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(54) **ELECTRICAL CONNECTOR WITH MODULAR INSERTS AND ASSEMBLY METHOD THEREOF**

(57) Electrical connector 1 comprising an outer housing to defining a mating direction X of the female electrical connector 1; at least one electrical terminal 20; at least one insert 30, individually surrounding the at least one electrical terminal 20; wherein the insert 30 comprises a terminal locking means 40 for selectively locking the electrical terminal 20 within the insert 30; wherein the terminal locking means 40 is an integral part of the insert 30 and is switchable between an assembly position 41 in which the electrical terminal 20 is insertable into the electrical connector 1 and a locking position 42 in which the electrical terminal 20 is locked within the electrical connector 1 by the terminal locking means 40. The application further comprises a method for an assembly of an electrical connector 1.

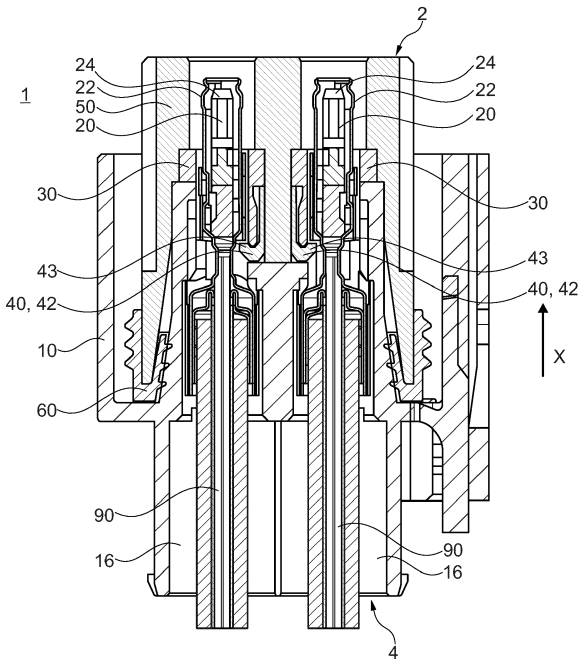

Fig. 2

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Description

1. Field of the invention

[0001] The present invention relates to an electrical connector with caged modular inserts. The electrical connector is particularly useful as female connector for a high-speed data connector system for automotive applications.

2. Prior art

[0002] Electrical connectors are widely used in automotive applications. On the one hand such electrical connectors are used to transmit electrical power to electric consumers. On the other hand electric connectors are more often used to distribute data in automotive vehicles.

[0003] Vehicles are adding high-resolution radars and cameras to support ever more sophisticated automated driving capabilities, and those devices create high-bandwidth streams of data to centralized computing platforms. To accommodate these emerging requirements, the industry is moving to networking technologies such as Automotive Ethernet and MIPI A-PHY, a new physical-layer interface for in-vehicle data transmission.

[0004] Ethernet has a long and successful history in IT, but the most common connectors used with Ethernet in the IT world-such as the RJ-45 jack found on many laptops and in data centers-are not nearly robust enough for automotive environments, which present unique challenges related to heat, vibration, electromagnetic interference, space constraints, dirt and dust. Keeping the connections clean and securely attached in that environment is critical to ensuring that the automated driving features operate as expected.

[0005] A high-speed data connector system is a connector system used in automotive networking applications that supports frequencies up to 20 GHz and data transmission rates up to 56G bit/sec. To protect against electromagnetic interference, the connectors provide a fully shielded interface. The high-speed data connector system cable assembly design supports the use of shielded twisted-pair cables for high bandwidths. An example of a high-speed data connector system is the H-MTD® connector system of the company Rosenberger Hochfrequenztechnik GmbH und Co. KG, Germany.

[0006] The object of the present invention is to provide an electrical connector, particularly for high-bandwidth data applications, that is easy to assemble, reliable, easily serviceable, preferably easy serviceable with standard tools and robust enough for automotive applications.

3. Summary of the invention

[0007] The above-mentioned object is realized by an electrical connector according to claim 1 or by a method for an assembly of an electrical connector according to claim 15.

[0008] Particularly, the above-mentioned object is realized by an electrical connector comprising an outer housing defining a mating direction of the female electrical connector; at least one electrical terminal; at least one insert, individually surrounding the at least one electrical terminal; wherein the insert comprises a terminal locking means for selectively locking the electrical terminal within the insert; wherein the terminal locking means is an integral part of the insert and is switchable between an assembly position in which the electrical terminal is insertable into the electrical connector and a locking position in which the electrical terminal is locked within the electrical connector by the terminal locking means.

[0009] Thus, each electrical terminal is individually surrounded by its insert, what makes the female electrical connector modular in terms of the number of female electrical terminals. It should be noted that one female electrical terminal can comprise more than one electrical contact. For example, in case of a high-speed data connector system terminal two electrical contacts for the twisted pair cable are provided in one electrical terminal. Preferably, the high-speed data connector system terminal provides a common shielding for the two electrical contacts of the twisted pair cable. In another example the electrical terminal for a coaxial cable can only comprise one electrical contact, that is shielded by an outer shield. The electrical contacts can be female or male. Thus, the electrical connector can be a female or male electrical connector, particularly a female or male electrical connector for a high-speed data connector system.

[0010] The terminal locking means provides secure locking of the electrical terminal within the electrical connector. Since the terminal locking means is an integral part of the insert it cannot be lost but is still movable in respect to the body of the insert. Further, no additional part is needed. Since the terminal locking means is switchable between an assembly position and a locking position, an easy assembly of the electrical terminal and a secure locking of the female electrical terminal within the female electrical connector is ensured, simply by moving the terminal locking means between these two positions. By being switchable the terminal locking means remains stable in the two positions. Thus, it adopts either the assembly position or the locking position but is not stable in-between. This on the one hand facilitates insertion of the electrical terminal and on the other hand reliably ensures mounting of the electrical terminal within the electrical connector. Further, since the terminal locking means can be switched between both positions a plurality of times, it is possible to easily disassemble the electrical terminal from the electrical connector. This allows servicing or adapting the electrical connection if needed.

[0011] Preferably, the terminal locking means has a locking protrusion that moves essentially perpendicularly to the mating direction when switching between the assembly position and the locking position. Thus, the lock-

ing protrusion reliably resists a pulling force onto the electrical terminal, since such pulling force is essentially perpendicularly to the switching movement of the locking protrusion.

[0012] Preferably, the terminal locking means has a latching protrusion, that latches with a latching rim of the insert in the locking position. Thus, the latching protrusion remains stable in the locking position.

[0013] Preferably, the latching protrusion of the terminal locking means additionally abuts the latching rim of the insert in the assembly position. Thus, the latching protrusion also remains stable in the assembly position.

[0014] Preferably, the terminal locking means comprises an integral un-locking lever at the locking protrusion, for switching the terminal locking means from the locking position to the assembly position. The un-locking lever facilitates an easy switching the locking protrusion into the assembly position for a simple removal of the electrical terminal out of the electrical connector. The un-locking lever can preferably be actuated by a manual tool.

[0015] Preferably, the un-locking lever is shaped to be switched from the locking position to the assembly position by means of a flat screwdriver. Thus, no special tools are needed for a disassembly of the electrical terminal.

[0016] Preferably, the terminal locking means further comprises a film hinge that connects the locking protrusion with a body of the insert, wherein the film hinge provides movement of the locking protrusion. The film hinge provides a reliable and easy movable connection between the locking protrusion and the insert. Furthermore, the film hinge supports defining the movement direction of the locking protrusion and provides elasticity for the switching between the assembly and the locking position.

[0017] Preferably, the insert further comprises a latching arm for latching with the outer housing. Preferably, the latching arm extends from the body of the insert in negative mating direction.

[0018] Preferably, the outer housing comprises at least one lock lance for latching with the electrical terminal. The lock lance provides a first locking feature for mounting the electrical terminal within the electrical connector after insertion in mating direction.

[0019] Preferably, the electrical connector further comprises a cage inner housing, connected to the inside of the outer housing, extending in mating direction out of the outer housing, and surrounding the at least one insert in mating direction. Since the cage inner housing extends in mating direction out of the outer housing and surrounds the at least one insert in mating direction it mechanically protects the insert prior and after assembly of the respective female electrical terminal. Preferably, the cage inner housing builds a protective "cage" around the insert during use.

[0020] Preferably, the cage inner housing comprises a switching tab that switches the terminal locking means from the assembly position to the locking position, when the cage inner housing is inserted into the outer housing. Thus, the cage inner housing automatically switches and/or secures the terminal locking means to the locking position. Thereby, the electrical terminal is secured by the cage inner housing as the switching tab blocks the terminal locking means in the locked position.

[0021] Preferably, the cage inner housing comprises coding features for allowing connection with a suitable corresponding electrical connector of different gender and for preventing a connection with a non-suitable electrical connector.

[0022] Preferably, the cage inner housing is connected to the outer housing by a retaining latch of the cage inner housing. Thus, the cage inner housing can be attached to the housing by simple insertion in mounting direction and latching.

[0023] Preferably, the cage inner housing comprising a release hook attached to the retaining latch for releasing the retaining latch by a tool. Thus, the cage inner housing can be disassembled from the electrical connector if necessary. Particularly, the cage inner housing can be disassembled from the electrical connector in case the electrical terminals need to be disassembled.

[0024] Preferably, the electrical connector further comprises an elastic seal, wherein the seal has a V-shaped cross-section and is arranged between the outer housing and the cage inner housing. Preferably, the seal waterproofs the connection between the outer housing and the cage inner housing. In addition the seal also waterproofs the connection between the electrical connector and an electrical connector of different gender connected to the electrical connector. The two legs of the V-shaped cross-section, thus, provide two sealing surfaces of the seal.

[0025] Preferably, the seal comprises ridges at both sealing surfaces, which improve the sealing performance.

[0026] Preferably, the cage inner housing comprises a tubular end that introduces into a cavity formed by the V-shaped cross-section of the elastic seal. Thus, the cage inner housing holds the seal in place and reinforces the seal.

