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INTERLOCKING ELECTRICAL CONNECTOR

Filed July 17, 1967

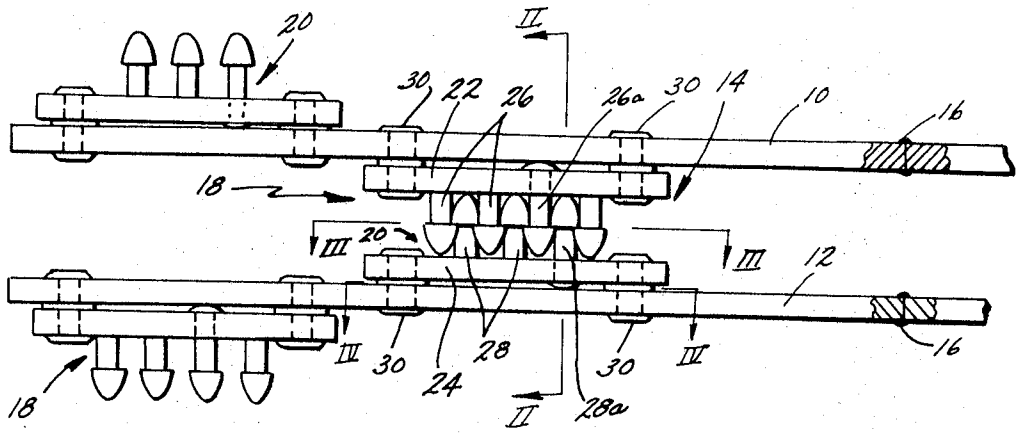

FIG. 1.

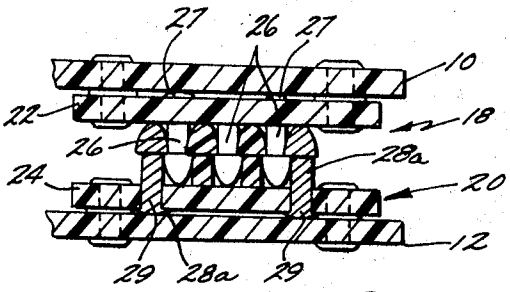

FIG. 2.

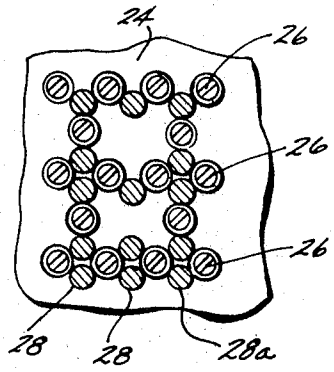

FIG. 3.

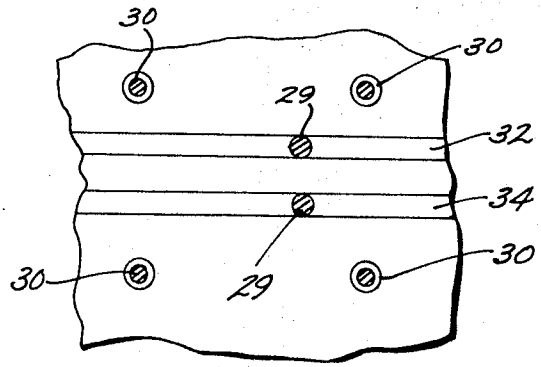

FIG. 4.

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INTERLOCKING ELECTRICAL CONNECTOR

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U.S. Cl. 339—17 7 Claims

ABSTRACT OF THE DISCLOSURE

An electrical connector which also provides a secure mechanical interlock when connected, comprised of a pair of connector elements, each of which includes a base portion and a plurality of pin members upstanding from the base portion. The pin members of the two elements interengage as the elements are pushed together, and these pin members have enlarged heads which interlock together upon mutual engagement. At least some of the pin members are electrically conductive, and the base portion of each connector element carries a contact which is electrically connected to or integral with such conductive pin members, to thus form a terminal for the respective connector element.

BACKGROUND

Many different types of electrical connectors are in use at the present time, as is well known. For the most part, such connectors are basically comprised of a first element defining one or more fingers or pins which slide into appropriate sockets or recesses in a second element; in such a manner that conductive portions within the recesses come into contact with conductive portions of the pins or fingers. For the most part, such connectors are not really addressed to the problem of providing a mechanical interconnection as well as an electrical one, although certain of these pin-and-socket connectors have in the past been provided which were in essence modified to include this as a secondary consideration. Generally, the latter type of connector either incorporated a close frictional contact between engaging parts, or else used added mutually rotatable parts such as screws or threaded collars or the like, by which an interlock could be created.

