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Contents:

(Illustrated articles are marked with an asterisk.)

TERRESTRIAL MAGNETISM.

The old notion that the earth possessed, near its north pole or in its interior, strong magnets which attracted the poles of the compass needle has long ago given place to the theory that our whole planet must be considered as a large magnet, and to the later hypothesis that this magnetism is caused by electric currents running east and west through its crust, and in regard to which the compass needle behaves as it does to all electric currents, namely: it places itself at right angles to the same, according to the law discovered by Oersted in 1829. By this theory the declination of the compass needle from the geographical north is simply explained by the fact that there is no cause which should compel these currents to run exactly east and west; on the contrary, by the irregular formation of the earth's crust, it cannot be expected otherwise than that these currents, which always follow the path of least resistance, should not coincide with the geographic parallels, and that consequently the direction of the compass needle, which must be at right angles to these currents, cannot coincide with the geographic meridians. This being the case, it is evident that the magnetic pole cannot coincide with the geographic pole, and in fact observations in high northern latitudes on this hemisphere have decided that, at present, the magnetic north pole, that is the point towards which the compass needle points, is situated in the arctic archipelago north of the American continent, in longitude of very near 100° west of Greenwich, and a latitude of 73° N. The magnetic south pole, in regard to latitude, is very near to the antipodes of this point, being in 74° S., but in regard to longitude, this is not the case; the antipodal point of 100° W. longitude lays in the meridian of 80° east of Greenwich; but the fact is that the magnetic south pole is at present at 140° east of Greenwich.

We can, of course, draw lines on the globe through those places where the compass needle points to the magnetic pole; in other words, when we travel from any place on earth and follow the direction of the compass needle till we reach the magnetic pole, and draw the line traveled over on the globe, we shall have a magnetic meridian. Those magnetic meridians can, of course, nowhere coincide with the geographical meridians, but must intersect them continuelly. Other systems of magnetic curves have been drawn; for instance, those of equal declination, that is, such curves as unite points where the declination of the compass needle from the geographic pole is the same. Those lines are quite irregular, much more so than the magnetic meridians, and even exhibit a great complexity. The line without declination runs from the magnetic north pole, south through Hudson's Bay and Lake Erie to Virginia, and enters the ocean in North Carolina; it skirts the Antilles and crosses the eastern point of South America. East of this line, the compass needle points north towards the west, and west of this line, it points north towards the east; and it generally deviates more in proportion as we go to greater distances from this line without declination; so while at present in Maine the declination is some 20° west, and in California, 20° east, it is in Newfoundland 40° west, and in northern Alaska, 40° east.

The reader will have noticed that we have used several times the expression "at present." This was by reason of the singular fact that all these data are continually changing. Observations made since the last three centuries and recorded on maps, for the years 1600, 1700, 1800, and 1870 prove that the magnetic poles are continually shifting their position; and this shifting is taking place regularly from east to west. Thus, in 1600, the magnetic north pole was somewhere north of Europe, and the line without declination ran through the heart of that continent, so that in the western European countries the declination was from 5° to 10° east; then it proved to be moving westward, so that the line of no declination passed over England some 100 years later, when the declination for the whole of Europe became west and was increasingly so till about 1820, when it had reached about 24°. Since this time, it is diminishing again in degree, while in the Eastern States of America it is increasing, so that in New York city, where a few years ago it was 6°, it is now more than 7° W. This points to a regular travel of the magnetic pole around the geographic pole, and, as far as we may conclude from a rather premature estimate, it will take a little over 600 years for a complete revolution, so that in the year 2200 it will again have arrived in the north of Europe.

There are two theories in explanation of this surprising phenomenon; one is that a great portion of the earth's magnetism is due to induction from celestial bodies and therefore under their influence, so that the relative position of the planets may affect the earth's polarity. The other theory, quite recently brought forward, is that the upheaval of continents and islands and in general all changes in the earth's crust, which are especially veryactive near the poles, modify either the magnetism or the direction of the electric currents which are the causes of the same.

