SIMPLE EXPERIMENTS IN PHYSICS.

BY GEO. M. HOPKINS.

The value of observation was never more apparent than in the case of the discovery of the action of an electric current upon a magnetic needle by Christian Oersted in 1819. While passing through his laboratory on one occasion, with a compass in his hand, he noticed that the needle acted in a peculiar manner. By a few experiments he ascertained that the disturbance was caused by an electric current flowing through wires strung across his laboratory. To this circumstance we

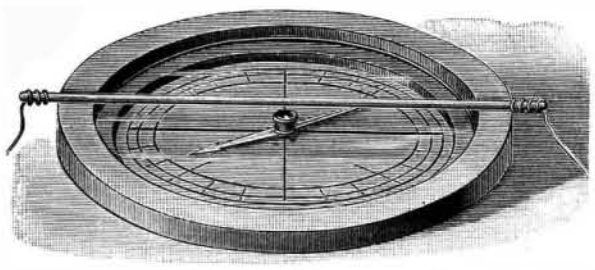


Fig. 1.—COMPASS FOR PROJECTING OERSTED'S EXPERIMENT.

owe the discovery of electro-magnetism. It is shown by experiment that the magnetic needle tends to arrange itself at right angles to a conductor carrying a current.

In Fig. 1 is illustrated a piece of apparatus for demonstrating this fact, either to a few individuals or to a large assemblage, by the aid of a lantern. It consists of a compass with a glass bottom having the scale marked on it. The needle turns on a pivot projecting from a little plate cemented to the center of the glass. When a conductor is laid across the compass, parallel with the needle, and a current is sent through the conductor, the needle is deflected in one direction or the other, depending upon the direction of the current.

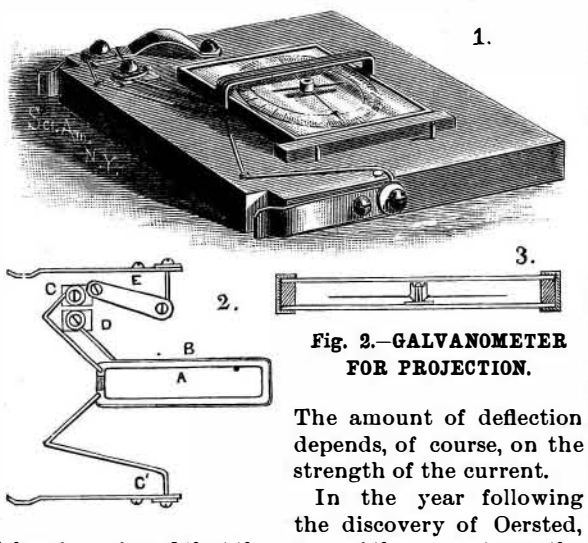


Fig. 2.—GALVANOMETER FOR PROJECTION.

The amount of deflection depends, of course, on the strength of the current.

In the year following the discovery of Oersted, Schweigger found that the power of the current over the needle was increased by causing the current to pass several times around the needle. Owing to this fact, the galvanometer was formerly known as the galvano-multiplier. A convenient and useful galvanometer for ordinary use, and for projection, is shown in Fig. 2; 1 showing the complete instrument in perspective, 2 being a diagram of the circuits, and 3 being a transverse section of the compass box. The foundation of this galvanometer is a fine photograph on glass of a complete scale of degrees of the size of an ordinary lantern slide. Upon the center of the photograph is cemented a small metallic disk, in which is secured a fine needle point, and upon the needle point is poised a jeweled compass needle taken from a pocket compass.

To diametrically opposite sides of the boss of the

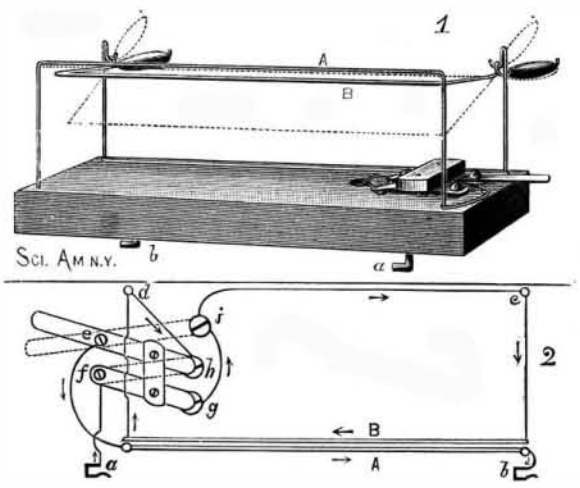


Fig. 3.—ATTRACTION AND REPULSION OF PARALLEL CONDUCTORS—AMPERE'S EXPERIMENT.

compass needle are soldered the heads of two entomological pins, which are perfectly adapted to this use, being long, thin, and finely pointed. These are arranged exactly at right angles with the needle. To one of these pins is cemented a thin paper arrow head, and upon the other pin is placed a small drop of solder to counterbalance the paper.

