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(54) VERTICAL ROLLER MILL

(57) A vertical roller mill of the present invention is configured such that: a grinding ability thereof is high; the size thereof is reduced; and the maintenance of a reducer is easily performed by taking out the reducer through a predetermined passage to the outside.

A vertical roller mill (50) includes: a rotating table (14) configured to cause grinding objects to be betten between the rotating table (14) and each of a plurality of grinding rollers (13), arranged substantially about a reducer (12) along a substantially circumferential direction, to grind the grinding objects, the rotating table (14) being rotated by a rotary driving unit (15) coupled to the rotating table (14) via a reducer (12); arm supporters (18) configured to respectively support a plurality of grinding rollers (13) via first and second arms (17 and 23) at positions above the reducer (12); stand legs (28) configured to support a plurality of arm supporters (18); and a passage (32) through which the reducer (12) passes under the grinding rollers (13) to be taken out from the vertical roller mill (50).

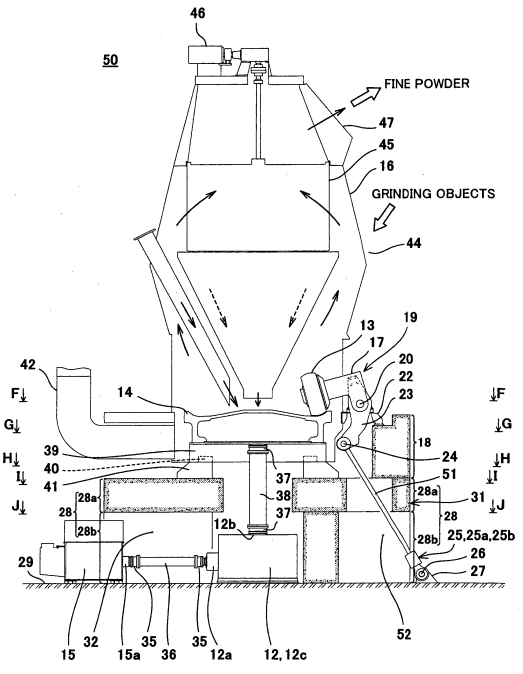

Fig. 6

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Description

Technical Field

[0001] The present invention relates to a vertical roller mill including a rotating table configured to cause grinding objects to be bitten between the rotating table and each of a plurality of grinding rollers to grind the grinding objects, the plurality of grinding rollers being arranged substantially about a reducer along a substantially circumferential direction, the rotating table being rotated by a rotary driving portion coupled to the rotating table via the reducer.

Background Art

[0002] One example of a conventional roller mill is a roller mill in which: a plurality of grinding rollers that rotate on a grinding table are respectively provided at locking levers; and the locking levers are respectively supported by locking lever shafts so as to be respectively rotatable about the locking lever shafts (see PTL 1, for example). The locking lever shafts are respectively provided at a plurality of posts via supporting blocks, and the plurality of posts are arranged along a substantially circumferential direction so as to externally surround the grinding table.

[0003] The plurality of locking lever shafts are respectively arranged at inward positions closer to an outer peripheral edge portion of the grinding table, having an annular plane shape, with reference to the posts arranged along the substantially circumferential direction. To be specific, the plurality of posts are respectively arranged at outward positions away from the grinding table with reference to the locking lever shafts.

[0004] In a case where the plurality of posts are respectively arranged at the outward positions away from the grinding table with reference to the locking lever shafts as described above, and even in a case where the numbers of grinding rollers, locking lever, locking lever shaft, and posts are increased for the purpose of increasing a grinding object grinding ability of the roller mill, the intervals each between the adjacent posts at which the grinding rollers are respectively provided can be increased.

[0005] With this, spaces each between the adjacent posts arranged along the substantially circumferential direction can be secured such that a gear device (reducer) provided inside the posts can be taken out through the spaces. Since the gear device can be taken out from the inside of the posts, the maintenance can be easily performed.

[0006] In this conventional roller mill, a suspensions is provided for each of the posts, and the suspensions are installed on an installation surface on which the gear device is installed via the posts. These suspensions also get in the way of the operation of taking out the gear device.

[0007] Therefore, as with the posts, the intervals each between the adjacent suspensions need to be increased by arranging the plurality of suspensions outwardly in a radial direction of the roller mill. Therefore, a wide space for installing the roller mill is required.

Citation List

Patent Literature

[0008] PTL 1: Published Japanese Translation of PCT Application No. 2008-525170

Summary of Invention

Technical Problem

[0009] According to the conventional roller mill, the numbers of grinding rollers, locking levers, locking lever shafts, posts, and suspensions are increased for the purpose of increasing the grinding ability. Then, to easily take out the gear device, the intervals each between the adjacent posts (suspensions) at which the grinding rollers are respectively provided are increased, and the plurality of posts (suspensions) are arranged at the outward positions away from the grinding table with reference to the locking lever shafts.

[0010] Therefore, it is necessary to secure a wide space for installing the roller mill, so that the cost for securing the space increases. Such a wide installation space may not be secured.

[0011] Further, as the number of grinding rollers increases, the positions of the posts get away from the grinding table, and an occupancy area of the roller mill increases. Therefore, there is a certain limit on the increase in the number of grinding rollers.

[0012] As above, in a case where the number of grinding rollers or the like is increased for the purpose of increasing the grinding ability in the conventional roller mill, the occupancy area of the roller mill increases. To be specific, it is impossible to obtain both the ease of the operation of taking out the gear device and the reduction in the size of the roller mill.

[0013] The present invention was made to solve the above problems, and an object of the present invention is to provide a vertical roller mill configured such that: a grinding ability thereof is high; maintenance of a reducer can be easily performed by taking out the reducer to the outside through a predetermined passage; and an entire size thereof can be reduced.

Solution to Problem

[0014] A vertical roller mill according to the present invention includes: a plurality of grinding rollers; a rotating table configured to cause grinding objects to be bitten between the rotating table and each of the plurality of grinding rollers to grind the grinding objects, the rotating

table being rotated by a rotary driving unit coupled to the rotating table via a reducer; a plurality of pressing drive units provided so as to respectively correspond to the plurality of grinding rollers and configured to respectively cause the grinding rollers to be pressed against the rotating table; arm supporters provided so as to externally surround the reducer and configured to respectively support the plurality of grinding rollers via arms at positions above the reducer; stand legs configured to support the plurality of arm supporters; and a passage through which the reducer passes under the grinding rollers to be taken out from the vertical roller mill, wherein: at least two upper leg portions of the stand legs are formed integrally, the two upper leg portions sandwiching the passage and respectively provided at both sides of the passage; and the passage is located under the upper leg portions.

[0015] According to the vertical roller mill of the present invention, the rotational power of the rotary driving unit is transmitted through the reducer to the rotating table. Thus, the rotating table can be rotated in a predetermined direction. In accordance with the rotation of the rotating table, the plurality of grinding rollers rotate. At this time, the grinding objects can be bitten between each of the plurality of grinding rollers and the rotating table to be ground. The plurality of pressing drive units can respectively cause the grinding rollers to be pressed against the rotating table, the grinding rollers being provided so as to respectively correspond to the plurality of pressing drive units. With this, the grinding objects can be bitten between each of the grinding rollers and the rotating table by desired pressing force to be ground.

[0016] The arm supporters are provided so as to externally surround the reducer. Therefore, the plurality of grinding rollers and the plurality of arms supported by the arm supporters can be arranged substantially about the reducer along a substantially circumferential direction.

[0017] The two upper leg portions of the stand legs are formed integrally, the two upper leg portions being respectively provided at both sides of at least the passage. Therefore, the strength of the upper leg portions that support the arm supporters can be improved. With this, the lower leg portion that supports the arm supporters via the upper leg portion does not have to be provided at a position immediately under the arm supporters. Therefore, a space for forming the passage can be secured under the upper leg portion. The reducer can pass under the grinding rollers to be taken out from the vertical roller mill through the passage.

[0018] The vertical roller mill according to the present invention may be configured such that: the pressing drive units configured to respectively cause the grinding rollers to be pressed against the rotating table are installed on an installation surface on which the reducer is installed; and arrangement spaces at each of which the pressing drive unit and a power transmission portion configured to transmit power of the pressing drive unit to the grinding roller are arranged or arrangement spaces at each of which the power transmission portion is arranged are formed at the stand legs.

