

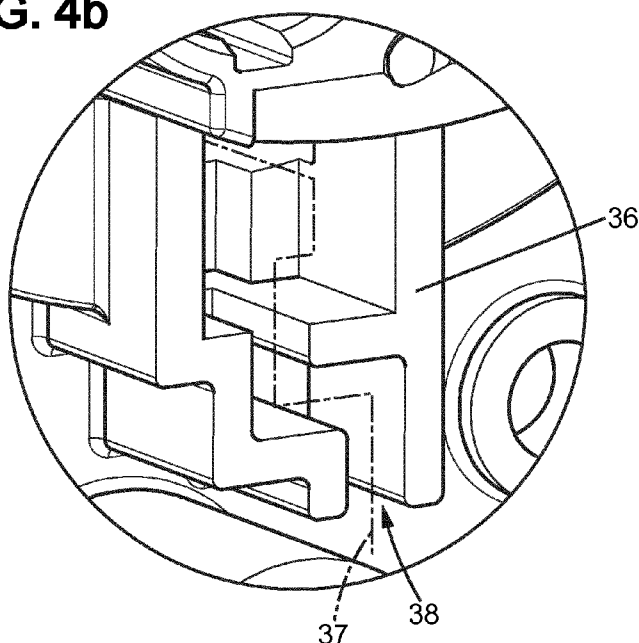


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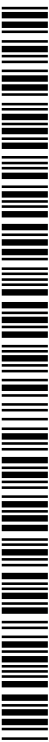
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(54) Title: ELECTRICAL CONNECTOR HOUSING AND DEVICE FOR VEHICLE CHARGING SYSTEM

**FIG. 4b**



(57) Abstract: Electrical connector housing, comprising: a connector body including a fixation element adapted to attach the connector housing to a panel such that the connector housing comprises a front side adapted to extend on one side of the panel and a rear side adapted to extend on the opposite side of the panel; the connector body being adapted to receive a plurality of electrical contacts. A multi contact rear body attached to the connector body and comprising a plurality of stopping surfaces contributing each to hold one of the electrical contacts; at least one ventilation duct (37) extending from the front side to the rear side. The ventilation duct comprises a shared portion delimited by a portion (36) of the multicontact rear body (15) and by a portion (36) of the connector body.



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**ELECTRICAL CONNECTOR HOUSING AND DEVICE  
FOR VEHICLE CHARGING SYSTEM**

FIELD OF THE INVENTION

5           The present invention relates to an electrical connector housing, in particular to the housing used in an electrical connector device for a vehicle electrical power charging system, and to a corresponding vehicle charging system.

10           The electrical power charging systems used for charging an electrical power vehicle usually comprise an electrical power inlet which is attached to the vehicle. When the user wants to recharge the vehicle accumulators, an electrical power link is connected between the vehicle  
15 power inlet and an electrical socket of an electrical power station.

          The connector body is usually provided with cavities in which the electrical contacts are received and protected against fingers introduction. The inlet is also  
20 provided with cavities for guiding a corresponding connector. The above cavities open to the front side of the inlet. A hermetic shutter is used to prevent water infiltration. However ambient air can easily reach 100 % of humidity. The humidity may accumulate and condense at  
25 the bottom of the contact cavities, which may provoke dangerous short circuit.

          As the vehicle inlets are usually attached to a wall of the vehicle, the connector body of the inlet comprises a front side oriented towards the outside of the vehicle  
30 and a rear side separated from the front side by the vehicle wall. So both sides of the vehicle wall may have slightly different pressure or different rates of

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humidity.

Some regulation or standards request that some housing cavities of the inlet to be provided with a ventilation duct which opens from the bottom of the cavity to the rear side of the inlet for drying the cavity.

The invention provides a simple construction for the ventilation duct.

#### 10 SUMMARY OF THE INVENTION

According to one aspect, an electrical connector housing comprises a connector body including a fixation element adapted to attach the connector housing to a panel such that the connector comprises a front side adapted to extend on one side of the panel and a rear side adapted to extend on the opposite side of the panel. The connector body is adapted to receive a plurality of electrical contacts.

The housing comprises a multicontact rear body attached to the connector body and comprising a plurality of stopping surfaces contributing each to hold one of the electrical contacts. The connector further comprises at least one ventilation duct extending from the front side to the rear side.

25 The ventilation duct comprises a portion delimited by a portion of the multicontact rear body and by a portion of the connector body.

The ventilation duct is an empty tube extending along a path of the duct and delimited by a wall forming the empty tube. The wall of the shared portion is made of two portions. One portion of the delimiting wall belongs to the connector body. The other portion of the

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delimiting wall belongs to the multicontact rear body. The duct does not have to be formed by a drilling step. The two piece parts can be moulded or stamped or the like. The attachment of the multicontact rear body to the  
5 connector body provides a precise position with respect to the connector body for both the stopping surfaces of the electrical contact and for the delimiting wall of the ventilation duct. There is no need to have a specific attachment feature for attaching two pieces parts  
10 together in order to form the shared portion of the ventilation duct.

According to another aspect, an embodiment is an electrical connector device for vehicle charger.

According to another aspect, an embodiment is a  
15 vehicle electrical power charging system.

In some other embodiments, one might also use one or more of the features as defined in dependent claims.

#### BRIEF DESCRIPTION OF THE DRAWINGS

20 Other characteristics and advantages of the invention will readily appear from the following description of some of its embodiments, provided as a non-limitative example, and of the accompanying drawings.

On the drawings:

25 - Figure 1 is a perspective view of a connector device, viewed from the front side.

- Figure 2 is a cut view of the connector device following the plan II-II of the figure 1 passing by two electrical contacts, showing a guiding portion of the  
30 multicontact rear body.

- Figure 2a is a detail view of figure 2.

