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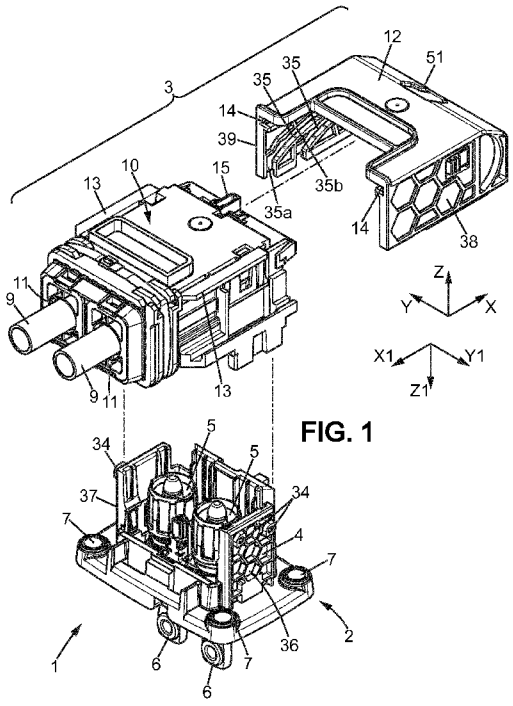

FIG. 1

(57) Abstract: The electrical connector assembly comprises: a first connector (2) having a housing (4), a second connector (3) having a housing (10), and a cover (12) movably mounted on the housing (10), the housing (10) of the second connector being movably mounted on the housing (4) of the first connector, an actuable lock (15) movably mounted on one of the housings (4,10). In the initial position of the cover (12), the cover covers the lock (15). In the final position of the cover (12), the cover does not cover the lock (15).

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ELECTRICAL CONNECTOR ASSEMBLY, AND CONNECTOR FOR SUCH ASSEMBLY

FIELD OF THE INVENTION

The instant invention relates to electrical connector assemblies, and connectors for such assemblies.

BACKGROUND OF THE INVENTION

An electrical connector assembly usually comprises a first connector and a second complementary connector. In assembled condition, electrical power or signals are transmitted between two appliances through the connector assembly. Hence, the two connectors need to be firmly locked to one another.

One common way of locking together two connectors is by snap-fitting one connector housing to another one. Hence, locking is performed as a consequence of the movement of the two connectors toward one another.

Another way is by providing a locking piece which is rigid and movable on one of the housings, for example under a separate actuation by the user. In such case, it is important to make sure that the lock is actuated after the connectors have been assembled. It is also important that the lock be not actuated before the connectors have been assembled, because such actuation may prevent connection of the connectors, and/or damage the lock during this connection.

SUMMARY OF THE INVENTION

It is provided an electrical connector assembly according to claim 1.

In the initial position of the cover, the cover prevents movement of the lock between its lock and release conditions, for instance the cover may mask access to the lock.

In the final position of the cover, the cover allows hand actuation of the lock.

With these features, one reduces the risk of the lock being actuated before the connectors are properly assembled.

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

BRIEF DESCRIPTION OF THE DRAWINGS

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

On the drawings:

- Fig. 1 is an exploded perspective view of an electrical connector assembly according to an embodiment of the invention,
- Fig. 2 is a partial view according to another perspective of the connector assembly of Fig. 1 in an unassembled condition,
- Fig. 3 is a sectional split view along line III-III of Fig. 7 of the connector assembly in assembled condition,
- Fig. 4 is a perspective view of a lock,
- Fig. 5 is a perspective view of the assembly of the lock and the cover in the final position of the cover,
- Fig. 6 is a perspective of the assembly of the lock in its release condition and of the first connector in the assembled condition of the connector housings, and
- Fig. 7 is a front view of the cover.

On the different Figures, the same reference signs designate like or similar elements.

DETAILED DESCRIPTION

Figure 1 schematically shows in perspective an example of an electrical connector assembly 1 according to the invention. The electrical connector assembly 1 comprises a first connector 2 and a second connector 3, which are to be mated/unmated along a mating direction Z.

Z is the direction along which the unmating of the two connectors takes place. The first connector 2 comprises a housing 4 which defines a plurality of pathways 5 for respective electrical contacts 6. The housing 4 is made of an electrically insulating material, so as to insulate the contacts 6 from one another. The contacts 6 extend for example in the respective passageways along direction Z. The housing 4 may further comprise fixation parts 7 such as through holes adapted to fasten the electrical connector 2 to an electrical appliance (not shown).

According to the embodiment described here, the second connector 3 is a right-angled connector. However, the invention could be implemented alternatively for straight connectors. In the right-angled electrical connector 3, the electrical parts are right angled. They are for example provided as right-angled contact elements 8 (see Fig. 3), each corresponding to a respective contact 6 of the first connector, and attached to a respective wire 9. The wires 9 enter the second connector 3 along the direction X, and the contact elements 8 have a first portion extending along the direction X, and electrically connected to the wire 9, and a second portion extending in the direction opposite to the direction Z.

