Aug. 21, 1951 R. P. HANNA 2,565,128

TWO-PART PREFORMED COILS

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Fig.1.

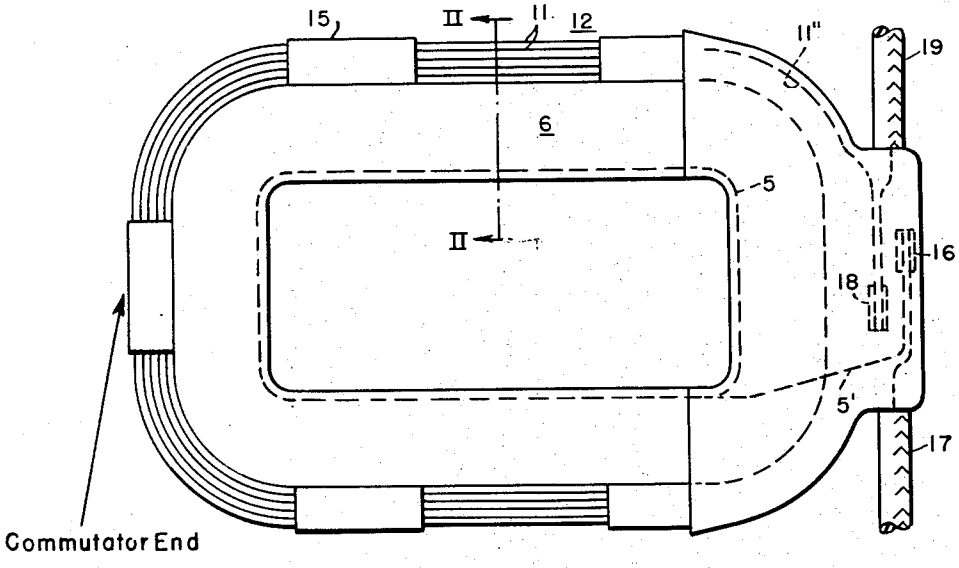


Fig.2.

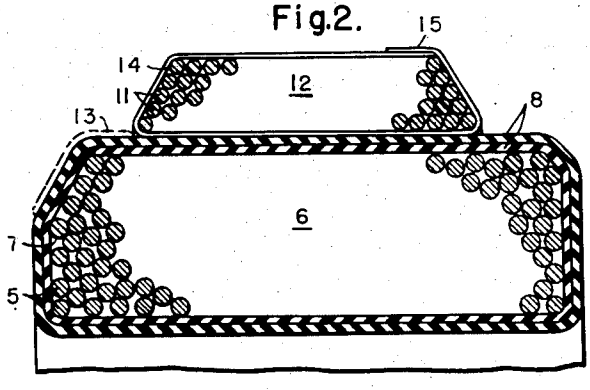
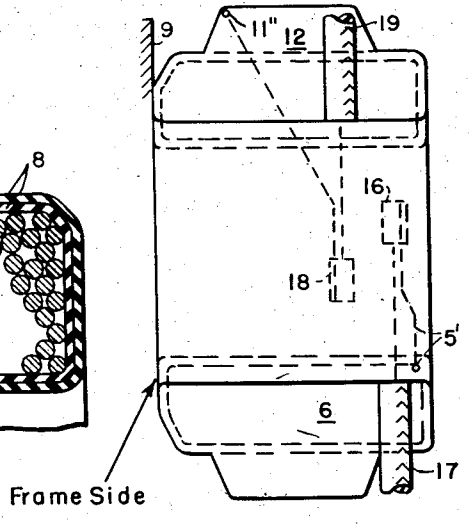


Fig.3.



WITNESSES:

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TWO-PART PREFORMED COILS

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1 Claim. (Cl. 175—21)

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My invention relates to electrical coils which are preformed so as to be mountable upon the shank of a pole-piece or magnetizable core-member, or upon a suitable mandrel or support of some other kind. Although not necessarily limited thereto, my invention relates more particularly to shunt-type field-coils for dynamo-electric machines of intermediate voltage-ratings.

An object of my invention is to provide two-part preformed coils, consisting of an inner coil which is completely covered with one or more layers of ground-insulation, around which is wound a smaller outer coil having no ground-insulation, said outer coil being stepped or spaced back from the side or sides where grounded supports are likely to be present, so that this stepped-back space will provide a surface creepage-distance, over the surface of the ground-insulation, for insulating the outer coil from ground. The two coil-portions may be electrically insulated from each other, but if they are parts of a single composite coil, the conductors of the inner and outer coil-portions will be electrically and thermally continuous. Since the outer coil is wound over the ground-insulation of the inner coil, it compresses that ground-insulation, so as to facilitate heat-flow therethrough, while at the same time providing a relatively cool metal member in close contact with the outer surface of the ground-insulation, which also has advantages in facilitating heat-transfer through the thickness of the ground-insuation. The outer coil is thus air-cooled, so that it serves as a cooling-means for the inner coil, with heat flowing through the thickness of the ground-insulation between the two coils. When the conductors of the inner and outer coils are electrically and thermally continuous, a very considerable part of the heat will also flow lengthwise through said electrically and thermally continuous conductors of the two coils.

Heretofore, field-coils for dynamo-electric machines have had to be either completely surrounded with ground-insulation, or they have had to be specially constructed, involving many costly manufacturing-steps, including the cutting of a "window" through the ground-insulation, so as to expose a portion of the coil underneath the ground-insulation, to facilitate the cooling of the coil. My present invention is an improvement over both of these previous coil-designs, running considerably cooler than either one of the previous designs, while having

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a reasonable manufacturing cost, a durable finish (as compared with the cut insulation of the "window" coils), and having a pleasing external appearance.

