Chapter 2 Fuel System and Lubrication

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Specifications

Fuel tank capacity	11.0 litres (2.9/2.4 US/Imp gallons)
Engine oil capacity	
Total	2.6 litres (5.5/4.6 US/Imp pints)
At oil change	2.0 litres (4.2/3.5 US/Imp pints)
At oil and filter change	2.3 litres (5.0/4.0 US/Imp pints)

Carburettor	**XS250**	**XS360**	**XS400**
Type	BS32	BS34	BS34
Make	Mikuni	Mikuni	Mikuni
Main jet	117.5	135	142.5
Air jet	0.6	0.6	45
Jet needle	4Z1-4	4FP21-3	5Z1-4
Needle jet	X-8	X-6	X-4
Needle position	4	3	4
Throttle valve	125	145	135
Pilot jet	20	17.5	42.5
Starter jet	25	40	30
Air screw (number of turns out)	1 to 1½	1 to 1½	1 to 1¼
Float height	26 ± 2.5 mm (1.047 ± 0.098 in)		32.0 ± 1 mm (1.26 ± 0.04 in)

Oil pump	
Type	Trochoid
Inner rotor/outer rotor clearance	0.03–0.09 mm (0.0012–0.0035 in)
Side clearance	0.03–0.09 mm (0.0012–0.0035 in)

1 General description

The fuel system comprises a petrol tank, from which petrol is fed by gravity to the carburettors, via a diaphragm type fuel cock. There are three positions, ON, RESERVE and PRIMING. Before starting the engine, turn the fuel tap to the 'ON' position, this enables the fuel to flow to the carburettors when the engine has started.

If the fuel in the tank is too low to be fed to the carburettors in the ON position, turn the lever to RESERVE position, which provides a limited amount of additional fuel. Only when there is no fuel in the carburettors is it necessary to turn to the PRIMING position, which will allow fuel to flow to the carburettors even with the engine stopped. Once the engine has started be sure to return the lever to the ON position or RESERVE position.

The tap is operated by means of the induction vacuum in the right-hand inlet tract, to which the tap diaphragm is interconnected by a small bore hose.

Two Mikuni constant velocity carburettors are fitted to all models, interconnected by a throttle butterfly valve control rod and mounted as a unit on a common mounting bar. Each carburettor is provided with a starter system (choke) controlled by a plunger, the two being interconnected by a rod allowing simultaneous operation from a lever or push-pull knob at the left-hand carburettor. Two separate air filter units are fitted, one of which is hidden behind each frame side cover.

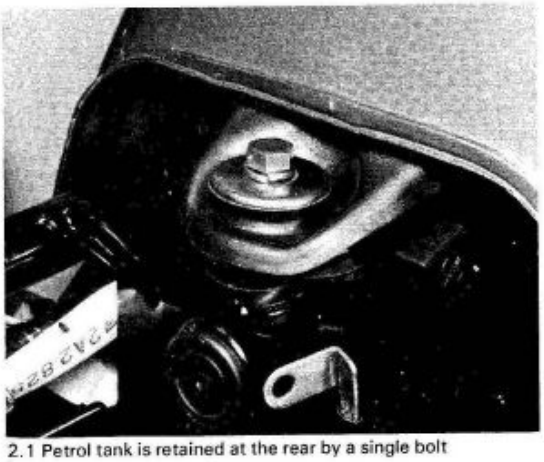
The lubrication system is fed by a trochoid type oil pump which is driven via an idler gear from the primary drive pinion. Oil picked up by the pump is strained by a gauze oil trap in the crankcase, where it is passed through a centrifugal oil filter to the working parts of the engine. A by-pass valve is included in the system, fitted within the oil filter centre bolt, which allows an uninterrupted flow of oil in the event of oil filter blockage. The gearbox and primary drive share the same oil as that used by the engine proper, the gearbox mainshaft being fed under pressure and the layshaft being lubricated by the gravity fed return system.

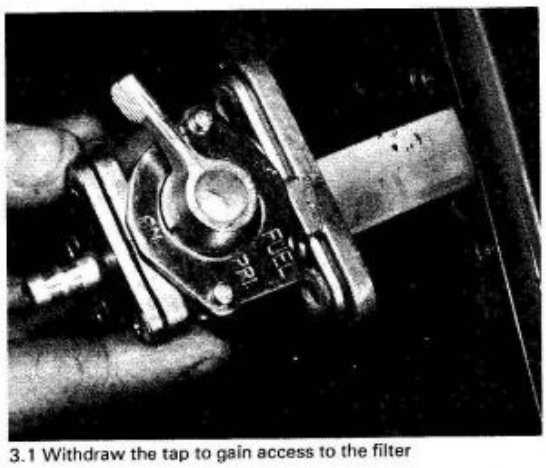
2 Petrol tank: removal and replacement

1 The fuel tank is retained at the forward end by two rubber buffers fitted either side of the underside of the tank which fit into cups on the frame top tube. The rear of the tank sits on a small rubber saddle placed on a frame cross-bar and is secured by a single bolt passing through a lug projecting from the tank.
2 To remove the tank, pull off the fuel line and vacuum tube at the petrol tap unions where they are held by spring clips. Raise the seat, remove the bolt, washer and damper from the rear of the tank, and lift the tank backwards and away from the machine.
3 When replacing the tank, reverse the above procedure. Make sure the tank seats correctly and does not trap any control cables or wires.

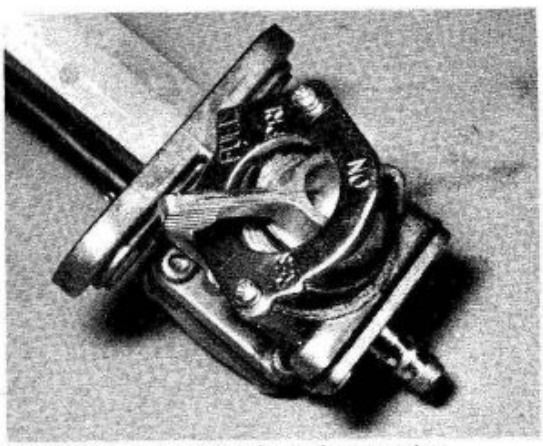
3 Petrol tap: removal and replacement

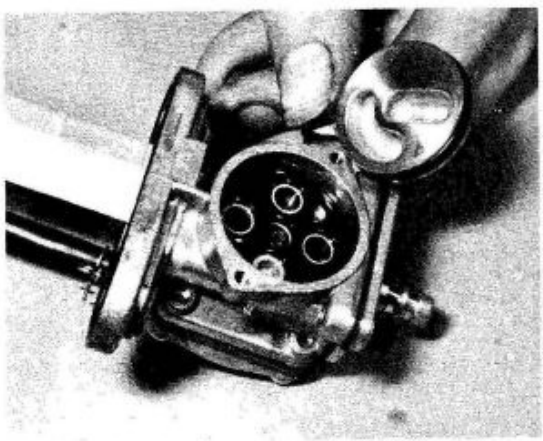
1 The petrol tap must be removed from the tank at regular intervals to gain access and allow cleaning of the filter gauze, which takes the form of a mesh pillar projecting into the petrol tank cavity. Before removing the tap, drain the fuel by attaching a suitable length of pipe to the tap union and turning the tap lever to the PRIME position, to allow an unrestricted flow of petrol. After draining the tank and detaching the vacuum pipe, remove the two screws which pass through the tap body flange and remove the tap.
2 The fuel filter should be cleaned thoroughly in petrol, agitating any adhering deposits with a soft brush. When replacing the tap note that there is an 'O' ring seal between the petrol tap body and the petrol tank, which must be renewed if it is damaged or if petrol leakage has occurred.
3 It is seldom necessary to remove the lever which operates the petrol tap, although occasions may occur when a leakage develops at the joint. Although the tank must be drained before the lever assembly can be removed, there is no need to disturb the body of the tap.
4 To dismantle the lever assembly, remove the two crosshead screws passing through the plate on which the operating positions are inscribed. The plate can then be lifted away, followed by a spring, the lever itself and the seal behind the lever. The seal or lever 'O' ring will have to be renewed if leakage has occurred. Reassemble the tap in the reverse order. Gasket cement or any other sealing medium is NOT necessary to secure a petrol tight seal.


2.1 Petrol tank is retained at the rear by a single bolt



3.1 Withdraw the tap to gain access to the filter


3.4a Tap lever is secured by plate and wave washer


3.4b Lift out lever to gain access to seal and 'O' ring

4 Carburettors: removal

1 Remove the petrol tank as described in section 2 of this Chapter to gain access to the carburettors and then remove both frame side covers. Each side cover is a push fit at three locating points.
2 Loosen the screw clips which hold the carburettors to the inlet stubs, and the air hose unit to the twin air filter boxes and carburettor mouths. Each air filter box may be pulled from place after removing the retaining strap, which is secured at the lower end by a single bolt, and at the top by a hook arrangement. Disconnect the air hose breather tube from the breather cover union on the crankcase, after displacing the spring clip. The air hose unit can now be pulled from the carburettors and tilted backwards and downwards so that it clears the carburettors. Careful manipulation may be required as the clearance is limited.
3 Pull the carburettors back out of the inlet stubs and lift them out, towards the right-hand side of the machine as a unit. Support the carburettors and disconnect the throttle cable at the carburettor end. Lift the outer cable from the slotted abutment and displace the nipple and inner cable end from the throttle pulley.

5 Carburettors: dismantling and reassembly

1 In order to dismantle the carburettors they must first be removed from the mounting bracket to which they are each retained by two screws. The carburettors are also connected by a bracket which acts as the throttle cable holder. The bracket is retained by two of the four diaphragm cover screws on each carburettor top.
2 Commence by removing the right-hand carburettor from the mounting bracket. On carburettors which have a lever operated choke rod, remove the operating lever, which is held by a single screw. Slacken the grub screw holding each choke lifter fork and withdraw the rod to free the forks. Some carburettors have a two-position push-pull choke operating rod. The rod is located in any given position by a spring loaded steel ball in each carburettor, which locates with a series of depressions machined in the rod. To remove the rod, slacken the choke operating fork grub screws and withdraw the rod. As the rod end leaves the support lug in each carburettor, the steel ball and spring will tend to fly out. Arrangements should be made to prevent this happening, as the components are tiny and easily lost.
3 Slacken all four screws on each carburettor top, to prevent distortion, and then remove the inner four screws, to free the top bracket. Unscrew the two screws securing the right-hand carburettor to the mounting bracket and separate the two instruments at the interconnecting petrol transfer pipe. The mounting screws are often very tight and are prone to shearing. Great care should be exercised in their removal.
4 Invert each carburettor and remove the four screws that hold the float chamber to its base. Remove the hinge pin that locates the twin float assembly and lift the float from position. This will expose the float needle. The needle is very small and should be put away in a safe place so that it is not misplaced. Make sure that the float chamber gasket is in good condition. Do not disturb the gasket unless leakage has occurred or it appears damaged.
5 Check that the twin floats are in good condition and not punctured. Because they are made of brass it is possible to solder a damaged float. This form of repair should only be made in an emergency, when a set of new floats are not available. Soldering will affect the weight of the float assembly and result in a different petrol level.

XS250 and 360 models

6 The needle jet is a push fit in the base of the mixing chamber, being retained by a small 'O' ring. Check the needle jet for wear together with the jet needle. After lengthy service, these two components should be renewed together, or high petrol consumption will result.
7 The float needle will also wear after lengthy service, and should be closely examined with a magnifying glass. Wear takes the form of a ridge or groove, which will cause the float needle to seat imperfectly. The needle and seating should always be renewed as a pair. The seating is a screw fit in the mixing chamber. Note the 'O' ring and also the tiny filter gauze, which is retained by the seat.
8 The main jet and pilot jet are both housed in the float chamber. The main jet is situated below a plug, which will unscrew from outside the float chamber. Always use a close fitting screwdriver when removing jets, or damage will result.

XS400 models

9 The jet configuration on XS400 model carburettors is slightly different from the other types in that all jets are located within the float chamber roof. Remarks on inspection and wear characteristics remain the same.
10 Unscrew the main jet from the centre turret and displace the needle jet from the body towards the venturi side of the carburettor. The pilot jet is closed by a brass plug, which may be removed to allow the jet to be cleaned. **Do not** remove the jet unless it is to be renewed as the method of removal which must be adopted will almost certainly enlarge the jet orifice. To remove the jet, insert a screwdriver and unscrew the jet until it can be felt to be free. The jet must now be unscrewed through the threads normally occupied by the blanking plug. In order to engage the jet with the second series of threads, it must be pulled and turned simultaneously. To accomplish this, select a short length of stiff wire whose diameter is slightly greater than the inside diameter of the jet bore. Taper the ends of the wire so that it may be inserted into the jet bore and pushed in firmly to engage the jet. The jet may now be pulled outwards and unscrewed.
11 The starter air jet is screwed into the left-hand side of the carburettor mouth and may be removed in the usual manner.

All models

12 Remove the two remaining screws which retain the carburettor top and lift the top from position, together with the piston spring. Carefully lift the diaphragm from position, bringing with it the piston and jet needle. Carefully check the condition of the diaphragm. If it has developed cracks or holes, it must be renewed as a unit, with the piston. The jet needle is retained by a nylon plate and is secured by a small circlip. The jet needle must be renewed if worn, as described in paragraph 6.
13 Before reassembly, clean the carburettors as described in the previous Section. The manually operated choke is unlikely to require attention throughout the normal service life of the machine.
14 Before the carburettors are reassembled, using the reversed dismantling procedure, each should be cleaned out thoroughly, using compressed air. Avoid using a piece of rag since there is always a risk of particles of lint obstructing the internal passageways or the jet orifices.
15 Never use a piece of wire or any pointed metal object to clear a blocked jet. It is only too easy to enlarge the jet under these circumstances and increase the rate of petrol consumption. If compressed air is not available, a blast of air from a tyre pump will usually suffice.
16 Do not use excessive force when reassembling a carburettor because it is easy to shear a jet or some of the smaller screws. Furthermore, the carburettors are cast in zinc-based alloy, which itself does not have a high tensile strength.
17 After replacing the carburettors on the machine they should be synchronised and adjusted, as described in Section 7 of this Chapter. Before refitting the air hose unit, check the synchronisation of the throttle valve butterflies.

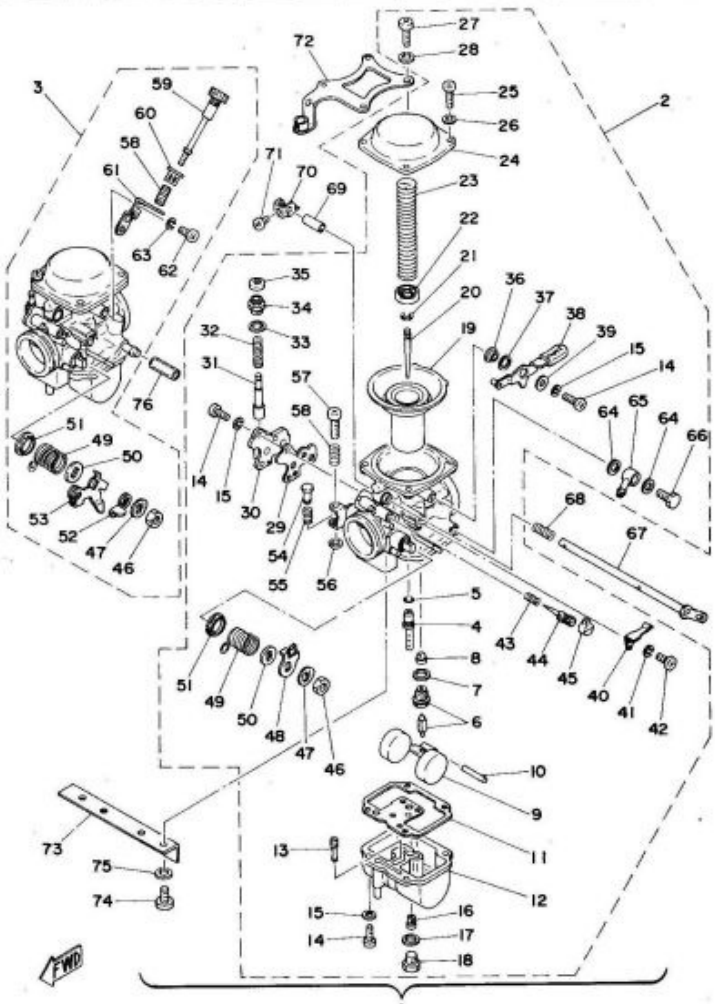
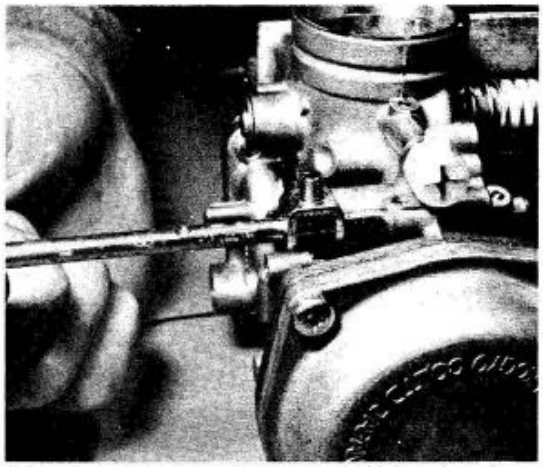
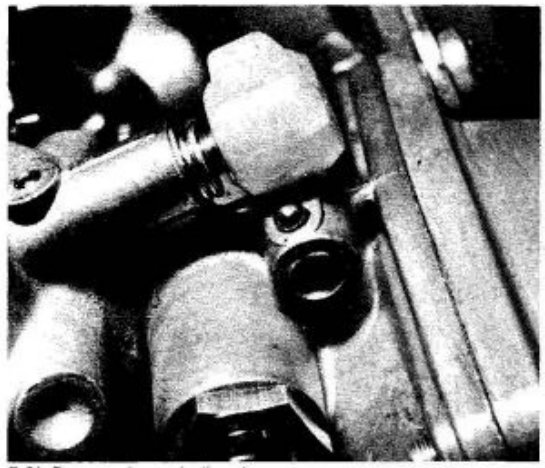


