United States Patent

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[54] **JACKET SEPARATOR FOR FLAT STRIP CABLE**
12 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **225/97,** 83/430, 83/500, 83/563, 83/925, 225/99, 225/103
[51] **Int. Cl.** **B26f 3/02,** B23d 19/06
[50] **Field of Search** ..... 225/97, 99, 103; 30/(Inquired); 83/500, 503, 675, 676, 925, 563, 564, 430

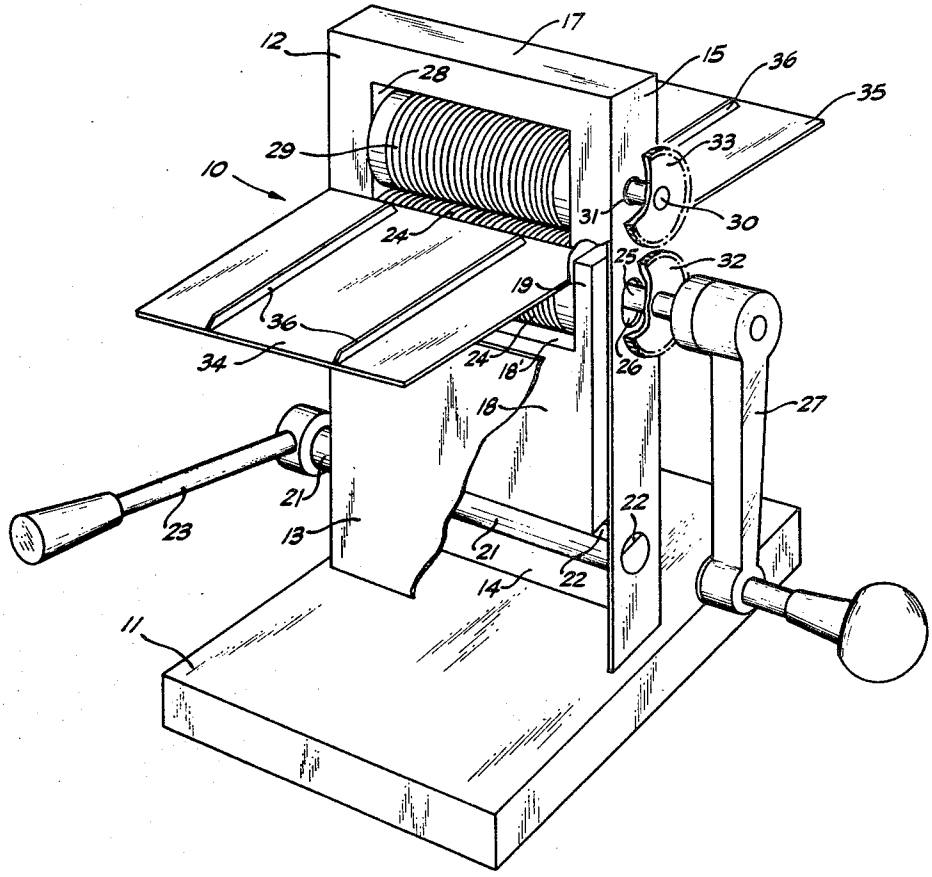
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ABSTRACT: A mechanism for separating the individual conductors of a flat strip cable comprising a pair of rollers, each of which has a plurality of radially extending annular teeth, the spacing between adjacent teeth on each roller being equal to twice the distance between adjacent conductors of the flat strip cable. The individual teeth have a concave outer end and the rollers are positioned in parallel spaced relationship so that the teeth on one roller are aligned with the spaces between the teeth on the other roller. A cam mechanism, operatively coupled to one of the rollers, is operative to separate the rollers so that the cable can be positioned therebetween and to bring the rollers together whereby the teeth thereon engage the cable. The teeth operate to urge alternate conductors in opposite directions thereby separating them. A crank mechanism, connected to one or both of the rollers, is operative, upon rotation, to simultaneously feed the cable out of the rollers and separate the conductors.



