

Nov. 29, 1966

J. E. ANTES

3,289,148

CONNECTORS

Filed July 29, 1964

FIG. 2

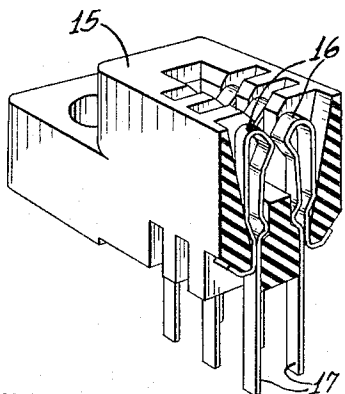


FIG. 3

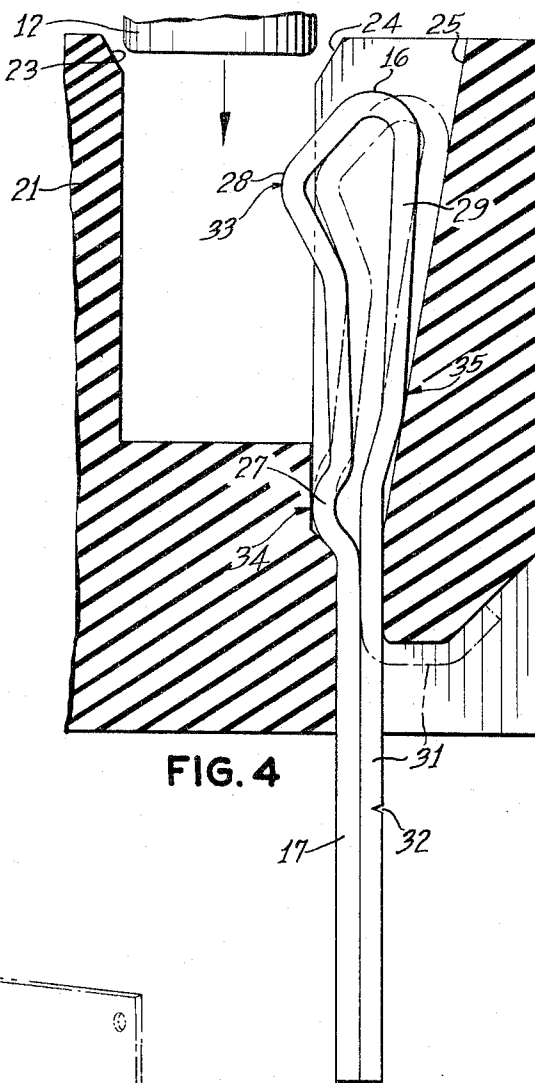
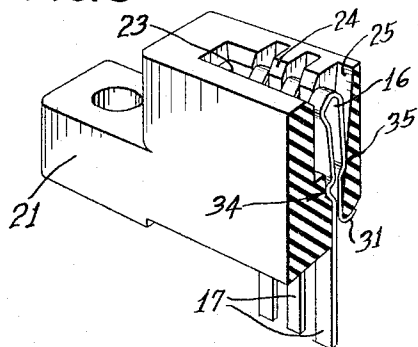
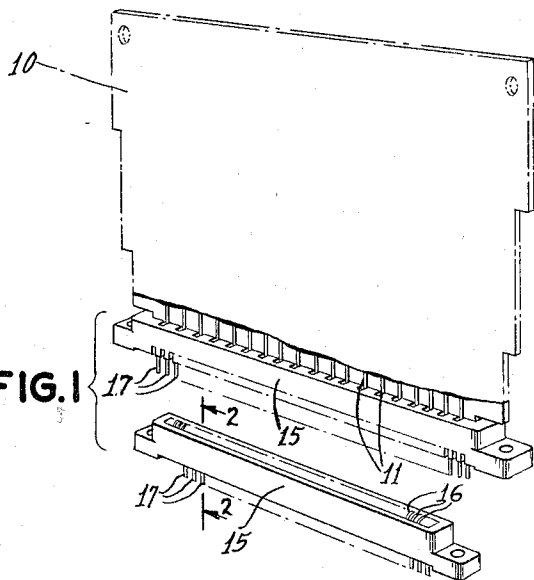


FIG. 4

FIG. 1



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3,289,148

CONNECTORS

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Filed July 29, 1964, Ser. No. 385,848

4 Claims. (Cl. 339-176)

This invention relates to connectors and more particularly to small or so-called miniature connectors, including multiple circuit connectors as used in conjunction with printed-circuit boards.

