IV. SIMPLE ELECTRIC MOTOR.

(Continued from last issue.)

BY GEORGE M. HOPKINS.

The next thing to be done is to construct the field magnet, which in this motor is in the form of a ring, as shown in Fig. 1. The core of the field magnet is formed by winding four strips of No. 24 sheet iron ¾ inch wide and 8 feet long upon a wooden core, as in the case of the armature core. The form on which the field magnet is wound being $\frac{3}{16}$ inch larger in diameter than the armature, and as this is variable, it must be ascertained after the armature is wound and balanced, on account of the variation in the winding depending on the covering of the wire and the care with which it is wound. In the motor illustrated, the field magnet ring is 2¾ inches internal diameter and 4½ inches external diameter. Before winding the field magnet core, the ends of the 8-foot strips are scarfed or beveled off and tinned, and then soldered together and coiled for convenience.

The strips should be wound upon the form as tightly as possible, and when the last layer is on, a stout wire is wrapped around the outside and twisted together to keep the sheet iron strip from unwinding, as in the case of the armature core.

As it is not necessary to anneal the field magnet, the wooden form is removed by boring a hole through it and then splitting the wood so that it can be removed piecemeal. The coil of sheet iron forming the field magnet core is composed of thirty-three layers.

The ring is divided into four quarters by radial lines, and midway between two of these lines, on opposite sides of the ring, are drilled holes for rivets $\frac{3}{16}$ inch in diameter, the holes being countersunk slightly on each side. These rivets with slight heads are inserted in the holes, with the heads inside the ring. They are then neatly riveted at the outside, leaving the inner side as smooth as possible. To accomplish this, it is necessary to move the binding wire away from the center of the field magnet ring.

When the two rivets are in place, the binding wire may be removed; then in the same sections near the ends are placed rivets, one at each end of each section. The sections riveted in this manner form inwardly projecting pole pieces. While drilling the holes for the rivets, it is necessary to clamp the strips firmly together to prevent the drill chips from working in between the layers of the magnet. Eleven layers of the magnet ring are sawed out between the pole pieces to make a space for the winding of the field magnet; the ends of the pole pieces are beveled as shown to facilitate winding. These spaces are covered with adhesive tape and are wound with four layers (about 45 feet) of No. 18 magnet wire, either single or double, cotton or silk covered.

One of the pole pieces will be at the bottom of the field magnet and the other at the top when the motor is complete; therefore the winding on each side of the field magnet begins at opposite sides of the same pole piece, and is wound in the same direction to bring the wire terminals near the base of the machine, and to cause the current in the two windings to unite in producing a north pole at the top of the magnet and a south pole at the bottom, or vice versa. If a mistake is made in the winding, this can be corrected in making the connections. It is not necessary to unwind and rewind.

The construction of this magnet is open to criticism on account of the disposition of the laminæ, but this construction is partly or wholly compensated for by the large rivets, which bind the pole pieces and the body of the magnet together.

The holes are drilled in the lower side of the magnet and tapped to receive machine screws, which pass upward through the base of the machine to hold the magnet, which latter sits upon a small wooden saddle about ⅛ inch thick in the middle. The field magnet winding, as well as the iron core, is covered with several coats of shellac varnish, for insulation and protection.

The journal boxes for the shaft are simply ⅝ brass balls axially bored to receive the shaft, and having an oil hole in the top. These boxes are each held in place by two brass plates bored to receive the sides of the balls, as shown, and attached to the sides of the square wooden standards by screws. The shaft is allowed to project at one or both ends sufficiently to receive a pulley or fan. The armature is wrapped around the sides with enough firm paper to cause it to fit tightly into the field magnet, and after the shaft is made level, the journal boxes are placed on the shaft, and the standards which support them are sawed off the proper length and secured to the base by screws, one for each standard, passing upwardly through the base and into the lower ends of the standard. To the base adjoining the standard at the commutator end is attached a wooden block, to the ends of which are secured light copper springs, which bear on opposite sides of the commutator and act as brushes for conveying the current to the armature.

The screws which hold the lower ends of these brushes also clamp the wires which extend downward through the base, one being connected with one of the binding posts which receive the battery wires, the other brush being connected with the outside terminal of one of the field magnet coils. The outside terminal of the other field magnet coil is connected with the remaining binding post. The inside terminals of the field magnet coils are connected together. The connections are clearly shown in the diagram (Fig. 2). The upper screws in the commutator brushes are used for varying the pressure of the brushes on the commutator as may be required; the brushes being bent outwardly to admit of this adjustment.

If the motor is to be used for driving a fan, the base will need to be set upon legs of some kind. In the motor illustrated, the base is supported upon four inverted clothes hooks which support it 2 inches from the table.

Fig. 1.—FIELD MAGNET CORE.

The oil cups are made of wood (soft maple or birch), with stems extending down into the $\frac{3}{16}$ holes in the spherical boxes; and in the portion of the wood above the journal box is formed a cavity which will contain a few drops of oil. The outside of the oil cup is varnished with shellac except at the end of the stem, before any oil is put in. This confines the oil to the cavity and the interior of the stem and causes it to slowly feed to the journal on which the stem rests. The fan can be purchased for a small sum. It may be necessary to bush it to fit the shaft. Either an 8-inch or a 10-inch fan may be used.

Of course, a small pulley will be substituted for the fan when the motor is used to drive a machine.

