

[54] FLEXIBLE FLAT CABLE SYSTEM

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[58] Field of Search 339/17 F, 17 L, 17 LM, 339/59, 61, 75 MP, 174, 176 MF, 176 MP

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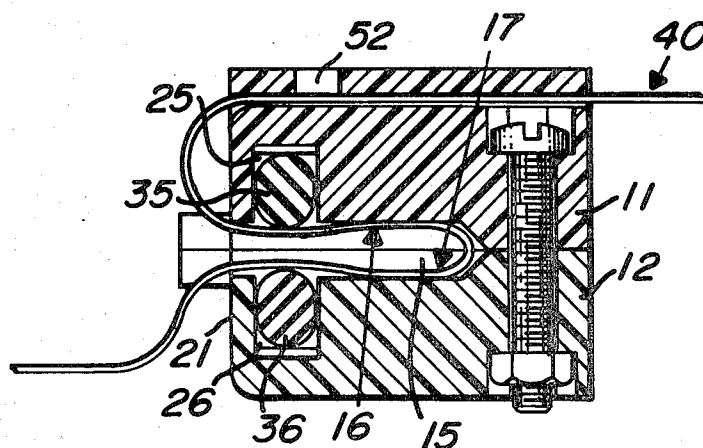
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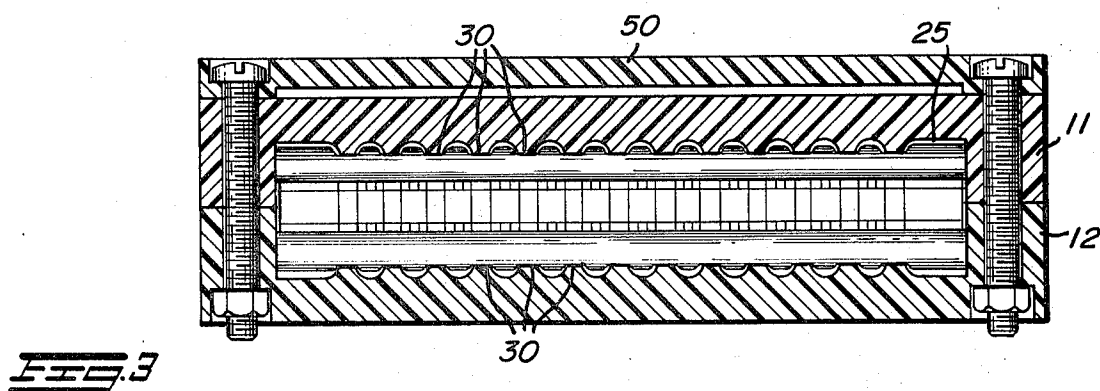
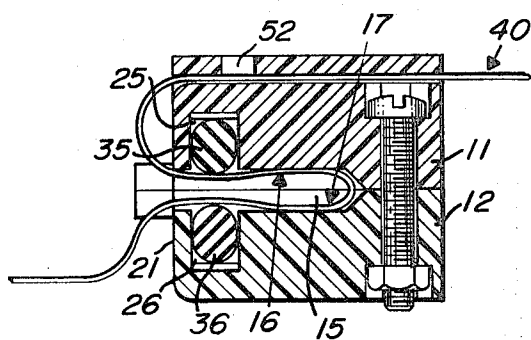
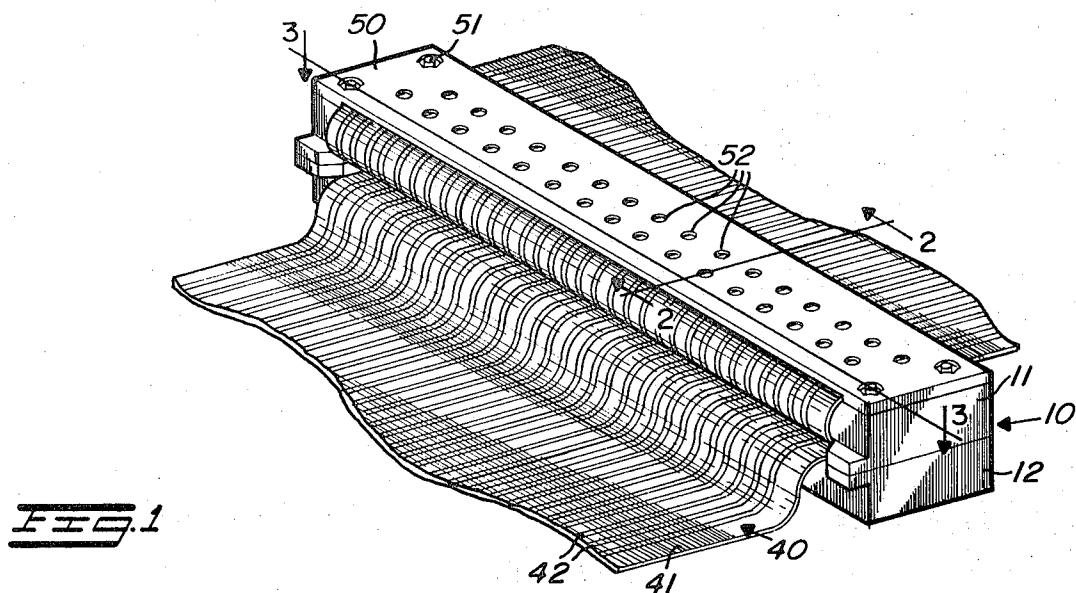
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ABSTRACT

