Jan. 27, 1948. M. F. MITSCHRICH 2,435,093

ELECTRICAL INSULATION

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FIG. 1.

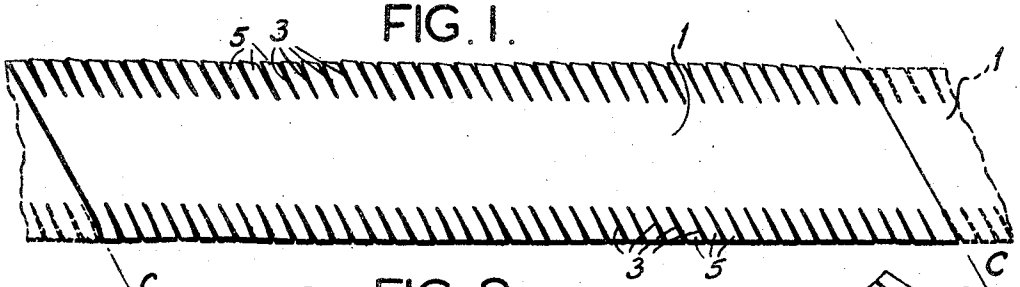


FIG. 2.

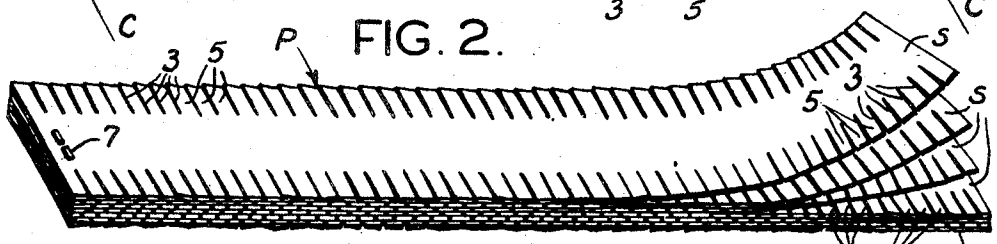


FIG. 3.

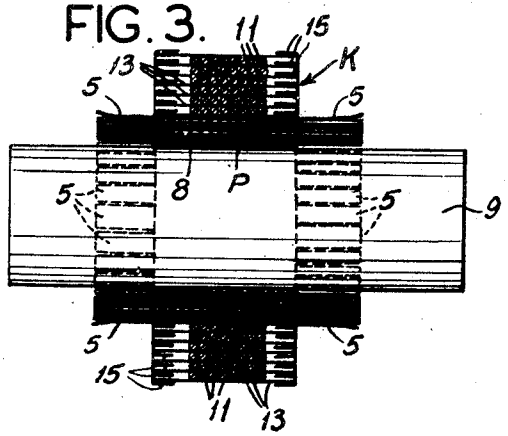


FIG. 4.

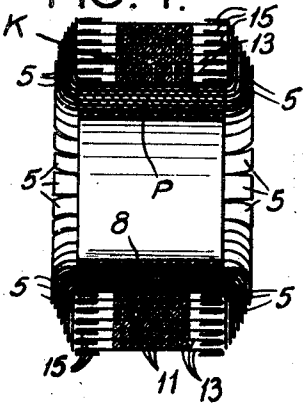


FIG. 6.

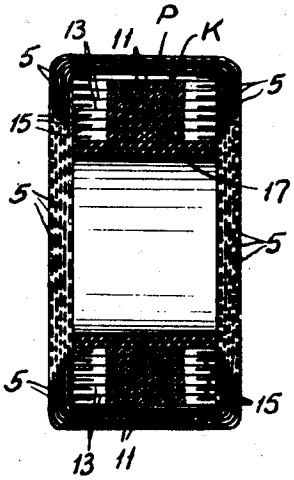
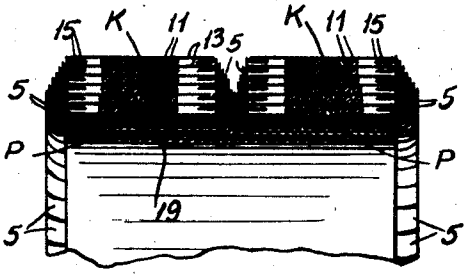


FIG. 5.



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FIG. 7.

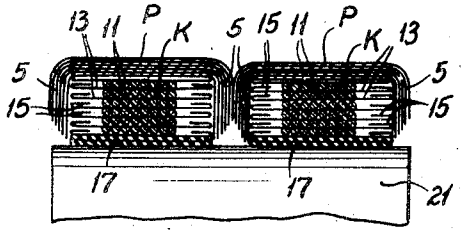


FIG. 8.

