AN EXPERIMENTAL MOTOR AND DYNAMO.

BY W. E. PARKER.

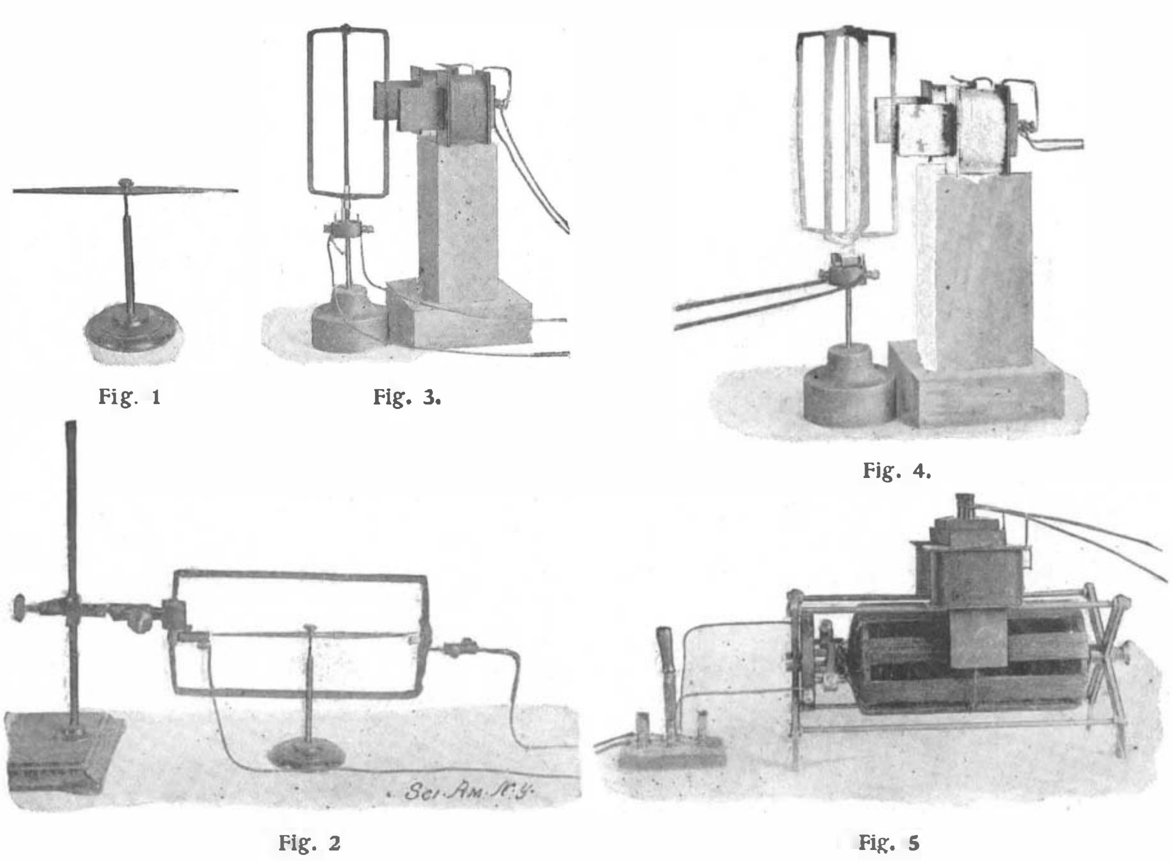
In his work in teaching physics the writer has often felt the need of a simple and inexpensive outfit for illustrating the principles of the electric motor and dynamo. Not finding anything satisfactory in the market, he has built the apparatus described and illustrated, having in mind a model used by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



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.

AN EXPERIMENTAL MOTOR AND DYNAMO.

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.

