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(72) Inventors:
• **Cowell, Christopher**
Pitlochry, PH18 5TP (GB)
• **Tanner, Elliot**
Llanberis, LL55 4LD (GB)

(74) Representative: **Hamilton, Alistair**
Ty Eurgain, Cefn Eurgain Lane
Rhosesmor
Mold, North Wales CH7 6PG (GB)

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(71) Applicant: **Treemagineers Ltd**
Pitlochry PH17 2QH (GB)

(54) **SYSTEM AND APPARATUS FOR MOVING OBJECTS**

(57) A system and apparatus for moving objects is disclosed. The system includes a carriage for lifting and/or moving a load on one or more lines comprising at least two sheaves (30, 40) that are in, an operative configuration, disposed for rotation about a respective axis between front and rear plates (10, 12). The carriage has an open configuration in which at least one sheave is spaced from at least one of the front or rear plates. Tran-

sition between the open configuration and the operative configuration is achieved by mutual rotation of the front and rear plates (10, 12) about a rotation axis perpendicular to the plates that is coincident with the axis of rotation of one of the sheaves (30). In the apparatus, the carriage is carried, in the operative configuration, on a main line (60), whereby the carriage can travel on the main line supported by one or more sheave (30, 40).

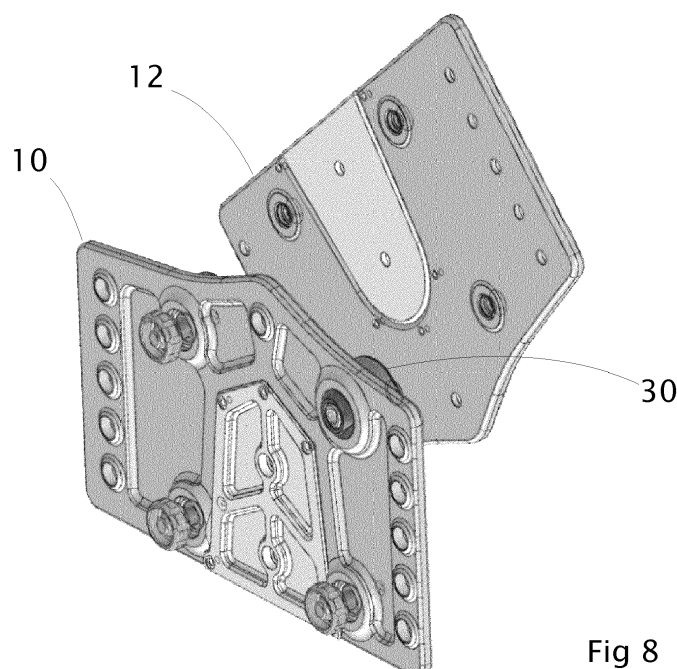


Fig 8

Description

[0001] This invention relates to a system and apparatus for moving objects.

[0002] A Tyrolean traverse is performed by connecting a main line between two remote locations, and placing a carriage on the main line. The carriage has a plurality of sheaves or other low-friction devices that allow it to travel along the main line. Control lines are connected to the carriage to control its movement along the main line. The carriage also has connection points to which a load can be connected. As the control lines are used to move the carriage along the main line, it is possible to move a load connected to the carriage between the remote locations. This arrangement has a variety of applications, including movement of inanimate objects, such as timber from a cut-down tree, or transport of people, either to cross a void, or to rescue an incapacitated person.

[0003] Although many carriages for use in performing a Tyrolean traverse are known, they all have limitations or disadvantages. They typically lack versatility, or cannot be installed on a main line without disconnecting the main line from its anchorages, so that an end of the main line can be threaded into the carriage.

[0004] An aim of this invention is to provide a carriage that is an improvement over known carriages.

[0005] To this end, from a first aspect, this invention provides a carriage for lifting and/or moving a load on a line comprising at least two sheaves that are in, an operative configuration, disposed for rotation about a respective axis between front and rear plates, the carriage having an open configuration in which at least two sheaves are spaced from at least one of the front or rear plates.

[0006] In the operative configuration, a line that is passing between the sheaves is constrained to move between the plates, while in the open configuration, a line can be removed from the carriage.

[0007] Transition between the open configuration and the operative configuration is typically achieved by mutual rotation of the front and rear plates about a rotation axis perpendicular to the plates, such as an axis of rotation of one of the sheaves. Each sheave preferably remains connected to one or other of the front and rear plate when the carriage is in the open configuration. In the operative condition, each sheave is typically connected to both the front and rear plates.

[0008] A carriage embodying the invention may further include locating means associated with a plurality of sheaves that serve to releasably connect the associated sheave with one or other of the front or rear plate to prevent mutual rotation of the front and rear plates. Where the carriage is opened by mutual rotation of the plates about the axis of a sheave, such locating means may be absent at that sheave. The locating means may include a locating pin that extends axially through the associated sheave. The locating pin can typically be releasably connected to the one or other of the front or rear plate by

threaded connection thereto.

[0009] In the operative configuration, the front and rear plates may have substantially coincidental peripheries. That is to say, when viewed in the direction of the axes of the sheaves, they appear to have the same peripheral shape and size.

[0010] A typical carriage embodying the invention has three or more and particularly four sheaves.

[0011] In a carriage optionally embodying this aspect of the invention, a recess may be formed in one or both of the front and rear plates that extends from an edge of the plate to a region between the axes of two sheaves to form a void between the axes. This can allow a load to be drawn into the void to provide a more advantageous path for lines to pass through the carriage and to reduce the tendency of the load to swing when suspended from the carriage. Preferably, the void extends from an edge of the plate to beyond a hypothetical line that interconnects the axes of rotation of two of the sheaves.

[0012] A similar recess may be formed in both the front and the rear plate, whereby, in the operative configuration, the recesses have substantially coincidental extents. Embodiments may further include a void plate releasably secured to one of the front or the rear plate (or a respective void plate on each of the front and the rear plates) to at least partially fill the void formed in the plate by the recess. The or each void plate may be secured to the associated front or rear plate by a plurality of removable fasteners.

[0013] From a second aspect, this invention provides apparatus for lifting and/or moving a load comprising a carriage according to any preceding claim carried, in the operative configuration, on a main line, whereby the carriage can travel on the main line supported by one or more sheave.

[0014] The apparatus may further include a lifting line that passes through and is supported by two or more sheaves of the carriage, there being a load carried on a length of the lifting line that extends between two sheaves. The load may be carried on a pulley that is supported on a length of the lifting line that extends between two sheaves. The apparatus may further include a control line or a plurality of control lines connected to the carriage.

[0015] From a third aspect, this invention provides a method of installing apparatus according to the second aspect of the invention, the method comprising:

- a. installing a main line between two anchorages;
- b. placing the carriage into the open configuration;
- c. arranging the carriage such that the main line passes between two or more of the sheaves of the carriage; and
- d. placing the carriage into the operative configuration such that the main line passes between the front

and rear plates.

[0016] An embodiment of the invention will now be described in detail, by way of example, and with reference to the accompanying drawings, in which:

Figures 1 and 2 show a carriage embodying the invention;

Figure 3 shows the carriage of Figures 1 and 2 with a front plate hidden;

Figure 4 shows an axle assembly being a component of the embodiment of Figures 1 and 2;

Figures 5 and 6 show a cross-section through the carriage of Figures 1 and 2 with a first connection pin in, respectively, a locked and an unlocked configuration;

Figure 7 shows the carriage of Figures 1 and 2 in an unlocked configuration;

Figure 8 and 9 show the carriage of Figures 1 and 2 in an open configuration;

Figure 10 and 12 show front and rear views of the carriage of Figures 1 and 2 with ropes in place, Figure 10 having a transparent front plate;

Figure 11 shows the arrangement of Figures 10 and 12 in use with a lifting pulley;

Figure 13 shows the carriage of Figures 1 and 2 in use with a lifting pulley and void plates removed;

Figure 14 is a semi-transparent view corresponding to Figure 13;

Figure 15 shows the arrangement of Figures 13 and 14 prior to lifting the pulley;

Figure 16 shows a partly transparent view of the carriage of Figures 1 and 2 with additional components installed;

Figure 17 shows a pin for use with an embodiment of the invention;

Figures 18 and 19 are front and oblique views of a second embodiment of the invention in an operative configuration;

Figure 20 is a view of the second embodiment in an open configuration; and

Figure 21 is a view of the second embodiment in an alternative operative configuration shown carrying a

load.

[0017] With reference to the drawings, a carriage being a first embodiment of the invention comprises a front plate 10 and a back plate 12, each being formed from a single piece of metal alloy. The front and rear plates have a generally similar peripheral shape, which in other embodiments will be subject to modification to meet specific functional requirements. In this embodiment, each plate 10, 12 has two side edges and a bottom edge that are all straight and form three sides of a rectangle interconnected by rounded corners. The fourth edge extends in concave, sloping lengths from each of its two corners to a central convex raised section.

[0018] A void 14 shaped approximately as an inverted 'U'. The recess has a peripheral flange. Several tapped holes 18 are formed through the flange. In the configuration shown in Figures 1 to 8, a void plate 20 fills the void 14 and is secured in place with fasteners 24 that pass through the void plate 20 and are retained in the tapped holes 18.

[0019] Four sheaves are disposed between the front and rear plates 10, 12. Each sheave includes a pulley wheel that is carried on a rolling-element bearing, whereby it can be mounted on an axle for free rotation thereon. A first of these 30 will be referred to as the "fixed sheave", is shown to the top-right of the front plate 10 in the figures. The fixed sheave 30 is carried for rotation on an axle 32. The axle 32 has an externally-threaded end portion that is screwed into and fixed immovably within a tapped bore in the rear plate 12. A cylindrical opposite end portion of the axle 32 is received within and fixed to the inner race of a rolling-element bearing, referred to as the front plate bearing, by a nut 36. The outer race of the front plate bearing is secured immovably within a hole in the front plate 10. It will be seen that the front plate 10 and the fixed sheave 30 can rotate independently with respect to the rear plate.

[0020] The three other sheaves 40, 40', 40" are disposed respectively to the top-left, bottom-left and bottom-right of the front plate 10, as shown in the figures. These will be referred to as "releasable sheaves". Each releasable sheave 40, 40', 40" is carried on a respective hollow axle 42, as shown in Figure 5. A threaded end portion of each axle 42 is retained immovably in a respective tapped hole in the front plate 10. Each axle 42 has an axial bore that is stepped to a lesser diameter in the region of the threaded portion. Within each bore there is a locating pin 44 that can slide axially and rotate within the bore. A transverse bore in the locating pin 44 contains a sprung ball 58 that can move between a position in which it partially projects from the locating pin 44 against a spring force to a position in which it is recessed within the transverse bore. An end portion of the locating pin 44 projects from the front plate 10 and carries a knob 46, by means of which it can be manually rotated. At the opposite end, the axle has an externally-threaded length 48. Axial movement of the locating pin 44 is limited by the knob

46 making contact with the front plate 10.

