

CHAPTER 3

THE IGNITION SYSTEM

- 3:1 Description**
- 3:2 Routine maintenance**
- 3:3 Ignition faults**
- 3:4 Removing and refitting distributor**

- 3:5 Distributor overhaul**
- 3:6 Timing the ignition**
- 3:7 Sparking plugs**
- 3:8 Fault diagnosis**

3:1 Description

The ignition system is conventional, comprising an ignition coil, distributor and contact breaker system. The distributor incorporates automatic timing control by means of centrifugal mechanism and a vacuum operated unit. As engine speed increases, the centrifugal action of rotating weights pivoting against the tension of small springs moves the contact breaker cam relative to the distributor drive shaft and progressively advances the ignition. Small bore pipe(s) connect between fittings on the vacuum unit and the carburetter. At high degrees of vacuum the unit advances the ignition, but under load, at reduced vacuum, the unit progressively retards the ignition.

Some later models are fitted with a rotor arm which incorporates an engine speed governor. This consists of a sliding weight which is thrown outwards by centrifugal force to contact a metal blade on the outer part of the rotor at a predetermined engine speed. This shortcircuits the ignition current to earth to prevent any further increase in engine speed. On engines equipped with fuel injection systems instead of carburetters, the distributor is additionally fitted with a set of trigger contacts which transmit timed current pulses to the fuel injection system control unit.

The ignition coil is wound as an auto-transformer with the primary and secondary windings connected in series, the common junction being connected to the contact breaker with the positive feed from the battery going to the opposite terminal of the LT windings via the ignition switch. On later models, LT current supply to the coil is via a resistor which reduces nominal battery voltage considerably. This resistance is bypassed when the starter is in operation, so that full battery voltage is supplied to the coil. The coil then provides increased voltage to the HT system for maximum sparking plug efficiency when the engine is being started. If a resistor is not incorporated, full battery voltage is supplied to the coil at all times.

When the contact breaker points are closed, current flows in the coil primary winding, magnetising the core and setting up a fairly strong magnetic field. Each time the contacts open, the battery current is cut off and the magnetic field collapses, inducing a high current in the primary winding and a high voltage in the secondary. The primary current is used to charge the capacitor connected across the contacts and the flow is high and virtually instantaneous. It is this high current peak which induces the surge in the secondary winding to produce the sparking plug voltage across the plug points. Without the

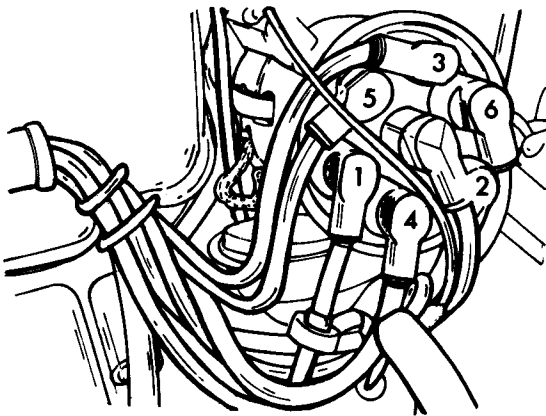


FIG 3:1 HT lead connections at distributor cap

capacitor the current peak would be much smaller and the sparking voltage considerably reduced, in fact to a point where it would be insufficient to fire the mixture in the engine cylinders. The capacitor, therefore, serves the dual purpose of minimising contact breaker wear and providing the necessary high charging surge to ensure a powerful spark.

3:2 Routine maintenance

Pull off the two spring clips to release the cap from the distributor body. On models provided with stereo suppression, detach the two thin wires from their connections on the distributor body. Remove the distributor cap leaving the HT leads attached, if the cap is to be removed complete, detach the HT leads by pulling off the plug-in connectors. Each lead is marked with the appropriate cylinder number and leads must be connected to the distributor cap in the correct firing order, as shown in FIG 3:1. For access to the contact breaker points, pull the rotor from the top of the distributor shaft and remove the dust cover if fitted.

