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## (54) Electrical connector terminal and electrical connector with same

(57) The present invention is adapted to provide an improved terminal for use in electrical connectors, with the preferred embodiment of the connector being a double pole electrical connector having a reduced number of parts, and a construction adapted for reducing the overall length of the electrical connector in the forward and rear direction. The double pole electrical connector comprises and insulative housing, two conductive terminals arranged in parallel relationship along the forward and rear direction of the insulative housing, and fitting nails outwardly extending from both side surfaces of the insulative housing in generally flush arrangement with a bottom surface of the insulative housing. The fitting nails are soldered to simultaneously establish connection between the conductive terminals and an external circuit, and fixing of the insulative housing to the substrate containing the external circuit.

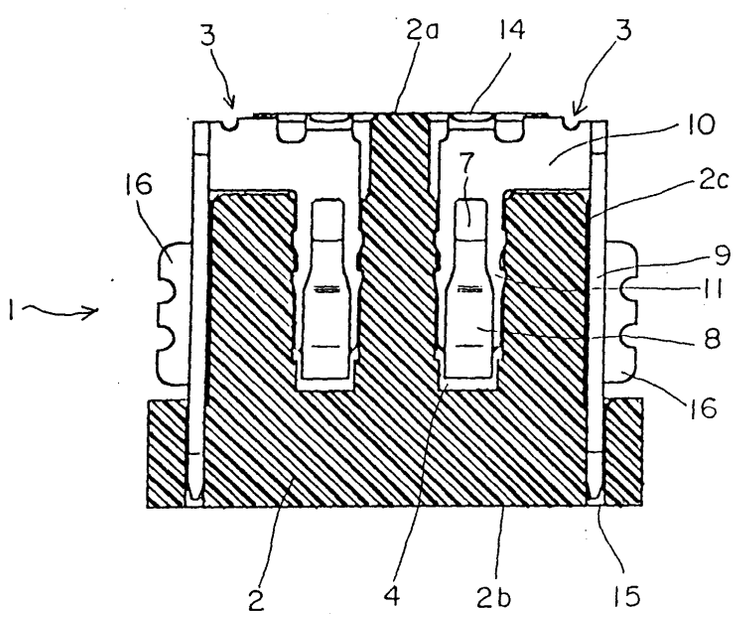


FIG.1

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## Description

### Field of the Invention

**[0001]** The present invention relates to terminals used in electrical connectors and an electrical connector using those terminals, and more particularly to an improved terminal that reduces the overall length of the connector and reduces the number of parts in the connector.

### Background of the Invention

**[0002]** Conventionally, one type of electrical connector is constructed by providing conductive terminals on an insulative housing in parallel relationship, with each conductive terminal having a front end for serving as a contact piece and a rear end for serving as a solder tail. The rearwardly extending solder tail is generally flush with a bottom surface of the insulative housing. By soldering the solder tails to a conductive member such as a printed circuit board, the electrical connector is mounted on the printed circuit board to establish an electrical connection between the electronic component and the circuit connected to the contact piece side of the printed circuit board. A connector of this type utilizing two conductive terminals is referred to as a double pole electrical connector.

**[0003]** If the electrical connector is mechanically connected with the printed circuit board only by the soldering portions of the solder tails, the solder tails tend to peel off since the external force applied to the contact pieces upon connecting and disconnecting the electronic component and the circuit is concentrated on the soldering portions of the solder tails. In order to reduce such a load, it has been suggested to provide fitting nails on opposite sides of the insulative housing to solder the fitting nails as well as the solder tails to the printed circuit board.

**[0004]** The foregoing electrical connector of a double pole type provided with fitting nails is effective in reducing the mechanical load on the soldering portions of the solder tails. However, since it necessitates at least five parts, i.e., the insulative housing, two conductive terminals and two fitting nails, it results in increased cost and complexity of manufacture.

**[0005]** In addition to the foregoing, in this era of miniaturization of connectors and the corresponding increase in package density, the shortening of the length of the connector contributes to reducing the size of the connector and a corresponding increase in package density.

### Summary of the Invention

**[0006]** It is therefore an object of the present invention to provide an electrical connector having a reduced number of parts and a construction adapted for shortening the overall length of the connector and associated terminals.

**[0007]** To accomplish the above-mentioned objective, the present invention contemplates integrating the fitting nails on conductive terminals to establish electrical connection of the conductive terminals and mechanical connection of an insulative housing by soldering of the fitting nails.

