

## **SECTION B**

### **THE IGNITION SYSTEM**

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# B

## THE IGNITION SYSTEM

### GENERAL DESCRIPTION

The automatic advance device is housed in the distributor unit, and it consists of a centrifugally and vacuum-operated mechanism by means of which the ignition is advanced in proportion to the engine speed and load.

Like the rest of the electrical equipment, the ignition is wired on the 'positive earth' system.

### Section B.1

#### LOCATING THE CAUSE OF UNEVEN FIRING

Start the engine and set it to run at a fairly fast idling speed.

Short-circuit each plug in turn by placing a hammer head or the blade of a screwdriver with a wooden or insulated handle between the terminal and the cylinder head. No difference in the engine performance will be noted when short-circuiting the plug in the defective cylinder. Shorting the other plugs will make uneven running more pronounced.

Having located the cylinder which is at fault, stop the engine and remove the cable from the terminal of the sparking plug. Restart the engine and hold the end of the cable about  $\frac{3}{8}$  in. (4.8 mm.) from the cylinder head.

If the sparking is strong and regular, the fault probably lies in the sparking plug. Remove the plug, clean, and adjust the gap to the correct setting, or alternatively fit a new plug (see Section B.11).

If there is no spark or if it is weak and irregular, examine the cable from the sparking plug to the distributor. After a long period of service, the insulation may be cracked or perished, in which case the cable should be renewed.

Finally, examine the distributor moulded cap, wipe the inside and outside with a clean dry cloth, see that the carbon brush moves freely in its holder and examine the moulding closely for signs of breakdown. After long service it may become tracked, that is, a conducting path may have formed between two or more of the electrodes or between one of the electrodes and some part of the distributor in contact with the cap. Evidence of a tracked cap is shown by the presence of a thin black line in the places indicated. A replacement distributor cap must be fitted in place of one that has become tracked.

### Section B.2

#### TESTING THE LOW-TENSION CIRCUIT

Spring back the securing clips on the distributor and remove the moulded cap and rotor. If the rotor is a tight fit, it can be levered off carefully with a screwdriver.

Check that the contacts are clean and free from pits, burns, oil or grease. Turn the engine and check that the

contacts are opening and closing correctly and that the clearance is correct when the contacts are fully opened to between .014 and .016 in. (.36 and .40 mm.).

Correct the gap if necessary.

Disconnect the cable at the contact breaker terminal of the coil and at the low-tension terminal of the distributor, and connect a test lamp between these terminals. If the lamp lights when the contacts close and goes out when the contacts open, the low-tension circuit is in order. Should the lamp fail to light, the contacts are dirty or there is a broken or loose connection in the low-tension wiring.

### Section B.3

#### LOCATING A LOW-TENSION CIRCUIT FAULT

Having determined, by testing as previously described, that the fault lies in the low-tension circuit, switch on the ignition, and turn the engine until the contact breaker points are fully opened.

Refer to the wiring diagram and check the circuit with a voltmeter (0–20 volts) as follows.

**NOTE.**—If the circuit is in order, the reading on the voltmeter should be approximately 12 volts.

- (1) **Battery to starter switch terminal.** Connect voltmeter to starter switch terminal and to earth. No reading indicates a faulty cable or loose connections.
- (2) **Starter switch to control box terminal 'A' (brown lead).** Connect a voltmeter to the control box terminal 'A' and to earth. No reading indicates a faulty cable or loose connections.
- (3) **Control box terminal 'A1'.** Connect a voltmeter to the control box terminal 'A1' and to earth. No reading indicates a fault in the series winding of the control box.
- (4) **Control box terminal 'A1' to terminal on ignition switch (brown with blue lead).** Connect a voltmeter to the ignition switch terminal and to earth. No reading indicates a faulty cable or loose connections.
- (5) **Ignition switch.** Connect a voltmeter to the second ignition switch terminal (white lead) and to earth. No reading indicates a fault in the ignition switch.
- (6) **Ignition switch to fusebox terminal 'A3' (white lead).** Connect the voltmeter to the fuse unit terminal 'A3' and to earth. No reading indicates a faulty cable or loose connections.
- (7) **Fuse unit terminal 'A3' to ignition coil terminal 'SW' (white lead).** Connect a voltmeter to the ignition coil terminal 'SW' and to earth. No reading indicates a faulty cable or loose connections.
- (8) **Ignition coil.** Connect a voltmeter to the ignition terminal 'CB' (white with black lead) and to earth.

No reading indicates a fault in the primary winding of the coil and a new coil must be fitted.

- (9) **Ignition coil to distributor (white with black lead).** Connect a voltmeter to the distributor low-tension terminal and to earth. No reading indicates a faulty cable or loose connections.
- (10) **Contact breaker and capacitor.** Connect the voltmeter across the breaker points. No reading indicates a fault in the capacitor.

