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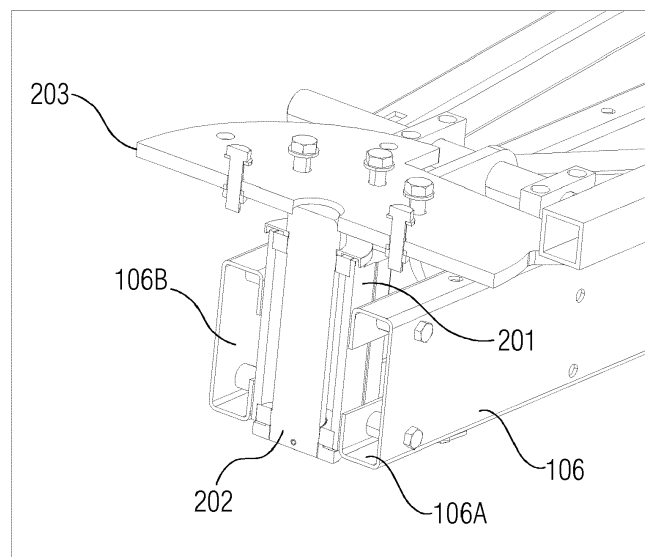
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(54) **ROTARY UNIT FOR A HIGH VOLTAGE SWITCHING DEVICE**

(57) A switching device (100) is provided. The switching device has movable current path arms (101A, 101B) detachably coupled with one another, for controlling transfer of electrical current therebetween, at least one insulator (104A, 104B) operably connected with the moveable current path arms (101A, 101B), a base frame (106) supporting the insulators and the moveable current

path arms (101A, 101B), and at least one rotary unit (201) physically integrated with the base frame (106) and configured to support said at least one insulator (104A, 104B). The rotary unit (201) is configured as a generally concave polygon having at least one surface (201A, 201B, 201E) physically disposed against the base frame (106).

FIG 2



Description

[0001] The present disclosure relates to switching devices such as air-insulated disconnectors. More particularly, the present disclosure relates to a rotary unit typically employed in disconnectors such as a center-break type, a double-break type disconnector, a knee-type, a vertical break type, a pantograph type, and/or a semi-pantograph type disconnector having turning/operating insulators installed on a rotary unit.

[0002] A switching device, for example, a disconnector. A disconnector is an essential part of electrical power substations. A disconnector indicates a visible isolating distance via an air-isolated gap. A disconnector is an assembly having a function of assuring an interruption of voltage supply line to the switchgear when the disconnector is open, thus isolating the switchgear from electric supply. A disconnector typically includes various configurations such as horizontal break, vertical break, pantograph, etc.

[0003] FIG 1A is a perspective view of an active part of a switching device 100 such as a horizontal center-break type disconnector according to state of the art. The switching device 100 has movable current path arms 101A and 101B detachably coupled to each other and capable of rotation to occupy two positions, namely a closed position and an open position. The configuration shown in FIG 1A represents the closed position wherein the moving arms 101A and 101B are in electrical contact with each other via a main contact system 103. In the open position, the moveable contact arms 101A and 101B rotate so as to break the electrical contact between them. Each of the moveable contact arms 101A and 101B are connected to the electricity supply and to the distribution bus bars via transfer contact systems 102C and 102D having rotatable terminal stems 102A and 102B respectively. Each of the terminal stems 102A and 102B, the moveable contact arms 101A and 101B, and the main contact system 103, are supported by insulators 104A and 104B which are in turn supported by a base frame 106. The base frame comprises rotary units 105 and 105B that incorporate a rotation drive mechanism providing linear and/or rotary movement to the insulators 104A and 104B and the contact system 103 thereby, leading to making and breaking of the current path between the moveable contact arms 101A and 101B. The rotary units 105A and 105B typically comprise ball-bearings, shaft, disc, etc., designed for handling high mechanical loads.

