

(19) **DANMARK**

(10) **DK/EP 3405997 T3**



(12)

Oversættelse af
europæisk patentskrift

Patent- og
Varemærkestyrelsen

-
- (51) Int.Cl.: **H 01 R 4/48 (2006.01)** **H 01 R 9/24 (2006.01)** **H 01 R 13/436 (2006.01)**
- (45) Oversættelsen bekendtgjort den: **2022-01-24**
- (80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2021-11-17**
- (86) Europæisk ansøgning nr.: **17700682.2**
- (86) Europæisk indleveringsdag: **2017-01-18**
- (87) Den europæiske ansøgnings publiceringsdag: **2018-11-28**
- (86) International ansøgning nr.: **EP2017050996**
- (87) Internationalt publikationsnr.: **WO2017125441**
- (30) Prioritet: **2016-01-18 DE 102016100755**
- (84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**
- (73) Patenthaver: **Bals Elektrotechnik GmbH & Co. Kg, Burgweg 22, 57399 Kirchhundem-Albaum, Tyskland**
- (72) Opfinder: **RAMM, Andreas, , 57399 Kirchhundem, Tyskland**
- (74) Fuldmægtig i Danmark: **CHAS. HUDE A/S, Langebrogade 1, 2. B2, 1411 København K, Danmark**
- (54) Benævnelse: **Elektrisk plug-in-konnektor og fremgangsmåde til montering af samme**
- (56) Fremdragne publikationer:
EP-A1- 1 355 380
EP-B1- 2 442 403
WO-A1-99/53572
WO-A2-2010/132530
DE-A1-102008 060 282
DE-C1- 4 319 018
DE-C1- 19 823 648
DE-U1- 20 205 805
DE-U1-202010 016 471
US-A1- 2014 227 914

Specification

The invention relates to an electrical plug-in connector which can be connected to an end of an electrical line or cable, for a plug-in device, in particular according to the standards IEC 309-1,
5 IEC 309-2 and/or EN 60309 1 + 2.

Electrical plug-in devices of this type are known to be used essentially for industrial applications in rooms or outdoors and are used to connect an electrical line to a device or a fixed installation, or to connect two electrical, in particular flexible lines or cables.

10

For this purpose, each of these plug-in devices comprises two plug-in connectors, and at least one plug-in connector, namely a plug or a socket, is connectable to an electrical line. The plug is usually the plug-in connector that is connected to the electrical line connected to a device or to a socket. The socket is usually the plug-in connector that is connected to an electrical line
15 connected to a power source.

Electrical plug-in connectors can furthermore be provided with electrically conductive spring connection terminals, hereinafter referred to as spring terminals, which usually each have a connection opening into which a free electrical wire end of an electrical line or cable to be
20 connected can be introduced, i.e. usually can be inserted or plugged in, in order to clamp this electrical wire end to the respective spring terminal without using screws. This is the way in which, usually, single-wire or multi-wire assemblies of electrical wires of electrical lines or cables are connected to such plug-in connectors.

25 In these plug-in connectors, the spring terminals are each attached to a rear end, hereinafter also referred to as the clamping end, of an electrically conductive contact element, which in turn is inserted in a contact support of the plug-in connector and held therein in a supporting manner.

In the case of a socket, the front end of such a contact element, hereinafter also referred to as the
30 contact end, usually is in the form of a female contact, and in the case of a plug it usually is in the form of a contact pin complementary to the female contact, and the contact pin is introduced into

the female contact when the two complementary connectors, that is the socket and the plug, are brought together along a longitudinal axis of the plug-in connectors and mated with each other.

Electrical plug-in connectors of the type described above preferably use clamping springs which
5 can be moved by a manually operated contact opener, by a first movement, from a first position in which the clamping spring is released, i.e. is in a predefined, mostly biased rest position, into a second position in which the contact opener, usually an elongated contact opener, compresses the clamping spring so that the clamping opening is opened for inserting or removing this free
10 wire end, and can be brought back towards the first position by a second movement of the manually operated contact opener, so that the clamping opening will be locked again. A wire end inserted therein when the clamping opening is open will thus be clamped to the respective spring terminal when the clamping spring is released and can only be released again when the clamping opening is open.

15 As a result, contact openers have the function of a pressure-exerting tool and usually have an elongated shape so that a clamping spring can be moved between the first position in which the clamping spring is released and a second position in which the spring is compressed.

During manufacturing, that is in the assembly of electrical plug-in connectors, it has proven to be
20 advantageous to first place the contact element and the clamping spring in the contact support, such that this clamping spring is arranged at the rear end of the contact element and the latter is inserted into the contact support along the longitudinal axis thereof, which is usually aligned at least in parallel with the longitudinal axis of the plug-in connector.

25 For further assembly of an electrical plug-in connector of the aforementioned type, a housing part designed in the form of a cap or a cover has to be mounted on the rear portion of the contact support. This housing part can be latched, screwed or otherwise connected to the contact support and has an inner surface which at least partially surrounds the clamping spring. In addition, the respective contact openers have to be introduced into the housing part during assembly, and for
30 this purpose the latter is provided with one or more openings depending on the number of wire ends to be connected. Consequently, depending on the number of wire ends to be connected, a multitude of contact openers have to be introduced into the housing part that has to be fastened

to the contact support during a manufacturing process, in a correspondingly more or less complex process step.

5 In addition, the installation of a contact opener associated with a clamping spring by inserting it between an inner surface of the housing part and the clamping spring or by mounting the housing part on the contact support on which the contact opener has already been arranged, causes an initial compression of the clamping spring and therefore a preloading thereof beyond that from the predefined rest position, which is why the clamping spring already experiences an undesirable weakening of its clamping force during assembly. DE 20205805U U1 discloses such an electrical
10 plug-in connector according to the preamble of claim 1.

It is therefore an object of the invention to further improve an electrical plug-in connector of the type described above and to simplify the manufacture of such an electrical plug-in connector.

15 This object is achieved by an electrical plug-in connector according to independent claim 1 and by a method for its production according to independent claim 5. Advantageous embodiments are specified in the dependent claims.

20 An electrical plug-in connector according to the invention can be connected to an end of an electrical line or a cable, i.e. to at least one end. An end of such an electrical line or cable to be connected has at least one free wire end.

