

however, the two systems of lines are running in opposite directions, resulting in mutual attraction, with the coalescence of those of the two sets of lines lying nearest together. Since the magnet's displaced lines are endowed with a sort of elastic tendency to restore themselves to their normal position, those at the left must tend to push, and those at the right to pull the conductor round in the direction of *a*. On reversing the magnet's poles rotation to the left occurs. The reason is easily understood when we remember that lines of force emerging from one pole of a straight magnet, after a curved passage through surrounding space, re-enter the magnet at its opposite end; hence, if we would indicate *m* with poles reversed, the arrow-heads on its lines should all point inward, giving a condition exactly the opposite of that illustrated, *w* being now driven to the left. Or, again, left-handed rotation ensues on simply reversing the current in *w* (which would be indicated by reversed arrow-heads on the circles), thus again reversing the directional relation between the two systems of lines. To Dr. Silvanus P. Thompson we are indebted for some striking experimental verifications of the established theories of these phenomena, his beautiful graphic demonstrations obtained by the iron filings method of electro-dynamic observation being of great educational value.*

A neat rotator, convenient for permanent laboratory or lecture table use, is shown in Fig. 2. In this instrument a round magnet of three-eighths-inch steel, eight inches high, carrying at its middle a metallic mercury cup, supports a revolving rectangularly shaped brass wire frame which turns on a mercury-surrounded needle point as in the preceding experiment, the needle being steadied at its upper end in a bearing in the extremity of a horizontal arm at the top of a suitable supporting standard. The open lower end of the frame terminates in two fine points that just graze the surface of the mercury in the lower cup. To prevent the mercury from touching the cup or that part of the magnet within it, the latter are covered thickly with shellac or paraffine. By a wire passing through a small vulcanite bushing in the side of the cup, the mercury is electrically connected with one of the binding posts on the base, the other post being wired directly to the base of the magnet. By changing in the posts the wires from the single cell of dry battery which runs the apparatus the effect of current reversals can be conveniently studied.

The rotation of a magnetic pole round an electric current is easily exhibited with the simple arrangement illustrated in Fig. 3. A pair of arc light carbons nine inches long fixed in paraffine within an ordinary tumbler are joined at their tops with a copper wire from which hangs by a hooked conducting rod a short piece of round Leclanché battery zinc, three-eighths of an inch in diameter. A four-inch length of fine knitting needle strongly magnetized has upon it a little nearer one end than the other a cylindrical cork float half an inch in diameter, its length made as short as is consistent with an ability to support the needle with its upper end about seven-eighths of an inch above the bichromate solution which fills the glass. The zinc, which should not be over an inch in length, should be brought as near as possible to the surface of the liquid without touching the lower end of the cork when the latter and the zinc hanger are in contact, the important object being to get as much vertical distance as possible between the lower ends of zinc and magnets. The zinc hanger, down to where it joins the zinc, and the needle with its float are protected from chemical action by being dipped for an instant in melted beeswax. When placed in the tumbler near the central wire the magnet is attracted to it and swims round it continuously in a direction determined by the polarity of the magnet's upper end. Two needles oppositely magnetized can thus be used to show right and left-hand rotations. As the cork must roll against the wire in its orbital movement, it should be made as smooth and truly cylindrical as possible.

The Scientific American in a Kipling Story.

There is nothing so inspiring to an American abroad, particularly if he be living in some neglected corner of the earth, as the sight of a fellow countryman, or even some American-made article bringing with it vivid recollections of the dear old country and the former happy days. Such a scene is cleverly presented by Rudyard Kipling in "The Captive," which appeared in a recent number of Collier's Weekly. In this story we are gratified to find that the object which brings cheer to the heart of a lonely and unfortunate American is a copy of the SCIENTIFIC AMERICAN. The character represented is an inventor who, in order to exhibit and test his new patent automatic field gun, has taken part in the Boer war. Unluckily being on the losing side, he is taken captive by the

*For an interesting review of Dr. Thompson's experiments with numerous photographic illustrations of iron filings "autographs" of the lines of force, showing their behavior under a great variety of conditions, the reader is referred to SCIENTIFIC AMERICAN SUPPLEMENT No. 161.

