

## SECTION N

### ELECTRICAL EQUIPMENT

(1½ and 2½ LITRE)

#### General Description.

- |                            |  |
|----------------------------|--|
| Section No. N.1            | The battery.                               |
| Section No. N.2            | The dynamo.                                |
| Section No. N.3            | Removal and replacement of the dynamo.     |
| Section No. N.4            | Dismantling the dynamo.                    |
| Section No. N.5            | Servicing the dynamo.                      |
| Section No. N.6            | The starter.                               |
| Section No. N.7            | Removal and replacement of the starter.    |
| Section No. N.8            | Servicing the starter.                     |
| Section No. N.9            | The control box.                           |
| Section No. N.10           | The windscreen wiper.                      |
| Section No. N.11           | The Trafficators.                          |
| Section No. N.12           | The electric horn.                         |
| Section No. N.13           | The fuses.                                 |
| Section No. N.14           | Replacement bulbs.                         |
| Sections Nos. N.15 to N.26 | The lamps.                                 |
| Section No. N.27           | Location and remedy of faults.             |
| Section No. N.28           | Correct acid level device on later models. |

#### Wiring Diagrams.

#### GENERAL DESCRIPTION

The 12-volt electrical equipment fitted incorporates compensated voltage control for the charging circuit. The positive earth system of wiring is employed.

The battery is mounted on the dash under the bonnet and is readily accessible for examination and maintenance.

The dynamo is mounted on the right of the cylinder block on the 2½ litre engine and on the left of the cylinder block on the 1½ litre engine. The dynamo in each case is driven by an endless belt from the engine crankshaft. A pivot mounting and adjustable link enable the belt tension to be adjusted.

The control box should not normally need attention.

The fuses are carried in external holders, as are the spare fuses, so that there is no need to remove the control box cover to gain access to them.

The starter motor is mounted on the flywheel housing on the left-hand side of the engine unit and operates on the flywheel through the usual sliding pinion device.

The headlamps employ the double-filament dipping system. On early Home models the near-side lamp beam is dipped and the off-side lamp extinguished on operation of the dipping switch. On Export models and later Home models both lamps are fitted with double-filament bulbs, both dipping either to the right or to the left according to the regulations existing in the country concerned.

## Section N.1

### THE BATTERY

MODEL GTW.11A (2½ LITRE)

MODEL GTW.9A (1½ LITRE)

#### ROUTINE MAINTENANCE

In order to keep the battery in good condition a periodical inspection should be made and the following carried out :—

##### (i) Topping up

About once a month (more often in warmer climates) remove the vent plugs from the top of each of the cells and examine the level of the electrolyte. If necessary, add distilled water to the level of the top of the separators. Do not fill above this level, otherwise the excess electrolyte will be thrown out from the cell. An hydrometer will be found useful for topping up, as it prevents the distilled water from being spilled on the top of the battery. Later cars have batteries fitted with a "correct level" device. (See Section N.28).

**Note.**—In very cold weather it is essential that the car be used immediately after topping up the battery to ensure that the distilled water is thoroughly mixed with the electrolyte. Neglect of this precaution may result in the distilled water freezing, with consequent damage to the battery.

When examining the cells, do not hold naked lights near the vent holes, as there is a danger of igniting the gas coming from the plates.

##### (ii) Testing the condition of the battery

Occasionally examine the condition of the battery by taking hydrometer readings. There is no better way of ascertaining the state of charge of the battery. The hydrometer contains a graduated float on which is indicated the specific gravity of the acid in the cell from which the sample is taken.

The specific gravity readings and their indications are as follows :—

- 1.280—1.300 Battery fully charged.
- About 1.210 Battery about half-discharged.
- Below 1.150 Battery fully discharged.

These figures are given assuming an electrolyte temperature of 60° F. (16° C.). If the temperature of the electrolyte exceeds this, .002 must be added to hydrometer readings for each 5° F. (2.8° C.) rise to give the true specific gravity. Similarly .002 must be subtracted from hydrometer readings for every 5° F. (2.8° C.) below 60° F. (16° C.).

The readings for each of the cells should be approximately the same. If one cell gives a reading very different from the rest it may be that the electrolyte has been spilled or has leaked from one of the

cells or there may be an internal fault. In this case it is advisable to have the battery examined by a battery specialist. Should the battery be in a low state of charge, it should be recharged by taking the car for a long daytime run or by charging from an external source of D.C. supply at a current rate of 5 amperes in the case of the GTW.9A battery of the 1½ litre model or 7 amperes in the case of the GTW.11A battery of the 2½ litre model.

After examining the battery, check the vent plugs, making sure that the air passages are clear, and screw the plugs into position. Wipe the top of the battery to remove all dirt and moisture.

#### STORAGE

If a battery is to be out of use for any length of time it should first be fully charged and then given a freshening charge about every fortnight.

A battery must never be allowed to remain in a discharged condition, as this will cause the plates to become sulphated.

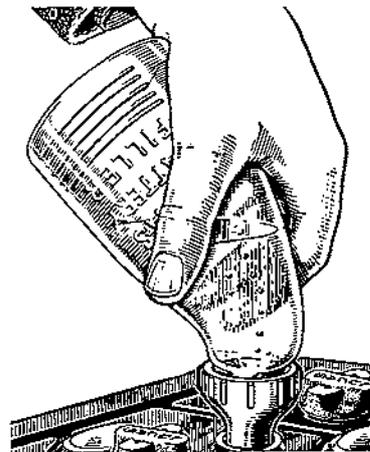


Fig. N.1.

Topping up the battery cells with a Lucas battery filler.

#### INITIAL FILLING AND CHARGING

Usually, the battery will have been filled and initially charged. If, however, it should be found necessary to prepare a new battery, supplied dry, proceed as follows :—

##### (a) Preparation of electrolyte

The specific gravity of the electrolyte necessary to fill the new battery, and the specific gravity at the end of the charge, are as follows :—

Climate	S.G. of filling acid (corrected to 60° F. or 16° C.)	S.G. at end of charge
Ordinarily below 80° F. (27° C.) ... ..	... 1.350	1.280—1.300
Between 80°—100° F. ...	... 1.320	1.250—1.270
Over 100° F. (38° C.) ...	... 1.300	1.220—1.240

The electrolyte is prepared by mixing distilled water and concentrated sulphuric acid 1.835 S.G. The mixing must be carried out in a lead-lined tank or a suitable glass or earthenware vessel. Steel or iron containers must **not** be used. The acid must be added slowly to the water, while the mixture is stirred with a glass rod. **Never add the water to the acid**, as the severity of the resulting chemical reaction may have dangerous consequences.

To produce electrolyte of the correct specific gravity, use the following proportions of acid and distilled water :—

To obtain specific gravity (corrected to 60° F. or 16° C.)	Add 1 part by volume of 1.835 S.G. acid to distilled water by volume as below
1.350	1.8 parts
1.320	2.2 „
1.300	2.5 „

Heat is produced by the mixture of acid and water, and it should, therefore, be allowed to cool before pouring it into the battery, otherwise the plates, separators and moulded container may become damaged.

#### (b) Filling in and soaking

The temperature of the filling-in acid, battery and charging room should be above 32° F. (0° C.).

Carefully break the seals in the filling holes and half fill each cell in the battery with dilute sulphuric acid solution of the appropriate specific gravity (according to temperature), see table in (a) above. The quantity of electrolyte required to half fill a two-volt cell is ½ pint (.28 litre).

The mixing of the electrolyte with the water contained in the separators, and the chemical action of the dilute acid upon the plates, especially the negative groups, results in the generation of heat. The battery should, therefore, be allowed to stand for at least six hours before further electrolyte is added, thereby allowing the heat generated by the first filling to be mainly dissipated and avoiding an excessive temperature rise which might cause damage to plates and container.

After a lapse of this period add enough dilute acid to fill each cell to the top edge of the separators and allow to stand for a further two hours before commencing the charge.

#### (c) Duration and rate of initial charge

Charge at a constant current of 3.5 amps. in the case of GTW.9A batteries on the 1½ litre model, or 4.5 amps. in the case of the GTW.11A batteries of the 2½ litre model, until the voltage and temperature-corrected specific gravity readings show no increase

over five successive hourly readings. This period is dependent upon the length of time the battery has been stored since manufacture, and will be from forty to eighty hours, but usually not more than sixty.

Throughout the charge the acid must be kept level with the top of the separators in each cell by the addition of acid solution of the same specific gravity as the original filling-in acid.

If, during charge, the temperature of the acid in any cell of the battery reaches the maximum permissible temperature of 120° F. (49° C.), the charge must be interrupted and the battery temperature allowed to fall at least 10° F. (5.5° C.) before charging is resumed.

At the end of the first charge, i.e. when specific gravity and voltage measurements remain substantially constant, carefully check the specific gravity in each cell to ensure that it lies within the limits specified. If any cell requires adjustment the electrolyte above the plates must be siphoned off, and replaced either with acid of the strength used for the original filling in, or distilled water, according to whether the specific gravity is too low or too high respectively. After such adjustment the gassing charge should be continued for one or two hours to ensure adequate mixing of the electrolyte. Re-check, if necessary, repeating the procedure until the desired result is obtained.

## Section N.2

### THE DYNAMO

#### Type

The dynamo is a Lucas Model C45PV.14, Service No. 255218, on the 2½ litre and Lucas Model C39PV, Service No. 22250F, on the 1½ litre. These identification marks are stamped on the yoke. When ordering replacements always quote these numbers.