[0004] FIG 1B is a perspective view of the base frame 106, according to state of the art, of the switching device 100 shown in FIG 1A. Each of the rotary units 105A and 105B (also known as rotary base units, rotary stool bases, rotary pedestals, etc.) of the base frame 106, enables transmission of a linear motion to a rotary motion. Typically, these rotary units 105A and 105B are casted or welded. Moreover, these are typically, semi-integrated to the substructure or base frame 106. These conven-

tional variants of the rotary units 105A and 105B, require high efforts for managing any variations in design specifications. Furthermore, these conventional variants of the rotary units 105A and 105B also demand additional items and/or elements for stabilizing the base frame 106, for applications especially, with additional mechanical stresses and/or environment stress due to increased terminal size, wind, and/or seismic loads, beyond standardizations.

[0005] Accordingly, it is an object of the present invention, to provide a switching device with a rotary unit configured such that the efforts required to accommodate design variations are reduced without compromising on mechanical stability.

[0006] The switching device disclosed herein achieves the aforementioned object by a rotary unit which has a shape of a generally concave polygon and a near complete integration into the base frame.

[0007] Disclosed herein is a switching device, for example, a high voltage disconnector such as a center break type disconnector or a double side break type disconnector. The switching device disclosed herein comprises movable current path arms detachably coupled with one another, for controlling transfer of electrical current therebetween. The switching device comprises at least one insulator operably connected with the moveable current path arms. The switching device comprises a base frame supporting the insulators and the moveable current path arms.

[0008] The switching device comprises at least one rotary unit physically integrated with the base frame and configured to support the insulator(s). The rotary unit transfers torque to the moveable current path arms via insulators for making and breaking of the electrical contact. As used herein, "physically integrated" refers to a rigid attachment between the rotary unit and the base frame such that the rotary unit is installed at least partially within the base frame and not completely above the base frame. This physical integration results in a significant stabilization effect on the base frame and partially eliminates stabilizing or stiffening elements used for enhancing mechanical strength of the base frame.

[0009] The rotary unit is configured as a hollow member defining a space there-within. The space is centrally defined in the rotary member such that the physical dimensions of this defined space are based on one or more elements to be accommodated there-within. The elements comprise, for example, bearings, bearing seats, a turning shaft, etc., to transmit the rotary movement to the insulators.

[0010] The rotary unit is configured as a generally concave polygon. As used herein, "generally concave polygon" refers to a three-dimensional structure having at least one concave surface. The generally concave polygon is, for example, a star-shaped unit. The rotary unit comprises one or more concave surfaces. The rotary unit is, for example, a triangular, a quadrangular, a polygonal, etc., structure having one or more concave surfaces. To

make the surfaces concave, the rotary unit is configured by an extrusion manufacturing or a casting manufacturing process, that is, either the material from the surfaces is removed, that is, extruded or a cast is developed so as to form one or more concave surfaces. According to one aspect of the present disclosure, an amount of material to be retained in the rotary unit is a function of the space required to be defined inside the rotary unit to accommodate the bearing, the bearing seats, and/or the turning shaft. According to another aspect of the present disclosure, the amount of material to be retained is a function of the mechanical stability required to support the insulator(s) and/or to be imparted to the base frame so that an equal distribution of mechanical stresses occurs across the rotary unit. The concave surfaces of the rotary unit provide cost optimized manufacturing due to reduced machining efforts. Moreover, with casting manufacturing the material requirements are significantly decreased thereby, decreasing costs associated therewith.

[0011] One or more concave surfaces of the rotary unit are physically disposed against one or more channels of the base frame so as to be in rigid contact with the base frame. The rigid connection between the rotary unit and the base frame is achieved via fasteners comprising, for example, screws, nuts, studs, etc. According to one aspect of the present disclosure, due to the concave surfaces, the rotary unit assumes an isotoxal geometry, for example, having a top and a bottom surface shaped as a multi-vertex star, for example, a three-point star, a four-point star, or even an eight-point star. The star-shaped geometry optimizes weight of the rotary unit while enabling easy integration within the base frame. According to this aspect, one or more vertices of the rotary unit are physically disposed against the channels. According to this aspect, the rotary unit is configured to have orifices drilled or punched along a length wise edge at each of the vertices that are physically disposed against the channels. The fasteners can be installed in these orifices to affix the rotary unit to the channels. According to another aspect of the present disclosure, the rotary unit assumes a hyperboloid shape with a top and a bottom surface shaped as a multi-vertex star. According to this aspect, only as much material is retained, as required for providing a surface area for supporting one or more elements such as the turning shaft, the bearing, the insulators, etc.

