April 28, 1970 R. F. COBBAN ET AL 3,509,520

ELECTRICAL CONNECTOR

Filed March 7, 1966

FIG.1.

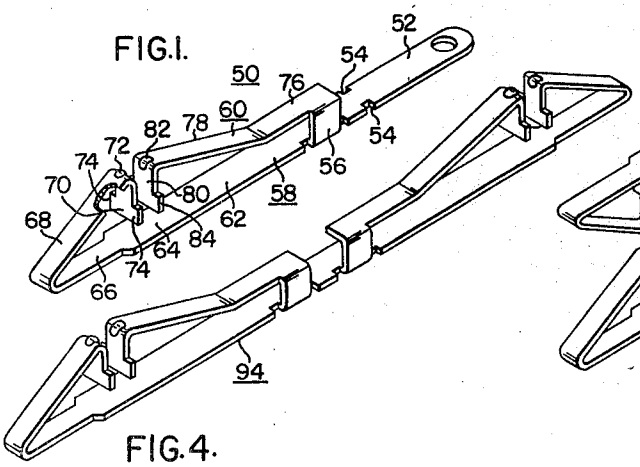


FIG.2.

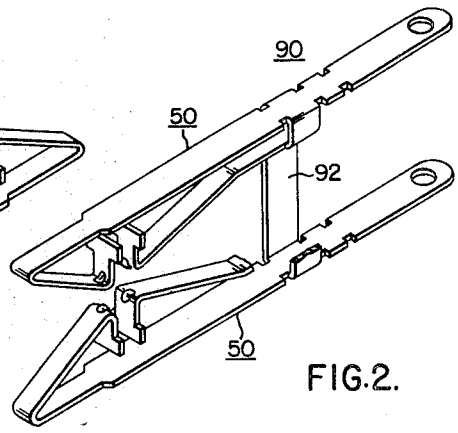


FIG.4.

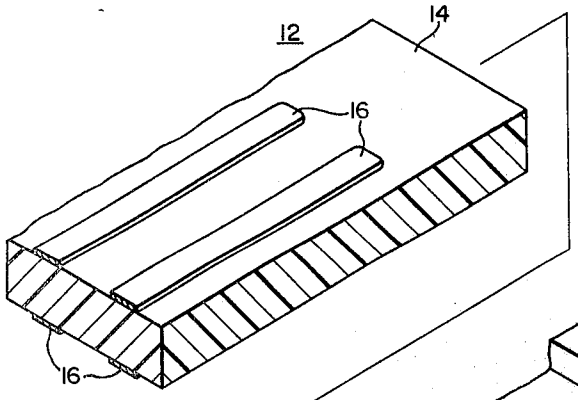
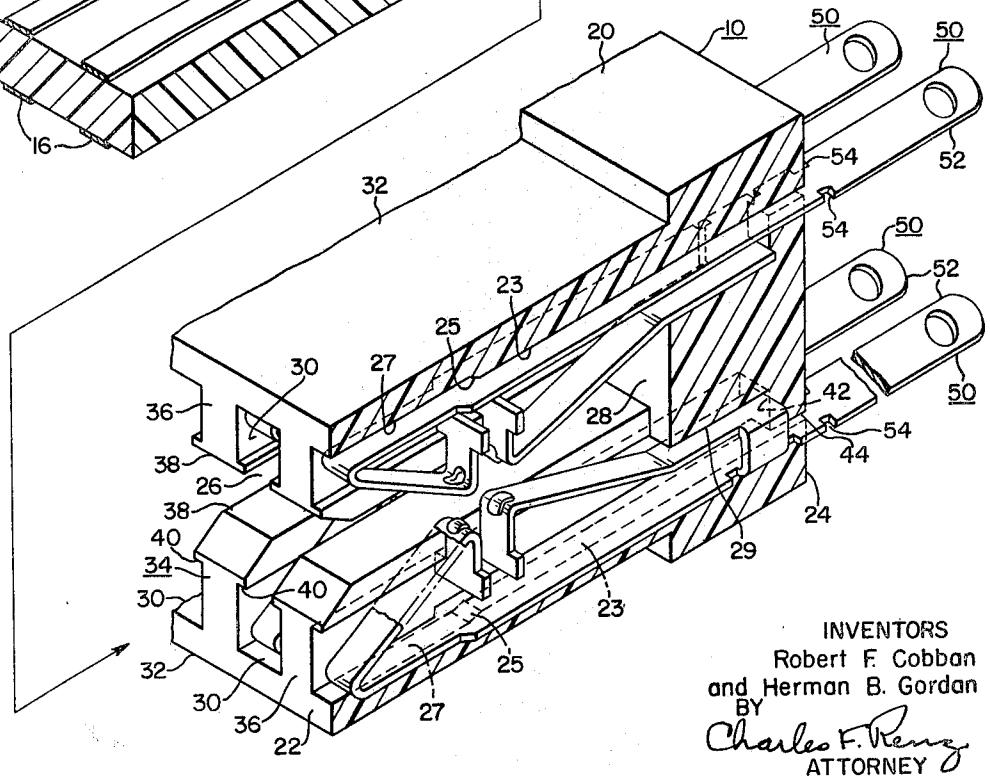


