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OUR CIRCULATION.

We have had no doubt, for a long time, that the circulation of the SCIENTIFIC AMERICAN was far in advance of that of any other paper of its class, either in this country or in Europe; and some information that we have recently received in regard to the numbers printed of the leading publications abroad, has led us to the conclusion that the circulation of this paper surpasses that of all the other mechanic and scientific periodicals of the world combined.

EARTH CURRENTS AND THE ATLANTIC CABLE.

If a piece of insulated wire is bent in a coil, and a current of electricity is passed through it, the axis of the coil becomes a magnet and continues so as long as the current is flowing. From this fact it has been supposed that the magnetism of the earth is induced by currents of electricity passing around the globe, this current being excited by the heat of the sun as the earth rotates beneath it.

In the year 1840 a series of very delicate observations on the variations in the magnetism of the earth were commenced at Girard College, Philadelphia, and the results have been the subject of elaborate discussion by Professor Bache in several papers that have been published by the Smithsonian Institution as a part of its contributions. We recently published Professor Bache's conclusions in regard to the more regular variations in the earth's magnetism—those which occur daily and those of the eleven-year period—corresponding with the recurrence of spots on the sun. Beside these, the observations discovered occasional variations of great irregularity and violence, which have been called magnetic storms. It seems that such a storm was prevailing at the time the signals became unintelligible on board the *Great Eastern*, and may have been the only cause of the signals failing. If this was so, the cable was cut, without any necessity, when in perfect condition.

The registering apparatus employed to record variations of magnetism is the most delicate of any instrument known to either mechanic arts or scientific observation. The force is so small that the needle must be suspended to traverse with the greatest possible ease; a pencil rubbing against paper would hold it fast. A thin silver mirror is mounted upon the needle, and upon this is thrown a beam of light which is reflected upon a strip of photographic paper, the apparatus being placed in a dark room where no light other than the reflected beam can reach the

paper. The paper is slowly unrolled from one roller and wound upon another by clock-work, the spot of light printing a continuous line as the paper is drawn along. For horizontal variations the paper has, of course, a vertical motion, and for the vertical dip a horizontal motion—the variations giving a zig-zag form to the line.

The English papers publish the following letter, in relation to the recent magnetic storm, from Professor Airy, the Astronomer Royal:—

"ROYAL OBSERVATORY, }
"Greenwich, Aug. 5—12 M. }

"DEAR SIR:—At the date of my letter yesterday the magnetic storm had somewhat subsided. Very soon, however, there were signs of great activity, and by 11 o'clock of last night (Friday, August 4th), the magnetic storm was sensibly as violent as before, and continued so through all the early morning hours. It has declined a little through the morning, but at the present time (Saturday, August 5, at noon) it is still very active.

"The spontaneous earth currents were not quite so strong in the last twenty-four hours (ending Saturday, August 5, at noon) as in the preceding twenty-four hours (ending Friday, August 4, at noon), but they are still very active. A nearly continuous register is made by the currents on the Dartford wire (which at first were not very strong) to midnight of Friday, August 4; but since that time the traces have been lost, and the currents on the Croydon wire have been very violent; only for a short time, ending about Friday, August 4, at 3 P. M., was the motion sufficiently gentle to have left any record, and then imperfectly. After that time the currents were so violent that the trace is totally lost.

"It is scarce in possibility that a telegraph current can have passed along the Atlantic cable in a legible state during any part of this time. "G. B. AIRY.

"G. SAWARD, Esq."

NYSTROM ON WORK AND POWER.

We have a kindly feeling toward Mr. Nystrom, having received from him several valuable contributions. It has seemed to us, however, that his method of explaining the difference between work and power was calculated rather to confuse than to elucidate the subject. In reply, he forwards us a communication containing his explanation, with a request that we would lay it before our readers and let them judge for themselves. We comply with his request with pleasure, and the communication will be found on another page.

The raising of 1 pound of matter 1 foot in vertical height is 1 foot-pound of "work." The raising of 33,000 pounds 1 foot is 33,000 foot-pounds of work, whether 1 minute or 100 years be consumed in the operation.

The power—either of a steam engine, waterfall or animal—that can raise 33,000 pounds 1 foot in each minute of time is 1-horse power; the power that can raise 33,000 pounds in half a minute is 2-horse power; and the power that can raise 33,000 pounds in one-tenth of each minute is 10-horse power.

