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(54) **AN ANCHOR CHAIR**

(57) The anchor chair (10) is configured for transmitting a pulling force from an elongated foundation element (20) to a wall (30), wherein the elongated foundation element (20) extends through the wall (30) and the anchor chair (10). The anchor chair (10) comprises a passage for the elongated foundation element, the passage comprising a cavity between a first opening located on a first side of the anchor chair, which first side is facing away from the wall in attached state, and a second opening located on an opposite side of the anchor chair, which opposite side is facing the wall in attached state and which opposite side defines in attached state a contact area of the anchor chair to contact the wall. The first opening (122) is a slot-shaped opening having two long sides and two short sides, whereby in attached state, the long sides of the slot-shaped opening of the anchor chair (10) are oriented parallel to a plane, the plane being perpendicular to the wall and comprising the elongated foundation element (20).

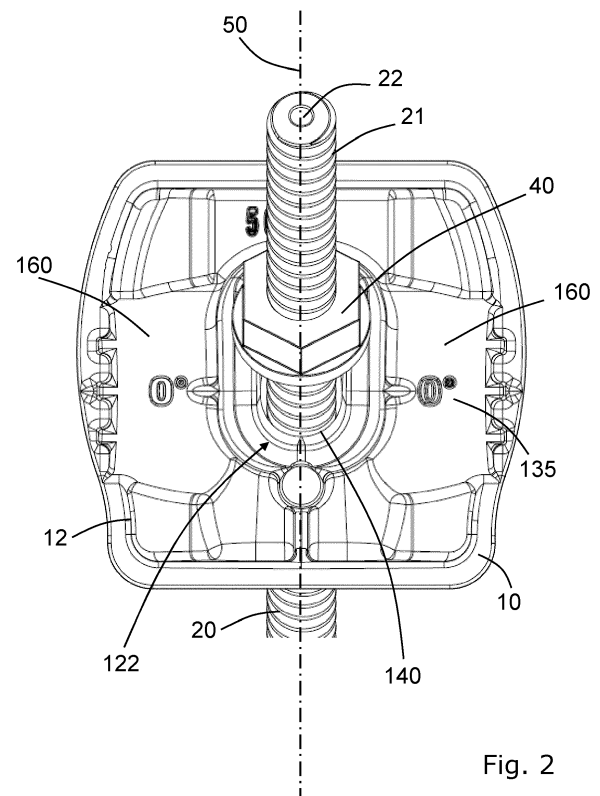


Fig. 2

Description

Field of the Invention

[0001] The technical field concerns an anchor chair, also named anchor, as well as a composition comprising an anchor chair, for anchoring an elongated foundation element to a wall, wherein the anchor chair transmits a pulling force from an elongated foundation element to a wall.

Background of the Invention

[0002] The invention concerns anchor chairs that are used, inter alia, for grout anchors, screw anchors, screw injection anchors and anchor partitions as anchorage elements for walls such as for example construction pit walls, dam walls, walls for a quay construction, walls for basement floors, tunnel walls, and such walls. In this case, such an anchor chair transmits a pulling force from an elongated foundation element to such a wall. In this case, the elongated foundation element is inserted, for example through the wall in the surrounding soil or the surrounding rock.

[0003] A known anchor chair for anchoring a wall is for example described in US3971177. As described in US3971177 with reference to the embodiment illustrated in Figure 3, the associated references of which will be used below, the elongated foundation element 3, also called earth anchor, is arranged in a bore 2 in the soil, after which grout 9 is inserted in the bore 2 such that the elongated foundation element 3 is surrounded by it. It is clear that in this case the elongated foundation element 3 was arranged through a bore in a wall 1 to be anchored in the soil E. This wall 1 forms, for example, the vertical wall of a construction pit. On the side facing away from the soil, at the height of the opening in the wall, through which an end of the elongated foundation element protrudes, an anchor chair 14 is arranged. This anchor chair 14 forms a pressure plate for the anchor nut 15. After the elongated foundation element 3 is sufficiently secured in the bore 2 in the soil E by means of the hardened grout 9, by arranging and screwing the anchor nut 15 against the anchor chair 14, a pulling force can be applied to the elongated foundation element 3 which is transmitted to the wall 1 via the anchor chair 14. In other words, such an anchor chair is configured for transmitting a pulling force from an elongated foundation element to a wall, wherein the elongated foundation element extends through the wall and the anchor chair. Preferably, in this case, the pulling force must apply a desired pretension in the elongated foundation element 3. Further it is also clear that the elongated foundation element is attached at an angle with respect to the plane of the vertical wall in the soil and that the plane of the anchor chair against which the anchor nut abuts makes a similar angle with respect to the vertical wall.

[0004] This angle can be chosen depending on the lo-

cation in the wall, the application, and other parameters and can be, for example, 30°, 45° or 60° with respect to the plane of the wall. This requires the use of different associated anchor chairs, of which the abutment surface for the anchor nut is chosen accordingly to make an angle, such that the abutment surface extends substantially transverse to the longitudinal axis of the elongated foundation element. This requires the use of different types of anchor chairs, each having an abutment surface at a different angle, what reduces the efficiency as all necessary types of anchor chairs must be present on the construction site. It also increases the risk of mistakes, wherein the correct type of anchor chair is not used, and the end of the elongated foundation element is exposed to unacceptable forces and/or deformations when attaching the anchor nut against the anchor chair. It is further clear that the anchor chair consists of plate material. To resist the desired pulling force of the elongated foundation element without unwanted deformations, typically a relative thick and strong plate material must be used, which is disadvantageous for manufacturing such an anchor chair, as this for example complicates sawing operations, pleating operations, boring operations, and the like, that are necessary for manufacturing the anchor chair. After arranging the anchor nut it is difficult to verify if the side facing the wall of the anchor chair leans correctly against the wall for transmitting the pulling force on the wall, whereby unacceptable deformations of the wall and/or the anchor chair may occur which remain hidden from view as they are completely covered by the anchor chair.

[0005] CN 110106889 A, WO 02/077372 A1 and GB 2340144 describe several elongated foundation elements having a same orientation, whereby a pulling force can be applied to the elongated foundation elements via an anchor chair.

[0006] There is still a need for a more robust anchor chair, which can be manufactured more efficiently, can be used more flexibly and that facilitates a verification of the correct placement.

Summary of the Invention

[0007] In order to achieve one or more of these objects, according to a first aspect of the invention, an anchor chair is provided. The anchor chair is configured for transmitting a pulling force from an elongated foundation element to a wall, wherein the elongated foundation element extends through the wall and the anchor chair. The anchor chair comprises a passage for the elongated foundation element, the passage comprising a cavity between a first opening located on a first side of the anchor chair, which first side is facing away from the wall in attached state, and a second opening located on an opposite side of the anchor chair, which opposite side is facing the wall in attached state and which opposite side of the anchor chair is configured for contacting the wall in attached state, in particular which opposite side defines a contact

area of the anchor chair for contacting the wall in attached state. The first opening is a slot-shaped opening having two long sides and two short sides, whereby in attached state, the long sides of the slot-shaped opening of the anchor chair are oriented parallel to a plane, the plane being perpendicular to the wall and comprising the elongated foundation element. This plane hence is perpendicular to the wall and the axis of the elongated foundation element is parallel, even coplanar, with this plane.

[0008] According to a second aspect of the invention, an anchor chair configured for transmitting a pulling force from an elongated foundation element to a wall is provided, wherein the elongated foundation element extends at an application angle through the wall and the anchor chair. The anchor chair comprises a passage for the elongated foundation element, wherein the passage comprises a cavity between a first opening located on a first side of the anchor chair, which first side is configured for facing away from the wall in attached state, and a second opening located on an opposite side of the anchor chair, which opposite side is configured for facing the wall in attached state. The first opening is a slot-shaped opening having two long sides and two short sides, which slot-shaped opening extends along a front outer surface defined by the long sides and the short sides of the slot-shaped opening on the first side of the anchor chair, whereby in attached state, the front outer surface extends perpendicular to the axis of the elongated foundation element for several, i.e. a plurality of, application angles of the elongated foundation element.

[0009] The application angle is the angle between the axis of the elongated foundation element and the perpendicular line, perpendicular to the plane of the wall, when the anchor chair is in attached state. The angle can be found in the plane which is perpendicular to the plane of the wall and which comprises the axis of the elongated foundation element.

[0010] According to embodiments, the slot-shaped opening may extend along a front outer surface defined by the long sides and the short sides of the slot-shaped opening on the first side of the anchor chair. In attached state, the front outer surface may extend perpendicular to the axis of the elongated foundation element for a plurality of application angles of the elongated foundation element. According to some embodiments, the front outer surface may extend perpendicular to the axis of the elongated foundation element for all application angles of the elongated foundation element. This provision has the advantage that when the elongated foundation element in attached state and the front outer surface extends perpendicular to the axis of the elongated foundation element, the pulling force from an elongated foundation element to a wall is transmitted in the most efficient way.

[0011] According to the first and/or second aspect of the invention, the cavity with the first opening and the second opening, wherein the first opening being slot-shaped, causes that the anchor chair can be used in a flexible manner, for example for elongated foundation

elements that are arranged at different application angles with respect to the wall. Because the slot-shaped opening ends in the cavity, and further the cavity ends at the second opening on the side facing the wall, this ensures that the anchor chair can be arranged efficiently over the end of the elongated foundation element protruding from the wall at any application angle for which the slot-shaped opening is configured.

