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LUCAS

Quality

EQUIPMENT

VOLUME 2

WORKSHOP INSTRUCTIONS

MAGNETOS

MODELS 4VR, 4VRA, 4VRS, 6VR, 6VRA, 6VRS and 8WRSF

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MAGNETOS

MODELS 4VR, 4VRA, 4VRS, 6VR, 6VRA, 6VRS and 8WRSF

1. GENERAL

Magnetos in this range are suitable for vertical, horizontal and off-vertical mounting, and may be screened or unscreened. Screened magnetos incorporate a standard magneto fitted with a metal cover and screened cables. The magnetos are driven at half engine speed by the engine cam-shaft to which they are coupled by a dog coupling or an engine engagement gear.

Four-cylinder and six-cylinder models employ a single contact breaker, while model 8WRSF has a twin contact breaker.

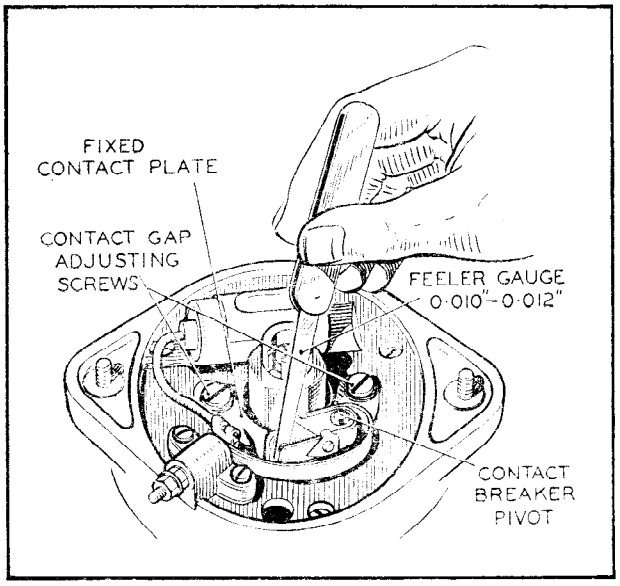

Fig. 1.
Checking the contact breaker gap

HOW THE MAGNETO WORKS

The magneto shaft, permanent magnet and laminated pole shoes form an assembly known as the rotor. This, supported on bearings, rotates between a pair of laminated pole pieces in the stator. These stator pole pieces are bridged by the laminated core of a coil having a primary winding of relatively few turns of thick wire and a secondary winding of many turns of fine wire. A contact breaker is arranged to interrupt the primary circuit at the instant a spark is required.

The rotor is driven by the engine and this rotation produces an alternating magnetic field in the laminated iron core of the coil. This field induces low tension alternating voltages in the primary and secondary windings of the coil. The magnetic field due to current flowing in the primary winding opposes any change in direction of the magnetic field in the laminated iron core. In this way, field reversal due to the rotating magnet is delayed until the contact breaker opens. At this instant, the restraining influence of the primary winding is removed and the consequent rapid reversal of the magnetic field, linked with the coil, causes a high voltage to be induced in the secondary winding.

This high voltage is taken to a rotating electrode and distributed to each plug in turn.

AUTOMATIC TIMING CONTROL (WHEN FITTED)

An automatic timing control is a centrifugally operated mechanism enabling an angular movement of the magneto rotor to occur relative to the drive. The mechanism consists of two members flexibly coupled by pivoted spring-loaded governor weights and toggles. At low engine speeds and during starting, the weights are held in by spring tension. As the engine speed increases, the governor weights swing out and advance the rotor relative to the drive.

An automatic timing control improves the performance of an engine by advancing the spark as the engine speed increases.

IMPULSE STARTER (WHEN FITTED)

An impulse starter consists of two members flexibly coupled by a clock type spring. One member is secured to the magneto shaft, while the other carries the driving dogs or engine engagement gear. When the engine is cranked, that member secured to the magnto shaft is at first prevented from turning by a trip lever. The coupling spring is therefore wound up until a projection on the driving member trips the lever. The magneto rotor is then rapidly accelerated through the sparking position. This sequence is repeated until the engine starts and the levers are held out of engagement by centrifugal force.

An impulse starter improves the low speed performance and hence facilitates manual starting of the engine, by increasing the spark intensity and delaying the instant of sparking.

SPEED LIMITER (WHEN FITTED)

A speed limiter is a spring-loaded governor fitted to the rotating electrode. As the engine speed increases the governor arm swings out until, at a predetermined

speed, it short circuits to earth the high tension current from the distributor.

The speed limiter is arranged to operate at a predetermined speed between 700 r.p.m. and 3,000 r.p.m. with a tolerance of ±50 r.p.m.