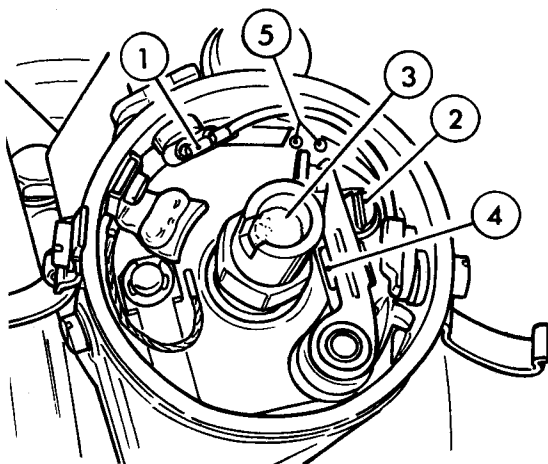


FIG 3:2 Upper distributor components

Lubrication:

This should be carried out at the intervals recommended in the manufacturer's service schedule. Remove the distributor cap as described previously. FIG 3:2 shows the upper distributor components. Apply just enough engine oil to the felt pad 3 to soak it. Apply a thin smear of an approved grade of grease to cam follower 4 and the six-sided cam against which it operates. When lubricating the internal parts of the distributor, take great care to avoid oil or grease contaminating the contact breaker points, lubricating sparingly for this reason.

Adjusting the contact breaker points:

Turn the engine until one of the cams has opened the contact breaker points to their fullest extent, then check the gap between the points with clean feeler gauges. The correct gap is 0.35 to 0.40mm (0.014 to 0.016in). To adjust the gap, slacken the screw shown at 2 in FIG 3:2 and insert the point of a screwdriver between the pips and cut-out provided (5). Turn the screwdriver to open or close the points gap as necessary, then tighten the retaining screw and recheck the gap. If dwell meter equipment is available, adjusting the points to give the correct dwell angle (see **Technical Data**) will provide the most accurate setting.

Cleaning the contact breaker points:

Use a fine carborundum stone or special contact point file to polish the points if they are dirty or pitted, taking care to keep the faces flat and square. If the points are too worn to clean up in this manner, they should be renewed. On completion, wipe away all dust with a cloth moistened in petrol then set the points gap as described previously.

Renewing the contact breaker points:

Refer to FIG 3:2. Pull off the connector 1, then remove screw 2 and lift out the contact breaker points. Wash the mating faces of the new contact points with methylated spirits to remove the protective coating. Fit the contact points set to the base plate and secure with the single screw. Push the connector on to the terminal. Set the contact points to the correct gap as described previously.

Checking rotor arm:

To test rotor insulation, connect an ohmmeter between the rotor centre and outer contacts. Resistance should be approximately 5000 ohms.

Alternatively, check by fitting the rotor in position and removing the central HT lead from the distributor cap. Hold the end of the lead approximately 12mm (0.5in) from the rotor centre contact. To avoid shocks, hold the lead with insulated pliers or a thick glove. With the ignition switched on, flick open the contact points. If a spark jumps the gap the rotor is faulty and must be renewed. Always fit a new rotor if the original is cracked or the brass parts are badly eroded.

On models having a rotor equipped with an engine speed governor, check that the centrifugal weight 1 (see FIG 3:3) and contact blade 2 are in good condition. Check that the weight moves out towards the contact freely and returns unaided when released. If any faults are found, renew the rotor.

3:3 Ignition faults

If the engine runs unevenly, set it to idle at about 1000rev/min and, taking care not to touch any conducting parts of the sparking plug leads, remove and replace each lead from its plug in turn. To avoid shocks during this operation it is best to wear a pair of thick gloves or to use insulated pliers. Doing this to a plug which is firing correctly will accentuate the uneven running but will make no difference if the plug is not firing.

Having by this means located the faulty cylinder, stop the engine and remove the plug lead. Pull back the insulation or remove the connector so that the end of the lead is exposed. Alternatively, use an extension piece, such as a small bar or drill, pushed into the plug connector. Hold the lead carefully to avoid shocks, so that the end is about 3mm ($\frac{1}{8}$ in) away from the cylinder head. Crank the engine with the starter or flick open the contact points with the ignition switched on. A strong, regular spark confirms that the fault lies with the sparking plug which should be removed and cleaned as described in **Section 3:7**, or renewed if defective.

If the spark is weak and irregular, check the condition of the lead and, if it is perished or cracked, renew it and repeat the test. If no improvement results, check that the inside of the distributor cap is clean and dry and that there is no sign of tracking, which can be seen as a thin black line between the electrodes or to some metal part in contact with the cap. Tracking can only be cured by fitting a new cap. Check the carbon brush inside the cap for wear or damage, and check that it moves in and out freely against the pressure of its internal spring. Check the brass segments in the cap for wear or burning. Renew the cap if any fault is found. Wipe the cap clean both inside and outside before refitting.

