AN EXPERIMENTAL MOTOR AND DYNAMO.

BY W. E. PARKER.

In his work in teaching physics the writer has often felt the need of a simple and inexpensive outfit for illustrating the principles of the electric motor and dynamo. Not finding anything satisfactory in the market, he has built the apparatus described and illustrated, having in mind a model used by himself at college.

The magnetic needle shown in Fig. 1 is an ordinary needle mounted so as to move freely in a horizontal plane, and above it is suspended a wire. If an electric current is passed through the wire the needle is deflected, the direction of deflection depending on the direction of the current and the position of the wire, whether above or below the needle. A current flowing through the wire above the needle in a given direction will produce a deflection of the same kind as a current beneath the needle flowing in an opposite direction. It becomes easy, therefore, to increase the effect of the current upon the needle by replacing the single wire by a coil of many turns of fine wire, as in Fig. 2. When a momentary current is passed through the coil, the needle is thrown violently around, and by properly timing the impulses due to a series of momentary currents, the needle may be kept in rapid rotation in either direction. Here then is the fundamental electric motor: constant rotary motion, produced by a magnet, and an electric current passing through a coil of wire.

So far as the principle is concerned, it is immaterial whether the magnet or the coil of wire be made the moving part. In Fig. 3 the coil is mounted vertically, so that it is capable of rotation, and the magnetic needle is replaced by a powerful electromagnet. When a current is passed through the coil in the position shown, it is thrown violently around till the opposite side comes next to the pole of the magnet; if at this instant the direction of the current through the coil is reversed, it will continue in rotation. It is, however, difficult to reverse the current by hand with sufficient rapidity and at exactly the right time, hence it is not possible to produce continuous rotation for any considerable period of time.

We may substitute for the single coil two coils mounted at right angles, as in Fig. 4, and having their ends connected to a mechanical switch, or commutator, which automatically reverses the current through the coils at the proper instant. With this addition continuous rotation immediately results, the direction of which may be changed at will, either by reversing the current through the moving coils, or changing the polarity of the magnet.

The machine shown in Fig. 5 approaches a little more nearly the commercial form. Here we have replaced the two coils by four, intersecting at angles of 45 degs., mounting them upon a shaft supported by durable bronze bearings, the electromagnet which furnishes the field resting upon the two upper rods which hold the bearings in position. The direction of rotation may be changed at will by reversing the polarity of the field or the current through the armature. The polarity of the field may be reversed by changing the position of the electromagnet, or by reversing the current through it. To reverse the armature current, a switch may be inserted in the armature circuit, or, what is much easier, the position of the brushes may be reversed by turning the brush holder on its bearing through 180 degs.; this showing also the effect upon the speed of the machine of the position of the brushes.

The machine shown in Fig. 5 operates equally well as a series or shunt motor; and if the field is separately excited and the armature driven by a belt, it may be used as a shunt dynamo. The apparatus operates most satisfactorily with an E. M. F. of 8 to 12 volts, though 4 volts will give good results.

Arrangements have been made whereby the entire outfit can be placed on the market at a reasonable price. Further information may be had by addressing Mr. Parker at the High School, Torrington, Conn.

Fig. 1

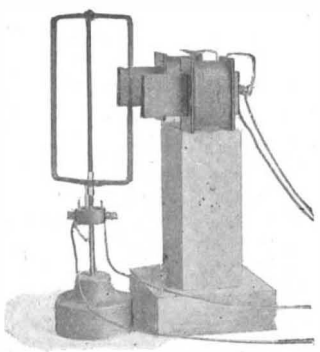


Fig. 3.

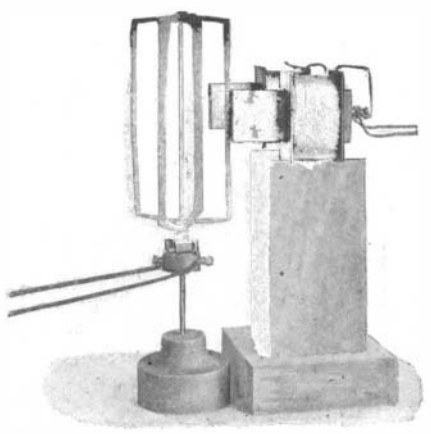


Fig. 4.