[0019] The reason why the arrangement spaces at each of which the pressing drive unit and the power transmission portion configured to transmit the power of the pressing drive unit to the grinding roller are arranged can be formed as above or the arrangement spaces at each of which the power transmission portion is arranged can be formed as above is because even in a case where the arm supporter is provided above the passage, the lower leg portion that supports the arm supporter via the upper leg portion does not have to be provided at a position immediately under the arm supporter, and therefore, spaces where the arrangement spaces are formed can be secured under the upper leg portion.

[0020] On this account, both the pressing drive unit and the power transmission portion can be arranged at the arrangement space or the power transmission portion can be arranged at the arrangement space.

[0021] In a case where the pressing drive units are installed on the installation surface on which the reducer is installed, the pressing drive units can be installed at a lower position. With this, the labor, cost, and time for the installation and maintenance of the pressing drive units can be reduced.

[0022] The vertical roller mill according to the present invention may be configured such that: the upper leg portions that support all of the plurality of arm supporters are formed integrally; and all of the plurality of pressing drive units are installed on an installation surface on which the reducer is installed.

[0023] As above, in a case where the upper leg portions of the stand legs that support all of the plurality of arm supporters 18 are formed integrally, the strength of the entire upper leg portion can be improved. Therefore, it is possible to provide the vertical roller mill configured such that: the grinding material grinding ability thereof is high; and the size thereof is reduced.

[0024] In a case where all of the plurality of pressing drive units are installed on the installation surface on which the reducer is installed, the labor, cost, and time of the installation of the pressing drive units can be significantly reduced. In addition, the height of the vertical roller mill can be prevented from increasing in accordance with the height of the pressing drive unit. Thus, the height of the entire vertical roller mill can be reduced. As a result, the manufacturing cost of the vertical roller mill can be reduced, and the height of a building that accommodates the vertical roller mill can be reduced. Further, the cost for the building can be reduced.

[0025] The vertical roller mill according to the present invention may be configured such that the upper leg portions formed integrally support at least one of the arm supporters at a position above the passage.

[0026] With this, since the upper leg portions formed integrally support at least one arm supporter at a position above the passage, the reducer goes under the arm supporter to be taken out through the passage. Therefore, even in a case where the number of grinding rollers in-

creases, and the intervals each between the adjacent grinding rollers narrow, the ease of maintenance of the reducer can be secured while maintaining the small size of the entire vertical roller mill.

[0027] The vertical roller mill according to the present invention may be configured such that: an output portion of the reducer is coupled to the rotating table via a connecting shaft; and the rotating table is rotatably supported by a table support base frame via a thrust bearing.

[0028] As above, the output portion of the reducer is coupled to the rotating table via the connecting shaft. With this, the upper surface of the rotating table can be arranged at such a position that the grinding rollers respectively driven by the pressing drive units contact the upper surface of the rotating table. Thus, the grinding objects can be bitten between each of the grinding rollers and the rotating table, provided above the reducer 12, to be ground.

[0029] The rotating table receives high pressing force from the plurality of grinding rollers. The pressing force can be supported by the table support base frame via the thrust bearing. With this, the pressing force can be prevented from being applied to a casing of the reducer. As a result, the strength of the casing does not have to be increased in accordance with the increase in the grinding ability. Therefore, a structure for increasing the strength of the casing is unnecessary, so that the structure of the casing can be simplified. Thus, the weight of the casing can be reduced, and the manufacturing cost can be reduced.

[0030] The pressing force applied to the rotating table by the plurality of grinding rollers can be supported by the table support base frame via the thrust bearing. Therefore, even in a case where the rotating table is increased in diameter for the purpose of increasing the grinding object grinding ability of the vertical roller mill, the shape of the table supporting portion can be set freely without considering the connection with the reducer.

[0031] Further, the output portion of the reducer and the rotating table are coupled to each other via the connecting shaft, and the rotating table is rotatably supported by the table support base frame via the thrust bearing. Therefore, an operation of separating the reducer from the table supporting portion and taking out the reducer from the vertical roller mill can be easily performed for the purpose of, for example, the maintenance of the reducer.

[0032] The vertical roller mill according to the present invention may be configured such that the table support base frame is provided at the stand legs.

[0033] With this, the table support base frame can be supported by the stand legs.

[0034] The vertical roller mill according to the present invention may be configured such that the stand legs and the arm supporters are made of concrete.

[0035] With this, vibrations and impacts generated when biting the grinding objects between each of the plurality of grinding rollers and the rotating table to grind the grinding objects can be suppressed by a concrete stand. With this, respective parts included in the vertical roller mill can be prevented from being damaged and can be increased in life. In addition, for example, by adopting a concrete stand that is lower in cost than the steel stand, the manufacturing cost can be reduced regarding the material cost.

[0036] The vertical roller mill according to the present invention may be configured such that the plurality of grinding rollers are six or more grinding rollers.

[0037] By providing six or more grinding rollers, the grinding ability can be improved. In addition, even in a case where the number of grinding rollers is six or more, the reducer can be taken out from the vertical roller mill through predetermined passage, and the lower leg portions of the stand legs do not get in the way of this operation. Even in a case where the number of grinding rollers increases, the stand legs do not have to be arranged at positions outwardly away from the rotating table. Therefore, the grinding ability of the vertical roller mill can be improved without being restricted by the occupancy area of the vertical roller mill or the moment applied to the stand legs. With this, when grinding a large amount of grinding objects, the number of vertical roller mills can be reduced. Thus, the introduction cost and the running cost can be reduced.

[0038] The vertical roller mill according to the present invention includes: a plurality of grinding rollers; a rotating table configured to cause grinding objects to be bitten between the rotating table and each of the plurality of grinding rollers to grind the grinding objects, the rotating table being rotated by a rotary driving unit coupled to the rotating table via a reducer; a plurality of pressing drive units provided so as to respectively correspond to the plurality of grinding rollers and configured to respectively cause the grinding rollers to be pressed against the rotating table; stands provided so as to externally surround the reducer and configured to support the plurality of pressing drive units and the plurality of grinding rollers at positions above the reducer; and a passage through which the reducer passes under the pressing drive units and the grinding rollers to be taken out from the vertical roller mill.

[0039] According to the vertical roller mill of the present invention, the rotational power of the rotary driving unit is transmitted through the reducer to the rotating table. Thus, the rotating table can be rotated in a predetermined direction. In accordance with the rotation of the rotating table, the plurality of grinding rollers rotate. At this time, the grinding objects can be bitten between each of the plurality of grinding rollers and the rotating table to be ground. The plurality of pressing drive units can respectively cause the grinding rollers to be pressed against the rotating table, the grinding rollers being provided so as to respectively correspond to the plurality of pressing drive units. With this, the grinding objects can be bitten between each of the grinding rollers and the rotating table by desired pressing force to be ground.

[0040] The stands are provided so as to externally surround the reducer. Therefore, the plurality of pressing drive units and the plurality of grinding rollers supported by the stands can be arranged substantially about the reducer along the substantially circumferential direction.

[0041] Further, the stands support the plurality of pressing drive units and the plurality of grinding rollers at positions above the reducer. Therefore, the reducer can be taken out from the vertical roller mill through the predetermined passage formed under the pressing drive units and the grinding rollers.

[0042] The vertical roller mill according to the present invention may be configured such that: the at least two stands sandwiching the passage and respectively provided at both sides of the passage are formed integrally; and the passage is formed at lower portions of the stands.

[0043] With this, the strength of the stands can be improved. Therefore, the lower portion of the stand that supports the pressing drive units and the grinding rollers does not have to be provided at a position immediately under the pressing drive units and the grinding rollers. On this account, the space for forming the passage can be secured at the lower portion of the stand. Then, the reducer can pass under the pressing drive units and the grinding rollers to be taken out from the vertical roller mill through the passage.

[0044] The vertical roller mill according to the present invention may be configured such that each of the stands includes at least one of the pressing drive units and/or at least one of the arm supporters at positions above the passage.

[0045] The stands are configured such that at least one pressing drive unit and/or at least one arm supporter are located above the passage. Therefore, the reducer goes under the pressing drive unit and the arm supporter to be taken out through the passage. On this account, even in a case where the number of grinding rollers and the number of pressing drive units increase, and this narrows, for example, the intervals each between the adjacent grinding rollers, the ease of maintenance of the reducer can be secured while maintaining the compact size of the entire vertical roller mill.

[0046] The vertical roller mill according to the present invention may be configured such that: an output portion of the reducer is coupled to a table supporting portion via a connecting shaft; the rotating table is provided so as to be fixed to an upper portion of the table supporting portion; and the table supporting portion is rotatably supported by a table support base frame via a thrust bearing.