A housing having an elongated slot therein with opposed parallel channels in the upper and lower surfaces adjacent the opening of the slot and parallel spaced apart ridges extending transverse to the longitudinal axis of the channels in the bottom surface of each of the channels. An elongated cylindrical, silicone rubber member having a diameter slightly larger than the width and depth of the channels positioned in each of the channels so as to extend slightly into the slot and a flexible flat cable having a fold therein transverse to the parallel conductors and positioned in the slot between the resilient members with each conductor parallel to and overlying a ridge in the adjacent channel. Said cable further defining openings between the conductors positioned in overlying relationship to the resilient members and a portion of the cable folded back over the housing and fixed in position by a strip of plastic having openings therethrough to provide test point access to the conductors.

5 Claims, 4 Drawing Figures





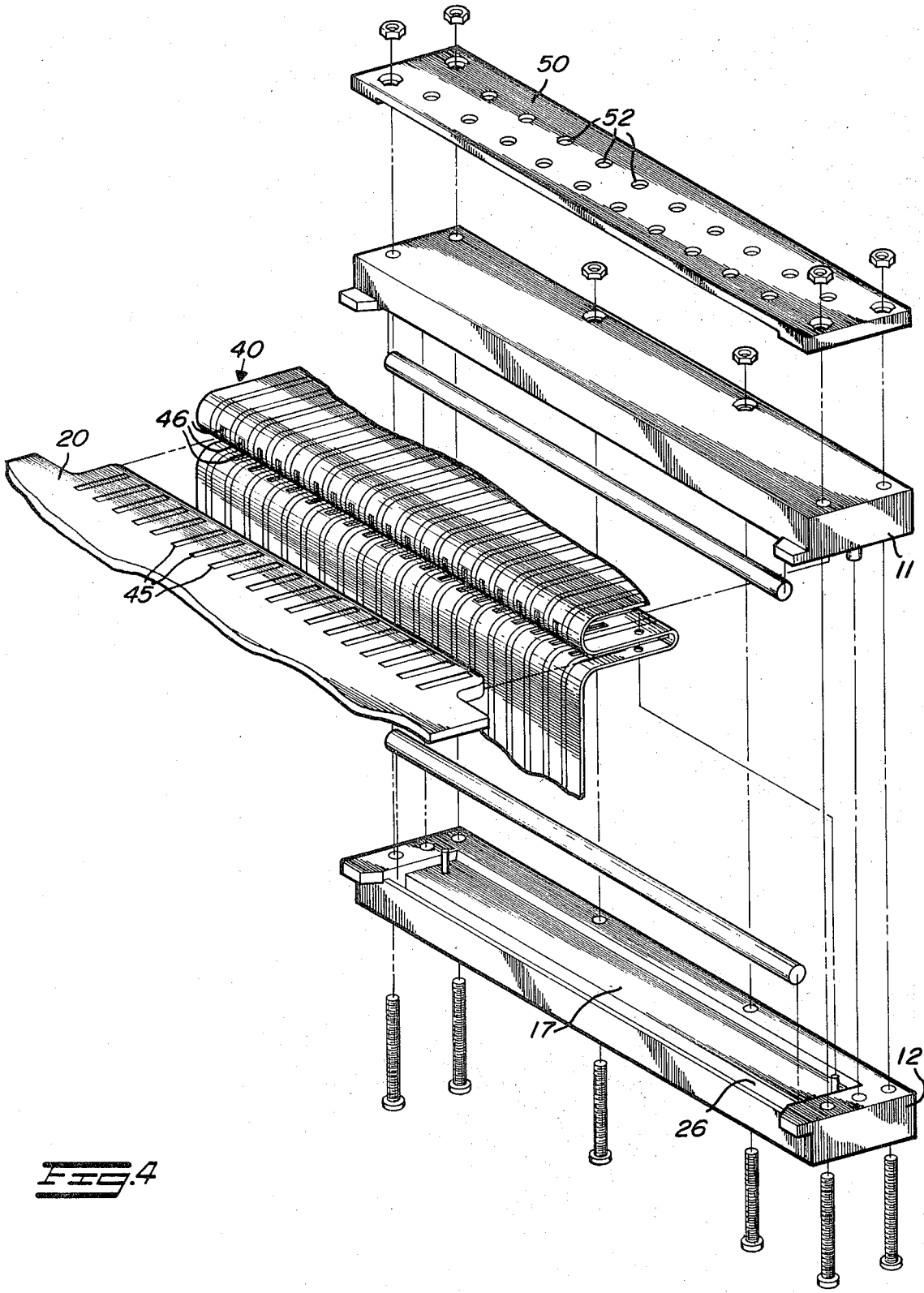


FIG. 4

FLEXIBLE FLAT CABLE SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

In electronic equipment utilizing a plurality of spaced apart parallel printed circuit boards, it is convenient to provide connection between the boards by means of a flat flexible cable having spaced apart parallel conductors extending axially therethrough. A great variety of connectors have been devised for connecting the flat cables to the printed circuit boards. In general, much difficulty has been encountered in providing a solid, low resistance connection between each of the conductors in the cable and each point on the printed circuit board.

2. Description of the Prior Art

In general, the prior art has attempted to include a springy material, such as the flexible plastic U-shaped insert described by McCullough in U.S. Pat. No. 3,319,216 entitled Connector for Flat Cables or the metal spring fingers described by Schneck in U.S. Pat. No. 3,102,767 entitled Electrical Connector for Flat Conductor Cable, to apply pressure to