[0021] Three bosses 50, 50', 50", each corresponding with a respective one of the releasable sheaves 40, 40', 40", are located immovably in the rear plate 12. Each boss 50, 50', 50" includes a cylindrical stem 52 that passes through a bore in the rear plate 12 and a head 54 that is within a recess in the surface of the rear plate 12 that faces away from the front plate 10. The cylindrical stem 52 has an internally threaded bore.

[0022] In an operative configuration of the carriage, the front and rear plates 10, 12 lie adjacent to one another with their peripheries being coincident. The axially threaded length 48 of each locating pin 44 is received within the threaded bore of the stem 52 of the respective boss 50, where it can be tightened by manual rotation of the knob 46. This configuration is shown in Figure 5. A shoulder of the knob 46 enters a similarly-sized recess on the front plate 10 to clamp the front plate 10 against the axle 42. This results in the front and rear plates being securely clamped together, such that the four sheaves 30, 40, 40', 40" can rotate about respective axes normal to the plates 10, 12 - when in the operative configuration, the four sheaves 30, 40, 40', 40" function essentially identically. Optionally, a respective screw 56 is passed through the head 54 of each boss 50, 50', 50" into a tapped bore in the locating pin 44 to prevent it rotating and sliding within the axle 42, and thereby preventing it from moving to the open configuration until such time as the screw 56 is removed.

[0023] To obtain an open configuration, locating pins 44 are rotated by the knobs 46 to cause their threaded lengths 48 to be withdrawn from the boss 50. The locating pins 44 are each pulled to the limit of their travel in the direction of the front plate 10. This allows the sprung balls 58 to project from the locating pins 44 to resist the return of the locating pins 44 to their locking positions. This configuration is shown in Figures 6 and 7. In the open configuration, the front plate 10 can be rotated with respect to the rear plate 12 about the axis of the fixed sheave 30, as shown in Figures 8 and 9.

[0024] It will be seen that when the carriage is in the operative configuration, a line 60, 62 that passes between the upper sheaves 30, 40 and the lower sheaves 40', 40" can be removed only by sliding an end of the line from between the plates 10, 12. If the ends of such a line are fixed, then removal of the carriage is not possible. However, when the carriage is in the open configuration, it can be removed from or installed upon a line, even if its ends are not accessible. Subsequent closure of the carriage secures it to the line.

[0025] In this embodiment, the front and rear plates 10, 12 are provided with a number of through hole pairs which are in alignment with one another when the carriage is in the operative configuration. The number and location of these hole pairs will vary from one embodiment to another in accordance with the specific applications for which it is intended. The position and function of these will become apparent from the following descrip-

tion of the operation of the apparatus. The hole pairs are dimensioned such that they can receive a pin 66 of a type shown in Figure 17. The pin 66 has a cylindrical shaft 68 which is a close sliding fit within the through holes on which a piece of apparatus can be carried and a head 70. The shaft 68 carries a locking tab 72 that prevents removal of the shaft 68 from the hole until it is released by operation of a release button 74. A respective column of such hole pairs 78, 80 five in this case, is formed adjacent to the sides of the plates 10, 12; a hole 82 is formed through the centre of the plates near to convex raised section of the fourth edge. Two further hole pairs 84, 86 are formed through the void plate 20.

[0026] A first mode of operation uses three lines to transport an object between locations. The first line is a main line 60 that is installed to extend between anchorages at spaced-apart locations to which objects are to be transported and is fixed in this application. It is typically advantageous for such a line to be installed and left in place for a period during which multiple transportation operations are to be transformed. Therefore, it is the case that ends of the line will preferably not be freed to allow installation or removal of apparatus to or from the line. The second line is a lifting line 62.

[0027] For use, the carriage is moved to its open configuration. It is then placed on the main line 60 such that it hangs supported by its upper sheaves 30, 40. The lifting line 62 is brought adjacent to the main line, and the carriage is closed. In this way, the main line now supports the carriage from the upper sheaves 30, 40, and the lifting line rests on the lower sheaves 40', 40". A pin 66 inserted through one of the hole pairs in one or both columns 78, 80. This can be used to secure a control line 64, either by tying the control line 64 to it or by passing it through a pre-formed loop in the control line 64. As shown in Figure 12, a loop of the lifting line 62 is drawn downwardly from the carriage, and a lifting pulley 76 is applied to it, whereby the lifting line 62 can run freely through the pulley 76.

[0028] With the arrangement described in the last-preceding paragraph, the pulley 76, and a load attached to it, can be raised or lowered with respect to the carriage by, respectively, shortening or lengthening the overall length of the lifting line 62. The carriage can be drawn along the main line 60 by means of the control line 64. Note that if the main line 60 slopes steadily, just one control line 64 may be needed, acting in a direction against gravity, while in other cases, two control lines may be needed to draw the carriage in opposite directions on the main line 60.

[0029] In a modification to this operation, the void plates 20 are removed from the front and rear plates 10, 12, as shown in Figures 13 to 14 and sliders 16 are applied to the flange to allow smooth passage of ropes past the voids 14 thereby exposed. This arrangement allows the pulley 76 to be lifted further, as compared with the previous arrangement, such that it enters the voids 14 in the front and rear plates, such that the loop of the lifting

line 62 is all but straightened out. This reduces the resistance to movement of the sheaves 40', 40" over the lifting line, so allowing the carriage to move with less resistance. The pulley 76 is also less likely to swing as the carriage is moved. However, the absence of the void plates 20 reduces the strength of the front and rear plates 10, 12, so this arrangement has a lesser load-carrying capacity.

[0030] A variety of other components may be connected to the carriage to vary its function. For example, at any of the hole pairs, a sheave 90 may be carried on a pin 66. A rope guide and knot blocker 92 can be carried on several pins 66 to control and limit movement of one or more lines through the carriage. By selecting these additional components, a user can deploy the carriage and lines in a wide variety of configurations to suit particular tasks and operating environments.

[0031] With reference to Figures 18 to 21, an alternative embodiment of the invention includes just two sheaves: one fixed sheave 130 and one releasable sheave 132. These are carried between front and rear 110, 112 plates in essentially the same manner as the sheaves 30, 32 of the first embodiment, with the fixed sheave being carried on a fixed axle and the releasable sheave being carried on a releasable axle. The plates 110, 112 have an approximately rectangular profile with rounded corners.

[0032] In an operative configuration of the carriage, the front and rear plates 110, 112 lie adjacent to one another with their peripheries being coincident, as shown in Figures 18, 19 and 21. When the locking pin of the releasable axle is unscrewed and pulled by means of the knob 146 away from the rear plate 112, the plates can be mutually pivoted about the fixed axle to an open configuration as shown in Figure 20. In the open condition, a line 160 can be placed between the sheaves 130, 132, whereupon the plates 110, 112 can be returned to the closed configuration to constrain the line 160 to pass between the plates 110, 112.

[0033] Each plate 110, 112 is provided with a row of holes 178, 180, such that when the plates are in the closed configuration, the pairs of holes, one in each plate, are in alignment to form hole pairs. The hole pairs are dimensioned such that they can receive a pin 66 of a type shown in Figure 17.

[0034] The carriage can be supported by one of its sheaves 110, 112 from a main line 160. It can be drawn along the main line 160 using one or more control lines 164 secured by a pin 166 passed through a hole pair. A load can be carried from the axle of the other sheaves.

[0035] In an alternative mode of operation, the carriage is placed on a main line 160 while in the closed configuration, such that it is supported on the line 160 by both of its sheaves 110, 112, as shown in Figure 21. One or more pins 166 can then be inserted into hole pairs below the main line 160 to prevent the carriage from separating from the line 160, and to provide an anchorage to which control line(s) 164 can be connected and to which a load

188 can be connected.

Claims

1. A carriage for lifting and/or moving a load on one or more lines comprising at least two sheaves (30, 40) that are in, an operative configuration, disposed for rotation about a respective axis between front and rear plates (10, 12), the carriage having an open configuration in which at least one sheave is spaced from at least one of the front or rear plates **characterised in that** transition between the open configuration and the operative configuration is achieved by mutual rotation of the front and rear plates (10, 12) about a rotation axis perpendicular to the plates that is coincident with the axis of rotation of one of the sheaves (30).
2. A carriage according to claim 1 in which each sheave (30, 40) remains connected to one or other of the front and rear plate (10, 12) when the carriage is in the open configuration.
3. A carriage according to claim 1 or claim 2 in which, in the operative condition, each sheave (30, 40) is connected to both the front and rear plates (10, 12).
4. A carriage according to any preceding claim further including locating means associated with one or more sheaves (40) that serve to releasably connect the associated sheave with one or other of the front or rear plate to prevent mutual rotation of the front and rear plates (10, 12).
5. A carriage according to claim 4 in which the locating means includes a locating pin (44) that extends axially through the associated sheave, wherein the locating pin can be releasably connected to the one or other of the front or rear plate by threaded connection thereto.
6. A carriage according to any preceding claim having three or more sheaves (30, 40, 40', 40").
7. A carriage according to any preceding claim in which there is a recess (14) in one or both of the front and rear plates (10, 12) that extends from an edge of the plate to a region between the axes of two sheaves to form a void between the axes.
8. A carriage according to claim 7 in which the void (14) extends from an edge of the plate to beyond a hypothetical line that interconnects the tangential upper edges of rotation of two of the sheaves (30, 40).
9. A carriage according to claim 7 or claim 8 further including a void plate (20) releasably secured to one

