

[54] **STRIP-TYPE DIP RECEPTACLE**

[72] Inventor: **Donald W. Rossman**, Jenkintown, Pa.
[73] Assignee: **Elco Corporation**, Willow Grove, Pa.
[22] Filed: **Oct. 21, 1970**
[21] Appl. No.: **82,672**

[52] U.S. Cl. **339/17 CF, 339/192 R, 339/210 M, 339/221 M**
[51] Int. Cl. **H01r 33/76, H05k 1/16**
[58] Field of Search **339/17 C, 17 CF, 17 F, 17 L, 339/17 LC, 17 LM, 156, 174, 176 M, 176 MF, 176 MP, 191 M, 192 R, 210 M, 221, 256 R, 258 R**

[56] **References Cited**

UNITED STATES PATENTS

3,172,718	3/1965	LaLonde.....	339/176 MP
3,555,497	1/1971	Watanabe.....	339/258 R
3,530,422	9/1970	Goodman.....	339/176 MP
3,533,045	10/1970	Henschen.....	339/176 MP
3,418,535	12/1968	Martinell.....	317/101 CC

Primary Examiner—**Marvin A. Champion**
Assistant Examiner—**Lawrence J. Staab**

Attorney—**D. R. Pressman**

[57] **ABSTRACT**

A strip-type DIP (Dual In-line Package) receptacle for use in pairs for removably retaining integrated circuits (IC's) or other components of the DIP type to a printed circuit board or other substrate and for providing contact tails which are electrically connected to the leads of the IC and which extend from the underside of the substrate so that interconnections between leads of IC's can be effected economically or automatically. The receptacle comprises a strip-shaped main insulator, a plurality of contacts, and a strip-shaped side insulator which preferably is welded ultrasonically to the main insulator after the nose portions of the contact are positioned in cavities of the main insulator. Each contact comprises straight, aligned body and tail portions and a thinner, C-shaped nose portion having a mating surface which is offset from the axis of the body and tail portions. Because of said offset feature, adjacent strips may be mounted in alternate orientations (preferably by a force fit into plated-through holes in a PC board), thereby to provide uniformly-spaced contact tails under IC's mounted with non-uniform lead spacing.

4 Claims, 10 Drawing Figures

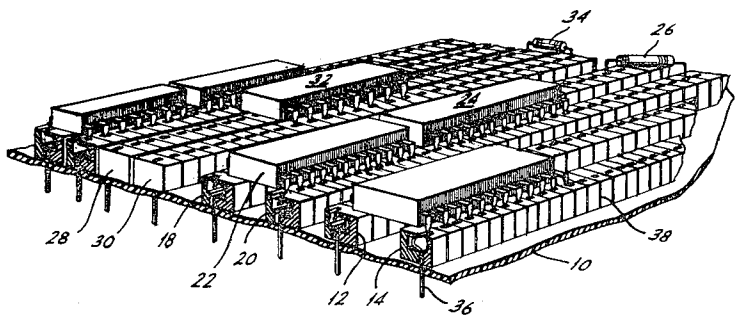


FIG. 1.

