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(54) **VERTICAL ROLLER MILL**

(57) This vertical roller mill (1) is provided with a reduction gear (11) which is arranged below a rotary table (2), a vertical transmission shaft (13) for transmitting driving force from the reduction gear (11) to the rotary table (2), an output flange (23) to which an upper end of the vertical transmission shaft (13) is connected at the center portion thereof and which configures a bottom surface of the rotary table (2), a thrust bearing mechanism (27) for slidably supporting a peripheral portion of the output flange (23) from below, and a radial bearing mechanism (38) for restricting movement of the output flange (23) in the radial direction.

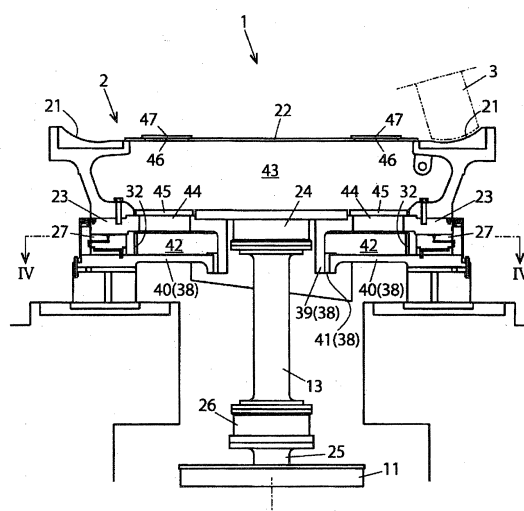


FIG. 3

Description

Technical Field

[0001] The present invention relates to a vertical roller mill in which materials to be ground are bitten between a rotary table and a grinding roller so as to grind the materials.

Background Art

[0002] Conventionally, a vertical roller mill, in which materials (materials to be ground) are bitten between a plurality of grinding rollers and a rotary table so as to grind the materials, has been used for producing concrete aggregate, and the like.

[0003] Recently, the devices of vertical roller mill are becoming larger in order to enhance their throughputs. Patent Literature 1 discloses a vertical roller mill for responding to the enlarged devices. In this vertical roller mill of Patent Literature 1, a rotary table and a reduction gear are largely separated in the vertical direction corresponding to enlargement of the mill and also the rotary table and the reduction gear are connected by a vertical transmission shaft.

[0004] Also, in a conventional vertical roller mill in which the rotary table and the reduction gear are close to each other, a thrust bearing mechanism for slidably supporting the rotary table from below is configured integrally with the reduction gear.

[0005] In contrast, in the vertical roller mill of Patent Literature 1, the thrust bearing mechanism is separated from the reduction gear and the thrust bearing mechanism and the reduction gear are largely separated in the vertical direction.

Related Art Literature

Patent Literature

[0006] Patent Literature 1: WO2013/069293A1

Summary of the Invention

Problem to be solved by the Invention

[0007] As mentioned above, when the rotary table is largely separated upward from the reduction gear in order to enlarge the vertical roller mill, the rotary table and the reduction gear need to be connected by the vertical transmission shaft. As a result, an axis deviation of the rotary table upon rotation could become larger, and therefore a countermeasure for preventing that is needed.

[0008] Also, in a configuration in which the thrust bearing mechanism is largely separated upward from the reduction gear in order to enlarge the vertical roller mill, the thrust bearing mechanism cannot be withdrawn up to a working area together with the reduction gear so as to

perform maintenance and replacement works unlike the conventional thrust bearing mechanism integrated with the reduction gear. Therefore, the problem is how to perform maintenance and replacement works on the thrust bearing mechanism separated from the reduction gear, wherein the maintenance and replacement works on the thrust bearing mechanism become more difficult than before, partly because installation areas for a plurality of thrust bearing mechanisms become larger corresponding to enlargement of the mill, in particular enlargement of the table. The present invention has been made in view of the above-mentioned problem of the conventional art, and aims to provide a vertical roller mill capable of preventing an axis deviation of the rotary table upon rotation even when the mill is enlarged.

[0009] Also, the present invention aims to provide a vertical roller mill capable of performing maintenance and replacement works on the thrust bearing mechanism without problems even when the mill is enlarged.

Means for Solving the Problem

[0010] In order to solve the above-mentioned problem, a first aspect of the present invention is a vertical roller mill in which a material to be ground is bitten between a rotary table and a grinding roller so as to grind the material, comprising: a reduction gear arranged below the rotary table; a vertical transmission shaft for transmitting a driving force from the reduction gear to the rotary table; an output flange to which an upper end of the vertical transmission shaft is connected at a center portion of the output flange, the output flange configuring a bottom surface of the rotary table; a thrust bearing mechanism for slidably supporting a peripheral portion of the output flange from below; and a radial bearing mechanism for restricting a movement of the output flange in a radial direction.

[0011] In a second aspect of the present invention, the radial bearing mechanism has a movable side bearing member provided to the output flange; a fixed side bearing member provided to a structure on which the thrust bearing mechanism is placed; and a bearing body provided between the movable side bearing member and the fixed side bearing member.

[0012] In a third aspect of the present invention, the movable side bearing member includes a cylindrical member provided to a center portion of a bottom surface of the output flange, and the fixed side bearing member includes an annular member in which a center opening is formed, through which the cylindrical member is inserted.

[0013] In a fourth aspect of the present invention, the bearing body is a sliding bearing.

[0014] In a fifth aspect of the present invention, a working space is formed between the output flange and the fixed side bearing member, and a working opening through which an operator enters the working space is formed in the output flange.

[0015] In a sixth aspect of the present invention, the rotary table has a hollow structure, and the working opening communicates with an inner space of the rotary table.

[0016] In a seventh aspect of the present invention, a table cover is provided radially inward an annular grinding surface of the rotary table, and a working opening through which an operator enters the inner space of the rotary table is formed in the table cover.

[0017] In an eighth aspect of the present invention, the working opening formed in the output flange and the working opening formed in the table cover at least partially overlap each other viewed from a vertical direction.

[0018] In a ninth aspect of the present invention, the vertical roller mill has a door member for openably sealing the working opening.

