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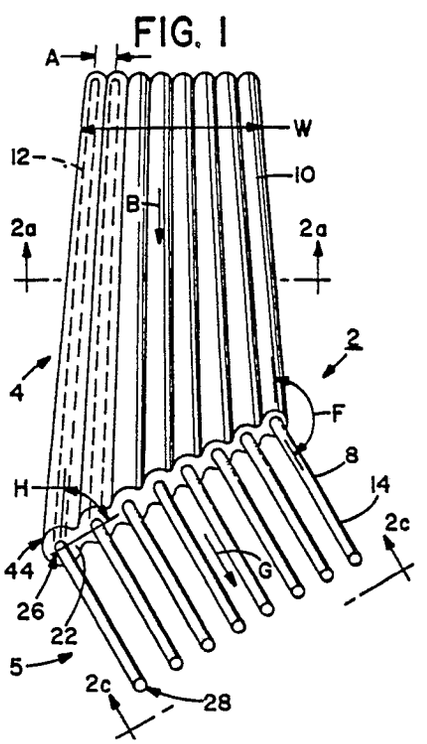
(54) Multi-conductor transmission cable having converted conductor pitch for termination and method for making the same.

(57) A multi-conductor flat cable (2) has a first linear pathway (B) with a first conductor pitch pattern (12) and a second linear pathway (G) with a second conductor pitch pattern (14). The second linear pathway (G) is formed by stripping the insulation (10) from a portion of the cable (2) along the diagonal path relative to the first linear pathway (B). The exposed conductors (8) are uniformly bent along a diagonal line to thereby trigonometrically increasing the conductor pitch along the second linear pathway (G).

FIG. 1



EP 0 297 297 A1

MULTI-CONDUCTOR TRANSMISSION CABLE HAVING CONVERTED CONDUCTOR PITCH FOR TERMINATION AND METHOD FOR MAKING THE SAME

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to multi-conductor flat cables and, more particularly, to a multi-conductor flat cable having a converted spacing between conductors and a method for making the same.

2. Prior Art

Multi-conductor flat cables or ribbon cables have been in use for a number of years as a means for electrical connection. The cables are generally connected to circuit boards and the like by means of mass termination connectors which make discrete individual contact with the conductors in the cable.

In recent years, the spacing between individual conductors in ribbon cables or conductor pitch has been varied for reasons of economy and design. The spacing between individual conductors has also been reduced in transmission line cables for maintaining impedance in the cable. In particular, conductor pitch has been decreasing primarily for reasons of utility and overall size of application. The spacing between conductors in cables has been reduced to the point of a development of a miniature multi-conductor flat cable having a conductor pitch as small as about 0.030 inch (thirty mils) or less. However, due to the varying sizes of conductor pitch in various cables and the varying sizes of terminal pitch in connectors, matching a cable with a pre-existing electrical connector or developing a new electrical connector having properly spaced terminals can be time consuming, economically inefficient and increase the cost of the electrical connection and the device in which the cable and connectors are used in.

In the past, several methods and devices have been used to allow a cable having a first conductor pitch to be connected to a connector having terminals with a different terminal pitch or spacing between terminals. One such device is described in U.S. Patent 4,614,028 by Rich. The device in Rich is a connector housing having a pitch change mass termination incorporated into the connector. The Rich patent also describes other various approaches for changing conductor pitch such as discrete wire termination, use of transitional interconnection members, multi-pitch fabricated conductor cable and connectors with spread pitch type terminals.

A problem arises in using presently available approaches for changing conductor pitch in ribbon cables in that specially fabricated connectors or interconnectors, such as paddle boards, must be used to terminate the cables.

A problem arises in using presently available approaches for changing conductor pitch in ribbon cables in that specially fabricated connectors and interconnectors unnecessarily increase the cost of terminating the cable.

A further problem arises in using presently available approaches for changing conductor pitch in ribbon cables in that no single approach is provided for changing the conductor pitch of a cable to accommodate different sizes of connectors.

A further problem arises in using presently available approaches for increasing the spacing between conductors in ribbon cables in that special connectors and interconnectors can only accommodate specific size cables.

A further problem arises in using presently available approaches for increasing the spacing between conductors in that new connectors which are fabricated to connect to relatively tightly spaced conductors must be manufactured with increasingly precise tolerances due to the relatively small scale of the cable.

A further problem arises in using presently available approaches for increasing conductor pitch in that relatively long lengths of cable or relatively long interconnection devices must be used to connect cables and connectors having different pitchs.

SUMMARY OF THE INVENTION

The foregoing problems are overcome and other advantages are provided by a multi-conductor flat cable having a converted conductor pitch and a method for making the same.

In accordance with one embodiment of the invention, a multi-conductor flat cable has a plurality of conductors which are generally encased and separated by a dielectric material along a first section of the cable. The conductors are generally orientated in the first section, such as in the manner in which the cable is manufactured, along a first linear pathway with a first conductor pitch. A

second section of the cable has the conductors exposed or stripped of insulation along a diagonal path relative to the first linear pathway with a diagonal edge of insulation being located proximate a junction between the first and second sections. The conductors have bent portions at the junction of the first and second sections of the cable such that the conductors in the second section of the cable are uniformly perpendicular to the diagonal edge and thereby form a second linear pathway. The second linear pathway is generally obliquely angled from the first linear pathway with the conductors retained in parallel relationship to one another. The exposed second linear pathway thereby has an enlarged spacing between conductors with a distance between adjacent conductors substantially equivalent to the distance between conductors measured along the diagonal edge of insulation.

