Jan. 23, 1968 C. J. KROGEL ET AL 3,365,357

METHOD OF MAKING TWINNED PULP INSULATED CONDUCTORS

Filed April 21, 1965 2 Sheets-Sheet 1

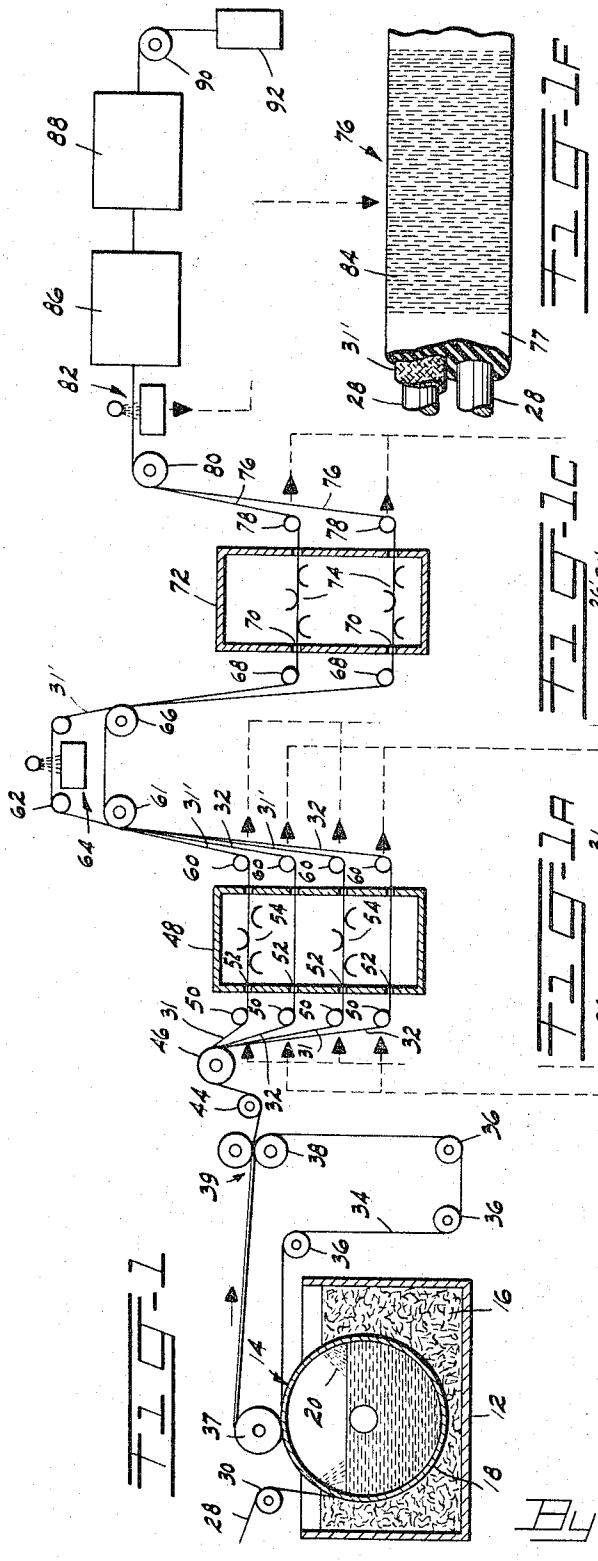

FIG-1

FIG-1F

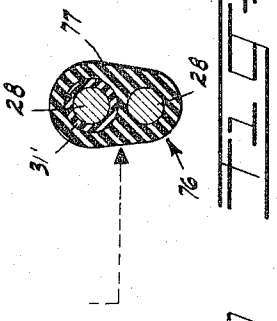

FIG-1E

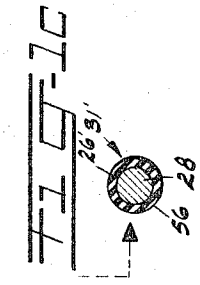

FIG-1C

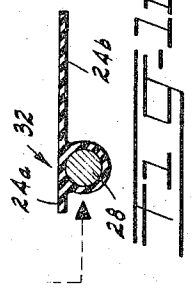

FIG-1D

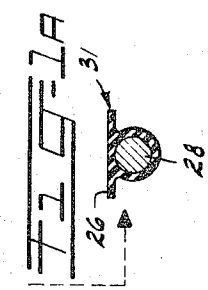

FIG-1A

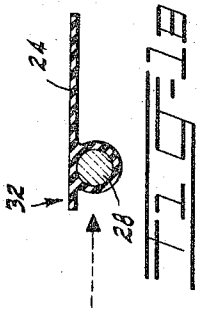

FIG-1B

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METHOD OF MAKING TWINNED PULP INSULATED CONDUCTORS