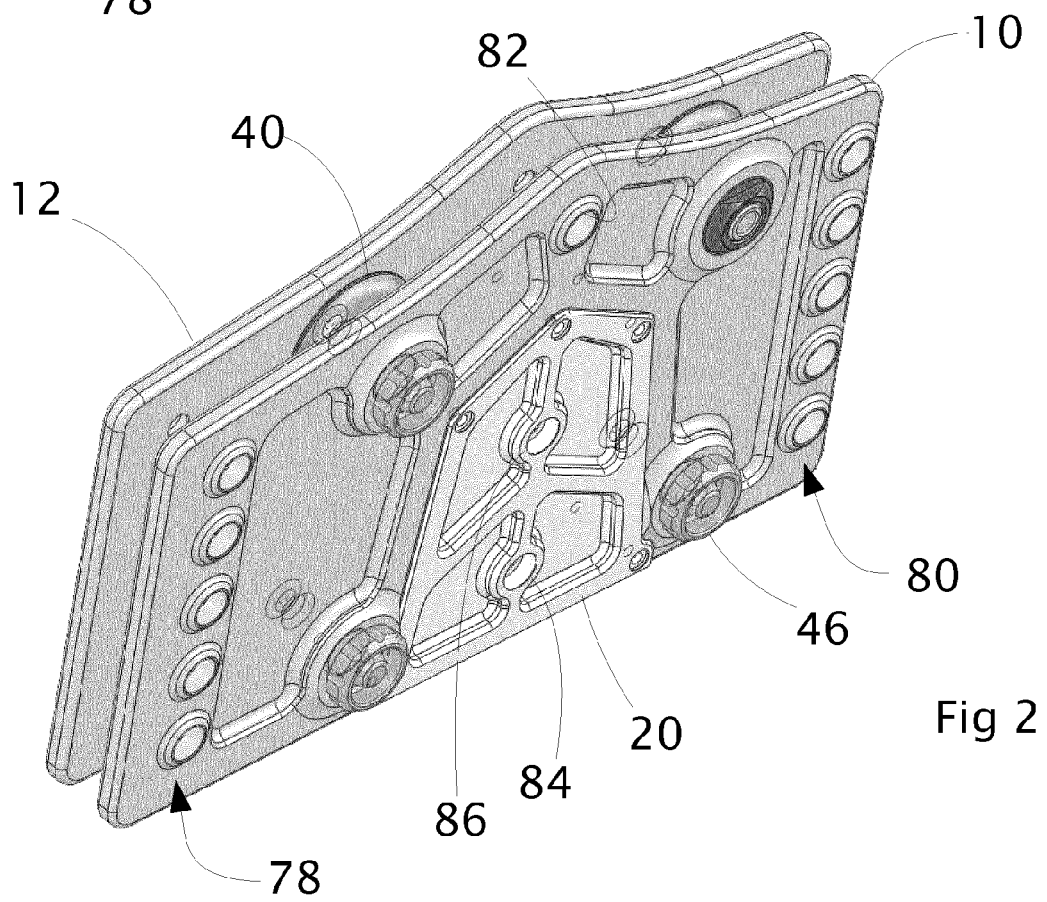
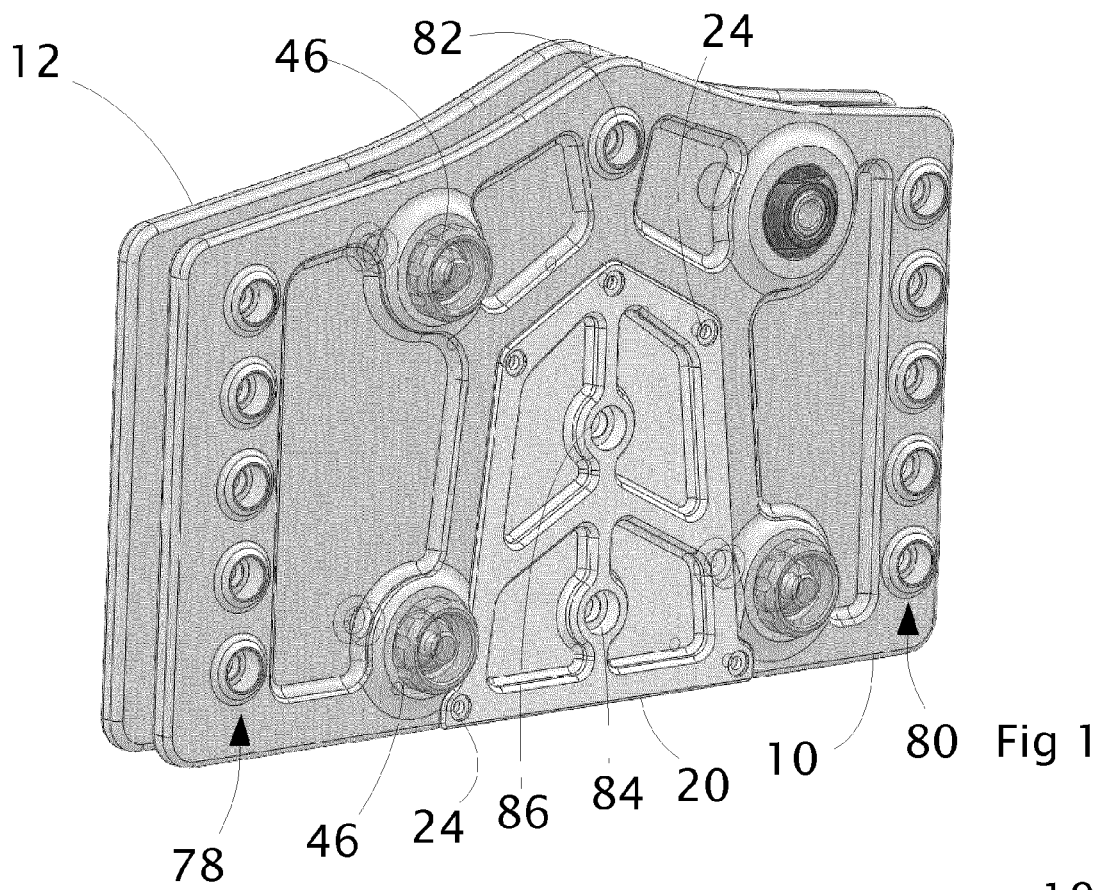
of the front or the rear plate (10, 12) to at least partially fill the void (14) formed in the plate by the recess.

10. A carriage according to claim 9 having a respective void plate on each of the front and the rear plates. 5
11. Apparatus for lifting and/or moving a load comprising a carriage according to any preceding claim carried, in the operative configuration, on a main line (60), whereby the carriage can travel on the main line supported by one or more sheave (30, 40). 10
12. Apparatus according to claim 11 further including a lifting line (62) that passes through and is supported by one or more sheaves of the carriage (40', 40"), there being a load carried on a length of the lifting line that extends between two sheaves. 15
13. Apparatus according to claim 11 or claim 12 in which the load is carried on a pulley that is supported on a length of the lifting line that extends between two sheaves. 20
14. Apparatus according to any one of claims 11 to 13 further including one or more control lines (64) connected to the carriage. 25
15. A method of installing apparatus according to any one of claims 11 to 14 comprising: 30
 - a. installing a main line between two anchorages;
 - b. placing the carriage into the open configuration;
 - c. arranging the carriage such that the main line passes between two or more of the sheaves of the carriage; and 35
 - d. placing the carriage into the operative configuration such that the main line passes between the front and rear plates. 40

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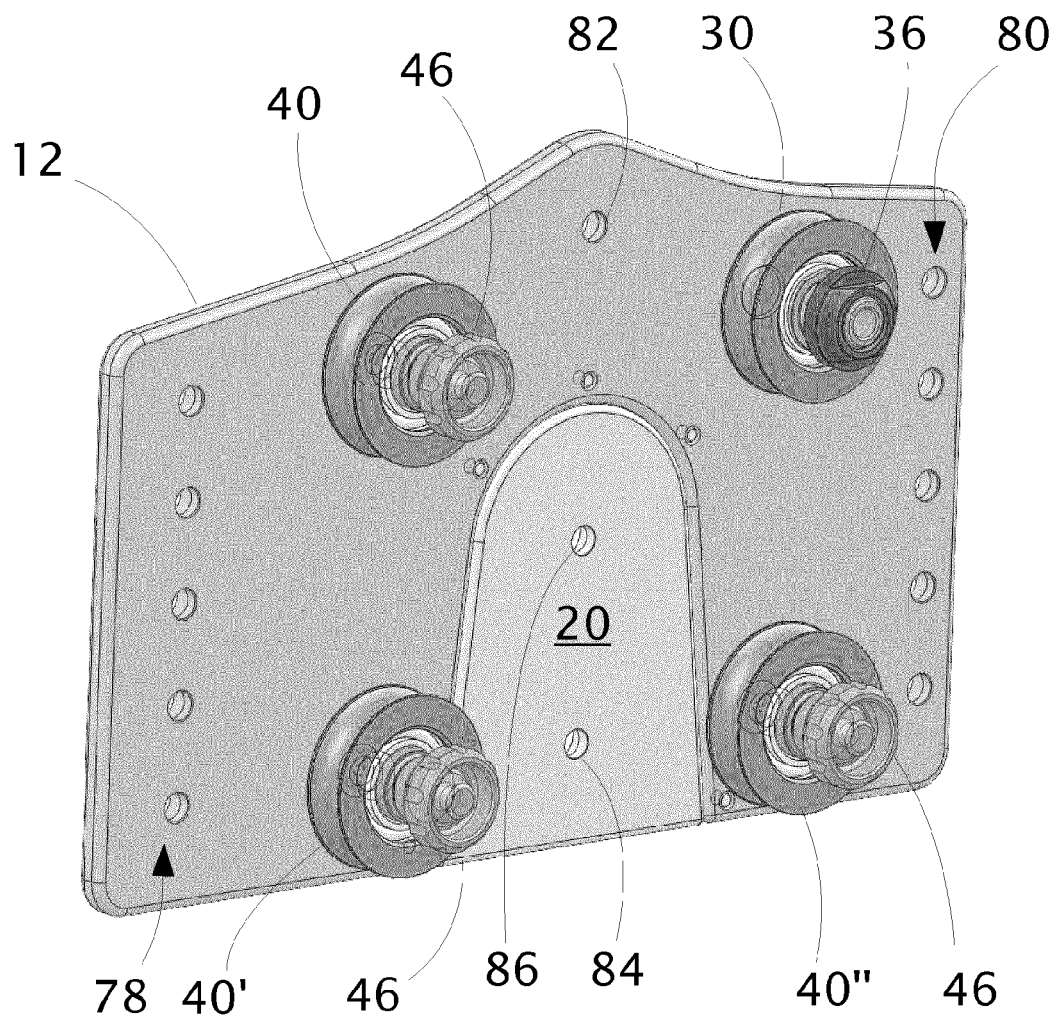


