

[54] CONNECTOR ADAPTER

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193 P

[56] References Cited

UNITED STATES PATENTS

2,844,807	7/1958	McMulkin	339/193 P
3,075,167	1/1963	Kinkaid	339/176 MP
3,176,261	3/1965	Greco et al.	339/176 MP
3,381,260	4/1968	Brown	339/218 M
3,696,319	10/1972	Olsson	339/176 MF X
3,746,932	7/1973	Hogan et al.	339/176 MP X
3,853,389	12/1974	Occhipinti	339/258 R
3,865,454	2/1975	Blinder	339/17 C

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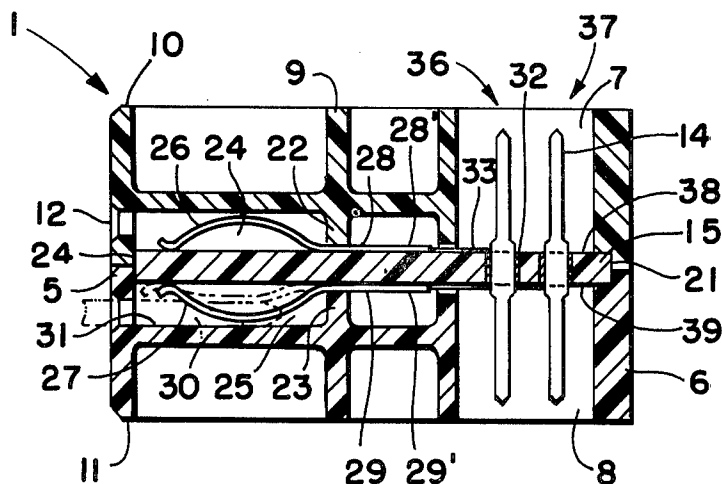
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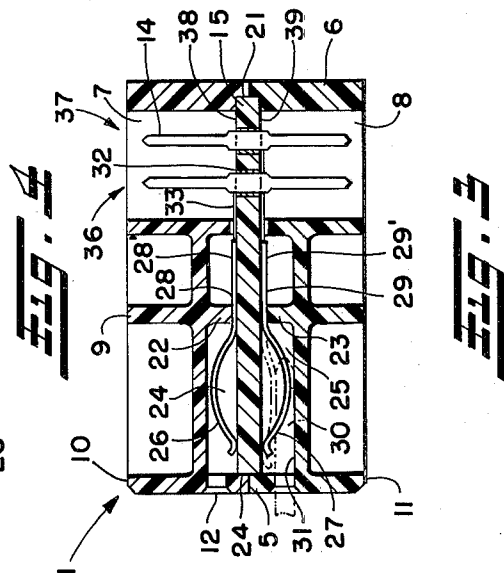
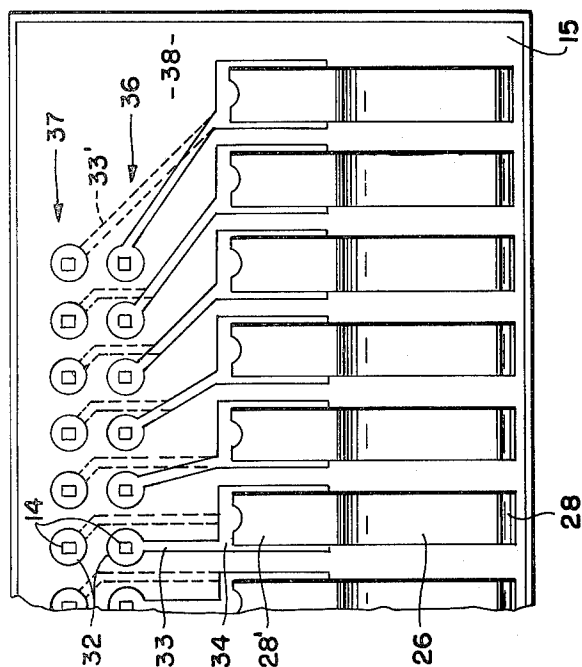
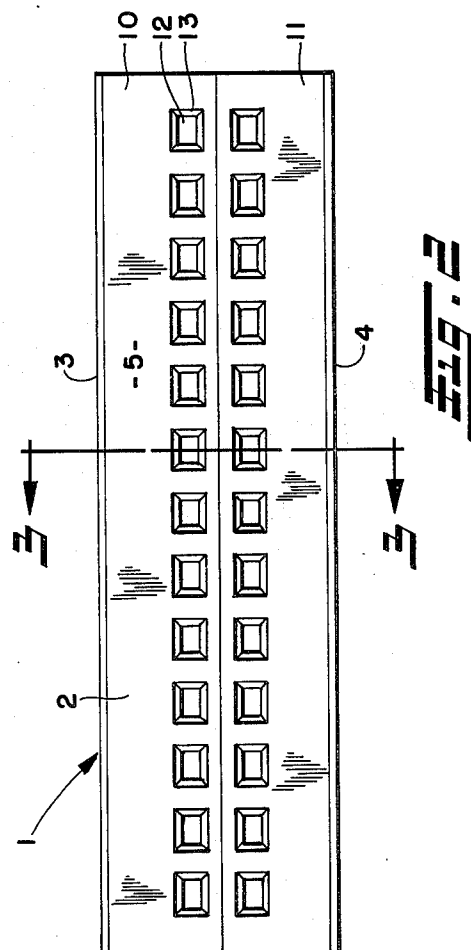
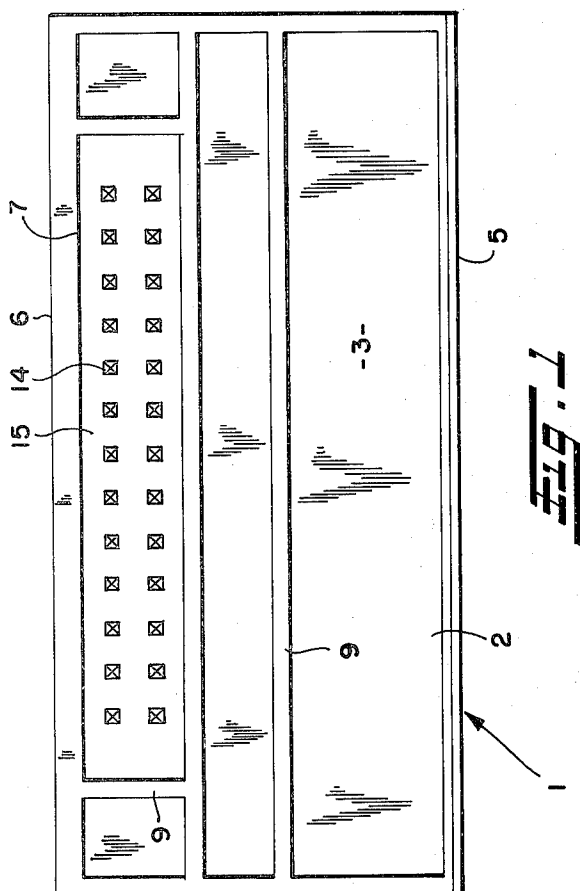
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[57] ABSTRACT

