

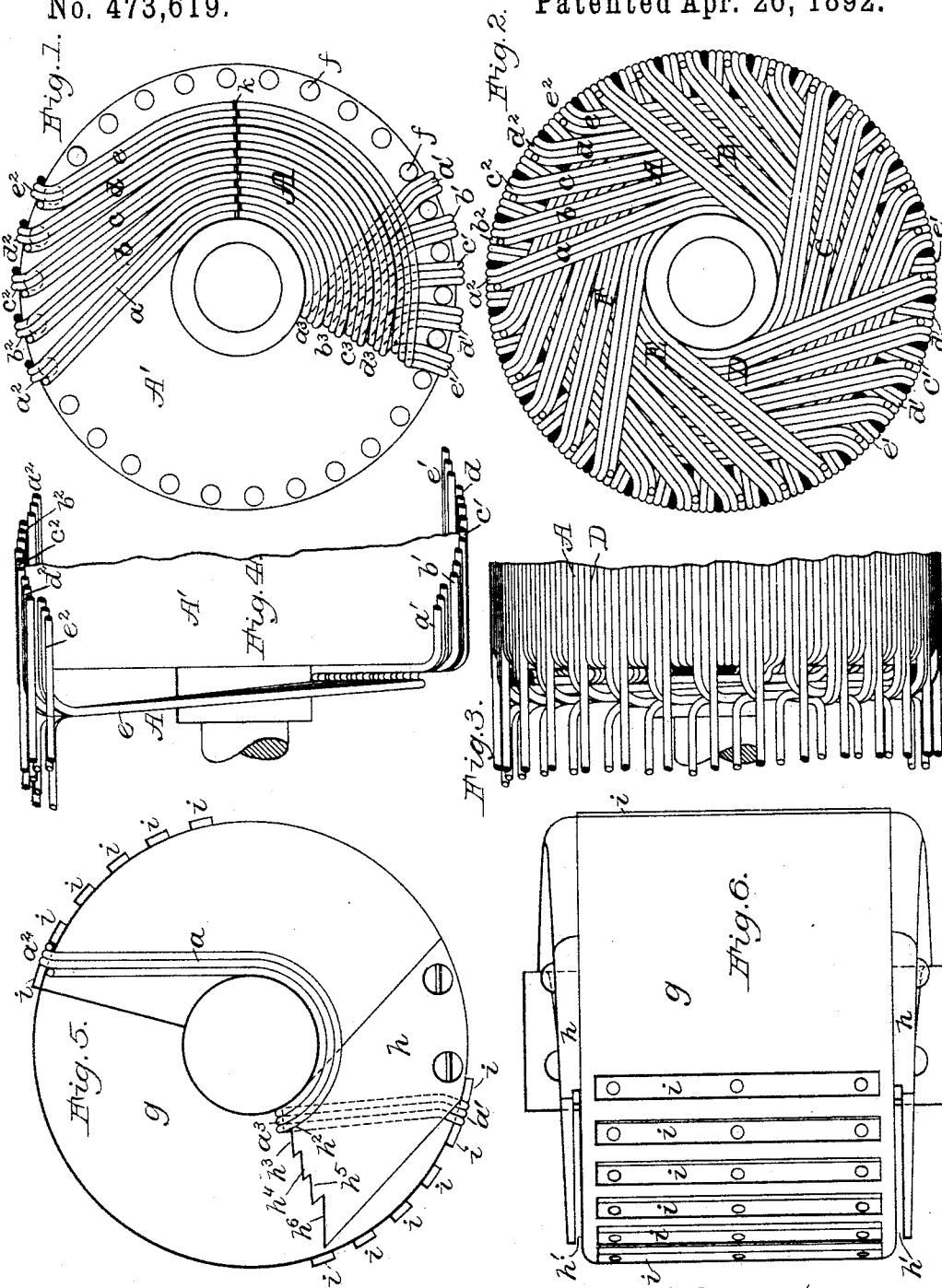
(No Model.)

2 Sheets—Sheet 1.

R. EICKEMEYER.
DYNAMO ELECTRIC MACHINE.

No. 473,619.

