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(54) Title: A CABLE CLAMP FOR A THROUGH HOLE

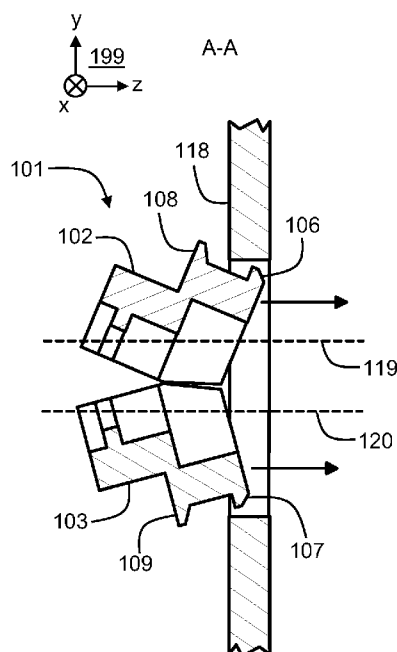


Figure 1d

(57) Abstract: A cable clamp for clamping a cable with respect to a through hole of a solid object is presented. The cable clamp comprises first and second elements (102, 103) and retainer devices (105) for keeping the first and second elements with respect to each other so that the cable gets clamped between the first and second elements and the cable clamp gets locked to the edges of the through hole with the aid of first claws extending over the edges of the through hole on a first side of the solid object and with the aid of second claws capable of extending over the edges of the through hole on the second side of the solid object. The cable clamp can be inserted into the through hole when the first and second elements are tilted with respect to each other so that the first claws are nearer to each other.



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A CABLE CLAMP FOR A THROUGH HOLE

Field of the invention

The invention relates to a cable clamp suitable for clamping a cable with respect to
5 a through hole of a casing of an electrical device or with respect to a through hole
of another solid object.

Background

In conjunction with many electrical devices, a cable has to be clamped with re-
spect to a casing or another mechanical structure of the electrical device in order
10 to provide a strain relief for protecting electrical components connected to the ca-
ble against damaging when strain is directed to the cable. The clamping can be
accomplished with a cable clamp which comprises means for pressing against the
sheath of the cable and means for attaching to the casing or another mechanical
structure of the electrical device. Publication US2003122040 presents a cable
15 clamp that comprises a first element, a second element, and retainer devices for
keeping the first and second elements together so that a cable gets clamped be-
tween the first and second elements. The cable clamp further comprises a cantile-
ver provided with a through hole so that the cable clamp can be attached to a cas-
ing or another mechanical structure of an electrical device with e.g. a screw.

20 In many cases, a casing of an electrical device is provided with a through hole for
arranging a lead-in for a cable and there is a need to clamp the cable with respect
to the edges of the through hole in order to provide a strain relief for protecting
electrical components connected to the cable against damaging when strain is di-
rected to the cable. A cable clamp of the kind described in the above-mentioned
25 publication US2003122040 is unsuitable for situations where the cable clamp
needs to be locked to the edges of the through hole and simultaneously to clamp
the cable. Especially challenging are cases where the diameter of a cable to be
clamped is significantly smaller than the diameter of the through hole. Therefore,
there is a need for such cable clamps that are suitable for situations of the kind
30 mentioned above.

Summary

The following presents a simplified summary in order to provide a basic understanding of some aspects of various invention embodiments. The summary is not an extensive overview of the invention. It is neither intended to identify key or critical elements of the invention nor to delineate the scope of the invention. The following summary merely presents some concepts of the invention in a simplified form as a prelude to a more detailed description of exemplifying embodiments of the invention.

In accordance with the invention, there is provided a new cable clamp for clamping a cable with respect to a through hole of a solid object. The solid object can be, for example but not necessarily, a wall of a casing of an electrical device.

A cable clamp according to the invention comprises a first element, a second element, and one or more retainer devices for keeping the first and second elements with respect to each other so that the first and second elements are in a first mutual position, wherein:

- a) in response to being in the first mutual position, the first and second elements are capable of i) clamping the cable between the first and second elements and ii) being locked to the edges of the through hole with the aid of first claws capable of extending over the edges of the through hole on a first side of the solid object and with the aid of second claws capable of extending over the edges of the through hole on the second side of the solid object, and
- b) in response to being in a second mutual position, where the first and second elements are tilted with respect to each other so that the first claws are nearer to each other than in the first mutual position, the first and second elements are capable being inserted to the through hole.

A direction, in which the first claws are nearer to each other in the second mutual position than in the first mutual position, is substantially parallel with directions in which the first claws are capable of extending over the edges of the through hole

on the first side of the solid object when the first and second elements are in the first mutual position.

The above-described cable clamp can be installed into the through hole when the first and second elements are tilted with respect to each other, and thereafter the one or more retainer devices can be used to force the first and second elements to the first mutual position where the cable gets clamped between the first and second elements and also the cable clamp itself gets locked to the edges of the through hole.

In accordance with the invention, there is provided also a new electrical device that can be, for example but not necessarily, a part of telecommunication equipment and it may comprise, for example, a processing system for supporting at least one of the following data transfer protocols: Internet Protocol "IP", Ethernet protocol, MultiProtocol Label Switching "MPLS" protocol, and/or Asynchronous Transfer Mode "ATM". An electrical device according to the invention comprises:

- a cable,
- a casing having a through hole for the cable,
- one or more electrical components inside the casing and connected to the cable, and
- a cable clamp according to the invention for clamping the cable with respect to the edges of the through hole of the casing.

A number of exemplifying and non-limiting embodiments of the invention are described in accompanied dependent claims.

Various exemplifying and non-limiting embodiments of the invention both as to constructions and to methods of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific exemplifying embodiments when read in connection with the accompanying drawings.

The verbs "to comprise" and "to include" are used in this document as open limitations that neither exclude nor require the existence of unrecited features. The features recited in dependent claims are mutually freely combinable unless otherwise explicitly stated. Furthermore, it is to be understood that the use of "a" or "an", i.e.
5 a singular form, throughout this document does not exclude a plurality.

