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EQUIPMENT

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WORKSHOP INSTRUCTIONS

CAMSHAFT-SPEED MAGNETOS

MODELS
4VRA, 4VRS, 6VRA and 6VRS

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CAMSHAFT-SPEED MAGNETOS

MODELS 4VRA, 4VRS, 6VRA, 6VRS.

1. GENERAL

The magneto is arranged to be mounted in the same way as a distributor, and is driven at half engine-speed from the camshaft. A rotating magnet design is used, and in order to facilitate servicing the contact-breaker is of the standard pattern used in coil ignition distributors.

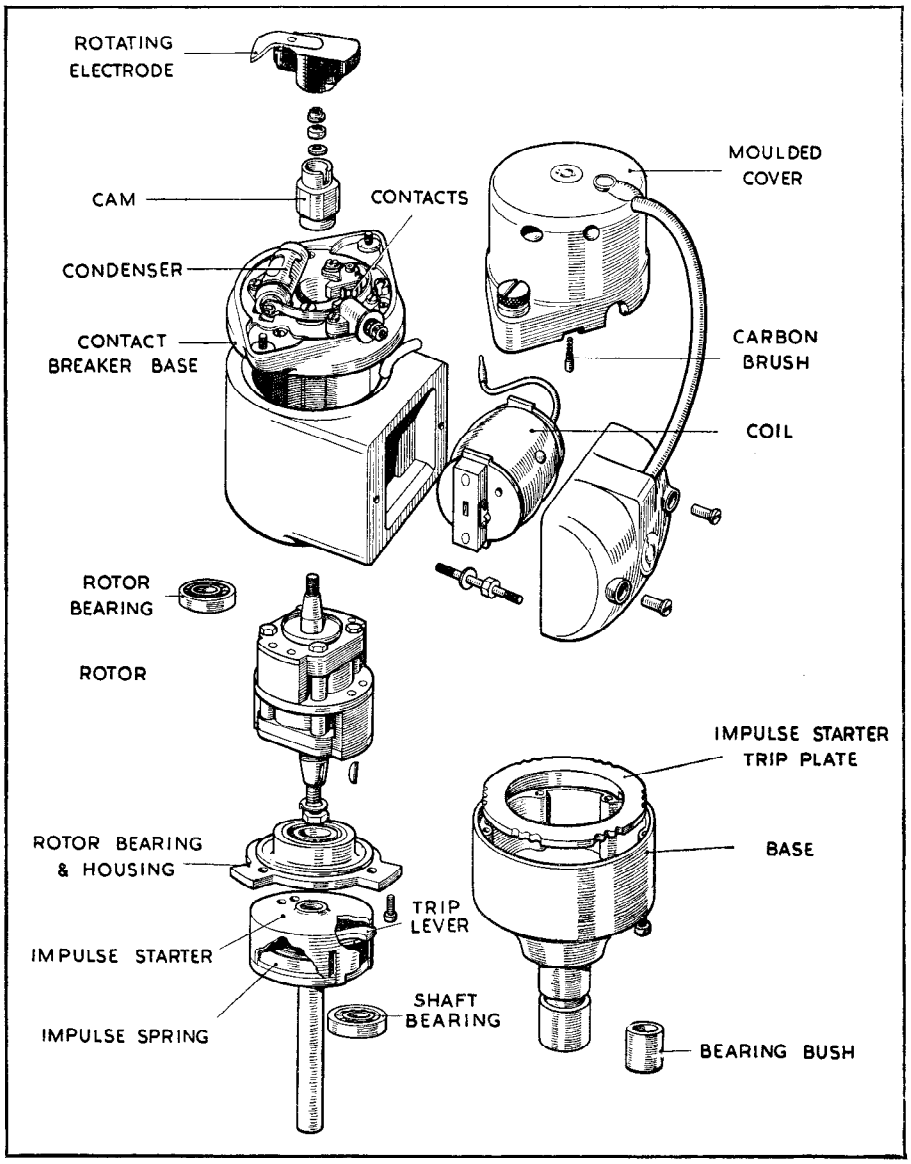

Fig. 1.
Magneto, model 4VRS, dismantled

The coil consists of a laminated core, around which are wound the primary or low tension and the secondary or high tension windings. The high tension winding is brought out to a terminal stud, from which the connection to the rotating distributor arm is made by means of a contact spring in the coil cover and a short length of rubber covered cable.

