

ELECTRICAL INSTRUMENTS.*

CURRENT INDICATOR OR AMPERE METER.—This apparatus is to indicate the current strength at all times. It should be put up in each case where a constant current strength is required as in arc light circuits or in the series multiple system of incandescent lighting.

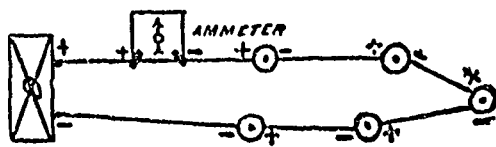


FIG. 1.

The instrument must be connected in series with the arc lamps or with the groups of incandescent lamps in the series multiple system. It is also used in the multiple arc or multiple series system and is always put in one outgoing wire of the dynamo, Fig. 1.

PRESSURE OR POTENTIAL INDICATOR, OR VOLTMETER.—This instrument is absolutely necessary on dynamos which must

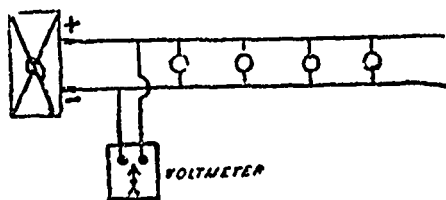


FIG. 2.

be kept at a constant e. m. f., as in the multiple arc or multiple series system of incandescent lighting. The instrument is connected in parallel with the lamps, as shown in Fig. 2.

CURRENT REGULATOR.—This instrument, also called rheostat or resistance box, consists of a box which contains wire or some other resistance and which can be switched in or out of the electric circuit by means of a crank. If this is to be done by hand, the instrument is called a hand regulator; if done automatically it is called an automatic regulator.

The regulator for series dynamos is connected anywhere in the circuit, the whole current generated by the dynamo passing through it. By putting more or less resistance in the circuit, the current flowing through the other parts of the circuit can be strengthened or weakened. In shunt dynamos the regulator is put in the shunt winding of the field. Putting in or taking out the resistance decreases or increases the strength of the field

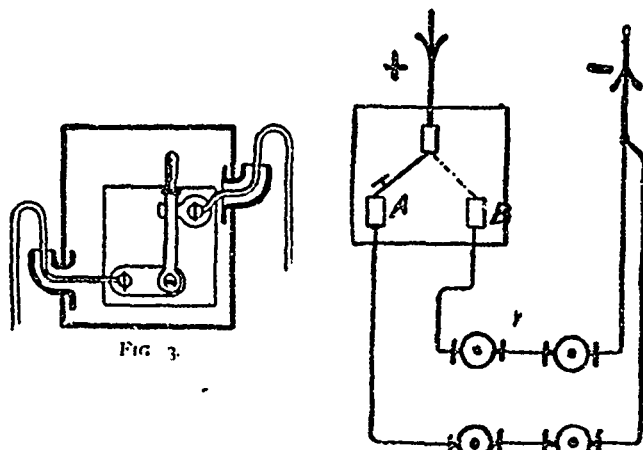


FIG. 3.

magnets and thus controls the current generated in the armature. In some arc light dynamos the regulation of the current is effected by putting more or less resistance in shunt with the field circuit, and in others by automatic devices for shifting the brushes. The movement of the latter towards the neutral point will decrease the current, while moving it toward the maximum point will increase the current strength.

SWITCHES.—A switch is an instrument to break or make circuit, or, in other words, to cut off the current in certain places for a number of lamps or cut them in again. The switches should be constructed so that they will open and close very quickly and not show very much sparking. [See Fig. 3.] This is accomplished by having the switch so arranged that the human hand will start it, while a powerful spring throws the

switch open or closes it immediately. The contact should be sufficient to prevent any heating at these points.

Two-way switches are used in various ways; for instance, for two different sets of lamps. If one set of lamps is not required, the handle, as shown in Fig. 4, is moved from *A* to *B* and the lamps marked *X* will go out, while those marked *Y* will be started.

SAFETY DEVICES.—Strips of an alloy which fuses at a low temperature are used as safety devices, or plugs, in incandescent wiring. The cross-section of the plug must be of such size that it will melt before the wire it protects gets dangerously warm. Hence the diameter of the safety plug depends upon the cross-section of the wire to be protected and not upon the number of the lamps. The safety plug is not supposed to protect incandescent lamps from an excess of current, but to protect the building from fire by preventing any part of the electric light conductors from getting too hot. The marking of safety plugs with the number of lamps they can carry has misled many an employe of an electric light company to think that the plugs are put in for the protection of a certain number of lamps. The

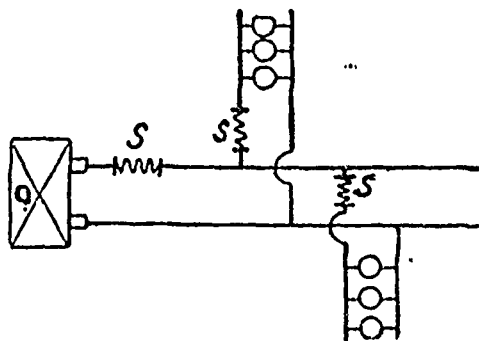


FIG. 5.

marking of the plugs simply expresses their carrying capacity in 16 candle power lamps instead of in amperes. See Fig. 5, in which safety plugs are marked *S*.

The blowing out of safety plugs is very often caused, not by an excess of current, but by poor contact between safety plug and safety plug holder. A poor contact, of course, will generate heat, which will gradually fuse the metal on one end.

LIGHTNING ARRESTERS.—Where electric light lines are put up outside of buildings, they are liable to be struck by lightning. To meet such a contingency, the dynamo and station apparatus are protected by a lightning arrester (fig. 6): *D* represents the dynamo; *A* and *B* are brass plates, through which the two outgoing wires pass, and *C* is a brass plate connecting to moist earth. The space between the toothed sides of *A* and *B* and the centre plate *C* is adjusted to the thickness of a piece of cardboard. If lightning should come in on one of the wires, it would leap over this narrow space and run into the ground without doing any serious mischief. Such an arrester will keep the lines discharged, and very often during a thunder storm the atmospheric electricity will continuously leap across these plates in the form of blue sparks. These discharges may sometimes cause the centre plate to fuse to one or even both toothed plates. In the latter case, the current of the dynamo may follow the arcs which are simultaneously set up between *A*, *C* and *B*, *C*. If the centre plate should be fused to both toothed plates the dynamo would be short-circuited through *A*, *C*, *B*, and the belt would be thrown off or the armature, and possibly some of the instruments in the circuit, might be burned.

In order to prevent such an accident, numerous devices have been designed to operate in connection with the lightning arrester. They may be classified as follows.

First, Safety fuses inserted between the dynamo and the strips *A* and *B*. They will fuse when the dynamo is short-circuited, break the current and thus save the armature.

Secondly, Electro-magnets which are energized when the dynamo is short-circuited and open the circuit.

Thirdly, Devices which will extinguish any electric arc that might be formed between *C* and *A* or *C* and *B*. Such devices are based on the principle that a magnet will attract the electric arc and pull it away from the plates *A* and *C* or *B* and *C*.

Whatever devices are used, one important point should not be overlooked. This is the absolute necessity of a good earth contact. The wire leading from *C* to earth should be at least a

* From "Dynamo Tenders' Hand-Book."