

The
Maintenance Book
of the
BROLT

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“Brolt is British”

The
Maintenance
Book
of the
Brolt
Electric Lighting
and
Starting System

ISSUED BY
THE MANUFACTURERS
BROLT L^{TD}
OLDBURY (Worcs.)

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Introductory Note

The whole purpose of this Booklet is to provide the user of the BROLT Equipment with such detailed information as is essential to efficient maintenance and thus ensure against that lack of care and attention which is so often traceable to lack of knowledge.

With this object we have divided the book into 2 parts, the first describing the main principles of the system and giving general and detailed instructions on efficient maintenance, and the second dealing exhaustively with the location of faults, and by Chart (see end of book) and fuller explanation in the text, placing the user in the position of being able to analyse the cause of same correctly.

With this information and care in following instructions there are very few contingencies which cannot be met and dealt with by the user quite unaided, but whenever the point is reached where we recommend return to works or service depot, we strongly urge this course.

Finally, we would say that we are here not only to produce the BROLT Equipment but to see that it yields the maximum efficiency, and to ensure this we at all times place at the disposal of the user our specialized knowledge and assistance.

B R O L T L T D .
OLDBURY (WORCS.)

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The main principles of the Brodt System

The Brodt Lighting Set consists of a Dynamo, Automatic Cut-out, Accumulator, Switchboard, Set of Lamps, necessary Wiring, and in certain cases Junction Box and Distribution Board.

The Brodt Lighting and Starting Set comprises in addition to the above, a Starting Motor and Foot Switch.

The Function of the Dynamo is to generate the current with which the battery is charged.

The Function of the Automatic Cut-out is to prevent the discharge of the current from the battery through the Dynamo when the car is standing, or when the speed of the Dynamo falls below its generating speed.

The Accumulator is used for the storage of current generated by the Dynamo—the Lamps and Starting Motor are dependent on the Battery for the current they consume.

The Switchboard controls the charging of the battery and the manipulation of the lamps, and contains a fuse which protects the dynamo in case of a faulty connection in the

battery circuit, also a combined ampere-meter and voltmeter, the amperemeter recording the output when the dynamo is charging, the volt meter indicating the condition of the battery.

The Junction Box

is used when it is desired to tap off extra circuits for Electric Horn, Cigar Lighter etc., and obviates running extra cables to the battery.

The Distribution Board

is an elaboration of the Junction Box and is utilised for Interior Lighting, Horn, etc. By its use the wiring is split into two distinct sections, one running to the switchboard and serving for the road lamps only, the other being used for all extra lights and appliances, each circuit being protected by its own fuse.

The Functions of the Starting Motor

and Footswitch are too obvious to need explanation.

General Running and Maintenance Instructions

DYNAMO

The Brolt Dynamos are all of the constant current type and consist of 5 essential parts :—

- (a) The Armature, a rotating cylindrical drum wound round with wire, in which the current is generated.
- (b) The Commutator, which is suitably connected to the armature windings and rotates with them.
- (c) The Brushes, which press on the commutator and collect the current from it, passing it out to the necessary wires of the system.
- (d) The Field Magnet or electro-magnet, its function being to give a strong magnetic field for the armature to rotate in.
- (e) The Bearings and other purely mechanical details of the machine.

The regulation of the Dynamo output is obtained by purely electrical means. The robust and simple nature of the Brolt Dynamo reduces the need for attention to an absolute minimum. The lubricators on the Dynamo bearings—one at the Commutator End and one at the Pulley End—should be half filled with good quality engine oil or light gas engine oil about every thousand miles, i.e., as often as the magneto bearings,

DYNAMO
(contd.)

care being taken not to drop oil on the commutator. The driving belt, which should be kept clean, will drive without being excessively tight and need not be tightened unless slipping. A slipping belt is indicated when the ammeter fails to register at the usual speeds, or the needle oscillates violently. 90% of Lighting Set troubles are due entirely to slipping belts which result in the undercharging of the battery. The belt must be kept clean and free from oil and grease or it will not function properly.

The Brushes and Commutator should be examined periodically to see that they are not wearing unduly. Normally the commutator will acquire a hard, brown, glossy surface which should not be interfered with, but if it appears to be rough, blackened or greasy, it should be cleaned and brightened by lightly holding fine glass paper on its surface whilst it is revolving—ON NO ACCOUNT SHOULD EMERY PAPER OR EMERY BE USED.

Any carbon or copper dust must be cleaned away from the brush gear and interior of the enclosing cover. It is important to see that the brushes are clean and will slide freely in the guides. Bad commutation is indicated by a drop in output, fluctuation of ammeter needle whilst Dynamo is charging, and violent sparking at the brushes. On no account should the connections or brush rocker adjustment on the dynamo itself be interfered with, as these are all very carefully tested and adjusted before leaving the Works, and while provision

DYNAMO (contd.)

for adjustment of output is provided, it is essential that such adjustment should be performed only by a competent electrician, otherwise the output may be increased above that for which the machine has been designed and this will lead to overheating, and may cause the burning out of the windings. It is essential that the perforated metal openings in the enclosing cover of ventilated dynamos do not get choked with dust or grease, and if necessary, to prevent this, any obstruction should be brushed lightly away.

THE CUTOUT

is entirely automatic in action and beyond periodical inspection to see that all terminals and screws are tight, it should require no attention. The cut-out is usually arranged to make contact at about 10 miles per hour.

THE ACCUMU- LATOR

may be described as the heart of the system, and incidentally, it is the most vulnerable part of the equipment. Too much attention therefore cannot be given to the well-being of this vital unit. It should always be kept fully charged, the acid level maintained to cover the top of the plates (care being taken not to touch or cover the lead connecting bars) and the electrolyte must be kept the correct specific gravity.

Distilled water only should be added to replace loss by evaporation. In the event of accidental loss, owing to spilling, replace with Diluted Brimstone Sulphuric Acid of 1.200 gravity. This should preferably be obtained from a chemist, ready mixed, and every care

THE
ACCUMULA-
TOR (contd.)

taken to use an earthenware or glass funnel. On no account should a metal funnel or jug be used, unless of pure lead.

It will repay for the time expended if the acid level is examined once a week.

See that the battery terminals are tight and free from corrosion, and occasionally apply a little vaseline to same. Keep the top of the cells dry and free from external acid, taking care that the contact surface is free.

It is extremely important to see that the battery is securely mounted and that it cannot be shaken in its mountings. Examine all mountings periodically, and see that all screws, bolts and packings are tight.

Always charge in the right direction. To ensure this, see that the positive (red) wire is connected to the positive terminal, and the negative (black) wire to the negative terminal of the battery.

Overcharge rather than undercharge. Overcharging unless gravely aggravated will not injure the battery, whereas operating below a fully charged condition is distinctly harmful. The worst that can happen with an overcharged battery is the evaporation of the electrolyte and this will occur only after long and continuous overcharging, a state which can be easily rectified by adding distilled water.

A fully charged battery should, with both head lamps switched on, read its full voltage, either 12 or 6 volts, according to the voltage of the Set.

**THE
ACCUMULA-
TOR (contd.)**

If after a long charge the battery fails to give this reading, check each cell independently with a portable volt meter. Each cell should give a reading of 2 volts with the engine at rest and the head lamps switched on. In the event of locating a faulty cell, have it attended to immediately. Never allow a battery to be discharged below 11 volts for a 12 volt Set or 5.5 volts for a 6 volt set, or 1.85 volts per cell, as a cell will not retain its rated capacity if left in a run-down or discharged condition. If owing to neglect or accident, the battery is right down, it is better to remove it from the car and have it properly re-charged by a reputable garage which makes a business of such work.