If these checks do not cure a weak HT spark, or if no spark can be obtained at the plug or lead, check the LT circuit as described next.

Testing the LT circuit:

The LT circuit connects the battery, ignition switch, coil primary winding and the contact breaker assembly and provides timed pulses of current to the coil primary windings as the contacts open and close. These pulses control the secondary coil winding which provides current at high voltage to the distributor, where the distributor rotor directs it through the HT leads to the sparking plugs.

Remove the distributor cap and check that the contact breaker points are clean and correctly set, as described in **Section 3:2**. Disconnect the thin wire from the coil that connects to the distributor. Connect a 12-volt test lamp between the terminals to complete the circuit, switch on the ignition and turn the engine slowly. If the lamp lights and goes out as the points close and open, the circuit is in order. If the lamp fails to light, there is a fault in the LT circuit. Note that a 12-volt bulb will not glow with full brightness on models which have a resistor in circuit with the coil. This resistor is cut out of the circuit when the starter motor is operating, so that extra current is supplied to the coil to ensure a quick start. Full brightness of the lamp should be achieved when the switch is turned to crank the engine with the starter motor.

Remove the lamp and reconnect the wire to the coil and distributor. If the fault lies in the LT circuit, use the lamp

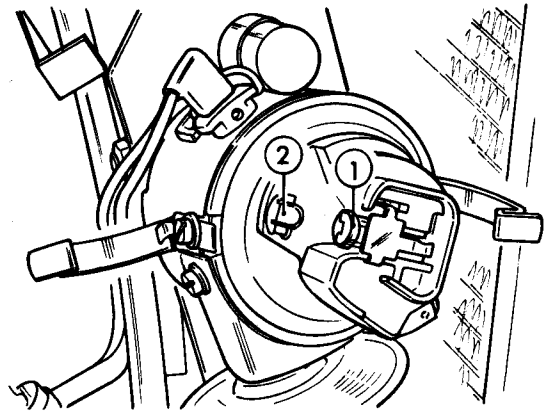


FIG 3:3 Rotor arm centrifugal weight 1 and contact 2. Later type shown

to carry out the following tests with the ignition switched on. Remove the wire from the ignition switch side of the coil and connect the lamp between the end of this wire and earth. If the lamp fails to light, it indicates a fault in the wiring between the battery and the coil or in the ignition switch. Reconnect the wire if the lamp lights.

Disconnect the wire from the coil that connects to the distributor. Connect the lamp between the coil terminal and earth. If the lamp fails to light it indicates a fault in the coil primary winding and a new coil must be fitted. Reconnect the wire if the lamp lights and disconnect its other end from the distributor. If the lamp does not light when connected between the end of this wire and earth it indicates a fault in the section of wire.

Capacitor:

The best method of testing a capacitor (condenser) is by substitution. Disconnect the original capacitor and connect a new one between the LT terminal on the distributor and earth for test purposes. If a new capacitor is proved to be required, it can then be properly fitted. The capacitor is recognised as a small cylinder attached to the outside of the distributor body.

