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(54) Title: SEALABLE SQUIB CONNECTOR

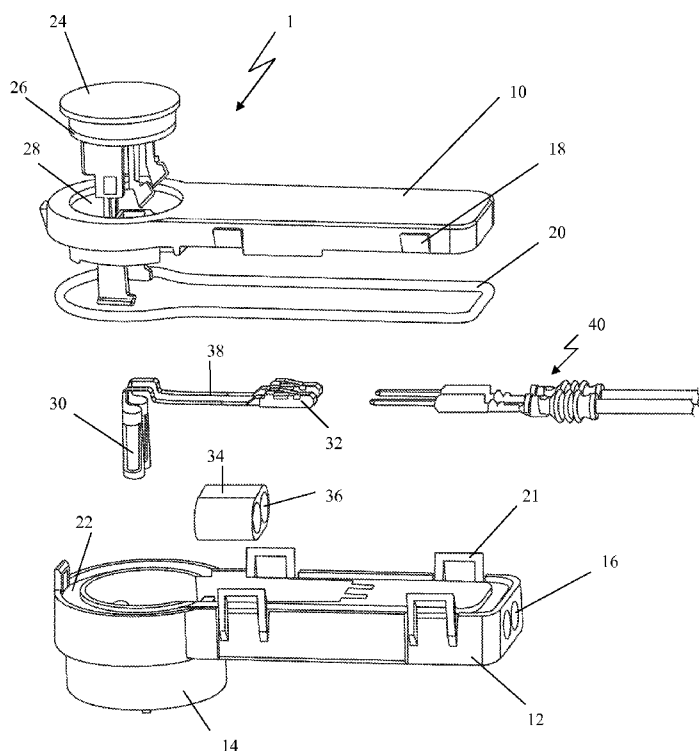


Fig. 1

(57) Abstract: The present invention relates to a connector, e.g. an airbag squib connector (1), comprising a sealable connector housing comprising at least one aperture (16) in a wall of the housing for the insertion of a cable terminal therein and an electrical contact (30) for establishing an electrical connection with a counter connector. The connector is further provided with at least one contact adapter element (32), which is electrically coupled or integrated with the electrical contact (30), and which is adapted to receive a cable terminal after assembly of the connector housing, to allow a sealed assembly of a cable and the squib connector after assembly of the connector housing.

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Sealable Squib Connector

1. Field of the invention

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The invention relates to a sealable connector, in particular a squib connector for use in an ignition system, also called pigtail connectors.

2. Technical background

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Modern passenger cars include a number of seat belt pretensioners and airbags, i.e. inflatable protective systems, which serve to cushion the impact of a passenger or a pedestrian with parts of a passenger car in case of an accident. Airbag assemblies are for example located in the steering wheel or column, the dashboard, the side of the door panels or close to bumpers in front of the car. Ignition systems that trigger a movement of the hood may be also used for protecting pedestrians. Detectors and deceleration sensors in the passenger vehicle detect bumps or high deceleration values as they occur in case of an accident and send a trigger signal via a wire or cable to SRS (Safety (or supplemental) Restraint System). SRS devices are actuated by means of an explosive device known as a squib. The wires or cables from the detector, sensor, or a dedicated control unit, are connected to the squib by means of so-called squib connectors. To this aim the squib is usually provided with a socket which contains two contact pins. The squib connector in turn is attached to the cables or wires on the one end and comprises a plug-part corresponding to the socket on the other end, which plug-part has two receptacles for the insertion of the contact pins of the squib socket.

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Typical airbag squib connectors are for example described in the US patents no. 6,676,452 and 6,145,193.

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In order to avoid potentially fatal accidents, the squib connection has to be secured against unintended de-connecting, undesired firing of the igniter due to for example potential differences during the assembly of so called SRS (Safety (or supplemental) Restraint System) and in particular against the deteriorating effects of e.g. moisture and/or dust often found in vehicles and/or close to bumpers. Therefore it is often necessary to seal the squib connector, which in turn necessitates, that the cables or wires coming from the triggering device are fixed to the connector housing already during assembly of the connector and thus at the production or cable assembly facility of the squib connector and not at the production facility of the vehicle to be equipped with the connector. For example, a typical sealed plug connector consists of two connector halves, whereby one halve contains the electrical contacts welded or crimped to a striped end of the cable and the other halve, the cover, is subsequently attached, for example, welded to the first halve. In this way a closed assembly of squib connector and cable is produced, which is completely sealed against the environment. One disadvantage of this method is, however, that the so-produced connector cannot be disassembled and that the cable has to be attached to the connector already at the production facility of the connector. In many applications, however, it is desired that connectors and cables can be assembled at different locations and still be sufficiently sealed against the environment for the respective intended purposes.

