Chapter 1 Engine, clutch and gearbox

For information relating to the RD350 F II and N II models, refer to Chapter 8

Contents

Specifications

Note: *Specifications relate to all models unless shown differently*

Engine

Type	Water-cooled, parallel twin cylinder two-stroke
Bore	64.0 mm (2.520 in)
Stroke	54.0 mm (2.126 in)
Compression ratio	6.0:1
Capacity	347 cc (21.2 cu in)

Cylinder head

Type	Cast aluminium alloy
Maximum warpage	0.03 mm (0.0012 in)
Head gasket thickness:	
RD350 LC II	0.7 mm (0.026 in)
Other models	Not available
Combustion chamber volume	21.3 – 21.9 cc (1.29 – 1.34 cu in)

Cylinder barrel

Type	Aluminium alloy, cast-in iron sleeve
Bore size	64.00 – 64.02 mm (2.5197 – 2.5205 in)
Service limit	64.1 mm (2.5236 in)
Taper limit	0.05 mm (0.0020 in)
Maximum ovality	0.01 mm (0.0004 in)

Pistons

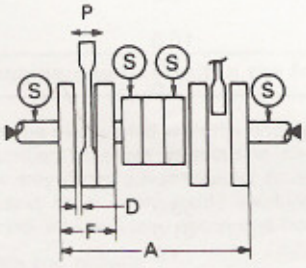
Piston diameter	64.0 mm (2.520 in)
Piston/bore clearance	0.060 – 0.065 mm (0.0024 – 0.0026 in)
Service limit	0.1 mm (0.004 in)
Piston oversizes	+0.25, +0.50 mm (0.010, 0.020 in)

Piston rings

Type:	
Top	Keystone
Height	1.2 mm (0.047 in)
Width	2.6 mm (0.102 in)
2nd	Plain, with expander
Height	1.5 mm (0.059 in)
Width	2.15 mm (0.085 in)
End gap (installed):	
Top	0.30 – 0.45 mm (0.012 – 0.018 in)
2nd	0.35 – 0.50 mm (0.014 – 0.020 in)
Ring/groove clearance:	
Top	0.02 – 0.06 mm (0.0008 – 0.0024 in)
2nd	0.03 – 0.07 mm (0.0012 – 0.0028 in)

Crankshaft assembly

Width:	
(F)	54.00 – 54.05 mm (2.130 – 2.132 in)
(A)	155.90 – 156.05 mm (6.136 – 6.142 in)
Maximum deflection (S)	0.05 mm (0.002 in)
Big-end side clearance (D)	0.25 – 0.75 mm (0.01 – 0.03 in)
Connecting rod small-end deflection (P)	0.36 – 0.98 mm (0.0142 – 0.0386 in)
Service limit	2.0 mm (0.08 in)



Clutch

Type	Wet, multiplate
Friction plates:	
Quantity	7
Thickness	3.0 mm (0.12 in)
Service limit	2.7 mm (0.106 in)
Plain plates:	
Quantity	6
Thickness	1.2 mm (0.047 in)
Warpage limit	0.05 mm (0.002 in)
Clutch springs:	
Quantity	6
Free length	36.4 mm (1.43 in)
Clutch drum:	
Thrust clearance	0.07 – 0.12 mm (0.003 – 0.005 in)
Radial clearance	0.011 – 0.048 mm (0.0004 – 0.0019 in)
Pushrod warpage limit	0.2 mm (0.008 in)

Primary drive

Type	Helical gear
Reduction ratio	66/23T (2.870:1)
Backlash tolerance	154 – 156 (sum of gear tolerance number
Drive gear backlash number	90 – 98
Driven gear backlash number	57 – 65

Secondary drive

Type	Chain and sprockets
Reduction ratio	39/17T (2.294:1)

Gear selector mechanism

Type	Cam drum
Guide bar bend limit	0.025 mm (0.001 in)

Kickstart mechanism

Friction clip force	0.8 – 1.2 kg (1.8 – 2.9 lb)

Gearbox

Type	6-speed, constant mesh
Ratios:	
1st	36/14 (2.571:1)
2nd	32/18 (1.778:1)
3rd	29/22 (1.318:1)
4th	26/24 (1.083:1)
5th	25/26 (0.962:1)
Top	24/27 (0.889:1)

Torque wrench settings

Component	kgf m	lbf ft
Cylinder head	2.8	20.0
Cylinder barrel	2.5	18.0
Spark plug	2.0	14.0
YPVS valve Allen screw:		
RD350 LC II	0.7	5.1
Other models	0.6	4.3
YPVS pulley:		
RD350 LC II	Not available	
Other models	1.0	7.2
Primary drive gear	6.5	47.0
Clutch centre nut	9.0	65.0
Clutch spring retaining bolts	1.0	7.2
Gearbox sprocket	8.0	58.0
Kickstart lever	2.5	18.0
Gearchange pedal:		
RD350 LC II	1.5	10.0
Other models	1.6	11.0
Reed valve assembly	1.5	11.0
Reed valve petals:		
RD350 LC II	Not available	
Other models	0.1	0.7
Flywheel generator rotor:		
RD350 LC II	8.0	58.0
Other models	8.5	61.0
Exhaust pipe	1.8	13.0
Silencer bracket bolt	6.5	47.0
Thermostat cover	1.2	8.7
Housing cover:		
RD350 LC II	1.0	7.2
Other models	0.8	5.8
Radiator cover	0.3	2.0
Hose union (cylinder head)	1.2	8.7
Oil pump:		
RD350 LC II	0.4	3.0
Other models	0.5	3.6
Coolant drain plug	1.4	10.0
Transmission drain plug	2.0	14.0
Crankcase cover screws:		
RD350 LC II	1.0	7.2
Other models (R)	1.0	7.2
Other models (L)	0.7	5.1
Crankcase bolts (see text):		
Lower	2.5	18.0
Upper	1.0	7.2

Component	kgf m	lbf ft
Bearing cover plate	1.0	7.2
Tachometer gear stopper plate:		
RD350 LC II	0.4	2.9
Other models	0.5	3.6
Gear selector cam stopper plate:		
RD350 LC II	1.4	10.0
Other models	1.0	7.2
Stopper lever	1.4	10.0
Neutral switch	0.4	2.9
Gearchange lever adjuster screw	3.0	22.0
Thermosenser (temperature gauge sender unit):		
RD350 LC II	1.2	8.7
Other models	1.4	10.0
Engine mounting bracket bolts	2.4	17.0
Engine mounting bolts	6.5	47.0

1 General description

The Yamaha RD350 YPVS models employ a water-cooled twin cylinder two-stroke engine built in unit with the primary drive, clutch and gearbox. The engine features a light alloy one-piece cylinder head incorporating cast-in passages for the coolant. Separate light alloy cylinders are fitted, each having an integral cast iron liner.

Induction is controlled by a combination of conventional piston porting, reed valves and the Yamaha power valve system (YPVS). The YPVS system consists of a spool-type valve unit mounted transversely across the two exhaust ports. The valve is able to rotate in the port, thus altering its shape. This allows the exhaust port timing to be varied to suit any given engine speed. The YPVS valve is controlled via two Bowden cables from a servomotor unit mounted below the fuel tank. A microprocessor in the servomotor unit senses engine speed and adjusts the YPVS valve to the necessary setting. In this way, the engine is able to produce high torque at low engine speeds, and has unrestricted performance at high engine speeds.

A pressed-up crankshaft is used, carried on four caged ball main bearings. Both the big-end and small-end bearings are of the needle roller type.

Primary drive is by gears to the wet multi-plate clutch mounted on the end of the gearbox input shaft. The gearbox is of the six-speed constant mesh type. Gearbox lubrication is by oil bath, whilst the engine is lubricated by direct injection via a metered pump driven off the crankshaft.

2 Operations with the engine/gearbox unit in the frame

The items listed below can be overhauled with the engine/gearbox unit in place. Where a number of these operations need to be undertaken simultaneously it may prove advantageous to remove the unit to gain better access and more comfortable working. Engine removal is fairly straightforward, and will take about one hour.

a) Cylinder head, barrels and pistons
b) YPVS valves
c) Clutch assembly and primary drive pinion
d) Oil pump
e) Water pump
f) Ignition pickup
g) Alternator assembly
h) Gear selector mechanism (external components only)
i) Kickstart mechanism
j) Final drive sprocket

3 Operations with the engine/gearbox unit removed from the frame

To gain access to the following items it is first necessary to remove the unit from the frame and to separate the crankcase halves:

a) Crankshaft assembly
b) Gearbox components
c) Gear selector drum and forks

4 Removing the engine/gearbox unit from the frame

1 To allow access to the engine area for removal purposes, it will be necessary to remove the fairing belly pan (RD350 LC II) or the fairing lowers (RD350 F). This operation is described in Chapter 5. Once removed, place the fairing sections away from the work area to avoid accidental damage.

2 Place the machine on its centre stand, leaving working space on both sides and at the front. Start the engine and allow it to reach normal operating temperature. Place a drain tray or bowl of at least 2.0 litre (0.44 Imp gal) capacity below the engine unit, remove the transmission drain plug and allow the oil to drain. When draining is complete, refit the plug for safekeeping.

3 Remove the seat and place it to one side. Check that the fuel tap is turned to the "ON" position, then remove the left and right-hand side panels. Disconnect the fuel and vacuum pipes at the fuel tap. Remove the single holding bolt at the rear of the tank, lift it slightly and pull it rearwards until it comes free of the mounting rubbers on each side of the steering head.

4 When the engine has cooled fully, and not before, the cooling system should be drained. Note that care must be taken to avoid removing the radiator cap or removing drain plugs while there is residual pressure in the system. If the coolant was changed recently it can be retained for re-use, otherwise discard it and fill with a fresh solution during reassembly. The procedure for draining the system, including precautions to be taken when handling the coolant mixture, will be found in Chapter 2. Disconnect the radiator top and bottom hose at the engine end, and also the smaller bypass hose between the engine and radiator filler neck.

5 Free the exhaust pipe retaining nuts at the exhaust ports, then release the silencer to footrest bracket mounting bolts. Lift each half of the system clear of the machine and place them to one side. Disconnect and remove the gearchange pedal and linkage. Disconnect both spark plug caps and the temperature gauge sender lead. Lodge them clear of the engine around the frame top tubes.

6 Remove the oil pump cover. Prise off the pipe from the oil tank at the pump stub, plugging its open end to prevent oil leakage. Rotate the pump pulley to its fully open position to allow the cable to be disengaged. Free the cable and return spring and lodge the cable clear of the engine.

7 Release the pulley cover on the left-hand end of the YPVS valve. Slacken the two cable adjuster locknuts, then screw the adjusters fully inwards. Unscrew the central retaining bolt to free the pulley, and disconnect the cables. Remove the two cross-head screws to free the cables, together with the pulley housing.

8 Moving to the carburettors, make a simple sketch of the drain and vent pipe routing so that they can be refitted correctly. Remove the pipes and place them to one side. Unscrew the carburettor tops and withdraw the throttle valve assemblies, taking care not to bend the needles. It is not necessary to disconnect the cables from the valves. Slacken the clips which retain the carburettor stubs to the inlet and air filter rubbers. Disconnect the rubbers, then manoeuvre the carburettors clear of the engine and remove them.

9 Free the tachometer cable at the crankcase by unscrewing the knurled retaining ring (RD350 LC II model). Slacken the adjuster at the upper end of the clutch cable. Disconnect the cable at the

handlebar lever, then at the lower end, lodging it clear of the engine unit.

10 Trace the wiring from the left-hand side of the engine unit (alternator, ignition pickup and neutral switch) and disconnect it at the two multi-pin connectors. Remove the left-hand outer cover to gain access to the gearbox sprocket. Knock back the locking tab which secures the sprocket retaining nut. Apply the rear brake, holding it on while the retaining nut is slackened. Slide the sprocket off its splines and disengage it from the chain. The latter can be left to rest against the frame tube.

11 Remove the two bolts which pass up through the ends of the engine stabiliser bars and into the underside of the crankcase. The bars can be either removed or just pivoted down and clear of the engine. Remove the engine mounting bolts and plates as shown in the accompanying photographs. As these are removed, the engine will tend to drop and trap the remaining bolts. To remove these, carefully lift or lever the engine upwards until they can be displaced and removed. The engine is now free and will be left sitting on the frame cradle.

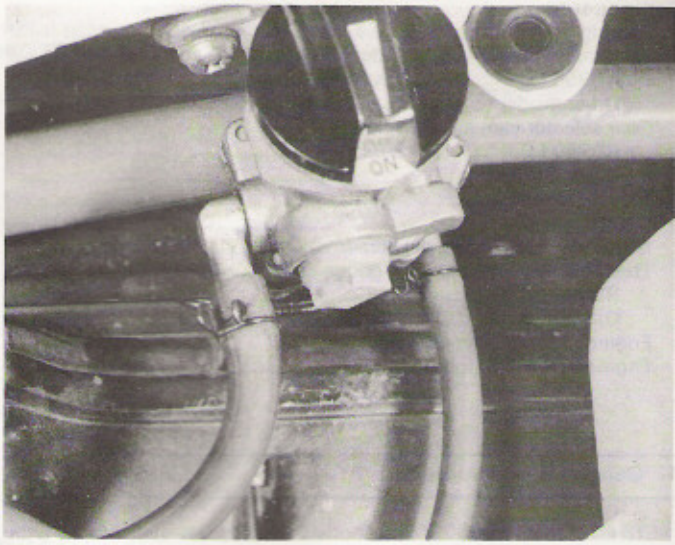
12 Make a final careful check around the engine to ensure that nothing remains which might impede removal. Pay particular attention to cables or wiring which might get caught on the unit as it is lifted out. In an emergency, it is just feasible for one strong person to remove the engine unit unaided, but this approach is not recommended. It is much better to involve at least two people at this stage to allow the unit to be manoeuvred out of the frame without damage. Take the weight of the unit, then carefully remove it from the right-hand side, placing it on a bench to await further attention.

5 Dismantling the engine/gearbox unit: general

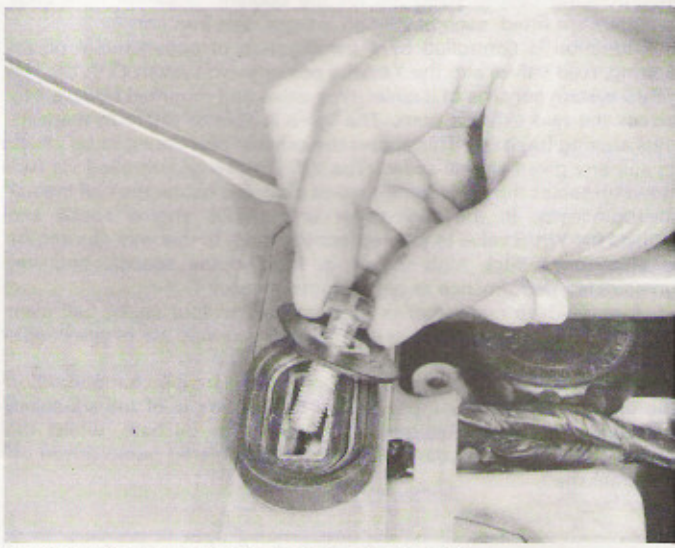
1 Before commencing work on the engine unit, the external surfaces must be cleaned thoroughly. A motorcycle engine has very little protection from road grit and other foreign matter, which will sooner or later find its way into the dismantled engine if this simple precaution is not observed.

2 One of the proprietary engine cleaning compounds such as 'Gunk' or 'Jizer' can be used to good effect, especially if the compound is worked into the film of oil and grease before it is washed away. When washing down, make sure that water cannot enter the inlet or exhaust ports or the electrical system, particularly if these parts are now more exposed.

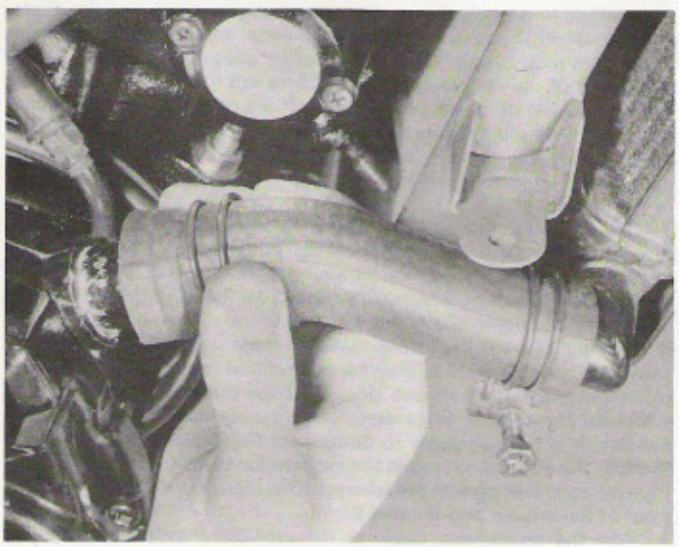
3 Never use force to remove any stubborn part, unless mention is made of this requirement in the text. There is invariably good reason why a part is difficult to remove, often because the dismantling operation has been tackled in the wrong sequence.



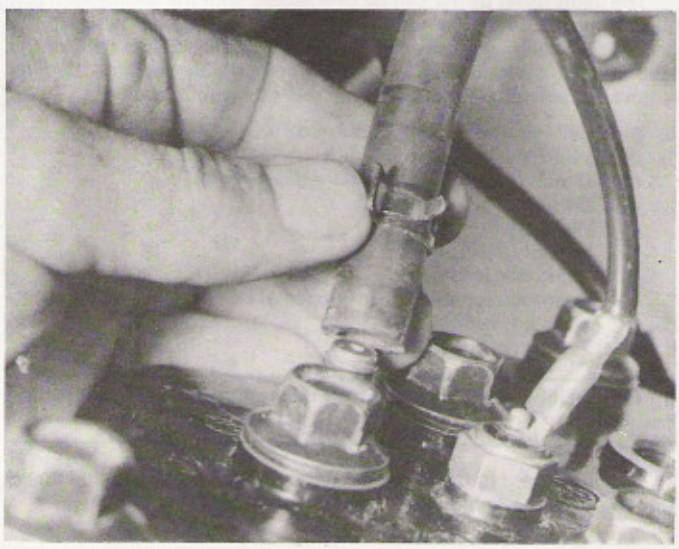
4.3a Check that fuel tap is turned to 'ON' position, then remove the fuel and vacuum pipes



4.3b Tank is secured at the rear by a single bolt

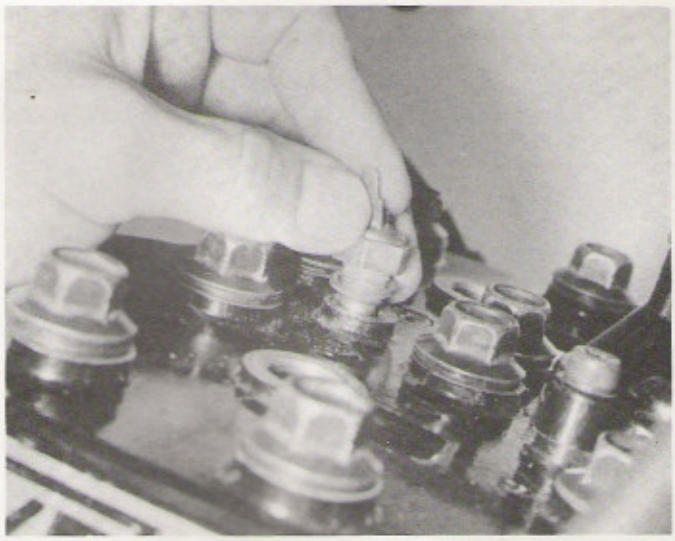


4.4 Disconnect coolant hoses between engine and radiator ...

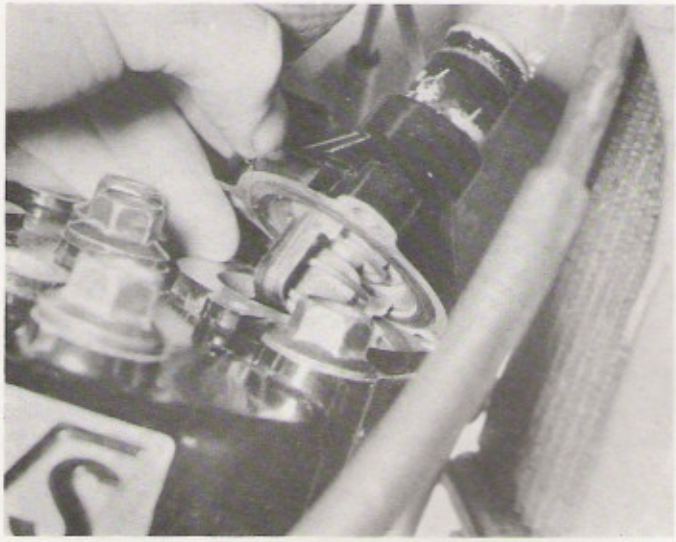


4.5a ... not forgetting the bypass hose

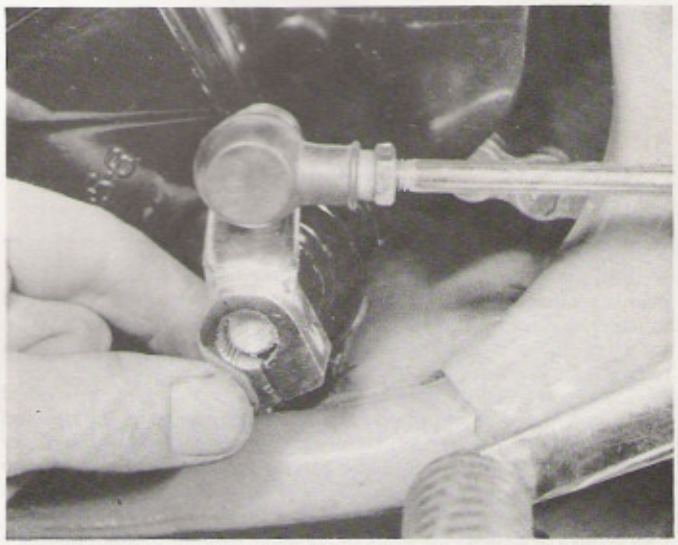
4.5b Disconnect the water temperature sender lead



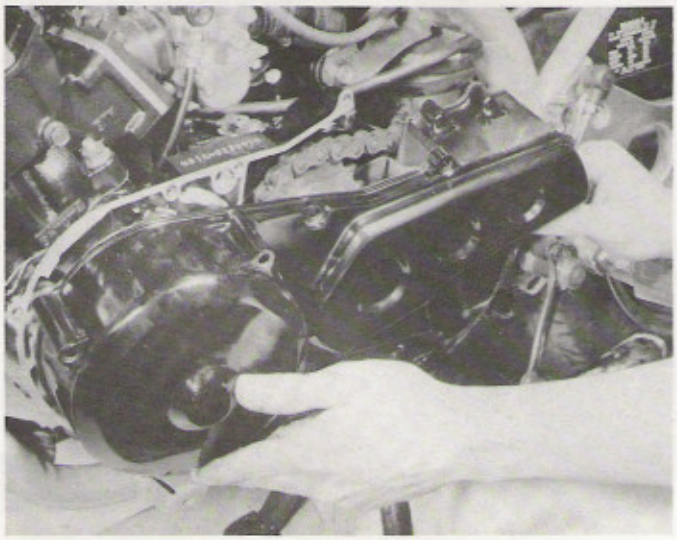
4.5c It is a good idea to remove the sender to avoid damage during engine removal



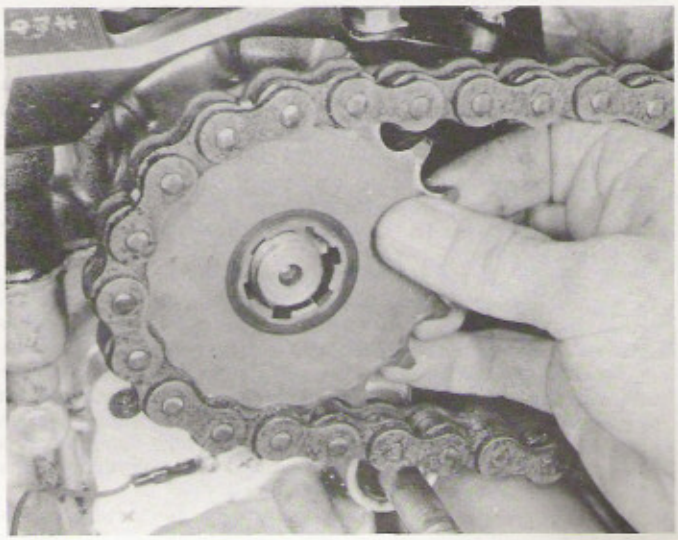
4.5d The thermostat housing and unit can also be removed to give improved clearance



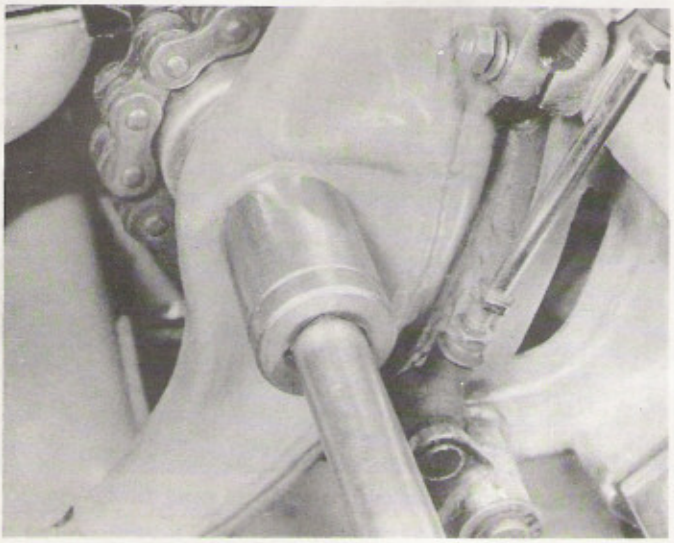
4.5e Disconnect the gearchange linkage as shown



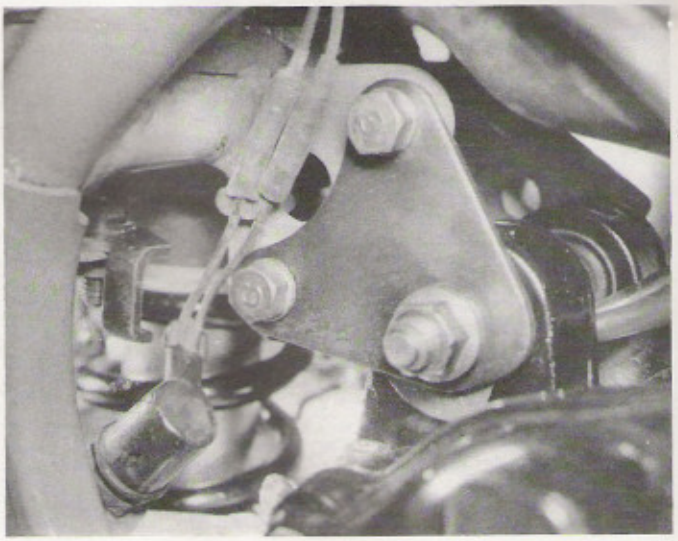
4.10a Release the retaining screws and lift away the left-hand cover



4.10b Knock back the tab washer and remove nut to free the gearbox sprocket



4.11a Swinging arm pivot bolt doubles as engine rear mounting bolt



4.11b Upper rear engine mounting bracket arrangement

6 Dismantling the engine/gearbox unit: removing the cylinder head, barrels and pistons

1 Free the balance pipe which connects the two inlet rubbers. The pipe is secured by wire clips, the ends of which should be squeezed together to allow the pipe end to be pulled clear. Take care not to strain the inlet rubber; it is easily torn. Remove the four Allen bolts which retain each reed valve unit to its cylinder barrel and remove it.

2 Slacken the clamps holding the coolant hose to the underside of the cylinder head and to the crankcase stub. Disengage the hose and remove it. Unscrew the temperature gauge sender from the cylinder head, taking care not to lose the sealing washer. Release the Allen screws which retain the thermostat housing to the cylinder head. Lift away the housing and remove the thermostat.

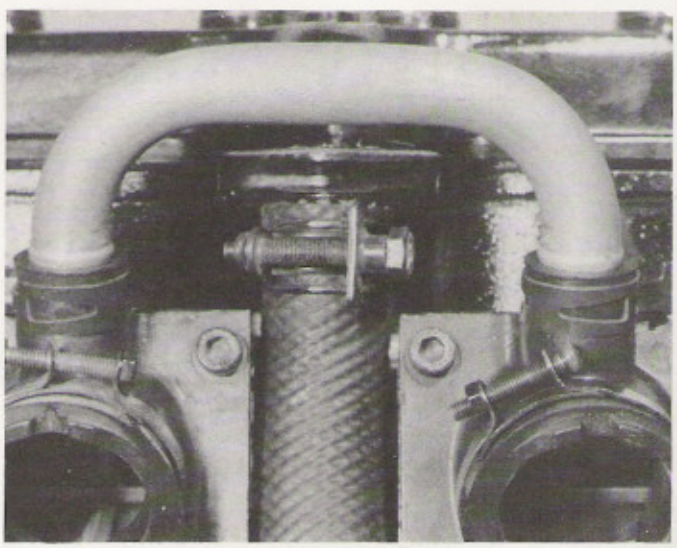
3 Remove or slacken the spark plugs before the head is removed; it is easier to do so at this stage than with the head detached. To free the head, slacken the cylinder head sleeve bolts by following the numbers cast into the head material in descending order. Each bolt should be slackened by a half turn until all are loose. Then remove the bolts and lift the head away. In the unlikely event that the head is stuck to the gasket, tap around the joint using a hide mallet, or a hammer and a hardwood block.

4 Before the barrels can be removed, it is necessary to disconnect the two power valves at the centre connection joint by releasing the two screws. Remove the four retaining nuts from the flange of each barrel. Lift each barrel slightly and pack some clean rag into the crankcase mouth to catch any debris or residual coolant. Carefully lift each barrel away, supporting its piston as it emerges from the bore. Place the inverted barrels and head on some rag to allow any remaining coolant to drain away.

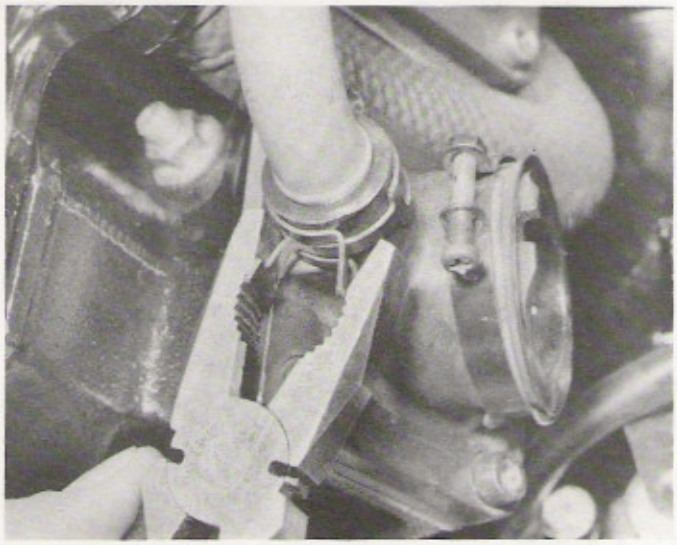
5 The power valve should now be removed from each barrel. Although this is not an essential operation, it is normal practice to remove and clean the valve and to inspect it for damage before reassembly. Start by releasing the single Allen screw which secures the retainer plate at the inner end of the valve. Hold the outer end of the valve with a pair of pliers, using a strip of thin card to protect the valve from damage from the plier jaws. Slacken and remove the long through bolt which retains the two halves of the valve. If the through bolt is unusually stiff, a hardwood strip can be introduced through the exhaust port to wedge the valve.

6 Using the retainer groove in the inner end of the valve, lever the valve half out with a screwdriver. Take care not to damage the valve or barrel material. The outer half of the valve can now be displaced and removed. Check that the two small dowel pins are in place, then fit the two halves of the valve together and refit the through bolt to hold them. Place the valve with the barrel to which it belongs; do not interchange them.

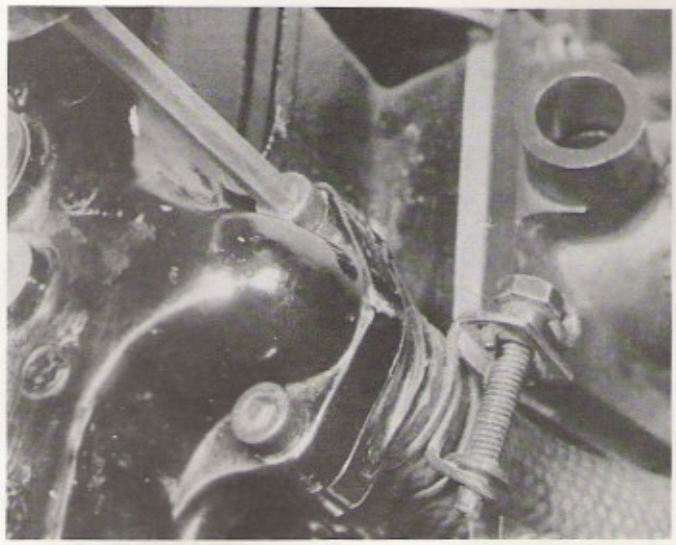
7 Prise out the end of one gudgeon pin (piston pin) circlip using a pair of pointed-nose pliers. Push out the gudgeon pin from the opposite end and remove it, lifting the piston clear of the connecting rod. If the gudgeon pin proves tight, warm the piston with a rag soaked in hot water to expand the alloy, taking care to avoid burnt fingers. If available, a hot air gun can be used instead. Repeat for the other piston. As each piston is removed, mark the inside of the skirt to indicate the bore to which it belongs. Displace the small-end bearing from the connecting rod and place it with its piston and gudgeon pin.



