## NEW FORM OF LIQUID RHEOSTAT FOR STARTING ELECTRIC MOTORS.

BY OUR BELGIAN CORRESPONDENT.

When circuits into which artificial resistances are introduced are traversed by heavy currents, coarse resistance wires, straight or coiled, and stretched upon insulators in the open air, ordinarily are employed. But it is possible, also, to use a solution of a metallic salt in which are immersed plates of the same metal as that of the dissolved salt. The resistance of the bath is modified at will by varying the distance apart of the plates. When it is unnecessary to pay any attention to the electromotive force of polarization, wrought iron electrodes and a solution of carbonate of soda are employed.

The use of liquid resistances offers certain advantages. The superheating that not only damages metallic resistances, but, under certain circumstances, constitutes a danger, cannot occur when liquid resistances are employed. Moreover, the putting of metallic resistances out of circuit, which is usually effected by a switch moving over a series of contacts, destroys the contacts and necessitates expensive repairs. Liquid resistances are, therefore, superior to the others, and they would certainly have been more widely used were it not for certain disadvantages inherent in them. These may be summed up as follows: (1) the creeping of the salts of the liquid, and, consequently, a diminution in the insulation of the apparatus; (2) evaporation, which ruins the terminals, the contacts, and the conductors of the resistance box; (3) the adherence of the oil and air valves; (4) the absence of "overload" and "no voltage" releases (maximum and minimum).

A new rheostat, designed to remedy these inconveniences, has been invented by Mr. Woolliscroft and has been put on the market by the Sandycroft Foundry Co., Limited, of Chester, England. It consists of a cast-iron drum, hermetically closed and filled half full of a solution of soda and water. The drum is provided externally with contacts and terminals, and internally with electrodes. In Fig. 1, on the left, is shown the friction contact segment insulated from the drum, and just beneath the "no resistance" contact, or the one with which the resistance is all cut out. The distance that separates them is such that it can be completely bridged by the forked current collector, which is seen mounted on top of one of the supporting posts of the drum.

The drum is mounted on two of these insulated posts, and has on its side a hole for filling it with liquid. The hole is closed by a screw plug containing a small hole that acts as a safety valve and gives vent to the gases engendered by electrolysis. Since this aperture is never submerged, no losses of liquid can occur.

A minimum release magnet (see Fig. 1 on the right), connected with the shunt winding of the motor, is mounted, together with a handle, on a lever that revolves upon the same axis as the drum. When this magnet is energized, if the handle is placed in a horizontal position, a catch on the armature of the magnet engages with another on the side of the drum. Then, as the handle is raised, the drum, being locked to it, moves along with it. The effect of this movement is to plunge the two electrodes attached to the drum into the liquid. The more they are submerged, the less the resistance in the circuit becomes, until the drum finally reaches the end of its travel, and the resistance is all cut out by means of the special contact already mentioned.

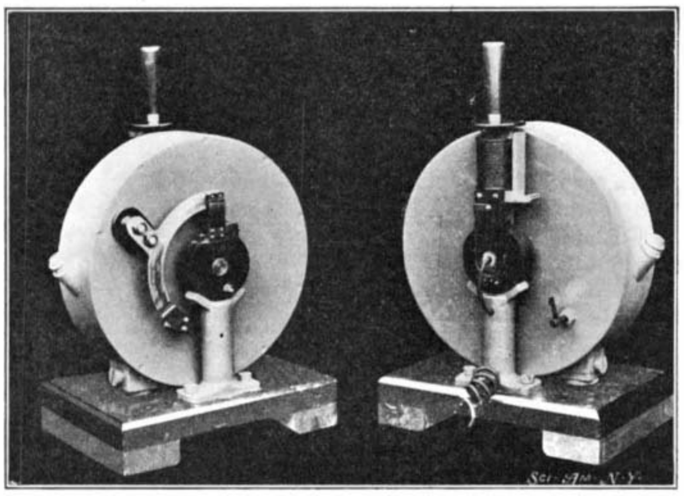

Fig. 1.—New Type of Electric-Motor-Starting Rheostat with Automatic "No Voltage" and Overload Releases.

