United States Patent

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[45] **Mar. 21, 1972**

[54] MARKING APPARATUS AND METHOD

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[73] Assignee: **Anaconda Wire and Cable Company**

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[21] Appl. No.: **794,011**

[52] **U.S. Cl.** **156/51**

[51] **Int. Cl.** **H01b 19/04**

[58] **Field of Search** 156/51; 101/36–46

[56] **References Cited**

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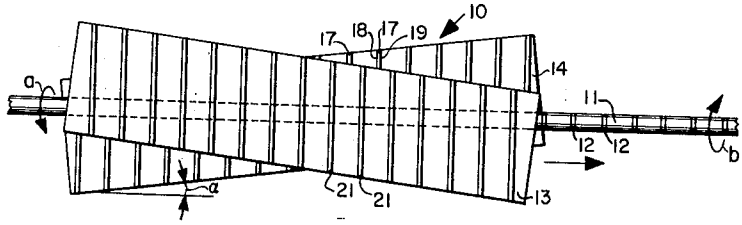
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[57] **ABSTRACT**

Stripes are applied to insulated wire by passing it between two endless belts at least one of which carries ink or transverse marking areas. The belts are canted at opposite angles so that the wire is caused to roll across the printing surface.

29 Claims, 8 Drawing Figures



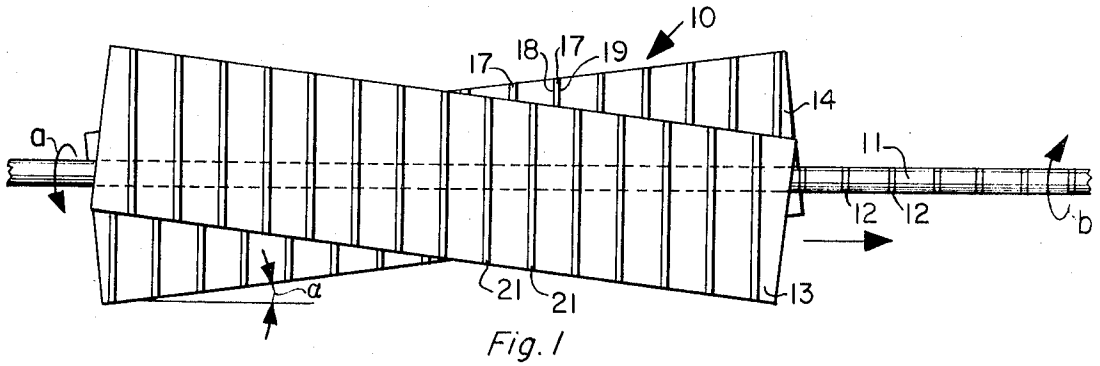
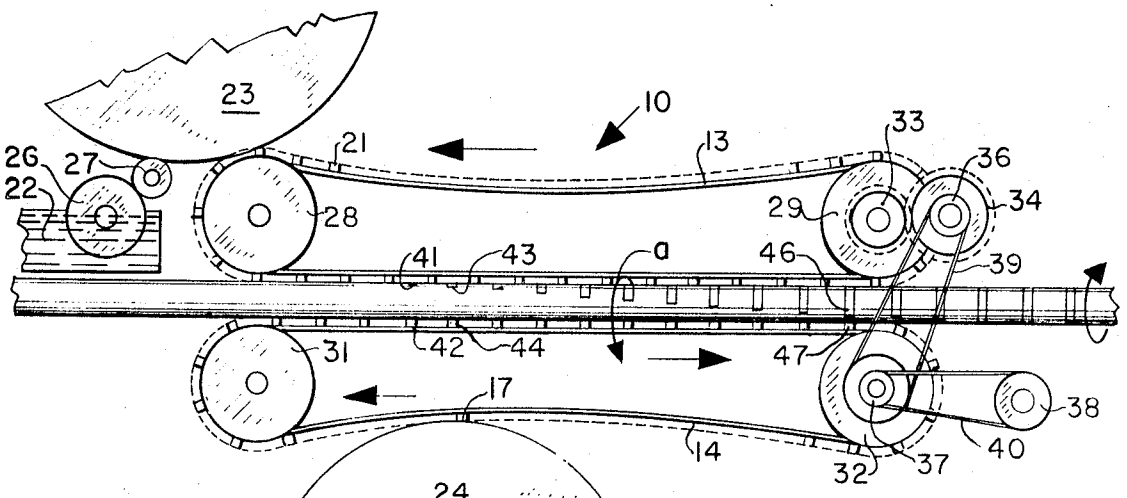