Whenever the battery is disconnected or removed from the car, remove the dynamo fuse from the switchboard, as this will protect the Dynamo.

**STORAGE OF
BATTERIES**

If the battery has to be stored for a short period only it is essential to see that it is fully charged, that the acid is of the correct gravity, and that the plates are fully covered. Do not empty and refill with water.

See that the tops of the cells are clean and dry, and grease all lugs and terminals with vaseline.

Batteries, when stored, should be kept in a dark place. It is quite safe to leave them thus for 2 to 3 months, although an occasional short charge will be beneficial.

**STORAGE OF
BATTERIES
(contd.)**

In the event of requiring to store the battery for a longer period, fully charge the battery, empty out the whole of the electrolyte and refill with distilled water. In this condition slowly discharge the battery to 1.5 volts per cell, empty out the whole of the water, and see that the cells are properly dried and the outsides clean. The battery can then be stored indefinitely.

When taken into use again, refill the battery with acid of the correct strength and charge as per instructions on the battery.

**THE
FIRST
CHARGE**

Owing to the uncertainty of the length of time that a new car may be in the hands of the Agent after leaving the Works and before actual delivery to the owner, it is the practice of the principal Car Manufacturers to send out their cars with the batteries in an uncharged state. When this is the case, under no circumstances should the first charge to the battery be given by the electrical equipment on the car, as its life and well-being depend entirely upon correct treatment during the first charge, which must be at a low rate and continuous. Under such conditions, the Accumulator should be taken from the car, and the first charge given from an external source, and whilst this is usually done by the leading Agents and Garages, in taking delivery of your car, you should make certain that the battery is fully charged. Special instructions for the first charge are usually on the label of the battery, or will be found on the card inside the battery box.

SWITCH-BOARD

The switchboard is subjected to rigid test before leaving the Works and requires no attention whatever. Under no circumstances should the INTERNAL connections be interfered with. The charging switch may be permanently left in the "on" position where a Starting Motor is fitted to the Car.

Should the fuse blow, due to an open battery circuit, replace with a single strand of the fuse wire supplied, which will be found wrapped round the fuse holder. Under no circumstances must this fuse be strengthened either by using a heavier gauge or by using double strands in an endeavour to prevent the fuse blowing, as injury to the Dynamo may be the result. A blown fuse will be indicated by the meter failing to register.

To take the voltage reading of the Accumulator depress the dynamo switch dolly beyond its normal off position, at the same time switch on all lights and read volts on the volt scale of the meter.

WIRING

The wiring should be periodically examined to see that there is no chafing and that all the terminals are tight. Especially does this apply to the Battery as loose terminals allow the wires to jump up and down and cause the connection to be broken for very short periods — a condition which will cause the fuse to blow and if the lights are on, the bulbs to be burnt out.

LAMPS

See that the Lamps are set parallel with each other and vertical with the road. Use the correct bulbs for which the lamps have been designed and see that the bulbs are in focus with the reflector. There is a correct position which varies with every bulb, and in the event of replacing a bulb, see that it is properly focussed in order to get the best results.

There are two types of locking devices for the bulb adapters, according to the design of the lamps, one consisting of a knurled locking collar immediately behind the lamp, the other a split clamp held by a screw. To focus the bulbs, release the locking device, and the adapter and bulb can be readily moved longitudinally in or out.

To focus the light, the simplest method is to place a light object, such as a newspaper, about 100 yards from the lamps, then move the adapter, containing the bulb, either forward or backward until the best illumination is obtained on the paper, at the same time observing the uniformity of the beam upon the road. In the event of lights flickering, examine the bayonet connections and see that these are clean and that the springs are not sticking.

The Lamps going to a dull red and the ammeter failing to register with the light switch on will indicate a short circuit on the wiring, in which case the fault can be traced by disconnecting and testing each lamp separately. Trouble with the Lamps does not

LAMPS (contd.) indicate trouble with the dynamo, as the Lamps take their current direct from the accumulator.

Do not clean the reflectors of the Lamps with the ordinary metal cleaning polishes or they will be permanently damaged. Should they require cleaning use a dry Selvet cloth.

STARTING MOTOR.

The Starting Motor is designed and fitted for the purpose of turning the engine only, and provided it performs this operation it is functioning correctly.

Consider for a moment that the amount of current required to operate a Starting Motor is anything from 60 to 160 amps, according to the size of the Starter. Assume a medium size Starting Motor consuming, say 100 amps., in conjunction with a 50 ampere hour battery. Batteries are now universally rated on a 10 hour rating, viz., full capacity divided by 10 equals the normal charging and discharging rate, therefore with a 50 ampere hour battery 5 amps. is the normal charging and discharging rate, but the capacity of the battery is fixed by the discharging rate. If the battery is discharged at less than its normal rate the capacity of the battery is really greater, i.e., a 50 ampere hour battery will discharge 5 amps. (its normal 10 hour rating), for 10 hours, but will discharge $2\frac{1}{2}$ amps. for about 22 hours, therefore on a $2\frac{1}{2}$ amps. discharge rate the capacity of the battery would be 55 amp. hours, and inversely, if the discharge rate is exceeded, the capacity is lowered. Taking 100 ampere continuous current

**STARTING
MOTOR**
(contd.)

to operate a Starter from a 50 ampere hour battery, the battery would be completely discharged in about 10 minutes, and continuous discharging at this rate will cause disintegration of the plates, buckling, and eventually destroy the battery, whereas it is quite capable of standing these heavy discharges for comparatively short periods.

If the engine fails to start immediately, do not blame the Starting Motor, and do not exhaust the batteries by uselessly keeping the switch in, but investigate the cause.

Try starting the engine by hand—if you find to do this you have to flood the carburettor or close the air intake, etc., it is essential that you should perform the same operation when using the Starting Motor.

IF THE ENGINE DOES NOT FIRE IN THE FIRST 12 REVOLUTIONS HAVE IT TUNED UP AND DO NOT DESTROY THE BATTERY BY USING THE STARTING MOTOR LIKE A DONKEY ENGINE.

In operating the switch, press it right home, as otherwise arcing at the contacts may take place.

Lubricators will be found at both ends of the Starting Motor for the ball bearings carrying the armature, and these should be filled periodically. An extra lubricator will be found on the outboard bearing, and a light engine oil should be injected about every 1000 miles. Do not use oil on the screw-thread of the pinion, as this will simply

**STARTING
MOTOR**
(contd.)

collect dust, and probably cause the pinion to stick. A little powdered graphite occasionally sprinkled on the screw-thread will provide adequate lubrication for this part.

In the event of laying the car up, thoroughly grease the screw-thread of the pinion in order to prevent damp rusting it.

Provided by the Clyno Register
Not For Resale

Location of Faults

For the purpose of assisting users to trace systematically any faults which may arise in connection with the BROLT Lighting and Starting System generally, the Charts which will be found at the end of this Booklet, have been specially prepared.

On reference thereto, it will be noticed they are divided into three main sections:—

Chart "D" dealing with dynamo, switchboard and cutout faults—Chart "L" with the Lighting Circuit generally, under two sections, A and B, and—Chart "S" with the starter.

The best course to adopt in tracing any fault is to refer first to the Chart which, from observed symptoms, covers the fault concerned and test out in systematic order all the probable causes likely to be at the root of the trouble until the correct solution is arrived at, when the advice given should be acted upon.

The following information is for the purpose of explaining the Charts in greater detail and to that end reference numbers have been placed against each section on the Charts "D," "L" and "S," thus identifying them with the following paragraphs in proper sequence.

