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(71) Applicant: **Diesse S.R.L.**
25011 Calcinato, Fraz. Ponte San Marco (BS) (IT)

(72) Inventor: **Speziani, Francesco**
25011 CALCINATO, Fraz. PONTE SAN MARCO BS (IT)

(74) Representative: **Modiano, Micaela Nadia et al**
Modiano & Partners (IT)
Via Meravigli, 16
20123 Milano (IT)

(54) **Rotational die-casting apparatus with mold**

(57) A gravity die-casting apparatus (1) with a mold (2) comprising a shell forming machine (3) comprising a footing (4) with which at least one mold (2) is to be associated and means for feeding the molten mass at a casting intake region (2a) of the mold (2), the mold (2) having at least one mold portion (12a, 12b,...) that can move on a working surface, the mold (2) being movable with respect to the footing (4) about at least one substantially horizontal oscillation axis (100), the mold (2) being able to rotate about the oscillation axis (100) through an angular stroke of at least 180°.

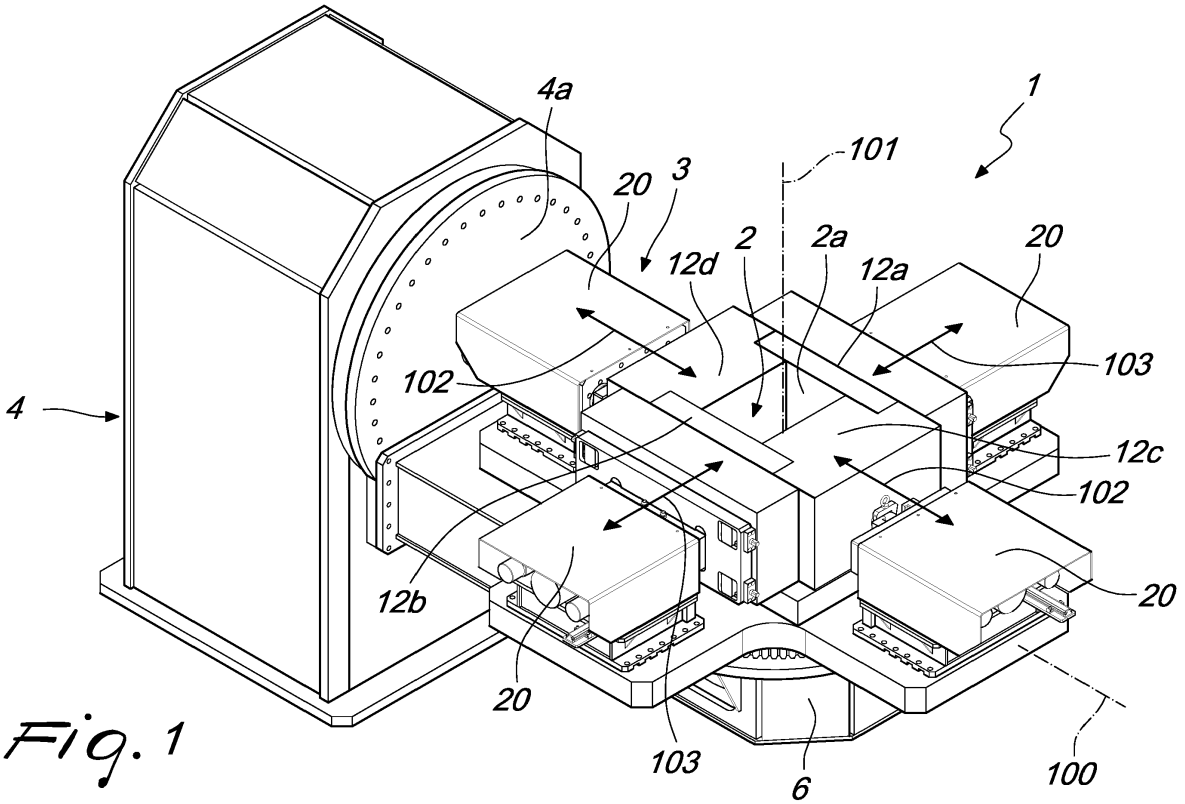

Fig. 1

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Description

[0001] The present invention relates to a gravity die-casting apparatus with mold.

[0002] Currently, one of the processes most widely used for the manufacture of metal castings is the so-called oscillating mold casting process.

[0003] Such process is performed by an apparatus that comprises a shell forming machine that has a device for opening/closing two mold parts and allows the oscillation, during casting, by gravity, of the shell about one or more horizontal axes.

[0004] Mold oscillation is performed in order to ensure optimum quality of the casting.

[0005] In particular, oscillating the mold avoids the formation of turbulence that might cause the embedding of air bubbles in the molten mass.

[0006] The casting of the molten mass within the mold can be performed manually by an operator who pours a certain quantity of molten mass into a feeder opening, defined by the mold, or by a robot.

[0007] In any case, the entry of the molten mass into the mold at the feeder opening must occur with a certain orientation.

[0008] Since the placement of the feeder robots is often determined by the overall layout of the apparatus, it is often necessary, when the mold is associated with the shell forming machine, to study its orientation as a function of the position of the feeder robot, acting on the mold movement means.

[0009] In some cases this entails long times for the setup of the system.

[0010] The aim of the present invention is to provide an apparatus that can eliminate the drawbacks noted above.

[0011] Within this aim, an object of the present invention is to provide an apparatus that is extremely flexible in its use.

[0012] This aim, as well as these and other objects that will become better apparent hereinafter, are achieved by an apparatus according to the provisions of claim 1.

[0013] Further characteristics and advantages of the invention will become better apparent from the description of some preferred but not exclusive embodiments of an apparatus according to the present invention, illustrated by way of nonlimiting example in the accompanying drawings, wherein:

Figure 1 is a perspective view of an apparatus according to the invention with the shelf on a horizontal plane;

Figure 2 is again a perspective view of an apparatus with the shelf on a vertical plane;

Figure 3 is a top view of the apparatus;

Figure 4 is a front view of the apparatus;

Figure 5 is a side elevation view of the apparatus;

Figure 6 is a perspective view of a constructive variation of the apparatus;

Figure 7 is a side elevation view of the variation of the apparatus shown in Figure 6;

Figures 8 to 10 are perspective views of the various steps of use of the apparatus shown in Figures 6 and 7.

[0014] In the examples of embodiment that follow, individual characteristics, given in relation to specific examples, may actually be interchanged with other different characteristics that exist in other examples of embodiment.