[0019] In a tenth aspect of the present invention, a movement of the thrust bearing mechanism upon operation is restricted by a pin member which is provided detachably to the structure on which the thrust bearing mechanism is placed, and the thrust bearing mechanism can be moved inside in a radial direction by removing the pin member from the structure.

[0020] In an eleventh aspect of the present invention, the upper end of the vertical transmission shaft is connected to the center portion of the output flange via a coupling mechanism.

[0021] In a twelfth aspect of the present invention, the vertical roller mill further has a height adjusting means for adjusting a height of the thrust bearing mechanism.

Effect of the Invention

[0022] In the vertical roller mill according to the first aspect of the present invention, an axis deviation of the rotary table upon rotation can be prevented even when the mill is enlarged.

[0023] In the vertical roller mill according to the fifth aspect of the present invention, maintenance and replacement works on the thrust bearing mechanism can be performed without problems even when the mill is enlarged.

Brief Description of Drawings

[0024]

FIG. 1 is a longitudinal section view illustrating a schematic view of a vertical roller mill according to an embodiment of the present invention.

FIG. 2 is a II - II line section view of FIG. 1.

FIG. 3 is a III - III line section view of FIG. 2.

FIG. 4 is a IV to IV line section view of FIG. 3.

FIG. 5 is an enlarged longitudinal section view illustrating a thrust bearing mechanism of the vertical roller mill in FIG. 1 and structures surrounding the same.

FIG. 6 is an enlarged longitudinal section view illustrating a working space 42 of the vertical roller mill

in FIG. 1 and structures surrounding the same.

Embodiment of the Invention

[0025] A vertical roller mill according to an embodiment of the present invention is described hereunder with reference to the drawings.

[0026] As illustrated in FIG. 1 and FIG. 2, a vertical roller mill 1 according to this embodiment includes a rotary table 2 having a top surface to which raw materials (materials to be ground) are supplied. Six grinding rollers 3 are provided around the rotary table 2, where the materials are bitten between the rotary table 2 and themselves so as to grind the materials. The six grinding rollers 3 are arranged on a vertical circumference centering on the pivot axis of the rotary table 2 at regular angular intervals (60 degrees).

[0027] The grinding roller 3 is pressed against the rotary table 2 by a roller pressing mechanism 4. The roller pressing mechanism 4 includes a first arm 5 which is provided with the grinding roller 3 at its tip end portion, and a second arm 6 which has a tip end portion connected to a proximal end portion of this first arm 5. To a proximal end portion of the second arm 6, a tip end portion of a driving shaft (cylinder pin, for example) 8 of a pressure driving portion (hydraulic cylinder, for example) 7 is connected.

[0028] In the roller pressing mechanism 4, the grinding roller 3 is pressed against the rotary table 2 via the first arm 5 and the second arm 6 by pulling in the driving shaft 8 of the pressure driving portion 7.

[0029] As illustrated in FIG. 1 and FIG. 3, a rotary driving source 10 and a reduction gear 11 for the rotary table 2 are installed on a mill installation surface 9, and the rotary driving source 10 and the reduction gear 11 are connected by a horizontal connection shaft 12. Additionally, the reduction gear 11 and the rotary table 2 are connected by a vertical transmission shaft 13.

[0030] The rotary table 2 and the grinding roller 3 are covered by a mill casing 14. Raw materials are supplied to the rotary table 2 through a raw material supply chute 15 which is arranged such that it passes through the mill casing 14.

[0031] A dried air duct 16 is connected to a side lower portion of the mill casing 14, and dried air is supplied to an inside of the mill casing 14 through this dried air duct 16. A separator 17 is provided above the rotary table 2. Ground raw materials are blown up by the dried air which is supplied to the lower portion of the mill casing 14 through the dried air duct 16 and are transferred to the separator 17.

[0032] The separator 17 is rotationally driven by a separator driving device 28 which is composed of an electric machinery and the like, and, among the ground raw materials, only raw materials (refined grain) whose granularity (grain size) is smaller than a prescribed granularity are discharged from a refined grain product discharge duct 18 which is provided to an upper portion of the mill

casing 14. On the other hand, raw materials (coarse grain) whose granularity (grain size) is larger than the prescribed granularity are separated by the separator 17 and returned to the rotary table 2 so as to be ground again.

[0033] Below the mill casing 14, a maintenance passage 19 is formed for passing the reduction gear 11 under the grinding roller 3 and its pressing mechanism 4 so as to pull out the reduction gear 11. More specifically, the maintenance passage 19 is formed through a concrete stand portion 20 which supports the roller pressing mechanism 4 and the like.

[0034] Namely, the concrete stand portion 20 includes two stand leg portions 20A which are provided on both sides of the maintenance passage 19 which is positioned therebetween, and a connecting portion 20B which connects the upper ends of these two stand leg portions 20A so as to form a ceiling section of the maintenance passage 19. This configuration secures a maintenance passage even if the number of the grinding roller 3 and its pressing mechanisms 4 increases.

[0035] Moreover, in the vertical roller mill according to this embodiment, the rotary table 2 has a hollow structure as illustrated in FIG. 3. A table cover 22 is detachably provided to a radial inside of an annular grinding surface 21 of the rotary table 2.

[0036] A bottom surface of the rotary table 2 is configured by an output flange 23, and an upper end of the vertical transmission shaft 13 is connected to a center portion of the output flange 23 via a coupling 24. Connecting the vertical transmission shaft 13 and the output flange 23 via the coupling 24 allows displacement (axis deviation) of the vertical transmission shaft 13 relative to the output flange 23 to some extent upon rotation.

[0037] A lower end of the vertical transmission shaft 13 is connected to an output shaft 25 of the reduction gear 11 via a coupling 26. Connecting the vertical transmission shaft 13 and the output shaft 25 of the reduction gear 11 via the coupling 26 allows displacement (axis deviation) of the vertical transmission shaft 13 relative to the output shaft 25 of the reduction gear 11 to some extent upon rotation.