[0047] As above, the output portion of the reducer is coupled to the table supporting portion via the connecting shaft, and the rotating table is provided so as to be fixed to the upper portion of the table supporting portion. With this, the upper surface of the rotating table can be arranged at such a position that the grinding rollers respectively driven by the pressing drive units provided at positions above the reducer contact the upper surface of the rotating table. Thus, the grinding objects can be bitten between each of the grinding rollers and the rotating table, provided above the reducer 12, to be ground.

[0048] The rotating table receives high pressing force from the plurality of grinding rollers. The pressing force can be supported by the table support base frame via the thrust bearing. With this, the pressing force can be prevented from being applied to the casing of the reducer. As a result, the strength of the casing does not have to be increased in accordance with the increase in the grinding ability. Therefore, a structure for increasing the strength of the casing is unnecessary, so that the structure of the casing can be simplified. Thus, the weight of the casing can be reduced, and the manufacturing cost can be reduced.

[0049] The pressing force applied to the rotating table by the plurality of grinding rollers can be supported by the table support base frame via the table supporting portion and the thrust bearing. Therefore, even in a case where the rotating table is increased in diameter for the purpose of increasing the grinding object grinding ability of the vertical roller mill, the shape of the table supporting portion can be set freely without considering the connection with the reducer.

[0050] Further, the output portion of the reducer and the rotating table are coupled to each other via the connecting shaft, and the rotating table is rotatably supported by the table support base frame via the table supporting portion and the thrust bearing. Therefore, the operation of separating the reducer from the table supporting portion and taking out the reducer from the vertical roller mill can be easily performed for the purpose of, for example, the maintenance of the reducer.

[0051] The vertical roller mill according to the present invention may be configured such that the table support base frame is provided at the stands.

[0052] With this, the table support base frame can be supported by the stands.

[0053] The vertical roller mill according to the present invention may be configured such that the stands are made of concrete.

[0054] With this, vibrations and impacts generated when biting the grinding objects between each of the plurality of grinding rollers and the rotating table to grind the grinding objects can be suppressed by the concrete stands. With this, respective parts included in the vertical roller mill can be prevented from being damaged and can be increased in life. In addition, for example, by adopting a concrete stand that is lower in price than the steel stand, the manufacturing cost can be reduced regarding the material cost.

[0055] The vertical roller mill according to the present invention may be configured such that the plurality of grinding rollers are six or more grinding rollers.

[0056] By providing six or more grinding rollers, the grinding ability can be improved. In addition, even in a case where the number of grinding rollers is six or more, the reducer can be taken out from the vertical roller mill through the predetermined passage, and the pressing

drive units do not get in the way of this operation. Even in a case where the number of grinding rollers increases, the stands do not have to be arranged at positions outwardly away from the rotating table. Thus, the grinding ability of the vertical roller mill can be improved without being restricted by the occupancy area of the vertical roller mill or the moment applied to the stands. With this, when grinding a large amount of grinding objects, the number of vertical roller mills can be reduced. Thus, the introduction cost and the running cost can be reduced.

Advantageous Effects of Invention

[0057] According to the vertical roller mill of one aspect of the present invention, even in a case where the arm supporter is provided above the passage, the lower leg portion that supports the arm supporters via the upper leg portion does not have to be provided at a position immediately under the arm supporter. Therefore, the space for forming the passage can be secured under the upper leg portion. On this account, it is possible to provide the vertical roller mill configured such that: the grinding object grinding ability thereof is high; the size thereof is reduced; and the maintenance of the reducer can be easily performed by externally taking out the reducer through the predetermined passage to the outside.

[0058] The vertical roller mill according to another aspect of the present invention is configured such that: the stands provided so as to externally surround the reducer support the plurality of pressing drive units and the plurality of grinding rollers at positions above the reducer; and the passage is provided, through which the reducer passes under the pressing drive unit and the grinding roller to be taken out from the vertical roller mill. Therefore, even in a case where the number of grinding rollers and the number of pressing drive units are increased for the purpose of increasing the grinding object grinding ability of the vertical roller mill, it is unnecessary to arrange the plurality of pressing drive units at radially outer sides about the reducer for the purpose of increasing the intervals each between the adjacent pressing drive units. This is because it is unnecessary to take out the reducer from between the adjacent pressing drive units. On this account, it is possible to provide the vertical roller mill configured such that: the grinding object grinding ability thereof is high; the size thereof is reduced; and the maintenance of the reducer can be easily performed by taking out the reducer through the predetermined passage to the outside.

Brief Description of Drawings

[0059]

[Fig. 1] Fig. 1 is a partially omitted E-E cross-sectional view showing a vertical roller mill according to Embodiment 1 of the present invention.

[Fig. 2] Fig. 2 is a partially omitted A-A cross-sectional view showing the vertical roller mill according to Embodiment 1 of the present invention.

[Fig. 3] Fig. 3 is a partially omitted B-B cross-sectional view showing the vertical roller mill according to Embodiment 1 of the present invention.

[Fig. 4] Fig. 4 is a partially omitted C-C cross-sectional view showing the vertical roller mill according to Embodiment 1 of the present invention.

[Fig. 5] Fig. 5 is a partially omitted D-D cross-sectional view showing the vertical roller mill according to Embodiment 1 of the present invention.

[Fig. 6] Fig. 6 is a partially omitted K-K cross-sectional view showing the vertical roller mill according to Embodiment 2 of the present invention.

[Fig. 7] Fig. 7 is a partially omitted F-F cross-sectional view showing the vertical roller mill according to Embodiment 2 of the present invention.

[Fig. 8] Fig. 8 is a partially omitted G-G cross-sectional view showing the vertical roller mill according to Embodiment 2 of the present invention.

[Fig. 9] Fig. 9 is a partially omitted H-H cross-sectional view showing the vertical roller mill according to Embodiment 2 of the present invention.

[Fig. 10] Fig. 10 is a partially omitted I-I cross-sectional view showing the vertical roller mill according to Embodiment 2 of the present invention.

[Fig. 11] Fig. 11 is a partially omitted J-J cross-sectional view showing the vertical roller mill according to Embodiment 2 of the present invention.

Description of Embodiments

[0060] Hereinafter, Embodiment 1 of the vertical roller mill according to the present invention will be explained in reference to Figs. 1 to 5. A vertical roller mill 11 shown in Fig. 1 includes a rotating table 14 configured to cause grinding objects to be bitten between the rotating table 14 and each of a plurality of grinding rollers 13 to grind the grinding objects, the plurality of grinding rollers 13 being arranged so as to externally surround a reducer 12 when viewed from above, that is, arranged substantially about the reducer 12 along a substantially circumferential direction. The rotating table 14 is rotated by a rotary driving unit 15 coupled to the rotating table 14 via the reducer 12. The rotating table 14 and the grinding rollers 13 are covered with a casing 16.

[0061] In the present embodiment, for example, six grinding rollers 13 are respectively provided at arm supporters 18 of stands 31 via first arms 17 and arm bearing bases 22. These six grinding rollers 13 are pressed against the rotating table 14, formed in an annular shape, by six roller pressing mechanisms 19, respectively. These six roller pressing mechanisms 19 are the same as one another. Therefore, the roller pressing mechanism 19 shown in Fig. 1 will be explained, and explanations of the other roller pressing mechanisms are omitted.

[0062] The roller pressing mechanism 19 shown in Fig. 1 includes the grinding roller 13. The grinding roller 13 is

rotatably provided at a tip end portion of the first arm 17. A base end portion of the first arm 17 is coupled to a first arm shaft 20. The first arm shaft 20 is rotatably provided at an arm bearing portion 21 (see Fig. 2). The arm bearing portion 21 is fixed to the arm supporter 18 of the stand 31 via the arm bearing base 22.

[0063] An upper end portion of a second arm 23 is coupled to the first arm shaft 20. A lower end portion of the second arm 23 is rotatably coupled to a tip end portion of a pressing drive unit 25 via a second arm shaft 24. A pressing drive unit shaft (cylinder pin, for example) 26 is provided at a base end portion of the pressing drive unit 25, and the pressing drive unit shaft 26 is rotatably provided at a pressing drive device support base 27. The pressing drive device support base 27 is fixed to pressing drive device supporting portions 28 of the stands 31.