[0015] With reference to the figures, the present invention relates to an apparatus, generally designated by the reference numeral 1, for gravity die-casting in a mold.

[0016] The apparatus 1 comprises a shell forming machine 3, which comprises a footing 4 with which at least one mold 2 is to be associated.

[0017] The apparatus 1 further comprises means for feeding the molten mass at a casting intake region 2a of the mold 2.

[0018] The mold 2 has at least one mold portion 12a, 12b,... that can move on a working surface.

[0019] The mold 2 can move with respect to the footing 4 about at least one substantially horizontal oscillation axis 100.

[0020] In particular, the mold 2 can move on command with respect to the footing 4 about the oscillation axis 100 during the operations for casting the molten mass into the mold 2.

[0021] According to a first aspect of the present invention, the mold 2 can rotate about the oscillation axis 100 through an angular stroke at least equal to 180°.

[0022] Advantageously, the mold 2 can rotate about the oscillation axis 100 through an angular stroke at least equal to 270°.

[0023] With reference to the embodiment shown in Figures 6 to 10, the mold 2 can rotate about the oscillation axis 100 through 360° in both directions of rotation.

[0024] Preferably, the means for feeding the molten mass at a casting intake region 2a of the mold 2 are adapted to allow such feeding when the casting intake region 2a is at least partially directed downwardly.

[0025] According to a further aspect of the present invention, the mold 2 can rotate about a rotation axis 101 that is substantially perpendicular to the working surface.

[0026] Advantageously, the rotation axis 101 is substantially perpendicular to the intake region 2a.

[0027] According to a preferred embodiment, the footing 4 supports a shelf-like body 6 for supporting the mold 2.

[0028] With reference to this embodiment, the shelf-like body 6 is supported by the footing 4 so that it can rotate about the oscillation axis 100.

[0029] Conveniently, the mold 2 is supported by the shelf-like body 6 so that it can rotate about the rotation axis 101.

[0030] Advantageously, the shelf-like body 6 can be moved on command with respect to said footing 4 along

a movement direction 104 that is substantially parallel to the rotation axis 101.

[0031] Substantially in a manner similar to known solutions, the apparatus 1 comprises mold closing and locking means 20, which are adapted to move respective portions 12b, 12c, ... of the mold 2 along respective opening/closing directions 102, 103 that lie on the working surface.

[0032] The oscillation of the mold 2 about the oscillation axis 100 can be obtained by way of first motor means intended to move a center bearing body 4a that is supported rotatably by the footing 4 and, in turn, supports the shelf-like body 6.

[0033] The rotation of the mold 2 about the rotation axis 101 can instead be actuated by second motor means, supported advantageously by the shelf-like body 6, the output shaft of which is connected to a pinion that engages a gear 6a that is integral with the resting surface of the mold 2.

[0034] With reference to the embodiment shown in Figures 6 to 10, the means for feeding the molten mass at the casting intake region 2a of the mold 2 comprise at least one hand ladle 30, into which the molten mass is to be poured and means for transferring the molten mass from the hand ladle 30 toward the intake region 2a.

[0035] Preferably, the means for transferring the molten mass from the hand ladle 30 toward the intake region 2a act when the intake region 2a is directed downwardly.

[0036] The molten mass is fed to the hand ladle 30 with the free rim 30a of the hand ladle 30 directed upwardly.

[0037] The hand ladle 30 is adapted to pass on command between a feeding condition, in which it is spaced from the intake region 2a, and a condition for coupling to the intake region 2a, in which its free rim 30a is hermetically adjacent to the peripheral rim of the intake region 2a.

[0038] The transfer of the molten mass from the hand ladle 30 to the mold 2 is performed by rotating the mold 2 and the hand ladle 30 about the oscillation axis 100.

[0039] For this reason, means are provided for coupling rotationally the hand ladle 30 to the mold 2 at least during the step for transfer of the molten mass from the hand ladle 30 to the mold 2.

[0040] The hand ladle 30 is supported by an elongated element 31, which in turn is supported by the center bearing body 4a.

[0041] Conveniently, the elongated element 31 can rotate on command with respect to the center bearing body 4a about a first axis 106 that lies on a plane that is tangent to the oscillation axis 100.

[0042] The elongated element 31 furthermore can rotate with respect to the center bearing body 4a about a pivoting axis that is diametrical to the oscillation axis 100.

[0043] The hand ladle 30 can rotate about a positioning axis 105 that is arranged substantially at right angles to the first axis 106 and/or to the oscillation axis 100.

[0044] The positioning axis 105 is extended conveniently substantially parallel to the movement direction 104.

[0045] The rotation of the hand ladle 30 about the positioning axis 105 allows to place the hand ladle 30 outside the footprint, allowing the assembly and disassembly of the mold 2 and the corresponding maintenance operations.

[0046] The movement of the hand ladle 30 about the first axis 106 instead allows to perform operations of a different type on the hand ladle 30.

[0047] Conveniently, the hand ladle 30 furthermore can move longitudinally parallel to the positioning axis 105 in order to allow its approach and spacing with respect to the mold 2.

[0048] Use of an apparatus according to the invention is evident from what has been described above.

[0049] In particular, thanks to the possibility to rotate the mold 2 and the corresponding intake region 2a about the rotation axis 101 it is possible to orient very rapidly and effectively the mold 2 in order to make the molten mass casting operations efficient.

[0050] During casting, the mold 2 is therefore oscillated about the oscillation axis 100.

[0051] All the characteristics of the invention indicated above as advantageous, convenient and the like may also be omitted or be replaced with equivalents.

[0052] The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims.

[0053] In practice it has been found that the invention has achieved the intended aim and objects in all of the embodiments.

[0054] In practice, the materials used, as well as the contingent shapes and dimensions, may be any according to requirements.

[0055] All the details may further be replaced with other technically equivalent elements.

[0056] The disclosures in Italian Patent Application No. VR2014A000106 from which this application claims priority are incorporated herein by reference.

[0057] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A gravity die-casting apparatus (1) with a mold (2) comprising a shell forming machine (3) comprising a footing (4) with which at least one mold (2) is to be associated and means for feeding the molten mass at a casting intake region (2a) of said mold (2), said mold (2) having at least one mold portion (12a, 12b,...) that can move on a working surface, said mold (2) being movable with respect to said footing

(4) about at least one substantially horizontal oscillation axis (100), **characterized in that** said mold (2) can rotate about said oscillation axis (100) through an angular stroke of at least 180°.

