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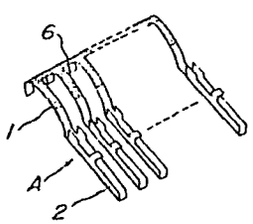
(54) **Electric connector.**

(57) An electric connector comprises elongated contacts and an insulating housing. Each the elongated contact comprises at one end a curved contact element having at a front end a support piece extending in a longitudinal direction of the contact, at the other end a terminal element, and an elastic fixing lug integral with the contact and supported at one end on a side of the curved contact element by the contact at an intermediate portion thereof between the curved contact and terminal elements.

FIG. 5



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ELECTRIC CONNECTOR

This invention relates to an electric connector, and more particularly to a multi contact connector including a plurality of contacts each having a contact support structure for supporting a contact in an insulating housing.

In an electric connector, particularly a multi contact connector, contacts are in general inserted and fixed in fixing apertures formed in an insulating housing with a predetermined intervals. In this case, with a male connector a contact A for example as shown in a perspective view of Fig. 1 includes a curved contact element 1 having at one end a ratch turn-up portion 1a, and a terminal element 2 adapted to be soldered having a U-shaped section including two sidewalls 2a. The two sidewalls 2a include ratch projections 2b at one end on a side of the contact element 1, and a fixing piece 2c formed on one of the sidewall 2a at its mid portion and bent at substantially right angles to the sidewall 2a flush with upper edges of the sidewalls 2a at their ends on the side of the contact element A.

On the other hand, an insulating housing B is formed for example as shown in a plan view and a sectional view of Figs. 2a and 2b. The insulating

housing B includes support grooves 3a formed in both sides of an upper end of an insulating wall 3 for supporting the ratch turn-up portions 1a of the contacts A and an insertion positioning flange 4 integrally formed with the insulating wall 3 for positioning a mating connector whose contacts are to be connected to this contacts A. The insertion positioning flange 4 has contact fixing apertures 5 spaced apart from each other by a predetermined distance between two contacts A. Each the contact fixing aperture 5 is formed therein a ratch protrusion 5a having a length in the direction of the contact fixing aperture 5 somewhat shorter than a distance between the ratching projections 2b and the fixing piece 2c of the contact A in a manner such that the ratch projections 2b abut against the ratch protrusion 5a when the contact A is held in the fixing aperture 5 with the ratch turn-up portion 1a of the contact 1 being in the support groove 3a of the insulating wall 3.

In assembling the contact A in the insulating housing B, the terminal element 2 of the contact A is inserted into the contact fixing aperture 5 so that the ratch turn-up portion 1a is in the support groove 3a and simultaneously the ratch projections 2b abut against the ratch protrusion 5a as shown in Fig. 3. Thereafter, a fixing tool (not shown) is inserted into the terminal element 2 from its one end remote from the contact element and the fixing piece 2c is raised away from the

insulating wall 3 so that the ratch projections 2b and the fixing piece 2c of the contact A are anchored at the ratch protrusion 5a to hold the contact A in the housing B.

In case of a female connector, as shown in Fig. 4, an insulating housing B has insulating walls 3 on both sides and a mating connector insertion aperture 5. Each the insulating wall 3 is formed in a front end with a support groove 3a for the ratch turn-up portion 1a. A bottom of the mating connector insertion aperture 5 is formed on both sides with contact fixing apertures 5 each having a ratch protrusion 5a. In the same manner as above described, the contact A is fixed in the insulating housing B.

In assembling a multi contact connector, the process for inserting a number of contacts one by one into fixing apertures of an insulating housing is complicated to increase the cost of the connector. It is therefore desirable for automatic assembling and low cost to form a required number of contacts A in a unitary body connected by connecting pieces 6 as shown in a perspective view of Fig. 5, thereby enabling the unitary contacts to be inserted and fixed in the fixing apertures of the insulating housing. The unitary contacts also makes it possible to transfer the contacts continuously into a plating apparatus for the contacts, so that the unitary contacts can be partially plated shown at dotted portions in Fig. 5. Accordingly, the

construction of the unitary contacts before assembling is desirable for saving plating materials.