[0038] As illustrated in FIG. 3 and FIG. 4, in the vertical roller mill 1 according to this embodiment, a plurality of thrust bearing mechanisms 27 are arranged at regular angular intervals in the circumferential direction for slidably supporting a peripheral portion of the output flange 23 from below.

[0039] As illustrated in FIG. 5, the thrust bearing mechanism 27 is placed on a placement surface 29 of a frame section (structure) 28. High-pressure oil is supplied to a bearing surface 30 of the thrust bearing mechanism 27 through an oil supply pipe 31. An oil stop member 32 is detachably provided in the vicinity of the thrust bearing mechanism 27.

[0040] The high-pressure oil supplied to the bearing surface 30 through the oil supply pipe 31 is stored in a space which is formed by structures (including the oil

stop member 32) surrounding the thrust bearing mechanism 27. Height of the oil stop member 32 is set such that a liquid level of the stored oil is higher than the bearing surface 30 of the thrust bearing mechanism 27.

[0041] The thrust bearing mechanism 27 is placed on a pedestal 33 which is placed on the placement surface 29 of the frame section 28 via a height adjusting member (height adjusting means) 34. The height adjusting member 34 is a plate liner, and the height of the thrust bearing mechanism 27, namely the height of the bearing surface 30 can be adjusted by adjusting the thickness of the height adjusting member 34.

[0042] In the placement surface 29 of the frame section 28, a pin member 35 is detachably provided adjacent to the pedestal 33, and movement of the pedestal 33 during operation is restricted by the pin member 35. Removing the pin member 35 from the placement surface 29 enables the pedestal 33 and the thrust bearing mechanism 27 placed thereon to move at least in the radially inward direction of the rotary table 2.

[0043] A movable side sealing member 36 is provided to a peripheral portion of the output flange 23, and this movable side sealing member 36 cooperates with a fixed side sealing member 37, which is provided to a structure on the fixed side, so as to serve a sealing function

[0044] The vertical roller mill 1 according to this embodiment includes a radial bearing mechanism 38 for restricting radial movement of the output flange 23, as illustrated in FIG. 3.

[0045] The radial bearing mechanism 38 has a movable side bearing member 39 which is provided to the output flange 23, a fixed side bearing member 40 which is provided to the frame section 28 on which the thrust bearing mechanism 27 is placed, and a bearing body 41 which is provided between the movable side bearing member 39 and the fixed side bearing member 40. The bearing body 41 is constituted by a sliding bearing.

[0046] The movable side bearing member 39 includes a cylindrical member which is provided to a center portion of the bottom surface of the output flange 23. The fixed side bearing member 40 includes an annular member in which a center opening is formed, through which the cylindrical member configuring the movable side bearing member 39 is inserted.

[0047] This configuration allows radial force which is generated by action of the roller to be supported at the frame section 28 via the movable side bearing member 39, the bearing body 41, and the fixed side bearing member 40. Thereby, an axis deviation of the table 43 and the output flange 23 can be efficiently prevented. Note that, the movable side bearing member 39 may be or not may be integral with the output flange, and it may be coupled to the output flange using bolts or the like.

[0048] As illustrated in FIG. 3 and FIG. 6, a working space 42 is formed between the output flange 23 and the fixed side bearing member 40. As illustrated in FIGS. 3, 4, and 6, in the output flange 23, a working opening (man-hole) 44 is formed, through which an operator enters the

working space 42 from an inner space 43 of the rotary table 2. The working opening 44 is usually sealed by an openable door member 45.

[0049] As illustrated in FIG. 3 and FIG. 6, in the table cover 22, a working opening (manhole) 46 is formed, through which an operator enters the inner space 43 of the rotary table 2. The working opening 46 is usually sealed by an openable door member 47.

[0050] The working opening 44 formed in the output flange 23 and the working opening 46 formed in the table cover 22 at least partially overlap each other viewed from the vertical direction (rotation axis direction).

[0051] In the vertical roller mill 1 according to this embodiment, an axis deviation of the output flange 23 upon rotation is restricted by the radial bearing mechanism 38. Thereby, an axis deviation of the rotary table 2 upon rotation is restricted. Accordingly, radial force applied to the table, which is generated by a roller load in an unusual state, can be supported by this section, and also breakage of the movable side sealing member 36 and the fixed side sealing member 37 due to the axis deviation of the output flange 23 can be prevented.

[0052] Note that, since the upper end of the vertical transmission shaft 13 is connected to the output flange 23 via the coupling 24 as mentioned above, an deviation of the vertical transmission shaft 13 caused by misalignment between the reduction gear 11 and the thrust bearing mechanism 27 upon installation of the main body is absorbed at the coupling 24. The coupling 26 on the lower end side of the vertical transmission shaft 13 also contributes to absorption of axis deviation. Therefore, centering accuracy requested upon installation of the vertical transmission shaft 13 can be decreased.

[0053] Additionally, when performing maintenance or replacement works on the thrust bearing mechanism 27 in the vertical roller mill 1 according to this embodiment, in a state that oil around the thrust bearing mechanism 27 is previously extracted, an operator opens the door member 47 of the table cover 22 and enters the inner space 43 of the rotary table 2 from the working opening 46, and further opens the door member 45 of the output flange 23 and enters the working space 42 from the working opening 44.

[0054] After entering the working space 42, the operator removes the oil stop member 32 so as to secure accessibility to the thrust bearing mechanism 27. Note that, the thrust bearing mechanism 27 should be replaced in a state that the rotary table 2 is lifted a little previously using a hydraulic jack or the like. This allows the output flange 23 and the thrust bearing mechanism 27 to be separated from each other, and therefore the load on the thrust bearing mechanism 27 from the output flange 23 can be eliminated.

[0055] The operator removes the pin member 35 from the pedestal 33, thereby enabling the thrust bearing mechanism 27 to be drawn inside in the radial direction. In this state, the thrust bearing mechanism 27 is drawn inside in the radial direction using a suitable means and

is moved to immediate below the working opening 44 of the output flange 23.

[0056] The working opening 46 of the table cover 22 is arranged immediate above the working opening 44 of the output flange 23, and the thrust bearing mechanism 27 is hoisted and taken out through these working openings 44, 46 using a suitable means.