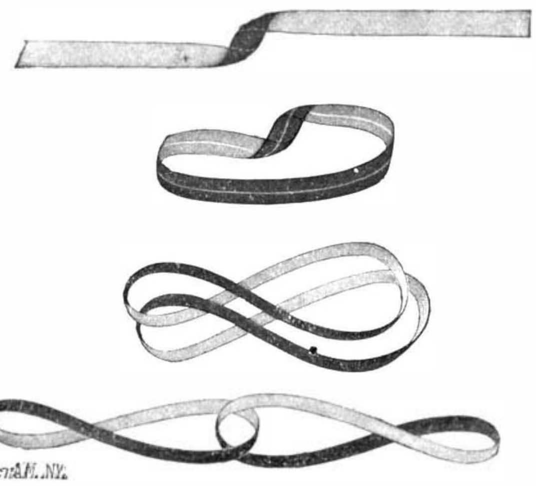
Arrangements have been made whereby the entire outfit can be placed on the market at a reasonable price. Further information may be had by addressing Mr. Parker at the High School, Torrington, Conn.

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



A PERPLEXING PUZZLE.

its center line, will form two rings, one looped within the other as shown in the third and fourth views.

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.

An Investigation of the Physical Effects of Mountain Climbing.

Some interesting experiments and observations have been made by Signor Mosso, upon the subject of man's endurance in mountain climbing. Up to the present, the highest point to which a man has ever climbed is 23,393 feet—the summit of Aconcagua, the loftiest mountain of the main Cordillera range of the Andes. Signor Mosso asks will it ever be possible to reach 29,000 feet? We live at the bottom of an ocean of air, and our bodies are specially adapted for life at low levels; consequently, when we are placed in unusual conditions, such as exist at great heights, we are affected in different ways. Respiration becomes difficult, the circulation of the blood is altered, the heart is fatigued, "mountain sickness" is experienced, followed by lassitude and exhaustion. The reason that so few men have attempted the ascent of the highest mountain peaks in the world is due to the general conviction that man cannot withstand the rarefied air of these altitudes. From his own experiments and observations, however, Signor Mosso is convinced that man will be able slowly to accustom himself to the diminished barometric pressure of the Himalayas. To accomplish such a climb, it will be necessary for the climber to acclimate himself during a slow rate of progress, in order to reach the top in conditions of health and strength. His victualing arrangements must be generously but prudently made, more especially as the last stages would have to be performed very slowly. Mountain expeditions have hitherto adopted too rapid a rate of ascent. The nervous system consequently has not time to accustom itself to the action of rarefied air, nor the organisms to the cold, the fatigue of the ascent consumes the strength of the climber, and leaves him no time to regain it; whereas by slowly making the ascent the climber adapts himself to the fluctuating conditions as he rises higher and higher.

BEET-TOPPING DEVICE.

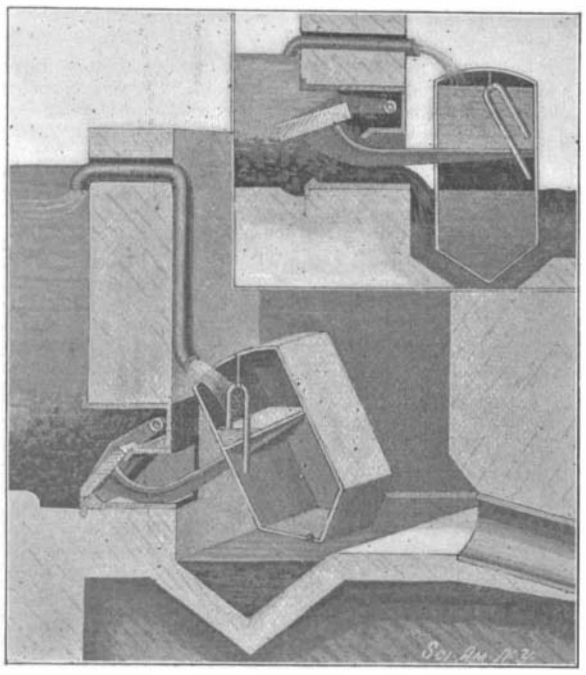
Messrs. Klaas Zuidewind and Adrian Van Putten, of Holland, Mich., are the inventors of a new hand-operated device for topping beets. The top or crown of a beet is of a woody nature, containing little or no sugar, and it is therefore necessary to remove this portion. The device here illustrated is designed to be operated by a person in a standing position, and is so constructed as to release the severed top when the device is open. It is furthermore provided with an adjustable gage for regulating the depth of the cut. This gage automatically centers itself above the meeting edges of the knives employed, and upon contact with the top of the beet will indicate to the operator that the device is in position for topping.

