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METHODS AND APPARATUS FOR COLOR CODING ELECTRIC CONDUCTORS

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FIG. 1.

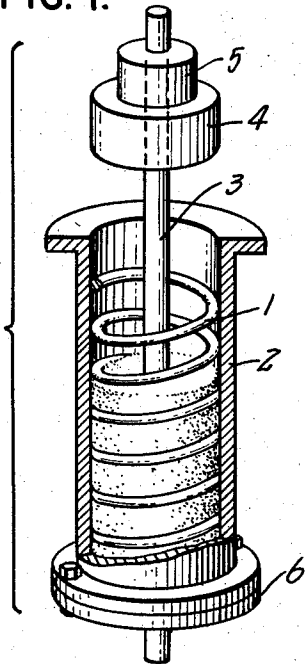


FIG. 2.

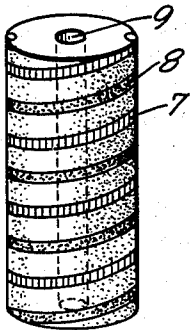


FIG. 3.

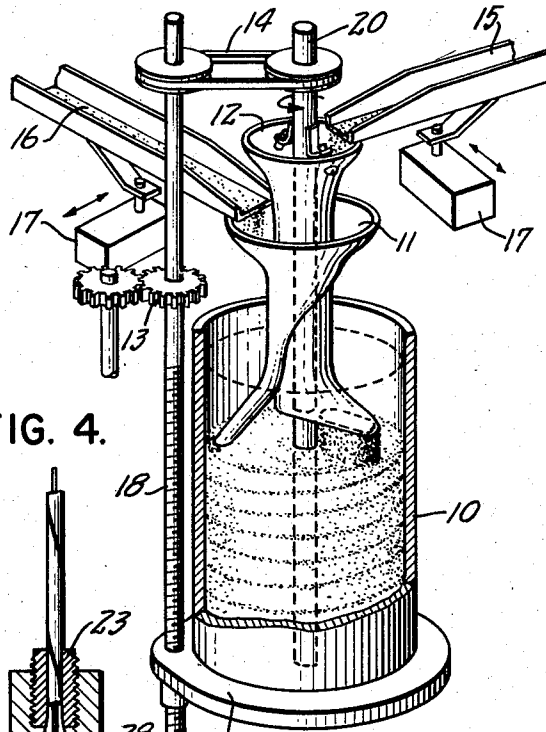
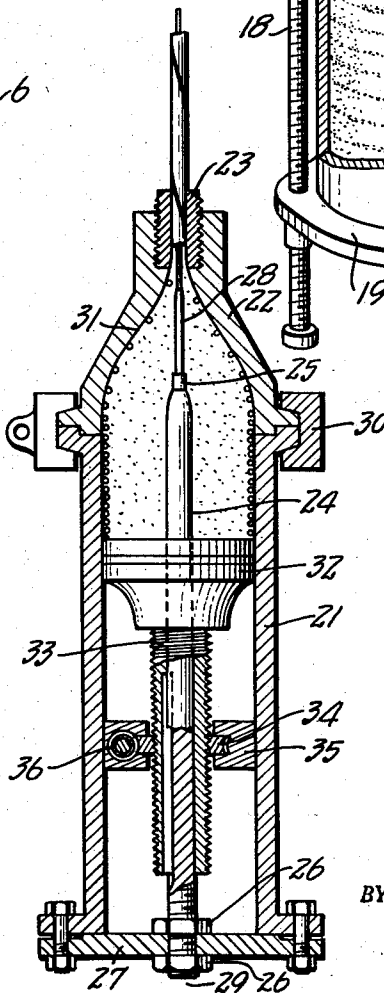


FIG. 4.



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METHODS AND APPARATUS FOR COLOR CODING ELECTRIC CONDUCTORS

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2 Claims. (Cl. 18—61)

This invention relates to methods and apparatus for color coding electric conductors and cables having an extruded coating of insulating material.

