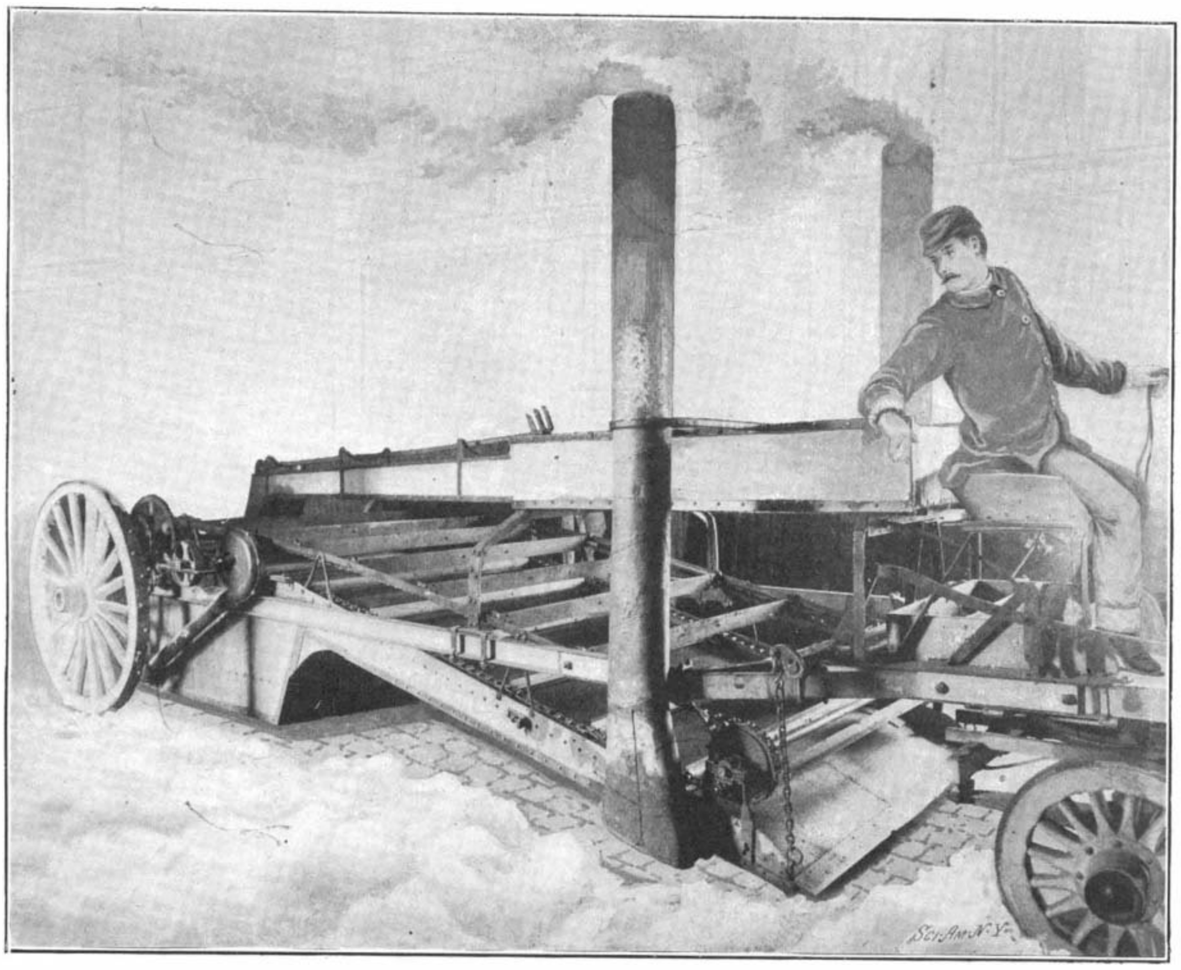
MACHINE FOR REMOVING AND DISPOSING OF SNOW.

While the problem of expeditiously removing snow from our city streets without seriously interfering with traffic is apparent to all, we venture to state that few people realize the seriousness of another problem which confronts the Street-cleaning Department, namely, the disposal of snow thus accumulated. A fall of but a few inches amounts to an astonishing figure when multiplied by the street area of a large city, and the snow gathered must often be carted immense distances before a dumping ground of sufficient capacity can be reached.

