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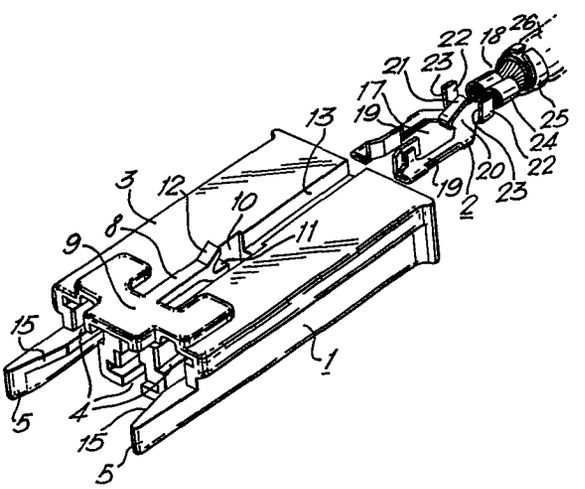
(54) Electrical connector and contact receptacle.

(57) An electrical connector comprises a slab like insulating housing (3) having three parallel through passageways (4) communicating with pin-receiving apertures defined by slots in a lower side of the housing (3). Fork-like contact receptacles (2) are received in respective passageways (4) to engage laterally or axially with complementary pins received through the slots. A resilient latch arm (8) on the housing is arranged to engage the head of a pin to resist lateral withdrawal of the connector. Extensions (5) at a forward end of the housing serve to guide the connector into lateral engagement with a pin-cluster.



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Electrical Connector and Contact Receptacle.

This invention relates to an electrical connector and to a contact receptacle for such connector and is particularly concerned with so-called cluster block connectors utilised in effecting releasable electrical connection to hermetically sealed motors of refrigerator units.

Generally, electrical connection through a hermetically sealed enclosure is effected through a cluster of three conductive pins mounted in a ceramic disc secured within a metal annulus which is welded to the hermetic container at an aperture. Releasable connection to the pins is effected by a connector having pin-receptacle contacts suitably arranged to engage the pins. Difficulties are presented in that access to the pins is generally restricted and, due to the nature of the motor and compressor unit, the connection is subject to vibration and adverse atmospheric environment.

Commonly used connectors are adapted for axial connection with the pins but this requires access space above the pins.

It is an object of the invention to provide a connector capable of axial or lateral engagement with the pins and to provide an improved contact receptacle for use in such a connector.

An electrical connector according to the present invention comprises a slab-like insulating housing having a plurality of through passageways open at opposite ends of the housing and having pin receiving apertures at a side face of the housing communicating with respective passage-

ways, each passageway containing an electrical contact receptacle having a receptacle portion registering with the pin-receiving aperture and a conductor terminating portion connected to a conductor wire extending from an open end of the passageway and is characterised in that the pin receiving apertures extend to the open ends of the passageways opposite the ends through which the conductor wires extend, and the receptacle portions of the contact receptacles each comprise a pair of resilient arms extending lengthwise of the associated passageway for receipt of a pin through the associated aperture between them. The arms at facing end portions having opposed contact surfaces which diverge towards adjacent open ends of the passageways whereby the connector may be engaged laterally or axially with complementary pins.

The invention also includes an insulating housing for such a connector which is characterised by the pin-receiving apertures extending to the open ends of the passageways at one end of the housing whereby pins may be entered into the passageways either laterally through the open ends or axially through the apertures.

In one embodiment, the housing at one of the passageways is formed with a resilient latch arm extending rearwardly from a forward end at which it is integrally formed with a bridge extending over the passageway, the free end of the arm projecting into the passageway through a slot and having a rear facing shoulder adapted to engage the head of a pin extending transversely of the passageway to resist lateral disengagement of the connector.

Suitably the housing is formed at its forward end with a pair of side extensions which are chamfered on the facing surfaces to provide a rearwardly convergent pin-guide.