With the construction of the contacts A whose ratch turn-up portions 1a are supported in the support grooves 3a and ratch projections 2b abut against the ratch protrusions 5a of the insulating housing B, however, it is absolutely necessary to insert the contacts A into the insulating housing B in the directions shown by arrows in Figs. 3 and 4, the directions being coincident with the directions in which mating contacts are inserted between the contacts A. As the result, the connecting pieces 6 are unavoidably arranged at the front ends of the contact elements of the contacts as shown in Fig. 5, so that the ratch turn-up portions 1a cannot be supported in the support grooves 3a because the connecting pieces 6 obstruct the turn-up portions from engaging in the support grooves 3a. Accordingly, the construction of the unitary contacts as shown in Fig. 5 cannot be employed, so that the partial plating as shown in the dotted portion in Fig. 5 is difficult resulting in high cost.

In raising the fixing piece 2c of the terminal element 2 so as to abut against the ratch protrusion 5a of the insulating housing B, a tool is inserted into the terminal element 2 and turned about a point as a fulcrum of a lever at the edge of the bottom of the U-shaped terminal element 2. In this case, the contact A having the ratch turn-up portion 1a snugly supported in

the support groove 3a is locally subjected to a turning moment perpendicular to a longitudinal direction of the contact A, so that the contact A is twisted and deformed to make it impossible to contact a mating contact element under good condition.

In order to correct any misarrangement of lead wires or change the circuits, it is desirable to make a multi contact connector so as to be able to draw the contacts connected with lead wires out of fixing apertures of the insulating housing and insert them different fixing apertures. However, after once the lead wires have been soldered to the terminal elements, the openings of the terminal elements for introducing the tool for raising or bending the fixing pieces 2c are closed by the lead wires, so that the tool cannot be inserted into the terminal elements to access the fixing pieces. Accordingly, the correction of misarrangement of the lead wires and change of the circuit cannot be easily effected.

With the arrangement shown in Figs. 1-4, moreover, the fixing aperture 5 should be sized to receive the terminal element 2 of the contact with the minimum clearance without play.

In case of the insulating housing having the contact fixing aperture 5 for receiving the terminal element 2 of the contact, however, the contact is often provided with elongately extending lugs 7a for crimping lead wires to form a crimping terminal element as shown

in Fig. 6a. Accordingly, the crimping terminal element could not be inserted into the insulating housing, because the extending lugs obstruct the terminal element from passing through the fixing aperture 5 which has been formed exactly with respect to the terminal element without play. As the result, it should be required to insert through the contact fixing apertures the lead wires one by one in a direction shown by an arrow in Fig. 6b after the extending lugs have been bent or crimped on the lead wires to eliminate the above obstruction. This fixing operation of the contacts to the insulating housing is very troublesome.

It is a principle object of the invention to provide an improved electric connector which eliminates all the disadvantages of the prior art.

In order to achieve this object, according to the invention an electric connector includes at least one elongated contact and an insulating housing for receiving the elongated contact therein; said elongated contact comprises at one end a curved contact element having at a front end a support piece extending in a longitudinal direction of said contact, at the other end a terminal element, and an elastic fixing lug integral with said contact and supported at one end on a side of said curved contact element by the contact at an intermediate portion thereof between the curved contact and terminal elements, said elastic fixing lug extending in parallel with said terminal element but

progressively extending with the other end not supported by the contact away from a surface of the contact on the same side as that of the curved side of said curved contact element with respect to said surface of the contact; and said insulating housing comprising at least one support groove opening in a direction of insertion of a mating connector and formed in a front end of an insulating wall for receiving said support piece of said contact, a lug detaching aperture for receiving said elastic fixing lug of said contact when the support piece of the contact has been received in said support groove, and a contact fixing aperture having a size permitting said elastic fixing lug deformed toward the surface of the contact to pass therethrough before said support piece of the contact has not been completely received in said support groove, thereby enabling the contact to be fixed in said insulating housing by inserting said contact thereinto until the support piece is received in said support groove.