the conductors in the cable and press them against the contacts on the printed circuit board. However, where a solid elongated springlike member is incorporated it applies equal pressure along the entire cable and, since the nonconducting material between the conductors is at least as thick as the conductors, equal pressure along the entire surface of the cable fails to provide a good contact. In the connectors utilizing individual metal spring fingers the cost of the connector is relatively high and the device is relatively complicated to manufacture.

SUMMARY OF THE INVENTION

The present invention pertains to a cable system including a housing having an elongated slot therein with a pair of opposed parallel channels in the upper and lower surfaces thereof adjacent the opening and parallel spaced apart ridges in the bottom surface of each of the channels extending transversally to the channel. A resilient cylindrical member having cross sectional dimensions slightly larger than the channel and positioned in the channel so as to extend slightly outwardly into the slot and a flat flexible cable having a fold therein transverse to the conductors positioned between the resilient members with their portions of the conductors overlying the resilient members and parallel with and overlying a ridge in the adjacent channel. The cable further defining openings between the conductors to facilitate individual movement of the conductors to afford compliance to said printed circuit board. A portion of the cable being folded back over the housing with a strip of material overlying the portion to maintain it immovable and a plurality of spaced apart openings through said strip in overlying relationship to bear portions of conductors to provide test point access to said conductors.

It is an object of the present invention to provide an improved flexible flat cable system.

It is a further object of the present invention to provide a connector for a flexible flat cable wherein the contact between the conductors of the cable and a printed circuit board inserted therein is improved.