The engine drives the rotor, and by its rotation an alternating low tension current is induced in the primary winding. At the instant when this current is at or near a maximum, the lobe of the cam opens the contact breaker points, and a high voltage is induced in the secondary. At the same moment the rotor arm of the distributor connects the magneto to the sparking plug in the cylinder under compression, and the mixture is ignited.

The magneto is normally provided with horizontal high tension connections. Models 6VRA and 4VRA are fitted with a centrifugal automatic timing control, and Models 6VRS and 4VRS with an impulse coupling, which automatically provides retarded ignition at low speeds for greater ease of starting.

2. ROUTINE MAINTENANCE

In general, routine maintenance consists of cleaning, lubrication and the occasional adjustment of the contact breaker.

NOTE.—Take great care to prevent oil or grease getting on or near the contacts.

(a) EVERY 2,000 MILES, OR EVERY 75 RUNNING HOURS.

Models 4VRA and 6VRA : add a few drops of thin machine oil through the oiler in the base to lubricate the magneto shaft and the automatic timing control. The bearings of Models 4VRS and 6VRS are packed with grease, and need no other lubrication.

(b) EVERY 5,000 MILES, OR EVERY 200 RUNNING HOURS

Smear the cam with a little Mobilgrease No. 2. Place a spot of oil on the pivot on which the contact breaker lever works.

Thoroughly clean the moulded distributor cap, inside and out, with a soft, dry cloth, paying particular attention to the spaces between the metal electrodes. Ensure that the small carbon brush moves freely in its holder.

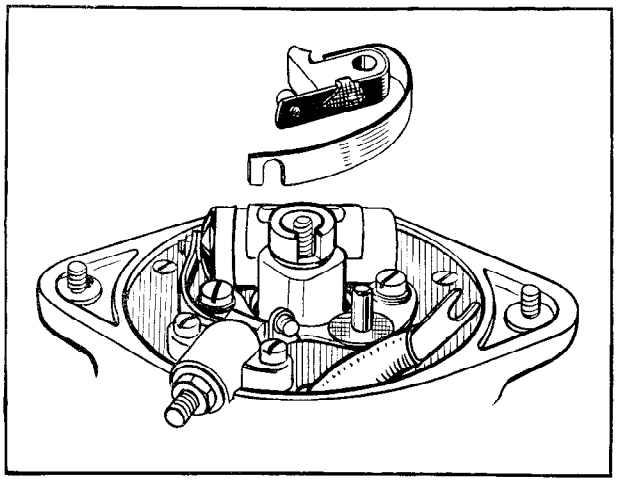

Fig. 2.
Removal of moving contact

Check the contacts for cleanliness and freedom from oil or grease. If they are burnt or blackened, clean them with fine emery cloth or a very fine carborundum stone and then wipe with a petrol moistened cloth. Cleaning is facilitated by removal of the moving contact. The contact breaker spring is slotted for this purpose.

After cleaning, check the contact breaker setting. Turn the engine by hand until the contacts show the maximum opening, which should measure ·010″ to ·012″, i.e., a gauge of this thickness should be a sliding fit between the contacts. If adjustment is necessary, keep the engine in the position giving maximum opening of the contacts and slacken the two screws securing the fixed contact plate. Move the plate until the gap is set to the thickness of the gauge. Tighten the screws firmly after adjustment.

Check the adjustment with other positions of the engine giving maximum opening.

Any necessity for over-frequent gap adjustment will usually be due to excessive wear of the heel of the contact breaker lever, resulting from lack of cam lubrication.