It is preferable that the elastic fixing lug is integrally supported by a support member formed by bending a part of the contact.

It is further preferable that the lug detaching aperture diverges to facilitate accessing the elastic fixing lug after assembling the contact in the insulating housing. It is advantageous to insert a tool into the lug detaching aperture to deform the elastic fixing lug

so as to dislodge the lug from a bottom of the lug detaching aperture. In this manner, the contact connected with a lead wires is removed for correction of misarrangement of the wire and the change of circuits.

In a preferred embodiment, the insulating housing including a plurality of contacts comprises the insulating wall in the form of a rectangular shape having the support grooves equal in number to the contacts on both sides respectively in one row and an insertion positioning flange, and the insertion positioning flange is formed on both sides and on a side of the support grooves with the lug detaching apertures equal in number to the support grooves respectively in one raw and on both sides and on an opposite side of the support groove with the contact fixing apertures equal in number to the support grooves, respectively in one row thereby forming a male connector.

In another embodiment, the insulating housing including a plurality of contacts comprises the two insulating walls in the form of rectangular shape having the support grooves equal in number to the contacts respectively in one row and an insertion positioning flange common to and connecting the two insulating walls, and the insertion positioning flange is formed on both sides and on a side of said support grooves with the lug detaching apertures equal in number to the support grooves, respectively in one row,

and on both sides of the flange and on an opposite side of the support groove with the contact fixing apertures equal in number to the support grooves respectively in one row, thereby forming a female connector.

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 perspective view of a contact of a male connector of the prior art;

Fig. 2a is a schematic plan view of a male connector of the prior art;

Fig. 2b is a sectional view taken along the line IIb-IIb in Fig. 2a;

Fig. 3 is a partial sectional view of a connector of the prior art for explaining the assembling the connector;

Fig. 4 is a sectional view of a female connector of the prior art for explaining the assembling the connector;

Fig. 5 is a perspective view of unitary contacts connected by connecting pieces;

Fig. 6a is a perspective view of a contact having lugs for crimping lead wires;

Fig. 6b is a sectional view of housing for explaining the assembling the contact having the lugs shown in Fig. 6a;

Fig. 7 is a perspective view of a contact

used for the connector according to the invention;

Fig. 8 is a sectional view of an insulating housing of the connector according to the invention;

Fig. 9 is a sectional view of the male connector consisting of the contacts and the insulating housing shown in Figs. 7 and 8;

Fig. 10 is a perspective view of unitary contacts capable of being used for the connector according to the invention; and

Fig. 11 is a sectional view of a female connector using the contacts shown in Fig. 7 according to the invention.

Referring to Figs. 7-9 illustrating one embodiment of the invention, a contact A comprises a curved contact element 1 having at its front end a support piece 8 and extending in a longitudinal direction of the contact and a terminal element 2 having an elastic fixing lug 9 in parallel with the terminal element. The elastic fixing lug 9 is in the form of a substantially elongated rectangular shape in parallel with the longitudinal direction of the contact and a short side or edge of the rectangular shape on the side of the terminal element is substantially perpendicular to the longitudinal direction. However, the portion of the elastic fixing lug 9 rises progressively away from the surface of the contact. The elastic fixing lug 9 is supported at its supported portion 9b on the side of the contact element by a support member

9a which is formed by bending a part of the contact substantially perpendicularly to the surface of the contact between the curved contact element 1 and the terminal element 2.

