Service Instruction Manual

Fourth Issue

STANDARD VANGUARD

SERIES I AND II
and
TRIUMPH "RENOWN" MODELS

ELECTRICAL EQUIPMENT

SECTION M

THE STANDARD MOTOR COMPANY LTD., COVENTRY

ILLUSTRATIONS

Series II Supplement

SPECIFICATION OF EQUIPMENT

*Dynamo	C45XV, C39PV-2 C39ZV C39PV	Fitted to Models Vanguard Saloon, Estate Car, Van and Pick-up Truck.
	C39PV C39PV-2	Fitted to Models 20T, 20TR, and "Renown."
Starter	M418G fitted with (a) SB Drive or Rubber Drive (b) Separate Switch or Switch on CE Bracket	Fitted to Vanguard Saloon, Estate Car, Van and Pick-up Truck.
	M418G (Rubber Drive)	Fitted to 20T, 20TR and "Renown."
Distributor	DKY4A DVX4A	Fitted to Vanguard Saloon, Estate Car, Van and Pick-up Truck, 20T and 20TR.
	DVX4A	Fitted to "Renown."
*Control Box	RF95	Fitted to all models.
	RB106-1	Fitted to all models (latest versions).
Battery	STXW11A STXW9A FTW9A GTW9A	Fitted to Vanguard Saloon, Estate Car, Van and Pick-up Truck.
	STXW11A	Fitted to 20T and 20TR.
	GTW9A	Fitted to "Renown."
Headlamps	F700P and F700 Mark II and III	Fitted to Vanguard Saloon, Estate Car, Van and Pick-up Truck.
	MBD163 Dip and Switch	Fitted to 20T and 20TR.
	MBL147	Fitted to "Renown."
Sidelamps	489	Fitted to Vanguard Saloon, Estate Car, Van and Pick-up Truck.
	1142	Fitted to 20T, 20TR and "Renown."
Stop Tail Lamp	464	Fitted to Vanguard Saloon, Estate Car, Van and Pick-up Truck.
Number Plate, Illumination Lamp and Reverse Lamp	469	Fitted to Vanguard Saloon and Van.
Number Plate, Illumination Lamp	467	Fitted to Pick-up Truck.
Number Plate Box	288	Fitted to 20T, 20TR and "Renown."
Trafficator	SF34	Fitted to all models exdept 20TR.
	SF40	Fitted to 20TR.
Wiper	CR4 CRT14 (on latest versions)	Fitted to Vanguard Saloon, Estate Car, Van, Pick-up, and "Renown."
	SW4	Fitted to 20T and 20TR.
Horn	WT614	Fitted to all models except 20TR.
	WT28	Fitted to 20TR.

*NOTE:- Control Box Model RB.106-1 must only be used in conjunction with Dynamo Model C.39PV-2. If used with earlier dynamos there is a risk of overloading the dynamo.

BATTERY

1. GENERAL.

The battery is supplied either filled and charged or " dry-charged," that is with the cells in a charged condition but sealed and without electrolyte. Details of preparing a "dry-charged" battery for service are given on para. 5 below.

2. ROUTINE MAINTENANCE.

Every 1,000 miles, or monthly (or more frequently in hot climates), examine the level of the electrolyte in the cells, and if necessary add distilled water to bring the level up to the tops of the separators. The use of a Lucas battery filler will be found helpful in this topping-up process, as it ensures that the correct electrolyte level is automatically maintained and also prevents distilled water from being spilled over the top of the battery.

Distilled water should always be used for topping-up. In an emergency, however, drinking water, clean rainwater or melted snow may be used. The following waters must not be used : salt water, chlorinated water, chemically softened water or stagnant water having an offensive odour.

N.B.—Never use a naked light when examining a battery, as the mixture of oxygen and hydrogen given off by the battery when on charge, and to a lesser extent when standing idle, can be dangerously explosive.

Examine the terminals. If they are dirty, scrape them clean and coat them with petroleum jelly. Wipe away all dirt and moisture from the top of the battery, and ensure that the connections and the fixing band are clean and tight.

N.B.—The specific gravity of the electrolyte varies with the temperature. For convenience in comparing specific gravities, they are always corrected to 60°F., *which is adopted as a reference temperature. The method of correction is as follows* :—

For every 5°F. *below* 60°F., *deduct* .002 from the observed reading to obtain the true specific gravity at 60°F. For every 5°F. *above* 60°F., *add* .002 to the observed reading to obtain the true specific gravity at 60°F.

The temperature must be that actually indicated by a thermometer immersed in the electrolyte, and not the ambient temperature.

3. SPECIFIC GRAVITIES AND CHARGING RATES.

	Home trade and climates normally below 80°F. (27°C.)	*Sub-tropical climates* 80°—100°F. (27°—38°C.)	*Tropical climates frequently above* 100°F.
Specific gravity of electrolyte—cell discharged	Below 1.150	Below 1.120	Below 1.100
Specific gravity of electrolyte—cell fully charged	1.280—1.300	1.250—1.270	1.220—1.240
Specific gravity of filling electrolyte, UNCHARGED BATTERY	1.350	1.320	1.300
Specific gravity of filling electrolyte, "DRY-CHARGED" BATTERY	1.275	1.275 (*Climates* normally below 90°F.) 1.215 (Climates often above 90°F.)	1.215
Maximum permissible electrolyte temperature during charging	100°F. (38°C.)	110°F. (43°C.)	120°F. (49°C.)

	STXW11A	*STXW9A and GTW9A*
Initial charging current for new battery	4.5 amperes	3.5 amperes
Normal recharge current	7 amperes	5 amperes

4. SERVICING.

(a) Battery persists in low state of charge.

First consider the conditions under which the battery is used. Remember that if the battery is subjected to heavy loads (*i.e*, long periods of night parking with lights on) without suitable opportunities for recharging, a low state of charge is only to be expected. A fault in the dynamo or regulator, or neglect during a period out of commission, may also be responsible for the trouble.

Vent plugs

See that the ventilating holes in each vent plug are clear, and that the rubber washer fitted under the vent plug is undamaged.

Level of electrolyte

The surface of the electrolyte should be level with the tops of the separators. If necessary, top up with distilled water. Any loss of acid from spilling or spraying (as opposed to the normal loss of water by evaporation) should be made good by dilute acid of the same specific gravity as that already in the cell.

Cleanliness, etc.

See that the top of the battery is free from dirt or moisture which might provide a discharge path. Ensure that the battery connections are clean and tight.

Hydrometer tests.

Measure the specific gravity of the acid in each cell in turn, with a hydrometer. The reading given by each cell should be approximately the same; if one cell differs appreciably from the others, an internal fault in that cell is indicated. This will probably be confirmed by the heavy discharge test described below.

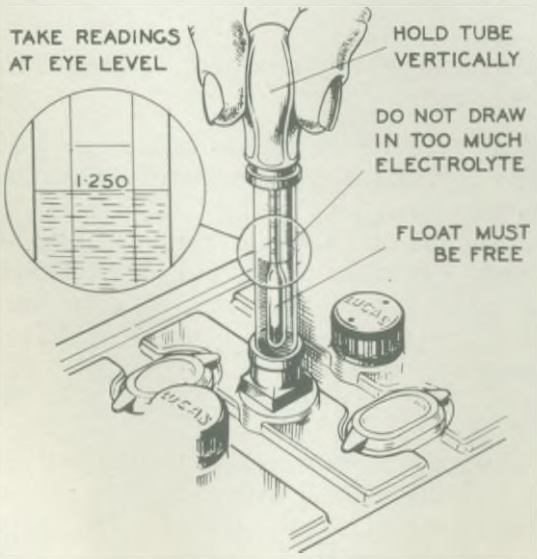


Fig. 1. Taking hydrometer readings

The appearance of the electrolyte drawn into the hydrometer when taking a reading gives a useful indication of the state of the plates: if it is very dirty, or contains small particles in suspension, it is possible that the plates are in a bad condition.

Discharge test.

A heavy discharge tester consists of a voltmeter, 2 or 3 volts full scale, across which is connected a shunt resistance capable of carrying a current of several hundred amperes. Pointed prongs are provided for making contact with the inter-cell connections. Press the contact prongs against the exposed positive and negative terminals of each cell. A good cell will maintain a reading of 1.2—1.5 volts, depending on the state of charge, for at least 6 seconds. If, however, the reading rapidly falls off, the cell is probably faulty, and a new plate assembly may have to be fitted.

(b) Recharging from an external supply.

If the above tests indicate that the battery is merely discharged, and is otherwise in a good condition, it should be recharged, either on the vehicle by a period of daytime running or on the bench from an external supply.

If the latter, the battery should be charged at the current quoted in para. 3 until the specific gravity and voltage show no increase over three successive hourly readings. During the charge the electrolyte must be kept level with the tops of the separators by the addition of distilled water.

A battery that shows a general falling-off of efficiency, common to all cells, will often respond to the process known as "cycling." This process consists of fully charging the battery as described above, and then discharging it by connecting to a lamp board, or other load, taking about 5 amperes. The battery should be capable of providing this current for at least 7 hours before it is fully discharged, as indicated by the voltage of each cell falling to 1.8. If the battery discharges in a shorter time, repeat the "cycle" of charge and discharge.

5. PREPARING NEW BATTERIES FOR SERVICE.

Batteries for the home market are normally supplied filled and charged, and may be put into service on the vehicle without further attention. In an emergency, however, it may be necessary to use a battery supplied dry and uncharged : in this event the instructions in para (a) below, " Initial filling and charging," should be followed.

Batteries for export markets are supplied " dry-charged." Before fitting to the vehicle the battery must be filled with acid as described in para. (b) ; no initial charging is necessary.

(a) Initial filling and charging of new batteries.

Preparation of electrolyte.

Electrolyte of the specific gravity given in para. 3 is prepared by mixing distilled water and concentrated sulphuric acid, usually of 1.835 S.G. The mixing must be carried out either in a lead-lined tank or in suitable glass or earthenware vessels. Slowly add the acid to the water, stirring with a glass rod. Never add the water to the acid, as the resulting chemical reaction causes violent and dangerous spurting of the concentrated acid. The approximate proportions of acid and water are indicated in the following table :—

To obtain Specific Gravity (corrected to 60°F.) of :	*Add 1 vol. of acid of 1.835 S.G. (corrected to 60°F.) to :*
1.350	1.8 volumes of water
1.320	2.3 volumes of water
1.300	2.5 volumes of water

Heat is produced by the mixture of acid and water, and the electrolyte should be allowed to cool before taking hydrometer readings—unless a thermometer is used to measure the actual temperature, and a correction applied to the reading as described in para. 3—and before pouring the electrolyte into the battery. The total volume of electrolyte required is approximately 6 pints.

Filling the battery.

The temperature of the acid, battery and filling-in room must not be below 32°F.

Carefully break the seals in the filling holes and half fill each cell with electrolyte of the appropriate specific gravity. Allow the battery to stand for at least 6 hours, in order to dissipate the heat generated by the chemical action of the acid on the plates and separators, and then add sufficient electrolyte to fill each cell to the top of the separators. Allow to stand for a further two hours and then proceed with the initial charge.

Initial charge.

The initial charging rate is given in para. 3. Charge at this rate until the voltage and specific gravity readings show no increase over five successive hourly readings. This will take from 40 to 80 hours, depending on the length of time the battery has been stored before charging.

Keep the current constant by varying the series resistance of the circuit, or the generator output. This charge should not be broken by long rest periods. If, however, the temperature of any cell rises above maximum quoted in para. 3, the charge must be interrupted until the temperature has fallen at least 10°F. below that figure. Throughout the charge, the electrolyte must be kept level with the top of the separators by the addition of more acid as required.

At the end of the charge carefully check the specific gravity in each cell to ensure that, when corrected to 60°F., it lies within the specified limits. If any cell requires adjustment, some of the electrolyte must be syphoned off and replaced either by distilled water or by acid of the strength originally used for filling-in, depending on whether the specific gravity is too high or too low. Continue the charge for an hour or so to ensure adequate mixing of the electrolyte and again check the specific gravity readings. If necessary, repeat the adjustment process until the desired reading is obtained in each cell. Finally, allow the battery to cool, and syphon off any electrolyte above the tops of the separators.

(b) Preparing " dry-charged " batteries for service:

Electrolyte of the appropriate specific gravity, either 1.275 or 1.215, is prepared as described in para. (a) above : for electrolyte of 1.275 S.G., add 1 volume of 1.835 S.G. sulphuric acid to 2.8 volumes of distilled water, and for electrolyte of 1.215 S.G., 1 volume of acid to 4 volumes of distilled water. The total quantity of electrolyte required is 6 pints.

Filling the cells.

Carefully break the seals in the cell filling holes and fill each cell with electrolyte to the top of the separators, *in one operation.* The temperature of the filling room, battery and electrolyte should be maintained between 60°F. and 100°F.

If the battery has been stored in a cool place, it should be allowed to warm up to room temperature before filling.

Batteries filled in this way are 90 *per cent charged, and may be fitted to the vehicle immediately.* When time permits, however, a short freshening charge will ensure that the battery is fully charged. Such a freshening charge should last for no more than 4 hours, at the normal recharge rate of the battery.

During the charge the electrolyte must be kept level with the top edge of the separators by the addition of distilled water. Check the specific gravity of the acid at the end of the charge; if 1.275 acid was used to fill the battery, the specific gravity should now be between 1.280 and 1.300: if 1.215, between 1.220 and 1.240.

DYNAMO

Testing in position.

Disconnect the cables from the dynamo terminals "D" and "F" and connect the two terminals with a short length of wire. Connect a voltmeter between the dynamo terminals and the dynamo frame. Increase the engine speed gradually and note the voltmeter reading, which should reach 12 volts at a comparatively low speed. Do not run the engine at a speed above 1,500 r.p.m. If no reading is given, or if it is low or erratic, the dynamo must be removed for examination.

Note: Models C45XV and C39ZV dynamos are fitted with plug-in dynamo connectors instead of terminals. To test in position take out the connectors and join the sockets by a short length of insulated wire. Take great care when replacing connectors, and also cables to connectors, to see that the large connector is fitted to the yellow cable and plugged into the main dynamo socket and the small connector is fitted to the yellow with green cable and plugged into the field terminal socket.

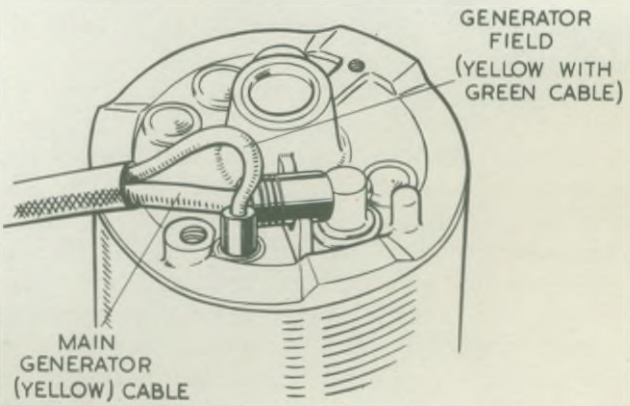


Fig. 2. Showing the correct position of plug-in connectors

To dismantle (Dynamo Model C45XV or C39ZV).

Take off the driving pulley, unscrew the two through bolts and pull off the commutator end bracket. The driving end bracket complete with armature can then be withdrawn from the dynamo frame. If it is necessary to remove the armature from the driving end bracket, it can be done by means of a hand press. It should be noted that there are no connections to be uncoupled between the dynamo frame and commutator end bracket.

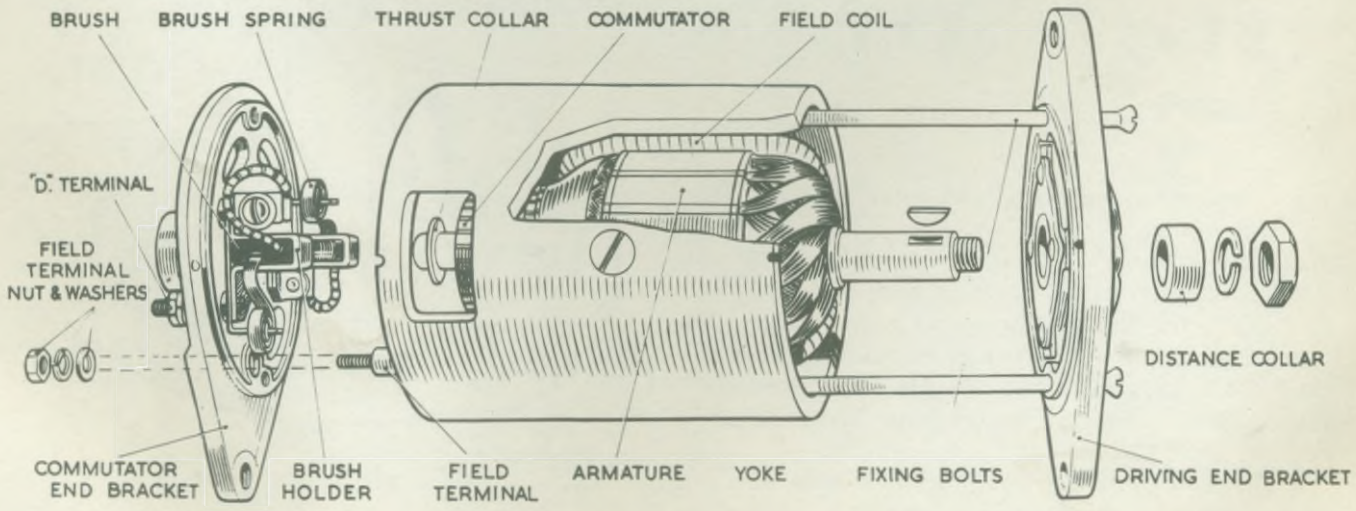


Fig. 3. Exploded view of Dynamo Model C39PV

To dismantle (Dynamo Model C39PV or C39PV-2).

Take off the driving pulley.

Remove the cover band, hold back the brush springs and remove the brushes from their holders.

Unscrew the locking nuts from the through bolts from the driving end.

Withdraw the two through bolts from the driving end.

Remove the nut, spring washer and flat washer from the smaller terminal (*i.e.*, field terminal) from the commutator end bracket and remove the bracket from the dynamo yoke. The driving end bracket, together with the armature can now be lifted out of the frame. If it is necessary to remove the armature from the driving end bracket, it can be done by means of a hand press. It should be noted that there are no connections to be uncoupled between the dynamo frame and the commutator end bracket.

Armature.

Examine the commutator and if burned or blackened, clean with a petrol-moistened rag, or in bad cases by carefully polishing with very fine glass-paper. If necessary, undercut the insulation to a depth of $\frac{1}{32}$" with a hacksaw blade ground down to the thickness of the insulation.

Check the armature by means of a growler test or volt-drop test, and test the insulation by connecting a test lamp at mains voltage between the commutator segments and the shaft.

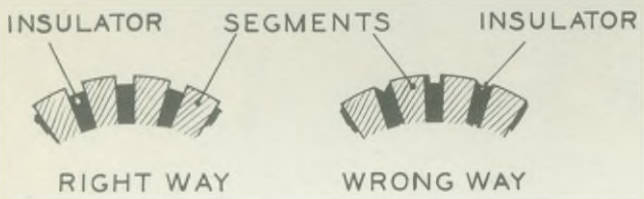


Fig. 4. Method of undercutting commutator insulation

Brushgear.

Examine the brushes. If they are worn so that they do not make good contact on the commutator, or if the brush flexible is exposed on the running face, take out the screw securing the eyelet on the end of the brush flexibles and remove the brushes.

Fit new brushes into holders and secure eyelets on the ends of the brush lead in the original positions. Brushes are pre-formed and do not require bedding.

Field coils.

Test the resistance of the field coils by means of an ohmmeter. If this is not available, connect a 12-volt D.C. supply with an ammeter in series, between the field terminal and the dynamo frame. The ammeter reading should be approximately 2 amps. If no reading, the field coils are open-circuited and must be replaced.

To test for earthed file coils, unsolder the end of the field winding from the earth terminal of the dynamo frame and with a test lamp connected from supply mains, check between field terminal and earth. If lamp lights, field coils are earthed and must be replaced.

When replacing field coils, an expander should be used so as to press the pole shoes into position. A few taps on the outside of the dynamo frame with a copper-faced mallet will assist the expander to seat the pole shoes. When pole shoes are finally home, fully tighten up fixing screws and caulk to lock them in position.

