United States Patent [19]

Johnson et al.

[11] **3,740,699**

[45] **June 19, 1973**

[54] **PRINTED CIRCUIT BOARD CONNECTOR**

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[73] Assignee: **GTE Sylvania Incorporated**, Seneca Falls, N.Y.

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[52] **U.S. Cl.** ..... **339/176 MP**, 339/221 M

[51] **Int. Cl.** **H05k 1/07**

[58] **Field of Search** ..... 339/17 F, 17 L, 17 LC, 339/17 LM, 17 M, 65, 75 MP, 176 MF, 176 MP, 184 M, 186 M, 217 S, 221 M

[56] **References Cited**

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[57] **ABSTRACT**

A printed circuit board connector having an insulative body in which are positioned a plurality of contacts designed to slidably engage angular indentations within corresponding recesses situated within the body during circuit board insertion. This motion results in a substantial reduction of the insertion forces encountered by the circuit board, these forces common in most connectors of this variety.

4 Claims, 6 Drawing Figures

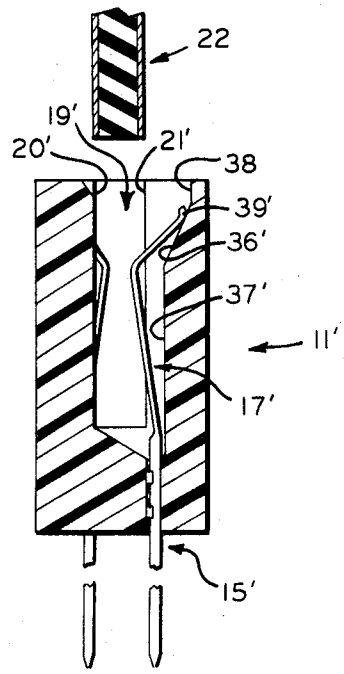
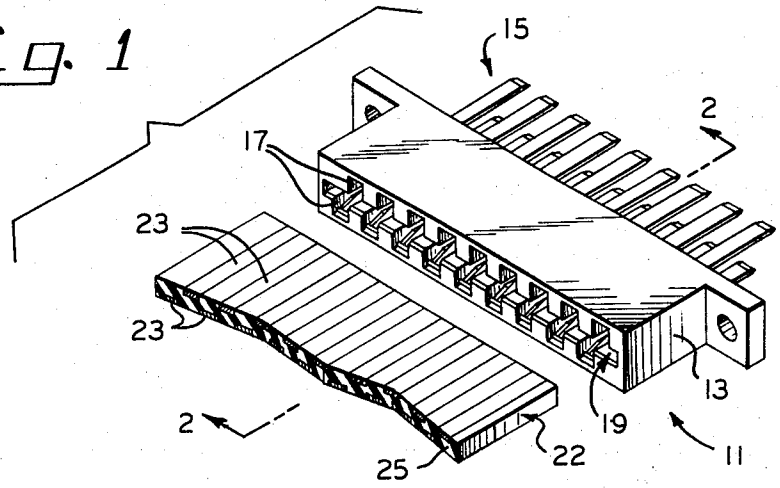