In a preferred embodiment, the insulation of the cable is stripped from the cable at an angle such that the enlarged second conductor pitch in the second linear pathway is generally equivalent to the spacing between terminals in a ribbon cable connector. The connector is connected to the cable at the exposed portion of the cable perpendicular to the second linear pathway with the terminals of the connector in discrete individual electrical connection with respective conductors in the cable.

In an alternate embodiment, the exposed conductors are redirected a second time to form a third linear pathway. The insulation is not stripped from the third linear pathway which allows the cable to continue to additional connectors. In another embodiment, a patterned junction may be formed between the first linear pathway and the second linear pathway to thereby produce a second pitch pattern in the second linear pathway different from the first pitch pattern of the first linear pathway.

In accordance with one method of the invention, a ribbon cable comprising substantially parallel conductors encased and separated by dielectric material having a first conductor pitch pattern and oriented in a first linear pathway is intended to be connected to an electrical connector having terminals oriented with a second terminal pitch pattern. A position on the cable is identified for connection to the electrical connector. A portion of the dielectric material is stripped from the cable along a diagonal path relative to the first linear pathway. The exposed conductors are reorientated adjacent a diagonal edge of insulation towards a perpendicular direction to the diagonal edge. The resulting second linear pathway has exposed conductors with a trigonometrically enlarged conductor spacing. An electrical connector can be connected to the cable along the second linear pathway with the conductors in the second linear pathway aligning with the terminals in the electrical connector.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing aspects and other features of the invention are explained in the following description, taken in connection with the accompanying drawings where:

Fig. 1 in a perspective view of a multi-conductor cable incorporating features of the invention.

Fig. 2a is a cross-sectional view of the cable in Fig. 1 taken along line 2a-2a.

Fig. 2b is a cross-sectional view of a first linear pathway section of an alternate embodiment of a cable.

Fig. 2c is an end view of the cable in Fig. 1 taken along line 2c-2c.

Fig. 3 is a perspective view of a ribbon cable mass termination connector.

Fig. 4 is a perspective view of the cable in Fig. 1 having a connector attached thereto.

Fig. 5a is a top cross-sectional view of an alternate embodiment of the invention.

Fig. 5b is an enlarged view of section b in Fig. 5a.

Fig. 5c is an enlarged view of section c in Fig. 5a.

Fig. 6 is a perspective view of the cable in Fig. 5a having a connector attached thereto.

Fig. 7 is an alternate embodiment of the invention.

Fig. 8 is an alternate embodiment of the invention.

Fig. 9 is an alternate embodiment of the invention.

DETAILED DESCRIPTION OF THE INVENTION

Referring to Fig. 1, there is shown a perspective view of a multi-conductor flat transmission cable or ribbon cable 2 incorporating features of the invention. The cable 2, in this embodiment, comprises a first linear pathway section 4 having first portions 12 of a plurality of conductors 8 and a cover 10 and a second linear pathway section 5 having second portions 14 of the conductors 8.

Referring also to Fig. 2a, a cross-sectional view of the first section 4 of the cable 2 along line 2a-2a of Fig. 1 is shown. The conductors 8 are generally individual electrical wires or the like made of an

electrically conductive material. The conductors 8 are also relatively ductile and have a relatively small cross-sectional shape and size to allow for flexibility of the cable 2. The first portions 12 of the conductors 8 are located in the first section 4 and are generally arranged in a row in the cable 2 in generally parallel relationship to each other. In this embodiment, the first portions 12 of the conductors 8 are generally spaced from adjacent conductors by a spacing or pitch A generally measured between the centerlines of parallel portions of adjacent conductors. The cover 10 is generally made of a relatively flexible dielectric material or insulation which is located about the conductors 8 in the first section 4 to substantially encase the conductors 8 and maintain their spaced apart parallel relationship. This arrangement of the conductors 8. as described above, generally forms a first pattern or pitch pattern and in this embodiment the pitch pattern generally consists of a row of equally spaced conductors 8 having the pitch A.

Referring now to Fig. 2b, a cross-sectional view of an alternate embodiment of the first section 4 is shown. In this embodiment, the conductors 8 have two different conductor pitches C and D. The first pitch C is generally smaller than the second pitch D and thereby forms groups 13 of conductors 8. The pitch pattern, in this embodiment, generally consists of a row of conductor having groups of conductors 13 with the two pitchs C and D and is shown merely as an illustrative embodiment to emphasize that the invention of the present application is intended for use with all pitch patterns.

Referring back to Figs. 1 and 2a, the first section 4, having the conductors 8 and cover 10 arranged as described above, generally forms a first linear pathway B. The first linear pathway B generally runs along the entire length of the first section 4. Because the conductors 8 and cover 10 are relatively flexible, the first section 4 is relatively flexible along its entire length such that the first linear pathway B can vary, but remains along the uniform parallel path of the conductors 8. In addition, the first section 4 has a width W which can vary with such factors as the number of conductors 8 in the first section 4 or the spacing A between conductors 8. Obviously, the length of the first section 4 can either be pre-determined or substantially continuous.