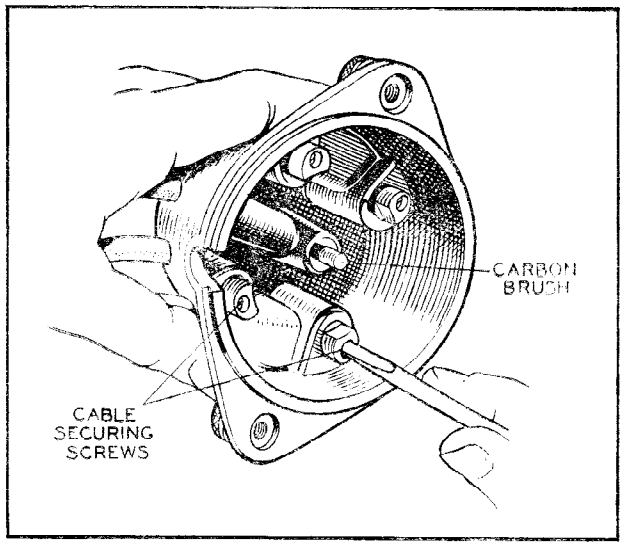

Fig. 2.
Connecting high tension cable to cover having horizontal outlets

2. ROUTINE MAINTENANCE

(a) AFTER THE FIRST 500 MILES OR AFTER 20 RUNNING HOURS

During the first 500 miles or the first 20 hours' running of a new magneto or replacement contact breaker set, most of the bedding down of the contact breaker heel occurs. The contact breaker setting should therefore be checked and, if necessary, reset as described in para. 2 (e).

(b) EVERY 2,000 MILES OR EVERY 80 RUNNING HOURS

On models 4VRA and 6VRA, remove the lubricator plug in the magneto base and add enough thin machine oil to bring the oil level to the lubricator plug.

Do not lubricate models 4VRS, 6VRS and 8WRSF as this can impair the operation of the impulse starter at low temperatures.

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

(i) Clean the outside of the magneto and the high tension cables with a clean fluffless cloth.

(ii) Slacken the two securing nuts and remove the moulded distributor cover.

(iii) Wipe the inside of the cover, and the spaces between the electrodes, with a clean fluffless cloth.

(iv) Ensure that the small carbon brush moves freely in its holder.

(v) Examine the contact breaker. Ensure that the contacts are smooth and clean, and that the gap is correctly set. If necessary, proceed as described in para. 2 (*d*) and 2 (e).

(vi) Apply a spot of clean engine oil to the visible end of the contact breaker pivot post.

(vii) Smear a little Mobilgrease No. 2 on the cam. If a felt-pad cam lubricator is fitted, apply a smear of Mobilgrease No. 2 to the pad.

(*d*) CLEANING CONTACT BREAKER

(i) Slacken the contact breaker spring securing nut and withdraw the spring and lever.

(ii) Polish rough or pitted contacts with a fine carborundum stone, silicon carbide paper or emery cloth.

(iii) Clean the contacts using a cloth moistened with petrol or methylated spirits (de-natured alcohol).

(iv) Refit the contact breaker.

(e) CHECKING CONTACT BREAKER SETTING

(i) Crank the engine until the contacts are fully open.

(ii) Insert a 0.010″—0.012″ feeler gauge in the gap. If the gap setting is correct the gauge will be a sliding fit. If necessary, slacken the two screws securing the fixed contact plate and move the plate until the gap is set to the gauge. Tighten the securing screws.

(*f*) EVERY 1,000 RUNNING HOURS

Remove the contact breaker lever from the pivot post and smear the post with Mobilgrease No. 2.

(*g*) EVERY 2 YEARS

About every two years, or when the engine is overhauled the magneto should be dismantled, as described in para. 4, and the ball and roller bearings re-packed with grease.

(*h*) REPLACEMENT OF HIGH TENSION CABLES

Occasionally inspect the high tension cables and replace any which have cracked or damaged insulation. Replacement for unscreened cables must be 7 mm. (p.v.c.-covered or neoprene-covered) rubber insulated ignition cable. A defective screened cable must be renewed complete with braiding.

(i) *Covers having horizontal outlets:*

Slacken the cable securing screw located inside the distributor cover, see Fig. 2.

Remove the original cable.

Cut the replacement cable at the required length.

Push the cable fully home in the outlet hole and tighten the cable securing screw.

The cable connection at the centre terminal is made accessible by removing the carbon brush.

(ii) *Covers having vertical outlets:*

Withdraw the moulded terminal from the distributor cover.

Remove the split washer from the original cable. Pass the replacement cable through the moulded terminal and bare about $\frac{1}{4}$" of the end of the cable. Thread the cable core through the split washer and bend back the strands.

Screw the moulded terminal into the distributor cover.

3. TEST DATA

(a) *Cam timing*	4VR, 4VRA and 4VRS	6VR, 6VRA and 6VRS	8WRSF
Firing angles:	0°, 90°, 180° etc. ±1°	0°, 60°, 120° etc. ±1°	0°, 45°, 90° etc. ±1°
Contact Breaker Open Period:	55°±2°	36°±2°	28°±2°
Contact Breaker Closed Period:	35°±2°	24°±2°	17°±2°

(b) *Contact breaker gap:*

0.010"—0.012".

(c) *Contact breaker spring tension:*

18—24 oz.

(d) *Capacitor:*

0.18—0.23 microfarad.

