

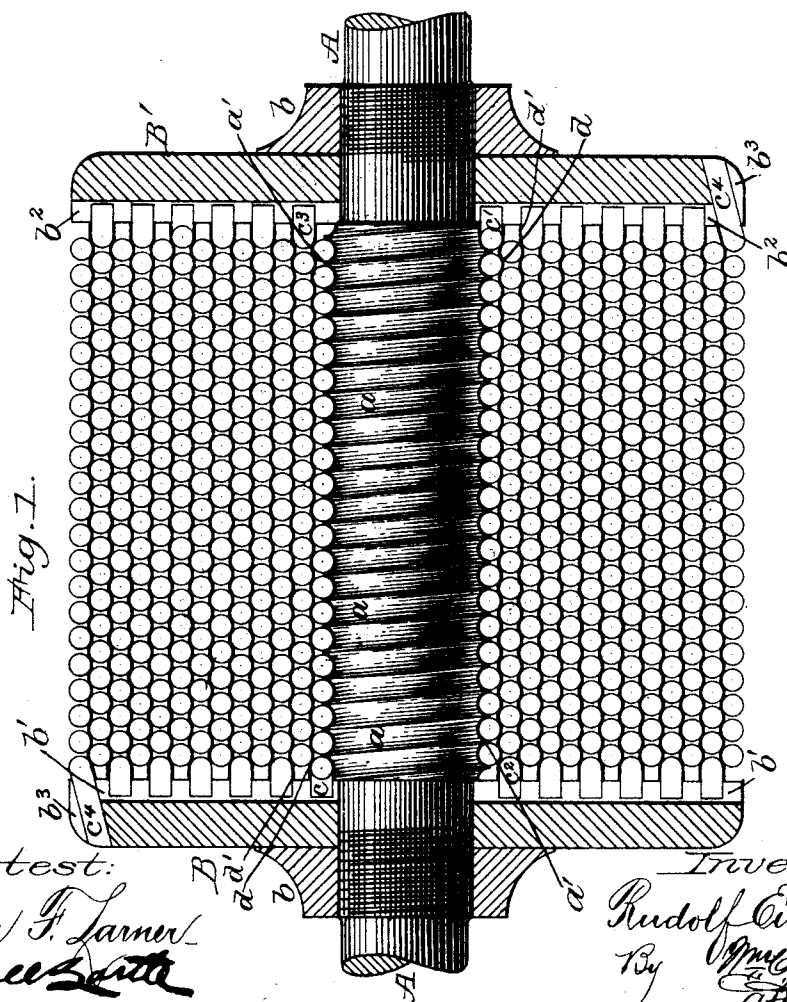
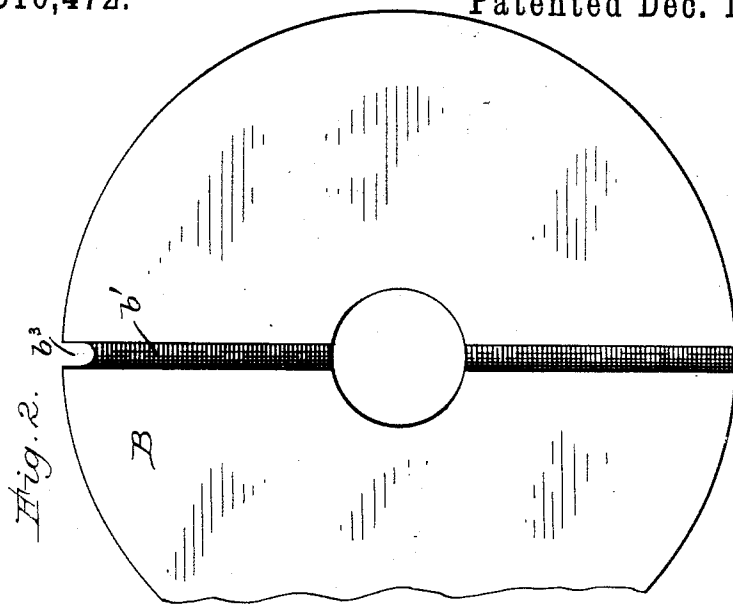
(No Model.)

2 Sheets—Sheet 1.

R. EICKEMEYER.
DYNAMO ELECTRIC MACHINE.

No. 510,472.

Patented Dec. 12, 1893.



