March 31, 1964 P. F. GRECO ETAL 3,127,228

PRINTED CIRCUIT CONNECTOR

Filed March 17, 1960

FIG. 1b

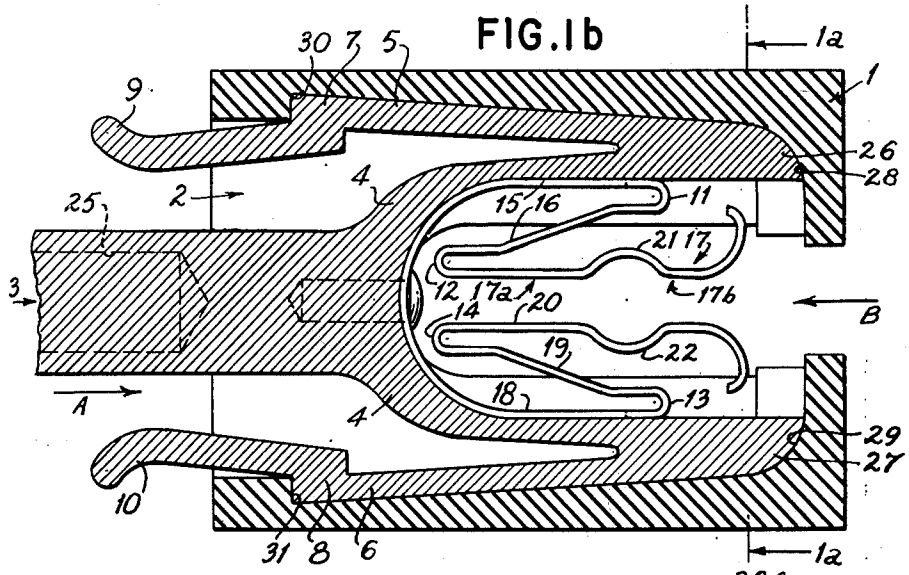


FIG. 2b

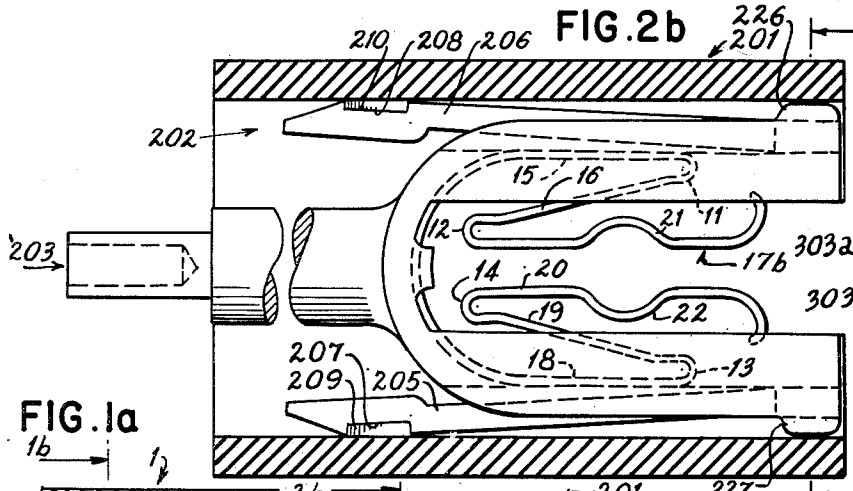


FIG. 3a

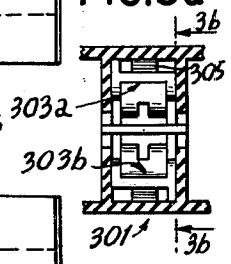
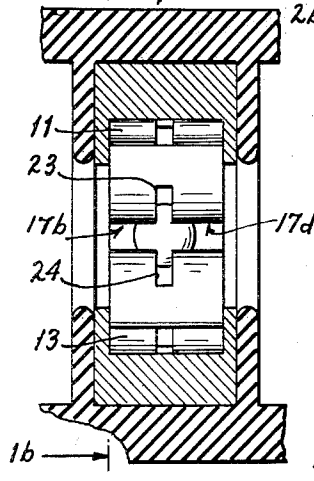