#### To test on vehicle

- (a) Make sure that belt slip is not occurring. The belt should be capable of being deflected approximately ½ in. (13 mm.) at the centre of its longest run between two pulleys with moderate hand pressure. If the belt is too slack, tightening is effected by slackening the two bolts or bolt upon which the dynamo pivots, the bolt securing the slotted adjustment link to the engine and the Simmonds nut holding the dynamo to this link. Gently pull the dynamo outwards by hand until the correct tension is obtained. The slotted link bolt must then be tightened, followed by the other bolts.

- (b) 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 the control box terminal "F."
- (c) After switching off all lights and accessories, disconnect the cables from the terminals of the 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 renewed, if a spare is obtainable.

If the dynamo is in good order, remove the temporary link from 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. No reading on the voltmeter indicates a break in the cable to the dynamo. If the reading is correct test the control box (see Section N.9).

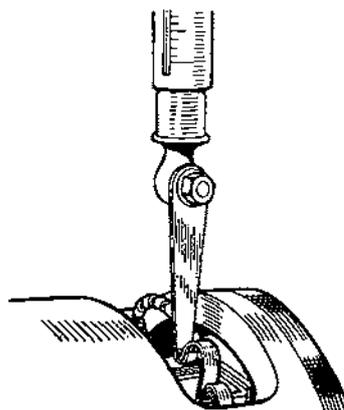


Fig. N.2.

Testing the tension of the brush springs with a spring balance.

## Section N.3

### REMOVAL AND REPLACEMENT OF THE DYNAMO

To remove the dynamo, slacken its attachment bolts and swing it towards the engine to give maximum belt slackness. Carefully free the belt from the dynamo pulley.

Disconnect the dynamo leads from the terminals.

Remove all bolts holding the machine to the engine and lift the dynamo away.

Replacement of the dynamo is an exact reversal of this procedure.

## Section N.4

### DISMANTLING THE DYNAMO

Take off the dynamo pulley.

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

With model C39PV dynamos unscrew the locking nuts from the through bolts at the commutator end and withdraw the two through bolts from the driving end.

With model C45PV dynamos unscrew and withdraw the two through bolts from the driving end bracket.

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

**Note.**—Take care not to lose the spring and cup from the end of the armature shaft.

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.

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  $\frac{3}{32}$  in. (.8 mm.) with a hacksaw blade ground down to the thickness of the insulator.

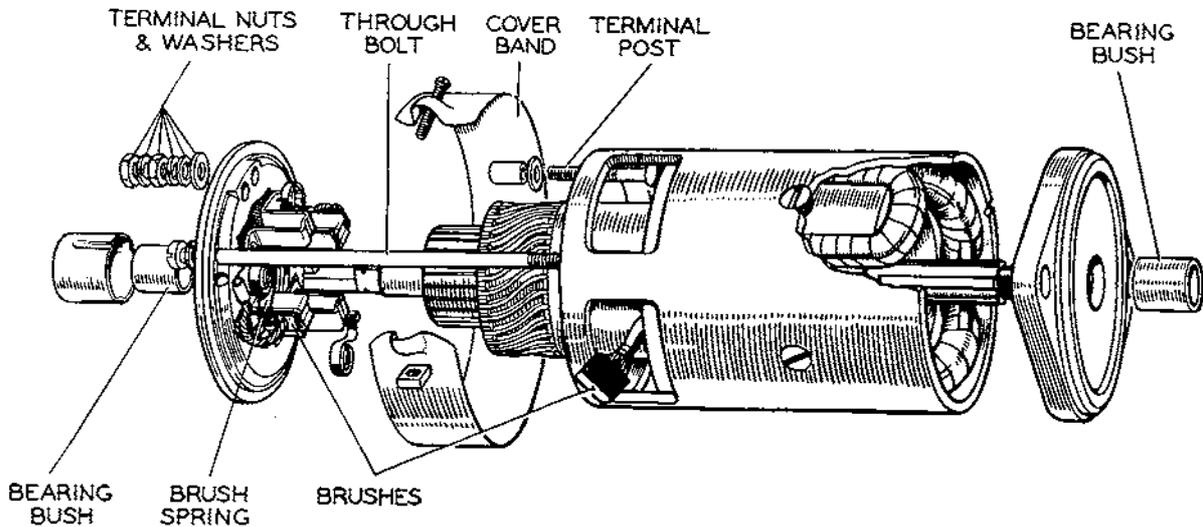


Fig. N.3.  
Dynamo components.

## Section N.5

### 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 spring tension with a spring scale if available. The correct tension is 22 to 25 oz. (624 to 710 gm.) for model C39PV and 36 to 44 oz. (1020 to 1247 gm.) for model C45PV. 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,

#### 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 renewed. 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 supply mains, test across the field terminal and earth. If the lamp lights the field coils are earthed and must be renewed.

When renewing 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 refitted 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.

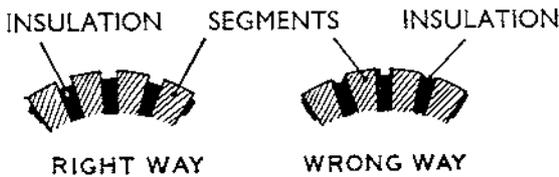


Fig. N.4.

The correct method of undercutting the commutator segments.

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

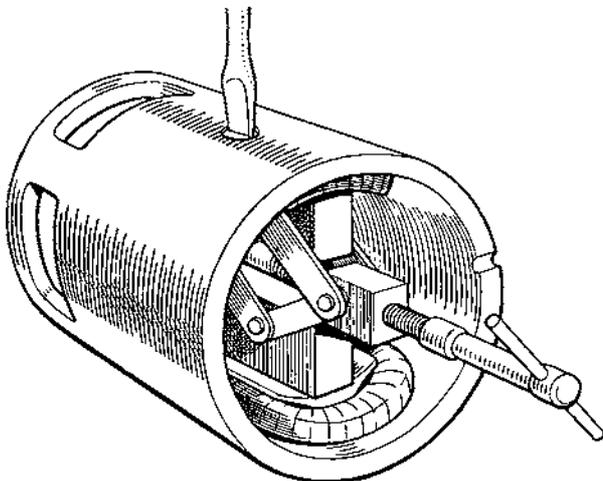


Fig. N.5.

To fit the pole shoes correctly an expander of the type illustrated is required.

### Bearings

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

To replace the bearing 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.

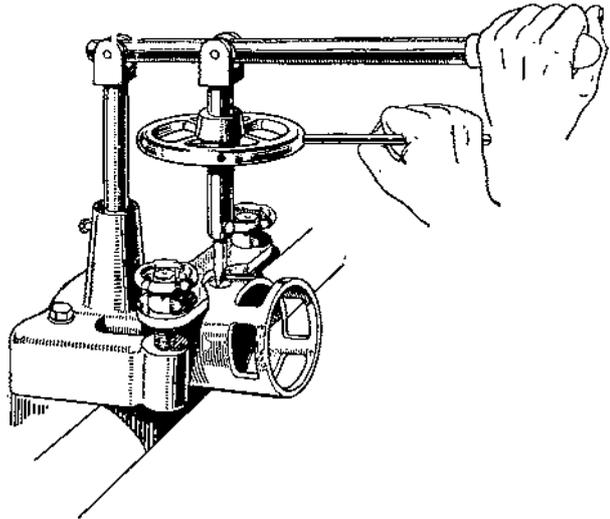


Fig. N.6.

The use of a wheel-operated screwdriver is necessary to remove and replace the pole shoe attachment screws.

The ball bearing at the driving end is renewed 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 in Section N.4.

Before refitting the dynamo to the vehicle, unscrew the lubricator from the commutator end bracket, lift out the felt wick and spring and half-fill the cap with high-melting-point grease (see Ref. D, page P.2). Replace spring and wick and screw the lubricator in position in the end bracket.

## Section N.6

### THE STARTER

#### Type

The starter on 1½ litre models is a Lucas Model M418G, Service No. 25521B, and on the 2½ litre it is a Lucas Model M45G, Service No. 26043A. These identification marks are stamped on the yoke.

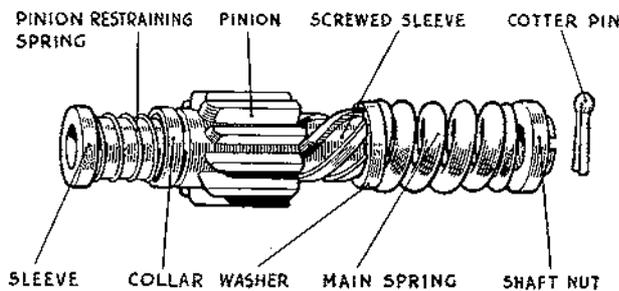


Fig. N.7.

The starter pinion assembly.

When ordering replacements always quote these numbers. Starters bearing different type numbers have been fitted to earlier models and it is therefore necessary to check the type number stamped on the starter fitted to the car concerned.

#### 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 windings, but that the pinion is meshed permanently with the geared ring on the flywheel. In this case the starter must be removed from the engine for examination.

Should the lamps retain their full brilliance when the 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, and the instrument must be removed from the engine for examination.

Sluggish or slow action 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 drive is indicated if the starter is heard to operate but does not crank the engine.

## Section N.7

### REMOVAL AND REPLACEMENT OF THE STARTER

To remove the starter, release the cable from the starter terminal and unscrew the three bolts attaching the flange to the flywheel housing. The unit can then be withdrawn without difficulty.