Chart "D"

Charging Current Failure

NO CHARGE

**Ammeter
not registering**

1

The ammeter on the switchboard shows positively any failure of the dynamo, driving belt, switch contacts, cutout or the wiring between these components and the battery.

**FUSE
MELTED**

2

First of all examine the fuse provided in the switchboard. This is either fixed in the cover as a plug or in the case of commercial switchboards,

inside the case under the cover. If this is found to have melted, reload from spare fuse wire by stretching a single strand across the clips. The melting of fuse most likely proves the connections are loose at the battery or switchboard terminals. These should be cleaned and well tightened up. There are, however, other causes for the fuse melting and these are dealt with separately under column "A" on chart "L". See also paragraph 4 below.

NOT MELTED

**See if belt is
slipping**

3

Fuse proving to be in order, next examine driving belt to see if it is slipping. This is indicated by ammeter failing to register at the usual speeds or violently oscillating. The

remedy is obvious. (NOTE :—The driving belt supplied will drive without being excessively tight and need not be tightened unless slipping.)

**Inspect Dynamo
Contacts in
Switchboard**

4

The dynamo switch contacts in switchboard should be examined next to see if proper contact is being made between the switch blade and the two contact jaws situated on either side. If this appears to be bad, carefully adjust to give connection between the blade and also to clear each other when switch is in the "off" position. If the contacts foul each other the fuse will melt when engine is running and dynamo switch is in the "off" position.

**Examine
Fuse Contacts**

5

The fuse contact jaws should be set to have a firm grip of fuse plug. Bad contact would cause ammeter to cease reading or to oscillate violently.

Switch Dynamo on

**Remove Dynamo
belt, carefully push
in cutout arm**

6

Having tested out as above, the fault will be either on the dynamo, the cable between the dynamo and switchboard, or the cutout. Taking these in order, observe instructions given in section 6 on chart "D", when, if the dynamo remains stationary pass on to section 7, or, on dynamo proving to be in order proceed to examine cutout. See section 10.

**Dynamo
remains
stationary**

7

Dynamo remaining stationary will either be due to a fault in the dynamo or cable. Place test lamp across main brushes or the positive and negative mains at the terminal block, and switch on the dynamo. If no current is shown, fault is on wiring. Replace cable.

Current OK

**Examine Dynamo
Commutator
and Brushes**

8

Current being through to dynamo terminals, examine commutator and brushes, cleaning the former with fine glass paper and a soft cloth, and see that the latter are free in the brush holders and not excessively worn. In fitting new brushes, bed the face to suit the curvature of the commutator and see that brush spring tension is light and flexible and not excessive or too weak.

**Commutator and
Brushes OK**

**Internal fault on
Dynamo**

9

The above paragraph includes all minor faults that an amateur or ordinary motor driver can be expected to deal with satisfactorily, and for internal troubles return to Works Service Station.

Dynamo Revolves

**Replace Belt
Start Engine
Switch Dynamo on
Observe Cutout**

10

After testing as described in section 6 and finding the dynamo revolves O K, the trouble lies with the cutout. Observe instructions given in section 10 and carefully note the action of movable contact arm on the cutout.

**Cutout operates
but only pulls
in when engine
is raced**

11

Cutout failing to pull in except when engine is raced proves tension of spring is too great, and requires adjusting to pull in at a road speed of about 10 to 12 m.p.h. With this setting the ammeter should read from $1\frac{1}{2}$ to 2 amperes immediately on cutting in. Care should be taken when adjusting the spring tension and should only be carried out by a competent electrician. If in doubt return to Works Service Station.

Cuts in but not out until switched off, or will not cut in even when engine is raced

12 If cutout will cut-in but fails to cut-out until dynamo is switched off, or will not operate when engine is raced, there is a broken connection or coils are damaged. Return to Works Service Station.

&
13

Chart "L" LIGHTING FAILURE

Lighting troubles generally may be said to fall into either one of two distinct classes according to the observed symptoms. To facilitate location of these, the Chart has been divided into two main sections, A and B, as described below.

Section "A" deals with lighting troubles due to loose or broken connections in the battery circuit or internal battery troubles, the usual symptoms being a sudden increase in the normal brilliancy or the burning out of the bulbs.

Section "B" deals with lighting troubles due to short circuits in either the lamp cables or adapters, the usual symptoms being that the lamps burn dull red or failure of the battery to hold its charge.

Col. A

All Lights suddenly go bright or burn out

REPLACE FUSE

Examine Connections at switchboard and battery terminals

1

If all lights suddenly go bright above normal or burn out altogether, carefully examine the connections both at the switchboard and battery terminals and see that they are clean and well screwed home. This is important, being the most usual cause of this trouble. It will

be generally attended by the fuse melting and this should then be replaced.

Connections O K

Examine Bridges between cells

2

The connections proved to be in order, next examine the bridges connecting the individual sections of the cells for fractures. If fractured, return to Works Service Station for repairs.

BRIDGES O K

Examine Battery for sulphating

3

Next, an examination of the plates of the battery should be made and any trace of sulphate deposit immediately removed. It is advisable to return the battery to Works Service Station if the sulphating is at all extensive. For further information see special note on accumulators, page 7.

phating is at all extensive. For further information see special note on accumulators, page 7.

Battery not sulphated

Inspect Acid level in cells

4

The level of the acid should be maintained about $\frac{1}{4}$ above the plates. A periodical examination can be made through the vent holes. Acid being lower in one section more than another points to leakages in the case. This should be located immediately and repaired. For further information see special note on accumulators, page 7.

Acid Level O K

Disconnect battery cable at switchboard

Place test lamp across the ends

5

The cable between the battery and switchboard should be tested for break, to do this, disconnect from switchboard and apply test lamp to the ends, when, on lamp failing to light up or light only intermittently, is proof of a break in cable. To discover

intermittent breaks it will be necessary to bend the cable about. In either case, it will be necessary to replace with a new length. A repair should not be attempted on this cable owing to its important function on the system.

CURRENT OK

Reconnect battery cable at switchboard

Place test lamp between negative bus bar and switch unit frame or dolly

6

Having thoroughly examined the various parts indicated above without discovering the fault, the trouble is almost certain to be in the switchboard itself. To test:— Reconnect the battery cable to the terminals and place test lamp between the negative Bus Bar and the switch Unit frame or switch dolly.

Failure to light up proves there is an internal fault on switchboard. Return switchboard to Works Service Station.

Col. B

Lights Dull Red or Batteries Low

See if the current is registered on the ammeter

1

If the lights burn dull or the battery fails to hold its charge, the cause may be either due to the fuse having melted, the charging current failed, or to a short circuit somewhere on the system generally. Which of the three causes to test out can be quickly determined by

observing whether the ammeter is registering current, when the instructions given against the section applying to the actual case can then be followed.

NO CURRENT
Examine the fuse

FUSE MELTED
Examine as directed
under Col. A.

2

No current being registered on the ammeter, examine the Fuse to see whether this has become displaced or melted. If there are obvious signs of this having melted, replace from spare fuse wire and locate the cause as directed on chart "L" column "A". Note:—Failure to reload the fuse or locate the cause of no

charge will quickly lead to the battery becoming discharged owing to the heavy demand made upon it by lamps and various other circuits of the Electrical equipment.

FUSE OK
Examine as directed
under Chart "D"

3

If the ammeter is not registering current and the Fuse is found to be intact, the charging circuit generally should be tested out as indicated on Chart "D."