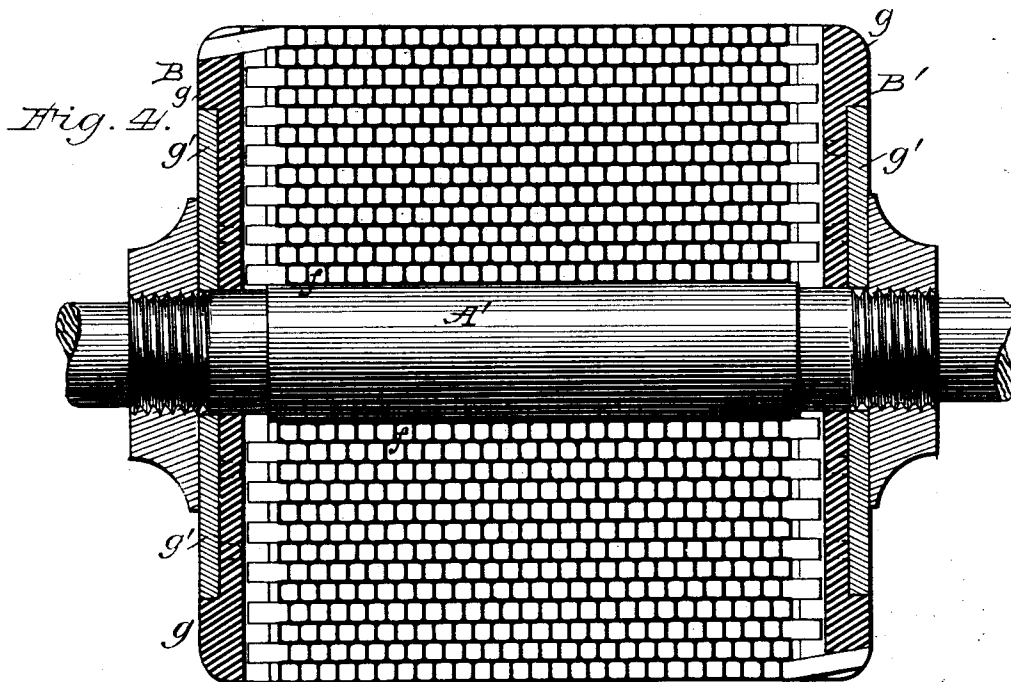
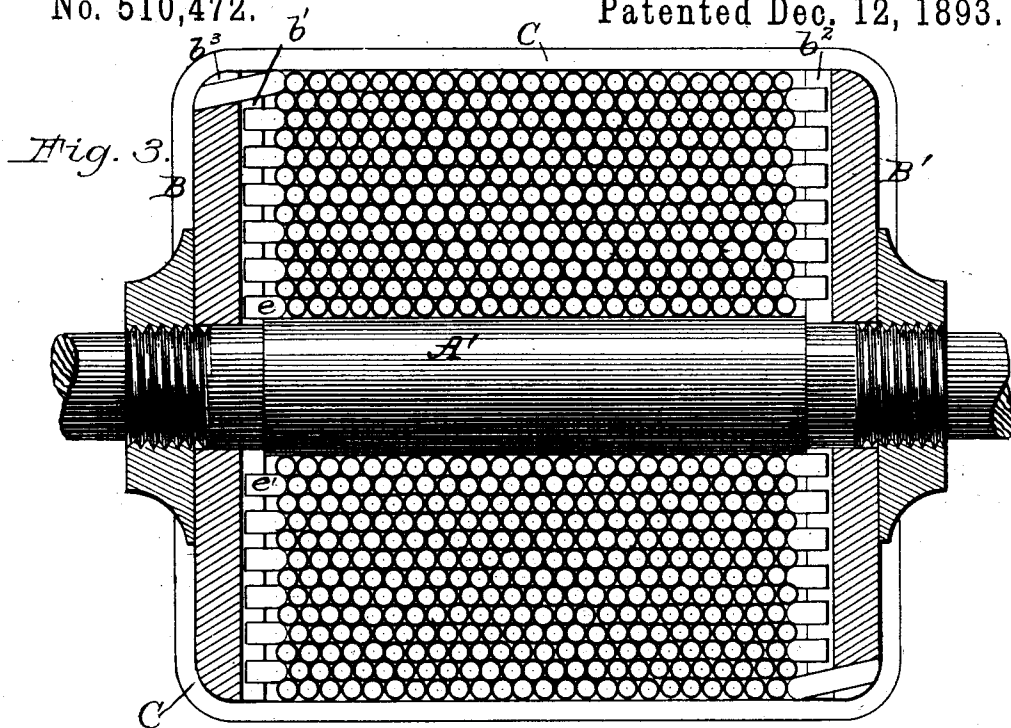
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Attest:
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Fig. 5.