[0027] Preferably, the terminal is a high-speed data terminal, preferably a shielded coaxial terminal or a shielded high-speed modular twisted pair data terminal. Thus, the electrical connector is suitable for high-bandwidth data transmission.

[0028] Preferably, the electrical connector comprises more than one, preferably two, three, four, five or six electrical terminals, and correspondingly more than one, preferably two, three, four, five or six inserts. Thus, each of the electrical terminals can individually be assembled or locked by the corresponding insert.

[0029] The above-mentioned problem is also solved by a method for an assembly of an electrical connector comprising the following steps:

a. providing an outer housing defining a mating direction of the electrical connector;

b. providing an insert within the electrical connector,

wherein the insert comprises a terminal locking means as an integral part of the insert;
c. providing a cage inner housing, connected to the inside of the outer housing, extending in mating direction out of the outer housing, and surrounding the at least one insert in mating direction;
d. inserting at least one electrical terminal into a back side of the outer housing such that the electrical terminal is at least partially surrounded by the insert; and
e. switching the terminal locking means from an assembly position in which the electrical terminal is insertable into the electrical connector to a locking position in which the electrical terminal is locked within the electrical connector by the terminal locking means.

[0030] By this assembly method, the same advantages are achieved as explained above in view of the electrical connector.

4. Short description of the drawings

[0031] In the following, preferred embodiments of the invention are disclosed by reference to the accompanying figure, in which shows:

Fig. 1	a three-dimensional view of a preferred embodiment of an electrical connector;
Fig. 2	a sectional view of the electrical connector of Fig. 1;
Fig. 3	a partial three-dimensional explosion view of the electrical connector of Fig. 1;
Figs. 4A-C	different views of a preferred embodiment of an insert of the electrical connector of Fig. 1;
Fig. 5A	a three-dimensional view of the insert of Figs. 4A-C with a terminal locking means in the assembly position;
Fig. 5B	a three-dimensional view of the insert of Figs. 4A-C with a terminal locking means in the locking-position;
Fig. 6A	a side view of the insert of Figs. 4A-C together with a preferred embodiment of an electrical terminal, with a terminal locking means in the assembly position;
Fig. 6B	a side view of the insert of Figs. 4A-C together with an electrical terminal, with a terminal locking means in the locking position;
Figs. 7A-C	sectional side views of the insert of Figs. 4A-C together with a preferred embodiment of an outer housing during the insertion of the insert into the outer housing;
Figs. 8A-B	sectional side views of the assembly of Figs. 7A-C during the insertion of an electrical terminal, wherein Fig. 8B is rotated by 90° around the insertion direction versus Fig. 8A;
Figs. 8C-D	sectional side views of the assembly of Figs. 7A-C after the insertion of an electrical terminal, wherein Fig. 8D is rotated by 90° around the insertion direction versus Fig. 8C;
Fig. 9A	a sectional side view of the assembly of Figs. 8A-C with a terminal locking means in the assembly position;
Fig. 9B	a sectional side view of the assembly of Figs. 8A-C with a terminal locking means in the locking position;
Fig. 10A	a three-dimensional view of a preferred embodiment of a cage inner housing;
Figs. 10B-Ca	sectional side view and a three-dimensional side view of the cage inner housing of Fig. 10C;
Fig. 11A	a partial sectional side view of the electrical connector of Fig. 1 during assembly of the cage inner housing;
Fig. 11B	a partial sectional side view of the electrical connector of Fig. 1 after assembly of the cage inner housing;
Figs. 12A and C	side views of the assembly of Figs. 6A-B and a tool during switching of the terminal locking means from the locked position to the assembly position;
Fig. 12B	a partial three-dimensional view of an electrical connector with removed cage inner housing during

switching of the terminal locking means from the locked position to the assembly position by a manual tool;

Fig. 13 a partial three-dimensional view of the electrical connector of Fig. 12B during release of a lock lance of the outer housing;

Figs. 14A-B a partial sectional side view and a three-dimensional view of the assembly of Figs. 7A-C during the release of the insert by a manual tool.

5. Detailed description of preferred embodiments

[0032] In the following, preferred embodiments of the invention are described in detail with respect to the figures.

[0033] Figs. 1, 2 and 3 show an electrical connector 1 according to a preferred embodiment of the present invention. The electrical connector 1 is preferably a female electrical connector and comprises as main components an outer housing 10, six female electrical terminals 20, a cage inner housing 50, and six inserts 30. Each of the six inserts 30 have a terminal locking means 40 for individually locking the respective electrical terminal 20 within the electrical connector 1. Further the electrical connector 1 preferably comprises an elastic seal 60 that is arranged between the outer housing 10 and the cage inner housing 50. The electrical terminals 20 are electrically and mechanically connected to corresponding electrical cables 90. Further, the female electrical connector 1 preferably comprises for each of the cables 90 cable seals (not shown) that are arranged between each of the cables 90 and cable receptacles 16 of the outer housing 10. The female electrical connector 1 further preferably comprises a latching tab for latching with a corresponding male electrical connector (not shown).

[0034] The electrical connector 1 comprises a connector side 2 where it connects with a corresponding electrical connector of different gender (not shown) and a cable side 4 where the electrical cables 90 extend. The mating direction is indicated by an arrow X and shows the movement direction for establishing connection with a corresponding electrical connector of different gender (not shown).

[0035] As particularly shown in Fig. 2, in the preferred embodiment the electrical connector 1 is a female connector for a high-speed data connector system for automotive applications. Preferably, the electrical connector 1 can be a H-MTD® type female electrical connector. The electrical connector 1 comprises six female electrical terminals 20 each one for one shielded twisted pair high-speed data cable 90. Thus, each electrical terminal 20 is shielded by a metal shield 22 and comprises two female electrical contacts 24, one for each line of the twisted pair cable 90 (see also Fig. 8B). Of course, in other embodiments the electrical connector 1 can comprise only one or up to six or even more female electrical terminals 20 for two, three, four, five or up to six or even more twisted pair cables 90 with up to twelve or even more individual electrical data lines. As a replacement for standard Ethernet connectors the female electrical connector 1 can comprise four female electrical terminals 20 with eight individual electrical data lines and eight female electrical contacts 24. Of course, the electrical connector 1 could also be a male electrical connector 1 with male electrical terminals 20 and male electrical contacts 24.

[0036] The electrical connector 1 provides a robust, reliable and preferably water-resistant connector for shielded high-speed twisted-pair data cables. Thereby, the electrical terminals 20 are reliably individually locked within the electrical connector 1. Since the outer housing 10 is a one-piece element the electrical terminals 20 are held exactly in place, what improves contact overlap of the electrical connection. In addition, the electrical terminals 20 can be individually removed from the electrical connector 1, when the locking is released. All locking elements of the electrical connector 1 are caged in the inside of the electrical connector 1 by the cage inner housing 50, what prevents any unintentional unlocking of the female electrical terminals 20. The locking of the electrical terminals can be done with a standard manual tool or preferably tool-less. For the unlocking of the electrical terminals 20 only a standard manual tool 100 (see Figs. 12-14) is needed, such that disassembly of the electrical connector 1 can be done without any damaging.

[0037] Each electrical terminal 20 is individually surrounded by a corresponding insert 30, which is shown in detail in Figs. 4A-C. The inserts 30 comprise an essentially hollow body 32 that in assembled condition surrounds one of the electrical terminals 20. Further, the inserts 30 comprise a latching arm 36 for latching with the outer housing 10.

[0038] Further the inserts 30 comprise a terminal locking means 40 for selectively locking the electrical terminal 20 within the insert 30. The terminal locking means 40 is integrally formed with the insert 30 and comprises a film hinge 47 that connects a locking protrusion 43 to the body 32 of the insert 30. The film hinge 47 provides that the locking protrusion 43 can move essentially perpendicular to the mating direction X of the electrical connector 1.

[0039] As shown in Figs. 5A and 5B the terminal locking means 40 is switchable between an assembly position 41 (see Fig. 5A) in which the electrical terminal 20 is insertable into the electrical connector 1 and a locking position 42 (see Fig. 5B) in which the electrical terminal 20 is locked within the electrical connector 1 by the terminal locking means 40. The two positions of the terminal locking means 40 are stably maintained after switching to increase reliability of the assembly. To this end, the terminal locking means 40 comprises a latching protrusion 44, that latches with a latching rim 34 of the

insert 30 in the locking position 42. In addition, the latching protrusion 44 of the terminal locking means 40 abuts the latching rim 34 of the insert 30 in the assembly position 41. Thus, the terminal locking means 40 does not accidentally switch between the assembly position 41 and the locking position 42 and vice versa. As shown in Figs. 6A and 6B the terminal locking means 40 is generally hook-shaped to lock with the latching rim 34 either in the assembly position 41 or in the locking position 42.

[0040] The switching of the terminal locking means 40 can be done manually by a simple tool, for example by a screwdriver 100. However, the terminal locking means 40 can also switch automatically to the locking position 42 during assembly of the electrical connector 1.

[0041] Fig. 6A shows the insert 30 when a terminal 20 is inserted. The terminal locking means 40 is still in the assembly position 41, where the locking protrusion 43 is switched to the outside of the insert 30 and the latching protrusion 44 abuts the latching rim 34. In this assembly position 41 the electrical terminal 20 could be pulled out of the insert 30. When the terminal locking means 40 is switched to the locking position 42, as shown in Fig. 6B the locking protrusion is switched to the inside of the insert 30 and blocks a rear edge 26 of the metal shield 22 of the electrical terminal 20. Thus, the electrical terminal 20 is locked within the insert 30.

[0042] For manually un-locking the terminal locking means 40 comprises an integral unlocking lever 46 that can be actuated by a manual tool, for example by screwdriver 100 (see Fig. 12A-C). The un-locking lever 46 preferably extends perpendicularly to the mating direction to one side of the locking protrusion 43.

[0043] The Figs. 7A to 11B show the assembly process of the electrical connector in detail. In a first step the inserts 30 are introduced against mating direction X into corresponding receptacles 18 (see Fig. 3) of the outer housing 1. Thereby the latching arm 36 latches with a latching hook 12 of the outer housing 10. Thus, each of the inserts 30 is secured within the outer housing 10.

