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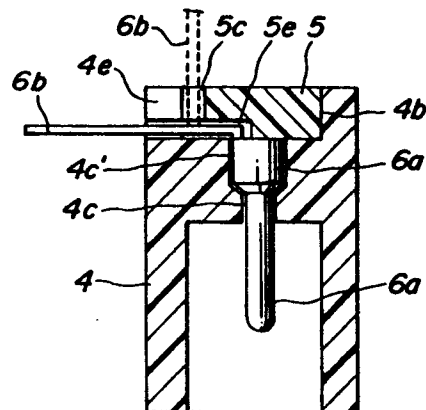
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**Contact fixing structure for connector.**

A contact fixing structure for an electrical connector, particularly miniaturized multi-contact connector including an insulating housing, a fixing plate and a plurality of contacts each having a contact element (6a) and a thin contact tail (6b) electrically connected to the contact element and extending substantially perpendicularly to the contact element. The structure comprises a fixing plate fitting portion (4b) formed in the insulating housing for fitting the fixing plate (5) therein, contact insert apertures formed in the fixing plate fitting portion (4b) to fix the contact elements inserted in the contact insert apertures (4c, 4c') by the fixing plate (5) fitted in the fixing plate fitting portion of the insulating housing, and contact tail extending grooves (4e) formed in at least one of the insulating housing and the fixing plate and being somewhat larger than the contact tails for extending the contact tails (6b) of the contacts out of the insulating housing when the contact elements are inserted in the contact insert apertures and fixed therein by the fixing plate.

**FIG. 3c**



## Description

## CONTACT FIXING STRUCTURE FOR CONNECTOR

This invention relates to a contact fixing structure for an electrical connector, particularly a miniaturized multi-contact connector.

Recently, various kinds of electronic parts have been miniaturized. For example, densities of parts loaded in printed circuit boards have been considerably increased, so that the numbers of terminals for connecting the printed circuits to external circuits have been also considerably increased. In order to connect the printed circuit boards to the external circuits, therefore, it is required for the connectors to have a great number of contacts irrespective of outer diameters of the connectors being substantially equal to those of prior art connectors.

To this end, diameters of male contact pins and sizes of female contacts for receiving the male contacts are made as small as possible. At the same time, the male contact pins are arranged with required intervals in plural rows shifted so as to locate each contact between contacts in adjacent rows, and the female contacts are arranged in similar rows for receiving the male contact pins as shown in Fig. 1. In this manner, contact tails 1b of the contact pins in the rows b extend between contact tails 1a of the contact pins in the rows a in order to accomplish the multi-contacts. In the example shown in Fig. 1, the contact tails extend perpendicularly to the rows of the contacts. However, contact tails may extend in directions the same as those of the rows of the contacts. In this case, diameters of male contact pins are often less than a few times a tenth of one mm and female contacts are also small corresponding thereto. In fixing such very small contacts in an insulating housing, therefore, it is not an easy matter that the contact is provided on its one side with a pawl 2 adapted to engage in an anchoring shoulder 3a formed in the insulating housing 3 so as to fix the male contact thereto as shown in Fig. 2 as in the prior art. In this case, accordingly, the contact is forced into an insert aperture of the insulating housing with an interference, thereby fixing the contact in the aperture. However, as the contact is very small and weak in mechanical strength as above described, it is likely to be bent to give rise to irregularity in intervals between the contacts, which makes difficult the practical use of such small contacts.

It is a primary object of the invention to provide an improved contact fixing structure for an electrical connector, particularly miniaturized multi-contact connector, which eliminates all the disadvantages above described and is capable of securely fixing contacts to an insulating housing without difficulties.

