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Dorjee et al.

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[45] **Feb. 27, 1973**

[54] MULTIPLE CONNECTOR

[75] Inventors: **Hendrik Dorjee; Jan Lesterhuis,** both of Emmasingel, Eindhoven, Netherlands

[73] Assignee: **North American Philips Co., Inc.,** New York, N.Y.

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Related U.S. Application Data

[63] Continuation of Ser. No. 696,822, Jan. 10, 1968, abandoned.

[30] **Foreign Application Priority Data**

Jan. 14, 1967 Netherlands 6700633

[52] **U.S. Cl.** ....**339/17 LC,** 339/176 MP, 339/186 M

[51] **Int. Cl.**.....**H01r 13/64,** H01r 13/26

[58] **Field of Search**.....339/17, 176, 186, 192, 193; 317/101

[56] **References Cited**

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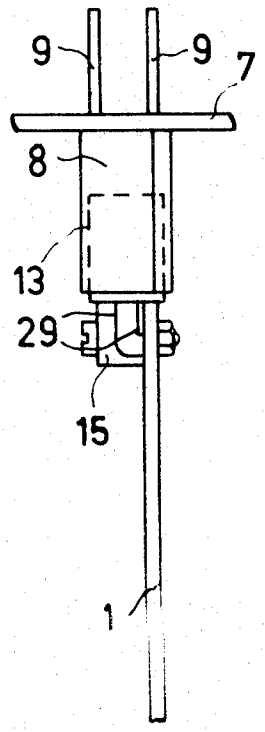
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Primary Examiner—Richard E. Moore
Attorney—Frank R. Trifari

[57] **ABSTRACT**

A connector assembly for securing a printed circuit board into a module. A multiple pin connector is attached to a plate or circuit board within a module. A circuit board with a female connector attached thereto is provided. The connector structure provides a compact, reliable and economical connector assembly.