CURRENT OK

To test lamp circuits
and all separate
circuits generally

For detailed description see Col. B,
section 4, also
paragraph 4

4

Charging current being indicated on the ammeter under these conditions is a clear indication of a short circuit somewhere on the system. It will generally be noticed which circuit, when switched on, causes the other lamps to go dull, making fairly obvious the section to test out. When this is not the case, disconnect one of the battery wires, switch on all lamp circuits, then by switching off each

circuit one at a time and flicking the disconnected battery wire on its terminal until the remaining lamps are normal, the one then switched off is the faulty one. If this circuit

consists of two or more separate branches, as in the case of the head and tail or side and tail, it will be an easy matter to disconnect the group of cables and test again independently until the fault is located. Wiring troubles can be usually traced to the lamp adapters. Do not switch on the current for more than 2 or 3 seconds at a time, as the heavy current is liable to damage the insulation of the cables or burn out the switchboard.

All Lamp Cables and Extra Circuits OK	5
---------------------------------------	---

All Switches Off
Disconnect one battery wire at battery and insert test lamp in series

Having thoroughly examined all lamp cables, and all the separate circuits as directed in the preceding paragraph, the fault can only exist on the battery cable or in the switchboard itself, but it is only in extremely rare cases that this is found to be so. To test cable, carry out instructions given in section 5 and note results.

CURRENT	6
---------	---

Disconnect battery wires from switch terminals.

If current is shown by the lamp lighting up, even though dull red, disconnect battery cable from switch terminals and again note results.

CURRENT	7
Fault on battery cable	
Replace	

Current still being shown even when battery wires have been disconnected from switchboard, proves there is a short circuit on the battery cable. Replace by a new length.

NO CURRENT
Internal fault on switchboard
Return to Works Service Station

8

No current being shown under these conditions proves there is an internal fault on switchboard. Return switchboard to Works Service Station.

NO CURRENT
All lamp circuits and switchboard OK

9

Place test lamp on the other pole and test for earths between battery cable and starter, dash, lamp, horn, etc.

Returning to paragraph 5 with one battery wire disconnected and test lamp in series and no current being shown, place test lamp on the other Pole to test for earths between this cable and any other circuits, which may be tapped off direct from the battery itself, and locate by a process of elimination similar to that described in paragraph 4 and section 4 above.

Chart "S"

STARTER FAILURE

Start by hand to prove starter is at fault.
Will not start by hand
Starter is not at fault

1

It is as well before proceeding to examine the starter to make quite sure that it is the starter which is at fault. If the engine can be started by hand then the starter is at fault providing of course that it is operated under the same conditions as for handstarting such as flooding the carburetter, closing the extra air and priming if necessary.

Engine starts by hand

2

STOP ENGINE
Press volt switch and starter switch
Note volts

The engine having been started by hand satisfactorily; press the voltswitch and at same time operate the starter footswitch and note voltage.

Below 9 Volts
Low battery

3

examine for the cause of the battery being in this condition under Chart "D" and Chart "L" column B.

If below 9 volts, a low battery is the cause of the trouble. Have the battery charged up, preferably from an external source, and retest. Also

Between 10 & 11 volts
Battery OK

4

Operate starter and note if terminals or foot switch body heat up

The voltage being between 10 and 11 volts proves battery is in charged condition. Operate starter again and note if any of the terminals on the starter, footswitch or battery heat up.

Terminals or foot switch body heat up
Clean connections and tighten up or return foot switch
Works Service Station

5

The terminals heating up prove bad contact is being made or that they are loose. Take apart, clean and well tighten up. If the footswitch body heats up, dismantle same and examine contacts inside, and if burnt, return switch to Works Service Station.

Terminals Cool
Foot switch and connections O K

6

See if starter brushes are sticking or off commutator

Next carefully examine the starter brushes to see that they are not sticking in their respective holders and that the proper spring tension is applied, also that the brushes are bedding down on the commutator evenly. The brushes can be removed and the face examined to see this best.

Brushes Sticking
Ease and make slide freely

7

If the Brushes are sticking or not bedding on the commutator, ease down or bed to the commutator surface with fine emery cloth.

BRUSHES O K

See if pinion is free in screw thread

8

Having thoroughly examined the Brush gear and commutator and made certain that the connections at the brush gear are clean and tight, inspect the pinion to see that it works freely in the screw thread.

Tight or Jammed
See paragraph 9 and foot note

9

The pinion proving to be tight or jammed, if not locked with the teeth of the gear ring will be found to revolve at a high speed. This condition is usually brought about by exposure to damp and dirt when not in use, or by the springs inside the barrel having become displaced. See note below re lubrication of Pinion. When in this condition, starter must be returned to Works Service Station or only repaired by competent Garage Mechanic.

PINION OK

**Internal fault
Return starter to
Works Service
Station**

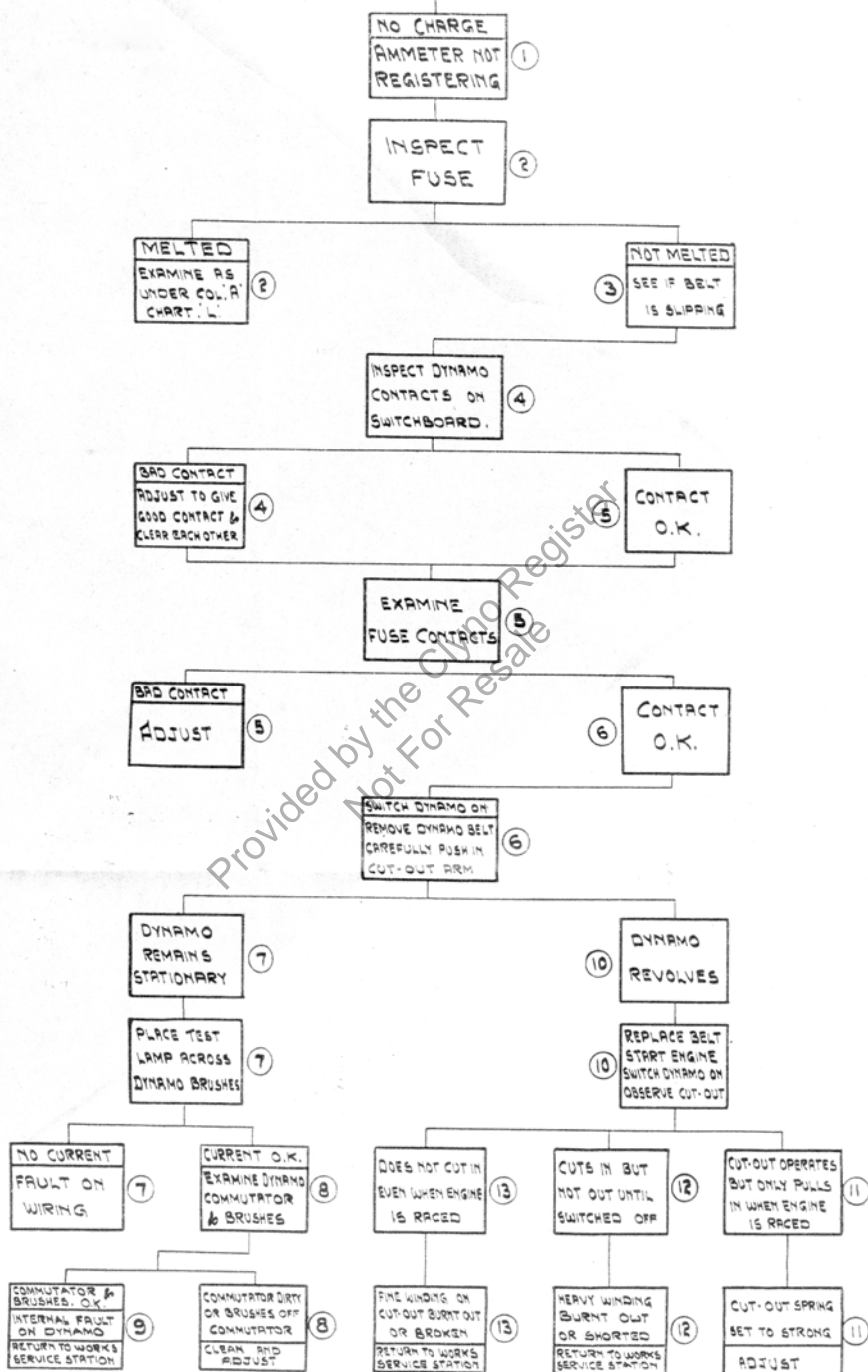
10

Pinion being found to be in perfect order, points to an internal fault on the winding of the starter. Return to Works Service Station.