SUMMARY OF THE INVENTION

The present invention provides a new and unique form of electrical connector which, by virtue of a unique unitary structure, simultaneously provides a mechanical connector of considerable strength. The connector element of the invention is particularly well suited as an interconnection between adjacent circuit boards or modules, particularly those embodying strip or ribbon-like conductive paths in the general family known as "printed circuits," although there are numerous other applications where the connector element of this invention will find great advantage.

Briefly stated, the connector element of the invention comprises a pair of interconnectable elements, each of which have a base portion extending in a plane and a plurality of pin members upstanding from such base portion and supported in position thereby. These pin members are arranged on each base portion so that they extend between and interengage the pin members on the other base, and in this manner hold the two elements together. At least one of the pin members of each such element is electrically conductive, and is arranged to come into mutual contact with a conductive pin member on the other such element when the two elements are interconnected by their respective pin members, to thereby establish electrical conduction between such elements.

DRAWINGS

FIG. 1 is a fragmentary side elevation of a pair of circuit boards interconnected by the connector means of the invention;

FIG. 2 is an enlarged sectional elevation taken through the plane II—II of FIG. 1;

FIG. 3 is an enlarged sectional plan view taken through the horizontal plane III—III of FIG. 1; and

FIG. 4 is a sectional plan view taken through the horizontal plane IV—IV of FIG. 1.

PREFERRED EMBODIMENT

In FIG. 1, a pair of parallel circuit boards **10** and **12** are shown, interconnected both electrically and mechanically by the interlocking connector means **14** of the invention. The two circuit boards **10** and **12** are typical of many specific types of such boards, as will be understood, and in the example which is shown each side of the circuit boards is to be understood as carrying a desired arrangement of electrically-conductive strips providing "printed circuit" paths for carrying operating voltage. A standard wire connector **16** is shown on each of the circuit boards **10** and **12** to indicate that the printed circuit strips on each side are electrically connected.

The connector means **14** of the invention, as seen in FIGS. 1 and 2, comprises a pair of interconnectable elements **18** and **20**, each having a base portion **22** and **24**, respectively, and a plurality of pin members **26** and **28**, respectively, which are supported on each of the said base portions and extend perpendicularly away from the same. Each of the base portions **22** and **24** is secured to one of the circuit boards **10** and **12**, as for example by rivets **30**. As will be observed from FIG. 1, each of the circuit boards preferably has a connector element **18** secured to one side and a connector element **20** secured to its other side, either in direct alignment with each other, or offset from one another, as illustrated.

Most of the pin members **26** and **28** on the base portions **22** and **24**, respectively, may be formed integrally with such base portions, preferably of a stiffly resilient plastic material which is formable through molding techniques. However, while most of the pin members may be of such a plastic material, certain pins such as pins **26***a* and pin **28***a* (FIGS. 1 and 2) should be made of metal or otherwise made to be electrically conductive, and these pins preferably extend completely through their respective base portions **22** and **24** in the manner illustrated, to terminate on the opposite side thereof in a contact head which on pin **26***a* is designated **27**, and on pin **28***a* is designated **29**. These contact heads **27** and **29** are arranged to come into contact with a conductive strip such as **32** or **34** (FIG. 4) forming a part of the printed circuitry on the circuit boards **10** and **12** when the particular connector element **18** or **20** carrying such contact head is riveted or otherwise secured to that circuit board. In this manner a conductive path is established between the conductive strips on the circuit boards, through the contact heads and mutually contacting conductive pin members of the two connector elements **18** and **20**.

The conductive pin members **26***a* and **28***a* of the two connector elements **18** and **20** are arranged on their respective base portions such that these conductive pins will come into mutual contact when the various pins on one connector element are interengaged with the pins on the other such element, to thereby establish a conductive path between the two connector elements. This is illustrated in FIGS. 1 and 2, where pin member **26***a* and **28***a* are seen in contact with one another. The initial interengagement of the various pin members of a pair of connector elements occurs when such pin members are

intermeshed, i.e., when the pin members of one connector are slide between the pin members of the other connector. However, each of the pin members has an enlarged mushroom-like head portion which is generally conical in shape, and the lowermost extremity of each such head portion (i.e., the conical base, located closest to the base portion of that connector element) defines a flat shoulder edge. This edge interengages beneath the corresponding shoulder of a pin member on the other connector element when the various pin members on the two connector elements are fully engaged with each other. This creates a positive mechanical interlock between the two connector elements which is very strong, and easily strong enough to form the only necessary structural interlock between a pair of adjacent circuit boards.