Fig. 2.1 Carburettor – lever choke type

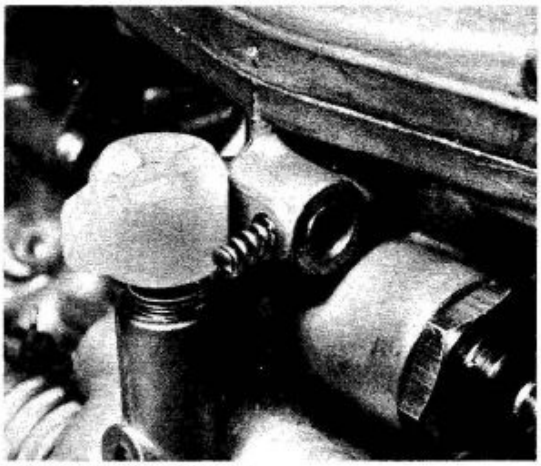
1 Carburettors – complete
2 L/H carburettor
3 R/H carburettor
4 Needle jet (main nozzle) – 2 off
5 'O' ring– 2 off
6 Needle valve assembly – 2 off
7 Sealing washer – 2 off
8 Filter screen – 2 off
9 Float assembly – 2 off
10 Float pivot pin – 2 off
11 Gasket – 2 off
12 Float bowl – 2 off
13 Pilot jet – 2 off
14 Screw – 15 off
15 Spring washer – 2 off
16 Main jet – 2 off
17 Sealing washer – 2 off
18 Drain plug – 2 off
19 Piston/diaphragm unit – 2 off
20 Needle – 2 off
21 Clip – 2 off
22 Needle seat – 2 off
23 Piston spring – 2 off
24 Carburettor top – 2 off
25 Screw – 4 off
26 Spring washer – 4 off
27 Screw – 4 off
28 Spring washer – 4 off
29 Choke casing gasket – 2 off
30 Choke body – 2 off
31 Choke plunger – 2 off
32 Choke spring – 2 off
33 Washer – 2 off
34 Housing – 2 off
35 Dust cap – 2 off
36 Collar
37 Washer
38 Choke lever
39 Washer
40 Spring plate
41 Spring washer
42 Screw
43 Spring – 2 off
44 Pilot screw – 2 off
45 Anti-tamper cap – 2 off
46 Nut – 2 off
47 Special washer – 2 off
48 Throttle arm
49 Throttle return spring – 2 off
50 Collar – 2 off
51 Spacer – 2 off
52 Throttle link arm
53 Throttle control arm
54 Plunger
55 Spring
56 'E' clip
57 Throttle synchronisation screw
58 Spring – 2 off
59 Remote throttle stop screw
60 Bush
61 Bracket
62 Screw – 2 off
63 Spring washer – 2 off
64 Sealing washer – 4 off
65 Banjo
66 Banjo bolt
67 Choke rod
68 Spring
69 Collar
70 Choke fork – 2 off
71 Screw – 2 off
72 Bracket
73 Mounting bar
74 Screw – 4 off
75 Spring washer – 4 off
76 Transfer pipe



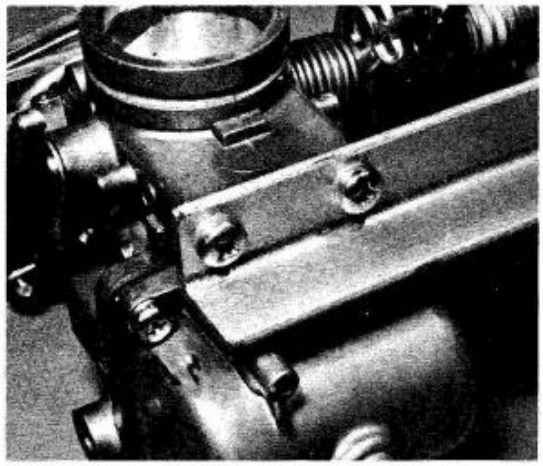
5.2a Loosen choke arm grub screws and withdraw the rod



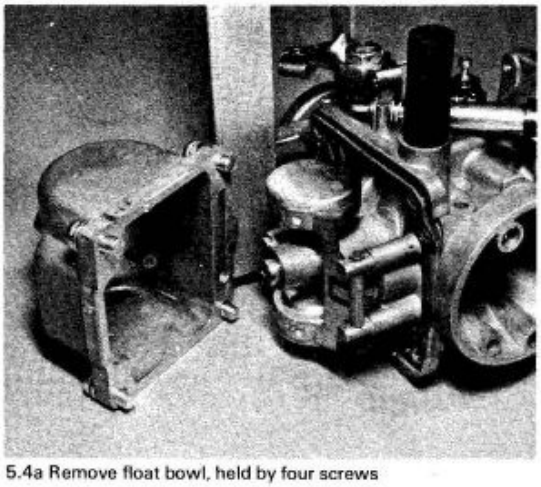
5.2b Prevent detent ball and ...



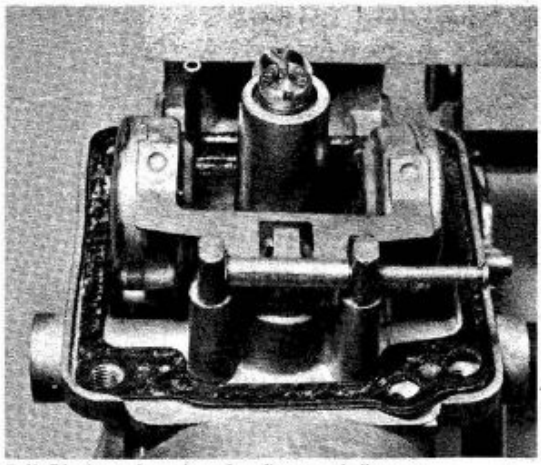
5.2c ... spring from flying out



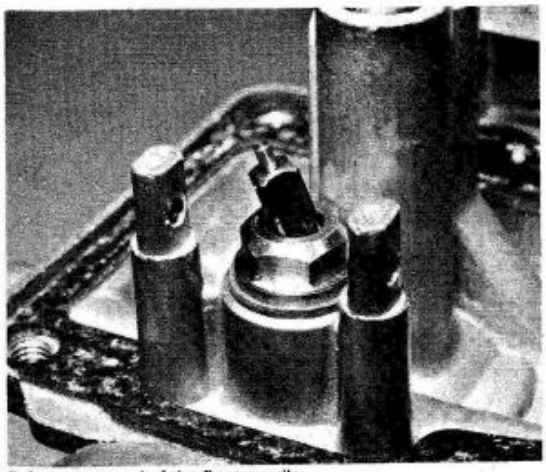
5.3 Each carburettor is held on mounting bar by two screws



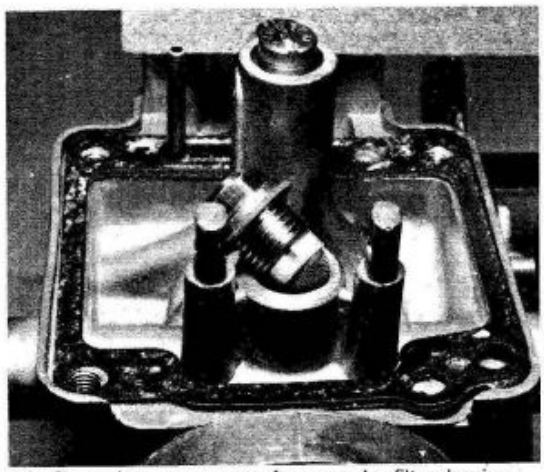
5.4a Remove float bowl, held by four screws



5.4b Displace pivot pin to free floats and allow ...

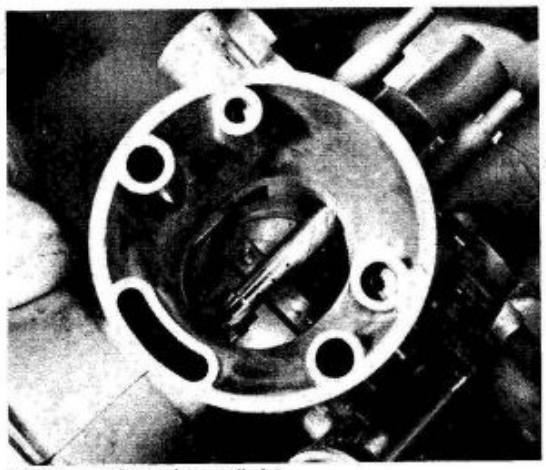


5.4c ... removal of the float needle

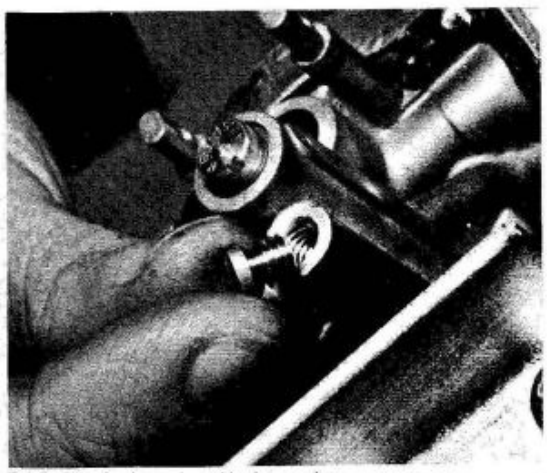


5.4d Float valve seat unscrews for renewal or filter cleaning

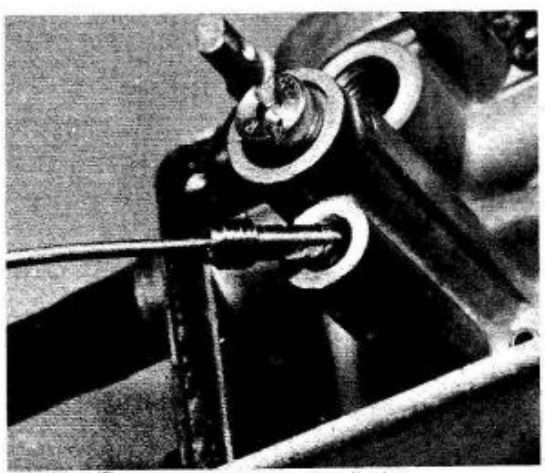
5.10a Unscrew the main jet and ...



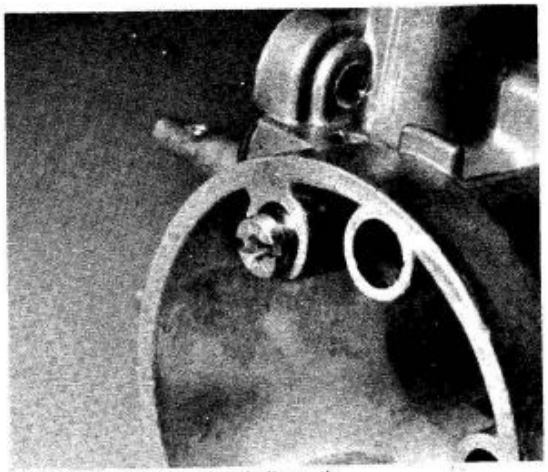
5.10b ... push out the needle jet



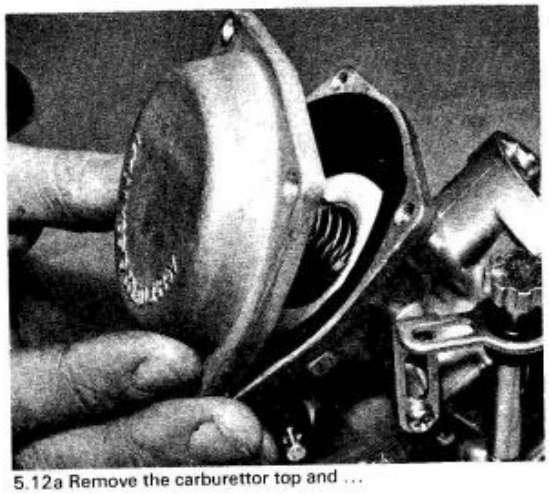
5.10c Pilot jet is enclosed by brass plug



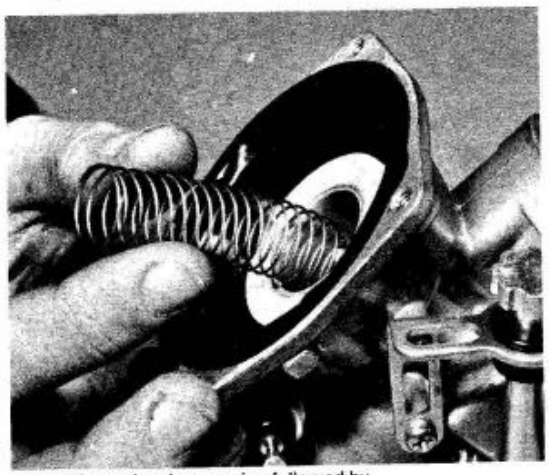
5.10d Use tapered rod to withdraw the pilot jet



5.11 Starter jet screws into bell mouth

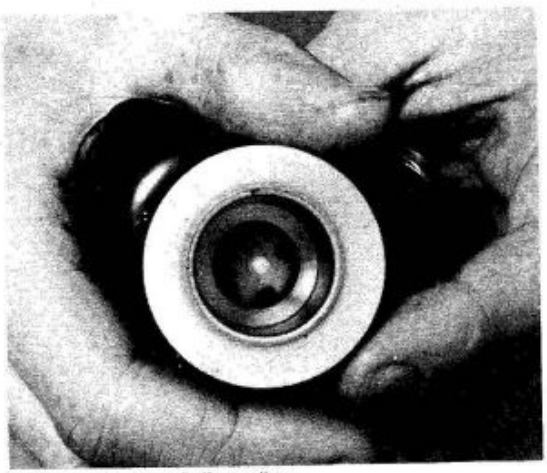


5.12a Remove the carburettor top and ...

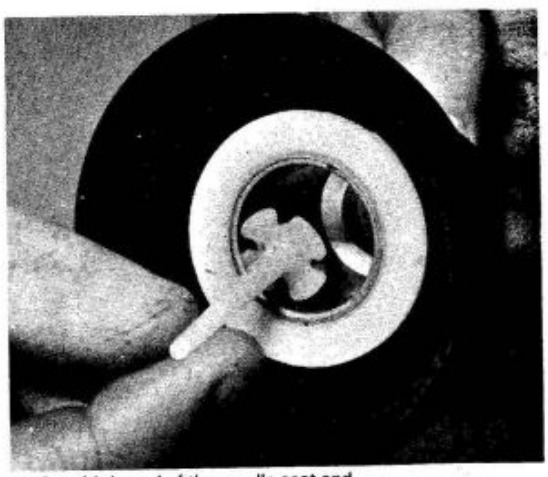


5.12b lift out the piston spring followed by ...

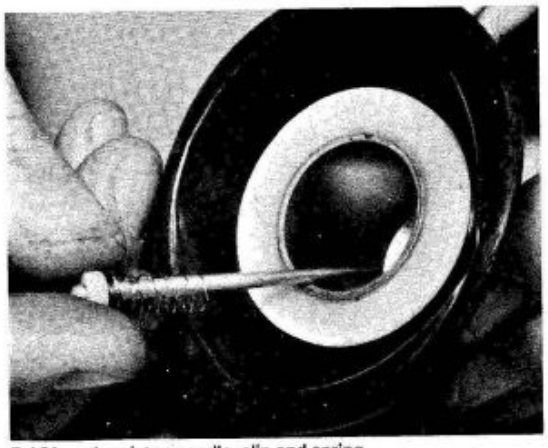
5.12c the piston/diaphragm unit



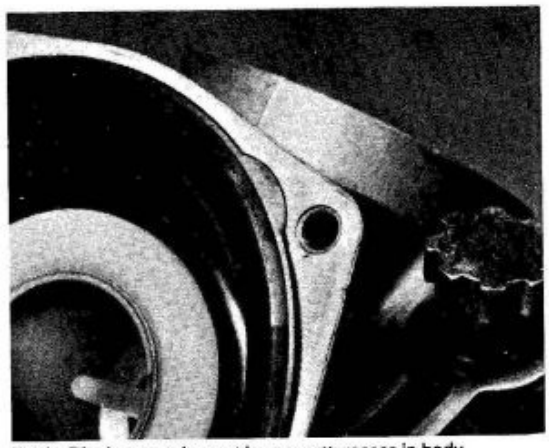
5.12d Remove the circlip to allow ...



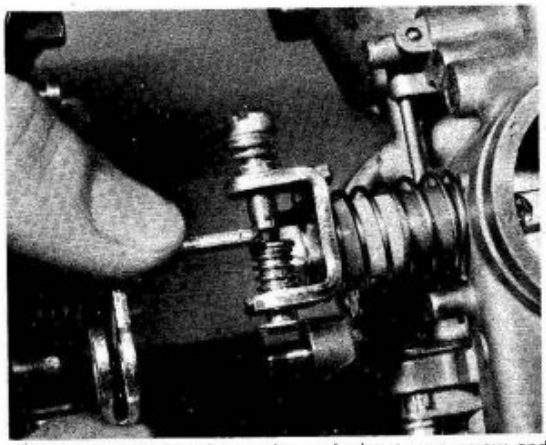
5.12e withdrawal of the needle seat and ...



5.12f ... the piston needle, clip and spring



5.14a Diaphragm tab must locate with recess in body



5.14b Throttle link rod must be pushed between screw and plunger

6 Carburettors: adjusting float level

1 If problems are encountered with fuel overflowing from the float chambers, which cannot be traced to the float/needle assembly, or if consistent fuel starvation is encountered, the fault will probably lie in maladjustment of the float level. It will be necessary to remove the float chamber bowl from each carburettor to check the float level.

If the float level is correct the distance between the uppermost edge of the floats and the flange of the mixing chamber body will be as follows.

XS250 and 360	26 ± 2.5 mm (1.047 ± 0.098 in)
XS400	32 ± 1.0 mm (1.26 ± 0.040 in)

Adjustments are made by bending the float assembly tang (tongue), which engages with the float, in the direction required (see accompanying diagram).