The second section 5 generally comprises the second portions 14 of the conductors 8 in spaced apart parallel relationship. The second section 5 has a first end 26 located proximate the first section 4 and a second end 28. The second end 28, in this embodiment, comprises the second portions 14 of the conductors 8 being substantially free. In an alternate embodiment the second end 28 can have the conductors 8 relatively fixed to one another by means such as a cover of dielectric material or alternatively having the cable continue either exposed or covered. Located proximate the first end 26 of the second section 5 is a junction 44 formed between the first section 4 and the second section 5 and is easily identified, in this embodiment, by an insulation edge 22. The edge 22 is generally established by the presence of the cover 10 in the first section 4 and the absence of a cover 10 in the second section 5. However, in alternate embodiments, the junction 44 need not be proximate the edge 22. In one such alternate embodiment, the junction 44 may be located at a predetermined distance from the edge 22 with the first portions 12 of the conductors being relatively exposed between the edge 22 and the junction 44. In another alternate embodiment, the second section 5 need not have its second portions 14 of the conductors totally exposed.

Referring also to Fig. 2c, there is shown an end view of the second section 5 of the cable 2 in Fig. 1 taken along line 2c-2c. The conductors 8 in the second section 5 are the same conductors as in the first section 4. The conductors 8 are thus relatively continuous between the first and second sections 4 and 5. The second portions 14, in this embodiment, form a row of uniformly parallel exposed conductors 8. However, the second portions 14 of the conductors 8 are oriented at an angle F to their respective first portions 12. In addition, the second section 5 also has a spacing between conductors or a conductor pitch E which is different then the conductor pitch A in the first section 4. The angle F. in this embodiment, is the same for each conductor such that the second portions 14 of the conductor 8 form a second pitch pattern along a second linear pathway G.

The first pitch A is automatically changed or converted to the second pitch E at the junction 44, or in this embodiment, proximate the edge 22. The junction 44, in this embodiment, is disposed diagonally across the width W of the cable 2 at an angle H relative to the first linear pathway B. The conductors 8 proximate the diagonal edge 22 form redirection conductor portions which are bent or reorientated from their path along the first linear pathway B to their path along the second linear pathway G. The bent conductors portions at the junction 44, proximate the region of the edge 22 form a trigonometric or geometric pitch conversion to convert conductor pitches or pitch patterns. The trigonometric conversion of the conductor pitch allows for the uniform conversion of the pitch between the first section 4 and second section 5 of the cable 2 in an orderly fashion.

In a preferred embodiment, the second portion 14 of the conductors 8 are uniformly obliquely lateral or horizontal from the first portions 12 of the

conductors 8 with the second portions 14 of the conductors 8 in the second section 5 being orientated substantially perpendicular to the edge 22. In this preferred embodiment, the pitch E in the second section 5 would generally be equivalent to the distance between the centerlines of the conductors 8 along the edge 22 or, said another way, the fixed pitch A in the first section 4 divided by the cosine of the angle H. Obviously, in other embodiments, the angle F can vary to increase or decrease the desired second pitch E even though the first pitch A remains constant because of the cover 10. The length of the second section 5 can also vary as well as the angle H. In addition, the first portions 12 of the conductors 8 need not been held in total parallel relationship in the first section 4 such as in braided flat cable.

The multi-pitch cable 2, as described above, can be manufactured by a variety of methods. In a preferred method, a substantially uniform cable 2 is formed with a first uniform pitch A. A portion of the dielectric material of the cover 10 is stripped from a predetermined position on the cable along a diagonal line or path relative to the first linear pathway B. An edge 22 is thereby created and the conductors are uniformly bent proximate the edge 22 in a horizontally or laterally oblique angle. In a preferred method, the cover 10 in the first section 4 is used as a retaining means to hold the first portions 12 of the conductors 8 such that the second portions 14 can be laterally redirected with the conductors bending at the edge 22. The exposed conductors thereby form a second linear pathway G obliquely angled from the first linear pathway B having a trigonometrically converted second conductor pitch E which is different from the first conductor pitch A. A pitch conversion done in this fashion is uniform, orderly and relatively fast. The second section 5 can then be connected to a connector 16 (not shown) or otherwise be terminated.

Referring now to Fig. 3, a multi-conductor flat cable connector 16 is shown. The connector 16, in the embodiment shown, is commonly known as a mass termination connector. However, any suitable type of connector can be used. The connector 16 generally comprises a base 18, a cover 20 and a plurality of electrical terminals 24. The base 18 and cover 20 are generally made of a dielectric material and are intended to connect to each other with the cable 2 therebetween. The terminals 24 are generally made of an electrically conductive material and are discretely mounted in the base 18. The terminals 24 are mounted in the base 18 with a general pitch or spacing I between the centers of adjacent terminals 24 and thereby have a terminal pitch pattern. In the embodiment shown, the terminal pitch pattern consists of a row of equally spaced terminals at a spacing of I.

Referring to Figs. 1, 3, and 4, Fig. 4 shows a perspective view of the connector 16 of Fig. 2 attached to the cable of Fig. 1. The connector 16, in this embodiment, is mounted perpendicular to the second linear pathway G on the second section 5. The connector 16 generally abuts against the edge 22 of the cover 10 of dielectric material in the first section 4. The conductors 8 of the cable 2 have been bent or reoriented at the junction 44 such that the second conductor pitch E is substantially equivalent to the terminal pitch I. The connector 16 is, therefore, allowed to be connected to the second section 5 of the cable 2 in a relatively fast manner with each of the conductors 8 in the second section 5 being spaced and oriented to make independent and relatively accurate contact to respective terminals 14 in connector 16 without any addition reorientation or any interconnection devices. The converted pitch E on the cable 2 thereby allows a connector 16 having a terminal pitch pattern which is relatively larger than the pitch pattern of the first section 4 of the cable 2 to be electrically connected therewith in a fast, accurate and orderly fashion. In addition, the conversion of the conductors 8 from the first section 4 to the second section 5 can be accomplished in a relatively small area and length of cable. In an alternate embodiment, the second section 5 may have the second portions 14 of the conductors 8 bent both laterally in addition to being bent vertically relative to the first portions 12 of the conductors 8 in the first section 4. In an effort to more clearly describe the invention, a basic sample or example will be described. Referring to Fig. 1, if the first section 4 has a pitch A equal to about 0.030 inch and angle F is about 139 degrees with angle H about 41 degrees and the second portions 14 being perpendicular to the edge 22, then the pitch E is about 0.050 inch or an increase of about 66 percent in spacing.

