THE **ELECTRICAL** SYSTEM

The electrical system is of the 12 volt earth return type, the positive terminal of the battery being earthed.

THE BATTERY

The battery is supported in a suitable carrier behind the engine above the gearbox housing. It is insulated from the engine by the bulkhead.

The battery on the diesel engine has 15 plates per cell with a capacity of 138 ampere hours at the 10-hr. rate.

The battery on the vaporising oil and petroi engined tractors has 9 plates per cell with a capacity of 51 ampere hours at the 10-hr. rate.

Provided the battery is properly maintained, it will function satisfactorily between the extreme temperatures of summer and winter.

MAINTENANCE

Cleanliness

Keep the battery and the surrounding parts, particularly the tops of the cells, clean and dry and brush away any dirt or dust.

The terminals should be kept clean and coated with petroleum jelly (not grease).

If distilled water or electrolyte has been spilled on top of the battery, it should be cleaned off immediately, as even weak acid will quickly attack and corrode the cable connections, clamp frame and bolts. Use a rag soaked in a solution of hot water and weak ammonia.

Electrolyte Level

When topping up, use distilled water. Use only a clean lead, glass or earthenware container.

The correct working level of the electrolyte is $\frac{1}{4}$ in. to $\frac{3}{8}$ in. above the separators on the petrol and vaporising oil engine batteries and $\frac{5}{8}$ in. on the diesel engine battery. It is good practice to top up the battery just prior to running the tractor, especially in cold weather, to ensure thorough mixing of the acid and the water and so prevent freezing.

If the battery is found to need an excessive amount of topping up, steps should be taken to determine the reason. For example, the battery may be receiving an excessive charge, in which case the regulator setting should be checked. If one cell in particular needs topping up more than another, it is likely that the case is cracked, in which event the battery must be replaced and the battery carrier cleaned and repainted if necessary.

Specific Gravity

The specific gravity reading indicates the state of charge of the battery and should be checked with a hydrometer.

If the level of the electrolyte is so low that a hydrometer reading cannot be taken, no attempt should be made to take a reading after adding distilled water until the battery has been on charge for at least one hour.

Table "A" gives the specific gravity of the Plectrolyte at various acid temperatures when the battery is fully charged.

Table "B" gives the low limits of specific gravity at various acid temperatures when the battery is fully discharged at the normal rate.

Table "A"	Table "B"
1.264 at 110 F.	1.094 at 110 F.
1.268 at 100 F.	1.098 at 100 F.
1.276 at 80 F.	1.106 at 80 F.
1.280 at 70 F. (normal)	1.110 at 70 F. (normal)
1.284 at 60 F.	1.114 at 60 F.
1.292 at 40 F.	1.122 at 40 F.
1.300 at 20 F.	1.130 at 20 F.
1.308 at 0 F.	1.138 at 0 F.
1.315 at —20 F.	1.146 at —20 F.

Temperature Correction

Specific gravity varies with temperature and therefore the reading obtained on a hydrometer, at any acid temperature other than the standard of 70'-F., must be corrected as follows :—

Add four points (0.004 specific gravity) for every 10 F. above 70 F.

Subtract four points (0.004 specific gravity) for every 10 F. below 70 F.

Example :—

Hydrometer reading at 80°F. 1.276

1.276 + 0.004 1.280

Therefore battery is fully charged.

Variations in Cell Specific Gravity

There should be little variation in the specific gravity readings from cell to cell on any battery in reasonably good condition. If the variation is greater than 0.025, then the reason should be investigated.

If acid has been spilled at any time or lost due to a leak, topping up the level with distilled water will lower the specific gravity.

This can be corrected when next charging the battery by adding a solution of sulphuric acid which has an approximate specific gravity of 1.350 or 37' Baume (tropical batteries 1.245 ; 28.5° Baumé), until the specific gravity of the electrolyte is again standard.

Never use neat or strong acid for this purpose and always add the acid to the water.

A large variation, which is not the result of acid loss, is probably an indication of an internal short circuit and an early inspection of the battery by a competent electrician is advisable.

Checking Battery Condition

There are three methods of checking battery condition ; open circuit voltage test, high rate discharge test and specific gravity test.

Open Circuit Voltage Test

The open circuit voltage of a 12 volt battery should be above 12.6 volts (2.1 volts per cell) for a battery in good condition.

However, the voltage reading on open circuit is liable to be misleading. If the voltage is low then the cells are definitely in poor condition, but a high voltage reading on open circuit does not necessarily indicate that the cells are in good condition.

***High** Rate Discharge Test*

The high rate discharge test gives an indication of the condition and capacity of the battery. On a Diagnosis Test Set high rate discharge test, a 12 volt battery should maintain 100 amp. flow for 10 seconds with no appreciable fall in voltage.

Where a hand instrument is used for checking the individual cells of a battery, the actual reading obtained will depend upon the exact type of instrument used, but the cell voltage on a 5 to 6 seconds test should remain steady between 1.2 and 1.7 volts.

Variations in individual cell readings can indicate faults, but if all cells in any one battery fall below standard, re-charge and again test before rejecting the battery.

Never make a high rate discharge test on a battery known to be low in charge.

Specific Gravity Test

The best method of checking the state of charge of the battery is by means of a specific gravity reading, taken on a suitable hydrometer (see page 191). A fully charged battery should give specific gravity readings of 1.270 to 1.285 (31° to 32" Baumé) when checked with a hydrometer and corrected to 70°F.

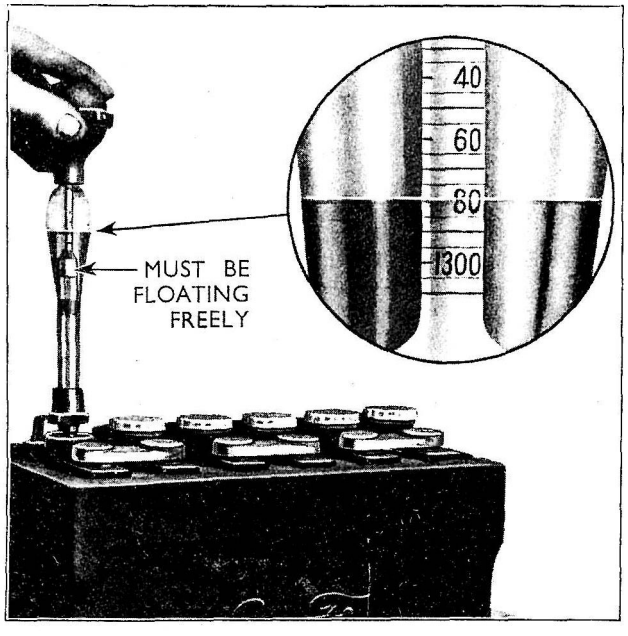

Fig. **234**
Checking Battery Specific Gravity

General

Never bring a flame or spark near a battery at any time, particularly during or shortly after a charge, as the gases produced may be explosive.

Never add acid to the cells unless :—

1 The specific gravity and voltage at the end of the charge have remained constant over five successive hourly readings.

2 Gas is evolved freely from each cell.

3 The specific gravity is more than .010 (10 points) below 1.280 at 70°F., or as given in the fully charged specific gravity table "A." (See page 191.)

Never empty acid from a battery to refill with fresh acid unless the battery is fully charged.

Never leave a battery in a discharged condition. It should be recharged as soon as possible.

Avoid high temperatures above 110°F., as electrolyte temperatures above this tend to shorten the life of the battery.

Keep the filler plugs tight and clean. Check the gas vents to ensure they are clear.

STORING BATTERIES

New batteries in store should receive careful attention until they are to be used in service.

When new batteries are received, dry and wet units should be segregated in order that no doubt shall exist as to which batteries require periodic attention.

Wet Batteries

It is common knowledge that wet batteries held in stock gradually deteriorate.

The actual loss of charge amounts to a fall in specific gravity of approximately 0.0015 in every 24 hours. This means that a fully charged battery having a specific gravity of 1.270 to 1.285 (corrected to 70°F.) will, during one month, fall to approximately 1.230 (corrected to 70°F.), which is an appreciable drop from the fully charged condition.

For this reason, the date on which a new battery is received should be chalked on the battery case. A storekeeper or

electrician may then be made responsible to see that all wet batteries in store are recharged at least once every month, until they are to be put into service.

Ensure that all chalk marks are erased before the battery finally leaves the store.

Dry Batteries

Dry batteries must not be allowed to stand in an unfilled state after the time period (approximately one year) stamped on the battery label has expired.

Full instructions detailing the procedure to be followed when preparing dry batteries for service are printed on the label attached to every dry battery supplied in service.

CHARGING FROM AN EXTERNAL SOURCE

Before starting the charge, the battery should be topped up with distilled water to $\frac{1}{4}$ in. to $\frac{3}{8}$ in. above the separators on the petrol and vaporising oil engine batteries and $\frac{5}{8}$ in. on the diesel engine battery.

The normal charge rates are as follows :—

Battery	*Bench* Charge *Normal Rate*	Initial Charge Rate (converting dry batteries)	
		Rate	*Hours*
Diesel	10—12 amp.	10 amp.	48
Petrol–Vap. Oil	4 amp.	2.5 amp.	96

The charge should be continued until the specific gravity and cell voltage in each cell show no further rise during five hours of continuous charging and all cells gas freely. If the specific gravity of the electrolyte in any cell or cells fails to rise while on charge and gassing does not rake place, the cells should be tested for internal short circuits.

The maximum permissible temperature of electrolyte during external charging is 110 F. and, if this is exceeded, the charge should be suspended or reduced to one-half to allow the temperature to fall.

If, at the end of the charge, the specific gravity varies by more than 10 points (i.e. .010), from the figures given in table **"A"** (page 191), the specific gravity must be adjusted, either raised by adding fresh electrolyte, the S.G. of which should be 1.350 (37' Baumé), or lowered by the addition of distilled water. The specific gravity of any two cells of a battery should not vary more than .015.

When adjusting the specific gravity, care must be taken not to leave too much electrolyte in the cell or cells, any surplus over $\frac{3}{8}$ in. above the tops of the separators must be removed.

To test a cell suspected of being short circuited, take the individual voltage of each cell of the battery while it is on charge, and when charged carry out a high rate discharge test. The cell voltage between individual cells should not vary more than 0.15 volt. The voltage of a faulty cell on high rate discharge will fall rapidly. If it is confirmed that a cell is internally shorted, the battery must be renewed.

SPECIAL INSTRUCTIONS

Cold Climates

In cold climates, the electrolyte of a partially discharged battery (specific gravity approximately 1.150: 19 Baumé) will be frozen at temperatures below 0°F., and a fully discharged battery (specific gravity approximately 1.110. $14\frac{1}{2}$° Baumé) will freeze at 16°F. For this reason, special precautions should be taken when operating in cold climates to prevent the condition of the battery from falling below the following specific gravities :—

1.200 (24 Baumé) specific gravity at 0 F.
1.245 ($28\frac{1}{2}$ Baumé) specific gravity at —20 F.
1.265 ($30\frac{1}{2}$ Baumé) specific gravity at —30 F.

The electrolyte level in each cell should be frequently checked and adjusted to $\frac{1}{4}$ in. to $\frac{3}{8}$ in. above the separators (petrol and vaporising oil engines) and $\frac{5}{8}$ in. on diesel engine batteries. When topping up, use clean distilled water. This should be done only during charging and preferably when the cells are gassing freely, so that the water becomes mixed with the electrolyte before it has time to freeze.

Tropical Climates

Wet batteries supplied with new tractors or as service replacements have an acid specific gravity of 1.270 to 1.285 (31 to 32" Baumé) when in a fully charged condition. These readings are corrected to 70 F.

The specific gravity of the electrolyte in batteries (with wooden separators) to be used under tropical conditions should, however, be between 1.200 and 1.215 (24' to $25\frac{1}{2}$' Baumé), 1.240 to 1.255 (28' to 29.5 Baumd) on batteries with Porvic separators, when corrected to 70 F. It will, therefore, be necessary to adjust the specific gravity of all wet batteries supplied in service on arrival at their destination.

Methods of Adjusting Specific Gravity in Tropical Climates

1 Immediately the battery arrives at its destination, check and top up the electrolyte level with distilled water. Then place the battery on charge at its normal rate (see table above).

2 Continue the charge until the specific gravity has reached its maximum, i.e. until the gravity of each cell remains constant for a period from 2 to 5 hours and all cells are gassing freely.

3 Discontinue the charge, turn the battery upside down and allow it to drain for 10 to 15 minutes.

4 Turn the battery back to its normal upright pcsition and clean the exterior surface of the casing thoroughly, using a cloth moistened with ammonia. This will counteract the effect of spilled acid.

5 With a minimum of delay, refill each cell with acid of 1.140 specific gravity (18° Baumé).

If the cells are not refilled directly after draining, the negative plates will tend to oxidise.

6 Again place the battery on charge at its normal rate and continue the charge for 4 to 6 hours.

7 If the "aid specific gravity following the charge is above 1.215 (25½° Baumé) when corrected to 70°F., adjust by withdrawing acid from the cells with a squeezeball and restoring the level with distilled water.

If the specific gravity is below 1.200 (24° Baumé) adjust by adding acid of specific gravity greater than 1.210 (25" Baumé) on batteries with wooden separators or 1.240 (28° Baumé) on batteries with Porvic separators.

8 Following an adjustment to the electrolyte specific gravity, replace the battery on charge at the normal rate until the specific gravity of the acid in each cell has stabilised.

9 Before putting the battery into service, again check the acid levels, adjusting if necessary to ¼ in. to ⅜ in. (petrol and vaporising oil engine) or ⅝ in. (diesel) above the separators. Remove acid if the levels are too high or add acid of 1.210 specific gravity (25" Baumé) (wooden separators) or 1.255 (29.5" Baumé) (Porvic type separators) if too low.

Always give idle batteries a freshening charge at least once a month.

BATTERY CONNECTIONS

If the battery connections are suspected of having a high resistance, the following tests should be applied.

The Earth Strap

Using a 0–3–0 volt centre zero meter or the leads V— and V+ on the Diagnosis Test Set, connect the negative lead to a good earth on the body near the battery earth strap.

Connect the positive lead to the positive terminal post (not the battery clamp) whilst the starter motor is cranking the engine with the ignition switched off.

The reading should be less than 0.1 volts. If it is less than this reading, the connection from the battery to earth is in good condition.

If the reading is more than 0.1 volts, connect the negative lsad to the earth strap on the engine front bulkhead. If the reading is now less than 0.1 volts, the resistance is at the earth strap connection on the body and the surrounding parts should be cleaned. If the reading is more than 0.1 volts the resistance is at the terminal on the battery which should be cleaned or replaced.

The Negative Cable

Use a 0–15 volt meter in parallel to the circuit to be tested (on the Diagnosis Test Set, use the leads V— and V+). Connect the negative lead to the battery negative post. Remove the starter motor brush cover, clip the positive lead to an insulated screwdriver and press it onto the negative brush, taking care to insulate the screwdriver Rom the starter motor yoke.

The meter should now read full battery voltage. Operate the starter motor switch with the ignition switched "off," when the reading should be less than 0.5 volts.

If the reading is less than 0.5 volts, the connections at the battery, starter motor switch and starter motor are satisfactory.

Should a high reading exist, indicating a high resistance, the positive lead should be connected to the upper terminal on the starter motor switch. Operate the switch, when the reading should be less than 0.5 volts.

If the reading is more than 0.5 volts, connect the negative lead of the volt meter to the battery negative cable clamp. If the reading is now less than 0.5 volts, the resistance is at the battery cable clamp.

If the upper portion of the negative cable is in order, connect the positive lead to the negative brush of the starter motor and the negative lead to the lower terminal on the switch. Again operate the switch when the reading should be less than 0.5 volts. If both readings are less than 0.5 volts, there is a high resistance in the switch.

Having determined the location of the high resistance, the part should be cleaned or replaced as necessary.

THE GENERATOR

The generator is of the two-brush type and is used in conjunction with the voltage control regulator mounted in the instrument box. The generator is driven at 1.7 times engine speed.

Testing the Generator

Output Test

Disconnect the "D" and "F" terminals of the generator and join them together with a short piece of wire. Connect a 0–30 volt meter between this junction and earth. Run the engine at 1,000 r.p.m. when the voltage reading should rise rapidly without fluctuation above 24 volts. Do not increase the engine speed above fast idle in an endeavour to obtain this voltage, as this will give a false reading.

If there is no reading, first check the generator leads, brushes and brush connections. If the reading is very low, the field or armature windings may be suspected.

Motoring Test

If the output reading is incorrect, but does not indicate the cause of the trouble, remove the fan belt by slackening the generator mounting bolts and moving the generator in towards the engine. Connect a 0–30 amp. meter between the joined terminals of the generator and the battery negative post.

The generator should now motor and the current consumption should be 4 to 6 amps.

(a) A high reading on the ammeter is an indication of tight generator bearings.

(b) An excessively high reading will indicate a short circuit.

(c) A low reading is a general indication of bad commutation.

Field Coil Resistance

The resistance of the field coils should be calculated by Ohm's law, after taking a reading of the current consumption.

The field coil current consumption should be checked with an ammeter connected between the battery negative post and the "F" terminal of the generator.