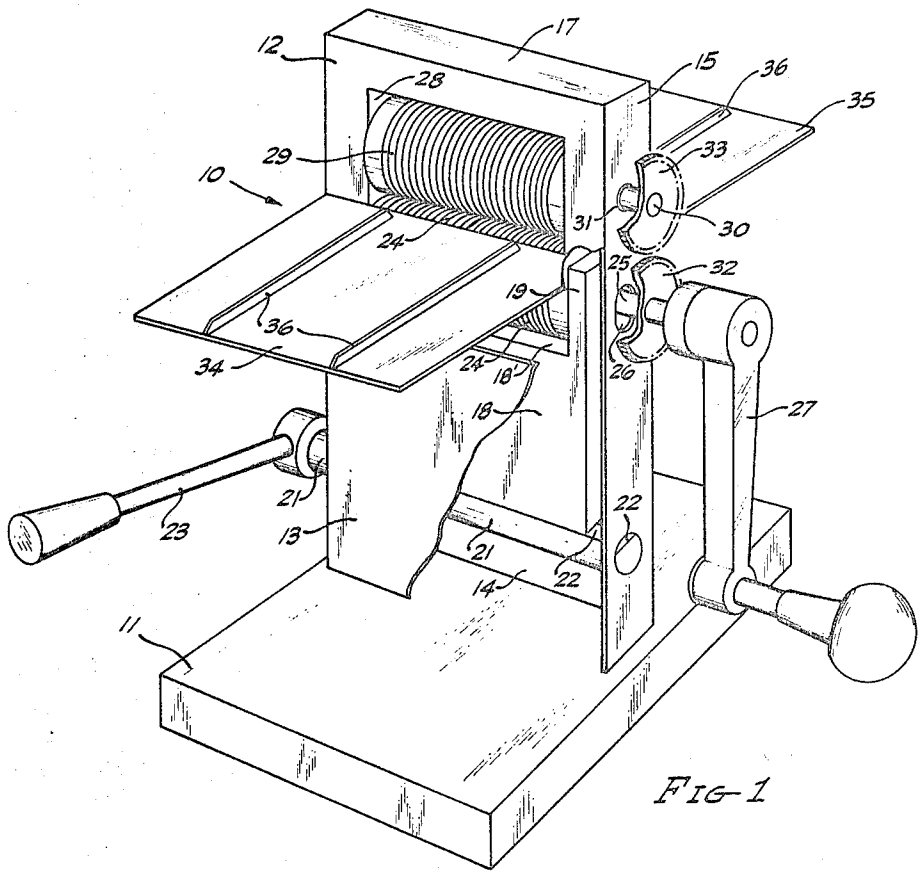


FIG-1

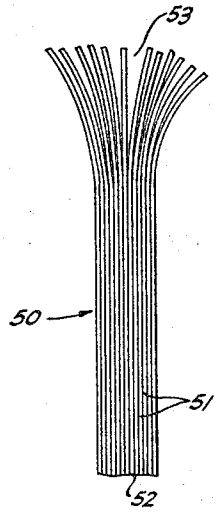


FIG-2

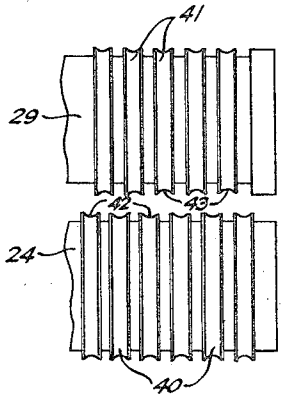


FIG-3

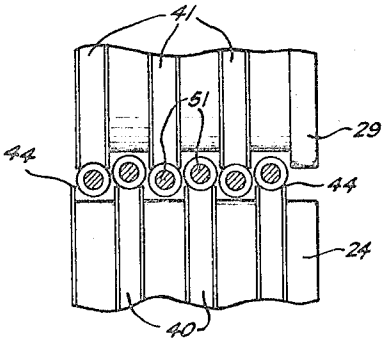


FIG-4

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JACKET SEPARATOR FOR FLAT STRIP CABLE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a jacket separator for flat strip cable and, more particularly, to apparatus for simply, quickly and simultaneously separating the individual electrically insulated conductors of a flat strip cable.