[0012] Hence, many different application angles, also called passage angles, may be used to orient the elongated foundation element in view of the contact area of the anchor chair with the wall, when the elongated foundation element is installed in the anchor chair. The application angle may vary continuously between a minimum application angle and a maximum application angle. The installation of the anchor chair at different possible application angles can be made using only one anchor chair for all possible application angles. As such, only one type of anchor chair needs to be present on the construction site. Possible small variation on used application angles, can easily be compensated as the application angle may vary continuously in the anchor chair.

[0013] As the end of the elongated foundation element needs to be inserted through the second opening in the cavity, and as at the first opening the elongated foundation element does not occupy the complete opening of the slot-shaped opening, at any time the further arranging of the anchor chair over the end of the elongated foundation element extending through the wall via the second opening can be verified. Also during and/or after applying a pulling force, for example by means of an anchor nut, the part of the slot-shaped opening which is not occupied by the elongated foundation element offers a view on connecting the side facing the wall of the anchor chair to the wall, as well as the condition of the wall near the second opening through which the elongated foundation element extends.

[0014] According to embodiments of the first and/or second aspect of the invention, the first opening is a slot-shaped opening having two long sides and two short sides, which slot-shaped opening extends along a front outer surface defined by the long sides and the short sides of the slot-shaped opening on the first side of the anchor chair. According to embodiments, the front outer surface may be a curved front outer surface. Preferably the curved front outer surface is a cylindrical front outer surface. The front outer surface of the anchor chair at the first side, at the location where the slot-shaped opening is present, may be a cylindrical front outer surface, the axis of the cylinder being parallel to the plane of the wall and perpendicular to the direction from the top edge of the anchor chair to the bottom edge of the anchor chair.

[0015] The section of the cavity according to a plane perpendicular to the plane of the wall and parallel to the direction from the top edge of the anchor chair to the bottom edge of the anchor chair, may have a circle sector-shape. The arc of the sector may be between 10° and 100°, such as between 10° and 90°, and preferably is

more than 45°, such as more than 50°. As such a wide variety of application angles of the elongated foundation element may be used.

[0016] According to embodiments of the first and/or second aspect of the invention, an abutment surface for receiving a fastening element may be provided adjacent the slot-shaped opening. This abutment surface may as well be curved, such as curved according to a cylindrical surface. At any position of the elongated foundation element, the abutment surface may be perpendicular to the axis of this elongated foundation element when inserted in the cavity. The abutment angle is the angle of the abutment surface, i.e. the tangent plane of the abutment surface, of the passage with respect to the wall, or in other words with respect to the longitudinal plane of the wall. In other words, if the wall has a substantially vertical longitudinal plane, the abutment angle is the angle with respect to this vertical plane; if the wall has a substantially horizontal longitudinal plane, the abutment angle is the angle with respect to this horizontal plane; if the wall comprises at the height of the arranged anchor chair a longitudinal plane that was arranged at another suitable orientation, the abutment angle is the angle with respect to the orientation of this last longitudinal plane. An abutment angle may be defined as the angle, while the anchor chair is in attached state, between the plane of the wall and the tangential plane at the abutment point, the latter being the point defined by the crossing of the axis of the elongated foundation element and the abutment surface. As the axis of the elongated foundation element is preferably perpendicular to the tangential plane at the abutment point, the abutment angle preferably varies between a minimum abutment angle and a maximum abutment angle, most preferred between -10° and 80°, such as between -10° and 60°, e.g. between -10° and 50°. The maximum abutment angle is preferably more than 45°.

[0017] By the provision of an abutment surface, a good aligned support surface is obtained by the respective abutment surface for abutting the fastening element for the elongated foundation element, such as, for example, an anchor nut that is screwed against this abutment surface in order to subject the elongated foundation element to a suitable pretension. This allows to transmit the pulling force from the elongated foundation element to the wall via the anchor chair in an efficient manner.

[0018] According to some embodiment, an anchor chair is provided, wherein the said abutment angles of the abutment surface at the height of the first opening vary along the first opening, being a slot-like opening.

[0019] This makes it possible to use the anchor chair for use with elongated foundation elements that are arranged at a different application angle with respect to the wall, while always having a good and efficient transmission of the pulling force from the elongated foundation element to the wall via the anchor chair. A same anchor chair can then be used for different foundation elements with a different application angle by a simple arrange-

ment of the elongated foundation element in the first opening, of which the abutment angle of the abutment surface is suitable for abutting the fastening element for the elongated foundation element that was arranged at the selected application angle. Hence the number of different types of anchor chairs that is necessary in cases where elongated foundation elements applied with different application angles, is reduced to only one, i.e. the anchor chair according to the first and/or second aspect of the invention.

[0020] According to embodiments of the first and/or second aspect of the invention, the first opening may have an obround circumference. The two circular parts of the obround shape of the first opening may be oriented towards the top side and the bottom side of the anchor chair. The second opening may have a circular or obround circumference.

[0021] The width of the obround or circular circumference may be equal for both the first opening and the second opening. This width defines the maximum diameter of the elongated foundation element which fits in the anchor chair. The width may be more than 20mm such as more than 30 mm, e.g. between 32 mm to 42 mm. Preferably the elongated foundation element has a diameter being at maximum slightly less than the minimum of the widths of the first opening and the second opening.

[0022] The cavity, the first opening and the second opening are arranged for cooperating with an elongated foundation element extending through the cavity and the two openings along a variety of application angles. According to embodiments of the first and second aspect of the invention, the application angle may vary between -10° and 80°. Preferably the application angle varies between -10° and 80°, such as between -10° and 50°, e.g. between 0° and 50°. Using an application angle between 0° and the maximum angle, e.g. 50°, will cause the elongated foundation element to be inserted in the wall downwards oriented. By rotating the anchor chair 180° around the axis of the elongated foundation element when installed at 0° application angle, also upwards oriented elongated foundation elements can be accommodated. An upwards inclined angle between 0° and minus the maximum application angle, e.g. -50° may be achieved. Thus an anchor chair with a slot-shaped first opening, which allow the insertion of an elongated foundation element under an application angle of e.g. -10° to 50° may accommodate elongated foundation elements applied under an application angle of -50° to 50°.

[0023] The application angle may thus vary between a minimum application angle and a maximum application angle, each of this minimum and maximum being obtainable when the elongated foundation element is positioned in one of the extreme positions in the first opening. The minimum application angle is defined when the elongated foundation element is inserted and contacts the edge of the slot-shapes in a first extreme position, the elongated foundation element being as perpendicular as possible to the plane of the wall when the anchor chair

is in attached state. The maximum application angle is defined when the elongated foundation element is inserted and contacts the edge of the slot-shapes in a second extreme position of the slot-shaped opening, the elongated foundation element being as parallel as possible to the plane of the wall when the anchor chair is in attached state. The application angle may be 0° , when the axis of the elongated foundation element is perpendicular to the plane of the wall when the anchor chair is in attached state.

[0024] According to embodiments of the first and/or second aspect of the invention, an indicator configured for identifying the abutment angle and/or the application angle, is arranged near the first opening of the passage, which first opening is located on the first side of the anchor chair

[0025] Such an indicator may indicate the abutment angle and/or the application angle at the two extreme positions of the slot of the slot-shaped first opening. Additionally, one or more indications of the abutment angle and/or the application angle may be provided along the long sides of the slot-shaped opening.

[0026] Such an indicator is particularly advantageous, as the magnitude of the application or abutment angles is often not clearly visible enough to identify, for example, during use on a construction site in a fast, efficient and reliable manner. Such an indicator makes it possible to perform a verification of the installed angle with the desired angle in a fast, efficient, and reliable manner.

[0027] According to embodiments of the first and/or second aspect of the invention, the side of the anchor chair facing the wall in attached state, comprises two wedge-shaped sides, which are configured for abutting in attached state near and/or against corresponding contact surfaces of the wall.

[0028] This allows to efficiently arrange the anchor chair in a correct position with respect to the wall, which allows for optimally transmitting the pulling force from the elongated foundation element to the wall. This is in particular the case if the wall is constructed from a series of piles, one adjacent to the other. Such pile walls are referred to as secant pile walls. The wedge-shaped sides may correspond to one of the inclined surfaces of two adjacent piles. In general, when reference is made to the surface of the wall or to the plane of the wall, this term refers to the substantially flat plane which defines the orientation of the wall, even if the outer surface is not flat, or plane, such as is the case with e.g. a secant pile wall, or a wall comprising at its outer surface sheet piles, also referred to as sheet piling walls.

[0029] According to embodiments of the first and/or second aspect of the invention, the anchor chair may be mirror-symmetrical with respect to the plane defined by the axes of the elongated foundation element positioned at the two extreme positions of the first opening.

[0030] This allows to position the anchor chair in a similar manner regardless which of the outer edges parallel to the short side of the slot-shaped opening is used as

upper edge of the anchor chair, and with the long sides oriented upwards.

[0031] According to embodiments of the first and/or second aspect of the invention, the anchor chair may consist of a single-piece casting, in particular a single-piece casting of cast iron.