Fig 3

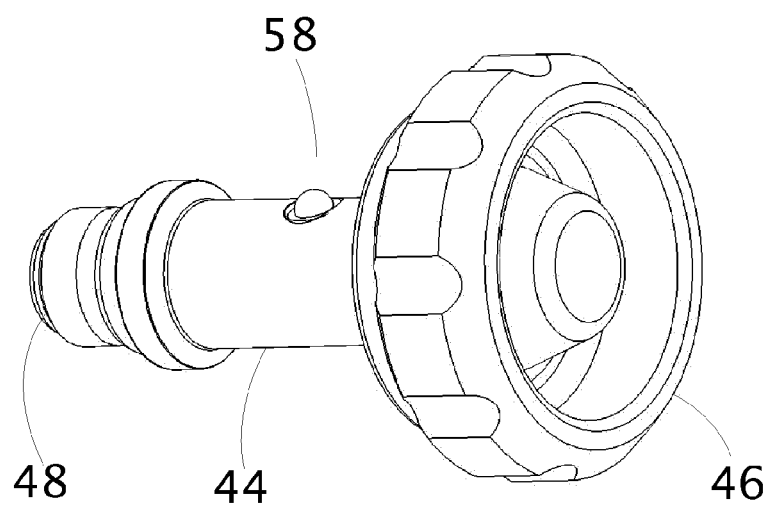
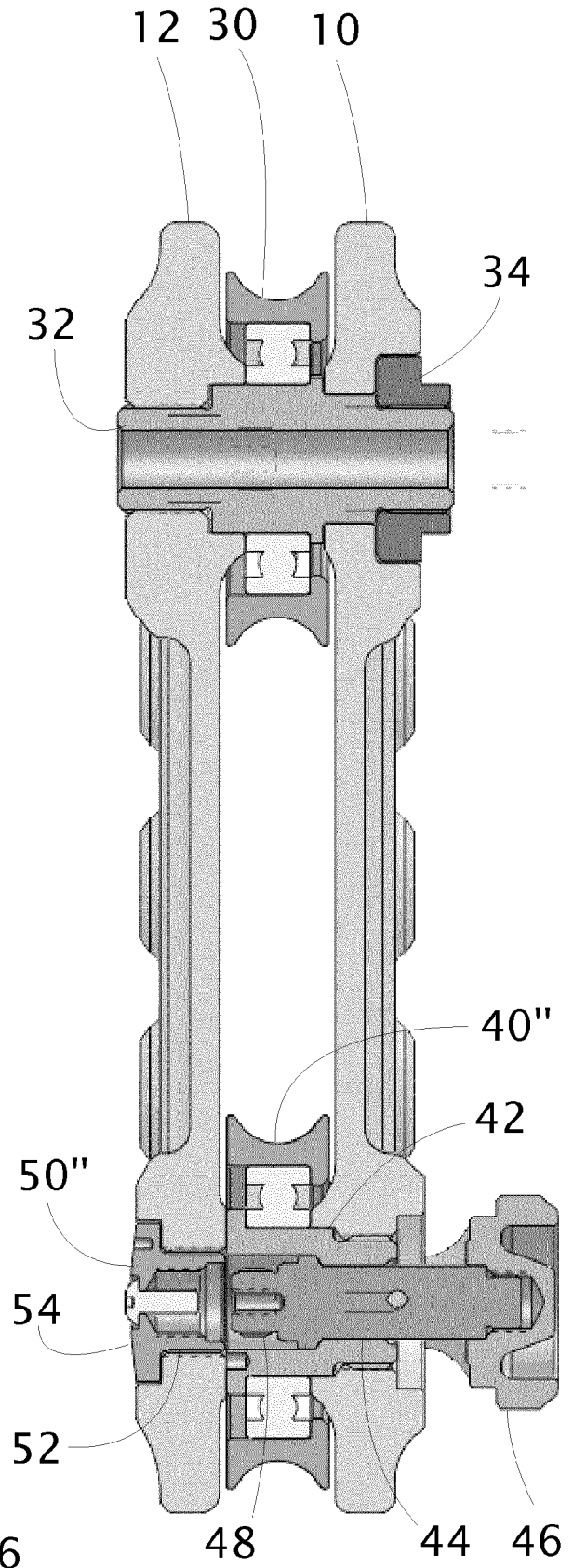
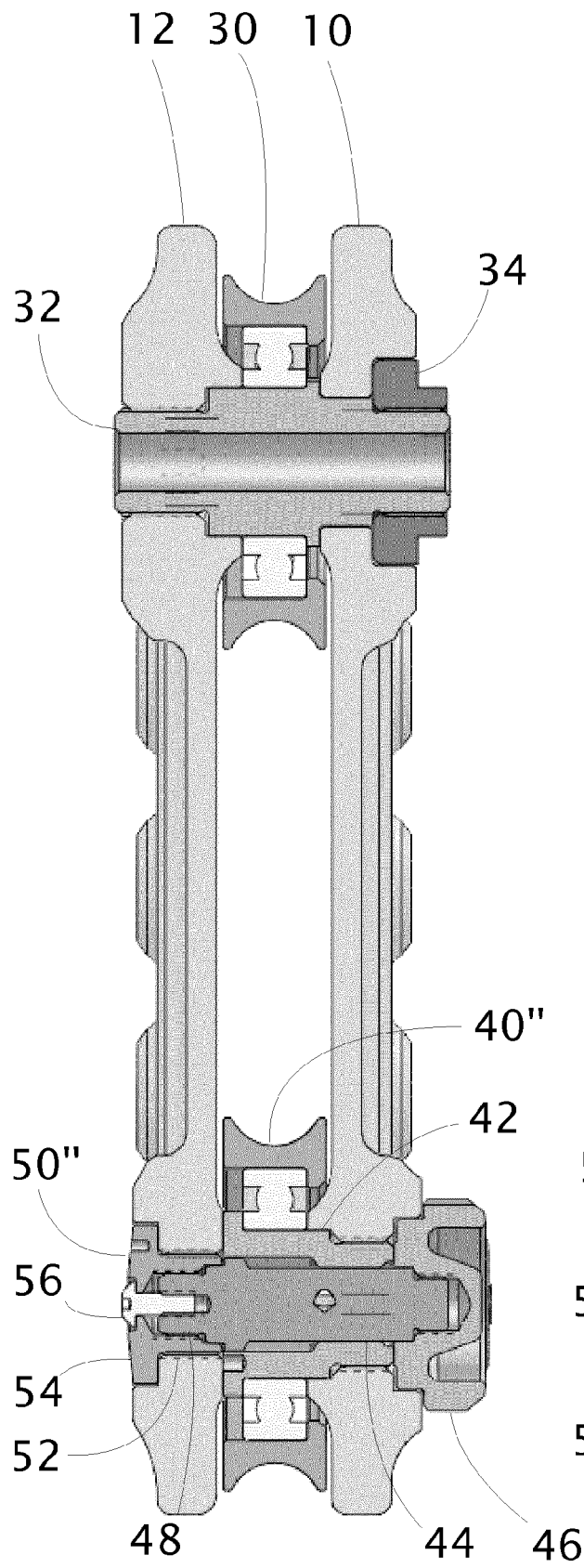
