No. 660,659. Patented Oct. 30, 1900.

A. ROTHERT.

SHAPED SPOOL FOR DRUM ARMATURES.

(Application filed Jan. 30, 1900.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

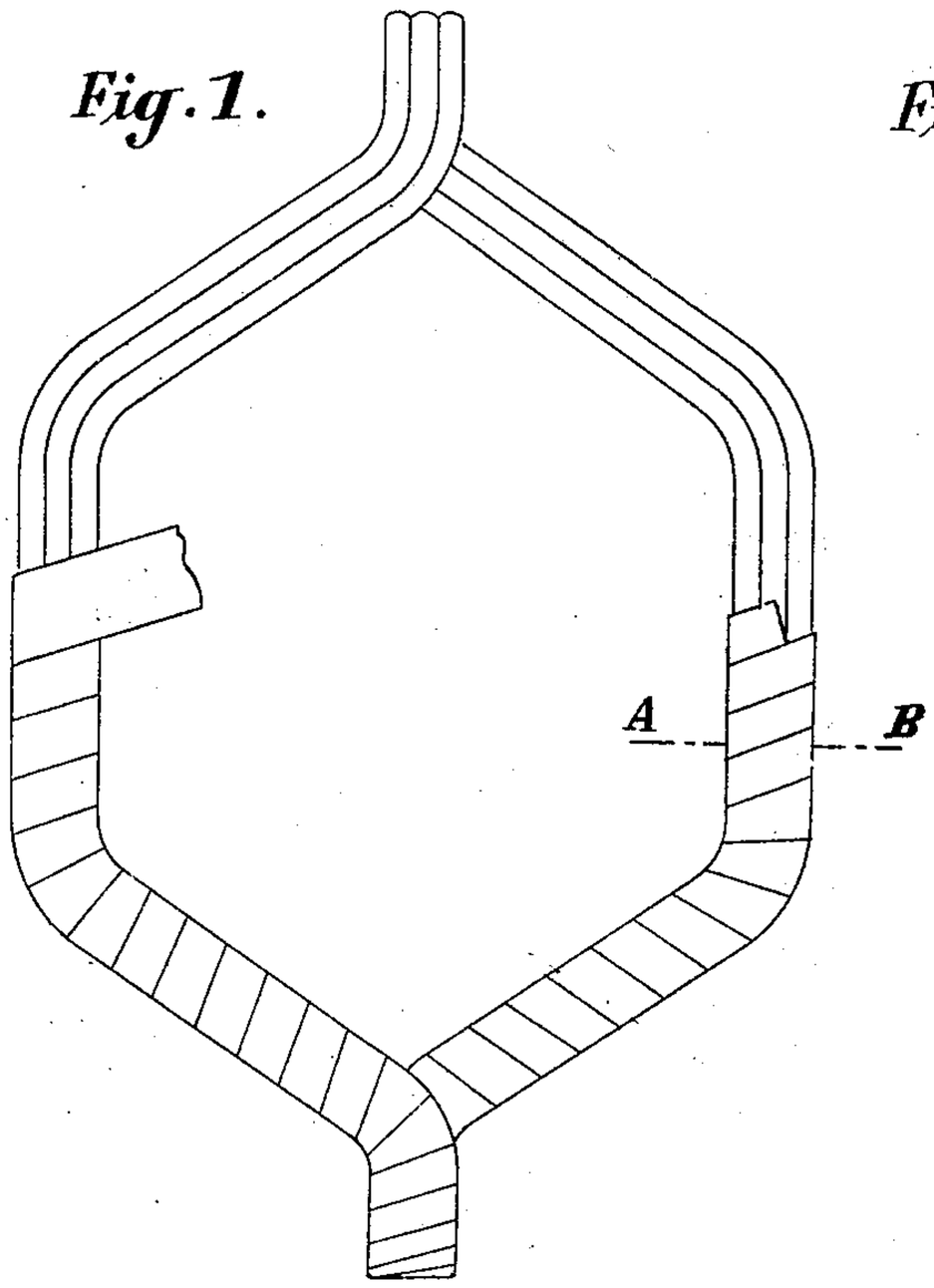


Fig. 2.

