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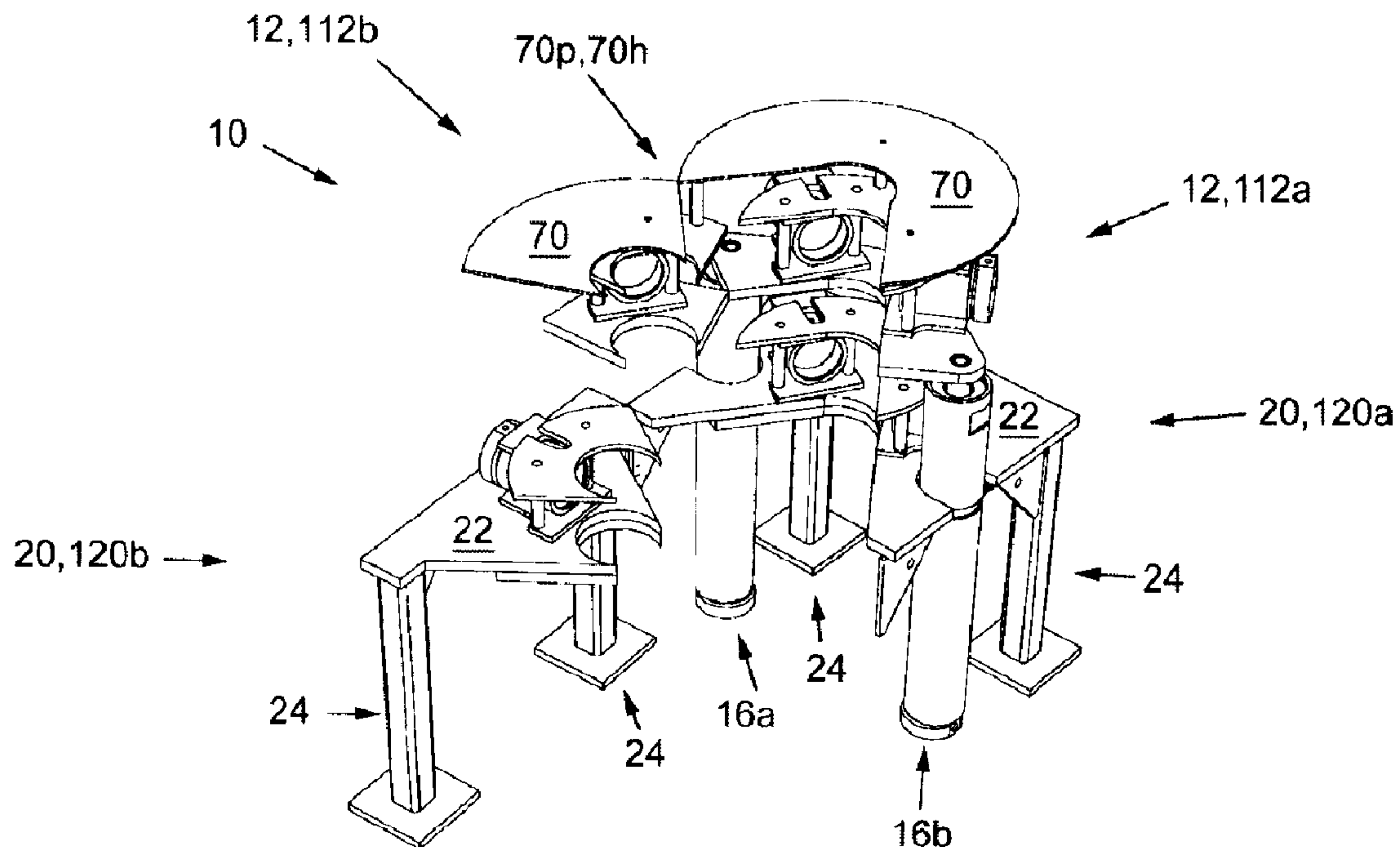
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(54) **Titre : SYSTEME DE TYPE POUSSER-TIRER ET STRUCTURE DE SOUTIEN POUR APPAREIL DE FORAGE SOUS PRESSION
OU ELEMENT SIMILAIRE SUR UN PLANCHER DE FORAGE**

(54) **Title: PUSH / PULL SYSTEM AND SUPPORT STRUCTURE FOR SNUBBING UNIT OR THE LIKE ON A RIG FLOOR**



(57) **Abrégé/Abstract:**

In one aspect the invention provides a support structure for use on a rig floor and for supporting a unit used to manipulate tubular components through a wellhead, the support structure comprises a first section, a second section and a central passage of sufficient diameter to allow passage of the tubular components therethrough. When the first section and the second section are assembled together, said sections together are suitable to support said unit used to manipulate tubular components through a wellhead.



ABSTRACT OF THE INVENTION

In one aspect the invention provides a support structure for use on a rig floor and for supporting a unit used to manipulate tubular components through a wellhead, the support structure comprises a first section, a second section and a central passage of sufficient diameter to allow passage of the tubular components therethrough. When the first section and the second section are assembled together, said sections together are suitable to support said unit used to manipulate tubular components through a wellhead.

**“PUSH / PULL SYSTEM AND SUPPORT STRUCTURE FOR
SNUBBING UNIT OR THE LIKE ON A RIG FLOOR”**

FIELD OF THE INVENTION

5 The invention relates to rigs above a wellhead, such as snubbing units and push / pull units, for manipulating tubing in and out of a well.

BACKGROUND OF THE INVENTION

It is well known to attach a variety of rigs such as hydraulically
10 operated rigs above a wellhead. For example, snubbing units are known in the oil and gas industry for facilitating access to a well which is under pressure including, for example, well operations such as well completions. A snubbing unit includes structure and equipment above a wellhead for manipulating tubular components such as pipe, tubing, and bottom hole assemblies (BHA) in and out of a well while
15 controlling the well under pressure.

Generally, a snubbing unit employs stationary (lower) and traveling (upper) slip assemblies, opposingly oriented, to releasably and controllably shift tubular components into and out of the well through a wellhead despite the possibility of either heavy tubular loads, which urge the tubular components to fall
20 into the well, or the pressure-generated forces on the tubular components, which urge the tubular components out of the well. The snubbing unit is installed above an existing wellhead seal, such as that created by a blow-out preventer (BOP), and

incorporates its own seals to seal the tubular components as they are introduced or removed from the wellhead, such as through the use of a stripping head.

Most conventional snubbing units fall into either rig-assisted or self-contained units. Rig-assisted snubbing units are typically snubbing units that are
5 pivotally mounted to a truck and require assistance by an onsite service rig so as to winch them upright, pivoting from the truck, to a snubbing position over the wellhead. Self-contained units are typically transported to site on a truck and lifted into position, over the wellhead, by a separate crane unit. During operations, self-contained snubbing units do not require the assistance from an on-site rig.

10 When snubbing in low-pressure well environments, such as wells with surface pressures under 12,000 kPa, a compact, rig-assisted snubbing unit is often the ideal choice. A compact snubbing unit can be easily transported to the well site, such as in a 1 ton pickup truck, and is practical and cost effective for single wells and underbalanced drilling. Additionally, a compact snubbing unit reduces or
15 eliminates viewing obstructions often experienced by service rig operators when utilizing traditional (larger) sized snubbing units. One example of a compact snubbing unit is the one marketed under the trade-mark MINI BRUTUS by Team Snubbing Services Inc. of Rocky Mountain House, Alberta, Canada.

Despite the many advantages of a compact snubbing unit, the set-up
20 of such a unit still requires the snubbing unit to be installed above an existing wellhead seal and to incorporate its own seals to seal the tubular components as they are introduced or removed from the wellhead. Typically a compact snubbing unit, such as the MINI BRUTUS™, is installed above a blow-out preventer (BOP)

and incorporates an RS-100 stripping head as its seal to seal the tubular components.

5 Push / pull systems or push / pull units are also known in the art and are used to manipulate tubular components in and out of a well. Push / pull units provide alternatives to, and/or improvements over, conventional snubbing systems. Such push / pull systems are generally mounted at the rig floor (e.g. on the rotary table) and, therefore, allow live well operations to be conducted at the rig floor rather than in the greatly elevated work baskets as is generally the case with conventional snubbing units. One example of a push / pull system is that
10 manufactured by Tesco Corporation of Calgary, Alberta, Canada. However, the prior art push / pull systems manufactured by Tesco Corporation is cumbersome, large and heavy, does not have the compactness that has become associated with compact snubbing units such as the MINI BRUTUS™ and cannot be used to retrofit such compact snubbing units and/or convert such units into a push / pull system.

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Applicant's prior-filed applications (U.S. serial no.s 61/148,922 and 12/464,034) and issued Canadian patent no. 2,652,068, address many of these above-noted disadvantages, and as more clearly illustrated in Figures 1 – 18 and the following background description thereof.

20 A PRIOR ART compact snubbing or push/pull unit 12 (or most of the components thereof) is supported on a PRIOR ART load bearing apparatus or support structure 20 having a central passage 20c of sufficient diameter to allow passage of tubular components T therethrough, preferably having at least one

tensile member mount 21 to facilitate the connection of one or more tensile members 40 between the support structure 20 and a mounting point on a rig or rig floor RF and having a support member or support plate 22. The support plate 22 is adapted to be secured to, or within, the compact snubbing unit 12. The compact snubbing unit 12 comprises stationary (lower) and traveling (upper) slip assemblies 14s, 14t, traveling plate 15t (to support the travelling slip assembly 14t and having a central passage 15tc of sufficient diameter to allow passage of tubular components T therethrough), bottom or stationary plate 15s (to facilitate mounting of the compact snubbing unit 12 to the support structure 20 and having a central passage 15sc of sufficient diameter to allow passage of tubular components T therethrough) and a pair of jacking rams 16a, 16b securely mounted to the stationary plate 15s and actuatable in a conventional manner to releasably and controllably shift tubular components T into and out of the well through a wellhead. Preferably, jacking rams 16a, 16b are hydraulic rams.

Jacking rams 16a, 16b are securely mounted to the compact snubbing unit 12 in the conventional manner. The stationary plate 15s comprises paired ram cut-outs or recesses 15a, 15b, said ram recesses 15a, 15b being substantially positioned at 180° across from each other around central passage 15sc and at the periphery of the stationary plate 15s (see FIG. 12). Further, the jacking rams 16a, 16b each comprise an annular groove 16ag, 16bg of such diameter and dimensions to allow secure placement of the jacking rams 16a, 16b within the ram recesses 15a, 15b (see FIG. 7) and the compact snubbing unit 12 further comprises ram keepers or ram retainers 17a, 17b. As such, jacking rams 16a, 16b are securely

mounted to the compact snubbing unit 12 in the conventional manner, i.e. by placing the annular grooves 16ag, 16bg of jacking rams 16a, 16b within the respective ram recesses 15a, 15b and then bolting or otherwise fasten the ram retainers 17a, 17b so as to maintain secure placement of the jacking rams 16a, 16b on the stationary plate 15s (see FIGS 6-8, 10 and 11).

The support structure 20 further comprises ram openings or ram passages 22a, 22b, in the support plate 22, each ram passage 22a, 22b being coaxially aligned with ram recesses 15a, 15b of the stationary plate 15s and each ram passage 22a, 22b being of sufficient diameter to allow passage of the jacking rams 16a, 16b therethrough (see FIGS. 1, 5-6, 9 and 10). Preferably, ram passages 22a, 22b, while allowing of passage of the jacking rams 16a, 16b therethrough, are positioned and are of such dimensions so as to have the support structure 20 still provide some contact surface area SA or support for the ram retainers 17a, 17b and are not so large so as to also allow passage of said ram retainers 17a, 17b therethrough when the compact snubbing unit 12 is mounted to the support structure 20 and is subject to pushing or pulling forces from the tubular components T. As more clearly shown in FIGS. 1-6, the support structure 20 comprises plurality of rig engaging members or legs 24 distributed around and connected to the support plate 22.

The support plate 22 is secured to the compact snubbing unit 12 by bolting or fastening to the stationary plate 15s in a conventional manner. The stationary slip assembly 14s is unfastened from the stationary plate 15s, stationary plate 15s and ram retainers 17a, 17b are fastened directly underneath the support

plate 22 and stationary slip assembly 14s is placed and fastened directly above the support plate 22 thereby sandwiching the support plate 22 between the stationary slip assembly 14 and the stationary plate 15s (see FIGS. 6 and 10). As such, support structure 20 is mounted within the compact snubbing unit 12. In another variation of this PRIOR ART support structure (not shown), the stationary plate 15s is fastened directly on top of and against the top surface of the support plate 22 and then the support structure 20 can more easily accommodate significant downward forces, such as those which might be created when heavy tubular loads urge the tubular components T to fall into the well.

During operations, the support structure 20 is positioned on a rig floor RF above a wellhead (not shown) extending from the ground and including standard wellhead components and wellhead seals. Loads and downward forces from the compact snubbing unit 12 and/or tubular components T are generally distributed into the rig floor RF through the support structure 20 and legs 24. Where upward forces (e.g. where the well pressure-generated forces on the tubular components T urge the tubular components T out of the well) are expected to be incurred, one or more tensile members 40 can be utilized to further secure the support structure 20 to the rig or rig floor RF via the tensile member mounts 21. Typically, tensile members 40 are chains and fasten the support structure 20 to the rig floor RF in a conventional manner.

FIG. 13 illustrates an alternate PRIOR ART variation of a support unit 20, which is similar to that of FIGS. 1-12, but wherein the compact snubbing unit 12 does not comprise a stationary plate, wherein the ram passages 22a, 22b are

adapted to act as, and have similar dimension to, the ram recesses 15a, 15b of the embodiment in FIGS. 1-12, and wherein the jacking rams 16a, 16b are securably mounted directly to the support plate 22 of the support structure 20 (in a similar or identical manner as they are mounted to the stationary plate 15s of the embodiment
5 of FIGS. 1-12) through use of ram retainers 17a, 17b.

FIGS. 14-18 illustrate the configuration of another PRIOR ART variation of a support unit 20 which is similar to that of FIGS. 1-12, but which further comprising a worker platform 50 to support a worker W. The worker platform 50 places a worker W in a safe and efficient position to conduct well operations and to
10 handle the tubular components T.

However, prior to installing a compact snubbing unit or push/pull unit and/or in combination with a support structure 20, tubular components may already be positioned fully through a rig floor, or extend up from the wellhead partway up
15 through the rig floor. For example, when tubular components are stuck in a wellbore, then a snubbing or push/pull unit 12 may be helpful to provide additional force to move and loosen such stuck tubular components T. In such a case, the tubular components T may need to be disconnected and removed; and/or the compact snubbing unit or the push / pull unit 12 may have to be lifted into position,
20 over top of such tubular component T, by a separate crane unit or the like. This complicates installation of the compact snubbing or push / pull unit 12, may require cranes or the like and adds to the installation time and cost of the compact snubbing or push / pull unit 12 onto the rig floor. What is needed is a compact snubbing or

push / pull unit and/or support structure 20 that does not suffer from the above-noted disadvantages and which can be easily installed onto a rig floor RF when tubular components T are already present and extend up through the rig floor RF.

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BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention will now be described, by way of example only, with reference to the accompanying drawings, wherein:

Figures 1-18 are various views of PRIOR ART support structures supporting PRIOR ART snubbing and/or push/pull units;

Figures 19-28 are various perspective views of a first embodiment of the invention;

Figures 29-40 are various perspective views of a second embodiment of the invention; and

Figures 41-43 are various perspective views of a third embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The following description is of preferred embodiments by way of example only and without limitation to the combination of features necessary for carrying the invention into effect. Reference is to be had to the Figures in which identical reference numbers identify similar components. The drawing figures are

not necessarily to scale and certain features are shown in schematic form in the interest of clarity and conciseness.

FIGS. 19-43 illustrate the configuration of three embodiments of the present invention 10 which are somewhat similar to the PRIOR ART apparatus and devices of FIGS. 1-18, but wherein the invention 10 is now in two parts to facilitate easy placement of the invention 10 around any tubular components T which may already be positioned fully through a rig floor RF, or which extend up from the wellhead partway up through the rig floor RF (e.g. see Fig. 30). In these three embodiments, the compact snubbing or push/pull unit 12 (or most of the components thereof) now comprise a first section 112a and a second section 112b which, when assembled or placed together, provide the functionality of a complete compact snubbing unit 12. Likewise, the support structure 20 comprises a first section 120a and a second section 120b (with the support plate 22 also being divided into a first support plate section 122a and a second support plate section 122b) which, when assembled or placed together, provide the functionality of a complete support structure 20.

Preferably, first section 120a of the support structure 20 supports the first section 112a of the compact snubbing unit 12, along with a portion of the second section 112b. More preferably, second section 120b of the support structure 20 supports the remaining portion of the second section 112b of the compact snubbing unit 12; e.g. see Fig. 19. In the three embodiments of FIGS 19-42, the first section 120a of the support unit 120a also comprises the ram passages

22a, 22b, which allow passage of the jacking rams 16a, 16b therethrough. However, in other embodiments (not shown), ram passages may be on the second section or one ram passage may be on each section. Additionally, in these three embodiments, first section 120a and second section 120b of the support structure

5 20 preferably further comprise central passage recesses 20ca, 20cb which: (i) each have an opening or entry RO of sufficient dimension to allow a tubular component T to, at least, be partially placed into the recess and (ii) when the first and second sections 120a, 120b of the support unit 20 are placed together or adjacent to each other, create the central passage 20c of sufficient diameter to allow passage of

10 tubular components T therethrough; see FIGS. 30 and 36.

Preferably, in the three embodiments of FIGS. 19-43, the first section 112a of the compact snubbing unit 12 comprises a first section of the travelling plate 115ta, a first section of the stationary plate 115sa, a first portion 114sa of the

15 stationary (lower) slip assembly 14s which is associated with the first section of the stationary plate 115sa, and a first portion 114ta of the traveling (upper) slip assembly 14t which is associated with the first section of the traveling plate 115ta. Preferably, both the jacking rams 16a, 16b are operably associated with the first section 112a of the snubbing unit 12. However, in other embodiments (not shown)

20 the jacking rams 16a, 16b may be associated with the section 112b of the compact snubbing unit 12; or one jacking ram is associated with each of the first and second sections 112a, 112b. More preferably, the first and second sections 114sa, 114sb of the stationary slip assembly 14s are each, respectively, mounted to the first and

second sections 120a, 120b of the support structure 20; preferably on the first and second sections 122a, 122b of the support plate 22, respectively.

Further, in the three embodiments of FIGS. 19-43, the second section 112b of the compact snubbing unit 12 comprises a second section of the travelling plate 115tb, a second section of the stationary plate 115sb, a second portion 114sb of the stationary (lower) slip assembly 14s which is associated with the second section of the stationary plate 115sb, and a second portion 114tb of the traveling (upper) slip assembly 14t which is associated with the second section of the traveling plate 115tb. Preferably, the first and second sections 114ta, 114tb of the traveling slip assembly 14t are pivotally connected, such as at a pivot point 15p via a hinge 15h (see FIGS. 21 and 43).

Preferably, a guard plate 70 having a first section 170a and a second section 170b is provided, with first section 170a thereof mounted to the top of the first section of the traveling slip 114ta and with the second section 170b thereof positionable over the top of the second section of the traveling slip 114tb; preferably via support members 72. Guard plate 70 further comprises a central passage 70c of sufficient diameter to allow passage of tubular components T therethrough. First and second sections 170a, 170b of the guard plate 70 are preferably hinged via hinge 70h at pivot point 70p. Advantageously, hinged guard plate 70 and support members 72 provides additional support (and hinging functionality) for the first and second sections 114ta, 114tb of the traveling slip assembly 14t which are pivotally connected, at a pivot point 15p (see FIG. 21).

Preferably, although not necessary, first and second sections 120a, 120b of the support structure 20 are connected together via a hinge 60 at pivot point P, to allow the first and second sections 120a, 120b to pivot with respect to each other around a substantially vertical pivot axis. Advantageously, hinge 60 allows
5 each of first and second sections 120a, 120b to still substantially support each other (and, hence, the entire support structure 20) in an upright manner on the rig floor RF with only two legs 24 on each of said second sections 120a, 120b. In embodiments of the support structure 20 wherein first and second sections 120a, 120b are provided without a hinge (not shown), additional legs 24 may be provide
10 on each section 120a, 120b (to stabilize each section), or additional operators may need to be provided to maintain separated sections 120a, 120b upright until they are fastened securely together around a tubular component T.