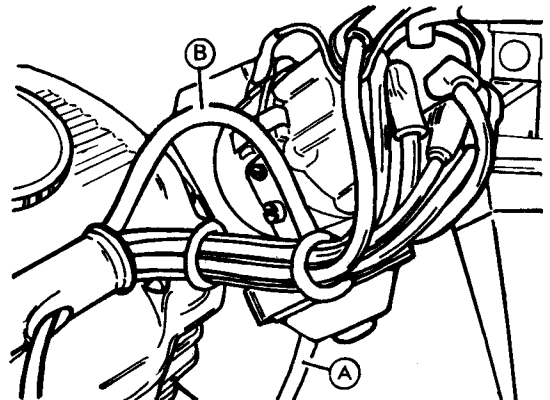


FIG 3:4 Double acting vacuum unit hose connections

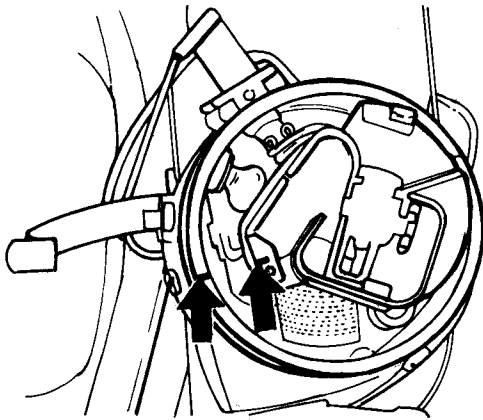


FIG 3:5 Aligning rotor and housing timing marks, later type shown

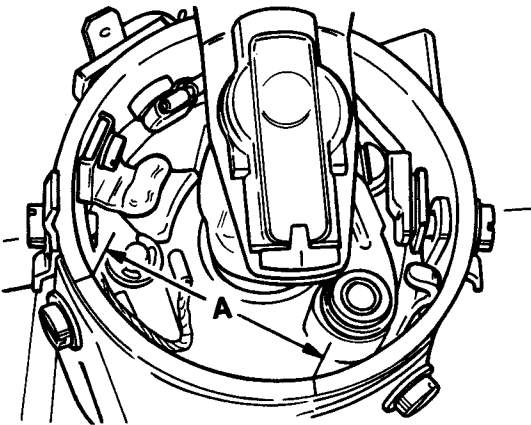


FIG 3:6 Aligning rotor for distributor refitting, early type shown

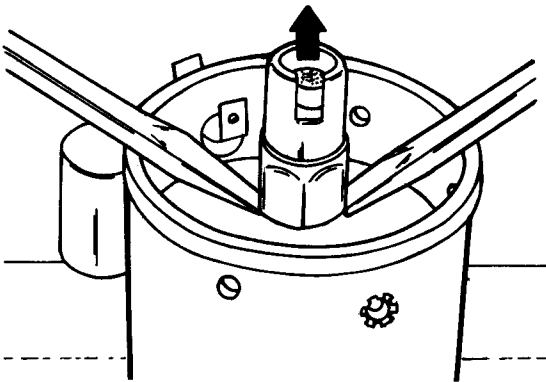


FIG 3:7 Removing cam assembly on later models

An alternative check for the capacitor is to charge it from a DC source, such as the car battery, then leave it for about 5min. The terminal and case of the capacitor should then be shorted with a piece of wire and, if the capacitor is in good condition, a noticeable spark should result.

3:4 Removing and refitting distributor

Removing:

Remove the distributor cap as described in **Section 3:2**. On models fitted with a double-acting vacuum unit, refer to **FIG 3:4** and remove pipes **A** and **B** from the unit, taking care not to mix the hoses so that they can be refitted correctly. On standard models fitted with this type of unit, hose **A** connects to a fitting on the front carburettor at lefthand side of idle shut off valve, hose **B** to the same carburettor at righthand side of valve. On models with this type of vacuum unit which are also equipped with exhaust emission control systems, hose **A** leads to the vacuum connection on the carburettor and hose **B** to the electromagnetic change-over valve. Disconnect the distributor LT wiring. On fuel-injection models, pull off the trigger contact plug at the distributor.

Turn the engine until the mark on the rotor aligns with the mark on the distributor body as shown in **FIG 3:5**. This is the TDC point on the firing stroke for No 1 (front) cylinder. Remove the bolt securing the clamp at the base of the distributor, then lift the distributor assembly from the engine. To avoid altering the timing settings, do not turn the engine while the distributor is removed.

Refitting:

If the engine has not been turned while the distributor was removed, align the rotor and shaft assembly as shown in **FIG 3:6** so that distance **A** between marks on rotor and body is approximately 35mm (1.4in). Offer the distributor into position and turn the rotor as little as necessary until the gear on the shaft aligns with the drive gear. Push the distributor body fully home, when the rotor should turn to the position shown in **FIG 3:5**. Turn the distributor body as little as necessary to exactly align the marks, then refit the clamp and tighten the bolt just sufficiently to secure the body. Reconnect the LT wiring. Carry out the ignition timing procedure described in **Section 3:6**.