The second connector 3 comprises an electrically insulating housing 10 having a body 100 defining a plurality of pathways 11 each corresponding to a respective contact.

The second connector 3 further comprises a cover 12 which is slidable with respect to the housing 10 between an initial and a final position. In the present example, the cover 12 is provided to slide along direction X and is provided on the side of the second connector housing which is opposite to the side which receives the electrical wires 9. The cover 12 is able to slide with respect to the housing 10 from its initial position to its final position

along the direction opposite to the direction X. Sliding is provided by complementary shapes of the housing 10 and the cover 12, such as for example, lateral wings 13 of the housing 10 which are guided in a longitudinal groove 14 of the cover (Fig. 1).

The cover 12 is provided with a through opening 51, and an abutment tab 52 projects inward at this opening.

The second connector 3 further bears a lock 15 which is part of a locking system of the connector assembly. The lock 15 is an integral (rigid) part which is movable in respect to the housing 10 between a lock and a release conditions. In the present example, the lock 15 is provided to slide with respect to the housing 10 along the direction Y from its lock condition to its release condition. It is for example also provided on the side of the housing 10 which is opposite to the wires 9.

In the initial position of the cover 12 with respect to the housing 10, the cover 12 covers the lock 15, so that the lock 15 is not accessible from outside. In particular, a user with normally-sized fingers cannot access or actuate the lock 15 in the initial position of the cover.

As can be seen in particular on Fig. 2, where the cover 12 is not shown, and Fig. 4, the lock 15 has a sliding surface 16 which is flat in order to slide on a complementary flat surface 17 of the housing. The lock 15 is provided through a through groove 18 of the housing 10 with an actuation portion 19 protruding above the flat surface 17. The lock further includes a lock portion 20 protruding below the flat surface and a neck portion 21 linking the actuation portion 19 to the lock portion 20. The neck portion 21 is designed to be guided inside the groove 18.

The lock 15 further comprises mounting means 22 which is used to cooperate with complementary mounting

means 23 of the housing to retain the lock 15 in each of its lock and release conditions with respect to the housing 10. Hence, mounting means 22 comprises a flexible arm 24 carrying a protrusion 25 which is insertable in a corresponding receiving groove 26 of the housing 10. The receiving groove 26 is provided with two protrusions 27 and 28 which are spaced apart along the Y direction and define respectively the lock and the release conditions of the lock 15.

As can be seen in particular on Fig. 6, the locking system comprises, in addition to the lock 15, a locking part 29 provided on the first housing 4 of the first connector. The locking part 29 comprises a locking surface 30 which is complementary with a locking surface 31 of the lock 15 so as to prevent any relative movement of the lock 15 and of the housing 4 along direction Z when these two surfaces 30, 31 face each other. In particular, the locking surface 31 of the lock 15 is provided facing direction Z whereas the locking surface 30 of the housing 4 is provided facing opposite direction Z.

Further, the lock 15 comprises an abutment surface 32, and the housing 4 comprises a complementary abutment surface 33 which will be described in more details below. The abutment surface 32 is provided as a surface of the lock portion 20, which faces opposite the direction Y, whereas the abutment surface 33 is provided as a surface of the housing 4 which faces direction Y.

Turning back to Fig. 1, the connector assembly 1 further comprises a mate assisting system. The mate assisting system is adapted to cause a relative mating movement of the housings 4 and 10 relative to one another as the cover 12 moves with respect to the housing 10 of the second connector from its initial to its final positions.

As a purely illustrative example, the mate assistance system can be provided as pins 34 of the housing

4 of the first connector and complementary grooves 35 of the cover 12. For example, the housing 4 has two lateral walls 36 and 37 which extend in the X-Z plane, and are spaced apart along the direction Y with the pins 34 provided on an outer surface of such walls. Two pins 34 are provided per wall. Similarly, the cover 12 has two lateral walls 38, 39 corresponding respectively to the lateral walls 36 and 37 and which each comprise two grooves, each pair of grooves 35 correspond to a pair of pins 34. Each groove 35 comprises a first portion 35a which extends along the direction Z, and a second slanted portion 35b which is slanted in the X-Z plane. Providing four parallel pin/groove systems enable to guide the movement along a given axis.

The second connector 3 further comprises a locking system adapted, in its active condition, to lock the cover 12 and the housing 10 in the initial position of the cover. In particular, it prevents movement of the cover along the X direction with respect to the housing 10. This lock can for example be provided as a flexible lance 40 provided on a first side of the housing 10 and which cooperates with a stop 42 of the cover 12. In the initial position of the cover 12 with respect to the housing 10, the end 40a, cooperates with the stop 42 so as to prevent movement of the cover along direction X. Movement of the cover along the direction opposite the direction X is normally hindered by friction the lance 40, on a stop 44 provided facing the external face of the lance.

As shown on Fig. 3, in the final position of the cover, the cover 12 is locked to the housing 10 by a locking system which comprises the end 41a of a lance 41 parallel to the lance 40 on the other side of the housing 10, and cooperating with a stop 47 provided in the cover 12. Movement in the direction opposite is prevented by abutment of the internal face of the cover 12 on the

corresponding face 48 of the housing.