2. The gravity die-casting apps (1) according to claim 1, **characterized in that** said mold (2) can rotate about said oscillation axis (100) through an angular stroke of at least 270°.

3. The gravity die-casting apparatus (1) according to one or more of the preceding claims, **characterized in that** said mold (2) can rotate about said oscillation axis (100) through 360° in both directions of rotation.

4. The gravity die-casting apparatus (1) according to one or more of the preceding claims, **characterized in that** said means for feeding the molten mass at said intake region (2a) are adapted to allow said feeding when said intake region (2a) is at least partially directed downwardly.

5. The gravity die-casting apparatus (1) according to one or more of the preceding claims, **characterized in that** said mold (2) can rotate about a rotation axis (101) that is substantially perpendicular to said working surface.

6. The apparatus (1) according to claim 1, **characterized in that** said rotation axis is substantially perpendicular to said intake region (2a).

7. The apparatus (1) according to one or more of the preceding claims, **characterized in that** said footing (4) supports a shelf-like body (6) for supporting said mold (2).

8. The apparatus (1) according to one or more of the preceding claims, **characterized in that** said shelf-like body (6) is supported by said footing (4) so that it can rotate about said oscillation axis (100).

9. The apparatus (1) according to one or more of the preceding claims, **characterized in that** said mold (2) is supported by said shelf-like body (6) so that it can rotate about said rotation axis (101).

10. The apparatus (1) according to one or more of the preceding claims, **characterized in that** it comprises means for moving said shelf-like body (6) with respect to said footing (4) along a movement direction (104) that is substantially parallel to said rotation axis (101).

11. The apparatus (1) according to one or more of the preceding claims, **characterized in that** it comprises mold closing and locking means (20) adapted to move respective portions (12b, 12c,...) of said mold (2) along respective opening/closing directions (102, 103) that lie on said working surface.

12. The apparatus (1) according to one or more of the preceding claims, **characterized in that** said means for feeding the molten mass at said intake region (2a) comprise at least one hand ladle (30) into which the molten mass is to be poured and means for transferring the molten mass from said hand ladle (30) toward said intake region (2a).

13. The apparatus (1) according to one or more of the preceding claims, **characterized in that** said means for transferring the molten mass from said hand ladle (30) toward said intake region (2a) act when said intake region (2a) is directed downwardly.

14. The apparatus (1) according to one or more of the preceding claims, **characterized in that** said hand ladle (30) is adapted to pass on command between a feeding condition, in which it is spaced from said intake region (2a), and a condition for coupling to said intake region (2a), in which its free surface (30a) is hermetically adjacent to the peripheral rim of said intake region (2a).

15. The apparatus (1) according to one or more of the preceding claims, **characterized in that** the transfer of the molten mass from said hand ladle (30) to said mold (2) is performed by means of the rotation of said mold (2) and of said hand ladle (30) about said oscillation axis (100).