It is therefore an object of the present invention to provide a sealed or sealable connector, in particular a squib connector, which reduces or minimizes the above described problems and disadvantages.

These and other objects, which become apparent upon reading the following description, are solved by a connector according to claim 1.

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3. Summary of the invention

According to the invention a connector is provided, in particular a squib connector, which comprises a sealed or sealable connector housing comprising at least one aperture in a wall of the housing for the insertion of a cable or a cable terminal therein and at least one electrical contact for establishing an electrical connection with a counter connector, as for example a squib socket of an airbag squib. The connector further comprises at least one contact adapter element, which is electrically coupled or integrated with the electrical contact and which is adapted to receive a cable or a cable terminal, after assembly of the assembly housing. In other words, the connector housing can be assembled together with the electrical contact, the contact adapter element and all further elements necessary or desirable in the connector and after assembly of the connector it is possible to insert a cable, respectively a cable terminal, into the assembled connector housing, thus establishing an electrical contact between the cable and the electrical contact of the connector via the contact adapter element. To achieve a sealed connection between cable and connector housing the cable or cable terminal may be sealingly press fitted into the aperture or provided with a dedicated sealing element, as for example a sealing plug. Such a sealing element may also be provided by or on the housing for sealingly close the aperture of the housing once the cable or cable terminal introduced in the housing. It should be noted that the term "cable terminal" used herein is to be understood in its broadest sense as any kind of contact end of a cable or wire serving to establish electrical and/or mechanical contact.

The connector housing is for example produced by injection moulding of a suitable insulating material around the electrical contact(s) and the contact adapter element. In this way an integrated part is produced, which is sealed against the environment except for the apertures provided in the wall of the housing for the insertion of the cables respectively cable terminals. In this context it should be noted, that the terms "sealable con-

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connector” or “sealed connector” are used herein to describe a connector housing, which is sufficiently sealed against moisture, water, oil, dust, dirt, etc. for the intended purposes, as for example the use as airbag squib connector of passenger vehicles.

5 In a preferred embodiment, the housing comprises first and second halves, which define an essentially closed space therebetween in assembled condition and which comprise a sealing element, which is arranged between the first and second halve of the connector housing. The first and second halve may be assembled by means of a detachable connection or by
10 a permanent connection, as for example by means of a welded connection. The sealing element is preferably an uninterrupted sealing ring made for example from a suitable rubber material. The sealing element maybe integrally formed with the first and/or the second halve of the connector housing or it may for example be glued to one of the halves of the housing. In a
15 preferred embodiment, the sealing element is pressed between the two halves of the housing and hold by means of a pressing force. In the case of a connector housing, which is made from more than one part, as for example from first and second halves, the aperture for the insertion of the cable terminal is preferably not arranged at the edge of one of the parts of the
20 connector housing. The aperture is rather preferably provided in a wall of the housing, such that the aperture is surrounded by material. In this way the later to be inserted cable terminal can be sealed more efficiently.

 In a further preferred embodiment the connector comprises a ferrite or coil element arranged inside of the housing, which serves to shield the
25 connection against electromagnetic interference. The ferrite or coil element is mounted to the connector during assembly of the connector and arranged inside the connector so that upon inserting a cable into the connector the ferrite element surrounds at least partially the adapter element and/or the inserted cable terminal, to provide an effective shielding.

30 In a further preferred embodiment of the invention the connector further comprises a CPA (connector position assurance) device as well as a

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sealing element, which is arranged between the CPA device and the connector housing. The principle function of a CPA is for example described in the above-mentioned US 6,676,452 and well known to the person skilled in the art.