Bearings.

Bearings which are worn to such an extent that they will allow excessive side movement of the armature shaft must be replaced.

Commutator end.

To remove and replace bearing bush at commutator end proceed as follows :—

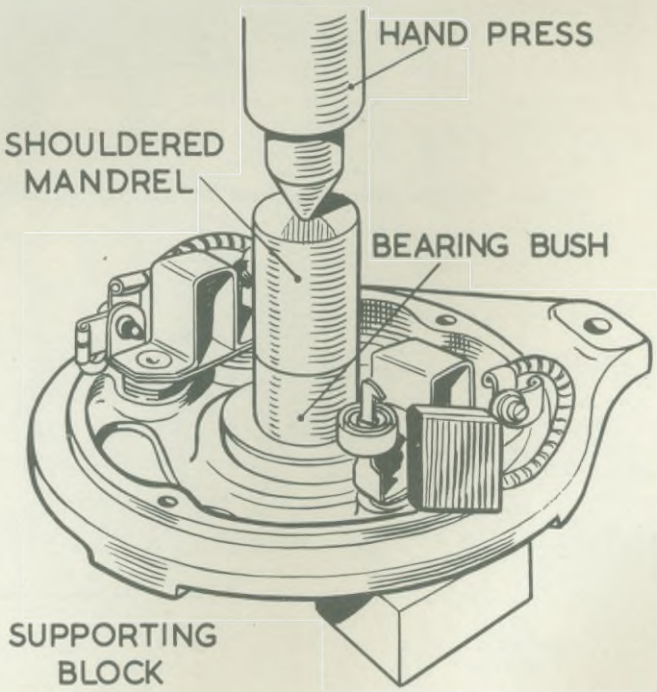


Fig. 5. Method of fitting bearing bushes

(a) Press the bearing bush out of bracket by means of a hand press or bench drill.

Note: On the latest dynamos the bearing housing is "blind" and not bored straight through the end bracket. On such machines the bearing may be removed by the use of a lipped expanding type extractor. Alternatively a $\frac{5}{8}$" top may be screwed into the bearing and bush and tap withdrawn together.

(b) Press the new bearing bush into the end bracket using a shouldered mandrel of the same diameter as the shaft which is to fit in the bearing.

Note: Before fitting a new porous bronze bearing bush, it should be immersed for 24 hours in clean thin engine oil.

Driving end.

The ball-bearing at the driving end is replaced as follows :—

1. Knock out the three rivets which secure the bearing retaining plate to the end bracket and remove the plate.
2. Press the bearing out of the end bracket and remove the corrugated washer, felt washer and oil retaining washer.
3. Before fitting the replacement bearing see that it is clean and lightly pack it with high melting-point grease.
4. Place the oil retaining washer, felt washer and corrugated washer in the bearing housing in the end bracket.
5. Locate the bearing in the housing and press it home by means of a hand press.
6. Fit the bearing retaining plate. Insert three new rivets from the outside of the end bracket and open the rivets by means of a punch to secure the plate rigidly in position.

To reassemble dynamo.

1. If the armature has been removed from the driving end bracket, first press the armature shaft into the bearing in the end bracket and then fit the armature in position in the dynamo frame and locate driving end bracket.
2. Raise the brushes in their holders and wedge in this position by locating the springs on the sides of the brushes.
3. Fit the commutator end bracket until the brushes are just started on the commutator and then raise the springs to release the brushes and ensure that the ends of the springs are central on the top of the brushes.

   The end bracket can then be pushed home, and the through-bolts inserted and tightened up.

Before refitting the dynamo to the vehicle, unscrew the lubricator on the end of the dynamo, lift out the felt pad and spring, and about half fill the lubricator with H.M.P. grease. Replace the spring and felt pad, and screw the lubricator in position.

STARTER

If difficulty is experienced with the starter not meshing correctly with the flywheel, it may be that the starter drive requires cleaning. The pinion should move freely on the screwed sleeve; if there is any dirt or other foreign matter on the sleeve it must be washed with paraffin. To do this it will be necessary to remove the driving end bracket from starter frame (see dismantling instructions below).

In the event of the starter pinion becoming jammed in mesh with the flywheel, it can usually be freed by turning the starter armature by means of a spanner applied to the shaft extension at the commutator end. This is accessible by removing the cap.

If it is necessary to remove the starter from the engine, disconnect the earthing cable (positive) from the battery terminal to avoid any damage of causing short circuits and remove cables from starter switch.

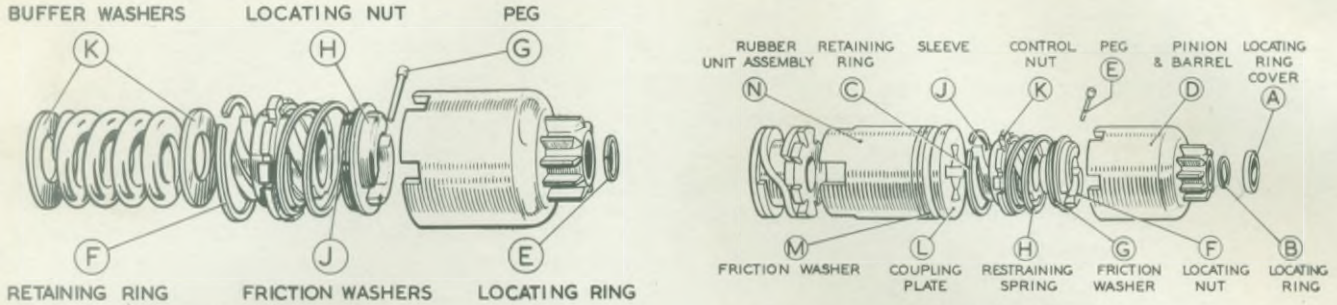
Dismantling starter motor.

Take off the cover band at the commutator end, hold back the brush springs and take out the brushes from their holders.

Unscrew and withdraw the two through bolts.

Remove the terminal nuts and washers from the terminal post on the CE bracket and then remove the commutator and driving end brackets.

Note: On some models the starter switch is mounted on the CE bracket, whilst on other types an adaptor plate is fitted. In these instances it will be necessary to remove starter switch or adaptor plate and then remove the nut securing the field coil lead to the contact plate before dismantling the starter.



(a) SB Type Drive

(b) Rubber Type Drive

Fig. 6. Starter drive dismantled

Starter drive (SB type).

Secure the armature by gripping the squared end of the shaft in a vice and remove the locating ring (E) from the end of the shaft.

Remove the retaining ring (F) and the barrel and pinion assembly can be withdrawn.

Take out the peg (G) securing the locating nut.

Remove the locating nut (H), friction washers (J) and restraining spring.

Slide the sleeve and control nut off the splined shaft. Remove the buffer washers (K) and the main spring. Should either the control nut or screwed sleeve be damaged, then a replacement assembly of screwed sleeve and control nut must be fitted. These components must not be renewed individually. Reassemble by reversing the above procedure.

Note: On some models the locating nut is secured by caulking the nut into the keyway provided in the shaft, therefore no peg (G) is fitted. When reassembling it will be necessary to fit a new locating nut.

Starter drive (Rubber type).

Secure the armature by gripping the shaft extension in a vice and remove the locating ring cover (A) and locating ring (B).

Remove the retaining ring (C) and withdraw the barrel and pinion assembly. Remove the peg (E), or, on some starters, uncaulk the locating nut (F) and remove the locating nut, friction washers and restraining spring. Slide the sleeve and control nut off the shaft. Finally remove coupling plate (L), friction washer (M) and rubber assembly (N).

Should either the control nut or screwed sleeve be damaged, then a replacement assembly of screwed sleeve and control nut must be fitted. These components must not be renewed individually.

Note: When reassembling it will be necessary to fit a new locating nut.

Commutator.

Examine the commutator and if burned or blackened, clean with a petrol-moistened rag, or in bad cases by carefully polishing with very fine glass-paper.

Note: The insulation on the starter commutator must not be undercut.

Brushes.

Examine the brushes. If they are worn so that they do not make good contact on the commutator, or if the brush flexibles are exposed on the running face, they must be replaced. Two of the brushes are connected to terminal eyelets on the brush boxes, and the other two are connected to tappings on the field coils.

The flexible connectors must be removed by unsoldering and the connectors of the new brushes secured in their places by soldering. The brushes are pre-formed so that bedding to the commutator is unnecessary.

Field coils.

The field coils can be tested for open circuit by connecting a 12-volt battery and test lamp to the tapping points on the field coils at which the brushes are connected. If the lamp does not light there is an open circuit in the wiring of the field coils.

Lighting of the lamp does not necessarily mean that the field coils are in order, as it is possible that one of them may be earthed to a pole shoe or to the starter frame. This may be checked by removing one of the test leads from the brush connector and holding on to a clean part of the starter frame.

Should the lamp light it indicates that the field coils are earthed and must be replaced.

When replacing field coils the procedure as detailed in the dynamo section should be followed.

Bearings.

Bearings which are worn to such an extent that they will allow excessive side play of the armature shaft must be replaced. To replace the bearing bushes proceed as follows :—

1. Press the bearing bush out of the end bracket.
2. Press the new bearing bush into the end bracket using a shouldered mandrel of the same diameter as the shaft which is to fit in the bearings.

Note : Before fitting a new porous bronze bearing bush it should be immersed for 24 hours in clean, thin engine oil.

Reassembly.

The reassembly of the starter is a reversal of the dismantling procedure.

STARTER SWITCH

On earlier models the starter switch is mounted on the commutator end of the starter and the procedure for testing in position, removing and servicing is given below.

Later vehicles have the starter switch mounted remote from the starter. These switches are non-adjustable and should be replaced if faulty.

Test in position.

If the switch operates but does not complete the circuit to the starter, the switch must be removed for examination and, if necessary, replacement of the contacts.

Removing starter switch from starter.

1. Take out the four screws securing the switch to the starter end bracket. One screw is positioned under the rubber insulator.
2. Pull the complete switch from the end bracket.

Replacement of contacts.

If examination shows that the contacts are badly burned they must be renewed.

The contacts must be replaced as a complete set, comprising two fixed contact plates for fitting in the commutator end bracket and the moving contact disc for mounting on the switch plunger. The new components must be accurately fitted to the dimensional limits shown in Fig. 8

To remove the old fixed contacts from the starter end bracket, remove the nut (B) securing the connection from the starter field coils and withdraw the three screws (C) and insulating bushes (D). Fit the replacement contacts in position, taking care to place the insulating bushes (D) over the securing bolts before screwing them home (see Fig. 7).

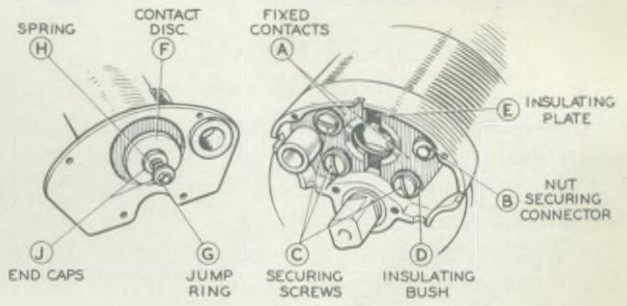
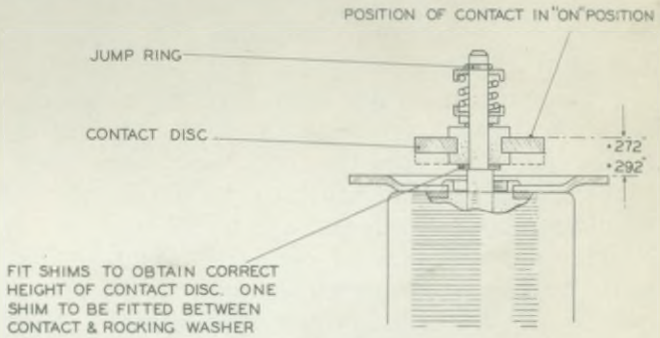


Fig. 7. Starter switch removed

After fitting the two fixed contacts, the faces of the contacts must be machined in order to obtain a flat surface. The diameter of the machined portion must be 1" and the depth of the machined surface must be .245" ± .005" from the edge of the starter end bracket.

To remove the original contact disc from the starter switch, withdraw the jump ring (G) from the end of the spindle. The correct position of



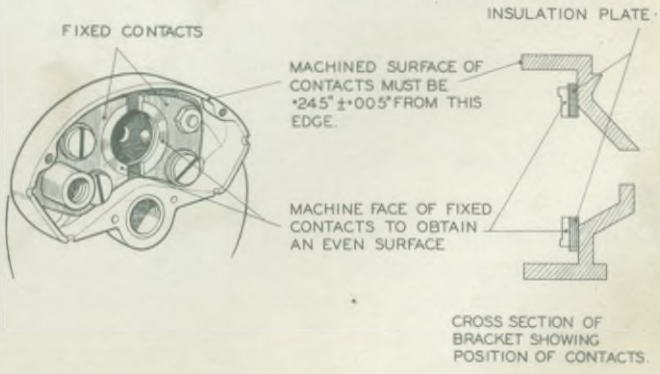


Fig. 8. Setting of starter switch contacts

the contact disc relative to the switch fixing plate, as shown in Fig. 8, must be obtained by fitting shims behind the disc. Replace the spring (H) with its end caps (J) on the spindle and secure by means of the jump ring (G)

Finally, fit the switch to the starter end bracket and reconnect the cable to the switch.

DISTRIBUTOR
Model DKY4A

Routine maintenance (every 3,000 miles)

Lubrication.

Lightly smear the cam with a very small amount of clean engine oil.

Apply a spot of clean engine oil to the top of the pivot on which the contact breaker works.

Lift the rotor arm from the top of the spindle by pulling it off vertically and add a few drops of thin machine oil to lubricate the cam bearing and distributor shaft. Do not remove the screw exposed to view as the screw is drilled to enable the oil to pass through. Take care to refit the rotor arm correctly, pushing it on to the shaft as far as it will go.

Add a few drops of thin machine oil through the hole in the contact breaker base through which the cam passes, to lubricate the automatic timing control. Do not allow any oil to get on or near the contacts.

Every 6,000 miles

Cleaning.

Wipe the inside and outside of the moulding with a soft dry cloth, paying particular attention to the spaces between the metal electrodes. See that the small carbon brush on the inside of the moulding moves freely in its holder.

Examine the contact breaker. The contacts must be free from grease or oil. If they are burned or blackened, clean them with a fine carborundum stone or very fine emery cloth, afterwards wiping away any trace of dirt or metal dust with a petrol-moistened cloth. Cleaning of the contacts is made easier if the contact breaker lever carrying the moving contact is removed. To do this, slacken the nuts on the terminal post and lift off the slotted end of the contact breaker spring.

After cleaning, check the contact breaker setting.

Contract breaker adjustment.

Turn the engine by hand until the contacts are seen to be fully opened, and check the gap with a gauge having a thickness of .010″—.012″. If the gap is correct, the gauge should be a sliding fit, but if the gap varies from the gauge,

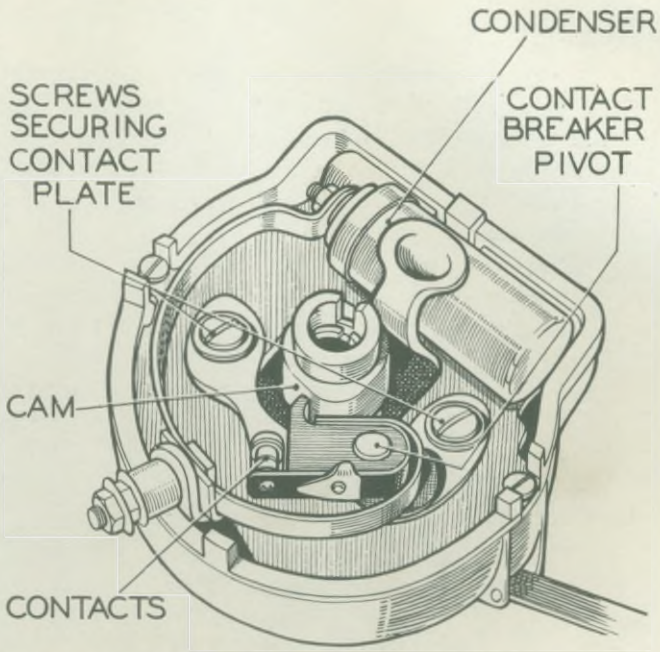


Fig. 9. Contact breaker assembly. Distributor type DKY4A

the setting must be adjusted. To do this, keep the engine in the position giving maximum contact opening and slacken the two screws securing the fixed contact plate. Adjust the position of the plate until the gap is set to the thickness of the gauge and tighten the two locking screws. Recheck the gap for other positions of the engine giving maximum contact opening.

High tension cables.

Examine the high tension cables. Any which have the insulation cracked or perished, or show signs of damage in any other way, must be replaced by 7-mm. rubber-covered ignition cable.

Dismantling.

1. Spring back the securing clips and remove the moulded cap.
2. Lift the rotor off the top of the spindle. If it is a tight fit it should be carefully levered off with a screwdriver.
3. Slacken the nut on the terminal post and lift off the end of the contact breaker spring. The contact breaker lever can now be lifted off its pivot. Take out the two screws, complete with spring washers and flat steel washers, which secure the plate carrying the fixed contact, and remove the plate.
4. Take out the two screws and spring washers fitted at the edge of the contact breaker base, which can then be removed from the body of the distributor.

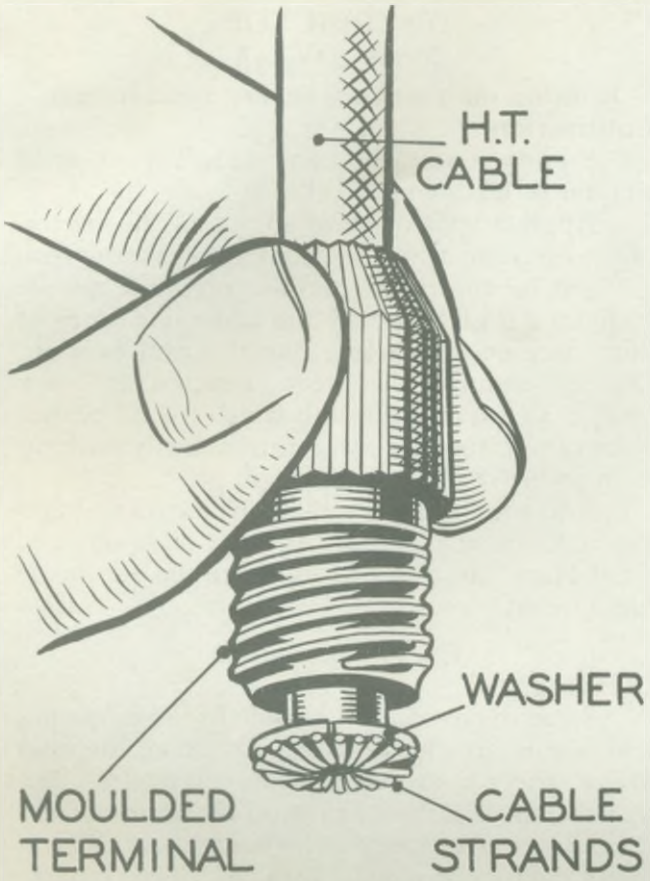


Fig. 10. Fitting H.T. cable

5. Remove the driving dog from the shaft.
6. Lift the cam, automatic timing control and shaft assembly from the distributor. Take out the screw from inside the top of the cam spindle. (Before dismantling, carefully note the positions in which the various components are fitted so that they can be replaced correctly.) Lift off the cam, when the automatic timing control will be accessible.

Condenser.

The best method of testing the condenser is by substitution. Disconnect the original condenser and connect a new one between the L.T. terminal of the distributor and earth.

Should a new condenser be necessary, it is advisable to fit a complete condenser and contact breaker plate assembly, but should a condenser only be available, care must be taken not to overheat the condenser when soldering in position.

Replacement of bearing bushes.