Fig. 1



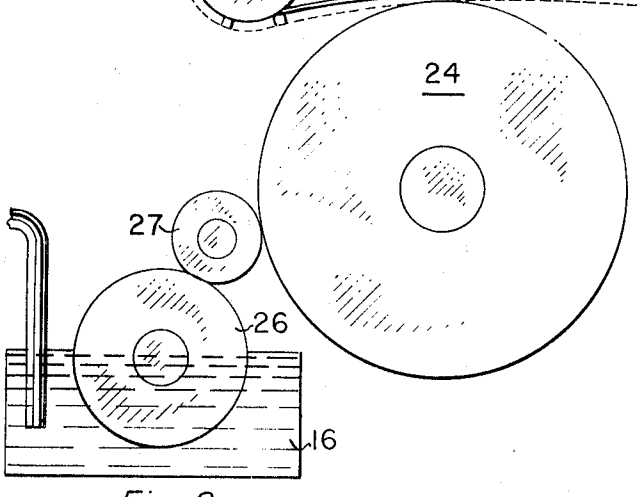


Fig. 2

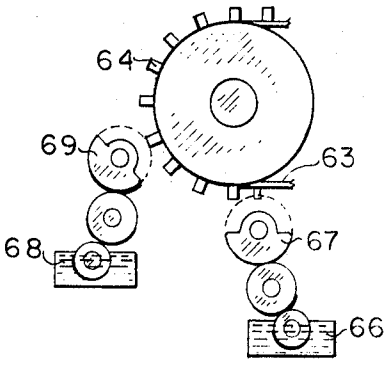


Fig. 6

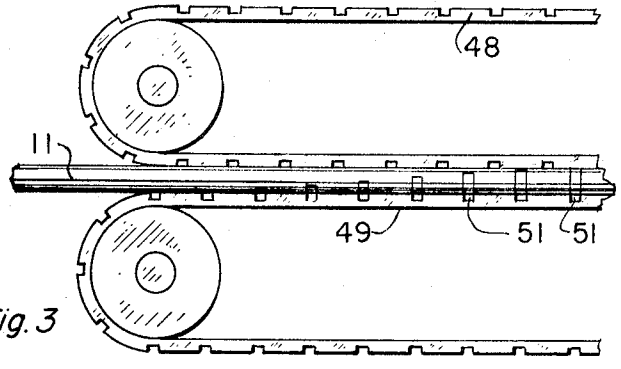


Fig. 3

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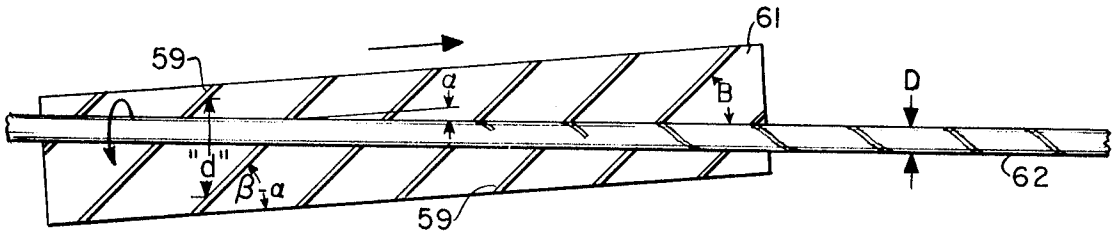


