SECTION L

THE ELECTRICAL EQUIPMENT

THE DYNAMO.

Type.

The dynamo is a Lucas Model C39PV, Service No. 22257A. These identification marks are stamped on the yoke.

To Test on Vehicle.

The cutting-in speed is from 1,050 r.p.m. to 1,200 r.p.m. at 13 dynamo volts.

The output is 17 amps. at 1,800 r.p.m. to 2,000 r.p.m. at 13.5 dynamo volts taken on a resistance load of .8 ohms without regulator.

(a) Make sure that the driving belt is not slipping, and it should be capable of being deflected approximately .50 at the centre of its run between the pulleys with moderate hand pressure, and gently pulling the dynamo outwards by hand until the correct tension is obtained. The slotted link bolt must then be tightened, followed by the two upper bolts.

(d) Check that the dynamo and control box are connected correctly. The dynamo terminal "D" should be connected to the control box terminal "D" and the dynamo terminal "F" connected to control box terminal "F".

(c) After switching off all lights and accessories, disconnect the cables from the terminals of dynamo marked "D" and "F" respectively.

(d) Connect the two terminals with a short length of wire.

(e) Start the engine and set it to run at normal idling speed.

(f) Clip the negative lead of a moving coil type voltmeter, calibrated 0-20 volts, to one dynamo terminal and the other lead to a good earthing point on the dynamo yoke.

(g) Gradually increase the engine speed, when the voltmeter reading should rise rapidly and without fluctuation. Do not allow the voltmeter reading to reach 20 volts. Do not race the engine in an attempt to increase the voltage. It is sufficient to run the dynamo up to a speed of 1,000 r.p.m.

If there is no reading—check the brush gear.

If the reading is low (approximately 1 volt) the field winding may be faulty.

(h) Remove the dynamo cover band and examine the brushes and commutator. Hold back each of the brush springs and move the brush by pulling gently on its flexible connector. If the movement is sluggish remove the brush from its holder and ease the sides by lightly polishing on a smooth file. Always replace brushes in their original positions. If the brushes are worn so that they no longer bear on the commutator, or if the brush flexible has become exposed on the running face, new brushes must be fitted. If the commutator is blackened or dirty, clean it by holding a petrol-moistened cloth against it while the engine is turned slowly by hand cranking. Re-test the dynamo; if there is still no reading on the voltmeter, there is an internal fault and the complete unit should be replaced. If the dynamo is in good order, leave the temporary link in position between the terminals and restore the original connections, taking care to connect the dynamo terminal "D" to the control box terminal "D" and the dynamo terminal "F" to the control box terminal "F". Remove the lead from the "D" terminal on the control box and connect the voltmeter between this cable and a good earthing point on the vehicle. Run the engine as before. The reading should be the same as that measured directly at the dynamo.

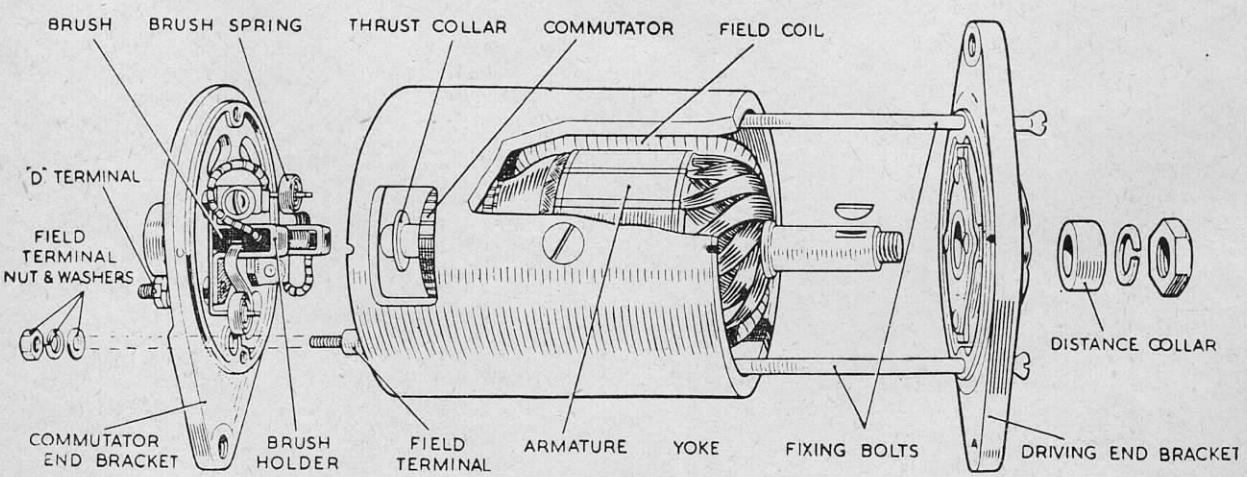

FIG. 41.—The dynamo components.

