(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 136 040**
**A2**

# (12) EUROPEAN PATENT APPLICATION

(21) Application number: **84305602.9**

(22) Date of filing: **17.08.84**

(51) Int. Cl.⁴: **H 01 B 11/00**

(30) Priority: **31.08.83 US 527998**

(43) Date of publication of application: **03.04.85 Bulletin 85/14**

(84) Designated Contracting States: **DE FR GB IT SE**

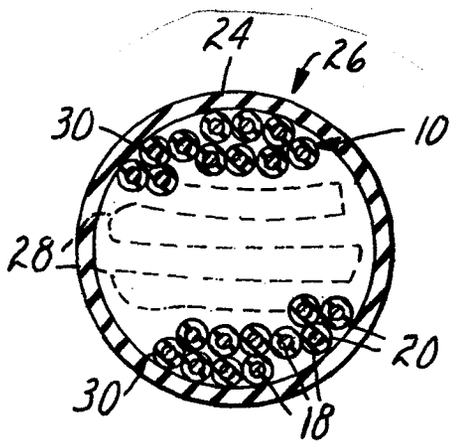
(71) Applicant: **MINNESOTA MINING AND MANUFACTURING COMPANY, 3M Center, P.O. Box 33427, St. Paul, MN 55133 (US)**

(72) Inventor: **Da Costa Limao Gatta, Jose Antonio c/o MINNESOTA, MINING AND MANUFACTURING COMPANY 2501 Hudson Road, P.O. Box 33427 St. Paul Minnesota 55133 (US)**

(74) Representative: **Baillie, Iain Cameron, c/o Ladas & Parry Isartorplatz 5, D-8000 München 2 (DE)**

## (54) Round jacketed electrical cable.

(57) A round jacketed electrical cable (26) having a plurality of longitudinally extending conductors (18) with insulation (20) encasing each of the conductors (18). The conductors (18) have bonded longitudinal portions (14) forming a unitary ribbon cable (10) and having separated longitudinal portions (16) in which the insulation (20) of the conductors (18) are laterally separate. The insulation (20) in the bonded longitudinally portions (14) form lateral alignment grooves (22). The ribbon cable (10) in the bonded longitudinal portions (14) is folded over onto itself forming a plurality of pleats (28, 30). A jacket (24) surrounds the insulation (20). An electrical cable (26) is formed which has physical characteristics of being round and flexible as well as being mass terminable.

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# ROUND JACKETED ELECTRICAL CABLE

## Technical Field

The present invention relates generally to electrical cable and more particularly to round jacketed electrical cable, particularly with facility for mass termination.

## Background Art

Electrical cable is utilized to interconnect telecommunication equipments in order to complete a data or voice link. Examples of these equipments include telephones, computers, data storage units, facsimile devices and combinations of these equipments. Typically a "round jacketed" cable has been used for this purpose. A round jacketed cable presents advantages in terms of ease of routing, reduced space required, and mechanical flexibility in all directions. These round jacketed cables are usually composed of individual wires or separate twisted wire pairs which must be individually terminated. Individual termination of these conductors is a very time consuming process.

Flat or "ribbon" type cable has also been utilized in the telecommunications field. In a ribbon cable a plurality of insulated conductors are joined together in a known spaced relationship in a single plane. An example of this type of ribbon cable is Scotchflex 3365 cable, manufactured by Minnesota Mining and Manufacturing Company, Saint Paul, Minnesota. Ribbon cable offers the ability to mass terminate the cable using insulation displacement connectors as well as offering a large number of conductors in a small space.

Some markets, however, continue to require a round jacketed cable and thus ribbon cable, and its attendant mass terminability advantages, has been unavailable for this use.

There does exist a cable which combines the mass terminability aspects of ribbon cable with the geometric advantages of a round jacketed cable. This cable is marketed under the tradename "Okiflex" by Oki Electric Cable Company, Ltd. This cable consists of a ribbon cable which has been spirally wrapped to form a generally circular cross-section and then jacketed to form a round jacketed cable. While this cable can be mass terminated, a substantial amount of jacketed material must be stripped back from the termination point in order for the ribbon cable to be "unwound" from the spiral and to lay reasonably flat for mass termination.