[0064] The pressing drive unit 25 causes the grinding roller 13 to be pressed against the rotating table 14 and is, for example, a hydraulic cylinder device. The hydraulic cylinder device is configured such that: the second arm shaft 24 is provided at a tip end portion of a piston rod 25a thereof; and the pressing drive unit shaft 26 is provided at a base end portion of a cylinder 25b thereof. In the present embodiment, the hydraulic cylinder device is used as the pressing drive unit 25. However, the other driving unit may be used.

[0065] When the pressing drive unit 25 operates in a contraction direction by predetermined force, the roller pressing mechanism 19 shown in Fig. 1 can cause the grinding roller 13 to be pressed against the rotating table 14 by predetermined force. When the pressing drive unit 25 operates to become a predetermined extended state, the roller pressing mechanism 19 shown in Fig. 1 can cause the grinding roller 13 to move upward to reduce pressing force with respect to the rotating table 14.

[0066] Next, the stands 31 including the arm supporters 18 and the pressing drive device supporting portions 28 shown in Fig. 1 will be explained. The pressing drive device supporting portions 28 corresponds to "stand legs" recited in claims.

[0067] First, as shown in the D-D cross-sectional view of Fig. 5, lower portions (lower leg portions 28b) of the pressing drive device supporting portions (stand legs) 28 are formed as two semicircular portions. As shown in Fig. 3, upper portions of the pressing drive device supporting portions (stand legs) 28 are formed on the lower portions (lower leg portions 28b) of the pressing drive device supporting portions (stand legs) 28. The upper portions of the pressing drive device supporting portions (stand legs) 28 corresponds to "upper leg portions 28a" recited in claims.

[0068] Next, lower portions of the arm supporters 18 shown in Fig. 3 are provided on the pressing drive device supporting portions (stand legs) 28, and upper portions of the arm supporters 18 shown in Fig. 2 are respectively provided on the lower portions of the arm supporters 18. The stands 31 including the arm supporters 18 and the pressing drive device supporting portions (stand legs) 28 are made of, for example, reinforced concrete.

[0069] As shown in Figs. 1 and 4, the pressing drive device supporting portions (stand legs) 28 are provided along the substantially circumferential direction so as to externally surround the reducer 12 and support six pressing drive units 25, a table supporting portion 39, and a table support base frame 41 at positions above the reducer 12.

[0070] Further, as shown in Figs. 1 and 5, a predetermined passage 32 is formed so as to penetrate the lower portions (lower leg portions 28b) of the pressing drive device supporting portions (stand legs) 28. The passage 32 is formed such that the reducer 12 can go under the pressing drive units 25 and the grinding rollers 13 to be taken out from the vertical roller mill 11. For example, the pressing drive device support bases 27 are provided at positions higher than an upper surface of the reducer 12. A motor base 34 used when taking out the reducer 12 is shown on the passage 32 shown in Fig. 5.

[0071] As shown in Fig. 1, the reducer 12 is provided on an installation surface 29 on which the vertical roller mill 11 is installed, and is arranged at a substantially center position of the vertical roller mill 11. An input shaft 12a of the reducer 12 is coupled to a rotating shaft 15a of the rotary driving unit 15 (electric motor) via a coupling 35, a connecting shaft 36, and another coupling 35. An output portion 12b of the reducer 12 is coupled to the table supporting portion 39, having a circular plate shape, via a coupling 37, a connecting shaft 38, and another coupling 37.

[0072] The rotating table 14 is provided so as to be fixed to an upper portion of the table supporting portion 39, and the table supporting portion 39 is rotatably supported by the table support base frame 41 via a thrust bearing 40. The table support base frame 41 is provided so as to be fixed to the pressing drive device supporting portions (stand legs) 28. The table support base frame 41 is formed in, for example, an annular shape, and the connecting shaft 38 is inserted through a center of the table support base frame 41.

[0073] As shown in Fig. 2, each of hot air supply ducts 42 is provided between the adjacent arm supporters 18. The number of hot air supply ducts 42 connected to the vertical roller mill 11 is, for example, six. As shown in Fig. 5, a passage 33 is formed at an opposite side of the passage 32 through which the reducer 12 is taken out, and a circulating material discharging conveyor 43 is arranged on the passage 33. The circulating material discharging conveyor 43 discharges the grinding objects having coarse particle diameters from the vertical roller mill 11 and again supplies the grinding objects through a material supply chute 44 into the vertical roller mill 11. The grinding objects, having the coarse particle diameters, in the vertical roller mill 11 are supplied through a circulating material discharge chute 48 shown in Fig. 4 to the circulating material discharging conveyor 43.

[0074] Next, the actions of the vertical roller mill 11 configured as above will be explained. According to the

vertical roller mill 11 shown in Fig. 1, the grinding objects are supplied onto the rotating table 14 through the material supply chute 44 provided above the rotating table 14, and the plurality of grinding rollers 13, such as six grinding rollers 13, are caused to be pressed against an upper surface of the rotating table 14 by the pressing drive units 25 via the first and second arms 17 and 23. With this, the vertical roller mill 11 can bite the grinding objects between the rotating table 14 and each of the plurality of grinding rollers 13 to grind the grinding objects.

[0075] The ground grinding objects are blown up by hot air, supplied from the hot air supply ducts 42, to be transferred to a separator 45 provided at an upper side.

[0076] The separator 45 is rotated by a separator driving device 46 (electric motor, for example). The separator 45 can discharge only fine powder, which is finer than a predetermined particle size (particle diameter) in the ground grinding objects, through a fine powder discharge duct 47 provided at an upper portion of the casing 16. In addition, the separator 45 can return the rest of the ground grinding objects back onto the rotating table 14 such that the grinding objects are ground again.

[0077] Rotational power of the rotary driving unit 15 shown in Fig. 1 is transmitted through the reducer 12 and the table supporting portion 39 to the rotating table 14. Thus, the rotating table 14 can be rotated in a predetermined direction. In accordance with the rotation of the rotating table 14, the plurality of grinding rollers 13 rotate. A plurality of pressing drive units 25, such as six pressing drive units 25, can respectively cause the grinding rollers 13 to be pressed against the rotating table 14. With this, the grinding objects can be bitten between each of the grinding rollers 13 and the rotating table 14 by desired pressing force to be ground.

[0078] The stands 31 including the pressing drive device supporting portions 28 and the arm supporters 18 are provided so as to externally surround the reducer 12. Therefore, the plurality of pressing drive units 25 and the plurality of grinding rollers 13 supported by the stands 31 can be arranged substantially about the reducer 12 along the substantially circumferential direction.

[0079] Two upper portions (upper leg portions 28a) of the pressing drive device supporting portions (stand legs) 28 are formed integrally as shown in Figs. 4 and 1, the two upper portions sandwiching the passage 32 shown in Fig. 5 and being respectively provided at both sides of the passage 32. Therefore, the strength of the upper portions (upper leg portions 28a) that support the arm supporters 18 can be improved. With this, the lower portions (lower leg portions 28b) of the pressing drive device supporting portions (stand legs) 28 do not have to be provided at positions immediately under the arm supporters 18, the lower portions (lower leg portions 28b) supporting the arm supporters 18 via the upper portions (upper leg portions 28a). Therefore, a space for forming the passage 32 can be secured under the upper portion (upper leg portion 28a). The reducer 12 can pass under the grinding rollers 13 to be taken out from the vertical roller mill 11 through the passage 32.

[0080] According to the vertical roller mill 11, even in a case where the arm supporter 18 is provided above the passage 32, the lower portion (lower leg portion 28b) that supports the arm supporters 18 via the upper portion (upper leg portion 28a) of the pressing drive device supporting portion (stand leg) 28 does not have to be provided at the position immediately under the arm supporter 18. Therefore, the space for forming the passage 32 can be secured under the upper portion (upper leg portion 28a). On this account, it is possible to provide the vertical roller mill 11 configured such that: the grinding object grinding ability thereof is high; the size thereof is reduced; and the maintenance of the reducer 12 can be easily performed by taking out the reducer 12 through the predetermined passage 32 to the outside.

[0081] Further, as shown in Fig. 1, the pressing drive device supporting portions 28 and the arm supporters 18 support the plurality of pressing drive units 25 and the plurality of grinding rollers 13 at positions above the reducer 12. Therefore, the reducer 12 can pass under the pressing drive unit 25 and the grinding roller 13, that is, go under the pressing drive unit 25 and the grinding roller 13 to be taken out from the vertical roller mill 11 through the predetermined passage 32 (see Figs. 1 and 5).

