United States Patent [19]

Lundergan et al.

[11] **3,884,544**

[45] **May 20, 1975**

[54] **CONNECTOR FOR CIRCUIT BOARDS OR THE LIKE**

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[73] Assignee: **AMP Incorporated**, Harrisburg, Pa.

[22] Filed: **Oct. 17, 1973**

[21] Appl. No.: **407,326**

[52] **U.S. Cl.**..... **339/198 G**; 339/241; 339/256 R; 339/217 R

[51] **Int. Cl.**..... **H01r 9/00**

[58] **Field of Search** ..... 339/198, 256, 252, 241, 339/32, 33, 217; 24/208 A, 216

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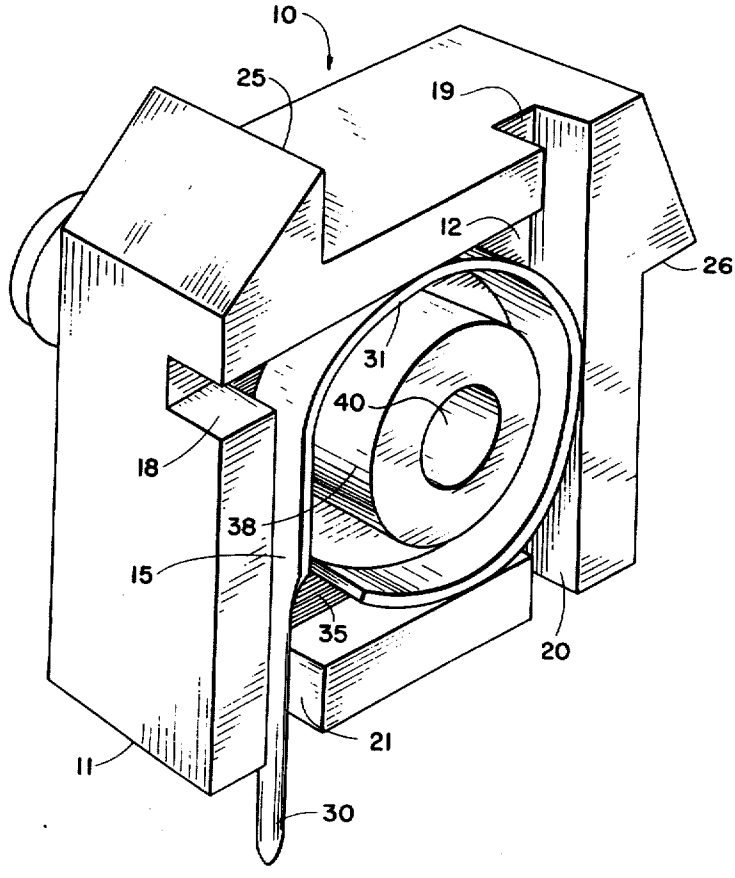
[57] **ABSTRACT**

A contact for use on printed circuit boards, or the like, or in establishing connections to at least one printed circuit board, includes a female contact assembly housing with an internal cavity. Top side and bottom holes are provided in the housing communicating with an internal cavity in which a contact member is located. Contact member includes a straight portion outwardly extending through one of the holes, and a curved portion within the cavity. Thus, when a male contact rod is inserted through one of the holes into the cavity, it contacts the curved portion of the contact within the cavity to establish an electrical conduction path thereto. The female assemblies are provided with an outstanding post with an enlarged portion adjacent its end from one side, and a hole of dimensions similar to that of the outstanding post and enlarged end to receive a similar post from an adjacent identical female connector assembly. The female assemblies can be fabricated in an alignment of the desired number, to form a female connector block of desired dimension.

The male rods or posts are mounted in a header which can include, if desired, a clip which engages a shoulder of the female unit to thereby lock the male and female assemblies in connected relationship.

