March 6, 1934. F. PUNGA ET AL 1,950,268

FORMED HALF COIL FOR THE EXCITATION OF ROTATING FIELD MAGNETS

Filed Nov. 20, 1930

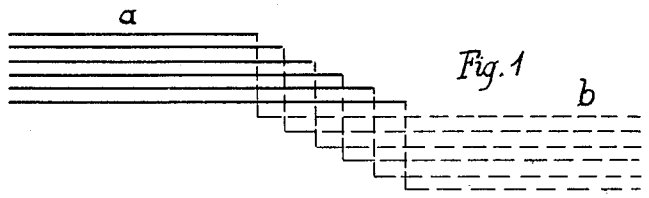


Fig. 1

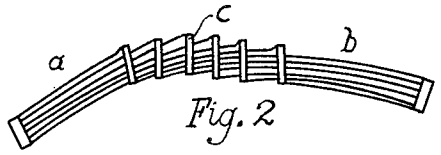


Fig. 2

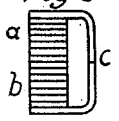


Fig. 3

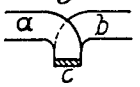


Fig. 4

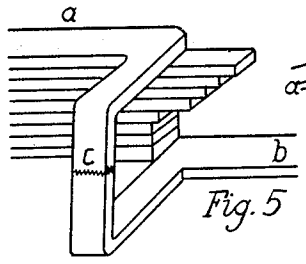


Fig. 5

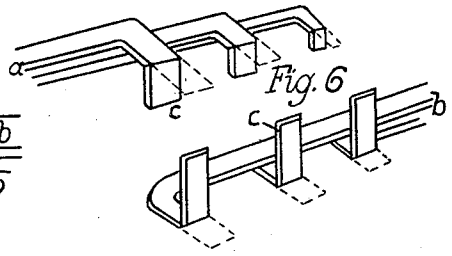


Fig. 6

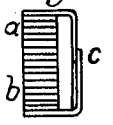


Fig. 7

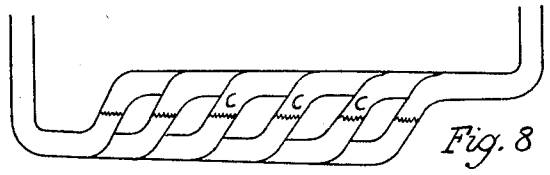


Fig. 8

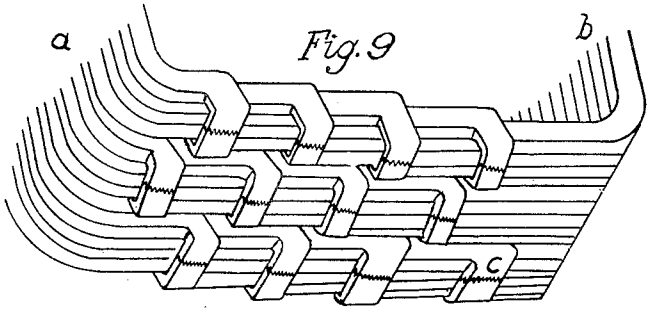
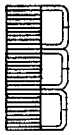


Fig. 9


Fig. 10

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FORMED HALF COIL FOR THE EXCITATION OF ROTATING FIELD MAGNETS

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Application November 20, 1930, Serial No. 496,954
In Germany November 22, 1929

5 Claims. (Cl. 171—252)

In the known construction of dynamo electric machines having high speed field magnets with subdivided windings and teeth on the magnet body which hold the windings, the windings must be inserted turn by turn into the radial slots; the deeper the slots the more difficult the insertion of the individual turns.

Ingenious and expensive constructions have been used in which the projections or teeth which hinder the insertion of the windings are set into dovetail slots in the magnet body only when or after the coils are inserted. With this construction, form wound, insulated, pressed coils can be used. The great advantages of such coils lie not only in the possibility of separately making them and reliably insulating them, but in the far more satisfactory cooling conditions which are given by the pressing on of the outer insulation and avoidance of air cells, by the possibility of reducing the thickness of the outer insulation and combining it with the intermediate insulation or with suitable arrangement of air conduits in the slots and entirely omitting the outer insulation. These conditions enable the current density of the copper and correspondingly the output of the machine to be considerably increased so that expense involved in making the insertable inductor teeth and the necessity for having a large number of various complicated and expensive coil presses available is justified.

The present invention has for its object to make such pressed and easily cooled coils usable with the much simpler and cheaper inductor construction with integral teeth on the magnet body, that is with slots machined out. This is possible with so-called form wound half coils.

A further object of the invention is to provide an arrangement for the connection of the halves of the split coils so that they may be completely accessible and freely accommodate them in the shortest coil ends measured circumferentially, and at the same time resulting in a superior cooling of the conductors.

