

[54] **ADAPTOR FOR CONNECTING FLAT CONDUCTOR CABLE**

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339/103 M

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339/97, 119, 103, 105, 107, 154, 156, 174,
176, 192, 195, 196, 220; 317/101 CC, 101
CP, 101 DH; 174/DIG. 3

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[57] **ABSTRACT**

An adaptor for connecting flat conductor cable, especially to a DIP header or a PC board, is prefabricated as a one-piece member having a flat planar surface with parallel slots for receiving one end of the flat cable from one side through one of the slots and then locking it against the flat planar surface by bending the male contact pins of terminal contacts secured to the flat cable through substantially a 90° angle and feeding the same through the other slot, such that the male contact pins project through the other side of the flat planar surface. On the other side, elongate flat surfaces oriented at right angles to each other are provided for positioning the adaptor and its associated conductor cable in proper relation to the DIP header or PC board. Accordingly, the adaptor inherently contains strain relief provisions for the conductor cable.

5 Claims, 4 Drawing Figures

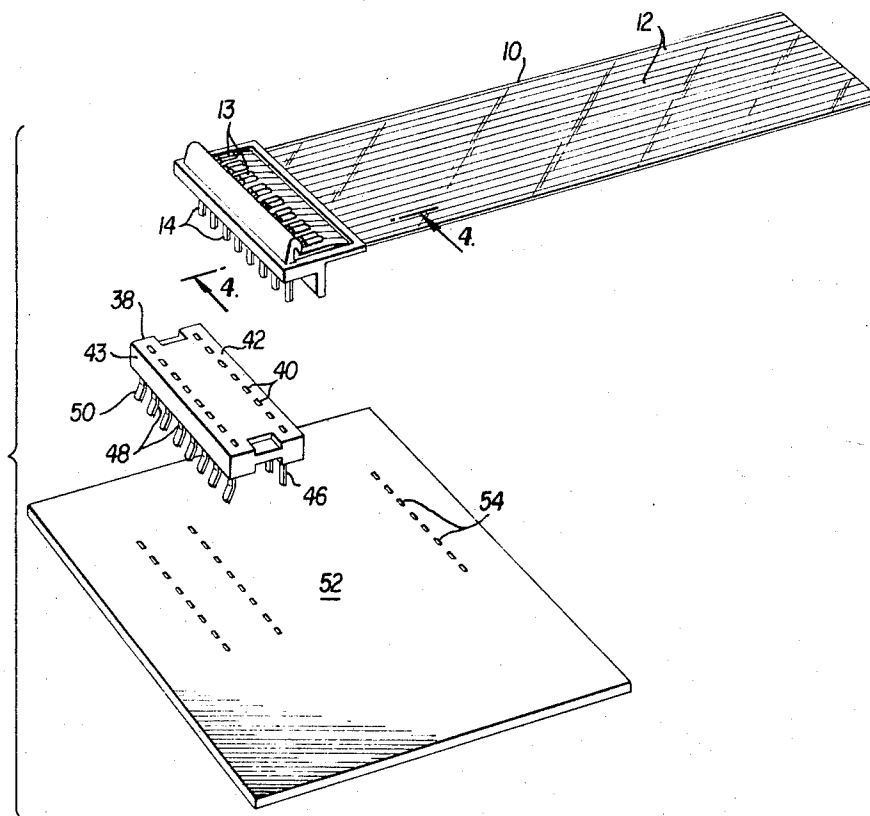


FIG. 1

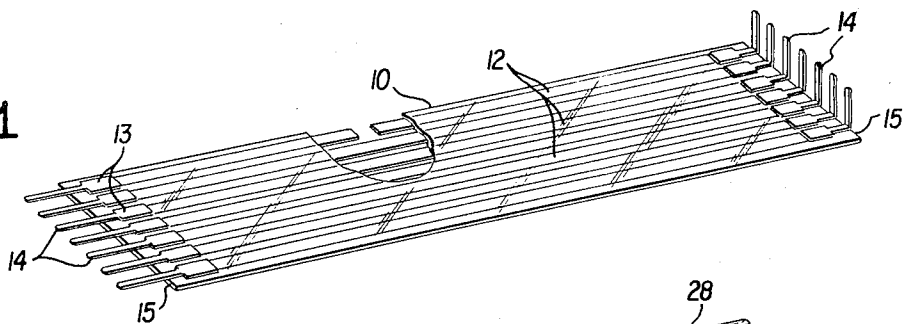


FIG. 2

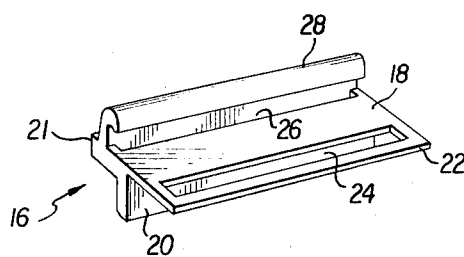


FIG. 3

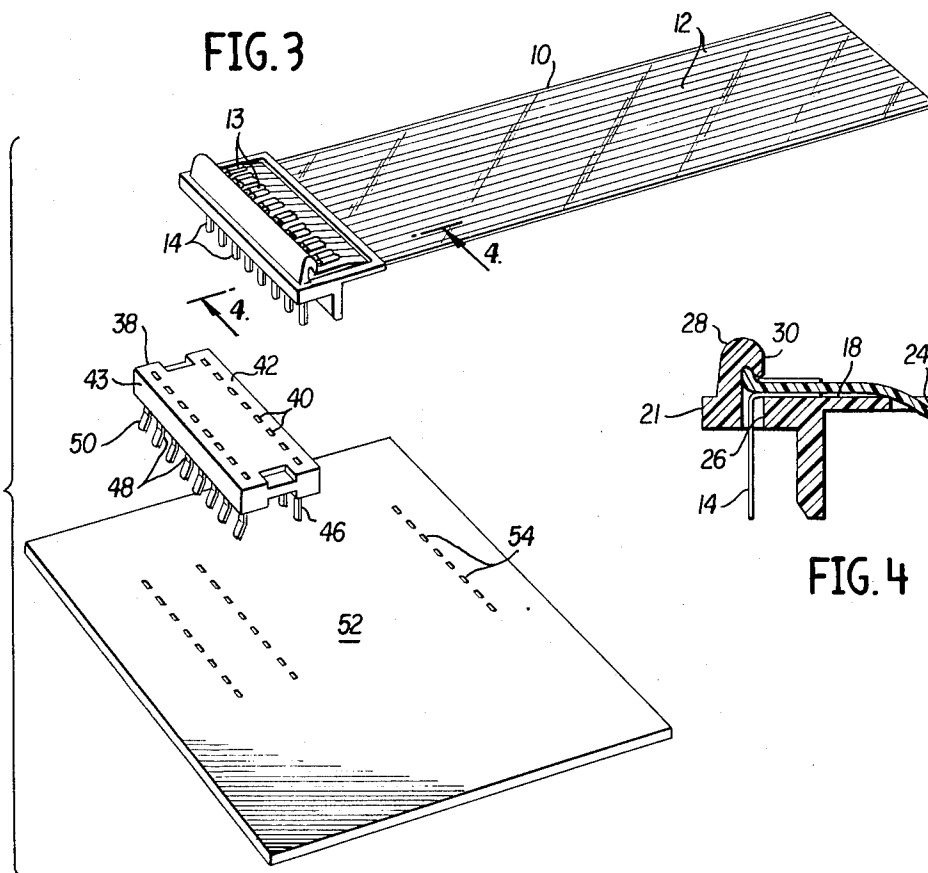
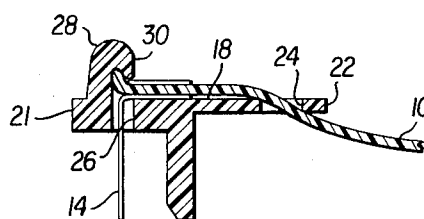


FIG. 4



ADAPTOR FOR CONNECTING FLAT CONDUCTOR CABLE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to electrical connectors, especially detachable connectors, and more particularly to an adaptor for securing a flat multi-conductor cable to DIP headers or PC boards.