Brief description of the figures

Exemplifying and non-limiting embodiments of the invention and their advantages are explained in greater detail below in the sense of examples and with reference to the accompanying drawings, in which:

10 figures 1a, 1b, 1c, 1d, and 1e illustrate a cable clamp according to an exemplifying and non-limiting embodiment of the invention,

figure 2 illustrates a cable clamp according to an exemplifying and non-limiting embodiment of the invention,

15 figures 3a and 3b illustrate a cable clamp according to an exemplifying and non-limiting embodiment of the invention,

figure 4a and 4b illustrate a cable clamp according to an exemplifying and non-limiting embodiment of the invention,

figures 5a, 5b, and 5c illustrate a cable clamp according to an exemplifying and non-limiting embodiment of the invention, and

20 figure 6 illustrates an electrical device according to an exemplifying and non-limiting embodiment of the invention.

Description of exemplifying and non-limiting embodiments

Figure 1a shows a perspective view of a cable clamp 101 according to an exemplifying and non-limiting embodiment of the invention. Figure 1b shows a front view
25 of the cable clamp, and figure 1c shows a side view of the cable clamp. Figures 1d and 1e show section views that illustrate installation of the cable clamp 101 into a through hole of a wall 118. The section is taken along a line A-A shown in figure

1b and the section plane is parallel with the yz-plane of a coordinate system 199. The cable clamp comprises a first element 102, a second element 103, and retainer devices 104 and 105 for keeping the first and second elements with respect to each other so that the first and second elements are in a first mutual position. In the exemplifying case illustrated in figures 1a-1e, the retainer devices 104 and 105 are screws. A situation where the first and the second elements 102 and 103 are in the above-mentioned first mutual position with respect to each other is illustrated in figures 1a-1c, and 1e. As illustrated in figure 1e, the first and second elements 102 and 103 are capable of being locked to the edges of the through hole of the wall 118 with the aid of first claws 106 and 107 extending over the edges of the through hole on a first side of the wall and with the aid of second claws 108 and 109 extending over the edges of the through hole on the second side of the wall. As illustrated in figure 1d, the first and second elements 102 and 103 can be inserted into the through hole of the wall 118 when the first and second elements 102 and 103 are in a second mutual position where the first and second elements are tilted with respect to each other so that the first claws 106 and 107 are nearer to each other than in the first mutual position shown in figure 1e. As illustrated in figure 1e, the first and second elements 102 and 103 are capable of clamping a cable when being in the first mutual position. In figures 1d and 1e, the outer surface of the cable is depicted with dashed lines 119 and 120.

In the exemplifying case illustrated in figures 1a-1e, the first and second elements 102 and 103 of the cable clamp 101 are separate pieces of material. Figure 2 shows cable clamp 201 according to another exemplifying and non-limiting embodiment of the invention. The cable clamp 201 comprises a bendable isthmus 212 between first and second elements 202 and 203 of the cable clamp. The bendable isthmus allows the first and second elements to be turned with respect to each other between mutual positions such as illustrated in figures 1d and 1e.

Figure 3a shows a side view of a cable clamp 301 according to an exemplifying and non-limiting embodiment of the invention. Figure 3b shows a view of a section taken along a line A-A shown in figure 3a. The section plane is parallel with the xy-plane of a coordinate system 399. The cable clamp 301 comprises a first element 302, a second element 303, and retainer devices 304 and 305. In the exemplifying

cable clamp 301 illustrated in figures 3a and 3b, the first element 302 comprises a clamping part 310 that is a separate piece with respect to a body of the first element 302. The retainer devices 304 and 305 are arranged to press the clamping part 310 towards the second element 303 so as to press a cable between the clamping part 310 and the second element 303 as illustrated in figure 3b. The outer surface of the cable being clamped is depicted with a dashed line circle 319 in figure 3b. In the exemplifying case illustrated in figures 3a and 3b, the retainer devices 304 and 305 are screws arranged to fit with threaded holes of the second element 303.

Figure 4a shows a side view of a cable clamp 401 according to an exemplifying and non-limiting embodiment of the invention. Figure 4b shows a view of a section taken along a line A-A shown in figure 4a. The section plane is parallel with the xy-plane of a coordinate system 499. The cable clamp 401 comprises a first element 402, a second element 403, and retainer devices 404 and 405. In the exemplifying cable clamp 401 illustrated in figures 4a and 4b, the first element 402 comprises a first clamping part 410 that is a separate piece with respect to a body of the first element 402 and the second element 403 comprises a second clamping part 411 that is a separate piece with respect to a body of the second element 403. The retainer devices 404 and 405 are arranged to press the first and second clamping parts 410 and 411 towards each other so as to press a cable between the first and second clamping parts 410 and 411 as illustrated in figure 4b. The outer surface of the cable being clamped is depicted with a dashed line circle in figure 4b. In the exemplifying case illustrated in figures 4a and 4b, the retainer devices 404 and 405 are screws arranged to fit with threaded holes of the second clamping part 411.

Figure 5a shows a side view of a cable clamp 501 according to an exemplifying and non-limiting embodiment of the invention. Figure 5b shows a view of the cable clamp 501 seen along an arrow B shown in figure 5a. Figure 5c shows a view of a section taken along a line A-A shown in figure 5b. The section plane is parallel with the yz-plane of a coordinate system 599. The cable clamp 501 comprises a first element 502, a second element 503, and a retainer device 504 for keeping the first and second elements together as illustrated in figures 5a-5c. In this exemplify-

ing case, the retainer device 504 is a clip spring arranged to keep the first and second elements 502 and 503 in the mutual position illustrated in figures 5a-5c. The clip spring 504 can be made of a sheet of suitable spring material such as for example steel. It is also possible that there is two or more clip springs for keeping
5 the first and second elements 502 and 503 in the mutual position illustrated in figures 5a-5c. The outer surface of a cable being clamped is depicted with a dashed line circle in figure 5b.