[0032] This allows to manufacture the anchor chair in an efficient manner from cast iron, cast steel and the like. The casting can have dimensions that exceed the thickness of typical metal plates and still extend transverse to the wall over a smaller distance than known anchor chairs which are manufactured as a sheet steel structure. A single-piece casting consisting of cast iron is furthermore particularly resistant to corrosion and suitable for being subjected to pressure during the transmission of the pulling force from the elongated foundation element to the wall.

[0033] In the context of this application a cast steel means a cast alloy of iron containing a mass percentage for carbon of less than 2,1% (m/m), this means a mass fraction for carbon of less than 0,021 kg/kg. Cast iron is in the context of this application a cast alloy of iron containing a mass percentage for carbon of more than 2,2% (m/m), this means a mass fraction for carbon of more than 0,022 kg/kg, for example a mass fraction of 0,030 kg/kg or more, in particular a mass fraction of 0,035 kg/kg or more. Depending on the type of cast iron, one speaks of a carbon content or a carbon equivalent. For example, with nodular cast iron, one speaks for example of a carbon content of 0,035 kg/kg. For example, with lamellar cast iron, one speaks for example of a carbon equivalent of between 3,53% and 3,8%.

[0034] According to embodiments of the first and/or second aspect of the invention, the anchor chair may comprise one or more arms extending sideways in a direction parallel to the wall in attached state.

[0035] These arms allow the anchor chair to bridge a certain distance along the wall, such that for example the wall can be anchored and/or supported to cross beams, support beams, profiles and the like by means of the anchor chair. Also with such a type of anchor chair it is advantageous to limit the number of different types of required anchor chairs, in particular because an anchor chair with such arms needs more material to be manufactured.

[0036] According to a third aspect of the invention, a composition comprising the anchor chair according to the first and/or second aspect of the invention is provided. The composition further comprises an elongated foundation element configured for arranging the anchor chair on an end of the elongated foundation element protruding from the wall via the cavity and for bringing the elongated foundation element through the cavity of the anchor chair for transmitting a pulling force from the elongated foundation element to the wall.

[0037] According to a fourth aspect of the invention, a method for attaching the anchor chair according to the first and/or second aspect of the invention to an elongated

foundation element, wherein the method comprises the following steps:

- arranging the elongated foundation element through a wall, in particular through the wall in the soil such that the longitudinal axis of the elongated foundation element has a defined application angle with respect to a direction transverse to the wall;
- inserting an end of the elongated foundation element protruding from the wall in the cavity of the anchor chair through the second opening;
- arranging the end of the elongated foundation element through the anchor chair via the first opening of the anchor chair;
- fastening the elongated foundation element to the anchor chair by mounting a fastening element to the end of the elongated foundation element extending through the first opening of the anchor chair.

[0038] The advantage of the method according to the fourth aspect of the invention, is that a very easy way of installing an anchor chair is provided. As only one type of anchor chairs is used to accommodate an elongated foundation element under a different application angle, less mistakes in using wrong anchor chairs are made.

[0039] According to a fifth aspect of the invention, a method for manufacturing the anchor chair according to the first and/or second aspect of the invention is provided, the anchor chair being manufactured as a single-piece casting, in particular as a single-piece casting of cast iron.

Brief Description of the Drawings

[0040]

Fig. 1 illustrates an anchor chair according to the present invention, in a perspective view.

Fig. 2 shows a front view of the anchor chair of Fig. 1.

Fig. 3 is a cross section of the anchor chair of Fig. 1 in attached state to the wall.

Fig. 4 illustrates a perspective view of the anchor chair of Fig. 1.

Fig. 5 illustrates a front view of the anchor chair of Fig. 1.

Fig. 6 illustrates a side view of the anchor chair which is to contact the wall.

Fig. 7 illustrates a top view on the upper side of the anchor chair.

Fig. 8 illustrates a bottom view on the lower side of the anchor chair.

Fig. 9 illustrates a cross section of the anchor chair similar to Fig. 3.

Fig. 10 illustrates another embodiment of an anchor chair according to the present invention.

[0041] The same reference numbers refer to the same or similar elements throughout the various figures.

Detailed Description of Embodiment(s)

[0042] An anchor chair 10 according to the present invention, in attached state to a wall 30, in this case a secant pile wall, is shown in figure 1, figure 2 and figure 3. Figure 1 shows a perspective view of the anchor chair 10 and figure 2 shows a front view of the anchor chair 10. Figure 3 is a cross section of the anchor chair 10 in attached state to the wall 30, seen according to a plane 50 (see Fig. 2), which plane 50 is perpendicular to the wall 30 and comprising the elongated foundation element 20, more particular its axis 22.

[0043] The anchor chair 10 is configured to transmit a pulling force from an elongated foundation element 20 to the wall 30. A fastening element 40, for example a nut is screwed on the outer end 21 of the elongated foundation element 20 extending from the wall 30 through the anchor chair 10. As such, the pulling force from the elongated foundation element 20 is transmitted to the wall 30 via the fastening element 40 and the anchor chair 10.

[0044] More details of the anchor chair 10 of figures 1 to 3 are shown in figures 4 and 5. Figure 4 shows a perspective view of the anchor chair 10, whereas figure 5 shows a front view of this anchor chair 10. Figure 6 is a side view on the side of the anchor chair 10 which is to contact the wall 30. Figure 7 is a top view of the anchor chair 10 and figure 8 is a view on the lower side of the anchor chair 10.

[0045] The anchor chair 10 comprises a passage 112 for the elongated foundation element 20 to pass through. The passage 112 comprises a cavity 140 between a first opening 122 located on a first side 12 of the anchor chair 10, which first side 12 is facing away from the wall 30 in attached state. The passage 112 further has a second opening 142 located on the second, opposite side 14 of the anchor chair 10, which opposite side 14 is facing the wall 30 in attached state and which opposite side 14 defines in attached state a contact area 1400 (see Fig. 6) of the anchor chair 10 to contact the wall 30.

[0046] As best seen in Fig. 5, the first opening 122 is a slot-shaped opening having two long sides 1222 and 1224 and two short sides 1226 and 1228, whereby in attached state, the long sides 1222 and 1224 of the first slot-shaped opening 122 of the anchor chair 10 are oriented parallel to a plane 50, this plane 50 being perpendicular to the wall 30. This plane 50 comprises the elongated foundation element 20, in particular the axis 22 of the elongated foundation element 20. In this example, the first opening 122 has a substantial obround shape.

[0047] The first slot-shaped opening 122 extends along a front outer surface 1220 defined by the long sides 1222 and 1224 and the short sides 1226 and 1228 of the first slot-shaped opening 122 on the first side 12 of the anchor chair 10. In attached state, the front outer surface 1220 extends perpendicular to the axis 22 of the elongated foundation element 20 for all application angles of the elongated foundation element 20. As can be seen in Fig. 3 the tangent plane 25 extends perpendicular to the axis 22, so that the value of the abutment angle β substantially equals the value of the application angle α . This allows that in attached state, the front outer surface 1220 near the fastening element 40 extends substantially perpendicular to the axis 22 of the elongated foundation element 20.

[0048] Figure 9 shows a cross section of the anchor chair 10 seen according to a plane 50, which is the plane 50 perpendicular to the wall 30 and comprising the elongated foundation element 20, more particular its axis 22, when the anchor chair 10 is in attached state to the wall 30. As can be noticed, the front outer surface 1220 is curved, more specific is a cylindrical front outer surface.

[0049] As shown in figure 3, the application angle α is approximately 30° . The application angle α is the angle between the axis 22 and the perpendicular line 24, which line 24 is perpendicular to a plane of the wall 30, thus also to a plane 31 arranged parallel to the wall 30. A positive angle is measured counter clockwise from the perpendicular line 24 to the axis 22. The elongated foundation element 20 is oriented downwards in the wall 30. In case the elongated foundation element 20 is near the maximum extreme position 1230 in the first opening 122, the application angle α is slightly more than 45° . In case the elongated foundation element 20 would be in the other, minimum extreme position 1232 in the first opening 122, the elongated foundation element 20 would be at an application angle of slightly less than 0° . In other words, the elongated foundation element 20 would be substantially perpendicular to the wall 30. To provide elongated foundation elements 20 oriented upwards in the wall 30, which can be required when the wall is e.g. the upper wall of a tunnel, the anchor chair can be turned 180° round a line 24 perpendicular to the opposite side 14. Application angles of -45° and more may be achieved as such.

[0050] As shown in figures 3 and 9, adjacent and around the first slot-shaped opening 122, an abutment surface 1240 for abutting the fastening element 40 is provided. The abutment surface 1240 is arranged in a part of the first side 12 of the anchor chair 10 surrounding the first opening 122, or in other words, the first opening 122 is arranged in a part of the first side 12 comprising the first abutment surface 1240. The tangent plane 25 to the abutment surface 1240 is perpendicular to the axis 22 of the elongated foundation element 20 for all application angles. Since in attached state, the abutment surface 1240 and the front outer surface 1220 extends perpendicular to the axis 22 of the elongated foundation element

20 for all application angles α of the elongated foundation element 20, an abutment angle β in the range of 50° to -10° may be provided. This abutment angle β is the angle of the tangent plane 25 to the abutment surface 1240 with respect to the wall 30, or in other words with respect to the longitudinal plane 31 parallel to the wall 30. The provision of this abutment surface 1240 has the advantage that the fastening element 40 finds a fitting seat and may abut the front outer surface 1220 of the anchor chair 10 properly.

