United States Patent

Olsson

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[45] **Oct. 3, 1972**

[54] **FLAT CONDUCTOR CABLE CONNECTOR**

[72] Inventor: **Billy E. Olsson,** New Cumberland, Pa.

[73] Assignee: **Berg Electronics, Inc.,** New Cumberland, Pa.

[22] Filed: **Aug. 20, 1970**

[21] Appl. No.: **65,407**

[52] **U.S. Cl.**.....**339/17 F,** 339/17 LC, 339/92 M, 339/176 MF, 339/258 R

[51] **Int. Cl.**.....**H05k 1/04,** H01r 7/28

[58] **Field of Search**..339/17 F, 17 L, 17 LC, 17 LM, 339/75 MP, 92 M, 174, 176 MF, 176 MP, 217 S, 258 R, 258 P, 99

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Primary Examiner—Stephen J. Novosad
Assistant Examiner—Lawrence J. Staab
Attorney—Thomas Hooker

[57] **ABSTRACT**

A flat conductor cable connector of the type having a first body with a recess formed in the body and terminals positioned along the recess and a second body having a nose about which the conductors of a flat cable are wrapped so that when the nose is inserted into the recess an electrical connection is formed between each conductor and a terminal in the first body. Each terminal includes a stop extending into the path of insertion of the nose to limit insertion of the nose into the recess.

13 Claims, 11 Drawing Figures

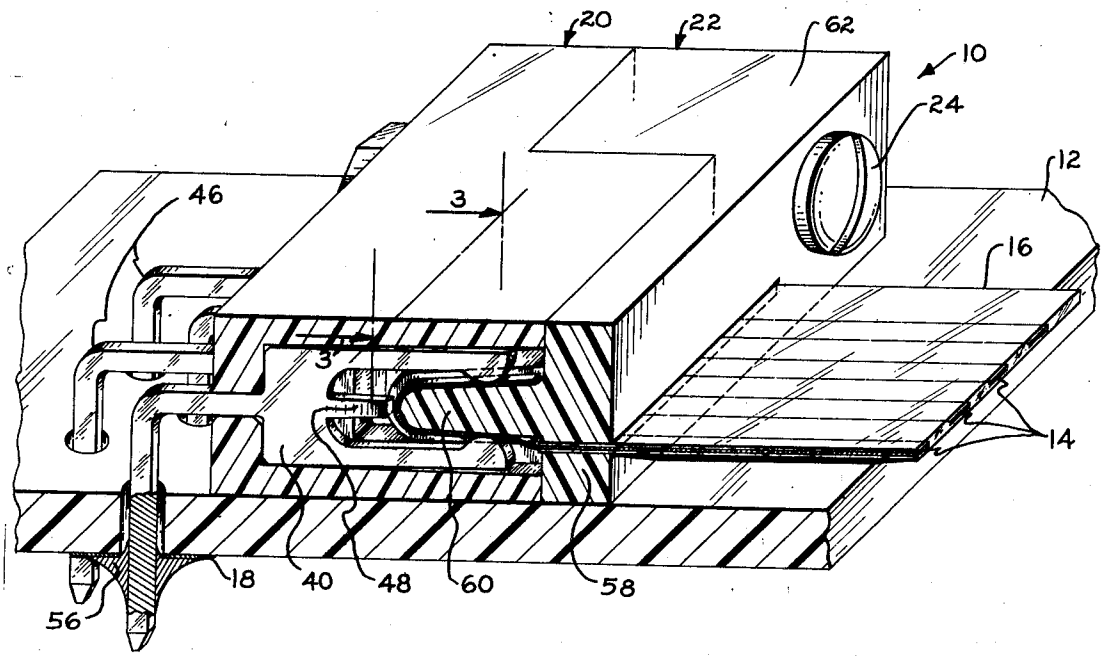
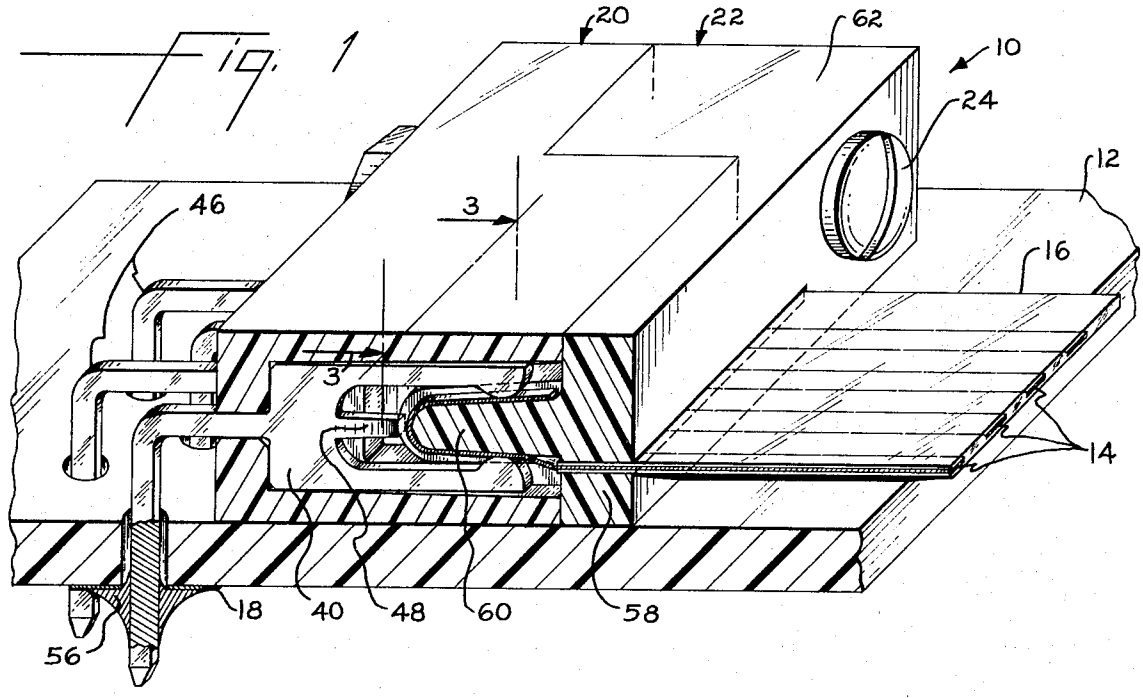