For an accurate reading, the battery voltage applied to the generator for this test should be 13.5 volts. With this voltage applied, the current reading should be observed and the field coil resistance calculated from Ohm's law, viz. :—

$$R = \frac{E}{I}$$

where R-=the field coil resistance in ohms.
E=the applied voltage.
I =the current reading on the ammeter.

The correct field coil resistance is 6.1 ohms at 68°F.

Dead Segment Test

Connect the "D" and "F" terminals on the generator together and connect a 0 to 50 amp. meter between the joined terminals and the battery negative post.

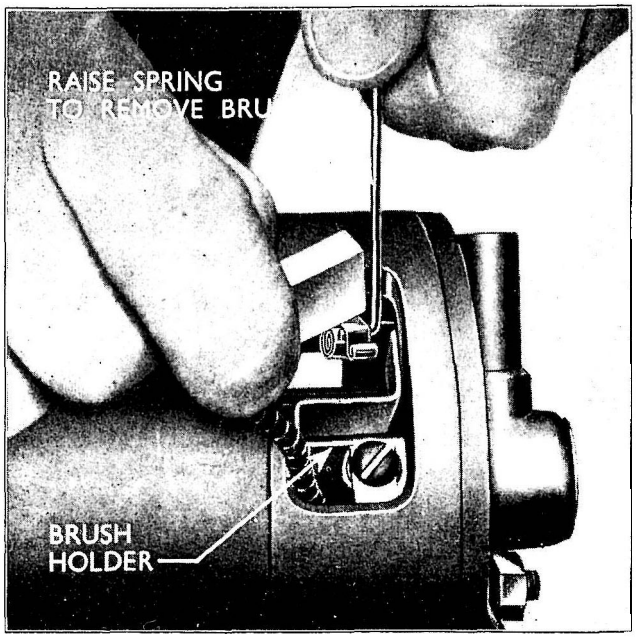

Fig. **235**
Removing Generator Brushes

When using the Diagnosis Test Set, switch the dial to 90 amps. and connect the 90 amp. shunt strap. Connect lead "A+" to the joined generator terminals and the "A—" lead to the battery negative post.

Rotate the generator pulley very slowly against the pull of the magnets. The pull should be even and the reading on the meter should not vary more than five amps.

Note — If this condition is not fulfilled, examine the commutator for dirt, high micas, etc.; clean if necessary and re-test. If the reading on the meter still varies, the armature windings are probably faulty. If the reading suddenly rises, it indicates a short circuit on a commutator segment and if it falls, a dead or open circuit on one or more segments may be suspected. The faulty segment will now be opposite one brush and will probably show evidence of arcing.

If the brushes are worn or damaged, they must be renewed.

OVERHAULING THE GENERATOR

To Remove

1 Slacken the three securing bolts and move the generator in towards the engine so that the fan belt may be detached.

2 Disconnect the generator to regulator leads and remove the three securing nuts and bolts.

3 Lift the generator from its supports on the side of the cylinder block.

To Replace

1 Place the generator on its support brackets with the end brackets in front of the support bracket legs and locate it with the three securing bolts. (It may be necessary to slacken the bolt securing the generator adjusting strap to the cylinder block.)

2 Refit the fan belt over the generator pulley and move the generator away from the engine until there is $\frac{1}{2}$ in. free movement in the fan belt, measured midway between the generator and fan pulleys. Tighten the adjustment bolt and generator mounting bolts securely.

3 Reconnect the leads to the terminals on the generator end plate. The yellow-red tracer wire connects to the "F" terminal and the yellow-black and red tracer lead connects to the "D" terminal.

To Dismantle

1 Remove the generator as described above.

2 Slacken the clamp screw and slide the cover band away from the brush apertures.

3 Lift the brush springs off the brushes and draw the brushes out of their holders. (See Fig. 235.)

4 Secure the pulley and unscrew the pulley nut and spring washer. If the pulley is tight on the shaft, it may be removed, using the universal pulley puller AT/U 6312–A. Detach the key and spacer.

5 Unscrew the two through-bolts which hold the end plates together and detach the "D" and "F" terminal nuts and spring washers. The commutator end bracket is now free and can be removed from the yoke. If it is a tight fit, it should be carefully levered off with a screwdriver.

Do not lose the thrust washer on the commutator end of the armature shaft.

6 The drive end bracket and armature may now be pulled from the generator yoke.

Note — The drive end bracket and armature need not be separated unless the front bearing requires attention.

To renew the field coils, refer to page 199.

To Reassemble

1 Replace the field coils as described on page 199.

2 Place the armature and drive end bracket assembly in the generator yoke from the front end, so that the dowel on the bracket locates in the slot in the yoke end face.

3 Replace the distance washer on the commutator end of the armature shaft. Ensure that the insulator strip is fitted between the field coil connections and the generator yoke.

4 Place the insulator on the field coil terminals and check that the brush cover band is located around the generator yoke.

5 Check the brush gear as described below. Secure the brush leads to the brush holder terminals with screws and lockwashers. Enter the brushes into their holders and turn the springs until they rest against the sides of the brushes, thus holding them clear of the commutator.

6 Position the commutator end bracket on the armature shaft so that the head of the dowel engages in the slot of the poke end face.

7 Replace the two through-bolts from the commutator bracket end, screwing them into the drive end bracket. Make sure that the R.H. bolt (looking from the commutator end) passes between the insulator strip and the generator yoke, thus clearing the field coil bridge connection.

8 Position the brushes into the holders, and ensure that the springs rest on top of the brushes.

9 Slide the cover band over the brush apertures and tighten the clamp screw.

10 Refit the generator terminal insulator, noting that the "D" terminal has a square shank and the field terminal "F" has a round shank. Loosely refit the terminal nuts and spring washers.

11 Locate the spacer on the front of the armature shaft and fit the key in the shaft key-way.

Align the key-way in the pulley with the key on the shaft and gently tap the pulley into position, using a hide mallet. Refit the generator pulley nut and lockwasher and tighten securely.

12 Refit the generator as described on page 195.

THE GENERATOR BRUSHES

To Remove

1 Remove the generator, if necessary, as described on page 195.

2 Slacken the brush cover band and slide the band clear of the apertures in the yoke.

3 Raise the brush springs, using a piece of wire shaped into a hook and draw the brushes out of the brush holders. (See Fig. 235.)

4 If the brushes are sticking, clean with a petrol-moistened rag and, if necessary, ease the sides by polishing on a smooth file.

If the brushes are worn so that they do not bear on the commutator or the brush lead is exposed on the brush face, new brushes must be fitted.

5 Unscrew the brush terminal screw, holding the brush lead, taking care not to lose the lockwasher. The brush may now be removed.

6 Slide the loop on the brush spring off the post and remove the spring if necessary.

To Replace

The contact face of the brush is pre-formed so that bedding to the commutator is unnecessary.

1 Replace the brush spring on the post and "wind-up" the spring until it exerts pressure on the top of the brush holder.

2 Raise the brush spring and locate the brush into the holder, ensuring that it is free to slide. Place the end of the brush spring on the top of the brush.

3 Connect the brush lead to the terminal on the holder and secure with a screw and lockwasher.

4 Refit the brush cover band and tighten the clamp screw.

5 Replace the generator as described on page 195.

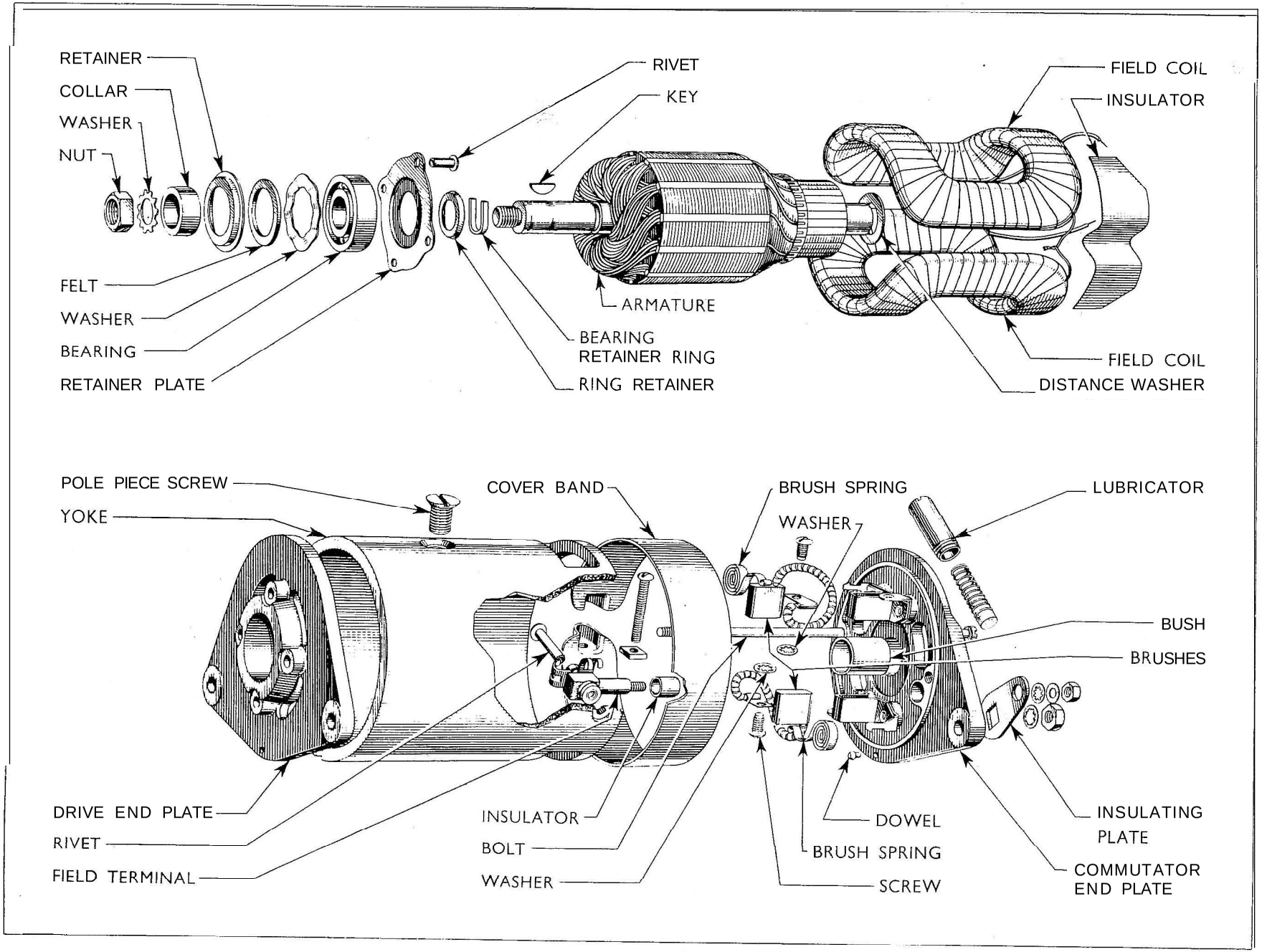

Fig. *236*

Exploded View of the Generator

THE COMMUTATOR

The commutator should be inspected when the generator is dismantled. A commutator in good condition will be smooth and free from pits or burned spots.

Clean the commutator with a petrol-moistened cloth. If this is ineffective, carefully polish it with a strip of very fine glass paper, not emery cloth, while the armature is rotated.

If the commutator is badly worn or scored, mount the armature, with or without the drive end bracket, in a lathe, rotate at high speed and take a light cut with a very sharp tool.

Polish the commutator with very fine glass paper. Undercut the mica insulation between the segments to a depth of $\frac{1}{32}$ in. with a hacksaw blade ground down to the thickness of the mica (see Fig. 237), i.e. to the width of the spaces between the commutator segments, if the proper equipment is not available.

Finally, polish the commutator with fine glass paper and remove all copper dust. Check the armature for short circuits to the shaft or core.

THE ARMATURE

The armature may be tested for shorts, open circuits or broken connections before the generator is dismantled (see page 195). If the armature is suspected of being faulty and no signs of burning, arcing or broken connections are visible, it should be checked on suitable armature testing equipment or by substitution.

No attempt should be made to machine the armature core or true a distorted shaft.

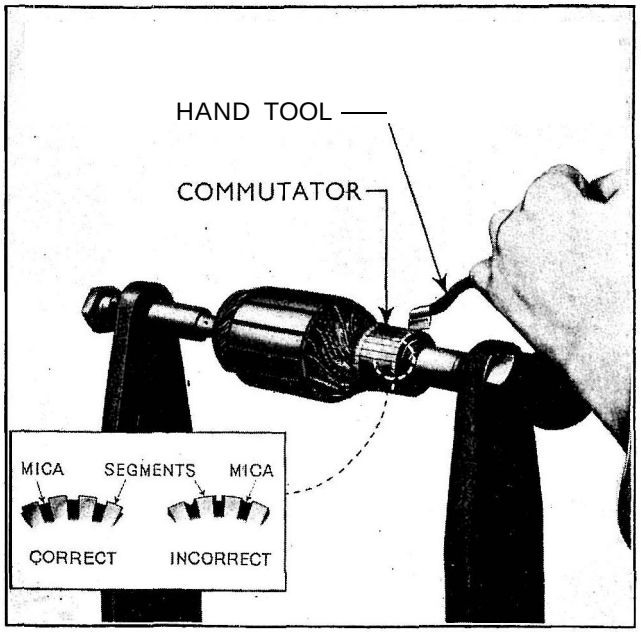

Fig. **237**
Undercutting the Generator Commutator Segments

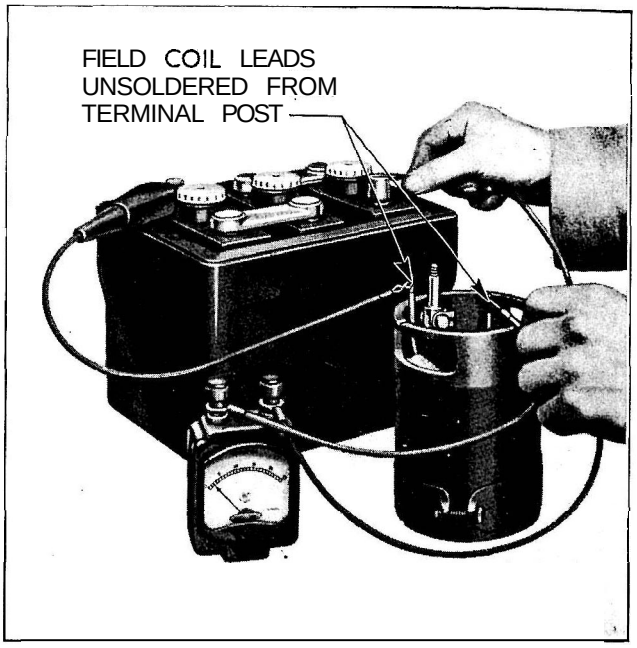

Fig. 238
Testing Field Coils for Continuity

GENERATOR FIELD COILS

To Test the Field Coils

To check field coils suspected of being faulty, it is necessary to unsweat the field coil tappings from the terminal post. (On current generators with a plastic insulator between the terminal tags, remove the terminal post before unsoldering the leads.)

Continuity

Connect the prods of a suitable line tester between the two coil tappings. If the proper equipment is not available, use a 6 or 12 V. battery and voltmeter as shown in Fig. 238.

If the bulb lights or a reading is given on the meter, it indicates a complete circuit through the field coils.

Earth

Connect the test prods between one tapping and the generator yoke. If the bulb lights, the coils are earthing.

It is also advisable to check the terminal post for earthing. Connect the test prods between the insulated tag of the post and the generator yoke.

Renewing the Terminal Post

If the terminal post is earthing, it should be replaced by tapping the securing rivet out of the yoke and fitting a new assembly. Fit a new rivet and peen over the outer end securely, ensuring that the terminal post points towards the commutator end of the yoke.

To ensure correct alignment of the post, temporarily fit the commutator end plate and insulator bush on the end of the yoke before finally peening over the rivet end.

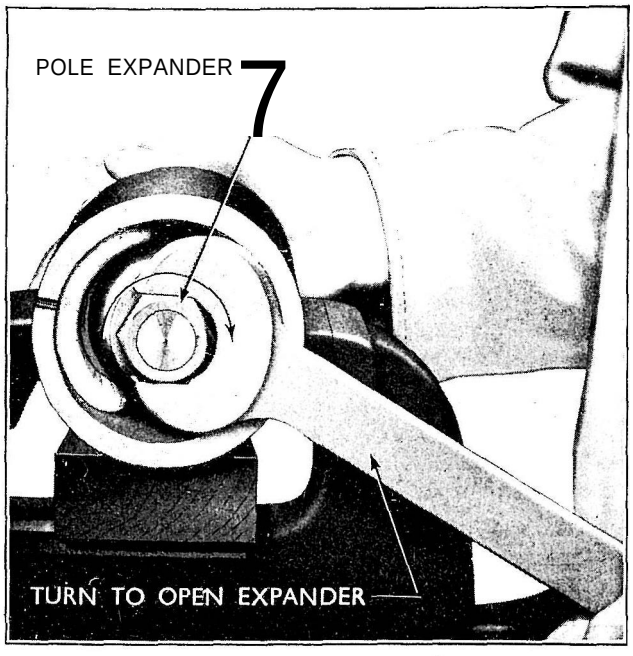

Fig. **233**
Expanding the Pole Piece Screws

To Remove the Field Coils

1 Dismantle the generator as described on page 195.

2 Remove the insulation strip which prevents the junction of the field coils contacting the yoke and through-bolts.

3 Mark the yoke and pole pieces in order that they can be refitted in their original positions. Make the marks on each pole piece distinguishable from the others, so that they cannot be refitted in the wrong position and thus alter the residual magnetic polarity of the generator.