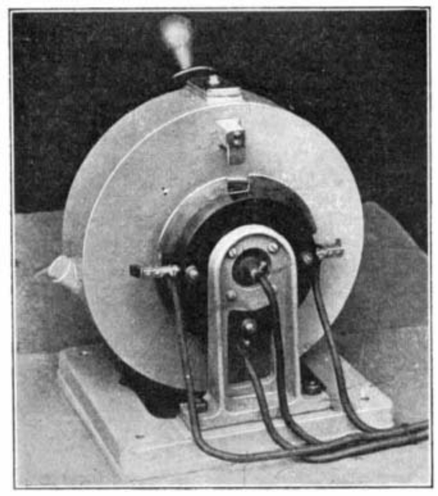

Fig. 2.—Reversing Switch for 5-Horse-power Electric Motor.

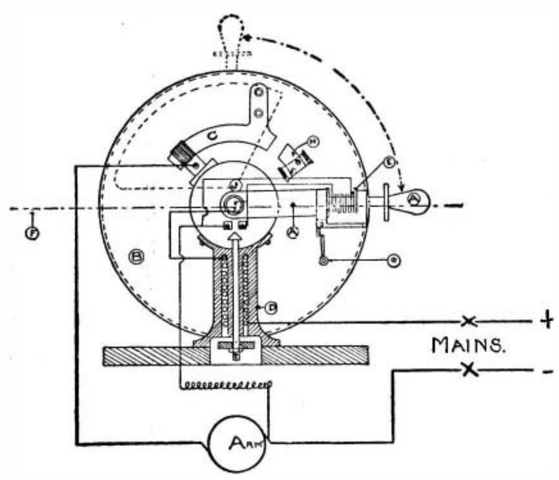


Fig. 3.—Diagram Showing Circuits of "No Voltage" and Overload Release Magnets.

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A "maximum" release magnet is contained in one of the cast-iron supports. This release magnet, in case the current that is passing should be excessive during the operation of starting or during the running, short-circuits the minimum release magnet, causing it to let go the drum, which immediately returns, by gravity, since it is suitably weighted, to the position of interruption.

The diagram, Fig. 3, shows the electrical connections clearly. The current, entering from the mains, passes through the heavy wire of the overload magnet in the supporting post of the drum, and then in through the axis to one resistance plate of the drum. The other resistance plate is connected with the insulated segment on the outside, and the current passes from this segment through the collecting forked contact and back to the mains, thus completing the circuit. The connections of the "no voltage," or underload, magnet are indicated in lighter lines, running from the shunt coil around the magnet and back to the wire in the axis of the drum, which connects with the other side of the armature and shunt coil, as above stated. When an overload occurs, the armature of the large magnet rises, and the plunger on its upper end completes the circuit through the two points shown, which, being a path of less resistance for the current, is taken by the latter in preference to that through the magnet, thus causing the latter to release its armature.

The same company is also constructing a special type of reversing switch based upon the same principle. Fig. 2 shows one for 5 horse-power. It is particularly adapted for elevators, cranes, etc., in which motors requiring a reversal of the current are employed. The house also adapts the system to use with polyphase currents, for which it is particularly well fitted.

The advantages claimed for the system are the following: Simplicity of construction, absolute efficiency in its operation, and absence of sparks. The motor cannot be set in operation too rapidly and may be stopped either through a bipolar apparatus or a liquid resistance. There is no limit of maximum time for the starting, and it is impossible for the resistance to burn. A motor may be stopped at any moment by pressing a button. The apparatus requires scarcely any attention. By varying the density of the solution, the resistances may be adapted to voltages of as high as 700. The apparatus can be easily carried without loss of liquid, and is always ready for operation.

The reduction of fire risks makes these apparatus recommendable for mines, flour mills, powder mills, oil manufactories, and, in general, for all industrial exploitations in which risks are run from the presence of inflammable materials, dust, or gas.

