No. 720,511. PATENTED FEB. 10, 1903.

H. A. BALCOME.

DRUM ARMATURE.

APPLICATION FILED APR. 23, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

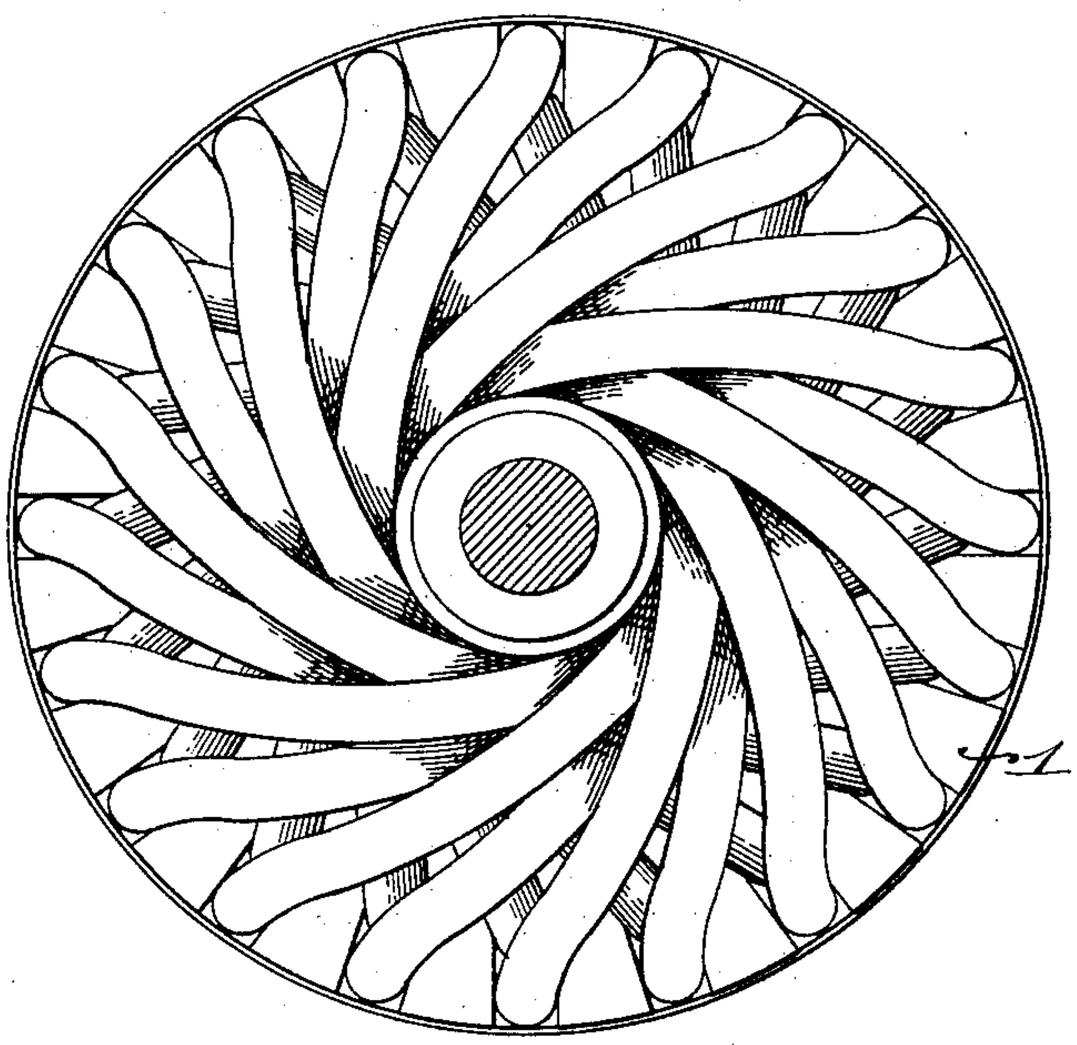

Fig. 1.