An actuation system 49 is provided so as to disengage the lance 41 from the stop 47. The actuation system 49 is for example provided as a flexible button provided on the cover 12 and facing the lance 41 in the final position of the cover and which, under actuation of a user, will flex, thereby causing bending of the lance 41 out of engagement with the stop 47.

In addition, an intermediate lock and an intermediate stop can be provided, so as to lock the cover 12 on the housing 10 in an intermediate position upon movement of the cover from its final position to its initial position. This intermediate lock is for example provided by the lance 40 cooperating with the stop 44 of the cover 12. The actuation is provided by an intermediate actuation system 50 which is for example similar to the actuation system 49, comprising a flexible button which, in the intermediate position of the cover will flex, thereby causing bending of the lance 40 out of engagement with the stop 44. The actuation systems 49 and 50 can be offset with respect to one another along direction X so as to ensure actuation of the one after the other. The lances 40 and 41 and the stops 42 to 47 may also be provided along different heights along direction Z as shown. The internal face of the intermediate stop 44 can also be provided slanted, so as to not hinder the movement of the cover 12 with respect to the housing in the direction opposite the direction X, when setting the cover in place from its initial position to its final position. This also applies to the internal surface of the stop 42, so as to enable to assemble the cover to the housing 10.

The system further comprise a so-called “connection position assurance” (CPA) system which comprises a moving part which

- can be moved from a first position to a second

position when the first and second connectors are assembled, and,

- cannot be moved from its first to its second position before the two connectors are assembled.

Such "CPA" enables a visual indication that the connectors are properly assembled; if the connectors are not properly assembled, the operator will know it, since he will not be able to displace the part from its first to its second positions.

In the present case, the CPA element is provided by the lock 15 itself.

Operation of the system will now be disclosed.

Initially, one provides, on one side, the first connector 2, and in the other side, the second connector 3. The second connector 3 is provided with the lock 15 in its release condition and the cover 12 in its initial position. In this position, the lock 15 and in particular its actuation portion 19, is totally covered by the cover 12, and therefore is not accessible by an operator with normal-sized fingers.

Upon mating, the second connector 2 will be moved along the direction opposite to direction Z with respect to the first connector 2 to mate the connectors to one another. In fact, the second connector 3 is placed on the first connector 2 so that the pins 34 are located in the vertical portions 35a 35b of the respective grooves of the cover 12. Then, the cover 12 is moved from its initial position to its final position along the direction opposite to X. Cooperation of the mate assisting system, i.e. the pins 34 sliding in the grooves 35 will cause, upon movement of the cover 12 with respect to the housing 10 along the direction opposite X, the respective movement of the housings 10 and 4 toward one another.

In the final position of the cover 12, as shown on Fig. 5, the actuation portion 19 of the lock 15 will

protrude through the opening 51 of the cover (see also the opening on Fig. 7). Hence, only in this position, can the lock 15 be hand-actuated to move from its release position to its lock position. At this stage, the cover 12 is locked on the housing 10 by cooperation of the lance 41 with the stop 47 as shown on Fig. 3.

In this final position, the tab 52 of the cover is then clear of the lock 15, hence not preventing any movement of the lock (cf. Fig. 5).

However, all the way of travel of the cover from an intermediate position to this final position, the tab 52 faces a corresponding part of the lock 15, thereby preventing the lock 15 from moving toward its lock position.

Hence, between the initial and the intermediate position, the cover covers the lock, thereby preventing its actuation. Between the intermediate and the final positions, where the lock is partly accessible through the opening 51, its movement is prevented by the tab 52. Depending on the embodiments, the tab 52 could prevent movement of the lock on part or all along the path of the cover.

Also in this final position, the operator can actuate the actuation portion 19 of the lock 15 to have the lock 15 moved from its release condition to its lock condition, along the direction opposite to Y. The release condition of the lock is shown on Fig. 6. In its lock condition, the locking surface 31 faces the locking surface 30 of the housing 4 of the first connector, so that movement of the second connector with respect to the first connector along direction Z is prevented. The two connectors are locked to one another.

It should be mentioned that if the two housings are not perfectly assembled before operation of the lock 15, the lock 15 can also act as a supplementary mate assisting

device, by cooperation of the slanted surface 31 with the cooperating surface 30, thereby imparting further relative movement toward one another along direction Z of the two connectors.

However, if the operator tries to actuate the lock 15 before the two housings are sufficiently assembled to one another, abutment of the abutment surfaces 32 and 33 of, respectively, the lock 15 and the housing 4, will prevent movement of the lock from its release condition to its lock condition. In such case, the lock acts as CPA element, because it is prevented from moving, thereby indicating that the two connectors are not properly assembled.

