Feb. 5, 1963 G. C. ROLLINS ET AL 3,076,235

METHOD FOR STRIPING CONDUCTOR COATINGS

Filed March 9, 1960 2 Sheets-Sheet 1

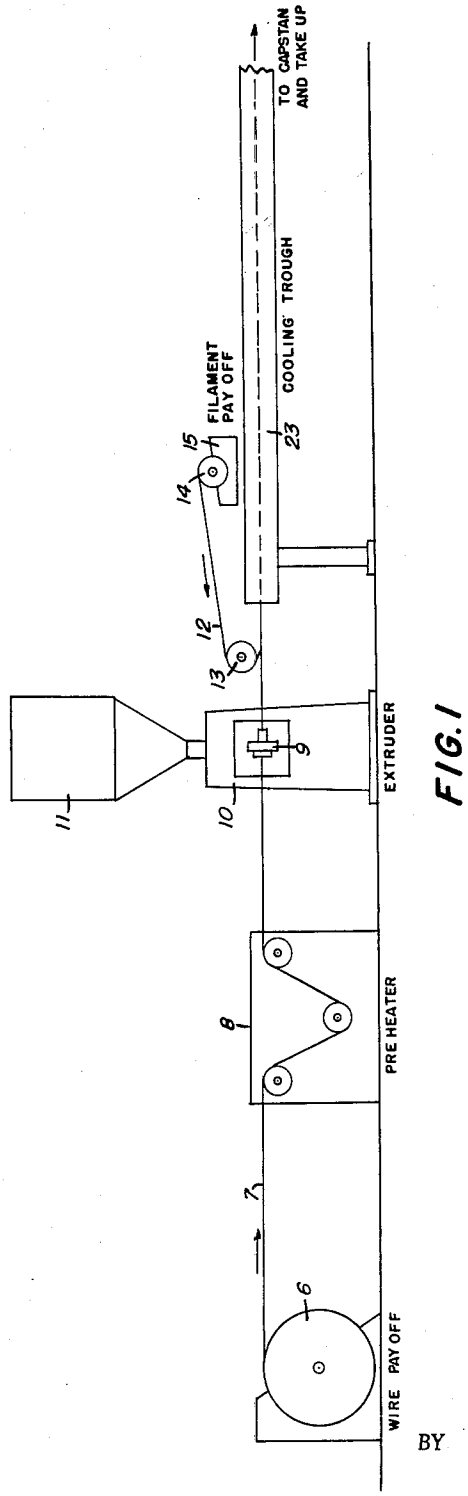

FIG. 1

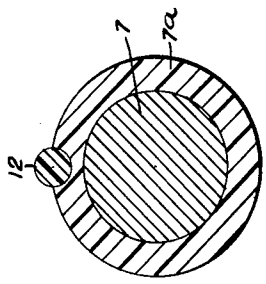

FIG. 5

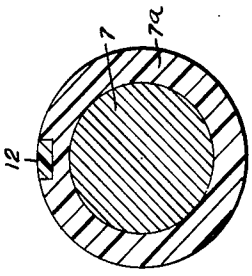

FIG. 4

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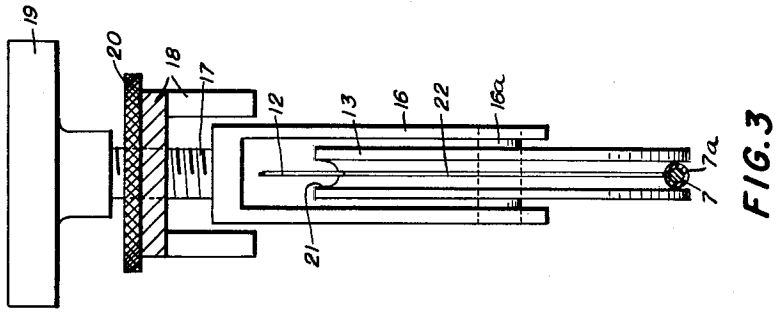