[0012] The above mentioned and other features of the invention will now be addressed with reference to the accompanying drawings of the present invention. The illustrated embodiments are intended to illustrate, but not limit the invention.

[0013] The present invention is further described hereinafter with reference to illustrated embodiments shown in the accompanying drawings, in which:

FIG 1A is a perspective view of an active part of a switching device such as a horizontal center-break type disconnecter accord-

ing to state of the art.

FIG 1B is a perspective view of the base frame, according to state of the art, of the switching device shown in FIG 1A.

FIG 2 illustrates a rotary unit according to an embodiment of the present disclosure, integrated within a base frame.

FIGS 3A-3B illustrate different views of the rotary unit, according to an embodiment of the present disclosure having two concave surfaces.

FIGS 4A-4B illustrate different views of the rotary unit, according to an embodiment of the present disclosure having four concave surfaces.

[0014] Various embodiments are described with reference to the drawings, wherein like reference numerals are used to refer like elements throughout. In the following description, for the purpose of explanation, numerous specific details are set forth in order to provide thorough understanding of one or more embodiments. It may be evident that such embodiments may be practiced without these specific details.

[0015] FIG 2 illustrates a rotary unit 201 according to an embodiment of the present disclosure, integrated within a base frame 106. The rotary unit 201 is physically disposed against channels 106A and 106B of the base frame 106. The rotary unit 201 is affixed inside the base frame 106 via screws, nuts, studs, etc. This configuration provides the required stability and/or stiffness to the base frame 106 thereby, at least partially eliminating additional stiffening elements. As shown in FIG 2, a turning shaft 202 is centrally disposed inside the rotary unit 201 with help of bearings (not shown) and bearing seats (not shown). The turning shaft 202 transfers rotary movement to one or more of the insulators 104A and 104B shown in FIG 1A. This transfer of movement is achieved via a turn table 203 positioned over the turning shaft 202.

[0016] FIGS 3A-3B illustrate different views of the rotary unit 201, according to an embodiment of the present disclosure having two concave surfaces 201B. FIG 3A is a perspective view of the rotary unit 201. FIG 3B is a plan view, that is, a top view of the rotary unit 201 shown in FIG 3A. The rotary unit 201 is a hollow member defining a space 201C there-within. The space 201C accommodates the turning shaft 202 shown in FIG 2. The rotary unit 201 has a generally cuboidal shape with two concave surfaces 201B and two nearly flat surfaces 201E. Due to the concave surfaces 201B, the rotary unit 201 has a generally star shape with four corners. Each of the nearly flat surfaces 201E is disposed against channels 106A and 106B respectively. Around the corners there are flat surfaces 201A. Multiple orifices 201D are drilled into the

flat surfaces 201A adjacent to the nearly flat surfaces 201E, to hold the fasteners such as screws, studs, etc., to be affixed to the channels 106A and 106B of the base frame 106. The rotary unit 201 is configured as a generally concave polygon, for example, by extruding material from the surfaces 201B and 201E. Amount of material extruded from the surfaces 201B make them concave compared to the material extruded from surfaces 201E making them nearly flat. The bearing or the space 201C required to be defined by the rotary unit 201 and/or the fastening mechanism used for affixing the rotary unit 201 to the channels 106A and 106B defines an amount of material that can be extruded from the rotary unit 201.

[0017] FIGS 4A-4B illustrate different views of the rotary unit 201, according to an embodiment of the present disclosure having four concave surfaces 201B. FIG 4A is a perspective view of the rotary unit 201 and is another embodiment of the rotary unit 201 shown in FIGS 3A-3B. FIG 4B is a plan view, that is, a top view of the rotary unit 201 shown in FIG 4A. The rotary unit 201 shown in FIG 4A has comparatively more material extruded from all four surfaces 201B making them concave surfaces 201B thereby, making the rotary unit 201 a generally star-shaped unit having four corners or vertices. The rotary unit 201 has flat surfaces 201A around these four corners. Multiple orifices 201D are drilled on the flat surfaces 201A through which fasteners are inserted so as to affix the rotary unit 201 to the channels 106A and 106B.

