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(71) Applicant: Aptiv Technologies Limited

St. Michael (BB)

(72) Inventors:

- DEMOMENT, FABRICE  
28210 Nogent-le-Roi (FR)

• BELLIARD, FREDERIC

28170 Tremblay-les-Villages (FR)

• GOUBAND, PHILIPPE

28500 Charpont (FR)

(74) Representative: INNOV-GROUP

310, avenue Berthelot

69372 Lyon Cedex 08 (FR)

### Remarks:

Amended claims in accordance with Rule 137(2) EPC.

## (54) CONNECTOR WITH A COMMON GROUNDING PLATE

(57) An electrical connector comprising:

- a plurality of terminals (7) connected to a shielded cable (10) comprising a cable shield surrounding a core wire (13),
- an insulating housing accommodating said terminals (7),
- a grounding cable (15).

The electrical connector further comprises a common grounding plate (18) electrically connected both to the cable shields and to said free end of the grounding cable (15).

A method for assembling such an electrical connector.

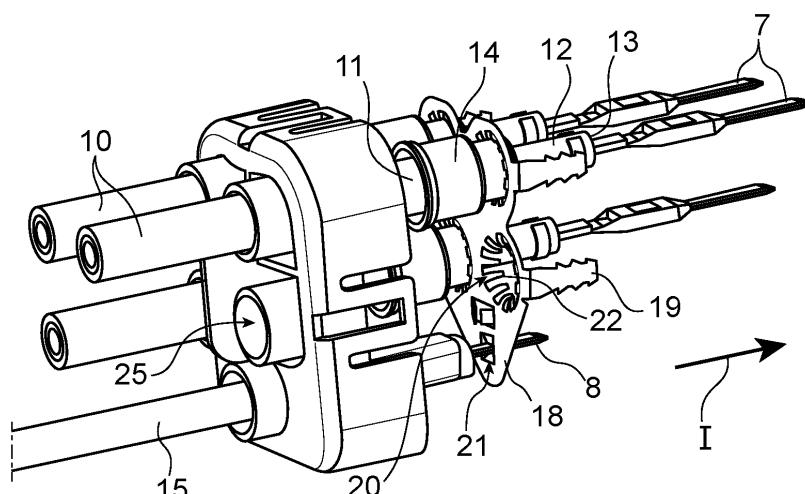


FIG. 2

**Description****TECHNICAL FIELD**

**[0001]** The present disclosure relates in general to the field of electrical connectors, and in particular to the field of connectors for connecting shielded cables, such as shielded cables for high voltage current. Such connectors are intended to be used in any kind of industry, and in particular in the automotive industry.

**PRIOR ART**

**[0002]** Connectors, and in particular power connectors for automotive applications, are known in which power terminals are attached (e.g. crimped) to shielded cables. Then the grounding of the shielding cables is performed by harness makers who must splice the shielding braids of these shielded cables with a grounding wire that is itself connected to the vehicle body.

**[0003]** However, this harness preparation is quite complex and time consuming. In particular the splicing must be done for each shielded cable individually. Moreover, such a technology creates complications for designing sealed connectors.

**[0004]** The disclosure below aims to remedy, at least partially, the above-mentioned drawbacks.

**SUMMARY**

**[0005]** Indeed, it is disclosed below an electrical connector according to claim 1. In this connector the common grounding plate electrically connects the shielding braids of the shielded cables and the grounding cable. In other words, this connector comprises an additional way corresponding to a grounding cable allowing the cable shields (e.g. shielding braids) to be easily connected to an equipment ground (e.g., the vehicle ground). This solution avoids the complex and time-consuming task of splicing the shielding braid of each cable.

**[0006]** Advantageously, this electrical connector comprises one or more of the features mentioned in claims 2 to 10, each one of these features being considered independently of each other or in combination of one or several others.

**[0007]** It is also disclosed below a method according to claim 12, for assembling an electrical connector. Advantageously, this method comprises one or more of the features mentioned in claims 13 to 15, each one of these features being considered independently of each other or in combination of one or several others.

