No. 736,417. PATENTED AUG. 18, 1903.

F. A. MERRICK.

ARMATURE COIL.

APPLICATION FILED FEB. 19, 1901.

NO MODEL. 3 SHEETS—SHEET 1.

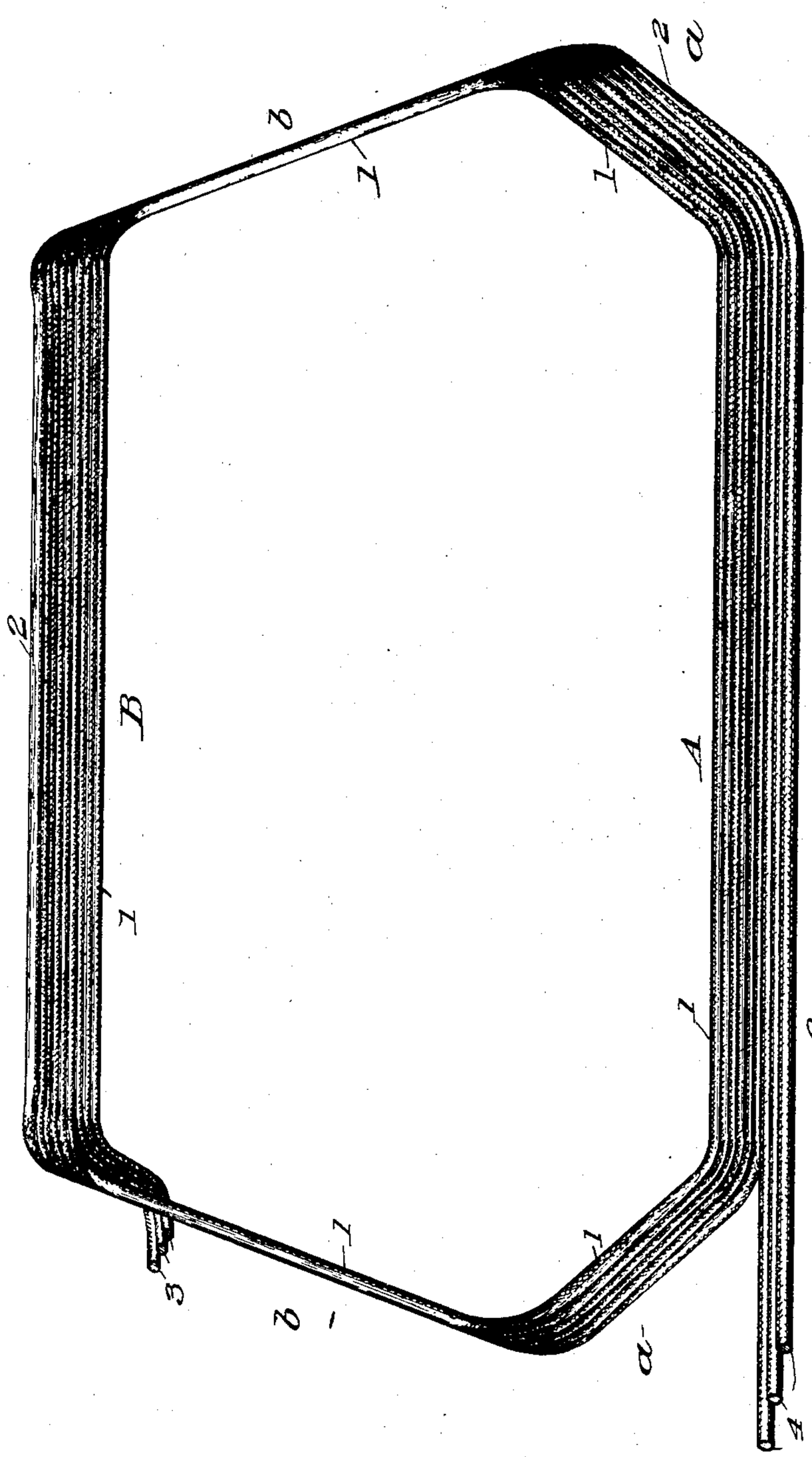

Fig. 1.

WITNESSES:

F. E. Brindle

Chas. G. Cox

INVENTOR

F. A. Merrick,

BY Geo. H. Parmelee,

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NO MODEL. 3 SHEETS--SHEET 2.