In order to achieve this object, the contact fixing structure for an electrical connector including an insulating housing, a fixing plate and at least one contact having a contact element and a thin contact tail electrically connected to said contact element and extending substantially perpendicularly to said contact element according to the invention comprises a fixing plate fitting portion formed in said insulating housing for fitting said fixing plate therein,

a contact insert aperture formed in said fixing plate fitting portion to fix said contact element inserted in said contact insert aperture by the fixing plate fitted in said fixing plate fitting portion of said insulating housing, and a contact tail extending groove formed in at least one of said insulating housing and said fixing plate and being somewhat larger than said contact tail for extending said contact tail of said contact out of said insulating housing when said contact element is inserted in said contact insert aperture and fixed therein by said fixing plate.

In a preferred embodiment of the invention, a plurality of contact insert apertures for a plurality of contacts are arranged in plural rows, each row being shifted to each other to locate each aperture between the aperture of the adjacent rows, and on a side of the contact fixing plate in opposition to a recess forming the fixing plate fitting portion there are provided contact tail horizontally extending grooves starting from locations corresponding to positions of the contact insert apertures of the insulating housing for horizontally extending contact tails of the contacts.

Both longitudinal side edges of the insulating housing formed by the recess forming the fixing plate fitting portion may be formed with contact tail horizontally extending grooves for horizontally extending the contact tails of the contacts.

Moreover, both longitudinal side edges of the fixing plate may be formed with contact tail vertically extending grooves corresponding to the contact tail horizontally extending grooves of the insulating housing for vertically extending the contact tails of the contacts.

The invention will be more fully understood by referring to the following detailed specification and claims taken in connection with the appended drawings.

Fig. 1 is a plan view of a connector of the prior art;

Fig. 2 is a sectional view illustrating a contact of the prior art;

Fig. 3a is a front elevation of a contact in connection with the invention;

Fig. 3b is a sectional view of a connector according to the invention when a fixing plate is removed from an insulating housing;

Fig. 3c is a sectional view of the connector shown in Fig. 3b when the fixing plate is fitted in the insulating housing;

Fig. 4a is a perspective view illustrating an insulating housing of a connector according to the invention;

Fig. 4b is a perspective view illustrating a contact fixing plate to be fitted in the housing shown in Fig. 4a;

Figs. 4c and 4d are perspective views of contacts used in the connector according to the invention;

Fig. 5a is a partial perspective view for explaining the mounting of contacts in the connector according to the invention;

Fig. 5b is a partial perspective view for explaining the mounting of the contact fixing plate according to the invention;

Fig. 6 is a sectional view of a male connector of one embodiment of the invention;

Fig. 7 is a sectional view of a female connector of another embodiment of the invention;

Fig. 8a is a sectional view of a connector of a further embodiment of the invention; and

Fig. 8b is a sectional view of a connector of a still further embodiment of the invention.

Figs. 3a-3c illustrate one embodiment of the invention, wherein a contact element (contact pin) 6a is formed with an enlarged diameter head 6a' to which a thin contact tail 6a is electrically connected substantially perpendicular to the contact element 6a to form a contact 6 as shown in Fig. 3a. An insulating housing 4 is formed with a contact insert aperture 4c having a slightly enlarged aperture 4c' corresponding to the head 6a' of the contact element 6a. The insulating housing 4 is further formed with a fitting recess 4b for receiving a fixing plate 5 for fixing the contact 6 and with a groove 4e through which the contact tail 6b extends as shown in Fig. 3b. With this arrangement, after the contact element 6a has been inserted into the contact insert aperture 4c of the insulating housing 4 with the contact tail 6a being arranged in the groove 4e, the fixing plate 5 is fitted in the fitting recess 4b so that the head 6a' of the contact element 6a is urged and fixed to the fitting recess 4b with the aid of a shoulder formed by the apertures 4c and 4c'. In this manner, even a thin contact element can be fixed simply and securely to the housing without the limitation of thickness of the contact element, which would otherwise occur in case of a contact element fitted in an insert aperture with interference. Reference numeral 5e denotes a second groove making possible to extend the contact tail 6b in a direction of the groove 4e. Reference numeral 5c denotes a groove for extending the contact tail 6b in a direction in parallel with the contact element 6a as the case may be as shown by dotted lines in Fig. 3c.

