

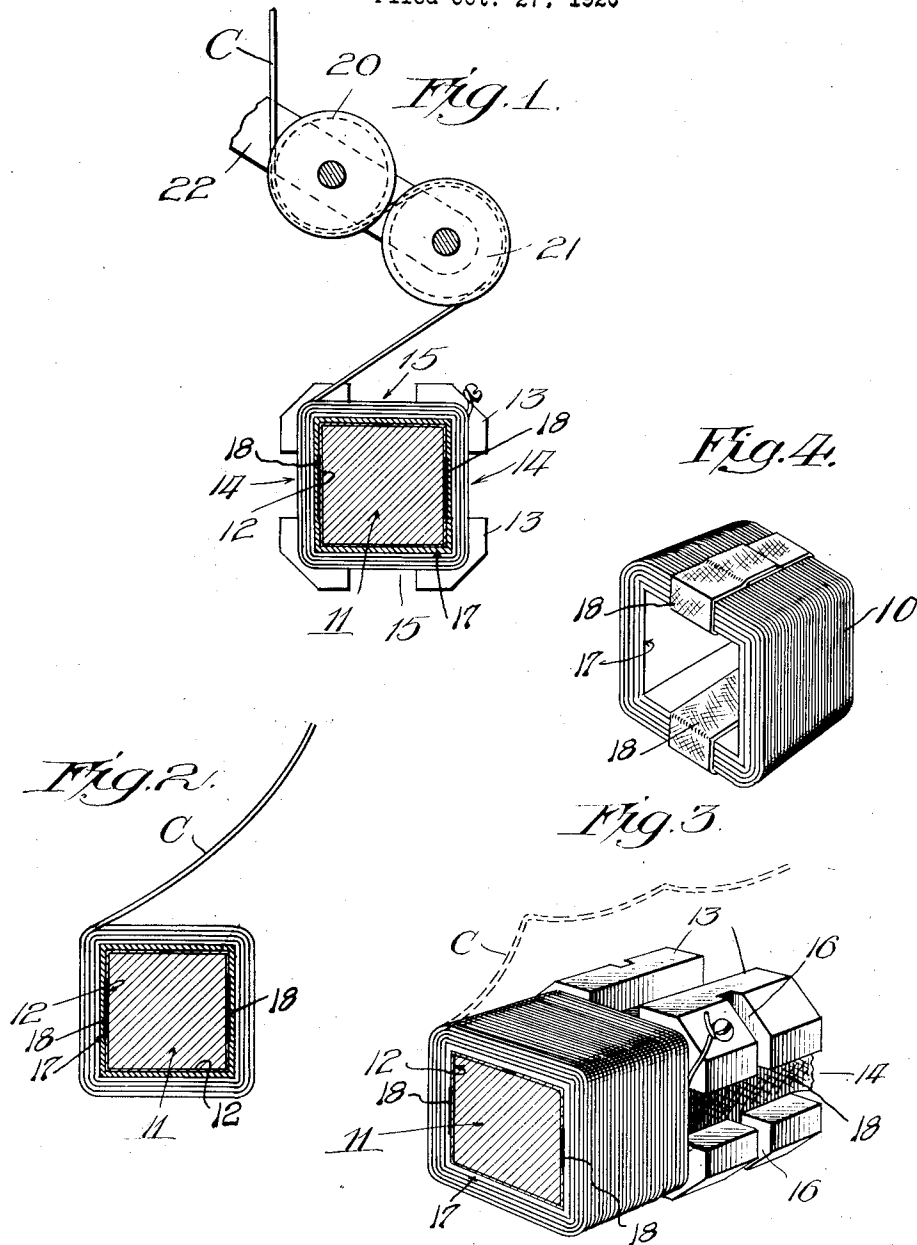
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METHOD OF MAKING POLYSIDED COILS

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Witness:

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UNITED STATES PATENT OFFICE.

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METHOD OF MAKING POLYSIDED COILS.

Application filed October 27, 1920. Serial No. 420,049.

To all whom it may concern:

Be it known that I, CHESTER H. THORDARSON, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Methods of Making Polysided Coils; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the characters of reference marked thereon, which form a part of this specification.

This invention relates to the art of producing coils for electrical devices, such as transformers and the like, particularly of that type which is of polygonal cross section or polysided, either square or oblong, presenting exterior angles between their sides, and relates also to a novel method of making such coil.