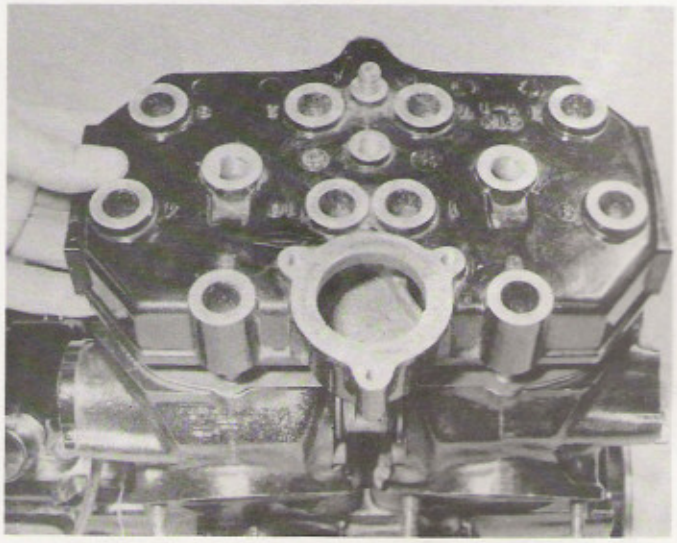
6.1a Remove the balance pipe from between the two inlet rubbers



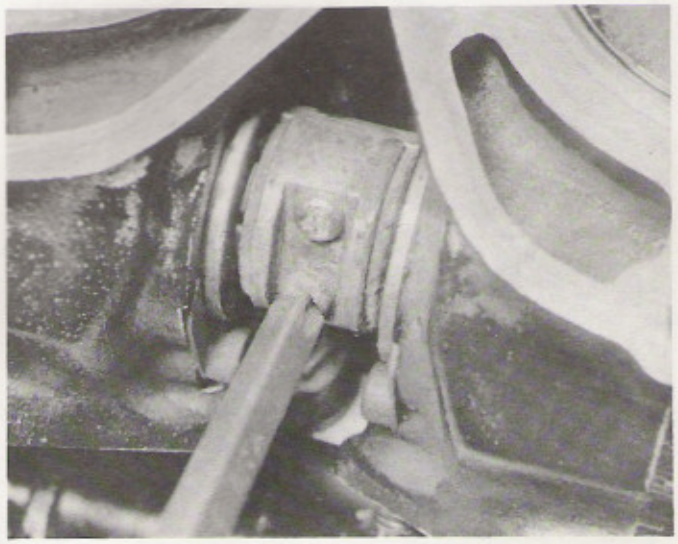
6.1b Note that pipe is held by spring clips which can be slid off after squeezing the 'ears' together as shown



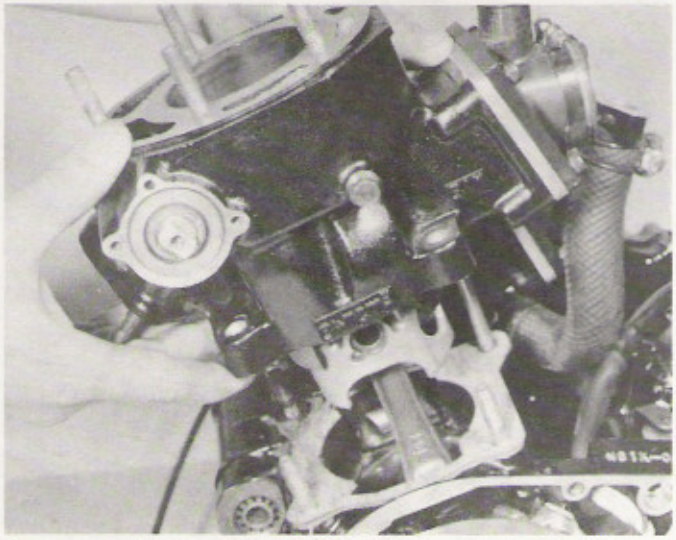
6.2 Remove the two Allen bolts to free the coolant hose adaptor



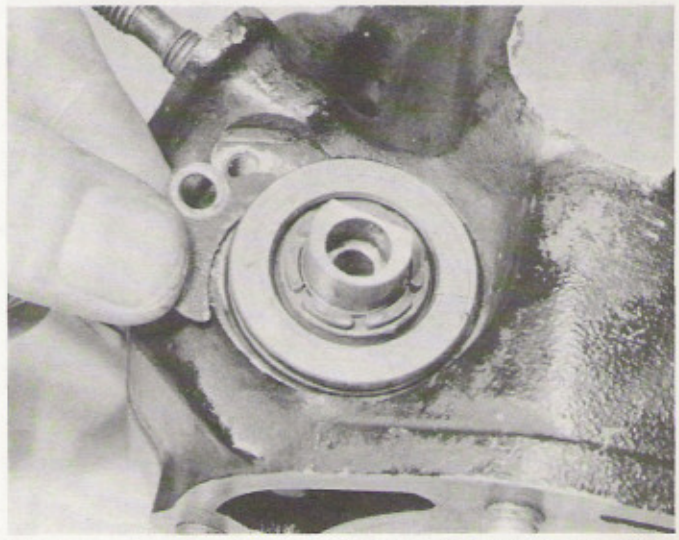
6.3 Slacken and remove the cylinder head sleeve bolts and lift the head away



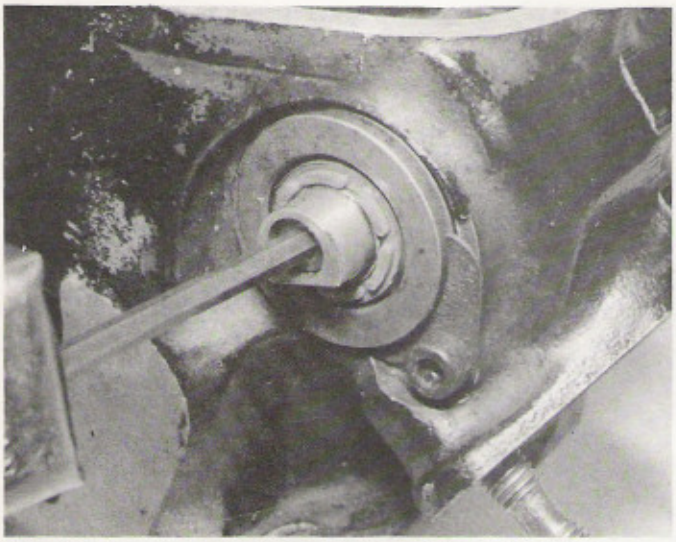
6.4a Disconnect the joint piece between the two power valves



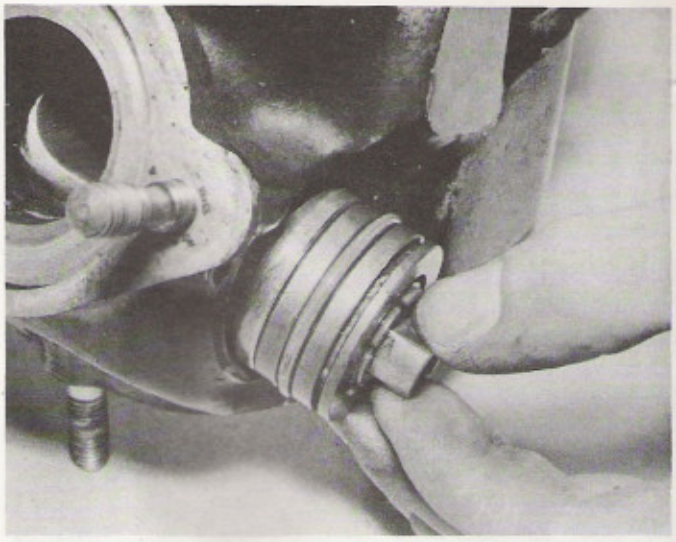
6.4b Remove the cylinder base nuts and lift away the cylinder barrels



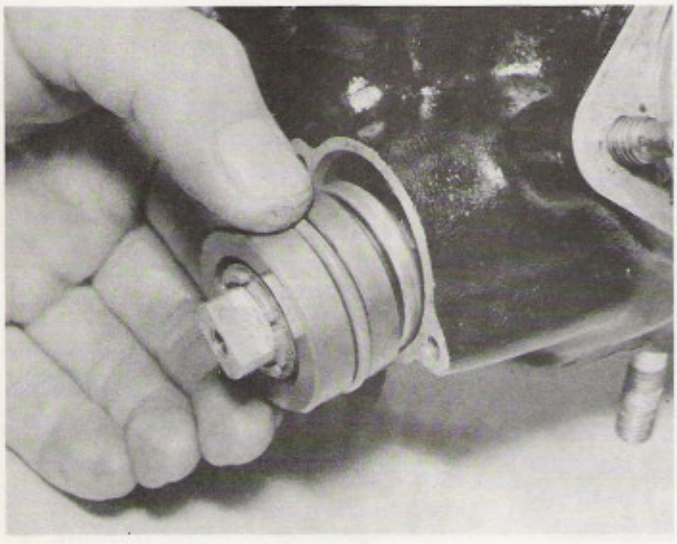
6.5a Each power valve is secured at its inner end by a retainer plate



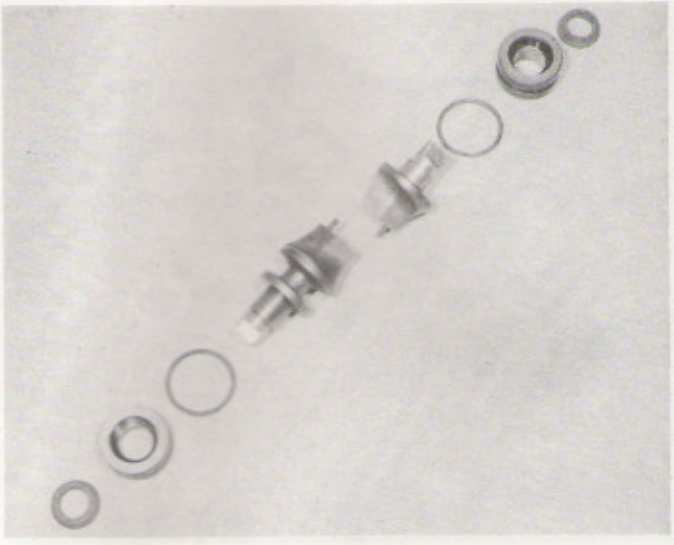
6.5b Hold the valve with pliers and remove the long Allen bolt



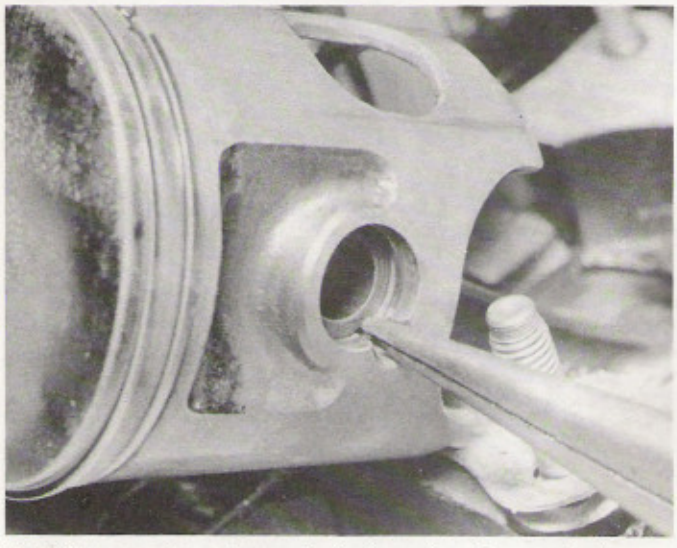
6.6a The two valve halves can now be removed. Lever out the inner half using the retainer groove ...



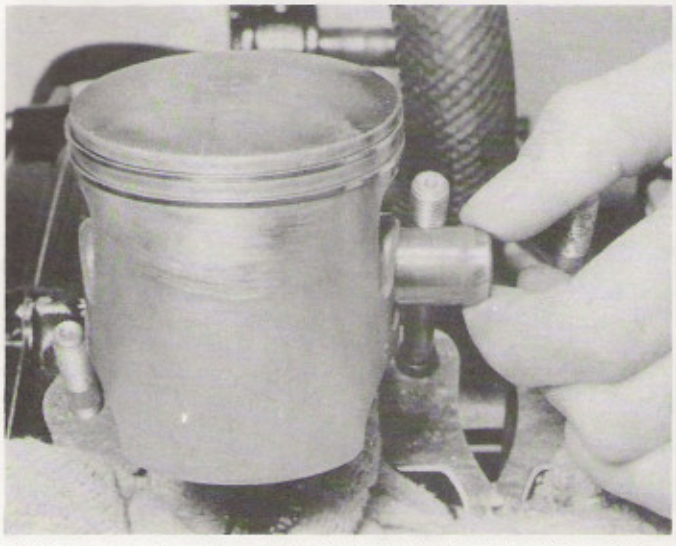
6.6b ... then displace and remove the outer half, taking care to retain the two small dowel pins



6.6c A complete power valve assembly shown here in its component parts



6.7a Disengage the gudgeon pin circlips using snipe-nosed pliers



6.7b Gudgeon pins can now be displaced to allow the pistons to be lifted away

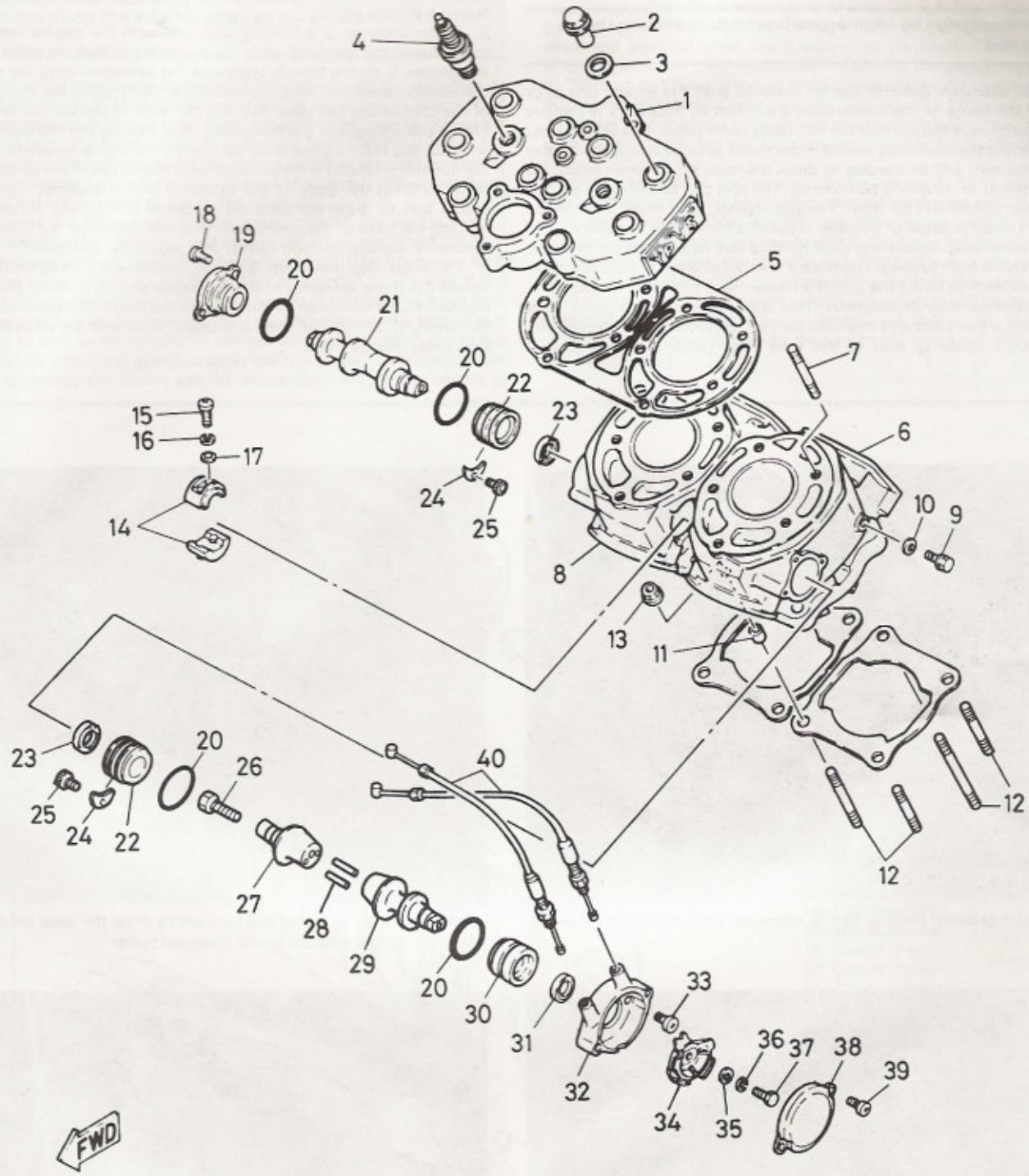


Fig. 1.1 Cylinder head, barrels and power valve

1 *Cylinder head*
2 *Sleeve bolt – 8 off*
3 *Washer – 8 off*
4 *Spark plug – 2 off*
5 *Cylinder head gasket*
6 *Left-hand barrel*
7 *Stud – 8 off*
8 *Right-hand barrel*
9 *Drain plug*
10 *Sealing washer*
11 *Dowel*
12 *Stud – 8 off*
13 *Nut – 8 off*
14 *Connection joint*
15 *Screw – 2 off*
16 *Spring washer – 2 off*
17 *Washer – 2 off*
18 *Screw – 2 off*
19 *End cap*
20 *O-ring*
21 *Right-hand cylinder valve complete*
22 *Valve holder*
23 *Oil seal*
24 *Retaining plate*
25 *Allen screw*
26 *Bolt*
27 *Inner valve half*
28 *Dowel pin*
29 *Outer valve half*
30 *Valve holder*
31 *Oil seal*
32 *Pulley housing*
33 *Screw – 2 off*
34 *Pulley*
35 *Washer*
36 *Spring washer*
37 *Bolt*
38 *Pulley cover*
39 *Screw – 2 off*
40 *Operating cables*

7 Dismantling the engine/gearbox unit: removing the alternator

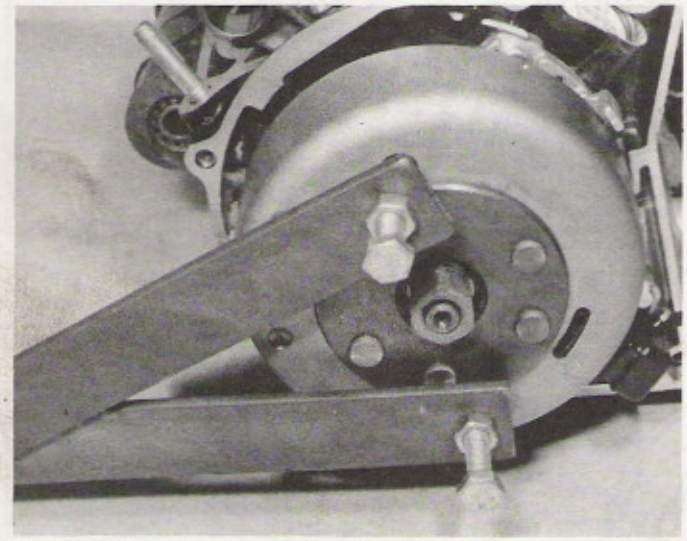
1 The alternator asembly can be removed with the engine unit in or out of the frame. In the former case it will first be necessary to remove the gearchange linkage and the left-hand outer cover, and to trace and disconnect the alternator wiring if the stator is to be removed. A rotor extractor tool will be needed to draw the rotor off its taper safely; do not attempt to remove it by levering. The tool can be obtained as Part Number 90890-01189 from Yamaha dealers, but many motorcycle dealers stock a range of suitable extractors from other suppliers.

2 Slacken and remove the rotor holding nut whilst holding the rotor to prevent it from turning. There are a number of ways to hold the rotor; the best method being the use of a home-made tool like that shown in the accompanying photograph. This was made up with some steel strip and a few bolts and need not be very elaborate. If you prefer, you can buy a made up tool of this type from Yamaha dealers as Part Number 90890-01235.

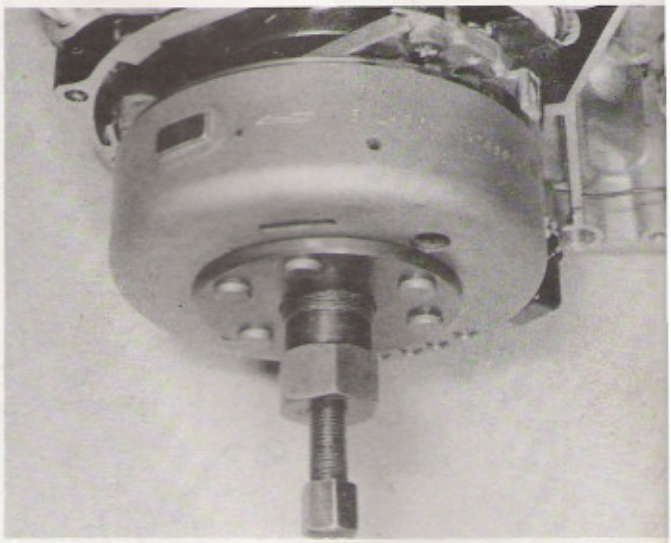
3 In the absence of a holding tool, and with the engine unit in the frame, select top gear and apply the rear brake to lock the crankshaft. If the engine is on the bench, postpone the operation until the cylinder barrels have been removed, then pass a smooth round bar through one of the connecting rod eyes. Support the ends of the bar on hardwood blocks placed against the crankcase, thus locking the crankshaft.

4 With the rotor immobilised by one of the above methods, remove the nut and washer. Fit the extractor into the thread in the centre of the rotor. Holding the body of the extractor with a spanner, tighten the centre bolt to draw the rotor off its taper. If it proves stubborn, try tapping the head of the centre bolt; this will usually jar the rotor free. If necessary, tighten the bolt further and repeat the process.

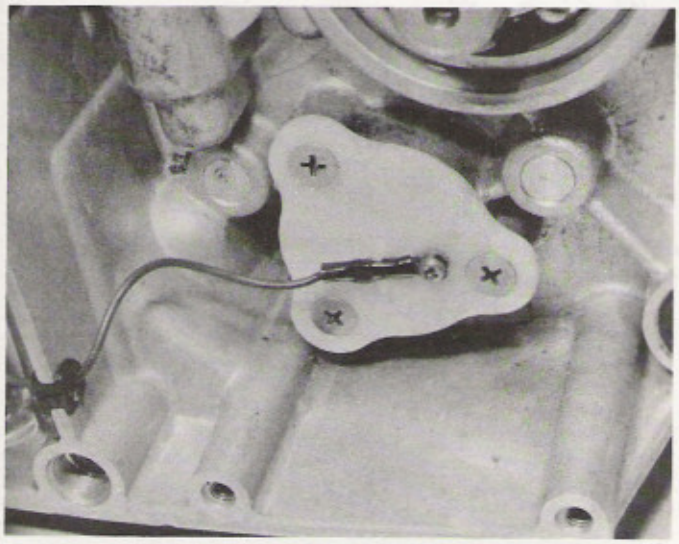
5 Once the rotor has been removed, unscrew the three bolts which secure the stator assembly to the crankcase and lift it away. The wiring and block connector can be fed through the hole in the crankcase once the wiring grommet has been displaced. Note that the neutral switch lead must also be freed.



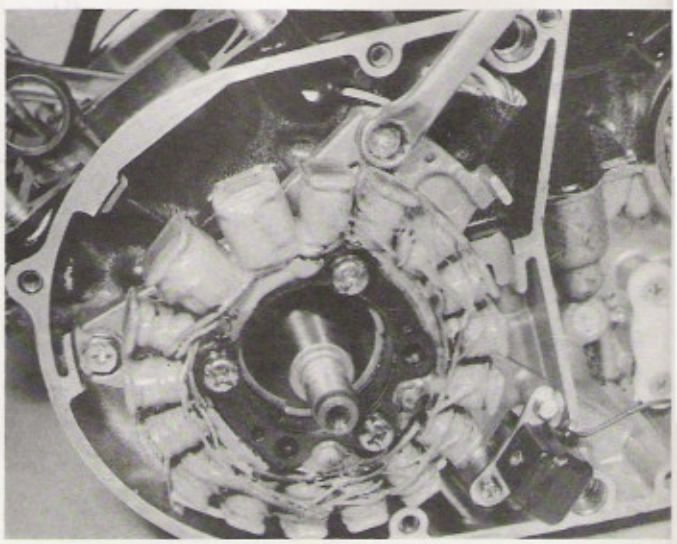
7.2 Use fabricated holding tool to allow the rotor nut to be removed



7.4 A proprietary extractor can be used to draw the rotor off its taper, but do not attempt to use a legged puller



7.5a Neutral switch lead must be disconnected before stator can be removed



7.5b Remove the stator mounting bolts and lift the assembly clear

8 Dismantling the engine/gearbox unit: removing the clutch

1 The above mentioned parts may be removed with the engine in or out of the frame. In the former case it will be necessary to remove first the transmission drain plug and allow the oil to drain, and to release the kickstart lever and oil pump cable and pipes. Note that the water pump is housed in the right-hand engine casing and thus the cooling system must be drained before it can be removed, though it is not necessary to disturb either the water pump or the oil pump.

2 Release the screws around the outer edge of the engine casing. These are invariably tight and will require the use of an impact driver to loosen them without damaging the screw heads. The cover can now be lifted away complete with the pumps and placed to one side. If the work is being undertaken with the engine in the frame, the nut which secures the primary drive pinion must be slackened at this stage if it is wished to remove the pinion. To prevent crankshaft rotation as the nut is removed, select top gear and apply the rear brake. Once the nut has been loosened, the clutch can be dismantled. Where the engine is being stripped on the workbench it is easier to lock the crankshaft by passing a round metal bar through one of the connecting rod small-end eyes, its ends being supported on small wooden blocks placed against the crankcase mouth to protect the gasket face.

3 Slacken and remove the six bolts which secure the clutch pressure plate, releasing them evenly by about one turn at a time until they are no longer under spring tension. Lift the pressure plate clear together with the six clutch springs. Displace and remove the clutch plain and friction plates.

4 Before the clutch centre nut can be removed, some method of holding the centre must be devised. Yamaha produce a special holding tool, Part Number 90890-04086, and this can be used if available. Alternatively, the home-made equivalent shown in the accompanying photograph will prove equally effective. The tool was made up from 1 in x 1/8 in mild steel strip, the edges of the angled jaws being ground to fit snugly in the clutch centre splines. An assistant will be required to hold the clutch centre with the improvised tool while the nut is removed. Take care not to allow the tool to slip or the soft alloy splines will be damaged.

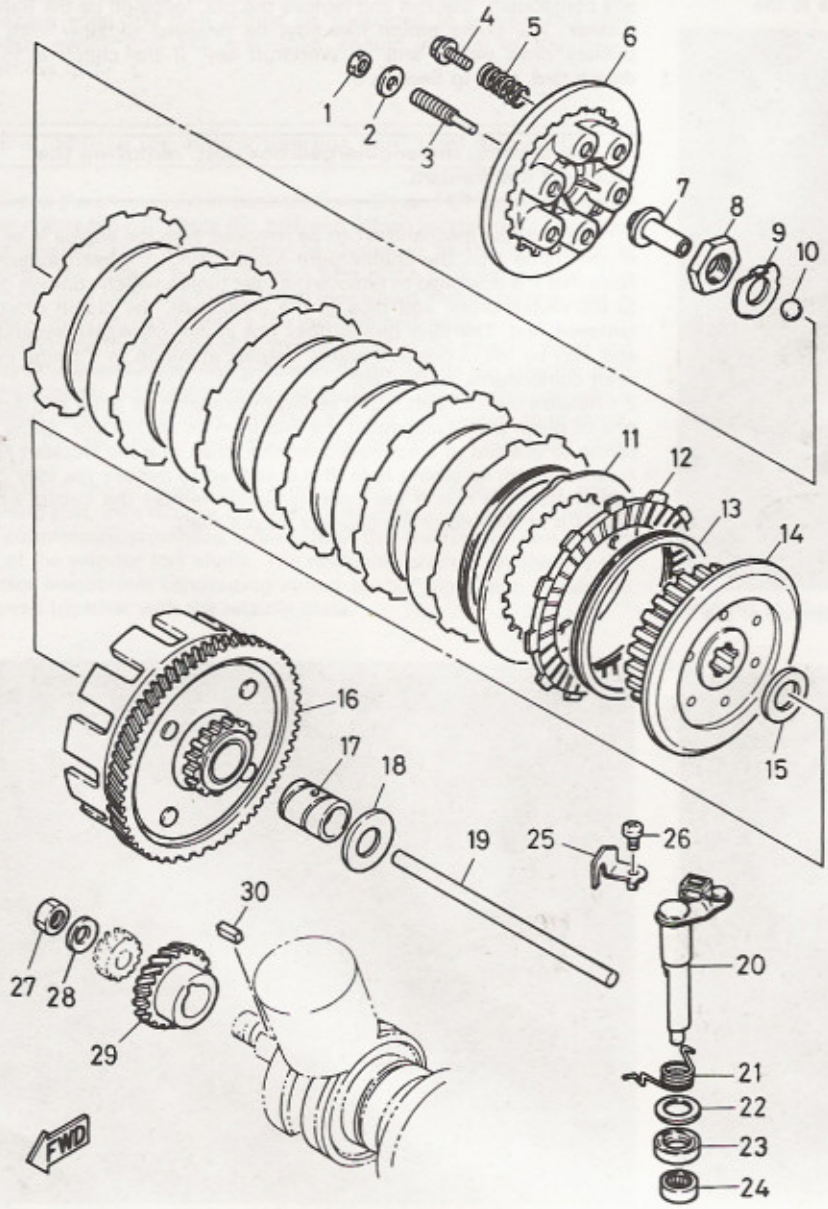
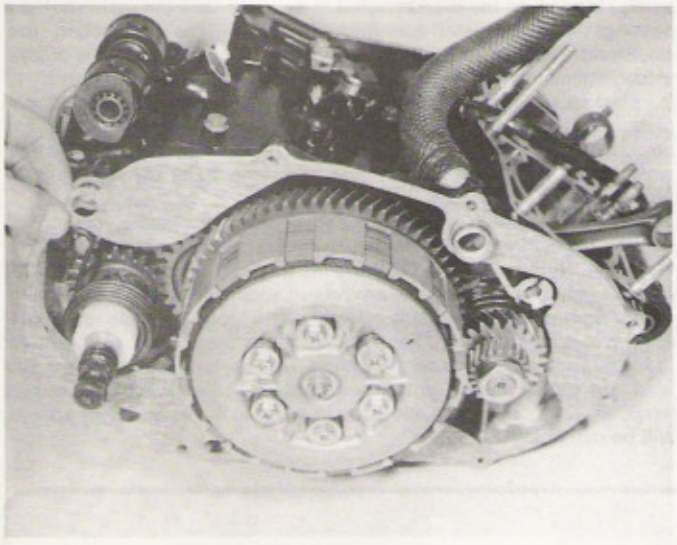
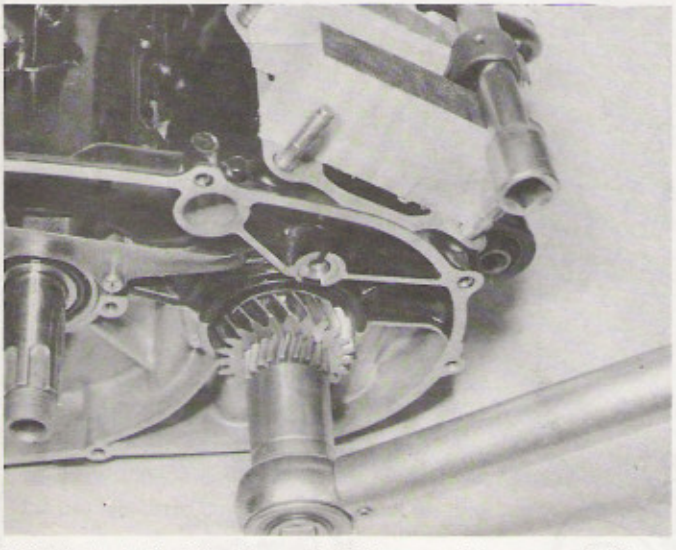


Fig. 1.2 Clutch

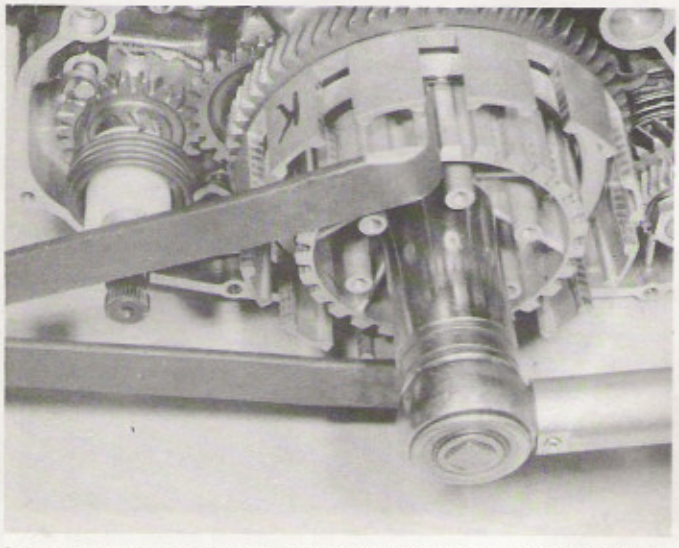
1 *Locknut*
2 *Washer*
3 *Adjuster screw*
4 *Bolt*
5 *Spring*
6 *Pressure plate*
7 *Headed pushrod*
8 *Centre nut*
9 *Lock washer*
10 *Ball*
11 *Plain plate*
12 *Friction plate*
13 *Rubber damping ring*
14 *Clutch centre*
15 *Thrust washer*
16 *Clutch drum*
17 *Centre sleeve*
18 *Thrust washer*
19 *Pushrod*
20 *Release shaft*
21 *Return spring*
22 *Washer*
23 *Oil seal*
24 *Bearing*
25 *Retaining plate*
26 *Screw*
27 *Nut*
28 *Washer*
29 *Primary drive pinion*
30 *Woodruff key*



8.2a Remove the outer cover and gasket to gain access to the clutch



8.2b Method of locking the crankshaft to permit the removal of the primary drive pinion nut



8.4 Make up the holding tool shown to allow the clutch centre nut to be slackened.

9 Dismantling the engine/gearbox unit: removing the primary drive and pump drive pinions

1 The pinions referred to in the heading are mounted on the right-hand end of the crankshaft and are secured by a large nut. The crankshaft (primary drive) pinion is located by a Woodruff key, whilst the outer pinion, which drives the oil and water pumps, is located by pressure from the securing nut. It follows that the nut is very tight and will require the use of a stout socket and lever bar to facilitate loosening. A ring spanner can be used with good effect but on no account attempt removal with an open-ended spanner.

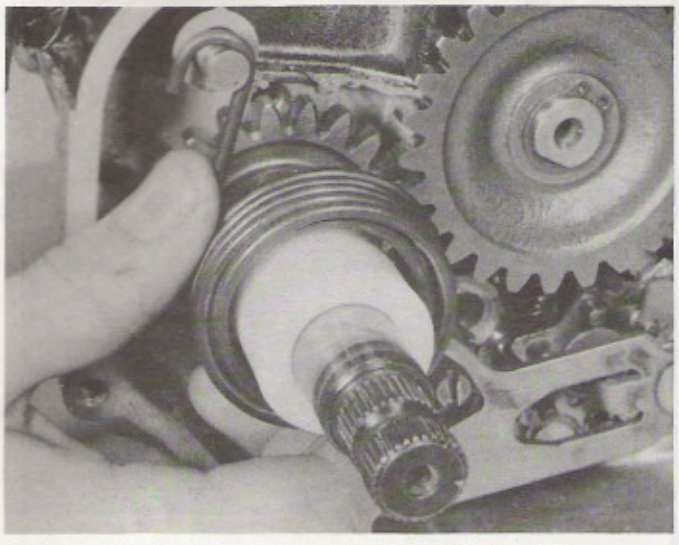
2 As mentioned in the previous Section, a secure method of holding the crankshaft is essential. If the engine is installed in the frame, it is recommended that the securing nut is slackened before the clutch is removed. This will allow the crankshaft to be locked through the transmission by selecting top gear and applying the rear brake.

3 If, on the other hand, the unit is to be dismantled on the workbench, wait until the cylinder head, barrels and pistons have been removed. A close-fitting round metal bar can now be passed through one of the connecting rod small-end eyes and its free ends supported by wooden blocks placed against the crankcase mouth. This will provide positive restraint for the crankshaft without risk of damage to any component. Slacken and remove the nut, followed by the Belville washer. The pump pinion can now be removed together with the primary drive pinion and its Woodruff key. If the clutch is to be dismantled, refer to Section 8.

10 Dismantling the engine/gearbox unit: removing the kickstart mechanism

1 The kickstart mechanism can be removed with the engine in or out of the frame after the engine right-hand casing has been detached. Note that if it is wished to remove the idler pinion which conveys drive to the clutch drum, and thus to the crankshaft, the clutch must be removed first. The idler pinion does not impair crankcase separation and may be left in position unless specific attention to it or the input shaft components is required.

2 Release the kickstart return spring by grasping its outer end with a pair of pliers and disengaging the end from its anchor pin. Allow the spring to unwind in a controlled manner, then pull the kickstart shaft assembly from its casing hole. If it is wished to remove the idler gear pinion after the clutch has been removed, release the circlip which retains it to the end of the gearbox output shaft.



10.2 Unhook the return spring and withdraw the kickstart mechanism from the crankcase

11 Dismantling the engine/gearbox unit: separating the crankcase halves

1 The remaining external engine components can be left in position and do not impair crankcase separation. Their removal is described in Section 12, and it should be noted that if required they can be removed without complete dismantling of the unit. Bear in mind, however, that any internal components, such as the tachometer drive shaft cannot be dealt with unless the crankcase halves have been parted. The only remaining item to be removed at this stage is the input shaft right-hand bearing retainer, which bridges the crankcase halves. It is retained by two cross-head screws which are invariably stubborn and will require the use of an impact driver to effect safe removal.

2 The crankcase bolts are numbered to indicate the correct tightening sequence and should be released in reverse order, starting at the highest number and working backwards. Each bolt should be slackened initially by about 1/4 turn, then removed completely. There are eight bolts on the underside of the unit and a further eight on the upper face of the crankcase. Once all of the bolts have been removed, separate the joint by striking the front and rear edges of the upper crankcase half with a soft-faced mallet.

3 When the joint has been broken the upper crankcase half can be lifted away. Note that the connecting rods will tend to fall against the crankcase edge and they should be supported to prevent this. The gearbox shafts and the crankshaft should remain in the lower crankcase half.

12 Dismantling the engine/gearbox unit: final dismantling

1 Grasp the ends of the crankshaft assembly and lift it away from the lower crankcase half. Note the half-ring which locates the right-hand main bearing. This will probably be displaced as the crankshaft is removed and should be placed in a safe place to avoid its loss. The gearbox input shaft and output shaft assemblies should be removed in a similar manner, again noting the locating half-rings.

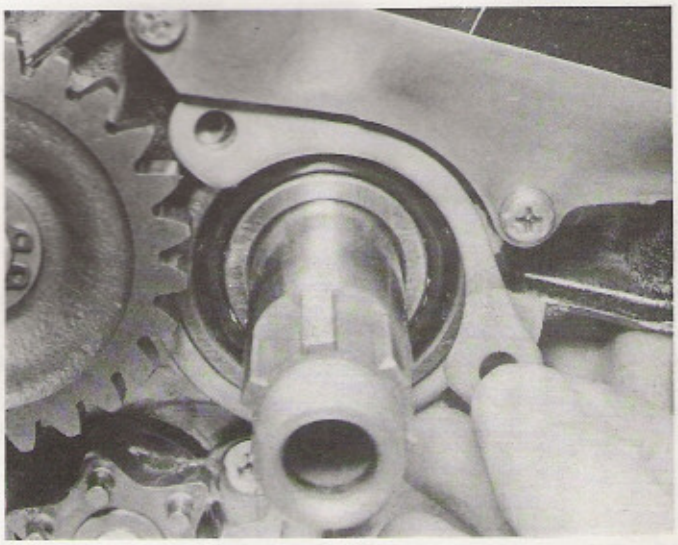
2 Disengage the selector claw from the end of the selector drum and remove the gearchange shaft assembly by displacing the selector shaft on the opposite side of the crankcase. Note that the seal through which the shaft must pass is easily damaged and if it is necessary to re-use it, protect the seal lip by wrapping some pvc tape around the shaft splines.