Fig. 4

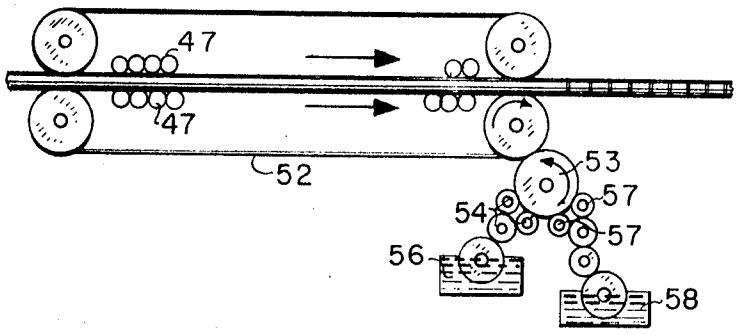


Fig. 5

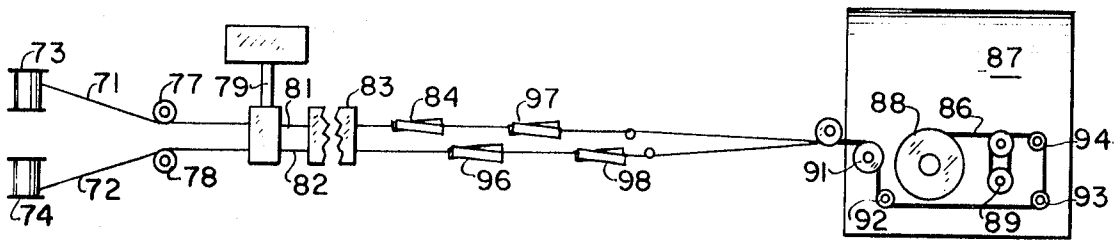


Fig. 7

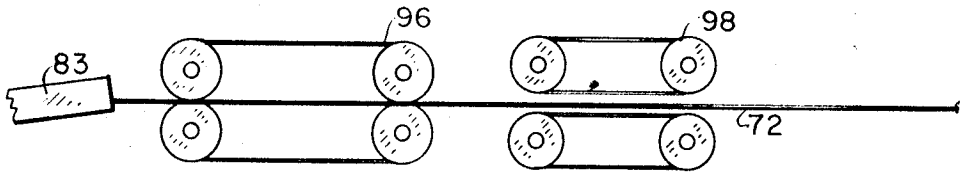


Fig. 8

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MARKING APPARATUS AND METHOD

BACKGROUND OF THE INVENTION

In the manufacture and use of insulated wires for electrical purposes it has long been known to code or identify each wire by means of one or more colored stripes applied continuously or at regular intervals along its surface. Various types of apparatus have been used for this purpose, operating on widely different principles, but no such apparatus has been completely satisfactory for applying stripes at the high speed of modern wire manufacture. Several of the known devices are suitable for marking vertically advancing strands at moderate speeds but cannot be used for horizontal strands, such as those advancing from the usual type of insulation extrusion apparatus. Many of the known devices are unsatisfactory because they must be shut down to replenish the marking ink supply. Difficulty has been encountered with others from clogging of ink supply lines. In many stripers the ink tends to smear, particularly at high operating speeds, and to make too broad or uneven a stripe. In some known apparatus this is due to whipping or vibration, particularly at high speeds, of the wire being coded.

In the manufacture of telephone cables, coding of the conductors is provided by the introduction of different colored dyes or pigments into the extruded insulating material. For economical manufacture it is essential that the extrusion machines should be able to operate continuously for long periods of time without having to clean out one color of plastic and substitute another. It is the practice, therefore, to accumulate many reels of insulated wire during the run of a particular color and, later, to twin two different colored wires together to form a twisted pair. Because of the requirement that the individual members of a pair should be differently coded, it has not been practicable to extrude them concurrently from a single extrusion machine, and the coding apparatus so far available has not been capable of operating satisfactorily at extrusion speeds so as to code each wire differently in the course of a dual extrusion.

SUMMARY

I have invented an apparatus for marking a continuously advancing strand comprising two endless belts that roll the strand as it passes between them. In my apparatus a first endless belt has a surface adjacent to the strand and advancing in a line having a first component with the same speed and direction as the strand and a second component with a direction transverse of the strand. My apparatus also comprises a second endless belt with a surface facing the surface of the first belt and advancing in a line having one component with the same speed and direction as the strand and another component transverse of the strand, but in a direction opposite to the direction of the second component of the first endless belt.

The surface of at least one of the belts comprises printing areas that engage the strand and the apparatus also comprises means for applying marking composition to these areas and means for guiding the strand between the belts so that it is rotated by belt friction and urged to roll over the printing areas and be marked by them.

Preferably my apparatus will roll the strand substantially 360° so that where the printing areas, which, preferably, are straight edged, are normal to the line of advance of the strands the markings will take the form of circular stripes around the strand circumference and where the printing areas are oblique to the lines of advance of the strands they will produce helical stripes. The printing areas may be raised, intaglio, or smooth for offset marking, and marking areas may be comprised on both of the belts. In the latter case each belt may have a different color composition or ink, or one or both belts may have different inks applied to different of its printing areas.

In my method for marking an advancing strand of indefinite length the strand is paid-off and taken up along an angularly fixed axis and its surface is brought in contact with a plurality of printing areas that advance with it. The strand is seized at these areas and twisted so as to roll the strand surface through a large angle, such as 360°, upon them. Thereafter the strand is released to untwist and resume its original angular position during takeup.

