No. 685,966. Patented Nov. 5, 1901.

J. B. BLOOD.

WINDING FOR DYNAMO ELECTRIC MACHINES.

(Application filed Mar. 1, 1901.)

(No Model.) 2 Sheets—Sheet 1.

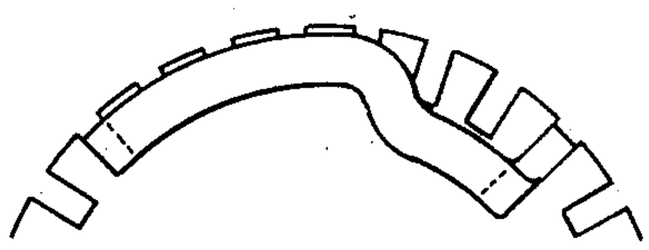


Fig. 1

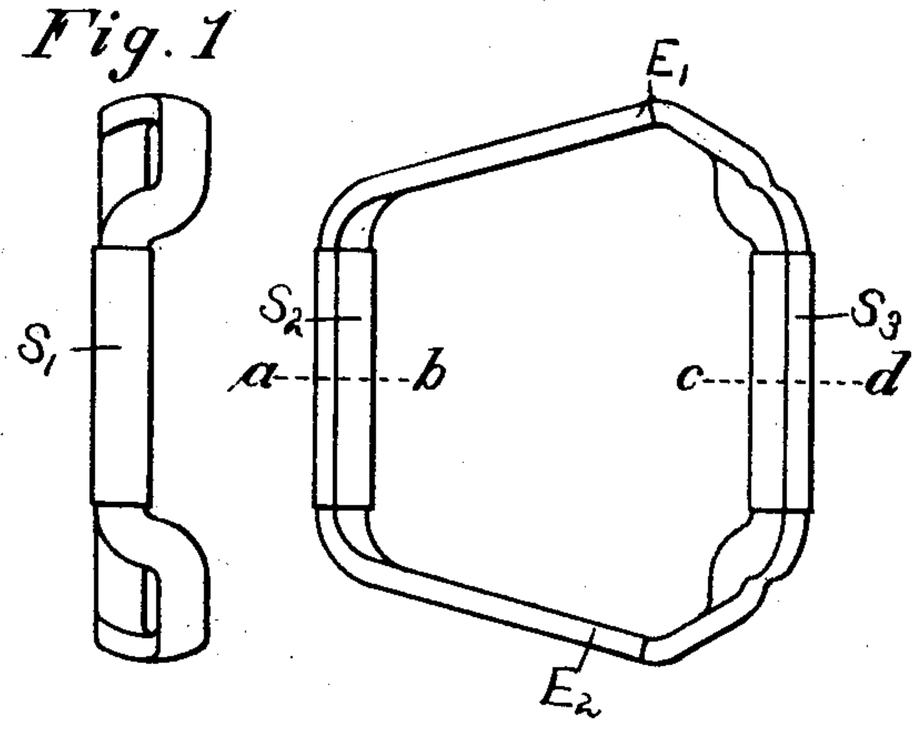
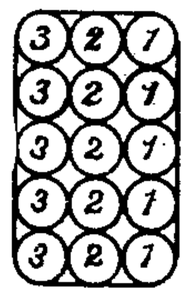
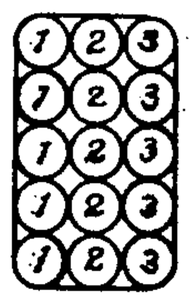


