

CONNECTOR FOR USE BETWEEN INTEGRATED CIRCUIT UNITS AND CIRCUIT BOARDS

This application is an improvement upon apparatus, such as shown for example in U.S. Pat. application Ser. No. 753,287, filed Aug. 16, 1968, in my name jointly with John M. Pierini and Reidar G. Larsen, entitled Connector For Use Between An Integrated Circuit And A Circuit Panel.

Said application discloses a so-called open-entry connector, i.e., one without a cover, for use between integrated circuit units and a circuit board. So-called closed-entry connectors are also known, i.e., those with covers, but they do not have the advantages of the improvements disclosed herein. The present invention provides an improved, so-called closed-entry, top-loading connector, which also has means for top unloading. The conductors shown in said application were barbed or finned to be positively held in place in holes in the bottom of a receptacle to ensure against displacement before, during and after wiring terminal posts of the conductors. This made difficult the removal and replacement of damaged conductors. Thus, among other things, the barbs or fins scarified their containing holes so that when new conductors were inserted, they were not as accurately positioned nor as strongly held as were the original conductors and therefore did not always function like new. Moreover, removal of conductors for replacement required undesirable extraction from the bottom side of the connector housing.

The present invention provides smooth, nonbarbed terminal post components of the conductors which have snug frictional fits in the holes through which they pass, so that they may be conveniently and with a comparatively small force inserted from the top and accurately held in place. They may be easily removed from the top without damage to the receptacle. As a result a replaced conductor becomes held like new, rather than less accurately and less securely as was the case heretofore. To provide for a more positive anchoring of the conductors against movements while being wired when in place on a board, I provide central positive latching means between the cover and the housing. The latching means is releasable and located between the ends of the connector, rather than at its ends, so that the connector may be made more compactly and consequently more connectors carried in less space on a board having continuous rows of holes located at invariable pitch distances therebetween. Bridging application of integrated circuit units to adjacent connectors is by this means also provided for.

Referring to the drawings, which are illustrative:

FIG. 1 is a side elevation of a cover which forms the closed-entry part of the connector;

FIG. 2 is a top plan view of FIG. 1;

FIG. 3 is a bottom plan view of FIG. 1;

FIG. 4 is a right side elevation of FIG. 1;

FIGS. 5-8 are cross sections taken on lines 5-5, 6-6, 7-7 and 8-8 respectively on FIG. 2;

FIG. 9 is a front elevation of a receptacle in the form of an open-top housing;

FIG. 10 is a plan view of the inside of the housing of FIG. 9 viewed through its open top;

FIG. 11 is a bottom plan view of FIG. 9;

FIG. 12 is a right-end elevation of FIG. 9;

FIGS. 13-16 are cross sections taken on lines 13-13, 14-14, 15-15 and 16-16 respectively on FIG. 10;

FIG. 17 is a front elevation, parts being broken away showing an assembled cover and receptacle, the dotted lines illustrating application of an integrated circuit unit;

FIG. 18 is a top plan view of FIG. 17;

FIG. 19 is a bottom plan view of FIG. 17;

FIG. 20 is a right-end elevation of FIG. 18;

FIG. 21 is a longitudinal section taken on line 21-21 of FIG. 18;

FIG. 22 is an ideal section taken on line 22-22 of FIG. 19;

FIG. 23 is an enlarged face view of a composite removable conductor;

FIG. 24 is a left side view of FIG. 23, partly in section;

FIG. 25 is an isometric view of a so-called dual in-line pin-pack integrated circuit unit;

FIG. 26 is a fragmentary view of a circuit board showing rows of holes therein, and connector locations by dotted lines;

FIG. 27 is a sectional view illustrating operation of a cover unlatching tool;

FIG. 28 is an enlarged detail cross section taken on line 28-28 of FIG. 13; and

FIG. 29 is an enlarged detail of parts of FIG. 22, parts being broken away.

Corresponding reference characters indicate corresponding parts throughout the several views of the drawing.

Referring to the drawings in general, a molded cover C constituting a cover member of the connector is shown in FIGS. 1-8. It is designed to be latched with a molded lower receptacle in the form of a housing H, having an open top as shown in FIGS. 9-16. As latched these parts are shown in FIGS. 17-22. Both parts C and H are composed of material such as glass-filled nylon or the like having superior electrical insulating properties and surfaces which present desired friction. This material is also somewhat resilient.

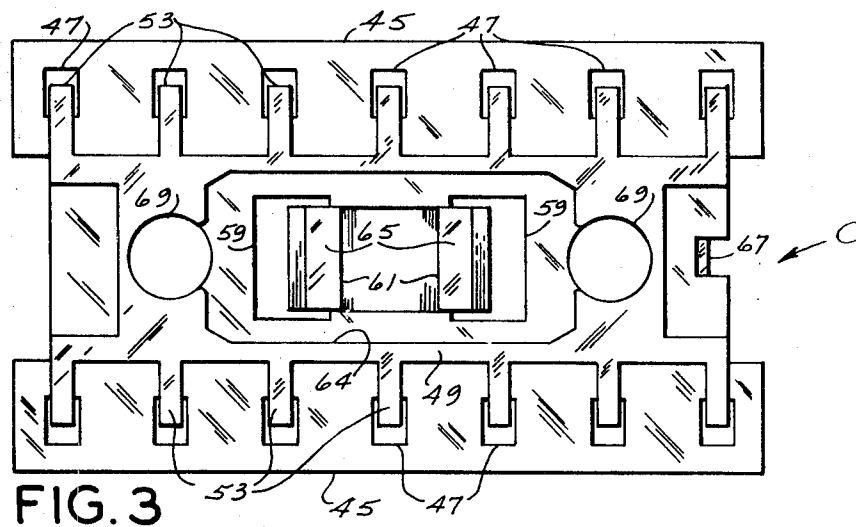
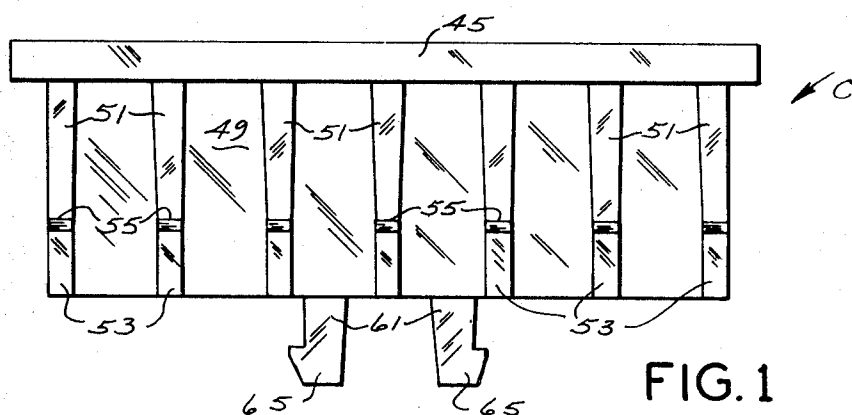
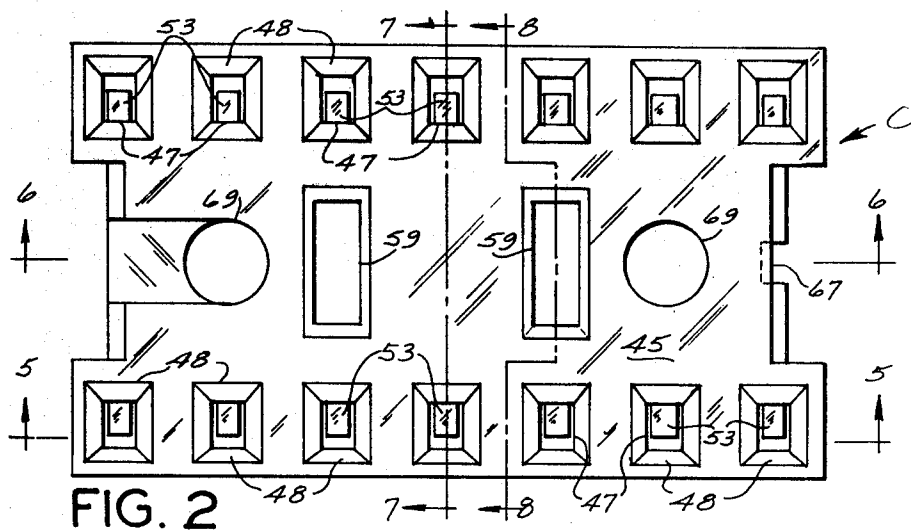
Referring in particular to FIGS. 9-16, the receptacle H is in the form of a hollow rectangular housing having sidewalls 1, end walls 3 and a bottom wall 5. Without the cover C the housing is open at the top. In the bottom wall 5 are two openings 7 extending into two shallow outside rectangular recesses 9. The openings 7 are for the reception of holding screws, bolts or like fasteners (not shown). The recesses 9 are for the reception of an adhesive such as epoxy resin or the like (not shown) for fastening, if screws, bolts or rivets are not used. These means are for attachment of the housing H to one side of a circuit board B (FIGS. 22 and 26).