Patented Apr. 26, 1892.



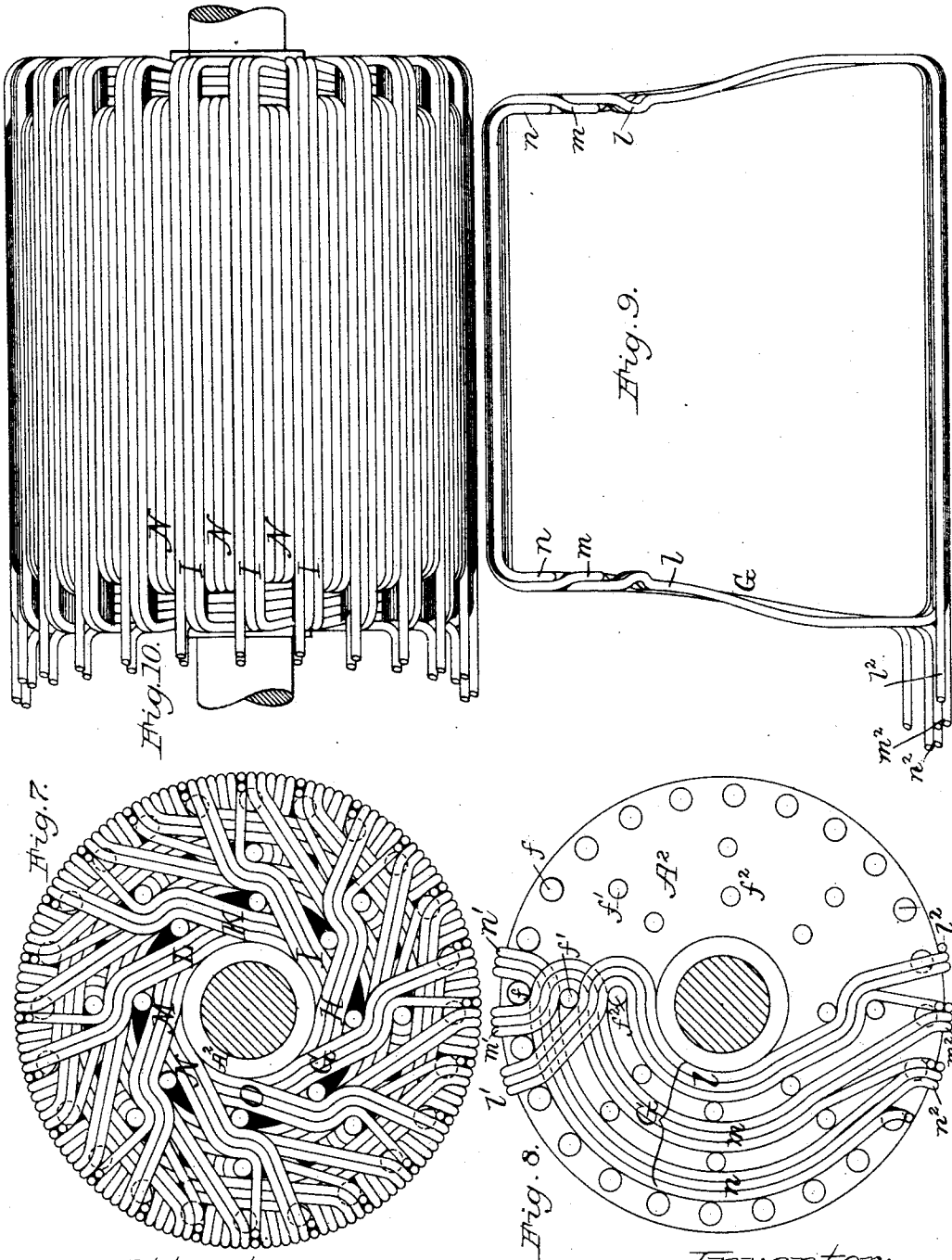
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UNITED STATES PATENT OFFICE.

RUDOLF EICKEMEYER, OF YONKERS, NEW YORK.

DYNAMO-ELECTRIC MACHINE.