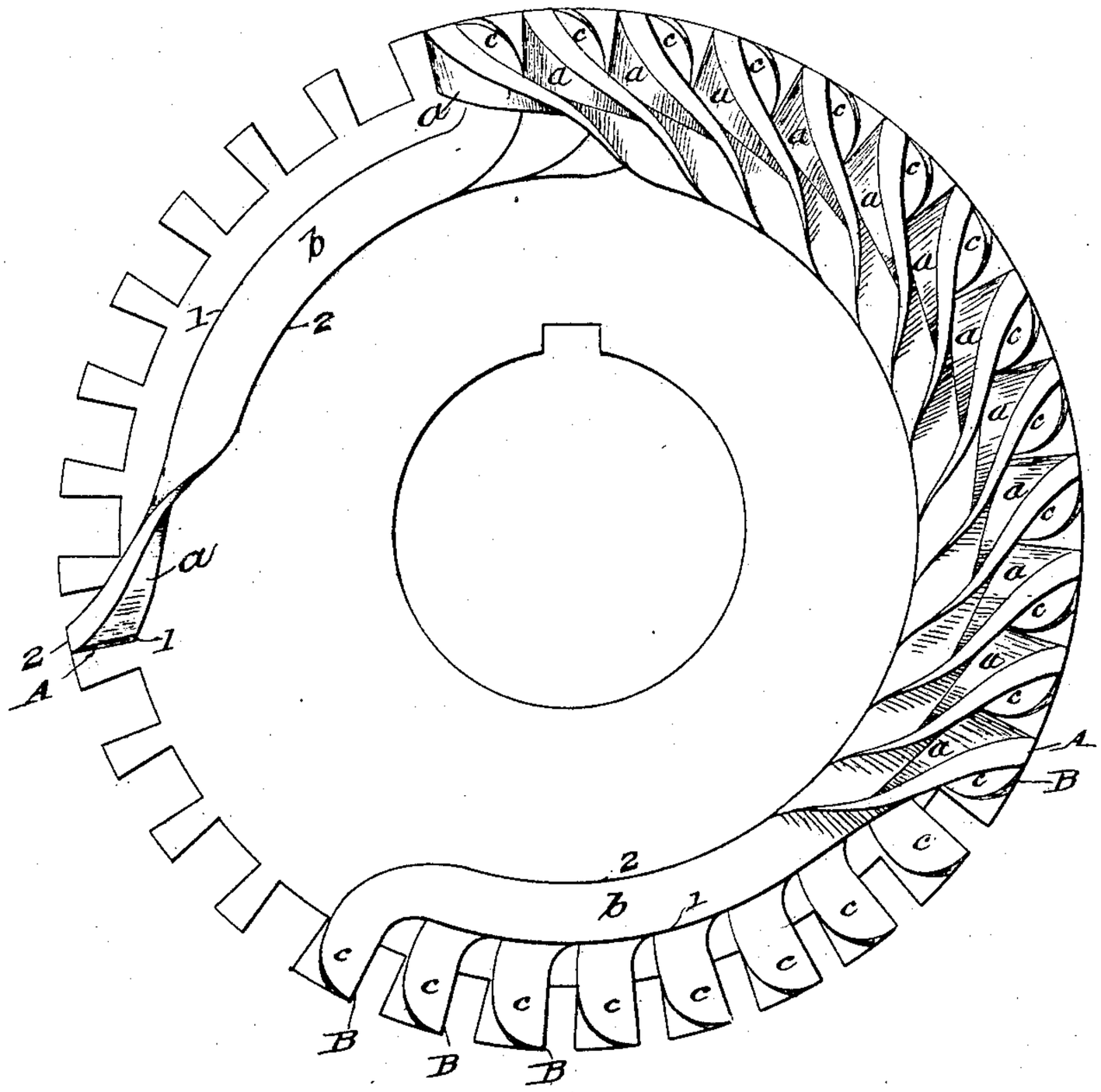

Fig. 2.

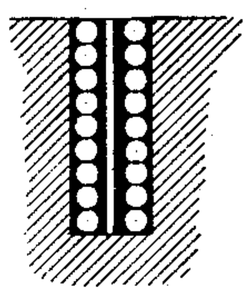

Fig. 3.

WITNESSES:

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Sara G. Cox

INVENTOR

F. A. Merrick

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No. 736,417. PATENTED AUG. 18, 1903.

F. A. MERRICK.

ARMATURE COIL.

APPLICATION FILED FEB. 19, 1901.

NO MODEL. 3 SHEETS—SHEET 3.