- Figure 3 is a perspective view of a

- 4 -

multicontact subassembly showing three covering plates delimiting a shared portion of three ventilation ducts.

- Figure 4 is a perspective view of the connector body, viewed from the rear side, showing the front size  
5 of a shared portion of three ventilation ducts.

- Figures 4a et 4b are detail views of figure 4.

- Figure 5 is a side view of the connector device following arrow V of the figures 1 and 6.

- Figure 6 is a back view of the multicontact  
10 rear body.

- Figure 7 is a partial cut view of a lateral cavity provided with a ventilation duct following the plan VII of figures 1 and 4, 6.

- Figure 8 is a partial cut view of a peripheric  
15 cavity following the plan VIII-VIII of figures 1, 5, 6.

#### DETAILED DESCRIPTION

As illustrated in figure 1, the connector device  
20 comprises a connector body 1, seven electrical contacts 2a, 2b, 2c, 2d, 2e, 2f, 2g and a shutter 3. Each electrical contact 2a-2g has a connecting portion 4 of a male type. In a variant, the connecting portion could be either of a male type or of a female type. The number of  
25 electrical contacts may be any number. The electrical contacts 2a-2g can be of different types. For example, the contact 2a, 2b can be low power or signal contacts. The contact 2c could be a ground contact. The contacts 2d, 2e, 2f, 2g could be electrical power contacts adapted  
30 for high intensity current for charging electricity powered vehicles.

The connector body 1 comprises a panel flange 5

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which is a fixation element 5 adapted to fix the connector body 1 to a panel not illustrated in the figure. The panel comprises a through hole through which the connector body is passing. The panel flange 5 defines the front side of the connector device (figure 1) and the back side (figure 6).

The connector body 1 comprises a plurality of contact cavities 6 surrounding the connecting portion 4 of the corresponding contact 2a-2g. The connector body 1 further comprises a peripheral cavity 7 surrounding all the contacts cavities 6. Both the contact cavities 6 and the peripheral cavity 7 are open to the front side of the connector device in order to receive a complementary part of a complementary connector. Each of the cavities 6, 7 comprise a hole duct 6a, 7a opening at the bottom corner of the corresponding cavity.

The connector body 1 comprises a peripheral wall 8 surrounding the peripheral cavity 7. Two lateral walls 9a, 9b protrude outside the peripheral wall 8 respectively at the left end and at the right end the peripheral wall 8 and surround two lateral cavities 10a, 10b. The left cavity 10a receives a spring mechanism 11 (visible in figure 7). A left axis 12a is vertically fixed to the lateral wall 9a. The shutter 3 is rotatably mounted around the left axis 12a. A right axis (not represented) is vertically fixed to the right wall 9b. The shutter 3 is provided with a spring clip 13 which cooperates with the right axis to maintain the shutter 3 in a closed position. The shutter 3 covers the peripheral wall 8 and hermetically seals a front inner room 14 on which opens all the cavities 6 and 7. The front inner room 14 communicates with a front side atmosphere only

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temporarily when the shutter 3 is open and when the complementary connector is not yet mated to the connector device. Therefore, the front inner room 14 is most of the time isolated from the front side atmosphere. The  
5 condensation within the front inside room 14 can be dried via ventilation ducts which extend from the bottom holes 6a, 7a towards the rear side atmosphere.

In a variant, a shutter may be rotatably mounted on the right axis 12b and clipped on the left axis 12a.

10 Both lateral cavities 10a, 10b are also provided with a bottom hole 20a, 20b at the bottom corner of the respective cavity 10a, 10b.

As illustrated by figure 2, the connector device further comprises a multicontact rear body 15 which  
15 covers a back side of the connector body 1. The multicontact rear body 15 comprises a bottom wall 16 and a plurality of guiding portions 17a, 17e extending upwardly from the bottom wall 16. Each of the guiding portions 17b, 17e, comprises an inner cylindrical guiding  
20 surface 18b, 18e receiving and guiding the respective electrical contact 2b, 2e along a contact axis 19b, 19e.

As illustrated in figures 2 and 3, each of the guiding portions 17b, 17e is provided with six spring arms 21b, 21e surrounding the electrical contact 2b, 2e.  
25 Each spring arm 21b, 21e comprises a locking projection 22b, 22e which protrudes radially inside the guiding surface 18b, 18e and enters into an axial stop recess 23b, 23e of the electrical contact 2b, 2e. The axial stop recess 23b, 23e is an annular groove opening radially  
30 outwards.

In a variant, the number of spring arms may be any number and may be different for each guiding portion.

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As illustrated in figure 2a, the power contact 2e comprises a contact body 24e which is a single-block piece part, machined by bar turning. The contact body 24e comprises a back tubular portion 25e into which the cable wire extremity is soldered. The back tubular portion 25e is at the opposite extremity of the contact body 24e with respect to the connecting portion 4.

The contact body 24e further comprises a holding portion 26e extending axially between the back tubular portion 25e and the connecting portion 4. The annular groove 23e is provided on the holding portion 26e. The holding portion 26e extends radially inside the outside diameter of the back tubular portions 25e. So, the diameter of the bar, from which the contact body 24 is machined, corresponds to the outside diameter of the back tubular portion 25e.

The contact body 24e further comprises a guiding shoulder 48e extending axially at the back of the axial step recess 23e and extending radially further the back tubular portion 25e. The spring arm 21e may also comprise an inner guiding shoulder 47e arranged to cooperate with the guiding shoulder 48e. This provides a more precise coaxial guiding of the contact 2e close to the holding portion 26e. This allows the contact 2e to slightly rotate around the holding portion 26e. The guiding shoulders 47e or 48e also provide an axial stop to a cable guiding bending member 49e.