Referring now to Fig. 5a, b and c, an alternate embodiment of the cable 2 is shown. In this embodiment, the cable 2 comprises a first section 4, a second section 5 and a third section 6. The first section 4 is substantially the same as the first section 4 of the cable 2 of Fig. 1 wherein first portions 12 of the conductors 8 are encased and separated by a cover 10 of dielectric material. The first section 4 has a first conductor pitch A and a first linear pathway B. The second section 5 is substantially similar to the second section 5 of the cable 2 of Fig. 1 wherein second portions 14 of the conductors 8 are oriented in a second linear pathway G having a second conductor pitch E and being obliquely lateral from the first linear pathway B.

The third section 6 comprises third portions 30

of the conductors 8 generally arranged in a parallel row with a third conductor pitch J. A cover 32 of dielectric material generally encases and separates the third portions 30 of the conductors 8. An edge 34 of insulation is formed proximate a junction 46 between the second section 5 and the third section 6. The third section 6 generally has a third linear pathway K which is obliquely angled to the second linear pathway G.

In the embodiment shown, the second portions 14 of the conductors 8 are bent or reorientated proximate the second junction 46 at an angle L between the second portions 14 and the third portions 30 to convert the pitch of the conductors from the second pitch E to the third pitch J. In a preferred embodiment, the angle L is equal to the angle F and the first pitch A is equivalent to the third pitch J. Also in a preferred embodiment, the length of the second section 5 is equivalent to the width of the connector 16 such that the connector can be attached to the second section 5 without allowing the conductors 8 to be exposed after assembly as shown in Fig. 6.

In a preferred method of fabricating the cable 2 of Fig. 5a, a multi-conductor cable having a substantially uniform pitch pattern and a continuous cover 10 is stripped of a portion of the cover 10 across the width X of the cable 2 at a pre-determined position along a diagonal path. Although any type of means can be used to strip the insulation, in a preferred method, the insulation is cut and then slid away from the cut along the conductors to expose the conductors. The exposed conductors 8 are uniformly bent proximate a first position to create a second pathway and uniformly bent again proximate a second position to create a third pathway to thereby convert the conductor pitch from a first conductor pitch A in a first section 4 to a second conductor pitch E in a second section 5 and from the second conductor pitch E to a third conductor pitch J in a third section.

Referring now to Figs. 7, 8 and 9, alternate embodiments of the invention are shown. Fig. 7 shows a cable 2 having a curved junction 44 between the first section 4 and the second section 5 proximate a curved edge 22 of insulation. The conductors 8 have their pitch converted at the junction 44 proximate the edge 22 with the second portion 14 of each conductor 8 being relatively perpendicular to the edge 22 proximate their individual bend. In the embodiment shown, the angle F is not the same for each conductor; however, the second portions 14 of the conductors 8 are all relatively uniformly perpendicular to the edge 22 proximate their bends.

Fig. 8 shows an alternate embodiment of the invention with the cable 2 having a patterned junction 44 proximate the edge 22. As shown in the figure, the junction 44, as outlined by the edge 22, has a stepped pattern. The conductors 8 have their pitch converted at the junction 44 proximate the edge 22 with the angle F being substantially uniform among conductors 8. However, in this embodiment, the second portions 14 of the conductors 8 are not uniformly perpendicular to the edge 22. The resulting pitch pattern conversion allows the single pitch first section 4 to be converted into a dual pitch second section 5.

Fig. 9 shows an alternate embodiment of the invention with the cable 2 having a patterned shape relative to the first linear pathway B to form two junctions 35 and 37 proximate two edges 36 and 38. The conductors 8 have their pitch converted at the junctions 35 and 37 proximate the two edges 36 and 38. Each junction is located in an area for pitch conversion of only a limited pre-determined number of conductors 8 in the cable 2. In the embodiment shown, the first junction 35 is located proximate an area of a first pitch conversion of a first four conductors 40 and the second junction 37 is located proximate an area of a separate and independent pitch conversion of a second four different conductors 42.

It should be understood that the foregoing description is only illustrative of the invention. Various alternative and modifications can be devised by those skilled in the art without departing from the spirit of the invention. Accordingly, the present invention is intended to embrace all such alternative modifications and variances which fall within the scope of the appended claims.

Claims

1. A multi-conductor flat cable comprising:
conductor means comprising substantially parallel conductors oriented in a first linear pathway having a first conductor pitch pattern and a second linear pathway having a second conductor pitch pattern, said second linear pathway being obliquely angled to said first linear pathway;
first conductor pitch conversion means for converting conductor pitch between said first conductor pitch pattern and said second conductor pitch pattern, said conductor pitch conversion means comprising redirectional conductor portions between said first linear pathway and said second linear pathway for uniform and trigonometric conversion of conductor pitch; and
insulation means separating said con-

ductor in at least a portion of said first linear pathway.

