(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 1 958 744 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
20.08.2008 Bulletin 2008/34

(51) Int Cl.:
B28B 1/26 *(2006.01)*

(21) Application number: **07425085.3**

(22) Date of filing: **15.02.2007**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK RS

(71) Applicant: **Garoll S.r.l.**
25039 Travagliato (Brescia) (IT)

(72) Inventor: **Vianello, Pietro**
25060 Cellatica
Brescia (IT)

(74) Representative: **Crippa, Paolo Ernesto et al**
Jacobacci & Partners S.p.A.
Piazza della Vittoria, 11
25122 Brescia (IT)

(54) **Pressure die casting machine**

(57) The invention relates to a pressure die casting machine, in particular for manufacturing ceramic products, for example sanitary articles, comprising two mould holders (22) suitable for receiving each a respective half mould. The mould holders are connected to respective support means (20) reciprocally moving between a relative separation position, suitable for the demoulding and drawing of the cast piece, and a relative approach position, wherein the two half moulds are closed along a contact plane for casting and emptying the mould. The support means (20) are in turn connected to orientation means (16, 18) suitable for orientating said support means (20) so as to make said contact plane between the two half moulds turnable by at least 90° between a substantially vertical position and a substantially horizontal position.

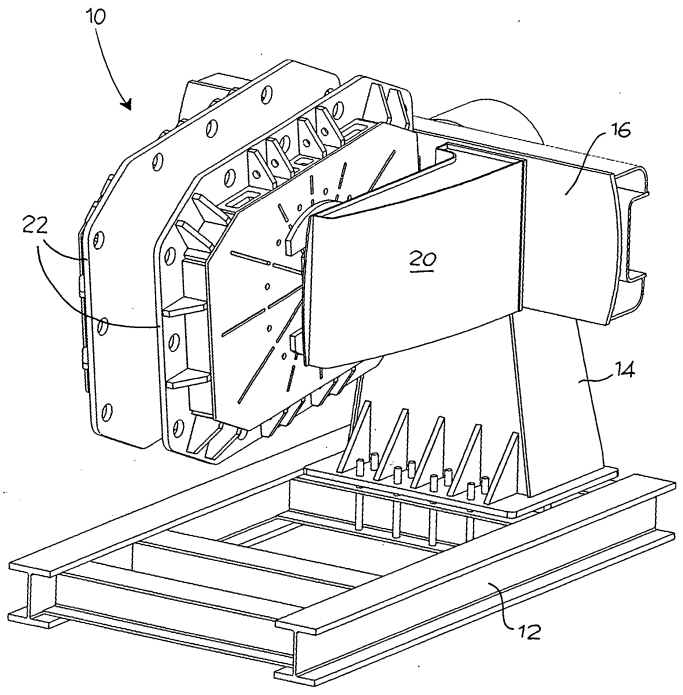


Fig.1

EP 1 958 744 A1

Description

[0001] The present invention relates to pressure die casting machines, in particular for manufacturing ceramic products, such as sanitary articles.

[0002] As known, pressure die casting machines comprise at least two half moulds which, placed in contact, define a cavity wherein a casting material is injected, for example a ceramic mixture, called "barbotine" by the men skilled in the art. Each half mould is fixed to a relative mould holder, in turn connected to an element supporting the machine.

[0003] At least one of the support elements of the mould holders is movable at least in the approach/removal direction relative to the other mould holder so as to close the mould for forming the article and open the mould for the demoulding and drawing thereof.

[0004] The ceramic articles that have internal cavities, for example washbasins, are obtained thanks to the drying of the ceramic mixture in contact with the mould cavity walls, whereas the mixture that does not contact said walls, and that therefore does not solidify, must be quickly made to outflow from the mould so as to obtain the cavity, before it solidifies. It is therefore preferable, especially in the case of articles that exhibit a prevailing extension in a plane, to arrange the mould, and thus the mould holders, so that such plane is vertically oriented, to convey the liquid mixture as quickly as possible to a point of the mould wherefrom it is made to outflow outside through a special duct.

[0005] On the other hand, it is also known that the sanitary articles are drawn from the open half mould still in the "green" state, that is, in a state wherein they are only slightly hardened and exhibit poor mechanical resistance as they are barely capable of self-supporting. During the steps of drawing from the half-moulds and in the subsequent transfer, any stresses exceeding their resistance may irreparably damage the article just moulded, which must therefore be discarded. In particular, this applies in the case of sanitary articles having a thin structure at least in one dimension.

[0006] To obviate this problem, it is therefore suitable to carry out the operations of demoulding and drawing of the article from the half mould when this is in horizontal position.

[0007] In other cases, on the other hand, it is preferable to carry out also the casting and the emptying of the ceramic mixture with the mould in horizontal position, or slightly inclined relative to the horizontal. For example, some washbasins with a modern design are designed to have the entire side wall totally exposed to the sight. Carrying out the casting and mould emptying operations in vertical position would mean providing a casting and emptying hole in such side wall of the washbasin, with obvious aesthetic disadvantages. This problem is more easily overcome by carrying out the casting and mould emptying in substantially horizontal or slightly inclined position, since the hole can be obtained, for example, in a corner of the washbasin base, thus in a position hidden to the sight.

[0008] Currently, quite specific pressure die casting machines exist which can be substantially divided into two macro-families: machines that carry out casting, emptying, demoulding and drawing of the cast articles with the mould in vertical position, and machines that carry out the same operations with the mould in horizontal position. One or the other type of machine is selected according to the type of article to be manufactured. To facilitate the emptying of the casting material, some horizontal casting machines are capable of slightly oscillating one of the two mould holders, usually the bottom one, for conveying the liquid casting material to a corner of the mould.

[0009] Moreover, pressure die casting machines have been proposed that combine some of the features of the two types of machines mentioned before, in order to try to obtain greater usage flexibility. For example, EP 1403022 A1 discloses a pressure die casting machine with single mould wherein a mould holder is fixed in vertical position to a support capable of shifting horizontally, whereas the other mould holder is fixed to a support crosspiece suitable for being placed in rotation about an axis substantially horizontal and perpendicular to the shifting direction of the other mould holder. The article forming therefore takes place with the mould in substantially horizontal position, whereas the drawing of the article from a half mould can be carried out after having rotated the relevant mould holder in horizontal position.

[0010] This machine, however, does not allow in any way to carry out the casting in horizontal position, since it is only one of the two mould holders that after the casting and emptying rotates to carry out the demoulding and drawing of the part. The other mould holder on the other hand, always remains fixed in substantially vertical position.

[0011] In view of this state of the art, the object of the present invention is to propose a single pressure die casting machine having a real and complete usage flexibility, that is, which should meet all of the aforementioned requirements, while maintaining a particularly simple and compact structure.

[0012] In particular, the object of the present invention is to provide a single machine wherein each of the operating steps of the pressure die casting process, that is, the injection of the casting material, the emptying of the mould, the demoulding and drawing of the pieces, can be carried out in the most suitable position, for example based on the type of mould or article to be manufactured.

[0013] Such objects and tasks are achieved with a pressure die casting machine according to claim 1.

[0014] To better understand the invention and appreciate its advantages, exemplary non-limiting embodiments thereof are described below with reference to the annexed drawings, wherein:

[0015] figure 1 shows a schematic perspective view of a pressure die casting machine according to the inven-

tion, in a configuration of vertical mould filling or emptying;

[0016] figure 2 shows a side view of the machine of figure 1;

[0017] figure 3 shows the machine in a horizontal demoulding configuration;

[0018] figure 4 shows a side view of the machine of figure 3;

[0019] figure 5 shows a perspective view of the machine in a horizontal mould filling configuration;

[0020] figure 6 shows a front view of the machine in a vertical demoulding configuration;

[0021] figure 7 shows the machine in the position of figure 1, shown with some construction details;

[0022] figure 8 shows a longitudinal section view of the machine of figure 7;

[0023] figure 9 shows the machine of figure 7, in an intermediate position;

[0024] figure 10 shows a front perspective view of the crosspiece and relevant moving slides of the mould holders;

[0025] figure 11 shows the crosspiece as seen from the back, that is, from the side of connection to the machine support upright;

[0026] figure 12 shows a cutaway view of the crosspiece at the level of the slide moving means;

[0027] figure 13 shows an enlarged view of the means for locking a mould holder to the slide; and

[0028] figure 14 shows a section view of the slide and of the mould holder at the level of said locking means.

[0029] With reference to the figures, reference numeral 10 globally indicates a pressure die casting machine according to the invention, in particular for manufacturing ceramic products, such as sanitary articles. In figures 1-6, the machine is shown for higher clarity in its essential elements, leaving aside some construction details shown in the following figures.

[0030] Machine 10 comprises a base 12 from which a support upright 14 extends in substantially vertical direction.

[0031] In the proximity of the upper end thereof, upright 14 carries a crosspiece 16. The latter is capable of rotating about a substantially horizontal axis X. For example, crosspiece 16 is connected to upright 14 through a fifth wheel 18 (figures 8, 11). Fifth wheel 18 is actuable in rotation by a motor 181 associated to upright 14.