1. In order to ensure easy running of the distributor shaft, when the shank has been rebushed, the new porous bronze bushes must be fitted so that they are in correct alignment. The bushes must be fitted by means of a vertical drilling machine or hand press, using a mandrel and a packing block of the type shown.
2. Fit the mandrel in the drilling machine or hand press and place the distributor body in an inverted position on the table below it.
3. To remove the bushes, a sleeve must be fitted over the mandrel to build it up to the required size. With this sleeve fitted in position, force the old bushes out of the shank by applying a steady pressure.
4. Before new bushes are fitted they should be allowed to stand for 24 hours immersed in thin engine oil.
5. Take the sleeve off the mandrel. Place one of the longer bushes on the mandrel, then the distributor body in an inverted position and finally one of the smaller bushes.
6. Locate the end of the mandrel through the packing piece and press the mandrel downwards, taking care that both bushes enter

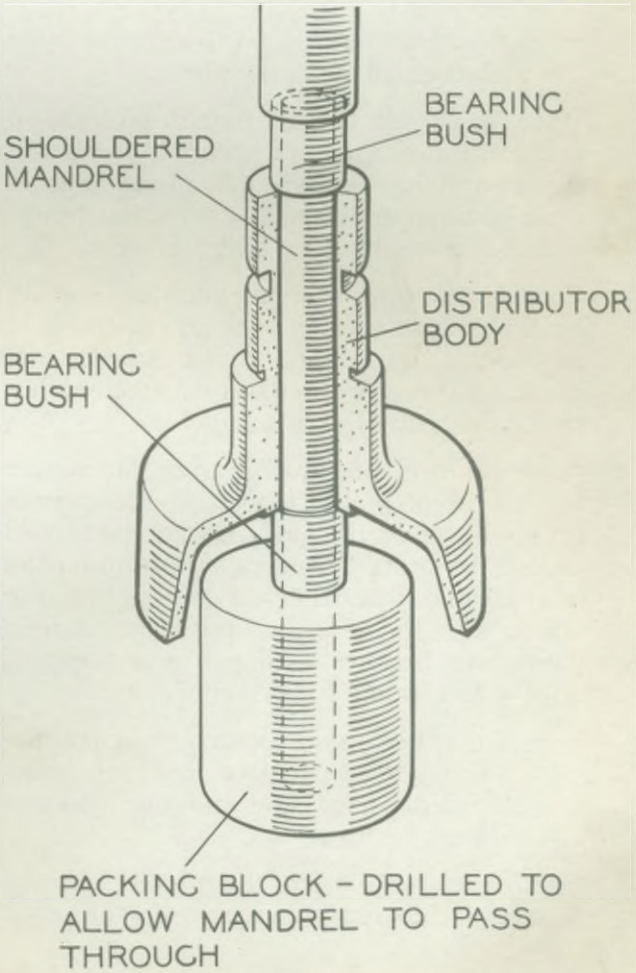


Fig. 11. Replacement of bearing bushes for distributor

the distributor shank squarely. Continue forcing the bushes into the shank until the mandrel reaches the end of its travel.

7. After fitting, the bushes must not be opened out as this would tend to impair the porosity of the bushes and so prevent effective lubrication.

Reassembly.

Note: Before reassembly, the distributor shaft, automatic advance mechanism, and the portion of the shaft on which the cam fits must be lubricated with thin engine oil.

1. Assemble the automatic timing control, taking care that the parts are fitted in their original positions, and that the control springs are not stretched. Two holes are provided in each toggle; the springs must be fitted to the inner hole in each case. Place the cam on its spindle and secure by tightening the fixing screw.
2. Fit the shaft assembly in position in the body and replace the driving member.
3. Place the contact breaker base in position on the distributor body and secure by replacing the two fixing screws. A spring washer must be fitted under each of the screw heads, and the screws must be fully tightened.
4. Position the plate carrying the fixed contact on the contact breaker base and secure it in position by means of the two screws, first placing a spring washer and flat steel washer under the head of each screw.
5. Place the insulating washer over the contact breaker pivot pin and position the contact breaker lever on the pin. Locate the slotted end of the contact breaker spring under the head of the terminal screw and tighten the nut to lock the spring in position. Adjust the contact breaker setting to give a gap of .010"—.012" when fully opened.

   Note: If it becomes necessary to renew the contacts, a replacement set comprising fixed and moving contacts must be fittd.

6. Place the rotor on top of the spindle, locating the register correctly and pushing the rotor fully home.
7. Fit the distributor cover moulding and secure by means of the spring clips.

DISTRIBUTOR
Model DVX4A

Routine maintenance (every 3,000 miles)

Lubrication.

Lightly smear the cam with a very small amount of clean engine oil.

Apply a spot of clean engine oil to the top of the pivot on which the contact breaker works.

Lift the rotor arm from the top of the spindle by pulling it off vertically and add a few drops of thin machine oil to lubricate the cam bearing. Do not remove the screw exposed to view there is a clearance through which the oil passes. Take care to refit the rotor arm correctly pushing it on to the shaft as far as it will go.

Add a few drops of thin machine oil through the hole in the contact breaker base marked "Oil Here" in order to lubricate the automatic timing control.

Every 6,000 miles

Cleaning.

Wipe the inside and outside of the moulding with a soft dry cloth, paying particular attention to the spaces between the metal electrodes. See that the small carbon brush on the inside of the moulding moves freely in its holder.

Examine the contact breaker. The contacts must be free from grease or oil. If they are burned or blackened, clean them with a fine carborundum stone or very fine emery cloth, afterwards wiping away any trace of dirt or metal dust with a petrol-moistened cloth. Cleaning of the contacts is made easier if the contact breaker lever carrying the moving contact is removed. To do this, slacken the nut(s) on the terminal block and lift off the spring, which is slotted to facilitate removal.

After cleaning check the contact breaker setting.

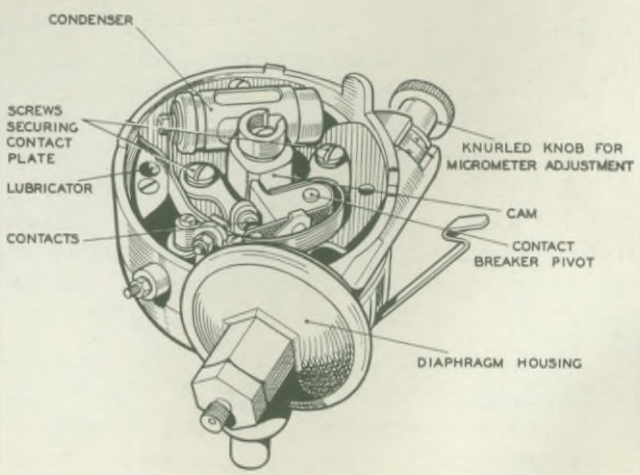


Fig. 12. DVX4A distributor head

Contact breaker adjustment.

Turn the engine by hand until the contacts are seen to be fully opened, and check the gap with a gauge having a thickness of .010"—.012". If the gap is correct, the gauge should be a sliding fit, but if the gap varies from the gauge, the setting must be adjusted. To do this, keep the engine in the position giving maximum contact opening and slacken the two screws securing the fixed contact plate. Adjust the position of the plate until the gap is set to the thickness of the gauge and tighten the two locking screws. Recheck the gap for other positions of the engine giving maximum contact opening.

High tension cables

Examine the high tension cables. Any which have the insulation cracked or perished, or show signs of damage in any other way, must be replaced by 7-mm. rubber-covered ignition cable (see Fig10).

Dismantling.

Spring back the securing clips and remove the distributor moulding.

Lift the rotor arm off the top of the spindle. If it is a tight fit, it should be carefully levered off with a screwdriver.

To remove the moving contact, unscrew the nut from the moulded junction block, lift off the washer and cable eyelet and take out the bolt. The contact breaker spring can then be lifted off the pivot pin. Remove insulating washer from the pivot pin. Take out the two screws, complete with spring washers and flat steel washers, from the plate carrying the fixed contact and remove the plate.

Unscrew the screw from the condenser band clip. Unscrew the terminal nut, lift off the spring washer and remove the condenser and connecting strip.

Undo the three screws fitted at the edge of the contact breaker base casting and lift them out. The screws are accessible through the apertures cut in the contact breaker plate. The contact breaker base can then be removed from the body of the distributor when the eyelet securing the earthing cable is withdrawn from the base casting.

Remove the jump ring from the underside of the contact breaker base, lift off the star-shaped spring and slide the contact breaker plate out of the base.

Undo the two nuts from the studs securing the vacuum unit to its bracket, pull the unit off its seating so that the studs are clear of the fixing bracket and rotate the vacuum unit to unscrew the connecting rod from the control barrel.

Remove the driving gear or dog from the shaft.

Take out the screw from inside the top of the cam spindle and lift off the cam. Before dismantling, carefully note the positions in which the various components are fitted in order that they can be replaced correctly. To remove the automatic timing control and shaft assembly from the distributor, it must be pressed out of its bearing. The bearings must not be disturbed unless they are worn and need replacing. The bearing bush fitted at the lower end of the shank can be removed by driving it out with a suitable punch ; while the ball bearing at the top can be removed by means of a shouldered mandrel locating on the inner journal of the bearing.

Reassembly.

If the bearings have been removed, the distributor should be assembled with new bearings fitted. Press the ball bearing into its housing at the top of the shank using a shouldered mandrel which locates on the inner and outer journals of the bearing. The bearing bush at the lower end of the shank must also be fitted using a shouldered mandrel.

Before fitting the bearing bush it should be allowed to stand completely immersed in thin oil for at least 24 hours.

Place the distance collar over the shaft, fit the shaft in its bearings and replace the driving member.

Assemble the automatic timing control, taking care that the parts are fitted in their original positions and that the control springs are not stretched. Place the cam on its spindle and tighten the locking screw.

1. Fit the sleeve of the micrometer adjustment into its housing in the contact-breaker base, so that the timing scale appears in the window on the right of the body. Screw the control barrel fully home in the sleeve. With the barrel and sleeve pushed as far into the housing as they will go, screw the vacuum unit connecting rod into the barrel, taking care that the serrated washer is correctly fitted.

   Position the vacuum unit on its fixing plate so that the two studs fit through the holes provided. Place a spring washer over each stud and secure by tightening the locking nuts.

2. See that the two cables are connected to the terminal and to the earthing screw in the base casting. Position the contact breaker plate in the base casting so that the peg fitted in the control barrel locates in the hole provided in the contact breaker plate. Place the star-shaped spring over the bearing sleeve on the under side of the base casting and secure by springing the jump ring into its location. Place the contact breaker base on the distributor body and secure by means of the three screws.
3. Insert the terminal post on the condenser through the hole in the connector strip. Replace the spring washer and tighten the terminal nut. Secure the band clip by replacing and tightening the fixing screw.
   Position the plate carrying the fixed contact on the contact breaker base and secure it by replacing and lightly tightening the two screws, first placing a spring washer and flat steel washer under the heads of each of the screws. The eyelet on the end of the cable connected to the earthing screw must be fitted under the head of one of the screws. Place the insulating washer over the contact breaker pivot pin and position the contact breaker lever on its pivot pin. Insert the square-headed bolt through the condenser connecting strip and the hole in the end of the contact breaker spring. Fit the bolt in the moulded junction block, place the eyelet on the end of the connector from the low tension terminal over the bolt, followed by a spring washer and secure by tightening the nut. Adjust the contact breaker setting to give a maximum opening of .010"—.012".

Note: If it becomes necessary to renew the contacts a replacement set comprising fixed and moving contacts must be fitted.

Place the rotor arm on the top of the spindle, locating the register correctly and push it fully home.

Fit the distributor moulding and secure by means of the spring clips.

CONTROL BOX

Testing in position to locate fault in charging circuit.

If the procedure given on page 3 shows the generator to be in order, proceed to check further as follows :—

1. First ensure that the wiring between battery and regulator is in order. To do this, disconnect the wire from the A terminal of the control box and connect the end of the wire removed to the negative terminal of a voltmeter.
   Connect the positive voltmeter terminal to an earthing point on the chassis. If a voltmeter reading is given, the wiring is in order and the regulator must be examined.
2. If there is no reading, examine the wiring between battery and control box for broken wires or loose connections.
3. Reconnect the wire to terminal A.

Regulator adjustment.

The regulator is carefully set during manufacture to suit the normal requirements of the standard equipment and in general it should not be necessary to make further adjustments. However, if the battery does not keep in a charged condition, or if the generator output does not fall when the battery is fully charged it may be advisable to check the setting and re-adjust if necessary.

It is important before altering the regulator setting when the battery is in a low state of charge, to check that its condition is not due to a battery defect or to the generator belt slipping.

Electrical setting.

It is important that a good quality MOVING COIL VOLTMETER (0—20 volts) be available before attempting to adjust the regulator.

The electrical setting can be checked without removing the cover from the control box.

Withdraw the cables from the terminals marked A and A1 at the control box and join the wires together.

Connect the negative lead of the moving coil voltmeter to the D terminal on the generator, and connect the other lead from the meter to a convenient chassis earth. Start the engine.

Slowly increase the speed of the engine until the voltmeter needle " flicks " and then steadies ; this should occur at a voltmeter reading between the limits given below for the appropriate temperature of the regulator.

Setting at 10°C. (50°F.)	16.1—16.7 volts
Setting at 20°C. (68°F.)	15.8—16.4 volts
Setting at 30°C. (86°F.)	15.6—16.2 volts
Setting at 40°C. (104°F.)	15.3—15.9 volts

If the voltage at which the reading becomes steady occurs outside these limits, the regulator must be adjusted.

Shut off the engine, remove the control box cover, release the locknut (A) holding the adjusting screw (B) and turn the screw in a clockwise

direction to raise the setting, or in an anti-clockwise direction to lower the setting. Turn the adjustment screw a fraction of a turn and then tighten the locknut.

When adjusting, do not run the engine up to more than half throttle, as while the dynamo is on open circuit, it will build up to a high voltage if run at high speed, and so a false voltmeter reading would be obtained.

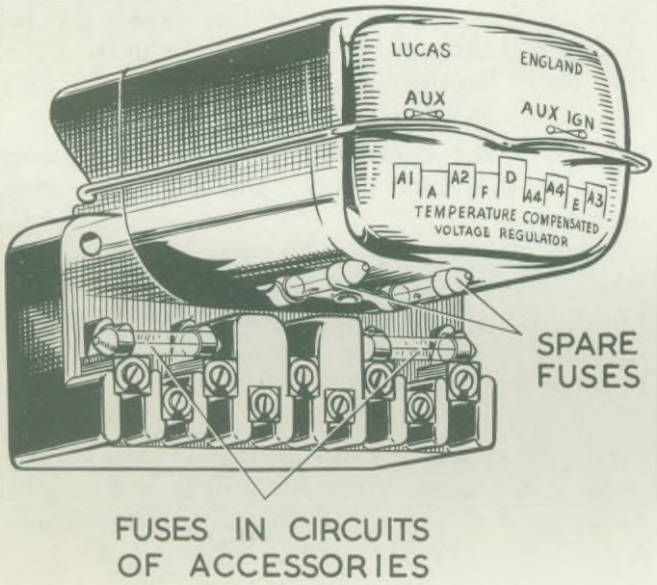


Fig. 13. Control box Model RF95

Mechanical setting.

The mechanical setting of the regulator is accurately adjusted before leaving the works and provided the armature carrying the moving contact is not removed, the regulator will not require mechanical adjustment. If, however, the armature has been removed from the regulator for any reason, the contacts will have to be reset. To do this proceed as follows :—

1. Slacken the two armature fixing screws " E." Insert a .018" feeler gauge between the back of the armature " A " and the regulator frame.
2. Press back the armature against the regulator frame and down on to the top of the bobbin core with gauge in position and lock the armature by tightening the two fixing screws.
3. Check the gap between the underside of the shim (G) and the top of the bobbin core. This gap should be .012"—.020". If the gap is outside these limits, correct by adding or removing shims " F " at the back of the fixed contact.

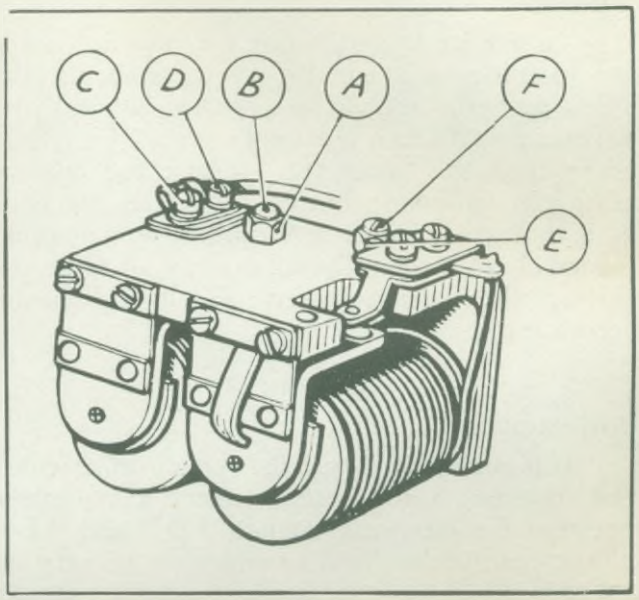


Fig. 14. Cut-out and regulator assembly

Note : On some regulators a stop rivet is fitted on the underside of the arm instead of a shim. When checking on this type the gap should be .022"—.030" between the underside of the arm and bobbin core. DO NOT CHECK GAP BETWEEN STOP RIVET AND BOBBIN CORE.

4. Remove gauge and press the armature down when the gap between the contacts should be .006"—.017".

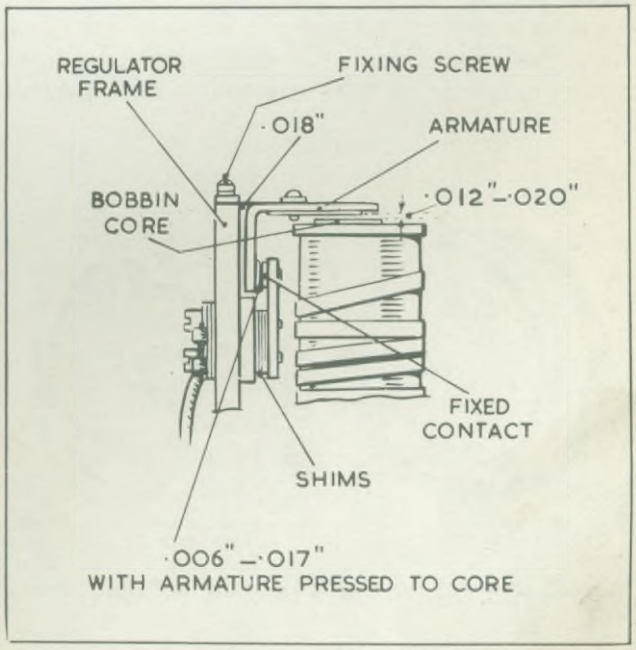


Fig. 15. Mechanical setting of regulator

Cleaning contacts.

To render the regulator contacts accessible for cleaning, slacken the screws securing the plate carrying the fixed contact. It will be necessary to slacken the upper screw (C) a little more than the lower (D) so that the contact plate can be swung outwards. Clean the contacts by means of fine carborundum stone or fine emery cloth. Carefully wipe away all traces of dirt or other foreign matter. Finally tighten the securing screws.

Cut-out

Adjustment.

If it is suspected that the cutting-in speed of the dynamo is too high connect a voltmeter between the terminals marked " D " and " E " at the control box and slowly raise the engine speed. When the voltmeter reading rises to about 12.7—13.3 the cut-out contacts should close.

If the cut-out has become out of adjustment and operates at a voltage outside these limits it must be reset. To make the adjustment, slacken the locknut (E), turn the adjusting screw (F) a fraction of a turn in a clockwise direction to raise the operating voltage or in an anti-clockwise direction to lower the voltage. Tighten the locknut after making the adjustment.

Cleaning.

To clean the contacts remove the cover, place a strip of fine glass-paper between the contacts and then, closing the contacts by hand, draw the paper through. This should be done two or three times, with the rough side towards each contact.

HEADLAMPS
Models F.700 and F.700P

Bulb replacement.

To remove the light unit for bulb replacement, unscrew the screw securing the front rim and lift off the rim. Next remove the dust-excluding rubber when three spring-loaded adjustment screws will be visible. Press the light unit in against the tension of the adjustment screw spring and turn it in an anti-clockwise direction until the heads of the screws can be disengaged through the slotted holes in the light unit rim. Do not disturb the screws as this will alter the lamp setting.

Twist the back shell in an anti-clockwise direction and pull if off. The bulb can then be removed.

