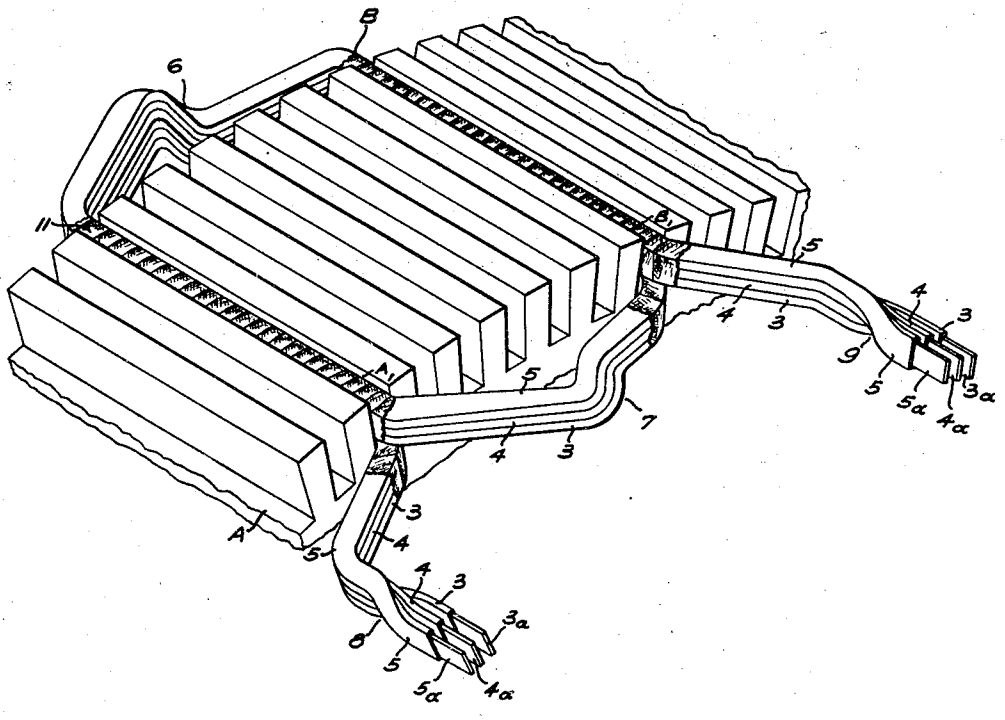
J. C. DAVENPORT.

WINDING FOR DYNAMO ELECTRIC MACHINES.

APPLICATION FILED APR. 22, 1914.

1,244,709. Patented Oct. 30, 1917.



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UNITED STATES PATENT OFFICE.

JOHN C. DAVENPORT, OF NORWOOD, OHIO, ASSIGNOR TO ALLIS-CHALMERS MANUFACTURING COMPANY, OF MILWAUKEE, WISCONSIN, A CORPORATION OF DELAWARE.

WINDING FOR DYNAMO-ELECTRIC MACHINES.

1,244,709. Specification of Letters Patent. Patented Oct. 30, 1917.

Application filed April 22, 1914. Serial No. 833,784.

To all whom it may concern:

Be it known that I, JOHN C. DAVENPORT, a citizen of the United States, residing at Norwood, in the county of Hamilton and State of Ohio, have invented a certain new and useful Improvement in Windings for Dynamo-Electric Machines, of which the following is a specification.

This invention relates in general to windings for dynamo-electric machines, and has particular relation to windings of the type in which a plurality of conductors are wound in the same slots and connected to separate segments of a commutator.

Where a plurality of separate conductors of strap or ribbon material are disposed edgewise in the slots of a rotating core, there is considerable danger, especially in high speed machines, due to centrifugal force, of the conductors wearing through the insulation at the edges. Further, where a plurality of ribbon or strap conductors are wound edgewise in slots, especially if the number of turns per coil is greater than two, the closed end connections, which in the latter case embody an offset cross-over, must be decidedly cumbersome, necessitating extra copper and taking up considerable space, in order to insure that the ends of the coil emerge from the high side of one slot and the low side of the other slot occupied by the same coil, and that the terminal portions of the conductors or individual strands of the coil be so relatively disposed that they may be connected to segments that are spaced apart to the required angular extent.