Figs. 4a-4d are exploded perspective views of one embodiment of the connector according to the invention, which is capable of extending contact tails in directions perpendicular to and in parallel with contact elements arranged in shifted plural rows. This connector comprises an insulating housing 4, a contact fixing plate 5 and contacts 6 and 7. These members are assembled as shown in perspective views of Figs. 5a and 5b and sectional views of Fig. 6, in order to fix the contacts 6 and 7 to the insulating housing. These members are constructed as follows.

As shown in Fig. 4a, the insulating housing 4 is formed with a contact fixing plate fitting recess 4b which includes at both ends press-fitting fixing grooves 4a. A bottom of the recess 4b is formed with insert apertures 4c (4c') for male contact pins or contact elements 6a (6a') and 7a (7a') in four rows a, b, a' and b' shifted to each other so as to locate each insert aperture between the insert apertures in the adjacent rows. Moreover, both longitudinal side

edges 4d of the insulating housing 4 formed by the recess 4b are formed with contact tail horizontally extending grooves 4e equally spaced corresponding to the insert apertures 4c, respectively, for horizontally extending the contact tails therein.

As shown in Fig. 4b, the contact fixing plate 5 has an outer configuration and a size so as to be press-fitted in the recess 4b of the insulating housing 4 and is provided at ends with fitting protrusions 5a adapted to be fitted in the fixing grooves 4a formed at both the ends of the recess 4b of the insulating housing 4. Moreover, both longitudinal side edges 5b of the contact fixing plate 5 are formed with contact tail vertically extending grooves 5c corresponding to the contact tail horizontally extending grooves 4e formed in the side edges 4d of the insulating housing 4. On a side of the contact fixing plate 5 in opposition to the contact fixing plate fitting recess 4b there are provided first contact tail extending grooves 5d extending from locations corresponding to the insert apertures 4c in the rows a and b' to the contact tail vertically extending grooves 5c and the second contact tail extending grooves 5e longer than the grooves 5d and extending from locations corresponding to the insert apertures 4c in the rows b and a' to the contact tail vertically extending grooves 5c.

As shown in Figs. 4c and 4d, the contacts 6 and 7 include contact pins or contact elements 6a and 7a and contact tails 6b and 7b, respectively. These contacts 6 and 7 are bent according to configurations of contact tail extending passages different in length formed by the insert apertures 4c of the insulating housing 4 and the first and second contact tail extending grooves 5d and 5e and the contact tail vertically and horizontally extending grooves 5c and 4e of the contact fixing plate 5.

In assembling these members, the contact pins 6a and 7a are inserted into the insert apertures 4c and their contact tails 6b and 7b are fitted in the contact tail horizontally extending grooves 4e as shown in Fig. 5a. Thereafter, while the contact tails 6b and 7b are arranged in the contact tail vertically extending grooves 5c, the contact fixing plate 5 is fitted and fixed into the fitting recess 4b of the insulating housing 4 to form a receptacle connector as shown in Figs. 5b and 6.

As can be seen from the above description, while the contact tails 6b and 7b are arranged in the contact tail horizontally extending grooves 4e, the contact pins 6a (6a') and 7a (7a') having shoulders are inserted into the insert apertures 4c (4c') having shoulders somewhat larger than diameters of the contact pins. Thereafter, the contact fixing plate 5 is press-fitted in the fitting recess 4b to fix the contact pins 6a (6a') and 7a (7a') in position with the aid of the contact fixing plate 5 and the insulating housing 4 as explained by referring to Fig. 3. It is not required to make diameters of contact pins and insert apertures exactly coincident with each other, which would otherwise be required in case that the contact pins are press-fitted in fixing apertures of an insulating housing as in the prior art. Accordingly, even if contact pins or contact elements are thin and weak due to multi-contacts, the contact pins are