4 Carefully mark the two wires connecting to the terminal post, as the inner wire (yellow) is insulated and the outer wire (red) connects to earth.

Unsweat the field coil wires at the terminal post. (On current generators with a plastic insulator between the terminal tags, remove the post before unsoldering the wires.)

5 To expand the pole pieces, use the pole piece expander A/CTY 10175. Locate the expander inside the yoke and tighten the end nut securely. (See Fig. 239.)

6 Mount the yoke and pole piece screwdriver AT2/U 10044 in a vice, as shown in Fig. 240, when the pole piece screws can be slackened off and finally removed.

7 Remove the pole piece expander, when the pole pieces and field coils can be withdrawn from the generator yoke.

To Replace

1 Place the new field coils over the pole pieces and position them in the .generator yoke. The pole pieces must be refitted in the same position from which they were removed and the field coil wires must point towards the apertures in the yoke and be on the same side as the terminal post. Take care not to trap the wires between the pole pieces and the yoke.

2 Replace the pole piece screws, tightening them up to retain the field coils in position.

3 Insert the pole piece expander and open it up to its fullest extent, tightening the pole pieces as much as possible.

4 Mount the yoke and pole piece screwdriver in a vice, and tighten the screws fully.

5 Remove the pole piece expander.

6 Replace the insulator strip between the field coil connections and the yoke.

7 Re-solder the two field coil connections to their correct terminal tags, ensuring that the wire to the inner tag does not earth at any point. (On current generators, refit the terminal post and secure with a new rivet.)

8 Reassemble the generator as described on page 196.

Note — It may be necessary to provide residual magnetism in the field coils after the generator has been replaced on the tractor, by flicking the cut-out points together with the generator connected up.

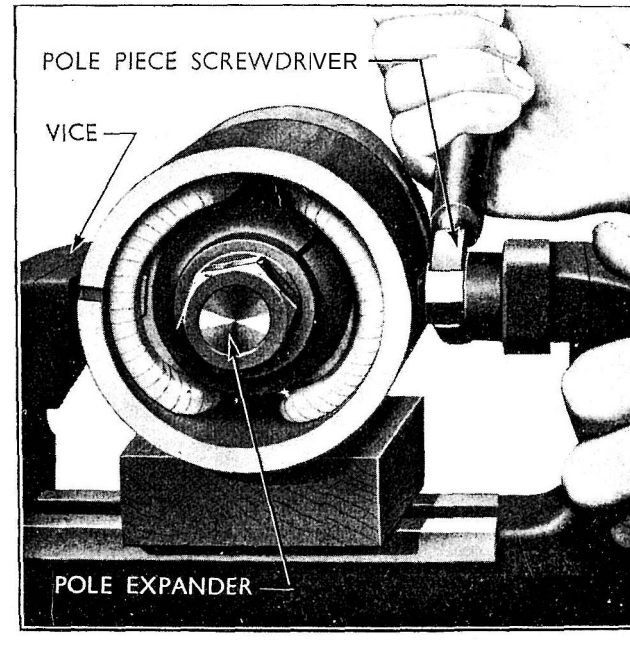

Fig. **240**
Removing the Pole Piece Screws

DRIVE END BRACKET BEARING

To Remove

1 Remove the pulley, key and spacer and dismantle the generator.

2 Press the armature shaft out of the drive end bracket.

3 Knock out the rivets which secure the bearing retainer plate to the end bracket and remove the plate.

4 Press the bearing out of the end bracket and remove the bearing washer, felt washer and retainer from the bearing housing.

To Replace

1 Clean the bearing housing and bearing and lubricate with high melting point grease.

2 Place the retainer, felt washer and bearing washer in the housing.

3 Locate the bearing in the housing and press it home, using a driver of sufficient diameter to take the thrust on the outer race of the bearing.

4 Fit the bearing retainer plate. Insert four new rivets from the inside of the end bracket and open the rivet ends by means of a punch to secure the plate rigidly in position.

5 Ensure that the flat metal clip and retainer are located in the groove on the armature shaft and press the drive end bracket onto the shaft so that the retainer plate abuts the clip.

6 Reassemble the generator and refit the pulley.

COMMUTATOR END BRACKET BEARING

To Remove

1 Remove the generator commutator end bracket and extract the bearing plug.

2 Unscrew and remove the commutator bush lubricator and wick.

3 Press the bearing bush out of the commutator end bracket, using the driver A/CT 10128–AB.

To Replace

Note — Before fitting the new bush it should be allowed to stand for about 24 hours, immersed in thin engine oil. The bush is of the porous bronze type, and this will allow the pores of the bush to be filled with lubricant. Do not drill a lubricating hole through the bush.

1 Refit the bush in the end plate, using the driver A/CT 10128–AB, so that the end of the bush is flush with the bottom of the chamfer.

2 Locate the end plate on the reaming fixture A/CT 10129 and ream the bush, using the reamer A/CT 10128.

3 Clean any swarf from the bush and replace the plug.

4 Pack the lubricator with petroleum jelly, replace the wick and spring and refit it to the bracket.

5 Reassemble the generator.

THE VOLTAGE CONTROL REGULATOR

The regulator incorporates a combined cut-out and voltage regulator. Normally, the regulator requires very little attention in service.

However, should it be suspected that it is not functioning correctly, tests should be made to ensure that the rest of the electrical circuits are in good condition and are not affecting the operation of the regulator.

To Remove

1 Remove the four screws securing the lower half of the control box to the rear panel.

2 Remove the two screws, lockwashers and nuts retaining the regulator to the base of the lower half of the box and disconnect the leads.

To Replace

1 Connect the leads to the regulator in the order shown in the wiring diagram at the end of this section.

2 Refit the regulator to the base of the lower half of the control box.

3 Secure the lower half of the box to the rear panel.

Preliminary Checks

Important points which can give a false indication of a regulator fault are given below, and should be carefully checked before attempting to effect any replacements.

Fan Belt

Make certain that the generator support brackets are securely tightened in position. Check the fan belt and ensure that it is adjusted correctly without the slightest suspicion of belt "slip." A slipping belt may cause an erratic or low charging rate. Ensure that the fan belt is correctly aligned and that the pulleys are not damaged.

Battery

Check the battery and test with a hydrometer and high rate discharge test-meter (see page 192). Top up if necessary. Clean off any corrosion from the battery lugs and cable ends and make certain that the top of the battery is dry.

A sulphated battery or corroded lugs will cause a low output even though the open circuit setting of the regulator may be correct. (Both these conditions will probably result in unsatisfactory starter motor: operation.)

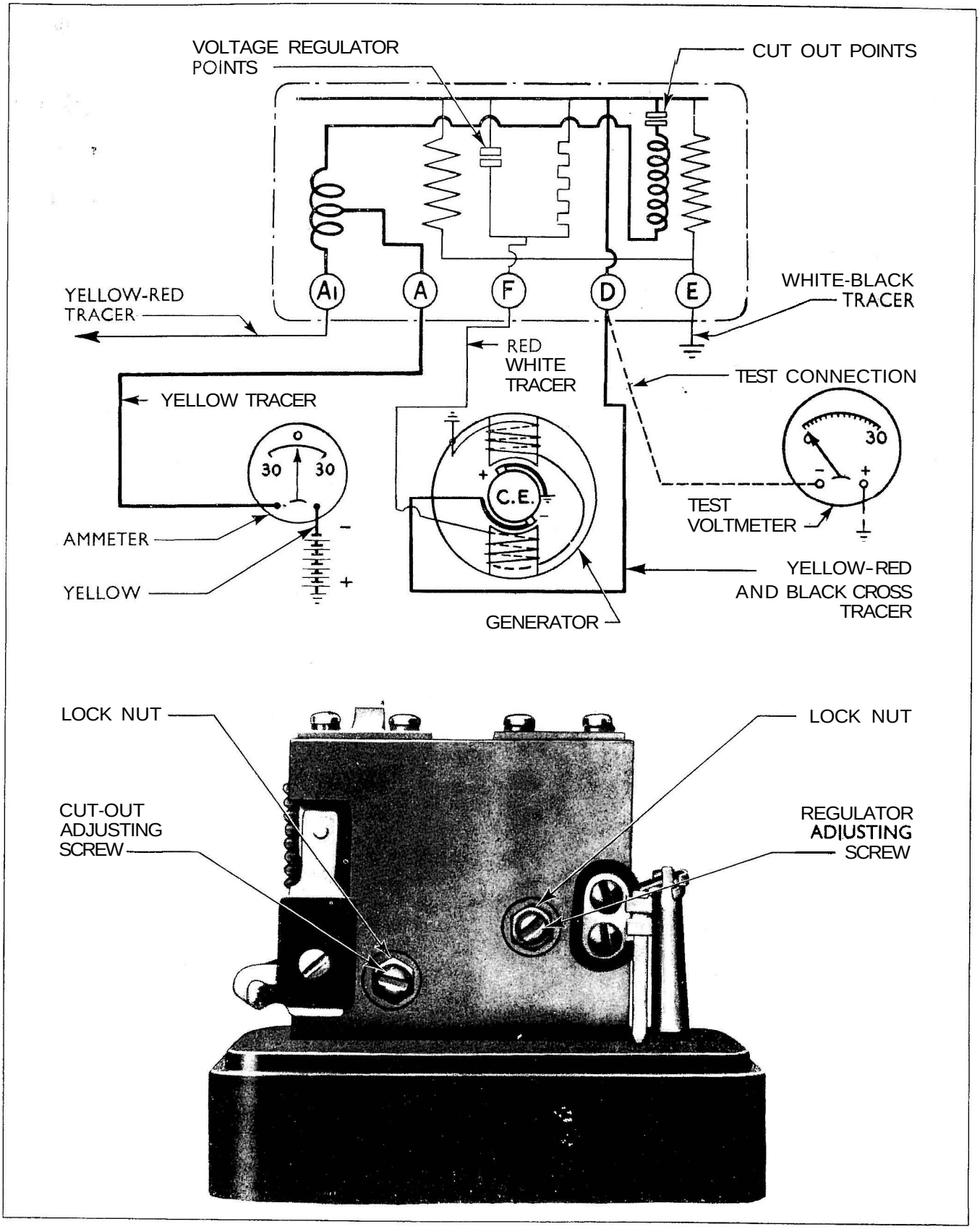

Fig. **241**
The Voltage Regulator

If a battery has a short-circuited cell, or the top of the battery has become soaked with acid, or is in a poor condition due to abuse or prolonged service, it will cause a high charging rate.

Check the earth connections from the battery and regulator to the body, to ensure that they are tight and in good condition.

Generator and Connections

Check that the generator is functioning satisfactorily and ensure that the leads "D" and "F" are not crossed either at the regulator or generator. If the leads are crossed, the regulator points will have "welded" together the moment the engine was started. Make sure that the leads are not broken or damaged and that the connections are tight.

To Test the Generator

1 Disconnect the leads from the regulator terminals marked "D" and "F" respectively and connect them together. Attach the negative lead of a 0–30 voltmeter to these leads and the positive lead to a good earth.

2 Start the engine and gradually increase the speed to approximately 1,000 r.p.m., when the voltmeter reading should rapidly rise without fluctuation above 24 volts. DO NOT increase the engine speed above a fast idle in an endeavour to obtain this voltage, as this will give a false reading.

If there is a law or no reading, first check the generator leads. If the leads are in good condition, carefully check over the generator and effect any necessary repairs (see page 195). It may be that the generator has been demagnetised, possibly due to the leads having been crossed (regulator points will be "welded" together in this case).

3 Reconnect the leads "D" and "F" from the generator to the terminals "D" and "F" on the regulator.

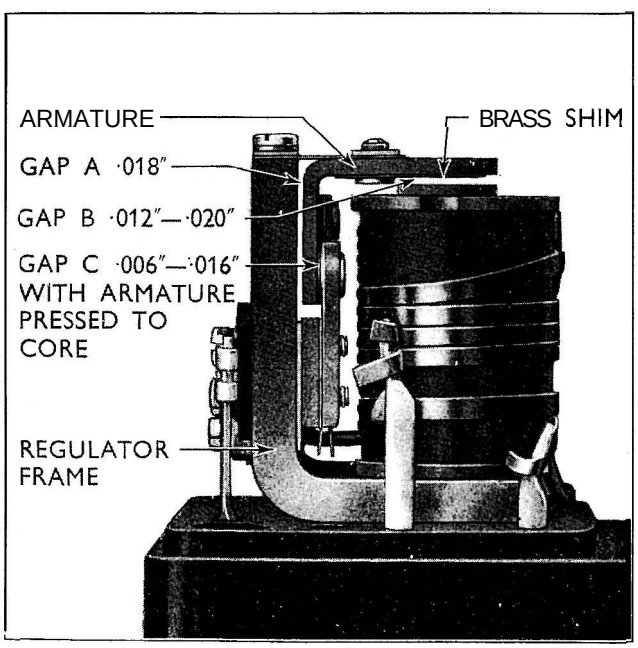

Fig. **242**
Voltage Control Regulator Coils

TESTING AND ADJUSTING TEE REGULATOR

1 Insulate the cut-out points with a thin strip of mica or withdraw the cables from the terminals marked "A" and "A1" (see Fig. 241) and join them together.

2 Connect the negative lead of the test voltmeter (0–30 v.) to terminal "D" on the regulator and the positive lead to a good earth.

3 Adjustment must be made with the regulator cold, i.e., immediately on starting the engine the atmospheric temperature should be noted by means of a thermometer.

4 Start the engine and gradually increase the speed until the voltmeter needle "flicks" and then steadies. This should occur at a voltmeter reading between the limits given below for the approximate temperature of the regulator unit.

Atmospheric Temperature	*Regulator Setting Volts*
50°F.	15.9—16.5
68°F.	15.6—16.2
80°F.	15.4—16.0
104°F.	15.1—15.7

If the reading is not between these limits, the regulator is in need of adjustment.

5 Increase the speed gradually to maximum r.p.m. when the voltmeter needle should not rise more than 0.5 volt above the tabulated readings.

If the voltmeter reading continues to rise as the engine speed is increased, possibly swinging the needle right over, it is indicative that either the regulator points are not opening or there is a poor or no earth between the regulator and the body.

If the points are not opening, the regulator should be renewed, as it is probable that they are "welded" or shorted, or there is an open circuit in the shunt coil.

6 If the voltage at which the reading becomes steady occurs outside these limits, the engine speed should be maintained at the same speed and the regulator adjusted. Release the locknut, holding the regulator adjusting screw and turn the screw in a clockwise direction to increase the voltage or in an anti-clockwise direction to decrease the voltage, keeping as near to the minimum figure as possible. Make sure that the locknut is tightened securely after the adjustment is completed.

7 Reconnect the wires to terminals "A" and "A1" or remove the insulation from the cut-out points.

Ampere Output Test

1 Connect a test ammeter in series with the lead "A" and terminal "A."

2 Speed up the engine and observe the charging rate. This will vary according to the state of charge of the battery? Check the tractor ammeter for accuracy.

Cleaning and Resetting the Regulator Points

1 To render the regulator contacts accessible for cleaning, slacken the screws securing the plate carrying the fixed contact, It will be necessary to loosen off the upper screw so that the contact can be swung outwards and downwards.

2 Remove the moving contact (two screws).

3 Clean the contact points with carbon tetrachloride or carborundum paper operated in a circular movement. Carefully wipe away all traces of dirt or other foreign matter. Finally, wipe both points with alcohol, replace the fixed contact and tighten the securing screws.

4 Finally wipe both points with alcohol, return the fixed contact to its upright position and tighten the two screws securely and then replace the moving contact.

It is possible that the control voltage will not be steady until the points have "bedded in" properly and the air gaps may require adjustment as described below.

5 Insert an 0.018 in. feeler gauge between the armature and the frame (gap A, Fig. 242) and an 0.020 in. feeler gauge between the armature and the core of the bobbin (gap B 0.012 in. to 0.020 in.).

6 Remove the feeler gauge, press down the armature on to the core and check the gap C of the contact points.

This should be 0.006 in. to 0.016 in. and may be adjusted either by increasing or decreasing the .005 in. thick shims located between the contacts and the packing plate. Do not allow the shims to "short" to the back frame.

7 After ensuring that the gap is correct, the screws securing the moving contact should be tightened securely.

If the contact points are found to be badly worn, replace the regulator assembly.

THE CUT-OUT

Examine the cut-out points and, if necessary, clean with carbon tetrachloride or carborundum paper. Ensure that the points are meeting correctly.

To Test and Adjust the Cut-Out

1 Connect the voltmeter between the "D" terminal and a good earth. (See Fig 241.)

2 Speed up the engine slowly and note the voltage immediately before the points close.

This voltage should be between 12.7 and 13.3 volts. The voltage may be adjusted by turning the cut-out adjusting screw in an anti-clockwise direction to decrease the voltage and vice versa. Turn the adjusting screw a little at a time, tighten the locknut and re-test as above.