5 With all embodiments of the connector according to the invention it is preferred that at least a part of the housing is moulded around the electrical contact of the connector. In this way a secure sealing between the insulating material of the housing and the electric conductive material of the electrical contact is assured. In case of a connector housing assembled
10 from several parts, for example first and second halves, one part of the connector may for example be moulded around the electrical contact(s) before final assembly of the connector. Generally, all inventive embodiments of the connector described herein are preferably squib connectors. For instance they may be airbag squib connectors of the right angle type, i.e. a
15 connector whereby the insertion direction of the cable or cable terminal into the housing of the connector is essentially perpendicular to the plug-in direction of the squib connector, i.e. the direction the squib connector is pushed, when the same is mated with the corresponding counter connector. Thought, the invention applies to straight connectors.

20 The present invention also relates to a squib connector system, which comprises a squib connector as described herein and at least one cable having a cable terminal. Most preferably, the cable terminal is a standardized part as described in US 6,280,237 or US 6,793,513. The housing aperture, the cable and/or the cable terminal is provided with a sealing
25 element, for example in the form of a rubber plug, to allow for a sealed connection between the connector housing, respectively the aperture provided in the connector housing, and the cable or cable terminal. The cable terminal is preferably adapted to be mechanically fastened with the connector housing and/or the contact adapter upon insertion of the cable terminal into
30 the housing. After full insertion of the cable respectively the cable terminal into the connector housing an electrical contact with the contact adapter

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element, and thus with the electrical contact of the connector via the contact adapter is established.

The present invention further relates to a method for assembly of an airbag squib connector whereby in a first step a connector as described herein is provided and at least one cable with a cable terminal as it is described above is provided and inserted into the (fully assembled) connector housing.

The present invention allows using standardized cable terminals. Thus, the connector can be fully assembled at the production side of the connector and only afterwards equipped with the necessary cable or cables at a different location. Nevertheless, the final product is sufficiently sealed or sealable against detrimental environmental influences, as for example moisture, dust or similar.

4. Description of the preferred embodiments

In the following the invention is described exemplarily with reference to the enclosed figures, in which

Fig. 1 is an exploded view of an assembly of a connector according to the present invention;

Figures 2A and B are schematic views of an assembled connector before (2A), respectively after (2B) cable terminals are inserted into the connector housing; and

Figures 3A to D are cut-side views of the connector of figures 1 and 2 showing the insertion process of a cable terminal.

Figure 1 is an exploded view of a connector 1 according to the present invention. The connector comprises a first housing half 10 in the form of a cover and a second housing half 12. The second housing half 12 is provided with a plug-in projection 14, which extends essentially perpendicular to the plane of the first half 12. The first half 12 further

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comprises two apertures 16 adapted for the insertion of a cable assembly 40 also shown in figure 1. As one can see from the figure the apertures are not arranged at the edge of the second half 12 (in opposition to typical prior art connectors). As one can further derive from figure 1, the first and second halves 10 and 12 will define a closed space therebetween in assembled condition. Both halves are provided with corresponding latching shoulders 18 and latching wings 21 to allow for a detachable connection of the connector parts. The connector further comprises a sealing element 20, which is arranged between the first and second halves of the connector housing. The second half 12 is provided with a corresponding sealing groove 22, which runs circumferentially around the upper edge of the second half, to accommodate the sealing element 20. The sealing element 20 is provided in form of an uninterrupted sealing ring and pressed between the two halves of the housing in assembled condition.

The connector shown is further provided with a CPA device 24 having a sealing element 26. In assembled condition, the CPA 24 is pushed into a circular opening 28 provided in the first half 10 so that the sealing element 26 provides a reliable seal between housing and CPA 24. The function of the CPA itself is well known to the skilled person.

The connector 1 is further provided with electrical contacts 30, which in assembled condition are arranged inside of the plug-in projection 14. The electrical contacts 30 serve to receive the contact pins of a corresponding squib socket (not shown). Attached to the electrical contacts 30 are two contact adapter elements 32, which will be described later in more detail. The contact adapter elements 32 can be fastened to the electrical contacts 30 for example by means of welding or crimping or they can be formed as one integral part or connected by any other suitable means. It is, however, essential, that after a cable or cable terminal is connected with the contact adapter element an electrical connection between the cable, respectively the cable terminal, and the electrical contacts is established, since otherwise connector 1 would not function properly. The connector

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shown is further provided with a ferrite element 34, having a substantially cylindrical shape with two through holes 36 running longitudinally through the ferrite element 34. In assembled condition the ferrite element 34 is arranged between the connector adapter element 32 and the electrical contacts 30, such that the connection strips 38 between the contacts and the adapter element runs through the holes 36. It should be noted that the connector shown in figure 1 is first fully assembled before any cable assembly 40 is inserted into the apertures 16 into the connector housing. The connector shown in figures 1 to 3 is a right angle strip connector, as the skilled person will recognize immediately.