securely fixed in position without irregularity in interval caused by bending of the contact pins in inserting them into insert apertures, thereby enabling the assembly of the connector to be simplified. On the other hand, the contact tails extend through the respective extending grooves 5e and 4e. In this case, as the contact pins connected to the respective contact tails are fixed in position by the contact fixing plate 5, the contact tails may be located in the respective grooves 5e and 4e with some plays. Accordingly, the contact tails may be previously connected to connecting pieces 8 as shown in dotted lines in Fig. 5a so as to be able to insert the contact pins into the insert apertures 4c by one operation. With this arrangement, the assembling of the connector is simplified and the connecting pieces 8 serve to maintain substantially constant the distances between the contact tails to make easy the insertion of the contact tails into the horizontally extending grooves 4e and hence the assembly of the connector. Moreover, as the contact tails are arranged in the extending grooves 5e (5d) and 4e of the contact fixing plate 5 and the insulating housing 4, the insulation between the adjacent contact tails is maintained under better conditions.

The invention has been explained in reference with fixing of male contacts in the above explanation. In case of female contacts, as shown in the cross-section of Fig. 7, after the contact sockets 6a and 7a have been inserted into contact insertion apertures 4c of an insulating housing 4, contact elements of the contacts (for example, sockets in this case) are fixed in position by means of a contact fixing plate 5 such that thin contact tails 6b and 7b electrically connected to the contact sockets 6a and 7a extend through contact tail extending grooves 5c, thereby achieving the same effect as above described. In this case, moreover, it is not needed to form shoulders required in the male contact pins, and the contact sockets and contact tails may of course be directly connected. Although the contact tails 6b have been explained to extend straight out of the insulating housing 4 without using any bent extending passage in this embodiment, it is preferable to use bent passages because tensile forces act directly on connections between the contact tails 6b and the contact elements (sockets) when the contact tails are subjected to tensile forces, if the passages are straight.

Fig. 6 illustrates one example wherein the insulating housing 4 is provided with the contact tail horizontally extending grooves 4e, and the contact fixing plate 5 is provided with the contact tail vertically extending grooves 5c, thereby enabling the contact tails 6b and 7b to extend perpendicularly to and in parallel with the contact pins or contact elements in solid lines and dotted lines. In the event that contact tails extend only perpendicularly to the contact pins, vertically extending grooves 5c of a contact fixing plate 5 are not needed as shown in Fig. 8a. If contact tails extend only in parallel with the contact pins, horizontally extending grooves 4e of an insulating housing 4 are not needed as shown in Fig. 8b.

While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and details can be made therein without departing from the spirit and scope of the invention.

## Claims

1. A contact fixing structure for an electrical connector including an insulating housing, a fixing plate and at least one contact having a contact element and a thin contact tail electrically connected to said contact element and extending substantially perpendicularly to said contact element, said structure comprising a fixing plate fitting portion formed in said insulating housing for fitting said fixing plate therein, a contact insert aperture formed in said fixing plate fitting portion to fix said contact element inserted in said contact insert aperture by the fixing plate fitted in said fixing plate fitting portion of said insulating housing, and a contact tail extending groove formed in at least one of said insulating housing and said fixing plate and being somewhat larger than said contact tail for extending said contact tail of said contact out of said insulating housing when said contact element is inserted in said contact insert aperture and fixed therein by said fixing plate.

2. A contact fixing structure as set forth in claim 1, wherein said contact element is provided with an enlarged diameter head and said contact insert aperture is provided with an enlarged aperture corresponding to said enlarged diameter head of said contact element.

3. A contact fixing structure as set forth in claim 1, wherein a plurality of contact insert apertures for a plurality of contacts are arranged in plural rows, each row being shifted to each other to locate each aperture between the apertures of the adjacent row.

4. A contact fixing structure as set forth in claim 3, wherein on a side of the contact fixing plate in opposition to a recess forming the fixing plate fitting portion there are provided contact tail horizontally extending grooves starting from locations corresponding to positions of said contact insert apertures of the insulating housing for horizontally extending contact tails of the contacts.

