require a slight percentage more or less of water, which makes it impossible to define the exact quantity to be used. For many purposes it is not necessary that the marshmallow root powder be of the finest quality.

Dr. Wühling recommended, as a means of retarding the setting process, the addition of 2 to 25 per cent of alcohol in making up the plaster mass, whereby the setting could be postponed for seconds, even for hours. The alcohol, which is volatilized, exercises no detrimental effect on the plaster mass, and plaster casts made with water containing alcohol are always more dense than those made with plain water.

If too much alcohol be added, however, the plaster mass will not set and is then useless.

Milk, whey and casein, are also recommended as retarding the setting of plaster.

Another medium for delaying the setting of plaster casts is the saturated solution of borax in water; before using it, the borax solution is diluted with water, the extent of the dilution being governed by the time for which we desire to defer the setting process. The following proportions have been tested and found reliable.

1 volume of borax solution, diluted with 12 volumes of water, retards the setting 15 minutes.

1 volume of borax solution, with 8 volumes of water, delays the setting 30 minutes.

1 volume of borax solution, with 4 volumes of water, retards the setting for 3 to 5 hours.

1 volume of borax solution, with 2 volumes of water, delays the setting process 7 to 10 hours.

1 volume of borax solution, with 1 volume of water, retards the setting 10 to 12 hours.

The periods differ again, according to the character of the various materials employed. The best method of producing a saturated solution of borax is to dissolve the borax in boiling water, then allow the solution to cool. The fluid that separates from the deposited crystals represents, at ordinary temperature, a saturated solution of borax.

A NEW DIRECT-READING WIND GAGE.*

By DR. ALFRED GRADENWITZ.

The apparatus so far used for measuring the speed or intensity of the wind may be divided into two classes, according as they either indicate instantaneous values, or record an average figure relating to the interval in question. Most of the instantaneous apparatus are based on the thrust exerted by the wind on a surface of given area, free to move so as to be placed in a zero position in the case of calm weather, from which it is deflected through an angle corresponding with the intensity of the wind. The suction effect of the moving air current has likewise been used for this kind of measurement.

In most of the above described devices special means had been provided continually to turn the surface acted on toward the wind. Apart from the smallness of the range available with these devices, the neces-

sity of rods which are horizontally fixed on a vertical rotating shaft. To each of the four branches of the cross, which are of exactly the same length, a metal hemisphere is attached. This cross always rotates in a forward direction when the wind strikes the hemisphere. The shock against the concave side is always greater than that striking the convex side. The direction of the wind being thus indifferent, there being only one direction of rotation, the wind intensity at any given moment can be fully utilized,

FIG. 3.—ELECTRICAL CONNECTIONS OF GEYER'S WIND GAGE.

thus losing no time in adjusting the apparatus to an alteration in the direction of the wind. While the Robinson cross was formerly used in ascertaining the average figures of the wind intensity, its axis operating a speed meter, it is here used for the first time in measuring the instantaneous values.

A wind gage recently constructed by Max Kohl, of Chemnitz, Germany, on plans by E. Geyer, Altenburg, renders it possible to read the direction of the wind both by night and day and at any desired distance from the apparatus proper. This wind-gage is therefore especially available for use in meteorological stations.

The apparatus as seen from Fig. 2 includes two light aluminium vanes of lengthened triangular shape, which are inclined with regard to each other, being separated by suitable rigid connecting pieces, so that the wind, after the apparatus has adjusted itself, will strike at the same angle two surfaces of equal size and shape. This double vane obviously shows the advantage of a safer and more accurate adjustment, while the remaining mechanical arrangement warrants the highest possible sensitiveness, the vanes themselves being counter-balanced by a sliding weight and the vertical axis located in ball bearings, so as to warrant an easy running of the apparatus.

In Fig. 3 is shown how electricity is used to transmit the readings of the apparatus to any desired place. It may be said that the apparatus, so far from being confined to the use of any given tension, may be connected both to the constant tension of lighting circuits and to a small stationary battery without any necessity of sending part of the existing tension through a permanently inserted resistance. In Fig. 2 is shown an apparatus, the electric gage of which is operated by a small battery including two dry cells, the underlying principle being as follows:

A resistance varying according to the position of a switch comprising sixteen contacts and communicating with the wind-gage is connected with the source of current, the circuit containing an ammeter, the index of which is deflected as far as the terminal mark of the scale in case no resistance is inserted. The scale is divided uniformly between zero and the terminal mark, the resistances inserted in the various positions of the switch being so graduated as to have the index moved through one division as the switch advances from one contact to the other. The sixteen contacts of the switch being arranged round the rotary axle of the wind-gage, correspond with sixteen different directions of the gage, and as each alteration in the position of the apparatus results in a corresponding alteration in the position of the index on the measuring instrument, the divisions of its scale may be standardized immediately in wind directions, thus enabling the actual direction of the wind to be immediately read off the electrical measuring instrument.