8 Claims, 11 Drawing Figures



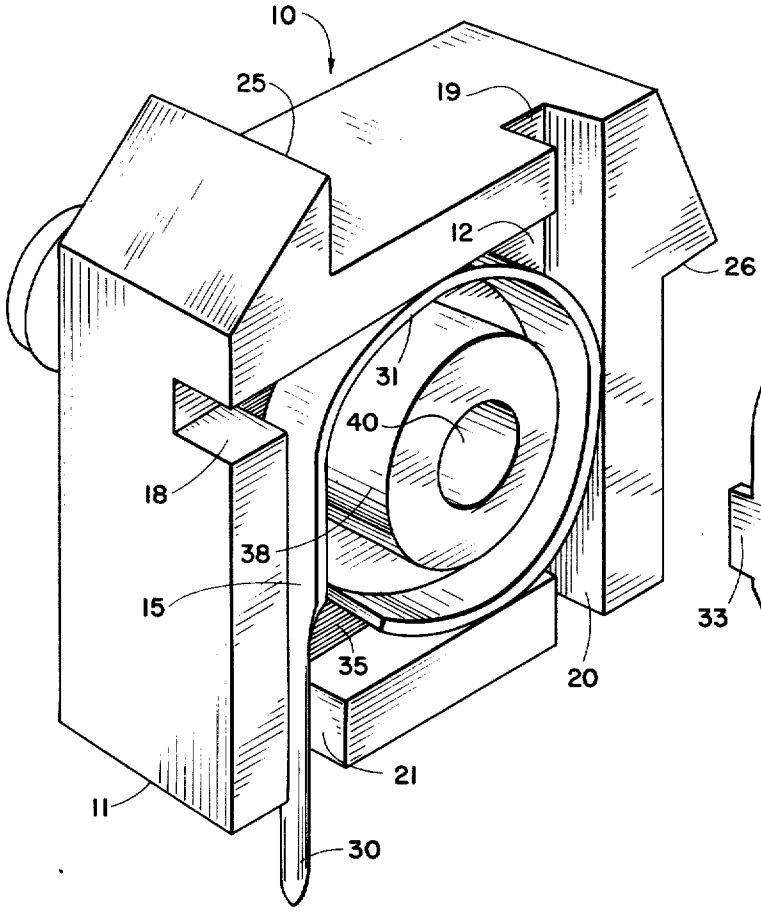


Fig. 1

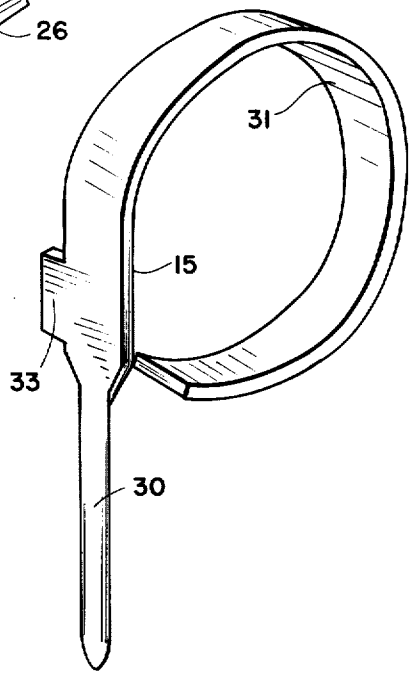


Fig. 1a

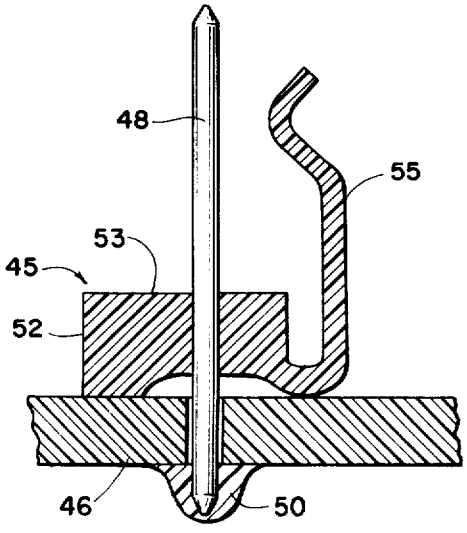


Fig. 2

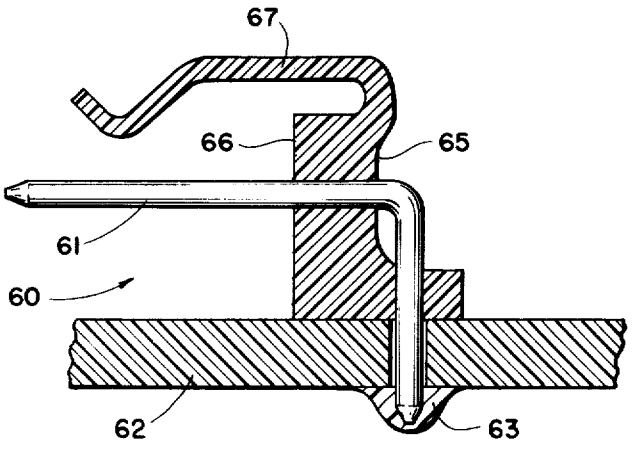


Fig. 3

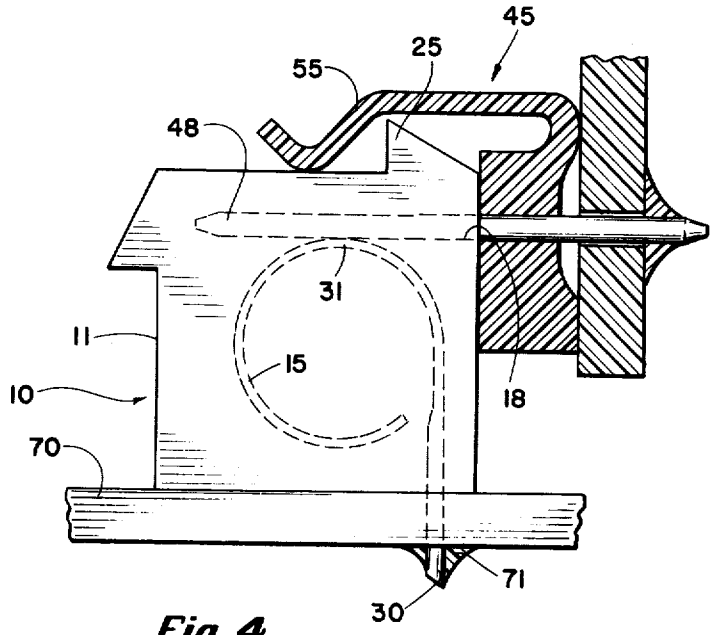


Fig. 4

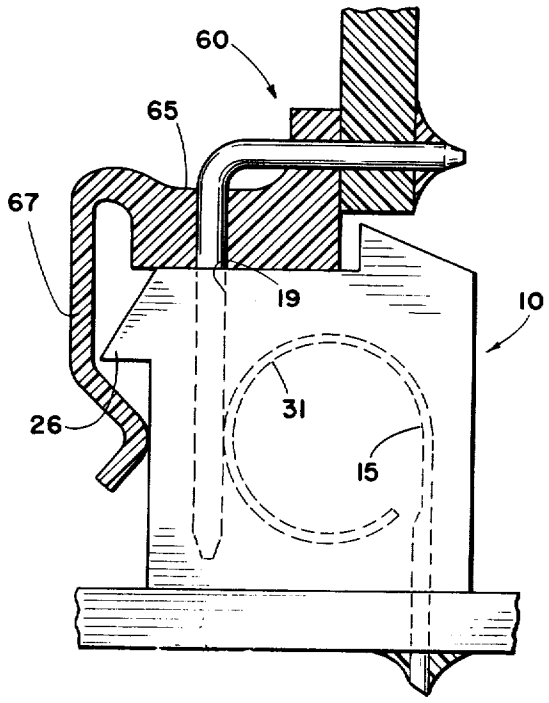


Fig. 5

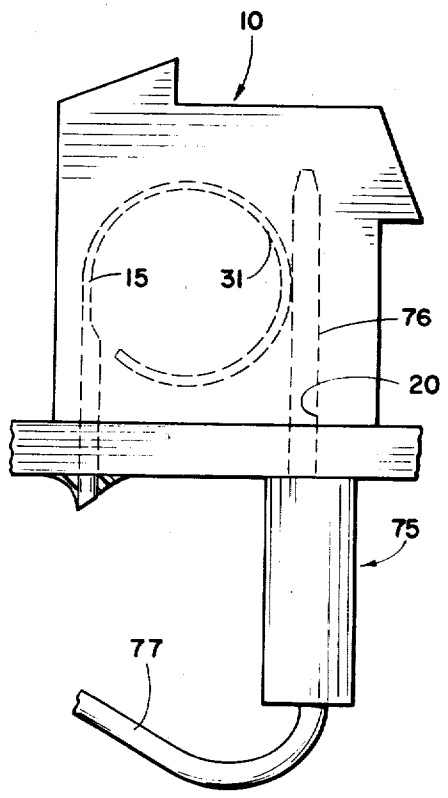


Fig. 6

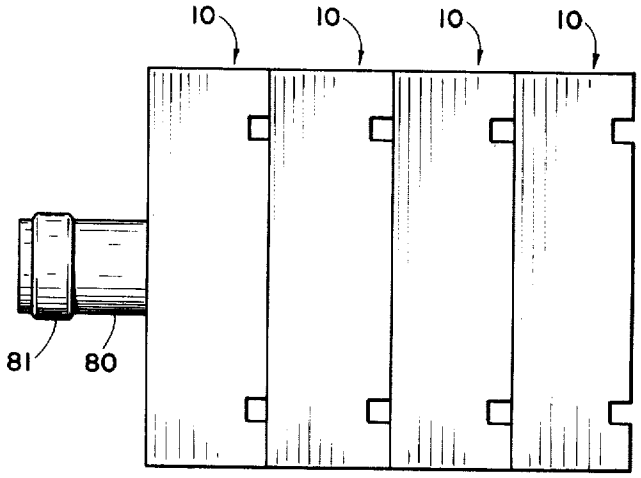


Fig. 7

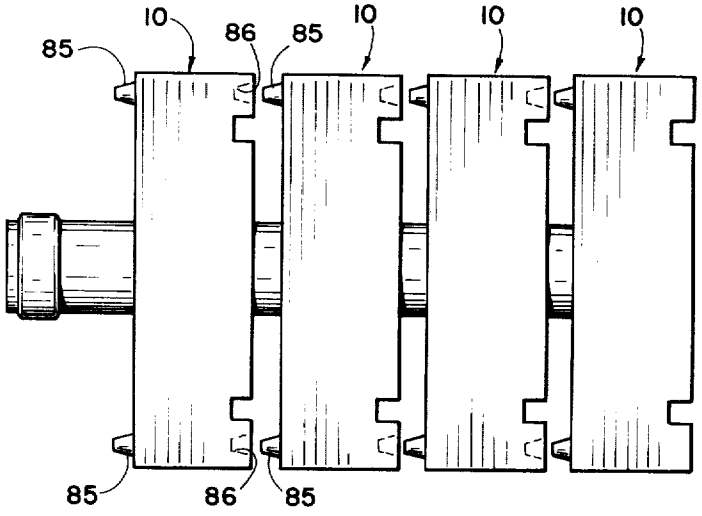


Fig. 8

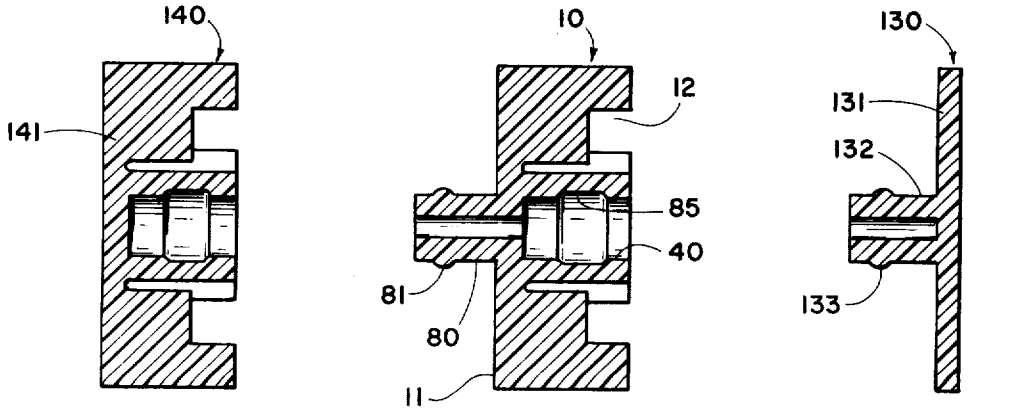


Fig. 10

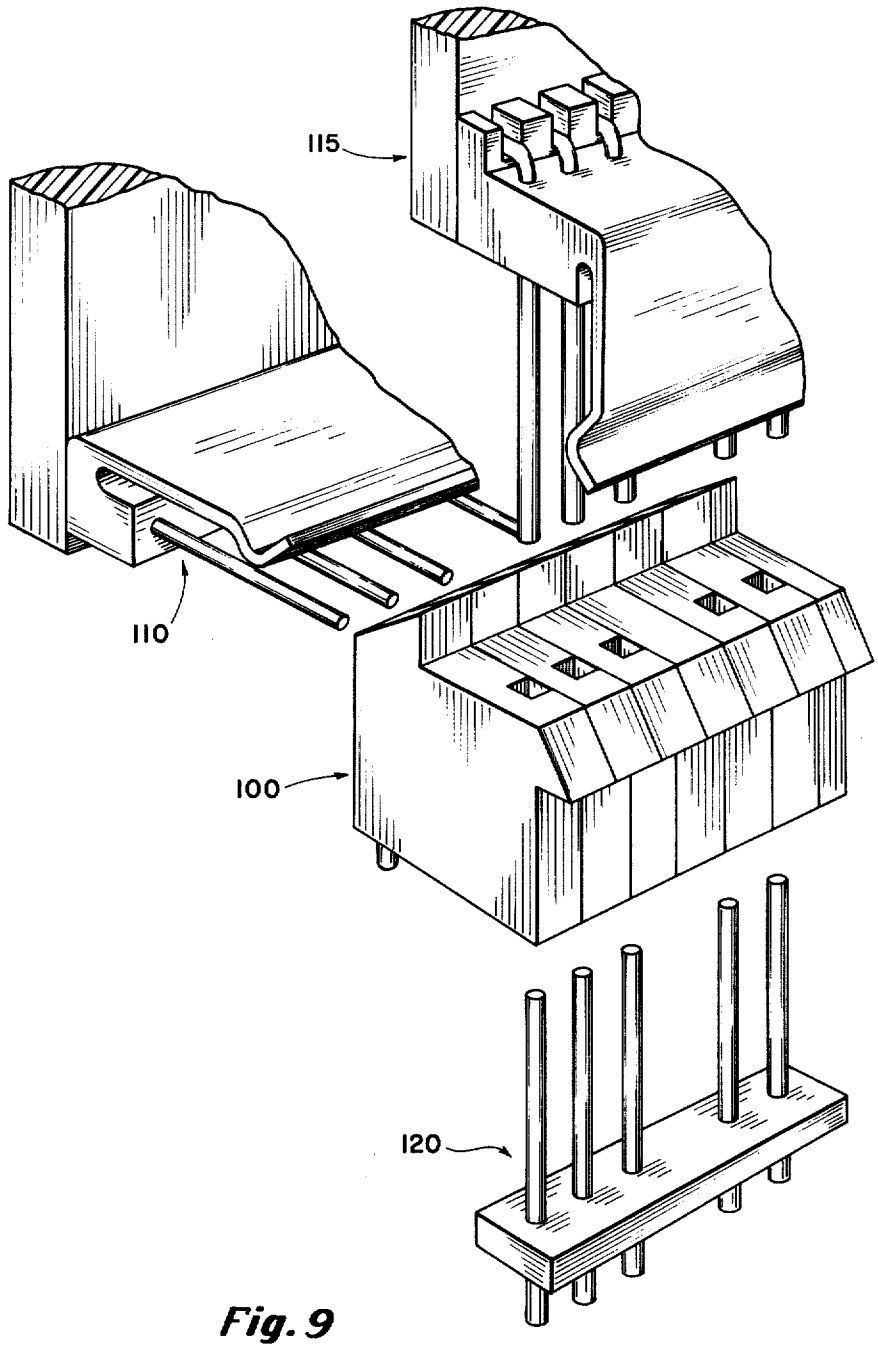


Fig. 9

CONNECTOR FOR CIRCUIT BOARDS OR THE LIKE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to electrical connectors, more particularly to improvements in electrical connectors which can be used in number to receive male receiving rods from a header or the like.

2. Description of the Prior Art