In a connector for a three pin arrangement, the housing is suitably provided with three passageways, the

outer pair being located upwardly of the central passageway whereby the central contact receptacle is arranged to engage a complementary pin further from the head of the pin than the receptacles of the outer pair. Suitably the outer pair of passageways are adapted to accommodate their contact receptacles in inverted relationship to that of the central passageway whereby a reduced height to the connector is obtained.

The invention further includes a contact receptacle for such a connector comprising a receptacle portion extending forwardly from a wire connecting section and being stamped and formed from sheet metal stock, the receptacle section being of fork-like form having a pair of resilient arms extending forwardly from a plate-like mounting section, characterised in that the arms are of double metal thickness formed by folds extending along outer sides of the arms, flanges being folded up between the arms from the underside layer at the forward ends of the arms to define opposed contact faces.

Suitably the flanges are supported on their remote sides by support flanges turned up from the upper layers of the arms.

The contact flanges at forward portions are formed with divergent portions presenting a flared entry, and transversely of the arms the contact flanges are suitably dished to present arcuately convex facing contact surfaces.

To facilitate the folding of the arms, the outer sides are suitably apertured along the fold.

For retention purposes in the complementary housing, the contact is formed between the arms with a resilient detent turned back from a forward end of the plate-like mounting section, and a pair of ears extend upwardly from opposite sides of the mounting section to provide shoulders opposed to the detent.

The invention will now be described, by way of

example, with reference to the accompanying partly diagrammatic drawings in which:-

Figure 1 is a perspective view of a connector housing and a contact receptacle arranged for insertion into a housing passageway;

Figure 2 is a plan view of the housing of Figure 1;

Figure 3 is an underside view of the housing of Figure 1;

Figure 4 is a sectional elevation taken on the line 4-4 of Figure 2, viewed in the direction of the arrows, and with a contact receptacle in position;

Figure 5 is a sectional elevation taken on the line 5-5 of Figure 2, viewed in the direction of the arrows and with a contact receptacle in position;

Figure 6 is an end view taken from the right hand of Figure 4, but with the contact removed;

Figure 7 is an end view taken from the left hand of Figure 4, but with the contact removed;

Figure 8 is a sectional elevation corresponding to Figure 4 but with the connector engaging a pin cluser mounted in the wall of an hermetic enclosure;

Figure 9 is a plan view of a contact receptacle corresponding to that of Figure 1 but prior to connection to a conductor wire;

Figure 10 is a side elevation of the contact receptacle of Figure 9; and

Figure 11 is a section taken on the line 11-11 viewed in the direction of the arrows.

The connector of Figure 1 comprises a slab-like insulating housing 1 as shown in Figures 2 to 7 adapted to receive three contact receptacles 2 shown in greater detail in Figures 9 to 11.

The housing 1 is suitably moulded from a resilient insulating material, and comprises a generally rectangular slab-like body 3 having three parallel, open-ended passage-

ways 4 extending between opposite ends, and formed at a forward end with a pair of side extensions 5. On its underside, as seen in Figure 3, the body is formed with slots 6 and 7 extending rearwardly from the forward end, the slots communicating with respective passageways 4 to define pin-entry apertures. The central slot 6 extends rearwardly further than the side slots 7. On its upper side as seen in Figures 1, 2 and 4, the body 3 is formed with a central resilient latch arm 8 extending rearwardly from a bridge 9 at the forward end of the body. The latch arm 8 projects into a slot 10 communicating with the central passageway 4 and terminates at its rear end forwardly of but generally opposite the rear end of the slot 6. At its free rear end the latch arm 8 is formed with a downwardly projecting shoulder portion 11 and an upwardly extending ear portion 12, the shoulder portion 11 presenting a rear facing shoulder spaced forwardly of the rear end of slot 10 and the ear portion 12 projecting outwardly of the slot 10. A groove 13 extends rearwardly from the rear of slot 10 in the upper surface of the body 3, to the rear end of the body 3.

As seen in the end views of Figures 6 and 7, the passageways 4 are of generally T-section having a broad stem portion and a thin head portion, the T-section of the central passageway 4 being inverted and positioned below the outer passageways 4. Towards its rear end, each passageway 4 is formed with a contact retaining shoulder 14 facing forwardly, the shoulder in the central passageway being in the roof of the passageway and those of the outer passageways 4 in the floor.