[0032] In accordance with an embodiment, crosspiece 16 is capable of rotating by at least 90° between a substantially horizontal position and a substantially vertical position.

[0033] Crosspiece 16 in turn supports a pair of slides 20, arranged in parallel and facing each other. The slides overhang from crosspiece 16, substantially in a direction parallel to the axis of rotation X of the crosspiece. Each slide 20 is fixed to a mould holder 22. Each mould holder 22 serves as support for at least one respective half mould (not shown) which, placed in contact with the other half mould, as a whole forms a mould for the ware.

[0034] At least one slide 20 can shift along crosspiece 16 along an axis Y substantially orthogonal to the axis of rotation X of the crosspiece, so that the two half moulds are mobile between a relative removal position, suitable for the shakeout and drawing of the cast piece, and a relative contact position, wherein the machine is closed for casting and emptying the mould.

[0035] In accordance with an advantageous embodiment, both slides 20 are mobile for reciprocally approaching and separating along axis Y. In particular, according to a preferred embodiment, slides 20 are connected to a common movement system 24 which allows the concurrent shifting of the slides. For example (figure 12), said movement system 24 comprises a worm screw 241 actuable in rotation by a motor 242. A half 241' of said worm screw 241 exhibits a thread in one direction; the other half 241" exhibits a thread with an opposite direction. A slide 20 is associated to a half of screw 241; the other slide to the other half of the screw. Therefore, actuating the worm screw in one direction causes the shifting of slides 20 in directions opposite to each other. Slides 20 slide on roller recirculation runner system 243.

[0036] In accordance with an embodiment, each mould holder 22 is fixed to the respective slide 20 in adjustable manner. In other words, there are provided means 26 for locking the mould holders 22 to the respective slides 20 suitable for allowing a locking of the mould holder 22 in an angular position about axis Y particularly useful for facilitating the mould emptying (see for example Figure 2).

[0037] In accordance with an embodiment (figures 13, 14), said locking means comprise a plurality of holes 261 obtained in each slide along at least two opposite circumference arcs. Each mould holder 22 can therefore be fixed to the slide by fixing screws that screw in at least two holes 261 diametrically opposite and selectable on the basis of the angular position or inclination to be imparted to mould holders 22.

[0038] According to an embodiment, each mould holder 22 is further supported by the respective slide 20 through an axial pin 262. The latter comprises a head 263 that engages the mould holder 22 in the direction of coupling with slide 20, and a distal end 264 that inserts in a through axial opening 265 obtained in slide 20. Said distal end 264 protrudes from the external side of slide 20 and is engaged by a sector locking member 266. Such sector locking member 266 also constitutes a safety device that constrains mould holder 22 to the respective slide 20, in any inclination they are, even if the locking screws have not been screwed yet.

[0039] Figures 7 to 12 show the casting machine enriched with some construction details thereof. For example said figures show containment and conveying members of the ducts for feeding/discharging the casting material and of the auxiliary circuits, such as for compressed air, water, vacuum, etc. For example, such ducts rise through the support upright 14, pass in crosspiece 16 through an axial opening 183 of fifth wheel 18, and come out at the top from said crosspiece 16 through openings

162. Hence, the slave ducts of a half mould are conveyed to the respective mould holder 22 through a respective chain 30 mounted on crosspiece 16 and a respective raceway 32 that connects the end of such chain to slide 20.

[0040] It should be noted that mould holders 22 may be of the type suitable for receiving equipment 34 for quick mould change according to the disclosure of a previous European patent application no. 05425722.5.

[0041] The pressure die casting machine according to the invention has such versatility as to be usable in different ways according, for example, to the article to be cast.

[0042] For example, in the case of articles that exhibit a prevailing extension in a plane, it is advantageous to orientate crosspiece 16 in a substantially horizontal position so as to position the mould in vertical position (figures 1 and 2). Vertical mould means that the two half moulds close to form the mould along a substantially vertical contact plane. As explained before, this facilitates the filling and emptying of the mould for this type of articles. Once these two operations have been carried out, the crosspiece can be rotated in vertical position to facilitate the operations of demoulding and drawing of the cast piece (figure 3). As an alternative, these operations can be carried out also with the mould in vertical position (figure 6).

[0043] On the other hand, for other types of articles it may be advantageous to carry out the mould filling in horizontal position (figure 5), that is, with the crosspiece in vertical position. In this case, the contact plane between the two half moulds is a horizontal plane. The mould emptying can bet carried out, according to the needs, keeping the mould in horizontal position (or with a slight inclination) or rotating it by 90° in vertical position (figure 1).

[0044] The next steps of demoulding and drawing of the cast article can take place, as in the previous cases, keeping the mould in vertical emptying position or returning the mould to the horizontal position.

[0045] It should be noted that when the mould holders are open and in horizontal position (figure 3), the mould can be carried in the proximity of the lower mould holder, for example by a lift truck, and easily mounted on such mould holder. To this end, base 12 of the machine can be advantageously suitable for being buried in the floor so as to facilitate the approach of the lift truck to the lower mould holder as much as possible.

[0046] Thanks to the use of the worm screw movement system half right and half left, when the machine is in position of vertical crosspiece and the mould holders are spaced from one another, the lowering of the upper mould holder, aided by the force of gravity, contributes to facilitating the lifting of the lower mould holder.

[0047] It is therefore clear that the same pressure die casting machine described can be used for manufacturing any type of product, both in terms of geometry and of complexity.

[0048] It is evident that a man skilled in the art may make several changes and adjustments to the pressure die casting machine according to the present invention in order to meet specific and incidental needs, all falling within the scope of protection of the invention as defined in the following claims.

Claims

1. Pressure die casting machine, in particular for manufacturing ceramic products, for example sanitary articles, comprising two mould holders (22) suitable for receiving each a respective half mould, wherein said mould holders are connected to respective support means (20), wherein at least the support means of a mould holder are movable relative to the support means of the other mould holder between a relative separation position, suitable for the demoulding and drawing of the cast piece, and a relative approach position, wherein the two half moulds are closed along a contact plane for casting and mould emptying, **characterised in that** said support means (20) are in turn connected to orientation means (16, 18) suitable for orienting said support means (20) so as to make said contact plane between the two half moulds turnable by at least 90° between a substantially vertical position and a substantially horizontal position.

2. Machine according to claim 1, wherein said support means (20) are mounted on a crosspiece (16) turnably supported by a support upright (14).

3. Machine according to claim 2, wherein the crosspiece is turnable about a substantially horizontal axis (X).

4. Machine according to claim 3, wherein the crosspiece is connected to the support upright by a fifth wheel (18).

5. Machine according to any one of claims 2-4, wherein said support means (20) comprise a pair of slides (20) facing and parallel to each other that extend overhanging from the crosspiece (16).

6. Machine according to claim 5, wherein at least one slide (20) can shift along the slide (16) along an axis (Y) substantially orthogonal to the axis (X) of rotation of the crosspiece (16).

7. Machine according to claim 6, wherein both slides (20) are mobile for approaching and separating reciprocally.

8. Machine according to claim 7, wherein the slides (20) are connected to a common movement system (24)

that allows the concurrent shifting of the slides.

9. Machine according to claim 8, wherein said movement system (24) comprises a worm screw (241) actuable in rotation by a motor (242), a half (241') of said worm with a thread in one direction, the other half (241") with a thread in an opposite direction, each slide (20) being associated to a respective half of the screw.

10. Machine according to any one of claims 6 to 9, wherein the slides (20) slide on a roller recirculation runner system (242) associated to the crosspiece (16).

11. Machine according to any one of the previous claims, wherein each mould holder (22) is fixed to the respective support means (20) through locking means (26) suitable for allowing a locking of the mould holder (22) in one between a plurality of angular positions in the contact plane.

12. Machine according to claim 11, wherein said locking means comprise a plurality of holes (261) obtained in each slide (20) along at least two opposite circumference arcs, each mould holder (22) being connectable to the slide by fixing screws that screw in at least two holes (261) diametrically opposite and selectable on the basis of the desired angular position.

13. Machine according to any one of claims 5 to 12, wherein each mould holder (22) is supported by the respective slide (20) through an axial pin (262).

14. Machine according to claim 13, wherein said axial pin (262) comprises a head (263) that engages the mould holder (22) in the direction of coupling to the slide (20), and a distal end (264) that inserts in a through distal opening (265) obtained in the slide (20), said distal end (264) being protruding from the external side of the slide (20) so as to be engageable by a sector locking member (266).

15. Machine according to any one of claims 2 to 10, wherein the support upright extends from a base suitable for being buried in the ground.