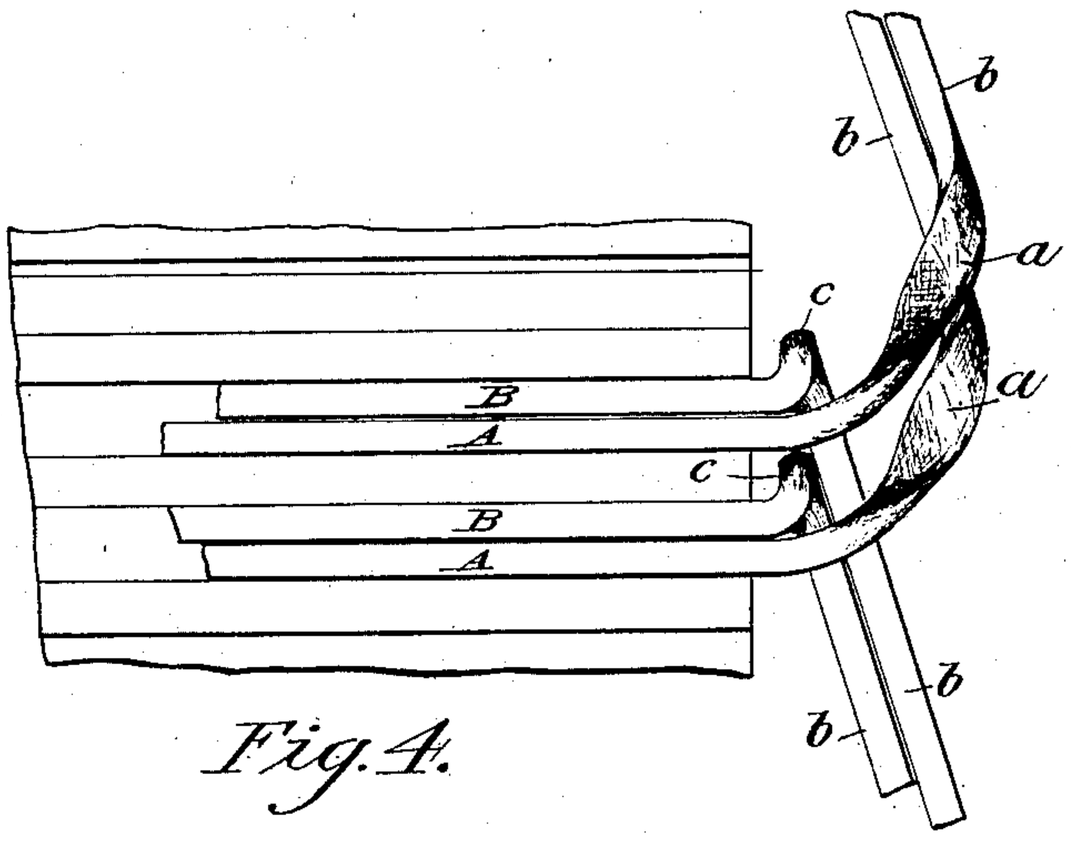

Fig. 4.

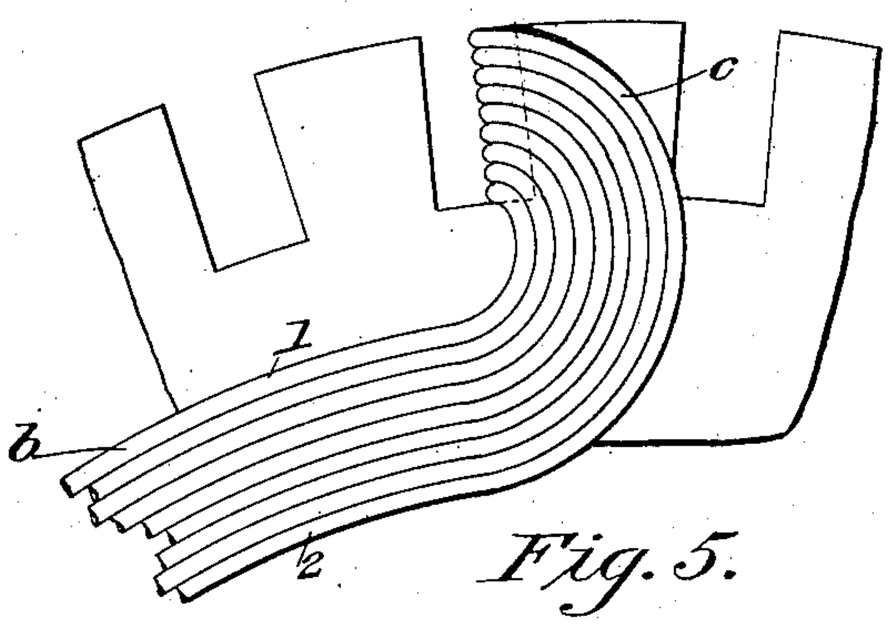

Fig. 5.