5. A contact fixing structure as set forth in claim 4, wherein both longitudinal side edges of said insulating housing formed by said recess forming said fixing plate fitting portion are formed with contact tail horizontally extending grooves for horizontally extending said contact tails of the contacts.

6. A contact fixing structure as set forth in claim 4, wherein both longitudinal side edges of said fixing plate are formed with contact tail vertically extending grooves corresponding to said contact tail horizontally extending grooves

of the insulating housing for vertically extending  
said contact tails of the contacts.

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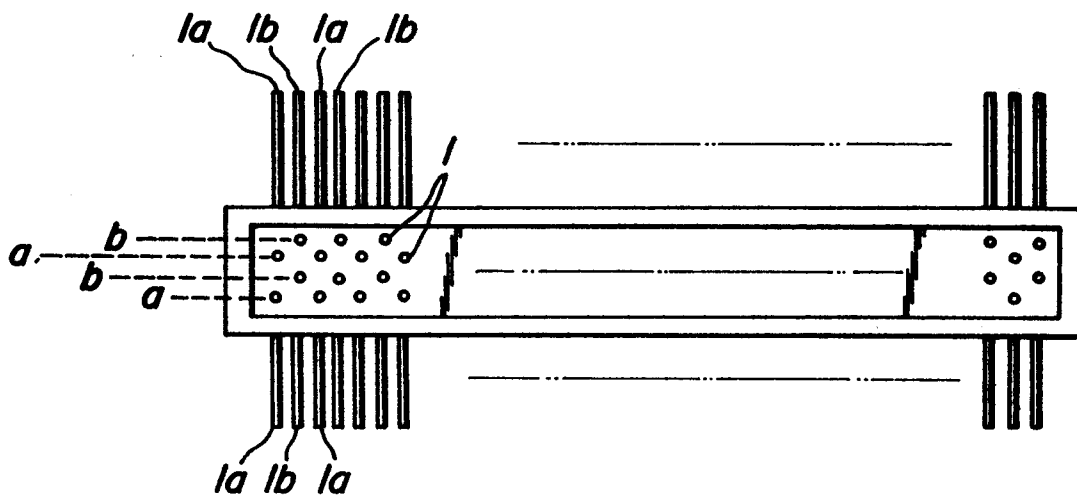
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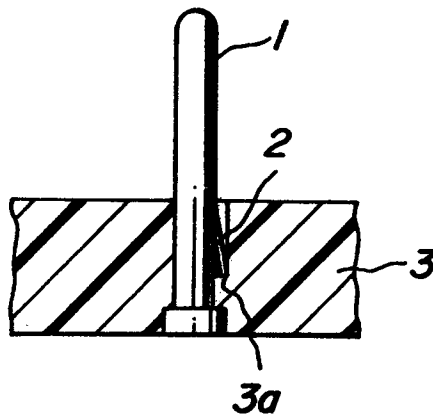
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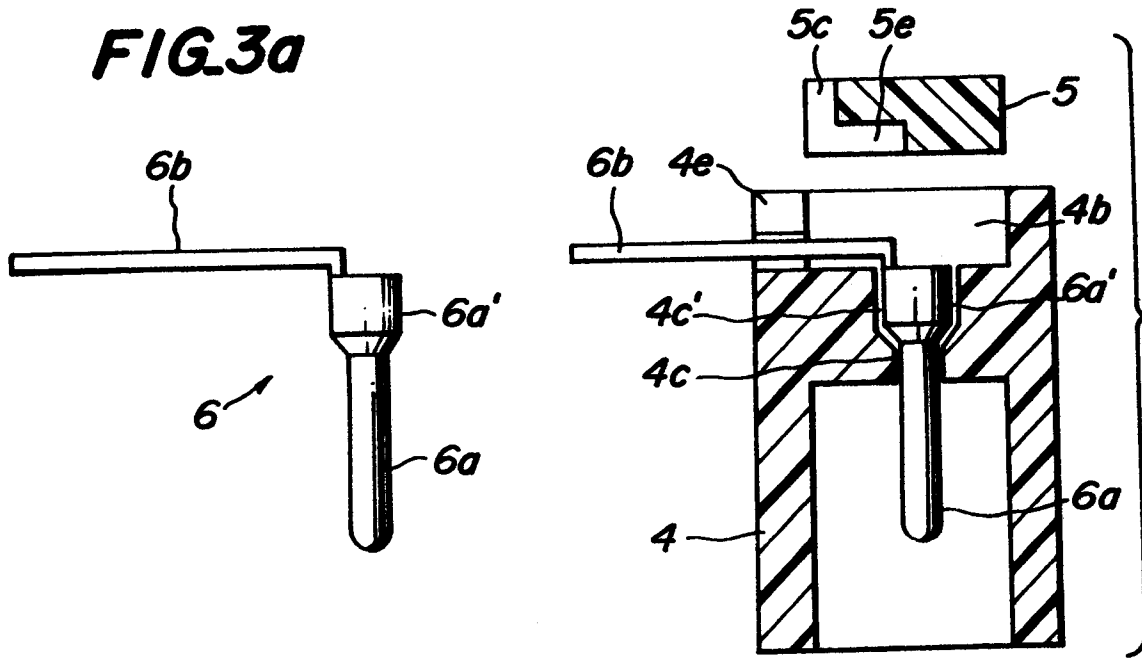
**FIG. 1**  
PRIOR ART



