APPENDIX VIII.

IGNITION

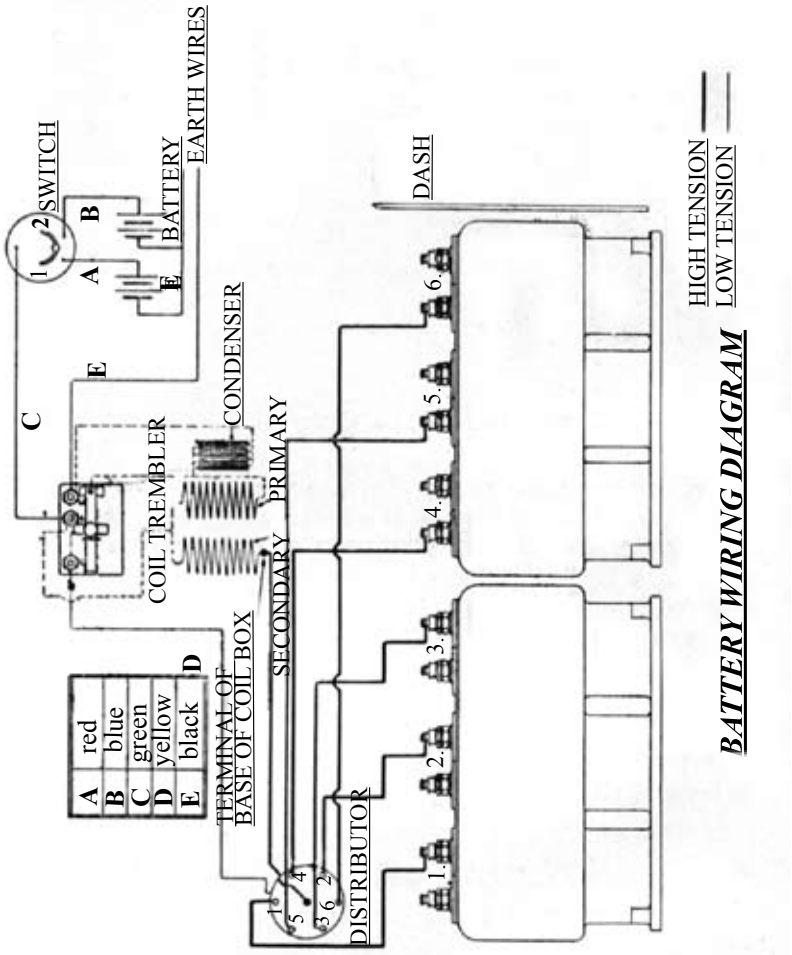

Fig. 68.

The battery ignition is useful for -

1. Starting the engine (when it is preferable to have both switched on)>
2. Slow running in traffic.
3. Re-starting on the switch
4. Investigating when anything is wrong.

