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(54) **Electrical connector assembly with integrated wire holding means**

Elektrische Steckverbinderanordnung mit integriertem Kabelhaltemittel

Ensemble de connecteur électrique avec supports de serrage de câble intégrés

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(73) Proprietor: **Delphi Technologies, Inc.**  
**Troy, MI 48007 (US)**

(72) Inventors:  
• **SIWEK, Bartłomiej**  
**30-348 Krakow (PL)**

• **MILKOWSKI, Ryszard**  
**31-317 Krakow (PL)**

(74) Representative: **Allart, René Paul Pruli Slamet**  
**Delphi France SAS**  
**Legal Staff - Patents**  
**Bât. Le Raspail, ZAC Paris Nord II**  
**22, avenue des Nations**  
**95972 Roissy CDG Cedex (FR)**

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**Description**

## TECHNICAL FIELD

**[0001]** The present invention relates generally to an electrical connector assembly, more particularly to an electrical connector for use in a supplemental inflatable restraint (SIR) system for the protection of vehicle occupants.

## BACKGROUND OF THE INVENTION

**[0002]** It is known to mount an air bag of a SIR system in a vehicle, the air bag inflation being triggered by a device known as an initiator. The initiator is connected to an electrical connector which is operatively coupled to a pair of wires leading from a controller. An example of such a connector is disclosed in US6217388B1. This document discloses a connector assembly comprising a connector housing with a plug portion, a pair of terminal fittings mounted in the connector assembly and crimped to a pair of wires, and a connector position assurance (CPA) device.

**[0003]** Although the patent '388 discloses a good electrical connector, it still has some deficiencies. The number of parts necessary to build the connector makes the assembly relatively complex. Additionally, the construction disclosed in this document is not convenient when it is required to have a connector with a cable outlet parallel to the mating axis of the plug portion, the terminal fittings being substantially parallel to the pair of wires. WO9741623 discloses a connector with a lateral cable outlet. US5788534 discloses a connector with a clamping mechanism.

## SUMMARY OF THE INVENTION

**[0004]** It is an object of the present invention to solve the above mentioned problem and to provide an improved electrical connector assembly. According to the invention, it is provided an electrical connector assembly comprising a connector housing configured to receive at least one terminal fitting attached to the free end of an electrical wire, characterized in that the electrical connector assembly further comprises a holder which is mounted onto the connector housing for holding the terminal fitting in the housing, said holder having:

- locking means which cooperates with complementary locking means provided on the connector housing in order to retain the holder in a locked position onto the connector housing,
- a first clamping surface which cooperates with a second clamping surface provided on the connector housing in order to clamp a portion of the electrical wire when the holder is in its locked position,

and in that said second clamping surface is located on

at least one of said complementary locking means provided on the connector housing.

- said complementary locking means provided on the connector housing includes a flexible arm and in that said second clamping surface is located on an inner side of the flexible arm;
- said second clamping surface is constituted of a flange extending along a transverse axis with regards to the mating axis;
- the flexible arm has a cam surface against which a portion of the terminal fitting is sliding during its insertion into the housing in order to bias the flexible arm outwardly;
- the holder locking means includes a retaining lug which cooperates with a complementary detent latch portion provided on the flexible arm in order to retain the holder in the locked position.

**[0005]** Thanks to the invention, only two steps are necessary for attachment of the terminal fitting to the connector assembly. Firstly the terminal fitting is inserted in the connector housing and then the holder is mounted on the connector housing. Thus, the manufacturing and assembly of the connector according to the invention are made easier and more reliable with a limited number of parts.

**[0006]** According to other features of the present invention:

- the terminal fitting comprises a ferrite block which is fitted into the connector housing, and said clamping surfaces are arranged above the ferrite block when the terminal fitting is received in the connector housing and the holder is in its locked position;
- said holder comprises an axial portion forming a cover substantially parallel to an axial casing portion of the connector housing, and the cover comprises a wire slot for receiving a portion of the electrical wire, said portion of the electrical wire being clamped between the bottom of the wire slot and the second clamping surface;
- said electrical connector assembly is configured to receive a terminal fitting with only two electrical wires, and said retaining lug extends between the two electrical wires;
- the connector is of a straight type, the mating axis of the connector being substantially parallel to the drawing direction of the corresponding electrical wire, and the holder is slidably mounted onto the connector housing along a mounting direction which is substantially orthogonal to the mating axis, from a removed position to its locked position;
- a connector position assurance device is axially mounted on the connector housing through a portion of the holder.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0007]** The present invention is now described by way of example with reference to the accompanying drawings in which:

- figure 1 is an exploded perspective view showing a connector assembly according to the present invention having a connector housing and a holder for retaining a terminal fitting;
- figure 2 is a perspective view showing a first step of the assembly of the connector of figure 1 wherein the terminal fitting is to be inserted in the connector housing and is bending a flexible arm outwardly;
- figure 3 is a view similar to the one of figure 2 showing a second step of the assembly wherein the terminal fitting is inserted in the connector housing;
- figure 4 is a view similar to the one of figure 2 showing a third step of the assembly wherein the holder is about to be slidably mounted towards an axial casing portion of the connector housing;
- figure 5 is a view similar to the one of figure 2 showing the connector housing with the holder in locked position holding the terminal fitting in the housing.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

**[0008]** An exemplary embodiment of a connector assembly 10 according to the teaching of the present invention is shown on figure 1 to 5.

**[0009]** In the present description, axial, radial, transverse will be used in connection with the connector parts, with reference to the connector mating axis A1. In a non-limitative purpose, the connector mating axis A1 is orientated vertically along with the orientation of figure 1.

**[0010]** The connector assembly 10 includes a connector housing 12 comprising a frame portion 14, a substantially cylindrical plug portion 16 extending downwardly from the frame portion 14, along the connector mating axis A1, for connection with a corresponding counterpart connector (not shown), and a substantially axial casing portion 18 extending upwardly from the frame portion 14.

**[0011]** The connector housing 12 is configured to receive a terminal fitting 20 having here two parallel axial terminals 24, 26 inserted into respective holes 28, 30 of the frame portion 14, and extending axially in the plug portion 16 for electrical connection. The axial terminals 24, 26 are connected to respective wires 32, 34 through an electronic interference damping device in the form of a ferrite block 36 which has two through holes 38, 40 for the insertion of the lower free ends of the wires 32, 34.

**[0012]** In the embodiment shown, the ferrite block 36 comprises a casing of substantially oblong cross section with an upper transverse surface 42 and a lower transverse surface 44 of oblong shapes connected by an axial wall 46.

**[0013]** The connector assembly 10 is preferably of the straight type, meaning the cable outlet, or wire outlet, is

substantially parallel to the mating axis A1.

**[0014]** A holder 48 is mounted onto the connector housing 12 in order to hold the terminal fitting 20 in position. The holder 48 comprises a bottom portion forming a sliding portion 50 which is provided with two opposing parallel inner grooves 52, 54 on its bottom face in order to slidably cooperate with two corresponding opposing guiding surfaces 56, 58 on the frame portion 14. The sliding movement of the holder 48 on the frame portion 14 allows snap-fitting assembly of the holder 48 with the connector housing 12 along a snap-fitting transverse axis A2 which is substantially perpendicular to the mating axis A1.

**[0015]** For the purpose of snap-fitting assembly, the holder 48 and the frame portion 14 are provided with complementary locking means including lateral locking lugs 60, 62 cooperating with lateral locking apertures 64, 66 to retain the holder 48 in a locked position, as shown in figure 5.

**[0016]** The holder 48 comprises an axial portion 68 forming a cover which is fitted to the axial casing portion 18 such that the ferrite block 36 is enclosed between the cover 68 and the axial casing portion 18 when the holder 48 is in its locked position.

**[0017]** Advantageously, a first pair of locking apertures 64 is located on the sliding portion 50 lateral walls, complementary with a first pair of locking lugs 60 located on the frame portion 14 lateral walls, and a second pair of locking apertures 66 is located on the axial casing portion 18 lateral walls, complementary with a second pair of locking lugs 62 located on the cover 68 lateral walls.

**[0018]** Advantageously, an upper part of the axial casing portion 18 is provided with a retention portion in the form of a flexible arm 70, or beam. According to the embodiment shown, said flexible arm 70 is constituted of a beam extending substantially transversally, perpendicularly to the snap-fitting axis A2, between the two lateral walls of the axial casing portion 18. Said flexible arm 70 is able to bend elastically outwardly, in an opposite direction to the cover 68 along the snap-fitting axis A2, when the terminal fitting 20 with the ferrite block 36 is inserted into the connector housing 12. The flexible arm 70 is provided on its inward side with a detent latch portion 71 having an upper slanted cam surface 72 which is able to cooperate with the lower transverse surface 44 of the ferrite block 36 in order to bend the flexible arm 70 outwardly, from a rest position, shown on figures 3 to 5, to a bent position, shown on figure 2.