British, and is found by a visitor in one of the prison camps. Uncommunicative at first, the American immediately breaks his reserve upon hearing the rattle of a newspaper wrapper. His excitement grows when he observes the New York postmark and sees that it is the—"Yes! The SCIENTIFIC AMERICAN. Oh, it's good! Can I keep it? I thank you, I thank you."

Fiction though this be, the fact of the matter is that the SCIENTIFIC AMERICAN brings cheer to American hearts in every quarter of the globe, keeping our countrymen, the world over, in touch with the advances in practical science for which America is justly famous.

Foot and Mouth Disease.

BY R. L. ADAMS.

The disease which has broken out in Massachusetts, especially in the vicinity of Boston, known as the foot and mouth disease (Epizootic Aphtha), is not new to this country. Thirty years ago it caused considerable havoc in Massachusetts, New York, and Connecticut, as well as in Canada. It was finally suppressed and exterminated, at a cost of \$3,000, and until a few weeks ago not a single case had been reported in the United States since.

The germs which spread the disease in this last case—first found in Brighton Stock Yards, Brighton, Mass., a few weeks since—may have been brought over from Scotland fens, or some districts of France, or from some foreign country where the disease is prevalent, on some traveler's clothes who had visited one of these places and inspected the live stock, or on the straw or hay packed around articles imported from them. The second herd found with the disease was in Dedham, Mass., and the herd here had contracted the disease from a cow bought at an auction in Concord. The cow proved to be lame, and so it was sent back, but too late to prevent the introduction of the disease and its spreading to the herd. From these places the disease spread rapidly to other places, and there is danger of its spreading still further.

The disease is propagated by germs and is highly contagious. Persons can carry the germs on their clothing or shoes, dogs can transport them, and they can be taken into the systems of a healthy herd which passes over the same road that a sick animal passed over a few hours previous. Cattle are not the only animals subject to it, for it is contracted by sheep, swine, horses, poultry, and sometimes by man. In the latter it comes from drinking the milk or eating the flesh of infected animals, and sometimes by coming in contact with the sores; for instance, the hands coming in contact with the sores on the teats, while milking. The disease has the nature of an eruptive fever, which is easily recognized by the symptoms, consisting of a higher temperature in the mouth, bleeding teats, an erect coat, loss of appetite, and the secretion of "ropy" saliva. Little blisters, about one-half inch in diameter, form in the mouth and various other parts of the body, as on the teats. The animal drivels, and in walking around treads on this saliva, in which the virus obtained foothold when the blisters broke, and gets the sores in his hoofs. The irritation caused by the sores causes the animal to lie down, so that he gets the sores on various other parts of his body. In two or three days the blisters grow ripe, break, and discharge their contents. If a number of these occur in one place, it makes a raw spot and is very irritating. The disease runs its course in ten or fifteen days, and the animal gets well in the majority of cases, although it sometimes proves fatal.

As the germs are carried only on solid matter, no persons are allowed near infected places; and if caught are liable to arrest. Fifty thousand dollars has been appropriated to exterminate the disease, and with such competent men as we have in charge, it will probably be stamped out in a few weeks. Isolated herds will probably be bought and killed, while communities infected with it will be quarantined and traffic stopped. At present Portland is the only exporting place in New England doing business, for Maine and Connecticut are the only States in New England free from the disease.

With the breaking of a bottle of champagne over the shore end, the landing of the Pacific cable was celebrated on December 14. The landing and splicing of the cable which is to connect the mainland with Honolulu was effected without accident, and was witnessed by about 40,000 persons. The work of hauling in the cable was done so expeditiously that the officials arrived on the beach only two minutes before the cable. When the splicing was completed late in the afternoon, horses were hitched to the end, and the cable was hauled through a conduit to the cable station. At the same time a steamer put out to sea five miles, and anchored the cable with balloon buoys; the end was then taken up by a cable steamer and taken aboard. The splicing to the main body was completed during the night.

