(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 258 414 B1**

(12) # EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification: **08.01.92 Bulletin 92/02**

(51) Int. Cl.^{5}: **H01R 13/52**

(21) Application number: **87901947.9**

(22) Date of filing: **25.02.87**

(86) International application number: **PCT/US87/00401**

(87) International publication number: **WO 87/05157 27.08.87 Gazette 87/19**

(54) **HOUSING ASSEMBLY FOR WATER SEAL CONNECTOR.**

(30) Priority: **25.02.86 JP 38377/86**
26.05.86 JP 119102/86

(43) Date of publication of application: **09.03.88 Bulletin 88/10**

(45) Publication of the grant of the patent: **08.01.92 Bulletin 92/02**

(84) Designated Contracting States: **BE CH DE FR GB IT LI LU NL SE**

(56) References cited:
EP-A- 0 072 104
US-A- 3 784 959

(73) Proprietor: **THOMAS & BETTS CORPORATION**
920 Route 202
Raritan New Jersey 08869 (US)

(72) Inventor: **SONOBE, Toshimitsu**
2-15-5, Todoroki Setagaya-ku
Tokyo 158 (JP)
Inventor: **YAMAMOTO, Masahiro**
117-1, Sasanodai Asaki-ku
Yokohama Kanagawa 241 (JP)

(74) Representative: **Howick, Nicholas Keith et al**
CARPMAELS & RANSFORD 43 Bloomsbury Square
London WC1A 2RA (GB)

EP 0 258 414 B1

Description

This invention relates to a housing assembly for use in a water seal connector.

Recently, many electronic devices have been designed with connectors for the purpose of electrically coupling multiple wires of moduled or packaged members. This design was developed for the purpose of convenience in exchanging members needing repair, or for inserting optional members, or in deference to the spatial arrangement of members. This type of design disadvantageously results in a number of problems in certain operating environments.

For example, in the case of usage in environments subject to flooding or high humidity, it is necessary to provide a water seal to function with the said connector. Generally, in connectors with water seals, the working efficiency of electrical connections is less than optimal, presenting problems.

A sealed electrical connector is shown in EP-A-0072104. This connector includes a sealing member having holes through which conductors pass, the holes being arranged in a pattern to correspond with passageways in the connector. However, there is no discussion or appreciation of how to deal with a problem of positioning of the sealing member for proper alignment, or of distortion of the sealing member, as contacts are inserted. US-A-3784959 shows registration of a hard dielectric member with a connector casing using pins, but does not address the problem of deformation of a soft sealing member when connectors are inserted.

According to the invention, there is provided a housing assembly for use in a water seal connector, comprising:

a readily deformable rubber bush having a through hole for inserting a contact therethrough, and

a housing for defining a cavity therein for receiving and sealably holding said rubber bush;

wherein said housing has at least one hole at the bottom of said cavity arranged to be in alignment with said hole in said bush, said hole being adapted to receive and hold said contact; said cavity has a plurality of projections on a surface of the bottom thereof; and said rubber bush has a plurality of recesses on a side surface thereof adjacent to the surface of the bottom, said recesses co-operating with said projections to prevent distortion of said hole in said bush and thereby maintain the alignment of said hole with the hole in said housing when the contact is inserted through the through hole of said rubber bush.

By way of example, one embodiment of a connector according to the invention will now be described with reference to the accompanying drawings, in which:-

Fig. 1 is an exploded view of a connector showing an embodiment of the present invention;

Fig. 2 is a cross-sectional view showing the connection configuration of the connector illustrated in Fig. 1;

Fig. 3 is an exploded view showing a cap housing of the connector illustrated in Fig. 1;

Fig. 4A is a partially cutaway view showing a receptacle contact of the connector;

Fig. 4B is a view taken on line A-A of Fig. 4A.