Fig. 1



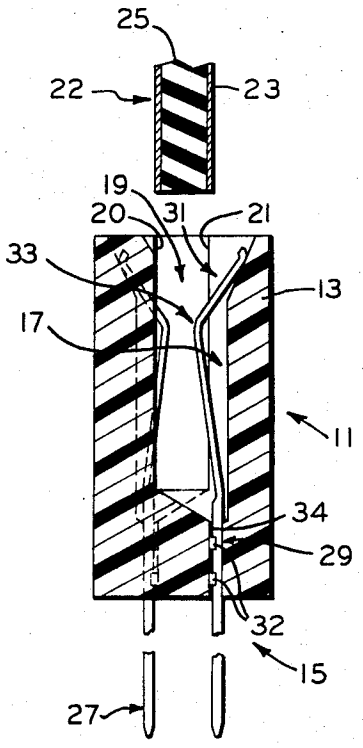


Fig. 2

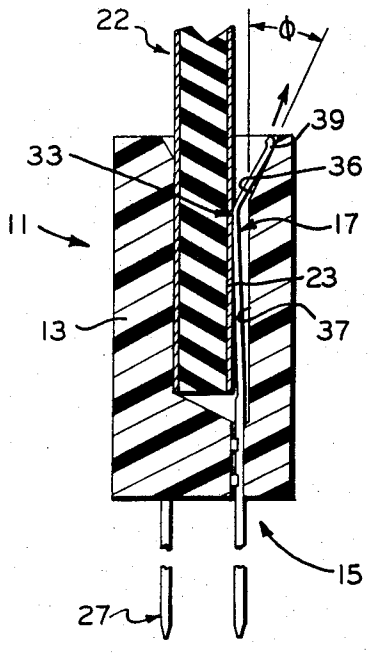


Fig. 3

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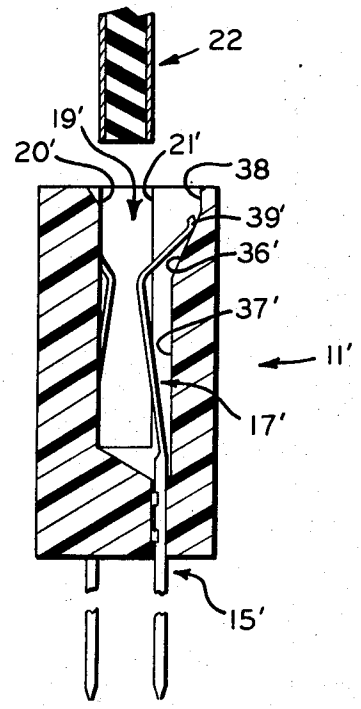


Fig. 4

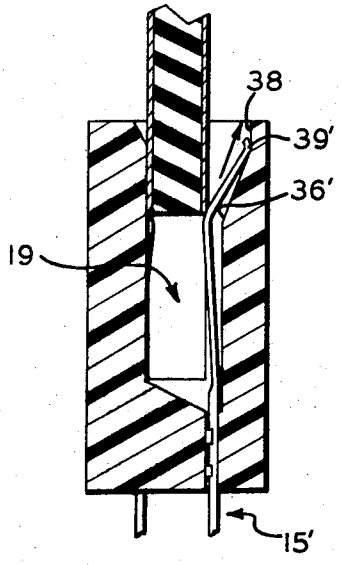


Fig. 5

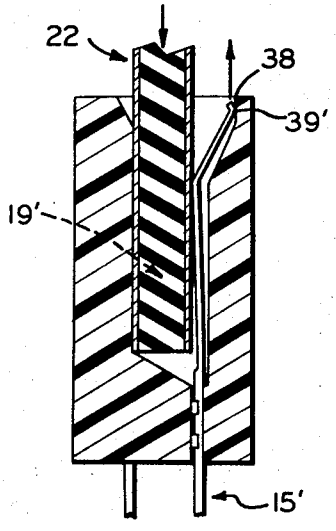


Fig. 6

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PRINTED CIRCUIT BOARD CONNECTOR

BACKGROUND OF THE INVENTION

This invention relates to connectors for printed circuit boards and more particularly to connectors specifically designed to minimize the insertion forces occurring due to interference between the contacts of these connectors and the electrically conducting surfaces of the circuit boards during board insertion.

Connectors of the prior art which have been particularly adapted for reducing insertion forces between contact and circuit board during board insertion have most usually accomplished this reduction by providing open areas in the connector block in which portions of the contacts are free to move, once engagement with the board is initiated. Particular mention is made to U.S. Pat. No. 3,120,988, issued to Gilbert and No. 3,131,017, issued to Mittler. In U.S. Pat. No. 3,120,988, recesses **40** are provided in the insulative block to allow lateral movement of the upper portions of the contacts. In like manner, pockets **48** in U.S. Pat. No. 3,131,017 are provided to compensate for this movement.

While these and similar type connectors substantially reduce the board insertion forces during insertion, it can be seen that the provision of these open areas results in a substantial increase in the overall width of the connector block. In much of today's electronic circuitry where compactness is a necessity, this excessive width is a highly undesirable feature.