In the construction of circuits, particularly printed circuit boards, and the like, it is often desirable to include means for connecting the circuit elements of the printed circuit board to other external circuits or other external printed circuit boards. One way in which this has been achieved in the past is through the use of an electrical plug or connector for receiving a corresponding mating plug, each leading to the respective circuits desired to be interconnected.

In the past, typically a female connector is located on the printed circuit board, and the male connector provided separately for insertion thereinto, although, dpending upon the particular application, the male portion may be attached to the printed circuit board.

Typically the female portion of the plug or connector are formed of plastic, nylon, or other electrical insulating material with a number of holes aligned along the direction thereof, and with an electrically conducting female contactor located within each of the holes. Typically, these are formed in long strips; including, for example, fifteen, twenty, or more holes and connectors. In use, the desired number of connectors are sawed or cut from the connector strip, and applied to the printed circuit board in the desired location.

The printed circuit boards frequently have precise areas for definite locations, frequently, in fact, holes, for receiving the connector. The particular tolerances of the connector to be applied, therefor, in its cut dimension must be particularly controlled to enable it to be fitted at the desired location. Furthermore, to be universally usable, the connectors typically used are of very precise construction; that is, the spacing and alignment of the individual holes and connectors are within a specified standard, such as, plus or minus two-thousandths of an inch. This preciseness, although facilitating uniformity, additionally dictates or requires that the male contactor portion which is inserted into the precisely constructed female portion also be of particular critical spacing between the male contactor members, and in the alignment of the members.