As illustrated in the figures 3, 5, 6, 8, the multicontact rear body 15 further comprises a peripheral wall 27 as well as a bottom plate 28 and two lateral plates 29a, 29b. The plates 28, 29a, 29b extend radially outwardly from the peripheral wall 27.

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As illustrated in the figures 3, 4, the peripheral wall 27 cooperates with a retention element 30 radially protruding from a rear axial protrusion 31 of the connector body 1 for attaching the multicontact body 15 to the connector body 1.

As illustrated in the figures 2, 2a, 3, the assembly method comprises a first step of assembling a sub assembly illustrated in Figure 3. The wire extremity is soldered in the back tubular portion 25e and all the contacts are assembled in a similar way. All the contact assemblies are introduced into the corresponding guiding surface 18e. During the axial introduction of the contact, the locking projections 22e of the guiding portion 17e are deflected radially outwards to a biased position until the contact reaches an axial position in which the locking projections 22e are aligned with the axial stop recess 23e. Then, the locking projections 22e automatically spring back radially inwards due to the elasticity of the spring arm 21e.

The front side of the locking projections 22e constitutes a rearward axial stop 40e which prevents the contact 2e from moving rearwards. The backside of the locking projection 22e constitutes a forward axial stop 41e which prevents the contact 2e from moving forwards. The rearward axial stop 40e and the forward axial stop 41e cooperate with the axial stop recess 23e to hold axially the contact 2e in both directions of the contact axis 19e. Additionally, the spring arm 21e comes back in a position compatible with the introduction into the receiving cavity 42e of the connector body 1. The other contact assemblies are introduced in the multicontact rear holder 15 in a similar way.

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In a second step, the sub assembly is introduced in the connector body 1 and the bead 30 and the elastic peripheral wall 27 attach the sub assembly with the connector body 1.

5 In the case where the contact is not fully inserted in its final position, at least one of the locking projections 22e cannot enter the axial stop recess 23e and thereby the introduction of the guiding portion 17e into the receiving cavity 42e is made impossible. The  
10 spring arm 21e acts as a mistake-proofing mechanism. The fact that the locking projection does not correctly cooperate with the axial stop recess of the contact during the first step is directly transformed into a stop which makes the second step impossible.

15 As illustrated in the figures 4, 4a, the connector body 1 comprises rear protrusions 32a, 32b extending backwards from the panel flange 5, parallel to the mating axis of the connector device. Each of the rear  
20 protrusions 32a, 32b delimits a lateral rear chamber 33a, 33b encompassing the bottom hole 20a, 20b. Once the connector is assembled, the lateral rear chamber is covered by the lateral plates 29a, 29b and is opened to the rear side atmosphere by a lateral outlet 34a, 34b. Therefore, when the multicontact rear body 15 is attached  
25 to the connector body 2, the connector device is provided with two lateral ventilation ducts 35a, 35b extending each from the corresponding bottom hole 20a, 20b, passing through the lateral rear chamber 33a, 33b. Said lateral ventilation ducts 35a, 35B are in communication with the  
30 rear side atmosphere via the lateral outlet 34a, 34b.

The lateral outlet 34a, 34b opens downwards and is laterally shifted with respect to the bottom hole 20a,

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20b (see figure 4a). The ventilation duct 35a, 35b comprises baffle means, formed by a portion of the rear protrusion, which allows increasing the residence time of the air flow from the front side atmosphere to the rear side atmosphere and thereby slows down the dust flow through the duct. The lateral rear cavity 33a, 33b is a shared portion 33a, 33b of the path of the ventilation duct 35a, 35b which is delimited, for the rear side by the multicontact body 15, and for the lateral and front side by the connector body 2.

As illustrated in the figures 4, 4b, the connector body 1 further comprises a bottom rear protrusion 36 extending backwards, parallel to the mating axis and forming a baffle means for the ventilation duct 37. The ventilation duct 37 extends from the peripheric bottom hole 7a to an outlet 38. The portion of the path of the ventilation duct 37 delimited for the rear side by the bottom plate 28 and for the lateral and front side by the connector body 1 is a shared portion 39 of the ventilation duct 37. The shared portion 39 extends along a path having a zigzag shape and extends along a plane which is perpendicular to the mating axis.

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**CLAIMS**

1. Electrical connector housing, comprising:
- a connector body (1) including a fixation element (5) adapted to attach the connector housing to a panel, the connector housing comprising a front side adapted to extend on one side of the panel and a rear side opposite to the front side; the connector body (1) being adapted to receive a plurality of electrical contacts (2e);
  - 10 - a multicontact rear body (15) attached to the connector body (1) and comprising a plurality of holding members (40e, 41e) contributing each to hold one of the electrical contacts; and
  - at least one ventilation duct (35a, 35b, 37) extending from the front side to the rear side,
  - 15 **characterized in that** the ventilation duct comprises a shared portion (33a, 33b, 39) delimited by a portion (29a, 29b, 28) of the multicontact rear body (15) and by a portion (32a, 32b, 36) of the connector body (1).
- 20
2. Housing according to claim 1, wherein the shared portion of the ventilation duct has a zigzag path so as to form a baffle.
- 25
3. Housing according to claim 1 or 2, wherein the shared portion (39) extends in a plane substantially perpendicular to a mating axis of the electrical connector housing.
- 30
4. Electrical connector device comprising:
- a plurality of electrical contacts (2a-2g),
  - a connector body (1) including a fixation element (5)

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adapted to attach the connector device to a panel the connector housing comprising a front side adapted to extend on one side of the panel and a rear side opposite to the front side and the connector body (1) being adapted to receive the plurality of electrical contacts (2e);

- a multicontact rear body (15) attached to the connector body (1); and comprising a plurality of stopping surfaces (40e, 41e) contributing each to hold a respective electrical contact (2e); and

- at least one ventilation duct (35a, 35b, 37) extending from the front size to the rear side, wherein the ventilation duct comprises a shared portion (33a, 33b, 39) delimited by a portion (29a, 29b, 28) of the multicontact rear body (15) and by a portion (32a, 32b, 36) of the connector body (1).