4 Claims, 4 Drawing Figures



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SHEET 1 OF 2

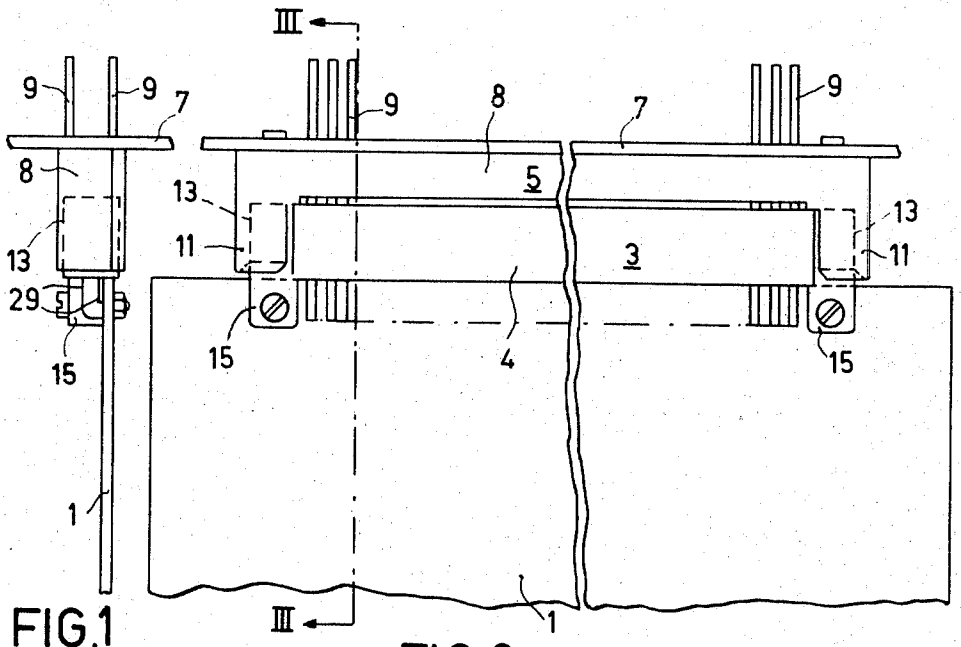


FIG.1

FIG.2

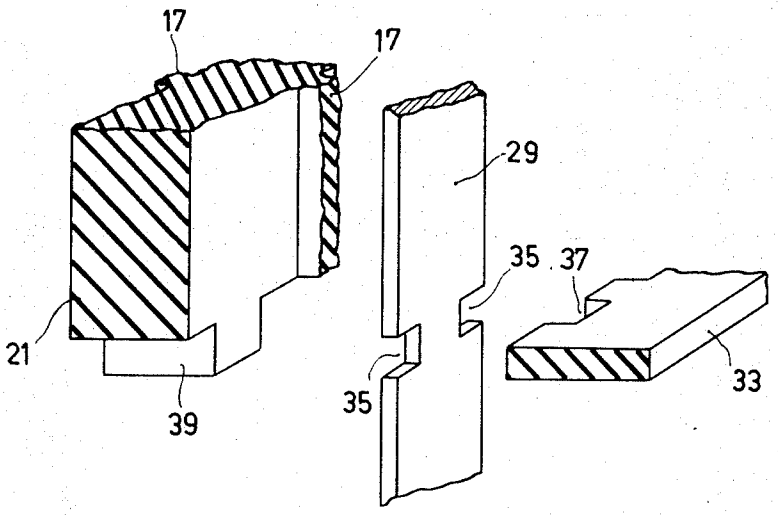


FIG.4

INVENTORS
HENDRIK DORJEE
JAN LESTERHUIS
BY
Frank R. Trifari
AGENT

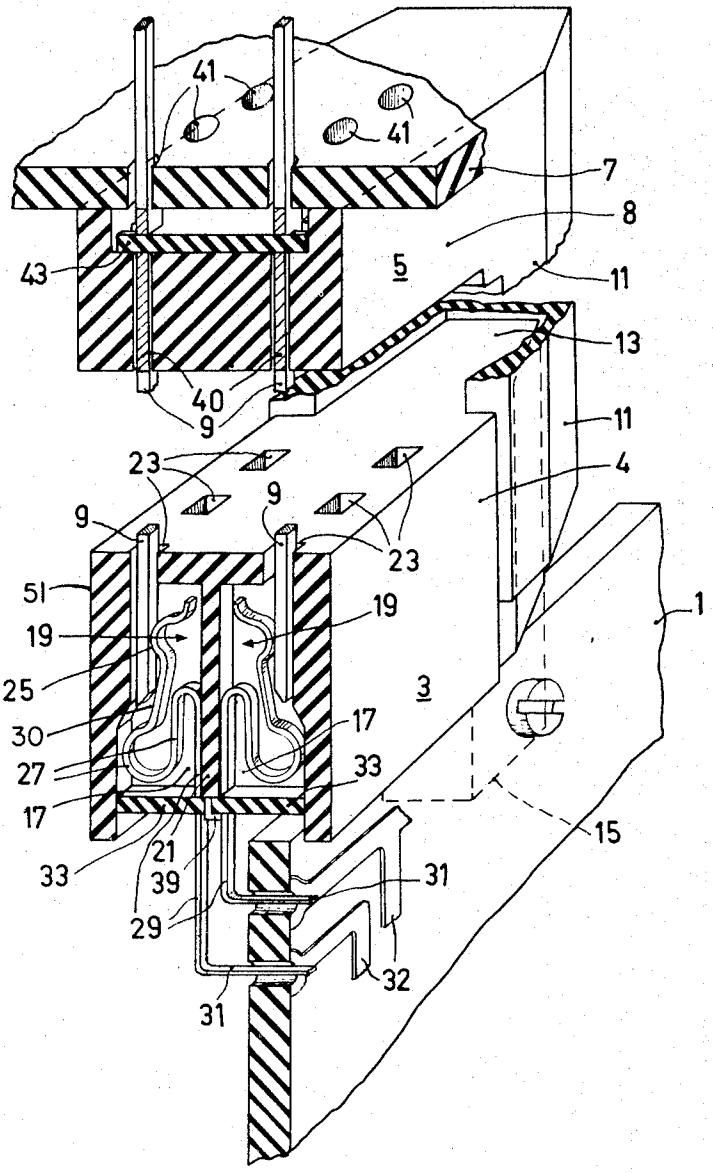


FIG.3

INVENTORS
HENDRIK DORJEE
JAN LESTERHUIS
BY
Frank R. Trifari
AGENT

MULTIPLE CONNECTOR

This is a continuation of application Ser. No. 696,822, filed Jan. 10, 1968, now abandoned.

This invention relates to a connector assembly for securing a printed circuit board into a module.

