

of an electric current is measured by the strength of the influence it exerts on a magnet in its neighbourhood. The resistance, due to friction, to a flow of water in a pipe, is proportional to the size and length of the pipe.

The resistance in conductors depends on their cross section or size and their length. A small wire offers greater resistance than a large, and a long one than a short.

To apply these data:—An accumulator contains positive and negative plates with a conducting medium of dilute sulphuric acid between them; all the positive plates are electrically connected to the positive terminal; the potential or pressure here is higher by 4 volts or so (in the ordinary accumulator) than that at the negative terminal which is connected with all the negative plates; given a conductor connecting the two terminals, a current will flow from the positive to the negative terminal.

In the ordinary ignition outfit this conductor is represented by a wire from the battery to a coil of fairly thick wire wound round a bundle of iron wires (the end of this bundle can be seen under the trembler blade); a wire from this coil (known as the primary winding) to the trembler and platinum points thereon, a wire turn from the trembler through the other terminal of the coil to the blade of the contact maker, which we will suppose to be in contact with the metal section of the rotating part of the contact maker—the metal section being in electrical contact with the two to one shaft—the engine then becomes part of the circuit, and also the earth wire attached to some part of the engine. The earth wire being connected to the switch puts that in the circuit, and also the wire from the switch to the negative terminal of the battery, supposing the switch to be "on." This primary circuit carries a current of half to one ampere at a low pressure of 4 volts. Now 4 volts is not sufficient pressure to overcome much resistance in the way of imperfect contacts in the primary circuit, *i.e.*, the contact must be perfect if four volts is to make the current intense enough, *i.e.*, the amperage high enough, to get the maximum effect in the primary winding and its iron core. Supposing one contact is defective, four volts may not be enough to push more than '1 ampere through the primary winding; result feeble effect, feeble action of trembler blade and consequently a feeble spark without sufficient heat to ignite the compressed charge promptly. In this low pressure primary circuit there are ten contacts requiring attention, excluding those inside the coil case, which generally leaves the factory in good order. The positive terminal of the battery; bright metal surfaces in intimate contact required here; sulphate of copper etc., due to creeping of the acid and corroding effect thereof must be got rid of entirely; the terminal wiped over with weak ammonia solution, thoroughly dried and painted with anti sulphuric enamel or sealing wax dissolved in warm spirit with a little linseed oil added to prevent the enamel being too brittle. The positive terminal of the coil will not give trouble if clean and screwed up tight. The platinum studs in the trembler must be in a correct position and in contact across the full width. Any unevenness or slight projection concentrates the spark at "break" on that point causing disintegration of the platinum, which, by the way, should be platinum, and not an alloy.

The other coil terminal and that on the contact maker require but ordinary attention.

The wipe contact should be kept in particularly good order to ensure thorough and instant contact. It sometimes happens that

such contact is not obtained until the brush has travelled an appreciable distance on the metallic segment, the poor contact up to this point allowing a feeble current to flow through the coil producing an abortive spark and ineffective ignition of the mixture round the spark gap; this must anticipate and spoil the effect of the fat hot spark that follows.

The hard steel brushes wear concave after a time, and the contact surface becomes covered with pin point erosions which retain dirt; it must be ground down to the correct shape again and quite true so that it will make a good contact right across the metal segment. The rotating fibre disc and segment require truing up so that the fibre and metal edges are flush.

The necessity for lubrication and occasional cleaning with petrol is obvious.

The next point of contact is the bearing of the two to one shaft; this at high speed and running in heavy oil sometimes offers undue resistance to the current; a small spring brush pressing on the end of the shaft, and efficiently earthed to the engine, gets over this difficulty and will often make a great difference to the spark.

The next point is the earth wire connection. This is often hidden away in a remote corner far from the engine; rust, dirt, and a loose nut spoil it electrically often enough. Make it fast in an accessible position, and as near the contact breaker as practicable. In one instance where the earth connection was removed from the top of the cylinder to a nut by the inlet valve close to the contact maker, a marked and unexpected improvement resulted.