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UNITED STATES PATENT OFFICE.

RUDOLF EICKEMEYER, OF YONKERS, NEW YORK.

DYNAMO-ELECTRIC MACHINE.

SPECIFICATION forming part of Letters Patent No. 510,472, dated December 12, 1893.

Application filed May 23, 1889. Serial No. 311,785. (No model.)

To all whom it may concern:

Be it known that I, RUDOLF EICKEMEYER, of Yonkers, in the county of Westchester and State of New York, have invented certain new and useful Improvements in Dynamo-Electric Machines; and I do hereby declare that the following specification, taken in connection with the drawings furnished and forming a part of the same, is a clear, true, and complete description of the several features of my invention.

My said improvements relate to armatures, and especially to those of the cylindrical or drum form, and the objects of my invention, are to secure in the cores of such armatures, a perfectly balanced condition, low magnetic resistance, non liability of Foucault currents, and a desirable bulk of soft magnetic metal within required external dimensions, together with economy in construction, and perfect symmetry of form.

An armature embodying my invention, has a core composed of soft iron wire, and it is to be understood that I am well aware, that such wire has for many years been employed in the construction of cores, for various forms of armatures, and also that said wire has been variously applied, and in great variety of arrangement. In my armature cores, the wire is applied to the interior foundation or supporting shaft, in spiral windings, but this is not broadly new.

In my armature cores, I employ a spirally scored or grooved foundation for the reception of the initial coil or layer of wire, and also clamping heads which are grooved outwardly from the center on their inner faces; each of these features has special value, and by embodying both in one core highly satisfactory results accrue. The spirally grooved foundation may be a spirally grooved armature shaft, or a spirally grooved sleeve detachable from the armature shaft, and in either case, it not only secures an accurate spacing of the convolutions of the initial layer of wire, but also assures correspondingly similar spacing of the succeeding layers, and hence enables the use of naked wires, if desired, with lateral air space insulation, or the use of insulated wires, or of applied insulating material in mass, without liability of unduly crushing and penetrating the in-

sulating matter lying between the convolutions of wire in each coil or layer. The several layers are insulated in radial lines by the use of intervening concentric layers of suitable sheeted insulating material. Each layer of wire being independent of the others, its two ends must be separately and firmly secured, and heretofore this has been done by inserting the wire tips into holes drilled for that purpose into the heads of the core, whereas the grooves on the inner faces of the heads of my cores afford freely accessible engaging seats for the bent ends of each and every coil of wire, this not only involving substantial economy in the construction of the heads, but also in assembling the coils, and, still further, in leaving the ends of each coil free to be forced inwardly toward the axial line of the core, under the compacting influence of the overlying coils.

After fully describing in detail, the novel cores and armatures illustrated in the drawings, the several features of my invention will be duly set forth, in the several clauses of claim hereunto annexed.

Figure 1, illustrates in section an armature core embodying the several features of my invention. Fig. 2, is an inner face view, of one of the core heads or flanges of the armature shown in Fig. 1. Fig. 3, illustrates in section, an armature embodying my radially grooved heads, and containing round iron wire which is jacketed for insulation. Fig. 4, illustrates in section, an armature core embodying the radially grooved head, and containing insulated iron wire, which is square in cross section. Fig. 5, illustrates the use of square iron wire laid cornerwise, and on a spirally grooved core foundation.