**[0008]** According to the present invention, by providing conductive portions (pads) within the printed circuit board at the position corresponding to each fitting nail on the printed circuit board and soldering the fitting nails to these conductive portions, it is possible to simultaneously establish the electrical connection between the conductive terminals and the circuit within the printed circuit board, and the mechanical connection between the insulative housing and the printed circuit board.

**[0009]** The double pole embodiment of this electrical connector can be constructed with three parts, i.e., an insulative housing and two conductive terminals. Furthermore, since no solder tail extends rearwardly of the insulative housing, the overall length of the insulative housing can be reduced by the amount that the solder tails would normally extend rearward from the housing.

### Brief Description of the Drawings

**[0010]** The present invention will be understood more fully from the detailed description given herebelow and from the accompanying drawings of the preferred embodiment of the present invention, which, however, should not be taken to be limitative of the invention, but are for explanation and understanding only, and wherein like reference numerals identify like parts and wherein:

FIGURE 1 is a cross sectional view of a preferred embodiment of a double pole electrical connector according to the present invention taken along line A-A of Figure 4;

FIGURE 2 is a top view of the preferred embodiment of the double pole electrical connector according to the present invention;

FIGURE 3 is a front view of the preferred embodiment of the double pole electrical connector according to the present invention;

FIGURE 4 is a rear view of the preferred embodiment of the double pole electrical connector according to the present invention;

FIGURE 5 is a side view of the preferred embodiment of the double pole electrical connector according to the present invention;

FIGURE 6 is a top view of the conductive terminal attached to a carrier employed in the preferred embodiment;

FIGURE 7 is a front view of the conductive terminal employed in the preferred embodiment shown in Figure 6;

FIGURE 8 is a side view of the conductive terminal

employed in the preferred embodiment shown in Figure 6; and

FIGURE 9 is a side view of a contact portion of the conductive terminal employed in the preferred embodiment.

Detailed Description of the Preferred Embodiment

**[0011]** The present invention will be discussed in detail hereinafter in terms of the preferred embodiment of the present invention with reference to the accompanying drawings. In the following description, numerous specific details are set forth in order to provide a thorough understanding of the present invention. It will be clear, however, to those skilled in the art that the present invention may be practiced without these specific details. In other instances, well-known structures are not shown in detail in order to avoid unnecessarily obscuring the present invention.

**[0012]** Figure 1 is an illustration of a cross sectional view of the preferred embodiment of a double pole electrical connector 1 embodying the inventive terminals described hereinafter. The external appearance of the preferred embodiment shown in Figure 1 is further shown in Figures 2 to 5.

**[0013]** The double pole electrical connector 1 comprises an insulative housing 2 molded of insulative plastic, and two conductive terminals 3 stamped and formed of sheet metal. Two terminal receiving cavities 4 are formed in the insulative housing 2 from the rear end surface 2a to the front end surface 2b (vertical direction in Figure 2) thereof. The conductive terminals 3 are inserted into engagement within each terminal receiving cavity 4 from a rear end surface 2a of the insulative housing 2. A socket opening 5 is formed in a front end surface 2b of the insulative housing 2 corresponding to each terminal receiving cavity 4.

**[0014]** Each conductive terminal 3 has a contact portion 8 having a contact piece 7 integrated with a termination portion 9 adapted for fitting into engagement with any one of both side surfaces 2c of the insulative housing 2 via a transversely connecting piece 10. The contact portion 8 includes the contact piece 7 extending in cantilevered fashion from the front end of a base plate portion 12 having a plurality of locking barbs 11 for engaging with an inner wall of each terminal receiving cavity 4 formed on opposite sides thereof via a generally U-shaped portion 13. The contact portion 8 is adapted for being inserted into each terminal receiving cavity 4. The base plate portion 12 and the transversely connecting piece 10 lie in flush. A stopper piece 14 is projected at generally a right angle on the rear end side of the base plate portion 12. Alternatively, a stopper piece may be located on either the termination portion or the connecting piece.

**[0015]** On the other hand, the termination portion 9 is extended on a plane being generally perpendicular to the transversely connecting piece 10. The termination portion 9 is longer than the contact portion 8, and substantially similar to the length in the forward and rear direction of the insulative housing 2. Termination portion receiving cavities 15 for receiving the termination portions 9 are provided on opposite sides proximate the front end of the insulative housing 2. When the contact portions 8 are inserted into the terminal receiving cavities 4, the forward end of each termination portion 9 is entered into engagement with each termination portion receiving cavity 15.