It should be noted that in the locked condition of the lock 15, the protrusion 25 will cooperate with the protrusion 28 of the housing to retain the lock with respect to the housing 10 in the lock condition of the lock. Thus, movement of the lock 15 with respect to the housing from its release with lock condition imparts deformation of the flexible arm 24 of the lock.

In order to disassemble the connector assembly, the operator will first actuate the lock 15 through the opening 51 from its lock condition to its release condition.

Then, the operator will actuate the actuation button 49 so as to move the lance 41 out of engagement with the stop 47, and move the cover 12 along direction X with respect to the housing 10. Cooperation of the pins 34 and the slots 35 will also cause partly a movement of the housing of the second connector 3 along direction Z with respect to that of the first connector 2. The cover 12 will reach a stage where the lance 40 cooperates with the stop 44 in an intermediate position. The operator will then actuate the actuation system 50 so as to deflect the lance 40 out of engagement with the stop 44 and continue the movement of the cover 12 along the direction X.

Although the invention was described with the lock 15 provided on the housing 10 of the second connector, it may also alternatively be provided on the housing 4 of the first connector.

The axis system X_1 ; Y_1 ; Z_1 is opposed to the axis system X, Y, Z.

CLAIMS

1. An electrical connector assembly comprising:

- a first connector (2) having a housing (4),
- a second connector (3) having a housing (10), and a cover (12) movably mounted on said housing between an initial and a final position, the housing (10) of the second connector being movably mounted on the housing (4) of the first connector between an unassembled condition and an assembled condition,
- an actuable lock (15) movably mounted on one of said housings (10), said lock (15) being movable, under actuation, when the housings (4, 10) of the first and second connectors are in their assembled condition, between a release condition where it does not maintain said housings (4,10) relative to one another and a lock condition where it maintains the housings to one another,

wherein, in the initial position of the cover (12), the cover (12) prevents movement of the lock between its lock and release conditions,

wherein, in the final position of the cover (12), the cover (12) allows hand actuation of the lock.

2. Electrical connector assembly according to claim 1, wherein the cover (12) and the housing (4) of the first connector have corresponding features (34, 35) which cooperate with one another when the cover (12) is moved with respect to the housing (10) of the second connector from the initial to the final position, to cause relative movement of the housings (4,10) of both connectors from their unassembled condition to their assembled condition.

3. Electrical connector assembly according to claim 1 or 2, wherein the housings (4,10) of both connectors are movable with respect to one another along a vertical direction (Z), and wherein the cover (12) is movable with respect to the housing (10) of the second connector along a

first horizontal direction (X).

4. Electrical connector assembly according to any of claims 1 to 3, wherein the cover (12) is movable with respect to the housing (10) of the second connector along a first horizontal direction (X), and wherein the lock (15) is movable with respect to the housing (10) of the second connector along a second horizontal direction (Y) which is normal to the first horizontal direction (X).

5. Electrical connector assembly according to any of claims 1 to 4, wherein the housing (10) of the second connector comprises a body (100) adapted to receive electrical wires.

6. Electrical connector assembly according to any of claims 1 to 5, wherein the lock (15) is slidably mounted on the housing (10) of the second connector, wherein the lock (15) comprises a first abutment portion (32), wherein the housing (4) of the first connector comprises a second abutment portion (33) and wherein, when the first and second housings (4,10) are in an intermediate relative position, intermediate between the unassembled and assembled conditions, the first and second abutment portions (32,33) cooperate to prevent the lock (15) from moving from its release to its lock condition.

7. An electrical connector assembly according to any of claims 1 to 6 wherein, in the initial position of the cover, the cover (12) covers the lock (15), thereby preventing hand actuation of the lock,

wherein, in the final position of the cover, the cover (12) does not cover the lock.

8. An electrical connector assembly according to any of claims 1 to 7 wherein the cover has an abutment part (52), and wherein, at least between an intermediate position of the cover and its final position, wherein the intermediate position is intermediate between the initial and final positions of the cover, the abutment part (52)

faces a complementary part of the lock (15), thereby preventing movement of the lock between its lock and release conditions and wherein, in the final position of the cover, the abutment part (52) is away from the complementary part of the lock.

9. Electrical connector assembly according to any of claims 1 to 8, wherein a locking system is provided (40, 42, 44), said locking system having an active condition where it maintains the cover on said housing in the initial position.

10. Electrical connector assembly according to any of claims 1 to 9, wherein a locking system (40,44) is provided, said locking system having an active condition where it maintains the cover (12) on said housing (10) in an intermediate position intermediate between the initial and final positions, said locking system also having an inactive condition where it allows movement of the cover (12) with respect to the housing (10), and wherein the cover comprises an actuator (50) adapted to place said locking system in its inactive condition.

11. Electrical connector assembly according to any of claims 1 to 10, wherein the lock (15) is slidably mounted on the housing (10) of the second connector, wherein the lock (15) and the housing (4) of the first connector comprise cooperating slanted portions (30,31) and wherein, when the first and second housings (4, 10) are in an intermediate relative position, intermediate between the unassembled and assembled conditions, upon movement of the lock from (15) its release to its lock condition, the cooperating slanted portions (30,31) cause relative movement of both housings (4,10) to their assembled condition.