More advantageously, the support structure 20 (and any snubbing unit or push/pull unit thereon) can be moved or shuffled along the rig floor RF and, if any
15 tubular components T are positioned through a rig floor or partially extend up from the wellhead through the rig floor, the first and second sections 120a, 120b can be pivoted to open up the central passage 20c sufficiently to allow the support structure 20 to move and fit around such tubular components T (e.g. move in direction M as shown in FIG. 30). Then, once the support structure 20 is sufficiently placed around
20 the tubular components T, first and second sections 120a, 120b are pivoted to fully close around said tubular components T, and thereby also providing full functionality of the support unit and/or compact snubbing or push/pull unit (e.g. see FIG. 36). In another embodiment (not shown), first and second sections 120a, 120b of the

support structure 20 are not pivotally connected and can simply be maneuvered independently to be placed around tubular components T as desired. Even more advantageously, by pivoting (instead of simply have two separate first and second sections 120a, 120b of the support structure 20 and associated sections of snubbing unit), a single operator can usually manipulate the support structure 20 (and snubbing unit) on his own between an open (e.g. FIG. 30) and a closed (e.g. FIG. 36) configuration; e.g. such as by shuffling the hinged device along the rig floor RF and around the tubular components T.

Preferably, and as illustrated in the embodiment of FIGS. 29-40, a hydraulic ram-based actuator 80 is provided to pivot first and second sections 120a, 120b, so as to actuate the support unit 20 between the open (e.g. FIG. 30) and the closed (e.g. FIG. 36) configuration. Actuator 80 preferably comprises hydraulic ram 82, a first linkage member 84 to operably connect actuator 80 to the first section 120a and a second linkage member 86 to operably connect the actuator 80 to the second section 120b (e.g., see FIG. 30). As ram 82 is actuated between a retracted and an extended position (see FIGS. 30 and 36, respectively), the first and second section 120a, 120b are moved about hinge 60 (at pivot point P) so as to move the support unit 20 between the open (FIG. 30) and a closed (FIG. 36) configurations.

Preferably, and as illustrated in the embodiment of FIGS. 41-43, one or more bolt-down connector plates 90 are provided to enable an operator to securely fasten first and second sections 120a, 120b together, when the support unit 20 is in a closed configuration. More preferably, connector plates 90 comprise a plurality of bolt holes which can align with corresponding bolt holes (not show) in

the relevant section of the support plate 22, thereby allowing bolts to be placed therethrough (i.e. through both the connector 90 and the relevant sections 22, 122a, 122b of support plate). Even more preferably, similar connector plates (not shown) are provided to securely fasten various components of the first and second sections 5 112a, 112b of the snubbing unit or push/pull unit 12 together (such as on relevant sections of traveling plate 14t, 114ta, 114tb or stationary plate 15s, 115sa, 115sb). Advantageously, such connector plates 90 for the support unit 20 and/or for the snubbing or push/pull unit 12, along with hinge 60, provide structural support to these embodiments of the support structure 20 and thereby provide an additional 10 safety factor during operation (i.e. to securely keep the respective first and second sections together). More advantageously, connector plates 90 and appropriately aligned bolt holes and bolts therethrough could also act as a hinge 60 if so desired.

Unless otherwise specified, it is preferred that the components of the 15 invention be made of steel or other suitable high-strength materials capable of taking stresses and strains during its intended use during well operations.

Those of ordinary skill in the art will appreciate that various modifications to the invention as described herein will be possible without falling 20 outside the scope of the invention.

CLAIMS

**THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE
PROPERTY OR PRIVILEGE IS BEING CLAIMED ARE DEFINED AS FOLLOWS:**

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1. A support structure for use on a rig floor and for supporting a unit
used to manipulate tubular components through a wellhead, comprising:

a first section;

a second section; and

10

a central passage of sufficient diameter to allow passage of the
tubular components therethrough;

wherein, when the first section and the second section are assembled
together, said sections together are suitable to support said unit used to manipulate
tubular components through a wellhead.

15

2. The support structure of claim 1, wherein:

the first section of the support structure further comprises a first
central passage recess which has an opening of sufficient dimensions to allow a
tubular component to, at least, be partially placed into the first central passage
recess;

20

the second section of the support structure further comprises a
second central passage recess which has an opening of sufficient dimensions to

allow a tubular component to, at least, be partially placed into the second central passage recess; and

wherein, when the first and second sections of the support unit are placed adjacent to each other, the first central passage recess and the second
5 central passage recess together create said central passage.

3. The support structure of claim 2, wherein the first and second sections can be moved relative to each other so as to open up the central passage sufficiently to allow the support structure to move and fit around said tubular
10 components.

4. The support structure of claim 3, wherein the first section and the second sections are connected together via a hinge at pivot point, to allow the first and second sections to pivot with respect to each other around a substantially
15 vertical pivot axis.

5. The support structure of claim 4, further comprising a hydraulic ram-based actuator to pivot first and second sections, so as to actuate the support unit between an open and a closed configuration.
20

6. The support structure of claim 1, wherein the first section and the second sections can be positioned to so as to place the support unit in an open or a closed configuration, as may be desired, the support structure further comprising at

least one bolt-down connector plate to enable an operator to securely fasten first and second sections together, when the support unit is in the closed configuration.

7. The support structure of claim 1, further comprising a first support
5 plate section and a second support plate section.

8. The support structure of claim 1, wherein the unit used to manipulate tubular components through a wellhead comprises a first section and a second section; and

10 wherein the first section of the support structure supports the first section of the unit used to manipulate tubular components through a wellhead, along with a first portion of the second section of the unit used to manipulate tubular components through a wellhead.

15 9. The support structure of claim 8, wherein second section of the support structure supports a second remaining portion of the unit used to manipulate tubular components through a wellhead.

20 10. A system for use on a rig to manipulate tubular components through a wellhead, the system comprising:

a unit used to manipulate tubular components through a wellhead, comprising a first section and a second section;

the support structure of claim 1 to support said unit used to manipulate tubular components through a wellhead at a position above the rig's floor; and

wherein the first section of the support structure supports the first section of the unit used to manipulate tubular components through a wellhead,
5 along with a first portion of the second section of the unit used to manipulate tubular components through a wellhead.

11. The support structure of claim 10, wherein second section of the support structure supports a second remaining portion of the unit used to
10 manipulate tubular components through a wellhead.

Application number / numéro de demande: 2823 031

Figures: 14, 15, 16, 17, 18 } 5 pages

Pages: _____

Unscannable items
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Documents reçu avec cette demande ne pouvant être balayés
(Commander les documents originaux dans la section de préparation des dossiers au
10^{ème} étage)