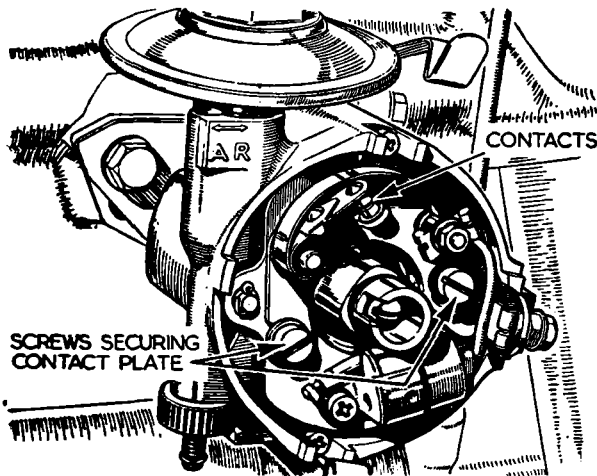


Fig. B.1

*The distributor with the cover and rotor arm removed, showing the contact breaker mechanism*

## Section B.4

### HIGH-TENSION CABLES

The high-tension cables must be examined carefully and any which have the insulation cracked, perished or damaged in any way must be renewed.

To fit the cables to the terminal of the ignition coil, thread the knurled moulded terminal nut over the lead, bare the end of the cable for about  $\frac{1}{4}$  in. (6 mm.), thread the wire through the brass washer removed from the original cable and bend back the strands over the washer. Finally, screw the terminal into the coil.

To make the connections to the terminals in the distributor moulded cap, first remove the cap and slacken the screws on the inside of the moulding till they are clear of the cables. Fill the holes in the distributor cap with Silicone grease, then cut the new cables off to the required length, push them completely home and tighten the securing screws.

The cables from the distributor to the sparking plugs must be connected up in the correct firing order, which is 1, 3, 4, 2. Screw them firmly to the suppressors.

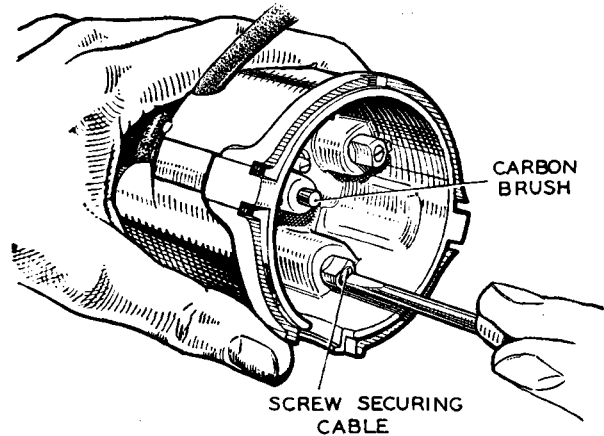


Fig. B.2

*The method of connecting H.T. leads*

## Section B.5

### CONTACT BREAKER

After the first 500 miles (800 km.) and subsequently every 6,000 miles (9600 km.) check the contact breaker as follows:

- (1) Turn the crankshaft until the contact breaker points are fully opened and check the gap with a gauge having a thickness of from  $\cdot014$  to  $\cdot016$  in. ( $\cdot36$  to  $\cdot40$  mm.). If the gap is correct, the gauge should be a sliding fit. Do not alter the setting unless the gap varies considerably from the gauge thickness.

To adjust the setting, keep the engine in the position which gives maximum opening of the contacts and then slacken the two screws securing the fixed contact plate. Adjust the position of the plate until the gap is set to the thickness of the gauge and then tighten the two locking screws.

Remember that the cam only keeps the contact points fully open over a very small angle and that care must be taken to ensure that the points are in the fully open position.

- (2) If the contacts are dirty or pitted, they must be cleaned by polishing them with a fine carborundum stone, and afterwards wiping them with a cloth moistened with petrol (gasoline). The moving contact can be removed from its mounting in order to assist cleaning. Check and adjust the contact breaker setting after cleaning the contacts.
- (3) Check that the moving arm is free on its pivot. If it is sluggish, remove the arm and polish the pivot pin with a strip of fine cloth. Afterwards clean off all trace of emery dust and apply a spot of clean engine oil to the top of the pivot. The

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contact breaker spring tension should be between 20 and 24 oz. (567 and 680 gm.) measured at the contacts.