If the engine has been turned and the timing setting lost, the engine must be reset to the firing point for No 1 cylinder. To do this, either remove the rocker cover and turn the engine until both valves for No 1 (front) cylinder are closed (see **Chapter 1**), or remove the sparking plug from No 1 cylinder and turn the engine until compression can be felt by a thumb placed over the plug hole. Now turn the engine as little more as necessary to align the central mark on the crankshaft vibration damper pulley in line with the pointer on the timing cover as described in **Section 3:6**. Install the distributor as described previously then check the ignition timing as described in **Section 3:6**.

3:5 Distributor overhaul

Remove the distributor as described in **Section 3:4**, then pull off the rotor arm and remove the dust cap if fitted. Remove the contact points set as described in **Section 3:2**.

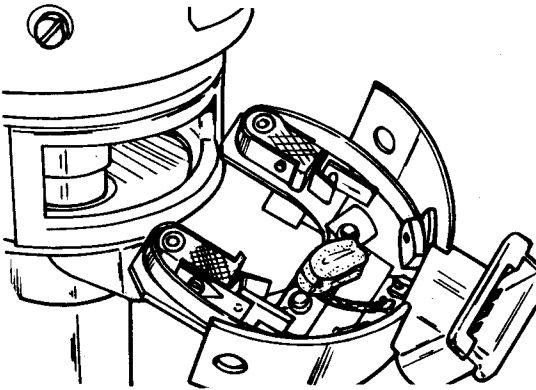


FIG 3:8 Removing trigger contacts on fuel injection models

Remove the small circlip to detach vacuum unit operating arm from contact breaker base plate, then remove the screws and detach the vacuum unit from distributor body. Remove the contact breaker plate. On later models, the cam assembly is separate from the distributor shaft and can be removed by levering upwards with two screwdrivers as shown in **FIG 3:7**. When this is done, do not remove the lubricating felt pad from the centre of the cam assembly or the circlip beneath it will escape. On later models the cam is an integral part and must be removed complete with the distributor shaft.

On distributors used with fuel injection engines, the trigger contacts can be removed as shown in **FIG 3:8**.

To remove the shaft from the distributor body, the grooved dowel pin must first be drilled out as shown in **FIG 3:9**, taking care not to damage the gear or shaft. Remove the gear and extract the shaft and centrifugal mechanism through the top of the distributor body. When doing so, refer to **FIG 3:10** and collect thrust washers 1 and insulating washers 2, noting their positions for correct reassembly.

Examine all components for wear or damage. Note that, on units fitted with trigger contacts as shown in **FIG 3:8**, if the contacts are badly oiled, the distributor shaft sealing ring must have failed, this dictating renewal of the complete distributor assembly. Note that the trigger contact assembly must not be lubricated at all, and that the assembly should be renewed complete at intervals of approximately 60,000km (40,000 miles).

Check the fit of the distributor shaft in the bearing bushes and renew bushes if excessive play exists or if they are worn or damaged. If faults are found in the centrifugal advance mechanism on early models, the complete distributor shaft assembly must be renewed. On later models, the centrifugal mechanism can be dismantled as follows, referring to **FIG 3:11**. Disconnect springs 2 and pull off lubricating felt 3, circlip 4, washer 5 and the cam assembly. Remove clips 6 and detach the centrifugal weights 7. Note that, if the holders or springs are renewed, the centrifugal advance curve should be checked on special equipment at a service station after the distributor is reassembled.

When servicing is complete, reassemble the distributor in the reverse order of dismantling, using a new grooved