**BRIEF DESCRIPTION OF THE DRAWINGS**

**[0008]** Other features, purposes and advantages of the disclosure will become apparent on reading the following detailed description given with reference to the appended drawings and by way of non-limiting examples and in

which:

Figure 1 is a schematic representation in perspective of an example embodiment of a connector assembly; Figure 2 is a schematic representation in perspective of a power connector of the connector assembly shown in Figure 1, this power connector being represented without its housing; Figure 3 is a schematic cross-section of a portion of the power connector of the connector assembly shown in Figure 1; and Figure 4 is a schematic cross-section of a detail of the power connector shown in Figure 3.

**15 DETAILED DESCRIPTION**

**[0009]** Figure 1 discloses an example of a connector assembly 1. The connector assembly 1 comprises a connector 2 and a counterpart connector 3. In this example, the connector 2 is a male connector and the counterpart connector 3 is a female connector. For example, both the connector 2 and the counterpart connector 3 are 4-way power connectors (with an additional way for the connector 2 as disclosed below). The connector 2 comprises in particular a housing 4 and a seal retainer 5, both made of a dielectric material. The connector 2 also comprises a common grounding plate 18 (see Fig. 2), a single wire seal 16 (see Fig. 3) and a common seal 24 (see Fig. 3). The housing 3 has a plurality of compartments 6 (see Fig. 3). Each compartment 6 is configured for accommodating a terminal 7 (in this example a male power terminal) (see Fig. 2). A grounding terminal 8 is accommodated in a cavity 9 formed in the seal retainer 5 (see Figs. 3 and 4).

**[0010]** Each terminal 7 is mechanically attached and electrically connected to a shielded cable 10. For example, each terminal 7 is crimped on a shielded cable 10. Each shielded cable 10 is intended to transmit high power currents. Each shielded cable 10 comprises an outer sheath 11, an inner sheath 12, both made of electrically insulating material, an electrically conducting cable shield (e.g. a shielding braid) being inserted between the outer sheath 11 and the inner sheath 12. The inner sheath 12 envelops a core 13 formed of at least one electrically conductive wire. The cable shield surrounds the core 13 except at the end of the shielded cable 10, where the cable shield is turned up over the outer sheath 11. An electrically conducting ferrule 14 is mounted at the end of each shielded cable 10, on a portion of the cable shield which is turned up over the outer sheath 11.

**[0011]** The use of ferrules 14 is optional, but it helps improve the electrical connection between the common grounding plate 18 and the cable shields.

**[0012]** The grounding terminal 8 is mechanically attached and electrically connected to a free end of a grounding cable 15. For example, the grounding terminal 8 is crimped on the grounding cable 15. For example, the grounding terminal 8 is also crimped onto the single

wire seal 16 (even though, this is not shown on the figures). The single wire seal 16 is configured for providing a sealing barrier between the cavity 9 and an external insulating sheath 17 of the grounding cable 8. The grounding cable 15 is intended to be connected to the ground of a vehicle. The use of a grounding terminal 8 is optional, but it helps improve the electrical connection between the common grounding plate 18 and the grounding cable 15.