The exemplifying cable clamp illustrated in figures 5a-5c further comprises flexible material 513 on the surface that is intended to face towards the wall surface of a
10 through hole into which the cable clamp can be installed. The flexible material can be e.g. rubber or some other suitable flexible material, and a layer of the flexible material can be attached to the appropriate surfaces of the first and second elements 502 and 503. The exemplifying cable clamp illustrated in figures 5a-5c comprises a flexible band made of the flexible material 513 and surrounding the
15 surface intended to face towards the wall surface of a through hole.

In the above-described exemplifying cable clamps 101, 201, 301, 401, and 501, the first and second elements 102, 103, 202, 203, 302, 303, 402, 403, 502, and 503 can be made of for example plastic or metal. The method of manufacture may comprise for example mold casting and/or machining.

20 Figure 6 illustrates an electrical device according to an exemplifying and non-limiting embodiment of the invention. The electrical device can be, for example but not necessarily, a part of telecommunication equipment and the electrical device may comprise, for example, a processing system for supporting at least one of the following data transfer protocols: Internet Protocol "IP", Ethernet protocol, Multi-
25 Protocol Label Switching "MPLS" protocol, and/or Asynchronous Transfer Mode "ATM". The electrical device comprises a casing 615. In figure 6, a section view of the casing 615 is shown. The section is taken along a plane parallel with the yz-plane of a coordinate system 699. The electrical device comprises one or more electrical components inside the casing. Two of the electrical components are de-
30 noted with reference numbers 617 and 616. The electrical device comprises a cable 614 connected to the electrical component 616 and a cable clamp 601 for

clamping the cable 614 with respect to the edges of a through hole of the casing 615. The cable clamp 601 can be, for example, such as any of the cable clamps illustrated earlier in this document. The cable 616 can be, for example, an electrical cable or an optical cable.

- 5 The specific examples provided in the description given above should not be construed as limiting the applicability and/or the interpretation of the appended claims.

What is claimed is:

1. A cable clamp (101, 201, 301, 401, 501, 601) for clamping a cable with respect to edges of a through hole of a solid object, the cable clamp comprising a first element (102, 202, 302, 402, 502), a second element (103, 203, 303, 403,
5 503), and one or more retainer devices (104, 105, 304, 305, 404, 405, 504) for keeping the first and second elements with respect to each other so that the first and second elements are in a first mutual position, wherein
 - a) in response to being in the first mutual position, the first and second elements are capable of i) being locked to the edges of the through hole with
10 the aid of first claws (106, 107) for extending over the edges of the through hole on a first side of the solid object and with the aid of second claws (108, 109) for extending over the edges of the through hole on a second side of the solid object, and ii) clamping the cable between the first and second elements, and
 - 15 b) in response to being in a second mutual position, where the first and second elements are tilted with respect to each other so that the first claws are nearer to each other than in the first mutual position, the first and second elements are capable being inserted to the through hole,
- characterized** in that a direction, in which the first claws are nearer to each other
20 in the second mutual position than in the first mutual position, is substantially parallel with directions in which the first claws are capable of extending over the edges of the through hole on the first side of the solid object when the first and second elements are in the first mutual position.
2. A cable clamp according to claim 1, wherein the first element (302) comprises a clamping part (310) being a separate piece with respect to a body of the first
25 element, and the one or more retainer devices are capable of pressing the clamping part towards the second element so as to press the cable between the clamping part and the second element.
3. A cable clamp according to claim 1, wherein the first element (402) comprises a first clamping part (410) being a separate piece with respect to a body of the
30

first element and the second element (403) comprises a second clamping part (411) being a separate piece with respect to a body of the second element, and the one or more retainer devices are capable of pressing the first and second clamping parts towards each other so as to press the cable between the first and
5 second clamping parts.

4. A cable clamp according to any of claims 1-3, wherein the retainer elements are screws (104, 105, 304, 305, 404, 405) arranged to fit with threaded holes of the second element.
5. A cable clamp according to any of claims 1-3, wherein the one or more re-
10 tainer elements is/are one or more clip springs (504) for keeping the first and second elements in the first mutual position.
6. A cable clamp according to any of claims 1-5, wherein the first and second elements (102, 103, 302, 303, 403, 403, 502, 503) are separate pieces of material.
7. A cable clamp according to any of claims 1-5, wherein there cable clamp
15 comprises a bendable isthmus (212) between the first and second elements (202, 203) and allowing the first and second elements to be turned with respect to each other between the first and second mutual positions.
8. A cable clamp according to any of claims 1-7, wherein the first and second elements are made of one of the following: plastic, metal.
- 20 9. A cable clamp according to any of claims 1-8, wherein the cable clamp further comprises flexible material (513) on a surface for facing towards a wall surface of the through hole of the solid object.
10. A cable clamp according to claim 9, wherein the cable clamp comprises a flexible band made of the flexible material and surrounding the surface for facing
25 towards the wall surface of the through hole of the solid object.
11. An electrical device comprising:

- a cable (614),

- a casing (615) having a through hole for the cable,
 - one or more electrical components (616, 617) inside the casing and connected to the cable, and
 - a cable clamp (601) according to any of claims 1-10 for clamping the cable
- 5 with respect to edges of the through hole of the casing.

12. An electrical device according claim 11, wherein the one or more electrical components comprise a processing system for supporting at least one of the following data transfer protocols: Internet Protocol "IP", Ethernet protocol, MultiProtocol Label Switching "MPLS" protocol, Asynchronous Transfer Mode "ATM".