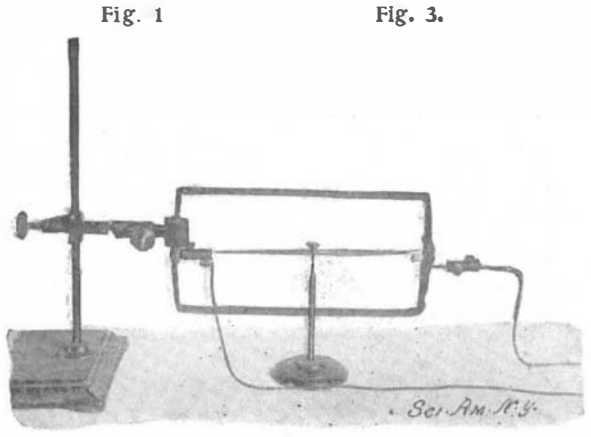


Fig. 2

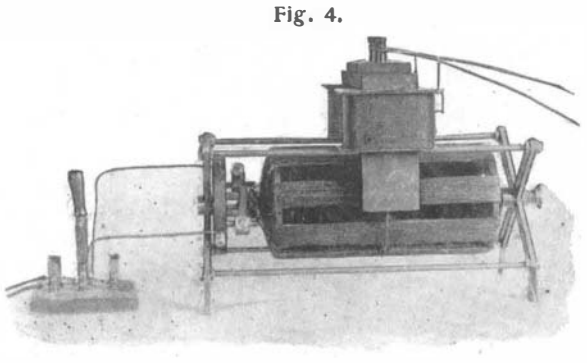


Fig. 5

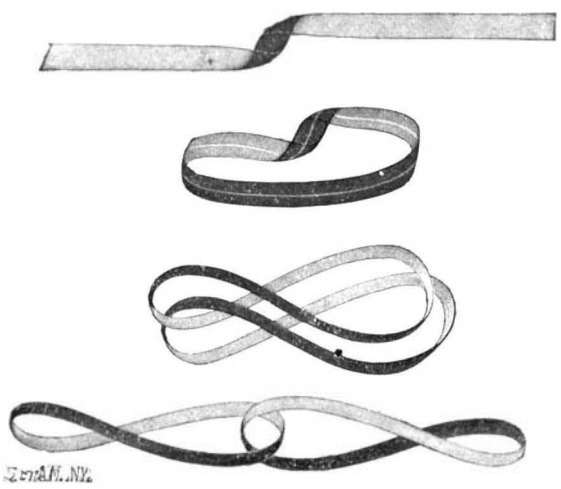
1. Magnetic Needle.—2. Needle Arranged to Turn in Magnetic Field.—3. Coil Arranged to Rotate in the Field of a Strong Magnet.—4. Two Coils at Right Angles in Field of Magnet.—5. Experimental Motor and Dynamo.

Japanese dentists perform their operations in tooth drawing with the thumb and forefinger of one hand.

A PERPLEXING PUZZLE.

The following puzzle, culled from an English magazine, has been sent to us by Mr. O. Podewils, of New York city, who asks to have it explained.

If a flat strip of paper be taken, and its ends pasted together to form a ring, and it be then cut along its center line, two similar but entirely separate rings will be formed, unconnected in any way. If, however, the paper be twisted as illustrated in the uppermost view, and its ends be pasted together to form a ring with a single twist in it, this ring, when cut along its center line, will form two rings, one looped within the other as shown in the third and fourth views.



A PERPLEXING PUZZLE.

Perplexing as this may seem at first glance, the explanation is quite simple. We may consider the upper edge of the paper strip as one ring, and the lower edge as the other. Now, following the edges of the twist, as shown in the second view, it is evident that one edge has been twisted completely around the other edge; or in other words, one edge or ring has been passed through the other ring, which when cut apart form two interlooped rings.