With these and other objects in view, the invention can be more easily understood by reference to the accompanying drawing:

Fig. 1 is a diagrammatic illustration showing the manner of connection of the conductors at the ends of the coil;

Fig. 2 is a side elevational view of a plurality of conductors at the end of the coil and the manner in which they are connected;

Fig. 3 is a right sectional view of Fig. 2;

Fig. 4 is a plan view of Fig. 2;

Fig. 5 is a perspective view showing in detail the manner of connecting the conductors;

Fig. 6 is a perspective view showing the top and bottom halves of the conductor coils, spaced apart prior to their connection;

Fig. 7 is a sectional view of a modified form of connection;

Fig. 8 is a plan view showing the manner of connecting the ends of conductors when lying in two parallel groups;

Fig. 9 is a perspective view of three superposed independently twisted groups of coils;

Fig. 10 is a side elevational view of the coil shown in Fig. 9.

In the figures, *a* refers to the conductors of the left hand side of the coil, *b* the conductors of the right hand side of the coil, and *c* the transposition or connecting pieces.

With what may be termed twisted bars, the individual conductors *a* and *b* are brought out of the superposed conductors and carried upward or downward past the other conductors, so here to achieve the desired object, the individual conductors of the field magnet coils are piled one on top of another, stepped and bound. The division of the two halves is effected at any desired suitable position, preferably in free lying polar arcs; the transposition or connection pieces can be arranged in recessed slots as in the Punga-Roos twisted bar Patent No. 1,478,252 but preferably at a certain spacing from the superposed conductors. Thereby not only is space obtained for soldering or welding and the coil insulation protected from damage but very effective cooling surfaces are formed, since each individual conductor is directly swept by the cooling air on all sides over a portion spaced from the pile of conductors.

The connecting pieces *c*, as shown in Fig. 6, are first turned edgewise through 90°, then bent flatwise from the dotted line to the full line positions shown in the drawing and then soldered or welded together, either butted as in Fig. 3 or overlapping as in Fig. 7. In the latter case, to protect them against mechanical stresses, the overlapping can be so arranged that the end of one piece rests against the base of the other.

If a large number of conductors lie on one another then there is no space available in the circumferentially shortest coil end of the coil nearest the pole, to accommodate the transposition or connecting pieces side by side. This difficulty is avoided, as shown in Fig. 9, by dividing the superposed conductors *a* and *b* into two or

more groups which are separately twisted, that, is, divided, layered and connected as shown. With, for instance 24 superposed conductors, by dividing them into two groups there are only 12 neighboring transposition or connection pieces in each group, and with three groups only 8, so that the lack of peripheral space is entirely overcome. Corresponding with the subdivision into two or three groups, there are two or three superposed rows of transposition or connection pieces c. Since with coils having long ends subdivision into groups may not be necessary, subdivided and unsubdivided coils may be used on one and the same inductor. For clearness, the corresponding connecting pieces of the three groups are shown relatively staggered, but it may be desirable to superpose them for support against centrifugal force.

In Fig. 8 another mode of construction in which the freeing, dividing and joining of the connecting pieces c are effected in the intermediate space between two parallel groups of conductors, and the connecting pieces all lying accessible at the top of the coil.

Whereas complete coils are limited by the capabilities of the winding machine, it is possible with form wound half coils to shape the individual conductors of the half coils as desired before insulation, as may be required by the position, support and cooling in the slot or under the end cap, by the dimensions of the end cap itself, or by the arrangement and formation, for example of the damping winding. The coil winding machine can be replaced by simple bending devices, the size of the coil presses is reduced by a half and if only the longitudinal sides are pressed, only a single, simple longitudinal press per inductor is necessary.

What we claim is:

1. A high speed rotor coil split along the axis of the rotor in which each half of the said coil comprises a plurality of superposed conductors, the ends of the said halves being connected to each other at the end of the rotor and at the outside of and spaced from the said superposed layer of conductors.

2. A high speed rotor coil split along the axis of the rotor in which each half of the said coil comprises a plurality of superposed conductors, the ends of the said halves being connected to each other at the end of the rotor the ends of the conductors being so stepped and inclined that each conductor half from its top position may be connected to the opposite half positioned at the bottom and the connections being located at the outside of the superposed conductors.

3. A high speed rotor coil as defined by claim 1 in which the halves of the coils are stepped and offset in such a manner that the conductor when it is in the uppermost position of one of the halves is connected to the corresponding uppermost conductor of the other half.

4. A high speed rotor coil as defined by claim 1 in which the coil is subdivided into a plurality of separately interconnected groups.

5. A high speed rotor coil as defined by claim 1 in which the cojoining ends of the individual conductors are bent outwardly away from the coil and toward each other, to present ends ready for connection.

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