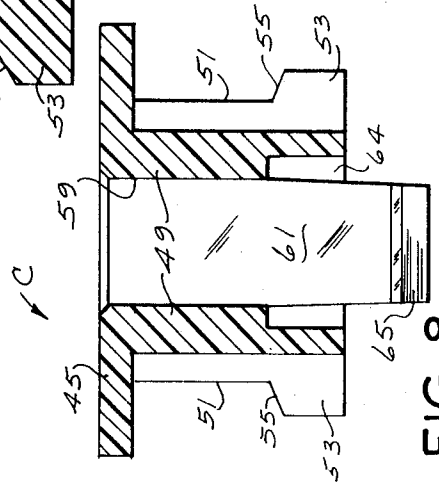
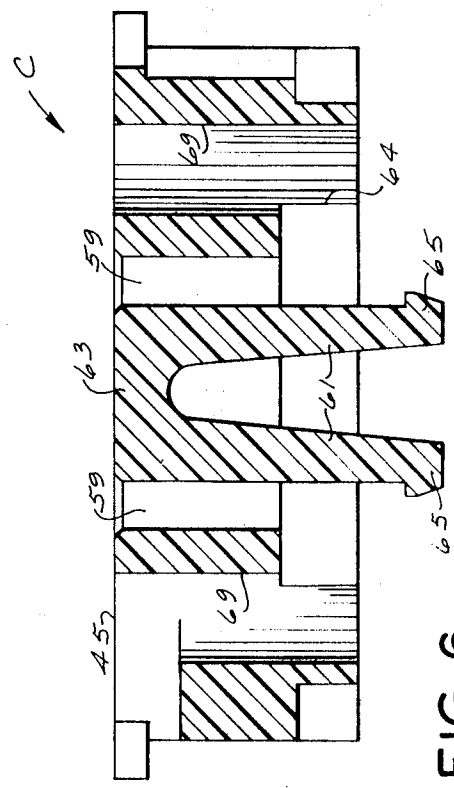
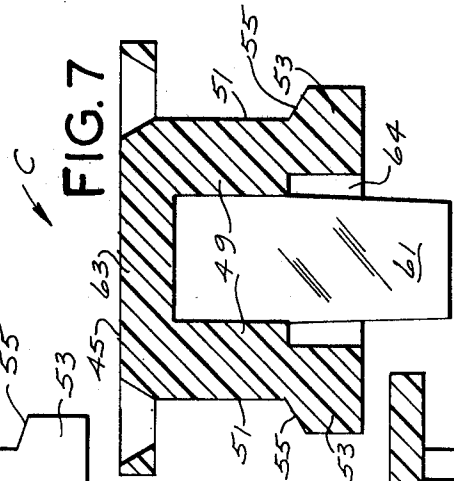
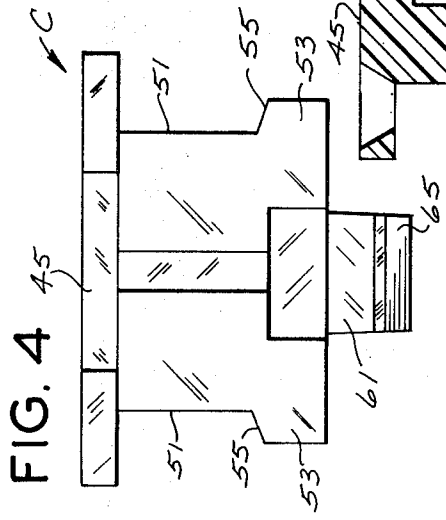
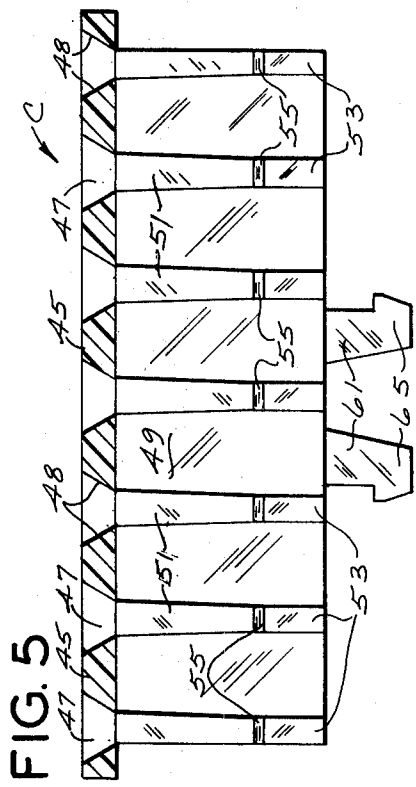
Centrally located between the end walls 3 of the housing H (FIGS. 14, 16, 19, 21, 22 and 27) is a third opening 11 in the bottom wall 5 of rectangular form. Opposite end faces of this opening 11 are formed as opposed catch-forming shoulders 13 having inner sloping cam-forming walls 15 converging downwardly towards the shoulders 13.