[0044] In a next step, as shown in Figs. 8A-D the electrical terminals 20 are inserted into the inserts 30. This is done in mating direction X from the cable side 4 of the electrical connector 1. When the electrical terminal 20 has reached its final position, as shown in Figs. 8C and 8D the elastic lock lance 14 of the outer housing 10 latches with the electrical terminal 20 and locks it in place. Preferably, the lock lance 14 snaps behind the rear edge 26 of the metal shield 22 and locks the electrical terminal 20 in assembled position.

[0045] In a further step, as shown in Figs. 9A and 9B the electrical terminal 20 is additionally locked in the insert 30 by switching the terminal locking means 40 from the assembly position 41 (see Fig. 9A) to the locking position 42 (see Fig. 9B). Thereby, the locking projection 43 moves also behind the rear edge 26 of the metal shield 22 and additionally locks the electrical terminal 20 in assembled position. The switching of the terminal locking means 40 can be done manually or automatically by the assembly of the cage inner housing 50.

[0046] A cage inner housing 50 is shown in Fig. 10A in detail. Preferably, the cage inner housing 50 protects all inserts 30 of the electrical connector 1. To this end, the shown cage inner housing 50 comprises an essentially hollow body and openings or cavities 58 for each of the inserts 30 and electrical terminals 20. The cage inner housing 50 is rigidly connected to the outer housing 10 by a retaining latch 52 that latches with a latch or pocket of the outer housing (see Figs. 10B and 10C). The cage inner housing 50 further comprises coding features 51 for allowing connection with a suitable electrical connector of different gender (not shown) and for preventing a connection with a non-suitable electrical connector (not shown). In the shown embodiment the coding features 51 comprise a plurality of ribs that are arranged in mating direction X. The cage inner housing further comprises an essentially tubular end 56 that during assembly enters into the cavity 64 of the elastomeric seal 60 (see Figs. 11A and 11B).

[0047] As shown in Figs. 11A and 11B, the cage inner housing 50 further comprises switching tabs 57. When the cage inner housing 50 is inserted into the outer housing 10 and around the inserts 30 the switching tabs 57 move downwards and thereby switch the terminal locking means 40 from the assembly position 41 to the locking position 42 (see Fig. 11B). Thus, the terminal locking means 40 is automatically switched and secured in the locking position 42 by the cage inner housing 50.

[0048] Fig. 11A and 11B also show details of the elastomeric seal 60. It is made of an elastomeric material and seals the connector side cavity to a male electrical connector (not shown) and simultaneously between the outer housing 10 and the cage inner housing 50. The elastomeric seal 60 is essentially annular and has a V-shaped cross section 62. The V-shaped cross-section 62 forms an inner sealing wall 65, an outer sealing wall 66 and an annular cavity 64 in-between the sealing walls 65, 66. The elastomeric seal 60 further comprises inner rims 67 that extend from an inner sealing wall 65 to the inside and outer rims 68 that extend from the outer sealing wall 66. The rims 67, 68 further improve the tightness of the final connection.

[0049] After the assembly of the cage inner housing 50 the electrical terminals 20 finally assembled and are securely held in place within electrical connector 1.

[0050] The electrical connector 1 can also be disassembled without any damage, as shown in in Figs. 12A to 14B.

[0051] In a first disassembly step (not shown) the cage inner housing 50 is disassembled from the electrical connector 1. To do so the retaining latches 52 are bent outwards by manual tools, e.g. a flat screwdriver that engages a release hook 54 at the outside of the retaining latch 52 (see. Fig.10A-C). This disengages the retaining latch 52 from the outer housing 10 and allows the cage inner housing 50 to be removed.

[0052] In a second disassembly step, as shown in Figs.

12A-C a manual tool 100, e.g. a flat screwdriver 100 engages behind the un-locking lever 46 of each of the terminal locking means 40 to move them from the locking position 41 (see Fig. 12A) outwards to the assembly position (see Fig. 12C).

[0053] In a third disassembly step, as shown in Fig. 13 the manual tool 100 can be used to bend the elastic lock lance 14 of the outer housing 10 outwards to release the electric terminal 20 from engagement. Then the electric terminal 20 can be pulled out of the electric connector 1.

List of reference signs:

[0054]

1	electrical connector
2	connector side
4	cable side
10	outer housing
12	latching hook
14	lock lance
16	cable receptacles
20	electrical terminal
22	metal shield
24	electrical contacts
26	rear edge
30	inserts
32	body
34	latching rim
36	latching arm
40	terminal locking means
41	assembly position
42	locking position
43	locking protrusion
44	latching protrusion
46	un-locking lever
47	film hinge
50	cage inner housing
51	coding features
52	retaining latch
54	release hook
56	tubular end
57	switching tabs
58	openings/cavities
60	elastomeric seal
62	V-shaped crossection
64	cavity
65	inner sealing wall
66	outer sealing wall
67	inner rims
68	outer rims
100	manual tool/flat screwdriver
X	mating direction

Claims

1. Electrical connector (1) comprising:

- an outer housing (10) defining a mating direction (X) of the female electrical connector (1);
- at least one electrical terminal (20);
- at least one insert (30), individually surrounding the at least one electrical terminal (20);
- wherein the insert (30) comprises a terminal locking means (40) for selectively locking the electrical terminal (20) within the insert (30);
- wherein the terminal locking means (40) is an integral part of the insert (30) and is switchable between an assembly position (41) in which the electrical terminal (20) is insertable into the electrical connector (1) and a locking position (42) in which the electrical terminal (20) is locked within the electrical connector (1) by the terminal locking means (40).

2. Electrical connector according to claim 1, wherein the terminal locking means (40) has a locking protrusion (43) that moves essentially perpendicularly to the mating direction (X) when switching between the assembly position (41) and the locking position (42).

3. Electrical connector according to one of the claims 1 or 2, wherein the terminal locking means (40) has a latching protrusion (44), that latches with a latching rim (34) of the insert (30) in the locking position (42).

4. Electrical connector according to claim 3, wherein latching protrusion (44) of the terminal locking means (40) additionally abuts the latching rim (34) of the insert in the assembly position (41).

5. Electrical connector according to one of the claims 1 to 4, wherein the terminal locking means (40) comprises an integral un-locking lever (46) at the locking protrusion (43), for switching the terminal locking means (40) from the locking position (42) to the assembly position (41).

6. Electrical connector according to claim 5, wherein the un-locking lever (46) is shaped to be switched from the locking position (42) to the assembly position (42) by means of a flat screwdriver (100).

7. Electrical connector according to one of the claims 1 to 6, wherein the terminal locking means (40) further comprises a film hinge (47) that connects the locking protrusion (43) with a body (32) of the insert (30), wherein the film hinge (47) provides movement of the locking protrusion (43).

8. Electrical connector according to one of the claims 1 to 7, wherein the insert (30) further comprises a latching arm (36) for latching with the outer housing (10).

9. Electrical connector according to one of the claims 1

to 8, wherein the outer housing (10) comprises at least one lock lance (14) for latching with the electrical terminal (20).

10. Electrical connector according to one of the claims 1 to 9, further comprising a cage inner housing (50), connected to the inside of the outer housing (10), extending in mating direction (X) out of the outer housing (10), and surrounding the at least one insert (30) in mating direction (X).

11. Electrical connector according to claim 10, wherein the cage inner housing (50) comprises a switching tab (57) that switches the terminal locking means (40) from the assembly position (41) to the locking position (42), when the cage inner housing (50) is inserted into the outer housing (10).

12. Electrical connector according to one of the claims 10 or 11, wherein the cage inner housing (50) comprises coding features (51) for allowing connection with a suitable corresponding electrical connector of different gender and for preventing a connection with a non-suitable electrical connector.

13. Electrical connector according to one of the claims 10 to 12, wherein the cage inner housing (50) is connected to the outer housing (10) by a retaining latch (52) of the cage inner housing (50) and wherein the cage inner housing (50) comprising a release hook (54) attached to the retaining latch (52) for releasing the retaining latch (52) by a tool (100).

14. Electrical connector according to one of the claims 1 to 13, comprising more than one, preferably two, three, four, five or six electrical terminals (20), and correspondingly more than one, preferably two, three, four, five or six inserts (30).

15. Method for an assembly of an electrical connector (1) comprising the following steps:

a. providing an outer housing (10) defining a mating direction (X) of the electrical connector (1);
b. providing an insert (30) within the electrical connector (1), wherein the insert (30) comprises a terminal locking means (40) as an integral part of the insert (30);
c. providing a cage inner housing (50), connected to the inside of the outer housing (10), extending in mating direction (X) out of the outer housing (10), and surrounding the at least one insert (30) in mating direction (X);
d. inserting at least one electrical terminal (20) into a back side (4) of the outer housing (10) such that the electrical terminal (20, 21) is at least partially surrounded by the insert (30); and
e. switching the terminal locking means (40) from an assembly position (41) in which the electrical terminal (20) is insertable into the electrical connector (1) to a locking position (42) in which the electrical terminal (20) is locked within the electrical connector (1) by the terminal locking means (40).

