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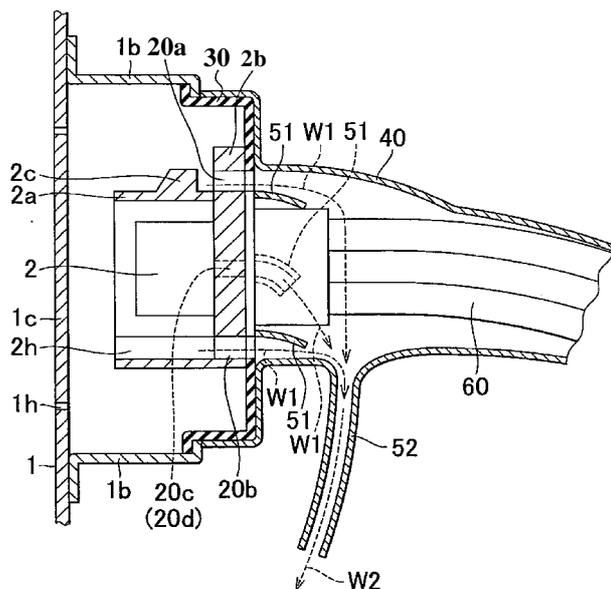
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[Continued on next page]

(54) **Title:** INLET ASSEMBLY

FIG. 5



(57) **Abstract:** A drainage inducing member that promotes drainage is arranged on an edge portion on the back side of a drain hole provided in an inlet base of an inlet assembly, in order to better promote the drainage of water that has reached the drain hole to the outside.

WO 2011/104609 A1

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INLET ASSEMBLY

BACKGROUND OF THE INVENTION

1. Field of the Invention

5 **[0001]** The invention relates to the structure of an inlet assembly that includes an inlet to which a connector that is connected to an external power supply connects.

2. Description of the Related Art

[0002] A vehicle that runs by driving a motor with electric power stored in a power storage device, such as an electric vehicle or a hybrid vehicle (HV), that will
10 hereinafter simply be referred to as an "electric vehicle", has been put into practical use. Also in recent years, progress has also been made with the development of a so-called plug-in vehicle (PHV) that is provided with a system that charges a power storage device with electric power supplied from an external power supply referred to as a charging stand or the like.

15 **[0003]** In such a plug-in vehicle, a charging inlet for connecting a charge connector is provided on the side of the vehicle (such as on a front left fender of the vehicle). One end of the charge connector is connected to a commercial power supply or the like. The connector remains connected to the charge inlet of the vehicle in a driveway or a parking lot, for example, for a fixed period of time.

20 **[0004]** The connector remains connected to the inlet in order to perform charging. In this case, in cold areas or in winter, it is possible that rainwater or water adhered by spattered mud or the like may freeze on the inlet assembly that includes the inlet or on the connector, such that the connector is unable to be disconnected from the inlet. Also, water adhered onto the inlet assembly may freeze, thereby preventing the
25 connector from being able to be connected to the inlet.

[0005] Incidentally, Japanese Patent Application Publication No. 07-192826 (JP-A-07-192826) relates to an electric vehicle charge connector, and describes an

electric vehicle that includes a structure that enables charging to be performed to a charging apparatus mounted in the vehicle using an external power supply. Japanese Patent Application Publication No. 2003-200936 (JP-A-2003-200936) relates to the shape of a drain hole of a container, and describes technology that prevents a water
5 film over a drain hole, by slanting the side surface on the outside of the drain hole. Japanese Patent Application Publication No. 07-179149 (JP-A-07-179149) relates to a drainage structure of a stay of a vehicle door mirror, and describes technology that improves the drainage effect by incrementally making the diameter of a drain hole smaller.

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SUMMARY OF THE INVENTION

[0006] The invention thus provides an inlet assembly that has a structure that promotes the drainage of water that has adhered to the inlet assembly to the outside.

[0007] One aspect of the invention relates to an inlet assembly provided in a vehicle in which a power storage device mounted inside is charged using an external
15 power supply.

[0008] This inlet assembly includes an inlet to which a connector that is connected to the external power supply connects, an inlet base that secures the inlet to the vehicle, and a cylindrical guide wall that surrounds the inlet and guides the connector into connection with the inlet. A drain hole is provided in the inlet base,
20 and a drainage inducing member that promotes drainage is arranged on an edge portion of the drain hole, on a back side of the inlet base, the back side being a side opposite the side on which the inlet is provided.