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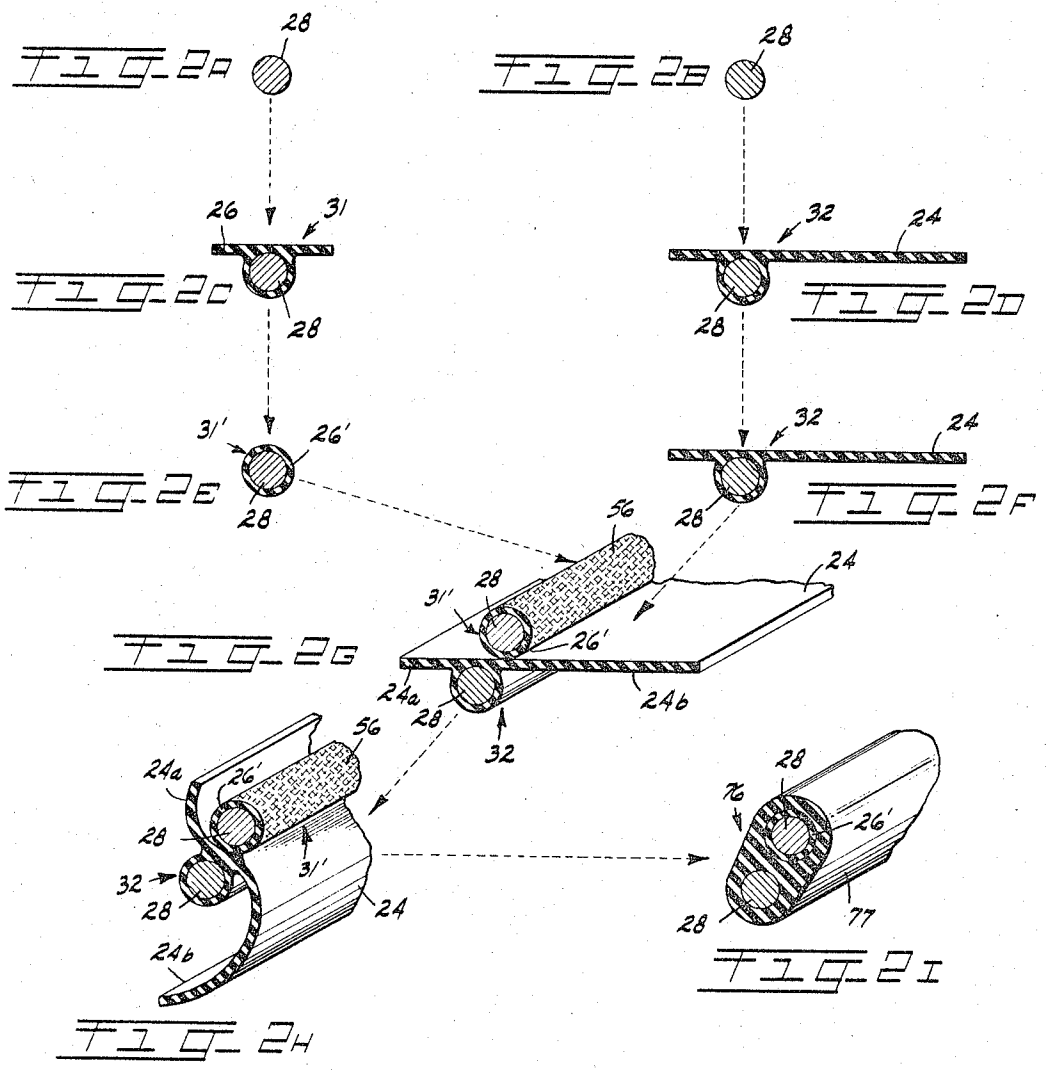

FIG. 2A FIG. 2B FIG. 2C FIG. 2D FIG. 2E FIG. 2F FIG. 2G FIG. 2H FIG. 2I

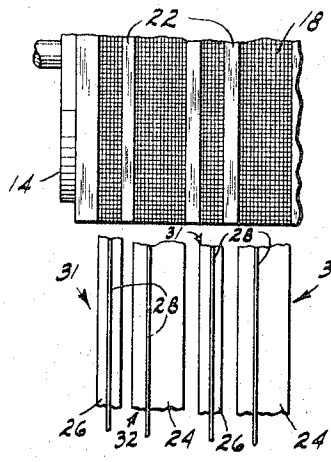

FIG. 3

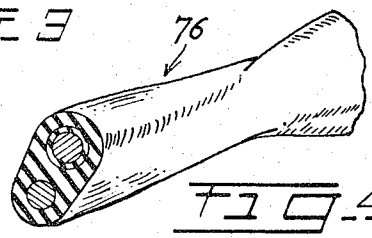

FIG. 4

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METHOD OF MAKING TWINNED PULP INSULATED CONDUCTORS

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7 Claims. (Cl. 162—106)