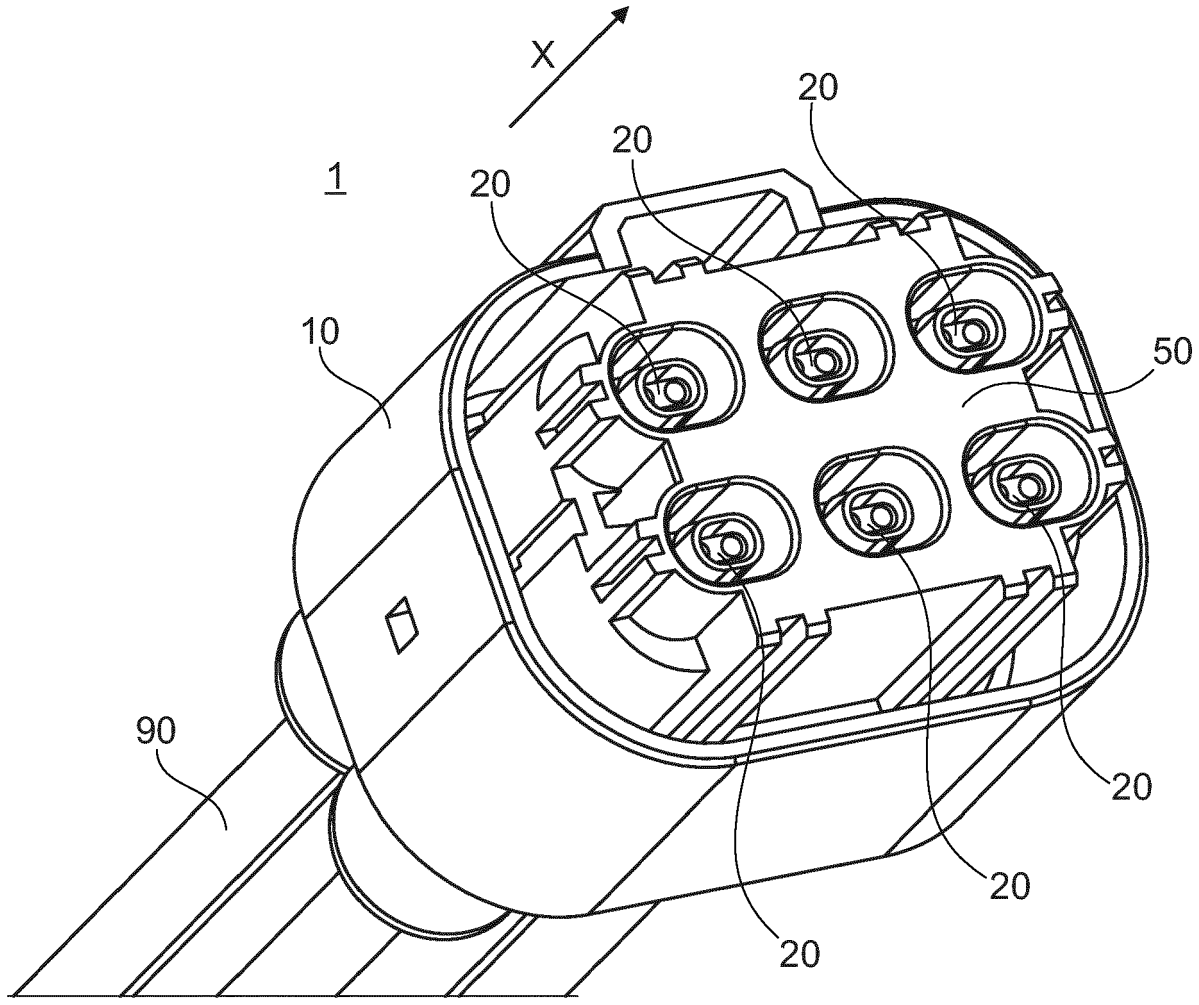

Fig. 1

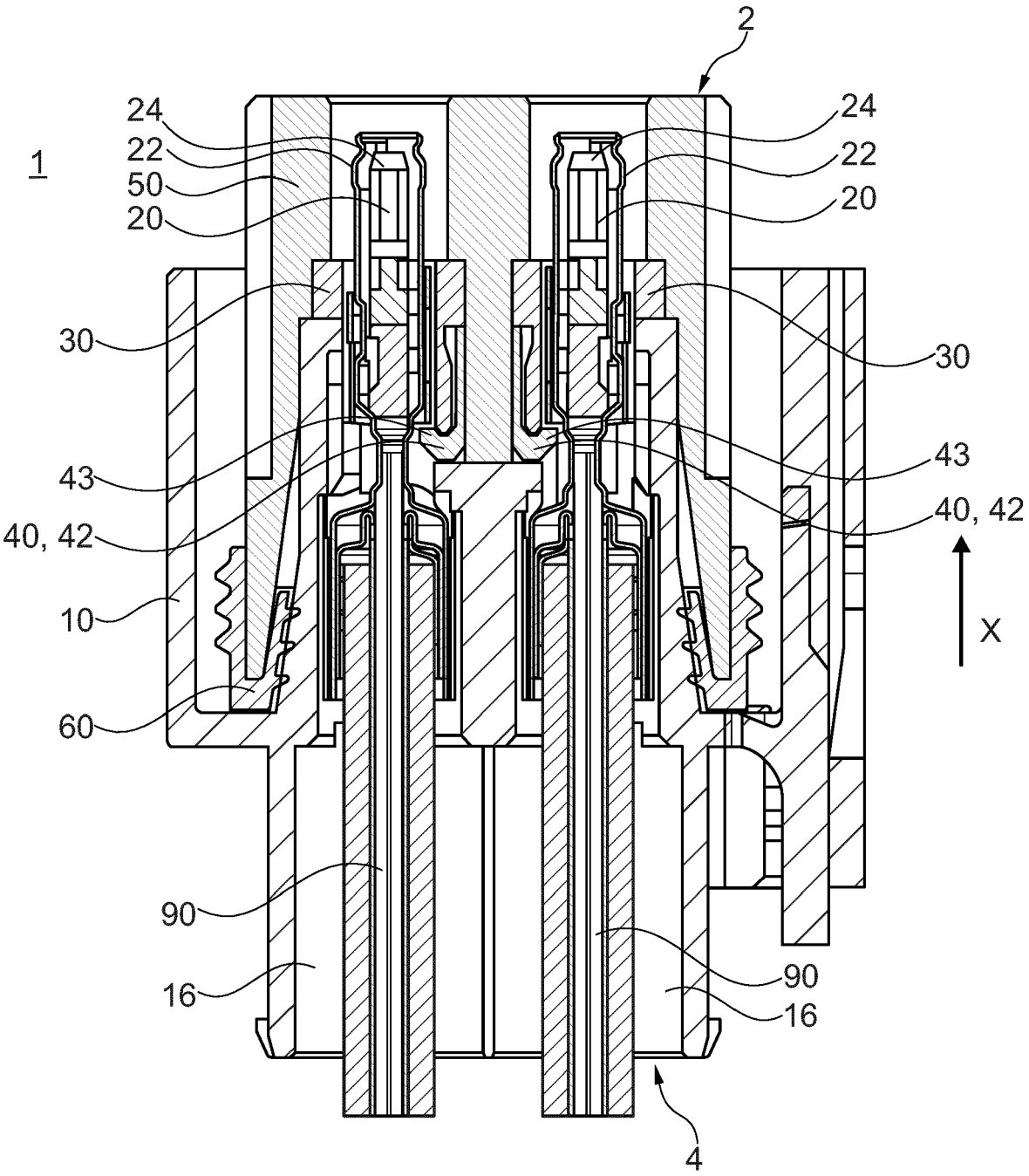

Fig. 2

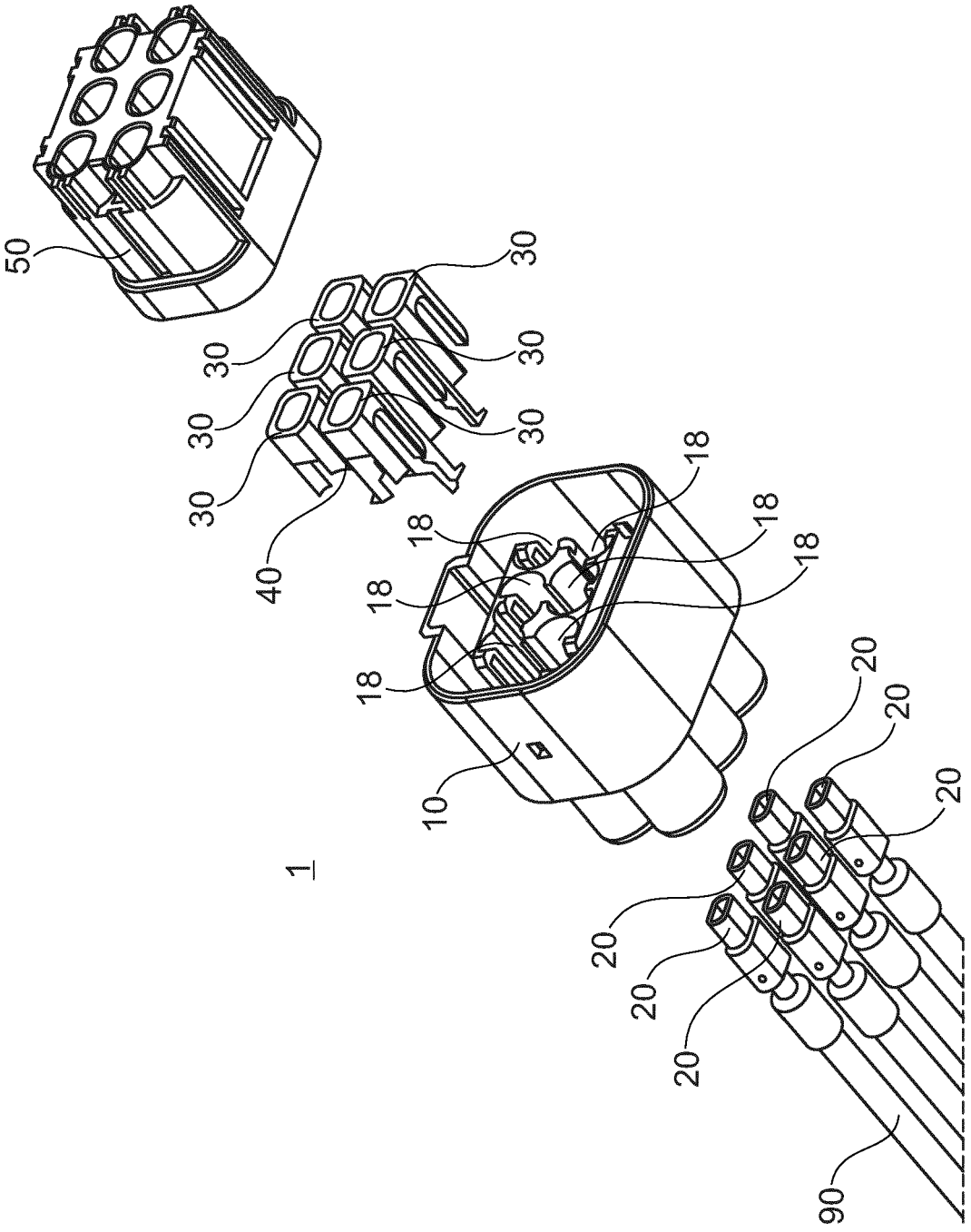

Fig. 3

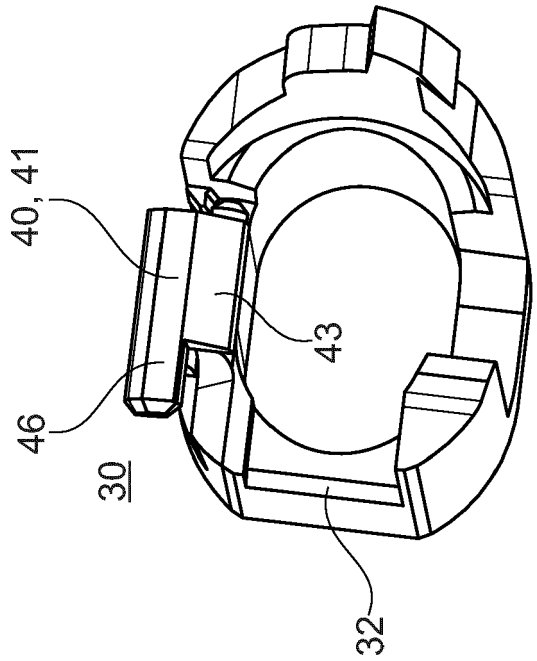

Fig. 4C

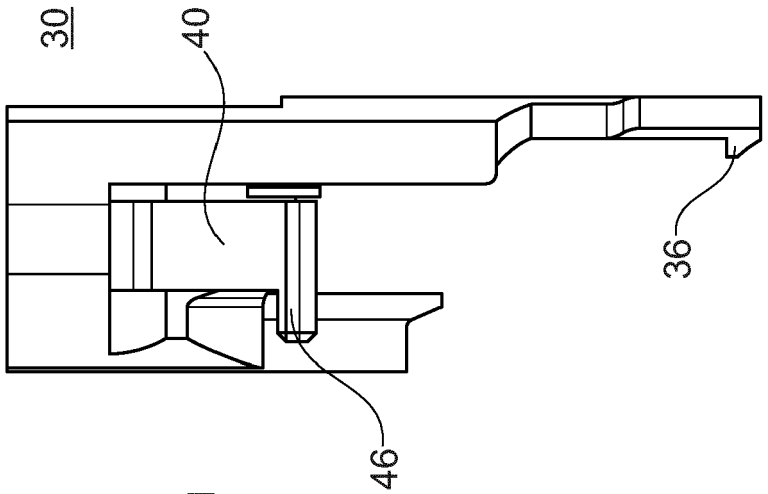

Fig. 4B