NOTE:—It is not necessary to lubricate the pinion when in daily use, as the Starter bearings are packed with grease and the pinion treated with special graphite before being despatched from the Works. Only when the car is out of commission for any length of time or exposed to damp is it necessary to oil or grease the pinion to protect from rust. The excess being removed by paraffin or petrol on being put into use again.

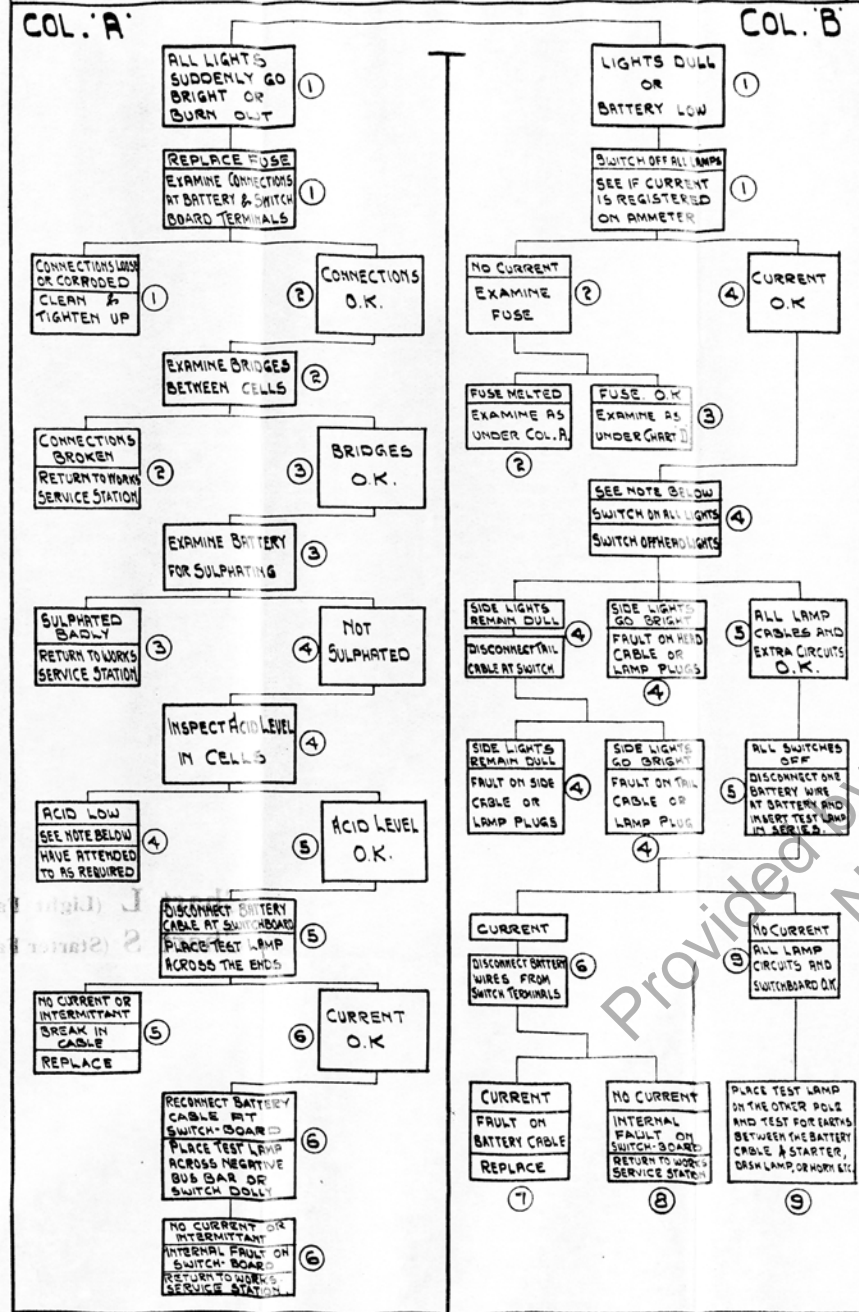
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Not For Resale

CHART 'D' CHARGING CURRENT FAILURE



FULLER EXPLANATION OF THE SYSTEMS GIVEN ON THE CHART WILL BE FOUND IN THE CHAPTER "LOCATION OF FAULTS" UNDER PARAGRAPH BEARING THE IDENTIFICATION NUMBERS GIVEN.

CHART 'L' LIGHT FAILURE



NOTE:- ACID LOW IN ALL SECTIONS CAN GENERALLY BE ACCOUNTED FOR BY LACK OF PERIODICAL ATTENTION & NOT TO LEAKAGES IN CASE. ADD DISTILLED WATER WHERE DUE TO EVAPORATION & DILUTED SULPHURIC ACID OF 1-200 G.G. AFTER LEAKING OR SPILLING.