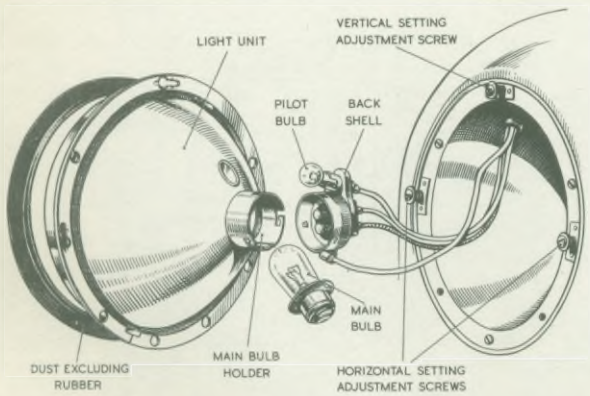
Place the replacement bulb in the holder taking care to locate it correctly. Engage the projections on the inside of the back shell with the slots in the holder, press on and secure by twisting it to the right.

Position the light unit so that the heads of the adjusting screws protrude through the slotted holes in the flange, press the unit in and turn in a clockwise direction. Replace the dust-excluding rubber and refit the front rim.

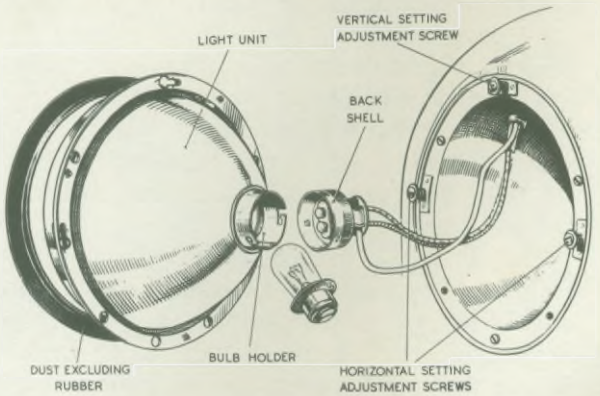
Setting.

If adjustment to the setting is required, first remove the front rim and rubber, as described above.

Vertical adjustment is made by turning the screw at the top of the lamp. Horizontal adjustment can be altered by the adjustment screws on each side of the light unit.



(a) Bulb removal for Lucas headlamps Model F700P



(b) Lucas flush fitting headlamps Model F700 with light unit and bulb removed

Fig. 16. Exploded views of headlamps showing bulbs

Models F.700 and F.700P Mark II

Replacement of light unit.

In the event of damage to either the front lens or reflector, a replacement light unit must be fitted as follows :—

1. Remove light unit assembly as already described.
2. Remove the small clamping bracket on the light unit rim by bending back the two metal tags, and remove the rim from the light unit taking care that the sealing ring remains in position.
3. Position the replacement light unit in the rim so that the die cast projection at the edge of the light unit fits into the indentation in the rim, taking care that the sealing ring is correctly positioned.
4. Replace the rim clamping bracket and secure by the metal tags, making sure that the two edges of the rim make a neat and secure joint.

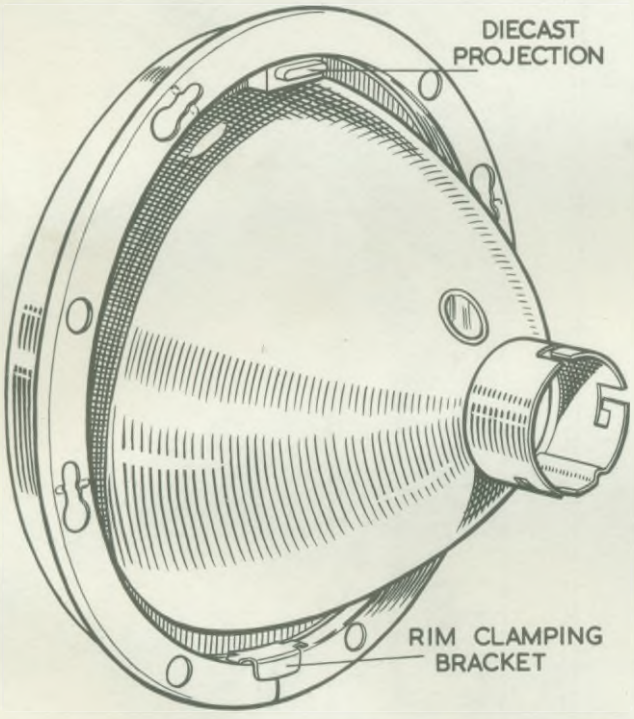


Fig. 17. Light unit assembly (replacement of Mark II models)

Models F.700 and F.700P Mark III

Remove the light unit assembly as described above.

Withdraw the three screws from the light unit rim and remove the seating rim and unit from light unit.

Position the replacement light unit between the unit rim and seating rim taking care to see that the die-cast projection in the edge of the light unit fits into the slot in the seating rim and also see that the seating ring is correctly positioned.

Finally secure in position by means of the three fixing screws.

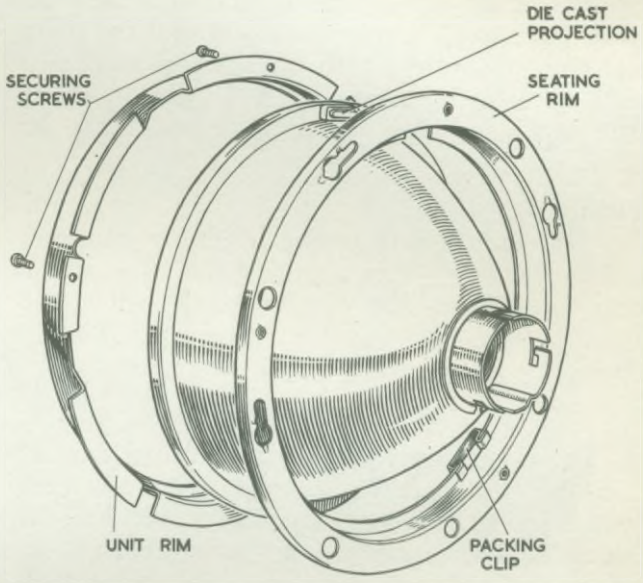


Fig. 18. Light Unit assembly for Lucas Headlamp Model F700 Mark III

Model MBD163

Bulb replacement.

Pull forward the fixing clip at the bottom of the lamp front and swing it downwards. Remove the front from the bottom of the lamp first. When replacing locate the top of the rim first, then press on at the bottom and refit the fixing clip. The bulb is accessible without removing the reflector.

Focusing.

In order that the lamp shall give the best results, the bulb must be as near as possible to the focal point of the reflector. If the bulb is out of focus, the lamps will have a poor range and will cause dazzle to approaching traffic.

When focusing headlamps, it will be found an advantage to cover one lamp while testing the other. If the lamp does not give a uniform long range beam without any dark centre, the bulb needs adjusting. To make the adjustment remove the lamp front as described above and then remove the reflector as follows :—

The reflector is secured to the lamp body by means of a rubber bead. The reflector can be withdrawn when the rubber is removed. When replacing the reflector, the projection on the rim must fit into the left-hand location at the top of the lamp body. When refitting the rubber bead locate its thinner lip between the reflector rim and the edge of the lamp body.

To make the adjustment slacken the clamping clip at the back of the reflector and slide the bulb holder backwards and forwards, noting the effect after each adjustment with the reflector and front fitted. When the best position for the bulb has been obtained, the clamping screw must be tightened.

Setting.

If the adjustment to the setting is required, slacken the single fixing nut at the base of the lamp and move the lamp on its adjustable mounting to the required position. Finally tighten the fixing nut.

Model MBL147

These lamps are of the stem-fitting variety. They incorporate a Lucas light unit with pre-focus bulb so that no focusing of the bulb is required. The method of bulb renewal is exactly the same as Models F700 and F700P except for the removal of the front rim which is as follows :—

Pull forward and and fixing clip and swing it downwards. The front together with the light unit can then be withdrawn from the lamp body.

Setting.

As described for MBD163 lamps.

Sidelamp Model 489.

To gain access to the bulb remove the rim and glass assembly as follows :—

Move aside the rubber ring and lever off the rim and glass assembly from the bottom of the lamp.

When refitting move aside rubber ring, locate rim at top of lamp, press on and finally position rubber ring so that it fits around rim.

Model 1142.

Remove the screw at the rear of the lamp body and remove the front rim assembly.

STOP TAIL LAMPS AND NUMBER PLATE ILLUMINATION AND REVERSE LAMPS

To gain access to the bulbs on these lamps, remove the front cover by unscrewing the two securing screws.

TRAFFICATORS

If the action of a trafficator becomes sluggish it must be lubricated as described below.

In order to raise the arm of the trafficator for lubrication purposes or bulb replacement, switch on the trafficator and then, supporting the arm in a horizontal position, move the switch to the " OFF " position.

Lubrication of catch pin.

Apply, by means of a small brush, a drop of thin machine oil, such as sewing machine oil, to the catch pin between the arm and the operating mechanism. Use only the slightest trace as any excess may affect the operating mechanism.

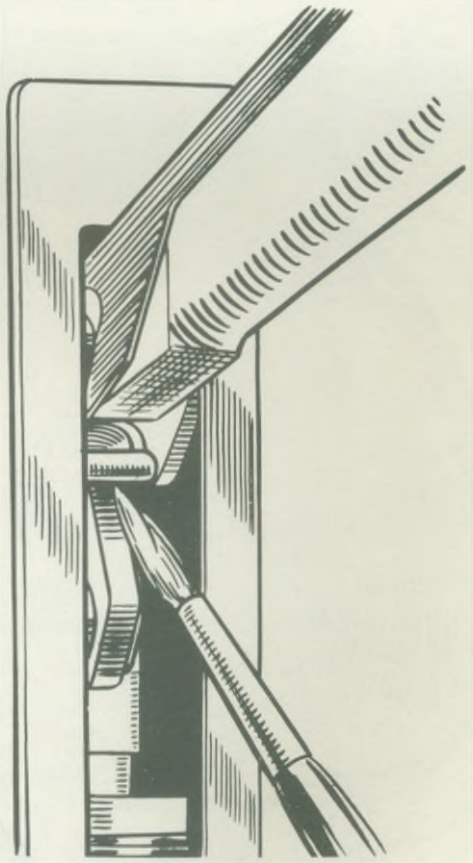


Fig. 19. Lubricating catch-pin (trafficator)

Arm pivot bearing.

Withdraw screw on underside of arm and slide off the cover. Place the connecting wire to the bulb on one side and apply two or three drops of thin machine oil to the lubricating pad at the top of the arm.

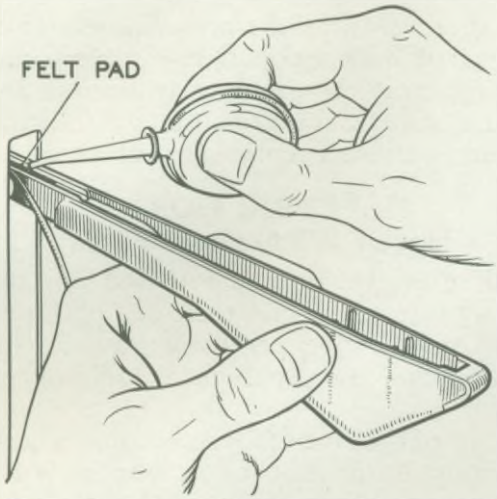


Fig. 20. Lubricating arm pivot bearing

Bulb replacement.

Withdraw the screw on the underside of the arm and slide off the metal arm cover ; the burnt-out bulb may then be replaced. To replace the arm cover, slide it on in an upwards direction so that the side plates engage with the slots on the underside of the spindle bearing. Finally secure the plate by means of its fixing screw.

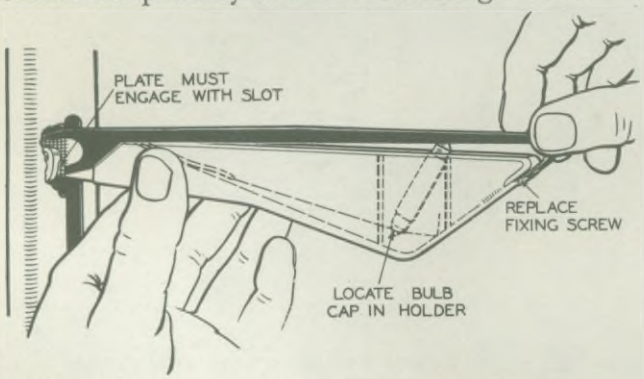


Fig. 21. Trafficator bulb replacement

WINDSCREEN WIPER

Normally the windscreen wiper will not require any servicing apart from the occasional renewal of the rubber blades.

Should any trouble be experienced, first check for loose connections, worn insulation, etc., before dismantling the motor.

Model CR4

1. To detach the cable rack from the motor and gearbox.

Remove gearbox cover.

Remove split pin and washer (on earlier models only) from crankpin and final gear-wheel. Lift off the connecting link.

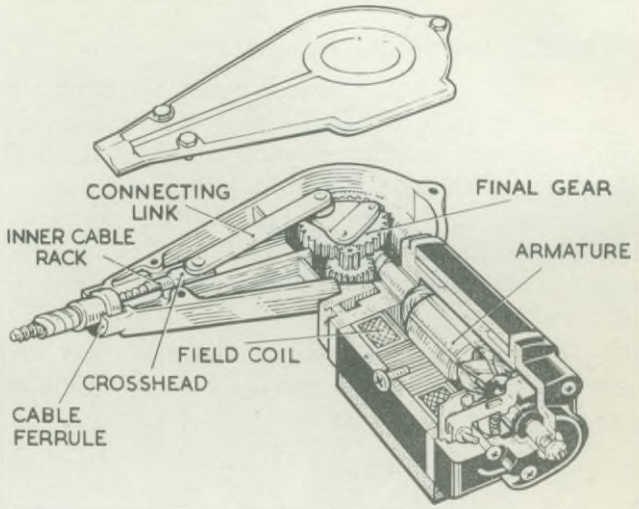


Fig. 22. Windscreen wiper motor and gearbox

2. Commutator dirty.

Removing the connecting leads to the terminals, withdraw the three screws securing the cover at the commutator end. Lift off the cover. Clean the commutator with a cloth moistened with petrol and carefully remove any carbon dust from between the commutator segments.

3. Brush lever stiff or brushes not bearing on commutator.

Check that the brushes bear freely on the commutator. If they are loose, and do not make contact, a replacement tension spring is necessary. The brush levers must be free on their pivots. If they are stiff, they should be freed by working them backwards or forwards by hand. Packing shims are fitted beneath the legs of the brush levers to ensure that the brushes are central and that there is no possibility of the brush boxes fouling the commutator. If the brushes are considerably worn they must be replaced.

4. Motor operates but does not transmit motion to spindles.

Remove the cover of the gearbox. A push-pull motion should be transmitted to the inner cable of the flexible rack. If the crosshead moves sluggishly between the guides, lightly smear a small amount of medium-grade engine oil in the groove formed in the die-cast housing. When overhauling, the gear must be lubricated by lightly packing the gearbox with a grease of the zinc-oxide type.

Model SW4

1. Switch out of adjustment.

Remove the metal switch cover plate which is secured by two screws. Observe whether the switch contacts are opening and closing with the movement of the control knob, and also whether the contacts are clean. The switch contacts should open just as the driving clutch disengages. If necessary, bend the switch blade to obtain this condition.

After resetting the switch, see that the contacts are effectively open when the wiper spindle is in the parked position.

2. Commutator dirty.

Remove the commutator end bracket by unscrewing the two counter-sunk screws, and the screw with the barrel head.

Clean the commutator by means of a cloth moistened with petrol. Carefully remove any carbon dust from between the segments of the commutator. In reassembling take care that the end bracket is lined up so that the armature rotates freely.

3. Brush levers stiff.

If the brush levers are stiff on their pivots they should be freed by working backwards and forwards by hand.

4. Mechanism binding.

Remove the metal facia covering the driving links. Observe whether the links are fouling any part of the bodywork and also observe whether the swinging cranks on the clutch mechanisms behind the control knobs are clearing the clutch body at each end of the stroke. If fouling is taking place at these points, affect an adjustment by means of the clotted fixing holes in the clutch bodies and in the support bracket of the rotating shaft from the motor. In any case, see that all these screws are tight.

5. Armature bearings binding.

This may be due to lack of lubrication. Lubricators are provided on the motor unit through which a small quantity of a good grade thin machine oil may be applied. Ascertain that a blow on the motor end bracket has not thrown the bearings out of line.

A screw and locknut are provided in the commutator end bracket to take up the end thrust of the armature. Under normal conditions this should not require adjustment.

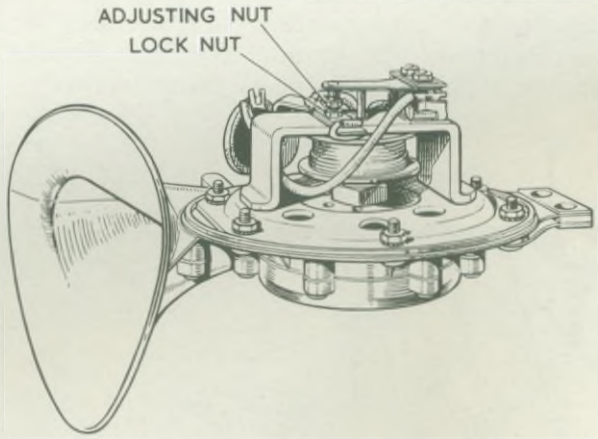
6. Armature damaged.

If after following the preceding examination the wiper still does not operate, or its performance is unsatisfactory, the fault may be due to the armature. Check the armature by substitution and if necessary fit a replacement armature.

ELECTRIC HORN
Models WT.614 and WT.28

All horns before being passed out of the works are adjusted to give their best performance and will give a long period of service without any attention; no subsequent adjustment is required.

If one of the horns fails or becomes uncertain in its action, it does not follow that the horn has broken down. First ascertain that the trouble is not due to a loose or broken connection in the wiring of the horn. If both horns fail or become uncertain in action, the trouble is probably due to a blown fuse or discharged battery. If the fuse has blown, examine the wiring for the fault and replace with the spare fuse provided.



WIND TONE HORN, MODEL WT614, WITH COVER REMOVED

Fig. 23. Showing adjustment points for horn

It is also possible that the performance of a horn may be upset by the fixing bolt working loose, or by some component near the horn being loose. If, after carrying out the above examination, the trouble is not rectified, the horn may need adjustment, but this should not be necessary until the horns have been in service for a long period.

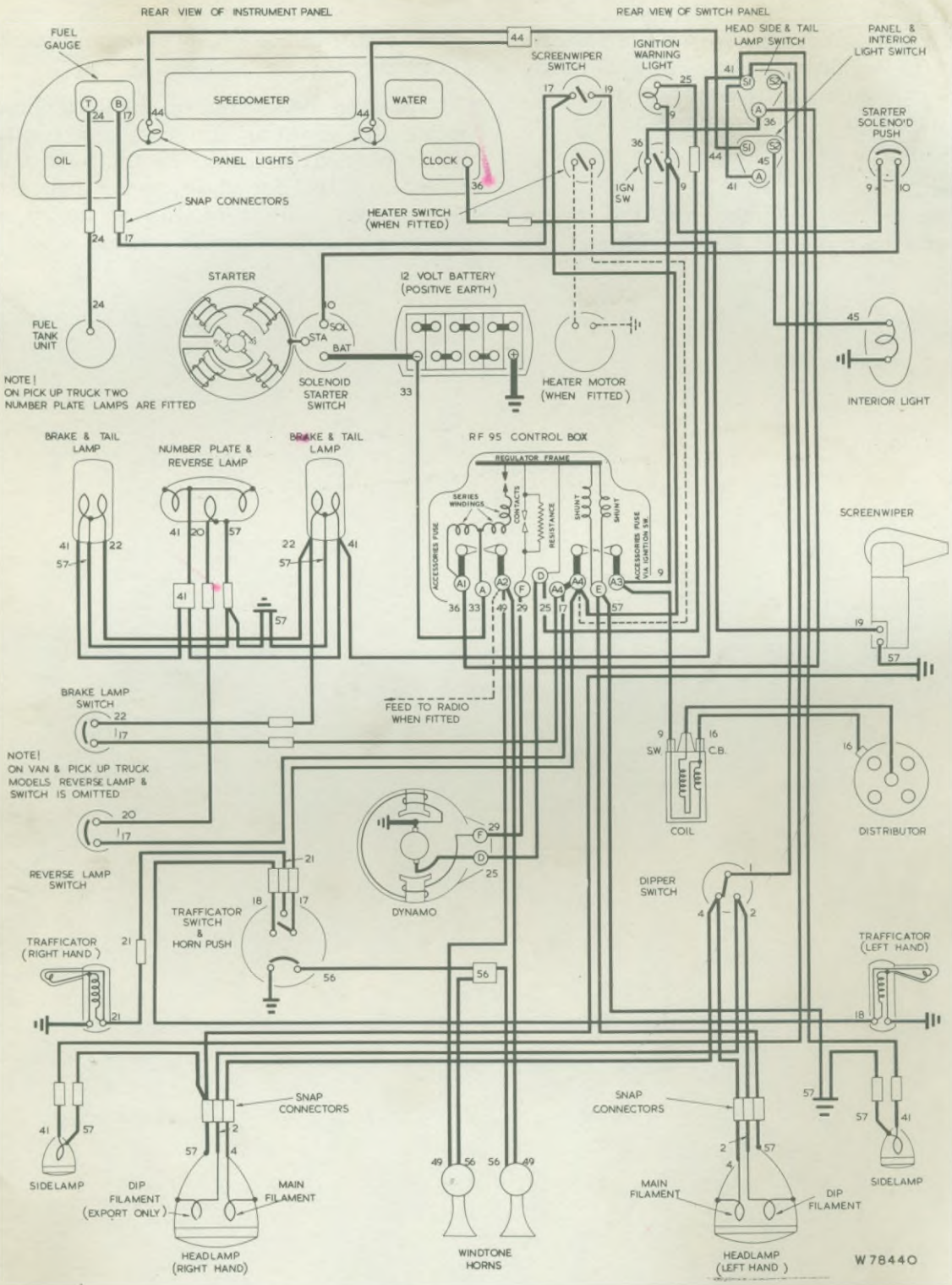
Adjustment does not alter the pitch of the note, it merely takes up wear in moving parts. When adjusting the horns, short circuit the fuse, otherwise it is liable to blow. Again, if the horns do not sound on adjustment, release the push instantly.