Fig. 1

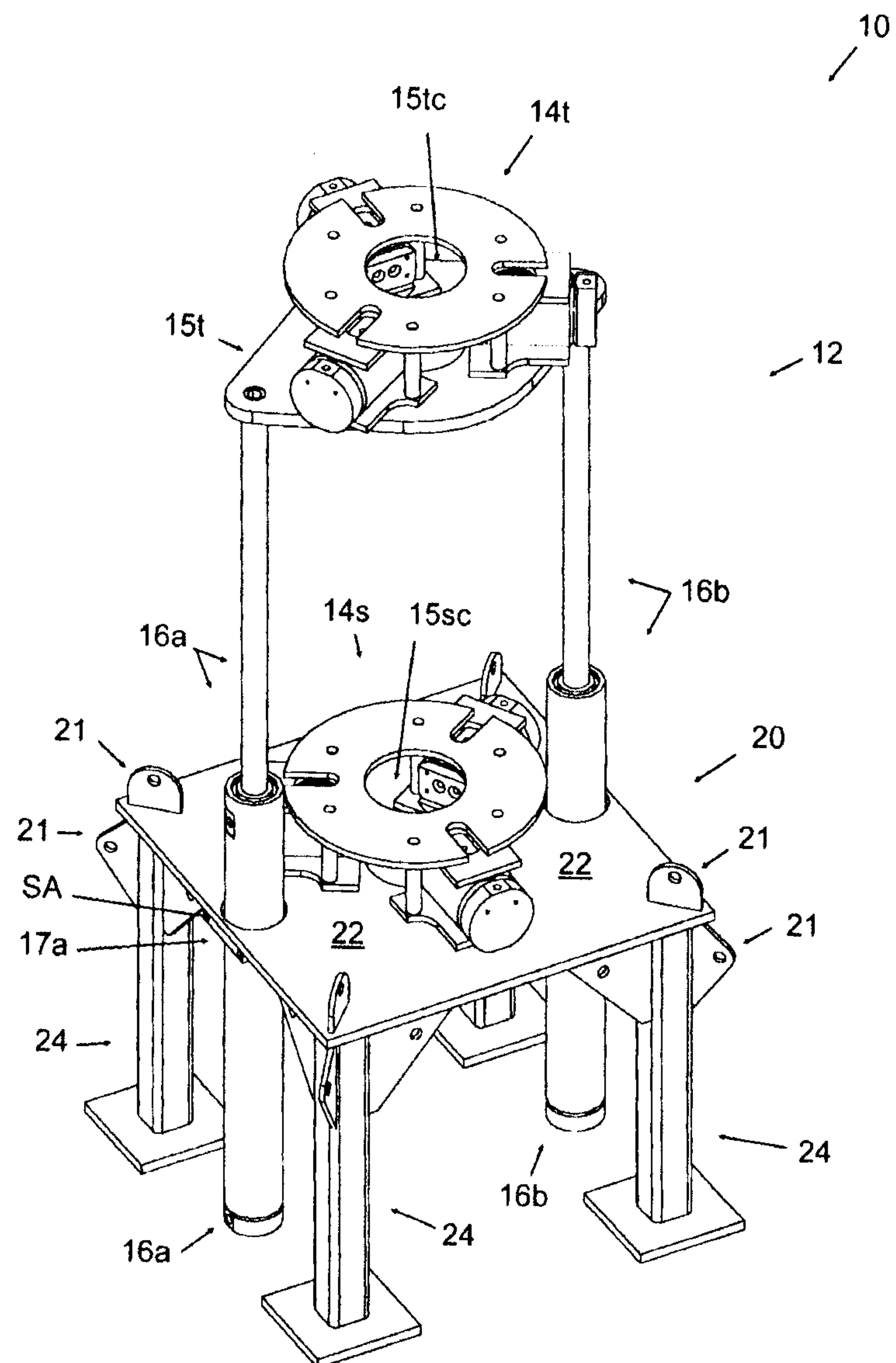


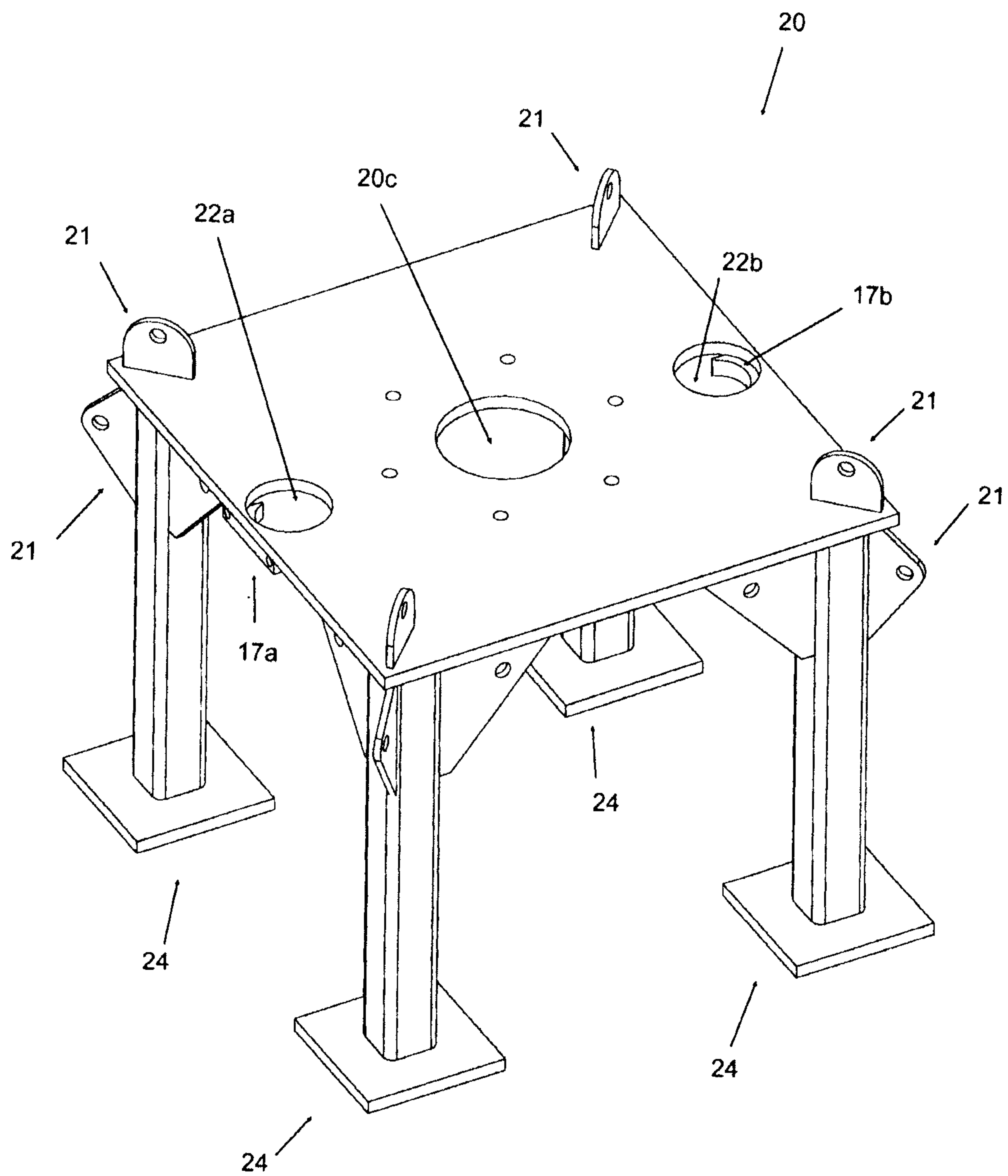
Fig. 2

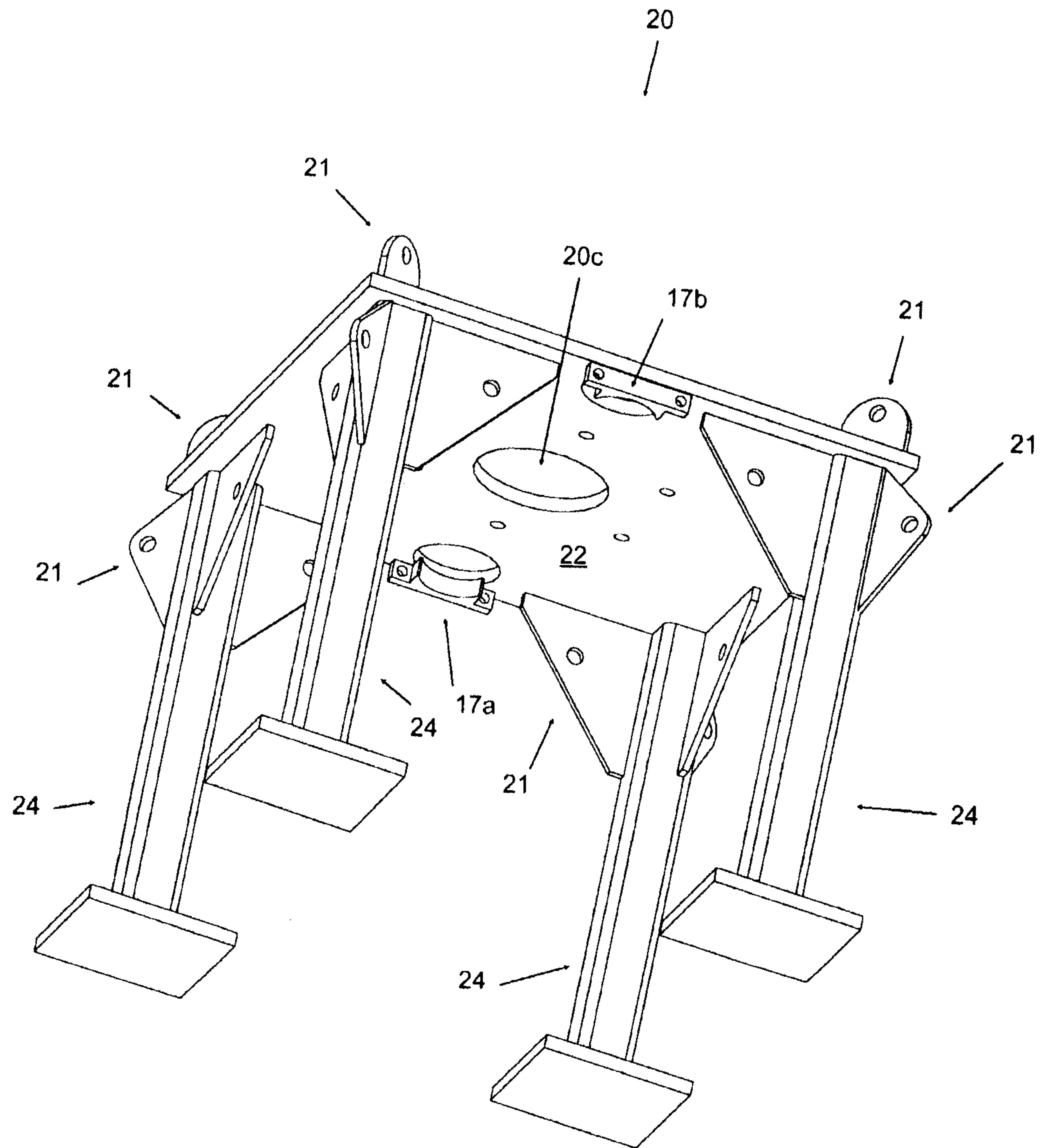
Fig. 3

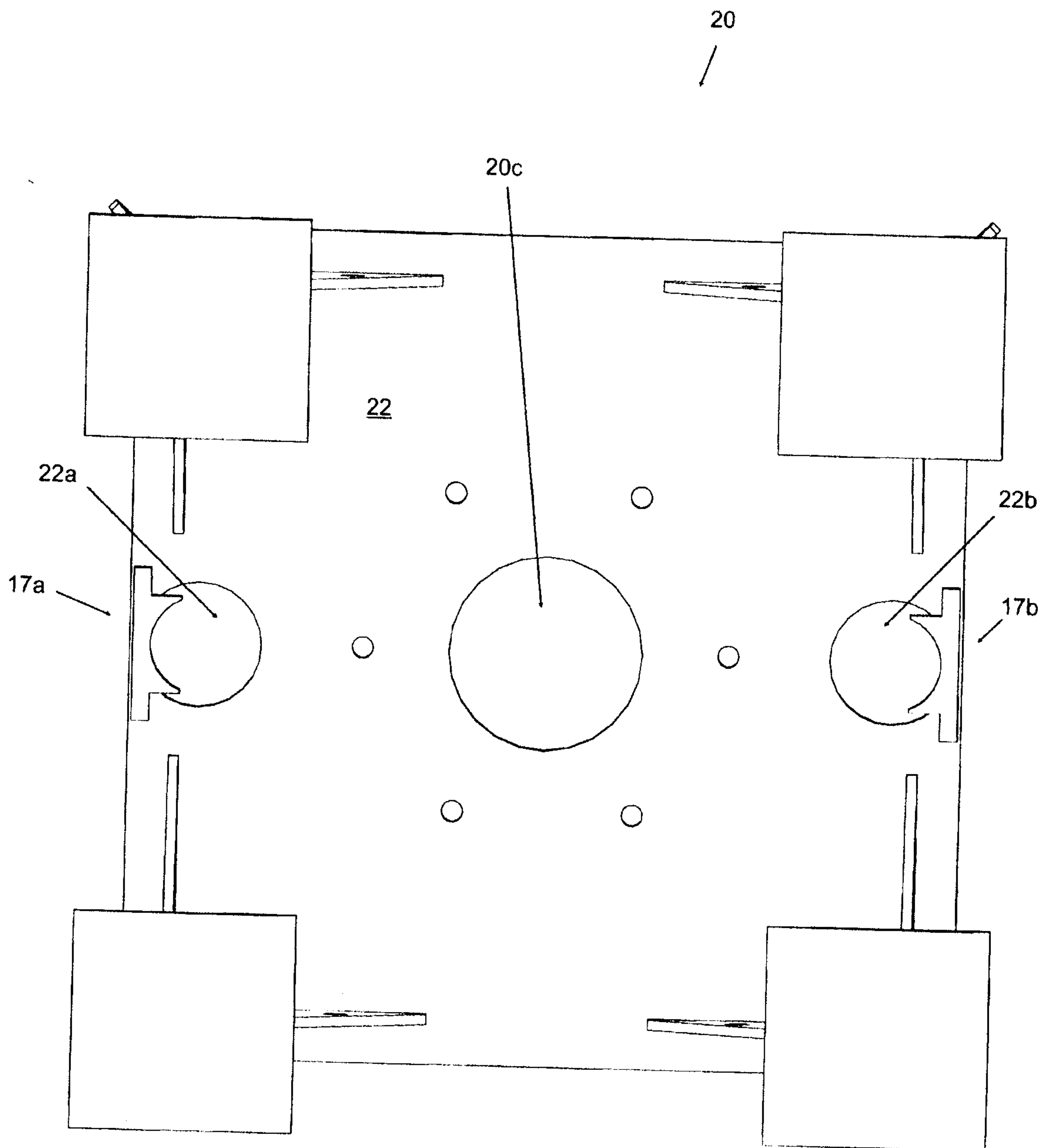
Fig. 4

Fig. 5

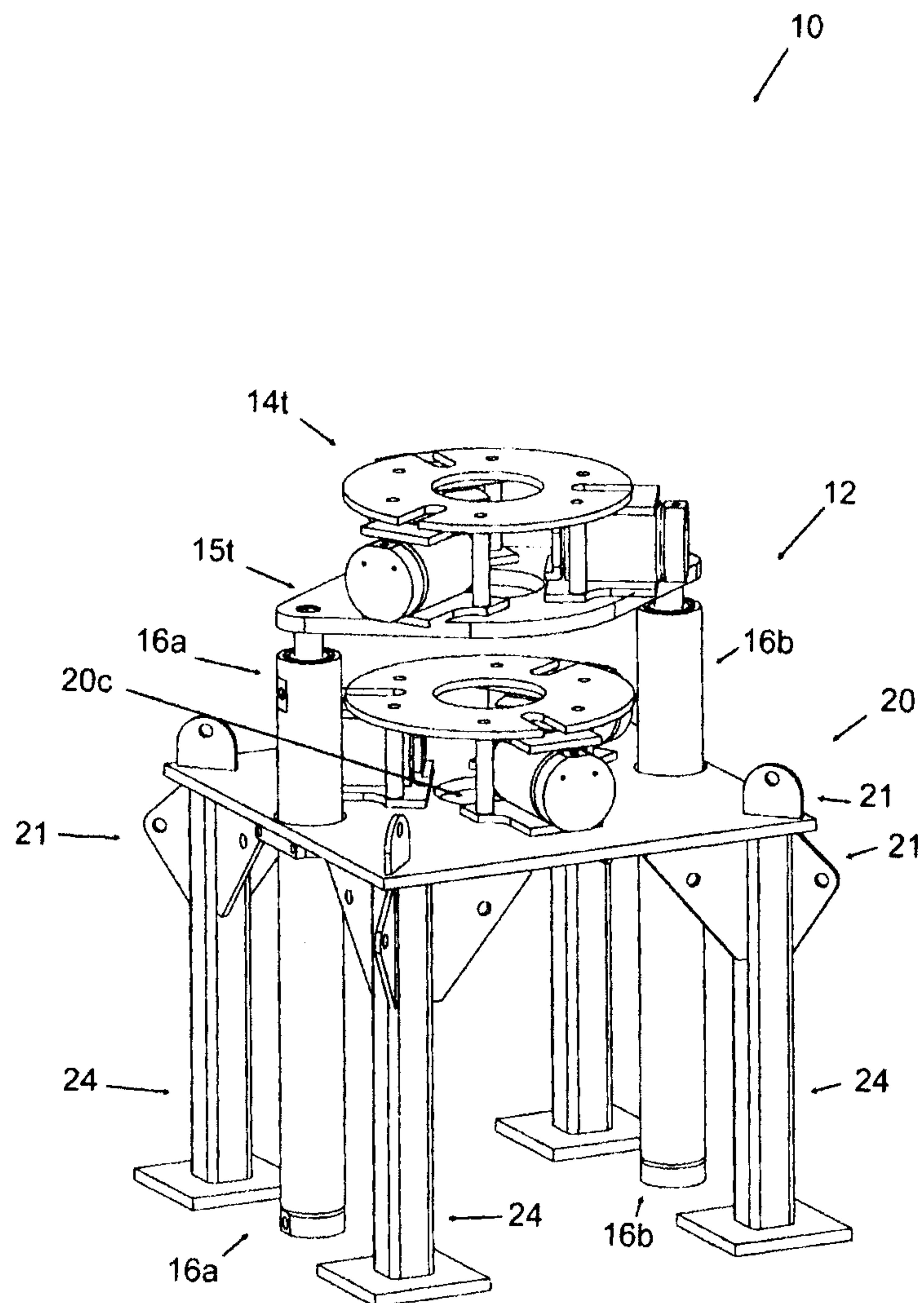


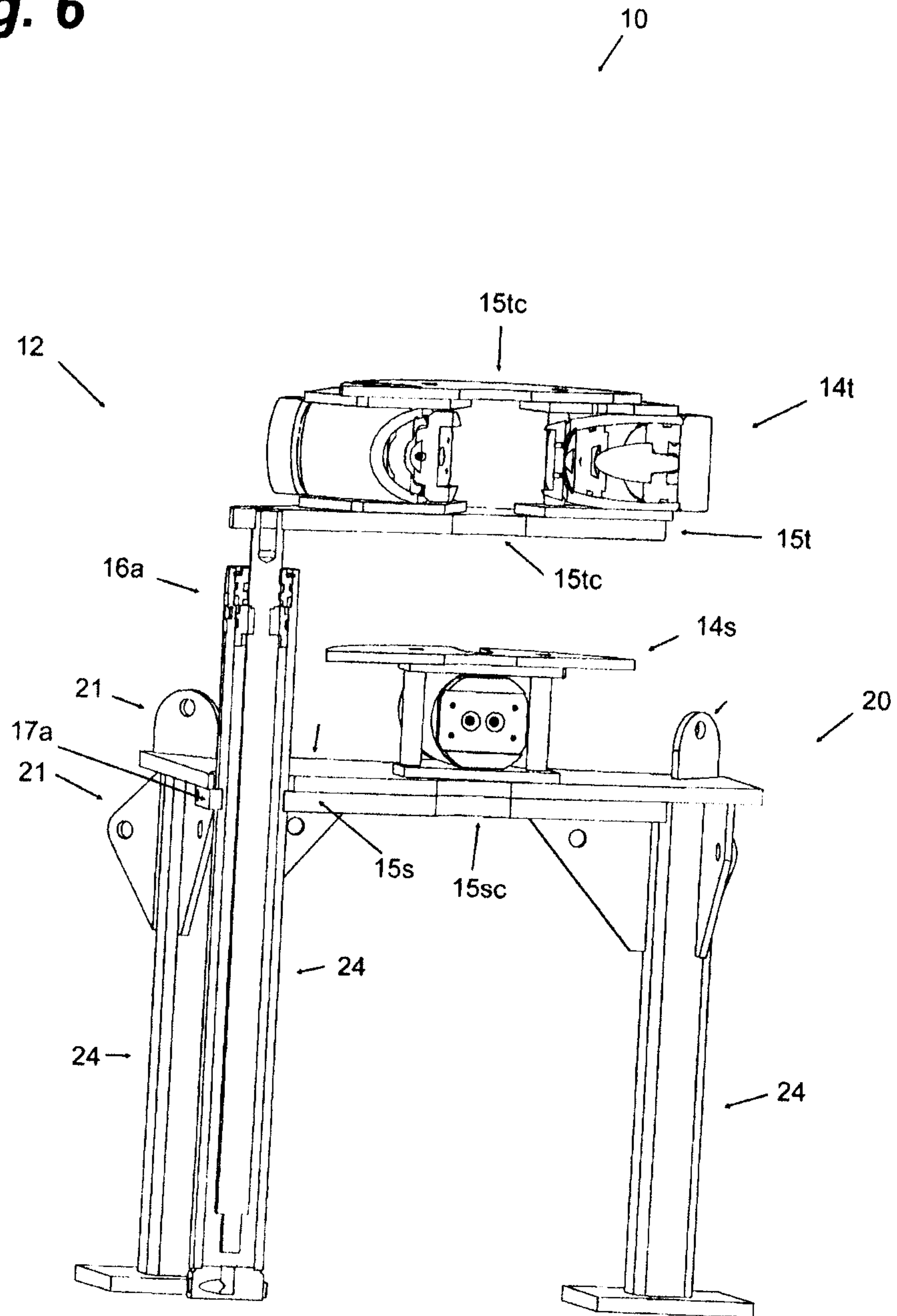
Fig. 6

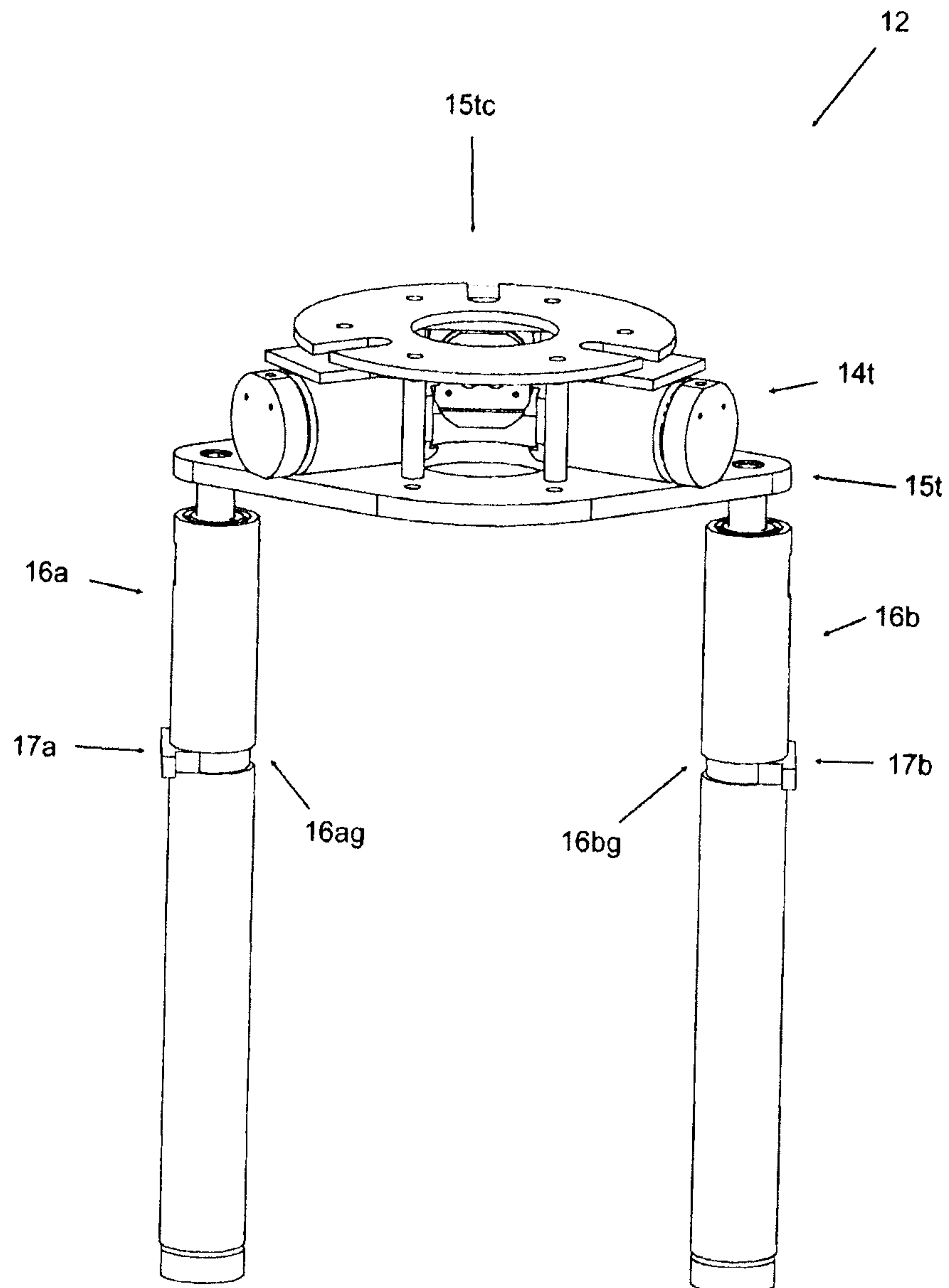
Fig. 7

