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(54) Electrical connector

(57) An electrical connector (1) comprising a first (2) and a second part (3) mutually matching each other so as to engage in a removable way one with the other so as to obtain an electrical connection apt to give continuity to an electrical network comprising a neutral line (N1) and at least a first (L1) and a second phase line (L2), each one of the first (2) and second part (3) comprising, in a mutually mirror configuration, a first conducting element (4) apt to be connected to the neutral line (N1) and a second (5) and a third conducting element (6) apt to be connected to the first (L1) and second phase line (L2), respectively; wherein at least the first part (2) comprises a further conducting element (7) integrated therein and apt to be put in electrical contact with an electrical user device (8), and further comprises a selector (9) integrated into the first part (2) and configured to selectively make the further conducting element (7) electrically contact only one of the second (5) and third conducting element (6), wherein the first and second part are configured so that, once engaged one with the other, the selector (9) cannot be accessed from outside the connector.

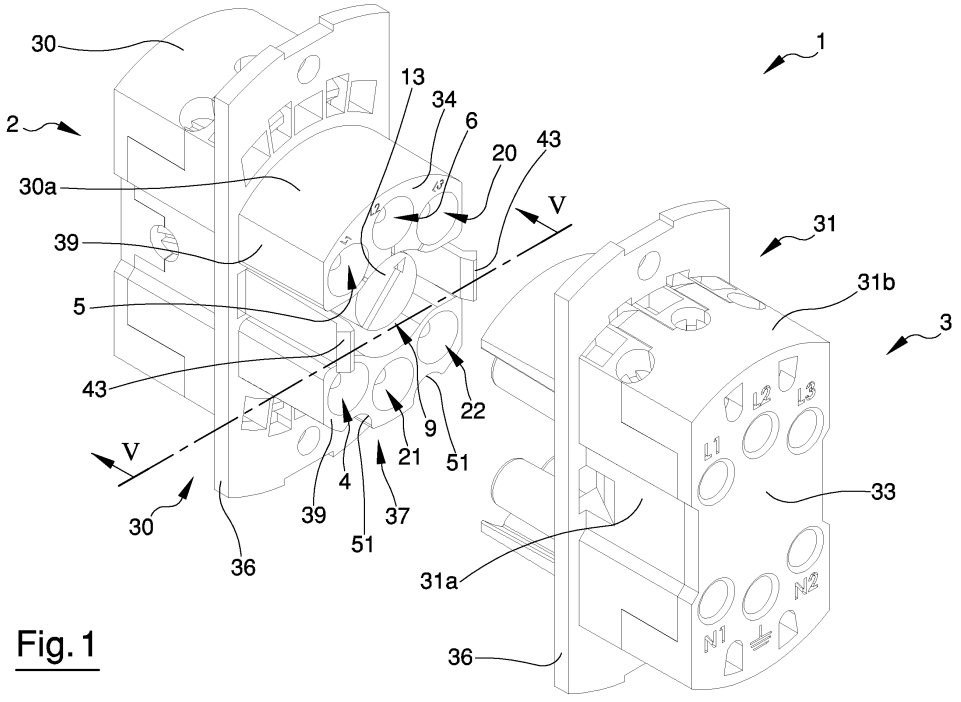


Fig. 1

EP 2 221 929 A1

Description

[0001] The present invention relates to an electrical connector for electrically connecting in a disengageable manner two electrical devices, in particular lighting devices.

[0002] It is known about electrical connector for electrically connecting in a removable manner two lighting devices, so as to give electrical continuity to an electrical network comprising at least two separate and distinct supply lines. Typically, the electrical network comprises an electrically neutral line (commonly referred to as neutral), a grounded line (commonly referred to as ground) and two or more (three in the typical case of a 5-pole electrical network) distinct supply lines (each of them commonly referred to as phase). There is typically one neutral and/or one ground for all present phases, except e.g. for circuits with safety lighting system, in which the corresponding electrical circuit (phase and neutral) is distinct from the remaining lines. These connectors are typically used for connecting two or more lighting devices in a row one to the other, being it possible to supply each device with a selected one of the two or more available supply lines or phases. Thus, the plurality of devices is divided into subsets whose number corresponds to the number of available supply lines, and each subset can be activated by means of its supply line, independently from the other subsets. For instance, each phase can be controlled by a respective on/off switch.

[0003] A known electrical connector comprises two distinct, removable parts, each of them comprising a first conducting element intended to carry the neutral of the electrical network, and at least two further conducting elements (typically three in the case of a 5-pole connector), which are electrically insulated from one another and from the first conducting element, each of them being intended to carry a respective phase of the electrical network. Typically, each part of the connector also comprises a further conducting element, electrically insulated from all the other conducting elements and intended to carry the ground of the electrical network. The two parts comprise each a respective interface, comprising at least the ends of the aforesaid conducting elements and a mechanical interface, and the respective interfaces are suitably counter-shaped the one with respect to the other (e.g. for the ends of the conducting elements according to a male-female pattern) so as to be able to couple with each other and establish a mutual, removable electrical and mechanical connection. Once connected, the electrical connector ensures the electrical continuity for the aforesaid network thanks to the electrical contact between the respective conducting elements of the two parts.

[0004] Typically, the aforesaid known electrical connector is installed between each pair of adjacent lighting devices and, to this purpose the two complementary parts of the connector are typically mounted onto the two opposite ends of each lighting device, respectively. Moreover, each lighting device comprises inside a number of electrical wires corresponding to the number of the aforesaid conducting elements of a single part of the connector, and extending between the two opposite ends of the device so as to electrically connect the corresponding pairs of the conducting elements of the two parts. It is thus possible to connect in a row any number of devices, maintaining the continuity of the aforesaid electrical network.

[0005] So that each lighting device is supplied with a selected phase, it is known to manually implement during installation an electrical connection between the light source of the lighting device (optionally comprising a respective power supply unit) and the electrical wire inside the device corresponding to the selected phase. This connection can be obtained by applying directly onto the selected phase wire a simple terminal (e.g. of the type known as "mammut") or a T-tap (in which a metal contact is pressed manually into the insulation of the electrical wire until it contacts its metal core).

[0006] The Applicant has realized that this solution involves longer device installation times as well as dangers to the electrical safety of the system containing the lighting devices and/or a loss of warranty for these devices. As a matter of fact, in order to establish the aforesaid electrical connection it is necessary to open the case of the lighting device, identify the selected electrical wire (here errors are likely), cut the selected electrical wire and/or remove or damage the insulation thereof in at least one portion to as to left the conducting wire uncovered, establish a stable contact between the conducting wire of the selected phase and the conducting wire of the light source, eventually shut the device.

[0007] The aforesaid electrical connection between the light source and the electrical wire of the selected phase can also be implemented manually by using the terminal of the aforesaid connector, into which both the selected electrical wire and the electrical wire of the light source can be inserted. However, the operations performed directly onto the wires carrying the electrical network involve in their turn dangers for the electrical safety of such network. More to the point, one or more of the aforesaid operation do not comply with existing rules concerning electrical safety and/or lighting systems and appliances.

[0008] Another known solution for electrically connecting the light source and the electrical wire of the selected phase comprises an interconnection device, differing from the aforesaid 5-pole connector and every part of it, interposed between two adjacent lighting devices and engaged on opposite sides to the two parts of the aforesaid connector, belonging to the two devices, respectively, in order to mechanically and electrically connect these parts so as to give continuity to the aforesaid electrical network. The interconnection device comprises an electrical shunt for each of the aforesaid lines of the electrical network (as for a T-tap), and shows a respective outlet socket, typically in the form of a 5-pole female socket.

The aim of the outlet socket is to supply one of the two lighting devices, which comprises an inlet plug (typically a 5-pole male plug) removably engaging with the outlet socket. The inlet plug is electrically connected with the light source of the lighting device by means of respective electrical wires. The inlet plug further comprises a selector selectively putting into electrical contact the light source with the selected phase.

[0009] The Applicant has realized that also the latter solution has some drawbacks. First of all, the presence of the interconnection device and of the inlet plug hugely increases connector complexity, with disadvantageous consequences on manufacturing, storage, installation and maintenance costs. Moreover, the interconnection device, when present, requires the allocation of a corresponding space between the two adjacent lighting devices and, when not present, requires ad hoc solutions for making up for the absence thereof. More to the point, the selector separated from the connector involves additional construction costs due to the need to ensure the electrical insulation of the conducting elements thereof and between said elements, as well as of all electrical wires terminating therein.

[0010] In another known solution for supplying the lighting device from a selected phase, a 5-pole electrical connector as described above is used, which further comprises a selector integrated in one of the two parts thereof and apt to selectively put in electrical contact a selected one of the three further conducting elements of phases with a still further conducting element intended to be put in contact with the supply of the lighting device with a 3-pole tap-off. For installation, first the selector is actuated for selecting the desired phase, then the 3-pole tap-off is inserted. As a matter of fact, the part containing the selector is upstream from the other part with respect to the supply of the electrical network.

[0011] The Applicant has realized, as far as it knows for the fist time that also the latter solution has some drawbacks. As a matter of fact, even when the two parts of the 5-pole connector are mutually engaged for giving continuity to a 5-pole electrical circuit, the selector remains accessible so that it can be actuated in order to change the selected phase even after installation, without first decoupling the two parts of the connector and without either first removing the 3-pole tap-off. This involves a potential danger for the electrical network and/or for the electrical device connected to the 3-pole tap-off (e.g. due to current overloads) in case of handling of the selector with 3-pole tap-off inserted and selector under voltage.