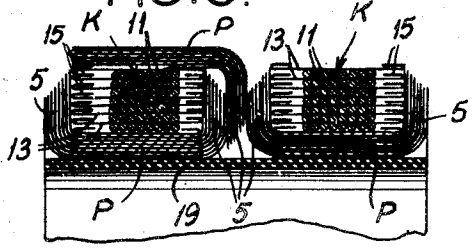


FIG. 9.

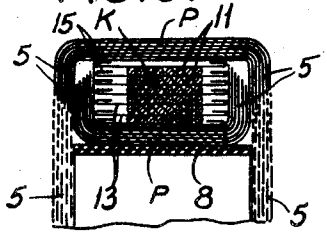


FIG. 10.

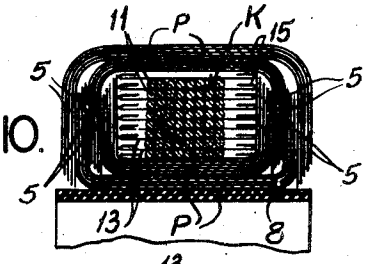


FIG. 12.

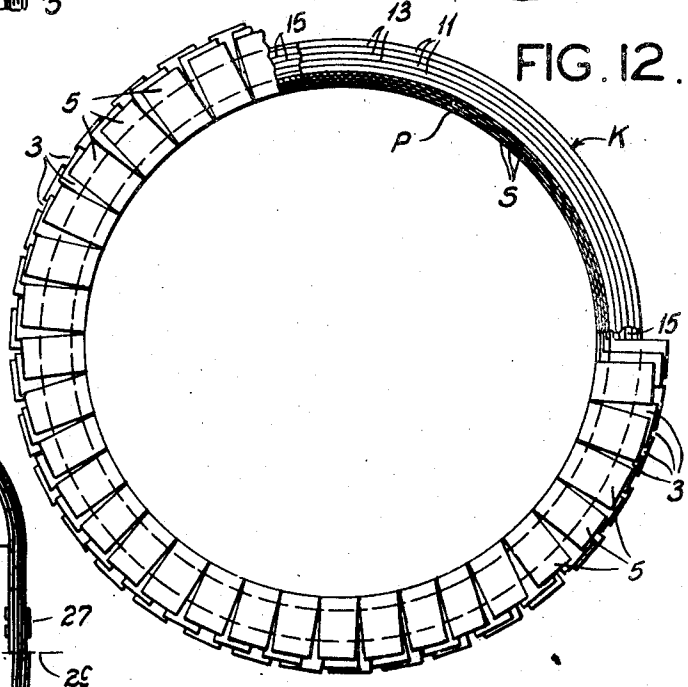
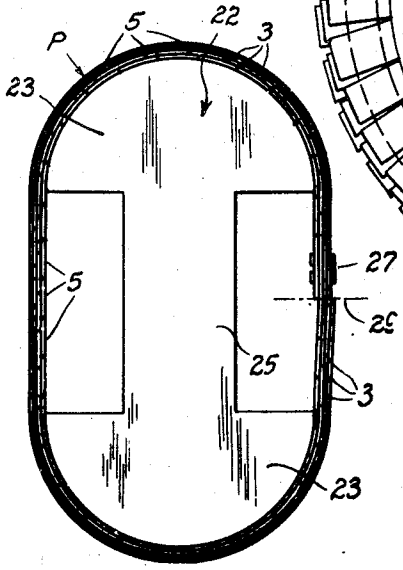


FIG. 11.



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UNITED STATES PATENT OFFICE

2,435,093

ELECTRICAL INSULATION

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Application December 7, 1946, Serial No. 714,851

12 Claims. (Cl. 174—138)

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This invention relates to electrical insulation, and with regard to certain more specific features, to multi-sheet insulation for annular coils and the like.

Among the several objects of the invention may be noted the provision of more convenient means for applying tabbed multi-sheet insulations to annular coils which will eliminate the tedious slitting processes heretofore used for forming the tabs; the provision of means of the class described which will provide for better insulation around coils to which the invention is applied; and the provision of means of the class described which will increase production and quality while decreasing cost. Other objects will be in part apparent and in part pointed out hereinafter.