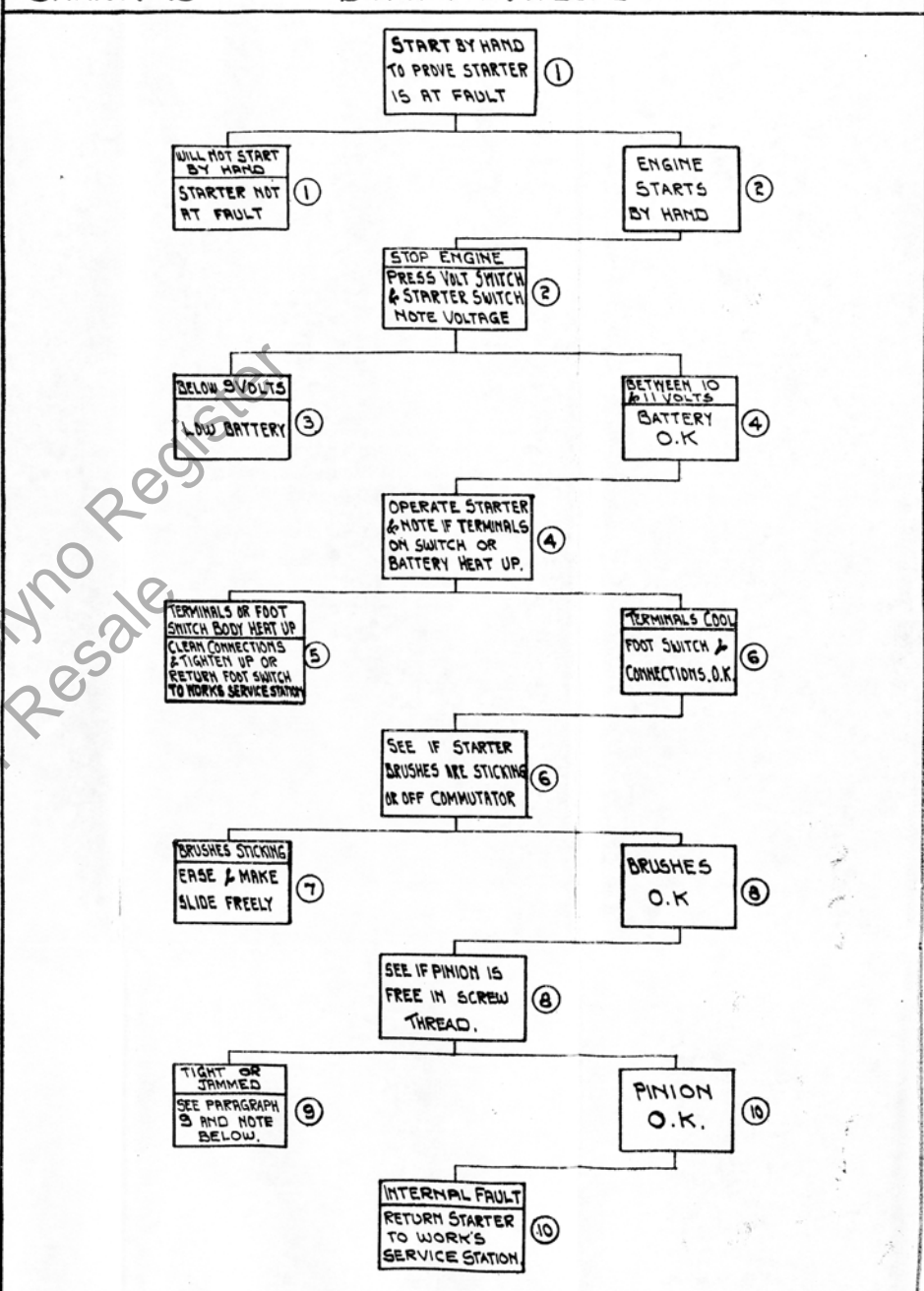
COL. A.

NOTE:- BEFORE EXAMINING LAMP CIRCUITS DISCONNECT ALL LAMP, INTERNAL LAMP & HORN CIRCUITS & TEST EACH SEPARATELY (THEN PROCEED AS ABOVE IF NOT ON ANY OF THESE CIRCUITS.) ALSO EXAMINE TERMINALS IN SWITCHBOARD FOR STRAY STRANDS BRIDGING TERMINALS

COL. B.

FULLER EXPLANATION OF THE SYSTEMS GIVEN ON THE CHART WILL BE FOUND IN THE CHAPTER "LOCATION OF FAULTS" UNDER PARAGRAPH BEARING THE IDENTIFICATION NUMBERS GIVEN.

CHART 'S' STARTER FAILURE



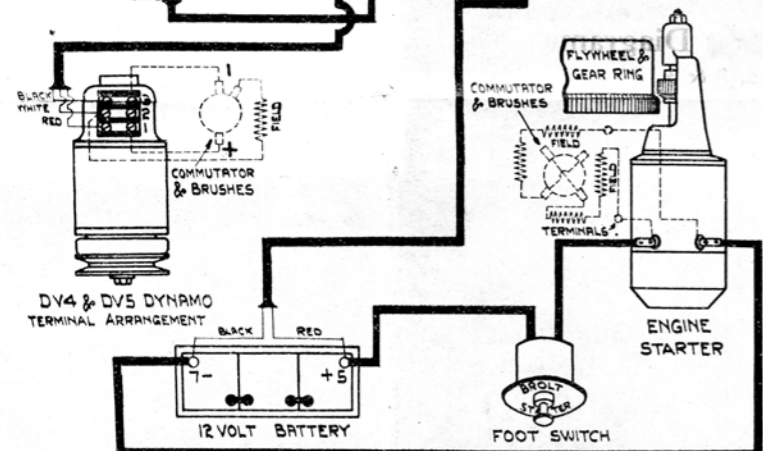
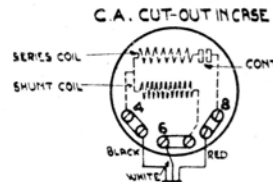
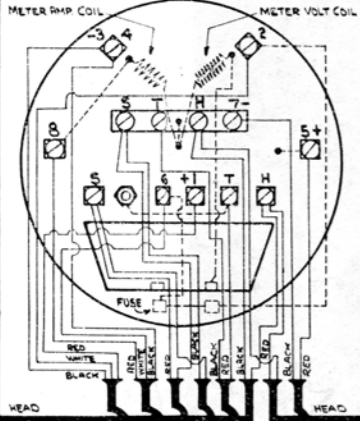
NOTE:- DUE TO SCREW THREAD HAVING BECOME JAMMED UP WITH DIRT WHEN IN THIS CONDITION PINION WILL PROBABLY REVOLVE AT A HIGH SPEED WITHOUT MOVING INTO GEAR RETURN TO WORKS SERVICE STATION OR HAVE ATTENDED TO BY GOOD GARAGE MECHANIC.

FULLER EXPLANATION OF THE SYSTEMS GIVEN ON THE CHART WILL BE FOUND IN THE CHAPTER "LOCATION OF FAULTS" UNDER PARAGRAPH BEARING THE IDENTIFICATION NUMBERS GIVEN.

BROLT

CABLE FOR	CONDUCTOR	FILLING	TYPE
DYNAMO	3 CORE	RED	B
BATTERY	TWIN	NATURAL	A
LAMP	TWIN	BLACK	C & D
STARTER	SINGLE	—	E

TYPE 'P' SWITCHBOARD



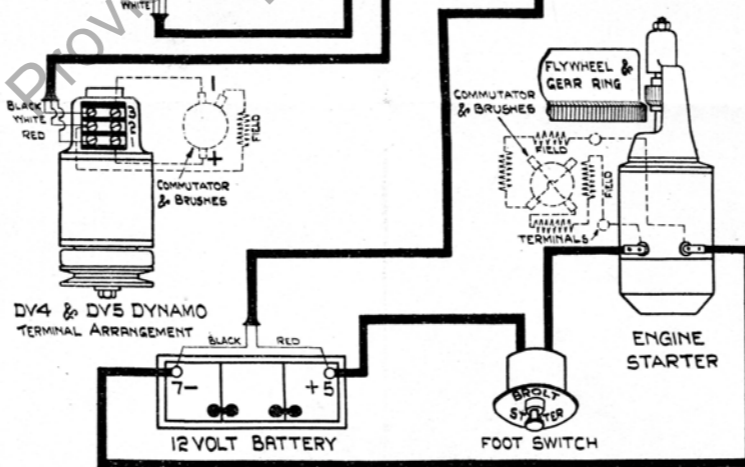
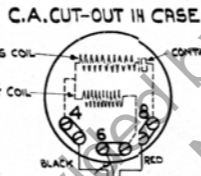
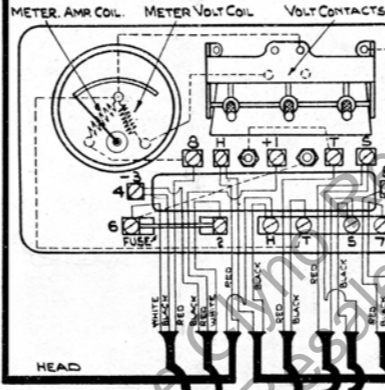
ALL INTERNAL CONNECTIONS SHOWN DOTTED