On the other hand, an insulating housing B is formed at a front end of its insulating wall 3 in the form of a rectangular shape with support grooves 10 opening in directions of insertion of a mating connector for supporting the support pieces 8 of contacts A and formed with an insertion positioning flange 4 integral therewith. The insertion positioning flange 4 is formed with contact fixing apertures 5 which are so dimensioned as to permit the supported portions 9b of the elastic fixing lugs 9 supported by the support members 9a of the contacts to pass therethrough without large clearances. The insertion positioning flange 4 is moreover formed with lug detaching apertures 11 opening or diverging to the side of the support grooves 10 for inserting a tool into directions shown by arrows in Fig. 8.

When the contacts A are inserted with their support pieces 8 preceding into the insulating housing B from the bottom as viewed in Fig. 9, the support pieces 8 first start to enter the support grooves 10 of the housing. With further insertion of the contacts, the elastic fixing lugs 9 are urged toward the insulating wall 3 by walls of the contact fixing apertures 5 until the support pieces 8 have completely entered the support

grooves 10. When the support pieces 8 have completely entered the support grooves 10, the elastic fixing lugs 9 are released from the contact fixing apertures 5 and snap outwardly into the lug detaching apertures 11, thereby fixing the contacts A in position to the insulating housing B.

As above described, according to the invention the contacts A can be fixed to the insulating housing B by inserting the contacts A with their support pieces preceding into the fixing apertures 5 of the housing B. Accordingly, a connecting piece 6 can be provided on the sides of terminal elements of the contacts as shown in Fig. 10, instead of the sides of contact elements as shown in Fig. 5. In assembling the contacts in the insulating housing, a number of contacts A connected by the connecting piece 6 are simultaneously inserted into a number of contact fixing apertures of the insulating housing B, and then the connecting piece 6 is removed from the contacts A by cutting along a dot line in Fig. 10. This arrangement of the contacts shown in Fig. 10 facilitates the partial plating of the contacts to lower the manufacturing cost.

According to the invention, when the elastic fixing lugs 9 of the contacts have passed through the contact fixing apertures 5 of the insulating housing, the elastic fixing lugs 9 freely snap outwardly to fix the contacts in position in conjunction with the support pieces 8 in the support grooves 10 of the housing.

Accordingly, there is no risk of the undue deformation of the contacts causing poor connection between the contacts of connector, due to the use of the tool required in the prior art above described. According to the invention, moreover, in removing the contacts from the insulating housing, the elastic fixing lugs 9 are urged toward the insulating wall 3 and detached from the lug detaching apertures 11 by a tool inserted in the apertures 11 on the side of inserting a mating connector. It is not required to insert a tool from the side of the terminal elements as required in the prior art. Even after lead wires have been connected to the terminal elements of the contacts, the contacts can be easily removed from the insulating housing to provide for the correction of misarrangement of the wire and the change of circuits.

According to the invention, moreover, as the contacts A are inserted into the housing B from on the side opposite to the mating connector, the terminal elements 2 of the contacts are allowed to be fairly larger than the contact fixing apertures 5. All that is required for the apertures 5 is that they allow the elastic fixing lugs 9 deformed toward the insulating wall 3 to pass through the apertures 5. Insulating housings having contact fixing apertures substantially the same in shape and size can be used commonly to various kinds of connectors such as those having soldered or clamped lead wires. Therefore, the number

of parts of connectors is reduced so as to decrease the manufacturing cost. In this manner, all the disadvantages of the prior art can be eliminated.

Although the above has been explained with male connectors, the same holds true in female connectors. Fig. 11 illustrates a female connector mating with the male connector shown in Fig. 9. This female connector comprises insulating walls on both sides and an insertion positioning flange 4 common to the insulating walls. It will not be described in further detail since the insulating walls and the insertion positioning flange of the female connector shown in Fig. 11 are substantially the same as those of the male connector shown in Fig. 9.