FIG. 1a



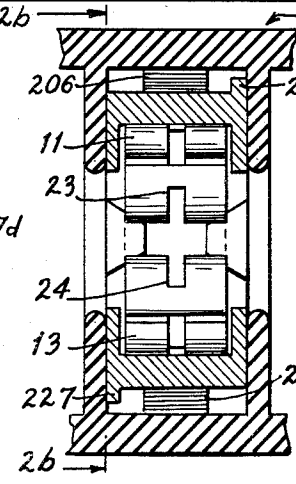
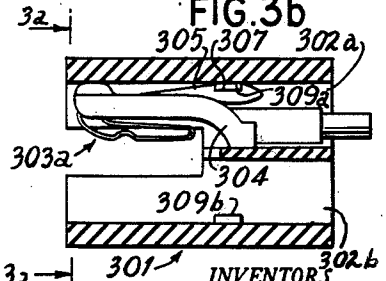


FIG. 2a

FIG. 3b



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3,127,228

PRINTED CIRCUIT CONNECTOR

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This invention relates to electrical connectors, and more particularly to the printed circuit type.

The prior art contains many multiple miniature connectors which are designed to receive printed circuit cards or plugs provided with mating multiple circuit contacts. These connectors generally have resilient metal contacts which are permanently mounted in the connector body and to which wire leads are permanently soldered.

These connectors suffer from several disadvantages: The contacts have only a single, flat, contact making surface which does not assure a good contact, especially under circumstances of severe vibration; and also have inherently a rather low removal force capability. By removal force is meant the force necessary to extract the plug from the connector. A defective contact cannot be removed from the connector body and replaced, nor can contacts and their associated wires be removed and replaced for ready modification of circuitry or testing; resulting in replacement of the entire multiple contact connector.

An object of this invention is to provide a connector having contacts of novel configuration which supply several contact areas capable of making good contact, and which have inherently a very high removal force capability, all in spite of any severe vibration.

Another object of this invention is to provide a connector having contacts which may be readily removed and replaced, from either end of the connector, or while the card or plug is in the connector.

Yet another object of this invention is to provide a connector having contacts which are light enough not to cause abnormal wear of the mating printed circuit contacts, and yet provide a connector which will resist abuse in use.

A feature of this invention is a dielectric body having a central cavity containing a plurality of spaced apart contact members, each having a series of reversely bent elements, at least the innermost element having a longitudinal slit and a mediate bend, these elements being supported by a more massive frame element which removably interlocks with the mody and to which the wires are attached.

These and other objects and features of this invention will become more apparent by reference to the following description taken in conjunction with the accompanying drawings, in which:

FIG. 1*a* is a front elevation of a portion of the connector of this invention.

FIG. 1*b* is a side elevation taken along line 1*b*—1*b* of FIG. 1*a*.

FIG. 2*a* is a front elevation of a portion of another embodiment of the connector of this invention.

FIG. 2*b* is a side elevation taken along line 2*b*—2*b* of FIG. 2*a*.

FIG. 3*a* is a front elevation of a portion of yet another embodiment of the connector of this invention.

FIG. 3*b* is a side elevation taken along line 3*b*—3*b* of FIG. 3*a*.

Referring to FIGS. 1*a* and 1*b*, reference character 1 indicates generally a dielectric body having a central cavity 2 into which is inserted a contact indicated generally at 3. The contact comprises a yoke member 4 shaped somewhat like a tuning fork. Included on the sides of tines of

the fork are locking spring elements 5 and 6 having shoulders at 7 and 8 and manually operable portions 9 and 10. Attached between the tines of the fork is a Z shaped spring contact member having reverse bends at 11, 12, 13 and 14, to form elements 15, 16, 17, 18, 19 and 20. Elements 17 and 20 have a mediate bend at 21 and 22, and a lengthwise slit at 23 and 24, respectively. A conductor (not shown) may be secured to the tail of the contact by insertion in the tubular cavity 25 and crimping or soldering thereto.

In assembly, the contact 3 is inserted from the rear of the body in the direction indicated by the arrow A, until nose portions 26 and 27 abut the inner faces 28 and 29 of the cavity. Shoulders 7 and 8 snap into corners 30 and 31, locking the contact in place.

In disassembly, manually operable portions 9 and 10 are depressed, releasing shoulders 7 and 8, and the contact is extracted.

In use, a contact board or plug (not shown) is inserted in the direction of arrow B. If a flat board is used, elements 17 and 20 each provide four individually sprung contact areas, as at 17*a* and 17*b*. If a board having a humped profile to match the bends at 21 and 22 is used, then the entire surface of elements 17 and 20 will provide contact, with the advantage that the interlocking with the bends 21 and 22 will provide a very high removal force capability.