(e) *High speed test:*

Regular sparking should occur on a rotary gap set at 8 kv. with a load of 2.5 micromhos, at 3,000 r.p.m. for all model VR magnetos and at 2,500 r.p.m. for model 8WRSF. If a speed limiter is fitted, it must be replaced with a normal rotating electrode for the purpose of this test.

(f) *Low speed test:*

Models 4VR, 4VRA, 6VR and 6VRA should spark with no missing at 65 r.p.m. on a 5 mm. 3-point spark gap.

Models 4VRS, 6VRS and 8WRSF should give regular sparking on a 7 mm. 3-point spark gap at all speeds at which the impulse starter operates.

(g) *Impulse starter:*

The impulse starter should operate regularly at speeds up to 75 r.p.m. and have cut out completely at a maximum speed of 200 r.p.m.

NOTE: When a magneto is mounted other than vertically, the cut-out speed will rise; at an angle of 45° from the vertical the maximum speed at cut out can be 220 r.p.m. (approx.).

(h) *Automatic timing control and speed limiter:*

Refer to Lucas Publication SB222 against the appropriate Magneto Service No. for test data.

4. SERVICING

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

(i) Run the engine at a fairly fast idling speed.

(ii) Disconnect or short circuit each plug in turn. Disconnecting or short circuiting an inoperative plug will cause no noticeable change in the engine running note. If however the plug is operating correctly, the engine note will increase in roughness.

(iii) Stop the engine and, if necessary, remove the cable from the terminal of the inoperative plug.

(iv) Restart the engine and hold the end of the cable $\frac{3}{16}$" from the cylinder head.

If sparking is strong and regular, the sparking plug must be removed, cleaned and adjusted or a replacement plug fitted. If sparking is not strong and regular, examine and renew the cable as described in para. 2 (h).

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

(i) If the magneto has recently been refitted, it may be incorrectly timed. Refer to the engine manufacturer's instructions and check.

(ii) Check the contact breaker for cleanliness and correct contact gap setting as described in para. 2.

(iii) If a remote cut-out switch is fitted, disconnect the switch cable at the low tension terminal on the magneto body, and crank the engine. If the magneto now functions correctly, inspect the cable and switch for a short circuit to earth.

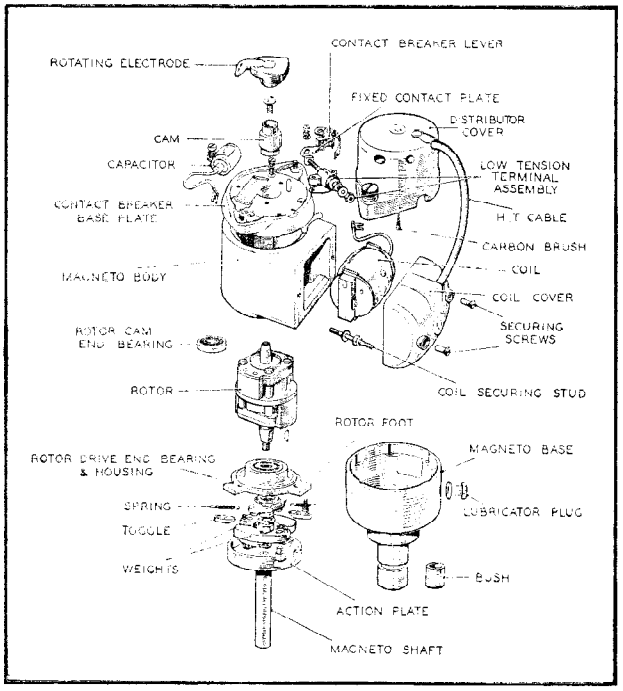

Fig. 3.
Model 4VRA dismantled

(c) CHECKING CAPACITOR

The possible causes of capacitor 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 the contacts when the magneto is turned by hand.

(iii) Abnormally low insulation resistance when the magneto has warmed up, indicated by poor low speed performance.

It should be noted that loose or dirty connections to the capacitor will produce the same symptoms as (i), and that in the case of (iii) the insulation resistance must fall to less than 1 megohm before ignition performance is appreciably affected.

The capacitor is secured to the contact breaker base by means of a screw and spring washer.

If the cause of faulty operation cannot be traced from the foregoing checks, the magneto should be removed from the engine for dismantling.

(d) DISMANTLING

(i) Disconnect the high tension cables at the plug terminals.

(ii) Slacken the low tension terminal securing nuts and remove the low tension cable.

(iii) Withdraw the two slotted securing screws and remove the coil cover.

(iv) Slacken the securing nuts and remove the distributor cover.

(v) Remove the rotating electrode and, if fitted, the contact breaker cover plate.

(vi) Withdraw the capacitor securing screw or contact breaker spring securing nuts and withdraw the capacitor and contact breaker lever.

(vii) Withdraw the securing nuts and remove the fixed contact plate and washer.

(viii) Soften the solder with a hot iron and remove the coil cable from the terminal tag (on model 8WRSF, slacken the securing screw and press the coil cable out of its terminal).

(ix) Unscrew the coil securing studs and remove the coil. If fitted, remove the protective sleeve.

(x) Withdraw the securing screws and pull the contact breaker base plate away from the magneto body.