AMENDED CLAIMS

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What is claimed is:

1. A cable clamp (101, 201, 301, 401, 501, 601) for clamping a cable with respect to edges of a through hole of a solid object, the cable clamp comprising a first element (102, 202, 302, 402, 502), a second element (103, 203, 303, 403, 503), and one or more retainer devices (104, 105, 304, 305, 404, 405, 504) for keeping the first and second elements with respect to each other so that the first and second elements are in a first mutual position, wherein
- a) in response to being in the first mutual position, the first and second elements are capable of i) being locked to the edges of the through hole with the aid of first claws (106, 107) for extending over the edges of the through hole on a first side of the solid object and with the aid of second claws (108, 109) for extending over the edges of the through hole on a second side of the solid object, and ii) clamping the cable between the first and second elements, and
- b) in response to being in a second mutual position, where the first and second elements are tilted with respect to each other so that the first claws are nearer to each other than in the first mutual position, the first and second elements are capable of being inserted to the through hole,
- characterized** in that a direction, in which the first claws are nearer to each other in the second mutual position than in the first mutual position, is substantially non-intersecting with directions in which the first claws are capable of extending over the edges of the through hole on the first side of the solid object when the first and second elements are in the first mutual position.
2. A cable clamp according to claim 1, wherein the first element (302) comprises a clamping part (310) being a separate piece with respect to a body of the first element, and the one or more retainer devices are capable of pressing the clamping part towards the second element so as to press the cable between the clamping part and the second element.
3. A cable clamp according to claim 1, wherein the first element (402) comprises a first clamping part (410) being a separate piece with respect to a body of the

first element and the second element (403) comprises a second clamping part (411) being a separate piece with respect to a body of the second element, and the one or more retainer devices are capable of pressing the first and second clamping parts towards each other so as to press the cable between the first and
5 second clamping parts.

4. A cable clamp according to any of claims 1-3, wherein the retainer devices are screws (104, 105, 304, 305, 404, 405) arranged to fit with threaded holes of the second element.

5. A cable clamp according to any of claims 1-3, wherein the one or more retainer devices is/are one or more clip springs (504) for keeping the first and second elements in the first mutual position.
10

6. A cable clamp according to any of claims 1-5, wherein the first and second elements (102, 103, 302, 303, 403, 403, 502, 503) are separate pieces of material.

7. A cable clamp according to any of claims 1-5, wherein the cable clamp comprises a bendable isthmus (212) between the first and second elements (202, 203) and allowing the first and second elements to be turned with respect to each other between the first and second mutual positions.
15

8. A cable clamp according to any of claims 1-7, wherein the first and second elements are made of one of the following: plastic, metal.

9. A cable clamp according to any of claims 1-8, wherein the cable clamp further comprises flexible material (513) on a surface for facing towards a wall surface of the through hole of the solid object.
20

10. A cable clamp according to claim 9, wherein the cable clamp comprises a flexible band made of the flexible material and surrounding the surface for facing towards the wall surface of the through hole of the solid object.
25

11. An electrical device comprising:

- a cable (614),

- a casing (615) having a through hole for the cable,
 - one or more electrical components (616, 617) inside the casing and connected to the cable, and
 - a cable clamp (601) according to any of claims 1-10 for clamping the cable
- 5 with respect to edges of the through hole of the casing.

12. An electrical device according claim 11, wherein the one or more electrical components comprise a processing system for supporting at least one of the following data transfer protocols: Internet Protocol "IP", Ethernet protocol, MultiProtocol Label Switching "MPLS" protocol, Asynchronous Transfer Mode "ATM".