According to the invention, moreover, the insulating housing is formed in the insulating wall 3 with support grooves 10 opening in the directions of insertion of a mating connector for holding front ends of contact elements of contacts. A distance to be insulated between the front ends of the contacts in opposition to each other through the insulating wall 3 becomes longer than those of the prior art which is clear in comparison of Fig. 9 with Fig. 3 wherein the ratch turn-up portion 1a of the front end of the contact element 1 is received in the support groove 3a in the front end of the insulating wall 3.

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. An electric connector including at least one elongated contact and an insulating housing for receiving the elongated contact therein; said elongated contact comprising at one end a curved contact element having at a front end a support piece extending in a longitudinal direction of said contact, at the other end a terminal element, and an elastic fixing lug integral with said contact and supported at one end on a side of said curved contact element by the contact at an intermediate portion thereof between the curved contact and terminal elements, said elastic fixing lug extending in parallel with said terminal element but the other end not supported by the contact being progressively extending away from a surface of the contact on the same side as that of the curved side of said curved contact element with respect to said surface of the contact; and said insulating housing comprising at least one support groove opening in a direction of insertion of a mating connector and formed in a front end of an insulating wall for receiving said support piece of said contact, a lug detaching aperture for receiving said elastic fixing lug of said contact when the support piece of the contact has been received in said support groove, and a contact fixing aperture having a size permitting said elastic fixing lug deformed toward the surface of the contact to pass therethrough before said support piece of the contact

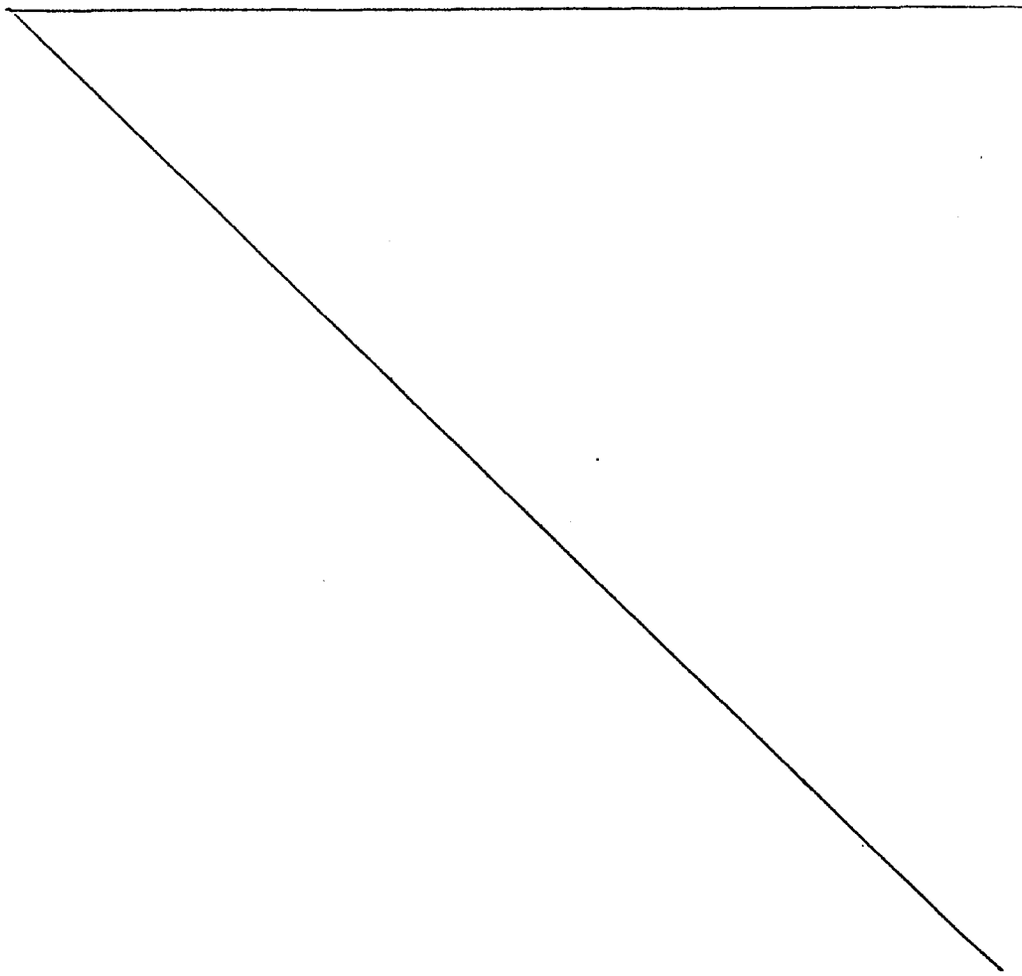
has not been completely received in said support groove, thereby enabling the contact to be fixed in said insulating housing by inserting said contact thereinto until the support piece is received in said support groove.