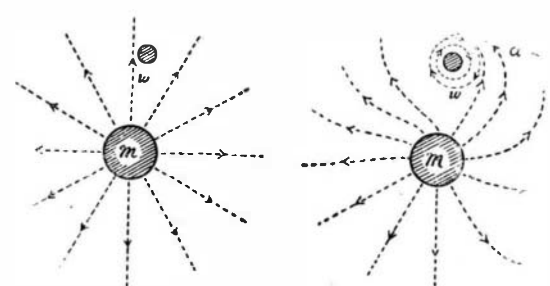
An improved method of surmounting these difficulties is afforded by the machine illustrated herewith, which is designed to scrape up the snow from the pavement and at the same time reduce it to water which flows off into the sewers. To this end the machine comprises a furnace or heater of peculiar shape mounted to swing between the side rails of the frame. The forward portion of this heater is inclined downward and terminates in a shoe or scraper adapted to scrape up the snow as the shoe is drawn along. The shoe may be raised, when desired to prevent it from engaging with the ground, by means of a lever adjacent to the driver's seat and having suitable connection with the forward end of the furnace. The smokestacks shown communicate with the forward end of the furnace, and a forced draft is provided by means of blowers having pipes leading to the ashpit. The snow scraped up onto the shoe is carried along the inclined surface of the furnace by an endless conveyer, and coming thus in contact with the heated surface is immediately melted. The endless conveyers and blowers are operated by chain and sprocket connections with the rear wheels of the machine. Above the conveyer is a coal bin from which a chute leads rearward and is inclined downward, so that the coal may pass to the rear platform when the fireman opens the gate at the end of the shoe. Mr. Jacob Mandrey, of Wakefield, N. Y., is the inventor of this machine.


MACHINE FOR MELTING AND REMOVING SNOW.

ELECTRO-MAGNETIC ROTATIONS.

BY HOWARD B. DAILEY.

There is nothing that so adds to the fascination of the study of physical science as an easily tried experiment. Those presented here, illustrating some of the rotational features of electro-magnetism, besides being of great historic interest, are of special value as aids in elementary study in that department of electro-dynamics dealing with the singular natural tendency of electric currents to move across the lines of force of a magnetic field. In 1821 in a series of brilliant experiments in which the illustrious Faraday showed the rotation of a current-bearing conductor round a magnetic pole, with its antithesis, the movement of a magnet round an electrical current, occurred the first utilization of this curious physical principle for the accomplishment of rotary mechanical motion; and in the beautifully ingenious forms of illustrative apparatus employed by him are to be recognized the earliest true examples of electric motors known—the embryonic prototypes of that most valuable and indispensable of mechanical appliances, the perfected modern motor, whose present universal adaptation to the countless uses of the mechanic arts testifies to the immense importance of this great contribution to electrical science. The first figure shows a simple method of demonstrating the phenomenon of current rotation round a magnetic pole. The apparatus is constructed from easily procurable materials, and has the advantage of comprising within itself the voltaic combination for producing the necessary electric current. A plate of carbon from an old dry battery, and a permanent bar magnet of quarter-inch round steel eight inches high are wired into electrical communication at their lower ends, and placed within a tall glass tumbler, the magnet upright in the center, and the carbon against the side of the glass, both being fixed in position with paraffine melted and poured into a depth sufficient to entirely cover



-A- -B-

Fig 4.—ROTATION OF CURRENT-BEARING CONDUCTORS AROUND A MAGNETIC POLE.

all the metallic connection. To give the magnet a firm anchorage in the wax, a piece of sheet metal about the size of an old-fashioned penny is drilled through its middle and forced onto the magnet's lower end and soldered fast. To insure the perfect flow of the wax about the bases of carbon and magnet the operation of pouring should be done with the tumbler standing in a bath of hot water. A strip of sheet zinc one-fourth of an inch wide, shaped like an inverted U, with its two parallel legs about eleven-sixteenths of an inch apart has soldered in the middle of its bend a stiff sewing needle, its point extending downward about three-fourths of an inch and turning freely in a small indentation made in the end of the magnet before tempering. To insure good electrical contact here the needle sets in a small mercury cup formed with a short piece of rubber tubing on the magnet's upper end, care being taken to have the latter and the pivot point bright and clean. Bichromate battery fluid is now poured into the tumbler until its surface reaches a little more than midway between the magnet's two poles, immersing the ends of the zinc to a depth of about an inch, the fluid being prevented from touching the magnet by a covering of snugly fitting rubber tubing extending well down into the wax. It is evident that the arrangement forms a galvanic cell with a part of its closed circuit (the zinc) freely movable. As the poised strip with its current is well within the influence of the magnet's upper pole, it sets up a vigorous rotation about it in a direction depending upon which pole is uppermost. By using a larger containing vessel and two magnets with opposite poles above the fluid, both right and left handed rotations can be shown at once. After some hours running the ends of the zinc will have been eaten off by the acid; if, then, the instrument be desired for further use, new ends having some length so that they can be pushed down as they waste away may be bound on with small rubber bands.