The compass thus formed is provided with a glass cover, separated from the scale by narrow strips of wood. The baseboard upon which the compass is mounted is provided with a round central aperture, a little larger than the circle of the scale. Across this aperture is secured an oblong rectangular coil, which will presently be described. The ends of the coil are let into recesses in the baseboard, so that when the compass is in its place the needle will occupy a central position in the coil. The compass, after adjustment, is fastened in place by six small brass screws, and along one edge of the compass is arranged a permanent bar magnet, which is held in its place by two pins. The bar magnet permits of bringing the pointers to zero, and renders the compass independent of the earth's magnetism, so that the galvanometer may be used in any position without regard to the magnetic meridian.

The coil consists of a narrow copper trough, A (see diagram), of U-shaped cross section, one-fourth inch wide and one-eighth inch deep, separated a short distance at one end of the coil, so that the current may be sent around the needle through the copper trough alone when desirable.

In the trough is wound a quantity of No. 40 silk-covered copper wire, forming the coil, B, one terminal of which is fastened to one end of the copper trough in such a way that the trough forms a continuation of the coil. The opposite or outer end of the fine wire coil is connected with the switch point, D. The corresponding end of the trough is connected with the switch point, C, and the remaining terminal of the trough is connected by a wire, C', with the contact spring at one edge of the baseboard. The contact spring at the opposite edge of the baseboard is connected with the pivot of the switch arm, E.

The contact springs are designed to make connections with the studs on the lantern, which in turn are connected with the conductors of the galvanometer circuit.

When the switch arm, E, is on the point, C, as shown in the diagram, the current passes through the trough only. Arranged in this way, the galvanometer is adapted to the measurement of heavy currents. When the switch arm is on the point, D, the current goes through both the fine wire coil and the trough. In this way the instrument is adapted to light currents. This galvanometer is adapted to the general run of experimental work. It makes a good image on the screen or ceiling when used in a lantern with a vertical attachment. The magnet interferes somewhat with its sensitiveness, and may be removed when very delicate action is desired.

In 1820 Ampere discovered that the action of a conductor in which a continuous current of electricity is maintained is like that of a magnetic needle. He replaced the needle by a delicately pivoted conductor, and demonstrated that all of the phenomena of the needle could be reproduced by the suspended conductor.

Another curious discovery, due to the same great physicist, is that of the mutual attraction and repulsion of parallel conductors. Apparatus for exhibiting this phenomenon is illustrated by Fig. 3. In this figure the perspective view shows the device adapted for projection, and the diagram shows the circuits.

Two parallel wires, A, B, are arranged one above the other, the wire, A, being fixed, the wire, B, being movable. The wire, A, is bent twice at right angles and its ends are inserted in the baseboard. The wire, B, is bent twice at right angles, and the arms thus formed are provided with eyes which are suspended on delicate pivots on the standards, *c*, *d*. These arms are prolonged beyond their pivots and provided with weights for counterbalancing the wire, the weights being so arranged as to cause the wire, B, to rest normally a short distance, say one-fourth or three-eighths inch, from the wire, A.

The connections with the battery or other electric generator are through the hooks, *a*, *b*. A current-reversing switch is provided, by which the current may be made to flow in the same direction or in opposite direction through the conductors, A, B. With the switch in the position shown, the current arriving at the hook, *a*, passes in the direction of the arrow to the switch arm, *f*, point, *g*, point, *i*, and standard, *c*, through the conductor, B, to the standard, *d*, thence to point, *h*, to the switch arm, *e*, thence through the conductor, A, to the hook, *b*. The current flowing in opposite directions through the conductors, A, B, causes the repulsion of the conductor, B.