In figure 2A the connector 1 is shown in assembled condition. As it is indicated by the arrow in figure 2A the two cable assemblies 40 shown are not yet inserted or fixed to the connector 1. Thus, although connector 1 is fully assembled, it is possible to fix the cable assemblies with the connector without the necessity to disassemble the connector. In the following, the cable assemblies 40 are described to facilitate understanding. However, it should be clear for the skilled person, that also other cable assemblies 40 may be used with the connector of the present invention, since the contact adapter element 32 can be shaped to accommodate a large variety of cable assemblies. Each cable assembly 40 comprises a cable 41, which is surrounded by a plug-like sealing element 42 and an electrical contact pin 44 which is arranged inside of a pin receptacle 43. The pin receptacle 43 serves among others for a mechanical connection of the cable assembly with the connector housing. At this point, it should again be noted that the term "cable terminal" is to be understood in its broadest sense as any kind of contact end of a cable, which is intended to be inserted into the connector housing to establish an electrical connection. In the case of a squib connectors, the stripped ends of the cable are provided with some kind of separate contact arrangement, as shown in the figures, usually consisting of contact pins 44 as well as further suitable fastening elements 33. Figure 2B shows the connector 1 after the cable assemblies

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40 are inserted into the housing through the apertures 16. In the condition shown in figure 2B the connector is ready for use.

Figure 3 shows a cut side view of the connector 1 of figures 1 and 2. In the views of figure 3 one can clearly see the location of the different parts of the connector in assembled condition. Electrical contact 30 is arranged inside of plug part 14 and the ferrite element 34 partially surrounds the contact adapter element 32. In figure 3A the connector is fully assembled, but no cables are yet fixed to the connector. Figure 3B shows the insertion process of the cable assembly 40 into the aperture 16 provided in the second housing half 12. To facilitate the explanations, the cable terminal in Figs. 3A to C comprising pin 44 and fastening element 43 is generally denoted with the reference number 50. Figure 3C shows the connector after the full insertion of the cable terminal 50 into the connector housing. As one can see from the figure the sealing element 42 seals the gap between the aperture 16 and the cable 41, such that the connector shown in figure 3C is fully sealed and ready to use. The pin 44 of the cable terminal 50 is received by the contact adapter element 32. As one can best see from figure 3D, the contact adapter element is made from sheet metal, which is bent into the form of an essentially rectangular open box, to receive the pin 44 of the cable terminal. As one can further see from the detail shown in figure 3D, the contact adapter element 32 is provided with a protruding latching arm 35, which abuts against a shoulder 13 provided on an interior surface of first half 10 of the housing, such that a movement of the contact adapter element in the insertion direction of the cable terminal is prevented, i.e. in the direction indicated by the arrows in figures 3A and B. Similarly, the fastening element 33 of the cable terminal 50 is provided with a locking protrusion 45, which abuts a locking shoulder 11 provided on an interior surface of the second half 12, to prevent an accidental removing of the cable out of the connector housing.

It should be clear to the skilled person that the embodiment shown in the figures is preferred, but that, however, also an integrated, moulded

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solution for the connector housing is possible. The parts 10, 12 and 14 of the connector housing may for example be one integral plastic part, which is moulded around the electrical parts 34, 30, 38, 32 located inside of the connector. Obviously, in this case no separate sealing element 20 is necessary.