When making adjustments to a horn always disconnect the supply lead of the other horn, taking care to ensure that it does not come into contact with any part of the chassis and so cause a short circuit.

Adjustment.

Remove the fixing screw from the top of the horn and take off the cover. Detach the cover securing bracket by springing it out of its location.

Slacken the locknut on the fixed contact and rotate the adjusting nut until the contacts are just separated (indicated by the horn failing to sound). Turn the adjusting nut half a turn in the opposite direction and secure it in this position by tightening the locknut.



KEY TO CABLE COLOURS					
1	BLUE	23	GREEN WITH BROWN	45	RED WITH GREEN
2	BLUE WITH RED	24	GREEN WITH BLACK	46	RED WITH PURPLE
3	BLUE WITH YELLOW	25	YELLOW	47	RED WITH BROWN
4	BLUE WITH WHITE	26	YELLOW WITH RED	48	RED WITH BLACK
5	BLUE WITH GREEN	27	YELLOW WITH BLUE	49	PURPLE
6	BLUE WITH PURPLE	28	YELLOW WITH WHITE	50	PURPLE WITH RED
7	BLUE WITH BROWN	29	YELLOW WITH GREEN	51	PURPLE WITH YELLOW
8	BLUE WITH BLACK	30	YELLOW WITH PURPLE	52	PURPLE WITH BLUE
9	WHITE	31	YELLOW WITH BROWN	53	PURPLE WITH WHITE
10	WHITE WITH RED	32	YELLOW WITH BLACK	54	PURPLE WITH GREEN
11	WHITE WITH YELLOW	33	BROWN	55	PURPLE WITH BROWN
12	WHITE WITH BLUE	34	BROWN WITH RED	56	PURPLE WITH BLACK
13	WHITE WITH GREEN	35	BROWN WITH YELLOW	57	BLACK
14	WHITE WITH PURPLE	36	BROWN WITH BLUE	58	BLACK WITH RED
15	WHITE WITH BROWN	37	BROWN WITH WHITE	59	BLACK WITH YELLOW
16	WHITE WITH BLACK	38	BROWN WITH GREEN	60	BLACK WITH BLUE
17	GREEN	39	BROWN WITH PURPLE	61	BLACK WITH WHITE
18	GREEN WITH RED	40	BROWN WITH BLACK	62	BLACK WITH GREEN
19	GREEN WITH YELLOW	41	RED	63	BLACK WITH PURPLE
20	GREEN WITH BLUE	42	RED WITH YELLOW	64	BLACK WITH BROWN
21	GREEN WITH WHITE	43	RED WITH BLUE		
22	GREEN WITH PURPLE	44	RED WITH WHITE		

Fig. 24. Wiring diagram applicable to 2-Litre Saloon, Van, Pick-up and Estate Cars

STANDARD VANGUARD SALOON AND ESTATE CAR
VAN AND PICK-UP TRUCK
SERIES II SUPPLEMENT

ELECTRICAL SPECIFICATION

Unit	*Lucas Model*
Generator	C39PV-2
Starting Motor	M418G
Starter Switch	ST950
*Distributor	DVX4A
Ignition Coil	B12
Headlamps	F700
Side Lamps	489
Side and Flasher Lamps (U.S.A.)	488
Stop-tail, Reverse and Reflex Reflector Unit	531
Stop-Tail and Flasher Lamps (U.S.A.)	464
Number Plate Lamp	467/2
Control Box	RB106/1
Fuse Unit	SF6
Windtone Horns (high note and low note)	WT614
Horn Circuit Relay	SB40
Windscreen Wiper	CRT14
Trafficators	SF80
Battery	GTW9A/2

* Model DM2 Type B164 after Engine Nos. V202584E and TDC2086E

BATTERY

1. GENERAL

The battery is supplied either filled and charged or " dry-charged," that is with the cells in a charged condition but sealed and without electrolyte. Details of preparing a "dry-charged" battery for service are given in para. 5 below.

2. ROUTINE MAINTENANCE.

Every 1,000 miles, or monthly (or more frequently in hot climates), examine the level of the electrolyte in the cells, and if necessary add distilled water to bring the level up to the tops of the separators.

Correct Acid-Level Device

For ease of topping up, a correct acid-level device is located under each cell vent plug. This device consists of a tube with a perforated flange which fits in the filling orifice.

When topping up a cell, remove the rubber vent plug and carefully pour distilled water into the flange until no more water drains through into the cell. By lifting the tube slightly, the small amount of water in the vent plug hole will drain quickly into the cell, and the electrolyte level will then be correct. Refit the vent plug.

Distilled water should always be used for topping-up. In an emergency, however, clean rainwater or melted snow may be used. The following waters must not be used; salt water, chlorinated water, chemically softened water or stagnant water having an offensive odour.

N.B.—Never use a naked light when examining a battery, as the mixture of oxygen and hydrogen given off by the battery when on charge, and to a lesser extent when standing idle, can be dangerously explosive.

Examine the terminals. If they are dirty, scrape them clean and coat them with petroleum jelly. Wipe away all dirt and moisture from the top of the battery, and ensure that the connections and the fixing band are clean and tight.

N.B.—The specific gravity of the electrolyte varies with the temperature. For convenience in comparing specific gravities, they are always corrected to 60°F., *which is adopted as a reference temperature. The method of correction is as follows:—*

For every 5°F. *below* 60°F., *deduct* .002 from the observed reading to obtain the true specific gravity at 60°F. For every 5°F. *above* 60°F., *add* .002 to the observed reading to obtain the true specific gravity at 60°F.

The temperature must be that indicated by a thermometer immersed in the electrolyte, and not the ambient temperature.

3. SPECIFIC GRAVITIES AND CHARGING RATES.

	Home trade and climates normally below 80°F. (27°C.)	*Sub-tropical climates* 80°—100°F. (27°—38°C.)	*Tropical climates frequently above* 100°F.
Specific gravity of electrolyte—cell discharged	Below 1.150	Below 1.120	Below 1.100
Specific gravity of electrolyte—cell fully charged	1.280—1.300	1.250—1.270	1.220—1.240
Specific gravity of filling electrolyte, UNCHARGED BATTERY	1.350	1.320	1.300
Specific gravity of filling electrolyte, "DRY-CHARGED" BATTERY	1.275	1.275 (Climates normally below 90°F.) 1.215 (Climates often above 90°F.)	1.215
Maximum permissible electrolyte temperature during charging	100°F. (38°C.)	110°F. (43°C.)	(120°F. (49°C.)
Initial charging current for new battery			3.5 amperes
Normal recharge current			5 amperes

4. SERVICING.

(a) Battery persists in low state of charge.

First consider the conditions under which the battery is used. Remember that if the battery is subjected to heavy loads (*i.e.*, long periods of night parking with lights on) without suitable opportunities for recharging, a low state of charge is only to be expected. A fault in the dynamo or regulator, or neglect during a period out of commission, may also be responsible for the trouble.

Vent plugs

See that the ventilating holes in each vent plug are free from obstruction.

Level of electrolyte

The surface of the electrolyte should be level with the tops of the separators. If necessary, top up with distilled water. Any loss of acid from spilling or spraying (as opposed to the normal loss of water by evaporation) should be made good by dilute acid of the same specific gravity as that already in the cell.

Cleanliness, etc.

See that the top of the battery is free from dirt or moisture which might provide a discharge path. Ensure that the battery connections are clean and tight.

Hydrometer tests.

Measure the specific gravity of the acid in each cell in turn, with a hydrometer. The reading given by each cell should be approximately the same; if one cell differs appreciably from the others, an internal fault in that cell is indicated.

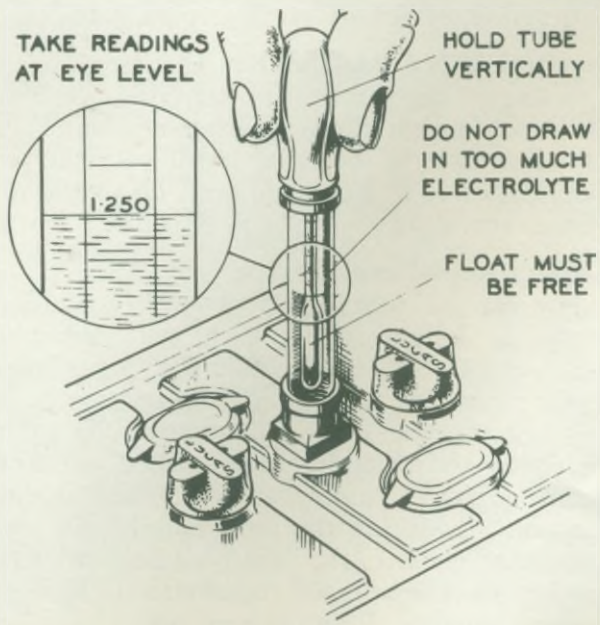


Fig. 1. Taking hydrometer readings.

This will probably be confirmed by the heavy discharge test described below.

The appearance of the electrolyte drawn into the hydrometer when taking a reading gives a useful indication of the state of the plates : if it is very dirty, or contains small particles in suspension, it is possible that the plates are in a bad condition.

Discharge test.

A heavy discharge tester consists of a voltmeter, 2 or 3 volts full scale, across which is connected a shunt resistance capable of carrying a current of several hundred amperes. Pointed prongs are provided for making contact with the inter-cell connections. Press the contact prongs against the exposed positive and negative terminals of each cell. A good cell will maintain a reading of 1.2—1.5 volts, depending on the state of charge, for at least 6 seconds. If, however, the reading rapidly falls off, the cell is probably faulty, and a new plate assembly may have to be fitted.

(b) **Recharging from an external supply.**

If the above tests indicate that the battery is merely discharged, and is otherwise in a good condition, it should be recharged, either on the vehicle by a period of daytime running or on the bench from an external supply.

If the latter, the battery should be charged at the current quoted in para. 3 until the specific gravity and voltage show no increase over three successive hourly readings. During the charge the electrolyte must be kept level with the tops of the separators by the addition of distilled water.

A battery that shows a general falling-off of efficiency, common to all cells, will often respond to the process known as " cycling." This process consists of fully charging the battery as described above, and then discharging it by connecting to a lamp board, or other load, taking about 5 amperes. The battery should be capable of providing this current for at least 7 hours before it is fully discharged, as indicated by the voltages of each cell falling to 1.8. If the battery discharges in a shorter time, repeat the " cycle " of charge and discharge.

5. PREPARING NEW BATTERIES FOR SERVICE.

Batteries for the home market are normally supplied filled and charged, and may be put into service on the vehicle without further attention. In an emergency, however, it may be necessary to use a battery supplied dry and uncharged : in this event the instructions in para. (a) below, " Initial filling and charging," should be followed.

Batteries for export markets are supplied " dry-charged." Before fitting to the vehicle the battery must be filled with acid as described in para. (b); no initial charging is necessary.

(a) **Initial filling and charging of new batteries.**

Preparation of electrolyte.

Electrolyte of the specific gravity given in para. 3 is prepared by mixing distilled water and concentrated sulphuric acid, usually of 1.835 S.G. The mixing must be carried out either in a lead-lined tank or in suitable glass or earthenware vessels. Slowly add the acid to the water, stirring with a glass rod. Never add the water to the acid, as the resulting chemical reaction causes violent and dangerous spurting of the concentrated acid. The approximate proportions of acid and water are indicated in the following table :—

To obtain Specific Gravity (corrected to 60°F.) of :	*Add 1 vol. of acid of 1.835 S.G. (corrected to 60°F.) to :*
1.350	1.8 volumes of water
1.320	2.3 volumes of water
1.300	2.5 volumes of water

Heat is produced by the mixture of acid and water, and the electrolyte should be allowed to cool before taking hydrometer readings—unless a thermometer is used to measure the actual temperature, and a correction applied to the reading as described in para. 3—and before pouring the electrolyte into the battery. The total volume of electrolyte required is approximately 6 pints.

Filling the battery.

The temperature of the acid, battery and filling-in room must not be below 32°F.

Carefully break the seals in the filling holes and half fill each cell with electrolyte of the appropriate specific gravity. Allow the battery to stand for at least 6 hours, in order to dissipate the heat generated by the chemical action of the acid on the plates and separators, and then add sufficient electrolyte to fill each cell to the top of the separators. Allow to stand for a further two hours and then proceed with the initial charge.

Initial charge.

The initial charging rate is given in para. 3. Charge at this rate until the voltage and specific gravity readings show no increase over five

successive hourly readings. This will take from 40 to 80 hours, depending on the length of time the battery has been stored before charging.

Keep the current constant by varying the series resistance of the circuit, or the generator output. This charge should not be broken by long rest periods. If, however, the temperature of any cell rises above maximum quoted in para. 3, the charge must be interrupted until the temperature has fallen at least 10°F. below that figure. Throughout the charge, the electrolyte must be kept level with the top of the separators by the addition of more acid as required.

At the end of the charge carefully check the specific gravity in each cell to ensure that, when corrected to 60°F., it lies within the specified limits. If any cell requires adjustment, some of the electrolyte must be syphoned off and replaced either by distilled water or by acid of the strength originally used for filling-in, depending on whether the specific gravity is too high or too low. Continue the charge for an hour or so to ensure adequate mixing of the electrolyte and again check the specific gravity readings. If necessary, repeat the adjustment process until the desired reading is obtained in each cell. Finally, allow the battery to cool, and syphon off any electrolyte above the tops of the separators.

(b) **Preparing " dry-charged " batteries for service:**

Electrolyte of the appropriate specific gravity, either 1.275 or 1.215, is prepared as described in para. (a) above: for electrolyte of 1.275 S.G., add 1 volume of 1.835 S.G. sulphuric acid to 2.8 volumes of distilled water, and for electrolyte of 1.215 S.G., 1 volume of acid to 4 volumes of distilled water. The total quantity of electrolyte required is 6 pints.

Filling the cells.

Carefully break the seals in the cell filling holes and fill each cell with electrolyte to the top of the separators, *in one operation.* The temperature of the filling room, battery and electrolyte should be maintained between 60°F. and 100°F. If the battery has been stored in a cool place, it should be allowed to warm up to room temperature before filling.

Batteries filled in this way are 90 per cent charged, and are capable of giving a starting discharge one hour after filling. When time permits, however, a short freshening charge will ensure that the battery is fully charged. Such a freshening charge should last for no more than 4 hours, at the normal recharge rate of the battery.

During the charge the electrolyte must be kept level with the top edge of the separators by the addition of distilled water. Check the specific gravity of the acid at the end of the charge; if 1.275 acid was used to fill the battery, the specific gravity should now be between 1.280 and 1.300: if 1.215, between 1.220 and 1.240.

DYNAMO

Testing in position.

Disconnect the cables from the dynamo terminals " D " and " F " and connect the two terminals with a short length of wire. Connect a voltmeter between the dynamo terminals and the dynamo frame. Increase the engine speed gradually and note the voltmeter reading, which should reach 12 volts at a comparatively low speed. Do not run the engine at a speed above 1.500 r.p.m. If no reading is given, or if it is low or erratic, the dynamo must be removed for examination.

To dismantle

Take off the driving pulley.

Remove the cover band, hold back the brush springs and remove the brushes from their holders.

Remove the nut, spring washer and flat washer from the smaller terminal (i.e. the field

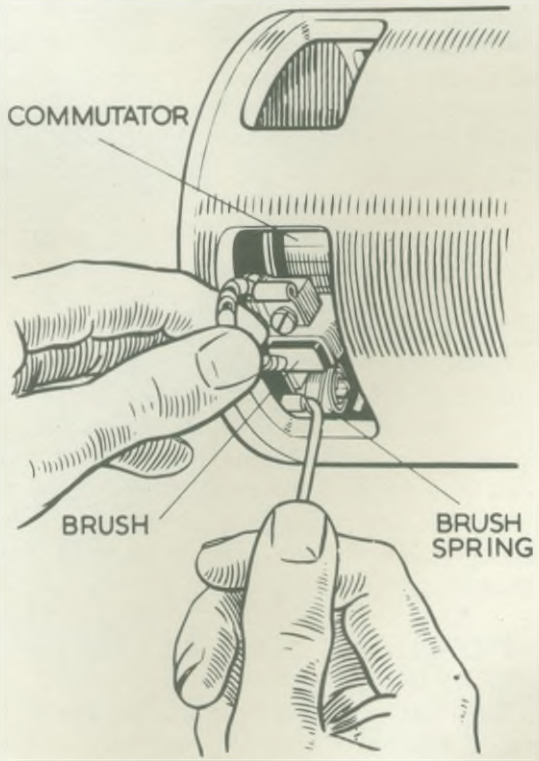


Fig. 2. Checking brush gear.

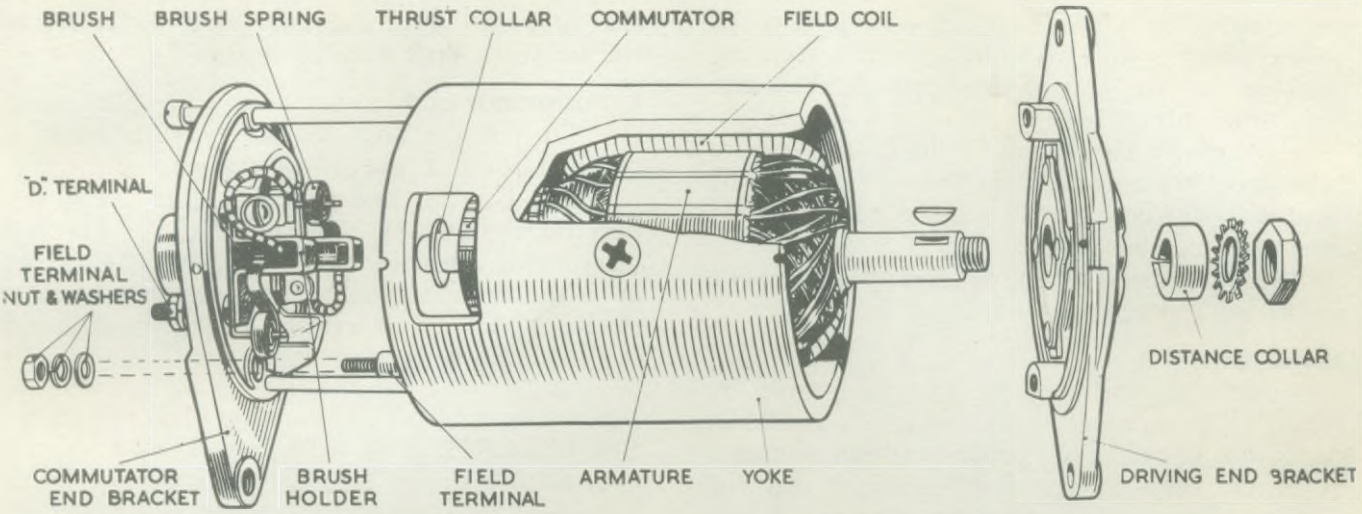


Fig. 3. Exploded view of Dynamo C39PV-2

terminal) on the commutator end bracket. Unscrew and withdraw the two through bolts and withdraw the commutator end bracket from the generator yoke.