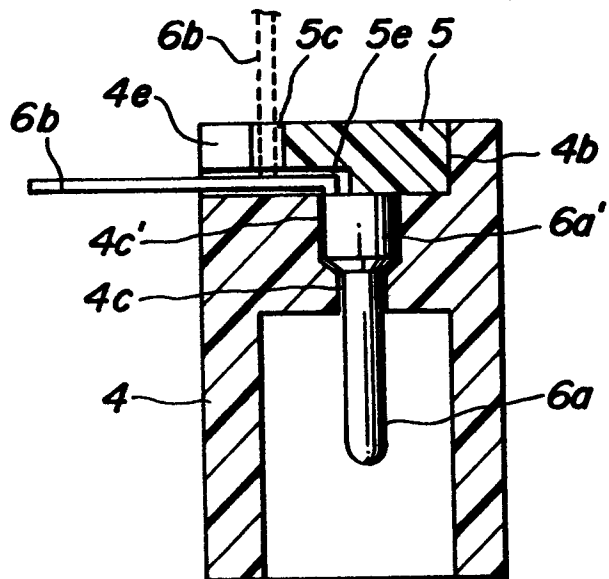
**FIG. 2**  
PRIOR ART



**FIG.3b**



**FIG.3c**





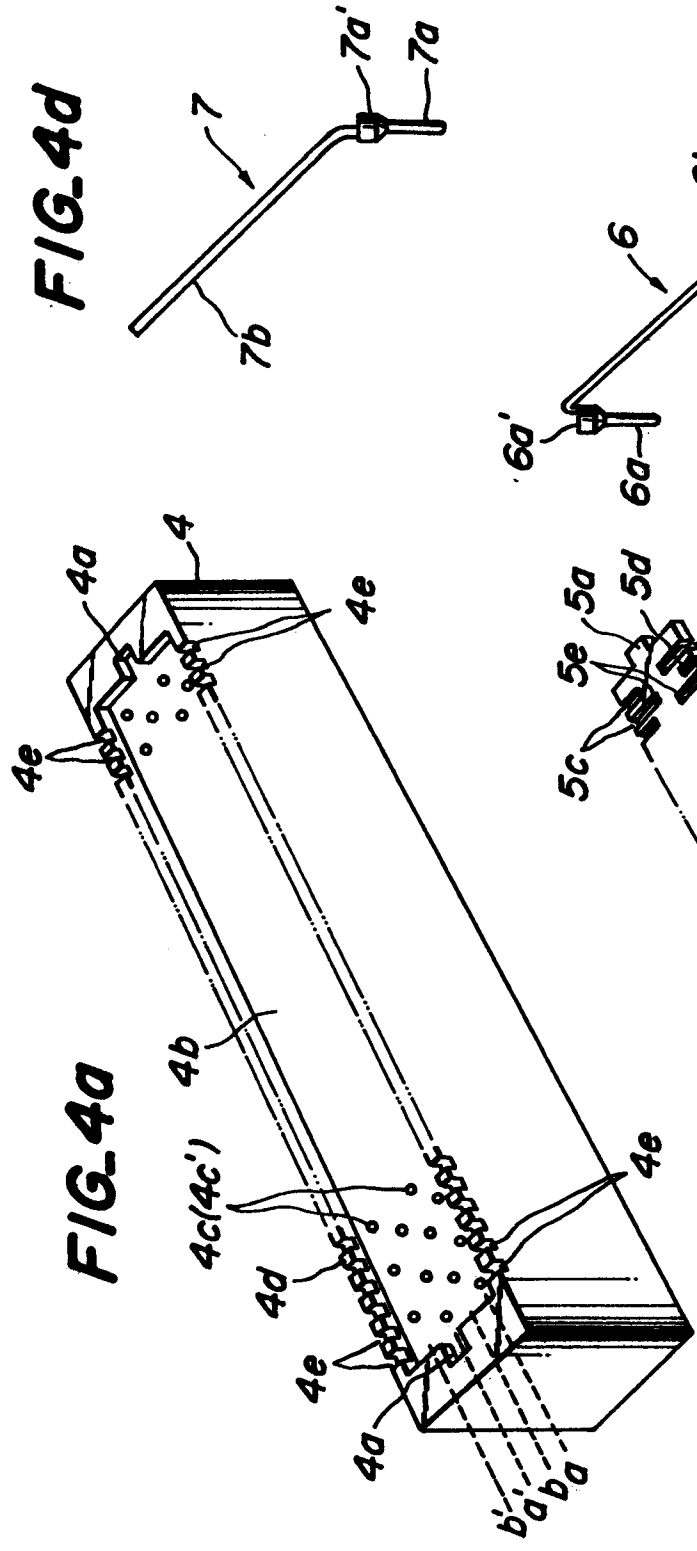