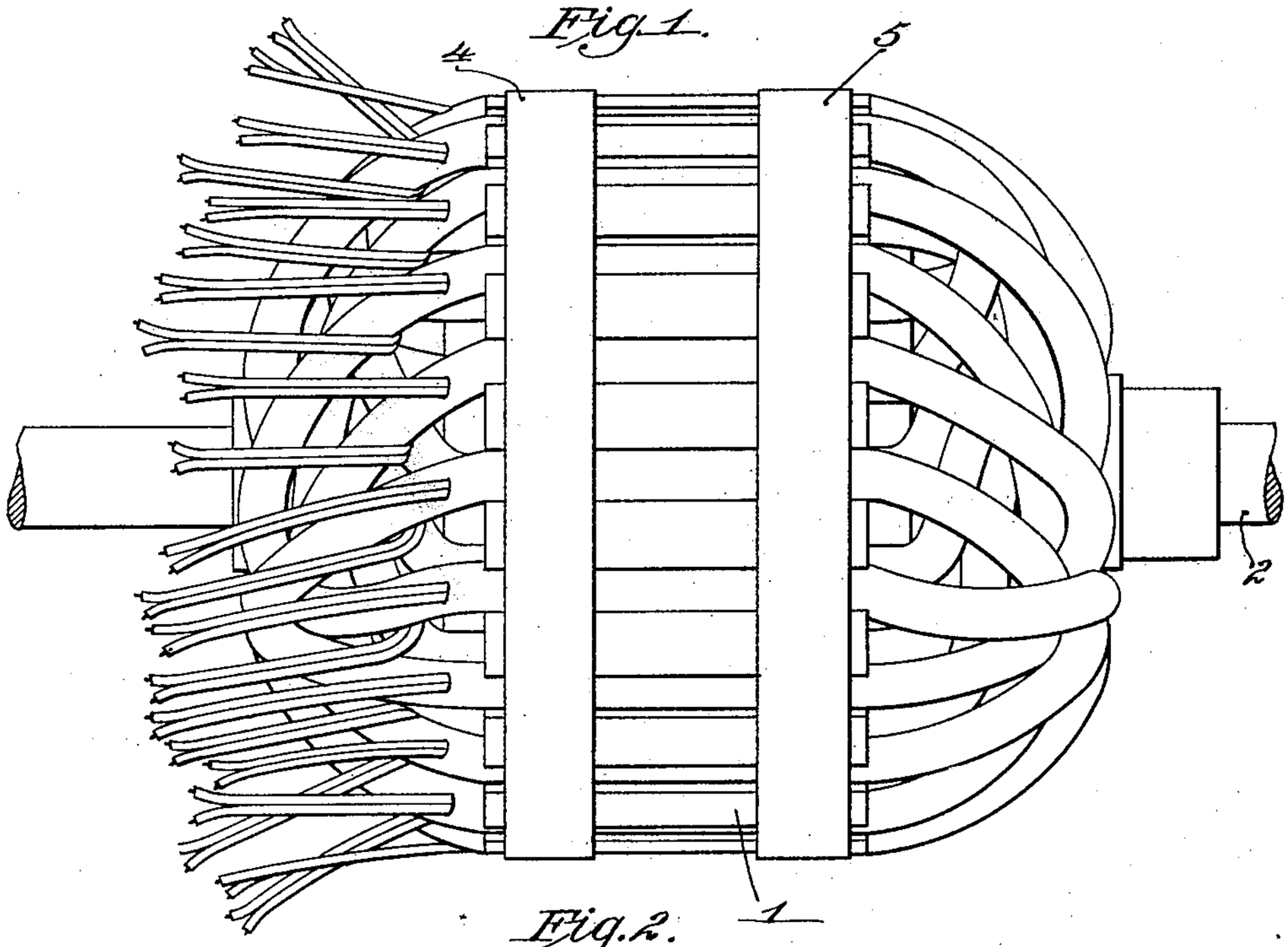

Fig. 2.

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NO MODEL. 2 SHEETS—SHEET 2.

