No. 734,778. PATENTED JULY 28, 1903.

R. VARLEY.

ELECTRICAL HELIX.

APPLICATION FILED FEB. 4, 1903.

NO MODEL.

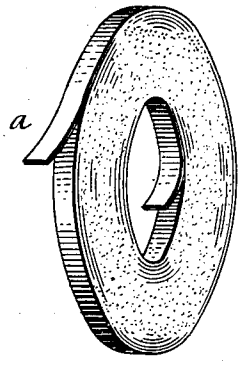

Fig. 1.

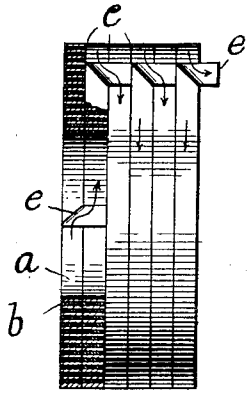

Fig. 2.

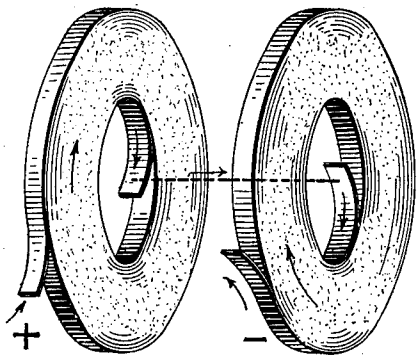

Fig. 3.

Witnesses
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By his Attorney
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No. 734,778. Patented July 28, 1903.

UNITED STATES PATENT OFFICE.

RICHARD VARLEY, OF PROVIDENCE, RHODE ISLAND, ASSIGNOR TO VARLEY DUPLEX MAGNET COMPANY, A CORPORATION OF NEW JERSEY.

ELECTRICAL HELIX.

SPECIFICATION forming part of Letters Patent No. 734,778, dated July 28, 1903.

Application filed February 4, 1903. Serial No. 141,856. (No model.)

To all whom it may concern:

Be it known that I, RICHARD VARLEY, a citizen of the United States, residing at Providence, in the county of Providence and State of Rhode Island, have invented certain new and useful Improvements in Electrical Helices, of which the following is a full, clear, and exact description.

This invention relates to coils for electromagnetic purposes, the object being to provide a winding built up of a number of disk-like units connected together in a manner to produce a continuous winding, the turns of which are all in the same direction.

A further object of the invention is to produce an electrical coil in which the convolutions are insulated by a material capable of resisting a high temperature, thus adapting the winding for use on magnets, transformers, and other apparatus where it will at times be subjected to excessive currents of electricity.

A further object of the invention is to provide an electrical coil which can be wound of bare wire and the insulating material applied after the winding operation; and a final object of the invention is to produce an electrical coil which will occupy the smallest cubical space for a given number of turns and which can be manufactured at low cost.

My invention therefore consists of a winding composed of a plurality of disks or units, each of which is formed of wire wound with each convolution directly over the preceding convolution, forming when completed a flat spiral or disk, the adjacent convolutions being separated and insulated by enamel or other suitable insulating material. Such disks or units are arranged side by side in such relation to each other that when the adjacent units are connected together by their inner or outer terminals the direction of a current of electricity flowing from one spiral to another will not be changed.

In the accompanying drawings, Figure 1 is a perspective view of one of the units of winding. Fig. 2 is a view, partly in section and partly in side elevation, of a number of units assembled to form a continuous unidirectional winding; and Fig. 3 is a diagram of the circuits.

The coil or winding is made of flat or ribbon wire, which in order to obtain exact equivalent cross-sections is formed by rolling out ordinary round copper wire of known gages. This flat wire is wound by any suitable process in a manner to produce a flat spiral or disk-like structure, (shown in Fig. 1,) one convolution being wound directly over, radially speaking, the other, so that all of the convolutions will be in one plane at right angles to the axis of the disk. One of the preferred processes for winding this disk-like coil is described in a companion application filed of even date herewith, Serial No. 141,857. Briefly stated, that process consists in simultaneously winding a temporary separating medium between the convolutions of the wire and in afterward removing a portion of the separating medium and substituting a plastic material adapted to become vitreous by the application of heat, then removing the remainder of the temporary separator and filling in the empty space with the same plastic material, and as a final operation baking the coil to vitrify the plastic material. The drawing in the present case shows only the flat conductor *a* and the permanent vitreous insulation *b*. It is found that a coil constructed in this manner is thoroughly insulated and obviously is adapted to withstand temperatures very much higher than can be resisted by the ordinary cotton or silk insulation commonly used and that electromagnet and transformer coils built up from these disks or units are capable of standing great overheating without injury to the insulation.

In order to assemble the disks or units into electromagnet, transformer, or other windings, they are placed side by side or one above the other on a concentric axis, as shown in Fig. 2, with the winding of each alternate coil arranged reversely to that of the others, so that when the two inner ends of two oppositely-wound units are connected together the direction of current flowing from one coil into the next will not be reversed. Likewise when the outer end of one of the connected coils is connected with the outer end of the next adjacent coil in the succession the current will not be reversed in flowing from one to the other. In this manner the succeeding coils are all connected in series. In assembling the units to form a complete winding any suit-

able insulation may be interposed between them. I prefer to insert thin disks *c*, of mica, but a thin layer of enamel or vitreous material can be formed upon one or both sides of each unit.

Any suitable method may be adopted for connecting the terminals of the units together, the method I have shown being that of bending over at right angles one terminal, as shown at *e*, and soldering it to the straight end of the other terminal, similar connections being made both internally and externally of the coil.

It will be seen that since the wire is rectangular in cross-section the largest possible amount of it can be wound in a given cubical space. The insulating material is uniform in thickness throughout, and the structure is substantial and not liable to mechanical injury. Such a coil is eminently adapted to arc-lamp magnets, transformer-windings, and for other purposes where excessive currents are sometimes encountered. The shape of the units may obviously be other than circular when desired.

Having described my invention, I claim—

An electromagnetic winding or coil consisting of more than two flat spirals arranged in succession along a common axis, each consisting of a plurality of convolutions of wire all arranged in the same plane at right angles to the axis, the inner ends of two adjacent spirals being connected together, while the outer ends thereof are connected to the outer ends respectively of the two adjoining spirals, the direction of winding of adjacent spirals being opposed to each other, whereby current traversing the winding will flow in the same direction around the axis throughout all of the spirals.

In witness whereof I subscribe my signature in presence of two witnesses.

RICHARD VARLEY.

Witnesses:

WILLETT CHADWICK,

M. M. CROSWELL.