5. Device according to claim 4, wherein the shared portion has a zigzag path.

20

6. Device according to claim 4 or 5, wherein the portion of the connector body delimiting said shared portion comprises at least one rear protrusion (32a, 32b, 36) extending from the connector body (1) towards the rear side and wherein the portion (29a, 29b, 28) of the multicontact rear body (15) delimiting said shared portion covers said at least one rear protrusion.

7. Device according to claim 6, wherein said at least one rear protrusion is configured to be removable from a mould towards the connector device mating direction.

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8. Device according to claim 6 or 7, wherein the portion of the multicontact rear body (15) covering said at least one protrusion is a substantially flat portion (29a, 29b, 28)

5

9. Device according to any of claims 4 to 8, wherein the multicontact rear body (15) comprises a plurality of holding elements (22b, 22e) designed each to cooperate with a respective electrical contact so as to retain the electrical contact (2b, 2e) in both directions along the mating axis of the connector device.

10. Device according to any of claims 4 to 9, wherein the connector (1) comprises a receiving cavity (7) adapted to receive a part of a complementary connector device, one of said at least one ventilation duct (37) opening out at a bottom portion of the receiving cavity (7) which is located at the closed end and at the lower part of the receiving cavity.

20

11 Device according to any of claims 4 to 10, comprising a movable sealing shutter (3) provided with a return spring (11) located inside a cavity (10b), one of said at least one ventilation duct (35b) opening out at a bottom portion of the cavity which is located at the closed end and at the lower part of the receiving cavity.

12. Device according to any of claims 4 to 11, comprising a thermo-sensor (43) attached to the multicontact rear body (15).

30

13. Electrical power charging system for vehicle,

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comprising:

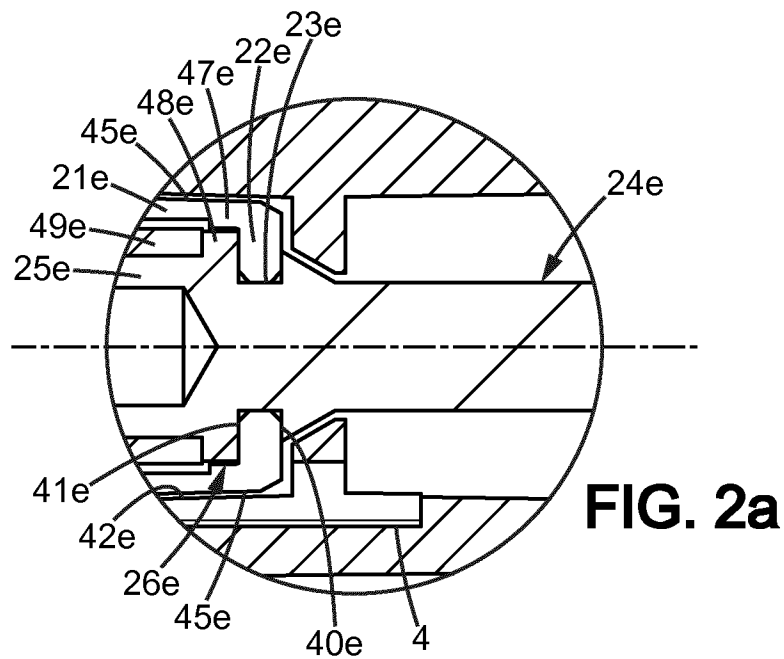
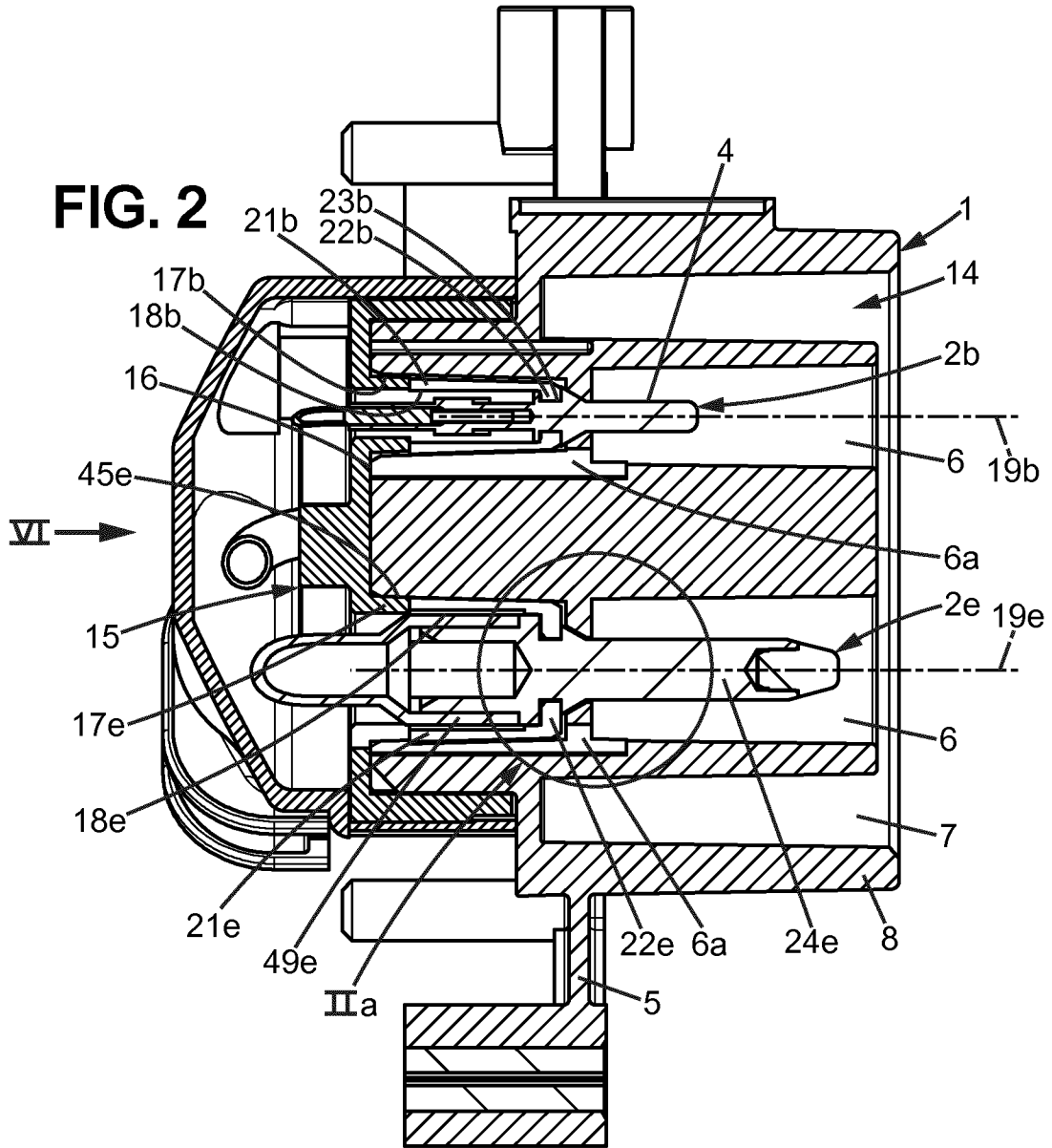
- an electrical power station provided with an electrical power socket,