Furthermore, the plug-in connector is to be connected to a plug-in connector that is complementary to that plug-in connector along a longitudinal axis.

25 According to the invention, an electrical plug-in connector comprises at least one contact element, in particular an elongated contact element, which is inserted in the contact support in parallel with this longitudinal axis and is held thereby in a supporting manner. This contact element has a front end and a rear end, and the rear end has a clamping spring with a clamping
30 opening in which one of the at least one free wire end can be clamped.

Furthermore, an electrical plug-in connector comprises a housing part which can be assembled on the contact support, that is to say it can be mounted thereto, and which has an inner surface which at least partially surrounds the clamping spring after the assembly or once mounted.

- 5 A contact opener, in particular an elongated contact opener, is arranged at least partially between this inner surface and the clamping spring, which contact opener is allocated to the clamping spring and is held so as to be movable between two positions.

10 With a first movement, the contact opener can be moved from a first position in which the clamping spring is released, i.e. arranged in a predefined, in particular biased rest position, into a second position in which the contact opener compresses the clamping spring so that the clamping opening is opened for insertion or removal of this free wire end. With a second movement, the contact opener can be brought back towards the first position that blocks the clamping opening.

15 According to the invention, this inner surface of the housing part also forms a region in which at least a part of the contact opener can be accommodated such that the clamping spring is released in its first position.

20 Advantages of the invention arise on the one hand from the fact that the contact opener, in its first position, finds a place at least partially in a region of the inner surface of the housing part which at least partially surrounds the clamping spring, that is a space so that the clamping spring is released on the one hand, i.e. is in the predefined in particular biased rest position, and, on the other hand, the housing part can be mounted to the contact support either together with the
25 contact opener or without it, i.e. in particular without touching and/or having to compress the clamping spring.

Furthermore, the invention enables simplified pre-assembly in the manufacture or assembly of an electrical plug-in connector.

30 For example, on the one hand, one or more contact openers can be arranged, in particular fixed, on the housing part in one method step, in order to then, in a further method step, mount such a

preassembled unit to a contact support in which a contact element with a clamping spring arranged thereon has already been inserted, without need to substantially touch and/or compress the clamping spring.

- 5 In a possible alternative of the invention it is possible, for example, to arrange, in particular fix, a contact opener on a contact support in which a contact element with a clamping spring arranged thereon has already been inserted, in order to then, in a further method step, mount the housing part to such a preassembled unit without need to substantially touch and/or compress the clamping spring.

10

In a further possible alternative of the invention, one or more contact openers can be arranged, in particular fixed, on the housing part in one method step, in order to then, in a further method step, mount such a preassembled unit to a contact support, and only then to introduce one or more contact elements, each one with a clamping spring arranged thereon, without need to substantially touch and/or compress the clamping spring.

15

A clamping spring that is most advantageously suitable for clamping free wire ends, in particular an electrically conductive clamping spring, is in the form of a tension spring, in particular a cage clamp spring, and/or a screwless connection terminal.

20

- Such a clamping spring may favourably include a yoke spring with a clamping leg connecting a contact leg and a clamping leg to one another. The clamping leg of this clamping spring has a clamping or connection opening recessed therein, which allows the clamping leg and the contact leg to overlap with a portion of the contact leg. The connection opening of the clamping spring allows to introduce the free wire ends. The contact leg of such a clamping spring contacts a contact surface on the rear end of a contact element which, together with the contact leg, is introduced through the connection opening of the clamping leg, whereby the clamping spring can be clamped to the contact element. Furthermore, the free wire end to be clamped has to be introduced into the connection opening. Such a clamping spring is usually also referred to as a cage clamp spring and can be found as prior art for the present invention, in particular also in EP 2 442 403 B1 of the same applicant, so that in this regard the disclosure thereof is fully incorporated into the disclosure of the present invention.

25
30

With this type of a tension spring, the spring force acts as a tension spring force on the clamping leg. For clamping the free wire end, the clamping leg of the yoke spring is compressed. This shifts the clamping leg, thereby in particular opening the connection opening of the yoke spring on an
5 opposite side to the side on which the contact leg contacts a contact surface, and the associated free wire end can be introduced into the connection opening or clamping opening. The energy stored during compression is at least partially released again when the yoke spring is released and results in a tension spring force on the clamping leg. The yoke spring pulls the clamping leg back towards the side of the rear end of the contact element opposite the contact surface,
10 whereby the free wire end which was previously passed through the connection opening is also clamped to this electrical contact surface. This side opposite to the contact surface at the rear end of a contact element thus expediently defines the electrical contact surface for the wire end.

For assembly to the contact element, a cage clamp spring can be clamped to the rear end of the
15 contact element by pressing the clamp leg of the yoke spring towards the clamping leg and pushing the contact surface of the rear end of the contact element through the connection opening and by releasing or letting go the clamping leg, so that the clamping spring is attached to or fixed on and thereby carried by the contact element.

20 According to the invention, a surface oriented at least partially transverse to the longitudinal axis is formed on the inner surface which at least partially surrounds the clamping spring, as well as on a side of the contact opener facing this inner surface, which will also be referred to as the first longitudinal side below, and this inner surface and the side of the contact opener facing this inner surface correspond to one another and may advantageously be of any desired shape in the
25 practical implementation, in particular cam-shaped or arc-shaped.

In this case, in order to actuate the clamping spring along the longitudinal direction, a sliding movement of the clamping opener is enabled on the surface of the inner surface of the housing part, which is oriented transversely to the longitudinal axis.

30

According to the invention, a first movement of the contact opener is implemented as a pulling movement along the longitudinal axis, which occurs in the viewing direction of the rear end of the

contact element, and the second movement is implemented as a pushing movement along the longitudinal axis, which occurs in the viewing direction of the front end of the contact element.

5 In a further embodiment of the invention, the contact opener engages indirectly or directly against the clamping spring on a second longitudinal side opposite the side of the contact opener facing this inner surface, i.e. the second longitudinal side opposite the first longitudinal side of the contact opener, and/or the contact opener is formed in one piece.

10 In a particularly favourable embodiment of the electrical plug-in connector, a second longitudinal side of the contact support opposite a side facing this inner surface, i.e. a second longitudinal side of the contact opener opposite the first longitudinal side, has a planar surface which is oriented in parallel with the longitudinal axis.

15 The invention furthermore encompasses a method for the manufacture, that is for assembling an electrical plug-in connector as described above.