12. Electrical connector assembly according to any of claims 1 to 11, wherein the cover (12) has a finger-sized through hole (51), and wherein an actuation portion

(19) of the lock (15) projects through the through hole in the final position of the cover (12).

13. Electrical connector for an electrical connector assembly according to any of claims 1 to 12, and comprising all the features of the second connector (3) and of the lock (15) as defined in said claim.

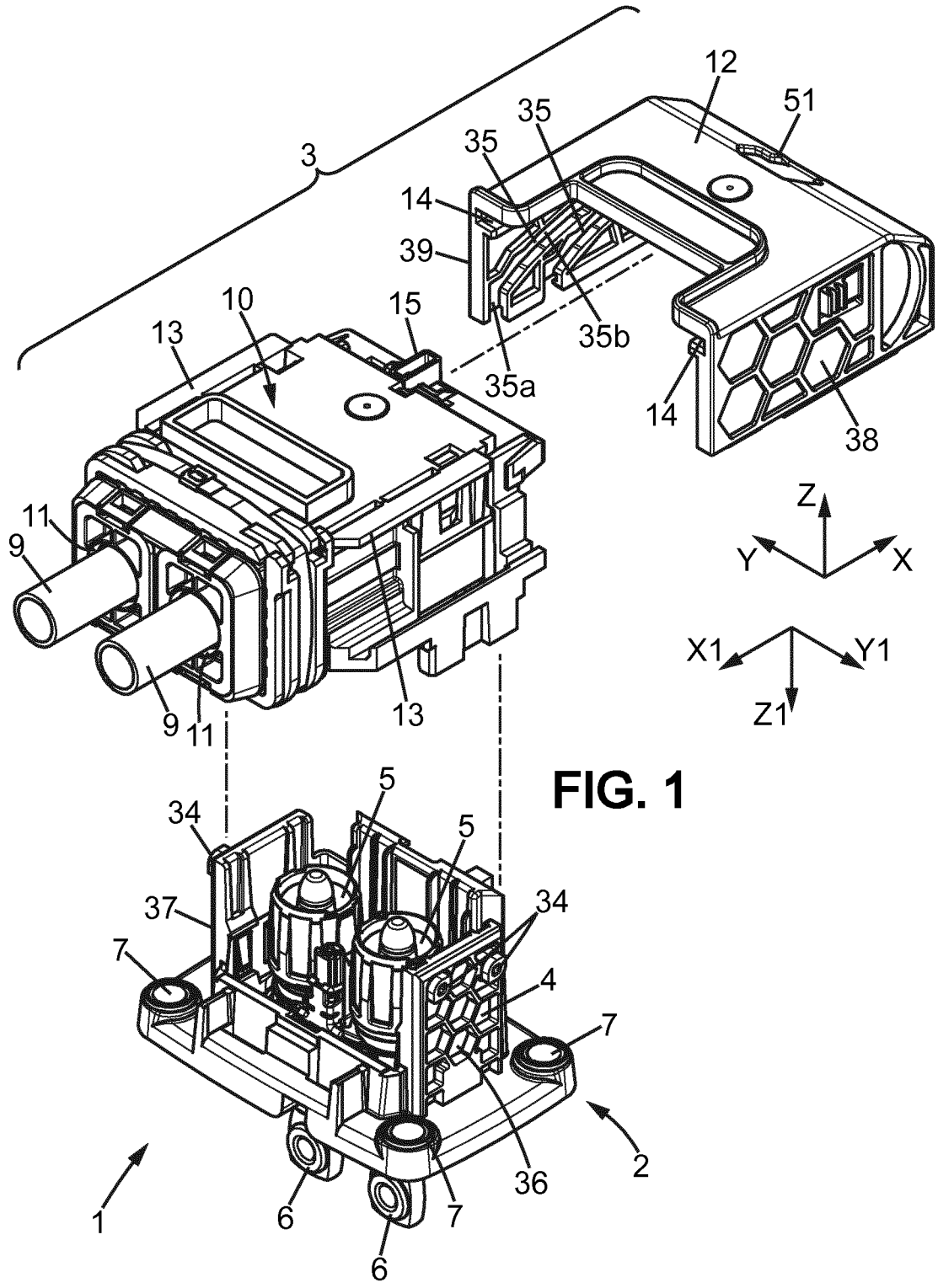
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FIG. 1