[0009] In the structure described above, at least two of the drain holes may be provided in the inlet base, a respective one of the drainage inducing members may be
25 provided for a respective one of the drain holes, and the inlet assembly may also include a collective drainage member that collects water drained from the drainage inducing members in a single location and drains the water.

[0010] In the structure described above, a grommet that covers a cable that is

connected to the inlet may be provided on the back side of the inlet base, and the collective drainage member may be provided on the grommet.

[0011] According to the inlet assembly of the invention, it is possible to provide an inlet assembly that has a structure that promotes the drainage of water that
5 has adhered to the inlet assembly to the outside.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The features, advantages, and technical and industrial significance of this invention will be described in the following detailed description of example embodiments of the invention with reference to the accompanying drawings, in which
10 like numerals denote like elements, and wherein:

FIG 1 is a diagram of a charging stand and a vehicle provided with an inlet assembly according to an example embodiment of the invention;

FIG 2 is a front view of the inlet assembly according to the example embodiment;

15 FIG 3 is an enlarged front view of the inlet assembly according to the example embodiment;

FIG 4 is a plan view of an inlet shield according to the example embodiment; and
FIG 5 is a sectional view taken along line V in FIG 2.

DETAILED DESCRIPTION OF EMBODIMENTS

20 [0013] An inlet assembly according to an example embodiment of the invention will now be described with reference to the accompanying drawings. Incidentally, in the example embodiment described below, when reference is made to a number or an amount or the like, the invention is not limited to this number or amount or the like unless specifically noted. Also, like or corresponding parts will be denoted
25 by like reference characters and redundant descriptions will not be repeated.

[0014] FIG 1 is a diagram of a charging stand and a vehicle provided with an inlet assembly according to an example embodiment of the invention. The charging stand 10 is an alternating current (AC) power supply provided especially for charging a

charger 3 mounted in an electric vehicle such as a vehicle 1. Incidentally, the charging stand 10 may also be a direct current (DC) power supply.

[0015] The vehicle 1 is an electric vehicle that runs by driving a motor, not shown, using electric power in the charger 3. The vehicle 1 may be an electric
5 vehicle provided with only a motor as a driving source, or a hybrid vehicle provided with both a motor and an engine.

[0016] The vehicle 1 is a so-called plug-in vehicle, and has a charging system for charging a power storage device B with alternating current (AC) power supplied from the external charging stand 10. This charging system includes an inlet 2, the
10 charger 3, and an ECU 4. The inlet 2 is configured to be able to connect to a connector 12 of a charge cable CA that extends from the charging stand 10. In response to a control signal from the ECU 4, the charger 3 converts AC power supplied from the charging stand 10 to DC power that can be charged to the power storage device B, and supplies this DC power to the power storage device B.

[0017] When the connector 12 of the charge cable CA is connected to the
15 inlet 2 of the vehicle 1, a pilot signal CPLT (described later) that is generated by an ECU 100 of the charging stand 10 is input to the ECU 4 via the charge cable CA and the inlet 2. The ECU 4 performs charging control of the power storage device B by controlling the charger 3 based on information such as the pilot signal CPLT.

[0018] Meanwhile, the charging stand 10 includes a commercial power
20 supply 11, a switch SW, the charge cable CA, and the ECU 100. The commercial power supply 11 is a so-called single phase three-wire type alternating current power supply that is widely used in Japan for example.

[0019] The charge cable CA is connected at one end portion to the switch SW
25 via a connecting portion 13, and is connected at the other end portion to the connector 12. The connector 12 is a connector that is configured to be able to be connected to the inlet 2 of the vehicle 1. Incidentally, the connecting portion 13 may be formed by a connector and be able to disconnect the charge cable CA from the charging stand 10.

[0020] Next, the structure of an inlet assembly 200 according to this example embodiment will be described with reference to FIG 2. As an example, this inlet assembly 200 is housed in an inlet opening 1h provided in the side of the vehicle 1 (such as a front left fender of the vehicle). The inlet opening 1h can be opened and closed by a cover 1c (see FIG 5).

[0021] The inlet assembly 200 includes the inlet 2 to which the connector 12 connects, an inlet base 2b that secures this inlet 2 to the vehicle 1, and a cylindrical guide wall 2a that surrounds the inlet 2 and guides the connector 12 into connection with the inlet 2. In this example embodiment, the inlet 2, the inlet base 2b, and the guide wall 2a are integrally molded by a resin molded component.