It is a further object of the present invention to provide a flexible flat cable system which is simple and inexpensive to manufacture.

These and other objects of this invention will become apparent to those skilled in the art upon consideration of the accompanying specification, claims and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Referring to the drawings, wherein like characters indicate like parts throughout the figures:

FIG. 1 is a view in perspective of an embodiment of the improved cable system;

FIG. 2 is an enlarged sectional view as seen from the line 2—2 in FIG. 1;

FIG. 3 is an enlarged sectional view as seen from the line 3—3 in FIG. 1;

FIG. 4 is an exploded view in perspective of the cable system illustrated in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the figures, the numeral 10 generally designates an elongated housing having a generally rectangularly shaped cross section. The housing 10 is formed of two elongated sections 11 and 12 each of which is approximately one-half of the housing 10 and generally a mirror image of the other section. Each section 11 and 12 of the housing 10 is composed of a non-conducting material and may be formed, for example, by molding plastic or the like.

An elongated slot 15 is formed in the housing 10, in the embodiment illustrated at the junction of the sections 11 and 12, and extends into the housing 10 so as to define spaced apart surfaces 16 and 17. The width of the slot 15 is slightly greater than the thickness of a printed circuit board 20 (see FIG. 4) adapted to be inserted in connecting relation therein. Further, the depth of the slot 15 is sufficient to receive the edge of the printed circuit board 20 in firm physical engagement therein. The opening of the slot 15 is in a leading edge or surface 21 of the housing 10.

First and second channels 25 and 26 are formed in the surfaces 16 and 17, respectively, of the slot 15 so as to be generally parallel with the opening or front surface 21 of the housing 10 and in overlying or opposed relationship with each other. The channels 25 and 26 extend approximately the full length of the slot 15 and have a generally rectangularly shaped cross section. The bottom surface of each of the channels 25 and 26 has a plurality of spaced apart, parallel ridges or corrugations formed therein. The ridges 30 extend generally transverse to the longitudinal dimensions of the slot 15 and channels 25 and 26. Further, the ridges 30 are positioned so that ridges in the channel 25 overlie ridges in the channel 26.

A pair of elongated, cylindrically shaped, resilient members 35 and 36 are positioned in the channels 25 and 26, respectively. The length of the members 35 and 36 is approximately equal to the length of the channels 25 and 26 and the diameter of the members 35 and 36 is slightly greater than the width and the depth of the channels 25 and 26. Because the cross sectional dimensions of the members 35 and 36 is slightly larger than the cross sectional dimensions of the channels 25 and 26, the members 35 and 36 are frictionally engaged in the channels 25 and 26 and extend slightly outwardly

into the slot 15. It should be understood that the members 35 and 36 are illustrated with a circular cross section but they might have substantially any convenient configuration, such as rectangular or trapezoidal. The members 35 and 36 should extend outwardly into the slot 15 from the channels 25 and 26 sufficiently so that the distance therebetween is smaller than the thickness of the printed circuit board 20. In the present embodiment the members 35 and 36 are formed of silicone rubber material which is highly resilient and has substantial memory so that it returns to substantially its original shape when the circuit board 20 is removed from the slot 15.

