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(54) Title: ELECTRICAL CONNECTING DEVICE

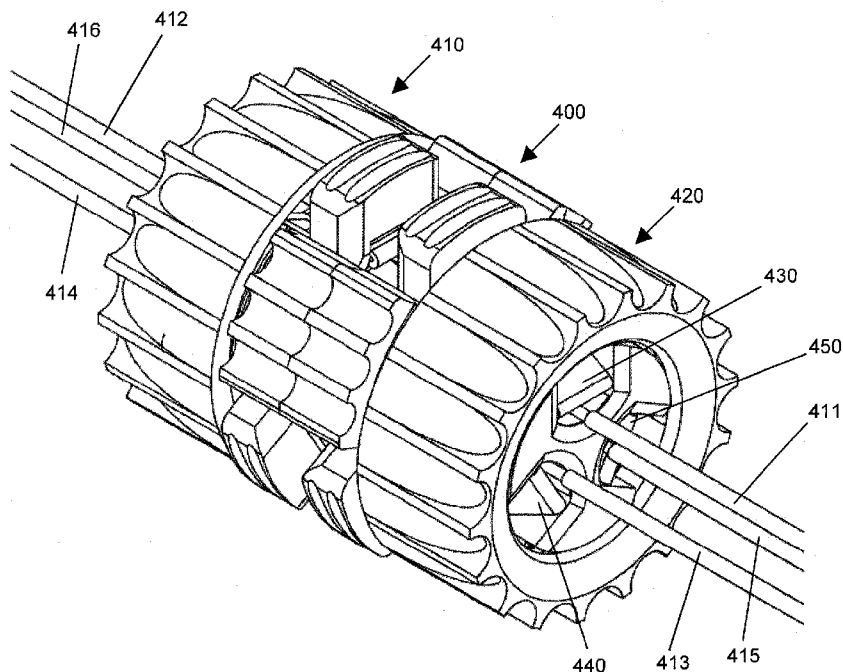


Fig. 4C

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(57) Abstract: The invention discloses a device and method for connecting conductive wires in a simple and reliable manner without requiring special tools. The device includes a terminal slot into which conductive wires are inserted and clamped; a fastening mechanism fastens all the clamped conductive wires simultaneously.

ELECTRICAL CONNECTING DEVICE

FIELD OF THE INVENTION

The invention relates to the field of electrical wires connecting devices.

5 BACKGROUND OF THE INVENTION

Conventional electrical connecting devices may be used to electrically connect a first wire or set of wires to a second wire or a set of wires, respectively. A conventional electrical connecting device may include one or more conductive elements, respectively, and one or more screws to fasten one or more wires of the second set to the one or more conductive elements,
10 respectively.

For Example, figure 1a and figure 1b illustrates a prior art connector - Screw terminal 100, including conductive element 104 and isolating shell 102. Figure 1 also illustrates a fasten screws 101a and 101b and wire canal 105 with ports 103a and 103b. In order to connect wires with connector 100, one should insert a bare edge of a wire or a set of wires into port 103a and
15 while he holds the wires in position to screw in screw 101a in order to fasten them to conductive element 104 and then should insert a bare edge of a wire or a set of wires into port 103b and while he holds the wires in position to screw in screw 101b in order to fasten them to conductive element 104.

the above prior art do not fully serves the needs of a user of rapid, safe and tools free
20 installation of a connection between two or more wires or sets of wires. For example, user who would like to connect 2 wires and do not have any tool besides the connector. In addition to that the operation of such a connector is time consuming, and when using such a connector thin wires are liable to partly cut through the wire.

Figure 2 illustrates a prior art connector – Wire nut 200 also known as cone, thimble
25 connectors, Marrette or Marr connectors, including molded grooves 201, isolating shell 204 and portion 203 including over-molded conducting metal <http://en.wikipedia.org/wiki/Metal> coiled insert for threading onto the wires. Figure 1 also illustrates wires 202a and 202b. In order to

connect wires with connector 200, one should twist two or more bare edges of wire together like illustrated in figure 2 and then twist on the connector on top of the twisted bare edges.

The above prior art do not fully serves the needs of a user of one solid secure connector who can perform well with every combination of wires. For example this solution requires a different nut size for every combination of wires size and amount. In addition to that, this solution do not give the user any feedback on how strong and secure is the connection between the wires, and it tends to cut thin wires, furthermore a splitting point in building's electrical systems using wire nuts in order to connect the cables causes disorientation as for the source and destiny of the electricity for technicians who come to modify those systems.

Figure 3a and figure 3b illustrates a prior art connector – clamping device 300, including isolation shell 305 conductive element 301, figure 3a also include ports 304a and 304b, clamping arms 302a and 302b and conductive wall 303. In order to connect wires with connector 300 one should push a bare edged wire through port 304a until clamping arm 302a tight the wire against wall 303 and then push a bare edged wire through port 304b until clamping arm 302b tight the wire against wall 303.

The above prior art do not fully serves the needs of a user of connector who can perform well with every kind of wires and do not require tools in order to operate it. For example connector 300 do not suit for connecting multi cable wires, for they are not strong enough to push the clamping arm and tend to bend over instead of penetrating. Furthermore disconnecting the wires from such connector requires a screwdriver in order to release the pressure the clamping arm puts on the wires.

SUMMARY OF THE INVENTION

Various methods and systems are possible for connecting a first wire or set of wires to a second wire or a set of wires. Such system or method may include an electrical connecting device including one or more connecting mechanism to electrically connect one or more
5 electrical wires to one or more other wires, as described below.

An embodiment of an electrical connecting device may include one or more conductive elements.

An embodiment of an electrical connecting device may include isolation shell.

An embodiment of an electrical connecting device may include two connecting
10 mechanism to electrically connect one or more electrical wires to one or more other wires.

An embodiment of an electrical connecting device may include clamping mechanism to lock/unlock the wires to/from the conductive element respectively, as described below.

An embodiment of an electrical connecting device may include secure mechanism to ensure the clamping mechanism stays locked.

15 An embodiment of an electrical connecting device could also include 2 separate conductive elements in one device, in order to connect a first set of phase and neutral wires to a second set of phase and neutral wires respectively.

An embodiment of an electrical connecting device could also include 3 separate conductive elements in one device, in order to connect a first set of phase, neutral and ground
20 wires to a second set of phase, neutral and ground wires respectively.

An embodiment of an electrical connecting device could also include 5 separate conductive elements in one device, to connect a first set of 3 phases, neutral and ground wires to a second set of 3 phase, neutral and ground wires respectively.

25 An embodiment of an electrical connecting device could also include 3 or more different ports, to connect sets of wires that come from 3 or more different directions respectively.

An embodiment of an electrical connecting device could also include releasing mechanism, to simultaneously unlock all the locked wires of the first or second sets of wires.

An embodiment of an electrical connecting device could also include sealing mechanism, in order to become water resist.

5 An embodiment of an electrical connecting device could also include inherent indicator, to indicate whether the electrical wires connected to it are active or not.

An embodiment of an electrical connecting device could also include a mechanism to expose the wires.