In the armature core shown in Fig. 1, the core foundation, is the armature shaft A, and this is novel in that it is spirally scored, as at a , and the dimensions of the score, with the spiral web or projection a' , are such, that when the initial layer of wire is tightly wound upon the shaft, the convolutions of the wire will be slightly separated, or at least, not in close contact. In other words the pitch of the spiral groove, is slightly greater than the pitch the spirally wound wire would have, if it were wound with its convolutions in close contact. It is of course immaterial how this spiraling

of the core foundation may be effected, whether by cutting away the shaft, as in screw cutting, or by spirally winding a wire thereon and securing it firmly in its path, or by the use of a separate sleeve, in which the spiral groove may be formed in the operation of casting. On this shaft there are two heads or flanges B, and B', each being non rotative on the shaft, and each has at its outer side, a clamp nut *b* fitted to a screw threaded portion of the shaft. As here shown, the armature core contains thirteen separate layers of iron wire, which in this instance, has no jacket other than that afforded by a previously applied suitably flexible varnish, or any kind of varnish applied during the operation of winding, and each of these layers is secured at its ends, to the two core flanges or heads B, and B', each of these having on its inner face a groove, respectively as at *b'*, and *b''*. These grooves as here shown, occupy radial lines, but additional grooves thus or otherwise arranged may be employed, without departure from my invention. Commencing with the initial layer of wire, one end thereof at *c*, is bent at right angles to afford a hook-like function when entered into the groove *b'* of the head B, and then after tightly coiling the wire until the head B', is reached, the wire is cut off at a proper length, and the end *c'*, bent to form a hook which is forced into the groove *b''*, of the head B', on the side of the shaft A, which is opposite to that, at which the winding began. A sheet or layer of thin flexible sheeted fabric *d*, is then applied over the initial layer of wire, and for this purpose, thin freshly varnished paper, or thin cotton cloth may be relied upon, if charged with any of the well known insulating materials which when hard, will remain so under ordinary temperatures. It will be seen that in applying the second layer, the ends of the first coil may be forced inwardly toward the axis of the core, because of the freedom in that direction afforded by the grooves *b'* and *b''*. On this insulating layer *d*, the second layer of wire is wound, but its initial end *c''*, is located in the groove *b'*, on the opposite side of the shaft to that at which the end *c*, was hooked. When this second layer is completed, the wire is cut to proper length, the end *c'''*, bent to form a hook which is forced into the groove *b''*, on the side of the shaft opposite to that at which the end *c'*, of the initial layer is located. It will be seen that the convolutions of this second layer, correspond with the convolutions of the first, but they occupy a spiral path over the spaces between the convolutions of the initial layer. In this second layer, sufficient space between its convolutions may be afforded, to secure good air space insulation electrically, on lines parallel with the axis of the core, but said spaces may be filled with any good insulating matter, such as powdered mica, glass or asbestos, or a flexible ribbon of vulcanized fiber, care being taken to avoid the presence of so much of such matter, as

would prevent the convolutions of the next layer of wire, from occupying their proper positions, and properly depressing the insulating layer *d'*, of paper, applied as before described. The other layers or coils of wire, and the interposed layer of insulating fabric, are applied as already described, but at the end *c''*, of the outer layer the bent portions are long enough to occupy notches *b'''*, which are cut through the peripheries of the heads from their respective grooves *b'*, and *b''*, and said ends are therein firmly secured in position. It will be seen, although this core is thus economically built up of coiled wire, that a minimum of interstitial space may be, and is secured, and that an armature thus constructed, is truly circular, well balanced and symmetrical, and that magnetic resistance is reduced to a minimum; also that Foucault currents cannot be therein developed to an appreciable extent.

It is sometimes desirable, as hereinbefore indicated, to employ round soft iron wire, which is jacketed with wrapped woven or braided fibrous material, charged with such insulating matter as shellac in solution, or other flinty gums not readily softened under such temperatures as are liable to be ordinarily developed in the armatures of dynamo electric machines. In Fig. 3, I illustrate an armature containing round iron wire, well jacketed. In this instance the armature shaft A', is not spiraled, the wire being tightly coiled thereon, and the jacketed convolutions are in close contact with each other. The layer *e*, is separate and detached from the layer *e'*, and so on, throughout the core, the ends of the wire in each layer being secured to the heads B, and B', in substantially the same manner as before described. If a complete insulation of each layer of wire from said heads be desired, it will be readily accomplished by providing the grooves *b'*, and *b''* with an insulating lining, readily applied, as, for instance, by a coat of varnish, and a dusting of powdered asbestos or mica, which when hard may receive one or more additional coatings of varnish and dust. With the wire jacketed as described, the insulating layers of thin fabric need not be used.