A flexible flat cable, generally designated 40, is formed of an elongated ribbon 41 of nonconducting material having a plurality of parallel spaced apart conductors 42 extending axially therethrough. A fold is formed in the cable 40 transverse to the conductors 42 and the fold is positioned in the slot 15 so that opposite sides thereof are adjacent and in overlying relationship to the surfaces 16 and 17 of the slot 15. The ridges 30 in the channels 25 and 26 are spaced apart a distance approximately equal to the spacing between the conductors 42 in the cable 40 and are positioned so that the portions of the conductors 42 in the cable 40 overlying the members 35 and 36 are in parallel overlying relationship to the ridges 30 in the adjacent channel 25 or 26 (see FIG. 3). A portion of the non-conducting material 41 in the cable 40 which insulates the portions of the conductors 42 overlying the resilient members 35 and 36 is removed to allow contact between the conductors 42 and a plurality of spaced apart contact areas 45 on the surface of the printed circuit board 20. When the printed circuit board 20 is inserted in the slot 15 the resilient members 35 and 36 are compressed slightly and the outwardly extending edges or surfaces of the ridges 30 impart pressure on the portions of the conductors 42 overlying the resilient members 35 and 36 tending to force the conductors 42 into tight physical and electrical contact with the contact areas 45. The depressed portions between the ridges 30 provide a substantially reduced pressure on the cable 40 at areas where electrical contact is not made so that insertion forced on the printed circuit board 20 can be substantially reduced. To further enhance the pressure applied to the cable 40 by the ridges 30, openings 46 are provided in the non-conducting material 41 between the conductors 42 in overlying relationship to the resilient members 35 and 36. The openings 46 allow movement of individual conductors 42 without transmitting the force applied thereon to the adjacent nonconducting material 41. Thus, a simple connector is formed which applies pressure to each of the individual conductors 42 for a low resistance contact with a printed circuit board 20 while requiring a relatively low insertion force for the printed circuit board.

A portion of the cable 40 is folded over the upper surface of the body 10 and a strip 50 of nonconducting material, which may be similar to the material forming the body 10, is fixedly engaged in overlying relationship thereto by some means, such as screws 51. The screws 51 may also be utilized to hold the sections 11 and 12 in fixed engagement. The strip 50 has a plurality of spaced apart openings 52 therethrough, which openings 52 are positioned so that each overlies a different conductor 42 in the cable 40. Further, a portion of the nonconducting material 41 is stripped from the con-

ductors 42 beneath the strip 50 so that bear conductors 42 are available in the openings 52. Thus, the openings 52 provide a readily available, test point access to the conductors 42 and, hence, to the contact areas 45 and components on the circuit board 20.

While we have shown and described a specific embodiment of this invention, further modifications and improvements will occur to those skilled in the art. We desire it to be understood, therefore, that this invention is not limited to the particular form shown and we intend in the appended claims to cover all modifications which do not depart from the spirit and scope of this invention.

We claim:

1. A cable system comprising:

- a. a flat flexible cable having a plurality of parallel spaced apart conductors extending longitudinally therethrough and maintained in position by a flexible, nonconducting material;
- b. a connector housing having an elongated slot therein for receiving an edge of a printed circuit board, said slot opening outwardly along one side of said housing and extending inwardly to form sides, spaced apart a distance slightly greater than the thickness of the printed circuit board to be received therein;
- c. said housing further defining first and second channels opening into said slot and extending generally parallel with and spaced from the opening of said slot, said first and second channels being in opposite sides of said slot in generally parallel, opposed relationship;
- d. the bottom surface of each of said channels having a plurality of parallel ridges formed therein extending transverse to the longitudinal axis of said channels and spaced apart approximately the same distance as the spacing between the conductors in the flexible cable;
- e. first and second elongated, resilient cylindrical members having cross sectional dimensions slightly greater than the cross sectional dimensions of said channels in said housing and positioned in said channels so as to extend outwardly into said slot;
- f. said cable having a fold therein extending transverse to the conductors with said fold being positioned in said slot so that the conductors extend into said slot between said resilient members with each conductor overlying and parallel to a ridge in said channels; and
- g. said cable further defining elongated openings in the nonconducting material between the conductors and positioned adjacent said resilient members for providing movement of individual conductors.

2. A cable system as claimed in claim 1 wherein the resilient cylindrical members are formed from material including silicone rubber.

3. A cable system as claimed in claim 1 wherein the resilient cylindrical members have a round cross section with the diameter thereof being slightly larger than the depth and the width of the channels.

4. A cable system as claimed in claim 1 wherein the housing includes two generally mirror image halves with the junction extending axially along the slot.

5. A cable system as claimed in claim 1 including a portion of the cable extending outwardly from the slot folded back in overlying relationship to a side of the

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housing and a generally flat elongated strip affixed to the housing in overlying relationship to said portion of cable and said side for holding said portion of cable substantially immovable, said strip defining a plurality of spaced apart openings therethrough each overlying

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a different conductor in said portion of cable and the nonconducting material being at least partially removed from the portion of conductor in each of said openings so as to expose the portions of conductors.

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