2. Description of the Prior Art

Insulated electrical conductors, which are widely used throughout most industries, have always been manufactured and supplied either in rolls of single conductors or in generally cylindrical cables consisting of a plurality of conductors electrically insulated from each other. Furthermore, whereas one of these two configurations has always been acceptable for substantially all uses, in some areas of advanced technology both configurations are unsuitable. For example, the electronics industry now extensively uses printed circuit boards and large scale, integrated, microelectronic circuits. The advantage of such circuits and circuit boards lies in the fact that large numbers of circuits can be contained in a very small space. Since a large number of circuits are present, multiple conductors are required. However, the cylindrical cables often take up more space than is available, whereas the large number of conductors required makes the use of single conductors unpractical.

To solve this problem, the electronics industry has developed flat strip cable which consists of a plurality of individual insulated conductors, the jackets of which are connected together side-by-side in a single plane. Such flat strip cable has the same advantage as the usual cylindrical cables, i.e. a large number of conductors are provided in a unitary structure, without the disadvantage of taking up a large amount of space. Because the cable is provided in flat strips and can be stacked one on top of the other, a large number of conductors can be positioned in a relatively small space.

Although such flat strip cable has substantially solved one of the problems of the electronics industry, it has created another. More specifically, since the jackets of the individual conductors of the flat strip cable are connected together, it is necessary to separate the individual conductors for a predetermined length at the end of the cable so that the individual conductors may be separately connected to different electrical terminals. While this may seem to be a simple matter, in practice it is not. When attempting to separate the individual conductors by hand, by grasping one of the conductors and pulling it away from the remainder, the jackets often tear. Since the tearing of a single conductor of a strip usually requires the discarding of the entire strip, even the remotest possibility of the tearing of the insulation on the cables is unacceptable. Therefore, the usual practice is to have a technician separate the jackets of the cable using a razor blade or other sharp instrument and carefully cutting the connection between individual conductors. However, while this method yields the desired result, it is evident that it is time consuming, costly and subject to mistake.

SUMMARY OF THE INVENTION

According to the present invention, these problems of the prior art are completely solved by providing apparatus for simply, efficiently and automatically separating the individual insulated conductors of a flat strip cable. The present invention operates to perform, in a matter of seconds, an operation which heretofore has taken a technician many minutes. Furthermore, the present apparatus is far more accurate and not as easily subject to damaging the conductors as was the case with previous hand methods.

Briefly, the present invention comprises a pair of generally cylindrical rollers, each of which has a plurality of radially extending annular teeth, the spacing between adjacent teeth on each roller being equal to twice the spacing between adjacent conductors of the flat strip cable. The individual teeth have a concave outer end, the radius of curvature of which is substantially equal to that of the outside surface of the individual conductors. The rollers are positioned in parallel, spaced relationship so that the teeth on one roller are aligned with the spaces between the teeth on the other roller and vice verse.

A cam mechanism, operatively coupled to one of the rollers, is operative to separate the rollers so that the cable can be positioned therebetween. The cam mechanism is then actuated to bring the rollers together whereby the teeth thereon engage the individual conductors. Since alternate conductors are contacted by teeth on opposite rollers, the teeth operate to urge alternate conductors in opposite directions thereby separating the conductors. A crank mechanism, connected to one or both of the rollers, is operative, upon rotation, to simultaneously feed the cable out of the rollers and separate the conductors.

It is, therefore, an object of the present invention to provide a novel jacket separator for flat strip cable.

It is a further object of the present invention to provide apparatus for simply, quickly, and simultaneously separating the individual electrical conductors of a flat strip cable.