[0082] Therefore, even in a case where each of the number of grinding rollers 13 and the number of pressing drive units 25 is increased from, for example, four to six as in the present embodiment for the purpose of increasing the grinding object grinding ability of the vertical roller mill 11, it is unnecessary to arrange the six pressing drive units 25 at radially outer sides about the reducer 12 for the purpose of increasing the intervals each between the adjacent pressing drive units 25. This is because it is unnecessary to take out the reducer 12 from between the adjacent pressing drive units 25. On this account, it is possible to provide the vertical roller mill 11 configured such that: the grinding object grinding ability thereof is high; the size thereof is reduced; and the maintenance of the reducer 12 can be easily performed by taking out the reducer 12 through the predetermined passage 32 to the outside.

[0083] The stands 31 are configured such that at least one pressing drive unit 25 and/or at least one arm supporter 18 are located above the passage 32. Therefore, the reducer 12 goes under the pressing drive unit 25 and the arm supporter 18 to be taken out through the passage 32. On this account, even in a case where the number of grinding rollers 13 and the number of pressing drive units 25 increase, and this narrows, for example, the intervals each between the adjacent grinding rollers 13, the ease of maintenance of the reducer 12 can be secured while maintaining the compact size of the entire vertical roller mill 11.

[0084] As shown in Fig. 1, the output portion 12b of the reducer 12 is coupled to the table supporting portion 39 via the connecting shaft 38 and the like, and the rotating table 14 is provided so as to be fixed to the upper portion

of the table supporting portion 39. With this, the upper surface of the rotating table 14 can be arranged at such a position that the grinding rollers 13 respectively driven by the pressing drive units 25 provided above the reducer 12 contact the upper surface of the rotating table 14. Thus, the grinding objects can be bitten between each of the grinding rollers 13 and the rotating table 14, provided above the reducer 12, to be ground.

[0085] The rotating table 14 receives high pressing force from the plurality of grinding rollers 13. The pressing force can be supported by the table support base frame 41 via the thrust bearing 40. With this, the pressing force can be prevented from being applied to a casing 12c of the reducer 12 and the connecting shaft 38. As a result, the strengths of the casing 12c and the connecting shaft 38 do not have to be increased in accordance with the increase in the grinding ability. Therefore, a structure for increasing the strength of the casing 12c is unnecessary, so that the structure of the casing 12c can be simplified. Thus, the weight of the casing 12c can be reduced, and the manufacturing cost of the casing 12c can be reduced.

[0086] The pressing force applied to the rotating table 14 by the plurality of grinding rollers 13 can be supported by the table support base frame 41 via the table supporting portion 39 and the thrust bearing 40. Therefore, even in a case where the rotating table 14 is increased in diameter for the purpose of increasing the grinding object grinding ability of the vertical roller mill 11, the shape of the table supporting portion 39 can be set freely without considering the connection with the reducer 12.

[0087] Further, the output portion 12b of the reducer 12 and the rotating table 14 are coupled to each other via the table supporting portion 39, the connecting shaft 38, and the couplings 37, and the rotating table 14 is rotatably supported by the table support base frame 41 via the table supporting portion 39 and the thrust bearing 40. Therefore, an operation of separating the reducer 12 from the table supporting portion 39 and taking out the reducer 12 from the vertical roller mill 11 can be easily performed for the purpose of, for example, the maintenance of the reducer 12.

[0088] Vibrations and impacts generated when biting the grinding objects between each of the plurality of grinding rollers 13 and the rotating table 14 to grind the grinding objects can be suppressed by the concrete stands 31 that support the rotating table 14. With this, respective parts, such as the roller pressing mechanisms 19, the reducer 12, and the grinding rollers 13, included in the vertical roller mill 11 can be prevented from being damaged and can be increased in life.

[0089] Even in a case where the number of grinding rollers 13 is six or more, the reducer 12 can be taken out from the vertical roller mill 11 through the predetermined passage 32, and the pressing drive units 25 do not get in the way of this operation. Therefore, even in a case where the number of grinding rollers 13 increases, the stands 31 do not have to be arranged at positions away from the rotating table 14 in a radially outer direction. Thus, the grinding ability of the vertical roller mill 11 can be improved without being restricted by the occupancy area of the vertical roller mill 11 or the moment applied to the stands 31. With this, when grinding a large amount of grinding objects, the number of vertical roller mills 11 can be reduced. Thus, the introduction cost and the running cost can be reduced.

[0090] Next, a comparison between a case where the pressing drive unit 25 (hydraulic cylinder device, for example) shown in Fig. 1 is installed on the installation surface 29 and a case where the pressing drive unit 25 is provided at a position above the reducer 12 will be explained. For example, to manufacture the vertical roller mill 11 having a high grinding ability, the vertical roller mill 11 includes six grinding rollers 13. Here, a case is assumed where the pressing drive units 25 are installed on the installation surface 29, not the pressing drive device supporting portions 28 of the stands 31. If the stands 31 are made of steel, the stands 31 can be designed such that the reducer 12 can be taken out through the space between the leg portions of the stands 31. However, if the stands 31 are made of reinforced concrete, the installation area of the leg portions becomes larger than that of the leg portions of the stands 31 made of steel. Therefore, the space between the leg portions becomes narrow. Thus, there is a possibility that the reducer 12 cannot be taken out through the space.

[0091] However, in the present embodiment, the pressing drive units 25 are provided at positions above the reducer 12. With this, even in a case where the stands 31 are made of reinforced concrete, the reducer 12 can go under the pressing drive unit 25 and the grinding roller 13 to be taken out through the passage 32, and the pressing drive units 25 do not get in the way of this operation.

[0092] Therefore, according to the vertical roller mill 11 of the present invention, even in a case where the vertical roller mill 11 includes six or more grinding rollers 13 for the purpose of manufacturing the vertical roller mill 11 having a high grinding ability, the passage 32 through which the reducer 12 is taken out can be easily formed at the stands 31. Therefore, the stands 31 made of reinforced concrete can be adopted. As above, in a case where the stands 31 are made of reinforced concrete, vibrations and impacts transmitted from the grinding roller 13 can be suppressed, and the manufacturing cost of the stands 31 can be reduced.

[0093] Next, Embodiment 2 of the vertical roller mill according to the present invention will be explained in reference to Figs. 6 to 11. A vertical roller mill 50 of Embodiment 2 shown in Fig. 6 is different from the vertical roller mill 11 of Embodiment 1 shown in Fig. 1 as below.

[0094] In Embodiment 1 shown in Fig. 1, the plurality of pressing drive units 25 are supported by the pressing drive device supporting portions (stand legs) 28 at positions above the reducer 12, and the reducer 12 passes through the predetermined passage 32 (see Figs. 1 and 5), formed at the lower portions (lower leg portions 28b) of the pressing drive device supporting portions (stand

legs) 28, to be taken out from the vertical roller mill 11.

[0095] On the other hand, in Embodiment 2 shown in Fig. 6, the plurality of pressing drive units 25 are installed on the installation surface 29 on which the reducer 12 is installed, and the reducer 12 passes through the predetermined passage 32 (see Figs. 6 and 11), formed at the lower leg portions (lower portions) 28b of the stand legs (pressing drive device supporting portions) 28, to be taken out from the vertical roller mill 50.

[0096] Other than the above, Embodiment 2 is the same as Embodiment 1 shown in Fig. 1. Therefore, the same reference signs are used for the same components, and detailed explanations thereof are omitted.

[0097] To be specific, the vertical roller mill 50 of Embodiment 2 shown in Fig. 6 includes the rotating table 14 configured to cause the grinding objects to be bitten between the rotating table 14 and each of the plurality of grinding rollers 13 to grind the grinding objects, and the rotating table 14 is rotated by the rotary driving unit 15 connected to the rotating table 14 via the reducer 12. The vertical roller mill 50 further includes: the plurality of pressing drive units 25 provided so as to respectively correspond to the plurality of grinding rollers 13 and configured to cause the grinding rollers 13 to be pressed against the rotating table 14; the arm supporters 18 provided so as to externally surround the reducer 12 and configured to respectively support the plurality of grinding rollers 13 via the first and second arms 17 and 23 at positions above the reducer 12; the stand legs 28 configured to support a plurality of arm supporters 18; and the passage 32 through which the reducer 12 passes under the grinding roller 13 to be taken out from the vertical roller mill 50. The two upper leg portions 28a of the stand legs 28 are formed integrally, the two upper leg portions 28a sandwiching at least the passage 32 and being respectively provided at both sides of the passage 32, and the passage 32 is formed under the upper leg portion 28a.