**[0013]** As shown on figures 2 and 3, the common grounding plate 18 is mounted into the housing 4. For example, the common grounding plate 18 comprises fixing means 19. For example, the fixing means 19 have a fishbone shape, each secured, hooked, in a respective slot made in the housing 4, thereby attaching the common grounding plate 18 in the housing 4. The common grounding plate 18 comprises a plurality of openings 20, 21: in this example, four first openings 20 in which a ferrule 14 is inserted and one second opening 21 in which the grounding terminal 8 is inserted. The four first openings 20 are each respectively surrounded by at least one first flexible (i.e. elastic) tongues 22 (in this example twelve first flexible tongues 22) (see Figure 4). At least one second flexible (i.e. elastic) tongue 23 extends from the edge of the second opening 21 (in this example two second flexible tongues 23) (see Figure 4). The first flexible tongues 22 and the second flexible tongues 23 are bent so as to extend, in an insertion direction I of the shielded cables 10 and the grounding cable 15, from the common grounding plate 18 to a free end. This orientation of the first flexible tongues 22 and the second flexible tongues 23 allows for an easy insertion of the ferrules 14 and the grounding terminal 8, respectively in the first openings 20 and the second openings 21. The free end of the first flexible tongues 22 and the second flexible tongues 23 could alternatively extend towards the seal retainer 5, in a direction opposite the insertion direction I. The free ends of the first flexible tongues 22 and the second flexible tongues 23 are configured so as to establish an electrical contact between the common grounding plate 18, the ferrules 14 and the grounding terminal 8. In other words, the ferrules 14 and the grounding terminal 8 are electrically connected to each other through the common grounding plate 18. The first flexible tongues 22 and the second flexible tongues 23 maintain a resilient electrical contact between respectively the ferrules 14 and the grounding terminal 8.

**[0014]** The common seal 24 is configured for providing a sealing barrier between the seal retainer 5 and the outer sheath 11 of each shielded cable 10, and between the seal retainer 5 and the housing 4. The common seal 24 is advantageously mounted in the seal retainer 5.

**[0015]** For assembling the various elements of the electrical connector 2, one can implement for example the following steps.

**[0016]** On the one hand, the common grounding plate 18 is mounted in the housing 4 (in particular with the insertion of the fixing means 19 in corresponding housing

slots).

**[0017]** On the other hand, the free ends of the shielded cables 10 are passed through passages 25 made through the rear face of the seal retainer 5 and through the common seal 24. The terminals 7 can be attached to the respective free end of each shielded cable 10 either before or after the shielded cables 10 are passed through the passages 25. The ferrules 14 are placed on the shielded cables 10 and connected to the cable shield either before or after the terminals 7 are attached to the shielded cables 10 (but after the shielded cables 10 are passed through the passages 25). Further, the grounding terminal 8 and the single wire seal 16 are placed and mounted on the free end of the grounding cable 15. Then, the grounding terminal 8 is inserted in the cavity 9 of the seal retainer 5. An assembly is thus obtained comprising the seal retainer 5, the common seal 24, the single wire seal 16 and the free ends of the shielded cables 10 and the grounding cable 15, respectively with the ferrules 14 and terminals 7 on the one hand, and the grounding terminal 8, on the other hand.

**[0018]** This assembly can then be mounted in the housing 4 in inserting, in the insertion direction I, the free ends of the shielded cables 10 with the ferrules 14 as well as the grounding terminal 8, respectively into the first opening 20 and the second openings 21 of the common grounding plate 18. Thereby, the common grounding plate 18 is connected to the cable shields (via each ferrule 14) and to the grounding cable 15 (via the grounding terminal 8). The seal retainer 5 is clipped onto the rear face of the housing 4.

## Claims

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1. An electrical connector (1) comprising:

- 40 - a plurality of terminals (7) each respectively electrically connected to a shielded cable (10) comprising a cable shield surrounding a core (13) formed of at least one electrical wire,
- 45 - an insulating housing (4) having a plurality of compartments (6) configured for accommodating said terminals (7),
- 50 - a grounding cable (15) having a free end located in said housing (4),

**characterized in that** it comprises a common grounding plate (18) electrically connected both to the cable shields of at least two shielded cables (10) and to said free end of the grounding cable (15).

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2. The electrical connector (1) of claim 1, wherein each one of said at least two shielded cables (10) comprises a conductive ferrule (14) electrically connected to the respective cable shield of one of said at least two shielded cables (10), the common grounding plate (18) being electrically connected to each

ferrule (14).