**[0016]** Each fitting nail 16 is outwardly continuous with a lower side edge of the intermediate portion of each termination portion 9 at generally a right angle. Therefore, the fitting nail 16, the contact portion 8, the transversely connecting piece 10 and the termination portion 9 are integrated to form each conductive terminal 3. The fitting nail 16 is located adjacent to the contact portion 8 in the pitch direction of the electrical connector.

**[0017]** The positional relationship between the contact portion 8 and the termination portion 9 allows the termination portion 9 to extend along the side surface 2c of the insulative housing 2 to be placed into fitted condition, when the contact portion 8 is inserted into each terminal receiving cavity 4 of the insulative housing 2. The fitting nail 16 is positioned in generally flush arrangement with a bottom surface 2d of the insulative housing 2.

**[0018]** When the contact portion 8 is inserted into each terminal receiving cavity 4 of the insulative housing 2, the contact piece 7 is opposed to the inner wall (the upper wall) surface of each terminal receiving cavity 4 to construct the socket structure in cooperation with the inner wall surface.

**[0019]** As shown in Figures 6-9, each pair of the conductive terminals 3 contain two symmetric terminals that are continuously stamped and formed on one side of a carrier 6. A pair of the conductive terminals 3 being symmetric with respect to each other are inserted into engagement relative to the insulative housing 2. A chain line 6a in Figure 6 shows a cut-off position of the conductive terminals 3 and the carrier 6.

**[0020]** The preferred embodiment of the double pole electrical connector 1 constructed as set forth above can be mounted to a printed circuit board by providing conductive portions for conducting a circuit within the printed circuit board (not shown) so as to correspond to each fitting nail 16, and soldering two fitting nails 16 to these conductive portions. By soldering of the fitting nails 16 and the conductive portions, it is possible to simultaneously complete electrical connection between the conductive terminals 3 and the circuit within the printed circuit board, and mechanical connection between the insulative housing 2 and the printed circuit board.

**[0021]** No solder tail is present on the rear side portion of the rear end surface 2a of the insulative housing 2. Accordingly, the length of the double pole electrical connector 1 can be shortened. Therefore, it is possible to reduce the required area on the printed circuit board and

increase the density of the components on the printed circuit board.

**[0022]** Since the fitting nail 16 is large in comparison with the normal solder tail, the mechanical strength thereof is also large. Accordingly, it is also possible to increase the soldering strength with the printed circuit board, and reduce the possibility of peel off. Particularly with the structure in which the fitting nail 16 is integrated with the termination portion 9 at generally a right angle as shown in the preferred embodiment, the mechanical strength is significantly increased to enhance the peel off resistance and the integrity with the insulative housing 2. Furthermore, when the fitting nails 16 are located adjacent to the contact portion 8 in the pitch direction (the arrow direction in Figs. 3 and 4) of the electrical connector, it can prevent the external force applied to the contact portions 8 from being transmitted to the fitting nails 16 under pry. Therefore , it is suitable for reinforcement of the peel off resistance.

**[0023]** Furthermore, since the mechanical strength of the fitting nail 16 is large in comparison with the normal solder tail, it is less likely to be damaged during handling prior to mounting to the printed circuit board. In the case of the normal solder tails, handling may cause deformation of the solder tails. On this point, in the case of the fitting nails 16, it reduces the possibility of deformation of the fitting nails because the mechanical strength is large.

**[0024]** As set forth above, according to the present invention, the double pole electrical connector is constructed with an insulative housing and two conductive terminals so that the number of parts can be reduced with a corresponding reduction in the number of manhours required to manufacture the connector and the total cost of manufacture. Since the solder tails do not extend rearwardly of the insulative housing, the overall length of the insulative housing can be shortened to reduce the size, and contribute to the high density mounting. In conjunction therewith, since the fitting nails are soldered to the printed circuit board, the peel off resistance thereof is high in comparison with the soldering of the solder tails to perform the mounting. Furthermore, the fitting nails are not easily deformed, as the solder tails are, to facilitate handling of the double pole electrical connector.

**[0025]** Furthermore, in the construction as set forth above, since each fitting nail is continuous with and generally perpendicular to the lower edge of each termination portion, it is possible to improve the strength of the fitting nails to increase the peel off strength of the soldering portions. In conjunction therewith, the integrity with the insulative housing can be improved via the termination portion.