FIG. 2

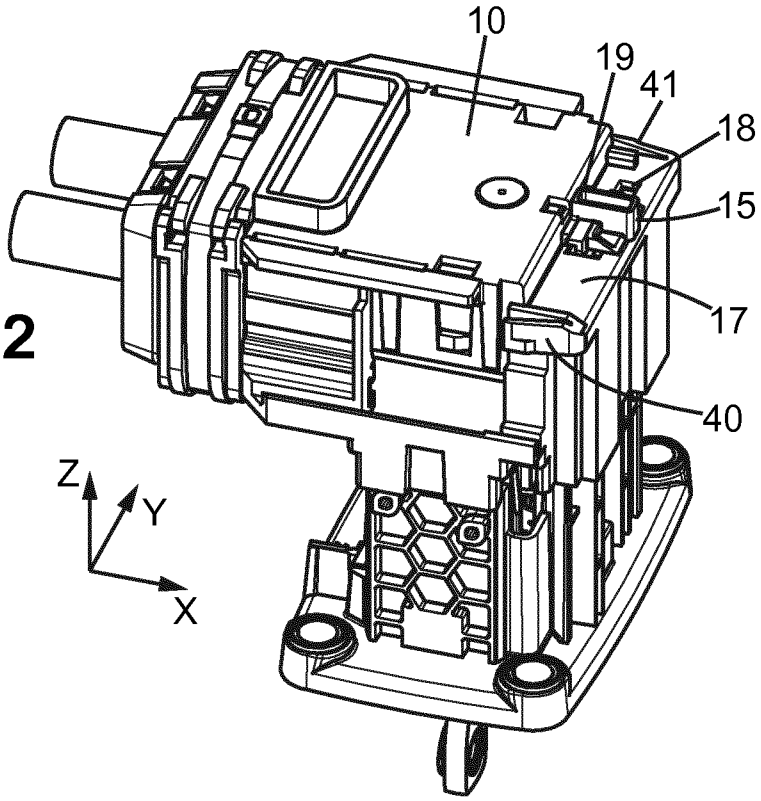
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FIG. 3

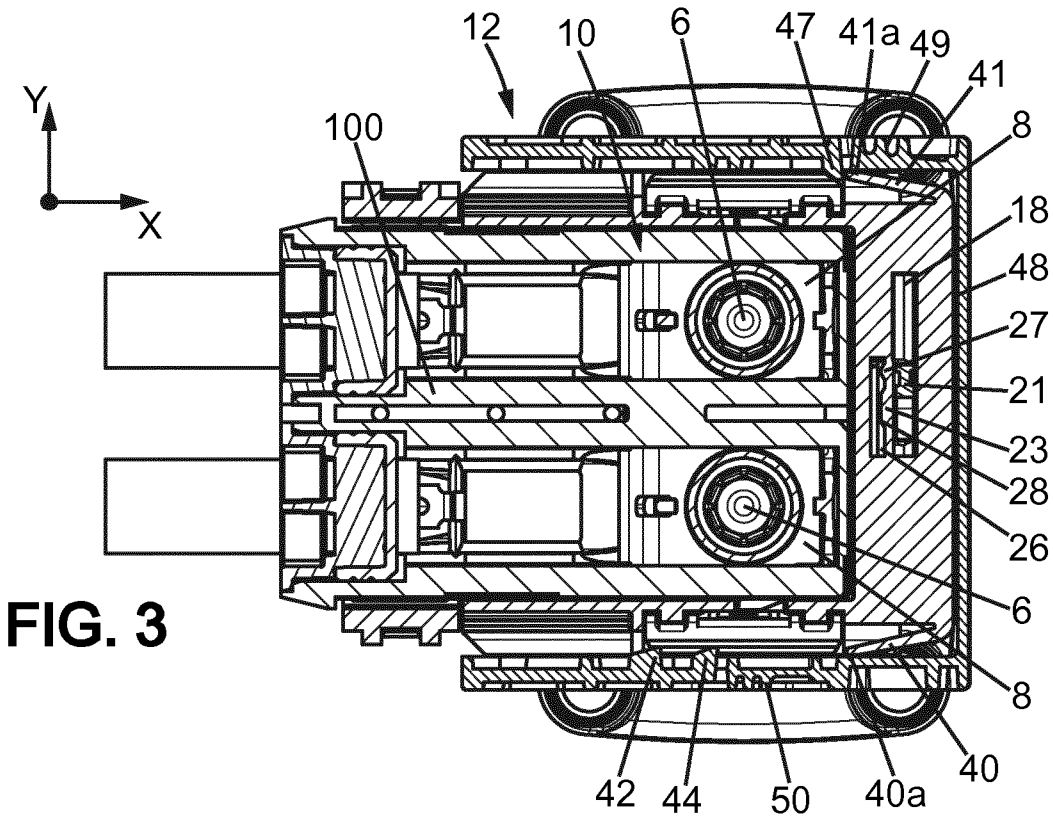
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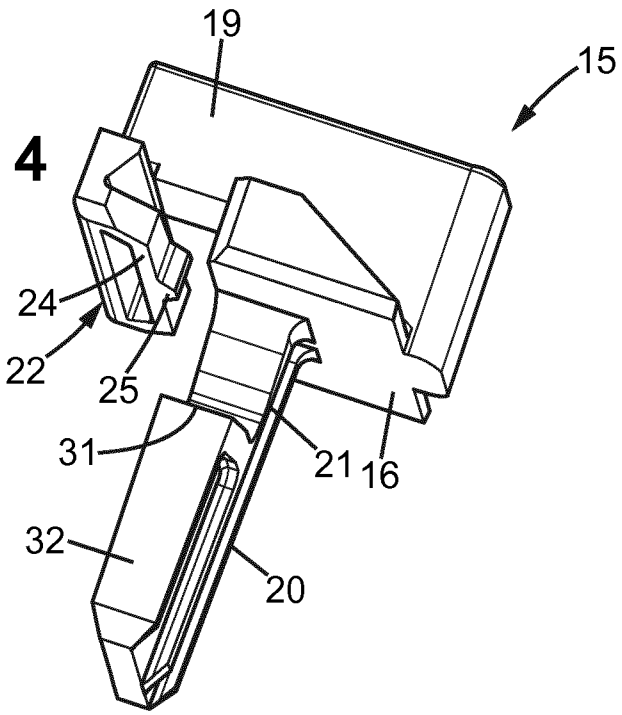
FIG. 4