This voltage should be obtained when gap A is 0.011 in.–0.015 in. (2.744 mm.–3.81 mm.), gap B is 0.030 in.–0.034 in. (7.72 mm.–8.63 mm.), gap C is 0.008 in. (2.03 mm.) and gap D is 0.002 in.–0.006 in. (0.5 mm.–1.5 mm.). (See Fig. 243.)

These figures can be used as an initial setting if new cut-out points are fitted.

Ensure that the points close before the armature touches the core of the bobbin.

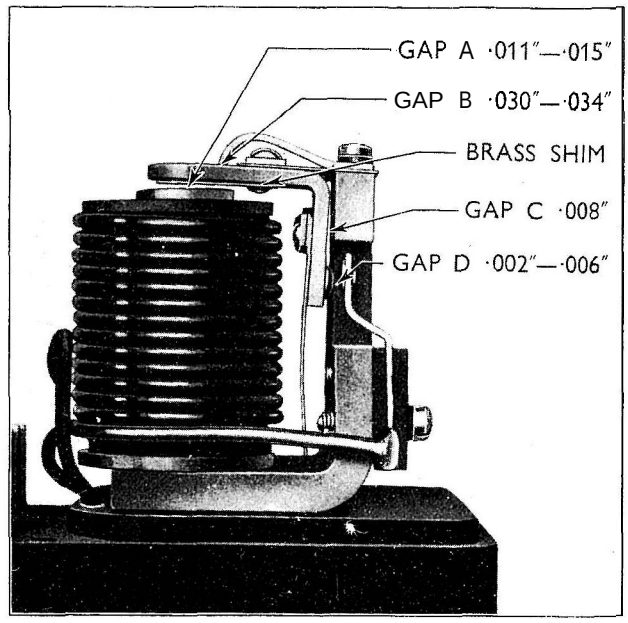

Fig. **243**
Voltage Control Regulator Cut-out Coils

THE DISTRIBUTOR

The distributor is mounted on the right-hand front side of the engine and is driven by the auxiliary drive shaft.

The ignition advance is mechanically controlled according to engine speed by governor weights inside the distributor body and according to engine load by vacuum control acting on the contact breaker plate.

The corrections to spark advance are made necessary because of the wide variations in engine speed and load to which the engine is subjected under normal operating conditions.

In the vacuum control mechanism, one side of the diaphragm is linked to the breaker plate and the other side is connected by a vacuum line to the carburettor just above the throttle plate. A spring is fitted between the vacuum side of the diaphragm and the housing nut.

The vacuum applied at the diaphragm, combined with the action of the diaphragm spring, gives correct spark advance according to the load placed on the engine. Maximum advance is obtained when depression on the vacuum diaphragm is high (when the manifold depression is high) and decreases as manifold depression decreases. As the vacuum advance does not operate at idling speed, due to the throttle plate being closed, a correctly retarded spark is obtained for starting.

The mechanical governor mechanism consists of two weights, pivoted so that they move outwards from the distributor shaft as engine speed rises. The weights are restrained by two springs and the outward movement is in direct proportion to the shaft speed. As the weights move outwards they turn the cam relative to the shaft and thus alter the firing point.

It is important to remember that, in practice, the total amount of advance provided by the distributor at a constant engine speed is determined by a combination of both engine speed and engine load.

From engine No. 1238809 the initial static advance was reduced from 14" to 6" on Vap. Oil engines and 9° to 1° on Petrol engines.

Note — Always fit a new timing plate when the distributor shaft and springs are changed to the current type.

Care must also be taken to ensure that the current shaft (distributor) and weight plate assembly (stamped 14°–16° on the action plate) is not confused with the shaft used on early type distributors. This shaft is stamped 10°–12° on the action plate.

Current type distributors which incorporate the distributor parts mentioned above, are identified by the marking 40362 'A' or 'B' stamped on the side of the body. (See Fig. 244.) Any other marking will indicate previous distributors with 14" (Vap. Oil) and 9° (Petrol) initial static advance. If distributors are modified in Service, any previous identification marking on the side of the body should be obliterated.

CONTACT BREAKER POINTS

To Adjust the Contact Breaker Points Gap

1 Remove the distributor cap.

Model	*Current Type*		*Description*	*Previous Type*	
	Part No.	*Identification*		*Part No.*	*Identification*
Vap. Oil and Petrol	EIADKN–12175–B	Stamped 14°–16° on Action Plate	Shaft (Dist.) and Weight Plate Assy.	EIADKN-12175–A	Stamped 10°–12° on Action Plate
	1 of :— EIAKDN–12191–B	9½ Coils Long hook	Spring (Dist. Weight)	EIADKN–12191–A 2 used	12½ Coils Short hook
	1 of :— EIADKN–12192 or EIADKN–12191–A	12½ Coils Short hook			
Vap. Oil only	EIADKN–6023–B	6° Adv. stamped on plate	Plate (Timing)	EIADKN–6023–A	14° Adv. stamped on plate
Petrol only	EIADN–6023–B	1° Adv. stamped on plate	Plate (Timing)	EIADN–6023–A	9° Adv. stamped on plate

Fig. 244
Modified Distributor Weight Springs

2 Turn the engine so that the heel of the contact breaker is on a high point of the cam.

3 Slacken the locking screws securing the adjustable contact to the breaker plate and adjust the points gap to 0.014 in.–0.016 in. This adjustment is made by turning the eccentric screw (see Fig. 245).

Align the breaker points to make full face contact by bending the adjustable contact bracket. Do not bend the breaker arm.

4 Tighten both locking screws and recheck the gap on all cam lobes to determine if the cam is worn or if the setting has altered.

5 Measure the contact breaker arm spring tension by pressing the hook of the scale AT/SV 12162 against the breaker arm adjacent to the contact point. Take the readings just as the points separate and if not to specification (18–22 ozs.) bend the spring to increase or decrease the tension as required.

6 Refit the distributor cap and check the leads to ensure that none are disconnected.

To Remove the Contact Points

1 Remove the distributor cap and lift the rotor from the distributor cam.

2 Unscrew the contact breaker terminal nut, lift off the leads, insulating bush, contact breaker arm and the fibre washer.

3 Remove the two screws securing the adjustable contact plate and lift it off.

To Replace

Check the condition of the contacts and fit new parts if they are worn or burned. Contacts that show a greyish colour and are only slightly pitted need not be renewed. If necessary, contacts can be smoothed with a very fine emery stone and then thoroughly cleaned with carbon tetrachloride. Do not use a file.

1 Secure the adjustable contact plate to the breaker plate, using two screws with flat and spring washers. Do not tighten the screws fully.

2 Locate the fibre washers on the pivot and terminal posts and refit the contact breaker arm so that the contact points are together and the loop end of the spring is over the terminal post.

3 Fit the two heads over the terminal post, then the insulating bush and secure by means of the nut and washer.

4 Ensure that the contact points abut squarely and adjust the contact breaker points as described. (See Fig. 245.)

5 Refit the rotor squarely on the distributor cam boss, with the slot and lug in line. Press the rotor into position so that the lower face abuts the cam. Replace the distributor cap.

DISTRIBUTOR CONDENSER

The condenser is fitted in parallel across the contact breaker points and a short circuit in the condenser will cause ignition failure as the points will no longer interrupt the low tension circuit.

In such cases, the condenser will have to be replaced. An open circuit, however, cannot readily be checked without the use of specialised equipment, such as the Diagnosis Test Set. The capacity of the condenser is 0.18 to 0.22 microfarad.

The usual signs of a failing condenser or a faulty connection are excessively burned contact breaker points and difficult starting.

To Remove the Condenser

1 Remove the distributor cap and rotor, unscrew the breaker arm terminal nut and detach the condenser lead.

2 Unscrew the screw retaining the condenser to the breaker plate and remove the condenser.

To Replace

1 Locate the condenser in the slot on the breaker plate and refit the securing screw, noting that the breaker plate earth lead is connected beneath this screw.

2 Refit the condenser lead on the breaker arm terminal, and replace the retaining nut.

3 Check that there is no possibility of a short circuit in the lead and refit the rotor and distributor cap.

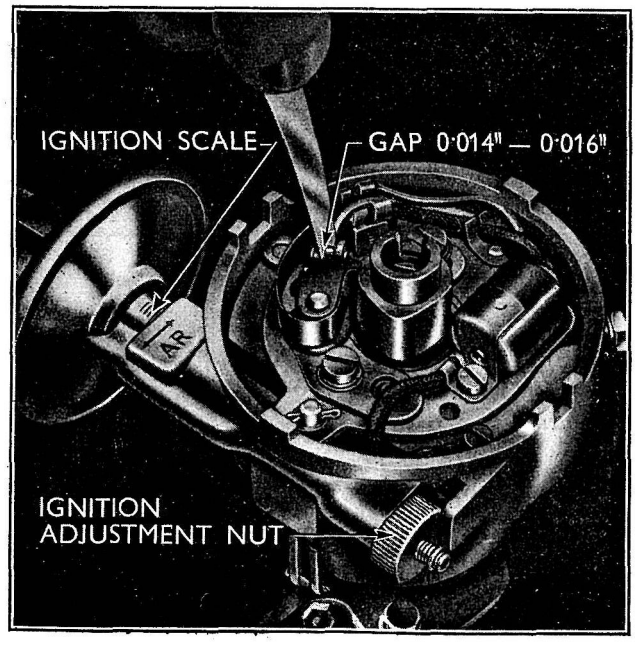

Fig. 245
Adjusting the Contact Breaker Points Gap

OVERHAULING THE DISTRIBUTOR

To Remove

1 Disconnect the spark plug leads from the plug terminals.

2 Disconnect the L.T. lead from the distributor primary terminal and the H.T. lead from the distributor cap.

3 Disconnect the vacuum line from the union on the distributor vacuum housing.

4 Loosen the distributor body clamp bolt and remove the distributor assembly (it is not necessary to remove the clamp plate securing bolts).

To Dismantle

1 Remove the distributor cap and leads by releasing the two retaining clips.

2 Remove the rotor by lifting it straight up from the distributor cam.

3 Remove the contact breaker points assembly as described on page 205.

4 Remove the condenser retaining screw and detach the condenser (one end of the breaker plate earth lead is retained by this screw).

5 Detach the split pin or clip retaining the vacuum diaphragm actuating arm to the contact breaker plate.

6 Remove the two screws retaining the bearing plate to the distributor body.

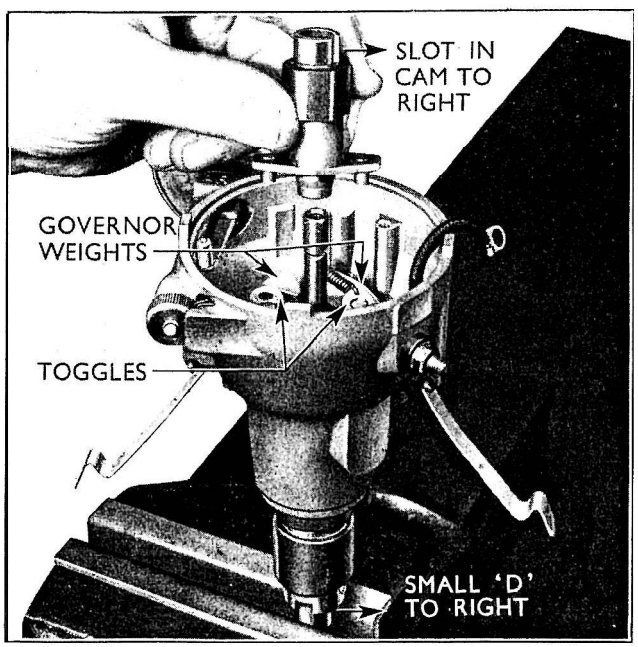

Fig. 246
Replacing Distributor Cam

Note — The bearing plate screw adjacent to the advance adjustment nut retains the other end of the breaker plate earth lead.

Lift the bearing and breaker plate assembly out of the distributor body.

7 Note the position of the rotor slot in the cam in relation to the offset drive at the bottom of the distributor shaft.

8 Remove the screw retaining the cam to the distributor shaft and carefully lift the cam clear of the toggles on the governor weight plate.

9 Remove the governor weight assemblies, lifting them straight up from the weight plate. Detach the spring, toggle and flat washer from the peg of each weight.

10 If it is necessary to remove the distributor driving collar, file off the end of the retaining pin and drive it through the collar with a suitable punch.

Note — The driving collar should only be removed if the distributor shaft and weight plate assembly is to be renewed.

Unscrew the greaser cup from the side of the body and extract the spring ana lubricating pad.

11 Remove the distributor shaft and weight plate assembly from the distributor body, together with the fibre washer and spacing washer underneath the weight plate.

12 Separate the contact breaker plate from the bearing plate by removing the retainer ring and bearing plate retainer. Separate the plates and remove the felt lubricating pad.

13 To remove the vacuum unit, detach the small circlip securing the advance adjustment nut and unscrew the nut, when the vacuum unit may be pulled out of the distributor body.

Remove the vacuum unit ratchet spring and advance adjustment nut spring.

14 To dismantle the vacuum unit, unscrew the nut, detach the spring and spring retainer.

Detach the spacing washers (where fitted) from the union nut.

15 Detach the primary lead from the distributor body by removing the securing nut, washer and insulators.

To Reassemble

1 Replace the primary lead and insulators on the terminal in the side of the distributor body, refitting the securing nut and washer.

2 Locate the spacing washer on the underside of the new distributor shaft to abut the weight plate and refit the assembly in the distributor body.

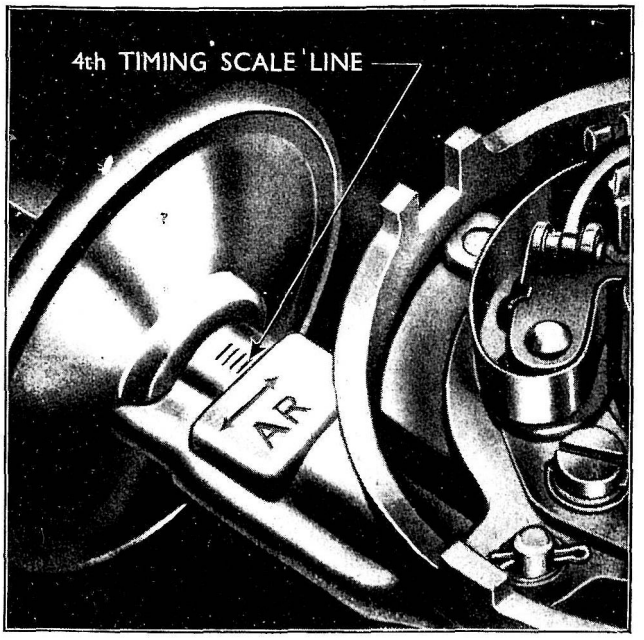

Fig. 247
Timing Scale

3 Locate a fibre washer on the lower end of the shaft and refit the driving collar. Fit a new collar retaining pin and peen over the end.

The end-float and side play of the distributor shaft should be within the limits given in the specification.

Replace the lubricating pad, spring and greaser cup in the side of the body. (Refill the cup with high melting point grease.)

4 Assemble the governor weights, fitting a flat washer, toggle and spring on the peg of each weight. (For details of springs see Fig. 244.) The inner hole of the toggle engages on the peg.

5 Install the governor weights on the weight plate and check for wear on the weight bushes, pegs and toggles. Renew parts if necessary. Check the action of the weights in the fully advanced and retarded positions and lightly lubricate all parts with engine oil.

6 Refit the distributor cam assembly to the shaft and ensure that it turns smoothly without looseness. Engage the cam pegs in the outer holes of the toggles with the rotor slot in the cam towards the small "D" of the shaft driving collar (see Fig. 246).

Refit the securing screw.

7 Check the vacuum unit linkage for wear. Reassemble the unit, fitting the spring and spring retainer in the housing bore. Check that the original number of spacing washers are fitted on the union nut and tighten the nut securely.

8 Refit the vacuum housing into the distributor body.

9 Replace the adjustment nut spring, vacuum unit ratchet spring, adjustment nut and circlip. Tighten the nut until the fourth line on the timing scale behind the vacuum housing is in line with the edge of the distributor body, as shown in Fig. 247.

10 Check the fit of the breaker plate in the bearing plate and also the breaker arm pivot for looseness or wear.

Soak a new lubricating felt pad in engine oil and place it in position between the two plates. Secure the plates with the retainer which must be fitted with the prongs towards the bearing plate. Refit the retainer ring as shown in Fig. 248.

11 Locate the contact breaker plate assembly in the distributor body, engaging the end of the vacuum unit arm in the bushed hole in the breaker plate. Secure the plate with two screws to the distributor body noting that the screw adjacent to the advance adjustment nut retains ohe end of the breaker plate earth lead.

Secure the vacuum unit arm to the breaker plate with a spring clip or split pin.

12 Check the condition of the condenser and renew if necessary. Locate the condenser on the breaker plate and refit the securing screw, noting that the end of the breaker plate earth lead is held by this screw.