As seen in Figures 1 to 3, the forward side extensions 5 are chamfered on their facing sides at 15 to define a rearwardly convergent path to the outer sides of the outer slots 7, and, as seen in Figure 3, the forward wall of the body 3 bordering the slot 6 at its forward end

is formed with convergent surfaces 16 defining a guide into the slot 6.

The contact receptacle 2, as seen in Figure 1, comprises a receptacle portion 17 extending forwardly from a wire connecting section 18, and is suitably stamped and formed from sheet metal. The receptacle section 17 is of fork-like form having a pair of resilient arms 19 extending forwardly in spaced parallel manner from a plate-like mounting section 20, with the wire connecting section 18 extending from a rear of the section 20. The wire connecting section and the mounting section 20 are of single metal thickness but the arms 19 are of double metal thickness. At a forward end the section 20 is formed between the arms 19 with an upwardly and rearwardly extending latching detent 21, and rearwardly of the detent 21 at opposide sides ears 22 are folded up to present forward facing shoulders 23 opposed to the latching detent 21. The wire connecting section comprises a conventional wire crimp ferrule 24 and insulation support ferrule 25, initially of U-form as shown in Figures 9 and 10, and secured by crimping to the core and insulation of insulated conductor wire 26.

The arms 19 comprising a double metal thickness are formed by folding at outer sides of the arms to define an underside metal layer, and to facilitate the folding, apertures 27 are formed at central portions of the fold lines. At the forward ends of the arm, flanges 28 are folded up from the underside layer, as seen most clearly in Figure 11, to define opposed contact surfaces 29. Smaller flanges 30 are folded up from the inner edges of the upper metal layer to support the rear sides of the flanges 28. The flanges 28 at their forward ends 31 are folded outwardly in divergent manner, as seen most clearly in Figure 9, to provide a convergent pin-entry into the contact zone between the opposed contact faces 29. The flanges 28, as seen in

Figure 11, are also dished, or embossed to present arcuately convex facing contact surfaces with a convergent pin-entry from the lower side or from the upper side.

The contact receptacle 2 as shown in Figures 9 and 10 is shown prior to connection to a conductor wire, and the terminal extends laterally from a carrier strip 36 integrally joined to the insulation support ferrule 25 by a severable neck portion 37. Suitably contact receptacles are formed in strip with a plurality of terminals extending laterally at regular intervals from a continuous carrier strip 36 so that they may be applied to respective conductor wires in a terminating machine.

As seen in Figure 4, the contact receptacle 2 is inserted into the central passageway from its rear end in the orientation shown in Figure 1, i.e. with the section 20 engaging the floor of the passageway and the latch 21 projecting upwardly, until the latch 14 engages the forward shoulder 14 to resist withdrawal of the contact rearwardly. The ears 22 register on opposite sides of the shoulder and the forward facing shoulders 23 engage complementary shoulders in the housing to resist further forward movement. The contact surfaces 29 on flanges 28 are positioned above the rear end of the pin-entry slot 6 to admit upward entry of a pin between the contact surfaces as shown in Figure 8.

The contact receptacles 2 for the outer passageways 7 are inserted in inverted position with the plate section 20 uppermost and the latch ears 21 projecting downwardly to engage the shoulders 14 on the floors of the passageways as shown in Figure 5.

In the assembly of Figure 8 a cluster member 32 comprises a triangular array of three parallel spaced pins 33 extending through and on opposite sides of a ceramic disc mounted in a metal annulus 34 secured by welding in an aperture of an hermetic vessel 35 to provide an hermetic seal. The connector comprising the housing 1 containing