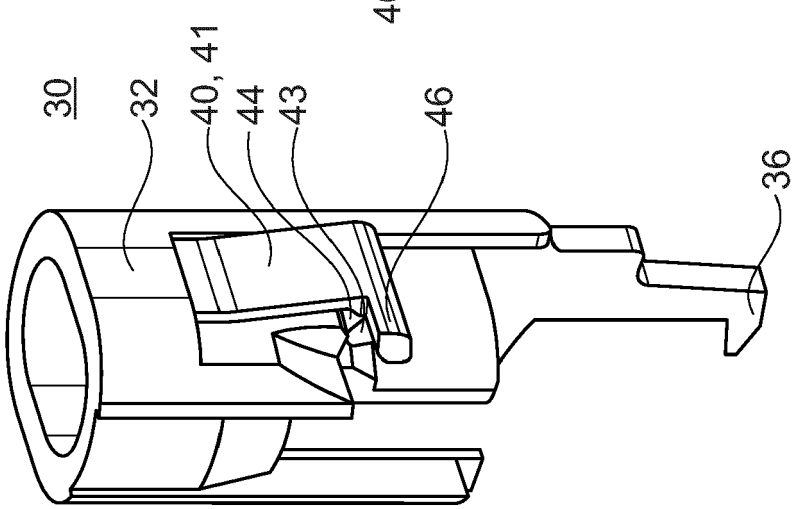

Fig. 4A

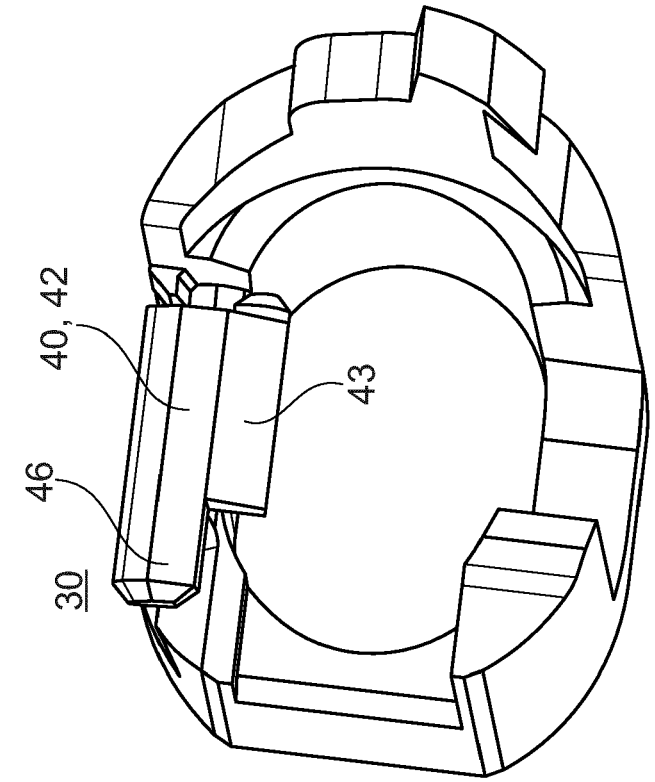

Fig. 5B

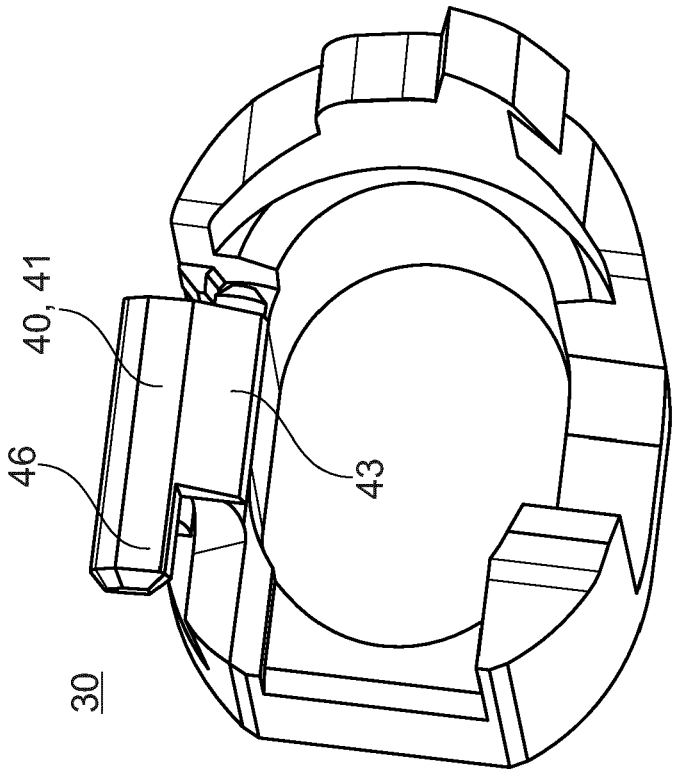

Fig. 5A

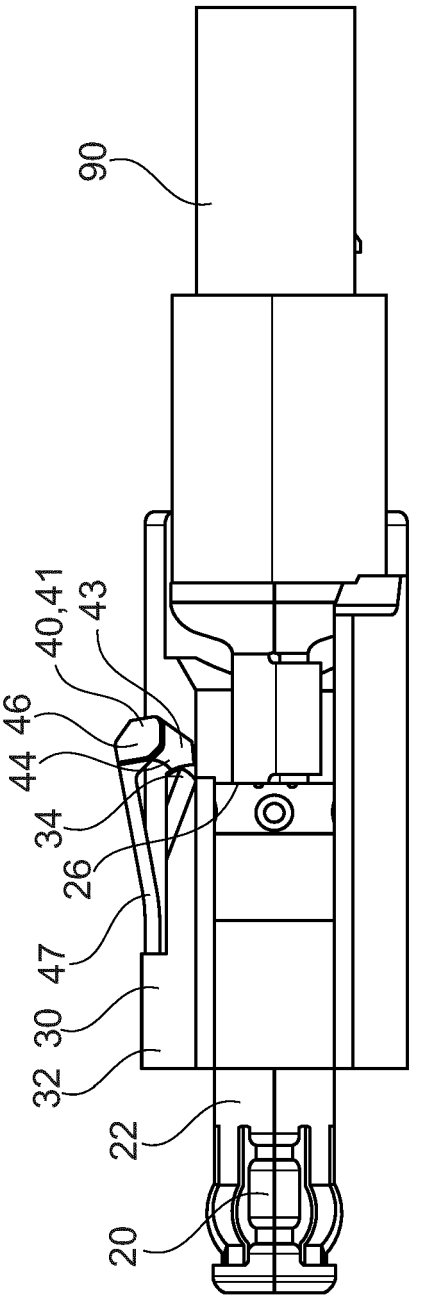
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Fig. 6A