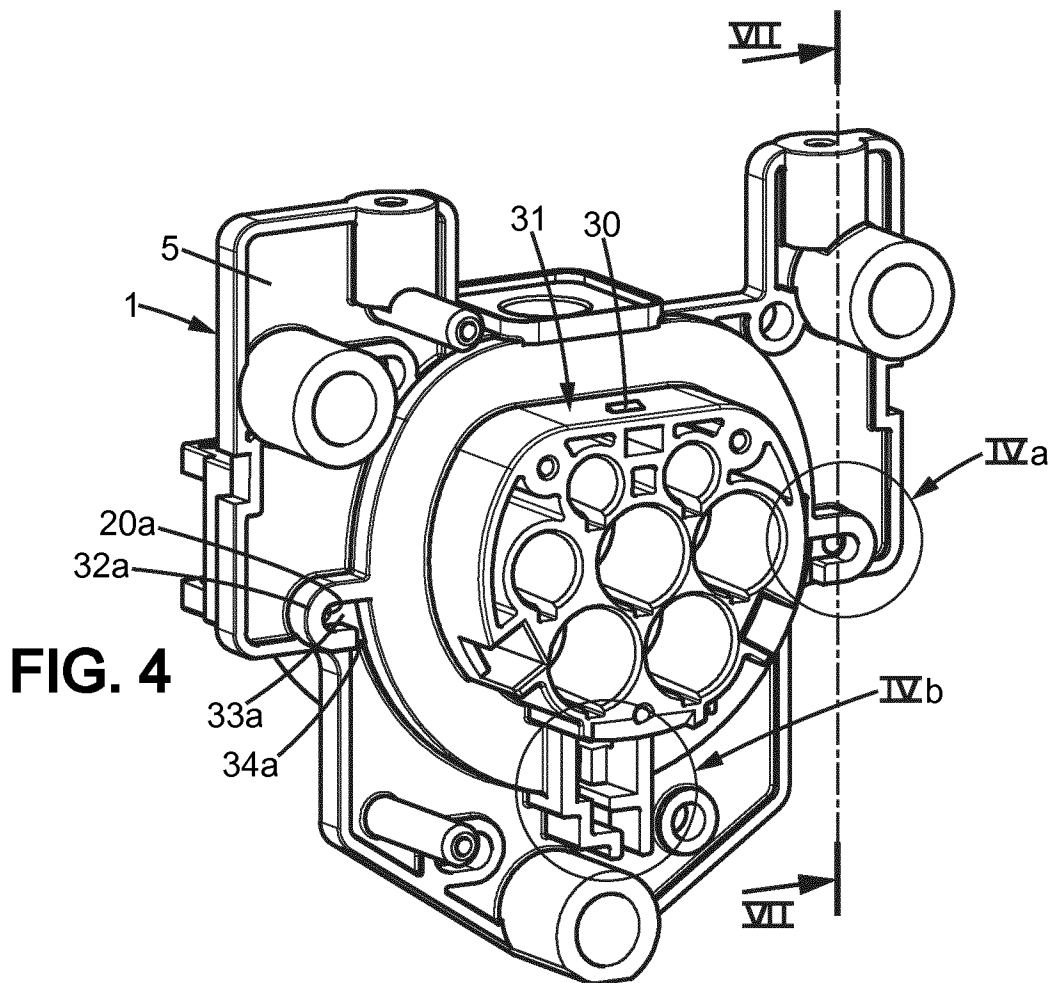
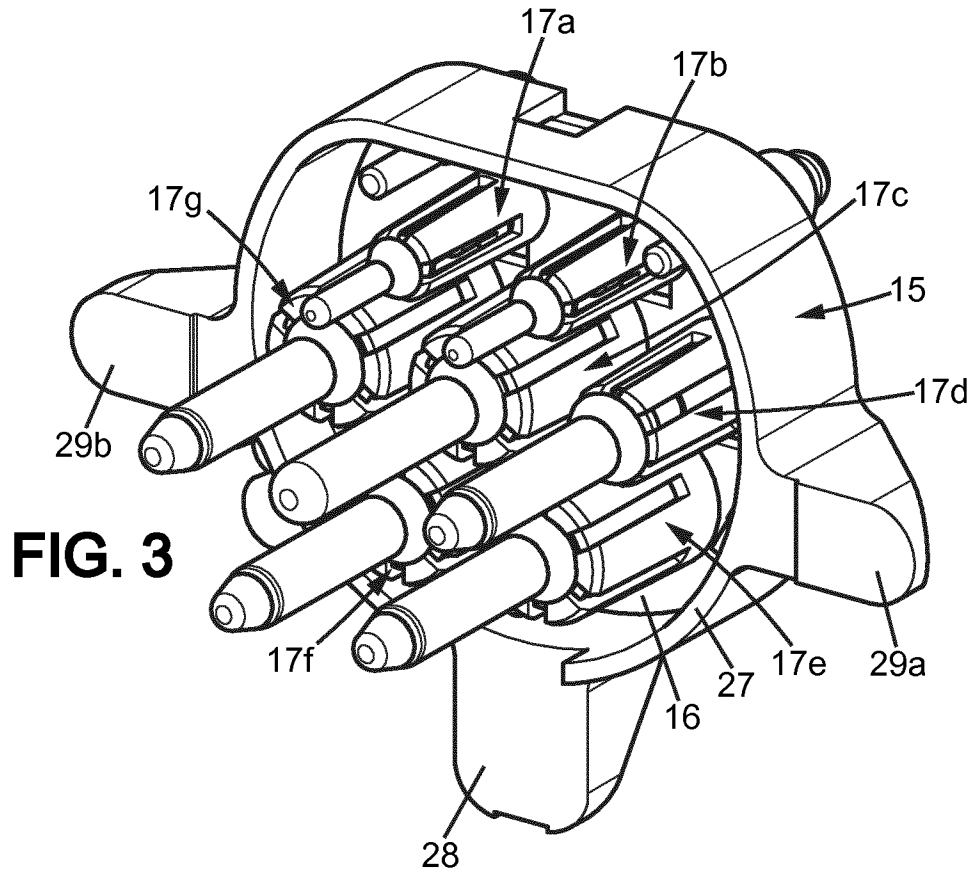
5 - an electrical power inlet adapted to be attached to the vehicle, and