**[0026]** Still further, in the construction as set forth above, the contact portions and the fitting nails are located at substantially identical positions in the forward and rear direction of the insulative housing. Therefore, when the external force is applied to the contact portions, it can prevent the force from being transmitted to the fitting nails, and minimize the likelihood of solder peel off.

**[0027]** Although the present invention has been illustrated and described with respect to the exemplary embodiment thereof, it should be understood by those skilled in the art that the foregoing and various other changes, omissions and additions may be made therein and thereto, without departing from the spirit and scope of the present invention. Therefore, the present invention should not be understood as limited to the specific embodiment set out above but to include all possible embodiments which can be embodied within a scope encompassed and equivalents thereof with respect to the features set out in the appended claims.

## Claims

**1.** An electrical terminal (3) comprising:

a contact portion (8), said contact portion having a base plate (12) with a first end and a contact piece (7);
a termination portion (9), said termination portion having a first end;
a connecting piece (10), said connecting piece having a first end, an inner end and an outer end, said connecting piece (10) interconnecting said contact portion (8) and said termination portion (9), said contact portion (8) being adjacent said inner end of said connecting piece, said termination portion (9) being adjacent said outer end of said connecting piece, and said first end of said base plate (12) and said first end of said termination portion (9) being proximate said first end of said connecting piece (10); and
a stopper piece (14).

**2.** The electrical terminal of claim 1 wherein said stopper piece (14) is proximate said first end of said base plate (12).

**3.** The electrical terminal of claim 1 wherein said stopper piece (14) is proximate said first end of said termination portion (9).

**4.** The electrical terminal of claim 1 wherein said stopper piece (14) is proximate said first end of said connecting piece (10).

**5.** The electrical terminal of claim 1 wherein said base plate (12) of said contact portion (8) and said contact piece (7) of said contact portion (8) are interconnected by a generally U shaped portion (13).

**6.** The electrical terminal of claim 1 wherein said ter-

mination portion (9) includes a fitting nail (16).

**7.** The electrical terminal of claim 6 wherein said fitting nail (16) is forward of said first end of said termination portion (9).

**8.** The electrical terminal of claim 7 wherein said fitting nail (16) is generally at a right angle relative to said termination portion (9).

**9.** The electrical terminal of claim 1 wherein said base plate (12) includes at least one locking barb (11).

**10.** The electrical terminal of claim 5 wherein said termination (9) portion includes a fitting nail (16).

**11.** The electrical terminal of claim 10 wherein said fitting nail (16) is forward of said first end of said termination portion (9) and said fitting nail (16) is generally at a right angle relative to said termination portion (9).

**12.** An electrical connector (1) comprising:

an insulative housing (2), said insulative housing having a first end (2a), a substrate mounting surface and at least one sidewall (2c);
at least one terminal receiving cavity (4), said terminal receiving cavity (4) extending from the first end (2a) of said housing (2);
at least one termination portion receiving cavity (15), said at least one termination portion receiving cavity being proximate said at least one sidewall (2c); and
at least one electrically conductive terminal (3), said terminal having a contact portion (8) being received in said terminal receiving cavity (4), said contact portion (8) having a base plate (12) with a first end and a contact piece (7); a termination portion (9), said termination portion having a first end and a second end, said second end of said termination portion being received in said termination portion receiving cavity (4); a connecting piece (10), said connecting piece having a first end, an inner end and an outer end, said connecting piece (10) interconnecting said contact portion (8) and said termination portion (9), said contact portion (8) being adjacent said inner end of said connecting piece (10), said termination portion (9) being adjacent said outer end of said connecting piece (10); and a stopper piece (14).

**13.** The electrical connector of claim 12 wherein said stopper piece (14) is proximate said first end of said base plate (12).

**14.** The electrical connector of claim 12 wherein said stopper piece (14) is proximate said first end of said termination portion (9).

**15.** The electrical connector of claim 12 wherein said stopper piece (14) is proximate said first end of said connecting piece (10).

**16.** The electrical connector of claim 12 wherein said base plate (12) of said contact portion (8) and said contact piece (7) of said contact portion (8) are interconnected by a generally U shaped portion (13).

**17.** The electrical connector of claim 12 wherein said termination portion (9) includes a fitting nail (16).

**18.** The electrical connector of claim 17 wherein said fitting nail (16) is generally at a right angle relative to said termination portion (9).