[0051] As is best seen in figures 7 and 8, the anchor chair 10 is mirror-symmetrical with respect to the plane 50, which plane is also defined by the axes 22 of the elongated foundation element 20 positioned at the two extreme positions 1230 and 1232 of the first opening 122. The opposite side 14 facing the wall 30 comprises two wedge-shaped sides 170, which are configured for abutting in attached state near and/or against corresponding contact surfaces 150 of the wall 30, particularly in case the wall is a secant pile wall. The wedge-shaped sides 170 define a contact area 1400 of the anchor chair 10 to contact the wall 30. As such, the anchor chair 10 is arranged at least partially between corresponding inclined wall parts of the wall 30. Arranging the anchor chair 10 at least partially between such corresponding contact surfaces 150 in the wall 30 is advantageous as this reduces the distance by which the anchor chair 10 protrudes beyond the wall 30, whereby for example, less space is lost for arranging additional elements beyond the wall 30 where the anchor chair 10 is arranged.

[0052] The anchor chair 10 also comprises side parts 160 located near the openings 122 and 142 that limit the common cavity 140. The side parts 160 extend for example to the wedge-shaped sides 170. Because of the side parts 160, a firm and robust construction of the anchor chair 10 is obtained.

[0053] As best seen in figure 1, 4 and 5, the anchor chair 10 is provided with one or more indicators 135 configured for identifying the abutment angle and/or the application angle. These indicators 135 are arranged near the first opening 122 of the passage 112, which first opening 122 is located on the first side 12 of the anchor chair 10. In the embodiment shown, the application angle α being either 0° or 50° is indicated. The operator installing the anchor chair 10 may easily verify the application angle that the elongated foundation element 20 has in view of the wall 30.

[0054] This anchor chair 10 has several advantages. The anchor chair 10 may receive elongated foundation elements 20, usually steel bars with a diameter of 32 mm up to 42 mm, at any application angle between the minimum application angle and the maximum application angle. As such, mistakes or slight variations in the direction of the elongated foundation element 20 made while introducing the elongate foundation element 20 in the wall 30, may be accommodated without may difficulties. The fastening element 40 can be provided, e.g. screwed, on the outer end 21 of the elongated foundation element 20

without many difficulties, while the pulling force will be transmitted to the wall 30 efficiently. Only one type of anchor chair 10 for each of the application angles is needed. So little to no mistakes can be made.

[0055] Figure 3 shows a composition comprising the anchor chair 10, the composition further comprising an elongated foundation element 20 configured for arranging the anchor chair 10 on an end 21 of the elongated foundation element 20 protruding from the wall 30. Via the passage 112 and the second opening 142, the elongated foundation element 20 is brought through the cavity 140 of the anchor chair 10 and further through the first opening 122 to the first side 12 of the anchor chair 10.

[0056] So according to a method for attaching the anchor chair 10 according to the invention to an elongated foundation element 20, the method comprises first arranging the elongated foundation element 20 through a wall 30 in the soil such that the longitudinal axis 22 of the elongated foundation element 20 has a defined application angle α with respect to a direction transverse to the wall 30. Thereafter a step of inserting the outer end 21 of the elongated foundation element 20 protruding from the wall 30 in the cavity 140 of the anchor chair 10 through the second opening 142 is to be performed. Next the end 21 of the elongated foundation element 20 is arranged through the anchor chair 10 via the first opening 122 of the anchor chair 10. Thereafter, the elongated foundation element 20 is fastened to the anchor chair 10 by mounting a fastening element 40 to the end 21 of the elongated foundation element 20 extending through the first opening 122 of the anchor chair 10.

[0057] Because the first slot-shaped opening 122 is adapted to receive the outer end 21 of the elongated foundation element 20 at any application angle between the minimum and the maximum application angle, no problem with possible variations within tolerances for the application angle in view of the specified application angle, is encountered. The method according to the invention results in a fast, carefree, and easy mounting of the anchor chair. As the variation in application angles is significant, only one type of anchor chair is to be available on the construction site and little to no mistakes can be made.

[0058] In the embodiment of Fig. 10 the anchor chair 10 further comprises one or more arms 144, 146 extending sideways of the first opening 122 in a direction parallel to the wall and arranged preferably near the long sides 1222, 1224 of the first slot-shaped opening 122. The central part of this anchor chair 10 is made similar to the embodiment of Figs. 1 to 9.

[0059] Preferably, according to the illustrated embodiments of Figs. 1 to 10, the anchor chair 10 consists of a single-piece casting. This means that the anchor chair 10 only consist of a cast structure, which has been manufactured with a suitable material such as cast iron, cast steel, and the like. Cast iron is preferred in this case as it enables a simple and efficient casting process and use of material. When the anchor chair 10 is manufactured

in this way as a single-piece casting, this allows a compact and simple to manufacture casting that is able to resist high pressure forces generated by transmitting the pulling force in the elongated foundation element 20 to the wall 30.

[0060] Although the present invention has been illustrated by reference to specific embodiments, it will be apparent to those skilled in the art that the invention is not limited to the details of the foregoing illustrative embodiments, and that the present invention may be embodied with various changes and modifications without departing from the scope thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein. In other words, it is contemplated to cover any and all modifications, variations or equivalents that fall within the scope of the basic underlying principles and whose essential attributes are claimed in this patent application. It will furthermore be understood by the reader of this patent application that the words "comprising" or "comprise" do not exclude other elements or steps, that the words "a" or "an" do not exclude a plurality, and that a single element, such as a computer system, a processor, or another integrated unit may fulfil the functions of several means recited in the claims. Any reference signs in the claims shall not be construed as limiting the respective claims concerned. The terms "first", "second", "third", "a", "b", "c", and the like, when used in the description or in the claims are introduced to distinguish between similar elements or steps and are not necessarily describing a sequential or chronological order. Similarly, the terms "top", "bottom", "over", "under", and the like are introduced for descriptive purposes and not necessarily to denote relative positions. It is to be understood that the terms so used are interchangeable under appropriate circumstances and embodiments of the invention are capable of operating according to the present invention in other sequences, or in orientations different from the one or ones described or illustrated above.

Claims

1. An anchor chair (10) configured for transmitting a pulling force from an elongated foundation element (20) to a wall (30), wherein the elongated foundation element (20) extends through the wall (30) and the anchor chair (10), the anchor chair (10) comprising a passage (112) for the elongated foundation element (20), wherein the passage (112) comprises a cavity (140) between a first opening (122) located on a first side (12) of the anchor chair (10), which first side (12) is facing away from the wall (30) in attached state, and a second opening (142) located

- on an opposite side (14) of the anchor chair (10), which opposite side (14) is facing the wall (30) in attached state and which opposite side (14) of the anchor chair (10) is configured for contacting the wall (30) in attached state, **characterized in that** the first opening (122) is a slot-shaped opening having two long sides (1222, 1224) and two short sides (1226, 1228), whereby in attached state, said long sides (1222, 1224) of the first opening (122) of the anchor chair (10) are oriented parallel to a plane (50), said plane (50) being perpendicular to the wall (30) and comprising said elongated foundation element (20).
2. An anchor chair according to claim 1, wherein said slot-shaped opening extends along a front outer surface (1220) defined by the long sides (1222, 1224) and the short sides (1226, 1228) of the slot-shaped opening on the first side (12) of the anchor chair (10), whereby in attached state the front outer surface (1220) extends perpendicular to the axis (22) of the elongated foundation element (20) for a plurality of application angles (α) of the elongated foundation element (20).
 3. An anchor chair according to claim 2, wherein the front outer surface (1220) extends perpendicular to the axis of the elongated foundation element (20) for all application angles (α) of the elongated foundation element (20).
 4. An anchor chair according to claim 3, wherein said front outer surface (1220) is a curved front outer surface, in particular a cylindrical front outer surface.
 5. An anchor chair according to any one of the preceding claims, wherein an abutment surface (1240) for receiving a fastening element (40) is provided adjacent the first opening (122).
 6. An anchor chair according to any one of the preceding claims, wherein the first opening (122) has an obround circumference.
 7. An anchor chair according to any one of the preceding claims, wherein the second opening (142) has a circular or obround circumference.
 8. An anchor chair according to any one of the preceding claims, wherein the application angle (α) varies between -10° and 80° .
 9. An anchor chair according to any one of the preceding claims, wherein an indicator (135) configured for identifying the abutment angle (β) and/or the application angle (α), is arranged near the first opening (122) of the passage (112).
 10. An anchor chair according to any one of the preceding claims, wherein the side (14) of the anchor chair (10) facing the wall (30) in attached state comprises two wedge-shaped sides (170) defining a contact area (1400), which are configured for abutting in attached state near and/or against corresponding contact surfaces (150) of the wall (30).
 11. An anchor chair according to any one of the preceding claims, wherein the anchor chair (10) is mirror-symmetrical with respect to the plane (50) defined by the axes of the elongated foundation element positioned at the two extreme positions (1230, 1232) of the first opening (122).
 12. An anchor chair according to any one of the preceding claims, wherein the anchor chair (10) consists of a single-piece casting, in particular a single-piece casting of cast iron and/or wherein the anchor chair (10) is manufactured as a single-piece casting, in particular as a single-piece casting of cast iron.
 13. An anchor chair according to any one of the preceding claims, wherein the anchor chair (10) comprises one or more arms (144, 146) extending sideways in a direction parallel to the wall (30) in attached state.
 14. A composition comprising the anchor chair (10) according to one or more of claims 1 to 13, wherein the composition further comprises an elongated foundation element (20) configured for arranging the anchor chair (10) on an end (21) of the elongated foundation element (20) protruding from the wall (30) via the cavity (140) and for bringing the elongated foundation element (20) through the cavity (140) of the anchor chair (10) for transmitting a pulling force from the elongated foundation element (20) to the wall (30).
 15. A method for attaching the anchor chair (10) according to one or more of claims 1 to 13 to an elongated foundation element (20), wherein the method comprises the following steps:
 - arranging the elongated foundation element (20) through a wall (30) such that the longitudinal axis (24) of the elongated foundation element (20) has a defined application angle (α) with respect to a direction transverse to the wall (30);
 - inserting an end (21) of the elongated foundation element (20) protruding from the wall (30) in the cavity (140) of the anchor chair (10) through the second opening (142);
 - arranging the end (21) of the elongated foundation element (20) through the anchor chair (10) via the first opening (122) of the anchor chair (10);
 - fastening the elongated foundation element (20) to the anchor chair (10) by mounting a fas-