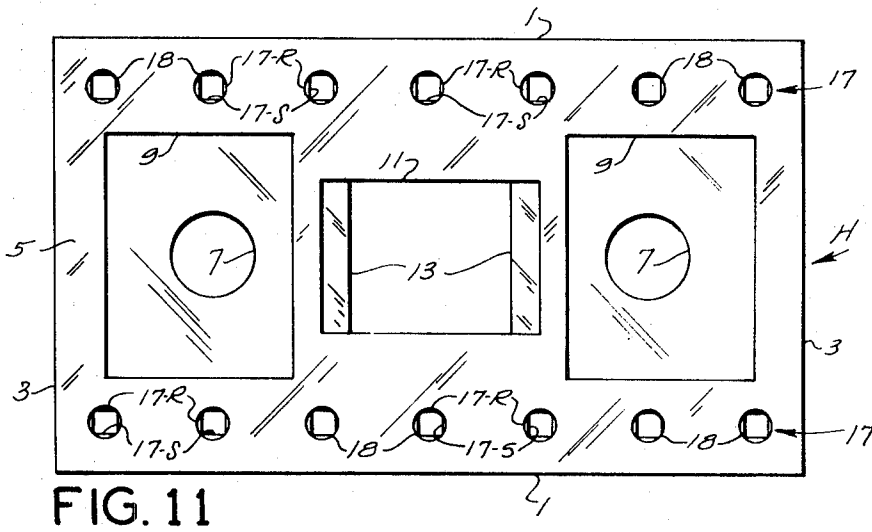
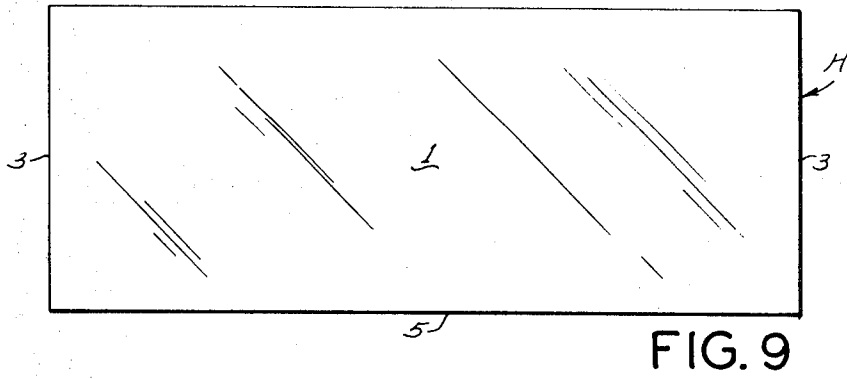
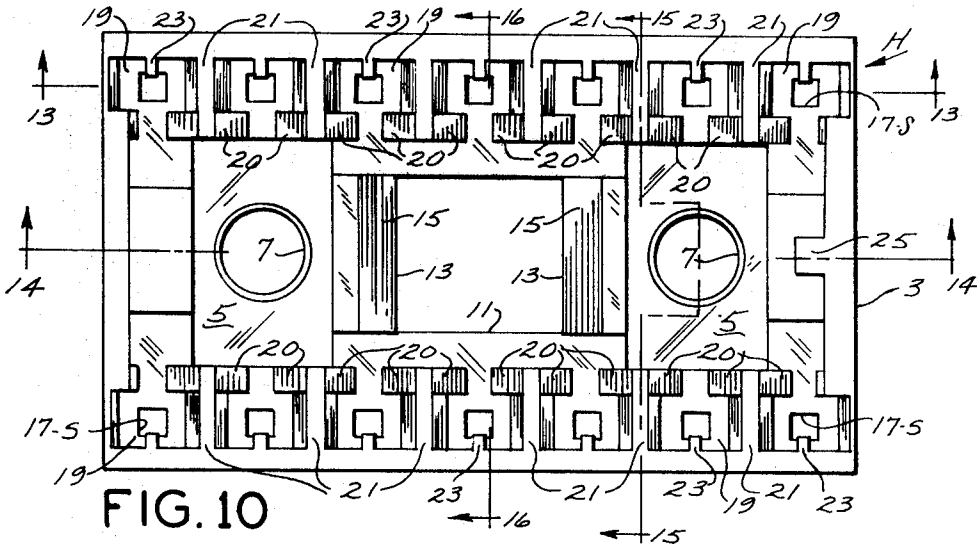
Extending through the bottom 5 and just within the sidewalls 1 are two sidewise rows of holes each generally numbered 17 (FIGS. 11, 13, 16, 22 and 28). These holes are round (circular) in cross sections towards their outer ends and of square cross sections towards their inner ends. The outer round portions are numbered 17-R and the inner square portions 17-S. The circles defining the round sections 17-R lie slightly within the corners of the square defining the cross sections of 17-S (FIG. 28). This produces in each hole 17 four thin axial land portions 18 in 17-R along which corners of square terminal posts 39 (to be further described below) have a snug sliding frictional force-fit. Nylon or like material provides proper conditions for the frictional effect desired along lands 18 for smooth and easy insertion of the square posts 39 which also fit the square hole parts 17-S, without sidewise play. Thus the posts attain and adequately maintain assembled positions from which however they may be readily removed under moderate axial force, as well as being insertable under such a moderate force.

The inner square ends 17-S of the holes 17 terminate in upwardly flaring side pockets 19 located just within the housing sidewalls 1. The pockets 19 are formed by the inner faces of the sidewalls, tapered cross walls 21 extending inwardly perpendicularly to the side walls, and by curved flange portions 20 on the inner margins of the cross walls 21. Extending from sidewalls 1 into the pockets 19 are vertical ribs 23 centered in the pockets and terminating at their lower ends at spaces 27 above the square hole parts 17-S (see FIGS. 13, 14 and 17). The bottoms of the spaces 19 form shoulders or seats 29 above the upper ends of the square openings 17-S.

Each conductor, which is of composite form (as detailed in FIGS. 23 and 24), is formed at its upper end by a spring contact clip 33 having two spring leaves 35 joined at their lower ends by an offset bridge portion 37 from which extends an elongate terminal post 39 of square cross section. Each post







