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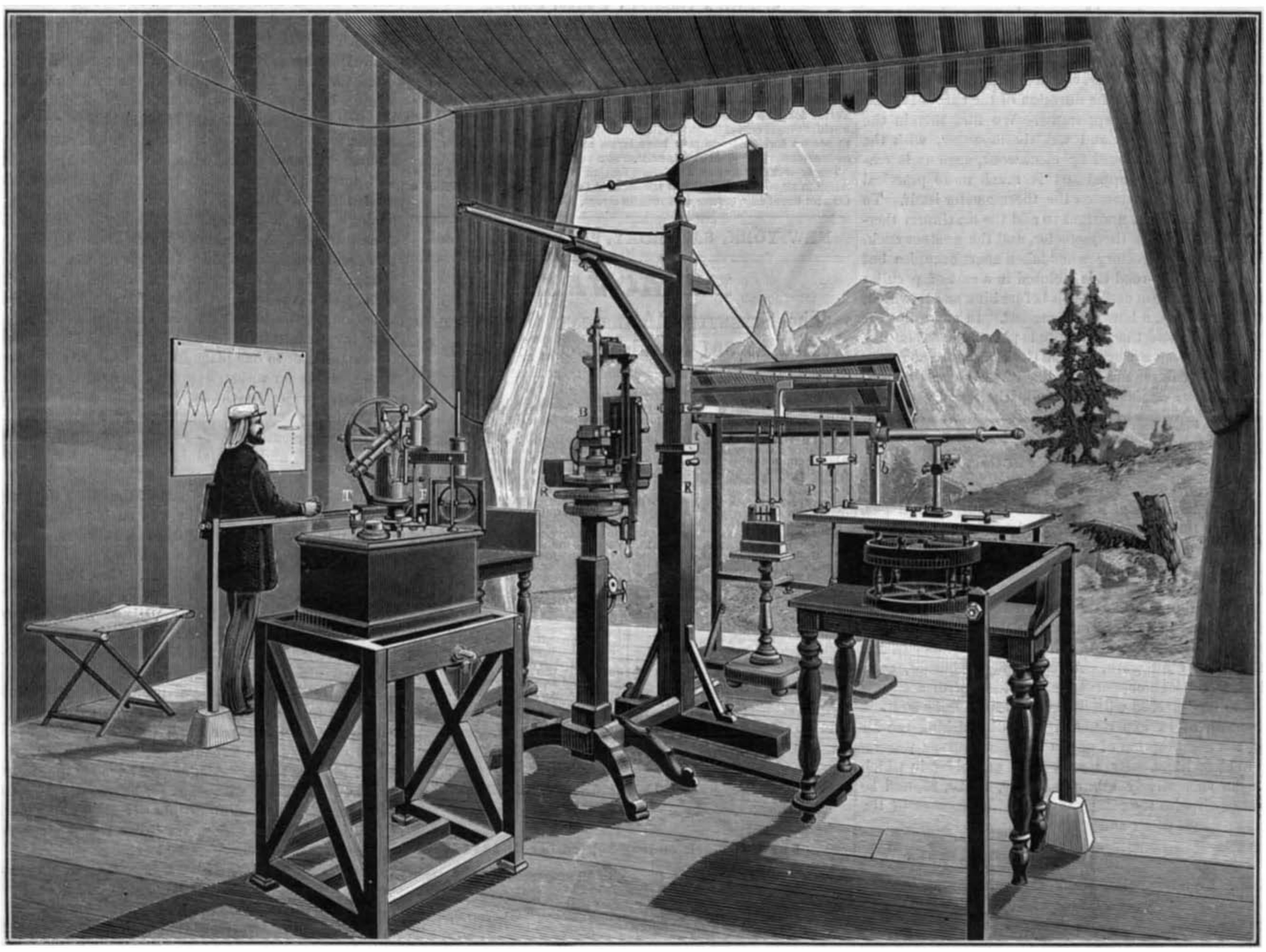
RAGONA'S PORTABLE ASTRONOMICAL, MAGNETIC, AND METEOROLOGICAL OBSERVATORY.

Our correspondent at the Turin Exhibition recently called attention to Mr. Ragona's portable observatory, which permits of making observations upon terrestrial magnetism with as much facility in the field as in a permanent observatory. We give an engraving of this apparatus, along with a few details concerning the different parts thereof.