[0057] When installing a new thrust bearing mechanism 27, in the reverse procedure of the above-mentioned procedure, the thrust bearing mechanism 27 is hoisted down to the working space 42 through the working openings 44, 46 and placed on the fixed side bearing member 40 temporarily, and further moved outside in the radial direction. Next, the height of the thrust bearing mechanism 27 is adjusted by the height adjusting member 34, and also the thrust bearing mechanism 27 is fixed by the pin member 35 in a prescribed position.

[0058] As above, by the vertical roller mill 1 according to this embodiment, the operator can access the thrust bearing mechanism 27 by utilizing the working openings 44, 46, the working space 42, and the inner space 43, and also replacement works and maintenance works of the thrust bearing mechanism 27 can be performed without any trouble since the thrust bearing mechanism 27 can be carried in and carried out.

[0059] As for the height adjusting work of the thrust bearing mechanism 27, the operator can accurately perform the height adjusting work using the height adjusting member 34 on site while measuring a small gap between the thrust bearing mechanism 27 and the output flange 23 in the working space 42.

[0060] Additionally, in the vertical roller mill 1 according to this embodiment, the output flange 23 can be lightened, since the working opening 44 is formed in the output flange 23, thereby reducing the weight of the output flange 23 by the removed material.

[0061] Note that, although, in this embodiment, the four working openings 44 are formed in the output flange 23 in the circumferential direction at regular angular intervals, form of the working opening 44 is not limited to this, and any form will do so long as it enables entry of the operator and carry-in/carry-out of the thrust bearing material 27. The same applies to the working opening 46 which is formed in the table cover 22.

[0062] Additionally, although this embodiment has a configuration that six grinding rollers are arranged, the number of installed grinding rollers of a vertical roller mill according to the present invention is not limited to this, and more or less grinding rollers may be installed.

Description of Reference Numerals

[0063]

- 1 ... vertical roller mill
- 2 ... rotary table
- 3 ... grinding roller
- 4 ... roller pressing mechanism

5 ... first arm
 6 ... second arm
 7 ... pressing driving portion
 8 ... driving shaft of pressing driving portion
 9 ... mill installation surface
 10 ... rotary driving source
 11 ... reduction gear
 12 ... horizontal connection shaft
 13 ... vertical transmission shaft
 14 ... mill casing
 15 ... raw material supply chute
 16 ... dried air duct
 17 ... separator
 18 ... refined grain product discharge duct
 19 ... maintenance passage
 20 ... stand portion
 20A ... stand leg portion
 21 ... annular grinding surface of rotary table
 22 ... table cover
 23 ... output flange
 24, 26 ... coupling
 25 ... output shaft of reduction gear
 27 ... thrust bearing mechanism
 28 ... frame section
 29 ... placement surface of frame section
 30 ... bearing surface of thrust bearing mechanism
 31 ... oil supply pipe
 32 ... oil stop member
 33 ... pedestal of thrust bearing mechanism
 34 ... height adjusting member (height adjusting means) of thrust bearing mechanism
 35 ... pin member
 36 ... movable side sealing member
 37 ... fixed side sealing member
 38 ... radial bearing mechanism
 39 ... movable side bearing member
 40 ... fixed side bearing member
 41 ... bearing body
 42 ... working space
 43 ... inner space of rotary table
 44 ... working opening (manhole) of output flange
 45 ... door member of output flange
 46 ... working opening (manhole) of table cover
 47 ... door member of table cover

Claims

1. A vertical roller mill provided with a rotary table and a grinding roller in which a material to be ground is bitten therebetween so as to grind the material, comprising:

a reduction gear arranged below the rotary table;
 a vertical transmission shaft for transmitting a driving force from the reduction gear to the rotary table;
 an output flange to which an upper end of the

vertical transmission shaft is connected at a center portion of the output flange, the output flange configuring a bottom surface of the rotary table;

a thrust bearing mechanism for slidably supporting a peripheral portion of the output flange from below; and

a radial bearing mechanism for restricting a movement of the output flange in a radial direction.

2. The vertical roller mill according to claim 1, wherein the radial bearing mechanism has a movable side bearing member provided to the output flange; a fixed side bearing member provided to a structure on which the thrust bearing mechanism is placed; and a bearing body provided between the movable side bearing member and the fixed side bearing member.

3. The vertical roller mill according to claim 2, wherein the movable side bearing member includes a cylindrical member provided to a center portion of a bottom surface of the output flange, and wherein the fixed side bearing member includes an annular member in which a center opening is formed, through which the cylindrical member is inserted.

4. The vertical roller mill according to claim 2 or claim 3, wherein the bearing body is a sliding bearing.

5. The vertical roller mill according to any one of claims 2 to 4, wherein a working space is formed between the output flange and the fixed side bearing member, and wherein a working opening through which an operator enters the working space is formed in the output flange.

6. The vertical roller mill according to any one of claims 2 to 4, wherein the rotary table has a hollow structure, and wherein the working opening communicates with an inner space of the rotary table.

7. The vertical roller mill according to claim 6, wherein a table cover is provided radially inward an annular grinding surface of the rotary table, and wherein a working opening through which an operator enters the inner space of the rotary table is formed in the table cover.

8. The vertical roller mill according to claim 7, wherein the working opening formed in the output flange and the working opening formed in the table cover at least partially overlap each other viewed from a vertical direction.

9. The vertical roller mill according to any one of claims 5 to 8 having a door member for openably sealing the working opening.
10. The vertical roller mill according to any one of claims 1 to 9, wherein a movement of the thrust bearing mechanism upon operation is restricted by a pin member provided detachably to the structure on which the thrust bearing mechanism is placed, and wherein the thrust bearing mechanism can be moved inside in a radial direction by removing the pin member from the structure.
11. The vertical roller mill according to any one of claims 1 to 10, wherein the upper end of the vertical transmission shaft is connected to the center portion of the output flange via a coupling mechanism.
12. The vertical roller mill according to any one of claims 1 to 11 further having a height adjusting means for adjusting a height of the thrust bearing mechanism.