No reading on the voltmeter indicates a break in the cable to the dynamo. Carry out the same procedure for the "F" terminal connecting the voltmeter between cable and earth. Finally remove link from the dynamo. If the reading is correct test the control box.

Dismantling the Dynamo.

Take off the dynamo 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 at the commutator end.

Withdraw the two through bolts from the driving end.

Remove the nut, spring washer and flat washer from the smaller terminal (field terminal) on 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 yoke.

The driving end bracket which, on removal from the yoke, has withdrawn with it the armature and armature shaft ball bearing, need not be separated from the shaft unless the bearing is suspected and requires examination; in which event the armature should be removed from the end bracket by means of a hand press.

Servicing the Dynamo.

Brushes.

Test if the brushes are sticking. Clean them with petrol and, if necessary, ease the sides by lightly polishing with a smooth file. Replace the brushes in their original positions.

Test the brush tension wiht a spring scale if available. The correct tension is 20 to 25 ozs. Fit a new spring if the tension is low.

If the brushes are worn so that the flexible is exposed on the running face, new brushes must be fitted. Brushes are pre-formed so that bedding to the commutator is unnecessary.

Commutator.

A commutator in good condition will be smooth and free from pits or burned spots. Clean the commutator with a petrol-moistened cloth. If this is ineffective, carefully polish with a strip of fine glass-paper while rotating the armature. To remedy a badly worn commutator, mount the armature (with or without the drive end bracket) in a lathe, rotate at high speed and take a light cut with a very sharp tool. Do not remove more metal than is necessary. Polish the commutator with very fine glass-paper. Undercut the insulators between the segments to a depth of 1/32 with a hacksaw blade ground down to the thickness of the insulator.

Field Coils.

Test the field coils, without removing them from the dynamo yoke, by means of an ohmmeter. The reading on the ohmmeter should be between 6.0 and 6.3 ohms. If this is not available, connect a 12-volt D.C. supply with an ammeter in series between the field terminal and dynamo yoke. The ammeter reading should be approximately 2 amps. If no reading is indicated 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 on the dynamo yoke and, with a test lamp connected from the supply mains, test across the field terminal and earth. If the lamp lights the field coils are earthed and must be replaced.

When replacing the field coils, carry out the procedure outlined below, using an expander and wheel-operated screwdriver.

(a) Remove the insulation piece which is provided to prevent the junction of the field coils from contacting the yoke.
(b) Mark the yoke and pole shoes in order that they can be fitted in their original positions.
(c) Unscrew the two pole shoe retaining screws by means of the wheel-operated screwdriver.
(d) Draw the pole shoes and coils out of the dynamo yoke and lift off the coils.
(e) 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.
(f) Locate the pole shoes and field coils by lightly tightening the fixing screw.
(g) Insert the pole shoe expander, open it to the fullest extent and tighten the screws.
(h) Finally tighten the screws by means of the wheel-operated screwdriver and lock them by caulking.
(i) Replace the insulation piece between the field coil connections and the yoke.

Armature.

The testing of the armature winding requires the use of a voltage drop test and growler. If these are not available, the armature should be checked by by substitution. No attempt should be made to machine the armature core or to true a distorted armature shaft.

Bearings.

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

To replace the bearing bush at the commutator end, proceed as follows:—

(a) Press the bearing bush out of the commutator end bracket.
(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 the new bearing bush it should be allowed to stand completely immersed for twenty-four hours in thin engine oil. This will allow the pores of the bush to be filled with lubricant.

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

(a) Knock out the rivets which secure the bearing retaining plate to the end bracket and remove the plate.

(b) Press the bearing out of the end bracket and remove the corrugated washer, felt washer and oil-retaining washer.

(c) Before fitting the replacement bearing see that it is clean and pack it with a high-melting-point grease.

(d) Place the oil-retaining washer, felt washer and corrugated washer in the bearing housing in the end bracket.

(e) Locate the bearing in the housing and press it home by means of a hand press.