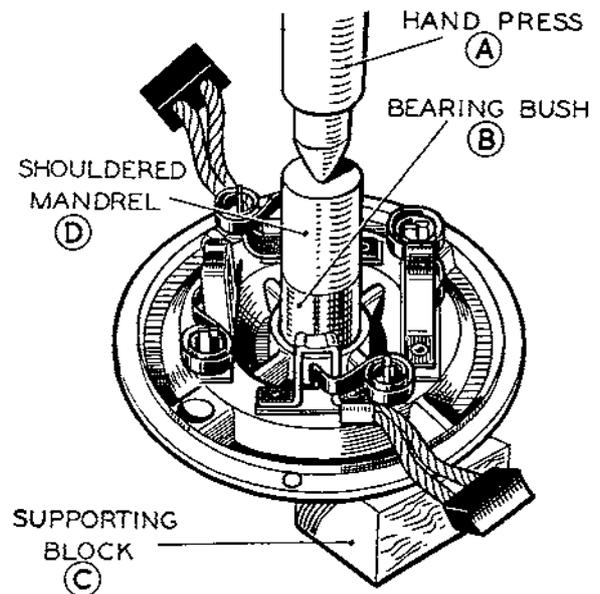


Fig. N.8.

The method of inserting a new bush in the end cover.

## Section N.8

### SERVICING THE STARTER

#### Examination of commutator and brush gear

Remove the cover band "A" (Fig. N.9) and examine the brushes "B" and the commutator "C." Hold back each of the brush springs "D" and move the brush by pulling gently on its flexible connector. If the movement is sluggish, remove the brush from its holder "E" 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 renewed.

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

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

they must be renewed. Two of the brushes are connected to terminal eyelets "A" (Fig. N.11) attached to the brush boxes "B" on the commutator end bracket, and two brushes (Fig. N.10) 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 place by soldering. The brushes are pre-formed so that bedding of their working faces 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 renewed.
- (c) Remove the cotter pin from the shaft nut at the end of the starter drive. Hold the squared starter shaft extension at the commutator end by means of a spanner and unscrew the square

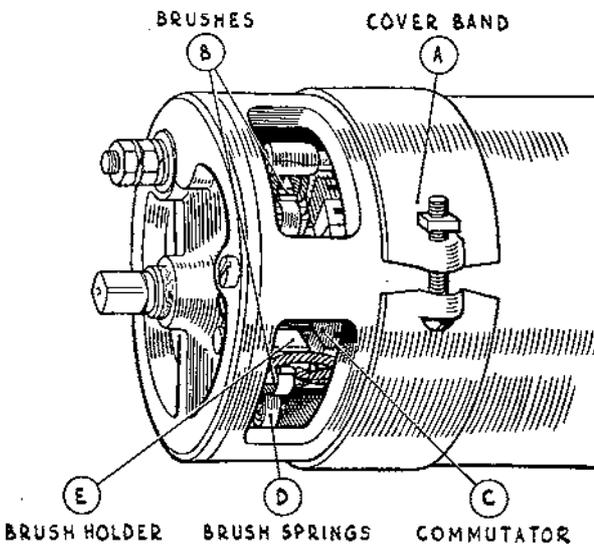


Fig. N.9.

The starter brush gear.

the starter body or end bracket. Under these light load conditions, the starter should run at a very high speed.

If the operation is still unsatisfactory, the starter should be dismantled for detailed inspection and testing.

### Dismantling

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

Withdraw the terminal nuts and washers from the terminal post.

Unscrew the two through bolts and withdraw the commutator end bracket.

Remove the driving end bracket complete with armature and drive from the starter yoke.

### Brushes

- (a) Test the brush springs with a spring scale. The correct tension is 30—40 oz. (850—1134 gm.). 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,

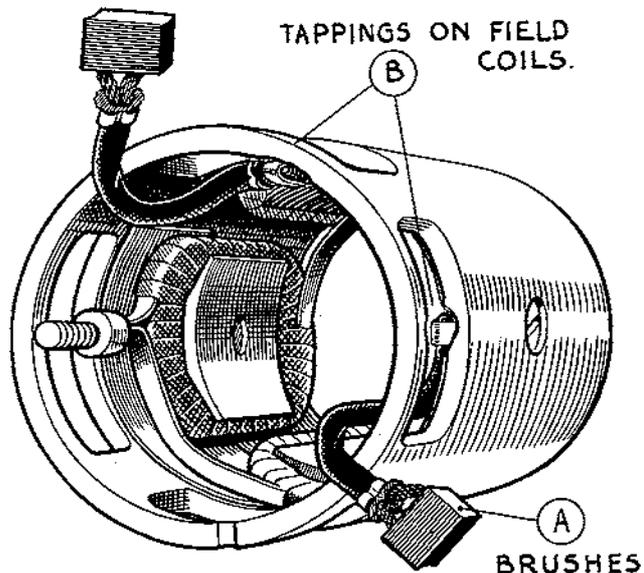


Fig. N.10.

The starter brush leads.

shaft nut. Lift off the main spring, washer, screwed sleeve with pinion, collar, pinion restraining spring and spring restraining sleeve.

### Commutator

A commutator in good condition will be smooth and free from pits and burned spots. Clean 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 described above and remove the armature from the end bracket. Now

mount the armature in a lathe, rotate it at a 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 insulation on the starter commutator **must not be undercut**.

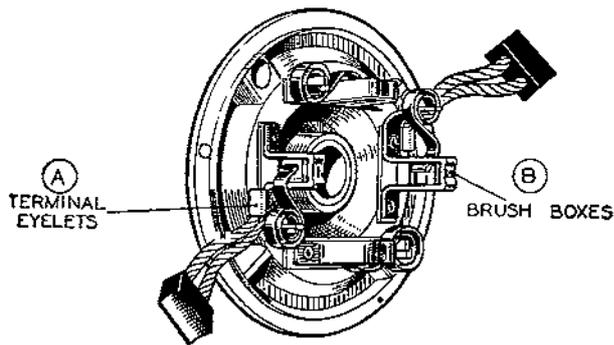


Fig. N.11.  
The starter end cover.

#### Field coils

The field coils can be tested for continuity by connecting a 12-volt battery with a 12-volt bulb in series between the tapping points of the field coils at which the brushes are connected. Failure of the lamp to light indicates 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 with a test lamp connected from the supply mains, the test lead being connected to one of the field coil tapping points and to a clean part of the yoke. Should the lamp light, it indicates that the field coils are earthed to the yoke.

Should the above tests indicate that the fault lies in the field coils, they must be renewed. When renewing field coils carry out the procedure detailed in the Dynamo Section N.5.

#### 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 renewed—no attempt should be made to machine the armature core or to true a distorted armature shaft.

#### Bearings (commutator end)

Bearings which are worn to such an extent that they will allow excessive side play of the armature shaft

must be renewed. To renew the bearing bush, proceed as follows :—

- (a) 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 bush is of the porous phosphor-bronze type and, before fitting, new bushes 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

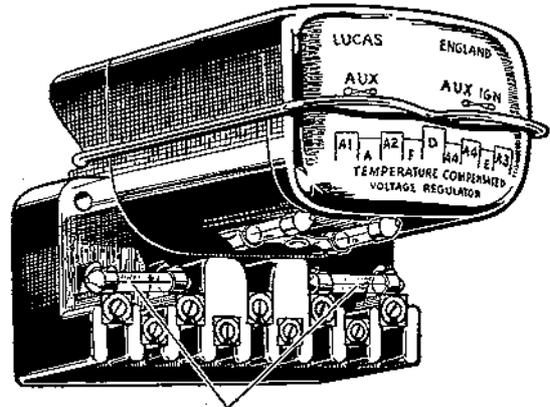
The reassembly of the starter is a reversal of the operations described in this Section.

## Section N.9

### 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



FUSES IN CIRCUITS  
OF ACCESSORIES

Fig. N.12.

The control box on the earlier models, showing the location of the fuses. On later models they are carried in a separate fuse box (see Section N.13).

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 readjust it.

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 dynamo belt slipping.

### How to check and adjust electrical setting

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

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.

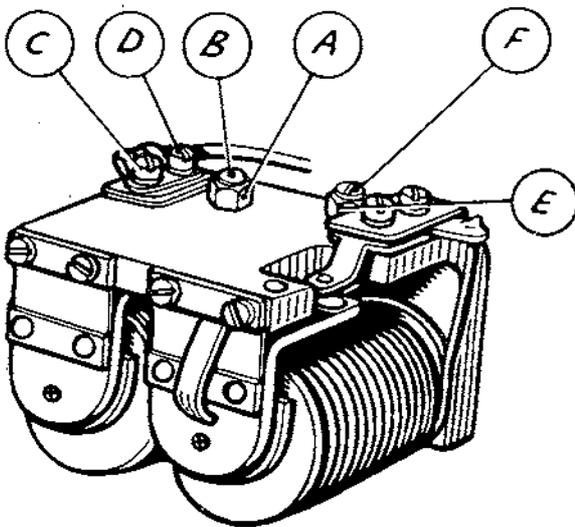


Fig. N.13.  
The cut-out and regulator assembly.

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
" " 20° C. (68° F.)	15.8—16.4 "
" " 30° C. (86° F.)	15.6—16.2 "
" " 40° C. (104° F.)	15.3—15.9 "

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

Switch off the engine, remove the control box cover, release the locknut "A" (Fig. N.13) 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 adjusting screw a fraction of a turn and then tighten the locknut.

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. N.14). Insert a .018 in. (.46 mm.) feeler gauge between the back of the armature "A" and the regulator frame.
- (ii) Press back the armature against the regulator frame and down onto the top of the bobbin core with the gauge in position and lock the armature by tightening the two fixing screws.