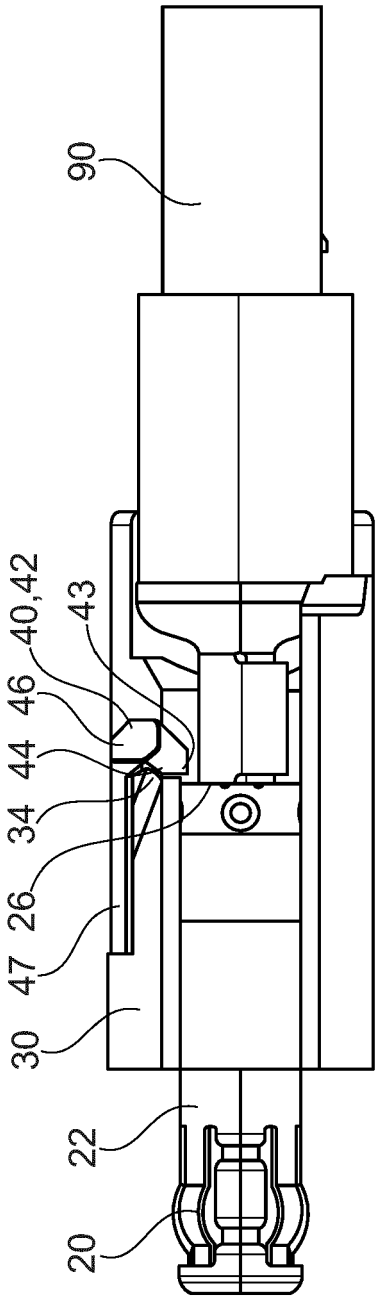
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Fig. 6B