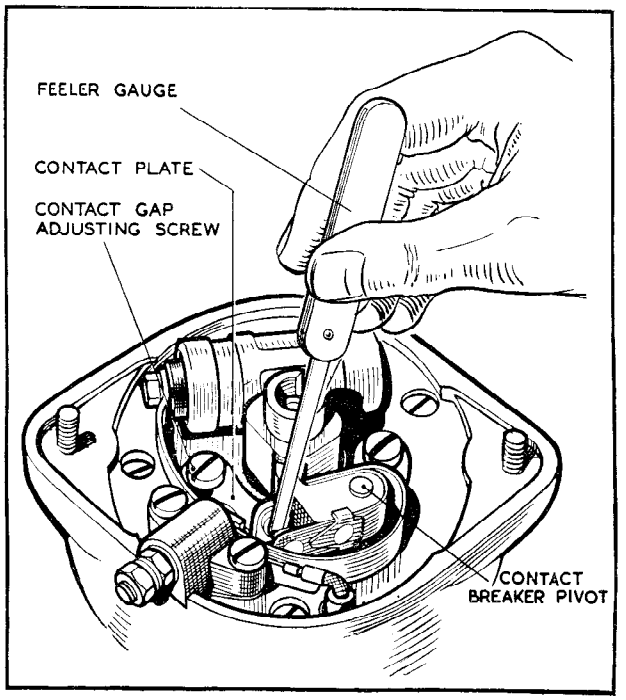

Fig. 3.
Checking the contact breaker gap

3. DESIGN DATA

	4 cyl. model	6 cyl. model
(a) Firing angles	0°, 90°, 180°, 270°, ± 1°	0°, 60°, 120°, etc., ± 1°
Contact breaker open period	55° ± 2°	36° ± 2°
Contact breaker closed period	35° ± 2°	24° ± 2°

(b) Contact breaker gap : 0·010″ to 0·012″.

(c) Contact breaker spring tension, measured at contacts : 20 — 24 ozs.

(d) Condenser capacity : 0·2 microfarad.

(e) Automatic timing control, when fitted : the operating range of this control varies with each model of engine to which the magneto is fitted, and no general figures can therefore be given.

(f) Impulse starter, when fitted : the impulse starter must operate regularly at speeds up to 75 r.p.m., but must not operate at speeds above 150 r.p.m.

(h) High speed test : no missing must occur at 3,000 r.p.m., using an 8 kV rotary gap.

(j) Low speed test : regular sparking must occur at 45 r.p.m. on a 5·5 mm. 3 point gap.

4. SERVICING

(a) TESTING IN POSITION TO LOCATE CAUSE OF UNEVEN FIRING

Run the engine at a fairly fast idling speed.

Short circuit each plug in turn with, say, the blade of an insulated screw-driver or a hammer-head, placed across the terminal to contact the cylinder-head.

Short-circuiting the defective plug will cause no noticeable change in the running note. On the others, however, there will be a pronounced increase in roughness. Having thus located the defective cylinder, stop the engine and remove the cable from the sparking plug terminal.

Restart the engine and hold the end of the cable about $\frac{3}{16}$" from the cylinder head. If sparking is strong and regular, the fault lies with the sparking plug, and it should be removed, cleaned and adjusted, or a replacement fitted. If, however, there is no spark, examine the cable from the plug to the distributor for deterioration of the insulation, renewing the cable if the rubber is cracked or perished.

To connect a new cable to the distributor moulding, cut the cable squarely to the required length. Loosen the securing screw from the inside of the cap, push the cable into the cap as far as it will go, and tighten the securing screw so that its point pierces right through the cable to make good contact with the core.

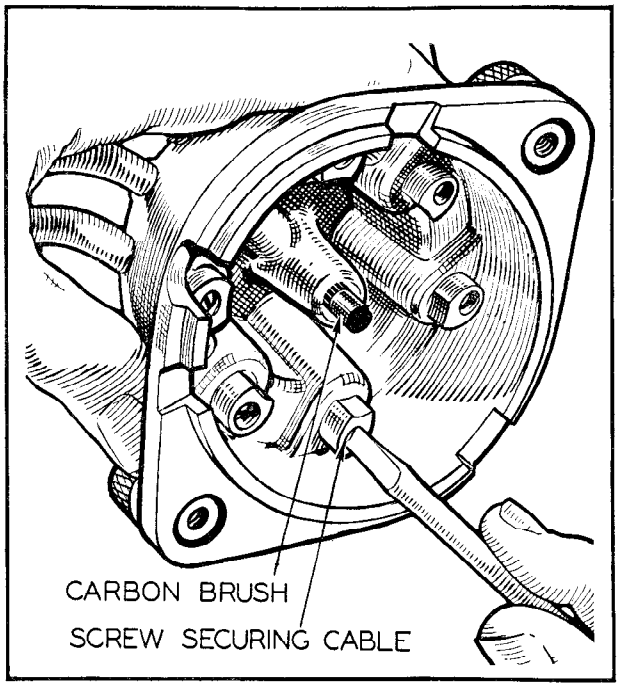

Fig. 4.
Connecting a new high tension cable

Clean and examine the distributor moulding, ensuring that the carbon brush can move freely. If tracking has occurred, indicated by a thin black line on the moulding, usually between two or more electrodes, a replacement moulding must be fitted.