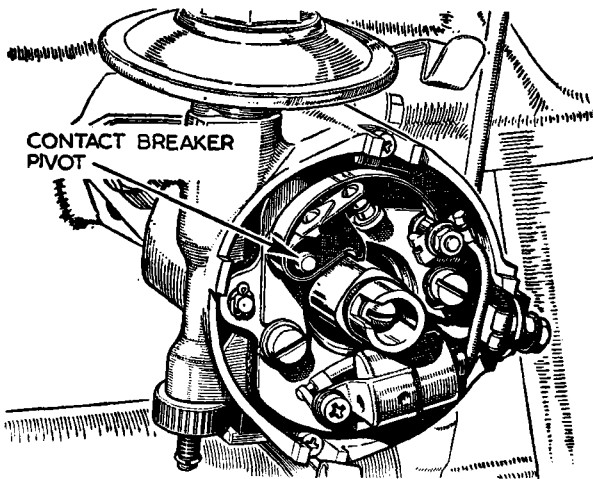


Fig. B.3

*The pivot for the moving contact point*

### Section B.6

#### REMOVING AND REPLACING THE DISTRIBUTOR

The distributor can be removed and replaced without interfering with the ignition timing, provided the clamp plate pinch-bolt is not disturbed.

To facilitate the replacement of the distributor, turn the engine over until the rotor arm is pointing to the segment in the cover for No. 1 cylinder plug lead to provide a datum for replacement.

Remove the distributor cover, and disconnect the low-tension lead from the terminal on the distributor. Disconnect the suction advance pipe at the union on the distributor.

Extract the two bolts securing the distributor clamp plate to the distributor housing and withdraw the distributor.

To replace the distributor, insert it into the distributor housing until the driving dog rests on the distributor drive shaft. The rotor arm should then be rotated slowly until the driving dog lugs engage with the drive shaft slots, both of which are offset to ensure correct replacement. Turn the distributor body to align the clamping plate holes with those in the housing. The remainder of the assembly is now in the reverse order to that of removal.

**NOTE.**—Provided that the crankshaft has not been turned the rotor arm will be opposite the segment for No. 1 plug lead. The high-tension leads can then be replaced on their respective plug terminals in the order of firing, i.e. 1, 3, 4, 2, remembering that the distributor rotation is anti-clockwise when viewed from above.

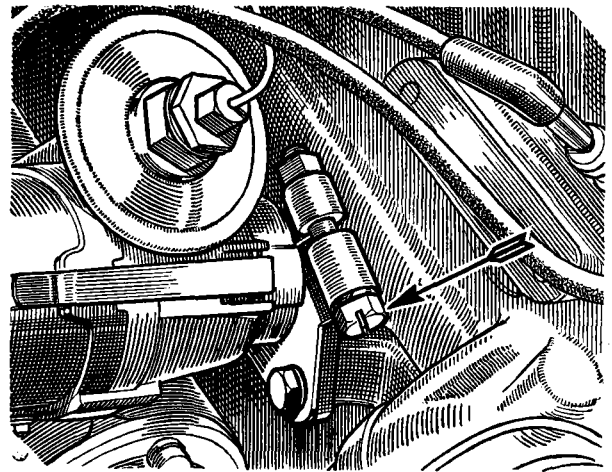


Fig. B.4

*Showing the distributor clamp bolt*

### Section B.7

#### STATIC IGNITION TIMING

Before timing the ignition refer to 'GENERAL DATA' for the correct setting.

To set the distributor in the correct position for firing, the following procedure should be followed:

- (1) Turn the crankshaft in the direction of rotation until No. 1 piston is at T.D.C. on its compression stroke. This can best be effected by turning the engine and observing the valves. When the valves are 'rocking' (i.e. exhaust just closing and inlet just opening) on No. 4 cylinder, No. 1 piston is approximately at T.D.C. on its compression stroke. If the crankshaft is now rotated until the notch in the

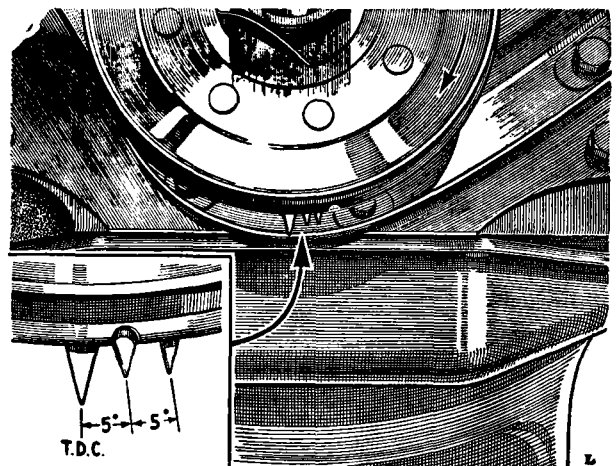


Fig. B.5

*The notch in the pulley approaching the T.D.C. position for pistons 1 and 4. The inset shows the timing set at 5° B.T.D.C.*

rear flange of the crankshaft pulley is in line with the long pointer on the timing cover or the dimples on the crankshaft and camshaft gears are in line, the piston is exactly at T.D.C. (see Fig. B.5).