3 Release the selector drum stopper arm by removing its single retaining bolt, then remove the selector drum retainer which is held by two countersunk crosshead screws. Note that the retainer also locates one of the selector fork shafts. The remaining shaft is retained by the selector mechanism centralising spring anchor pin which should be removed together with the retainer plate.

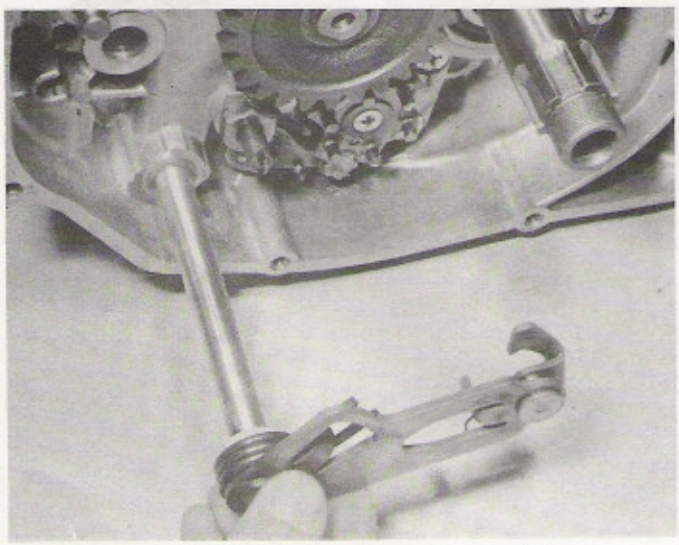
4 Working from inside the crankcase, use a pair of pointed-nose pliers to displace the circlips on the inner ends of the selector fork shafts whilst the shafts are pushed through the casing. Support the selector forks and withdraw the shafts completely, then slide the shafts back through the forks to keep them in the correct relative positions as a guide during reassembly. The selector drum and its bearing can now be pushed out of the casing and removed.

5 The tachometer drive (where fitted) need not be disturbed unless it requires specific attention, but if removal proves necessary proceed as follows. Remove the circlip and plain washer which retain the white plastic drive pinion, then remove the pinion from the shaft end. Displace the drive pin and place it with the pinion for safe keeping. Release the single bolt which retains the tachometer drive body to the crankcase and remove it complete with the driven shaft. Remove the single screw which retains the drive shaft locating plate to allow the shaft to be displaced and removed. The drive gear should be slid off the shaft as the latter is pulled clear of the crankcase, having first released the circlips which retain it.

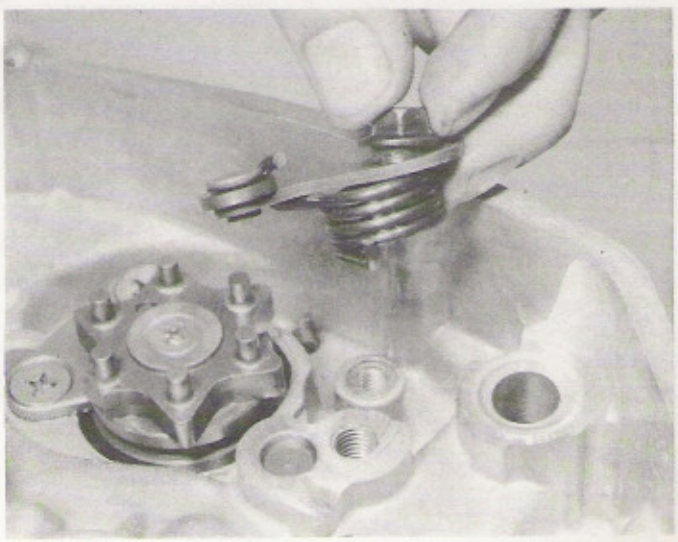
6 The clutch release arm is held in position by a retainer plate, and this will have been removed together with the crankcase bolt which retains it. The arm can be withdrawn from the crankcase upper half by lifting it upwards.



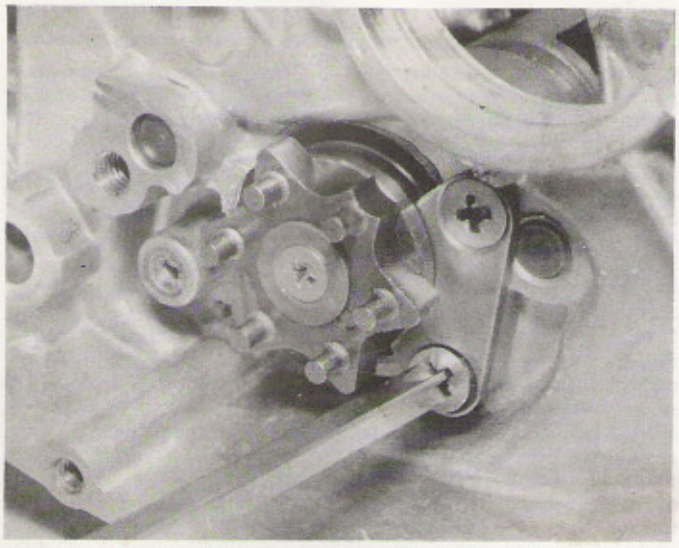
11.1 This bearing retainer bridges the crankcase halves and must be removed to allow separation



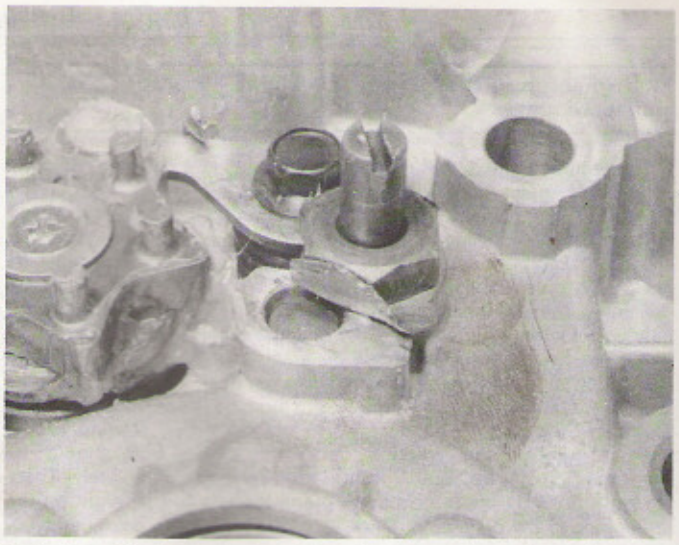
12.2 Disengage and withdraw the selector claw assembly



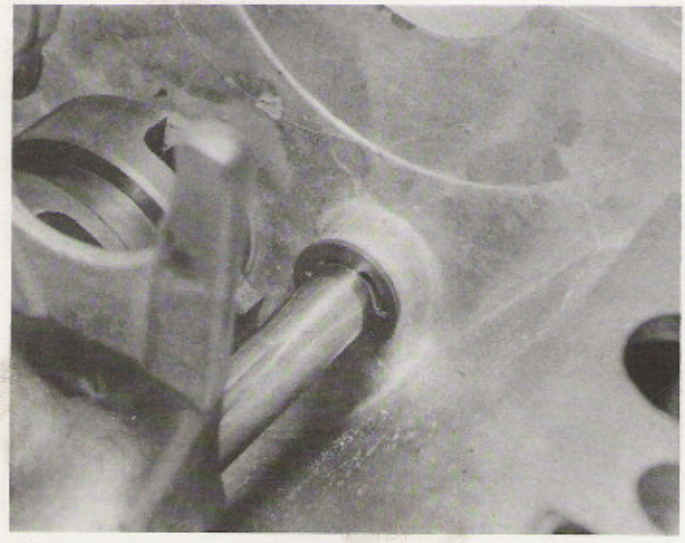
12.3a Stopper arm assembly is held by a single pivot bolt



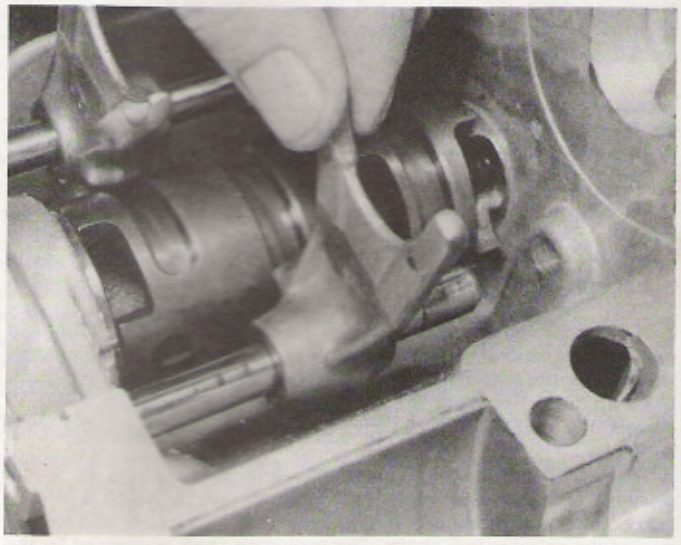
12.3b Selector drum retainer is secured by two countersunk screws



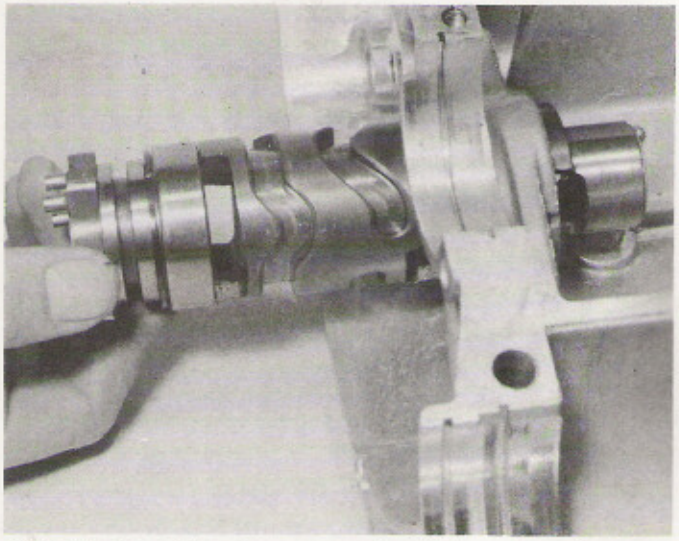
12.3c Knock back the locking tab and unscrew the anchor pin



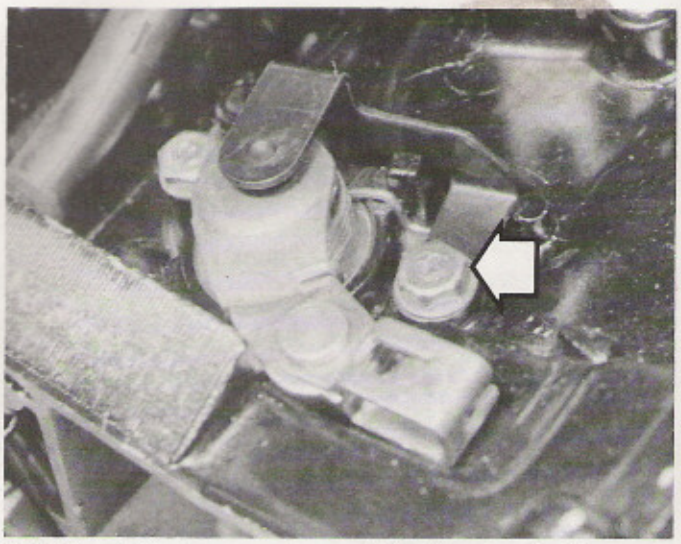
12.4a Release the circlips which retain the selector fork shafts ...



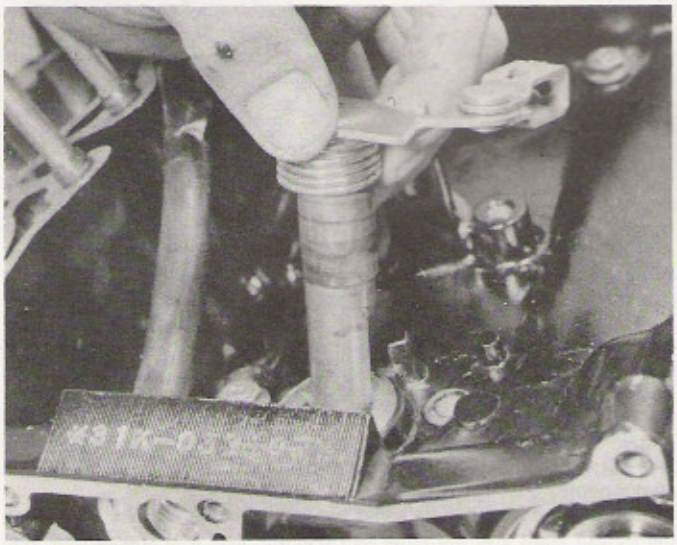
12.4b .. then slide shafts out of casing while supporting the selector forks



12.4c The gear selector drum can now be withdrawn from the crankcase



12.6a The clutch release arm is normally held in place by this retainer and one of the crankcase bolts (arrowed) ...



12.6b ... and can be lifted out of the casing bore for examination

13 Examination and renovation: general

1 Before examining the parts of the dismantled engine unit for wear, it is essential that they should be cleaned thoroughly. Use a paraffin/petrol mix to remove all traces of old oil and sludge that may have accumulated within the engine.
2 Examine the crankcase castings for cracks or other signs of damage. If a crack is discovered, it will require professional repair.
3 Examine carefully each part to determine the extent of wear, checking with the tolerance figures listed in the main text or in the Specifications section of this Chapter. If there is any question of doubt, play safe and renew.
4 Use a clean, lint-free rag for cleaning and drying the various components. This will obviate the risk of small particles obstructing the internal oilways, causing the lubrication system to fail.

14 Gearbox input and output shafts: dismantling and reassembly

1 The gearbox clusters should not be disturbed needlessly, and need only be stripped where careful examination of the whole assembly fails to resolve the source of a problem, or where obvious damage, such as stripped or chipped teeth is discovered.
2 The input and output shaft components should be kept separate to avoid confusion during reassembly. Using circlip pliers, remove the

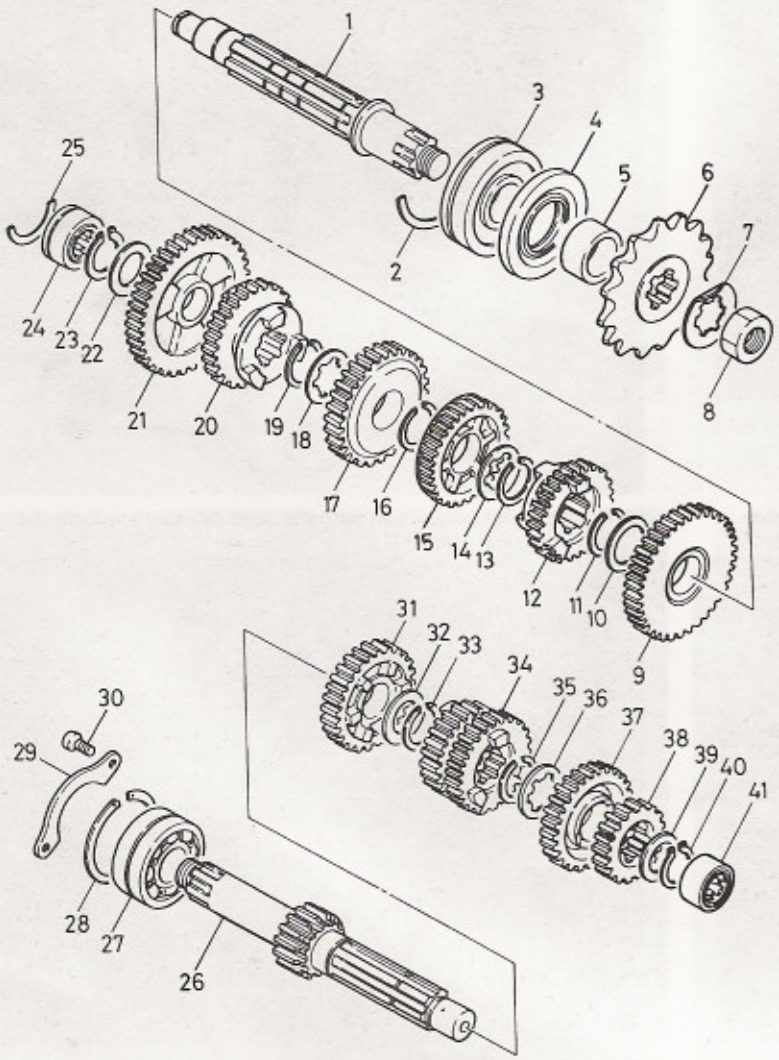


Fig. 1.3 Gearbox components

1 *Output shaft*
2 *Bearing locating ring*
3 *Output shaft left-hand bearing*
4 *Oil seal*
5 *Spacer*
6 *Final drive sprocket*
7 *Tab washer*
8 *Nut*
9 *Output shaft 2nd gear pinion*
10 *Thrust washer*
11 *Circlip*
12 *Output shaft 6th gear pinion*
13 *Circlip*
14 *Splined thrust washer*
15 *Output shaft 4th gear pinion*
16 *Circlip*
17 *Output shaft 3rd gear pinion*
18 *Splined thrust washer*
19 *Circlip*
20 *Output shaft 5th gear pinion*
21 *Output shaft 1st gear pinion*
22 *Thrust washer*
23 *Circlip*
24 *Needle roller bearing*
25 *Bearing locating ring*
26 *Input shaft and 1st gear pinion*
27 *Input shaft right-hand bearing*
28 *Circlip*
29 *Bearing retainer*
30 *Screw*
31 *Input shaft 5th gear pinion*
32 *Thrust washer*
33 *Circlip*
34 *Input shaft 3rd and 4th gear pinion*
35 *Circlip*
36 *Splined thrust washer*
37 *Input shaft 6th gear pinion*
38 *Input shaft 2nd gear pinion*
39 *Thrust washer*
40 *Circlip*
41 *Needle roller bearing*

circlip and plain washer which retain each part. As each item is removed, place it in order on a clean surface so that the reassembly sequence is self evident and the risk of parts being fitted the wrong way round or in the wrong sequence is avoided. Care should be exercised when removing circlips to avoid straining or bending them excessively. The clips must be opened just sufficiently to allow them to be slid off the shaft. Note that a loose or distorted circlip might fail in service, and any dubious items must be renewed as a precautionary measure. The same applies to worn or distorted thrust washers.

3 Having checked and renewed the gearbox components as required (see Section 20) reassemble each shaft, referring to the accompanying line drawing and photographs for guidance. The correct assembly sequence is detailed below.

Input shaft (mainshaft)

4 Note that the input shaft is readily identified by its integral 1st gear pinion. Slide the 5th gear into position with the dogs facing away from the 1st gear.

5 Fit the plain thrust washer and secure the 5th gear pinion with its circlip. The double 3rd/4th gear pinion is fitted next, with the smaller, 22 tooth, gear towards the 5th gear pinion. Fit a circlip to the next exposed groove, followed by a splined thrust washer. This retains the 3rd/4th gear pinion but allows it to move along the shaft to effect gear changes.

6 Slide the 6th gear pinion into place, noting that the engagement dogs face inwards, towards the 3rd/4th gear. The 2nd gear pinion is fitted next and is retained by a plain thrust washer and a circlip. The needle roller bearing should now be lubricated and slid into place to complete assembly. If it has been removed, fit the large caged ball bearing and large thrust washer to the right-hand end of the shaft.

Output shaft (layshaft)

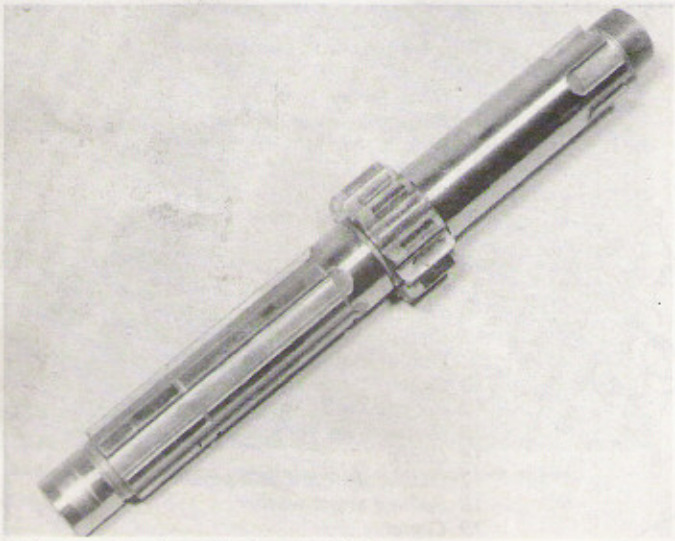
7 Slide the 2nd gear pinion up against the shouldered portion of the output shaft, noting that it must be fitted from the right-hand end, with the engagement webs away from the shoulder. Fit a plain thrust washer and retain the pinion with a circlip.

8 Slide the 6th gear pinion into position with the selector groove away from the previous gear. Fit a circlip to limit the 6th gear pinion's movement then slide a splined thrust washer into place.

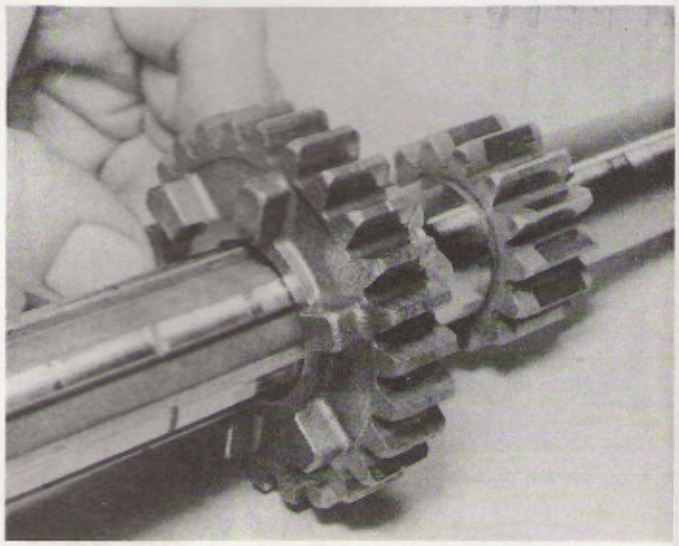
9 The 4th gear pinion is fitted next, noting that the heavily chamfered teeth face outwards, towards the right-hand end of the shaft. Secure it with a circlip, then fit the 3rd gear pinion, plain face inwards, and retain it with a splined thrust washer and a circlip.

10 The 5th gear pinion can now be slid into place with the selector groove inwards, followed by the large 1st gear pinion with its plain face outwards. Fit a plain thrust washer and a circlip to retain the above components.

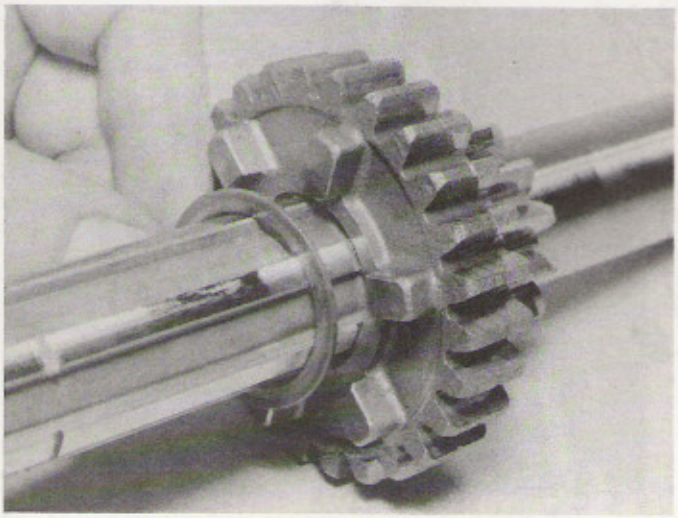
11 Place the caged needle roller bearing over the right-hand end of the output shaft and the large ball bearing, seal and spacer over the left-hand end. The idler gear which runs on the right-hand end of the output shaft can be fitted at this stage noting that a thrust washer is fitted on each side of the pinion and that the assembly is retained by a circlip.



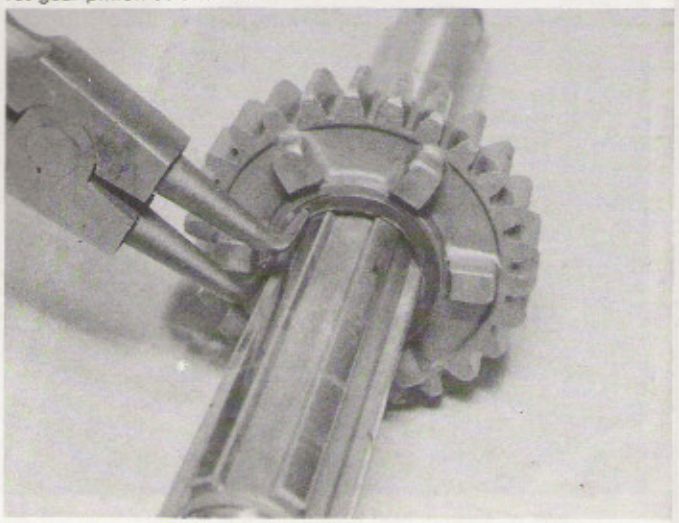
14.4a Input shaft can be identified by its integral 1st gear pinion



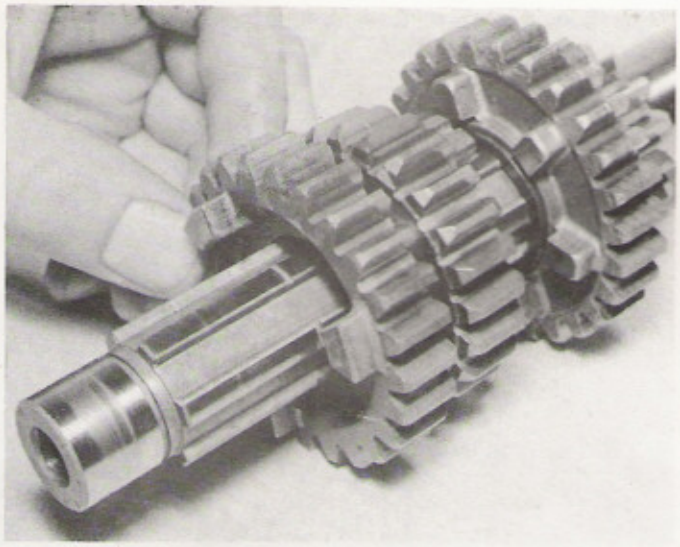
14.4b Fit the 5th gear pinion with the dogs facing away from the 1st gear pinion as shown



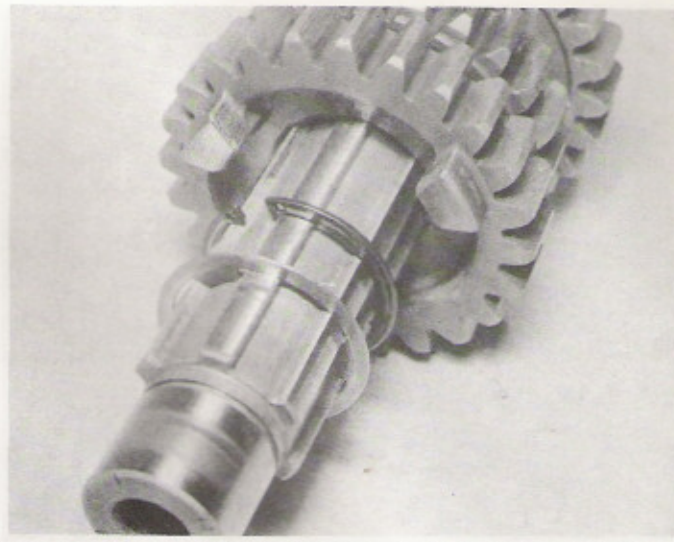
14.5a Slide a plain thrust washer up against the pinion ...



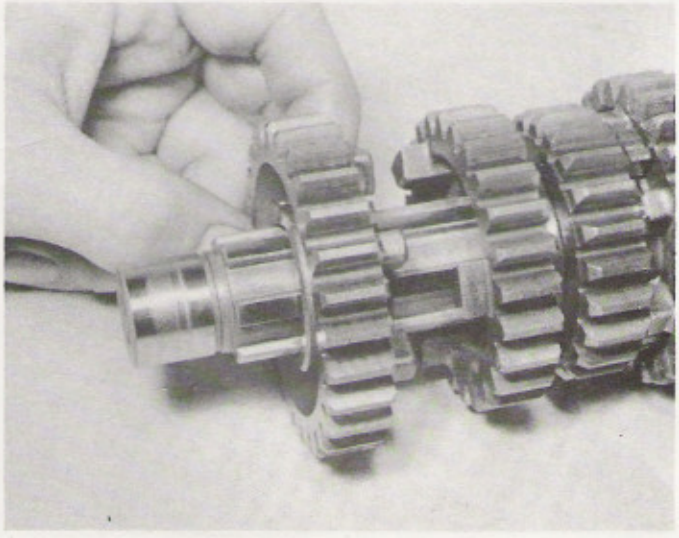
14.5b ... and secure it with a circlip



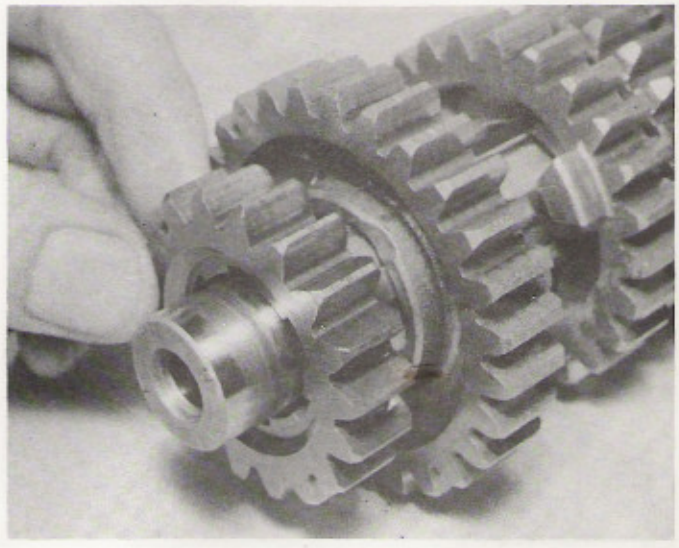
14.5c The double 3rd/4th gear pinion is fitted next, facing in the direction shown



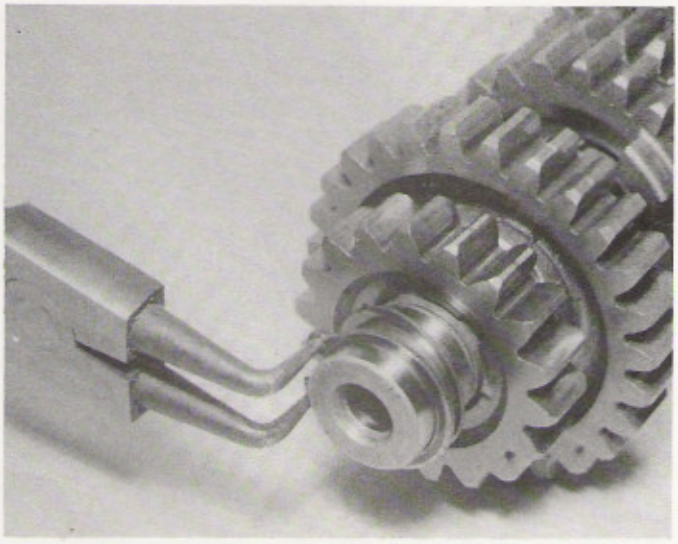
14.5d Fit the circlip in the position shown, leaving the gear free to slide on the shaft, then fit the splined thrust washer



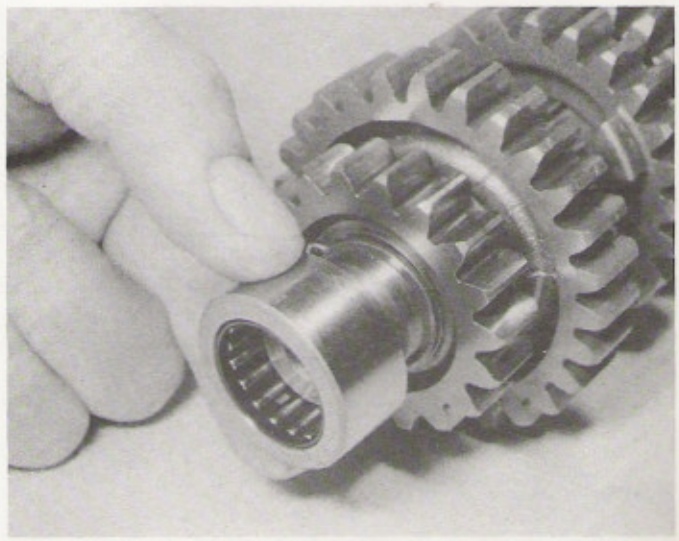
14.6a The 6th gear pinion can now be fitted with the engagement dogs innermost



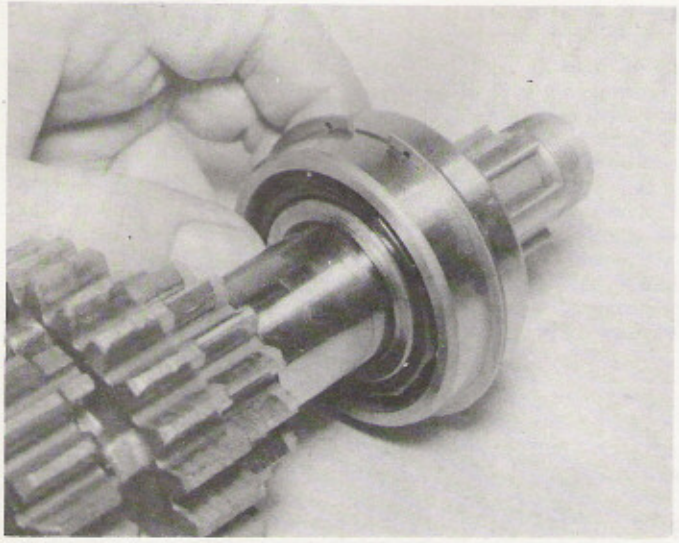
14.6b The 2nd gear pinion is fitted, directly against the 6th gear ...



14.6c ... and is retained by a thrust washer and circlip

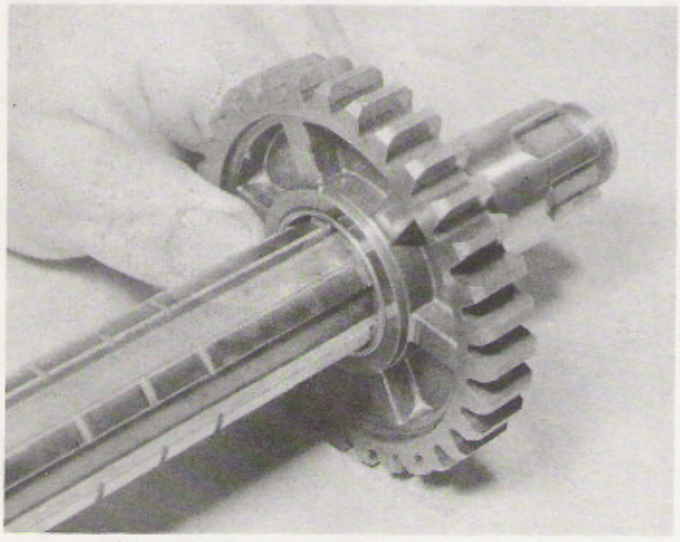


14.6d Complete input shaft assembly by fitting the needle roller bearing on the left-hand end of the shaft ...

