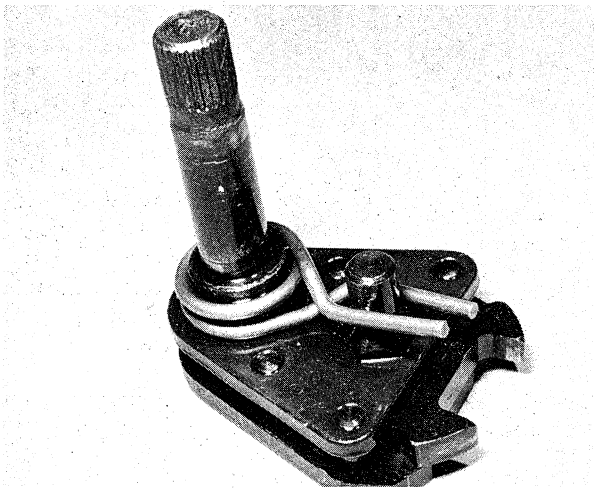
1 The selector forks should be examined closely to ensure that they are not bent or badly worn. The greatest area of wear occurs either side of the fingers which engage with the sliding dogs, and at the pins which locate with the channels in the gear change drum. Check also that the forks are a good sliding fit on the selector rod. Bad gear selection or jumping out of gear can often be traced to the above faults.

2 Check the channels in the change drum for wear. Damage to this component is unlikely unless lubrication failure has occurred. If the change pins in the end of the drum are scored or worn, they may be renewed individually.

3 Ensure that the plunger spring that bears on the change drum has not lost its action and that the pawl end is not excessively worn. Remove the selector pawl assembly from the gearbox end cover and check the condition of the pawl spring and pawl profile. Wear here will be self-evident, as will weakening or fracture of the centraliser spring.



5.1a Push the selector pawl mechanism from end cover



5.1b Check condition of pawls and springs

6 Gearbox bearings and oil seals: examination and renewal, 5-speed gearbox only

1 After washing the gearbox bearings thoroughly in petrol or white spirit, check each bearing for roughness when rotated and for up and down play. The bearings should always be checked when still installed in the cases.

2 The bearings may be removed after heating the case to 150 - 160° (300 - 320°F) in an oven. The input shaft ball bearing and the output shaft ball bearing are secured by retainer plates on the inside of the cases. Each plate is retained by three bolts, each of which has a tab washer. After removal of the plates, the bearings may be drifted out. The remaining bearings are fitted into blind holes in the cases and may therefore be difficult to remove. A special expanding puller should be acquired with which to draw them from place. It will be found that a locking fluid was used on many bearings, during original assembly. This will marginally increase the difficulty of removal. When refitting the bearings, the casings should be heated again to the specified temperature. Apply a small quantity of locking fluid to the outer races before inserting them. Attempt to insert each bearing in one operation as the hot cases will dramatically shorten the rate at which the fluid hardens.

3 It is recommended that new oil seals be fitted to the gearbox as a matter of course, during major dismantling. Failure of a re-used oil seal at a later date will require considerable additional dismantling in order to allow renewal. The oil seals may be prised or drifted out of position. Always refit the oil seals with the spring side facing towards the inside of the gearbox. Use a suitable tubular drift to ensure that the seals are not distorted.

7 Gearbox reassembly - 5-speed gearbox only

1 If the gear pinion assemblies have been removed from the various shafts, they must be refitted prior to replacing the shafts in the cases. Where new components have been installed which may effect the overall length of the complete gear clusters on each shaft, or if gear selection was difficult and has not been traced to worn components, the overall lengths of the shafts must be adjusted on reassembly by means of shims.

2 Assemble the layshaft components by reversing the dismantling procedure and by referring to the relevant photographs. The total distance should be measured between the points shown in Fig. 2.3. When taking this measurement a special bronze washer should be fitted in place of the thrust bearing and the two thrust washers which lie either side. This is to give the correct final bearing running clearance. If the distance is incorrect, place shims between the thrust bearing outer washer and the end washer. Both the special bronze washer and shims are available, especially to carry out the operation.

3 A similar procedure should be adopted when refitting the gear pinion assemblies to the mainshaft. The overall length of the completed assembly, measured between the two points shown in Fig. 2.3 should be 144.7 - 145.2 mm (5.6920 - 5.7150 in). Insert additional shims between the mainshaft 4th gear pinion and the inner face of the roller bearing. When replacing the mainshaft end nut, which secures the roller bearing, apply locking fluid to the threads. If locking fluid is not available, bend in a portion of the nut shoulder so that it engages with the short axial channel in the threaded portion.

4 Place the gearbox casing on the workbench supported on blocks. Insert the complete input shaft through the centre bearing and gently drive it home with a rawhide mallet. Do not omit the 'O' ring and the shim from the shaft. Lubricate the bearings in the casing with clean oil. Assemble the two gear shafts together and insert them into the gearbox simultaneously. If difficulty is encountered in holding the layshaft shims and thrust bearing in position, apply a little heavy grease to each shim and the bearing.

5 Slide the two selector forks into position in the two mainshaft sliding dogs. Install the selector drum, together with the shims, into the casing so that the two forks engage with the channels in the drum. Fit the selector drum rod and the selector fork rod. Push the top of the selector drum over towards the gearbox wall, and replace the layshaft selector fork and sliding dog. Rotate the selector drum until the gears are in the neutral position. In this position the two semi-circular cut-outs in the drum pin plate are in the correct position to accept the gearchange pawls when the cover is refitted.

6 The gearbox end cover and gasket should now be replaced, temporarily and secured by four diagonally placed socket screws, prior to checking correct gear selection. Insert the speedometer drive gear and the small drive ball, and fit and tighten the shouldered nut. Refit the gear change detent plunger, spring and the breather union cam detent housing.

Adjust the gear selector pawl operation by means of the eccentric bolt located immediately adjacent to the splined gear selector shaft. The eccentric bolt should be placed so that when the shaft is moved slightly to right or left it can be felt that the two pawls are an equal distance away from the pins on the change drum, when the splined shaft is at rest. This procedure should be carried out with the gearbox in the neutral position.

7 Attempt to select each gear in turn a number of times, moving up and down throughout the whole range. Rotation of either the input shaft or the output shaft will aid selection. Assuming that all other areas of gearbox assembly are correct, difficult selection may be due to an incorrectly positioned selector drum. If problems are encountered in selecting 1st gear and 3rd gear, shims should be removed or inserted between the end of the selector drum and the gearbox wall. Difficulty in selecting 2nd gear and 4th gear, may be remedied by placing shims between the selector drum and gearbox end cover. Shims are available in 0.6, 0.8, 1.0 and 1.2 mm (0.023, 0.031, 0.039 and 0.047 in) sizes. It is important that a small amount of selector drum endfloat remains after adjustment.

8 When selection is correct, the gearbox end cover should be secured with the total number of screws. Tighten the output shaft nut fully and secure it by bending a portion of the nut shoulder into the shaft groove. Refit the neutral indicator switch, with the curved portion of the brass contact strip away from the drum.

9 Lubricate the clutch pushrod and slide the plastic guide over the the rod. Insert the rod into the gearbox, ensuring that the guide enters the hollow input shaft. Assemble the clutch thrust

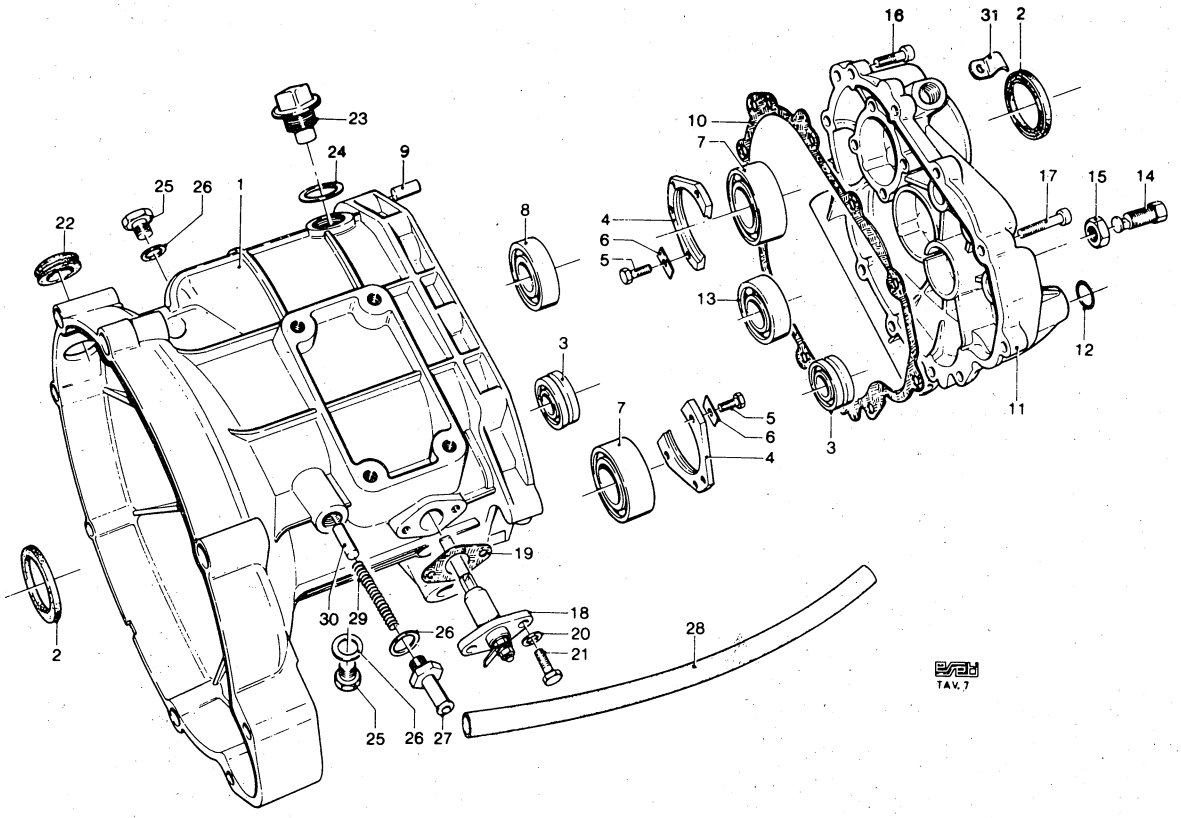
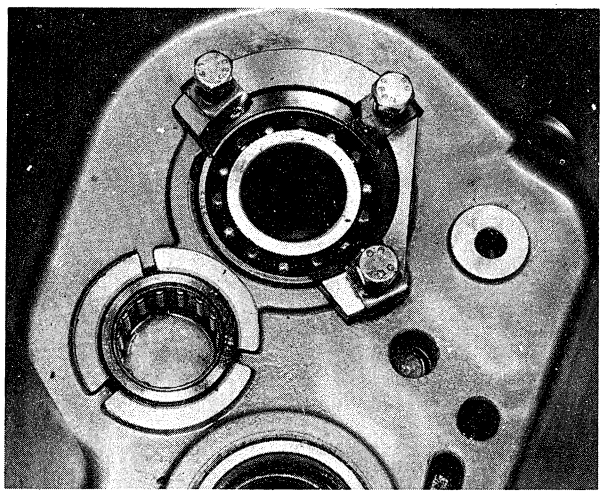
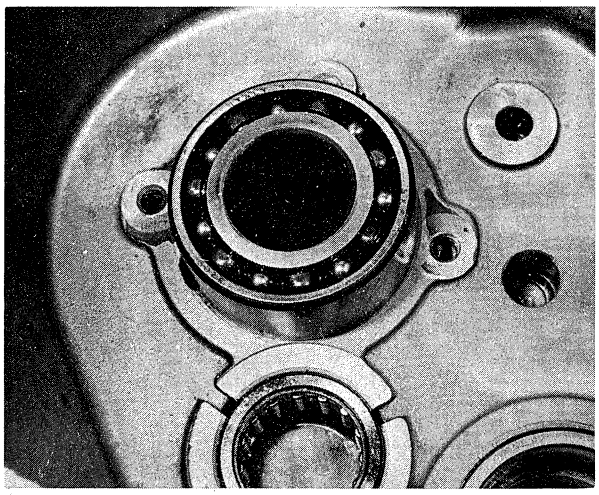


Fig. 2.2. Gearbox casing - component parts - 5 speed models

1 *Gearbox housing*
2 *Oil seal - 2 off*
3 *Journal ball bearing - 2 off*
4 *Bearing retainer plate - 2 off*
5 *Bolt - 6 off*
6 *Tab washer - 6 off*
7 *Journal ball bearing - 2 off*
8 *Journal ball bearing*
9 *Dowel - 2 off*
10 *Gasket*
11 *End cover*
12 *'O' ring*
13 *Journal ball bearing*
14 *Eccentric centraliser screw*
15 *Lock nut*
16 *Socket screw - 10 off*
17 *Socket screw*
18 *Neutral indicator switch*
19 *Gasket*
20 *Washer - 2 off*
21 *Bolt - 2 off*
22 *Inspection plug*
23 *Oil filler plug*
24 *Sealing ring*
25 *Drain plug and level plug*
26 *Sealing washer - 3 off*
27 *Breather/detent housing bolt*
28 *Breather hose*
29 *Detent spring*
30 *Plunger*
31 *Cable clip*



6.2a Input shaft bearing retained by plate

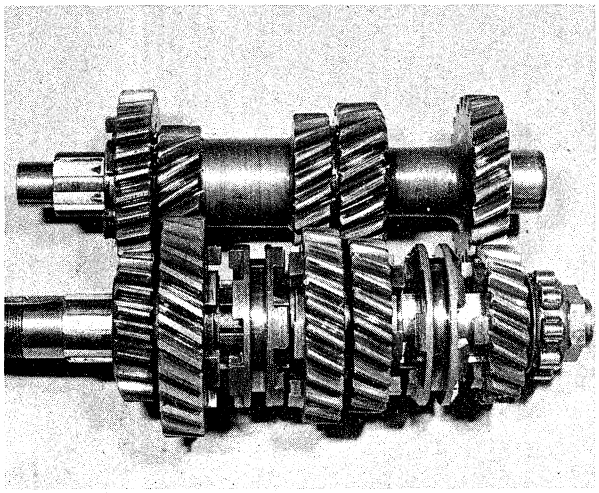


6.2b After heating casing, bearings may be displaced

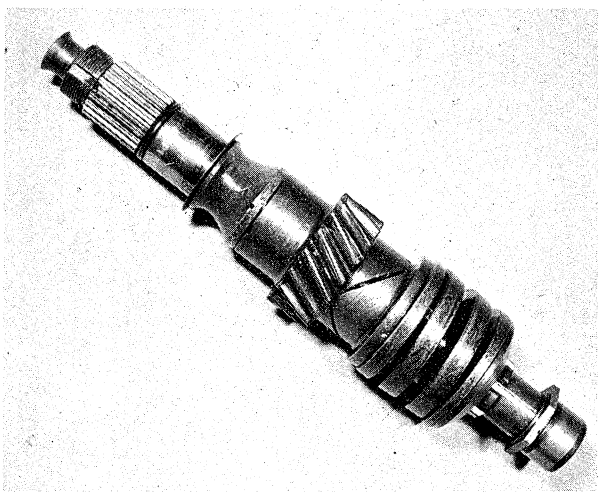
bearing assembly as a unit and position it on the pushrod end. Grease the assembly and push it home into the end cover. Fit the clutch operating arm and return spring, using a new split pin to secure the clevis pin. The clevis pin should be lubricated with graphite grease.