FIG. 3

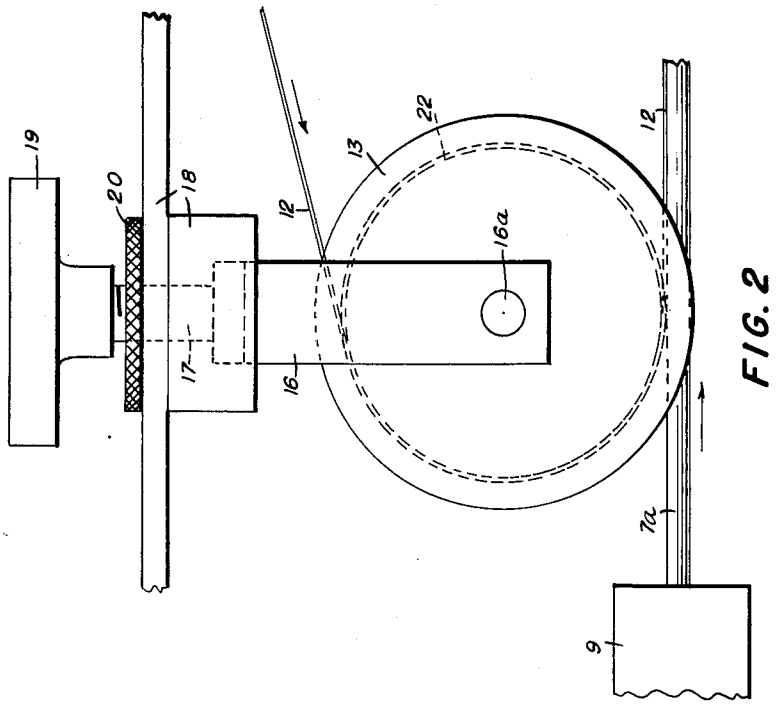

FIG. 2

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METHOD FOR STRIPING CONDUCTOR COATINGS

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This invention relates to the striping of the insulating coating of wire conductors and cables and consists more particularly in new and useful improvements in a method for applying an identifying stripe to a wire coating of polyethylene or the like, by bonding to said coating at the time of the extrusion process, a separate filament of similar or compatible material.

In the manufacture of cables used in the communications field for example, the cable is usually composed of a series of insulated conductors and because of the large number of similar conductors contained within a single cable, it is necessary to identify individual conductors or groups of conductors embodied in the cable. Conventionally, two basic methods of conductor striping have been used, namely the ink striping method and the method wherein two or more extruders are utilized, each containing plastic materials of the desired color.

In the ink striping method, a stripe of colored ink is applied to the wire by means of a wheel running in an ink bath and transferring the ink to the surface of the wire coating against which the wheel is pressed, the passage of the wire causing the wheel to turn. An alternate ink striping method employs a hypodermic needle which rests against the surface of the running wire and ink is forced through the hypodermic needle onto the coating.

The ink striping method has presented several difficult problems, both during manufacture and during use of the end product. The ink must have a precisely controlled viscosity to enable it to be carried by the printing wheel to the wire coating and to enable it to be transferred to the wire coating in a sharp, delineated stripe. If the ink is too thin, it will run on the surface of the wire, making an uneven blurred stripe. If it is too thick, the wheel will transfer an excess amount of ink and it will smear on the surface of the wire. The viscosity is controlled by the addition of a thinner to the ink solution and depends entirely on the operator's ability to judge the amount of thinner required.

After the ink is on the wire, it must be dried before it can be taken over a sheave or wound on a reel. This is done by passing the wire through a heated tube and the speed at which the ink can be dried determines the production rate and usually restricts high speed processing. In the case of a hypodermic needle applicator, the viscosity and homogeneity of the ink is even more critical since the needle is so easily clogged.

Perhaps the most difficult problem with ink striping is obtaining a bond between the ink and the plastic coating on the wire. With polyvinyl chloride insulation, a reasonably good bond can be obtained, but with polyethylene insulation which is now largely in use, it is impossible to obtain a good bond. A poor bond between the ink stripe and the insulation results in flaking of the ink from the insulation during further processing of the wire and in handling the wire in the field. Flaking of the ink or loss of the ink on the surface due to abrasion results in loss of ability to identify a wire by its colored stripe.