If the magneto has been replaced recently, it may be incorrectly timed. Refer to the engine manufacturers' instructions.

(b) TESTING IN POSITION TO LOCATE CAUSE OF IGNITION FAILURE

Remove the moulded cap, and examine for dirt or oil, signs of tracking and condition of carbon brush. Examine the cable from the coil to the centre terminal of the distributor for cracked or perished insulation, renewing if necessary.

Lift off the rotor, carefully levering with a screwdriver if it is a tight fit.

Check the contacts for cleanliness and correct gap setting as described in Para. 2 above.

Check the tension of the contact breaker spring. The correct value is 20 — 24 oz., measured at the contacts.

Disconnect the lead to the switch from the low-tension terminal on the magneto body, and turn the engine. If the magneto now functions normally, inspect the lead and switch for an accidental short-circuit to earth.

CONDENSER

The possible causes of condenser trouble, and the symptoms by which each may be recognised, are :—

(*i*) Open circuit, indicated by excessive burning at the contacts.

(*ii*) Short circuit, indicated by complete failure of ignition and no sparking at contacts when the magneto is turned by hand.

(*iii*) Abnormally low insulation resistance, indicated by poor low speed performance, when the condenser becomes heated after a period of running.

It should be noted that loose or dirty connections to the condenser will produce the same symptoms as (*i*), and that in the case of (*iii*) the insulation resistance must fall to a very low value before ignition performance is appreciably affected.

The condenser is secured to the contact breaker base by means of a clip retaining screw and spring washer. Its connecting strip is slotted to enable it to be lifted off the terminal bolt.

(c) DISMANTLING

Disconnect the plug and low tension leads from the magneto, and remove from the engine.

Remove the distributor cover.

Lift off the rotor arm, first noting, in cases where an off-set driving dog is fitted, the position of the arm in relation to the driving dog.

Remove the driving dog or gear from the shaft.