- (2) Turn the crankshaft back until the mark on the pulley is in the correct position (see 'GENERAL DATA'). As a guide to this position the two short pointers on the timing cover are  $5^{\circ}$  and  $10^{\circ}$  B.T.D.C.
- (3) Set the contact breaker points to  $\cdot 014$  to  $\cdot 016$  in. ( $\cdot 36$  to  $\cdot 40$  mm.) when in their position of maximum opening.
- (4) Insert the distributor into its housing, and engage the drive dog lugs with the drive shaft slots (both of which are offset) by slowly rotating the rotor arm.
- (5) Screw in the two bolts securing the distributor clamp plate to the distributor housing.
- (6) Position the distributor so that the vacuum control unit side of the body is to the front and the unit is vertical.
- (7) Rotate the distributor body anti-clockwise until the points are fully closed. Then slowly rotate it in a clockwise direction until the points just commence to open. Secure the distributor body in this position by tightening up the clamp plate pinch-bolt and nut. Finally, check that the rotor arm is opposite the correct segment for the cylinder which is at the top of its compression stroke.

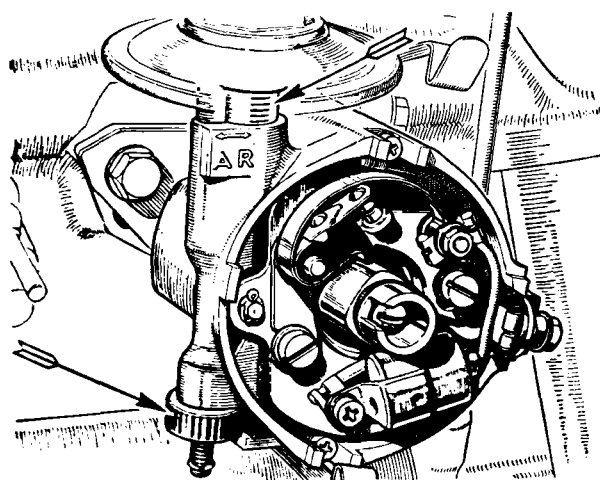


Fig. B.6

*The adjusting nut provided to give the ignition point micrometer control*

**IMPORTANT.**—To obtain an accurate setting an electrical method should be used to determine the actual position at which the points break, and the following method can be used.

With the low-tension lead connected to the distributor, turn on the ignition switch and connect a 12-volt

lamp in parallel with the contact breaker points (i.e. one lead from the distributor low-tension terminal and the other to earth) and turn the distributor as detailed in paragraph (7) until the lamp lights, which indicates that the points have just opened.

**NOTE.**—If the distributor drive gear assembly has been removed from the engine it should be refitted in accordance with instructions given in Section A.27 before the above operation is carried out.

Should a stroboscopic lamp be used, care must be taken that with the engine running the speed is low enough to ensure that the centrifugal advance weights are not in operation. If the vacuum advance take-off is direct from the induction manifold the take-off must be disconnected before attempting the timing check, otherwise engine timing will be retarded.

## Section B.8

### DISMANTLING THE DISTRIBUTOR

The contact breaker plate may be removed as an assembly to give access to the centrifugal weights without completely dismantling the distributor. To do this the rotor arm must first be removed and then the low-tension terminal nuts slackened to enable the slotted connector to be withdrawn from between the head of the terminal bolt and the insulating washer. Next take out the spring clip securing the suction advance unit arm to the plate and release the plate assembly by extracting the two screws which secure it to the distributor body.

Before completely dismantling make careful note of the positions in which the various components are fitted, so that they may be replaced correctly.

- (1) Remove the moulded cap.
- (2) Lift the rotor off the top of the spindle.
- (3) Remove the nut and washer from the moving contact anchor pin. Withdraw the insulating sleeve from the capacitor lead and low-tension lead connectors, noting the order in which they are fitted. Lift the moving contact from the pivot pin and remove the large insulating washer from the pivot pin and the small one from the anchor pin.
- (4) Take out the two screws, each with a spring and flat washer, securing the fixed contact plate, and remove the plate.
- (5) Take out the securing screw and remove the capacitor. Note that the earthing lead, which is attached to the same screw, passes under the capacitor to keep clear of the cams.
- (6) Remove the spring clip retaining the suction advance unit arm to the contact breaker base-plate. Extract the two screws securing the base-

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plate to the distributor body, noting that one also secures the earthing lead, and lift out the base-plate.

