MASS BONDING OF TWISTED PAIR CABLES

Inventor: Albert Malcolm Wittenberg, Short Hills, N.J.

Assignee: Bell Telephone Laboratories, Incorporated, Murray Hill, N.J.

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References Cited

UNITED STATES PATENTS

1,475,139 11/1923 Pearson

Primary Examiner—E. A. Goldberg
Attorney—R. J. Guenther, Edwin B. Cane et al.

ABSTRACT

A tape cable structure includes several sets of twisted wire pairs which are laminated so that the twist points are in a fixed phase relation with each other. In one embodiment, even twist length ratios between the adjacent twisted pairs are used. The relationship between the twist points can be adjusted to permit mass termination of the cable. When severed as by a heat knife along a transverse section of the tape at which the twists of all pairs are in phase, the two tape sections are drawn apart to expose substantially parallel bare wires ready for connection.

5 Claims, 3 Drawing Figures
MASS BONDING OF TWISTED PAIR CABLES

FIELD OF THE INVENTION

This invention relates to laminated tape cable and more specifically to the mass terminating of such cables in which pairs of wires are twisted.

BACKGROUND OF THE INVENTION

Laminated tape cable is finding increasing usage in the wiring of medium and large scale electronic equipment such as in the back plane of computer hardware, in electronic telephone central offices, and in electronic PBXs. A significant cost-saving is realized by using laminated tape cable versus stringing individual conductors, because mass termination techniques may be employed with the tape cable.

Mass terminating, however, with its attendant cost advantages occurs only for tape cable in which the wires are essentially straight and parallel to one another. In this type structure, the positions of the conductors are fixed for the entire length of the cable. Yet, in many instances, it is desirable that the wire pairs of a tape cable be twisted. For this configuration, mass terminating techniques have not been available for want of a structure that is readily skinnable and also that duplicates the advantages of conductor parallelism found in the usual tape cable.

Accordingly, the following are objects of the invention:

- To devise a structure of laminated twisted pair cable that is amenable to mass bonding;
- To avoid having to individually strip, sort, and then bond wires of a laminated twisted pair cable; and
- To realize the advantages both of twisted pairs and laminated tape cable in a single structure without accruing a cost penalty.

SUMMARY OF THE INVENTION

The above and other objects are achieved pursuant to the invention by a tape cable structure in which several sets of twisted wire pairs are laminated in a thermoplastic material so that the twist points are in a fixed phase relation with each other. In one embodiment even twist length ratios between the adjacent twisted pairs, such as 2:4:8 are used. In general, twist lengths are selected so that, from an initial in-phase position at a first cable cross section, there will occur at periodic intervals the same in-phase relationship between the conductors.

Pursuant to one aspect of the invention, the plastic laminate sheet is provided with edge notches at the point where all pairs are in phase. For pairs having a 2:4:8 relationship, the notches may alternate between, for example, a square and a triangular geometry. This facilitates identification of points where a wire in each pair, say the "tip" wire of a tip and scale pair, is in phase with every other tip wire; or where one tip wire is exactly out of phase with the others.

Pursuant to a primary aspect of the invention, stripping is accomplished by first terminating the cable to its desired length and then severing the plastic laminating material and the wire insulation so that the necessary amount of bare wire will be eventually exposed to make the electrical connections. The lamina and insulation are cut along a cross section corresponding to a point where all twist-pair loops are at their maximum separation in the plane of the cable. This is readily achieved, for example, with a hot-knife stripper. Then, the two severed sections of lamina with the insulation still imbedded in each are separated by sliding the short end off the wire. The wires, although of different twist lengths, straighten out because of their initial parallelism at the stripping point due to their in-phase relationship. The wires then can be laid onto terminals or connector blocks and bonded in a relatively simple operation as done for laminated tape cable.

The invention and its further objects, features, and advantages will be made more readily apparent by a reading of the following detailed description of illustrative embodiments and by reference to the drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a schematic perspective diagram of a laminated twisted pair cable embodying the invention;

FIG. 2 is a side schematic view showing the tape cable of FIG. 1 being prepared by hot-knife techniques for bonding; and

FIG. 3 is a schematic perspective diagram showing placement of the prepared twisted pair cable upon an exemplary terminal block.

DETAILED DESCRIPTION OF AN ILLUSTRATIVE EMBODIMENT

As seen in FIG. 1, the laminated twisted pair cable of the present invention designated generally as 10 consists of plastic insulated conductor pairs 11, 12, 13, 14 which have respectively twist lengths that shall be denoted A, B, C, D respectively, where twist length D may equal twist length A as suggested in FIG. 1. The conductor insulation alternatively can be lacquer. The gauge of the wires advantageously is 19 gauge or above. The tape medium consists of lamination layers 15, 16 which are made of polyvinyl chloride, for example, or some equivalent thermoplastic material whose properties are that it can maintain the position of the wires while the insulation is removed, and that it be readily stripped by some means, such as a hot knife.