In closing, we cannot forego drawing attention to two significant facts. One is that the aurora borealis appears to proceed always from the magnetic and not from the geographic pole as a center; the other is that the magnetic pole appears to coincide with the point of greatest cold, and even that the lines of equal mean temperature, or the so-called isothermal lines, when drawn on the globe, show such a close relation to the magnetic pole as to give evidence that they are to a great extent governed by the same fundamental law.

THE INTERNATIONAL EXPOSITION AT VIENNA, 1873.

In reply to inquiries for the name of the United States Commissioner for the above exhibition, we would state that Thomas B. Van Beuren, Esq., 51 Chambers street, New York, is the proper address. All persons who are desirous of going to the trouble and expense, of shipping their goods to Austria for this show, should communicate with the Commissioner as above. It is stated that there will be but few American exhibitors. This is not to be wondered at when we consider that under our present financial conditions—due, as the free traders allege, to our taxes and high tariff—it is not possible for Americans to compete with Europeans in filling orders for manufactured goods. It is, therefore, useless for our people to go over to Austria to exhibit the products of their skill and ingenuity. The only practical result would be that our best patterns would be copied without benefit or reward to the American maker. He could fill no orders, export no goods, simply because the continental manufacturers can do the work much cheaper and underbid his best proposals. When prices advance on the other side of the Atlantic, or become reduced here, then will be the time to talk to our people about going abroad to show their goods.

As for the exhibition of new inventions at Vienna, the Austrian patent laws offer but precious little encouragement and protection for American inventors, as we have heretofore had occasion to explain.

TUNNEL UNDER THE HARLEM RIVER, NEW YORK

The Park Commissioners of New York city contemplate the construction of a large tunnel at the upper end of the island, for the purpose of providing a carriage way under the Harlem river, from the end of the Seventh avenue drive. This is an excellent improvement and we trust will be speedily carried out. It will furnish a much needed communication between New York city and Westchester county. At the present time, the only avenues of access are the draw bridges, which occasion frequent delays, not only to the general traffic but to the railway trains.

The tunnel will be built of solid masonry, and extend 1,663 feet on the New York side, and 1,078 feet on the Westchester side of the river. It is contemplated to have the top of the arch 18 feet below high water mark, so that vessels drawing 17 feet can pass over safely. The tide falls about five feet at that point; and at low tide, vessels drawing less than 13 feet will be able to pass over in safety. It is proposed to have the tunnel about 2,759 feet long, and 16 feet in hight, to permit persons to stand on top of the highest omnibus, and 34 feet in width; this affords 20 feet of wheeling space and seven feet on each side for foot passengers. The descent will begin at 150th street, and the top of the tunnel will strike the water bed at 155th street, at a point about 200 feet south of the present Macomb's Dam bridge. The descent will not be steeper than many of the roads in the Central Park, and will not inconvenience horses drawing heavy loads. The expense is estimated to be about $1,500,000. A. W. Grant, C. E. is the engineer of this important work.

WILLIAM BRIDGES ADAMS.

We regret to have to record the decease of this distinguished civil engineer, inventor and scientific writer, whose name and works are doubtless familiar to our readers. He died recently, in England, the land of his birth, at the age of 75 years. Many of his suggestions in respect to railway improvements have been brought into common use, and among them is the so called fish joint, for uniting the ends of rails.

The employment of light steam cars and carriages is becoming every day more common. Their practicability was perhaps as completely demonstrated by the late Mr. Adams as by any other one person. We find in *Engineering* the following particulars concerning the performances of one of the early vehicles of this kind, made by Mr. Adams:

The total length of the carriage was 12 ft. 6 inches, including machinery, water tank, and seats for seven passengers, all being placed on one frame, which was hung below the axles, and carried on four wheels, 3 ft. 4 inches in diameter. The floor was within 9 inches of the level of the rails. The engine had two steam cylinders, 3½ inches in diameter, and 6 inch stroke, acting on a cranked axle. The boiler was cylindrical, placed vertically, and was 1 ft. 7 inches in diameter by 4 ft. 3 inches high. It contained a firebox, 16 inches in diameter by 14 inches high, with 38 tubes, 3 ft. 3 inches long by 1½ inches in diameter, giving 5½ ft. of heating surface in the firebox and 38 ft. in the tubes. The water tank was placed under the seat, and had a capacity of 40 gallons.