**IMPORTANT.**—Note the relative position of the rotor arm drive slot in the cam spindle and the offset drive dog at the driving end of the spindle, to ensure that the timing is not 180° out when the cam spindle is re-engaged with the centrifugal weights during assembly.

- (7) Remove the cam retaining screw and spindle.
- (8) Take out the centrifugal weights. These may be lifted out as two assemblies, each complete with a spring and toggle.
- (9) To release the suction advance unit, remove the circlip, adjusting nut and spring. Withdraw the unit.
- (10) To release the spindle from the body, drive out the parallel driving pin passing through the collar of the driving tongue member at the lower end of the spindle.

### Section B.9

#### CAPACITOR

The best method of testing the capacitor is by substitution. Disconnect the original capacitor and connect a new one between the low-tension terminal of the distributor and earth.

Should a new capacitor be necessary, it is advisable to fit a complete capacitor and bracket, but should a capacitor only be available, use a hot iron to soften the solder securing the defective capacitor to the bracket. Care must be taken not to overheat the new capacitor when soldering it in position. The capacity of the capacitor is .2 microfarad.

### Section B.10

#### REASSEMBLING THE DISTRIBUTOR

Reassembly is a direct reversal of the dismantling procedure given in Section B.8, although careful attention must be given to the following points:

- (1) As they are assembled, the components of the automatic advance mechanism, the distributor shaft, and the portion of the shaft on which the cam fits must be lubricated with thin, clean engine oil (Ref. F on page P.2).
- (2) Turn the vacuum control adjusting nut until it is in the half-way position when replacing the control unit.
- (3) When engaging the cam driving pin with the centrifugal weight, ensure that it is in the original position. When seen from above, the small offset of the driving dog must be on the right and the driving slot for the rotor arm must be downwards.

- (4) Adjust the contact breaker to give a maximum opening of .014 to .016 in. (.36 to .40 mm.).

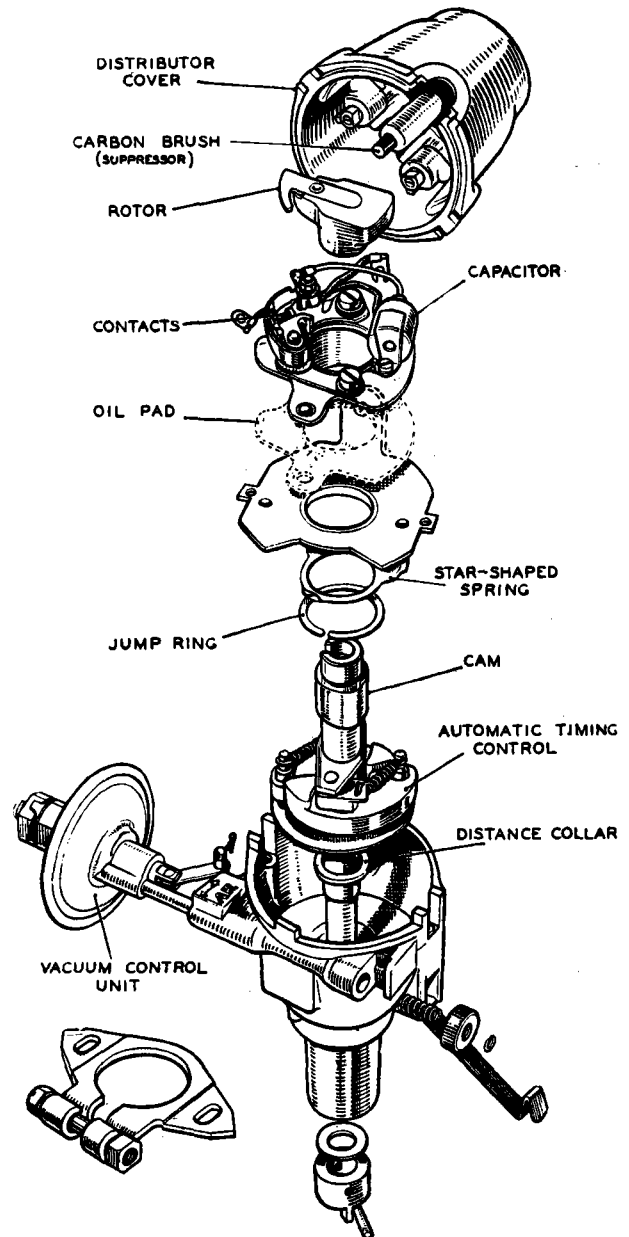


Fig. B.7

The component parts of the distributor

### Section B.11

#### SPARKING PLUGS

Inspect, clean, adjust and renew sparking plugs at the recommended mileage intervals (see 'MAINTENANCE ATTENTION').