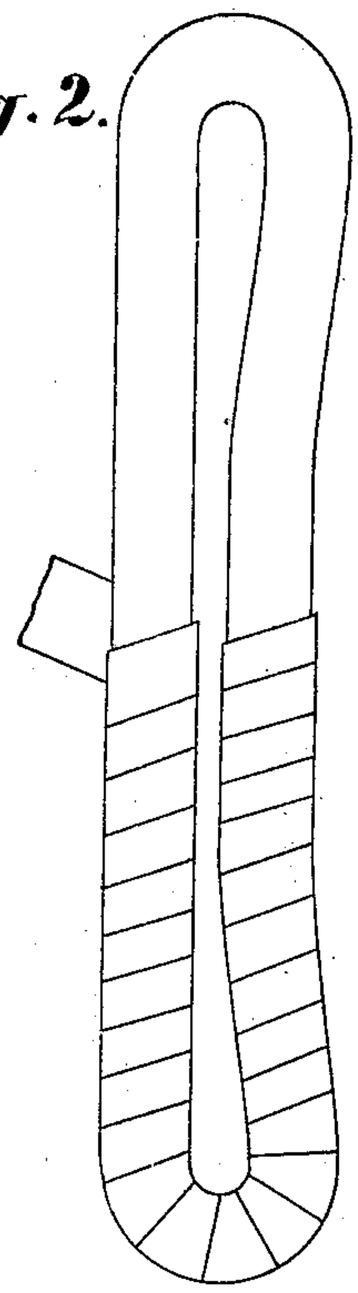


Fig. 3.

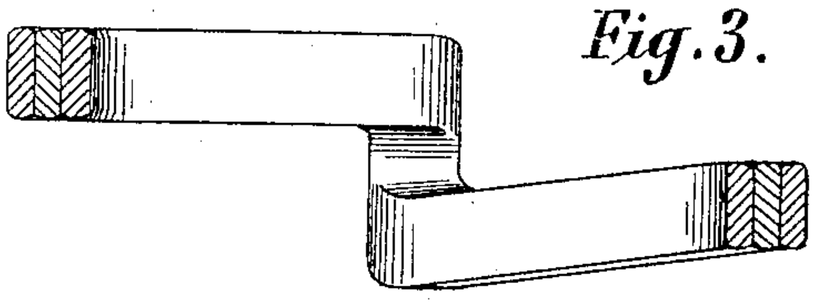


Fig. 4.

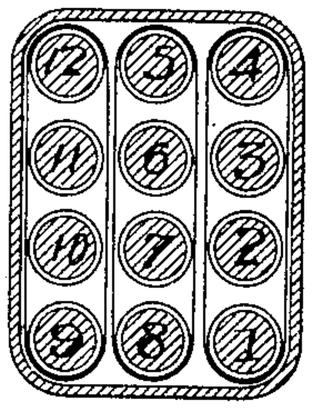
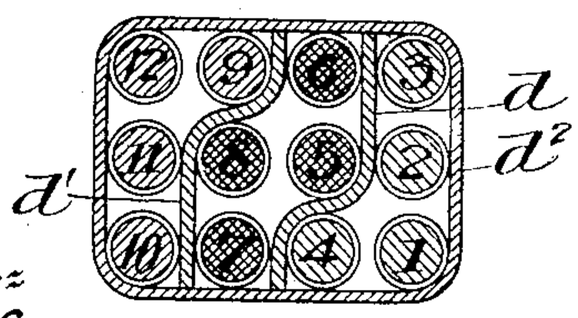


Fig. 5.



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No. 660,659. Patented Oct. 30, 1900.

A. ROTHERT.

SHAPED SPOOL FOR DRUM ARMATURES.

(Application filed Jan. 30, 1900.)

(No Model.) 2 Sheets—Sheet 2.

Fig. 6.

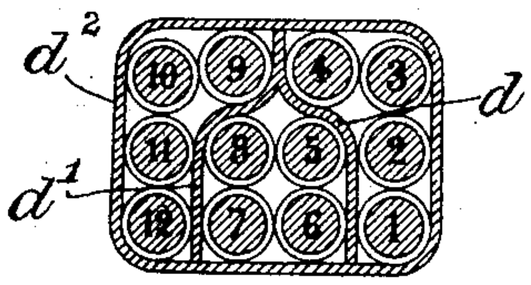


Fig. 7.