Fig. 2



Section a-b



Section c-d

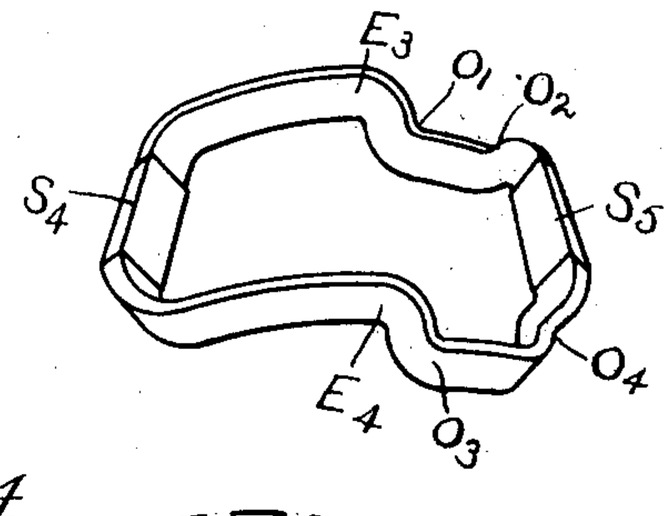


Fig. 3

Fig. 4

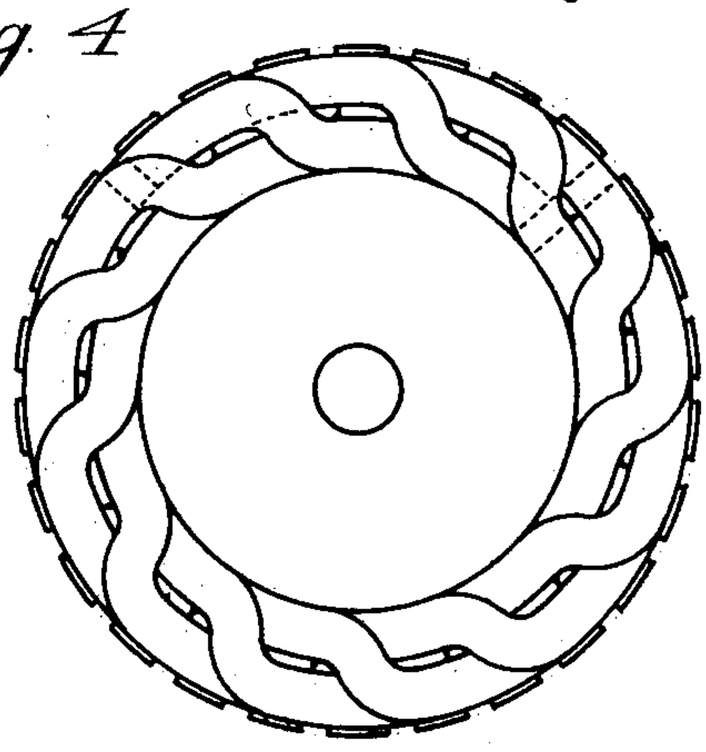
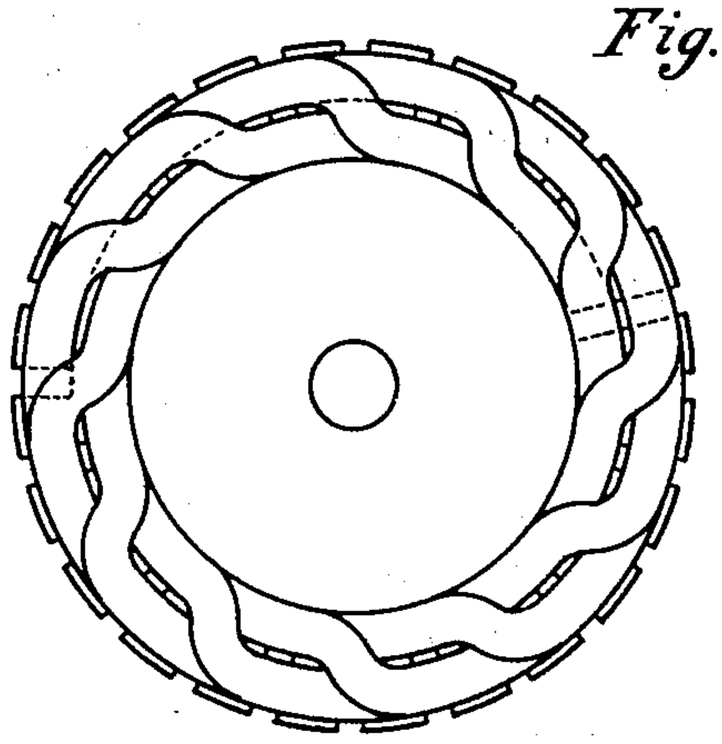


Fig. 5



WITNESSES:

Louis C. Dodge

Joshua Tate

INVENTOR

John Balch Blood

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Fig. 6

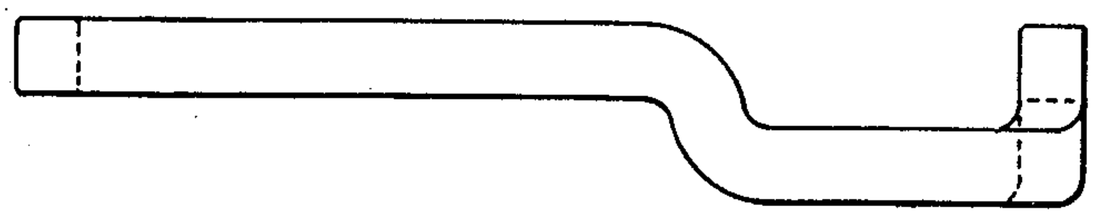


Fig. 7

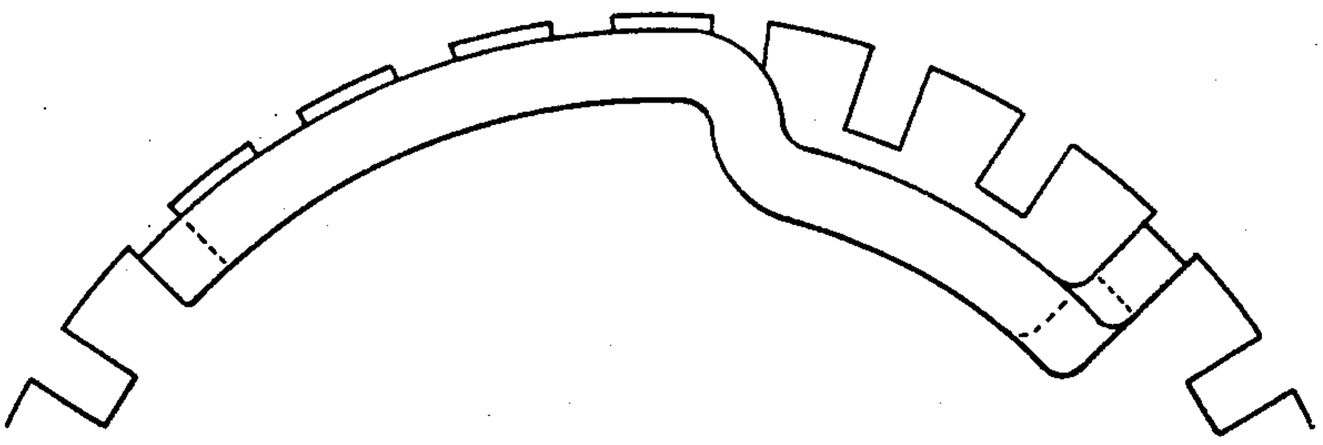


Fig. 8

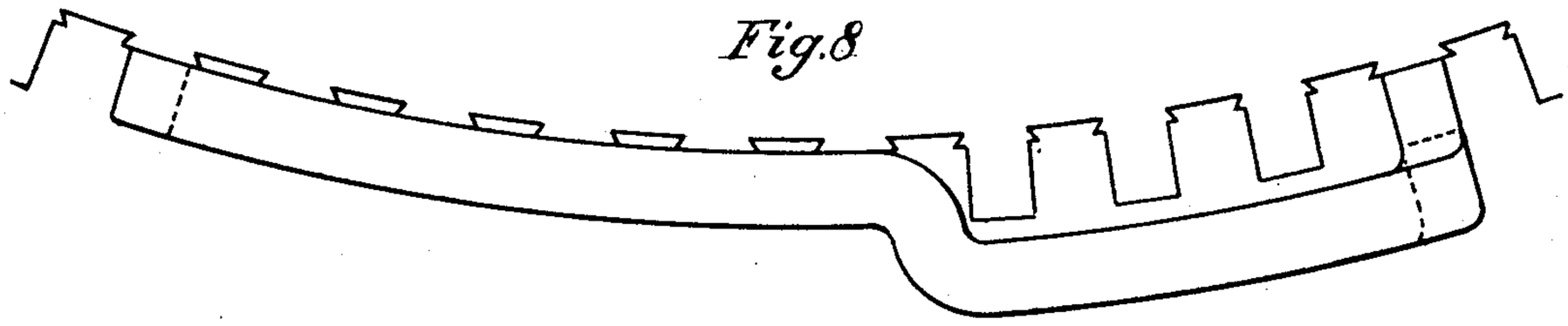
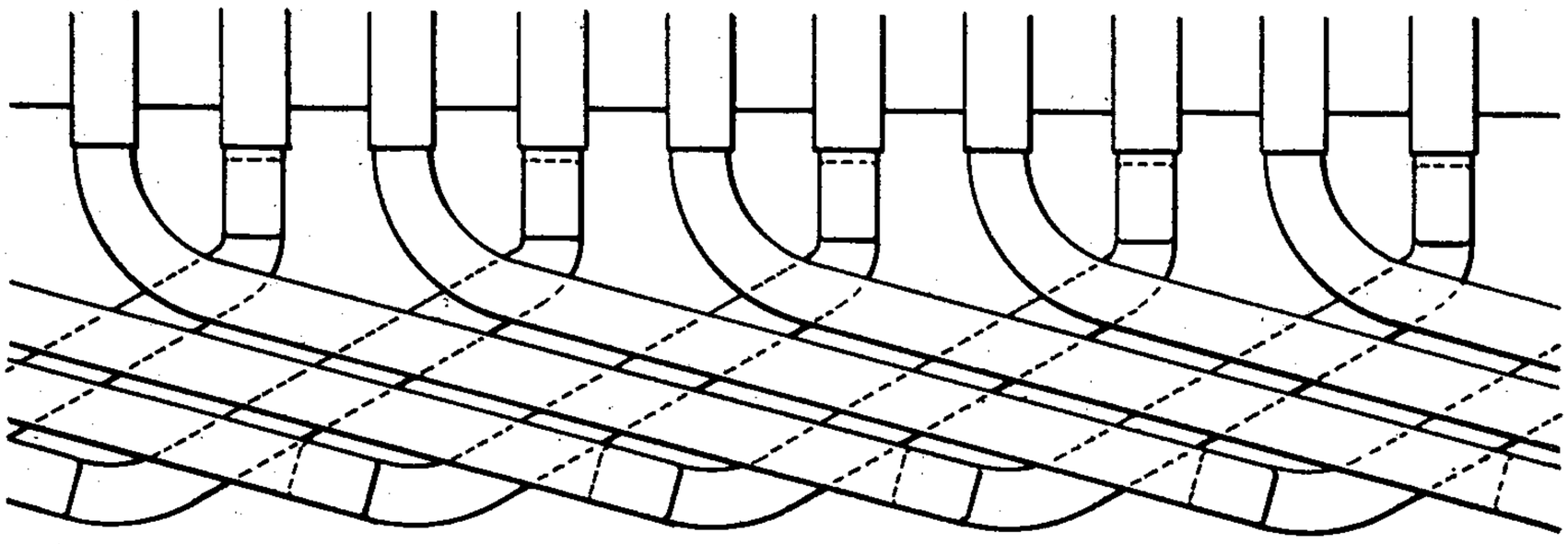