[0012] Moreover, the above connector is particularly bulky because of the configuration and/or spatial arrangement of the conducting elements and/or selector, especially in the main longitudinal direction of the connector, besides being complex.

[0013] Under these circumstances, the technical task underlying the present invention is to propose an electrical connector of the type comprising two parts mutually matching each other and able to be disengaged from one another, and an electrical device comprising this connector, which overcome one or more of the prior art drawbacks as mentioned above.

[0014] One of the aims of the present invention in one or more of its various aspects is to provide for an electrical connector and a corresponding installation method, which can ensure a high level of electrical safety both during and after installation.

[0015] One of the aims of the present invention in one or more of its various aspects is to propose an electrical connector of the type comprising two parts, with phase selection, which has a minimum overall size, in particular in the main direction of development of said connector.

[0016] One of the aims of the present invention in one or more of its various aspects is to propose an electrical connector and an electrical device comprising this connector, which are simple and cheap to manufacture and/or store and/or install and/or use.

[0017] One or more of the technical tasks and/or aims referred to are basically achieved by an electrical connector, an electrical device, an electrical system and an installation method in accordance with one or more of the appended claims and/or one or more of the following aspects.

[0018] The invention relates to an electrical connector comprising a first and a second part mutually countershaped for being apt to engage, in a removable way, one with the other for obtaining an electrical connection apt to give continuity to an electrical network comprising at least one neutral line (N1) and at least a first (L1) and a second phase line (L2), each one of the first and second part comprising, in a mutually mirror configuration, a first conducting element intended to be connected to said at least one neutral line (N1) and a second and a third conducting element intended to be connected to said at least first and second phase line, respectively, wherein the first, second and third connecting element are electrically insulated from one another; and wherein at least said first part comprises a further conducting element integrated therein and electrically insulated from said first conducting element of the first part, and intended to be put in electrical contact with an electrical user device, and further comprises a selector integrated into said first part and configured to selectively put said further conducting element in electrical contact with only one of said second and third conducting element.

[0019] In one aspect of the invention, said first and second part are configured so that, once engaged one with the other, said selector cannot be accessed from outside the connector. Thus, the electrical safety of the system is ensured even after installation.

[0020] In a further aspect of the invention, said selector comprises an electrical contacting element which can be selectively shifted at least between a first position in which an electrical bridge between said further conducting element and said second conducting element of said first part is established, and a second position in which an electrical bridge between said further conducting el-

ement and said third conducting element of said first part is established, wherein said second and third conducting element of said first part are at the same distance from said further conducting element, wherein said electrical contacting element is turnably pivoted on said further conducting element and in electrical contact with the latter, and said selector comprises a control element with which said electrical contacting element is engaged for being turned between said first and said second position, and wherein said control element has an axis of rotation arranged parallel to the main direction of development of said first, second and third conducting element and of said further conducting element. Thus the connector is particularly compact.

[0021] In a further aspect of the invention, said first and second part each comprise a respective main body onto which said first, second and third conducting element are mounted, so that each conducting element has a first end on a first end of the corresponding main body and a second end on a second end of the corresponding main body, opposite to the first one, the first and second end of the conducting elements being able to be accessed from outside the corresponding main body at least when the first and second part are disengaged, and wherein said further conducting element and said selector are mounted onto said corresponding main body of said first part, so that said further conducting element has a first end, which can be accessed from outside the corresponding main body, on said first end of the corresponding main body, said selector being placed mainly on said second end of the corresponding main body and being able to be accessed from the side of said second end when and only when the first and second part are disengaged. With such an optimal arrangement and configuration of the various elements of the connector, the latter is particularly compact, rational and simple, though ensuring all the necessary electrical connections.

[0022] In further aspects of the present invention, the latter has the technical features contained in the dependent claims 2 to 10, considered without their dependence.

[0023] Further characteristics and advantages of the present invention will be more readily apparent from the indicative and thus non-limiting description of some preferred embodiments of an electrical connector, of a device comprising this connector and of the related installation method according to the present invention, including a preferred, though not exclusive embodiment thereof, thanks to the accompanying drawings, in which:

- Figure 1 is a perspective view of a connector according to the present invention, with the two parts disengaged;
- Figure 2 is a perspective view of the connector of Figure 1 from another angle;
- Figure 3 is a perspective view of the connector of Figure 1 and 2, with the two parts engaged;
- Figure 4 is a view in vertical longitudinal section of the connector of Figure 3 along section line IV-IV;
- Figure 5 is a view in horizontal longitudinal section of the connector of Figure 1 along section line V-V;
- Figure 6 is a view in cross section of a part of the connector of Figure 4 along section line VI-VI;
- Figure 7 is an exploded view of a part of the connector of Figure 1;
- Figure 8 is a schematic drawing of a lighting device comprising a connector according to the present invention;
- Figure 9 shows a lighting system comprising a row of lighting devices according to an aspect of the present invention, connected by means of a connector according to the present invention.

[0024] With reference to the accompanying figures, the numeral 1 globally refers to an electrical connector according to the present invention. The connector 1 and some of its elements have a main longitudinal development lying horizontally in the plane of Figure 4. The electrical connector 1 comprises a first 2 and a second part 3, distinct one from the other and mutually countershaped one to each other for being able to engage one with the other in a removable way. In the present description and claims, the term "disengageable" or "removable" referring to a connection or coupling or engagement, of electrical and/or mechanical type, between two parts means the property thanks to which the two parts can be easily separated by few simple operations, preferably manually only and/or with simple tools.

[0025] Once engaged or connected one to the other, the first 2 and second part 3, implement an electrical connection apt to give continuity to an electrical network comprising at least one neutral line (symbolically referred to as N1) and at least a first (L1) and a second phase line (L2). Typically, as in the example shown, once engaged or connected one to the other, they are apt to give continuity to an electrical network comprising at least a third phase line (L3) and/or a further neutral line (N2). The further neutral line N2 can be used for optional emergency devices, such as emergency lights, as I known in the art. Typically, the electrical network also comprises a ground line (⏚) and as a consequence, as in the example shown, once engaged or connected one to the other, the two parts 2 and 3 are apt to give continuity to an electrical network also comprising this ground line. Advantageously, each of the first 2 and second part 2 comprise, in a mutually mirror configuration, a first conducting element 4 intended to be connected to said at least one neutral line (N1), and a second 5 and third conducting element 6 intended to be connected to said at least a first (L1) and a second phase line (L2), respectively. The first 4, second 5 and third conducting element 6 of each part 2, 3 are electrically insulated from one another, so as to be able to give continuity to the aforesaid electrical network. Preferably, each of the first 2 and second part 3 further comprise, in a mutually mirror configuration, a fourth conducting element 20, electrically insulated from all the remaining electrical conductors, intended to be connected

to said third phase line (L3). If the electrical network has further phase lines beyond the third one, each part 2, 3 can comprise a corresponding number of additional conducting elements electrically insulated from one another and intended to be connected to a corresponding phase line. Preferably, each of the first 2 and second part 3 further comprises, in a mutually mirror configuration, a ground conducting element 21 and/or a neutral conducting element 22 intended to be connected to said ground line (⏚) and said further neutral line (N2), respectively. All the aforesaid conducting elements of each part 2, 3 are electrically insulated from each other so as to be able to give continuity to the aforesaid electrical network. Each of the aforesaid conducting elements of one part 2 or 3 is intended to engage with the corresponding conducting element of the other part 3 or 2 and to establish with the latter a removable electrical (and optionally mechanical) connection.

[0026] Preferably, the first, second and third conducting element 4, 5 and 6 (and, if present, the fourth conducting element 20 and/or the ground conducting element 21 and/or the neutral conducting element 22) of each part 2, 3 are parallel to one another, e.g. they develop mainly in the same longitudinal direction. More preferably, the aforesaid conducting elements are (basically) aligned with each other with respect to a plane orthogonal to their longitudinal development.

[0027] Advantageously, at least the first part 2 comprises a further conducting element 7, electrically insulated from the first conducting element 4 of the first part (and from the ground conducting element 21 and the neutral conducting element 22 optionally present on the first part 2), and intended to be put in electrical contact with an electrical user device 8.

[0028] Preferably, also the further conducting element 7 is parallel to the remaining conducting elements of the first part 2, e.g. it develops mainly along the same longitudinal direction. More preferably, the further conducting element 7 (see e.g. Figure 4) lies on the same orthogonal plane containing the remaining conducting elements for a substantial portion of their longitudinal development.

[0029] Preferably, the first, second and third conducting element 4, 5, 6 (and optionally the aforesaid fourth conducting element 20 - and optional additional elements - and/or ground conducting element 21 and/or neutral conducting element 22) of each part 2, 3 and/or the further conducting element 7 of the first part 2 comprise a first end 40 and second end 41, preferably longitudinally opposite the first one. Advantageously, on the first end 40 lies a main body of the respective conducting element, typically comprising a terminal (e.g. with recess and clamping screw) for the fastening to an electrical conducting wire. This main body advantageously develops along the aforesaid longitudinal direction and has at least one side surface portion having the shape of a cylindrical surface having an axis developing along said longitudinal direction. Advantageously, on the second end 41 of one or more of the conducting elements of the first part 2 lies an elongated, cylindrical portion, developing parallel to the longitudinal development and having a smaller orthogonal section than the orthogonal section of the main body. Preferably one or more (better all of them) of the conducting elements have the aforesaid elongated portion adjacent to or in contact with the main body. Preferably, one or more of the conducting elements (better all of them) are carried out as one piece.