**[0019]** The cover 68 has a first clamping surface 74 which cooperates with a second clamping surface 76 located on the flexible arm 70, here on the detent latch portion 71, in order to clamp retained portions of the wires 32, 34 right above the ferrite block 36, when the holder 48 is in its locked position, as shown on figure 5.

**[0020]** According to the embodiment shown, the second clamping surface 76 is constituted of a flange located radially on the inner side of the detent latch portion 71. Advantageously, the upper portion of the cover 68 has

two wire slots 78, 80, or notches, for receiving the two retained portions of the wires 32, 34. The bottom of each wire slot 78, 80 forms a portion of the first clamping surface 74 such that, in the locked position of the holder 48, the retained portions of the wires 32, 34 are blocked into the wire slots 78, 80 under elastic pressure from the second clamping surface 76.

**[0021]** Advantageously, the upper portion of the cover 68 is provided with an elastic retaining lug 82 extending radially outwardly along the snap-fitting axis A2 towards the detent latch portion 71 in order to retain the holder 48 in the locked position. Said detent latch portion 71 and said retaining lug 82 have complementary cooperating locking surfaces allowing snap-fitting of the two parts together which helps maintaining the clamping force on the retained portions of the wires 32, 34. In the locked position, the retaining lug 82 extends above the ferrite block 36, between the two wires 32, 34, and the outer free end of the retaining lug 82 is received in a complementary locking notch 84 arranged in the axial casing portion 18, below the detent latch portion 71.

**[0022]** It has to be noted that, when the terminal fitting 20 is in position and the holder 48 is in its locked position of figure 5, the retained portion of the cables 32, 34 is pulled transversely along the snap-fitting axis A2 ensuring good retention of the cables 32, 34.

**[0023]** According to the embodiment shown, a connector position assurance (CPA) device 86 is axially mounted on the connector housing 12 through the sliding portion 50 of the holder 48. The CPA device 86 will not be described in details as it is a conventional device in the field of connector assemblies.

**[0024]** The assembly of the connector assembly 10 according to the invention will now be described in connection with figures 2 to 5.

**[0025]** First the terminal fitting 20 connected to the wires 32, 34 is brought downwardly along the mating axis A1 towards the connector housing 12 in order to insert the terminals 24, 26 into the corresponding holes 28, 30 of the frame portion 14, and in order to have the ferrite block 36 received in a corresponding receptacle of the connector housing 12. During axial insertion of the terminal fitting 20, the lower surface 44 of the ferrite block 36 comes into abutment against the cam surface 72 which biases the flexible arm 70 outwardly, as shown in figure 2. Alternatively, a tool could be used to bend the flexible arm 70 outwardly in order to allow insertion of the ferrite block 36 along the mating axis A1.

**[0026]** At the end of the terminal fitting 20 insertion, the terminals 24, 26 are fully received within the corresponding holes 28, 30, and the flexible arm 70 has gone back to its rest position, as shown in figure 3.

**[0027]** Then the holder 48 is fitted to the connector housing 12 by sliding its sliding portion 50 along the snap-fitting axis A2 towards the axial casing portion 18, as shown in figure 4, until the holder 48 reaches its locked position shown in figure 5, wherein all the locking lugs 60, 62 are received in their locking apertures 64, 66, and

wherein the retaining lug 82 is received in its locking notch 84 and snap-fitted to the detent latch portion 71. In the locked position, the retained portions of the wires 32, 34 are clamped between the clamping surfaces 74, 76.