This invention relates to the manufacture of insulated conductors, and more particularly to twinned pulp insulated conductors and the method of making such conductors.

In the manufacture of electrical communications cable, it is necessary that the cable be fabricated in such a manner that one can readily identify individual pairs of insulated conductors therein and distinguish each insulated conductor of each pair. It is also necessary that the pairs of the cable be twisted with different twist lengths in order to preclude "cross-talk" between the several pairs of conductors therein.

If the pairs are twisted in short lengths, as has been the custom in the past, the twisting thereof also will serve to bind the two conductors of each pair together to keep the several pairs distinguishable from each other. However, if the twist length is relatively long, the conductors tend to be substantially parallel and difficulty arises in identifying the conductors of the pairs in the field, for example, when it is required to splice conductors together from one cable to another. Because of the longer twist length the conductors of a pair tend to separate and the making of improper connections may result.

As mentioned above, in the past the problem of separation of the conductors of a pair had been obviated by twisting the pairs of conductors in short lengths. This was possible since the insulating and twisting operations were conducted separately. Initially, the conductor was coated, for example, in a pulp insulating machine, reeled and stored; then, at a later time, the reels were sent to twister units where single conductors from two reels were twisted together and collected on a single reel. Under these conditions, it was possible to run the twisters at a high angular velocity and, therefore, to impart twists of short length to the wires. The use of a high angular velocity was possible since there was no time limitation when stopping the twister units to change the twisted pair reels.

It has been found, however, that it is advantageous economically to utilize a continuous process of insulating and twisting pairs of conductors rather than the separate operations outlined above. In this continuous type process there is a time limitation involved in stopping the twister units to change reels, since the conductors are being fed continuously from the insulating apparatus. Because the angular velocity of the twister unit must be lower in a continuous operation to match the relatively low velocity of the pulp insulating machine, and additionally lower to allow for reel changes, twists of longer lengths are imparted to the pairs. However, as set forth above, longer twist's lengths lead to the possibility of strand separation. One method of avoiding this condition is to provide two conductors with a unitary coating of insulation. However, if this method is used without taking remedial steps, it will be impossible to identify each conductor of the pair for splicing purposes. In addition, the two conductors of the pair may be forced together during twisting, causing shorts.

It is, accordingly, an object of this invention to provide a new and improved process of making pairs of insulated conductors which may be twisted in twists of relatively

large lengths without the possibility of conductor separation and loss of identity.

It is another object of this invention to provide a method of manufacturing pairs of conductors having a unitary covering of insulation wherein each conductor of the pair and the pair itself may be readily identified.

It is another object of this invention to provide a pair of conductors having a unitary covering of insulation wherein each conductor of the pair may be readily identified.

It is another object of this invention to provide a pair of conductors having a unitary covering of insulation wherein adequate spacing is attained between the two conductors.

In accordance with the objects, the process comprises coating one conductor with an insulating material, coding said coating with a first marking, coating a second conductor with an insulating material so that it has an excess portion thereon, and wrapping the excess portion of said insulating material about both conductors to form a unitary coating about the conductor pair.

These and other features, advantages and objects of the invention will be understood clearly from the following detailed description and the accompanying drawings wherein:

FIGS. 1–1F inclusive, is a schematic sequence illustrating a process of making twinned pulp insulated conductors with schematic showings of the conductors at each step in the process;

FIGS. 2A–2I inclusive, is a schematic sequence illustrating the various stages of fabricating the twinned pulp insulated conductors;

FIG. 3 is a partial view of a rotatable screen which forms the ribbons of pulp on the conductors; and

FIG. 4 is a view of a twisted pair of pulp insulated wires.