2. A cable as in Claim 1 wherein said redirectional conductor portions are substantially exposed.

3. A cable as in Claim 1 wherein said redirectional conductor portions are diagonally disposed relative to said first linear pathway.

4. A cable as in Claim 1 wherein said redirectional conductor portions are disposed relative to said first linear pathway in a pattern of equal spacing between conductors.

5. A cable as in Claim 1 wherein said redirectional conductor portions are disposed relative to said first linear pathway in a pattern of unequal spacing between conductors.

6. A cable as in Claim 1 wherein said conductors in said second linear pathway are substantially exposed.

7. A cable as in Claim 1 further comprising a second conductor pitch conversion means for converting conductor pitch between said second linear pathway and a third linear pathway.

8. An electrical conductor assembly comprising:

multi-conductor flat cable means having substantially parallel conductors orientated in a first linear pathway and a second linear pathway, said first linear pathway having a first conductor pitch pattern, said second linear pathway being obliquely angled to said first linear pathway and having a second conductor pitch pattern; and

electrical connector means connected to said conductors substantially perpendicular and along said second linear pathway, said electrical connector means having connector terminals with a predetermined connector terminal pitch pattern whereby said second conductor pitch pattern is substantially equivalent to said connector terminal pitch pattern.

9. An assembly as in Claim 8 further comprising conductor pitch conversion means for converting conductor pitch between said first conductor pitch pattern and said second conductor pitch pattern.

10. An assembly as in Claim 8 wherein said cable means further comprises insulation means for selectively protectively insulating said conductors in at least a portion of said first linear pathway.

11. An assembly as in Claim 10 wherein said conductors are uniformly obliquely redirected at a first junction between said first linear pathway and said second linear pathway whereby said conductors have a trigonometrically converted second conductor pitch.

12. An assembly as in Claim 8 wherein said terminal pitch pattern is relatively larger than said first conductor pitch pattern.

13. A method of preparing a multi-conductor flat cable for electrical connection, said multi-conductor flat cable having substantially parallel wire conductors encased and separated by dielectric insulation with a first predetermined conductor pitch pattern and oriented along a first linear pathway, the method comprising the steps of:

stripping said dielectric insulation from a portion of said cable; and

redirecting said wire conductors about said stripped insulation portion uniformly horizontally angular from said first linear pathway to form a second linear pathway, said second linear pathway having a second conductor pitch pattern and being obliquelly angled from said first linear pathway thereby forming an electrical connection section along said second linear pathway having a trigonometrically and orderly converted second conductor pitch pattern.

14. A method as in Claim 13 wherein said insulation is stripped across an entire cable width portion of said cable.

15. A method as in Claim 13 wherein said insulation is stripped about a diagonally shaped path relative to said first pathway to form a diagonal insulation edge.

16. A method as in Claim 13 wherein said insulation is stripped about a shaped pattern to form a patterned insulation edge adjacent.

17. A method as in Claim 13 wherein the step of displacing said dielectric insulation comprises the steps of:

cutting a portion of said insulation at an angle relative to said first linear pathway; and

slidingly moving said insulation from said cut portion along said conductors.

18. A method as in Claim 13 wherein said dielectric insulation is stripped by removing said insulation from said cable.

19. A method as in Claim 13 further comprising the step of redirecting said wire conductors angularly from said first linear pathway to a plane other than a plane of said first linear pathway.

20. A method as in Claim 15 wherein said wire conductors are redirected perpendicular to said insulation edge.

21. A method as in Claim 13 further comprising the step of redirecting said wire conductors between said second linear pathway and a third linear pathway.

22. A method of establishing an electrical contact between conductors in a multi-conductor flat cable and an electrical connector, said multi-conductor flat cable having substantially parallel wire conductors encased and separated by dielectric material with a first predetermined spacing between said conductors and a first linear pathway, the method comprising the steps of:

separating said dielectric material from a portion of said cable about a predetermined path relative to said first linear pathway;

reorientating said wire conductors proximate said path to a second linear pathway obliquely lateral to said first linear pathway such that said wire conductors of said second linear pathway have a trigonometrically enlarged second spacing between said conductors; and

connecting said electrical connector to said wire conductors on said second linear pathway, said electrical connector having individual contact terminals with a third predetermined spacing between said terminals whereby said second spacing between conductors in said second linear pathway is substantially equivalent to said third predetermined spacing of said connector terminals for a fast and accurate connection therebetween.

23. A method as in Claim 22 wherein said wire conductors are reorientated uniformly.

24. A method as in Claim 22 wherein said enlarged second pathway spacing between conductors increases by at least 66 percent from said first predetermined spacing between conductors.

25. A method as in Claim 22 wherein said parallel wire conductors in said first linear pathway have a first spacing pattern of at least two different predetermined spacings between conductors.

26. A method of preparing a ribbon cable for accepting a ribbon cable connector, said ribbon cable having a first spacing between conductors and said connector having a second spacing between terminals, said first spacing being less than said second spacing, the method comprising the steps of:

stripping insulation from a portion of said ribbon cable at an angle to said conductors, said angle being determined such that the distance between adjacent conductors measured along said angle is substantially equivalent to said spacing between conductor terminals in said connector; and

bending said conductors of said cable approximately perpendicular to said angle at which said insulation is stripped.