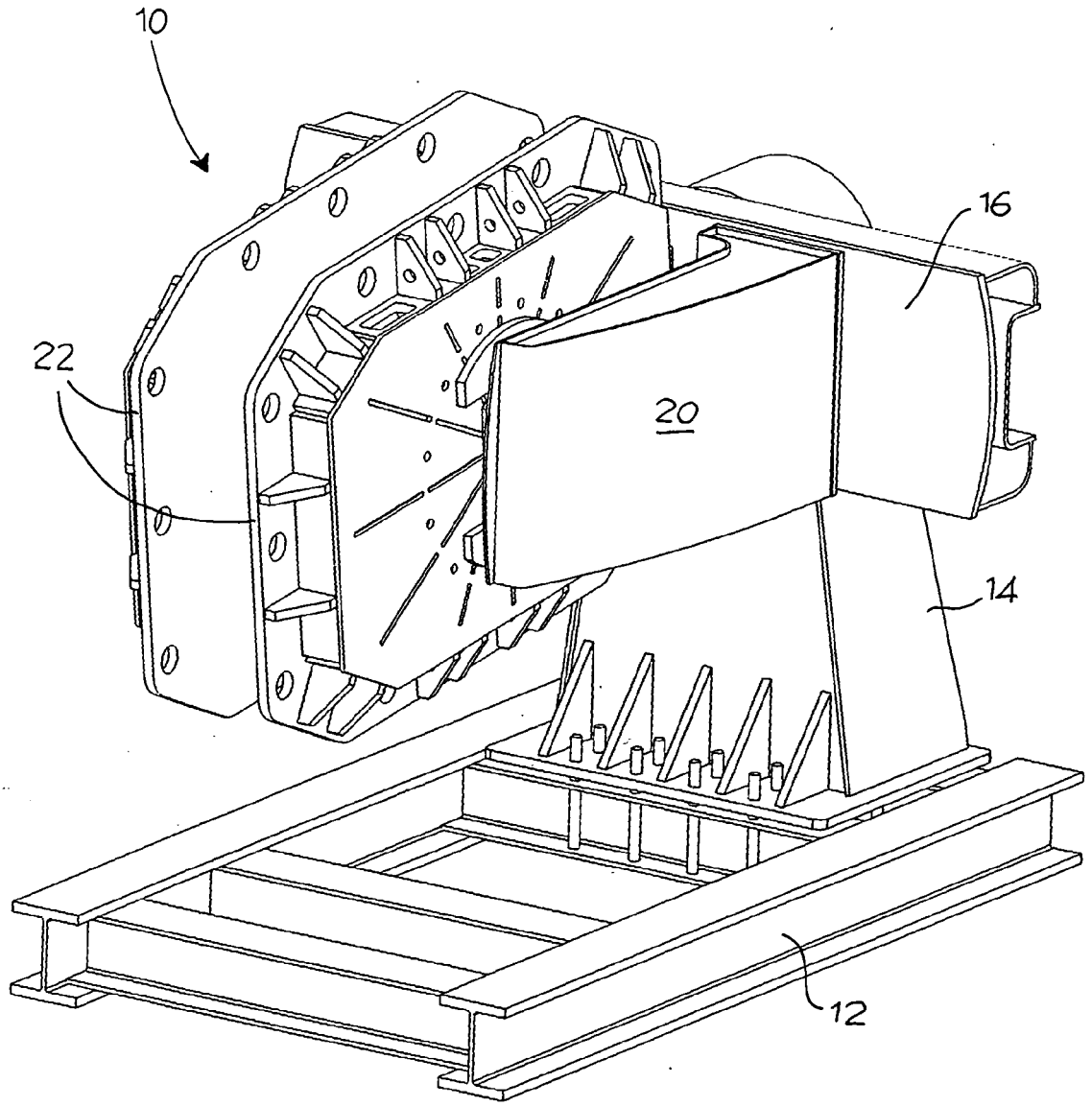


Fig.1

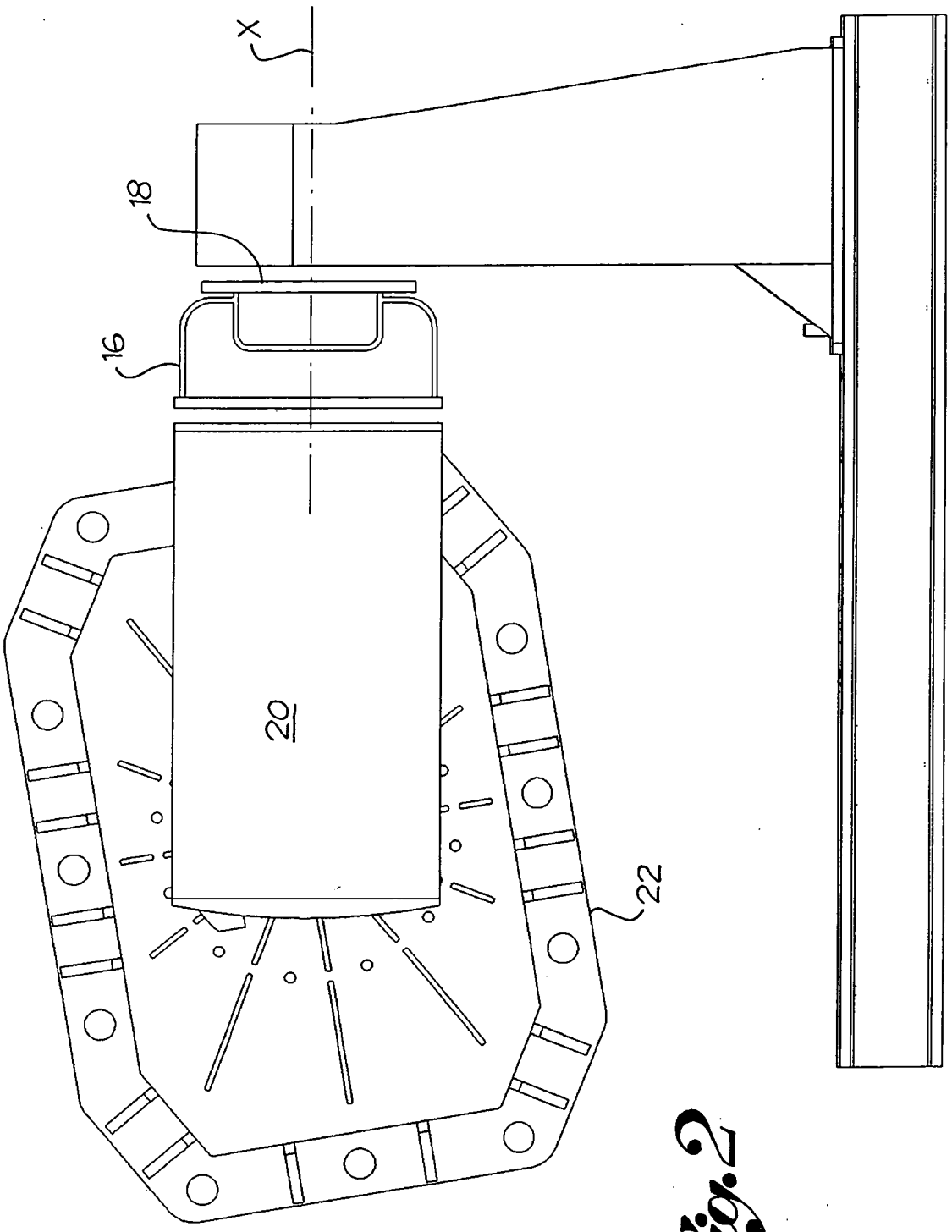


Fig.2

