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(54) A CONNECTING TERMINAL

(57) A connecting terminal (100) for electrical wires (2,2',2"), comprising: a busbar assembly (4) comprising a number of clamping sites (6,6',6") for electrical wires; a number of engagement sliders (8,8',8") for changing the configuration of an associated clamping site of said busbar assembly between an open receiving configuration and a closed clamping configuration and vice versa; an electrically insulating housing (10); wherein in respect of one or more of said clamping sites (6,6',6") said busbar assembly (4) comprises a busbar (12) and a spring portion (14,14',14"), wherein said spring portion comprises a first end (16,16',16") and a second end (18,18',18"); wherein said first end of said spring portion being connected to said busbar (12) at a connection site (20,20',20'") at a first end (16,16',16") thereof located at a first end (42) of said busbar; wherein said second end (18,18',18") of said spring portion (14,14',14") comprises one or more engagement parts (22,22') and a connection part (24); said clamping site (6,6',6") being defined between said busbar (12) and said connection part (24) of said spring portion (14,14',14"); wherein said busbar assembly (4) is accommodated in the interior (26) of said housing (10); wherein in respect of one or more of said engagement sliders (8,8',8"), said engagement slider comprises a first end (28) and a second end (30); said first end defining one or more engagement elements (34,34'); wherein in respect of one or more of said engagement sliders (8,8',8"), said first end (28) of said engagement slider is accommodated in the interior (26) of said housing in such a way that said engagement slider (8,8',8") can be displaced into and partly out of said housing (10); and in such a way that said second end (30) of said engagement slider (8,8',8") extends out of said housing (10) through an engagement slider opening (36,36',36") in said housing (10); wherein in respect of one or more clamping sites (6,6',6") of said busbar assembly (4), said engagement slider (8,8',8") is arranged in relation to said busbar assembly (4) in such a way that when said engagement slider (8,8',8") is displaced partly out of said housing in order to arrive at said open receiving configuration, said one or more engagement elements (34,34') of said engagement slider engage with said one or more engagement parts (22,22') of said spring portion (14,14',14") in the sense that the tension of said spring portion is increased, thereby creating a relative wide gap between said busbar (12) and said connection part (24) of said spring portion (14,14',14"); and in such a way that when said engagement slider (8,8',8") is displaced into said housing (10) in order to arrive at said closed clamping configuration, said one or more engagement elements (34,34') of said engagement slider at least partly disengage with said engagement parts (22,22') of said spring portion (14,14',14") in the sense that the tension of said spring portion is decreased, thereby creating a relative narrow gap between said busbar (12) and said connection part (24) of said spring portion (14,14',14"); wherein said housing (10) comprises a number of wire insertion openings (38,38',38"); wherein one or more of said wire insertion opening define a passage (40) into said housing (10), and extending to an associated clamping site (6,6',6") of said busbar assembly (4).

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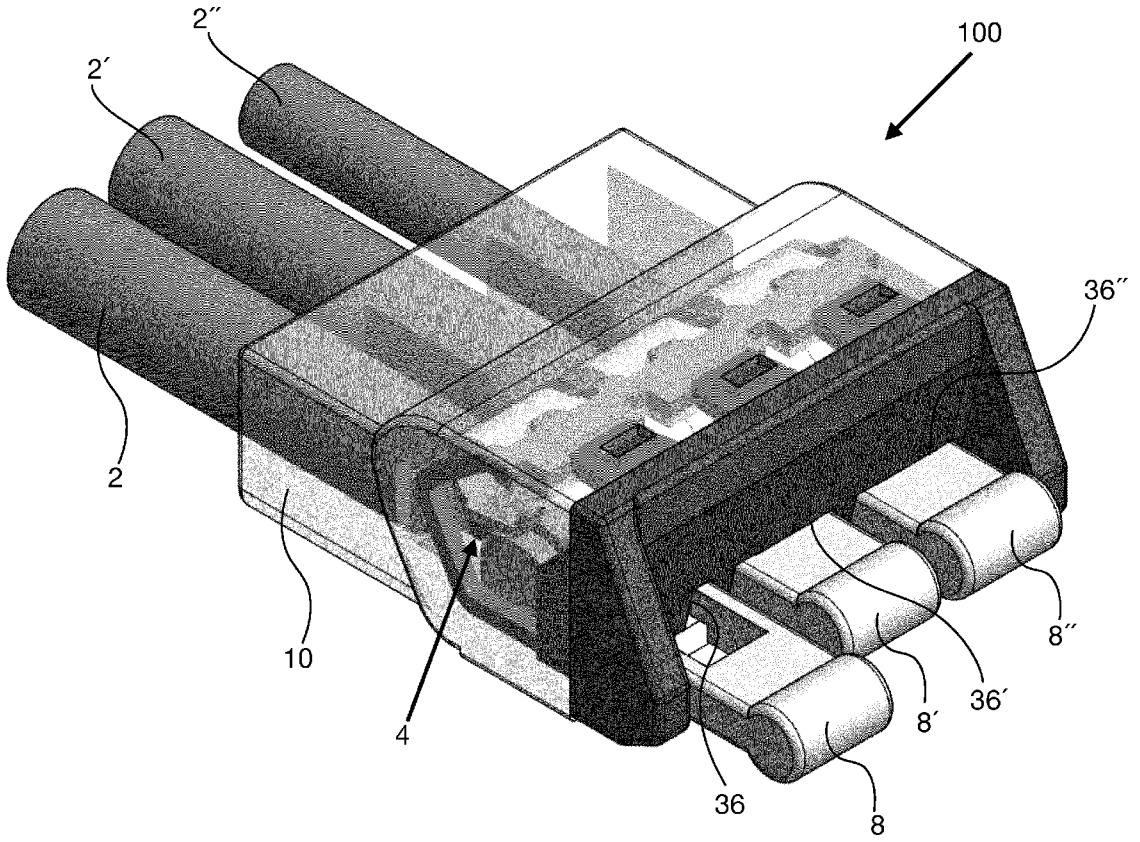

Fig. 1

Description

Field of the invention

[0001] The present invention relates in general to the field of electric connectors.

[0002] More specifically the present invention relates in a first aspect to a connecting terminal for electrical wires.

[0003] In a second aspect the present invention relates to the use of a connecting terminal according to the first aspect of the present invention for electrically insulating, from the surroundings, an electric conductor of one or more wires; or for electrically connecting two or more wires.

Background of the invention

[0004] Within the field of building constructions, such as buildings for offices or homes it is customary to hide the electrical installations of cables being connected to the grid in concealed areas, such as above the ceiling, in installation ducts or in the area being available within the switches being attached to the inner walls of the buildings.

[0005] Hereby an aesthetic appearance of the inner area of the building is attained and at the same time any hazards associated with the risk of encountering electrical shocks are avoided.

[0006] For many years a very popular type of connecting terminal consisted of a plastic housing having embedded therein a busbar. The busbar comprised a couple of screw terminals arranged in pairs and each terminal of each pair of terminals extended in opposite direction. Accordingly, the pairs of screw terminal extended consecutively in a direction perpendicular to the direction of extension of the screw terminals and each pair of screw terminals were separated from its adjacent pair of screw terminals with a couple of small plastic strips which could easily be cut. In this way one could adjust the number pairs of screw terminals needed to a specific job by cutting off that number and leave the rest behind.

[0007] In order to electrically connect two electrical wires to each other, one would arrange one conductor in one opening of a terminal of a pair of screw terminals and screw in the associated screw tightly. The other conductor would similarly be arranged in the opening of the other terminal of the same pair of screw terminals and its associated screw would subsequently be screwed in tightly in order to hold that conductor in place.

[0008] Although this type of a connecting terminal has proven its worth for many years it is a fact that the job of screwing in the screws is rather time consuming, especially in the case of constructing new buildings or in the case of rewiring an existing building where hundreds or even thousands of electrical connections are to be made.

[0009] A special type of connection terminal has recently been introduced into the marked. This connecting terminal comprises a plastic housing which houses a busbar. The housing at one side thereof comprises a range of openings for receiving an end of a wire which is to be connected to the busbar. The openings are arranged in a row. The opposite of the housing comprises a number of toggles corresponding to the number of the openings in that housing. Each toggle of the connecting terminal can be switched between an open configuration and a closed, clamping configuration. In the open configuration the busbar is prepared for receiving an end of the wire at a specific location between said toggle and the corresponding opening in the housing for that wire. This is brought about in that the busbar, in respect of each toggle, comprises a clamping spring which can shift between a tensioned state and a relaxed state.

[0010] When bringing a toggle into an open configuration, that toggle engages the associated clamping spring in such a way that the clamping spring is being lifted from the surface of the busbar. In this configuration and end of a wire can be inserted into the associated opening in the housing. Subsequently, when the toggle is brought to its closed, clamping configuration, the toggle releases the tension of the clamping spring whereby the clamping spring clamps and hence secures the end of the wire between the busbar and the clamping spring.

[0011] The toggle and its elements effecting the tensioning and the relaxing of the clamping spring is in the form of a pivoting arrangement arranged in the housing of the connector.

[0012] Although the above solution in considerably time saving when connecting a great number of wires, compared to the previous described connecting screw terminal, this solution nevertheless suffers from some disadvantages.

[0013] One disadvantage of this terminal is that when one wire is to be connected to the connecting terminal, one must make sure that the configuration of the corresponding toggle is in an open configuration wherein the associated clamping spring is tensioned and thereby prepared to receive an end of a wire. Subsequently, the end of a wire must be inserted into the corresponding opening of the housing. Then, one must make sure that the wire stays in that position while shifting the toggle to a closed, clamping configuration.

[0014] Accordingly, three manual operation must be performed in order to secure a single wire to the connecting terminal described above.

[0015] Moreover, with the connecting terminal of described above, it may easily happen that when the toggle is being shifted from its open configuration to its closed, clamping configuration, the wire moves in the hand of the technician performing the operations, resulting in a failed connection or in that the technician ending up having doubts whether the wire indeed is securely fixed to the terminal. In both situation the entire process has to be repeated.

[0016] Accordingly, there is a need for improving the prior type of connecting terminals which will eliminate the

problems mentioned above.

[0017] The present invention in its various aspect seeks to solve these problems.

[0018] Accordingly, it is an objective of the present invention to provide devices and uses which solve the problems associated with the prior art connection devices.

Brief description of the invention

[0019] These objectives are fulfilled according to the first and the second aspect of the present invention.

[0020] Accordingly, the first aspect of the present invention relates to a connecting terminal for electrical wires, comprising:

- a busbar assembly comprising a number of clamping sites for electrical wires;
- a number of engagement sliders for changing the configuration of an associated clamping site of said busbar assembly between an open receiving configuration and a closed clamping configuration and vice versa;
- an electrically insulating housing;

wherein in respect of one or more of said clamping sites said busbar assembly comprises a busbar and a spring portion, wherein said spring portion comprises a first end and a second end; wherein said first end of said spring portion being connected to said busbar at a connection site thereof located at a first end of said busbar; wherein said second end of said spring portion comprises one or more engagement parts and a connection part; said clamping site being defined between said busbar and said connection part of said spring portion;
wherein said busbar assembly is accommodated in the interior of said housing;
wherein in respect of one or more of said engagement sliders, said engagement slider comprises a first end and a second end; said first end defining one or more engagement elements;
wherein in respect of one or more of said engagement sliders, said first end of said engagement slider is accommodated in the interior of said housing in such a way that said engagement slider can be displaced into and partly out of said housing; and in such a way that said second end of said engagement slider extends out of said housing through an engagement slider opening in said housing;
wherein in respect of one or more clamping sites of said busbar assembly, said engagement slider is arranged in relation to said busbar assembly in such a way that when said engagement slider is displaced partly out of said housing in order to arrive at said open receiving configuration, said one or more engagement elements of said engagement slider engage with said engagement parts of said spring portion in the sense that the tension of said spring portion is increased, thereby creating a relative wide gap between said busbar and said connection part of said spring portion; and in such a way that when said engagement slider is displaced into said housing in order to arrive at said closed clamping configuration, said one or more engagement elements of said engagement slider at least partly disengages with said engagement parts of said spring portion in the sense that the tension of said spring portion is decreased, thereby creating a relative narrow gap between said busbar and said connection part of said spring portion;
wherein said housing comprises a number of wire insertion openings; wherein one or more of said wire insertion openings define a passage into said housing, and extending to an associated clamping site of said busbar assembly.