10 Replace the speedometer driveshaft and housing. Retain the small end float shim on the shaft with a dab of grease. This will aid reassembly.

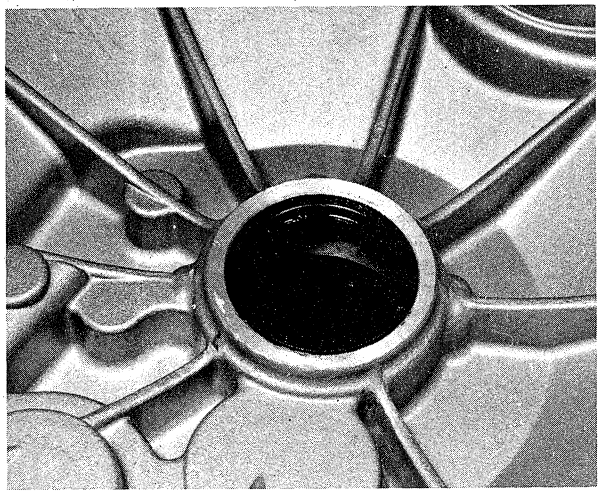
11 The gearbox is now complete with the exception of the splined boss which is fitted to the input shaft. If the clutch was dismantled and has yet to be reassembled, the splined boss should be used to centralise the clutch friction plates prior to the boss being replaced on the shaft. When refitting the boss, lubricate the plain collar portion where it passes through the oil seal. Do not omit to bend up the tab washer to secure the nut, after tightening.



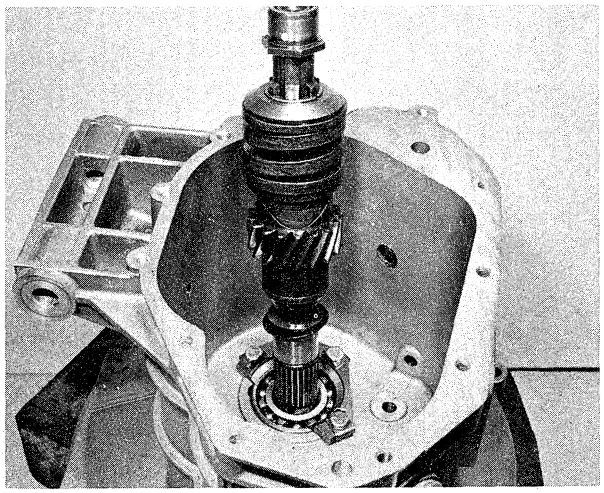
7.1 Mainshaft and layshaft - general view



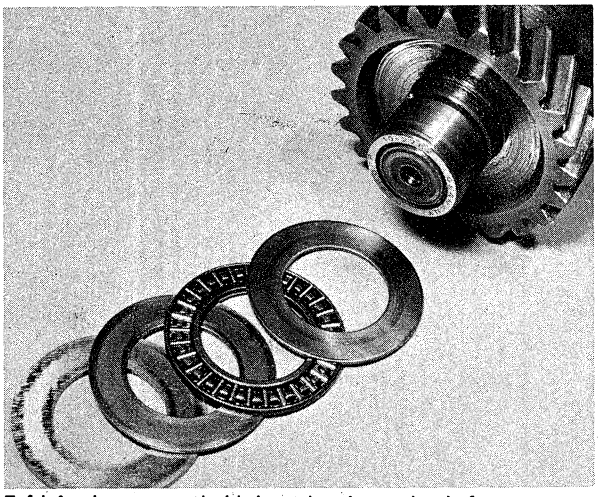
7.4a Place 'O' ring and shim on input shaft



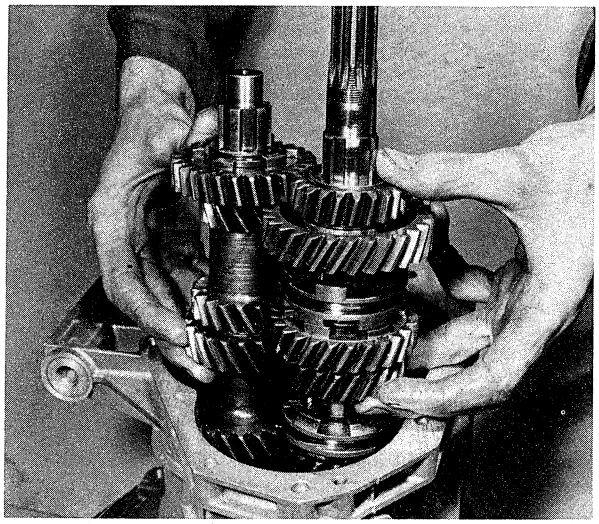
7.4b Lubricate the oil seal lip and ...



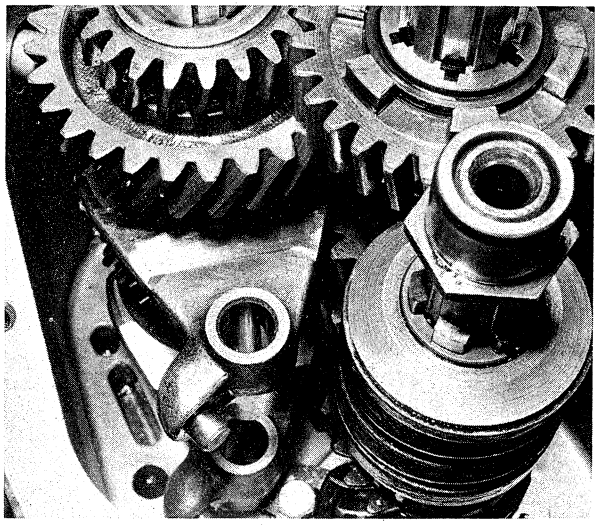
7.4c ... insert the shaft into the casing



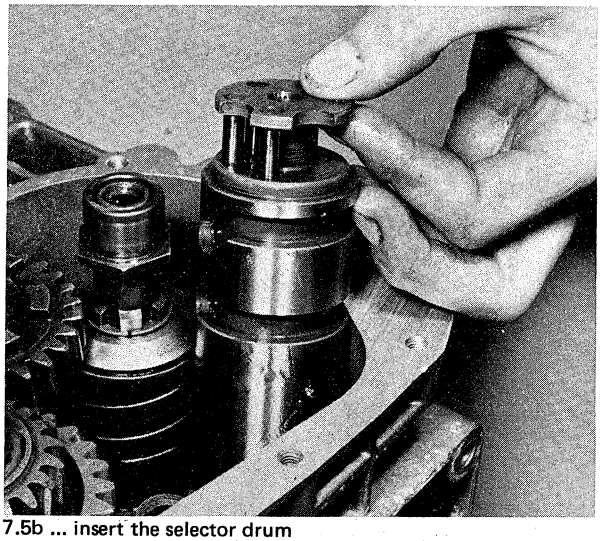
7.4d Apply grease to hold thrust bearing on layshaft



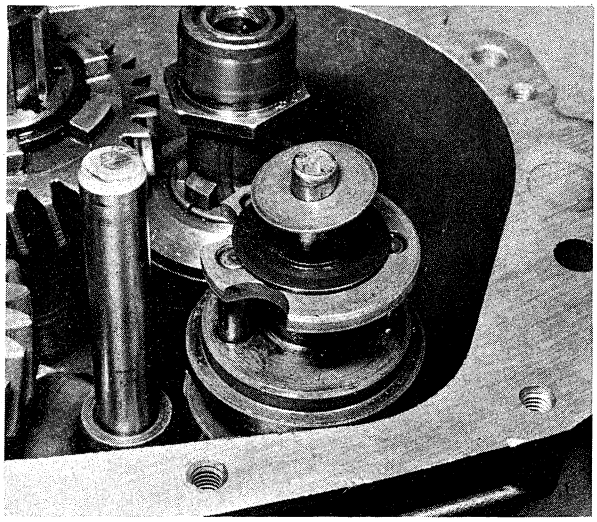
7.4e Insert mainshaft and layshaft simultaneously



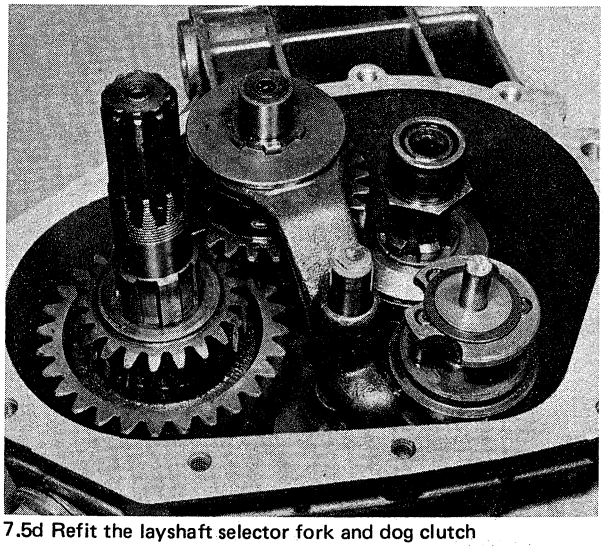
7.5a Fit the two mainshaft selector forks and ...



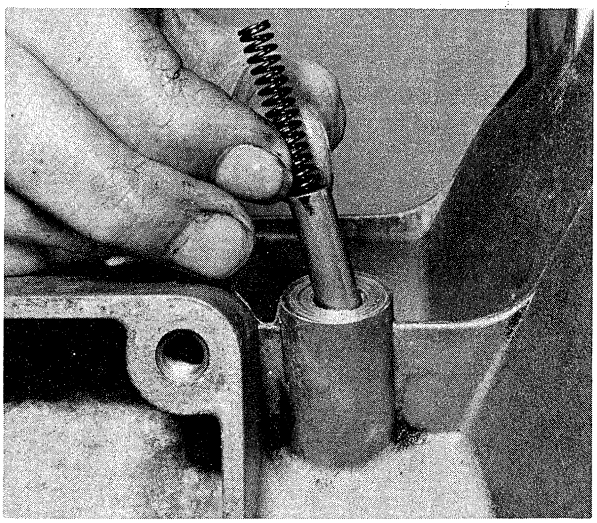
7.5b ... insert the selector drum



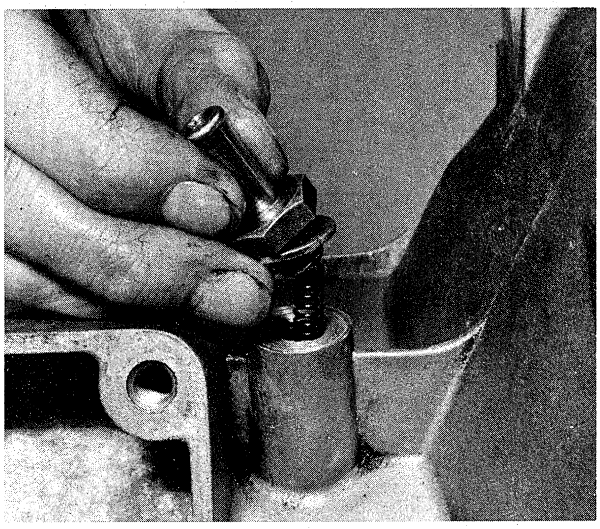
7.5c Replace the fork rod and drum endfloat shims



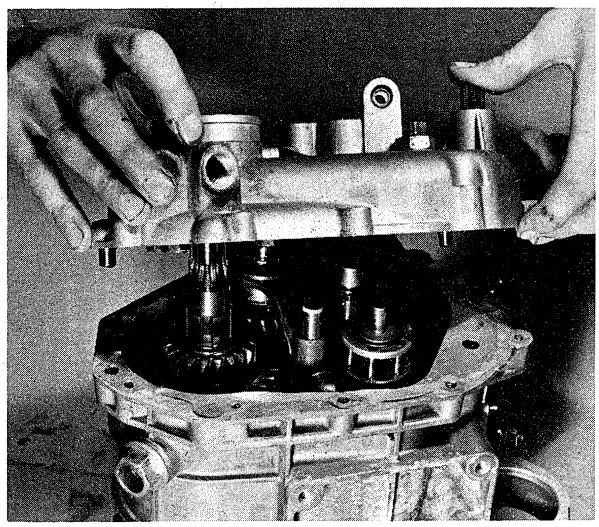
7.5d Refit the layshaft selector fork and dog clutch



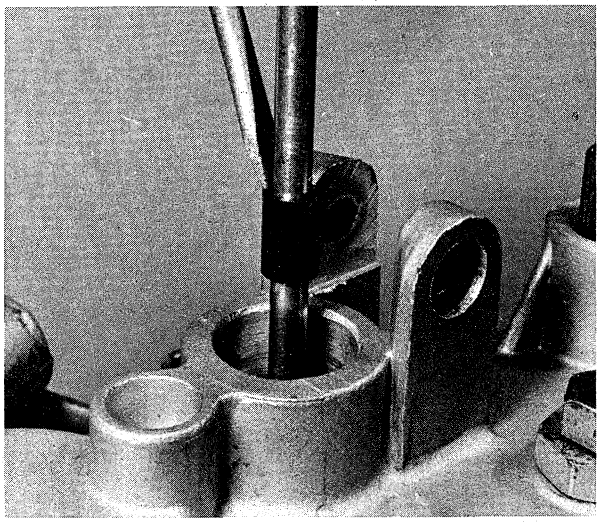
7.6a Insert the detent plunger and spring and ...