3. The electrical connector (1) of claim 2, wherein the common grounding plate (18) is electrically connected to each ferrule (14) by at least one first flexible tongue (22). 5

4. The electrical connector (1) of claim 3, said at least one first flexible tongue (22) extends in an insertion direction (I), from the common grounding plate (18) to a free end. 10

5. The electrical connector (1) according to any one of the preceding claims, wherein a grounding terminal (8) is electrically connected to the free end of the grounding cable (15). 15

6. The electrical connector (1) of claim 5, wherein the grounding terminal (8) is accommodated in a cavity (9) formed in a seal retainer (5) mounted onto the housing (4). 20

7. The electrical connector (1) of claim 6, comprising a single wire seal (16) configured for providing a sealing barrier between the cavity (9) formed in the seal retainer (5) and an external insulating sheath (17) surrounding the grounding cable (15). 25

8. The electrical connector (1) according to any one of claims 5 to 7, comprising a common seal (24) configured for providing a sealing barrier between the seal retainer (5) and each one of said at least two shielded cables (10). 30

9. The electrical connector (1) of any of one of claims 5 to 8, wherein the common grounding plate (18) is electrically connected to said grounding terminal (8) by at least one second flexible tongue (23). 35

10. The electrical connector (1) of claim 9, wherein said at least one second flexible tongue (23) extends in the insertion direction (I), from the common grounding plate (18) to a free end. 40

11. The electrical connector (1) according to any one of the preceding claims, wherein the common grounding plate (18) comprises fixing means (19) configured for fixing the common grounding plate (18) onto the housing (4). 45

12. A method for assembling an electrical connector (1) having an insulating housing (4), comprising the steps of

- mounting a common grounding plate (18) into the housing (4),
- inserting, in an insertion direction (I), into the housing (4) into which the common grounding

plate (18) is mounted, a free end of a grounding cable (15) and at least two shielded cables (10) each having a respective cable shield, thereby connecting the common grounding plate (18) to the cable shields of said at least two shielded cables (10) and to the free end of the common grounding cable (15). 55

13. The method of claim 12, comprising, before the step of inserting the free end of the grounding cable (15) into the housing (4), a step of attaching and connecting the free end of the grounding cable (15) to a grounding terminal (8), and a step of accommodating the grounding terminal (8) into a seal retainer (5).

14. The method of claim 13, comprising the step of mounting the seal retainer (5) onto the housing (4), thereby connecting the common grounding plate (18) to the cable shields and to the grounding terminal (8). 20

15. The method according to any of claims 12 to 14, comprising a step of mounting a ferrule (14) on each one of said at least two shielded cables (10), the step of inserting said at least two shielded cables (10) into the housing (4) then allowing the common grounding plate (18) to be connected to the cable shields via each ferrule (14). 25

**Amended claims in accordance with Rule 137(2) EPC.**

1. An electrical connector (1) comprising:

- a plurality of terminals (7) each respectively electrically connected to a shielded cable (10) comprising a shielding braid surrounding a core (13) formed of at least one electrical wire,
- an insulating housing (4) having a plurality of compartments (6) configured for accommodating said terminals (7),
- a grounding cable (15) having a free end located in said housing (4),

**characterized in that** it comprises a common grounding plate (18) electrically connected both to the shielding braids of at least two shielded cables (10) and to said free end of the grounding cable (15),

wherein each one of said at least two shielded cables (10) comprises a conductive ferrule (14) electrically connected to the respective shielding braid of one of said at least two shielded cables (10), the common grounding plate (18) being electrically connected to each ferrule (14) by at least one first flexible tongue (22),

**characterized in that** the grounding plate (18) is mounted in the insulating housing (4) and **in**

that said at least one first flexible tongue (22) extends in an insertion direction (I) of the terminals (7) in the insulating housing (4), from the common grounding plate (18) to a free end.

2. The electrical connector (1) according to claim 1, wherein a grounding terminal (8) is electrically connected to the free end of the grounding cable (15).

3. The electrical connector (1) of claim 2, wherein the grounding terminal (8) is accommodated in a cavity (9) formed in a seal retainer (5) mounted onto the housing (4).