- an electrical power link, provided at a first extremity with a plug adapted to mate with the electrical power socket and at a second extremity with a connector device adapted to mate with the electrical power inlet,

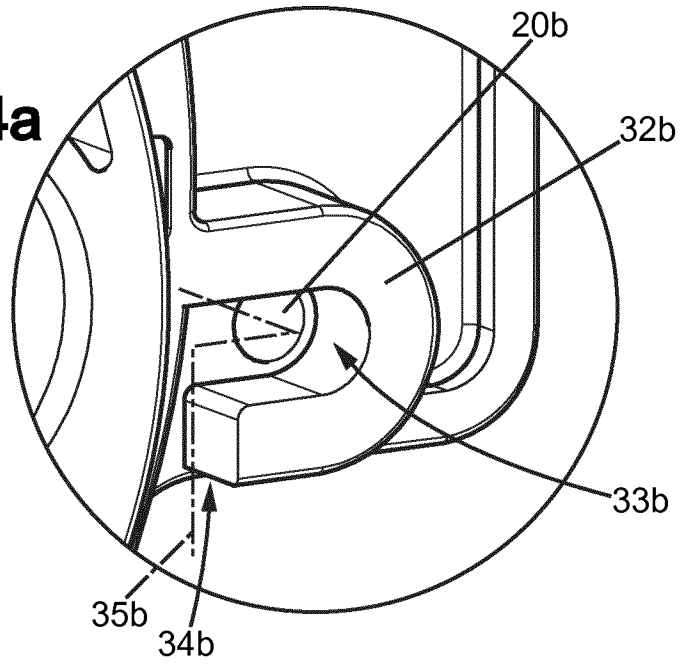
10 wherein at least one device taken in the group including the electrical power socket and the electrical power inlet, is an electrical connector device according any of the claims 4 to 12.