tening element (40) to the end (21) of the elongated foundation element (20) extending through the first opening (122) of the anchor chair (10).

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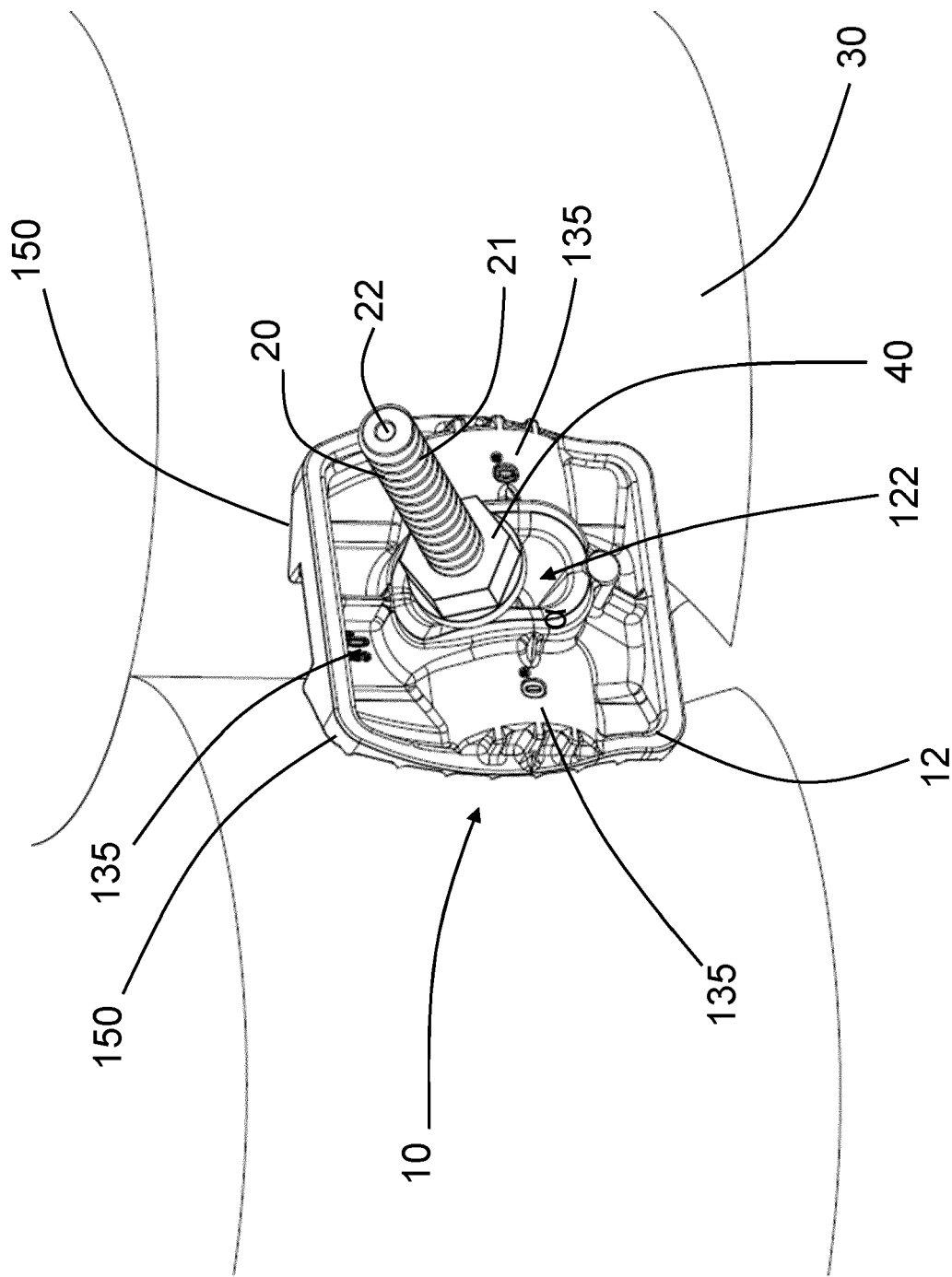
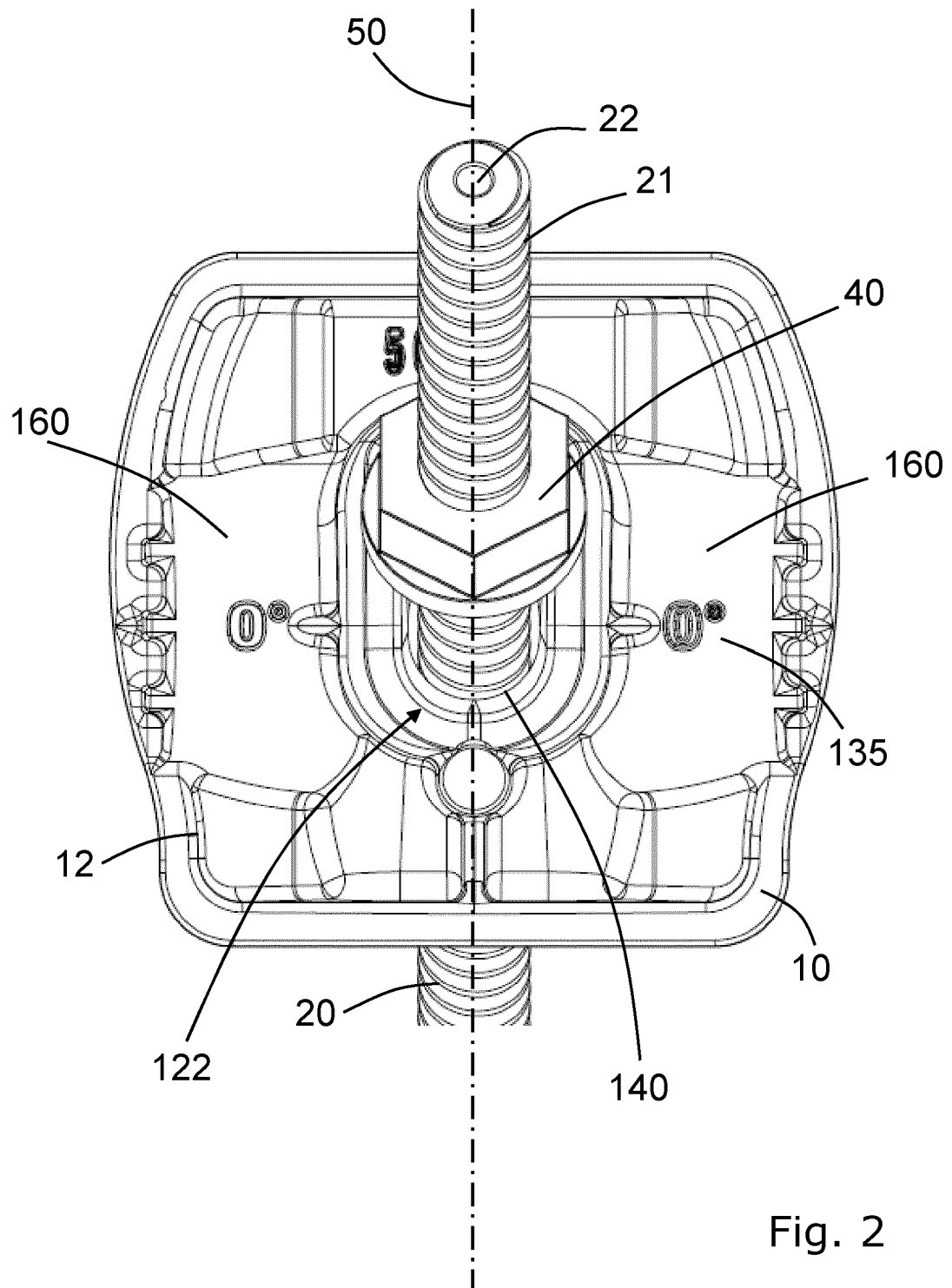
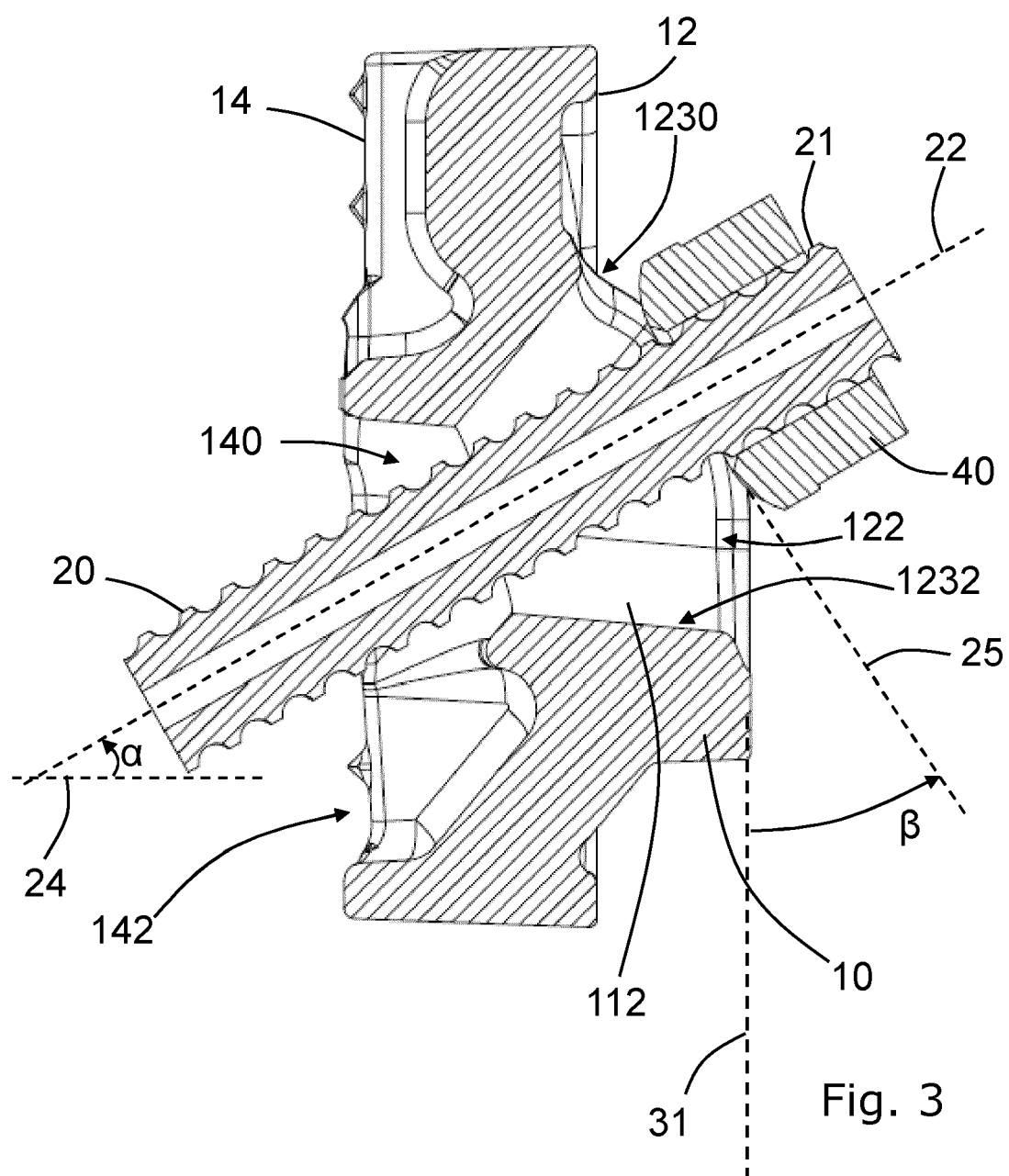