(f) Fit the bearing retaining plate. Insert the new rivets from the inside of the end bracket and open the rivets by means of a punch to secure the plate rigidly in position.

Reassembly.

In the main the reassembly of the dynamo is a reversal of the operations described.

Before refitting the dynamo to the vehicle, unscrew the lubricator from the commutator end bracket, lift out the felt wick and spring and refill the cap with high-melting-point grease. Replace spring and wick, and screw the lubricator in position in the end bracket.

THE STARTER.

Type.

The starter is a Lucas Model M35G, Service No. 25022. These identification marks are stamped on the yoke.

Its lock torque is approximately 9.3 lbs./ft. with 300 to 350 amps. and 7.5 to 8.0 volts.

To Test on Vehicle.

Switch on the lamps and operate the starter control. If the lights go dim, but the starter is not heard to operate, an indication is given that current is flowing through the starter windings, but that the starter is meshed permanently with the geared ring on the flywheel. This has probably been caused by the starter being operated while the engine is still running. In this case the starter must be removed from the engine for examination.

Should the lamps retain their full brilliance when the starter switch is operated, check that the switch is functioning. If the switch is in order, examine the connections at the battery, starter switch and starter, and also check the wiring between these units. Continued failure of the starter to operate indicates an internal fault in the starter, and the starter must be removed from the engine for examination.

Sluggish or slow action of the starter is usually caused by a poor connection in the wiring which produces a high resistance in the starter circuit. Check as described above.

Damage to the starter drive is indicated if the starter is heard to operate but does not crank the engine.

Removal and Replacement of Starter.

Remove the two nuts, bolts and spring washers securing the exhaust bracket to the third cross-member.

Remove the nut, bolt and spring washer securing the exhaust pipe clip to the exhaust bracket attached to the gearbox.

Remove the three nuts and spring washers attaching the exhaust pipe to the exhaust manifold and lower the exhaust system complete to the ground.

The exhaust system should be supported at intervals during these operations.

Remove the set screw securing the cable from the starter switch to the starter motor at the commutator end.

Unscrew the three set bolts securing the starter motor to the flywheel housing and withdraw tht starter.

Replacement is carried out in the reverse manner to that detailed for removal.

Servicing the Starter.

Examination of the Commutator and Brush Gear.

Remove the starter cover band and examine the brushes and the commutator. Hold back each of the brush springs and move the brush by pulling gently on its flexible connector. If the movement is sluggish, remove the brush from its holder and ease the sides by lightly polishing on a smooth file. Always replace brushes in their original positions. If the brushes are worn so that they no longer bear on the commutator or if the brush flexible has become exposed on the running face they must be replaced.

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

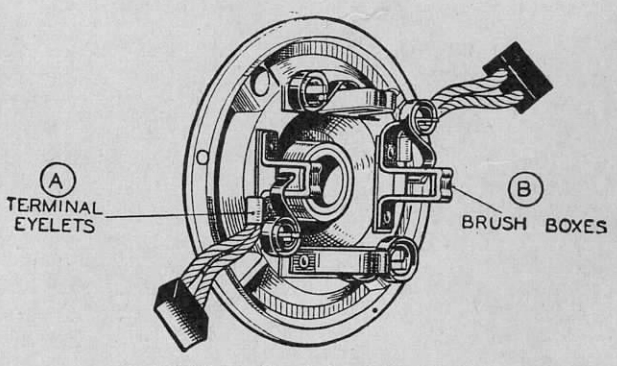

FIG. 42.—The starter end cover.

Dismantling.

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

Withdraw the two through bolts and remove the armature complete with driving end bracket.

Remove the terminal nuts and washers from the terminal post at the commutator end bracket and remove the commutator end bracket.

Brushes.

(a) Test the brush springs with a spring scale. The correct tension is 30 to 40 ozs. Fit a new spring if the tension is low.
(b) If the brushes are worn so that they no longer bear on the commutator, or if the flexible connector has become exposed on the running face, they must be replaced. Two of the brushes are connected to terminal eyelets attached to the brush boxes on the commutator end bracket, and two are connected to a tapping on the field coils.

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

Drive.

(a) If the pinion is tight on the screwed sleeve, wash away any dirt with paraffin.
(b) If any parts are worn or damaged they must be replaced.
(c) Remove the split pin from the shaft nut at the end of the starter drive. Hold the squared end of the starter shaft at the commutator end by means of a spanner and unscrew the shaft nut.
(b) Lift off the main spring and remove the retaining ring.