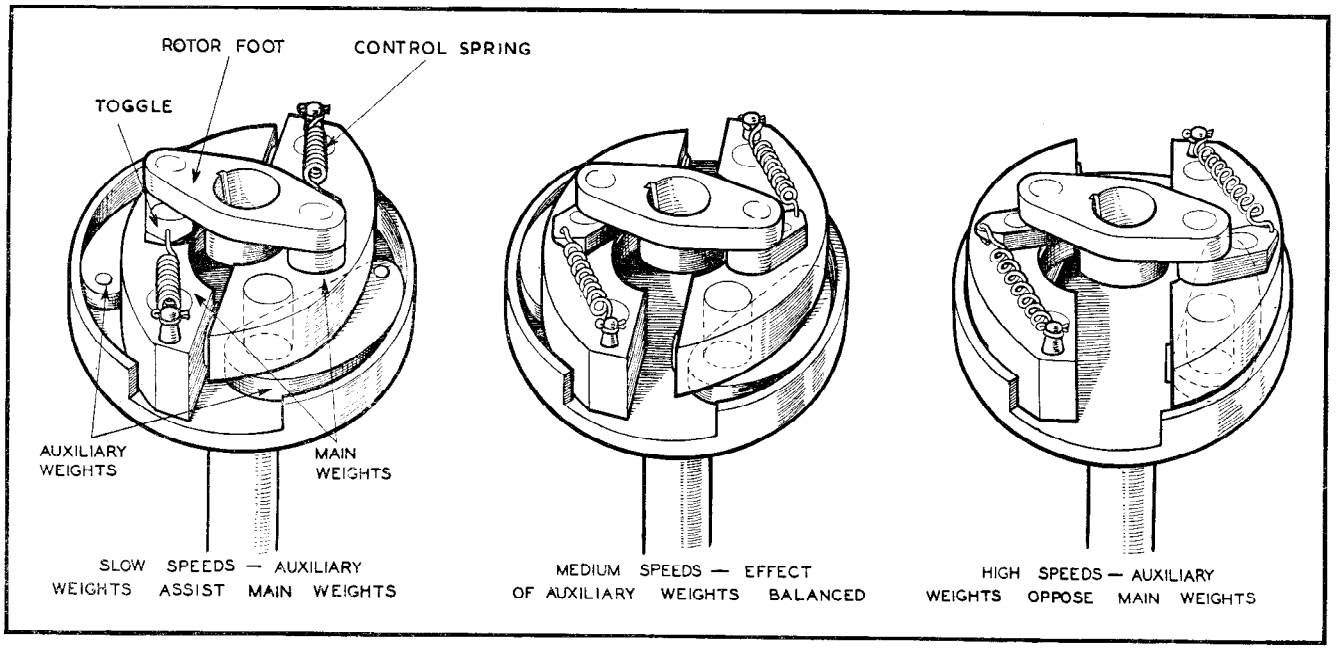

Fig. 5
Operation of automatic timing control

Mark the position of the magneto base, in relation to the body, by scribing a line across the joint between them. Remove the six base securing screws, or on some later models unscrew the six slotted nuts. Insert the magneto and lift off the base and shank : press down on the end of the shaft while doing this to prevent the shaft coming away with the base.

IMPULSE STARTER (MODELS 6VRS, 4VRS)

Note the method of assembly of the starter. Lift off the driving shaft, together with the impulse spring and drive plate, disengaging the end of the spring from the slot in the starter body. Knock back the tab washer, and unscrew the nut securing the impulse starter body.

AUTOMATIC TIMING CONTROL (MODELS 6VRA, 4VRA).

Note the arrangement of the automatic timing control, in order to be sure of reassembling it correctly. Lift off the shaft, together with the weights, springs and toggles of the automatic timing control. Knock back the tab washer, and unscrew the nut securing the rotor foot.

Unscrew the three screws that secure the housing of the lower rotor bearing : slide out the complete housing, rotor and cam assembly.

Do not remove the cam from the rotor unless the cam end bearing or the cam itself is to be replaced. If removal of the cam is necessary, note carefully the relation of the rotor location slot in the cam to the keyway in the drive end of the rotor shaft.

Slacken the low tension terminal nut, and lift off the slotted connecting tag soldered to the lead from the coil. Soften the solder with a hot iron and remove the tag.

CONTACT BREAKER

Take out the three screws securing the contact breaker base, which can then be removed complete with contacts, condenser, etc.

Lift the contact breaker spring off the terminal bolt, and remove the contact breaker lever. Lift the fibre washer from the pivot. Take out the screw and spring washer securing the condenser clip, and remove the condenser and its connecting strip. Unscrew the two screws that secure the fixed contact plate, together with their spring and plain washers, and remove the plate.

NOTE.—If the contacts are worn, a new set comprising both fixed and moving contacts must be fitted on reassembly.

Remove the moulded coil cover. Unscrew the two studs holding the coil in position, and remove the coil.

(d) BEARING REPLACEMENT

MAGNETOS INCORPORATING IMPULSE STARTER

The roller bearing at the upper end of the rotor can be pulled off with an extractor, after the cam and felt pad have been removed. The outer journal of the bearing can be removed by means of an expanding-collet type extractor.

The ball bearings at the lower end of the rotor and at the upper end of the shank can also be removed by means of an extractor.

Press out the bearing bush at the lower end of the shank, using a suitable mandrel.

The new bearings should be forced into position with a hand press or a drilling machine, taking care that all bearings are fitted squarely. In the case of the ball and roller bearings a suitable sleeve must be used, fitting over the shaft and locating on the inner journal of the bearing.

MAGNETOS INCORPORATING AUTOMATIC TIMING CONTROL

The roller and ball bearings of the rotor are removed and replaced as described above.

These magnetos have no ball bearing in the base, and are fitted instead with porous bearing bushes at top and bottom of the shank. These bushes can be removed and replaced by means of a hand press, using suitable mandrels.

NOTE.—Before a new bearing bush is fitted, it must be immersed in thin engine oil for 24 hours. In cases of emergency, this period may be reduced to 2 hours by heating the oil to 100°C. **The bushes must not be overbored by reamering or any other means, as this will impair the porosity and hence the effective lubricating quality of the bushes.**

(e) RE-ASSEMBLY

Reassemble the contact breaker, and secure to the magneto body by means of the three fixing screws.

Thread the low tension lead from the coil through its rubber sleeve, resolder the connecting tag and secure to the low tension terminal. Make sure that the insulation of this wire is not frayed.