[0018] The rotary unit 201 shown in FIGS 3A-3B provides highly optimized mechanical stability and stiffness to the base frame 106 due to its configuration, that is, overall amount of material extruded or casted. The rotary unit 201 shown in FIGS 4A-4B provides a higher degree of freedom while assembly due to its symmetrical configuration.

[0019] While the present invention has been described in detail with reference to certain embodiments, it should be appreciated that the present invention is not limited to those embodiments. In view of the present disclosure, many modifications and variations would be present themselves, to those skilled in the art without departing from the scope of the various embodiments of the present invention, as described herein. The scope of the present invention is, therefore, indicated by the following claims rather than by the foregoing description. All changes, modifications, and variations coming within the meaning and range of equivalency of the claims are to be considered within their scope.

List of Reference Numerals

[0020]

100 switching device/disconnector

101A, 101B movable current path arms

102A, 102B terminal stems

103 contact system

104A, 104B insulators

105A, 105B rotary units/rotary bases/rotary stool bases/rotary pedestals (state of the art)

106 base frame

106A, 106B channels of the base frame

201 rotary unit (present disclosure)

202 turning shaft

203 turn table/rotary disc

201A flat surface/flat edge(s)

201B concave surface(s)

201C space/hollow center

201D orifices/holes/threaded bores

201E nearly flat surface(s)

Claims

1. A switching device (100) comprising:

- movable current path arms (101A, 101B) detachably coupled with one another, for controlling transfer of electrical current therebetween;
- at least one insulator (104A, 104B) operably connected with the moveable current path arms (101A, 101B); and
- a base frame (106) supporting the insulators and the moveable current path arms (101A, 101B); **characterized by:**
- at least one rotary unit (201) physically integrated with the base frame (106) and configured to support said at least one insulator (104A, 104B).

2. The switching device (100) according to claim 1, wherein the rotary unit is configured as a hollow member defining a space (201C) there-within.

3. The switching device (100) according to claim 2, wherein the space (201C) is defined based on one or more elements (202) to be accommodated there-within.

4. The switching device (100) according to any one of the previous claims, wherein the rotary unit (201) is configured as a generally concave polygon.

5. The switching device (100) according to any one of the previous claims, wherein the rotary unit (201) comprises at least one concave surface (201B, 201E). 5
6. The switching device (100) according to claim 5, wherein the at least one concave surface (201B, 201E) of the rotary unit (201) is configured by one of an extrusion manufacturing and a casting manufacturing. 10
7. The switching device (100) according to any one of the previous claims, wherein one or more surfaces (201A, 201B, 201E) of the rotary unit (201) are physically disposed against one or more channels (106A, 106B) of the base frame (106). 15
8. The switching device (100) according to any one of the previous claims is a high voltage disconnecter. 20