13 Replace the contact points assembly as described on page 205, and initially set the points gap to 0.014 in. to 0.016 in.

14 Replace the rotor by locating it in the slot of the distributor cam.

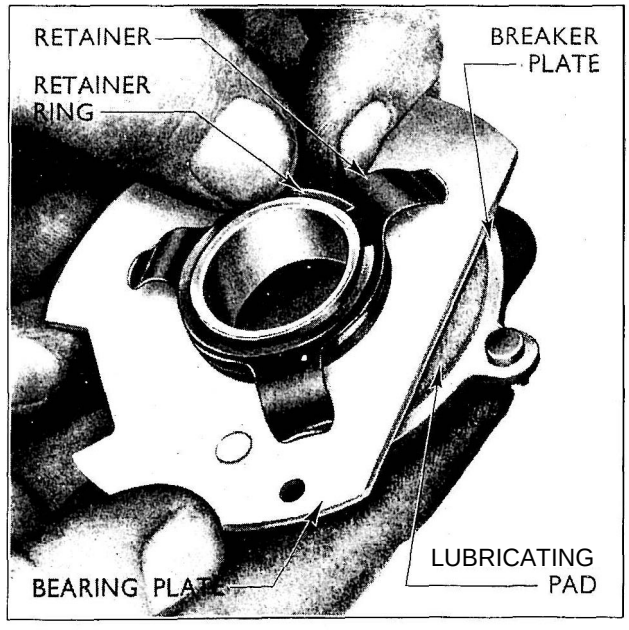

Fig. 248
Reassembling Breaker Plate

To Replace

1 Locate the distributor on the engine, engaging the tongue on the driving collar with the oil pump drive gear slot (with the timing pointer on the cylinder front cover in line with the notch in the crankshaft pulley as No. 1 piston comes up on the compression stroke). The large "D" on the oil pump drive gear should point to No. 2 cylinder with the drive slots at 45" to the engine centre line. (See Fig. 249.)

2 Replace the distributor cap and leads, securing the cap with the two retaining clips.

3 Reconnect the leads to the spark plug terminals and the H.T. and L.T. coil wires to the distributor.

4 Reconnect the vacuum line to the vacuum housing union and tighten the union nut securely.

5 Re-time the ignition as described below.

IGNITION TIMING

1 Turn the engine until No. 1 piston is coming up to T.D.C. on the compression stroke (this can be checked by removing number one spark plug and feeling the pressure developed in the cylinder, or by removing the oil filler cap and checking that both valves on No. 1 cylinder are closed).

Continue turning the engine until the notch on the crankshaft pulley is in line with the timing pointer.

This will give the initial timing setting of 6° on the V.O engine and 1° on the Petrol engine, before T.D.C. (See Fig. 244 for early type settings.)

Fig. 249
Oil* Pump *Drive Gear

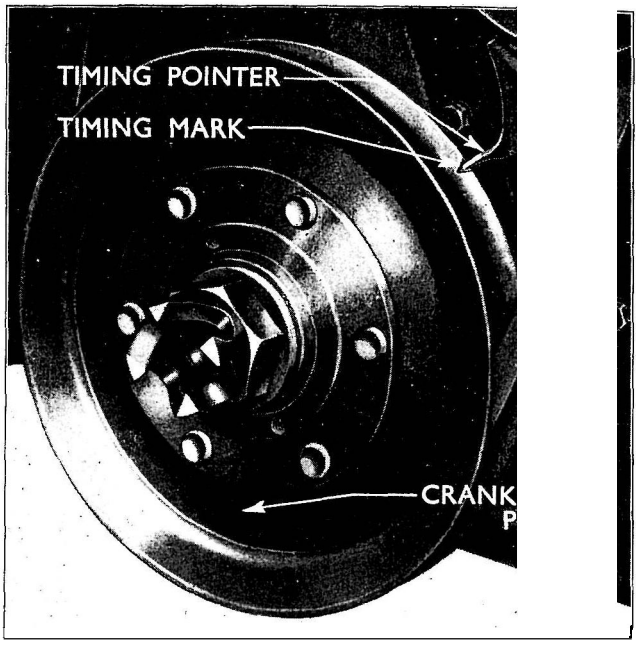

Fig. 250
Timing Pointer

2 Turn the adjustment nut at the rear of the distributor body until the fourth line of the ignition timing scale, just behind the vacuum control diaphragm housing, is in line with the edge of the distributor body, as shown in Fig. 247. Remove the distributor cap.

3 Slacken off the distributor body clamp bolt and rotate the body clockwise until the contact breaker points are just opening, when the rotor arm is in line with number one H.T. contact on the distributor cap.

4 Tighten the distributor body clamp bolt and replace the distributor cap.

5 Where a 4.62 : 1 compression cylinder head (current production) is fitted, retard ½ division on micro adjuster, which is equivalent to 4° on the crankshaft.

To Check the Timing with a Timing Light

1 Connect up the two main leads to **six volts only of the battery,** using the clips provided. The positive lead clip has a red outer covering and the negative lead clip has a black covering. Connect the third lead, which has the smaller clip, to the primary terminal of the distributor.

2 Check that the notch on the crankshaft pulley is visible and mark with chalk or paint if necessary.

3 With the distributor body clamp bolt slackened off, start up the engine and allow to idle.

4 Point the timing light at the timing pointer and observe if the pointer and the notch on the pulley are in line. (See Fig. 250.)

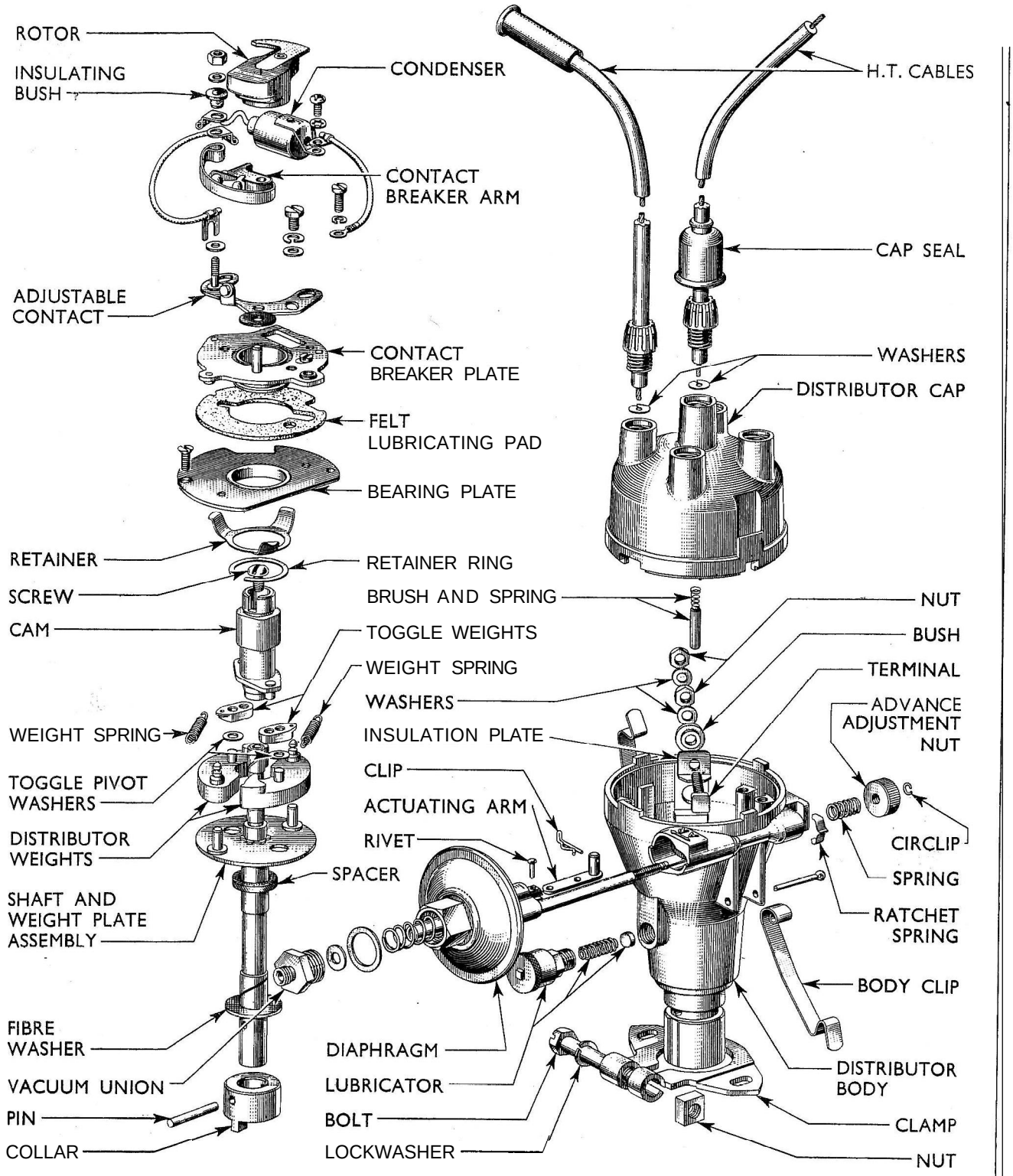

Fig. 251 **Exploded View of the Distributor**

If the notch of the pulley is above the pointer, the engine is too far advanced and the distributor body should be turned anti-clockwise slightly to retard the ignition.

Should the notch be below the pointer, the distributor body should be turned clockwise slightly to advance?the ignition.

5 After the adjustment has been made, the distributor body clamp bolt should be tightened securely.

The operation of the governor weights may be checked by opening and closing the throttle. As the throttle is gradually opened, the notch will move away from and above the timing pin and as the throttle is closed, the notch will move down in line with the pin.

Any tendency for the notch to jump suddenly away from the timing pin will indicate that the governor weights are binding or that the toggle springs are weak.

Note — If 4.62 : 1 compression cylinder head is fitted and timing is consequently retarded 1°, this will be apparent at this stage.

DISTRIBUTOR TESTS ON STROBOSCOPE

In order to check the mechanical and vacuum advance characteristics of the distributor accurately, the unit should be mounted on the stroboscope of the Diagnosis Test Set.

The mounting adaptor 610–S should be bolted above the stroboscope plate and the distributor drive coupling 610–21 fitted into the drive dogs. The distributor should then be mounted in the jaws of the support clamp, engaging the distributor driving collar in the drive coupling end. Approximately $\frac{1}{16}$ in. vertical play should be allowed in the drive coupling.

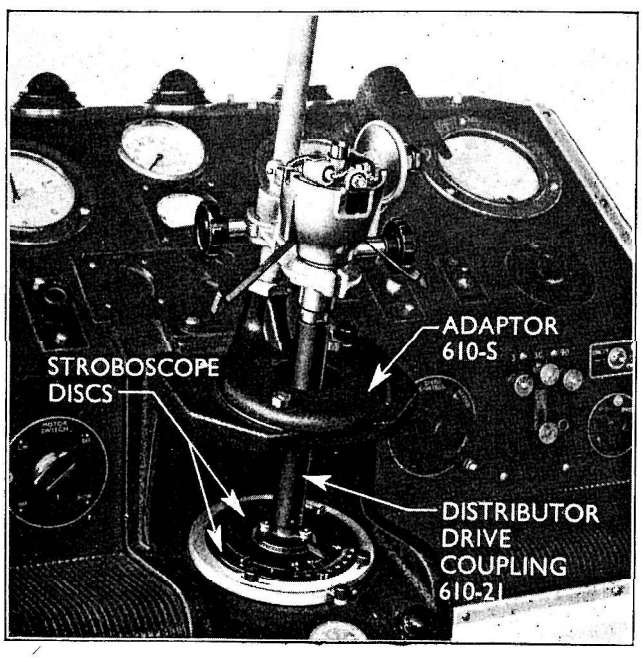

Fig. *252*
Distributor .Mounted on Diagnosis Test Set

Checking Vacuum Diaphragm for Leaks

The vacuum diaphragm may be checked for air leaks on the Diagnosis Test Set, using the manometer attachment connected to the vacuum diaphragm housing.

Maximum vacuum should be obtained on the manometer and should remain steady. A rapidly falling vacuum reading indicates a leaking diaphragm or connection.

Checking Automatic Mechanical Advance

The ignition advance characteristics produced by the governor weights may be checked on the stroboscope attachment.

The arrow on the inner stroboscope disc must be set in line with the mark on the outer. disc.

Adjust the speed to the figures given in the following table, checking the advance figures on the stroboscope disc :

Crankshaft R.P.M.	*Degrees Advance (Distributor)*
	Petrol and Vap. Oil Engine
400	0°—1°
600	1.5° — 4.75°
800	5.5° — 8.50°
1000	8.25°—10.5°
1200	10.5° —12.25°
1400	12.5° —14.25°
1600	14.0° —16.0°

Check the advance characteristics of the distributor on deceleration only.

If spark advance is not within the specified limits on deceleration, overhaul the governor weight assembly and replace the governor toggle springs.

When the advance is found slightly under specifications, renew the governor springs.

Checking Vacuum Advance

The vacuum advance is checked at a constant speed before the governor weights start to operate. In this way, the mechanical advance does not affect the vacuum advance reading.

Connect the vacuum line to the distributor vacuum housing union nut and adjust the manometer to maximum vacuum.

The vacuum should be gradually reduced to the figures given in the following table and the degrees advance checked.

If the spark advance is not within the specifications, the breaker plate moves freely and no leakage is noted in the vacuum chamber, it will be necessary to replace the vacuum diaphragm return spring.

Carburettor Vacuum (Inches of Mercury)	*Degrees Advance (Distributor)*
	Petrol and Vap. Oil Engine
4 ins.	0°—1.0°
5 ins.	1.25"—3.5"
6 ins.	3.6° —5.75"
8 ins.	6.0" —8.0"
10 ins.	6.0° —8.0"
12 ins.	6.0" —8.0"
14 ins.	6.0" —8.0"
16 ins.	6.0" —8.0"

On previous distributors, if the variations are small, some adjustment may be obtained by installing spacer washers between the spring and the union nut to increase the spring tension. Spacer washers. installed on the outside between the union nut and the diaphragm housing will decresse the spring tension. No adjustment is provided on current distributors.

THE **IGNITION COIL**

The ignition coil requires very little attention and should give thoroughly satisfactory service. The coil is mounted on the engine rear bulkhead on the R.H. side.

The only care required in service is to ensure that the mounting bolts are kept tight and that the two L.T. terminals are kept clean and firmly secured. The H.T. terminal should be inspected periodically for signs of corrosion.

The insulated end of the ignition coil should be kept clean and free from dust, otherwise surface leakage may occur, particularly in damp conditions.

SPARK PLUGS

Current engines are fitted with Champion single point 14 mm. spark plugs (type N.7).

The points gap should be checked periodically and readjusted to 0.040 in. Whenever possible, a wire type spark plug gauge should be used, and the outer point should be bent towards or away from the centre electrode to increase or decrease the spark plug gap. The correct tool should be used to bend the outer point.

Care should be taken, when cleaning spark plugs, .that the porcelain insulators are kept clean and free from cracks, to avoid creating an alternative path to earth for the H.T. current, which would partially, if not fully, short circuit the spark plug gap, thus giving rise to difficult starting and cause oil dilution in consequence of the unburnt fuel passing the piston rings into the sump.

When refining spark plugs, make sure that the copper asbestos washers are not defective or flattened. New washers should be fitted if necessary.

THE STARTER MOTOR (DIESEL)

The starter motor is mounted on the front of the flywheel housing on the L.H. side of the engine.

The motor has four pole pieces and four sets of field coils. Four commutator brushes are fitted, two of which are earthed ; the other two are insulated and connected to the field coils. The armature shaft is supported in an outboard bearing in the starter motor drive housing when the latter is depressed.

The solenoid switch is located under the battery carrier and is controlled by a relay switch mounted on top of the starter motor drive housing, which is operated by the pinion actuating lever and starter control lever.

The key in the centre of the lightirig switch controls the relay switch circuit.

To Test the Starter oh the Tractor

If the starter armature does not rotate when thc control lever is depressed ensure that the switch key is in the "on" position and check the condition of the battery and connections.

If these are in good condition depress the button on the end of the solenoid ; should the starter now operate, check the relay switch, switch key and their connections.

If the starter motor does not operate check the solenoid and starter motor connections. Ensure that the srarter motor has a good earth connection.

If the starter motor stili does not operate it should be removed for examination.