Disclosure of Invention

The present invention provides a round jacketed electrical cable having a plurality of longitudinally extending conductors with insulation encasing each of the conductors. The conductors have bonded longitudinal portions in which the insulation of the conductors are bonded together forming a unitary ribbon cable and has separated longitudinal portions in which the insulation of the conductors are laterally separate. The insulation in the bonded longitudinal portions form lateral alignment grooves. The ribbon cable in the bonded longitudinal portions is folded over onto itself forming a plurality of pleats. A jacket surrounds the pleated ribbon cable forming an electrical cable which has physical characteristics of being round and flexible as well as being mass terminable. In a preferred embodiment, the conductors are of uniform cross-sectional area. In a preferred embodiment, the bonded longitudinal portions are equally spaced and lie in a single plane. In a preferred embodiment, the plurality of pleats are wider at the center of the ribbon cable than at the edges of the ribbon cable. In a preferred embodiment, an electrical conductor is interposed between the pleated ribbon cable and the jacket

forming a shielded round jacketed mass terminable electrical cable.

The folding of the ribbon cable into pleats offers a distinct advantage in use over the spirally wrapped "Okiflex" cable. The amount of (length of) jacket which must be stripped back from the termination point is much less for the cable of the present invention than the spirally wrapped cable. In fact, it is estimated that only one-half of unjacketed cable from the termination point is required to be stripped as compared to a spirally wrapped round jacketed ribbon cable. Further, the cross-sectional area of the spirally wrapped cable is generally larger than the cable of the present invention because the spirally wrapped cable is loosely wrapped to account for termination stripping length. If wound as tightly, the spirally wrapped cable would have an even greater termination stripping length. The cable of the present invention is one which can be made flexible in all directions in a shorter distance from the termination point, allows a much neater appearance and is less susceptible to damage from external objects while still providing all of the advantages of a round jacketed ribbon cable.

The individual conductors of the ribbon cable are slit apart periodically, or joined periodically, depending upon your perspective, within the cable. The periodicity of bonded longitudinal portions with separated longitudinal portions provides mass terminability at closely spaced portions of cable where the individual conductors are not separated, and aids in maintaining cable flexibility.

Brief Description of Drawings

The foregoing advantages, construction and operation of the present invention will become more readily apparent from the following description and accompanying drawings in which:

FIGURE 1 illustrates the ribbon cable utilized in the present invention;

FIGURE 2 is a cross section of the ribbon cable of Figure 1, taken along Section Line 2-2;

FIGURE 3 is a cross-section of the ribbon cable of Figure 1 taken along Section Line 3-3;

FIGURE 4 is an end view of the round jacketed cable of the present invention;

FIGURE 5 is an end view of an alternative embodiment of a round jacketed cable of the present invention; and

FIGURE 6 is an isometric view of a round jacketed cable of the present invention being unfolded in preparation for termination.

Detailed Description

Figure 1 illustrates a ribbon cable 10 from which the rounded jacketed electrical cable of the present invention may be constructed. The ribbon cable 10 comprises a plurality of insulation encased conductors 12 with a known transverse spaced relationship lying in a single plane. The ribbon cable 10 has periodic bonded longitudinal portions 14 interspersed with separated longitudinal portions 16. In the bonded longitudinal portions 14 the insulation encased conductors 12 maintain their transversely fixed spaced relationship through the bonding of the insulation encased conductors 12 to each other. In the bonded longitudinal portions 14 the ribbon cable 10 acts and looks like a standard ribbon cable such as Scotchflex 3365 cable, manufactured by Minnesota Mining and Manufacturing Company, Saint Paul, Minnesota. In the bonded longitudinal portions 14 the ribbon cable 10 may be easily mass terminated using standard available insulation displacement connectors (not shown). In a preferred embodiment, each bonded longitudinal portion 14 is at least as long as the length required to connect to the insulation displacement connector being utilized. In an example of a standard commercially available insulation displacement connector, a termination area of two-thirds of one inch

(16.9 millimeters) is required. Thus in a preferred embodiment, each of the bonded longitudinal portions 14 are at least two-thirds of one inch long (16.9 millimeters) enabling a mass termination at each bonded longitudinal portion 14.

