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.

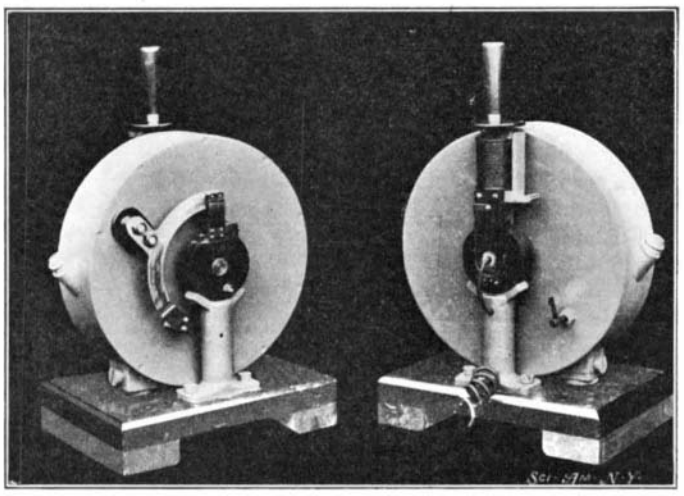


Fig. 1.—New Type of Electric-Motor-Starting Rheostat with Automatic "No Voltage" and Overload Releases.

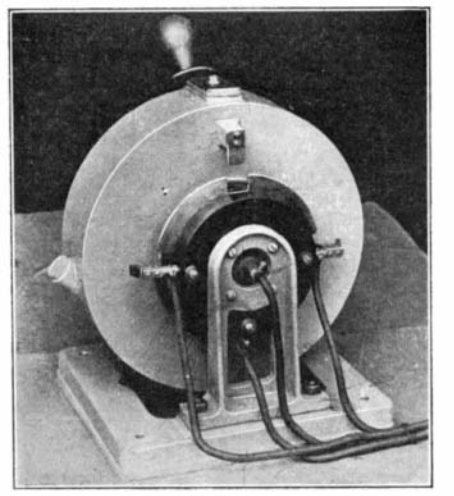


Fig. 2.—Reversing Switch for 5-Horse-power Electric Motor.

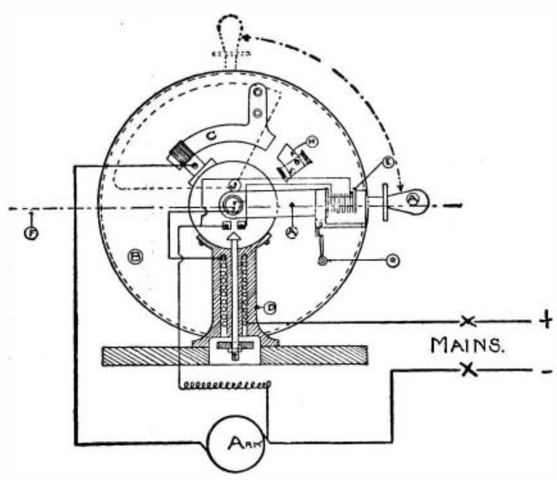


Fig. 3.—Diagram Showing Circuits of "No Voltage" and Overload Release Magnets.

LIQUID RHEOSTAT FOR STARTING ELECTRIC MOTORS.

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.