The invention accordingly comprises the elements and combinations of elements, steps and sequence of steps, features of construction and manipulation, and arrangements of parts which will be exemplified in the structures and methods hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which several of various possible embodiments of the invention are illustrated,

Fig. 1 is an isometric view of a slitted paper strip illustrating an initial step;

Fig. 2 is an isometric view showing an assembly or pad of slitted strips, separated at one end to illustrate certain features;

Fig. 3 is a diagrammatic vertical section showing certain steps in the formation of a coil to be insulated;

Fig. 4 is a view similar to Fig. 3 but showing a succeeding step and one form of finished product;

Fig. 5 is a diagrammatic section showing an exemplary assembly of several insulated coils made according to Fig. 4;

Fig. 6 is a view similar to Fig. 4 but showing another form of finished product;

Fig. 7 is a diagrammatic section showing the assembly of several coils made according to Fig. 6;

Fig. 8 is a view similar to Fig. 6, showing a modification;

Fig. 9 is a view similar to Fig. 4 showing another modification;

Fig. 10 is a view similar to Fig. 9 showing still another modification;

Fig. 11 is a plan view of a winding fixture illustrating a convenient means for making the assembly of Fig. 2; and,

Fig. 12 is an end view of a circular flat-wire coil showing the application of the invention thereto.

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Similar reference characters indicate corresponding parts throughout the several views of the drawings. Thicknesses of sheets and their spacings are diagrammatically exaggerated for clarity, and it will be understood that actually they are thin.

It has been customary to construct electric coils and similar item with wound insulating sleeves, either inside or outside, or both, composed of wound layers of paper or the like in which projecting edges of the paper windings were slitted by staggered tabs adapted to be bent over the coil ends. Tedious time-consuming processes have been used for forming the tabs, such as cutting them into the paper after winding and the like. The present invention avoids these costly and time-consuming procedures and provides a better product.

Referring now more particularly to Fig. 1, there is shown at numeral 1 what originally is a strip of paper or other suitable flexible sheet-insulating material of indefinite length which may be drawn, for example, from a supply roll. This strip of material is slitted, preferably according to even spacing as shown at 3, to provide equal-sized tongue tabs 5. The slitting may be done prior to the time that the paper is placed on the roll or as it comes from the roll. The slitting process per se is not described herein, since there are various known fast methods for accomplishing this, such as by rotary knives, shears, die-cutting and the like.

The slitted sheet is cut at intervals as indicated at C, to provide individual segmented, slitted strips. These will hereinafter be referred to by the character S. Each strip S constitutes a layer, the edges of which are evenly slitted to provide oppositely extending tabs of equal widths.

Next, a number of the strips S are stacked into a pad P, as shown in Fig. 2, with the slits 3 staggered so that each tab 5 overlaps an adjacent slit in an adjacent strip. This may be accomplished by adjusting alternate layered strips S longitudinally one-half the pitch distance between slits, or, the cuts C illustrated in Fig. 1 may on one set of strips be at slit 3 and another set may be through tabs 5. The number of layers used depends upon the insulation desired on the finished coil, but an exemplary figure would be nine.

After the requisite number of layered strips S have been stacked into a pad, as illustrated in Fig.

2, they are joined or anchored together in any suitable manner, such as by means of a staple 7, preferably at one end. It will be understood that other means will be used such as stitching, adhesive or the like. It is preferable that there be a single anchor point, as illustrated, in order to prevent buckling which might occur later. Thus the pad P is completed.

An exemplary way of applying the insulation pad P to a coil is shown in Figs. 3 and 4. The pad assembly of anchored layers may be wrapped around a fibre board sleeve 8 located on a mandrel 9. Dimensions are predetermined preferably such that the ends of the assembly abut on the mandrel or they may have some overlap. The stated overlap is feasible without producing too much of a step at the overlap because actually the pad P is thin, being only several times as thick as the sheets S of which it is constituted. In addition, when the assembly of Fig. 2 is wrapped around a mandrel such as 9 there is a scarfing action at the free ends of the layers S due to the increased peripheral distances in which the successive layers lie. This is one reason for the single anchor point, whereby this, the requisite sliding between sheets, may occur without buckling. A preference for the anchor point being at one end of the pad is to gain coverage for the anchor by means of the overlap.

Next, with the insulation assembly on the mandrel, the coil is wound. The coil in Fig. 3 is of a type having layers of wire 11 interwound with successive layers of paper 13, the latter having folded selvages 15. After the coil (indexed K as a whole) has been wound, it is as usual bound fast, as by winding it with tape (not shown). The next step is to remove the assembly, including the sleeve 8 from the mandrel 9, after which the protruding, staggered and overlapped tabs 5 may be forced into the radial positions shown in Fig. 4 over the ends of the coil. The coil may then be dipped into a suitable insulating compound such as wax, shellac or the like, which will hold the tabs in the position shown, or if desired, additional wrapping tape may be looped through sleeve 8 and around the tabs 5 and outside of coil K if so desired. Since the insulating compound and wrappings are old, these are not shown nor further described.