SPECIFICATION forming part of Letters Patent No. 473,619, dated April 26, 1892.

Application filed December 23, 1889. Serial No. 334,668. (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 my invention.

In my Letters Patent, No. 377,996, dated February 14, 1888, I disclosed certain improvements in winding-drum armatures for dynamo-electric machines, and certain other improvements in the same connection have been made the subject of my application for patent filed June 13, 1888, Serial No. 276,990.

One characteristic feature in armatures embodying my said prior improvements is that they are clothed or covered by a set of complete counterpart coils, each having a long side and a short side, and they are all readily applicable to or detachable from the core or drum of an armature, without liability of material derangement of or injury to the coils. As heretofore devised by me, these coils have each been separable from the others, and in any one armature all coils were alike in form; but I have now for the first time, as I believe, invented a novel system of grouping coils and also what I will term a "multiple coil," in that it is composed of two or more complete and electrically-independent coils, each having its own terminals, and these coils are securely united, so that when the structure is mechanically considered each group constitutes a complete section of winding, which is of keystone form, in that it is longer on one side than on the other, and which can be readily applied to or detached from the drum or core, and enabling the latter to be completely clothed or covered by a set of these multiple coils, all of which are counterparts, notwithstanding the fact that each of them is composed of complete coils, no two of which are alike in form or contour, although they all contain a substantially uniform length of wire and correspond as to the number of convolutions.

An armature "winding" for dynamo-electric machines embodying the main features

of my present invention may be somewhat varied as to the structure and arrangement of the electrically-independent but grouped coils—as, for instance, each may contain one or more convolutions of wire and each at its ends may be laterally bent and folded upon itself in tangential lines, or they may be curved without any doubling of any coil upon itself, as will be hereinafter clearly indicated, and the manner or means involved in mechanically uniting the several coils of a group for forming each multiple coil are quite immaterial so long as each of the multiple coils constitutes a complete structure applicable to and detachable from the armature-core, and serves as an effective section of winding.

After fully describing my invention as practically embodied by me in different forms, some of which are illustrated in the drawings, the features deemed novel will be duly specified in the several clauses of claim hereunto annexed.

Referring to the drawings, Figure 1 is an end view of an armature-core with one form of one of my multiple coils applied thereto. Fig. 2 in end view illustrates one end of an armature clothed with the same form of my novel multiple coils in accordance with my invention. The opposite end would present the same appearance, but without showing the terminals of the coils. Fig. 3 is a partial side view of the clothed armature, showing the terminals of the coils at the commutator end of the drum. Fig. 4 is a side view of a portion of the drum shown in Fig. 3 with a part of a group of coils in position thereon. Figs. 5 and 6 in end and side views illustrate a coiling frame or "former" devised by me for the convenient production of such coils as are shown in the previous figures, one of said coils being shown in Fig. 5 as if ready for removal from the frame. Figs. 7, 8, and 9 respectively illustrate in end view an armature clad with my multiple coils in another form, an armature-core in end view with but one of said coils in position, and a plan view of said coil detached. Fig. 10 illustrates the clothed armature in side view.

I will first describe the multiple coil A, (shown on the armature drum or core A' in Figs. 1 and 4.) This multiple coil is composed

of a group of five electrically independent or individual coils respectively indicated at a , b , c , d , and e . I will term the "sides" of the coils those portions which lie upon the periphery of the drum or core A' , one side of each coil being longer than the opposite side, the internal dimensions of the long side being considerably greater than the external dimensions of the short side. The several short sides of the coils in this group are indicated at a' , b' , c' , d' , and e' , and the several long sides at a^2 , b^2 , c^2 , d^2 , and e^2 , and as these several coils have inclined ends they are of what may be termed a "keystone" form. It of course follows that the multiple coil A has that general form or contour. Although each of the individual coils has this same long side and short side and a keystone contour and all have a uniform length of wire, no two of them in any one multiple coil or group are of the same precise form.