An object of this invention is to provide a winding of improved form in which a plurality of separate conductors are wound in each slot, and which insures that the closed end connections of the coils occupy a limited space and require a limited amount of copper, and that the terminal portions are suitably disposed for connection to the proper commutator segments.

A further object of this invention is to provide a winding of improved form in which the coils are made up of a plurality of separate conductors of ribbon or strap material, and in which the separate conductors are laid flatwise in the slots one upon another, and the terminals are properly disposed for connection to the commutator segments.

A further object of this invention is to produce a coil made up of a plurality of separate conductors of ribbon or strap material, forming a plurality of strands and wound together for disposition in the same slots and comprising a plurality of turns, the strands being wound one upon another and the terminal portions being suitably disposed for connection to the proper commutator segments.

These and other objects are obtained by this invention, the novel features of which will appear from the description and drawing, disclosing one embodiment of such invention, and will be particularly pointed out in the claims.

The accompanying drawing shows a view in perspective of a coil embodying the principles of this invention, the coil being shown as made up of two turns of three separate conductors, and the individual strands of conducting material being laid flatwise in slots of a rotating armature, a portion of the insulation of the coil being removed.

Referring to the drawing, A indicates a portion of an armature core, and B a coil, here shown as of the wave type, comprising a multi-strand element made up of single strands of insulated conductors 3, 4, 5, the conducting material being of ribbon or strap form and indicated at 3_a, 4_a, 5_a. The strands are laid one upon another and wound together so as to form a complete double-turn coil, and so that one terminal portion of said coil lies on the upper side and the other on the lower side. The formed coil is shown as being laid in slots of the armature, so that one coil end emerges from the outer portion of one slot and the other coil end emerges from the inner portion of another slot.

Tracing the coil formed of the strands 3, 4, 5, from the terminal portion at the left in the drawing, it is apparent that these strands pass rearwardly through slot A_1, at the inner portion thereof, forming the bottom or inner layer of the completely formed coil; and it also forms the bottom or inner layer of the V-shaped end turn at the rear side of the core, indicated at 6. The strands then pass forward at the bottom or inner portion of slot B_1, maintaining the same relative positions and making a V-shaped end turn at the front end of the core, indicated at 7,

and then pass rearwardly through slot A_1, at the outer portion thereof, that is, superposed over the first layer. The strands follow the V-turn of the lower layer at 6 at the rear end of the core, and then pass forward again through the slot B_1, being disposed at the outer portion of this slot. The terminal portions are bent so as to bring the same opposite the proper commutator segments, these portions being here shown as being bent over so as to be connected as a wave winding.

As is apparent, the several strands of which the coil is composed, occupy the same relative positions throughout the inductor or electromotive force producing portions occupying the core slots and also the closed end turns, enabling one to bring out one of the terminals at the high or outer side of one slot and the other terminal at the low or inner side of another slot, and this with the simplest form of end turns.

When the strands are laid flatwise in the slots of the core, the closed end connections may comprise only V-shaped bends, the front end, however, being necessarily so formed as to carry the winding element from the inner portion of one slot to the outer portion of the other slot. For convenience in properly disposing adjacent coils, it is desirable to form both the front and rear end connecting portions with a slight offset to form plain S-bends. The terminal portions of the strands 3, 4, 5, are given a quarter turn in the same angular direction, as indicated at 8 and 9, and are separated so as to dispose the ends of the individual conductors 3_a, 4_a, 5_a, in substantially radial planes and at the same angular distance apart for connection to the proper commutator segments.

The individual conductors and the coils may be insulated in any suitable manner. Each conductor is shown as being separately insulated to form a strand, and the three strands that are wound together are preferably taped or otherwise held together, this taping being indicated at 11 and being shown as removed at the front and rear portions of the coil. If desirable, the parallel straight portions of the coil that lie in the slots and the rear end turn may be taped together.

The absence of U-shaped bends in the end turns, the same being replaced by plain S-bends, saves both copper and space, and by using coils the individual strands of which are laid flatwise in the slots, the simplest form of bends in the closed end portions of the formed coils is sufficient to properly dispose the terminal portions. The simple quarter turns in the terminal portions produce an arrangement in which there is no interference with the front closed end turn of any adjacent winding and in which the terminal portions occupy scarcely any more room than where the strands are untwisted.