Morin and other writers, therefore, say that the idea of work is independent of time, but that time is an element in the measure of power. It seems to us that these writers are correct. It seems to us, also, that the matter is extremely plain and simple.

Mr. Nystrom, on the other hand—while accepting, if we understand him, the above illustrations of both work and power—denies that work is independent of time, or that time is an element of power, and asserts that the subject is not generally understood, even by educated engineers. We have criticised his arguments upon it as calculated rather to confuse than elucidate it; from this criticism he wishes to appeal to the judgment of our readers—an appeal in which we cheerfully concur.

THE WAY TO PREVENT RAILROAD ACCIDENTS.

There is only one chief cause of railroad accidents, that is—carelessness. There are railroads in the country that have been in operation many years, and that never have had an accident. Can there be any doubt about the reason for this exemption? It is due to one thing, and one only—thorough and energetic care on the part of the managers. The properties of iron, wood and steam are constant; the uni-

verse is governed by fixed laws; the same care in the management of other roads would result in the same safety.

The manifest means for securing this thorough care in the management of all roads are to make it for the interest of managers to be careful. The principal cause of carelessness is a desire to save money. Incompetent superintendents are hired at low salaries; repairs are postponed or imperfectly performed, and risks of accidents are encountered rather than the expense to prevent them.

Now, our railroad directors are not usually men who delight in useless slaughter, like Champ Ferguson or Captain Wirz. If it were just as cheap, they would usually prefer to carry their passengers through in safety, rather than to tumble them down an embankment or pitch them into a river.

The plain remedy, then, is to make it cheaper for railroad directors to run their trains with safety than it is to run them with the recklessness that now prevails. Let every accident cost the company so much that it will be for their interest to avoid it. Let juries exact heavy damages in all cases of death or injury.

In order that this may be done in the State of New York, a change in the law is necessary. The revised statutes limit the damages that may be recovered in case of actual death by the carelessness of railroad managers to \$5,000. If a lawyer, doctor or broker, with an income of \$10,000, is suddenly killed by the carelessness of some opulent railroad company, the widow is offered the pittance of \$300 a year. There is not a mechanic in the country who cannot earn two, three or four times this sum. As a first step toward railroad reform let us have a repeal of this absurd law.

TYNDALL AND THE CLIMATE OF CALIFORNIA.

The interior of California is occupied by a great valley, lying between the coast range of mountains and the Sierra Nevada, being some 60 miles in width, from east to west, and 300 in length, from north to south. The climate of this valley is very peculiar; like the rest of California, it has no rain during the summer, but, unlike the coast district, the days are excessively hot, while the nights are remarkably cool. For months together the thermometer ranges in the afternoon from 100° to 109° in the shade, but after about 5 o'clock, it begins to grow cool, and the temperature continues to fall till sunrise. A bowl of butter at sunset will be liquid oil, and at sunrise as hard as if it were imbedded in ice. Another noticeable feature of the climate is the extreme dryness of the atmosphere; lumber is seasoned with wonderful rapidity, and clothes washed and hung upon a line are completely dried in a few minutes.

In a nice laboratory in England a philosopher is engaged in some very abstruse investigations of the nature and action of heat. His apparatus is of wonderful delicacy—his thermometer being so sensitive that the approach of the human hand within three feet of it will vary its indications. With this delicate apparatus, with large knowledge, and with patient labor, the eminent physicist has prosecuted his examination of the subtle and invisible force which was the subject of his investigations. Among other facts, he learned that while heat passes freely through atmospheric air, its course is seriously obstructed by minute quantities of the vapor of water.

What a miracle is civilization! Sitting in our office in New York, by the aid of books and mails, we are able to glance in one direction across the stormy ocean to the laboratory of the philosopher, and in the other across the broad continent to the parched valley of the Sacramento, and to perceive an interesting relation between the two. The discoveries of Tyndall have taught us why it is that the dryness of the California atmosphere causes the days to be hot and the nights cool. The absence of aqueous vapor from the air allows the sun's rays to pour down with undiminished force during the day, and during the night the same cause permits the radiation of heat from the earth to go on with greater rapidity than in the moister air of other climes.

Colt's factory is to be run twenty hours a day, in consequence of the increased demand for pistols. Many of the orders, it is said, come from Southern negroes.