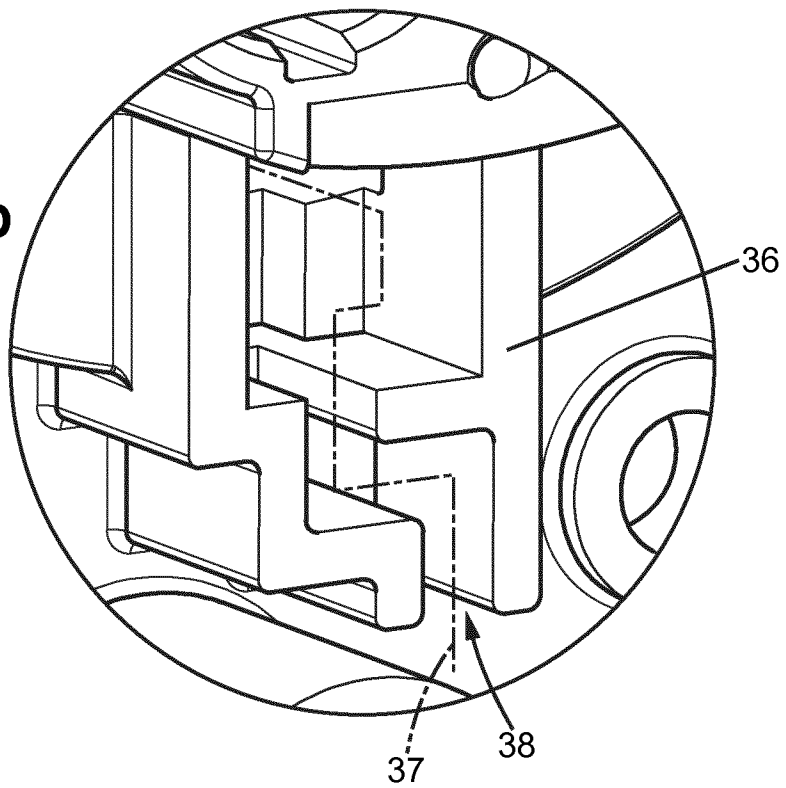


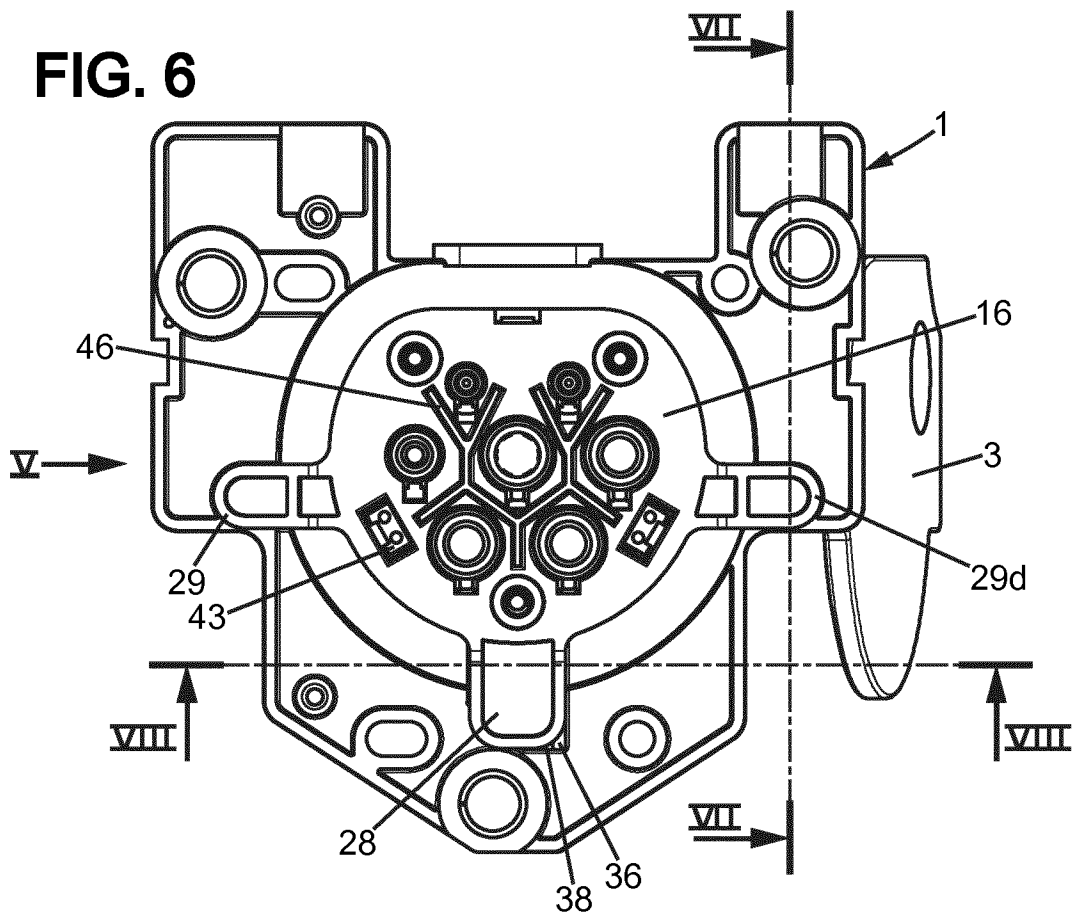
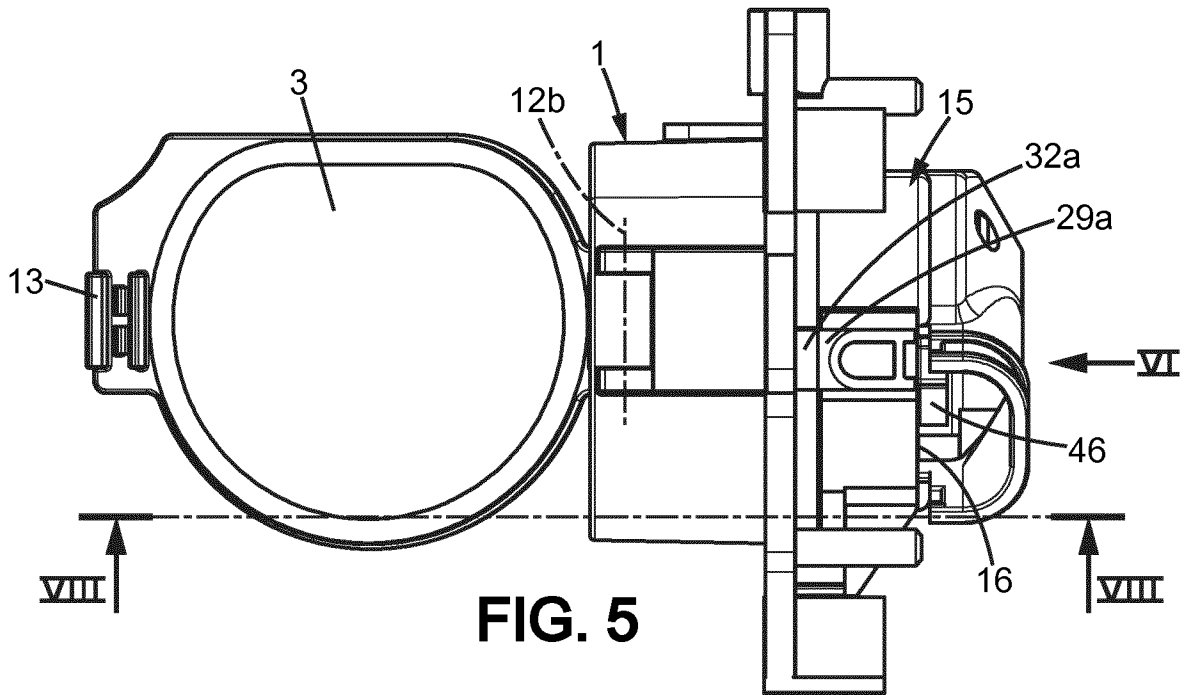