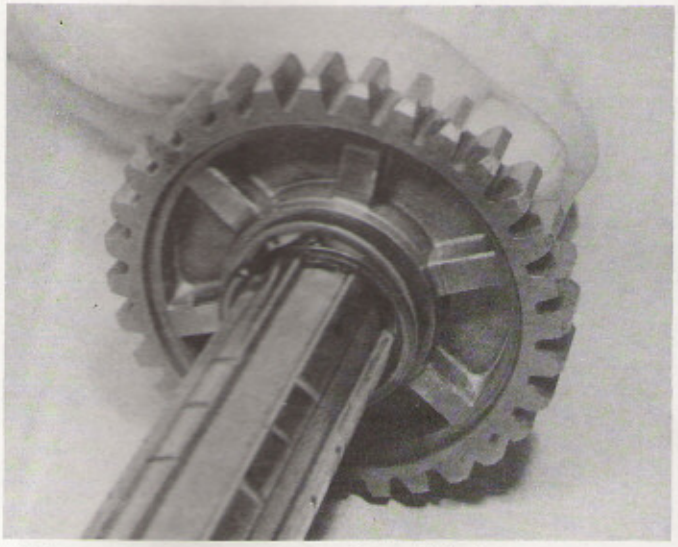


14.6e ... and the larger caged ball bearing to the right-hand end of the shaft

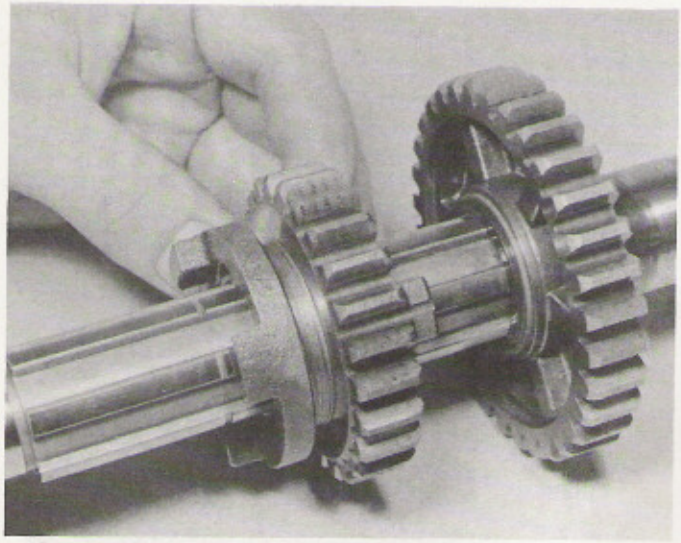
14.7a The output shaft has a plain shoulder at the left-hand end



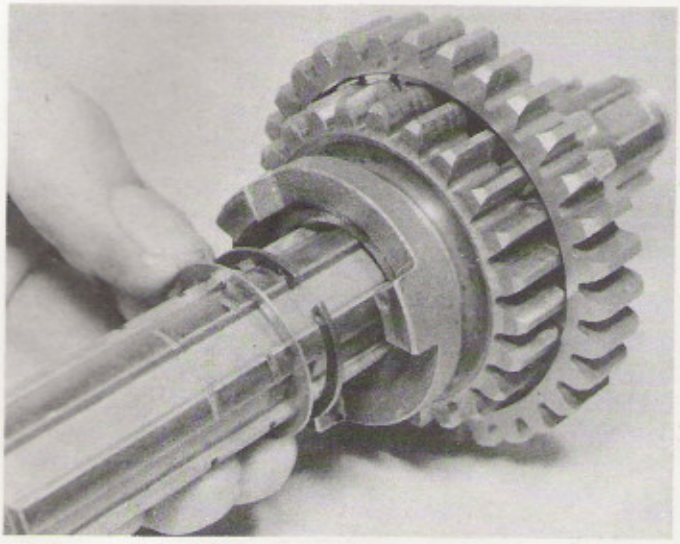
14.7b Slide the 2nd gear pinion into place, facing in the direction shown ...



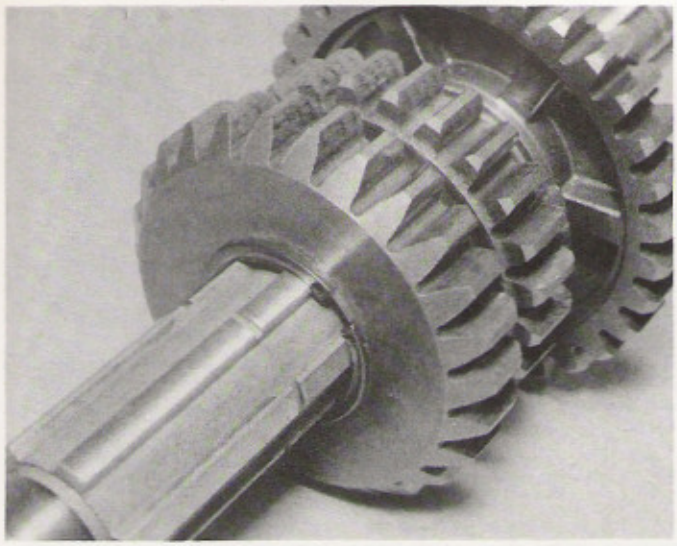
14.7c ... and retain with a thrust washer and circlip



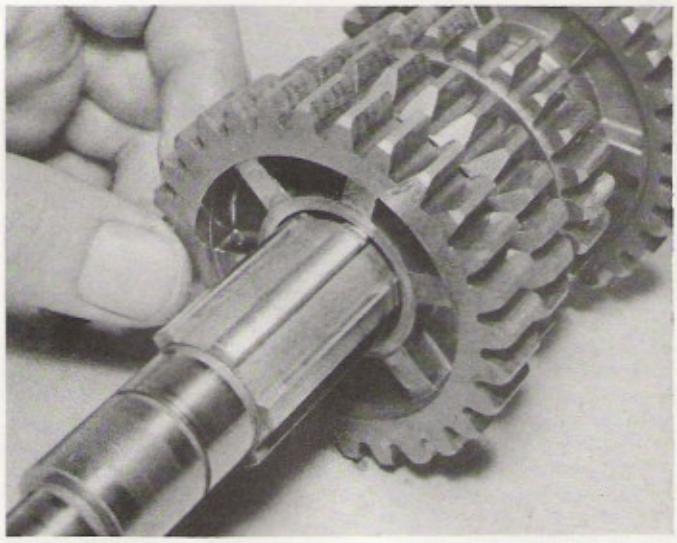
14.8a Slide the 6th gear pinion onto the shaft with the selector groove outwards as shown ...



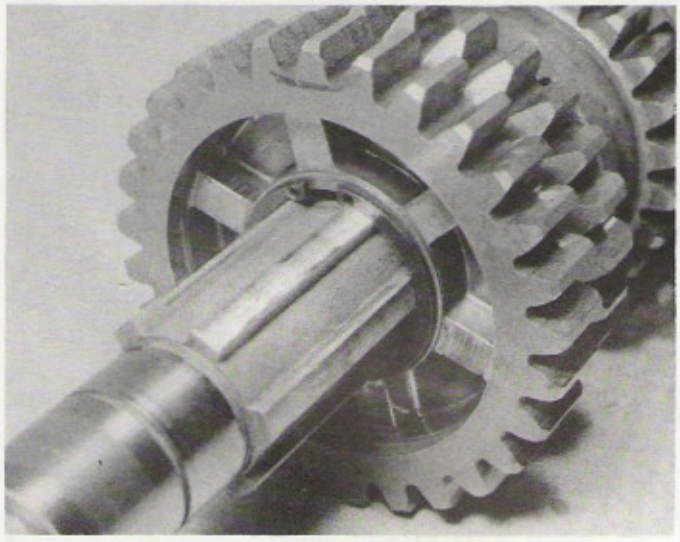
14.8b ... and fit the circlip and splined washer to limit its movement



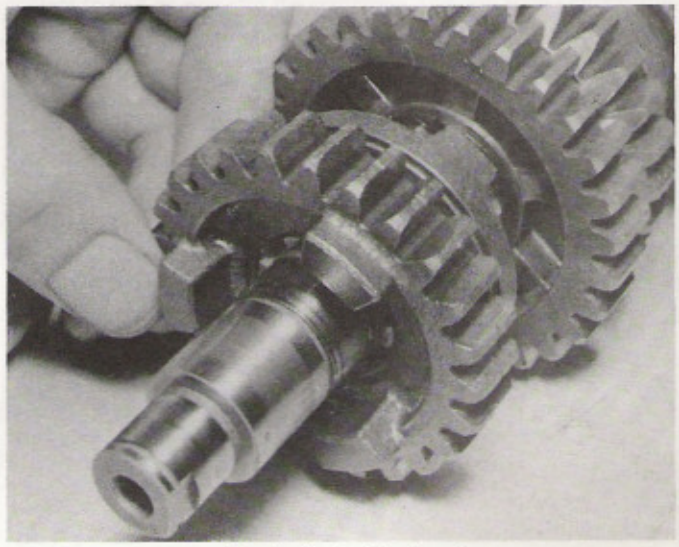
14.9a The 4th gear pinion is fitted next with its chamfered teeth outermost



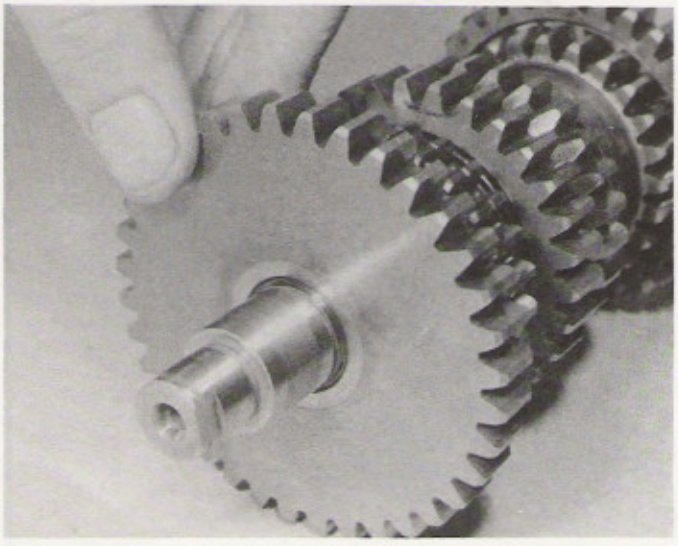
14.9b Now fit the 3rd gear pinion ...



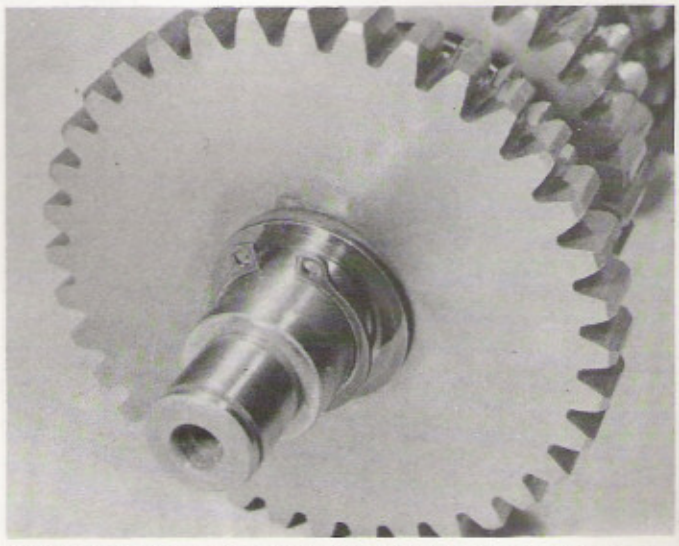
14.9c ... splined washer and circlip



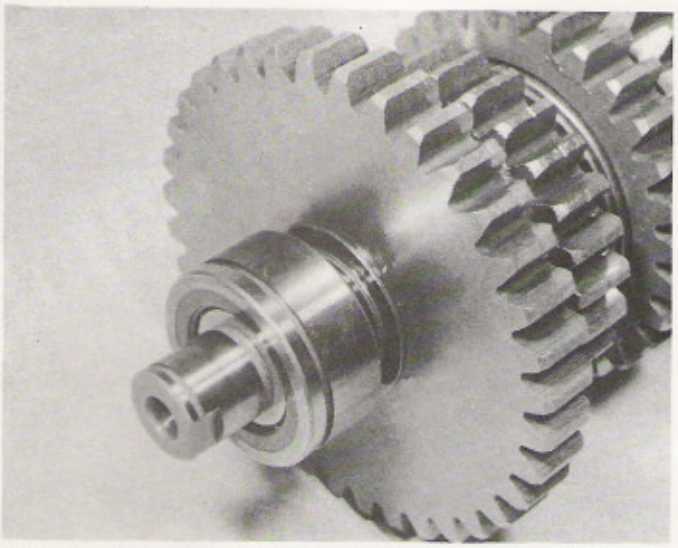
14.10a The 5th gear pinion is fitted with the selector groove inwards ...



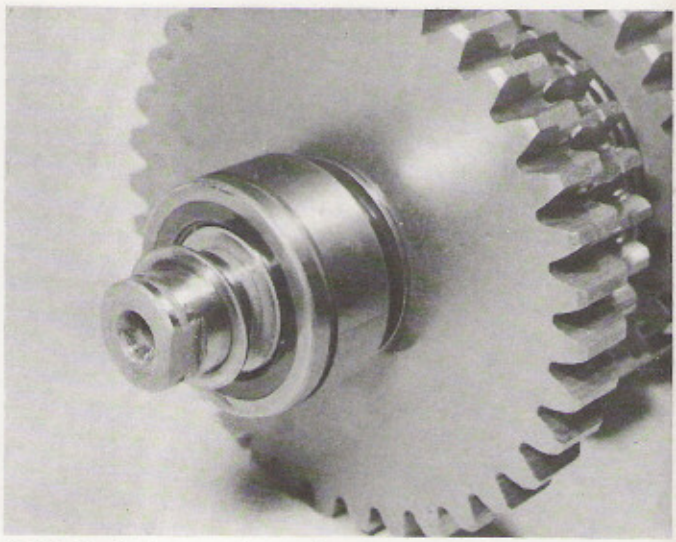
14.10b ... followed by the large 1st gear pinion, plain face outermost



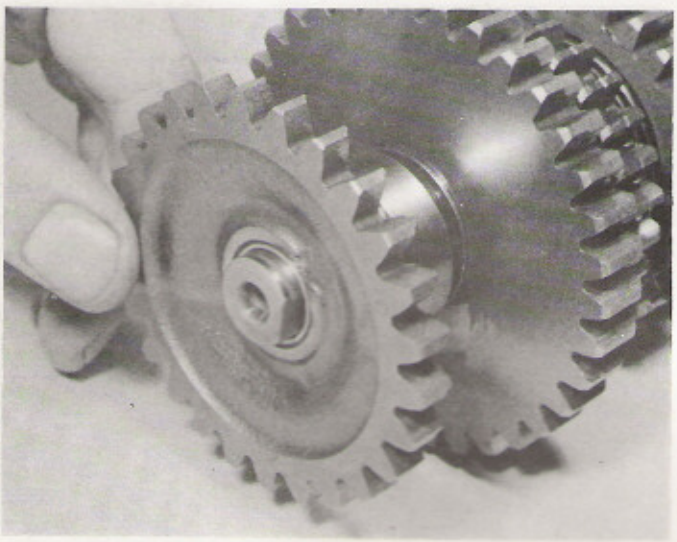
14.10c Secure the last two gears with a plain thrust washer and a circlip



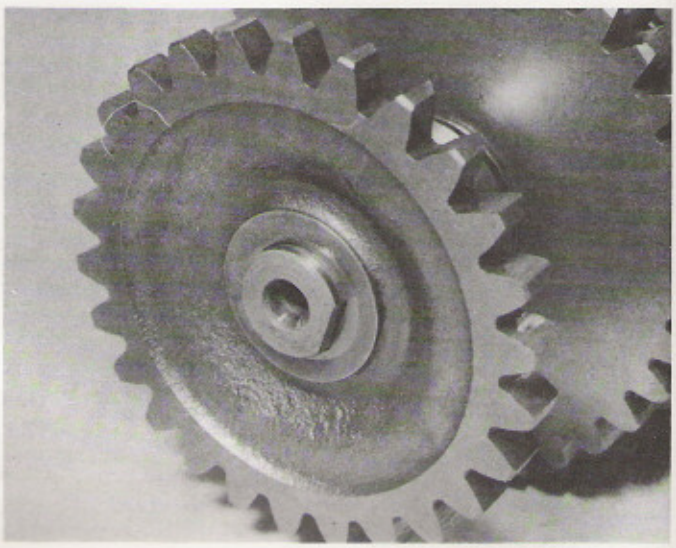
14.11a Fit the caged needle roller bearing over the shaft right-hand end



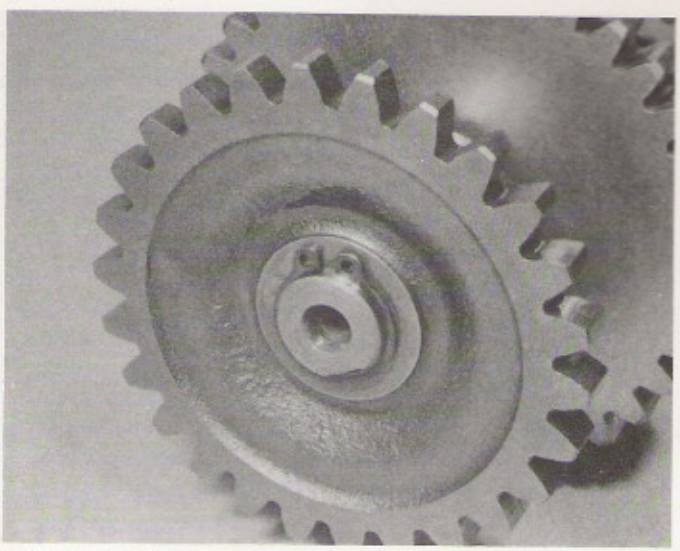
14.11b Fit the thrust washer as shown ...



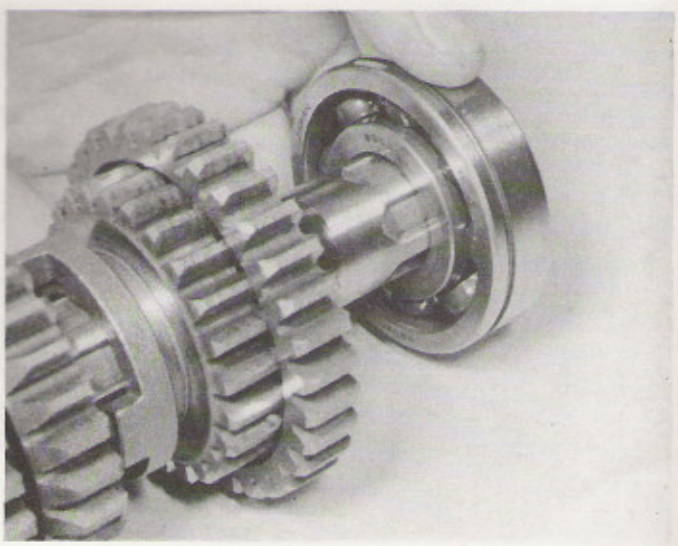
14.11c ... followed by the idler gear ...



14.11d ... and its special thrust washer (note flat in its internal bore)



14.11e Secure the idler gear with the circlip



14.11f Fit the large caged ball bearing to the left-hand end of the shaft

16 Big-end and main bearings: examination and renovation

1 Failure of the big-end bearing is invariably accompanied by a knock within the crankcase that progressively becomes worse. Some vibration will also be experienced.

2 There should be no vertical play whatsoever in the big-end bearings, after the oil has been washed out. If even a small amount of vertical play is evident, the bearings are due for replacement. (A small amount of endfloat is both necessary and acceptable.) Do not continue to run the machine with worn big-end bearings, for there is risk of breaking the connecting rods or crankshaft.

3 If a dial gauge and V-blocks are available check the amount of radial clearance in the big-end bearings, measuring this as lateral deflection at the small-end of each connecting rod to magnify the clearance in the big-end bearings. A serviceable bearing will allow between 0.36 and 1.0 mm (0.0142 – 0.0394 in) free play, whilst 2.0 mm (0.0787 in) of movement is indicative of the need for renewal of the bearing concerned.

4 Check the connecting rod side clearance by measuring the gap between it and the adjacent flywheel boss with feeler gauges. Clearance should be between 0.25 mm (0.0098 in) minimum and 0.75 mm (0.0295 in) maximum.

5 The crankshft main bearings are of the ball journal type. If wear is evident in the form of play, or if the bearings feel rough as they are rotated, replacement is necessary. Always check after the old oil has been washed out of the bearings. Whilst it is possible to remove the outer bearings at each end of the crankshaft, it is probable that the centre bearing will also require attention.

6 *In the event that the big-end or main bearings prove to be in need* of renewal it will be necessary to have the work done by an authorised Yamaha dealer. It is not practicable to attempt to overhaul the crankshaft without the necessary press and trueing equipment. The Yamaha dealer will also be able to check and correct runout in a crankshaft that has become twisted or distorted for any reason. If the owner possesses a dial gauge and stand, runout may be checked by supporting the crankshaft on its centre bearings and then measuring deflection as the crank is rotated with the dial gauge needle resting on the end of each mainshaft and on both outer main bearings. No one reading should exceed 0.05 mm (0.0020 in). Correction of excessive runout requires a large degree of skill and experience if the problem is not to be made worse by the operator misunderstanding the cause of the problem. For this reason, professional help should be enlisted.

7 Failure of both the big-end bearings and the main bearings may not necessarily occur as the result of high mileage covered. If the machine is used only infrequently, it is possible that condensation within the engine may cause premature bearing failure. The condition of the flywheels is usually the best guide. When condensation troubles have occurred, the flywheels will rust and become discoloured. Note too that lack of care when disturbing the cylinder head or barrels can allow coolant to find its way into the crankcase. This will soon corrode and destroy the bearings and should be avoided for obvious reasons.

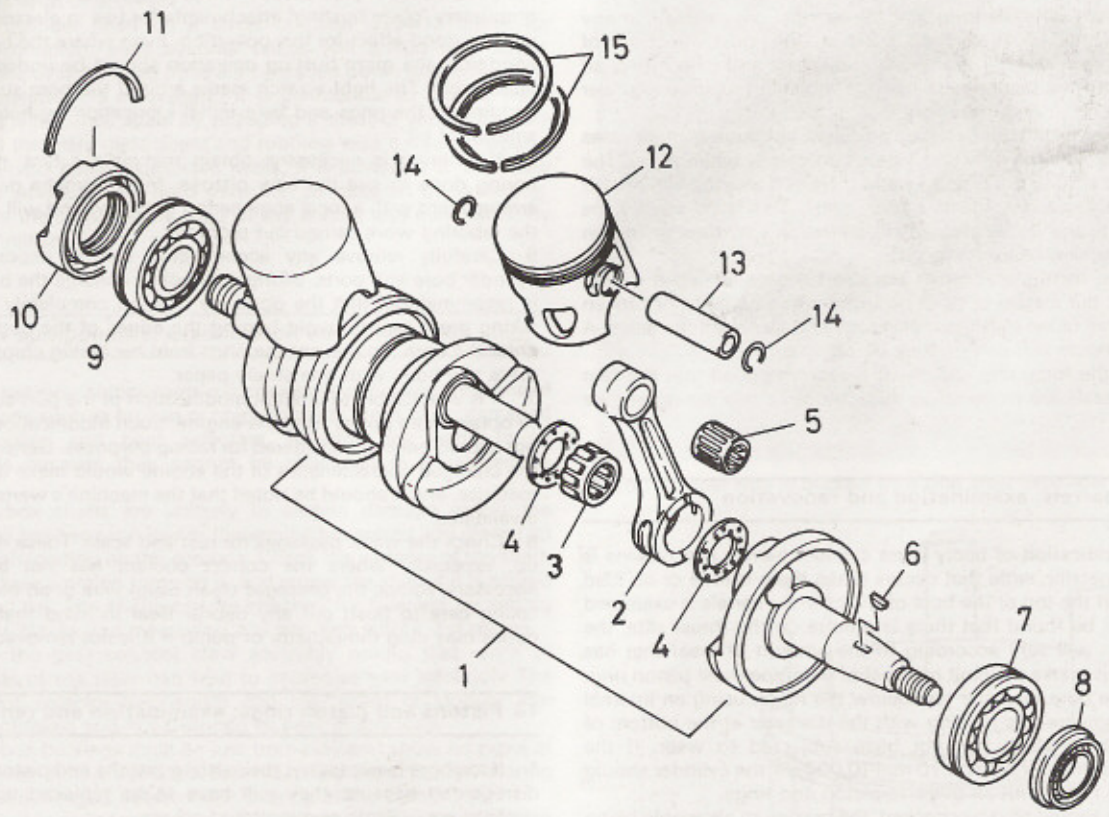
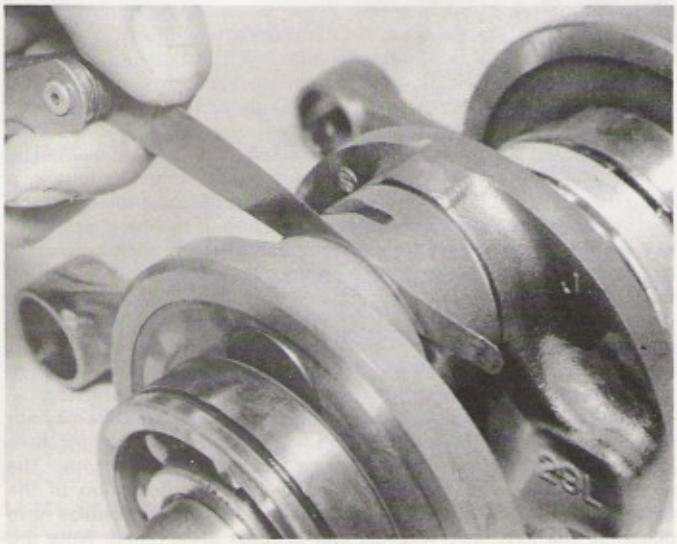
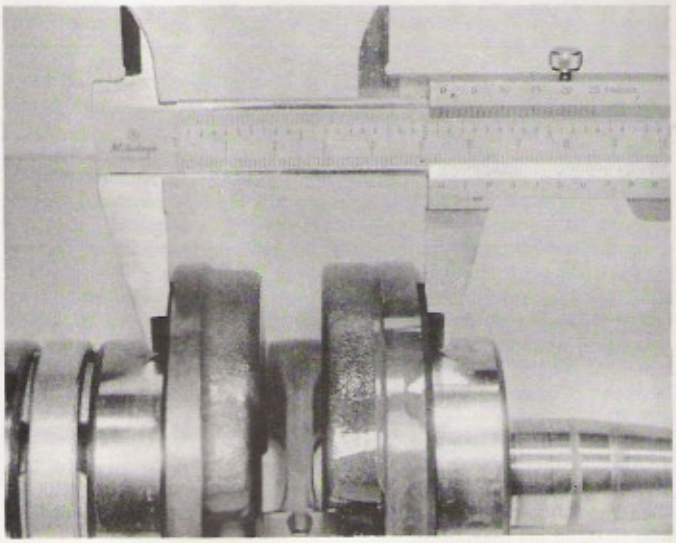


Fig. 1.4 Crankshaft

1 *Crankshaft*
2 *Connecting rod*
3 *Big-end bearing*
4 *Thrust washer*
5 *Small-end bearing*
6 *Woodruff key*
7 *Left-hand main bearing*
8 *Oil seal*
9 *Right-hand main bearing*
10 *Oil seal*
11 *Half-ring*
12 *Piston*
13 *Gudgeon pin*
14 *Circlip*
15 *Piston rings*



15.4a Big-end bearing side clearance can be checked using feeler gauges



15.4b Check the dimensions of the crankshaft assembly (see specifications)

16 Oil seals: examination and renovation

1 The crankshaft oil seals form one of the most critical parts in any two-stroke engine because they perform the dual function of preventing oil from leaking along the crankshaft and preventing air from leaking into the crankcase when the incoming mixture is under crankcase vacuum during induction.
2 Oil seal failure is difficult to define precisely, although in most cases the machine will become difficult to start, particularly when warm. The engine will also tend to run unevenly and there will be a marked fall-off in performance, especially in the higher gears. This is caused by the intake of air into the crankcases which dilutes the mixture, giving an exceptionally weak mixture for ignition.
3 It is unusual for the crankshaft seals to become damaged during normal service, but instances have occurred when particles of broken piston rings have fallen into the crankcases and lacerated the seals. A defect of this nature will immediately be obvious.
4 In view of the foregoing remarks it is recommended that the two crankshaft oil seals are renewed as a matter of course during engine overhaul.

17 Cylinder barrels: examination and renovation

1 The usual indication of badly worn cylinder barrels and pistons is piston slap, a metallic rattle that occurs when there is little or no load on the engine. If the top of the bore of the cylinder barrels is examined carefully, it will be found that there is a ridge on the thrust side, the depth of which will vary according to the amount of wear that has taken place. This marks the limit of travel of the uppermost piston ring.
2 Measure the bore diameter just below the ridge, using an internal micrometer. Compare this reading with the diameter at the bottom of the cylinder bore, which has not been subjected to wear. If the difference in readings exceeds 0.10 mm (0.004 in) the cylinder should be rebored and fitted with an oversize piston and rings.
3 Bore ovality should also be checked, the maximum allowable being 0.01 mm (0.0004 in). Given that the bores are within the above limits and that the pistons are in serviceable condition (see Section 18) the parts may be re-used. Ovality may be corrected to some extent by honing, provided that this does not cause the maximum piston to bore clearance to be exceeded. A Yamaha dealer or a reputable engineering company will be able to assist with honing work should this prove necessary.
4 If scoring of the cylinder walls is evident it will normally prove necessary to have it re-bored to the next oversize, though light scratching may sometimes be removed by careful honing or by judicious use of abrasive paper. If the latter approach is adopted be careful to avoid removing more than the absolute minimum of material. The paper should be applied with a rotary motion **never** up and down the bore, which would cause more problems than it solves. One of the proprietary 'glaze busting' attachments for use in electric drills can be used to good effect for this operation. Even where the bore is in good condition, the glaze busting operation should be undertaken prior to reassembly. The light scratch marks around the bore surface assist in bedding in the rings and help initial lubrication by holding a certain amount of oil.
5 If reboring is necessary, obtain the pistons first, then have the boring done to suit the new pistons. Most Yamaha dealers have an arrangement with a local engineering company and will be able to get the reboring work carried out promptly.
6 Carefully remove any accumulated carbon deposits from the cylinder bore and ports, taking care not to damage the bore surface. It is recommended that the ports are cleaned completely but carefully, taking great care to avoid burring the edges of the ports where they enter the bore. To prevent the rings from becoming chipped or broken dress any burrs with fine emery paper.
7 It is inadvisable to attempt modification of the port sizes or profiles to obtain more power from the engine. Such modifications are feasible but should only be considered for racing purposes. Generally speaking, the changed characteristics of the engine would make it unwieldy for road use, and it should be noted that the machine's warranty would be invalidated.
8 Check the water passages for rust and scale. These may have built up, especially where the correct coolant has not been used. If necessary, scrape the passages clean using wire or an old screwdriver, taking care to flush out any debris. Bear in mind that any residual debris may clog the radiator or pump if it is not removed.

18 Pistons and piston rings: examination and renovation

1 If a rebore is necessary, the existing pistons and piston rings can be disregarded because they will have to be replaced with their new oversize equivalents as a matter of course.
2 Remove all traces of carbon from the piston crowns, using a blunt-ended scraper to avoid scratching the surface. Finish off by polishing the crowns with metal polish, so that carbon will not adhere so readily in the future. Never use emery cloth on the soft aluminium.
3 Piston wear usually occurs at the skirt or lower end of the piston and takes the form of vertical streaks or score marks on the thrust face. There may also be some variation in the thickness of the skirt, in an extreme case.
4 The piston ring grooves may have become enlarged in use, allowing the rings to have greater side float. If the clearances exceed those given, the rings, and possibly the pistons, must be renewed.

Piston to ring clearances

Top	0.02 – 0.06 mm (0.0008 – 0.0024 in)
2nd	0.03 – 0.07 mm (0.0012 – 0.0028 in)

5 Piston ring wear is measured by removing the rings from the piston and inserting them in the cylinder, using the crown of a piston to locate them about 20 mm from the bottom of the bore. Make sure they rest squarely in the bore. Measure the end gap with a feeler gauge; if the gap exceeds that given below, the rings must be replaced.

Piston ring end gap (installed)

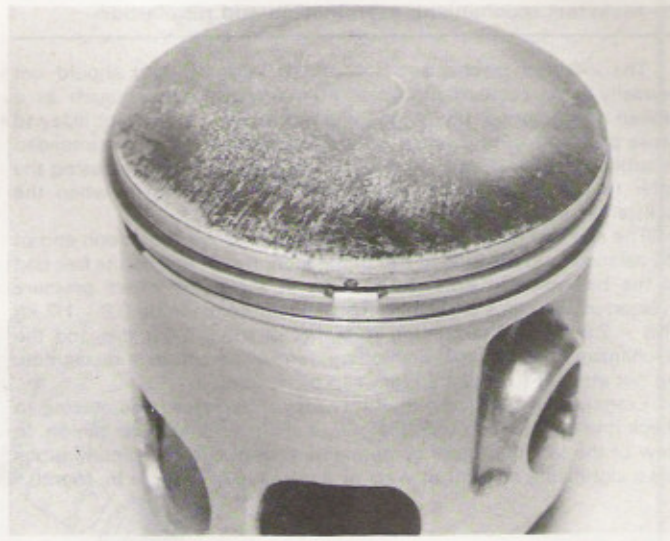
Top	0.30 – 0.45 mm (0.0118 – 0.0177 in)
2nd	0.35 – 0.50 mm (0.0138 – 0.0197 in)

19 Cylinder head: examination and renovation

1 Remove all traces of carbon from the cylinder head, using a blunt-ended scraper. Finish by polishing with metal polish, to give a smooth, shiny surface. This will aid gas flow and will also prevent carbon from adhering so firmly in the future.
2 Check the condition of the threads in the sparking plug holes. If the threads are worn or stretched as the result of overtightening the plugs, they can be reclaimed by a 'Helicoil' thread insert. Most dealers have the means of providing this cheap but effective repair.
3 Inspect the water passages cast into the cylinder head, and where necessary remove any accumulated corrosion or scale. As mentioned previously, this can result from failure to use the recommended coolant mixture. Be sure to remove any debris from the passages by flushing them through with clean water.
4 Lay the cylinder head on a sheet of plate glass to check for distortion. Aluminium alloy cylinder heads will distort very easily, especially if the cylinder head bolts are tightened down unevenly. If the amount of distortion is only slight, it is permissible to rub the head down until it is flat once again by wrapping a sheet of very fine emery cloth around the plate glass sheet and rubbing with a rotary motion.
5 If the cylinder head is distorted badly, it is advisable to fit a new replacement. Although the head joint can be restored by skimming, this will raise the compression ratio of the engine and may adversely affect performance.

20 Gearbox components: examination and renovation

1 Give the gearbox components a close visual inspection for signs of wear or damage such as broken or chipped teeth, worn dogs, damaged or worn splines and bent selectors. Replace any parts found unserviceable because they cannot be reclaimed in a satisfactory manner.
2 The gearbox shafts are unlikely to sustain damage unless the lubricating oil has been run low or the engine has seized and placed an unusually high loading on the gearbox. Check the surfaces of the shaft, especially where a pinion turns on it, and renew the shaft if it is scored or has picked up. The shafts can be checked for trueness by setting them up in V-blocks and measuring any bending with a dial gauge.
3 Examine the gear selector claw assembly noting that worn or rounded ends of the claw can lead to imprecise gear selection. The springs in the selector mechanism and the detent or stopper arm should be unbroken and not distorted or bent in any way.
4 The gearbox bearings must be free from play and show no signs of roughness when they are rotated. Each shaft has a ball journal bearing at one end and a caged needle roller bearing at the other.
5 It is advisable to renew the gearbox oil seals irrespective of their condition. Should a re-used oil seal fail at a later date, a considerable amount of dismantling is necessary to gain access and renew it.
6 Check the gear selector rods for straightness by rolling them on a sheet of plate glass. A bent rod will cause difficulty in selecting gears and will make the gear change action particularly heavy.
7 The selector forks should be examined closely, to ensure that they are not bent or badly worn. Wear is unlikely to occur unless the gearbox has been run for a period with a particularly low oil content.
8 The tracks in the gear selector drum, with which the selector forks engage, should not show any undue signs of wear unless neglect has led to under lubrication of the gearbox.