[0030] The first part 2 advantageously comprises a selector 9 operatively coupled with the further conducting element 7 and configured so as to selectively put in electrical contact the further conducting element 7 with one only of the second 5 and third conducting element 6 (and, if present, the fourth conducting element 20 and optional additional elements). The further conducting element 7 is electrically insulated from the second 5 and third conducting element 6 (and fourth element 20, if present), when it is not connected to one of them by means of the selector 9. Advantageously, the further conducting element 7 and/or the selector 9 are integrated into the first part 2 of the connector 1 and are not separated and cannot be separated from it, when the first part 2 is wholly assembled. The selector 9 and/or the further conducting element 7 can be separated from the first part 2, e.g. in order to enable the first part 2 to be assembled or disassembled to maintenance purposes. However, according to the present invention in one or more of its aspects, when the part 2 is assembled, the selector 9 and/or the further conducting element 7 cannot be separated from the first part 2, as it would otherwise be possible, with a simple manual operation, if such elements 9 and/or 7 were coupled with the first part 2 with a removable connection. Conversely, in order to separate the selector 9 and/or the further conducting element 7 from the first part 2, the latter must be at least partially disassembled (e.g. by separating the half-portion 30a from 30b, see further below).

[0031] Preferably, the selector 9 comprises an electrical contacting element 10 which can be selectively shifted between at least a first position in which an electrical bridge between the further conducting element 7 and the second conducting element 5 of the first part 2 is established, and a second position in which an electrical bridge between the further conducting element 7 and the third conducting element 6 of the first part 2 is established. The electrical contacting element 10 can optionally take also a third position (and additional positions), in which an electrical bridge between the further conducting element 7 and the fourth conducting element 20 (and additional elements) of the first part 2 is established.

[0032] Advantageously, the second and third conducting element 5, 6 of the first part 2 (and optionally the fourth conducting element 20) are at the same distance from the further conducting element 7 with respect to a plane orthogonal to the longitudinal direction, e.g. they are arranged along an arc of circle having as center the further conducting element 7. It is thus possible to implement a selector 9 acting upon one conducting element

only (the further conducting element 7) intended to be connected to the electrical user 8, with related advantages as far as compactness of the connector 1 and easier electrical insulation are concerned. As shown by way of example, also the remaining conducting elements (the first element 4 and optionally the ground conducting element 21 and/or the neutral conducting element 22) can be at the same distance from the further conducting element 7, and preferably at the same distance as the one between the latter and the second and third (and fourth 20) conducting element 5, 6, e.g. they are arranged along an arc of circle identical to the one described above and arranged opposite the further conducting element 7. Thus, the connector 1 is particularly compact. The mobile contacting element 10 can further take at least one further position, e.g. an intermediate position between the first and second position and/or between the second and third position, in which the further conducting element 7 remains electrically insulated both from the second 5 and from the third 6 conducting element, and/or more generally from all the conducting elements included in the first part 2 of the connector 1 (including the optional fourth conducting element 20).

[0033] By way of example, as shown, the electrical contacting element 10 is always in electrical contact with the further conducting element 7 during use. In a possible embodiment, a fuse (not shown) is placed between the contacting element 10 and the further contacting element 7, so as to electrically protect the electrical user 8. In a preferred embodiment of the selector 9, as shown by way of example, the electrical contacting element 10 turnably pivots on the further conducting element 7 and is in permanent electrical contact with the latter. In the example shown, the electrical contacting element 10 is plate-shaped and has a through hole 12 into which the further conducting element 7 is inserted so as to establish a permanent, rotary electrical contact.

[0034] Advantageously, the selector 9 comprises a control element 11 with which the electrical contacting element 10 is engaged so as to be shifted (typically turned) between the first and second position (and optional third position). Typically, the control element 11 is electrically insulating, e.g. it is made of insulating material such plastics and/or ceramics.

[0035] Preferably, the control element 11 comprises on one end a socket element 13, in the example shown with a cylindrical shape, protruding from the first part 2 of the connector, so as to be actuated manually or with a simple tool, preferably when and only when the first part 2 is disengaged from the second part 3 of the connector 1. The control element 11 can further comprise on a second end (in the example shown basically disk-shaped and coaxial to the cylindrical socket element 13), opposite the first one, a seat 14, in the example shown with a basically rectangular shape, counter-shaped to the electrical contacting element 10 so as to transmit to the latter during use the twisting action exerted onto the control element 11 (e.g. onto the socket element 13). The control element 11 can have an internal recess 15 for housing at least one portion of the further conducting element 7.

[0036] Advantageously, the further conducting element 7 can be inserted with a transversal clearance into the hole 12. Advantageously, the aforesaid through hole 12 is a slot having a first size as (or slightly larger than so as to enable insertion) the corresponding size of the portion of the further conducting element 7 (in the example the second end 41 of the element 7) inserted into said hole, and a second size, orthogonal to the first one, basically larger than the corresponding size of the aforesaid portion 41 of the further conducting element 7. The electrical contacting element 10 can slide transversally, typically with a limited stroke at both ends, with respect to the control element 11 (e.g. it can slide within the seat 14) and to the further conducting element 7, thanks to the slot 12.

[0037] As shown by way of example in the figure, a first elastic element 16 can be placed (e.g. inside a suitable seat 17 developing orthogonally to the longitudinal direction, adjacent to the seat 14 and with respect thereto in longitudinal position nearer the socket element 13) under compression between the control element 11 and the electrical contacting element 10 so as to exert a thrust setting apart the two elements in orthogonal direction and keep the electrical contacting element 10 radially pushed outside the control element 11. For instance, when the electrical contacting element 10 is in the first or second position, the first elastic element 16 pushed the electrical contacting element 10 against the second 5 or third 6 conducting element, respectively, in order to ensure an adequate electrical contact. When the contacting element 10 is shifted from the first or second position, the suitable shape of its radially outer end, which cooperates with the outer cylindrical surface of the corresponding conducting element, generates a thrust of the latter radially towards the center of the control element 11, thus overcoming the action of the spring 16.

[0038] In a preferred solution, as shown in the figure, a second elastic element 18 is placed under compression between the electrical contacting element 10 and the terminal part of the second end 41 of the further conducting element 7 (e.g. it is blocked by a nut 19 screwed onto the aforesaid threaded terminal part), so as to keep the electrical contacting element 10 pushed against the main body 40 of the further conducting element 7.

[0039] In an alternative embodiment (not shown) of the selector 9, it is not the electrical contacting element 10 and the control element 11 that are shifted with respect to the main body 30 of the part 2 (see further below), but the second 5 and third 6 conducting element (and optionally the fourth element 20 and additional elements and the elements 4,21 and 22), which integrally one to the other are shifted with respect to the main body 30 of the part 2, e.g. by rotation of a ring nut onto which they are mounted, the ring nut being concentric and radially outside the further conducting element 7. In this case

also the second part 3 can be provided with a corresponding ring nut to match the other one.

[0040] In a further alternative embodiment (not shown) of the selector 9, the electrical contacting element 10 is a U-shaped staple having a first end in electrical contact (better permanent but also non-permanent) with the further (only one) conducting element 7, and a second end which can be selectively and alternatively put in electrical contact with the second 5 or third 6 (or optionally the fourth element 20 or additional elements) conducting element. In this case the control element 11 can be an electrically insulated handle of the U-bolt, which can be actuated manually or with a screwdriver.

[0041] Typically one or more (better all of them) of the conducting elements 4, 5, 6, 7, 20, 21, 22 of each respective part 2, 3 and/or the electrical contacting element 10 are made of conducting material (e.g. nickel-plated brass or nickel-plated copper).

[0042] In a preferred solution, as in the example shown, the first 2 and second part 3 comprise each a respective main, electrically insulating body 30, 31 (e.g. made of insulating material such as plastics or ceramics). Byway of example, each main body 30, 31 is made up of a first 30a, 31 a and a second half-portion 30b, 31 b, distinct from one another and mutually counter-shaped one to each other for being apt to engage one with the other, preferably in a removable way, so as to form the respective main body. Suitable mechanical means for removable fastening (in the example elastic teeth engaging into suitable seats of the other half-portion) keep the two half-portions jointed together.

[0043] The aforesaid respective first, second and third conducting element 4, 5, 6 (optionally the aforesaid fourth conducting element 20 - and optional additional elements - and/or the ground conducting element 21 and/or the neutral conducting element 22) are advantageously mounted onto the each main body 30, 31, so that each aforesaid conducting element has its first end 40 on a first end of the respective main body and its second end 41 on a second end of the respective main body, typically though not necessarily longitudinally opposite the first end. More preferably, the aforesaid first end 40 lies on a respective first face 32, 33 of the respective main body 30, 31, which delimits longitudinally the aforesaid first end of the respective main body 30, 31. The aforesaid second end 41 lies on a respective second face 34, 35 delimiting longitudinally the aforesaid second end of the respective main body 30, 31. It should be pointed out that the wording "on a face" does not necessarily means that the end of the conducting element extends as far as the lying plane of the face or even farther. Typically, as can be seen in Figure 4, the ends of the conducting elements end conversely in retired position with respect to the plane of the respective face (e.g. for reasons of electrical safety).