It is a still further object of the present invention to provide apparatus comprising a pair of identical rollers having annular teeth, which rollers are positioned in parallel spaced relationship with the teeth on each being aligned with the spaces between the teeth on the other.

Still other object, features and attendant advantages of the present invention will become apparent to those skilled in the art from a reading of the following detailed description of the preferred embodiment constructed in accordance therewith, taken in conjunction with the accompanying drawings wherein like numerals designate like parts in the several FIGS. and wherein:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view, with certain portions partly broken away, of a jacket separator for flat strip cable constructed in accordance with the teachings of the present invention;

FIG. 2 is a plan view of a typical piece of flat strip cable;

FIG. 3 is a plan view of a portion of the rollers of the apparatus of FIG. 1, in the open position, showing the general relationship therebetween; and

FIG. 4 is an exploded view of a portion of the rollers of FIG. 3, in the closed position, showing the relationship between the rollers and the conductors.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings and, more particularly, to FIG. 1 thereof, the present jacket separator, generally designated 10, comprises a horizontally positioned base 11 and a hollow, generally rectangular, body 12 which is connected to and extends in a vertical direction from base 11. Body 12 comprises front and rear panels 13 and 14, respectively, side panels 15 and 16 (the latter not being shown in FIG. 1), and a top panel 17. Positioned within body 12, between panels 13—16, is a generally rectangular slide member 18 having a rectangular slot 18' in the upper end thereof to thereby form a pair of upwardly extending arms 19 and 20 (the latter not being shown in FIG. 1) on opposite sides of slide member 18. Slide member 18 is operative to reciprocate in a vertical direction under the control of a cam member 21 which may, most simply, consist of an elongated rod having a flattened surface 22. Rod 21 is connected to a handle 23 for rotation thereof. In the position shown in FIG. 1, with the bottom of slide member 18 in contact with surface 22 of rod 21, slide member 18 is in its lowermost position. However, rotation of arm 23 in a clockwise direction as viewed in FIG. 1 causes rotation of rod 21 and elevation of slide member 18 as the bottom thereof comes into contact with the cylindrical surface of rod 21.

Positioned between arms 19 and 20 in slot 18' at the upper end of slide member 18 and extending partially outwardly of front and rear panels 13 and 14 through generally rectangular openings 28 therein, is a first cylindrical roller 24 which is mounted on a shaft 25 which extends through cylindrical openings in arms 19 and 20 and through a pair of elongated slots 26 in side panels 15 and 16. Elongated slots 26 permit lateral motion of shaft 25 with roller 24 and slide member 18. In addition, one end of shaft 25 terminates in a crank mechanism 27 whereby rotation of crank mechanism 27 causes rotation of shaft 25 and roller 24.

A second roller 29, which is substantially identical to roller 24, is positioned in parallel spaced relationship relative thereto, directly above roller 24 between openings 28 in panels 13 and 14 and is mounted for rotation on a shaft 30 which extends through cylindrical openings 31 in each of side panels 15 and 16 whereby shaft 30 and roller 29 are prevented from moving in a lateral direction. A pair of substantially identical gears 32 and 33 are mounted on shafts 25 and 30, respectively, gears 32 and 33 engaging when shaft 25 and roller 24 are in their uppermost position.

Front and rear panels 13 and 14 have mounted thereon a pair of horizontally positioned platforms 34 and 35, respectively, the upper surfaces of which are approximately aligned with the outer extremity of roller 24 when in its lowermost position. Platforms 34 and 35 support a plurality of guide rails 36 whose function will become more apparent hereinafter.

Referring now more specifically to FIGS. 3 and 4, rollers 24 and 29 each include a plurality of radially extending, annular teeth 40 and 41, respectively, which are, in all material respects, identical. More specifically, each of teeth 40 and 41 has a generally rectangular cross section with the exception of a concave outer surface 42 and 43, respectively. Concave surfaces 42 and 43 may extend the entire width of teeth 40 and 41, respectively, but preferably terminate a short distance from the sides thereof to leave flattened surfaces 44 at the outer edges thereof to give added strength to such edges. Rollers 24 and 29 and teeth 40 and 41 are preferably made from a rigid or semirigid plastic such as Delrin, Celcon or Nylon but may also be made of a metal such as stainless steel or aluminum.