(xi) Mark the position of the magneto base in relation to the magneto body, by marking a line across the joint.

(xii) Remove the driving member and thrust washer or, on model 8WRSF, the locking nut and tab washer from the magneto shaft.

(xiii) Remove the six base securing nuts or bolts.

(xiv) Invert the magneto, press down on the end of the shaft and lift off the base.

(xv) Dismantle the automatic timing control or impulse starter, when fitted, as described in para. 4 (e) or 4 (f).

(xvi) Withdraw the three drive end bearing housing securing screws and pull the bearing housing and rotor away from the magneto body.

(e) DISMANTLING AUTOMATIC TIMING CONTROL (4VRA AND 6VRA)

(i) Note the arrangement of automatic timing control, see Fig. 5.

(ii) Remove the driving shaft and timing control from the rotor.

(ii) Lift the weights, springs and toggles off the action plate.

(iv) Press back the tab washer, unscrew the securing nut and pull the rotor foot off the magneto shaft.

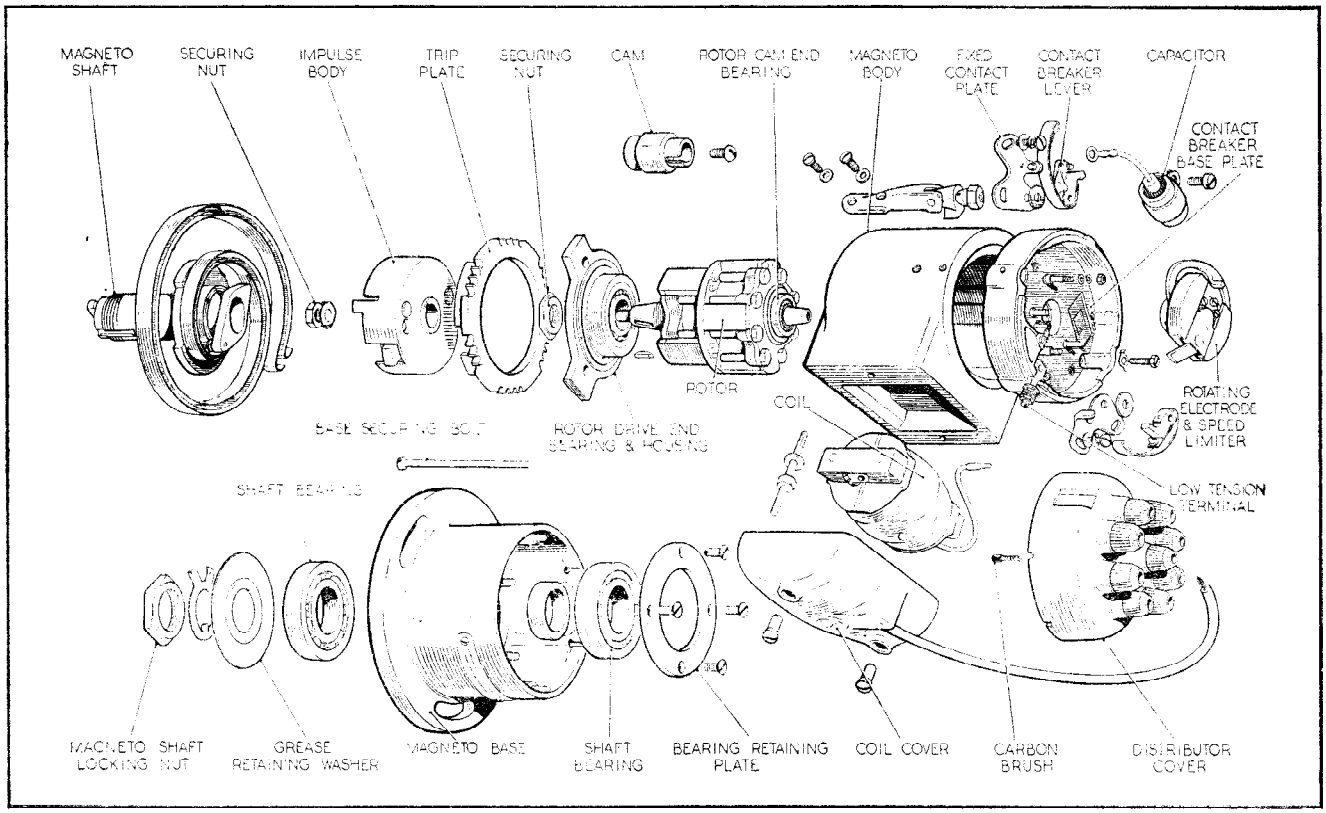

Fig. 4.
Model 8WRSF dismantled

(*f*) DISMANTLING IMPULSE STARTER (4VRS, 6VRS AND 8WRSF)

(i) Note the arrangement of the impulse starter, see Fig. 4.

(ii) Mark the position of the trip plate in relation to the holes in the magneto body, and remove the trip plate.

(iii) Pull the impulse starter driving plate and impulse spring away from the impulse starter body.