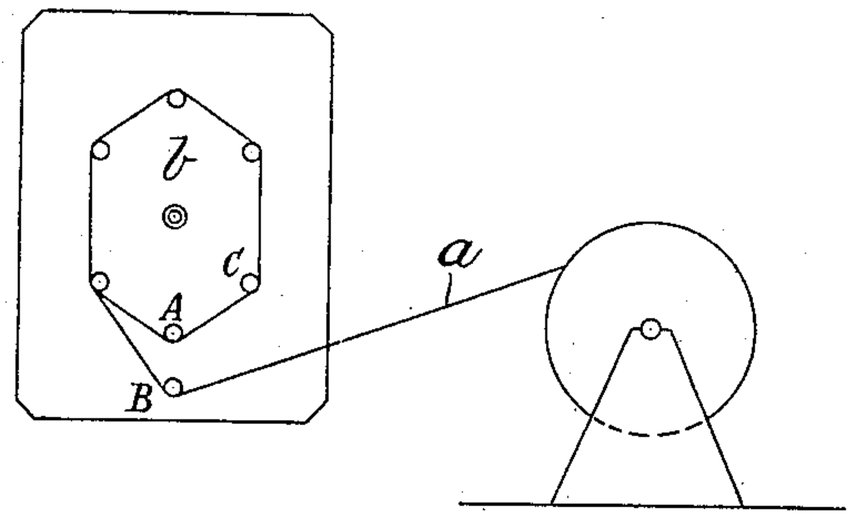
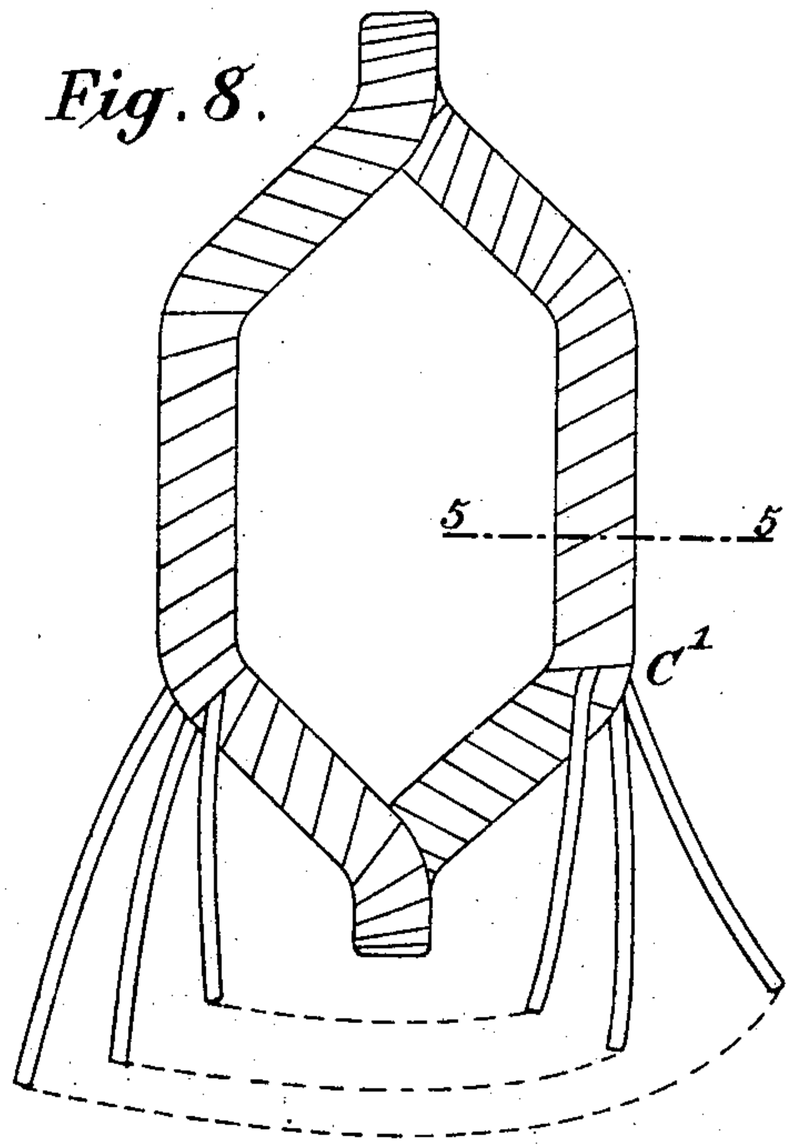