The Reforestation of South Australia.

According to the report of the Conservation of Forests the reforestation of South Australia by the State during 1901 resulted in 68,695 trees being planted, of which 49,219, or 71.5 per cent, have thrived. In the Ayers district, however, only 42.25 per cent of the trees have survived, owing to the ravages of grasshoppers which have destroyed them. The losses have been confined for the most part to the manna gum and the Tasmanian blue gum, planted many years ago at Bundaleer. Although some of them have attained substantial proportions, the testing conditions of the northern districts are not favorable to their reaching in most cases beyond the pole and firewood stage. The value of this class of forest produce is but low. It has, however, in all cases returned the original cost per acre with more or less additional revenue. During the unfortunate continuation of dry seasons to which South Australia has been subject of late years valuable experience has been gained regarding the resisting power which various trees possess to inimical influences. The red gum, the blue gum, and the sugar gum, being species indigenous to the country, have stood well, as would naturally be expected. They cannot, however, claim a monopoly of drought-resisting power, as the Victorian ironbark, both at Bundaleer and Wirrabara, has held out well even on indifferent soils, and made steady growth in spite of adverse conditions. The growth of the sugar gums at the Ayers Forest Reserve in the older plantations is very encouraging. Since they have been planted the seasons have certainly been far from favorable, and the position of the reserve is one of considerable exposure to the arid northerly winds, which are so trying to all vegetation. Notwithstanding these drawbacks, however, large numbers of the trees have attained heights of from 14 to 20 feet, with a circumference of from 12 to 18 inches.

On the Kuipo Forest Reserve, in addition to what has been cleared for planting purposes, about forty acres have been cleared of the undergrowth of honeysuckle as well as of the manna gum timber, in order to promote the stocking of this area with red gum by natural generation, and a promising start has been made by the young seedlings after burning the debris from the clearing. The ironbarks already planted are making satisfactory progress. As an exceptionally large amount of replanting has been necessary this year in consequence of the heavy losses last season at Wanilla, Ayers, and Bundaleer, caused by rabbits and grasshoppers, it has only been possible to plant about 100 acres. Owing to the spread of the rabbit pest it is now absolutely necessary to protect young plantations on almost all reserves by wire netting the fences, which, of course, very largely increases the cost of fencing. Hitherto large reserves such as Bundaleer and Wirrabara, which for years have been the centers of the greater part of the operations, have been practically free from this scourge, but in consequence of the recent protracted droughts in the pastoral country these pests have gradually worked their way further and further into the more settled parts, and will now evidently have to be reckoned with for the future.

Professor Rowland.

Yet perhaps a few more words of personal delineation may help to keep in mind his remarkable individuality. He was tall, slender, but not slim, well proportioned, alert, giving every indication of a healthy body. Of physical exercise he was very fond; in winter the horse, in summer the sailboat, gave him never failing delight. He knew where to find the trout and how to handle the rod. He would take great risks in following the hounds. "You should think of the fox, and not of the ditch," I have heard him say when he was chided for his rash horsemanship. He landed once in Liverpool and saw an advertisement of a meet. He took a train to the nearest station, hired the best nag he could find, joined in the run, won the brush, and then disappeared from among his competitors, who hardly knew what to make of this unexpected victor. He designed a sailboat, and before it was launched he told the builders to paint the water-line where his calculations said that it should be. They objected; he persisted. The boat was launched, and the builders smiled when they saw that the line was above the water's edge. "Put in the mast," said Rowland, and the boat sank to the painted line. "That was what I had figured on," he exultantly said. The incident was closed.—D. C. Gilman, in Scribner's Magazine.

French Population.

The French government has issued the results of the quinquennial census taken in France in 1901. The total population is returned at 38,961,945, showing an increase of 444,613, as compared with 1896. The increase between 1891 and 1896 was 175,027. The movement of French population from the country districts to large towns is still noticeable. The population of Paris is returned at 2,714,068, and France has now fifteen towns with populations of 100,000 and upward; in 1896 the corresponding number of towns with populations of more than 100,000 did not exceed twelve.