27. A method of assembling a ribbon cable to a ribbon cable connector comprising the steps of preparing a ribbon cable as in Claim 26 and further comprising the step of connecting said ribbon cable connector to said cable proximate said stripped insulation portion.

FIG. 1

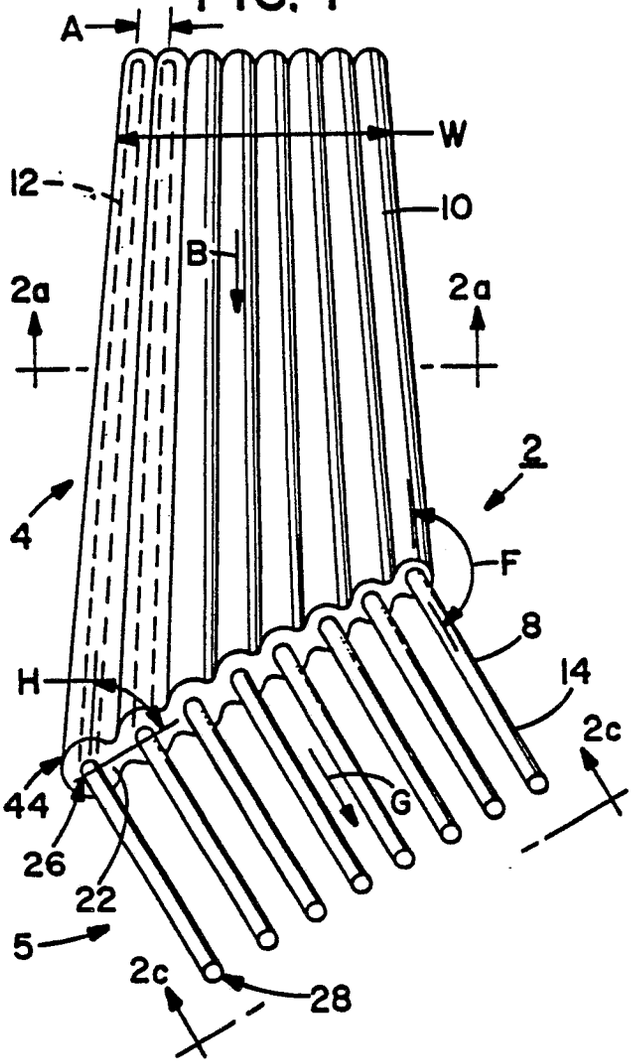


FIG. 2a

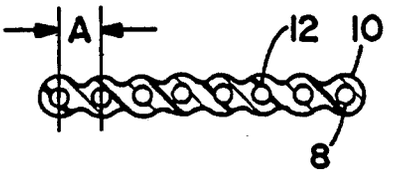


FIG. 2b

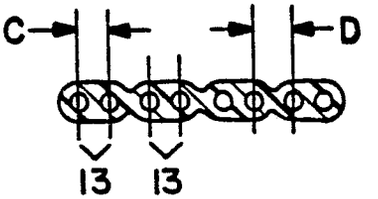
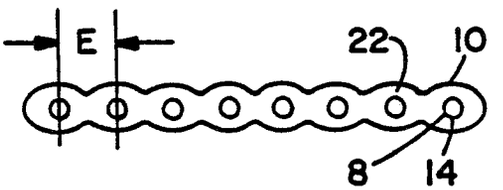