7 Carburettors: synchronisation and adjustment

1 It is imperative that the two carburettors work in harmony with each other if maximum performance and fuel economy are to be expected. The slow running mixture of each carburettor is set by the manufacturer to give the correct mixture and the cleanest exhaust emission. The manufacturers recommend that the mixture is not altered and to this end fit special plastic caps to the two pilot adjuster screws, to prevent movement of the screws except within a narrow margin. Synchronisation of the carburettors is therefore controlled by the adjuster screw on the throttle valve butterfly connecting arm.

2 Synchronisation of the butterfly valves can be made usually after detaching the airhose unit and then using a pair of vacuum gauges attached to the take-off unions provided, which project from the top of each inlet stub. When making the manual adjustment, rotate the adjuster screw as necessary, so that both butterfly valves open simultaneously and close simultaneously. After setting the carburettors initially, remove the vacuum hose from the right-hand take-off union and detach the sealing boot from the left-hand union. Connect up the two vacuum gauges as advised by the manufacturer of the gauge set. Start the engine and adjust the reading on right-hand gauge to within 5 Hg cm at 1,200 rpm. Adjustment is again made on the central throttle link screw. Synchronisation is now correct.

3 After completing synchronisation adjust the tick-over speed of the engine to 1,200 rpm by means of the remote throttle stop, which is located to the rear of the two carburettors, and which has a serrated nylon head.

4 Stop the engine and adjust the throttler cable so that there is 3-5 mm (0.12 - 0.20 in) slack, measured between the outer cable and the abutment on the carburettor bracket. Slack may be increased or reduced by means of the cable adjuster at the handlebar twist grip.

8 Carburettor settings

1 Some of the carburettor settings, such as the sizes of the needle jets, main jets and needle positions, etc, are predetermined by the manufacturer. Under normal circumstances it is unlikely that these settings will require modification, even though there is provision made. If a change appears necessary, it can often be attributed to a developing engine fault.

2 As stated previously, alteration of the idle mixture is not recommended. Some alterations however, can be made in the mid-range mixture by altering the height of the jet needle. This is accomplished by changing the position of the needle clip. Raising the needle will richen the mixture and lowering the needle will weaken the mixture.

3 Always err slightly on the side of a rich mixture, since a weak mixture will cause the engine to overheat. Reference to Chapter 3 will show how the condition of the spark plugs can be interpreted with some experience as a reliable guide to carburettor mixture strength. Flat spots in the carburation can usually be traced to a defective timing advancer. If the advancer action is suspect, it can be detected by checking the ignition timing with a stroboscope.

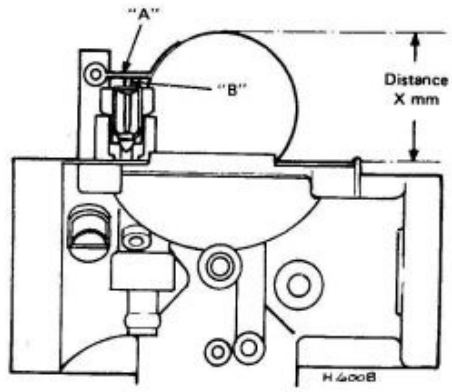
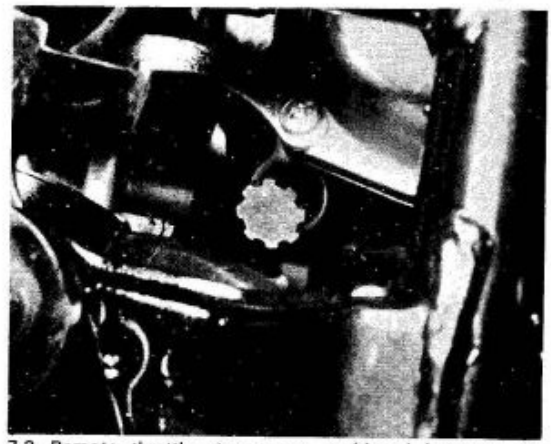


Fig. 2.2 Checking the float level height

9 Air filters: dismantling and cleaning

1 Two identical air filters are utilised, one of which is fitted behind each frame side cover. The two separate air filters are connected to the carburettors by an air hose unit which incorporates a balance pipe.

2 At regular intervals both air filters should be removed for cleaning in a similar manner. Remove both frame side covers, each of which has a three-point push fit method of retention.



7.3 Remote throttle stop screw positioned between carburettors

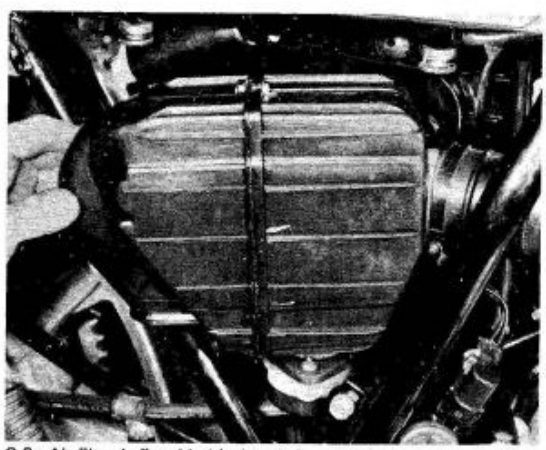
Slacken the air hose/air filter box screw clip and remove the single bolt holding the lower end of the retaining strap. Hinge the strap up and pull the complete air filter box from position. The air filter box is a two-piece moulding held by two screws. After removal of the screws, separate the two halves and withdraw the air filter element.

3 To clean the element, tap it lightly to loosen the accumulation of dust and then use a soft brush to sweep the dust away. Alternatively, compressed air can be blown into the element from the inside.

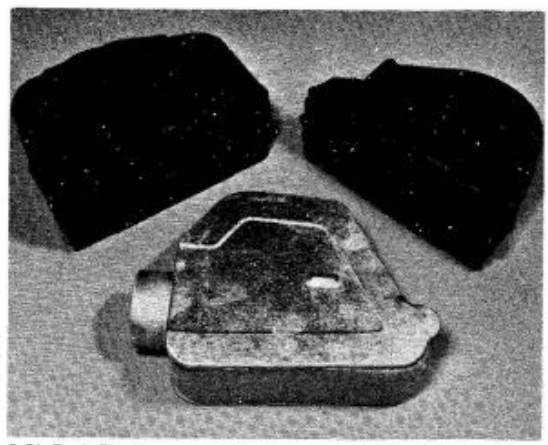
4 If the element is damp or oily it must be renewed. A damp or oily element will have a restrictive effect on the breathing of the carburettor and will almost certainly affect the engine performance.

5 On no account run without the air filters attached, or with the element missing. The jetting of the carburettors takes into account the presence of the air filters and engine performance will be seriously affected if this balance is upset.

6 To replace the element, reverse the dismantling procedure. Give a visual check to ensure that the inlet hoses are correctly located and not split or otherwise damaged. Check that the air filter cases are free from splits or cracks.



9.2a Air filter is fitted behind each frame side cover



9.2b Each filter box separates to allow element removal

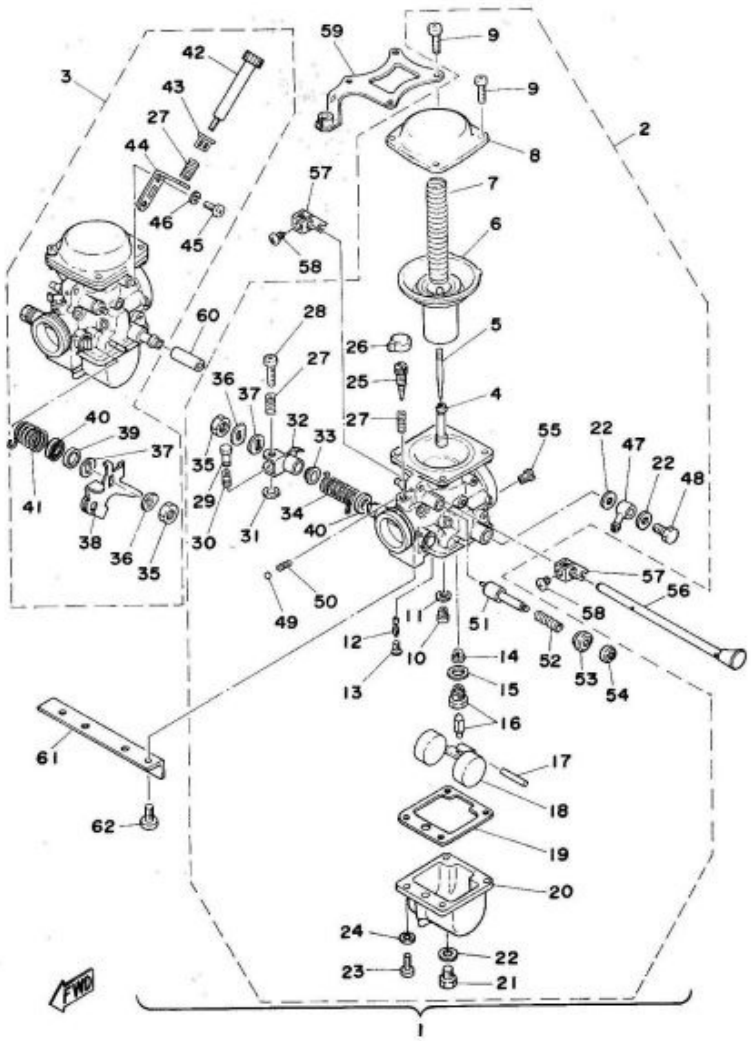


Fig. 2.3 Carburettor – two position choke type

1 *Carburettors complete*
2 *L/H carburettor*
3 *R/H carburettor*
4 *Needle jet (main nozzle) – 2 off*
5 *Needle – 2 off*
6 *Piston/diaphragm unit – 2 off*
7 *Piston spring – 2 off*
8 *Carburettor top – 2 off*
9 *Screw – 8 off*
10 *Main jet – 2 off*
11 *Washer – 2 off*
12 *Pilot jet – 2 off*
13 *Plug – 2 off*
14 *Filter screen – 2 off*
15 *Sealing washer – 2 off*
16 *Needle valve assembly – 2 off*
17 *Float pivot pin – 2 off*
18 *Float assembly – 2 off*
19 *Gasket – 2 off*
20 *Float bowl – 2 off*
21 *Drain plug – 2 off*
22 *Sealing washer – 4 off*
23 *Screw – 8 off*
24 *Spring washer – 8 off*
25 *Pilot screw – 2 off*
26 *Anti-tamper cap – 2 off*
27 *Spring – 3 off*
28 *Throttle synchronisation screw*
29 *Plunger*
30 *Spring*
31 *E clip*
32 *Throttle link arm*
33 *Bush*
34 *LH throttle return spring*
35 *Nut – 2 off*
36 *Special washer – 2 off*
37 *Special washer – 2 off*
38 *Throttle control lever*
39 *Spacer*
40 *Seal – 2 off*
41 *R/H throttle return spring*
42 *Remote throttle stop screw*
43 *Bush*
44 *Bracket*
45 *Screw – 2 off*
46 *Spring washer – 2 off*
47 *Banjo*
48 *Banjo bolt*
49 *Steel ball – 2 off*
50 *Spring – 2 off*
51 *Choke plunger – 2 off*
52 *Plunger spring – 2 off*
53 *Cap – 2 off*
54 *Cover – 2 off*
55 *Pilot air jet – 2 off*
56 *Choke operating rod*
57 *Choke fork – 2 off*
58 *Screw – 2 off*
59 *Bracket*
60 *Transfer pipe*
61 *Mounting bar*
62 *Screw – 4 off*

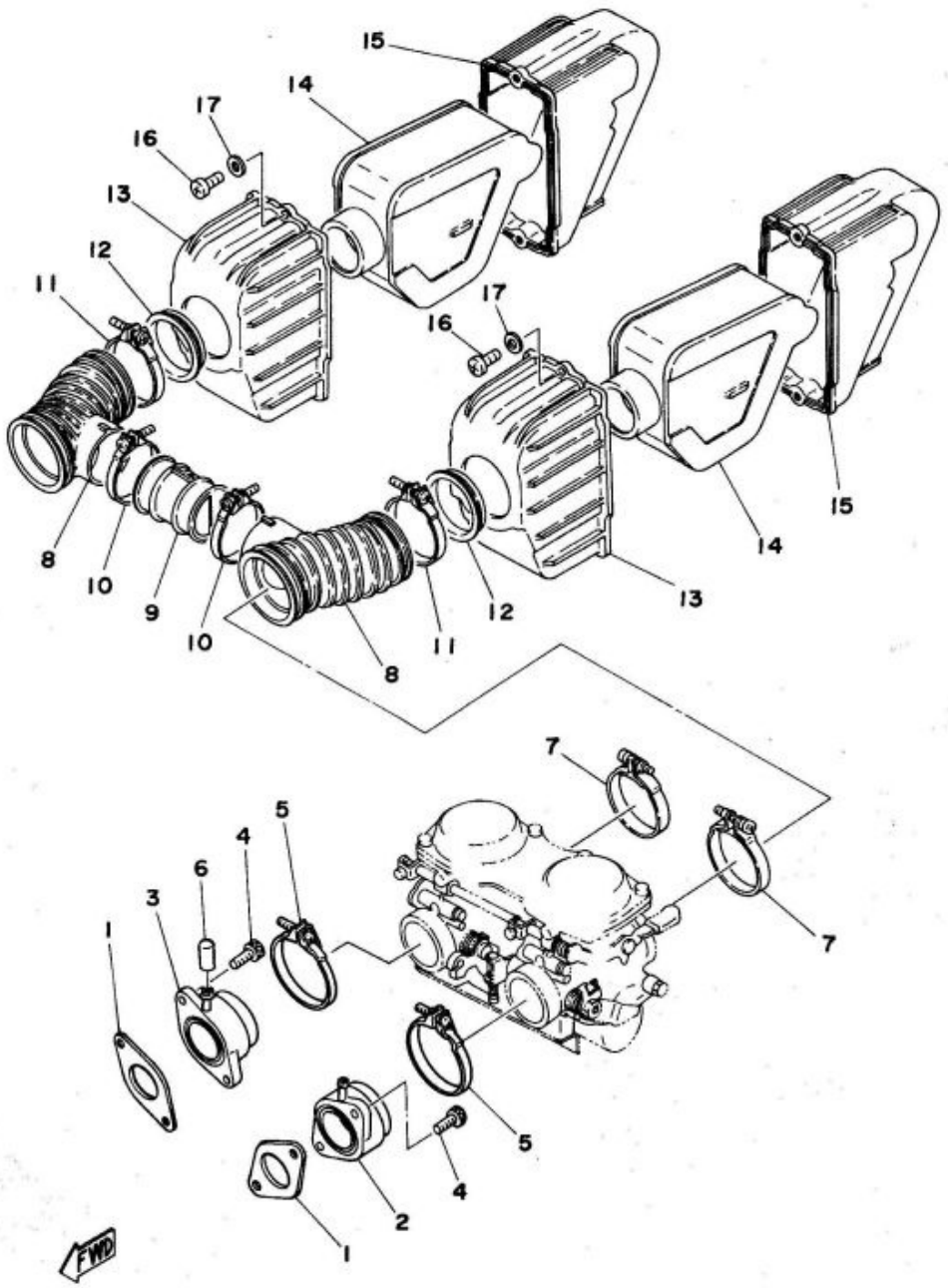


Fig. 2.4 Air filter assembly

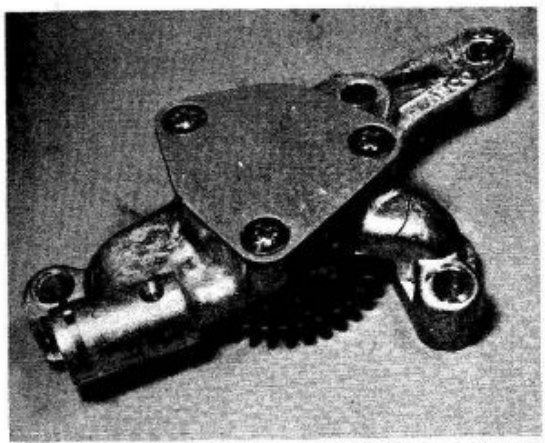
1 *Gasket – 2 off*
2 *Inlet stub*
3 *Inlet stub*
4 *Socket screw – 4 off*
5 *Screw clip – 2 off*
6 *Dust excluder*
7 *Screw clip – 2 off*
8 *Inlet hose – 2 off*
9 *Balance pipe*
10 *Screw clip – 2 off*
11 *Screw clip – 2 off*
12 *Grommet – 2 off*
13 *Air filter casing half – 2 off*
14 *Air filter element – 2 off*
15 *Air filter casing half – 2 off*
16 *Screw – 4 off*
17 *Plain washer – 4 off*

10 Exhaust system

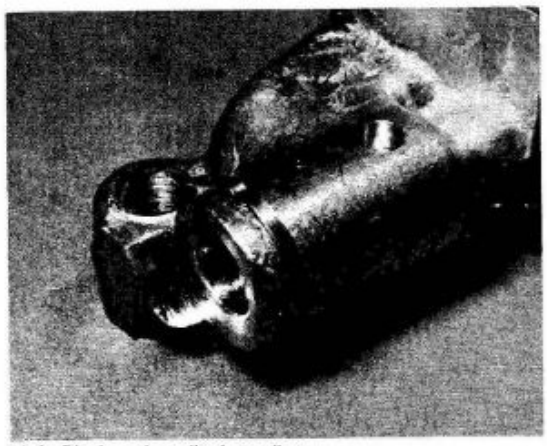
1 Unlike a two-stroke, the exhaust system does not require such frequent attention because the exhaust gases are usually of a less oily nature.
2 Do not run the machine with the exhaust baffles removed, or with a quite different type of silencer fitted. The standard production silencers have been designed to give the best possible performance, whilst subduing the exhaust note to an acceptable level. Although a modified exhaust system or one without baffles, may give the illusion of greater speed as a result of the changed exhaust note, the chances are that performance will have suffered accordingly.