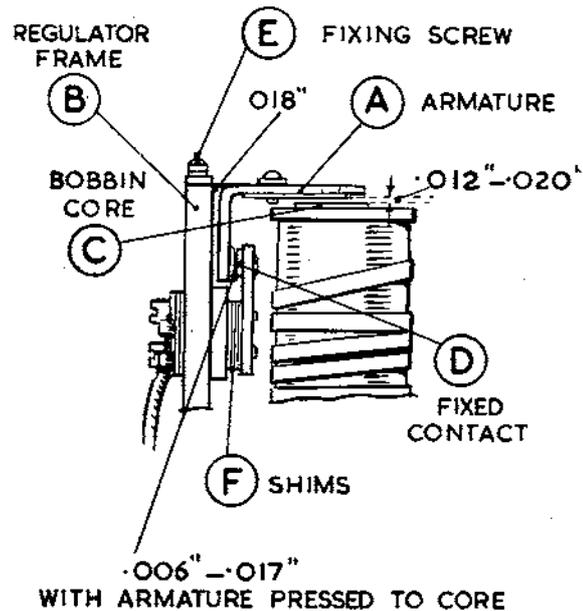


Fig. N.14.  
The mechanical adjustment for the regulator.

- (iii) Check the gap between the under side of the arm and the top of the bobbin core. This must be .012 in. to .020 in. (.30 mm. to .51 mm.). If the gap is outside these limits correct by adding or removing shims "F" (Fig. N.14) 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 in. (.15 mm.) and .017 in. (.43 mm.).

*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. N.13) 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 and 13.3 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. N.13), 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.

**Section N.10**

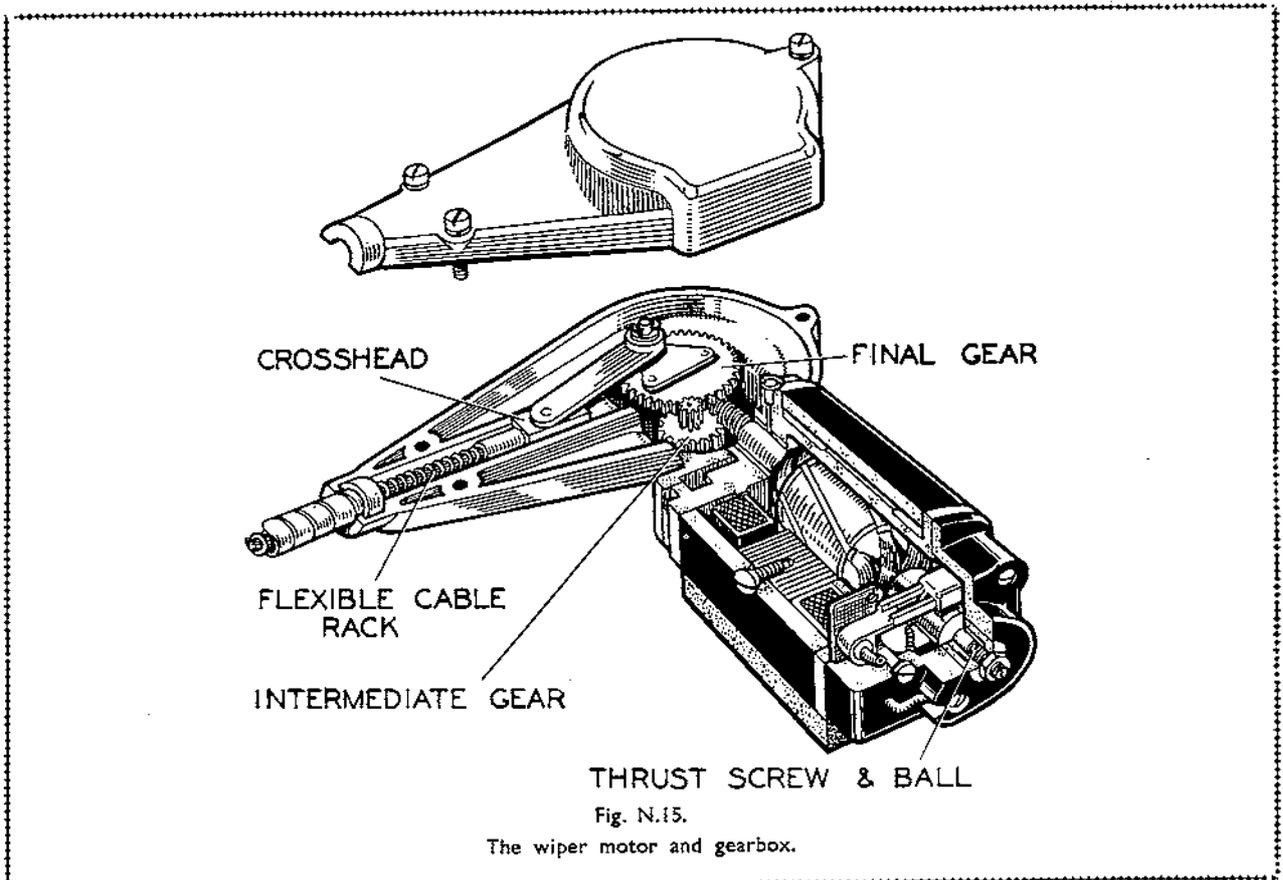
**THE WINDSCREEN WIPER**

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.

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

Remove the gearbox cover. Remove the split pin and washer from the crank pin and final gear wheel. Lift off the connecting link.



## 2. Commutator dirty

Remove 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 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 and forwards by hand and by applying a trace of thin machine oil. 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 renewed.

## 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 cross-head 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 to Ref. D (page P.2).

## Section N.II

### THE TRAFFICATORS

#### Removing the Trafficators

Unscrew the three Phillips screws holding the small crescent-shaped piece of trim in position. There are also two panel pins, one at either end. Lift off the trim.

Remove four screws (two on each clamp plate) holding the Trafficator box in position, and lift out the unit. When reassembling make quite sure that the waterproofing strip between the Trafficator box and the body side is in good order.

#### Replacement of Trafficators

Replacement of the Trafficator arm is a reversal of the procedure for removal.

#### Removing the arm

Drill out the rivet securing the arm to the bracket.

Remove the Trafficator arm cover and withdraw the cable and bulb.

Open out the clip securing the cable to the arm of the Trafficator and remove the arm.

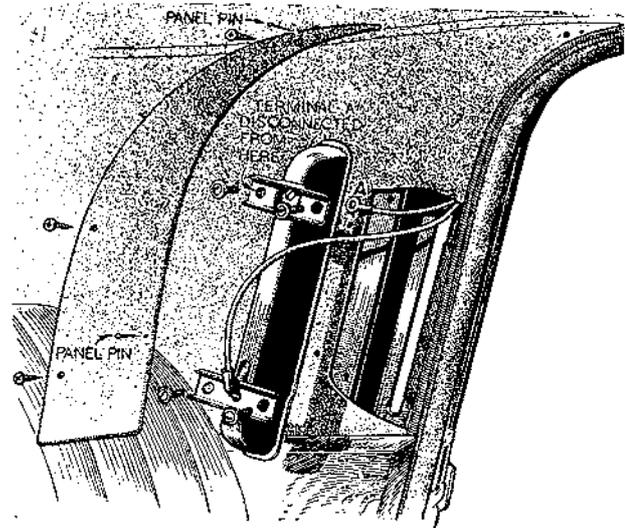


Fig. N.16.

Method of removing the Trafficator assembly. Note that the trim is held with panel pins as well as screws.

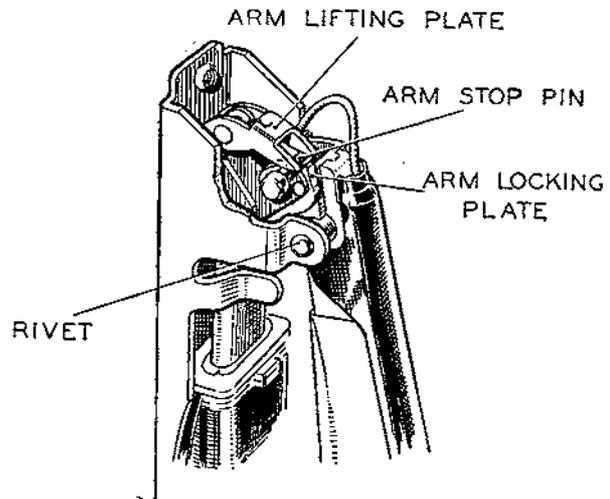


Fig. N.17.

The Trafficator arm hinge mechanism.

#### Replacement of the arm

Place the new arm in position so that the arm stop pin locates between the arm lifting plate and locking plate (Fig. N.17).

Secure it in this position by fitting a new rivet.

Remove the arm cover, replace the cable and bulb and refit the cover.

Finally secure the cable to the arm by means of the clip, taking care to see that the bending over of the clip does not damage the cable or its insulating covering. Also see that when the Trafficator is operated the cable can move in a wide arc.

### Section N.12

#### THE ELECTRIC HORN

All horns before being passed out are adjusted to give their best performance and will give a long period of service without attention.

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. Check

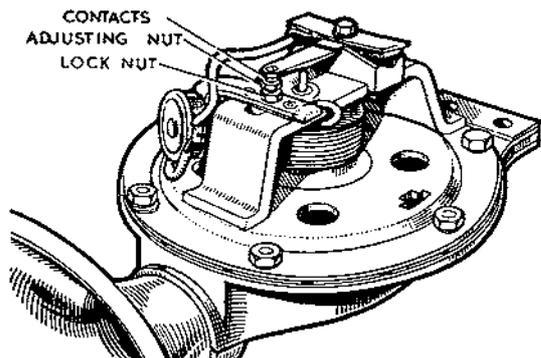


Fig. N.18.  
The horn contacts.

the attachments for tightness, and if 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 of 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.

### Section N.13

#### FUSES

The fuses are accessible without removing the cover of the control box on earlier models and are equally accessible on the separate fuse box on later models.

*Fuse marked "AUX" (early models)*

*Fuse connecting "A1" and "A2" (later models)*

This fuse protects the accessories which are connected so that they operate irrespective of whether the ignition switch is "on" or "off."