Refit the coil, taking care that the high tension stud will make contact with the spring in the moulded coil cover, when the latter is fitted. Secure the coil with the two fixing studs ; the earthing tag on the coil must be firmly held under one of the studs.

Pack the rotor bearings with high melting point grease, and refit the cam, rotor and bearing assembly into the body of the magneto. The brass bearing housing must be so fitted that, with the coil uppermost and looking at the driving end of the shaft, the narrowest of the three lugs on the housing is on the right of the bearing.

CAM TIMING

If the cam has been removed from the rotor assembly, the following replacement procedure must be adhered to in order to ensure correct timing of the cam with respect to the rotor.

(*i*) Refit the cam to the rotor in approximately its original position relative to the keyway in the drive end of the rotor shaft. Do not tighten the fixing nut.

(*ii*) Set the contact breaker gap to ·010″ to ·012″ at its maximum opening.

(*iii*) Place a ·086″ (2·1 mm.) gauge (i.e. a No. 44 drill shank), between the trailing edge of the rotor and the pole tip. The gauge is most easily inserted through the aperture at the top of the coil. Clamp the gauge in position by turning back the rotor.

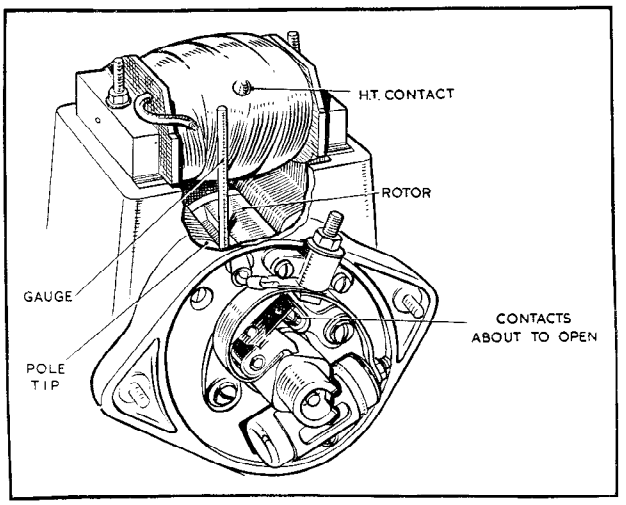

Fig. 6.
Timing the contact breaker

(*iv*) **Adjust the cam until the contacts are just about to break,** i.e. the slightest movement of the rotor in the correct direction of rotation results in the contacts opening.

(*v*) Tap the cam home and tighten the fixing nut and lock nut.

The diagram shows the timing position for a four-cylinder, anti-clockwise rotation magneto. (Note that direction of rotation always refers to the driving end view of the magneto). Six-cylinder models have a six lobe cam, but the timing procedure is still as detailed above. Clockwise rotation machines are timed in the same manner, but the gauge must obviously be inserted between the rotor and the opposite pole piece to that shown in the diagram, and the contact breaker heel will be on the reverse face of the cam lobe.

Remagnetise the magneto using a pot-type magnetiser.

NOTE.—This must always be done **before** reassembling the automatic timing control, or impulse starter.

The reassembly of the impulse starter or automatic timing control, whichever is fitted, are dealt with separately. It is especially important to ensure that the impulse starter fitted to models 4VRS and 6VRS is correctly assembled and timed, as this will greatly affect the low speed performance of the magneto.