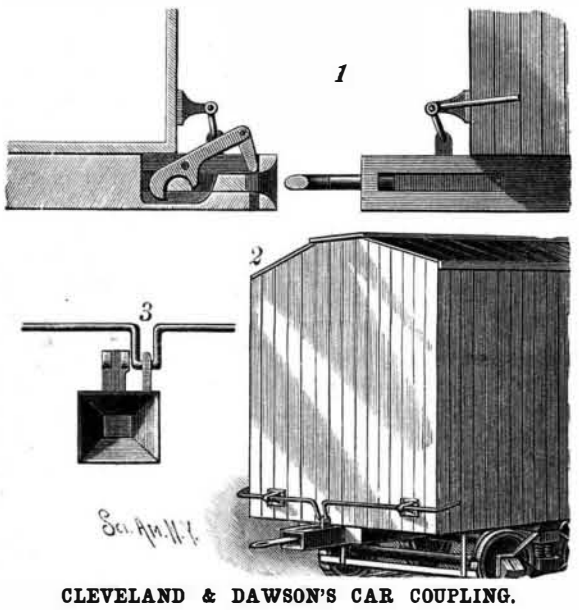
By shifting the switch arms, *e*, *f*, to the points, *i*, *h*, the current will flow through both conductors in the same direction, thereby causing them to mutually attract each other, the result being the movement of the conductor, B, toward conductor, A. This apparatus is designed especially for projection, the parallel wires only being visible on the screen.

Total Eclipse on New Year's Day.

A total eclipse of the sun will take place on January 1, 1889. The line of totality goes through a portion of California, Nevada, and Idaho. The Lick Observatory is directly in the path of the central line.

AN IMPROVED CAR COUPLING.

A car coupling designed to automatically couple cars as they come together is illustrated herewith, and has been patented by Messrs. George W. Dawson and Benjamin F. Cleveland, of Sac City, Iowa. The drawheads are duplicates of each other, and in each is a sliding block that is forced back by the entrance of the connecting link. This block is vertically recessed to form a rounded portion, which serves to raise and lower the outer end of a pivoted bar on which the coupling pin is pivoted, as shown to the left in Fig. 1, this pivoted bar working in a slot in the upper surface of the drawhead, and its lower edge being recessed to form projections which span the rounded portion of the sliding bar. To lift the coupling pin for uncoupling, the sliding block must be forced forward in the drawhead, which is effected by a rod held across the end of the car, and bent

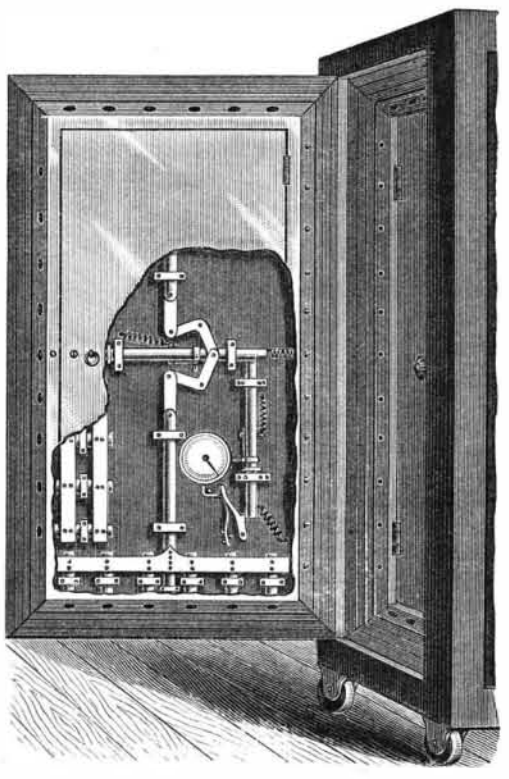


CLEVELAND & DAWSON'S CAR COUPLING.

to form a crank which connects with an arm attached to the sliding block, as shown in Figs. 2 and 3. When the sliding block is forced forward, it not only serves to lift the pivoted bar and coupling pin, but holds them in elevated position, ready to receive and engage the link of another car.

AN IMPROVED SAFE OR VAULT DOOR LOCK.