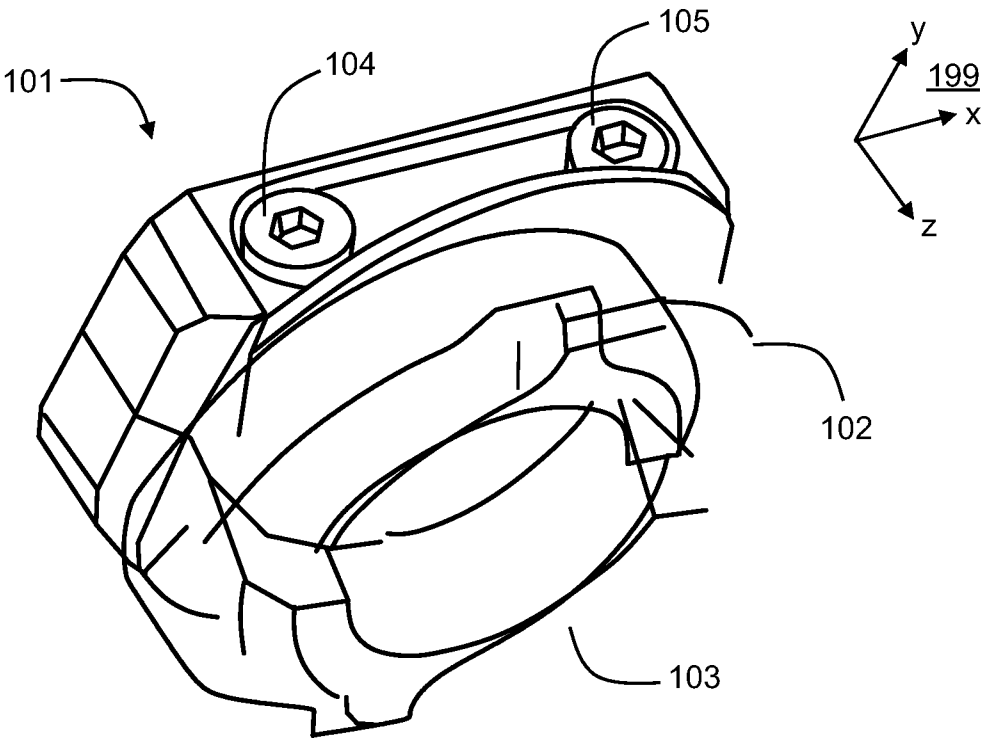


Figure 1a

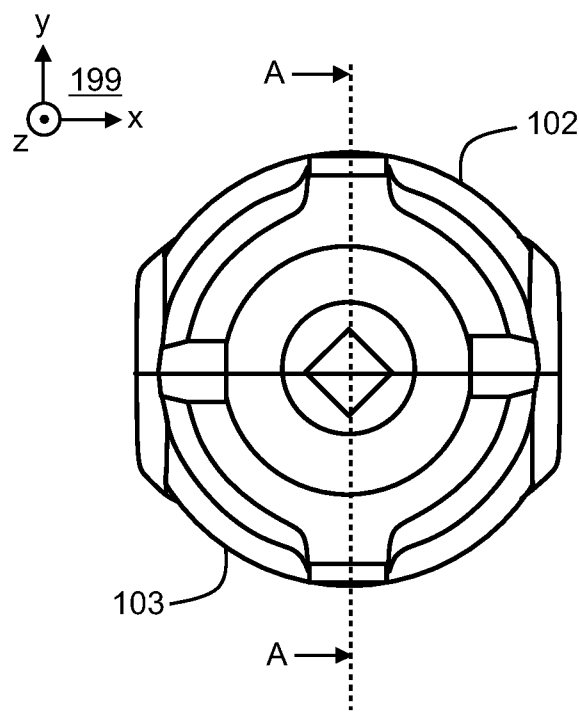


Figure 1b

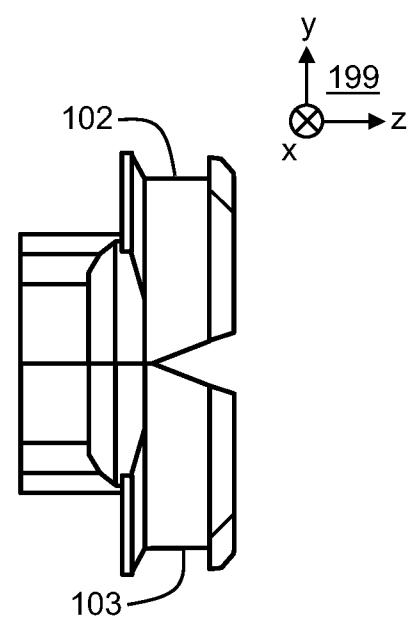


Figure 1c

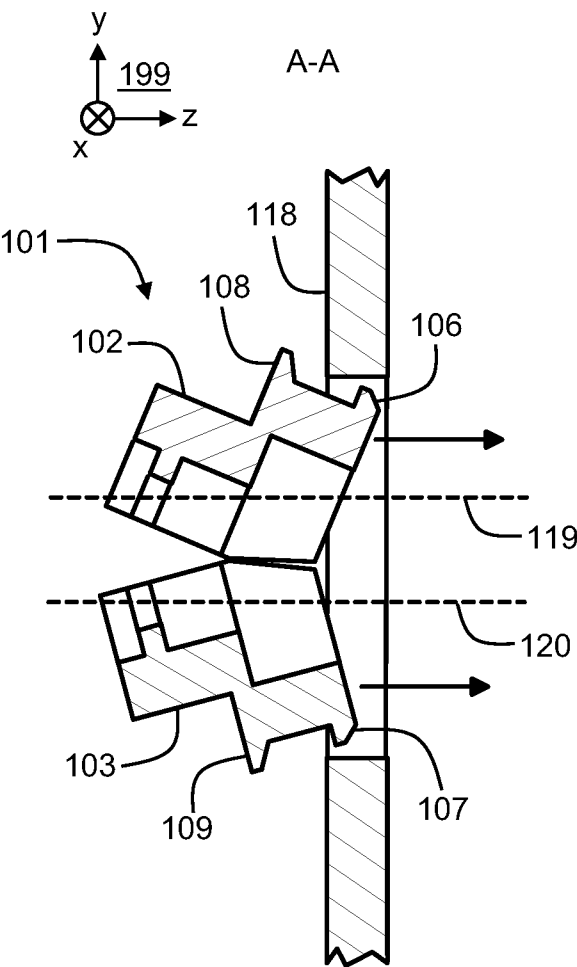


Figure 1d

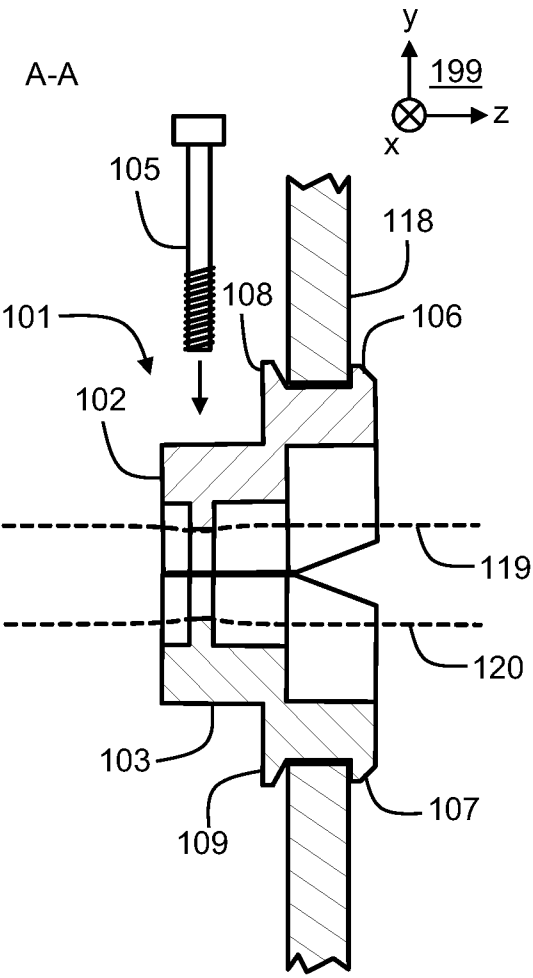


Figure 1e

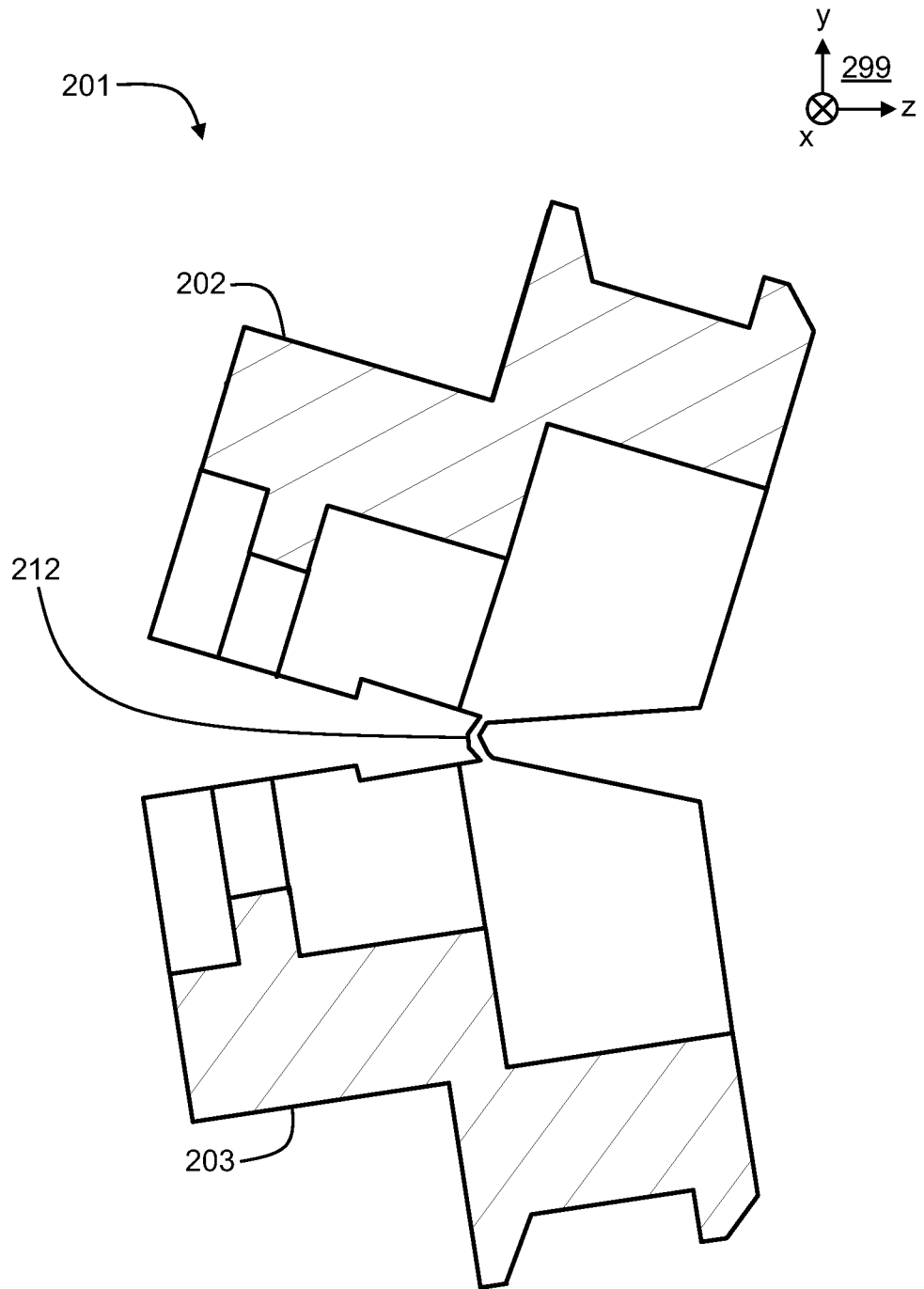


Figure 2