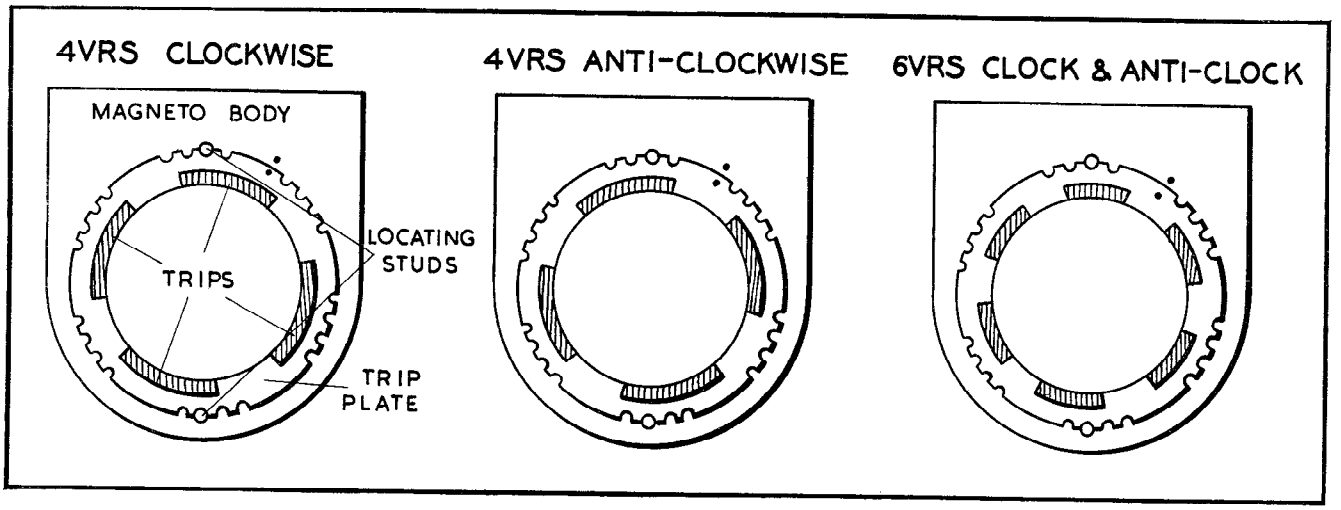

Fig. 7.
Positioning the trip plate

REASSEMBLY OF IMPULSE STARTER

Refit the impulse starter body on to the rotor shaft, taking care that it engages correctly with the key on the shaft, and secure by fitting the tab washer and nut. To ensure the correct positioning of the trip plate and as a guide in fitting the base, two locating studs are required : they should be approximately 2″ long, and threaded 3 B.A. at one end. Two base fixing screws, with the heads reduced to the diameter of the shank, will serve. (In some models the base is secured by means of six threaded studs, screwed into the body of the magneto : the temporary locating studs will obviously be unnecessary in such cases). Screw the two studs into diametrically opposite holes in the magneto body. Place the trip plate so that the slots in the circumference of the plate fit over the studs, and the dot marked on the plate corresponds with the similar dot on the body.

In certain earlier models, this dot may not be marked: in such cases fit the trip plate as shown in Fig. 7 for the appropriate model of magneto.