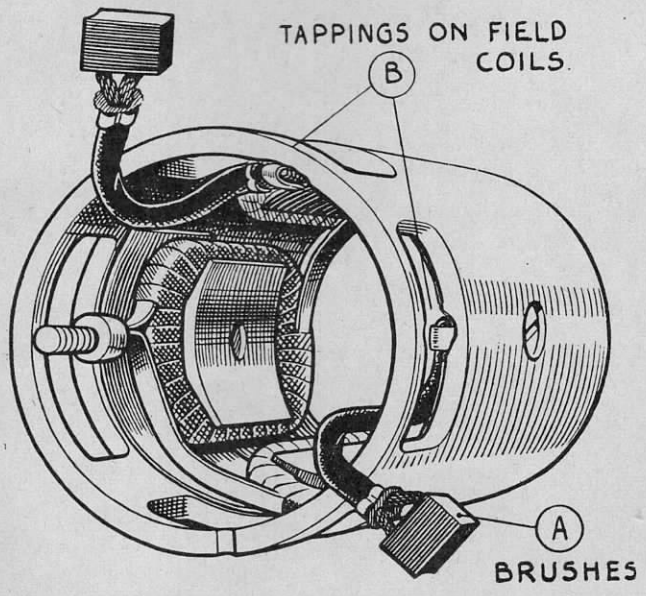

FIG. 43.—The brush connections for the starter.

(e) The control nut, sleeve and restraining spring will now slide off.
(f) Withdraw the splined washer from the armature shaft and remove the pinion and barrel assembly.

Commutator.

A commutator in good condition will be smooth and free from pits and burned spots. Clean the commutator with a petrol-moistened cloth. If this is ineffective, carefully polish with a strip of fine glass-paper, while rotating the armature. To remedy a badly worn commutator, dismantle the starter drive as previously described and remove the armature from the end bracket. Now mount the armature in a lathe, rotate it at high speed and take a light cut with a very sharp tool. Do not remove any more metal than is absolutely necessary, and finally polish with very fine glass-paper.

The insulators between the commutator segments must not be undercut.

Field Coils.

The field coils can be tested for an open circuit by connecting a 12-volt battery, with a 12-volt bulb in one of the leads, to the tapping point of the field coils to which the brushes are connected, and the field terminal post. 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 yoke. This may be checked by removing the lead from the brush connector and holding it on a clean part of the starter yoke. Should the bulb now light it indicates that the field coils are earthed.

Should the above tests indicate that the fault lies in the field coils, they must be replaced. When replacing field coils carry out the procedure detailed for the dynamo.

Armature.

Examination of the armature will in many cases reveal the cause of failure, e.g., conductors lifted from the commutator due to the starter being engaged while the engine is running and causing the armature to be rotated at an excessive speed. A damaged armature must in all cases be replaced—no attempt should be made to machine the armature core or to true a distorted armature shaft.

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 bush, proceed as follows:—

(a) Remove the old bearing bush by pressing it out of the end bearing, using a suitable shouldered mandrel in the press. Take care that the mandrel does not contact the bearing face and damage it during removal.

(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: The bearing bushes are of the porous phosphor-bronze type and before fitting them they should be allowed to stand completely immersed for twenty-four hours in thin engine oil in order to fill the pores of the bush with lubricant.

Reassembly.

The reassembly of the starter is a reversal of the operations described above.

NOTE: Secure the body of the starter in a vice and test by connecting it with heavy gauge cables to a battery of the correct voltage. One cable must be connected to the starter terminal and the other held against the starter body or end bracket. Under these light load conditions the starter should run at a very high speed.

THE CONTROL BOX.

Regulator Adjustment.

The regulator is carefully set before leaving the Works to suit the normal requirements of the standard equipment, and in general it should not be necessary to alter it. If, however, the battery does not keep in a charged condition, or if the dynamo output does not fall when the battery is fully charged, it may be advisable to check the setting and if necessary to re-adjust it.

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

How to Check and Adjust Electrical Setting.

The regulator setting can be checked without removing the cover on the control box.

Withdraw the cables from the terminals marked "A" and "A.1" at the control box and join them together. Connect the negative lead of a moving coil voltmeter (0-20 volts full scale reading) to the "D" terminal on the dynamo and connect the other lead from the meter to a convenient chassis earth.