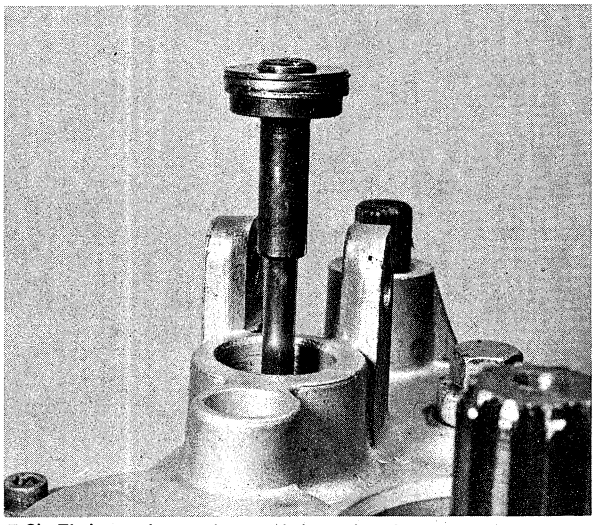
7.6b ... secure them with the breather union



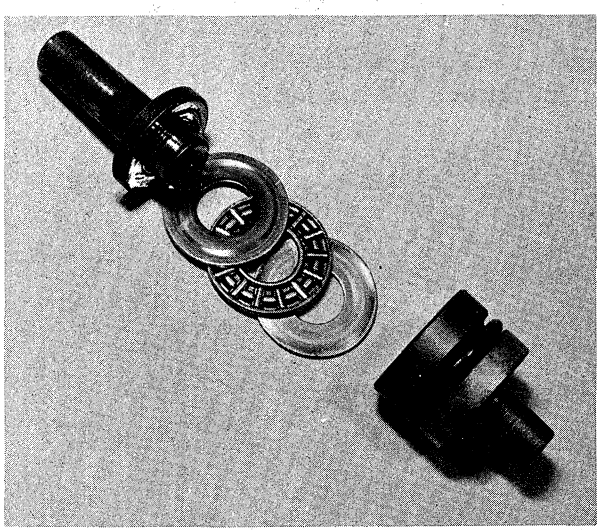
7.8 Fit the endcover and a new gasket



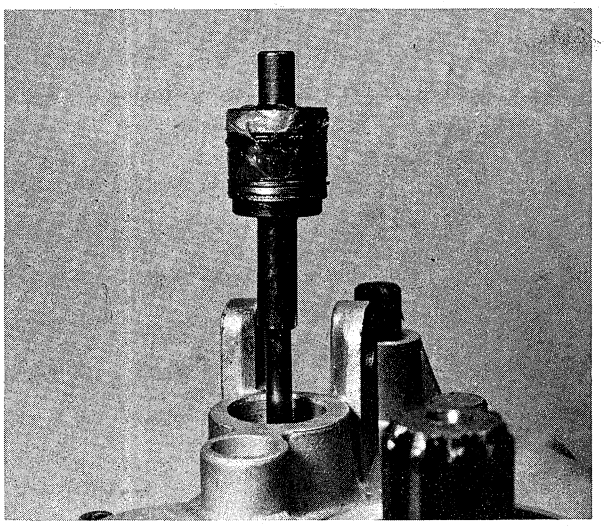
7.9a Use screwdriver to slide pushrod bush into input shaft



7.9b Fit inner thrust piece and thrust bearing



7.9c Pushrod thrust piece components - general view



7.9d Grease completed unit before inserting

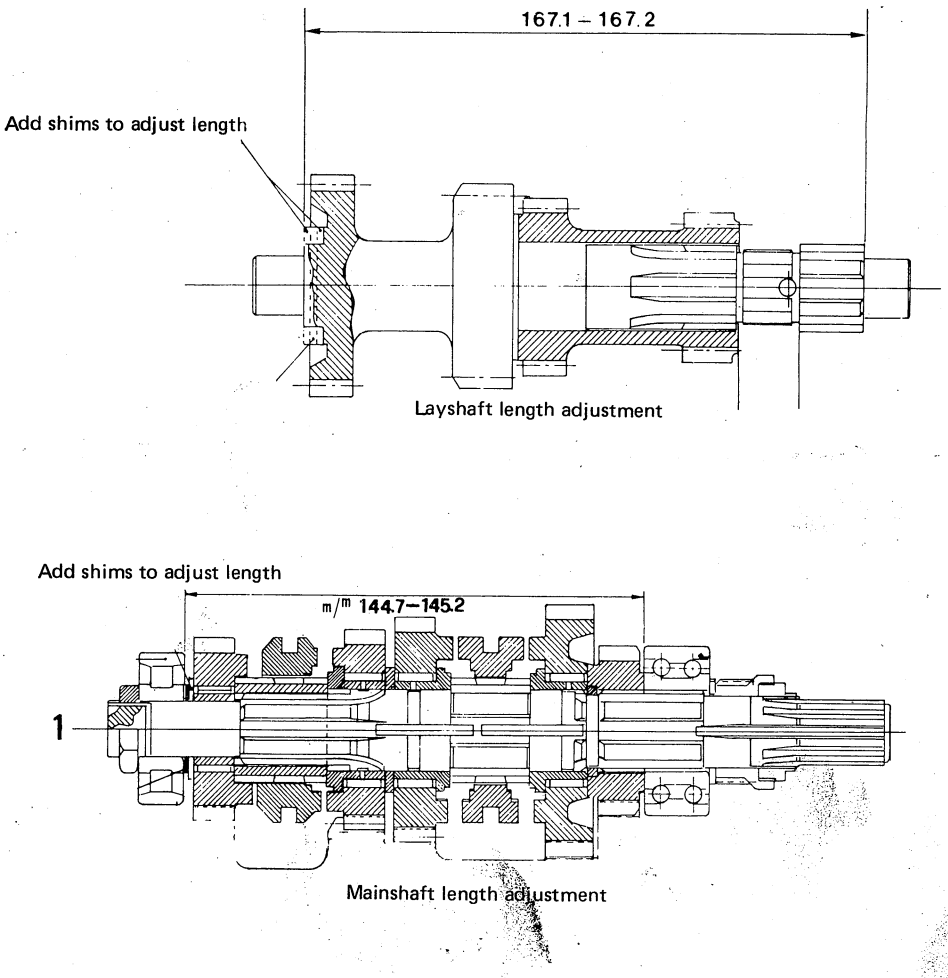


Fig. 2.3. Layshaft adjusted length and mainshaft adjusted length

8 Clutch: removal, examination and replacement, 5-speed gearbox only

1 The clutch components are retained by eight bolts passing through the periphery of the starter ring gear into the flywheel face. Unscrew the eight bolts and lift off the starter ring gear. Remove the following components consecutively; outer friction plate, intermediate plate, inner friction plate, clutch thrust piece, spring back plate and eight clutch springs. Because the complete assembly is under pressure from the clutch springs, the eight bolts must be unscrewed evenly about one turn at a time, so that the spring pressure is released in a controlled and even manner. Note that the spring back plate has an index mark which should be in line with the TDC mark on the flywheel. Alignment of these two marks ensures the clutch springs will enter the recesses in the back plate inner face.

2 After an extended period of service, the two friction plates, will wear, which may cause slip and in extreme cases, clutch snatch. If slippage is allowed to continue, damage may occur to the spring back plate and starter ring gear faces, due to overheating. Check the width of each friction plate, using a vernier gauge or micrometer. When new, the friction plates measure 8.0 mm (0.3149 in). If either plate has worn by more than 0.5 mm (0.020 in) both plates should be renewed. The friction plates fitted to the 850 Le Mans models are of a heavier material than that utilised for all other models. These plates have a longer expected life and can be fitted as replacements to any 5-speed model.

3 Inspect the intermediate plate for signs of blueing (over-

heating) or scoring on the faces. Using a straight edge, check for warpage of the plate, which will cause clutch drag and noisy gearchanges.

4 The uncompressed or free length of the clutch springs should be checked against that of a new component. If any spring has taken a marked set, the springs should be renewed as a set and not individually.

5 If the faces of the starter ring gear and spring back plate have become scored, these must be renewed. Check the condition of the internal and external teeth on the plates and the teeth on the flywheel and splined gearbox input shaft boss. Excessive wear on these will induce a heavy clutch action and slow disengagement.

6 The clutch release mechanism, which is housed in the gearbox end cover, is unlikely to give trouble unless lubrication failure has caused damage to the thrust bearing. The clutch pushrod should be checked for straightness by rolling it on a flat surface. A bent rod will cause heavy clutch action and must be renewed.

7 Replacement of the clutch is straightforward, the procedure being essentially a reversal of the dismantling operation. Install each of the eight clutch springs in the recesses in the flywheel face. Apply a small amount of heavy graphite grease to the internal splines in the flywheel. Apply the grease sparingly, to prevent any finding its way onto the clutch plates. Insert the clutch spring plate into position so that the index mark on the plate aligns with the TDC mark on the flywheel. This will aid alignment of the springs with the recesses in the rear of the spring plate.

8 Replace the two friction plates and the intermediate plate, followed by the starter ring gear. Insert and start the eight bolts, but do not tighten them at this stage. Because the two friction plates are fully floating when not under spring pressure, they must be centralised before tightening down the starter ring gear, to enable easy entry of the splined boss of the gearbox input shaft. A special tool is recommended with which to accomplish this task. If this tool is not available, the splined boss may be removed from the gearbox input shaft and used as the centraliser. When using the latter method, first insert the clutch thrust piece to aid centralisation of the boss.

9 With the tool in place, tighten down the eight bolts evenly, about one turn at a time against the spring pressure. The centralising tool should be an easy sliding fit if the plates are positioned correctly. Remove the tool and insert the clutch thrust piece if this has not been done already.