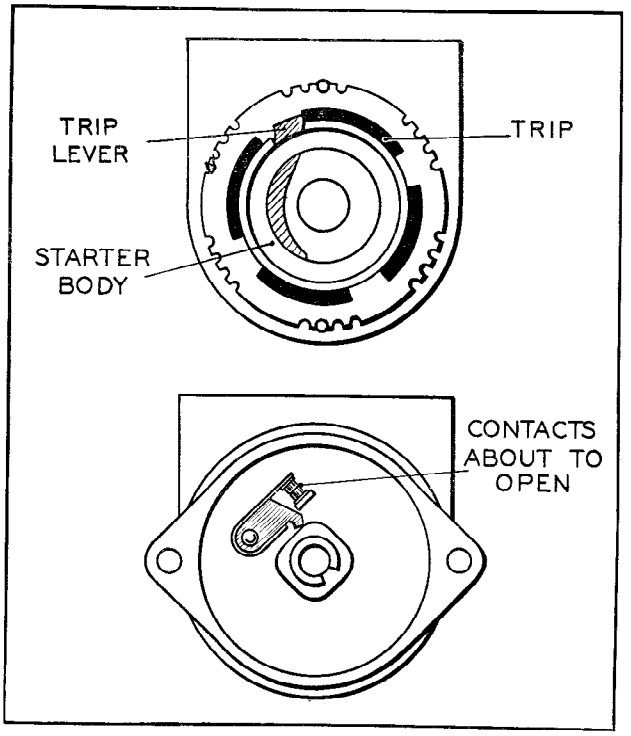

Fig. 8.
Timing the impulse starter

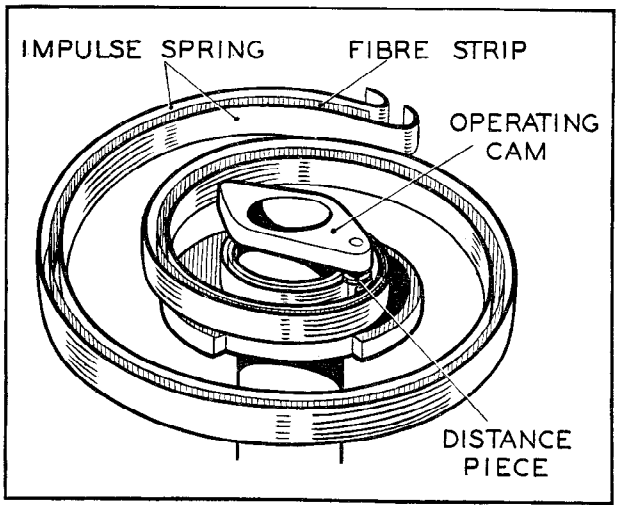

Fig. 9.
The impulse starter spring

Turn the body of the impulse starter in the direction of rotation until one trip lever engages with a trip. In this position the contacts should be just about to break. If necessary, move the trip plate, one notch at a time, until this condition is obtained.

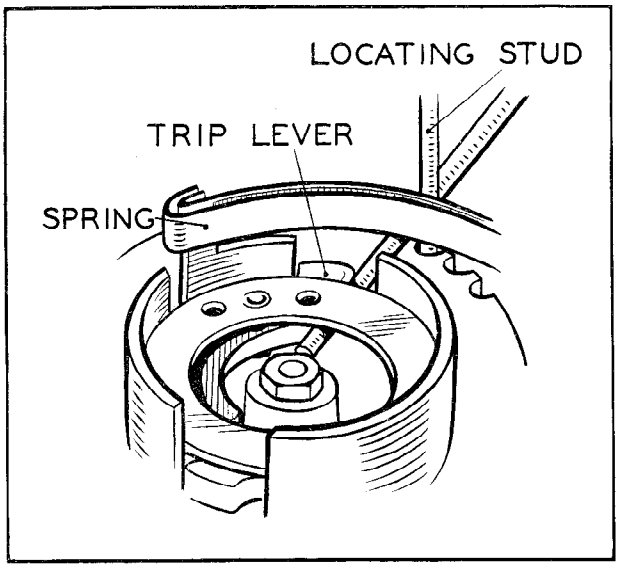

Fig. 10.
Fitting the impulse spring

The correct position of contacts and trip lever for a 4VRS clockwise-rotation magneto is shown below.

Finally check the position of the trip plate by releasing the trip lever and turning the body in the direction of rotation. The contacts must have separated when the leading edge of the trip lever is $\frac{1}{8}$" to $\frac{1}{4}$" under the trip. Further adjustment of the trip plate may be necessary to achieve this.

If it is necessary to fit a new impulse spring, the old spring can be removed by unscrewing its fixing screw from the underside of the drive plate. (Note the position of the small distance piece).

Soak the fibre strip in oil and place in position between the leaves of the new spring.

Thread the spring over the cam on the drive plate, and refit the fixing screw and distance piece. See that the spring is fitted so that it winds up when the shaft is turned in the direction of rotation.

Hold the magneto body lightly in a vice, base uppermost. Lock the impulse starter body by inserting a steel rod or similar wedge between one of the trip levers and a locating stud. Hook the outer end of the spring into the narrow slot in the impulse starter body, and wind up the spring until the projection on the body engages with the recess in the drive plate.

Pack the ball race in the base with high melting point grease. Slide the base over the two locating studs, taking care that the marks scribed across the joint when dismantling now coincide. Secure by fitting two or more of the fixing screws.

Remove the locating studs and fit the remaining fixing screws ; tighten all the fixing screws securely.

Refit the driving dog, coil cover, rotor arm and distributor cap.

REASSEMBLY OF AUTOMATIC TIMING CONTROL

Fit the rotor driving foot on to the shaft, taking care that it does not ride over the key, and secure with the tab washer and nut.

Assemble the main weights, auxiliary weights, springs and toggles on to the action plate. See that the brass washers are in position under the toggles.

Support the magneto in an inverted position, and engage the pins on the rotor foot with the holes in the toggles. Place the fibre washer over the shaft.

Slip the base and shank over the shaft, and press into position, taking care that the reference marks scribed across the joint now coincide. Fit the six fixing screws and tighten down securely.

Refit the driving dog, coil cover, rotor arm and distributor cap.

NOTE.—When fitting driving dogs or gears, great care must be taken that the driving shaft is not forced endways in driving on the dog. A tapped hole is provided in the end of the shaft so that by inserting a bolt the shaft can be supported while driving on the dog.