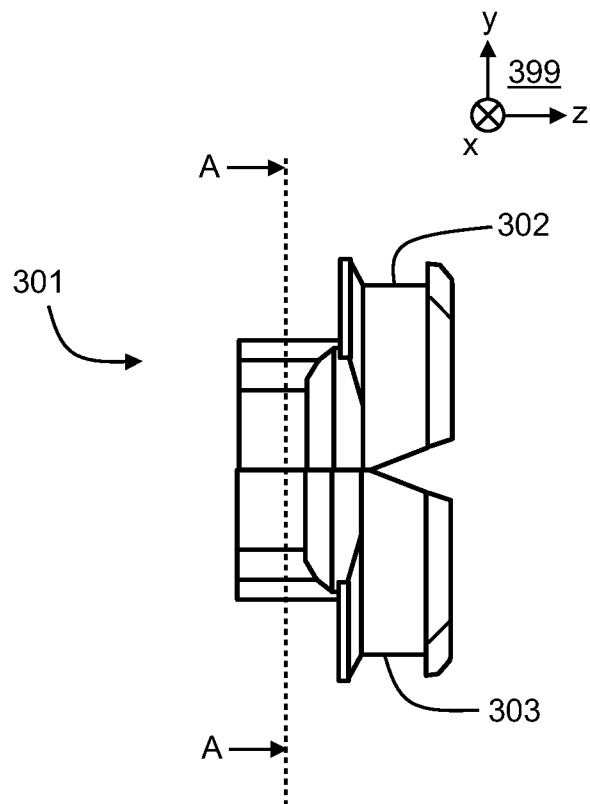


Figure 3a

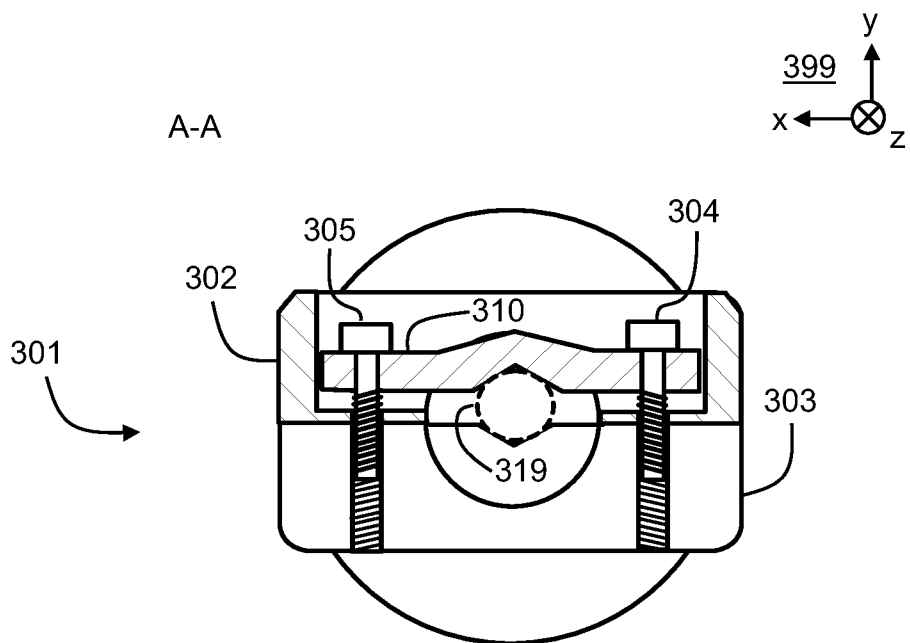


Figure 3b

5 / 7

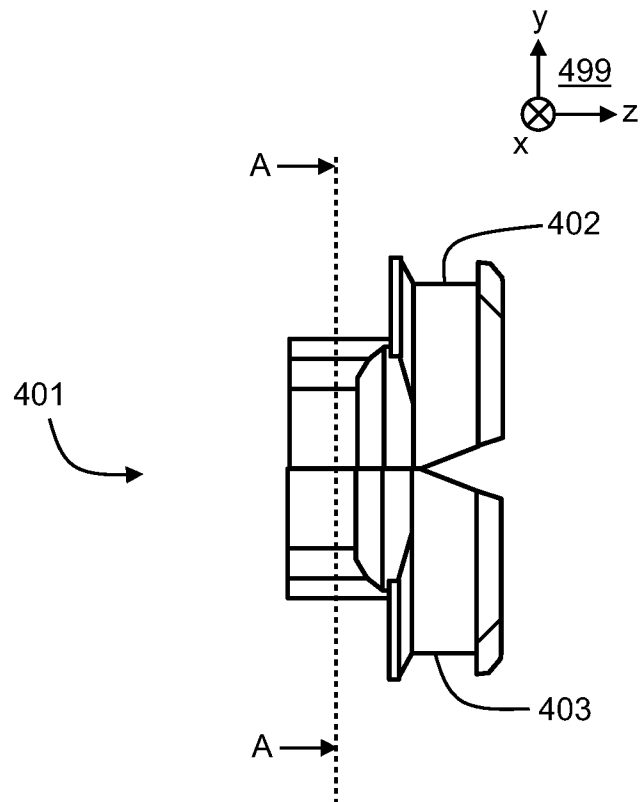


Figure 4a

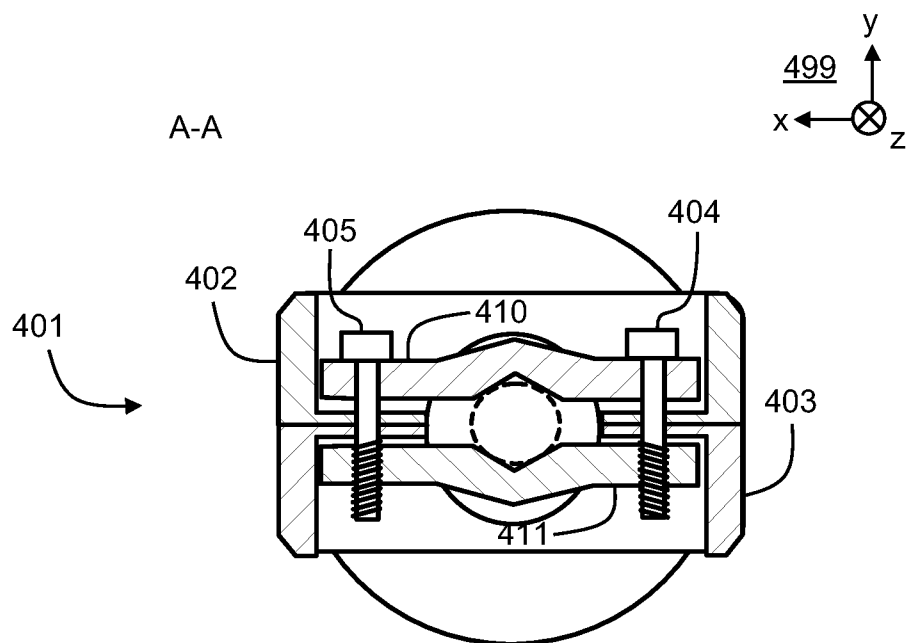


Figure 4b

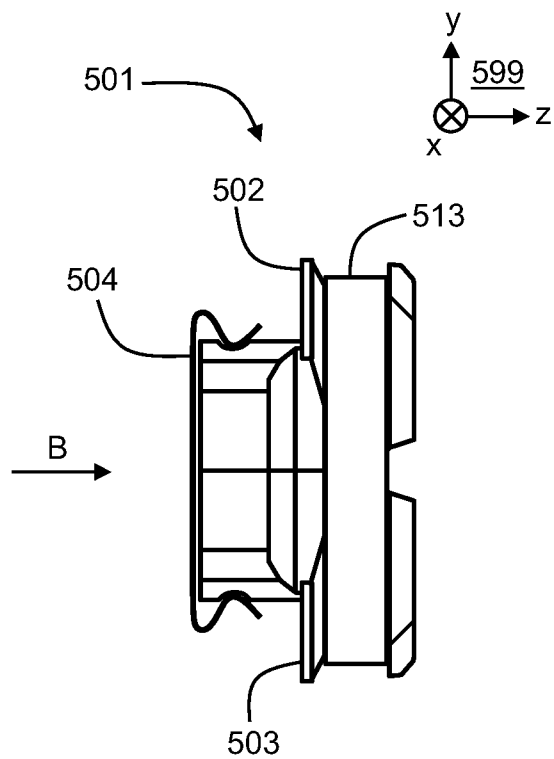


Figure 5a

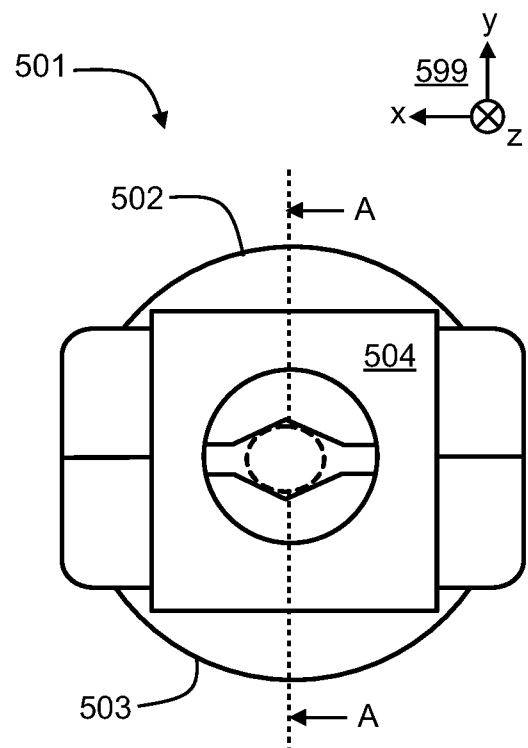


Figure 5b

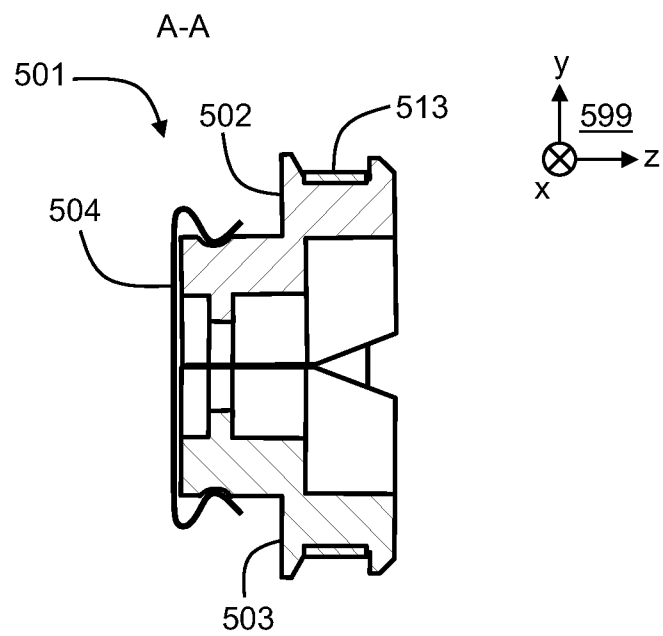