(iv) Press back the tab washer, unscrew the securing nut and pull the impulse starter body off the magneto shaft.

(v) Remove the locating key from the magneto shaft.

(*g*) REFITTING BEARINGS AND BEARING BUSHES

When the magneto is dismantled, ball and roller bearings should be re-packed with high-melting-point grease.

All bearings and bearing bushes which show signs of wear must be replaced as follows:

Replacement ball and roller bearings must be fitted as complete units comprising matched pairs of inner and outer races.

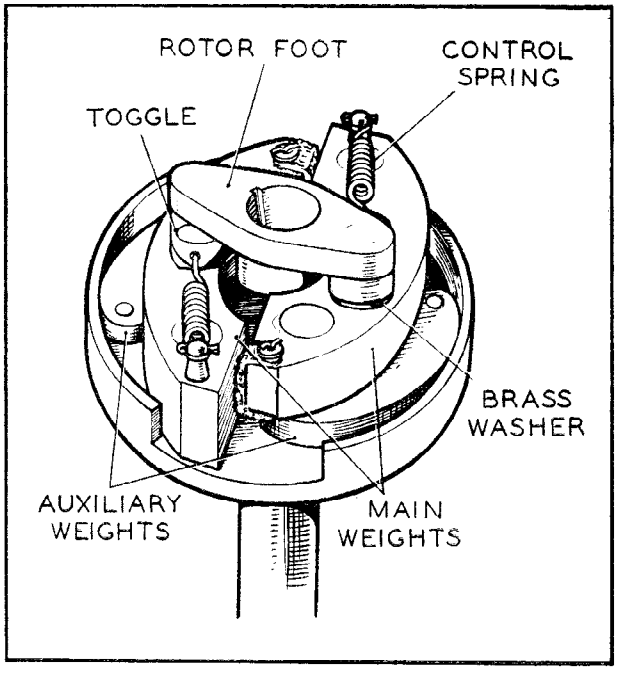

Fig. 5.
Automatic timing control

Before a new bearing bush is fitted it must be immersed in clean thin engine oil for 24 hours. On occasions of urgency the time may be shortened by heating the oil to 100°C. for 2 hours and allowing the oil to cool before removing the bush.

(i) *Rotor drive end bearing (all models)*

Remove the locking nut from the magneto shaft.

Press the rotor shaft out of the drive end bearing assembly.

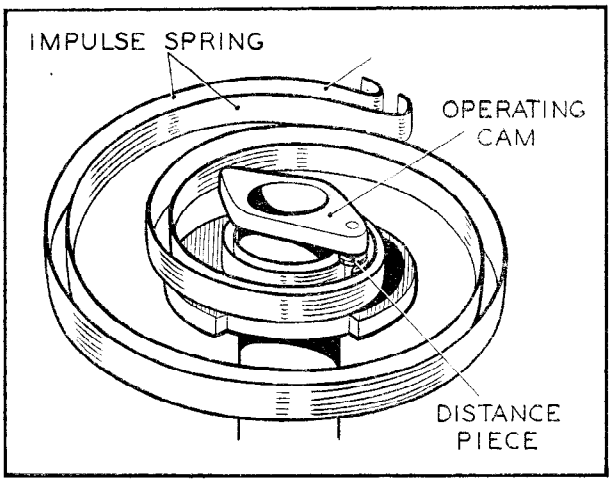

Fig. 6.
Impulse spring for anti-clockwise rotation

Pack the replacement bearing with high-melting-point grease.

Press the replacement drive end bearing assembly on the rotor shaft.

Refit the locking nut.

(ii) *Rotor cam end bearing (all models)*

Note the position of the slot in the end of the cam with relation to the keyway at the driving end of the shaft. This relationship must be maintained when refitting the cam.

Withdraw the cam retaining screw or, on earlier models, the cam retaining nut and pull the cam, backing shim (if fitted) and felt pad off the rotor shaft.

Pull the cage and inner race of the roller bearing off the rotor shaft.

Pack the replacement bearing with high-melting-point grease.

Press the replacement bearing assembly on the rotor shaft.

Refit the felt pad and cam.

(iii) *Shaft bushes (models 4VRA and 6VRA)*

Press the bearing bushes out of the shank, using a hand press and mandrel.

Fit the new bearing bushes using a hand press.

(iv) *Shaft bush and shaft bearing (models 4VR, 4VRS, 6VR and 6VRS)*

Remove the ball bearing from the upper end of the shank using a bearing extractor.

Press the bearing bush out of the lower end of the shank using a hand press and mandrel.

Pack the replacement ball bearing with high-melting-point grease.

Refit the replacement ball bearing and new bearing bush using a hand press.

(v) *Shaft bearings (model 8WRSF)*

Withdraw the four bearing retaining plate securing screws and remove the plate from inside the magneto base.

Remove the two bearings from the magneto base using a bearing extractor. Each bearing must be extracted from its own side of the magneto base.

Pack the replacement bearings with high-melting-point grease.

Refit the replacement bearings using a hand press.

Refit the bearing retaining plate.