## Claims

1. Electrical connector assembly (10) comprising a connector housing (12) configured to receive at least one terminal fitting (20) attached to the free end of an electrical wire (32, 34), wherein the electrical connector assembly (10) further comprises a holder (48) which is mounted onto the connector housing (12) for holding the terminal fitting (20) in the housing (12), said holder (48) having:

- locking means (62, 64, 82) which cooperates with complementary locking means (60, 66, 70) provided on the connector housing (12) in order to retain the holder (48) in a locked position onto the connector housing (12),
- a first clamping surface (74) which cooperates with a second clamping surface (76) provided on the connector housing (12) in order to clamp a portion of the electrical wire (32, 34) when the holder (48) is in its locked position, wherein

said second clamping surface (76) is located on at least one of said complementary locking means (70) provided on the connector housing (12), **characterized in that**

said complementary locking means (70) provided on the connector housing (12) includes a flexible arm (70) and **in that** said second clamping surface (76) is located on an inner side of the flexible arm (70), wherein said second clamping surface (76) is constituted of a flange extending along a transverse axis with regards to the mating axis (A1), wherein the flexible arm (70) has a cam surface (72) against which a portion of the terminal fitting (20) is sliding during its insertion into the housing (12) in order to bias the flexible arm (70) outwardly, wherein the holder locking means includes a retaining lug (82) which cooperates with a complementary detent latch portion (71) provided on the flexible arm (70) in order to retain the holder (48) in the locked position.

2. Electrical connector assembly (10) according to claim 1, **characterized in that** the terminal fitting (20) comprises a ferrite block (36) which is fitted into the connector housing (12), and **in that** said clamping surfaces (74, 76) are arranged above the ferrite block (36) when the terminal fitting (20) is received in the connector housing (12) and the holder (48) is in its locked position.

3. Electrical connector assembly (10) according to the preceding claim, **characterized in that** said holder (48) comprises an axial portion forming a cover (68) substantially parallel to an axial casing portion (18) of the connector housing (12), and **in that** the cover (68) comprises a wire slot (78, 80) for receiving a portion of the electrical wire (32, 34), said portion of the electrical wire (32, 34) being clamped between the bottom of the wire slot (78, 80) and the second clamping surface (76).
4. Electrical connector assembly (10) according to the preceding claim in combination with claim 1, **characterized in that** said electrical connector assembly (10) is configured to receive a terminal fitting (20) with only two electrical wires (32, 34), and **in that** said retaining lug (82) extends between the two electrical wires (32, 34).
5. Electrical connector assembly (10) according to anyone of the preceding claims, **characterized in that** the connector assembly (10) is of a straight type, the mating axis (A1) of the connector being substantially parallel to the drawing direction of the corresponding electrical wire (32, 34), and **in that** the holder (48) is slidably mounted onto the connector housing (12) along a mounting direction (A2) which is substantially orthogonal to the mating axis (A1), from a removed position to its locked position.
6. Electrical connector assembly (10) according to anyone of the preceding claims, **characterized in that** a connector position assurance device (86) is axially mounted on the connector housing (12) through a portion of the holder (48).

#### Patentansprüche

1. Elektrische Verbinderbaugruppe (10), die ein Verbindergehäuse (12) aufweist, das konfiguriert ist zum Aufnehmen zumindest eines Anschlussstücks (20), das an dem freien Ende einer elektrischen Leitung (32, 34) angebracht ist, wobei die elektrische Verbinderbaugruppe (10) weiter einen Halter (48) aufweist, der an dem Verbindergehäuse (12) befestigt ist, zum Halten des Anschlussstücks (20) in dem Gehäuse (12), wobei der Halter (48) aufweist:

- Verriegelungsmittel (62, 64, 82), die mit komplementären Verriegelungsmitteln (60, 66, 70), die an dem Verbindergehäuse (12) vorgesehen sind, zusammenwirken, um den Halter (48) in einer verriegelten Position an dem Verbindergehäuse (12) zu halten,
- eine erste Klemmfläche (74), der mit einer an dem Verbindergehäuse (12) vorgesehenen zweiten Klemmfläche (76) zusammenwirkt, um

einen Teil der elektrischen Leitung (32, 34) einzuklemmen, wenn der Halter (48) in seiner verriegelten Position ist,

wobei sich die zweite Klemmfläche (76) auf zumindest einem der komplementären Verriegelungsmittel (70) befindet, die an dem Verbindergehäuse (12) vorgesehen sind,