Fig. 1



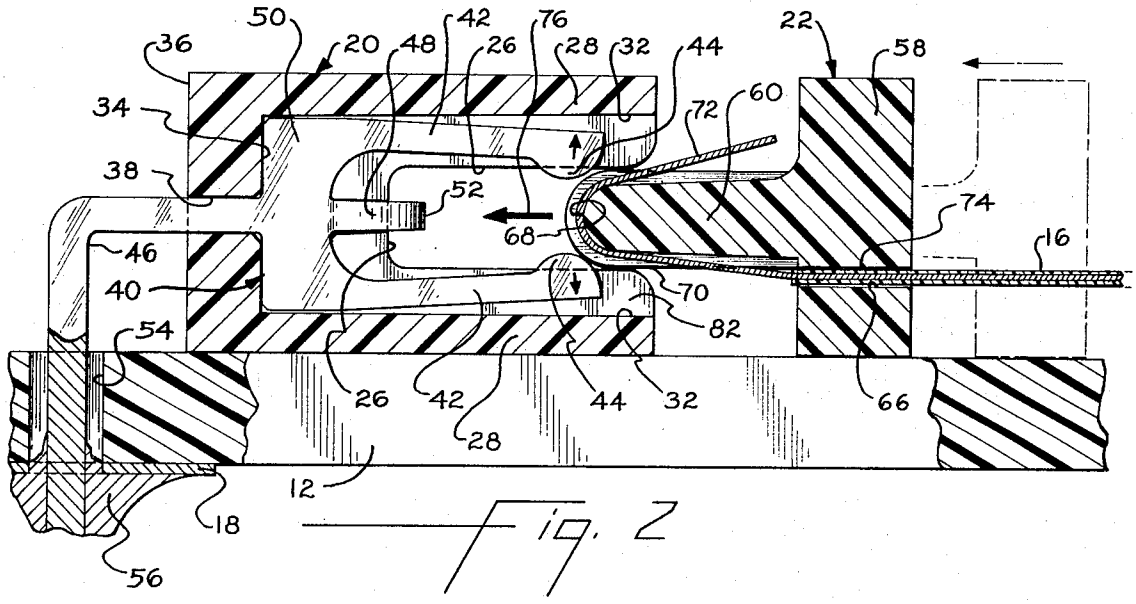


Fig. 2

INVENTOR.
Billy E. Olsson

BY
Thomas Hooker
His Attorney

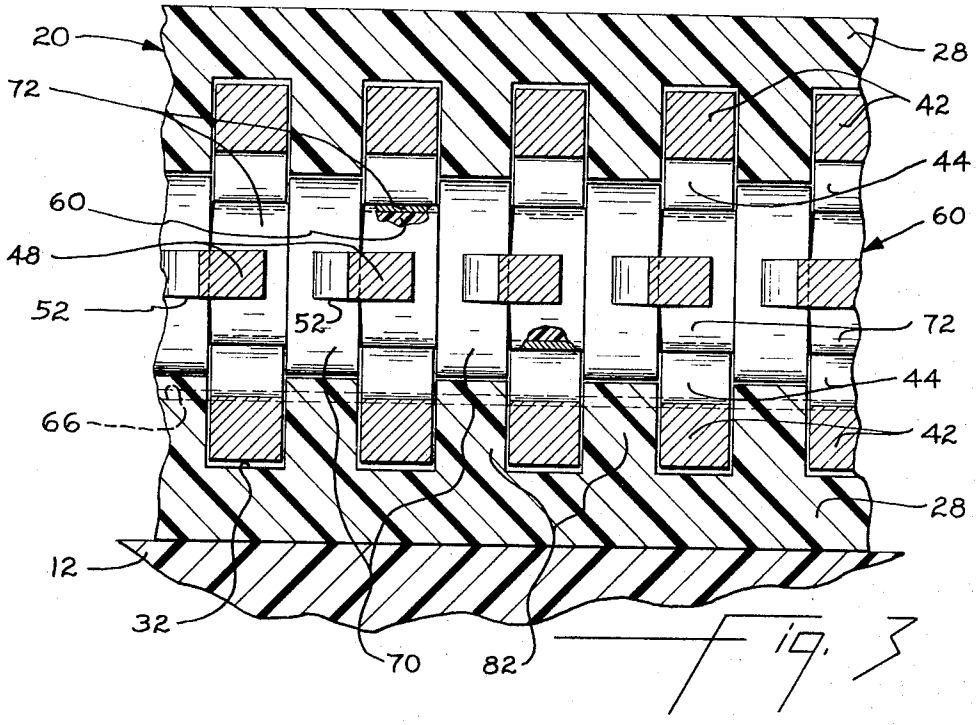


Fig. 3

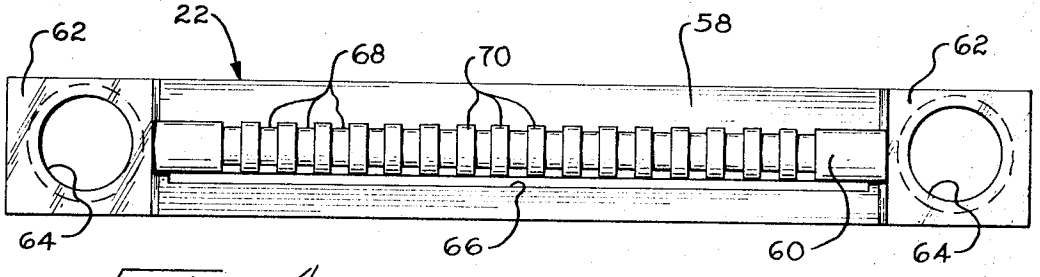


Fig. 4