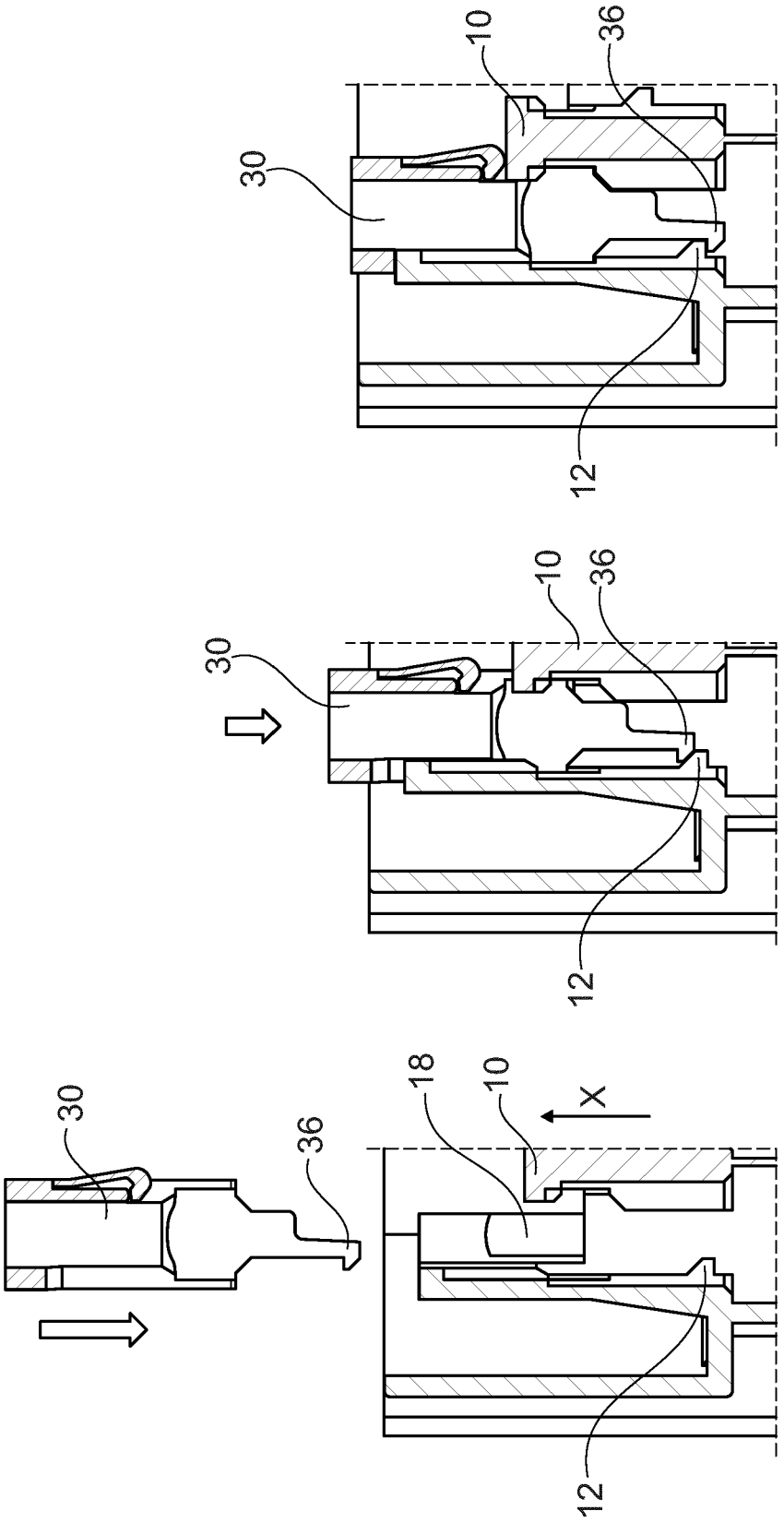

Fig. 7A

Fig. 7B

Fig. 7C

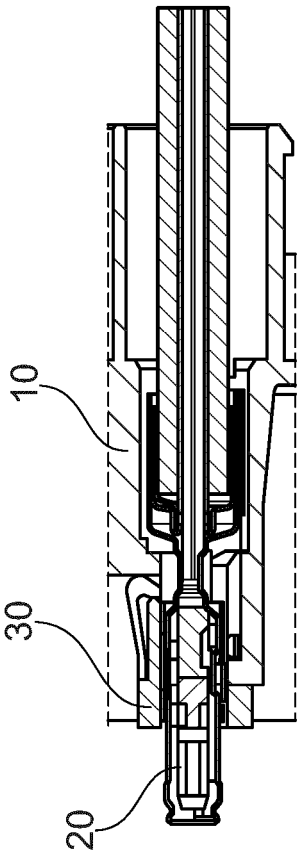

Fig. 8C

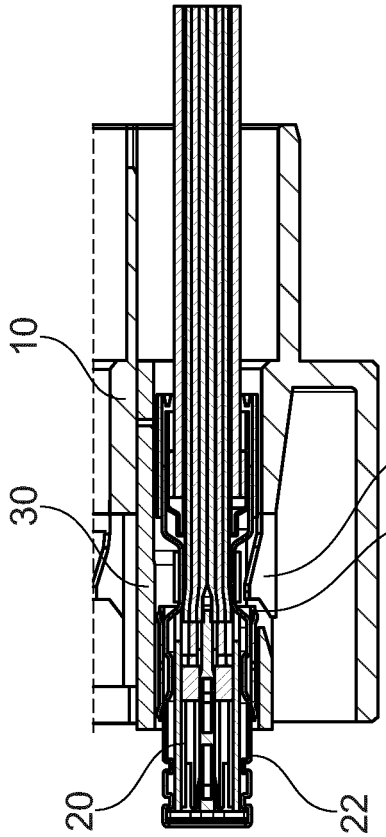

Fig. 8D

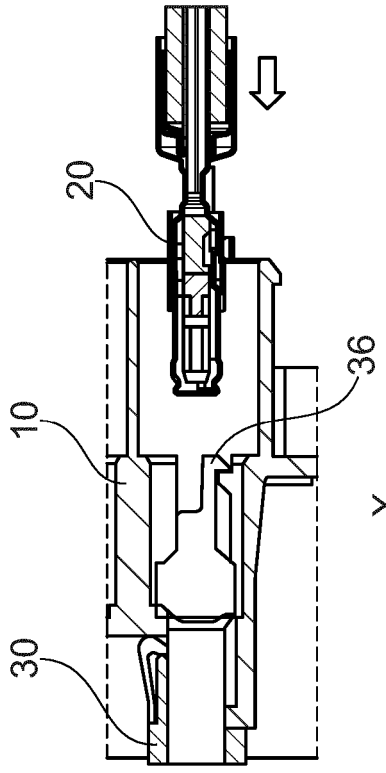

Fig. 8A

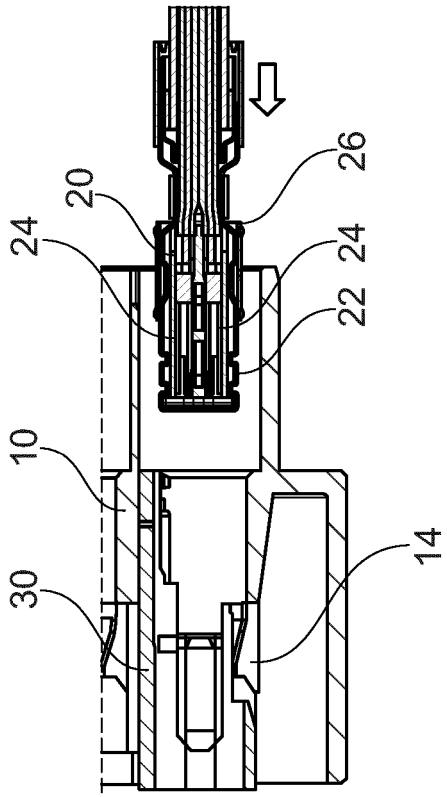

Fig. 8B

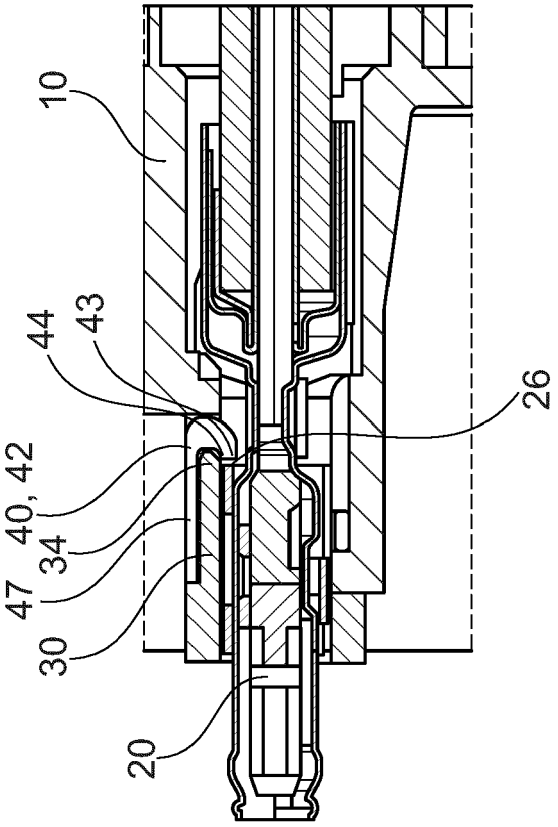

Fig. 9B

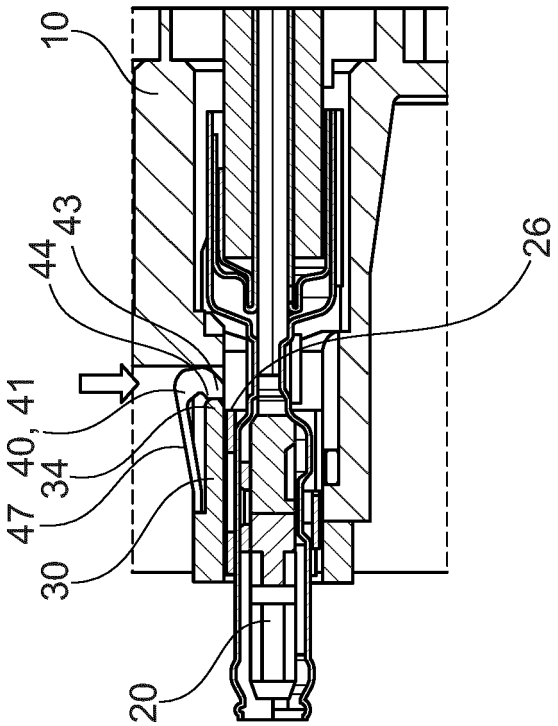

Fig. 9A

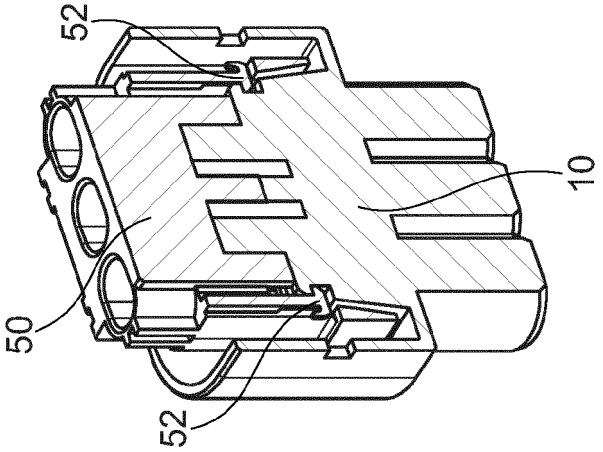

Fig. 10C

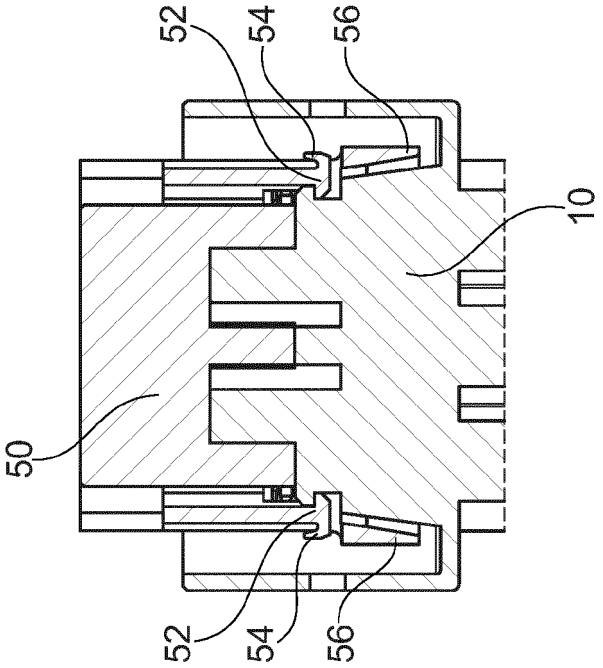

Fig. 10B

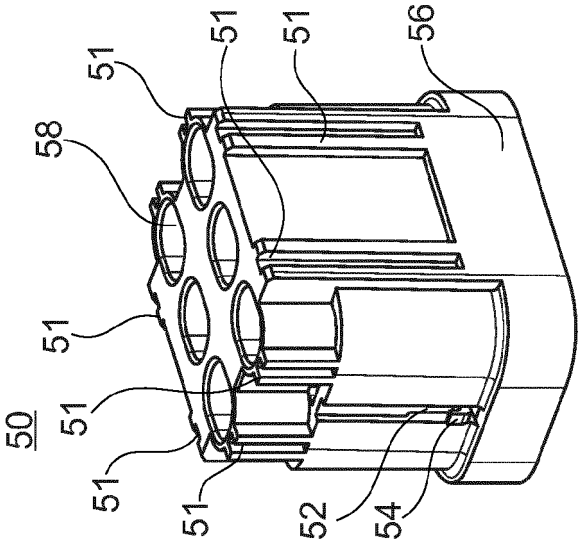

Fig. 10A

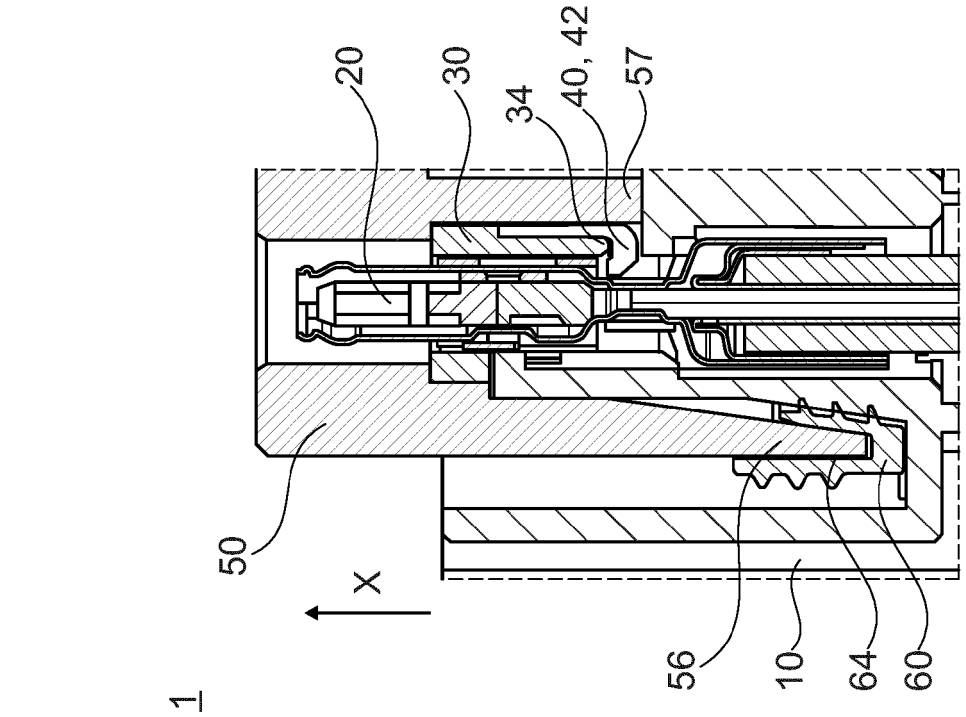

Fig. 11B

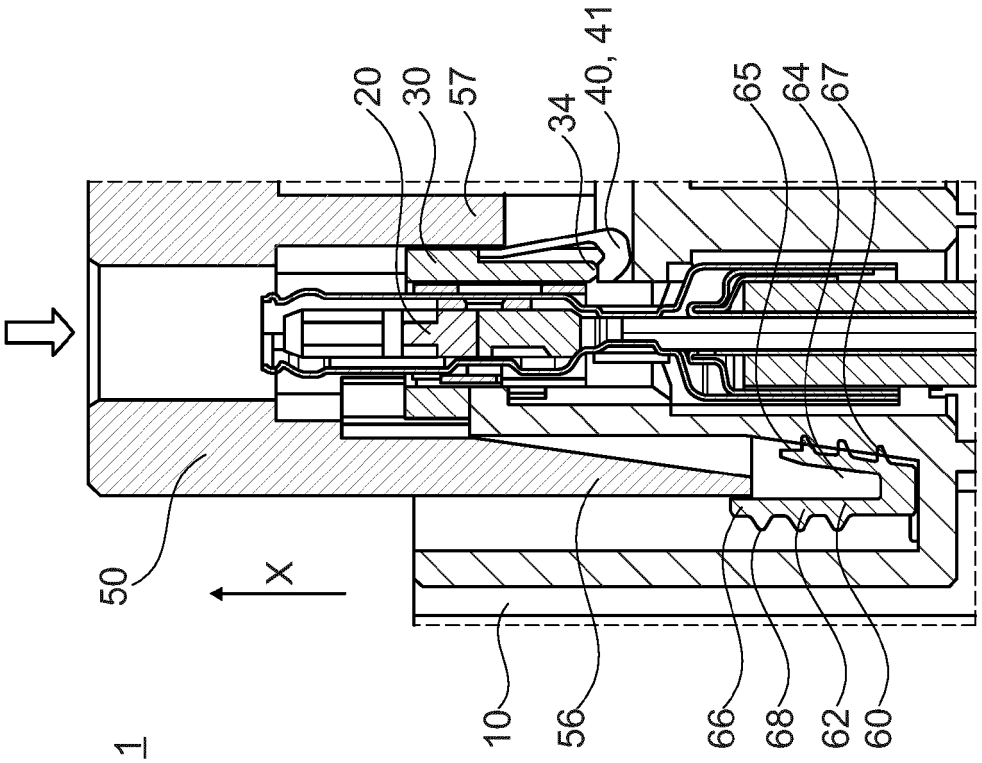

Fig. 11A

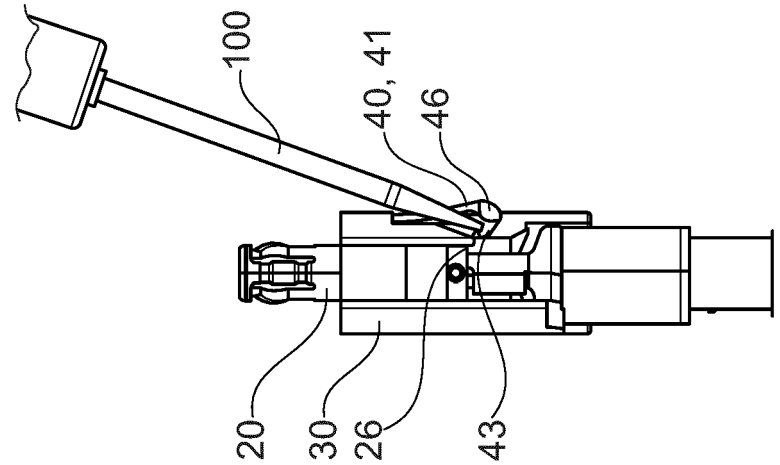

Fig. 12C