12 VOLT INTERNAL & EXTERNAL WIRING DIAGRAM FOR DYNAMOS TYPE DV4 & 5. SWITCHBOARD TYPE 'P' STARTERS TYPE LI-2-3

BROLT

CABLE FOR	CONDUCTOR	FILLING	TYPE
DYNAMO	3 CORE	RED	B
BATTERY	TWIN	NATURAL	A
LAMP	TWIN	BLACK	C & D
STARTER	SINGLE	—	E

TYPE 'K' SWITCHBOARD



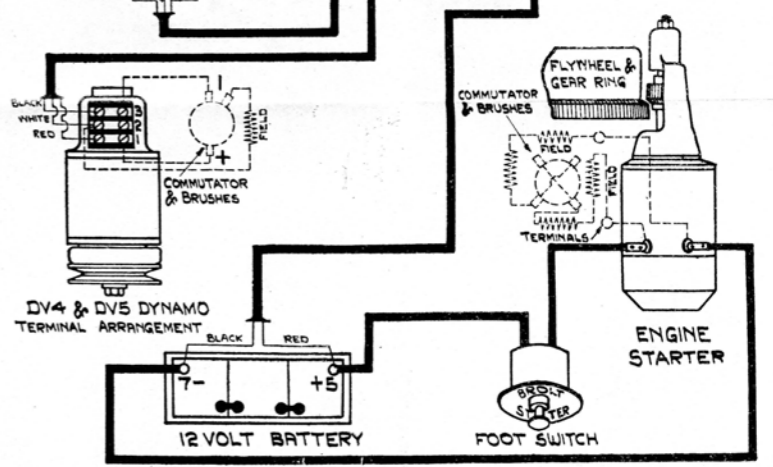
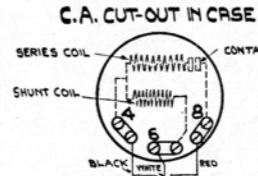
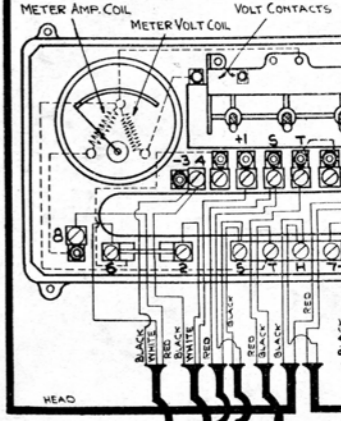
ALL INTERNAL CONNECTIONS SHOWN DOTTED

12 VOLT INTERNAL & EXTERNAL WIRING DIAGRAM FOR DYNAMOS TYPE DV4 & 5. SWITCHBOARD TYPE 'K' STARTERS TYPE LI-2-3.

BROLT

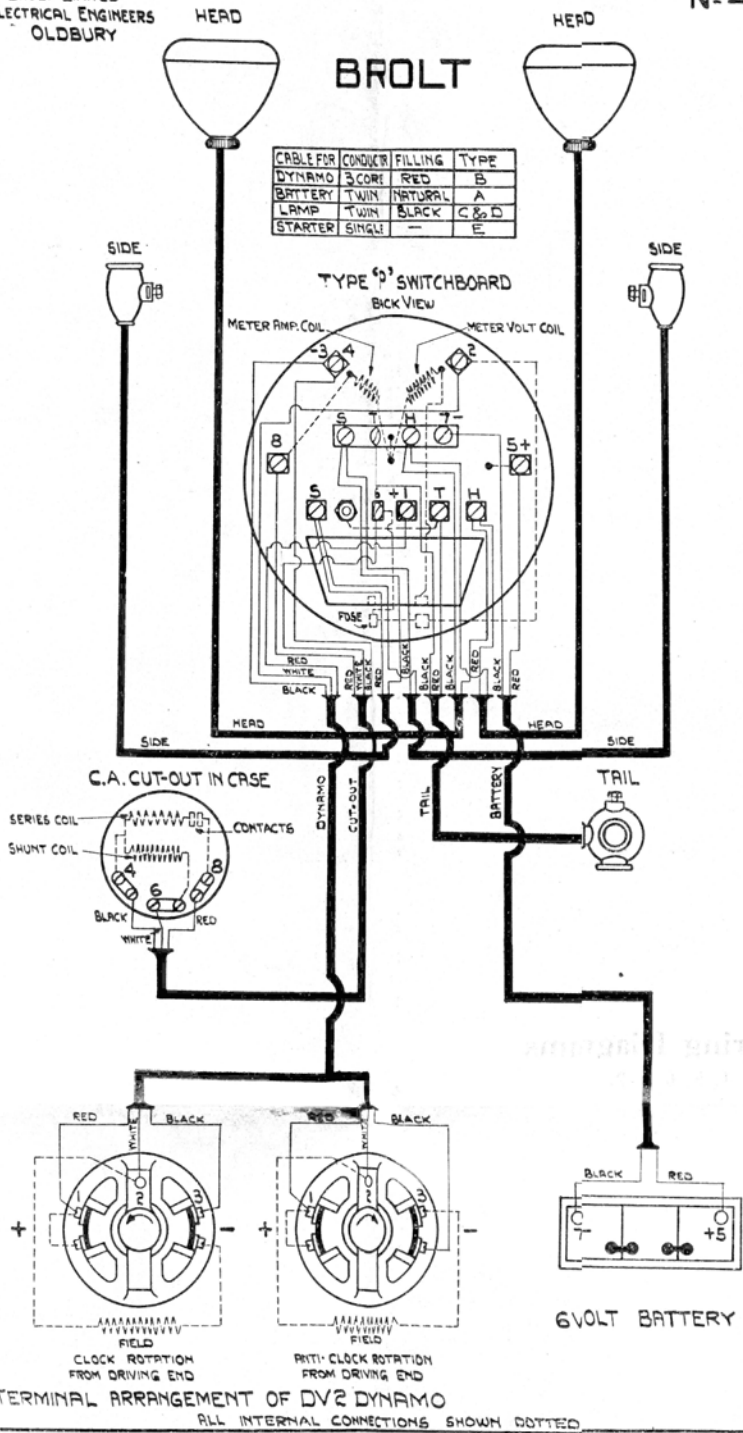
CABLE FOR	CONDUCTOR	FILLING	TYPE
DYNAMO	3 CORE	RED	B
BATTERY	TWIN	NATURAL	A
LAMP	TWIN	BLACK	C & D
STARTER	SINGLE	—	E