18.5a Note how ring ends locate over peg in ring grooves

18.5b Scraper ring is backed by a thin steel expander

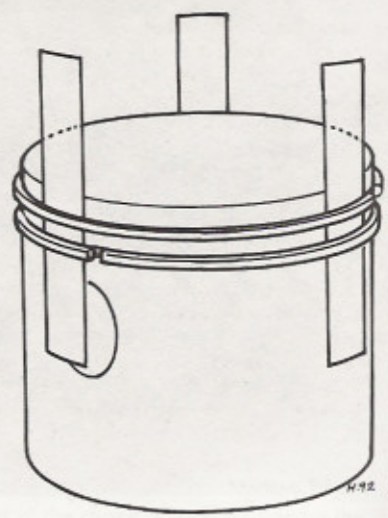


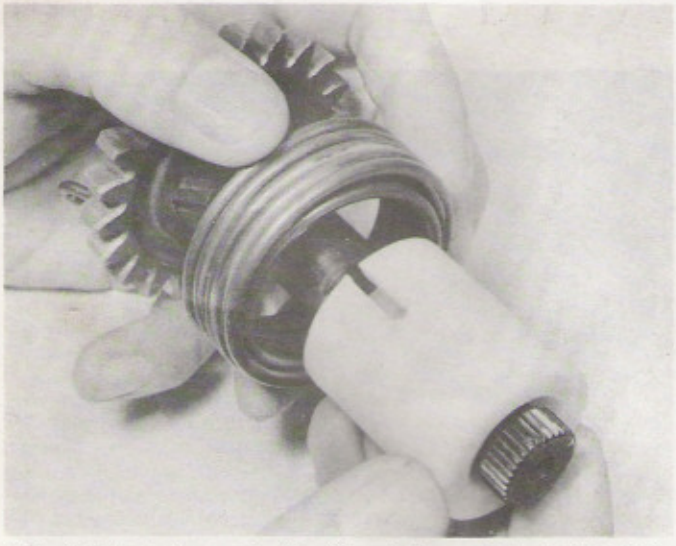
Fig. 1.5 Method of removing gummed piston rings

21 Kickstart mechanism: examination and renovation

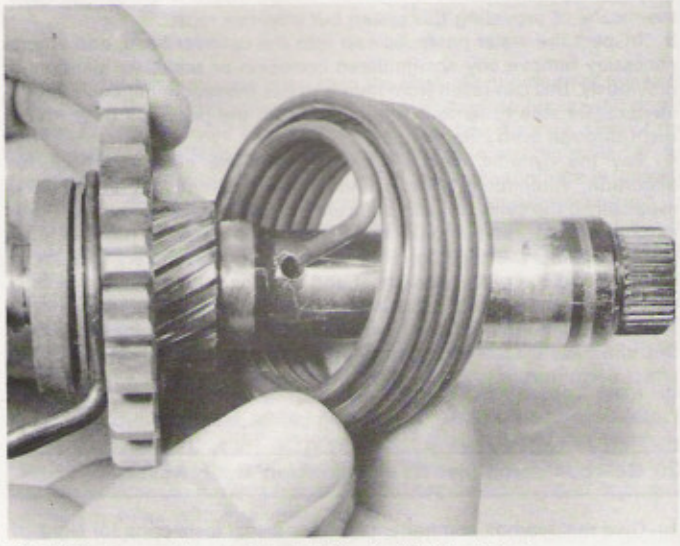
1 The kickstart mechanism is a robust assembly and should not normally require attention. Apart from obvious defects such as a broken return spring, the friction clip is the only component likley to cause problems if it becomes worn or weakened. The clip is intended to apply a known amount of drag on the kickstart pinion, causing the latter to run up its quick thread and into engagement when the kickstart lever is operated.
2 The clip can be checked using a spring balance. Hook one end of the balance onto the looped end of the friction clip. Pull on the free end of the balance and note the reading at the point where pressure overcomes the clip's resistance. This should normally be 0.8 – 1.2 kg (1.8 – 2.9 lb). If the reading is higher or lower than this and the mechanism has been malfunctioning, renew the clip as a precaution. Do not attempt to adjust a worn clip by bending it.
3 Examine the kickstart pinion for wear or damage, remembering to check it in conjunction with the output shaft-mounted idler pinion. In view of the fact that these components are not subject to continuous use a significant amount of wear or damage is unlikely to be found.

22 Primary drive: examination and renovation

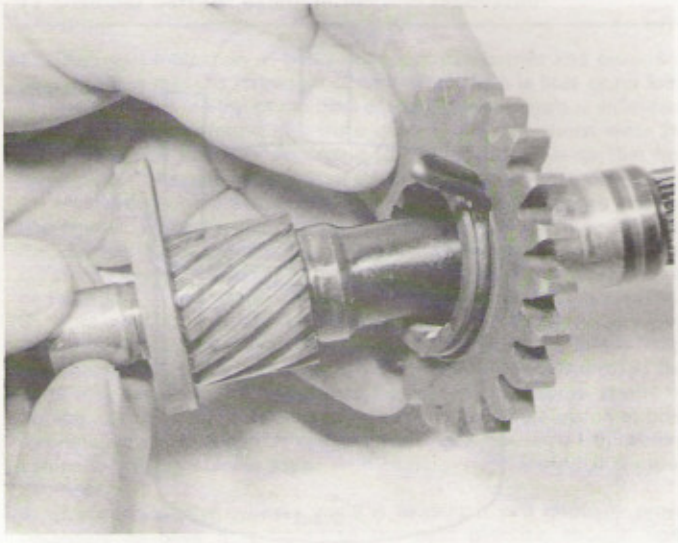
1 The primary drive consists of a crankshaft pinion which engages a large gear mounted on the inner face of the clutch drum. Both components are relatively lightly loaded and will not normally wear until very high mileages have been covered.
2 If wear or damage is discovered it will be necessary to renew the component concerned. In the case of the large driven gear it will be necessary to purchase a complete clutch drum because the two items form an integral unit and cannot be obtained separately.
3 When obtaining new primary drive parts note that the two components are matched to give a prescribed amount of backlash. To this end, ensure that the match marks marked on the inner face of each are similar to avoid excessive or insufficient clearance.
4 To check the backlash of the two components, examine the back face of each and make a note of the number etched into the metal. These two numbers, when added together, give the backlash figure. The number on the drive (crankshaft) pinion will be between 90 and 98, whilst that of the driven gear (clutch) will be between 57 and 65. The prescribed backlash tolerance is 154-156.



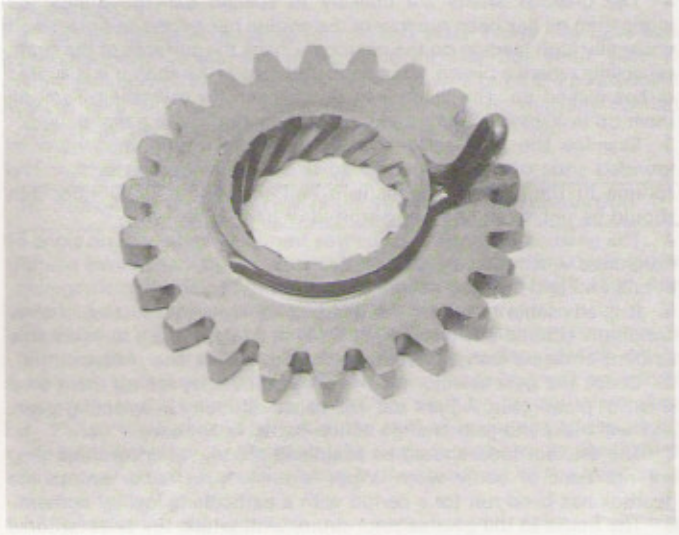
21.1a Kickstart return spring is held central by a white plastic spacer



21.1b Spring end hooks into hole in the kickstart shaft



21.1c Kickstart pinion is removed as shown



21.1d Use spring balance to check force needed to move the friction clip

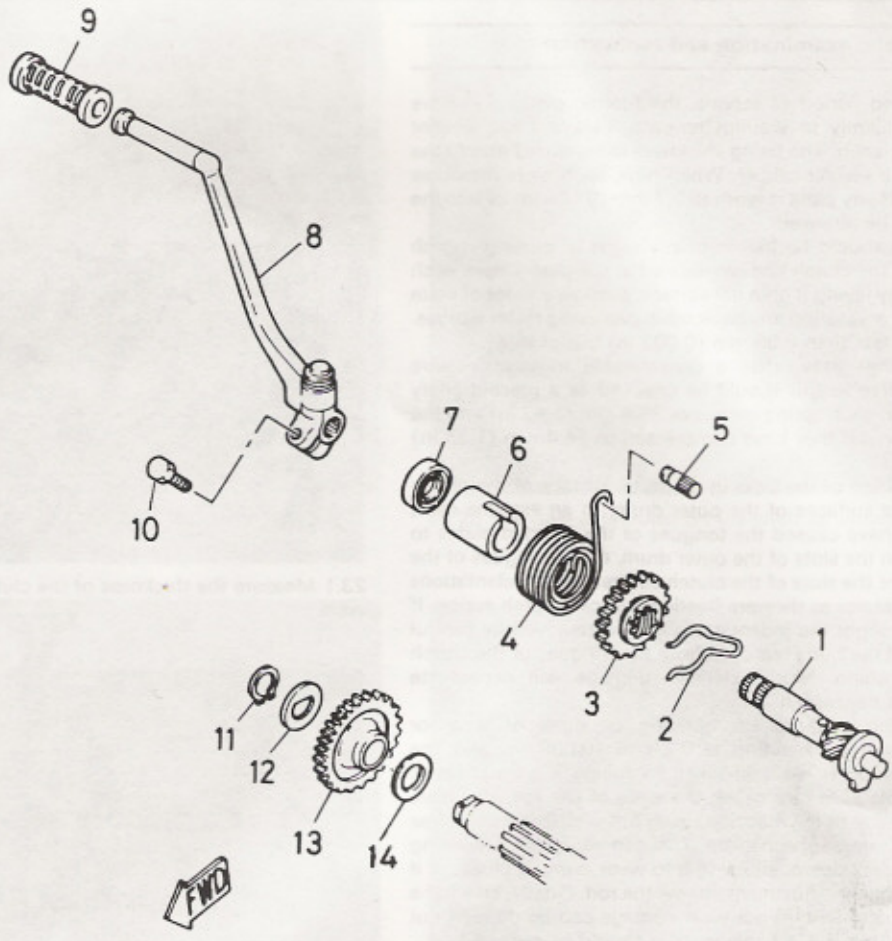
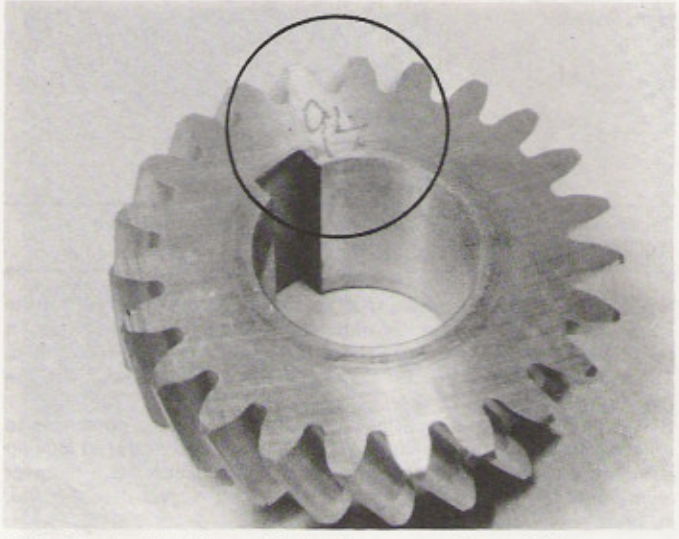
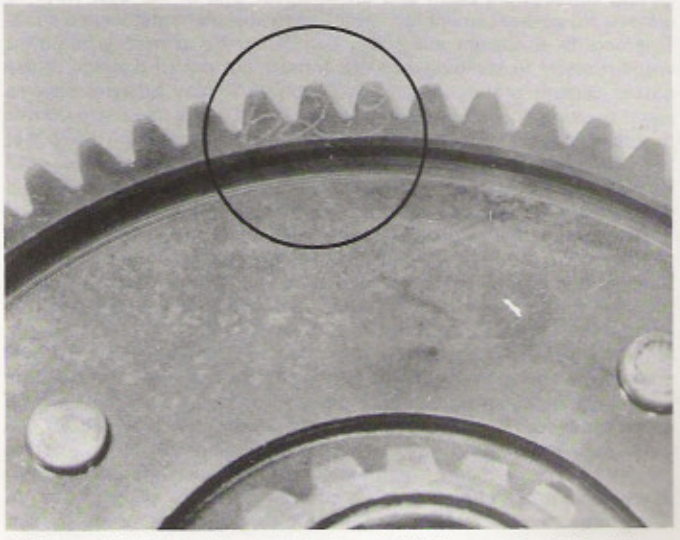


Fig. 1.6 Kickstart mechanism

1 Kickstart shaft	*6 Spring guide*	*11 Circlip*
2 Friction clip	*7 Oil seal*	*12 Special washer*
3 Kickstart pinion	*8 Operating lever*	*13 Idler pinion*
4 Return spring	*9 Rubber*	*14 Thrust washer*
5 Spring anchor	*10 Pinch bolt*	



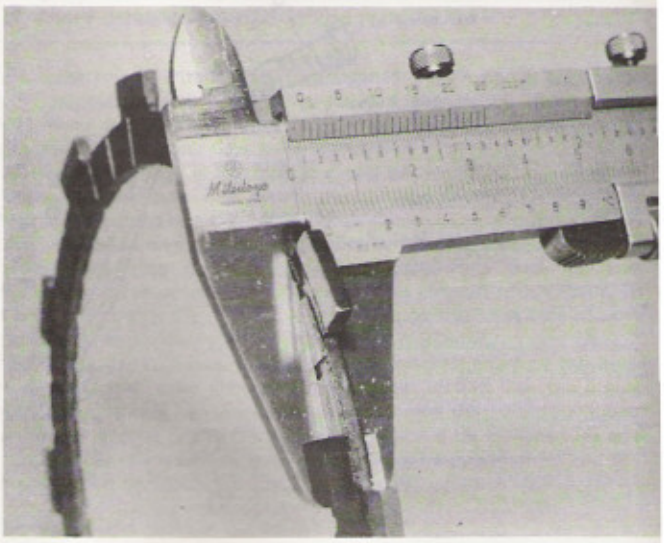
22.4a The backlash figure of the primary gear shown is 94 (circled)



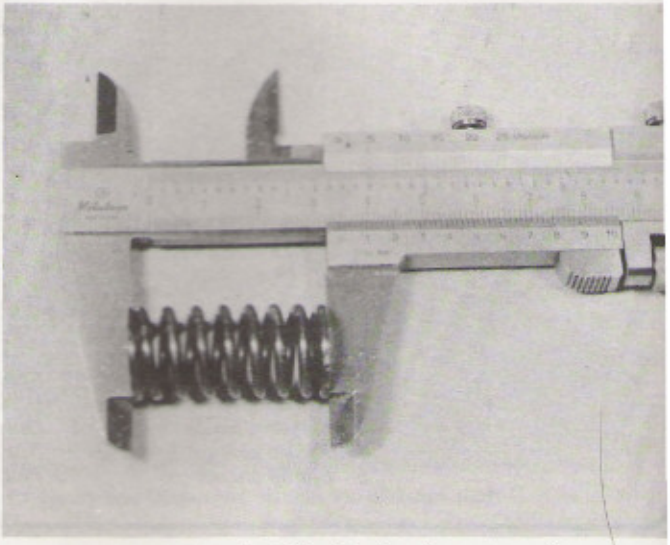
22.4b ... while that of the clutch drum is 62 (ignore the 'B'), giving a backlash total of 156 (see text)

23 Clutch assembly: examination and renovation

1 After an extended period of service, the friction plates will have become worn sufficiently to warrant renewal, to avoid subsequent problems with clutch slip. The lining thickness is measured across the friction plate using a vernier caliper. When new, each plate measures 3.0 mm (0.118 in). If any plate is worn to 2.7 mm (0.106 in) or less the friction plates must be renewed.
2 The plain plates should be free from any signs of blueing, which would indicate that the clutch had overheated in the past. Check each plate for distortion by laying it on a flat surface, such as a sheet of plate glass or similar, and measuring any detectable gap using feeler gauges. The plates must be less than 0.05 mm (0.002 in) out of true.
3 The clutch springs may, after a considerable mileage, require renewal, and their free length should be checked as a precautionary measure. When new, each spring measures 36.4 mm (1.43 in) and the set should be renewed if they have compressed to 34.4 mm (1.35 in) or less.
4 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 indentations 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.
5 Check the clutch pushrod for bending or signs of wear or overheating. The limit for bending is 0.2 mm (0.008 in) and the trueness of the pushrod is easily checked by rolling it on a sheet of glass or a surface plate. In rare cases, the ends of the rod may have become overheated due to the machine being run with insufficient free play in the cable or release mechanism. This can cause the hardening of the rod ends to break down, allowing it to wear away. If blued, or if the clutch needs frequent adjustment, renew the rod. Finally, check the clutch release shaft and arm. Minor wear damage can be dressed out with abrasive paper, but if it is badly worn it should be renewed.



23.1 Measure the thickness of the clutch friction plates to assess wear



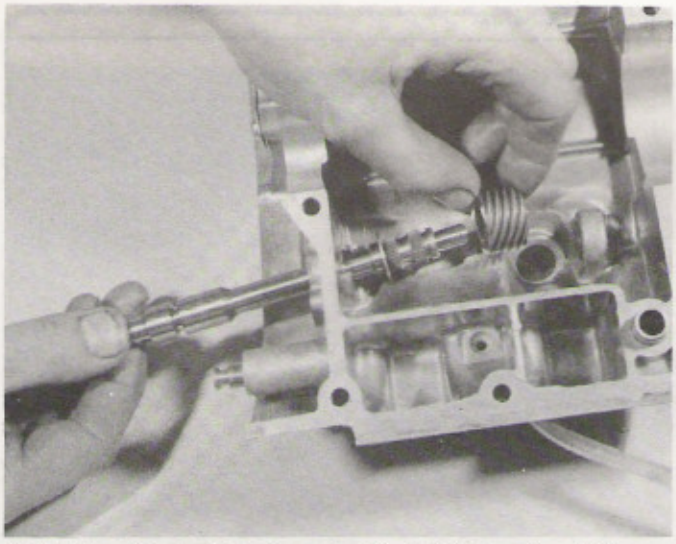
23.3 Check the free length of the clutch springs, renew if compressed

24 Engine reassembly: general

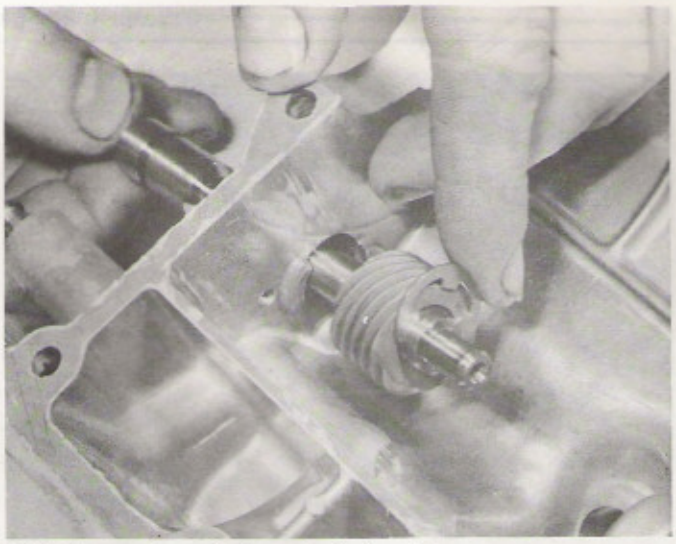
1 Before reassembly of the engine/gearbox unit is commenced, the various component parts should be cleaned thoroughly and placed on a sheet of clean paper, close to the working area.
2 Make sure all traces of old gaskets have been removed and that the mating surfaces are clean and undamaged. One of the best ways to remove old gasket cement is to apply a rag soaked in methylated spirit. This acts as a solvent and will ensure that the cement is removed without resort to scraping and the consequent risk of damage. If the gasket cement proves particularly stubborn it may be necessary to resort to using an aluminium or brass scraper. Do not use a screwdriver or a steel scraper because this will almost invariably damage the gasket face. One safe method is to use a brass wire brush such as those sold for cleaning suede shoes. This will usually prove very effective and will not damage the alloy.
3 Gather together all the necessary tools and have available an oil can filled with clean engine oil, Make sure all new gaskets and oil seals are to hand, also all replacement parts required. Nothing is more frustrating that having to stop in the middle of a reassembly sequence because a vital gasket or replacement has been overlooked.
4 Make sure that the reassembly area is clean and that there is adequate working space. Refer to the torque and clearance settings wherever they are given. Many of the smaller bolts are easily sheared if over-tightened. Always use the correct sized screwdriver bit for the cross-head screws and never an ordinary screwdriver. If the existing screws show evidence of maltreatment in the past it is advisable to renew them as a complete set. It is strongly recommended that a set of Allen screws are used instead of the original cross-head screws. Allen screw sets can be obtained through most good accessory retailers and are an inexpensive but thoroughly practical improvement to most Japanese machines.

25 Engine reassembly: refitting the tachometer drive – RD350 LC II

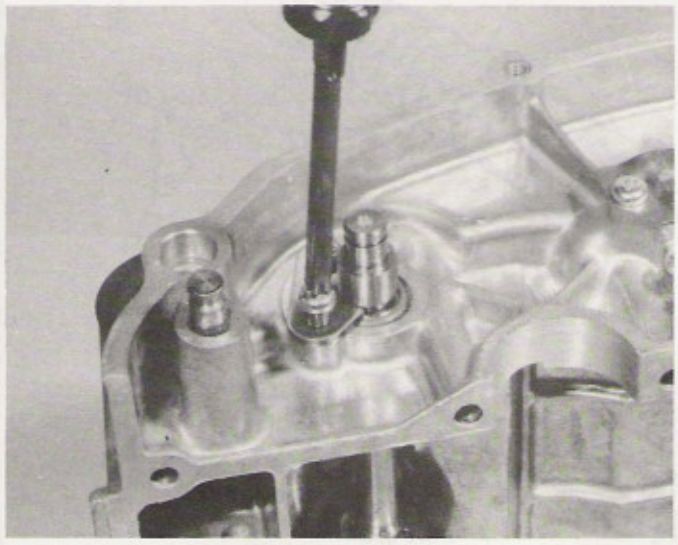
1 Slide the tachometer drive shaft part way into the upper half of the crankcase and fit the innermost of the drive pinion retaining circlips. Fit the drive pinion over its splines and secure it with the remaining circlip. The shaft can now be pushed fully home having lubricated it and the gear with clean engine oil.
2 On the outside of the casing, fit the retaining plate and screws to hold the shaft in position. Note that Loctite or a similar thread locking compound should be used on the two screws. Slide the drive gear locating pin through the shaft end, and place the gear over the end, securing it with its plain washer and circlip.
3 Assemble the tachometer driven gear and holder, having fitted a new O-ring to the latter where necessary. Slide the assembly into place and secure the single retaining bolt.



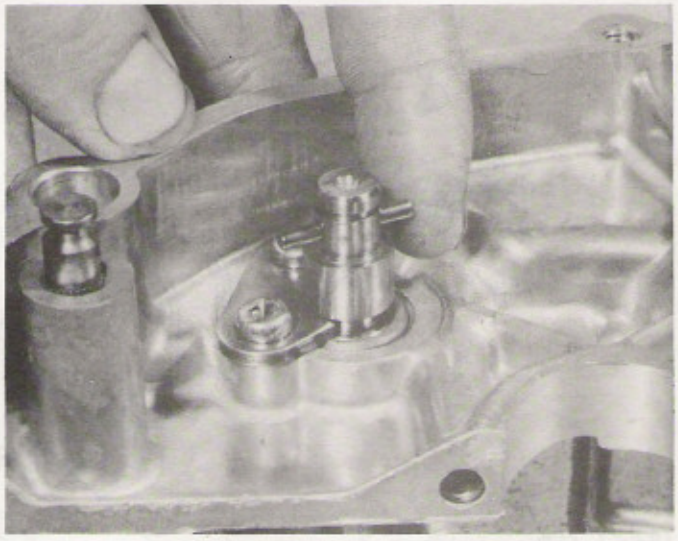
25.2a Where fitted, slide tachometer driveshaft into casing, fitting the inner circlip and drive gear



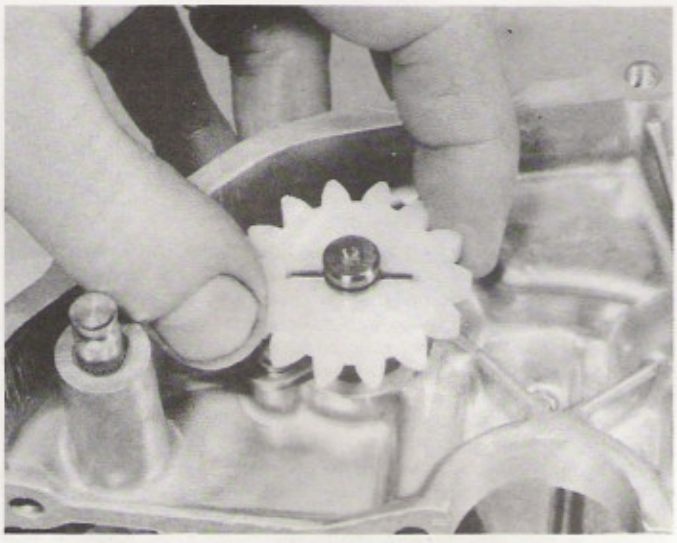
25.2b The gear is retained on the shaft as shown



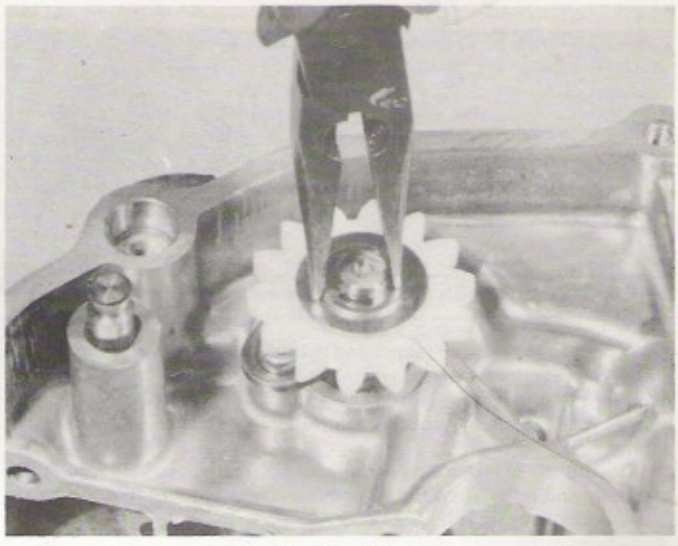
25.2c Fit the retainer plate and its two screws



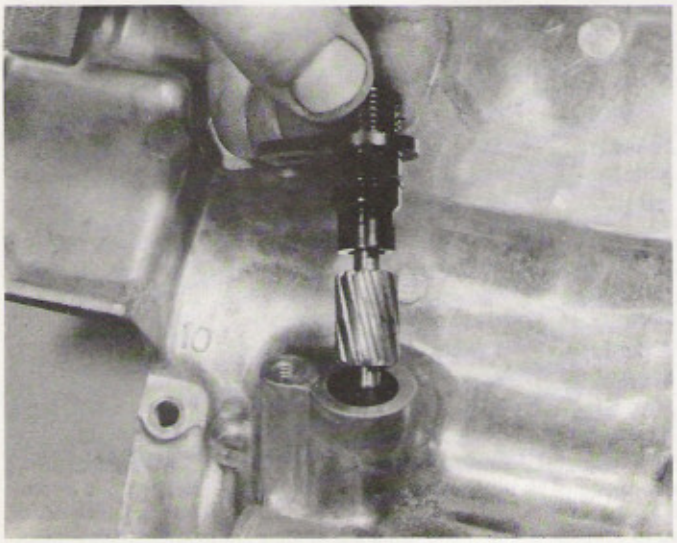
25.2d Place drive pin through the hole in the shaft end ...



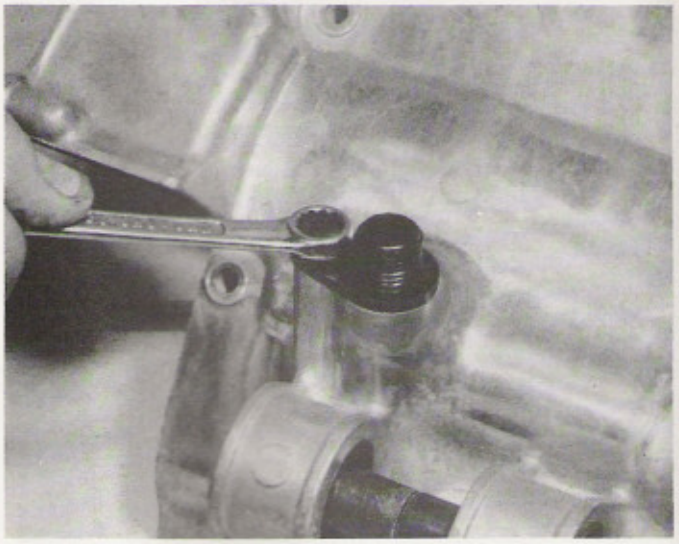
25.2e ... and fit the pinion over it



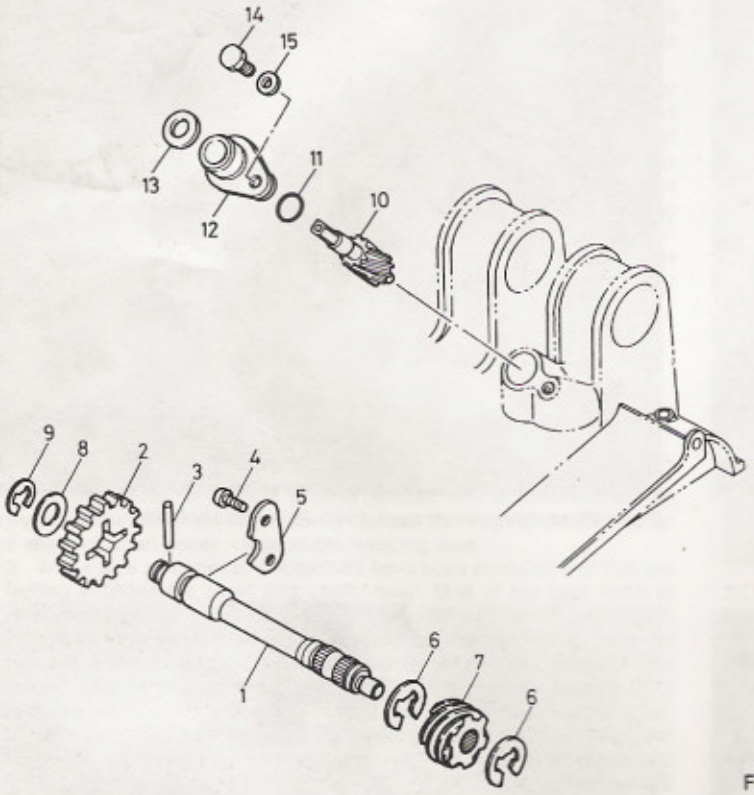
25.2f Retain the assembly with the plain washer and circlip



25.2g Fit the tachometer drive body using a new O-ring ...



25.2h ... and secure it using its single bolt



1 *Tachometer driveshaft*
2 *Plastic drive pinion*
3 *Pin*
4 *Screw – 2 off*
5 *Locating plate*
6 *Circlip – 2 off*
7 *Drive gear*
8 *Washer*
9 *Circlip*
10 *Driven gear*
11 *O-ring*
12 *Drive body*
13 *Washer*
14 *Bolt*
15 *Washer*

Fig. 1.7 Tachometer drive assembly – RD350 LC II only

26 Engine reassembly: refitting the selector mechanism

1 Lubricate and fit the large needle roller bearing to the right-hand end of the selector drum and retain it with its circlip. Assemble the cam plate on the end of the drum, noting the small pin and the flat which locates it. Position the special cam retaining washer and secure the screw.

2 Moving to the left-hand end of the drum, fit the neutral switch plate assembly and retain it with its single screw. Make sure that the spring and contact are properly located.

3 Lubricate the plain (left-hand) end of the selector drum and slide it into position in the lower casing half. Do not fit the retaining plate at this stage. The selector forks and shafts should be fitted next. Note that two of the forks are identical, one being fitted to the front shaft and the other to the right-hand side of the rear shaft. The remaining fork is fitted to the left-hand end of the rear shaft.

4 Slide each shaft part way into the casing and fit the appropriate forks over it. The location pins should be arranged so that they engage with the selector drum tracks. Once the shafts are through the forks fit the circlips to the grooves on their inner end so that when they are pushed fully home the circlips serve to locate the shaft ends.

5 Fit the selector drum retainer, noting that it also retains the front selector fork shaft. It is advisable to use Loctite on the two securing screws. Next, fit the selector mechanism centralising spring anchor pin, noting that the tab washer beneath it has an extended section which retains the rear selector fork shaft. The selector drum detent arm (stopper arm) can be fitted next and its pivot bolt tightened firmly. The selector shaft and claw assembly should be left off for the time being.