Current electronic packaging techniques, particularly in the field of computers, utilize banks of removable printed circuit boards in modules. The connection between the printed circuit board and the module to which the circuit board is being attached must take up a minimum of space, yet it must provide a positive and reliable connection. Additionally, the connection must insure a proper interconnection after repeated exchanges of circuit boards has occurred. The attainment of this result is quite difficult due to the small size and the relative fragility of the components involved. For example, misaligned contact pins on the connector are a common occurrence. Also, the soldering tongues associated with the contacts to which the supply wires are attached, are readily deformed thus giving rise to short circuits between adjacent tongues.

An object of this invention is to provide a structurally reliable connector assembly for attaching printed circuit boards to modules or the like.

According to the invention a compact and rugged connector assembly is provided which includes a socket connector attached to an insertable printed circuit board, which includes a plurality of resilient spring contacts, each of which is retained in an individual compartment; and a connector plug attached to a module for receiving the connector socket. The connector socket includes an elongated channel-shaped housing having a plurality of transverse partitions which separate the open channel area into a row of separate compartments. A plurality of apertures corresponding in number to the number of individual compartments in the cross-member of the channel-shaped housing provide access to each compartment for the electrical contact pins attached to a male or plug-type connector. A resilient spring contact is located in each of the compartments. Each aperture providing access to a compartment and the spring contact within the compartment, are positionally related so that insertion of a contact pin through the access aperture will deflect a portion of the spring contact. The deflected portion of the spring contact will biasingly engage the contact pin and also wedge the contact pin against one of the interior sidewalls of the compartment thereby insuring electrical contact between the contact pin and the spring contact as well as providing structural support for the contact pin. The spring contact is shaped to include a first portion for engaging the contact pin inserted into the compartment within which the spring contact is located, a second section which serves to bias the first section into engagement with the contact pin and a third section which extends to the exterior of the socket housing and provides an interconnection with a printed circuit lead on a printed circuit board.

In one embodiment of the invention the housing includes at least one axially extending partition which is parallel to the sidewalls of the channel-shaped housing. The transverse partitions thus divide the open channel area into at least two axially extending rows of compartments. A spring contact is located in each of the compartments. The contact pin receiving aperture for each compartment is located in a position which is as remote as is possible from the contact receiving aperture for the compartment in an adjacent row. For example, in the case of a housing having a single partition thus providing only two rows of compartments the apertures are located adjacent the housing sidewalls. The contacts on the male or plug-type connector can therefore be spaced a maximum distance apart thereby minimizing leakage between adjacent contact pins.

The spring contacts are retained in their respective compartments by a strip attached to the open side of the channel-shaped connector socket housing. In one embodiment of the invention the insulating strip is profiled in a manner to engage those portions of the spring contacts which extend to the exterior of the connector socket housing, thus providing a positive retention of the spring contacts within their respective compartments.

Means are also included on the connector plug and the connector socket to guide the contact pins on the connector plug into the proper compartment in the connector socket and to absorb the stresses which would normally be absorbed by the connector pins during engagement and disengagement of the connector assembly.

The invention will be described in greater detail with reference to a preferred embodiment thereof illustrated in the accompanying drawing, in which:

FIG. 1 is a side elevation of a connector assembly according to the invention,

FIG. 2 is a front elevation of the connector assembly of FIG. 1, and

FIG. 3 is a perspective view of a transverse section of the connector assembly of FIGS. 1 and 2.

The connector assembly shown in FIGS. 1 and 2 includes an insertable printed circuit board of standard type which may include a circuit printed thereon as well as a plurality of discrete electrical components attached thereto. Attached to the edge of the circuit board 1 is a multiple pin connector socket generally designated 3. The socket connector 3 includes an elongated housing of insulating material in which a plurality of spring contacts 30 are housed. The socket connector 3 is adapted to be mated with the plug connector 5, the latter of which is secured to another printed circuit board or carrier plate 7 which is part of a module (not shown).

In the illustrated embodiment, the plate 7 is of the type which is rigidly mounted in a module and may have a plurality of connector plugs 5 attached thereto. Plug connector 5 includes an elongated housing 8 of synthetic insulating material containing a plurality of pin-shaped contacts 9. The contacts 9 within the plug connector 5 are arranged in parallel rows with the longitudinal axis of each contact 9 being directed normally to the plane of plate 7. The circuit board 1 with the socket connector 3 attached thereto is adapted to be mated with the plug connector 5 thus normally aligning the circuit board 1 with the plate 7.