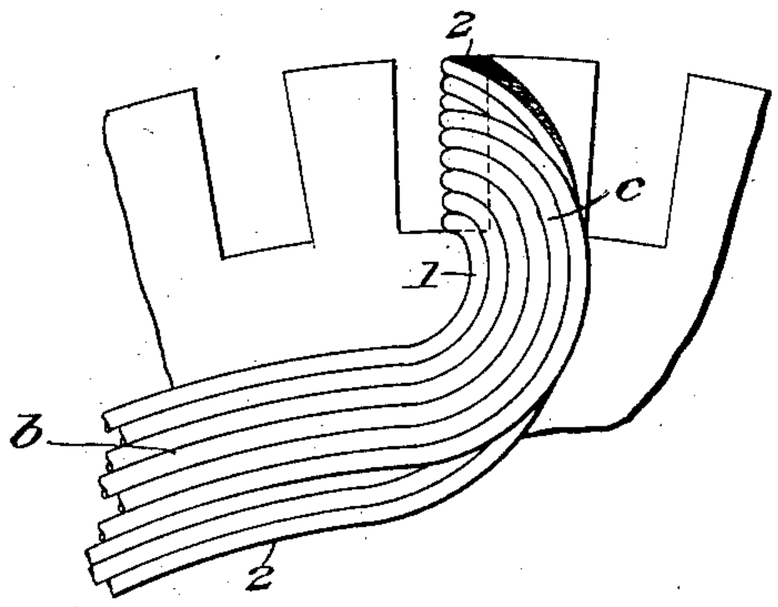

Fig. 6.

WITNESSES:

W. E. Brindle

Bora G. Bolt

INVENTOR

F. A. Merrick.

BY

Geo. H. Parmelee

his ATTORNEY.

No. 736,417. Patented August 18, 1903.

UNITED STATES PATENT OFFICE.

FRANK A. MERRICK, OF JOHNSTOWN, PENNSYLVANIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, OF PITTSBURG, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

ARMATURE-COIL.

SPECIFICATION forming part of Letters Patent No. 736,417, dated August 18, 1903.

Application filed February 19, 1901. Serial No. 47,959. (No model.)

To all whom it may concern:

Be it known that I, FRANK A. MERRICK, of Johnstown, in the county of Cambria and State of Pennsylvania, have invented a new and useful Improvement in Armature-Coils, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates to form-wound separable armature-coils of that type in which both sides of the coil are equidistant from the axis of the armature or in the same circumferential plane and are in contact with the periphery of the drum or core and also to windings composed of a plurality of such coils.

The objects of my invention are to provide a coil of the above-mentioned type so constructed that its leads or terminals leave the coil in the most convenient manner to facilitate their manipulation and connection to the commutator, to avoid crossing upon each other the individual turns or conductors of which the coil is composed, and to so construct and dispose of the end-connecting portions of the coils as to economize in space. I attain these objects by a coil of the novel shape, construction, and arrangement herein described, and pointed out in the appended claims, reference being had to the accompanying drawings, in which—

Figure 1 is a plan view of a coil unwrapped embodying my invention; Fig. 2, an end view showing a number of the coils assembled upon an armature coil or drum; Fig. 3, a transverse section through one of the core-slots, showing the disposition of the conductors therein; Fig. 4, a fragmentary plan view showing the manner in which the end portions of the coils are constructed and arranged; Fig. 5, an end view of a portion of one of the coils unwrapped and applied to an armature; and Fig. 6 a view similar to Fig. 5, but showing a slight modification.

The coil shown in Fig. 1 is, as a matter of fact, composed of three separate grouped coils formed by winding simultaneously upon a suitable former three separate conductors. The invention, however, is equally applicable to a coil formed of any suitable number of conductors from one up, and the term "coil" as used herein and in the claims should be understood as applying to a winding member composed either of a single unit of any desired number of turns or of a number of such units grouped into a single structure. I would further state that while the coil illustrated is designed for a four-pole machine my invention is not limited thereto, but is equally applicable to other polar arrangements.