**dadurch gekennzeichnet, dass**

das komplementäre Verriegelungsmittel (70), das an dem Verbindergehäuse (12) vorgesehen ist, einen flexiblen Arm (70) umfasst, und dass sich die zweite Klemmfläche (76) auf einer Innenseite des flexiblen Arms (70) befindet,

wobei die zweite Klemmfläche (76) aus einem Flansch besteht, der sich entlang einer Querachse in Bezug auf die Verbindungsachse (A1) erstreckt, wobei der flexible Arm (70) eine Nockenfläche (72) hat, gegen die ein Teil des Anschlussstücks (20) während seiner Einführung in das Gehäuse (12) gleitet, um den flexiblen Arm (70) nach außen zu beeinflussen,

wobei das Halter-Verriegelungsmittel eine Haltetasche (82) umfasst, die mit einem komplementären Rastverriegelungsteil (71) zusammenwirkt, der an dem flexiblen Arm (70) vorgesehen ist, um den Halter (48) in der verriegelten Position zu halten.

2. Elektrische Verbinderbaugruppe (10) gemäß Anspruch 1, **dadurch gekennzeichnet, dass** das Anschlussstück (20) einen Ferritblock (36) aufweist, der in das Verbindergehäuse (12) eingepasst ist, und dass die Klemmflächen (74, 76) über dem Ferritblock (36) angeordnet sind, wenn das Anschlussstück (20) in dem Verbindergehäuse (12) aufgenommen ist und der Halter (48) in seiner verriegelten Position ist.

3. Elektrische Verbinderbaugruppe (10) gemäß dem vorhergehenden Anspruch, **dadurch gekennzeichnet, dass** der Halter (48) einen axialen Teil aufweist, der eine Abdeckung (68) im Wesentlichen parallel zu einem axialen Gehäuseteil (18) des Verbindergehäuses (12) bildet, und dass die Abdeckung (68) einen Leitungsschlitz (78, 80) aufweist zum Aufnehmen eines Teils der elektrischen Leitung (32, 34), wobei der Teil der elektrischen Leitung (32, 34) zwischen der Unterseite des Leitungsschlitzes (78, 80) und der zweiten Klemmfläche (76) eingeklemmt ist.

4. Elektrische Verbinderbaugruppe (10) gemäß dem vorhergehenden Anspruch in Kombination mit Anspruch 1, **dadurch gekennzeichnet, dass** die elektrische Verbinderbaugruppe (10) konfiguriert ist zum Aufnehmen eines Anschlussstücks (20) mit nur zwei elektrischen Leitungen (32, 34), und dass sich die Haltetasche (82) zwischen den zwei elektrischen Leitungen (32, 34) erstreckt.

5. Elektrische Verbinderbaugruppe (10) gemäß einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Verbinderbaugruppe (10) ein gerader Typ ist, die Verbindungsachse (A1) des Verbinders im Wesentlichen parallel zu der Ziehrichtung der entsprechenden elektrischen Leitung (32, 34) ist, und dass der Halter (48) verschiebbar auf dem Verbindergehäuse (12) entlang einer Befestigungsrichtung (A2), die im Wesentlichen orthogonal zu der Verbindungsachse (A1) ist, von einer entfernten Position zu seiner verriegelten Position angebracht ist.
6. Elektrische Verbinderbaugruppe (10) gemäß einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** eine Verbinderpositionssicherungs- vorrichtung (86) axial an dem Verbindergehäuse (12) durch einen Teil des Halters (48) angebracht ist.

#### Revendications

1. Ensemble formant connecteur électrique (10) comprenant un boîtier de connecteur (12) configuré pour recevoir au moins un raccord-borne (20) attaché à l'extrémité libre d'un fil électrique (32, 34), dans lequel l'ensemble formant connecteur électrique (10) comprend en outre un élément de maintien (48) qui est monté sur le boîtier de connecteur (12) pour maintenir le raccord-borne (20) dans le boîtier (12), ledit élément de maintien (48) ayant :
- des moyens de blocage (62, 64, 82) qui coopèrent avec des moyens de blocage complémentaires (60, 66, 70) prévus sur le boîtier de connecteur (12) afin de retenir l'élément de maintien (48) dans une position bloquée sur le boîtier de connecteur (12),
  - une première surface de serrage (74) qui coopère avec une seconde surface de serrage (76) prévue sur le boîtier de connecteur (12) afin de serrer une portion du fil électrique (32, 34) quand l'élément de maintien (48) est dans sa position bloquée,

dans lequel ladite seconde surface de serrage (76) est située sur l'un au moins desdits moyens de blocage complémentaires (70) prévus sur le boîtier de connecteur (12),