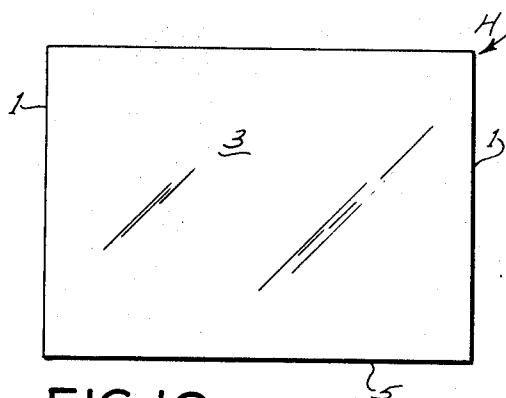


FIG. 12

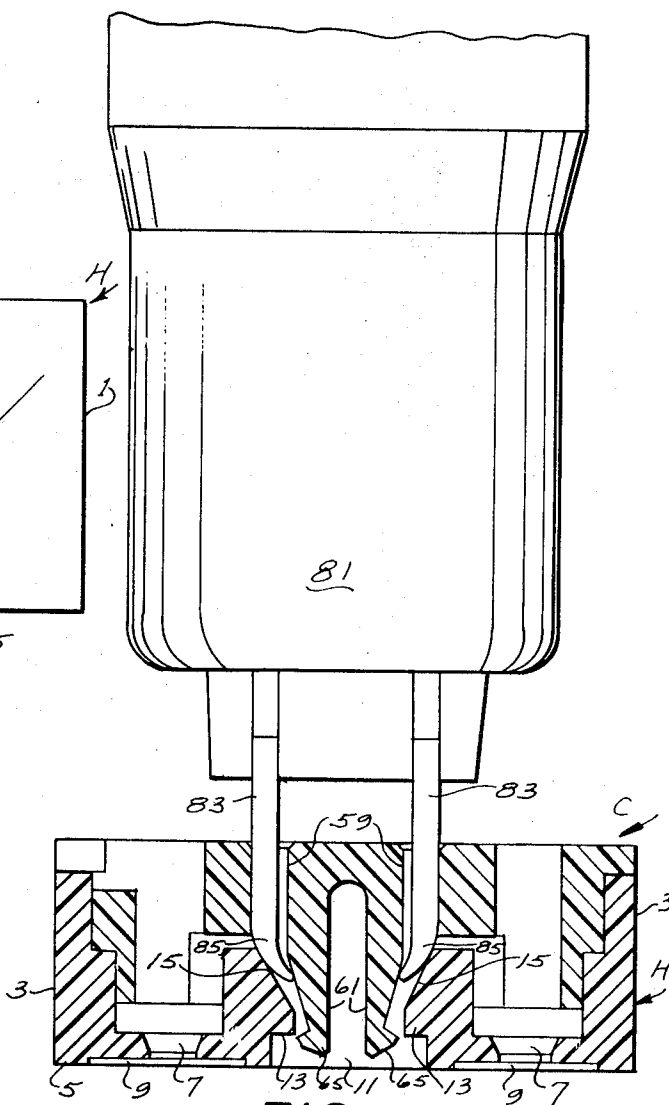


FIG. 27

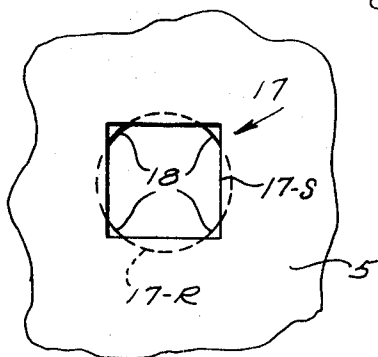
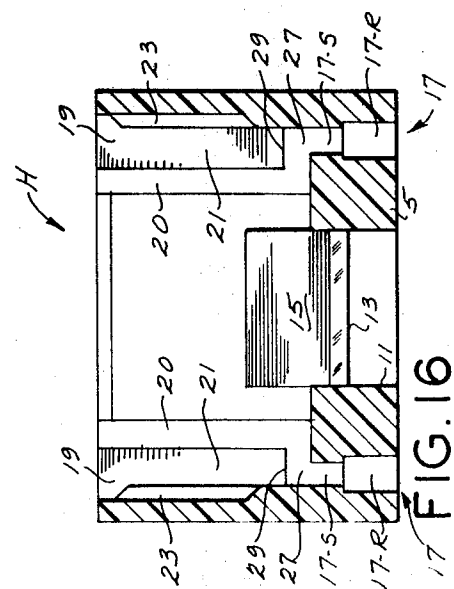
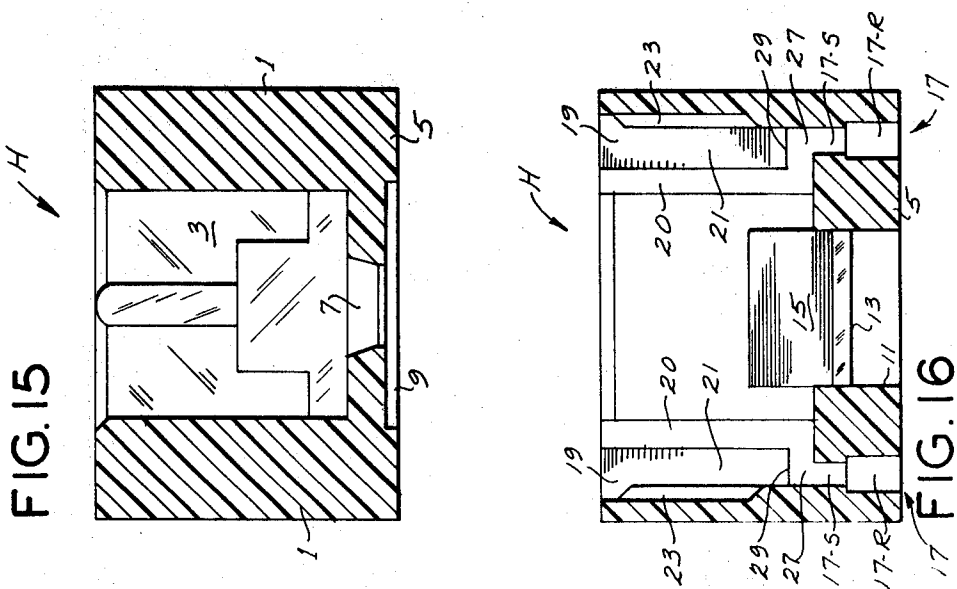