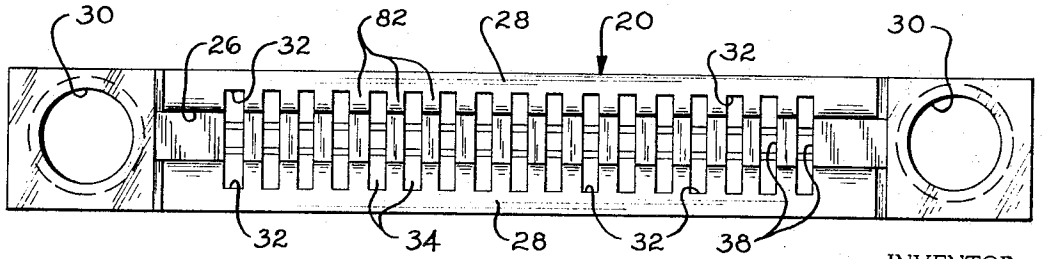


Fig. 5

INVENTOR.
Billy E. Olsson
BY
Thomas Hooker
His Attorney

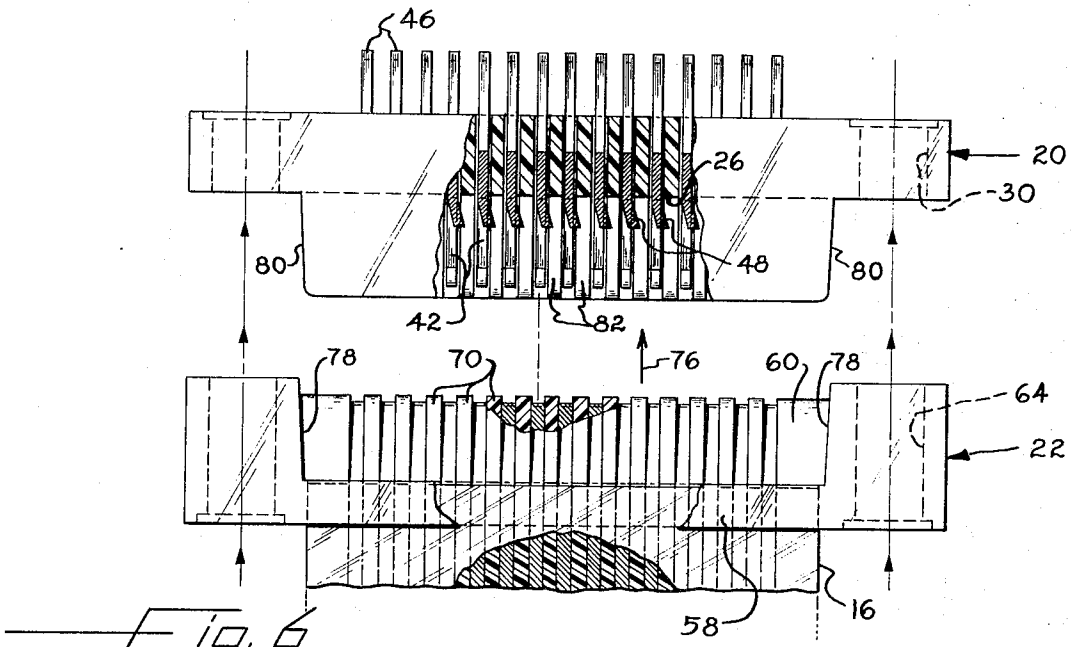


Fig. 6

Fig. 7

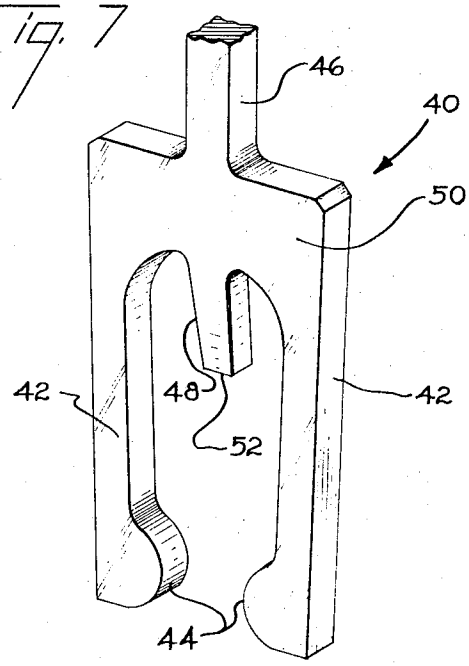
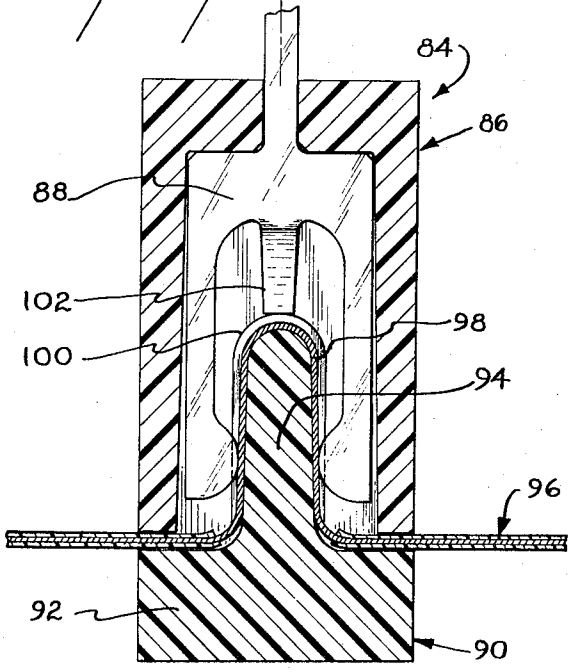