#### **caractérisé en ce que**

lesdits moyens de blocage complémentaires (70) prévus sur le boîtier de connecteur (12) incluent un bras flexible (70) et **en ce que** ladite seconde surface de serrage (76) est située sur un côté intérieur du bras flexible (70),

dans lequel ladite seconde surface de serrage (76) est constituée d'une bride s'étendant le long d'un axe transversal par rapport à l'axe d'accouplement (A1),

dans lequel le bras flexible (70) présente une surface de came (72) contre laquelle coulisse une portion du raccord-borne (20) pendant son insertion dans le boîtier (12) afin de solliciter le bras flexible (70) vers l'extérieur, dans lequel les moyens de blocage de l'élément de maintien incluent une patte de retenue (82) qui coopère avec une portion de verrouillage à cran complémentaire (71) prévue sur le bras flexible (70) afin de retenir l'élément de maintien (48) dans la position bloquée.

2. Ensemble formant connecteur électrique (10) selon la revendication 1, **caractérisé en ce que** le raccord-borne (20) comprend un bloc de ferrite (36) qui est logé dans le boîtier de connecteur (12), et **en ce que** lesdites surfaces de serrage (74, 76) sont agencées au-dessus du bloc de ferrite (36) quand le raccord-borne (20) est reçu dans le boîtier de connecteur (12) et que l'élément de maintien (48) est dans sa position bloquée.
3. Ensemble formant connecteur électrique (10) selon la revendication précédente, **caractérisé en ce que** ledit élément de maintien (48) comprend une portion axiale formant un couvercle (68) sensiblement parallèle à une portion de case axiale (18) du boîtier de connecteur (12), et **en ce que** le couvercle (68) comprend une fente à fil (78, 80) pour recevoir une portion du fil électrique (32, 34), ladite portion du fil électrique (32, 34) étant serrée entre le fond de la fente à fil (78, 80) et la seconde surface de serrage (76).
4. Ensemble formant connecteur électrique (10) selon la revendication précédente en combinaison avec la revendication 1, **caractérisé en ce que** ledit ensemble formant connecteur électrique (10) est configuré pour recevoir un raccord-borne (20) avec uniquement deux fils électriques (32, 34), et **en ce que** ladite patte de retenue (82) s'étend entre les deux fils électriques (32, 34).
5. Ensemble formant connecteur électrique (10) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** l'ensemble formant connecteur (10) est du type droit, l'axe d'accouplement (A1) du connecteur étant sensiblement parallèle à la direction de traction du fil électrique correspondant (32, 34), et **en ce que** l'élément de maintien (48) est monté en coulissement sur le boîtier de connecteur (12) le long d'une direction de montage (A2) qui est sensiblement orthogonale à l'axe d'accouplement (A1), depuis une position enlevée jusqu'à sa position bloquée.
6. Ensemble formant connecteur électrique (10) selon l'une quelconque des revendications précédentes,

**caractérisé en ce qu'un** dispositif pour assurer la position de connexion (86) est monté axialement sur le boîtier de connecteur (12) à travers une portion de l'élément de maintien (48).