**19.** The electrical connector of claim 18 wherein said fitting nail (16) is generally flush with said substrate mounting surface of said housing (2).

**20.** The electrical connector of claim 19 wherein said fitting nail (16) is soldered to an external circuit on a substrate to establish electrical connection to said external circuit and to fix the insulative housing (2) to said substrate.

**21.** The electrical connector of claim 12 wherein said first end of said base plate (12)and said first end of said termination portion (9) are proximate said first end of said connecting piece (10).

**22.** A double pole electrical connector (1) comprising:

an insulative housing (2), said insulative housing having a first end (2a), a substrate mounting surface and opposing sidewalls (2c);
two terminal receiving cavities (4), said terminal receiving cavities (4) extending from said first end (2a) of said housing (2);
two termination portion receiving cavities (15), each of said termination portion receiving cavities (15) being proximate said opposing sidewalls (2c); and
two electrically conductive terminals (3), each said terminal having a contact portion (8) being received in said terminal receiving cavity (4), said contact portion (8) having a base plate (12) with a first end and a contact piece (7); a termination portion (9), said termination portion (9) having a first end and a second end, said second end of said termination portion (9) being received in said termination portion receiving cavity (4); a connecting piece (10), said connecting piece having a first end, an inner end and an outer end, said connecting piece (10)

interconnecting said contact portion (8) and said termination portion (9), said contact portion (8) being adjacent said inner end of said connecting piece (10), said termination portion (9) being adjacent said outer end of said connecting piece (10), said first end of said base plate (12) and said first end of said termination portion (9) being proximate said first end of said connecting piece (10); and a stopper piece (14).

**23.** The double pole electrical connector of claim 22 wherein said stopper piece (14) is proximate said first end of said base plate (12).

**24.** The double pole electrical connector of claim 22 wherein said stopper piece (14) is proximate said first end of said termination portion (9).

**25.** The double pole electrical connector of claim 22 wherein said stopper piece (14) proximate said first end of said connecting piece (10).

**26.** The double pole electrical connector of claim 22 wherein said base plate (12) of said contact portion (8) and said contact piece (7) of said contact portion (8) are interconnected by a generally U shaped portion (13).

**27.** The double pole electrical connector of claim 22 wherein said termination portion (9) includes a fitting nail (16).

**28.** The double pole electrical connector of claim 27 wherein said fitting nail (16) is generally at a right angle relative to said termination portion (9).

**29.** The double pole electrical connector of claim 22 wherein said stopper piece (14) said first end of said housing (2), said base plate (12) of said contact portion (8) and said contact piece (7) of said contact portion (8) are interconnected by a generally U shaped portion (13), said termination portion (9) includes a fitting nail (16), said fitting nail (16) being generally at a right angle relative to said termination portion (9), and said base plate (12) includes at least one locking barb (11).

**30.** The double pole electrical connector of claim 29 wherein said fitting nail (16) is generally flush with said substrate mounting surface of said housing (2).

**31.** The double pole electrical connector of claim 30 wherein said fitting nails (16) are soldered to an external circuit on a substrate to establish electrical connection to said external circuit and to fix the insulative housing (2) to said substrate.