When sparking plugs are removed from the engine their gaskets should be removed with them and replaced

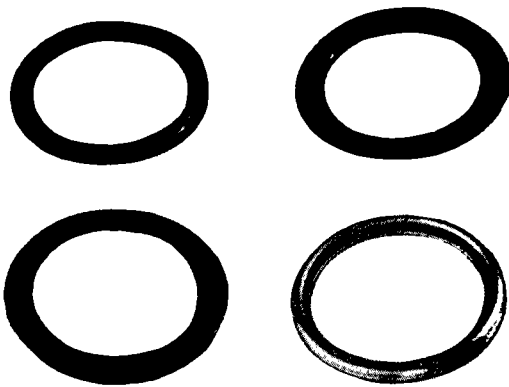
on the plugs, which should be placed in a suitable holder. It is advisable to identify each plug with the number of the cylinder from which it was removed so that any faults revealed on examination can be traced back to the cylinder concerned.

When examining the plugs, place a new plug of the same type beside the others to afford a ready comparison of the relative condition of the used plugs.

Examine for signs of oil fouling. This will be indicated by a wet, shiny, black deposit on the insulator. This is caused by oil pumping due to worn cylinders and pistons, or gummed-up or broken rings. Under such conditions, oil from the cylinder walls is forced up past the rings on the suction stroke of the piston, and is eventually deposited on the plugs.

A permanent remedy for this cannot be effected, the only cure being the fitting of a new piston and rings, or, in extreme cases, a rebore may be necessary.

Next examine the plugs for signs of petrol (gasoline) fouling. This is indicated by a dry, fluffy, black deposit which is usually caused by over-rich carburation, although ignition system defects such as a run-down battery, faulty distributor, coil or condenser defects, or a broken or worn-out cable may be additional causes. If the plugs appear to be suitable for further use, proceed to clean and test them.



*Fig. B.8*

*Showing plug gaskets in various conditions*

First remove the plug gaskets and examine them for condition. Gaskets in different conditions are illustrated in Fig. B.8. The upper left gasket was obviously not properly compressed, owing to the plug not having been tightened down sufficiently. A large proportion of the heat of the plug is normally dissipated to the cylinder head through the copper gasket between the plug and the head. Plugs not screwed down tightly can thus easily become over-heated so that they operate out of their proper heat range, thus producing pre-ignition,

short plug life and 'pinking.' On the other hand, it is unnecessary and unwise to tighten up the plugs too much. What is required is a reasonably good seal between the plug and the cylinder head.

The lower left-hand gasket clearly indicates that the plug was pulled down too tightly or has been in service too long. Note its distorted condition and the evidence of blow-by, which is also a cause of plug overheating.

The upper right-hand gasket demonstrates a gasket in good condition, providing an adequate seal and a good path for heat dissipation.

For comparison a new gasket is shown at the lower right-hand corner of Fig. B.8. If gaskets are at all questionable they should be replaced by new ones.

If the plugs require cleaning it is preferable to make use of a proper plug cleaner of the type recommended by the plug manufacturers, and the makers' instructions for using the cleaner should be followed carefully.

Occasionally a blistered insulator or a badly burnt electrode may be noticed when examining the plugs.

If the plug is of the type normally recommended for the engine and it was correctly installed (down tightly on the gasket), this condition may have been brought about by a very lean mixture or an overheated engine. There is, however, a possibility that a plug of another type is required, but as a rule the recommended Champion plug should be adhered to (see 'GENERAL DATA').

After cleaning carefully, examine the plugs for cracked insulators and wear of the insulator nose due to excessive previous cleaning. In such cases the plugs have passed their useful life, and new plugs should be installed.

Examine the insulator for deposits underneath the side electrode which have possibly accumulated and which act as a 'hot spot' in service.

After cleaning the plugs in a special cleaner, blow all surplus abrasive out of the body recesses, and off the plug threads, by means of an air-blast. Next examine the threads for carbon. Any deposits can be removed and the threads cleaned with a wire brush. A wire buffing wheel may also be utilised, but reasonable care must be used in both methods in order not to injure the electrodes or the tip of the insulator. The thread section of the plug body is often neglected when cleaning the plugs, owing to the fact that it is not generally realised that, like the gaskets, the threads are a means of heat dissipation and that when they are coated with carbon it retards the flow of the heat from the plug, producing overheating. This simple procedure will also ensure absence of binding on the threads on replacement and also avoid unnecessary use of the plug spanner.

When replacing a plug, always screw it down by hand as far as possible and use the spanner for final tightening only. Whenever possible use a box spanner to avoid possible fracture of the insulator.

Examine the electrodes for correct gap by inserting a feeler between them. Avoid an incorrect reading in the case of badly pitted electrodes. See 'GENERAL DATA' for the correct clearance.