[0098] In the present embodiment, as shown in the I-I cross-sectional view of Fig. 10, the upper leg portions 28a that support all of the plurality of arm supporters 18 are formed integrally. The present embodiment may also be configured such that: the two upper leg portions 28a of the stand legs 28 are formed integrally, the two upper leg portions 28a sandwiching the passage 32 and being respectively arranged at both sides of the passage 32; and the upper leg portions 28a of the other stand legs 28 are formed separately.

[0099] According to the vertical roller mill 50 shown in Fig. 6, the rotational power of the rotary driving unit 15 is transmitted through the reducer 12 to the rotating table 14. Thus, the rotating table 14 can be rotated in a predetermined direction. In accordance with the rotation of the rotating table 14, the plurality of grinding rollers 13 rotate. At this time, the grinding objects can be bitten between each of the plurality of grinding rollers 13 and the rotating table 14 to be ground. The plurality of pressing drive units 25 can respectively cause the grinding rollers 13 to be pressed against the rotating table 14, the grinding rollers 13 being provided so as to respectively correspond to the plurality of pressing drive units 25. With this, the grinding objects can be bitten between each of the grinding rollers 13 and the rotating table 14 by desired pressing force to be ground.

[0100] As shown in Figs. 6, 10, and 11, since the two upper leg portions 28a of the stand legs 28 are formed integrally, the two upper leg portions 28a being respectively provided at both sides of at least the passage 32, the strength of the upper leg portions 28a that support the arm supporters 18 can be improved. With this, the lower leg portion 28b that supports the arm supporters 18 via the upper leg portion 28a does not have to be provided at the position immediately under the arm supporter 18. Therefore, the space for forming the passage 32 can be secured under the upper leg portion 28a. Thus, the reducer 12 can pass under the grinding roller 13 to be taken out from the vertical roller mill 50 through the passage 32.

[0101] According to the vertical roller mill 50, even in a case where the arm supporter 18 is provided above the passage 32 as described above, the lower leg portion 28b that supports the arm supporters 18 via the upper leg portion 28a does not have to be provided at the position immediately under the arm supporter 18. Therefore, the space for forming the passage 32 can be secured under the upper leg portion 28a. On this account, it is possible to provide the vertical roller mill 50 configured such that: the grinding object grinding ability thereof is high; the size thereof is reduced; and the maintenance of the reducer 12 can be easily performed by externally taking out the reducer 12 through the predetermined passage 32 to the outside.

[0102] Further, as shown in Figs. 6 and 11, in the vertical roller mill 50, the two pressing drive units 25 respectively arranged at both sides of at least the passage 32 are installed on the installation surface 29 on which the reducer 12 is installed. The pressing drive unit 25 is, for example, a hydraulic cylinder device. The hydraulic cylinder device is configured such that: the piston rod 25a thereof is coupled to the second arm shaft 24 via a power transmission portion 51; and the pressing drive unit shaft 26 is provided at a base end portion of the cylinder 25b thereof. In the present embodiment, the hydraulic cylinder device is used as the pressing drive unit 25. However, the other driving unit may be used.

[0103] Arrangement spaces 52 at each of which the pressing drive unit 25 and the power transmission portion 51 are arranged are formed at the stand legs 28, the power transmission portion 51 being configured to transmit the power of the pressing drive unit 25 to the grinding roller 13 via the first and second arms 17 and 23.

[0104] In the present embodiment, as shown in Fig. 6, the pressing drive unit 25 is arranged in the arrangement space 52. However, instead of this, the pressing drive unit 25 may be arranged outside the arrangement space 52, that is, outside the stands 31.

[0105] The reason why the arrangement spaces 52 at each of which the pressing drive unit 25 and the power transmission portion 51 are arranged can be formed as above is because even in a case where the arm supporter 18 is provided above the passage 32 as described above, the lower leg portion 28b that supports the arm supporters 18 via the upper leg portion 28a does not have to be provided at a position immediately under the arm supporter 18, and therefore, spaces where the arrangement spaces 52 are formed can be secured under the upper leg portion 28a. On this account, the pressing drive units 25 and the power transmission portions 51 can be arranged at the arrangement spaces 52.

[0106] In a case where the pressing drive units 25 are installed on the installation surface 29 on which the reducer 12 is installed, the pressing drive units 25 can be installed at a low position. With this, the labor, cost, and time for the installation and maintenance of the pressing drive units 25 can be reduced.

[0107] As shown in Figs. 6, 10, and 11, in the vertical roller mill 50, the upper leg portions 28a that support all of the plurality of arm supporters 18 are formed integrally, and all of the plurality of pressing drive units 25 are installed on the installation surface 29 on which the reducer 12 is installed.

[0108] As above, in a case where the upper leg portions 28a of the stand legs 28 that support all of the plurality of arm supporters 18 are formed integrally, the strength of the entire upper leg portions 28a can be improved. Therefore, it is possible to provide the vertical roller mill 50 configured such that: the grinding object grinding ability thereof is high; and the size thereof is reduced.

[0109] In a case where all of the plurality of pressing drive units 25 are installed on the installation surface 29 on which the reducer 12 is installed, the labor, cost, and time of the installation of the pressing drive units 25 can be significantly reduced. In addition, the height of the vertical roller mill 50 can be prevented from increasing in accordance with the height of the pressing drive unit 25. Thus, the height of the entire vertical roller mill 50 can be reduced. As a result, the manufacturing cost of the vertical roller mill 50 can be reduced, and the height of a building that accommodates the vertical roller mill 50 can be reduced. Further, the cost for the building can be reduced.

[0110] As shown in Figs. 6 and 7, the vertical roller mill 50 is configured such that the upper leg portions 28a formed integrally support the arm supporter 18 at a position above the passage 32.

[0111] With this, since the upper leg portions 28a formed integrally support the arm supporter 18 at a position above the passage 32, the reducer 12 goes under the arm supporter 18 to be taken out through the passage 32. Therefore, even in a case where the number of grinding rollers 13 increases, and the intervals each between the adjacent grinding rollers 13 narrow, the ease of maintenance of the reducer 12 can be secured while maintaining the small size of the entire vertical roller mill 50.

[0112] As shown in Fig. 6 and the like, in the vertical roller mill 50, the table support base frame 41 is provided at the stand legs 28. The stand legs 28 and the arm supporters 18 are made of concrete. The vertical roller mill 50 configured as above has the same actions as the vertical roller mill of Embodiment 1 having the configuration shown in Fig. 1 and similar to the configuration of the vertical roller mill 50.

[0113] Further, by providing six or more grinding rollers 13 in the vertical roller mill 50 shown in Fig. 6, the grinding ability can be improved. In addition, even in a case where the number of grinding rollers 13 is six or more, the reducer 12 can be taken out from the vertical roller mill 50 through predetermined passage 32, and the lower leg portions 28b of the stand legs 28 do not get in the way of this operation. Even in a case where the number of grinding rollers 13 increases, the stand legs 28 do not have to be arranged at positions outwardly away from the rotating table 14. Therefore, the grinding ability of the vertical roller mill 50 can be improved without being restricted by the occupancy area of the vertical roller mill 50 or the moment applied to the stand legs 28. With this, when grinding a large amount of grinding objects, the number of vertical roller mills 50 can be reduced. Thus, the introduction cost and the running cost can be reduced.

[0114] Each of the above embodiments has explained an example in which six grinding rollers 13 are respectively provided at the arm supporters 18 (stands 31). However, instead of this, two or more grinding rollers 13 except for six grinding rollers 13 may be provided at the stands 31.

[0115] In the above embodiments, the stands 31 including the pressing drive device supporting portions (or the stand legs) 28 and the arm supporters 18 as shown in Figs. 1 and 6 are made of reinforced concrete. However, instead of this, the stands 31 may be made of steel.

[0116] Further, in the above embodiments, as shown in Figs. 3, 5, 7, and 11, the passage 32 through which the reducer 12 is taken out is formed between the adjacent pressing drive units 25 and under the pressing drive units 25. However, instead of this, the passage 32 may be formed under any one of the pressing drive units 25.

[0117] In the above embodiments, the output portion 12b of the reducer 12 shown in Figs. 1 and 6 may be a table supporting portion originally included in the reducer 12 that is a standard product or may be an output portion different from the table supporting portion included in the reducer 12 that is the standard product.