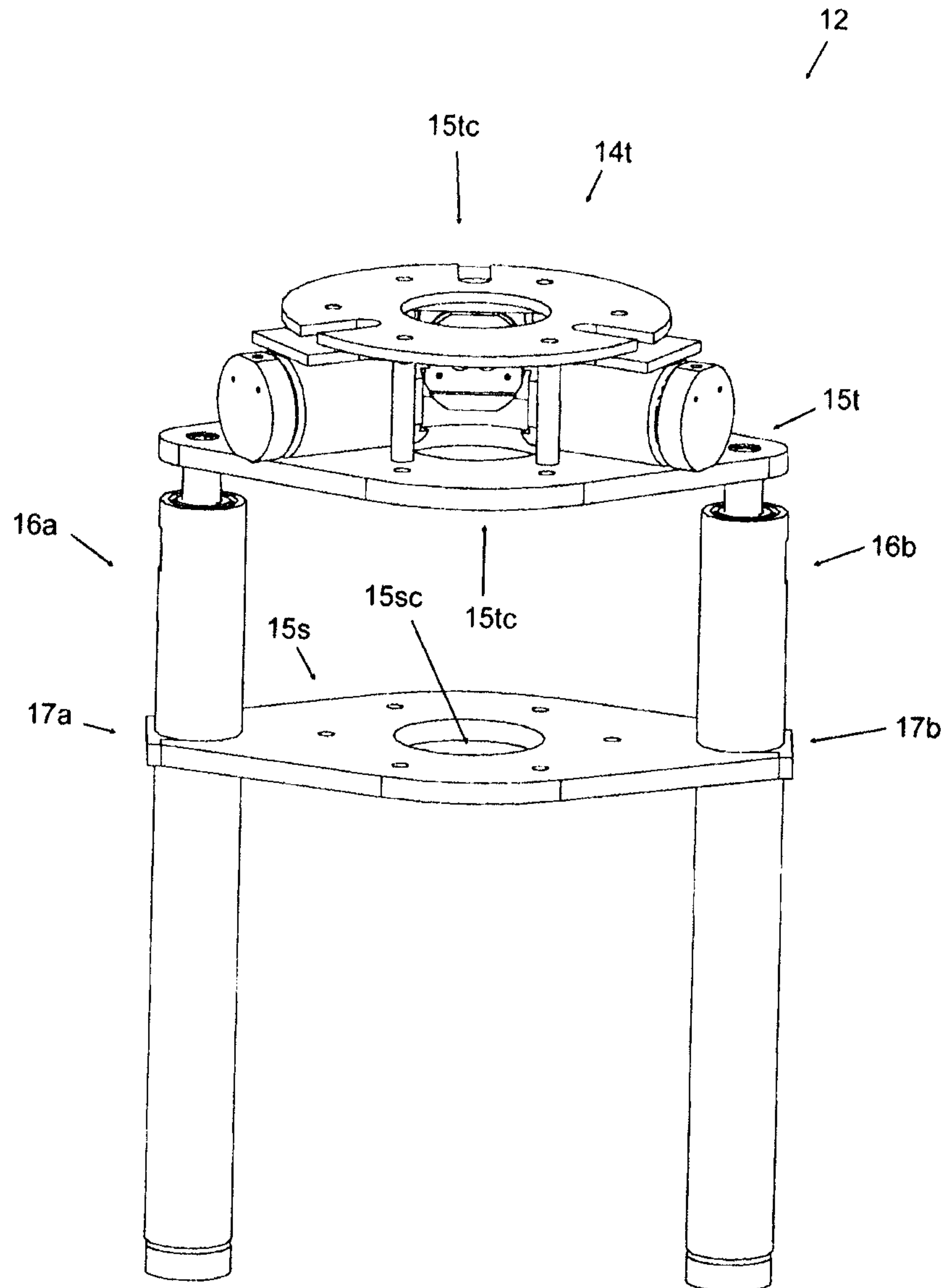
Fig. 8

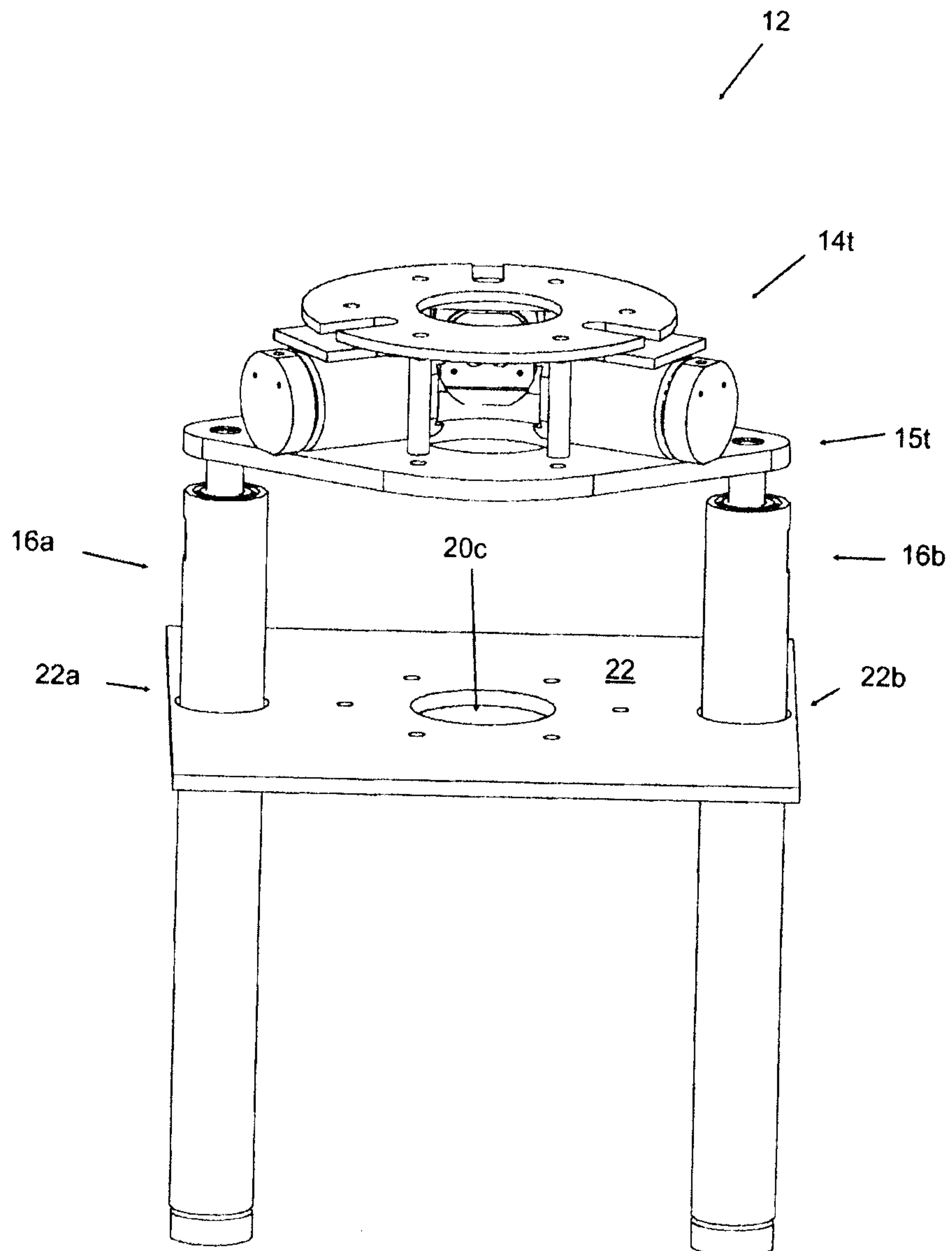
Fig. 9

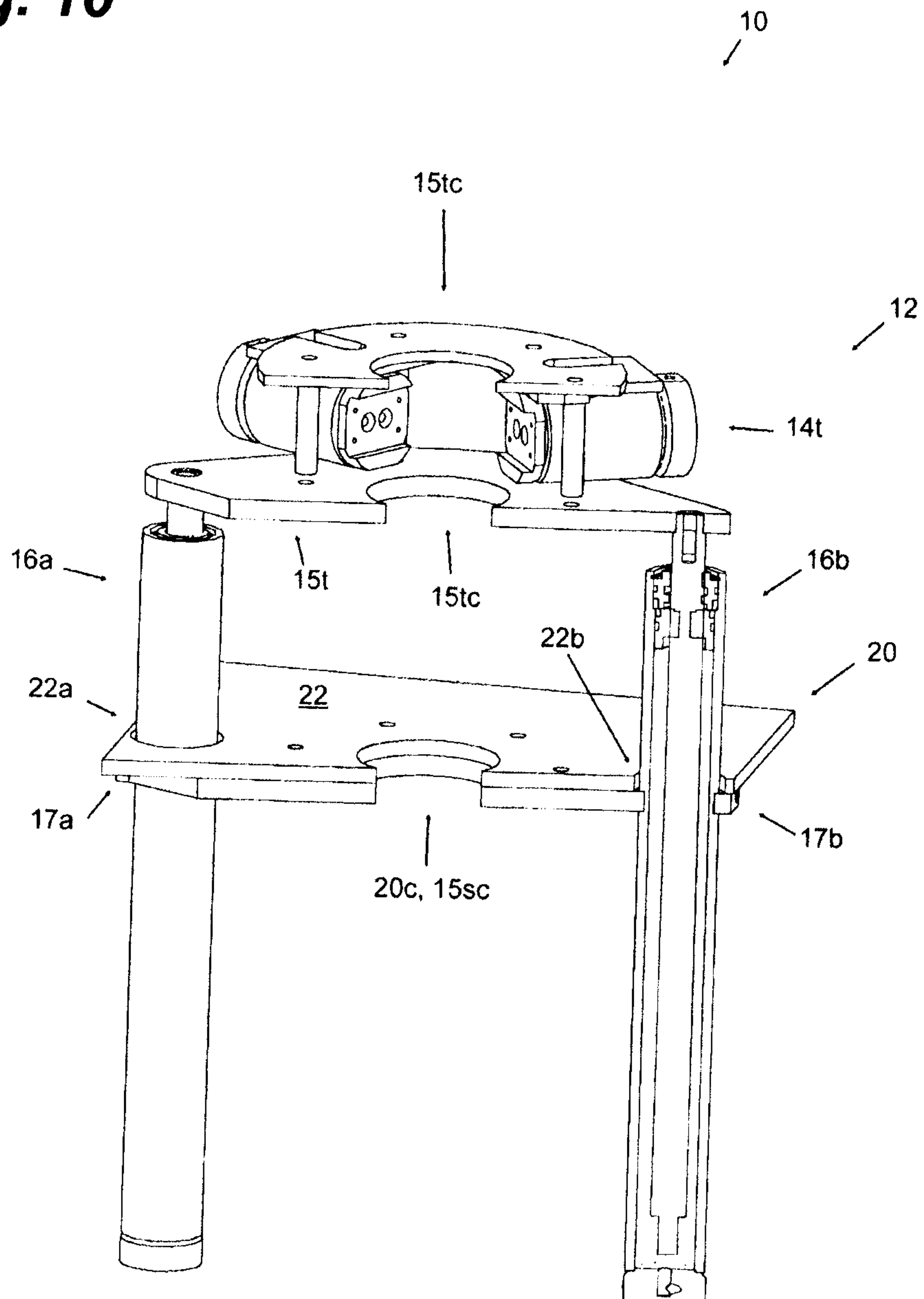
Fig. 10

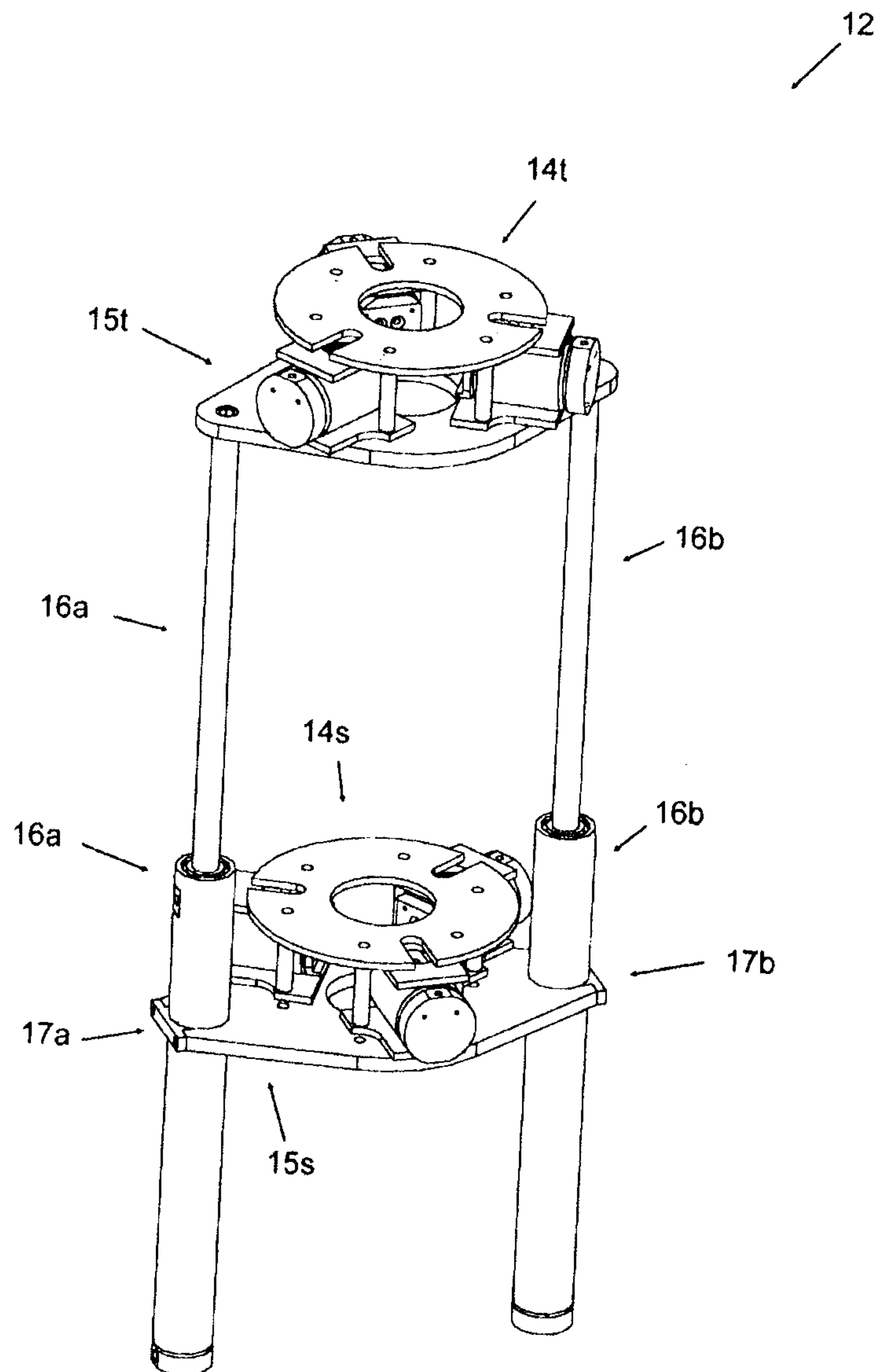
Fig. 11

Fig. 12

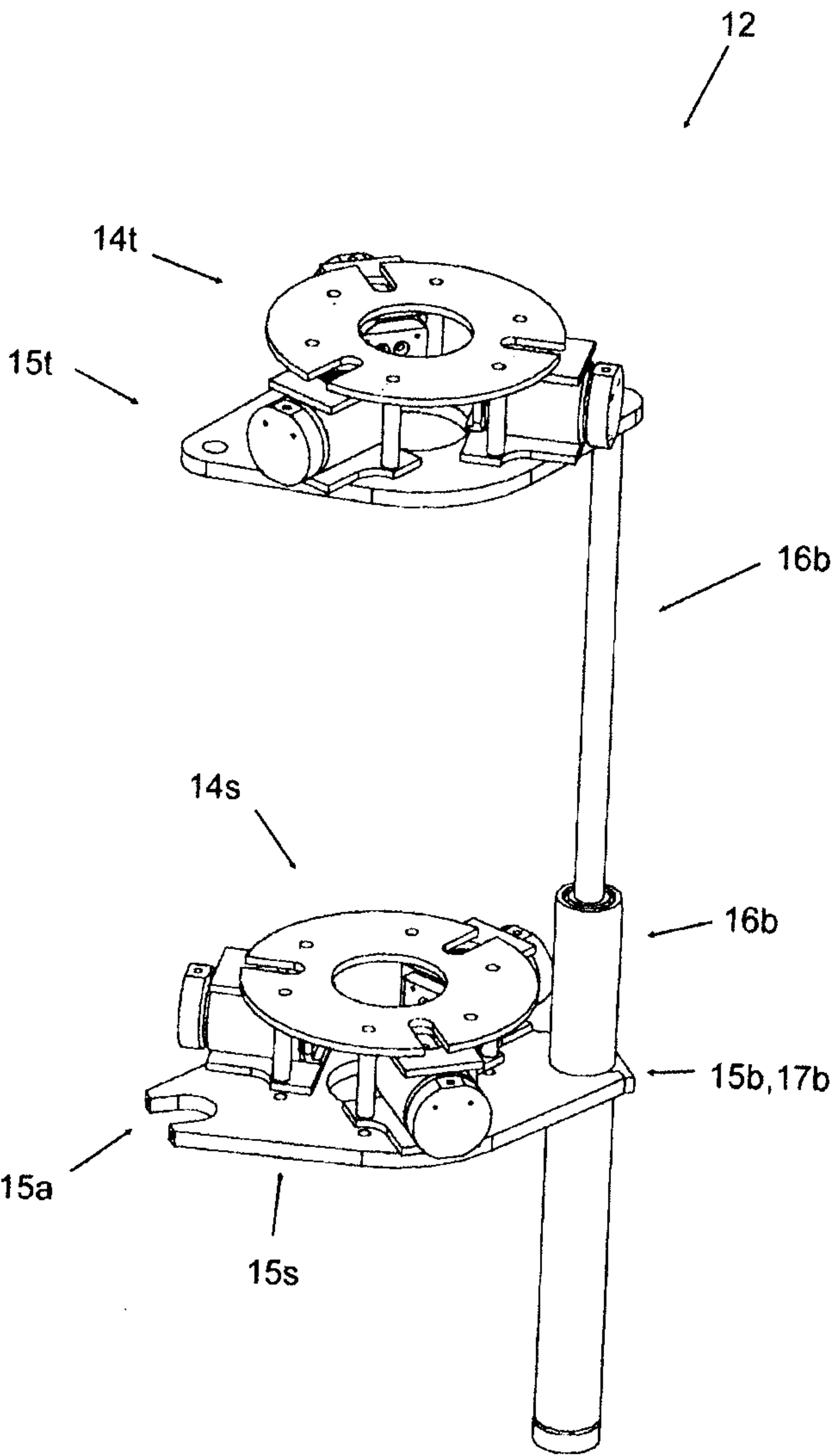


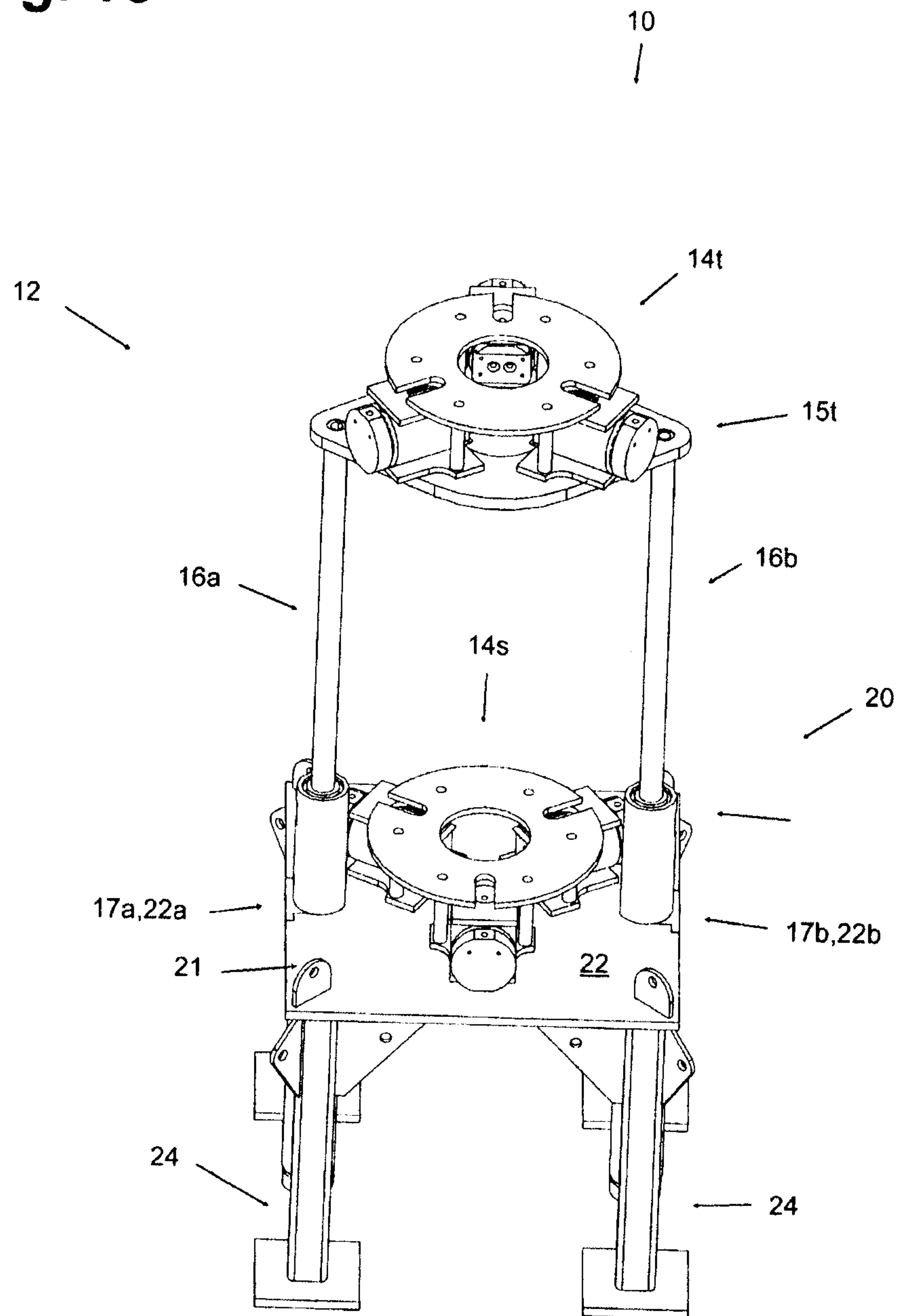
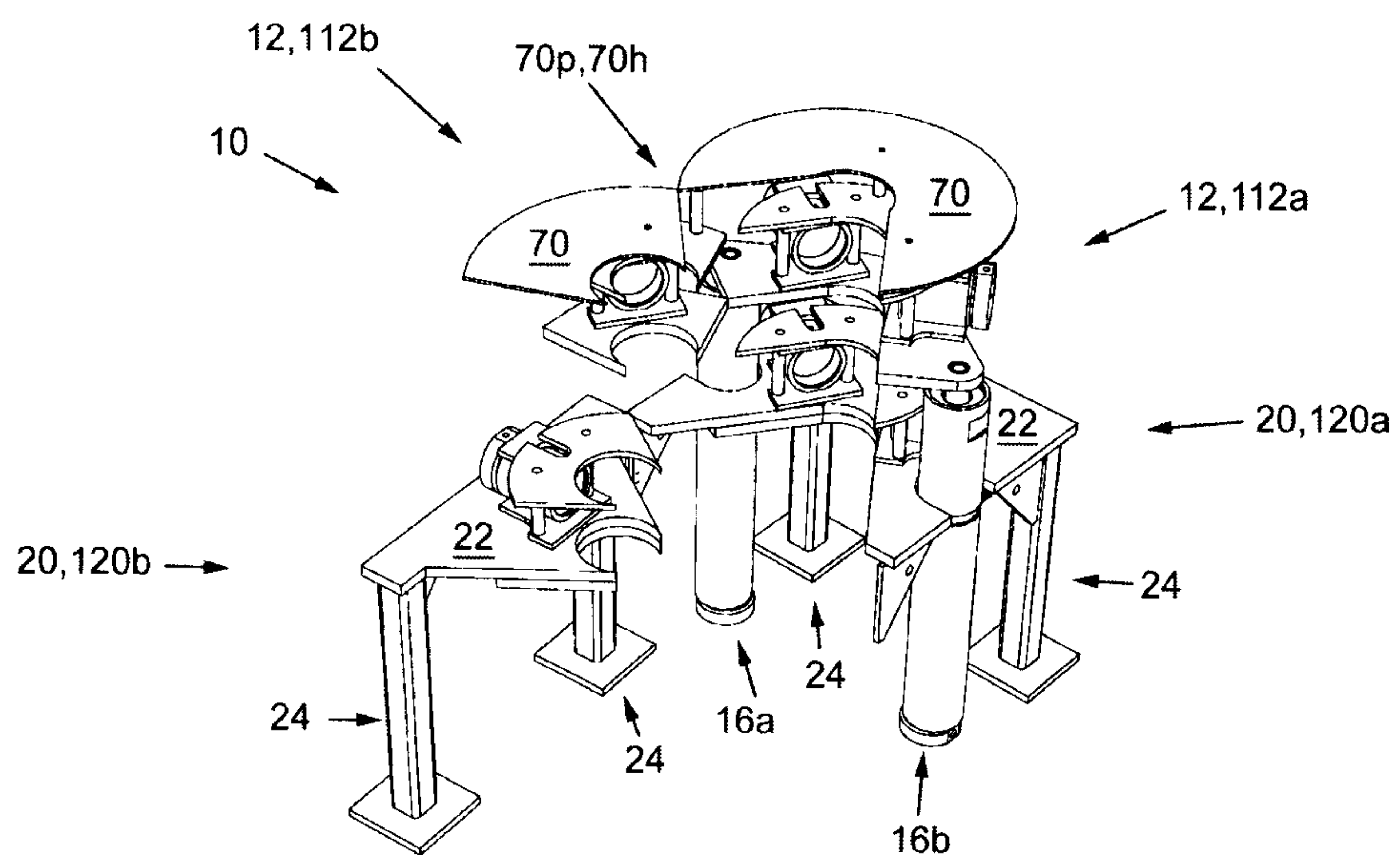
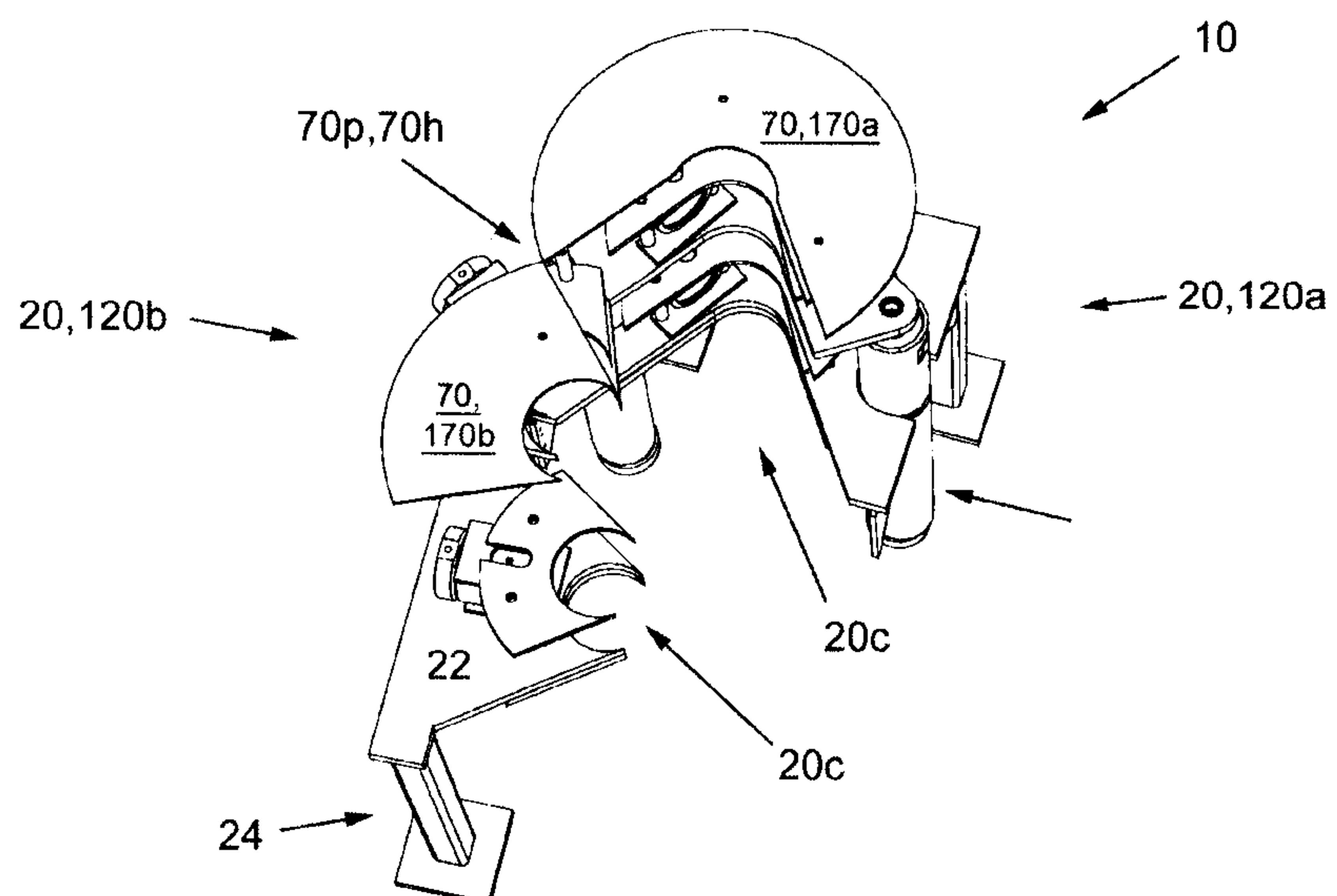
Fig. 13