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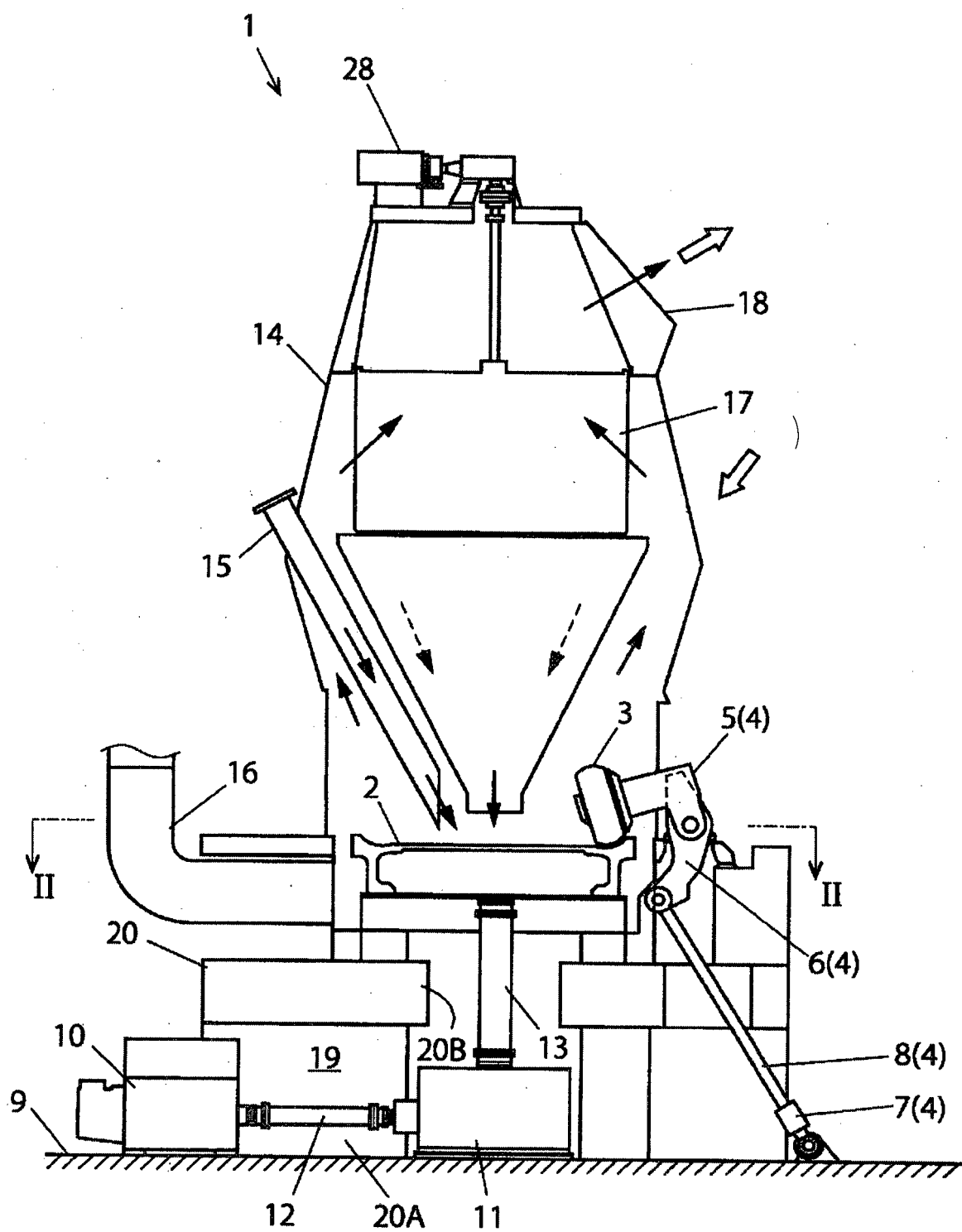