The accompanying illustration represents a safe or vault door which locks automatically when it is closed, and unlocks automatically at any predetermined time at which the clock which actuates the works may be set prior to closing the door. This has been patented by Mr. William M. Brown, Jr., of No. 1627 H Street, Sacramento, Cal. Our engraving shows an inside face view of the door partly broken away, with the bolt works in the position they have when the door is open and just prior to closing it. The door is made principally of steel and iron plates bolted together and rabbeted at the edges to fit into corresponding rabbets at the front of the body of the safe, and the lock or set works are so arranged as to give no clew to their arrangement on the safe door, being covered by an inner



BROWN'S SAFE OR VAULT DOOR LOCK.

door, which is opened to set the hands of the clock mechanism at the time the door is to open. The clock mechanism has a dial, preferably divided into hours from 1 to 24, and its hand is set to cause the spring barrel at any predetermined time to draw on a downwardly extending cord and lever, pulling a shoulder of

the lever from under a vertical bar, allowing a spring to draw this bar downward clear of a shoulder of the horizontal main bolt bar. A spring is connected to this bar and the door to draw the bar inward and simultaneously withdraw the bolts from the top and bottom and outer edge in the jamb of the safe, to unlock the door. The trip lever is automatically set as the bolts are thrown when the door is closed, to prevent the opening of the door until the desired time, when it opens of itself, without the use of any outside knob or device to disclose the position or arrangement of the bolt works.

How to Have Healthy Swine.

Keep large and small separate and not more than ten in a lot.

Feed regularly and liberally of wholesome food, always some bulky food, and let each feed be eaten up clean before more is given.

Give wallowing places, ashes, charcoal, and salt, and plenty of exercise in timber pastures yielding shade, roots, nuts, acorns, etc. But no doubly soured slops.

Provide ventilated shelters from wind, rain, and snow, but no litter. Hogs with litter get too warm. If you wish disease, put your hogs to the straw pile.

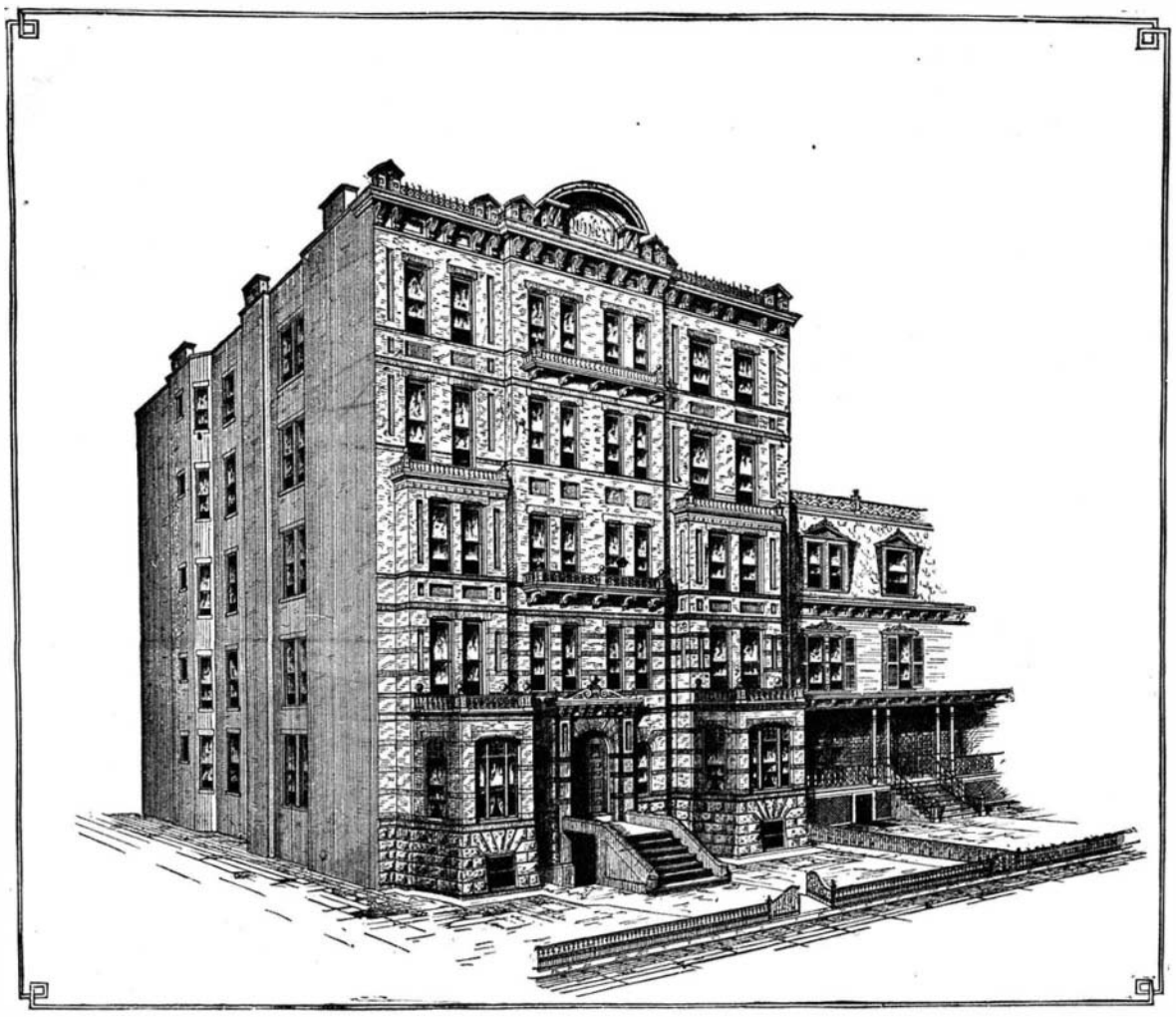
Maintain cleanliness in all things. Breed only mature animals, and never from a show herd. The offspring of immature or pampered animals is predisposed to disease.

