No. 649,086. Patented May 8, 1900.

# R. VARLEY.

## ELECTROMAGNETIC COIL.

(Application filed Jan. 2, 1900.)

(No Model.)

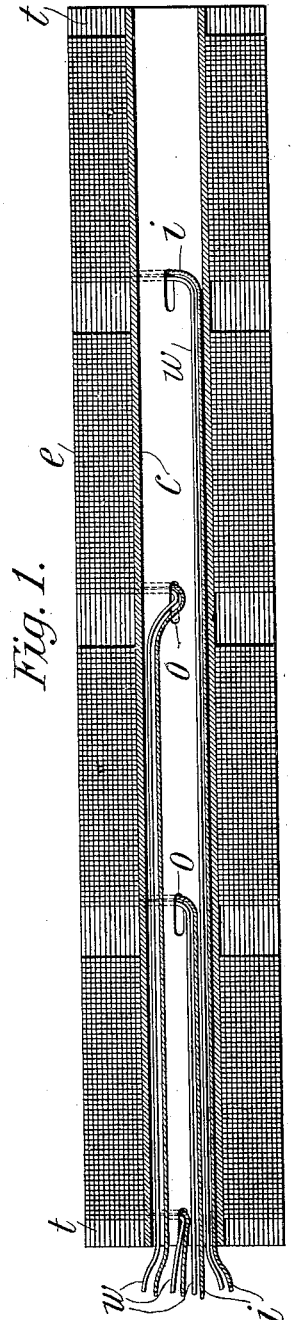


Fig. 1.

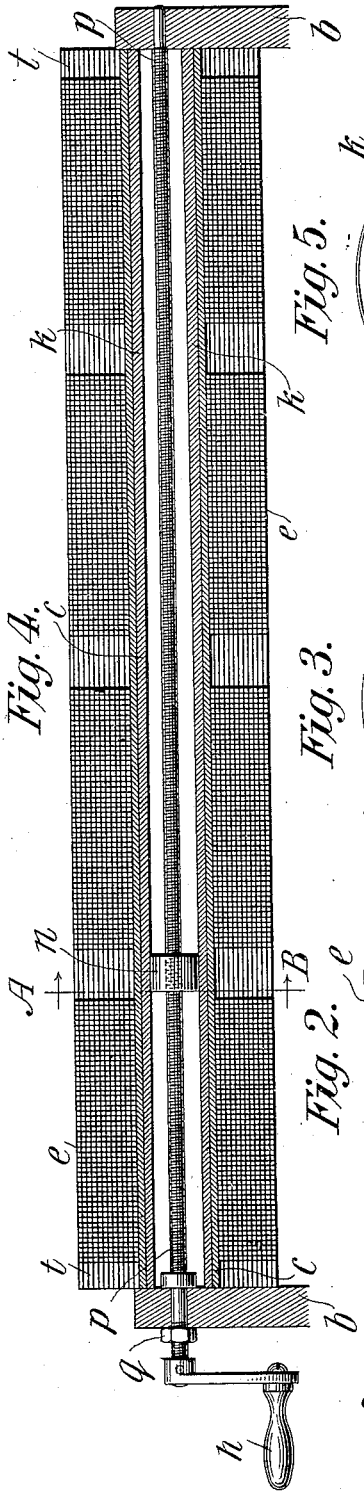


Fig. 4.

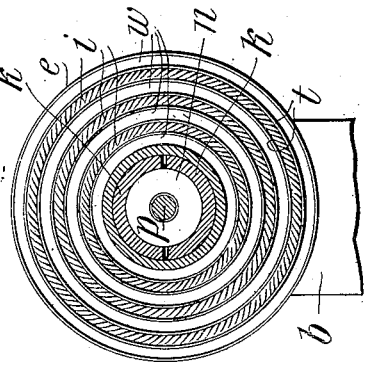


Fig. 5.

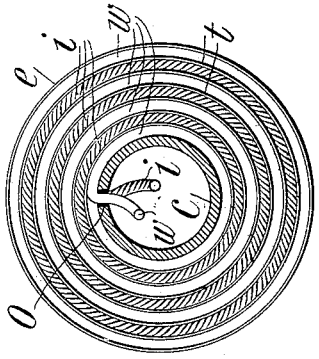


Fig. 3.

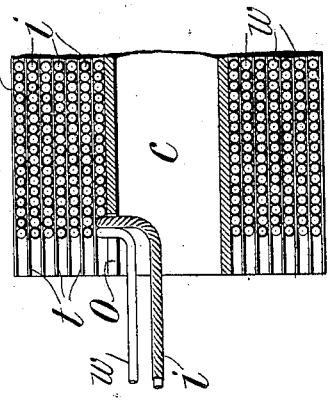


Fig. 2.

WITNESSES:

C. E. Ashley

A. M. Donlevy.

INVENTOR:

Richard Varley,

By his Attorney

H. B. Vansize

# UNITED STATES PATENT OFFICE.

RICHARD VARLEY, OF JERSEY CITY, NEW JERSEY.