10 BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, purely by way of example, to the accompanying drawings.

With specific reference now to the drawings in detail, it is stressed that the particulars shown are by way of example and for purposes of illustrative discussion of the preferred embodiments
15 of the present invention only, and are presented in the cause of providing what is believed to be the most useful and readily understood description of the principles and conceptual aspects of the invention. In this regard, no attempt is made to show structural details of the invention in more detail than is necessary for a fundamental understanding of the invention, the description taken with the drawings making apparent to those skilled in the art how the several forms of the
20 invention may be embodied in practice. In the accompanying drawings:

Fig. 1 shows an exemplary prior-art Screw-terminal connector;

Fig. 1A is a schematic drawing of a cutaway view of the Screw-terminal connector;

Fig. 2 shows an exemplary prior-art Wire-nut connector;

Fig. 3 shows an exemplary prior-art Clamping-device connector;

25 Fig. 3A is a schematic drawing of a cutaway view of the Clamping-device connector;

Figs. 4A and 4B are schematic drawings of isometric and top views, respectively, of an electrical connecting device according to an exemplary embodiment of the invention;

Fig. 4C is schematic drawings of isometric view of an electrical connecting device with wired cables according to an exemplary embodiment of the invention;

Figs. 4D, 4E, 4F and 4G are schematic drawings of cross-sectional views of the device of Fig. 4B along section line "AA";

Fig. 5 is a schematic drawing of an isometric view, of the ring of the device of Fig. 4a;

Fig. 6 is a schematic drawing of an isometric view, of the main body of the device of Fig. 4a;

Fig. 7 is schematic drawing of an isometric view of clamping and conductive element of the device of Fig. 4a;

It will be appreciated that for simplicity and clarity of illustration, elements shown in the drawings have not necessarily been drawn accurately or to scale. For example, the dimensions of some of the elements may be exaggerated relative to other elements for clarity or several physical components included in one functional block or element. Further, where considered appropriate, reference numeral may be repeated among the drawing to indicate corresponding or analogous elements. Moreover, some of the blocks depicted in the drawings may be combined into a single function.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

In the following detailed description, numerous specific details are set forth regarding the apparatus and method, in order to provide a thorough understanding of the present invention. It will be apparent, however, to one skilled in the art that the present invention may be practiced without such specific details. In other instances, well-known components, structures and techniques have not been shown in detail to avoid unnecessarily obscuring the subject matter of the present invention. Moreover, various examples are provided to explain the operation of the present invention. It should be understood that these examples are exemplary. It is contemplated that there are other methods and systems that are within the scope of the present invention. Also, the same reference numerals are used in the drawings and in the description to refer to the same elements to simplify the description.

Unless specifically stated otherwise, as apparent from the following discussions, it is appreciated that the term “set” may be used throughout the specification to describe one or more components, devices, elements, and the like.

Embodiments of the invention may include an electrical connecting device including one
5 or more connecting mechanism to electrically connect one or more electrical wires to one or more other wires or other conductive elements, as described below.

According to exemplary embodiment of the invention, the electrical connecting device may include a first clamping mechanism able to clamp/unclamp one wire or more of a first set of wires to /from each conducting element of a set of conducting elements, respectively, and/ or a
10 second clamping mechanism able to clamp/unclamp one wire or more of a second set of wires to /from each conducting element of a set of conducting elements, respectively.

According to some exemplary embodiments of the invention, the electrical connecting device may include three connecting mechanism to electrically connect three wires to three other wires, respectively, as described below.

15 Reference is made to Figs. 4A and 4B, which schematically illustrate an isometric view and a top view, respectively, of an electrical connecting device 400 according to exemplary embodiments of the invention.

According to exemplary embodiments of the invention, device 400 may include a first locking mechanism 410, and a second locking mechanism 420, each able to be in a “locked”
20 state or in an “unlocked” state, as described in detail below. For example, mechanism 410 and 420 as are shown in illustration 4B are in the locked state and unlocked state, respectively.

According to exemplary embodiments of the invention, the locking mechanism may include at least one clamping device and a locking ring, as described below. For example, mechanism 410 may include a first tab 407 (not shown), a second tab 408, a third tab 409 (not
25 shown) and a locking ring 402, and mechanism 420 may include a first tab 427 (not shown), a second tab 428, a third tab 429 (not shown) and a locking ring 422. At least part of an outer surface 404 of device 400 may be threaded, such that ring 402 and/or ring 422 may be fastened or released in relation to surface 404. For example, ring 422 may be fastened, e.g., by moving

ring 422 away from a top end 423 of device 400, or released e.g., by moving ring 422 toward end 423, and ring 402 may be fastened, e.g., by moving ring 402 away from a top end 403 of device 400, or released e.g., by moving ring 422 toward end 403.

5 According to exemplary embodiments of the invention, a body 405 of device 400, tabs 407, 408, 409, 427, 428, and/or 429, and/or rings 402 and/or 422, may be formed of any suitable non-conductive, e.g., rigid material, for example any suitable plastic material as is known in the art with desired insulation and durability properties.

Reference is also made to Fig. 4C, which schematically illustrate isometric view of the device of Fig. 4A.

10 According to exemplary embodiments of the invention, device 400 may include a first connecting mechanism 430 to electrically connect a first wire 411 to a second wire 412, a second connecting mechanism 440 to electrically connect a first wire 413 to a second wire 414 and a third connecting mechanism 450 to electrically connect a first wire 415 to a second wire 416, as described below.

15 Reference is also made to Fig. 4D which schematically illustrate cross-sectional views of the device of Fig. 4B along section line "AA".

According to exemplary embodiments of the invention, device 400 may include a first conductive element 430, which may have a first clamping portion 431 and a second clamping portion 432, a second conductive element 440, which may have a first clamping portion 441 and a second clamping portion 442(not shown), and a third conductive element 450, which may have a first clamping portion 451 and a second clamping portion 452(not shown). Clamping portions 20 431, 432, 441, 442, 451 and/or 452 may each have an "open" state, e.g., to enable insertion of a wire, or a "closed" state, e.g., to clamp the wire, as described below.

According to exemplary embodiments of the invention, clamping portion 431 may 25 include a spring element 434 and a first end section of a base element 433, clamping portion 432 may include a spring element 435 and a second end section of a base element 436, clamping portion 441 (not shown) may include a spring element 444 and a first end section of a base element 443, clamping portion 442(not shown) may include a spring element 445 and a second

end section of a base element 446, clamping portion 451 (not shown) may include a spring element 454 and a first end section of a base element 453, and clamping portion 452(not shown) may include a spring element 455 and a second end section of a base element 456. Elements 430,440 and/or 450 may be formed of any conductive material as is known in the art. For
5 example, elements 430,440 and/or 450 may be formed of brass, copper or steel.

According to exemplary embodiments of the invention, the spring element, e.g., element 434, may be positioned apart from the base element, e.g., element 433, for example, when the clamping portion, e.g., portion 431, is in the open state, to form a desired gap between the spring element and the base element.

10 According to exemplary embodiments of the invention, clamping portion 431 may be used to clamp wire 411, clamping portion 441 may be used to clamp wire 413 and clamping portion 451 may be used to clamp wire 415, for example, using locking mechanism 420, as described below. Additionally or alternatively, clamping portion 432 may be used to clamp wire 412, clamping portion 442(not shown) may be used to clamp wire 414 and clamping portion
15 452(not shown) may be used to clamp wire 416, for example, using locking mechanism 410, as described below.

According to some exemplary embodiments of the invention, device 400 may be used for clamping wires having different sizes. For example, one or more of wires 411, 412, 413, 414, 415, and/or 416 may have different size than the other wires. According to these embodiments,
20 each of the clamping portions of device 400 may be adapted to allow inserting and/or clamping a corresponding wire. For example, the spring element and/or the base element of the clamping portion may be adapted to form a desired gap, e.g., corresponding to the wire to be clamped.

According to exemplary embodiments of the invention, each of the locking mechanism may be able to “lock” at least one of the clamping portions in it’s closed state. For example
25 mechanism 420 may be able to lock, e.g., simultaneously, clamping portions 431, 441 and 451 in their closed state, and mechanism 420 may be able to lock, e.g., simultaneously, clamping portions 432, 442(not shown) and 452(not shown) in their closed state, as described below.

According to exemplary embodiments of the invention, mechanism 420 may be unlocked by releasing ring 422 and may be locked by fastening ring 422, as described below.

Reference is also made to Fig. 4E which schematically illustrate cross-sectional views of the device of Fig. 4B along section line "AA".

According to exemplary embodiments of the invention, clamping portion 431 of conductive element 430 may be in "open" state. For example, tab 428 may be pushed toward the center of body 400 and by that bending element 434, to allow insertion of wire 411.

According to exemplary embodiments of the invention, the user may insert wire 411 into the gap formed between elements 433 and 434.

Reference is also made to Fig. 4F which schematically illustrate cross-sectional views of the device of Fig. 4B along section line "AA".

According to exemplary embodiments of the invention, clamping portion 431 of conductive element 430 may be in "close" state. For example, when tab 428 is released spring element 434 may be urged to move towards element 433 to the closed state, to clamp wire 411 and hold it in position.

Reference is also made to Fig. 4G which schematically illustrate cross-sectional views of the device of Fig. 4B along section line "AA".