FIG.3.



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ELECTRICAL CONNECTOR

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U.S. Cl. 339—176 5 Claims

ABSTRACT OF THE DISCLOSURE

A receptacle comprising an insulating body having an opening in the front face thereof, a terminal member mounted within said opening and providing a first and second contact members extending in the same direction and connected together by a bridging member, said first member extending forwardly toward the front face of said body for a first distance from said bridging member to form a first resilient contact element, said second member extending forwardly from said bridging member for a greater distance than said first member and bent backwardly toward said first member to form a second resilient contact element, forward of said first contact element and in alignment therewith and adapted to resiliently engage one side of a printed circuit board inserted into said opening.

This invention relates to electrical devices for making connections with devices such as rigid or flexible circuits and more particular to connectors of the type adapted to engage and establish an electrical contact with circuits having circuitry printed on one or both sides of a support.

One of the major problems existing in the present state of the art of rigid or flexible circuit contacts is that the contacts are frequently sensitive under mechanical vibration. Consequently, once the vibration reaches the natural frequency of the spring-type contacts, then intermittency in the circuits will result. It is also found in the present art that the wiping action provided by the spring-type contact may not be adequate in pressure to insure a good contact due to the presence of dirt or residue on the printed circuits.

It is accordingly the general object of this invention to provide a new and improved connecting device.

It is another object to provide an improved contact for a connector.

It is another object to provide an improved connector in which different contact pressures are provided to prevent intermittency of the circuit due to mechanical vibrations.

It is another object to provide an improved contact or terminal in which two separate and distinct spaced points of contact are made by the terminal so that on insertion of the printed circuit into the connector the first contact point engaging the printed circuit exerts a greater contact pressure than the second contact point engaging the circuit.

Briefly, the present invention accomplishes the above cited objects by providing a connector in which the terminal is mounted within the body so as to provide pretensioned spaced contacts and with preventive means associated therewith to prevent permanent deformation of the contacts. The invention also provides an improved terminal in which two separate and distinct contacts are provided in a line parallel to the insertion path and in which the first of the contacts provides a greater contact pressure than the second contact to provide a cleansing action of the printed circuit upon insertion into the connector.

These and other objects and advantages of the invention will become more apparent when considered in view of the following detailed description and drawings, in which:

FIGURE 1 is a perspective view of a terminal incorporating the present invention,

FIG. 2 is a perspective view of a double redundant receptacle contact terminal incorporating the teachings of this invention,

FIG. 3, is a perspective view of a portion of a single ended receptacle or connector having a terminal of the type illustrated in FIG. 1 incorporating the teachings of this invention, and

FIG. 4 is a perspective view of a double ended receptacle contact terminal incorporating the teachings of this invention.

Referring in detail to FIG. 3, a portion of a connector of receptacle **10** is illustrated. A printed circuit board **12** for insertion into the receptacle **10** is also illustrated. The printed circuit board **12** includes a board or support member **14** of an electrically insulating material having a plurality of electrically conductive elements **16** provided thereon. The conductive elements **16** can be bonded or attached to the printed circuit board in any suitable manner and the printed circuit board **12** is adapted to be connectable and insertable relative to the connector member **10**. This is only one example of the use of this invention and other circuits and connectors of the type described in the copending application Ser. No. 352,156, by L. Travis may be used with the connector described herein.