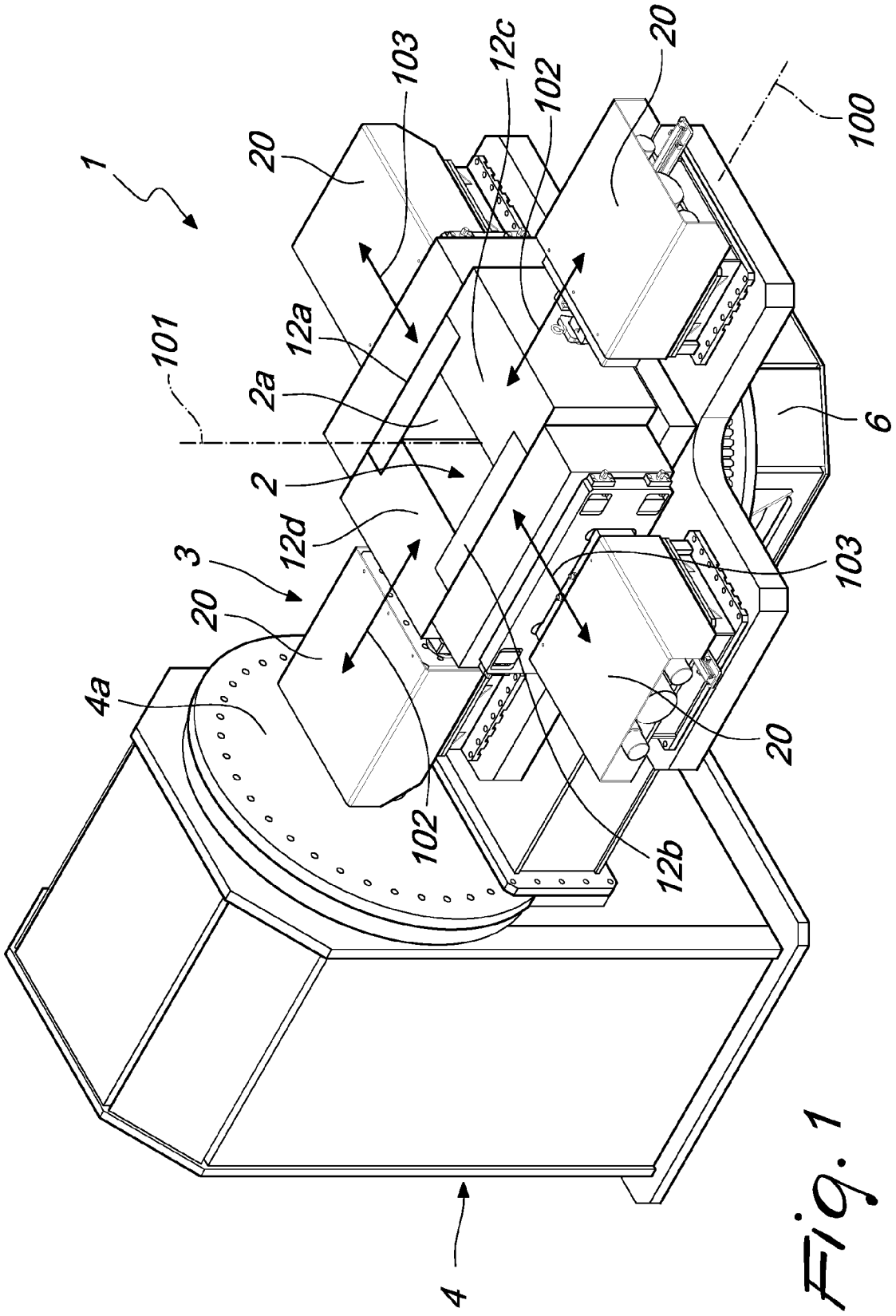


Fig. 1

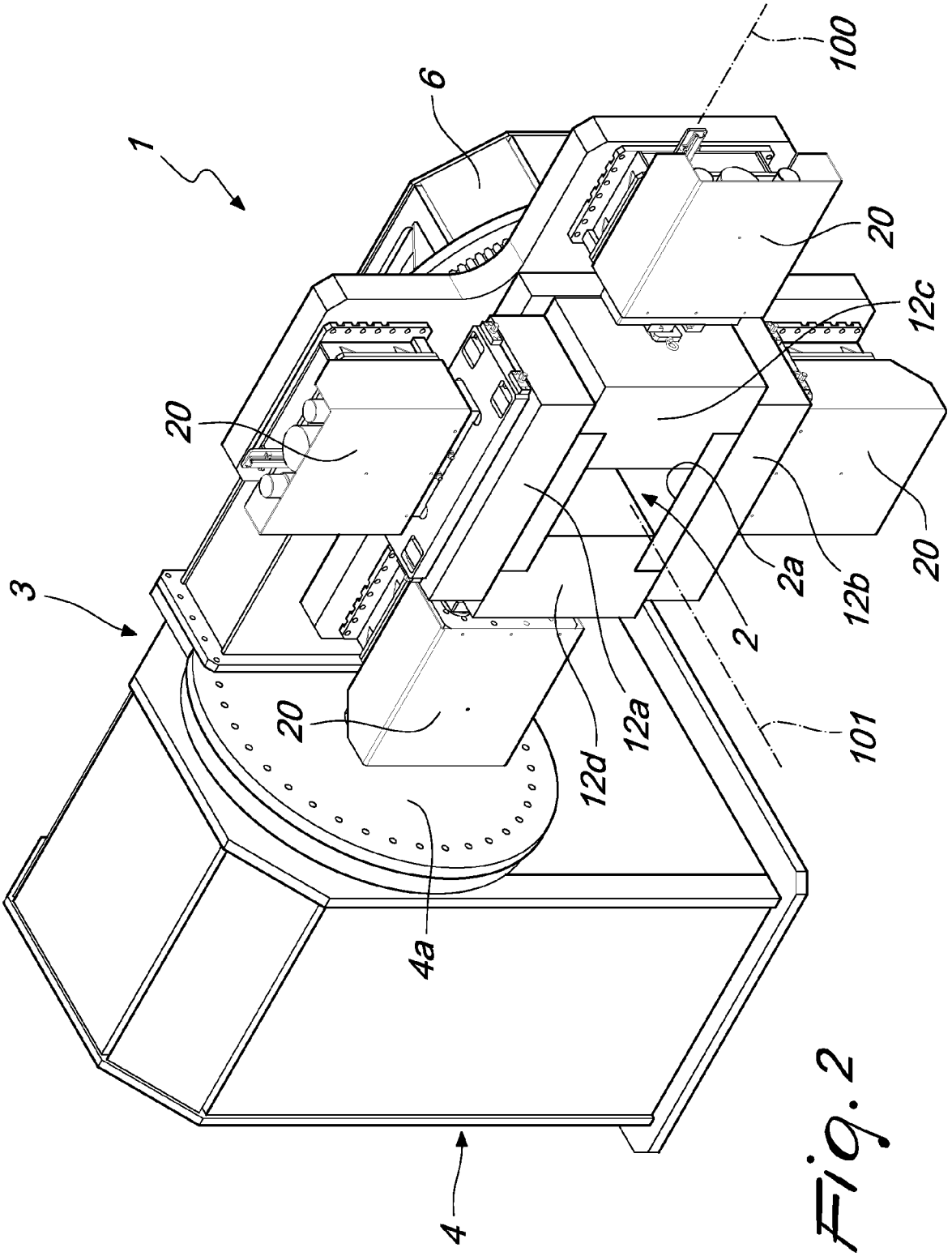


Fig. 2