An adapter for coupling different size multiple conductor electrical cable terminations, which have respective connector pins and contacts located in different size arrays or spaced-apart positional patterns, includes a printed circuit board to which a plurality of contacts are attached at one edge for receiving the connector pins from one of the cable terminations and to which a corresponding plurality of connector pins are attached in plated-through holes for connection with the contacts in the other cable termination. The spacings of the contacts and connector pins in the adapter correspond to the spacings, respectively, of the connector pins and contacts in the cable terminations to be coupled thereby. Electrically conductive paths are printed on the printed circuit board between respective contacts and connector pins thereon to effect fanning in or fanning out between the same, and the printed circuit board, including the connector pins and contacts thereon, is located in a housing, which facilitates coupling between the same and conventional cable terminations.

10 Claims, 4 Drawing Figures





CONNECTOR ADAPTER

BACKGROUND OF THE INVENTION

This invention relates, as indicated, to a connector adapter for coupling two or more multiple conductor electrical cable terminations, which have, respectively, connector pins and contacts located in different spaced-apart patterns or arrays, and more particularly relates to such a connector adapter which uses printed circuits on a printed circuit board to fan in and to fan out and to which respective contacts and connector pins are directly attached.

Conventional techniques for electrically connecting respective electrical conductors in two multiple conductor electrical cables have included individually splicing respective conductors, which task is long and tedious. Another technique for such connection is to connect wires from one of the cables, for example by soldering, to a plurality of respective wire wrapping posts and then to wrap the respective conductors in the second cable about such posts, and the time required for such connections is also quite lengthy.

A more efficient method for electrically connecting respective conductors in two multiple conductor electrical cables is by the addition of respective male and female cable terminations at the ends of both such cables, the male termination having a plurality of extending connector pins connected to respective conductors in one cable and the female termination having a plurality of contacts therein connected to respective conductors in the other such cable. Insertion of respective connector pins into corresponding contacts when the two terminations are coupled together forms effective electrical connections between corresponding conductors in the two cables. This technique is useful when respective cable terminations are of the same size, i.e., the contacts and connector pins are located at positions in same size patterns or arrays as opposed to overall termination dimensions, but such technique has been ineffective when the respective cable terminations are of different sizes, i.e., the connector pins and contacts in the respective cable terminations are located in different size positional patterns or arrays.

SUMMARY OF THE INVENTION

In the instant invention an adapter is provided to couple two different size cable terminations by using respective printed circuits on opposed surfaces of a printed circuit board to fan in or to fan out between respective contacts and connector pins located thereon. The contacts are preferably soldered to terminal pads of respective printed circuits, and the connector pins are preferably soldered in respective plated-through holes for both electrical connection to the respective printed circuits and mounting relative to the printed circuit board. Moreover, the contacts and connector pins are conveniently located in different size positional arrays or patterns for connection with cable terminations of respective sizes corresponding thereto, the reference to size hereafter referring to contact and connector pin spacing or to size of connector pin and contact arrays as opposed to overall dimensions of the connector adapter or cable terminations. The printed circuit board, including the contacts and connector pins thereon, is retained in an electrically non-conduc-

tive housing for facilitating manipulation thereof and connection with cable terminations to provide for electrical connection between corresponding conductors to which the latter are connected.

Accordingly, a primary object of the invention is to provide a connector adapter improved in the noted respects.

Another object of the invention is to facilitate coupling between male and female cable terminations of different size, which have respective connector pins and contacts arranged in different size arrays or patterns.

A further object of the invention is to connect a plurality of pins arranged in a first array pattern in a first cable termination with a corresponding plurality of contacts arranged in a second array pattern in a second cable termination.

An additional object of the invention is to provide an adapter for coupling multiple electrical conductor cable terminations having a corresponding number of connector pins and contacts, respectively, arranged in different arrays or patterns.

These and other objects and advantages of the instant invention, which comprises a connector adapter which provides for electrical connection between the plurality of contacts positioned in a first array or pattern in a female cable termination and the plurality of connector pins positioned in a second array or pattern in a male cable termination, such cable terminations being otherwise incompatible for direct coupling and electrical connection therebetween, will become apparent as the following description proceeds.

To the accomplishment of the foregoing and related ends, the invention, then, comprises the features hereinafter fully described in the specification and particularly pointed out in the claims, the following description and the annexed drawing setting forth in detail a certain illustrative embodiment of the invention, this being indicative, however, of but one of the various ways in which the principles of the invention may be employed.

BRIEF DESCRIPTION OF THE DRAWING

In the annexed drawing:

FIG. 1 is a top view of a connector adapter in accordance with the invention;

FIG. 2 is a front view of the connector adapter illustrated in FIG. 1;

FIG. 3 is a section view of a portion of the connector adapter taken along the line 3—3 of FIG. 2; and

FIG. 4 is a plan view of a printed circuit board, including contacts and connector pins affixed thereto, used in the connector adapter of the invention, such figure being on a slightly larger scale than the other figures.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawing, wherein like reference numerals refer to like elements in the several figures, and particularly to FIGS. 1 and 2, the connector adapter of the invention is illustrated generally at 1. The connector adapter 1 includes a molded housing 2 of plastic, phenolic or other electrically non-conductive material, having a top 3 and a bottom 4 and front and rear walls 5, 6; and in the top and bottom, respectively, are formed relatively wide openings 7, 8, the latter being seen, however, only in FIG. 3, of a size de-

signed to receive a first female cable termination.