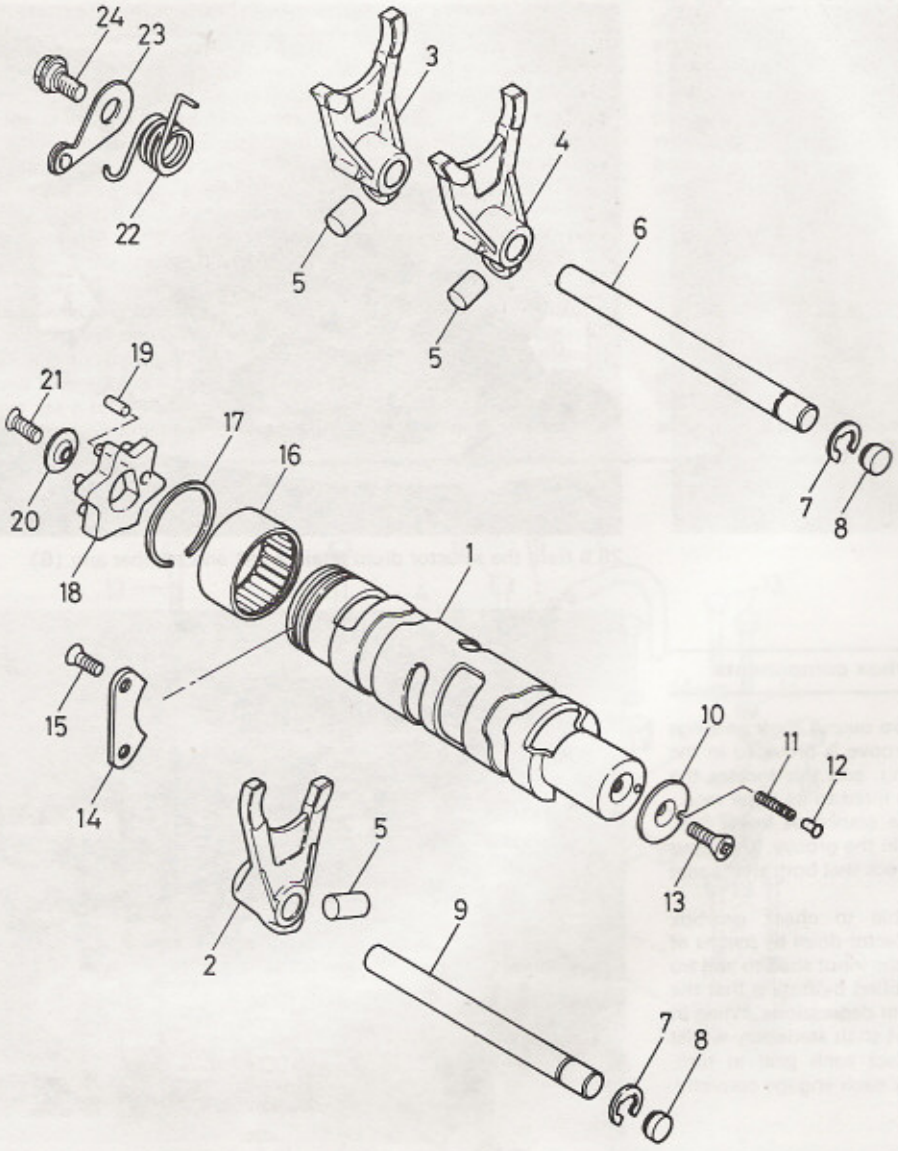
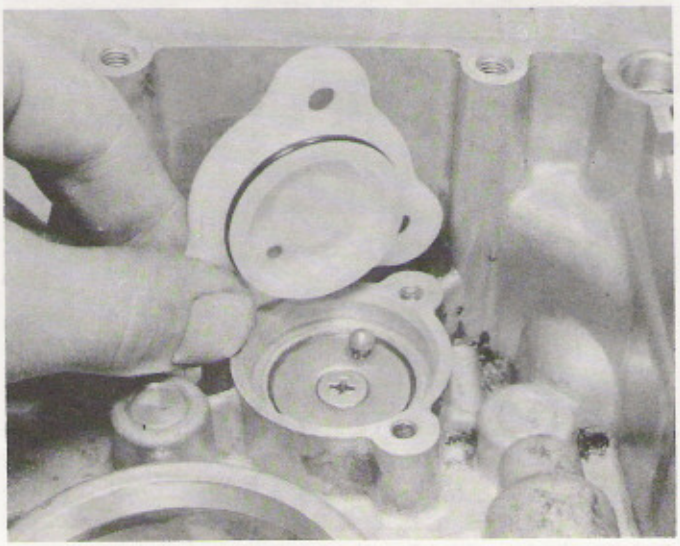
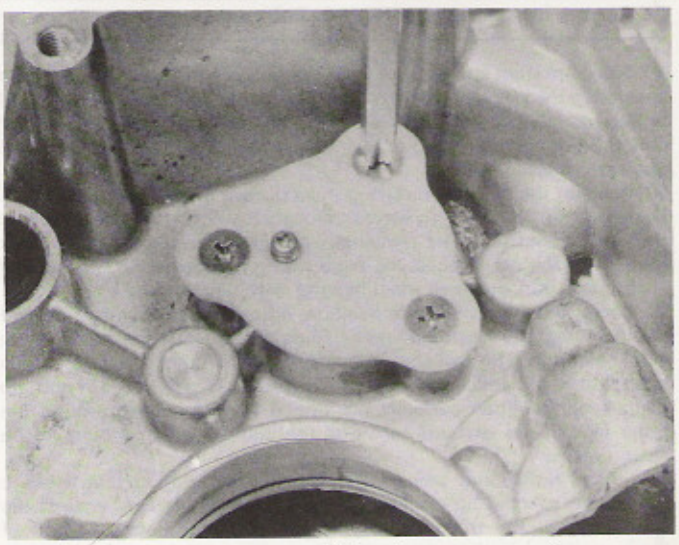


Fig. 1.8 Selector mechanism

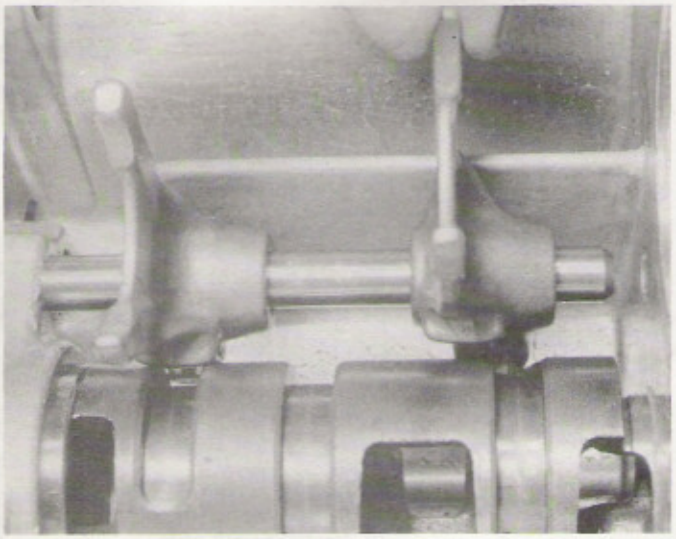
1 *Selector drum*
2 *Front selector fork*
3 *Rear selector fork*
4 *Rear selector fork*
5 *Location pin*
6 *Selector fork shaft*
7 *Circlip*
8 *Selector fork shaft plug*
9 *Selector fork shaft*
10 *Neutral switch plate*
11 *Spring*
12 *Neutral contact*
13 *Screw*
14 *Selector drum retainer*
15 *Screw*
16 *Bearing*
17 *Circlip*
18 *Cam plate*
19 *Cam plate locating pin*
20 *Special washer*
21 *Screw*
22 *Spring*
23 *Selector drum stopper arm*
24 *Bolt*



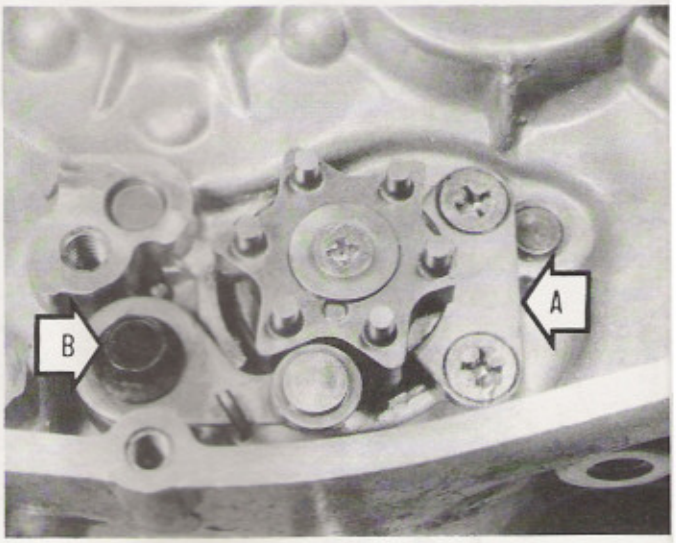
26.2a Check that contact is in place and offer up the neutral switch



26.2b Secure the switch cover with its three countersunk screws



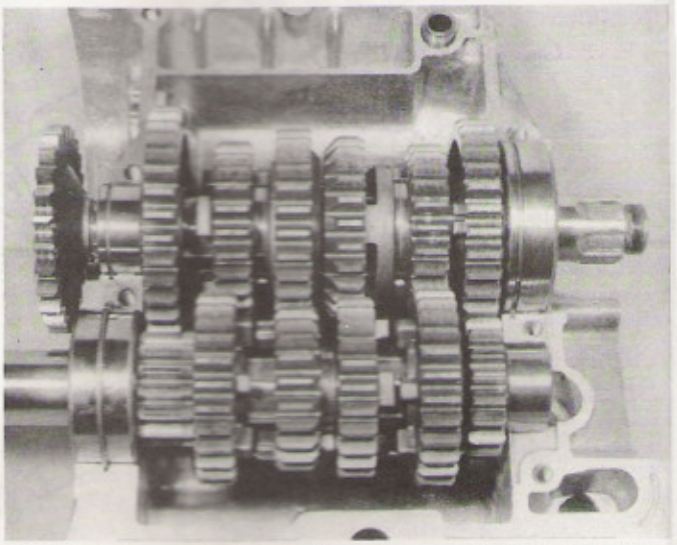
26.3 Refit the selector drum, forks and shafts



26.5 Refit the selector drum retainer (A) and stopper arm (B)

27 Engine reassembly: refitting the gearbox components

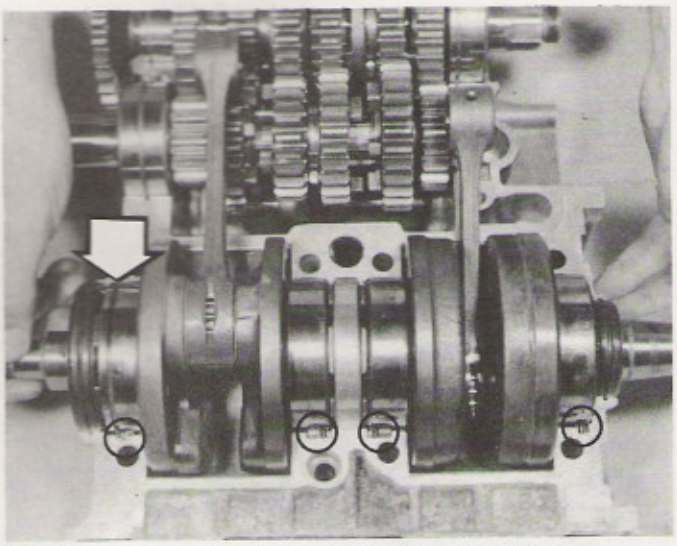
1 Position the half rings which locate the two output shaft bearings in their grooves in the crankcase. A similar groove is provided in the recess for the input shaft's right-hand bearing, and this locates the bearing by means of the large circlip which is fitted to its outer race.
2 Lower the output shaft assembly into the crankcase lower half, ensuring that the selector fork fingers engage in the groove. The input shaft is now positioned in a similar manner. Check that both shafts seat securely.
3 Before proceeding further it is advisable to check gearbox operation. This can be done by turning the selector drum by means of the cam. To facilitate gear engagement, rotate the input shaft to and fro as each gear is selected. Neutral can be identified by noting that the detent arm drops into the shallowest of the cam depressions. When in neutral it should be possible to hold the output shaft stationary whilst the input shaft is turned. From neutral, select each gear in turn, ensuring that all six are available and that they each engage correctly.



27.2 Place the gear clusters in the crankcase, making sure that they locate correctly

28 Engine reassembly: refitting the crankshaft

1 The crankshaft should always be refitted using **new** oil seals. These are vital to the efficient running of all two-stroke engines. If a worn seal is reused, crankcase compression will be lost and performance will suffer. Before commencing reassembly, pack the gap between the seal lips with grease.
2 Position the locating half-ring in its groove in the right-hand main bearing boss. The half ring serves to locate the right-hand bearing, and thus the crankshaft. The remaining bearings are pegged to prevent rotation of the outer races, the pegs sitting in recesses to the front of each one. Lubricate each main bearing with new engine oil.
3 Lower the crankshaft into position, ensuring that the half ring and the three pegs are located correctly. Slide the seal into position over the crankshaft end. The seal should be positioned so that the outer face is flush with the crankcase boss, leaving a small gap between it and the main bearing. When correctly positioned the small bead around the outer face of the seal will locate in the corresponding groove in the casing recess.
4 Fit the right-hand seal in a similar manner, noting that it has a castellated spacing lip on its inner face. This should butt against the outer race of the main bearing, forming an additional method of location. When both seals are in place make sure that the crankshaft assembly is firmly seated along its length.



28.3 Note position of locating pins (circled) and half-ring (arrowed)

29 Engine reassembly: joining the crankcase halves

1 Make sure that the crankcase halves are clean and completely free of grease. To this end it is sound practice to give the jointing faces a final wipe with a clean rag moistened with methylated spirit or clean petrol. Allow the solvent to evaporate completely, then apply a thin film of jointing compound to the gasket face of one half. One of the RTV (room temperature vulcanising) silicone compounds, often sold as 'Instant Gasket' is recommended. Allow the compound to cure for a few minutes and in the meantime fit the two locating dowels to their recesses in the lower casing half.

2 The crankcase upper half can now be lowered into position, noting that the connecting rods must be fed through the crankcase apertures as the two halves meet. As the joint is closed, check that everything locates correctly, then tap the upper casing half down with the palm of one hand to ensure that it locates firmly.

3 There are a total of 16 crankcase securing bolts, each of which is numbered in the correct sequence for tightening. The numbers are cast into the crankcase next to the appropriate hole. When fitting the bolts it should be noted that bolts No 9, 14 and 15 have cable or wiring clips attached to them as shown in the tightening sequence diagram (Fig. 1.10).

4 Fit the upper crankcase bolts first (Nos 9 to 16) and tighten them just enough to secure the crankcase. Turn the unit over on the workbench and install the lower crankcase bolts (Nos 1 to 8). The bolts should now be tightened in two stages and in the sequence shown below:

a) Bolts 9 to 16 to 0.5 kgf m (3.62 lbf ft)
b) Bolts 1 to 8 to 1.0 kgf m (7.23 lbf ft)
c) Bolts 1 to 8 to 2.5 kgf m (18.08 lbf ft)
d) Bolts 9 to 16 to 1.0 kgf m (7.23 lbf ft)

5 The crankcases are now secured and before moving on, check that the crankshaft and the gearbox shafts rotate smoothly with no tight spots. If necessary, separate the crankcase halves and rectify any alignment problem before proceeding further.

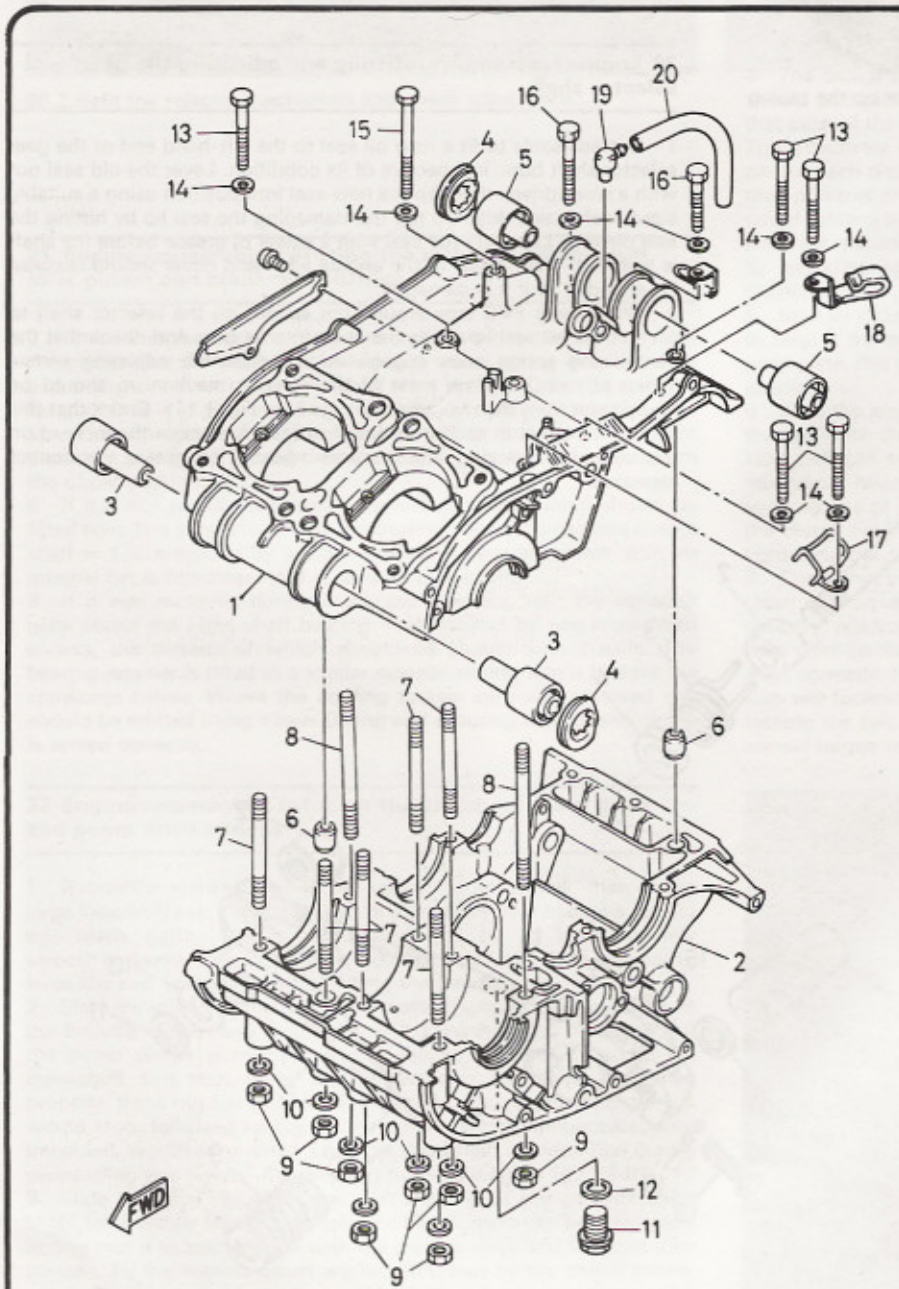
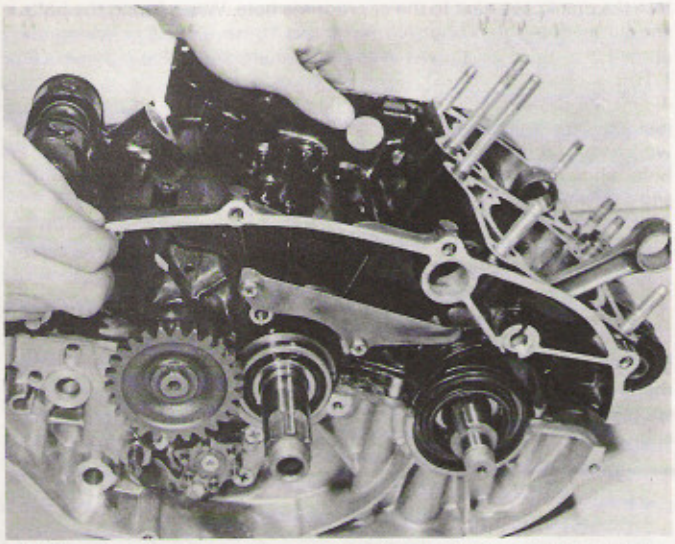


Fig. 1.9 Crankcases

1 *Upper crankcase half*
2 *Lower crankcase half*
3 *Front mounting bush*
4 *Damping spacer*
5 *Rear mounting bush*
6 *Dowel*
7 *Stud*
8 *Stud*
9 *Nut*
10 *Washer*
11 *Drain plug*
12 *Sealing washer*
13 *Bolt*
14 *Washer*
15 *Bolt*
16 *Bolt*
17 *Cable clip*
18 *Cable clip*
19 *Pipe union*
20 *Pipe*



29.2 Apply sealant to crankcase joint faces and offer up the casing upper half

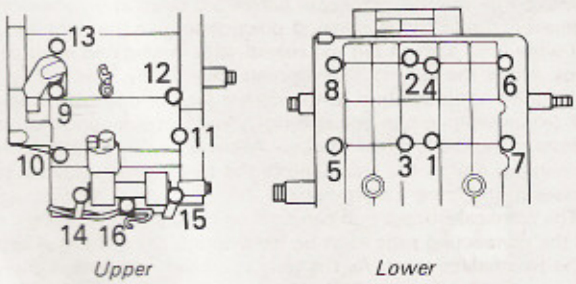


Fig. 1.10 Crankcase bolt tightening sequence (see text)

30 Engine reassembly: refitting and adjusting the gear selector shaft

1 It is advisable to fit a new oil seal to the left-hand end of the gear selector shaft bore, irrespective of its condition. Lever the old seal out with a screwdriver, then tap the new seal into position using a suitably sized socket as a drift. Do not risk damaging the seal lip by hitting the seal directly. Lubricate the seal with a smear of grease before the shaft is installed. The oil seal in the engine left-hand cover should likewise be attended to if it is damaged.

2 Wrap some PVC tape around the splines on the selector shaft to protect the oil seal lip. Slide the shaft into its bore and check that the centralising spring ends engage on the eccentric adjusting screw. When at rest, the claw ends of the selector mechanism should be equidistant from the two adjacent pins (see Fig. 1.11). Check that this setting is correct in each gear and if necessary slacken the locknut on the centralising spring adjuster and adjust it to obtain the correct clearance.

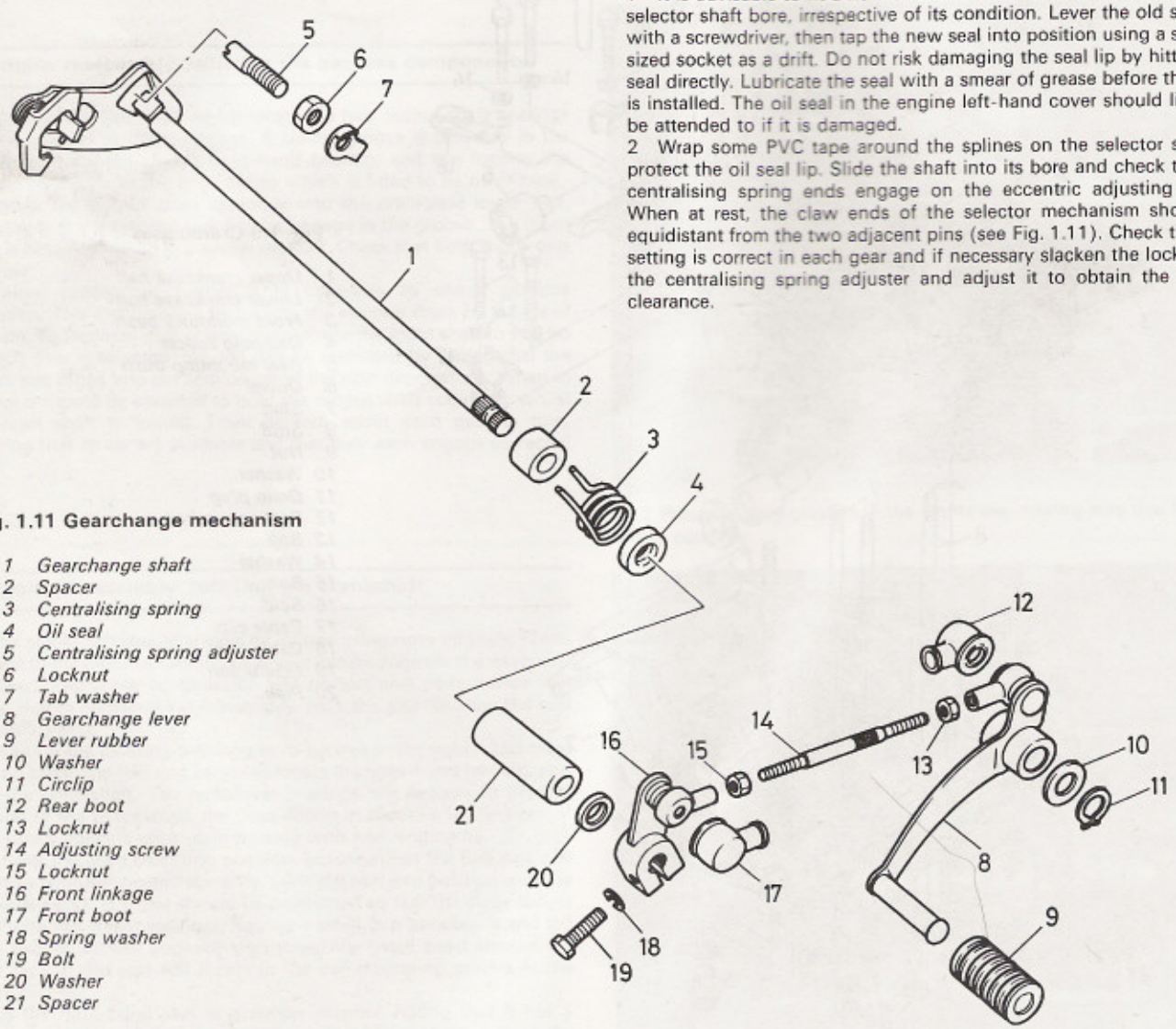
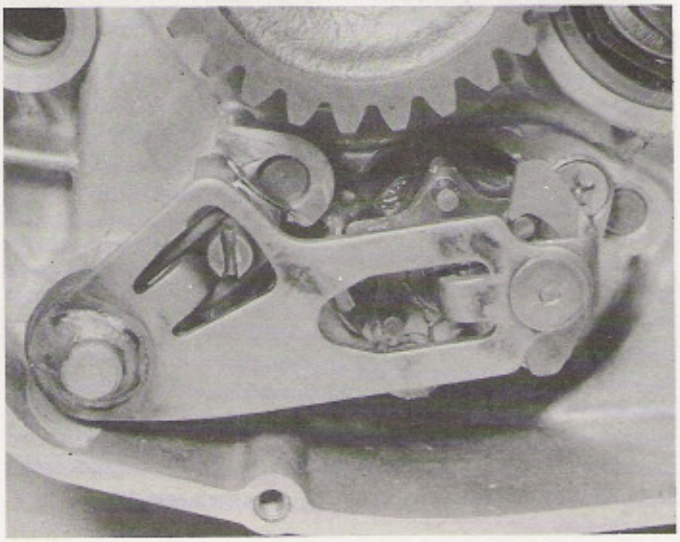


Fig. 1.11 Gearchange mechanism

1 *Gearchange shaft*
2 *Spacer*
3 *Centralising spring*
4 *Oil seal*
5 *Centralising spring adjuster*
6 *Locknut*
7 *Tab washer*
8 *Gearchange lever*
9 *Lever rubber*
10 *Washer*
11 *Circlip*
12 *Rear boot*
13 *Locknut*
14 *Adjusting screw*
15 *Locknut*
16 *Front linkage*
17 *Front boot*
18 *Spring washer*
19 *Bolt*
20 *Washer*
21 *Spacer*



30.2 Refit the selector mechanism and check adjustment

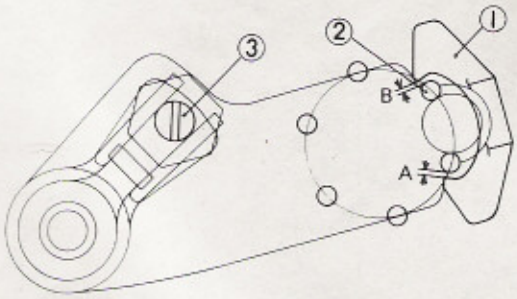


Fig. 1.12 Gearchange selector mechanism adjustment

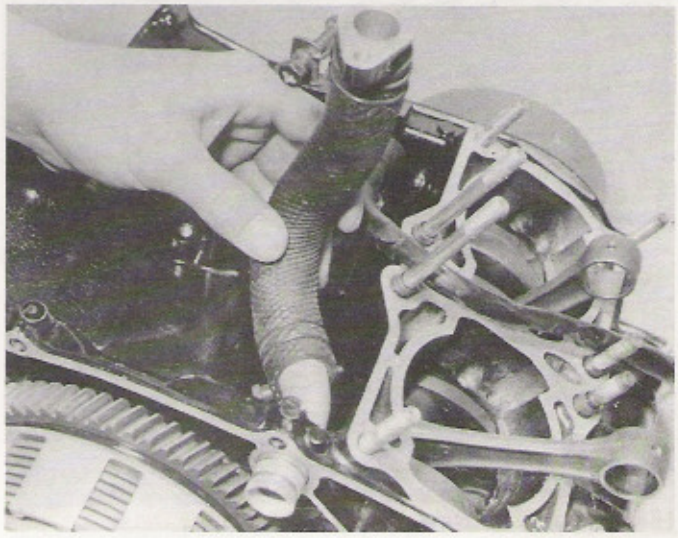
1 Selector shaft
2 Pins
3 Eccentric adjusting screw
A & B Equal spacing

31 Engine reassembly: refitting the kickstart mechanism, idler pinion and crankcase fittings

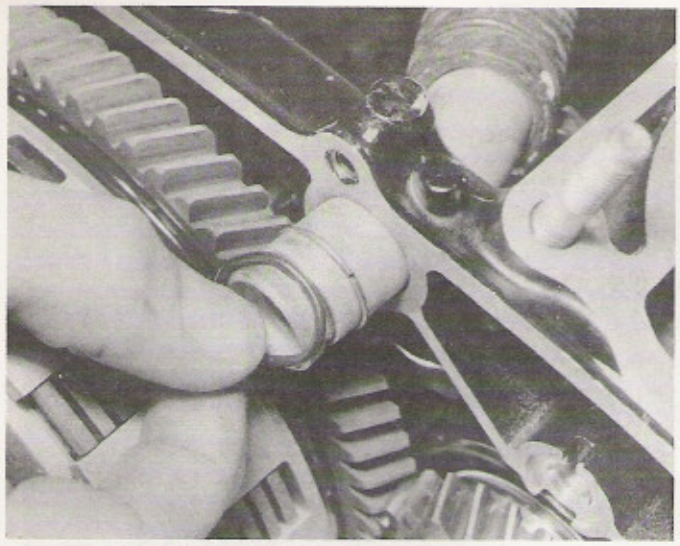
1 Check that the kickstart pinion friction clip is in position, then slide the pinion over the shaft. Fit the kickstart return spring over the shaft and engage its inner tang in the shaft cross drilling. Once the spring is located slide the plastic spring guide into position to retain it. The assembly can now be fitted into the casing bore. Grasp the free end of the return spring and hook it over the anchor pin which protrudes from the upper casing half.
2 If it is not already in position the kickstart idler pinion should be fitted next. It is supported on the protruding end of the gearbox output shaft and is preceded by a plain washer. A special washer with an internal flat is fitted next and is secured by a circlip.
3 If it was removed during crankcase overhaul, refit the deflector plate above the input shaft bearing. It is retained by two cross-head screws, the threads of which should be coated with Loctite. The bearing retainer is fitted in a similar manner, noting that it bridges the crankcase halves. Where the cooling system stub was removed this should be refitted using a new O-ring and ensuring that its wire circlip is seated correctly.

32 Engine reassembly: refitting the clutch, primary drive and pump drive pinions

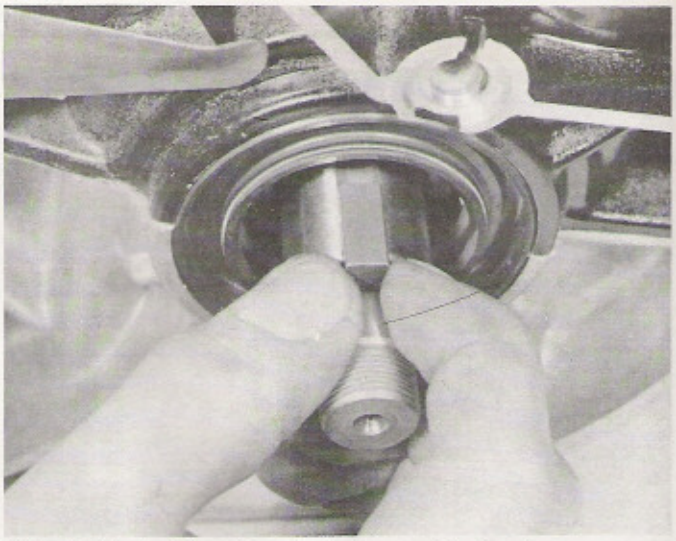
1 Rotate the crankshaft until the keyway is uppermost, then fit the large Woodruff key. The crankshaft primary drive gear can now be slid into place, noting that its shouldered face should be completely smooth and well lubricated where it enters the oil seal. Take care not to force the seal lip inwards when fitting the pinion.
2 Slide the smaller pump drive pinion over the crankshaft end, then fit the Bellville washer and securing nut. It is worth noting that although the pump pinion is relatively lightly loaded it is not keyed to the crankshaft and thus relies on the securing nut being tightened properly. If the nut becomes loose in service, the oil and water pumps would stop, followed swiftly by the engine which, unlubricated and uncooled, would soon seize. Lock the crankshaft as described during dismantling and tighten the securing nut to 6.5 kgf m (47 lbf ft).
3 Slide the large thrust washer over the end of the gearbox input shaft, followed by the clutch bush. The clutch drum can be fitted next, noting that it should engage with the primary drive and kickstart idler pinions. Fit the second thrust washer, followed by the clutch centre, tab washer and clutch centre nut. Lock the clutch, using the same method that was employed during dismantling, and tighten the nut to 6.5 kgf m (47 lbf ft).
4 The clutch plain and friction plates and the rubber damper rings should be coated with engine oil prior to installation. It will be noted that each of the plain plates has a part of its outer edge machined off. This effectively makes the plate become slightly out of balance. This causes each plate to be thrown outwards under centrifugal force and thus prevents clutch noise. To prevent the whole clutch from getting out of balance it is necessary to arrange the plates so that the machined areas are spaced evenly around its circumference. This can be achieved by arranging each cutaway area to be approximately 60° from the previous one.
5 Start by sliding a damper ring over the clutch centre, taking care not to twist it during fitting. A friction plate is fitted next, followed by a plain plate, this process being repeated until all the clutch plates are in position.
6 Slide the long pushrod through the hollow input shaft, noting that the end with the reduced diameter should be fitted first. The single steel ball can be pushed into the shaft bore now, followed by the mushroom-headed pushrod. Offer up the clutch pressure plate, aligning one of its three arrow marks with the corresponding mark on the clutch centre. Fit the clutch springs and secure the assembly by tightening the clutch bolts evenly and firmly in a diagonal sequence.
7 Check that the mating surfaces of the crankcase and outer cover are clean and dry and fit the locating dowel to its recess. Place a new gasket in position. Lubricate the primary drive and pump drive pinions, then offer up the cover, ensuring that the oil and water pump drives align correctly. Note that a smear of grease around the cooling system stub will facilitate installation. Fit the securing screws remembering to include the two cable clips. Though of largely academic interest, the correct torque setting for the securing screws is 1.0 kgf m (7.2 lbf ft).



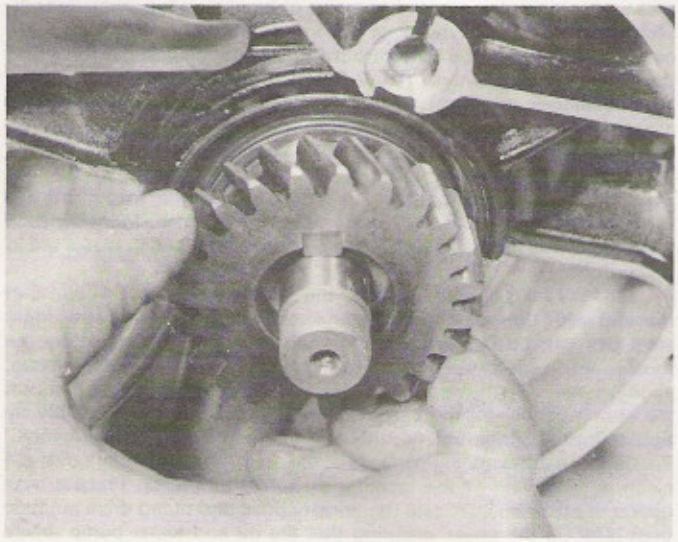
31.3a Pass coolant stub through the crankcase bore ...



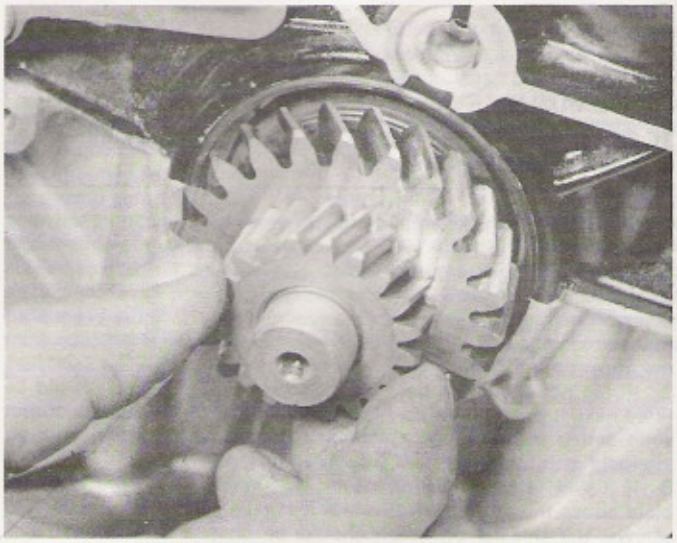
31.3b ... and fit the wire circlip and a new O-ring



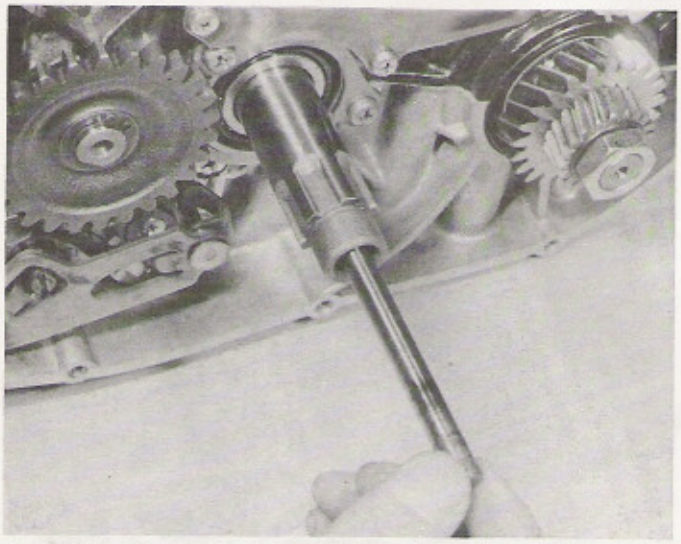
32.1a Fit Woodruff key in its slot in the crankshaft end ...