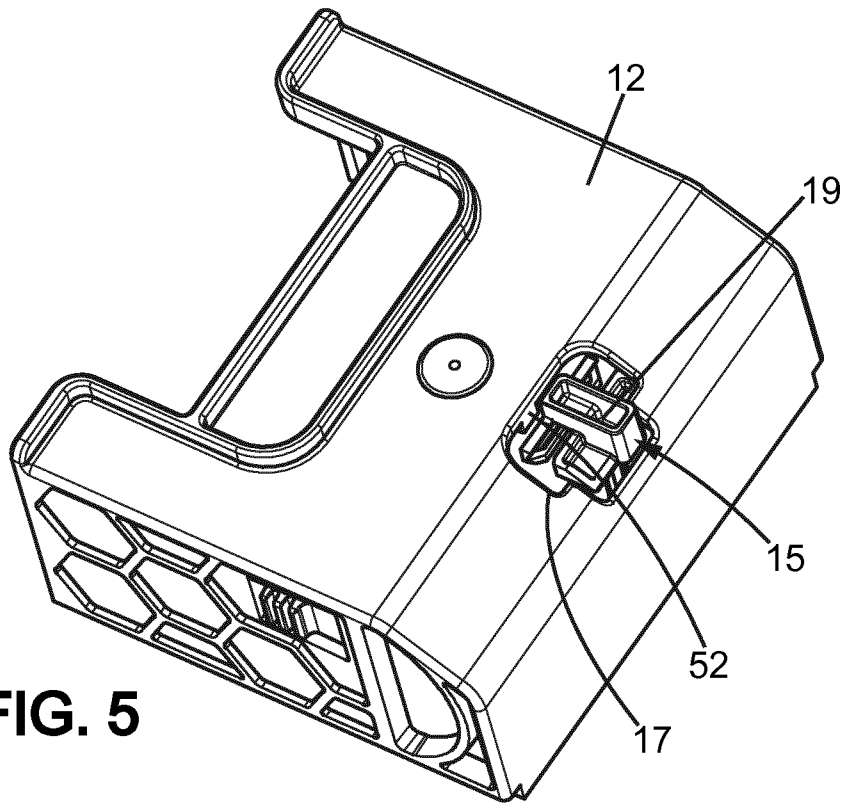
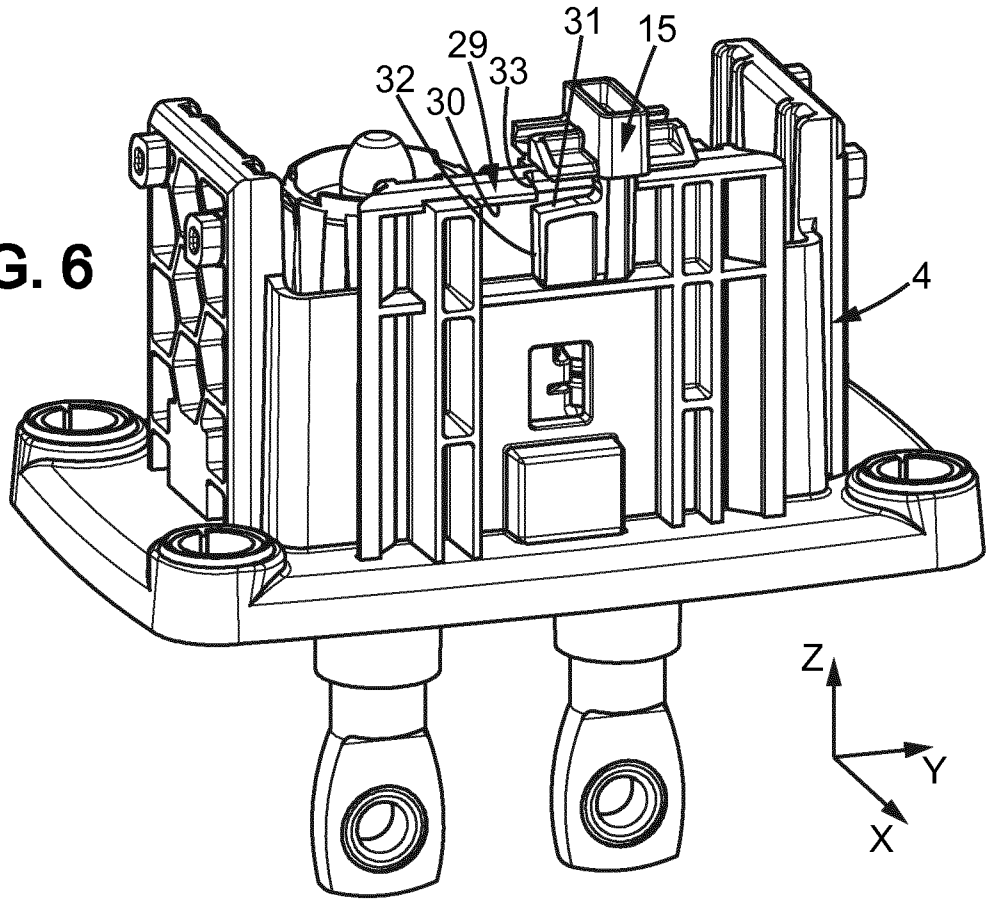