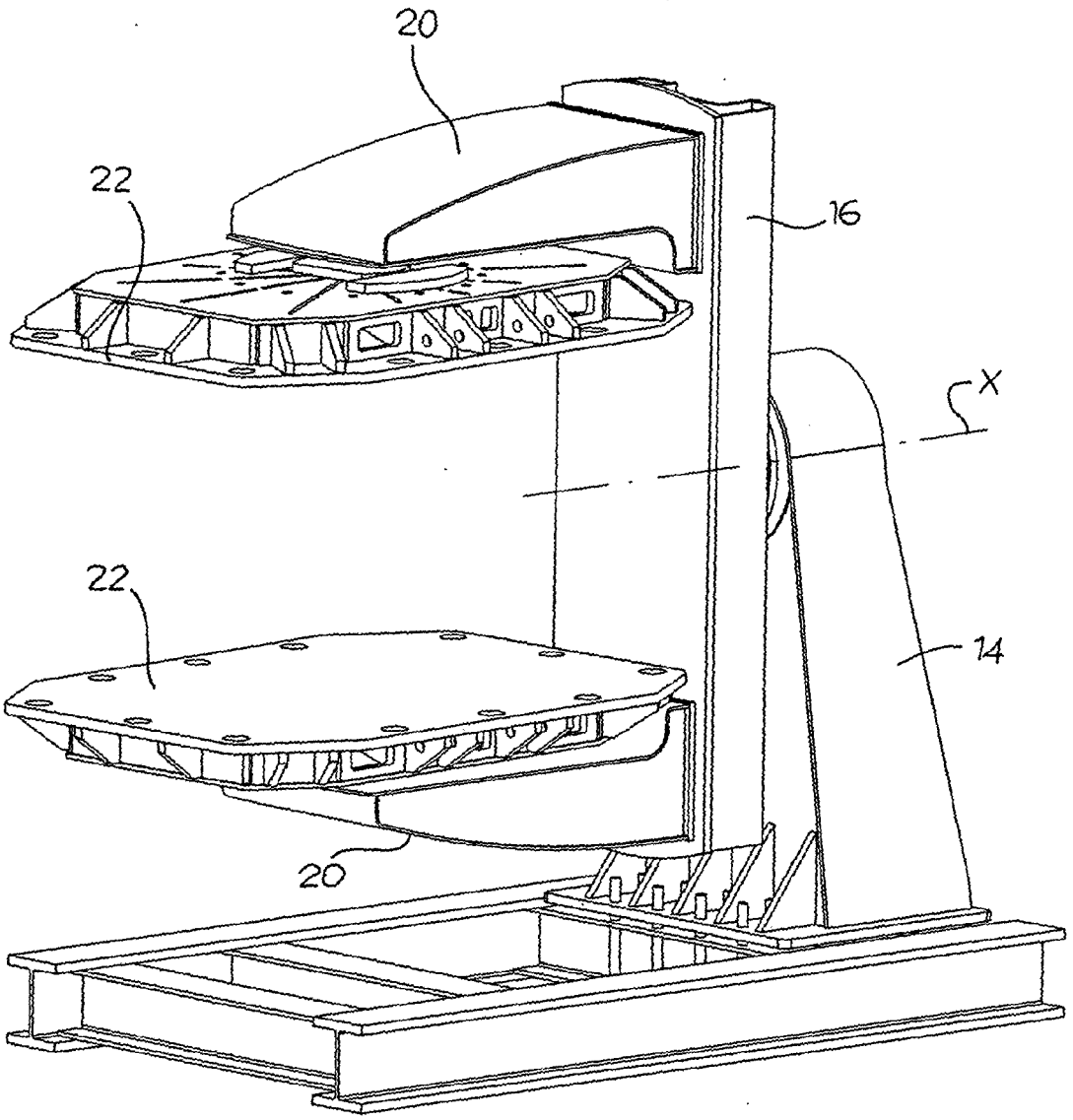


Fig.3

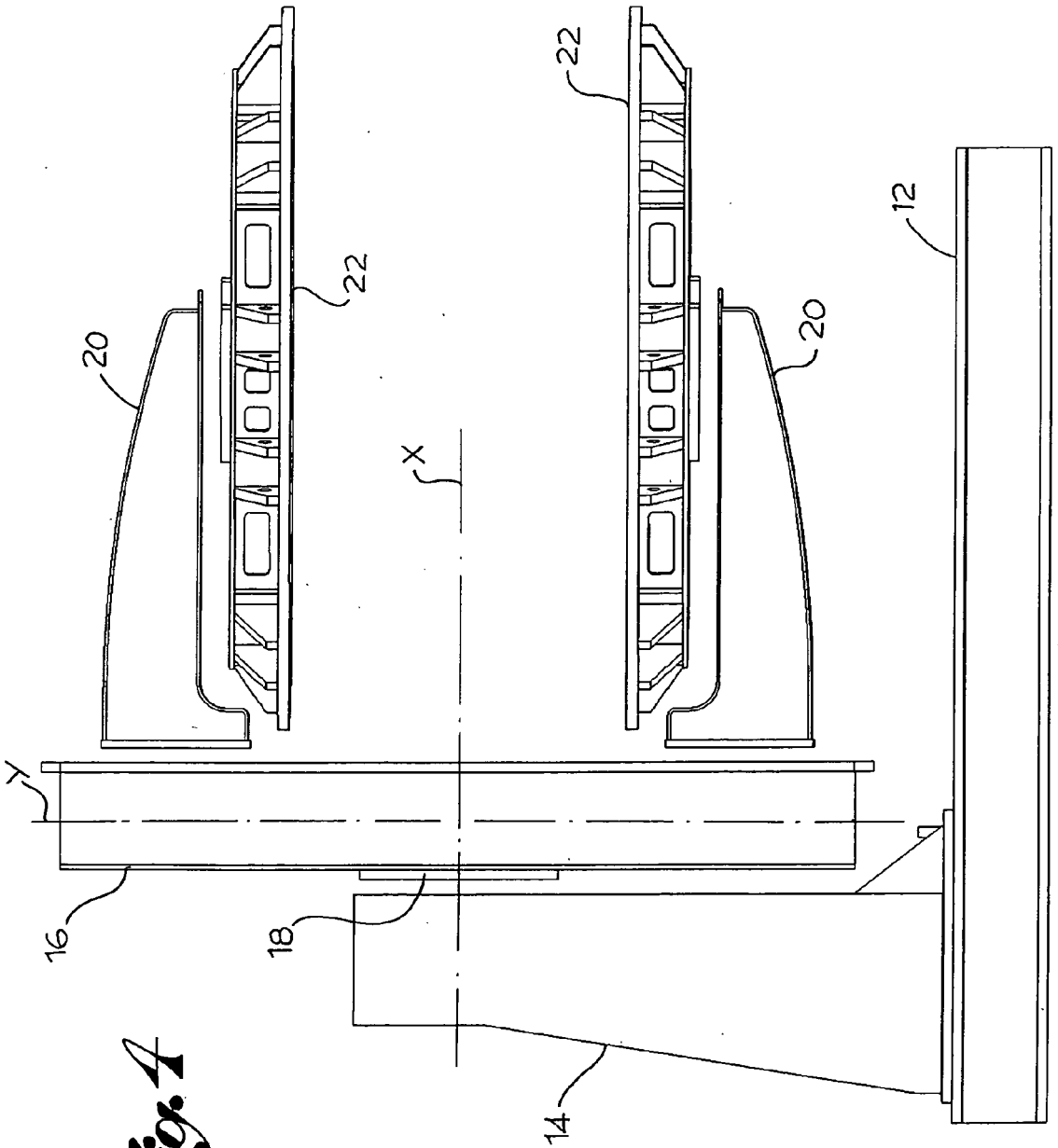


Fig. 4

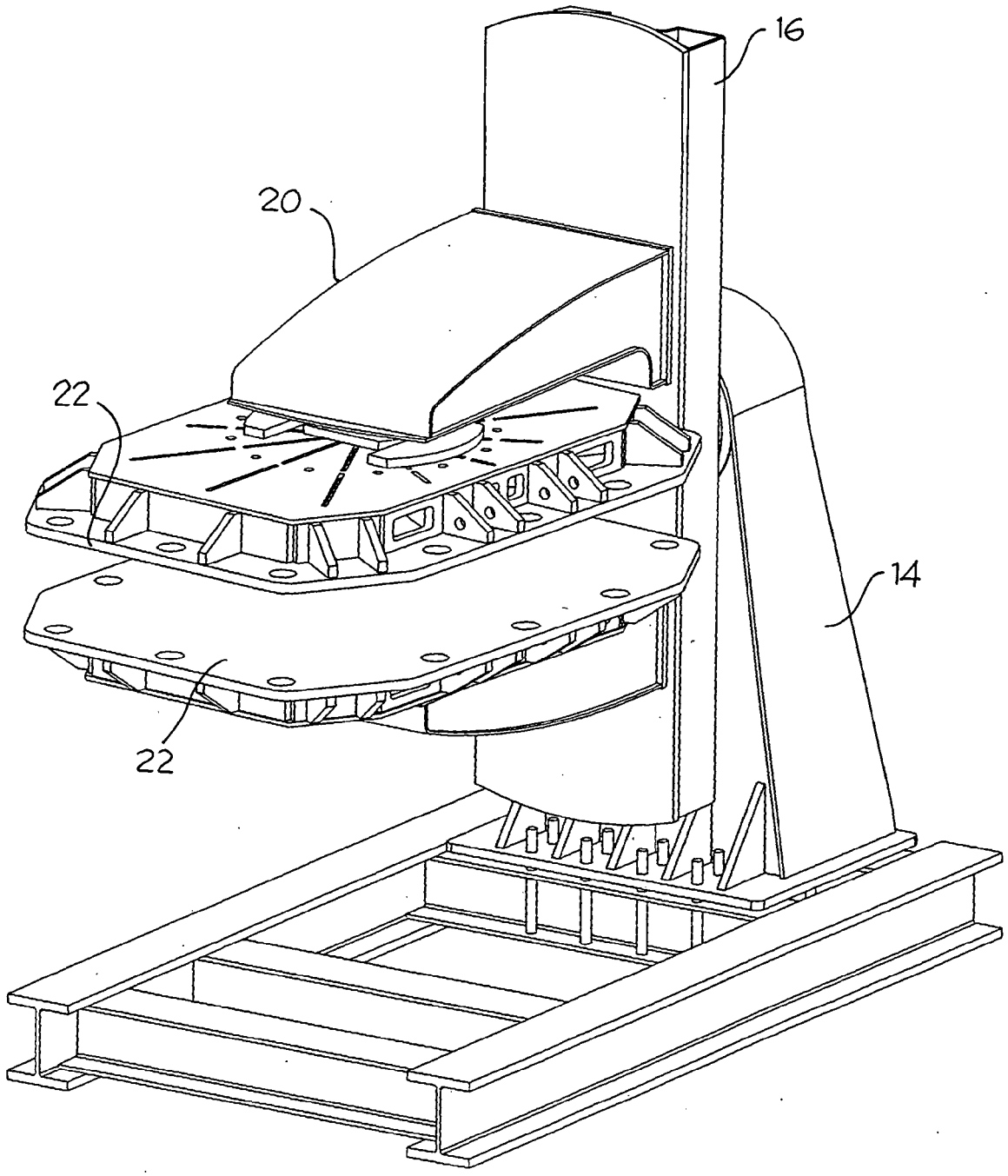