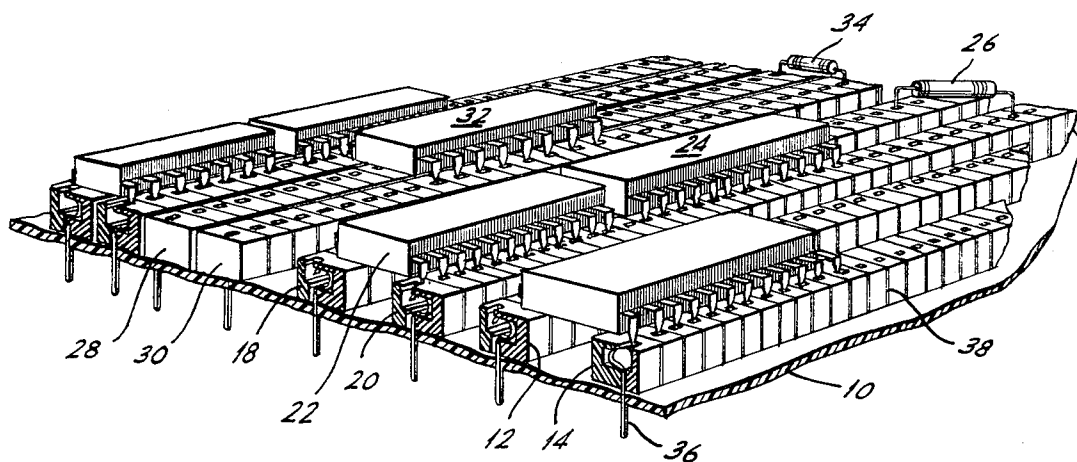


FIG. 2.

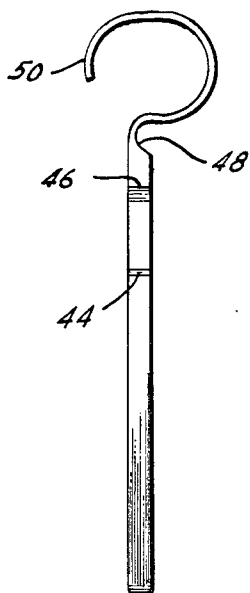


FIG. 3.

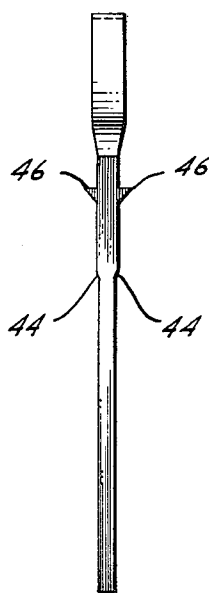
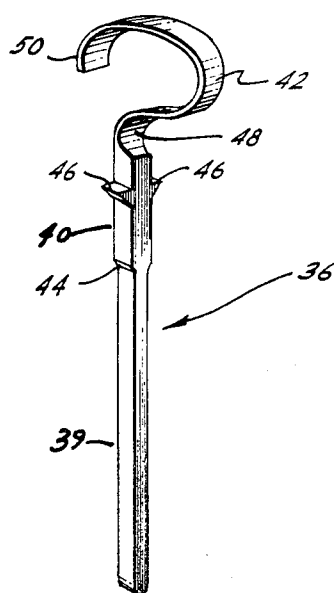


FIG. 4.



INVENTOR.
DONALD W. ROSSMAN

DR Rossman
ATTORNEY

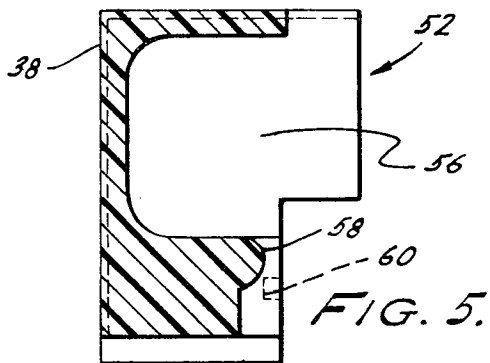


FIG. 5.

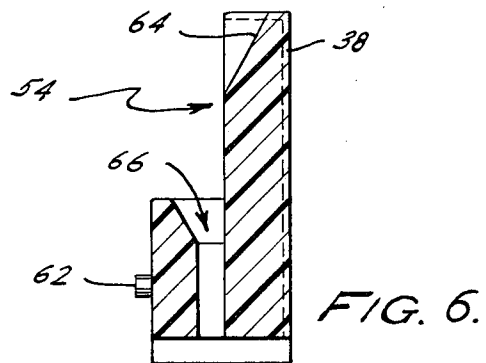


FIG. 6.