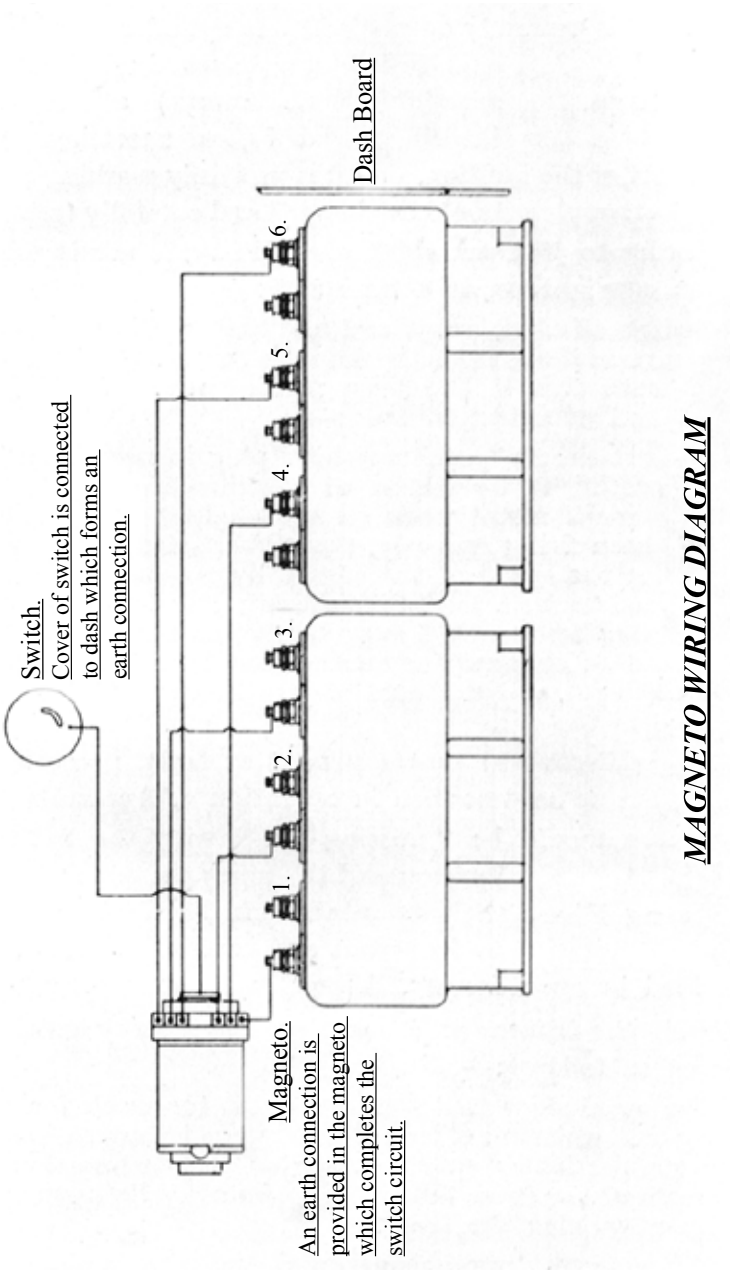

Fig. 69.

Outside these requirements the magneto is the better ignition.

Figs. 68 and 69 show the wiring of the battery and magneto respectively.

Plugs.

The most frequent trouble with ignition is found in the plugs. This generally affects one cylinder at a time. and, therefore, gives bad ignition generally (not always) at regular intevals, and *before* upsetting any other part of the ignition, which is probably working well, the defective plug should be changed and carefully tested.

In order to discover which plug, if any, is missing fire run on one ignition at a time and :-

(a) Switch off the current and feel the sparking plugs to ascertain if one is colder than the others. This would indicate that it had been missing fire. Or, is this method of detection fails : -

(b) "Short circuit " each sparking plug in succession by connecting it by means of a screw driver to some convenient metal work on the engine ; if the plug has been firing properly, this " short circuiting " will reduce the speed of the engine by reason of the additional miss-firing" thus caused ; if it does not, then the plug being tested is probably the faulty one, and should be changed for another one known to be good (and clean), whcich should always be carried in readiness on the car.

Having discovered that a plug is at fault, proceed to examine same as described in operation 2, Appendix II.

Missing Fire.

If there should be " missing-fire " with the battery ignition and the plugs are not at fault' the commutatot aand distributor should be looked ar and carefully cleaned, as described in operation 45, Appendix I (See p. 32.)

Should the failure still continue on the battery ignition, proceed as follows : -

(a) The usual signs that the mixture is too weak for the battery ignition are irregular firing or failure to fire at some particular speed (at which the carburation is weakest). These failures can generally be improved by advancing the ignition.

(b) Examine the terminals at which the wires make contact with the accumulators, and see that the screws are firmly screwed down, and the wires making good contact. Trace the wires through the whole electric system, especially the low-tension (the smaller of the two sets of wires), to see that there are not loose connections or fractures.

(c) Test the accumulators with a voltmeter ; each cell should record not less than two volts. A cell will work as low as 1.8, but they should not be allowed to run lower than 1.9 volts each.

(d) Not until you have gone through the whole of the above tests should the trembler on the coil be touched. If one of the platinum points is deeply pitted, and the other point has asumed the shape of a cone to fit into the pit, proceed as described in operation 15, Appendix II.

If the " missing-fire" is sometimes on all the cylinders and on both ignitions, then it almost certainly a question of carburation (which is treated under the heading of " Carburation ", but should this failurwe take place with the magneto ignition only, the low-tension contact breaker on the magneto should be examined carefully (Fig. 21) to see that the small lever carrying the platinum point is working *freely*, and that the platinum points are in good order and correctly set. The small round cap must of course be slipped off first. The setting is correct when the break is the amount equal to the thickness of the gauge on the special magneto spanner (shown in Fig. 21).

It is good practice to carry a spare contact breaker for the magneto.

If all these are found in good working order, the earth wire, which leads to the switch intended to stop the ignition, should be examined, and can best be tested by disconnecting it entirely from the magneto, stopping the engine when desired by the throttle. If this does not locate the fault, then it ay be something more serious inside the magneto, which should be taken off and returned to the makers.