three contact receptacles 2 as described above is assembled to the pins 33 to effect secure electrical connection by moving the connector from the right towards the cluster of pins 33, initially to engage two outer pins 33 between the extensions 5 with the central pin registering with the entrance to the slot 6. The chamfered surfaces 15 and 16 serve to guide the pins 33 into the slots 7 and 6 as the connector is moved towards the pins. The pins engage the convergent entry surfaces 31 of the contact receptacles to flex the arms 14 apart until the pins are engaged between opposed contact faces 29 of the contact receptacles 2. The rear ends of the slots 6, 7 and 10 define stops limiting relative lateral movement of the connector and the pins 33 in this assembly operation and serve to ensure that the pins 33 are properly located with regard to the contact surfaces 29. The pin 33 in the central slot 6, during the above assembly operation, engages the underside of the shoulder portion 11 of the latch arm 8, camming it upwardly until the pin 33 passes the shoulder portion 11 which relaxes downwardly to engage a side of the pin opposite the rear end of slot 10. This shoulder portion 11 thus resists relative lateral movement between the connector and the pins 33 in an opposite direction.

In order to release the connector in an opposite direction to that described in the assembly, i.e. left to right, it is necessary to lift the ear 12 to disengage the shoulder portion 11 from the central pin. The groove 13 provides access for a tool should space above the connector be restricted.

Where space is not restricted above the connector, it may be engaged with or disengaged from the pins 33 in conventional axial manner, the arcuately convex contact surfaces 29, seen in Figure 11, facilitating entry of a pin 33 between the contact surfaces whether the contact

receptacle is in the Figure 11 orientation, as in the central passageway 4, or in inverted orientation as in the outer passageways 4.

By virtue of the double thickness of the arms 19 of the contact receptacles 2, and the arrangement of the general plane of the sheet metal in the direction of flexure, the receptacles are stiff in flexure and not only provide high contact force on the pins, but are also resistant to adverse vibration in their operational environment. The contact design results in a low height as seen in side elevation and this, together with the inverted arrangement of the central contact relative to the outer contacts, enables a connector of low height to be provided. This is advantageous in the restricted space normally available in installations of the kind for which the connector is intended.

In order further to secure the connector against inadvertent release from the pin cluster, the central pin is suitably provided with an enlarged head, for example by welding, soldering or otherwise bonding a disc-like cap on the pin. In use, as in Figure 8, the disc-like cap engages the upper side of the receptacle to inhibit axial withdrawal of the connector from the cluster of pins. It will be understood that in such an arrangement, axial mating of the connector with the pins is precluded.

Claims:-

1. An electrical connector comprising a slab-like insulating housing (1, 3) having a plurality of through passageways (4) open at opposite ends of the housing and having pin receiving apertures (6, 7) at a side face of the housing communicating with respective passageways (4), each passageway (4) containing an electrical contact receptacle (2) having a receptacle portion (17) registering with the pin-receiving (6, 7) aperture and a conductor terminating portion (18) connected to a conductor wire (26) extending from an open end of the passageway (4) characterised in that the pin receiving apertures (6, 7) extend to the open ends of the passageways (4) opposite the ends through which the conductor wires (26) extend, and the receptacle portions (17) of the contact receptacles (2) each comprise a pair of resilient arms (19) extending lengthwise of the associated passageway (4) for receipt of a pin (33) through the associated aperture (6, 7) between them, the arms (19) at facing end portions having opposed contact surfaces (29) which diverge towards adjacent open ends of the passageways (4) whereby the connector may be engaged laterally or axially with complementary pins (33).

2. A connector as claimed in Claim 1, characterised in that the housing (1, 3) at one of the passageways (4) is formed with a resilient latch arm (8) extending rearwardly from a forward end at which it is integrally formed with a bridge (9) extending over the passageway (4), the free end (11) of the arm projecting into the passageway (4) through a slot (10) and having a rear facing shoulder adapted to engage the head of a pin (33) extending transversely of the passageway (Figure 8) to resist lateral disengagement of the connector.

3. A connector as claimed in Claim 2, characterised in that the housing (1, 3) is formed at its forward end with a pair of side extensions (5) which are chamfered on

the facing surfaces (15) to provide a rearwardly convergent pin-guide.

4. A connector as claimed in Claim 1, characterised in that the housing (1, 3) is provided with three passageways (4), the outer pair being located upwardly of the central passageway (4) whereby the central contact receptacle (2) is arranged to engage a complementary pin (33) further from the head of the pin (33) than the receptacles (2) of the outer pair.