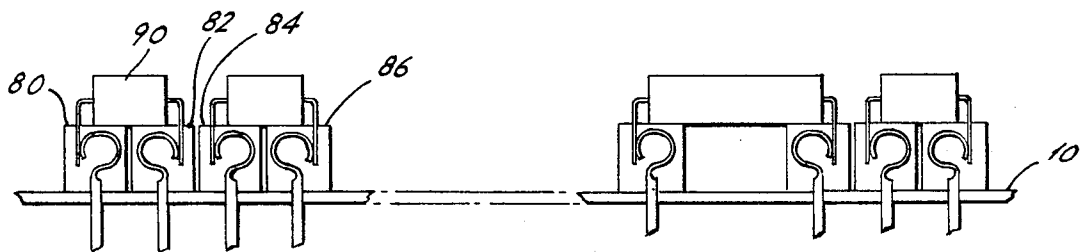


FIG. 7.

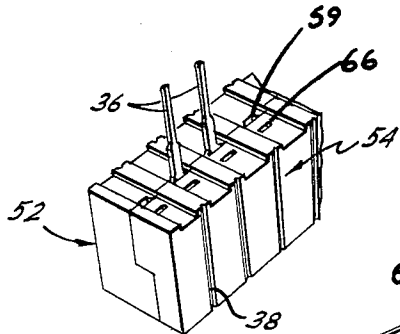


FIG. 9.

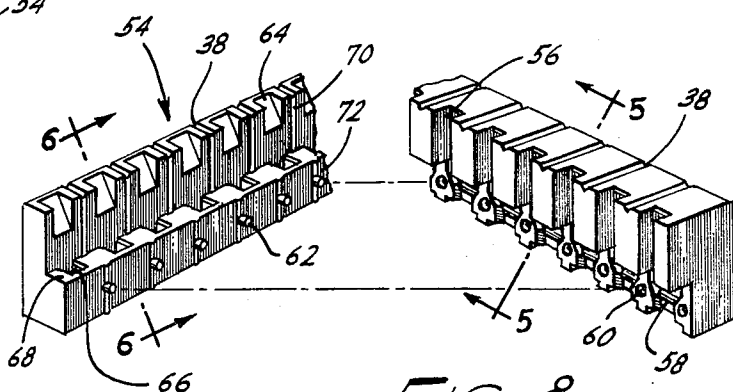


FIG. 8.

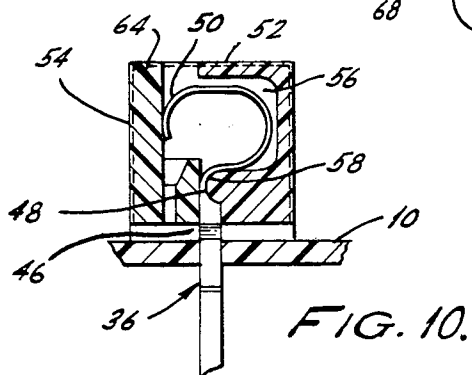


FIG. 10.

INVENTOR.
DONALD W. ROSSMAN

D. W. Rossman
ATTORNEY

STRIP-TYPE DIP RECEPTACLE

This invention relates generally to an integrated circuit (IC) receptacle, and particularly to an economical, reliable IC receptacle which can accommodate IC's of all standard sizes, while providing high packaging density and flexibility of external lead locations.

In recent years, IC's have come into extensive use in all types of electronic equipment. An IC generally comprises from tens to thousands of electronic components such as transistors, diodes, resistors, capacitors, etc., formed within a semiconductive wafer and packaged in a sealed insulating housing having protruding metal leads. The most popular IC package is the Dual In-line Package (DIP), which comprises an elongated block of insulating material (generally epoxy) having flat leads protruding from opposite sides thereof and bent downwardly to provide two rows of leads which point in a common direction. The DIP is designed to be plugged into an IC receptacle.

IC receptacles are available in a variety of sizes, each size being designed for a specific size IC package. As will be recognized by those skilled in the art, the requirement for receptacles of plural sizes greatly increases the cost of such receptacles since separate tooling (including dies, molds, engineering, etc.) must be provided to make each size receptacle.