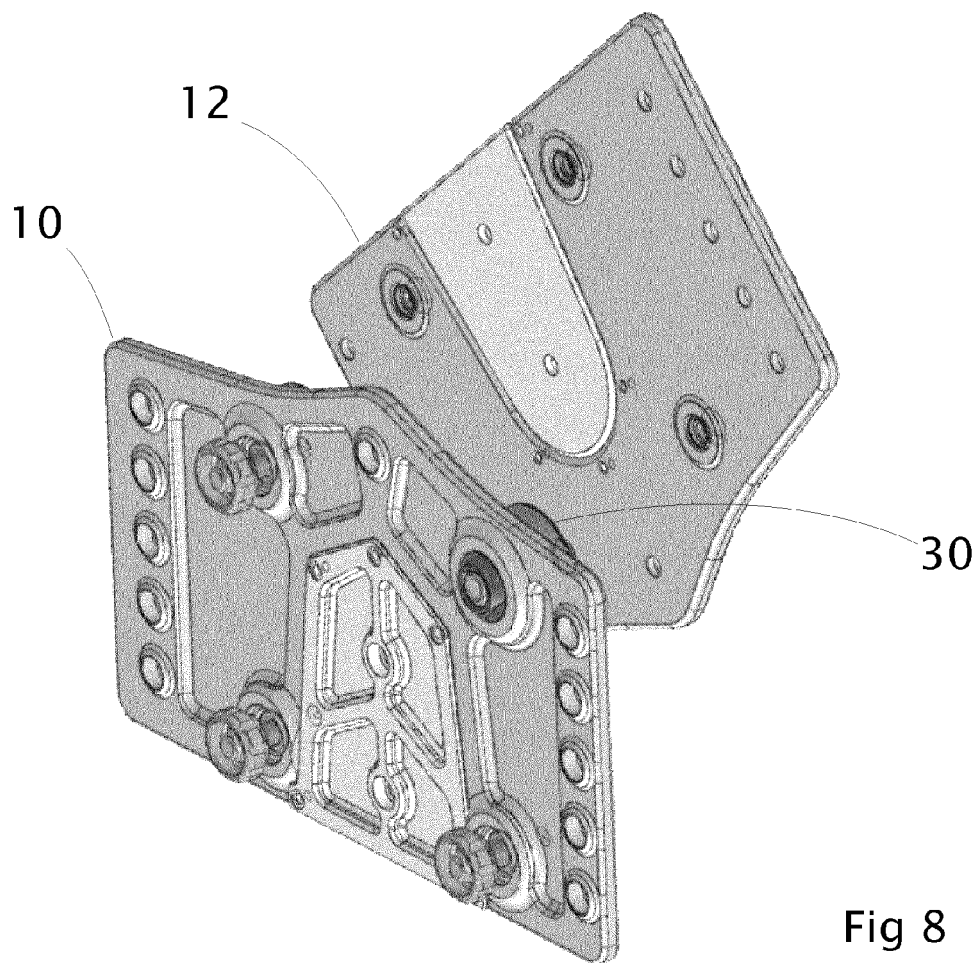
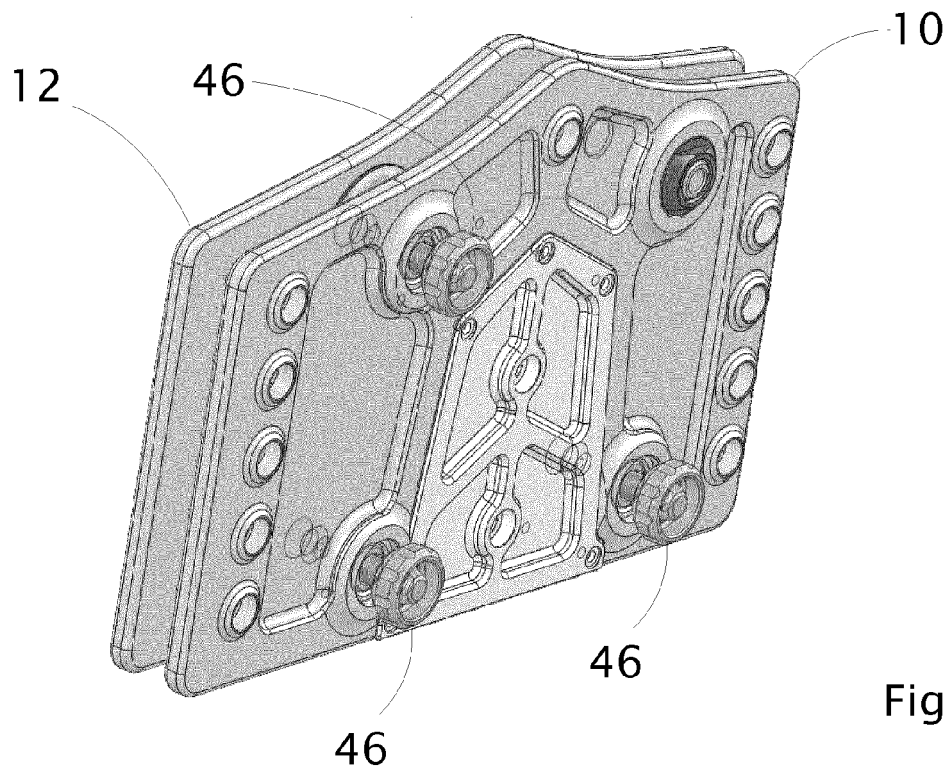
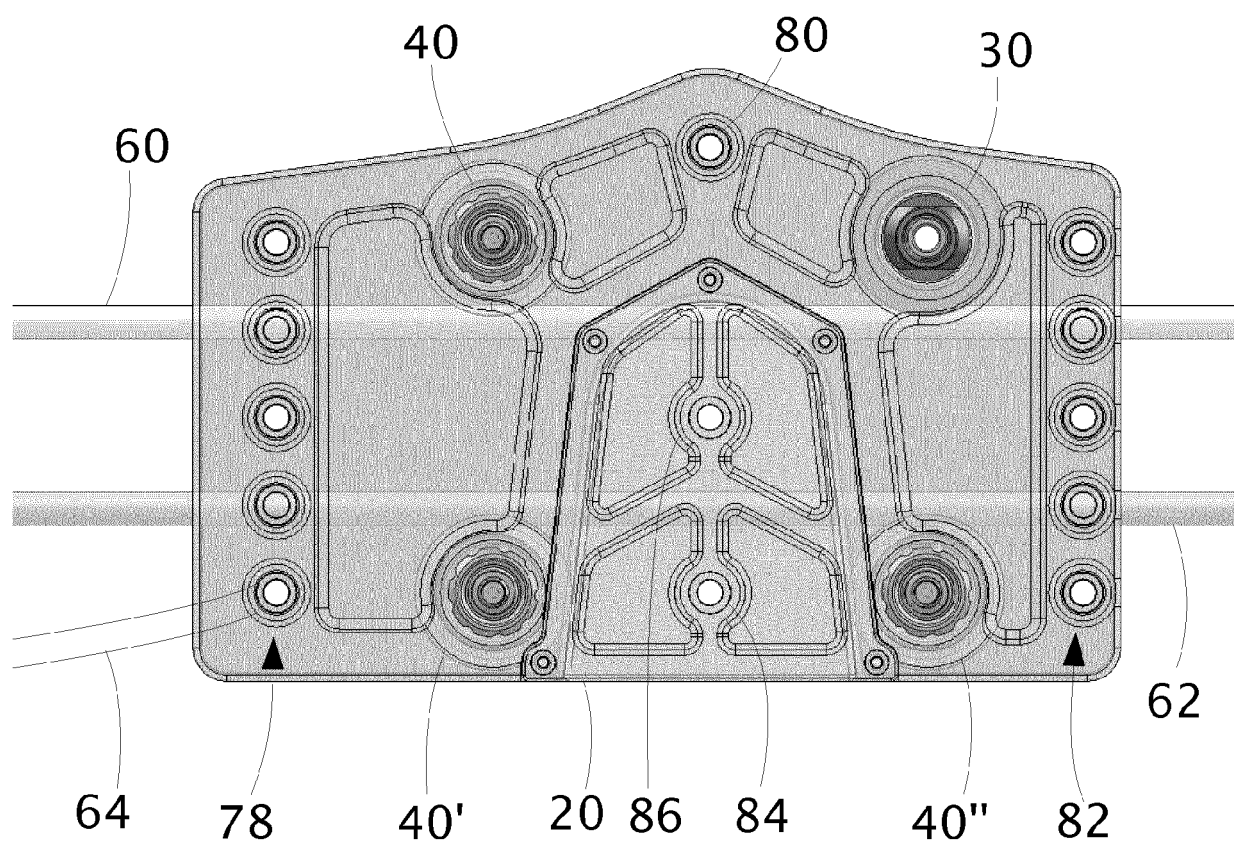
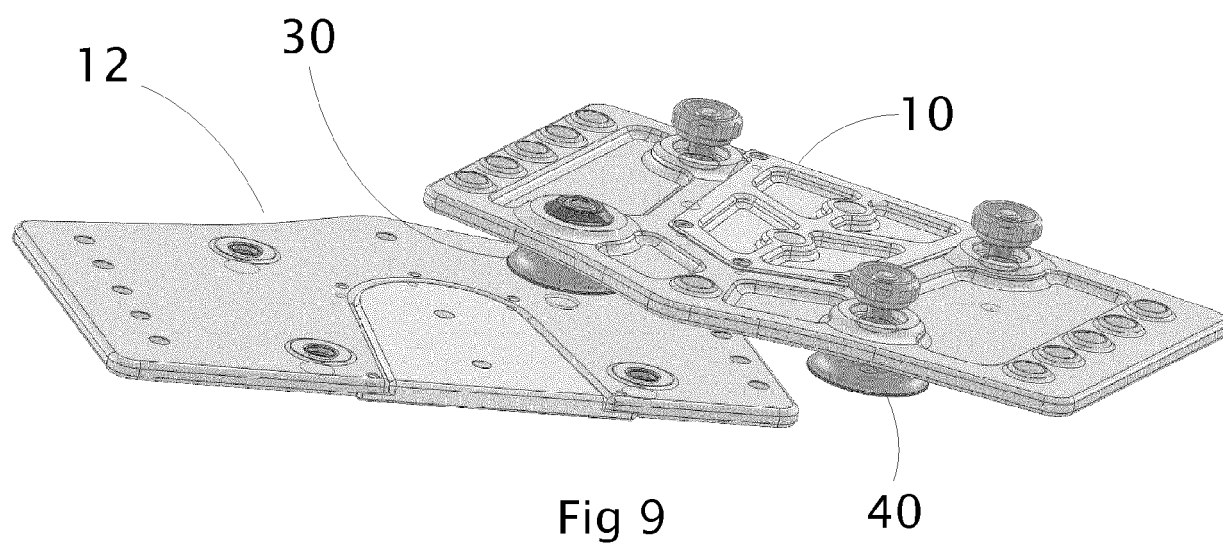