2. An electric connector as set forth in claim 1, wherein said elastic fixing lug is integrally supported by a support member formed by bending a part of the contact.

3. An electric connector as set forth in claim 1, wherein said elastic fixing lug is in the form of a substantially elongated rectangular shape whose short side on a side of the terminal element is substantially perpendicular to the longitudinal direction of said contact to snugly seat at a bottom of said lug detaching aperture.

4. An electric connector as set forth in claim 1, wherein said lug detaching aperture diverges to facilitate accessing said elastic fixing lug after assembling said contact in the insulating housing.

5. An electric connector as set forth in claim 1, wherein said insulating housing including a plurality of contacts comprises said insulating wall in the form of a rectangular shape having said support grooves equal in number to said contacts on both sides respectively in one row and an insertion positioning flange, and said insertion positioning flange is formed on both sides and on a side of said support grooves with said lug detaching apertures equal in number to said support grooves respectively in one row and on both sides and on an opposite side of said support groove with said contact fixing apertures equal in number to said support grooves, respectively in one row thereby forming a male connector.



6. An electric connector as set forth in claim 1, wherein said insulating housing including a plurality of contacts comprises said two insulating walls in the form of rectangular shape having said support grooves equal in number to said contacts respectively in one row and an insertion positioning flange common to and connecting said two insulating walls, and said insertion positioning flange is formed on both sides and on a side of said support grooves with said lug detaching apertures equal in number to said support grooves respectively in one row, and on both sides of said flange and on an opposite side of said support groove with said contact fixing apertures equal in number to said support grooves respectively in one row, thereby forming a female connector.