Additionally, the hole size itself, in the past, has been very critical, for example plus or minus two-thousandths of an inch in many commerical applications.

The particular connectors, of the prior art typically are designed for a particular connection application. For example, ordinarily the connector to be used is of a particular configuration which will accept a male plug member from a single direction with respect to the board, for instance, from the top, side, or bottom. Thus, if a top connection is desired to be made, a top connection connector must be selected. Likewise, if a side or bottom is desired, a side or bottom connector must be selected for use.

Finally, in the connectors of the prior art, relatively high insertion and extraction forces are required. Often, in fact, depending upon the number, size, and type of connectors involved in the plug, the insertion or extraction forces may go as high as one pound or more. This is undesirable in many installations, such as in uses in printed circuit boards, or the like, in which the board may be broken by application of such forces.

What is needed, therefore, is a connector which can be employed to receive a corresponding connector from any direction, which has relatively low insertion and extraction forces to facilitate its mounting or use upon printed circuit boards, and in which the hole side, spacing, and other dimensions need not be of particularly critical tolerance, and which can be formed of single unit building blocks for fabricating a connector of desired size.

SUMMARY OF THE INVENTION

In light of the above, it is therefore, an object of the invention to present an electrical connector.

It is another object of the invention to present an electrical connector which can be fabricated in unit blocks and stacked or interconnected to form any number of desired connector assemblies.

It is still another object of the invention to present an electrical connector which requires no or little spacing and hole size tolerance in its fabrication.

It is still another object of the invention to present an electrical contactor which has a certain degree of play between individual units to facilitate installation in locations of varying dimensions.

It is still another object of the invention to present a connector which requires a low insertion and retraction force.

It is yet another object of the invention to present an electrical connector which can receive or accommodate, or include as a part thereof, male connector members mounted in a heavier assembly.

It is yet another object of the invention to present a connector assembly which can be keyed to insure proper plugging connection between male and female connector assembly portions.

It is yet another object of the invention to present an electrical connector which is mountable on a printed circuit board or the like.

These and other objects, features, and advantages, will become apparent to those skilled in the art from the following detailed description when read in conjunction with the accompanying drawings and appended claims.

In accordance with one form of the invention, there is provided a connector assembly having a plurality of housings, with each housing having two major surfaces oppositely positioned in two parallel planes, and with a recesed chamber or cavity formed in said first major surface. This recessed cavity takes the form of a closed channel with the inner walls being defined by a tubular element which extends from the bottom of said recessed cavity towards said first major surface. The outer walls of the recessed cavity are essentially straight and form a generally square cross-sectional configuration in a plane parallel to said parallel planes. A rod-like or stub-like element protrudes from the second major surface of the housing and is constructed to snap into the tubular element of another similar housing element. At least two holes extend through the sidewall of the housing and into said recessed channel, with said post-like portion of said contact extending through one of said holes.

A contact having a post-like portion, usually straight, and a curled-around or circular portion, is positioned in said closed channel with the curled-around portion encircling said tubular portion and with the axis of said curled-around portion being perpendicular to said parallel planes.

When the two housings are secured together by joinder of said tubular element of one housing and the stub-like protuberance of the other housing, the second major surface of said other housing covers the first major surface of said first major surface of said first housing to retain said contact in the recessed channel of said second housing.

In accordance with a feature of the invention the stub-like protuberance has an enlarged or bulbous shaped and, and the inside portion of said mating tubular portion has an internal bulge or enlarged portion, into which the enlarged end of said stub-like portion will snap-fit.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is illustrated in the accompanying drawing wherein:

FIG. 1 (and 1a) is a perspective view of the contact housing and of a contact removed from the housing and showing its relationship therewith.

FIG. 2 is a side elevational view, partially cut away, of a plug for insertion into the housing of FIG. 1.

FIG. 3 is another embodiment of a plug, partially cut away, for insertion into the housing of FIG. 1.

FIG. 4 is a side elevation, partly in cross-section, showing the plug of FIG. 2 inserted in side entry location into the housing of FIG. 1.

FIG. 5 is a side elevation, partly in cross-section, of the plug of FIG. 3 inserted in top entry location into the housing of FIG. 1.

FIG. 6 is a side elevation, partly in cross-section, of the housing of FIG. 1, having a bottom entry plug located therein.

FIG. 7 is a bottom elevation of a plurality of housings, plugged one into the other, in pushed together relationship.

FIG. 8 is the plurality of housings of FIG. 7 in a pulled apart relationship.

FIG. 9 is a perspective view of a plurality of housings forming a connector block and of plugs adapted for side, top, or bottom entry thereinto.

FIG. 10 is a side elevation, in cross-section, of the housing of FIG. 1, used in conjunction with end caps expanded therefrom.

Among the figures of the drawings, like reference numerals are used to indicate like parts. Various portions of the figures of the drawings have been exaggerated or distorted in size or dimension for use of description and clarity of illustration.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The invention, includes as an important part the capability to fabricate from individual units a number of connectors, in an alignment, in accordance with the particular needs under consideration. One of the units from which such alignment can be fabricated is shown in FIG. 1, and is denoted generally by the reference numeral 10. The unit 10 includes a block 11 having an interior cavity 12 formed adjacent one of its sides. The interior cavity 12 is of square shape in the height and depth dimensions of the block 11, and is of width corresponding to the width of the contact member 15 therewithin contained. Additionally, the width of the cavity 12 can be approximately equal to the largest diameter of the male rod to be used in conjunction with the connector, as will become apparent below. The block 11 can be of any electrical insulating material, and can conveniently be made of nylon, plastic, or the like.