[0022] A lock wall 2c is provided on an outer periphery upper end surface of the cylindrical guide wall 2a, and a lock pin 12a (see FIG 1) that is able to engage with this lock wall 2c is provided on the connector 12 side. Also, a positioning groove 2h into which a positioning wall 12c that is provided on the connector 12 side (see FIG 1) fits is provided in a lower end surface of the cylindrical guide wall 2a.

[0023] When plugging the connector 12 into the inlet 2, the lock pin 12a rides over the lock wall 2c by the connector 12 being pushed in while the positioning wall 12c provided on the connector 12 side is fitted into the positioning groove 2h. This secures the connection between the inlet 2 and the connector 12.

[0024] When unplugging the connector 12 from the inlet 2, the lock pin 12a is disengaged from the lock wall 2c, thereby enabling the connector 12 to be unplugged from the inlet 2, by pushing in an unlock button 12b provided on the connector 12 side.

[0025] The inlet assembly 200 includes an inlet cover 2d that protects the inlet 2. This inlet cover 2d is connected to the guide wall 2a by a cover hinge 2e so as to be able to open and close. Also, a lock lever 2f that secures the inlet cover 2d closed is provided. This lock lever 2f is also rotatably connected to the guide wall 2a by a lock lever hinge 2g.

[0026] An inlet shield 30 that prevents water and the like from getting into

6

the vehicle body from the outside, as well as serves as a screen, is provided on the back side (i.e., the inside of the vehicle 1) of the inlet base 2b, i.e., the side of the inlet base 2b that is opposite the side on which the inlet 2 is provided. A peripheral edge portion of this inlet shield 30 is provided standing upright facing the outside of the vehicle and surrounding the periphery of the inlet assembly 200. Bendable material formed of rubber or elastomer or the like is used for this inlet shield 30.

[0027] Next, drain holes provided in the inlet assembly 200 will be described with reference to FIG 3. To simplify the description, the inlet assembly 200 is shown without the inlet cover 2d, the cover hinge 2e, the lock lever 2f, and the lock lever hinge 2g in FIG 3.

[0028] Drain holes for draining water that has adhered to the surface on the back side are provided in this inlet assembly 200. More specifically, a drain hole 20a is provided on the back side of the lock wall 2c, a drain hole 20b is provided on the back side of the positioning groove 2h, a drain hole 20c is provided on the back side of the cover hinge 2e, and a drain hole 20d is provided on the back side of the lock lever hinge 2g.

[0029] All of these drain holes 20a to 20d are holes that extend through the inlet base 2b. The shapes of these drain holes 20a to 20d vary depending on the position in which they are provided. For example, they may be square, rectangular, circular, or oval. The opening area of each drain hole is approximately 10 mm² to approximately 100 mm².

[0030] The reason for providing the drain holes 20a to 20d in the positions described above is that because if water adheres and freezes in these areas, it may interfere with the plugging or unplugging of the connector 12, or interfere with the opening and closing of the inlet cover 2d. Accordingly, drain holes may also be provided in other areas where water, if frozen, may interfere with the unplugging of the connector 12.

[0031] Referring to FIG 4, notched areas 30b to 30e are provided in a center

open area 30a of the inlet shield 30 arranged on the back side of the inlet base 2b, so as not to block the drain holes 20a to 20d.

[0032] Next, the structure of the back side of the drain holes 20a to 20d will be described with reference to FIG 5. As shown in FIG 5, the inlet assembly 200 is arranged housed in an inlet box 1b provided inside the vehicle 1, and the inlet shield 30 hides the inside of the vehicle 1 from view.

[0033] Also, a cable 60 that is connected to the inlet 2 is arranged on the back side of the inlet assembly 200. Also, a grommet 40 is arranged to protect the cable 60 and the back side of the inlet assembly 200. Bendable material formed of rubber or elastomer or the like is used for this grommet 40.

[0034] Here, the drain holes 20a to 20d are provided in the inlet assembly 200, so if a large amount of water has adhered, this water is easily drained through these drain holes 20a to 20d. However, if the amount of water is small, the drain holes 20a to 20d may become blocked due to the surface tension of the water, and as a result, the water may have difficulty draining.