In the front part of the apparatus there is a theodolite for astronomical observations, for the determination of the instrumental azimuth of the magnetic needle, and for the measurement of deflections and of the duration of oscillations. The method of determining the absolute magnetic the needle is at rest, and then levels upon the vertical line of the cross projected upon a blue field. But in his apparatus observations can be made, even when the needle has a strong oscillatory motion. To this end, there is a small mirror, perpendicular to the direction of the needle, arranged upon the latter's mounting. The image of a scale graduated in millimeters (a scale which is found upon the support of the theodolite) is seen reflected upon the mirror, and the leveling is done upon the mean of the extreme excursions of the cross. The upper part of the compass carries an apparatus for torsion observations. Moreover, the compass is provided with an arrangement which permits, each time, of suppressing the observations upon the torsion division of the second rod, can carry the value of the absolute declination to any instant whatever of the day or night. The second telescope permits of observations upon variations with a precision nearly double that that can be obtained with the first, which is merely designed for leveling the cross.

The determination of the declination needle's variation is a point upon which Mr. Ragona has particularly dwelt. In fact, he has discovered some very interesting laws, which he made known to the Meteorological Section of the Rouen meeting of the French Association for the Advancement of Sciences (1883). A large sized tablet containing diagrams relative to these laws is now at the Turin Exhibition, in the same compartment with the portable observatory.



RAGONA'S PORTABLE ASTRONOMICAL, MAGNETIC, AND METEOROLOGICAL OBSERVATORY.

declination is one of Mr. Ragona's own invention. It is entirely independent of a knowledge of the hour and of the latitude of the place of observation. Mr. Ragona has given the mathematical formulas that permit of determining the absolute declination, when the instrumental azimuth of the needle is known, by the aid of the height of the instrumental azimuth of the needle, and by aid of the height of three of the fundamental stars of the ephemeris. We must refer those who are curious to search into these details to Mr. Ragona's memoir entitled, "Determinazione della declinazione magnetica in viaggio," and to the "Repertorium fur experimental Physik", von Dr. Ph. Carl, vol. xvii.

In the central part of the apparatus there is a declination compass, which is also of Mr. Ragona's invention. The needle is a small steel tube, which carries at the front extremity a cross engraved upon a very thin plate of glass. The needle is susceptible of two different suspensions for observations, and the passage from one to the other may be readily effected. One of these arrangements is a suspension from a very slender thread, without torsion, and the other is a resting upon a small plane of agate by means of a very fine steel point. As the observations have to be made at night, the compass carries a lantern provided with a blue light. For making his declination observations, Mr. Ragona waits until of the thread. The operation is performed once, at the beginning of the voyage, and before starting thereon. In fact, the thread is not only fastened above, but also below (on a voyage), so that it is firmly held and can no longer get out of order unless the apparatus be broken.

The needle of Mr. Ragona's compass carries a second mirror, almost perpendicular to the other, which is observed with a second telescope, and which reflects the divisions of a second leveling rod. This second telescope and second rod (a scale divided into millimeters) are upon a lateral support to the right of the observer, who has his eye to the telescope of the theodolite, and the support is capable of revolving upon its plane by means of a peculiar arrangement of its base. This lateral apparatus is very easily maneuvered, and is perfectly adapted for determining the variations of declination, and also for ascertaining its absolute value at any instant whatever during the entire duration of the exposure of the apparatus in the same place, without having need of making observations every time upon the absolute magnetic declination. In fact, the observer of the second telescope, having noted the division of the second leveling rod that corresponds to the moment at which the observer of the theodolite telescope has determined the absolute declination, and knowing the expression in arcs of the unit of

The determination of inclination is effected by means of an apparatus analogous to those already known; but, as the operations of reversing the needle and magnetization in the opposite direction are delicate ones, and the excessively delicate axis may not be true, Mr. Ragona adds to his apparatus a lever that permits not only of reversing the needle, but also of placing it in the interior of a bobbin fixed to the lower part. The magnetization in opposite direction is effected by means of a pile of two elements and a commutator, without there being any necessity of causing the needle to leave the interior of the apparatus, and in avoiding the danger of twisting the needle and dulling its axis. The reversals of the needle and its magnetization in opposite direction are effected with the greatest facility by means of the lever and a corresponding rack. The inclination apparatus is placed upon a lateral support to the left of the observer, who has his eye to the telescope of the theodolite, and in the same line (perpendicular to that of the magnetic meridian) in which stands to the right the lateral support for the variation apparatus.