Fig. 8



INVENTOR.
Billy C. Olsson

BY
Thomas Hooker
His Attorney

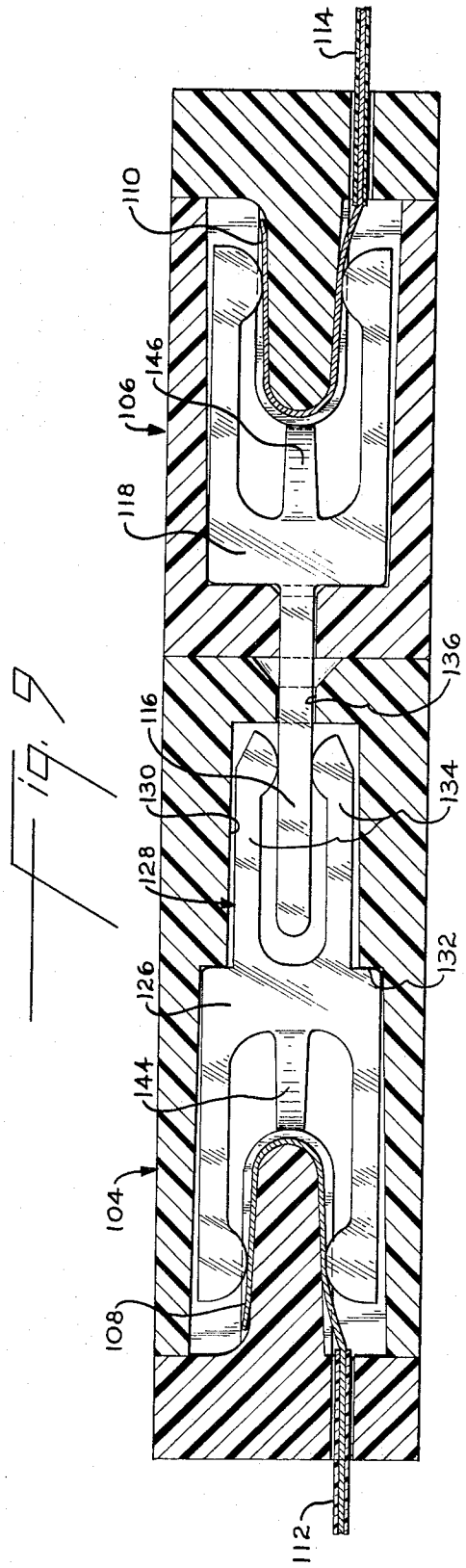


Fig. 9

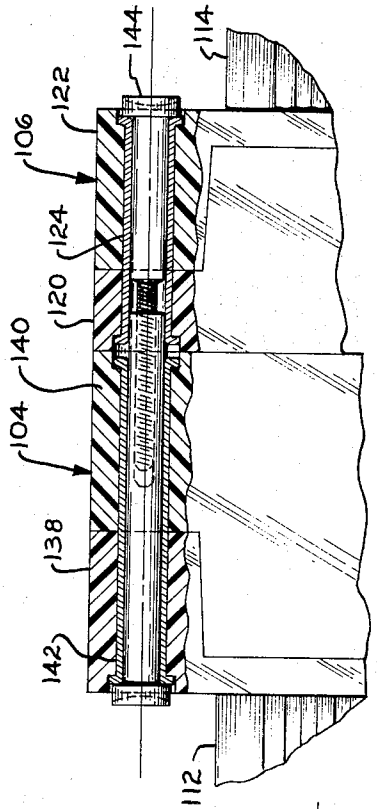


Fig. 11

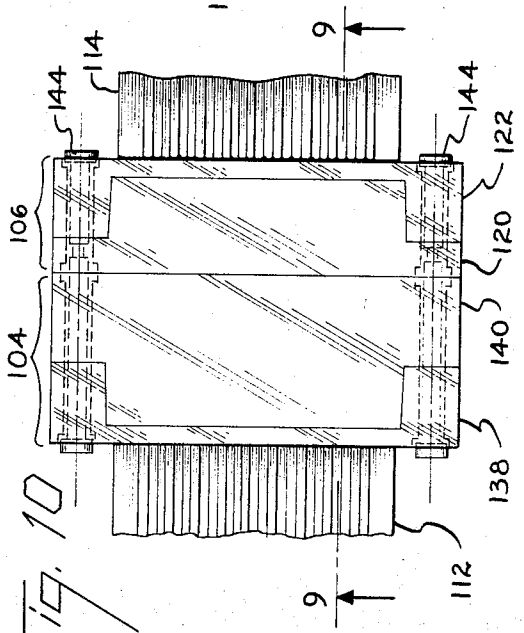


Fig. 10

INVENTOR.
Billy E. Olsson
BY
Thomas Hooker
His Attorney

FLAT CONDUCTOR CABLE CONNECTOR

The invention relates to an improved connector for a flat conductor cable where bared cable conductors are bent around an insulating nose and the nose is inserted into a recess in a terminal carrying block so that each terminal engages a single conductor. The desired relation between the terminals and nose, when fully inserted, is assured by a tang or stop which projects from the terminal into the path of the nose. Preferably the nose is provided with a plurality of ridges and valleys along its length so that the individual conductors lie in the valleys and are separated from adjacent conductors by ridges. In this embodiment the tang may extend laterally from the terminal toward an adjacent ridge on the nose so that during insertion of the nose into the recess the ridge is brought into contact with the tang.

The terminals may be of a bifurcated type having a pair of fingers for engaging each conductor on the opposite sides of the nose thereby forming redundant contacts between the terminal and the conductor. The sides of the recess may be relieved to accommodate the terminal fingers and define ridges between adjacent fingers. There is a slip fit between the ridges on the walls of the recess and the ridges on the nose so that these ridges cooperate to assure that the conductors are confined in their respective valleys when the connector is assembled.

In a further embodiment of the invention a pair of flat conductor cable connectors provide an inter-connection between the conductors of two flat conductor cables. The terminals of one connector extend into the body of the second connector for mating with the terminals in the second connector.

Conventional connectors for flat conductor or ribbon cables, such as those disclosed in U.S. Pat. Nos. 3,084,302, 3,275,968 and 3,277,425, utilize a two piece connector assembly where a terminal recess is formed in one part of the assembly and terminals are mounted in the recess along the length thereof. The second part includes a nose portion about which the bared conductors of the cable are wrapped. Electrical connections are formed by inserting the nose within the recess to bring the conductors into electrical engagement with the terminals in the recess. These connectors do not provide means directly connecting the terminals and nose for assuring that the nose, when fully inserted, is properly positioned in relation to the individual terminals.