The device as shown comprises two handle-portions pivoted together and provided with shoulders, which when brought into engagement limit the forward movement of the handles. At their lower ends these handle-portions spread out into a forked or bifurcated frame-section. To these sections the knives are adjustably secured, so as to permit adjustment relative to each other when worn out. The cutting edges of the knives are beveled from beneath, and their bottom surfaces are inclined, so that the heels of the knives will not engage with the ground until after the cutting process is completed, thereby avoiding friction and affording the knives a better chance to take hold of the beet at a proper depth. The gage-rod, as shown, is threaded into a carrier which is hung, with some play, on the hinge-bolt of the handles. This freedom of movement permits the gage-rod to always assume a vertical position. Being threaded in the carrier, adjustment can easily be made by turning the rod to the left or to the right. To operate the device, the handles are open and the body-portion brought over the beet to be topped. As soon as the flattened foot of the gage-rod is felt resting upon the upper surface of the beet, the operator will know it is time to close the handle, whereupon the knives, entering the crown of the beet at opposite sides, will quickly and cleanly sever the top portion. It is evident that earth will not collect and interfere with the action of the knives, since the body is open at all sides, and any dirt taken up will quickly find an escape.


BEET-TOPPER IN OPERATION.

AN AUTOMATIC SIPHON OVERFLOW VALVE.

Cases often are found in which it is necessary to have the overflow from a tank pass out at the bottom instead of at the top, when fresh layers of liquid accumulate on the surface. This is necessary, for example, in septic reservoirs for treating sewage by filtration, where, especially by the action of the bacteria, the filtered liquid sinks to the bottom and passes out. This emptying of the tank at the bottom is the end sought and attained in the construction of the Ridgeway valve, illustrated herewith.


AUTOMATIC OVERFLOW.

The illustration shows the valve as arranged in a sewage tank. The outlet opening is in the side of the tank at the bottom, and it leads into the V-shaped intermediate chamber, which in turn overflows into the main sewer. Normally, this outlet is closed by a square clapper that is suspended from a projecting arm pivoted horizontally above it. In this position the clapper is at an angle of 45 deg., as shown. A curved metallic arm fastened to the back of the clapper supports, outside the wall of the tank, a metal box which acts as a float and which is divided into two compartments by a central horizontal partition.

When the tank has become filled it overflows through the siphon pipe seen in the upper part of its side wall (Fig. 1), and the water that thus runs out flows into the upper chamber of the small metal box on the outside, where its weight, coupled with the leverage of the arm attached to the clapper, tends to raise the latter slightly and allow the fluid to escape through the outlet in the bottom. As this outlet is sufficiently large, the liquid escapes rapidly, and soon fills the bottom compartment of the box, and causes the clapper to open wide, because of the additional weight thus exerted upon the lever arm. By this time the upper compartment has become filled (Fig. 2), whereupon it is quickly emptied by a small siphon that connects the compartments.

As the weight of the box is thus considerably diminished the clapper closes by its own buoyancy, aided by the pressure of water in the tank and the rush of the outgoing current. The emptying of the tank is therefore stopped till the water again rises and starts the large siphon once more.

The invention may have some slight defects, such as allowing the surface water that fills the upper part of the movable box to escape; but it certainly is very ingenious, for, by regulating the different openings which let the water into the upper part of the movable box or control its escape therefrom, the time during which the clapper will remain open may be regulated exactly.—La Nature.