In the production of such a conductor for use in or with equipment at elevated temperatures it has been proposed to provide the conductor with an insulating coating of polytetrafluoroethylene known in the trade as "Teflon." Such insulated conductors exhibit a high degree of chemical and corrosion resistance, low dielectric loss over a wide frequency range and ability to withstand applied voltages at elevated operating temperatures. This insulating material, however, is so chemically inert, that after extrusion over a conductor, it resists the acceptance of any surface paint or colored coating which it may be desired to apply for the purpose of color coding or color identification.

It is an object of my invention, therefore, to provide a method and apparatus for color coding the extruded insulating coating of a conductor in cases where the material is of such a nature that its surface resists the application of color or dye when the latter is applied by painting, spraying or any other conventional technique.

According to my invention it is proposed to inlay or impregnate with coloring material the surface of a preform compressed from the material to be extruded before such preform is inserted in the extrusion apparatus.

Other features of the invention relate to methods of making the color coded preforms and to a design of extrusion head in which such preforms are adapted to be used.

These and other objects and features will be clear from the following description of typical embodiments of my invention taken in conjunction with the accompanying drawings in which—

Fig. 1 is a part sectional view of a device used for making the preforms;

Fig. 2 is a perspective view of a preform incorporating two color coding helices;

Fig. 3 is a schematic view of an alternative apparatus for making the preforms; and

Fig. 4 is a section of an extrusion head for use in practicing the invention.

In the extrusion of polytetrafluoroethylene or "Teflon" it has been proposed to add to the Teflon powder a predetermined percentage of a plasticizer, such as naphtha. The mixture, which is known as "lubricated" polytetrafluoroethylene, is then compressed into a cylindrical preform at a relatively low pressure which is just sufficient to produce a preform which can be easily handled. This preform is placed in the extruder barrel where it is compressed and extruded over a wire under a high pressure of the order of 24,000 lbs. per square inch.

According to the present invention it is proposed to incorporate the color coding material in the preform before it is placed in the extruder.

In Fig. 1, which illustrates one method of making the preform, a helix 1 wound from an uncured thread or

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string of colored Teflon is placed in a cylindrical barrel 2 within which is centrally mounted a rod 3. Two or more differently colored helices with their respective turns interleaved may, of course, be inserted in the barrel if it is desired to provide a plural-color coding on the insulated wire. Lubricated Teflon mix is then poured into the barrel 2 and the contents compressed by means of a ram 4 which is formed with a central bore 5 into which the rod 3 passes as the pressure is applied. Due to the compression of the mixture in the barrel 2, the pitch of the helix 1 will be correspondingly reduced. After the ram 5 has compressed the mixture to a sufficient extent the bottom plate 6 of the barrel 2 may be removed and the preform ejected.

Fig. 2 shows a preform made in the above-described manner and having two differently colored helical inlays 7 and 8 in its cylindrical surface and hole 9 passing through its axis.

Fig. 3 illustrates schematically an alternative method of making the color coded preform. In this arrangement, the natural and colored Teflon mixes are fed into a cylindrical barrel 10 via a pair of concentric funnels 11, 12, which are mounted so as to be rotated together about their axis by any suitable means, such as the gear train 13 and pulley belt 14. The spouts of the funnels 11 and 12 are arranged along different radii, that of the funnel 12 being elongated and extending substantially over the whole radius of the internal dimension of the cylindrical barrel 10, and that of the funnel 11 being of small diameter and located only adjacent the periphery of the interior cylindrical surface.

The natural Teflon mix and the colored Teflon powder are fed into the funnels 12 and 11, respectively, via chutes 15 and 16, which are preferably vibrated by any suitable vibrator means 17, whereby the powder is agitated in order to assist its flow into the funnels. A lead screw 18 rotated through the gear train 13 and passing through a threaded hole in the base 19 may be provided to lower the barrel 10 as the funnels 11, 12 are rotated. Alternatively the funnels may be stationary and the barrel 10 may be simultaneously rotated and lowered.