4. The electrical connector (1) of claim 3, comprising a single wire seal (16) configured for providing a sealing barrier between the cavity (9) formed in the seal retainer (5) and an external insulating sheath (17) surrounding the grounding cable (15).

5. The electrical connector (1) according to any one of claims 3 to 4, comprising a common seal (24) configured for providing a sealing barrier between the seal retainer (5) and each one of said at least two shielded cables (10).

6. The electrical connector (1) of any of one of the preceding claims, wherein the common grounding plate (18) is electrically connected to said grounding terminal (8) by at least one second flexible tongue (23).

7. The electrical connector (1) of claim 9, wherein said at least one second flexible tongue (23) extends in the insertion direction (I), from the common grounding plate (18) to a free end.

8. The electrical connector (1) according to any one of the preceding claims, wherein the common grounding plate (18) comprises fixing means (19) configured for fixing the common grounding plate (18) onto the housing (4).

9. A method for assembling an electrical connector (1) having an insulating housing (4) having a plurality of compartments (6) configured for accommodating terminals (7), the method comprising the steps of

- mounting a common grounding plate (18), having first flexible tongues (22), into the electrical connector (1),
- inserting, in an insertion direction (I), into the electrical connector (1) a free end of a grounding cable (15) and at least two shielded cables (10) each having a respective shielding braid, thereby connecting the common grounding plate (18) to the shielding braids of said at least two shielded cables (10) via said first flexible tongues (22), and to the free end of the common grounding

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cable (15),

**characterized**

- in that the grounding plate (18) is mounted in the insulating housing (4),
- in that the terminals (7) are inserted in the insulating housing (4) in an insertion direction (I), at least one first flexible tongue (22) extending from the common grounding plate (18) to a free end in said insertion direction (I), and
- in that a seal retainer (5) is mounted on the insulating housing (4).

10. The method of claim 9, comprising, before the step of inserting the free end of the grounding cable (15) into electrical connector (1), a step of attaching and connecting the free end of the grounding cable (15) to a grounding terminal (8), and a step of accommodating the grounding terminal (8) into the seal retainer (5).

11. The method of claim 10, comprising the step of mounting the seal retainer (5) onto the housing (4), thereby connecting the common grounding plate (18) to the shielding braids and to the grounding terminal (8).

12. The method according to any of claims 9 to 11, comprising a step of mounting a ferrule (14) on each one of said at least two shielded cables (10), the step of inserting said at least two shielded cables (10) into the housing (4) then allowing the common grounding plate (18) to be connected to the shielding braids via each ferrule (14).

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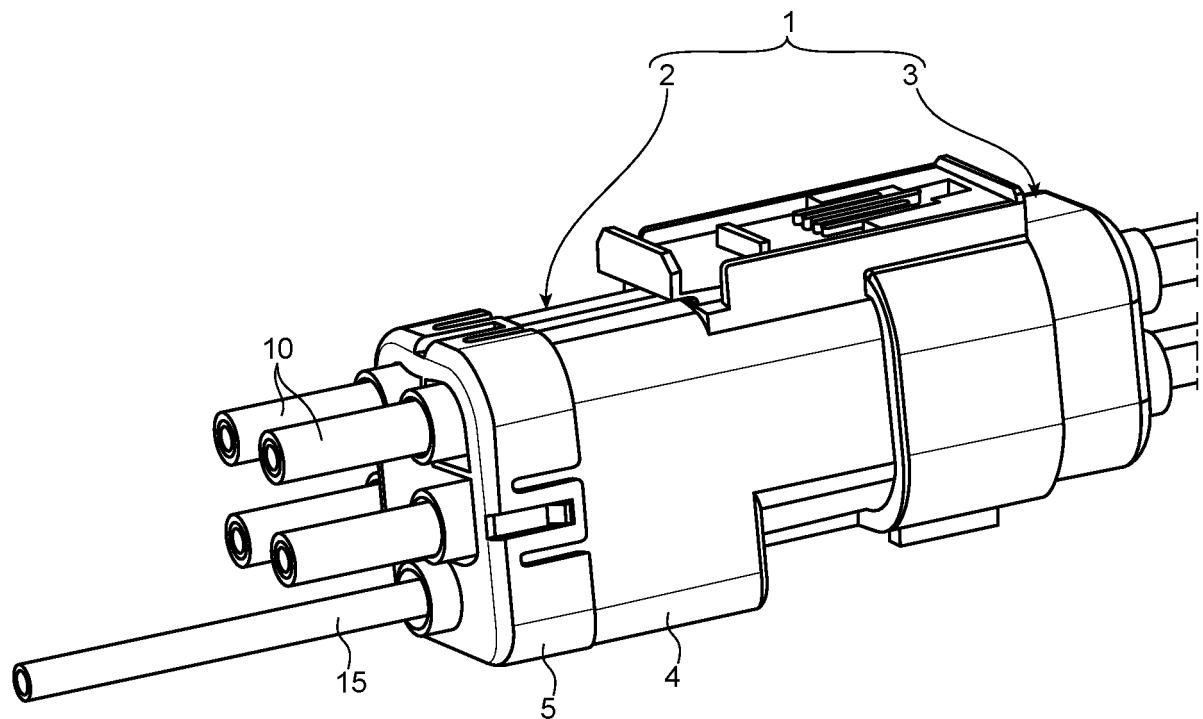