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 for the appropriate temperature of the regulator.

Setting at 10°C. (50°F.)	16.1 to 16.7 volts
Setting at 20°C. (68°F.)	15.8 to 16.4 volts
Setting at 30C. (86°F.)	15.6 to 16.2 volts
Setting at 40°C. (104°F.)	15.3 to 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" (Fig. 45) holding the adjusting screw "B". The screw turns in a clockwise direction to raise the setting or in an anti-clockwise direction to lower the setting. Turn the adjusting screw a fraction of a turn in the required direction and then tighten the locknut.

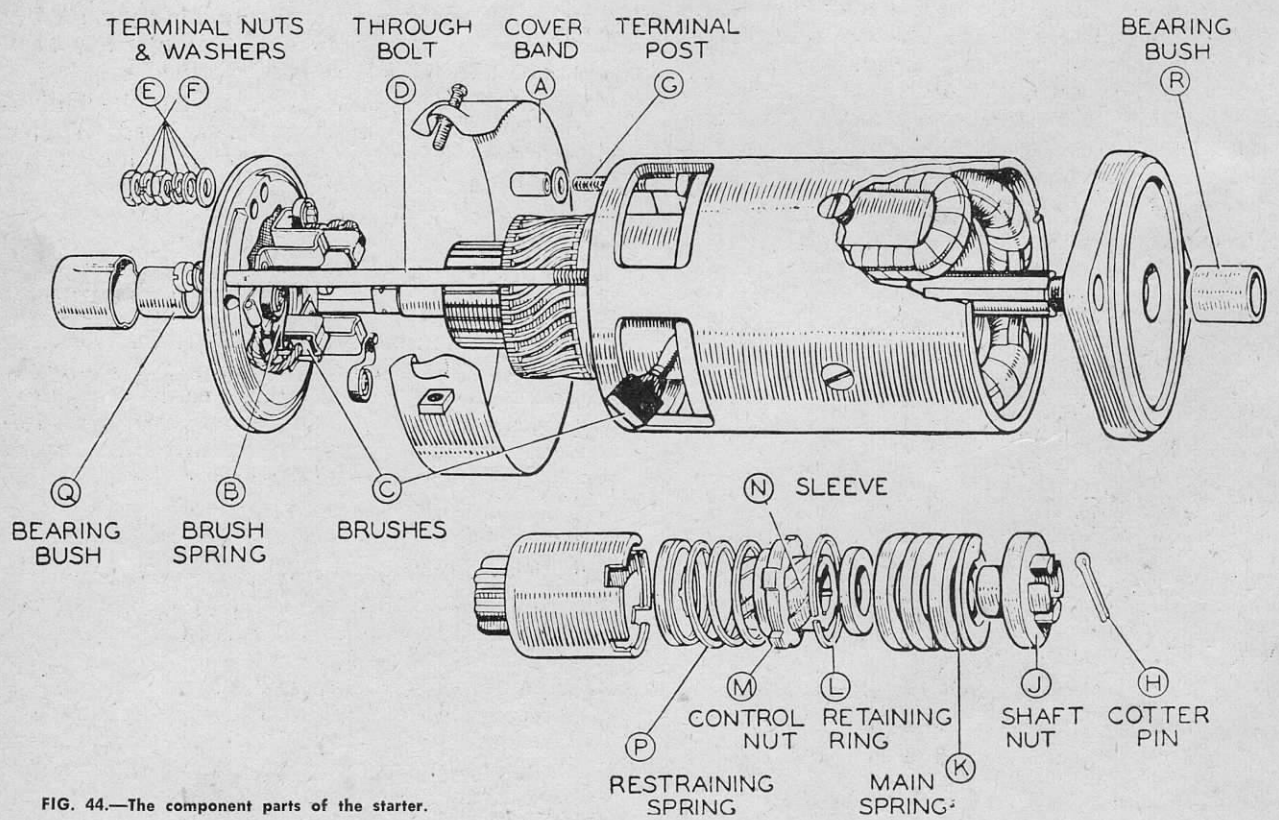

FIG. 44.—The component parts of the starter.