The laminate method is conventional except that the pair twists may be controlled during the laminating process by methods and apparatus such as described, for example, in the U.S. Pat. No. 3,579,823 of T. J. Gressitt issued May 25, 1971, and assigned to applicant's assignee which to the extent relevant is hereby incorporated by reference.

An alternative structure for the tape medium is a single layer such as layer 15, to which the conductors are suitably adhered or attached.

The structure of the present invention calls for laminating the wire pairs 11–14 with different twist lengths whose ratios with respect to one another are chosen so that at relatively closely spaced intervals in an in-phase relationship between the wires will occur. More particularly the in-phase relationship is at a point where, for each of the conductor pairs 11–14, there periodically exists the maximum separation between the conductors of each given pair at the same point in the plane of the cable. These "in-phase" points occur in the structure shown in FIG. 1 at cross sections of the cable 10 that are designated 17, 18, 19 respectively. Point 18 is where one cable is 180° out of phase with the other three pairs. The cable is terminated at point 17.

Advantageously, to help identify the tip and ring sense of the twisted pair having the longest twist length—which in the illustration FIG. 1 is pair 13—it is de-
sirable to provide edge notches having alternating shapes. Thus, the square-shaped edge notches 20 designate a cross section at which the tip conductor of pair 13 is in the “up” position; and the triangular notch 21 denotes a cross section at which the ring conductor of pair 13 is in the “up” position. This arrangement aids an installer in identifying tip and ring wires, not only of pair 13 but also of the other pairs in the cable preparatory to mass bonding.

FIG. 2 illustrates a hot knife 22 with opposing jaws 23, 24 that advantageously are mounted as opposite sides of a conventional noted hand tool, not shown. The jaws 23, 24 are positioned with respect to one of the two types of edge notches, heat is applied through the jaws, and the underlying plastic lamina as well as the plastic insulation of the conductor pairs 11–14 are parted.

Then, pursuant to the invention, the cable portions to either side of the part line are drawn apart manually in opposite directions as indicated by arrow 25, creating a gap 26 between the two sides. In this process, the wires of the conductor pairs 11–14 assume parallelism over the gap 26 width, by virtue of their initial orientation at the critical cross section.

The cable 10 is now ready to be applied to a terminal block 27 shown in FIG. 3. It is obvious that the two sides of cable 10 can be separated prior to this operation and the side which is to form no part of the connection simply discarded. It is possible to make twisted pairs insulated with a thin lacquer. The twists are usually very tight, but can nevertheless be spread at certain points where stripping would take place. Alternatively there could be provided a periodic straight section. It is seen that these cases are served also by the present invention.

In preferred inventive embodiments, the plastic laminating material must be sufficiently strong to resist the tendency of the conductors in each pair to close-in on each other as the gap 26 is opened. Furthermore, the plastic laminating material advantageously must adhere strongly to the wire insulation, but the wire insulation, in turn, should have less adhering strength with respect to the wires. It has been found that good results pursuant to the teachings of the present invention are obtained, with polyvinyl chloride insulated wires and with thin polyvinyl chloride sheets. Other arrangements are of course readily envisionable within the inventive teaching.

Various specific twist length ratios will occur to practitioners skilled in the art. As a general rule, the twist length design should be guided by the need to minimize electrical interaction (crosstalk) between nearby wire pairs.

It is to be understood that the embodiments described herein are merely illustrative of the principles of the invention. Various modifications may be made thereto by persons skilled in the art without departing from the spirit and scope of the invention.

What is claimed is:

1. A tape cable comprising:
   a longitudinally continuous insulative compliant tape medium;
   a plurality of plastic insulated conductor pairs attached along generally parallel paths to said medium, each pair having a predetermined different twist length, the twist lengths being selected to create at periodic transverse positions along said medium an in-phase relationship among all said twisted pairs;
   said medium being capable of being severed along any one of said transverse sections and the severed parts drawn apart with the tape medium and said plastic conductor insulation mutually adhering, thereby to expose a zone of bare wires spaced apart, substantially parallel and ready for connection.

2. A tape cable pursuant to claim 1 wherein said tape medium comprises first and second sheets laminated together with said plurality of pairs sandwiched therebetween.

3. A tape cable pursuant to claim 2 wherein said tape medium further comprises edge notches placed at the positions of said transverse sections for identification thereof;

4. The apparatus of claim 1 in combination with a connector element comprising a row of spaced upright metallic pins, the spaced-apart conductors of each said pair straddling a respective said pin.

5. A tape cable pursuant to claim 1, wherein said in-phase relationship is represented by a maximum mutual separation between the conductors of each pair occurring concurrently at said transverse positions.

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