At various locations on the sides of the block 11 are holes 18, 19, 20 and 21, communicating with the interior cavity 12. Although the holes 18–21, have been illustrated as being of square or rectangular configuration, that particular geometrical pattern being of relatively simple fabrication, it should be pointed out that the holes 18–21 can conveniently be of any size, one of the principal objects of the invention being to obviate or elimate the requirement of particularly rigid size tolerances of the parts, holes, and the like of the unit.

Outstanding from one or more of the sides are locking shoulders, for example, shoulders 25 and 26 being shown extending from the top end rear walls of the block 11. The locking shoulders are of general wedge shape to receive a locking clip, below described with respect to FIGS. 2 and 3, in detail, and serve to hold the male rod assembly in inserted position. The electrical contactor 15, shown in detail in FIG. 1*a*, forms the electrical contact member for contacting the male rod assembly inserted into the connector. The connector or contact 15 can be of pre-tinned brass spring material or other electrically conducting material exhibiting similar physical spring characteristics. The contact 15 includes a straight portion 30 and a curved curled-around portion 31. In place within the cavity 12 of the block 11, the straight portion 30 extends to outside the block 11 through hole 21. The curled-around portion 31 is located within the cavity 12, and is slightly compressed to urge itself generally outwardly against the interior walls of the interior cavity 12. Thus, electrical contact can be established to the contact member 15 at the part of the straight portion 30 extending to without the block 11 through the hole 21, thereby to be presented to any point along the length of the contact 15 within the block 11. To maintain the contact 15 within the cavity 12 in resisting the forces along the axis of the straight portion 30, a tip or shoulder 33 is provided. This shoulder 33 fits into a hole or slot in the rear wall 35 of the cavity 12 (receiving hole or slot not shown). Thus, an axial force upon the member 30 will not pull the contact 15 from within the block 11 in a manner similar to metal tape measures.

Within the cavity 12, a shoulder or post 38 is centered. The post 38 functions to prevent the contact member 15 from being deformed beyond its elastic limits, or the limits from which it can recover the forces of the rod member exerted thereagainst. Additionally, the post 38 has a hole 40 formed in its center, to facilitate connection between a plurality of units of construction similar to that of the housing 10, as below described.

One embodiment of a male connector assembly which can be used in conjunction with the female housing 10 of FIG. 1, is shown in FIG. 2, and is generally denoted by the reference numeral 45. The male connector assembly 45 is mounted to a printed circuit board shown at 46, and includes a rod or post 48, which is soldered by a pool of solder 50 to the appropriate lead (not shown) of the printed circuit board 46. The rod or post 48 can be of any electric conducting material,

such as pre-tinned brass posts or the like. The post **48** is mounted within a header **52** including a block portion **53** through which the rod or post **48** extends and a clip portion **55** for locking the header and post in insert position, as below described.

An alternative embodiment of the male assembly is shown in FIG. **3** and is denoted by the reference numeral **60.** The male assembly **60** is of similar construction to that of the male assembly **45** above described in FIG. **2,** but includes a post member **61** formed at a right angle to present a portion substantially parallel to the printed circuit board shown at **62** to which it is affixed by solder pool **63.** The header assembly **65** includes a block portion **66** and a clip portion **67,** similar to the header **52** above described with reference to FIG. **2.** In both embodiments illustrated in FIGS. **2** and **3,** the header portions **52** or **65** can be of nylon or extruded plastic or similar resilient material.

The operation of the contactor assembly, in accordance with the invention, including the incorporation of the housing **10** of FIG. **1** and the male assemblies **45** and **60** of FIGS. **2** and **3** are shown in FIGS. **4–6.** With particular reference to FIG. **4,** the housing or female contactor assembly **10** is shown mounted to a printed circuit board **70** by a pool of solder **71,** thereby making electrical connection to the printed circuit board circuit (not shown) and the part of the straight portion **30** of the contact **15.** Thus, the male contact assembly **45** is inserted into the side hole **18.** The post or rod **48** is thereby disposed adjacent and in contact with the interiorly disposed curved portion **31** of the contact **15.** The clip portion **55** of the header rides over and engages the wedge **25** on the top of the block **11,** thereby locking the male assembly **45** in the inserted position.

Because the male and female contact assemblies are physically locked in an inserted position as shown, the force necessary to establish and maintain the electrical contact between the contacts **15** and **48** need be only minimal, on the order, for example, of 200 grams. This contact pressure can be regulated by the variation of the spring pressure at the curved portion **31** of the interior contact **15.** The insertion and withdrawal pressure can be regulated by the particular choice of the material from which the header and clip portion **55** thereof are chosen, as well as the thickness and other dimensions of the clip portion **55.**

Alternatively, as shown in FIG. **5,** the male assembly **60,** illustrated above with reference to FIG. **3,** can be inserted into the top hole **19** of the female housing **10,** in a fashion similar to that above described with respect to the straight line male assembly **45** above described with reference to FIG. **4.** The clip portion **67** of the header **65** engages the shoulder or a wedge **26** to maintain the assemblies in the locked position illustrated.