It is to be understood, as also hereinbefore indicated, that the iron wire may be other than round in cross section, for however the wire may be in that respect, the prime advantages of my invention will accrue, as for instance, as shown in Fig. 4, wherein the armature shaft A', is as in Fig. 3, as are the heads B and B', with respect of their diametric grooves, but each layer *f*, is composed of iron wire which is square in cross section, and it is jacketed thinly, but effectually in such a manner that it may be safely bent in coiling, without liability of injury to the jacket; as for instance, each length of wire is tightly wrapped in a narrow strip of thin cotton cloth, and varnish is properly applied as the coiling operation progresses. In this core, it will

be seen that the interstitial spaces are reduced to a minimum, and that the convolutions of each layer, overlies the spaces between the convolutions of the underlying layer, the ends of the wire in each layer being arranged and secured as in the cores previously described. Although these flanges B, and B', are as before described, as to their diametric grooves, each is composed in part of a large disk *g*, of non electric material, such as wood, hard rubber, or vulcanized fiber, and a smaller disk *g'*, of non magnetic metal, the two being firmly united as by studs or screws. These heads are applied after the wire portion of the core has been built up, and the strong metal heads removed. With the scored foundation, there is no tendency in the wire layers to longitudinal expansion when freed at their ends, even when square rod or wire is coiled cornerwise, as illustrated in Fig. 5, the foundation A², in this case, being provided with a spiraled V-shaped groove, for the reception of the initial layer *h* of insulated square wire. When thus arranged every alternating layer of rod or wire may be naked, and with an outer layer composed of jacketed round wire, a desirable surface at the periphery will be secured. With a spirally scored foundation, and each layer serving as a scored foundation, for the next overlying, all of the layers are well confined against independent rotation, regardless of the grooved heads, or any heads, and the electric winding will serve as an efficient external binder.

It is obviously not essential, that the soft iron should be square in cross section, for securing the degree of compactness sometimes specially desirable, as, for instance, the wire may be hexagonal, or flat and twice as wide as it is thick, or otherwise in ribbon form, and instead of bending the ends for getting the hook-like effect, the metal at the ends may be sheared angularly at the edges, so as to enable it to properly lie against the inner faces of the flanges, and then sheared or cut laterally, to form the engaging face or edge of the hook. With the square, or with the ribbon wire, on a smooth foundation, it is of comparatively little consequence, for the convolutions of one layer, to accurately overlie or underlie the spaces between the convolutions of adjacent layers.

It is to be understood, that the longitudinal insulated wire serving as the armature conductor C, may be of any desired variety, my novel cores being equally well adapted for use in connection with all windings suitable for cylindrical armatures.

Now, although the best results will accrue if the several layers of wire be independent of each other, as hereinbefore described, it is to be understood, that certain portions of my

invention may be successfully employed, even if the several layers of wire constitute one continuous length; as, for instance, the core foundation and the grooved heads being as before described, and the initial coil laid upon the foundation, the wire can be doubled upon itself at the termination of that winding, and bent to afford a hook for occupying the groove in the head, and then without severing the wire, the insulating layer may be applied, and the coiling resumed, but in the opposite direction, and so on until the core is completed. A core thus constructed, would be preferable to any wire core known to me, previous to my present invention, and it would be novel, in that it would have a spirally scored foundation and each layer would be secured at its ends to radially scored core heads, and the convolutions of each layer would conform exactly to the convolutions of the preceding layer, and hence the cylindrical core would be solid, symmetrical, and well balanced.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In a cylindrical armature for dynamo electric machines, the combination substantially as hereinbefore described, of a core foundation having a spiral score or groove, a spiral layer of iron wire in said spiral groove, additional layers of iron wire, each of which serves as a spirally scored foundation for the reception of the next overlying layer, and having the convolutions in each layer electrically insulated from each other.

2. In an armature for dynamo electric machines, the combination substantially as hereinbefore described, of a core foundation, provided with two heads or flanges, and spirally scored or grooved between said heads, and several independent layers of iron wire, spirally coiled, each layer having air spaces between its convolutions to afford insulation lengthwise of the armature, and each layer insulated from underlying and overlying layers, and the convolutions of each layer overlying or underlying the spaces between the convolutions of the next adjacent coils or layers.

3. In an armature for dynamo electric machines, the combination substantially as hereinbefore described, of a core foundation, two flanges or heads, each grooved on its inner face, and a series of independent layers of coiled iron wire, the ends of which in each layer serve as retaining or securing hooks within the grooves in said flanges or heads.

RUDOLF EICKEMEYER.

Witnesses:

HENRY OSTERHELD,
EDWARD P. MOFFAT.