FIG. 1

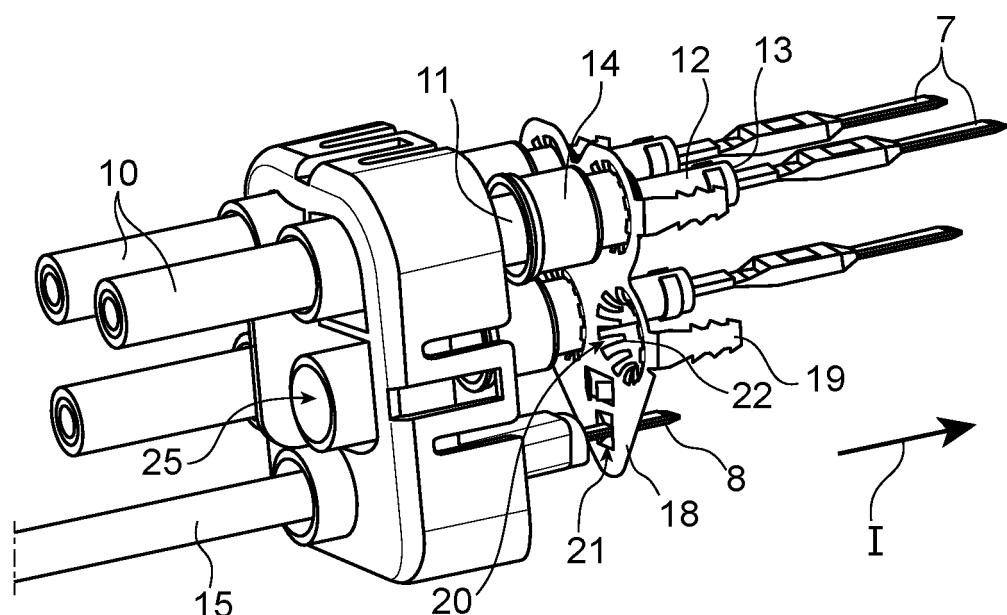


FIG. 2

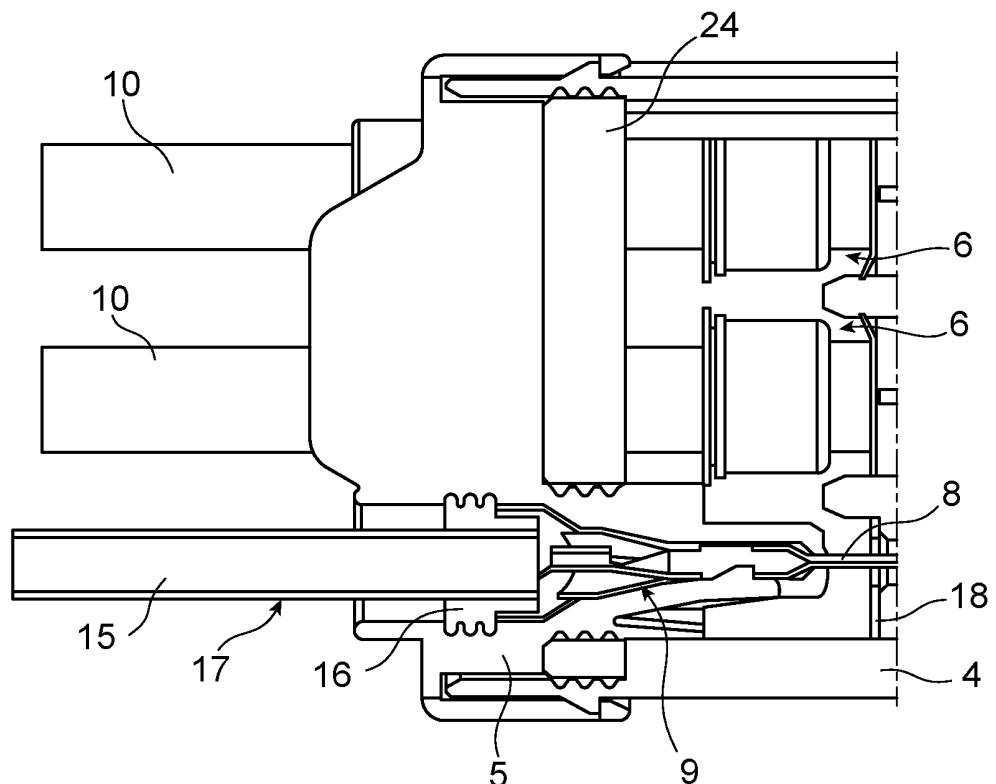


FIG. 3

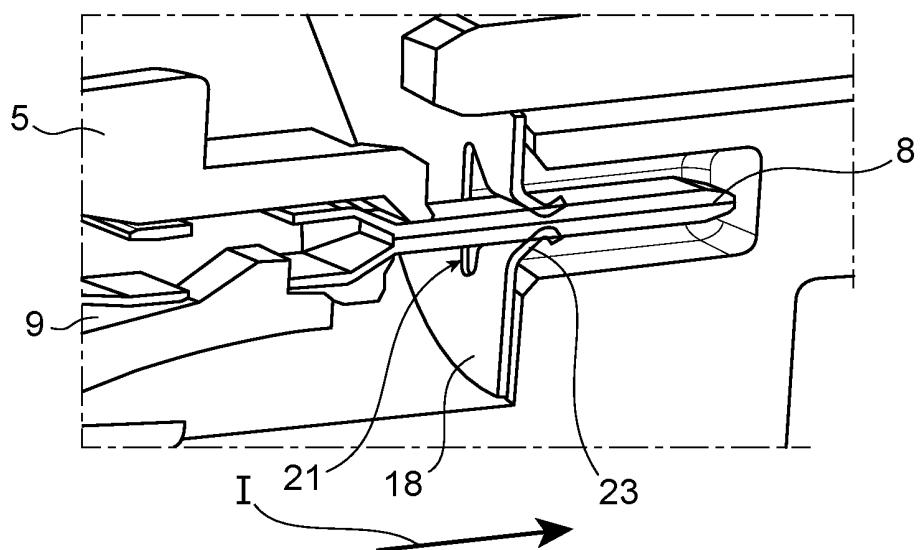


FIG. 4



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Application Number

EP 22 20 8445

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30			TECHNICAL FIELDS SEARCHED (IPC)
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55	1 Place of search The Hague	1 Date of completion of the search 20 April 2023	1 Examiner Kandyla, Maria
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