Mention is also made to U.S. Pat. No. 3,479,637, issued to Gilissen. In this patent the areas previously mentioned are omitted, resulting in an overall reduction in the width of the connector. However, the insertion force on the board during insertion is much greater, due to the stiffer contact arrangement. An increase in the resulting frictional force increases the possibility of poor electrical contact after repeated insertions and removals of the board as a result of uneven erosion of the surfaces of the circuit board as well as those of the contacts.

OBJECTS AND SUMMARY OF THE INVENTION

Consequently, it is a primary object of this invention to provide a connector in which the insertion forces encountered by the circuit board during board insertion is minimal.

It is an additional object of this invention to provide a connector having a substantially smaller cross-sectional area than those of similar type connectors of the prior art.

In accordance with one aspect of this invention, there is provided a connector having an insulative body with means located therein for receiving a printed circuit board. A plurality of recesses are formed within the insulative body, each having open access to the means for receiving the circuit board. Within each recess there is provided at least one surface which has an angular indentation formed therein. A plurality of electrical contacts are provided, these contacts each having a lower terminal portion, a central retaining portion, and an upper angular portion substantially disposed within one of the recesses. Each of these upper angular portions have means located thereon for slidably engaging the angular indentation of the recess during insertion of the board into the channel.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an isometric view of one embodiment of the present invention about to receive a printed circuit board;

FIG. **2** is an elevational view, in section, as taken along the line 2—2 in FIG. **1**;

FIG. **3** is an elevational view, in section, of the connector of FIG. **2** showing the displacement of one of the contacts after the circuit board has been fully inserted;

FIG. **4** is an elevational view, in section, of another embodiment of the present invention, prior to circuit board insertion;

FIG. **5** is an elevational view, in section, of the connector of FIG. **4**, showing partial circuit board insertion; and

FIG. **6** is an elevational view, in section, of the connector of FIG. **4** showing full circuit board insertion.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

For a better understanding of the present invention, together with other and further objects, advantages, and capabilities thereof, reference is made to the following specification and appended claims in connection with the accompanying drawings.

With particular reference to FIG. **1**, there is shown one embodiment of the present invention, connector **11**, which comprises an insulative body **13** and a plurality of electrical contacts **15** retained therein. Also within insulative body **13** are a plurality of recesses **17** each having open access to a means for receiving printed circuit board **22**, this means illustrated as a channel **19** which has a pair of opposing substantially parallel upstanding walls **20** and **21** (shown in FIG. **2**). Circuit board **22** has a plurality of electrical conducting areas **23** spaced about a body of insulating material **25** and positioned to align with corresponding recesses **17**.

In FIG. **2**, connector **11** is shown about to receive circuit board **22**. Contacts **15** are shown in position prior to board insertion, these contacts disposed along both sides of channel **19** in insulative body **13**. Each contact comprises a lower terminal portion **27** which extends from insulative body **13**, a central portion **29**, and an upper angular contacting portion **31**.

Positioned on central portion **29** is a means for retaining contact **15** within insulative body **13**, this means illustrated as a plurality of protuberances **32** for frictionally engaging internal surface **34** of body **13**. These protuberances are necessary, primarily for assuring proper alignment of the contact within the insulative body.

Each of the upper angular contacting portions **31** of contacts **15** is substantially disposed in one of the corresponding recesses **17** and is shown to comprise an angled contact area **33** which engages electrical conducting area **23** of circuit board **22**. Recess **17**, having open access to channel **19**, permits angled contact area **33** to partially extend into channel **19** prior to board insertion. When circuit board **22** is fully inserted into connector **11**, as shown in FIG. **3**, contact area **33** slidably engages electrically conducting area **23** thereby completing a simple electrical circuit between conducting area **23** of the board and lower terminal portion **27** of contact **15**. Lower portion **27** provides still further circuitry possibilities by being adaptable for accepting electrical wiring or for insertion into additional electri-

cal components, such as a socket or another circuit board.