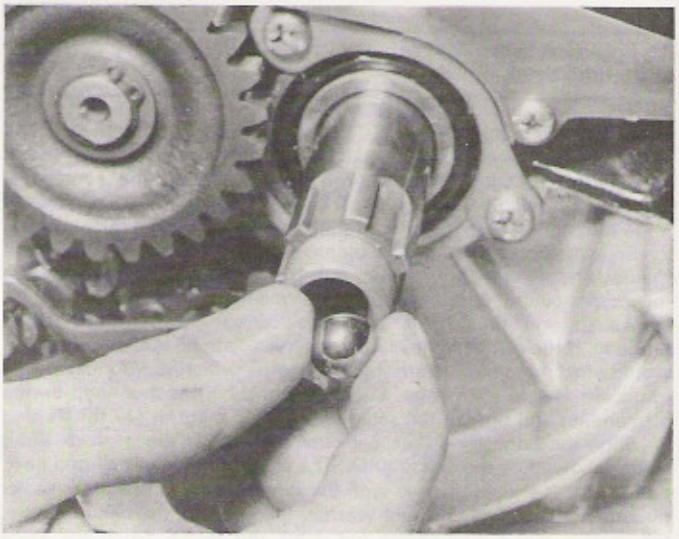
32.1b ... and slide primary drive pinion into place



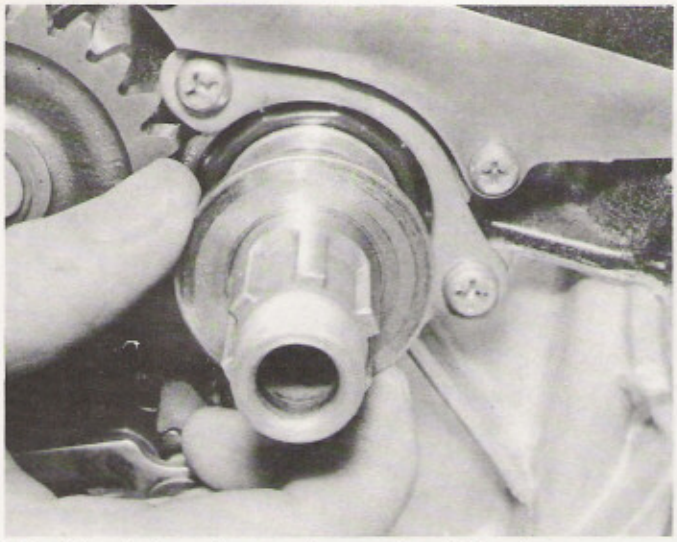
32.2 Fit the pump drive pinion and secure with Belville washer and nut



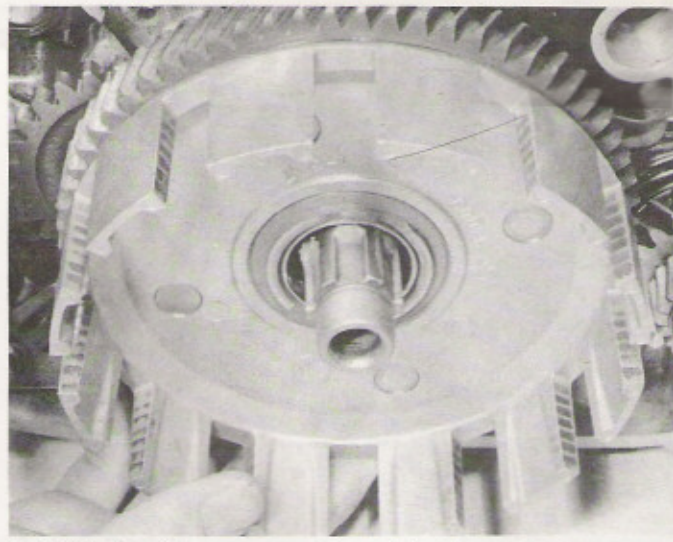
32.3a Slide pushrod into the end of the gearbox input shaft ...



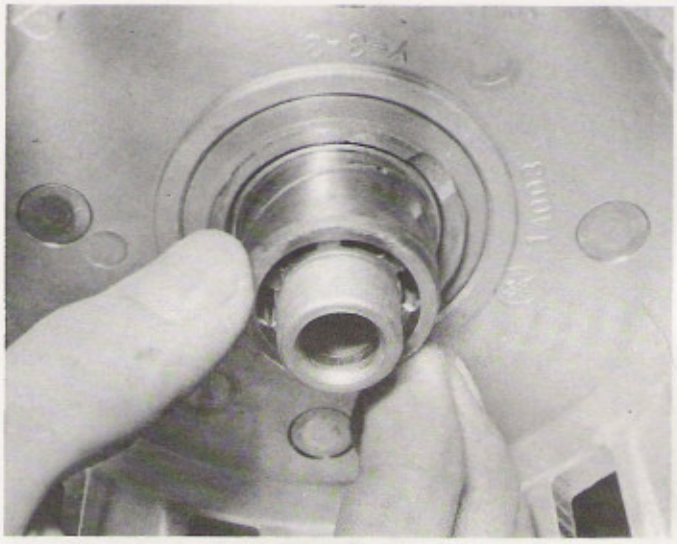
32.3b ... followed by the large steel ball



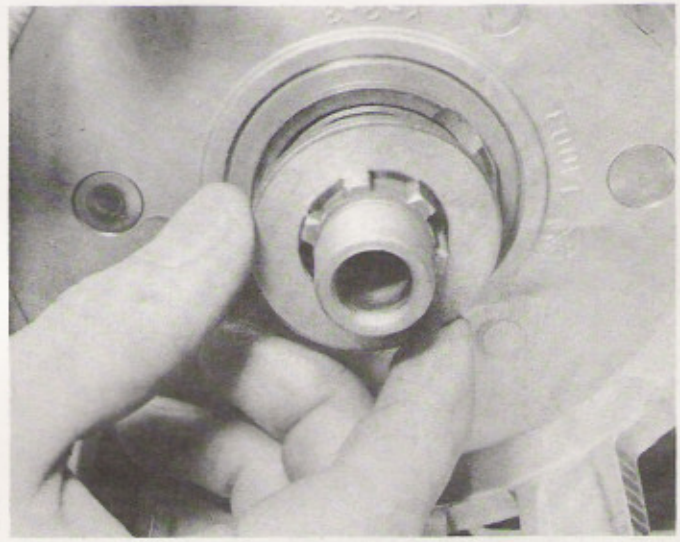
32.3c Place the large thrust washer over the shaft end



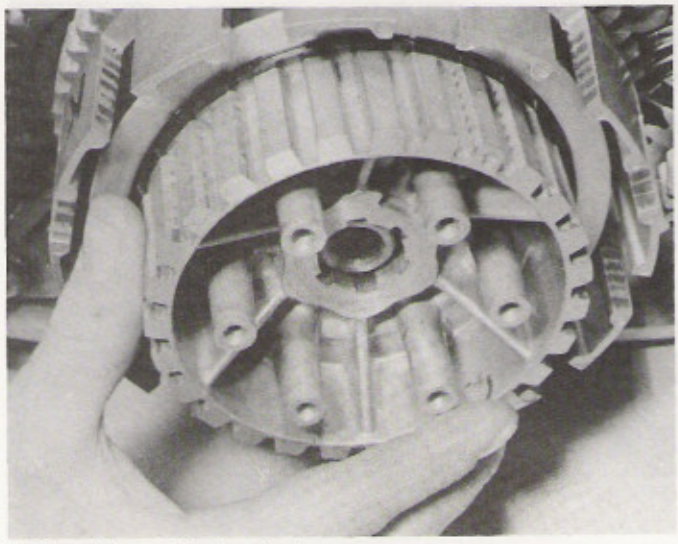
32.3d The clutch drum can now be positioned ...



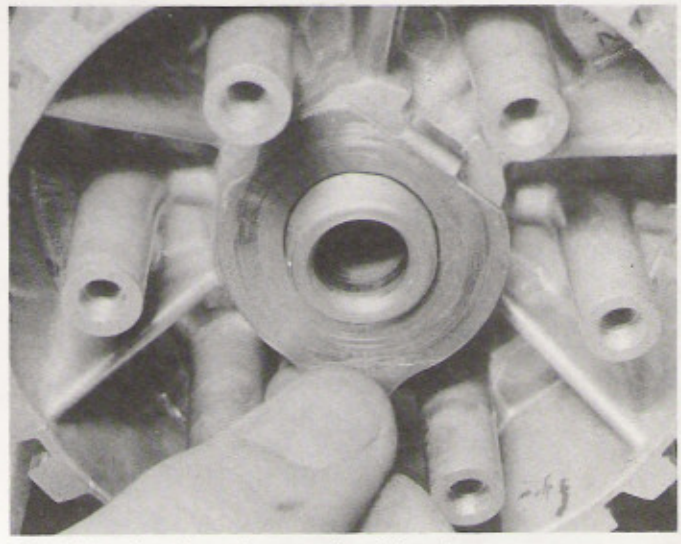
32.3e ... and the inner bush fitted



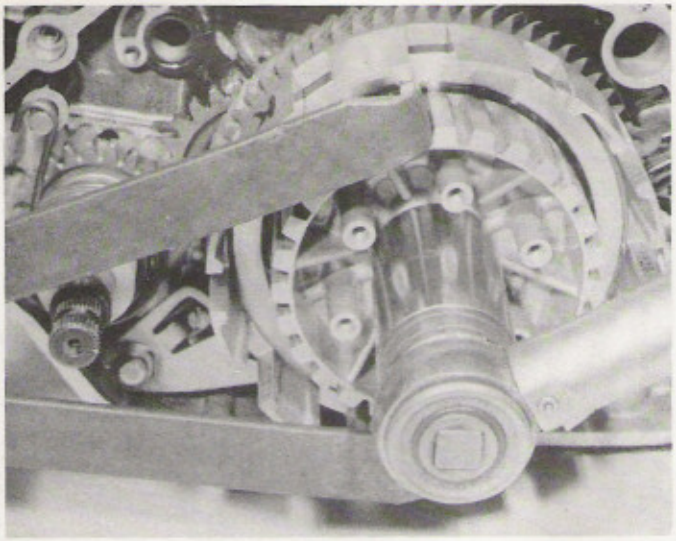
32.3f Now fit the second thrust washer ...



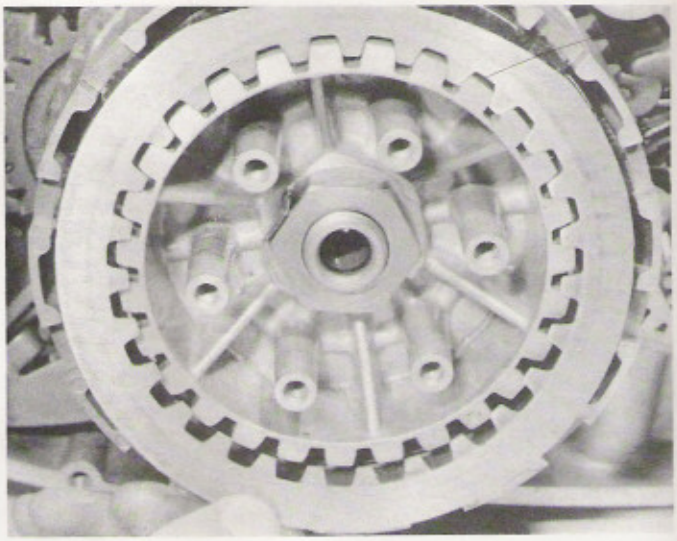
32.3g ... followed by the clutch centre



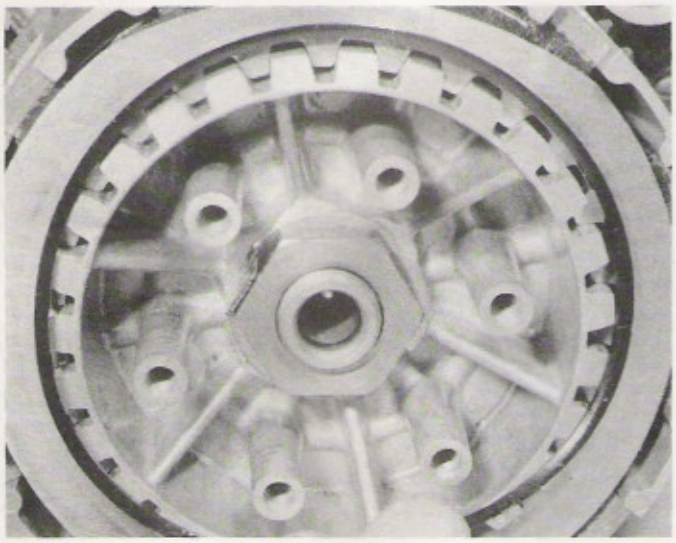
32.3h Place the tab washer over the shaft end ...



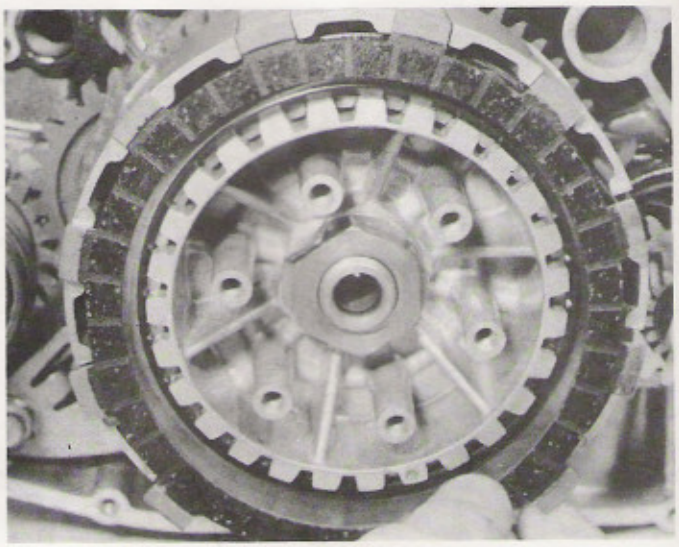
32.3i ... then lock the clutch centre and secure the nut and locking tab



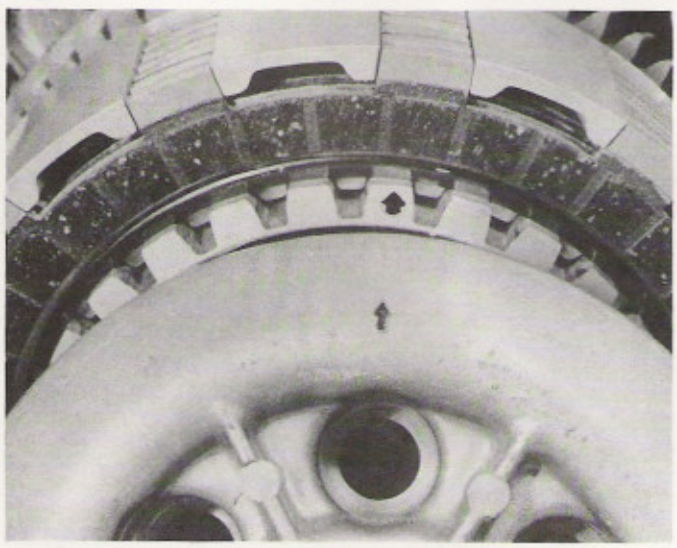
32.4a Install the clutch plain plates ...



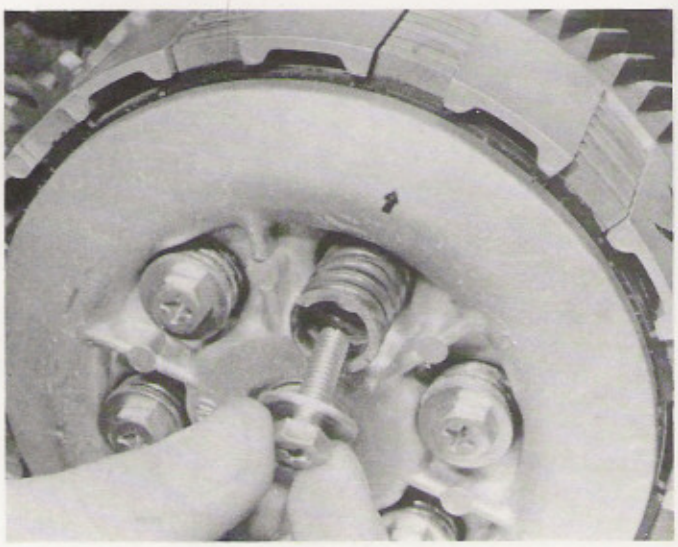
32.4b ... the rubber damper rings ...



32.4c ... and the friction plates alternately



32.6a Make sure that one of the arrows on the cluch cover lines up with the arrow mark on the clutch centre



32.6b Fit the springs and bolts, tightening them evenly and progressively

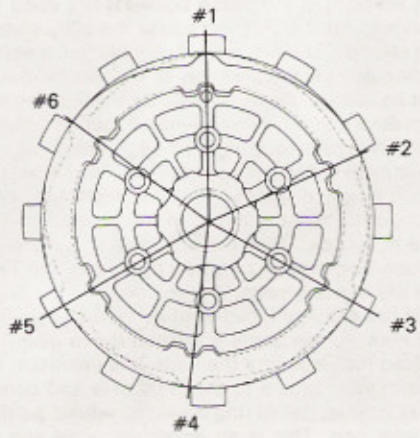


Fig. 1.13 Arrangement of clutch plain plate machined areas

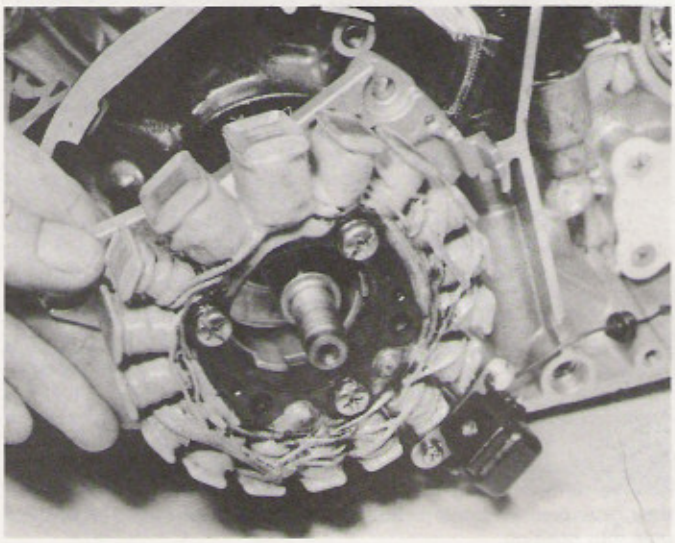
33 Engine reassembly: refitting the alternator, neutral switch and left-hand outer cover

1 Push the alternator stator wiring through its hole in the crankcase and locate the wiring grommet to retain it. The stator can now be offered up and the mounting screws fitted and tightened. Note that the ignition timing is not adjustable, and thus should be correct. If in doubt as to the accuracy of the ignition, refer to Chapter 4 for details.

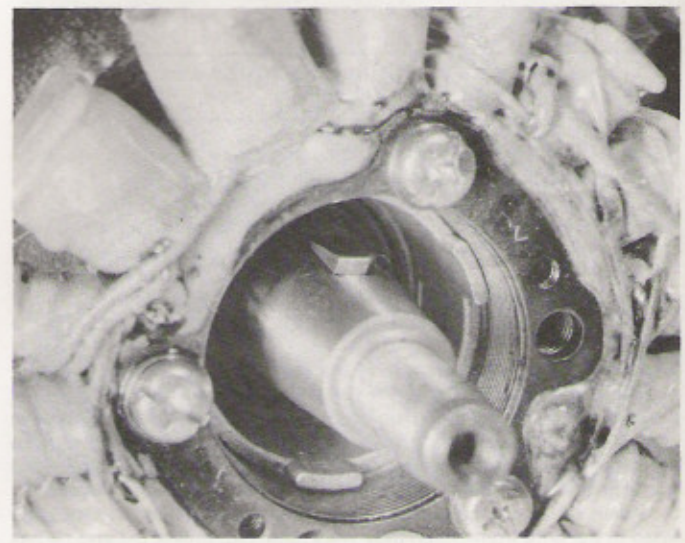
2 Fit the Woodruff key to the crankshaft keyway, ensuring that it seats correctly. Position the alternator rotor, then fit the plain washer, spring locking washer and securing nut. Lock the crankshaft and tighten the nut to 8.5 kgf m (61.0 lbf ft).

3 Check that the gearbox is in neutral, and where necessary temporarily refit the gear change pedal assembly and select neutral. Offer up the plastic neutral switch cover, ensuring that its contact aligns with the neutral contact on the end of the selector drum. Fit and tighten the three retaining screws. Feed the neutral switch lead behind the stator and through its slot in the casing wall, pushing the rubber guide block into place. Connect the lead to the neutral switch terminal.

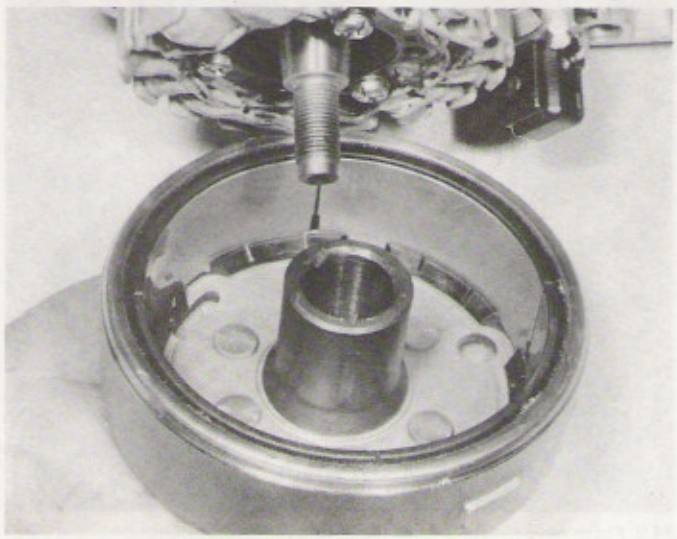
4 Slide the metal spacer over the protruding end of the gear selector shaft. If the engine is already in the frame the outer cover can now be refitted, otherwise leave it off until the engine has been installed and the chain and final drive sprocket refitted.



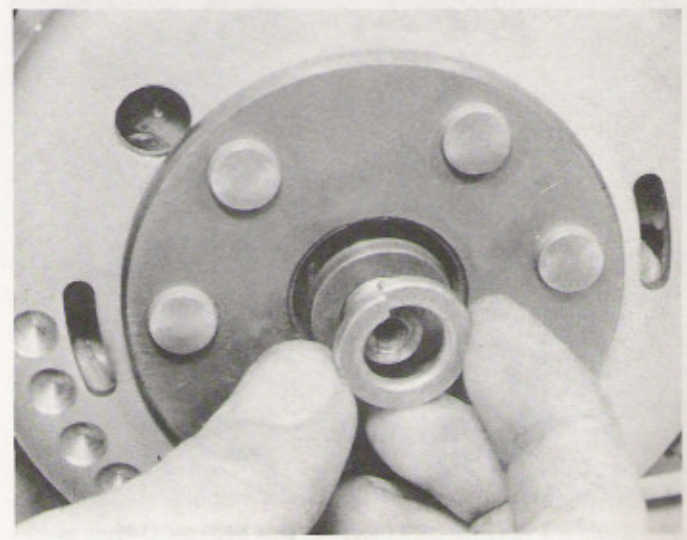
33.1 Install the alternator stator assembly in the casing recess



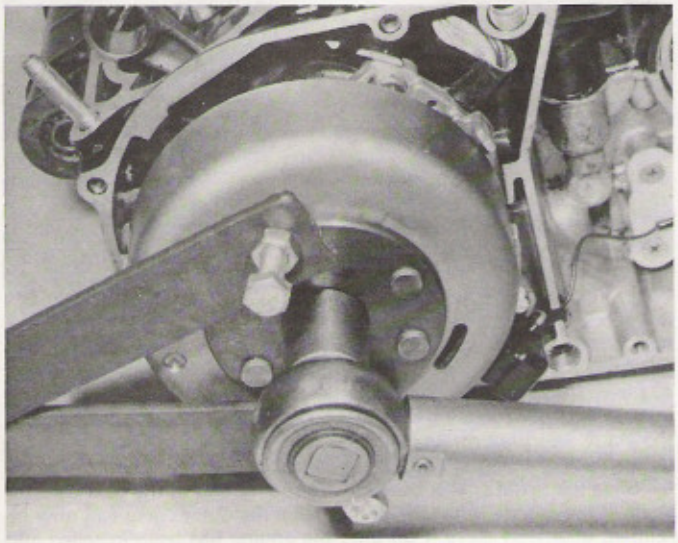
33.2a Fit the Woodruff key in the crankshaft slot ...



33.2b ... then offer up the rotor



33.2c Fit the plain and spring washers ...



33.2d ... lock the crankshaft and secure the rotor nut

34 Engine reassembly: refitting the YPVS valve, pistons, cylinder barrels and cylinder head

1 Check that the power valve components are clean and free from carbon deposits, paying particular attention to the cleaning groove along the face of the valve, and the valve bore in each barrel. Offer up the valve halves as shown in the accompanying photographs. Check that the two small dowel pins locate fully. Hold the flats on the end of the valve spindle with a pair of pliers, then fit and tighten the Allen-headed retaining bolt from the other end. Fit the small retainer plate and its single fixing bolt. Repeat the assembly sequence on the remaining valve.

2 Check that the crankcase mouth area is clean and free from grease deposits, then place the cylinder base gaskets over the holding studs. Lubricate the big-end and main bearings with two-stroke oil. Turn the crankshaft to TDC and pack clean rag around the connecting rods so that the crankcase mouths are covered. Lubricate the small-end bearings and slide them into position in the connecting rod eyes.

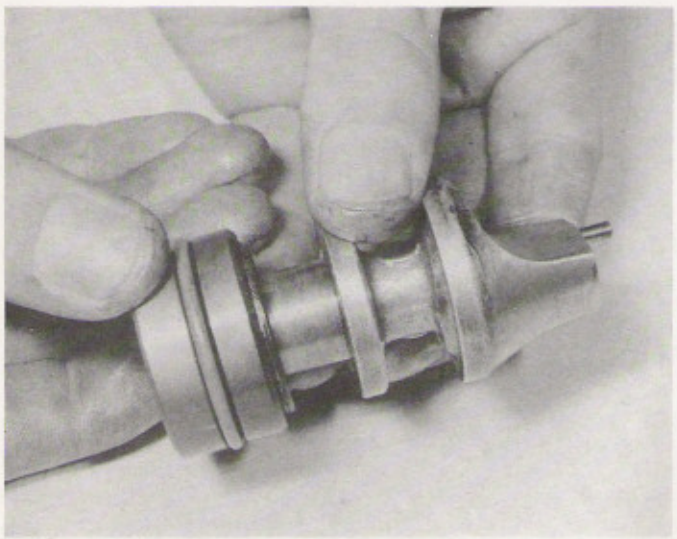
3 When fitting the pistons it is important to note that they must be fitted in the bore from which they were removed, unless the engine has been rebored in which case new pistons will be fitted. Note that each piston crown carries an arrow mark which should face forward. If the gudgeon pins are tight in the piston bosses it is a good idea to warm the pistons prior to fitting. This will cause the alloy piston to expand more than the steel pin and will make assembly much easier. Hot water at or near boiling point is the best way of heating them with no risk of distortion, but be wary of burns or scalding when using this method – use heavy gloves or some thick rag when handling the hot pistons.

4 Fit each piston in turn, locating the gudgeon pin with **new** circlips. It is false economy to risk reusing old circlips. They may appear to be in good order, and in practice may be quite satisfactory, but in view of their low cost do not run the risk of a weakened circlip breaking or working loose in service. Once the pistons are in place, lubricate the rings with clean two-stroke oil and check that the ring end gaps coincide with the locating pegs.

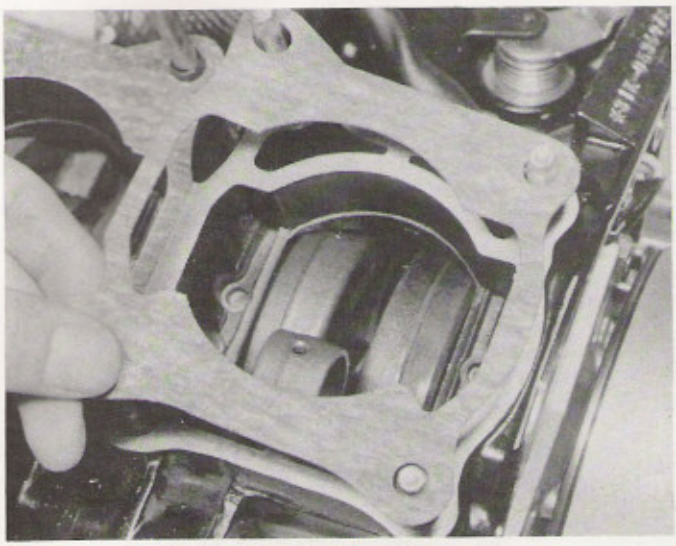
5 Each barrel has a tapered lead-in at its base to help in guiding the rings into the bore. As the barrel is pushed down over the piston use one hand to feed the rings into the bore. It is important to check that the barrels are exactly square to the crankcase and connecting rods, otherwise there is some risk of ring breakage where the ring ends pass close to the inlet port. This is an important point and warrants the removal of the reed valve units so that a visual check can be made. Once the piston rings have entered the bores correctly the rag padding may be removed from the crankcase mouth and the barrel pushed firmly down onto the base gasket.

6 When both barrels are in position, fit the retaining nuts to the base flange of each. These should be tightened evenly and progressively to a torque setting of 2.5 kgf m (18.0 lbf ft). In practice it proved impossible to get a torque wrench onto some of the nuts, and it was necessary to tighten them by hand using a ring spanner. Align the inner ends of the two power valves and connect them with the semi-circular joint piece. Fit and tighten the two retaining screws. It is worth noting that the screws are in an exposed position and are liable to corrosion. It may be worth replacing the standard screws with Allen screws to aid future removal.

7 Check that the mating surfaces of the cylinder head and barrels are clean and dry, then place the cylinder head gasket in position. Do not use jointing compound on either surface. Offer up the cylinder head and fit the eight retaining bolts finger tight. The head bolts should be tightened in the increasing sequence indicated by the numbers cast into the cylinder head. Initial tightening should be to about 1.0 kgf m (7.2 lbf ft). It will now be necessary to repeat the tightening operation, this time to the final value of 2.8 kgf m (20.0 lbf ft). Note that the cylinder head bolts must be re-tightened after the engine has been run and allowed to cool down. Fit the hose and adaptor between the cylinder head and the crankcase stub. The reed valve assemblies can now be refitted noting that the rubber adaptors must be renewed if they have cracked around the balance pipe stubs. Push the balance pipe into position.

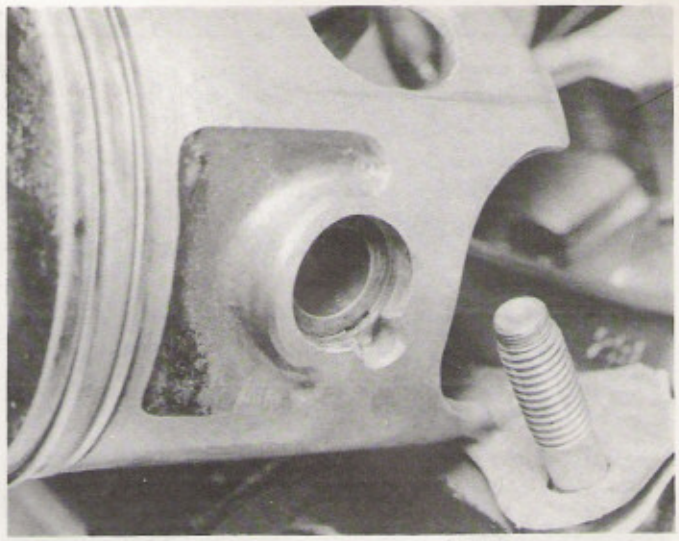


34.1 Clean the valve halves, fit locating pins and new O-rings as required

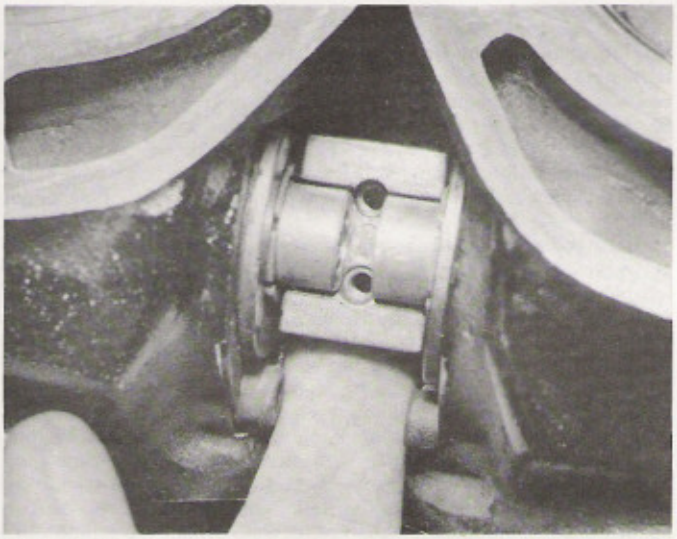


34.2 Place new cylinder base gaskets over holding studs

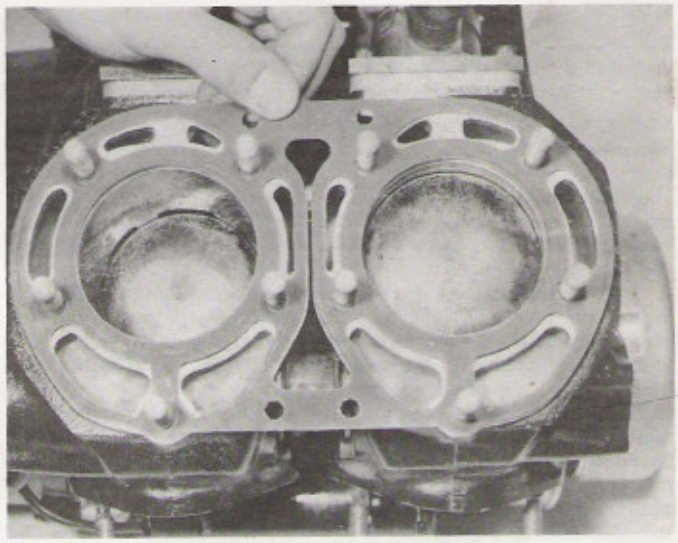
34.4a Use new circlips to secure the gudgeon pins ...



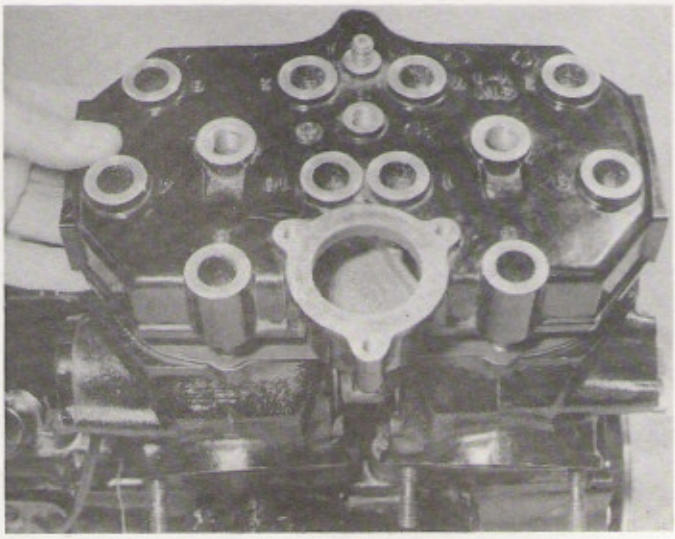
34.4b ... leaving end gaps clear of removal slot



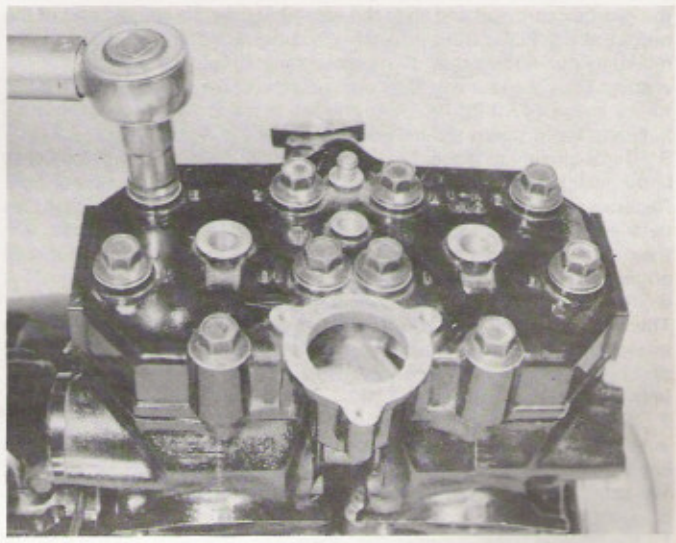
34.6 Join the power valves between the two cylinder barrels



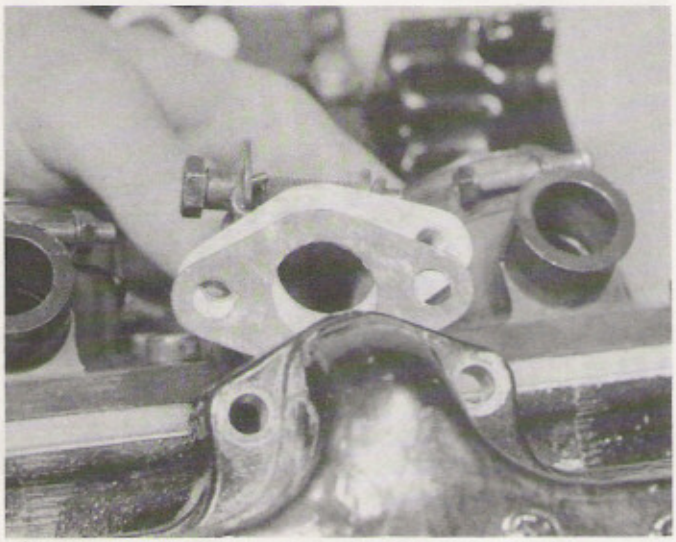
34.7a Fit a new cylinder head gasket ...