The top 3 and bottom 4 of the connector adapter 1 have a number of strengthening ribs 9 integrally molded therein, and the molded housing 2 is preferably formed of substantially identical upper and lower halves 10, 11 for convenience of assembly. Moreover, front wall 5 includes a plurality of contact access openings 12, the forward-most portions of which are beveled at 13, for receiving connector pins located on a male cable termination. The relatively wide openings 7, 8 in the upper and lower halves 10, 11 of the molded housing provide access to the connector pins 14, which are preferably mounted on a substantially planar substrate 15, such as a printed circuit board.

Turning now more particularly to FIGS. 3 and 4, the connector adapter 1 is illustrated in section in the former and the printed circuit board 15 is illustrated in the latter. The printed circuit board is preferably a planar electrically non-conductive member positionally retained in the molded housing 2 by a cut-out groove 21 formed in the rear wall 6 and by a pair of retaining ribs 22, 23 formed on the upper and lower housing halves, whereby the printed circuit board is retained in such housing in abutment at 24 with the front wall 5.

Respective channels 24, 25 are defined between the front wall of each of the housing halves and the respective retaining ribs 22, 23 to accommodate bowed portions 26, 27 of respective contacts 28, 29, and access to such channels is provided by way of respective contact access openings 12. A conventional connector pin 30 from a male cable termination, not shown, is illustrated in phantom in FIG. 3 inserted through the access opening 12 into the channel 25 in connection with the contact 29 causing the same to flatten as is also shown in phantom, whereby a good electrical connection is made between such pin and contact and the frictional forces between the two, as well as between the pin and the surface 31, effect retention of the pin.

The connector pins 14 are attached to the printed circuit board substrate 15 in plated-through holes 32 formed therein, and printed circuit electrically conductive paths 33 between respective pins and contacts provide electrical connection therebetween, while fanning in or out between the same. The tail portions 28', 29' of the contacts 28, 29 are preferably soldered to printed terminal pads 34, for example, forming extensions of the respective printed circuit electrically conductive paths 33, as illustrated in FIG. 4; since the thickness of the printed circuits 33 is substantially less than that of the contacts 28, 29, the terminal pads 34, are not seen in FIG. 3.

In the preferred embodiment of the invention the connector pins 14 are arranged in two rows 36, 37, and those in the forward-most row 36 are electrically connected by printed circuits 33 to respective contacts 28 located on the top surface 38 of the printed circuit board 15, while those in the rearwardmost row 37 are electrically connected by printed circuit 33' to the contacts 29 on the lower surface 39 of the printed circuit board. If desired, however, other patterns of connection between connector pins and contacts may alternatively be utilized. Moreover, although the connector pins 14 extend through the plated-through openings to both sides of the printed circuit board 15 for facilitating connection with one or even two cable terminations, such connector pins may alternatively be adapted to extend only on one side of the printed circuit board or they may alternately extend to opposite sides

thereof. Also, if desired, the contacts 28, 29 may be located only on a single side of the printed circuit board 15 for connection with connector pins on a male cable termination located in a single row, or more than two such rows of contacts may be built into the connector adapter 1 simply by effectively duplicating the same to provide for more than two rows of contacts 28, 29 and access openings 12, while still remaining within the scope of the invention. A still further modification of the invention envisions duplicating to the right of the connector pins 14 that portion of the connector adapter 1 shown in FIG. 3 to the left of the connector pins 14, thus providing for coupling to two male terminations of the same, or, if desired, different size.

In using the connector adapter 1 to couple two different size male and female cable terminations, the female termination would be fitted into one of the wide openings 7, 8 in the top or bottom of the connector adapter, whereby the contacts of the former will engage respective connector pins 14 of the latter. Moreover, the connector pins on the male cable termination would be fitted into respective access openings 12, facilitated by the bevels 13, for engagement with respective contacts 28, 29. Such connections being completed, the printed circuits 33 provide electrically conductive paths for connection between respective conductors in the connected multiple conductor cables.