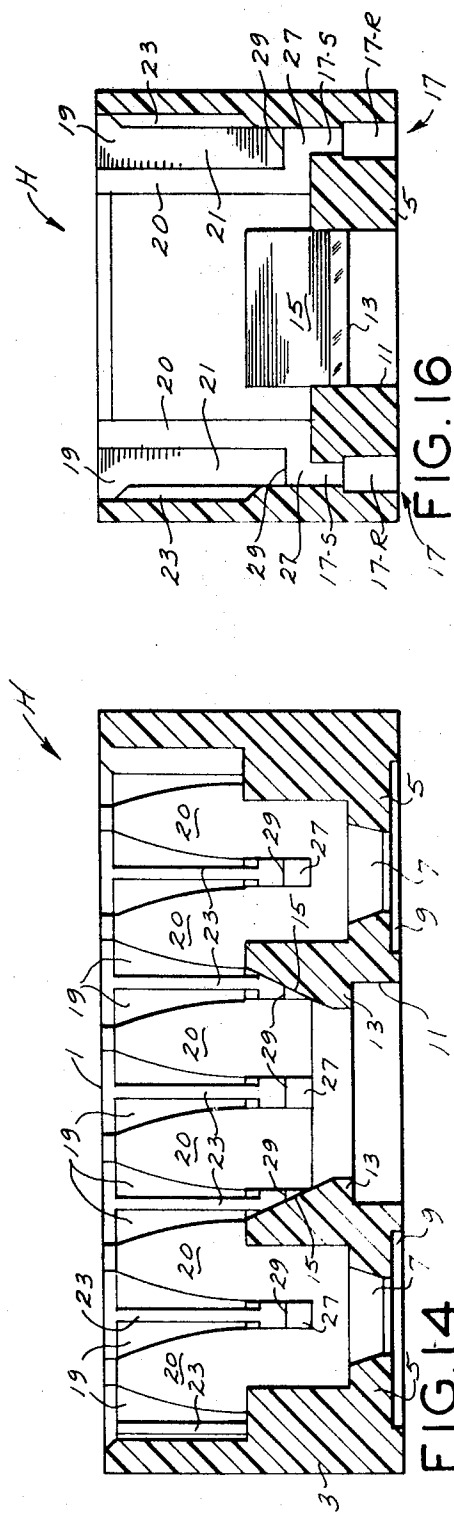
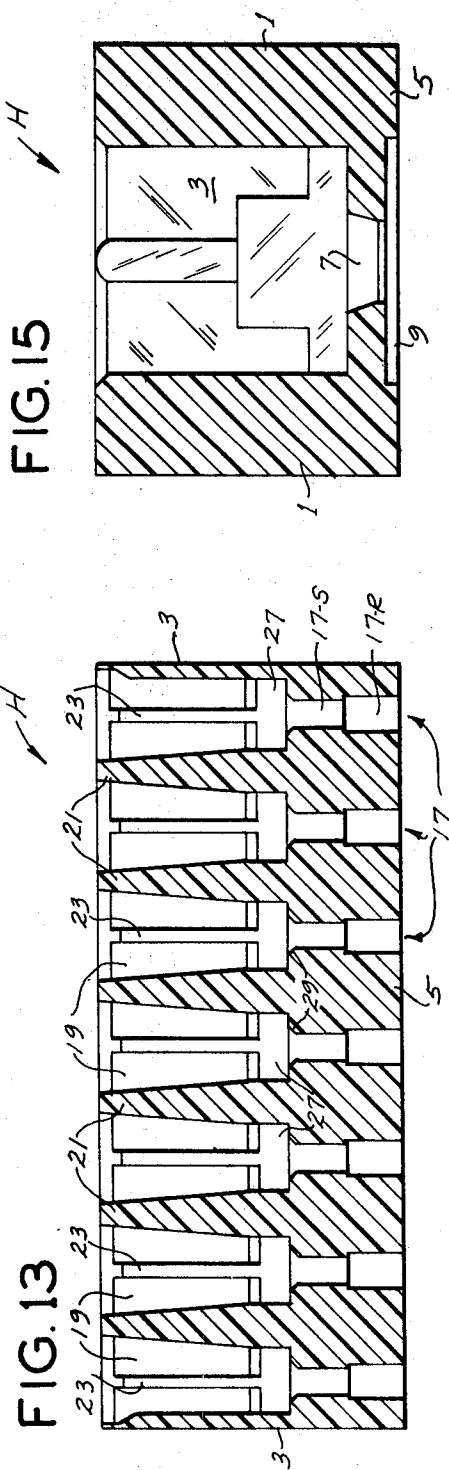
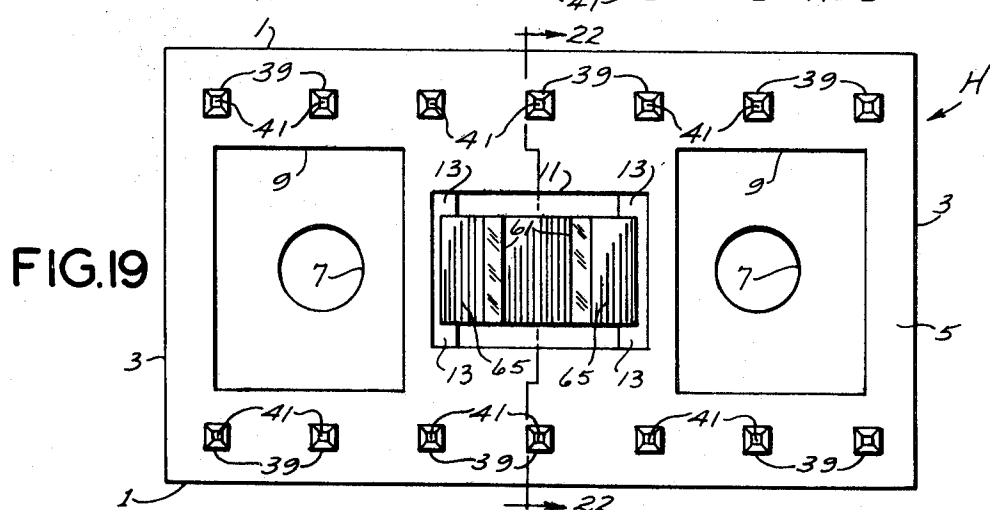
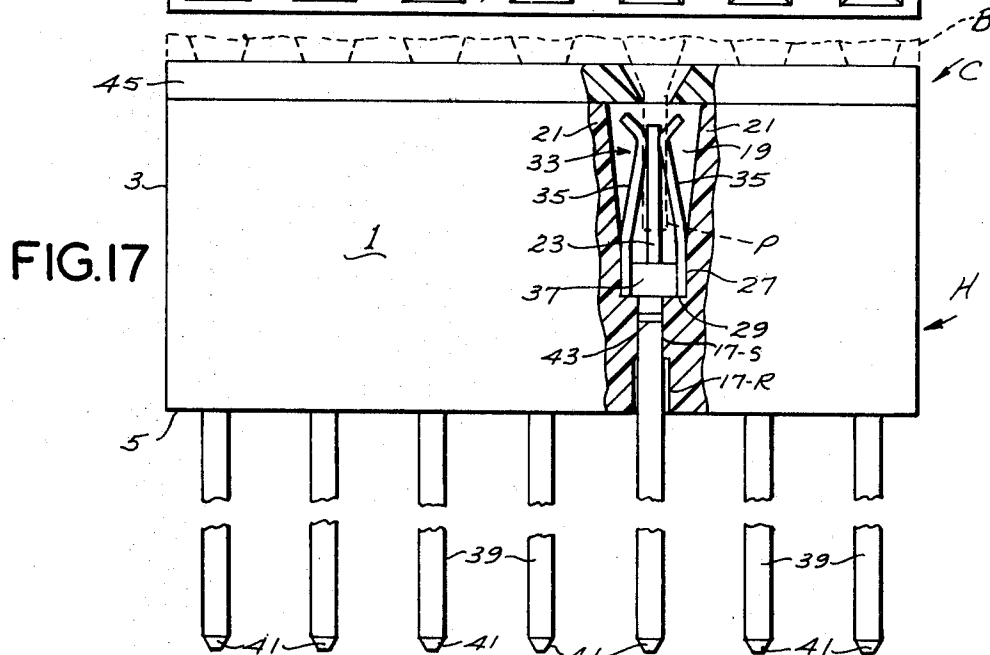
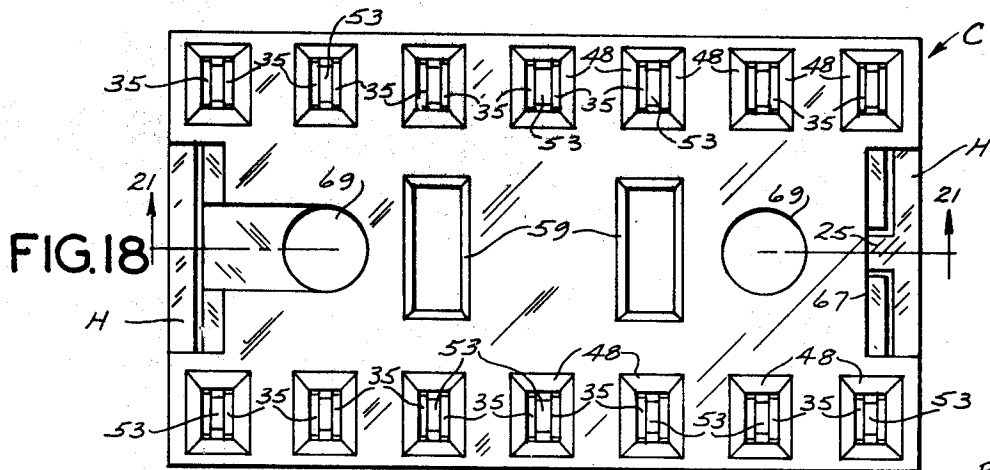
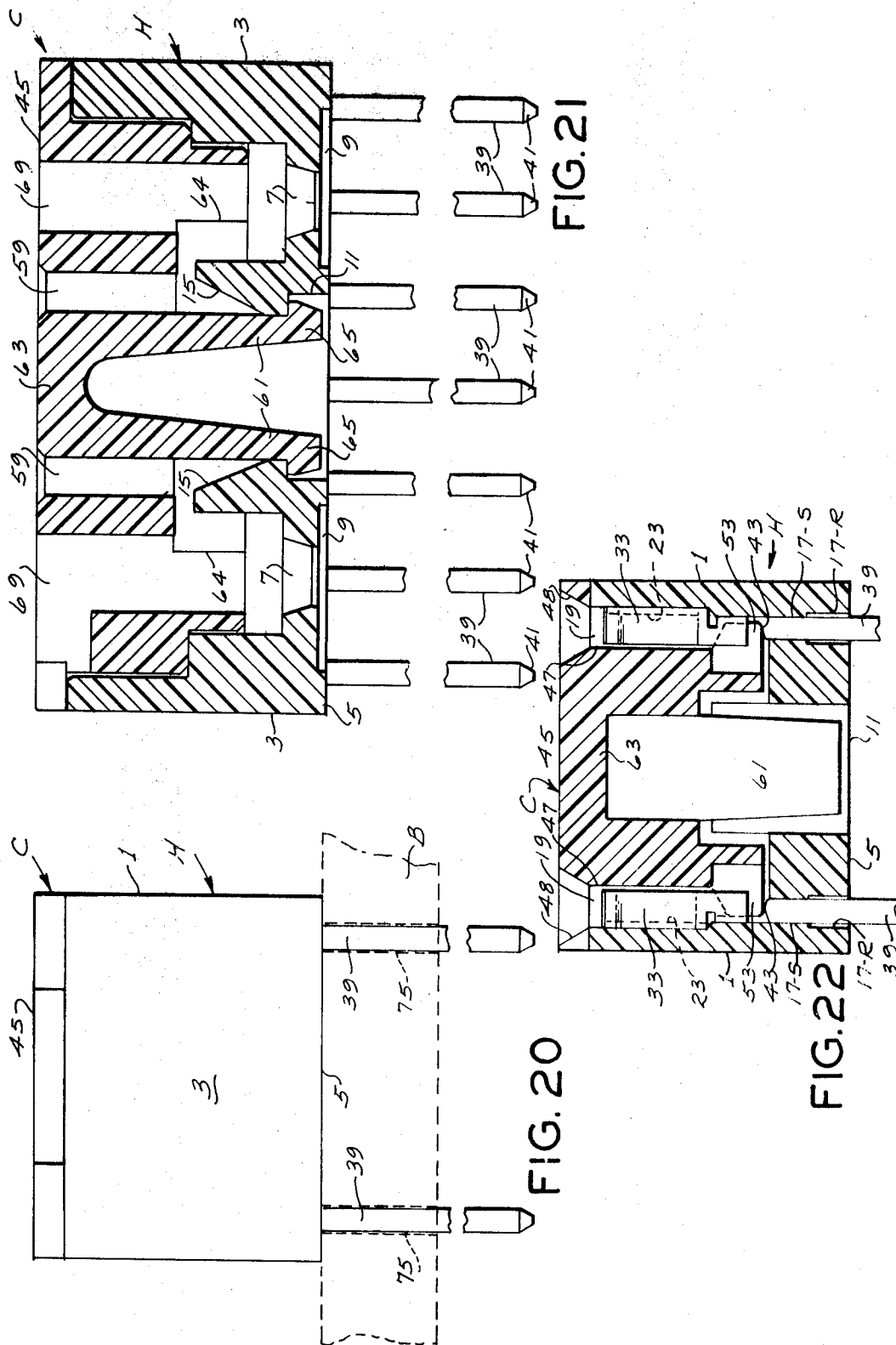