20 According to a first alternative of the method according to the invention, the housing part which has an inner surface that at least partially surrounds the clamping spring after assembly, and a contact opener that is arranged on this inner surface is mounted to the contact support in which at least one contact element is inserted in parallel with the longitudinal axis and is held thereby in a supporting manner, by associating the contact opener arranged on the housing part with the clamping spring and aligning the housing part and the arranged contact opener with this clamping spring in one method step.

25 In a further method step of the method according to the invention, the housing part and the contact opener arranged thereon in its first position along the longitudinal axis has then to be combined with the contact support such that this inner surface at least partially surrounds the clamping spring.

30 According to the invention, the contact opener is fixed to this inner surface of the housing part before the housing part is mounted to the contact support and/or has already been fixed to this inner surface of the housing part when the housing part was mounted to the contact support.

For example, on the one hand, one or more contact openers can be arranged, in particular fixed on the housing part in one method step, in order to then, in a further method step, attach such a preassembled unit on a contact support into which a contact element with a clamping spring
5 arranged thereon has already been inserted, without need to substantially touch and/or compress the clamping spring.

According to a second alternative of the method according to the invention, the contact opener is arranged or preassembled on the contact support and/or on the clamping spring in its first
10 position in one method step, while at least one contact element has already been introduced into the contact support parallel to the longitudinal axis and is held thereby in a supporting manner, and with the clamping spring arranged on the rear end.

In a further method step of this method according to the invention, the housing part is mounted to
15 the contact support by bringing together the housing part and the contact support along the longitudinal axis so that the inner surface of the housing part at least partially surrounds the clamping spring.

According to the invention, the contact opener is fixed to the clamping spring and/or to the contact
20 support prior to the assembly of the housing part on the contact support and/or is arranged on the contact support in a fixed manner during the assembly of the housing part.

As a result it is possible according to this optional alternative of the invention, to arrange, in particular fix a contact opener on a contact support into which a contact element with a clamping
25 spring arranged thereon has already been inserted, in order to subsequently fasten the housing part to such a preassembled unit without need to substantially touch and/or compress the clamping spring.

In a further possible alternative of the invention, one or more contact openers can be arranged, in
30 particular fixed on the housing part in one method step, in order to then, in a further method step, mount such a preassembled unit to a contact support, and to subsequently introduce one or more

contact elements, each one with a clamping spring arranged thereon, without need to substantially touch and/or compress the clamping spring.

Further advantages and features of the invention will become apparent from the following
5 exemplary description of preferred embodiments with reference to the accompanying figures.

In the figures:

Fig. 1 is a rear view of the contact connector according to the invention;

10

Fig. 2 is a perspective view of a contact connector of the invention according to Fig. 1;

Fig. 3 shows a longitudinal section A-A through a contact connector of the invention
according to Fig. 1;

15

Fig. 4 shows a longitudinal section through a contact connector according to the prior art.

It should be noted that the same components are denoted by the same reference symbols in the
figures. Figs. 1 to 3 show, by way of example, a preferred embodiment of a plug-in connector
20 according to the invention, which can be connected to an end of an electrical line or cable, i.e. to
at least one end, and this end to be connected has at least one free wire end, and the plug-in
connector can be connected to a plug-in connector complementary to this plug-in connector along
a longitudinal axis (L). The plug-in connector as shown in the figures in particular is to be
connected to five free wire ends of an electrical line or a cable. For the sake of clarity, however,
25 the figures neither show a line or cable nor a plug-in connector of complementary design to the
electrical plug-in connector according to the invention.

Fig. 1 shows a rear view of this exemplary plug-in connector according to the invention, which is
in the form of a socket in the present case.

30

This plug-in connector comprises a contact support 1 which in a preferred embodiment comes in
the form of a one-piece housing of the plug-in connector, although, according to the invention, a

contact support may also be introduced separately in a housing of a plug-in connector, for example.

Fig. 2 shows a perspective view of the plug-in connector according to Fig. 1, which can be connected to a plug-in connector of complementary design in the form of a plug along longitudinal axis L. For example, a protective cover 6 is furthermore provided, which has to be opened for this purpose, i.e. for the connecting, and which is favourably coupled to the contact support 1 by a hinge 61.

At least one contact element is inserted in the contact support 1 in parallel with this longitudinal axis L and is held thereby in a supporting manner. Since five wire ends have to be connected in the present example, five contact elements 3 (not visible in Figs. 1 and 2, one is visible in Fig. 3) are inserted in the illustrated contact support, each one in parallel with this longitudinal axis L of the contact support, so as to be held therein in a supporting manner. Each contact element 3 has a front end 31 and a rear end 32, and, as can be seen in particular in Figs. 1 to 3, clamping springs 4, 4', 4'', 4''', 4'''' with clamping openings 41, 41', 41'', 41''', 41'''' are attached on the rear ends thereof, each one for clamping therein a respective free wire end of the electrical line or cable to be connected. Therefore, the rear end 32 can also be referred to as the clamping end, and the front end of the contact element 3 as the contact end.

Figs. 1 to 3 also show the further housing part 2 which is assembled on the contact support 1 and which has one or more inner surfaces 22 (Fig. 3) which at least partially surround the one or more clamping springs 4, 4', 4'', 4''', 4'''. As can be seen, the housing part 2 may at least partially be mounted in the contact support.

Contact openers 5, 5', 5'', 5''', 5'''' (Fig. 2) which preferably have an elongated shape are intended for opening the clamping springs and clamping the free wire ends in order to connect them and to disconnect them again, if necessary. Such a contact opener 5, 5', 5'', 5''' and 5'''' is allocated to each one of the clamping springs 4, 4', 4'', 4''' or 4'''. Furthermore, each contact opener is arranged at least partially between such an inner surface 22 and the respective associated clamping spring and is held so as to be movable between two positions in the assembled state. For manually actuating the contact openers 5, 5', 5'', 5''', 5''', they favourably have actuating

portions at their rear ends, which protrude from the housing part 2, e.g. furthermore provided with a recess into which a tool such as a screwdriver etc. can engage.