Industrial Applicability

[0118] As above, the vertical roller mill according to the present invention has excellent effects of: having a high grinding ability; being able to be reduced in size; and being able to easily perform the maintenance of the reducer by taking out the reducer through the predetermined passage to the outside. Thus, the present inven-

tion is suitably applied to such a vertical roller mill.

Reference Signs List

[0119]

11	vertical roller mill
12	reducer
12a	input shaft
12b	output portion
12c	casing of reducer
13	grinding roller
14	rotating table
15	rotary driving unit
16	casing of vertical roller mill
17	first arm
18	arm supporter
19	roller pressing mechanism
20	first arm shaft
21	arm bearing portion
22	arm bearing base
23	second arm
24	second arm shaft
25	pressing drive unit
25a	piston rod
25b	cylinder
26	pressing drive unit shaft
27	pressing drive device support base
28	pressing drive device supporting portion, stand leg
28a	upper leg portion of stand leg
28b	lower leg portion of stand leg
29	installation surface
31	stand
32	passage through which reducer is taken out
33	passage of circulating material discharging conveyor
34	motor base
35, 37	coupling
36, 38	connecting shaft
39	table supporting portion
40	thrust bearing
41	table support base frame
42	hot air supply duct
43	circulating material discharging conveyor
44	material supply chute
45	separator
46	separator driving device
47	fine powder discharge duct
48	circulating material discharge chute
50	vertical roller mill
51	power transmission portion

Claims

1. A vertical roller mill comprising:

a plurality of grinding rollers;
a rotating table configured to cause grinding objects to be bitten between the rotating table and each of the plurality of grinding rollers to grind the grinding objects, the rotating table being rotated by a rotary driving unit coupled to the rotating table via a reducer;
a plurality of pressing drive units provided so as to respectively correspond to the plurality of grinding rollers and configured to respectively cause the grinding rollers to be pressed against the rotating table;
arm supporters provided so as to externally surround the reducer and configured to respectively support the plurality of grinding rollers via arms at positions above the reducer;
stand legs configured to support the plurality of arm supporters; and
a passage through which the reducer passes under the grinding rollers to be taken out from the vertical roller mill, wherein:

at least two upper leg portions of the stand legs are formed integrally, the two upper leg portions sandwiching the passage and respectively provided at both sides of the passage; and
the passage is located under the upper leg portions.

2. The vertical roller mill according to claim 1, wherein:

the pressing drive units configured to respectively cause the grinding rollers to be pressed against the rotating table are installed on an installation surface on which the reducer is installed; and
arrangement spaces at each of which the pressing drive unit and a power transmission portion configured to transmit power of the pressing drive unit to the grinding roller are arranged or arrangement spaces at each of which the power transmission portion is arranged are formed at the stand legs.

3. The vertical roller mill according to claim 1 or 2, wherein:

the upper leg portions that support all of the plurality of arm supporters are formed integrally; and
all of the plurality of pressing drive units are installed on an installation surface on which the reducer is installed.

4. The vertical roller mill according to any one of claims 1 to 3, wherein the upper leg portions formed integrally support at least one of the arm supporters at

a position above the passage.

5. The vertical roller mill according to any one of claims 1 to 4, wherein:

an output portion of the reducer is coupled to the rotating table via a connecting shaft; and
the rotating table is rotatably supported by a table support base frame via a thrust bearing.

6. The vertical roller mill according to claim 5, wherein the table support base frame is provided at the stand legs.

7. The vertical roller mill according to any one of claims 1 to 6, wherein the stand legs and the arm supporters are made of concrete.

8. The vertical roller mill according to any one of claims 1 to 7, wherein the plurality of grinding rollers are six or more grinding rollers.

9. A vertical roller mill comprising:

a plurality of grinding rollers;
a rotating table configured to cause grinding objects to be bitten between the rotating table and each of the plurality of grinding rollers to grind the grinding objects, the rotating table being rotated by a rotary driving unit coupled to the rotating table via a reducer;
a plurality of pressing drive units provided so as to respectively correspond to the plurality of grinding rollers and configured to respectively cause the grinding rollers to be pressed against the rotating table;
stands provided so as to externally surround the reducer and configured to support the plurality of pressing drive units and the plurality of grinding rollers at positions above the reducer; and
a passage through which the reducer passes under the pressing drive units and the grinding rollers to be taken out from the vertical roller mill.

10. The vertical roller mill according to claim 9, wherein:

the at least two stands sandwiching the passage and respectively provided at both sides of the passage are formed integrally; and
the passage is formed at lower portions of the stands.

11. The vertical roller mill according to claim 9 or 10, wherein each of the stands includes at least one of the pressing drive units and/or at least one of the arm supporters at positions above the passage.

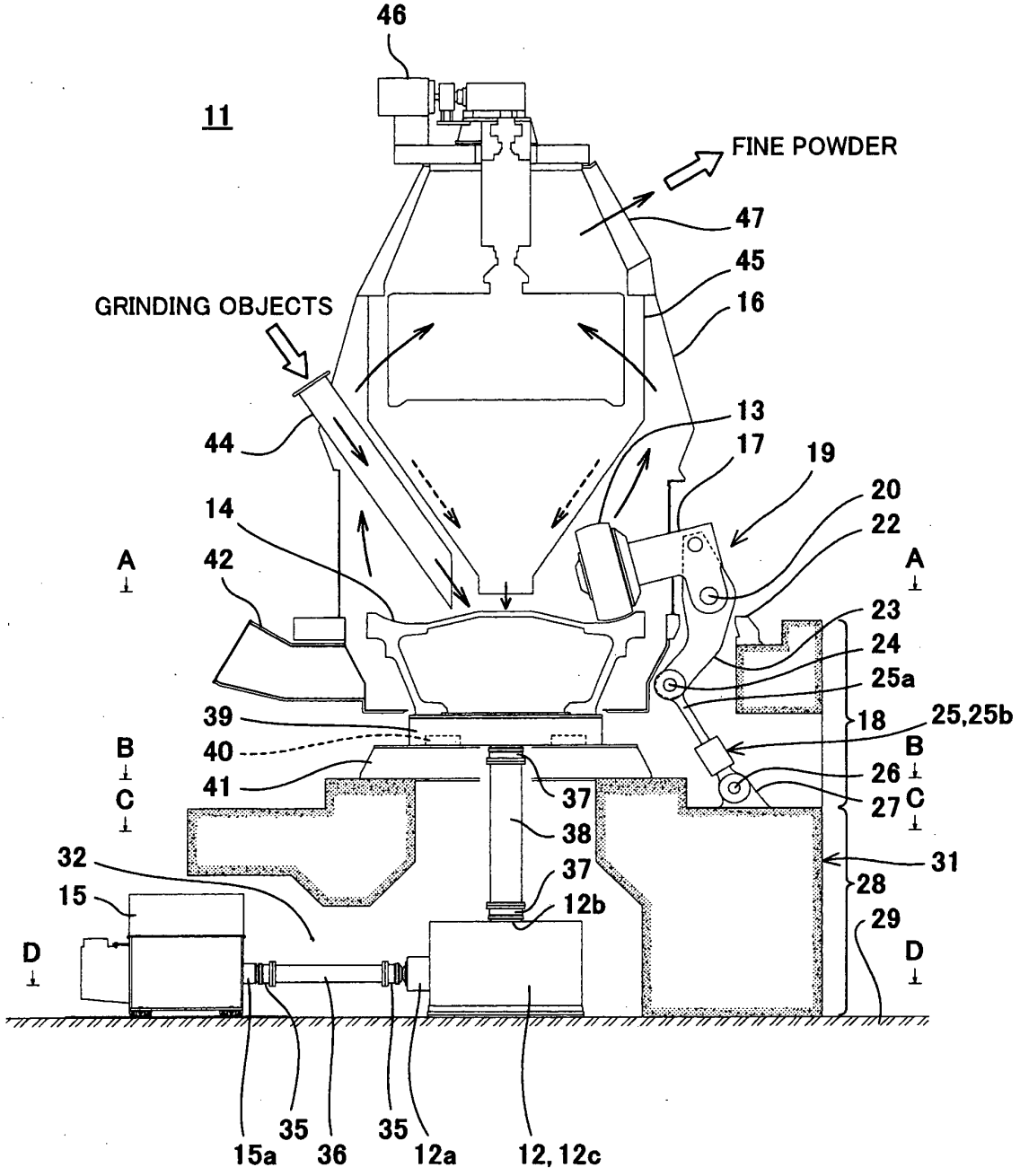
12. The vertical roller mill according to any one of claims 9 to 11, wherein:

an output portion of the reducer is coupled to a table supporting portion via a connecting shaft;
the rotating table is provided so as to be fixed to an upper portion of the table supporting portion; and
the table supporting portion is rotatably supported by a table support base frame via a thrust bearing.