With the copper conductors lying flatwise in the slots and disposed one upon another, there is much less liability of the conductors cutting through the insulation, with its consequent harmful results, than where the conductors are wound edgewise in the slots. Again, by adopting the flatwise type of winding for a coil made up of two or more turns, the closed end turns can be of simple form and occupy less space, there being no necessity for a cross-over in the end portions, this being particularly noticeable where more than two turns per coil are used, to bring the individual strands out to the commutator at the proper points, the relative manipulation of the strands for this purpose being taken care of by the simple 90 degree twists at the ends of the coils.

It is obvious that, although the invention is shown as applied to a winding of the wave type, it can as well be applied to a winding of the lap type.

It should be understood that it is not desired to be limited to the exact details of construction shown and described, for obvious modifications will occur to a person skilled in the art.

It is claimed and desired to secure by Letters Patent:

1. A coil for dynamo-electric machines, comprising a plurality of multi-strand turns located one upon another, the strands of said turns being disposed one upon another and occupying the same relative positions throughout the electromotive force producing portion of the coil, said strands being twisted the same direction at their terminal portions through an angle of 90 degrees.

2. A coil for dynamo-electric machines, comprising a plurality of multi-strand turns located one upon another, the strands of each turn being located one upon another and occupying the same relative positions throughout the electromotive force producing portion of said coil.

3. A coil for dynamo-electric machines, comprising a plurality of multi-strand turns located one upon another, the strands of said turns being located one upon another and occupying the same relative positions throughout the electromotive force producing portion of said coil, like terminal portions of said strands being twisted as a unit through an angle of 90 degrees and both sets of terminal portions being twisted in the same direction.

4. A coil for dynamo-electric machines, comprising a plurality of multi-strand turns located one upon another, the strands of said turns being disposed one upon another and occupying the same relative positions throughout the body portion of the coil and the strands at each end of the coil being collectively twisted through an angle of 90 degrees and all in the same direction, and said

terminal portions extending one from the upper side of the coil and the other from the lower side thereof.

5. In a dynamo-electric machine, a core provided with peripheral slots, a plurality of separate strands wound together to form a single coil made up of a plurality of turns, said strands being disposed one upon another throughout the coil and being laid flatwise in the slots of said machine and occupying the same relative positions throughout the inductor portions and the closed end turns of the coil, the terminal portions of said coil extending one from the outer portion of one slot and the other from the inner portion of another slot.

6. In a dynamo-electric-machine, a core provided with peripheral slots, a coil comprising a plurality of turns of multi-strand conductor, the strands being disposed one upon another and occupying the same relative positions throughout the inductor portions of the coil, and the turns being disposed one upon another in the slots of said machine, one terminal portion of said coil emerging from the outer or high side of one slot and the other terminal portion from the inner or low side of another slot, and said terminal portions being twisted through an angle of 90 degrees in the same direction to dispose the ends of the strands side by side with the ends of the several strands separated to the same extent.

7. A coil for dynamo-electric machines, comprising a plurality of conductors of rectangular cross-section of unequal dimensions, said conductors being disposed one upon another with the sides of greater dimension adjacent each other, said conductors occupying the same relative positions throughout the body portion of the coil and being wound in a plurality of turns one upon another, and the terminal portions of said coil being twisted through an angle of 90 degrees in the same direction.

8. A coil for dynamo electric machines, comprising a plurality of multi-strand turns, the strands of each turn being located one upon another and occupying the same positions relative to each other throughout the electromotive force producing portion of the coil, and the end portions of the coil being distorted to dispose the strands thereof side by side with the ends of the several strands spaced apart to the same extent.

9. In a dynamo electric machine having a slotted core, a coil comprising a plurality of multi-strand turns located one upon another, the strands being located one upon another and occupying the same positions relative to each other in slots of said core, and the end portions of said strands being disposed in substantially radial planes with the ends of each strand respectively spaced apart circumferentially to an extent equal to that of the other strands.

10. A coil for dynamo electric machines, comprising a multi-strand conductor having its several strands located one upon another and occupying the same relative positions throughout the slot-occupying portions and the closed end turns of the coil, the end portions of the coil being distorted to dispose the strands thereof at approximately right angles to the body portions with the ends of the several strands spaced apart to the same extent.

In testimony whereof, the signature of the inventor is affixed hereto in the presence of two witnesses.

JOHN C. DAVENPORT.

Witnesses:
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