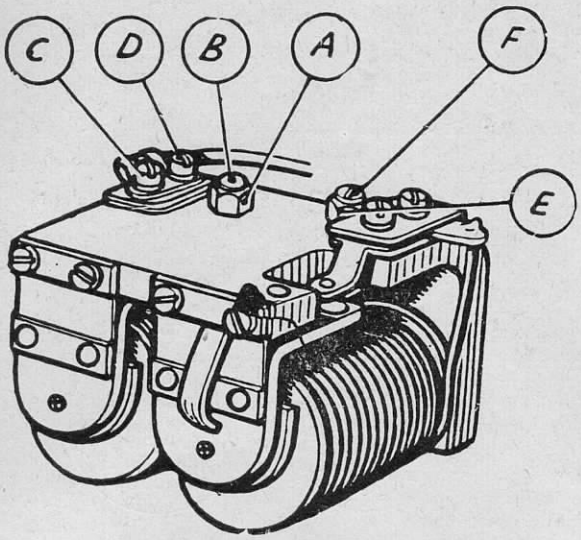

FIG. 45.—The cut-out and regulator assembly.

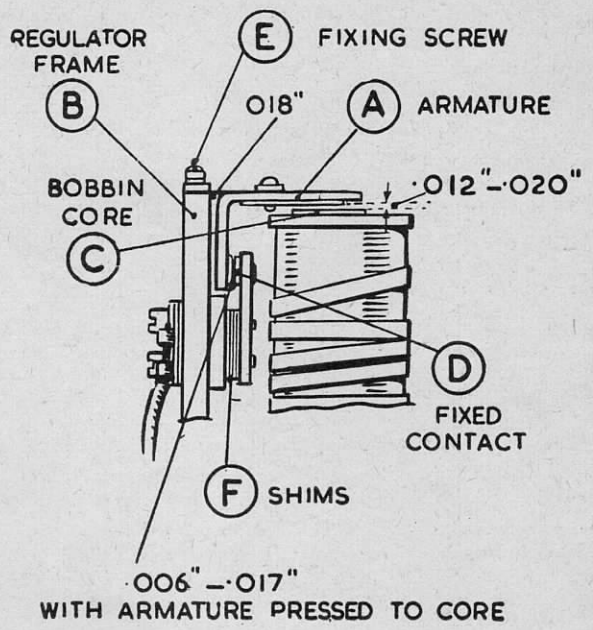

FIG. 46.—The mechanical adjustment for the regulator.

When the dynamo is run at a high speed on open circuit it builds up a high voltage. When adjusting the regulator do not run the engine up to more than half throttle or a false voltmeter reading will be obtained.

Mechanical Setting.

The mechanical setting of the regulator is accurately adjusted before leaving the Works, and provided that 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:—

(i) Slacken the two armature fixing screws "E" (Fig. 46). Insert a .018 feeler gauge between the back of the armature "A" and the regulator frame.

(ii) Press back the armature against the regulator frame and down on to the top of the bobbin core with the gauge in position, and lock the armature by tightening the two fixing screws.

(iii) Check the gap between the underside of the arm and the top of the bobbin core. This must be .012 to .020. If the gap is outside these limits correct by adding or removing shims "F" at the back of the fixed contact "D".

(iv) Remove the gauge and press the armature down, when the gap between the contacts should be between .006 and .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" (Fig. 45) 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 between 12.7 volts and 13.3 volts the cut-out contact 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" (Fig. 45), 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 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.

Radio Suppression.

When it is desired to fit suppressors for radio equipment make sure that this is done only in accordance with recommended practice. Suppressors and capacitors wrongly fitted may cause damage to the electrical equipment.