Another disadvantage of ink striping lies in the fact that sharp, clear contrasts between insulation colors and stripes cannot be achieved throughout the color spectrum. For instance, with a red stripe on a black conductor coating, it is impossible to put enough red pigment in an ink to completely mask the black coloring under the ink. The result, of course, is a stripe with a "washed out" appearance which can result in erroneous identification of the wire.

The other method of striping which utilizes the two or more extruders containing different colored plastic materials, involves apparatus wherein the extruders force the plastic materials through a common orifice through which the wire is running, forming an insulating coating on the wire. The colors of this coating correspond to the colors in each of the extruders. The most serious objection to this type of striping is the fact that color changes require the disassembly and cleaning out of one or more of the extruders which is a time consuming operation.

It is therefore the primary object of the present invention to overcome the above-noted difficulties and to provide a method for applying a preformed monofilament to an extruded wire coating, the material of said monofilament being similar to or compatible with that of the plastic coating on the wire and wherein the stripe is pressed into the still hot plastic coating on the wire at a point immediately posterior to the extruder die orifice.

Another object of the invention is to provide a method of this character wherein a monofilament stripe is applied to the wire coating while the latter is still hot, whereby, since the material of the monofilament and the plastic wire covering are similar, the material in the monofilament softens and forms a very effective heat sealed bond to the plastic wire covering.

A further object of the invention is to provide a method for applying a monofilament stripe to a wire coating with a heat sealed bond to thereby avoid flaking and, since the monofilament is embedded deeply in the insulation, any abrasion great enough to remove the monofilament stripe would completely destroy the insulation.

Still another object of the invention is to provide a method of this character wherein no solvents or thinners are required and bonding occurs so quickly that no practical limit of processing speed exists and the thickness of the monofilament permits sharp, clear contrast between the stripe color and the background color of the wire coating.

A marked advantage of the present invention resides in the fact that the monofilament need not be completely embedded in the conductor insulation, but can be permitted to protrude above the surface of the insulation, creating in effect a raised ridge along the surface of the conductor insulation, thus enabling the stripe to be felt as well as seen for use in identifying striped conductors from plain conductors.

A still further object of the invention is to provide a method for applying a monofilament stripe to a wire coating wherein the stripe colors, when applied to a common background color, can be changed without stopping the process, resulting in an obvious saving in time and scrap material.

With the above and other objects in view which will appear as the description proceeds, the invention consists in the novel features herein set forth, illustrated in the accompanying drawings, and more particularly pointed out in the appended claims.

Referring to the drawings in which numerals of like character designate similar parts throughout the several views:

FIG. 1 is a diagrammatic view illustrating the apparatus of the invention in side elevation;

FIG. 2 is an enlarged detail of the striping device in side elevation;

FIG. 3 is an edge view of the striping device shown in FIG. 2;

FIG. 4 is an enlarged transverse sectional view of a coated wire with an embedded stripe; and

FIG. 5 is a similar view showing a raised stripe or rib.

In the drawings, referring first to FIG. 1, **6** represents a conventional wire payoff reel from which conductor wire **7** is fed through a suitable electric preheater or the like **8**, to the extruder die **9** of a conventional extruding device **10**. The material for providing the insulating coating for the wire **7**, preferably polyethylene, is fed in heated condition, to the extrusion die **9** from reservoir **11**, and as the wire passes through the orifice of the extruder die **9**, it is coated with polyethylene in the usual manner.

As the coated wire leaves the extruder orifice **9** and while it is still hot, a preformed monofilament **12** of polyethylene is applied to the coating by means of a striping roller **13**, said monofilament being fed from a payoff reel **14** carried by a suitable support **15**. The filament **12**, while preferably of polyethylene, may be of other compatible material and of any desired color.

Turning to FIGS. 2 and 3 which illustrate the striping device more in detail, the roller **13** is rotatably supported by a bifurcated yoke **16** suspended from a threaded stem **17** which is vertically adjustable in a complementary threaded opening in a holding bracket **18** supported posterior to the extruder **9**. The threaded stem **17** extends through the bracket **18** and, fixed to its upper end, is an adjusting knob **19** whereby the position of the roller **13** with respect to the coated wire **7** may be adjusted and the pressure of the peripheral engagement of the roller with the wire may be controlled. A knurled lock nut **20** is preferably provided for maintaining a selected vertical position of the roller **13**.