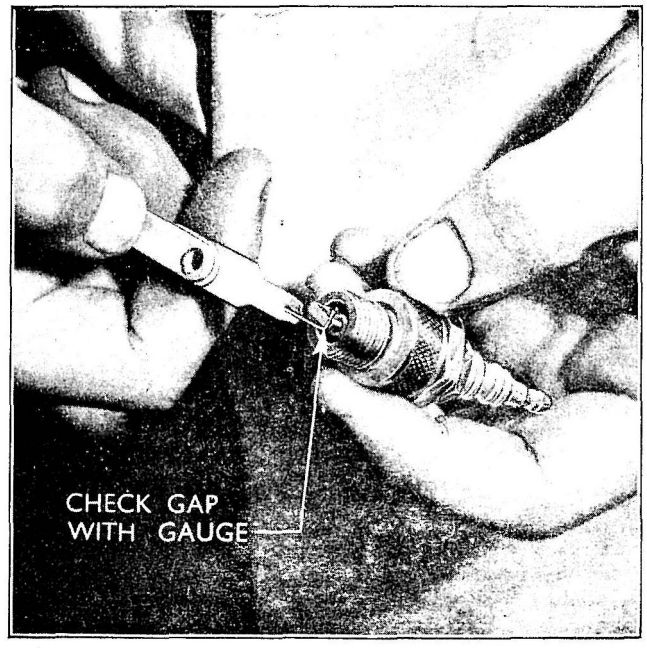

Fig. 253
Checking Sparking Plug Gap

To Remove the Starter Motor (Diesel)

1 Disconnect the negative terminal of the battery and the cable at the terminal on the end of the starter motor.

2 Disconnect the two leads from the relay switch.

3 Remove the split pin and clevis pin securing the operating rod to the pinion actuating lever.

4 Unscrew the three starter motor securing bolts evenly and detach the starter motor.

To Replace

I Pass the drive end of the starter motor into the flywheel housing aperture and locate the motor on the mounting flange.

2 Replace the three bolts and spring washers and tighten evenly.

3 Refit the clevis pin and split pin securing the operating rod to the pinion actuating lever.

4 Reconnect the two leads to the relay switch.

5 Reconnect the cable to the starter motor and reconnect the battery.

THE STARTER MOTOR DRIVE (DIESEL)

The starter motor drive is of the mechanical pre-engagement type operated by linkage connected to the starter control lever. The linkage is adjusted so that the relay switch contacts are closed when the pinion is almost fully meshed with the .flywheel ring gear.

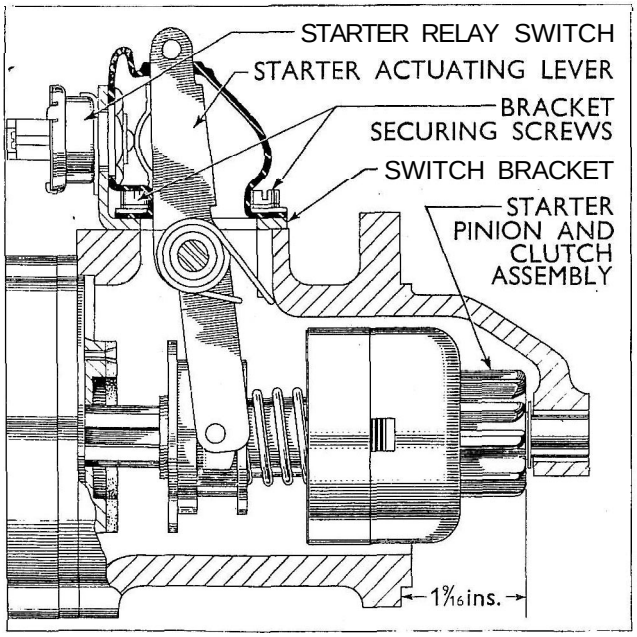

Fig. 254
Diesel Starter Actuating Mechanism in the Operating Position

A multi-plate metal clutch is incorporated in the drive to prevent the armature rotating at an excessive speed should the pinion be held in mesh after the engine has started.

To Remove the Pinion and Clutch Assembly

1 Remove the four dowelled screws securing the relay switch bracket to the starter motor body, and remove the bracket and cover.

2 Release the ends of the pinion return spring from under the flange in the housing.

3 Unscrew the nut from the pivot bolt and remove the bolt.

4 Remove the return spring, two spacers and the two halves of the actuating lever.

5 Remove the two through bolts securing the starter motor drive housing to the starter motor body and remove the drive housing.

6 Remove the thrust washer and slide the pinion and clutch assembly off the armature shaft.

To Refit the Pinion and Clutch Assembly

1 Refit the pinion and clutch assembly to the armature shaft and refit the thrust washer.

2 Replace the starter motor drive housing, ensuring that the dowel is correctly located. Enter the two through bolts and securely tighten.

3 Locate the lower half of the actuating lever with the curved face of the thrust shoes towards the pinion. Fit the upper half of the actuating lever with the plain face towards the pinion. Refit the return spring and two spacers with the loop in the spring away from the starter. body and enter the pivot bolt. Locate the spring ends in the housing behind the flange.

Note — The bolt will not enter if the lower half of the actuating lever is incorrectly located.

4 Refit the spring washer and nut to the pivot bolt and securely tighten.

5 Refit the relay switch cover and switch bracket assembly and enter the four dowelled screws.

6 Depress the actuating lever until the distance from the rear face of the pinion teeth to the starter motor mounting flange is $1\frac{9}{16}$ in. (See Fig. 254.) Adjust the relay switch plate until the contacts are just closed with the pinion at this setting. Securely tighten the retaining screws. Check that the contacts are closed by means of a battery and bulb.

To Dismantle the Pinion and Clutch Assembly

1 Open the lock ring retaining the circlip.

2 Depress the brake plate and remove the lock ring and circlip.

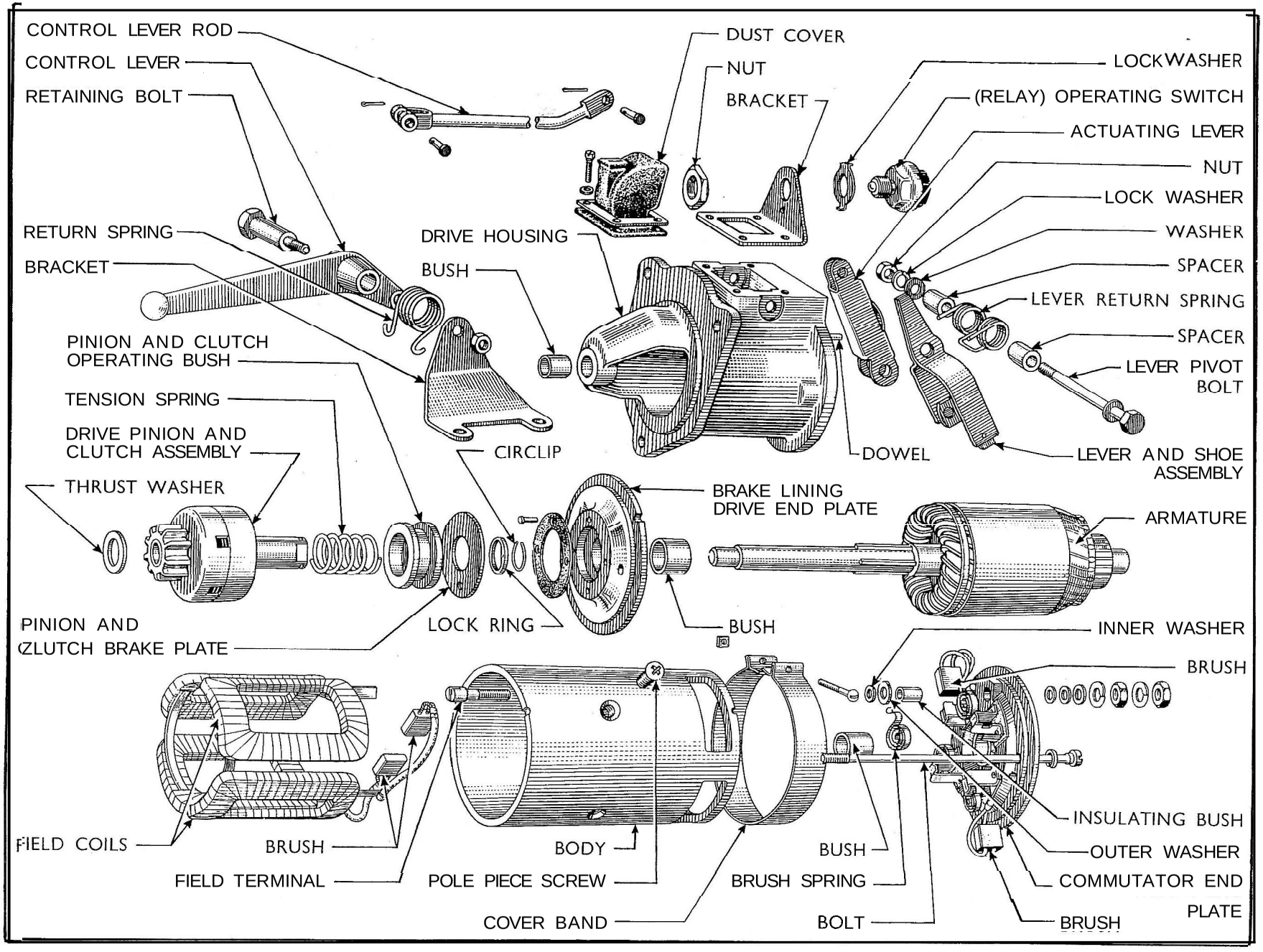

Fig. 255 **Exploded View of Starter Motor, Drive and Controls (Diesel)**

3 Remove the brake plate, operating bush and spring. The pinion and clutch assembly must not be dismantled as this is adjusted in manufacture to slip at the correct torque. If the clutch has been slipping due to foreign matter on the clutch plates, it is permissible to wash the assembly in petrol.

To Reassemble

1 Refit the spring and operating bush. The end of the spring must be located inside the bush.

2 Refit the brake plate and a new lock ring.

3 Depress the brake plate and fit the circlip.

4 Close the lock ring to hold the circlip securely in position.

Note — Refer to pages 216 and 217 for details of dismantling and reassembling the starter motor.

THE STARTER MOTOR

PETROL AND VAPORISING OIL

The starter motor is mounted on the front of the flywheel housing on the left-hand side of the engine.

The motor has four pole pieces and four sets of field coils. Four commutator brushes are fitted, two of which are earthed, the other two being insulated and connected to the ends of the field coils.

A square is machined on the end of the armature shaft, beneath the small metal cap, to assist in freeing the pinion if it jams in the flywheel ring gear.

If rhe starter armature does not rotate when the switch control is operated, first depress the centre contact on the switch located beneath the battery. If the starter now operates, the cable should be adjusted at the connector behind the bulkhead.

If the starter does not operate, check the condition of the battery and the battery connections as described on page 194.

If the battery is in good condition, check the starter switch. If the starter still does not operate, the motor should be removed for examination.

To Remove the Starter Motor (Petrol **and** Vap. Oil)

1 Disconnect the battery and the cable at the terminal on the starter motor end plate.

2 Unscrew the three starter motor securing bolts evenly and detach the starter motor.

To Replace

1 Pass the drive end of the starter motor into the flywheel housing aperture and locate the motor on the mounting flange.

2 Replace the three bolts and spring washers and tighten securely.

3 Reconnect the cables to the starter motor terminal and the battery.

4 Check that the starter motor turns the engine when the starter switch is operated.

Note — Refer to pages 216 and 217 for details of dismantling and reassembling the starter motor.

STARTER SWITCH (Petrol & Vap. Oil)

The cable operated switch is mounted behind the engine bulkhead adjacent to the battery carrier.

The cable adjustment should be checked periodically and approximately $\frac{1}{4}$ in. clearance maintained between the control knob and instrument panel.

STARTER DRIVE (Petrol & Vap. Oil)

The starter drive is of the outboard type (Fig. 256), the pinion moving towards the body of the starter motor when the switch is closed.

If the starter drive pinion is tight on the drive sleeve, wash in paraffin but do not oil the pinion or sleeve.

To Dismantle the Starter Drive

1 Remove the split pin securing the spring retaining nut. Unscrew the nut (L.H. thread) from the armature shaft.

2 Remove the main spring, thrust washer, pinion and sleeve.

3 Remove the spring cup, retaining spring and guide.

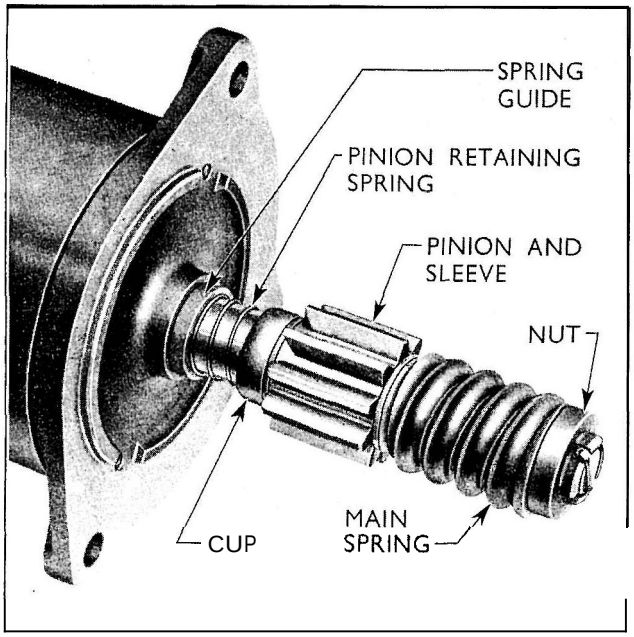

Fig. 256
Petrol and Vaporising Oil Engine Starter Motor Drive

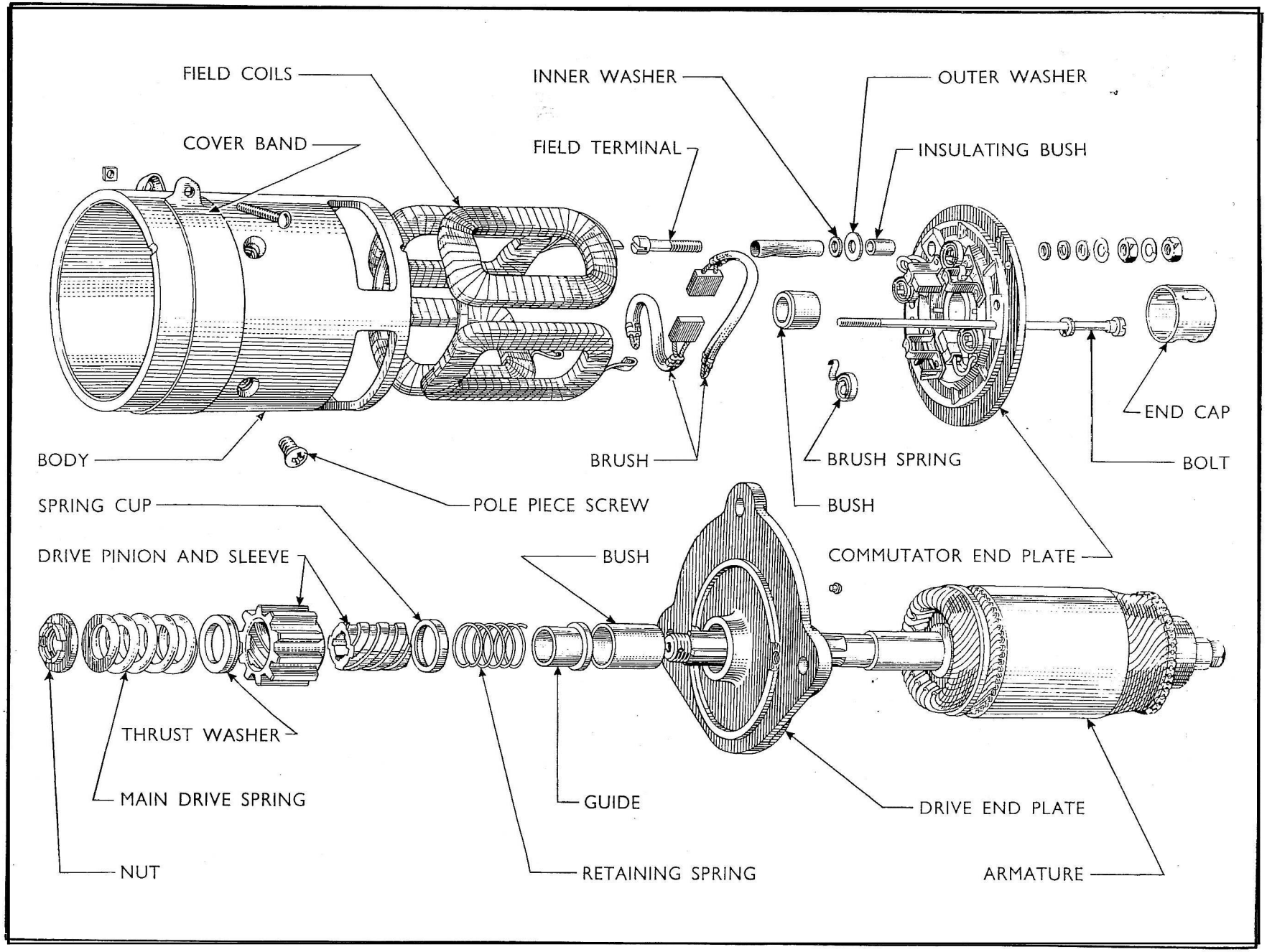

Fig. 257 **Exploded View of Starter Motor and Drive (Petrol & Vap. Oil)**

To Reassemble

1 Locate the spring guide, retaining spring and cup on the armature shaft.

2 Refit the drive pinion and sleeve.

Note — The chamfer on the pinion teeth must face towards the body of the starter motor.

3 Refit the thrust washer, spring and retaining nut. Tighten the nut (L.H. thread) against the shoulder on the shaft and refit the split pin.