Recently, strip-type DIP receptacles have appeared; these generally comprise elongated insulating housings containing contacts. The strips are designed for use in pairs, one for each row of the IC's leads. Such strip receptacles can accommodate IC's of all standard sizes since (1) a pair of strips can be mounted with appropriate separation according to the spacing between the two rows of the IC's leads; and (2) such strips are long enough to accept several IC's of the largest size, mounted end-to-end, or, alternatively, (3) such strips can be cut to appropriate lengths for a single IC.

However, the strip receptacles have certain drawbacks. The contacts used therein generally are relatively expensive, difficult to fabricate, and unreliable in performance. In addition, the spacing between the two rows of leads protruding from respective receptacles of a pair is governed solely by the spacing between the two rows of the IC's leads; hence uniform spacing between rows of receptacle leads where plural IC's were mounted side by side could only be obtained at a great sacrifice in component packaging density. Moreover these strips are relatively expensive and difficult to assemble economically in a mass production operation.

Accordingly, several objects of the present invention are to provide a strip-type DIP receptacle which: (1) is economical to fabricate and assemble, (2) provides great versatility in lead spacing, (3) can accommodate any standard size IC, (4) includes a contact of improved, yet economical design, and (5) provides generally improved performance. Other objects and advantages of the present invention will become apparent from the ensuing description thereof.

DRAWINGS

FIG. 1 shows four pairs of strip-type receptacles mounted on a board with IC's of various sizes and other components plugged into said receptacles.

FIG. 2 shows a side view of the novel contact used in the receptacle.

FIG. 3 shows a view of said contact taken from the right in FIG. 2; and

FIG. 4 shows a perspective view of said contact.

FIGS. 5 and 6 show side views in section of the main and side insulator parts of the insulating housing of the receptacle.

FIG. 7 is a diagrammatic showing which illustrates how IC's of various sizes can be plugged into the receptacle.

FIG. 8 is a perspective showing of the side and main insulators prior to assembly.

FIG. 9 is a bottom perspective view of the receptacle.

FIG. 10 is an end view, in section, of the receptacle mounted on a board.

FIG. 1

FIG. 1 is a perspective view showing four pairs of strip receptacles mounted on a board 10 with IC's of various sizes and other components plugged into said receptacles. Receptacles 12 and 14 are mounted on board 10 and spaced apart a sufficient distance so that a DIP type IC having a relatively large spacing between the two rows of leads thereof can be plugged into strips 12 and 14. Strips 18 and 20 are spaced closer together and an IC 22 of smaller width is plugged into these strips. A second IC 24, which is the same size as IC 22, is also plugged into strips 18 and 20 at a location adjacent the end of IC 22. An electrical component 26, such as resistor, also shown plugged into strips 18 and 20 at a location spaced from IC 24. Because the lead spacing of component 26 is greater than the spacing between corresponding lead openings of strips 18 and 20, component 26 is mounted at an oblique angle to strips 18 and 20. Strips 28 and 30 are mounted close to each other so as to accommodate a relatively narrow IC 32; also a two lead component 34 is plugged into strips 28 and 30.

The receptacle preferably is made long enough to accommodate a plurality of IC's of any standard length, i.e., IC's having any standard number of leads. Since the spacing between adjacent leads in each row of an IC currently is standardized at 100 mils, a pair of strips of sufficient length with 100 mils spacing between adjacent contact positions can accommodate any standard IC; in one embodiment, each strip was made about 5.6 inches long, 0.25 inch wide, and contained 56 contacts.

Each strip, such as strip 14, comprises an insulating housing and a plurality of metallic contacts, such as contact 36. Any desired connection between the IC's shown in FIG. 1 can be effected by providing interconnections between the tail portions of the contacts, i.e., the portions which extend below board 10. Such connections preferably are effected by automatic wire wrapping operations in which wires are connected between contact tails by automatic machinery, with the ends of each wire being connected between respective contact tails by tightly wrapping the ends of said wire (after the insulation is stripped therefrom) around the respective contact tails a plurality of times. Alternatively, however, interconnections between contact tails can be made by manual wire wrapping operations, manual wire soldering operations, or printed circuit soldering if board 10 is provided with printed circuitry on the underside thereof.