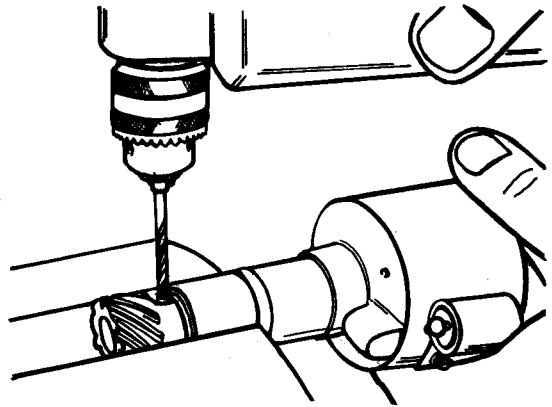


FIG 3:9 Drilling out grooved dowel pin

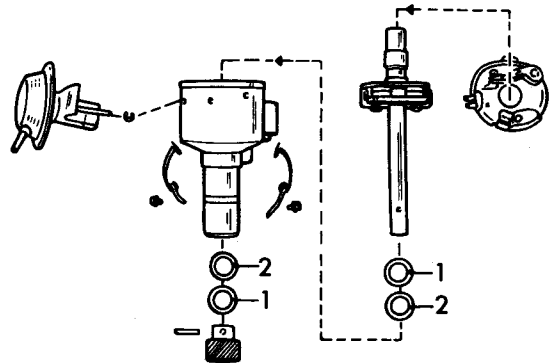


FIG 3:10 Distributor components

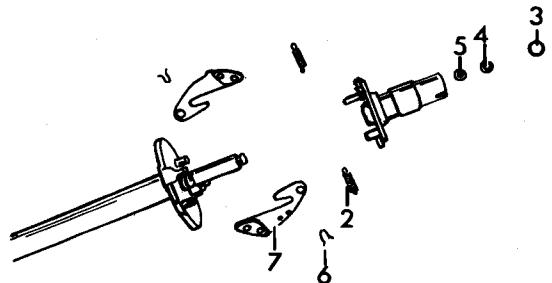


FIG 3:11 Centrifugal advance mechanism components, later models

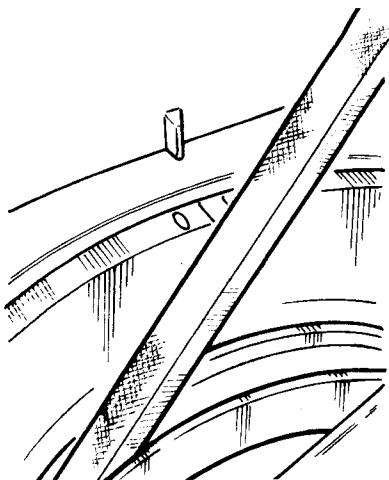


FIG 3:12 Aligning timing marks on vibration damper pulley

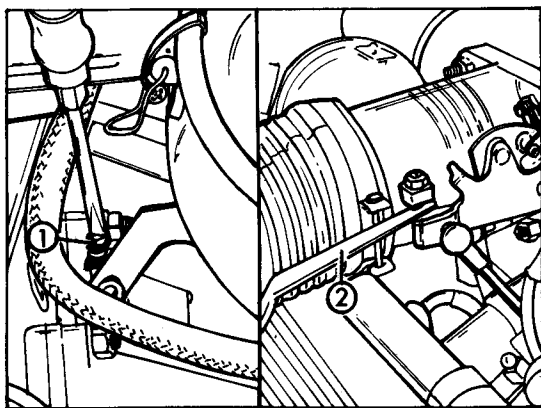


FIG 3:13 Raising idle speed with screw 1 (carburetters) or feeler 2 (fuel injection)

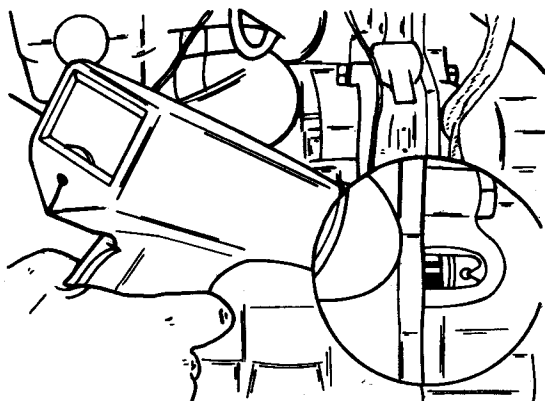


FIG 3:14 Checking timing with stroboscopic light

dowel pin to secure the gear to the shaft. Lightly lubricate the shaft with engine oil and the centrifugal weights with approved grease. On completion, adjust the contact points and lubricate the upper distributor components as described in **Section 3:2**, then refit the distributor as described in **Section 3:4**.

3:6 Timing the ignition

Static timing:

This method should be used to obtain a basic setting to allow the engine to be started and run up to normal operating temperature after servicing operations have been carried out. If the engine can be started and run, check the timing using the stroboscopic method described later.

Remove the distributor cap as described in **Section 3:2**. Make sure that the LT lead from the coil is properly connected at the distributor. Turn the engine until the centre timing mark on the crankshaft vibration damper pulley aligns with the pointer on the timing cover as shown in **FIG 3:12** and the mark on the rotor is aligned with the mark on the distributor body as shown in **FIG 3:5**. The pulley and rotor marks will align correctly once in every two engine revolutions. Slacken the distributor clamp bolt so that the distributor body can just be turned by hand.