In my method of making a coded cable an electrical conductor is continuously paid into an extrusion machine wherein a wall of polymeric insulation is extruded over it. The conductor advancing from the machine is passed between a pair of endless belts and thereby twisted and rolled over printing areas on at least one of the belts. The printed conductor advancing from the belts, and at least one other conductor, are passed into a stranding machine where they are twisted into a cable. This method has particular advantage where both conductors are concurrently insulated in a single extrusion machine.

By means of my invention I propose to apply precise markings on strands that are moving at very high speeds.

By means of my invention I further propose to apply markings continuously without stopping to renew the ink supply.

By means of my invention I further propose to apply multicolor markings in an economical and reliable manner.

Further purposes of my invention will be made apparent from the description hereinbelow given.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 shows a plan view of one embodiment of my invention.

FIG. 2 shows a side view of the embodiment of FIG. 1.

FIG. 3 shows a partial side view of another embodiment of my invention.

FIG. 4 shows a plan view, with the upper belt assembly removed, of still another embodiment of my invention.

FIG. 5 shows a side view of an embodiment of my invention employing offset printing.

FIG. 6 shows a side view of an embodiment of a feature of my invention.

FIG. 7 shows a plan of the steps in the method of my invention.

FIG. 8 shows a side view of an element of FIG. 7.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to FIGS. 1 and 2, a strand 11, which in the illustrated embodiment comprises an insulated conductor of circular section, is being marked with circumferential stripes 12-12 by means of an apparatus indicated generally by the numeral 10. The strand 11 passes between two endless belts 13, 14, at least one of which is coated with a suitable ink 16 or other marking composition which is transferred to the strand.

Suitable compositions for transferring or printing on wire insulations are known, and, in general, will vary not only in regard to the desired color but in accordance with the nature of the rubber or plastic insulation being coded and the nature of the printing process used e.g., relief, intaglio, or offset (lithographic). Compositions for each of these processes are commercially available, however, and the nature of the composition does not constitute a novel feature of the present invention.

My invention features a structure wherein the belts 13, 14 are not in alignment but are oppositely canted to the line of advance of the strand 11, which is being urged forward by a takeup apparatus, not shown in the drawing. The takeup apparatus may comprise a capstan and takeup reel but it may also comprise some manufacturing apparatus, such as a strander, and the strand may be paid into the apparatus 10 from a storage reel but my invention has particular utility where the strand 11 is supplied directly from some manufacturing step such as insulation extrusion.

Because the belts 13, 14 are canted they have the effect of twisting the strand 11 around its own axis and rolling it over

the surface of the belts. This comes about because the motion of the surface of each of the belts **13, 14** facing the strand comprises one component having the same speed and direction as the strand and one component normal to the strand direction. In the structure of FIG. **1** the normal component has a direction to the left, looking downstream of the strand movement, and the belt **13** a component to the right so that, again looking downstream, the strand, while it is gripped by the belts, is twisted clockwise as indicated by the arrow *a*. Of course, as soon as the strand is released downstream of the belts it is free to untwist as indicated by the arrow *b*. In the case of insulated electrical wires I have found that the necessary twist can be applied by my apparatus without overtwisting or otherwise damaging the strand.

In FIG. **1** the apparatus **10** applies the circular, spaced apart, marks **12** to the strand **11** by means of raised printing areas **17-17** on the lower belt **14** that have straight edges **18, 19** normal to the axis of advance of the strand **11**. Since the belt **14** is canted by an angle α from the strand **11** the edges **18, 19** are required to form the same angle α with a line normal to the motion of the belt **14**. In the apparatus of FIG. **1** the upper belt **13** is not used for printing but serves merely to guide and twist the strand **11**. Raised areas **21-21** on the belt **13** are positioned to contact the strand **11** at points between the stripes **12** so as not to smear the latter, but, as shown in FIG. **2**, a marking composition **22**, different, if desired, from the color of the composition **16** may be applied to the areas **21** to apply additional stripes. The composition **22, 16** are applied respectively to the areas **21, 17** by inking rolls **23, 24** which are coated by rolls **26, 27** in a known manner. Apparatus of the type shown for transferring marking composition to inking rolls is commercially available, and this and other known types of ink transfer apparatus can be used within the scope of my invention of which it does not comprise a novel feature. Suitable marking compositions may be designated as inks, paints, lacquers etc. but I have used the words "ink" and "printing" broadly within this specification to designate the marking composition of whatever type and the transfer area for transferring this composition to the strand surface. The belt **13** is mounted on rolls **28, 29** and the belt **14** on rolls **31, 32** of which the rolls **29** and **32** are driven by means of gears **33, 34**, sprockets **36, 37, 38** and chains **39, 40** or other gear means of which many known types and combinations are available. The sprocket **38** is synchronized with the takeup for the strand **11** by known types of apparatus, not shown, to drive the belts **13, 14** to have the component of their motion that is parallel with the strand **11** advance at the speed of the strand. The method by which circular marks are applied by the apparatus **10** is shown in FIG. **2** where, for the sake of clarity, the strand is shown without any ink being applied to the upper belt. As seen in FIG. **2** a mark **41** applied by a raised area **42** has just become visible in the side view while a mark **43** applied by a raised area **44** shows a greater extent due to the twisting of the strand **10** by the belts. Thus, advancing downstream, each of the marks is greater until the final mark **46** made by the raised area **47** makes a complete circle around the strand.