Each strip includes a plurality of parallel grooves, such as groove 38 of IC 14, to facilitate cutting the strip to any desired length. Each strip is attached to board 10 by means of an interference fit between portions of the contact which extend below the strip and holes in board 10.

FIGS. 2, 3, AND 4

The contact 36 of the present invention is shown in two side views and one perspective view in FIGS. 2, 3, and 4. To facilitate explanation, the bottom portion 39 of the contact will be referred to as the tail portion thereof, the middle portion 40 will be referred to as the body portion, and the uppermost portion 42 will be referred to as the nose portion.

The tail and body portions are elongated, straight, integral, and define an axis, hereinafter referred to as the contact's axis. The nose portion 42 is integral with the body portion, flattened, and of a smaller cross section than the body portion, and bent to have a general C shape. The tail portion preferably has a square cross section and the body portion 40 has a rectangular cross section wherein the side of the body portion viewed in FIG. 2 has the same dimension as the tail portion and the side viewed in FIG. 3 is slightly wider than that of the tail portion and is connected to the tail portion by a tapered portion 44.

The purpose of tapered portion 44 is to facilitate attaching the strips to board 10 by force fit. That is, holes are provided in board 10, preferably on a 100 mils grid, with the same

diameter as the diagonal dimension of the cross-section of tail 48. The strips are assembled to the board by inserting the contact tails into holes in the board until tapered portions 44 of the contacts meet the holes in the board. Thereafter, the body portions 40 of the contacts, which have a larger diagonal cross-sectional dimension than the diameters of the holes, are forced into interfering relationship with the holes so as to retain the strips firmly to board 10.

Body portion 40 also includes a pair of ears 46 having upwardly facing shoulders for restraining the contacts from upward movement through the insulator housing.

The uppermost part of body portion 40 of the contact is tapered such that one side thereof approaches the other side along an inward curve, as illustrated best at 48 in FIG. 2.

The part of nose portion 42 which is adjacent tapering part 48 of body portion 40 defines an angle (roughly 90°) with the axis of the contact; the inside side of said angle, including tapered portion 48, is inwardly curved so as to mate with a corresponding rib portion of the insulator housing, as will be discussed infra.

The surface 50 adjacent the free end of nose portion 42 is termed the mating surface since it contacts a respective lead of the IC when the IC is inserted in the receptacle. Said mating surface has an outward curve to facilitate engagement with said contact lead and, according to one feature of the invention, is offset from the contact's axis, preferably by 50 mils.

Contact 36 preferably is formed of phosphor bronze plated with nickel about 50 microinches thick, followed by gold about 25 microinches thick. The contact may be formed by milling a metal strip to have two different thicknesses (preferably about 25 and 7 mils) along the length thereof to provide for the different thicknesses of the nose and body portions; stamping from such strip contact blanks having the general pattern of FIG. 3 but with a much longer nose portion; and thereafter bending the nose portion to have the C-shape illustrated in FIG. 2. The dimension of the contact tail preferably is 25 mils on each side and the dimensions of the remainder of the contact are scaled approximately as indicated.

FIGS. 5, 6, AND 8

FIGS. 5 and 6 show cross-sectional end views of the main and side insulators which, when assembled, provide the housing part of the receptacle, and FIG. 8 shows perspective views of these parts. The main and side insulators preferably are bonded together ultrasonically after the contacts have been positioned in the main insulator. Such ultrasonic bonding may be effected after the contacts are placed in the main insulator by placing the side insulator on top of the main insulator, pressing the flat head of an ultrasonic welding machine on top of side insulator (using about 30 psi of force for a contact strip about 5.6 inches by one-quarter inch) and then applying about 250 watts of power at 20 kHz for about 0.8 second followed by a 0.2 second hold interval. Such ultrasonic energy will vibrate together the main and side insulators at their points of contact, thereby creating sufficient heat to fuse both parts together and thereby effect assembly of the parts in an economical, rapid, and reliable manner. The main and side insulators preferably are formed of a thermoplastic material, such as 20 percent glass filled nylon.