Preferably the periphery of the roller **13** is grooved as at **21** to embrace the coated wire **7** immediately after it leaves the orifice of the extruder **9** and in order to present the filament **12** in the center of the wire, a supplemental groove **22** is provided at the base of the main groove **21**. As best seen in FIGURES 2 and 3, the groove **21** is of a width and depth to substantially centrally receive the strand of filament **12** and simultaneously directly engage the peripheral coating *7a* of the wire **7**, on either side of the filament. Thus, as the hot coated wire **7** advances from the extruder, its frictional engagement with the periphery of the freely rotating roller **13** causes the latter to rotate, simultaneously advancing the monofilament **12** of a selected color and pressing the same into periphery of the wire coating. As the material in the monofilament **12** is similar to that of the plastic wire covering and as the latter is still hot, the material in the monofilament softens and forms an effective heat sealed bond to the plastic wire covering.

Returning now to FIG. 1, after the monofilament **12** is applied to the coating of wire **7**, the striped wire advances through a conventional cooling trough **23** and after being cooled passes to a capstan and take-up for storage.

As before indicated, the identifying monofilament stripe may be completely embedded in the plastic coating of the wire, or it may be permitted to protrude above the surface of the insulation in the form of a raised ridge. In FIG. 4, we have shown the monofilament **12** completely embedded and lying flush with the surface of the insulating coating *7a*, while in FIG. 5, the monofilament **12** is only partly embedded in the insulation *7a*, so as to form a raised ridge on the surface of the coated wire.

The extent to which the monofilament **12** is embedded in the coating *7a* is determined by the pressure applied by the roller **13** which, as before indicated, is adjustable by means of the knob **19** and its threaded stem **17**. Also, the depth of the supplemental groove **22** in the roller **13** will have a certain effect upon the depth of embedding the monofilament in the insulating coating. In fact, in some instances it may be desirable to eliminate this supplemental groove where it is desired to completely embed the monofilament.

The preformed monofilament **12** may be an extruded filament of the desired material or it may consist of an elongated strip slit from a sheet of plastic material. In either event, the filament is fed in preformed condition in the manner above described.

In this connection, it might be noted that while the conventional extruded stripe method possesses certain of the advantages of the monofilament stripe of the present invention, it would be extremely difficult to produce a raised ridge effect which is made possible in the present instance by the application of the preformed monofilament and the pressure control of its application to the hot wire coating.

From the foregoing, it is believed that the invention may be readily understood by those skilled in the art without further description, it being borne in mind that numerous changes may be made in the details disclosed without departing from the spirit of the invention as set forth in the following claims.

We claim:

1. A method of striping extruded wire coatings, comprising advancing a hot plastic coated wire longitudinally from an extruding die, continuously and independently of said die, applying longitudinally to the periphery of the hot plastic coating of said wire as the latter advances, a length of completely preformed, unheated, thread-like striping filament of plastic material compatible with said coating, simultaneously embedding said filament at least partially beneath the surface of said hot coating while confining the line of contact of said filament to a path lying within the lateral limits of said coated wire, and cooling the striped, coated wire.

2. A method of striping the plastic coating of a wire being extruded hot, from an extruding die, comprising embedding an end of a completely preformed, unheated, thread-like striping filament, of plastic material compatible with said coating, in the periphery of said coating as the latter adavnces in heated condition from said extruding die, longitudinally advancing said coated wire and filament while confining the line of contact of said filament to a path lying within the lateral limits of said coated wire and simultaneously embedding said filament longitudinally at least partially beneath the surface of said coating, and cooling the striped, coated wire.

3. A method as claimed in claim 2, including progressively applying pressure to said filament to embed the latter in said coating as the wire and filament are advanced.

4. A method as claimed in claim 2, wherein said striping filament is of the same material as that of said coating.

5. A method as claimed in claim 2, including controlling the depth of embedding of said filament by applying a regulated lateral pressure thereon as the wire advances.

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