[0021] In a second aspect the present invention relates to the use of a connecting terminal according to the first aspect of the present invention for electrically insulating, from the surroundings, an electric conductor of one or more wires; or for electrically connecting two or more wires.

[0022] The present invention in its various aspects provides for improved solutions for electrically connecting electrical wires to each other in the form of a connecting terminal. The connecting terminal of the present invention moreover provides for a more easy assembling of wires in that the number og manual operation which must be performed by a technician when electrically connecting a single wire to the inventive connecting terminal can be reduced.

[0023] The connecting terminal of the present invention allows connecting two or more wires of the single core type, the plural core type (such as comprising 8 - 19 wire cores, optionally being twisted or braided) and the multiple core type (such as comprising 20 - 50 wire cores, optionally being twisted or braided).

Brief description of the figures

[0024]

Fig. 1 is a perspective, partly see-through view of a connecting terminal according to the present invention as seen from the engagement slider end thereof.

Fig. 2 is a perspective view of a connecting terminal according to the present invention as seen from the wire insertion openings thereof.

Fig. 3 is a partly see-through plan view of a connecting terminal according to the present invention.

Fig. 4 is a cross-sectional view of a connecting terminal according to the present invention showing an engagement slider in a non-engaged configuration.

Fig. 5 is a cross-sectional view of a connecting ter-

minal according to the present invention showing an engagement slider in an engaged configuration.

Fig. 6 is cross-sectional view of a connecting terminal according to the present invention viewed in one direction.

Fig. 7 is across-sectional view of a connecting terminal according to the present invention viewed in the opposite direction as in Fig. 6.

Fig. 8a is a perspective view showing a busbar assembly of a connecting terminal according to the present invention.

Fig. 8b is a plan view showing a busbar assembly of fig. 8a as seen from one end.

Fig. 8c is across-sectional view of the busbar assembly of fig. 8a.

Fig.9 is a perspective view illustrating an engagement slider to be used in the connecting terminal of the first aspect of the present invention.

Fig. 10a is a perspective view illustrating a preferred embodiment of a connection terminal according to the present invention.

Fig. 10b is a cross-sectional view illustrating the connection terminal shown in Fig. 10a.

Fig. 11a is a perspective view illustrating the engagement slider of the connection terminal shown in fig. 10a and 10b.

Fig. 11b is a side view illustrating the engagement slider shown in fig. 11a.

Fig. 11c is a top view illustrating the engagement slider shown in fig. 11a.

Fig. 11d is a cross-sectional view illustrating the engagement slider shown in fig. 11a.

Fig. 11e is a perspective view illustrating the a cut-through of the engagement slider shown in fig. 11a.

Detailed description of the invention

The first aspect of the present invention

[0025] Accordingly, the first aspect of the present invention relates to a connecting terminal for electrical wires, comprising:

- a busbar assembly comprising a number of clamping sites for electrical wires;
- a number of engagement sliders for changing the configuration of an associated clamping site of said busbar assembly between an open receiving configuration and a closed clamping configuration and vice versa;
- an electrically insulating housing;

wherein in respect of one or more of said clamping sites said busbar assembly comprises a busbar and a spring portion, wherein said spring portion comprises a first end and a second end; wherein said first end of said spring portion being connected to said busbar at a connection site thereof located at a first end of said busbar; wherein said second end of said spring portion comprises one or more engagement parts and a connection part; said clamping site being defined between said busbar and said connection part of said spring portion;
wherein said busbar assembly is accommodated in the interior of said housing;
wherein in respect of one or more of said engagement sliders, said engagement slider comprises a first end and a second end; said first end defining one or more engagement elements;
wherein in respect of one or more of said engagement sliders, said first end of said engagement slider is accommodated in the interior of said housing in such a way that said engagement slider can be displaced into and partly out of said housing; and in such a way that said second end of said engagement slider extends out of said housing through an engagement slider opening in said housing;
wherein in respect of one or more clamping sites of said busbar assembly, said engagement slider is arranged in relation to said busbar assembly in such a way that when said engagement slider is displaced partly out of said housing in order to arrive at said open receiving configuration, said one or more engagement elements of said engagement slider engage with said engagement parts of said spring portion in the sense that the tension of said spring portion is increased, thereby creating a relative wide gap between said busbar and said connection part of said spring portion; and in such a way that when said engagement slider is displaced into said housing in order to arrive at said closed clamping configuration, said one or more engagement elements of said engagement slider at least partly disengages with said engagement parts of said spring portion in the sense that the tension of said spring portion is decreased, thereby creating a relative narrow gap between said busbar and said connection part of said spring portion;
wherein said housing comprises a number of wire insertion openings; wherein one or more of said wire insertion opening define a passage into said housing, and extending to an associated clamping site of said busbar assembly.

[0026] Accordingly, the connection terminal of the first aspect of the present invention allows for connecting a

plurality of electrically wires in a simple way in that the engagement slider 8,8',8" of an associated clamping site 6,6',6" can be slit into and partly out of the hosing in the operation of fastening and unfastening a conductor of the fire from that clamping site.

[0027] In the present description and in the appended claims it should be understood that the terms "relative narrow gap" and "relative wide gap" between the busbar and the connection part of the spring portion are to be interpreted relative to each other. Accordingly, in respect of and "relative wide gap", the distance between the busbar and the connection part of the spring portion is greater than in respect of a "relative narrow gap". It must also be understood that within the meaning of the present description and in the appended claims the term "relative narrow gap" may be interpreted as a "gap" with zero (0) distance between the busbar and the connection part of the spring portion.

[0028] In one embodiment of the connection terminal according to the first aspect of the present invention, the number of clamping sites in the busbar assembly corresponds to the number of engagement sliders and/or wherein the number of clamping sites in the busbar assembly corresponds to the number of wire insertion openings in said housing.

[0029] In one embodiment of the connection terminal according to the first aspect of the present invention the number of clamping sites in said busbar assembly and/or wherein the number of engagement sliders and/or the number of wire insertion openings in said housing independently is selected from the ranges of 1 - 100, such as 2 - 95, for example 3 - 90, such as 4 - 85, e.g. 5 - 80, such as 6 - 1575 for example 7 - 70, such as 8 - 65, such as 9 - 60, for example 10 - 55, such as 15 - 50, e.g. 20 - 45, such as 25 - 40 or 30 - 35.

[0030] In one embodiment of the connection terminal according to the first aspect of the present invention said one or more engagement parts of the spring portion on the one hand and said connection part of the spring portion of said second end of said spring portion on the other hand, in respect of one or more clamping sites of said busbar assembly extend in two different directions. Hereby a secure fastening of the conducting part of the wire can be ensured.

[0031] In one embodiment of the connection terminal according to the first aspect of the present invention the angle between one or both of said two outer engagement parts on the one hand and said connection part on the other hand independently is selected from the ranges of 15 - 120°, such as 20 - 110°, for example 30 - 100°, such as 40 - 90°, e.g. 50 -80° or 60 - 70°. Hereby a secure fastening of the conducting part of the wire can be ensured.

[0032] In one embodiment of the connection terminal according to the first aspect of the present invention said associated connection part of said spring portion, in a closed, clamping configuration in a situation where no wire end is arranged in said clamping site, in respect of one or more clamping sites of said busbar assembly, points towards the second end of said busbar. Hereby a secure fastening of the conducting part of the wire can be ensured.

[0033] In one embodiment of the connection terminal according to the first aspect of the present invention the busbar is U-shaped, comprising a first leg and a second leg connected to each other via a busbar bending portion.

[0034] Providing the bus bar in the form of a U-shape has proven to allow for reducing the physical volume of the connecting terminal.

[0035] In one embodiment of the connection terminal according to the first aspect of the present invention and in respect of one or more of said spring portions, said first end of said spring portion is being connected to said first leg of said busbar and said second end of said spring portion is arranged in the interior space of said U-shaped busbar. This embodiment ensures a minimum physical extension of the busbar assembly.

[0036] In one embodiment of the connection terminal according to the first aspect of the present invention and in respect of two or more clamping sites, preferably in respect of all clamping sites of said busbar assembly, said specific spring portion of said busbar assembly is in the form of an individual, separate spring portion not in itself forming an integral entity with spring portions associated with other clamping sites of said busbar assembly.

[0037] In one embodiment of the connection terminal according to the first aspect of the present invention and in respect of two or more clamping sites, preferably in respect of all clamping sites of said busbar assembly, said spring portions of said busbar assembly are in the form of an integrated entity in the form of a common spring.

[0038] These two alternatives of mode of manufacturing the busbar assembly are equally well-suited.

[0039] In one embodiment of the connection terminal according to the first aspect of the present invention and in respect of one or more of said clamping sites of said busbar assembly, preferably in respect of each clamping sites of said busbar assembly, said busbar comprises a through-going hole in the vicinity of said clamping site, thereby allowing an end of a wire to penetrate said busbar in order to arrive at said clamping site.

[0040] In one embodiment of the connection terminal according to the first aspect of the present invention and in respect one or more of clamping sites of said busbar assembly, preferably in respect of each clamping site of said busbar assembly, said busbar assembly and said housing and said associated engagement slider are designed in such a way that free access for an end of a wire is provided from said wire insertion opening of said housing to said associated clamping site, irrespective of whether said engagement slider is in an open receiving configuration or is in a closed clamping configuration, or is in a configuration therebetween.

[0041] Hereby it is possible to insert a solid core wire into the area of the clamping site irrespective of the po-

sition of the corresponding engagement slider, in relation to the housing.

[0042] In one embodiment of the connection terminal according to the first aspect of the present invention and in respect of one or more of said clamping sites of said busbar assembly, preferably in respect of each clamping sites of said busbar assembly, said engagement slider opening of said housing and said associated wire insertion opening of said housing are arranged at opposite ends of said housing.

[0043] Such a design has proven advantageous in view of the mechanical engagement which need be performed between the engagement slider and the spring portion of the busbar assembly.

[0044] In one embodiment of the connection terminal according to the first aspect of the present invention said busbar is being made from an electrically conducting material, such as a metal or an alloy and/or wherein each said spring portion of said busbar assembly is being made from an electrically conducting material, such as a metal or an alloy. Hereby, optimum electric conductivity is ensured.

[0045] In one embodiment of the connection terminal according to the first aspect of the present invention said engagement slider is being made from an electrically isolating material, such as a polymer, such as PBT (polybutadiene terephthalate), such as a PBT composite, such as glass filled PBT; or nylon.

[0046] In one embodiment of the connection terminal according to the first aspect of the present invention said housing is being made from an electrically isolating material, such as a polymer, such as polycarbonate.

[0047] PBT and polycarbonate have proven suitable for the stated purposes.

[0048] In one embodiment of the connection terminal according to the first aspect of the present invention and in respect of one or more of said engagement sliders, preferably in respect of each said engagement sliders, said second end of said engagement slider comprises one or more knobs for improving handling thereof.

[0049] In one embodiment of the connection terminal according to the first aspect of the present invention one of said one or more knobs comprises an indent for ease of handling thereof.

[0050] One or more indents allows for easy grapping, such as grapping by one or two fingers, in the handling of the engagement sliders.

[0051] In one embodiment of the connection terminal according to the first aspect of the present invention said one or more knobs extend in a direction perpendicular to the lengthwise direction of sliding of said engagement slider in and out of said housing.