FIG. 2c



PRIOR ART

FIG. 3

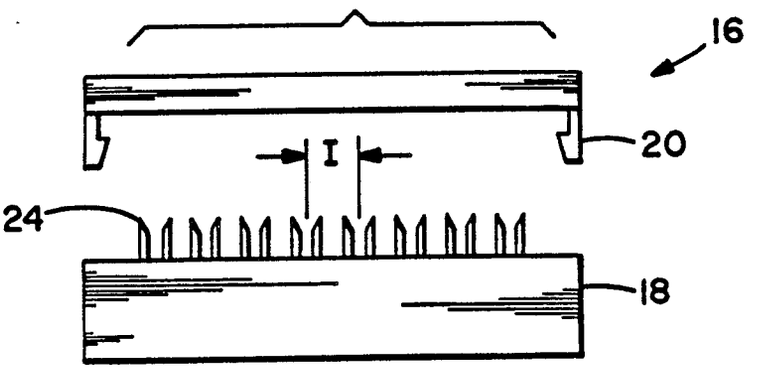


FIG. 4

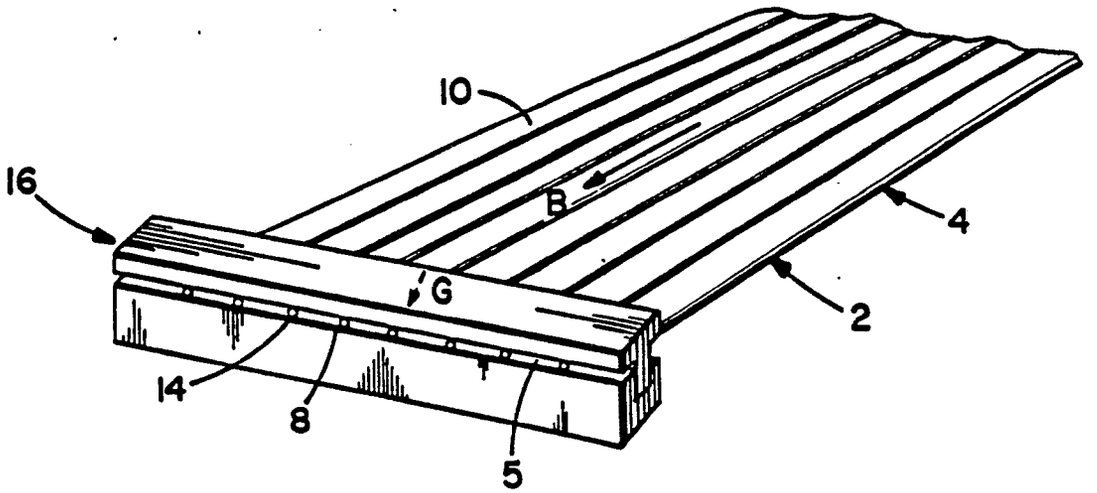


FIG. 5a

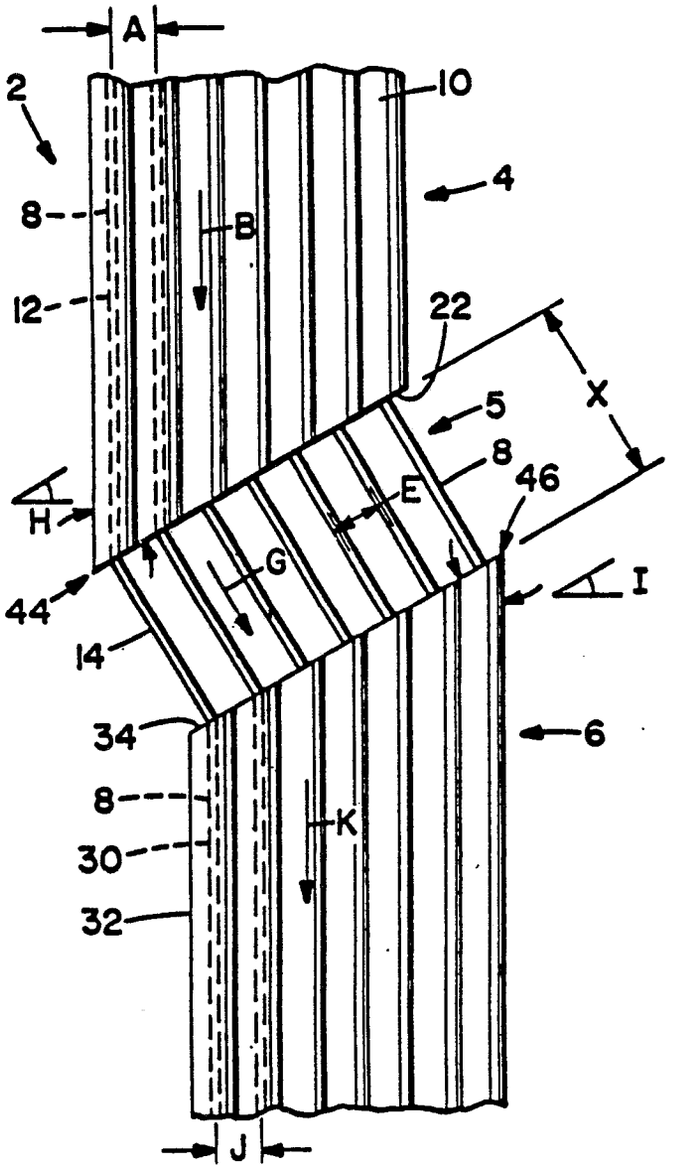


FIG. 5b

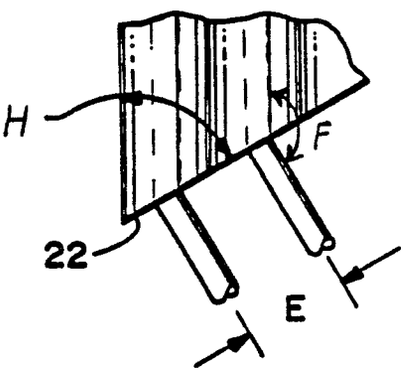


FIG. 5c

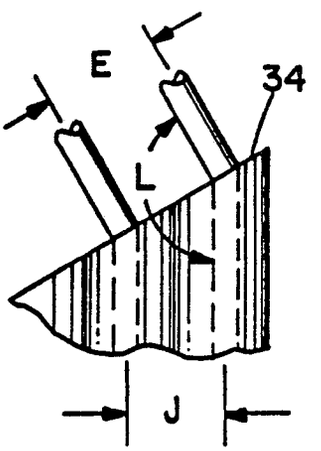


FIG. 6

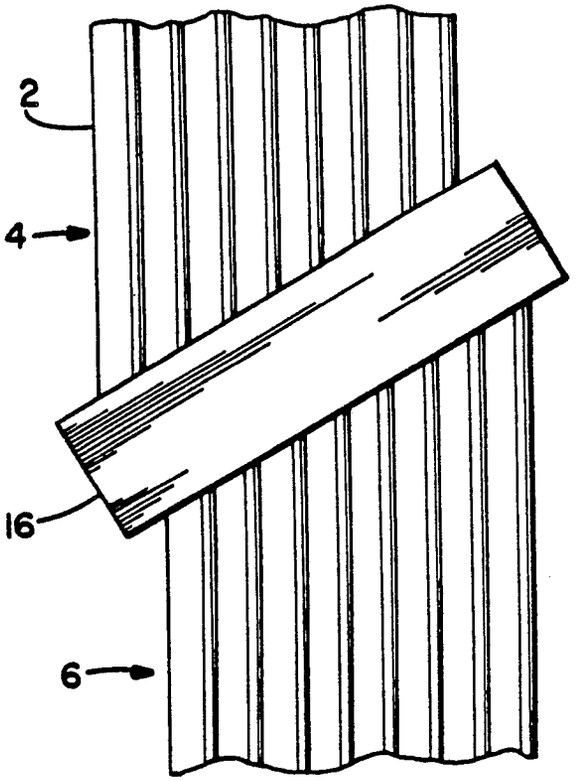


FIG. 7

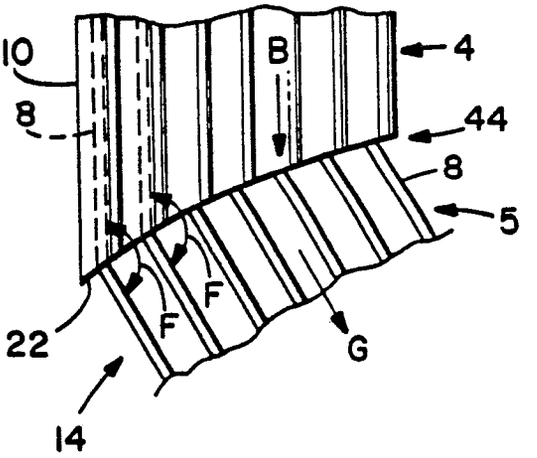


FIG. 9

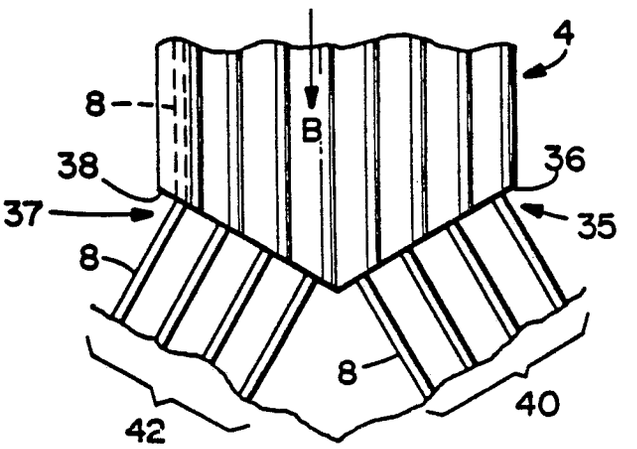
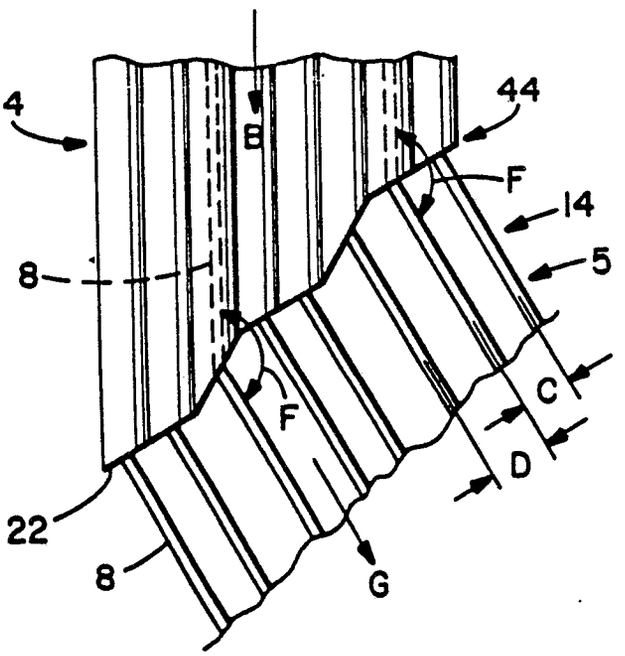


FIG. 8



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Application number

DOCUMENTS CONSIDERED TO BE RELEVANT

EP 88108706.8

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X;Y	DE - A1 - 3 335 194 (SIEMENS) * Totality * --	1-4,6,8-12,13-15,17-20,22-24,26,27;5,25	H 01 B 7/08 H 01 R 9/07
Y	AUSZÜGE AUS DEN GEBRAUCHSMUSTERN, vol. 11, no. 22, May 30, 1974 WILA VERLAG FÜR WIRTSCHAFTSWERBUNG page 970 * DE-U-7 406 973 (KABEL- UND LACKDRAHT)* --	5,25	
X	US - A - 4 484 791 (JOHNSON) * Column 1, line 63 - column 3, line 12; fig. 2 * --	1,3,4,8-12	
X	EP - A2 - 0 106 518 (AMP) * Page 4, line 3 - page 5, line 2; fig. 1-4 * --	1,3,4,7	TECHNICAL FIELDS SEARCHED (Int. Cl.4) H 01 B 7/00 H 01 R
X	US - A - 4 501 929 (ESCALLIER et al.) * Column 3, lines 18-64; column 5, lines 43-64; fig. 1,10 * --	1,3,4,7	
X	US - A - 4 406 915 (LANG) * Abstract; fig. 4,5 * --	1-4,6,7,8-12,13,14,16-19,21.	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	05-09-1988	KUTZELNIGG

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	CH - A - 308 153 (HASLER) * Page 2, lines 35-55; fig. 1 * ----	1,2,4, 6-10, 12	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

The present search report has been drawn up for all claims

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