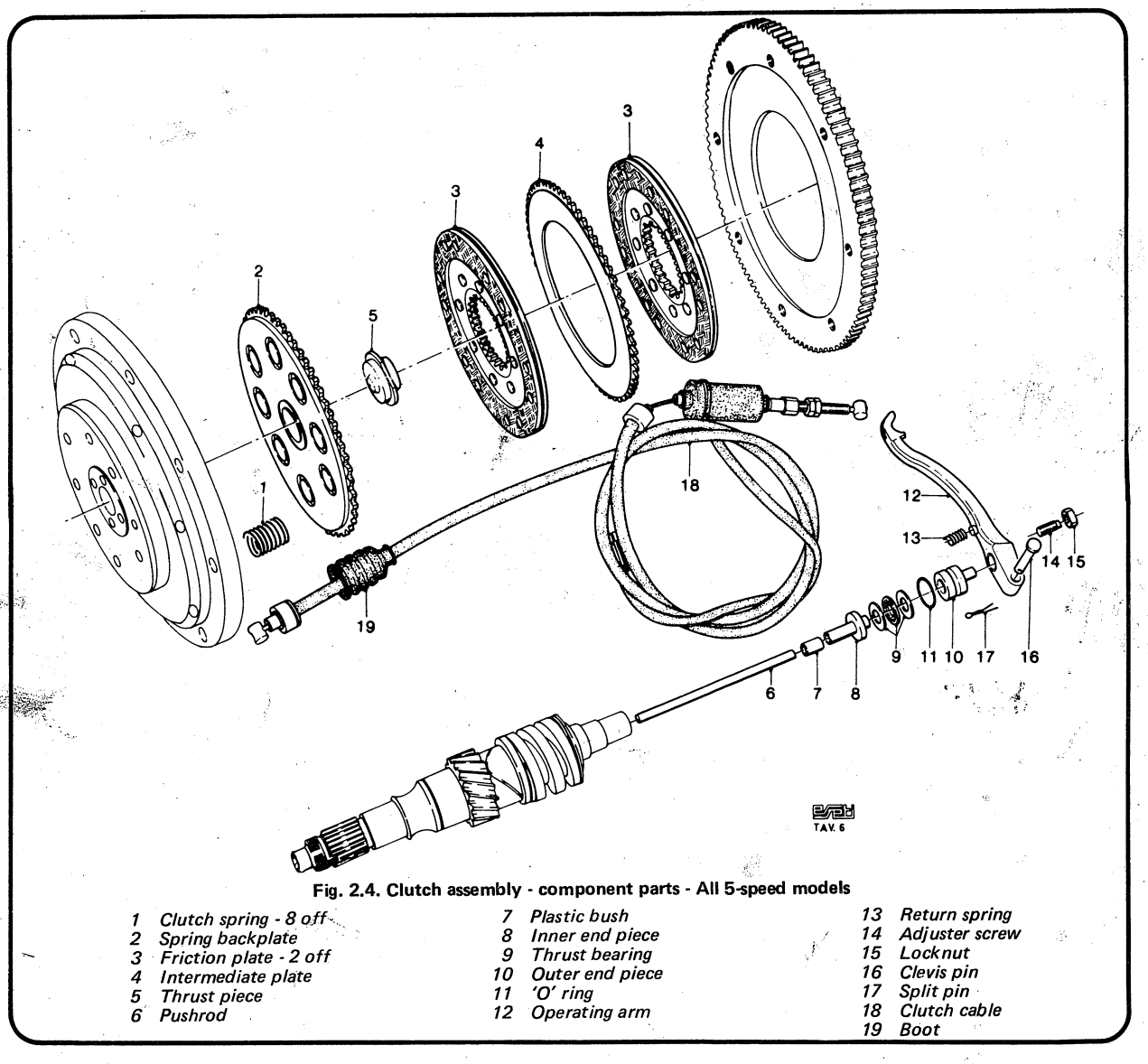
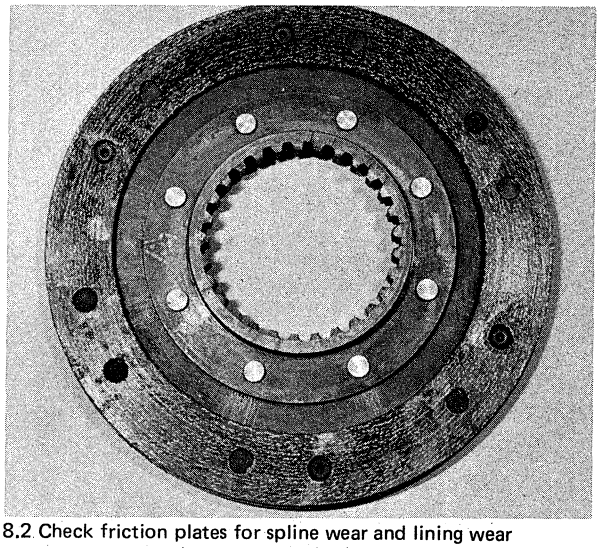
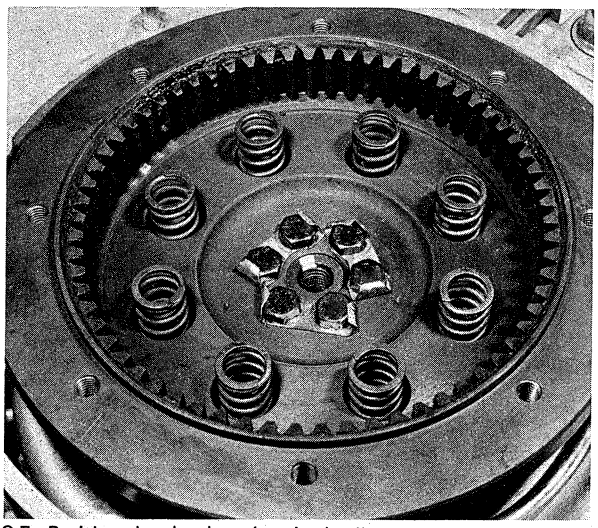


Fig. 2.4. Clutch assembly - component parts - All 5-speed models

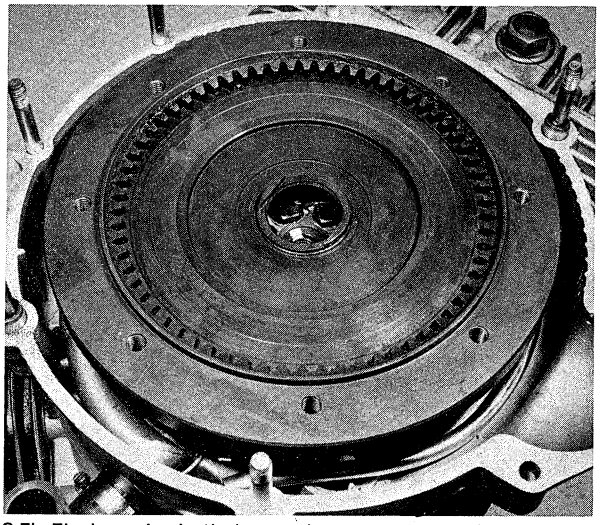
1 *Clutch spring - 8 off*
2 *Spring backplate*
3 *Friction plate - 2 off*
4 *Intermediate plate*
5 *Thrust piece*
6 *Pushrod*
7 *Plastic bush*
8 *Inner end piece*
9 *Thrust bearing*
10 *Outer end piece*
11 *'O' ring*
12 *Operating arm*
13 *Return spring*
14 *Adjuster screw*
15 *Locknut*
16 *Clevis pin*
17 *Split pin*
18 *Clutch cable*
19 *Boot*



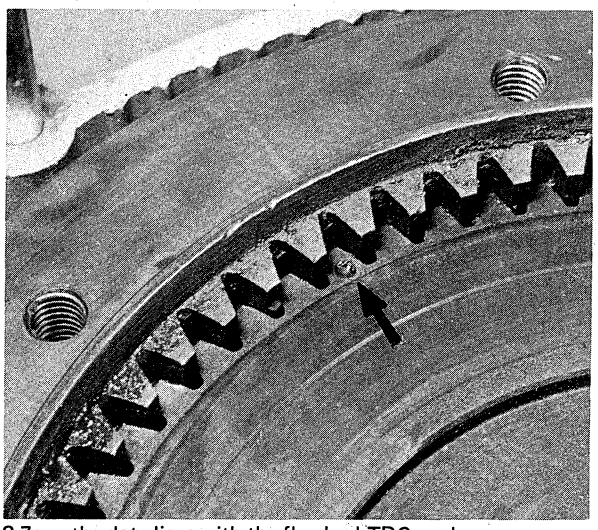
8.2 Check friction plates for spline wear and lining wear



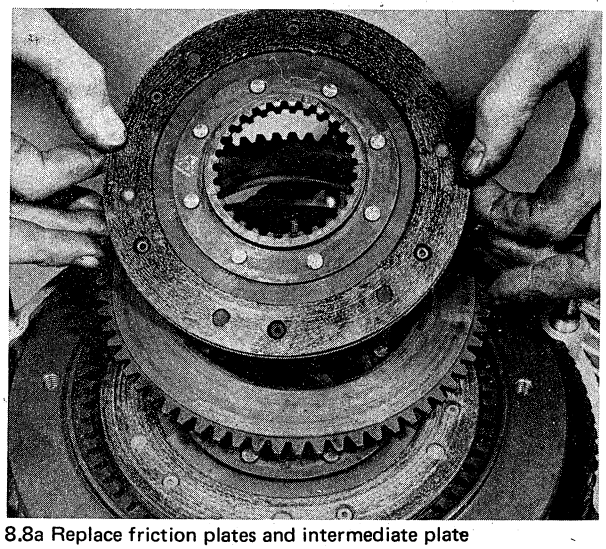
8.7a Position the clutch springs in the flywheel



8.7b Fit the spring backplate so that ...

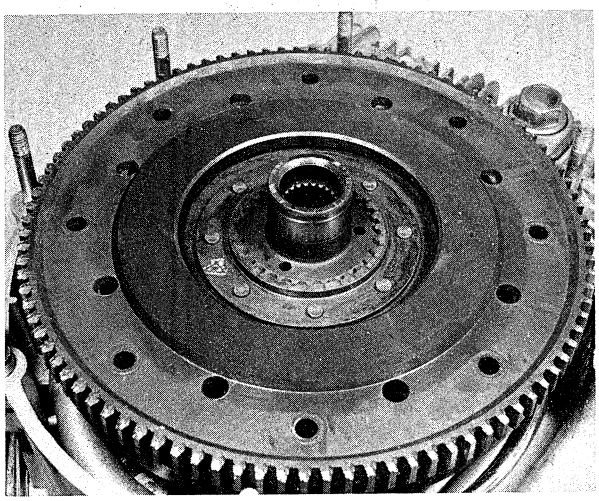


8.7c ... the dot aligns with the flywheel TDC mark



8.8a Replace friction plates and intermediate plate

8.8b Insert the clutch thrust piece



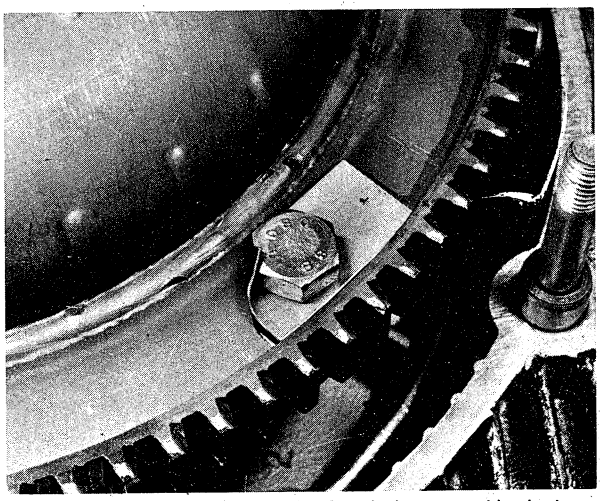
8.8c Use gearbox input boss to centralise the plates

9 Torque converter: principle of operation, V-1000 Convert model only

The torque converter consists of three fans running in an oil filled torroidal or doughnut shaped container bolted to the engine flywheel. The first fan, the turbine, is fixed to the crankshaft, the second fan - the pump - to the gearbox input shaft. As the engine is run at increasingly higher speed, the oil is forced out of the vanes of the turbine into those of the pump, and so drive is transmitted. The third fan, or stator, is free running in one direction and directs the oil across from the pump to the turbine. Except at the 'lock-up' point, when the relative speeds of the drive and driven components are almost the same, large amounts of heat are produced in the torque converter due to frictional losses. To prevent the fluid boiling, a cooling system is incorporated. It comprises an externally - mounted oil cooler, fed by an engine driven pump, through which the fluid from the converter is passed before being returned to the reservoir which feeds the torque converter.

10 Torque converter: removal, examination and replacement, V-1000 convert model only

1 The torque converter will only require removal if the engine flywheel is to be removed or if the converter itself requires renewal. Examination of the torque converter may be made with the unit in situ.
2 Check that the outer surface of the central boss is not scored and that a radial groove has not been worn in the metal by the oil seal lip. An imperfect boss will promote seepage of the hydraulic fluid.
3 Inspect the two internal needle roller bearings for damaged rollers. Slide the clutch input shaft into position in the converter and check for up and down play. Wear of the bearings is unlikely to occur until a substantial mileage has been covered. Check also that the tracks on the clutch input shaft where the bearings resolve are not worn or scuffed.
4 The torque converter is a sealed unit and therefore if any component fails the complete assembly must be renewed.
5 The torque converter is retained by four bolts which pass through the starter ring gear and into the periphery of the flywheel. Remove the bolts after bending down the ears of the locking plates.
6 It is recommended that on removal of the gearbox a cover be placed over the aperture in the torque converter to prevent the ingress of foreign matter.
7 To replace the torque converter on the engine, position the starter ring gear and the torque converter on the flywheel and insert and tighten the bolt lightly. It is essential that the boss of the torque converter into which the gearbox input shaft fits, runs absolutely concentrically. If this precaution is not taken difficulty may be encountered when trying to fit the gearbox to the engine. Additionally, oil leakage will occur at the oil seal. To check for correct rotation a dial gauge or index gauge should be mounted on a bracket retained on one of the gearbox mounting studs. If eccentricity is apparent, remove the four retaining bolts and move the torque converter one quarter of a turn until the bolt holes again line up. Refit the bolts and check again. The maximum permissible run out measured on the outer surface of the boss is 0.05 - 0.06 mm (0.0019 - 0.0023 in).
8 When the torque converter is running true, tighten the bolts and secure them by means of the locking tabs.



10.4 Torque converter retained by four bolts secured by lock-plates

11 Clutch: removal, examination and reassembly, V-1000 Convert model only

1 To gain access to the clutch the gearbox bell housing must be detached from the gearbox together with the clutch input shaft and the torque converter static shaft. Detach the pipe from the base of the bellhousing by unscrewing the banjo bolt from the union. Loosen and remove the six bolts which pass from the bellhousing into the gearbox. Using a rawhide mallet separate the two components which are located by two dowels in the mating surfaces.
2 Rotate the clutch centre boss, and by passing a spanner through one of the holes in the boss remove each of the six flange plate retaining bolts. Pull the centre boss from position complete with the integral shaft. The ball bearing and flange may be removed from the shaft after detaching the 'O' ring and circlip.
3 The clutch plates are secured in the clutch outer drum by a large internal circlip. Because the clutch plates are under pressure from the clutch springs the circlip cannot be removed until the pressure has been released. If an attempt is made to prise the circlip from position without releasing pressure, when freed the clutch plates will spring out causing damage to the components and also the operator.
4 To release the pressure on the clutch plates, release the lock-nut on the end of the clutch operating pull rod and tighten the adjuster down. In doing this the spring back plate will be drawn against the clutch springs. When it can be seen that the clutch plates are no longer under pressure, prise the circlip from place using a screwdriver, and remove the clutch plates one at a time, noting their relative positions for easy reassembly. Slacken off

the adjuster and remove it and the locknut from the clutch pullrod. Withdraw the rod and the ball bearing from the spring back plate.