[0052] In one embodiment of the connection terminal according to the first aspect of the present invention and in respect of one or more of said spring portions, said spring portion comprises two engagement parts and one connection part, said connection part being arranged between said two engagement parts.

[0053] In one embodiment of the connection terminal according to the first aspect of the present invention and in respect of one or more of said engagement sliders, said first end of said engagement slider defines two fork portions, wherein each fork portion comprises an engagement element.

[0054] Hereby improved engagement between the two engagement parts of the spring portion and the two engagement elements of the engagement slider.

[0055] In one embodiment of the connection terminal according to the first aspect of the present invention said connecting terminal is having dimensions and geometries which allow insertion of one or more wires via said wire insertion openings and securing said one or more wires at said one or more clamping sites, wherein said one or more wires are of the types having dimension selected from the ranges: 0.1 - 4.0 mm^2, such as 0.2 - 3 mm^2, e.g. 0.3 - 2.5 mm^2, for example 0.4 - 2.0 mm^2, such as 0.5 - 1.8 mm^2, for example 0.8 - 1.5 mm^2, such as 1.0 - 1.25 mm^2.

[0056] Such dimensions are common in the electric installations of buildings.

The second aspect of the present invention

[0057] In a second aspect the present invention relates to the use of a connecting terminal according to the first aspect of the present invention for electrically insulating, from the surroundings, an electric conductor of one or more wires; or for electrically connecting two or more wires. Referring now to the figures for illustrating the present invention in more detail, Fig. 1 and 2 are perspective view showing a connecting terminal according to the first aspect of the present invention.

[0058] Fig. 1 and 2 show in a partly transparent perspective view the connecting terminal 100 as seen from two different perspectives. The connecting terminal of Fig. 1 comprises a housing 10 in the interior of which is arranged a busbar assembly 4. In one end of the housing engagement slider openings 36, 36',36" are provided which accommodates the engagement sliders 8,8',8".

[0059] As seen in Fig. 2 three ends of wires 2,2',2" have been inserted into wire insertion openings 38,38',38" arranged in the opposite end of the housing 10 of the connecting terminal, compared to the end accommodating the engagement sliders 8,8',8".

[0060] As explained in more detail below each engagement slider 8,8',8" may, by displacement, engage with the busbar assembly 4 in such a way that in respect of a specific wire end being inserted into a specific wire insertion opening 38,38',38", the busbar assembly may alter its configuration between an open receiving configuration wherein the busbar assembly 4 will be prepared for receiving an end of a wire 2,2',2" and a closed clamping configuration, in which the busbar assembly clamps the end of the wire 2,2',2" being inserted in a specific wire insertion opening 38,38',38", thereby securing that wire 2,2',2" to the busbar assembly 4.

[0061] As there is access to the same busbar assembly 4 from each wire insertion opening 38,38',38" of the connecting terminal, a number of wires can be electrically connected to each other using the connecting terminal of the first aspect of the present invention.

[0062] Now, as the busbar assembly 4 is a key component of the connecting terminal 100 of the first aspect of the present invention, lest now turn to Fig. 8a, Fig. 8b and Fig. 8c. illustrating the busbar assembly.

[0063] Fig. 8a is a perspective view illustrating one embodiment of a busbar assembly to be used with the connection termination 100 of the first aspect of the present invention.

[0064] Fig. 8a shows that the busbar assembly 4 comprises a busbar 12 and three spring portions 14,14',14".

[0065] It is seen in Fig. 8a that the busbar 12 is U-shaped, comprising a first leg 46 and a second leg 48 connected to each other via a busbar bending portion 50.

[0066] Each spring portion 14,14',14" is attached at a first end thereof 16,16',16" to the first end 42 of the U-shaped busbar 12. The opposite, second end 18,18',18" of each spring portion 14,14',14" comprises a two outer engagement parts 22,22' and a middle connection part 24.

[0067] The clamping site 6,6',6" for a conductor of an end of a wire 2,2',2" is being defined as the space between the busbar 12 and the connection part 24 of each of the spring portion 14,14',14".

[0068] Accordingly, it is the connection part 24 of the busbar assembly 4 which together with the busbar 12 itself provides for clamping a wire end to the connecting terminal.

[0069] Fig. 8b is a front view of the busbar assembly illustrated in Fig. 8a.

[0070] Fig. 8b illustrates that the spring portions 14,14',14" are connected to the first end 42 of the busbar 12 at a connection site 20,20',20".

[0071] Fig. 8b also illustrates that the busbar 12, in respect of each clamping site 6,6',6" comprises a through-going hole 54,54',54" in the vicinity of said clamping site 6,6',6", thereby allowing an end of a wire 2,2',2" to penetrate said busbar in order to arrive at said clamping site 6,6',6".

[0072] Fig. 8c is a side view of the busbar assembly 4 illustrated in Fig. 8a and 8b.

[0073] Fig. 8c shows the busbar assembly 4 comprising the U-shaped busbar 12 with its two legs 46,48 and the busbar bending portion 50. The busbar 12 thus comprises the first end 42 and second end 44.

[0074] It is seen in Fig. 8c that one spring portion 14 is brought in its open, receiving configuration in which the corresponding clamping site is prepared to receive an end of an electric wire 2.

[0075] In contrast, the adjacent spring portion 14' is in its closed, clamping configuration in which the connecting part 24 of the spring portion 14' by virtue of the spring effect inherent for that spring portion 14' is pressed against the busbar 12 at the corresponding clamping site 6'.

[0076] It is seen that the connection part 24 of the spring portion 14', in its closed clamping configuration in this situation where no wire end is arranged in said clamping site 6', points towards the second end 44 of said busbar 12.

[0077] Fig. 8c also illustrates that the second end 18,18' of the spring portions 14,14' are arranged in the interior space 52 of the U-shaped busbar 12.

[0078] Moreover, it is seen in Fig. 8c that in respect of each spring portion 14,14' the outer engagement parts 22,22' of the spring portion on the one hand and the connection part 24 of the spring portion on the other hand of the second end 18,18' extends in two different directions, at an angle α which is slightly less than 90°.

[0079] In the embodiment of the busbar assembly 4 illustrated in Fig. 8a, 8b and 8c the spring portions 14,14',14" of the busbar assembly is in the form of an individual, separate spring portion not in itself forming an integral entity with spring portions associated with other clamping sites 6,6',6" of said busbar assembly.

[0080] Alternatively, the spring portions 14,14',14" of the busbar assembly 4 may be in the form of an integrated, common spring.

[0081] The busbar 12 is common in respect of each of the clamping sites 6,6',6".

[0082] In order to shift the configuration of a spring portion 14,14',14" in respect of the associated clamping site 6,6',6" between an open receiving configuration and a closed clamping configuration and vice versa, an associated engagement slider 8,8',8" is used.

[0083] The design of an embodiment of an engagement slider is illustrated in fig. 9 which is a perspective view illustrating an engagement slider 8,8',8" to be used with the busbar assembly illustrated in Fig. 8a, 8b, and 8c.

[0084] Fig.9 shows the engagement slider 8,8',8". The engagement slider 8,8',8" comprises a first end 28 which is intended to be accommodated in the interior 26 of the housing in such a way that the engagement slider 8,8',8" can be displaced into and partly out of said housing 10.

[0085] The engagement slider 8,8',8" also comprises a second end 30 which is intended for extending out of the housing 10 of the connecting terminal 100 through an engagement slider opening 36,36',36" therein.

[0086] Also seen in Fig. 9, the first end 28 of the engagement slider 8,8',8" defines two fork portions 32,32'. Each fork portion 32,32' comprising an engagement element 34.

[0087] The engagement slider 8,8',8" in its second end 30 comprises a knob 56 for ease of handling thereof.

[0088] When the engagement slider 8,8',8" illustrated in Fig. 9 is arranged in combination with the busbar assembly illustrated in Fig. 8a, 8b and 8c in such a way the fork engagement elements 34 of the engagement slider 8,8',8" engages with the two engagement parts 22,22' of a spring portion 14,14',14", when the engagement slider is displaced in the direction L as illustrated in Fig. 9, it is

possible, by displacement of the engagement slider 8,8',8", to change the configuration of an associated clamping site 6,6',6"of the busbar assembly 4 between an open receiving configuration and a closed clamping configuration and vice versa.

[0089] This is brought about by making sure that when an engagement slider 8,8',8" is displaced partly out of the housing 10 of the connecting terminal in order to arrive at said open receiving configuration, the fork engagement elements 34 of said engagement slider engage with said engagement parts 22,22' of said spring portion 14,14',14" in the sense that the tension of the spring portion is increased, thereby creating a relative wide gap between the busbar 12 and the connection part 24 of the spring portion 14,14',14"; and by making sure that when the engagement slider 8,8',8" is displaced into the housing 10 in order to arrive at the closed clamping configuration, the fork engagement elements 34 of the engagement slider at least partly disengages with the engagement parts 22,22' of the spring portion 14,14',14" in the sense that the tension of the spring portion is decreased, thereby creating a relative narrow gap, or even a gap of zero (i.e. zero (0) distance between the busbar 12 and the connection part 24) between said busbar 12 and said connection part 24 of the spring portion 14,14',14".

[0090] These two situations are further illustrating in Fig. 4 and 5.

[0091] First, however, we refer to Fig. 3 which is a partly transparent, top view illustrating a connecting terminal 100 according to the first aspect of the present invention. Fig. 3 illustrates the specific cross-sections A-A, C-C, D-D and E-E which are further illustrated in Fig. 4, Fig. 5, Fig. 6 and Fig. 7, respectively.

[0092] Accordingly, Fig. 4 is a cross-sectional view through the cut C-C, that is through the fork portion 32' of the engagement slider 8' in a longitudinal direction.

[0093] Fig. 4 illustrates a configuration of the engagement slider 8', its associated clamping site 6' is in a closed, clamping configuration in which the engagement slider 8' is displaced into the housing 10, thereby creating a relative narrow gap (in this situation, a gap of zero distance) between the busbar 12 and the connection part 24 of the spring portion 14'.

[0094] In this configuration an end of a conductor of a wire 2' would have been clamped between the busbar 12 and the connection part 24 of the spring portion 14', in case such wire 2' had been inserted into the wire insertion opening 38.

[0095] Fig. 5 is a cross-sectional view through the cut A-A, that is through the middle of the engagement slider 8 in a longitudinal direction.

[0096] Fig. 5 illustrates a configuration of the engagement slider 8 and its associated clamping site 6 is in a open, receiving configuration in which the engagement slider 8 is displaced partly out of the housing 10. Thereby the fork engagement element 34 of the slider 8 has engaged with the engagement parts 22,22' of the spring portion 14 of the busbar assembly. This has the consequence that the second end 18 of the spring portion 14 has been lifted, thereby creating a relative large gap between the busbar 12 and the connection part 24 of the spring portion 14. In the configuration illustrated in fig. 5 the clamping site 6 corresponding to the spring portion 14 and the engagement slider 8 has been prepared for receiving an end of a wire 2.

[0097] Once displaced into the housing, the engagement slider 8 will relieve the tension of the spring portion 14 and we will arrive at a situation corresponding to that of Fig. 4.

[0098] In contrast to the prior art connecting terminals which comprises toggles arranged in a pivoting arrangement, the connecting terminal of the first aspect of the present invention makes it possible to provide free access for an end of a wire 2,2',2" from the wire insertion opening 38,38',38" of the housing 10 to the associated clamping site 6,6',6", irrespective of whether the engagement slider 8,8',8" is in an open receiving configuration or is in a closed clamping configuration, or is in a configuration therebetween. Obviously, in case the engagement slider 8,8',8" is in an open receiving configuration, in which it is slit partly out of the housing 10, when the end of the wire 2,2',2" is entered into the clamping site 6,6',6" via the insertion opening 38,38',38", the user will have to slit that engagement slider into the housing 10 in order to lock the conducting end of the wire 2,2',2" between the connection part 24 of the spring portion 14,14',14" and the bus bar 12.