Referring to Fig. 1, it will be seen that the coil a at its end occupies a tangential line from its long side a^2 to the periphery of a boss or hub on the core and that said end then occupies nearly one-half of a circular line and then occupies a straight abrupt tangential line to the short side a' , this latter tangential portion having been bent or folded flatwise, as at a^3 , so as to occupy a different but substantially parallel plane from that occupied by the remaining portion of the same end of the coil, as clearly indicated in Figs. 1 and 4 and still more clearly in Fig. 5, wherein that coil a is shown still in position on the coiling-frame or former devised for its production. It will be seen that each of the coils has a similar bend b^3 , c^3 , and d^3 , said bends being located at different points, so that their adjacent tangential portions are consecutively shortened; but the coil e is only twisted and has no tangential portion. The several short sides and long sides in each complex coil are separated by spaces of such lateral dimensions that the long side of any one complex coil can properly occupy said spaces on the periphery of the core and be alternated in position with the short sides of a certain other appropriate group of coils, or, in other words, a counter-part multiple coil. The end of the armature-core is provided with an annular set of holes for receiving pins or studs f , which are inserted between the individual coils near their short sides, thus firmly locking the coils in position. As shown in Fig. 2, thirty individual coils are employed for covering that core; but these are embodied in six groups, united with multiple coils A , B , C , D , E , and F , and these are or may be absolute counterparts, all containing an equal length of wire and each having been constructed on the same former. The coils A and D alternate with each other at their sides, and the same is true of coil B with coil E and coil C with coil F , and it will be seen that the flatwise folded or bent portions of the ends in all the coils are hidden

from view by their other overlying portions. In mounting these multiple coils upon a core their relative arrangement is accomplished with ease, because the short-sided portions of the coils can, for instance, be readily passed through and under the long-sided portions of other coils, and both of these portions can readily be sprung to and fro in various ways to a desirable extent without injury to the coils.

As shown in Fig. 4, the bent or folded end portion of each coil in a group or in a multiple coil is separated from the outer or overlying portion of the same individual coil by a space about equal to the diameter of the jacketed wire of the coil, and also that the long-sided ends of each coil so overlie other short-sided ends that a free space is afforded between them, and hence an opportunity is afforded for a free circulation of air, with attending desirable cooling influences. The coiling frame or former, (shown in Figs. 5 and 6,) although specially devised by me for conveniently winding these particular coils, is founded upon the invention disclosed in my Letters Patent No. 377,997, dated February 14, 1888. For present purposes said frame need only be described as embodying a block g , having convex surfaces of unequal length, conforming to the opposite or other portions of the periphery of the armature drum or core, to be clothed by the group or multiple coil, and on said surfaces a number of longitudinal scores or grooves are provided, according to the number of individual coils to be embodied in any one group or any one multiple coil, and said scores are properly proportioned in dimensions, according to the size of wire and the number of convolutions desired in each coil. At each end of the block there is a movable cheek-piece h , so formed as to leave between each and the coincident end surface of the block a forming-slot h' , into which the wire is progressively laid after said wire has been bent or turned around the forming edge or face h^2 at the end of said block, all as clearly indicated. There are a series of five of these bearing-faces, as at h^2 , h^3 , h^4 , h^5 , h^6 , arranged in step-like order, and each one of these faces determines the exact proper bending-point in some one of the five coils, all of the remaining portions of the wire at the ends lying web-like closely together and side by side. On removing the cheek-pieces the coils may be readily displaced, each having ample resiliency to admit of its being sprung from the recesses or grooves, although if a specially heavy coil be formed it will generally be desirable to also detach the bars i , which afford between them the forming-spaces, into which the long and the short sides of the coils are respectively laid.

The several individual coils of each group may be united into one multiple coil by strong adhesive insulating matter or by means of

light bands of paper well varnished, or by interwoven twine, as indicated at *k* in Fig. 1; but whether these coils be thus united to form a multiple coil or merely grouped together upon the armature-core in the manner described such windings will involve a portion of my present invention, in that I have for the first time devised a winding composed of complete groups of coils having a long side and a short side, are uniform in length of wire and in number of convolutions, but are so dissimilar as to form that when grouped together upon an armature-core the several long sides of the coils in the group occupy a certain consecutive order and a reversed consecutive order at their short sides, so that as the drum is revolved in either direction the two sides of each individual coil will be simultaneously and with uniformity exposed to magnetic influences, whether operating upon a bipolar armature, as shown, or in a multipolar machine, it being obvious that the latter case would only involve coils which would embrace a lesser portion of the armature-core.