11 Oil pump: removal, examination and replacement.

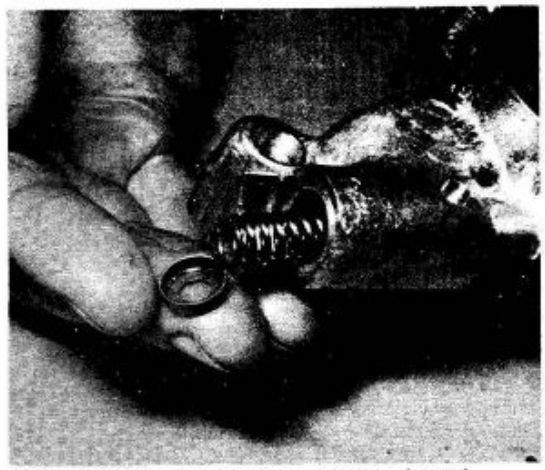
1 The oil pump is contained within the primary drive casing where it is driven via an idler gear from the primary drive pinion. The oil pump may be removed whilst the engine is still in the frame, after the oil has been drained and the primary drive cover removed.
2 The oil pump is retained by three socket bolts and is located by a single dowel pin, to allow adjustment of the primary drive pinion/idler pinion backlash. Remove the three bolts and lift the pump away, complete with the idler pinion. Slide the pinion off the stub spindle which projects from the rear of the pump unit.
3 Commence dismantling by removing the three countersunk screws which secure the pump cover plate. The screws will be very tight and require careful loosening to avoid damage to the heads. After removal of the cover, lift out the outer rotor. The inner rotor shaft and oil pump pinion are integral units. No provision is made for their removal from the pump body after initial assembly.
4 Incorporated in the pump casting is the pressure release valve which allows control of the feed oil pressure. If excess pressure is created, the valve plunger lifts, allowing oil to flow directly to the sump. The valve is comprised of a plunger, spring and spring seat retained by a split pin. Straighten the split pin and depress the spring seat slightly with a screwdriver. Withdraw the split pin whilst maintaining the pressure on the spring seat. This action will prevent the spring and seat from flying out. Remove the seat, spring and plunger.
5 Wash all the pump components with petrol and allow them to dry before carrying out an examination. Before partially reassembling the pump for various measurements to be carried out, check the casting for breakage or fracture, or scoring on the inside perimeter.
6 Refit the outer rotor and measure the clearance between the tip of the inner rotor and a peak on the outer rotor. The clearance should be 0.03 - 0.09 mm (0.001 - 0.002 in). Check also the clearance between the side of the adjacent peak and tip. The clearance should be the same. If wear is evident, the pump should be renewed as a unit. Place a straight edge across the pump body face and check the clearance between the rotor faces and the straight edge. The side float should not exceed 0.10 - 0.18 in (0.004 - 0.007 in). Excessive wear indicates need for renewal.
7 Examine the rotors and the pump body for signs of scoring, chipping or other surface damage which will occur if metallic particles find their way into the oil pump assembly. Renewal of the pump is the only remedy under these circumstances.
8 Reassemble the pump and the pump casing by reversing the dismantling procedure. The pump components must be ABSOLUTELY clean before assembly is commenced. The outer rotor should be fitted with the small punch mark on one face pointing inwards. Make sure all parts of the pump are well lubricated before the outer cover is replaced and that there is plenty of oil between the inner and outer rotors. Tighten the end cover down evenly and continually check the drive pinion revolves freely. A stiff pump is usually due to dirt on the rotor faces.
9 Fit the single location dowel into the casing and replace the pump complete with the idler pinion. Insert the three socket bolts and tighten them until it is just possible to move the pump up and down in line with the vertical plane of the engine. The backlash between the primary drive pinion and the oil pump idler pinion must now be adjusted. Select a 0.4 mm (0.015 in) feeler gauge and slide it between the driven sides of the central meshed teeth of the two pinions. The position of the feeler gauge will be just to the right of an imaginary line drawn between the centres of the two pinions. Push the oil pump forward bracket arm upwards so that the feeler gauge is gripped lightly and then tighten the socket bolt. Tighten the remaining two bolts and recheck the backlash.



11.3 The oil pump side plate is retained by three countersunk screws

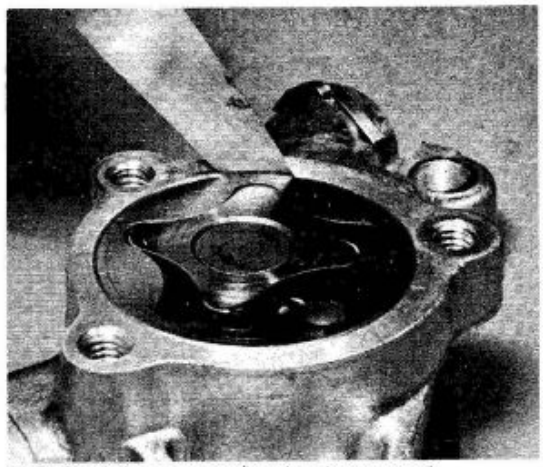


11.4a Displace the split pin to allow ...

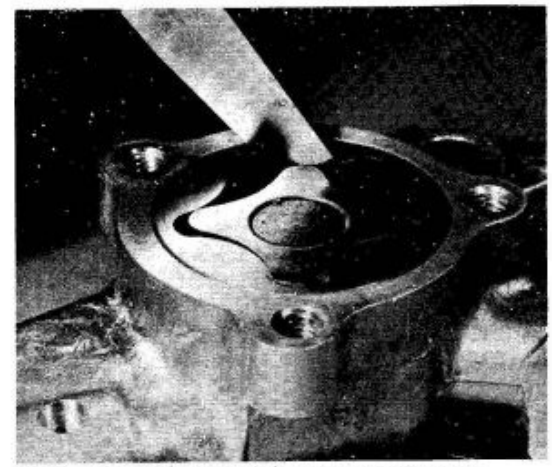


11.4b ... removal of the oil pressure release spring and ...

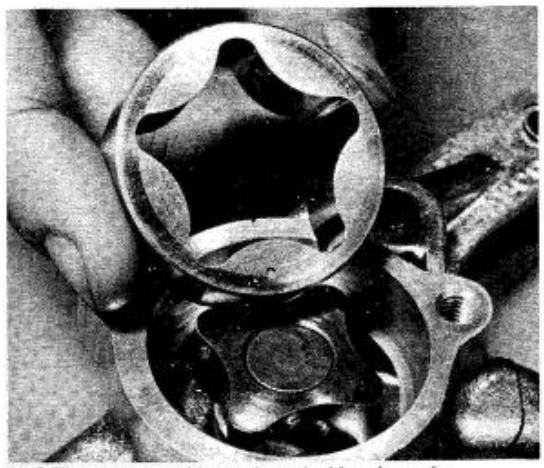
11.4c ... the pressure release valve plunger



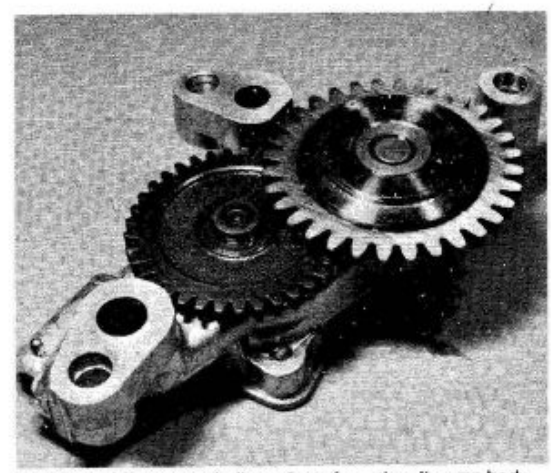
11.6a Check the outer rotor/housing clearance and ...



11.6b ... check the inner rotor/outer rotor tip clearance



11.8 Fit outer rotor with punch marked face inwards



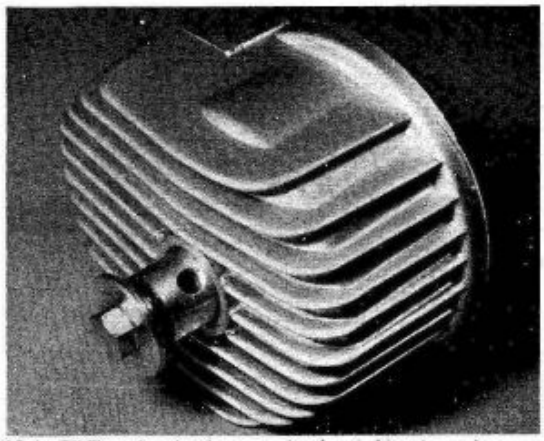
11.9 Pump idler gear spindle projects from the oil pump body

12 Oil filter: renewing the element

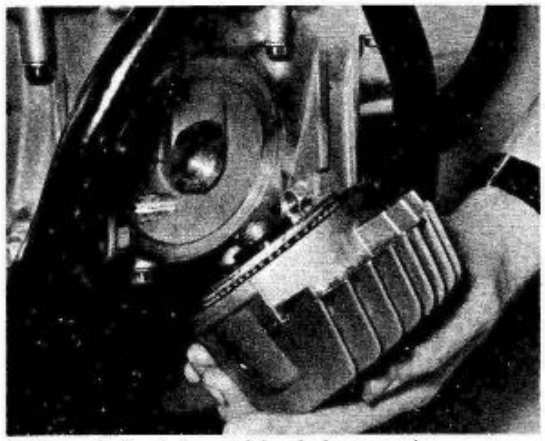
1 The oil filter is contained within a semi-isolated chamber at the front of the crankcase. Access to the element is made by unscrewing the filter cover centre bolt, which will bring with it the cover and also the element. Before removing the cover, place a receptacle beneath the engine to catch the engine oil contained in the filter chamber.
2 When renewing the filter element it is wise to renew the filter cover 'O' ring at the same time. This will obviate the possibility of any oil leaks. Do not overtighten the centre bolt on replacement; the correct torque setting is 1.3 - 1.7 kg m (9.5 - 12.0 lb ft).
3 The filter by-pass valve, comprising a plunger and spring, is situated in the bore of the filter cover centre bolt. It is recommended that the by-pass valve be checked for free movement during every filter change. The spring and plunger are retained by a pin across the centre bolt. Knocking the pin out will allow the spring and plunger to be removed for cleaning.
4 Never run the engine without the filter element or increase the period between the recommended oil changes or oil filter changes. Engine oil should be changed every 2,000 miles and the element changed every 4,000 miles. Use only the recommended viscosity.

13 Oil pressure warning lamp

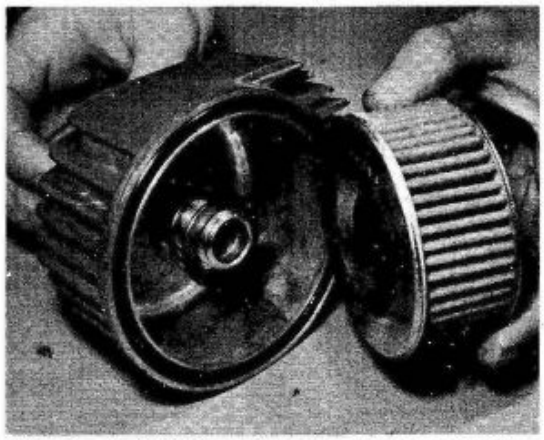
1 An oil pressure warning lamp is incorporated in the lubrication system to give immediate warning of excessively low oil pressure.
2 The oil pressure switch is screwed into the crankcase, directly behind the final drive sprocket cover and is connected with a warning light in the lighting panel on the handlebars. The light should be on whenever the ignition is on but will usually go out at about 1,500 rpm.
3 If the oil warning lamp comes on whilst the machine is being ridden, the engine should be switched off immediately, otherwise there is a risk of severe engine damage due to lubrication failure. The fault must be located and rectified before the engine is re-started and run, even for a brief moment. Machines fitted with plain shell bearings rely on high oil pressure to maintain a thin oil film between the bearing surfaces. Failure of the oil pressure will cause the working surfaces to come into direct contact, causing overheating and eventual seizure.



12.1a Oil filter chamber is secured to front of crankcase by ...



12.1b ... a hollow bolt containing the by-pass valve



12.1c Do not omit oil filter spring and washer on reassembly

14 Fault diagnosis: fuel system

Symptom	Cause	Remedy
Engine gradually fades and stops	Fuel starvation	Check vent hole in filler cap. Sediment in filter bowl or float chamber. Dismantle and clean.
Engine runs badly. Black smoke from exhausts	Carburettor flooding	Dismantle and clean carburettor. Check for punctured float or sticking float needle
Engine lacks response and overheats	Weak mixture Air cleaner disconnected or hose split Modified silencer has upset carburation	Check for partial block in carburettors. Reconnect or renew hose. Replace with original design.
Oil pressure warning light comes on	Lubrication system failure	Stop engine immediately. Trace and rectify fault before re-starting.
Engine gets noisy	Failure to change engine oil when recommended	Drain off old oil and refill with new oil of correct grade. Renew oil filter element.

Chapter 3 Ignition System

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General description ... 1
Charging system: checking the output ... 2
Contact breaker: adjustment ... 3
Contact breaker points: removal, renovation and replacement ... 4
Ignition timing: checking and re-setting ... 5
Condenser: function, removal and replacement ... 6
Condenser: testing ... 7
Ignition coils: checking ... 8
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Spark plugs: checking and resetting the gaps ... 10
Fault diagnosis: ignition system ... 11

Specifications

Ignition timing (BTDC)	
Retarded	10°
Advanced	36°
Contact breaker gap	0.30–0.40 mm (0.012–0.016 in)
Dwell angle	105°
Ignition coil	
Primary winding resistance	4.0 ohms ± 10% at 20°C (68°F)
Secondary winding resistance	9.5 K ohms ± 20% at 20°C (68°F)

Sparking plugs	**XS250**	**XS360**	**XS400**
NGK	BP-7ES	BP-6ES	BP-7ES
N-D	W22EP	W20EP	W22EP
Motorcraft	AG12	AG22	AG12
Plug gap	0.7–0.8 mm (0.028–0.032 in)		

1 General description

1 The Yamaha XS250, 360 and 400 twins are fitted with a 12 volt negative earth electrical system. Current derived from the crankshaft mounted alternator supplies twin ignition coils separately located which, in conjunction with a twin contact breaker assembly, provide the necessary spark at the correct time, to ignite the mixture in the cylinders.

2 The contact breakers are fitted within a chamber in the left-hand side of the cylinder head, where the cam and automatic timing unit are driven from the end of the camshaft.

3 Ignition source power is fed from the battery to the ignition coil primary windings. When the contact breaker opens, the low tension circuit is interrupted, and a high voltage is produced in the ignition coil secondary windings by magnetic induction. The high voltage passes through an HT lead to the spark plug.

4 A condenser in the contact breaker circuit prevents the contact breaker points from arcing as they open and close, to ensure that the spark at the spark plug gap has full intensity. The condenser is a twin unit contained within a single canister mounted on the frame top-tube or on the left-hand side of the battery box.

2 Charging system: checking the output

The charging system, which includes the alternator, rectifier and voltage regulator, can be checked satisfactorily only by using test equipment of the multi-meter type. If the charging performance is suspect, some initial tests may be made to determine the condition of the various components, as described in Chapter 6.

3 Contact breaker: adjustment

1 To gain access to the contact breaker assembly, it is necessary to remove the cover plate which is held by two cross head screws to the cylinder head. Note that the cover has a paper gasket to prevent the ingress of water.

2 Remove the alternator inspection cover and rotate the engine until the left-hand points are fully open. Removal of the spark plugs will aid rotation. Examine the faces of the points. If they are blackened and burnt, or badly pitted, it will be necessary to remove them for further attention. See Section 4 of this Chapter.

3 Adjustment is effected by slackening the two screws through the plate of the fixed contact breaker point and moving the point either closer, or further away, from the moving contact until the gap is correct as measured by a feeler gauge. The correct gap with the points FULLY OPEN is 0.3 - 0.4 mm (0.012 - 0.016 in).
4 Two small projections on the contact breaker base plate permit the insertion of a screwdriver to lever the adjustable point into its correct location. Repeat this operation if there is any doubt about the accuracy of the measurement. Although the adjustment is relatively easy, it is of prime importance.
5 Repeat the same procedure for the right-hand set of contact breakers, after turning the engine again so that the points are fully open.
6 Before replacing the cover and gasket, place a few drops of thin oil on the cam lubrication wick. Do not over lubricate, as excess oil will eventually find its way onto the two contact points, causing the ignition circuit to malfunction.

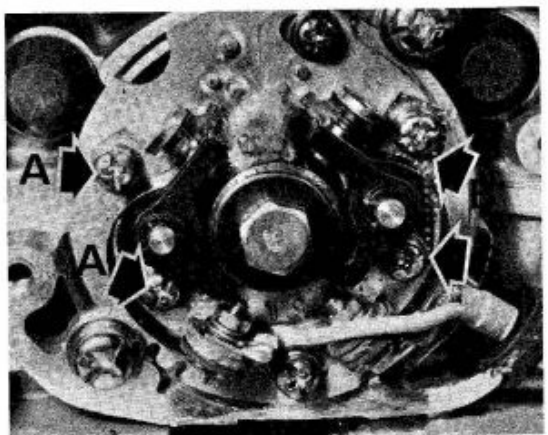
4 Contact breaker points: removal, renovation and replacement

1 If the contact breaker points are burned, pitted or badly worn, they should be removed for dressing. If it is necessary to remove a substantial amount of material before the faces can be restored, the points should be renewed.
2 To remove the contact breaker points, unclip the contact breaker leads at their snap connectors. Remove the four slot headed screws thereby releasing both the contact breakers. **Do not unscrew the two crosshead screws** that retain the contact breaker back plate, otherwise the ignition will have to be retimed. The contact breakers can themselves be separated by removing their circlip and washers and pulling the movable point off the pin, to facilitate inspection and cleaning.
3 The points should be dressed with an oil stone or fine emery cloth. Keep them absolutely square throughout the dressing operation, otherwise they will make angular contact on reassembly, and rapidly burn away. If emery cloth is used, it should be backed by a flat strip of steel. This will reduce the risk of rounding the edges of the points.
4 Replace the contacts by reversing the dismantling procedure, making quite certain that the insulating washers are fitted in the correct way. In order for the ignition system to function at all, the moving contact and the low-tension lead must be perfectly insulated from the base plate and fixed contact. It is advantageous to apply a very light smear of grease to the pivot pin, prior to replacement of the moving contact.
5 Check, and if necessary, re-adjust the contact breaker points when they are in the fully open position.