[0035] Therefore, in this example embodiment, drainage inducing members 51 that promote draining are provided on the peripheral portions on the back side of the drain holes 20a to 20d to further promote the drainage of water that has reached the drain holes 20a to 20d to the outside. Providing these drainage inducing members 51 reduces the surface tension of the water at the drain holes 20a to 20d so that the water can be brought over to the side with the drainage inducing members 51. The drainage inducing members 51 are fixed to the back side of the inlet base 2b using an adhesive or the like, in positions on the edge portions of the drain holes 20a to 20d.

[0036] Bendable material formed of rubber or elastomer or the like may be used for the drainage inducing members 51. Also, the drainage inducing members 51 may be tongue-shaped or cylindrical or the like.

[0037] If the grommet 40 is not provided on the back side of the inlet assembly 200, water that is brought in by the drainage inducing members 51 will drain

directly outside. However, if the grommet 40 is provided, water must be drained out of the grommet 40.

[0038] If a tube-shaped drainage inducing members 51 is provided for each drain hole 20a to 20d, the tube-shaped drainage inducing members 51 may simply to lead out of the grommet 40. The plurality of tube-shaped drainage inducing members 51 may also come together at a single location partway along to form a single tube-shaped drainage inducing member 51.

[0039] Also, as shown in FIG. 5, if a tongue-shaped drainage inducing member 51 or a short tube-shaped drainage inducing member 51 is used, a collective drainage member 52 that collects the water drained from the drainage inducing members 51 in one place and drains the collected water may be provided on a lower end surface of the grommet 40.

[0040] Incidentally, in FIG 5, the drain holes 20a to 20d are provided generally horizontal. However, if the inlet assembly 200 itself is arranged slanted gradually upward, the drain holes 20a to 20d may also be such that the back side slants downward to better promote drainage.

[0041] Also, even if the inlet assembly 200 itself is arranged horizontal, the drain holes 20a to 20d may open with the back side slanted downward to better promote drainage.

[0042] As described above, the inlet assembly according to this example embodiment is provided with the drain holes 20a to 20d. In addition, the drainage inducing members 51 are arranged on the edge portions on the back side of the drain holes 20a to 20d to better promote the drainage of water that has reached the drain holes 20a to 20d to the outside. As a result, water will not collect at the drain holes 20a to 20d, so water is able to be brought over to the side with the drainage inducing members 51.

[0043] As a result, it is possible to promote the drainage of water that has adhered to the inlet assembly 200 to the outside, and thus prevent a situation in which

the connector 12 is unable to be detached from the inlet 2, and a situation in which the connector 12 is unable to be attached to the inlet 2, due to the water freezing in cold regions or in winter.

[0044] The example embodiments disclosed herein are in all respects merely
5 examples and should in no way be construed as limiting. The scope of the invention is indicated not by the foregoing description but by the scope of the claims for patent, and is intended to include all modifications that are within the scope and meanings equivalent to the scope of the claims for patent.

CLAIMS

1. An inlet assembly provided in a vehicle in which a power storage device mounted inside is charged using an external power supply, comprising:
 - 5 an inlet to which a connector that is connected to the external power supply connects;
 - an inlet base that secures the inlet to the vehicle; and
 - a cylindrical guide wall that surrounds the inlet and guides the connector into connection with the inlet,
- 10 wherein a drain hole is provided in the inlet base, and a drainage inducing member that promotes drainage is arranged on an edge portion of the drain hole, on a back side of the inlet base, the back side being a side opposite the side on which the inlet is provided.
2. The inlet assembly according to claim 1, wherein at least two of the drain holes are provided in the inlet base, a respective one of the drainage inducing members is provided for a respective one of the drain holes, and the inlet assembly further includes a collective drainage member that collects water drained from the drainage inducing members in a single location and drains the water.
- 15
3. The inlet assembly according to claim 2, wherein a grommet that covers a cable that is connected to the inlet is provided on the back side of the inlet base, and the collective drainage member is provided on the grommet.
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FIG. 1