[0044] Nevertheless, the first ends 40 of the aforesaid conducting elements can be accessed through the respective face 32 or 33 from the outside of the respective main body 30, 31 when the corresponding first and second part 2, 3 are assembled. It should be pointed out that during use, in order to access the first ends 40, either the respective main body 30, 31 is removed from the device 90 or the latter is open or can be accessed in its internal part. The aforesaid access from outside enables to contact the electrical conducting wires intended to carry the electrical network inside the device 90 with the respective conducting element, and to fasten both.

[0045] Preferably, the second ends 41 of the aforesaid conducting elements can be accessed through the respective face 34 or 35 from the outside of the respective main body 30, 31 when, and only when the first and second part 2, 3 are disengaged (when they are engaged, it is typically not possible to access the aforesaid ends 41, see Fig. 4).

[0046] Preferably, the further conducting element 7 is mounted onto the respective main body 30 of the first part 2, so that the further conducting element 7 has its first end 40 on the first end of the respective main body 30 (preferably on the first face 32 and accessible through the first face 32 from the outside of the respective main body 30 even when the first part 2 is assembled), and a second end 41 facing the second end of the respective main body 30. By way of example, as in the example shown, the second end 41 of the further conducting element 7 lies on the second face 34 of the respective main body 30.

[0047] Preferably, the second end 41 of the further conducting element 7 cannot be accessed from the outside of the respective main body 30 even when the first and second part 2, 3 are disengaged from one another. For instance, the control element 11 can wholly enclose the second end 41 (e.g. housed in the internal recess 15) of the further conducting element 7.

[0048] Preferably, the selector 9 is mounted onto the respective main body 30 of the first part 2, so that its main direction of development is parallel to the aforesaid longitudinal direction. More preferably, the axis of rotation of the mobile contacting element 10 and/or of the control element 11 is parallel to the main direction of development of the conducting elements 4, 5 and 6 and typically also 7. In an embodiment, the selector 9 lies on the second end of the main body 30 of the second part 2, preferably on the second face 34. It can be advantageously accessed from the outside of the main body, from the side of the second face 34 of the main body, when and only when the first and second part 2, 3 are disengaged.

[0049] Advantageously, the first and second part 2, 3 are configured so that, once assembled and engaged with one another, the selector 9 cannot be accessed from the outside of the connector 1. It should be noted that, even when the parts 2 and 3 are engaged, the part 2 can always be partially disassembled (e.g. by disengaging the second half-portion 30b from the first one 30a) so as to be able to access the selector 9. However, after installation, e.g. with the connector mounted onto the device 90 and the parts 2 and 3 connected, the shape of the

connector 1 itself prevents the selector 9 from being further shifted, unless the two parts 2, 3 are disengaged. Preferably, each main body 30, 31 of the first and second part comprises a flange 36 (in the example as an integral part of the half-portion 30a), typically placed between the aforesaid opposite ends of the respective main body 30, 31 (and preferably also of the respective conducting elements), so as to enable the respective part 2, 3 to be mounted onto the electrical device 90 (Fig. 8). Typically, the flange 36 surrounds the perimeter of the whole main body and is provided with through holes in order to be mounted onto the electrical device 90. Preferably, the second end 41 of each conducting element 4, 5, 6 (and optionally 20 and/or 21 and/or 22) of the first part 2 is counter-shaped to the second end 41 of each corresponding conducting element 4, 5, 6 (and optionally 20 and/or 21 and/or 22) of the second part 3, so that said two second ends 41 are apt to mechanically fit one into the other and establish a removable electrical and mechanical connection. As shown by way of example in the figure, the second end 41 of each conducting element 4, 5, 6 (and optionally 20 and/or 21 and/or 22) of the first part 2 (or vice versa of the second part 3 - not shown) can be shaped as a pin, intended to fit into the second end 41, having a suitable recess, of each corresponding conducting element of the second part 3 (or vice versa of the first part 2) according to a "male-female" relation.

[0050] Preferably, the main bodies 30, 31 of the first 2 and second part 3 have a first 37 and a second mechanical interface 38, respectively, mutually counter-shaped one to each other for being apt to fit one into the other and establish a removable mechanical connection. In the example, the first mechanical interface 37 comprises, with relation to each conducting element 4, 5, 6 (and optionally 20 and/or 21 and/or 22) of the first part 2, a basically cylindrical seat which is coaxial with the respective conducting element contained therein, so as to leave inside the seat a basically tubular, longitudinal free space. A suitably matching cylinder fits into the latter, the cylinder belonging to the second mechanical interface 38 with relation to each conducting element 4, 5, 6 (and optionally 20 and/or 21 and/or 22) of the second part 3, and containing the latter.

[0051] By way of example, the first mechanical interface 37 (alternatively the second mechanical interface 38) comprises two structures 39 protruding longitudinally on said second end of the main body 30 (alternatively 31) and having on the orthogonal plane the shape of an arc of circle, mutually arranged on opposite sides with respect to the selector 9. Each structure 39 defines one or more (e.g. three) of the aforesaid seats for housing the conducting elements 4, 5, 6 (and optionally 20 and/or 21 and/or 22) of the first part 2. By way of example, the second mechanical interface 38 (alternatively the first mechanical interface 37) comprises two structures 42 protruding longitudinally on said second end of the main body 31 (alternatively 30) and having on the orthogonal plane the shape of an arc of circle, mutually arranged on opposite sides with respect to the longitudinal axis of symmetry of the conducting elements 4, 5 and 6 so as to match the aforesaid structures 39 of the first interface 37 when the parts 2, 3 are engaged.

[0052] The aforesaid structures 39 are basically symmetrical to each other, the center of symmetry being the longitudinal axis of the selector 9. The aforesaid structures 42 are basically symmetrical to each other.

[0053] The first 37 and/or second mechanical interface 38 further have a fit-in system 51, 52 apt to enable the two interfaces to mechanically fit into each other only in a predefined relative angular position between the two parts. By way of example, only one of the two aforesaid structures 39 (in the example the lower one in Figure 1 only) comprises one or more (two in the example) longitudinal grooves 51, and only one of the aforesaid structures 42 (in the example the lower one in Figure 2 only) comprises one or more (two in the example) longitudinal projections 52 apt to engage the corresponding longitudinal grooves 51. Thus, a correct coupling of the poles of the connector 1 is ensured during installation.

[0054] One of the two mechanical interfaces 37, 38 (in the example the first one 37) can comprise a pair of prongs 43 longitudinally protruding on said second end of the main body 30 and basically plate-shaped, mutually arranged on opposite sides with respect to the selector 9. By way of example, the prongs 43 are alternated with the aforesaid structures 39 (or 42) of the respective mechanical interface. Each prong 43 has on its free longitudinal end a tooth for the engagement with a suitable seat obtained in the second part 3 (by way of example on the respective flange 36).

[0055] The first (and/or second 38) mechanical interface 37 is advantageously shaped so as to basically wholly surround, with respect to an orthogonal plane, the selector 9 along its whole longitudinal development on said second end of the main body 30 (in other words, along its whole "external" longitudinal development). Preferably, the aforesaid structures 39 and/or the aforesaid prongs 43 of the first mechanical interface 37 extend longitudinally, parallel to the selector 9, for a length corresponding to (preferably larger than) the aforesaid external longitudinal development of the selector 9. The present invention further includes the case in which the aforesaid function of wholly surrounding the selector 9 is performed by suitable structures protruding from the respective main bodies, which do not act also as mechanical interfaces (whose function is performed in this case by suitable distinct structures). In the framework of the present application, these structures dedicated to the aforesaid function of wholly surrounding the selector 9 are construed as being part of the mechanical interfaces 37 and/or 38.

[0056] In one aspect, the present invention relates (Figure 8 to an electrical device 90 having two opposite ends and comprising an electrical user device 8 (e.g. a light source, optionally provided with a power supply) and an electrical connector 1 (comprising the two parts 2 and

3) according to any one of the aspect of the present invention, wherein the first 2 and second part 3 of the connector 1 are mounted onto the two ends, respectively, of the device 90, and wherein the further conducting elements 7 is electrically connected to the electrical user device 8 (e.g. through a respective electric wire 91). Figure 8 shows by way of schematic example the electrical wires 92 connecting each phase conducting element 5, 6 and 20 of the first part 2 to the corresponding phase conducting element of the second part 3. An electrical wire 93 connects by way of example the neutral conducting element 4 of the first part 2 to the corresponding neutral conducting element 4 of the second part 3 and through a branch (which might also start directly from a terminal of one of the two parts 2, 3) to electrical user 8. An electrical wire 94 connects by way of example the ground conducting element 21 of the first part 2 to the corresponding ground conducting element 21 of the second part 3 and through a branch (which might also start directly from a terminal of one of the two parts 2, 3) to electrical user 8.