FIG. 28







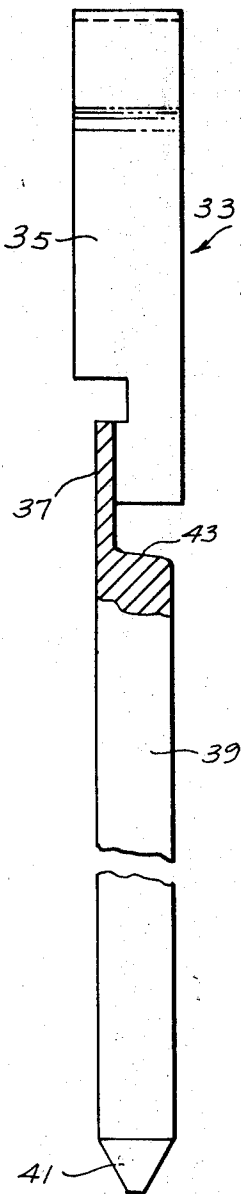


FIG. 24

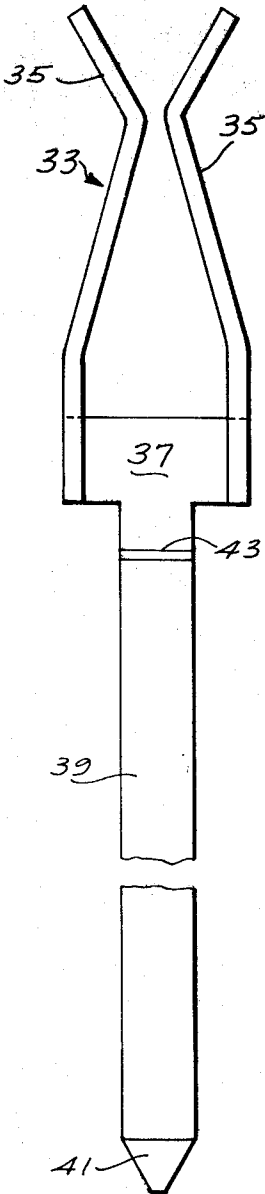


FIG. 23

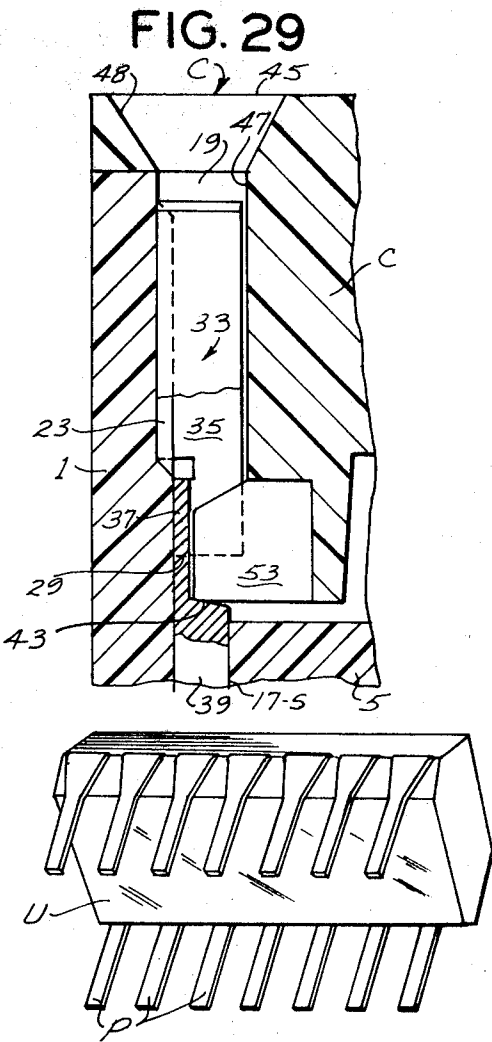


FIG. 25

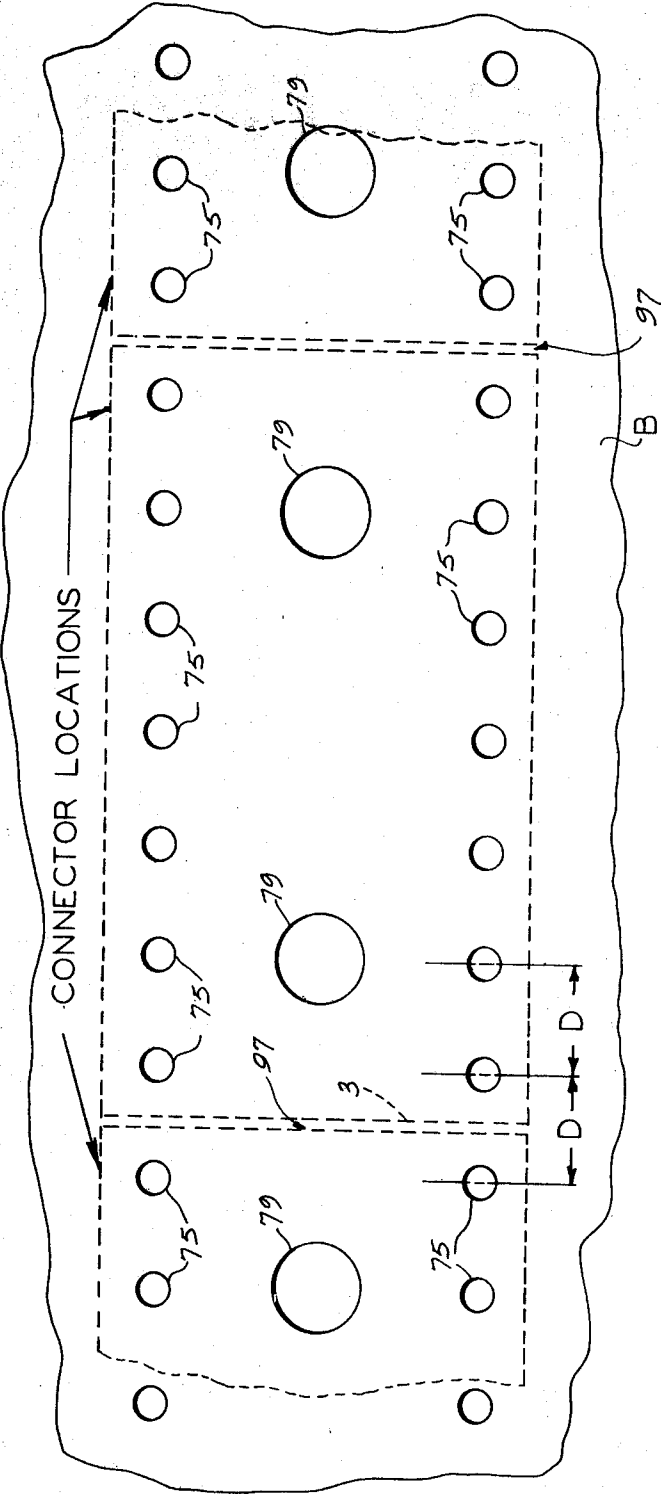


FIG. 26

CONNECTOR FOR USE BETWEEN INTEGRATED CIRCUIT UNITS AND CIRCUIT BOARDS

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Said application discloses a so-called open-entry connector, i.e., one without a cover, for use between integrated circuit units and a circuit board. So-called integrated circuit units and a circuit board. So-called closed-entry connectors are also known, i.e., those with covers, but they do not have the advantages of the improvements disclosed herein. The present invention provides an improved, so-called closed-entry, top loading connector, which also has means for top unloading. The conductors shown in said application were barbed or finned to be positively held in place in holes in the bottom of a receptacle to ensure against displacement before, during and after wiring terminal posts of the conductors. This made difficult the removal and replacement of damaged conductors. Thus among other things, the barbs or fins scarified their containing holes so that when new conductors were inserted, they were not as accurately positioned nor as strongly held as were the original conductors and therefore did not always function like new. Moreover, removal of conductors for replacement required undesirable extraction from the bottom side of the connector housing.