The determination of the horizontal intensity is effected by means of an apparatus that permits of employing the Gauss method, which Mr. Ragona has modified and improved. In order that it shall succeed, it is necessary to carry the disturbing magnet to two positions that are symmetrical with respect to the magnetic meridian and to the center of rotation of the compass needle, and in the same horizontal plane. In order to fulfill these conditions in a simple manner, Mr. Ragona uses the following precautions: He assures himself, by means of a small telescope and leveling rod, that the two copper rods divided into centimeters (one of them to the right and the other to the left of the compass) are well in a line with each other. The bar to the right that carries the scale is provided with an adjusting screw, which permits of establishing an exact coincidence. He assures himself of the horizontality of the rods by means of a level—the slight motions necessary for this purpose being executed by an adjusting screw; he makes sure of the perfect equidistance of the marks corresponding to the right and left, by means of a carriage which serves as a gauge and which he carries successively to each side; and, finally, he assures himself of the perfect perpendicularity of the line of the two copper rods relatively to the magnetic meridian, by means of a small apparatus which consists of two circular plates, each containing a very small aperture. The axis of the compass needle should be in the direction of these apertures. In order to obtain such a coincidence, there is a special adjusting screw that permits of giving each instrument a proper rotary motion around its axis.

In the central part of the apparatus, and behind the compass support, there is a square column designed for holding the tent when the apparatus is set up in the field. The same column is designed to support the posterior part of the apparatus (which is also covered in the field by a special tent), in which the meteorological instruments are exposed. The portable observatory, as regards these latter, includes only those of which the observation is useful and possible, taking into consideration the duration of the exhibition and the conformation of the apparatus. We find therein the Fortin barometer, the dry and wet thermometer, with the ventilation apparatus moved by clockwork, such as is employed in Italy. This apparatus is much more practical than that which sets in motion the thermometer itself. To these instruments it is important to add the maximum thermometer, the minimum thermometer, and the weather cock.

This movable observatory when taken apart occupies but little space. On the road it is inclosed in a cart of peculiar form that one man can easily push before him, and to which, for long excursions, a horse is harnessed. In mounting the apparatus in the field the theodolite is placed to the south of the compass in such a way that the theodolite, the compass, and the square column are in the line of the magnetic meridian, and the two apparatus for inclinations and variations in a line perpendicular to the latter.—*La Lumiere Electrique.*

The Heating Power of Gas.

M. Lefebvre, engineer to the Paris Gas Company, has recently been lecturing at Rouen upon heating by coal gas. Among other things, the lecturer explained to his audience the characteristics and performances of atmospheric as compared with lighting burners. Theoretically, with the gas under examination, 16 liters would raise a liter of water from freezing to boiling point. With a common steatite fish tail burner the mean of 26 experiments conducted by M. Lefebvre showed a practical consumption of 31·844 liters of gas to perform the same work. An atmospheric burner, composed of a vertical copper tube provided with a copper mushroom top, pierced with lateral holes, gave 39·60 liters as the mean of 13 experiments. By diminishing the air supply, the consumption of gas in the same burner was reduced to 35·32 liters. By means of a gasholder in which were made successively mixtures of 10, 15, 20, 25, and 30 per cent of air with the same gas, the calorific effect of the various mixtures of air and gas was shown as follows:

Percentage of air	0·0	10	15	20	25	30
Gas consumption	31·84	37·40	39·20	40·40	45·60	48·00

Going on from this point, M. Lefebvre showed the effect of adding hydrogen to gas. Having first determined the calorific power of a given burner with the normal gas to be 32·05, the lecturer successively added hydrogen in progressive increments of 10 per cent up to 60 per cent. The addition of the first 10 per cent of hydrogen lowered the efficiency of the burner—*i. e.*, increased the consumption of gas to perform the same work—from 32·05 to 34·40, and the figures corresponding to the higher increments of hydrogen are 36·80, 37·56, 40·24, 42·40, and 44·52. Thus it was shown that the more hydrogen is contained in a coal gas, the poorer is its heating effect. On the other hand, progressive additions of bicarbureted hydrogen(C_4H_4) resulted in a notable reduction of the bulk of gas consumed by the burner. The object of these tests was to expose the illusions as to the supply of "heating gas of low illuminating but high fuel value" fostered by partisans of water gas schemes.

Accident at the Mersey Tunnel Works.

An alarming occurrence lately took place in Birkenhead in connection with the Mersey Tunnel Works. A considerable portion of the roadway in Hamilton Street, under which the tunnel is bored, collapsed without the slightest warning just after a tramcar and a cab had passed over the place. A gang of men were employed below, but fortunately none suffered any injury. It is stated that an extensive bed of quicklime which lies near the tunnel works has been the cause of the collapse. In consequence of the accident, tramway and other vehicular traffic through the principal street in the town is suspended.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 458,

For the Week ending September 6, 1884.

Price 10 cents. For sale by all newsdealers.

RUFUS PORTER, FOUNDER OF THE SCIENTIFIC AMERICAN.