[0057] In one aspect, the present invention relates (Figure 9) to an electrical installation 96 comprising a plurality (two in the example) of devices 90 as described above, arranged one after the other, wherein for each pair of adjacent devices the first part 2 of the respective connector 1 of one of the devices 90 of the pair is engaged with the second part 3 of the respective connector 1 of the other one of the devices 90 of the pair, and wherein the plurality of devices 90 comprises at least two subsets of devices, the first subset having the respective selector 9 in the aforesaid first position, and the second subset in the aforesaid second position.

[0058] In one aspect, the present invention relates to the use of the electrical connector 1 according to any one of the aspects of the present invention, for electrically connecting two electrical user devices 90, the two devices having the first 2 and the second part 3 respectively mounted onto a respective end, comprising the steps of acting upon the selector 9 for establishing an electrical contact between the further conducting element 9 and one only of the second 5 and third conducting element 6, and engaging the first 2 and the second part 3 of the connector with each other so as to obtain said electrical connection. Advantageously, the devices 90 are installed so that the end carrying the first part 2 of the connector 1 (with the selector 9) faces the source of the electrical network, so that by disengaging the two parts of the connector, the conducting elements 4, 5 and 6 of the first part 2 are not under voltage and the selector 9 can be actuated under safety conditions.

Claims

1. An electrical connector (1) comprising a first (2) and a second part (3) mutually counter-shaped for being apt to engage, in a removable way, one with the other for obtaining an electrical connection apt to give continuity to an electrical network comprising at least one neutral line (N 1) and at least a first (L1) and a second phase line (L2), each one of the first (2) and second part (3) comprising, in a mutually mirror configuration, a first conducting element (4) intended to be connected to said at least one neutral line (N 1) and a second (5) and a third conducting element (6) intended to be connected to said at least first (L1) and second phase line (L2), respectively, wherein the first, second and third conducting element are electrically insulated from one another; and wherein at least said first part (2) comprises a further conducting element (7) integrated into said first part (2) and electrically insulated from said first conducting element (4) of the first part (2), and intended to be put in electrical contact with an electrical user device (8), and further comprises a selector (9) integrated into said first part (2) and configured to selectively make said further conducting element (7) electrically contact only one of said second (5) and third conducting element (6),
characterized in that said first and second part are configured so that, once engaged one with the other, said selector (9) cannot be accessed from outside the connector.

2. The electrical connector according to claim 1, wherein said selector (9) comprises an electrical contacting element (10) which can be selectively shifted at least between a first position in which an electrical bridge between said further conducting element (7) and said second conducting element (5) of said first part (2) is established, and a second position in which an electrical bridge between said further conducting element (7) and said third conducting element (6) of said first part (2) is established, wherein said second and third conducting element of said first part are at the same distance from said further conducting element (7).

3. The electrical connector according to claim 2, wherein said electrical contacting element (10) is turnably pivoted on said further conducting element (7) and in electrical contact with the latter, and said selector (9) comprises a control element (11) with which said electrical contacting element is engaged for being turned between said first and said second position.

4. The electrical connector according to claim 3, wherein said control element (11) has an axis of rotation arranged parallel to the main direction of development of said first, second and third conducting element (4, 5, 6) and of said further conducting element (7).

5. The electrical connector according to any one of

the preceding claims, wherein said first (2) and second part (3) each comprise a respective electrically insulating main body (30, 31) onto which said respective first (4), second (5) and third conducting element (6) are mounted, so that each conducting element has a first end (40) in correspondence of a first end of the corresponding main body and a second end (41) in correspondence of a second end of the corresponding main body, opposite the first one, the first (40) and second end (41) of the conducting elements being able to be accessed from outside the corresponding main body at least when the first and second part are disengaged, and wherein said further conducting element (7) and said selector (9) are mounted onto said respective main body (30) of said first part (2), so that said further conducting element (7) has a first end (40), which can be accessed from outside the respective main body, in correspondence of said first end of the respective main body (30), said selector (9) being placed mainly in correspondence of said second end of the respective main body (30) and being able to be accessed from the side of said second end when and only when the first and second part are disengaged.

5. The electrical connector according to any one of the preceding claims, wherein said first, second and third conducting element (4, 5, 6) of the first part (2) are arranged along an arc of a circle having as center the further conducting element (7).

6. The electrical connector according to any one of the preceding claims, wherein the main bodies (30, 31) of said first and second part have a first (37) and second mechanical interface (38), respectively, reciprocally counter-shaped for being apt to get interlocked the one with the other and establish a removable mechanical connection, and shaped so as, when mutually engaged, surround substantially completely said selector (9) with respect to a plane orthogonal to the direction of main development of said connector (1), at least along the whole outer longitudinal development of said selector (9).

7. The electrical connector according to any one of the preceding claims, wherein each first and second part (2, 3) further comprises, in a mutually mirror configuration, a respective fourth conducting element (20), electrically insulated from all remaining electrical conductors, intended to be connected to a third phase line (L3), and a ground conducting element (21), electrically insulated from all remaining electrical conductors, intended to be connected to a ground line ($\perp$), wherein the first, second, third and fourth conducting element (4, 5, 6 and 20) and the ground conducting element (21) of each part are parallel to each other and mutually aligned with respect to a plane orthogonal to their longitudinal development, and wherein the second, third and fourth conducting element (5, 6, 20) of the first part (2) are arranged, with respect to said orthogonal plane, along an arc of circle having as center said selector (9), and the first conducting element (4) and the ground conducting element (21) are arranged along a further arc of circle having radius equal to the radius of said arc of circle and placed opposite to said selector (9).

8. An electrical device (90) having two ends and comprising an electrical user device (8) and an electrical connector (1) according to any one of the preceding claims, wherein said first (2) and second part (3) of said connector are mounted onto said two ends, respectively, and wherein said further conducting element (7) is electrically connected to said electrical user device (8).

9. An electrical installation (96) comprising a plurality of devices (90) according to claim 8 arranged in succession to each other, wherein for each pair of adjacent devices said first part (2) of said respective connector of one of the devices of said pair is engaged with said second part (3) of said respective connector of the other one of the devices of said pair, and wherein said plurality of devices comprises at least a first and a second subset of devices, wherein in the first subset the selector (9) makes said further conducting element (7) electrically contact said second conducting element (5) and in the second subset the selector (9) makes said further conducting element (7) electrically contact said third conducting element (6), and wherein for each device (90) said first part (2) of the connector (1) lies, with respect to the direction of supply of said electrical network, upstream from said second part (3) of the connector (1) of the same device (90).

10. Use of the electrical connector (1) according to anyone of the preceding claims for electrically connecting two electrical devices (90), the two devices having said first (2) and said second part (3), respectively, mounted onto a respective end thereof, comprising the following steps:

- act upon said selector (9) for establishing an electrical contact between said further conducting element (7) and only one of said second (5) and third conducting element (6);
- engage the first (2) and the second part (3) of the connector (1) with each other so as to obtain the electrical connection.