[0099] This is an advantage in case the conductors of the wires, which are to be connected to the connecting terminal of the invention, comprises a single solid, rigid wire and not a plurality of soft wires which have been braided or twisted.

[0100] In the former situation it will be possible to connect a conductor to the busbar 12 of the connecting terminal 100 of the invention simply by inserting the wire 2,2',2" into an insertion opening 38,38',38, in respect of which the corresponding engagement slider already has been brought into a closed, clamping configuration.

[0101] As the end of the wire 2,2',2" is pushed further and further into the interior of the housing 26, though the wire insertion opening 38,38',38", the end of that wire will eventually engage with the connecting part 24 of the associated spring portion 14,14',14".

[0102] Once engaged with the connecting part 24 of the associated spring portion 14,14',14", the wire, when pushed just a little bit further into the opening 38,38',38", will fixed in the sense that the wire cannot be pulled out of the insertion opening without having to bring the spring portion 14,14',14" and the associated clamping site 6,6',6" into an open, receiving configuration by displacing the corresponding engagement slider 8,8',8" partly out of the housing.

[0103] Accordingly, the connecting part 24 of the spring portion 14,14',14" in pointing towards the busbar 12 at the clamping site 6,6',6" acts as a barb fixing the end of the wire to the clamping site 6,6',6", until it is being dis-

engaged by partly displacing the corresponding engagement slider 8,8',8" partly out of the housing 10.

[0104] Fig. 6 is a cross sectional view through the cut E-E, that is a transversal cut of the connecting terminal 100 looking into the wire insertion openings 38,38',38".

[0105] Fig. 6 illustrates in respect of the clamping site 6 and its associated spring portion 14, that these elements are clamping a wire 2 between the busbar 12 and the connecting part 24 of the spring portion 14.

[0106] Fig. 7 a cross-sectional view of the same situation as illustrated in Fig. 6, this time the cross-section being a cut D-D, that is a transversal cut of the connecting terminal 100 looking into the engagement slider end of the connecting terminal 100.

[0107] Again, it is illustrated that in respect of the clamping site 6 and its associated spring portion 14, these elements are clamping a wire 2 between the busbar 12 and the connecting part 24 of the spring portion 14, whereas in respect of the clamping sited 6' and 6" no wire end has been clamping into place.

[0108] In order to ease handling of the connection terminal 100, particularly in the operation of handling the engagement sliders 8,8',8" it is preferred that the second end 30 of the engagement sliders comprise one or more knobs 56 that ensure that the fingers of a technician do not slip when pulling the engagement sliders out og the housing 10. Such a knob or such knobs will also make it easier to slide the engagement sliders 8,8',8" into the housing. Accordingly, in a preferred embodiment of the connecting terminal 100 of the present invention, the connecting terminal 100, in respect of one or more of said engagement sliders 8,8',8", preferably in respect of each said engagement sliders, the second end 30 of the engagement slider comprises one or more knobs 56 for improving handling thereof.

[0109] Such an embodiment is seen in Fig. 10a.

[0110] Fig. 10a is a perspective view of a connection terminal 100 of the present invention. Fig. 10a discloses the connection terminal 100 into which three electrical wires 2,2',2" have been inserted. The second end 30 of the engagement sliders 8,8',8" comprises a knob 56.

[0111] In order to provide even better handling of the engagement sliders 8,8',8", it is preferred to provide each of the second ends 30 of the engagement sliders 8,8',8" with one or more indents 58 that improves the ability for a technician's finger to get a firm grip on the engagement sliders when pulling the engagement sliders 8,8',8" out of the housing 10. This is illustrated in Fig. 10b.

[0112] Fig 10b is a cross-sectional view of the connection terminal 100 of Fig. 10a as seen along a cut in the lengthwise direction L of the engagement slider.

[0113] Fig. 10b shows that the second end 30 of the engagement slider 8 comprises a knob 56 and that the second end of the engagement slider comprises an upper indent 58 and a lower indent 58.

[0114] These indents 58 improves the grip of fingers when pulling the engagement sliders 8,8',8" out of the housing 10 of the connection terminal 100.

[0115] Fig. 11a, 11b, 11c, 11d and 11e discloses the engagement slider 8,8',8" from the connection terminal illustrated in Fig. 10a and 10b in more detail.

[0116] Fig. 11a, 11b and 11c are a perspective view, a side view and a top view, respectively, illustrating the engagement slider 8,8',8" from the connection terminal illustrated in Fig. 10a and 10b.

[0117] Fig. 11d is a cross-sectional side view and Fig. 11e is a perspective cross-sectional view illustrating the same engagement slider cut through the cross-section A-A as illustrated in Fig. 11c.

[0118] Fig. 11a, 11b, 11c, 11d and 11e clearly discloses the presence of a knob 56 and the arrangement of two indents 58 in this knob.

[0119] Also seen in these figures is that in this special embodiment the first end 28 of the engagement slider comprises the fork portions 32,32 each of which comprises an engagement element 34,34'.

[0120] It should be understood that all features and achievements discussed above and in the appended claims in relation to one aspect of the present invention and embodiments thereof apply equally well to the other aspects of the present invention and embodiments thereof.

List of reference numerals

[0121]

2,2',2"	Electrical wire
4	Busbar assembly
6,6',6"	Clamping site
8,8',8"	Engagement slider
10	Housing
12	Busbar of busbar assembly
14,14',14"	Spring portion of busbar assembly
16,16',16",	First end of spring portion
18,18',18"	Second end of spring portion
20,20',20"	Connection site connecting spring portion to busbar
22,22'	Engagement part of spring portion
24	Connection part of spring portion
26	Interior of housing
28	First end of engagement slider
30	Second end of engagement slider
32,32'	Fork portion of engagement slider
34,34'	Engagement element of engagement slider
36,36',36"	Engagement slider opening in housing
38,38',38"	Wire insertion opening in housing
40,40',40"	Passage for wire end
42	First end of busbar
44	Second end of busbar
46	First leg of busbar
48	Second leg of busbar
50	Busbar bending portion
52	Interior space of U-shaped busbar
54,54',54"	Through-going hole in busbar

56	Knob of second end of engagement slider
58	Indent in knob
100	Connecting terminal
α	Angle
L	Lengthwise direction of displacement

Claims

1. A connecting terminal (100) for electrical wires (2,2',2"), comprising:

- a busbar assembly (4) comprising a number of clamping sites (6,6',6") for electrical wires;
- a number of engagement sliders (8,8',8") for changing the configuration of an associated clamping site of said busbar assembly between an open receiving configuration and a closed clamping configuration and vice versa;
- an electrically insulating housing (10);

wherein in respect of one or more of said clamping sites (6,6',6") said busbar assembly (4) comprises a busbar (12) and a spring portion (14,14',14"), wherein said spring portion comprises a first end (16,16',16") and a second end (18,18',18"); wherein said first end of said spring portion being connected to said busbar (12) at a connection site (20,20',20'") at a first end (16,16',16") thereof located at a first end (42) of said busbar; wherein said second end (18,18',18") of said spring portion (14,14',14") comprises one or more engagement parts (22,22') and a connection part (24); said clamping site (6,6',6") being defined between said busbar (12) and said connection part (24) of said spring portion (14,14',14");
wherein said busbar assembly (4) is accommodated in the interior (26) of said housing (10);
wherein in respect of one or more of said engagement sliders (8,8',8"), said engagement slider comprises a first end (28) and a second end (30); said first end defining one or more engagement elements (34,34');
wherein in respect of one or more of said engagement sliders (8,8',8"), said first end (28) of said engagement slider is accommodated in the interior (26) of said housing in such a way that said engagement slider (8,8',8") can be displaced into and partly out of said housing (10); and in such a way that said second end (30) of said engagement slider (8,8',8") extends out of said housing (10) through an engagement slider opening (36,36',36") in said housing (10);
wherein in respect of one or more clamping sites (6,6',6") of said busbar assembly (4), said engagement slider (8,8',8") is arranged in relation to said busbar assembly (4) in such a way that when said engagement slider (8,8',8") is displaced partly out of said housing in order to arrive at said open receiving configuration, said one or more engagement elements (34,34') of said engagement slider engage with said one or more engagement parts (22,22') of said spring portion (14,14',14") in the sense that the tension of said spring portion is increased, thereby creating a relative wide gap between said busbar (12) and said connection part (24) of said spring portion (14,14',14"); and in such a way that when said engagement slider (8,8',8") is displaced into said housing (10) in order to arrive at said closed clamping configuration, said one or more engagement elements (34,34') of said engagement slider at least partly disengage with said engagement parts (22,22') of said spring portion (14,14',14") in the sense that the tension of said spring portion is decreased, thereby creating a relative narrow gap between said busbar (12) and said connection part (24) of said spring portion (14,14',14");
wherein said housing (10) comprises a number of wire insertion openings (38,38',38"); wherein one or more of said wire insertion opening define a passage (40) into said housing (10), and extending to an associated clamping site (6,6',6") of said busbar assembly (4).

2. A connecting terminal (100) according to claim 1, wherein the number of clamping sites (6,6',6") in the busbar assembly (4) corresponds to the number of engagement sliders (8,8',8") and/or wherein the number of clamping sites (6,6',6") in the busbar assembly (4) corresponds to the number of wire insertion openings (38,38',38") in said housing.

3. A connecting terminal (100) according to any of the preceding claims, wherein in respect of one or more clamping sites (6,6',6") of said busbar assembly (4), said one or more engagement parts (22,22') of the spring portion (14,14',14") on the one hand and said connection part (24) of the spring portion (14,14',14") of said second end (18,18',18") of said spring portion (14,14',14") on the other hand, extend in two different directions.

4. A connecting terminal (100) according to claim 3, wherein the angle (α) between one or both of said two outer engagement parts (22,22') on the one hand and said connection part (24) on the other hand independently is selected from the ranges of 15 - 120°, such as 20 - 110°, for example 30 - 100°, such as 40 - 90°, e.g. 50 -80° or 60 - 70°.

5. A connecting terminal (100) according to any of the preceding claims, wherein in respect of one or more clamping sites (6,6',6") of said busbar assembly (4) said associated connection part (24) of said spring portion (14,14',14"), in a closed, clamping configuration in a situation where no wire end is arranged in said clamping site, points towards the second end

(44) of said busbar (12).

6. A connecting terminal (100) according to any of the preceding claims, wherein said busbar (12) is U-shaped, comprising a first leg (46) and a second leg (48) connected to each other via a busbar bending portion (50); wherein optionally in respect of one or more of said spring portions (14,14',14"), said first end (16,16',16") of said spring portion is being connected to said first leg (46) of said busbar (12) and wherein said second end (18,18',18") of said spring portion is arranged in the interior space (52) of said U-shaped busbar.

7. A connecting terminal (100) according to any of the preceding claims wherein in respect of two or more clamping sites (6,6',6"), preferably in respect of all clamping sites of said busbar assembly (4), said specific spring portion (14,14',14") of said busbar assembly is in the form of an individual, separate spring portion not in itself forming an integral entity with spring portions associated with other clamping sites (6,6',6") of said busbar assembly.

8. A connecting terminal (100) according to any of the claims 1 - 6, wherein in respect of two or more clamping sites (6,6',6"), preferably in respect of all clamping sites of said busbar assembly (4), said spring portions of said busbar assembly are in the form of an integrated entity in the form of a common spring.

9. A connecting terminal (100) according to any of the preceding claims, wherein in respect of one or more of said clamping sites (6,6',6") of said busbar assembly, preferably in respect of each clamping sites of said busbar assembly, said busbar (12) comprises a through-going hole (54,54',54") in the vicinity of said clamping site (6,6',6"), thereby allowing an end of a wire (2,2',2") to penetrate said busbar in order to arrive at said clamping site (6,6',6").