The width of the belts **13, 14** and of the printing areas **17** need be no greater than π Dcosα where D is the diameter of the strand **11**, but I prefer to add to this width to provide for normal tolerances and also to permit the use of a single set of belts for strands of different diameter. The width of the belts can be further narrowed, however, by providing printing areas on the upper belt which register with the areas of the lower belt, requiring each belt to print only a semicircle. In the structure of FIG. **1** this would be accomplished by shifting the phase of the areas **21** to register with the areas **17** and coating the areas **21** with the same ink **16**, as with the rolls **23, 26, 27**.

The belts **13, 14** may comprise a rubberized fabric but they may be steel or have steel ribbon backing or a reinforcement of steel wires to provide sufficient rolling pressure to the strand **11**. This pressure may also be supplied by backing rolls **47—47** (FIG. **5**) or smooth surfaced backing plates, not shown.

In FIG. **3** I have illustrated an intaglio marking apparatus where belts **48, 49** are steel and marking areas **51-51** are etched into the surfaces of the belt **49** to hold a suitable gravure type ink.

Offset printing in accordance with my invention is exemplified by the apparatus of FIG. **5** where the ink is transferred to a rubber belt **52** from a transfer roll **53** which is wetted in the known lithographic manner by the rolls **54** from a water tank **56** and inked by the rolls **57** from an ink supply tank **58**.

We have so far considered the use of my apparatus to apply circular stripes, in which case, the printing areas are normal to the strand axis. My apparatus has particular application, however, for printing helical stripes and this may be accomplished merely by sloping the printing areas relative to the strand as illustrated in FIG. **4** where a series of regularly spaced printing areas in the form of stripes **59—59** on a belt **61** make an angle β with the axis of a strand **62**. Since the belt, as before, forms an angle α with the strand **62** the angle made by the stripes **59** to the edge of the belt **61** will equal $\beta-\alpha$. In order that the marking form a continuous helix around the strand **62** the distance *d* normal to the strand, between stripes should equal πD where D represents the strand diameter. Instead of the right hand helix shown in FIG. **4** a left hand helix may be marked by sloping the printing stripes in the opposite direction and a pattern of crossing helices or other marking may, of course, be printed by my apparatus.

The structure of FIG. **6** will permit the application of different colored stripes when only one of the belts is used for printing. Here a lower belt **63** with raised stripes **64** has some of the printing areas of the stripes coated with one color ink **66** from a half cylinder roll **67** and other areas coated with an ink **68** from a half cylinder roll **69**. Multiple colors can also be applied by passing a strand through more than one of the apparatus **10** in tandem, each supplied with a different ink, and having the belts synchronized to avoid overlapping of the markings. The use of two belt printers of my invention in tandem, each supplied with a different ink, has an important advantage even when only one color code is applied to any single wire, for it permits a change in the color code without interrupting the manufacturing operation. To change colors in this method the upper belt assembly of one apparatus is lifted at the same time that the other is lowered.

In my method of making a coded cable, conductors **71, 72** (FIG. **7**) are paid from mounted reels **73, 74** past guide sheaves **77, 78** into an extrusion machine **79** where both the conductors are covered with polymeric insulation of the same color and composition to emerge as insulated conductor strands **81, 82**. From the extrusion machine the strands **81, 82** pass through a cooling trough **83** in the customary manner whereafter the strand **81** passes through a double belt marking apparatus **84** of the type hereinabove described wherein the strand **81** is temporarily twisted and marked with the desired coding. From the apparatus **84** the strand **81**, along with the strand **82**, is twinned to form a cable **86** in the form of a twisted pair in a strander **87**. The strander **87** comprises a takeup reel **88**, capstan **89** and guide sheaves **91-94**.