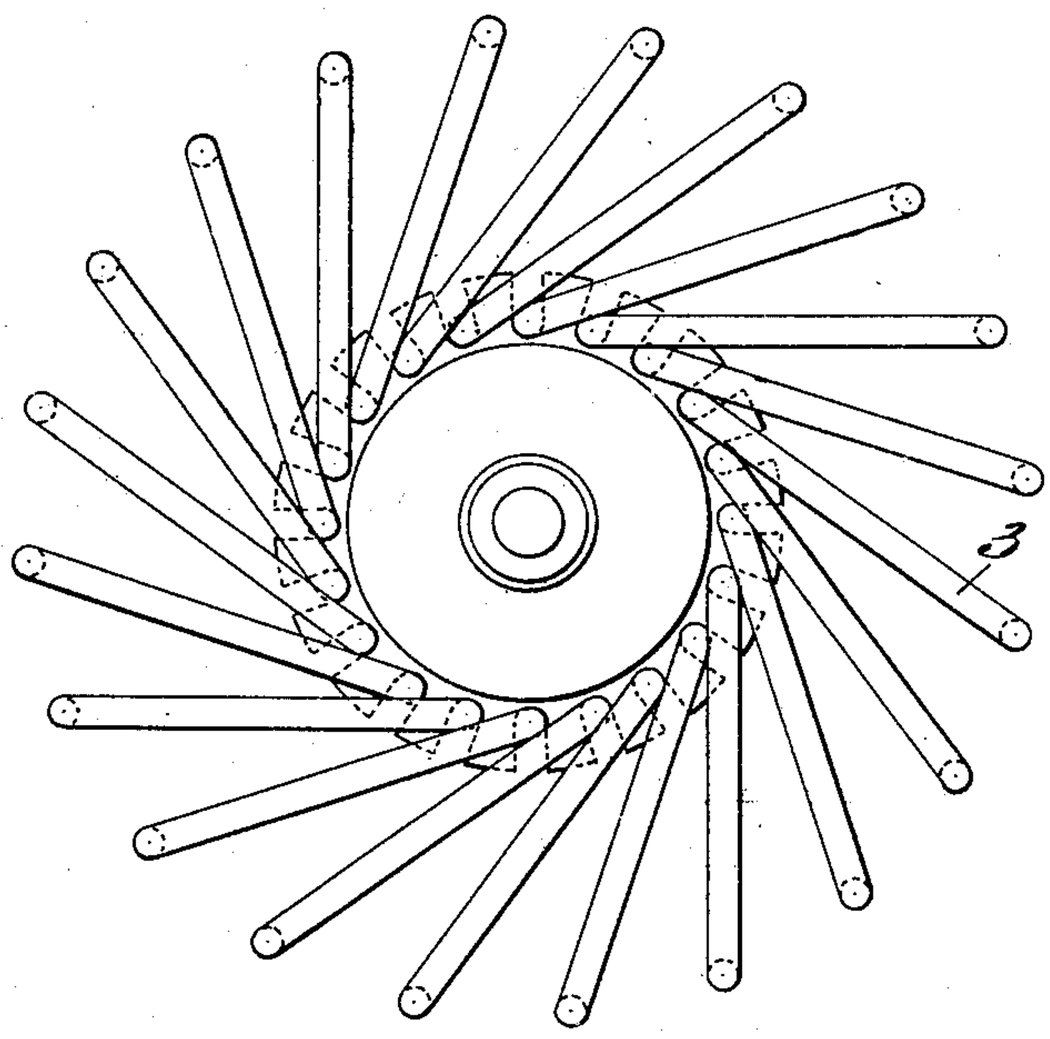

Fig. 3.

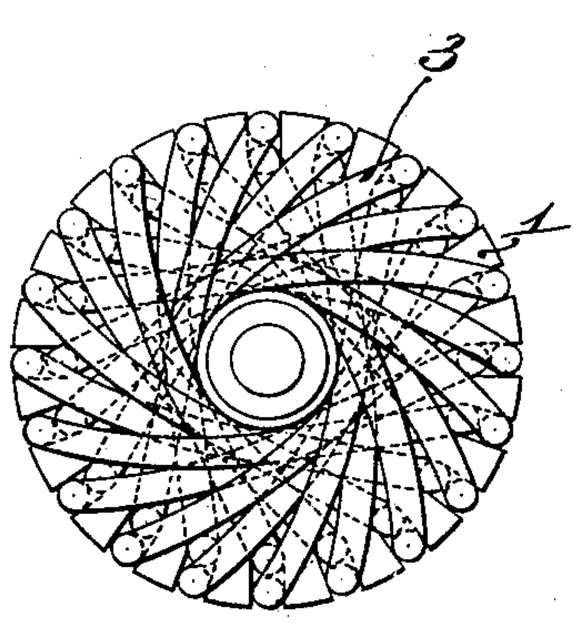

Fig. 4.