The manner in which the enlarged head portions on each of the pin members **26** and **28** move past one another and interlock their bottom shoulder edges is a result of the limited flexibility of individual pin members and the relative size and positioning of the pin members upon their respective base portions. The pin members on at least one connector should be positioned in an arrangement having an open or pin-free space at desired intervals, which permits the various pin members adjacent such space to flex slightly in a lateral direction and thereby allow the enlarged heads of pins on the other connector to move past the flexed ones on the first. One workable arrangement of pin members is illustrated in the plan view of FIG. 3, wherein it will be noted that while each of the sets of pins **26** and **28** occur in aligned rows, alternating rows contain a pin-free space. This space allows the pins surrounding such space to be moved laterally into it as a result of the insertion of other pin members from the other connector element therebetween. As FIG. 3 illustrates, the sides of the conductive pin members **26***a* and **28***a* are held firmly in contact with each other by the interengagement of the several pin members of each connector. As will be apparent, the specific number of pin elements which are made to be conductive may vary to suit different situations; it will also be apparent that contact redundancy may readily be implemented by providing a plurality of conductive pins on each connector, and by conductive strips or other such conductor means (not specifically shown) on the rearward or circuit board-side of the respective base portions **22** and **24**, which would serve to interconnect such a desired plural number of different conductive pin members on each such base portion.

As indicated previously, each of the connector elements **18** and **20** is secured to a given circuit board **10** or **12** in a manner such that the protruding contact heads **27** and **29** of the conductive pin members **26***a* and **28***a*, respectively, come into direct contact with a conductive strip **32** or **34** carried on the surface of the circuit board, as indicated in FIG. 4. Consequently, when the two connector elements **18** and **20** are snapped together by interengagement of their respective pin members, positive electrical contact is instantly established between the two circuit boards themselves; concurrently, an extremely sturdy mechanical interconnection is established between the two circuit boards. A satisfactory mechanical interconnection is likely to be obtained between the two connector elements even though they are not perfectly aligned when they are pushed together, i.e., when one connector element is laterally offset from the other although it will be understood that the rigidity of the mechanical interconnection is a direct function of the number of pin members which are interengaged and their respective locations. However, while contact between any two of the conductive pin members is satisfactory to establish an electrical circuit, some care is clearly necessary to insure that a given pair of conductive pin members actually do come into contact when the connector elements are interengaged, at least when a relatively small number of conductor pin members are present. That is, in order to insure the desired electrical contact when the

connector elements are interengaged, some care must be taken to properly align the two connector elements, or to align the circuit boards carrying the two elements, which will accomplish the same result. This is not a particularly difficult thing to achieve, as will be apparent, since the edges of the circuit boards may be used for such alignment purposes, as may any number of other desired expedients, such as particularly positioned guide pins and holes, etc.

As will be apparent from the foregoing disclosure, the connector element of the invention provides a unique means of both mechanically and electrically connecting a pair of circuit boards or the like. The connector elements are readily engaged and disengaged with each other by positive manual action, but while engaged form a secure mechanical connection. It is entirely conceivable that upon examining the foregoing disclosure, those skilled in the art may devise embodiments of the concept involved which differ somewhat from the embodiment shown and described herein, or may make various changes in structural details to the present embodiment, but which nevertheless are equivalents of the invention as defined by the following claims.

I claim:

1. An electrical connector, comprising: a pair of interconnectable elements; each such element having a base portion extending in a plane and a plurality of pin members upstanding from such base portion transversely of said plane and supported in position by said base portion; each such base portion carrying a conductor means thereon which provides an electrical terminal therefor; at least one of said elements having said pin members arranged in at least one grouping of pin members which are symmetrically spaced about a central area; said other element having at least one pin member arranged to extend between and interengage with the pin members of the other such element arranged in said grouping to hold the two elements together; interlocking means on at least some of the pin members on each such element for releasably securing interengaged pin members and thus, said elements, together; at least one of the interengaging pin members of each of said elements being electrically conductive, said conductive pin members having portions extending through the base portion of their respective elements, communicating with the side thereof opposite said pin members, and being electrically connected by said conductor means to the said terminal on respective elements, said conductive pin members of each of said elements coming into mutual contact when the pin members of such elements are interengaged, to thereby establish electrical conduction between said elements and between said terminals.

2. The electrical connector of claim **1**, wherein said interlocking means comprise shoulder portions formed on such pin members which interfit when the pin members are interengaged.

3. The electrical connector of claim **2**, wherein said interlocking means comprise enlarged head portions on such pin members and such pin members on each element are of substantially the same length, said shoulder portions being an edge extremity of such a head portion.

4. The electrical connector of claim **3**, wherein said enlarged head portions are generally conically shaped, with the thicker extremities thereof forming the conical base located closest to the base portion of the corresponding connector element; said shoulder portions being the edge extremity of said conical base.

5. The electrical connector of claim **1**, wherein said conductor means includes an integral extension of such conductive pin members.

6. The electrical connector of claim **5**, wherein said integral extension passes through said base portion.

7. The electrical connector of claim **6**, wherein the base portion of at least one of said elements includes means for attaching such element to a circuit board, and

said integral extension forms an electrical contact head on the side of the base portion opposite the pin members for touching a conductor on such circuit board.

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