FIG. 5

FIG. 6



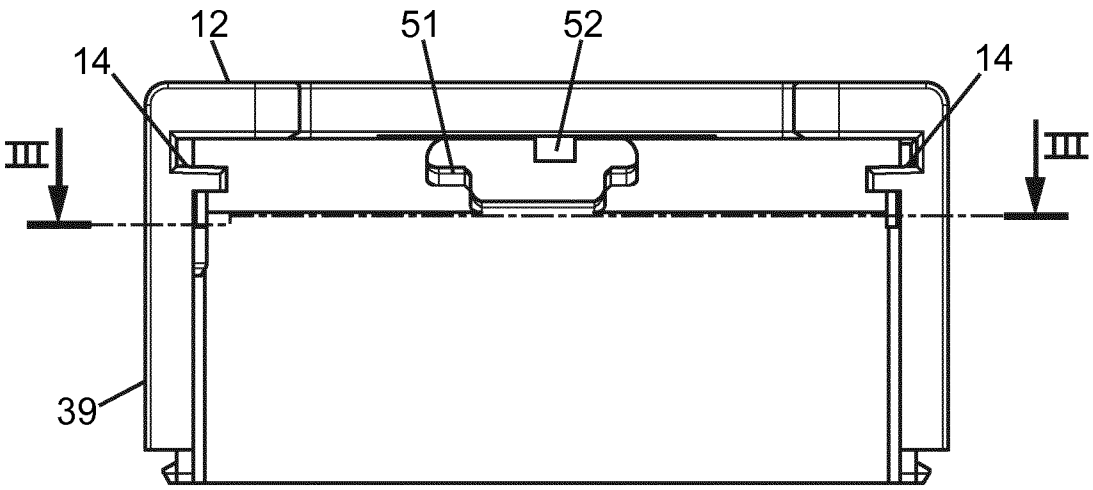


FIG. 7

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2012/059205

A. CLASSIFICATION OF SUBJECT MATTER
INV. H01R13/627 H01R13/639 H01R13/629
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

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2003/040210 A1 (HERLINGER GEORGE R [US] ET AL) 27 February 2003 (2003-02-27)	1,4,5, 7-9,11, 12
Y	the whole document	2,3,6,10
X	US 6 491 542 B1 (ZEREBILOV ARKADY Y [US]) 10 December 2002 (2002-12-10) column 3 - column 4; figures 1,2,4	1
X	US 6 846 195 B2 (ANNEQUIN SEBATIEN [FR]) 25 January 2005 (2005-01-25) column 3 - column 4; figures 1-4	1
Y	EP 2 120 297 A1 (RADIALL SA) 18 November 2009 (2009-11-18) abstract; figure 1	2

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
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INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2012/059205

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 6 210 186 B1 (FINK RANDY L [US] ET AL) 3 April 2001 (2001-04-03) figure 1	3,10
Y	US 2010/111597 A1 (KODAMA SHINJI [JP] ET AL) 6 May 2010 (2010-05-06) paragraph [0069]; figure 5	6

Form PCT/ISA/210 (continuation of second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2012/059205

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2003040210 A1	27-02-2003	NONE	
US 6491542 B1	10-12-2002	NONE	
US 6846195 B2	25-01-2005	EP 1383206 A1	21-01-2004
		FR 2842658 A1	23-01-2004
		US 2004053531 A1	18-03-2004
EP 2120297 A1	18-11-2009	EP 2120297 A1	18-11-2009
		FR 2931306 A1	20-11-2009
		US 2009286425 A1	19-11-2009
US 6210186 B1	03-04-2001	NONE	
US 2010111597 A1	06-05-2010	AU 2009227921 A1	20-05-2010
		CN 101740946 A	16-06-2010
		JP 2010113818 A	20-05-2010
		US 2010111597 A1	06-05-2010