According to exemplary embodiments of the invention, fastening tab 480 may have a predetermined configuration, e.g., shape and/size, such that when ring 422 is fastened, an end portion 481 of fastening tab 480 may apply to element 434 a force urging element 434 toward element 433. When ring 422 is released portion 431 is able to move from the close state to the open state.

According to exemplary embodiments of the invention, the user may unlock mechanism 420 by releasing ring 422 until fastening tab 480 do not apply a force on element 434 sufficiently allow clamping portion 431 to move to the open state.

Thus, clamping portions 431, 441, and 451 may be, in the open or close state, when mechanism 420 is unlocked, e.g., when ring 422 is released. Clamping portions 431, 441, and 451 may be, e.g., in the close state, when mechanism 420 is locked, e.g., when ring 422 is fastened.

According to exemplary embodiments of the invention, the configuration and/or operation of clamping portion 432, 441, 442, 451 and/or 452 may be similar to the configuration and/or operation of clamping portion 431, e.g., as described above.

5 According to exemplary embodiments of the invention, the configuration and/or operation of conductive elements 440 and 450 may be similar to the configuration and/or operation of conductive element 430, e.g., as described above.

According to exemplary embodiments of the invention, the configuration and/or operation of locking mechanism 410 may be similar to the configuration and/or operation of locking mechanism 420, e.g., as described above.

10 Although the above discussion refers to inserting one electrical wire into each clamping portion of the electrical connecting device, it will be appreciated by those skilled in the art that electrical connecting devices according to other embodiments of the invention may include one or more clamping portions, each adapted to clamp more than one wire. For example clamping portion 431 may be adapted to clamp one or more wires, e.g., by designing base element 433, 15 spring element 434, tabs 428 and 480 and/or ring 422 that a larger gap, e.g., corresponding to the total cross-section of the three wires, may be formed between elements 433 and 434 when portion 431 is in the open state. It may be also desired to modify the shape and/or size of body 405 and/or threaded surface 404, if, for example a relatively large number of wires is to be clamped by one or more clamping portions of device 400.

20 According to exemplary embodiments of the invention, ring 402 and/or ring 422 may have any desired configuration, for example, a configuration adapted to provide a comfortable grip of the ring, e.g., as described below.

Reference is also made to Fig. 5, which schematically illustrate isometric view of the device of Fig. 4A.

25 According to exemplary embodiments of the invention, at least a portion of an outer contour 502 of ring 500 may be adapted to provide a comfortable grip of the ring 500. For example, contour 502 may include one or more generally grooves 504, e.g., to allow friction with a user's fingers.

Reference is also made to Fig. 6, which schematically illustrate isometric view of the device of Fig. 4A.

According to exemplary embodiments of the invention, main body 600 may include gripping portions 695, 696, and 697 having a predetermined size and/or shape. For example, portion 695 may have a size and/or shape adapted to provide the user with a relatively comfortable grip of the device.

According to exemplary embodiments of the invention, main body 600 may include fastening tabs 611, 612, 613, 614, 615 and 616(not shown) having a predetermined size and/or shape. For example fastening tab 611 may have have a size and/or shape adapted to fasten element 434 toward element 433.

According to exemplary embodiments of the invention, one or more of the elements described above may be manufactured using molded elastical material, as described below. According to the other embodiments any other suitable material, e.g., as is known in the art, may be used.

Reference is also made to Fig. 7, which schematically illustrate an isometric view of clamping and conductive element of the device of Fig. 4a;

According to exemplary embodiments of the invention, element 700 may be manufactured using conductive and elastical material, e.g., brass, copper, or steel.

According to exemplary embodiments of the invention, element 700 may include grooves 721 and 722 to provide better grip of the wires. For example, portion 703 may include one or more generally grooves 721, e.g., to allow friction with the wires.

Although the above discussion refers to an electrical connecting device including Three connecting mechanism to electrically connect three wires to three other wires, respectively, it will be appreciated by those skilled in the art that according to other embodiments, the electrical connecting device may be modified, to include one or more connecting mechanism for electrically connecting one or more wires to one or more other wires, respectively.

According to exemplary embodiments of the invention, device 400 may also include an aperture for inserting an attachment element, e.g., a screw to attach device 400 to an external element, e.g., a surface of a desired unit or device.

5 According to exemplary embodiments of the invention, device 400 may also include a sealing mechanism, in order to become water resist.

According to exemplary embodiments of the invention, device 400 may also include an inherent indicator, to indicate whether the electrical wires connected to it are active or not.

According to exemplary embodiments of the invention, device 400 may also include a mechanism to expose the wires.

10 While the invention has been described with respect to a limited number of embodiments, it will be appreciated that many variations, modifications and other applications of the invention may be made. It will be appreciated that the above descriptions are intended only to serve as examples and that many other embodiments are possible within the spirit and the scope of the present invention.

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WHAT IS CLAIMED IS:

1. A method for connecting conductive wires by a connector comprising the following steps:
 - a. inserting one end of conductive wire into a terminal slot;
 - b. clamping the one end of conductive wire by a terminal clamp inside the slot;
 - c. fastening conductive wire inside slot by screwing a nut over terminal clamp.
2. A method according to claim 1, wherein a spring is provided for opening and clamping said conductive wire inside the terminal slot.
3. A method according to claim 1, wherein the connector includes a plurality of terminals.
4. A method according to claim 3, wherein the fastening is performed over the plurality of terminals simultaneously.
5. A method according to claim 1, wherein the fastening includes a stepping mechanism to indicate the fastening tightness.
6. A method according to claim 1, wherein steps a and b are performed at a plurality of sides of the connector in a corresponding manner to connect corresponding conductive wires.
7. A method according to claim 6, wherein the said fastening mechanism fastens corresponding conductive wires simultaneously.
8. A device for connecting conductive wires comprising:
 - a. a terminal slot;
 - b. a clamping element inside terminal slot;
 - c. a fastening mechanism.
9. A device for connecting conductive wires according to claim 8, wherein the clamping element is based on a spring.
10. A device for connecting conductive wires according to claim 8, having a plurality of terminals.
11. A device for connecting conductive wires according to claim 10, wherein the fastening mechanism is performed over the plurality of terminals simultaneously.

12. A device for connecting conductive wires according to claim 8, wherein fastening mechanism includes a sub stepping mechanism to indicate the fastening tightness.
13. A device for connecting conductive wires according to claim 8, wherein a set of a terminal slot and a clamping element is provided in a plurality of sides of the connector.
14. A device for connecting conductive wires according to claim 13, wherein the device is configured for connecting wires of corresponding terminal slots.
15. A device for connecting conductive wires according to claim 14, wherein said fastening mechanism fastens corresponding conductive wires simultaneously.