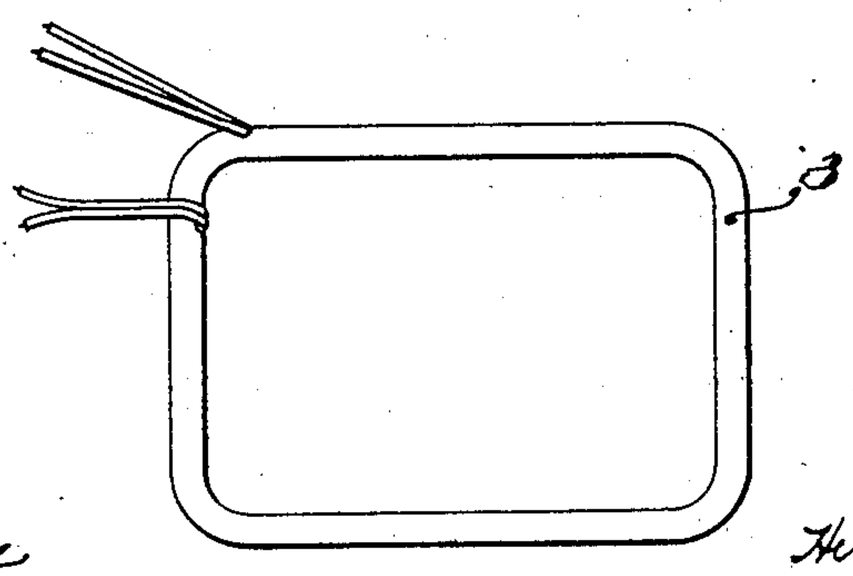

Fig. 5.

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UNITED STATES PATENT OFFICE.

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DRUM-ARMATURE.

SPECIFICATION forming part of Letters Patent No. 720,511, dated February 10, 1903.

Application filed April 23, 1902. Serial No. 104,265. (No model.)

To all whom it may concern:

Be it known that I, HERBERT A. BALCOME, a citizen of the United States, residing at Jamaica Plain, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Drum-Armatures; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The present invention relates to drum-armatures of dynamo-electric machines, and more particularly to an improved winding for such armatures.

Multipolar drum-armatures are now usually provided with a winding consisting of a series of coils which are separately wound and insulated before being placed upon the armature-core, and bipolar armatures are also sometimes provided with such a winding. These windings have either consisted of rigid or, as more usually termed in the art, "hard" coils of a shape which adapts them to be placed on the armature-core, with substantially no change in their shape, or have consisted of soft or flexible coils, which are placed on the armature-core and bent into position.

To produce coils of a shape which adapts them to be placed in position on the armature-core, forms of the shape which the coils are to assume must be employed, and the coils must be carefully wound on these forms. The provision of such forms and the time required in winding the coils thereon adds materially to the cost of manufacture. Moreover, such coils are necessarily hard or rigid and great difficulty is experienced in applying them to the armature-core, especially when the armature is of the bipolar type. It is therefore desirable to use soft or flexible coils, as such coils can be readily manipulated, and as they need not be of any particular shape before being applied to the armature-core they can be quickly and cheaply produced.

In applying soft or flexible coils to the core of a drum-armature and particularly in applying such coils to the core of a bipolar drum-armature difficulty has been experienced in securing a symmetrical and compact arrangement of the end portions of the coils; and the object of the present invention is to provide a drum-armature with an improved winding made up of such coils in which the end portions of the coils are symmetrically and compactly arranged at the ends of the armature-core.

With this object in view my invention consists of a drum-armature having a winding made up of a series of coils of equal length which before being applied to the armature-core are soft or flexible, said coils being stretched over the armature-core in the same direction, and the end portions of each coil passing over a number of coils and under an equal number of coils and being stretched taut to lie snugly against the ends of the armature-core and underlying coils.