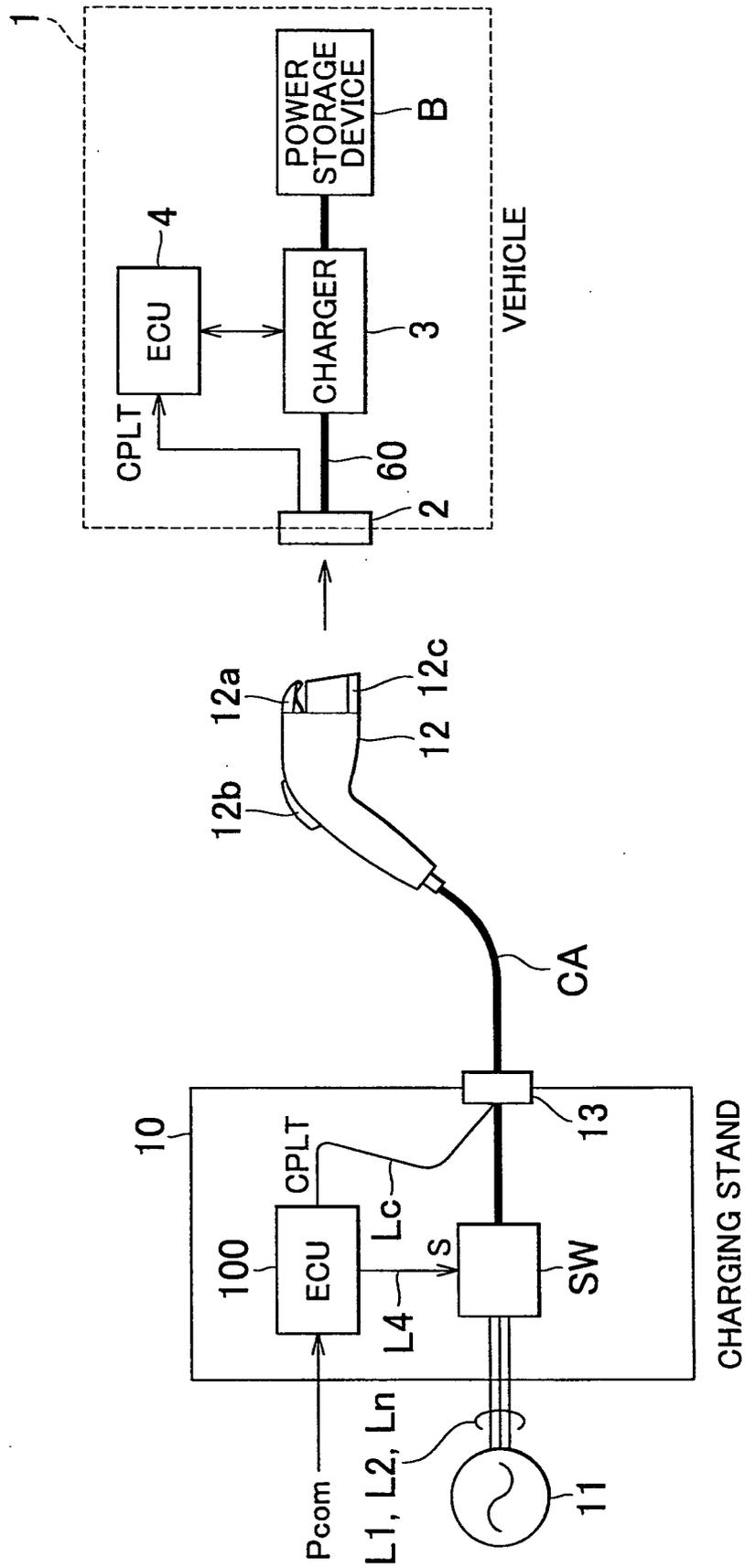


FIG. 2

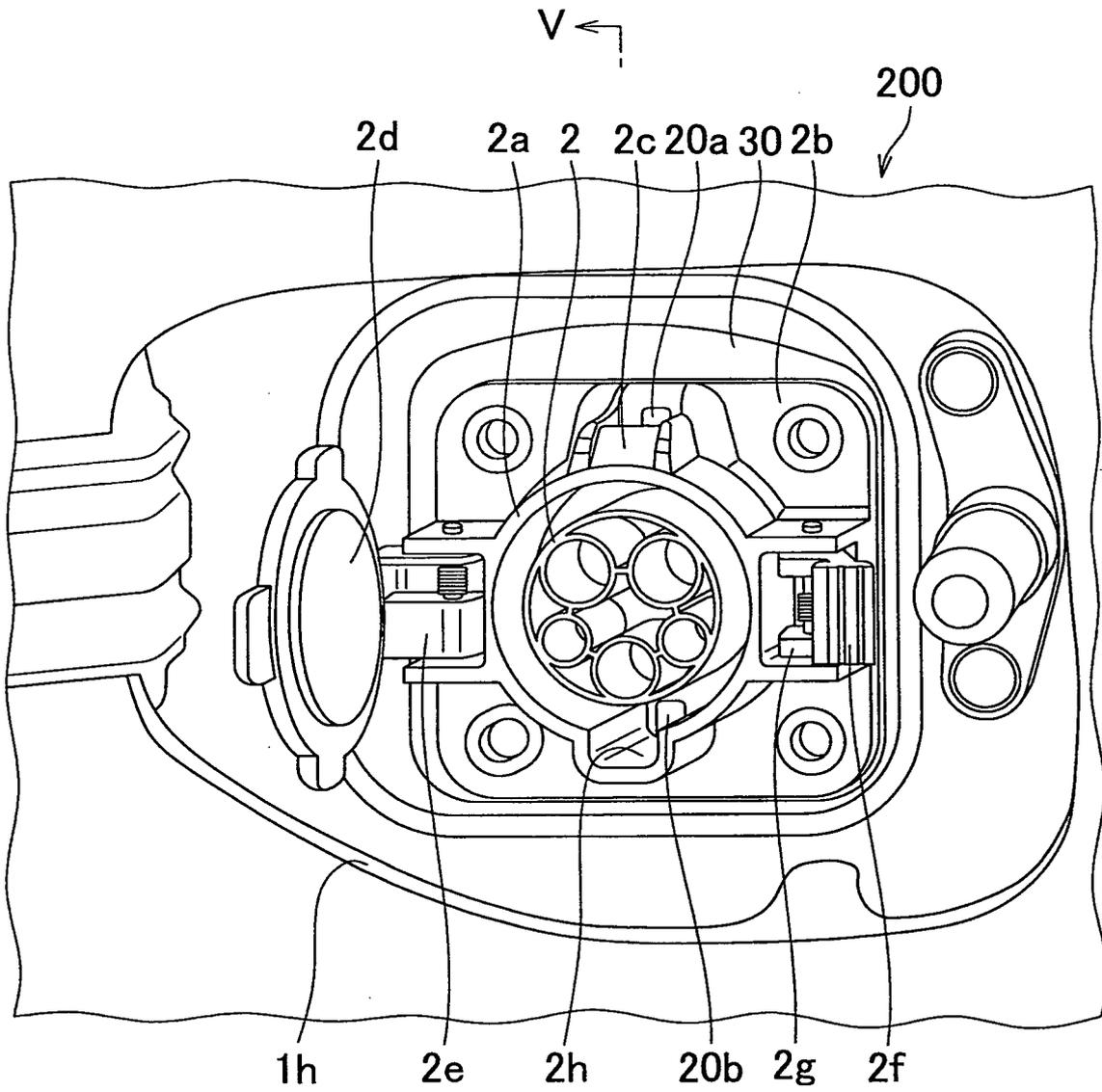