FIG. 3 is an enlarged view of the plug connector 5 and the socket connector 3. The contacts 9 which are mounted in the plug connector housing 8 are rigid metal strips which are preferably stamped from sheet material by a process to be described hereinafter. The contacts 9 are shown broken away with the end portions of the contacts being shown inserted within the

socket connector 3, and the remainder of the contacts 9 shown attached to the plug connector 5 which is shown in overlying spaced relation with respect to the socket connector 3.

At each end of the plug housing 8 there is located a channel-shaped section 11. Correspondingly, there is a tab portion 13 on each end of the socket connector housing 4. When the plug connector 5 and the socket connector 3 are placed in mating engagement, the channel-shaped sections 11 are guided by the tab portions 13, the latter of which are complementary in shape to the interior shape of the channel sections 11, thereby insuring a properly aligned interconnection.

The socket housing 4 is an elongated channel section having a central partition 21 parallel to the channel sidewalls. A plurality of transverse partitions 17 divide the housing up into a plurality of paired compartments 19. The compartments 19 are located in rows parallel to the longitudinal axis of the housing 4. An aperture 23 in the cross member of the channel-shaped housing, in the illustrated embodiment the upper housing surface, provides access to each of the compartments 19. Within each compartment 19 and in alignment with each aperture 23 is a curved spring contact strip 30. The spring contact strip 30 includes a curved contact end 25 for engaging an end of the inserted contact 9, a central portion 27 substantially S-shaped which serves to bias the end 25 against an inserted contact 9, a substantially straight portion 29 abutting the partition 21 and extending outside the housing 4 and a soldering tongue 31 which, in the illustrated embodiment, is normally aligned with the straight portion and serves as a solder connection to the printed circuit 32 on the circuit board 1. Each spring contact is retained in a compartment 19 by an insulating strip 33 which serves as a closure to the channel-shaped housing 4. The insulating strip is attached to the housing in a conventional manner, for example, by bonding. The closure strip 33 has a plurality of slots 37 therein to permit the straight portion 29 of the spring contact to pass through the housing for engagement for the printed circuit board 1.

FIG. 4 shows a particular connection between the insulating strip 33 and the housing sidewall 51 and the partition 21. The edges of straight portion 29 of the spring contact include a pair of opposed aligned notches. The partition 21 has a lug 39 extending from the lower end thereof. The edges of the insulating strip are slotted whereby the sidewalls of each slot 37 fit within the notches 35 of the straight portion 29 of the spring contact and further engage the lug 39. This particular connection fixedly positions this spring contact within the compartment 19 and precludes movement of the soldering tongue 31.

Each spring contact 30 is inserted into a compartment 19 within the housing 4 from the open side, in the illustrated embodiment the lower side. The spring contacts utilized in the illustrated embodiment can be fabricated by a relatively economical process. A complete row of spring contacts are stamped from a single sheet of metal. A transverse strip (not shown) interconnects all the ends thereof. After the stamping operation, the spring contacts are in a transition stage and have the shape of a comb, that is, the spring contacts correspond to the teeth, and the transverse strip corresponds to the supporting cross member of the comb. The spring contacts are next bent into the proper shape, that is, the S-shape portion and the curved end are formed on one end and a 90° bend is formed on the other end to provide a soldering tongue. The row of spring contacts is inserted into the open end of the socket connector housing 4 with each of the spring contacts lying in an adjacent compartment. After the insertion of the spring contacts into the compartments 19 the closure strip is bonded to the housing, thereby holding the spring contacts in place. The transverse strip is then removed from the spring contacts.

In the embodiment illustrated, two rows of spring contacts are included in the socket housing 4. The spring contacts are placed in the compartment such that the straight portions 29 abut the central partition 21.

The S-shaped portion 27 of each of the spring contacts 30 is positioned in a compartment in a plane parallel with the transverse partitions 17. The spring contact end portions 25 are thus positioned in adjacent confronting relationship with the interior sidewalls 51 of the socket housing 4. Hence, when the leading edge of the contact pins 9 are inserted into the compartments 19 the end portions 25 of the contact springs 30 will deflect. The deflection of the spring contact end portions 25 will biasingly engage the inserted portion of the contact pin 9 and wedge it against the interior sidewall 51. The positioning of the contact pins 9 in the manner illustrated insures a maximum distance between adjacent contact pins 9 thereby minimizing electrical leakage.