My invention is intended, primarily, as an improvement in bipolar armatures and is of especial value when embodied in an armature of this type; but it is to be understood that, broadly considered, it is not limited thereto, but may be embodied in armatures of the multipolar type without departing from the spirit thereof.

In carrying out my invention the coils may be arranged in a single layer or in a number of layers; but preferably they are arranged in two layers, with the opposite sides of each coil located in different layers, the advantages of such an arrangement being well understood by those skilled in the art.

A preferred form of my invention is illustrated in the accompanying drawings, in which—

Figure 1 is a view in end elevation of an armature embodying the same, the armature-shaft being shown in section. Fig. 2 is a view in side elevation of the armature before the commutator is added, illustrating the arrangement of the end portions of the coils at the ends of the armature-core. Figs. 3 and 4 are views illustrating somewhat diagrammatically two steps in the process of applying the coils, and Fig. 5 is a view of one of

the coils as it appears before being applied to the armature-core.

The armature illustrated in Figs. 1 and 2 is of the bipolar type and comprises a slotted armature-core 1 of well-known or suitable construction secured to an armature-shaft 2. The armature-core is provided with twenty slots, and the winding consists of a series of coils, twenty in number. One side of each of these coils lies in the bottom of a slot and the other side lies in the upper portion of the slot diametrically opposite, the coils being arranged on the core in two layers, with the opposite sides of each coil located in different layers. One of the coils is indicated at 3 in Fig. 5 as it appears before being applied to the armature-core. As shown in this figure, the coil is substantially rectangular in shape; but it may be circular or any other shape desired. The coils are soft or flexible—that is, they are not rigid—and can be stretched over the armature-core and caused to assume the positions indicated in Figs. 1 and 2.

The manner in which the coils are applied to the armature-core will be apparent from an inspection of Figs. 3 and 4. As indicated in these figures, one side of each coil is placed in the bottom of a slot, and then the coils are stretched over the core as far as possible and the other sides of the coils inserted in the slots. The coils are all of equal length, and the length of the coils is so proportioned to the size of the armature-core that when the coils are in their final position the end portions of each coil are stretched taut to lie snugly against the ends of the core and underlying coils, all or substantially all of the slack being taken up. In a bipolar armature provided with the number of slots sanctioned by good practice I have found it difficult, if not impossible, to stretch the coils over the armature-core directly from the position indicated in Fig. 3 to that which they finally assume. The coils are accordingly first stretched over the core as far as possible and the upper sides of the coils inserted in the slots, the appearance of the armature at this stage being indicated in Fig. 4. The upper side of one of the coils is then removed from its slot, and the upper side of the next preceding coil is moved forward to take its place. The upper sides of the other coils are advanced a slot in a similar manner, and the operation is repeated until the opposite sides of each coil are located in diametrically opposite slots.

It will be noted that all of the coils are stretched over the armature-core in the same direction and that the end portions of each coil pass over a number of coils and under an equal number of coils. Thus counting in the direction in which the coils are stretched around the armature-core the end portions of each coil pass over the end portions of those coils having one side located in the bottom of the slots intervening between the slots occupied by the sides of such coil and under the end portions of those coils having one side located in the upper portion of the intervening slots.

By applying the coils in the manner above indicated the end portions of the coils are caused to arrange themselves in a compact and symmetrical manner on the ends of the armature-core and around the armature-shaft. In the armature illustrated in Figs. 1 and 2 it will be seen that the end portions of none of the coils extend beyond the ends of the armature a distance greater than four times the thickness of a coil, the end portions of the coils lying snugly against the ends of the armature-core and against underlying coils and near the armature-shaft being arranged in four layers. At each end of the armature alternate coils have their end portions lying in the outer layer and passing close to the armature-shaft, and those coils which at one end of the armature have their end portions located in the outer layer at the other end of the armature have their end portions located in an inner layer, as is clearly indicated in Fig. 2. The end portions of the coils are thus arranged as compactly as possible, there being practically no slack in such portions. The end portions of the coils, therefore, by their mutual binding action tend to hold the coils securely in position on the armature-core and at the same time do not project a sufficient distance beyond the ends of the armature-core to necessitate the use of an objectionably long armature-shaft.

After the coils have been placed in position on the armature-core they may be permanently bound down and held in position by means of bands 4 and 5 in the usual manner.