Fig 4







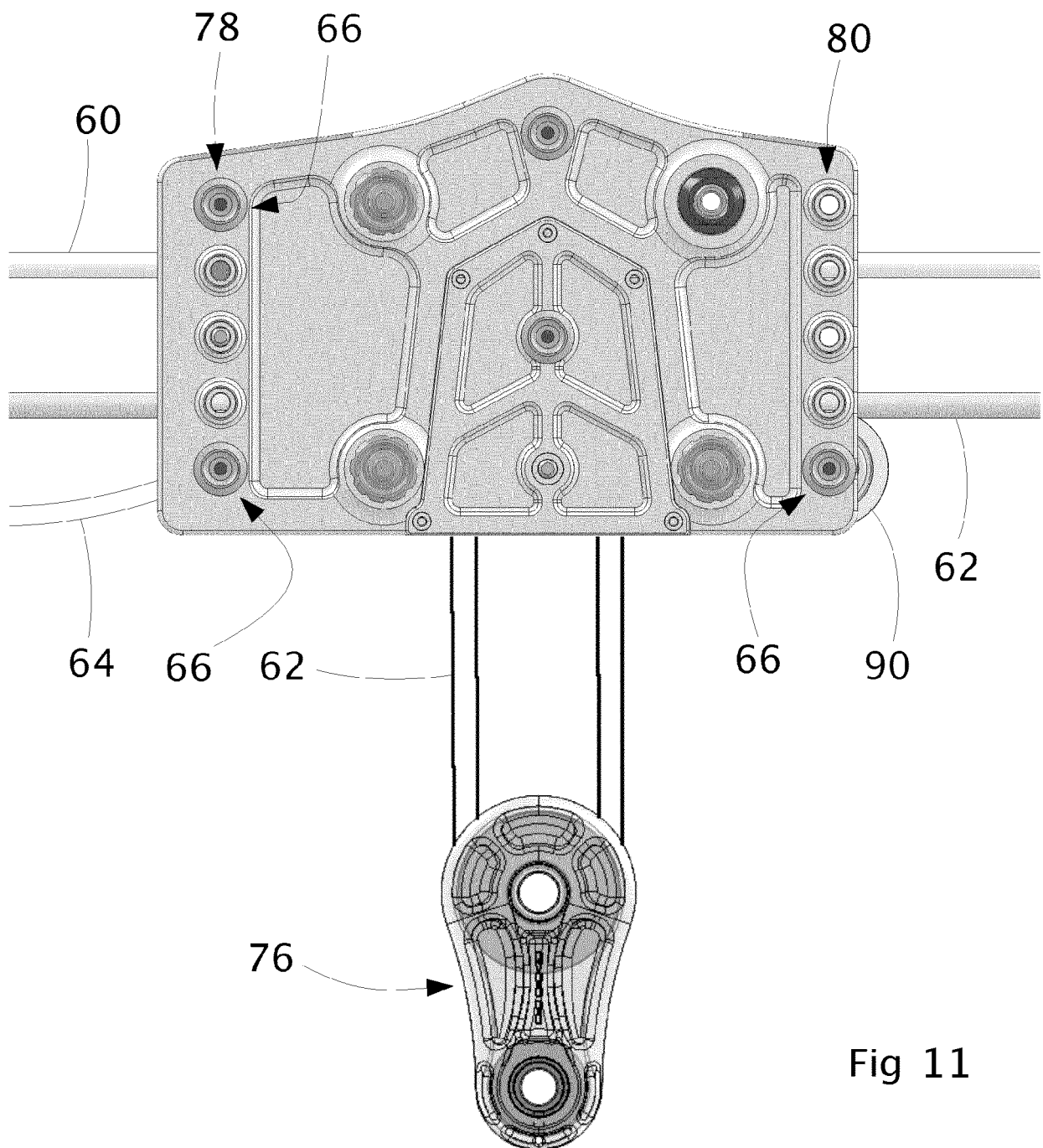
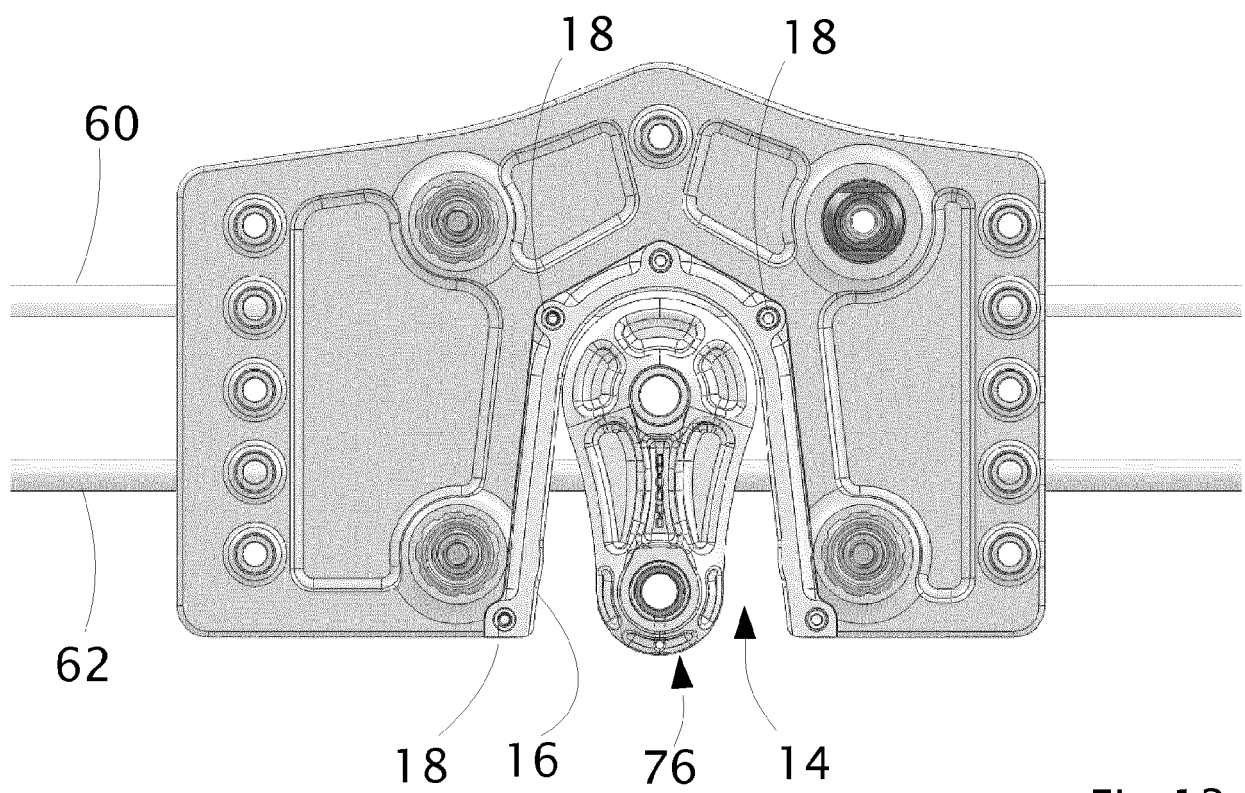
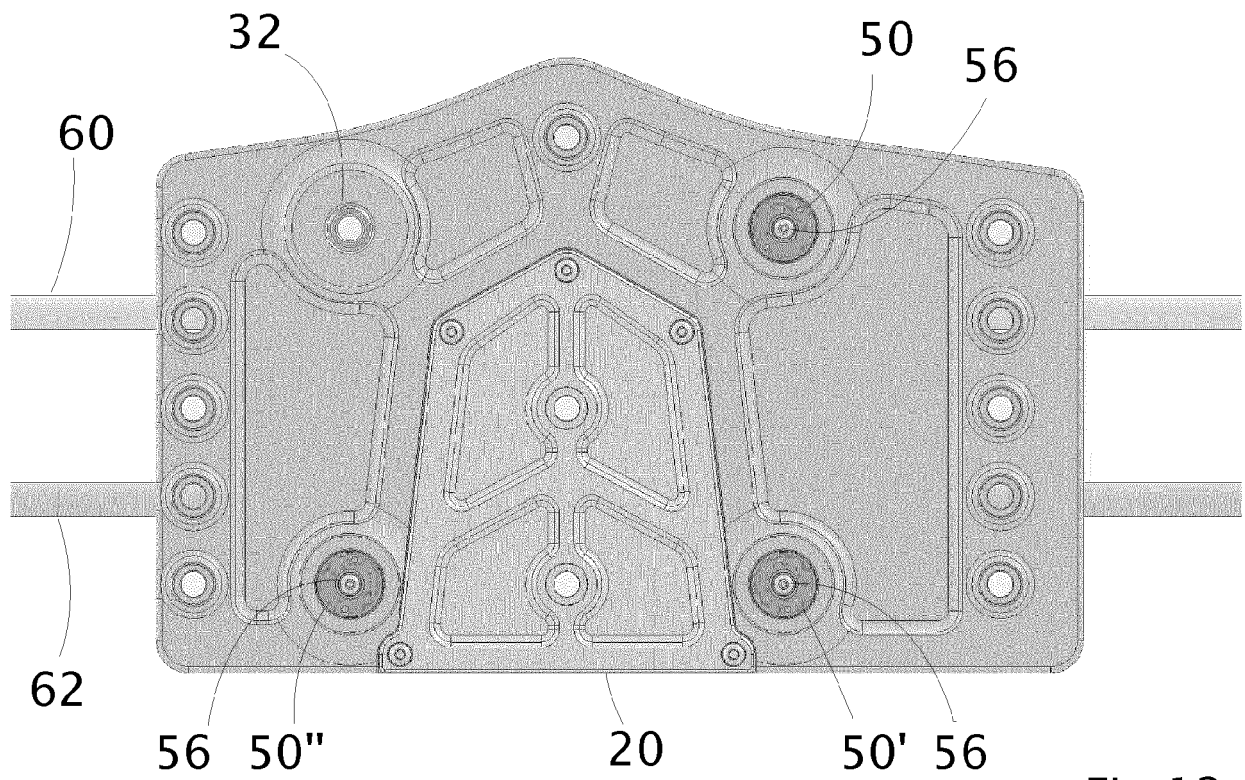
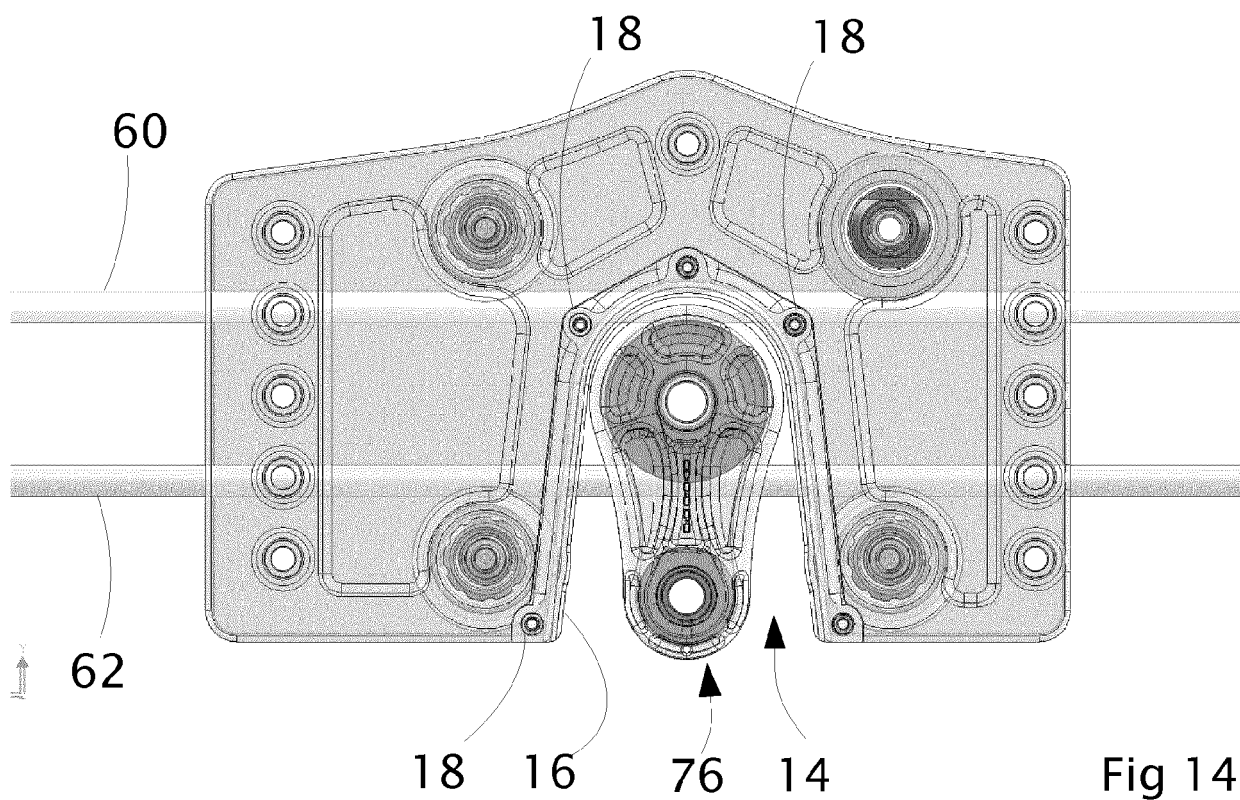
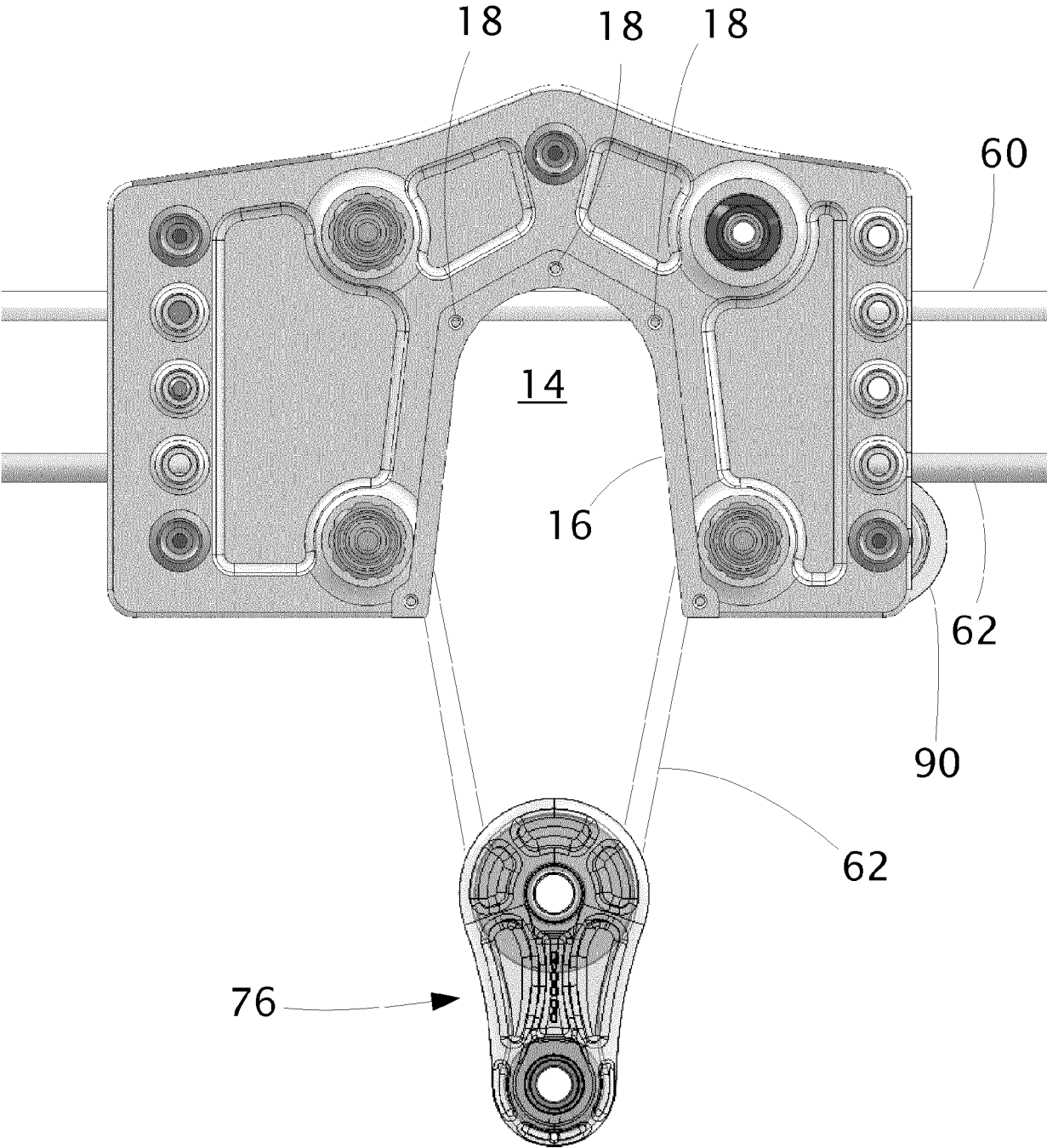