The present invention provides smooth, nonbarbed terminal post components of the conductors which have snug frictional fits in the holes through which they pass, so that they may be conveniently and with a comparatively small force inserted from the top and accurately held in place. They may be easily removed from the top without damage to the receptacle. As a result a replaced conductor becomes held like new, rather than less accurately and less securely as was the case heretofore. To provide for a more positive anchoring of the conductors against movements while being wired when in place on a board, I provide central positive latching means between the cover and the housing. The latching means is releasable and located between the ends of the connector, rather than at its ends, so that the connector may be made more compactly and consequently more connectors carried in less space on a board having continuous rows of holes located at invariable pitch distances therebetween. Bridging application of integrated circuit units to adjacent connectors is by this means also provided for.

Referring to the drawings, which are illustrative:

FIG. 1 is a side elevation of a cover which forms the closed-entry part of the connector;

FIG. 2 is a top plan view of FIG. 1;

FIG. 3 is a bottom plan view of FIG. 1;

FIG. 4 is a right side elevation of FIG. 1;

FIGS. 5-8 are cross sections taken on lines 5-5, 6-6, 7-7 and 8-8 respectively on FIG. 2;

FIG. 9 is a front elevation of a receptacle in the form of an open-top housing;

FIG. 10 is a plan view of the inside of the housing of FIG. 9 viewed through its open top;

FIG. 11 is a bottom plan view of FIG. 9;

FIG. 12 is a right-end elevation of FIG. 9;

FIGS. 13-16 are cross sections taken on lines 13-13, 14-14, 15-15 and 16-16 respectively on FIG. 10;

FIG. 17 is a front elevation, parts being broken away showing an assembled cover and receptacle, the dotted lines illustrating application of an integrated circuit unit;

FIG. 18 is a top plan view of FIG. 17;

FIG. 19 is a bottom plan view of FIG. 17;

FIG. 20 is a right-end elevation of FIG. 18;

FIG. 21 is a longitudinal section taken on line 21-21 of FIG. 18;

FIG. 22 is an ideal section taken on line 22-22 of FIG. 19;

FIG. 23 is an enlarged face view of a composite removable conductor;

FIG. 24 is a left side view of FIG. 23, partly in section;

FIG. 25 is an isometric view of a so-called dual in-line pin-pack integrated circuit unit;

FIG. 26 is a fragmentary view of a circuit board showing rows of holes therein, and connector locations by dotted lines;

FIG. 27 is a sectional view illustrating operation of a cover unlatching tool;

FIG. 28 is an enlarged detail cross section taken on line 28-28 of FIG. 13; and

FIG. 29 is an enlarged detail of parts of FIG. 22, parts being broken away.

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

Referring to the drawings in general, a molded cover C constituting a cover member of the connector is shown in FIGS. 1-8. It is designed to be latched with a molded lower receptacle in the form of a housing H, having an open top as shown in FIGS. 9-16. As latched these parts are shown in FIGS. 17-22. Both parts C and H are composed of material such as glass-filled nylon or the like having superior electrical insulating properties and surfaces which present desired friction. This material is also somewhat resilient.

Referring in particular to FIGS. 9-16, the receptacle H is in the form of a hollow rectangular housing having sidewalls 1, end walls 3 and a bottom wall 5. Without the cover C the housing is open at the top. In the bottom wall 5 are two openings 7 extending into two shallow outside rectangular recesses 9. The openings 7 are for the reception of holding screws, bolts or like fasteners (not shown). The recesses 9 are for the reception of an adhesive such as epoxy resin or the like (not shown) for fastening, if screws, bolts or rivets are not used. These means are for attachment of the housing H to one side of a circuit board B (FIGS. 22 and 26).

Centrally located between the end walls 3 of the housing H (FIGS. 14, 16, 19, 21, 22 and 27) is a third opening 11 in the bottom wall 5 of rectangular form. Opposite end faces of this opening 11 are formed as opposed catch-forming shoulders 13 having inner sloping cam-forming walls 15 converging downwardly towards the shoulders 13.

Extending through the bottom 5 and just within the sidewalls 1 are two sidewise rows of holes each generally numbered 17 (FIGS. 11, 13, 16, 22 and 28). These holes are round (circular) in cross sections towards their outer ends and of square cross sections towards their inner ends. The outer round portions are numbered 17-R and the inner square portions 17-S. The circles defining the round sections 17-R lie slightly within the corners of the square defining the cross sections of 17-S (FIG. 28). This produces in each hole 17 four thin axial land portions 18 in 17-R along which corners of square terminal posts 39 (to be further described below) have a snug sliding frictional force-fit. Nylon or like material provides proper conditions for the frictional effect desired along lands 18 for smooth and easy insertion of the square posts 39 which also fit the square hole parts 17-S, without sidewise play. Thus the posts attain and adequately maintain assembled positions from which however they may be readily removed under moderate axial force, as well as being insertable under such a moderate axial force.

The inner square ends 17-S of the holes 17 terminate in upwardly flaring side pockets 19 located just within the housing sidewalls 1. The pockets 19 are formed by the inner faces of the sidewalls, tapered cross walls 21 extending inwardly perpendicularly to the sidewalls, and by curved flange portions 20 on the inner margins of the cross walls 21. Extending from sidewalls 1 into the pockets 19 are vertical ribs 23 centered in the pockets and terminating at their lower ends at spaces 27 above the square hole parts 17-S (see FIGS. 13, 14 and 17). The bottoms of the spaces 19 form shoulders or seats 29 above the upper ends of the square openings 17-S.

Each conductor, which is of composite form (as detailed in FIGS. 23 and 24), is formed at its upper end by a spring con-

tact clip 33 having two spring leaves 35 joined at their lower ends by an offset bridge portion 37 from which extends an elongate terminal post 39 of square cross section. Each post 39 is smooth and its end has a dull point 41. The offset bridge 37 is connected on one side of an end face 43 of the post 39. As shown in FIG. 17 each contact clip 33 fits into a side pocket 19, with the corresponding rib 23 of the pocket having a position between the leaves 35 of the clip to spread it apart and pretension it somewhat. The partial spreading makes it easy for entry of integrated circuit pins of an integrated circuit unit and to obtain reliably pressured contacts therewith after entry. FIG. 25 shows such a unit U with its pins P. FIG. 17 is dotted lines shows the position of an inserted pin P which will have the effect of further spreading the leaves 35 of the clip 33 from their initial pretensioned position shown. Each pin P takes up a position inside of the adjacent rib 23. In FIG. 17 the positions of the leaves 35 are shown as pretensioned by a rib 23 but their final spring positions as determined by an introduced pin P are not shown, to avoid confusion in the drawing.

Engagement by each conductor bridge portion 37 with a seat 29 accurately positions each whole composite conductor (33,39) upon being pushed into place from the top of the housing H when open. This occurs against the friction above mentioned. Any conductor post 39 may also be easily removed from the top of housing H when open, for replacement by a new conductor when needed without damage to any parts of the holes 17 in the bottom of the housing H. Only modest forces to overcome the friction are required for removals and insertions. Each replaced conductor (33,39) is thus held like new. This constitutes an important advantage of the invention. The square forms of the posts 39 located in the square parts 17-S of holes 17 properly angularly orient the clips 33 in their pockets 19. The contacts of their corners with the lands 18 determine the desired amount of friction. Lands 18 are resilient.