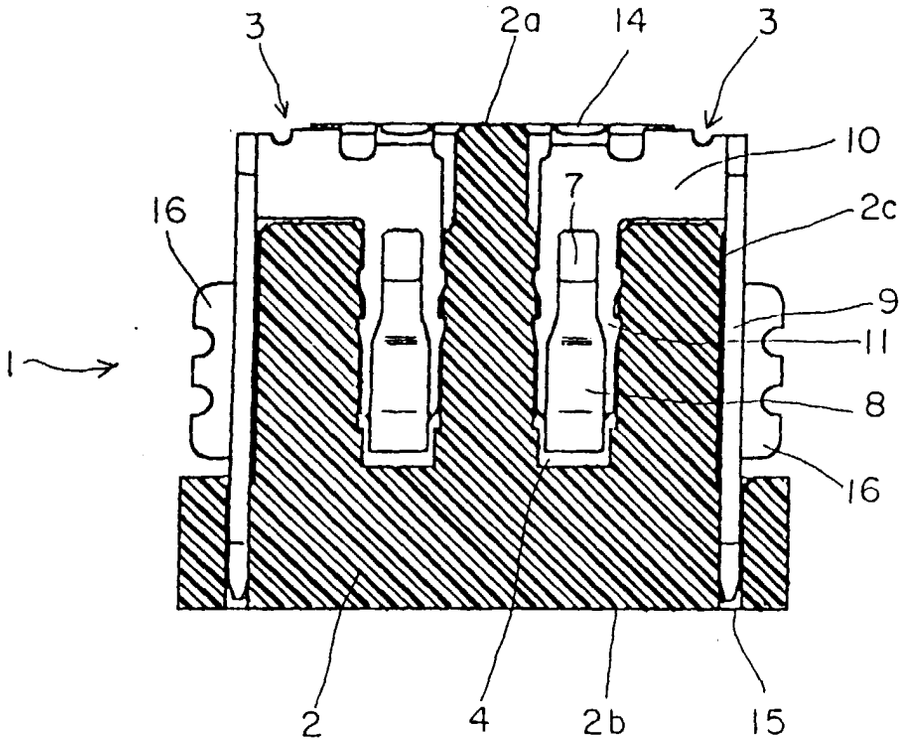


FIG.1

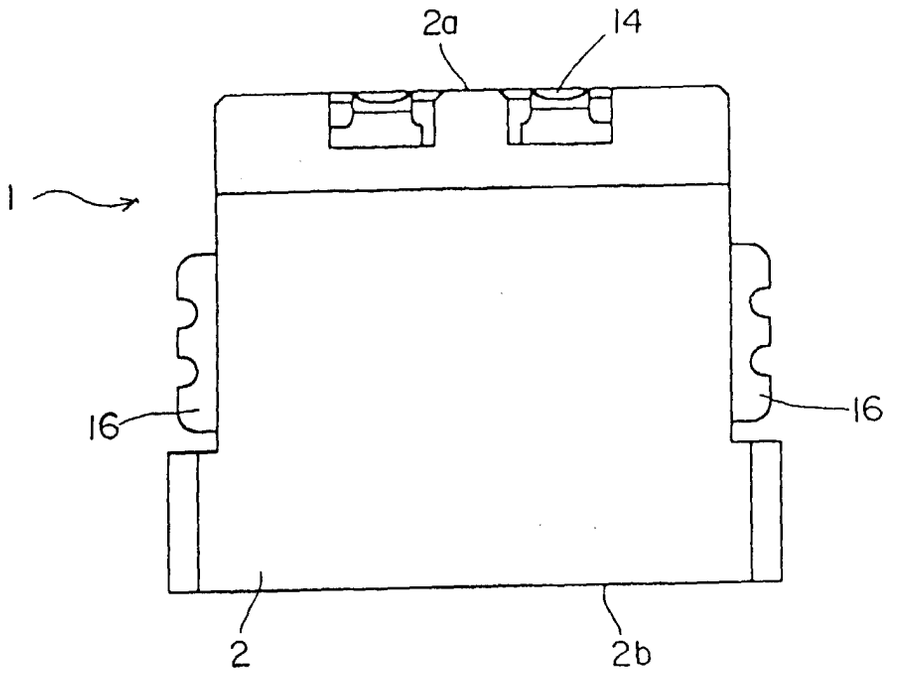


FIG.2

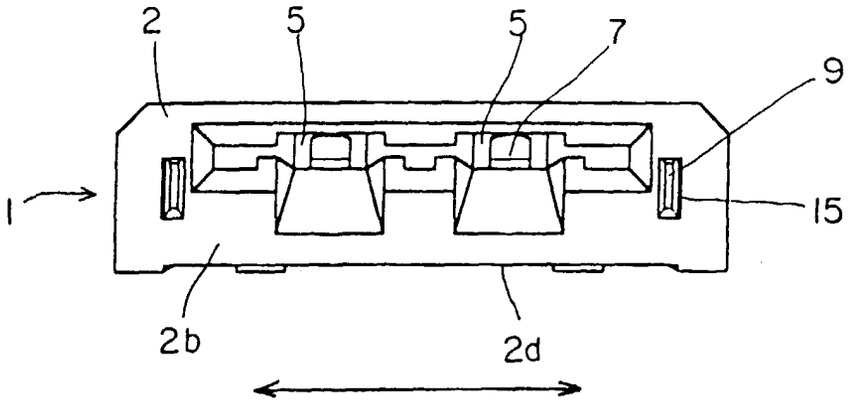


FIG.3