2. Description of the Prior Art

Electrical connector systems presently utilized for securing flat multi-conductor cable to dual-in-line-package (DIP) headers or printed circuit (PC) boards are usually constructed of a plurality of components and, in addition, contain conductors or contacts which essentially merely act as bridging means between the conductor cable and the DIP header or PC board. Such systems have consequently proven to be disadvantageous for a number of reasons. First, since the conductor cables in many cases are not connected directly to the DIP headers or PC boards, but rather to additional conductors or contacts of the connectors which thus act as bridge means between the conductor cable and the DIP headers or PC board, two connections are required for each conductor in the multi-conductor cable, one being from the conductor in the cable to a conductor in the connector and the other being from the conductor in the connector to the DIP header or PC board. Consequently, the likelihood of a breakdown in an individual connection is increased.

Additionally, the connections heretofore provided have been subject to being pulled loose through pressure or strains applied to the flat conductor cable. To alleviate this problem, connector assemblies have been designed for securing multi-conductor flat cables to printed circuit boards which positively force the conductors of the cable into engagement with the conductors of the printed circuit board and which include strain relief provisions for the cable. These assemblies, however, have not proven to be entirely satisfactory primarily because they are composed of a number of separate components, for example, a base member, a cover, separate conductors or contacts and a strain relief member, and assembly of the overall system usually requires a considerable period of time due to the number of individual operations involved.

Finally, since space is always at a premium in present integrated circuitry and the like, the amount of space required for such conventional connectors has proven to be undesirable and impractical.

SUMMARY OF THE INVENTION

Accordingly, the general purpose of the present invention is to provide an adaptor for connecting flat multi-conductor cable to DIP headers or PC boards, or other electrical components having corresponding pin receptacles, which has all of the advantages of similarly employed prior art devices with none of the above-identified disadvantages.

Therefore, it is an object of the present invention to provide an improved adaptor for connecting flat multi-conductor cable to DIP headers or PC boards.

Another object of the present invention is to provide an adaptor for connecting flat multi-conductor cable directly to a DIP header or PC board thereby insuring proper orientation and positive contact of each individ-

ual conductor of the cable with the conductors within the DIP header or on the PC board, and also being radially detachable from the header or the board.

A further object of the present invention is to provide an adaptor for securing flat multi-conductor cable to another electrical component which provides uniform strain relief over the entire width of the flat cable thereby insuring against dislodging of the contact of the several conductors of the cable from the conductors of the electrical component.

A still further object of the present invention is the provision of an adaptor for connecting flat multi-conductor cable to other electrical components which is simple and economical to manufacture and which provides increased reliability in assembly.

Yet a further object of this invention is to provide an adaptor for connecting flat multi-conductor cable to a flat planar surface of a DIP header or PC board, as opposed to along an edge of the header or board, thereby economizing space requirements and providing versatility of operation.

The foregoing and other objects are attained according to one aspect of the present invention through the provision of a novel one-piece adaptor which is prefabricated to provide convenient assembly with a flat multi-conductor cable in such a manner as to provide strain relief for the cable. Thus, the adaptor has a flat planar surface which is provided with parallel elongate slots for receiving one end of the cable from one side through one of the slots, whereupon it is locked against the flat surface by bending male contact pins of terminal connectors secured to the conductors of the cable at right angles while returning them to the same side by passing them through the other slot. On the opposite side of the flat planar surface, elongated flat surfaces oriented at right angles are provided which serve as abutments for positioning the adaptor and its associated flat conductor cable in proper relation to a DIP header or a PC board.