The plug connector 5, as previously described, is provided with a plurality of contact pins 9 located in parallel rows in the plug connector housing 8. The spacing between the contact pins 9 corresponds to the spacing between the apertures 23. The contact pins 9 are also stamped from sheet metal, preferably of greater thickness than the sheet metal from which the spring contacts are formed. The leading edge of each contact pin is beveled to facilitate insertion into the apertures 23 and contact with the spring contact end 25.

In a preferred embodiment, contact pin 9 has a thicker cross section in the region which is located in the plug housing 8. This increased cross section improves the rigidity of the contact pin and further, simplifies the manufacture of the plug housing 8. The plug housing 8 is fabricated by molding; hence, the larger the size of the opening for receiving the contact pins, the simpler the molding procedure.

The contact pins 9 are fixed within the plug housing 8 by means of an insulating strip 43. A plurality of slots are included in the strip 43 which engage each of the contact pins 9 and retain them in the apertures in a manner similar to the retention of the spring contacts 30 by the insulating strip 33. If the contact pins 9 are soldered into the carrier plate 7, strip 43 is not required.

The contact pins are manufactured by stamping a plurality of the pins from a single sheet of material, A transverse strip of the sheet material connects one set of ends of the pins and a second transverse strip connects the opposing ends of the pins. A V-shaped groove is stamped into the pins at the interconnection of each pin and the transverse strip, thus forming an area of

reduced cross section which permits the removal of the transverse strips from the pins by a breaking. The first transverse strip may then be broken off from the pins thereby leaving a comb-shaped assembly, whereby the contact pins **9** correspond to the teeth of the comb. The V-shaped section provides the beveled end on the contact pins **9**. The contact pins **9** are then inserted into the plug housing **8**. After the pins have been inserted in the plug housing **8**, the second transverse strip is broken off the pins and the strip **43** is attached to the housing **8** to retain the pins **9** therein. Prior to the pressing of the V-shaped curve into the pins, a layer of gold is rolled onto the pins. The shape of the pins does not effect the layer of gold applied thereto.

The above cited embodiments are intended as exemplary only, and while we have described our invention with a specific application and embodiment thereof, other modifications will be apparent to those skilled in the art.

What is claimed is:

1. A socket connector assembly attached to a printed circuit board comprising: an elongated hollow housing having an upper wall, lower wall and two parallel side walls; at least one longitudinal partition within the housing parallel to the side walls, a plurality of transverse partitions dividing the interior of the housing into a plurality of separate compartments, a plurality of apertures defined in the upper wall of the housing and positioned therein so as to provide access to each of the compartments, a plug connector having a housing attached to a carrier plate, plug contacts mounted within said plug connector housing and projecting therefrom, a spring contact means mounted within each compartment of said elongated hollow housing, said spring contact means having a first end portion with a curved contact portion thereon in alignment with said aperture biasingly engaging each said plug contact positioned between said curved contact portion of said spring contact means and one of said side walls when inserted through the aperture, a second end portion extending outwardly from the lower wall of the housing and interconnected with the printed circuit board, and aligning means associated with the socket connector for engaging said plug connector to align the interconnection of the plug contacts with the apertures in the socket connector, said means for aligning the socket connector and plug connector comprising a tab extension on the socket housing and a channel-shaped section on the plug connector which is guided by the tab during engagement.

2. A socket connector assembly as claimed in claim **1** wherein the spring contact means comprises an S-shaped spring contact.

3. A socket connector assembly as claimed in claim **2** wherein the lower housing wall comprises an insulating strip which retains the spring contact within the compartment by interlocking with the transverse partitions.

4. A connector assembly attached to a printed circuit board comprising a plug connector attached to a carrierplate having an elongated housing forming a channel-shaped section at one end, contact pins mounted within the housing and projecting therefrom, a socket connector including an elongated hollow housing having an upper wall, lower wall and two parallel opposed side walls; at least one longitudinal partition within the housing between the side walls, a plurality of transverse partitions dividing the interior of the housing into a plurality of separate compartments, a plurality of apertures defined in the upper wall of the housing and positioned therein so as to provide access to each of the compartments, spring contact means mounted within each compartment, said spring contact means having a first end portion with a curved contact portion thereon positioned adjacent said aperture for biasingly engaging a mating plug connector contact pin between said curved contact portion and one of said side walls when inserted through the aperture, a second end portion of said spring contact means extending outwardly from the lower wall of the housing interconnected with a printed circuit board, and means for aligning the plug connector and socket connector during engagement including a tab extension on the socket housing for cooperation with the channel-shaped section on the plug connector.

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