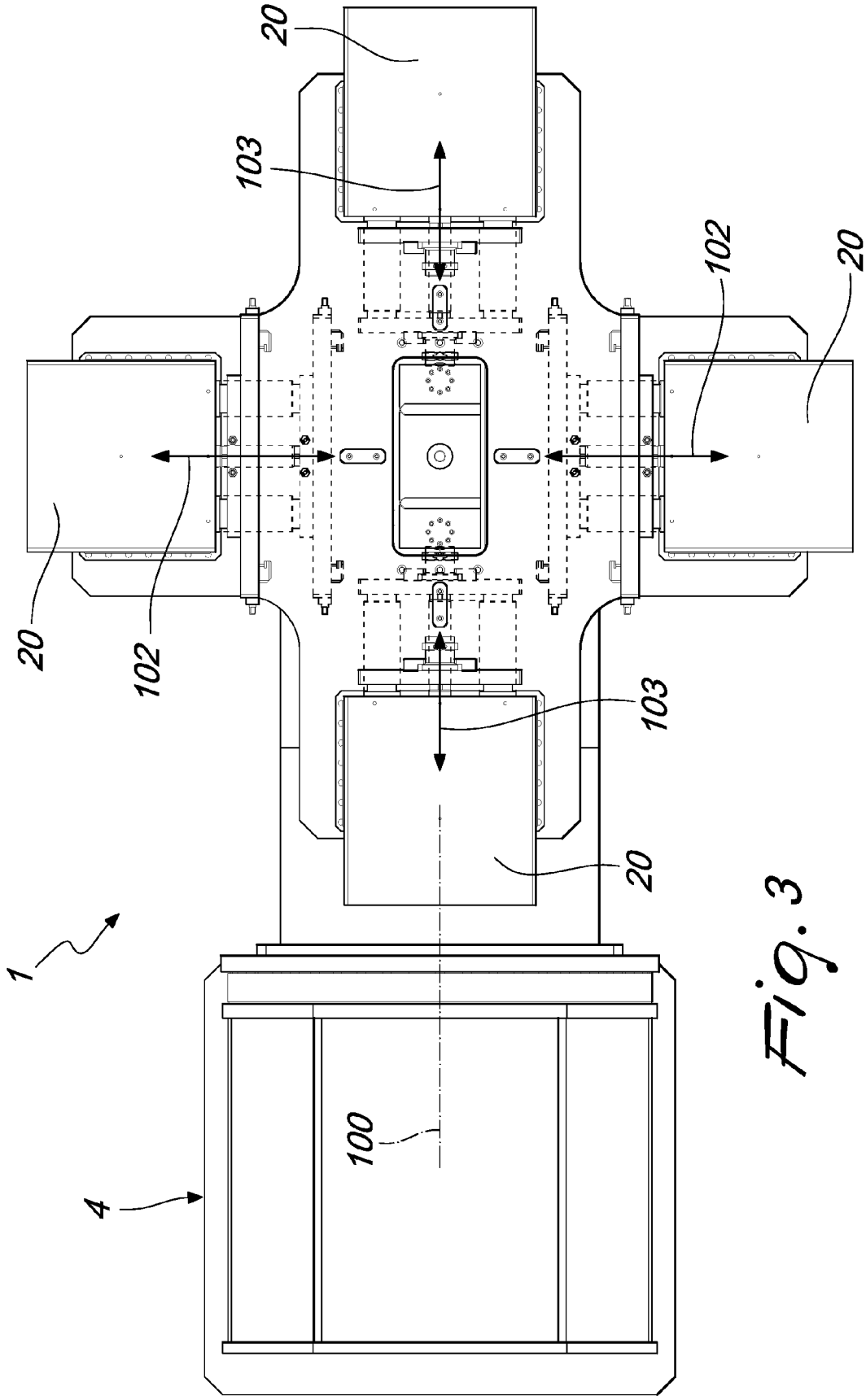


Fig. 3

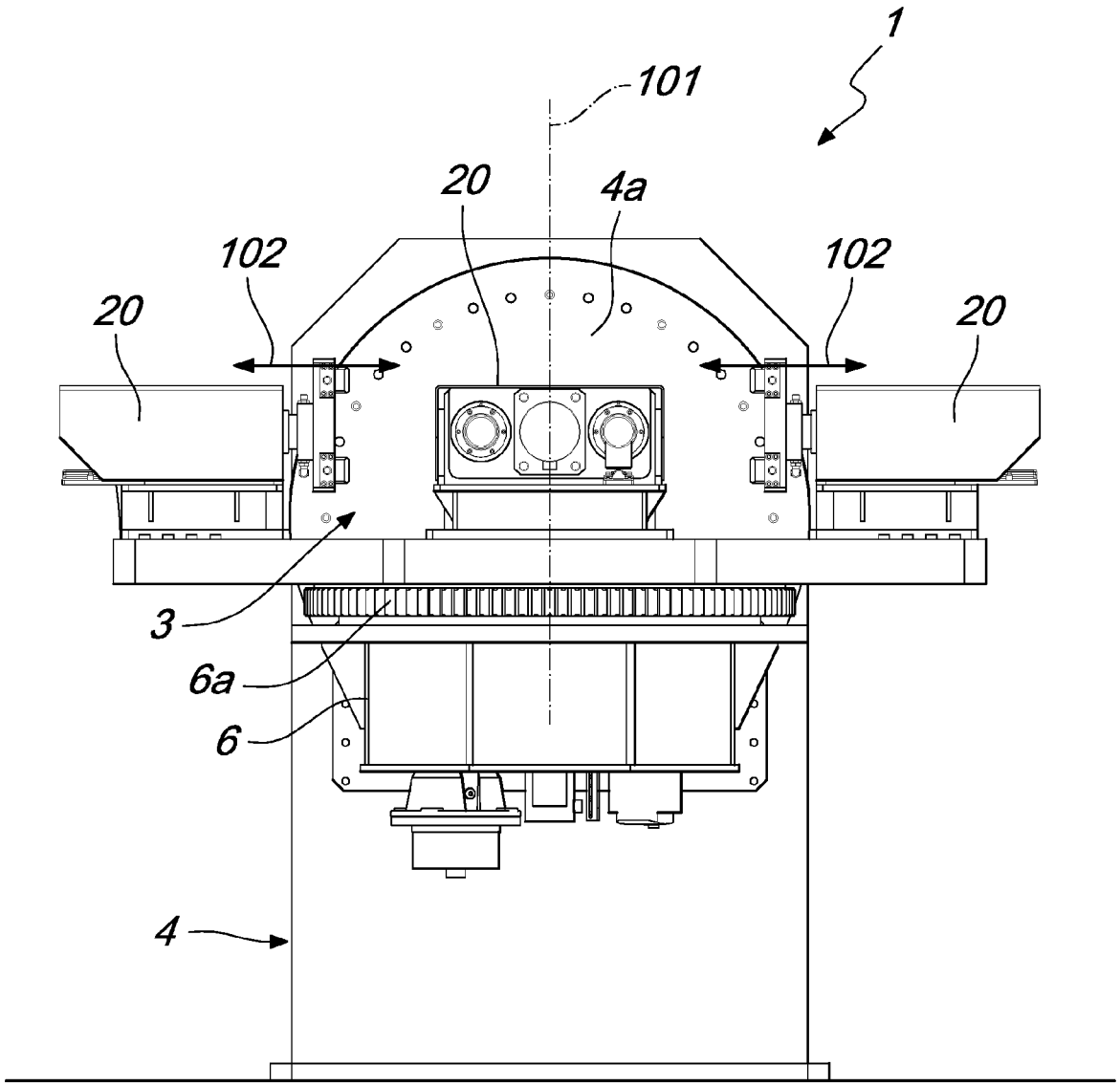


Fig. 4