10. A connecting terminal (100) according to any of the preceding claims, wherein in respect one or more of clamping sites (6,6',6") of said busbar assembly (4), preferably in respect of each clamping site of said busbar assembly, said busbar assembly (4) and said housing (10) and said associated engagement slider (8,8',8") are designed in such a way that free access for an end of a wire (2,2',2") is provided from said wire insertion opening (38,38',38") of said housing (10) to said associated clamping site (6,6',6"), irrespective of whether said engagement slider (8,8',8") is in an open receiving configuration or is in a closed clamping configuration, or is in a configuration therebetween.

11. A connecting terminal (100) according to any of the preceding claims, wherein in respect of one or more of said clamping sites (6,6',6") of said busbar assembly (4), preferably in respect of each clamping sites of said busbar assembly, said engagement slider opening (36,36',36") of said housing and said associated wire insertion opening (38,38',38") of said housing are arranged at opposite ends of said housing (10).

12. A connecting terminal (100) according to any of the preceding claims, wherein in respect of one or more of said engagement sliders (8,8',8"), preferably in respect of each said engagement sliders, said second end (30) of said engagement slider comprises one or more knobs (56) for improving handling thereof;
wherein optionally one of said one or more knobs (56) comprises an indent (58, 58') for ease of handling thereof and/or
wherein optionally said one or more knobs (56) extend in a direction perpendicular to the lengthwise direction (L) of sliding of said engagement slider (36,36',36") in and out of said housing (10).

13. A connecting terminal (100) according to any of the preceding claims, wherein in respect of one or more of said spring portions (14,14',14"), said spring portion (14,14',14") comprises two engagement parts (22,22') and one connection part (24), said connection part (24) being arranged between said two engagement parts (22,22').

14. A connecting terminal (100) according to any of the preceding claims, wherein in respect of one or more of said engagement sliders (8,8',8 "), said first end (28) of said engagement slider (8,8',8") defines two fork portions (32,32'), wherein each fork portion comprises an engagement element (34,34').

15. Use of a connecting terminal (100) according to any of the preceding claims for electrically insulating, from the surroundings, an electric conductor of one or more wires (2,2',2"); or for electrically connecting two or more wires (2,2',2").