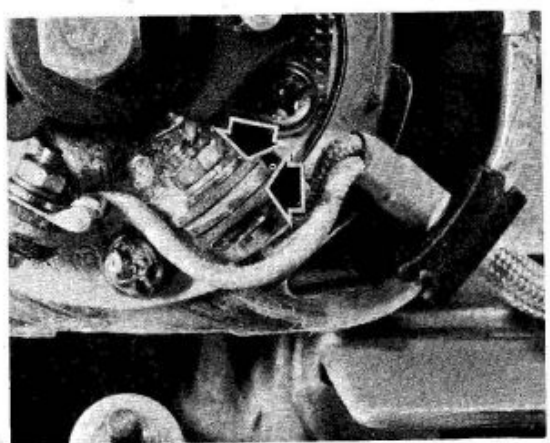
5 Ignition timing: checking and re-setting

1 To enable ignition timing to be carried out accurately, either manually or using a stroboscope, two sets of marks are made on the alternator rotor periphery, which may be aligned with an index pointer cast into the alternator cover. Each set of marks relates to a specific cylinder.
2 Commence by checking, and if necessary, adjusting the left-hand contact breaker points which control ignition timing of the left-hand cylinder. With the contact breakers having been gapped previously (see previous Section), turn the engine in an anti-clockwise direction so that the LF mark aligns and the left-hand cylinder is on its compression stroke. Note that the timing is accomplished in the fully retarded position, ie; with the balance weight of the auto-advance unit unextended.

If the timing is correct, the points should be just on the verge of opening as the LF mark comes into alignment. To check when the opening occurs, a 12 volt lamp bulb can be connected between the moving contact breaker point or the condenser connection, and earth on the engine. The lamp will light up and when the contact breaker points open, if the ignition circuit is switched on.
3 If the timing is incorrect, slacken the two screws which pass into the cylinder head, clamping the contact breaker assembly base plate in position. Rotate the complete assembly until the light flickers and then tighten the screws. Recheck the timing by rotating the engine backwards about 45° and then forwards again, until the LF mark aligns precisely with the index mark. The engine must be rotated one way and then the other to take up any backlash in the timing chain (camshaft chain).
4 Repeat the timing check procedure on the right-hand contact breaker using the RF mark on the alternator rotor. If the timing is incorrect **DO NOT** slacken the two screws previously used for timing. The right-hand contact breaker is mounted on a separate smaller base plate, retained by two screws passing through elongated holes in the plate. The elongated holes allow a limited amount of plate movement for ignition timing.
5 Timing the engine manually as described above should be acceptably accurate, provided that the contact breakers are in good condition and great care is taken. The use of a stroboscopic lamp, however, which enables ignition timing to take place with the engine running, is recommended. The LF or RF marks on the alternator rotor represent the fully retarded ignition timing positions for the crankshaft. The fully advanced timing marks for each cylinder are represented by two unmarked scribed lines on the alternator rotor, the first of which is 26° to the left of the retarded firing mark.



3.3 A = Points adjustment screws, LH cylinder, B = adjustment screws, RH cylinder


4.4 Ensure insulation washers are fitted in correct sequence

Spark plug maintenance: Checking plug gap with feeler gauges

Altering the plug gap. Note use of correct tool

Spark plug conditions: A brown, tan or grey firing end is indicative of correct engine running conditions and the selection of the appropriate heat rating plug

White deposits have accumulated from excessive amounts of oil in the combustion chamber or through the use of low quality oil. Remove deposits or a hot spot may form

Black sooty deposits indicate an over-rich fuel/air mixture, or a malfunctioning ignition system. If no improvement is obtained, try one grade hotter plug

Wet, oily carbon deposits form an electrical leakage path along the insulator nose, resulting in a misfire. The cause may be a badly worn engine or a malfunctioning ignition system

A blistered white insulator or melted electrode indicates over-advanced ignition timing or a malfunctioning cooling system. If correction does not prove effective, try a colder grade plug

A worn spark plug not only wastes fuel but also overloads the whole ignition system because the increased gap requires higher voltage to initiate the spark. This condition can also affect air pollution

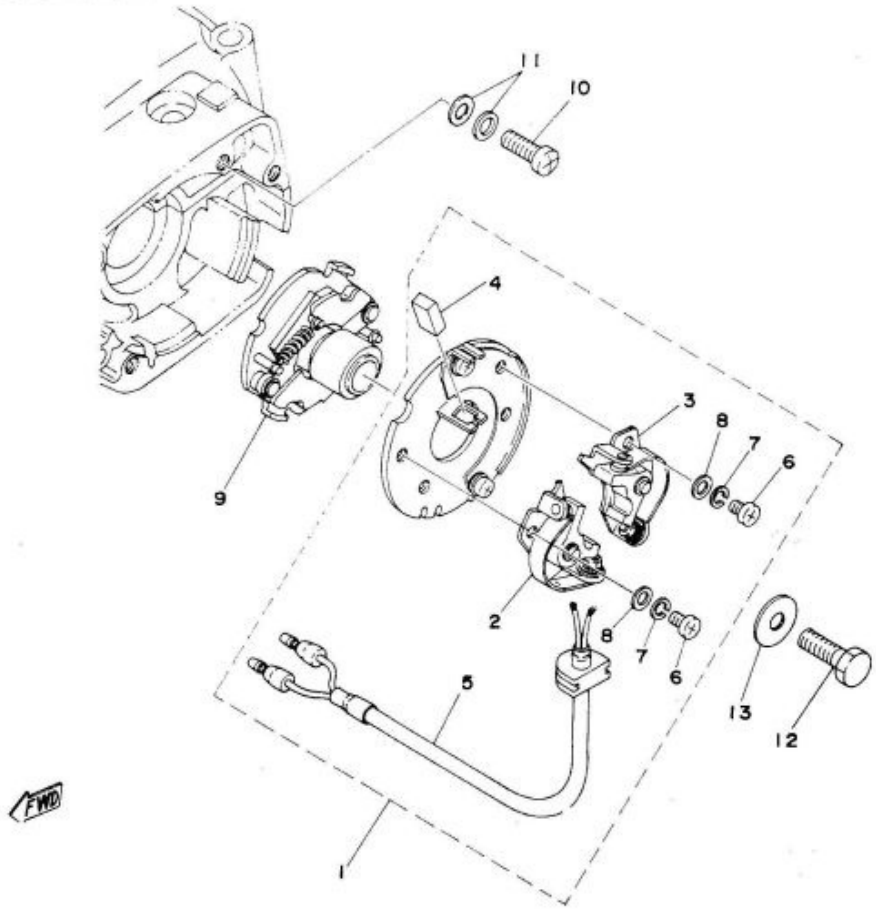
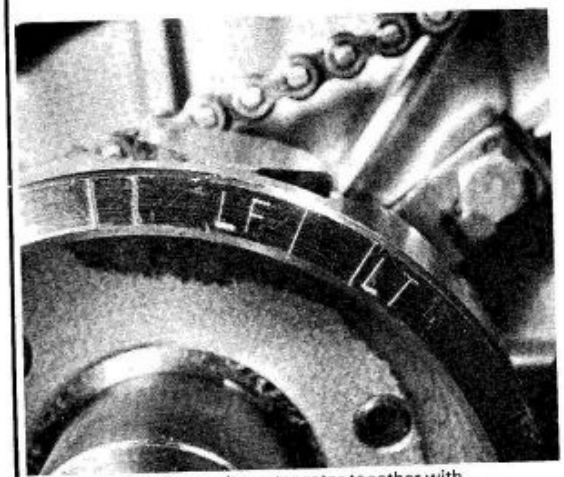
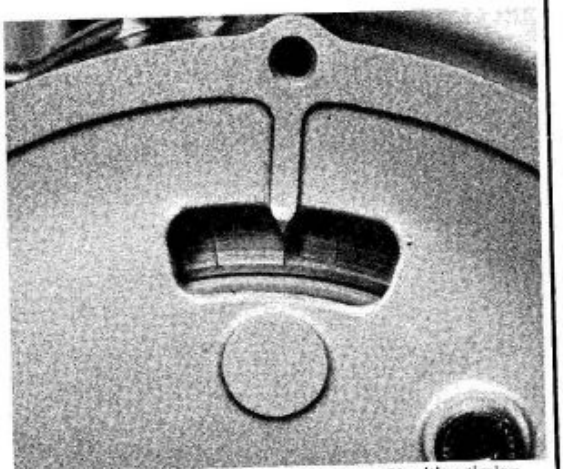


Fig. 3.1 Contact breaker assembly

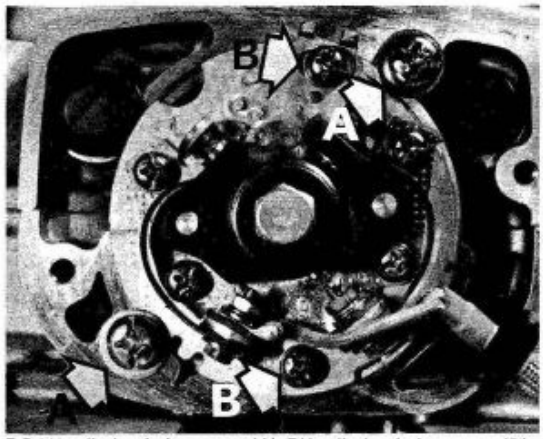
1 *Contact breaker plate assembly*
2 *Contact breaker assembly – left*
3 *Contact breaker assembly – right*
4 *Lubricator wick*
5 *Lead wire assembly*
6 *Screw – 4 off*
7 *Spring washer – 4 off*
8 *Plain washer – 4 off*
9 *Automatic timing unit*
10 *Screw – 2 off*
11 *Washer – 4 off*
12 *Bolt*
13 *Washer*



5.1a Timing marks on alternator rotor together with ...



5.1b ... index pointer on casing allow ease of ignition timing



5.3 LH cylinder timing screw (A), RH cylinder timing screw (B)

6 Condenser: function, removal and replacement

1 The condenser unit, which is located on the top tube of the frame, or to the left of the battery box, is comprised of two condensers within a common body, the body forming the common earth lead. Therefore good earthing of the mounting bracket is essential.
2 The condenser has two functions. Firstly it reduces the sparking at the contacts (and hence prevents the rapid wear of the points). Its second and most important function is to greatly increase the induced voltage in the secondary windings and hence strength of the high tension spark at break. Without the condenser the spark would be very weak.
3 If the engine is difficult to start, or if misfiring occurs, it is possible that a condenser is at fault. To check whether a condenser has failed, observe the points whilst the engine is running, after removing the contact breaker cover. If excessive sparking occurs across one set of points, and they have a blackened or burnt appearance, it may be assumed the condenser in that circuit is no longer serviceable. It follows that if one condenser fails, the complete unit must be renewed.
4 Access to the condenser can be made after removal of the petrol tank (see Chapter 2, Section 2) or by raising the dualseat, depending on the model and the location of the condenser. Disconnect the condenser leads at the block connector and remove the single retaining screw.

7 Condensers: testing

1 Without the appropriate test equipment, there is no alternative means of verifying whether a condenser is still serviceable.
2 Bearing in mind the low cost of a condenser, it is far more satisfactory to check whether it is malfunctioning by direct replacement.

8 Ignition coils: checking

1 Each cylinder has its own ignition circuit and if one cylinder misfires, one half of the complete ignition system can be eliminated immediately. The components most likely to fail in the circuit that is defective are the condenser and the ignition coil since contact breaker faults should be obvious on close examination. Replacement of the existing condenser will show whether the condenser is at fault, leaving by the process of elimination the ignition coil.
2 The ignition coil can best be checked using a multimeter set to the resistance position. Detach the orange lead and red/white lead at their snap connectors and detach the spark plug cap from the spark plug. Measure the primary winding resistance and the secondary winding resistance by connecting the multimeter as shown in the accompanying diagram.
The resistance values for each circuit should be as follows:

Primary coil resistance 4.0 ohms ± 10% at 20°C
Secondary coil resistance 9.5K ohms ± 20% at 20°C

Slight variation may be encountered if the ambient temperature departs greatly from that given. If the values differ from those given, the coil is faulty.
3 If the multimeter is not available, and by means of testing, the other components have been found to be satisfactory, the following method may be used to give an estimation of the coil's condition. Remove the suppressor cap and bare the inner wire. Remove the contact breaker cover and turn the engine over until the contact breaker points relevant to the coil to be tested are closed. Turn the ignition on and using an insulated screwdriver flick the points open and shut. If the bared end of the HT lead is held approximately 6 mm from an earthing point (the cylinder head) whilst this is done, a blue spark should jump the gap. If the spark is unable to jump a gap, or is yellowish in colour, the coil is probably at fault.
4 The ignition coils are sealed units and it is not possible to effect a satisfactory repair in the event of failure. A new coil must be fitted.
5 The ignition coils are mounted as a pair underneath the petrol tank. They bolt direct to metal plates on the duplex top frame tube and face in a rearward direction, parallel to the axis of the machine.

9 Automatic timing unit: examination

1 The automatic timing mechanism rarely requires attention, although it is advisable to examine it periodically, when the contact breaker is receiving attention. It is retained by a small bolt and washer through the centre of the integral contact breaker cam and can be pulled off the end of the camshaft when the contact breaker plate is removed.
2 The unit comprises spring loaded balance weights, which move outward against the spring tension as centrifugal force increases. The balance weights must move freely on their pivots and be rust-free. The tension springs must also be in good condition. Keep the pivots lubricated and make sure the balance weights move easily, without binding. Most problems arise as a result of condensation, within the engine, which causes the unit to rust and balance weight movement to be restricted.
3 The automatic timing unit mechanism is fixed in relation to the crankshaft by means of a dowel. In consequence the mechanism cannot be replaced in anything other than the correct position. This ensures accuracy of ignition timing to within close limits, although a check should always be made when reassembly of the contact breakers is complete.
4 The correct functioning of the auto-advance unit can be checked when the engine is running by the use of a stroboscopic light. If a strobe light is available, connect it to the ignition circuit as directed by the manufacturer of the light. With the engine running, direct the beam of the light at the index mark on the alternator cover, and so that the alternator rim is illuminated. Check that the fully retarded timing mark (either LF or RF depending on which contact breaker is connected to the light) is in alignment with the pointer with the engine at 1,200 rpm tickover. Increase the engine speed to 3000 rpm. As the speed increases through this range the firing mark should move smoothly away from the index mark to be replaced by the unmarked scribed advance marks. Sluggishness or erratic movement indicates a poorly performing ATU.

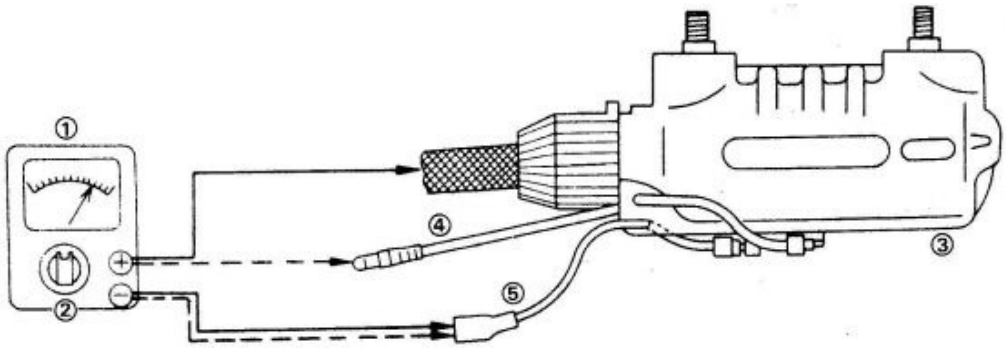
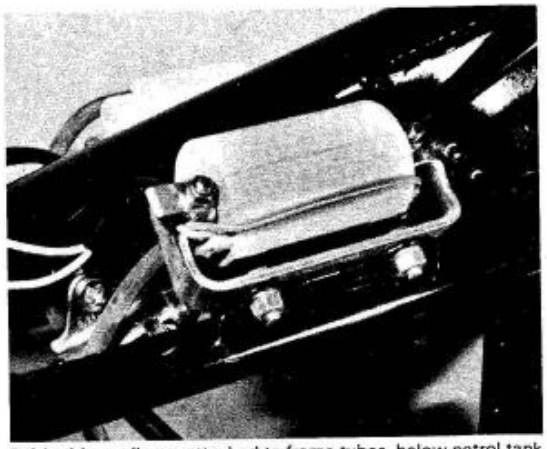
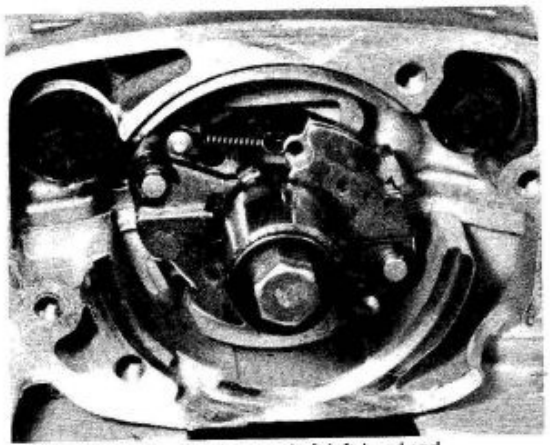


Fig. 3.2 Testing ignition coil continuity

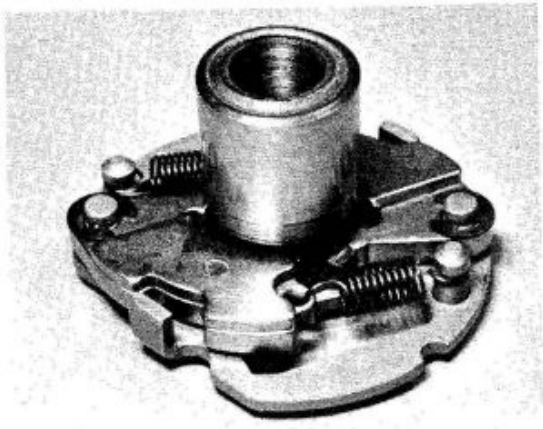
1 Multimeter
2 Set tester on the 'Resistance' position
3 Ignition coil
4 Red/white
5 Orange



8.4 Ignition coils are attached to frame tubes, below petrol tank



9.1 The ATU is fitted to the camshaft left-hand end



9.2 Check the condition of the ATU bob-weights and springs

10 Spark plugs: checking and resetting the gaps

1 The XS250 and 400 models are fitted as standard with NGK BP-7ES or Nippon Denso W22EP spark plugs. The XS2360 model has either NGK BP-6ES or Nippon Denso ND W20EP spark plugs. All plugs are gapped within the range 0.7-0.8 mm (0.028 - 0.032 in). Certain operating conditions may indicate a change in spark plug grade, the type recommended by the manufacturer gives the best, allround service.