By a first movement, for example in the viewing direction of the rear end of the contact element, each contact opener 5, 5', 5'', 5''' and 5'''' can be moved from a first predefined position, i.e. in a preferably biased rest position in which the respective associated clamping spring 4, 4', 4'', 4''' or 4'''' is released and its respective clamping opening 41, 41', 41'', 41''', 41'''' is blocked (Fig. 3), into a second position in which a contact opener 5, 5', 5'', 5''', 5'''' compresses the clamping springs 41, 41', 41'', 41''', 41'''' so that the clamping openings 41, 41', 41'', 41''', 41'''' are open for inserting or removing the free wire ends (according to Fig. 1). Each contact opener 5, 5', 5'', 5''' and 5'''' can then be returned towards the first position that blocks the clamping opening, by a second movement.

In particular, by a second movement in the opposite direction, the contact openers 5, 5', 5'', 5''', 5'''' can then be brought back towards the first predefined position, i.e. for example in the viewing direction of the front end of the contact element, in which the clamping springs 4, 4', 4'', 4''', 4'''' are again released so that the respective clamping openings are blocked again, i.e. blocked against connecting or inserting and releasing the wire ends. Consequently, a previously connected or inserted wire end will be clamped in this state.

Fig. 3 shows a longitudinal section A - A through a contact connector of the invention according to Figs. 1 and 2 with a single contact element 3 which is elongated in this exemplary embodiment. The contact element is inserted in the contact support 1 along the longitudinal axis L and is held therein in a supporting manner. On the rear end 32 of contact element 3, the clamping spring 4 is arranged, which has the clamping opening 41 into which the free wire end of the electrical line or cable to be connected can be inserted and clamped therein. Fig. 3 shows a state in which the clamping opening 41 is blocked against connecting or inserting a wire end.

The clamping spring 4 according to Fig. 3 is preferably designed as a cage clamp spring comprising a yoke spring 43 and is mounted on the rear end 32 of contact element 3. Accordingly, this clamping spring 4 has a clamping leg 42 with a clamping opening 41 for a wire end to be clamped, and for this purpose a free wire end has to be introduced through a housing

opening 20 in the housing part. Thus, the yoke spring 43 acts as a tension spring on the clamping leg 42. Consequently, for connecting or inserting a wire end and for releasing a connected wire end, the clamping opening 41 must first be aligned with the housing opening 20 in the illustrated example. Therefore, the contact opener 5 has to be moved, by a first movement, from the first position shown in Fig. 3 in which the clamping spring 4 is released, into the corresponding second position in which the contact opener 5 compresses the clamping spring 4, so that the clamping opening 41 is aligned with the housing opening 20 and is thus open for insertion or removal of this free wire end.

10 In particular, as shown in Fig. 3, for clamping a free wire end, the yoke spring 43 has to be compressed by manual actuation of the contact opener 5 which is held so as to be movable between two positions.

For this purpose, the contact opener 5 is arranged between an inner surface 22 of the housing part 2 mounted to the contact support 1, and this inner surface 22 partially surrounds the clamping spring and defines a region in which at least part of the contact opener 5 can be accommodated in order to release the clamping spring 4 in its first position.

20 This region is expediently defined by having surfaces 51 oriented or extending transversely to the longitudinal axis L formed on this inner surface 22 and on a side 5a of the contact opener 5 facing this inner surface 22.

Thus, the contact opener 5 is advantageously slidably moveable, by a first movement along the longitudinal axis L (in particular to the right in Fig. 3), from a first position according to Fig. 3, in which part of the contact opener 5 is accommodated in the region of the inner surface 22 and the clamping spring 4 is released, into a second position in which the contact opener 5 is or is being offset vertically relative to the longitudinal axis and to the clamping spring 4, so that the clamping spring 4 is compressed. This opens the connection opening 41 of the cage clamp spring 4, and the associated free wire end can be introduced into the connection opening 41.

30 By a second movement of the contact opener 5 opposite to the first movement along the longitudinal axis L (in particular to the left in Fig. 3), the contact opener can be brought back

towards the first position, whereby the contact opener 5 is or is being vertically offset back, away from the longitudinal axis away from the clamping spring 4, so as to be at least partially accommodated in the region of the inner surface 22 again, thereby releasing the clamping spring 4 again, such that the clamping spring 4 is completely relaxed and the clamping opening 41 is
5 blocked or, in the case where a wire end is inserted, is at least partially relaxed and a free wire end inserted in the clamping opening 41 is clamped.

Fig. 3 also shows that the first sliding movement favourably is a pulling movement along the longitudinal axis L, which occurs in the viewing direction of the rear end 32 of the contact element
10 3, and the second sliding movement favourably is a sliding movement along the longitudinal axis L, which occurs in the viewing direction of the front end 31 of the contact element 3.

In an alternative embodiment of the invention, which however is not illustrated in Figs. 1 to 3, for reasons of clarity, the contact opener 5 may expediently also be mounted so as to be pivotable
15 about a pivot axis, in particular also about any pivot axis.

Fig. 3 furthermore shows that the first sliding movement advantageously is a pulling movement along the longitudinal axis L, which occurs in the viewing direction of the rear end 32 of the contact element 3, and the second sliding movement advantageously is a sliding movement
20 along the longitudinal axis L, which occurs in the viewing direction of the front end 31 of the contact element 3.

Fig. 3 furthermore shows an embodiment in which the contact opener 5 advantageously engages on the clamping spring 4 with a side opposite to the first longitudinal side 5a of the contact opener 5, i.e. a second longitudinal side 5b opposite the side of the contact opener facing the inner surface 22, and also advantageously is formed in one piece, although it may also engage on the clamping spring 4 only indirectly, for example through a force-transmitting further component, and/or may be formed of multiple parts.

Furthermore, a second longitudinal side 5b of the contact opener 5 opposite the first longitudinal side 5a advantageously has a planar surface, which is preferably aligned in parallel with the longitudinal axis L, so that, during assembly of the electrical plug-in connector, a contact opener 5
30

arranged on the housing part 2 can be passed by the yoke spring by a movement along the longitudinal axis L without thereby having to substantially engage on the clamping spring and/or compress the clamping spring. Thus, the contact opener and the clamping spring can preferably be combined without any force or resistance therebetween. For a person skilled in the art, it will
5 however be apparent when studying the description, that other advantageous geometric configurations of the second longitudinal side 5b of the contact opener 5 are also conceivable for this purpose.

It can be seen that, for the assembly of the electrical plug-in connector, housing part 2 and
10 contact opener 5 have to be mounted on the contact support 1.