The driving end bracket, together with the armature can now be lifted out of the yoke. The driving end bracket, which on removal from the yoke has withdrawn with it the armature and the armature shaft ball-bearing, need not be separated from the shaft unless the bearing is suspected and requires examination, or the armature is to be replaced; in this event, the armature can be removed from the end bracket by means of a hand press.

Armature.

Examine the commutator and if burned or blackened, clean with a petrol-moistened rag, or in bad cases by carefully polishing with very fine glass-paper. If necessary, undercut the insulation to a depth of $\frac{1}{32}$" with a hacksaw blade ground down to the thickness of the insulation.

Check the armature by means of a growler test or volt-drop test.

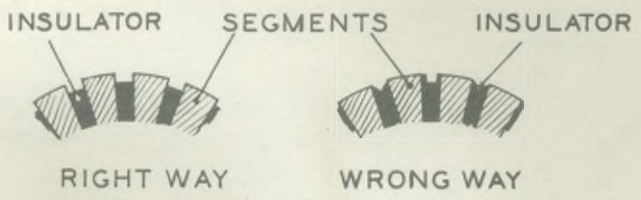


Fig. 4. Method of undercutting commutator insulation

Brushgear.

Examine the brushes. If they are worn so that they do not make good contact on the

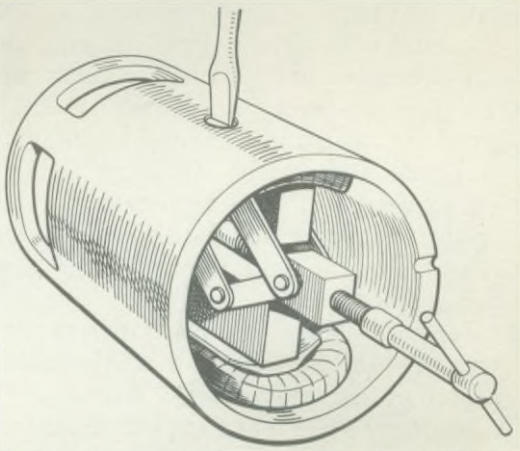


Fig. 5. Pole shoe and field coil assembly

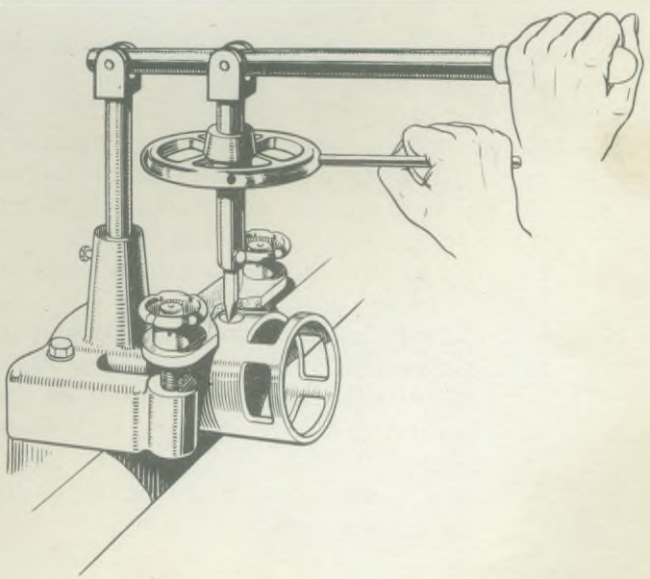


Fig. 6. Showing use of wheel-operated screwdriver.

commutator, or if the brush flexible is exposed on the running face, take out the screw securing the eyelet on the end of the brush flexibles and remove the brushes.

Fit new brushes into holders and secure eyelets on the ends of the brush lead in the original positions. Brushes are pre-formed and do not require bedding.

Spring tension on the brushes should not be allowed to fall below 15 oz.

Field coils.

Test the resistance of the field coils by means of an ohmmeter. If this is not available, connect a 12-volt D.C. supply with an ammeter in series, between the field terminal and the dynamo frame. The ammeter reading should be approximately 2 amps. If no reading, the field coils are open-circuited and must be replaced.

To test for earthed field coils, unsolder the end of the field winding from the earth terminal of the dynamo frame and with a test lamp connected from supply mains check between field terminal and earth. If lamp lights, field coils are earthed and must be replaced.

To do this, carry out the procedure outlined below, using a pole shoe expander and a wheel-operated screwdriver.

(i) Remove insulation piece which is provided to prevent the junction of the field coils from contacting with the yoke.

(ii) Mark the yoke and the pole shoes in order that they can be refitted in their original positions.

(iii) Unscrew the two pole shoe retaining screws by means of the wheel-operated screwdriver.

(iv) Draw the pole shoes and coils out of the yoke and lift off the coils.

(v) Fit the new field coils over the pole shoes and place them in position inside the yoke. Take care to ensure that the taping of the field coils is not trapped between the pole shoes and the yoke.

(vi) Locate the pole shoes and field coils by lightly tightening the fixing screws.

(vii) Insert the pole shoe expander, open it to the fullest extent and tighten the screws.

(viii) Fully tighten the screws by means of the wheel-operated screwdriver and lock them by caulking.

(ix) Replace the insulation piece between the field coil connections and the yoke.

Bearings.

Bearings which are worn to such an extent that they will allow excessive side movement of the armature shaft must be replaced.

Commutator end.

To remove and replace bearing bush at commutator end proceed as follows :—

The bearing housing is " blind " and not bored straight through the end bracket. On such machines the bearing may be removed by the use of a lipped expanding type extractor. Alternatibely a $\frac{5}{8}$" tap may be screwed into the bearing and bush and tap withdrawn together.

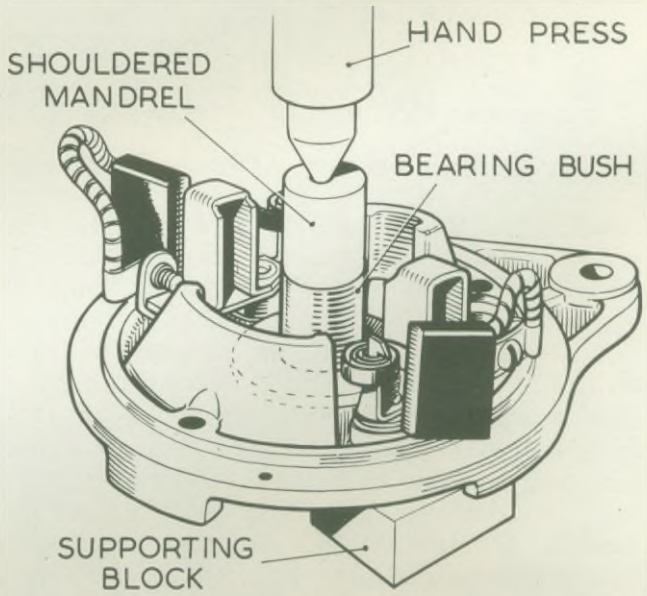


Fig. 7. Method of fitting bearing bushes

Press the new bearing bush into the end bracket using a shouldered mandrel of the same diameter as the shaft which is to fit in the bearing.

Note : Before fitting a new porous bronze bearing bush, it should be immersed for 24 hours in clean thin engine oil.

Driving end.

The ball-bearing at the driving end is replaced as follows :—

1. Knock out the rivets which secure the bearing retaining plate to the end bracket and remove the plate.
2. Press the bearing out of the end bracket and remove the corrugated washer, felt washer and oil retaining washer.
3. Before fitting the replacement bearing see that it is clean and lightly pack it with high melting-point grease.
4. Place the oil retaining washer, felt washer and corrugated washer in the bearing housing in the end bracket.

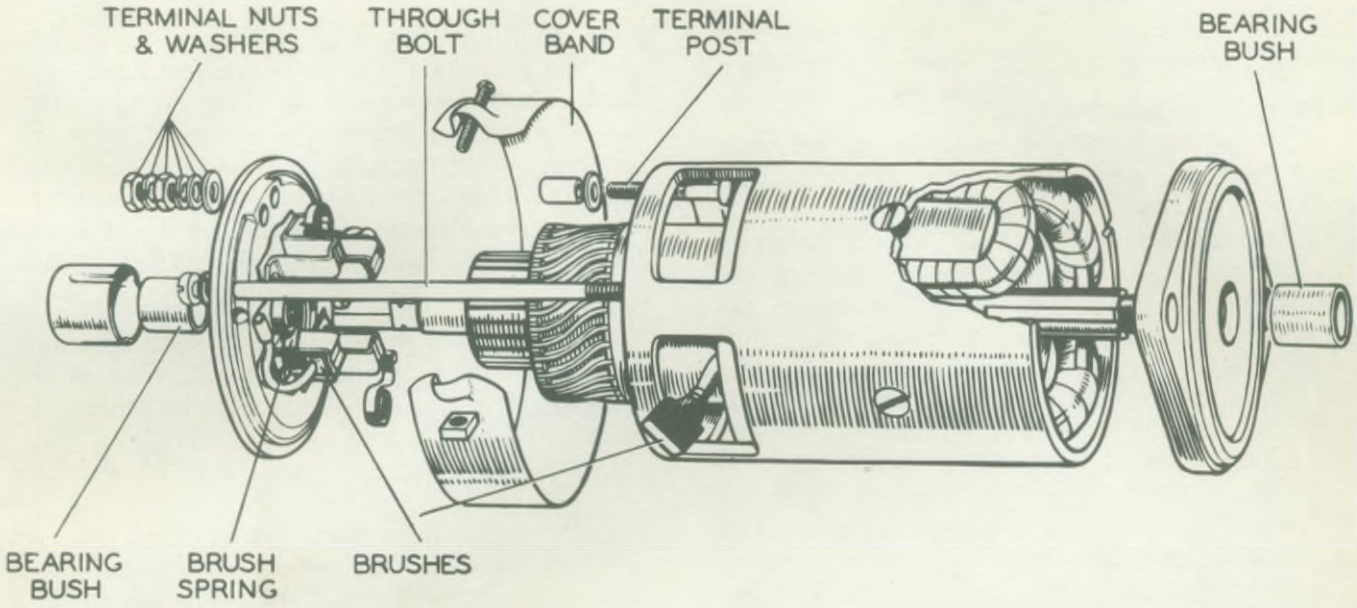


Fig. 8. Exploded view of Starter Motor Model M418G

5. Locate the bearing in the housing and press it home by means of a hand press.
6. Fit the bearing retaining plate. Insert new rivets from the outside of the end bracket and open the rivets by means of a punch to secure the plate rigidly in position.

To reassemble dynamo.

In the main the reassembly of the generator is a reversal of the operations described under " To Dismantle ".

If the armature has been removed from the driving end bracket, first press the armature shaft into the bearing in the end bracket and then fit the armature in position in the dynamo yoke and locate driving end bracket.

Before refitting the dynamo to the vehicle, unscrew the lubricator on the end of the dynamo, lift out the felt pad and spring, and about half fill the lubricator with H.M.P. grease. Replace the spring and felt pad, and screw the lubricator in position.

STARTER

If difficulty is experienced with the starter not meshing correctly with the flywheel, it may be that the starter drive requires cleaning. The pinion should move freely on the screwed sleeve; if there is any dirt or other foreign matter on the sleeve it must be washed with paraffin. To do this it will be necessary to remove the driving end bracket from starter frame (see dismantling instructions below).

In the event of the starter pinion becoming jammed in mesh with the flywheel, it can usually be freed by turning the starter armature by means of a spanner applied to the squared extension at the commutator end of the shaft. This is accessible by removing the cap.

If it is necessary to remove the starter from the engine, disconnect the earthing cable (positive) from the battery terminal to avoid any damage of causing short circuits and remove cables from starter switch.

Dismantling starter motor.

Take off the cover band at the commutator end, hold back the brush springs and take out the brushes from their holders.

Unscrew and withdraw the two through bolts.

Remove the terminal nuts and washers from

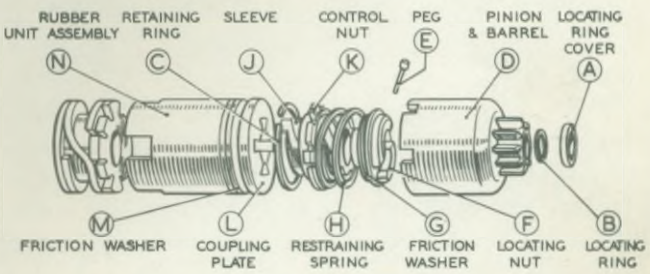


Fig. 9. Starter drive dismantled

the terminal post on the CE bracket and then remove the commutator and driving end brackets.

Starter drive (Rubber type).

Secure the armature by gripping the shaft extension in a vice and remove the locating ring cover (A) and locating ring (B).

Remove the retaining ring (C) and withdraw the barrel and pinion assembly. Remove the peg (E), or, on some starters, uncaulk the locating nut (F) and remove the locating nut, friction washers and restraining spring. Slide the sleeve and control nut off the shaft. Finally remove coupling plate (L), friction washer (M) and rubber assembly (N).

Should either the control nut or screwed sleeve be damaged, then a replacement assembly of screwed sleeve and control nut must be fitted. These components must not be renewed individually.

Note: When reassembling it will be necessary to fit a new locating nut.

Commutator.

Examine the commutator and if burned or blackened, clean with a petrol-moistened rag, or in bad cases by carefully polishing with very fine glass-paper.

Note: The insulation on the starter commutator must not be undercut.

Brushes.

Examine the brushes. If they are worn so that they do not make good contact on the commutator, or if the brush flexibles are exposed on the running face, they must be replaced. Two of the brushes are connected to terminal eyelets on the brush boxes, and the other two are connected to tappings on the field coils.

The flexible connectors must be removed by unsoldering and the connectors of the new brushes secured in their places by soldering. The brushes are pre-formed so that bedding to the commutator is unnecessary. Spring tension on the brushes should not be allowed to fall below 30 oz.

Field coils.

The field coils can be tested for open circuit by connecting a 12-volt battery and test lamp to the tapping points on the field coils at which the brushes are connected. If the lamp does not light there is an open circuit in the wiring of the field coils.

Lighting of the lamp does not necessarily mean that the field coils are in order, as it is possible that one of them may be earthed to a pole shoe or to the starter frame. This may be checked by removing one of the test leads from the brush connector and holding on to a clean part of the starter frame.

Should the lamp light it indicates that the field coils are earthed and must be replaced.

When replacing field coils the procedure as detailed in the dynamo section should be followed.

Bearings.

Bearings which are worn to such an extent that they will allow excessive side play of the armature shaft must be replaced. To replace the bearing bushes proceed as follows :—

1. Press the bearing bush out of the end bracket.
2. Press the new bearing bush into the end bracket using a shouldered mandrel of the same diameter as the shaft which is to fit in the bearings.

Note: Before fitting a new porous bronze bearing bush it should be immersed for 24 hours in clean, thin engine oil.

Reassembly.

The reassembly of the starter is a reversal of the dismantling procedure.

SOLENOID STARTER SWITCH

This switch is solenoid operated and energised from a separately mounted starter push. The switch is also arranged for manual operation. This feature is incorporated for special purposes only, such as testing or for emergency use in the event of a fault occurring in the push-button and solenoid circuit. In such circumstances, the switch can be operated by pressing in the rubber cap. This cap covers an extension to the switch movement.

Testing in Position : If it appears that faulty operation of the starting motor is due to some external cause, carry out a point-to-point circuit check using a 0-20 voltmeter as follows :—

1. Connect between the supply terminal of the Starter Push and earth. A zero reading indicates a completely discharged battery, faulty ignition switch or cable, or a loose connection.
2. Connect between the second terminal and earth. Operate the starter push, a zero reading indicates a faulty starter push, which must be replaced.
3. Pass to the starter switch and connect between the small terminal and earth. Operate the starter push. A zero reading indicates a faulty cable or loose connection.

4. Connect between the supply terminal of the starter switch and earth. A zero reading indicates a faulty cable or loose connection.
5. Connect between the second large terminal and earth. Operate the starter switch by depressing either, the rubber cup or the starting push. A zero reading indicates a faulty starting switch, which should be replaced.

DISTRIBUTOR
Model DVX4A

Routine maintenance (every 3,000 miles)

Lubrication.

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

Lightly smear the cam with a very small amount of Mobilgrease No. 2.

Apply a spot of clean engine oil to the top of the pivot on which the contact breaker works.

Lift the rotor arm from the top of the spindle by pulling it off vertically and add a few drops of thin machine oil to lubricate the cam bearing. Do not remove the screw exposed to view there is a clearance through which the oil passes. Take care to refit the rotor arm correctly pushing it on to the shaft as far as it will go.

Add a few drops of thin machine oil through the hole in the contact breaker base marked "Oil Here" in order to lubricate the automatic timing control.

Every 6,000 miles

Cleaning.

Wipe the inside and outside of the moulding with a soft dry cloth, paying particular attention to the spaces between the metal electrodes. See that the small carbon brush on the inside of the moulding moves freely in its holder.

Examine the contact breaker. The contacts must be free from grease or oil. If they are burned or blackened, clean them with a fine carborundum stone or very fine emery cloth, afterwards wiping away any trace of dirt or metal dust with a petrol-moistened cloth. Cleaning of the contacts is made easier if the contact breaker lever carrying the moving contact is removed. To do this slacken the nut(s) on the terminal block and lift off the spring, which is slotted to facilitate removal.

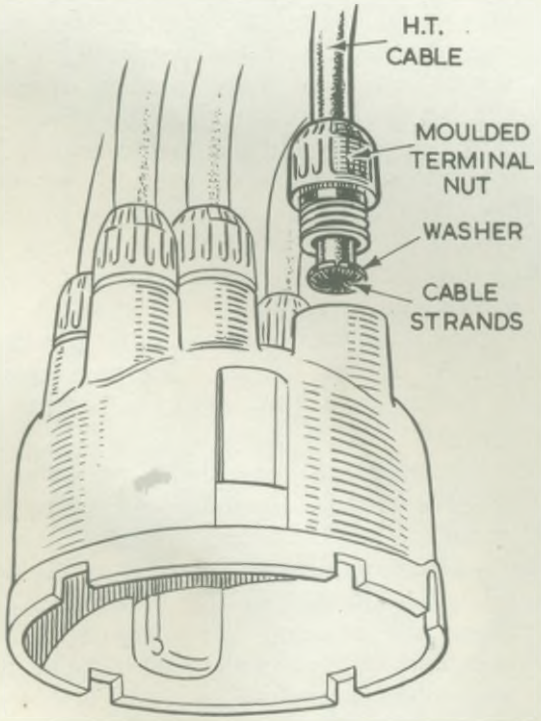


Fig. 10. Method of fitting high tension cables to distributor moulding (and to ignition coil)

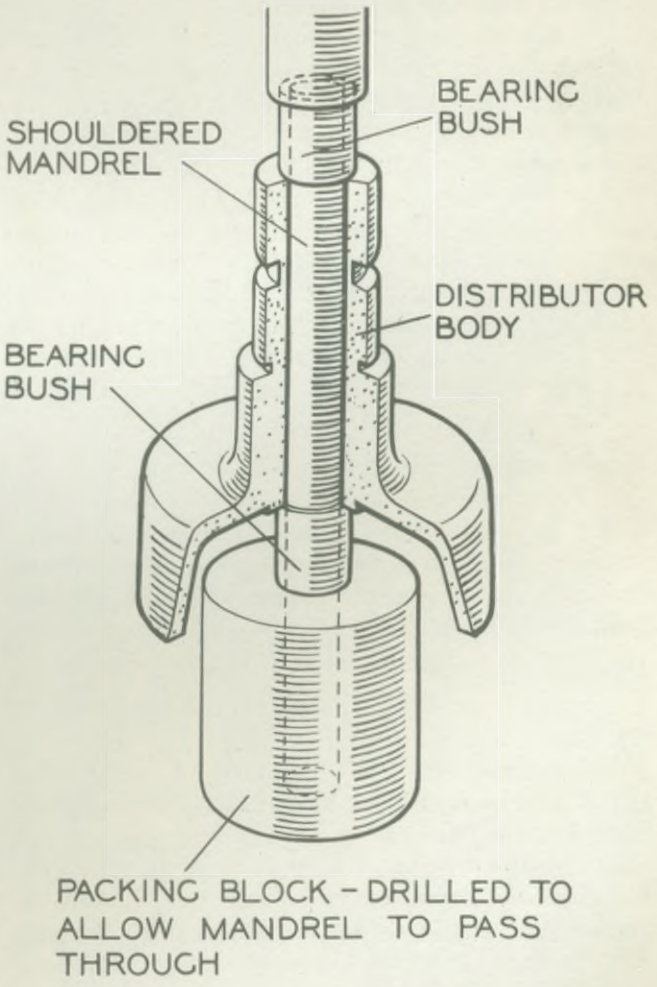


Fig. 11. Replacement of bearing bushes for distributor

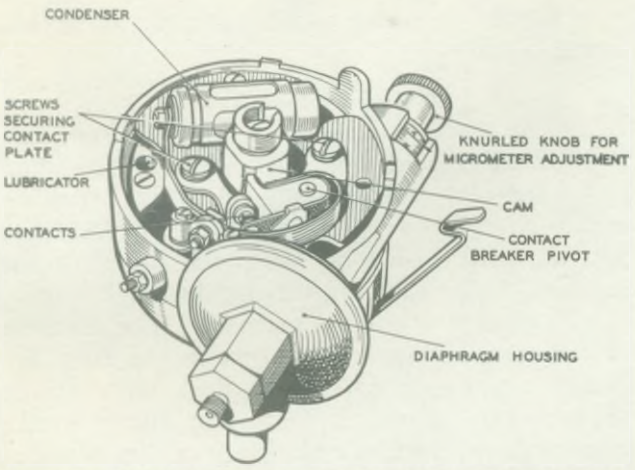


Fig. 12. DVX4A distributor head with rotor electrode removed

After cleaning check the contact breaker setting.