STARTER BRUSHES (All Models)

To Examine the Brushes

1 Remove the starter motor.

2 Loosen the screw and slide the brush cover band away from the brush apertures.

3 Lift the brush springs, using a piece of wire shaped into a hook and check the movement of the brushes in the holders.

4 If the brushes are sticking, clean them with a petrol-moistened cloth and, if necessary, ease the sides of the brushes by polishing on a smooth file. When satisfactory, replace the starter.

Note — If the brushes are worn so that they do not bear on the commutator or the brush lead is exposed on the wearing face, new brushes must be fitted.

If the commutator is blackened or dirty, clean by holding a petrol-moistened cloth against it while the armature is rotated.

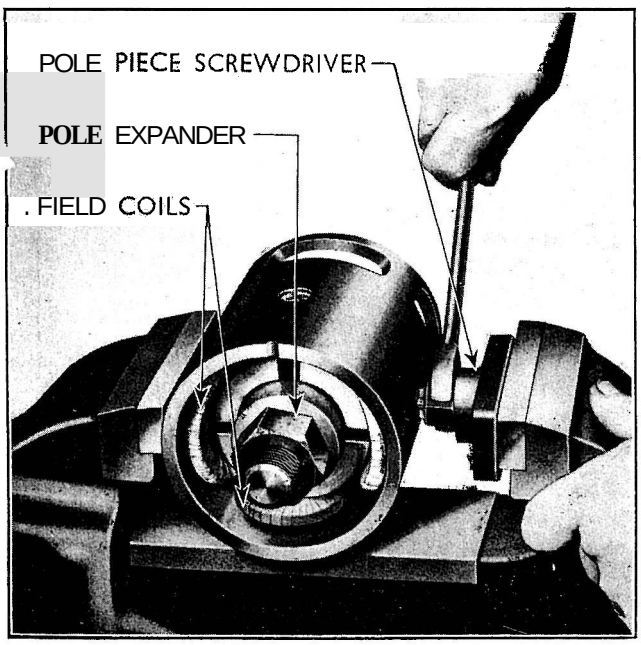

Fig. 258
Pole Piece Screwdriver and Pole Expander

To Remove the Commutator End Plate and Brushes

1 Remove the starter motor.

2 Slacken the cover band screw and slide the cover band away from the brush apertures.

3 Lift the brush springs and draw the brushes out of their holders.

4 Unscrew the starter cable terminal nuts and detach the spring, flat and fibre washers.

5 Unscrew the two through-bolts and carefully pull the commutator end plate from the starter motor, together with the earthed brushes. Remove the armature if necessary.

6 The brush leads are soldered into tags on the earthed brush holders on the end plate and to the ends of the fields coils. Carefully unsweat the brush leads from their connections and detach the brushes.

To Replace

1 Resolder the brush leads to the field coils and earthed brush holders.

2 Before fitting the end plate, check the brush springs and renew if necessary. Take care to close the ends of the brush spring posts after fitting new springs.

It is also advisable to check the insulated brush holders to ensure that they are not earthing. Use a battery and bulb for this test.

3 Check that the fibre washers are fitted on the field coil terminal post and a fibre bush is located in the terminal post hole in the commutator end plate.

4 Check that the insulator band is located between the yoke and the end of the field coils, and pass the insulated brushes through the apertures in the yoke.

5 Replace the commutator end plate on the starter motor yoke, passing the earthed brushes through the other apertures in the yoke and engage the dowel pin in the end plate with the notch in the yoke end.

6 Replace a fibre washer, flat washer, spring washer, nut, spring washer and nut (in that order) on the field coil terminal post and tighten the inner nut securely.

7 Replace the armature and drive end plate, if removed, engaging the dowel pin on the plate in the notch at the drive end of the yoke.

Replace the two through-bolts and tighten securely.

8 Lift the brush springs and insert the brushes into their holders, ensuring that they slide freely. (The field coil brushes locate in the insulated brush holders.)

9 Slide the brush cover band over the brush apertures and tighten the screw.

10 Replace the starter motor as described.

STARTER COMMUTATOR (All Models)

The commutator should be inspected when the starter motor is dismantled. A commutator in good condition should be smooth and free from pitting or burned spots.

Clean the commutator with a petrol-moistened cloth. If this is ineffective, carefully polish with a strip of fine glass paper, *not* emery cloth, while the armature is rotated.

If the commutator is badly worn or scored, remove the starter drive and detach the drive end plate. Mount the armature in a lathe, rotate at high speed, and take a light cut with a very sharp tool.

Polish the commutator with very fine glass paper. Do not undercut the mica insulation between the segments as is the normal practice with generators.

Check that the commutator segments are not earthing to the armature shaft and core by checking with a battery and bulb.

STARTER ARMATURE (All Models)

The armature can be inspected after it has been removed from the starter motor yoke. Visual examination will, in many cases, reveal any cause of failure, i.e., conductors lifting away from the commutator due to the starter pinion being jammed in the engaged position while the engine is running.

A damaged armature must be replaced in all cases. No attempt should be made to machine the armature core or to true a distorted armature shaft.

Armature Shaft Bushes

The bushes in the starter motor drive housing (Diesel only), and in the drive and commutator end plates, are serviced and can be renewed if they are found to be excessively worn or scored.

To renew the bushes, stepped drivers should be made to suit.

After reassembling the starter motor, check that the armature shaft is free to rotate in the bushes without binding.

STARTER FIELD COILS (All Models)

To Test

1 Remove the commutator end plate and withdraw the armature and drive end plate.

2 Test the field coils for continuity and earth as follows:—

Check for continuity between the two ends of the field coils, using a mains operated line tester, having a suitable bulb in circuit. Alternatively, the test prods on the Diagnosis Test Set can be used.

If the lamp does not light, there is an open circuit in one of the field coils. If the lamp lights, it does not necessarily mean that the field coils are in order, as it is possible that one of the coils may be earthing to the pole pieces or starter yoke.

This may be checked by touching one of the test prods on the starter yoke and the other on to one of the field coil tappings. If the bulb now lights, the coils are earthed.

Note — The field coils are not serviced separately, as invariably it is found that if one fails the others are affected.

To Remove

1 Mark the yoke and pole pieces so that they can be refitted in their original positions.

2 Detach the fibre insulating washers and sleeve from the field coil terminal post and the insulation band from the commutator end of the yoke.

3 Locate the pole piece expander in the starter yoke and tighten the nut to expand the tool against the pole pieces. Mount the starter yoke and pole piece screwdriver, tool No. AT2/U 10044, in a vice as shown in Fig. 258, and slacken the pole piece screws one at a time. Finally remove the screws with a crosshead screwdriver.

4 Withdraw the field coils and pole pieces from the yoke and carefully unsweat the field coil tappings from the terminal post.

To Replace

1 Locate the ends of the field coil tappings in the slot of the terminal post and solder them in position.

2 Solder new brush leads to the smaller connections on the field coils.

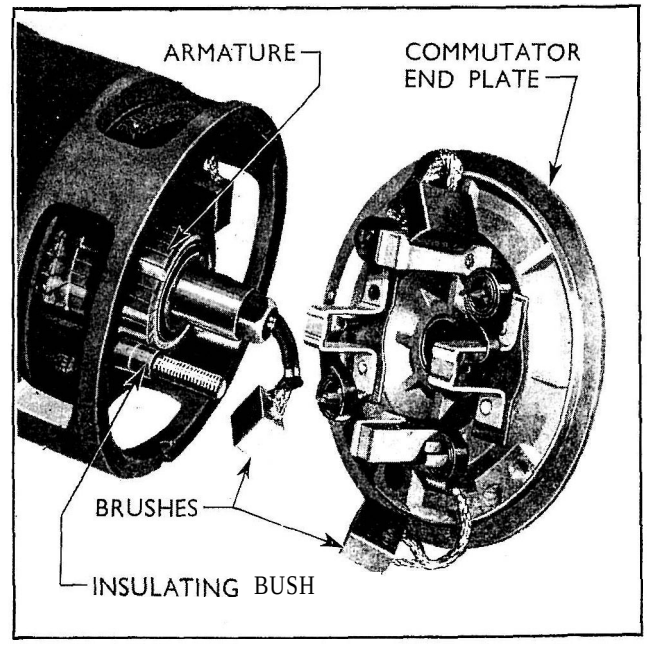

Fig. 259
Starter Motor Commutator End Plate

3 Temporarily replace the commutator end plate on the starter yoke and note the position of the field coil terminal in relation to the yoke. Reassemble the pole pieces to the field coils so that the mating marks on the yoke and pole pieces are together.

4 Insert the field coils and pole pieces into the starter yoke, align the securing screw holes and locate the pole pieces with the cross-head screws.

5 Insert the pole piece expander and tighten the nut to press the pole pieces against the yoke.

6 Place the starter yoke and pole piece screwdriver in a vice and tighten the screws securely, as shown in Fig. 258.

7 Slacken off the nut and remove the expander.

8 Replace the insulation band around the commutator end of the field coils between the coil tappings and the yoke.

9 Replace the insulator sleeve and washers on the field coil terminal post and check that the post is pointing along the axis of the yoke.

10 Replace the armature and commutator end plates.

SOLENOID SWITCH (Diesel)

To Remove the Solenoid Switch

1 Disconnect the battery terminals and remove the battery.

2 Disconnect the leads from the starter motor to the solenoid, the solenoid to the battery and from the relay terminal to the solenoid.

3 Remove the battery carrier, unscrew the two solenoid retaining screws and lift away the solenoid.

Note — Attempts to dismantle the solenoid should not be carried out as the complete part only is serviced.

To Replace

1 Install the solenoid (two screws) and refit the battery carrier.

2 Reconnect the starter motor leads from the battery, solenoid and relay switch.

3 Refit the battery and connect the battery terminals.

THE INSTRUMENT BOX (All Models)

The control box is secured to the tractor by the two rear fuel tank securing bolts and comprises the instruments, engine and electrical controls.

The instruments are the oil pressure gauge, temperature gauge and ammeter. The controls are the lighting and ignition switch. horn button. starter motor control and choke control on the petrol and vaporising oil engines.

On the diesel engined tractor the control box is as on the petrol and vaporising oil engine tractors, except that the starter motor control is omitted and the hole blanked off. The choke control is replaced by the engine stop control. The switch key controls the circuit to the starter motor relay switch.

In both control boxes the electrical controls are housed in the lower halves of the boxes.

For service operations on the temperature gauge and oil pressure gauge refer to the Cooling and Lubrication Sections.

To Renew the Electrical Controls

1 Disconnect the negative terminal of the battery.

2 Remove the four screws securing the lower half of the control box to the rear panel.

3 Pull the lower half of the panel away from the upper half and this will give access to the electrical controls.

To Replace

1 Fit the lower half of the control box to the upper half.

2 Enter and tighten the four screws securing the lower half of the control box to the rear panel.

3 Reconnect the negative terminal of the battery.

To Remove the Starter Motor or Choke Control (Petrol and Vap. Oil) or Stop Control (Diesel Engine)

1 Disconnect the negative terminal of the battery.

2 Remove the lower half of the control box.

3 Disconnect the appropriate control cable from its component.

4 Unscrew the nut securing the control to the control box and withdraw the control.

To Refit the Controls

1 Enter the control into the control box, thread the spring washer and nut over the control.

2 Locate the flat on the outer casing of the control in its correct position and tighten the retaining nut.

3 Reconnect the cable, leaving approx. Q in. clearance between the knob and face of the control box.

4 Refit lower half of control box.

5 Reconnect the negative terminal of the battery.

LIGHTING SYSTEM (All Models)

The lights fitted to the tractor consist of two headlamps (with double filament bulbs), side and tail lamps. The tail lamp unit incorporates a socket for lighting connection to trailers.

To Remove the Headlamps

1 Disconnect the negative terminal of the battery.

2 Remove the earth wire from the radiator shell.

3 Disconnect the wires at the snap connectors on the R.H. side of the radiator shell. In the case of the L.H. headlamp remove the clips securing the loom to the fan cowling.

4 Remove the nut and washer securing the headlamp to the shell and remove the lamp.

To Refit the Headlamps

1 Refit the headlamp to the radiator shell. Thread the washer and nut over the loom and tighten the nut.

2 Reconnect the leads at the snap connectors. On the L.H. headlamp clip the loom to the fan cowling.

3 Reconnect the earth wires to the radiator shell. Ensure that the connections are clean and thoroughly tightened.

4 Reconnect the negative terminal of the battery.

5 Realign the headlamps and securely tighten the retaining nut.

To Remove the Headlamp Bulb

1 Loosen the lamp rim clamping screw and push it clear of the clamp.

2 Lift the rim from the bottom and detach the tonpue from the slot in the lamp body.

3 Turn the bulb holder anti-clockwise sufficiently to free the retaining lugs-and draw the bulb holder out of its mounting.

4 Remove the bayonet type bulb.

To Replace the Headlamp Bulb

1 Refit the bulb to the bulb holder. Ensure that the word TOP stamped on the cap is towards the larger lug of the bulb holder.

2 Locate the bulb holder in the reflector. Turn clockwise to secure it on the retaining lugs.

3 Insert the tongue on the rim in the slot on top of the lamp body and press the rim firmly downwards.

4 Locate the rim clamping screw and tighten securely.

To Remove the Headlamp Glass or Reflector

1 Remove the headlamp rim and glass assembly.

2 Remove the bulb holder, turn anti-clockwise.

3 Remove the six spring clips securing the reflector to the rim and lift away the glass and rim.

To Refit the Headlamp Glass or Reflector

1 Fit a new cork gasket between the glass and reflector. Ensure that they are correctly located.

2 Fit a new cork gasket on the shoulder of the glass.

3 Fit the rim and ensure that the indentation of the reflector is adjacent to the locating tongue.

4 Refit the six spring clips.

5 Refit the bulb holder and instal the assembly on the lamp. Locate and tighten the clamping screw.

The Side Lamp

The side lamps are mounted on brackets on the rear wings. The bulbs are double contact type, one terminal being earthed to the body of the lamp. The bulb holders are rubber mounted to insulate the bulb from vibration.

To Remove the Sidelamps

1 Disconnect the negative terminal of the battery.

2 Remove the screw retaining the rim to the body and detach the rim and glass assembly.

3 Disconnect the feed and earth wires from the bulb holder and remove the rim and glass assembly.

4 Remove the two bolts holding the sidelamp bracket to the wing and remove the assembly.

5 Remove the sidelamp from the bracket.

To Refit the Sidelamps

1 Secure the sidelamp to the bracket with the nut and lockwasher.

2 Enter the wire through the holder bolt of the lamp. Secure the bracket to the wing by the two nuts and bolts. Ensure a good earth connection at this point.

3 Reconnect the feed and earth wires to the bulb holder terminals.

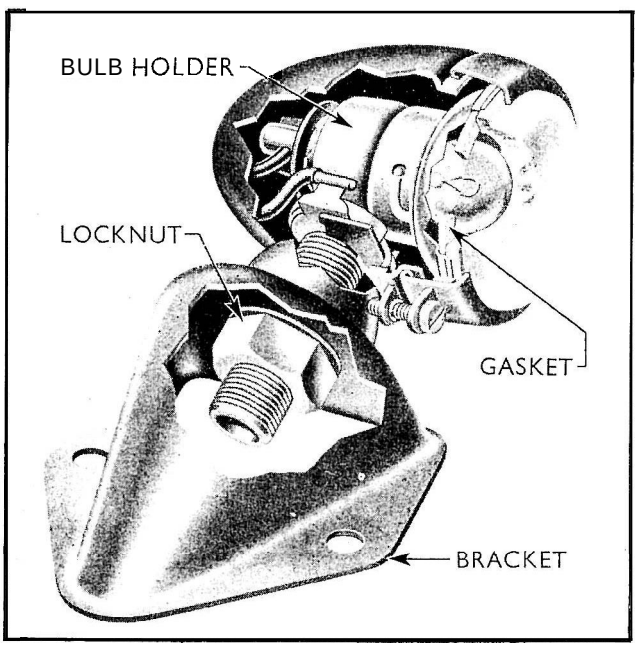

Fig. 260
Sectioned View of Sidelamp

4 Kefit the rim and glass assembly and tighten the retaining screw.

5 Reconnect the negative terminal of the battery.

To Remove the **Sidelamp** Glass

1 Remove the rim and glass assembly.

2 Remove the three spring clips around the edge of the rim.

3 Separate the rim and reflector and remove the glass.

To Replace the **Sidelamp** Glass

1 Fir new cork gaskets between the rim and glass and the glass and reflector.

2 Fit the three spring clips around the edge of the rim.

3 Refit the rim and glass assembly.

To Remove the **Sidelamp** Bulb

1 Remove the rim and glass assembly.

2 Turn the bulb holder anti-clockwise and withdraw it from the reflector.

3 Remove the bayonet type bulb.

To Refit the **Sidelamp** Bulb

1 Refit the bulb to holder.

2 Locate the bulb holder on the locking tongue. Turn clockwise to secure.

3 Refit the rim and glass assembly.

The Tail Lamp and Extension Lamp Assembly

This assembly comprises a tail lamp and bayonet type socket to enable a connection to be made to the lighting circuit of trailers. The tail lamp bulb is a single contact type. The extension light socket is double contact, one contact being earthed to the body of the casing.