Fig. 1





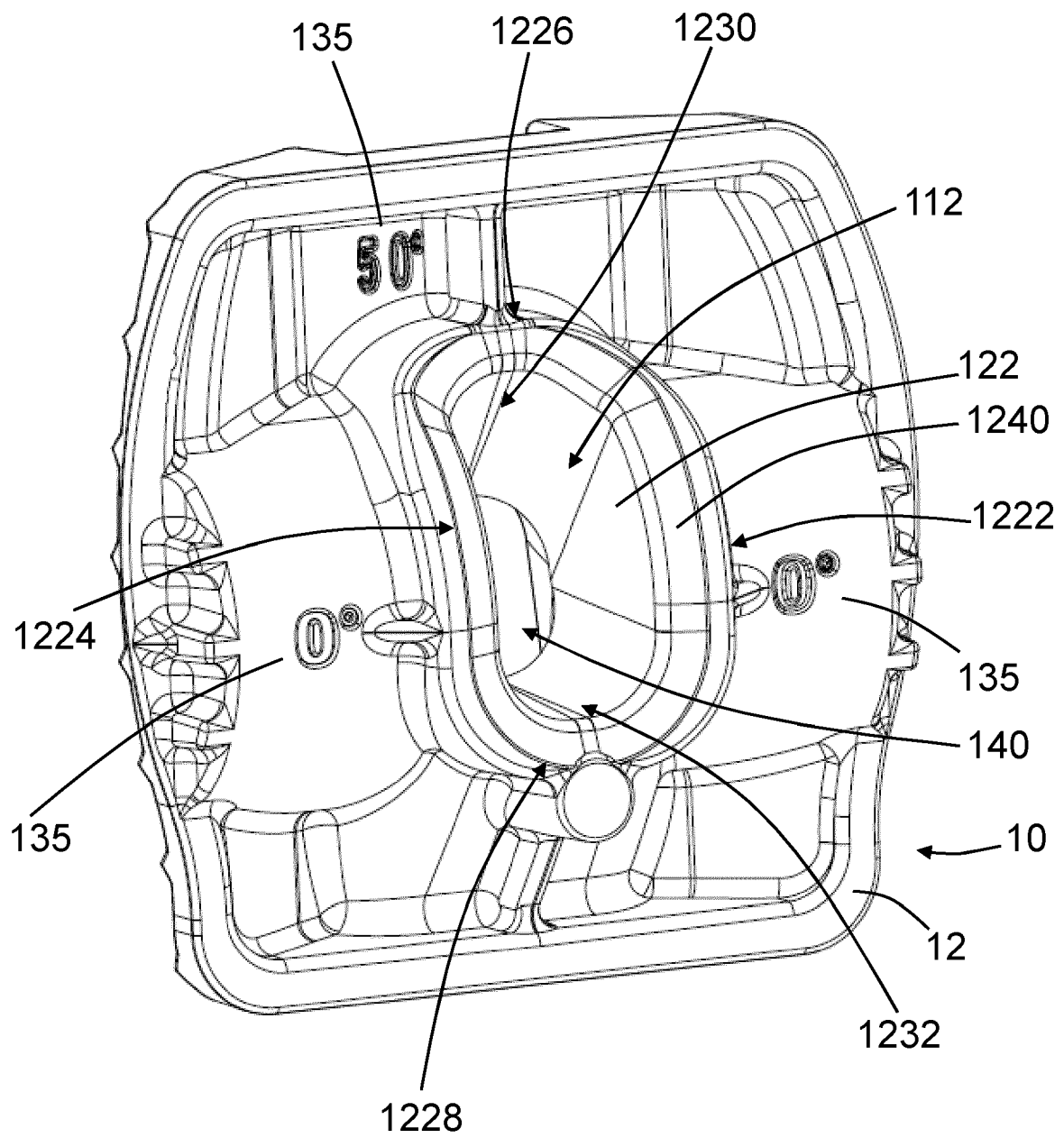


Fig. 4

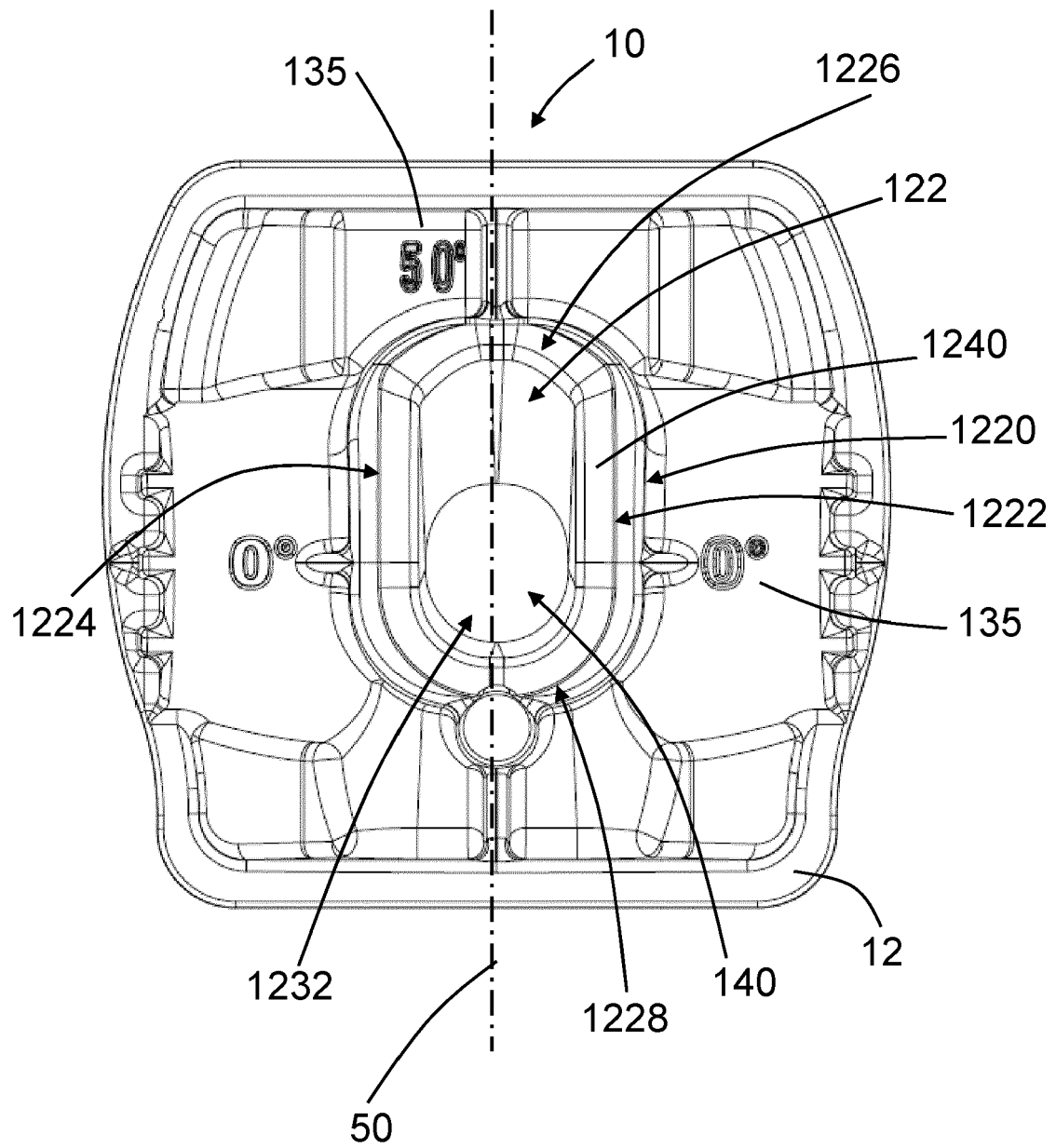


Fig. 5

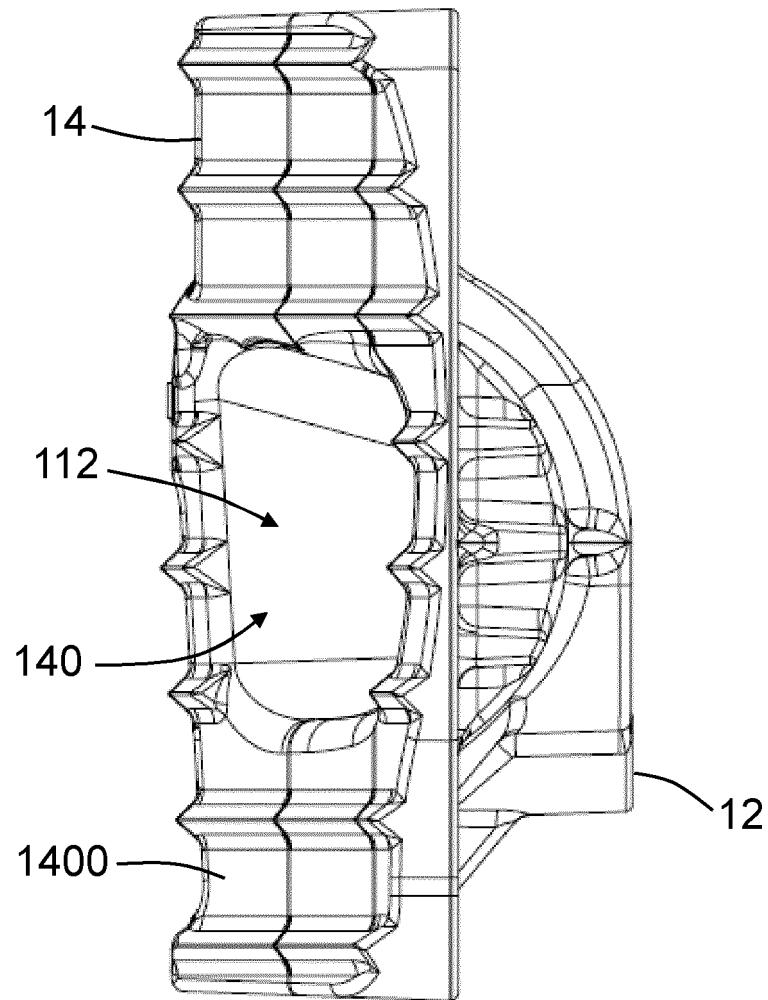


Fig. 6

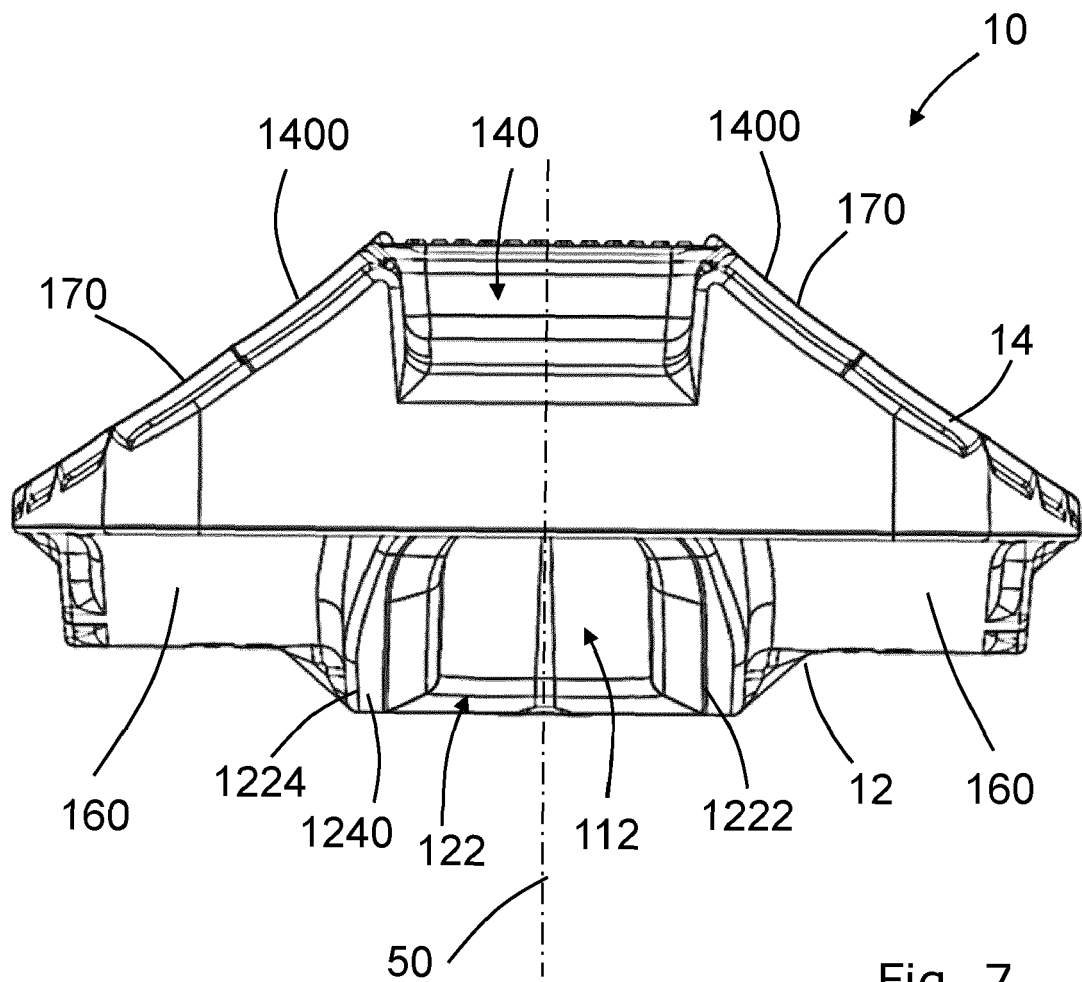