With reference to the drawings, a container **12** having a drum **14** rotatably mounted therein is partially submerged in a pulp suspension **16** which consists of pulp suspended in water. Drum **14** includes annular foraminous portions **18—18** through which the water may pass, as at **20**, so as to strain the pulp thereon. Annular portions **18—18** are separated by a plurality of stripes **22—22** (FIG. 3) which are painted along the length thereof with a material to block the formation of pulp in these regions. The pulp strips or ribbons **24—24** and **26—26** of respective predetermined widths are formed between the stripes **22—22**. To maintain the proper level of suspension **16** in container **12**, means (not shown) are provided to supply the pulp suspension from a mixing vat to the container in a manner which insures a continuous flow of suspension to the foraminous portions **18—18**, the water flowing therethrough and being drawn off by conventional means (not shown).

A plurality of conductors **28—28** in strand form (shown in FIG. 1 and schematically in FIGS. 2A and 2B) are fed from a plurality of laterally disposed supply reels (not shown) and guided by roller **30** into the suspension and about the foraminous portions **18—18** of rotating drum **14**. As drum **14** rotates each conductor **28** receives a ribbon of pulp when it passes through suspension **16** thereby forming ribboned conductors **31—31** and **32—32** (FIG. 3).

An endless belt **34**, of a soft, liquid absorbing material such as felt, travels around rollers **36—36**, transfer roller **37**, and lower roller **38** of a set of press rollers **39**, to facilitate freeing the ribboned conductors **31—31** and **32—32** from the drum **14**. The belt **34** is urged into contact with the drum by transfer roller **37** which, therefore, rotates with the drum. The ribboned conductors then travel with the upper surface of belt **34** through the press

rollers 39 which squeeze moisture therefrom. Immediately thereafter, the ribboned conductors are separated from the belt 34 and passed around guide rollers 44 and 46 to a housing 48.

In a preferred embodiment, the ribboned conductors are separated into four groups by rollers 50—50, each group consisting of conductors having ribbons of a similar width. The groups of ribboned conductors are fed through four vertically disposed entrance slots 52—52 of the housing 48 which contains polishers 54—54 in the path of the narrow ribboned conductors. The term polisher as used herein is defined as a mechanism, such as a series of rotating blocks, for wrapping the pulp ribbon around a conductor. As is shown schematically in FIGS. 1A and 1B, the narrow ribboned conductors 31—31 are fed through the polishers 54—54 while the wide ribboned conductors 32—32 simply pass through housing 48 unchanged (FIGS. 1D and 2F). As a result, the polishers 54—54, wrap or transform the ribbon coatings 26 of the narrow ribboned conductors 31—31 into coatings 26'—26' which are substantially concentric with the conductors 28—28 (FIGS. 1C and 2E), these conductors being designated 31'—31'.

After exiting from housing 48, the conductors 31'—31' and 32—32 are guided around rollers 60—60 to a roller 61 where they are again laterally disposed to each other in a horizontal plane. At this point, the conductors 31'—31' are separated from the wide ribboned conductors 32—32 by rollers 62—62 in order that the former conductors may pass to a suitable dye depositing means 64 whereat a colored marking 56 is deposited onto conductors 31'—31'. The conductors 31'—31', now colored, and wide ribboned conductors 32—32 are again gathered at a common roller 66, whereat, as seen in FIG. 2G, the conductors 31'—31' are positioned in contacting relationship with the top surface of ribbons 24—24 of the wide ribboned conductors 32—32.

The conductors 31'—31' and 32—32 are separated into groups of two as they travel about roller 66, each group consisting of a conductor 31', now polished with a coating 26'—26' and having colored markings 56—56 thereon, in contact with a wide ribboned conductor 32. Each group is fed around guide rollers 68—68 and through entrance slots 70—70 of a housing 72 wherein polishers 74—74 are mounted, each polisher functioning to polish ribbon 24 about both its own conductor 28 and conductor 31' in contact therewith (FIGS. 2G and 2H) in the following manner: each polisher 74 positions ribbon portion 24*a* about coated conductor 31' and ribboned portion 24*b* about its own conductor 28 to form a twinned pulp conductor 76 having a unitary coating 77, as shown in FIGS. 1E and 2I.

After exiting from housing 70 the twinned conductors 76 are guided around rollers 78—78 to a roller 80 where they are laterally disposed. The twinned conductors 76 are then advanced to a second color marking station 82 whereat the unitary coating 77 is coated with a desired colored marking 84. Either a continuous or intermittent marking or coloring, depending on the type of identification code desired, may be applied.

One advantage in coating one conductor initially by this method is that sufficient pulp may be provided between the conductors of a twinned pair for maintaining proper spacing of the two conductors in order to prevent shorts. Another advantage in providing a twinned conductor 76 with a double coded coating of pulp insulation around one conductor, i.e. conductor 28 (FIGS. 1E and 2I) is to facilitate a rapid identification of each conductor of the pair. The colored coating 56 of the coated conductors 31' allows each conductor of the pair to be readily identified for splicing purposes. Of course, the unitary coating 77 around the twinned conductor 76 allows the ready identification of each of conductors in a multiconductor cable.