The switch has been given the shape of a current collector as usual in connection with direct-current dynamos. Such a commutator, including mica-insulated lamellæ, affords an extraordinary safety in operation, warranting a permanently satisfactory contact. It may be mentioned that a conductive copper brush allows the current to pass without any appreciable friction losses due to the motion.

The several lamellæ, as seen from Fig. 3, are connected to fifteen resistances, 1 to 15, and to a sliding ring, 16, the commutator with the resistances 1 to 15 as well as the sliding ring 16 being attached to the

axle of the wind-gage, while the brush 25 is fixed in front of the commutator and the brush 26 in front of the sliding ring. Only these parts are mechanically connected to the wind-gage, while all the remaining devices, being arranged on a small switchboard, are connected to the former only by means of two wires.

The current coming from the battery, 17, may be so regulated by means of the hand-regulator, 18, as to cause the measuring instrument, 19, to show a deflection as far as the last division in case of absence of any resistance. The circuit is generally switched out by the switch, 20, 21, 22, provided with a breaking position. If this switch be so arranged as to connect the contacts 21 with the contacts 20, the resistance 23 will be inserted in the battery circuit behind the measuring instrument, 19, thus serving as checking resistance. Its magnitude has been so calculated as to about equal the conduction and transition resistances contained in the measuring circuit if all the resistances, 1 to 15, are switched off. The index of the ammeter thus points to the last division also on inserting the checking resistance so as to enable the tension of the battery to be checked before each set of measurements or even before each reading. By displacing the slide of the regulating resistance, 18, the normal tension can be readjusted for.

On making measurements the lever of the switch, 21, 22, is so arranged as to connect the contacts 21 with the contacts 22, when a perfect circuit will be constituted from the zinc pole of the battery through the resistance 18, the contacts 22, 21, 21, 22 of the switch, terminal 24, brush 26, sliding ring 16, and, e. g., through all the resistances 1 to 15 (as according to Fig. 2), brush 25, terminal 27 and ammeter 19 to the carbon pole of the battery. According to the magnitude of the inserted resistance, the index of the instrument will point to a given division of the scale, thus indicating the actual direction of the wind.

It may be mentioned that the wind-gage itself does not perform any mechanical work worth speaking of, both the friction in the ball bearings and that of the brushes being exceedingly small. The apparatus does not require any appreciable superintendence.

A lecture was recently delivered by Mr. Alfred Hands, F.R. Met. S., before the Royal Engineers at Chatham on "The Protection of Buildings from Lightning." In the course of his remarks he showed the impossibility of protecting buildings efficiently by means of set rules; each case had to be studied separately, and the system of protection applied which the complications of metal in and about the structure showed to be necessary. Hitherto too much importance had been attached to the form and composition of the conductor and too little to the fact that its efficiency depended almost entirely on the way in which it was applied and very little on what it was. He regarded the subject as somewhat analogous to the work of a medical practitioner. The conductors in the hands of an

FIG. 1.—KOHL'S WIND GAGE.

sity of a special directing vane greatly impaired the accuracy of the measurements.

In the novel wind gage constructed by Max Kohl, of Chemnitz (see Fig. 1), the instantaneous values are recorded accurately without the necessity of a directing device to turn the apparatus against the wind. The "Robinson cup cross" is made use of in the apparatus, consisting of a cross constituted by two iron

FIG. 2.—GEYER'S WIND GAGE.

expert were comparable to the drugs a physician might find it necessary to prescribe according to his diagnosis of the case. No one could claim infallibility, and anyone might overlook some factor that might have an important bearing on the case, but the fact remained that the possession of knowledge, experience, and an ability to discriminate as to the importance of details should enable a man to protect a building effectively, while absence of these would very probably result in failure. At all events, it was in this direction he thought we

* Specially prepared for the SCIENTIFIC AMERICAN SUPPLEMENT.

should strive to improve our methods, and not in trying to devise theoretically perfect but practically impossible mechanical ones. As regards the relative value of iron and copper for conductors, he considered the matter, so far as concerned conductivity and the dissipation of energy, to be of such trifling importance that it sank into insignificance in comparison with considerations of durability. A lightning conductor was expected to last for a long time, and iron was unfortunately too perishable for the purpose. As regards cost, an iron system, if of sufficient size to be fairly lasting, would be more costly than an ordinary copper tape one. Mr. Hands said that vagaries or freaks of lightning were an impossibility, and the belief in such was due only to the cases being wrongly reported. There were laws governing all natural phenomena, and lightning, like every other force in nature, must be amenable to law. Where they appeared at first sight inexplicable we should try to clear up the mystery, and not dismiss the matter by saying that in one respect nature was erratic.—From *The Engineer* (London).