2 Check the gap of the plug points during every three monthly or 2000 mile service. To reset the gap, bend the outer electrode to bring it closer to the centre electrode and check that a 0.7 mm (0.028 in) feeler gauge can be inserted. Never bend the central electrode or the insulator will crack, causing engine damage if the particles fall in whilst the engine is running.

3 With some experience, the condition of the spark plug electrodes and insulator can be used as a reliable guide to engine operating conditions. See accompanying photographs.

4 Beware of overtightening the spark plugs, otherwise there is risk of stripping the threads from the aluminium alloy cylinder heads. The plugs should be sufficiently tight to sit firmly on their copper sealing washers, and no more. Use a spanner which is a good fit to prevent the spanner from slipping and breaking the insulator.

5 If the threads in the cylinder head strip as a result of over tightening the spark plugs, it is possible to reclaim the head by the use of a Helicoil thread insert. This is a cheap and convenient method of replacing the threads; most motorcycle dealers operate a service of this kind.

6 Make sure the plug insulating caps are a good fit and have their rubber seats. They should also be kept clean to prevent tracking. These caps contain the suppressors that eliminate both radio and TV interference.

11 Fault diagnosis: ignition system

Symptom	Cause	Remedy
Engine will not start	Faulty ignition switch	Operate switch several times in case contacts are dirty. If lights and other electrics function, switch may need renewal.
	Starter motor not working	Discharged battery. Use kickstart until battery is recharged.
	Short circuit in wiring	Check whether fuse is intact. Eliminate fault before switching on again.
	Completely discharged battery	If lights do not work, remove battery and recharge.
Engine misfires	Faulty condenser in ignition circuit	Renew condenser and re-test.
	Fouled spark plug	Renew plug and have original cleaned.
	Poor spark due to generator failure and discharged battery	Check output from generator. Remove and recharge battery.
Engine lacks power and overheats	Retarded ignition timing	Check timing and also contact breaker gap. Check whether auto-timing unit has jammed.
Engine 'fades' when under load	Pre-ignition	Check grade of plugs fitted; use recommended grade only.

Chapter 4 Frame and Forks

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Specifications

Front forks

Type	Telescopic, hydraulically damped
Damping fluid capacity	130 cc (4.4/3.7 US/Imp fl oz)
Fluid specification	SAE 10W/30 engine oil or a fork oil
Fork spring free length	484 mm (19.05 in)

Rear suspension

Type	Swinging arm on two hydraulically damped suspension units
Spring length	205 mm (8.1 in)
Swinging arm free play (maximum)	1 mm (0.04 in)

1 General description

The Yamaha XS250, 360 and 400 models share a similar frame of traditional design, constructed from welded tubular members and having all main tubes, except the downtube, duplicated for strength.

The front forks are of the conventional telescopic type where the fork springs are contained within the fork stanchions and an oil damping medium is used. Rear suspension is of the swinging arm type, using oil filled suspension units to provide the necessary damping action. The units are adjustable so that the spring ratings can be effectively changed within certain limits, to match the load carried.

2 Front forks: removal from the frame

1 It is unlikely that the front forks will have to be removed from the frame as a complete unit, unless the steering head assembly requires attention or if the machine suffers severe frontal damage. Removal of the individual fork legs for inspection and renovation can be accomplished easily, without the need for disturbing the fork yokes and steering head bearings. If required, removal of the fork legs as described in this section may be followed by steering yoke and bearing dismantling, refering to the procedure in the following section.

2 Place the machine on the centre stand so that it rests securely on level ground. Raise the front wheel well clear of the ground by placing wood blocks below the crankcase.

3 Remove the front wheel as described in Chapter 5 Section 4.

4 On disc brake models detach the front brake caliper unit from the fork leg by removing the two bolts which pass through the fork leg lugs into the caliper support bracket. Release the hydraulic hose by removing the hose clamp bolted to the mudguard. **Do not** disconnect the hose from the caliper as fluid loss will result, and the front brake system will have to be bled of air. Swing the caliper unit back out of the way and tie it to a suitable part of the frame.

5 Remove the front mudguard. It is held in place by two bolts passing into each fork leg. Slacken the pinch bolts on the fork upper yoke and lower yoke which clamps the fork legs in place. Each fork leg may be pulled down and out of the fork yokes as a complete unit. It may be necessary to spring the clamps apart with a screwdriver blade to release the grip on the fork stanchions. Care should be taken if this method is adopted because excess force will fracture the yoke casting.

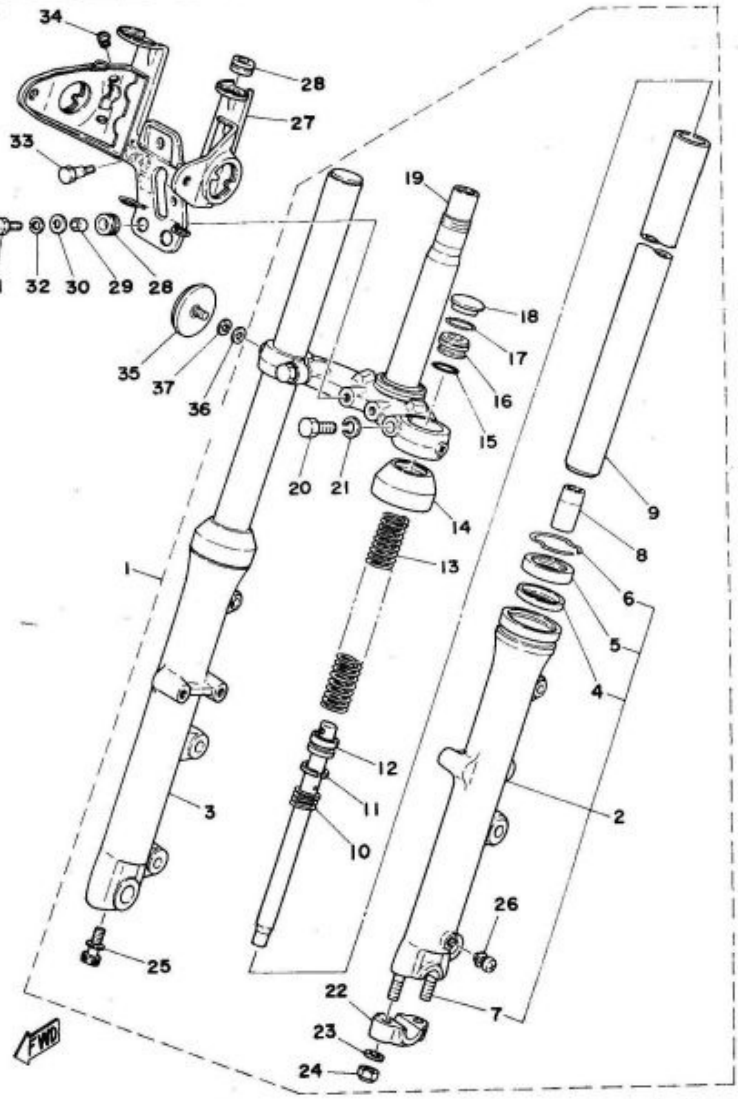
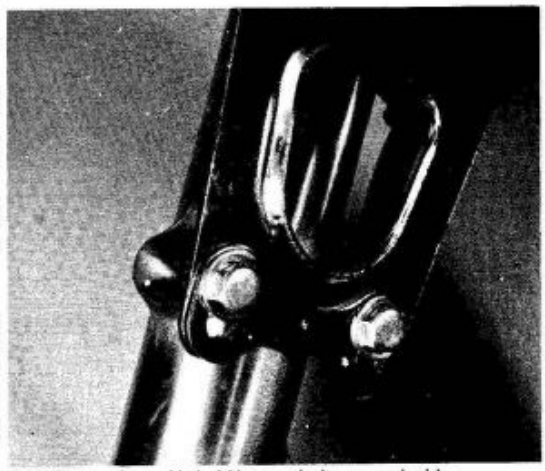
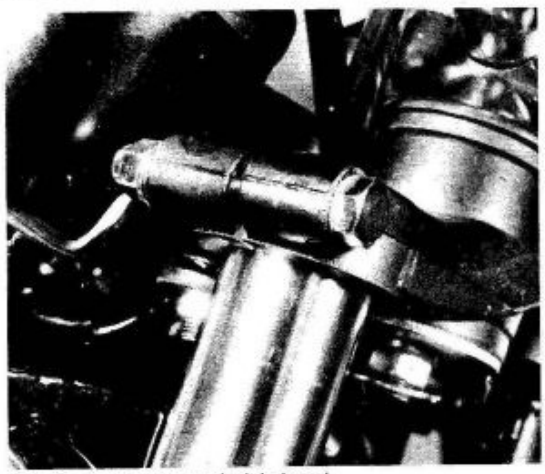


Fig. 4.1 Front fork assembly

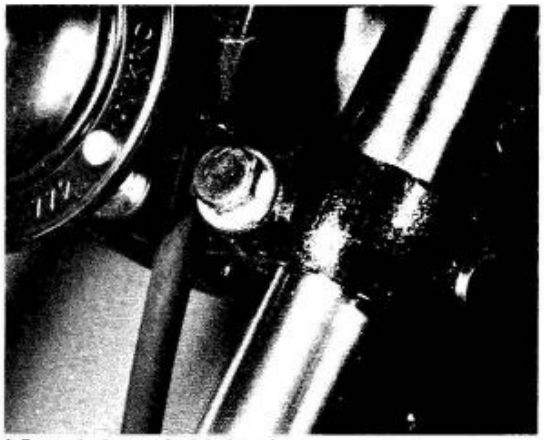
1 *Front fork assembly*
2 *Left-hand lower fork leg*
3 *Right-hand lower fork leg*
4 *Oil seal spacer – 2 off*
5 *Oil seal – 2 off*
6 *'E' clip – 2 off*
7 *Stud – 2 off*
8 *Damper rod seat – 2 off*
9 *Fork stanchion (inner tube) – 2 off*
10 *Rebound spring – 2 off*
11 *Piston ring – 2 off*
12 *Fork stanchion (upper tube) – 2 off*
13 *Fork spring – 2 off*
14 *Dust seal – 2 off*
15 *'O' ring – 2 off*
16 *Spring retaining plug – 2 off*
17 *Circlip – 2 off*
18 *Front fork cap – 2 off*
19 *Steering stem and bottom yoke*
20 *Pinch bolt – 2 off*
21 *Spring washer – 2 off*
22 *Spindle clamp*
23 *Plain washer – 2 off*
24 *Nut – 2 off*
25 *Clamp bolt – 2 off*
26 *Drain plug – 2 off*
27 *Headlamp bracket*
28 *Grommet – 4 off*
29 *Spacer – 2 off*
30 *Plain washer – 2 off*
31 *Bolt – 2 off*
32 *Spring washer – 2 off*
33 *Bolt*
34 *Rubber plug – 4 off*
35 *Reflector – 2 off*
36 *Plain washer – 2 off*
37 *Spring washer*



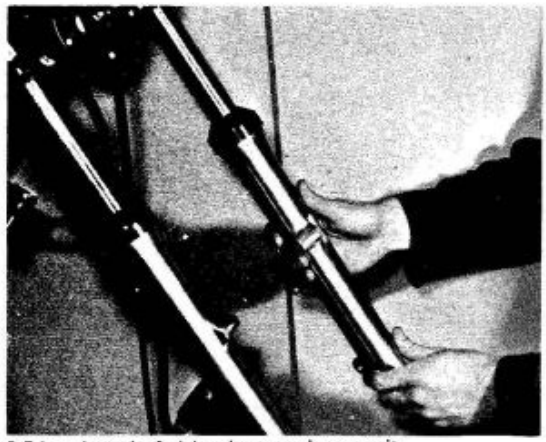
2.5a The mudguard is held by two bolts on each side



2.5b Slacken the upper pinch bolt and ...



2.5c ... the lower pinch bolt and ...



2.5d ... draw the fork leg downwards as a unit

3 Steering head yokes and bearings: removal from the frame

1 After removal of the fork legs as described in the preceding section, the steering head yokes and bearings may be detached to complete fork removal.
2 Raise the dualseat and disconnect the battery positive (+) lead. This will isolate the electrical system and prevent accidental shorting when the controls and headlamp leads are disconnected.
3 On disc brake models, disconnect the front brake stop lamp switch leads and remove the two bolts holding the master cylinder/reservoir unit to the handlebars. The master cylinder and caliper unit to which it is still interconnected by the brake hose may be removed from the machine. Do not allow the master cylinder to be inverted. This removal procedure precludes the need for bleeding the brake system on reassembly. On drum brake models, disconnect the brake cable from the handlebar lever.
4 Detach the controls from the handlebars, disconnecting cables and electrical leads where required. The electrical connections are made by block or snap connectors and the wires are colour coded to aid reassembly. Remove the handlebars after detaching the two clamps, held by two bolts each.
5 The speedometer and tachometer unit is secured on a mounting plate which is held on the fork upper yoke by two studs and nuts. Detach the instrument drive cables and remove the securing nuts, to allow the complete unit to be lifted away from the machine.
6 The headlamp unit is mounted in a bracket secured by two bolts to the lower yoke. The upper part of the bracket locates on studs. Remove the two bolts, lower the bracket slightly to disengage the upper mountings, and lift the assembly away from the yokes.
7 Remove the crown bolt and washer from the centre of the upper yoke. After slackening the pinch bolt at the rear of the yoke, the yoke may be lifted upwards, off the steering stem.
8 To release the lower yoke and steering head stem, unscrew the slotted sleeve nut at the top of the steering stem. A suitable 'C' spanner is provided in the tool kit with which to loosen the sleeve nut, but a soft punch can be used in the absence of the correct tool. As the steering head is released, the uncaged ball bearings from the lower race will be released and care should be taken to catch them by wrapping a rag around the bearing area. The bearings in the upper race will almost certainly remain in position.

4 Front forks: dismantling

1 It is advisable to dismantle each fork leg separately, using an identical procedure. There is less chance of unwittingly exchanging parts if this approach is adopted. Commence by draining each fork leg of damping oil; there is a drain plug in each lower leg above and to the rear of each wheel spindle housing.
2 Place the fork stanchion in a vice fitted with soft jaws, with a length of rubber inner tube around the stanchion, to prevent damage. Prise the rubber plug from the top of the stanchion. The fork spring is retained by a close fitting plug secured by an internal circlip within the stanchion end. To remove the circlip, the plug must be depressed slightly against the spring pressure and the circlip prised out with a small screwdriver. The help of a second person should be enlisted to depress the plug. After removal of the circlip, release the pressure and remove the plug, followed by the fork spring.
3 Place the fork lower leg in the vice and unscrew the socket screw recessed into the housing which carries the front wheel spindle. Prise the dust excluder from position and slide it up the fork stanchion. The stanchion can be pulled out of the lower fork leg. Remove the damper rod seat. Invert the upper tube and push the damper rod out of position towards the top end of the tube.
4 The oil seal which is fitted to the fork lower leg is retained by a circlip. **Do not** remove the oil seal unless it is to be renewed because the act of removal will almost certainly damage the fine sealing lip.

5 Front forks: examination and renovation

1 The parts most likely to wear are the oil seals and the bearing surfaces of the lower fork leg and the upper tube. As bushes are not fitted, wear in the fork lower leg can only be remedied by renewal of the complete fork lower leg.
2 Split or perished gaiters or dust covers must be attended to immediately otherwise the ingress of road grit will accelerate wear of the oil seal and upper tube.
3 After an extended period of service the fork springs may take a permanent set. If the spring lengths are suspect, they should be compared with a new set. It is wise to fit new components if the overall length has decreased. Always fit new springs as a pair, NEVER separately.

4 Check the outer surface of the stanchion for scratches or roughness. It is only too easy to damage the oil seal during reassembly, if these high spots are not eased down. The stanchions are unlikely to bend unless the machine is damaged in an accident. Any significant bend will be detected by eye, but if there is any doubt about straightness, roll the stanchion tube on a flat surface. If the stanchions are bent, they must be renewed. Unless specialist repair equipment is available, it is rarely practicable to straighten bent stanchions, and in any event the safety of repaired components of this nature is always suspect.

5 Wear of the damper rod piston ring will reduce damping efficiency and promote deterioration of road holding and handling. The ring may be renewed separately, if required.

6 Steering head bearings: examination and renovation

1 Clean and examine the cups and cones of the steering head bearings. They should have a polished appearance and show no signs of indentation. Renew the set if necessary.

2 Clean and examine the ball bearings which should also be polished and show no signs of surface cracks or blemishes. If any require replacement the whole set must be renewed.

3 All the balls are $\frac{1}{4}$ in diameter (do not mix metric and English sizes as they are slightly different). Nineteen balls are fitted into both top and bottom bearing races. This arrangement will leave a gap but an extra ball must not be fitted otherwise the balls will press against each other, accentuating wear and making the steering stiff.