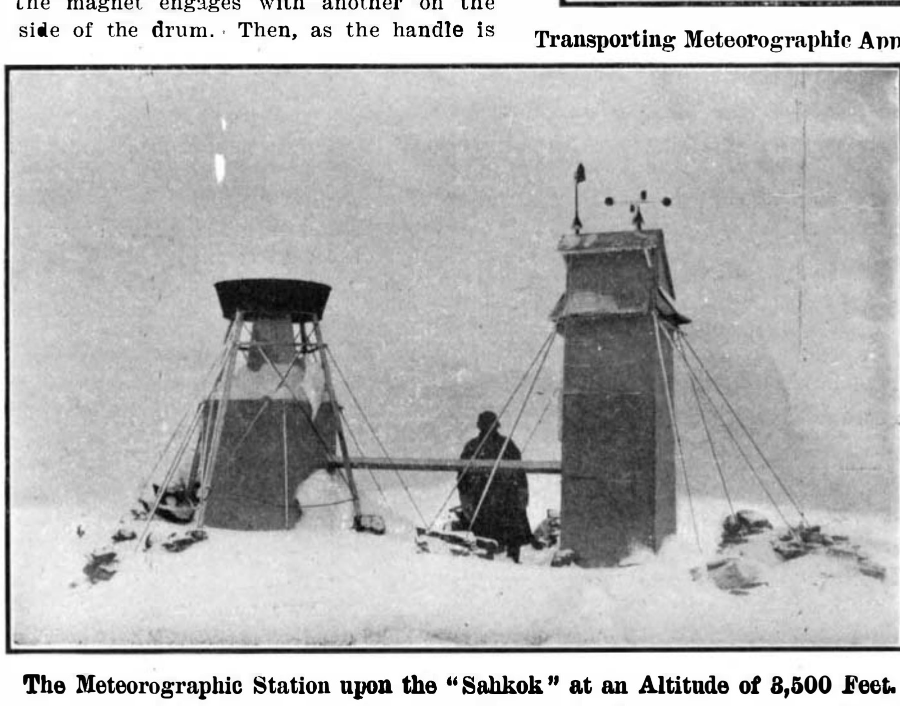
These resistances, moreover, have already been widely sold and, in every case, have given entire satisfaction. In many cases in which metallic resistances had not proved a success, as a consequence of the difficult conditions in which they had to operate, this system has surmounted all difficulties.—Translated for the SCIENTIFIC AMERICAN.

Transporting Meteorographic Apparatus up the Slopes of the Portitjokko.

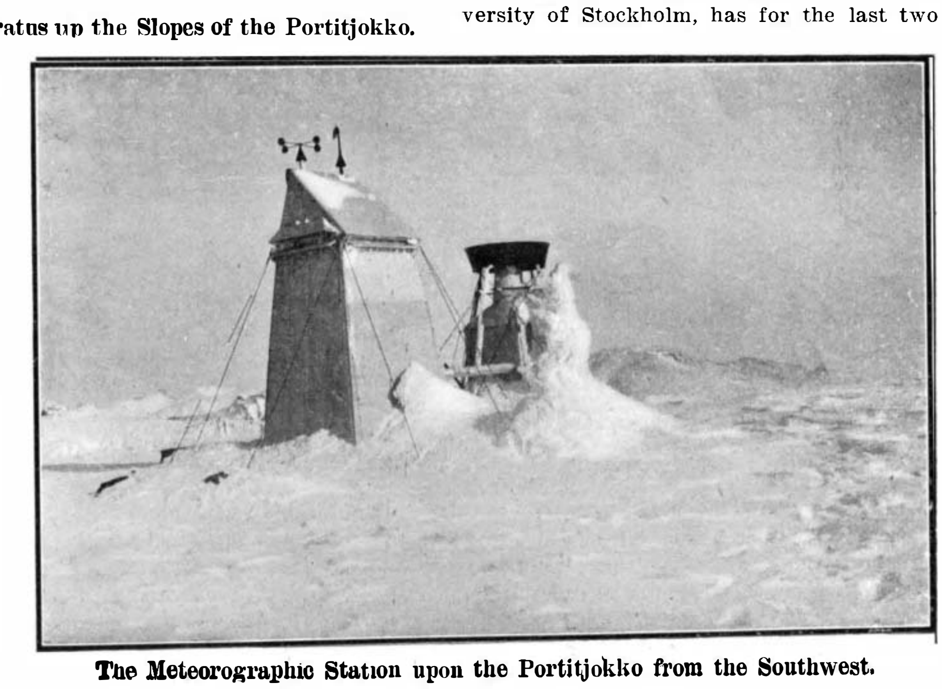
## THE REGISTRATION OF METEOROLOGICAL PHENOMENA IN LAPLAND.

BY EMILE GUARINI.

M. Axel Hamberg, instructor at the University of Stockholm, has for the last two



The Meteorographic Station upon the "Sahkok" at an Altitude of 3,500 Feet.



The Meteorographic Station upon the Portitjokko from the Southwest.

THE REGISTRATION OF METEOROLOGICAL PHENOMENA IN LAPLAND.