It will be noted that contact 3 may only be inserted or removed from the rear of the body 1, but that it may be conveniently done manually, and while the contact board or plug is actually inserted in the connector. The heavy construction of the yoke provides the contact with desirable ruggedness and protects the more fragile spring elements.

Referring now to FIGS. 2*a* and 2*b*, reference character 201 indicates generally a dielectric body having a central cavity 202 into which is inserted a contact indicated generally at 203. Contact 203 is similar to the contact 3 illustrated in FIG. 1. but for its body interlocking features. Locking-spring elements 205 and 206 include notches 207 and 208 which interlock with projection 209 and 210, respectively, on the cavity face. Upstanding side wall projections 226 and 227 serve to stabilize the contact with respect to the front of the body cavity.

It will be noted that contact 203 may be inserted and removed from either end of the connector, and may also be removed or inserted from the rear of the connector when a board or a plug is already engaged in the connector. Removal of the contact may be effected by the insertion of a probe type tool from either end to depress locking spring elements 205 and 206 thereby disengaging notches 207 and 208 from the projections 209 and 210 respectively.

FIGS. 3*a* and 3*b* illustrate a modification of the connector 203 shown in FIG. 2. Dielectric body 301 includes two cavities 302*a* and 302*b*, into which are inserted two identical contacts 303*a* and 303*b* in opposed relationship. These contacts are substantially a half of contact 203. Yoke 304 includes a locking-spring element 305 which has a notch 307 which is designed to interlock with either projection 309*a* or 309*b* on the cavity walls. An upstanding projection 326 is also provided on 305 to stabilize the contact with respect to the front of the body cavity.

It will be noted that contact 303 permits a separate and independent circuit to be established with circuitry on both sides of the board. Contact 303 may be inserted and removed from either end of the connector, and may be removed or inserted from the rear of the connector when a board is already engaged in the connector. Removal of the contact may be effected by the insertion of a probe

type tool from either end to depress locking spring element **306**.

The invention has thus been described but it is desired to be understood that it is not confined to the particular forms or usages shown and described. The same being merely illustrative, and the invention may be carried out in other ways without departing from the spirit of the invention, and therefore, the right is broadly claimed to employ all equivalent instrumentalities coming within the scope of the appendent claims, and by means of which objects of this invention are attained and new results accomplished, as it is obvious that the particular embodiments herein shown and described are only some of the many that can be employed to obtain these objects and accomplish these results.

We claim:

1. An electrical multicontact connector assembly for receiving and contacting a printed circuit board having a plurality of spaced apart conductive elements thereby to establish electrical connections betweeen said conductive elements and a plurality of external conductors, comprising: a dielectric body having walls forming a central cavity to receive the printed circuit board and a plurality of spaced apart contact assemblies disposed within said cavity; each said contact assembly including a yoke-shaped frame element, and a resilient contact element disposed entirely within said yoke-shape of said frame element and adapted to engage one of the conductive elements, said contact element being mechanically and electrically secured to said frame; each said frame including means for mechanically securing at least one of said external conductors thereto and for electrically connecting at least one of said external conductors to said contact element; each said frame element and said dielectric body having releasable mutual interlock means securing each said contact assembly within said cavity.

2. A connector according to claim 1 wherein said resilient contact element includes a portion having a series of reversely bent subelements adapted to provide a Z shaped compression spring.

3. A connector according to claim 1 wherein said mutual interlock means includes a resilient portion on said frame element engaging a surface discontinuity in one of the walls of said cavity.

4. A connector according to claim 3 wherein said resilient portion includes a manually operable subportion for disengaging said resilient portion from said cavity surface discontinuity.

5. A connector according to claim 1 wherein said central cavity includes front and rear openings shaped and adapted to permit the insertion and removal of said contact assembly.

6. A connector according to claim 1 wherein said contact element has two contact surfaces in opposed relationship.

7. A connector assembly according to claim 1 wherein said contact element includes a series of reversely bent portions forming a Z shaped compression spring; the reversely bent portion proximate the center of said frame adapted to engage the conductive element; said proximate portion including a longitudinal slit forming two resilient subportions; each said subportion including a mediate bend away from said frame center providing two resilient contact areas.