Rufus Porter, the original founder of the SCIENTIFIC AMERICAN, died recently at New Haven, Conn., in the 93d year of his age. Up to within three days of his decease his health was good, he was in the full possession of his faculties, and enjoyed considerable bodily vigor. He succumbed to a severe attack of diarrhœa. He was born at West Boxford, Mass., on the 1st of May, 1792. He was a remarkable natural genius. He showed a taste for mechanics while in the cradle; was in school learning Noah Webster's spelling book at the age of four; spent six months at Fryburg Academy when twelve years old; beyond this he had no educational advantages. By this time he had become quite an adept in the making of all sorts of mechanism, such as water wheels, windmills, lathes, etc. He was also something of a musician; he played the fife and the violin, and wrote poetry. In 1807 his family concluded it would be best for him not to fiddle any longer with life, but to settle down to something solid and useful, in short, become a shoemaker, like his elder brother. So, in 1807 he walked from Portland to West Boxford, 106 miles, and undertook the honest calling of the cobbler. But it was soon seen that he was not cut out for that species of industry; he gave it up, went back to Portland, played fife for military companies and the violin for dancing parties until 1810, when at the age of 18 he was apprenticed to a house painter, including sign painting, and he soon became proficient in the business. The breaking out of the war with Great Britain in 1812 gave him constant occupation in painting gun boats; also as fifer to the Portland Light Infantry.

In 1813 he painted sleighs at Denmark, Me.; beat the drum for the soldiers, taught others to do the same, and wrote a book on the art of drumming. This probably was his first book publication. In 1814 he was enrolled in the militia for the defense of the country, and was for several months in actual service; after this he taught school at Baldwin, married at Portland, taught at Waterford, made wind grist mills at Portland, painted in Boston, the same on through New York and New Jersey to Baltimore and Alexandria Va. A peculiarity which he developed about this time, and which continued through life, was a frequent change of place and occupation. Although he might be doing well at the business which for the time engaged his attention, he would sell out and abandon it the moment a new idea came into his mind. He could not hold fast to one thing or to one place for any considerable length of time. His brain was an overflowing fountain of new ideas and active projects. One of his most profitable businesses at this time was portrait painting. At Alexandria, in 1820, he made a camera obscura—a dark box fitted with a lens and mirror and containing a place for a sheet of paper.

With the lens placed in front of the sitter the image was focused on the paper, and he was enabled very rapidly to sketch the outlines of his subject with correctness, and to produce a satisfactory portrait in fifteen minutes, for which his customers readily paid a dollar. He adorned his camera box with bright colors, bought a light handcart for locomotion, planted a flag on his vehicle, and with this attractive establishment started on foot for Harrisonburg Hot Springs. He was welcomed in every town and village, his little show attracted attention, and his portraits were greatly in demand. He did very well in a pecuniary sense; but he was possessed with the desire of finding a substance that was capable of yielding perpetual heat. He was certain he could do wonders if he could make this discovery. It would be for him the lamp of Aladdin. Arrived at the Hot Springs he bored the earth with an auger having a five foot shank, in search of his hot substance, but found nothing more than a hydrate of lime; and much to his regret was obliged to resume portrait painting and trudge behind his gay camera and cart. Northward he wends his way, painting portraits from village to village, and at odd hours inventing mechanisms of various kinds.

He invented a revolving almanac, and suddenly stopped painting to make and introduce it, which he did with considerable profit and success; but at the moment when attention was needed for this new enterprise, a sudden and violent ambition seized him to make a twin boat to be propelled by horse power, and to run on the Connecticut River. This project brought him, in 1823, to Hartford, Conn. But nothing came of it; and he took up his old profession again of portrait painting, traveling once more from town to village with camera, cart, flag, and now accompanied by "Joe," a lad, a relative. In the course of his wanderings he spent some time in New York painting portraits as usual. One morning he was out strolling with Joe, when he saw some people who were about to start in the stage for Philadelphia. An impulse instantly seized him to go along. So he joined the party, directing Joe to get the camera and send it by next stage. But the box failed to come, and he was obliged to foot it back to New York, earning his meals by cutting people's portraits out of paper with scissors.

In 1824 he adopted the profession of landscape painter. That is to say, he painted landscapes on the walls of dwelling houses, public buildings, halls, etc., as a substitute for ornamental papers. His work was greatly admired, and proved profitable. He went from town to town on this business, carrying his apparatus on a hand cart. In the midst of his prosperity another boat fever came over him. He dropped everything and built a horse flat boat, 35 feet long, with cabin. He worked the boat on the Connecticut