Fig. 9



WITNESSES:

Louis C. Dodge.

John Hale

INVENTOR

John Balch Blood.

UNITED STATES PATENT OFFICE.

JOHN BALCH BLOOD, OF NEWBURYPORT, MASSACHUSETTS.

WINDING FOR DYNAMO-ELECTRIC MACHINES.

SPECIFICATION forming part of Letters Patent No. 685,966, dated November 5, 1901.

Application filed March 1, 1901. Serial No. 49,463. (No model.)

To all whom it may concern:

Be it known that I, JOHN BALCH BLOOD, a citizen of the United States, and a resident of Newburyport, in the county of Essex and State of Massachusetts, have invented certain new and useful Improvements in Windings for Dynamo-Electric Machines, of which the following is a specification.

My invention consists of a counterpart machine-formed coil adapted for a unilayer winding, with means and methods for its construction.

My invention is applicable to all sorts of dynamo-electric machines where successive counterpart coils and a unilayer are the desiderata. At the present time the two places of greatest applicability are in the case of armatures of direct-current machines and in the phase-winding of alternating-current machines.

Now while each of the above-mentioned desiderata—namely, formed counterpart coils and unilayer—is in itself sought as an end they are in combination more desirable on account of the coincident advantages of both factors.

Form-windings up to the present may be divided into two classes—first, counterpart coils with two-layer windings; second, non-counterpart coils with unilayer windings. These may be distinguished by the following generic features: The counterpart two-layer windings have a complete turn at the end of the coil and reversal of the order of the wires in the two limbs normal to the plane of the coil. The non-counterpart unilayer coils make the pass at the ends by an offset and the order of the wires in the two limbs reversed tangentially to the plane of the coil.

I will now define the terms used above and in this specification. The term "coil" is used as the complete entity from a mechanical standpoint, which is detachable from the remainder of the winding as a whole. This coil may be subdivided into smaller units, which I term "bobbins." I term the whole grouping of the wires the "winding." The straight portions of the coil, which in an armature, for example, lie along the periphery of the core, are termed "sides," while those portions which contain the pass are termed "ends." The "pass" is that bend or variation of the coil to allow it to pass other coils and mesh with them. The pass-bend is designated a "turn" when the direction of the wire is changed one hundred and eighty degrees in the bend. It is designated an "offset" when the direction is unchanged, but the axis of the wire moved out of line. The plane of the coil is the plane of the two sides. It will be observed that normal and tangential functions of the plane are respectively radial and circumferential functions of an armature or phase winding with cylindrical rotor.

To further define the difference between a turn and an offset, I would mention that a turn serves best for a wire winding of radial sequence, while an offset is used with winding of circumferential sequence.