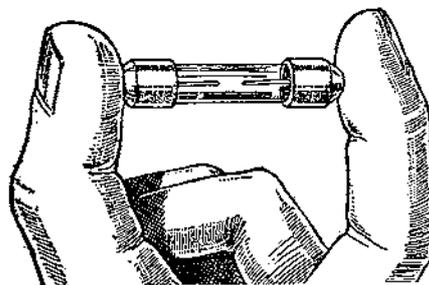


Fig. N.19.

The appearance of a burnt-out fuse.

*Fuse marked "AUX IGN" (early models)*

*Fuse connecting "A3" and "A4" (later models)*

This fuse protects the accessories which are connected so that they operate only when the ignition is switched on.

#### Units protected

The units which are protected by each fuse can readily be identified by referring to the wiring diagrams on pages N.17-N.22.

#### Blown fuses

A blown fuse is indicated by the failure of all the units protected by it, and is confirmed by examination of the fuse, which can easily be withdrawn from the spring clips in which it fits. If it has blown, the fused state of the wire will be visible inside the glass tube.

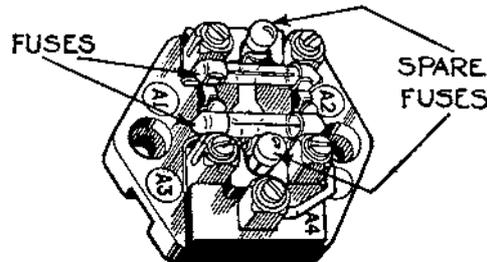


Fig. N.20.

The separate fuse box fitted to later models.

Before replacing a blown fuse, inspect the wiring of the units that have failed for evidence of a short circuit or other faults which may have caused the fuse to blow, and remedy the cause of the trouble. This is essential or the fuse is liable to blow again on replacement.

## Section N.14

### REPLACEMENT BULBS

	Lucas No.	Volts	Watts
Headlamps, Home (L/H), early models ... ..	300 (dip left)	12	36/36
Headlamps, Home (R/H), early models ... ..	162	12	36
Headlamps, Export (RHD) and later Home models ... ..	354 (dip left)	12	42/36
Headlamps, Export (LHD) ... ..	301 (dip right)	12	36/36
Headlamps, Export (Europe except France) ... ..	360	12	45/35
Sidelamps, stop- and tail-lamp and roof lamp ... ..	207	12	6
Trafficators ... ..	256	12	3
Warning and panel lights ... ..	987	12	2.2
Reverse lamp ... ..	57	12	36
Fog-lamps ... ..	162	12	36

## Section N.15

### THE HEADLAMPS

The design of the headlamp and its holder is such that the bulb is correctly positioned in relation to the reflector. No special attention to focusing is required when a replacement bulb is fitted.

In short, the lamps are of the pre-focused type, with replaceable bulbs.

#### The anti-dazzle device

Early Home models are equipped with double-filament bulbs in the left-hand headlamp, controlled by the dipping switch. Operation of the dip switch extinguishes the right-hand lamp and simultaneously deflects the left-hand headlamp beam downwards and to the left to provide good illumination of the left-hand kerb.

On Export models and later Home models both headlamps are fitted with double-filament main bulbs.

Operation of the dip switch extinguishes the main driving beam in each headlamp and brings the dipped beams into action.

Export cars have lighting equipment modified to suit the regulations existing in the countries concerned.

## Section N.16

### THE LIGHT UNITS

The light units consist of a lamp glass, reflector, and a back shell. The light unit is located to the front wing by three spring-loaded attachment screws in a domed recess. The back of the lamp is therefore sealed to give complete protection.

A dust- and weather-excluding rubber is fitted in the recess of the rim of the light unit and a plated rim is contracted onto this to complete the weather

sealing. When replacing a broken lamp glass make sure that a correct replacement is used as the formation of the prisms varies with the different lighting conditions (dip right, dip left, etc.).

## Section N.17

### REMOVING THE LIGHT UNITS

To remove the light unit for bulb replacement, unscrew the contracting screw at the bottom of the plated lamp rim and lift the rim away from the dust-excluding rubber.

Remove the dust-excluding rubber, which will reveal the three spring-loaded screws. Press the light unit inwards against the tension of the springs and turn it in an anti-clockwise direction until the heads of the screws can pass through the enlarged ends of the keyhole slots in the lamp rim.

This will enable the light unit to be withdrawn sufficiently to give attention to the wiring and bulbs.

## Section N.18

### REPLACING A HEADLAMP BULB

Withdrawal of the light unit gives immediate access to the bulb holder at the back of the reflector.

Twist the bulb holder in an anti-clockwise direction and pull it off. The bulb can now be withdrawn from its holder complete with its locating flange, which is an integral part of the bulb.

Insert the replacement bulb in the holder, making sure that the slot in the periphery of the bulb flange engages the projection in the holder.

Engage the projections on the bulb holder with the slots of the light unit, press it on and secure it by twisting it clockwise.

## **Section N.19**

### REFITTING THE LIGHT UNITS

Position the light unit so that the heads of the adjusting screws coincide with the enlarged ends of the attachment slots. Push the light unit towards the wing to compress the springs and turn the unit to the right as far as it will go, that is, approximately ½ in. (13 mm.).

Replace the dust-excluding rubber on the light rim with its flanged face forward and refit the plated rim.

## **Section N.20**

### SETTING THE HEADLAMPS

The lamps should be set so that the main driving beams are parallel with the road surface or in accordance with local regulations.

If adjustment is required, this is achieved by removing the plated rim and dust-excluding rubber as indicated in Section N.17.

Vertical adjustment can then be made by turning the screw at the top of the lamp in the necessary direction.

Horizontal adjustment can be effected by using the adjustment screws on each side of the light unit.

## **Section N.21**

### CLEANING THE LAMPS

Care must be taken when handling lamp reflectors to prevent them from becoming finger-marked. A transparent and colourless protective covering enables any finger-marks to be removed by polishing with a chamois leather or a very soft dry cloth. **Do not use metal polish on reflectors.**

Chromium-plated surfaces such as lamp rims should be washed with plenty of water, and when the dirt is completely removed they may be polished with a chamois leather or soft dry cloth. **Do not use metal polish on chromium plating.**

## **Section N.22**

### SIDELAMPS

Remove the fixing screw at the top of the lamp and withdraw the front. The bulb is then accessible in the lamp body.

## **Section N.23**

### STOP, TAIL AND REVERSE LAMPS

To gain access to the bulbs, slacken the single securing screw and swing open the lamp front.

## **Section N.24**

### THE PANEL LAMPS

Access to all the panel illuminating and warning lights is attained by removing the six Phillips screws holding the front of the panel to its brackets.

When the panel has been moved away the bulbs will be revealed.

## **Section N.25**

### THE IGNITION AND LAMP WARNING LIGHTS

There is a small amber light, situated on the instrument panel, which glows when the headlamps are in the undipped position. A red warning light glows when the ignition is switched on and the dynamo is not being driven fast enough to produce sufficient current for charging purposes.

The bulbs are identical to the instrument panel lamps and fitted in the same manner. Access to them is obtained by removing the six Phillips screws attaching the instrument panel to its brackets and withdrawing the panel.

## **Section N.26**

### THE ROOF LAMPS

The plastic covers to the roof lamps are secured by springing them into position. Each cover has four projections. Engage the lower two and then spring the remaining two into their slots. Removal is a reversal of this process.

The bulbs are of the festoon type, Lucas No. 207, 12-volt, 6-watt, and they only come into operation when the switches are moved and the sidelamps are alight.

## **Section N.27**

### LOCATION AND REMEDY OF FAULTS

Although every precaution is taken to eliminate possible causes of trouble, failure may occasionally develop through lack of attention to the equipment or damage to the wiring. The following pages set out the recommended procedure for a systematic examination to locate and remedy the causes of some of the more usual faults encountered.

The sources of trouble are by no means always obvious, and in some cases a considerable amount of deduction from the symptoms is needed before the cause is disclosed.

For instance, the engine might not respond to the starter switch ; a hasty inference would be that the starter motor is at fault. However, as the motor is dependent on the battery, it may be that the battery is exhausted.

This, in turn, may be due to the dynamo failing to charge the battery, and the final cause of the trouble may be, perhaps, a loose connection in some part of the charging circuit.

If, after carrying out an examination, the cause of the trouble is not found, the equipment should be checked by the nearest Lucas Service Depot or Agent.

## CHARGING CIRCUIT

1. *Battery in low state of charge*
  - (a) This state will be shown by lack of power when starting, poor light from the lamps, and hydrometer readings below 1.200. It may be due to the dynamo not charging or giving low or intermittent output. The ignition warning light will not go out if the dynamo fails to charge, or will flicker on and off in the event of intermittent output.
  - (b) Examine the charging and field circuit wiring, tightening any loose connections or renewing broken cables. Pay particular attention to the battery connections.
  - (c) Examine the dynamo driving belt ; take up any undue slackness by swinging the dynamo outwards on its mounting after slackening the attachment bolts.
  - (d) Check the regulator setting and adjust if necessary.
  - (e) If, after carrying out the above, the trouble is still not cured, have the equipment examined by a Lucas Service Depot or Agent.
2. *Battery overcharged*
  - (a) This will be indicated by burnt-out bulbs, very frequent need for topping up the battery, and high hydrometer readings. Check the ammeter reading when the car is running steadily with a fully charged battery and no lights or accessories in use ; the charge reading should be of the order of only 3—4 amperes.

If the ammeter reading is in excess of this value it is advisable to check the regulator setting and adjust if necessary.