5. A connector as claimed in Claim 4, characterised in that the outer pair of passageways (4) are adapted to accommodate their contact receptacles (2) in inverted relationship to that of the central passageway (4) whereby a reduced height to the connector is obtained.

6. A contact receptacle in or for a connector as claimed in Claim 1 comprising a receptacle portion (17) extending forwardly from a wire connecting section (18) and being stamped and formed from sheet metal stock, the receptacle section (17) being of fork-like form having a pair of resilient arms (19) extending forwardly from a plate-like mounting section (20), characterised in that the arms (19) are of double metal thickness formed by folds extending along outer sides of the arms (19), flanges (28) being folded up between the arms from the underside layer at the forward ends of the arms to define opposed contact faces (29).

7. A contact receptacle as claimed in Claim 6, characterised in that the flanges (28) are supported on their remote sides by support flanges (30) turned up from the upper layers of the arms (19).

8. A contact receptacle as claimed in Claim 7, characterised in that the contact flanges (28) at forward portions are formed with divergent portions (31) presenting a flared entry, and transversely of the arms the contact flanges (28) are dished to present arcuately convex facing

contact surfaces (29).

9. A contact receptacle as claimed in Claim 7, characterised in that the contact receptacle (2) is formed between the arms (19) with a resilient detent (21) turned back from a forward end of the plate-like mounting section (20), and a pair of ears (22) extend upwardly from opposite sides of the mounting section (20) to provide shoulders opposed to the detent (21).

FIG.1.