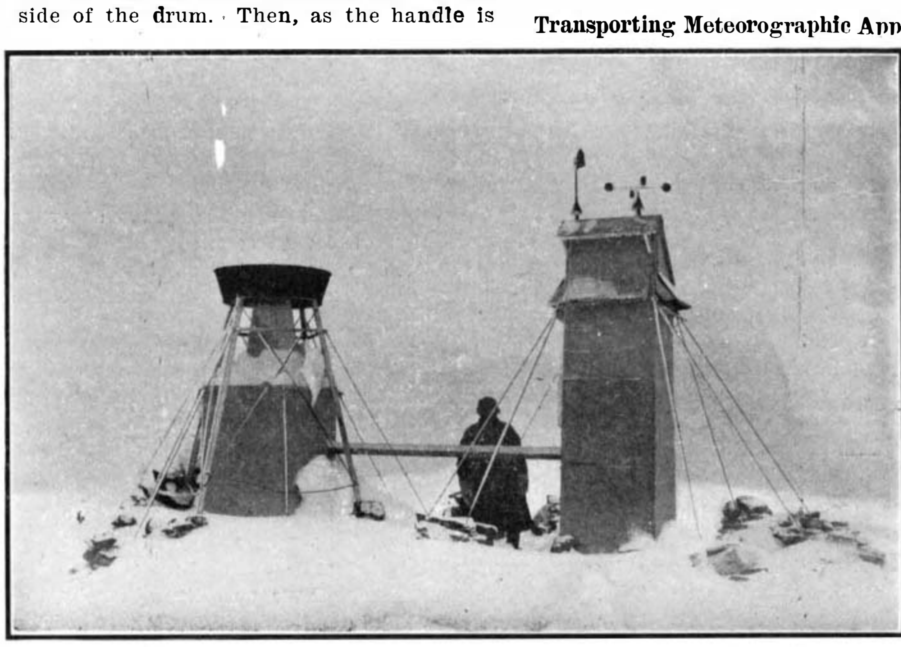
These resistances, moreover, have already been widely sold and, in every case, have given entire satisfaction. In many cases in which metallic resistances had not proved a success, as a consequence of the difficult conditions in which they had to operate, this system has surmounted all difficulties.—Translated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

Transporting Meteorographic Apparatus up the Slopes of the Portitjokko.

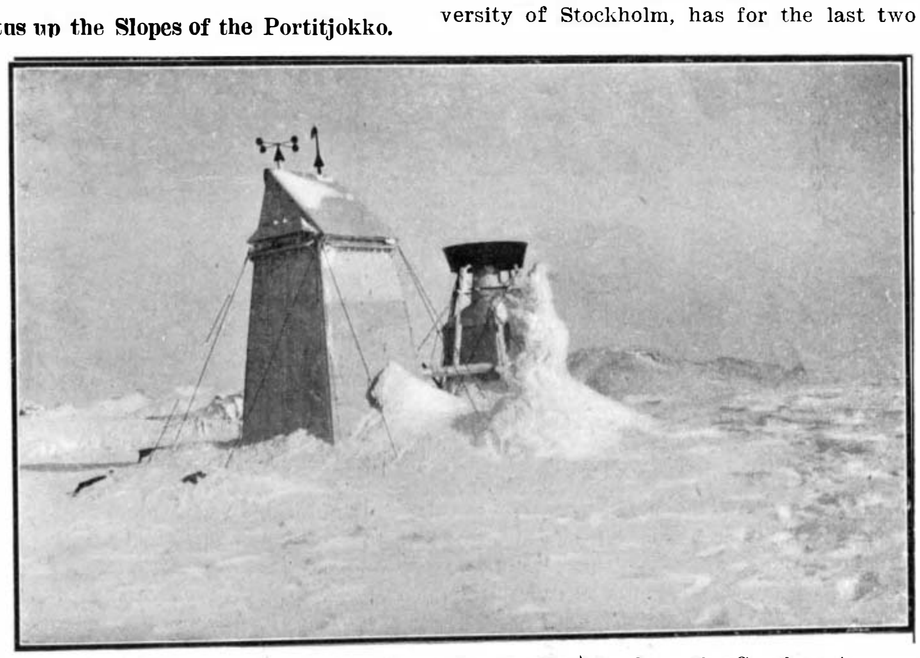
THE REGISTRATION OF METEOROLOGICAL PHENOMENA IN LAPLAND.

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 5,500 Feet.



The Meteorographic Station upon the Portitjokko from the Southwest.

THE REGISTRATION OF METEOROLOGICAL PHENOMENA IN LAPLAND.

years been engaged in establishing upon the Alps of Swedish Lapland an automatic meteorological observatory something like the one installed with so little success upon the summit of Mont Blanc by M. Janssen of the Institute of France.