With the foregoing and other objects in view, my invention consists in the combinations, systems, structures, parts, and methods of design and assembly, hereinafter described and claimed, and illustrated in the accompanying drawing, wherein

Figure 1 is a plan view of a finished coil embodying my invention,

Fig. 2 is an enlarged cross sectional view thereof, on a plane indicated by the line II—II in Fig. 1, and

Fig. 3 is an end view thereof.

It will be noted, more particularly from Fig. 2, that the illustrated form of embodiment of my invention is really a composite coil, having two parts, although the two parts may be electrically independent. One part of said composite coil comprises a plurality of turns of a conductor 5, which is wound into an inner coil 6 having a desired number of turns, and having suitable turn-to-turn insulation which is generally in the form of a thin insulating covering 7 surrounding the conductor 5, and represented, in Fig. 2, simply by the thickness of a line. I have illustrated my invention as using a small round wire for the conductor 5, but this is only by way of illustration, as the conductor could be a strap of either square or rectangular cross section, as is well known and commonly practiced in the coil-winding art. The inner coil 6 is completely wrapped or enclosed in one or more layers of ground-insulation 8, having the necessary thickness to provide an insulating-barrier between the conductor 5 of the inner coil 6 and any grounded surface, such as 9 (Fig. 3), against which one side of the coil may abut.

The other part of the composite coil comprises one or more turns of a conductor 11, wound as an outer coil 12 around the periphery of the ground-insulation 8. This outer coil 12 is usually, although theoretically not absolutely necessarily, wound with a smaller number of turns than the inner coil 6. The outer coil 12, in the preferred form of my invention, is stepped back on both sides, so that it is not as wide as the inner coil 6, these stepped-back spaces providing surfaces creepage-distances, such as that which is indicated in dotted lines at 13 in Fig. 2, for providing surface-creepage ground-insulation between the conductor 11 of the outer coil 12 and the surface-part of the ground-in-

sulation 8 which may be in contact with a grounded member such as the member 9 in Fig. 3. If the outer coil 12 consists of more than one layer, as is the case in the illustrated form of embodiment of my invention, then its conductor 12 will have an insulating covering 14, similar to the covering 7 which has been described in connection with the inner coil 6, for providing the necessary turn-to-turn insulation.

Before the outer coil 12 is wound over the ground-insulation 8 which encompasses the inner coil 6, one or more adherent tapes 15 are preferably laid down, so that, when the winding of the outer coil 12 is finished, these tapes 15 may be drawn around the coil to hold its wires together, as shown in Figs. 1 and 2. If the outer coil 12 is composed of a number of turns, it is sometimes advantageous if the surface of its conductor-insulation 14 is somewhat gummy or sticky, so as to facilitate holding the wires together during the winding-process, before the tapes 15 are drawn around the finished coil to hold it in shape.

The conductors 5 and 11 of the two coils 6 and 12 may be one continuous conductor or, if more convenient, the inner coil may be first formed, with only a sufficient length of conductor to leave short conductor-ends or terminals sticking out of the wrapped insulation 8, and then the starting-end of the conductor 11 for the second coil may be soldered to the "finish" lead of the first coil, so that the two conductors will be electrically and thermally continuous. In some cases, however, the two coils 6 and 12 may be electrically separate from each other.

As shown more particularly in Fig. 3, after the composite coil, as just described, has been completed, the "under" lead or starting-lead 5' of the inner coil 6 may be connected, by a suitable connector 16, to a terminal cable 17, while the "finish" lead 11'' of the outer coil 12 may be connected, by a terminal-connector 18, to a second cable 19.

It will also be understood that the finished composite coil may be subjected to any desired impregnating or varnishing treatment, or the like, as is well known in the art.

In appearance, my finished composite coil is characterized by an inner part, which is completely enclosed in the ground-insulation taping 8, with a second part 12 projecting out from a part of the surface of the ground-insulation taping 8, this second part being made up of only lightly insulated conductors 11. These conductors 11 are thus exposed to the air, so that they are well cooled. This well-cooled outer coil 12 presses down tightly against a portion of the surface of the ground-insulation taping 8, so that there is a fairly good heat-transfer, through the thickness of the ground-insulation 8, from the inner coil 6 to the cooled outer coil 12. I have reason to believe, also, that a very considerable part of the total heat-transfer is conducted lengthwise through the electrically continuous conductors 5 and 11, so that the heat flows from the relatively hot inner conductors 5, lengthwise through the conductor-length which separates the two coils, and thence into the outer conductors 11. In general, my improved coil has at least 20% more heat-transferring ability, for getting heat out of the inner coil 6, than is obtainable with either one of the previous types of coils which have been used for the same purpose.

While I have described and illustrated my invention in accordance with a single specific illustrated form of design, with some suggestions as to possible alternatives and modifications, I wish it to be understood that I am not limited to these precise details. I desire, therefore, that the appended claim shall be accorded the broadest construction consistent with its language.

I claim as my invention:

A two-part composite preformed coil adapted to be mounted with at least one side in contact with a grounded member; one part of said composite coil comprising a plurality of turns of a conductor, wound into an inner coil, and having turn-to-turn insulation between adjacent turns, and at least one layer of ground-insulation completely surrounding said inner coil; and the other part of said composite coil comprising at least one turn of a conductor, wound as an outer coil around the periphery of said ground-insulation and stepped back from said side of said ground-insulation whereby to provide a surface creepage-distance, at that side of the ground-insulation, between the grounded member and the outer coil; the conductors of said inner and outer coils being electrically and thermally continuous, whereby the two coils compose a single composite coil, and whereby the outer coil serves as a cooling-means for the inner coil.

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