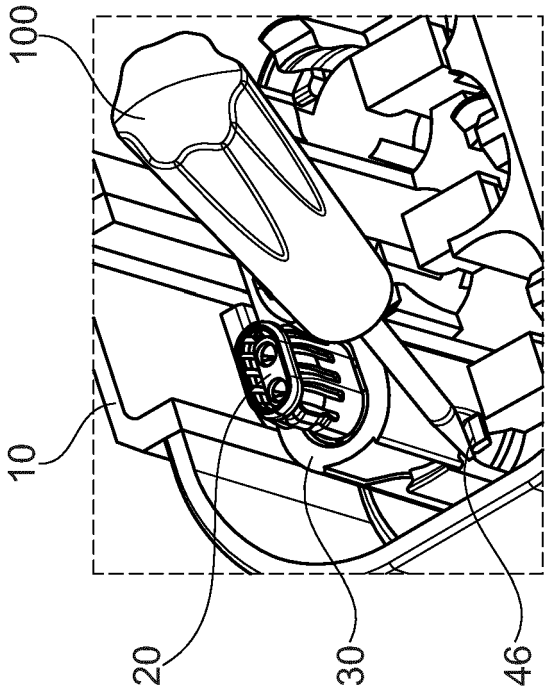

Fig. 12B

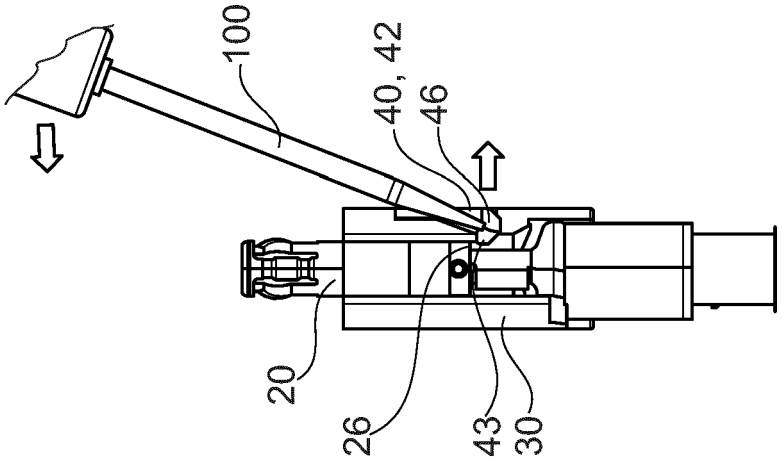

Fig. 12A

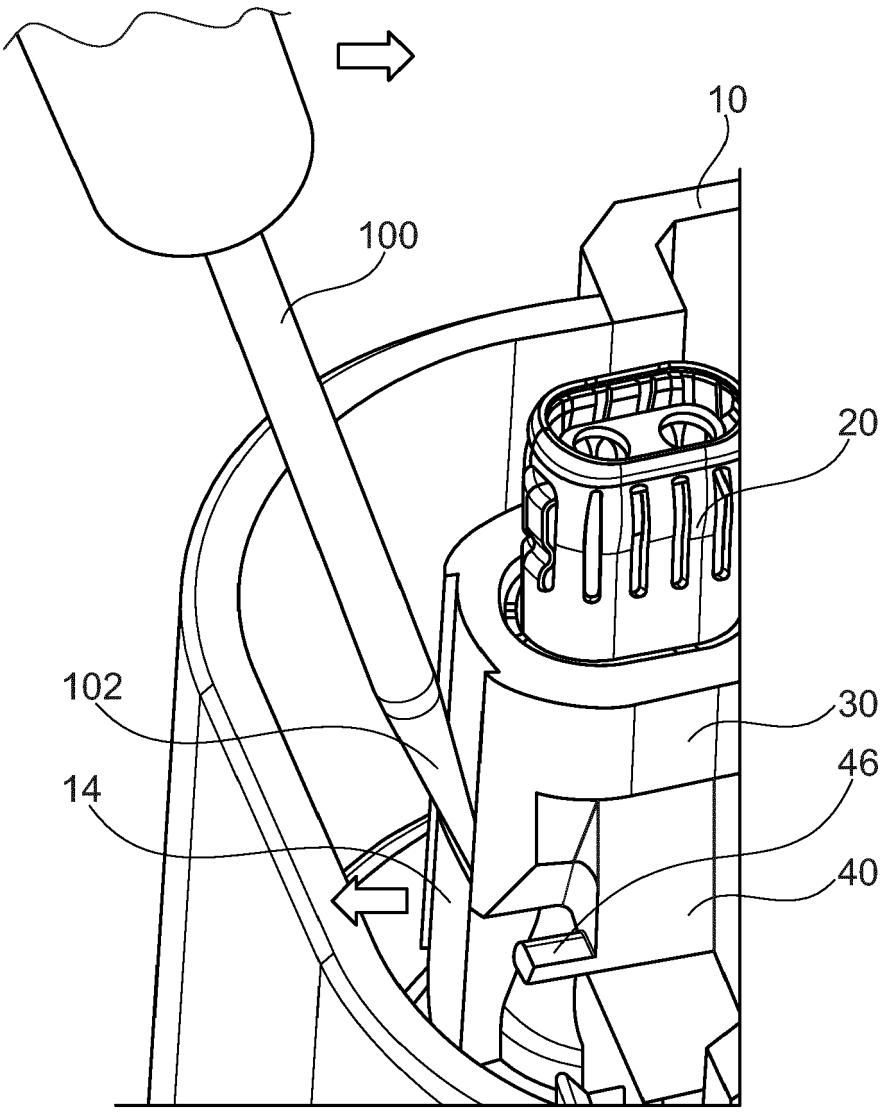

Fig. 13

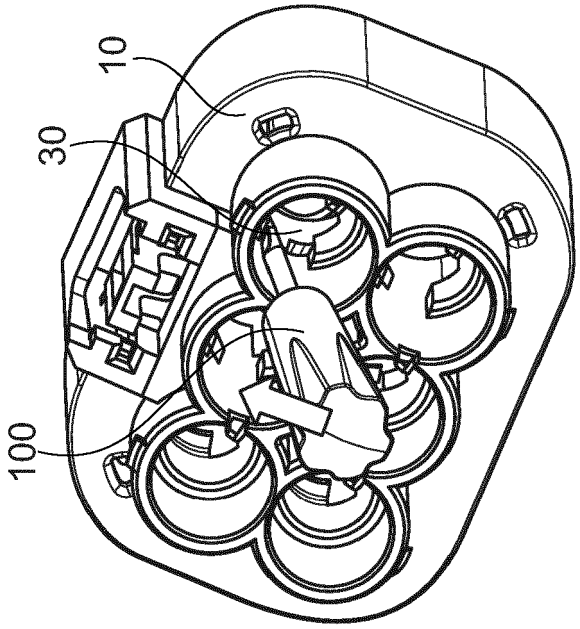

Fig. 14B

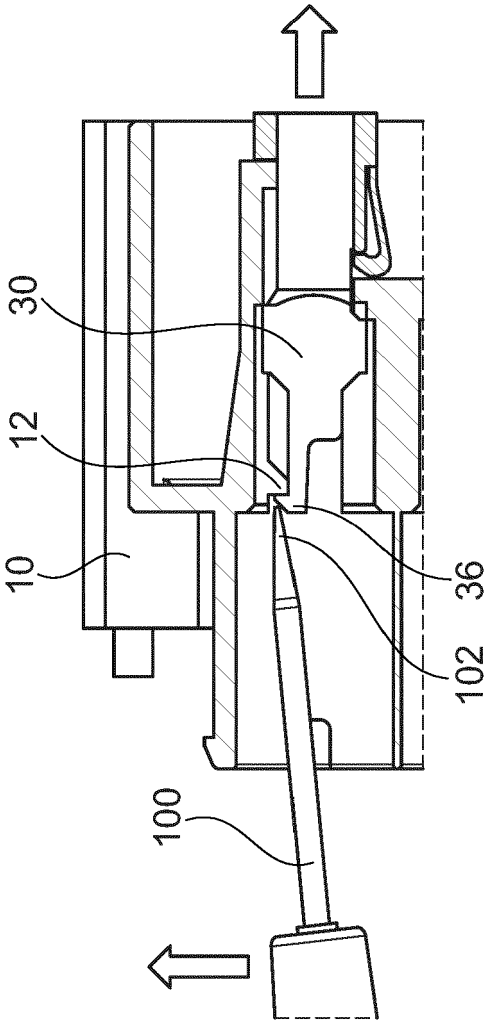

Fig. 14A

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EUROPEAN SEARCH REPORT

Application Number
EP 23 19 0901

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A	* column 2; figures 4,5,1,3,2 *	3,4	H01R13/436 H01R43/20
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H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	15 January 2024	Vautrin, Florent

CATEGORY OF CITED DOCUMENTS

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