Fig. 5A is an exploded view showing another embodiment of the receptacle contact according to the present invention;

Fig. 5B is a cross-sectional view showing one configuration of the receptacle contact; and

Fig. 6 is a perspective view showing a rear side of a rubber bush.

The water sealed connector, as shown in Figure 1, comprises multiple, generally tubular bodied receptacle contacts (10) terminating to a wire (100); multiple plug housings (20) housing the receptacle contacts; a cap housing (30) equipped with multiple pin contacts (200) that electrically connect with the receptacle contacts and receive the multiple plug housings.

Furthermore, in the plug housing, housing holes (21) have been drilled to hold the multiple receptacle contacts in place. In addition, in the cap housing, multiple pin contacts have been placed in an arrangement so as to be in alignment with receptacle contacts inside the cavity (31) designed to accept the plug housing.

Each receptacle contact is maintained in place in the housing hole (21) after insertion through the through hole (41) of the rubber bush (40) that is fixedly inserted into the plug housing.

Pin contacts protrude after insertion through the bottom of the cavity of the cap housing. The protrusions form a terminal and connect to a printed circuit board, for example.

Figure 2 is a cross-section of the connected plug housing and cap housing, showing receptacle and pin contact, establishing electrical flow.

With reference to Figure 4a, the receptacle contact connects at its tip with the ferrule (sleeve) (14) to form a stepped portion (13). In the housing hole (21) inside the plug housing, as shown in Figure 2, the ferrule engages with a lance-shaped member (22), a pair of top and bottom spear-shaped projections being disposed in the housing hole.

The stepped portion (13) is formed in one of two alternatives. One is to bend back the top area of the contact itself. The other is to enlarge the material of the end tip of the contact.

The lance (22) has a spear-like shape, with its tip a free end terminal along the part of the side wall of the housing hole towards the shaft direction of said hole. The lance tip engages with the stepped portion of the ferrule and serves to hold the receptacle contact inside the housing hole.

In further reference to Figure 1, a rubber bush

(40) preferably composed of heat resistant silicone rubber penetrated with oil to reduce insert resistance is provided. The side wall of the rubber bush has a number of integral ridges (43) that function as seal rings to provide sealing.

In this Figure, multiple projections (24) are disposed at the bottom of the cavity (23) of the plug housing which accepts the rubber bush (40). As will be mentioned later, these projections facilitate easy insertion of the contacts into through holes.

Furthermore recesses (42) are formed on the rubber bush side, cooperating with and connecting to the projections. Figure 6 represents a rubber bush with recesses for contact with projections, as shown.

It is preferable to arrange the projections in a regular pattern around the contact holes. However, in this invention, such pattern is not always necessary. Also, the height of the projections need not be uniform, but may vary.

Furthermore, in this invention, the recesses in the rubber bush are not limited in number or in depth. Recesses without corresponding projections can be provided as well.

Now referring to Figure 1, the numeral (25) represents a locking spring built into the top of the plug housing. The locking spring, composed of metal, is designed in the shape of an "s" as shown in Figure 2. One side of the "bent" end (25b) is designed to be fitted into the groove (26) built into the top of the housing. The other "bent" end of the locking spring (25a) functions as a handle. When the plug housing is inserted into the cavity of the cap housing, while simultaneously pushing down the "bent" of the locking spring, an opening latch (27) built into the side of the spring, engages the latch projection (32) built into the upper part of the inside wall of the cavity area.

Both sides of the locking spring are flanked by guiding walls (28). These are designed to eliminate problems such as wires interfering with the spring when inserting the plug housing into the cap housing.

Furthermore, the guiding walls function to determine the insert direction of the plug housing, eliminating any mistakes in insertion direction.

The height of these guiding walls is higher in the area of the handle. The guiding walls, likewise, efficiently prevent wire tangle even though the distance for the spring snap back is considerable.

In Figure 1, the numeral (50) represents a seal ring, preferably composed of heat resistant silicone rubber and coated with oil in the fashion as the rubber bush.