5 Lift the spring back plate from the clutch outer drum and remove the clutch springs. Note the shims, one of which lies between each spring and the back plate recess. The clutch outer drum is retained on the splined gearbox input shaft by a shouldered nut. The nut is secured by a portion of the shoulder being bent into the axial groove in the shaft. To prevent the input shaft rotating when loosening the nut, refit temporarily the final driveshaft, and place the shaft in the soft jaws of a vice. Care should be taken not to damage the shaft by overtightening. Place the gearbox in high gear and loosen the nut after bending the shoulder away from the shaft groove. After removal of the nut the clutch outer drum may be pulled off the shaft.

6 Commence clutch inspection by checking the friction plates. After an extended period of service, the clutch linings will wear and promote clutch slip. The limit of wear measured across each plate is 2.65 mm (0.104 in). When the overall width of the linings reach this level, the clutch plates must be replaced as a complete set.

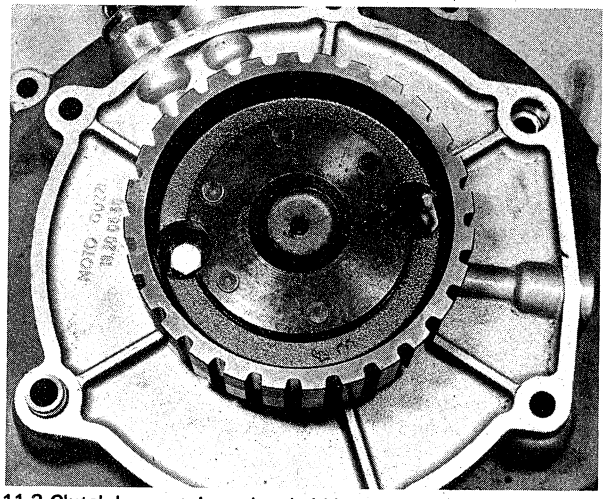
7 The plain clutch plates should not show any evidence of excess heating (blueing) and should not be more than 0.05 mm (0.002 in) out of true.

8 The clutch springs should have a free (uncompressed) length of 28.00 mm (1.102 in). If the springs have taken a set of 1mm (0.040 in) or more, the complete set must be renewed.

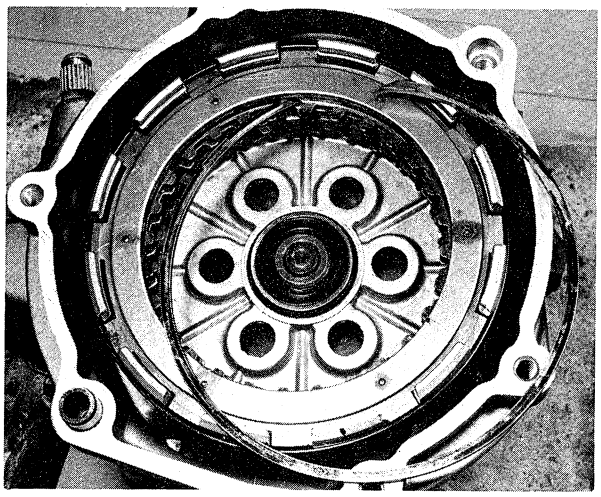
9 Check the condition of the slots in the outer surface of the clutch centre and the inner surfaces of the outer drum. In an extreme case, clutch chatter may have caused the tongues of the inserted plates to make indentions in the slots of the outer drum, or the tongues of the plain plates to indent the slots of the clutch centre. These indentations will trap the clutch plates as they are freed and impair clutch action. If the damage is only slight the indentations can be removed by careful work with a file and the burrs removed from the tongues of the clutch plates in similar fashion. More extensive damage will necessitate renewal of the parts concerned.

10 Check the clutch disengagement bearing for wear or roughness of rotation. Inspect the pullrod anchor bush, which is a drive fit in the bearing, for looseness and for wear on the surface which engages with the pullrod head. Check also the pullrod for similar wear and for straightness.

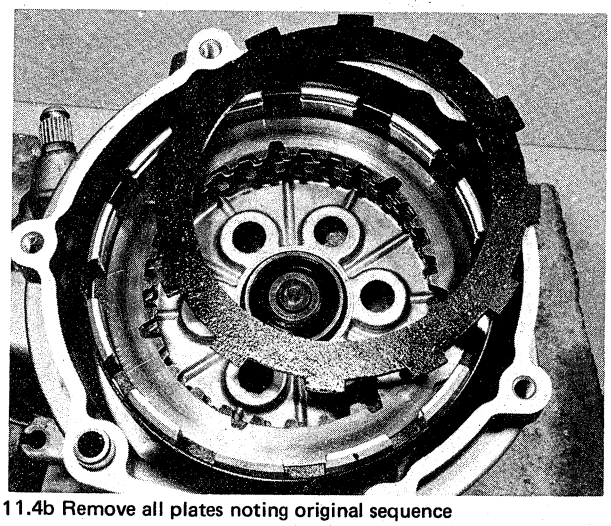
11 The clutch may be reassembled by reversing the dismantling procedure. When inserting the clutch plates commence by refitting a friction plate followed by a plain plate and so on. Fit the double thickness plain plate last and then replace the circlip. Ensure that the circlip is fully home in its seating groove before releasing the pullrod. When the clutch plates are still free, and the springs are still compressed align the internal tongues of the plain plates, using a straight edge, so that the clutch boss may enter the clutch easily on reassembly.



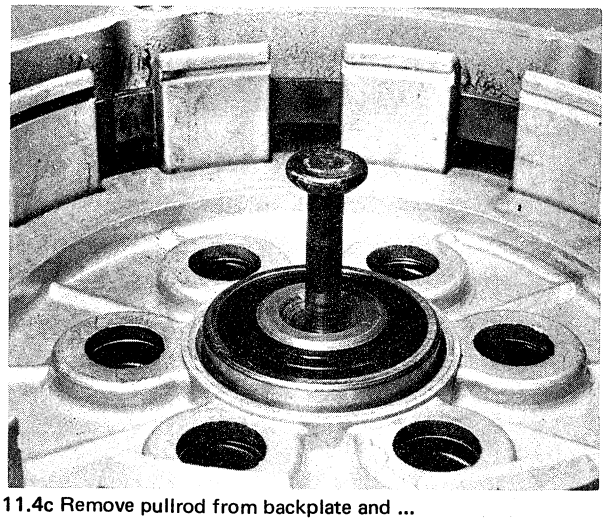
11.2 Clutch boss retainer plate held by six obscured bolts



11.4a Screw down adjusting nut before releasing circlip



11.4b Remove all plates noting original sequence



11.4c Remove pullrod from backplate and ...

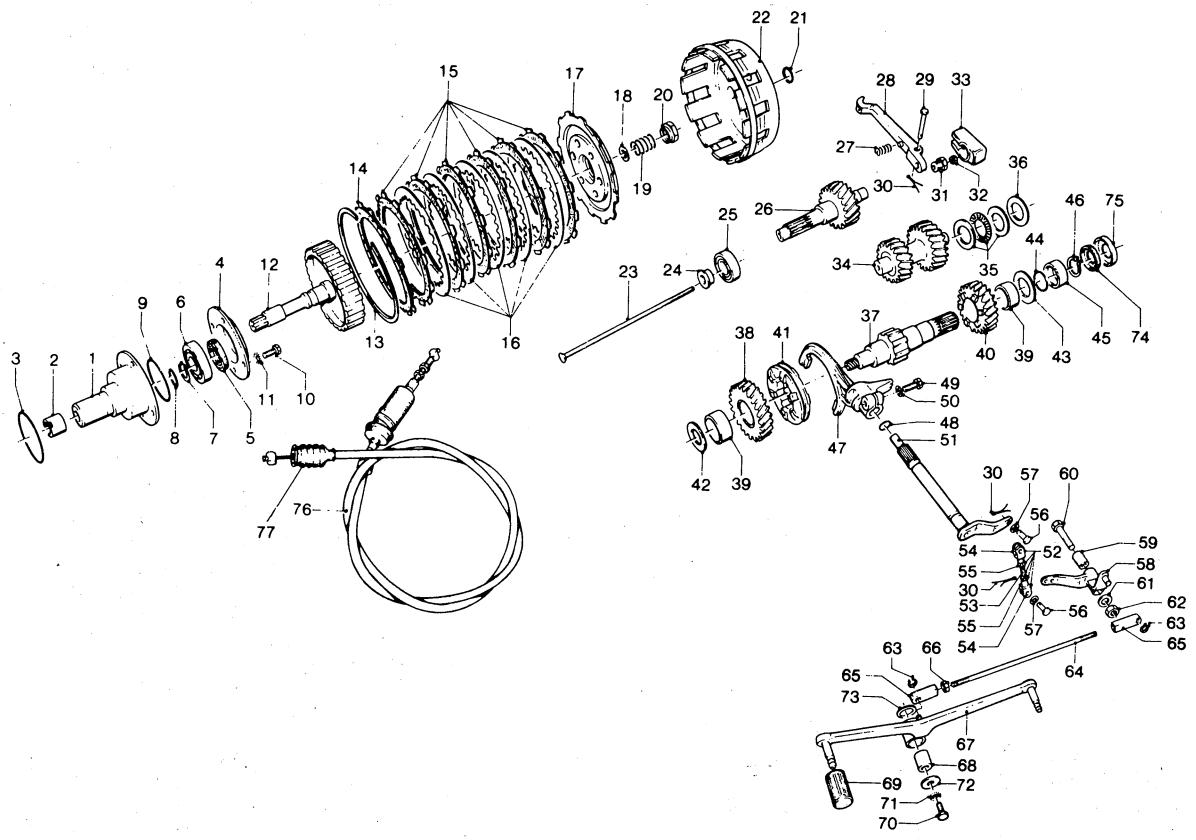
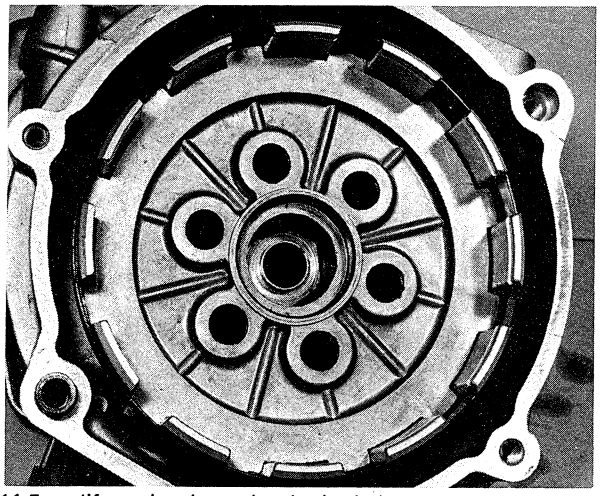
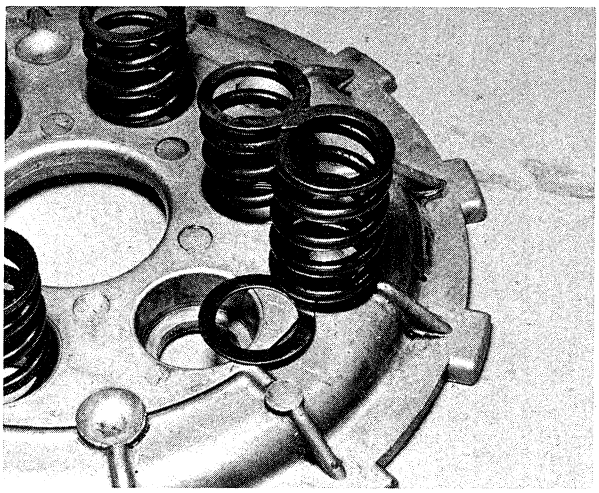


Fig. 2.5. Gearbox and clutch components - V-1000 model

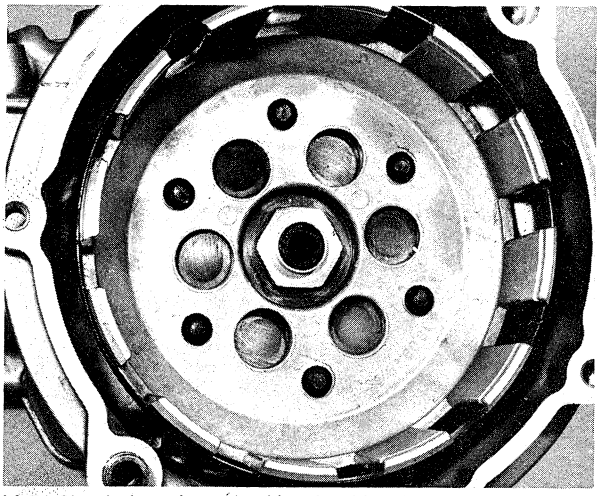
1 *Torque converter static shaft*
2 *Bush*
3 *'O' ring*
4 *Flange plate*
5 *Oil seal*
6 *Journal ball bearing*
7 *Circlip*
8 *'O' ring*
9 *'O' ring*
10 *Bolt - 5 off*
11 *Star washer - 5 off*
12 *Clutch input shaft*
13 *Circlip*
14 *Outer plate*
15 *Friction plate - 6 off*
16 *Plain plate - 5 off*
17 *Pressure plate*
18 *Shim - 6 off*
19 *Spring - 6 off*
20 *Nut*
21 *'O' ring*
22 *Clutch outer drum*
23 *Pull rod*
24 *Pull piece*
25 *Journal ball bearing*
26 *Gearbox input shaft*
27 *Return spring*
28 *Clutch operating arm*
29 *Pivot pin*
30 *Split pin*
31 *Adjuster nut*
32 *Locknut*
33 *Rubber boot*
34 *Layshaft*
35 *Thrust bearing*
36 *Thrust washer*
37 *Mainshaft*
38 *Low speed gear pinion*
39 *Bush*
40 *High speed gear pinion*
41 *Sliding dog clutch*
42 *Shim*
43 *Shim*
44 *'O' ring*
45 *Spacer*
46 *Circlip*
47 *Gear selector fork*
48 *'O' ring*
49 *Pinch bolt*
50 *Star washer*
51 *Selector shaft*
52 *Vertical link rod - complete*
53 *Link rod*
54 *Clevis fork - 2 off*
55 *Locknut - 2 off*
56 *Clevis pin - 2 off*
57 *Washer - 2 off*
58 *Intermediate arm*
59 *Bush*
60 *Bolt*
61 *Washer*
62 *Nut*
63 *Circlip*
64 *Horizontal link rod*
65 *Joint bar - 2 off*
66 *Lock nut*
67 *Gearchange lever*
68 *Bush*
69 *Rubber*
70 *Bolt*
71 *Star washer*
72 *Washer*
73 *Shim*
74 *Rubber shroud*
75 *Shroud*
76 *Clutch cable*
77 *Rubber boot*