FIG. 3

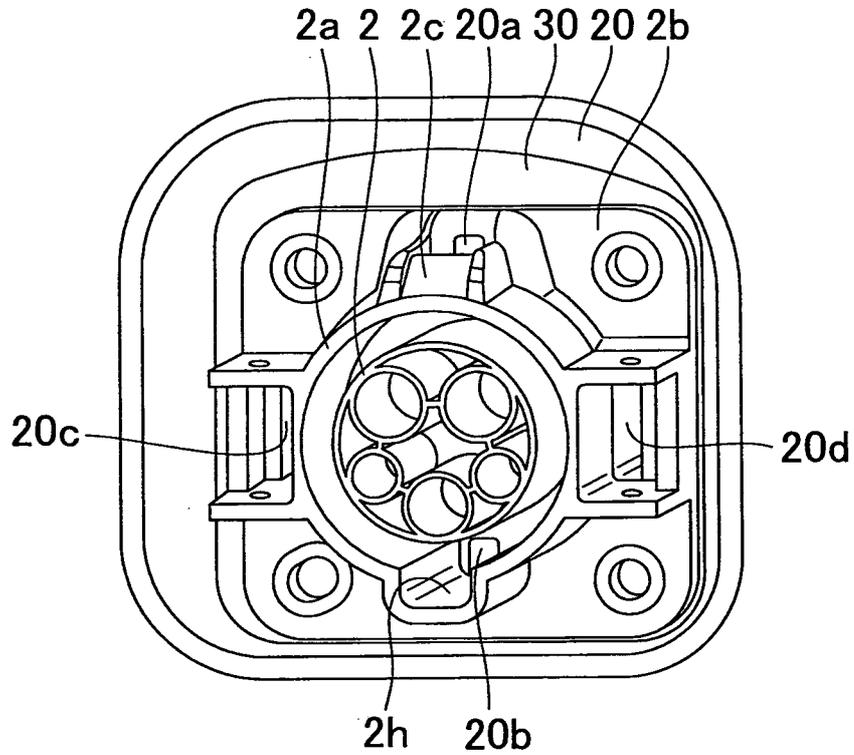


FIG. 4