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FIG 1A

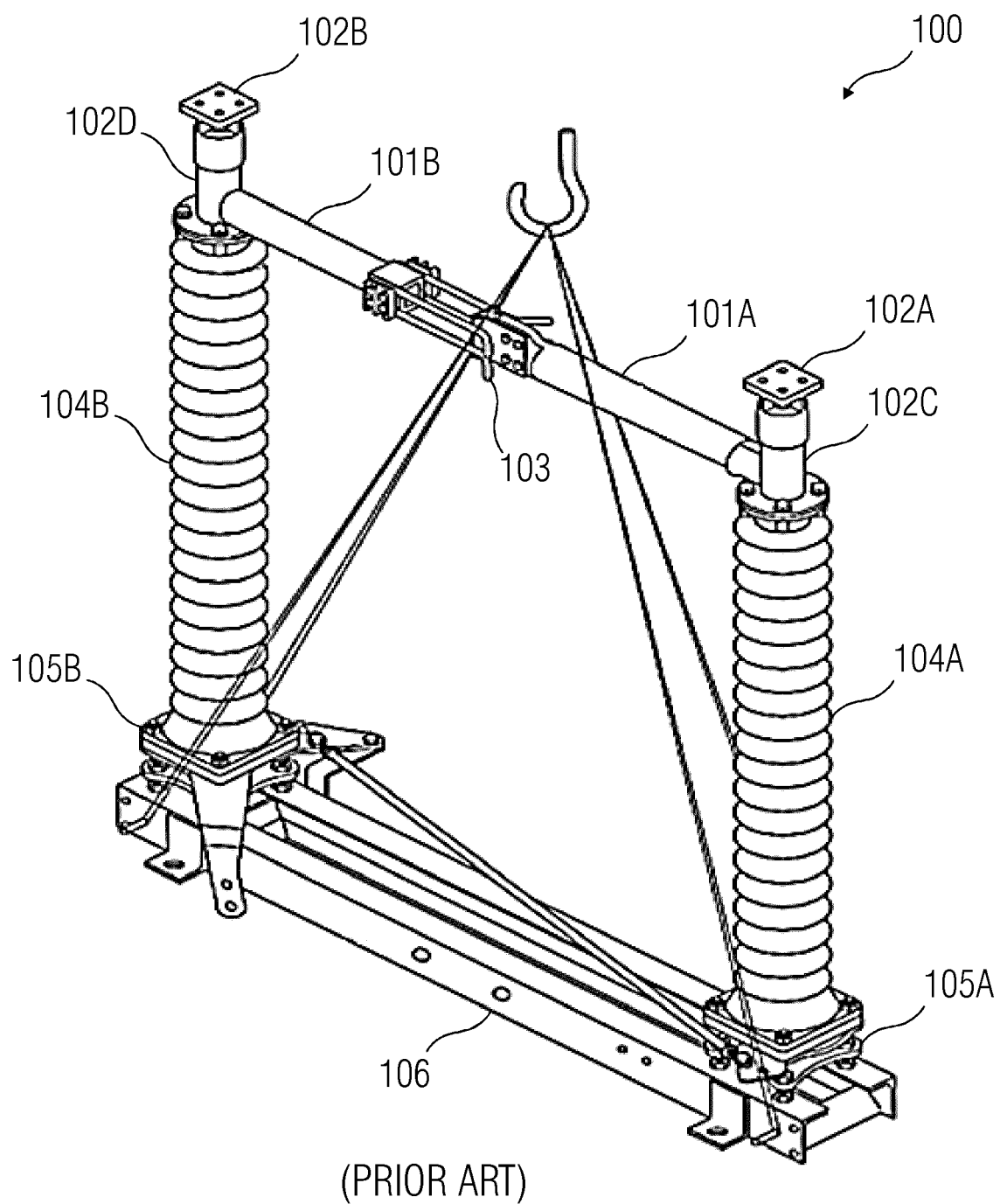


FIG 1B

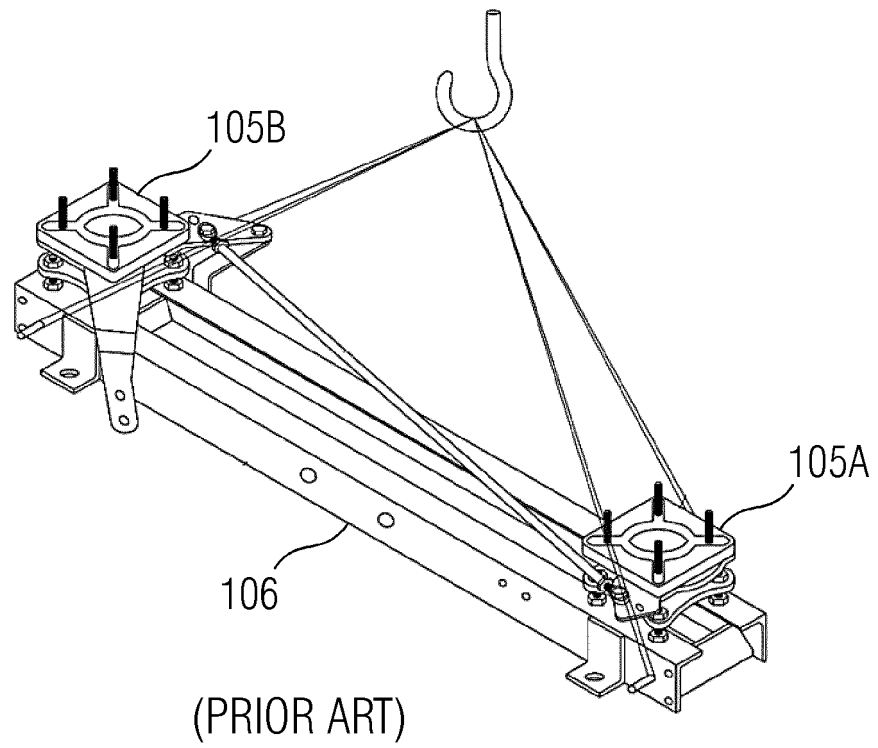


FIG 2

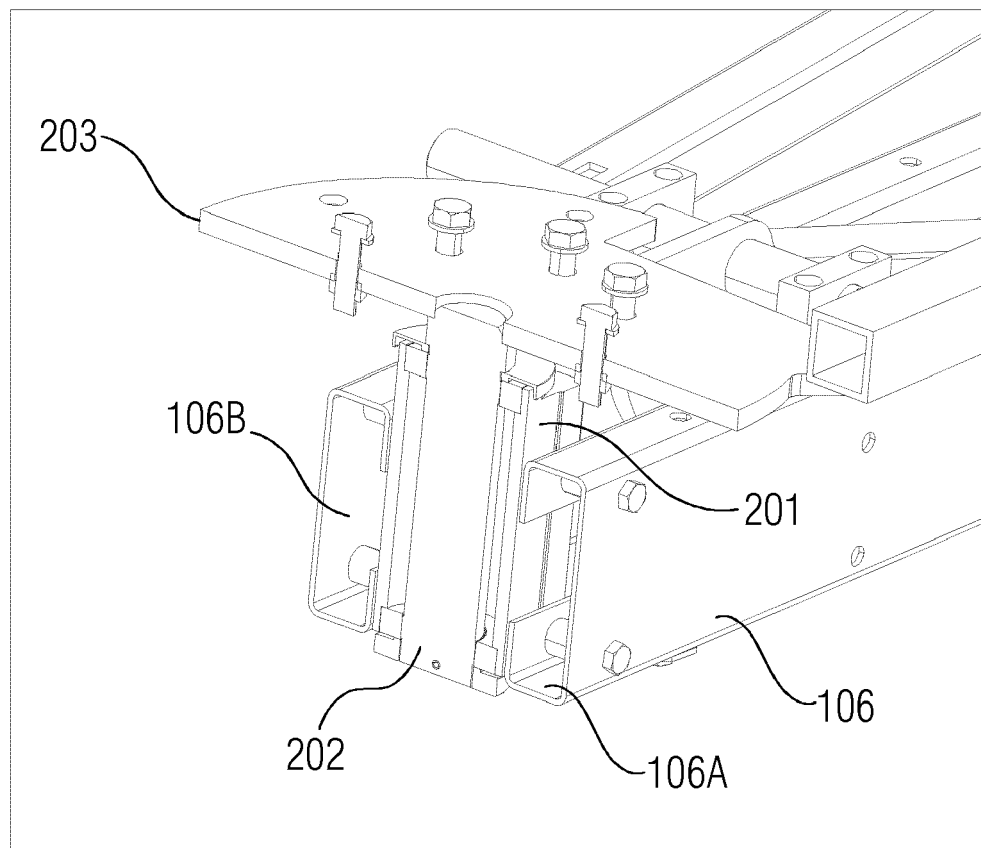