Fig. 5

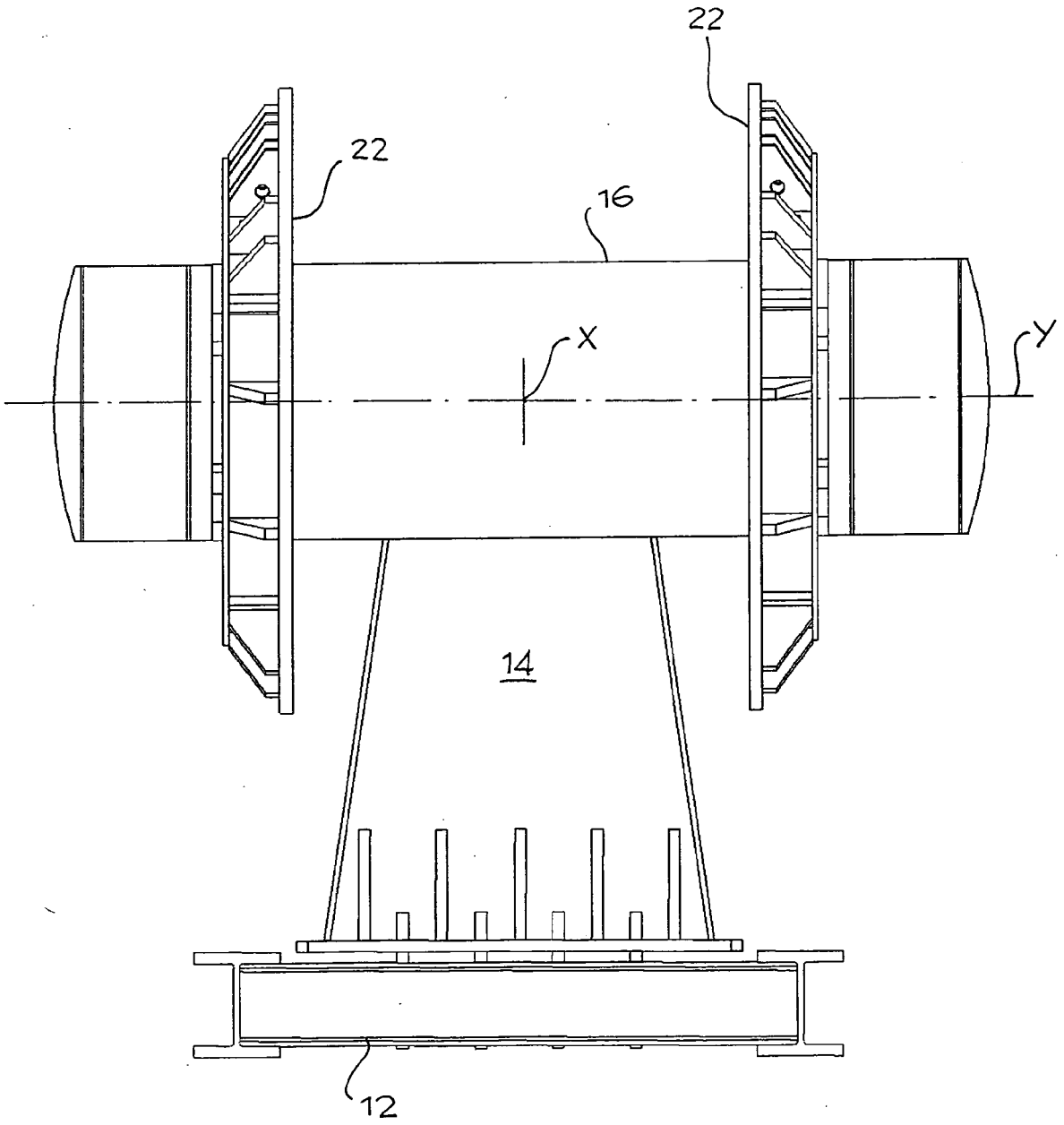


Fig.6

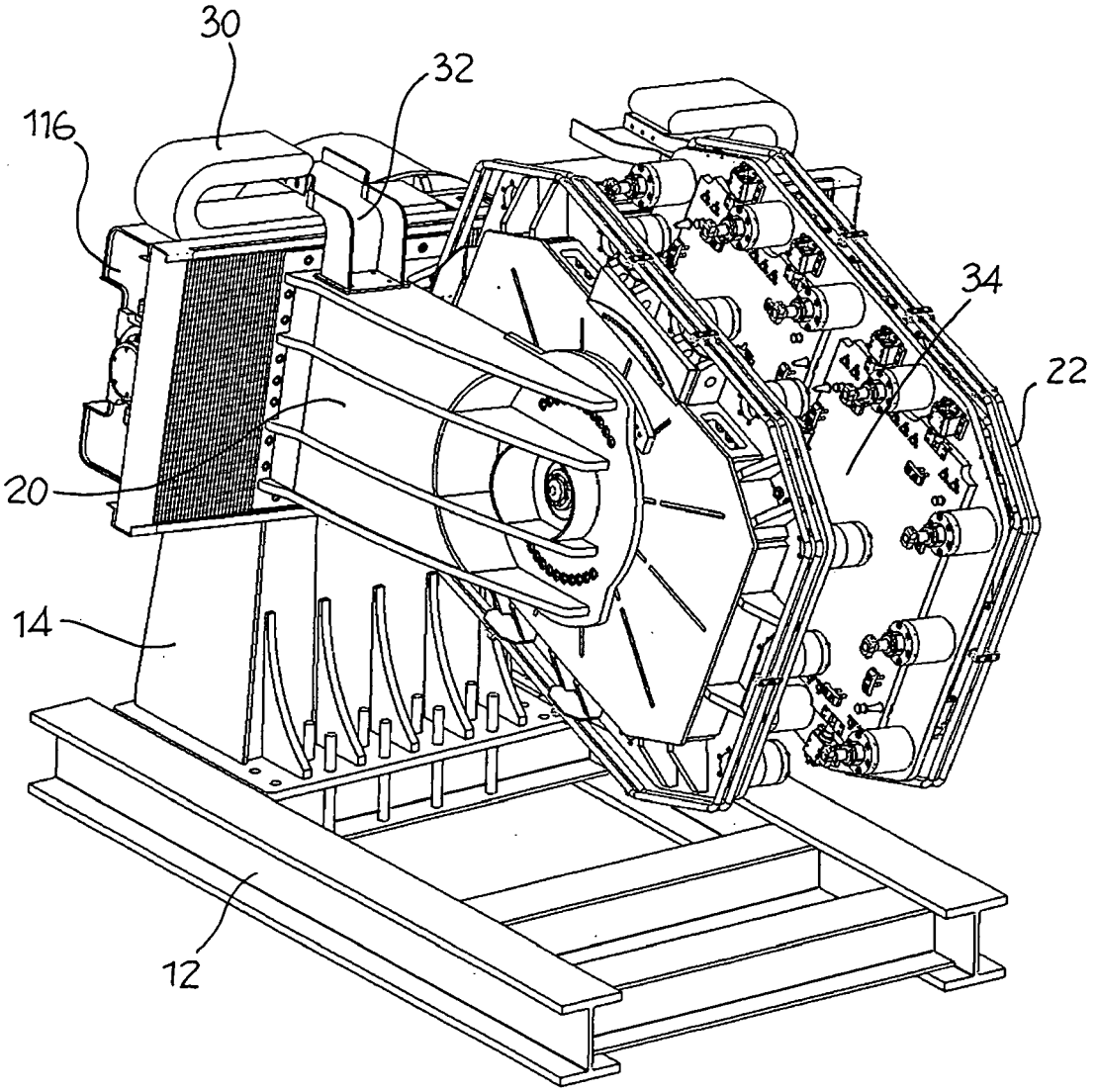


Fig.7