Fig. 8.



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UNITED STATES PATENT OFFICE.

ALEXANDER ROTHERT, OF RIGA, RUSSIA.

SHAPED SPOOL FOR DRUM-ARMATURES.

SPECIFICATION forming part of Letters Patent No. 660,659, dated October 30, 1900.

Application filed January 30, 1900. Serial No. 3,354. (No model.)

To all whom it may concern:

Be it known that I, ALEXANDER ROTHERT, a subject of the Emperor of Russia, residing at No. 6 Jagerstrasse, Riga, Russia, have invented certain new and useful Improvements in Shaped Spools for Drum-Armatures, of which the following is a full, clear, and exact specification.

My invention has relation to the shaping of a spool or coil for armature-drums; and in such connection it relates more particularly to the construction and arrangement of the elements or members comprising such a spool or coil.

Heretofore attempts have been made to arrange the windings of electrical machinery in a practical way by bending or winding the armature-wire on formers or shapers and attaching the shaped coils to the finished and already-insulated armature-drums. By these means a more regular winding was obtained, and in case of accident it could be more easily taken apart and repaired, relatively small parts of the armature only having to be unwound to find a defect. Recently dynamo-builders tend to reduce the number of armature-coils or winding members as far as possible in order that the work of winding may be reduced to a minimum, whether the armature be grooved or smooth or whether the dynamo or motor produce or be driven by a constant or alternating current. The reduction of the number of winding members to be attached to the armature is attended by certain difficulties as far as the purely electrical properties of the machines are concerned—such as sparkless running, constancy of momentum of rotation, &c.—in that the number of theoretical winding elements must not be too small. In constant-current machines the number of commutator-segments is dependent on the same. The main object is to combine a small number of winding members with a sufficient number of elements. Hitherto of late the rather considerable number of elements or members necessary has been made by winding each element on a separate form, then insulating the same, and combining several elements by binding them together, so that a relatively small number of winding members was attained, which were then fitted on the armature. In making the winding members by binding together several elements, each consisting of a shaped coil, the number of the wires present in each winding member must necessarily be a multiple of the wires contained in one element. In addition to this the wires must be arranged to correspond to the build of the element and to the manner of combining several elements. Thus, for instance, if three elements are combined to form a winding member by being horizontally disposed one next the other then the number of wires disposed horizontally one next the other in the combined winding member will necessarily be three or a multiple of three, while the number of vertically-superposed wires will be, of course, equal to that of one element.

My invention consists of a method by means of which the necessity of composing the winding members of a plurality of separately-made shaped coils (elements) is obviated, the said winding members being made directly as combined shaped coils, the wire being wound or bent on suitable formers and cut at suitable points, so that the number of turns between two severed points forms one element, the total number of turns in the winding member corresponding to the number of turns of all elements comprised in such a winding member. A winding member of this class in the form of a single shaped coil may contain any desired number of elements, and this method further comprises a very particular advantage—viz., that now the arrangement of the wires one next the other or one above the other is no longer dependent on the number of elements. Thus, for instance, the wires of a winding member containing three elements having each six turns may be arranged in nine layers of two wires each, which was techically hardly possible in the methods hitherto employed.