8. An electrical multicontact connector assembly for receiving and contacting a printed circuit board having a plurality of spaced apart conductive elements to thereby establish electrical connections between said conductive elements and a plurality of external conductors, comprising: a dielectric body having walls forming a central cavity having a front and rear volume, and a central portion dividing said rear volume of said cavity into two sub-rear-volumes, said cavity front volume adapted to receive the printed circuit board; a contact assembly disposed in one of said cavity sub-rear-volumes and extending into said cavity front volume; said contact assembly including an electrically conductive frame element for supporting a resilient contact element apart from said dielectric body, and a resilient contact element mechanically and electrically connected to said frame element and adapted to engage one of the conductive elements; means on each said frame for electrically and mechanically securing at least one of said external conductors thereto; each said frame element and said dielectric body having releasable mutual interlock means for securing said frame elements within said cavity.

9. An electrical connector for electrically connecting a plurality of conductive elements disposed on a printed circuit board to a plurality of external conductors, comprising: a receptacle having an elongated aperture; a plurality of slots therein, each of said slots including a groove and supporting walls disposed along the sides of said grooves; a surface discontinuity in said grooves; an electrical contact assembly disposed in each of said slots; said contact assembly comprising an electrically conductive frame element for supporting a resilient contact element apart from said receptacle, and a resilient contact element mechanically and electrically secured to said frame and adapted to engage a printed circuit board inserted into said aperture; means on said frame element for electrically and mechanically securing at least one of said external conductors thereto; and resilient means on said frame to engage said groove surface discontinuity to releasably secure said frame element in said groove.

10. An electrical connector assembly for electrically connecting a plurality of conductive elements disposed on a printed circuit board with a plurality of external conductors, comprising: a printed circuit board including a supporting element having a front end and a plurality of spaced apart conductive elements disposed on said front end; and a connection assembly including a dielectric body having a central cavity for receiving said printed circuit board front end; a plurality of pairs of opposed slots formed in said cavity; a contact assembly disposed in each slot pair; each said contact assembly including a resilient contact element and a frame element of U shape for supporting said resilient contact element apart from said dielectric body and for receiving a portion of said printed circuit board front end; means on each said frame element for electrically and mechanically securing at least one of said external conductors thereto; each said frame element and said dielectric body having releasable mutual interlock means securing each said frame element within said cavity; said resilient contact element mechanically and electrically connected to each said frame element; each said resilient contact element engaging one of said printed circuit board conductive elements.

11. A connector assembly according to claim 10 wherein each said resilient contact element includes a series of reversely bent portions forming a Z shaped compression spring; the bent portion remote from said frame element engaging said printed circuit board conductor element; said remote portion including a longitudinal slit forming two resilient subportions; each said subportion including a mediate bend in the direction of said frame element providing two resilient contact areas.

12. An electrical connector assembly for electrically connecting a plurality of external conductors with a plurality of spaced apart conductive elements disposed on the surface of a printed circuit board or like electrical device, comprising: a dielectric body portion having walls forming a central cavity, said walls having a plurality of spaced apart surface discontinuities therein; a plurality of contact assemblies removably disposed within said cavity in spaced apart relationship; each said contact assembly comprising a frame element for supporting a resilient contact element apart from said dielectric body portion and having resilient portions cooperating with said surface discontinuities for releasably securing said

frame in said cavity, and a resilient contact element secured to said frame for contacting a conductive element on a printed circuit board inserted in said cavity; each said frame including means for connecting at least one of said external conductors mechanically to said frame and electrically to said contact element.

13. A connector assembly according to claim 12 wherein each said resilient contact element includes a series of reversely bent portions forming a Z shaped compression spring; the bent portion remote from said frame element engaging said printed circuit board conductive element; said remote portion including a longitudinal slit forming two resilient subportions; each said subportion including a medial bend providing two essentially separately sprung resilient contact areas.

References Cited in the file of this patent

UNITED STATES PATENTS

2,666,189	Cook	Jan. 12, 1954
2,870,424	Franz	Jan. 20, 1959
2,875,425	Gilbert	Feb. 24, 1959
2,891,103	Swengel	June 16, 1959
2,935,725	Fox	May 3, 1960
2,978,666	McGregor	Apr. 4, 1961
2,979,689	Jackson et al.	Apr. 11, 1961

FOREIGN PATENTS

1,188,936	France	Mar. 16, 1959
1,219,360	France	Dec. 28, 1959
226,335	Great Britain	Dec. 24, 1924