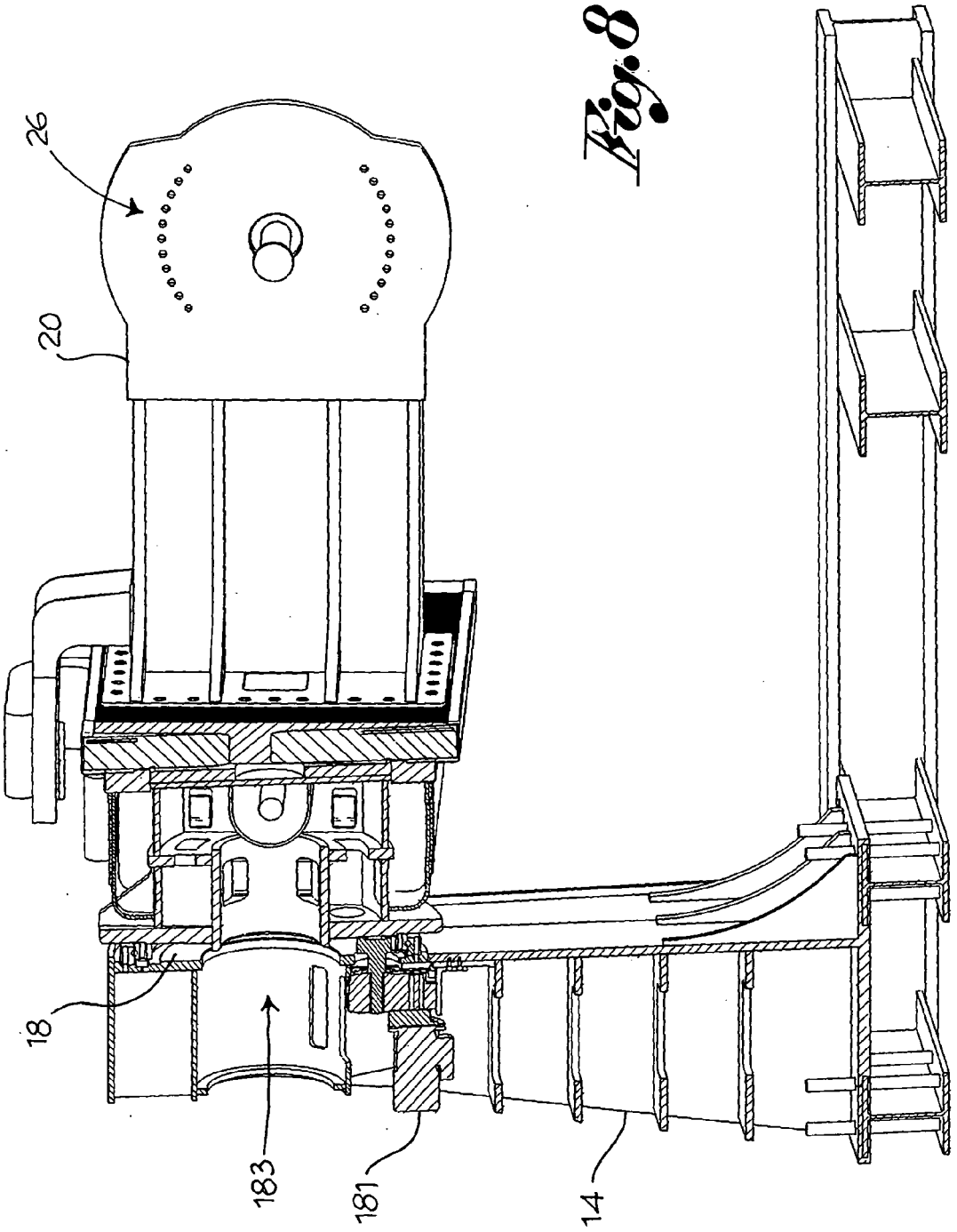


Fig. 8

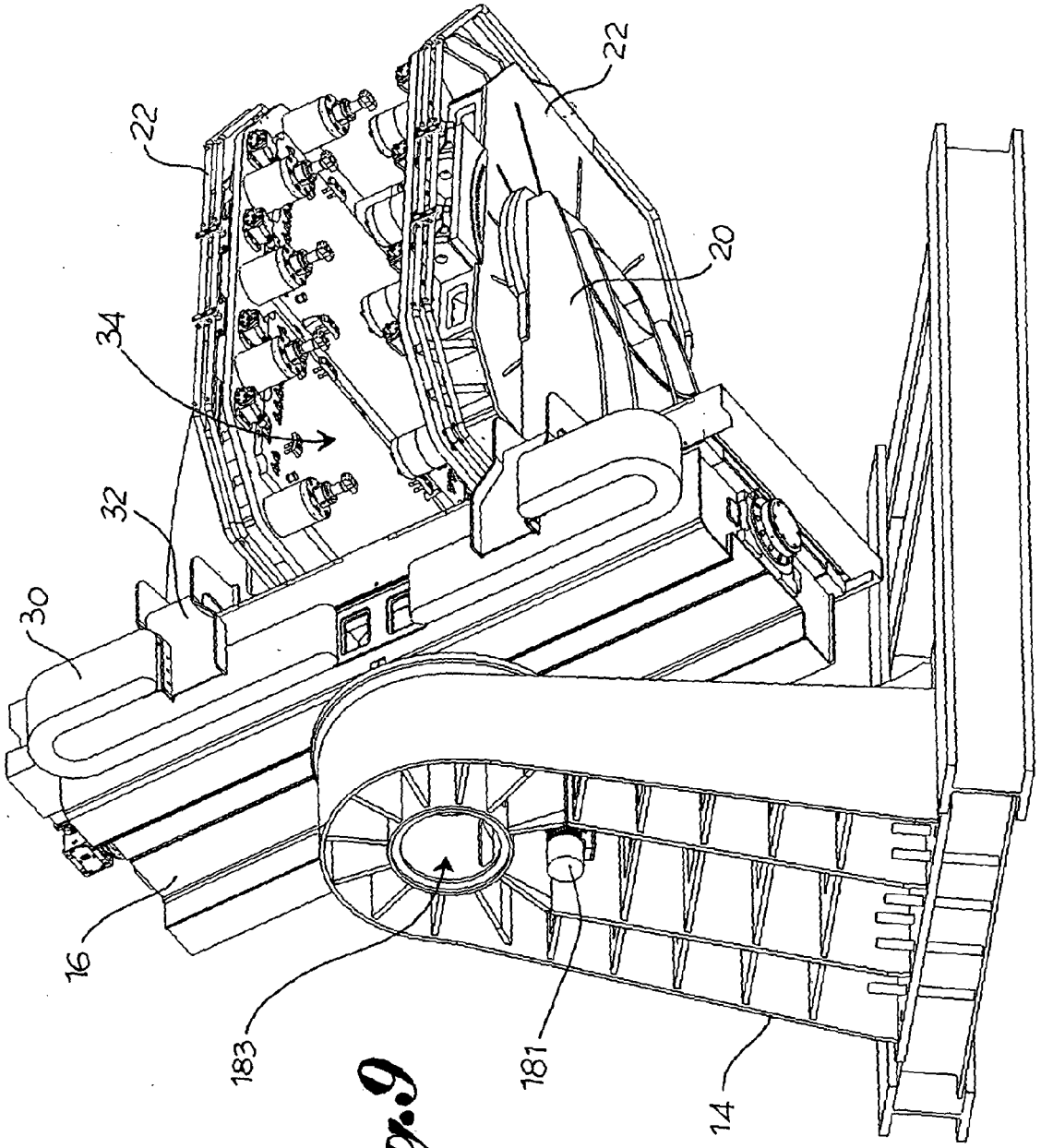


Fig.9