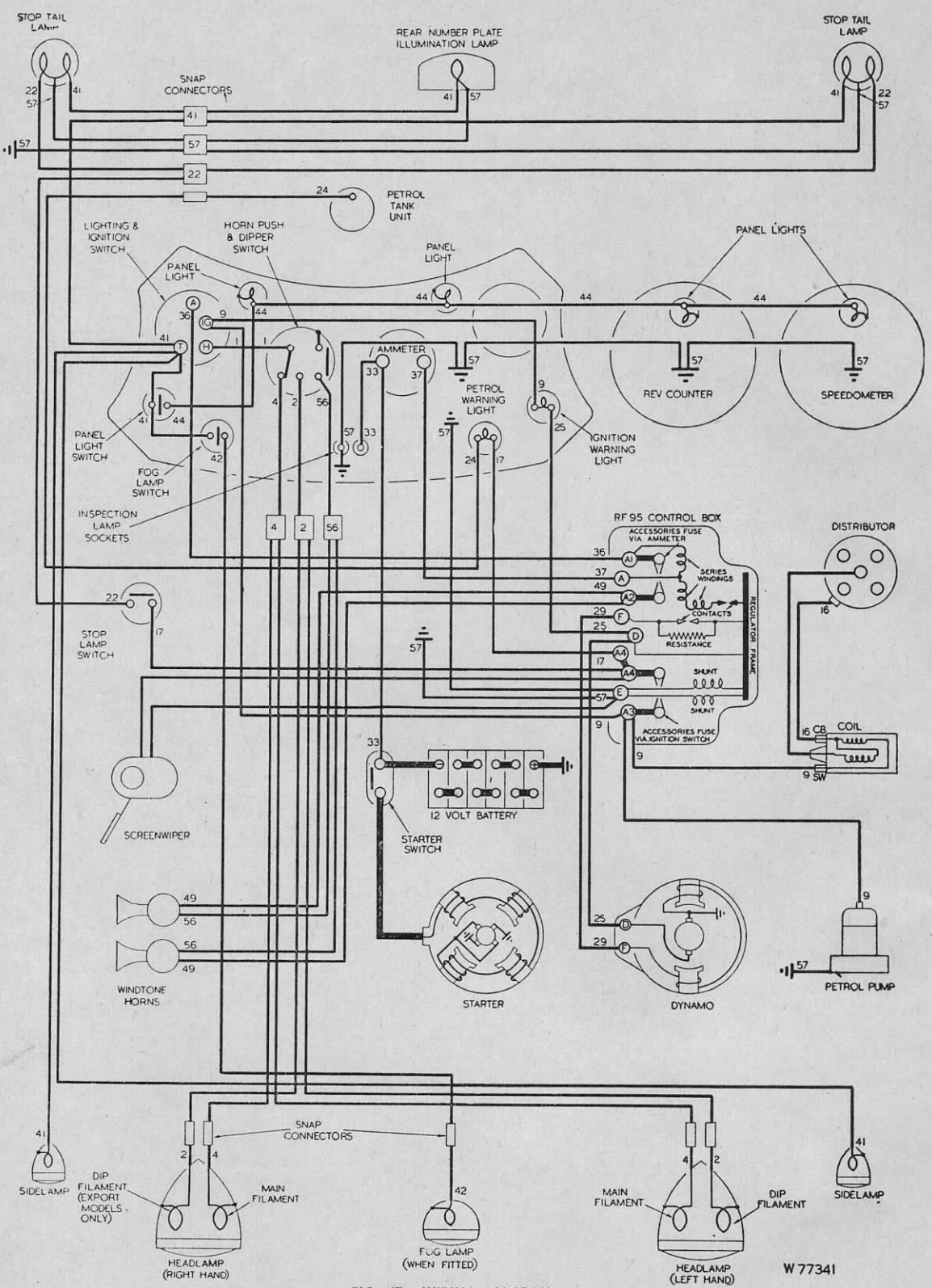

FIG. 47.—WIRING DIAGRAM.

KEY TO CABLE COLOURS:

1—Blue.
2—Blue with red.
3—Blue with yellow.
4—Blue with white.
5—Blue with green.
6—Blue with purple.
7—Blue with brown.
8—Blue with black.
9—White.
10—White with red.
11—White with yellow.
12—White with blue.
13—White with green.
14—White with purple.
15—White with brown.
16—White with black.
17—Green.
18—Green with red.
19—Green with yellow.
20—Green with blue.
21—Green with white.
22—Green with purple.
23—Green with brown.
24—Green with black.
25—Yellow.
26—Yellow with red.
27—Yellow with blue.
28—Yellow with white.
29—Yellow with green.
30—Yellow with purple.
31—Yellow with brown.
32—Yellow with black.
33—Brown.
34—Brown with red.
35—Brown with yellow.
36—Brown with blue.
37—Brown with white.
38—Brown with green.
39—Brown with purple.
40—Brown with black.
41—Red.
42—Red with yellow.
43—Red with blue.
44—Red with white.
45—Red with green.
46—Red with purple.
47—Red with brown.
48—Red with black.
49—Purple.
50—Purple with red.
51—Purple with yellow.
52—Purple with blue.
53—Purple with white.
54—Purple with green.
55—Pulple with brown.
56—Purple with black.
57—Black.
58—Black with red.
59—Black with yellow.
60—Black wiht blue.
61—Black with white.
62—Black with green.
63—Black with purple.
64—Black with brown.