BRIEF DESCRIPTION OF THE DRAWINGS

Various other objects, features and attendant advantages of the present invention will be more fully appreciated as the same becomes better understood from the following detailed description of a preferred embodiment of the invention, especially when considered in conjunction with the accompanying drawings wherein like reference numerals designate like or corresponding parts throughout the several figures, and in which:

FIG. 1 is a perspective view of a flat multi-conductor cable utilized in conjunction with the adaptor of the present invention;

FIG. 2 is a perspective view of an adaptor formed in accordance with the present invention;

FIG. 3 is a perspective exploded view of the adaptor shown in FIG. 2 being assembled with a flat multi-conductor cable, such as shown in FIG. 1, being illustrated as readily connectable to a dual-in-line-package (DIP) header, which in turn is securable to a printed circuit (PC) board; and

FIG. 4 is a cross-section view of the adaptor of the present invention having a flat multi-conductor cable secured thereto, being taken along the line 4—4 of FIG. 3.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now to the drawings, and more particularly to FIG. 1 thereof, there is shown a conventional flat multi-conductor tape cable 10, which may, for example, be the particular cable manufactured by and commercially available under the name "Tape Cable" from the Tape Cable Corporation of Rochester, New York. The cable 10 consists of upper and lower layers of insulation, as for example a transparent polyester, which may be "Mylar," manufactured by Du Pont, between which are sandwiched thin parallel printed copper conductors 12. The cable is generally available in different widths depending upon the number of conductors being contained therein, the conductors usually being on the order 0.060 inches in width and being spaced apart 0.100 inches on center, while the tape is about 0.008 inches thick and is very flexible, light in weight, and easily handled in complex wiring operations.

A plurality of conductor terminal contacts 13 are suitably secured to the conductors 12 by clamping, crimping or stapling, and have integrally formed therewith male contact pins 14 which project laterally from the ends 15, 15 of the flat conductor cable 10.

Referring now to FIG. 2, the novel and unique adaptor of the present invention will now be described. It will be noted that the adaptor being generally designated by the reference numeral 16 is a prefabricated, single-piece unit which is substantially T-shaped in cross-section, being comprised mainly of a horizontal portion providing an upper planar surface 18 and a depending leg 20 which, as shown, is perpendicular to the horizontal portion, is disposed substantially intermediate opposing end edges 21 and 22 thereof on the side opposite the planar surface 18, and extends substantially the full width of the horizontal portion between the opposing end edges 21 and 22. It is to be understood, of course, that depending upon the orientation of the adaptor during its use, the upper planar surface 18 thereof may be disposed in other than a horizontal position.

Parallel slots 24 and 26 are respectively provided in the horizontal portion of the adaptor 16 also being parallel with the plane of the depending leg 20 and being substantially equal in length to the width of the conductor cable 10 which the adaptor is designed to accommodate. Upstanding from the upper planar surface 18 and being disposed between the slot 26 and the edge 21 is an elongate arm 28 which preferably is inclined inwardly toward the slot 26, being provided with a curved end portion 30 which curves inwardly toward the upper planar surface 18 and above the slot 26, being substantially equal in length to the length of the slot.

In assembling the flat multi-conductor cable 10 within the adaptor 16, as best shown in FIGS. 3 and 4, the male contact pins 14 of one end 13 of the flat cable 10 are preferably first bent substantially 90° from their pre-assembly position shown in FIG. 1 and the end of the cable 10 is then inserted upwardly through the slot 24 and directed toward the upstanding arm 28 so as to pass over the upper planar surface 18. The male contact pins 14, upon being lodged beneath the downwardly curved terminal portion of the upstanding arm 28 may then be easily forced downwardly through the slot 26, whereupon the edges of the male contact pins 14 project below the lower surface of the horizontal

portion of the adaptor 16, but as shown in FIG. 4, preferably not projecting as far below the surface thereof as does the depending leg 20.