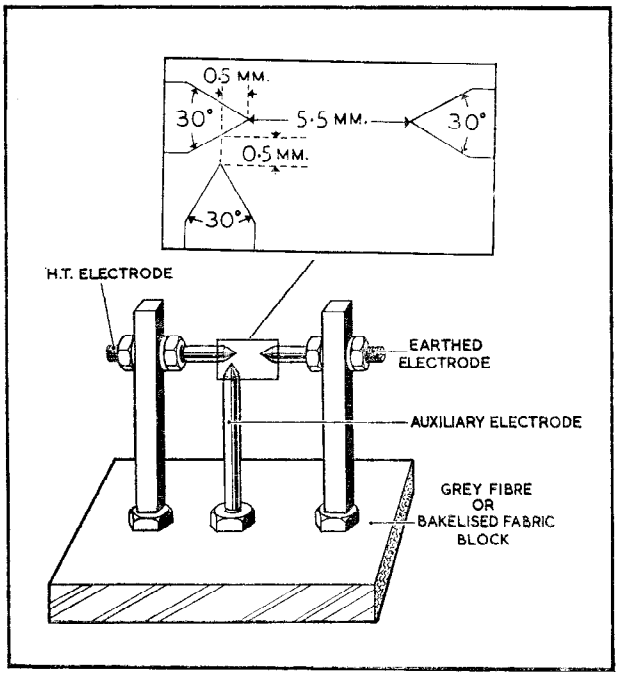

Fig. 7.
3-point spark gap

(h) TESTING THE COIL

The coil may be tested when fitted in the magneto body or removed from the magneto.

(i) *Equipment required:*

Four-cylinder contact breaker having closed periods of not less than 42° and having an operating range up to 750 r.p.m.

12-volt battery.

3-point spark gap, see Fig. 7.

1-ohm resistance.

0.5 amp. moving coil ammeter.

(ii) *Testing the coil when fitted in magneto*

Connect the cable from the coil, normally connected to the terminal post, to the positive terminal of the battery.

Connect the positive terminal of the ammeter to the magneto body.

Connect the coil, ammeter, test contact breaker and resistance, across four cells (8 volts) of the battery.

Connect a high tension cable from the contact stud on the coil to the 3-point spark gap.

Connect a high tension cable from the 3-point spark gap to the magneto body.

Run the contact breaker at 750 r.p.m.

Regular sparking should occur at the spark gap and the ammeter should read 0.7—0.8 amp.

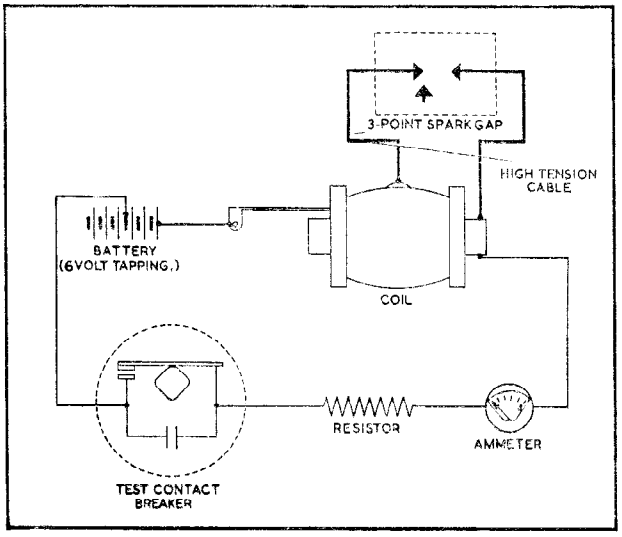

Fig. 8.
Circuit for testing magneto coil

(iii) *Testing coil when removed from magneto*

Connect up as described before, but remove the connections at the magneto body to the iron core of the coil, see Fig. 8.

Reduce the battery voltage to 6 volts (three cells).

Run the contact breaker at 750 r.p.m.

Regular sparking should occur at the spark gap and the ammeter should read 1.0 to 1.1 amp.

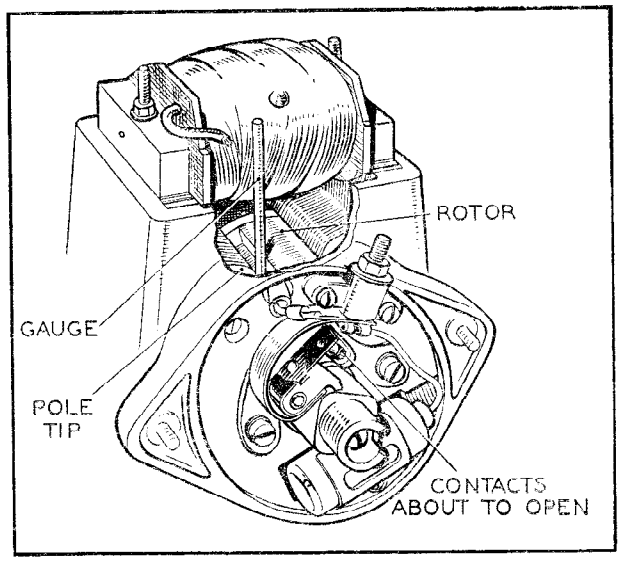

Fig. 9.
Position of gauge when refitting cam

(j) REASSEMBLING

Before reassembling, the felt pad cam-lubricator fitted to earlier magnetos must be renewed, or the sintered iron cam fitted to later magnetos must be re-impregnated by immersing the cam in medium viscosity engine oil for 24 hours.