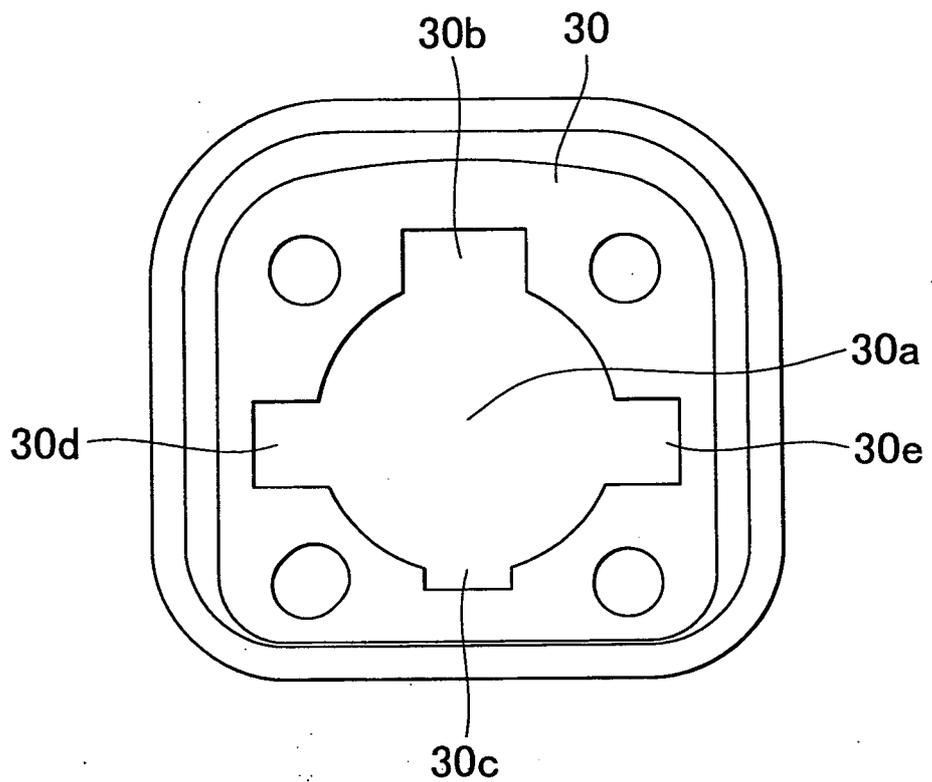
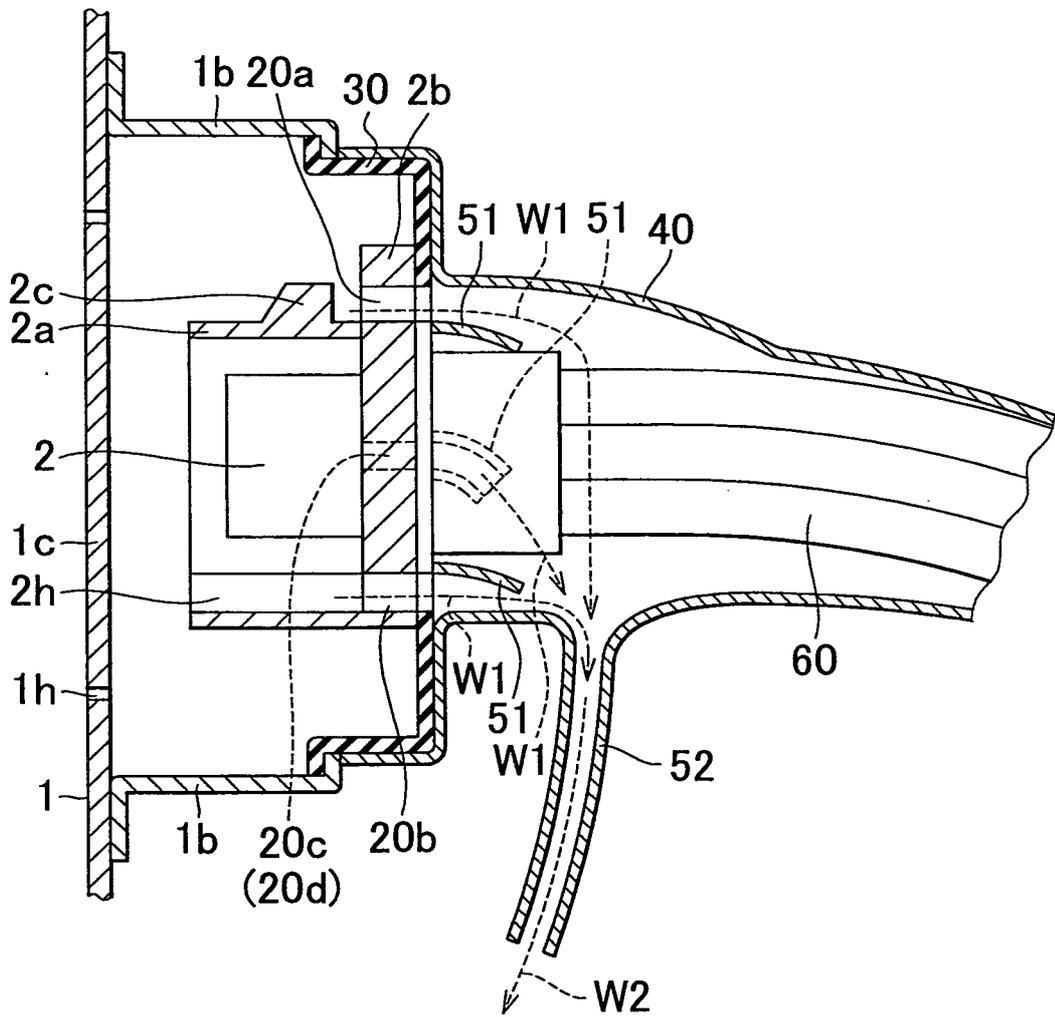