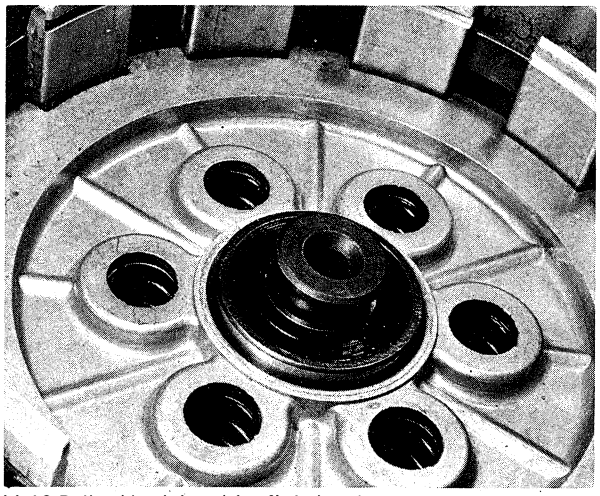
11.5a ... lift out bearing and spring backplate



11.5b Note the shims between plate and springs



11.5c Clutch drum is retained by shouldered nut



11.10 Pullrod bush is a drive fit in bearing

12 Gearbox: dismantling, examination and reassembly, V-1000 Convert model only

1 After removal of the clutch, the gearbox is ready for dismantling. Remove the clutch operating arm by detaching the clevis pin which is secured by a split pin. Unscrew the upper chrome bolt from the gearbox end cover and invert the gearbox so that the detent spring and plunger fall out. Prise the shroud and rubber spacer from the casing boss concentric with the output shaft.

2 Remove the gearbox end cover screws and using a rawhide mallet, separate the cover from the main casing. Note and remove the thrust washers, shims and thrust bearing on the end of the layshaft. Drift the input shaft from position in the bearing using a rawhide mallet. Remove the circlip and spacer from the output shaft and draw off the bearing; this will allow the high speed gear pinion and spacer to be withdrawn.

3 Pull the layshaft from position. Loosen the selector fork pinch bolt and pull the selector shaft from the fork. Grasp the end of the output shaft and pull the unit from position complete with the selector fork. Separate the selector fork and sliding dog from the upper end of the output shaft, and the shim and low-speed gear pinion from the lower end.

4 If required, the speedometer driveshaft may be removed by unscrewing the housing from the outside of the gearbox casing.

5 Examine the gear pinions to check that there are no broken or chipped teeth, and that the selector dogs on the gear faces are not rounded. Repairs to damage of this nature are not practicable, and as such the components in question must be renewed. All the free-running gear pinions are supported on plain bushes. If wear is evident in the form of scoring or scuffing, the bushes must be renewed. Check also that the shafts and pinions with which the bushes work are not damaged.

6 Inspect the selector fork for wear of the fingers, and for wear of the channel in the sliding dog clutch with which the fingers locate. Excessive clearance between the two components will induce less positive gear selection. Check also the projection on the fork which locates with the spring loaded detent plunger. The selector fork, together with the sliding dog clutch, was modified from gearbox No. G01001 onwards so that the finger ends locating with the sliding dog clutch can be renewed independently from the main fork. The modified components may be refitted in place of earlier components.

7 Refer to Section 7 of this Chapter for comments on bearing and oil seal inspection and removal.

8 Reassemble the gearbox by reversing the dismantling procedure. The shim fitted on the output shaft between the low

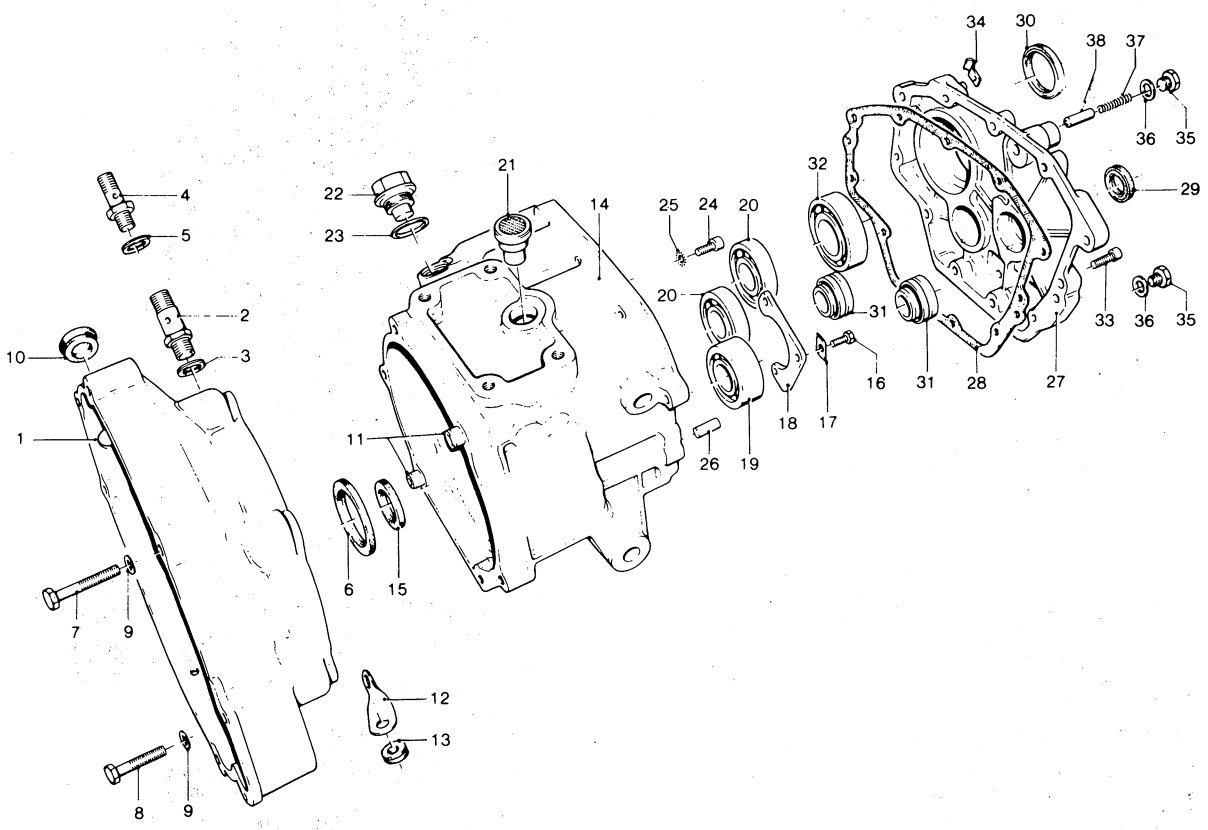


Fig. 2.6. Gearbox casing - V-1000 models

1 *Bellhousing*
2 *Fluid union*
3 *Sealing washer*
4 *Fluid union*
5 *Sealing washer*
6 *Oil seal*
7 *Bolt - 2 off*
8 *Bolt - 4 off*
9 *Plain washer - 6 off*
10 *Inspection plug*
11 *Dowel - 2 off*
12 *Cable guide*
13 *Grommet*
14 *Clutch/gearbox housing*
15 *Oil seal*
16 *Bolt - 3 off*
17 *Tab washer - 3 off*
18 *Bearing retainer plate*
19 *Journal ball bearing*
20 *Journal ball bearing*
21 *Breather plug*
22 *Oil filler cap*
23 *Sealing washer*
24 *Socket screw*
25 *Star washer*
26 *Dowel - 2 off*
27 *End cover*
28 *Gasket*
29 *Oil seal*
30 *Oil seal*
31 *Needle roller bearing - 2 off*
32 *Journal ball bearing*
33 *Socket screw - 11 off*
34 *Lead clip*
35 *Plug - 2 off*
36 *Sealing ring - 2 off*
37 *Detent spring*
38 *Detent plunger*

speed gear and the gearbox wall should be replaced with the chamfered edge facing the gear. The layshaft endfloat when in place should be 0.15 - 0.20 mm (0.005 - 0.007 in). Remove or add shims between the gearbox end cover and the needle thrust bearing outer washer to arrive at the correct clearance. The selector rod should be fitted into the selector fork so that the arm is in exact alignment with the plunger locating projection on the fork.

13 Gearbox: refitting to engine and adjusting the clutch, all models

1 Provided that the clutch plates have been aligned correctly, refitting of the gearbox onto the engine is straightforward. On 5-speed models if difficulty is encountered when inserting the splined boss into the clutch centre, a long handled screwdriver may be inserted between the two mating faces with which to rotate the flywheel.

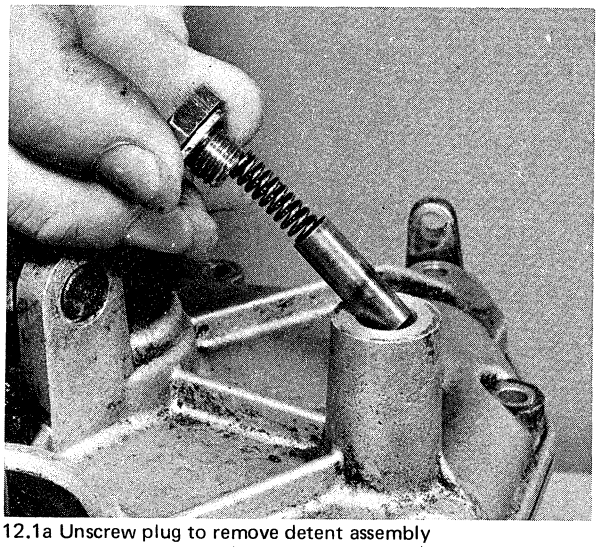
2 On automatic models, the gearbox must be refitted to the bellhousing and secured by means of the six bolts. Before replacing the completed assembly, lubricate the outer surface of the torque converter central boss so that it enters the oil seal in the bellhousing easily. Ensure that the bronze bush on the clutch shaft is fitted with the cut-aways outwards.

3 The adjustment of the clutch operating mechanism on all models should be made with the engine/gearbox unit in the frame and the clutch cable connected. On 5-speed models, loosen the locknut on the clutch operating arm and by means of the adjuster screw, set the arm so that at the point of clutch disengagement when the clutch lever is operated, the arm is at about 90° to the pushrod. This will give the greatest leverage and hence the most sensitive control of the clutch. Tighten the locknut and then adjust the cable at the handlebar lever adjuster so that there is 4 mm (1/8 in) movement at the ball end of the lever before clutch disengagement commences.

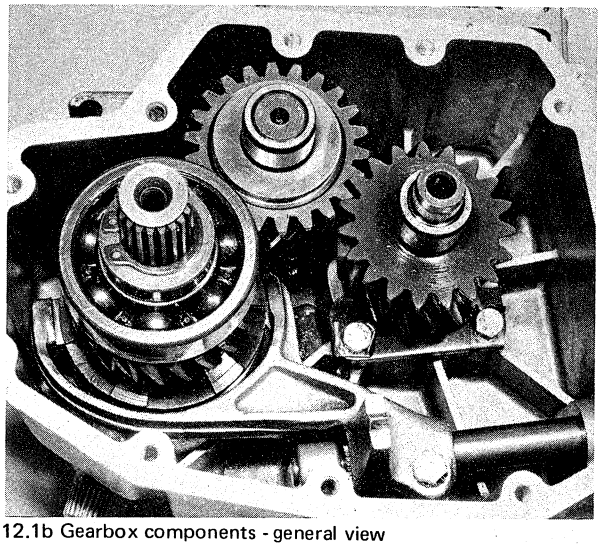
4 On V-1000 models, loosen the locknut on the adjuster and screw the adjuster in or out until the distance between the inner face (rear) of the cable abutment lug on the gearbox and the curved portion of the operating arm against which the cable nipple seats is as follows:

30 mm	*On a used machine*
33 mm	*On a new machine or when new clutch plates have been installed*

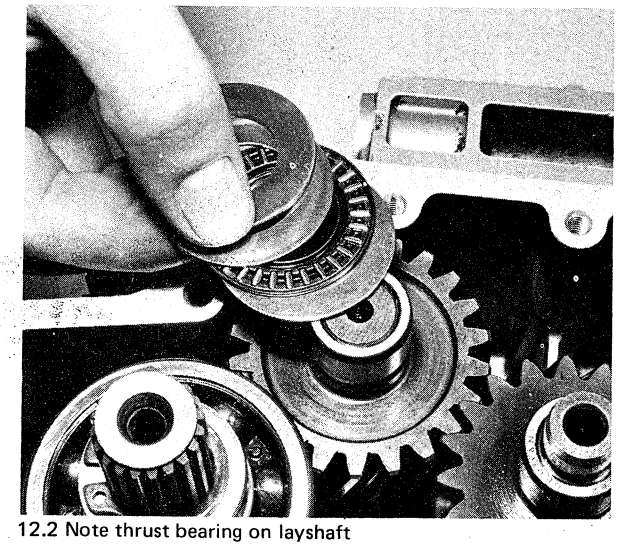
Tighten the locknut and then adjust the cable as described for 5-speed machines.