Remember that electrode corrosion and the development of oxides at the gap area vitally affects the sparking efficiency. The special cleaner can remove the oxides and deposits from the insulator, but the cleaner stream does not always reach this area with full effect owing to

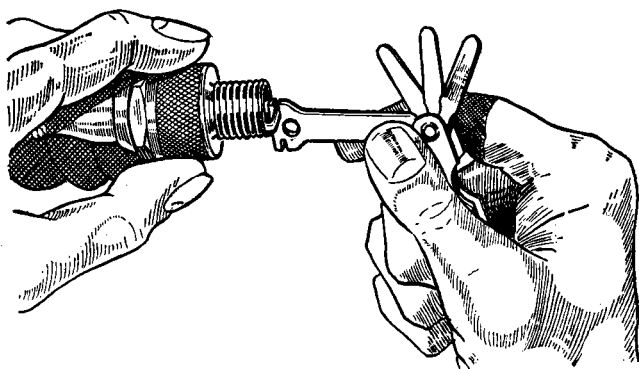


Fig. B.9

*Adjusting the plug gap with the Champion setting tool*

its location, and cannot necessarily deal with corrosion effectively as this sometimes requires too strong a blast for proper removal.

When plugs appear worthy of further use it is good practice to dress the gap area on both centre and side electrodes with a small file before resetting them to the correct gap. The intense heat, pressure, explosion shock, and electrical and chemical action to which the plugs are submitted during miles of service are so intense that the molecular structure of the metal points is eventually affected. Plugs then reach a worn-out condition and resetting the points can no longer serve a good purpose. When points are burnt badly, it is indicative that the plug has worn to such an extent that its further use is undesirable and wasteful.

Before replacing the plug in the engine, test it for correct functioning under air pressure in a plug tester, following out the instructions issued by the makers of the plug tester. Generally speaking, a plug may be considered satisfactory for further service if it sparks continuously under a pressure of 100 lb. per sq. in. (7 kg./cm.<sup>2</sup>) with the gap between the points set at .022 in. (.56 mm.). It is essential that the plug points should be reset to the correct gap (see 'GENERAL DATA') before the plug is refitted to the engine.

While the plug is under pressure in the tester, it should be inspected for leakage by applying oil round the terminal. Leakage is indicated by the production of air

bubbles, the intensity of which will serve to indicate the degree of leakage. The leakage gases have a 'blow-torch' effect when the engine is running which rapidly raises the temperature of the plug, raising it above its designed heat range, thus producing overheating, pre-ignition, and rapid electrode destruction.

The top half of the insulator is frequently responsible for poor plug performance due to the following faults: splashes; accumulation of dirt and dust; cracked insulators, caused by a slipping spanner; overtightness of the terminals.

Examine for a cracked insulator at the shoulder and the terminal post and remove any accumulations of dirt and dust.

### Section B.12

#### INTERFERENCE SUPPRESSORS

In order to reduce the interference with television reception to a minimum, all models are fitted with suppressors incorporated in the plug terminals of the high-tension leads.

Contrary to popular belief, these do not affect the ignition adversely.

### Section B.13

#### DM2.P4 PRE-TILT DISTRIBUTOR

The DM2.P4 distributor fitted to later cars has a pre-tilted contact breaker unit. The moving contact breaker plate is balanced on two nylon studs and the angle through which the plate may be tilted is controlled by a stud riveted to the moving contact breaker

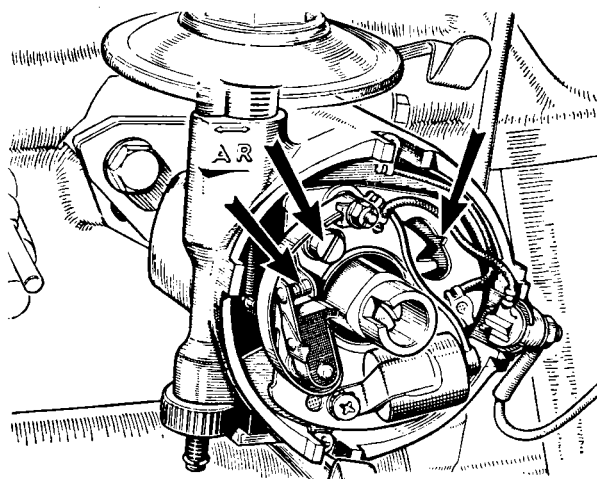


Fig. B.10.