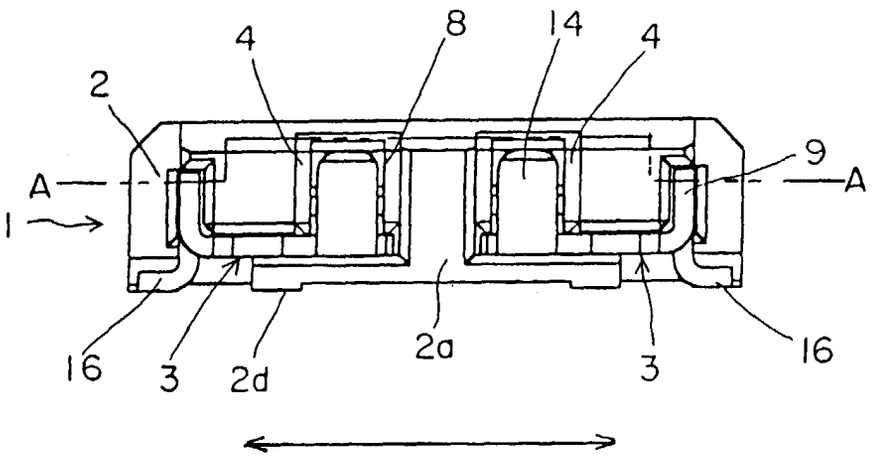


FIG.4

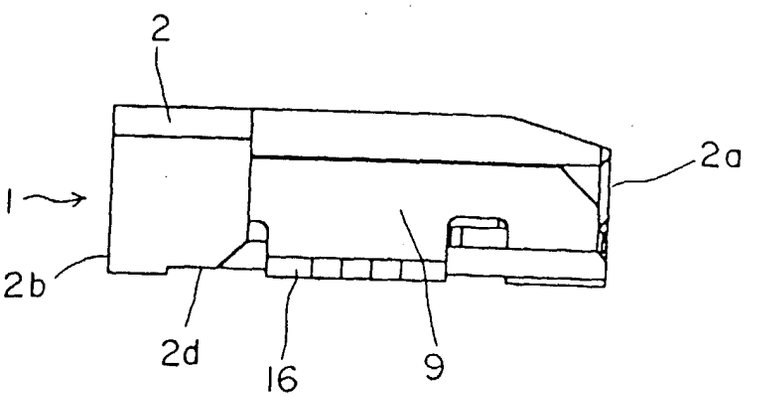


FIG.5

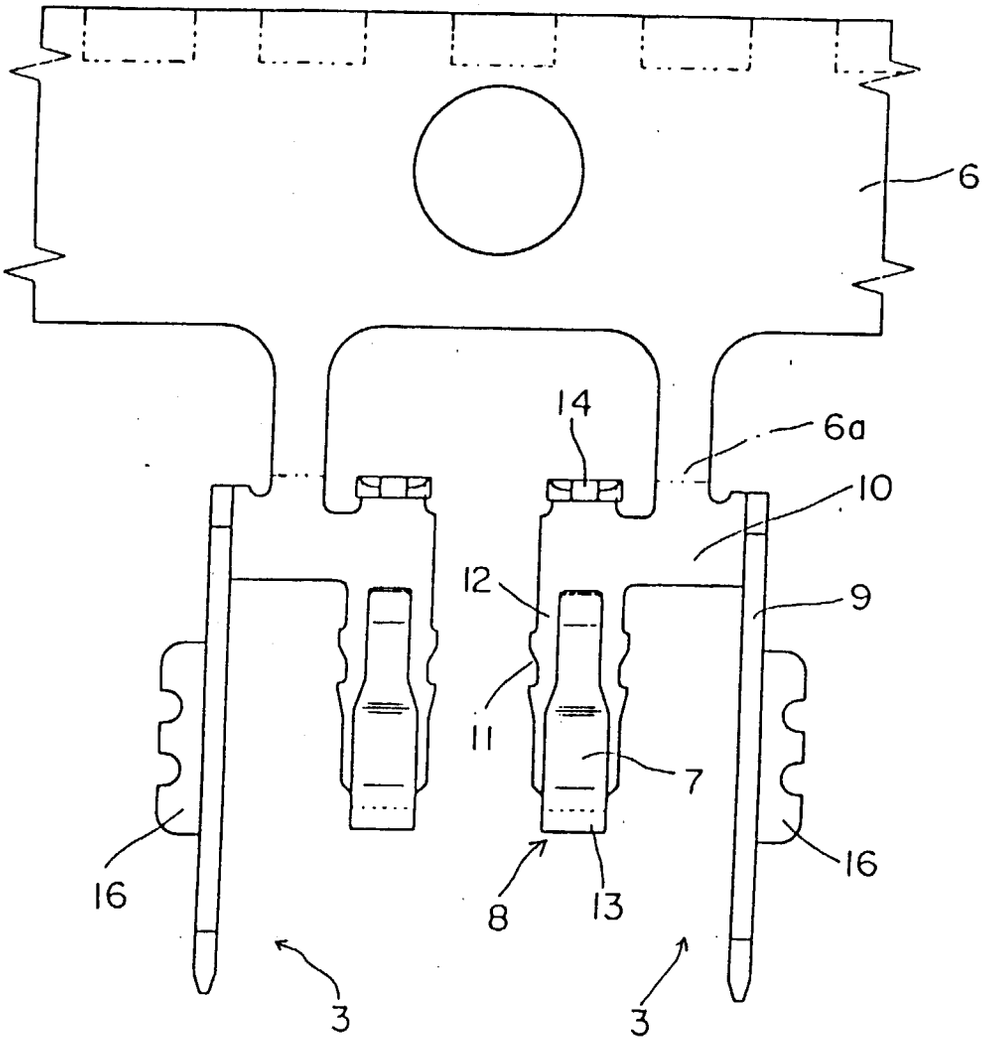


FIG.6