Each of the coils which I have illustrated in the drawings is composed of a number of turns of two wires lying side by side, so that, in effect, each coil is made up of two coils. The ends of these wires are connected to different commutator-segments, the number of commutator-segments being twice the number of slots.

While I prefer to form the coils of two wires, as thereby the number of slots in the armature-core can be decreased, it is to be understood that the coils may be formed of a single wire, if desired, and that my invention is in no wise limited to any particular kind of coil. It is also to be understood that while I have illustrated my invention as embodied in a bipolar armature provided with a double-layer winding as to its broader features it is not limited thereto, but may be embodied in multipolar armatures or in armatures provided with a single-layer winding.

In embodying my invention in an armature provided with a single-layer winding the coils will be applied to the armature-core in the manner above indicated, with the exception that the coils will be equal in number to half the number of slots and at the beginning of the operation of applying the coils the coils will be placed in every other slot. It will be

evident from an inspection of Fig. 1 that the coils of the armature illustrated could readily be applied in a single layer if the armature-core were provided with twice the number of slots.

So far as I am advised as to the state of the art I am the first to provide an armature-winding comprising a series of coils of equal length stretched over the armature-core in the same direction and having their end portions symmetrically arranged around the armature-shaft and lying snugly against the ends of the armature-core and against each other, so as to produce a mechanically-balanced and comparatively short armature.

I am aware that armature-windings consisting of a series of soft or flexible coils have heretofore been provided; but in such windings the coils either do not extend around the armature in the same direction and their end portions are not symmetrically arranged around the armature-shaft or the end portions of the coils do not fit snugly against the ends of the armature-core and against each other, but are loosely arranged, so as to exert no mutual binding action upon each other to hold the coils in position upon the armature-core, and extend to such a distance beyond the ends of the armature-core as to necessitate the use of an objectionably long armature-shaft.

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

1. A drum-armature having, in combination, a core and a winding consisting of a series of soft or flexible coils of equal length stretched over the core in the same direction, the ends of each coil passing over a number of coils and under an equal number of coils and being stretched taut to lie snugly against the core and underlying coils, substantially as described.

2. A drum-armature, having, in combination, a core and a double-layer winding consisting of a series of soft or flexible coils of equal length stretched over the core in the same direction, the two sides of each coil being located in different layers, and the ends of each coil passing over a number of coils and under an equal number of coils and being stretched taut to lie snugly against the core and underlying coils, substantially as described.

3. A bipolar drum-armature, having, in combination, a core and a winding consisting of a series of soft or flexible coils of equal length stretched over the core in the same direction, the opposite sides of each coil being located on substantially diametrically opposite portions of the core, and the ends of each coil passing over a number of coils and under an equal number of coils and being stretched taut to lie snugly against the core and underlying coils, substantially as described.

4. A bipolar drum-armature, having, in combination, a core and a double-layer winding consisting of a series of soft or flexible coils of equal length stretched over the core in the same direction, the opposite sides of each coil being located in different layers and on substantially diametrically opposite portions of the core and the ends of each coil passing over a number of coils and under an equal number of coils and being stretched taut to lie snugly against the core and underlying coils, substantially as described.

5. A drum-armature, having, in combination, a core and a winding consisting of a series of soft or flexible coils of equal length stretched over the core in the same direction, the ends of each coil passing over a number of coils and under an equal number of coils, and being stretched taut to lie snugly against the core and underlying coils, and the ends of alternate coils lying in an outer layer and passing close to the armature-shaft at one end of the armature and lying in an inner layer at the other end of the armature, substantially as described.

6. A bipolar drum-armature, having, in combination, a core and a double-layer winding consisting of a series of soft or flexible coils of equal length stretched over the core in the same direction, the opposite sides of each coil being located in different layers and on substantially diametrically opposite portions of the core, the ends of each coil passing over a number of coils, and under an equal number of coils and being stretched taut to lie snugly against the core and underlying coils, and the ends of alternate coils lying in an outer layer and passing close to the armature-shaft at one end of the armature and lying in an inner layer at the other end of the armature, substantially as described.

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

HERBERT A. BALCOME.

Witnesses:

FRED O. FISH,

HORACE VAN EVEREN.