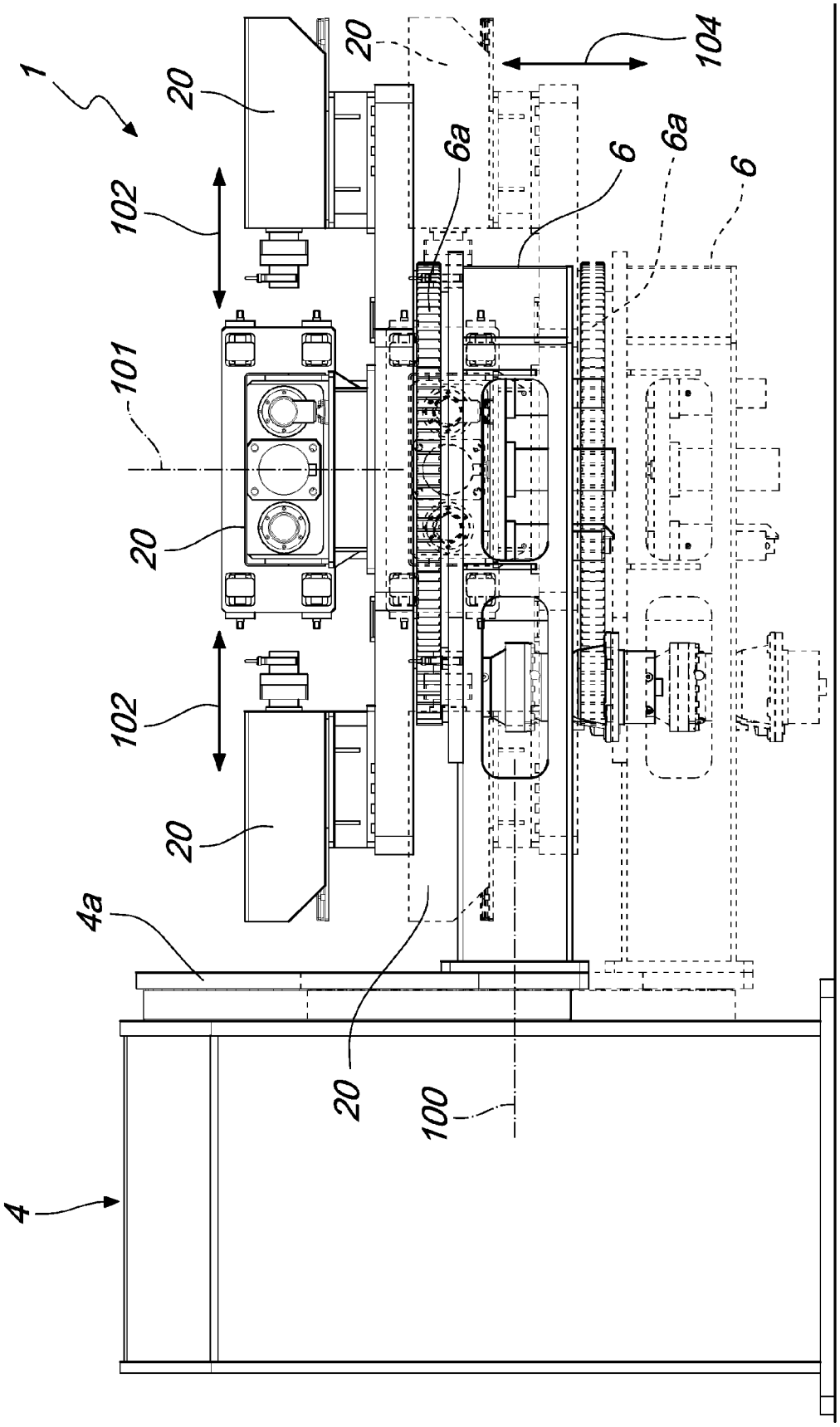


Fig. 5

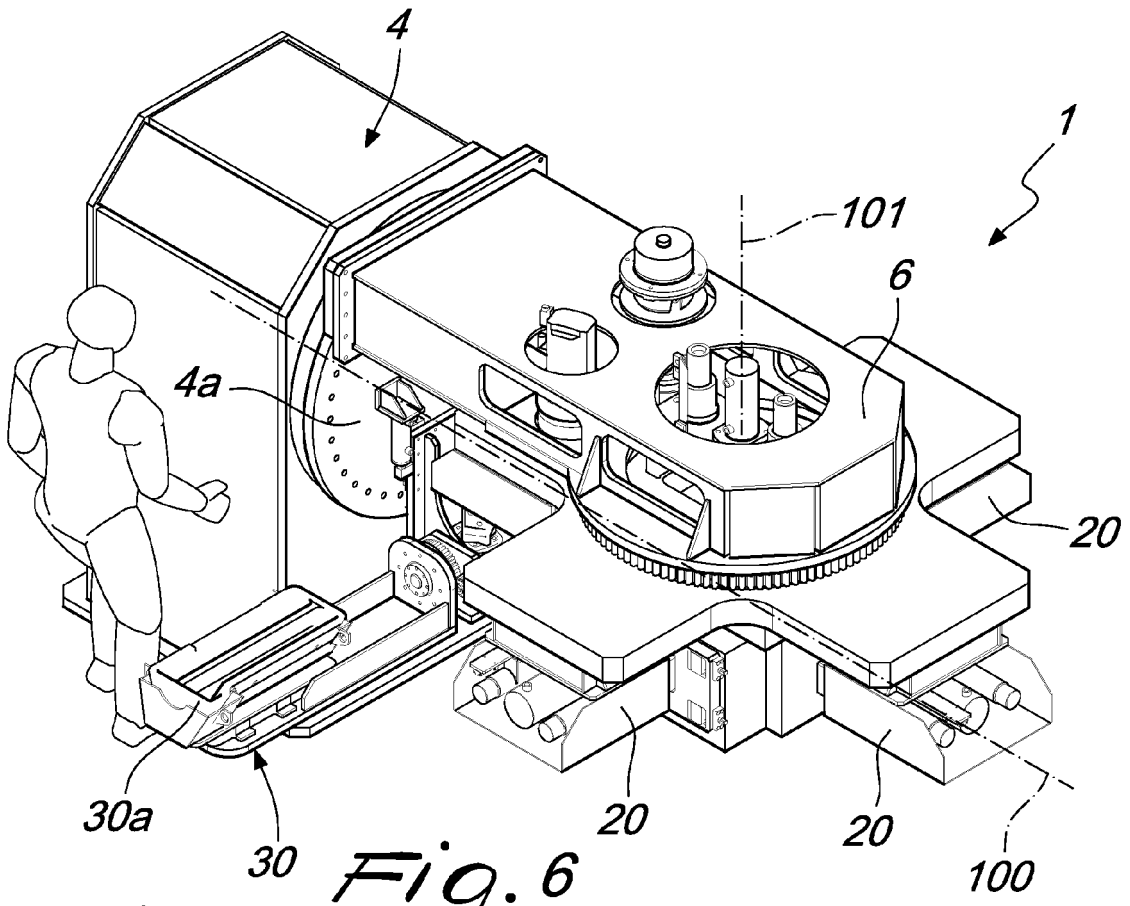


Fig. 6

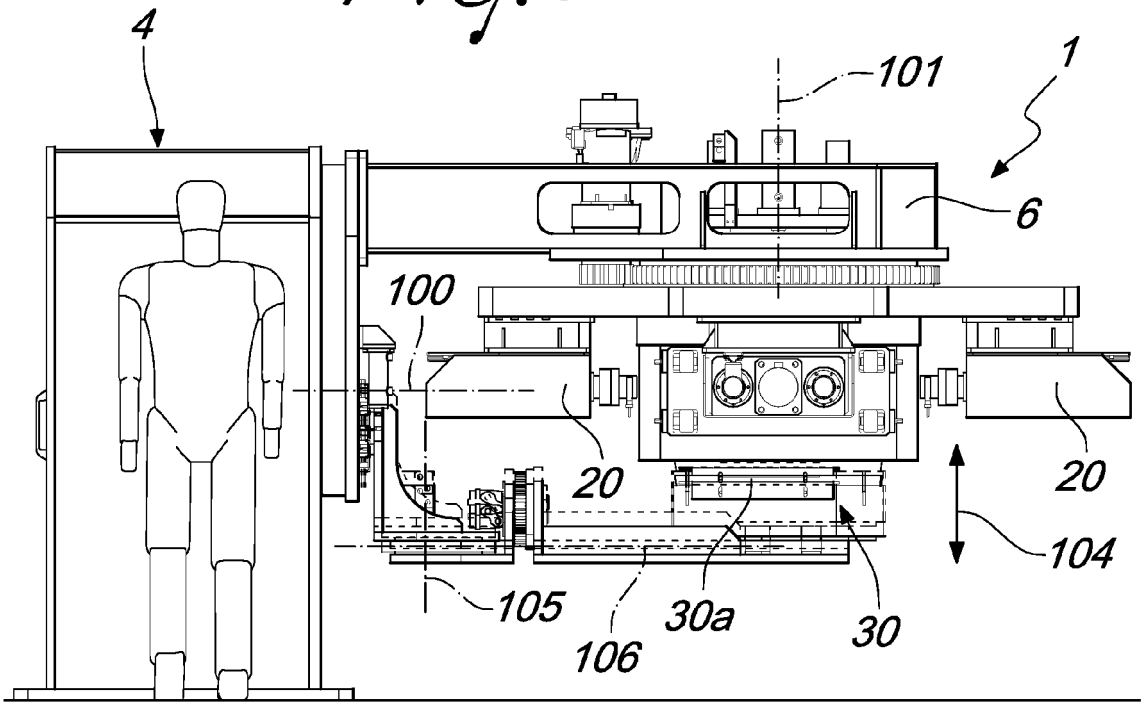