FIG. 5



INTERNATIONAL SEARCH REPORT

International application No PCT/IB2011/000357
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A. CLASSIFICATION OF SUBJECT MATTER
INV. H01R13/52
 ADD.

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 H01H

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	DE 196 50 097 AI (YAZAKI CORP [JP]) 12 June 1997 (1997-06-12) figures 1, 2, 9-11 column 1, line 1 - line 12 column 4, line 17 - column 5, line 3 -----	1-3
Y	US 2005/178576 AI (SAKA YUKINORI [JP] ET AL) 18 August 2005 (2005-08-18) paragraphs [0002] , [0 23] , [0 32] - [0044] claims 1-10 figures 1-4 ----- -/- .	1-3

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents :

<p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p>
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Date of the actual completion of the international search 29 July 2011	Date of mailing of the international search report 05/08/2011
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INTERNATIONAL SEARCH REPORT

International application No
PCT/IB2011/000357

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2004/214458 A1 (MAEBASHI AKEMI [JP]) 28 October 2004 (2004-10-28) claims 1-6 paragraph [0014] - paragraph [0020] paragraph [0052] - paragraph [0064] figures 1-4 -----	1-3
A	US 5 921 803 A (MORI SHIGEO [JP]) 13 July 1999 (1999-07-13) figure 3 column 3, line 10 - column 4, line 39 -----	1-3

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No PCT/IB2011/000357
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 19650097	AI	12-06-1997	JP 3292278 B2 17-06-2002
			JP 9161884 A 20-06-1997
			US 6123569 A 26-09-2000

US 2005178576	AI	18-08 -2005	DE 102005006653 AI 06-10-2005
			JP 2005229740 A 25-08-2005

US 2004214458	AI	28-10 -2004	CN 1551439 A 01-12-2004
			DE 102004019644 AI 25-11-2004
			US 2006216968 AI 28-09-2006

US 5921803	A	13-07 -1999	DE 19605206 AI 22-08-1996
			GB 2300526 A 06-11-1996
			JP 3195181 B2 06-08-2001
			JP 8222314 A 30-08-1996