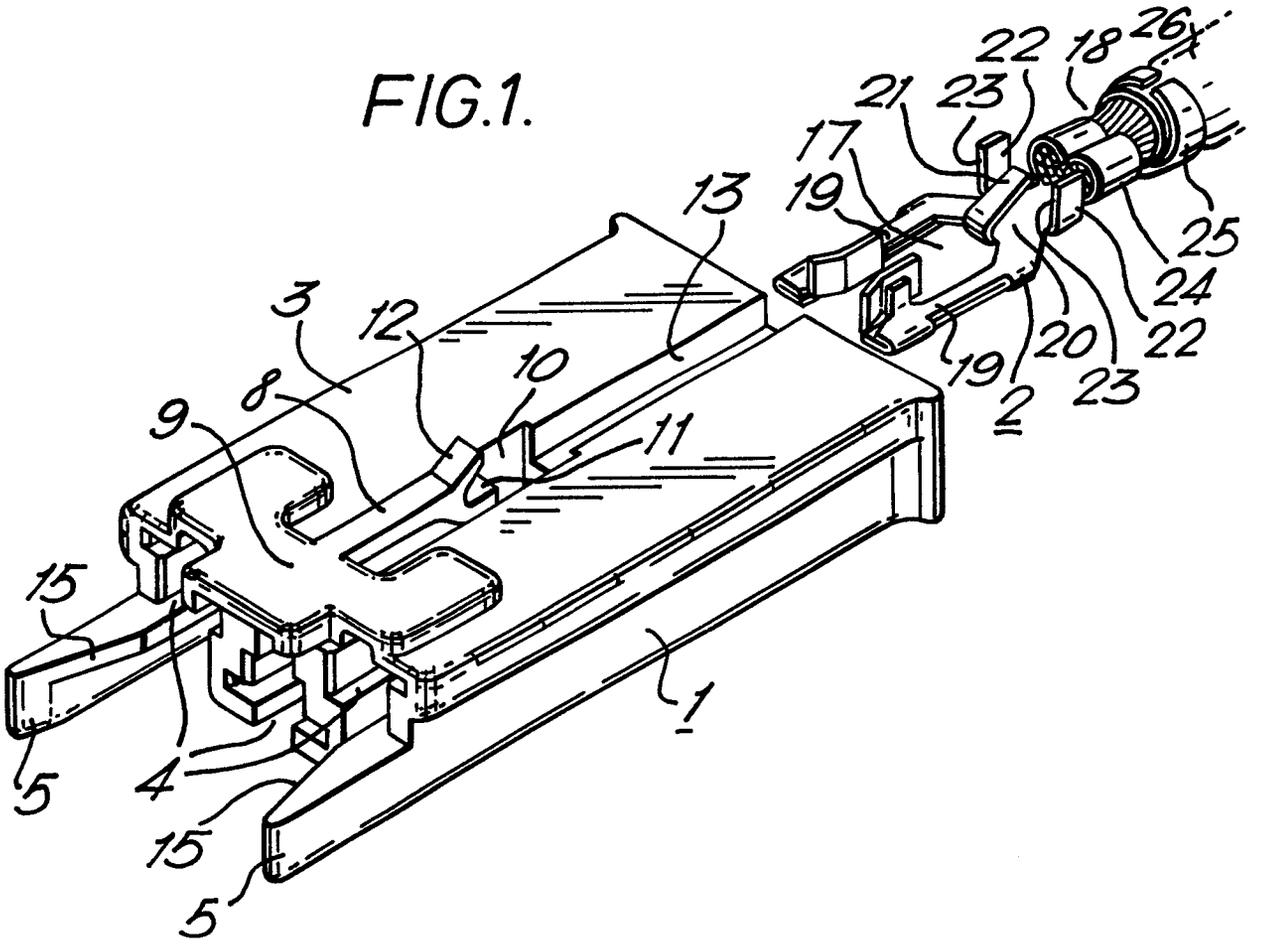
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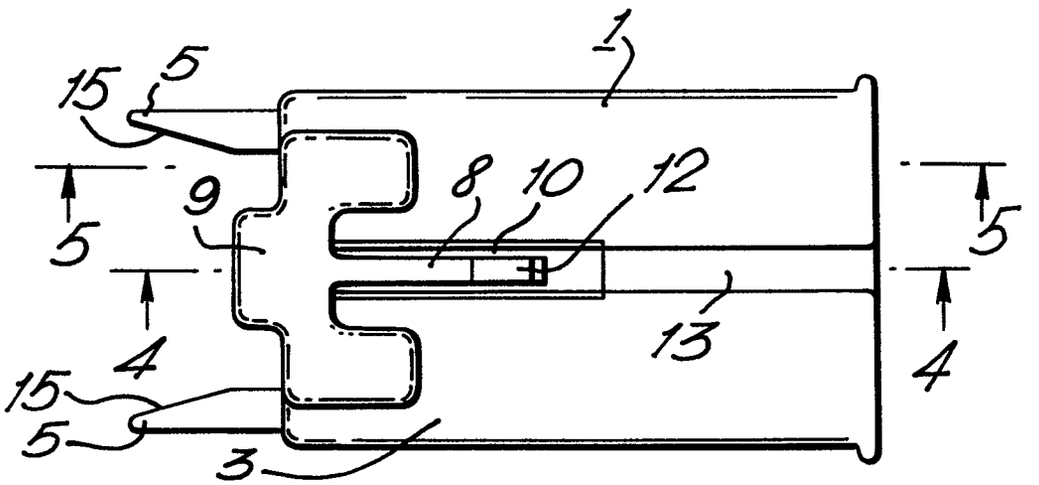
FIG.2.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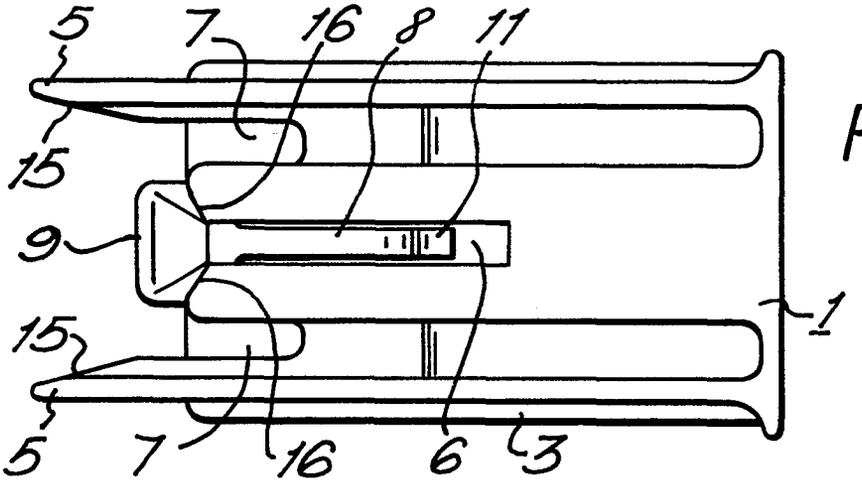