The connections in the switch depend on very small screws sometimes. These require tender handling and yet must be well home and tight. The contact surfaces generally keep bright from use. The negative terminal of the accumulator requires ordinary attention; it is not nearly so likely to corrode as the positive. When a battery terminal gets locked tight by corrosion, heat it slightly with a blowpipe, avoiding the celluloid carefully. This will loosen it at once and avoid injury to the lug through violent attempts at unscrewing.

In dealing with the secondary circuit, the entirely different conditions must be taken into consideration.

The current is at a very high tension, somewhere about 15,000 volts and 3 to 5 milliamperes (3/1000 to 5/1000 of an ampere) intensity. The difficulty is not to get the current to its point of utilisation, the spark gap in the plug, but to keep it on the right track. High tension currents will escape or leak away in every direction, if the insulation is not ample and free from the slightest defect. The secondary winding of the coil is carried out in such a way that the tension in any two turns of the wire close to one another is not very different, and the whole is embedded in hard paraffin, an excellent insulator. The insulation in the coil rarely fails, unless overstrained by excessive voltage and amperage in the primary winding, and air gap of half an inch or more in the external sparking plug circuit.

The high tension terminal is generally mounted on ebonite which provides sufficient insulation when quite dry on the surface and not too old. A very slight film of moisture on it and the coil box, will conduct the secondary current away.

The high tension leading to the plug should be heavily insulated with the best rubber, and this again sheathed in oil resisting material. All hydrocarbons, of which petrol and gas engine oil are two, will destroy the insulating

properties of rubber in time. The plug insulation consists of either mica or porcelain. The former is not impervious to oil at the high temperature attained in explosion engines. The oil having soaked in becomes gradually carbonised, and affords a path to a high tension current. Porcelain tends to crack when exposed to sudden changes of temperature, and a crack affords lodgment to carbonised oil with the same result as above.

It is as well to remind motorists who are still in their novitiate that the primary and secondary circuits are entirely separate, though one wire from the coil does serve as a path for both currents. The two circuits are in very close proximity in the body of the coil, and it is here that a low tension current of some magnitude is transformed into a high tension current of exceedingly small magnitude, by virtue of the laws of induction, which are somewhat difficult to understand and not of much practical importance to the motorist.

The condenser requires brief notice; it conserves the energy of the coil, prolongs the life of the platinum points in the trembler, and increases the energy and intensity of the spark very materially: experiments have demonstrated that a condenser will increase the length of the spark 100% more or less. The condenser is subject to two defects principally: accidental disconnection from the primary circuit, and piercing of the sheets of insulation which enter into its construction, due to electrical over-strain. The former defect is not difficult to remedy; the latter necessitates reconstruction.

The Firmness of the Mild Hindoo.

The Government of Bombay three months ago published their new rules relating to motor traffic. According to these, all cars must be registered and carry large numbers. There is a general clause against reckless driving. No general speed limit is fixed, but in the city of Bombay speed must not exceed fifteen miles an hour, and in roadside villages, within such limits as may be indicated on a notice board erected by the District Magistrate, shall not exceed six miles an hour or such higher rate as may be shown on the board. Heavy vehicles are not to be driven at greater speed than seven miles an hour. There is a provision that acetylene lamps must not be used unless hooded or screened. No competition in which more than five cars take part is permitted without previous sanction of the Government. Special regulations are made for heavy traffic. No motor shall proceed at night where prohibited by the District Magistrate, except in the case of a delay by accident, when a full explanation shall be made at the next police station.

The Eternal Tyre.

We have heard some tall stories about tyres wearing for inordinately long periods, but we do not remember hearing one that can touch the following, which, it is scarcely necessary to explain is taken from an American paper: "Here is a case where good tyres and a good car went together, to the great joy of their fortunate possessor, O. E. Shepard, of Campbell, Cal. A Diamond tyre on a Rambler touring car, driven by Mr. Shepard, has run a total of 25,500 miles without a puncture and without even having been off the rim. The tread is much worn, but aside from this, is said to be in excellent condition. The period covered by its service is about two years."