Fig. 7

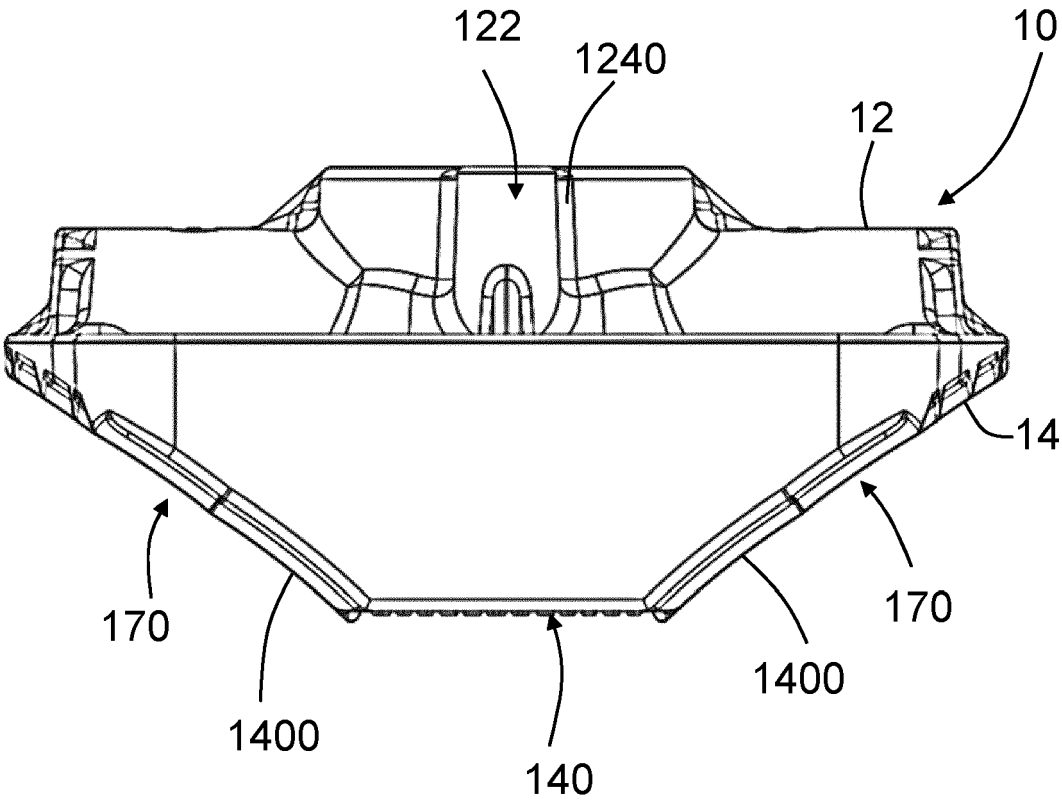


Fig. 8

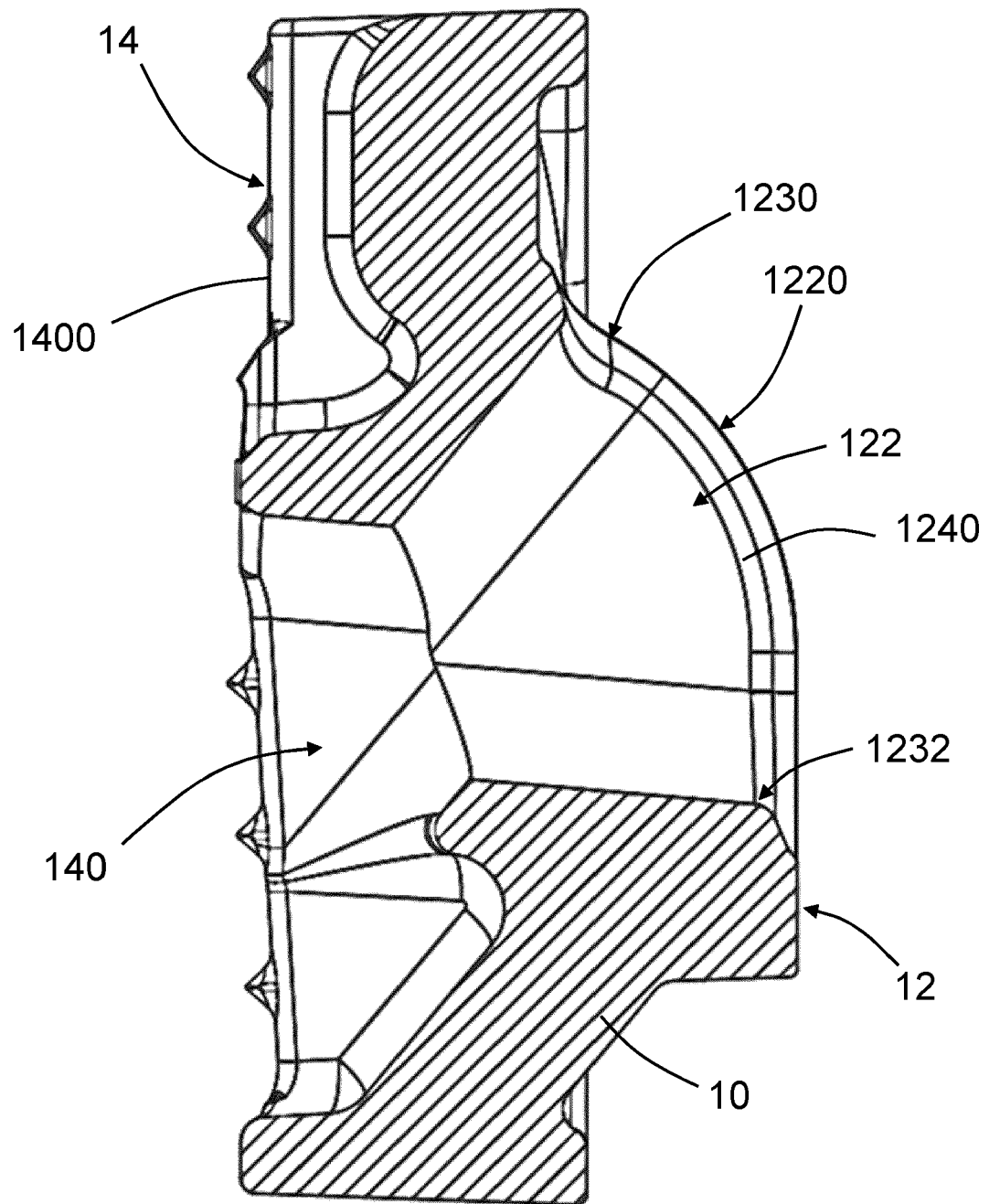


Fig. 9

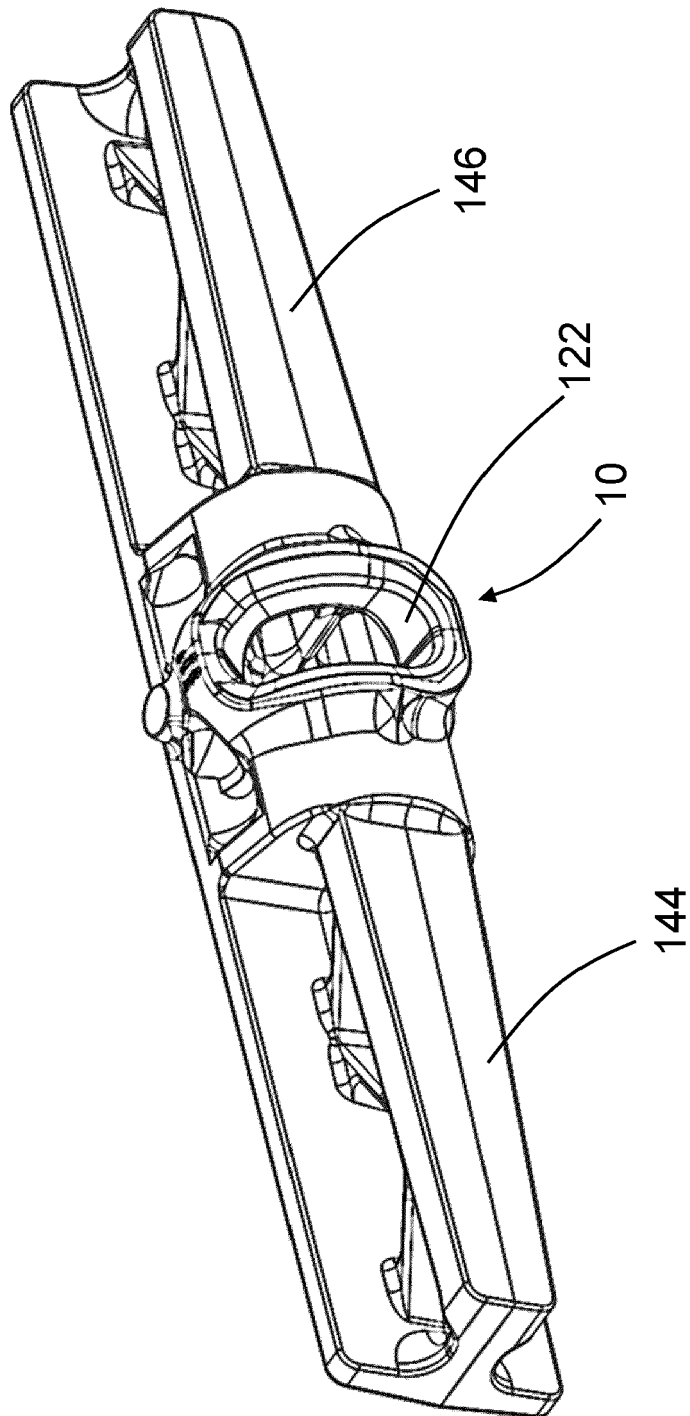


Fig. 10



EUROPEAN SEARCH REPORT

 Application Number
 EP 21 16 5750

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Place of search Munich		Date of completion of the search 9 September 2021	Examiner Koulo, Anicet
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