The purpose of the invention is to produce a coil which is wound in non-circular cross section, with the wires of the coil wound in layers, one over the other, and with the wires of the layers so laid upon the original support for the inner layer and the successive layers that the wire before being laid on the straight faces of the coil is given a predetermined set or preformation that will cause the parts of the different turns between the outer angles to lie squarely or straight on the sides of the coil, so that after the coil is wound, there is no tendency to cause it to unwind or bulge outwardly. The coil produced, therefore, has a solid symmetrical formation, so that there is no tendency for relative movement of the turns and, therefore, no liability for the insulation to be scraped off the wire.

The coil may be made either by hand or power machinery, and one of the essences of the invention, in respect of the method of making the coil, is to lead the wire to the successive layers in such a way that the turns tend to assume a preformed formation just before it is laid in the layers. Therefore, when the turns are laid on or wound in the successive turns and layers, there is a tendency for the turns to press toward the center of the coil and there is no tendency for the turns and layers to bulge outwardly to deform the coil by relative movements thereof during the time the coil is being wound and after it is formed. Therefore, the finished product comprises

a hollow wound body of wire, with each layer outside an inner layer laid smoothly on an underlying layer, and with the prebending or curving of the wire giving each turn or layer that faces or lies on the side of the coil between the outer angles a tendency to press towards the coil center.

The wire used in making up the coil is an insulated wire, being of that kind that is insulated by a thin film of flexible insulation, as enamel and the like but the invention may be adapted to wires or conductors that are otherwise insulated.

In practicing my improved method of producing electric coils, the end of the first turn of the coil is attached in any suitable manner to a winding form or bobbin, and thereafter the bobbin is rotated about its axis, and the wire is so fed onto the bobbin and into the successive layers by holding the loose portion of the wire at a proper tension against a surface over and against which it passes on its way to the bobbin that it will tend to give the wire, as it is laid on the bobbin or a layer a curve inwardly towards the axis of the bobbin.

This curvature may be effected by holding the loose part of the wire against the periphery of a guide or forming disc or other element the disc being preferably grooved to insure suitable lateral guidance of the turns as they are laid turn by turn in the coil. This curving of the wire to produce the results set forth may be effected by a single combined guiding and wire curving disc, or, preferably, by a pair of such discs, one arranged to guide the wire from a wire support or reel and the other arranged adjacent to the forming coil or winding. The latter arrangement is preferable because it avoids vibration between the curving disc and the coil as the coil is formed, because the second disc may be placed close to the bobbin on which the coil is wound.

The bobbin on which the coil or winding is formed will preferably be a split bobbin with a tendency to expand so that it will hold the inner layer of the coil firmly in place, and when contracted will permit the winding or coil to be readily removed therefrom.

In practice, strips of flexible material, such as taping, may be laid on the bobbin before the winding thereof begins and in such manner that after the coil is wound, said strips will extend outwardly beyond

the ends of the coils or winding and may thereafter be turned over and pasted on each other at diametric points of the coil to hold the turns of the coil structure in place, in addition to the tendency of the wire to hold itself in place by reason of the pre-deformation or curving of the wire before referred to.

Preferably the first layer may be wound directly on a fibrous support, as a closed sheet of paper, to properly hold the inner layer in place, and the inner support or tube may be formed about the bobbin and outside the taping.

A more extended detail of a machine for practicing my method to produce the novel coil will be found in my copending application for Letters Patent, Serial Number 425,317, filed on the 20th day of November, 1920.

As shown in the drawings;

Figure 1 illustrates the simple elements of a machine which may be parts of a hand or power machine for carrying out my invention.

Figure 2 is a cross section of the coil or winding, showing the manner in which it is supported during formation and showing the pre-formation of the wire as it is laid on the forming coil.

Figure 3 is a perspective view of a formed coil and a portion of the bobbin that is adapted to be supported on a suitable rotating mandrel.

Figure 4 is a perspective view of a finished coil embodying my invention.

As shown in the drawings, 10 (Figure 4) illustrates as a whole a coil embodying my invention which is herein shown as of substantially square cross section, but may be made of other non-cylindric cross sections. 11 (Figures 1, 2, and 3) designates a mandrel which may be a hand rotated or a machine driven mandrel. 12 designates a bobbin of the same cross section as and surrounding the mandrel. Said bobbin is split throughout its length and is made of springable sheet material, with a tendency to spread or open away from its split portion, so that after the coil has been formed, it can be readily removed by slight compression of the bobbin. At one end of each bobbin it is formed with longitudinally laid cast metal corner members 13, said cast members being spaced along the sides of the bobbin to form opposing grooves 14, 14 on two sides of one end of the bobbin and other like grooves 15, 15 on the other two sides of the bobbin. In the corner pieces 13 that laterally bound the grooves 14 are formed, registering saw cuts 16 in a plane at a right angle to the axis of the bobbin. Therefore, if there be a plurality of bobbins slidably mounted on a single mandrel, the plain sheet metal end of one bobbin will abut