Up to the present, two stations have been established, one upon Sähkok Mountain at about 3,500 feet above the level of the sea, and the other upon the Portitjokko at an altitude of 6,560 feet.

The first apparatus stopped for the first time after running for a month, and had to be taken to Stockholm for reconstruction. Each apparatus is calculated for an uninterrupted operation of one year, and weighs about 2,200 pounds. In order to facilitate carriage, the instruments are constructed in parts that can be transported by reindeer. The weights of the clockwork movement weigh 660 pounds, and are divided into parts, each weighing 35 pounds.

The second experiment gave good results. The registration is obtained by means of a bar, which, three times an hour, falls across needles and produces in the paper perforations corresponding to each of them. The great difficulty to be surmounted is the hoar frost. The Portitjokko station, for example, was, after a few months, completely surrounded by a stratum of frost of at least three feet in thickness, and the apparatus very naturally ceased to operate. The instruments were then taken down to 500 feet from the summit, but, even at this altitude, the formation of frost interfered with their operation, especially in autumn. It is then almost impossible to prevent interruptions in the registration of the velocity and direction of the wind. In order to obviate this inconvenience, M. Hamberg has the summit apparatus cleaned from time to time by a Laplander, and after this the running proceeds uninterruptedly till the succeeding autumn.

Not only the frost, but the fine snow, also, which it is very difficult to exclude, causes serious trouble. On the other hand, in order to assure the proper operation of the apparatus, the air that surrounds them in the hut must be kept as dry as possible, else the paper will wrinkle and the pieces of iron will rust, and, at every variation of temperature, the frost will deposit upon the clockwork movement and stop it.

In order to dry the air to as great a degree as possible, it became necessary to place paper cylinders around the clockwork movement, and, around the registering apparatus, an iron plate casing containing cups filled with chloride of calcium. It was owing only to such precautions that the running of the apparatus became uniform during the entire winter. The apparatus installed at 3,500 feet altitude has operated almost continuously for two summers, and the second, placed at 6,000, has operated equally as well. The anemometer and the weather vane, however, have sometimes been stopped by the autumnal frost.

The winding up of the clockwork and the changing of the paper bands of the registering apparatus are effected but once a year. The registration during the year requires the use of 65 feet of paper. The weight that actuates the clockwork movement descends but 60 inches a year. This movement was constructed by M. G. W. Linderoth, a Swedish horologist.

A complete station comprises two huts, one containing the paper-cylinders, the clockwork, and the registering apparatus, and the other the rain and snow registering apparatus. This latter is suspended from spiral springs in a large cask. When there is a fall of rain or snow, the cask descends according to the greater or less quantity of material that it receives, and thus causes the registration. The huts are constructed of wood and iron plate.

The problem of the meteorography of high altitudes is therefore solved, or at least will be ere long. From now on the curves obtained will probably teach us much upon this subject, for it is to be anticipated that M. Hamberg's experiment will not remain isolated, and that analogous observatories will be installed at numerous points of the globe. Perhaps it will even be possible to resume M. Janssen's experiment upon Mont Blanc.

Death of Gen. Di Cesnola.