Fig. 19**Fig. 20**

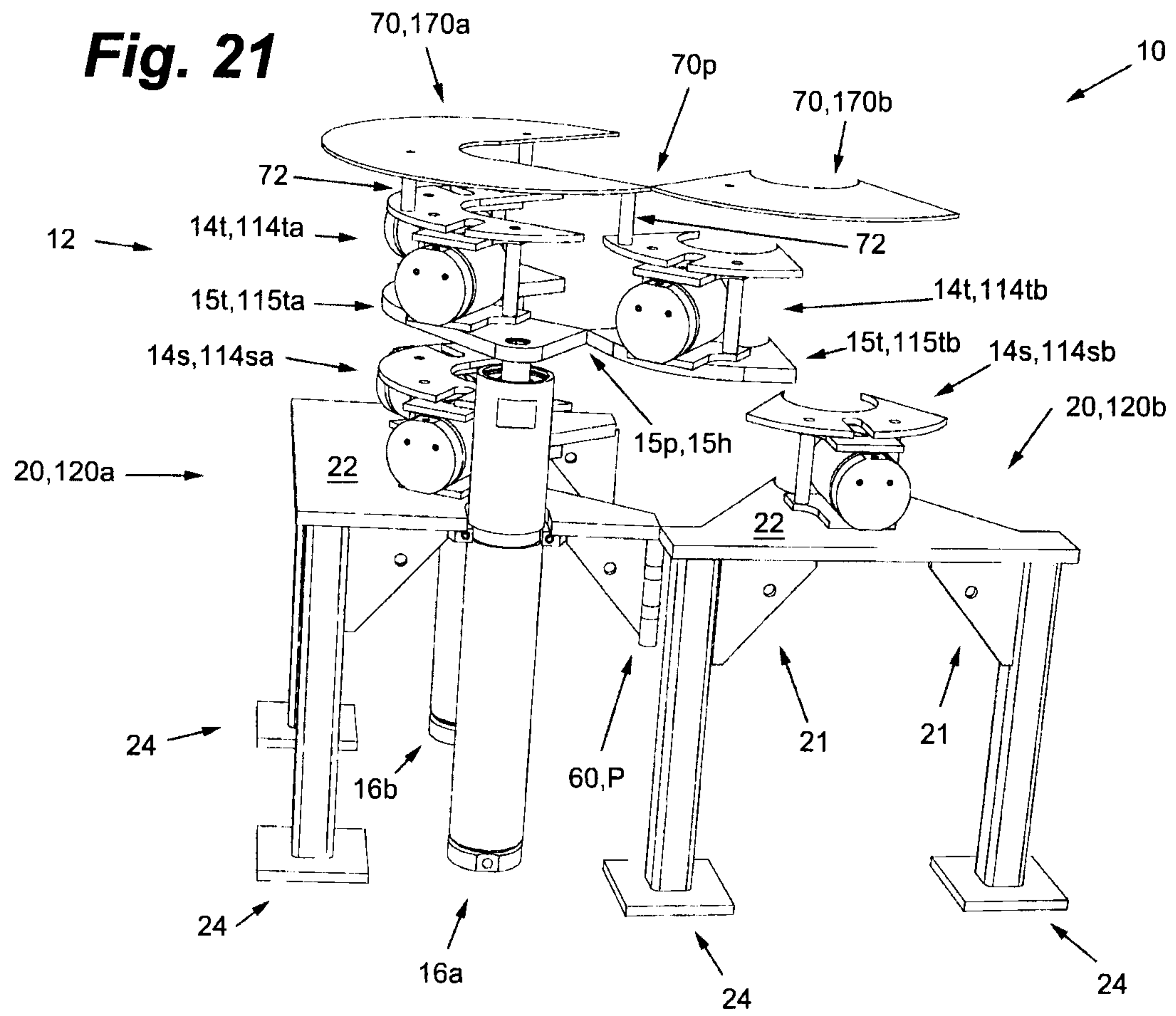


Fig. 22

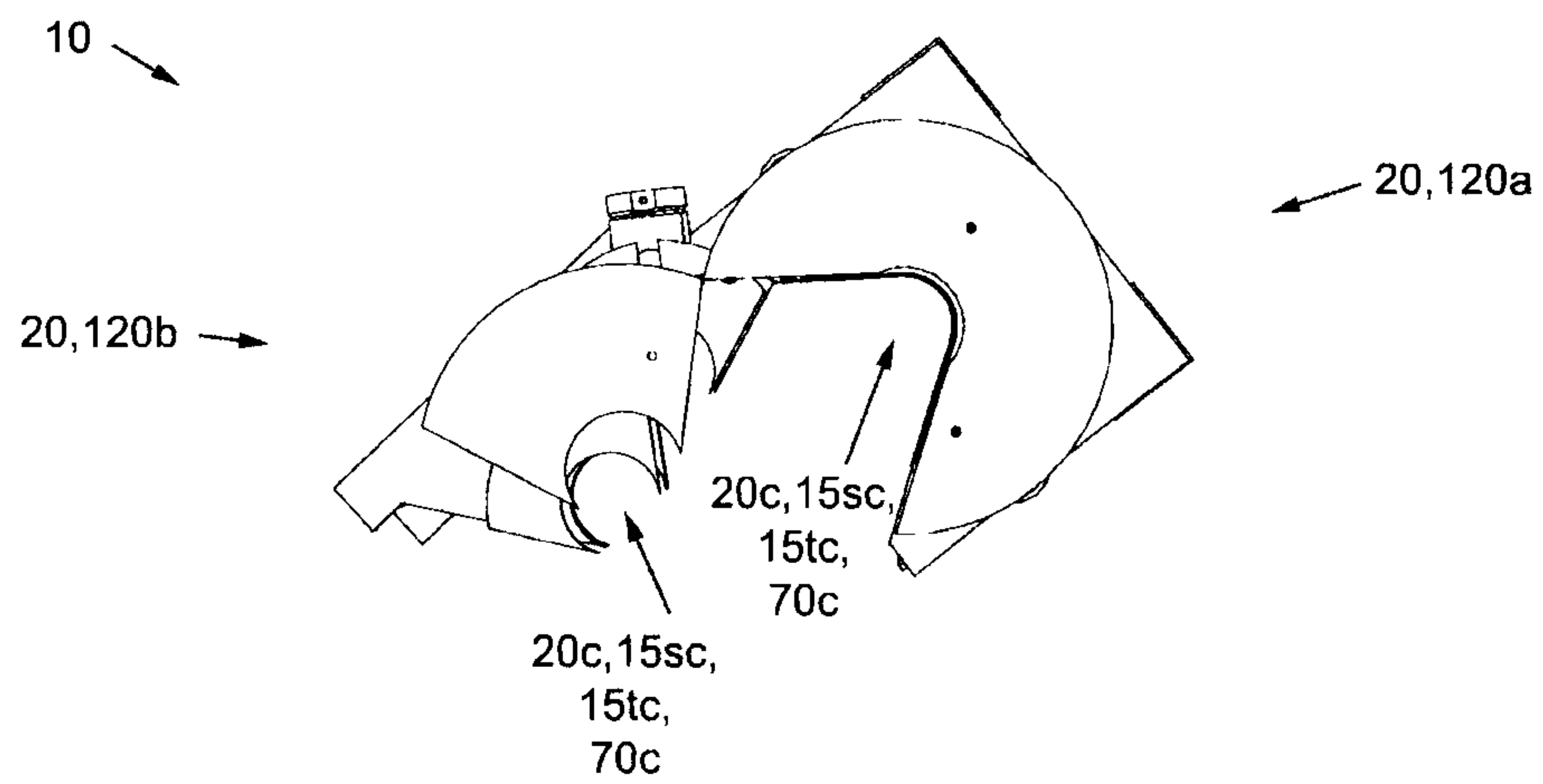


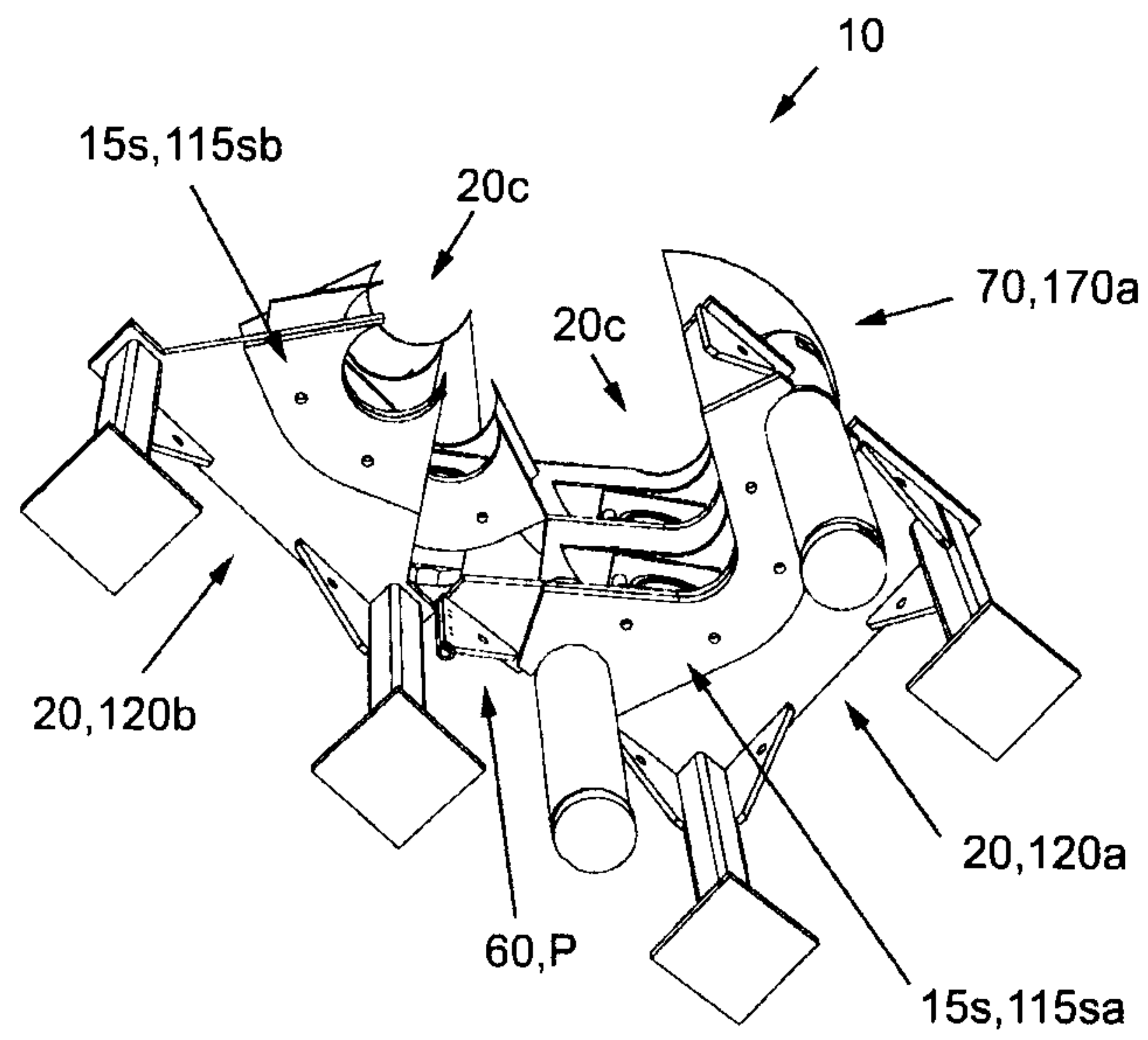
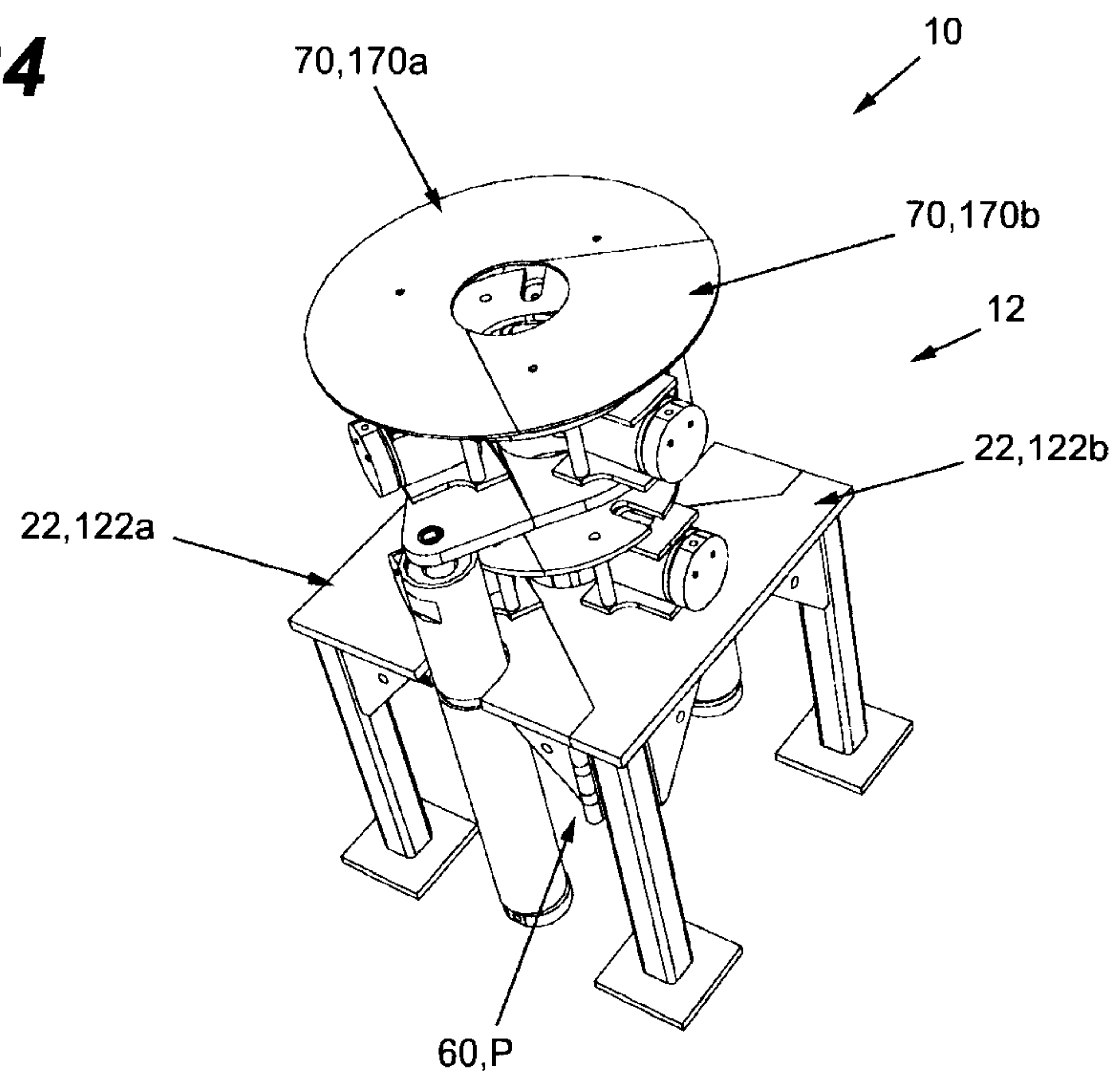
Fig. 23**Fig. 24**