Contact breaker adjustment.

Turn the engine by hand until the contacts are seen to be fully opened, and check the gap with a gauge having a thickness of 0.014″ 0.016″. If the gap is correct, the gauge should be a sliding fit, but if the gap varies from the gauge, the setting must be adjusted. To do this, keep the engine in the position giving maximum contact opening and slacken the two screws securing the fixed contact plate. Adjust the position of the plate until the gap is set to the thickness of the gauge and tighten the two locking screws. Recheck the gap for other positions of the engine giving maximum contact opening.

High tension cables.

Examine the high tension cables. Any which have the insulation cracked or perished, or show signs of damage in any other way, must be replaced by 7-mm. rubber-covered ignition cable (see Fig. 10).

Dismantling.

Spring back the securing clips and remove the distributor moulding.

Lift the rotor arm off the top of the spindle. If it is a tight fit, it should be carefully levered off with a screwdriver.

To remove the moving contact, unscrew the nut from the moulded junction block, lift off the washer and cable eyelet and take out the bolt. The contact breaker spring can then be lifted off the pivot pin. Remove insulating washer from the pivot pin. Take out the two screws, complete with spring washers and flat steel washers, from the plate carrying the fixed contact and remove the plate.

Unscrew the screw from the condenser band clip. Unscrew the terminal nut, lift off the spring washer and remove the condenser and connecting strip.

Undo the three screws fitted at the edge of the contact breaker base casting and lift them out. The screws are accessible through the apertures cut in the contact breaker plate. The contact breaker base can then be removed from the body of the distributor when the eyelet securing the earthing cable is withdrawn from the base casting.

Remove the jump ring from the underside of the contact breaker base, lift off the star-shaped spring and slide the contact breaker plate out of the base.

Undo the two nuts from the studs securing the vacuum unit to its bracket, pull the unit off its seating so that the studs are clear of the fixing bracket and rotate the vacuum unit to unscrew the connecting rod from the control barrel.

Take care not to mislay the spring and serrated washer inside the barrel. Unscrew the control barrel from its sleeve and remove it. The sleeve can now be slid out of its housing.

Remove the driving gear or dog from the shaft.

Take out the screw from inside the top of the cam spindle and lift off the cam. Before dismantling, carefully note the positions in which the various components are fitted in order that they can be replaced correctly. To remove the automatic timing control and shaft assembly from the distributor, it must be pressed out of its bearing. The bearings must not be disturbed unless they are worn and need replacing. The bearing bush fitted at the lower end of the shank can be removed by driving it out with a suitable punch; while the ball bearing at the top can be removed by means of a shouldered mandrel locating on the inner journal of the bearing.

Reassembly.

If the bearings have been removed, the distributor should be assembled with new bearings fitted. Press the ball bearing into its housing at the top of the shank using a shouldered mandrel which locates on the inner and outer journals of the bearing. The bearing bush at the lower end of the shank must also be fitted using a shouldered mandrel.

Before fitting the bearing bush it should be allowed to stand completely immersed in thin oil for at least 24 hours.

Place the distance collar over the shaft, fit the shaft in its bearings and replace the driving member.

Assemble the automatic timing control, taking care that the parts are fitted in their original positions and that the control springs are not stretched. Place the cam on its spindle and tighten the locking screw.

1. Fit the sleeves of the micrometer adjustment into its housing in the contact-breaker base, so that the timing scale appears in the window on the right of the body. Screw the control barrel fully home in the sleeve. With the barrel and sleeve pushed as far into the housing as they will go, screw the vacuum unit connecting rod into the barrel, taking care that the serrated washer is correctly fitted.
   Position the vacuum unit on its fixing plate so that the two studs fit through the holes provided. Place a spring washer over each stud and secure by tightening the locking nuts.
2. See that the two cables are connected to the terminal and to the earthing screw in the base casting. Position the contact breaker plate in the base casting so that the peg fitted in the control barrel locates in the hole provided in the contact breaker plate. Place the star-shaped spring over the bearing sleeve on the under side of the base casting and secure by springing the jump ring into its location. Place the contact breaker base on the distributor body and secure by means of the three screws.
3. Insert the terminal post on the condenser through the hole in the connector strip. Replace the spring washer and tighten the terminal nut. Secure the band clip by replacing and tightening the fixing screw.
   Position the plate carrying the fixed contact on the contact breaker base and secure it by replacing and lightly tightening the two screws, first placing a spring washer and flat steel washer under the heads of each of the screws. The eyelet on the end of the cable connected to the earthing screw must be fitted under the head of one of the screws. Place the insulating washer over the contact breaker pivot pin and position the contact breaker lever on its pivot pin. Insert the square-headed bolt through the condenser connecting strip and the hole in the end of the contact breaker spring. Fit the bolt in the moulded junction block, place the eyelet on the end of the connector from the low tension terminal over the bolt, followed by a spring washer and secure by tightening the nut. Adjust the contact breaker setting to 0.014"—0.016".

Note: If it becomes necessary to renew the contacts a replacement set comprising fixed and moving contacts must be fitted.

Place the rotor arm on the top of the spindle, locating the register correctly and push it fully home.

Fit the distributor moulding and secure by means of the spring clips.

CONTROL BOX

Testing in position to locate fault in charging circuit.

If the procedure given on page 3 shows the generator to be in order, proceed to check further as follows :—

1. First ensure that the wiring between battery and regulator is in order. To do this, disconnect the wire from the A terminal of the control box and connect the end of the wire removed to the negative terminal of a voltmeter.
   Connect the positive voltmeter terminal to an earthing point on the chassis. If a voltmeter reading is given, the wiring is in order and the regulator must be examined.
2. If there is no reading, examine the wiring between battery and control box for broken wires or loose connections.
3. Reconnect the wire to terminal A.

Regulator adjustment.

The regulator is carefully set during manufacture to suit the normal requirements of the standard equipment and in general it should not be necessary to make further adjustments. However, if the battery does not keep in a charged condition, or if the generator output does not fall when the battery is fully charged it may be advisable to check the setting and re-adjust if necessary.

It is important before altering the regulator setting when the battery is in a low state of charge, to check that its condition is not due to a battery defect or to the generator belt slipping.

Electrical setting.

It is important that a good quality MOVING COIL VOLTMETER (0—20 volts) be available before attempting to adjust the regulator.

The electrical setting can be checked without removing the cover from the control box.

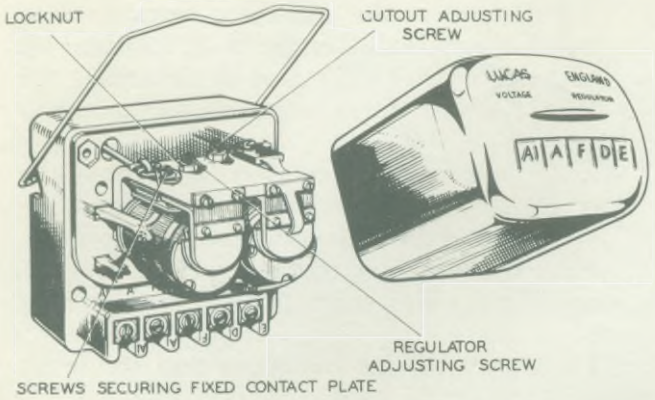


Fig. 13. Control box Model RB106/1

Withdraw the cables from the terminals marked A and A1 at the control box and join the wires together.

Connect the negative lead of the moving coil voltmeter to the D terminal on the generator, and connect the other lead from the meter to a convenient chassis earth. Start the engine.

Slowly increase the speed of the engine until the voltmeter needle " flicks " and then steadies; this should occur at a voltmeter reading between the limits given below for the appropriate temperature of the regulator.

Setting at 10°C (50°F.)	16.1—16.7 volts
Setting at 20°C. (68°F.)	15.8—16.4 volts
Setting at 30°C. (86°F.)	15.6—16.2 volts
Setting at 40°C. (104°F.)	15.3—15.9 volts

If the voltage at which the reading becomes steady occurs outside these limits, the regulator must be adjusted.

Shut off the engine, remove the control box cover, release the locknut (A) holding the adjusting screw (B) and turn the screw in a clockwise direction to raise the setting, or in an anti-clockwise direction to lower the setting. Turn the adjustment screw a fraction of a turn and then tighten the locknut.

When adjusting, do not run the engine up to more than half throttle, as while the dynamo is on open circuit, it will build up to a high voltage if run at high speed, and so a false voltmeter reading would be obtained.

Mechanical setting.

The mechanical setting of the regulator is accurately adjusted before leaving the works and provided the armature carrying the moving contact is not removed, the regulator will not require mechanical adjustment. If, however, the armature has been removed from the regulator for any reason, the contacts will have to be reset. To do this proceed as follows :—

1. Slacken the two armature fixing screws. Insert a .018" feeler gauge between the back of the armature and the regulator frame.
2. Press back the armature against the regulator frame and down on to the top of the bobbin core with gauge in position and lock the armature by tightening the two fixing screws.
3. Check the gap between the underside of the shim and the top of the bobbin core. This gap should be .012"—.020". If the gap

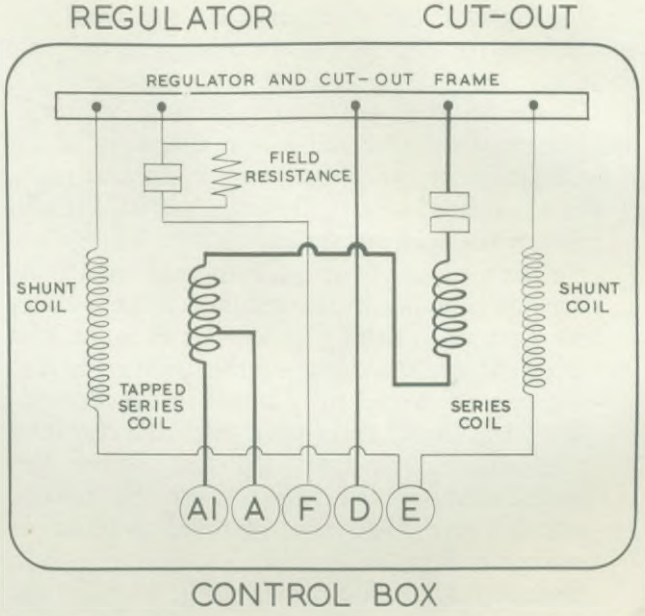


Fig. 14. Internal connections of RB106/1 Control Box

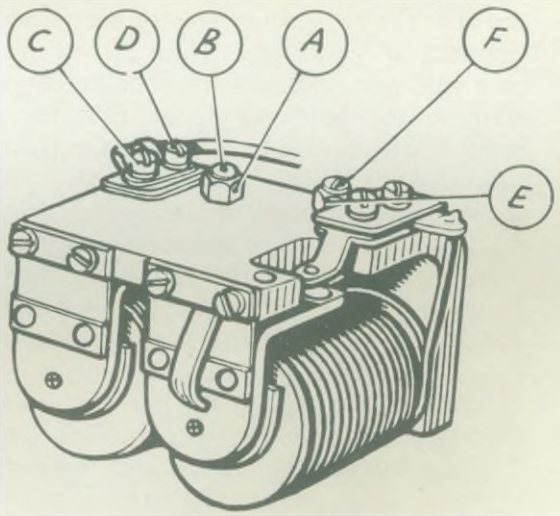


Fig. 15. Cut-out and regulator assembly

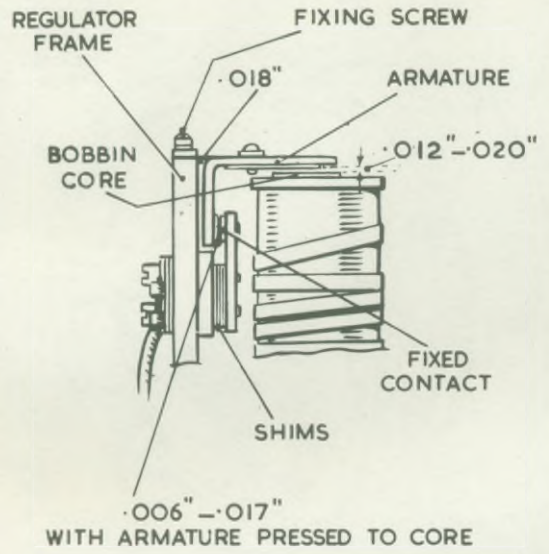


Fig. 16. Mechanical setting of regulator

is outside these limits, correct by adding or removing shims at the back of the fixed contact.

4. Remove gauge and press the armature down when the gap between the contacts should be .006"—.017".

Cleaning contacts.

To render the regulator contacts accessible for cleaning, slacken the screws securing the plate carrying the fixed contact. It will be necessary to slacken the upper screw (C) a little more than the lower (D) so that the contact plate can be swung outwards. Clean the contacts by means of fine carborundum stone or fine emery cloth. Carefully wipe away all traces of dirt or other foreign matter. Finally tighten the securing screws.

CUT-OUT

Electrical Setting.

If the regulator setting is within the correct limits, but the battery is still not receiving current from the generator, the cut-out may be out of adjustment, or there may be an open circuit in the wiring of the regulator and cut-out unit.

Remove the cable from terminal A on the control box, taking care that the bared end does not contact with the chassis.

Disconnect the voltmeter lead from terminal D and reconnect to terminal A. Run the engine as before; at a fairly low speed, the cut-out should operate, when a voltmeter reading should be given of the same value as that when the voltmeter was connected to terminal D.

If there is no reading, the setting of the cut-out may be badly out of adjustment, so preventing contact closure. To check the voltage at which the cut-out operates, remove the control box cover and connect the voltmeter between terminal D and earth. Start the engine and slowly increase its speed until the cut-out contacts are seen to close. This should occur at 12.7—13.3 volts.

If operation of the cut-out takes place outside the above voltage limits, adjust the setting as follows : slacken the locknut E and turn screw F a fraction of a turn in a clockwise direction to raise the voltage setting; or in an anti-clockwise direction to lower the setting. Test after each adjustment by increasing the engine speed and noting the closing voltage. Tighten locknut E after making the adjustment.

Mechanical setting.

If the cut-out armature has to be removed from the cut-out frame, care must be taken to obtain the correct gap settings when reassembling. The correct settings can be obtained as follows : Slacken the cut-out armature fixing screws and also the two screws which secure the fixed contact. Insert a 0.008" gauge between the back of the armature and the cut-out frame, and a 0.011"—0.015" gauge between the core face and the underside of the armature shim. Press the armature down and back against the two gauges and tighten the armature fixing screws.

With the gauges still in position, set the gap between the armature and the stop plate arm to 0.030"—0.034" by carefully bending the stop plate arm in the appropriate direction.

Remove the gauges and tighten the screws securing the fixed contact. Insert a 0.025" gauge between the core face and the armature. Press the armature down on to the gauge. The

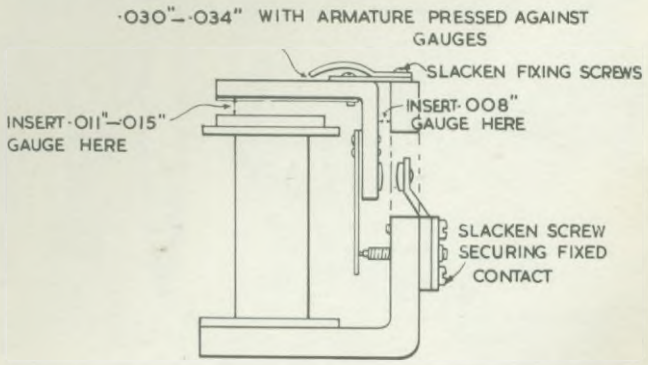


Fig. 17. Mechanical setting of cut-out

gap between the contacts should now measure 0.002"—0.006". Adjust the gap, if necessary by adding or removing shims beneath the fixed contact plate.

Cleaning.

To clean the contacts remove the cover, place a strip of fine glass-paper between the contacts and then, closing the contacts by hand, draw the paper through. This should be done two or three times, with the rough side towards each contact.

HEADLAMPS

Bulb replacement.

To remove the light unit for bulb replacement, unscrew the screw securing the front rim and lift off the rim. Next remove the dust-excluding rubber when three spring-loaded adjustment screws will be visible. Press the light unit in against the tension of the adjustment screw spring and turn it in an anti-clockwise direction until the heads of the screws can be disengaged through the slotted holes in the light unit rim. Do not disturb the screws as this will alter the lamp setting.

Twist the back shell in an anti-clockwise direction and pull it off. The bulb can then be removed.

Place the replacement bulb in the holder taking care to locate it correctly. Engage the projections on the inside of the back shell with the slots in the holder, press on and secure by twisting it to the right.

Position the light unit so that the heads of the adjusting screws protrude through the slotted

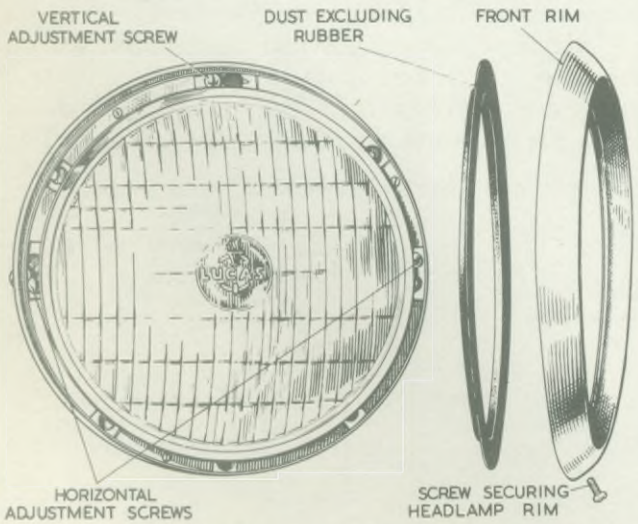


Fig. 18. F700 Headlamp Mark VI with front rim removed

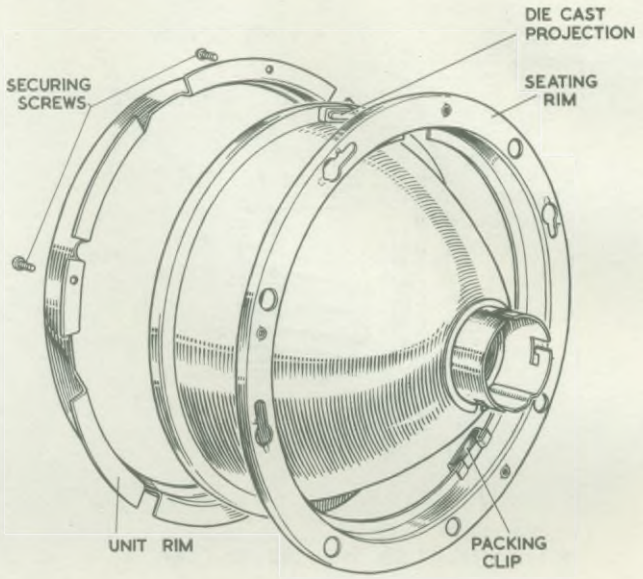


Fig. 19. Light Unit assembly for Lucas Headlamp Model F700 Mark VI

holes in the flange, press the unit in and turn in a clockwise direction. Replace the dust-excluding rubber and refit the front rim.