Stranders of the type described are commercially available and other suitable stranders are also known that can be used in the practice of my invention.

Marking of the strand **81** by the apparatus **84** will suffice to distinguish the members of the pair **86** from each other. Where further coding is desired, distinguishing marking can be applied to the strand **82** by an apparatus **96** similar to the apparatus **84**. Where it is desired to change the coding without interrupting the extrusion and stranding operations I have provided additional marking apparatus units **97, 98** which can be brought into operation when the units **81, 82** are deactivated, without interruption of the manufacturing process, as shown in FIG. **8**.

I have invented a new and useful apparatus and method of which the foregoing descriptions have been exemplary rather than definitive and for which I desire an award of Letters Patent as defined in the appended claims.

I claim:

1. Apparatus for marking continuously advancing strand comprising:

A. a first endless belt having a surface adjacent to said strand, said surface advancing in a line having a first component with the same speed and direction as said strand and a second component with a direction transverse of said strand,

B. a second endless belt having a surface facing said surface of said first belt and advancing in a line having one component with the same speed and direction as said strand and another component transverse of said strand in a direction opposite to the direction of said second component,

C. printing areas on the surface of at least one of said belts engaging said strand,

D. means applying marking composition to said areas, and

E. means guiding said strand between said belts whereby said strand is rotated by the belt friction in said transverse components and urged to roll over said printing areas and be marked thereby.

2. The apparatus of claim 1 wherein said strand is rolled substantially 360°.

3. The apparatus of claim 2 wherein said areas are straight-edged and normal to the line of advance of said strand thereby marking circular stripes on said strand.

4. The apparatus of claim 2 wherein said areas are straight-edged and oblique to the line of advance of said strand thereby producing a helical stripe on said strand.

5. The apparatus of claim 1 wherein said printing areas are raised.

6. The apparatus of claim 1 wherein said printing areas are intaglio.

7. The apparatus of claim 1 wherein said areas are offset.

8. The apparatus of claim 1 wherein both of said belts comprise printing areas.

9. An apparatus of claim 8 wherein a different color is applied to each of said belts.

10. An apparatus of claim 1 comprising means applying different color compositions to different of said areas.

11. The method of marking a continuously advancing strand of indefinite length comprising the steps of:

A. continuously paying-off and taking-up said strand, along an angularly fixed axis,

B. bringing the surface of said strand in contact with a plurality of printing areas advancing with said strand,

C. seizing said strand at said areas,

D. twisting said strand around its own axis so as to roll said surface through a large angle upon said areas, thereby marking said strand for a substantial length around the circumference thereof, and

E. releasing said strand.

12. The method of claim 11 wherein said angle approximates 360°.

13. The method of making a coded cable comprising the steps of:

A. paying an electrical conductor into an extrusion machine,

B. extruding a wall of polymeric insulation over said conductor in said machine,

C. passing the insulated conductor advancing from said machine between a pair of endless belts and thereby twisting said conductor and rolling it over printing areas on at least one of said belts,

D. passing the printed conductor advancing from said belts into a stranding machine along with at least one other insulated conductor and twisting said conductors into a cable.

14. The method of claim 13 wherein both of said conductors is concurrently insulated in a single extrusion machine.

15. The apparatus of claim 2 wherein said printing areas are raised.

16. The apparatus of claim 3 wherein said printing areas are raised.

17. The apparatus of claim 4 wherein said printing areas are raised.

18. The apparatus of claim 2 wherein said printing areas are intaglio.

19. The apparatus of claim 3 wherein said printing areas are intaglio.

20. The apparatus of claim 4 wherein said printing areas are intaglio.

21. The apparatus of claim 2 wherein said areas are offset.

22. The apparatus of claim 3 wherein said areas are offset.

23. The apparatus of claim 4 wherein said areas are offset.

24. The apparatus of claim 2 wherein both of said belts comprise printing areas.

25. The apparatus of claim 3 wherein both of said belts comprise printing areas.

26. The apparatus of claim 4 wherein both of said belts comprise printing areas.

27. An apparatus of claim 2 comprising means applying different color compositions to different of said areas.

28. An apparatus of claim 3 comprising means applying different color compositions to different of said areas.

29. An apparatus of claim 4 comprising means applying different color compositions to different of said areas.

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