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Claims

1. Connector (1), comprising:
 - a connector housing comprising at least one aperture (16) in a wall of the housing for the insertion of a cable or cable terminal therein; and
 - an electrical contact (30) for establishing an electrical connection with a counter connector; characterized in that it further comprises:
 - at least one contact adapter element (32), which is electrically coupled or integrated with the electrical contact (30), and which is adapted to receive a cable or cable terminal after assembly of the connector housing, to allow a sealed assembly of a cable and the connector after assembly of the connector housing.
2. Connector according to claim 1, wherein the housing comprises a first and a second half (12) defining an essentially closed space in assembled condition and a sealing element (20), which is arranged between the first and the second half of the connector housing.
3. Connector according to claim 2, wherein the sealing element (20) is an uninterrupted sealing ring.
4. Connector according to claim 2 or 3, wherein the sealing element is integrally formed with the first and/or the second half of the connector housing.
5. Connector according to any of the preceding claims 2 to 4, wherein the aperture (16) is not arranged at the edge of one of the halves of the connector housing.
6. Connector according to any of the preceding claims, further comprising a ferrite element (34) arranged inside the connector housing, such that it can

at least partially surround a part of the electrical contact (30; 38) and/or a cable terminal, when a cable terminal is inserted into the connector housing.

- 5 7. Connector according to any of the preceding claims, further comprising a CPA device (24) and a sealing element (26) between the CPA device and the connector housing, to allow for a sealed connection between CPA device and connector housing in fully assembled condition.
- 10 8. Connector according to any of the preceding claims, wherein the contact adapter element (32) is made from sheet metal, which is bent into the form of a essentially rectangular open box, adapted for the reception of a cable terminal, preferably adapted for the reception of a contact pin provided on a cable terminal.
- 15 9. Connector according to any of the preceding claims, wherein the contact adapter element (32) is provided with a latching arm (35) or locking protrusion which in assembled condition of the connector housing abuts a shoulder (13) provided on an interior surface of the housing (12), such that
- 20 a movement of the contact adapter element in insertion direction of a cable or cable terminal is prevented.
10. Connector according to any of the preceding claims, wherein at least a part of the housing is moulded around the electrical contact (30).
- 25 11. Connector according to any of the preceding claims, wherein the squib connector (1) is a right angle squib connector, such that the insertion direction of a cable terminal (50) into the housing (10, 12) of the squib connector is essentially perpendicular to the plug-in direction of the squib connector.
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12. Connector system (1, 40), comprising a connector (1) according to any of the preceding claims and at least one cable assembly (40) with a cable terminal (50), whereby the cable assembly and/or the cable terminal is(are) provided with a sealing element (42) to allow for a sealed connection between connector housing (12) and cable assembly or cable terminal and whereby the cable terminal (50) is adapted to be mechanically fastened with the connector housing (12) or the contact adapter element upon insertion of the cable terminal into the connector housing and which cable terminal (50) is in electrical contact with the contact adapter element (32) after full insertion into the connector housing.
13. Method for assembly of a sealed connector, comprising the steps of:
- providing a connector according to any of claims 1 to 11,
 - providing at least one cable with a cable terminal; and
 - inserting the cable terminal into the connector housing.