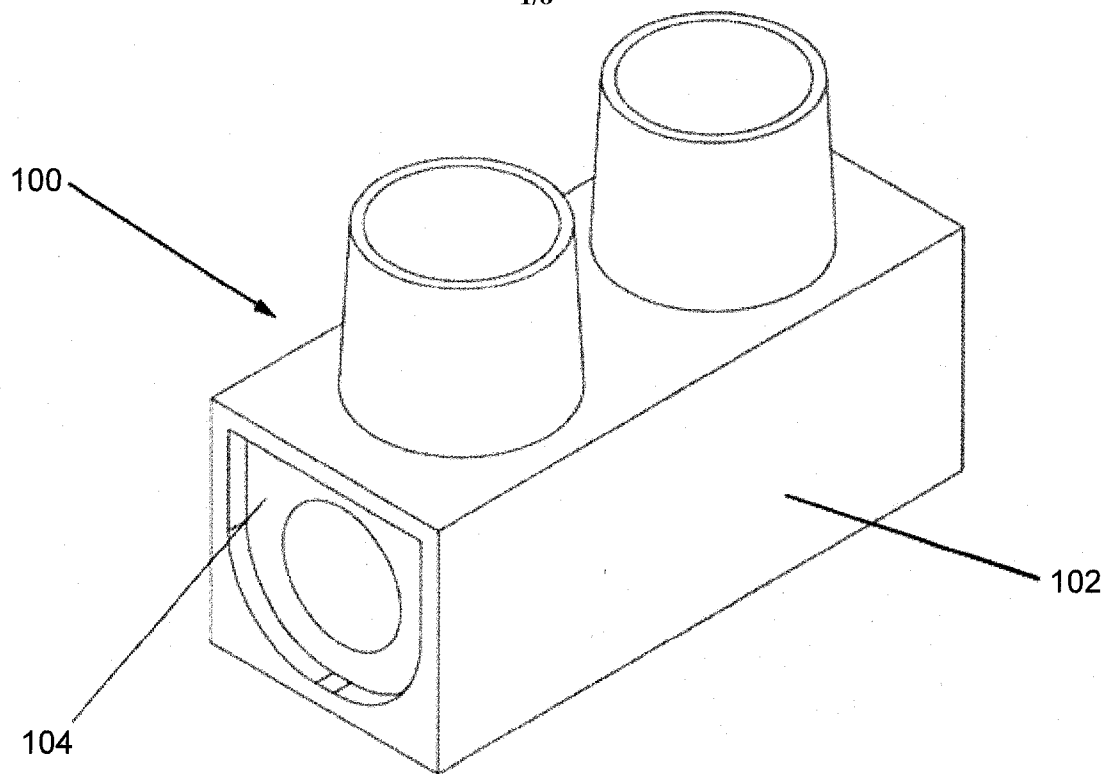


Fig. 1A

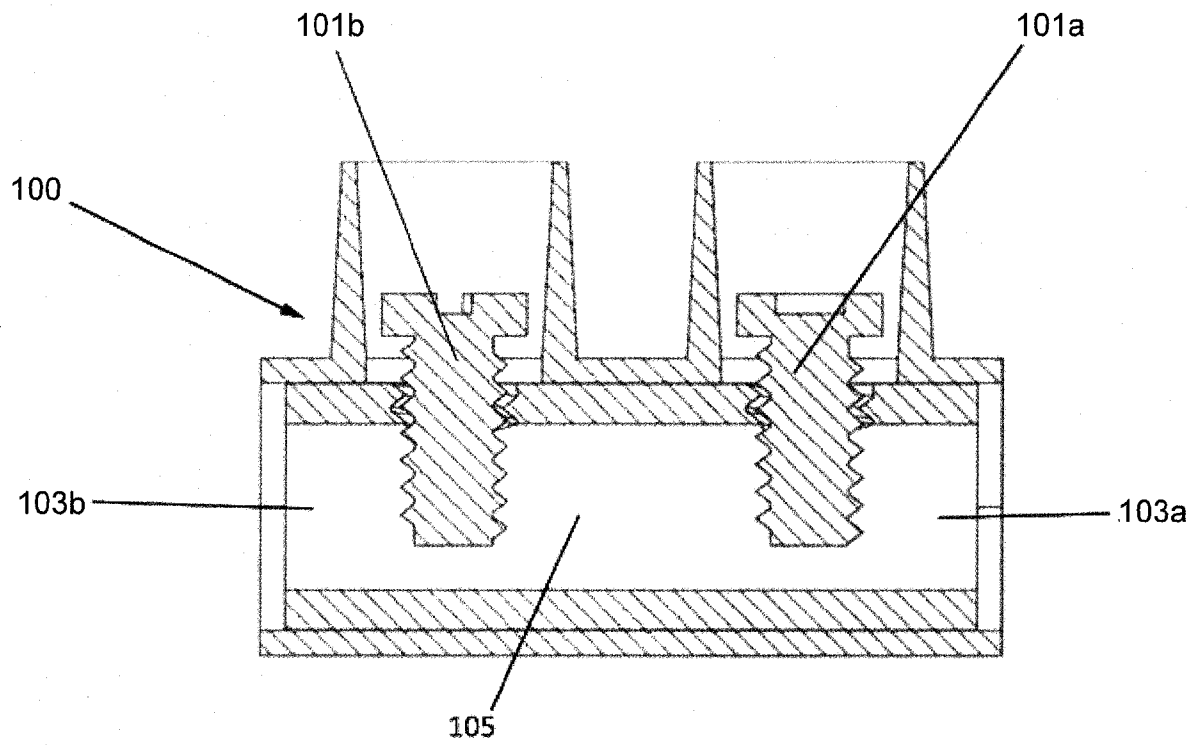


Fig. 1B

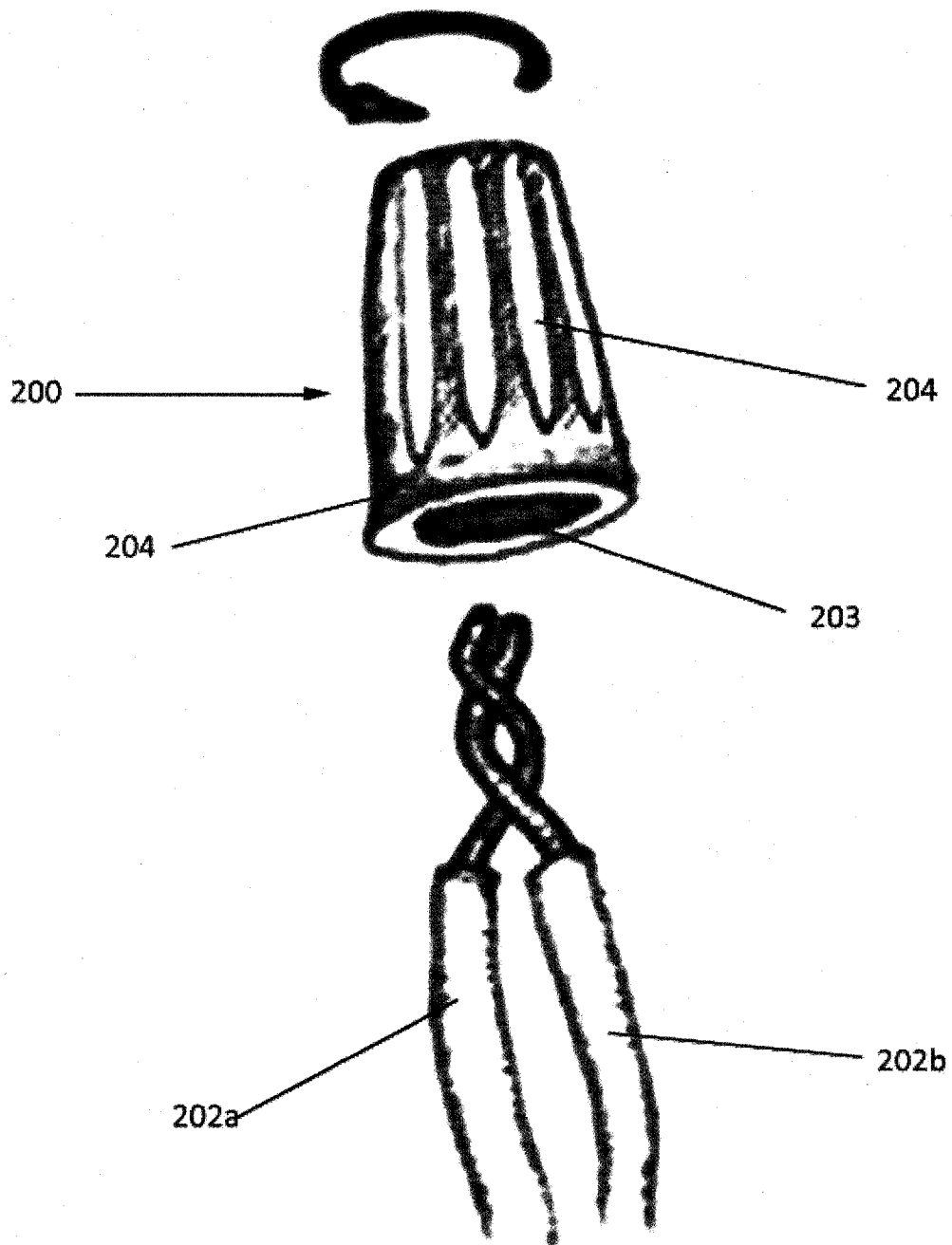


Fig. 2

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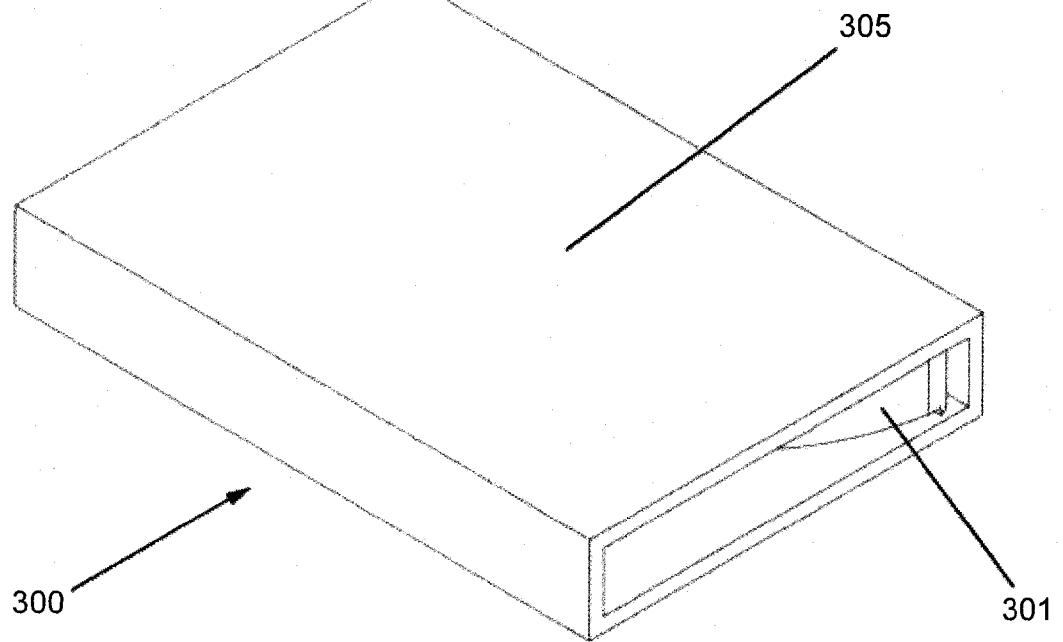