Other objects and features of the invention will become apparent as the description proceeds, especially when taken in conjection with the accompanying drawings illustrating the invention, of which there are four sheets.

IN THE DRAWINGS:

FIG. 1 is a partially broken away perspective view of an assembled flat conductor cable connector according to the invention;

FIG. 2 is a sectional view illustrating the connector prior to assembly of the two parts;

FIG. 3 is a sectional view taken along line 3—3 of FIG. 1;

FIG. 4 and 5 are views illustrating the sides of the two insulating bodies which are joined together;

FIG. 6 is a top view illustrating joining of the bodies illustrated in FIGS. 4 and 5;

FIG. 7 is a perspective view of one of the terminals which is mounted in the body illustrated in FIG. 5;

FIG. 8 is a sectional view illustrating a modification of the connector in FIG. 1;

FIG. 9 is a sectional view taken along line 9—9 of FIG. 10 illustrating a further modification of the connector;

FIG. 10 is a top plan view of the connector illustrated in FIG. 9; and

FIG. 11 is an enlarged view, partially broken away, of a part of the connector illustrated in FIG. 10.

The connector 10 illustrated in FIG. 1 is mounted on circuit board 12 so as to establish electrical connections between the individual conductors 14 of flat conductor cable 16 and printed circuitry 18 on the bottom surface of board 12. The connector includes two insulating bodies 20 and 22, preferably formed from a moldable plastic material, which are secured together in the joined position illustrated in FIG. 1 by a pair of suitable connectors 24, which may be of the nut and bolt type.

Insulating body 20, shown in FIG. 5, is provided with an elongate recess 26 in one face thereof. The recess is formed between walls 28 and extends nearly the entire length of the body. Bolt receiving holes 30 extend through the ends of body 20. Pairs of opposed terminal receiving grooves or recesses 32 are formed in the interior faces of walls 28, which define the sides of recess 26, at spaced intervals along the recess. Each pair of grooves 32 extends into body 20 a distance beyond the bottom of recess 26 to define a U-shaped terminal cavity or recess 34 in block 20. Each cavity 34 communicates with face 36 of the block away from the recess 26 through a passage 38.

A terminal 40, as illustrated in FIG. 7, is positioned in each terminal recess 34 in block 20. The terminals 40 may be stamp formed from flat spring stock material such as berillium copper or any other suitable material. Terminals 40 are of a bifurcated type having a pair of opposed spring fingers 42 each of which is provided with a rounded contact 44 at the free end thereof. A straight terminal tail 46 extends away from the terminal in a direction opposite that of fingers 42. A stop or tine 48 projects from the body 50 of the terminal between fingers 42 and is bent away from the terminal so that the end 52 is offset to one side of the terminal. This relationship is illustrated in FIGS. 3 and 6.

Terminals 40 are inserted into body 20 by positioning terminal tails 46 within terminal cavities 34 and then moving the terminals into the cavities and the tails through passages 38 until the position illustrated in FIGS. 1 and 2 is attained. The terminal tails 46 may then be suitably deformed so that the ends thereof extend through holes 54 formed through the thickness of board 12. The block 20 may be mounted on board 12 by suitable means (not shown) and then the bottom surface of the board may be soldered to form solder connections 56 between printed circuitry 18 and terminals 40. With the terminals 40 seated in recess 34 in block 20, each tang or stop 48 extends laterally relative to the terminal recess confining the terminal of which it is a part so that at least a portion of the tang end 52 is located to one side of the recess 34. The terminal contacts 44 extended into recess 26.

Insulating body or block 22 illustrated in FIG. 4 includes a base 58 and an elongate nose 60 which projects from base 58 and extends along practically the entire length of the body. Projections 62 at each end of body 22 extend away from base 58 past the end of nose 60 and are provided with holes 64 for reception of the means used to secure together blocks 20 and 22.

A flat conductor cable receiving groove 66 is formed through the thickness of base 58 immediately adjacent one edge of nose 60. Flat cable 16 has a tight sliding fit within groove 66 so that the individual conductors 14 within the cable are accurately positioned along the nose 60. Laterally extending recesses or valleys 68 are formed around the surface of nose 60 at regular intervals along the length thereof and are separated by ridges 70.

Prior to positioning the end of cable 16 in block 22, the insulating material at the end of the cable is stripped away from the conductors so that the individual conductors project from the cable in much the same way as teeth project from the body of a comb. The bared conductors 72 are then moved through slot 66 in base 58 so that the end 74 of the cable is positioned in the slot as shown in FIG. 2. Because of the tight sliding fit between the cable 16 and the slot 66, each bared conductor 72 is positioned adjacent a valley 68 so that when it is wrapped around the nose 60 it rests within the valley. FIG. 2 illustrates a bared conductor 72 wrapped around nose 60 and lying in a valley 68.