Fig. 25

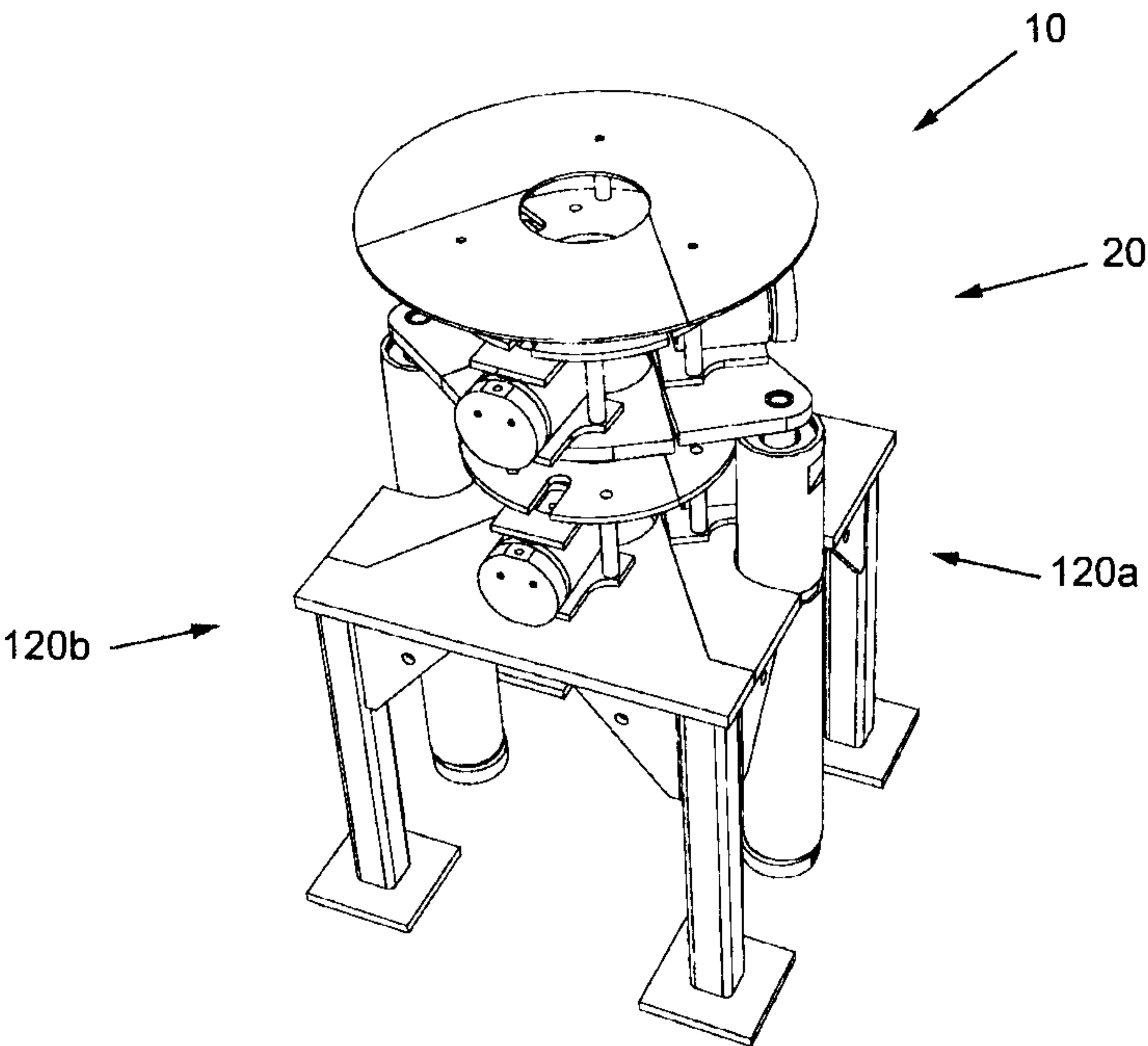


Fig. 26

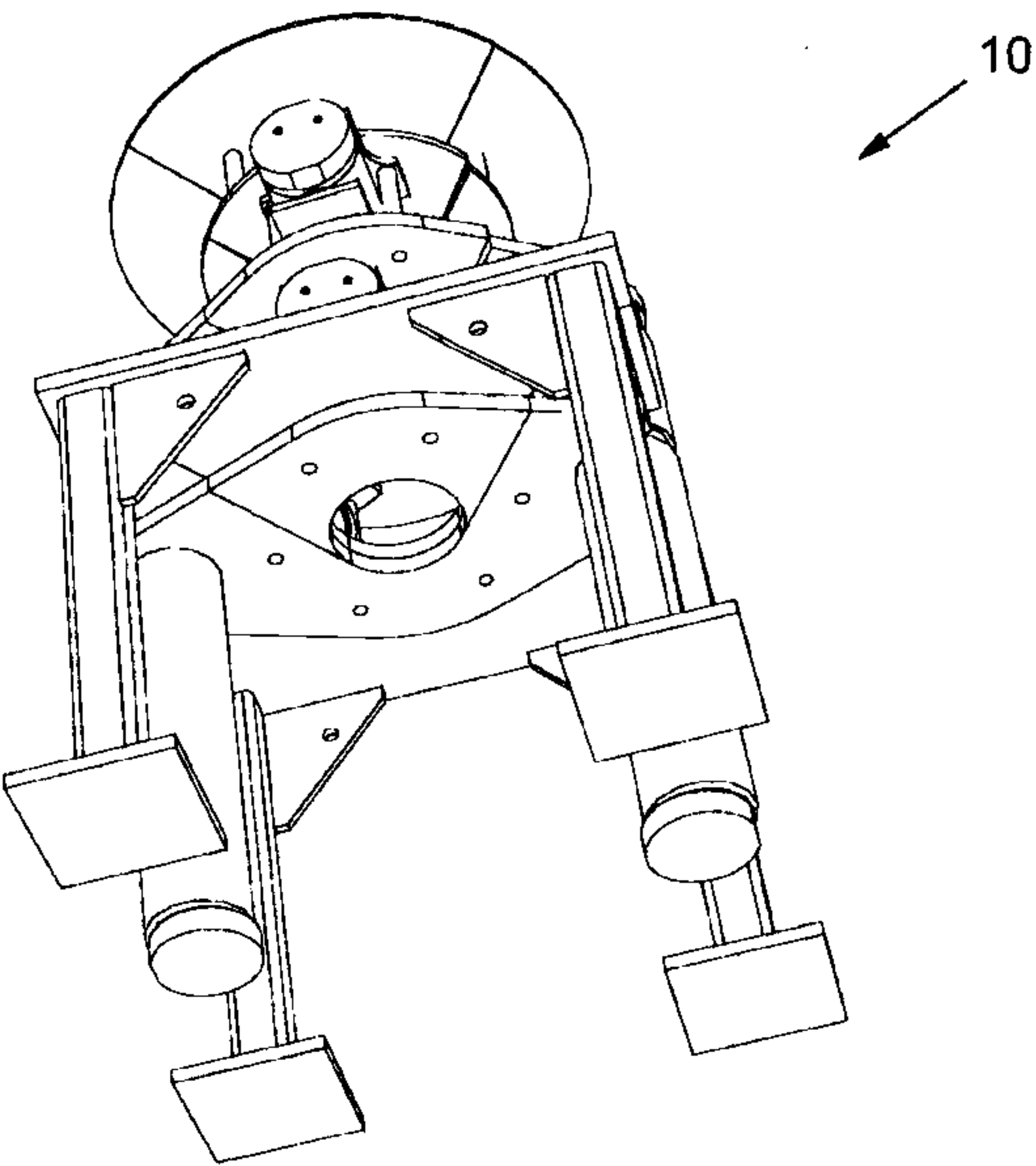


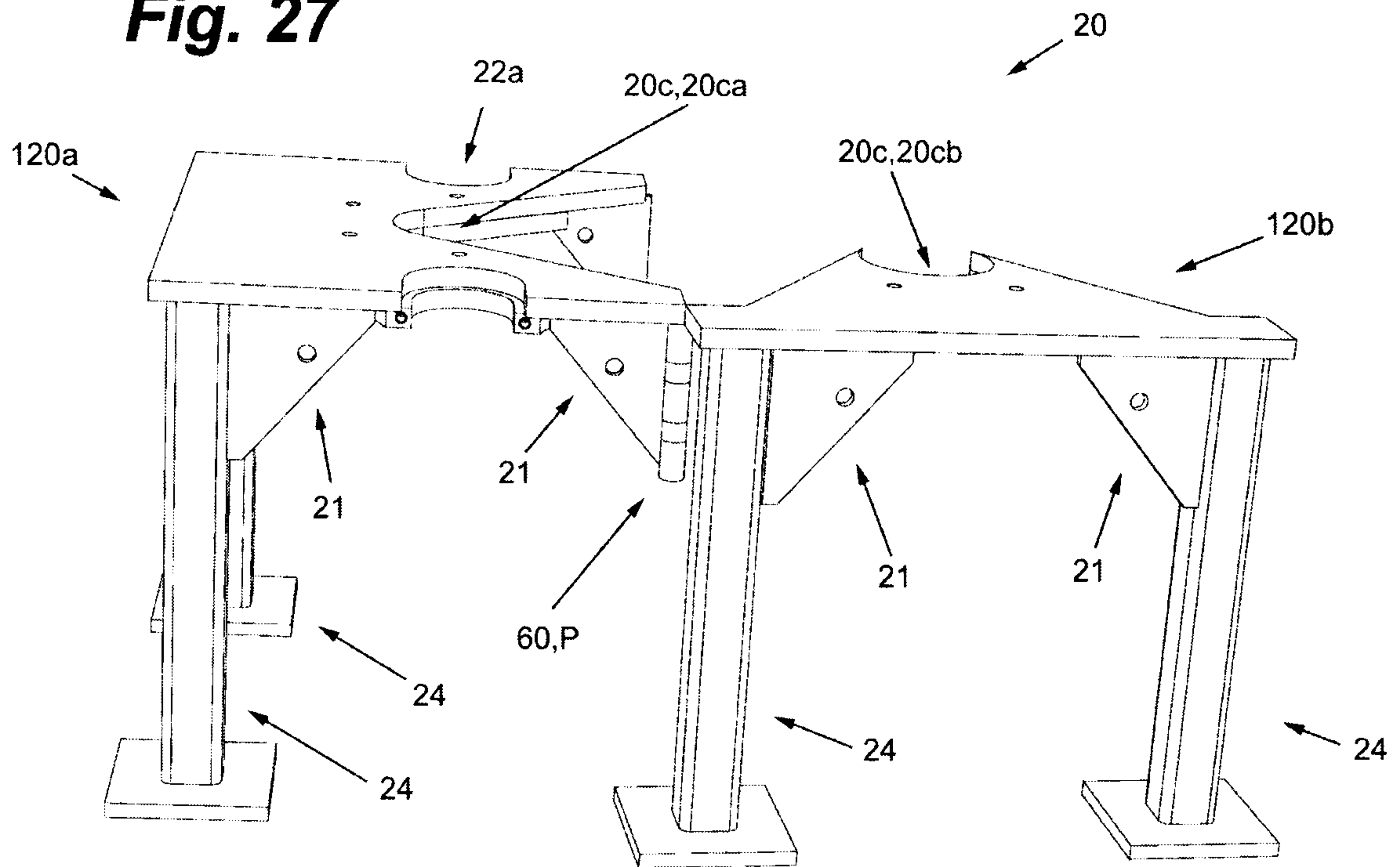
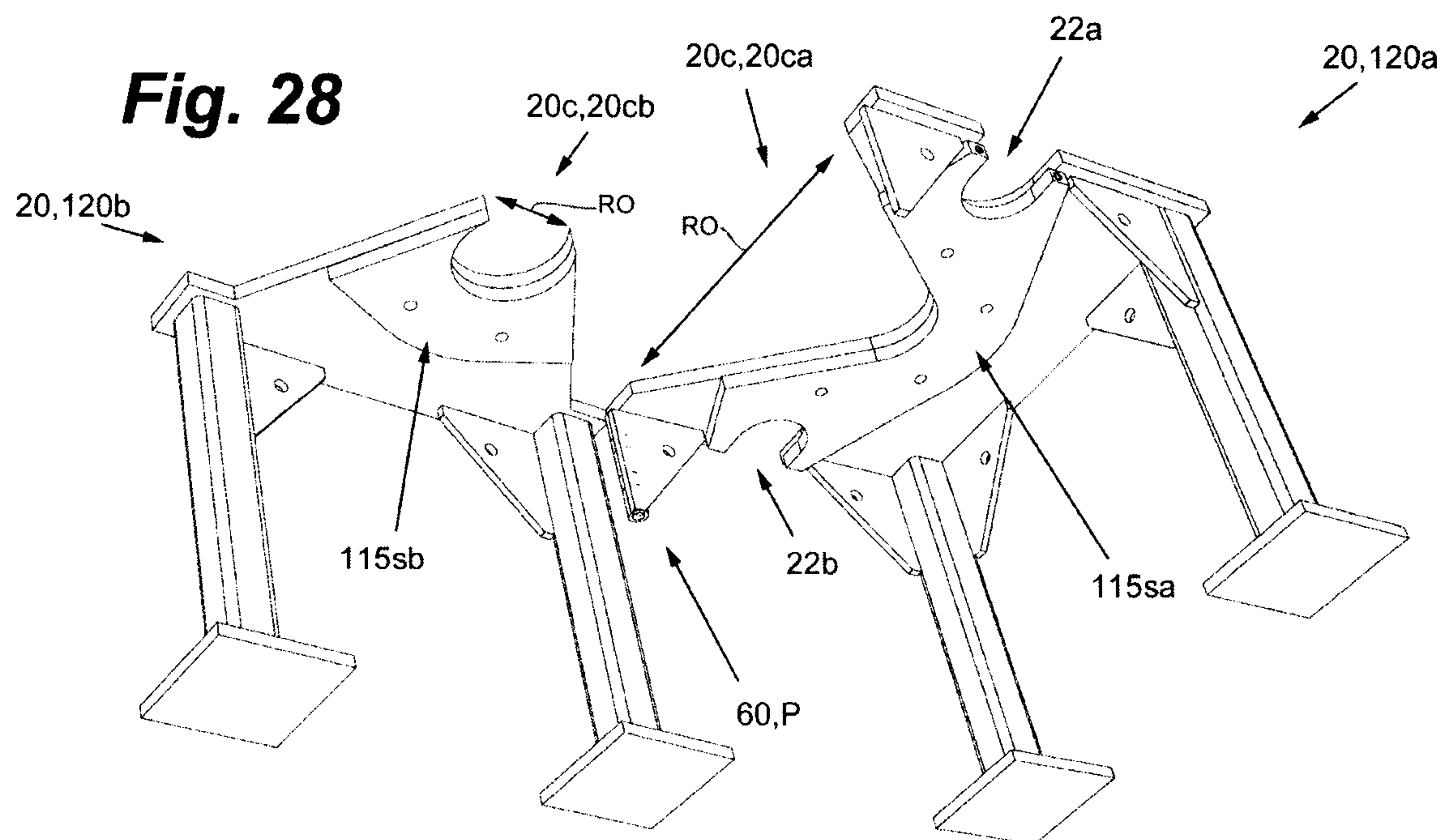
Fig. 27**Fig. 28**

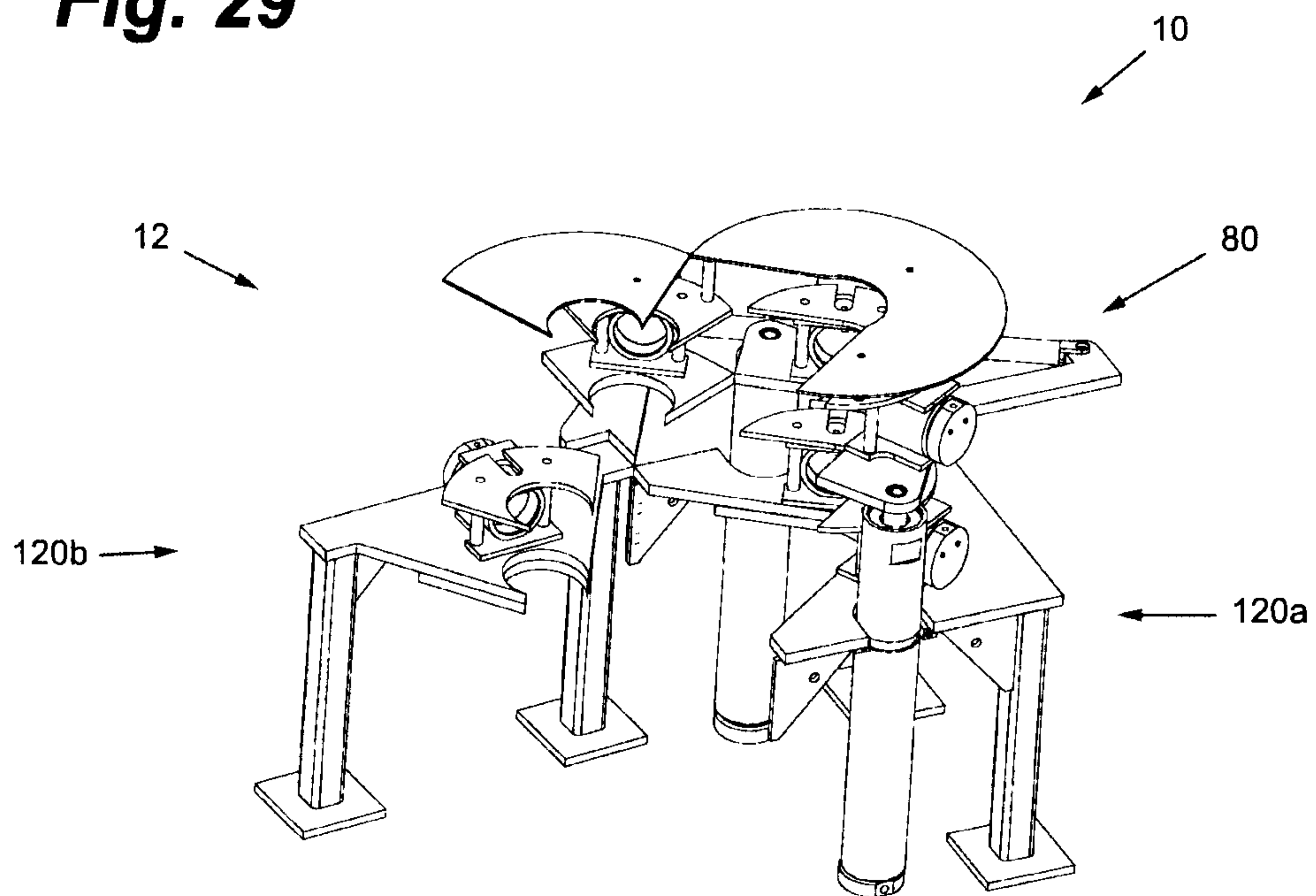
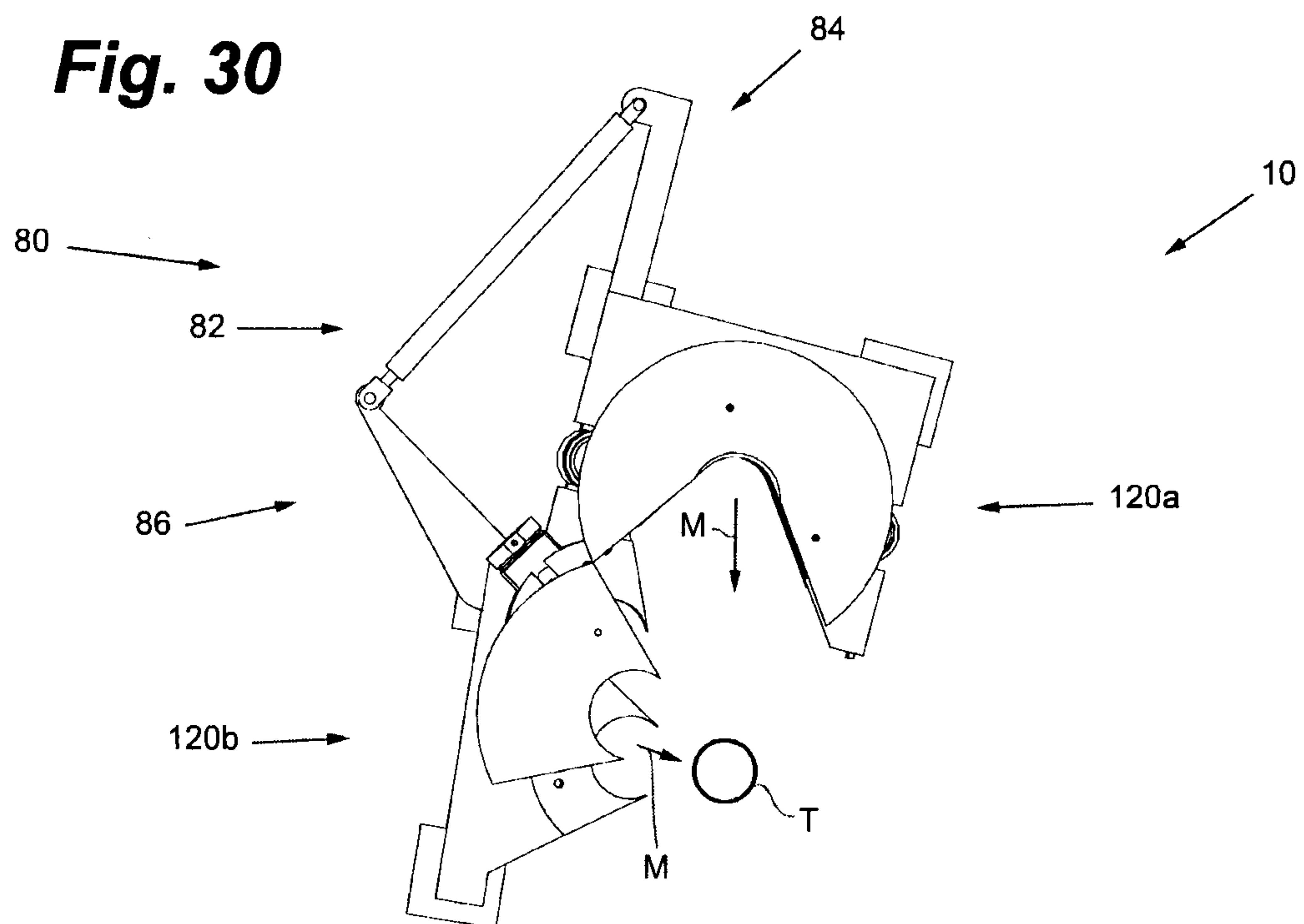
Fig. 29**Fig. 30**