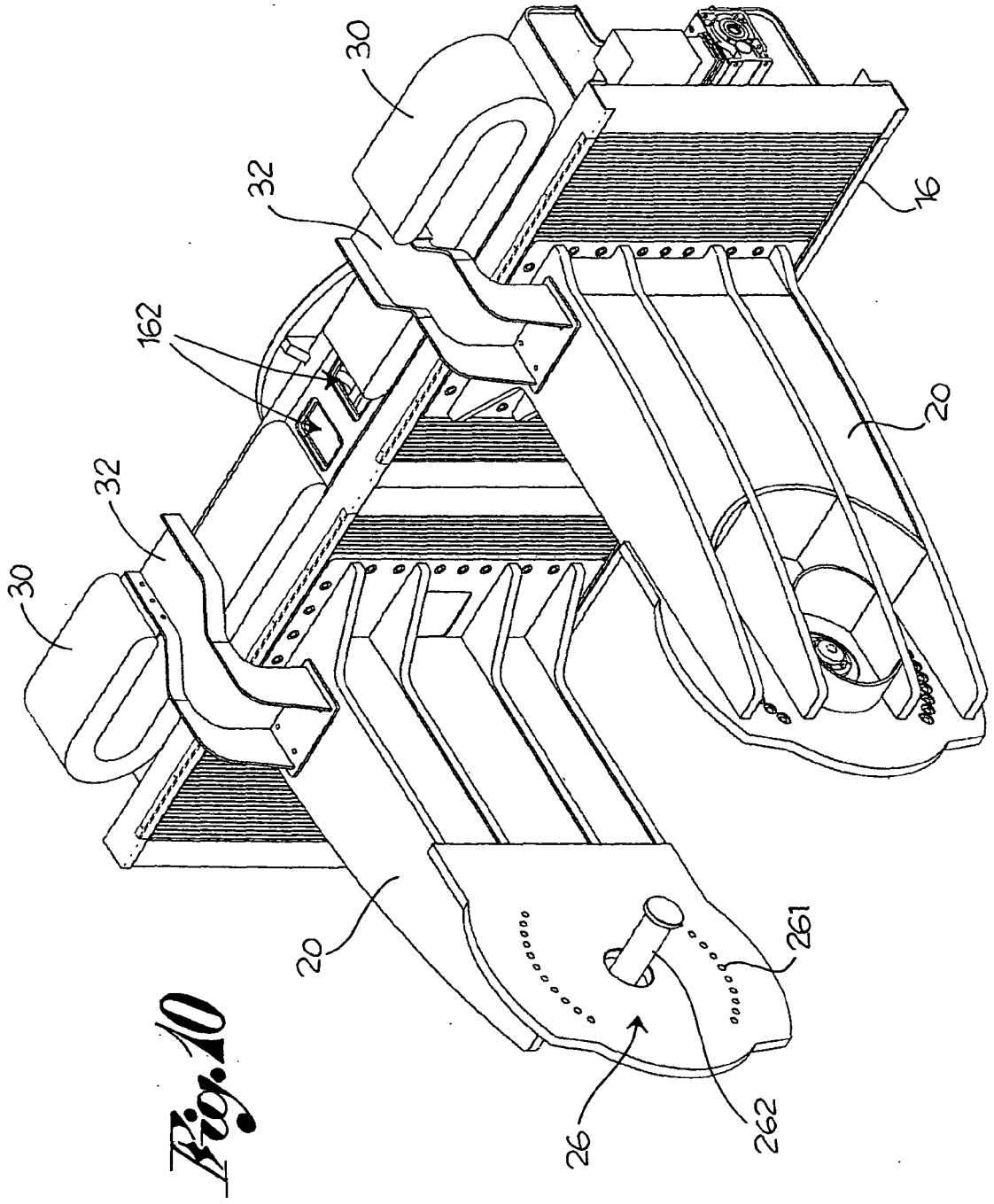


Fig.10

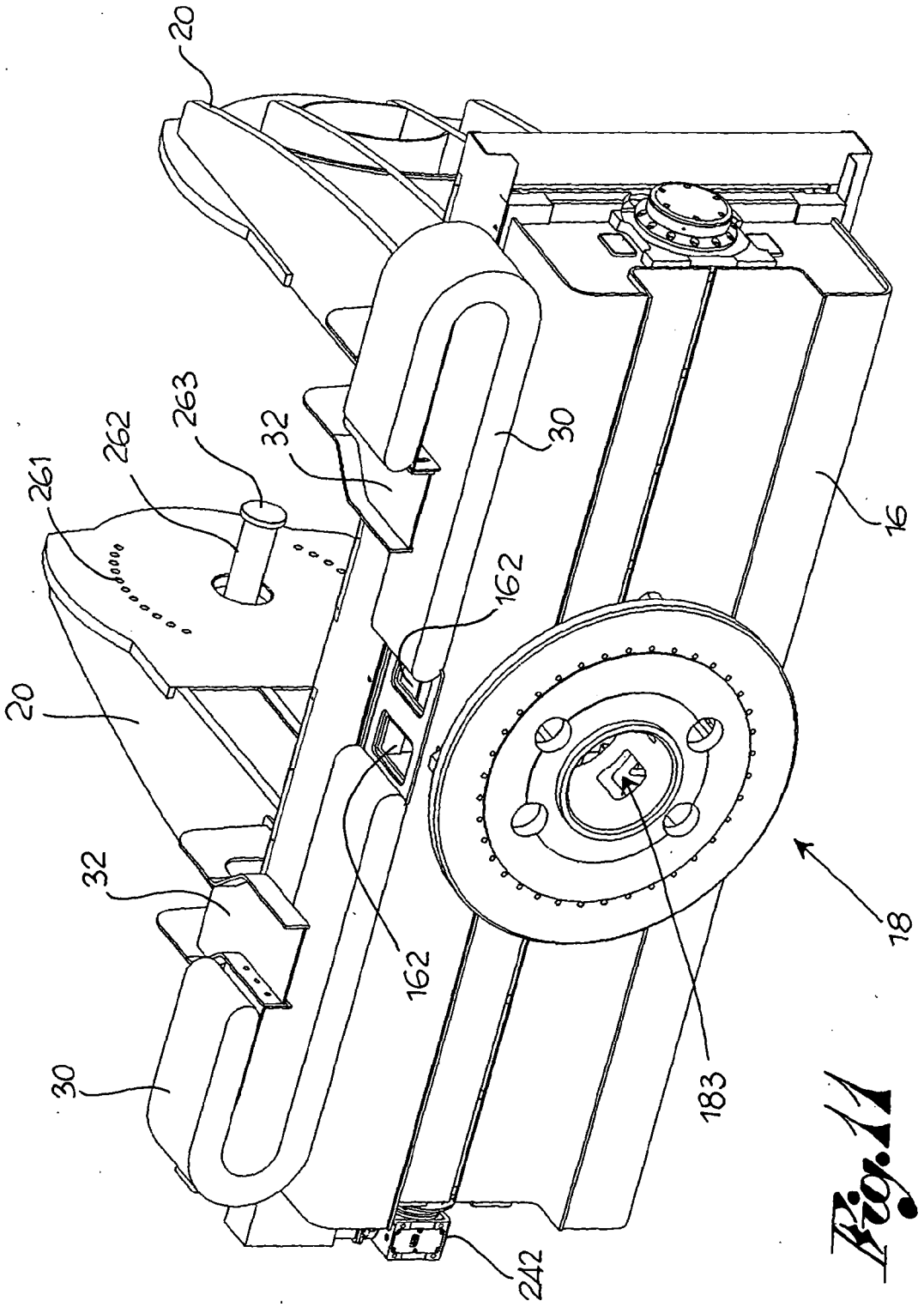
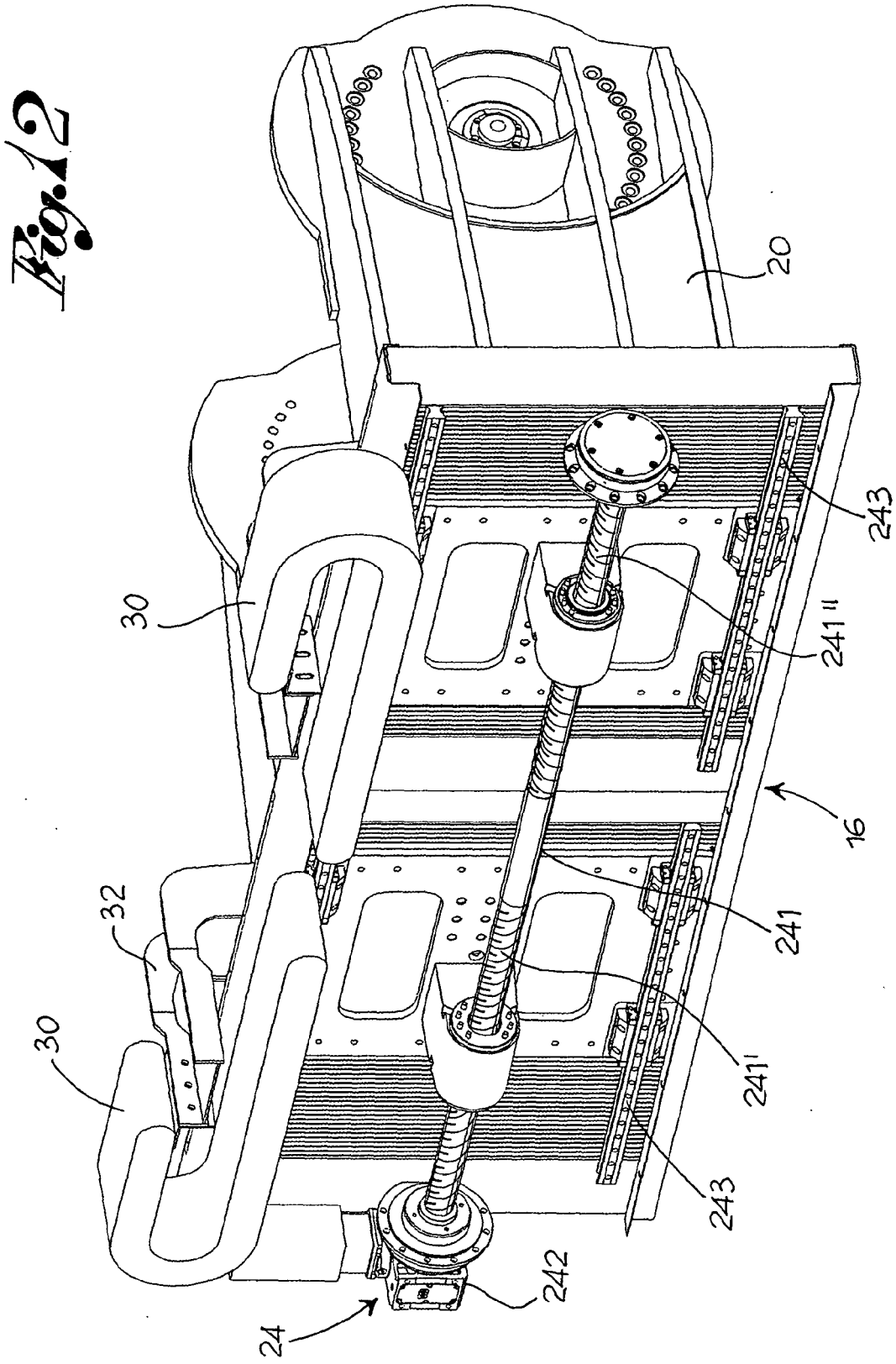