PROGRESSIVENESS IN ITALY.

LARGE DRAINAGE PLANT AS RELATED TO MOSQUITO EXTERMINATION.

By HENRY CLAY WEEKS, Secretary A.M.E. Society.

THE American Mosquito Extermination Society stands strongly for all means which will accomplish its object—the principal of which are the reclamation and drainage of saturated lands—salt or fresh. Its propaganda has already resulted in deep interest being taken in plans for draining extensive mosquito-breeding lands in many States, with their ultimate use for agricultural purposes, in some cases, so that the extermination idea means not only comfort and healthfulness, but involves many economic advantages which possibly otherwise would never have been contemplated.

The SCIENTIFIC AMERICAN SUPPLEMENT of May 20,

THE PRINCIPAL SIPHON.

Construction of the pipes under the new course of the Secchia. Just prior to covering in with the cement hood.

Its title is as follows:—An Italian Drainage Canal. The Great Bonifica dell'Agro Mantovano-Reggiano which has reclaimed nearly 80,000 acres. Milan, Italy, February, 1907.

mile, and it is navigable for 348.44 miles from its entrance into the sea. It drains and waters alternately a territory comprising 39,325 square miles. It has carried down so much alluvial soil that a delta has been formed extending inward from the Adriatic Sea a distance of 50 miles. This has so dammed up the flow as to cause the river to overflow its banks above and produce numerous ponds and lakelets, whose level is now 64.41 feet above the sea level, and great tracts formerly dry are now overflowed. There was no way to drain these lakelets by natural means, and this surplus water, standing in stagnant ponds of sundry differing levels and from which arose, during the tropical weather of the north Italian summer, the most noxious vapors, greatly interfered with the health of the inhabitants. Mantua was a fever district, yet it was rich agriculturally on account of its peculiar alluvial cultivable soil.

Not only the public health, but the physique of live stock have long been subject to epidemics of malaria, epizootic, and other diseases arising from neighboring swamps; while poisonous insect life has thrived to a threatening extent.

Early in the nineties, Italian engineers of the first class had their attention called to the desire for reclamation manifested by the citizens of Mantua and the adjoining province of Reggio. The late Ettore Zapparoli of Mantua, an eminent expert and graduate of the Milan Polytechnic Institute, devoted himself assiduously to a study of the field, and in July, 1899, succeeded in having his preliminary project approved by a royal decree at Rome. In brief, his plan was to collect the stagnant water by means of a system of small and outbranching tributary canals, bring it by that means to one point, introduce it there by either pumps or siphons to a main-line canal, and by carrying it far enough down the gradual descent of the river valley, deliver it into the Po at a point sufficiently below the level of the drained land and its surroundings to assure a constant flow.

The project was actively discussed, and met with

APPENDIX A. THE RIVER PO, DRAINAGE CANAL, AND SECCHIA RIVER.

1899, and January 5, 1901, first sounded the note for this larger campaign, and there has since been a steady advance. An appeal to the general government to take part was made as early as January 15, 1901, and again on January 7, 1903, and thereafter its soil survey of Long Island was made, encouraging the reclamation of salt marshes. In 1904 the Department of Agriculture started the Drainage Investigation, and has done some very important work in the meantime. A letter from Dr. Elwood Mead, chief of that division, says: "It is now engaged in collecting information for a report on the reclamation of the tide marshes of the Atlantic seaboard. While this report will deal principally with the benefits to agriculture, the improvement of the public health will not be overlooked." This department has already backed up proposed plans in numbers of cases, and has thus given authoritative aid in local movement. The government and the South Carolina Sanitary and Drainage Commission are co-operating in a survey of the swamp and tide lands in that State. Larger appropriations this year will enable broader drainage investigations by the government.

And yet the United States is behind some other countries in this respect. Italy is to have its great Pontine marshes reclaimed, and a deadly territory made valuable and habitable. The American Mosquito Extermination Society, learning of the great engineering scheme to reclaim the fertile valley of the Po, whose waters annually overflow from the melted snows of the Alps and the Apennines and leave large tracts of alluvial land covered with pools, which become stagnant and pestiferous, asked the government to have made a report on this work as encouragement for relief of many situations in the States. This very interesting report has recently been completed by our consul at Milan, and is here submitted by the society through the courtesy of the State Department and the editor.

[We make the following extracts from the report above mentioned.—Ed.]

The river Po has a length of 416.64 miles, and its source is in the west Alps at a height of 6,402.56 feet above sea level.

The fall of the river Po averages 15.365 feet per

ONE OF THE SMALL SIPHONS.

▲ two-piped application of the siphon principle used to effect a crossing of a high-level feeder and a low-level feeder.

ITALIAN DRAINAGE CANAL SYSTEM.