In still another embodiment, a plug, generally denoted by the reference numeral **75,** and including a post or rod **76** to which a wire **77** connects, is inserted into the bottom hole **20** of the female housing **10.** In the bottom entry configuration, on separate locking capability is presented, the post **76** being maintained in position by the spring contact force of the interiorly disposed contact **15.**

From the description above set forth with reference to FIGS. **4–6,** it is apparent that the female assembly or housing **10** and the particular male assembly with which it is used can be employed to establish electrical connection between a pair of printed circuit boards, thereby to complete electrical connections between the respective circuits thereof. On the other hand, particularly as illustrated in FIG. **6,** connection to the female assembly **10** can be made by separate wires from circuits originating other than upon the printed circuit boards.

If a plurality of connections are to be established, the units of the female housing or assembly **10,** shown in FIG. **1,** can be placed in a series alignment, as shown in FIG. **7.** To facilitate such alignment, a rod or stub-like element **80** is provided, as shown from the left most unit of the series in FIG. **7.** The stub like element **80** includes an enlarged portion or shoulder **81** thereabout to lock into a corresponding enlarged hole or socket **85** within shoulder **38** (see FIG. **1,** and FIG. **10**). With reference briefly to FIG. **10,** the block **11** at the second or interior larger diameter **85** is slightly larger than the diameter of the hole **40** extending to the edge of the block. Thus, the enlarged portion **81** of the post **80** is of slightly larger extent than the diameter of the hole **40,** but less than the diameter of the interior hole **85.** The material from which the block **11** is fabricated, as discussed above, if the post **80** and its enlarged shoulder **81** are to be of the same material or formed as a unit therewith, should be of resilient material to enable the enlarged portion **81** to be "popped" through the smaller diameter entrance to within the larger diameter hole **85.** Additionally, to enable a degree of play or axial movement between adjacent female assemblies, the interior hole **85** can be of width larger than the width of the expanded portion **81** of the post **80.** Thus, with reference again to FIGS. **7** and **8,** the units **10** can be located in and adjacent location, as shown in FIG. **7,** or can be pulled to an enlarged dimension, as shown in FIG. **8.** The series therefore can be employed in installations in which the particular tolerance of the dimensions is within the range between the adjacent positions of FIG. **7** and the expanded positions of FIG. **8.**

To prevent the adjacent units from rotating one with respect to the other shoulder and holes may be provided between adjacent units. For example, shoulders **85** can be provided and corresponding receiving holes **86** to mate therewith on adjacent units can be formed, as shown in FIG. **8.**

The series of units **10,** as illustrated in FIG. **9,** and denoted by the reference numeral **100** can then be employed in conjunction with an appropriate male header assembly. For instance, the straight line header assembly **110,** embodying the principals above described with reference to the single assembly **45** in FIG. **2,** including a plurality of post members can be inserted into the back or rear location of the assembly **100** for a side type entry. On the other hand, the male assembly **115,** incorporating the principals of the right angle assembly above described with reference to the assembly **60** in FIG. **3,** including a plurality of contactor members, may be inserted into the top of the unit **100** to be thereby locked into. Finally, a single plug assembly **120,** including a plurality of connectors or posts can be inserted into the bottom of the over-all unit **110.**

To prevent the male assembly from being plugged in upside down (with particular emphasis upon the embodiment of the bottom mounted assembly **120**), if desired a "key" can be employed. Thus, one of the female units can be a dummy, either in which the holes for entry therein are unformed, or are filled with a plug, or the like, and the male assembly provided with an absent

post or connector, thereby to define a unique relationship in which the respective assemblies can be connected.

To complete the end portions of the female housing, end caps can be employed, as shown in FIG. **10.** The cover **130** on the open end of the unit **10** encloses the cavity **12** to prevent the spring contact therewith from becoming dislodged, for instance, upon inserting a post or rod into the interior cavity **12.** The cover **130** includes a plate portion **131** for such enclosing purposes, and an outstanding post **132** having an enlarged portion **133** thereon to interfit the holes **40** and **85,** in a fashion similar to that above described with reference to adjacent female assemblies. On the post side of the assembly **10,** an end cap can be provided in the form of a female connector assembly from which the outstanding post has been omitted or removed. Thus, the post cap **140** presents a smooth face **141** at its end to complete the formed series of units. Additionally, and as can be seen from FIG. **7,** if a plurality of units **10** are to be employed together as hereinbefore set out, the cavity **12** in each block **11** connected to an adjacent block **11,** is enclosed by the adjacent wall of said adjacent block **11.**

Although the invention has been described and illustrated with a certain degree of particularity, it is understood that the present disclosure is made only by way of example and the numerous changes in the arrangement and combination of parts may be resorted to without departing from the spirit and scope of the invention as hereinafter claimed.

What is claimed is:

1. In an assembly of connectors for connecting external male terminals to female terminals, with each connector comprising:

an insulative housing having first and second oppositely positioned major surfaces lying respectively in first and second parallel planes, said side surfaces joining said first and second major surfaces;

a recessed chamber formed into said first major surface having side walls which define a generally trapezoidal cross sectional configuration for said chamber in a plane parallel to said parallel planes;

said housing further formed to have a tubular element extend axially from the bottom of said recessed chamber outwardly towards the plane of said first major surface;

at least first and second apertures formed in said side walls, and extending between the side surfaces of said housing and said recessed chamber, with said first aperture constructed to receive one of said external male terminals;

contact means comprising a post-like portion and a curled-around portion and positioned within said recessed chamber with said curled-around portion positioned around said tubular element with the axis of said curled-around portion being substantially perpendicular to said parallel planes, and said post-like portion extending through the second of said apertures; and

said housing further having a stub-like protuberance extending axially out from said second major surface and constructed to fit within the tubular element of a similar connector positioned adjacent thereto.