In connectors of this type, the contact members which are stamped out of thin metal are small but must be durable and effective to establish positive electrical contact with the prongs or contact surfaces of the mating connector or printed-circuit board. It is essential that the contacts in such a connector maintain an electrical connection of high conductivity even after an extended period of use. During normal use, the elements of the connector may be repeatedly engaged and separated, which tends to distort and damage the contact members. In order to increase the effectiveness of such contact members, it has been proposed to employ complex folded shapes and even to add auxiliary pressure springs bearing on the contacts. It has been found that, in addition to increased cost, these designs had the drawback of being difficult to assemble and adjust properly and were even more subject to accidental distortion and derangement which caused malfunctioning of the unit after a short period of use.

It is the primary object of the present invention to provide connector contacts of an improved design which lends itself to production methods and insures positive electrical contact with the mating connector or printed-circuit board during a period of extended use.

Another object of the invention is to provide an improved circuit board connector.

Still another object of the invention is to provide a connector having a flexible contact member in the form of a folded strip with an intermediate convex or open-loop portion forming the contact-making element, said strip further having an integral protuberance to form a definite fulcrum point for the flexing of the contact-making part of the contact member, the web of said strip preferably being of uniform cross-section, substantially throughout its length and free from apertures, stamped-out tabs and the like. The definite positioning of the critical contact-making part of the contact insures uniform contact pressure and low-resistance electrical contact in use.

In accordance with the invention, the connector comprises an insulating body part having one or more cavities to receive the contact members, said cavities extending through the insulating body and being tapered at the top, and contact members disposed in said cavities and separated by side walls or barriers. The contact members preferably consist of a strip of flat metal of substantially uniform cross-section from end to end and folded to form an intermediate contact-making loop which in the assembled connector lies in the tapered section of said cavity in the connector body. One or both of the legs of the strip constituting the contact member is provided with an offset bend or protuberance which permits a force-fit with the walls of the cavity to precisely locate and secure the contact member in place, and the protuberance also provides a fulcrum point for the upper contact-making loop which thus has a rocking or canting type of movement on a fixed radius. This construction insures reliable and effective electrical contact with the mating connector after repeated insertion and separation of the printed-circuit board in the connector. One of the legs of the strip which extends through the bottom of the connector body

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may be folded around the edge thereof to secure the contact member in place very simply during assembly.

The foregoing and other objects and advantages of the invention will be apparent from the following detailed description of the embodiments thereof shown in the accompanying drawings, wherein:

FIG. 1 is a perspective view of a connector shown in combination with a printed-circuit board of conventional type;

FIG. 2 is a transverse section through the connector body taken on the section line 2-2 of FIG. 1;

FIG. 3 is a similar view of a modification; and

FIG. 4 is a detail view to an enlarged scale of the contact member and connector body according to the invention.

The showing of the conventional parts of the connector is merely illustrative and will be described briefly, since the invention resides in the form of the contact member 16 and the mounting and arrangement of said member in the connector body. Referring to the drawings, FIG. 1 shows a printed-circuit board 10 having a series of terminal conductors 11 on the surface thereof. The board 10 is shown with the terminal edge inserted in a multiple contact connector 15. The connector 15 carries a series of spaced contacts 16 adapted to make electrical contact with the conductors 11 of the printed-circuit board 15. A series of terminals 17, one for each of the contacts 16, project from the bottom of the connector 15.

As shown in FIG. 2, in the case of a board having conductors 11 on both sides, the contacts 16 are arranged in pairs in a cavity in the connector body 15, the contact members on each side being separated by insulating side walls or barriers. As shown in FIG. 3, in the case of board terminals on only one side, contact members 16 are provided only on one side of the connector body 21.

The precise construction and mounting of the contact member 16 in the connector of FIG. 3 is shown to a greatly enlarged scale in FIG. 4, the arrangement being also identical with the modified construction of FIG. 2 except that a single-sided connector is shown. FIG. 4 shows a male prong or pin 12 for insertion into the connector 15 in the same manner that the board 10 might be engaged with the connector, as shown in FIG. 1.

The insulating connector body 21 embodies a series of cavities or passages for the respective contact members 16, said cavities extending through the connector body from top to bottom and having a tapered portion at the top and a recess at the top to receive the pin or prong 12 or the edge of the board 10. The recess may be provided with beveled edges as indicated at 23, 24, to facilitate the insertion of the contact member 12 into the connector body 21. The tapered rear wall 25 of the cavity provides clearance for the upper end of the contact member 16, which is formed from a flat strip of metal, such as high-conductivity copper or nickel alloy, for example. The strip may be made of drawn rectangular wire or stamped out of sheet metal stock. The strip is of uniform cross-section throughout its length, without any apertures, stamped-out tabs or other irregularities, and the contact member is formed by folding it back on itself with the intermediate portions 28, 29 separated to provide a contact-making loop adapted to engage the contact member 12 at the point 33.