(i) Pack the bearings with high-melting-point grease.

(ii) Remove any swarf or metallic objects from the rotor and insert the rotor into the magneto body.

(iii) Locate the drive end bearing housing on the magneto body and refit the three securing screws.

(iv) Thread the coil cable through the hole provided in the magneto body, locate the coil on the magneto body and refit the two securing studs.

(v) When fitted, position the protective sleeve over the coil lead.

(vi) Refit the contact breaker base to the magneto body.

(vii) Solder the coil cable to its connector.

(viii) Refit the insulation piece, low tension terminal post, insulation bush, fixed contact plate, contact plate, contact breaker lever and capacitor and tighten the terminal post securing nut.

(ix) If the position of the cam relative to the rotor shaft has not been disturbed, set the contact breaker gap to have a maximum opening of 0.010"—0.012".

(j) CAM TIMING

If the position of the cam has been disturbed it must be refitted as follows:

(i) Refit the cam to the rotor in approximately its original position relative to the rotor, but do not tighten the securing screw or securing nuts.

(ii) Set the contact breaker gap to have a maximum opening of 0.010″—0.012″.

(iii) Insert a gauge between the trailing tip of the rotor pole shoe and the adjacent stator pole. Use a 0.086″ gauge or a No. 44 drill shank for all VR magnetos and a 0.106″ gauge or a No. 37 drill shank for model 8WRSF, see Fig. 9.

(iv) Clamp the gauge in a vertical position by turning back the rotor.

(v) Adjust the position of the cam until the contacts are on the point of opening and further movement in the direction of normal rotation will separate them.

(vi) Tap the cam home and tighten the securing screw or securing nut.

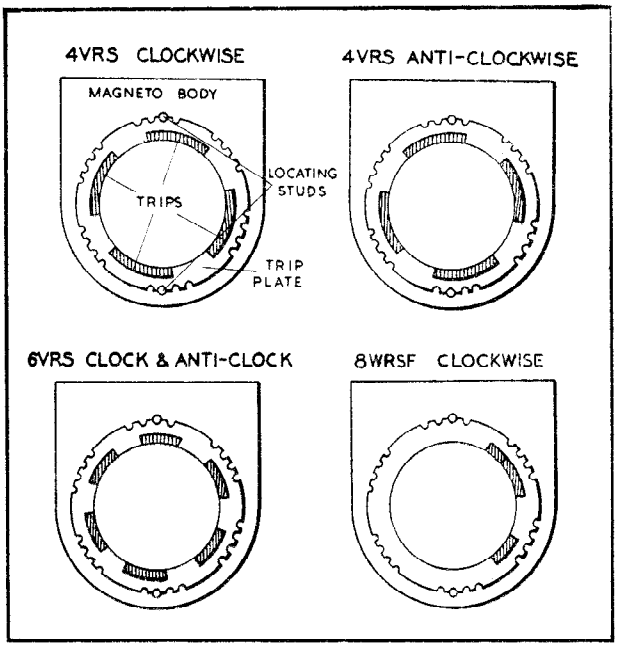

Fig. 10.
Position of trip plate in relation to locating studs

(k) REASSEMBLING AUTOMATIC TIMING CONTROL

(i) Lightly lubricate the timing control with thin machine oil.

(ii) Locate the rotor foot and key on the magneto shaft and refit the tab washer and securing nut.

(iii) Assemble the main weights, auxiliary weights, springs and toggles on the action plate. Ensure that the brass washers are in position under the toggles.

(iv) Engage the rotor foot with the holes in the toggles.

(v) Place the fibre washer on the driving shaft.

(vi) Invert the magneto and press the base over the driving shaft until the reference marks across the joints coincide.

(vii) Refit the base securing bolts or studs.

(viii) Refit the driving dog or engagement gear.