Fig. 7

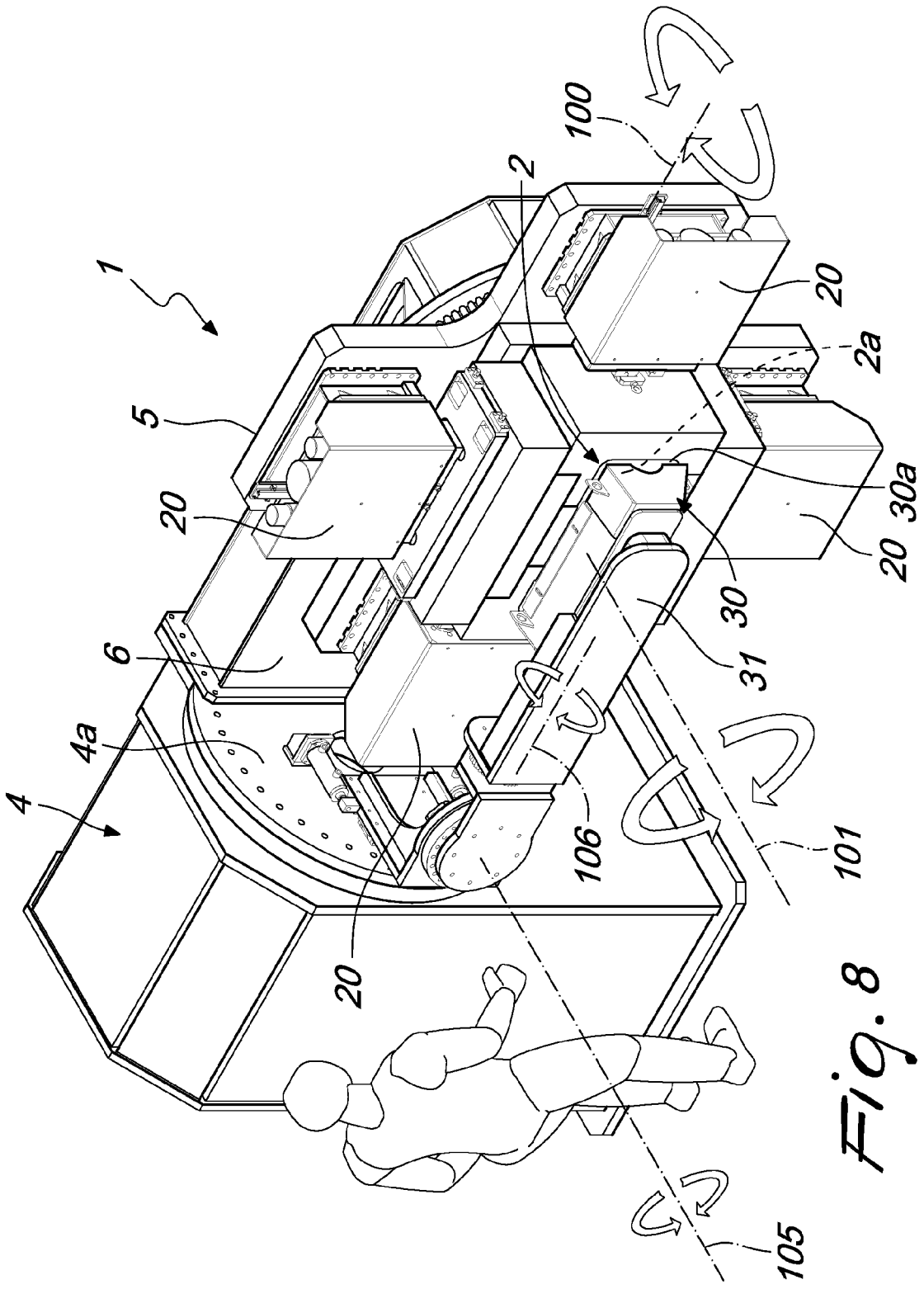
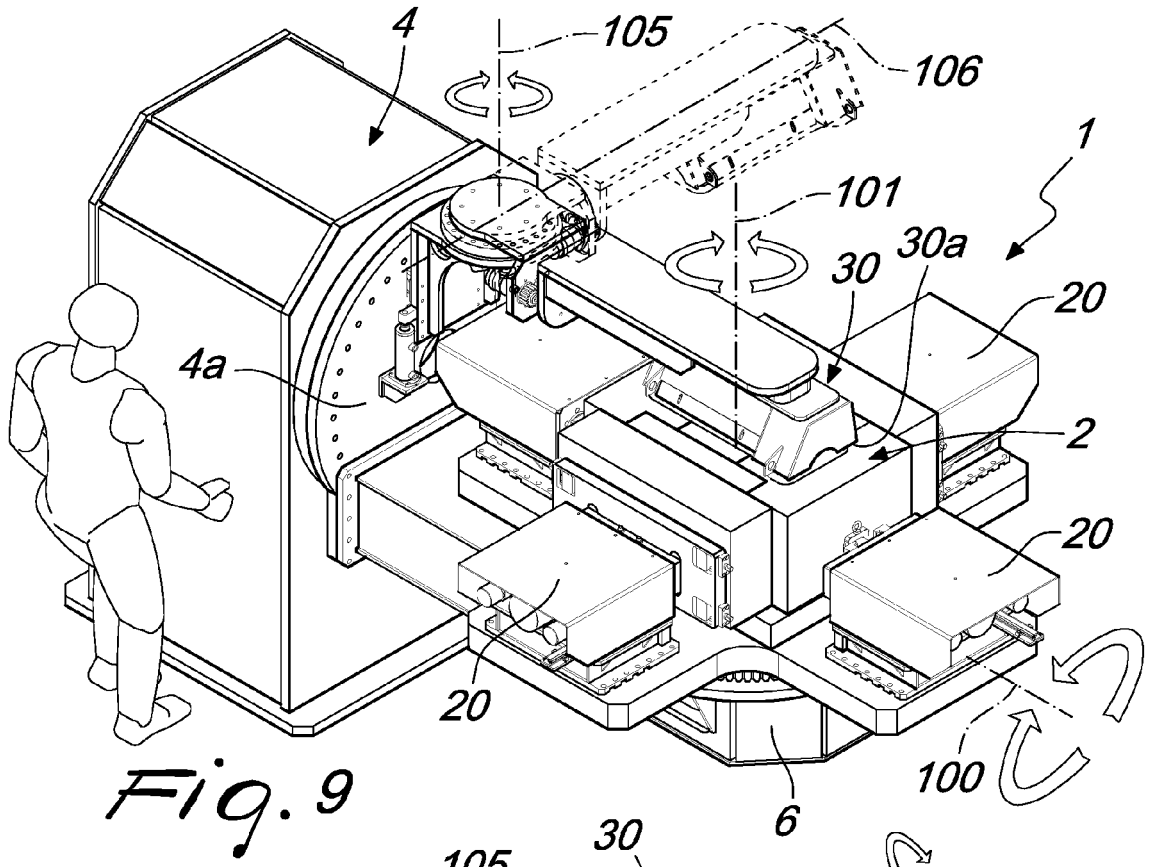