FIG_1
PRIOR ART

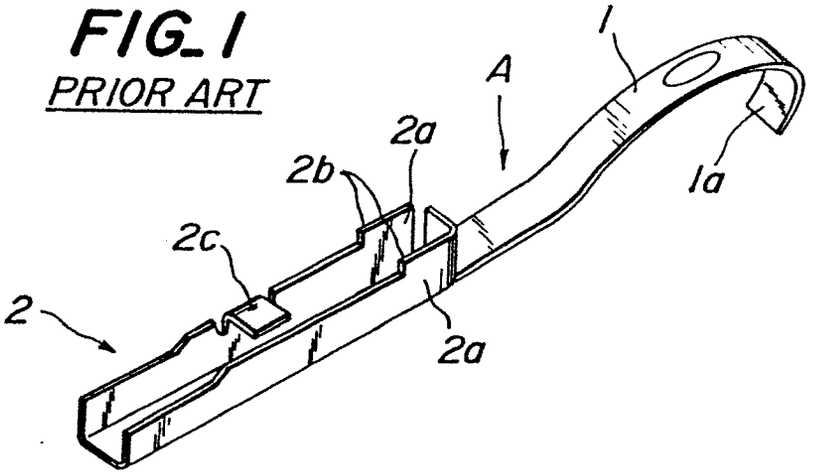


FIG_2a
PRIOR ART

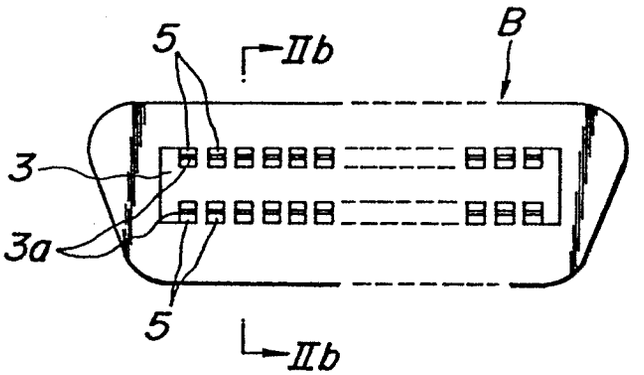


FIG_2b
PRIOR ART

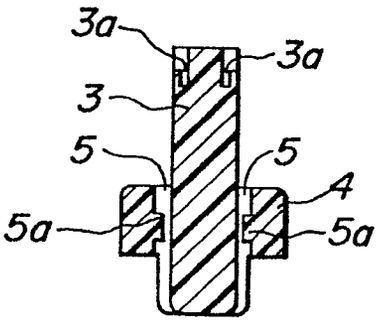


FIG_3
PRIOR ART

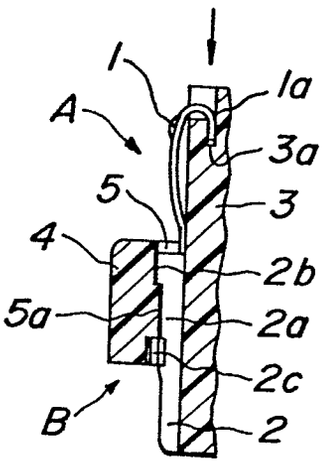


FIG_4
PRIOR ART

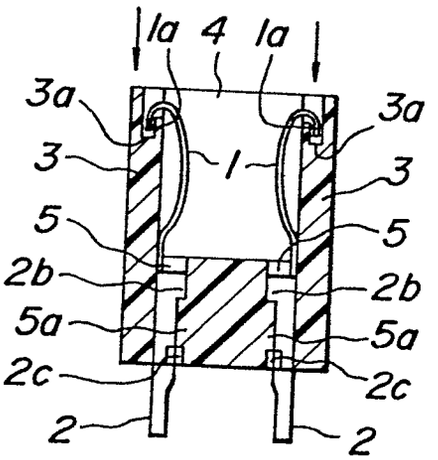


FIG_5

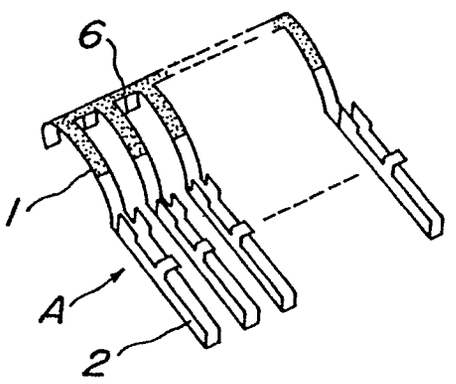