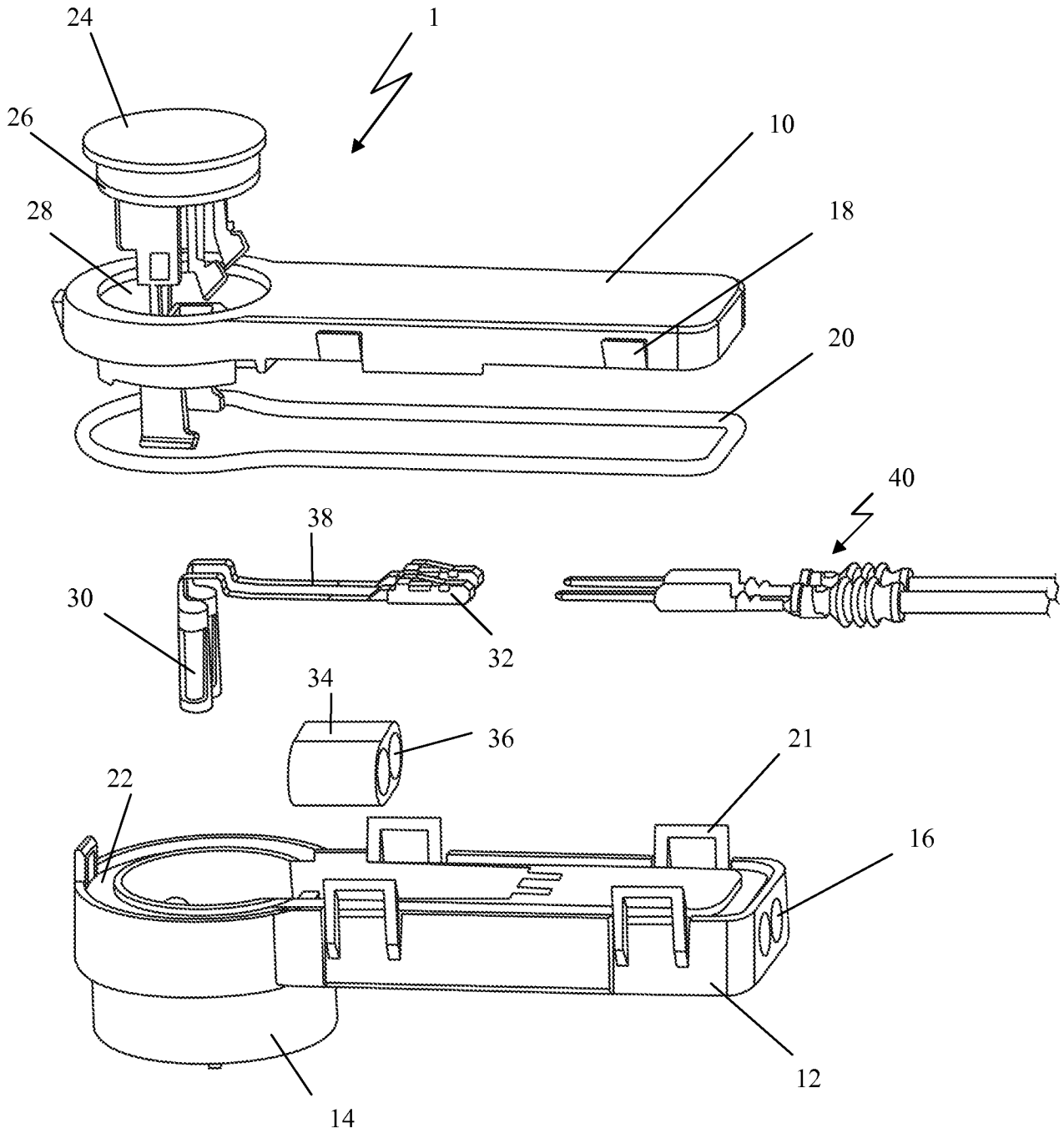


Fig. 1

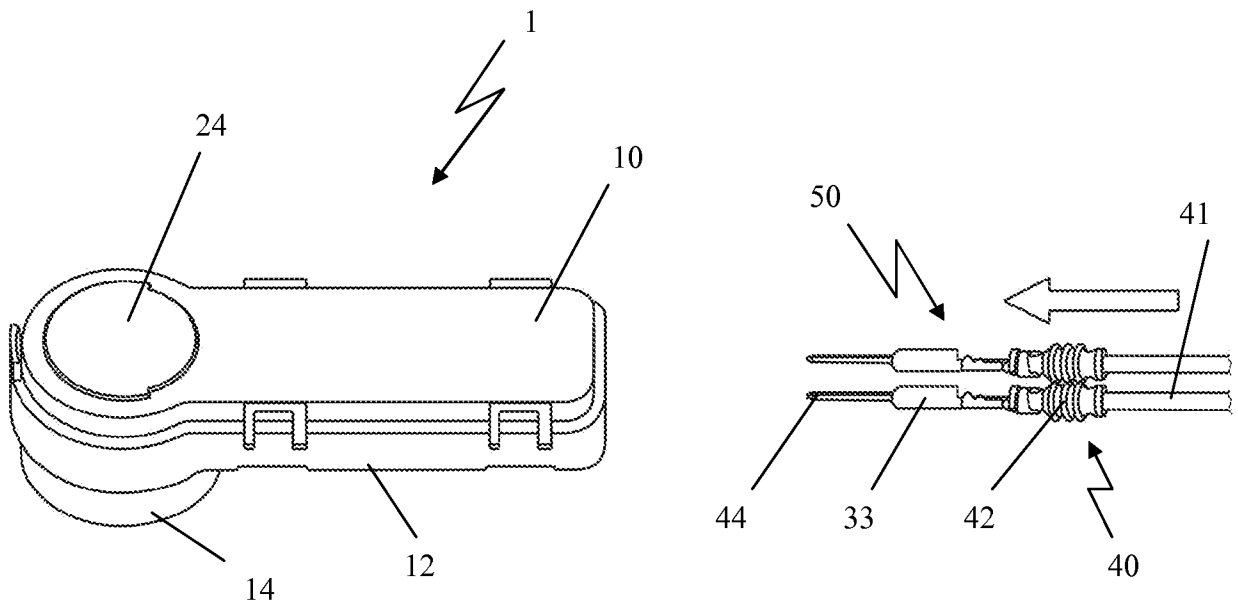


Fig. 2A

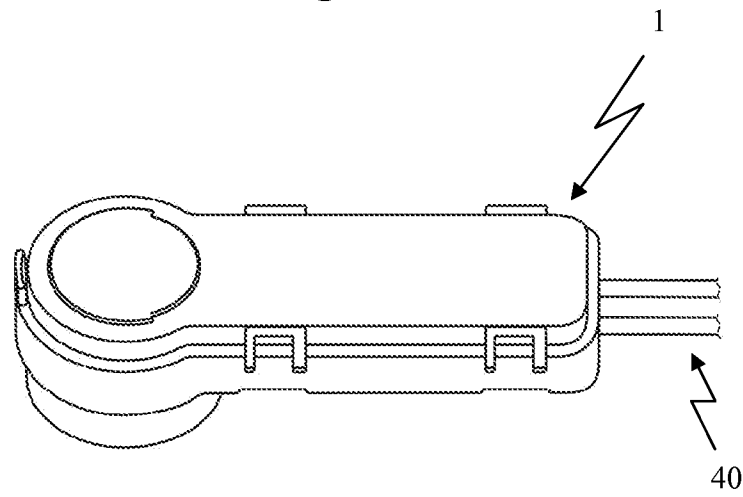


Fig. 2B

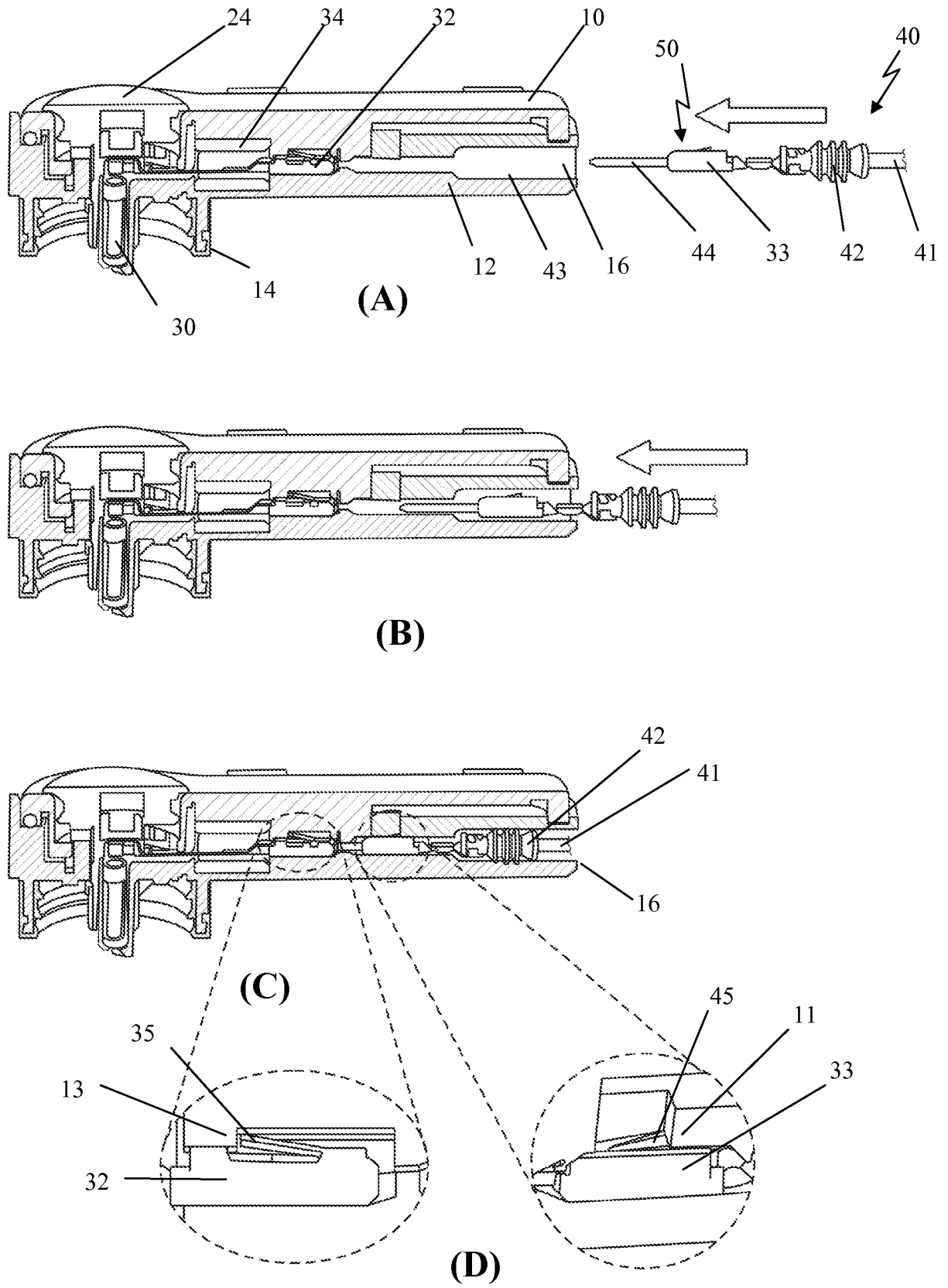


Fig. 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2008/055607A. CLASSIFICATION OF SUBJECT MATTER
INV. H01R13/52

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H01R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|--|-----------------------|
| Y | US 6 074 241 A (PATEL NAVIN KANJIBHAI [US] ET AL) 13 June 2000 (2000-06-13) column 3, line 1 - line 8; figures 1,6,7 ----- | 1-6,8,9, 11-13 |
| Y | US 2005/112915 A1 (MUELLER MANFRED [DE]) 26 May 2005 (2005-05-26) paragraph [0020] ----- | 1-6,8,9, 11-13 |
| Y | DE 199 42 921 A1 (AMPHENOL TUCHEL ELECT [DE]) 12 April 2001 (2001-04-12) column 2, line 11 - line 13 ----- | 2-5 |