Fig. 31

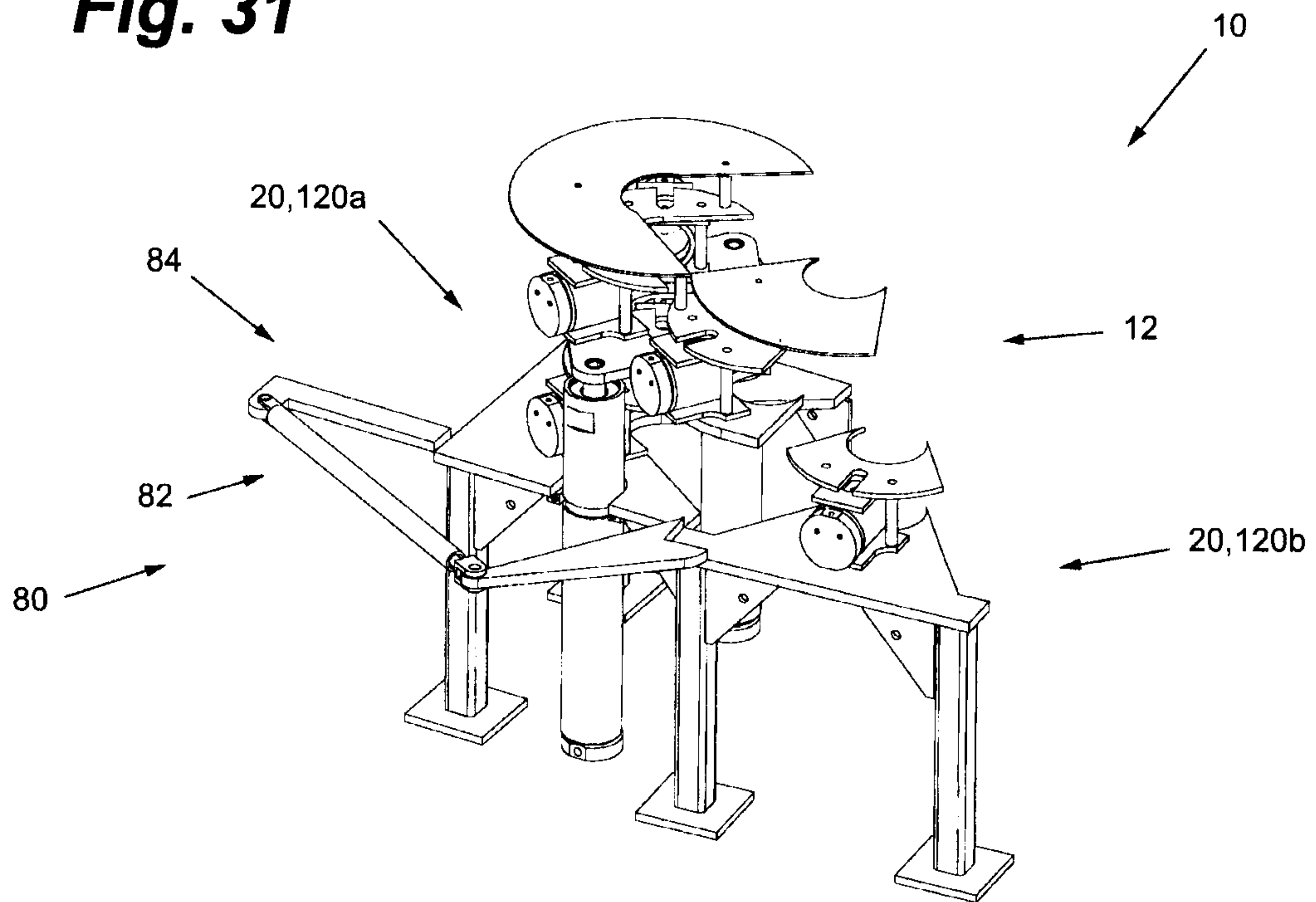


Fig. 32

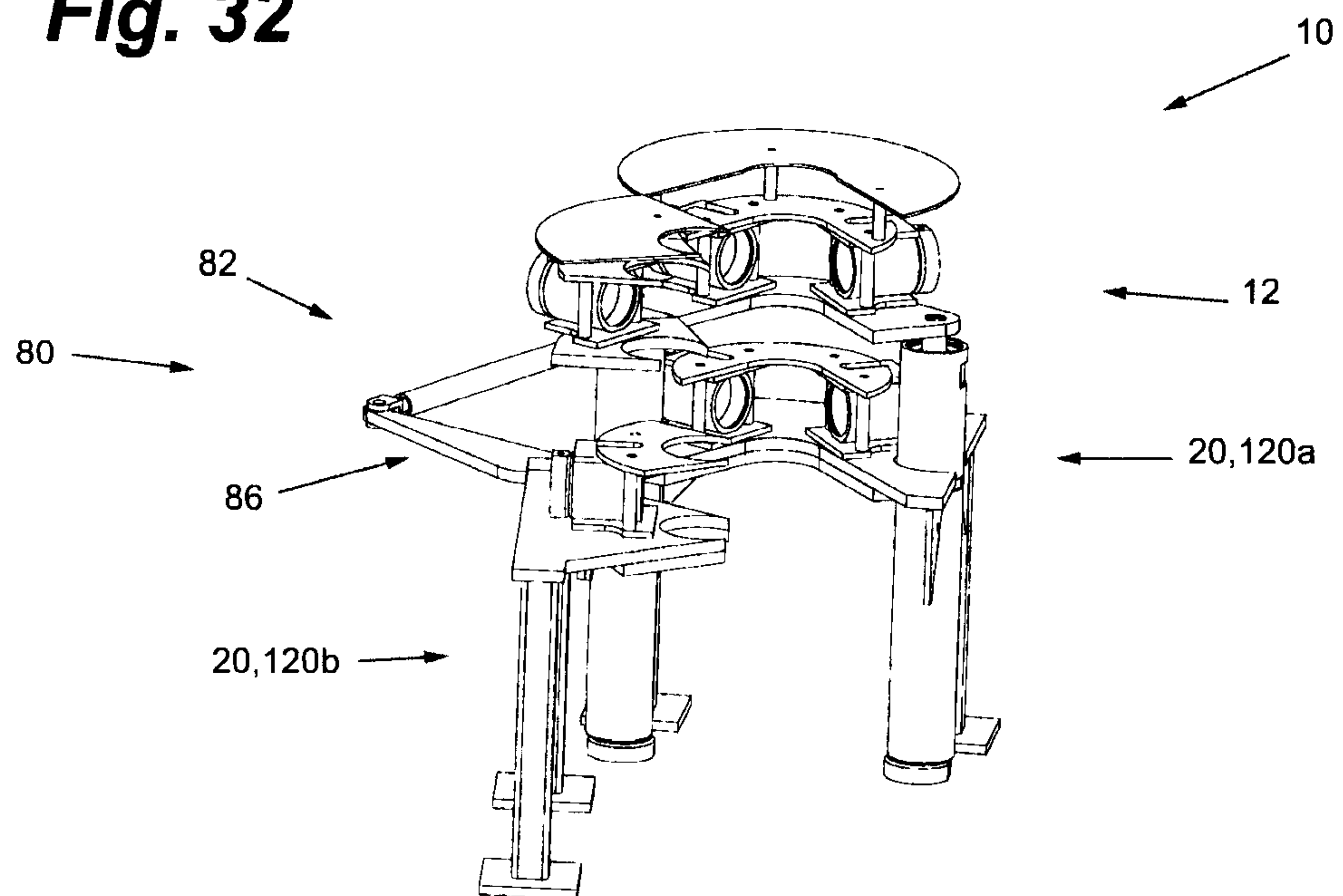


Fig. 33

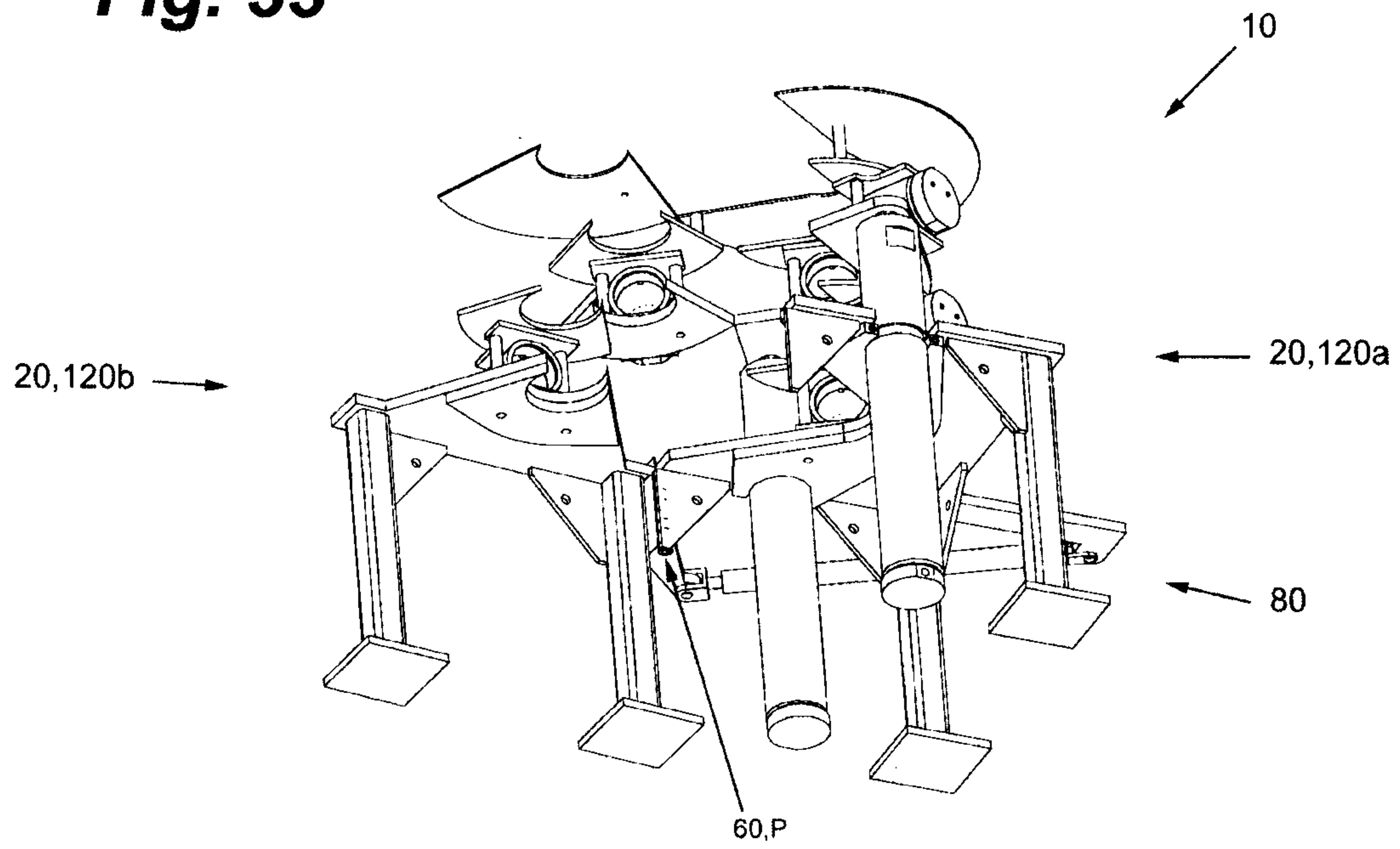


Fig. 34

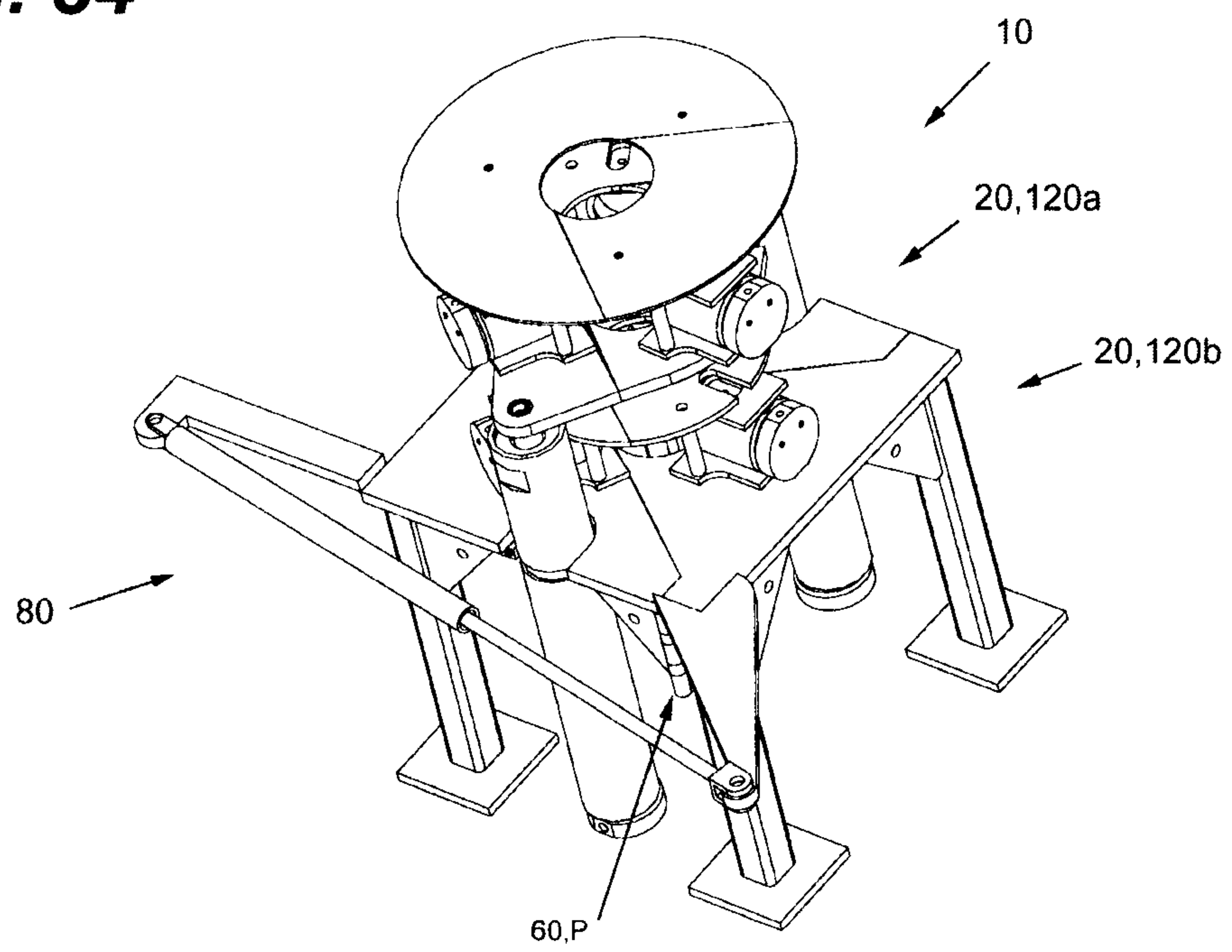


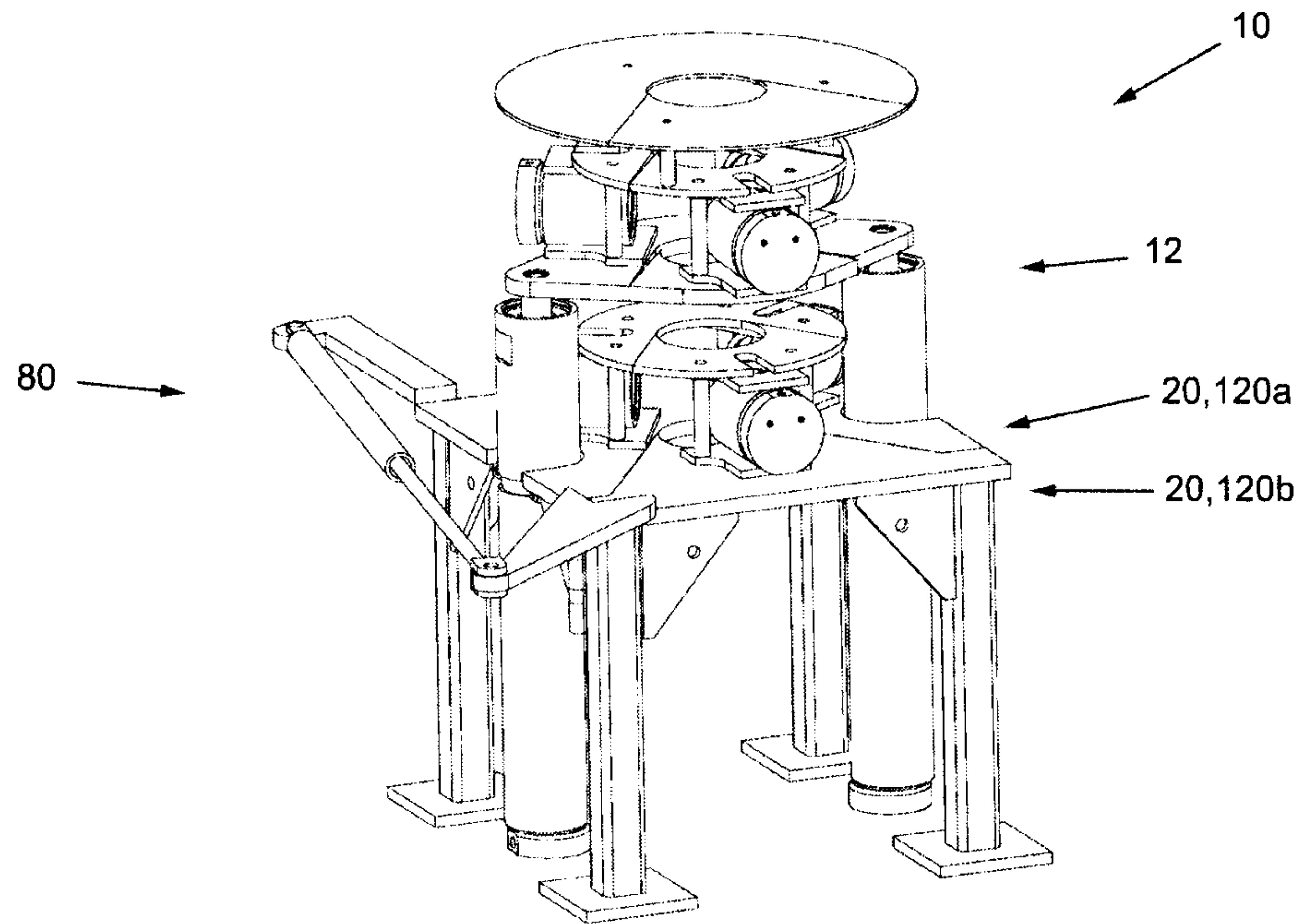
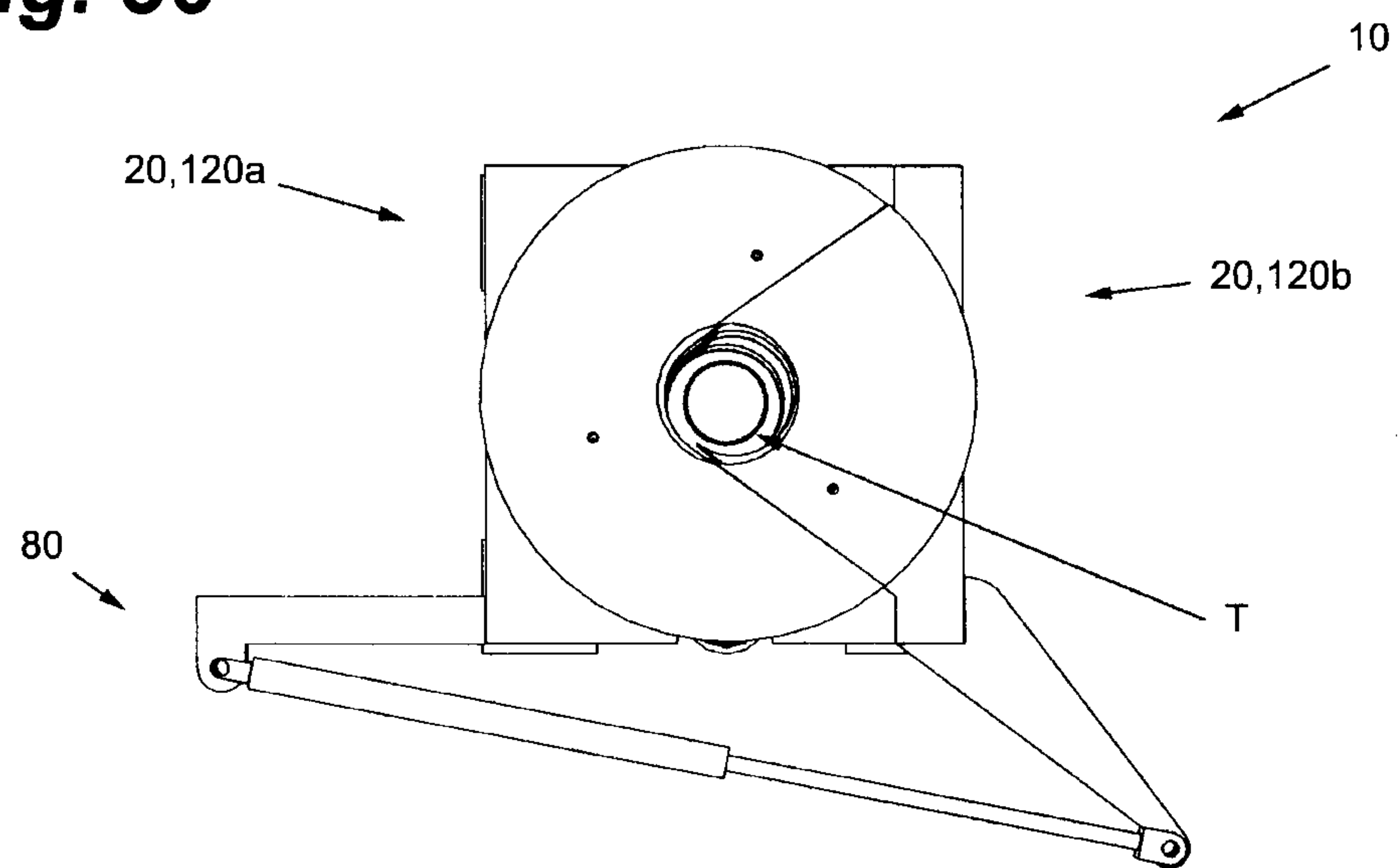
Fig. 35**Fig. 36**