Fig. 3A

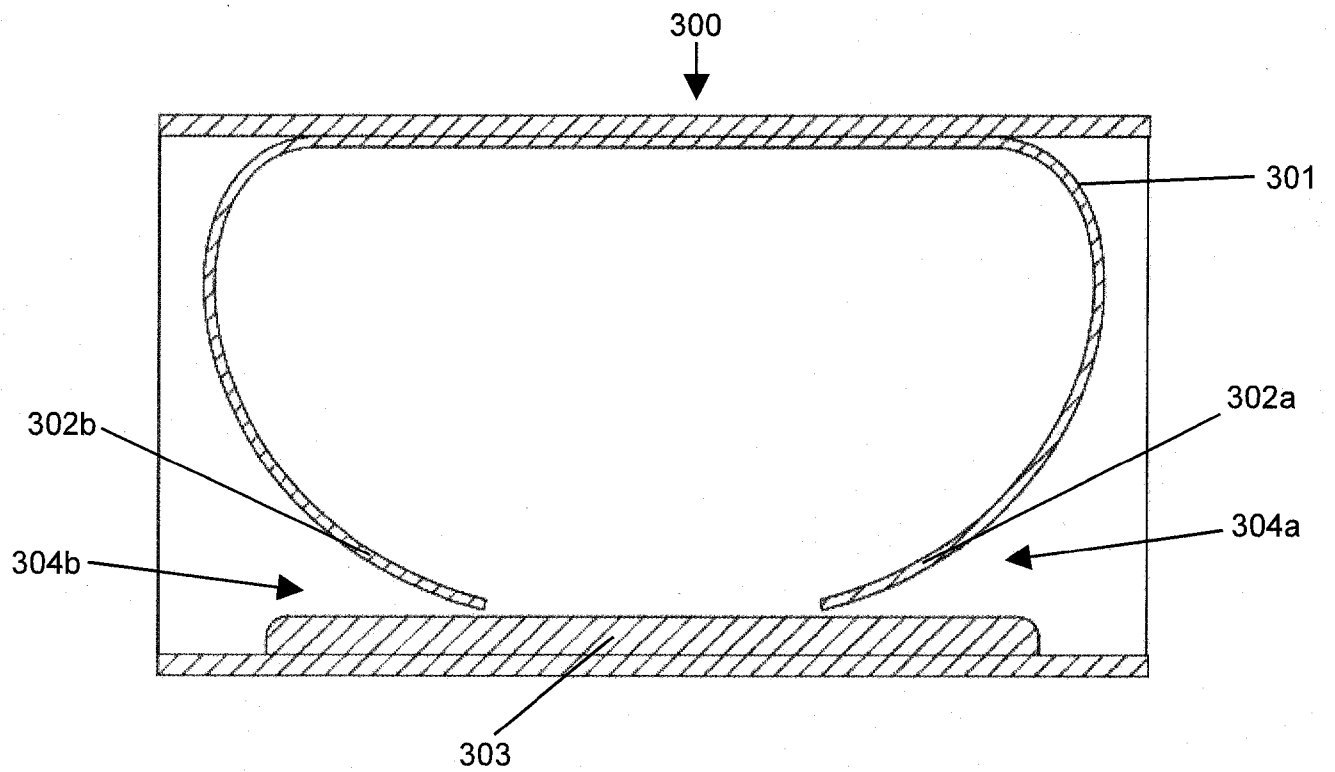


Fig. 3B

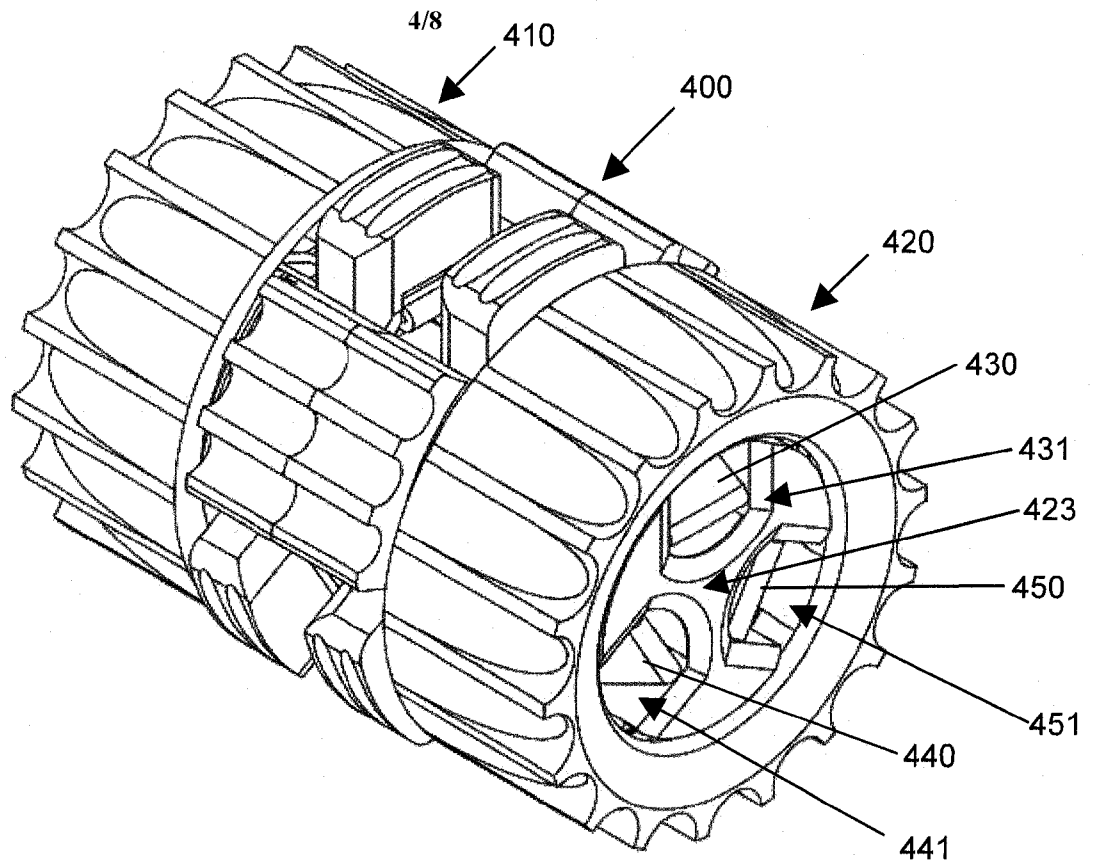


Fig. 4A

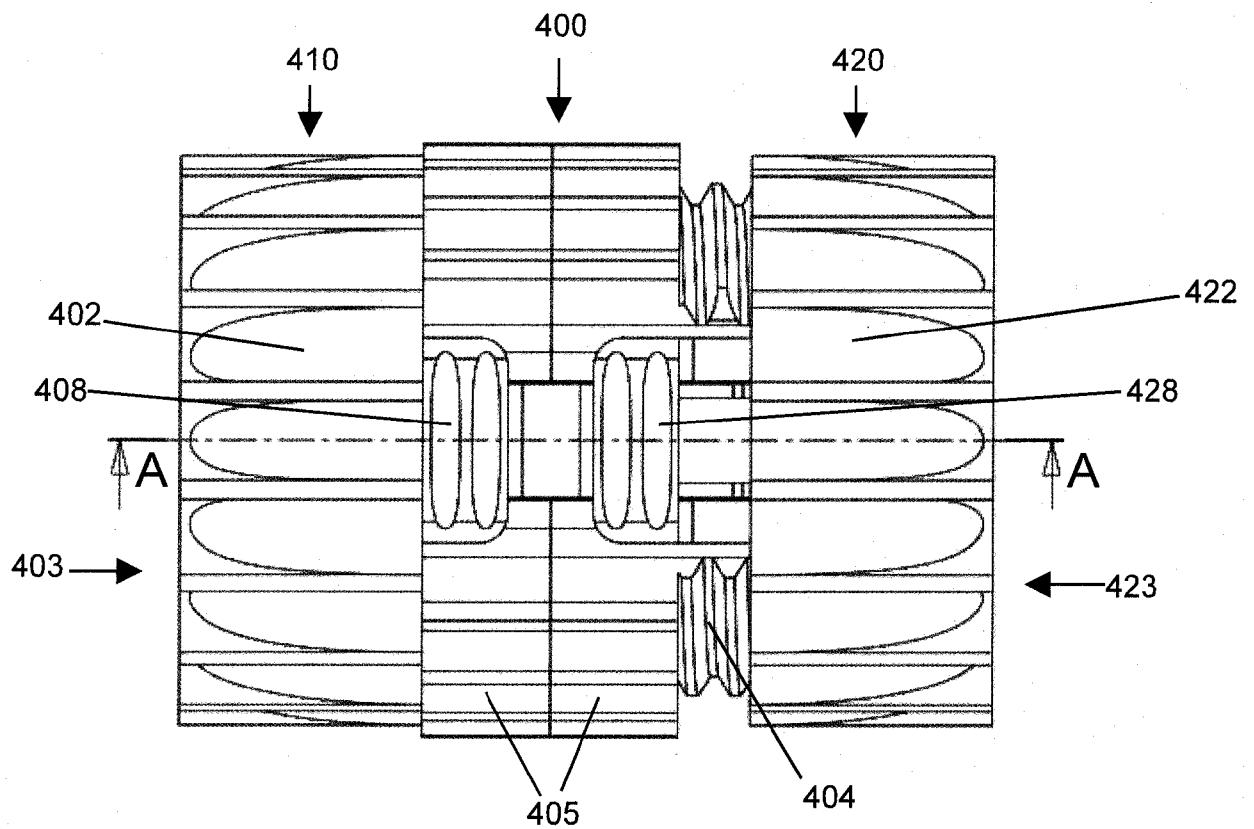