In each separated longitudinal portion 16 some or all of the insulation encased conductors 12 are separated from each other. Such separation is done to enable the completed round jacketed electrical cable to be more flexible when the ribbon cable 10 is subsequently pleated and encased in a jacket. The separated longitudinal portions 16 can be achieved either by separating an already joined ribbon cable 10 as in the case of slitting insulation encased conductors in the Scotchflex 3365 cable, or by bonding, either by use of an adhesive or by thermal bonding, separate insulation encased conductors 12 to form the bonded longitudinal portions 14. In an alternative embodiment, the bonded longitudinal portions 14 and separated longitudinal portions 16 are formed by taking separate insulation encased conductors 12 and utilizing a separate support structure to form the bonded longitudinal section 14. In a preferred embodiment, the conductors contained within each insulation encased conductor 12 are of uniform cross-sectional area. Typically such conductors are in the range of from 24 AWG to 30 AWG. A typical material which can be utilized for the insulation covering the insulation encased conductors 12 is polyvinylchloride. The bonded longitudinal portions 14 contain longitudinal grooves providing lateral alignment which enable the insulation displacement connectors to be aligned with each individual insulation encased conductor 12 in order to properly mass terminate the ribbon cable 10.

Figure 2 shows a cross-section of a ribbon cable 10 of Figure 1 taken along Section Line 2-2. Each insulation encased conductor 12 contains a conductor 18 surrounded by insulation 20. Notice that in Figure 2, which is a cross-section taken across a bonded longitudinal

portion 14, that all of the insulation encased conductors 12 are held together in a transversely fixed spaced relationship enabling easy mass termination. Also note that the insulation 20 encasing conductors 18 form a plurality of ridges over the conductors 18, creating a plurality of alignment grooves 22 to enable easy alignment of the insulation displacement connectors.

Figure 3 is a cross-section of the same ribbon cable 10 taken along a Section Line 3-3 during a separated longitudinal portion 16. In Figure 3 a plurality of conductors 18 are encased in insulation 20. However, in each separated longitudinal portion 16 some or all of the insulation encased conductors 12 are separated from their adjacent counterpart.

Figure 4 illustrates the ribbon cable 10 of Figure 1 which has been pleated and covered with a jacket 24 to form a round jacketed electrical cable 26 of the present invention. The ribbon cable 10 has been pleated by folding the ribbon cable 10 back and forth upon itself as illustrated in Figure 4 to form a compact structure of approximately circular cross-section. The pleated ribbon cable 10 is then covered by jacket 24 maintaining the circular cross-section. An example of a material suitable for use as a jacket 24 is polyvinylchloride, polyethylene or Teflon (a registered Trademark of DuPont). In a preferred embodiment polyvinylchloride is preferred as material for jacket 24. In a preferred embodiment, the interior pleats 28 are wider than the edge pleats 30. The variation in widths of the interior pleats 28 and edge pleats 30 enable the pleated ribbon cable 10 to more closely resemble a circular cross-section.

The round jacketed electrical cable 26 illustrated in Figure 5 also contains a pleated ribbon cable 10 to form a circular cross-section and is also encased within a jacket 24. Again, interior pleats 28 are preferred to be wider than edge pleats 30 to enable a more complete circular cross-section. In addition, the round

jacketed electrical cable 26 of Figure 5 contains a conductive shield 32 interposed between the pleated ribbon cable 10 and jacket 24. With the use of a suitable conductive shield 32, a round jacketed mass terminable electrical cable can be constructed which is also shielded and flexible.