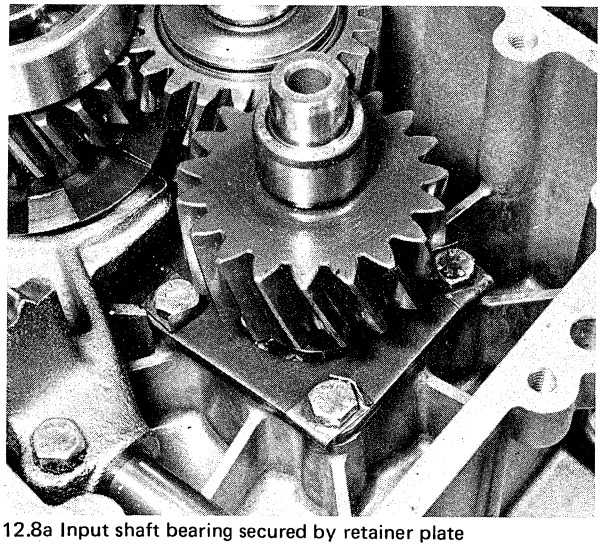
12.1a Unscrew plug to remove detent assembly



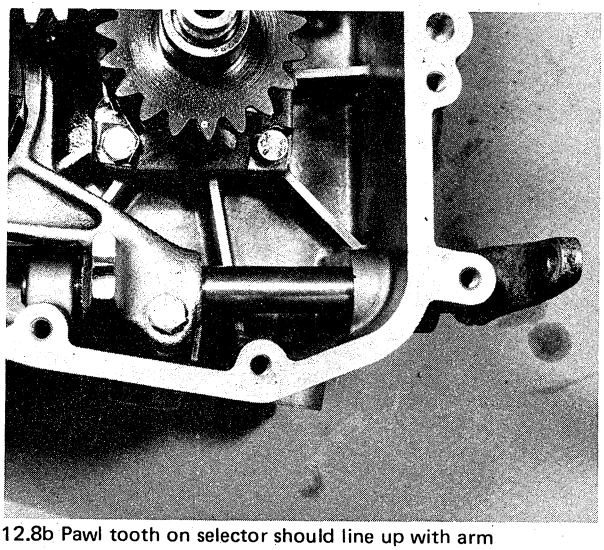
12.1b Gearbox components - general view



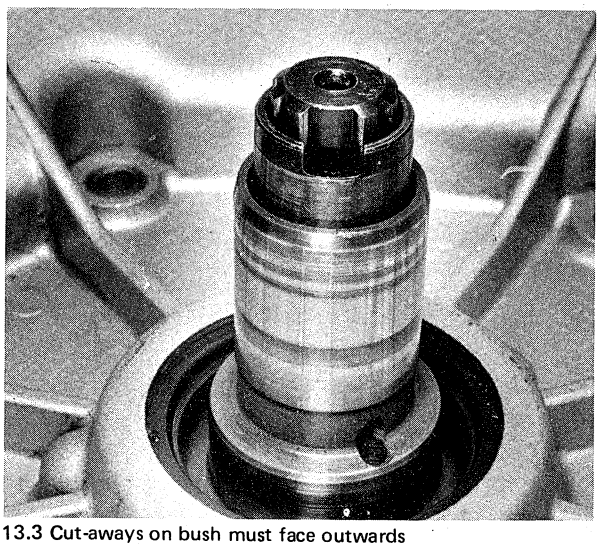
12.2 Note thrust bearing on layshaft



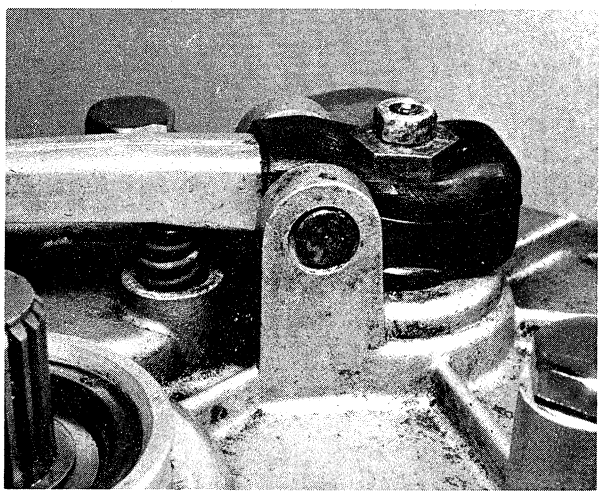
12.8a Input shaft bearing secured by retainer plate



12.8b Pawl tooth on selector should line up with arm



13.3 Cut-aways on bush must face outwards



13.4 Adjust clutch arm by means of adjuster nut

14 Torque converter oil pump: removal, examination and replacement, V-1000 Convert model only

1 The torque converter oil pump is housed within a chamber in the valve timing cover and is driven directly from the forward end of the camshaft via an hexagonal drive piece. To gain access to the oil pump, the timing cover must be removed. Ideally the engine/gearbox unit should be separated from the frame for this to be carried out as described in Chapter 1, Section 4. It is possible however, if a little ingenuity is exercised, to remove the timing cover with the engine/gearbox unit still in place. To do this, the engine must be supported on blocks and the front engine mounting bolt removed. In addition, the torque converter fluid cooler must be detached to aid access. See Chapter 3, Fig. 3.5 for diagram of oil pump.

2 Before disconnecting any feed or return pipes in the fluid circuit, the system must be drained. Remove the left-hand frame cover to gain access to the fluid reservoir. Unscrew the lower banjo bolt and allow the fluid to drain from the reservoir. Detach the upper hose from the cooler unit to allow all the fluid to be drained through the cooler feed pipe, which has already been disconnected.

3 Drain the engine oil into a suitable container and then remove the alternator, as described in Chapter 1, Section 8. The timing cover is retained by fourteen socket screws. After removal of the screws use a rawhide mallet to separate the cover from the engine. As the cover is removed, the hexagonal drive piece will remain in either the camshaft or the oil pump.

4 Before attending to the oil pump, unscrew the large domed nut from the outside of the timing cover and remove the detent spring and pressure release valve ball.

5 Unscrew the three bolts which secure the pump cover to the timing cover casing. Some models incorporate a one-piece lock plate to secure the three bolts. In this case the ears on the plate must be bent down before the nuts are loosened. Lift the outer cover from position complete with the driveshaft and the drive pin. The cover may be a tight fit in the casing. Unfortunately, no method is provided by which a tight fitting cover may be removed with ease. Very carefully use a sharp tipped screwdriver between the two mating surfaces to help displace the cover. This may damage the material, although unsightly, slight damage in this area is not critical because the faces do not comprise a sealing joint. After removal of the cover, detach the large 'O' ring from the cover spigot and displace the drive pin and the driveshaft.

6 Lift the inner rotor from place followed by the outer rotor. Clean all the components in petrol and allow them to dry before inspection.

7 Examine the two rotors for scoring, caused by swarf finding its way into the oil pump. Damage of this nature is unlikely unless contamination of the circuit has occurred during overhaul. Check also that the bore in the timing cover is not scored. The oil pump outer rotor runs directly in the timing cover, therefore, if damage occurs to the housing, the complete cover must be renewed. Check the diametrical clearances between the outer rotor and pump housing and between the outer and inner rotors, with a feeler gauge. The specifications are given at the beginning of the Chapter.

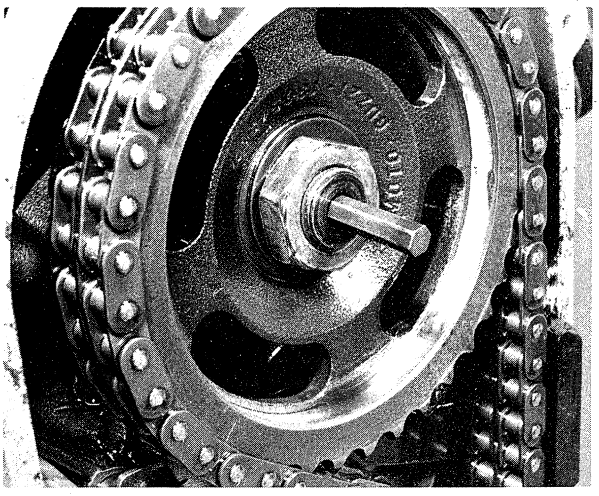
8 Check the driveshaft outer surface for scoring and ensure that an annular groove has not been worn by the oil seal lip. The driveshaft runs directly in the pump cover. If the clearance exceeds 0.145 mm(0.006 in), the shaft or pump cover should be renewed.

9 If damage to the oil seal occurs, hydraulic fluid will find its way into the engine oil causing a drop in the reservoir level and an undesirable contamination of the engine lubricant. The seal can be prised from position after removing the internal circlip with a suitable pair of pliers. Check carefully that the small oil feed hole in the pump cover has not become obstructed. Failure of oil to reach the driveshaft will cause seizure of the pump shaft and consequent temporary failure of the torque converter, due to a lack of fluid. The oil pump drive piece is made from a soft steel, the edges of which will round off if seizure occurs, and so prevent actual breakage of the drivepiece or driveshaft.

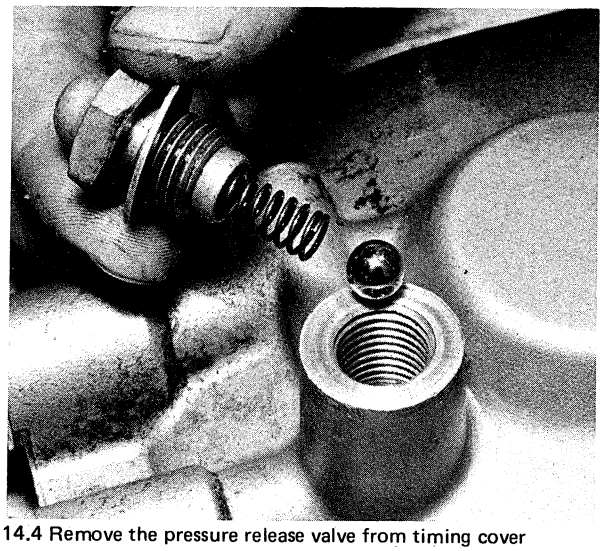
10 Reassemble the oil pump by reversing the dismantling procedure. Lubricate all the components with hydraulic fluid during reassembly. The two rotors must be fitted so that the punch-marked face of each is away from the timing cover. Ensure that the sealing 'O' ring is in good condition, before replacement.

15 Torque converter circuit pipes and seals: examination, V-1000 Convert model only

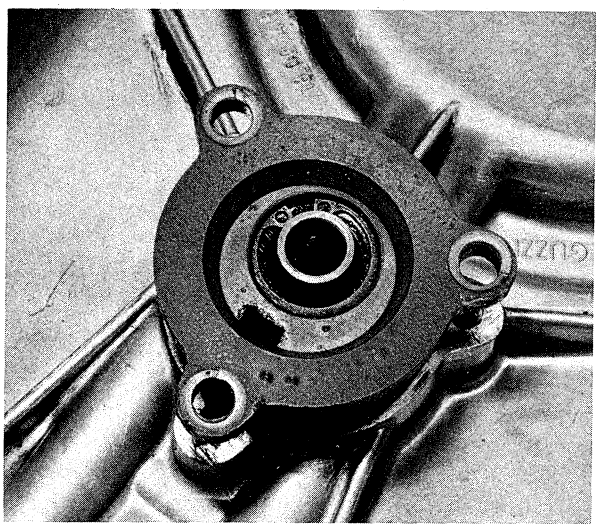
1 Inspect the feed and return pipes periodically for signs of perishing or damage caused by trapping or bad routing. When refitting pipes, ensure that they are positioned correctly away from hot components and that there are no kinks. Use new sealing washers at the banjo unions, whenever there is any doubt about their condition. Scored or compressed washers will promote leakage and encourage overtightening of the banjo bolts, which shear easily.