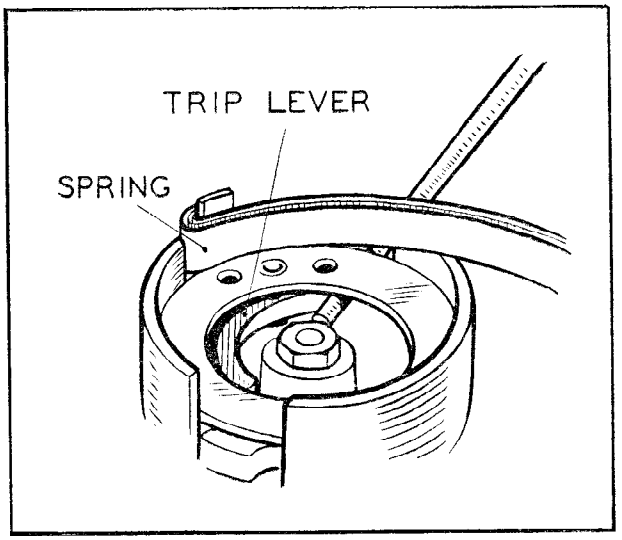

Fig. 11.
Fitting impulse spring for clockwise rotation

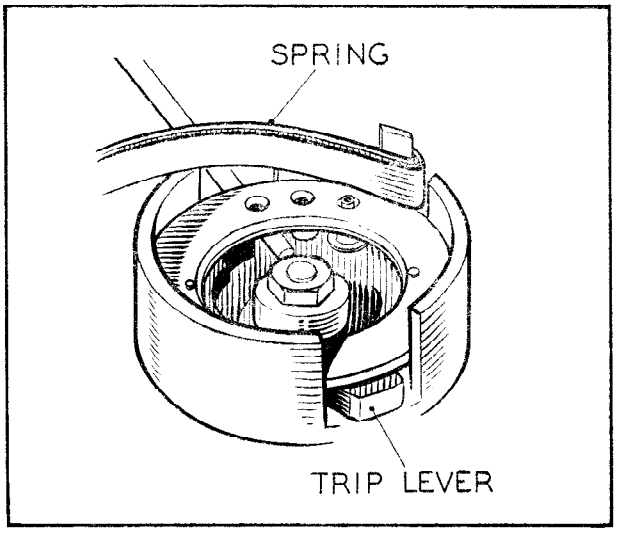

Fig. 12.
Fitting impulse spring for anti-clockwise rotation

(*l*) REASSEMBLING IMPULSE STARTER

(i) Refit the locating key in the keyway on the magneto shaft.

(ii) Locate the impulse starter body on the key and refit the tab washer and securing nut.

(iii) Lubricate the impulse spring with thin machine oil.

If the impulse spring has been removed from the driving plate, re-position it on the plate and refit the securing screw. Earlier models incorporate a small distance piece. This must be refitted between the operating cam and the impulse spring, see Fig. 6. Ensure that the spring is so fitted that it winds up when the shaft is rotated in the normal direction of rotation.

To ensure the correct positioning of the trip plate, and as a guide when refitting the base, two locating studs are required. These studs should be about 2" long and threaded 3 B.A. at one end. The magneto base securing studs or spare magneto base securing bolts with the heads filed down are suitable.

(iv) Screw the two locating studs into diametrically opposite holes in the magneto body, see Fig. 10.

(v) Position the trip plate to the magneto body so that the slots in the circumference of the trip plate fit over the studs, and the reference marks made when dismantling coincide. If reference marks were not made or are no longer discernible, position the trip plate as shown in Fig. 10.

(vi) Secure the magneto body in a vice, base uppermost and lock the impulse starter body.

(vii) Hook the outer end of the impulse 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 driving plate, see Figs. 11 and 12.

(viii) Rotate the impulse starter body in the normal direction of rotation until a trip lever engages with a trip.

With the impulse starter body in this position the contact breaker should be closed and the contact breaker heel approximately midway between the cam lobes, see Fig. 13.

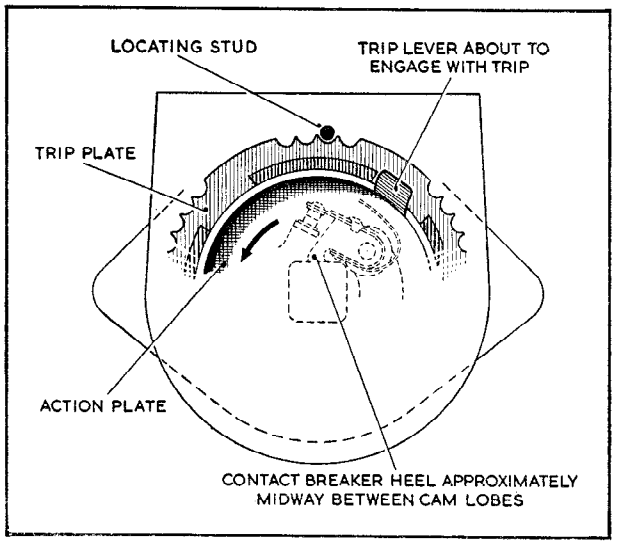

Fig. 13.
Operation of impulse starter in relation to contact breaker

This position of the trip plate normally gives a retard angle of 12°—18° on models 4VRS and 6VRS, and a retard angle of 6°—12° on model 8WRSF. If it is necessary to increase the retard angle, the trip plate should be rotated, in the normal direction of rotation of the magneto, relative to the locating studs.

(ix) Press the magneto base over the driving shaft and locating studs, so that the reference marks across the joint coincide.

(x) Refit the six base securing bolts or securing nuts.

(xi) On models 4VRS and 6VRS ensure that the shoulder on the underside of the impulse driving plate is in contact with the inner journal of the bearing in the upper end of the shank. To do this, insert a $\frac{1}{4}$" Whit. screw into the tapped hole in the end of the driving shaft; then pull on this screw until no more movement is possible.

(xii) Refit the thrust washer and driving member, or on model 8WRSF, the tab washer and locking nut.