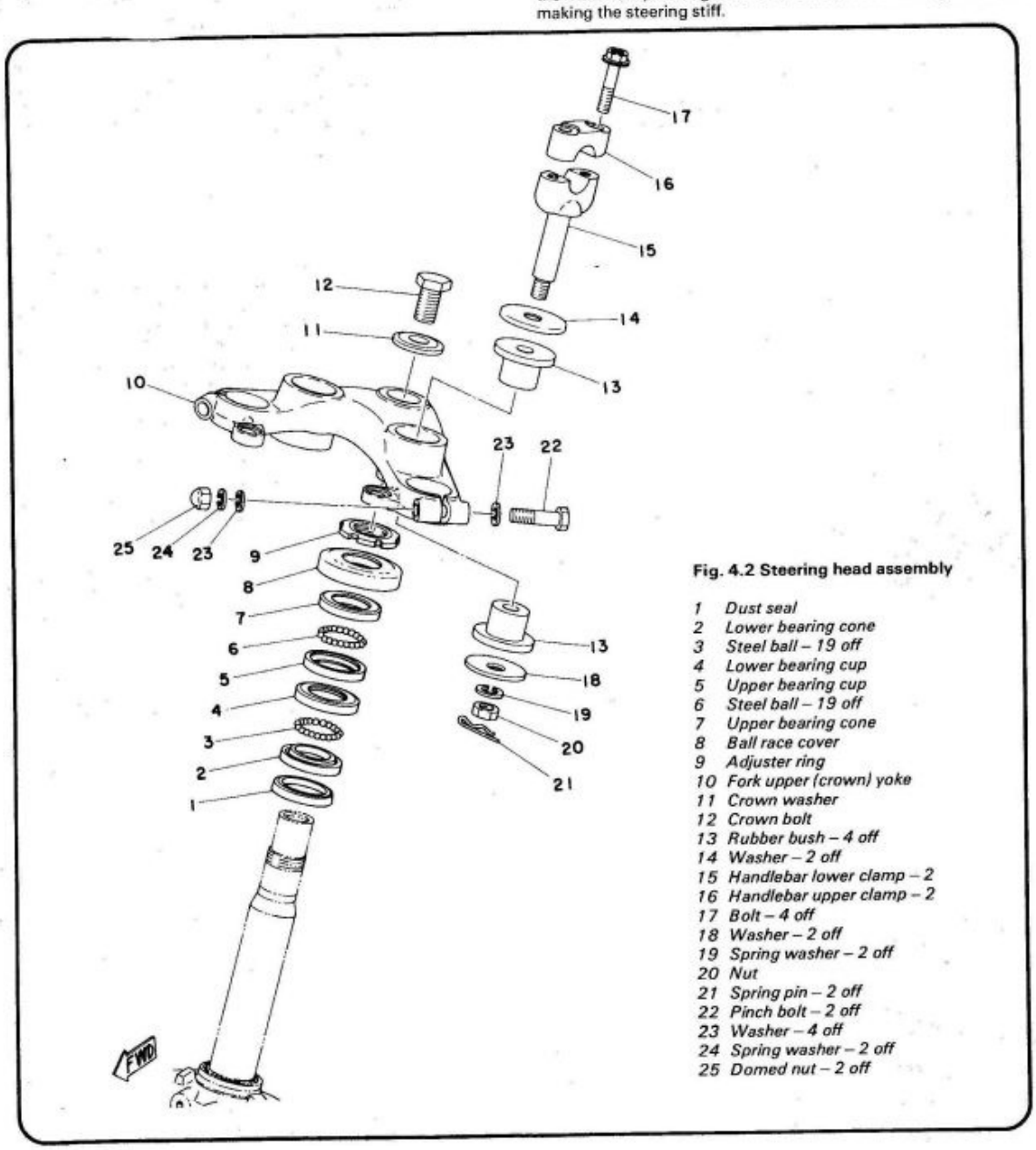
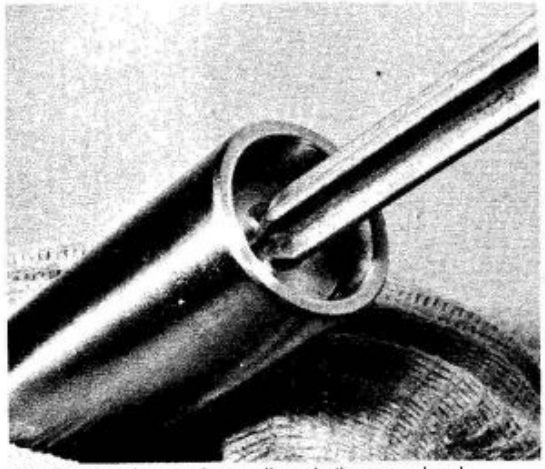


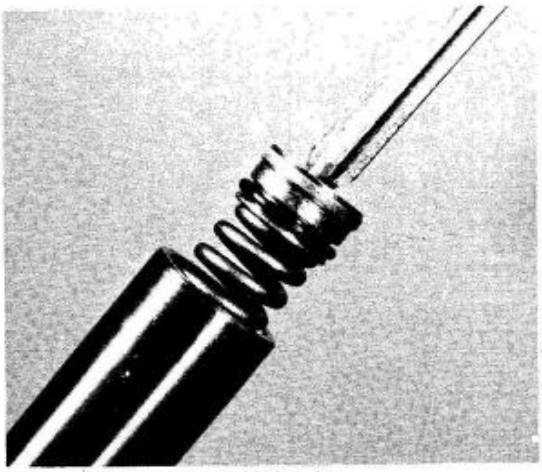
Fig. 4.2 Steering head assembly

1 *Dust seal*
2 *Lower bearing cone*
3 *Steel ball – 19 off*
4 *Lower bearing cup*
5 *Upper bearing cup*
6 *Steel ball – 19 off*
7 *Upper bearing cone*
8 *Ball race cover*
9 *Adjuster ring*
10 *Fork upper (crown) yoke*
11 *Crown washer*
12 *Crown bolt*
13 *Rubber bush – 4 off*
14 *Washer – 2 off*
15 *Handlebar lower clamp – 2*
16 *Handlebar upper clamp – 2*
17 *Bolt – 4 off*
18 *Washer – 2 off*
19 *Spring washer – 2 off*
20 *Nut*
21 *Spring pin – 2 off*
22 *Pinch bolt – 2 off*
23 *Washer – 4 off*
24 *Spring washer – 2 off*
25 *Domed nut – 2 off*

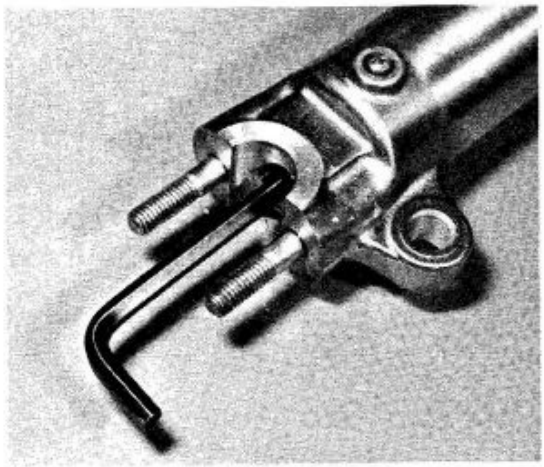
4.1 Drain plug in fork lower leg



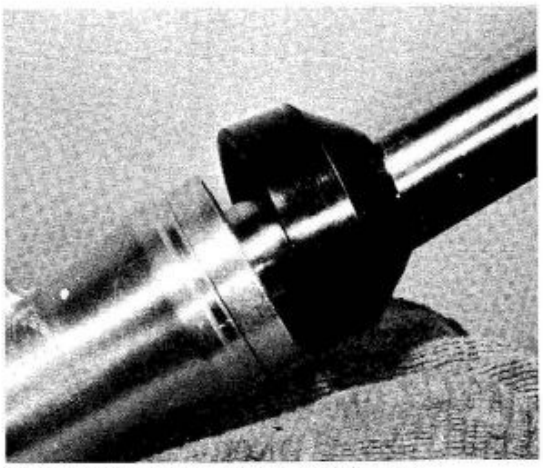
4.2a Depress the top plug to allow circlip removal and ...



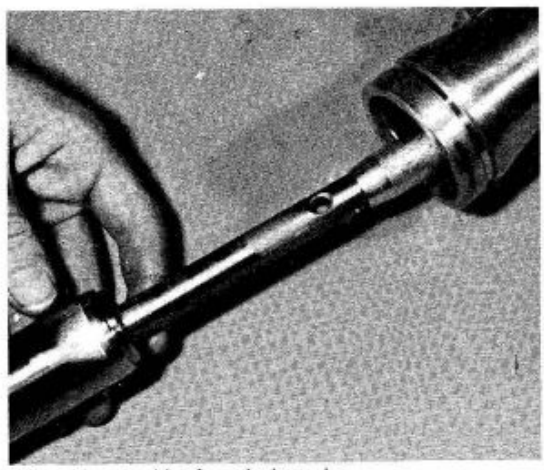
4.2b ... remove the plug and fork spring



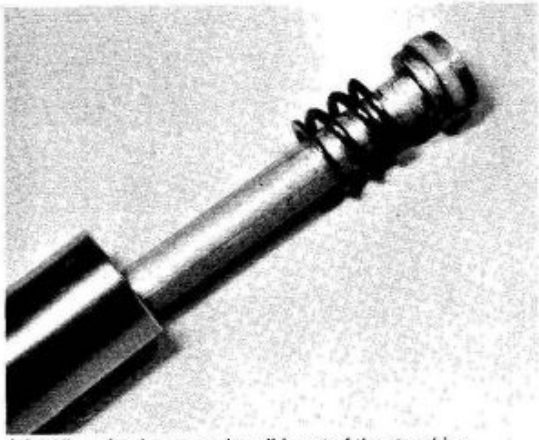
4.3a Unscrew the socket bolt from the lower leg



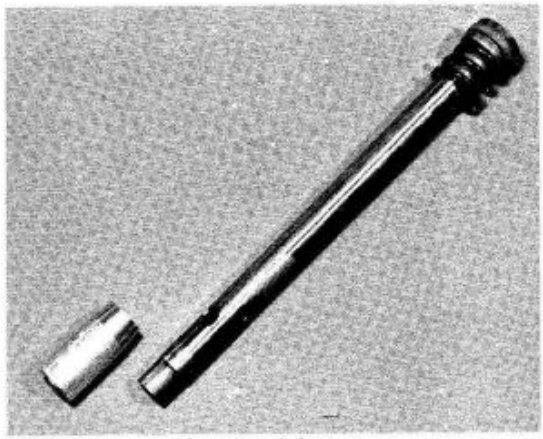
4.3b Prise off the dust excluder and withdraw ...



4.3c ... the stanchion from the lower leg



4.3d Allow the damper rod to slide out of the stanchion



4.3e Damper assembly – general view

4.4 Oil seal is secured by a circlip

7 Front forks replacement

1 Replace the front forks by following in reverse the dismantling procedures described in Section 2, 3 and 4 of this Chapter. Before fully tightening the front wheel spindle clamps and the fork lower yoke pinch bolts, bounce the forks several times to ensure they work correctly and settle down into their original settings. Complete the final tightening from the wheel spindle upwards.

2 Refill each fork leg with 130 cc (4.4/3.7 US/Imp fl oz) of ATF (automatic transmission fluid) or SAE 10W/30 fork oil; before the plug in the top of each fork leg is replaced. Check that the drain plugs have been re-inserted and tightened before the oil is added!

3 If the fork stanchions prove difficult to relocate through the fork yokes, make sure their outer surfaces are clean and polished so that they will slide more easily. It is often advantageous to use a screwdriver blade to open up the clamps, as the tubes are moved upwards into position.

4 Before the machine is used on the road, check the adjustment of the steering head bearings. If they are too slack, judder will occur, especially during braking. There should be no detectable play in the head races when the handlebars are pulled and pushed with the front brake applied hard.

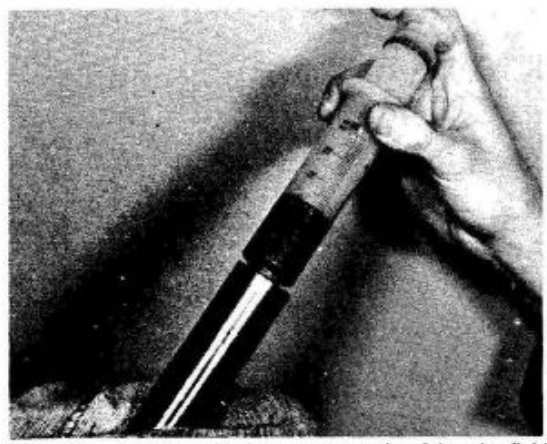
5 Overtight head races are equally undesirable. It is possible to unwittingly apply a loading of several tons on the head races when they have been overtightened, even though the handlebars appear to turn quite freely. Overtight bearings will make the machine roll at low speeds and give generally imprecise handling with a tendency to weave. Adjustment is correct if there is no perceptible play in the bearings and the handlebars will swing to full lock in either direction, when the machine is on the centre stand with the front wheel clear of the ground. Only a slight tap should cause the handlebars to swing.

8 Frame: examination and repair

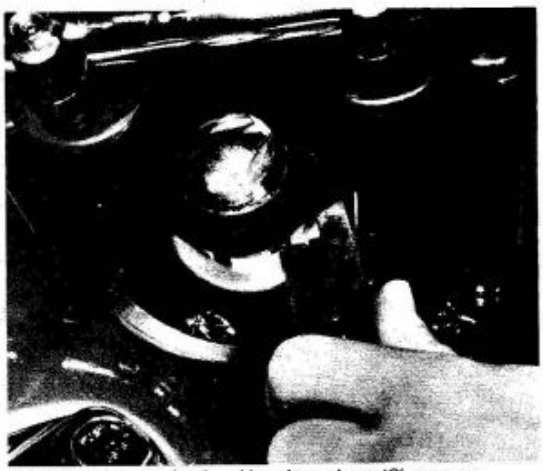
1 The frame is unlikely to require attention unless an accident has caused damage. In this case the frame should be taken to a specialist for repair.

2 It is wise to check the frame occasionally for cracks especially around the welded sections and those subjected to vibration and stress eg; footrest mounting lugs. Rust corrosion can also lead to defects and should be eliminated in its early stages.

3 A frame which is out of alignment will cause handling problems. If this is suspect, it is usually necessary to remove all the components so that the bare frame can be checked and possibly realigned by a specialist in this type of work.



7.2 Refill each fork leg with the correct quantity of damping fluid



7.4 Adjust the steering head bearing using a 'C' spanner

1 Frame complete
2 Engine rear mounting plate
3 Engine rear mounting plate
4 Bolt – 4 off
5 Spring washer – 4 off
6 Cylinder head steady plate
7 Cylinder head steady plate
8 Damper – 2 off
9 Bolt – 2 off
10 Nut – 2 off
11 Spring washer – 2 off
12 Bolt – 2 off
13 Bolt – 2 off
14 Bolt
15 Nut – 4 off
16 Nut
17 Spring washer – 4 off
18 Spring washer
19 Steering lock assembly
20 Conical spring
21 Lock cover
22 Wave washer
23 Rivet
24 Cable strap
25 Cable strap
26 Damper
27 Cable strap

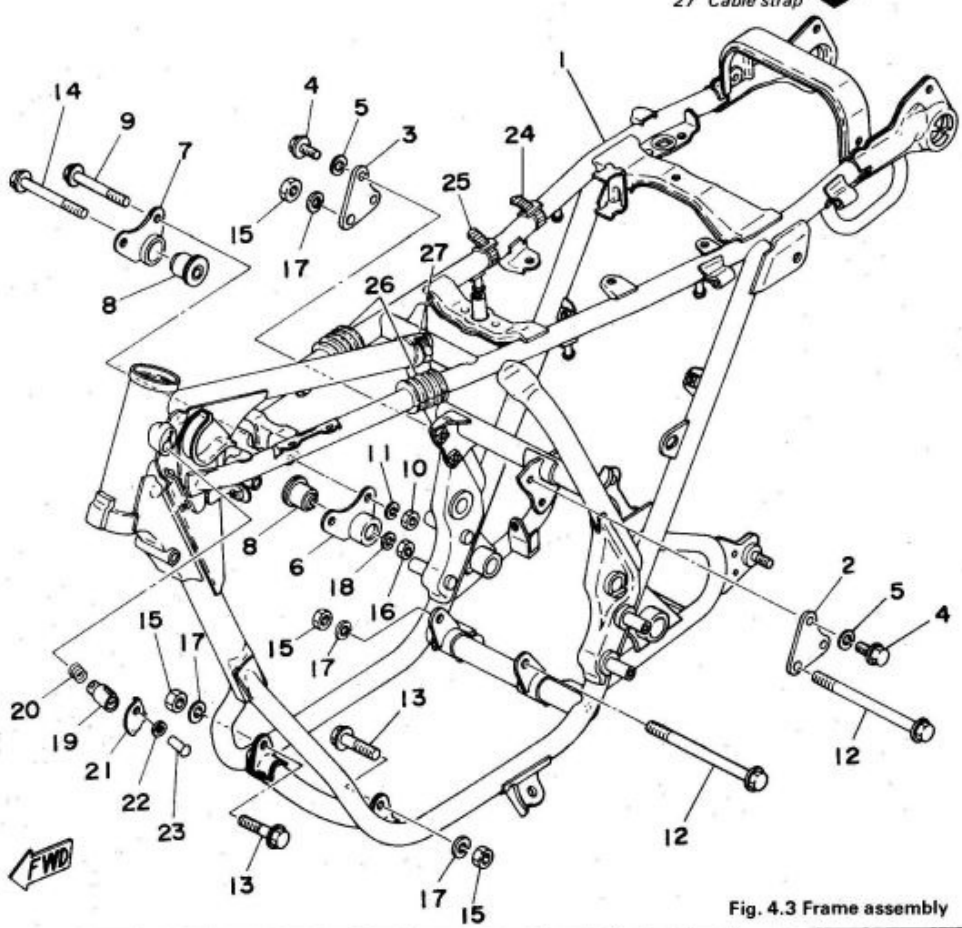


Fig. 4.3 Frame assembly

9 Swinging arm rear fork: removal and dismantling

1 The swinging arm bushes consist of two outer bushes pressed into each end of the fork crossmember which bears on a single inner bush which is retained on the swinging arm pivot spindle. When wear develops in the swinging arm bushes, necessitating renewal, the repair is quite straightforward.