FIG_6a
PRIOR ART

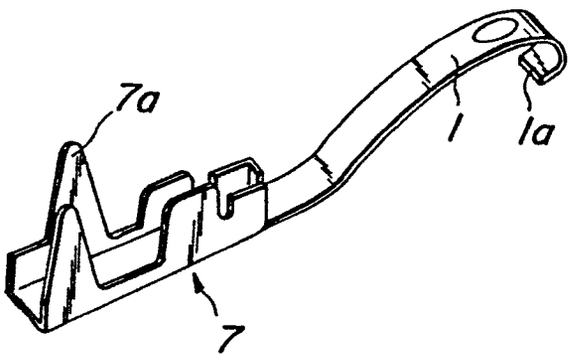


FIG_6b
PRIOR ART

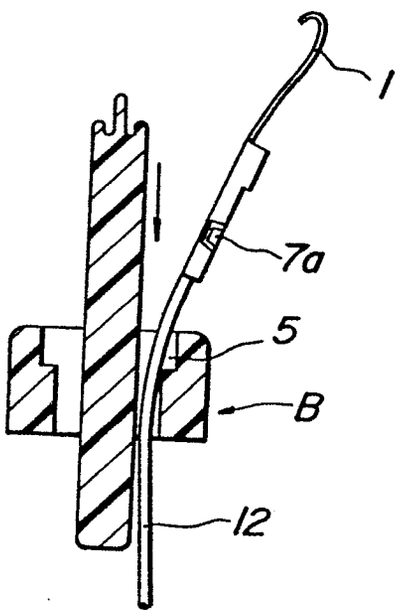


FIG_7

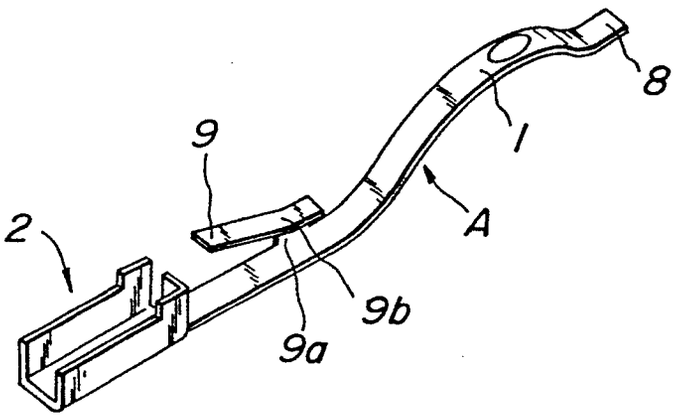


FIG_8

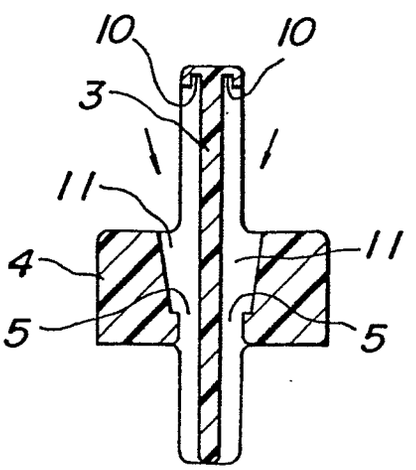


FIG_9

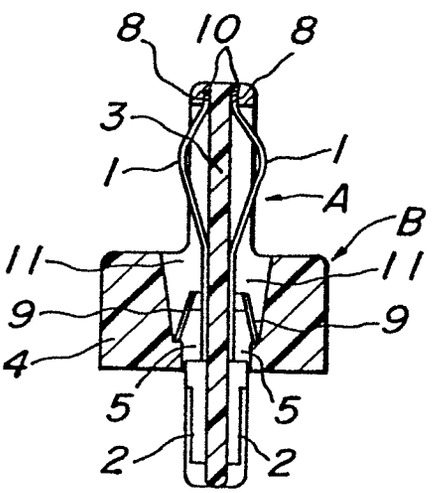


FIG_10

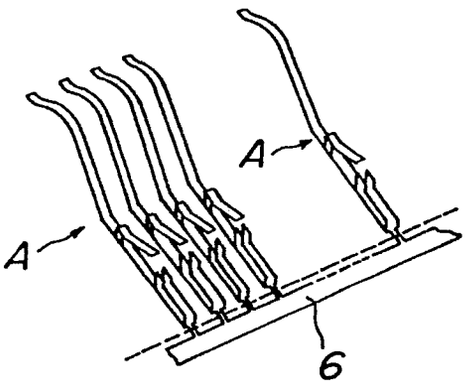


FIG_11