Fig. 4B

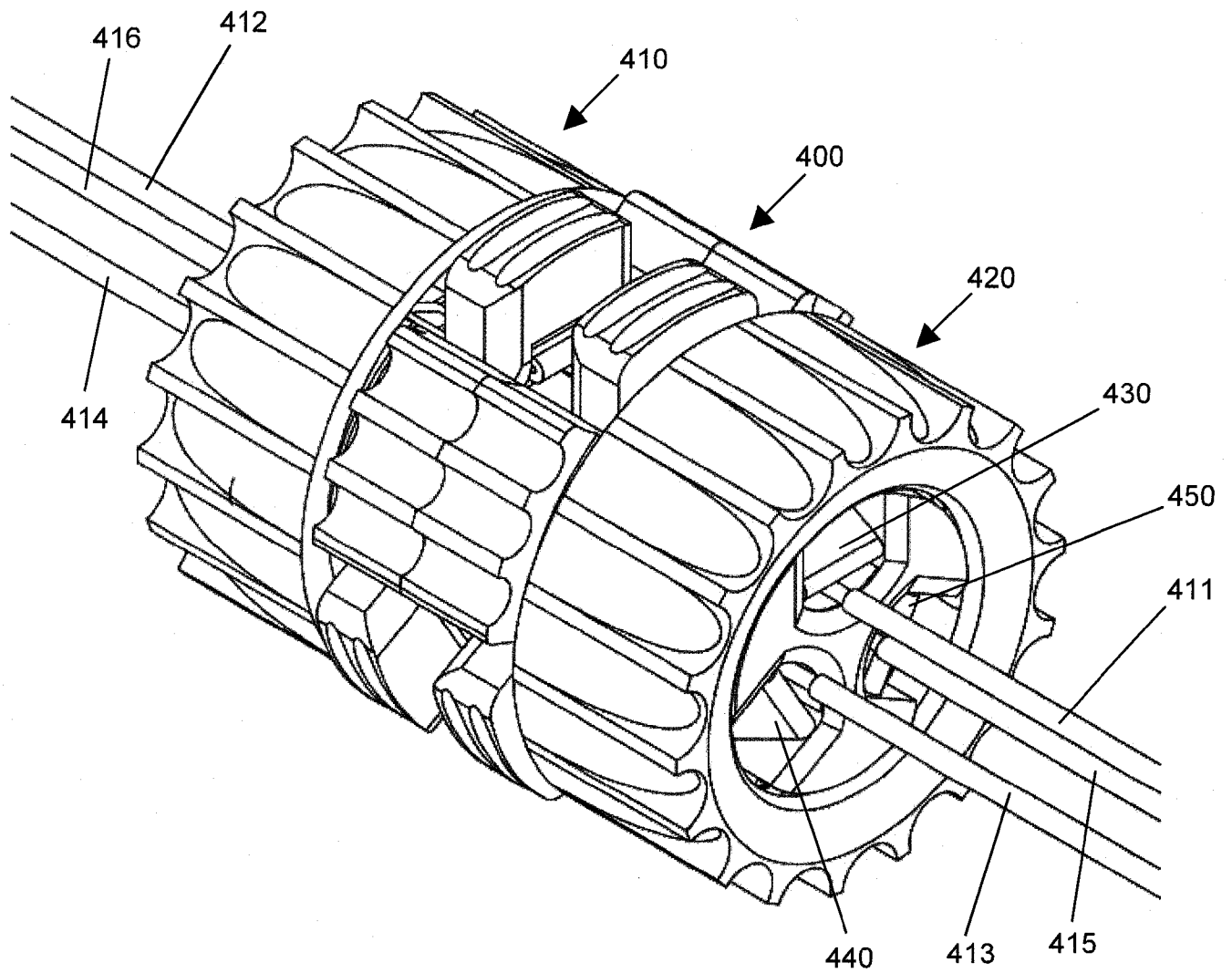


Fig. 4C

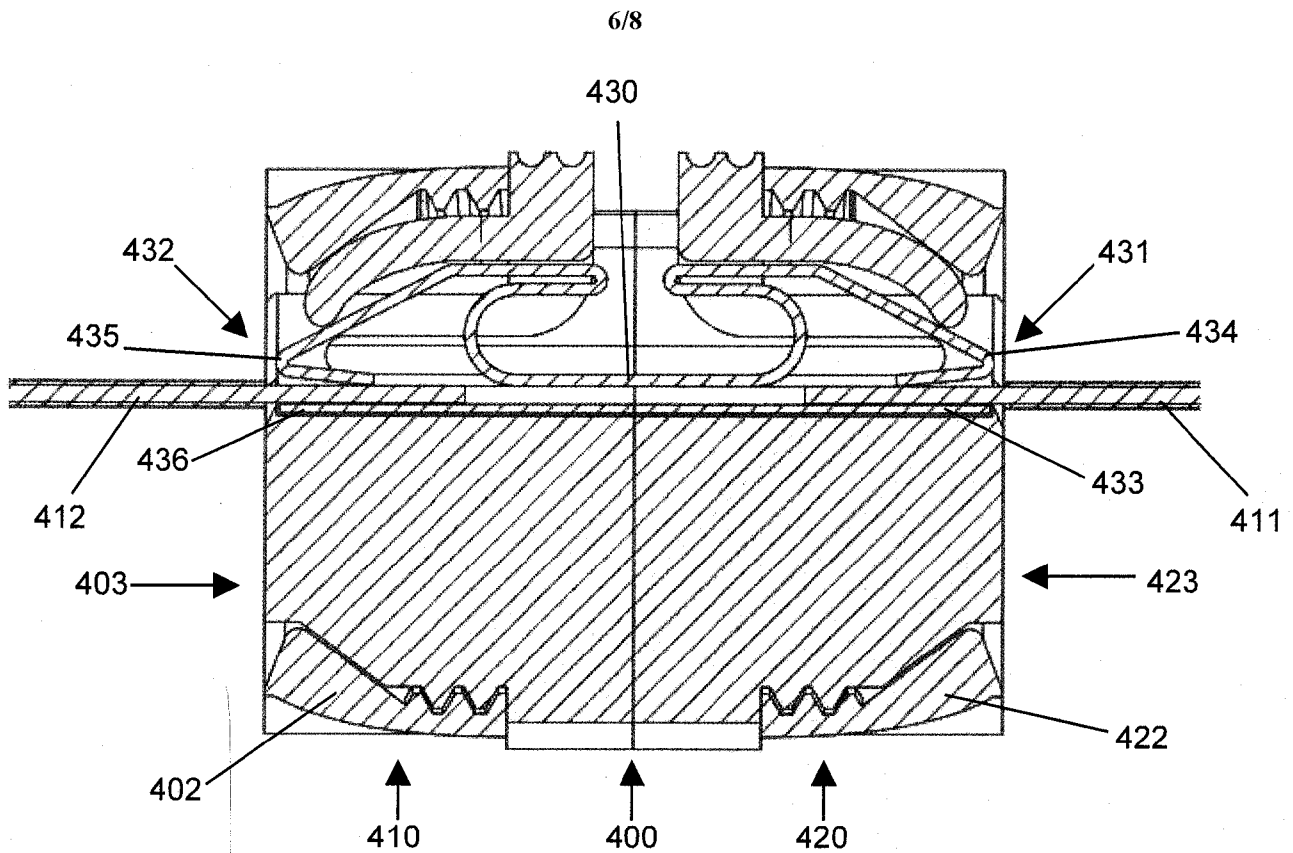


Fig. 4D

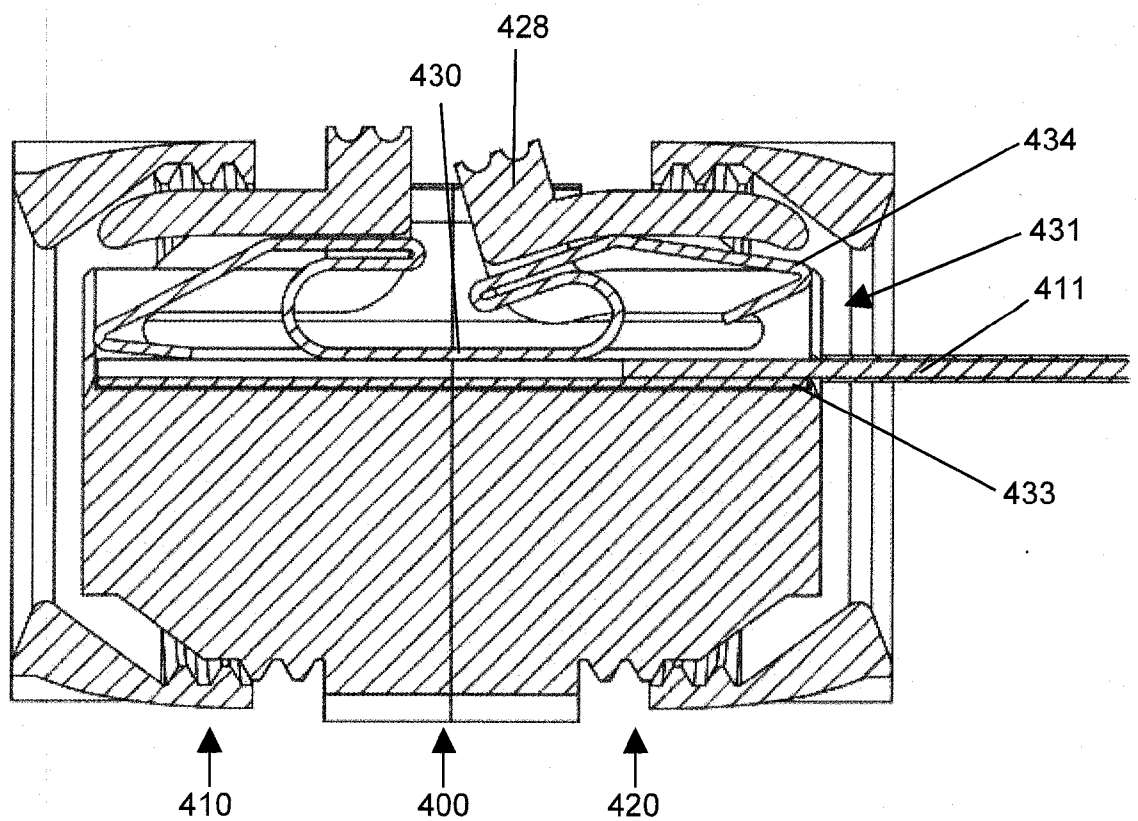