The shape of the coil is that of an irregular hexagon. Its two straight and parallel sides A and B are preferably of equal length and are disposed in planes which are radial to the armature-axis. The radial depth of each of these sides is substantially equal to the depth of the armature-slots and the thickness is equal to the diameter or thickness of one conductor plus its insulation.

The two ends of the coil are preferably of similar shape and are composed each of two oblique portions *a* and *b*, which extend beyond the end of the coil. The portion *a* leaves the side A at an obtuse angle and has, considered as a whole, no plane which can be defined by reference to other parts of the coil or to the armature, for the reason that it effects a gradual transition from the plane of the side A to the plane of the part *b* by a kind of helical bend or twist, the inner conductor 1 of the side A becoming in the part *b* the upper or outer conductor and the upper or outer conductor 2 of the side A becoming the inner conductor of the part *b*, the intermediate conductors changing their relative positions correspondingly in their natural order and sequence.

The part *b* forms an obtuse angle with the side B, to which it is connected by a bend *c*. Viewed in plan the planes of the lateral faces of the part *b* are preferably substantially vertical. They may, however, be somewhat inclined to the vertical without in any way affecting the character of the coil, provided, of course, that all the coils are substantially

the same in this respect. In end view the part *b* is seen to be arched or curved to lie in an annular plane concentric with the armature-axis.

The precise nature of the bend *c* will be best understood by reference to Figs. 4 and 5. In making this bend the top conductor 2 of the side B is bent abruptly backward and thence down and around, becoming the lower or inner conductor of the part *b*, while the lower conductor 1 of the side B by a concentric bend becomes the upper conductor of the part *b*. The intermediate conductors take their respective concentric positions in natural order between the conductors 1 and 2. In armatures where the depth of the coil-slots is greater than the distance between the said slots the bend *c* has to be somewhat modified at the back end of the armature, since the space between the slots is in such cases not sufficient to admit of a full backward bend of the form shown in Fig. 5.

The terms "inner" and "inward" or "inwardly" as used herein and in the claims are to be interpreted with reference to the armature-axis.

Fig. 6 shows the modification proper in such cases, which consists in making some of the conductors overlie others, so that the coil at this point is in part of double thickness. This modification is ordinarily not necessary at the commutator end of the armature, for the reason that the leads or terminals going to the commutator reduce the number of conductors in the bend *c* sufficiently to permit the use of a bend such as shown in Fig. 5.

It will be seen that the conductors of the coil reverse their relative positions four times in the coil, the conductors in the sides A and B having precisely the same relative dispositions, whereas in the two end portions *b* the relative disposition of the conductors is exactly reversed with respect to the two sides, although the same in each of said portions *b*. From this arrangement of the conductors it follows that the leads 3 from one side of the coil leave said side at its inner edge, while the leads 4 from the other side leave it at its outer edge. This arrangement very greatly facilitates the manipulation and connection to the commutator of these leads, as will be appreciated by those who are practically familiar with armature-windings. This disposition of the leads is furthermore effected without crossing the conductors upon each other at any point. On the contrary, each conductor throughout the coil preserves throughout its parallelism to the other conductors and wherever a transition is made from one plane to another the conductors each take their natural relative order and position.

The manner in which the coils are assembled upon the drum will be readily understood from Figs. 2 and 4. In each of the core-slots is placed the side A of one coil side by side with the side B of another coil, the end connections of these two coils extending in opposite directions across the end of the core. The coils are so placed, it will be noted, that the two sides of each coil bear against the farther sides of their respective slots. This makes it easier to apply and remove the coils, as it makes it unnecessary to spring the sides of the coils over the corners or edges of the armature-teeth, as must be done where the sides of the coils bear against the nearer walls of their respective slots. The radial and backward offset at the bend *c* enables the part *a* of each coil to pass under the part *b* of the adjacent coil, and the oblique disposition of the end portions *a* and *b* permits said portions in the various coils to successively lie side by side in parallel relation, as shown.

It will be readily seen from Fig. 4 how other coils may be added thereto to produce the symmetrical winding shown in Fig. 2.

In the coil shown the parts *a* of each coil are somewhat shorter than the parts *b*. The relative lengths of these two parts is not, however, an essential feature of the coil and will vary according to the number and size of coils, amount of available end space, &c. In some cases the parts *a* may make a lesser angle with the side *b* than is herein shown and will therefore meet the part *a* at a point somewhat near the center line of the coil. In other cases it will make a greater angle than that shown and will shorten accordingly. Hence I do not wish to limit myself to the exact construction which I have herein shown and described.