As will be readily appreciated, due to the relative motion between the funnels 11, 12 and the barrel 10, a thin stream of colored powder falling from the spout of the funnel 11 will be covered by a layer of the natural Teflon mix and will form a helical thread of coloring material on the outer surface of the cylindrical preform, after the powder in the barrel 10 has been compressed by a ram as described with reference to Fig. 1. The shaft 20 on which the funnels 11, 12 are mounted may extend through the entire length of the barrel 10 to form the axial hole 9 (Fig. 2) in the preform.

Fig. 4 shows an extrusion head for use with the preforms and comprising a cylindrical barrel portion 21, a die portion 22 and a tip 23. A tube 24, the upper end 25 of which has a reduced diameter, is secured as by the nuts 26 to the bottom plate 27 of the barrel 21. A hollow needle 28 having a small degree of flexibility is screwed into the reduced end 25 of the tube 24, the lower main portion of which has the same exterior diameter as the diameter of the axial hole in the Teflon mix preform. The conductor 29 over which the Teflon is to be extruded is threaded through the bore of the tube 24 and of the needle 28 and the orifice of the die tip 23. A removable collar 30 is adapted to hold together the die portion 22 and the barrel portion 21. It will be noted that the interior upper surface 31 of the die portion 22 is streamlined to assist the flow of the Teflon under pressure.

A ram 32 having an axial bore is made to have a sliding fit over the tube 24. Any suitable means may be provided for injecting the ram into the barrel. As shown, the reduced end of the ram 32 is cut with a lead screw thread

33 over which is threaded an internally threaded worm wheel 34 which is held against axial movement by brackets 35 mounted on the interior surface of the lower portion of the barrel 21. A worm 36 which projects through the wall of the barrel engages the teeth of the worm wheel 34.

In the extrusion process the collar 30 is removed and the die portion 22 is separated from the barrel 21. With the ram 32 in its lowermost position, a preform as shown in Fig. 2 is slipped over the needle 28 and the end of the tube 24. The die portion 22 is then replaced and the ram 32 is injected by rotating the worm 36 thereby compressing the preform and forcing the mix into the die 22 and causing it to flow over and around the conductor 29 at the orifice of the die tip 23.

During the passage of the mix through the streamlined interior of the die 22 the pitch of the helical color code strips 7 and 8 will increase progressively.

It will be appreciated that the extruder head of Fig. 4 is shown merely by way of example and that other forms of extruder heads may be used with the preform.

Other methods may also be used for applying the code color strips to the preform, as for example, by brushing or spraying with a colored dilution which will seep into the lightly compressed powder mix.

By the expression "insert of material" used in the specification and claims, is meant a surface inlay of the material or an impregnant either of which may be in the form of continuous helical strips, dotted or broken lines, or other code indication.

While I have described above the principles of my invention in connection with specific apparatus, it is to be

clearly understood that this description is made only by way of example and not as a limitation to the scope of my invention.

What is claimed is:

1. The method of making a preform of two contrasting colors, which comprises pouring a first stream of powder of one color into a cylindrical mold across a radial dimension of said mold, simultaneously therewith pouring into said mold adjacent the periphery thereof a fine stream of a material of a different color, producing relative rotation between said mold and said streams and compressing the contents of said mold.

2. An apparatus for making the preform according to claim 1, comprising a cylindrical mold, first funnel means positioned above said mold and having a spout opening extending radially across said mold, second funnel means positioned above said mold and having a spout with a small aperture located at the outer end of a radius of said mold, means for injecting differently colored powders respectively into said first and second funnel means, means for effecting a relative rotation between said two funnel means and said mold and means for effecting a relative movement between said two funnel means and said mold in the direction of the axis of said mold.

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