Main insulator 52 comprises an elongated member having a series of contact cavities, such as 56 (FIG. 8). The bottom floor of each cavity 56 contains a rib portion 58 which is designed to mate with tapered part 48 of the contact when it is positioned in cavity 56. Main insulator 52 has a generally rectangular overall cross-sectional configuration except for the large indentation at the lower right (FIG. 5) which mates with the large protruding portion at the lower left of side insulator 54 (FIG. 6) which otherwise also has a generally rectangular cross-sectional configuration. In addition, to provide added rigidity, the main insulator has circular depressions, such as 60, which mate with corresponding bosses, such as 62,

on the side insulator. The upper portion of side insulator 54 has tapered depressions, such as 64, to provide widened lead-in openings in the completed assembly so that the leads of the IC can easily be inserted into the housing. Similarly, side insulator 54 has tapered openings, such as 66, on the horizontal ledge thereof 69 in order to accommodate the IC's leads in final position. Openings 66 extend to the bottom of the side insulator as shown in FIG. 9.

The main and side insulators also include grooves such as 38 in their external surface between contact cavities which facilitate sawing the insulator into desired lengths. The side insulator, prior to assembly, includes projecting vertical ridges, such as 70 and 72, on the vertical surfaces thereof which face the main insulator and which are in line with the grooves 38. Ridges 70 and 72 provide a fusible portion to facilitate ultrasonic welding. When the main and side insulators are assembled together, ridges 70 and 72 will meet opposing surfaces of the main insulator and be fused thereto by the energy received from the head of the ultrasonic welding machine.

FIG. 10

FIG. 10 shows a cross-sectional view of the main and side insulators assembled together with a contact 36 seated therein and the entire assembly mounted on insulating board 10, which preferably is formed of glass-filled epoxy. The protruding rib 58 interfits with the tapering inwardly curved portion 48 of the contact so as to retain the contact firmly in the housing. The upper shoulders of ears 46 of the contact lie adjacent to lower surface of the housing to provide additional retention rigidity. The contact cavity 56 is deep enough to provide space between the right hand wall thereof and the righthand, outwardly curved surface of the contact in order to provide room for the contact to be deflected in response to insertion of a lead into the receptacle.

When assembled, openings as shown in FIG. 9 at 59 will be formed in the bottom of the housing at the junction of the main and side insulators underneath each of ribs 58 to accommodate the body portion of each contact. These openings communicate with the contact cavity 56 via a constricted channel formed by space between rib 58 and the righthand edge of the side insulator. The tapered transitional parts 48 of the contacts are held in this constricted channel.

FIG. 7

FIG. 7 shows a diagrammatic view of eight connector strips mounted on a board 10, with four IC's plugged into the receptacle strips. The four strips 80, 82, 84, and 86 on the lefthand side of FIG. 6 are mounted close to each other with the mating surfaces of the contacts in each pair of strips facing away from each other. Since the mating surface of each contact is offset by 50 mils from the axis of the contact, the rows of contact tails for each pair of receptacle strips will be more closely spaced than the rows of the IC's leads. Thus if the rows of leads of IC 90 are spaced apart by 300 mils, as is the most common practice, the contact tails of strips 80 and 82 will be spaced apart by 200 mils. By mounting the adjacent pair of strips 84 and 86 close to the pair of strips 82 and 84, the contact tails of strips 82 and 84 can also be spaced apart by 200 mils, so that a uniform 200 mil contact tail spacing can be provided even though plural IC's having 300 mil lead row spacing are mounted in a dense pattern. This is a highly advantageous and novel arrangement which permits IC's to be mounted with greatly increased density while retaining uniform contact tail spacing. Such uniform spacing greatly facilitates interconnection between contact tails using automatic wire wrapping machinery, as will be recognized by those skilled in the art.