Figure 6 illustrates the round jacketed electrical cable 26 being unfolded to enable the ribbon cable 10 to be mass terminated. As can be seen, ribbon cable 10 has been pleated and contained within jacket 24. Jacket 24 has been stripped away from the end of the round jacketed electrical cable 26 so that ribbon cable 10 may be unfolded to conform to a single plane so that the ribbon cable 10 could be mass terminated using standard available insulation displacement connectors. The amount of jacket 24 which must be stripped from the end of the round jacketed electrical cable 26 depends upon the manner in which the ribbon cable 10 is folded within jacket 24. Prior art cables have utilized a spiral wrap in which the ribbon cable 10 is rolled up to form a circular cross-section. In order to unwind such a spirally wound cable, the jacket must be stripped back a sufficient distance to enable the innermost edge insulation-encased conductor to unwind and lie flat in a plane with the other insulation encased conductors. Figure 6 illustrates that with the pleating of the ribbon cable 10 in the round jacketed electrical ribbon cable 26 of the present invention that only half as much jacket 24 need to be stripped back to enable the ribbon cable 10 to lie flat. In the pleating arrangement of the present invention the edge insulation encased conductors 12 lie at the outer extremities of the folded ribbon cable 10. As the unfolding occurs the cable can be unfolded from both sides of the ribbon cable 10 at once, enabling the ribbon cable 10 of the present invention to lie flat in half or less of the longitudinal space required in prior art spirally wound cables.

Thus, there has been shown and described a novel round jacketed electrical cable. It is to be understood, however, that various changes, improvements, and modifications in the present invention can be made by those skilled in the art without departing from the scope of the present invention.

Claims:

1. A round jacketed electrical cable, comprising:

a plurality of longitudinally extending conductors;

insulation encasing each of said conductors;

said conductors having bonded longitudinal portions in which said insulation of said conductors are bonded together forming a unitary ribbon cable, and having separated longitudinal portions in which said insulation of said conductors are laterally separate;

said insulation in said bonded longitudinal portions forming lateral alignment grooves;

said ribbon cable in said bonded longitudinal portions forming lateral alignment grooves;

said ribbon cable in said bonded longitudinal portions being folded over onto itself forming a plurality of pleats; and

a jacket surrounding said insulation;

whereby an electrical cable is formed which has physical characteristics of being round and flexible as well as being mass terminable.

2. A round jacketed electrical cable as in claim 1 wherein said plurality of pleats are wider at the center of said ribbon cable than at the edges of said ribbon cable.

3. A round jacketed electrical cable as in claim 2 wherein said conductors are of uniform cross-sectional area.

4. A round jacketed electrical cable as in claim 3 wherein said conductors within said bonded longitudinal portions are equally spaced and lie in a single plane.

5. A round jacketed electrical cable as in claim 1 further comprising an electrical conductor interposed between said insulation and said jacket.

6. A round jacketed electrical cable as in claim 1 wherein each of said bonded longitudinal portions are at least two-thirds of one inch (1.69 centimeters) long.

7. A round jacketed electrical cable as in claim 6 wherein said bonded longitudinal portions occur approximately every one to two feet (30.5 to 61.0 centimeters) along the longitudinal length of said round jacketed electrical cable.

8. A round jacketed electrical cable as in claim 6 wherein said bonded longitudinal portions occur approximately every four to six inches (10.16 to 15.24 centimeters) along the longitudinal length of said round jacketed electrical cable.

9. A round jacketed electrical cable as in claim 1 wherein some but not all of said insulation of said conductors are bonded together in said separate longitudinal portions.