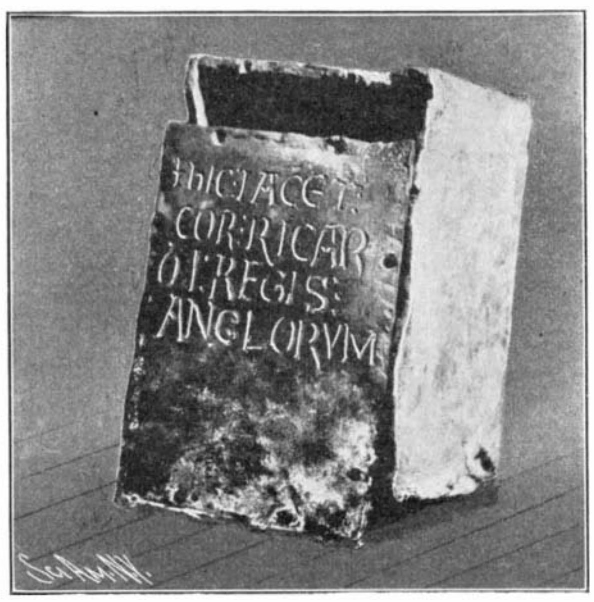
Gen. Luigi Palma di Cesnola, soldier, archæologist, director of the Metropolitan Museum of Art, died November 22, 1904. General di Cesnola's career was picturesque. Born in 1832, in Piedmont, Italy, he entered the army at the age of seventeen, served through the Italian war against Austria, and was decorated on the field of battle for bravery. Later he went through the entire Crimean war and was present at the fall of Sebastopol. His fighting career did not end there. He came to this country in 1860, taught languages for a while, and entered the United States service as an instructor in tactics and cavalry drill. When the civil war broke out he raised a company and fought in many important battles. He was captured by the Confederates and spent nine months in Libby Prison. At the close of the war President Lincoln promised him a promotion to the grade of brigadier-general. Although the President's untimely death prevented him from carrying out this promise, Di Cesnola always was known as a general.

It was as consul to Larnica, Cyprus, to which post he had been appointed by Lincoln, that Gen. Di Cesnola began his famous archæological investigations. For twelve years he thoroughly explored Cyprus, made excavations in which he gathered thousands of relics, which he afterward catalogued and described in his book "Cyprus: Its Ancient Cities, Tombs and Temples." This Cyprus collection may be regarded as the nucleus of the present Metropolitan Museum of Art. Gen. Di Cesnola became a trustee of the museum in 1877 and was later made its director. The museum as we know it to-day may be regarded as a monument to his energy, enterprise, and rare executive skill. In his death the museum has lost a director whose place it will be very difficult to fill.

AN INTERESTING RELIC.

In the splendid cathedral church of Rouen is a suite of three or four rooms containing what is known as the "Trèsor." This is a collection of very valuable and interesting relics, forming quite a little museum, to which admission may be obtained for the modest fee of 25 centimes. To an Anglo-Saxon quite the most interesting article in the collection is the plain leaden casket in which was buried the heart of the famous King Richard Cœur-de-Lion, who, it will be remembered, was slain by a bolt from the crossbow of Bertrand de Gourdon at the siege of the castle of Chaluz. His body was buried at the feet of his father at Fontrevault near Tours, but his heart was incased in two leaden caskets and buried in the cathedral of Rouen, "the faithful city."

The exact place of its burial seems to have been forgotten, but it was re-discovered in 1840, placed in a new receptacle, and reburied in the choir. The old leaden cases, the outer one of which was in a most dilapidated



THE CASKET THAT CONTAINED THE HEART OF RICHARD COEUR-DE-LION.

condition, were placed in the "Trèsor," with the following inscription:

CERCUEIL
ET
BOITE DE PLOMB
OU FÛT RENFERMÉ
LORS DE SA SEPULTURE EN 1199
LA CŒUR DE
RICHARD CŒUR-DE-LION.
TROUVÉS EN 1840
DANS LE SANCTUAIRE DE LA CATHEDRAL
DE ROUEN.

The inner case is in comparatively good condition, the inscription being perfectly legible after all these hundreds of years. The Latin is somewhat peculiar, and it is curious to find that at a period when the art of working in metals was at an advanced stage, the engraver of the inscription on the coffer which was to contain the heart of such a high and mighty potentate did not take the trouble to ascertain what space he required for the king's name, so that he had to carry over the terminal letter to the next line. It is noteworthy, too, that Richard is styled "Regis Anglorum," "King of the English"—not of "England"—while no reference at all is made to Normandy or Aquitaine. The box is about a foot long, eight inches wide, and five deep.

The Current Supplement.