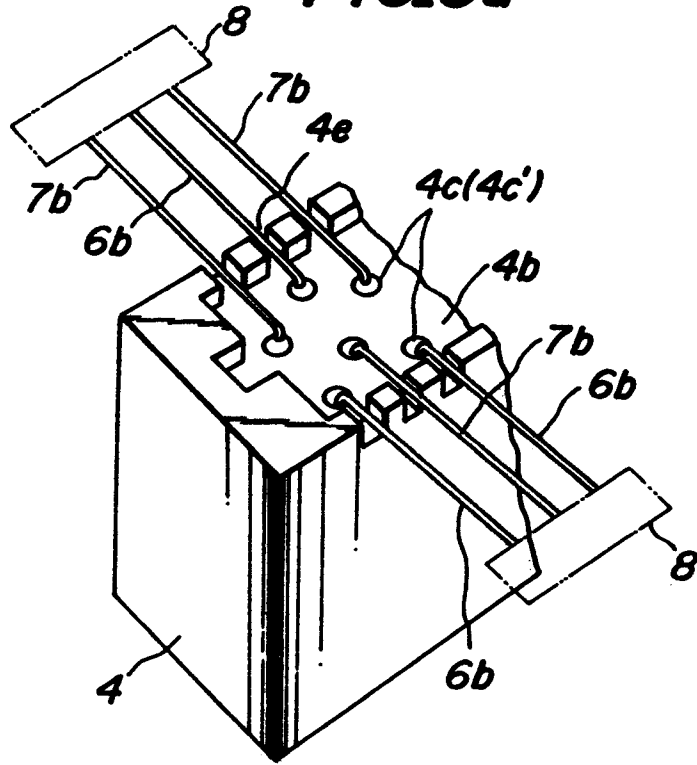
FIG. 4a

FIG. 4b

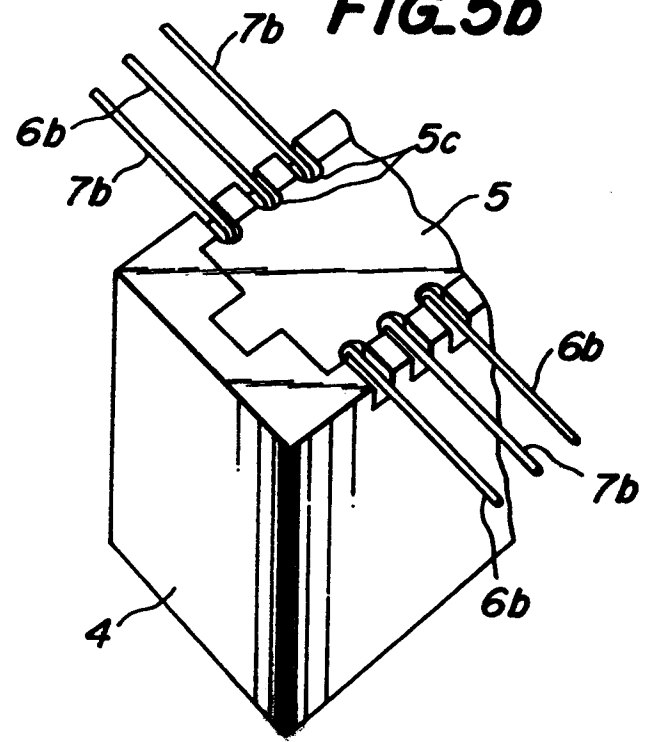
FIG. 4c

FIG. 4d

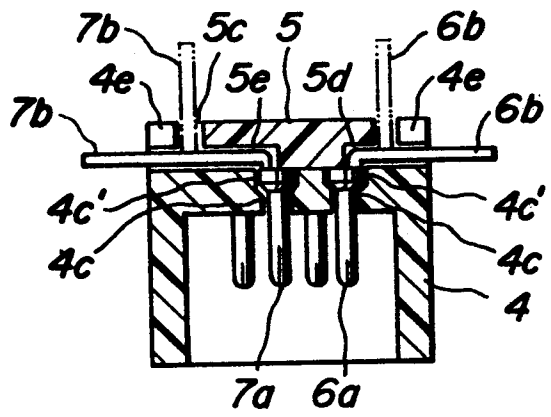