Referring now more particularly to FIGS. 1-8, showing the cover C, it has a comparatively flat top 45 along two sides of which are rows of lead-in ports 47 exteriorly beveled as at 48. Within these rows of ports the cover has inside downwardly extending parallel walls 49 (FIG. 8) which at intervals are provided with thin ribs 51 extending outwardly. At their lower ends the ribs 51 are terminated by outwardly extending flat lugs 53 braced by ribs 51 and bevels 55. The lugs 53 are centrally disposed under the beveled ports 47 (FIG. 2). Ribs 51 do not extend between the leaves or blades 35 when the cover C is applied to housing H. When, as shown in FIG. 22, the cover C is applied to the housing H containing conductors (33,39) the lugs 53 pass down between the leaves 35 of the spring clips 33 to engage the upper offset end faces 43 of the conductor posts 39. Thus when the cover C is applied to the housing H all of the composite conductors (33,39) are held in place by the lugs 53 on the offset end faces 43 of the posts 39. The bridge portions 37 rest on the seats 29 and the blades 35 of their spring clips 33 are held apart somewhat in tension by the ribs 23.

The cover C also has two top openings 59 from between which extend prongs 61 of a latch 63. These prongs 61 are resilient and extend through a bottom opening 64. They have lower outwardly directed claws 65 formed to ride down the cam surfaces 15 and latch under the catch parts 13 of the housing H when the cover C is applied (FIG. 21). Thus by applying the cover C to the housing H, after the conductors (33,39) are in place the cover becomes automatically positively latched shut. Then through holding action of its lugs 53 on the end faces 43 of posts 39, the conductors (33,39) are positively held against any accidental displacement such as might occur upon wiring then by wire spinner tools. Such tools sometimes involve the application of some axial force to a post being wired.

One end of the cover C has a groove 67 (FIG. 2) for engagement with an inner rib 25 in one end of the housing H (FIG. 10) so that the cover can be applied to the housing in only one

way. Additional openings 69 through the top of the cover C are formed in alignment with the fastener holes 7 in the bottom 5 of the housing H so that fastening screws or the like in the holes 7 of housing H may be reached by a screwdriver or the like.

FIGS. 17-22 show the housing H with the composite conductors (33,39) in place, and the cover C applied and latched shut. The cover C when latched shut provides the desired closed-entry arrangement so that the leaves 35 of the spring clips 33 just under the inlet openings 47 (FIG. 17) are not exposed but nevertheless can receive the pins P of so-called dual in-line integrated circuit units 73 such as shown in FIG. 25. FIG. 20 illustrates how the protruding conductor posts 39 of the conductors have been inserted through receiving openings 75 in the circuit board B (see also FIG. 26) after which the bottom 5 of the (usually H is suitably fastened in the board B, as above described. HOLES 79 in the board B are for registration with the holes 7 in the bottom 5 of the housing H. The posts 39 then extend from the back or wire side of the board B in position for wiring of the posts 39 (see FIG. 20). The wiring is often done by spinner tools which sometimes apply axial force tending to displace the conductors. By means of the invention such displacement is positively prevented by the latching arrangement between the cover C and the housing H and the contacts between its lugs 53 and the inner end faces 43 of the posts 39. However when the cover is unlatched conductors may easily be removed and replaced from the top of the open housing H even when left attached on the front of the circuit board B. Thus if, as sometimes occurs, one or more of the composite conductors (33,39) upon final electrical board tests is found to be broken or otherwise defective & usually in the region of the clip), all that is required is to unlatch and remove the cover C from the housing H which exposes the damaged conductor (33,39). The damaged conductor parts may then be pulled or pushed out from the top of the housing against the light friction holding force and replaced by a new conductor. If breakage is below the bridge 37, terminal post parts 39 may be oppositely withdrawn from the bottom of housing H, while the separated clip part may be removed through the open top. As above made clear, this all may be accomplished without scarification or other damage to he hole 17 so that a replaced conductor is held in place by the lands 18, as good as new, rather than less securely as heretofore. Angular orientation is easy because of the square portions 17-S of holes 17. The lands 18 being resilient and not scored by successive removals and insertions of the square posts 39 hold post replacements as accurately as an original post.

A suitable tool for disconnecting the claws 65 of prongs 61 from the catches 13 is shown in FIG. 27. This comprises two flexible jaws or pincers 83 held in a chuck 81. Members 83 have inwardly directed ends 85 for insertion through the openings 59. By pushing down on the chuck the pincer ends 85 ride down the cam walls 15 and constrict the prongs 61 so that the claws 65 are squeezed and withdrawn inwardly from the catches 13. Then by pulling up the chuck 81 the cover C is easily removed to expose the now only frictionally held conductors (33,39) for easy removal and replacement, as desired.

FIG. 26 illustrates the advantage of making the ends of the housing H and cover C flat and free of latch parts by placing the latter centrally in the connector. By this means the rows of holes 75 in the board B may be arranged with constant pitch D between all holes in a row. Then as indicated by the dotted lines, the simple rectangular shapes of adjacent connectors may be closely abutted within a few thousandths of an inch clearance 97 between them, without loss of the use of any holes for receiving terminal posts 39. As a result more connectors may be accommodated on a given size of board, or smaller boards used for a given number of connectors. Moreover, an integrated circuit unit such as U may if desired be applied with sets of its pins inserted in adjacent connectors so that the unit spans them as connected. Sets of holes 7 in the housing H, 69 in the cover and 79 in the board B, register to receive fasteners when an adhesive in pockets 19 is not used.

While square cross sections are preferred for posts 39 and hole portions 17-S, other polygonal cross sections may be used to provide lands such as 18, as for example, rectangular or hexagonal sections.

In view of the above, it will be seen that the several objects 5 of the invention are achieved and other advantageous results attained.

As various changes could be made in the above constructions without departing from the gist of the invention, it is intended that all matter contained in the above description or 10 shown in the accompanying drawings shall be interpreted as illustrative.

What is claimed is:

1. Electrical connector means for a plurality of circuit pins comprising an electrically insulating receptacle of substantially rectangular form having end and sidewalls, said receptacle having an open top and a bottom and having a plurality of 15 holes in said bottom arranged in two rows adjacent to respective sidewalls,

a plurality of removable conductors each including a terminal post and a contact clip, said conductors being arranged with said post having snug slidable fits in said respective holes for accurately locating and holding said conductor clips in the receptacle, to position said posts to form terminals extending from said bottom and to allow 20 for convenient removal of the conductors from the receptacle without damage thereto,

an electrically insulating cover of substantially rectangular form for closing said open top, said cover having a plurality of ports registrable with respective conductor clips for receiving and guiding said circuit pins into respective clips when the cover is closed and said conductor clips are positioned in the receptacle with the conductor post 30 extending from said respective holes,

said cover having holding means carried by the cover engaging said conductors to hold said conductors in position within said receptacle when the cover is closed,

and a substantially positive releasable latch means operative between the receptacle and cover when closed, whereby the conductor is substantially more strongly held in the receptacle by said holding means when the cover is shut than by said snug fit when the cover is open, said latch means comprising parts in the cover and receptacle respectively and located substantially centrally between said end walls of the receptacle when the cover is closed, the terminal posts being of substantially polygonal cross section having corner portions,

said holes having an inner portion of substantially the same polygonal cross section and having corners,

said holes having an outer portion of rounded cross section arranged to lie slightly within said corners of the polygonal cross section of said hole, whereby axially extending portions of the outer part of the hole form fictional holding lands engageable by the corner portion of said post introduced through the hole by way of its polygonal end.

2. A connector according to claim 1 wherein said polygonal cross sections are rectangular.

3. A connector according to claim 1 wherein said polygonal cross sections are square.

4. A connector according to claim 1 wherein the bottom of the receptacle and the cover include registered holes for application and removal of fasteners.

5. A connector according to claim 4 including pocket means on the outside of said bottom for the reception of adhesive fastening means.

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