| Y | US 5 993 230 A (GAUKER BRADFORD K [US] ET AL) 30 November 1999 (1999-11-30) column 6, line 63 - line 65; figure 19 ----- -/-- | 6,11 |

 Further documents are listed in the continuation of Box C. See patent family annex.

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Date of the actual completion of the international search

11 May 2009

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20/05/2009

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2008/055607

| C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT | | |
|--|--|-----------------------|
| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
| Y | EP 1 855 354 A (NECTO GROUP S R L [IT]) 14 November 2007 (2007-11-14) paragraph [0011]; figure 6 ----- | 8,9 |
| A | WO 2006/131140 A (FRAMATOME CONNECTORS INT [FR]; REGNIER VINCENT [DE]) 14 December 2006 (2006-12-14) figure 1 ----- | 1 |
| Y | WO 2007/043882 A (ELECTRISCHE APP NFABRIEK CAPAX [NL]; HENDRIKS HENRICUS CORNELIS MAR [N]) 19 April 2007 (2007-04-19) page 5, line 9 - line 15 ----- | 12 |
| A | DE 203 11 555 U1 (LUMBERG AUTOMATION COMPONENTS [DE]) 2 December 2004 (2004-12-02) figure 6 ----- | 1 |

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/IB2008/055607

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|--|------------------|-------------------------|---|
| US 6074241 | A | 13-06-2000 | NONE |
| US 2005112915 | A1 | 26-05-2005 | DE 10353356 A1 02-06-2005 EP 1531520 A2 18-05-2005 JP 2005150114 A 09-06-2005 |
| DE 19942921 | A1 | 12-04-2001 | NONE |
| US 5993230 | A | 30-11-1999 | US 6203342 B1 20-03-2001 |
| EP 1855354 | A | 14-11-2007 | NONE |
| WO 2006131140 | A | 14-12-2006 | CN 101194398 A 04-06-2008 EP 1891707 A1 27-02-2008 JP 2008543021 T 27-11-2008 |
| WO 2007043882 | A | 19-04-2007 | DE 112006002704 T5 28-08-2008 NL 1030163 C2 12-04-2007 |
| DE 20311555 | U1 | 02-12-2004 | NONE |