The twinned conductors 76 are fed through drying

ovens 86 and 88 to remove moisture from the pulp and to cause the insulation to set on the conductors. Oven 86 is maintained at a relatively high temperature at the entrance portion e.g. 1500° F. and a relatively lower temperature at the exit portion e.g. 800° F., with a constant gradient along its length to control the evaporation of the moisture from the pulp insulation of the conductors passing therethrough. It has been found that this single oven will satisfactorily dry the moisture from the pulp of normally coated conductors. However, in the event an excess of moisture was imparted to the pulp insulation, the heat in oven 86 may not be sufficient to dry out this excess moisture. Therefore, applicants have provided a second oven 88 in series with oven 86 to insure a complete dry out of the insulation. Oven 88 is maintained at a temperature high enough to evaporate any moisture which may have remained in the insulation of conductors passing therethrough, but low enough not to burn the insulation of the dried conductors. This temperature is in the area of 250° F., varying with the gauge of the wire being fabricated and the thickness of the insulation being applied thereto.

When the twinned conductors 76 exit from oven 88 they are guided by roller 90 to a twisting apparatus 92 where a twist of a relatively long length is applied rapidly to the continuously advancing conductor, since there now is no danger of the two conductors in the twinned conductor 76 becoming separated. A twisted pair 76 of pulp insulated wire is shown in FIG. 4.

It is to be understood that the above-described arrangements are simple illustrative examples of the application of the principles of the invention. Numerous other arrangements may be readily devised by those skilled in the art, which will embody the principles of the invention and fall within the spirit and scope thereof.

What is claimed is:

1. The method of making twinned insulated electrical conductors comprising the steps of:
   - applying insulating material about a first conductor,
   - applying insulating material about a second conductor with an excess portion extending therefrom, and
   - wrapping the excess portion of said insulating material first about the second conductor and thereafter about the insulated first conductor to form a unitary covering of insulating material about the two conductors.

2. The method of making insulated electrical conductors comprising the steps of:
   - applying a ribbon of pulp insulating material to a first conductor,
   - polishing said ribbon of insulating material about the first conductor so as to form an insulated covering concentric therewith,
   - applying a relatively wider ribbon of pulp insulating material having an excess portion to a second conductor, and
   - polishing the excess portion of said wider ribbon of insulating material about both the second conductor and the insulated first conductor to form a unitary covering of insulated material about the two conductors.

3. The method of making pulp insulated electrical conductors comprising the steps of:
   - applying a ribbon of wet pulp to a first conductor,
   - polishing the ribbon of pulp about the first conductor so as to form a covering of pulp concentric therewith,
   - coloring said concentric pulp covering with a first color,
   - applying a relatively wider ribbon of wet pulp of a second color to a second conductor,
   - polishing the relatively wider ribbon about both conductors to form a unitary covering of pulp about the two conductors, and
   - drying the pulp coverings.

4. The method of making insulated electrical conductors comprising the steps of:

covering a first conductor with an insulating material,

covering a second conductor with an insulating material with an excess portion extending therefrom,

placing the insulated first conductor and the insulated second conductor in contact with each other, and

wrapping one section of the excess portion of said insulating material about the insulated first conductor and the remaining section of the excess portion of said insulating material about the second conductor and first conductor to form a unitary coating of insulating material about the two conductors.

5. The method of making insulated electrical conductors comprising the steps of:

covering a first conductor with a wet insulating material,

covering a second conductor with a wet insulating material so that it has an excess portion thereon,

wrapping the excess portion of said insulating material about both the second conductor and the covered first conductor to form a unitary coating of insulating material about the two conductors,

subjecting the coverings of insulating material about

the two conductors to a heating atmosphere to dry the insulation, and

twisting the two insulated conductors with a twist of a desired length.

6. The method of making twinned insulated electrical conductors according to claim 1 comprising the steps of:

providing identifying indicia on at least one of the insulating materials.

7. The method of making insulated electrical conductors according to claim 2 comprising the steps of:

applying a coded marking to the insulated covering of the first conductor, and

applying a coded marking to the unitary covering formed about both conductors.

References Cited

UNITED STATES PATENTS

1,800,411	4/1931	Selvig	174—110 X
1,968,903	8/1934	Norton	174—112
2,947,652	8/1960	Burr	174—117

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