I claim:

1. A connector adapter for electrical and mechanical connection of a plurality of electrically conductive pins arranged in a first array pattern respectively to a plurality of electrically conductive contacts arranged in a second array pattern, comprising an electrically non-conductive housing, a substantially planar electrically non-conductive support surface in said housing, a plurality of electrically conductive paths on said support surface, a plurality of connector contacts arranged in first spaced-apart positions on said support surface and extending in a direction substantially parallel to the plane of said support surface, each connector contact having a first portion electrically connected to a respective electrically conductive path and a second portion positioned for mechanical engagement with a respective electrically conductive pin that is inserted in a direction substantially parallel to the plane of said support surface to effect substantial mechanical engagement, a plurality of upstanding electrically conductive connector pins supported by said support surface at second spaced-apart positions and extending substantially perpendicular to the plane of said support surface, each of said connector pins having a first portion electrically connected to a respective electrically conductive path and a second portion positioned for mechanical engagement with a respective electrically conductive contact that is inserted in a direction substantially perpendicular to the plane of said support surface to effect substantial mechanical engagement, said second portions of said connector pins being positionally arranged with respect to each other in such second array pattern, said plurality of electrically conductive paths on said support surface thus electrically connecting respective connector contacts and connector pins, and at least a portion of each of said connector contacts and connector pins being retained in said housing.

2. A connector adapter for electrical and mechanical connection of a plurality of electrically conductive pins arranged in a first array pattern respectively to a plural-

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ity of electrically conductive contacts arranged in a second array pattern, comprising a substantially planar electrically non-conductive support surface, a plurality of electrically conductive paths on said support surface, a plurality of connector contacts arranged in first spaced-apart positions on said support surface, each connector contact having a first portion electrically connected to a respective electrically conductive path and a second portion positioned for mechanical engagement with a respective electrically conductive pin, a plurality of upstanding electrically conductive connector pins supported by said support surface at second spaced-apart positions and extending substantially perpendicular to the plane of said support surface, each of said connector pins having a first portion electrically connected to a respective electrically conductive path and a second portion positioned for mechanical engagement with a respective electrically conductive contact, said second portions of said connector pins being positionally arranged with respect to each other in such second array pattern, said plurality of electrically conductive paths on said support surface thus electrically connecting respective connector contacts and connector pins, and an electrically non-conductive housing within which at least a portion of each of said support surface, connector contacts and connector pins are retained.

3. A connector adapter as set forth in claim 1, wherein said substantially planar support surface comprises a printed circuit board and said plurality of electrically conductive paths comprises respective printed circuits printed thereon, and wherein said first portion of each of said connector pins is electrically connected to a respective printed circuit in a plated-through hole.

4. A connector adapter as set forth in claim 3, wherein said first portion of each of said connector contacts is soldered to a respective printed circuit on said printed circuit board.

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5. A connector adapter as set forth in claim 3, wherein said printed circuits fan in from said connector contacts to said connector pins.

6. A connector adapter as set forth in claim 2, wherein said plurality of connector contacts are positioned on both the upper and lower surfaces of said substantially planar support surface.

7. A connector adapter as set forth in claim 2, wherein said second portion of each of said connector contacts is bow-shaped, and such bow-shaped portion is adapted for flattening upon engagement with an inserted pin to effect a relatively large contact area therebetween.

8. A connector as set forth in claim 2, wherein said housing comprises upper and lower parts fastened together, and each housing part including a respective portion cooperable with each other for firm retention of said support surface.

9. A connector adapter as set forth in claim 2, wherein said electrically conductive pins and contacts in said respective first and second array patterns are located in respective male and female multiple conductor electrical cable terminations, said connector pins being recessed in said housing and located within an opening of a shape to receive such female termination, said connector contacts being fully recessed within said housing and respective openings in said housing providing access for said pins to respective connector contacts, and said first and second spaced-apart positions correspond to the spacing in respective arrays, whereby pins in one of such cable terminations are connected to respective connector contacts in said adapter and contacts in the other cable termination are connected to respective connector pins in said connector adapter for electrical connection between respective conductors coupled to said respective cable terminations.

10. A connector adapter as set forth in claim 2 wherein said second portion of each of said connector pins comprises two such portions, each extending substantially in a perpendicular direction away from the respective opposed surfaces of said support surface.

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