Here, the housing part 2 which has the inner surface 22 which after assembly at least partially surrounds a respective clamping spring 4, and a contact opener 5 which is already arranged on this inner surface 22 of the housing part, can basically be mounted to the contact support into
15 which at least one contact element 3 with clamping spring 4 has been introduced in parallel to the longitudinal axis L and is held thereby in a supporting manner, by associating the contact opener 5 arranged on the housing part 1 with the clamping spring 4 and accordingly aligning the housing part 2 and the contact opener 5 arranged thereon with this clamping spring 4.

20 In a further method step of the assembly, the housing part 2 and a contact opener 5 already arranged thereon in the first position thereof along the longitudinal axis L can then be combined with the contact support 1, so that this inner surface 22 at least partially surrounds the clamping spring 4.

25 According to the invention, the contact opener 5 is fixed to this inner surface 22 of the housing part 2 before the assembly and/or is arranged thereon in a fixed manner during assembly. Upon initial actuation, once the connector has been assembled, this fixation can then be destroyed by applying a small amount of force, so that the one or more contact opener(s) is/are released for movement again.

30

Particularly advantageous for such a pre-assembly is the use of an injection moulding process, in particular a polymer injection moulding process in which one or more contact openers 5 are moulded onto the housing part 2.

- 5 This allows to first produce a one-piece component, consisting of the housing part 2 and one or more contact openers 5, and once the connector has been assembled, the contact opener(s) 5 can then be detached from the rest of the component, i.e. from housing part 2, to the extent to be released for movement according to the invention between the two positions. Depending on the injection mould, the joint between housing part 2 and contact opener 5 and the shaping thereof
10 may also be such that right from the beginning, i.e. without any detaching, the contact opener 5 is provided with freedom of movement according to the invention and is in its first position and an inner surface 22 is provided defining a region.

- 15 In a further preferred embodiment, the use of a two-component injection moulding process has been found to be particularly advantageous, in which the housing part 1 and the contact opener 5 are in particular made of different materials. This is the simplest way to differently predefine the material for the housing part 2 and for one or more contact openers 5, depending on predefined specifications, and to nevertheless produce them in advance, as one component. Also, in this case, the one or more contact opener(s) can then be disconnected from the rest of the
20 component, i.e. from the housing part 2, so as to be movable with only a minimal application of force if any, depending on the type of material.

- 25 In an alternative method for assembling the electrical plug-in connector, the contact opener 5 is arranged or preassembled in its first position thereof on the contact support 1 and/or on the clamping spring 4 in one method step, while at least one contact element 3 has already been inserted into the contact support 1 and is held therein in a supporting manner in parallel with the longitudinal axis L, and with the clamping spring 4 arranged on the rear end 32 thereof.

- 30 In a further method step of this alternative method according to the invention, the housing part 2 can be mounted to the contact support 1 by combining the housing part 2 and the contact support 1 along the longitudinal axis L so that the inner surface 22 of the housing part 2 at least partially surrounds the clamping spring 4.

Thus, according to the invention, the contact opener is fixed to the clamping spring and/or to the contact support prior to the assembly of the housing part to the contact support, and/or is arranged thereon in a fixed manner during assembly.

5

In a further possible alternative of the invention, one or more contact openers 5 can again initially be arranged, in particular fixed, on the housing part, for example in one step, in order to then attach such a preassembled unit to a contact support 1 in a further step, and only subsequently one or more contact elements 3, each one with a clamping spring 4 arranged thereon, are
10 introduced without substantially contacting the clamping spring and/or having to compress the clamping spring.

In order to illustrate the advantages of the invention, an exemplary connector according to the prior art will be briefly described below with reference to Fig. 4.

15

Fig. 4 shows a longitudinal section through such a plug-in connector according to the prior art, which, in contrast to the electrical plug-in connector of the invention according to Figs. 1 to 3 comprises a housing part 2' with an inner surface on which no region is provided where at least part of the contact opener 7 could be accommodated in order to release the clamping spring 4.

20

Furthermore, such a contact connector usually includes a contact opener 7 with a recess 8 which surrounds the yoke spring 43 in the first position in which the clamping spring is released, and has an elevation 9 which compresses the yoke spring 4 in a second position in which the contact opener 7 is pulled out along the longitudinal axis L. Furthermore, the contact opener 7 has a head
25 with some protrusion which provides a stop to prevent the contact opener 7 from being introduced too far into the housing part 2'.

As a result, an electrical plug-in connector according to Fig. 4 does not allow, in any of the positions that can be assumed by the contact opener 7, for a force-free installation of a contact
30 opener or assembly of an electrical plug-in connector which comprises such a contact opener which for this purpose is arranged or preassembled on the housing part and/or on a contact

support and/or on a clamping spring without need to compress the clamping spring to this end, and therefore it will experience a preload in excess of that in the pre-defined rest position.

Reference symbols:

	1	Contact support
	2, 2'	Housing part
5	20	Housing opening
	22	Inner surface
	3	Contact element
	31	Front end
	32	Rear end
10	4, 4', 4'', 4''', 4''''	Clamping spring
	41, 41', 41'', 41''', 41''''	Clamping opening
	42	Clamping leg
	43	Yoke spring
	5, 5', 5'', 5''', 5''''	Contact opener
15	5a	First longitudinal side of contact opener
	5b	Second longitudinal side of contact opener
	6	Protective cover
	61	Hinge
	7	Further contact opener
20	8	Recess
	9	Elevation
	L	Longitudinal axis

PATENTKRAV

1. Elektrisk plug-in-konnektor, der i den ene ende kan sluttes til et kabel, hvorved enden, som skal tilsluttes, i det mindste omfatter en fri tråd-ende, og hvorved
 5 plug-in-konnektoren langs en længdeakse (L) skal forbindes med en til plug-in-konnektoren komplementær plug-in-konnektor, med følgende karakteristiske træk:

- en kontaktbærer (1);
- 10 - mindst et kontaktelement (3), som i kontaktbæreren (1) er indført parallelt med denne længdeakse (A) og bærende holdes af denne, hvorved kontaktelementet (3) omfatter en forreste og en bageste ende (31, 32), og hvorved den bageste ende (32) omfatter en klemfjeder (4) med en klemåbning (41), i hvilken den mindst ene frie tråd-ende kan fastklemmes;
- 15 - en hus-del (2), som er monteret på kontaktbæreren (1) og omfatter en inderside (22), der efter monteringen af klemfjederen (4) i det mindste delvist omgiver denne;
- en kontaktåbner (5), navnlig en aflang kontaktåbner (5), som skal allokeres til klemfjederen (4), mindst delvist er arrangeret mellem denne inderside (22) og klemfjederen (4) og efter monteringen bevægeligt holdes
 20 mellem to stillinger;

hvorved en første bevægelse er en trækbevægelse af kontaktåbneren (5) langs længdeaksen (L), og som sker i synsretningen mod kontaktelementets (3) bageste ende (32), og en anden bevægelse er en skubbebevægelse for kontaktåbneren (5) langs længdeaksen (L), og som sker i synsretningen mod den første ende (31) af kontaktelementet (3);

hvorved indersiden (22) danner et område, i hvilket, i en første stilling for kontaktåbneren (5) mindst en del af kontaktåbneren (5) er modtaget, således at klemfjederen (4) er frigivet;

kendetegnet ved, at

- der på henholdsvis denne inderside (22) og på en mod denne inderside (22) vendende side (5a) af kontaktåbneren (5) er dannet en flade (51), som mindst delvist er orienteret på tværs af længdeaksen (L),

5 hvorved med henblik på aktivering af klemfjederen i kontaktåbnerens (5) længderetning, kontaktåbneren (5) kan bevæges ved hjælp af en første glidebevægelse på oversiden (51) af denne inderside (22), der er orienteret på tværs af længdeaksen (L), fra den første position, i hvilken klemfjederen (4) er frigivet, kan bevæges til en anden position, i hvilken kontaktåbneren (5) sammentrykker fjederen (4), således at klemåbningen er åbnet for indsættelse eller fjernelse af
10 denne frie ende, og kontaktåbneren (5) kan bevæges tilbage mod den første position, som spærrer klemåbningen, ved en anden glidebevægelse på overfladen (51) af denne underside (22), der er orienteret på tværs af længdeaksen (L).

15 2. Elektrisk plug-in-konnektor ifølge krav 1, hvorved klemfjederen er en bur-trækfjeder, som er fastklemt på kontaktelementet.

3. Elektrisk plug-in-konnektor ifølge et af kravene 1 til 2, hvorved kontaktåbneren 5 på den over for kontaktåbnerens (5) første langside beliggende anden langside
20 (5b) direkte eller indirekte hviler mod klemfjederen (4), og/eller kontaktåbneren (5) er dannet i eet stykke.

4. Elektrisk plug-in-konnektor ifølge et af kravene 1 til 3, hvorved en over for den første langside (5a) beliggende anden langside (5b) af kontaktåbneren (5) har en
25 første plan flade, som er orienteret parallelt med længdeaksen (L).

5. Fremgangsmåde til montering af en elektrisk plug-in-konnektor ifølge et af kravene 1 til 4, hvorved enten:

30 - der i et fremgangsmådetrin indsættes mindst eet kontaktelement (3) parallelt med længdeaksen (L) og holdes som følge heraf bærende af dette, hvorved klemfjederen (4) er arrangeret på den bageste ende (32),

- i et yderligere fremgangsmådetrin monteres hus-delen (2) og kontaktåbneren (5), der allerede er arrangeret på denne inderside (22) af hus-delen, på kontaktbæreren (1), ved at

- 5 kontaktåbneren (5), som er arrangeret på hus-delen (1), bliver allokeret til klemfjederen (4), og hus-delen (1) samt kontaktbæreren (5), der er arrangeret derpå, orienteres i forhold til denne klemfjeder (4), og
hus-delen (2) og kontaktåbneren (5), der er arrangeret derpå, kombineres i en første position deraf med kontaktbæreren (1) langs længdeaksen L, og således
10 omgiver denne inderside (22) mindst delvist klemfjederen (4),

eller

- i et fremgangsmådetrin bliver kontaktåbneren (5) arrangeret i dens første position på kontaktbæreren (1) og/eller på klemfjederen (4), hvorved
15 mindst eet kontaktelement (3) allerede er indsat i kontaktbæreren (1) parallelt med længdeaksen (L) og derved holdes støttet af denne, hvorved klemfjederen (4) er arrangeret på bagenden (32), og
- i et yderligere fremgangsmådetrin monteres hus-delen (2) på kontaktbæreren (1) ved, at hus-delen (2) og kontaktbæreren (1) sammenføres
20 langs længdeaksen L, således at denne inderside (22) mindst delvist omgiver klemfjederen (4),

eller

- 25 - i et fremgangsmådetrin arrangeres en eller flere kontaktåbnere (5) på hus-delen (2),
- i et yderligere fremgangsmådetrin fastgøres en sådan præmonteret enhed på en kontaktbærer (1),
og
30 - først dernæst indføres et eller flere kontaktelementer (3) med en respektiv derpå arrangeret klemfjeder (4),

således at denne inderside mindst delvist omgiver klemfjederen (4), hvorved den ene eller flerheden af kontaktåbnere (5) er arrangeret mellem denne inderside (22) og klemfjederen (4) i dennes første stilling,

- 5 hvorved kontaktåbneren/kontaktåbnerne (5) før monteringen af hus-delen (2) på kontaktbæreren (1) fikseres på denne inderside (22) af hus-delen (2), på klemfjederen (4) eller på kontaktbæreren (1).