RE-SETTING THE IGNITION.

Magneto Ignition.

When an engine does not pick up quickly and sweetly from slow speeds, it may be due to the ignition being too early and if bringing the ignition to a late position does not cure it, the magneto, if firing too early should be adjusted relatively later than the engine. The operations for this adjustment are as follows :-

Remove the large nut screwed into the front of the timing wheel case, unscrew the nut on magneto drive shaft inside case about two turns ; the magneto shaft can then be turned by hand the requisite amount. Tighten up the nut again, taking care that the adjustment is not disturbed.

Especial care must be take that the high-tension distributor is making contact with the No. I distributing plate when the No. I (front) piston is in the firing position. Then exact timing can be attained by observing the *exact* moment that the low-tension platinum points break contact, which should be when the mark on the flywheel (corresponding to the crank pin) is 3/8 in. past its central top position.

If it is found necessary at any time to remove the magneto, take care to put it back with the blocks on their respective pins and in their respective slots so that the numbers stamped on them correspond, as there is only one correct relation between the magneto and its driving shaft.

The low-tension contact maker of the battery ignition is very rarely found to be out of order, but is described in operation 13, Appendix II.

Also see that the number of circles cut in the ebonite on each terminal corresponds with the figure marked at each hole.

To remove the magneto, unscrew the front universal joint cover (right-hand thread) with the special spanner provided.

MAGNETO FAILING AT LOW SPEEDS

If the magneto fails to effect proper ignition at slow speeds of the engine, it is probably due to :-

(a) The points on the sparking plugs being too far apart.
(b) The platinum contact on the magneto having burnt itself out of adjustment, and therefore not making contact for the right length of time.
(c) The magnets becoming demagnetised. This might be after three or four years' use. Test with a screw driver.

IGNITION NOTES.

Keep magneto ignition well advanced ; the best position is where the engine seems *most powerful*.

A weak mixture or a throttled down mixture should be ignited earlier than a full charge of the full-strength.

Remember to lubricate the magneto at the various points (see "Lubrication").

Keep wires free from oil.

Wires leading to plugs should not be : bunched," but separated as much as possible.

Dirt and dust should be kept out of the coil box, and the ebonite and fittings should be carefully dusted occasionally (without upsetting the trembler adjustment).

In case of trembler troubles, the "earth" connections should be inspected to see if sound.

To prevent undue " pitting," of the platinum points, the direction of current should be reversed, by changing over the battery terminals, about every 1,000 miles, or each time the accumulators are being fitted after re-charging.

If the magneto will not switch off, see that the carbon button in the removable cover is making good contact with the head of the contact breaker locking screw.

A special descriptive pamphlet dealing with the Bosch Magneto System can be obtained on request.

THE CARE OF ACCUMULATORS.

NOTE.- The following instructions are reproduced with the kind permission of Messrs. Godin.

The accumulators may be dispatched *charged* or *discharged.* To dipatch a *charged* accumultator, the aciudlated water or electrolyte must first be emptied from the accumulator, the india rubber stoppers being first removed in order to effect this. When emptied the accumulator must *at once* be filled with pure water, distilled water in preference. Every care must be taken not to leave the *charged* plates exposed to the ait for more than a few seconds, otherwise they may be injured.

Dispatch of Accumulators

The accumulators when filled with pure water, must then have their vents firmly closed by a tightly fitting cork stopper, and they can then be packed in cases, after surrounding them well with shavings or sawdust.

Never despatch the accumulators when *filled with acid*, owing to the risks of damage in transit, and also for the reason that railway companies frequently refuse to accept accumulators for shipment when charged with acid.

When the distance is great it is advisable to first discharge the accumulator before dispatching. To effect this the two poles must be connected up to two rather thin metallic wires, iron or German silver in preference, and the discharge is then carried out by the interposition of an ampèremeter in the circuit, that is to say, the ampèremeter should be interposed between the two poles of the accumulator, *but through the wires*. The *length* of the wires at which the ampèremeter is interposed should be so varied as to discharge the accumulator at an intensity not greater than the maximum intensity of the charging rate ; for example, if the charging rate is two ampères, the discharge should not exceed two ampères.

The discharge must be forced, *but only in the above-mentioned exceptional case*, until the voltage of each element falls under one volt. When this reading is reached, the liquid (electrolyte) can be emptied from th accumulator, and it can be packed as in the preceding circumstances.