against the head portion of the other bobbin, as illustrated in my aforesaid application, so as to form between the head of a bobbin and the head of a neighboring bobbin a plain or recessed portion of the bobbin on which the coil is wound. When the coils are wound on a machine the bobbins will thus be spaced by the heads constituted by the enlargements 13, so as to afford separated spaces to receive the wire which will come from suitably located reels.

Before the wire *c* to constitute the coil is laid on a rotating bobbin to wind it as turns thereon to form the successive layers of the coil, an inner support 12 for the coil is laid on each collapsible wire receiving portion 17 of the bobbin, and along two opposite sides of the bobbin at the grooves 14 inside the support 12 adhesive strips 18 are applied to the sides which extend the length of the series of bobbins.

Thereafter the wire is wound upon the bobbins by first suitably attaching the inner ends of the first turns to the bobbins, and turning the mandrel with the bobbins thereon. In practice, either the bobbin or the means for feeding the wire thereto may be advanced so that the turns of each layer are laid closely and firmly against each other to constitute the first firmly formed layer which supports between the valleys thereof the turns of the overlying layers; the successive laying on of the turns of the successive layers being effected by continuing rotation of the bobbin while the bobbin is endwise displaced, or conversely, the spiral direction of the feed means be reversed.

In accordance with the main or principal feature of my invention, the wire is fed to the coil when held taut against preforming means which act or tend to give a set to the wire that is an inwardly curved set, which faces towards the center of the coil, so that when the wire is laid, this precurvature has the effect of causing the wire to lay flat at the sides of the coil, with no tendency for the layers to bulge outwardly and become enmeshed with other turns of the layers. This will be obvious from an inspection of Figure 3, which indicates in dotted lines a portion of the unwound terminal of a turn. Said figure shows how the precurvature, after a wire turn has been wound, has been given to each length of the turn between adjacent angles, and illustrates that the tendency for the turns to unwind, usually encountered, is fully overcome.

This effect is herein shown as produced by first leading the conductor from a suitable reel under a guide disc 20 and thereafter guiding the wire over the periphery of a laying on disc 21. Both discs may be rotatively supported in a suitable member 22. In practice, the laying on disc will be located as near as possible to the corners

of the rotating rectangular bobbin, but not in actual contact therewith, so as to avoid to the greatest extent possible a tendency of vibration between the laying on disc
 5 and the mandrel, which might cause a portion of a turn to be improperly laid, and so also as to prevent abrasion of the insulated wire.

So far as the broader phases of the invention are concerned, the wire may be
 10 otherwise guided to the forming coil and preformed for effective preservation to cause the turns to hug towards the axis of the coil.

15 I claim as my invention:

1. The improvement in the method of producing polysided coils, by a winding operation, which embraces the step of preforming
 20 the wire exterior to the coil and independently of the winding to overcome subsequent unwinding of the coil.

2. The improvement in the method of producing polysided coils by a winding operation, which embraces the step of preforming
 25 the wire exterior to the coil and independently of the winding to overcome subsequent unwinding of the coil in a manner to prevent bulging of the said turns that lie on the flat sides of the coil.

30 3. The method of producing polysided

electric coils which consists in winding a wire into a coil and preforming the wire prior to its entrance to the coil by a rotative element to cause the wire on the flat sides
 35 of the coil to tend to press inwardly toward the center of the coil.

4. The method of producing polysided electric coils which comprises the steps of rotating a forming coil about the coil axis
 40 and preforming the wire by a rotative element prior to its entrance to the coil.

5. The method of producing polysided electric coils which comprises the steps of laying the wire on the coil and preforming
 45 the wire prior to its entrance to the coil in a way to cause the wire to bend convexly towards the coil prior to the winding of the wire thereon.

6. The method of producing polysided coils which consists of rotating a forming
 50 coil about its axis to wind the turns thereon, and giving permanent presets to the turn parts prior to their entrance to the coil formation to cause said parts to hug the straight faces of the coil between the angles
 55 thereof.

In witness whereof I claim the foregoing as my invention, I hereunto append my signature this 20 day of October, 1920.

CHESTER H. THORDARSON.