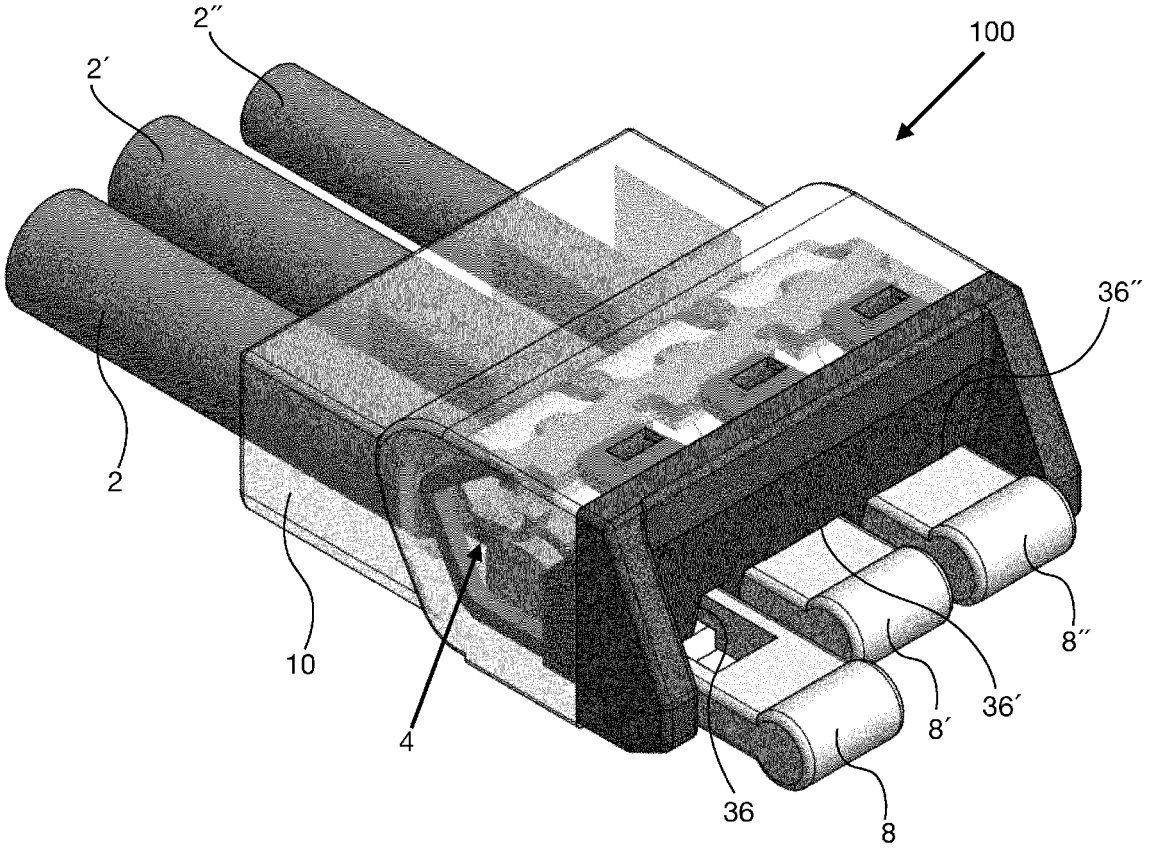

Fig. 1

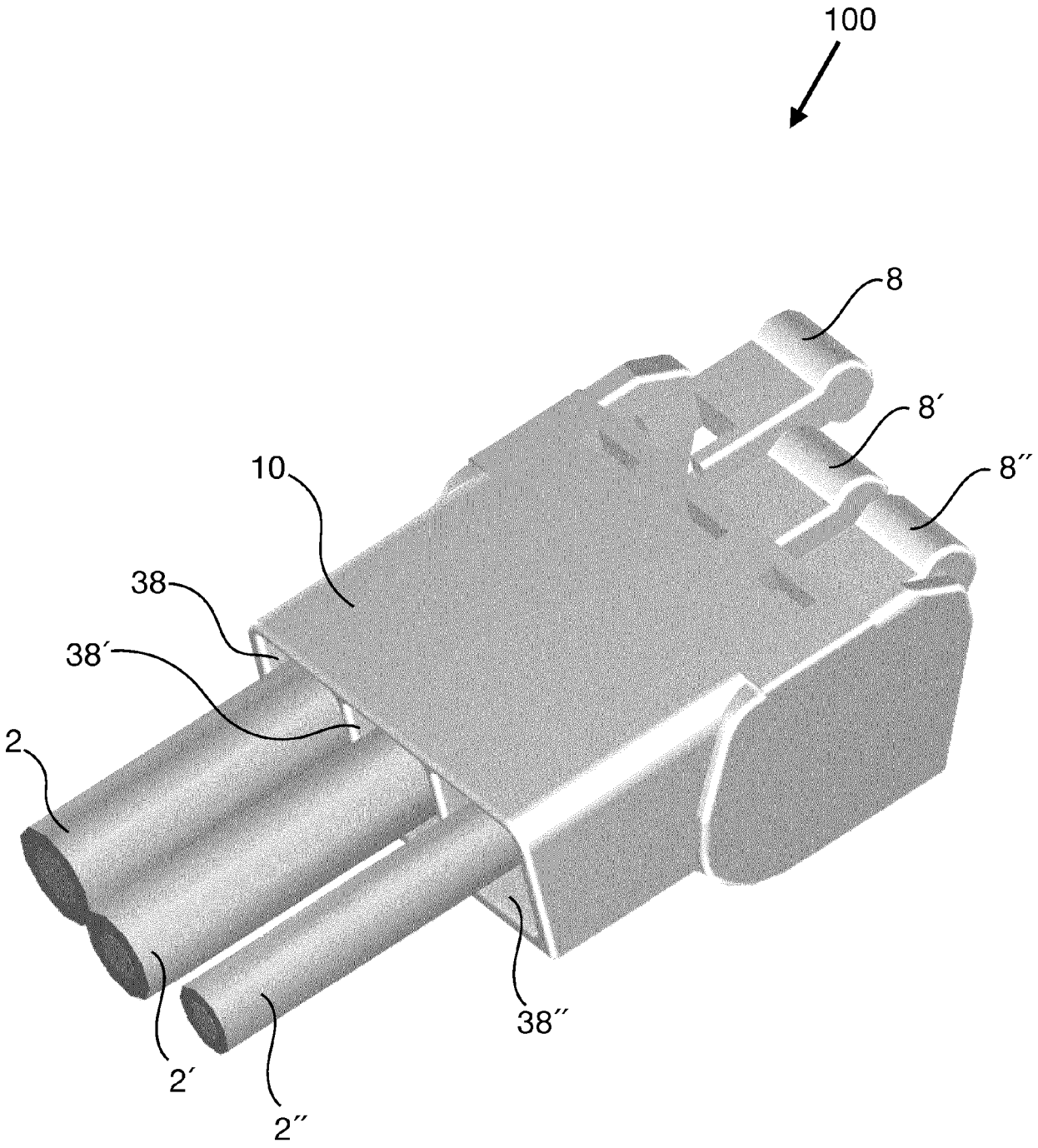

Fig. 2

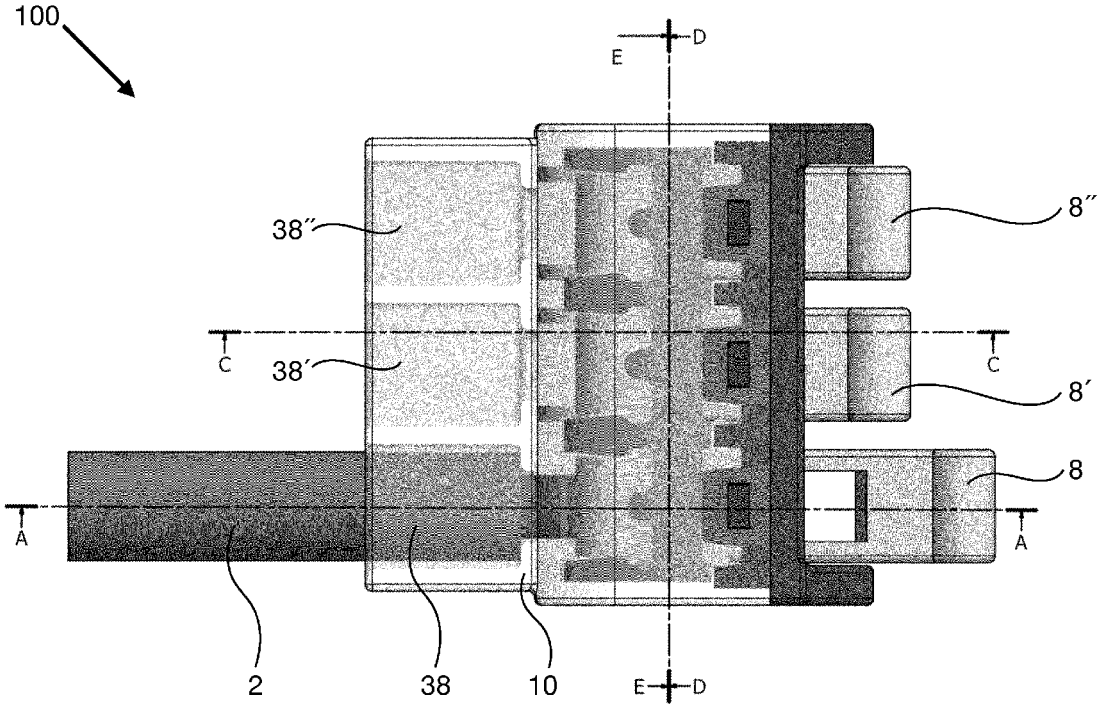

Fig. 3

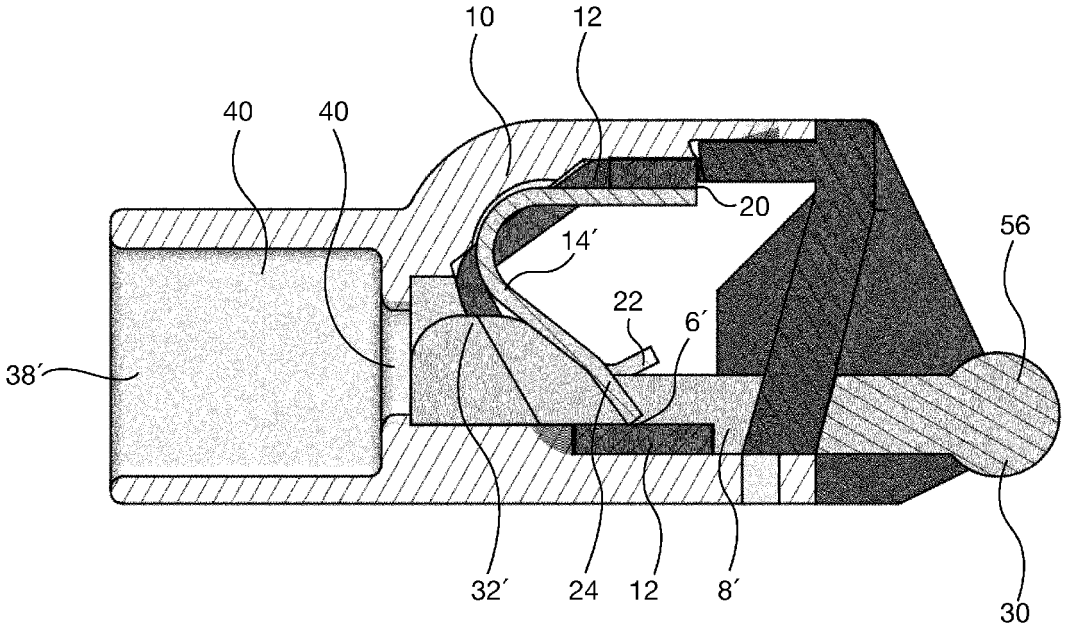

Fig. 4

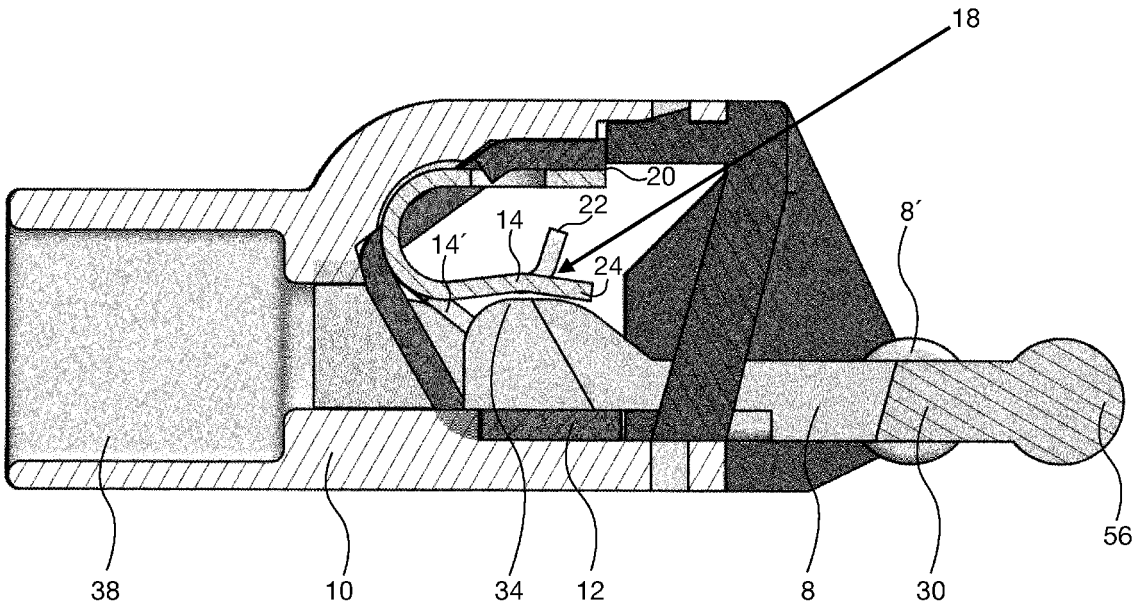

Fig. 5

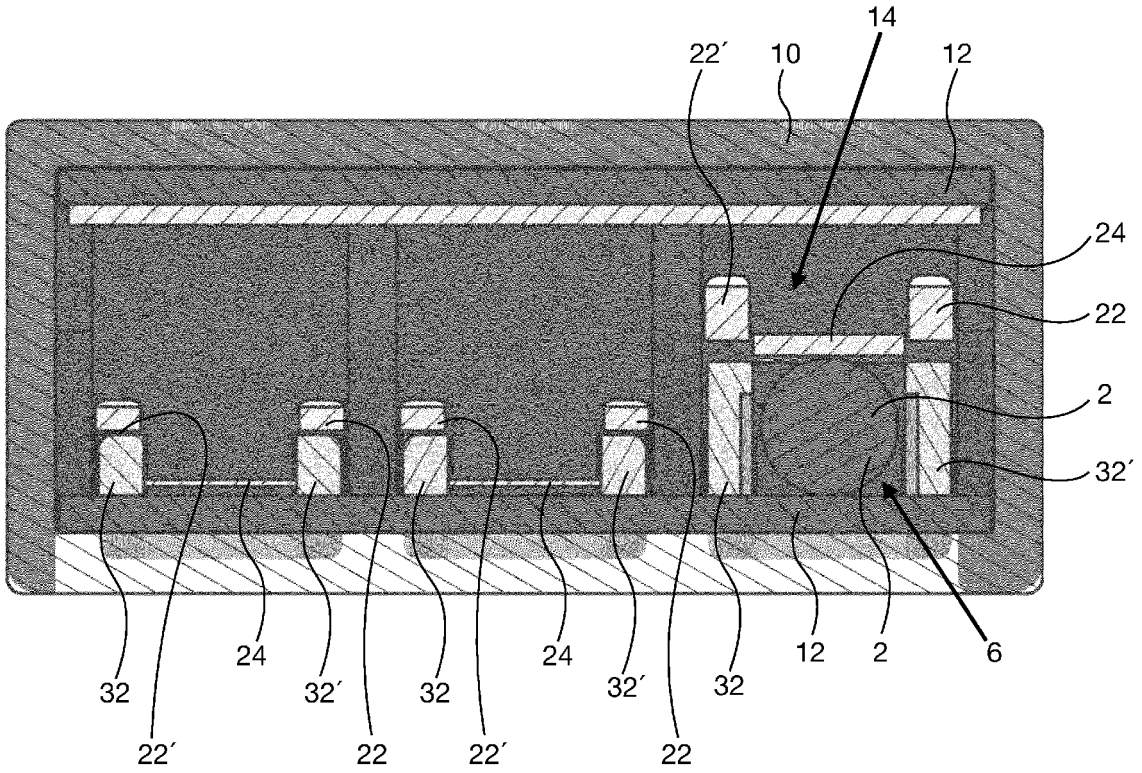

Fig. 6

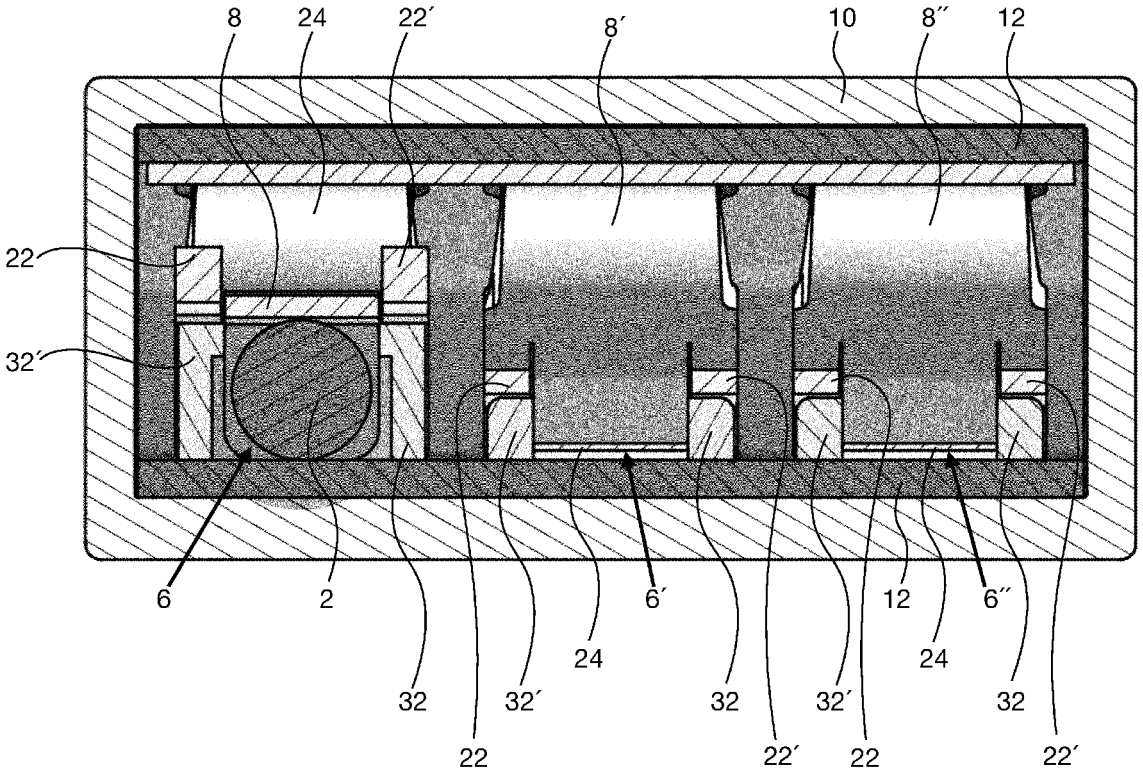

Fig. 7

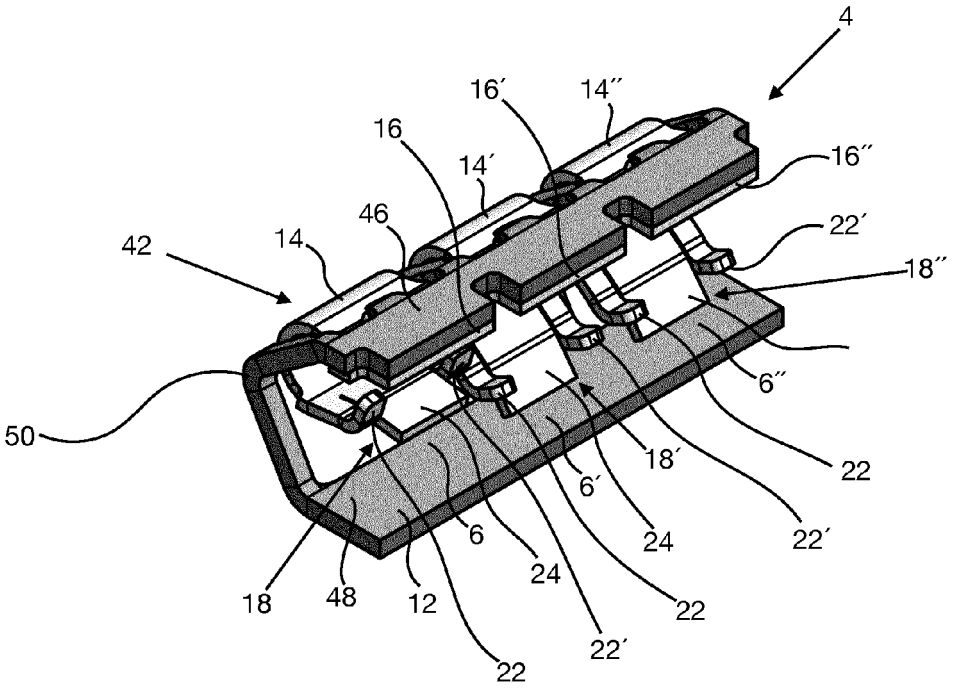