Connect a 12-volt test lamp in parallel with the contact breaker points. One lead will connect to the terminal on the side of the distributor and one to earth. Turn the distributor body clockwise as far as possible to ensure that the contact points are fully closed. Now switch on the ignition and turn the distributor body very slowly in an anticlockwise direction until the lamp just lights. Without moving the distributor from this position, tighten the clamp bolt.

Disconnect the timing lamp and refit the parts removed, then start the engine and allow it to run until it reaches normal operating temperature. Check the timing by means of the stroboscopic method described next.

Stroboscopic timing:

This work requires the use of special stroboscopic light equipment which is wired into the ignition circuit for No 1 cylinder. If such equipment is not available, the work should be carried out by a service station. Run the engine until it reaches normal operating temperature. Refer to **FIG 3:4** and pull off vacuum hose **A** and, if fitted, vacuum hose **B**. Make sure that the contact points are clean and correctly set as described in **Section 3:2**. Connect up the stroboscopic timing lamp according to the instructions supplied with it.

Start the engine and allow it to idle. Refer to **FIG 3:13** and raise engine idle speed to 1700rev/min on carburettor engine by turning screw 1, or increase engine speed to 2500rev/min on fuel injection engine by using a feeler gauge 2 of suitable thickness between screw and stop.

Direct the timing light through the aperture provided in the flywheel or automatic transmission drive plate cover as shown in **FIG 3:14**. Turn the distributor body by hand until, for manual transmission models, the ball appears in exact alignment with the pointer as shown in the inset. On automatic transmission models, note that the long pin indicates ignition firing point, the short pin indicates TDC.

When the timing is correct, tighten the clamp bolt to secure the distributor body and make sure that the setting has not altered. On models with double acting vacuum unit, which can be recognised by provision of hose **B** shown in **FIG 3:4**, reduce the idle speed appropriately and check that at 1000rev/min the TDC mark is visible through the timing aperture.

On completion, switch off the engine and restore the ignition circuit to normal. Refer to **FIG 3:13** and slacken screw 1 on carburettor engines until there is a small amount of play between the shaft and the stop, or remove the feeler gauge 2 on fuel injection engine. Reconnect the hose or hoses removed from the distributor vacuum unit.

3:7 Sparking plugs

Sparking plugs should be of the recommended type, details of which are given in **Technical Data**. Inspect and clean the plugs regularly. When removing them, ensure that their recesses are clean and dry so that nothing can fall into the cylinders. Have the plugs cleaned on an abrasive blasting machine and tested under pressure with the electrode gaps correctly set at 0.6 to 0.7mm (0.024 to 0.028in). The electrodes should be filed until they are bright and parallel. The gaps must always be set by bending the outer electrode only. As a general rule, plugs should be cleaned and tested at about 6000 mile intervals and renewed at about 12,000 mile intervals, or before if badly worn.

The HT leads from the distributor to sparking plugs and coil should be examined for cracks and defective insulation. Renew any lead found to be defective in any way. Lead connectors are of the plug-in type.

3:8 Fault diagnosis

(a) Engine will not fire

- 1 Battery discharged
- 2 Contact breaker points dirty, pitted or maladjusted
- 3 Distributor cap dirty, cracked or tracking
- 4 Carbon brush in cap worn or stuck in mounting
- 5 Faulty cable or loose connection in LT circuit
- 6 Distributor rotor arm cracked
- 7 Faulty coil
- 8 Broken contact breaker spring
- 9 Contact points stuck open

(b) Engine misfires

- 1 Check 2, 3, 5 and 7 in (a)
- 2 Weak contact breaker spring
- 3 HT plug or coil lead cracked or perished
- 4 Loose sparking plug
- 5 Sparking plug insulation cracked
- 6 Sparking plug gap incorrect
- 7 Ignition timing too far advanced

(c) Poor acceleration

- 1 Ignition retarded
- 2 Centrifugal advance weights seized
- 3 Centrifugal advance springs weak, broken or disconnected
- 4 Distributor clamp bolt loose
- 5 Excessive contact points gap
- 6 Worn sparking plugs
- 7 Faulty vacuum unit or leaking hose

NOTES