Contact between conducting area 23 and angled contact area 33 causes area 33 to be moved to the position as shown in FIG. 3. To allow for this movement and still maintain a relatively thin insulative body, an angular indentation is provided in surface 37 of recess 17, this indentation illustrated as a first angular wall 36. Surface 37 is substantially parallel to upstanding walls 20 and 21 of channel 19 and forms an acute angle ϕ with first angular wall 36. Means for slidably engaging first wall 36, illustrated as knurled end 39, slides along first wall 36 in the direction shown. Thus it can be seen that frictional force on circuit board 22 and contact 15 during board insertion is minimal and the relative thinness of insulative body 13 is still maintained. A further feature of this invention is that a more durable connector is possible because a more rugged contact can be employed without a substantial increase in the frictional force on the board and contact.

With particular reference to FIG. 4, there is illustrated another embodiment of the present invention, connector 11' about to receive printed circuit board 22. Connector 11' closely resembles connector 11 shown in FIGS. 1–3 with the exception that the angular indentation of recess 17' comprises a first angular wall 36' which mates with a second angular wall 38, second wall 38 being substantially parallel to surface 37'. As in connector 11, surface 37' of recess 17' is substantially parallel to upstanding walls 20' and 21' of channel 19'. Accordingly, contact 15' is substantially similar to contact 15 utilized in connector 11.

Second angular wall 38 thereby provides a means whereby the force exerted by contact 15' against circuit board 22 is altered during insertion. During the initial stage of board insertion knurled end 39' of contact 15' slidably engages first angular wall 36' and moves in a direction similar to that described for end 39 of contact 15 in FIG. 3. After moving a predetermined distance, knurled end 39' engages second angular wall 38, this occurring when the circuit board has reached a position as illustrated in FIG. 5.

Further board insertion, shown in FIG. 6, forces knurled end 39 to move along second wall 38 in the direction indicated. Because this direction of movement is substantially parallel to and opposite the direction of movement of circuit board 22, the frictional force between board 22 and contact 15' is somewhat larger than that of the minimal initial insertion force encountered when knurled end 39' moved along first wall 36' (illustrated in FIG. 5.) This increased force serves to provide a more reliable means for maintaining circuit board 22 in channel 19' than that of the embodiment illustrated in FIGS. 1–3. While walls 36' and 38 serve to accomplish the above mentioned results, it is obvious that these walls can be replaced by a single wall of predetermined configuration to still provide these desired features.

Thus there has been shown and described a printed circuit board connector which substantially reduces the frictional force encountered between the board surfaces and contacts within the connector during insertion of the board. This connector accomplishes this reduction of force while still maintaining a relatively thin insulative body, a highly desirable feature in the design of today's electronic circuitry.

While there have been shown and described what are at present considered the preferred embodiments of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the scope of the invention as defined by the appended claims.

What is claimed is:

1. A printed circuit board connector comprising:
   - a unitary insulative body having a channel located therein for receiving a printed circuit board, said channel having a pair of opposing substantially parallel upstanding walls;
   - a plurality of recesses formed within said insulative body and adapted for having open access to said channel, each of said recesses having at least one surface having an angular indentation formed therein, said angular indentation comprising a first angular wall extending a predetermined distance from said surface and forming an acute angle therewith and a second angular wall mating with said first angular wall; and
   - a plurality of electrical contacts established within said insulative body, each of said contacts having a lower terminal portion extending from said insulative body, a central portion having means for retaining said contact within said insulative body, and an upper angular contacting portion substantially disposed within one of said recesses and adapted for engaging a corresponding electrically conducting area of said printed circuit board, said upper angular contacting portion having a knurled end located thereon slidably engaging said first angular wall of said angular indentation during initial insertion of said printed circuit board into said channel, said knurled end slidably engaging said second wall of said angular indentation upon further insertion of said printed circuit board into said channel.

2. The printed circuit board connector according to claim 1 in which said means for retaining said contact within said insulative body comprises a plurality of protuberances extending from said central portion of said contact and adapted for frictionally engaging an internal surface of said insulative body.

3. The printed circuit board connector according to claim 1 in which said surface of said recess having said angular indentation formed therein is substantially parallel to said opposing upstanding walls of said channel.

4. The printed circuit board connector according to claim 1 in which said second angular wall is substantially parallel to said surface of said recess having said angular indentation formed therein.

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