FIG. 1

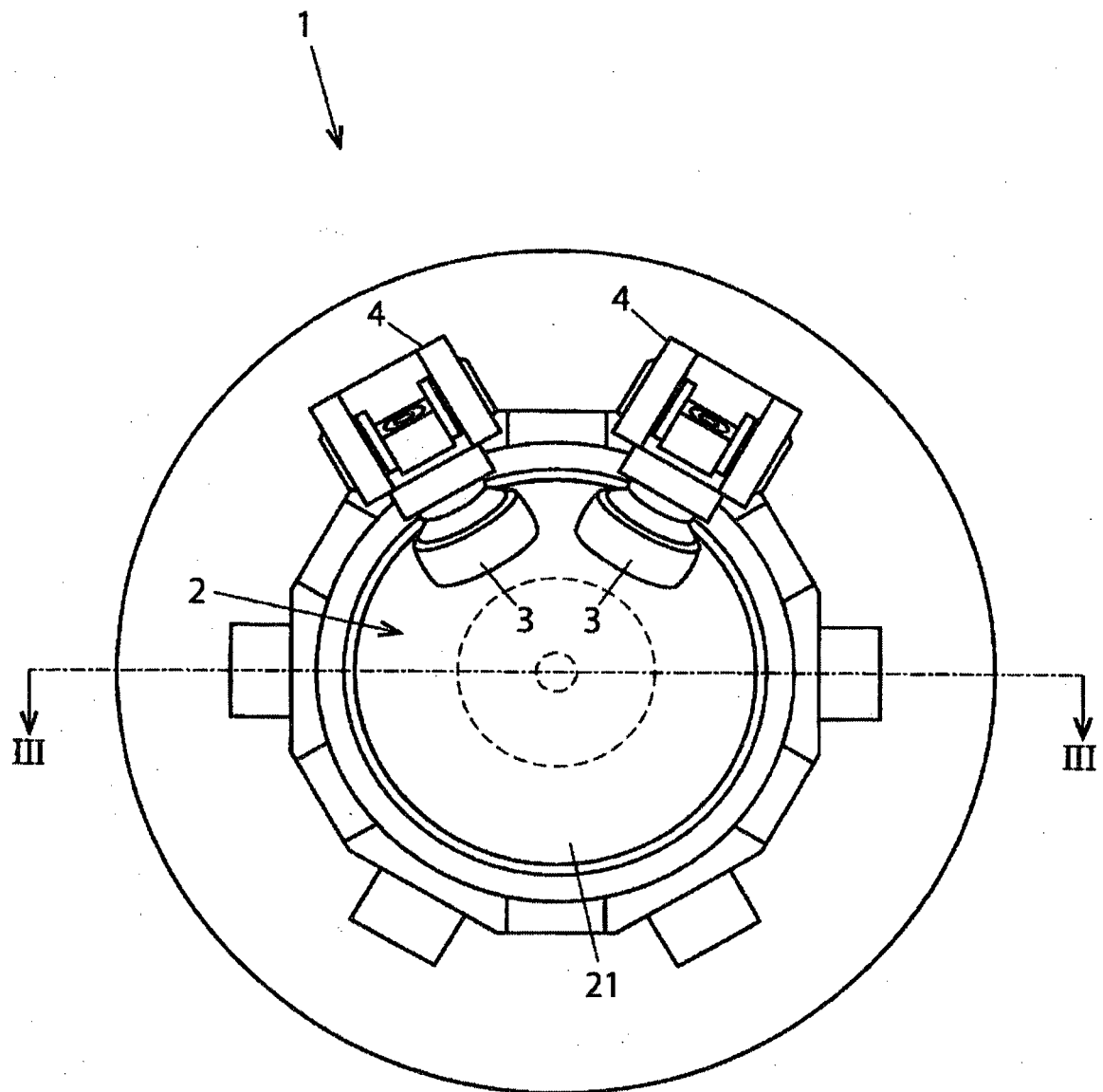


FIG. 2

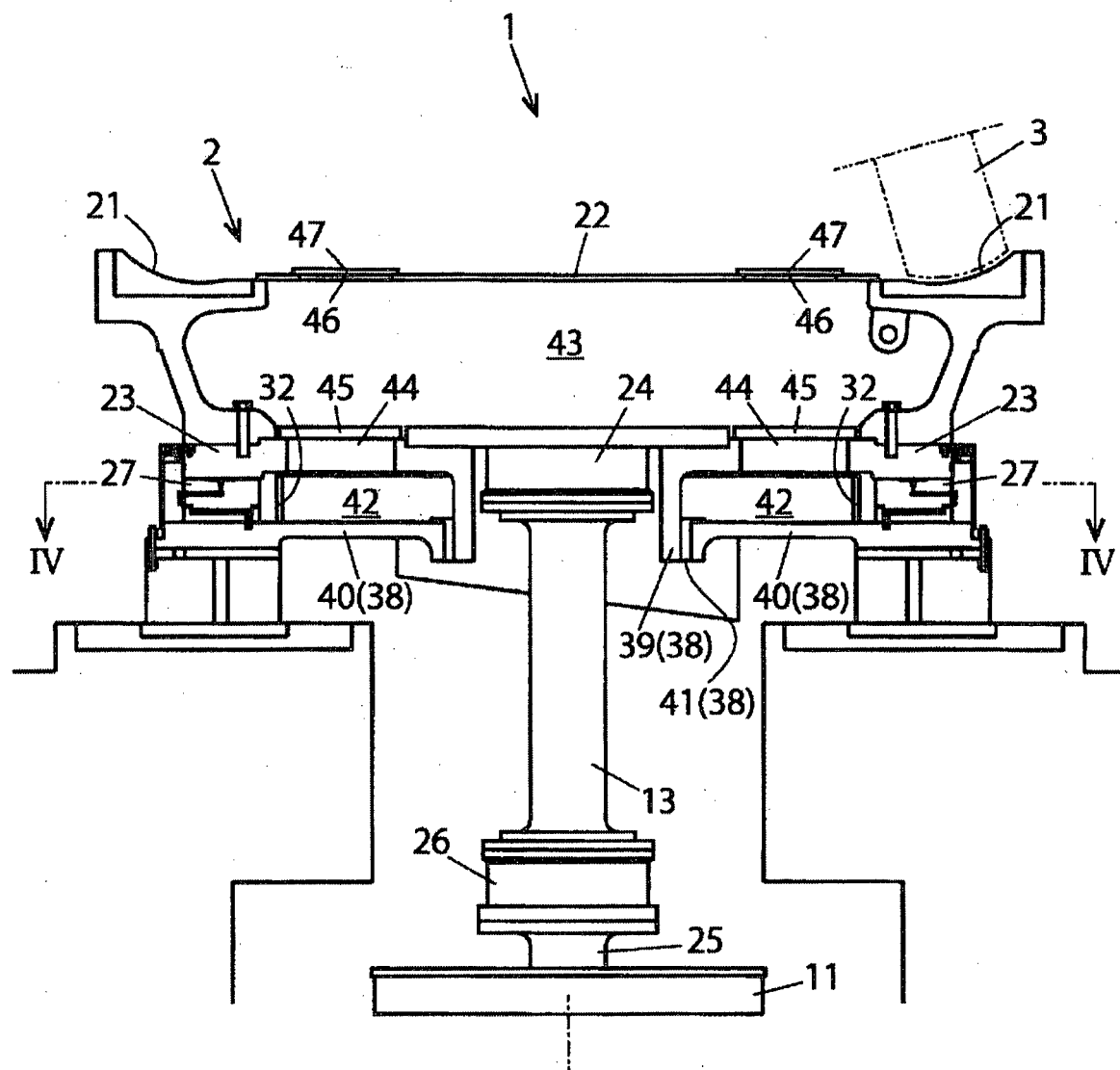


FIG. 3

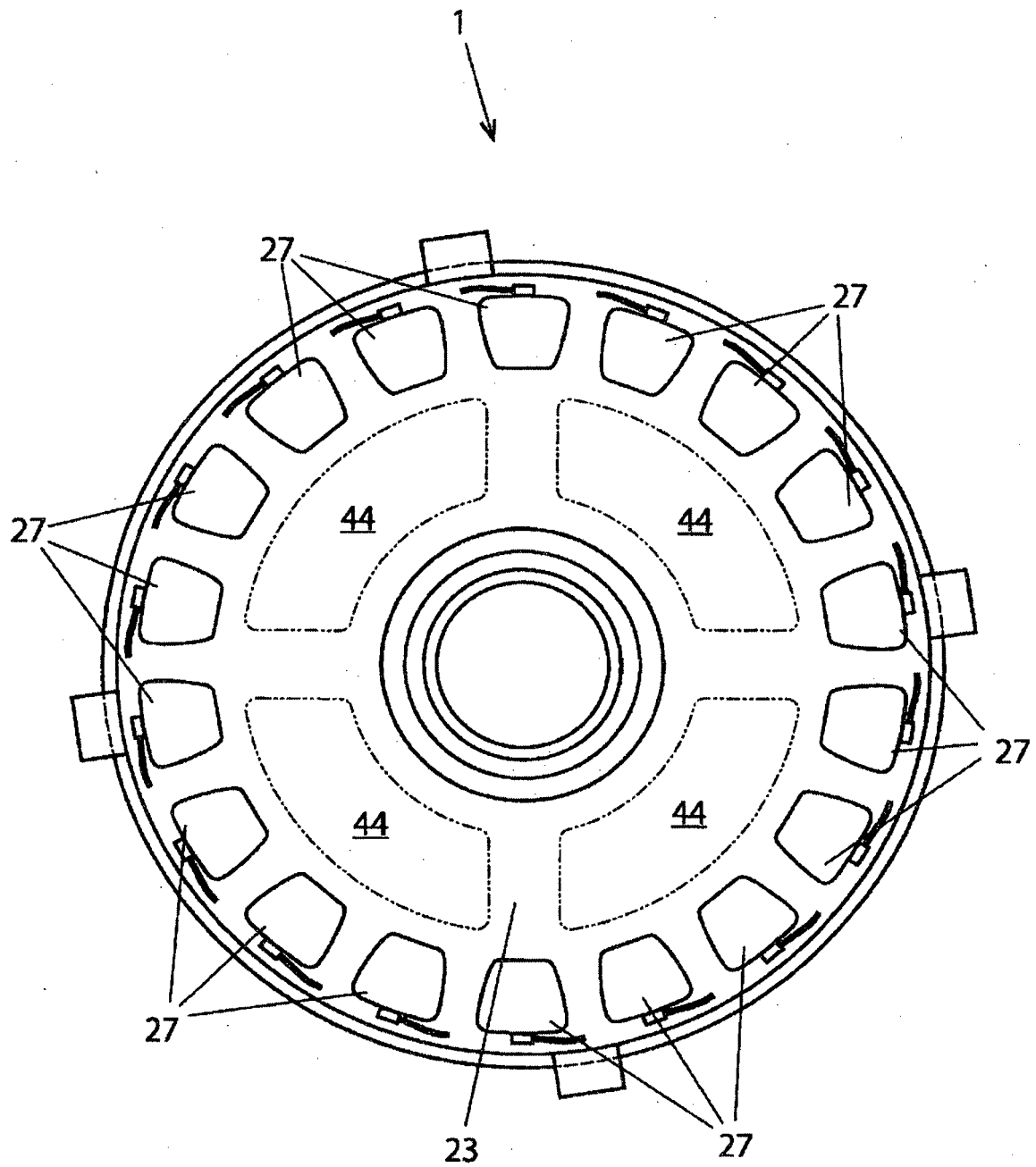


FIG. 4

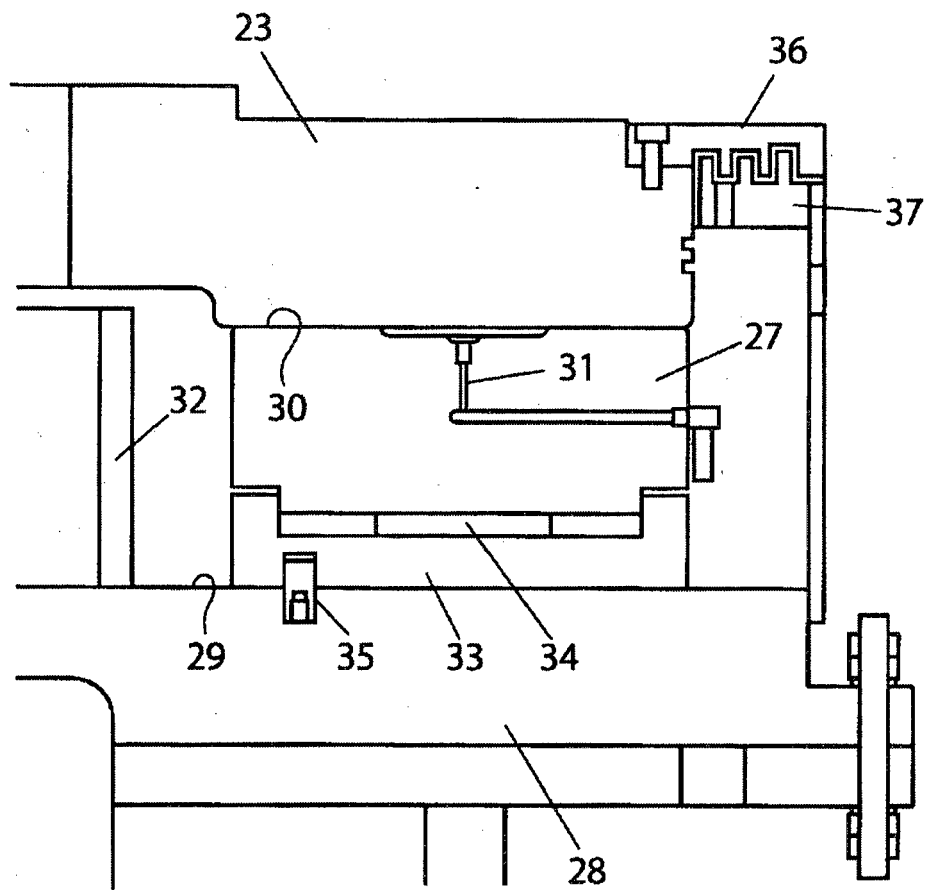


FIG. 5

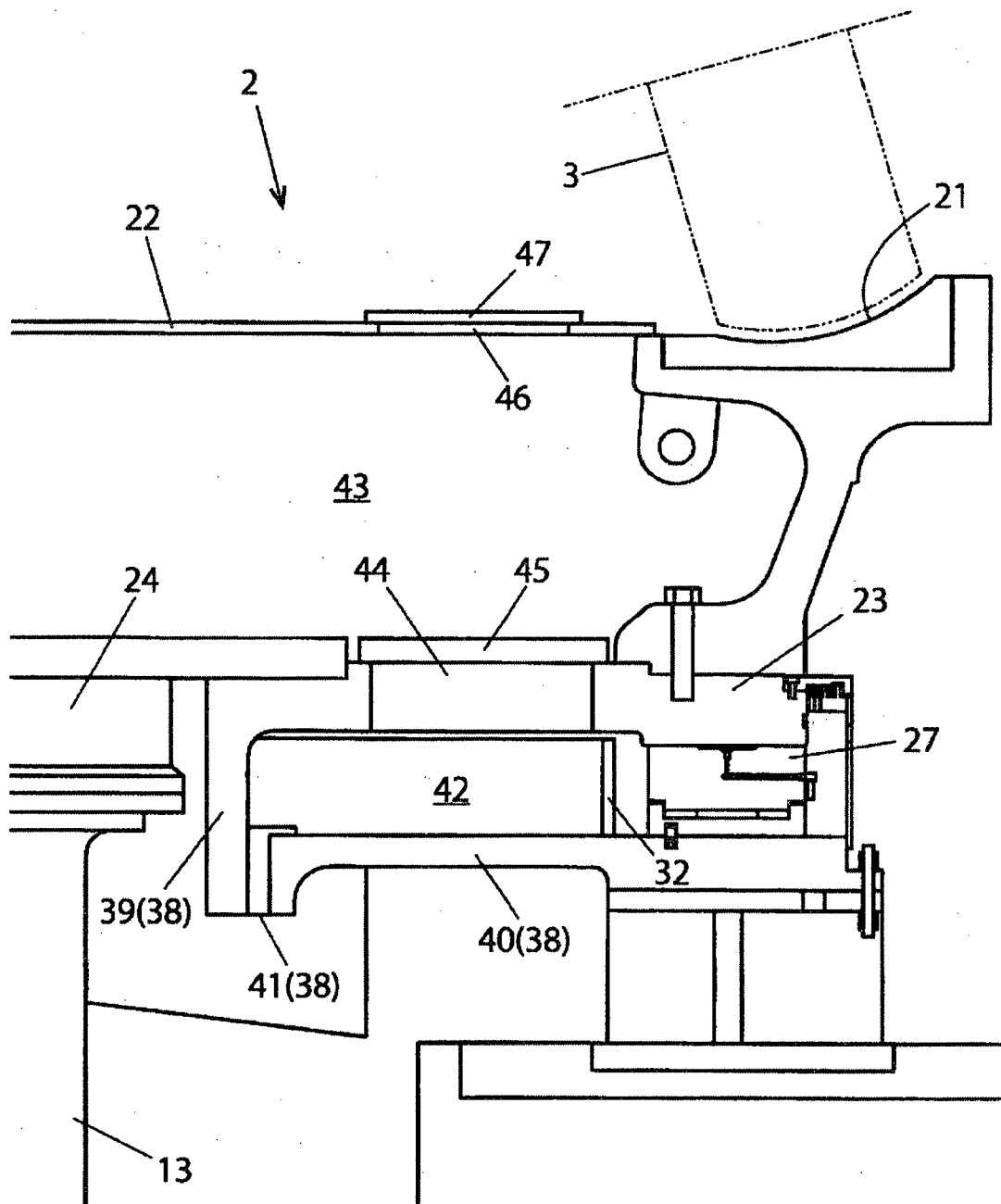


FIG. 6

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/065972

A. CLASSIFICATION OF SUBJECT MATTER

B02C15/04(2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B02C15/04

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho 1922-1996 Jitsuyo Shinan Toroku Koho 1996-2014

Kokai Jitsuyo Shinan Koho 1971-2014 Toroku Jitsuyo Shinan Koho 1994-2014

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 87548/1987 (Laid-open No. 197641/1988) (Ishikawajima-Harima Heavy Industries Co., Ltd.), 