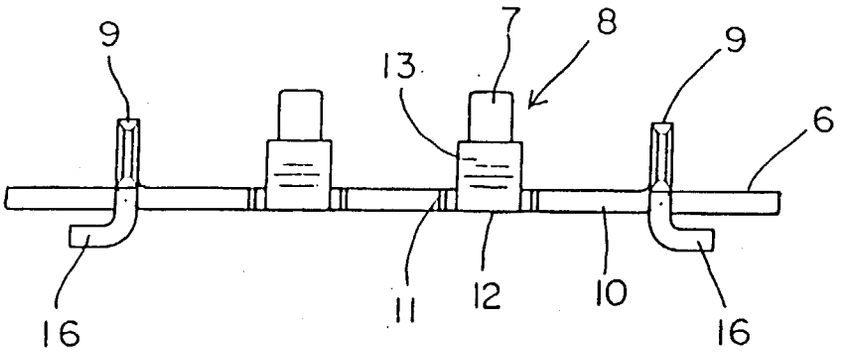


FIG.7

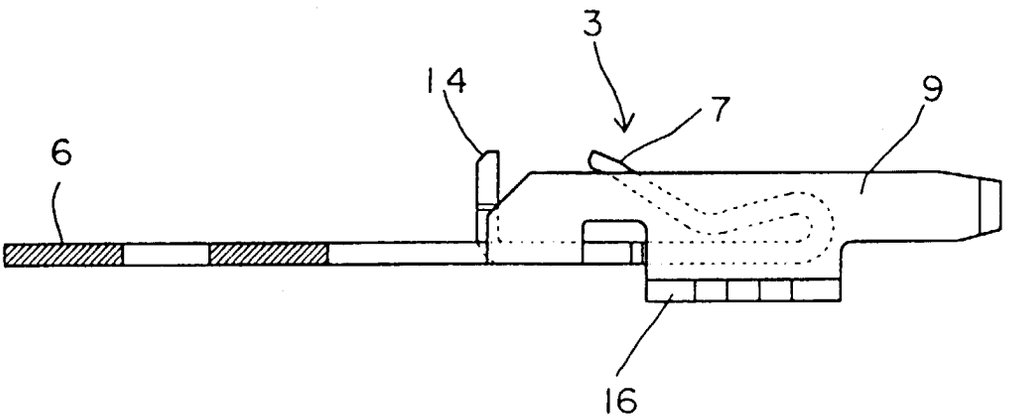


FIG.8

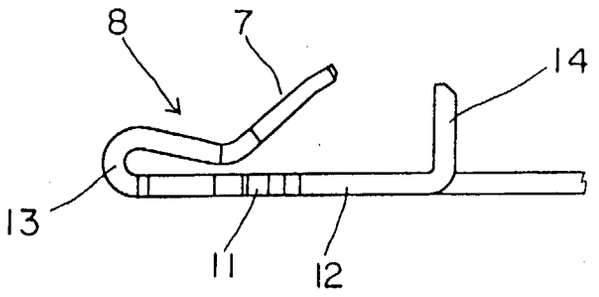


FIG.9