Referring briefly to FIG. 2, a typical piece of flat strip cable 50 consists of a plurality of insulated conductors 51, the jackets of which are normally connected together as at end 52 and which are to be separated along a predetermined length of cable 50 as at end 53. Therefore, and returning to FIGS. 3 and 4, the distance between adjacent teeth on each of rollers 24 and 29 is adjusted to be equal to twice the distance between adjacent conductors 51 of cable 50. In addition, rollers 24 and 29 are positioned relative to each other so that teeth 40 on roller 24 are aligned with the spaces between teeth 41 on roller 29 and teeth 41 on roller 29 are aligned with the aligned with the spaces between teeth 40 on roller 24. In this manner, the distance between the centerlines of adjacent teeth 40 and 41 is equal to the distance between the centerlines of adjacent conductors 51 of strip 50.

The radius of curvature of concave surfaces 42 and 43 on teeth 40 and 41, respectively, is approximately equal to or slightly greater than the radius of curvature of the outside surface of conductors 51. Although surfaces 44 may be eliminated and concave surfaces 42 and 43 may be semicylindrical and extend the entire width of teeth 40 and 41 so that there is no space between adjacent teeth 40 and 41, as a practical matter, the presence of flattened surfaces 44 and the inclusion of a slight space between adjacent teeth 40 and 41 require surfaces 42 and 43 to be less than semicylindrical.

In operation, when it is desired to separate the jackets of conductors 51, arm 23 is moved to the position shown in FIG. 1 where slide member 18 rests on surface 22 of cam mechanism 21 and roller 24 is in its lowermost position. In this position, as shown in FIG. 3, a sufficient space exists between teeth 40 and 41 for cable 50 to be inserted therebetween. Cable 50 is positioned on platform 34 between guide rails 36, and then inserted between rollers 24 and 29 onto platform 35 between guide rails 36. Cable 50 will be extended through rollers 24 and 29 by an amount equal to the length that conductors 51 are to be separated. After cable 50 is so positioned, handle 23 is rotated clockwise whereby cam mechanism 21 elevates slide member 18 and roller 24. When slide member 18 is completely seated on the curved surface of rod 21, teeth 40 and 41 of rollers 24 and 29 are positioned as shown in FIG. 4 where the extent of engagement of teeth 40 and 41 is just sufficient to separate conductors 51. Therefore, since alternate conductors 51 are contacted by teeth on opposite rollers, as teeth 40 and 41 come together, they are operative to urge alternate conductors 51 in opposite directions, as shown in FIG. 4, thereby separating conductors 51. Thereafter, rotation of crank mechanism 27 in a counterclockwise direction operates to simultaneously separate conductors 51 as they enter into the space between rollers 24 and 29 and feed cable 50 out of rollers 24 and 29.

As roller 24 is elevated to its uppermost position, gears 32 and 33 engage so that rotation of crank 27 rotates both rollers 24 and 29. By rotating both rollers, cable 50 is easily and automatically fed out of rollers 24 and 29. If gears 32 and 33 are omitted, pressure must be exerted on cable 50 as crank 27 is rotated so that the motion of cable 50 operates to rotate roller 29.

While the invention has been described with respect to a preferred physical embodiment constructed in accordance therewith, it will be apparent to those skilled in the art that various modifications and improvements may be made without departing from the scope and spirit of the invention. For example, it is evident that since the spacing between adjacent teeth 40 and 41 and the curvature of surfaces 42 and 43 are a function of the spacing between and size of conductors 51, a different set of rollers 24 and 29 must be provided for different gauges of wire. Therefore, either a separate mechanism 10 must be provided, with different size rollers, for each gauge of wire or rollers 24 and 29 may be made removable and interchangeable.