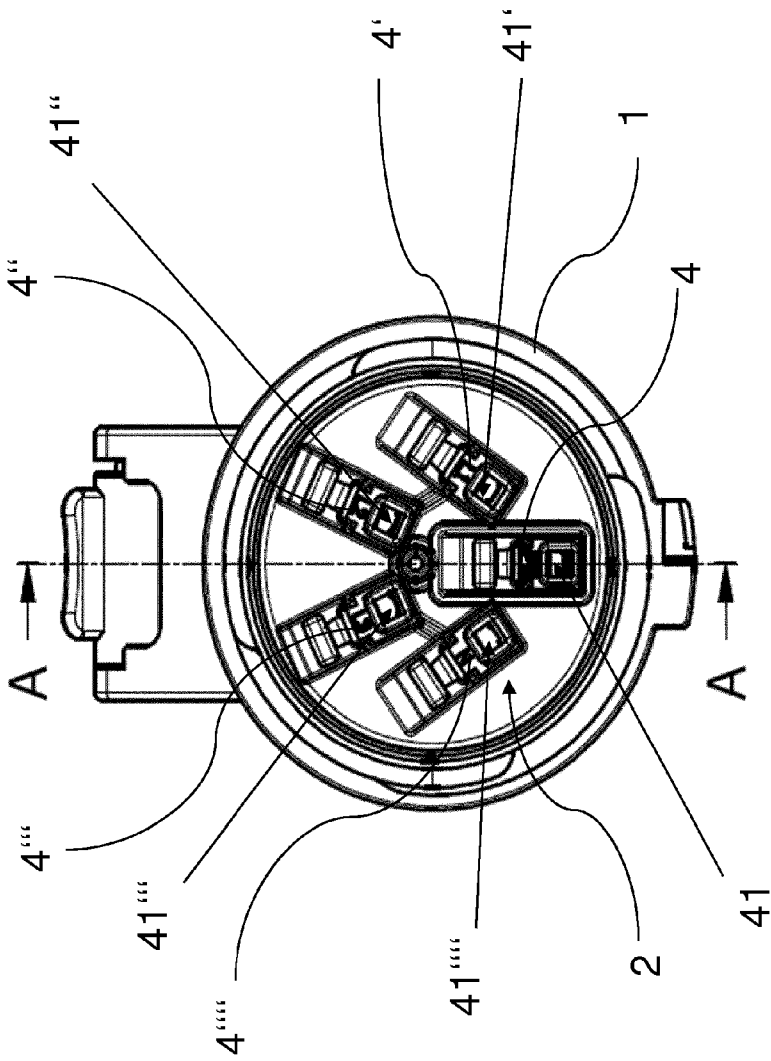
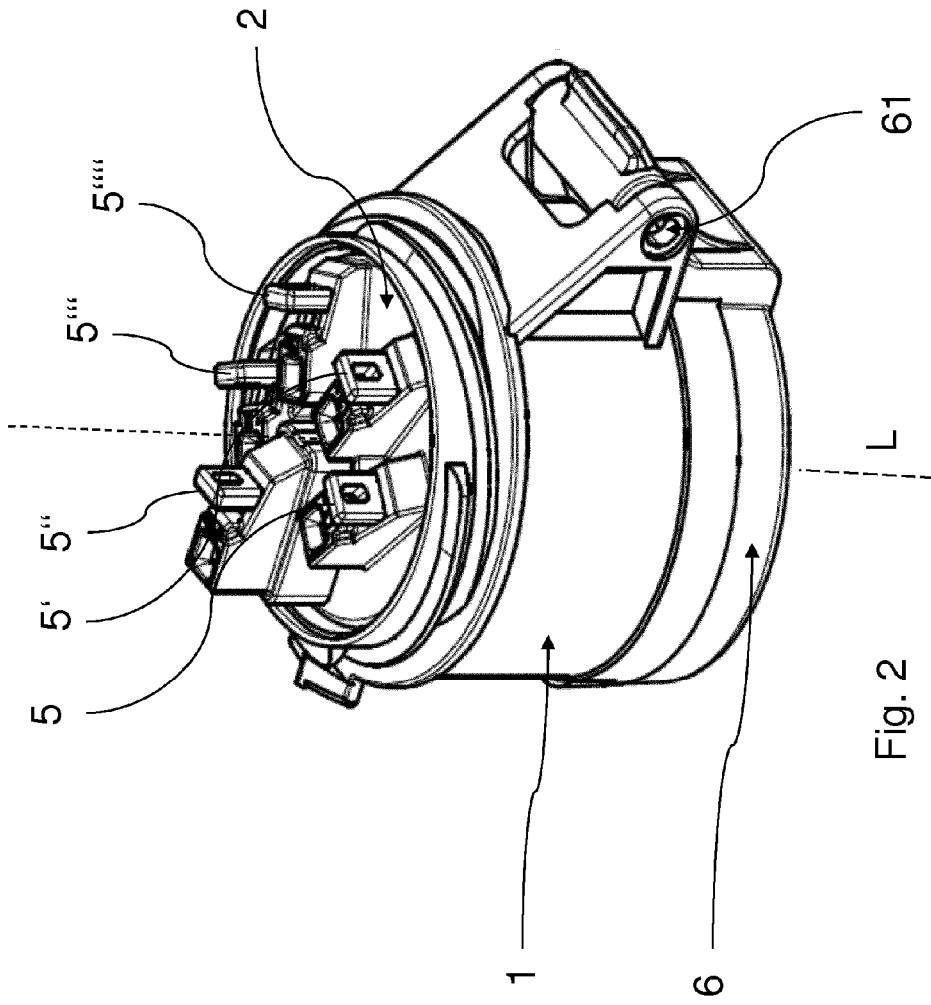