Fig 11







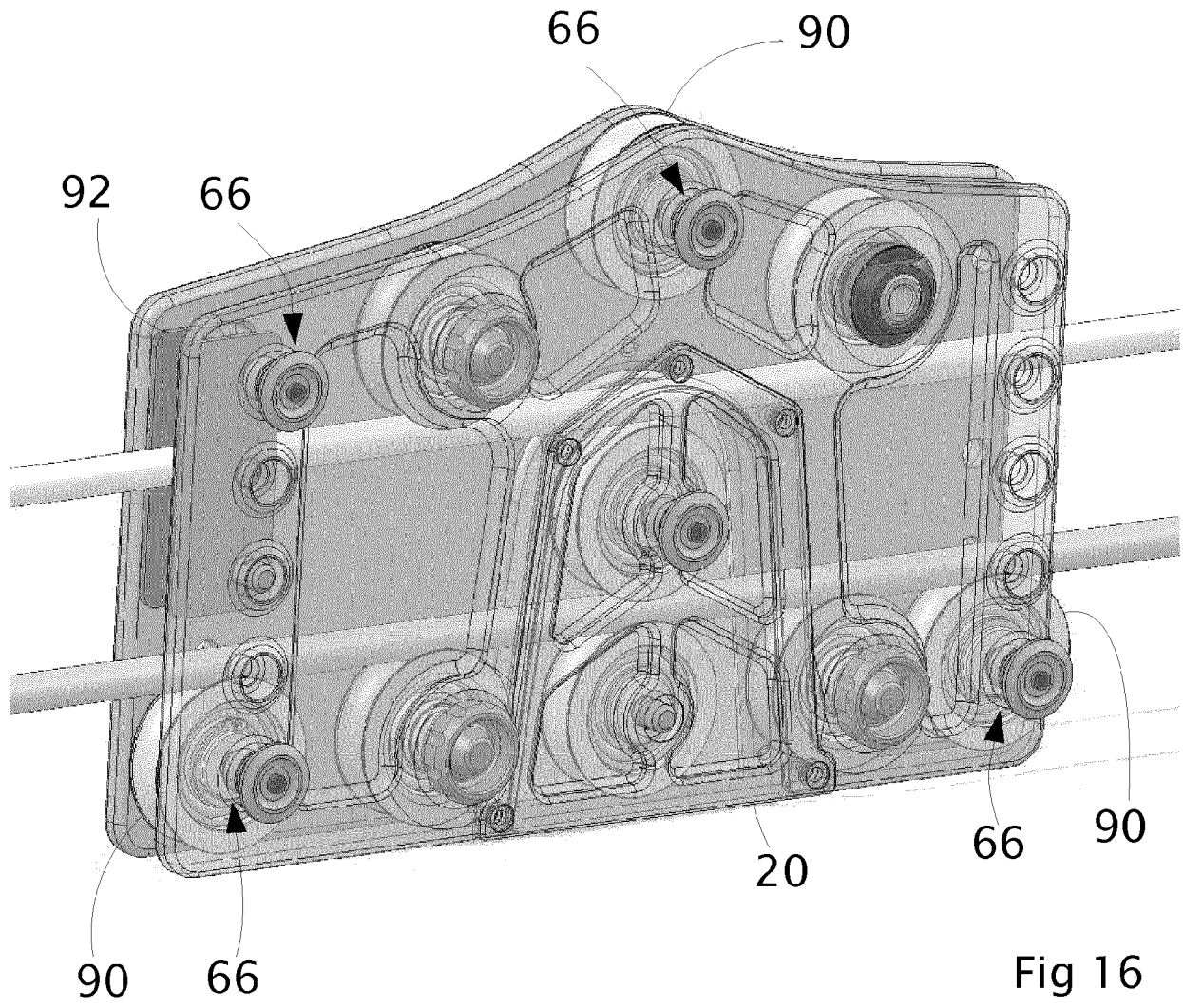


Fig 16

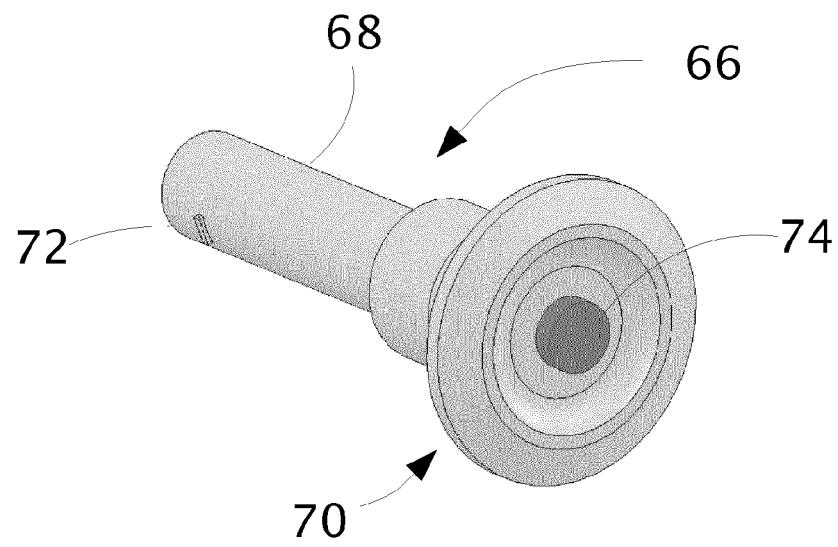


Fig 17

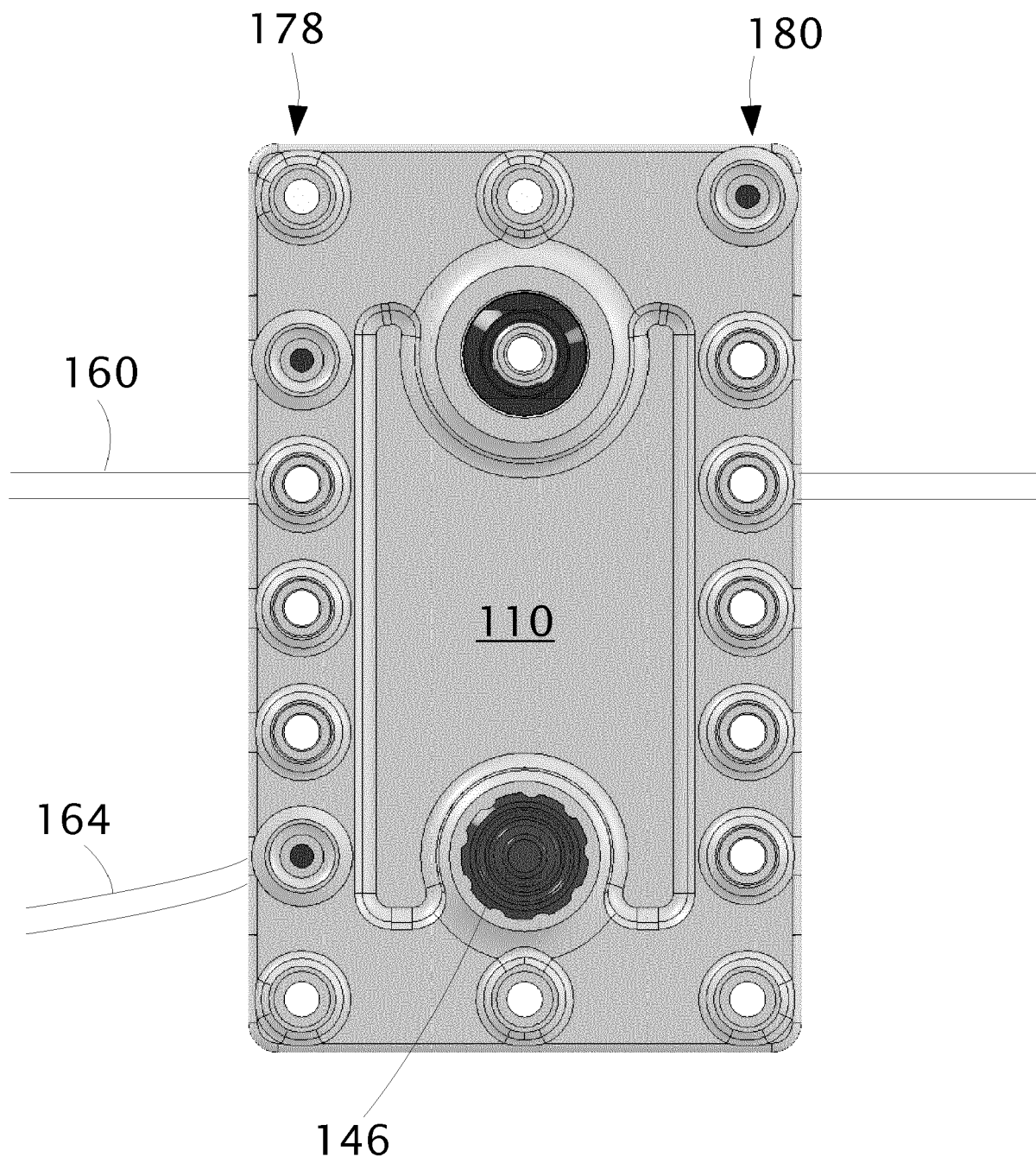


Fig 18

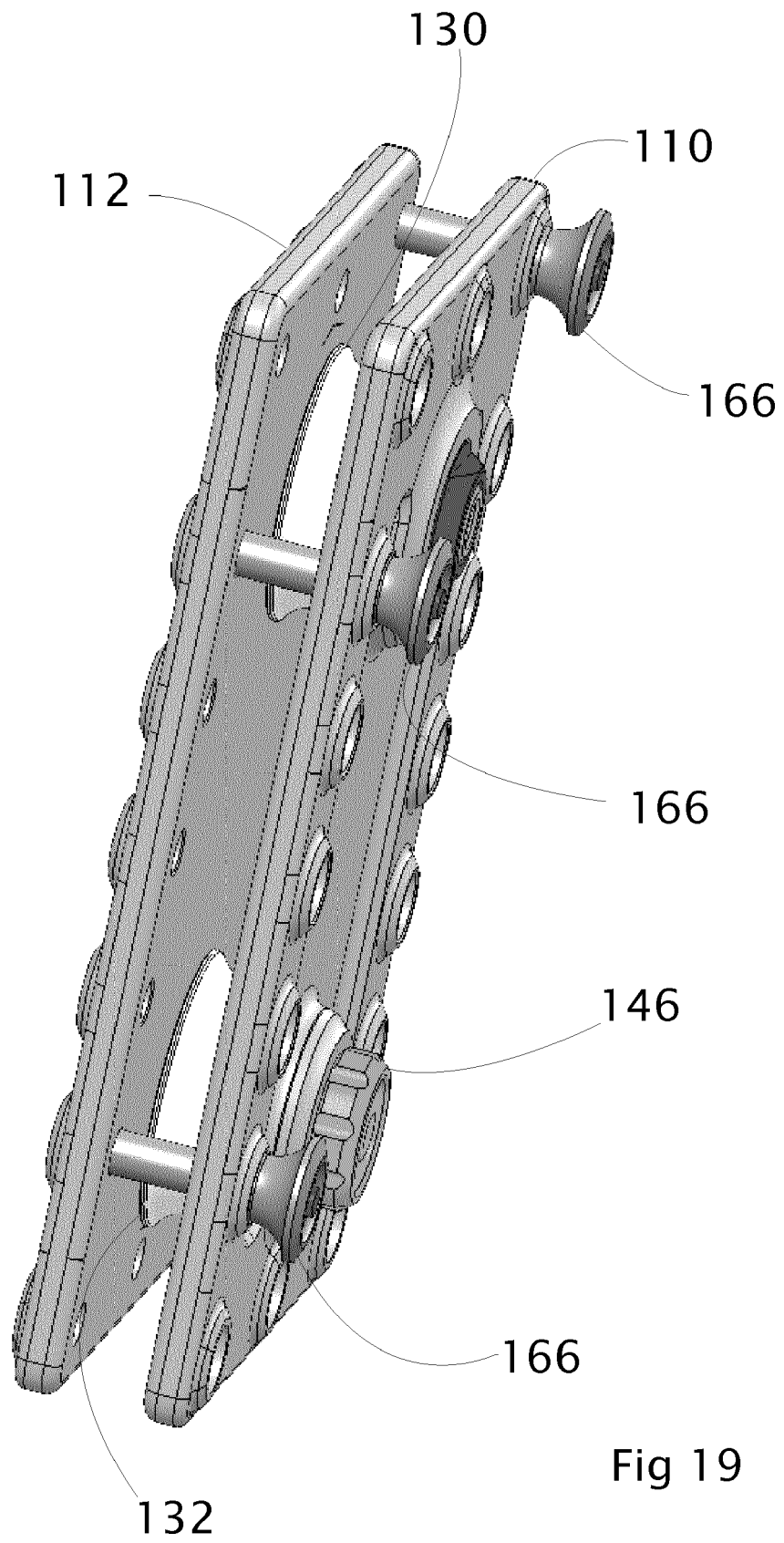