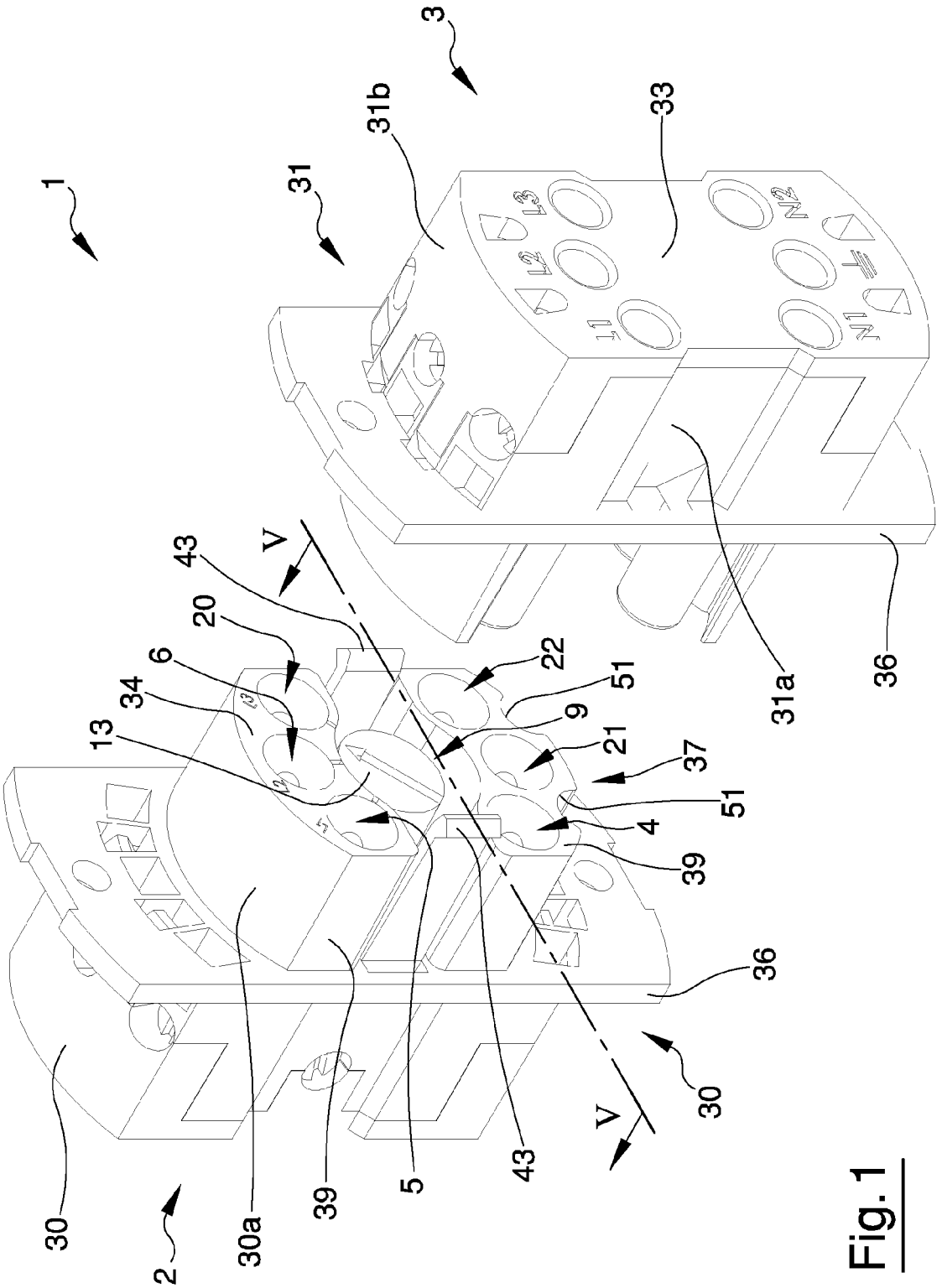
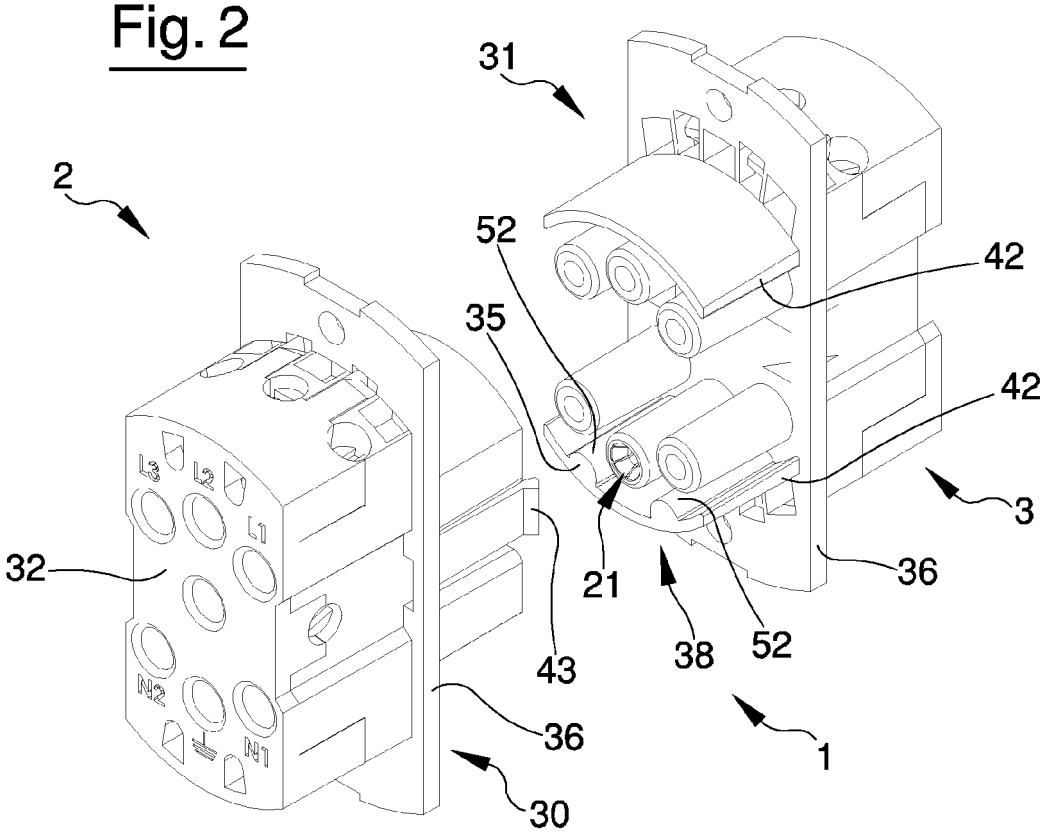


Fig. 1

Fig. 2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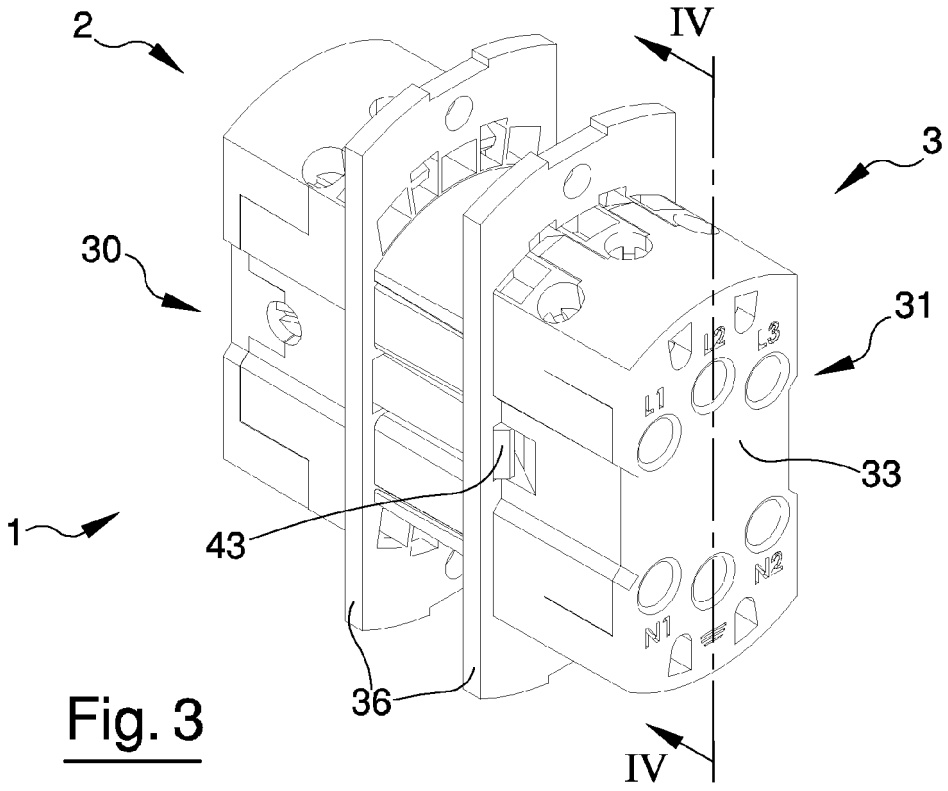
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N2
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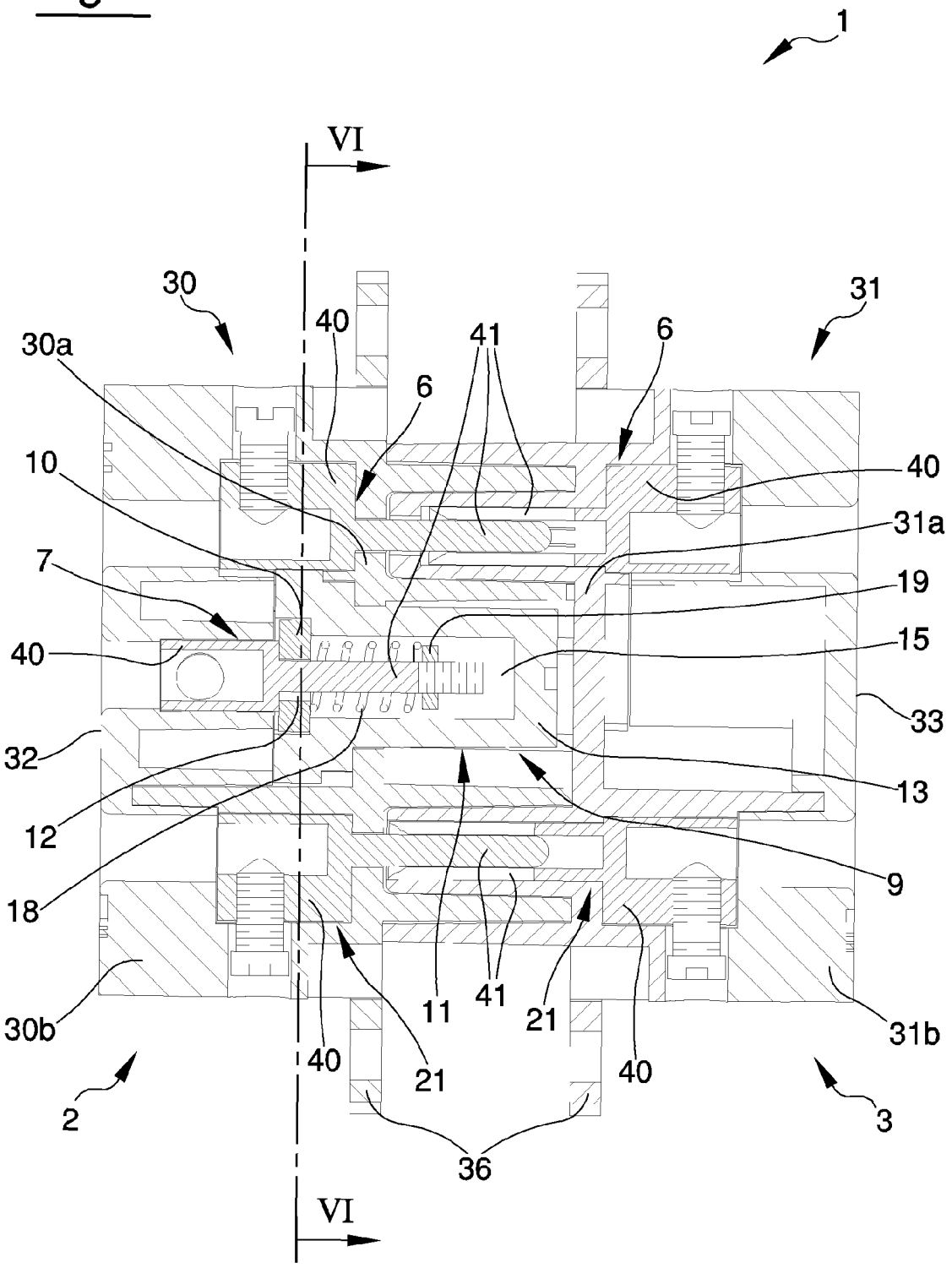
IV