FIG.3.

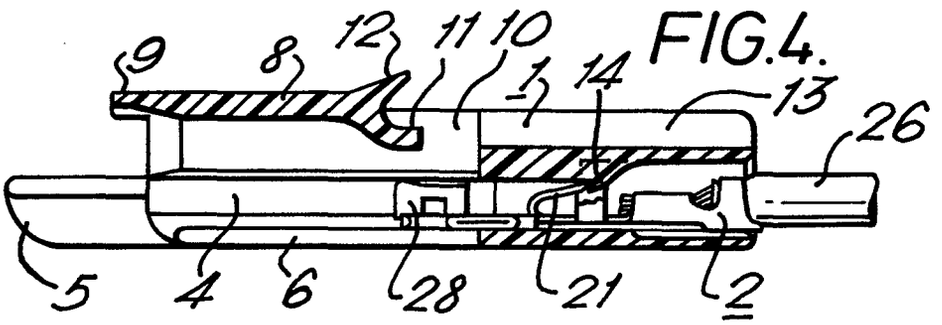

FIG.4.

FIG.5.

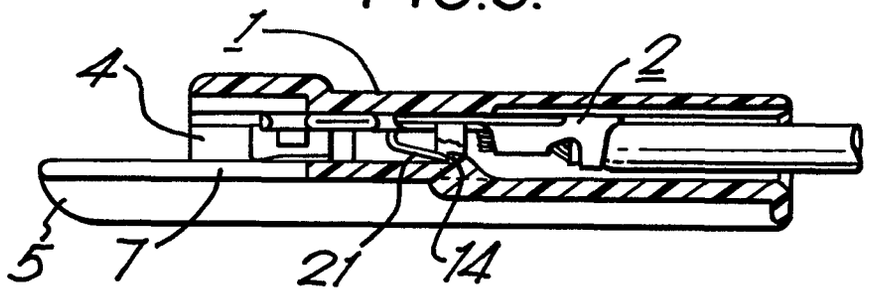

FIG.6.

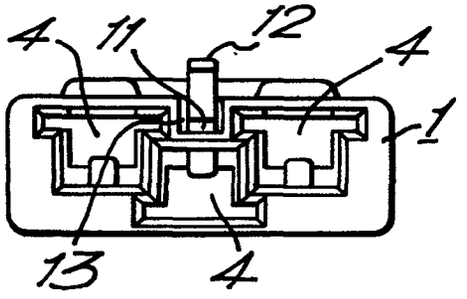

FIG.7.

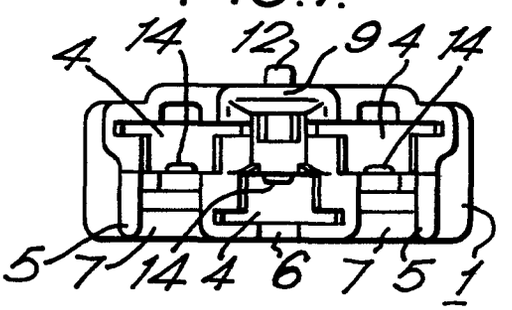

FIG.8.