Figure 3 presents a exploded view of the cap housing, with multiple pin contacts arranged alternately in a staggered pattern of three rows. As shown in Figure 3, each pin contact protrudes from a through capacitor (33). One side of the pole of the through capacitor is soldered onto the grounding plate (34) that covers the back of the cap housing. This capacitor functions as a filter to prevent external electrical noise.

Element (35) functions to align the leads of the pin contacts, as is well known.

Figure 4A and Figure 4B show an example of receptacle contact in the usage of this invention.

Numeral (10a) shows the generally tubular conductive main body. The main body is tubular to facilitate insertion of the contact with ease. The design also allows for a more dense concentration of contacts within the housing.

Numeral (11) is a means to electrically connect the wire to the connector. In this example as shown by the figure, the wire is fixed by pressure, such as crimping.

The main body of contact (10a) and the means (11) have a tapered area to facilitate removal of the contact from a housing hole.

Numeral (12) is a connecting device for terminals and pins such as on printed circuit board or similar connections. In Figure 1, connecting device (12) comprises at least a pair of leaf springs with free ends defined by a groove along the direction of the main core shaft of the mainbody. The tips of the pair of leafsprings are staggered towards each other as shown in Figure 4A. The pin contacts receptacle contact in two steps, facilitating insertion. Even if the pin is not aligned with the spring, the spring will still receive the pin. Furthermore, it will eliminate permanent distortion of the spring due to over stress of the spring.

Numeral (14) represents the ferrule (sleeve) covering the tip of the main body. The corner, namely the tip of the ferrule, is beveled, as shown in Figure 4A, so as to minimize damage to the rubber bush (40) when inserting the contact into the through hole (41).

The ferrule has a notch (14a) on its side wall designed to position it to the main body.

The ferrule, being of material different from the mainbody material, functions to strengthen the tip of the contact mainbody. In this invention, as previously mentioned, the stepped portion (13) made by the ferrule and the mainbody, serves as a stopping device for the lance set up in the housing hole of the housing.

As shown in Figure 5B, when notch (14a) is positioned on the side wall of the mainbody along with the stepped portion, the ferrule will be held in deeper by the lance. This will ensure the connection of the two and strengthen the contact.

Having described the preferred embodiments of the invention, its advantages and benefits should now be appreciated. In the housing assembly of this invention, the projections, set at the bottom of the cavity of the housing accepting the rubber bush, function so as to prevent distortion of the holes when the contact end of the wire is inserted through the through hole of rubber bush. Consequently, the contact is easily inserted into the through hole despite the arrangement of the

holes or the size of the wire to be connected. As a result, less effort is required. Accordingly, the preferred embodiments are provided in an illustrative rather than in a limiting sense, the true scope of the invention being set forth in the claims appended hereto.

Claims

1. A housing assembly for use in a water seal connector comprising,

a readily deformable rubber bush (40) having a through hole (41) for inserting a contact (10) therethrough, and

a housing (20) for defining a cavity (23) therein for receiving and sealably holding said rubber bush;

wherein said housing has at least one hole (21) at the bottom of said cavity arranged to be in alignment with said hole (41) in said bush, said hole (21) being adapted to receive and hold said contact; said cavity has a plurality of projections (24) on a surface of the bottom thereof; and said rubber bush has a plurality of recesses (42) on a side surface thereof adjacent to the surface of the bottom, said recesses co-operating with said projections to prevent distortion of said hole (41) in said bush and thereby maintain the alignment of said hole (41) with the hole (21) in said housing when the contact is inserted through the through hole (41) of said rubber bush.

2. A housing assembly according to Claim 1, wherein plural projections are provided in the vicinity of each opening of the housing hole (21).

3. A housing assembly according to Claim 2, wherein said projections are arranged oppositely each other with the opening of said housing hole (21) therebetween.