The number of miles run during the half year, ending July 4th, 1848, was 5,526, the quantity of coke consumed being 7 tuns 9 cwt., or at the rate of 3 lb. per mile. At the date of this extract, the engine had run altogether about 15,000 miles; the greatest speed attained on the level was 41 miles an hour, the ordinary speed that might be safely calculated on for a long journey being 25 miles an hour. She had performed the journey from London to Cambridge, a distance of 57½ miles in 1¾ hours, being at a rate of nearly 33 miles an hour, with a consumption of coke of 2¾ lb. per mile. This carriage was subsequently named the *Express*, and was sent down to Birmingham to be experimented with, where, to the astonishment of some of Mr. Samuel's friends—who had planned the matter—she ascended the Lickey incline of 1 in 37

SECURITY AGAINST THIEVES.

A bold bank robbery was committed not long ago at Uxbridge, Mass. The thieves surrounded the cashier's house in the dead of the night, and by means of ladders entered the open windows of the second story. They then gagged all the inmates, compelled the teller, on pain of death, to go with them to the bank and open the safe, which they immediately plundered. Loss, thirteen thousand dollars.

"The moral of the affair is," says *Appleton's Journal*, "that cashiers and tellers of banks must cease to go to bed with their chamber windows open, and that banks in the country must resort to some means of defense and protection more efficacious than the locks of a patent safe. An armed man and a stout dog in the Uxbridge bank would have prevented this robbery, and in the long run, it would be cheaper for a country bank to pay for a permanent night watchman than to be robbed, even if only once in a generation. The Uxbridge robbery is one of a series of similar outrages which have been perpetrated on the banks of New England during the last five years, and their frequency shows clearly that banks in the country cannot exist much longer in the old primitive fashion, but must fortify and arm themselves if they would keep their treasures safely."

We do not quite agree with the *Journal*. Instead of the dog and watchman, our advice to the banks is to make use of the better and surer means of protection which our ingenious inventors have provided in the shape of electrical alarms and detectors. For a tithe of the cost of maintaining a sleepy watchman, the Uxbridge bank might have had electric wires, attached to its doors and safes and also to the doors and windows of its cashier's dwelling, so arranged that any attempt of a burglar to enter would have rung an alarm bell and aroused the whole town. Entrance through open windows may be guarded by the use of a fly net to be connected with the wires. Any attempt to pass the net sounds the alarm. With the other forms of window, door, and safe alarms, our readers are familiar. We are never very sorry to hear of a bank robbery where the owners and officers have been so parsimonious as to refuse to employ the best electrical burglar alarms. Many of them turn up their ignorant noses at the idea of using such "patent gimcracks," as they call them, about their premises. But they must either use them or submit to robbery. Some of the heaviest and most astounding bank robberies have been committed upon banks that employed special watchmen at great expense, who were overpowered by the thieves, or were absent from their posts at the critical moment. But we have yet to hear of a single example of bank robbery where the electric alarm was properly applied.

THE INTERNATIONAL STATISTICAL CONGRESS.

The International Statistical Congress has opened its eighth session in St. Petersburgh, Russia. The delegates are divided into four sections, to each one of which the following subjects are assigned for consideration and report: To the first section, statistics of population, with methods of obtaining the same. Under this head, the number, sex, trades, and ages of the population of various countries will be discussed, together with the moral, intellectual, and physical condition of the people. Comparisons will also be made with reference to determining whether retrogression or progression has been made from a former state. To the physical development of man will be given considerable prominence. Investigations on this subject will include the hight, weight, volume, and development of different parts of the body, the strength, rate of walking, respiration, pulse, beating of the heart, and comparative acuteness of the senses.

To the second section, the most important part of the labor of the Congress is assigned. This is the discussion of industrial statistics. The subject is divided into five classes: Agriculture, mines and quarries, commerce and fisheries, and