The first charge takes a much longer time than the subsequent charges, and it is best to occupy at least double the length of time ordinarily required for a charge, *as the future good action of the accumulator depends in a great measure on the accuracy of the first charging*.

If one has the necessary time, it is recommended to adopt what is called the *desulphating* of the element.

To secure this, instead of filling with acid solution at 36 degrees Tw., *i.e.,* s.g. 1.176 (22 degrees Baumé), acid solution at about 8 degrees Tw., *i.e*., s.g. 1.034 (5 degrees Baumé), only must be used, and the acumulator charged with a current at the utmost equal to one-third of the intensity indicated as the maximum for the current of charge ; the charge must be prolonged to at least six times the duration of the ordinary charge.

During this operation the strength of the acidulated solution is raised, and one must be careful to maintain it nearly always at about 8 degrees Tw., *i.e*., s.g. 1.034 (5 degrees Baumé) by emptying a portion and replacing with pure distilled water.

The charge being complete, the feeble acid must be removed and replaced at once, without leaving the plates exposed to the air, by some acid solution at 40 degrees Tw., i.e., s.g. 1.200 (24 degrees Baumé).

This treatment is also recommended when the acumulator has been discharged to too great an extent.

In any case, it is essential, at the end of the charge, that the strength of the acid solution is 40 degrees Tw., i.e., s.g. 1.200 (24 degrees Baumé).

Thos e accumulators filled with solidified electrolyte are dispatched after simply emptying the small quantity of liquid which covers the gelatinous mass, the small stoppers being first removed.

Accumulators with Solidified Electrolyte

On receipt of the accumulators it is essential to pour into them a little distilled water (never acidulated water) in order to maintain on the surface of the geatinous mass a depth of liquid of about 1/8 inch, which must be replaced from time to time, when evaporation has deminished the quantity, which occurs principally before or just after charging the accumulators with current.

The actual charging is effected identically as with accumulators having a liquid electrolyte.

It is essential to remark that one must not send or keep in stock an accumulator *empty*, that is to say, without electrolyte or water, unless the elecrticity is completely discharged from the plates.

The accumulator may be recieved either charged or discharged. If it is received *charged*, it has been filled, at the period of its having been despatched, with distilled water.

Treatment on Reception of Accumulators

In this case the accumulators must be unpacked *immediately* ; the cork stoppers must be removed ; the distilled water emptied out ; and its place taken by the proper electrolyte or diluted sulphuric acid, showing 40 degrees Twaddle's hydrometer, s.g. 1.200 (24 degrees Baumé on the scale). Then close the outlets by the ventilated india-rubber stoppers provided.

To prepare the electrolyte or solution of acid, it is necessary to take sulphuric acid made from best Sicilian brimstone, free from contamination of iron or arsenic, and giving a reading of 168 degrees Twaddle's hydrometer, i.e., s.g. 1.815 (66 degrees Baumé), and to pour it slowly into distilled water, stirring meanwhile with a glass rod until a reading of 40 degrees Twaddle's hydrometer, i.e., s.g. 1.200 (24 degrees Baumé) is securd when the mixture is quite cold.

Never put water into the acid, but always the *acid into water*, an do this very slowly, in order to avoid an excessive and dangerous temperature. Allow this solution to cool thoroughly before filling the accumulators with it.

The levels of the electrolye must exceed the height of the plates by at least 1/8 inch.

It is advisable, when one recherges the accumulator, to verify that the acidulated water which fills it marks 40 degrees Tw., i.e., s.g. 1.200 (24 degrees Baumé) at the end of the charge, and if this is not the case, to so regulate the liquid that exactly this degree is secured. In case of too low a degree, never add acid 168 Tw., *i.e.,* s.g. 1.815 (66 degrees Baumé) directly into the accumulator, but drip into it, for instance, a solution of about 53 degrees Tw., i.e., s.g. 1.256 (30 degrees Baumé) after having emptied out part of the liquid until the required degree is arrived at. In case of too high a degree, empty out part of the solution, and replace it by pure distilled water.

If the accumulator is received discharged, it must first be filled with acidulated water at 36 degrees Tw., i.e., s.g. 1.176 (22 degrees Baumé) and charging at once proceeded with. This must be continued until the voltage of the

accumulator marks 2.5 volts per element, the reading to be taken whilst the current is passing though the accumulator.