4. A housing assembly according to Claim 1, wherein said projections are uneven in shape.

5. A housing assembly according to Claim 1, wherein some of said recesses are unused ones that are not engaged with said projections.

6. A housing assembly according to Claim 1, wherein said recesses are uneven in shape.

7. A housing assembly according to Claim 1, wherein there are a plurality of holes (21) in said housing in alignment with a plurality of through holes (41) in said rubber bush, and wherein there are plural projections adjacent each hole (21).

Patentansprüche

1. Eine Gehäuseanordnung zur Verwendung in einem wasserdichten Verbinder mit

einer leicht verformbaren Gummibuchse (40) mit einem durchgehenden Loch (41) zum Einschieben eines Kontaktes (10) und

einem Gehäuse (20) zum Ausbilden eines Innenraumes (23) zur Aufnahme und zum dichten Halten der Gummibuchse,

wobei das Gehäuse am Boden des Innenraumes mindestens ein mit dem Loch (41) in der Buchse ausgerichtetes Loch (21) aufweist und das Loch (21) zum Aufnehmen und Halten des Kontaktes bestimmt ist; der Innenraum auf einer Oberfläche seines Bodens mehrere Vorsprünge (24) aufweist; die Gummibuchse auf einer Seitenfläche an der Oberfläche des Bodens mehrere Ausnehmungen (42) aufweist und die Ausnehmungen zum Verhindern eines Verdrehens des Loches (41) in der Buchse mit den Vorsprüngen zusammenarbeiten und damit die Ausrichtung des Loches (41) mit dem Loch (21) in dem Gehäuse bei einem Einschieben des Kontaktes durch das durchgehende Loch (41) der Gummibuchse mit den Vorsprüngen aufrechterhalten.

2. Eine Gehäuseanordnung nach Anspruch 1, wobei in der Nähe jeder Öffnung des Gehäuseloches (21) mehrere Vorsprünge vorgesehen sind.

3. Eine Gehäuseanordnung nach Anspruch 2, wobei die Vorsprünge einander gegenüber mit dazwischen befindlicher Öffnung des Gehäuseloches (21) angeordnet sind.

4. Eine Gehäuseanordnung nach Anspruch 1, wobei die Vorsprünge in ihrer Form ungleich sind.

5. Eine Gehäuseanordnung nach Anspruch 1, wobei einige der Ausnehmungen unbenutzte sind, die mit den Vorsprüngen nicht in Anlage stehen.

6. Eine Gehäuseanordnung nach Anspruch 1, wobei die Ausnehmungen in ihrer Form ungleich sind.

7. Eine Gehäuseanordnung nach Anspruch 1, wobei mehrere Löcher (21) in dem Gehäuse mit mehreren der durchgehenden Löcher (41) in der Gummibuchse ausgerichtet und wobei mehrere Vorsprünge an jedem Loch (21) angeordnet sind.

Revendications

1. Ensemble de boîtier destiné à être utilisé dans un connecteur étanche à l'eau, comprenant

un manchon en caoutchouc aisément déformable (40) possédant un trou traversant (41) permettant l'insertion d'un contact (10) à travers lui, et

un boîtier (20) servant à définir en lui-même une cavité (23) destinée à recevoir et retenir d'une manière étanche ledit manchon de caoutchouc;

et dans lequel ledit boîtier possède au moins un trou (21) situé dans le fond de ladite cavité et agencé de manière à être aligné avec ledit trou (41) situé dans ledit manchon, ledit trou (21) étant adapté pour recevoir et retenir ledit contact; ladite cavité possède une pluralité de parties saillantes (24) sur une surface de son fond; et ledit manchon en caoutchouc possède une pluralité de renfoncements (42) sur l'une de ses surfaces latérales adjacente à la surface du fond, lesdits renfoncements coopérant avec lesdites

parties saillantes pour empêcher une déformation dudit trou (41) situé dans ledit manchon et maintenir de ce fait l'alignement dudit trou (41) avec le trou (21) situé dans ledit boîtier lors de l'insertion du contact à travers le trou traversant (41) dudit manchon en caoutchouc.