In Fig. 6 is shown the manner in which the assembly of Fig. 2 may be applied to the exterior of a coil. In this case the coil may be wound directly upon a coil support 17. After the coil K has been wound it is preferably taped and the assembly of sheets such as shown in Fig. 2 is wound around the outside of it with abutted or lapped ends, and then the tabs 5 are turned inward to protect the coil ends. It will be understood that the length of the pad of Fig. 2 is cut to extend throughout the periphery of the coil preferably with some overlap, and the length will be according to the periphery of the coil. Finally the insulated coil is taped and dipped as usual.

In Fig. 5 is shown how several of the coils shown in Fig. 4 may be mounted upon a suitable support 19 for application in electrical apparatus such as transformers or the like. In Fig. 7 is shown how several of the assemblies of Fig. 6 may be mounted upon a support 21 for final application. In both of these cases it will be noted that the bent tabs 5, where they are adjacent to one another on the adjacent coils, provide a thorough insulation in view of the fact that the adjacent tabs in adjacent layers S are

staggered. Thus breakdown through the slits 3 is discouraged.

If more insulation between coils is required, it may be accomplished as shown in Fig. 8 by arranging an additional pad assembly P, as shown in Fig. 8, wherein one slitted edge of it is sandwiched between coils with the remainder extending over the left-hand coil. This is in addition to the insulation within the coils provided along the lines already described.

To provide complete annular insulation around the coil, the arrangement of Fig. 9 is used wherein the inside of the coil is provided with an inside insulating pad P of the type illustrated in Fig. 4, and an outside pad of the type illustrated in Fig. 6. The result is a coil with two pads, one inside and one outside, with the sets of tabs bent against the ends of the coils, as indicated. It will be understood that the tabs on the outer coil may be turned in first and overlapped by the tabs on the inner coil, which would be a mere reversal of what is shown in Fig. 9.

In Fig. 10 is shown more insulation with two pads used interiorly of the coil and two pads used exteriorly in which the successive sets of tabs on the inner and outer pads are alternately bent around the coil ends.

In Fig. 12 is shown how the end of a coil appears so far as is concerned the staggered relationship between the tabs 5, whereby no direct passage is permitted through any group of slits 3. Fig. 12 also shows the application of the invention to a circular, flat-wire coil. It will be understood in this respect that the shape of a coil need not be circular for carrying out the invention, but that other annular shapes than circular may be used, such as for example, rectangular shapes such as Figs. 3–10 represents. This involves only a change in shape of the mandrel for forming purposes (see for example mandrel 9 in Fig. 3).

In Fig. 11 is shown a convenient way of making one of the pads P. This figure shows a fixture 22, comprising end portions 23 spaced by means of a member 25. Instead of cutting the pre-slitted strip of Fig. 1 up into sections, it is continuously wound around the member 23. In this case precautions must be taken that the peripheral distance around the fixture 21 is not an even multiple of the spacing between slits 3, so that successive turns of the strip will result in a staggered relationship of the tabs 5. It is of course true that any staggering effect will tend to be lost as the pad becomes thicker, but in practice, since the successive layers of paper are quite thin, and since only a few of them are required for a pad, the general result will be a continuously staggered condition. If it is desired to build up a number of layers with which stagger would be lost with even spacing of the slits 3, the slitting spacing can be gradually increased along the length of the strip 1 to maintain the desired stagger upon wrapping. Finally, when a sufficient amount of the strip has been wound upon the fixture 22 to produce the thickness of pad desired, it is anchored, such as by means of the staple 27 shown, and then cut as indicated at 29. The result is again a multi-layer pad such as shown in Fig. 2, which may be used in the manner above described.

If desired, instead of winding a continuous strip first on a mandrel such as shown in Fig. 11, and then stapling and cutting it to form a pad later to be applied to a coil, such a continuous

strip may be wound directly on the outside of a coil, provided the slits are prearranged, in view of the coil periphery, to become staggered so as to overlap the tabs. In such a case, neither anchoring means such as the staple 7 or 27, nor cutting is required to make any pad. Or, the continuous slitted strip may be wound upon a mandrel such as 9 and the coil thereafter wound upon the wound strip.

It is also feasible in some cases to treat the strips S (Fig. 1) individually. That is, after a coil has been wound, successive strips S may be abstracted from a supply of them and applied to the coil, one after another manually, each being held in position on the coil but each one as it is placed being arranged with its tabs 5 staggered with respect to the tabs of the strip already applied. Each will then be held in position by adhesive, tape or the like.

The pad assembly construction of Fig. 2 is however preferable, since it allows for prefabricating the multi-layer pads which may be stored for future use and this store drawn upon for future operations.