2 To remove the swinging arm, first place the machine on its centre stand with the weight off the rear wheel and remove the wheel as described in Chapter 5 section 3.

3 On disc brake models, detach the two clamps which hold the brake hose to the swinging arm fork. The clamps incorporate a locking tab which secures the heads of the bolts. Bend down the tabs before attempting to loosen each bolt. Remove the pivot bolt which secures the brake caliper unit to the mounting frame. Lift the caliper from position and move it forwards, so that it may be suspended from the frame. If this method of removal is used, there is no necessity to disconnect the caliper from the hydraulic hose.

4 Remove the chainguard which is retained by a single bolt at the rear, and detach both suspension units at their lower mountings.

5 Bend down the ear of the lockwasher which secures the swinging arm pivot bolt nut. Remove the nut and lockwasher. The pivot bolt should be drifted out carefully taking care not to damage the threads. Support the swinging arm fork and withdraw it from the rear of the machine.

10 Swinging arm rear fork: renovation and assembly

1 Remove the dust caps from both ends of the swinging arm fork crossmember and note the number of shims fitted at each side. The shims must be replaced in the same positions on reassembly. Push out the long inner bush.

2 After cleaning the inner bush and the outer bushes thoroughly, insert the inner bush again and check for play. If play is perceptible, the outer bushes must be renewed as a pair. The outer bushes may be drifted from position, using a long drift inserted from the opposite side of the crossmember. The bushes are made of a brittle material which will probably fracture during removal. For this reason they should not be disturbed unless they are to be renewed.

3 Reassemble the swinging arm fork by reversing the dismantling procedure. Grease the pivot shaft and bearings liberally before reassembly as no facility is provided for greasing after assembly.

4 Worn swinging arm pivot bearings will give imprecise handling with a tendency for the rear end of the machine to twitch or hop particularly during the transition from 'power-on' to 'power-off', or vice versa. Play can be detected by placing the machine on its centre stand and with the rear wheel clear of the ground, pulling and pushing on the fork ends in a horizontal direction. Any play will be greatly magnified by the leverage effect.

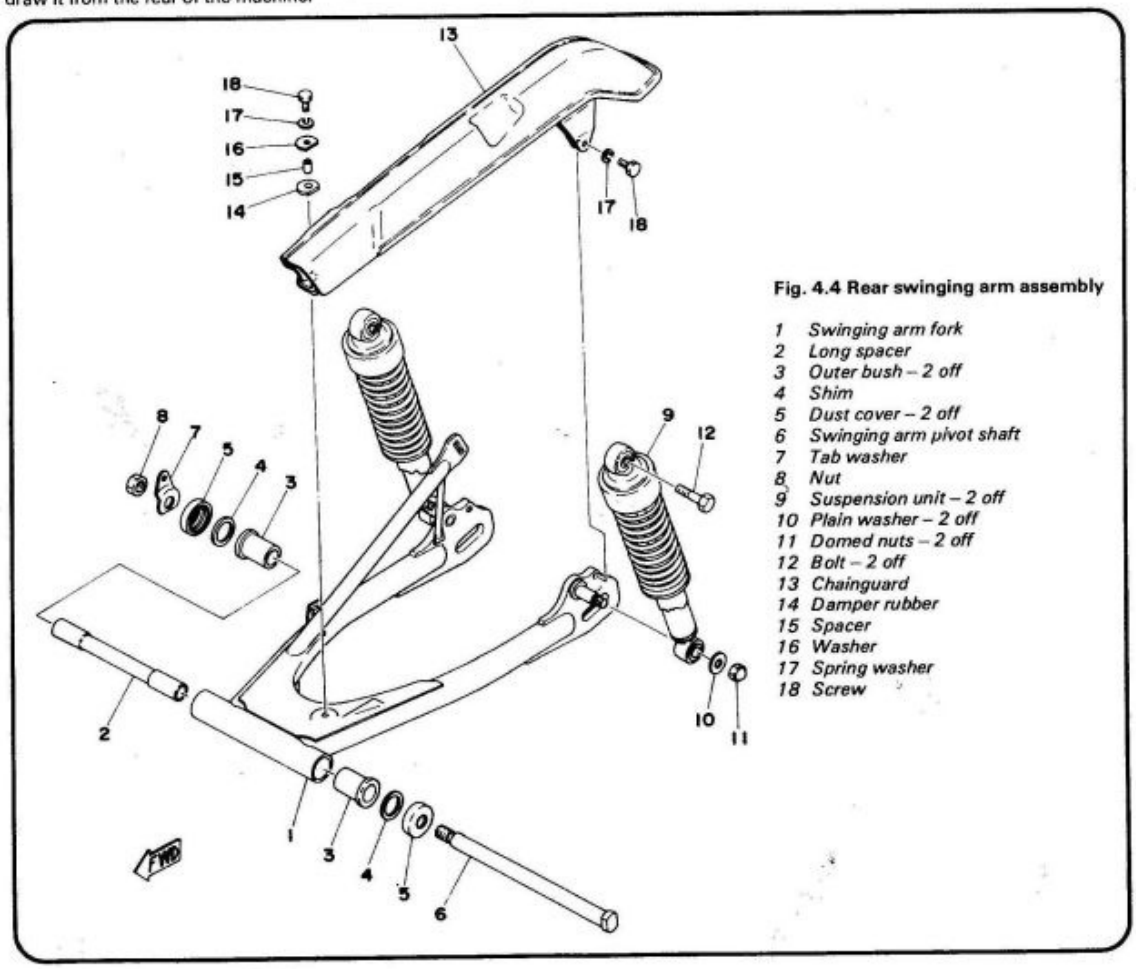
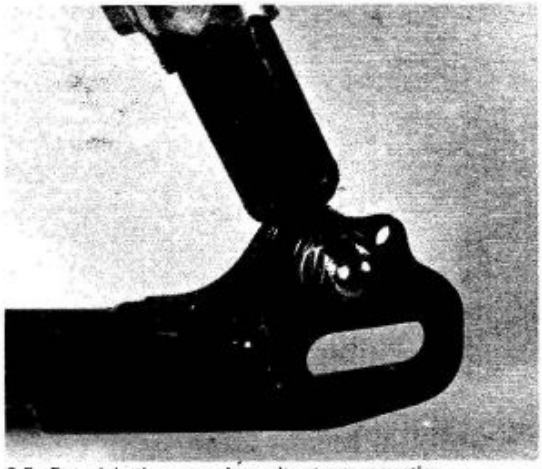
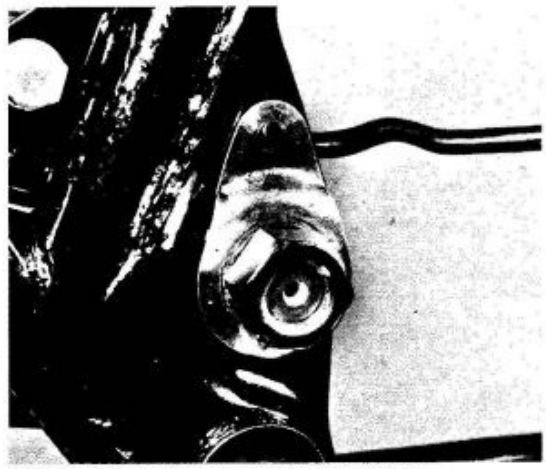


Fig. 4.4 Rear swinging arm assembly

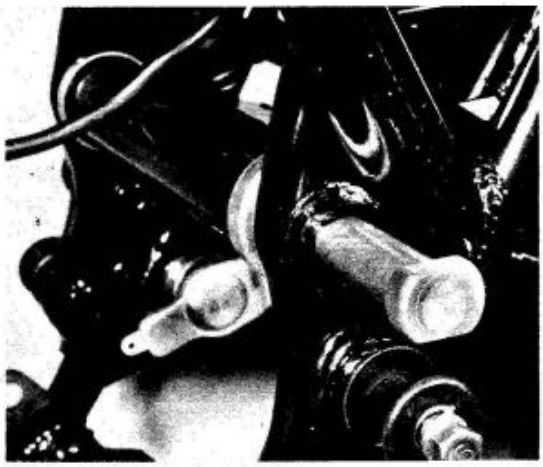
1 *Swinging arm fork*
2 *Long spacer*
3 *Outer bush – 2 off*
4 *Shim*
5 *Dust cover – 2 off*
6 *Swinging arm pivot shaft*
7 *Tab washer*
8 *Nut*
9 *Suspension unit – 2 off*
10 *Plain washer – 2 off*
11 *Domed nuts – 2 off*
12 *Bolt – 2 off*
13 *Chainguard*
14 *Damper rubber*
15 *Spacer*
16 *Washer*
17 *Spring washer*
18 *Screw*



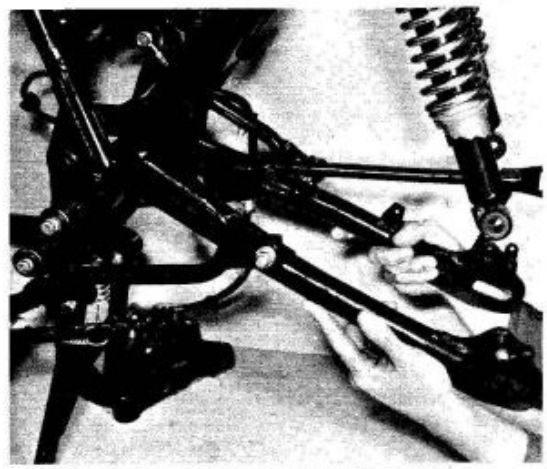
9.5a Detach both suspension units at rear mounting



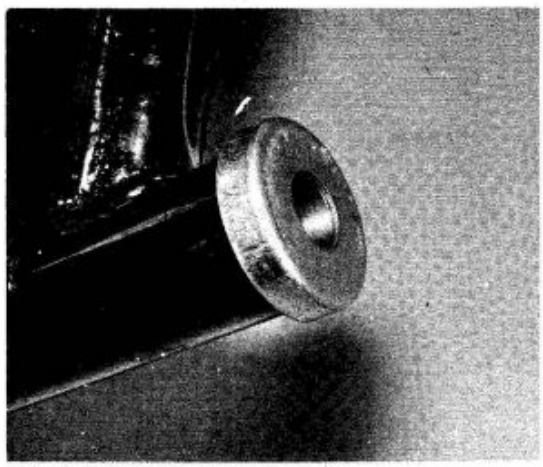
9.5b Bend down tab washer and loosen nut then ...



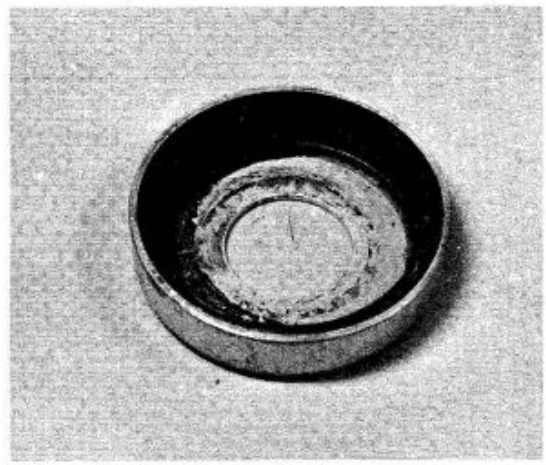
9.5c ... drive out the pivot shaft



9.5d Lift swinging arm fork away to rear of machine

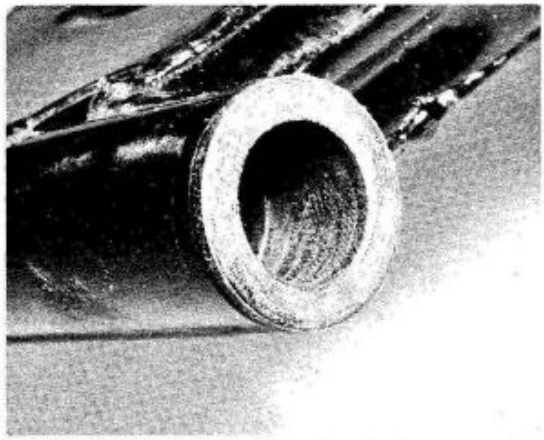


10.1a Pull off the dust caps and ...



10.1b ... note shims (if any) and sealing ring

10.1c Displace the long bush



10.2 Outer bushes are very brittle and may break on removal

11 Rear suspension units: examination

1 The rear suspension units fitted to the XS250, 360 and 400 models are of the normal hydraulically damped type, adjustable to give five different spring settings. A 'C' spanner should be used to turn the lower spring seat and so alter its position on the adjustment projection. When the spring seat is turned so that the effective length of the spring is shortened, the suspension will become heavier.
2 If a suspension unit leaks, or if the damping efficiency is reduced in any other way the two units must be replaced as a pair. For precise roadholding it is imperative that both units react to movement in the same way. It follows that the units must always be set at the same spring loading.

12 Centre stand: examination

1 The centre stand is attached to the machine by two bolts on the bottom of the frame. It is returned by a centre spring. The bolts and spring should be checked for tightness and tension respectively. A weak spring can cause the centre stand to 'ground' on corners and unseat the rider.

13 Prop stand: examination

1 The prop stand is secured to a plate on the frame with a bolt and nut, and is retracted by a tension spring. Make sure the bolt is tight and the spring not overstretched, otherwise an accident can occur if the stand drops during cornering. For the same reason check that the pivot nut split pin has not been displaced.

14 Footrests: examination and renovation

1 The front footrests are held on the frame by two bolts each, passing into threaded sleeves welded to the frame lugs. A damper rubber placed around each sleeve reduces vibration which might be transmitted to the rider's foot. The rear footrests are an integral part of the two silencer mounting brackets, each of which is secured to the frame on a single stud. The footrests pivot upwards on their mounting brackets and are spring loaded to keep them in their horizontal positions. If an obstacle is struck they will fold upwards, reducing the risk of damage to the rider's foot or to the main frame.
2 If the footrests are damaged in an accident, it is possible to dismantle the assembly into its component parts. Detach each footrest from the frame lugs and separate the folding foot piece from the bracket on which it pivots by withdrawing the split pin and pulling out the pivot shaft. It is preferable to renew the damaged parts, but if necessary, they can be bent straight by clamping them in a vice and heating to a dull red with a blow lamp whilst the appropriate pressure is applied. Do not attempt to straighten the footrests while they are attached to the frame.
3 If heat is applied to the main footrest piece during any straightening operation, it follows that the footrest rubber must be removed temporarily.

15 Rear brake pedal: examination and renovation

1 The rear brake pedal is secured to the shaft on which it pivots by a pinch bolt, and is located by splines. To allow removal of the pedal, the pinchbolt must be removed completely.
2 In the event of damage, the rear brake pedal may be straightened in a manner similar to that prescribed for footrest renovation. Bear in mind that the heat applied may damage the chrome finish.

16 Dualseat: removal and replacement

1 The dualseat is attached to two lugs on the left side of the frame by two clevis pins secured with split pins. If it is necessary to remove the dualseat withdraw the two split pins, take out the clevis pins, and the seat will lift off as a complete unit.

17 Speedometer and tachometer heads: removal and replacement

1 The speedometer and tachometer are both mounted together on a single panel on top of the front forks. They are secured in rubber mounted cases by two nuts with rubber washers over studs mounted on the bottom of the panel.
2 The instruments may be removed individually from their separate cases following the same procedure. Remove the two domed nuts and disconnect the drive cable by unscrewing the knurled ring. Pull the instrument head up and pull out the push fit warning and illumination bulb holders.

3 Unscrew the drive cables and pull out the push fit bulb holders. Check for blown bulbs while they are out.
4 Speedometer and tachometer heads cannot be repaired and if a defect occurs it is best to fit a new instrument. Remember that a speedometer in correct working order is required by law on a machine in the UK and many other countries.
5 If an instrument becomes erratic in operation or fails, suspect first the drive cable, which should be renewed as a complete assembly if found to be damaged.

18 Speedometer and tachometer drives: location and examination

1 The speedometer is driven by a gear that is driven internally from the wheel hub, and is housed inside the brake back plate (drum brake models) or in the case of disc brake models, by a separate gearbox driven from the hub fitted on the front wheel spindle, to the left of the wheel. The drive in both cases should be greased occasionally.
2 The tachometer drive is provided by a gear shaft fitting into the front of the camshaft cover, where it meshes with a scroll gear on the camshaft. As noted in Chapter 1, failure of the gear is rare, as it works in ideal conditions, being lubricated thoroughly and protected from contaminants by full enclosure.

19 Cleaning the machine

1 After removing all surface dirt with warm water and a rag or sponge, use a cleaning compound such as 'Gunk' or 'Jizer' for the oily parts. Apply the cleaner with a brush when the parts are dry so that it has an opportunity to soak into the film of oil or grease. Finish off by washing down liberally, taking care that water does not enter into the carburettors, air cleaners or electrics. If desired, a polish such as Solvol Autosol can be applied to the alloy parts to give them full lustre. Application of a wax polish to the cycle parts and a good chrome cleaner to the chrome parts will also give a good finish. Always wipe the machine down if used in the wet, and make sure the chain is well oiled. There is less chance of water getting into control cables if they are regularly lubricated, which will prevent stiffness of action.

20 Fault diagnosis: frame and forks

Symptom	Cause	Remedy
Machine veers to left or right with hands off handlebars	Wheels out of alignment Forks twisted Frame bent	Check and realign. Strip and repair. Strip and repair or renew.
Machine tends to roll at low speeds	Steering head bearing not adjusted correctly or worn	Check adjustment and renew bearings if necessary.
Machine tends to wander	Worn swinging arm bearings	Check and renew bearings. Check adjustment and renew.
Forks judder when front brake applied	Steering head bearings slack, worn fork components	Renew all worn parts, Check adjustment and renew.
Forks bottom	Short of oil	Replenish with correct viscosity oil.
Fork action stiff	Forklegs out of alignment Bent shafts, or twisted in yokes	Strip and renew or slacken clamp bolts, front wheel spindle and top bolts. Pump forks several times and tighten from bottom upwards.
Machine pitches badly	Defective rear suspension units or ineffective fork damping	Check damping action. Check grade and quantity of oil in front forks.