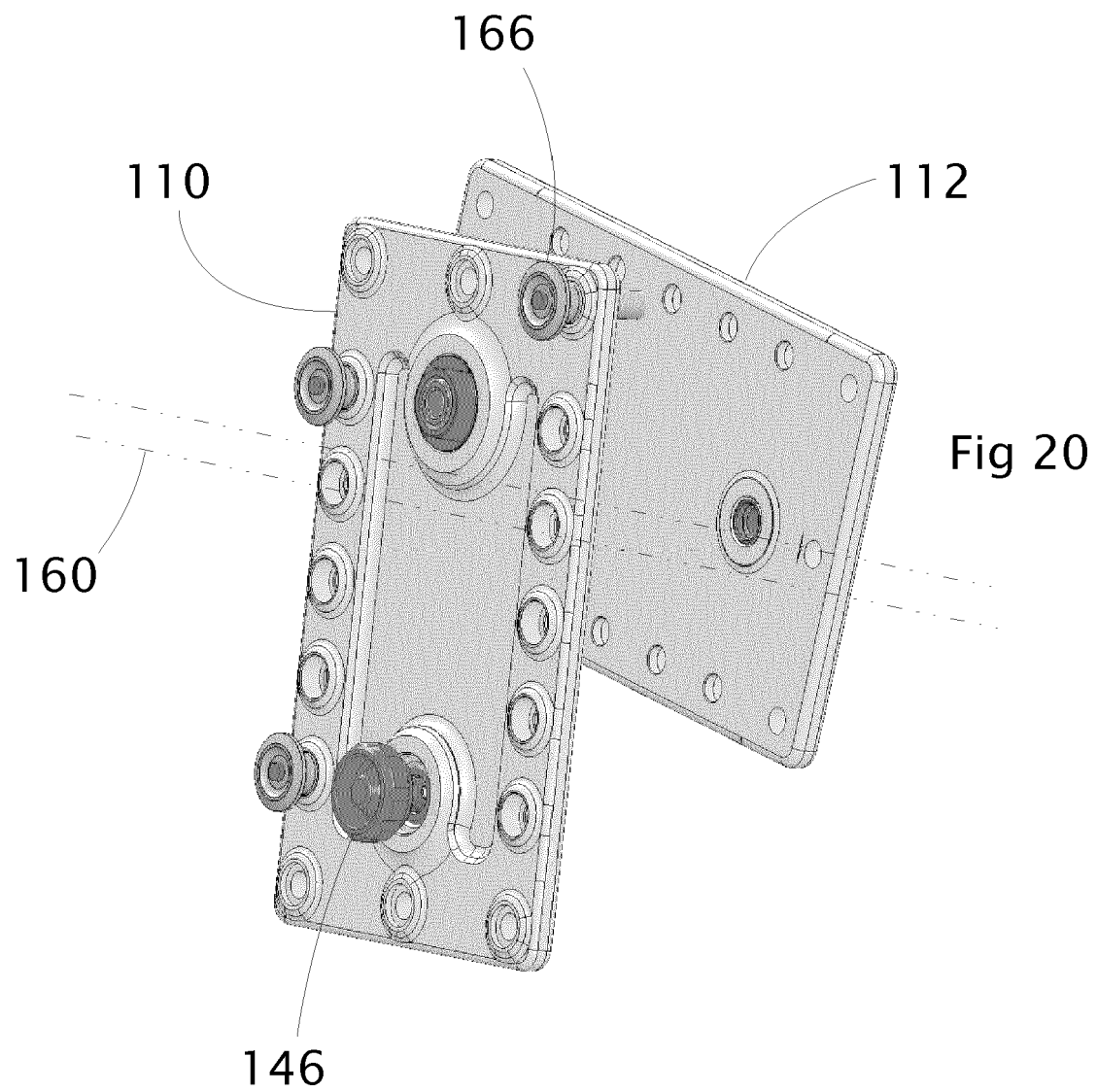


Fig 19



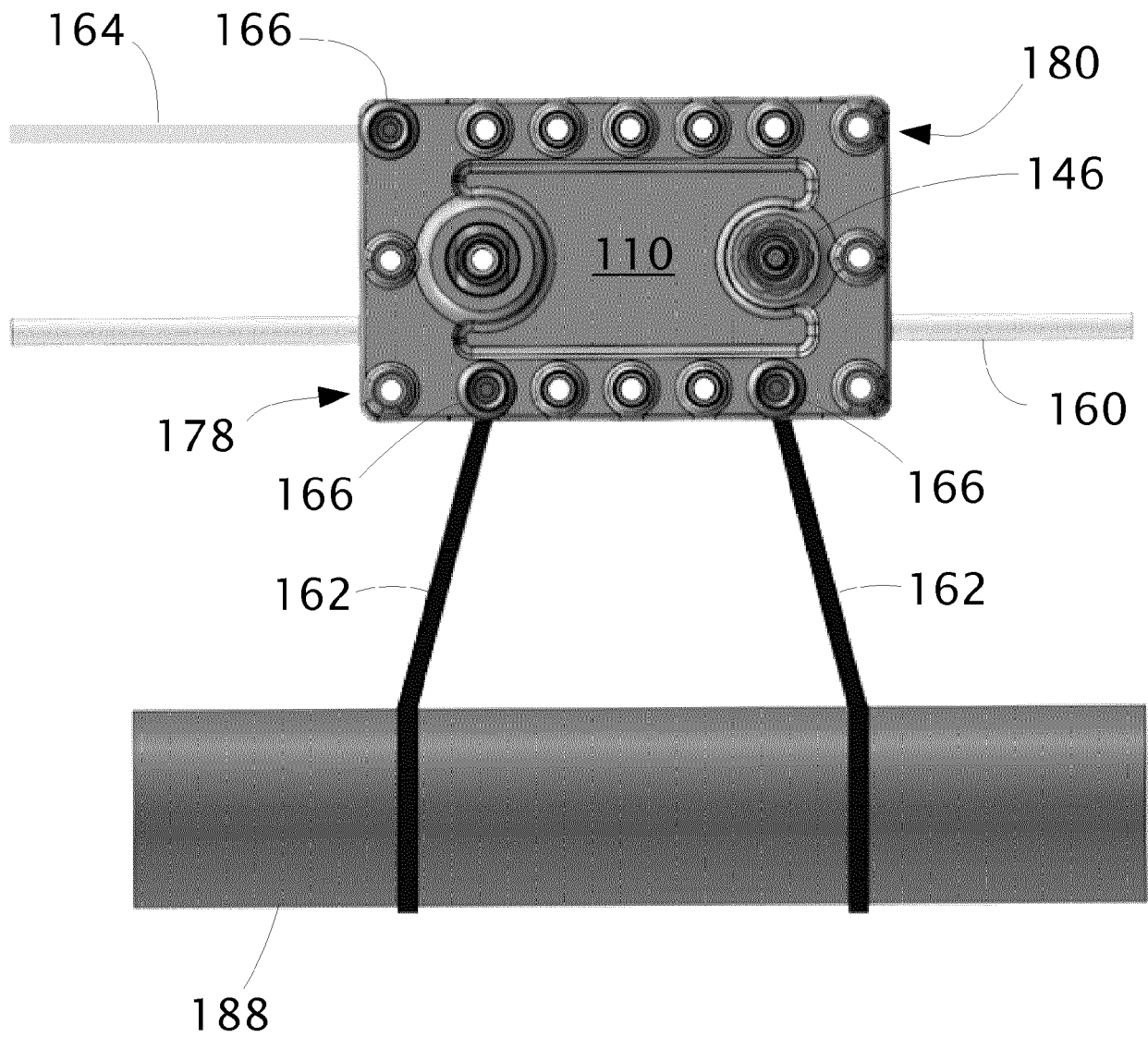


Fig 21



EUROPEAN SEARCH REPORT

 Application Number
 EP 16 19 4330

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