In view of the above, it will be seen that one feature of the invention is the assembly with a coil of a preslitted multi-layer strip material so arranged that the slits in adjacent layers are staggered. Another feature is the provision of a preformed multi-layer insulating pad in which the slits in adjacent layers are staggered. Another feature is the anchoring of the layers of the pad near one end whereby it will readily conform to various coil contours without buckling between the layers of the pad. Another is the anchoring closely enough to the end of the pad so that the free ends of the strips forming the free end of the pad may be made to overlap the anchor and thus provide insulation over the anchor in which case the anchor can be made of conducting material such as a metal staple.

It will be understood from the examples above given that if desired, several coaxial coils could be enveloped by means of one multi-layer insulating means such as described, and turning the endwise tabs against the ends of the endmost coils.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As many changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. A coil-insulating wrapper comprising a multi-ply band of insulating strips, said strips being anchored together at a local point and being marginally slitted, the slits in each layer being staggered with respect to the slits in an adjacent layer.

2. A coil-insulating wrapper comprising a multi-ply band of insulating strips, said strips being anchored together at a local point near one end and being marginally slitted, the slits in each layer being staggered with respect to the slits in an adjacent layer.

3. A coil-insulating wrapper comprising a multi-ply band of insulating strips having two ends adapted to be joined when applied to a coil, said strips being anchored together at one end of the band in a position where the ends of the band overlap when applied to a coil, each strip having marginal tabs staggered with respect to the marginal slits in the adjacent strip.

4. A coil-insulating wrapper comprising a multi-ply band of insulating strips having two ends adapted to be joined when applied to a coil, said strips being stapled together at one end of the band in a position where the ends of the band overlap when applied to a coil, each strip having marginal tabs staggered with respect to the marginal slits in the adjacent strip.

5. A method of producing a multi-ply slitted coil-insulation wrapper comprising slitting a continuous insulating strip to produce equally spaced marginal slits, wrapping the strip into a multi-layer loop on a form having a periphery of a length adapted substantially to stagger the slits in adjacent loops of the strip, anchoring all loops of the strip at a local point and severing near the anchor point the continuous multi-ply loop thus formed to form a multi-ply wrapper with staggered marginal tabs in adjacent layers.

6. The method of producing a multi-ply insulating pad comprising wrapping a continuous strip into a collar the edges of which strip have been preslitted to form tabs, said wrapping being on a periphery adapted to cause slits in adjacent wrapped layers to be staggered, anchoring adjacent layers of the collar at one point and opening the collar at a point adjacent to the anchor to provide a multi-ply pad having layers from the edges of which extend tabs which are staggered in adjacent layers.

7. The method of insulating a coil comprising forming a multi-ply pad of insulating strips anchored at one point and having edgewise tabs, the tabs in adjacent layers being staggered, and wrapping said pad as a collar in association with the coil so that at least some of said tabs extend from the end of the coil, and bending said extending tabs against the adjacent coil end.

8. The method of insulating a coil comprising forming a multi-ply pad of elongate form from strips the edges of which are slitted to form tabs, the slits in adjacent layers of the pad being staggered and the layers being anchored to maintain the stagger, winding said pad on a form to make a collar, winding on said collar a coil which is narrower than the collar, and bending the tabs against the coil ends.

9. The method of insulating a coil comprising forming a multi-ply pad of elongate form from strips the edges of which are slitted to form tabs, the slits in adjacent layers of the pad being staggered and the layers being anchored to maintain the stagger, winding on a support a coil which is narrower than the pad, winding the pad on the outside of said coil, and bending the tabs against the coil ends.

10. The method of insulating a coil comprising forming multi-ply pads of elongate form from strips the edges of which are slitted to form tabs, the slits in adjacent layers of each pad being staggered and the layers in a given pad being anchored to maintain the staggering, winding one of said pads on to a form to make a collar, winding on said collar a coil which is narrower than the collar, winding another pad on the outside of said coil, and bending the tabs of the respective pads against the coil ends.

11. The method of insulating a coil comprising forming a multi-ply pad of insulating strips having edgewise tabs staggered in adjacent layers of the pad, wrapping said pad as a collar in association with the coil so that at least some of said tabs extend from the end of the coil while holding

the strips in such manner as to maintain the stagger of the tabs, and bending said extending tabs against the adjacent coil end.

12. The method of insulating a coil comprising wrapping a continuous strip of insulating material whose marginal edges have been slit to form edgewise tabs into a collar wherein the slits in adjacent layers of the collar are staggered, organizing a coil with the collar in such manner that the tabs extend from the coil, and bending said tabs against the coil.

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