To gain access to the tail lamp bulb remove the screw locking the lamp body in position and turn the body anti-clockwise.

The Ignition and Lighting Switch

Note — On the diesel tractor the ignition key is used as a starter relay switch.

The combined switch is mounted in the control box.

With the handle turned anti-clockwise the side and tail lamps only are illuminated and the extension socket is alive.

With the handle turned clockwise to the first position all lights are illuminated. In the second position the head lamps are in the dip position.

Turning the switch key anti-clockwise completes the ignition circuit on the petrol and vaporising oil engined tractor. On the diesel tractor this switch completes the circuit to the starter motor relay switch.

To Remove the Switch

1 Disconnect the negative terminal of the battery.

2 Remove the lower half of the control box.

3 Detach the voltage regulator.

4 Remove the two nuts and spring washers securing the switch to the control box and ease the switch out of its location.

To Refit

1 Enter the switch into the control box and locate the mounting lugs on the two studs.

2 Fit the spring washers and nuts and tighten.

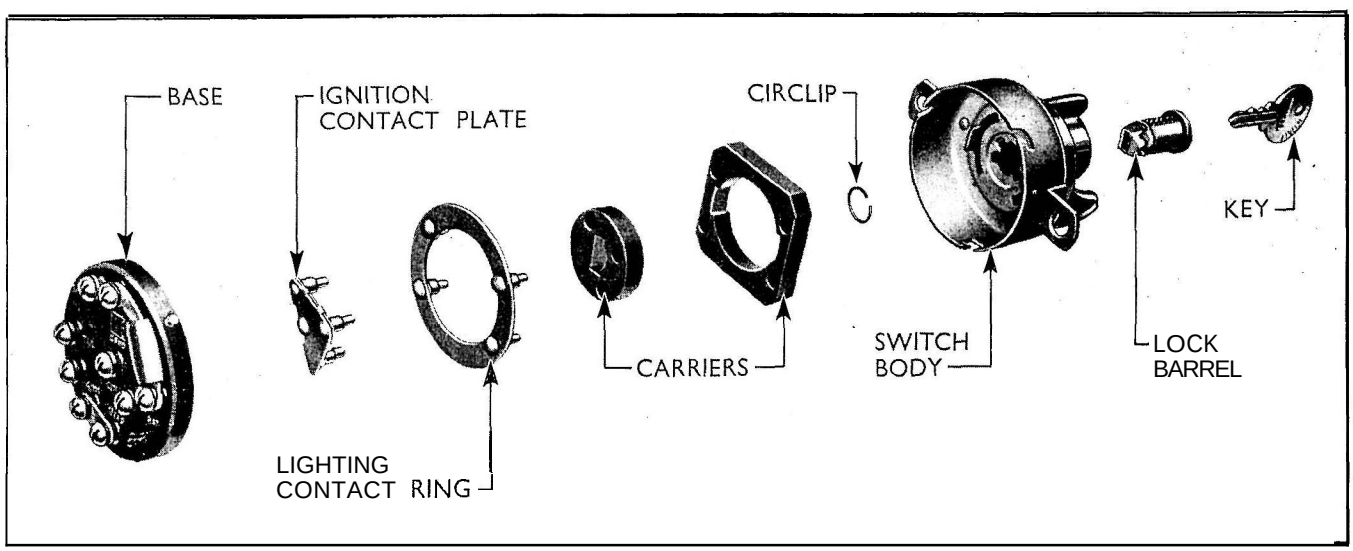

Fig. 261 **Exploded View of Ignition and Lighting Switch**

3 Refit the voltage regulator.

4 Refit the lower half of the control box.

5 Reconnect the negative terminal of the battery.

To Dismantle the Switch or Renew the Ignition Lock Barrel

1 Remove the switch (see above)

2 Turn the terminal base slightly anti-clockwise to free the base from the body. Take care that the internal contacts do not fall out.

3 Hold the switch body with the handle mounting downwards to expose the internal contacts. It will be observed that there is a brass ring with the four lighting contacts and a triangular brass plate in the centre carrying the two ignition contacts.

4 Remove the two brass plates and the two ebonite carriers when the bottom of the switch or lock barrel will be visible.

5 Remove the snap ring retaining the lock barrel in the body. Ensure that the ignition switch is in the off position and pull the lock barrel out of the body.

To Reassemble

1 Hold the body of the switch the correct way up with the lighting switch mounting facing the operator and in the off position.

Insert the lock barrel in its location with the key slot upwards, i.e. with the numerals to the left and the letters "FA" to the right.

Turn the body over to expose the back plate and replace the snap ring. Operate the switch to ensure that it works satisfactorily.

2 Replace the square ebonite carrier with the four holes upwards so that the two grooves engage with the two lugs of the switch handle mounting.

3 Replace the circular ebonite carrier with the three holes uppermost and the straight portion of the slot to the flat side of the lock barrel tongue.

4 Replace the two brass contact plates with the sprung legs engaging in the holes of the two carriers.

5 Inspect the switch contacts and check that they are in good condition and assemble the terminal base to the body. The three locating pins are offset so that the base may only be fitted in one position.

Press the base into the body and give the body a slight twist clockwise.

6 Refit the switch to the control box.

To Remove the Ammeter

1 Disconnect the negative terminal of the battery.

2 Remove the lower half of the control box and detach the voltage regulator.

3 Disconnect the ammeter lead, unscrew the two nuts and lockwashers, lift off the retaining bracket and ease out the ammeter.

To Refit

1 Locate the ammeter in position in the lower half of the control box and secure by means of the bracket and two nuts and lockwashers.

2 Refit the voltage regulator

3 Refit the lower half of the control box.

4 Reconnect the negative terminal of the battery.

The Horn

A high frequency horn is fitted below the air cleaner on the L.H. side and is operated by the push button in the centre of the control panel.

To adjust the horn turn the countersunk screw at the rear of the horn. Do not touch the adjusting screw and locknut in the centre of the horn.

Note — If there is mechanical vibration, check the mounting bolts for looseness. Should the vibration persist check the diaphragm for cracks around the outer edge.

Wiring Diagrams

For details of the wiring of the diesel tractor refer to Fig. 262 on page 222, and Fig. 263 on page 223 for the petrol and vaporising oil tractors.

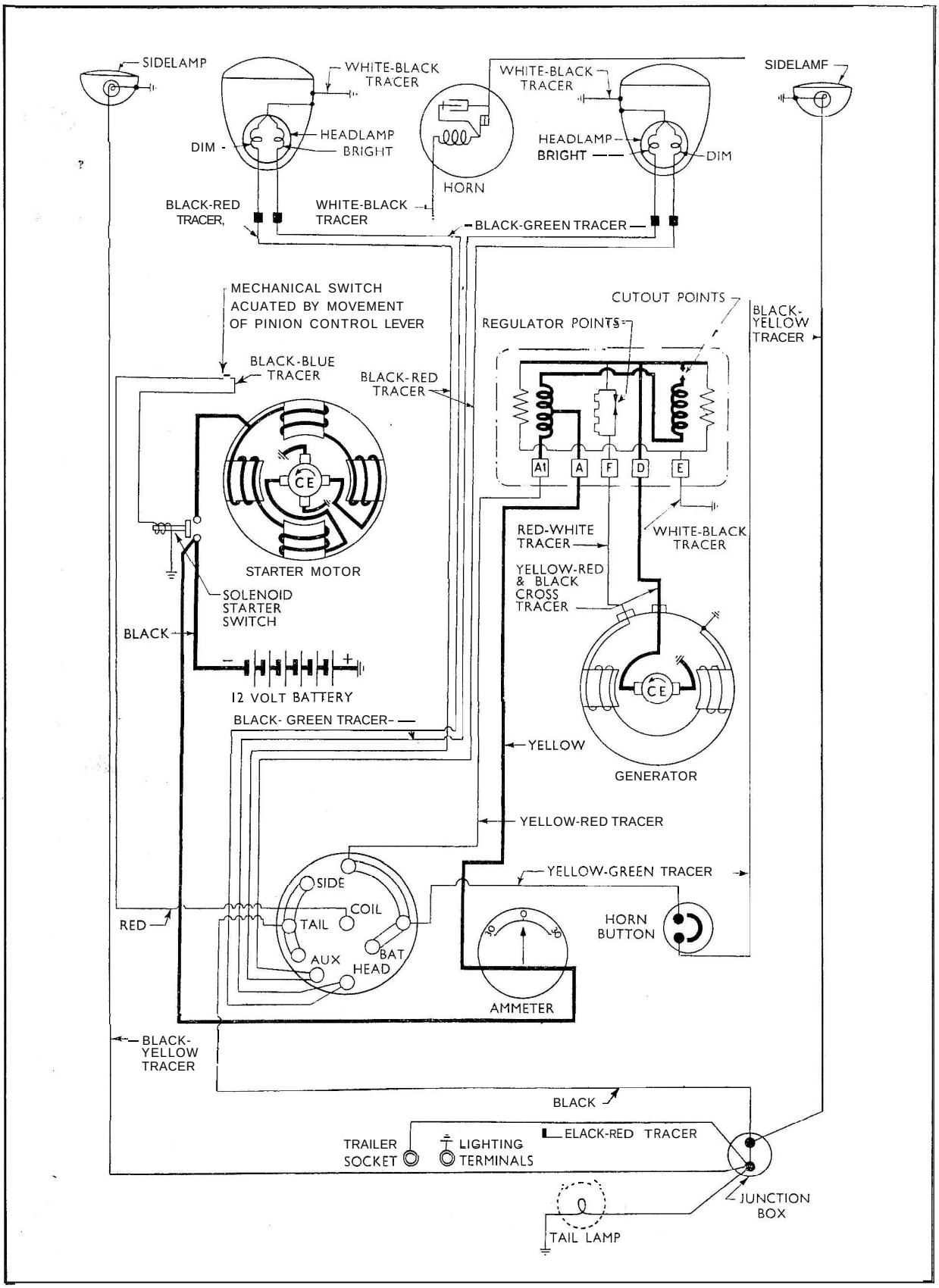

Fig. *262*
Wiring Diagram—Diesel Tractor

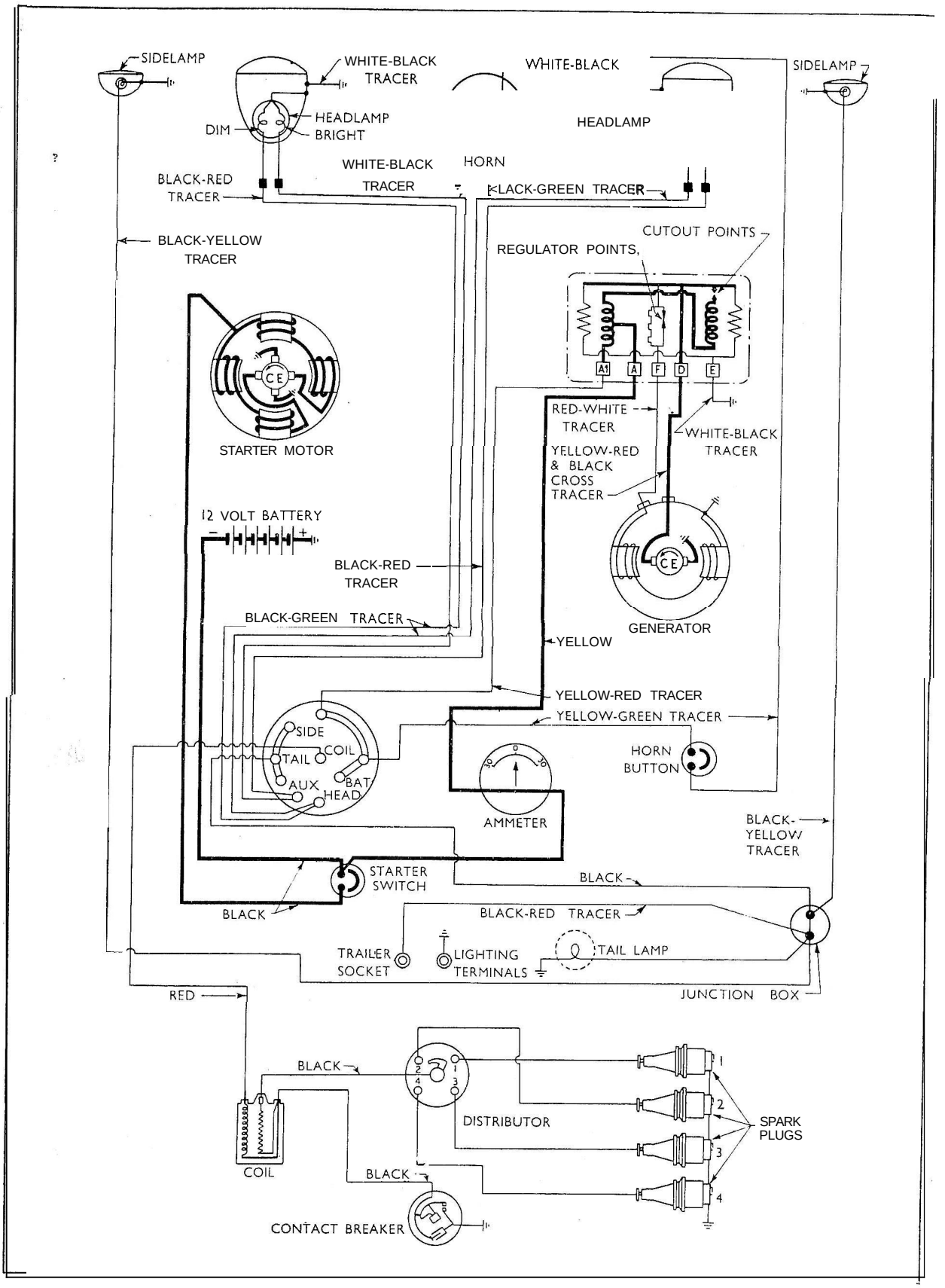

Fig. *263*
Wiring Diagram—Petrol and Vap. Oil Tractors

SPECIFICATION AND REPAIR DATA

ELECTRICAL EQUIPMENT (All Models)

Battery

Voltage		12 volt
Actual capacity in A.H. when discharged in 10 hrs.	Diesel	138
	Petrol / Vap. Oil	51
Amperes for 20 mins.	Diesel	168
	Petrol / Vap. Oil	65
Specific gravity charged		1.270–1.285
Low limit while discharging at 20 hour rate :		
Sp. gr.		1.10
Cell volts		1.85
Electrolyte capacity (pints)	Diesel	9.45
	Petrol / Vap. Oil	5.5

Generator

Brushes—No.	2
Length	0.625″ (i5.87 mm.)
Wear Limit	0.35" (8.89 mm.)
Regulation	C.V.C.
Max. output	13 amps.
Max. charging rate amps. at 1000 r.p.m. engine speed	14
Cut-in volts	12.5
Cut-in speed (engine R.P.M.)	600
Max. reverse current (amps.)	6
Regulating voltage at 68°F.	15.6–16.2
Effective pulley diameter :	
Engine	9.0" (223.51 mm.)
Generator	5.27" (133.86 mm.)
Ratio to engine speed	1 : 1.707

Distributor (Petrol and Vap. Oil Models)

Automatic advance begins r.p.m. :	
Crankshaft	500
Ends r.p.m. crankshaft	1500
Degrees crankshaft	25
Distributor shaft—diameter	0.4895″—0.490″
end-floa:	0.004"—0.006"
max. side play	0.005"
Breaker arm spring tension—ozs. :	18–22 ozs. when assembled (510.3–623.7 grms.)
Contact point spacing :	.014″ (.356 mm.) min. .016″ (.4064 mm.) max.
Governor weight springs stretch (ins.) (ozs.)	.202″ max. (5.13 mm.) at 26.32 ozs. (662.1 grm's.)
Coil resistance ohms at 68°F. :	
Primary	4.0–4.4
Secondary	7000–8000
Condenser capacity (microfarads)	0.18–0.22
Ignition riming :	
Current production (Petrol)	1° B.T.D.C.
Current production (Vap. Oil)	6° B.T.D.C.
Early production (Petrol)	9° B.T.D.C.
Early production (Vap. Oil)	14" B.T.D.C

Starter Motor

4.62–1 compression cylinder head (Vap. Oil) retard micro adjuster ½ division on current and early type distributors. Equivalent to 4° on crankshaft.

Ampere draw at normal temperature	Diesel	450
	Petrol / Vap. Oil	425
Gear ratio	Diesel	11.6
	Vap. Oil	12.8
Teeth on pinion	Diesel	11
	Petrol / Vap. Oil	10
Teeth on ring gear	(All models)	128
Lock torque lbs. ft.	Diesel	28
	Petrol / Vap. Oil	22.25
Normal engine cranking speeds r.p.m. (engine warm)	Diesel	200
	Petrol / Vap. Oil	140

Sparking Plugs (Petrol and Vap. **Oil** Models)

Size	14 mm.
Type	Champion N7
Point gap	0.040″ (1.016 mm.)

Lamp Bulbs

Headlamp (double filament / double contact)		12V–36W
Dipped		12V–24W
Side lamp	Single pole	12V– 4W
Tail lamp	Single pole	12V– 4W
Voltage drop		.5V max.