Correspondence.

How to Waterproof Boots at Home.

To the Editor of the SCIENTIFIC AMERICAN:

For the benefit of the readers of your valuable paper who are like myself obliged to do outdoor work during all seasons of the year, and particularly during the winter, when footwear, absolutely waterproof, is of the greatest importance to ward off colds, etc., I have for the last five years used successfully a dressing for leather boots and shoes, composed of oil and India rubber, keeping out moisture and uninjurious to the leather applied, leaving same soft and pliable. To prepare same, heat in an iron vessel either fish oil, castor oil, or even tallow to about 250 deg. F., then add, cut into small pieces, vulcanized or raw India rubber, about 1-5 of the weight of the oil, gradually stirring the same with a wooden spatula until the rubber is completely dissolved in the oil; lastly, add to give it color a small amount of printer's ink. Pour into a suitable vessel and let cool. One or two applications of this are sufficient to thoroughly waterproof a pair of boots or shoes for a season. Boots or shoes thus dressed will take common shoe blacking with the greatest facility.

CHARLES F. MILLER.

Kansas City, Mo., November 5, 1902.

The Keosauqua, Iowa, Water Power.

To the Editor of the SCIENTIFIC AMERICAN:

In the revival of the use of water power, which is now used almost exclusively where it can be procured for the manufacture of electricity for commercial purposes, all available water power should be located. There is an undeveloped water power of no mean importance at Keosauqua, Van Buren County, Iowa, forty-five miles above Keokuk at the great bend in the Des Moines River, which at that point is seven hundred feet wide, and in the lowest stage of water at the rapids is five hundred feet wide, with an average depth of sixteen inches, and at the time of extreme high water the river rises only eighteen feet above low-water mark. It is twelve miles around the bend, and the natural fall is thirty feet. The water power can be developed by building a ten-foot dam across the river at the beginning of the bend, and cutting a canal across the bend for a distance of a little less than two miles, the deepest cutting of which would be sixty-five feet, and the average cutting would be thirty-five feet for the entire distance, which would give a fall of forty feet.

This water power has been surveyed by competent engineers, and would have been developed before this, but for local causes, which are now entirely removed.

The natural conditions are favorable for the use of water power, and there is plenty of stone of a superior quality.

There is no question but what the entire power can be utilized as soon as developed, as there are a number of manufacturing concerns who are now using steam. Besides, the people of Iowa are just beginning to build interurban electric railway lines, and can use this power by transmission.

W. A. DUCKWORTH.

Keosauqua, Iowa, October 18, 1902.

The Use of Eyeglasses in Schoolrooms.

To the Editor of the SCIENTIFIC AMERICAN:

If one is familiar with the work of school children, stenographers, bookkeepers and copyists, he cannot fail to notice that a large proportion of these are wearing glasses before their time. Excessive use of eyes in ill-lighted rooms or in artificial light, is partly responsible for this, but another cause seems to be generally overlooked, namely, the horizontal position of the books and papers they use. In such position, nothing is in focus, and there is a constant strain of the eyes, in the oblique view they get of printed or written page.

The remedy is simple and obvious. Books and papers should be supported in front of the user. Musicians understand this, and support their music on a music rack, to the relief of the eyes and shoulders. When others adopt this plan, oculists will still have enough to tax their best skill and effort, but many will defer the use of glasses to mature age.

JOSEPH DANA BARTLETT.

Burlington, Vt.

Marconi Cape Cod Towers.

On the bluff back of Cape Cod, four 250-foot towers have been built for Marconi. The work of construction has been going on for about ten months. The arrival of Marconi at Cape Cod will doubtless mark the beginning of noteworthy experiments. The action of the Italian government in sending the "Carlo Alberto" to Venezuela places Marconi in a most awkward position. He had intended to carry on off-shore experiments in the ship. Now he must abandon work for the time being at least.