Setting.

If adjustment to the setting is required, first remove the front rim and rubber, as described above.

Vertical adjustment is made by turning the screw at the top of the lamp. Horizontal adjustment can be altered by the adjustment screws on each side of the light unit.

Remove the light unit assembly as described above.

Withdraw the three screws from the light unit rim and remove the seating rim and unit from light unit.

Position the replacement light unit between the unit rim and seating rim taking care to see that the die-cast projection in the edge of the light unit fits into the slot in the seating rim and also see that the seating ring is correctly positioned.

Finally secure in position by means of the three fixing screws.

Model MBD163

Bulb replacement.

Pull forward the fixing clip at the bottom of the lamp front and swing it downwards. Remove the front from the bottom of the lamp first. When replacing locate the top of the rim

first, then press on at the bottom and refit the fixing clip. The bulb is accessible without removing the reflector.

Focusing.

In order that the lamp shall give the best results, the bulb must be as near as possible to the focal point of the reflector. If the bulb is out of focus, the lamps will have a poor range and will cause dazzle to approaching traffic.

When focusing headlamps, it will be found an advantage to cover one lamp while testing the other. If the lamp does not give a uniform long range beam without any dark centre, the bulb needs adjusting. To make the adjustment remove the lamp front as described above and then remove the reflector as follows :—

Sidelamp Model 489.

To gain access to the bulb remove the rim and glass assembly as follows :—

Move aside the rubber ring and lever off the rim and glass assembly from the bottom of the lamp.

When refitting move aside rubber ring, locate rim at top of lamp, press on and finally position rubber ring so that it fits around rim.

Bulb : Lucas No. No. 989 12 volt 6 watt.

Side and Flasher Lamps, Model 488.

To gain access to the bulb, peel back the outer rubber lip and remove the rim; then peel back the inner rubber lip and remove the glass.

Bulb : Lucas No. 361 12 volt 6/18 watt.

Stop-Tail, Reverse and Reflex Reflector Unit, Model 531.

To gain access to the bulbs of the Stop-Tail or Reverse Lamps, unscrew the single screw securing the front plate and lift off the plate. The lamp glasses can be removed after peeling back the rubber retaining lips.

Bulbs :

Stop-Tail : Lucas No. 361 12 volt 18/6 watt.

Reverse Lamp : Lucas No. 221 12 volt 18 watt.

Stop-Tail and Flasher Lamps, Model 464.

To gain access to the bulbs, unscrew the two screws and lift off the rim, rubber gasket and glass.

Bulbs :

Stop-Tail : Lucas No. 361 12 volt 18/6 watt.

Flasher : Lucas No. 221 12 volt 18 watt.

Number Plate Lamp, Model 467/2.

To gain access to the bulb, unscrew the single cover securing screw and lift off the cover.

Bulb : Lucas No. 989 12 volt 6 watt.

" TRAFFICATORS "

Every 6,000 *miles* : Apply one drop of thin machine oil to the catch pin and to each side of the arm pivot.

Bulb replacement : Unscrew the single securing screw and lift off the arm cover. Remove the defective bulb and replace with a Lucas No. 256 12 volt 3 watt festoon bulb. Engage the securing tongue at the upper end of the arm cover with the top edge of the arm casting. Refit the securing screw.

Arm replacement : Remove the arm cover and bulb. Lift the bulb feed wire clear of the moulded arm. Slacken the arm clamping screw and withdraw the defective arm.

Insert the replacement arm and tighten the clamping screw. Refit the bulb connection, bulb and arm cover.

WINDSCREEN WIPER

Normally the windscreen wiper will not require any servicing apart from the occasional renewal of the rubber blades.

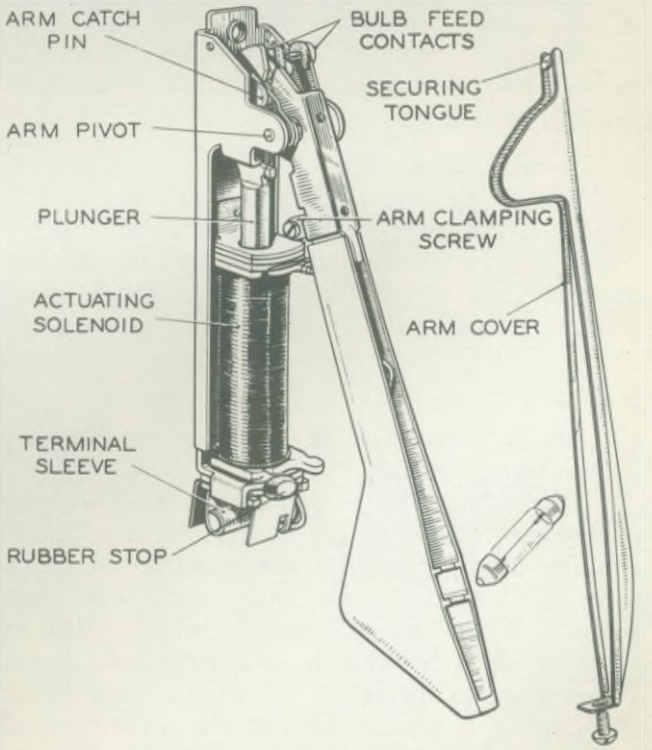


Fig. 20. Exploded view of Model SF88 " Trafficator "

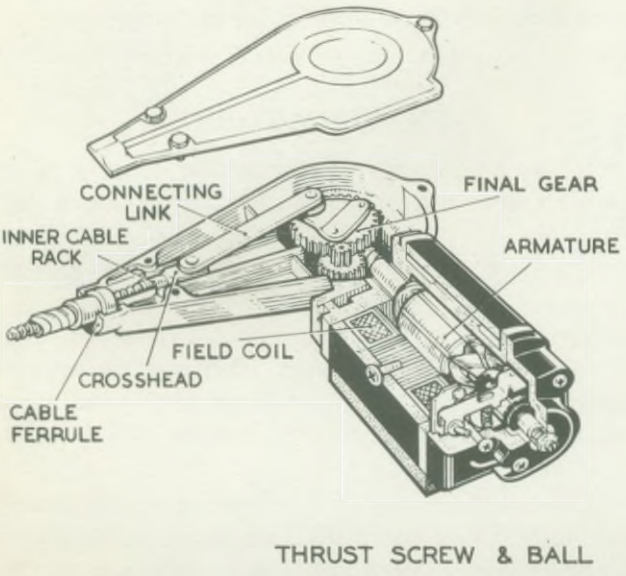


Fig. 21. Windscreen wiper motor and gearbox

Should any trouble be experienced, first check for loose connections, worn insulation, etc., before dismantling the motor.

1. **To detach the cable rack from the motor and gearbox.**

Remove gearbox cover.

Remove split pin and washer (on earlier models only) from crankpin and final gear-wheel. Lift off the connecting link.

2. **Commutator dirty.**

Removing the connecting leads to the terminals, withdraw the three screws securing the cover at the commutator end. Lift off the cover. Clean the commutator with a cloth moistened with petrol and carefully remove any carbon dust from between the commutator segments.

3. **Brush lever stiff or brushes not bearing on commutator.**

Check that the brushes bear freely on the commutator. If they are loose, and do not make contact, a replacement tension spring is necessary. The brush levers must be free on their pivots. If they are stiff, they should be freed by working them backwards or forwards by hand. Packing shims are fitted beneath the legs of the brush levers to ensure that the brushes are central and that there is no possibility of the brush boxes fouling the commutator. If the brushes are considerably worn they must be replaced.

4. **Motor operates but does not transmit motion to spindles.**

Examine the wiper arms and check that they are firmly secured to the wheelbox spindles. Remove the gearbox cover and examine the mechanism. Rotation of the armature should cause a push-pull motion of the cable rack.

To detach the flexible cable rack for inspection, proceed as follows :

Lift off the connecting link. Disengage the outer casing, cable rack and crosshead, from the gearbox. Replace the gearbox cover to prevent ingress of foreign matter.

Remove the wiper arms from the wheelbox spindles.

The cable rack can now be withdrawn from the outer casing. Check. also that the gears in the wheelboxes are undamaged and can correctly engage with the flexible rack. Before refitting the rack into the outer casing, grease it thoroughly with Duckham's H.B.B. or an equivalent grease. When overhauling, the gear must be lubricated by lightly packing the gearbox with a grease of the zinc-oxide type.

ELECTRIC HORN
Models WT.614 and WT.28

All horns before being passed out of the works are adjusted to give their best performance and will give a long period of service without any attention; no subsequent adjustment is required.

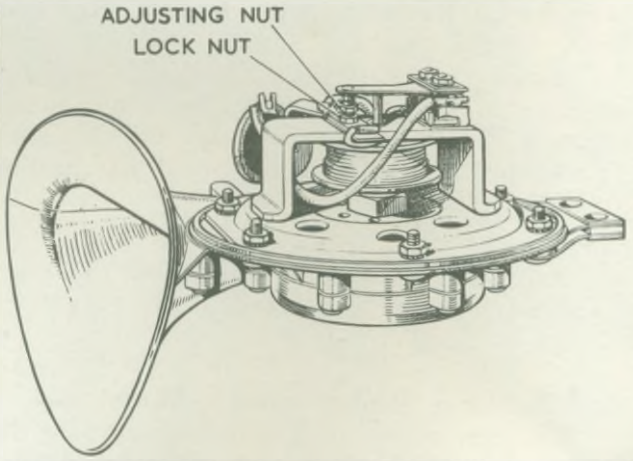


Fig. 22. Showing adjustment points for horn

If one of the horns fails or becomes uncertain in its action it does not follow that the horn has broken down. First ascertain that the trouble is not due to a loose or broken connection in the wiring of the horn. If both horns fail or become uncertain in action, the trouble is probably due to a blown fuse or discharged battery. If the fuse has blown, examine the wiring for the fault and replace with the spare fuse provided.

It is also possible that the performance of a horn may be upset by the fixing bolt working loose, or by some component near the horn being loose. If, after carrying out the above examination, the trouble is not rectified, the horn may need adjustment, but this should not be necessary until the horns have been in service for a long period.

Adjustment does not alter the pitch of the note, it merely takes up wear in moving parts. When adjusting the horns, short circuit the fuse, otherwise it is liable to blow. Again, if the horns do not sound on adjustment, release the push instantly.

When making adjustments to a horn always disconnect the supply lead of the other horn, taking care to ensure that it does not come into contact with any part of the chassis and so cause a short circuit.

Adjustment.

Remove the fixing screw from the top of the horn and take off the cover. Detach the cover securing bracket by springing it out of its location.

Slacken the locknut on the fixed contact and rotate the adjusting nut until the contacts are just separated (indicated by the horn failing to sound). Turn the adjusting nut half a turn in the opposite direction and secure it in this position by tightening the locknut.

Each horn, when correctly adjusted, passes 6½ amperes. This value should not be exceeded.

TRIUMPH "RENOWN" SALOON AND SPORTS CARS 1953

In general the information given for the 1953 "Vanguard" Series covers also the electrical equipment fitted to "Renown" Cars. Exceptions include the Headlamps, Side Lamps, Number Plate Lamp and "Trafficators".

Additional information to cover these Units is given below.

HEADLAMPS
Model MPL 147

These lamps are of the stem mounted external type and incorporate the Lucas Light-Unit and pre-focus pattern bulb.

Bulb replacement.

To gain access to the bulb, swing the rim-securing pull-catch outwards and downwards. This will release the front rim and light-unit assembly which can then be lifted out. Press in the backshell, turn it to the left and withdraw. The defective bulb can then be lifted out and replaced.

Light-unit replacement.

The light-unit is secured to the front rim by wire clips. To replace a light-unit, remove the rim and light-unit assembly, backshell and bulb as described above. Prise out the wire clips, substitute the defective light-unit and reassemble.

Bulbs.

R.H.D. Cars (Home).

Nearside lamp :	Lucas No. 302, 12 volt 48/48 watts.
Offside lamp :	Lucas No. 185, 12 volt 48 watts.

R.H.D. Cars (Export).

Nearside lamp :	Lucas No. 302, 12 volt 48/48 watts.
Offside lamp :	Lucas No. 302, 12 volt 48/48 watts.

L.H.D. Cars.

Nearside lamp :	Lucas No. 303, 12 volt 48/48 watts.
Offside lamp :	Lucas No. 303, 12 volt 48/48 watts.

SIDELAMPS
Model 1142

To gain access to the bulb, unscrew the screw at the back of the lamp body, and pull out the front rim and glass assembly to expose the bulb holder.

Replace the bulb, and return the bulb holder

and front rim assembly into the lamp body. Tighten the securing screw.

Bulb.

Lucas No. 207, 12 volt 6 watts.

NUMBER PLATE LAMP
Model 288/3

This lamp incorporates bulbs for Stop, Tail, Reverse and Number Plate illumination. The bulbs are located in pairs at each end of the lamp, and access to them is gained by unscrewing the securing screws and opening the hinged D-shaped windows.

Bulbs.

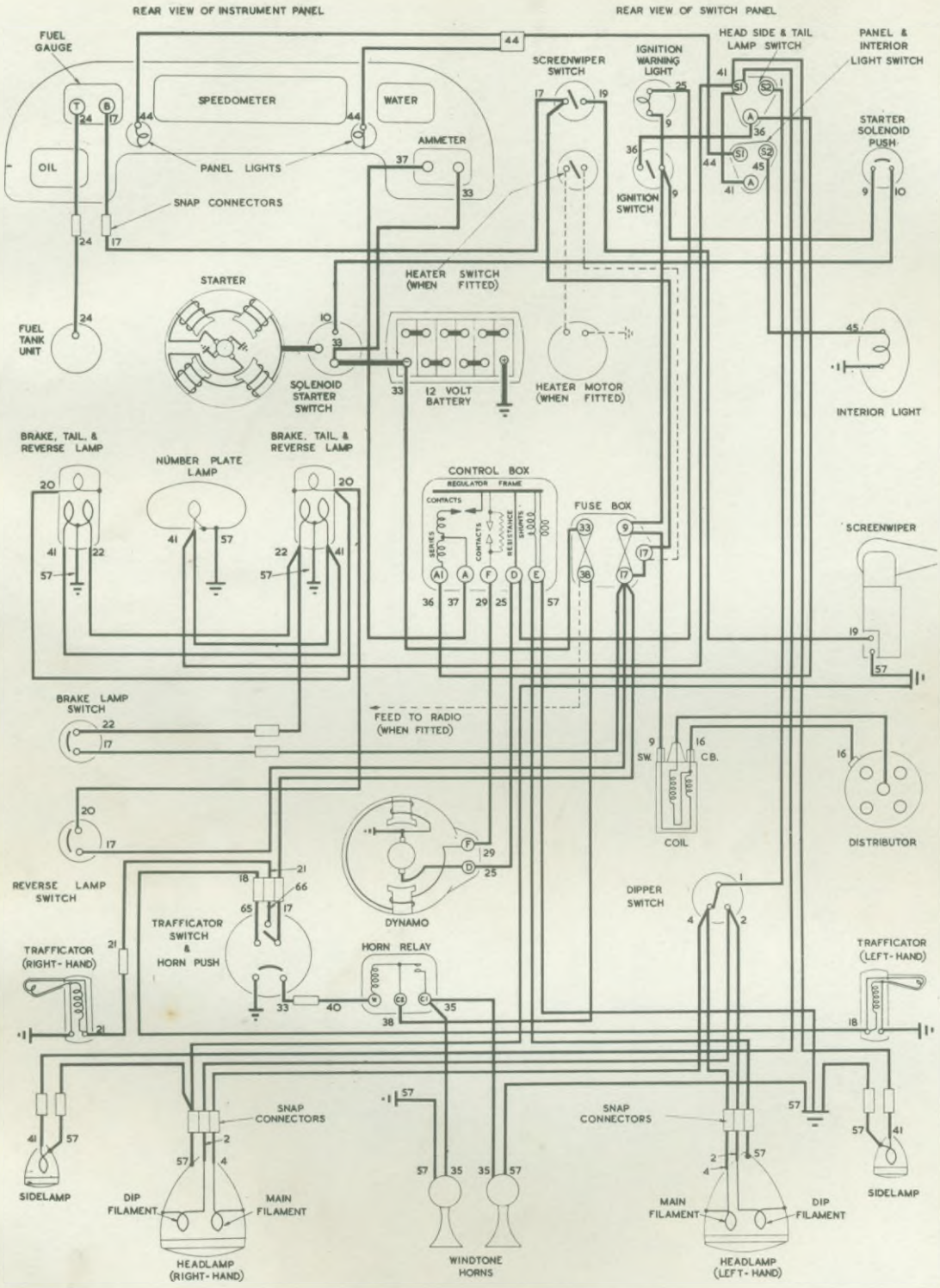
Tail and Reverse : Lucas No. 207 12 volt 6 watt.

Stop : Lucas No. 57. 12 volt 36 watt.

TRAFFICATORS
Models SF.34 and SF.80

At the time of writing, the change over from Model SF.34 to SF.80 is not complete, in the case of " Renown " Cars.

Instructions for the older type are given on pages 18—19 of the Vanguard Manual, Electrical Section, Issue Three. Instructions for the new SF.80 " Trafficator " are given for the Series II Vanguard Models.



KEY TO CABLE COLOURS			
1 BLUE	33 GREEN WITH BROWN	45 RED WITH GREEN	
2 BLUE WITH RED	34 GREEN WITH BLACK	46 RED WITH PURPLE	
3 BLUE WITH YELLOW	35 YELLOW	47 RED WITH BROWN	
4 BLUE WITH WHITE	36 YELLOW WITH RED	48 RED WITH BLACK	
5 BLUE WITH GREEN	37 YELLOW WITH BLUE	49 PURPLE	
6 BLUE WITH PURPLE	38 YELLOW WITH WHITE	50 PURPLE WITH RED	
7 BLUE WITH BROWN	39 YELLOW WITH GREEN	51 PURPLE WITH YELLOW	
8 BLUE WITH BLACK	40 YELLOW WITH PURPLE	52 PURPLE WITH BLUE	
9 WHITE	41 YELLOW WITH BROWN	53 PURPLE WITH WHITE	
10 WHITE WITH RED	42 YELLOW WITH BLACK	54 PURPLE WITH GREEN	
11 WHITE WITH YELLOW	43 BROWN	55 PURPLE WITH BROWN	
12 WHITE WITH BLUE	44 BROWN WITH RED	56 PURPLE WITH BLACK	
13 WHITE WITH GREEN	45 BROWN WITH YELLOW	57 BLACK	
14 WHITE WITH PURPLE	46 BROWN WITH BLUE	58 BLACK WITH RED	
15 WHITE WITH BROWN	47 BROWN WITH WHITE	59 BLACK WITH YELLOW	
16 WHITE WITH BLACK	48 BROWN WITH GREEN	60 BLACK WITH BLUE	
17 GREEN	49 BROWN WITH PURPLE	61 BLACK WITH WHITE	
18 GREEN WITH RED	50 BROWN WITH BLACK	62 BLACK WITH GREEN	
19 GREEN WITH YELLOW	41 RED	63 BLACK WITH PURPLE	
20 GREEN WITH BLUE	42 RED WITH YELLOW	64 BLACK WITH BROWN	
21 GREEN WITH WHITE	43 RED WITH BLUE	65 DARK GREEN	
22 GREEN WITH PURPLE	44 RED WITH WHITE	66 LIGHT GREEN	

Fig. 23. Wiring diagram applicable to 2-Litre Saloon, Van, Pick-up and Estate Cars