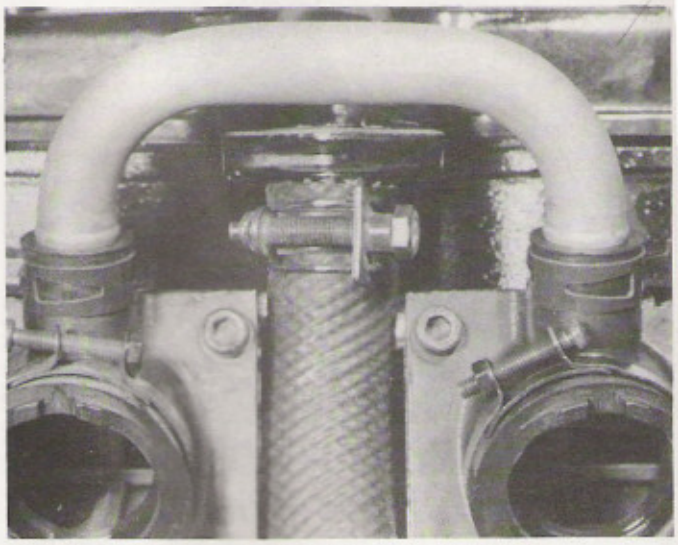
34.7b ... and lower the head into position



34.7c Tighten the head sleeve bolts in the prescribed sequence



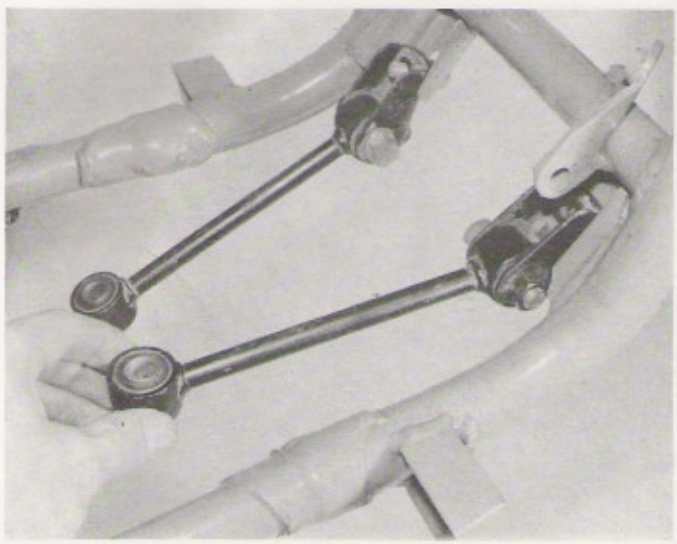
34.7d Reconnect the coolant hose adaptor between the two cylinders



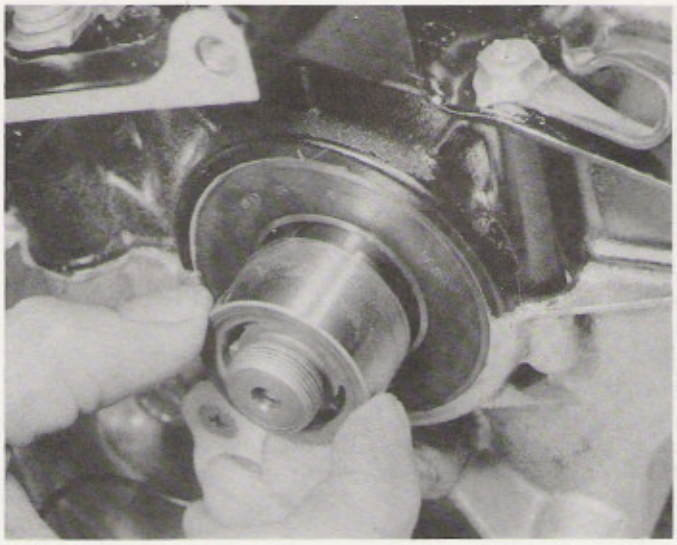
34.7e Refit the balance pipe between the inlet rubbers

35 Fitting the engine/gearbox unit into the frame

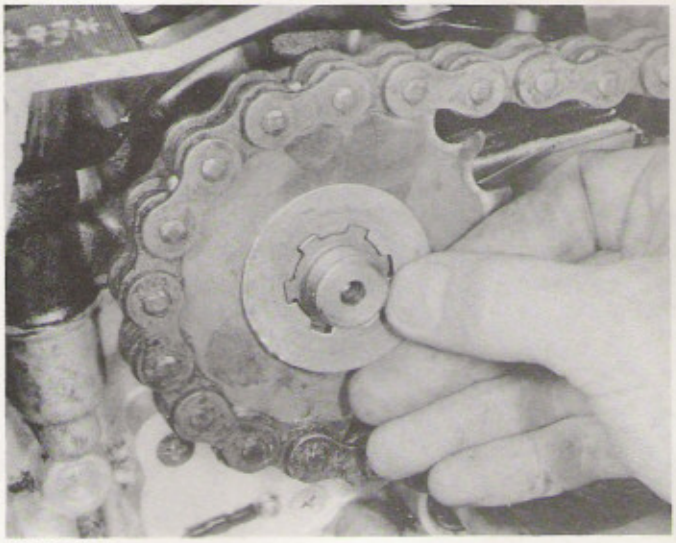
1 The engine/gearbox unit is refitted by reversing the removal sequence. As with removal, it is advisable to have an assistant to help manoeuvre the unit into position, but the job is just about feasible unaided if this proves unavoidable. Take care not to damage the paintwork during installation. This can be guarded against by wrapping some card or stiff paper around the more vulnerable areas and taping this in place.
2 Lift the unit into the frame cradle from the right-hand side. It will sit in this position while the mounting brackets are sorted out and positioned. Before the engine is secured, make sure that the final drive chain is looped around the projecting cast boss to the rear of the output shaft. Failure to check this will cause problems later on since it is difficult to get the chain into position with the engine bolted into place.
3 Fit the front and rear mountings in position, fitting the small frame mounting bolts and the large through bolts finger tight. When all are in position, tighten the small bolts to 2.4 kgf m (17.4 lbf ft) and the large through bolts to 6.5 kgf m (47.0 lbf ft). Fit the engine steady bars between the frame brace tube and the underside of the crankcase.
4 Refit the tachometer drive cable to its adaptor at the rear of the crankcase (RD350 LC II model only). The knurled retaining ring should be tightened securely by hand. Fit the final drive chain around the gearbox sprocket and slide the assembly over the splined end of the output shaft. Place the tab washer against the sprocket, then fit the retaining nut noting that its recessed face should be against the tab washer. Lock the rear wheel by applying the brake, then tighten the nut to 6.5 kgf m (47.0 lbf ft). Bend the tab washer over one of the nut's flats and tap it down securely with a hammer and punch.
5 If not already in place, fit the clutch release arm into the crankcase and check that the retainer is in place on the adjacent crankcase bolt. Reconnect the clutch cable, then carry out clutch adjustment as detailed in Routine Maintenance. When adjustment is complete, refit the outer cover using a new gasket and ensuring that the coolant stub engages correctly in its recess.
6 Refit the throttle valves and caps to their respective carburettors. The valves and bodies are handed, but it is possible to get them interchanged and reversed. Guard against this by ensuring that the synchronisation dot on each valve will coincide with the small window in the carburettor body.
7 Manoeuvre the instruments into position between the airbox and inlet adaptors, and secure the retaining clips. Reconnect the oil pump cable and fit the pipe from the oil tank and the two small delivery pipes. The pump cover should be left off until it has been bled and adjusted.
8 Refit the exhaust system using the new sealing rings at each port. Fit the retainer flanges and tighten the two nuts evenly. Fit the silencer mounting bolts to secure each half of the system to the footrest mounting plate. If it was removed, refit the thermostat and housing to the top of the cylinder head, using a new rubber sealing ring and tightening the retaining nuts evenly. Refit the temperature gauge sender unit using a new sealing washer. Fit the spark plugs and caps.
9 Route the alternator output leads across the crankcase and reconnect them next to the battery tray, using the colour coded wiring for guidance. Check that all breather and drain hoses are routed correctly, then refit and connect the battery, observing the correct polarity.
10 Turn the power valve assembly so that the screw heads on the curved joint face upwards. Fit the power valve pulley housing to the left-hand cylinder and refit the pulley. Align the notch in the pulley with the hole in the rear of the housing, then lock the pulley using a 4 mm diameter pin; a drill bit or Allen key can be used for this. Tighten the pulley retaining bolt and then remove the pin.
11 Adjust the pulley cables until all free play is removed, then back off the adjusters by 1/4 turn. Switch on the ignition. The power valve will open and close (this is a self-cleaning function which occurs each time the ignition is turned on). Check that the notch and the hole still align correctly. If necessary, adjust the position of the valve by slackening one cable and tightening the other. Switch the ignition off and then on again to check the setting. When all is well, switch the ignition off, tighten the locknuts and refit the valve covers.



35.1 Fit the engine steady bars loosely in place before engine is installed

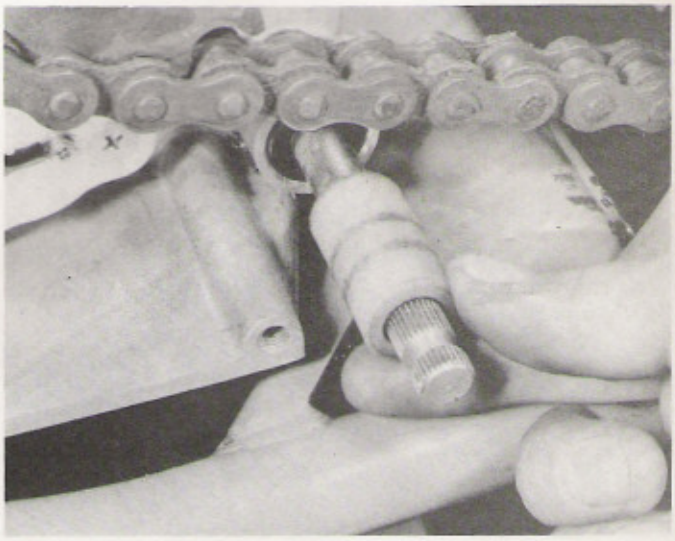


35.4a Grease and fit spacer into output shaft seal, if not already in place

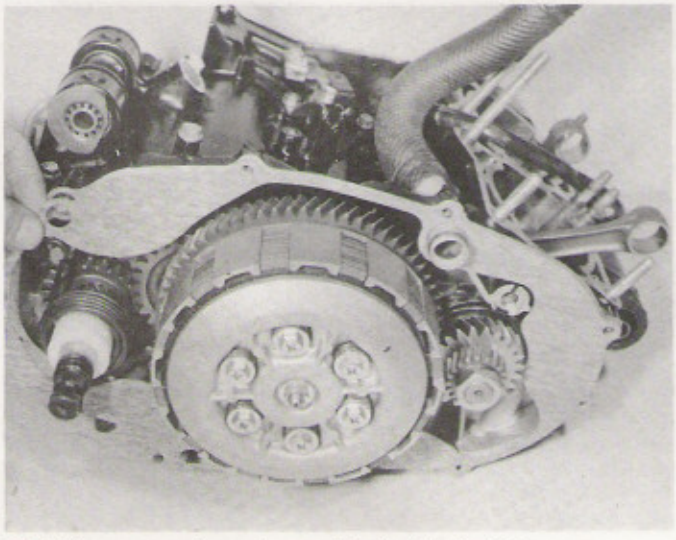


35.4b Fit the gearbox sprocket and tab washer ...

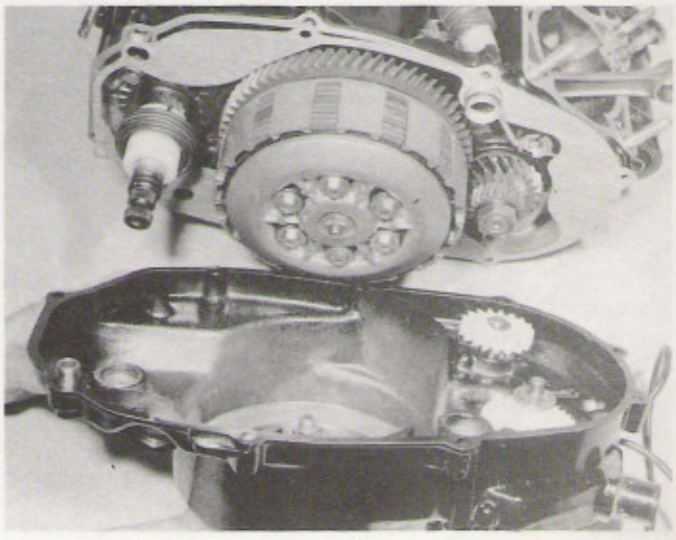
35.4c ... tighten securely and bend up the locking tab as shown



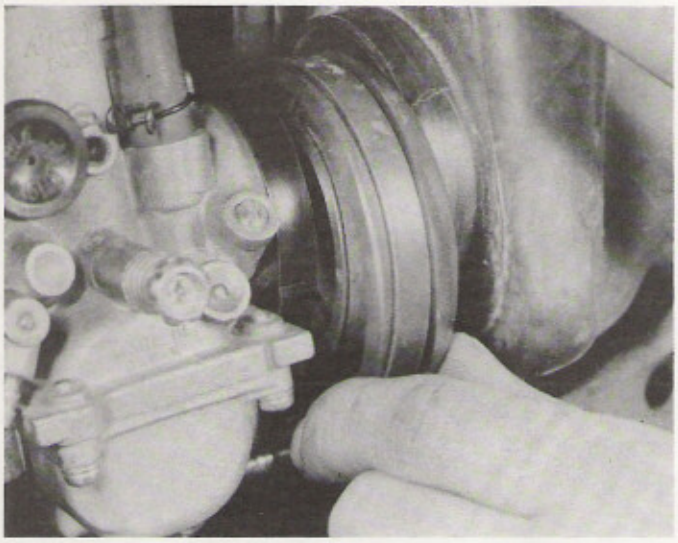
35.4d Do not forget the sleeve over the selector shaft end



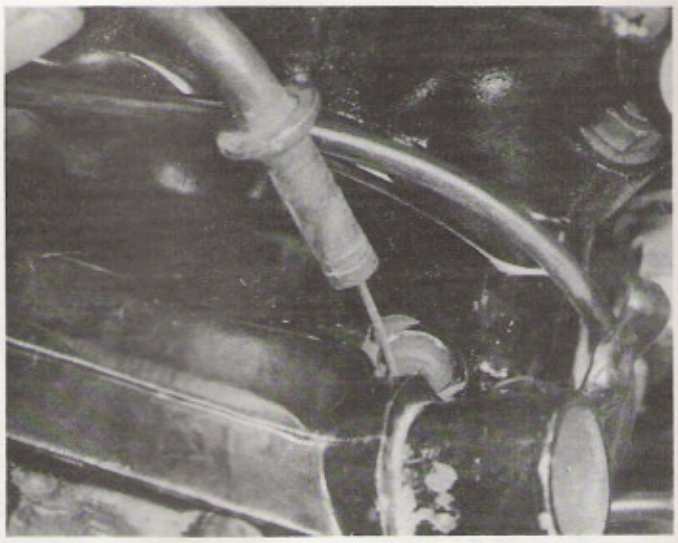
35.5a Fit a new gasket to the crankshaft right-hand face ...



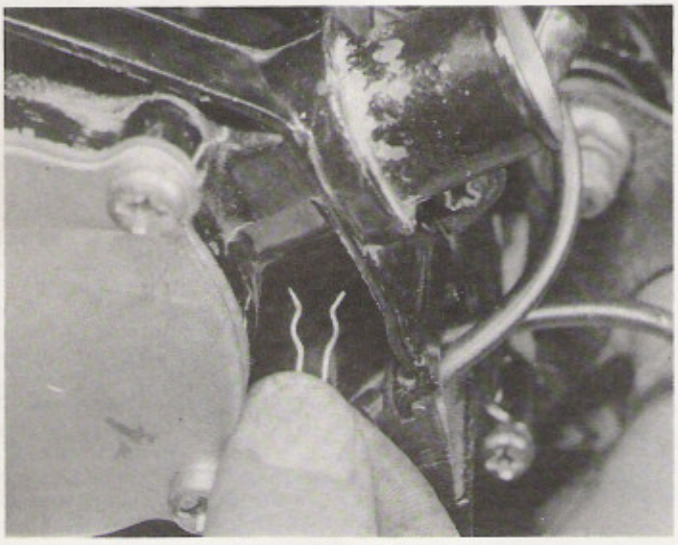
35.5b ... then fit cover, making sure that gears engage correctly



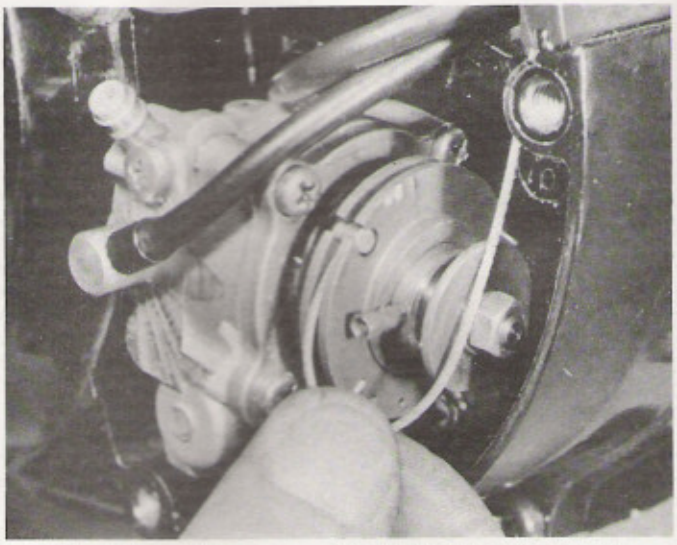
35.6 Refit the carburettors and secure the retaining clips



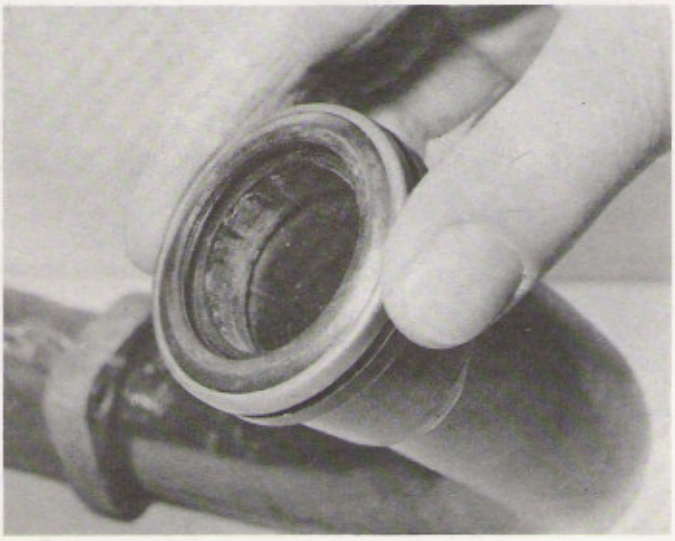
35.7a Pass oil pump cable through its hole in the crankcase ...



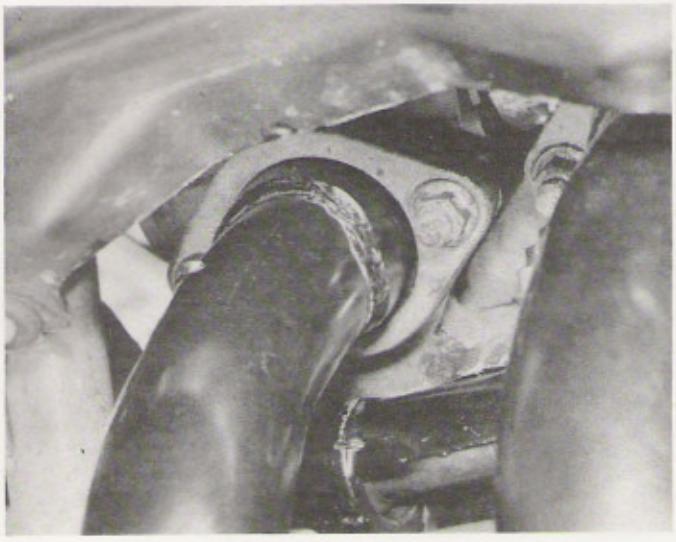
35.7b ... and secure it with its retaining clip as shown



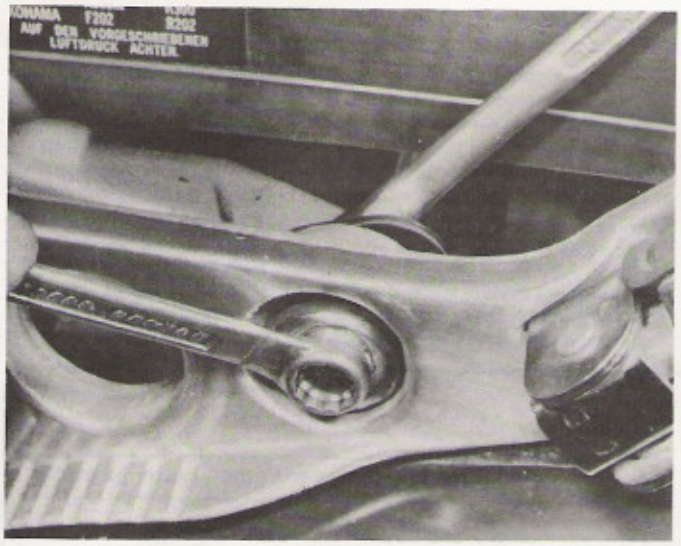
35.7c Hook the cable inner around the pump pulley. Do not fit cover until pump has been bled and adjusted



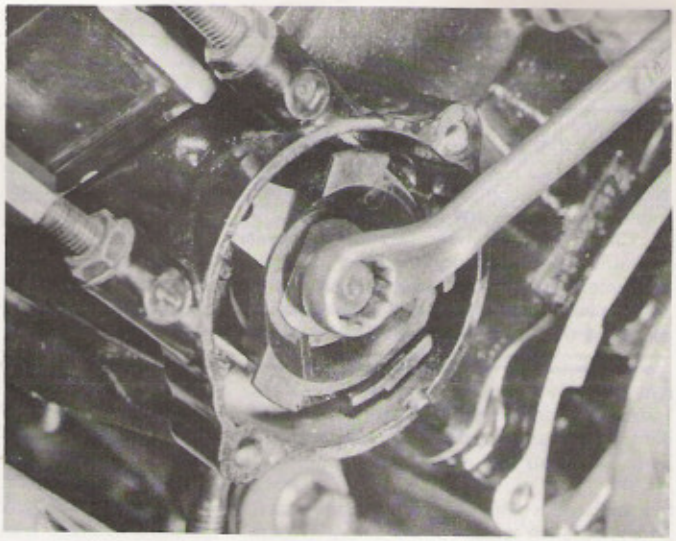
35.8a Use new sealing rings at the exhaust ports



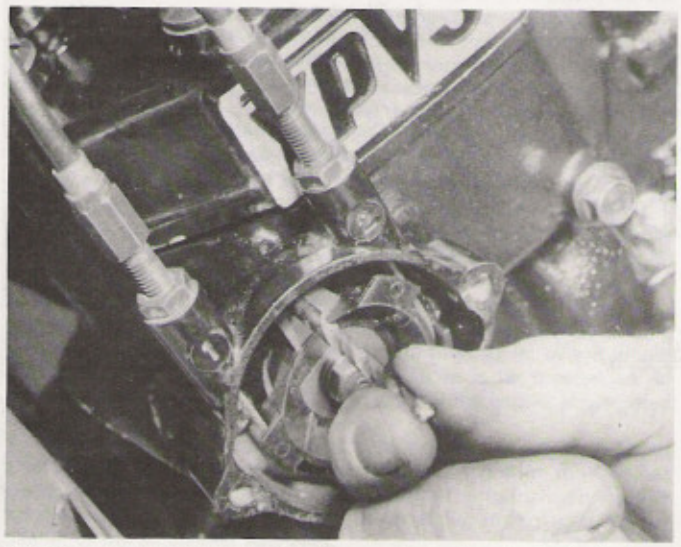
35.8b Fit and secure the retainer flanges at the front ...



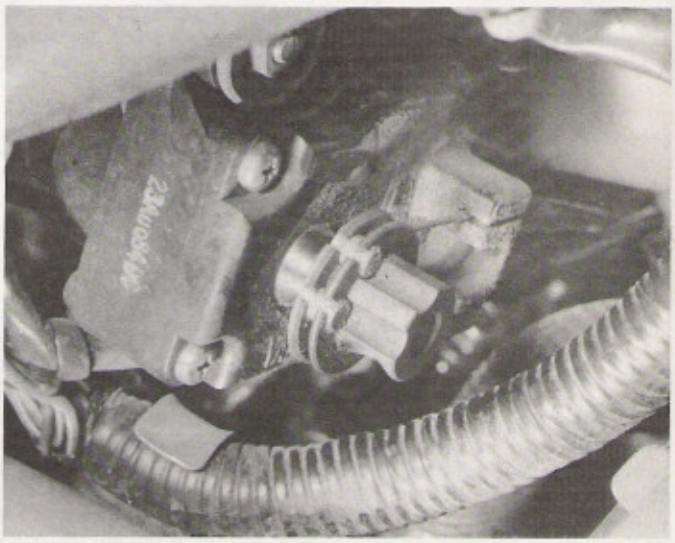
35.8c ... and the silencer mountings at the rear



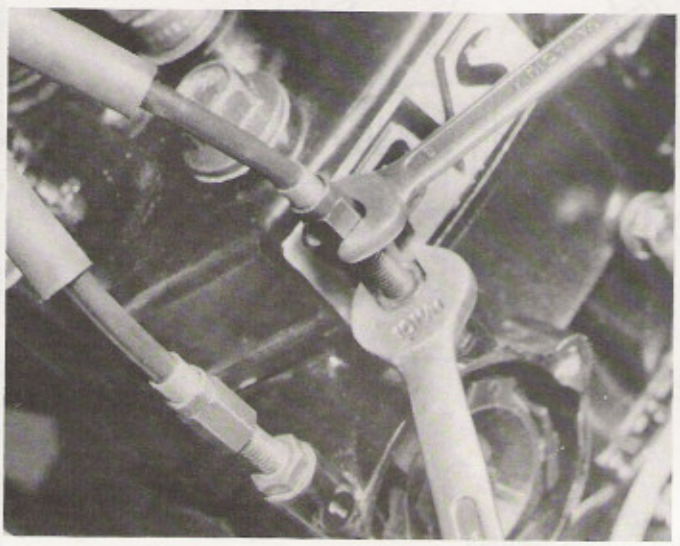
35.10a Refit the pulley assembly to the end of the power valve



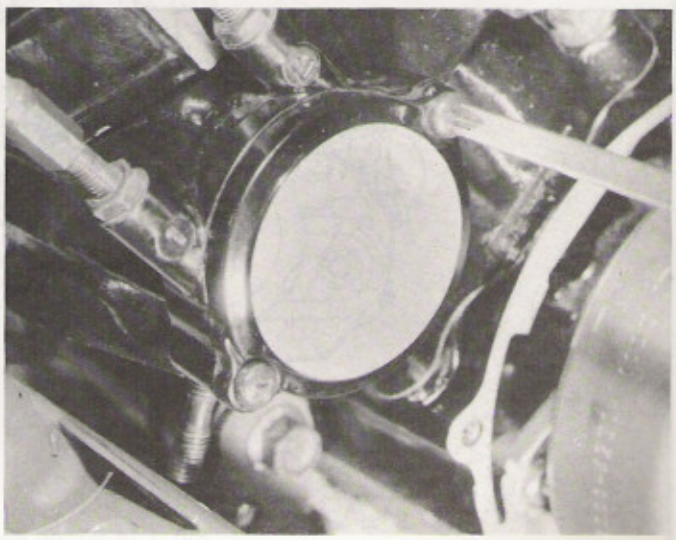
35.10b Pulley can be locked in place and adjustment checked using a twist drill or similar as shown



35.10c Check that cables are located correctly at the servomotor ...



35.10d ... then set the cable adjustment (see text)



35.10e When correctly adjusted, refit the outer cover

36 Engine reassembly: final connections and adjustments

1 Check throttle cable free play and where necessary adjust to give 3 – 7 mm (0.12 – 0.28 in) movement measured at the outer edge of the twistgrip flange, making any adjustment with the in-line adjuster immediately below the throttle twistgrip.

2 Check throttle synchronisation by observing the alignment marks through the inspection windows on the right-hand side of each instrument. Using the adjusters on the carburettor tops, set both throttle valves so that the marks are central in their windows. Open and close the throttle a few times, then recheck.

3 Once synchronisation has been set, check the oil pump cable adjustment as described in Chapter 3, noting that the correct alignment mark is dependent on the model and year of manufacture. The oil pump should now be bled by removing the small bleed screw and allowing the air to be expelled by oil flowing from the tank. When the oil is free of air bubbles, fit and tighten the bleed screw. The oil delivery pipes should be bled once the engine is running as described in Section 37 of this Chapter.

4 Reconnect the hose to the water pump stub on the outer cover and fill the cooling system using a mixture of 50% distilled water and 50% Glycol antifreeze. Do not use ordinary tap water because the impurities contained in it will promote corrosion and furring-up of the system. Fit

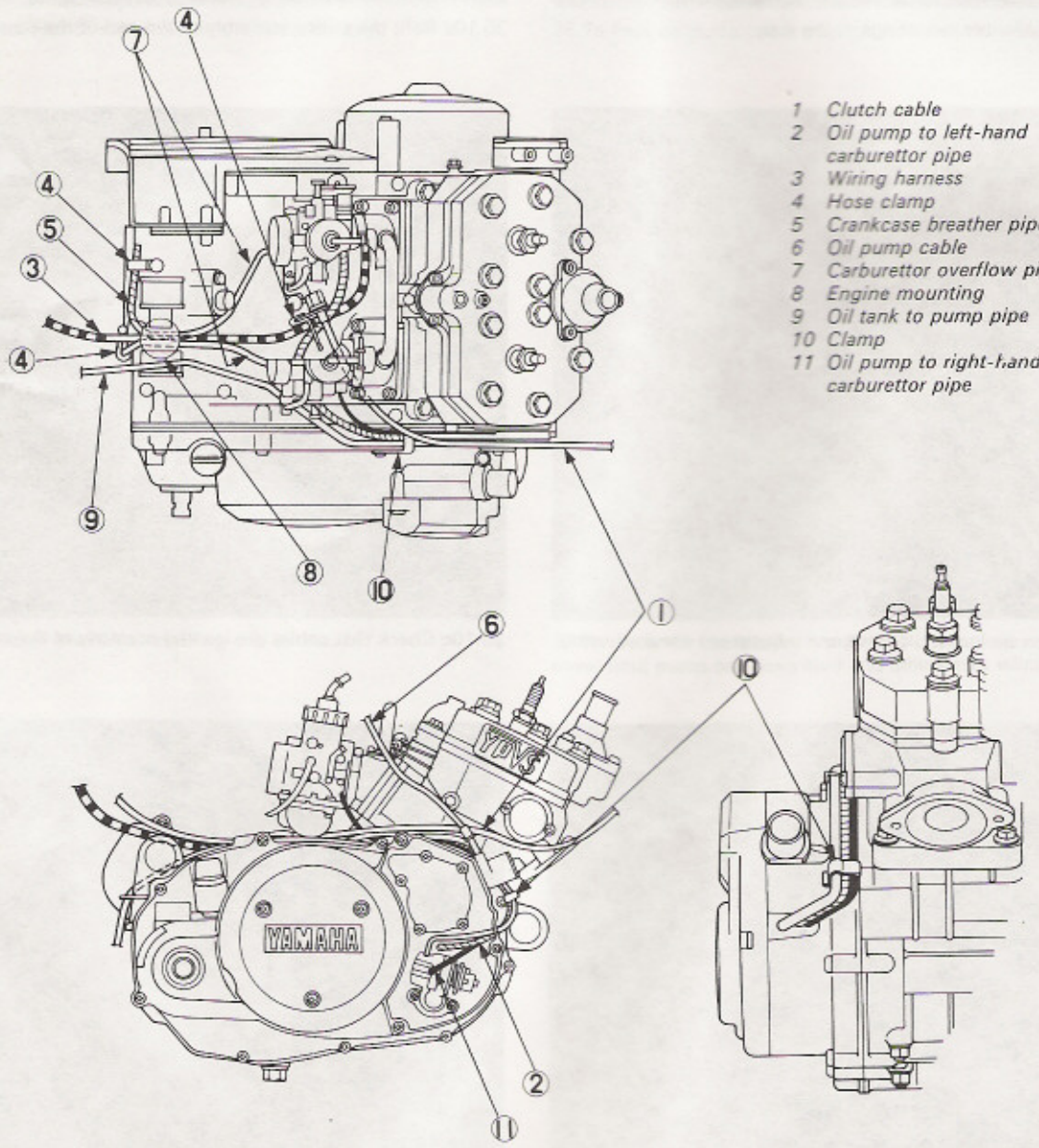


Fig. 1.14 Wiring and pipe routing diagram

the radiator cap and the guard, but do not fit the two right-hand retaining screws. This will allow the guard to be displaced to permit topping up of the cooling system.
5 Remove the transmission oil filler plug and add 1700 cc (2.99 Imp pint) of SAE 10W/30 SE motor oil. The level of the oil should be re-checked after the engine has been run.
6 Fit and secure the left-hand outer cover, and fit the kickstart lever if this is not already in position. Complete reassembly by fitting the fuel tank and pipe and the dual seat. Check around the machine to ensure that all remaining cables and connectors are in place. Where appropriate, readjust the rear chain play and secure the wheel spindle nut. Make a final check of the electrical system by turning the ignition switch on and testing the operation of the various electrical components.

37 Starting and running the rebuilt engine

1 Initial starting may prove a little difficult and it is possible that the oil used during reassembly may cause fouling of the spark plugs. Use the normal cold starting procedure and be prepared for flooding during the first few attempts. If necessary remove and dry the plugs and start again. When the initial start-up is made, run the engine slowly for the first few minutes, especially if the engine has been rebored or a new crankshaft fitted. Check that all controls function correctly and that there are no oil leaks, before taking the machine on the road. The exhausts will emit a high proportion of white smoke during the first few miles, as the excess oil used whilst the engine was reassembled is burnt away. The volume of smoke should gradually diminish until only the customary light blue haze is observed during normal running. It is wise to carry a spare pair of spark plugs during the first run, since the existing plugs may oil up due to the temporary excess of oil.
2 As soon as the engine is running evenly bleed the oil delivery lines by pulling on the pump cable so that the pump stroke is at maximum and the engine is held at a fast idle speed.
3 Remember that a good seal between the pistons and the cylinder barrels is essential for the correct functioning of the engine. A rebored two-stroke engine will require more careful running-in, over a longer period, than its four-stroke counterpart. There is far greater risk of engine seizure during the first hundred miles if the engine is permitted to work hard.
4 Do not tamper with the exhaust sysem or run the engine without baffles fitted to the silencer. Unwarranted changes in the exhaust system will have a very marked effect on engine performance invariably for the worse. The same advice applies to dispensing with the air cleaner or the air cleaner element.
5 Do not on any account add oil to the petrol under the mistaken belief that a little extra oil will improve the engine lubrication. Apart from creating excess smoke, the addition of oil will make the mixture much weaker, with the consequent risk of overheating and engine seizure. The oil pump alone should provide full engine lubrication.
6 Before taking the machine on the road, the cylinder head bolt torque and all oil and water levels should be rechecked. Replace all filler caps and covers. Remember to check the operation of all controls and electrical accessories before taking the machine on the road.

38 Taking the rebuilt machine on the road

1 Any rebuilt machine will need time to settle down, even if parts have been replaced in their original order. For this reason it is highly advisable to treat the machine gently for the first few miles to ensure oil has circulated throughout the lubrication system and that new parts fitted have begun to bed down.
2 Even greater care is necessary if the engine has been rebored or if a new crankshaft has been fitted. In the case of a rebore, the engine will have to be run in again, as if the machine were new. This means greater use of the gearbox and a restraining hand on the throttle until at least 500 miles have been covered. There is no point in keeping to any set speed limit; the main requirement is to keep a light loading on the engine and to gradually work up performance until the 500 mile mark is reached. These recommendations can be lessened to an extent when only a new crankshaft is fitted. Experience is the best guide since it is easy to tell when an engine is running freely.
3 Remember that a good seal between the piston and the cylinder barrel is essential for the correct functioning of the engine. A rebored two-stroke engine will require more careful running-in, over a long period, than its four-stroke counterpart. There is a far greater risk of engine seizure during the first hundred miles if the engine is permitted to work hard.
4 If at any time a lubrication failure is suspected, stop the engine immediately, and investigate the cause. If an engine is run without oil, even for a short period, irreparable engine damage is inevitable.
5 Do not on any account add oil to the petrol under the mistaken belief that a little extra oil will improve the engine lubrication. Apart from creating excess smoke, the addition of oil will make the mixture much weaker, with the consequent risk of overheating and engine seizure. The oil pump alone should provide full engine lubrication.
6 Do not tamper with the exhaust system. Unwarranted changes in the exhaust system will have a marked effect on engine performance, invariably for the worse. The same advice applies to dispensing with the air cleaner or the air cleaner element.
7 When the initial run has been completed allow the engine unit to cool and then check all the fittings and fasteners for security. Re-adjust any controls which may have settled down during initial use.