Figure 5c

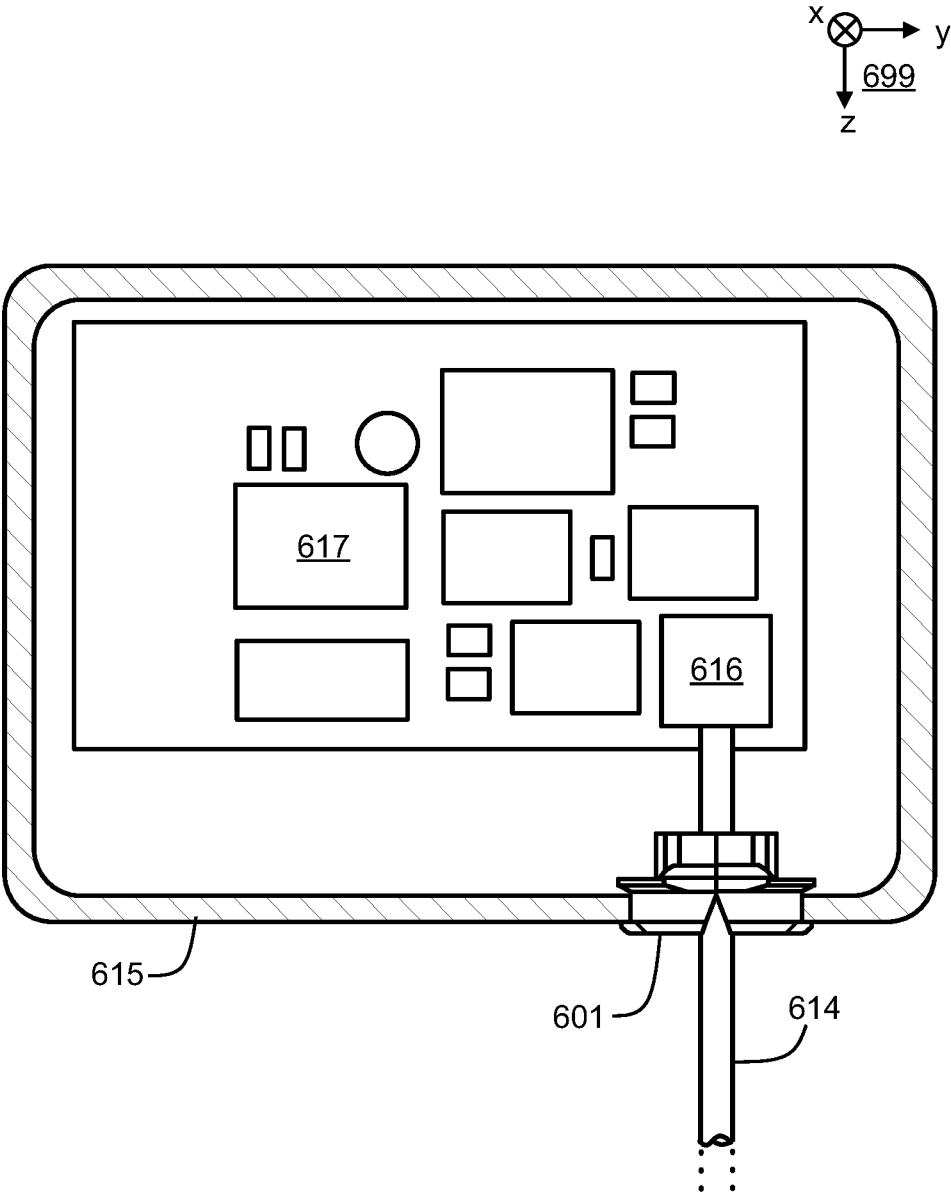


Figure 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2015/055148

A. CLASSIFICATION OF SUBJECT MATTER
INV. H02G3/08 H02G3/22
ADD. H02G15/007

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H02G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2014/041932 A1 (NICE CURTIS A [US]) 13 February 2014 (2014-02-13) paragraph [0018] - paragraph [0024]; figures 2a,2b	1,7-9,11
Y	GB 2 256 322 A (SHINAGAWA SHOKO CO LTD [JP]) 2 December 1992 (1992-12-02) the whole document	1,7-9,11
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INTERNATIONAL SEARCH REPORT

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