Give pure water, from deep wells protected from surface water. Well water is not freezing cold in winter nor lukewarm in summer. Water from creeks (unless fed by springs), ponds, or pools is disease-breeding.

Pigs should be farrowed in early spring and kept only on growing foods—milk, bran slops, oats, green rye, grasses, clover, sweet corn—until late fall; then fatten rapidly, on corn mostly, but also green rye, blue grass, pumpkins, boiled potatoes and turnips, with bran, steamed clover hay, etc.—*American Agriculturist.*

HOMES FOR THE MANY.

The two houses represented in the accompanying illustrations are as different in character as could well be selected. The building in the upper cut is a good type of the better class of Brooklyn apartment houses. It is situated on Quincy Street, between Nostrand and Marcy Avenues, and was erected at a cost of about $50,000. It has a frontage of 55 feet, and is 95 feet in depth. It was erected from the plans of Amzi Hill, architect.



NEW APARTMENT HOUSE, BROOKLYN, N. Y.

The country residence shown in the other cut was erected for Mr. Edwin A. Burgess, at Buttonwood, R. I., and is a good representative of an inexpensive seaside or summer residence. With a well planned interior, an extension kitchen, and spacious piazzas, it affords an airy, cool, and comfortable home.* It was built about two years ago, at a cost of about $3,000.