**FIG. 4a**

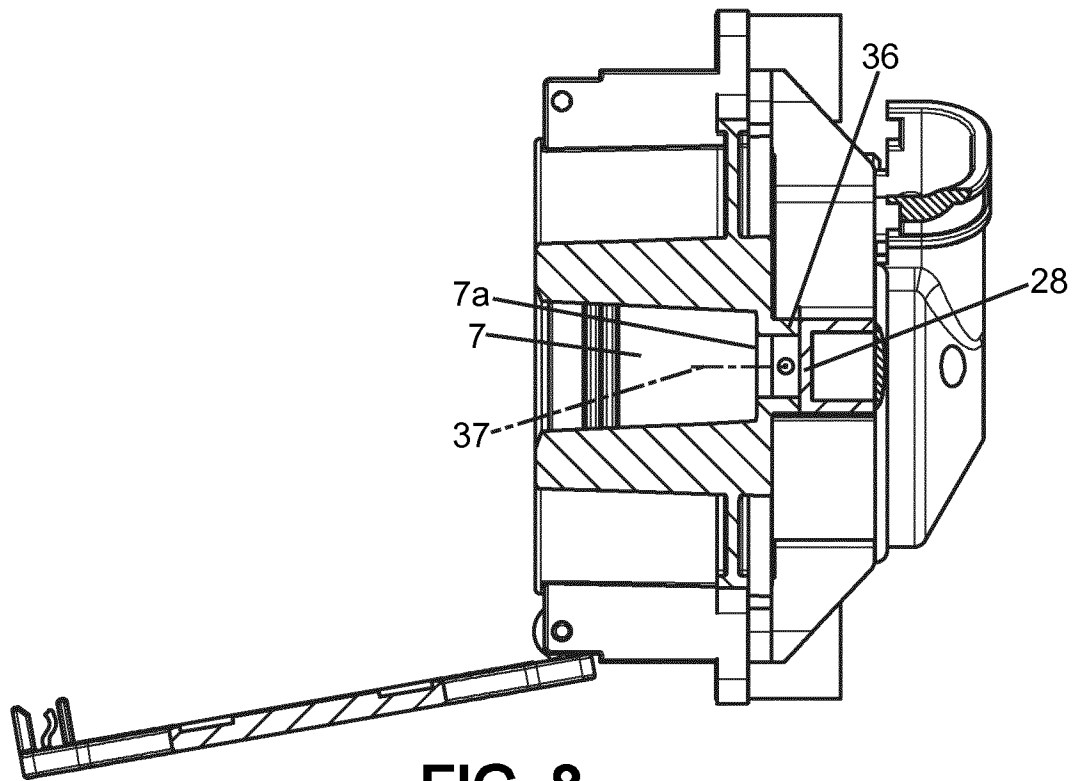
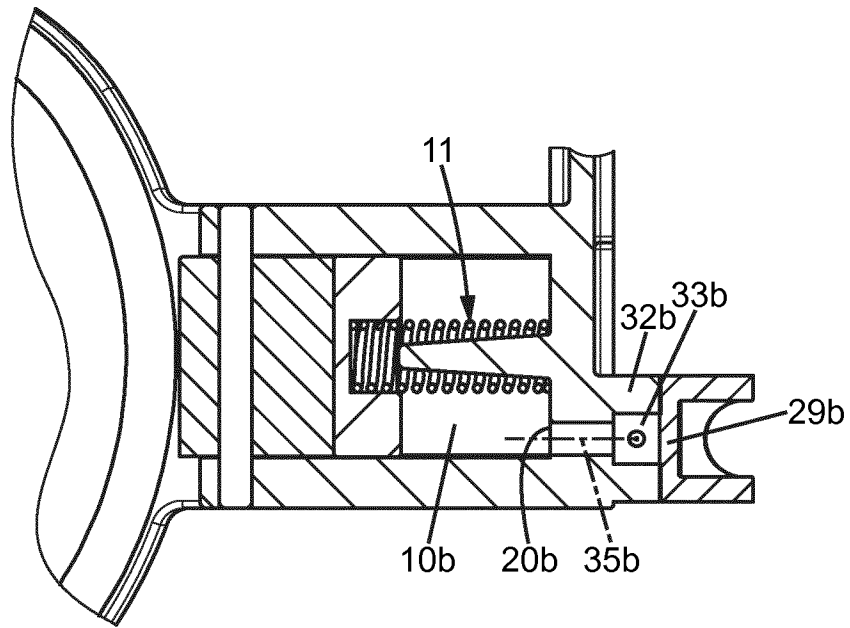


**FIG. 4b**





**FIG. 7**



**FIG. 8**

INTERNATIONAL SEARCH REPORT

International application No  
PCT/EP2012/057866

A. CLASSIFICATION OF SUBJECT MATTER  
INV. H01R13/506 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  
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 practicable, search terms used)  
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT		
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Further documents are listed in the continuation of Box C.

See patent family annex.

\* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier application or patent but published on or after the international filing date
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- "P" document published prior to the international filing date but later than the priority date claimed

- "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
- "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
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Date of the actual completion of the international search  26 July 2012	Date of mailing of the international search report  02/08/2012
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer  Ledoux, Serge

## INTERNATIONAL SEARCH REPORT

International application No  
PCT/EP2012/057866

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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