It is to be distinctly understood that the main features of my present invention are not restricted to individual coils which are bent or folded flatwise at their ends upon themselves with or without an intervening space, although coils having that form, as shown, will be hereinafter specifically claimed by me.

In Figs. 7, 8, 9, and 10 I illustrate groups of coils and multiple coils which embody the main features of my invention; but none of said individual coils are like those previously herein described with respect of the flatwise bending feature. In this instance each group or multiple coil includes three individual coils, and the armature shown in end view in Fig. 7 is clad with twenty-four individual coils in eight groups or multiple coils, as at G, H, I, K, L, M, N, and O, and one of these G is shown clearly by itself in Fig. 8 as when mounted in position. The armature-core A^2 has at its ends three sets of pin-holes annularly arranged for the reception of studs or pins f , f' , and f^2 . The three individual coils in the group G are shown at l , m , and n , the short sides being at l' , m' , and n' and the long sides at l^2 , m^2 , and n^2 , and each coil has three convolutions, and all are uniform as to length of wire. Commencing with coil l , it will be seen that its end portion lies in a curved line next to the hub of the core for a portion of its length and that near its short side l' it is curved edgewise, as if around one of the studs f^2 , and it thence extends by an edgewise bend backward and toward the periphery of the core, near which it occupies a radial line. The coil m is in like manner bent edgewise, as if around one of the studs f' , and thence backward and to the periphery on a radial line. The coil n near its short side n' is simply bent edgewise, as if around a pin f , so as

to occupy a radial line. The central portions of the ends of these coils are in contour, segmental portions of different circles having a common center, and in extending from the curved line to the periphery of the core each is only so far tangential as will enable the proper location of its long side on said periphery. In these groups one terminal of l is coupled with one terminal of coil m , the other terminal of the latter being coupled to one of the terminals of coil n ; but it is to be understood that matters pertaining to coupling the said terminals or connecting them with the bars of a commutator-hub are outside of my present invention.

As will be seen in Fig. 9, the coils l , m , and n when grouped have the keystone contour and that near their short sides at the ends they are only bent sufficiently to enable a desirable massing of those portions of the coils which underlie and overlie each other.

Although I have devised still other coils or windings more or less varied from those shown as to details in construction, it is believed that those herein disclosed, as guides to persons skilled in the art, will enable many other variations to be made by them without substantial departure from my invention.

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

1. In an armature for dynamo-electric machines, the combination, substantially as hereinbefore described, of a drum or core and a winding composed of a set of multiple coils, each of which is composed of a group of two or more independent coils, each having a short side and a long side, said short sides and said long sides in each group being separated by spaces for respectively receiving the long sides and the short sides of other similar coils, all of said coils in each group being mechanically connected and constituting a multiple coil, which as a complete section of winding is readily applicable to and detachable from the drum or core.

2. In an armature for dynamo-electric machines, the combination, substantially as hereinbefore described, of a drum or core and a series or set of detachable groups or sections of windings or coils completely clothing said drum, each group consisting of two or more individual coils, which are alike in having the same length of wire, a long side and a short side, but differ in contour or form at their ends and have the short sides of the coils in each group arranged in a consecutive order, which is the reverse of the order of arrangement of the long sides of said coils.

3. A section of armature-winding, substantially as hereinbefore described, composed of two or more separate or independent coils, each having its own terminals, all substantially alike as to length of wire, but longer at one side than at the other and united and

forming a multiple coil, readily applicable to and detachable from an armature drum or core.

4. A detachable section of armature-winding, substantially as hereinbefore described, consisting of two or more mechanically-united but independent coils, each longer at one side than at the other, each centrally at its ends

being in the form of a curved flat web and all but one of them folded flatwise inwardly near one side at a different point in each and thence extended tangentially.

RUDOLF EICKEMEYER.

Witnesses:

R. EICKEMEYER, Jr.,
E. P. MOFFAT.