For the purpose of facilitating this assembly, the slot 24 preferably is wider than the slot 26, since the slot 24 must receive both the flat multi-conductor cable 10 and the connector terminals 13 thereon, which add somewhat to the thickness of the cable, while the slot 26 need only receive the end portions of the male contact pins of the terminals 13. Also, the thickness of the horizontal portion of the adaptor 16 is preferably greater on one side of the depending leg 20 than on the other side thereof, namely being thicker on the upstanding arm 28 side, since this is the electrical component abutting surface and since the strain relief is provided primarily in this area. Thus, it may be seen that the slots 24 and 26, together with the upper planar surface 18, provide strain relief means for the cable 10, such strain relief acting uniformly throughout the longitudinal extent of the adaptor 16. Obviously, the cable 10 may thus be pulled forceably without having any strain pass beyond the slots 24 and 26 and, therefore, the conductors 12 and the male contact pins 14 of the cable 10 will not be affected. Further, it should be observed that it is the end surface of edge 15 of the cable 10 which engages the inwardly curved portion of the upstanding arm 28, the downwardly bent male contact pins being bent below the lower surface of the cable 10 or the surface engaging the upper planar surface 18 of the adaptor 16. The cable is resilient and forces edge 15 of the cable to resiliently lodge against the arm 28 and thereby transmit forces constantly downwardly on the pins 14 forcing the pins to be retained at all times in the slot 26.

Referring now particularly to FIG. 3, there is disclosed a dual-in-line package (DIP) header being generally designated by the reference numeral 38 having parallel rows of holes or female contacts 40 located in its upper surface 42 adjacent and parallel to the edges 43 and 44 thereof. Projecting from the lower surface of the DIP header 38 are a corresponding pair of rows of contact pins 46 and 48, one pin corresponding to each of the holes 40. While the pins 46 are perpendicularly oriented relative to the lower surface of the DIP header 38 along their entire length, the pins 48 may be partially angled away therefrom, as disclosed at 50, if desired, the angling of these projections facilitating an even firmer means of securing the DIP header 38 to a PC board, as hereinafter disclosed.

The DIP header 38 may then be readily secured to a printed circuit board 52 through holes in the PC board which terminate on the lower side thereof in electrical connections established to printed wiring thereon.

Thus, as shown, the adaptor 16 facilitates the connection of a flat multi-conductor cable 10 to a PC board 52 through a DIP header 38, with the downwardly bent male contact pins 14 being received in the holes 40 of the DIP header 38 and the upper surface 42 and edge 44 of the header 38 being abutted against the lower surface of the thickest side of the horizontal portion of the adaptor 16 and the depending leg 20, respectively, in such a manner that the connection is firmly made to prevent dislodging and undesired removal of the pins 14 from their sockets and to relieve strain upon the individual conductors 12 of the cable 10.

On the other hand, if desired, the adaptor 16 may just as easily connect the flat multi-conductor cable 10 directly to the PC board 52 if a row of holes 54 are provided in the printed circuit board for receiving the male contact pins 14 and connecting the same with printed lines on the lower side of the board which terminate in the holes 54. In this case, as in the previous illustration, the edge of the PC board adjacent the row of holes 54 abuts against the depending leg 20 of the adaptor 16 while the upper surface of the PC board abuts against the lower surface of the thicker side of the horizontal portion of the adaptor 16, to provide a firm engagement for securing the adaptor in place and preventing undesirable removal or dislodgement of the pins 14 from the holes 54. The pins 14 may be soldered in the holes 54 to the holes 54 may be provided with miniature resilient spring receptacles into which the pins 14 can be resiliently plugged.

Two of the adaptors may be secured adhesively back-to-back to make a single composite adaptor for two cables. Alternatively, two back-to-back adaptors may be molded in one-piece to provide a single adaptor for two cables.

Hence, the advantages flowing from the use of the novel adaptor of the present invention will be readily apparent to those skilled in the art. A simple, inexpensive, one-piece adaptor has been provided for connecting flat multi-conductor cable directly to a DIP header or PC board, or any other electrical component being provided with suitable female terminals for receiving the male contact pins of the cable, thereby insuring proper and reliable connections, and these connections additionally provide inherent strain relief so that the conductor cable will not be subjected to inadvertent or undesirable removal from the DIP header or PC board, although such may be intentionally and quickly removed from the header or board, if such is desired.

Obviously many modifications and variations of the present invention are possible in light of the above teachings. Accordingly, it is to be understood, therefore, that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described herein.