After the cable 16 has been positioned in slot 64 and the conductors 72 have been wrapped around nose 60, body 22 may be positioned as illustrated in FIGS. 2 and 6, and the connector may be assembled by moving body 22 into the direction of arrow 76. Movement of the body 22 in the direction of arrow 76 first positions tapered side walls 78 of body 22 to either side of the complimentarily tapered side walls 80 of body 20. This relationship is illustrated best in FIG. 6. Because of the tapered fit assured by engagement between walls 78 and 80, the nose 60 is moved into recess 26 with each bared conductor 72 correctly positioned for mating with a terminal 40. Likewise, the walls or ridge 70 on nose 60 are located adjacent corresponding walls or ridges 82 formed in the sides of recess 26 between the terminal cavities 34. There is, as illustrated in FIGS. 2 and 3, a close slip fit between ridges 70 and 82 so that the bared conductors 72 are positively confined within the proper valleys 68. In this way cross connections are eliminated.

Movement of body 22 from the position illustrated in FIG. 2 to the seated position of FIG. 1, moves nose 60 into recess 26 so that the terminal contact portions 44 engage the bared conductors 72 which are wrapped around the nose and are then spread apart. The tapered nose continues to force the contacts apart during insertion to form a wiped, high contact pressure electrical connection between each contact and the bared conductor 72. When the nose is fully inserted, as illustrated in FIG. 1, the offset ends 52 of terminal tines 48 abut the nose ridges 70 to assure that the terminals are properly positioned relative to the nose. In this way the terminals contacts 44 are located in a known position on the nose and a desired contact pressure is attained. In the connector 10 there is a sliding fit between each terminal 40 and housing 20 so that there is a possibility of the terminals shifting within the housing. When the nose 60 is inserted into recess 26, tines 48 assure that all of the terminals 40 within the body 20 are properly seated in recesses as illustrated.

While in the connector 10 the tines 48 extend laterally to one side of terminals 40 so that the end surfaces 52 engage nose ridges 70, it is not necessary that the tines be offset. Thus the invention includes constructions where tines or stops are not offset so that the end of such a tine would lie in the path of insertion of a nose recess or valley 68 and if a conductor is wrapped around the nose, would engage the bared conductor which lies in the recess. By utilizing a construction with offset tines, the ends of the tines engage the nose ridges 70 and not the conductor 72 thereby eliminating possible wear on the conductors.

When the blocks 20 and 22 have been joined, as illustrated in FIG. 1, they may be held together by means of a pair of nuts and bolts 24 to retain the tape cable in electrical connection with the terminals 40 and printed circuitry 18 on board 12. When the bodies 20 and 22 are joined together and the terminal contact fingers 42 have been bent outwardly of recess 26 to form wiped high pressure contacts with the conductor 72, the outer edges of the fingers are free of the walls of recesses 32 and body 20. In this way the contact pressure on the conductor is determined by the spring characteristics of the terminal and not by a force resulting from bottoming of the terminal fingers against the block 20. The movement of nose 60 into recess 26 is limited by the tines 48 and also engagement between the sides of base 58 and the ends of walls 28. When the parts 20 and 22 are fully joined together, the base 58 rests flush upon walls 28 and the ridges 70 engage tine ends 52. In this position the terminals 40 are seated in terminal recesses 34.

FIG. 8 illustrates a modification of the connector illustrated in FIG. 1 through 6 in which connector block 84 comprises a body 86 identical to body 20 and having a number of terminals 88 identical to terminals 40 confined therein, and a second body 90 which is similar to body 22. Body 90 includes a base 92 with a nose 94 identical to nose 60 extending therefrom. A flat conductor cable 96 with bared conductors 98 formed at a location intermediate the length of the cable is bent over nose 94 and along the sides of base 92, as illustrated, so that each bared conductor is fitted within a recess in nose 94. The parts 86 and 90 of the connector 84 are then assembled so that electrical connections are assured between the terminals 88 and the conductors in the cable 96. The ridges 100 on nose 94 engage the offset ends of terminal tines 102 to accurately position the nose relative to the terminals so that the desired electrical connection between the terminals and the bared conductors is attained.

FIGS. 9 through 11 illustrate a further modification of the invention in which two connectors 104 and 106 similar to connector 10 are used to establish electrical connections between conductors 108 and 110 in a pair of flat cables 112 and 114. Connector 106 is like connector 10 with the exception that the straight tail portions 116 of terminals 118 project a short distance from the body of the connector. As illustrated in FIG. 11 the body portions 120 and 122 of connector 106 are per-

manently secured together by a pair of flared rivets **124**.

Connector **104** differs from connector **10** in that each terminal **126** in the connector includes a bifurcated contact portion **128** confined in a extension **130** of terminal recess **132**. Contact portion **128** includes a pair of contact fingers **134** which form a high pressure wiped electrical connection with terminal tails **116** of connector **106** when the tails are inserted into connector **104** through openings **136** formed therein.