## ELECTROMAGNETIC COIL.

SPECIFICATION forming part of Letters Patent No. 649,086, dated May 8, 1900.

Application filed January 2, 1900. Serial No. 31. (No model.)

*To all whom it may concern:*

Be it known that I, RICHARD VARLEY, a citizen of the United States, residing in Jersey City, county of Hudson, State of New Jersey, have invented certain new and useful Improvements in Electromagnetic Coils, of which the following is a specification.

The object of my invention is to increase the efficiency of electromagnetic coils, to secure uniformity in size and resistance, and to decrease the cost of manufacture.

The invention relates to a magnet-coil having a series of coil-sections upon a self-supporting tube or core of insulating material. Each coil-section is composed of a number of layers of wire. Each layer consists of a number of convolutions, with suitable insulating material to separate one convolution from another. There is an inclosed air-space between the adjacent ends of the coil-sections. Thin paper is employed to separate pairs of layers.

I slot or perforate the tubular core at a point between adjacent coil-sections, and I thrust the initial end of the wire constituting the terminal of a coil-section through this slot or aperture in the wall of the tube. I am thus enabled to protect and manipulate the coil-terminals.

I employ a paper tube of sufficient thickness to give it the required mechanical strength to be self-supporting and to withstand manipulation. This tube is coated and saturated with paraffin, by which it is softened, so that the helical convolutions of the adjacent layer of wire and the exterior surface of the paper tube may be made to conform to each other and prevent longitudinal displacement of the tube. When the wire is fine or of small gage, the necessary tension to accomplish this object cannot be applied, and I provide means in such cases for expanding the diameter of the softened tube after the coil is wound.

The accompanying drawings illustrate my invention.

Figure 1 is a longitudinal central section through the coil. Fig. 2 is an enlarged section of one end thereof. Fig. 3 is an end view. Fig. 4 is a longitudinal central section showing the means for expanding the tubular core. Fig. 5 is a cross-section of the same on the line A B, Fig. 4.

Each coil-section *e* is composed of a series of layers of bare wire *w*, arranged in alternate convolutions with an insulating-strand *i*. This latter may either be a conductor covered with an insulating fiber or it may be a strand of insulating material. The superposed layers of helical convolutions of wire *w* are separated by tubes *t* of insulating material extending from one end of the series to the other. The tubes *t* are arranged concentrically, and the space between adjacent coil-sections *e* is an inclosed air-space. The coil-sections *e* are wound upon a specially-prepared core *c*. This is self-supporting and is saturated or coated with paraffin. At points in the core *c*, between adjacent coil-sections, are perforations through which the ends of the wire *w* are led out to provide for connection and manipulation. If the insulating-strand *i* is one in which a conductor is included, it, too, is led out. If, however, it be a strand of insulating material only, it need not be carried out with the wire *w*. A tubular core *c*, composed of paper coated or saturated with paraffin, I have discovered to be greatly superior to any known form of insulating-tube. It permits of the ready mechanical division of the coil-sections and may be made so thin as to occupy little space between the inner convolutions and the core of magnetic material.

In employing the paraffin-coated paper tube I find it necessary to guard against the displacement or movement of the coil-sections upon the core, and I provide means for expanding the core after the coils have been wound, whereby rotation or longitudinal displacement of the coil-sections is prevented. The means I prefer to employ for this purpose consist of a split tube of metal and a nut traveling on a screw upon the interior of the cylinder. The diameter of the cylinder is tapering, and as the nut is forced along by the rotation of the screw the paper tube is expanded.

*k* is the split metal tube. *p* is a screw with a handle *h*. It is journaled in the bearings *b*, which are fixed in position. The nut *q*, with the head upon the opposite side of the bearing, prevents longitudinal movement of the screw. *n* is a nut traveling on the screw. The nut *n* enters the split tube at the left-

hand end of Fig. 4, the end having the greater diameter, and as the screw *p* is rotated the nut *n* travels along, uniformly expanding the cylinder *k*, and the tube or core of paper *c* is pressed against the interior of the coil-sections, so that the surface of the core *c* takes the form of the interior of the coil and becomes fixed in position against the interior surface of the coil-sections *e*.

What I claim, and desire to secure by Letters Patent, is—

1. The combination with an electromagnetic coil composed of a series of coil-sections arranged end to end, with intervening air-spaces, of a core therefor consisting of a tube of insulating material, fixed in position against the interior of said coils.

2. The combination with an electromagnetic coil comprising a series of coil-sections, arranged end to end, with intervening air-spaces, of a tubular core of insulating material expanded upon the interior of said coil-sections.

3. In an electromagnetic coil the combination of a series of helical convolutions arranged in superposed layers and a core therefor consisting of a rigid self-supporting paper tube saturated with paraffin, its exterior surface conforming to the surface of the inner layer of the coil.

RICHARD VARLEY.

Witnesses:
CAROLINE E. DAVIDSON,
ANNA M. DONLEVY.