Fig. 8a

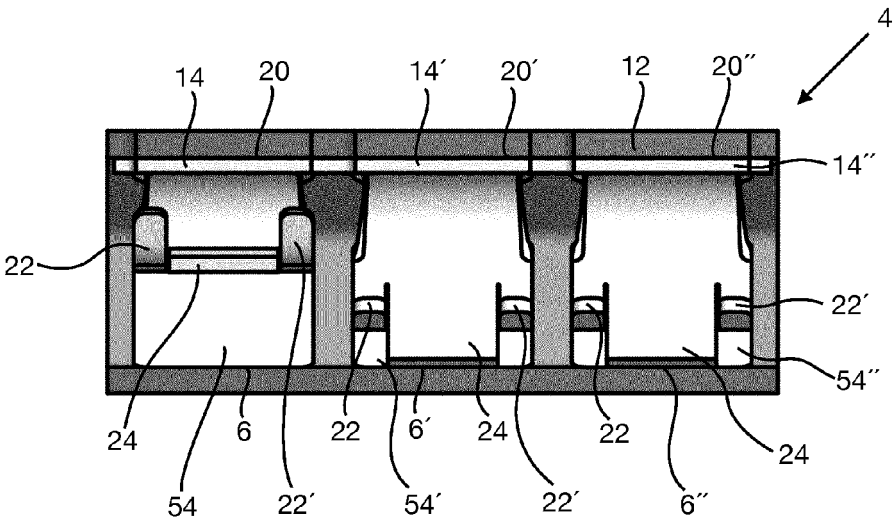

Fig. 8b

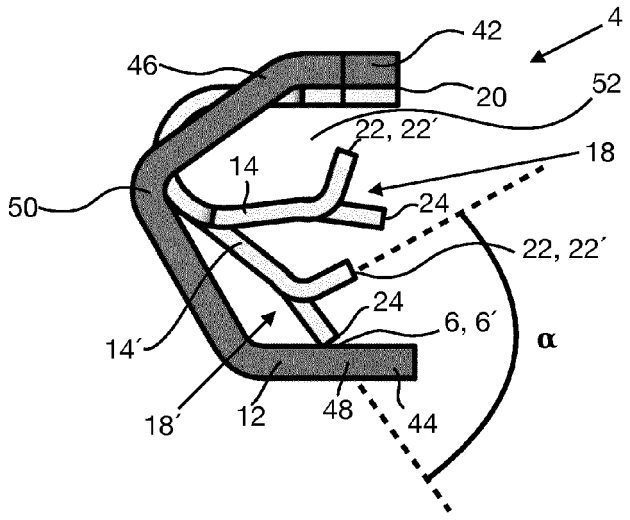

Fig. 8c

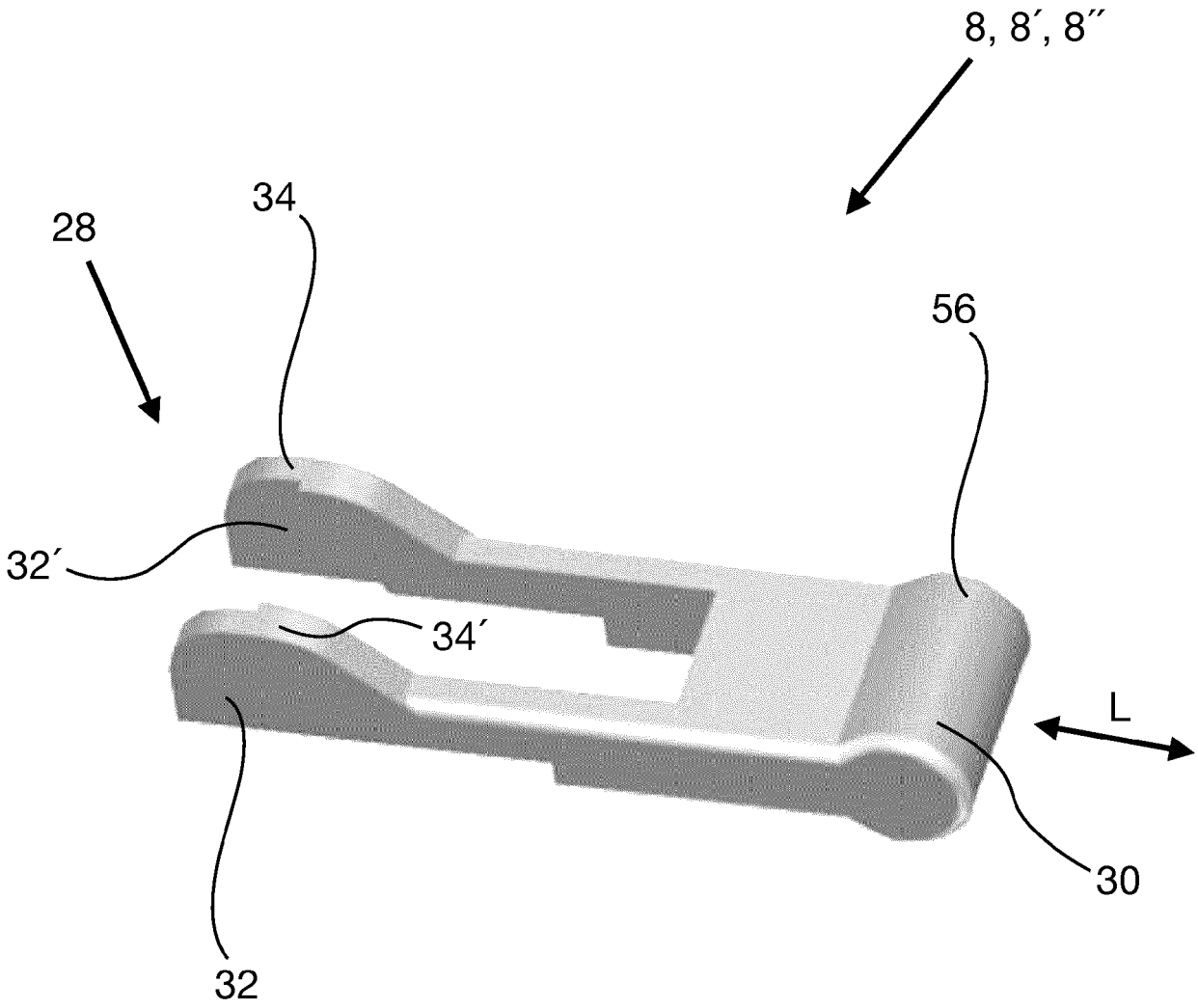

Fig. 9

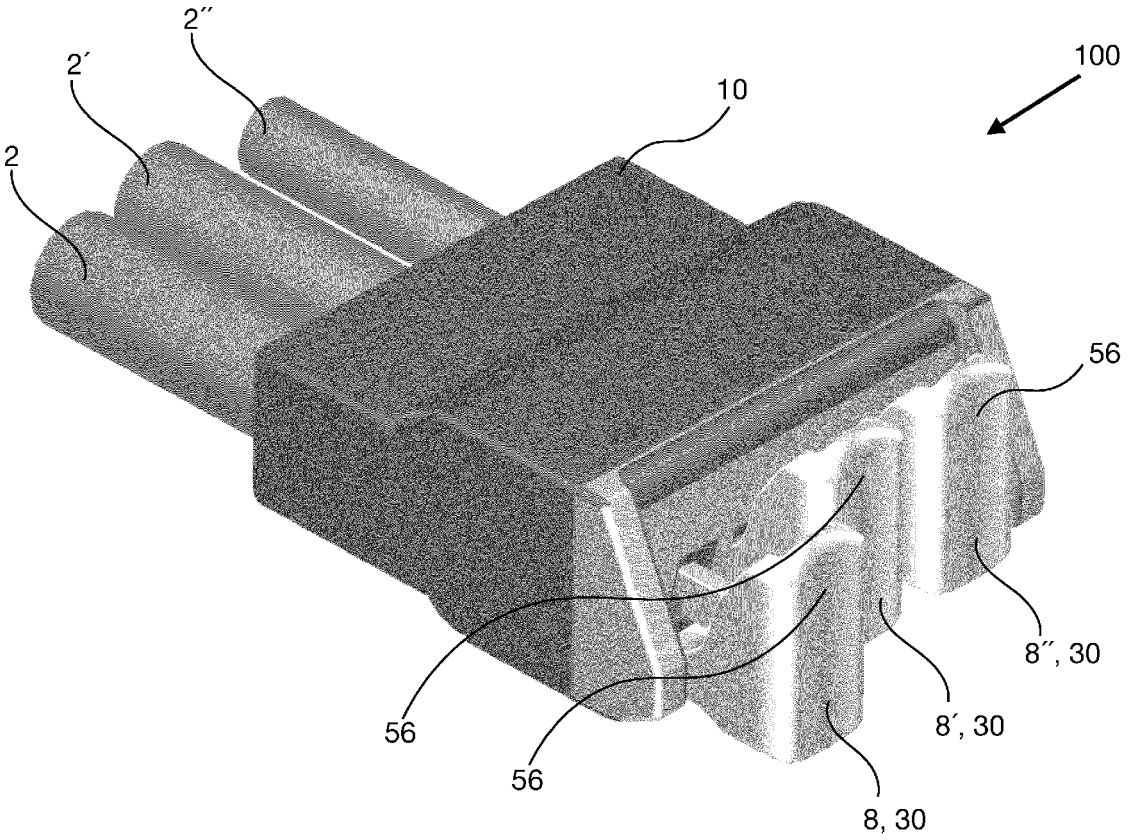

Fig. 10a

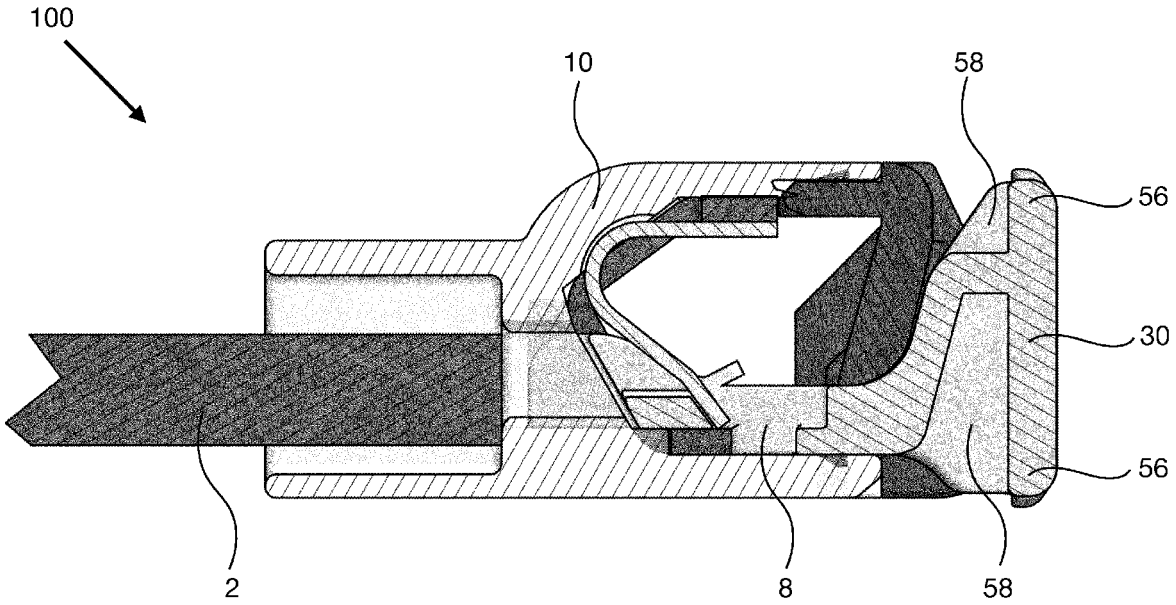

Fig. 10b

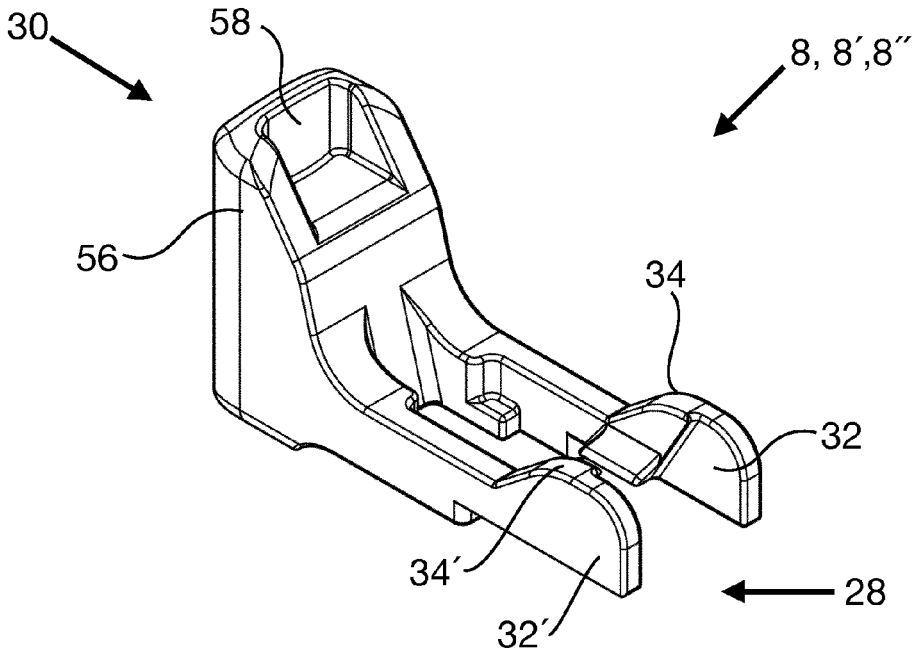

Fig. 11a

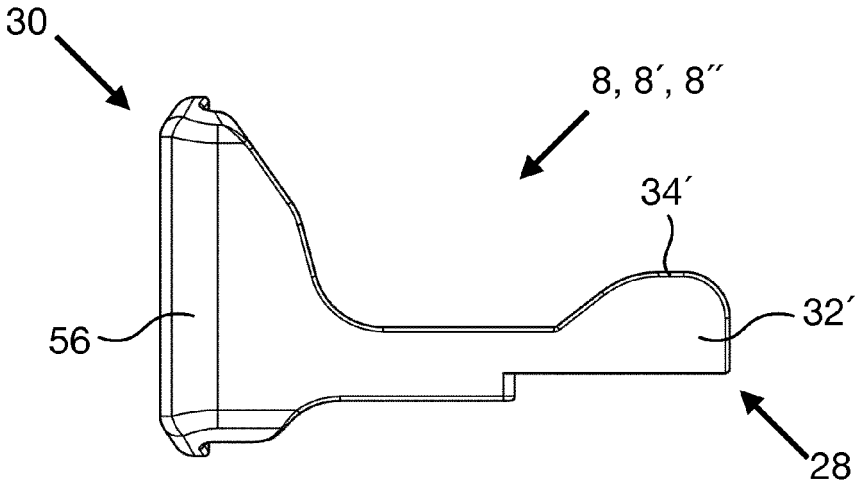