## STARTER MOTOR

1. *Starter motor lacks power or fails to turn engine*
  - (a) See if the engine can be turned over by hand. If not, the cause of the stiffness in the engine must be located and remedied.
  - (b) If the engine can be turned by hand, first check that the trouble is not due to a discharged battery.
  - (c) Examine the connections to the battery, starter and starter switch, making sure that they are tight and that the cables connecting these units are not damaged.
  - (d) It is also possible that the starter pinion may have jammed in mesh with the flywheel, although this is by no means a common occurrence. To disengage the pinion, rotate the squared end of the starter shaft by means of a spanner.
2. *Starter operates but does not crank engine*

This fault will occur if the pinion of the starter drive is not allowed to move along the screwed sleeve into engagement with the flywheel, due to dirt having collected on the screwed sleeve. Remove the starter and clean the sleeve carefully with paraffin.
3. *Starter pinion will not disengage from flywheel when engine is running*

Stop the engine and see if the starter pinion is jammed in mesh with the flywheel, releasing it if necessary by rotation of the squared end of the starter shaft. If the pinion persists in sticking in mesh, have the equipment examined at a Service Depot. Serious damage may result to the starter if it is driven by the flywheel.

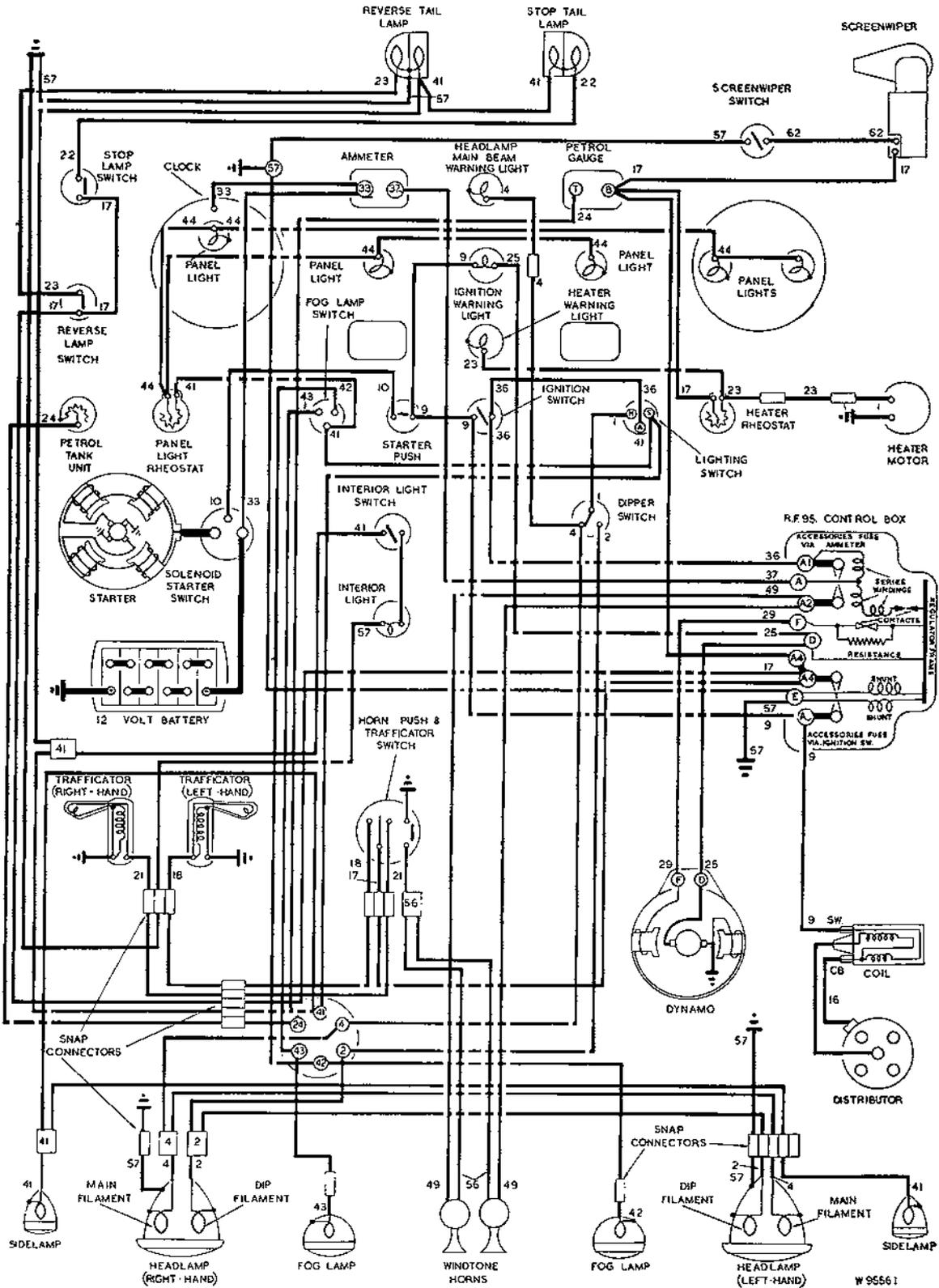
## LIGHTING CIRCUITS

1. *Lamps give insufficient illumination*
  - (a) Test the state of charge of the battery, recharging it if necessary from an independent electrical supply.
  - (b) Check the setting of the lamps.
  - (c) If the bulbs are discoloured as the result of long service, they should be renewed.
2. *Lamps light when switched on but gradually fade out*

As paragraph 1 (a).
3. *Brilliance varies with speed of car*
  - (a) As paragraph 1 (a).
  - (b) Examine the battery connections, making sure that they are tight, and renew any faulty cables.