Fig. 3

Fig. 4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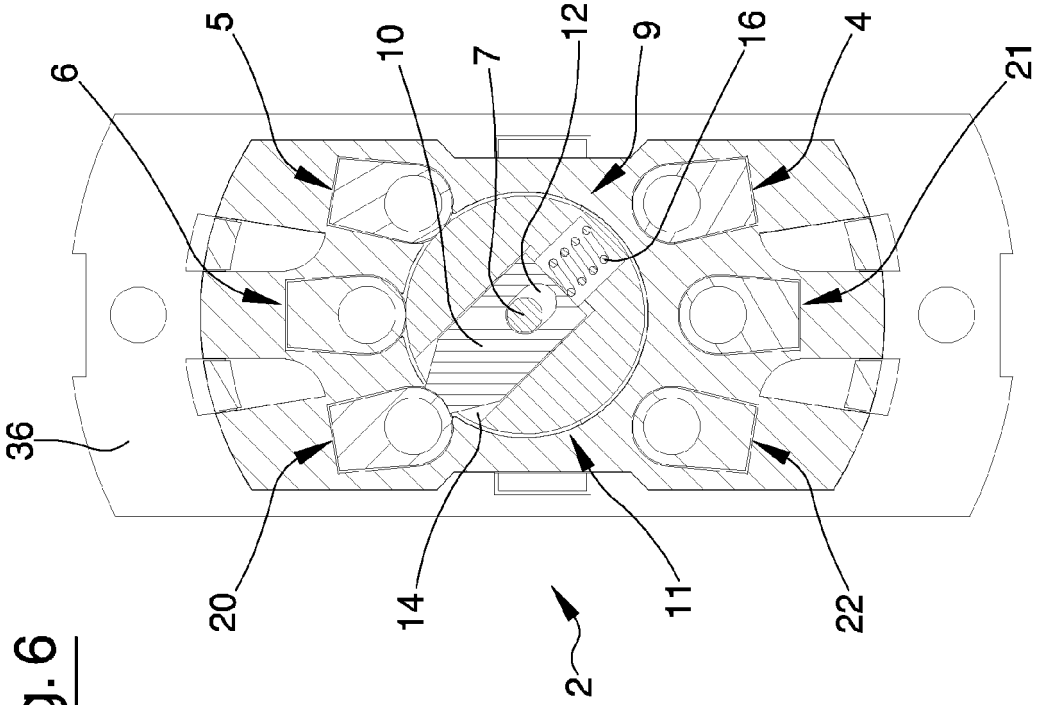
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Fig. 6

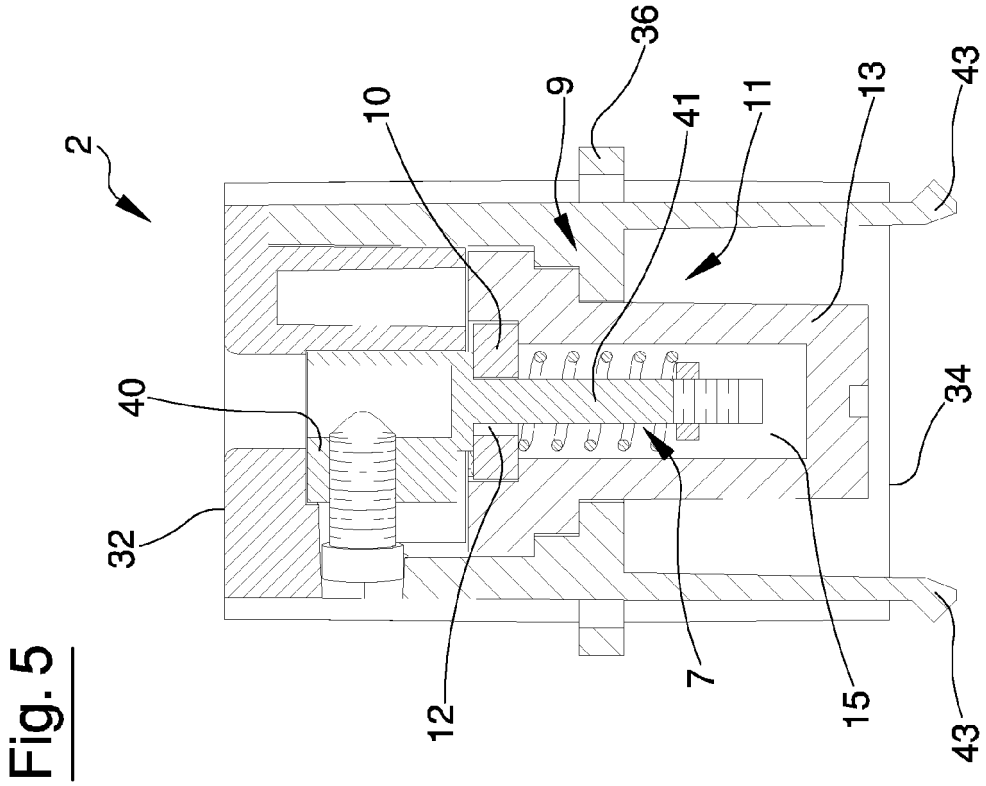
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Fig. 5

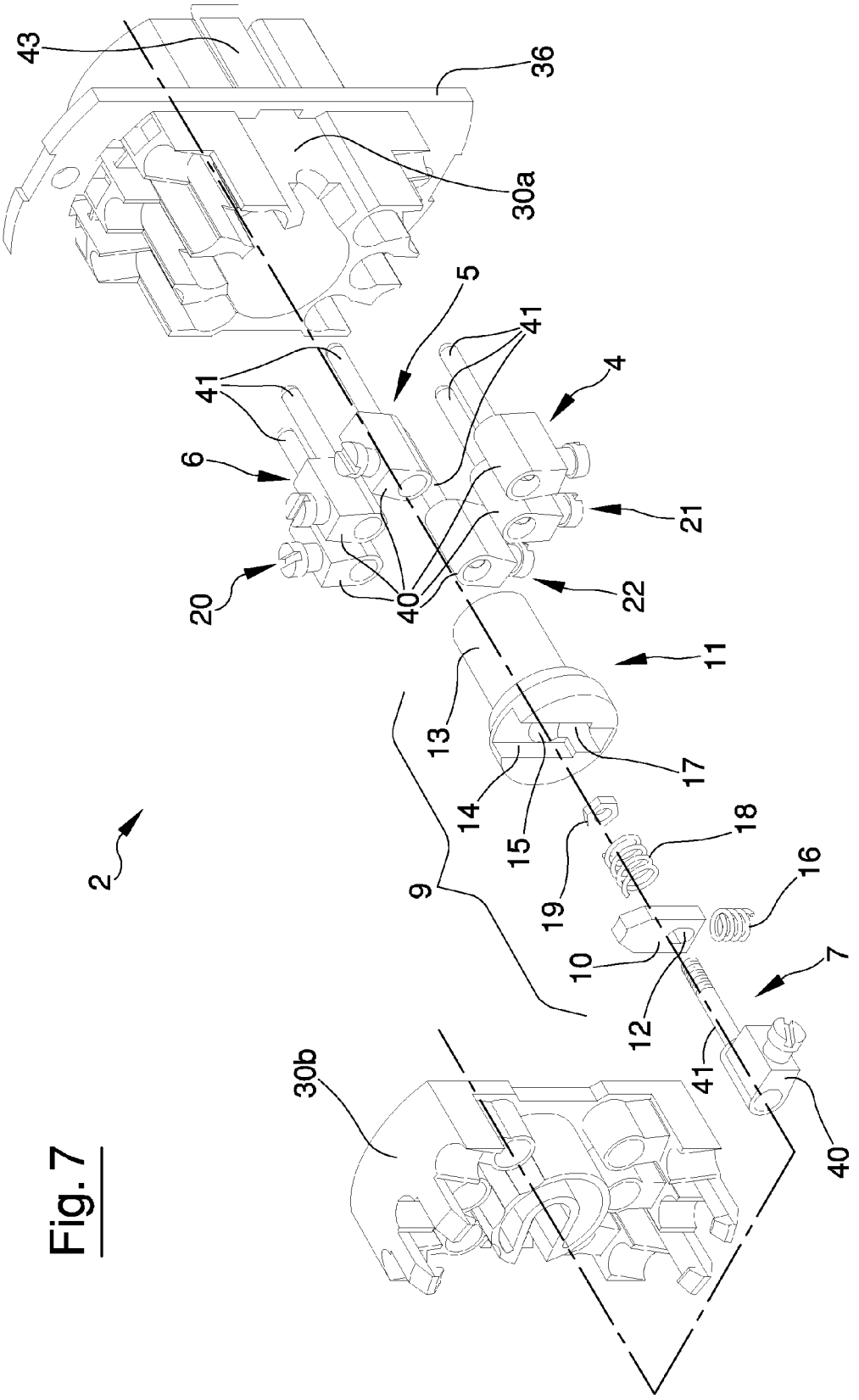
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Fig. 7