FIG 3A

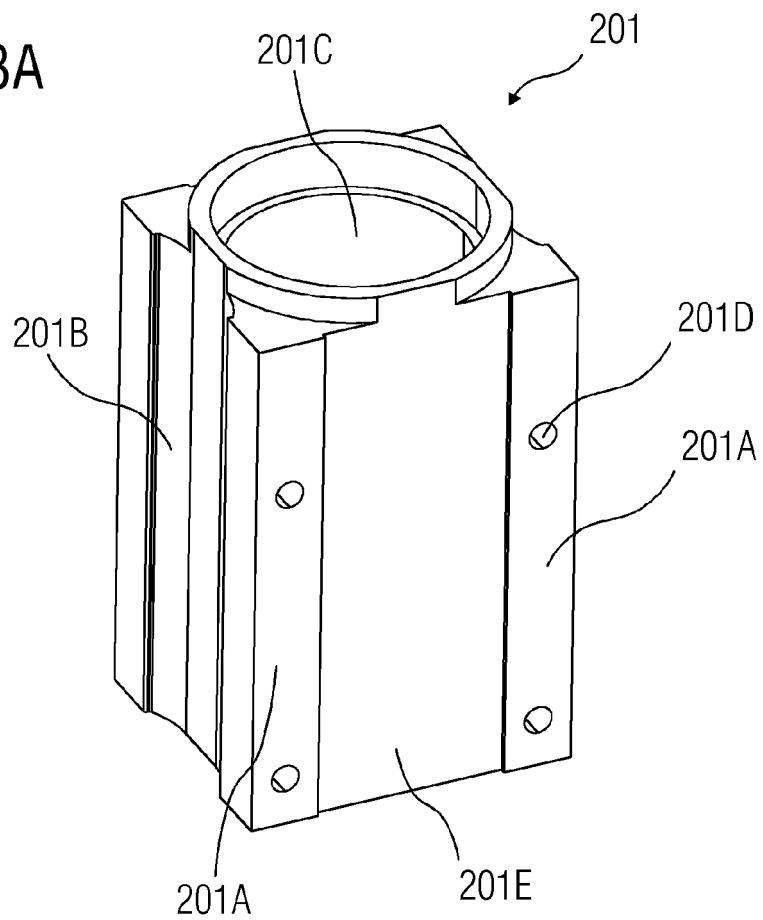


FIG 3B

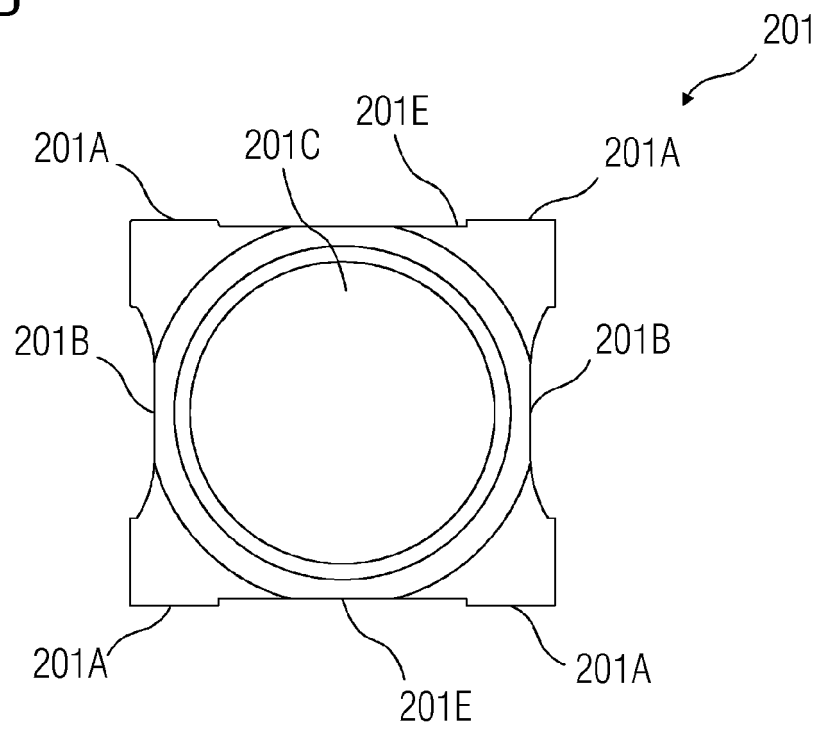


FIG 4A

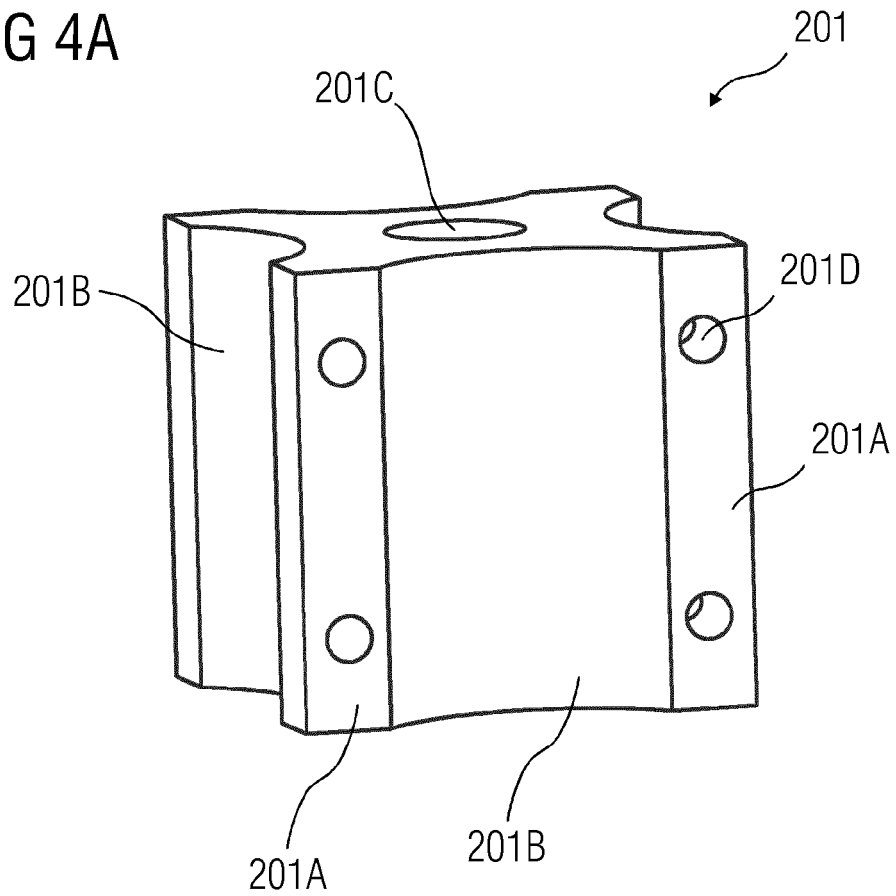
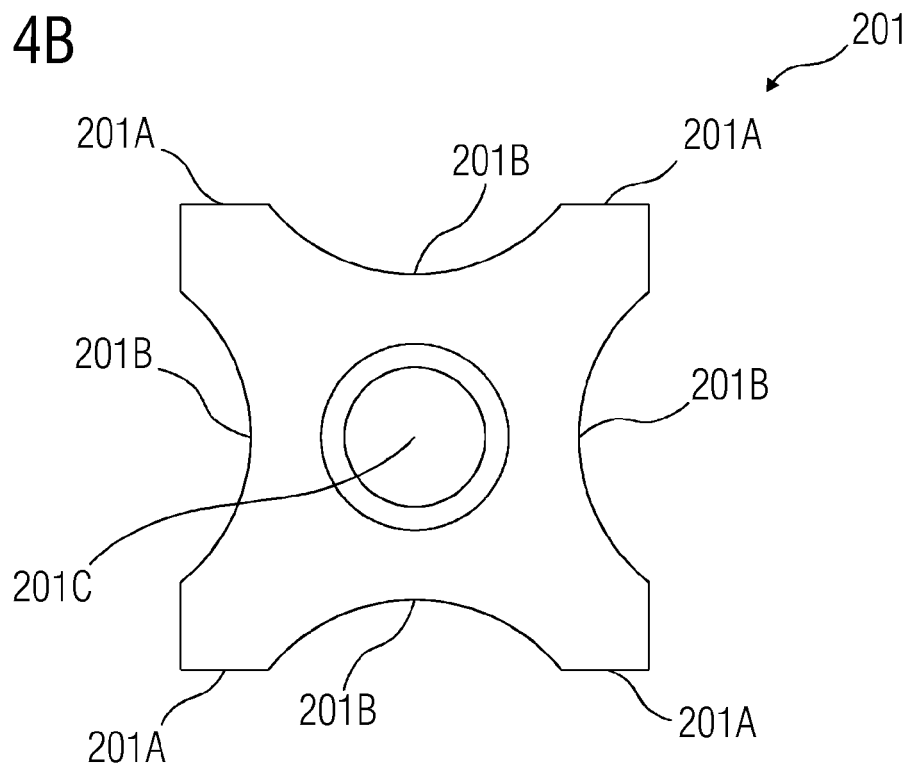


FIG 4B





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Application Number
EP 19 19 4582

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			TECHNICAL FIELDS SEARCHED (IPC)
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 30 January 2020	Examiner Findeli, Luc
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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