The charging can be effected with any intensity of cur-rent under the maximum intensity, and must be continued until

Charging of Accumulators.

the voltage of each element attains 2.5 volts, the reading to be taken whilst the current is being passed into the accumulator. An intense generation of gas should take place on the positive paltes (brownish colour) as well as on the negative plates (greish colour), when the voltage reading reaches 2.5 volts per element.

An excessive rate of a\charge is harmful to the plates.

Immediately a fully-charged accumulator is uncoupled from the wire conveying the electricity, its voltage falls to 2.1 volts per element.

Referring to the duration of the charge, it is evident that if the capacity of the accumulator is, for instance, 20 ampère hours, it will be necessary, in order to thoroughly charge it, to pass through it a current of 2 ampères during a minimum of 10 hours, or of I ampère during 20 hours, etc., and as on e must allow for an inevitable loss, the charge ought in reality to last a little longer.

The discharge can be effected with an intensity of current *under* the maximum intensity, and must be stopped when the voltage of each element falls to 1.8 volts, the resding being taken whilst the current is passing through the accumulator.

Discharging below 1.8 volts per element is harmful to the plates.

The discharged elements should be recharged, at the latest, 24 hours after the discharge.

If the accumulator is not to be put to use for some length of time, it should be previously well charged, and then recharged every two months, umtil gas is evolved.

The charging of accumulators can only be effected from a supply circuit or dynamo giving a *continuous* current.

Continuous Current.

Alternative current cannot be used for the charging. By " continuous " is meant flowing in one direction.

When only a few elements have to be charged (2 or 4, for instance), the method of connection consists of interposing in the circuit a certain number of lamps in order to annul the excess of voltage in the supply. The lamps must be 110 volts, if the circuit is at this pressure.

At 110 volts a lamp of 16 candle-power permits the passing of about 0.5 ampère. It is then easy to calculate the number of lamps necessary to be employed in interposition, according to the current requisite to charge the accumulator.

If, for example, the maximum current to be employed in charging is 2 ampères, 4 lamps of 16 candle power must be employed.

As lamps of 32 candle power permit the passing of double the number of ampères passed by 16 candle power lamps, onlt half the number of the first-mentioned lamps need be used.

It is essential to connect the positive pole of the accumulator to the positive wire of the distribution and the negative pole to the negative wire.

To recognise the wires one must employ *pole-finding paper,* or a pole-finder of a standard pattern.

The positive pole of each element of the accumulator is always painted red, and the negative black.

When rather a large number of accumulators have to be charged at one time, it is better to employ a special charging board, fitted with a liquid resistance, permitting the charging up to 40 elements on a circuit of 110 volts.

Charging by means of Primary Cells.

The best type of cells to employ are the bi-chromate batteries.

They are simple to use and very economical when only a few accumulators have to be charged.

To obtain a rapid and complete charge it is necessary to employ : -

Two cells for a single accumulator (I element).

Four cells for a double accumulator (2 elements)

Essential Points.

The voltage of an accumulator must always be measured during the charging or discharging. Never take the reading of an accumulator when at rest after a partial discharge. Always take the reading whilst discharging. As a fact, a partially-discharged accumu-ltaor will slowly recuperate whilst at rest, but immediately the discharging again takes place, the voltage reading falls rapidly.

To verify the capacity of the charge of the accumulator , the *voltmeter must be used exclusively.*

Never use the ampèremeter connected directly to the poles of the accumulator.

Never connect the two discharging poles to an accumulator *directly by a piece of metal or wire,* and never, under any circumstances, connect up one pole to a piece of metal or wire and bring this in close sontact with the other pole so that sparks are produced. This is, in effect, short-circuiting the accumulator and if persisted in will cause the plates to buckle, and so destroy the efficiency of the accumulator. The production of sprks indicates nothing and causes the rapid discharge of the accumulator, besides ultimately rendering it useless

After the completion of a charge or of refilling, the containing vessels should be washed with a piece of flannel and water to remove all clinging or sprayed acid off the cases and terminals. The terminals should be coated with vaseline to prevent them corroding.

ELECTRIC TAIL LAMP.

If an electric tail lamp is fitted, it is preferable to have a separate accumulator.

The following table shows the current consumption and life of each charge for battery ignition and tail lamp :_

		Current Consumption	List of Charges
Separate Accumulators	Battery Ignition	·6 ampère	100 hours
	Tail Lamp	·8 ampère	75 hours
One Accumulator	" Combined	1·4 ampères	43 hours