Layers are considered in the tangential plane, and with two layers one is normally over the other.

The attainment or object of my invention is a system of winding giving a coil having the advantages of both the counterpart two-layer and the non-counterpart unilayer coils, besides other advantages, among which is a simultaneous winding of the several bobbins in a given coil.

The above-mentioned counterpart winding has for its chief and almost sole advantage the fact of its being counterpart. The unilayer coil has many advantages over the two-layer coils. Up to the present time no one has been able to make a successful unilayer coil which was at the same time counterpart.

The advantages of the unilayer coil are that no high potential difference exists in one slot and that the insulation for a given amount of copper section is relatively less. On account of this last feature a cheaper machine for a given output can be built.

My invention gives a coil which has all the above advantages and besides a less overall length over the ends for a given length of side, a better arrangement of end connection, and a form of coil which admits of winding the bobbins simultaneously. The pass is accomplished by a double offset—one offset near each end of the coil and one offset at each end of one useful side. (Shown clearly in the drawings herewith.)

Referring to the drawings, Figure 1 shows three views of a coil adapted for a four-pole

armature. Fig. 3 shows a perspective view of this same coil. Fig. 4 shows end view of an armature using the coil shown in Figs. 1 and 3. Fig. 5 shows the end view of an armature using a two-pole coil. Fig. 6 gives end view showing generic feature of the coil. This coil is drawn with reference to the flat surface. Fig. 7 shows an end view for a coil on an armature, and Fig. 8 shows an end view of a coil for a phase-winding of an alternating-current machine. Fig. 9 shows development of a series of coils, showing how they lie with reference to each other and how the pass is accomplished.

Further referring to the drawings, S′, S^2, and S^3 in Fig. 1 and S^4 S^5 in Fig. 2 all indicate sides of the coil. E′ and E^2 in Fig. 1 and E^3 and E^4 in Fig. 3 indicate the ends of the coil. The offsets are shown best in Fig. 3 at respectively O′ O^2 O^3 O^4.

Fig. 2 shows the characteristic feature of horizontal winding in the layers and the relation of the layers to the coil as a whole. This coil is drawn consisting of five bobbins of three turns each per bobbin, each bobbin having its corresponding segment in the commutator. The winding would be in sequence, as the figures indicate. If the wires started in No. 1 of section *a b*, it would go over on this limb of the armature and return in No. 1 of section *c d*, going over again on No. 2 of section *a b*, returning in No. 2 of section *c d*, and finally completing the coil by going over on No. 3 of section *a b* and returning in No. 3 of section *c d*. Consequently the leads would be in such a case taken from the No. 1 wires of section *a b* and from the No. 3 wires of section *c d*. The winding, of course, could be reversed, and the No. 1 of section *c d* and the No. 3 wires of section *a b* could be respectively the leads of the bobbins. This Fig. 2 shows the separate layers vertically superimposed with horizontal winding in each layer. As compared with most of the existing plural bobbin-coils this is distinctly different. At present individual coils are wound vertically and stand in planes side by side around the periphery of the armature. If we use the same Fig. 2, the present style of winding might be indicated by considering the five wires numbered 1 as being in one coil, the five wires numbered 2 being the second coil, and the five wires numbered 3 being the third coil. This will be true only considering one section—as, for instance, section *a b*. The relation in the other section would be different.

An important feature of this invention is the possibility of winding simultaneously the layers of the coil where the wires in each layer make one unit of the winding and are connected to one segment of the commutator. Here referring to Fig. 2, the five layers may be wound simultaneously, the ends marked "No. 1" of section *a b* and the ends marked "No. 3" of section *c d* being, respectively, the ends of the several winding units.

What I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In a dynamo-electric machine a winding composed of detachable counterpart coils the ends of which connect the sides by means of a bend, in the circumferential plane of the sides, an offset toward the axis of the armature, and an offset away from the axis, substantially as described.

2. In a dynamo-electric machine a winding composed of detachable counterpart coils the layers of which are in vertical relation and each layer wound horizontally, substantially as described.

3. In a dynamo-electric machine a winding composed of detachable counterpart coils, the successive turns in each layer of which being away from the center line between the sides of the coil, substantially as described.

4. In a dynamo-electric machine a winding composed of detachable counterpart coils each coil having its layers wound horizontally and symmetrically with reference to a center line between the sides, substantially as described.

5. In a dynamo-electric machine a winding composed of detachable counterpart coils having the component layers of said coil wound simultaneously substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN BALCH BLOOD.

Witnesses:
LOUIS L. DODGE,
JOSHUA HALE.