The connector **10** consists of a body portion **20** having a front surface **22** and a rear surface **24**. The connector body **20** is provided with a rectangular slot **26** provided in the front surface **22** and extending inwardly for receiving the printed circuit board **12**. The slot **26** is provided with a floor surface **28** and the entry edge of the printed circuit board **12** when inserted into the connector **10** will rest against the floor surface **28** of the slot **26**. A plurality of channels **30** are provided transverse to the longer dimension sides of slot **26** and bottom of the side walls **32** of the connector body **20**. The channels **30** are defined by rib members **34** extending from the side walls **32**. The rib members **34** are essentially T-shaped in cross section and consist of a body portion **36** extending from the side wall **32** which is transverse to the side walls **32** and the slot **26**. The body portion **36** of the rib member **34** is provided with a cross piece **38** at the end remote from the side wall **32**. The outer surfaces of the cross pieces **38** defines the longer dimensions of the rectangular slot **26**. The cross pieces **38** are provided with a taper at the front surface **22** to permit ease of insertion of the printed circuit board **12**. The under surfaces of the cross pieces **38** projects beyond the body member **36** on both sides thereof to provide a locking ridge **40** on each side of the body portion **36**. The channels **30** extend inwardly from the front surface **22** to a floor surface **42** which is below the floor surface **28** of the slot **26** with respect to the front surface **22**. The floor surface **42** is provided with a rectangular opening **44** which extends through the floor surface **42** to the rear surface **24** of the connector body **20**.

Referring in detail to FIG. 1, a terminal contact **50** is illustrated. The terminal member **50** as shown in FIG. 3 is positioned within the channel **30**. The terminal member **50** consists of a terminal extension portion **52** which extends through the opening **44** in the floor surface **42** of the channel **30**. The terminal extension **52** is provided with notches **54** to permit twisting of the terminal portion **52** so as to lock the terminal **50** to the connector body **20**. The surfaces of the notches **54** bear against the back surface **24** of the connector body **20**. The terminal **50** includes a transverse bridge member por-

tion 56 which is secured to a first spring leg member 58 which is an extension of the terminal portion 52. The bidge member 56 connects the first leg member 58 to a second leg member 60. The first leg member 58 consists of a base portion 62. The base portion 62 consists of a first section 64 which is an extension of the terminal portion 52 and is of substantially the same dimensions, and a second section 66 which is of less width than the section 64. The base portion 62 rests on the inner surface of the side wall 32 of the connector body 20. The inner surface of the side wall 32 consists of a first section 23 which extends from the floor surface 42 of the channel 30 to a point 25 approximately two-thirds of the distance from the floor surface 42 to the front surface 22. The second or remaining section of the inner surface of the side wall 32 from the point 25 to the front surface 22, indicates as item 27, is recessed with respect to the first surface 23.

The first leg member 58 is provided with a bent back portion 68 to provide a reversely directed portion. The reversely directed portion 68 is provided with an inwardly directed portion 70 which is directed toward the base portion 62. The point at which the reversely directed portion 68 is bent inwardly to form the inwardly directed portion 70 provides a contact area 72. The contact area 72 is in the form of a dimple. The inwardly directed portion 70 is provided with projecting ears 74 which operatively contact the under surfaces 40 of the projecting members 38 on the rib members 34 of the body member 20 to restrict movement of the first leg member 58 and provide pretension of the spring portion of the leg member 58. The spring portion is defined primarily by the reversely directed portion 68 and the second section 66 of the base portion 64. The clearance provided between the base portion 62 and the recessed portion 27 of side wall 32 permits the portion of the base 62 adjacent the wall portion 27 to be a part of the spring portion.

The second leg 60 includes a base portion 76 which is substantially parallel to and in alignment with the base portion 62 of the leg 58. The second leg 60 is connected by the leg 58 by means of the connecting or bridge member 56. The base portion 76 is a resilient strip member having substantially the same dimensions as the second section 66 of the base portion 62 of leg 58. The length of the base 76 is less than one third the length of the base portion 62 of member 58 and as illustrated in FIG. 3 is adjacent a wall 29 of the channel 30 which extends between the floor surface 28 of the slot 26 and the floor surface 42 of the channel 30. Clearance is provided between the wall 29 and the base portion 76. The end of the base portion 76 secured to the bridge member 56 and one edge of the connecting member 56 are secured to the floor surface 42 when the terminal portion 52 is locked to the connector body 20.