Fig. 8


4
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106
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101
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100
6

Fig. 9

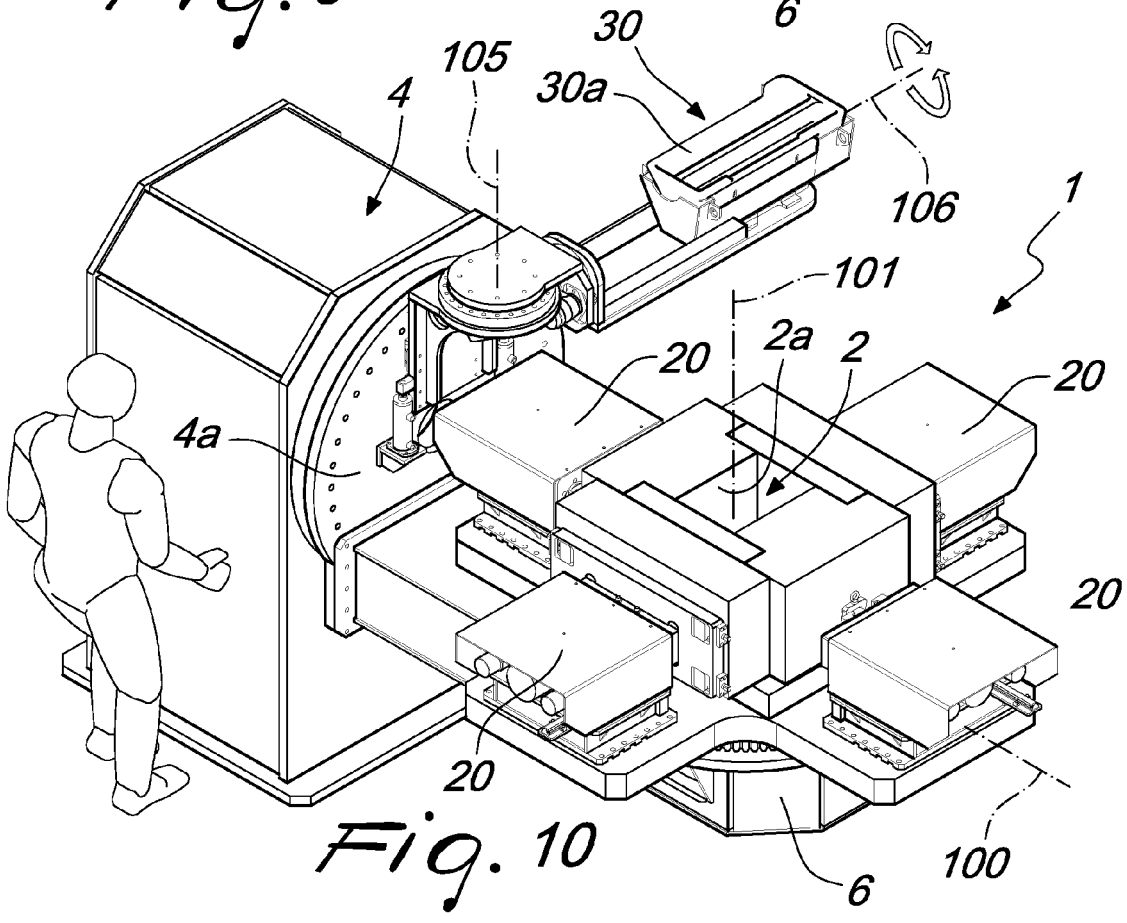
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Fig. 10

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EUROPEAN SEARCH REPORT

Application Number
EP 15 15 1676

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TECHNICAL FIELDS SEARCHED (IPC)
B22D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	30 September 2015	Rischard, Marc

CATEGORY OF CITED DOCUMENTS

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