# WIRING DIAGRAM FOR 1½ LITRE SALOON (EXPORT, L.H.D.) 1949/51

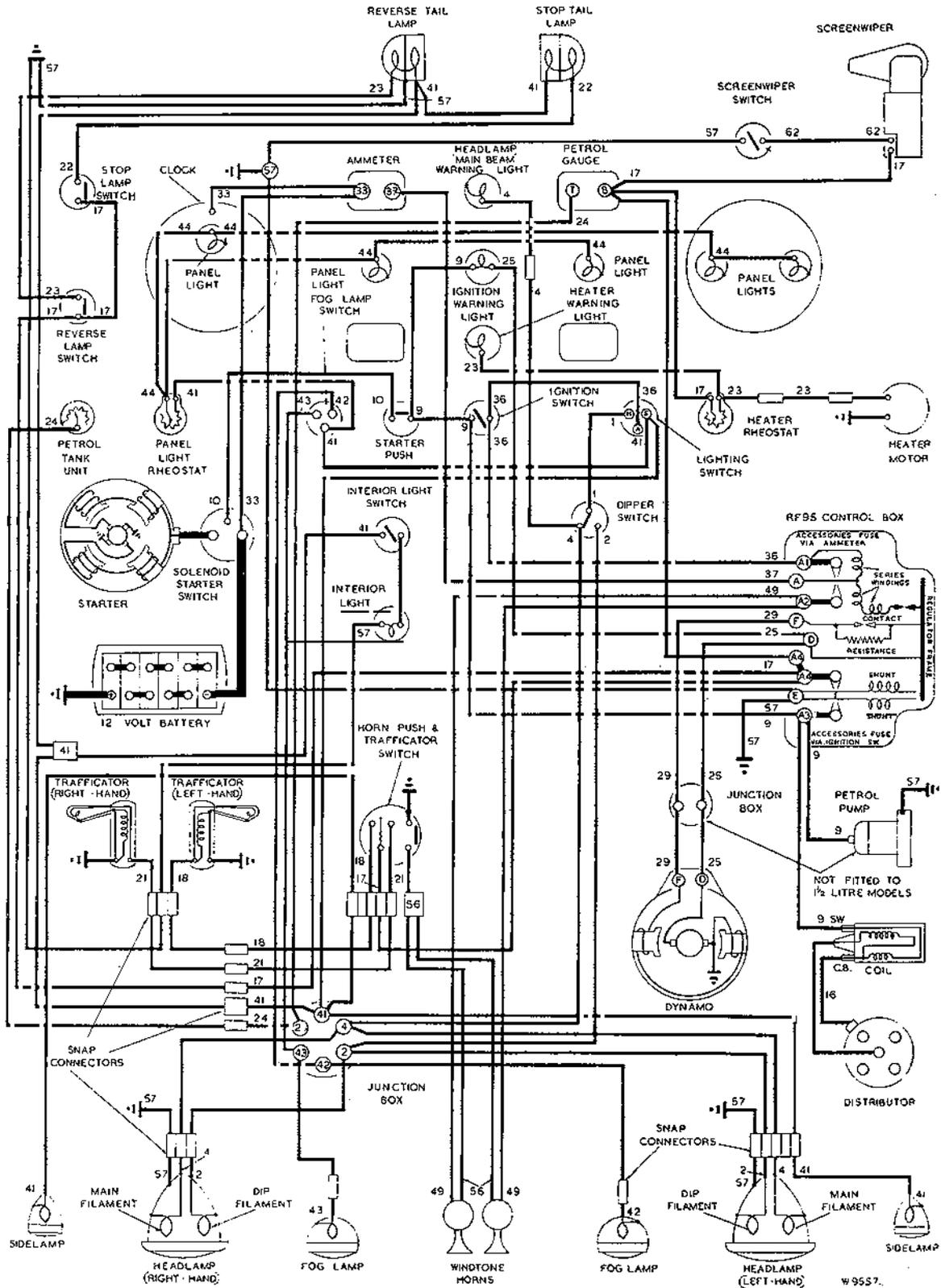
N



## KEY TO CABLE COLOURS

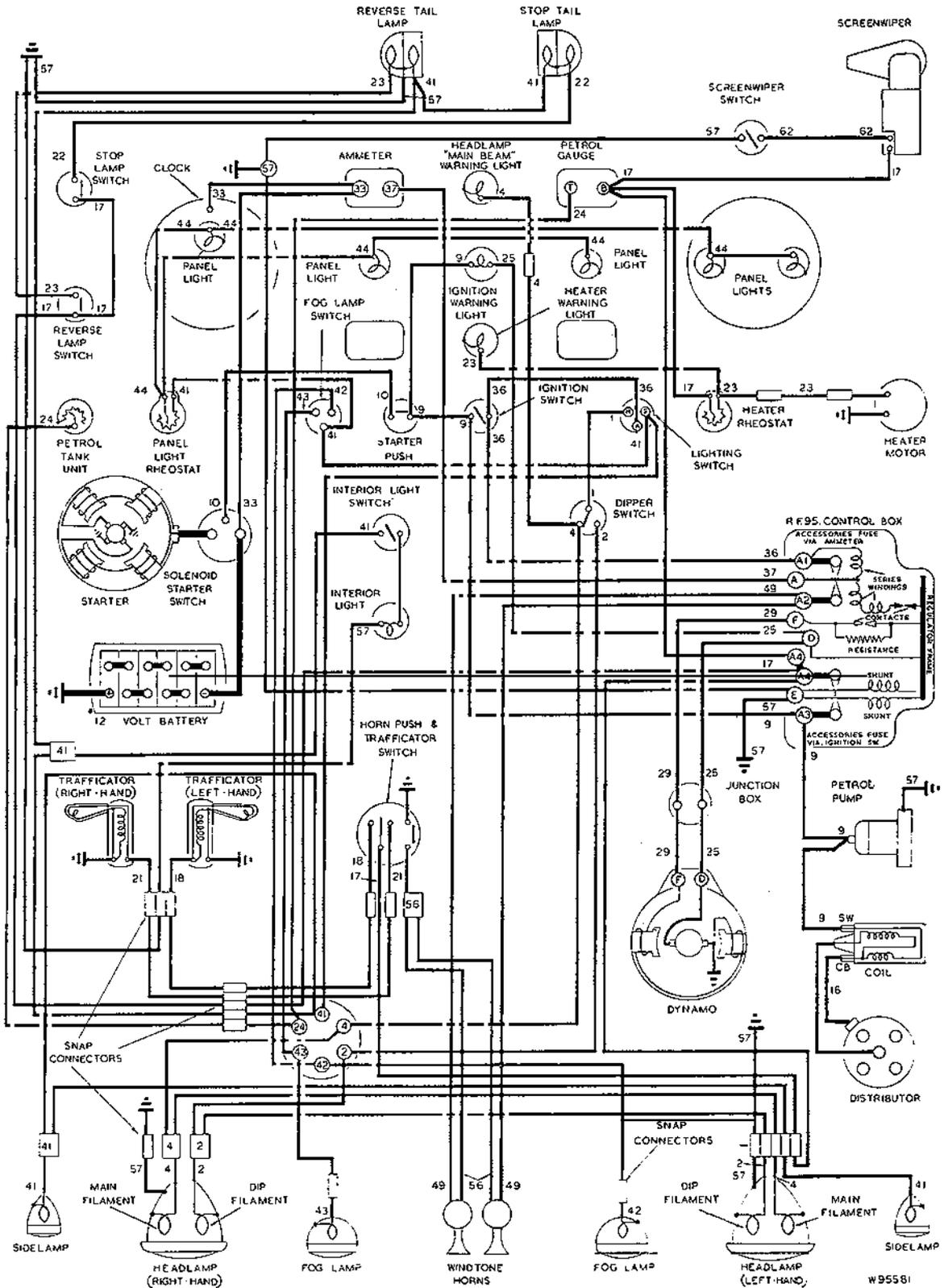
1 Black	14 White with Purple	27 Yellow with Blue	40 Brown with Black	53 Purple with White
2 Blue with Red	15 White with Brown	28 Yellow with White	41 Red	54 Purple with Green
3 Blue with Yellow	16 White with Black	29 Yellow with Green	42 Red with Yellow	55 Purple with Brown
4 Blue with White	17 Green	30 Yellow with Purple	43 Red with Blue	56 Purple with Black
5 Blue with Green	18 Green with Red	31 Yellow with Brown	44 Red with White	57 Black
6 Blue with Purple	19 Green with Yellow	32 Yellow with Black	45 Red with Green	58 Black with Red
7 Blue with Brown	20 Green with Blue	33 Brown	46 Red with Purple	59 Black with Yellow
8 Blue with Black	21 Green with White	34 Brown with Red	47 Red with Brown	60 Black with Blue
9 White	22 Green with Purple	35 Brown with Yellow	48 Red with Black	61 Black with White
10 White with Red	23 Green with Brown	36 Brown with Blue	49 Purple	62 Black with Green
11 White with Yellow	24 Green with Black	37 Brown with White	50 Purple with Red	63 Black with Purple
12 White with Blue	25 Yellow	38 Brown with Green	51 Purple with Yellow	64 Black with Brown
13 White with Green	26 Yellow with Red	39 Brown with Purple	52 Purple with Blue	65 Dark Green
				66 Light Green

## WIRING DIAGRAM FOR 1½ LITRE SALOON AND 2½ LITRE SALOON AND COUPÉ (HOME AND R.H.D. EXPORT) 1949/51



Key to cable colours as on page N.17.

WIRING DIAGRAM FOR 2½ LITRE SALOON AND COUPÉ (EXPORT, L.H.D.) 1949/51 WITH COMBINED CONTROL AND FUSE BOX

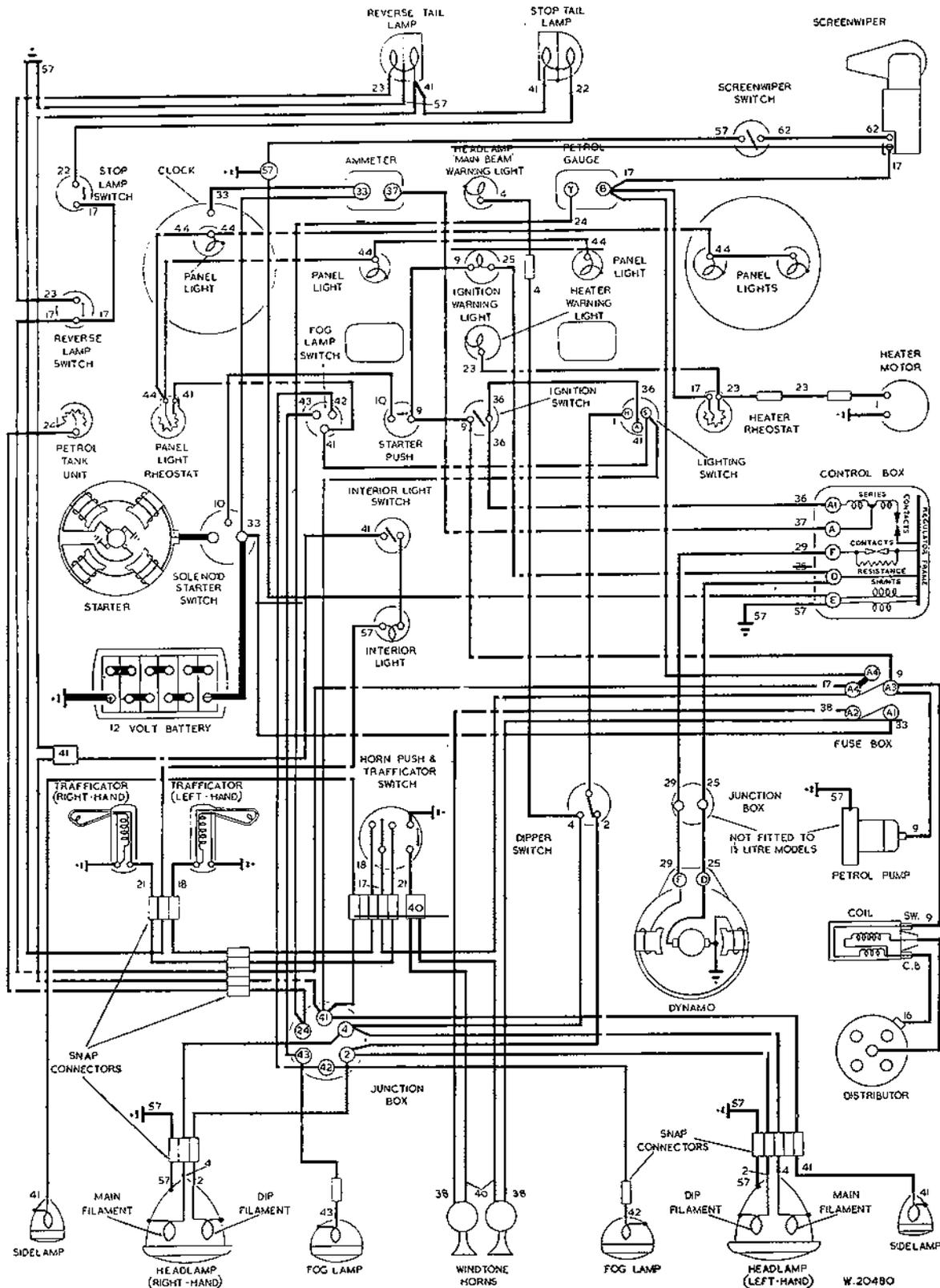


Key to cable colours as on page N.17.