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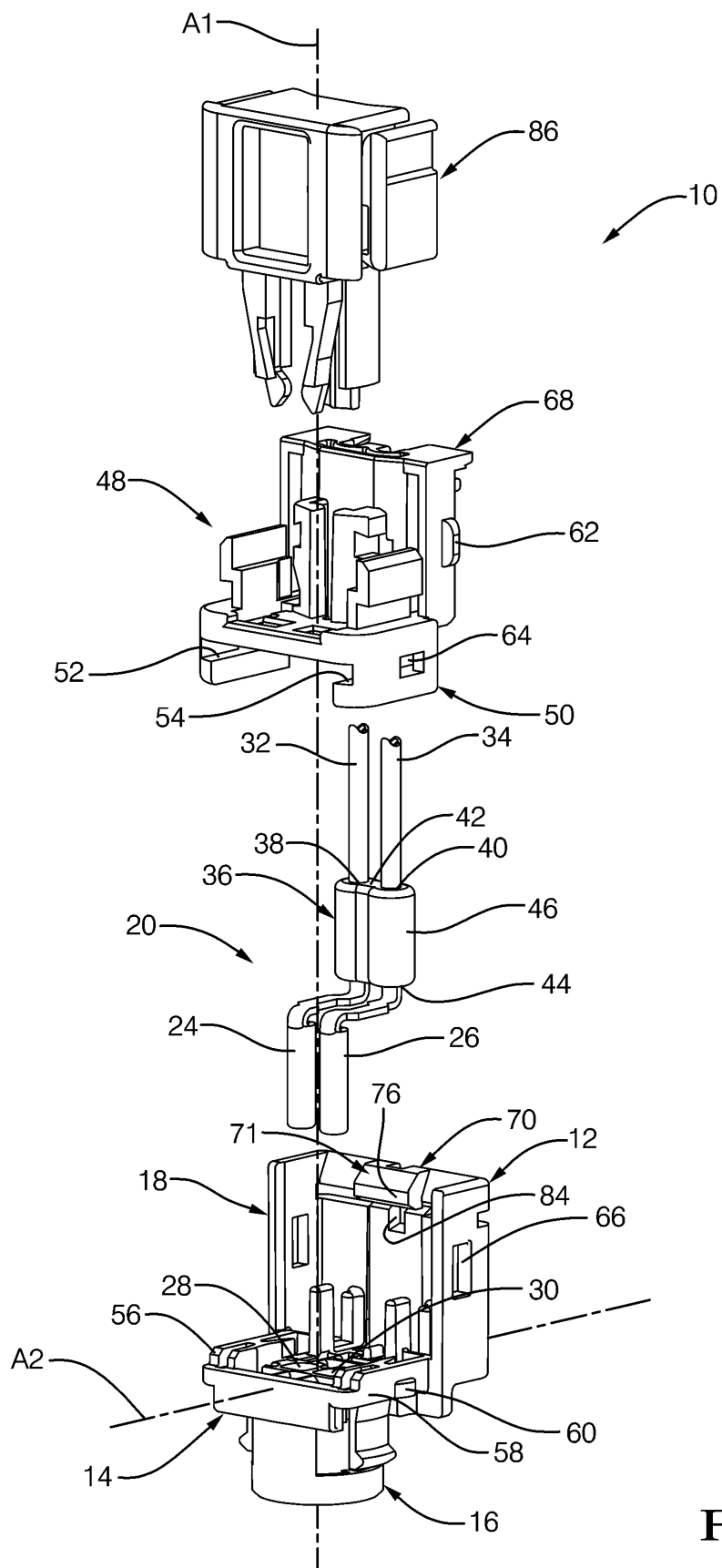
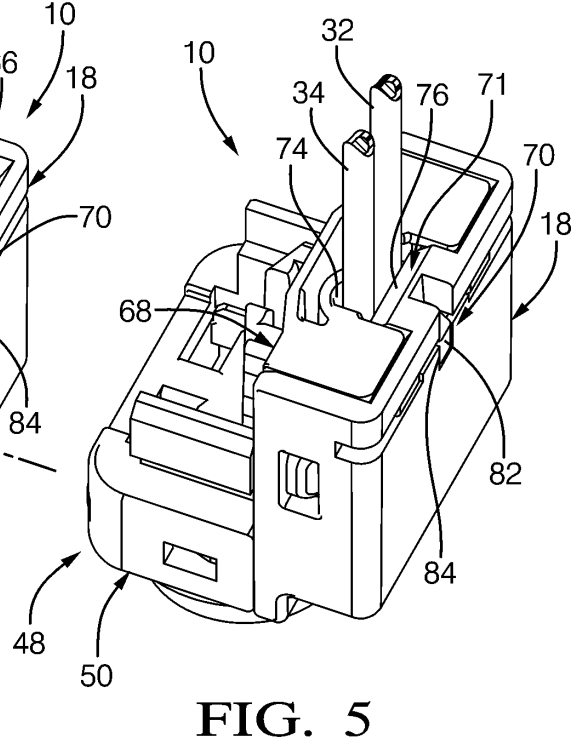
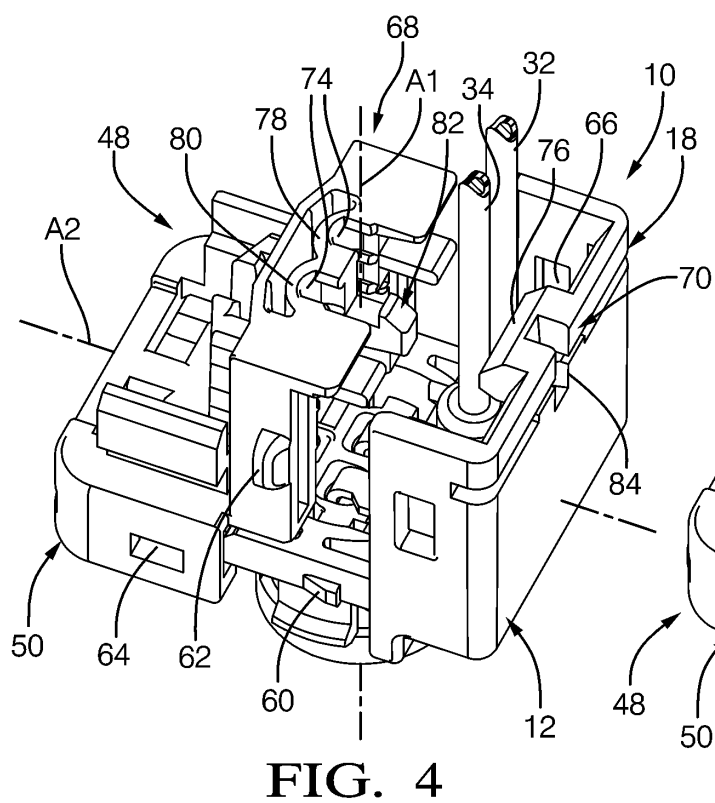