20 December 1988 (20.12.1988), specification, page 4, line 15 to page 7, line 3; fig. 1 (Family: none)	1-4, 10-12 5-9

☒ Further documents are listed in the continuation of Box C.
 ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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Date of the actual completion of the international search
16 September, 2014 (16.09.14)Date of mailing of the international search report
22 September, 2014 (22.09.14)Name and mailing address of the ISA/
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Authorized officer

Facsimile No.

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/065972

C (Continuation).	DOCUMENTS CONSIDERED TO BE RELEVANT	
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	CD-ROM of the specification and drawings annexed to the request of Japanese Utility Model Application No. 7182/1992 (Laid-open No. 67334/1993) (Kobe Steel, Ltd.), 07 September 1993 (07.09.1993), paragraphs [0013] to [0017]; fig. 1 to 2 (Family: none)	1-4, 10-12 5-9
Y	JP 53-96564 A (Loesche Hartzerkleinerungs-und Zementmaschinen GmbH & Co. KG), 23 August 1978 (23.08.1978), page 4, upper right column, line 16 to lower left column, line 9; fig. 5 & US 4218023 A & US 4339086 A & GB 1596937 A & DE 2703535 A1	12
A	JP 8-57333 A (Ube Industries, Ltd.), 05 March 1996 (05.03.1996), paragraphs [0009] to [0014]; fig. 1 to 8 (Family: none)	5-9

Form PCT/ISA/210 (continuation of second sheet) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- WO 2013069293 A1 [0006]