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

1. An armature-coil having two straight parallel sides, lying in the same circumferential plane, and connected by end portions composed each of two reversely-oblique parts, one of which is offset inwardly from the plane of the sides, and the other of which is a portion of a helix connecting the first-named part to one of the sides.

2. An armature-coil, consisting of two straight parallel sides lying in the same circumferential plane, and two longitudinally-projecting end portions composed each of two parts which form obtuse angles with their respective sides, the part adjacent to one side being offset inwardly therefrom, and the part adjacent to the other side forming a helical bend through which the offset portion rises to the plane of the sides.

3. The herein-described armature-coil, comprising two parallel sides lying in the same circumferential plane, and end or connecting portions composed each of two parts, that part adjacent to one of the sides being connected thereto by a backward and inward offset, and the part adjacent to the other side passing from the plane of that side to the

plane of the first-named part in an oblique direction and by a helical bend.

4. The herein-described armature-coil, comprising two parallel sides equidistant from the axis of the armature, and chordal end portions composed each of two parts, one of which is offset inwardly from the plane of the sides and lies obliquely in a plane concentric therewith, and the other of which forms a helical bend.

5. The herein-described armature-coil, having its two sides equidistant from the axis of the armature, and end portions formed each of two oblique parts which form longitudinal projections of the coil, one of said parts, when the coil is viewed in plan, showing an oblique edgewise disposition, and the other part showing a helical bend.

6. An armature-coil having parallel sides equidistant from the axis of the armature, and oblique end portions *b* joined to one of said sides by a backward and inward bend in a plane parallel with the planes of the end faces of the armature-core, and joined to the other of said sides by oblique helical bends.

7. An armature-coil, composed of the parallel sides A and B, the oblique, arched-end portions *b* joined to the side B by the backward and inward bends *c*, and the oblique helical end portions *a*, which join the portions *b* to the side A.

8. An armature-coil composed of a plurality of grouped conductors which maintain their parallel relation throughout the coil, but which change their relative relation to the inner and outer edges of the coil twice at each end portion thereof, whereby one set of commutator leads or terminals leaves one side of the coil at its inner edge, and the other set leaves the other side of the coil at its outer edge.

9. The combination with a slotted-drum armature, of a winding therefor composed of a plurality of similar separable coils, each coil having its sides of substantially the full depth of the core-slots and each side lying therein side by side with the opposite side of another coil, each coil extending from the farther side of one slot to the farther side of another slot, the end portions of the coils extending alternately in opposite directions across the ends of the drum and consisting in part of oblique edgewise-disposed portions lying side by side in an annular plane concentric with the plane of the sides, and in part of helical portions partially overlying each other.

10. An armature-coil having two substantially straight parallel sides lying in the same circumferential plane, and connected by end portions, each of which is composed of two parts, one of said parts leaving its corresponding side at an obtuse angle and having its lateral faces (when the coil is viewed in plan) lying in substantially vertical planes, the other of said parts also leaving its side at an obtuse angle and extended to meet the first-named part by a symmetrical bend, in which the individual conductors comprising the coil preserve substantial parallelism, but are transposed with respect to the outer and inner edges of the coil.

11. The herein-described armature-coil, consisting of two parallel sides lying in the same circumferential plane, and end or connecting portions consisting each of two parts, that part adjacent to one of said sides being connected thereto by a backward and inward offset, and the part adjacent to the other side leaving the first-named part at an obtuse angle and through a helical bend.

12. The herein-described armature-coil, consisting of two parallel sides lying in the same circumferential plane, and end or connecting portions consisting each of two parts, that part adjacent to one of said sides being connected thereto by a backward and inward offset, said offset at the end of the coil opposite the commutator end being in part of double thickness.

13. An armature-coil having an end portion joined to one of its sides by a short backward and inward bend away from the adjacent coil.

14. An armature-coil having end portions joined to one of its sides by a short backward and inward bend, by which the outer conductor of the adjacent side becomes the inner conductor of the said end portion.

15. An armature-coil having an end portion connected to one of its sides by an abrupt backward and inward bend, a portion of which has the conductors thereof displaced out of parallelism and overlying each other.

In testimony whereof I have affixed my signature in presence of two witnesses.

FRANK A. MERRICK.

Witnesses:
CORA G. COX,
H. W. SMITH.