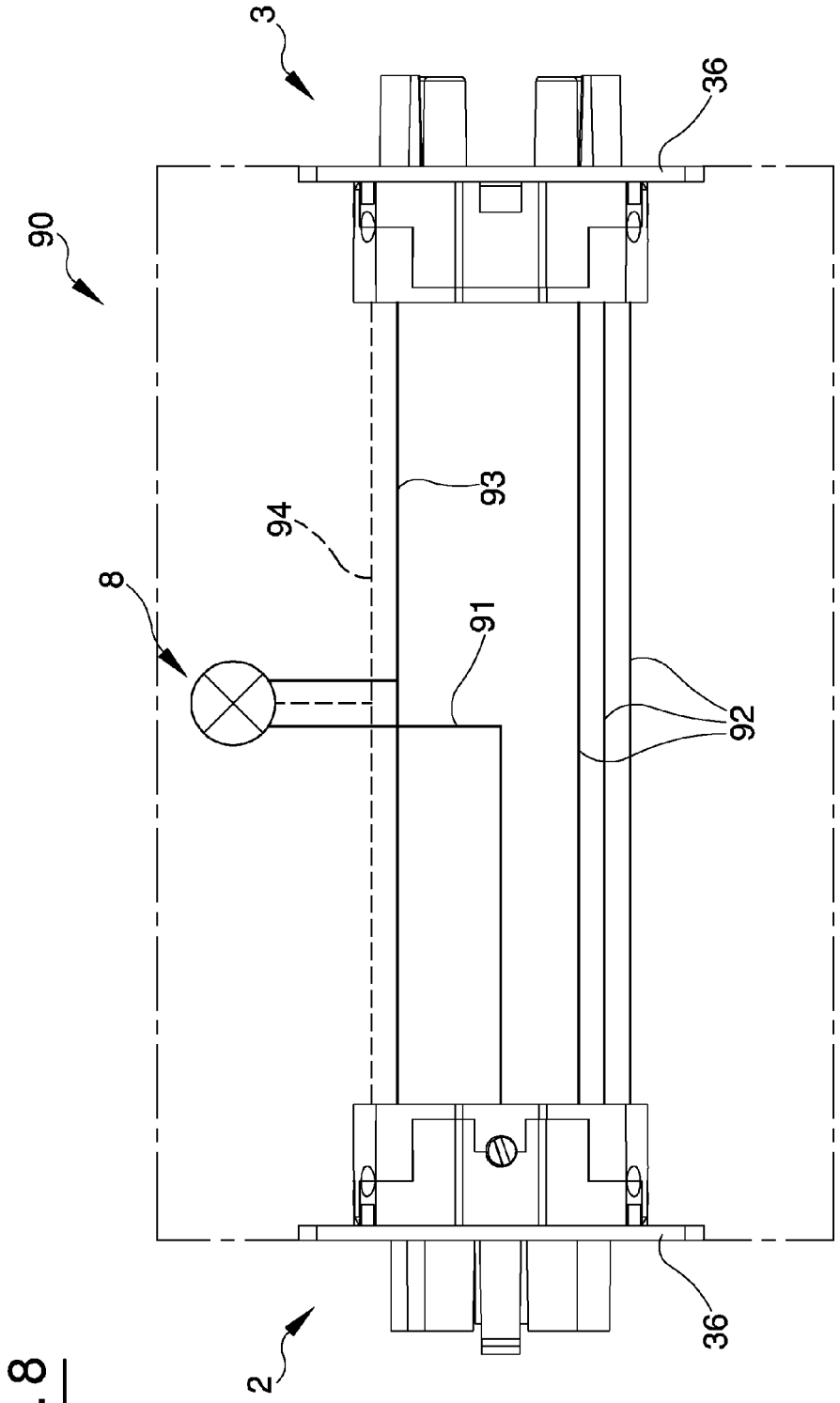

Fig. 8

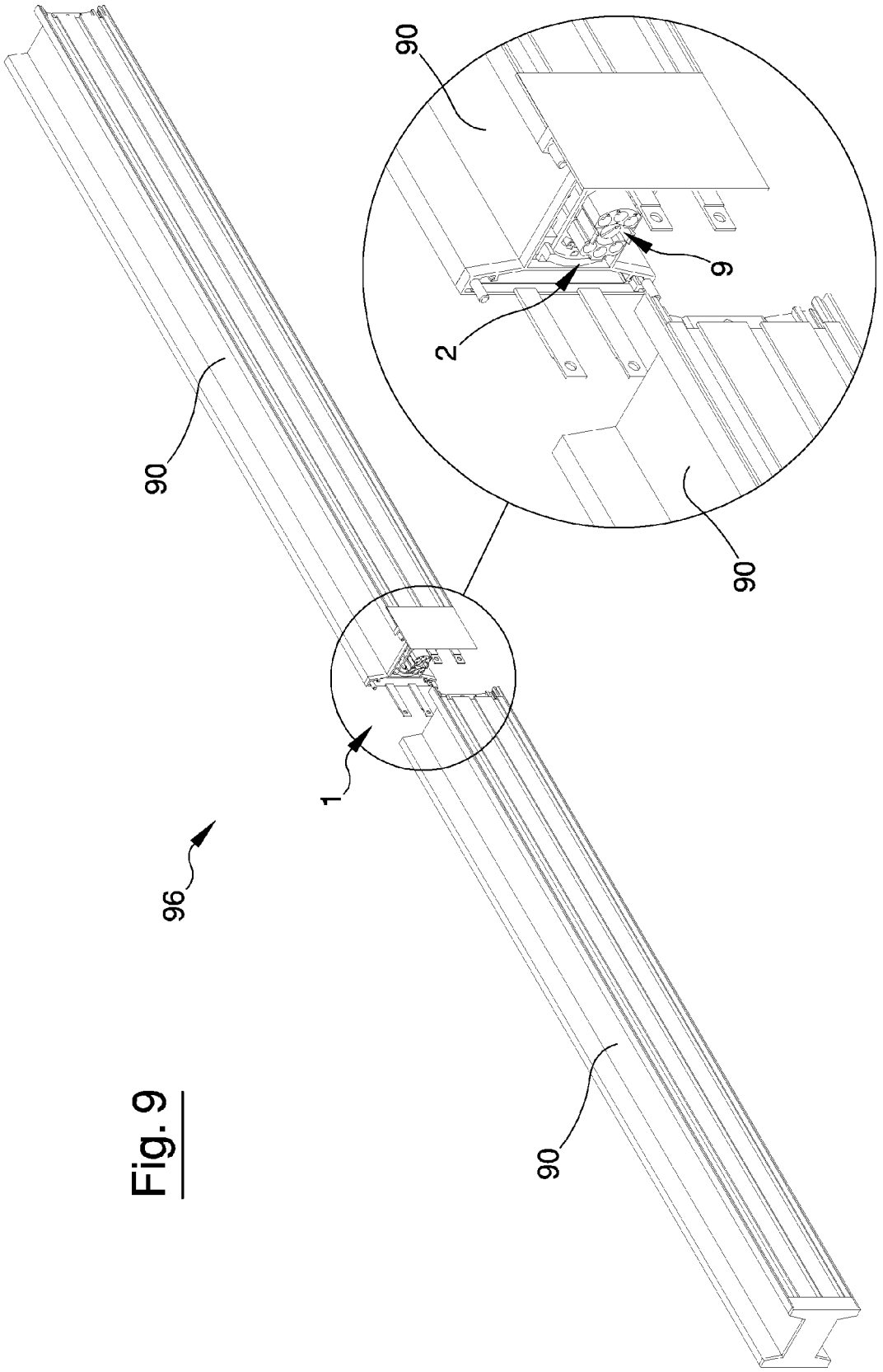

Fig. 9

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EUROPEAN SEARCH REPORT

Application Number
EP 09 17 2846

DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	US 2004/229488 A1 (DEWITT DONALD E [US] ET AL) 18 November 2004 (2004-11-18) * abstract * * paragraph [0020] * * paragraph [0025] - paragraph [0032] * * figures 1-7 *	1-11	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	8 April 2010	Chelbosu, Liviu

CATEGORY OF CITED DOCUMENTS

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3

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