Fig. 37

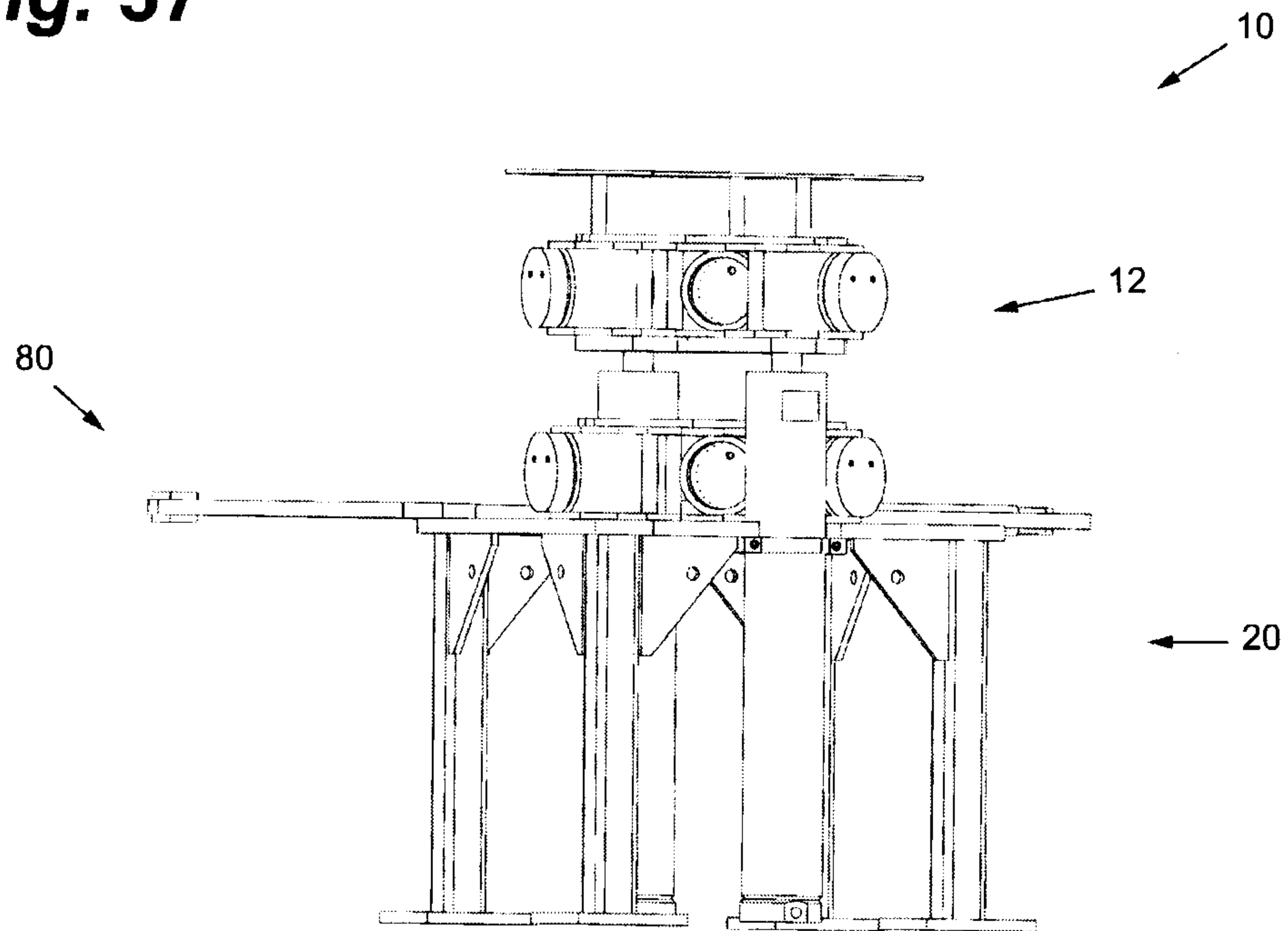
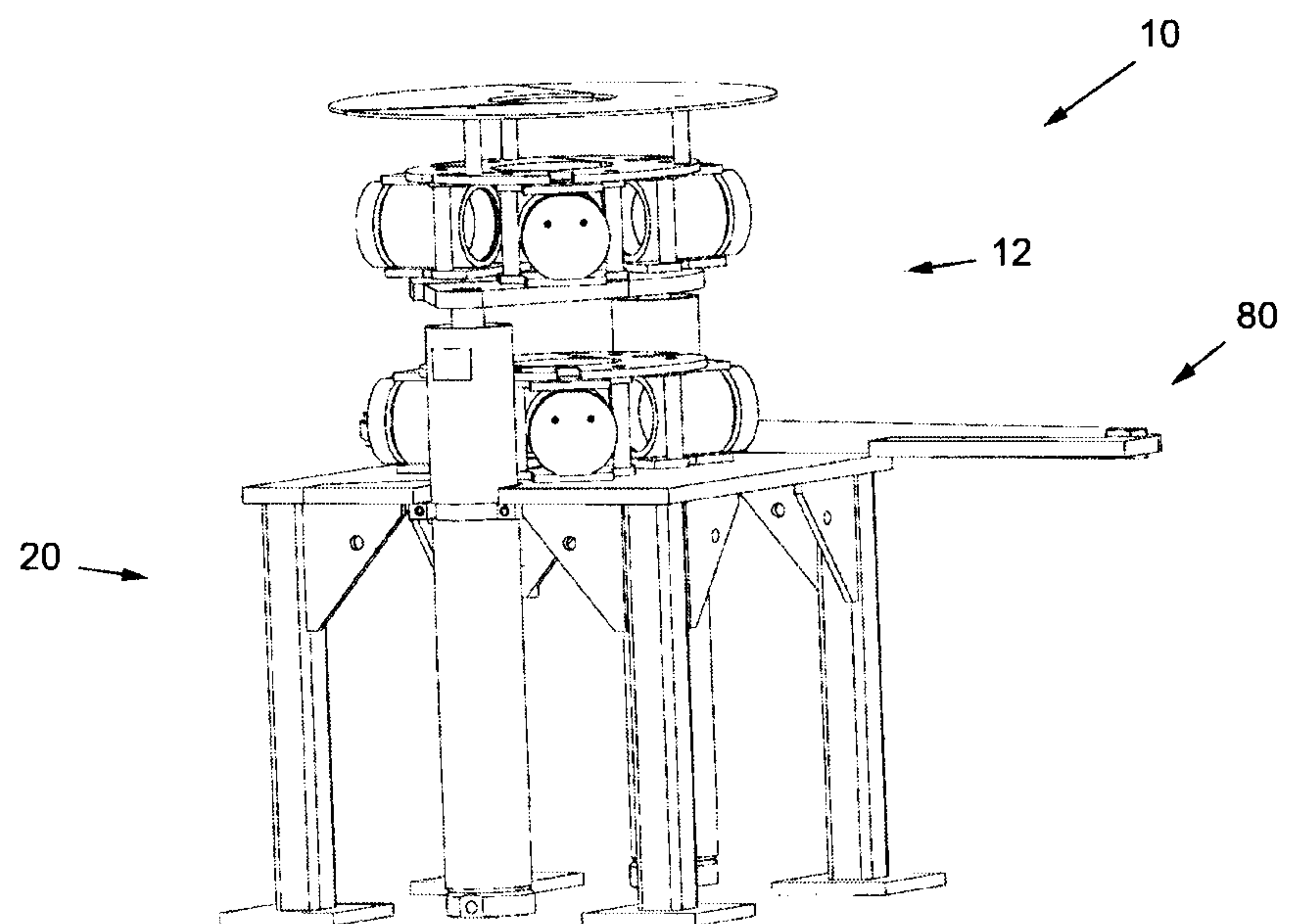


Fig. 38



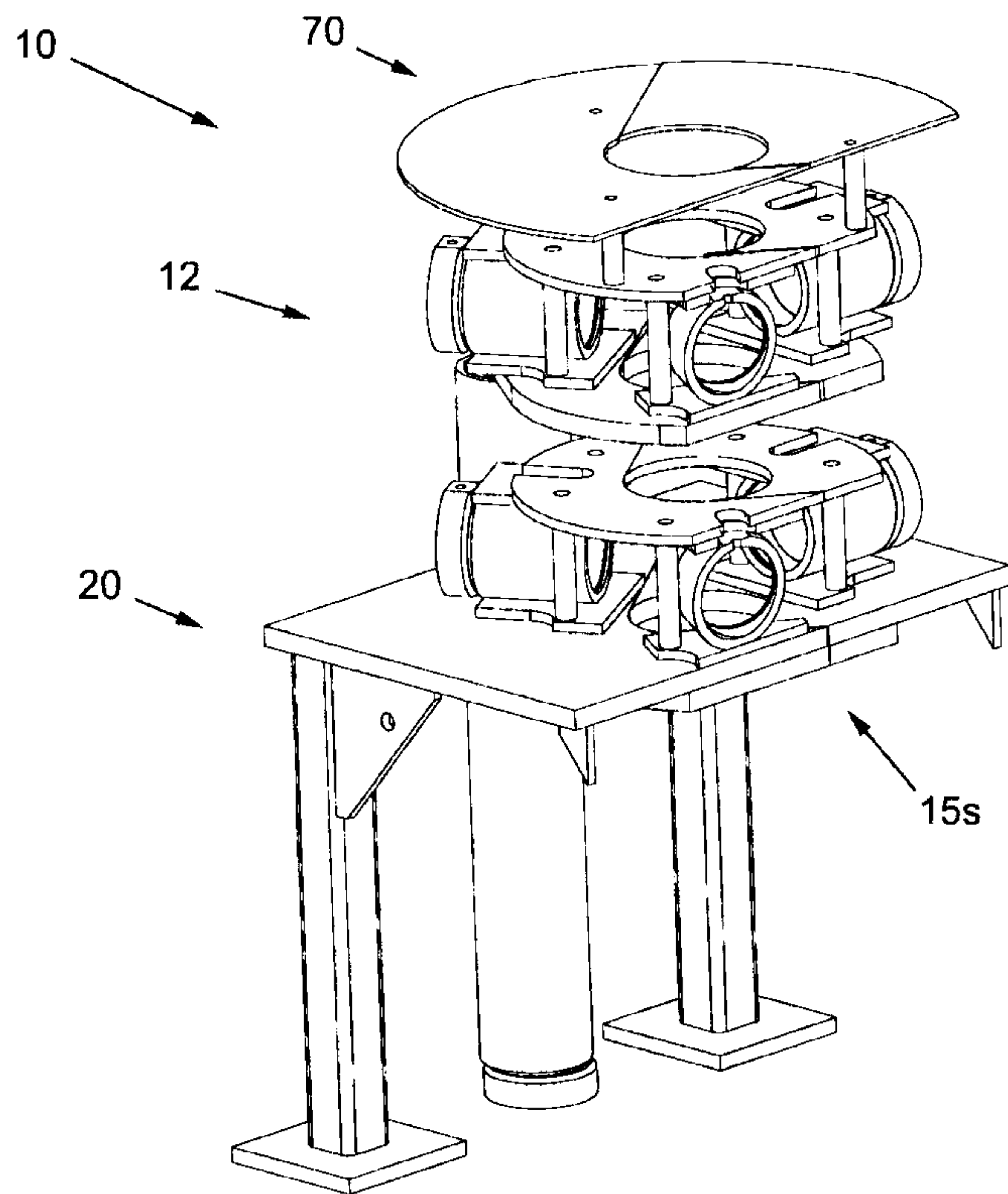


Fig. 39

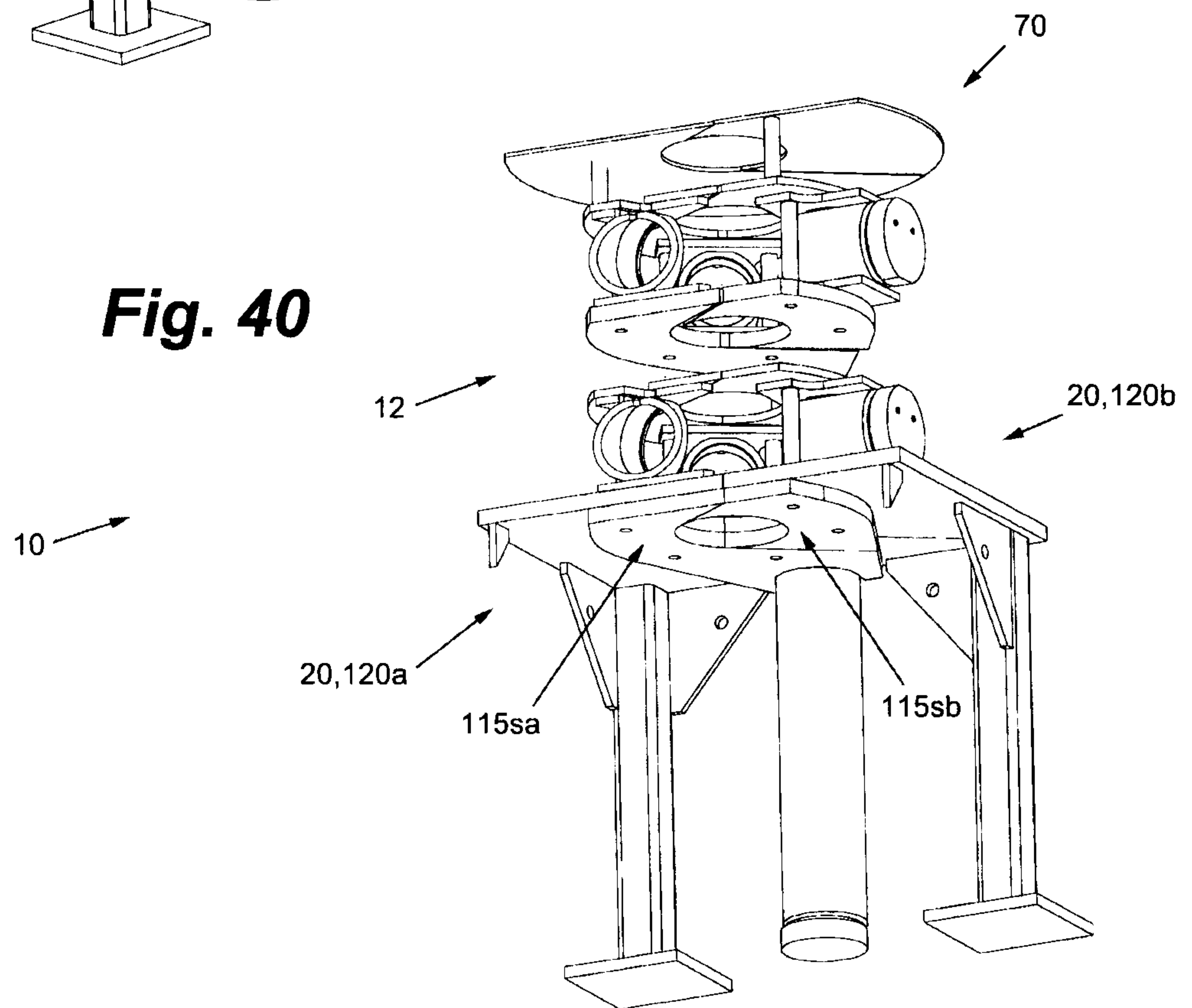


Fig. 40

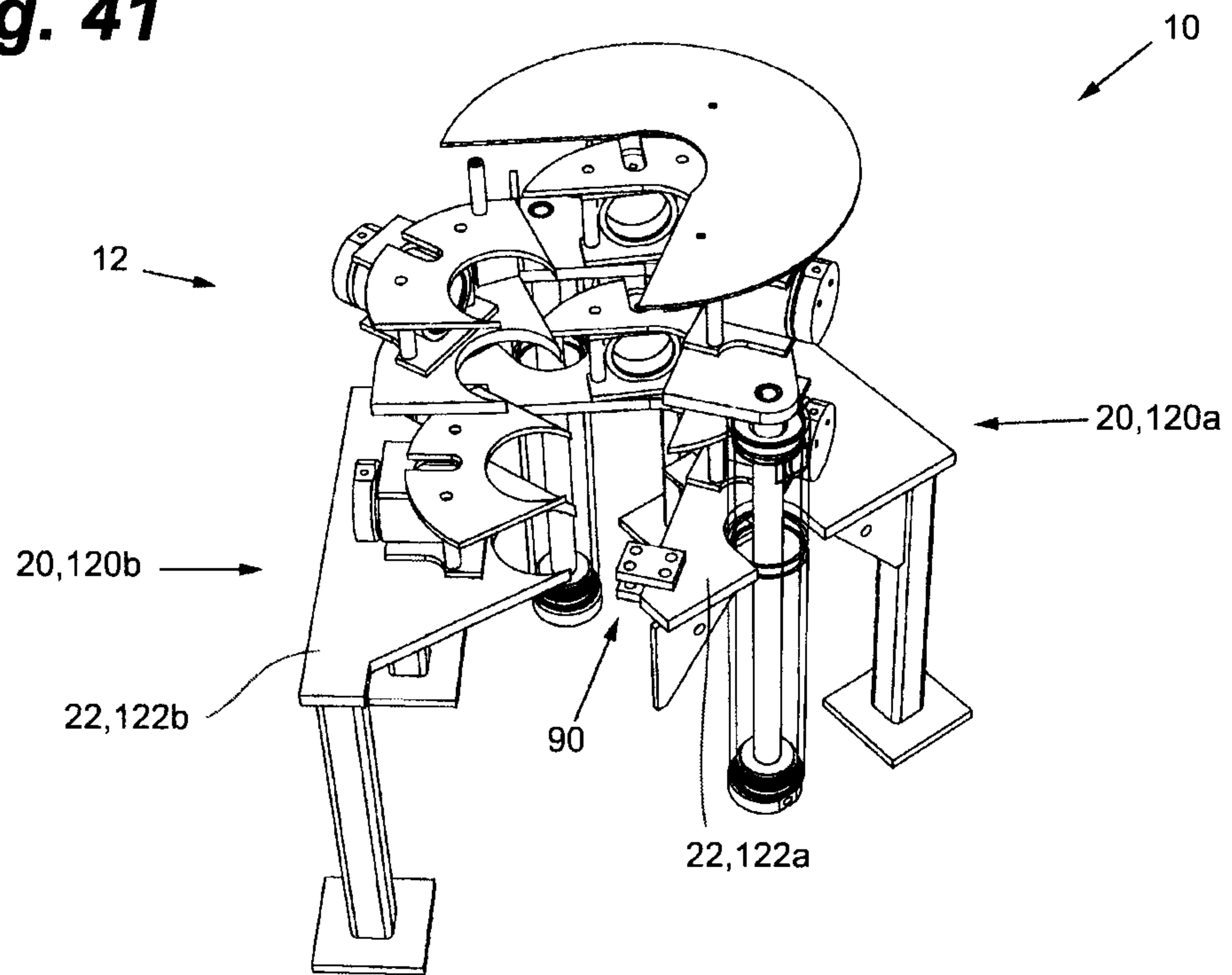
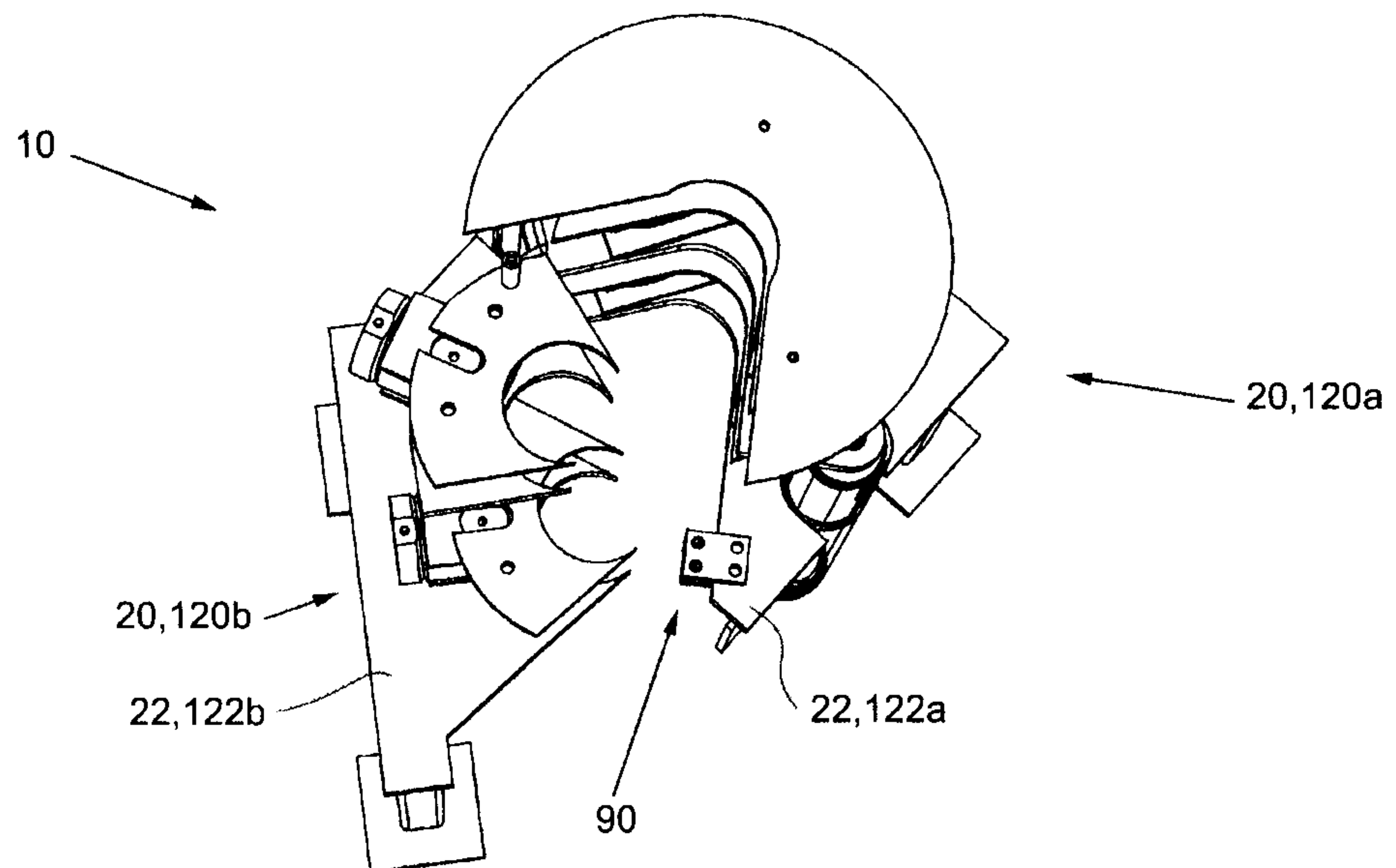
Fig. 41**Fig. 42**

Fig. 43