**FIG.5a**



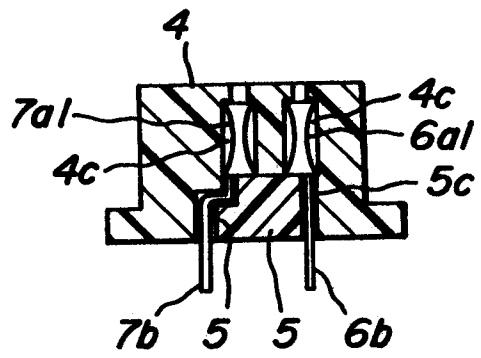
**FIG.5b**



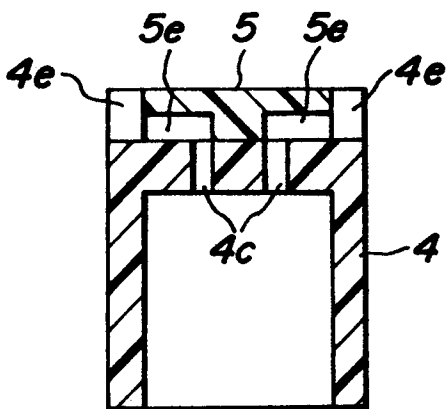
**FIG. 6**



**FIG. 7**



**FIG. 8a**



**FIG. 8b**