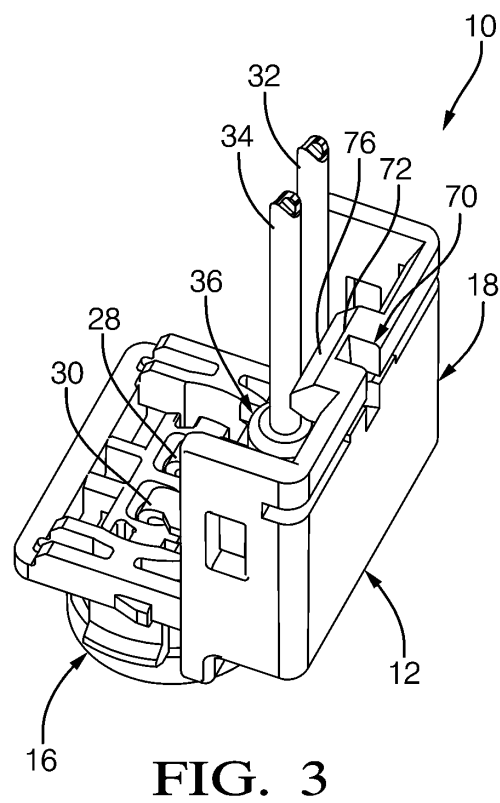
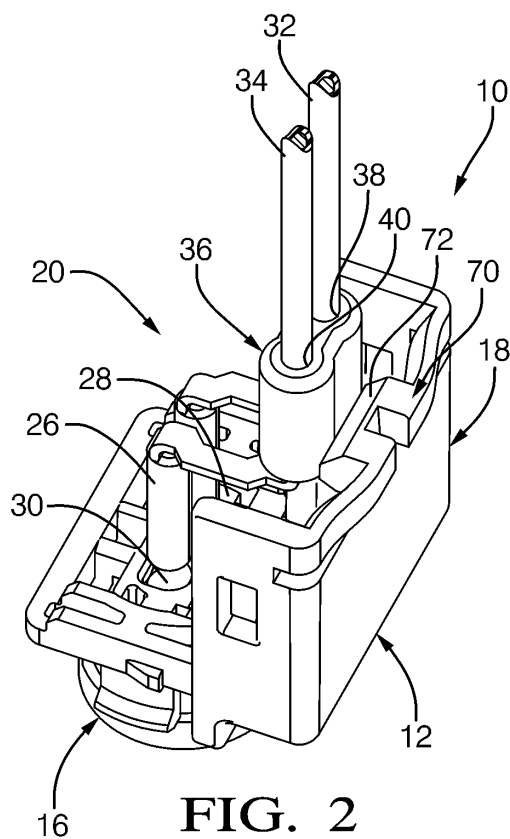


FIG. 1



**REFERENCES CITED IN THE DESCRIPTION**

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