The nature and scope of my invention will be more fully understood from the following description, taken in connection with the accompanying drawings, forming part hereof, in which—

Figure 1 is a plan view of a winding member built up in the old way of three elements, the lower portion being illustrated as bound by a tape and the upper portion being left free to illustrate the relative arrangement of

the three elements. Fig. 2 is a side elevational view of Fig. 1. Fig. 3 is a cross-sectional view of Fig. 1. Fig. 4 is an enlarged sectional view corresponding to a section taken on the line A B of Fig. 1, but illustrating the formation in the old way of a winding member by arranging three elements of four wires each and binding the same together. Fig. 5 is an enlarged sectional view, on the line 5 5 of Fig. 8, of a combined coil embodying my invention and containing three elements of four wires each arranged in three layers and the layers of insulating material preferably separating the elements. Fig. 6 is a sectional view of a coil, illustrating a still further modified mode of winding the coil embodying my invention and containing three elements of four wires each wound in three layers, the elements being separated by layers of insulating material. Fig. 7 is a diagrammatic view, in side elevation, of the reel and former adapted to wind the spool; and Fig. 8 is a plan view of a spool built up according to my invention.

Referring to Figs. 5, 6, 7, and 8 of the drawings, to secure the shaped coil of my invention, which is illustrated in complete form in Fig. 8, the wire *a* (see Fig. 7) is first wound around a reel or shaper *b* until a sufficient number of revolutions or windings to form one element have been laid on the reel. Thus in Figs. 5 and 6 four windings have been made, the winding 4 being superposed in Fig. 5 upon winding 1 and in Fig. 6 upon winding 3. The wire *a* is now continued down to a peg B, situated below the peg A of the reel, and then continued up to a peg C of the reel to form a loop. The layers 1, 2, 3, and 4, before the loop is formed, are bound together by a layer *d* of insulating material, which, however, does not cover the loop. The next element, consisting of layers or windings 5, 6, 7, and 8, is then wound upon the reel *b*, when again a loop is formed, the layers or windings being bound together by a layer *d'* of insulating material, which does not cover the loop. The third element, consisting of elements 9, 10, 11, and 12, is then wound and the wire 12 continued out into a free or exposed end C'. The entire spool is then covered by a layer d^2 of insulating material, which, however, does not cover the free end of the layers 1 and 12, and the two loops formed, respectively, between the first and second and the second and third sections of the spool. When these two loops are cut, (see Fig. 8,) there will be formed six free ends, which may be thereafter connected in any suitable manner to the commutator or collector.

The invention, as illustrated in Figs. 5, 6, and 8, is particularly adapted for employment in connection with drum-armatures for medium-sized constant-current machines having high tension—such, for instance, as tram-car motors. The number of commutator-segments on machines of this class may not be below a certain limit and is in general rather considerable. Important advantages are gained in constructing these motors by keeping the number of grooves down as low as possible, this number being generally a third or half the number of commutator-segments. The number of the winding elements must be equal to the number of commutator-segments, so that four or six elements lie in one groove, each two or three of them being combined to form one winding member.

In the above-mentioned circumstances—viz., that in the methods hitherto employed—the arrangement of the wires in a winding member, dependent on the number and build of the elements forming the said winding member, is often inconvenient in dimensioning machines of this class, in that the choice of dimensions for the teeth and grooves is very restricted and sometimes flat wire cross-sections, which are disadvantageous, have to be employed to avoid too deep or broad grooves. By means of the present invention much more freedom is acquired in this respect, in that the arrangement of the wires next or above one another may be adapted to the dimensions of the grooves and quite irrespective of the number of elements comprised in one winding member.

The number of windings contained in the various elements composing a winding-section need not be equal in all elements. In this respect also the novel method offers considerable advantages in practice, in that a difference in the number of windings in the elements combined to form a winding member may be attained by correspondingly arranging the points at which the wires are severed.

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

A combined shaped coil for drum-armatures containing several elements having equal or unequal numbers of turns and having the armature-wire wound on suitable formers in sufficient number of turns for all the elements forming one coil or winding member, the said wire being of suitable cross-section and severed at suitable points, the whole coil being thus subdivided into several elements having each the number of turns comprised between two severed points, that is, between one of the said points and beginning or end of the wire, substantially as and for the purposes described.

In witness whereof I have hereunto set my hand in presence of two witnesses.

ALEX. ROTHERT.

Witnesses:
CHR. SCHÜLIN,
WM. JORGENSEN.