To one having knowledge of the general significance of the term "Lines of Force," and of the methods of demonstrating their existence and action, the *rationale* of this class of phenomena is not difficult. In the diagram, *A* (Fig. 4), we may regard *m* and *w* as indicating respectively transverse sections of a bar magnet near one of its poles, and of a conducting wire with axis parallel with that of the magnet, the radial-arrow-directed lines representing the normal symmetrical arrangement of the lines of force in the magnetic field, when uninfluenced by the existence of any current in *w*. If, however, we start a flow of electricity through *w*, the conductor becomes the center of a system of lines of its own, which, however, unlike those of the magnet, arrange themselves in concentric circles surrounding the conductor throughout its whole length, these having either a right or left-handed directional sense, according as the current passes up or down in the wire. They are shown right-handed in *B* which represents in a general way the distorted condition of the field which their presence induces. In obedience to Faraday's well-known laws of electro-dynamic action by which lines running in like directions mutually repel, while those having contrary directional paths attract, and where near enough together tend to merge into one another, we find the magnet's lines at the left of *w* bending away and avoiding the wire, because of the similar direction of its own circular lines on that side, as shown by the arrow points. At the right,

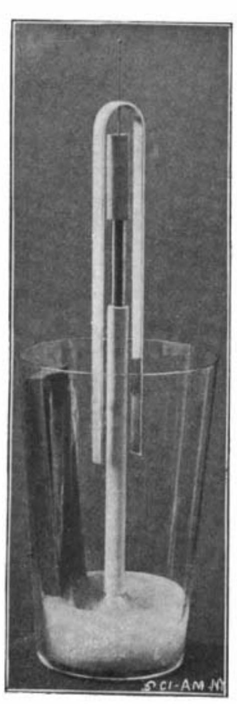


Fig. 1.—SIMPLE ELECTRO-MAGNETIC ROTATOR.

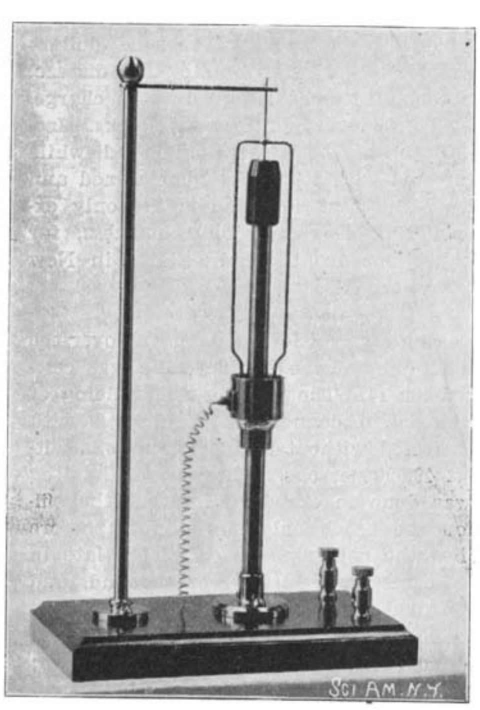


Fig. 2.—REVERSIBLE ROTATOR.

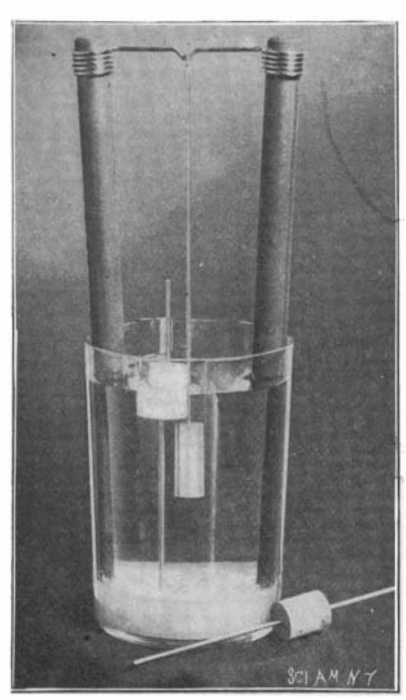


Fig. 3.—ELECTRIC ROTATOR WITH FLOATING MAGNET.

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.

* 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.

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 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.