Fig.11

Fig.12



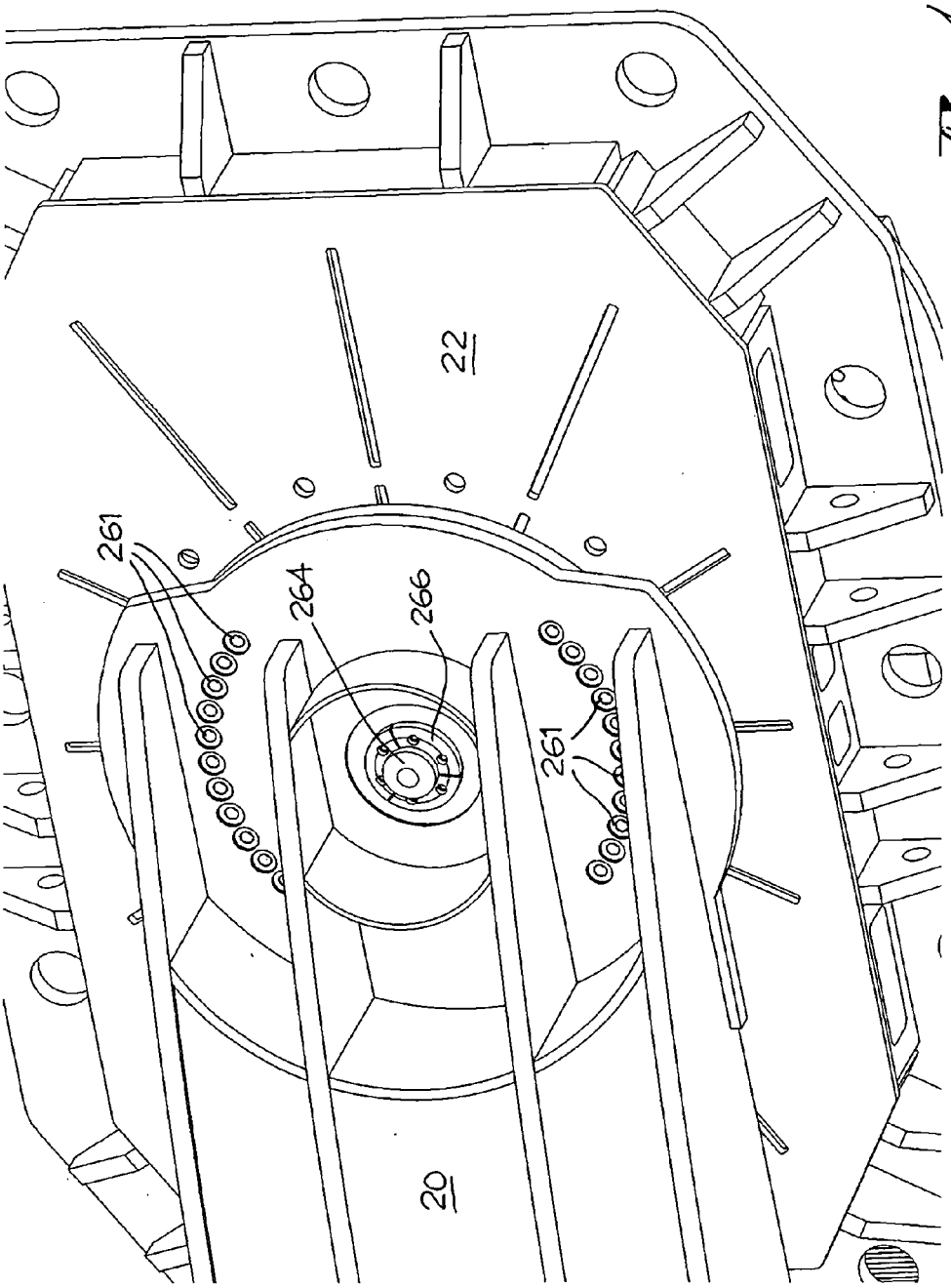


Fig.13

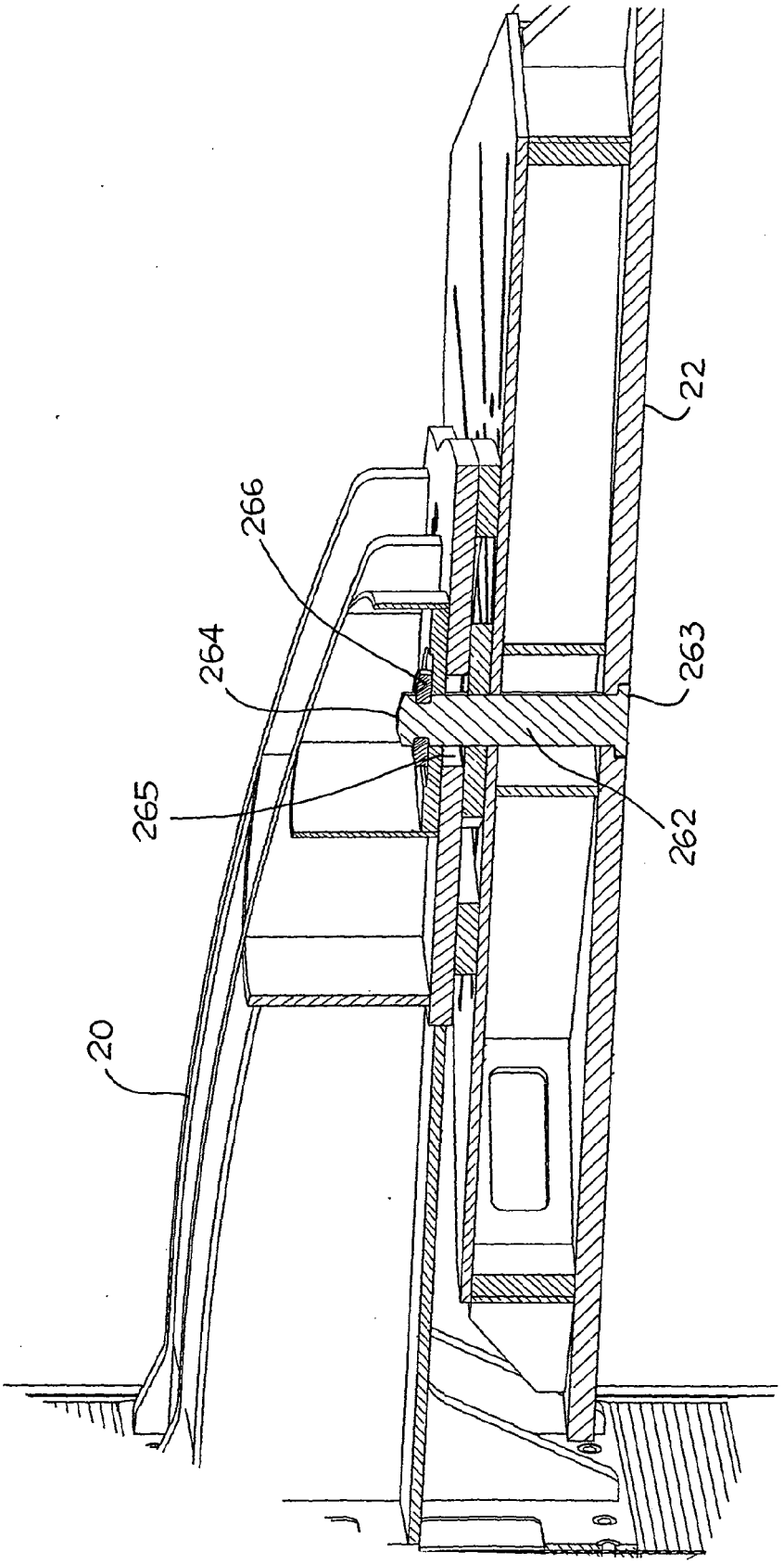


Fig.14

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 42 5085

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	US 3 856 452 A (AMADO J) 24 December 1974 (1974-12-24) * columns 2-5; figures *	1-7,10, 12,14,15 8,9,11, 13	INV. B28B1/26
Y	GB 388 267 A (CHRISTIAN BOSSAU) 23 February 1933 (1933-02-23) * columns 2-3; figures *	8,9,11, 13	
X	GB 1 231 146 A (JAMES MORRIS PALMER) 12 May 1971 (1971-05-12) * columns 2-3; figure * *	1-3	
A	US 3 799 729 A (HAGEN H) 26 March 1974 (1974-03-26) * abstract; figures *	1	

TECHNICAL FIELDS SEARCHED (IPC)

B28B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	9 August 2007	Labre, Arnaud

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 07 42 5085

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

09-08-2007

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3856452 A	24-12-1974	NONE	
GB 388267 A	23-02-1933	NONE	
GB 1231146 A	12-05-1971	NONE	
US 3799729 A	26-03-1974	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 1403022 A1 **[0009]**
- EP 05425722 A **[0040]**