I claim:

1. Apparatus for separating the conductors of a flat strip cable comprising, in combination:

first and second substantially identical, generally cylindrical rollers, each of which has a plurality of radially extending annular teeth, only the central portion of the outer end of each of said teeth being concave, the curvature of said concave portion being approximately equal to the curvature of the surface of said conductors, the distance between adjacent teeth on each of said rollers being substantially equal to twice the distance between adjacent conductors of said cable, said rollers being positioned in parallel, spaced relationship with the teeth on one being aligned with the spaces between the teeth on the other; and

means operatively coupled to at least said second roller for moving said rollers laterally relative to each other.

2. The apparatus of claim 1 wherein said rollers are operative to reciprocate, relative to each other, between a first position wherein the teeth thereon are spaced by an amount sufficient to insert said cable therebetween and a second position wherein said teeth engage said conductors and urge adjacent conductors in opposite directions thereby tearing the connection between adjacent conductors.

3. The apparatus of claim 2 wherein said first roller is rotatably mounted on a first, fixed axis and wherein said second roller is rotatably mounted on a second, laterally moveable axis.

4. The apparatus of claim 3 wherein said means for moving said rollers comprises:

support means rotatably mounting said second roller on said second axis; and

cam means operatively contacting said support means for movement of said support means and said second roller between said first and second positions.

5. The apparatus of claim 4 further comprising:

means operatively coupled to at least one of said first and second rollers for rotation thereof to simultaneously separate said conductors as they are fed into said rollers and feed said cable out of said rollers.

6. The apparatus of claim 4 wherein said first roller is mounted on a first shaft, said second roller is mounted on a second shaft and further comprising:

first gear means connected to said first shaft;

second gear means connected to said second shaft, said first and second gear means engaging when said rollers are in said second position; and

means operatively coupled to one of said first and second shafts for rotating said one shaft and, through said first and second gear means, for rotating said second shaft whereby said rollers are simultaneously rotated.

7. The apparatus of claim 2 further comprising:

means operatively coupled to at least one of said first and second rollers for rotation thereof to simultaneously separate said conductors as they are fed into said rollers and feed said cable out of said rollers.

8. The apparatus of claim 2 wherein said first roller is mounted on a first shaft, said second roller is mounted on a second shaft and further comprising:

first gear means connected to said first shaft;

second gear means connected to said second shaft, said first and second gear means engaging when said rollers are in said second position; and

means operatively coupled to one of said first and second shafts for rotating said one shaft and, through said first and second gear means, for rotating said second shaft whereby said rollers are simultaneously rotated.

9. The apparatus of claim 1 wherein the outer end of each of said teeth, on either side of said concave central portion, is flat.

10. The apparatus of claim 9 wherein said rollers are operative to reciprocate, relative to each other, between a first position wherein the teeth thereon are spaced by an amount sufficient to insert said cable therebetween and a second position wherein said teeth engage said conductors and urge adjacent conductors in opposite directions thereby tearing the connection between adjacent conductors, said flat portion on either side of said concave central portion on each of said teeth preventing said teeth from cutting said conductors.

11. In combination:

first and second members, each of which has extending therefrom a plurality of parallel, annular teeth, a portion of the outer end of each of said teeth being concave, and a portion of the outer end of each of said teeth, on either side of said concave portion, being flat, the spacing between adjacent teeth on each of said members being at least as great as the width of said teeth, said members being positioned in parallel, spaced relationship with the teeth on one being aligned with the spaces between the teeth on the other; and

means operatively coupled to at least said second member for moving said members laterally relative to each other.

12. The combination of claim 11 wherein said members are operative to reciprocate, relative to each other, between a first position wherein the teeth thereon are spaced by an amount sufficient to insert a flat strip cable therebetween and a second position wherein said teeth engage the conductors of said flat strip cable and urge adjacent conductors in opposite directions thereby tearing the connection between adjacent conductors, said flat portion on said teeth preventing said teeth from cutting said conductors.