Fig. 11b

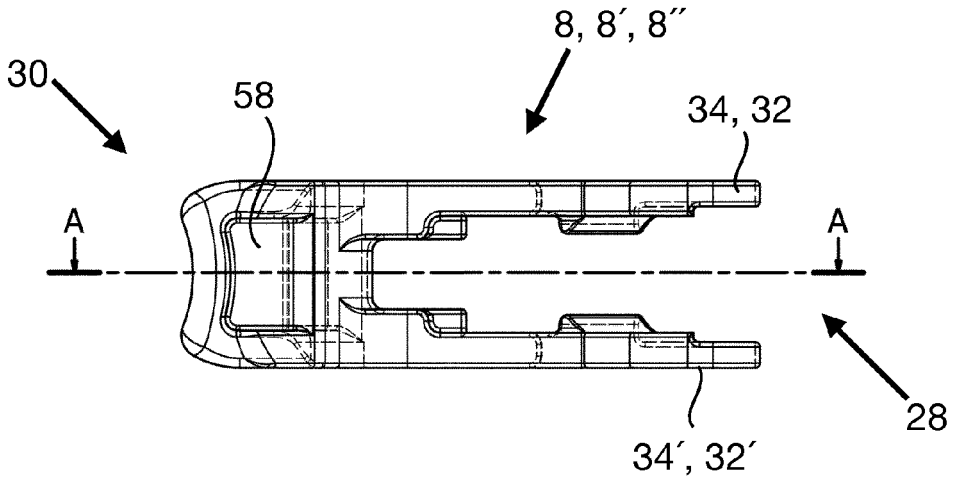

Fig. 11c

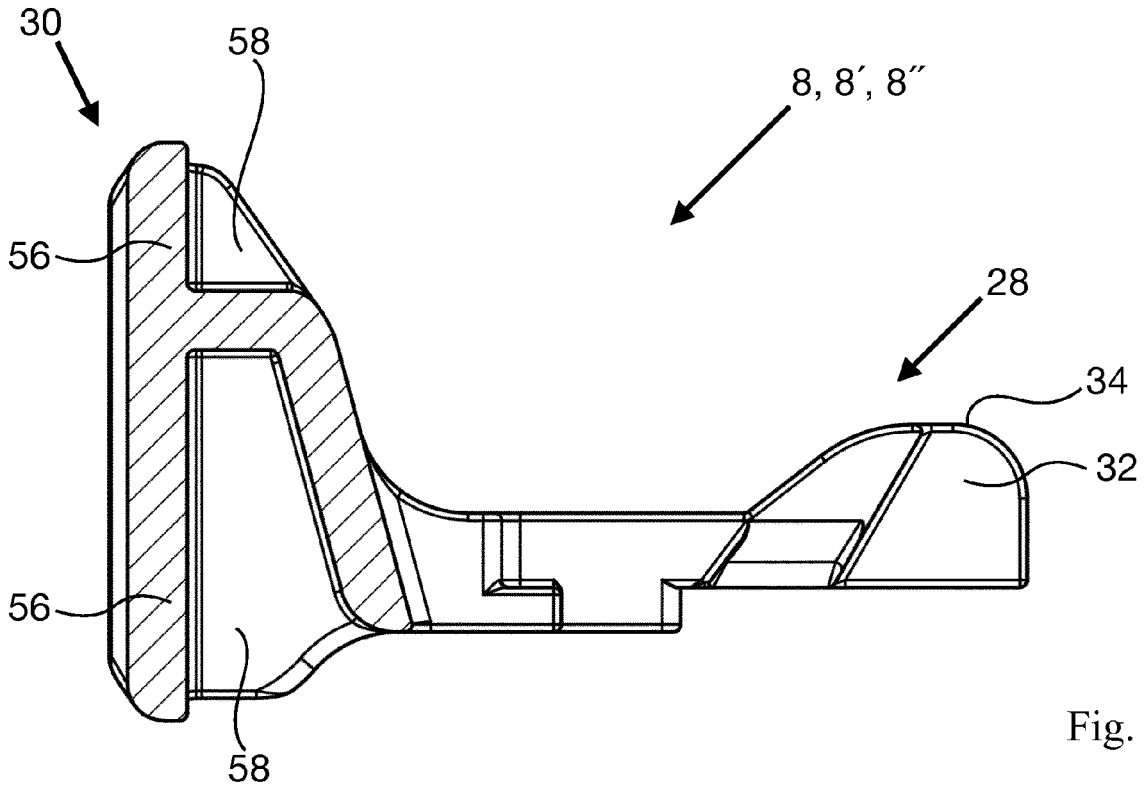

Fig. 11d

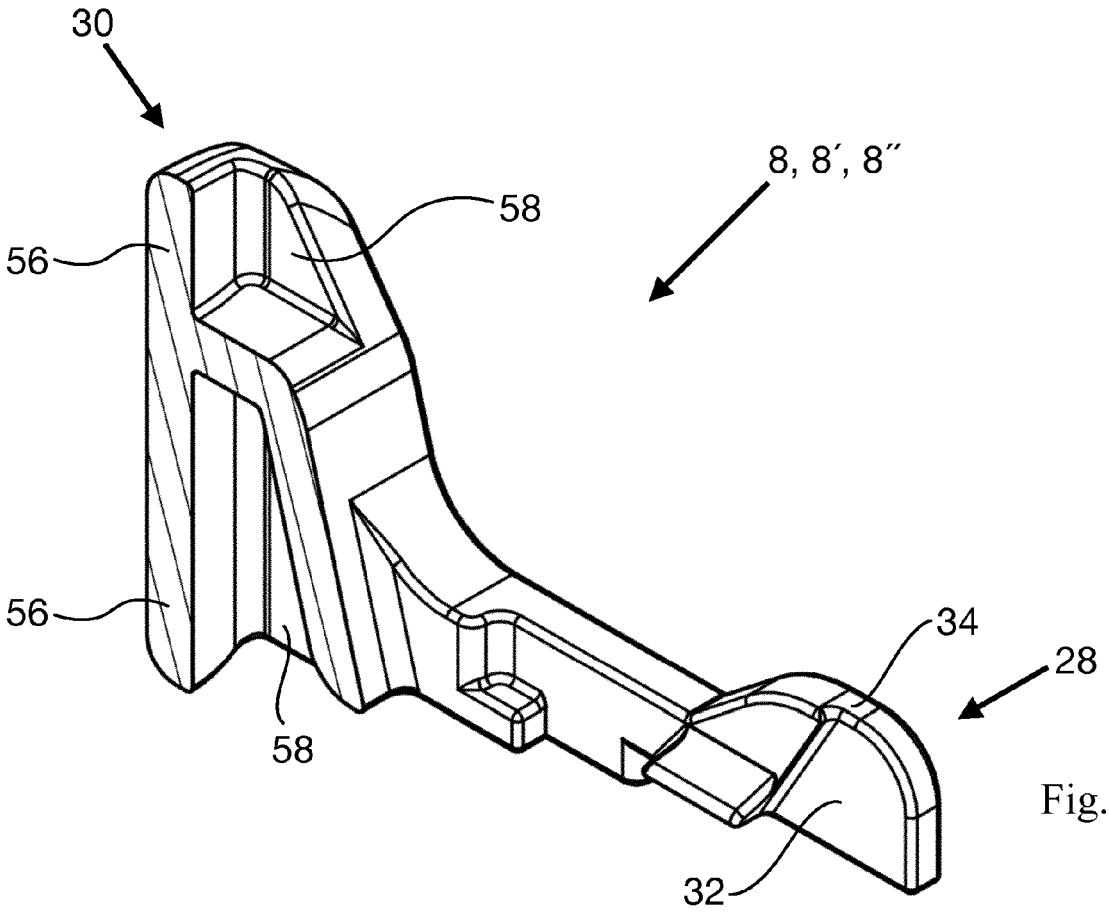

Fig. 11e

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EUROPEAN SEARCH REPORT

Application Number
EP 19 19 5342

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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