2. An assembly as in claim **1** in which:

said stub-like protuberance has an enlarged bulbous end;

in which the diameter of at least the first portion of the inside walls of said tubular element is larger than the diameter of a second portion of said inside walls of said tubular element positioned closer to the open end of said tubular element than said first portion; and

in which the sizes of said enlarged bulbous end of said stub-like protuberance and the inner configuration of said tubular element are constructed to enable the flared-out end of said stub-like element to pop into the inside of said cylindrical element when forced therein.

3. In an assembly of connectors for connecting external male terminals to external female terminals, with each connector comprising:

a housing having a generally block-shaped configuration with first and second oppositely positioned major surfaces lying respectively in first and second parallel planes;

a cavity formed into said first major surface having side walls which define a generally square cross sectional configuration for said cavity in a plane parallel to said parallel planes;

said housing further formed to have a cylindrically-shaped element extend axially from the bottom of said cavity outwardly towards the plane of said first major surface;

at least first and second apertures formed in the walls between the sides of said housing and said cavity, with said first aperture constructed to receive one of said external male terminals; and

contact means comprising a post-like portion and a curled-around portion and positioned within said cavity with the curled-around portion positioned concentrically around said cylindrically-shaped portion and said post-like portion extending through the second of said apertures;

said housing further having a stub-like protuberance extending axially out from said second major surface;

the inside of one of said cylindrically-shaped element and the stub-like element of an adjacent one of said housings being constructed to snap fit together.

4. An assembly as in claim **3** in which: said stub-like protuberance has a bulbous end;

in which at least a first portion of the inside walls of said cylindrically-shaped element is generally bulbous in configuration and has a larger cross-sectional area than the cross-sectional area of a second portion of said cylindrically-shaped element positioned closer to the open end of said cylindrically-shaped element than said first portion; and said cylindrically-shaped element; and

in which the size of said bulbous end of said stub-like protuberance and the inner configuration of said cylindrically-shaped element are constructed to have the flared end of said stub-like protuberance pop into the inside of said cylindrical element when forced therein.

5. A connector assembly for connecting an external male terminal to an external female terminal, and comprising:

a first housing member having a generally block-shaped configuration with first and second oppositely positioned major surfaces lying respectively in first and second parallel planes, and side surfaces joining said first and second major surfaces;

a recessed, closed channel formed in the first of said major surfaces and defined on its inner side by the outer surface of the wall of a tubular-shaped element and on its outer side by generally straight walls which form a square configuration in a plane parallel to said parallel planes;

at least a first and a second aperture formed in said straight walls between the said surfaces of said housing member and said recessed, closed channel;

contact means comprising a post-like portion and a curled-around portion, with axis of said curled-around configuration being substantially perpendicular to said parallel planes;

said contact means positioned within said recessed channel with the curled-around portion being positioned around said tubular-shaped element and said post-like portion extending through a first of said apertures; and

a second housing member comprising one major surface having a rod-like element extending axially and outwardly therefrom;

said rod-like element constructed to fit securely within the tubular-shaped member of said first housing to cover said recessed channel with the said one major surface of said second housing member.

6. An assembly as in claim **5,** in which:

said rod-like element has an enlarged end;

in which at least a first portion of the inside walls of said cylindrically-shaped element is generally bulbous in configuration and has a larger cross-sectional area than the cross-sectional area of a second portion of said cylindrically-shaped element positioned closer to the open end of said cylindrically-shaped element than said first portion; and tubular-shaped element; and

in which the sizes of said flared-out ends of said rod-like element and the inner configuration of said tubular-shaped element are constructed to have the bulbous ends of said rod-like element pop into the inside of said tubular-shaped element when forced therein.

7. In an assembly of connectors for connecting external male terminals to terminals, with each connector comprising:

an insulative housing having first and second oppositely positioned major surfaces lying respectively in first and second parallel planes, and side surfaces joining said first and second major surfaces;

a recessed chamber formed into said first major surface having side walls which define a generally trapezoidal cross sectional configuration for said chamber in a plane parallel to said parallel planes;

said housing further formed to have a rod-like element extend axially from the bottom of said recessed chamber outwardly towards the plane of said first major surface;

at least first and second apertures formed in the walls between the side surfaces of said housing and said recessed chamber, with said first aperture constructed to receive one of said external male terminals;

contact means comprising a post-like portion and a curled-around portion and positioned within said recessed chamber with said curled-around portion thereof being positioned around said rod like element with the axis of said curled-around portion being substantially perpendicular to said parallel planes, and said post-like portion extending through the second of said apertures; and

means for connecting two or more of said housings together with the said second major surface of a given housing being closely adjacent the first major surface of the adjacent housing.

8. A connector assembly comprising a plurality of similar connectors for connecting external male terminals to external female terminals, with each connector comprising:

a first housing member having a generally block-shaped configuration with first and second oppositely positioned major surfaces lying respectively in first and second parallel planes, and side surfaces joining said first and second major surfaces;

a recessed, closed channel formed in the first of said major surfaces and defined on its inner side by the outer surface of the wall of a rod-like element and on its outer side by generally straight walls forming a square;

at least a first and a second aperture formed in the walls between said side surfaces of said housing member and said recessed, closed channel;

contact means comprising a post-like portion and a curled-around portion, with the axis of said curled-around configuration being substantially perpendicular to said parallel planes;

said contact means positioned within said recessed channel with the curled-around portion being positioned around said rod-like element and said post-like portion extending through a first of said apertures; and

means for securing together two or more of said connectors in a row with the said second major surface of a given housing covering the first major surface of the adjacent housing.

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