As illustrated again in FIG. **11**, the insulating bodies **138** and **140** of connector **104** are permanently secured together by flared rivets **142**. When the connectors **104** and **106** are joined together with terminals tails **116** in electrical connection with contacts **128**, the rivets **124** and **142** are in alignment so that the connectors may be permanently secured together by means of a pair of nut and bolt connections **144**. FIG. **10** illustrates mated connectors **104** and **106** secured together by the nut and bolt connections **144**. In each of these connectors, the electrical connections are established between the conductors **108** and **110** and the terminals **126** and **118** as described in connection with connector **10**. Each of the connectors **104** and **106** utilizes offset tines **144** and **146** to assure that the respective terminals and nose portions are in proper position when the connector parts are joined together.

While I have illustrated and described a preferred embodiment of my invention, it is understood that this is capable of modification, and I therefore do not wish to be limited to the precise details set forth, but desire to avail myself of such changes and alterations as fall within the purview of the following claims.

What I claim as my invention is:

1. A connector assembly for a flat conductor cable comprising a first insulating body having an elongate recess formed therein with a number of terminals confined at intervals along said recess, each terminal including a contact for forming an electrical connection with one conductor of a flat cable and means for forming an electrical connection with a circuit element, a second insulating body including an elongate nose fitted in the recess, and a number of conductors of a flat conductor cable wrapped around said nose at regular intervals along the length thereof with each conductor engaging a contact of each terminal, each of said terminals including stop means spaced along the recess to one side of the terminal contact and facing toward the mouth of said recess in the path of insertion of said nose into the recess for maintaining a desired relationship between the terminals and the nose.

2. A connector assembly for a flat conductor cable comprising a first insulating body having an elongate recess formed therein with a number of terminals confined within said recess, each terminal including a contact for forming an electrical connection with one conductor of a flat cable and means for forming an electrical connection with a circuit element, and a second insulating body including an elongate nose to which the individual contacts of a flat conductor cable may be secured so that upon insertion of the nose within the cavity in said first body the contact of each terminal in said first body makes an electrical connection with one conductor of the cable, each of said terminals including stop means facing toward the mouth of said recess within the path of insertion of said nose for maintaining a desired relationship between the terminals and the nose, said nose including a plurality of lateral ridges arranged along the length thereof to define conductor receiving channels between adjacent ridges, said terminal contacts engaging conductors lying in said ridges and said stop means engaging portions of said nose when said nose is fully inserted within said recess.

3. An assembly as in claim **2** wherein each stop means engages a ridge on said nose.

4. An assembly as in claim **3** wherein each of said terminals includes a pair of contact fingers for engaging a cable conductor on both sides of said nose, and each stop means comprises a tang extending from the portion of the terminal between said fingers at an angle to the fingers so that the nose-engaging portion thereof is laterally offset from the contact fingers.

5. An assembly as in claim **3** wherein said second body includes a base with said nose projecting away from the base and a flat conductor cable receiving slot formed through the base adjacent one side of said nose whereby a flat conductor cable may be positioned within said slot with bared conductors of the cable in alignment with the grooves in the nose.

6. An assembly as in claim **2** including orientation means formed in each of said bodies for longitudinally positioning the nose accurately relative to the recess during insertion of the nose into the recess.

7. An assembly as in claim **6** wherein said orientating means comprises a tapered wedge type connection between said bodies.

8. An assembly as in claim **4** wherein each terminal is seated is an individual U-shaped terminal recess formed in said first body.

9. An assembly as in claim **8** wherein adjacent terminal recesses define ridges on the sides of said recess, such ridges and the ridges on said nose having a slip fit so as to confine the conductors in their respective channels.

10. A connector for joining together the conductors in two flat cables comprising two connector assemblies as defined in claim **3**, the means for forming electrical connections in one of said assemblies including terminal contacts projecting outwardly from a face of the first body thereof and away from the recess therein and the means for forming electrical connections in said second assembly including terminal contacts confined within said first body thereof for forming an electrical connection with the terminal contacts projecting from the first body of said first assembly, and means for confining said first and second assemblies together with each terminal in one assembly in electrical connection with a terminal in the other assembly.

11. A connector as in claim **10** wherein the bodies in each of said assemblies are secured together by means of hollow rivets and wherein said means for confining said assemblies together comprises a connection extending through the rivets of each of said assemblies.

12. An assembly as in claim **1** wherein each of said terminals includes a pair of contact fingers for engaging a cable conductor on both sides of the nose, and each stop means comprises a tang extending laterally from the part of the terminal between said fingers.

13. A terminal having a flat portion including a body and two spaced fingers extending in the same direction

from said body, said fingers including opposed contacts for engaging a connecting part, means for joining said body to a circuit element, and a tang extending laterally of said body from between said fingers, said tang including a stop surface facing in said direction and laterally offset to one side of the contacts on said fingers for engaging a connecting part inserted between said fingers to one side of said contacts.

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