If the motor when finished does not run in the desired direction, this may be changed by transposing the wire connections at the brushes, so as to change the direction of the current in the armature.

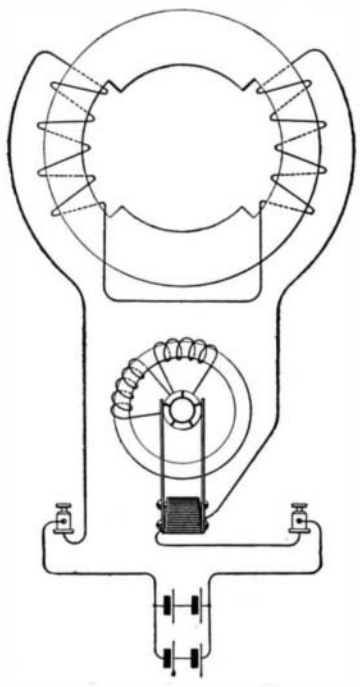

Fig. 2.—ELECTRICAL CONNECTIONS OF MOTOR.

Valuable Greek Antiquities.

Mr. J. Pierpont Morgan has recently presented to the Metropolitan Museum of Art a votive mask, a necklace and victor's wreath and bridal wreath, which were discovered some time ago at Olbia, an ancient colony of Miletia in Scythia. At first it was thought that the gold crown was that of a king, but an inscription on it shows that it was that of a priestess of Demeter. The work is not in repoussé, but appliqué. Upon the back of the necklace is another word which signifies "belonging to Zenoklides." This shows that the necklace and the crown belonged to two different persons, and not to one. The pendants of the glass amphoræ have all been fastened to the necklace, and it is now complete. The bridal wreath is composed of leaves of oak, myrtle and hawthorn made of silver which has become oxidized by long exposure to the earth. Between the leaves are little buds of gold. The specimens are among the most perfect possessed by any museum in the world.

Engineering Notes.

Five million dollars will be expended at Dover, England, for dock extension, with a view of accommodating vessels of the size of the "Oceanic," as several American lines have intimated that they will sail from that port when the work is completed.

The annual report on the changes in rates of wages and hours of labor in Great Britain during the year 1899 has just been issued. The prosperity of the country was such that the percentage of the unemployed was the lowest recorded since 1890. The changes of wages last year aggregated a rise of $575,000 per week, an increase of $100,000 over the year 1898.

The municipal authorities of Bristol are petitioning the British Parliament for the necessary powers to extend and to improve the dock accommodation at Avonmouth. The principal item of the scheme is the construction of a huge ocean dock to accommodate the largest cargo steamers and liners. The total cost of the undertaking is estimated to be $9,020,000.

The British Naval Department has issued applications for tenders for coal, and for the first time they require a twelvemonth's supply under normal conditions, and also for any further supplies that may be rendered necessary though any unforeseen circumstances. This is the largest single order ever placed in the coal trade in England. It is anticipated that it will amount to about 1,000,000 tons.

The first vessel, the "Runic," with which the White Star Line are founding their colonial fleet, has been launched from the yard of Messrs. Harland & Wolff, at Belfast. She is a twin screw steamer, 565 feet in length, 64 feet beam and of 12,400 gross tonnage. When completed, she will be one of the largest passenger steamers afloat, and her inauguration will commence a new era in connection with the colonial ocean traffic with Great Britain.

The Boston & Maine Railway gives cash prizes yearly to station agents for floral displays at their stations, says The Railway Review. Prizes of $50, $40 and $25 were distributed to the station agents at South Lancaster, Waltham and other places. At some of the principal stations on the Kansas City, Fort Scott & Memphis Railway greenhouses are to be established, in which passengers will be invited to pass their time while waiting for trains, and the surplus flowers will be supplied to the dining cars on the through trains.

Extensive dock works are to be undertaken at Manchester, which will considerably improve the commercial prosperity of that city. Some thirteen acres of land have been acquired, and a large new basin with a water frontage of one mile, railway tracks, warehouses, storage grounds, etc., are to be constructed. The object of the scheme is to enable the largest modern steamers to berth easily and comfortably. Probably the success of the Manchester Ship Canal is responsible for these large additions to the dock capacity of Cottonopolis.

The Current Supplement.

In the current SUPPLEMENT will be found many articles of general as well as of scientific interest, for the most part illustrated by clear engravings. "The Building of the Great Wachusett Dam," by J. A. Stewart, is a lucidly written description of a notable engineering undertaking. The inaugural address of Prof. John Perry, president of the Institution of Electrical Engineers, on "Electrical Engineering as a Trade and as a Science," is continued. The clay-working machinery exhibited at Paris is discussed in a well-illustrated article. Prof. MacCord contributes an interesting account of a new elliptical lathe which can perform all that can be done with the appliances hitherto employed, as well as work which could not formerly be executed on elliptical lathes. "Irrigation in the East and West" describes the work of the Department of Agriculture. "An Automobile Mowing-Machine" is a new invention which will probably excite no little interest. The inaugural address of Carl Hering, president of the American Institute of Electrical Engineers, is reproduced; the subject discussed is "The Paris Exposition of 1900." One of the most thoughtful and earnest articles is a paper by George W. Dickie, entitled "Can the American Shipbuilder under Present Conditions Compete with the British and German Shipbuilders?" The usual trade suggestions, notes and recipes will be found in their proper place.

Contents.

(Illustrated articles are marked with an asterisk.)