*The DM2.P4 distributor with the cover and rotor arm removed, showing the contact breaker mechanism*



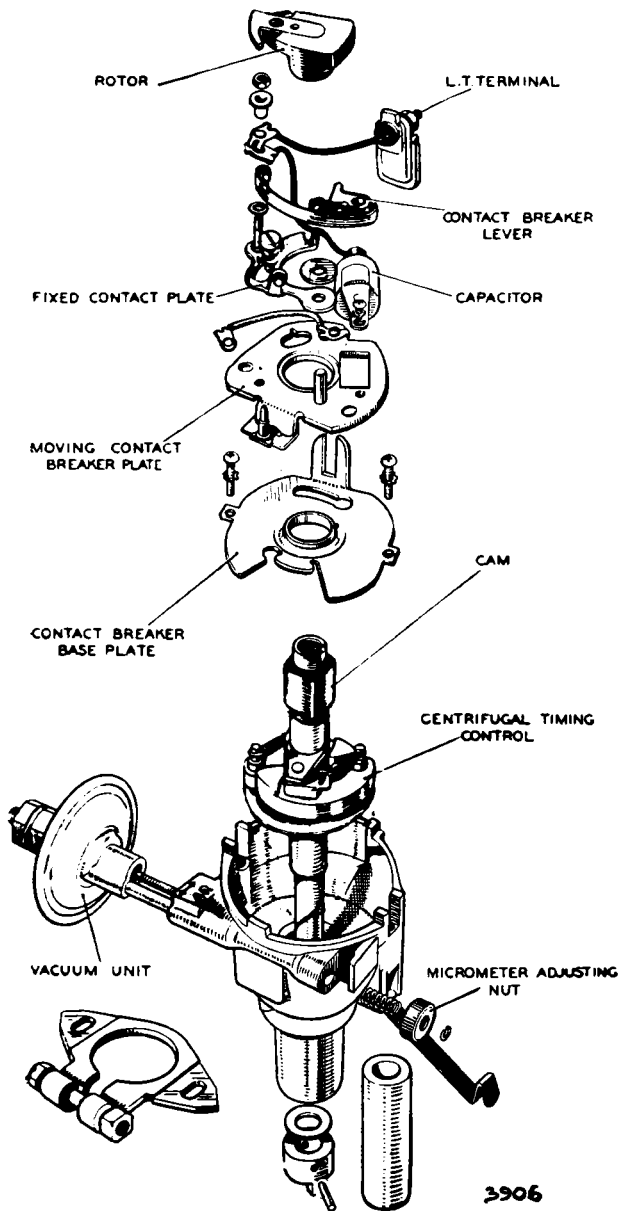


Fig. B.11

The component parts of the DM2.P4 distributor

plate locating in a slot in the base plate. The plate carrying the fixed contact is secured by one screw only (centre arrow, Fig. B.10) on the new units.

To adjust the contact breaker gap (left-hand arrow, Fig. B.10), turn the engine by hand until the contacts show the maximum opening. This should measure .014 to .016 in. (.356 to .406 mm.). If the setting is incorrect, slacken the securing screw and adjust the contact gap by inserting a screwdriver in the notched hole (right-hand arrow, Fig. B.10), and moving the plate

carrying the fixed contact. Turn clockwise to reduce the gap and anti-clockwise to increase the gap. Tighten the securing screw.

The base plate components are assembled with a special lubricant and no further lubrication is necessary during the normal service life of the distributor.

An improved version of the metalized capacitor is fitted and the eyelets on the cables connected to the contact breaker terminal post are squared and slotted to prevent them twisting round and short-circuiting against the distributor. A flexible actuating link connects the diaphragm in the vacuum unit with the moving contact breaker plate.

The new contact breaker base plates are not interchangeable with those of the previous type and, to avoid confusion, distributors incorporating the new base plate are issued under a new part number—1H811.

## Section B.14

### IGNITION VACUUM PIPE FUEL TRAP

At Engine No. 6625 a modified ignition vacuum pipe (Part No. 1H830) is fitted. A small trap which contains a fine-mesh gauze is incorporated in the pipe which will prevent fuel entering the vacuum control unit. The modified pipe may be fitted to earlier vehicles.

## Section B.15

### MODIFIED TYPE DM2 DISTRIBUTORS

A modified Type DM2 distributor incorporating a rolling weight centrifugal advance mechanism superseding the standard toggle type was introduced at Engine Nos. 16GC/U/H101 and 16GC/U/L101.

The rolling weight mechanism consists of a shaft and action plate with two action cams and two spring pillars riveted to the plate. Two rolling weights, each located by a boss on the under side of the cam foot, roll round the action plate cams and thus alter the position of the contact breaker cam relative to the distributor driving shaft when the distributor is rotating within the speed limits of centrifugal operation.

The rate of advance is controlled by springs anchored between the pillars on the action plate and two pillars on the cam foot. The maximum amount of advance is governed by the cam foot, which strikes one of the spring pillars when maximum advance has been reached.

The modified distributor is interchangeable with the previous model and the instructions for dismantling and assembly are given in Sections B.8 and B.10.