Fig. 4E

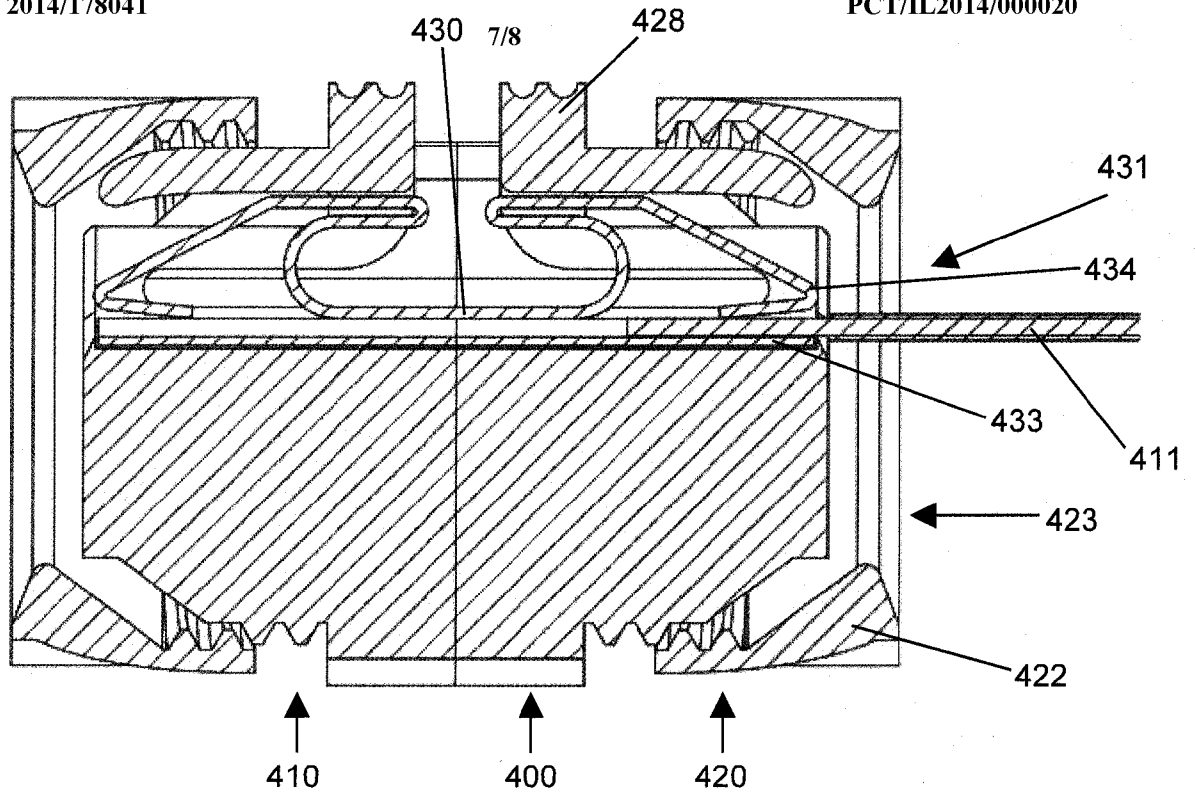


Fig. 4F

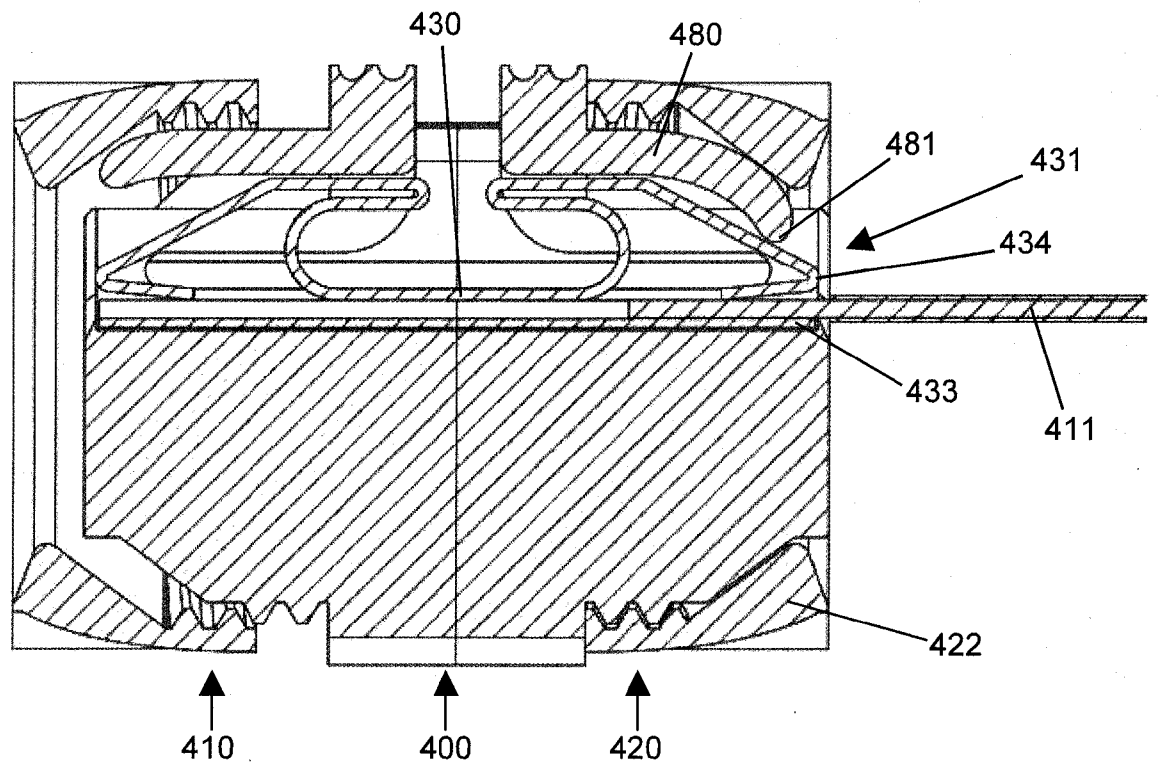


Fig. 4G

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