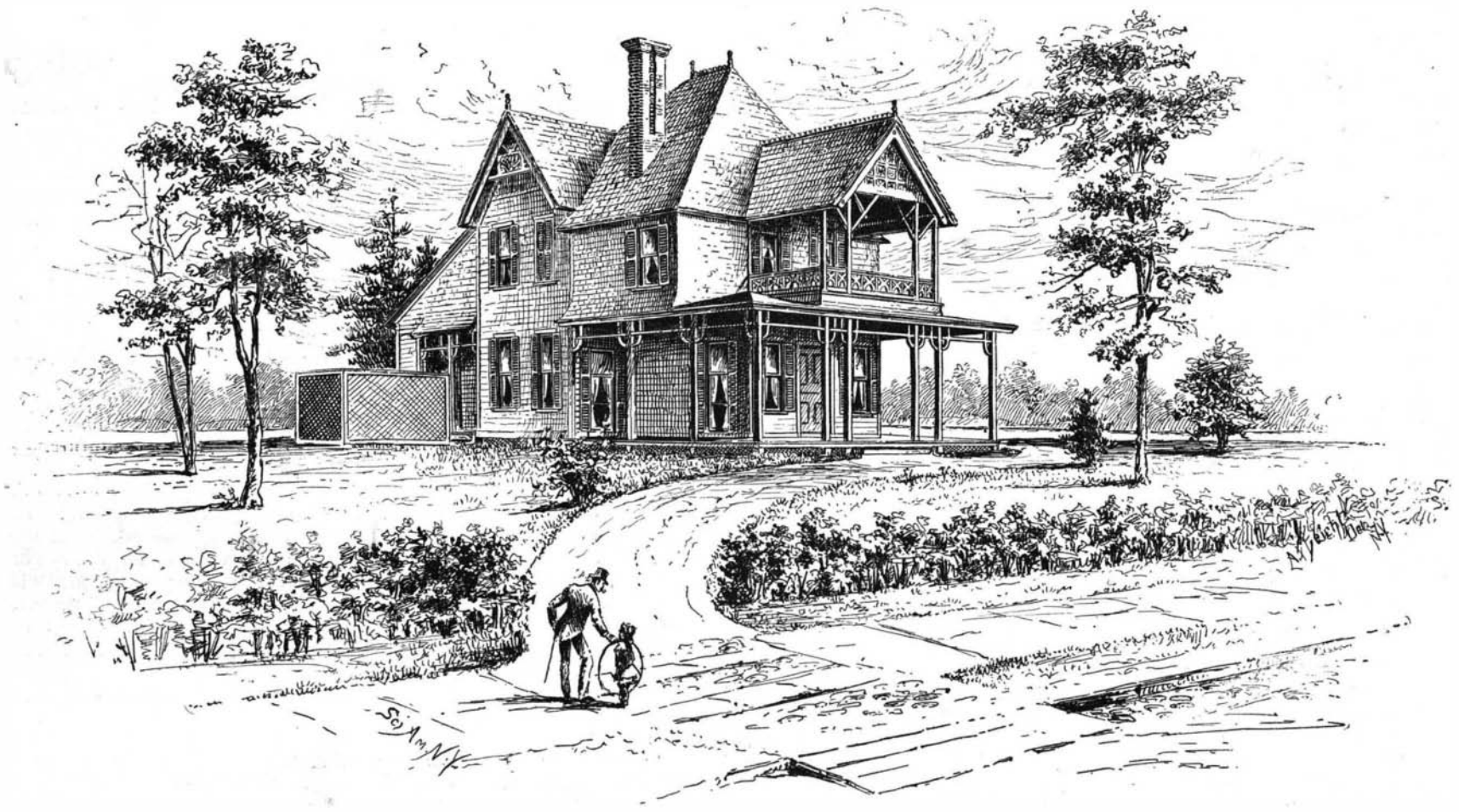
*See ARCHITECTS AND BUILDERS EDITION OF THE SCIENTIFIC AMERICAN of May, 1887, which contains the floor plans, and which gives a description of the construction and the materials used in both these buildings. Single copies, 25 cents, or $2.50 a year.

Storage Battery Motors.

To try and try again, even though the promise is small, to overcome one obstacle and then another, certainly deserves even if it cannot command success; and so it is that, if the storage battery motor people, now experimenting upon one of our surface railway lines, do not eventually show their system practically suited for such employment, it will not be for lack of industry, of brains, and of ingenuity. Two months ago only one car was making regular trips, its batteries needing recharging from the central station after each round trip of twelve miles—a process requiring some four or five hours. Now there are three cars running, the same needing recharging only at the end of the second round trip on the twenty-four miles, with only three hours consumed, at least so it is said, in the operation. Further than this, it is claimed that, in the not distant future, the apparatus bids fair to be that much perfected that only one charging will be required for the day's work of three round trips and thirty-six miles. As to the relative cost of this type of traction, we cannot speak with certainty; but as to its convenience, no one who has seen these cars will have a doubt.

Oil of Sassafras.

The manufacture of the oil of sassafras is becoming an important industry in some parts of the country, especially in the Southern States, where this tree is common. Only the roots are used; they are chopped up into small pieces by a machine constructed for the purpose, the oil being then distilled from the chips by the aid of steam. About one gallon of the oil, weighing nine pounds, is obtained from 1,000 pounds of the chips. The uses for which the oil of sassafras can be employed are numerous and varied. It is a favorite perfume for soaps and candies; it is used as a solvent for different gums, and as a liniment. It is also very largely employed in the manufacture of several popular proprietary medicines. The importance of this industry may be expected to increase rather than diminish, as the sassafras and the persimmon are the two trees which are spreading most rapidly over the old and abandoned fields throughout the Southern States outside of the pine belt proper; and at present prices good wages can be made digging out the roots.—*Garden and Forest.*



AN ATTRACTIVE CHEAP DWELLING HOUSE.