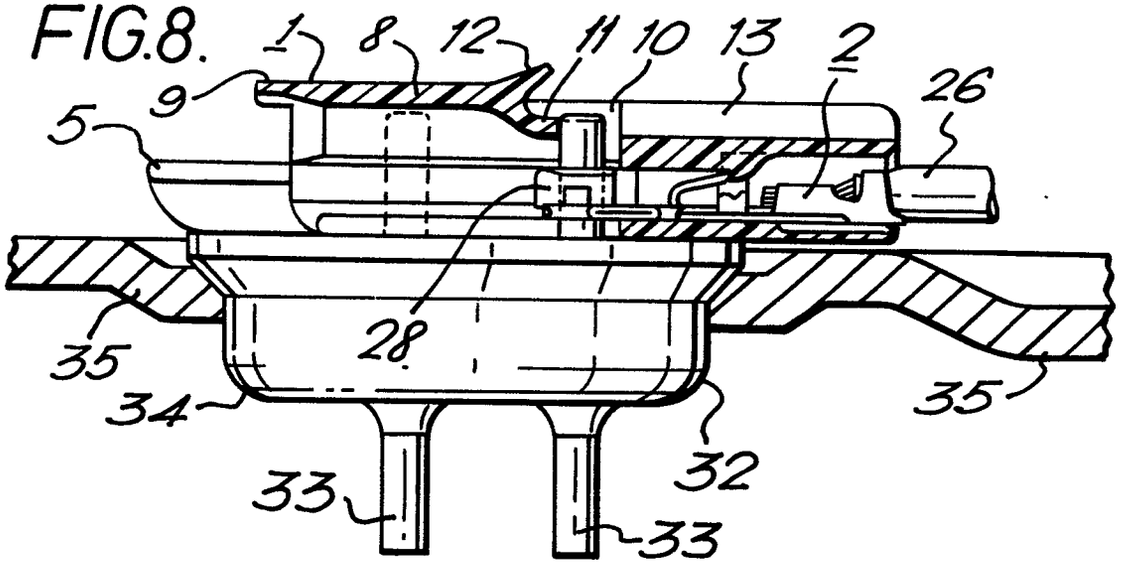

FIG.9.

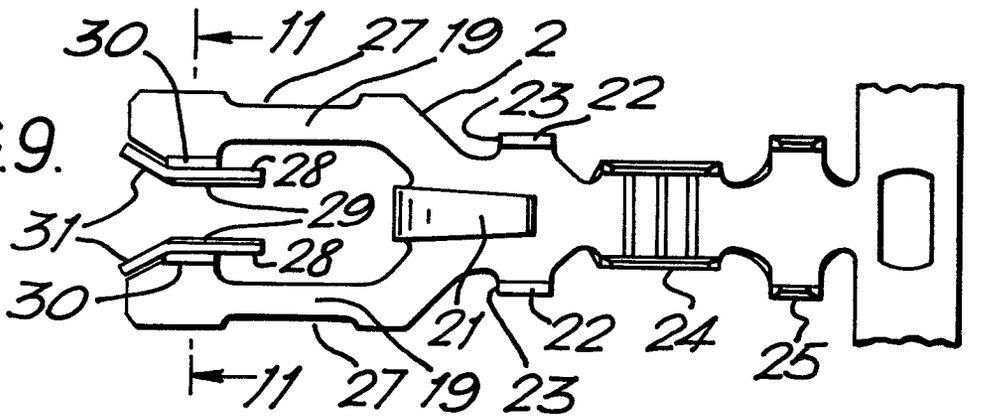

FIG.10.

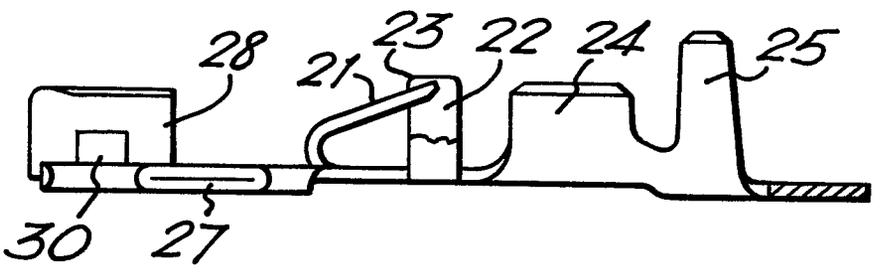

FIG.11.