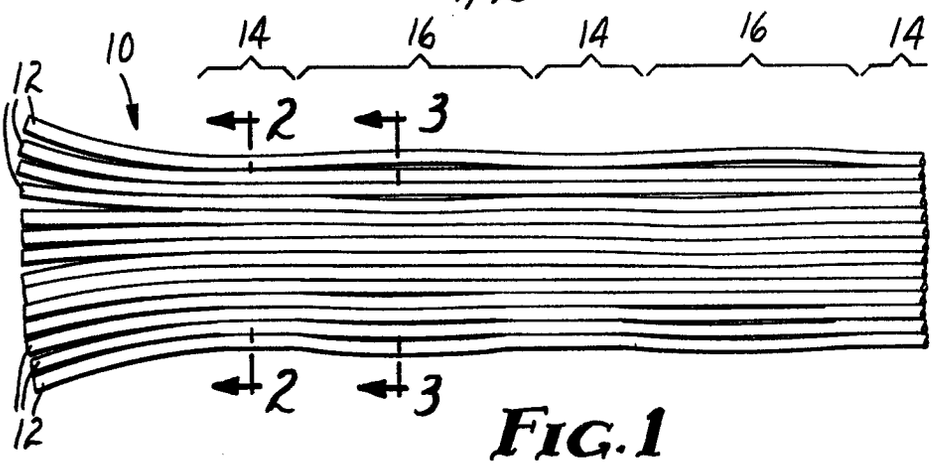


FIG. 1

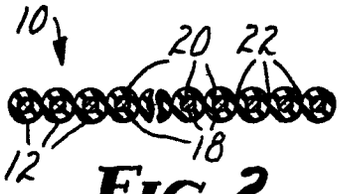


FIG. 2

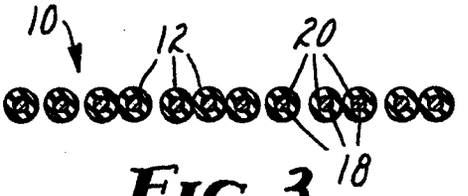


FIG. 3

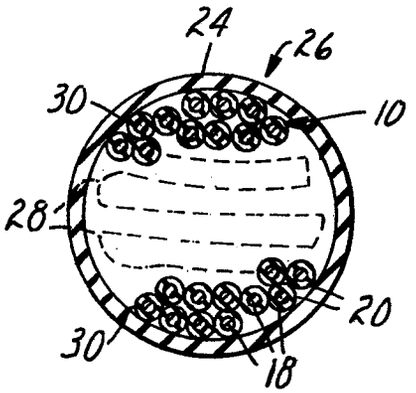


FIG. 4

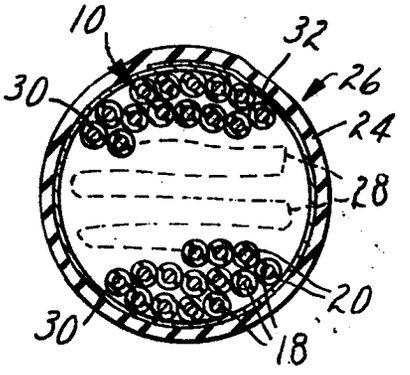


FIG. 5

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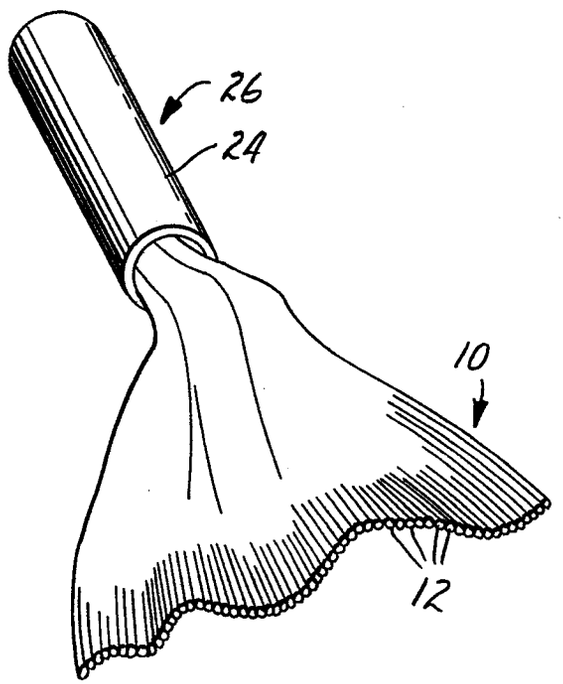


FIG. 6