The second leg member is also provided with a portion 78, which is outwardly inclined with respect to base portion 62 of the leg member 58, and then an inwardly turned portion 80 substantially perpendicular to the outwardly turned portion 78. The inwardly directed portion 80 is substantially parallel to the inwardly directed portion 70 of the first leg 58 and again a contact area or portion 82 in the form of a dimple is provided near the juncture of portion 78 and 80. This provides two contact portions 72 and 82 on terminal 50 lying in a line along the channel 30 provide two spaced contacts 72 and 82 along the line of the conductive elements 16 on the printed circuit board 12. The inwardly directed portion 80 is also provided with tabs or ears 84 which are operatively associated with the undersurface 40 of the cross pieces 38 on the ribs 34 os as to pretension the second arm or leg 60 and provide the two spaced contacts 72 and 82 in a plane parallel to and spaced from the outer surface of the cross pieces 38 within the slot 26. The length of the primary spring portion with regard to leg member 60 is that of the base portion 76 from the bridge member 56 and the inclined portion 78. The leg member 58 is designed to provide a greater contact pressure than the leg member 60 so as to achieve two independent spring contacting members of different contact pressures in a single terminal. This structure provides true redundancy in providing a terminal having two contacts provided by two separate spring legs of different natural frequencies of vibration. In placing the stiffer spring, formed by leg 58 at the forward portion of the connector and the softer spring formed by leg 60 in rearward portion of the connector and in alignment, then, on insertion of the printed circuit board 12 into the connector 10 to the first contact 72 on leg 58 will provide a cleaning or wiping action on the conductor 16 insuring removal of dirt and residue so that a good electrical contact can be made by the softer contacting spring contact 82 provided by the leg member 60. For example, the contact pressure of leg 58 may be 12 ounces and leg 60 may be 6 ounces. The contact terminals 50 may be of a suitable resilient electrically conductive material such as beryllium copper. The terminal may be formed in a progressive die and then heat treated. The terminal is of strip material having a thickness of about .012 inch.

By providing the rib member 34, the terminal member 50 cannot be compressed to the point of permanent set since the rib members 34 provide a positive stop for transverse movement of the printed circuit member 1' within the receptacle or connector 10.

In the specific embodiment illustrated in FIG. 3, a single ended receptacle 10 having opposed upper and lower terminals 50 is provided. It is obvious that the terminals 50 could be alternated within the receptacle 10. In the case of where the conductor 16 on board 12 is connected to a common conductor 16 on the opposite sides then a redundancy of contacts, namely four, could be provided. In FIG. 2, there is illustrated a double redundant receptacle terminal contact 90 wherein a connecting bridge 92 is provided between two terminals 50.

The invention has been shown with respect to a single ended receptacle. It is obvious that the terminals may be adapted for a double or multiple ended receptacle. Such a terminal 94 is illustrated in FIG. 4.

Since numerous changes may be made in the above-described apparatus and different embodiments of the invention may be made without departing from the spirit thereof, it is intended that all matter contained in the foregoing description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

We claim as our invention:

1. A receptacle comprising an insulating body having an opening in the front face thereof and a terminal member mounted within said opening and providing first and second contact members extending in the same direction and connected together by a bridging member, said first member extending forwardly toward the front face of said body for a first distance from said bridging member and forming a first resilient contact element, said second member extending forwardly from said bridging member for a greater distance than said first member and being bent backwardly toward said first member to form a second resilient contact element positioned forwardly of said first contact element and in alignment therewith, said first and second elements being adapted to resiliently engage one side of a printed circuit board inserted into said opening, said first contact member comprising a strip of electrically conductive material extending substantially parallel to said second contact member for a first distance and then diverting outwardly and then inwardly to provide a first resilient contact said second contact member comprising a strip of electrically conductive material extending forwardly from said bridging member and being bent back upon itself to provide a reversely bent outwardly diverting portion and then being bent inwardly substantially parallel to said inwardly di-

verting portion of said first contact member to provide a second reslient contact element in alignment with said first resilient contact.

2. A receptacle as defined in claime 1 in which said first contact member has less contact pressure on said printed circuit board than said second contact member.

3. A receptacle as defined by claim 1 in which said receptacle has a front and back surface, said terminal member is locked within said receptacle by means of a terminal extension extending rearwardly from said bridging member through the floor of said opening in said body and in which said terminal extension is deformed to lock said terminal member to the back surface of said receptacle.

4. A receptacle as defined by claim 1 in which said terminal member is located within a channel portion of said opening and in which said channel walls are provided with means to pretension said first and second contact members.

5. A receptacle as defined by claim 1 in which said terminal member is located within a channel portion of said opening and in which the channel walls defining said

channel provide means for preventing deformation of said first and second contact members on insertion of said printed circuit board into said receptacle.

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