# N ELECTRICAL EQUIPMENT

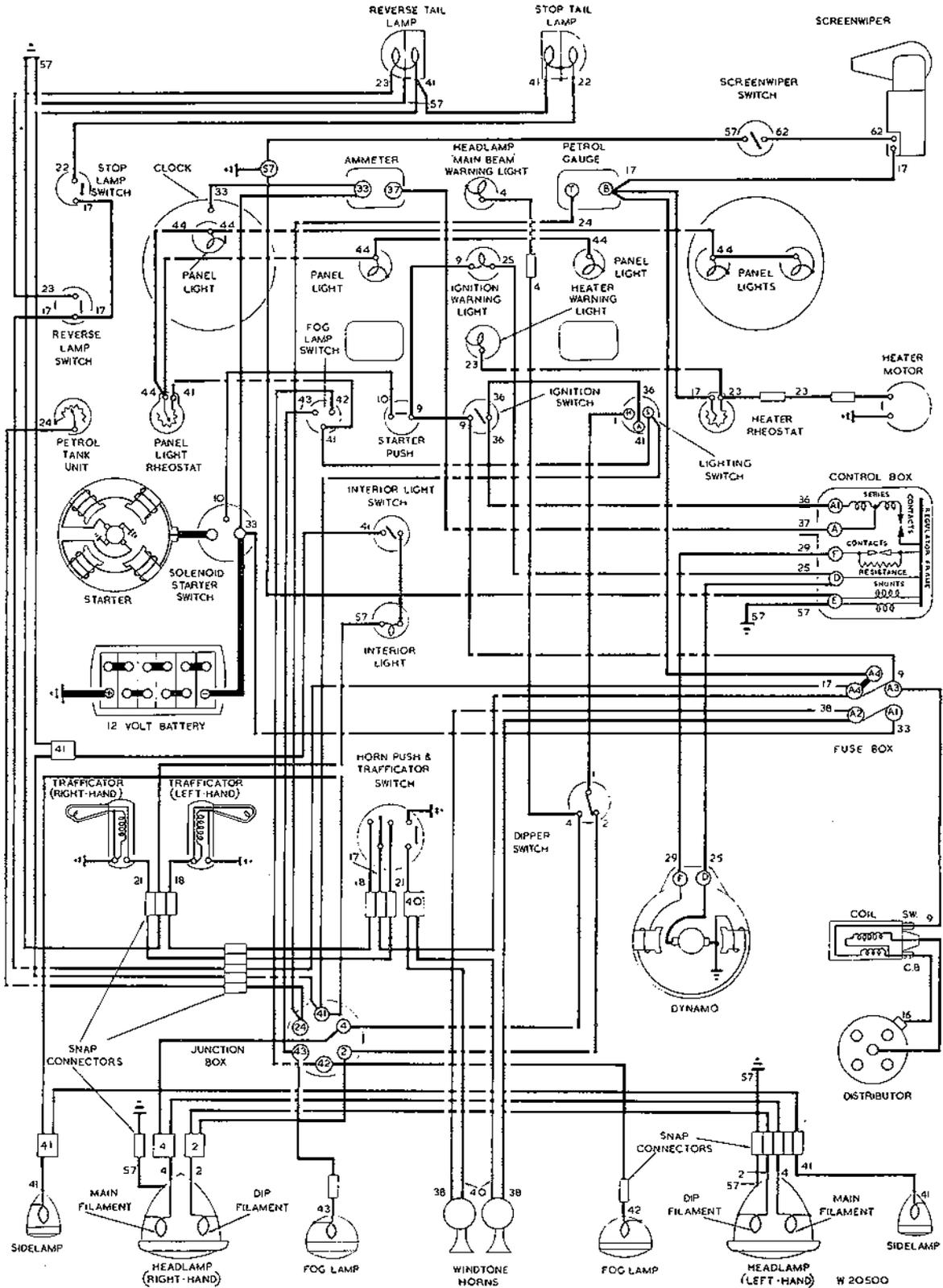
(1½ and 2½ LITRE)

## WIRING DIAGRAM FOR 1½ AND 2½ LITRE SALOONS (HOME AND R.H.D. EXPORT) 1951/52 WITH SEPARATE CONTROL AND FUSE BOXES



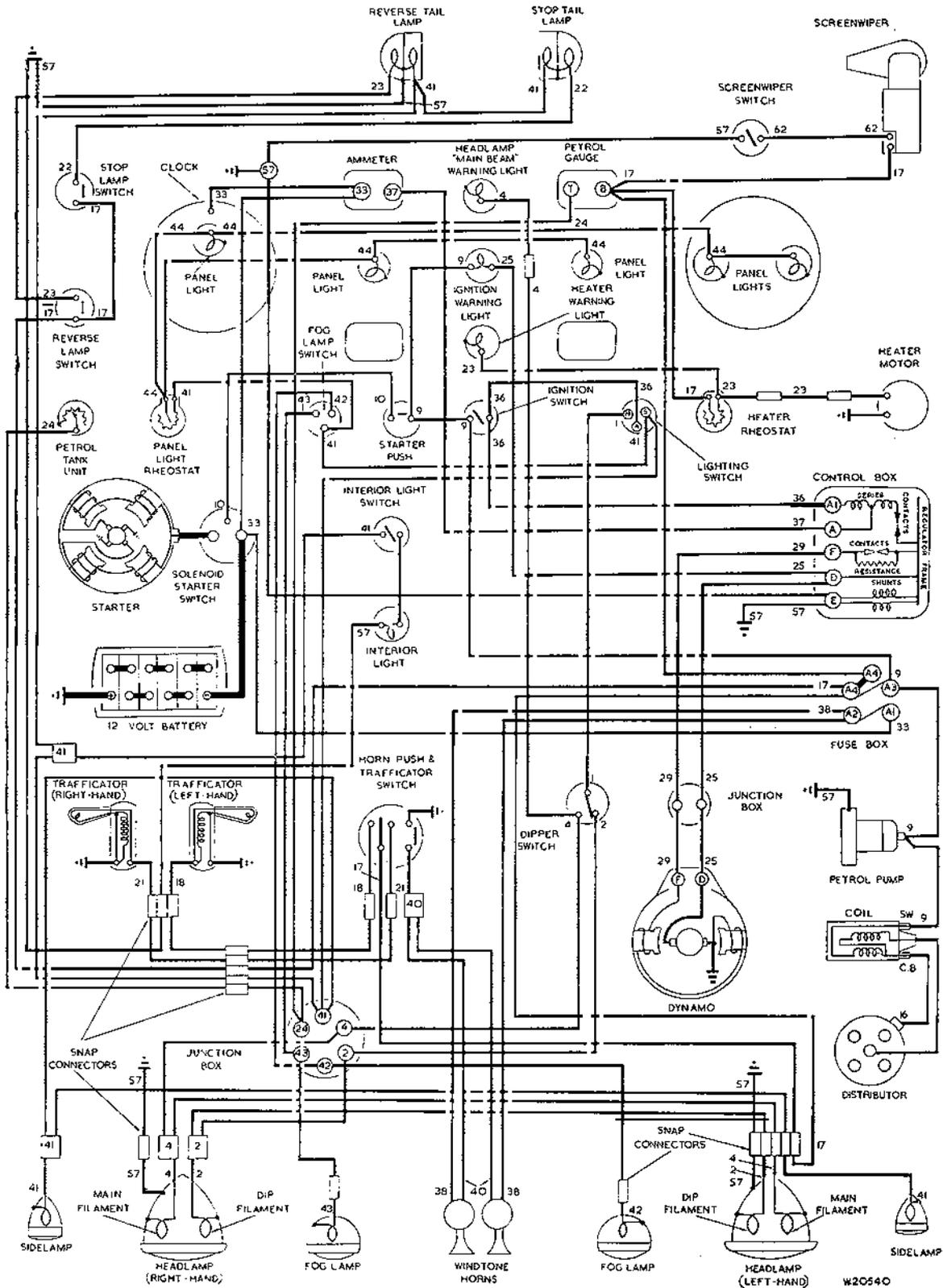
Key to cable colours as on page N.17.

WIRING DIAGRAM FOR 1½ LITRE SALOON (EXPORT, L.H.D.) WITH SEPARATE CONTROL AND FUSE BOXES



Key to cable colours as on page N.17.

## WIRING DIAGRAM FOR 2½ LITRE SALOON (EXPORT, L.H.D.) WITH SEPARATE CONTROL AND FUSE BOXES



Key to cable colours as on page N.17.

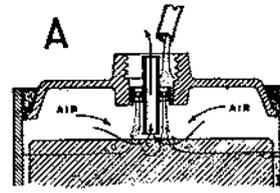
### Section N.28

#### CORRECT ACID LEVEL DEVICE ON LATER MODELS

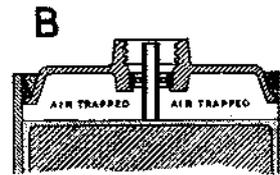
All later Lucas batteries fitted with rubber vent plugs are supplied with a device which ensures that the batteries are filled to the correct level. In order to fill the battery, remove each of the rubber plugs in turn and pour distilled water round the plastic tube onto the flange which will be found in the filling orifice, until no more water will enter. Lift the tube slightly to allow the visible water trapped by the flange to drain into the cell. The acid level in the cell is now correct, and it is important that no more water is poured in.

When you have completed this operation on each of the cells replace the rubber plugs.

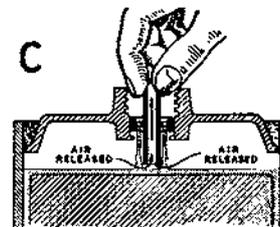
In temperate and cool climates these operations should not be necessary more often than once every 1,000 miles.



Here the electrolyte is below normal. Distilled water is being poured on the flange round the centre tube.



Cease pouring when the water ceases to run through. The level in the cell is controlled by an air lock.



Release the visible water by lifting the tube of the correct acid level device slightly. The electrolyte level is now correct.

Fig. N.21.

The method of using the correct acid level device.