TYPE 'KV' SWITCHBOARD



ALL INTERNAL CONNECTIONS SHOWN DOTTED

12 VOLT INTERNAL & EXTERNAL WIRING DIAGRAM FOR DYNAMOS TYPE DV4 & 5. SWITCHBOARD TYPE 'KV' STARTERS TYPE LI-2-3.



CABLE FOR	CONDUCTOR	FILLING	TYPE
DYNAMO	3 CORE	RED	B
BATTERY	TWIN	NATURAL	A
LAMP	TWIN	BLACK	C & D
STARTER	SINGLE	—	E

TYPE 'P' SWITCHBOARD
BACK VIEW

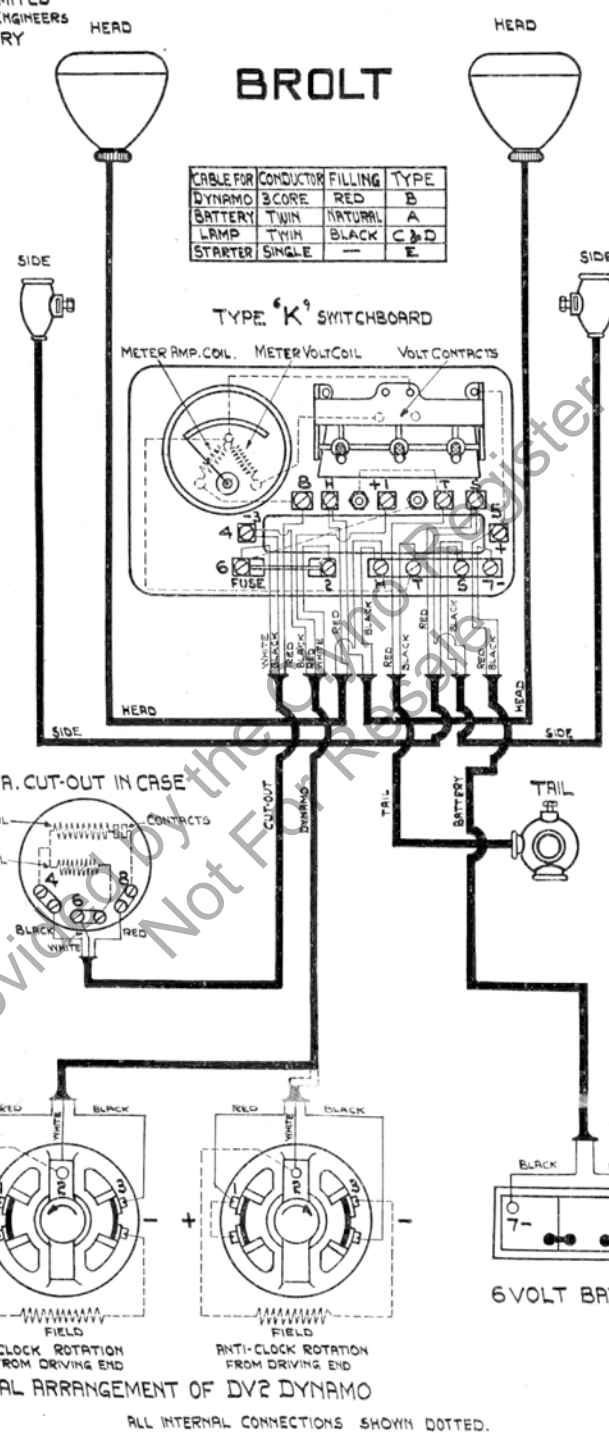
C.A. CUT-OUT IN CASE

6VOLT BATTERY

TERMINAL ARRANGEMENT OF DV2 DYNAMO

ALL INTERNAL CONNECTIONS SHOWN DOTTED.

6VOLT INTERNAL & EXTERNAL WIRING DIAGRAM
FOR DYNAMO TYPE DV2. SWITCHBOARD TYPE 'P'



CABLE FOR	CONDUCTOR	FILLING	TYPE
DYNAMO	3 CORE	RED	B
BATTERY	TWIN	NATURAL	A
LAMP	TWIN	BLACK	C & D
STARTER	SINGLE	—	E

TYPE 'K' SWITCHBOARD

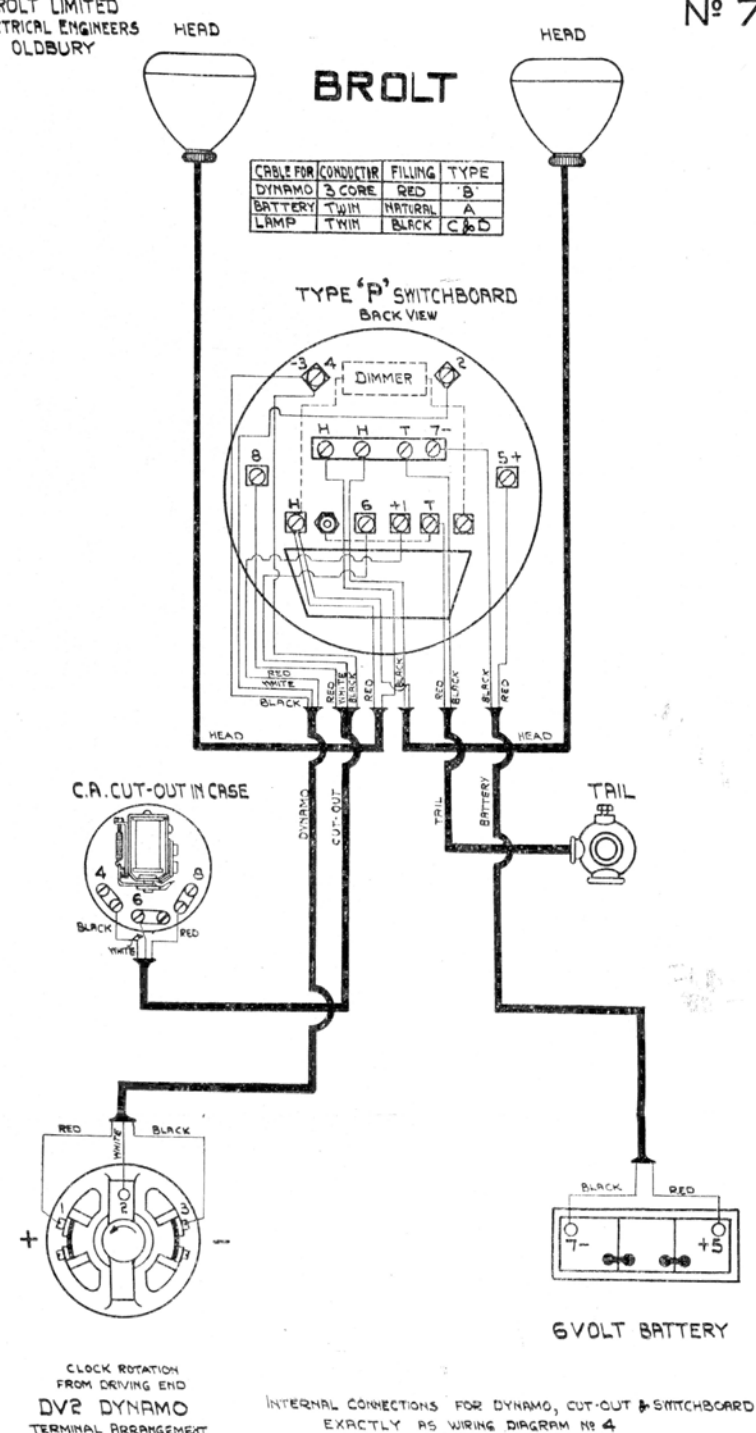
C.A. CUT-OUT IN CASE

6VOLT BATTERY

TERMINAL ARRANGEMENT OF DV2 DYNAMO

ALL INTERNAL CONNECTIONS SHOWN DOTTED.

6VOLT INTERNAL & EXTERNAL WIRING DIAGRAM
FOR DYNAMO TYPE DV2. SWITCHBOARD TYPE 'K'



CABLE FOR	CONDUCTOR	FILLING	TYPE
DYNAMO	3 CORE	RED	B
BATTERY	TWIN	NATURAL	A
LAMP	TWIN	BLACK	C & D

TYPE 'P' SWITCHBOARD
BACK VIEW

C.A. CUT-OUT IN CASE

6VOLT BATTERY

TERMINAL ARRANGEMENT

INTERNAL CONNECTIONS FOR DYNAMO, CUT-OUT & SWITCHBOARD
EXACTLY AS WIRING DIAGRAM Nº 4

6VOLT EXTERNAL WIRING DIAGRAM
FOR SWITCHBOARD TYPE 'P' WITH DIMMER
DYNAMO TYPE DV2