Fig. 1



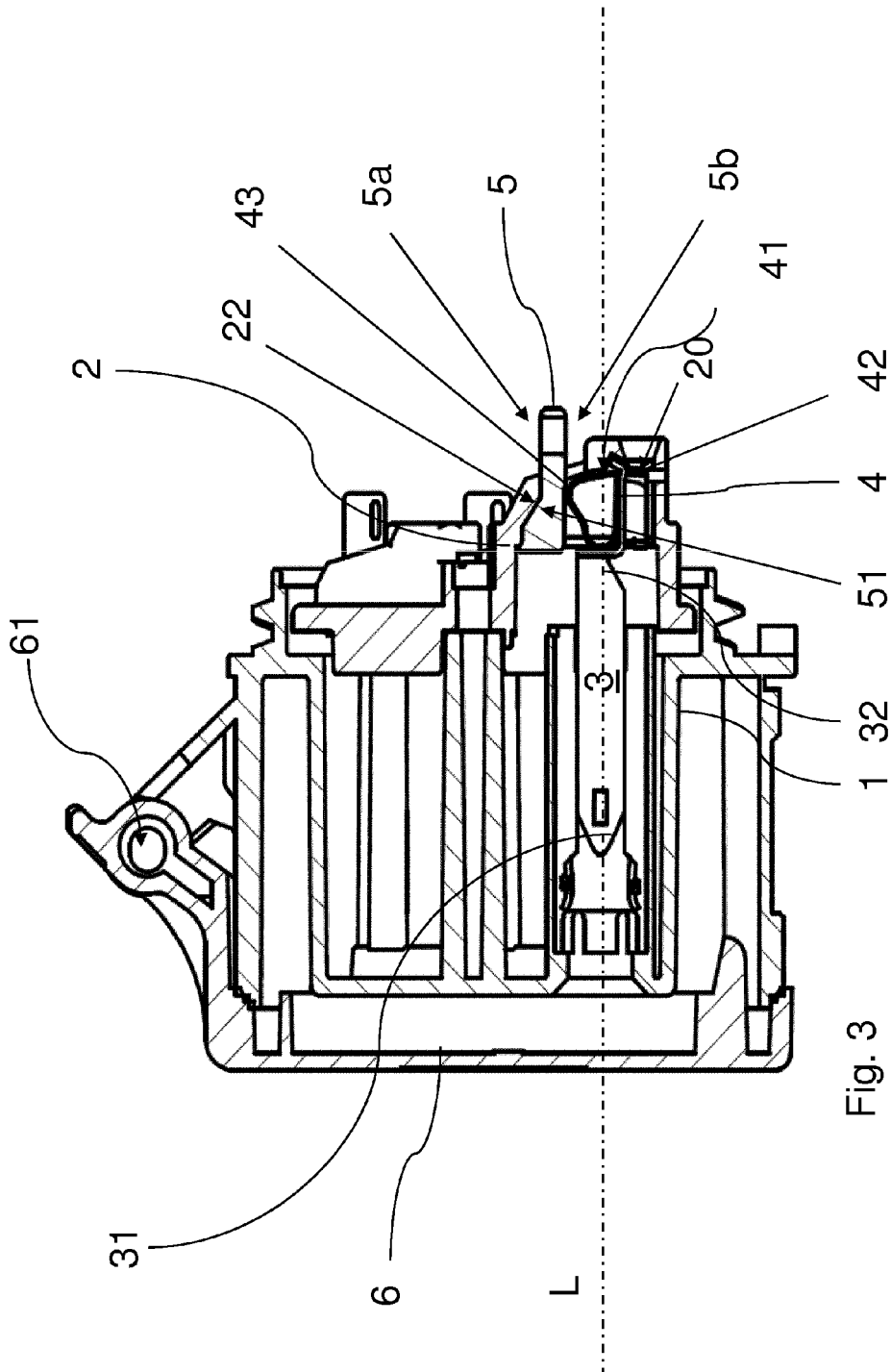


Fig. 3

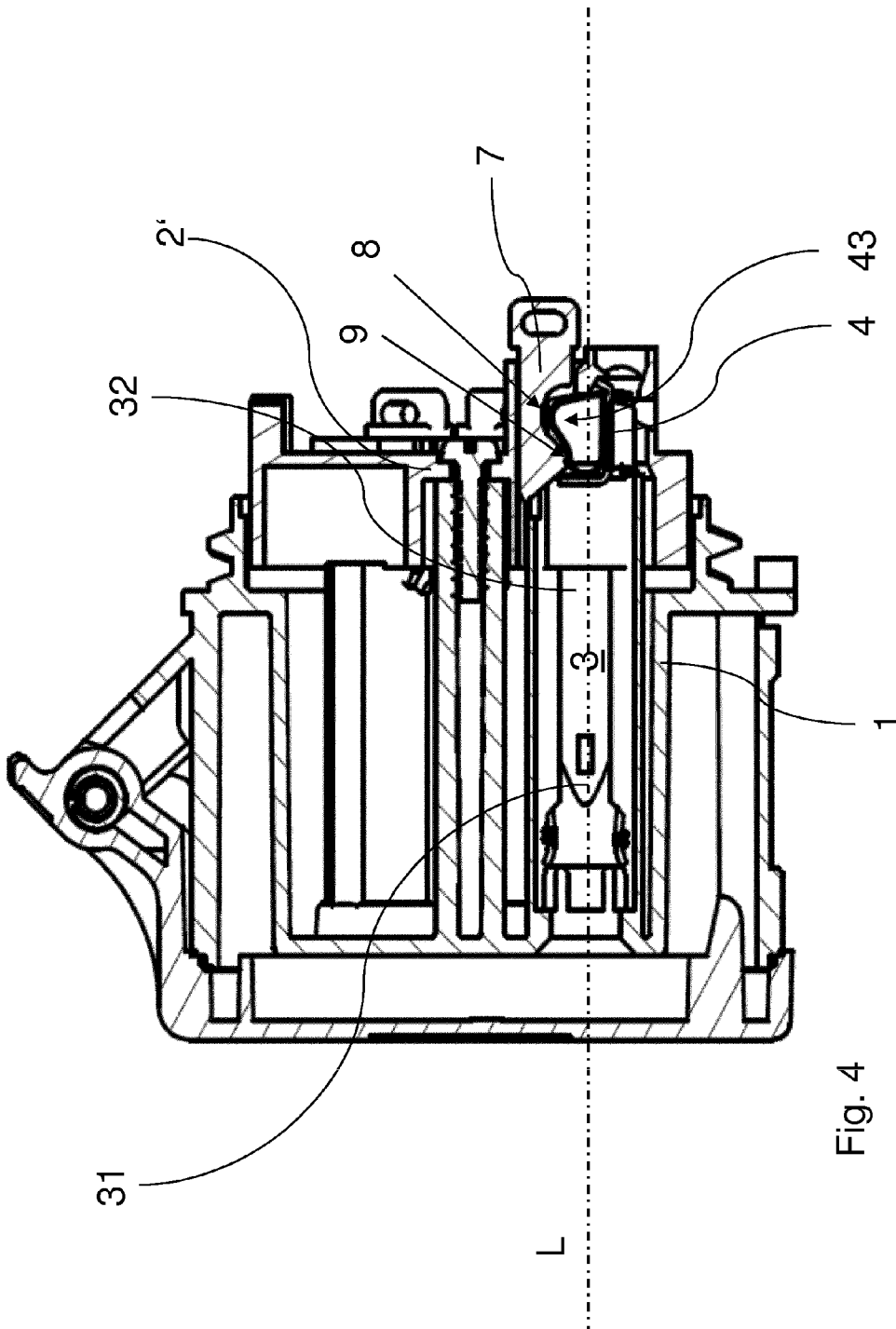


Fig. 4