2. Ensemble de boîtier selon la revendication 1, dans lequel une pluralité de parties saillantes sont disposées au voisinage de chaque ouverture du trou (21) du boîtier.

3. Ensemble de boîtier selon la revendication 2, dans lequel lesdites parties saillantes sont disposées dans des positions réciproquement opposées, de part et d'autre de l'ouverture dudit trou (21) du boîtier.

4. Ensemble de boîtier selon la revendication 1, dans lequel lesdites parties saillantes possèdent une forme irrégulière.

5. Ensemble de boîtier selon la revendication 1, dans lequel certains desdits renfoncements sont des renfoncements non utilisés dans lesquels ne s'engage aucune partie saillante.

6. Ensemble de boîtier selon la revendication 1, dans lequel lesdits renfoncements possèdent une forme irrégulière.

7. Ensemble de boîtier selon la revendication 1, dans lequel il est prévu, dans ledit boîtier, une pluralité de trous (21) alignés avec une pluralité de trous traversants (41) ménagés dans ledit manchon en caoutchouc, et dans lequel il est prévu une pluralité de parties saillantes adjacentes à chaque trou (21).

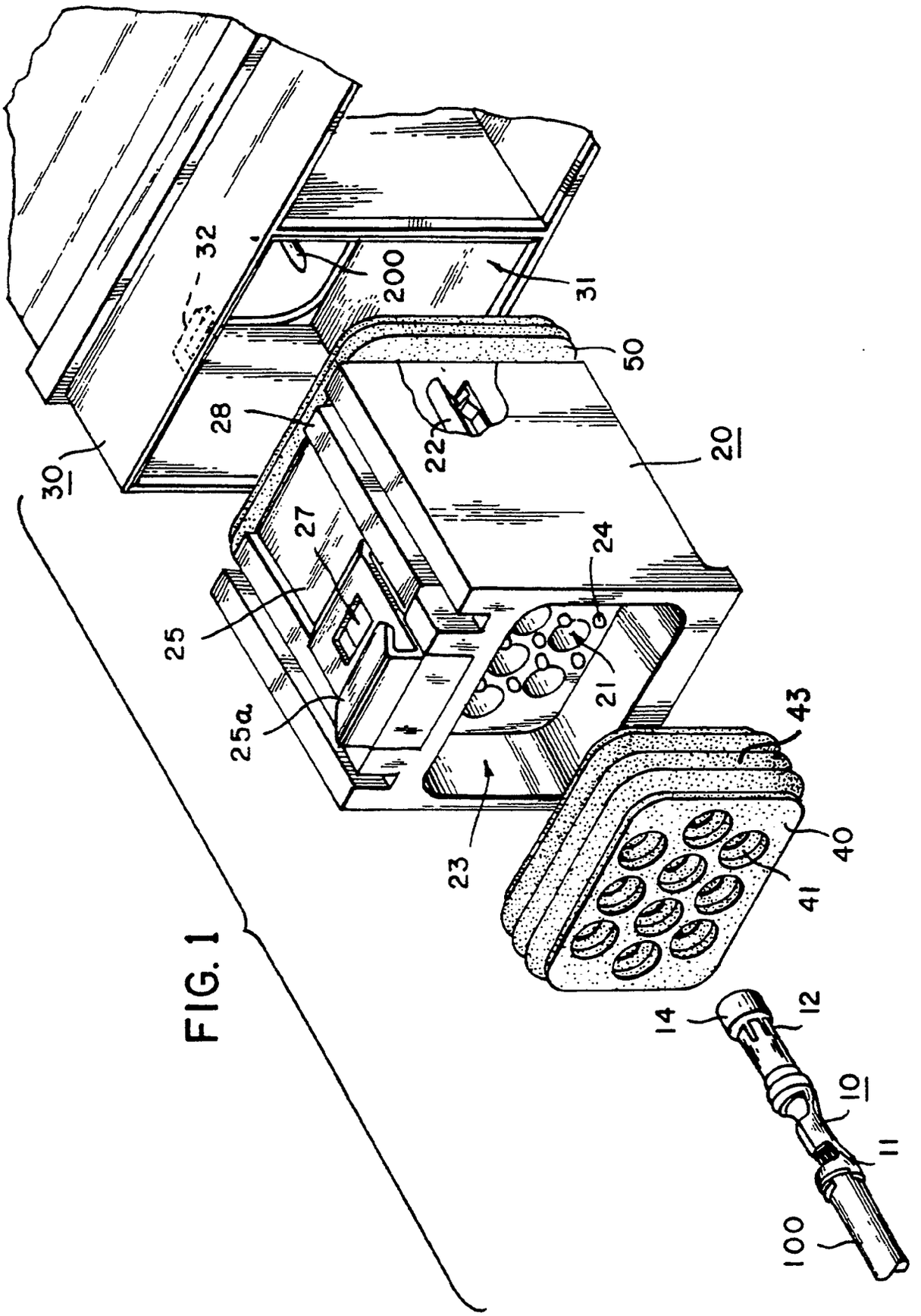

FIG. 1

FIG. 2

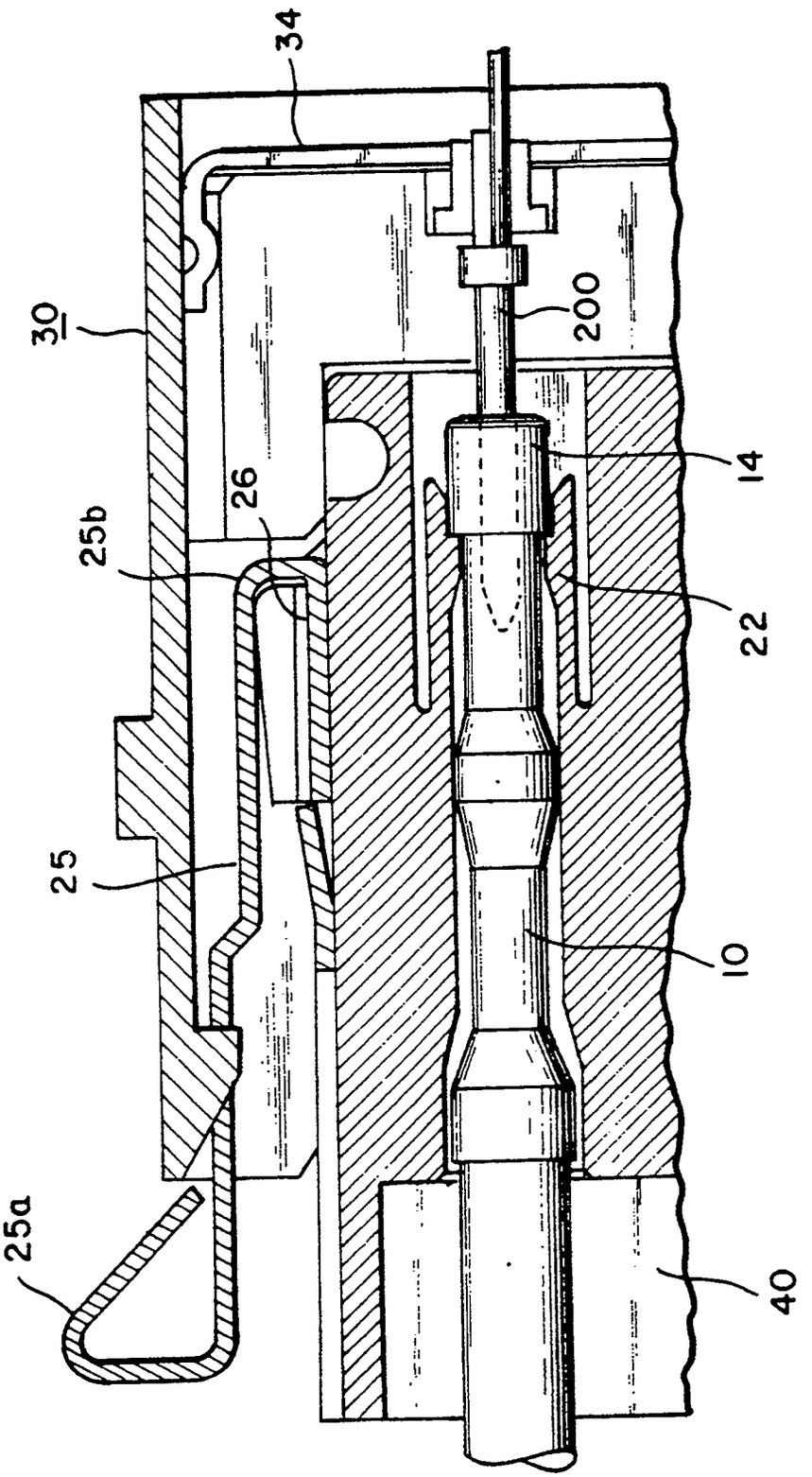

FIG. 3

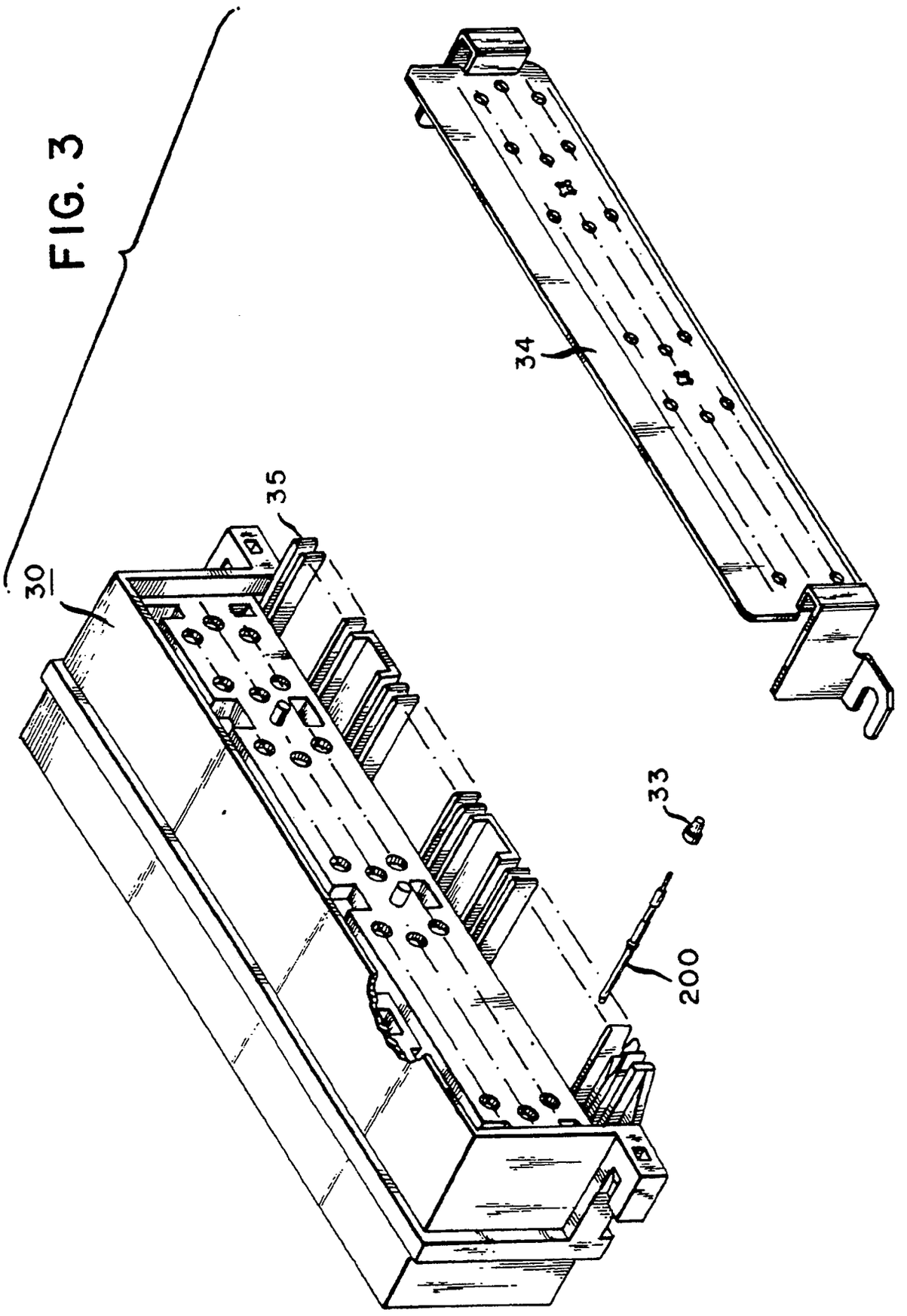

FIG. 4a

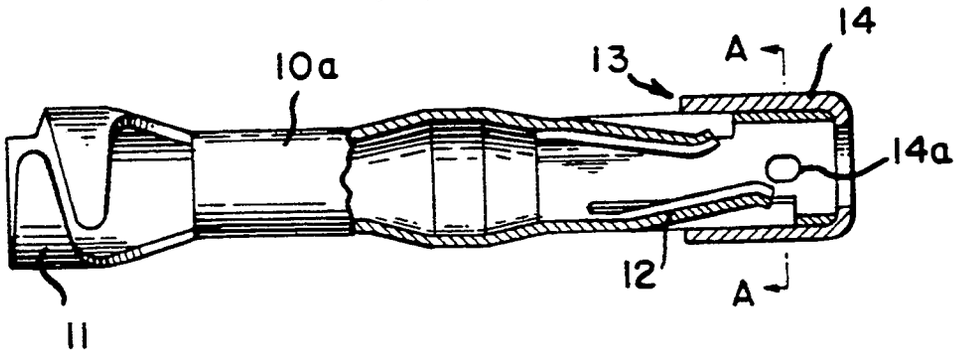

FIG. 4b

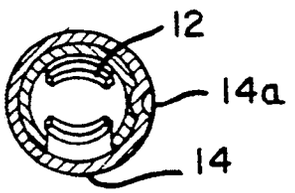

FIG. 5a

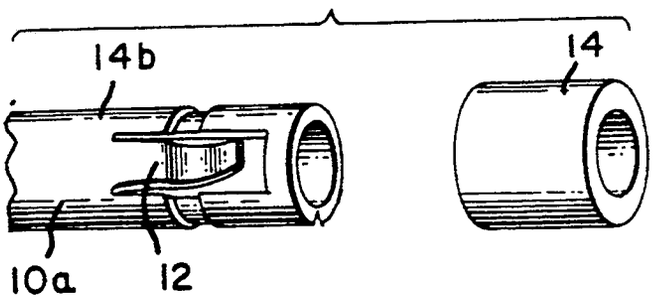

FIG. 5b

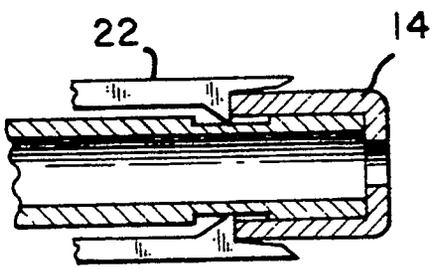

FIG. 6