The current SUPPLEMENT, No. 1509, opens with an excellently illustrated article by the St. Louis correspondent of the SCIENTIFIC AMERICAN, in which some interesting models at the Fair are described. One of the finest of these shows the methods of anthracite coal mining as carried out in the State of Pennsylvania. Another represents naval warfare on a mimic scale. Mr. A. A. Campbell Swinton recently read before the British Association an instructive paper on the development of electricity from water power. The paper is published in the current SUPPLEMENT. The SUPPLEMENT will hereafter publish every two weeks an article by Prof. N. Monroe Hopkins on experimental electro-chemistry. When completed the series will constitute a splendid student's manual. The articles are noteworthy for their practical character, the many clear drawings of easily-constructed apparatus that are used as illustrations, and the intelligible exposition of the subject. "A Chemist in the Days of the Stuarts" is the title of a contribution in which much curious historical information is given. The Navy Department exhibit in the Government Building at St. Louis is fully described and illustrated. The same applies to the exhibit of rolled and flanged steel plate. Douglas W. Freshfield's paper on "Mountains and Mankind" is concluded.

Electrical Notes.

The British Admiralty has obtained the exclusive use of a new apparatus, which is to be employed in connection with wireless telegraphy. Precisely what the invention comprises is not known, as it is a jealously-guarded secret. It is called a cryptogram, and is the invention of a Swiss mechanic. Its purpose is to prevent the interception of wireless messages, except by a person or station provided with the same device. The apparatus is stated by the English naval authorities to be perfect in operation, since when five of these instruments were submitted by them to a series of exacting tests, they proved so successful that the device was procured by them outright.

Mr. L. R. Lee, of the electricity station of the Manchester, England, corporation, has invented an apparatus for the ventilation of watertight-incased transformers used in underground stations, which are liable to flooding. In this invention discriminating valves are fixed to the case or tank containing the transformer, thereby enabling a continual supply of air to enter and leave the tank. One advantage of this device is that any water that may be left in the transformers during the process of manufacture can make its escape, by condensation on the underside of the cover, and then running out of the inclosing tank, the cover being formed in such a way that the water cannot remain inside. No apprehension need be entertained regarding the safety of a tank fitted with these valves in the event of flooding, for even if the water rises completely over the transformer, none can enter the case, and as soon as the water is drained away or removed, ventilation is at once automatically resumed.

A new method of wireless telephony is being developed by Prof. Quirino Majorana, of Rome. This system, according to reports in the Italian technical press, seems to be based essentially on the Marconi wireless telegraphy. In the latter, as is well known, a series of shocks corresponding to the various sparks is produced at the receiver, when the sparks are made to jump at the transmitting station. The receiver designed by Marconi enables the operator to decipher the telegrams acoustically, listening to the series of sparks. The number of sparks, however, does not exceed 10 per second in the Marconi apparatus, whereas Majorana has increased this number up to 10,000 per second, though the various sparks are evidently weaker than those used in wireless telegraphy. Persons placed at the receiving station will, therefore, not note anything, the succession of sparks being too rapid and the sparks themselves too similar to one another. As soon, however, as the uniformity of these sparks is interrupted artificially by the oscillations of the human voice, every word will be transmitted truly to the receiver. The Cologne Gazette, in a recent issue, points out the similarity of Majorana's endeavors to the scheme outlined by Prof. H. Th. Simon and Dr. Reich. According to the researches of these experimenters, the problem of wireless telephony by means of Hertzian waves has been solved at least theoretically. Transmitters so far used in wireless telegraphy yield trains of waves interrupted by relatively long pauses, and corresponding to the various spark discharges. Though the interval between the passage of a group of waves and the production of the subsequent group is only a minimal fraction of a second, this short interruption in the series of oscillations will be quite sufficient to render any transmission of acoustic waves of the human voice to a distance impossible. Wireless telephony requires continuous wave currents. These are obtained by Prof. Simon by the aid of an Arons-Hewitt mercury lamp as vacuum spark gap, when the discharge potential between the spark electrode exceeded 50,000 volts, and the frequency of the spark discharge 10,000,000 per second, that is much more than according to Majorana. In wireless telephony the intensity of the spark wave will have to be adapted to that of the acoustic waves. This will be possible either by the wave lengths or by the intensity being altered. The first scheme has been chosen by Prof. Fessenden, whereas Majorana seems to have adopted the second alternative.