Additional flexibility in contact tail positioning can be afforded by mounting the strips such that the mating surfaces of corresponding contacts in a pair of strips face each other, whereby the rows of contact tails will be more widely spaced than the rows of the IC's leads.

While the above description contains many specificities, these should not be construed as limitations upon the scope of the invention but merely as an exemplification of one preferred embodiment thereof. The true scope of the invention is indicated by the subject matter of the appended claims and the legal equivalents thereof.

I claim:

1. A receptacle for removably receiving a component having at least one extending lead, comprising an insulating housing and a contact mounted therein,
 said contact comprising an elongated member having a body portion for retention within said housing, a tail portion to which an external connection can be made, and a nose portion comprising a mating surface for engagement with said extending lead, said body portion interconnecting said tail and nose portions,
 characterized in that said body and tail portions are rectangular, straight, integrally formed, and define an axis, said body portion having a larger cross-sectional dimension than said tail portion and connected to said tail portion by a tapering portion, thereby to facilitate insertion of said body portion into an aperture designed to provide a force-fit with said body portion,
 said nose portion comprising a flat, elongated member integral with said body and tail portions, having a smaller cross-sectional area than said body and tail portions, and bent to have a generally C-shaped configuration, the part of said nose portion adjacent said body portion forming an angle with the axis of said body and tail portions, the part of said nose portion adjacent the free end thereof comprising an outwardly-curved mating surface which is spaced from the axis of said body and tail portions, thereby to enable said contact tail to be offset from said extending lead of said component in a plurality of directions to provide interconnection flexibility,
 said nose portion being connected to said body portion by a tapering transitional portion having a rectangular cross section, the surface of said transitional portion on the interior of said angle tapering along an inward curve toward the surface on the opposite side of said transitional portion, whereby said nose section will be able to be springably displaced by pressure upon said mating surface,
 said insulating housing comprising a body of insulating material having top and bottom surfaces, each having an

opening, and having a cavity connected to each of said openings, said contact being mounted in said housing so as to comprise a connector, the body portion of said contact extending through said bottom opening and said nose portion positioned in said cavity, said mating surface of said nose portion being positioned adjacent a vertical wall of said housing which is in communication with said top opening, whereby insertion of a component lead into said top opening will force said mating surface away from said vertical wall and compress said C-shaped configuration of said nose section,

said cavity of said housing communicating with said bottom opening of said housing via a channel, the floor of said cavity containing an opening smaller than said bottom opening and comprising a rib segment shaped to mate with said inward curve of said transitional portion of said contact, thereby to retain said body portion of said contact rigidly in said housing, said body portion of said contact containing a pair of upwardly-facing shoulders positioned to fit adjacent a bottom surface of said housing to prevent upward movement of said contact with respect to said housing.

2. The invention of claim 1 further including a second connector similar to said first-recited connector, said second connector comprising an insulating housing similar to said first-recited insulating housing, said second insulating housing containing a contact similar to said first-recited contact, said first and second connectors being attached to a substrate having a plurality of holes therein, the body portions of said contacts being force-fit to said holes, the lower surfaces of said insulating housings being mounted adjacent a surface of said substrate, and including a component having a plurality of leads extending in a common direction mounted in said connectors such that each of said leads is inserted into the opening in the upper surface of a respective one of said connectors.

3. The invention of claim 2 wherein said connectors are mounted on said substrate such that said mating surfaces of said contacts face each other, whereby said tail portions of said contacts will be more widely spaced than said leads.

4. The invention of claim 2 wherein said connectors are mounted on said substrate such that said mating surfaces of said contacts face away from each other, whereby said tail portions of said contacts will be less widely spaced than said leads.

* * * * *

50

55

60

65

70

75