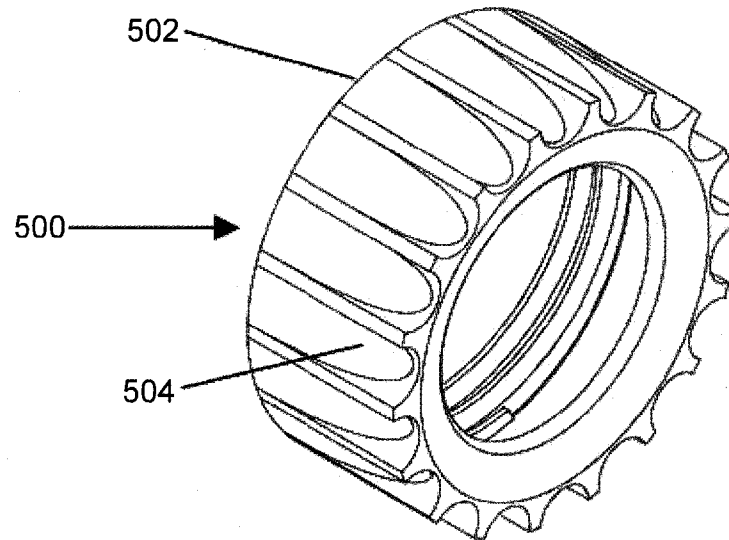


Fig. 5

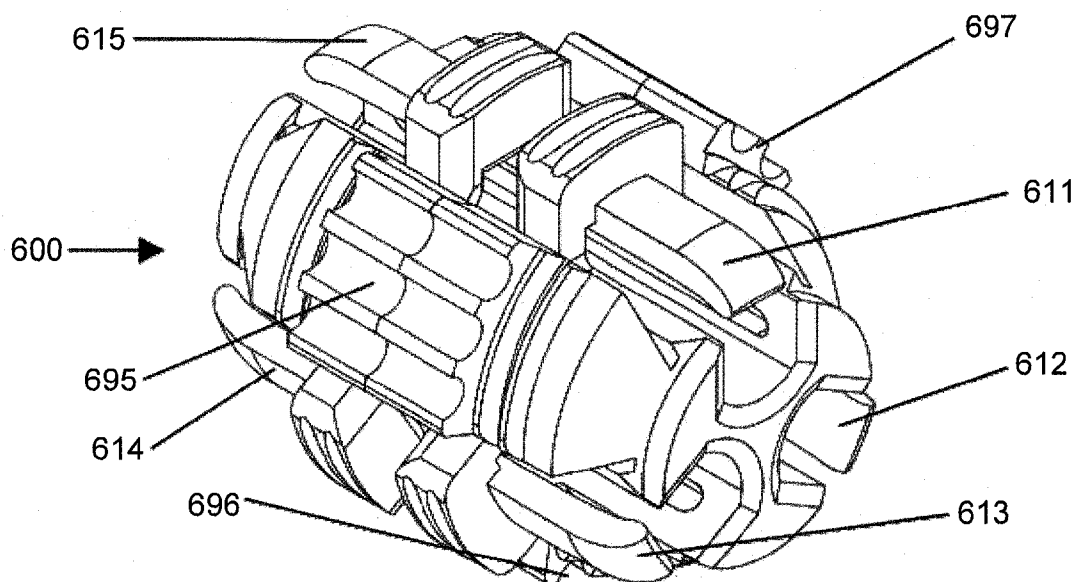


Fig. 6

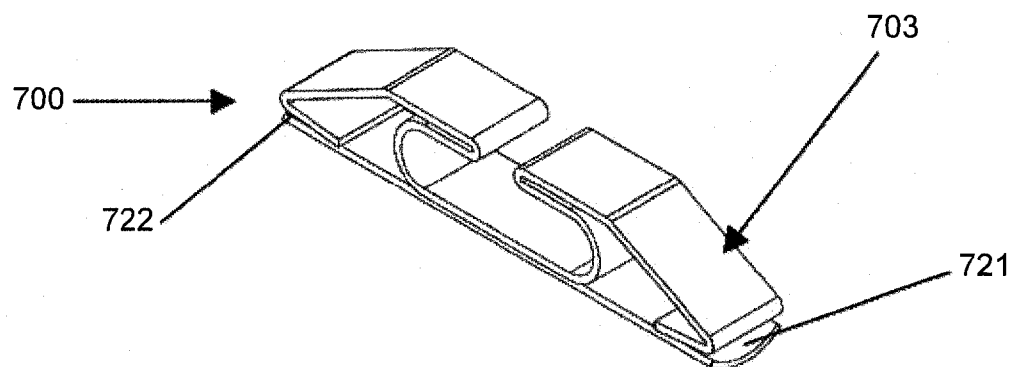


Fig. 7