The Balloon as a Detecter of Submarines.

The French Naval Department has been carrying cut a series of interesting experiments with balloons for detecting submarine boats, when submerged, the results of which proved that the course of a submarine craft can be easily followed from a balloon in the air. The "Gustave Zédé" was used for these experiments. The boat was submerged to a depth of ten feet and more, but it was easily discovered by the aeronaut when the boat ran counter to the sun's rays, although the balloon remained at a height of 1,500 feet. An ingenious telephonic apparatus was connected from the submarine to the balloon, in order that the latter might signal when it had discovered the boat. The experiments further proved that the green color at present employed in painting submarines is not an effective disguise, and that the ease with which submarines may be descried beneath the surface depends on their angle with regard to the sun.

Mediterranean Trip.

The Count de la Vaulx is making active preparations for another attempt to cross the Mediterranean by balloon, and the experiment will have a better chance of success, as it will be carried out early in the summer. Last year the trip was delayed until late in the autumn, and it was undoubtedly due to the bad weather that the aeronauts were unable to cross. The start is to be made from a different point on the coast this time, at Palavas-les-Flats, near Montpellier, and here a great balloon shed is being erected on the beach. The balloon, after the last trip, was sent to Paris to be reconstructed and will be called the "Mediterranéen No. 2." The balloon shed at Toulon offered a great resistance to the wind, and on one occasion was nearly carried off by a violent storm, although it was well braced by guy-ropes. The aeronauts will profit by this experience and are building the shed in a tent-like form which will offer less resistance. The balloon, which is now in construction, has a volume of 4,160 cubic yards, and the upper part has been made in conical form to shed the rain. M. Hervé has availed himself of the data obtained on the last trip to make some improvements in his steering and floating devices, of which an account will be given later. The balloon is arranged so as to be either attached to the float upon the water or to take a free flight; for the latter case it is provided with an interior air-balloon gaging 1,300 cubic yards which will be kept inflated by a ventilating fan. The former arrangement of water-ballast tanks will be used, and this time will be improved by adding a 12 horse power petrol motor which operates a pump for automatically filling the tanks by a pipe which runs down to the water, and the tank will also be discharged by an automatic device. It is probable also that the balloon will be made partially dirigible by using the motor to operate a propeller.

FASTENING DEVICE FOR HORSES.

It is no longer necessary for a driver to fasten his horse to a hitching post. If provided with the fastening device here illustrated, he needs simply to slip his reins on the catch in the wagon, and the horse will be unable to run away. Mr. Phillis Mayotte, of Wells, Mich., is the inventor of this new fastener. The construction of the device is very simple. Supported in a bracket on the vehicle is a spindle carrying a disk provided with hooks to serve as a fastening means for the reins. Beneath this disk is a ratchet wheel engaged by a spring-pressed pawl. The lower end of the spindle protrudes from the bracket, and is connected by a universal joint to a rod which telescopes in a tube carried in a bracket on the front axle. On the rod are a series of pins, which project through longitudinally ranging slots in the tube, whereby the rotary motion of the tube is communicated to the rod. At the lower end of the tube is a small bevel gear, which engages a large bevel gear on the hub of one of the front wheels. The teeth of these gears are curved outwardly, so as to allow for any unevenness in the road, and all play in the parts is taken up by a spring coiled in the tube and abutting against the end of the rod held therein. A lever on the rod connects with the top of the tube and permits the latter to be lifted sufficiently to disconnect the gears. This will be found useful in long drives, when it is desirable to save the parts from wear.


DEVICE FOR HOLDING HORSES.

To fasten the horse, one needs simply to wind the reins around the spindle and secure them under a hook on the disk. If the horse should start forward, the reins will be quickly wound up on the spindle, and the animal suddenly checked. Any subsequent backward movement would have no effect, on account of the spring-pressed pawl ratchet, which prevents rotation of the spindle in the opposite direction. Hence, whichever way the horse may turn, the wheels cannot be moved.