It will be noted that on one or both sides of the strip forming the contact member 16 the metal is upset or bent as indicated at 27, so that said member is gripped and held firmly when it is pressed down into the cavity, thus precisely positioning the contact member. Furthermore the protuberance on the other side of the contact loop forms a fulcrum at the point 35 for the upper contact-making portion of the member 16, when the same is deflected by engagement with the contact pin 12 of the mat-

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ing connector as shown in dotted lines in FIG. 4. Thus the deflected contact-making portion of the contact member 16 has a rocking or canting type of movement about a fixed fulcrum point, and the movement and contact pressure of the contact member are unchanging during the life of the connector.

The contact member 16 is locked in the connector body 21 by folding one leg into a slot in said body on the underside, as indicated in dotted lines at 31. The leg may be scored as shown at 32 to facilitate breaking off the end during assembly. For convenience in referring to the location of elements of the connector, the terms "top," "bottom," "lower" and "underside" are used to designate upper and lower parts as shown in the drawing, where the terminal end of the connector is at the bottom."

It will be apparent that the construction embodying the invention provides enhanced reliability although of simplified form and is adapted for quantity production with a minimum of labor, time and expense. While an embodiment of the invention has been shown and described in detail for the purpose of explaining the underlying principles thereof, it will be apparent to those skilled in the art that changes may be made in such details without departing from the scope of the invention.

What is claimed is:

1. In combination with a connector body part having a passage extending through said body part from top to bottom said passage having varying width and being larger near the top thereof and having a recessed portion to receive the male contact element of the mating connector at one side of the variable width section of the passage,

a contact member mounted in the passage in said connector body and extending through the bottom thereof to provide a terminal portion,

said contact member being formed by folding a strip of metal back upon itself to define an upper open-loop portion where it is engaged by the contact of the mating connector in the recessed portion of said body part and a lower terminal portion where the ends of the said strip touch when the strip is folded, the width of the open-loop portion of the contact member being less than the width of said passage at the point where the contact member is mounted in said passage to permit deflection of the contact member when it is engaged by the contact of the mating connector, one side of the open-loop portion of the contact member opposite the recessed portion of the body part being bent to provide a protuberance engaging the wall of said passage over a small area to act as a fulcrum for the upper part of the contact member which is deflected upon insertion of the mating connector contact, the other side of said open-loop portion of the contact member having a convex portion engaging the side of said passage at the narrow end thereof to prevent downward displacement of the contact member in said connector body part.

2. In a connector for establishing electrical connection to a plurality of conductors printed on both sides of a printed-circuit board, in combination,

an insulating body member having a plurality of cavities extending therethrough from top to bottom, said cavities tapering along a portion of their length and being of greater depth at the top, each cavity including opposed parallel side walls,

and a pair of contact members disposed in each of said cavities and fitting snugly between said side walls,

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each of said contact members consisting of a strip of metal of substantially uniform cross-section from end to end and folded to provide a terminal portion extending through the bottom of said body member and a bent end portion locking the contact member in the body member, the intermediate contact-making portion of said strip having the form of a convex loop disposed in the tapered portion of said body member in position to be engaged by the conductors on the board when it is inserted in the connector, said strip being provided with an integral upset protuberance resting against the bottom of the tapered section of the cavity in which it is disposed to form a fulcrum for the contact member as it is deflected by engagement with the printed-circuit board, both of the lower ends of the contact strip being deformed to anchor said strip at the bottom of said insulating body member.

3. In a connector for establishing electrical connection to a plurality of conductors printed on both sides of a printed-circuit board, in combination,

an insulating body member having a plurality of cavities extending therethrough from top to bottom, said cavities tapering along a portion of their length and being of greater depth at the top, each cavity including opposed parallel side walls,

and a pair of opposed contact members disposed in each of said cavities and fitting snugly between said side walls,

each of said contact members consisting of a flat strip of metal formed by folding the ends of the strip back on each other and having its ends extending through the bottom of said body member and an intermediate looped contact-making portion disposed in the tapered portion of said body member in position to be engaged by the conductors on the printed-circuit board, the shape of the bottom of said looped portion of said contact member and of the cooperating non-conforming surface of the body member on which it rests providing a definite fulcrum point for the deflection of the contact member as the printed-circuit board is inserted in the connector.

4. A connector as defined by claim 3 in which both legs of the folded contact member are provided with upset portions engaging the body member to obtain a rocking or canting type of movement upon deflection of the contact member and also anchor the contact member in place in said body member.

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