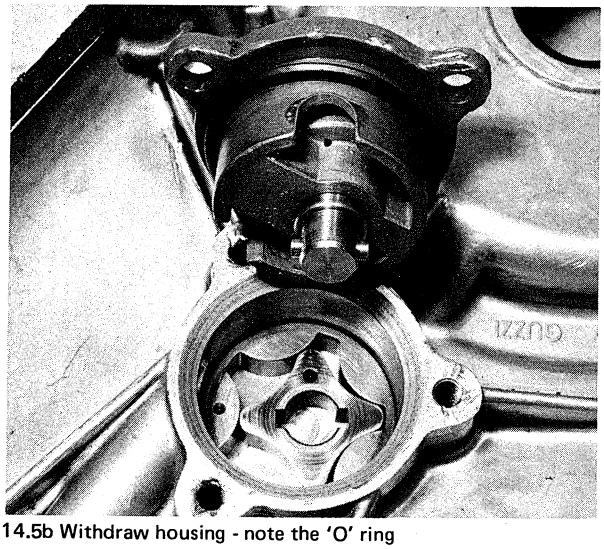
14.3 Hexagonal converter oil pump drive piece



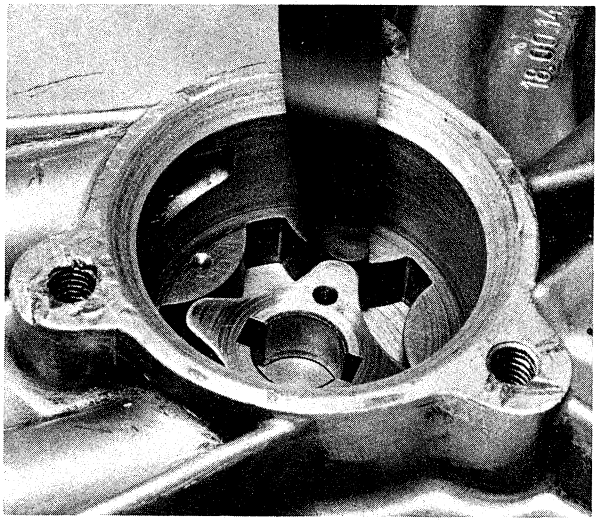
14.4 Remove the pressure release valve from timing cover



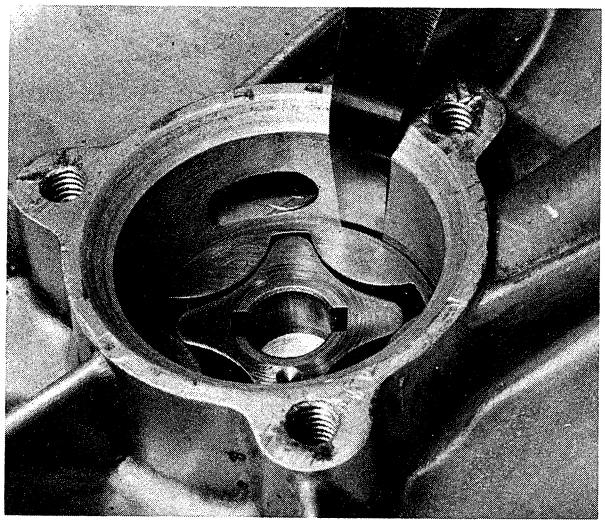
14.5a Pump cover is retained by three bolts



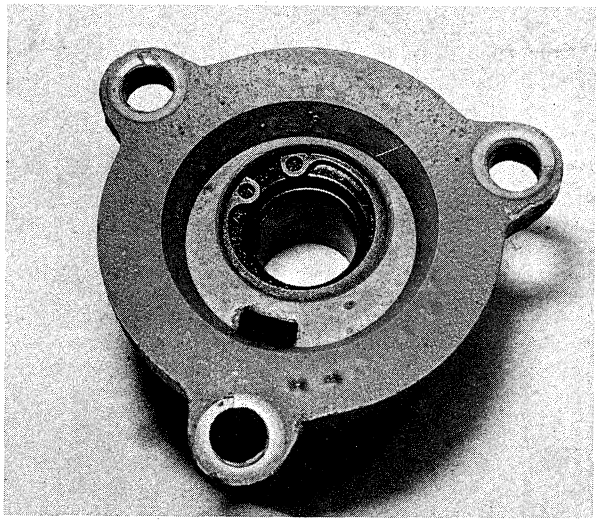
14.5b Withdraw housing - note the 'O' ring



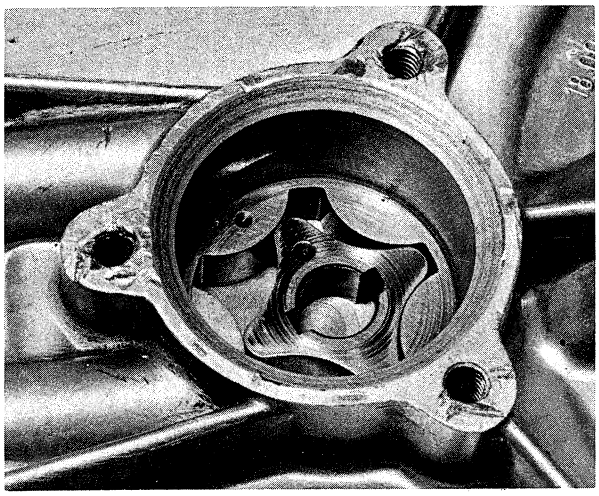
14.7a Using a feeler gauge check inner and ...



14.7b ... outer rotor for wear



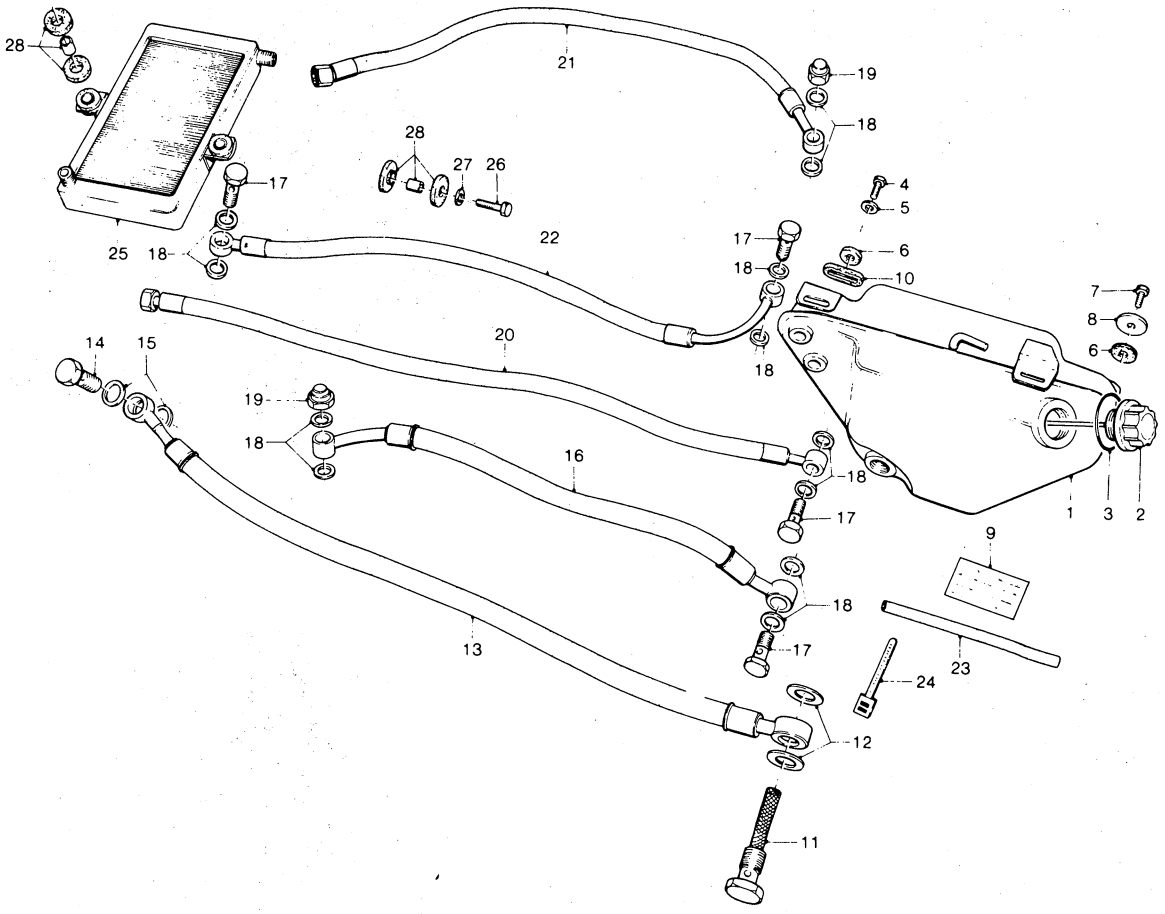
14.9 Oil seal is retained by a circlip



14.10 Fit rotors with both punch marks facing outwards

Fig. 2.7. Torque converter coolant system

1	*Fluid reservoir*	15	*Sealing washer - 3 off*
2	*Filler cap/dipstick*	16	*Return pipe*
3	*'O' ring*	17	*Banjo bolt - 4 off*
4	*Bolt*	18	*Sealing washer - 11 off*
5	*Plain washer*	19	*Domed nut - 2 off*
6	*Rubber sleeve - 2 off*	20	*Radiator return pipe*
7	*Bolt*	21	*Radiator feed pipe*
8	*Plain washer*	22	*Converter feed pipe*
9	*Warning sticker*	23	*Breather pipe*
10	*Rubber cushion*	24	*Strap*
11	*Banjo bolt with filter*	25	*Oil cooler*
12	*Sealing washer - 2 off*	26	*Bolt - 2 off*
13	*Pump feed pipe*	27	*Plain washer - 2 off*
14	*Banjo bolt*	28	*Rubber buffer - 4 off*

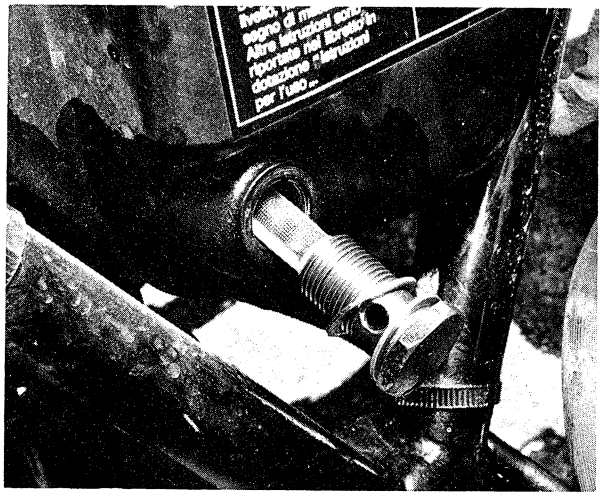


16 Torque converter reservoir: location and filter cleaning, V-1000 Convert model only

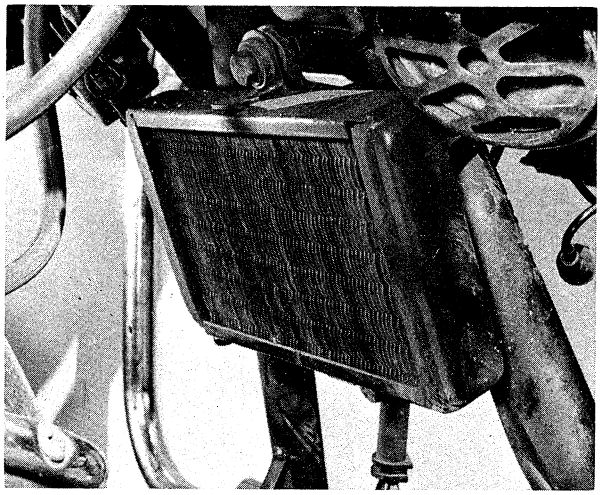
1 The torque converter fluid reservoir is retained on the left-hand side of the machine under the frame side-cover. Access may be gained by pulling the cover from position. The tank filler cap incorporates a dipstick to facilitate level checking.
2 The oil feed line banjo bolt (the lower bolt) incorporates a cylindrical gauze filter, which should be removed and cleaned in petrol whenever the fluid is renewed.

17 Torque converter oil cooler: removal and examination, V-1000 Convert model only

1 The torque converter hydraulic fluid cooler is similar in construction to the water radiator utilised on most motor cars. It is mounted on the forward frame down tubes to take advantage of the good air flow.
2 To remove the oil cooler, first drain the fluid by disconnecting the right-hand pipe followed by the left-hand pipe. Both pipes are retained by concentric olive type unions. Tie the pipes up above the level of the reservoir, to prevent all the fluid draining from the system. The cooler is retained on the frame by two bolts passing through rubber bushes.
3 Repair of a leaking cooler is impracticable and as such a damaged unit must be renewed. It is not possible to introduce a sealant into the system because of contamination.
4 After a period of service, the external cooling fins will become blocked by wind-blown matter causing a severe reduction in cooling efficiency. Frequent overheating of the fluid, evident by boiling noises eminating from the reservoir, can often be traced to this fault. Clean the outside of the cooler in a grease solvent, and after rinsing, dry, using a high pressure air hose. **Do not** apply the pressure hose to either the inlet or outlet as the pressure will damage the matrix.



16.2 Lower pipe banjo bolt incorporates filter screen



17.2 Oil cooler mounted on rubber bushes

18 Fault diagnosis - gearbox

Symptom	Cause	Remedy
Difficulty in engaging gears	Gear selectors not indexed correctly Selector forks bent or badly worn	Check alignment. Renew.
Machine jumps out of gear	Camplate plunger sticking Worn dogs or dogs on gear pinions	Remove and free. Renew defective pinions or dogs.
Gear change lever does not return to original position	Broken return spring	Renew spring.

19 Fault diagnosis: clutch

Symptom	Cause	Remedy
Clutch slip	Oil on plates	Remove and clean. Renew faulty seals.
	Lack of free play on operating rod	Readjust control arm or cable.
	Worn plates	Renew.
	Weak springs	Renew.
Operating action stiff	Bent pushrod	Renew
	Dry pushrod	Grease.
	Dry plate splines (not V-1000)	Grease.
	Damaged, trapped or frayed control cables	Check cable and renew if required. Ensure cable is lubricated and has no sharp bends.

20 Fault diagnosis: torque converter - V-1000 Convert model only

Symptom	Cause	Remedy
No drive to rear wheel	Fluid leakage	Check level in reservoir and inspect for leakage.
	Sheared drive piece	Remove timing cover and inspect.
Fluid boils consistently	Blocked oil cooler fins	Clean.