Accordingly, what is claimed as new and desired to be secured by Letters Patent of the United States is:

1. An adaptor for effecting positive contact between the individual conductor ends of a flat multi-conductor cable having male contact secured thereto and bent at an angle and the conductors of a corresponding electrical component, comprising:

means defining a planar surface;

a first elongate slot in said planar surface;

a second elongate slot in said planar surface being parallel to said first slot;

an elongate arm upstanding from said planar surface being parallel with said first and second elongate slots and positioned to form a barrier adjacent an edge of said planar surface on the side of said second elongate slot remote from said first elongate slot; and

means on the opposite side of said planar surface forming right-angled flat abutment surfaces for abutting said electrical component, said means forming said abutment surfaces including a portion of the opposite side of said planar surface-forming means being disposed opposite the upstanding arm adjacent said second elongate slot and a leg de-

pending from the opposite side of said planar surface.

2. The adaptor set forth in claim 1 wherein said upstanding arm terminates in a portion curved inwardly toward the planar surface and over said second elongate slot.

3. The adaptor set forth in claim 2, wherein said first elongate slot is wider than said second elongate slot.

4. A connector assembly for effecting positive contact between the individual conductor ends adjacent one end of a flat multi-conductor cable having male contact pins secured thereto and bent at an angle and the conductors of a printed circuit board comprising:

an adaptor being substantially T-shaped in cross-section having an upper planar surface on the T-cross bar and a leg depending from a lower surface of said T-cross bar forming the T-leg;

a first elongate slot in said T-cross bar for receiving said one end of said flat multi-conductor cable being inserted from said lower surface to project above said upper planar surface;

a second elongate slot in said T-cross bar being parallel to said first elongate slot and being disposed on the side of said depending leg opposite said first elongate slot for receiving said bent contact pins secured to said cable with said contact pins projecting below said lower surface of said T-cross bar;

an elongate arm upstanding from said upper planar surface being parallel to said first and second elongate slots and disposed on the side of said second elongate slot remote from said first elongate slot, being curved inwardly at its upper portion toward said upper planar surface and over said second elongate slot for directing said contact pins secured to said flat cable downwardly through said second elongate slot and maintaining said flat cable in engagement with said upper planar surface; and

a printed circuit board having a row of receptacles in an upper surface adjacent one edge for receiving said contact pins projecting downwardly through said second elongate slot of said adaptor and having said upper surface and said one edge for abutting said lower surface adjacent said second elongate slot and said depending leg, respectively.

5. A connector assembly for effecting positive contact between the individual conductor ends adjacent one end of a flat multi-conductor cable having male contact pins secured thereto and bent at an angle and the conductors of a printed circuit board comprising:

an adaptor being substantially T-shaped in cross-section having an upper planar surface on the T-cross bar and a leg depending from a lower surface of said T-cross bar forming the T-leg;

a first elongate slot in said T-cross bar for receiving said one end of said flat multi-conductor cable being inserted from the lower surface to project above said upper planar surface;

a second elongate slot in said T-cross bar being parallel to said first elongate slot and being disposed on the side of said depending leg opposite said first elongate slot for receiving said bent contact pins secured to said cable with said contact pins projecting below said lower surface of said T-cross bar;

an elongate arm upstanding from said upper planar surface being parallel to said first and second elongate slots and being disposed on the side of said depending leg opposite said first elongate slot for receiving said bent contact pins secured to said cable with said contact pins projecting below said lower surface of said T-cross bar;

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gate slots and disposed on the side of said second elongate slot remote from said first elongate slot, being curved inwardly at its upper portion toward said upper planar surface and over said second elongate slot for directing said contact pins secured to said flat cable downwardly through said second elongate slot and maintaining said flat cable in engagement with said upper planar surface;
a dual-in-line-package header having a series of holes in an upper surface adjacent an edge for receiving

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said contact pins projecting through said second elongate slot, having said upper surface and said edge for abutting said lower surface of said T-cross bar adjacent said second elongate slot and said depending leg, respectively, and having corresponding contacts depending therefrom; and
a printed circuit board having a row of receptacles for receiving said corresponding contacts depending from said dual-in-line-package header.

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