13. The vertical roller mill according to claim 12, wherein the table support base frame is provided at the stands.

14. The vertical roller mill according to any one of claims 9 to 13, wherein the stands are made of concrete.

15. The vertical roller mill according to any one of claims 9 to 14, wherein the plurality of grinding rollers are six or more grinding rollers.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C
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12a
12, 12c

Fig. 1

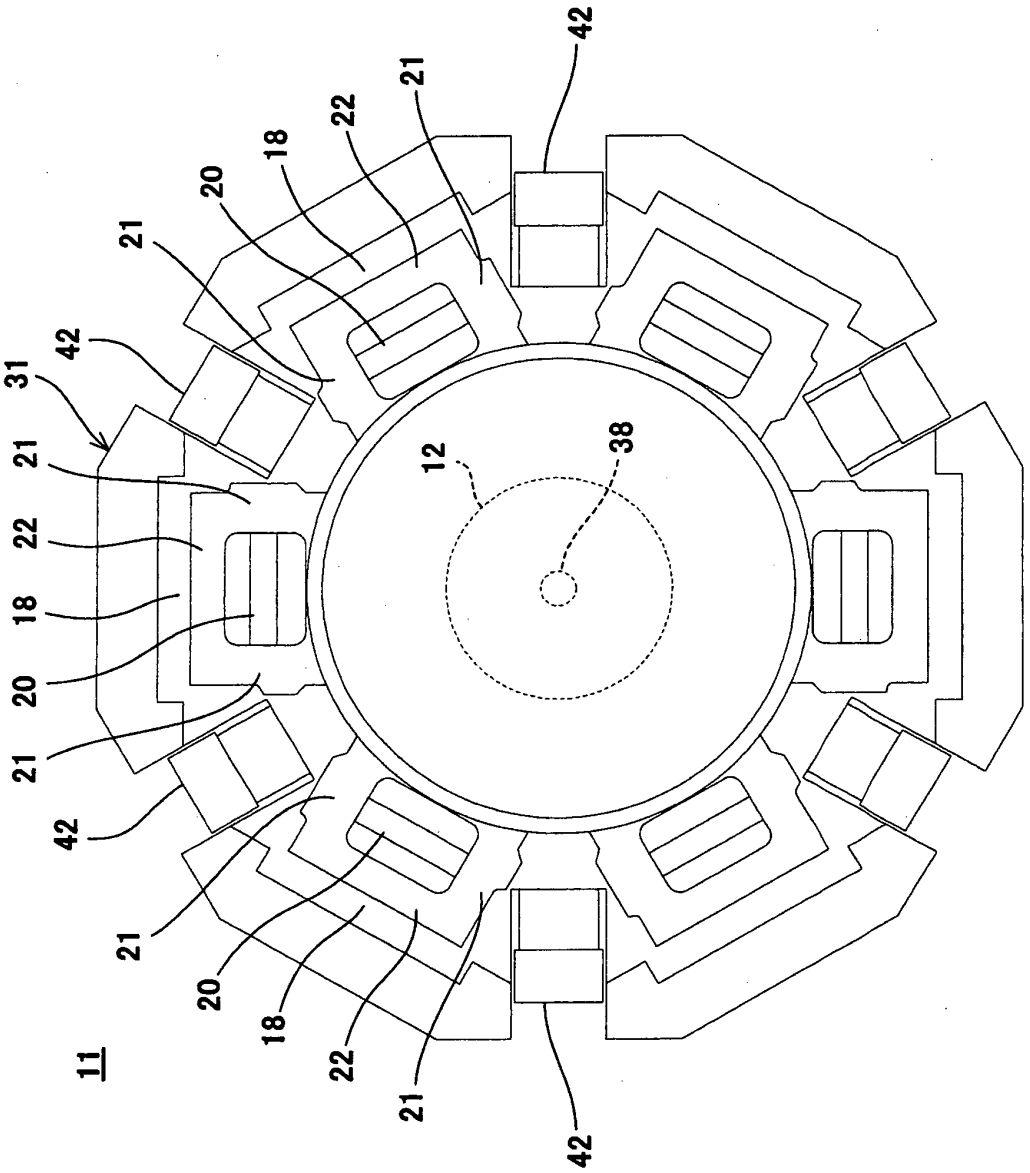


Fig. 2

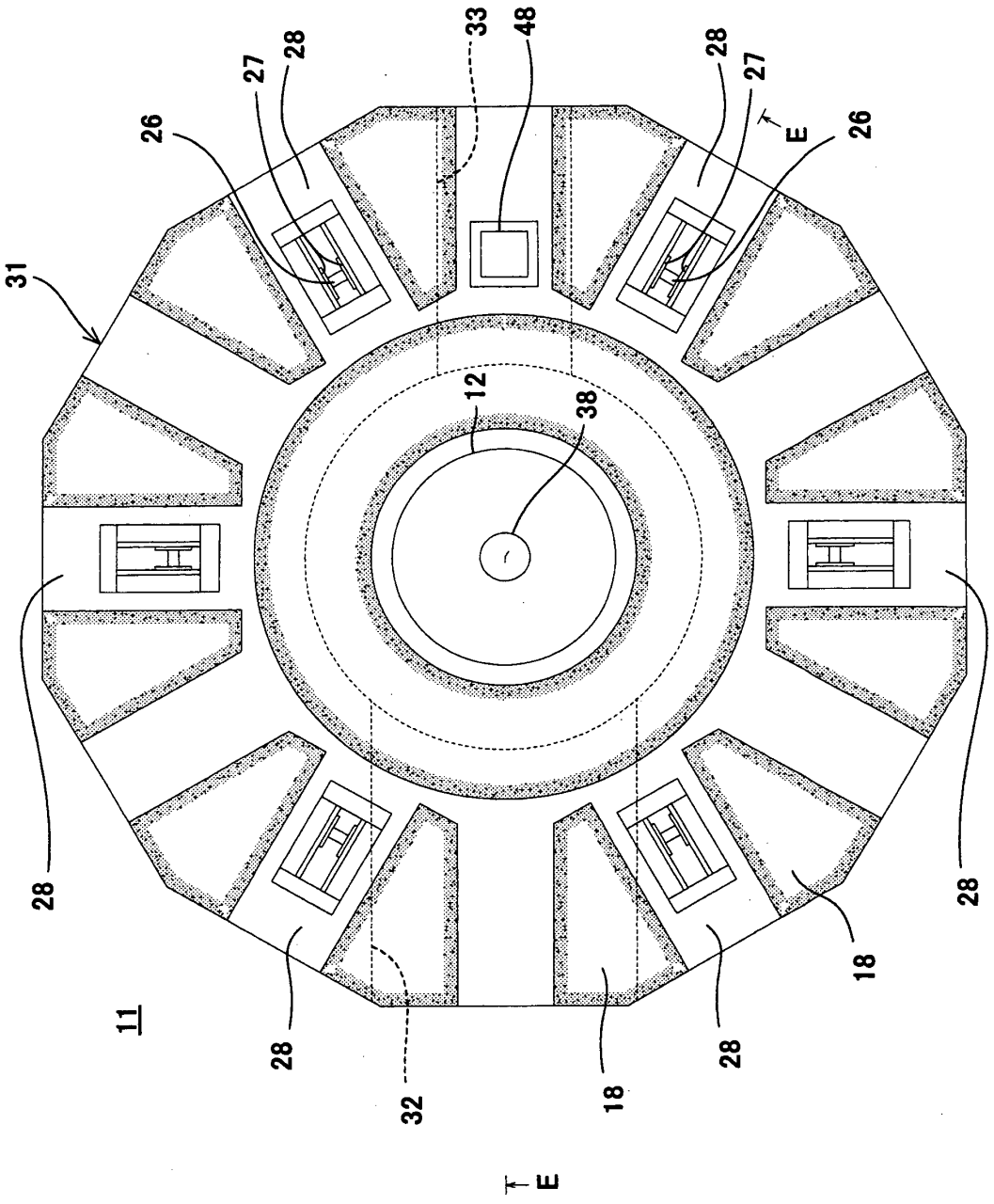


Fig. 3

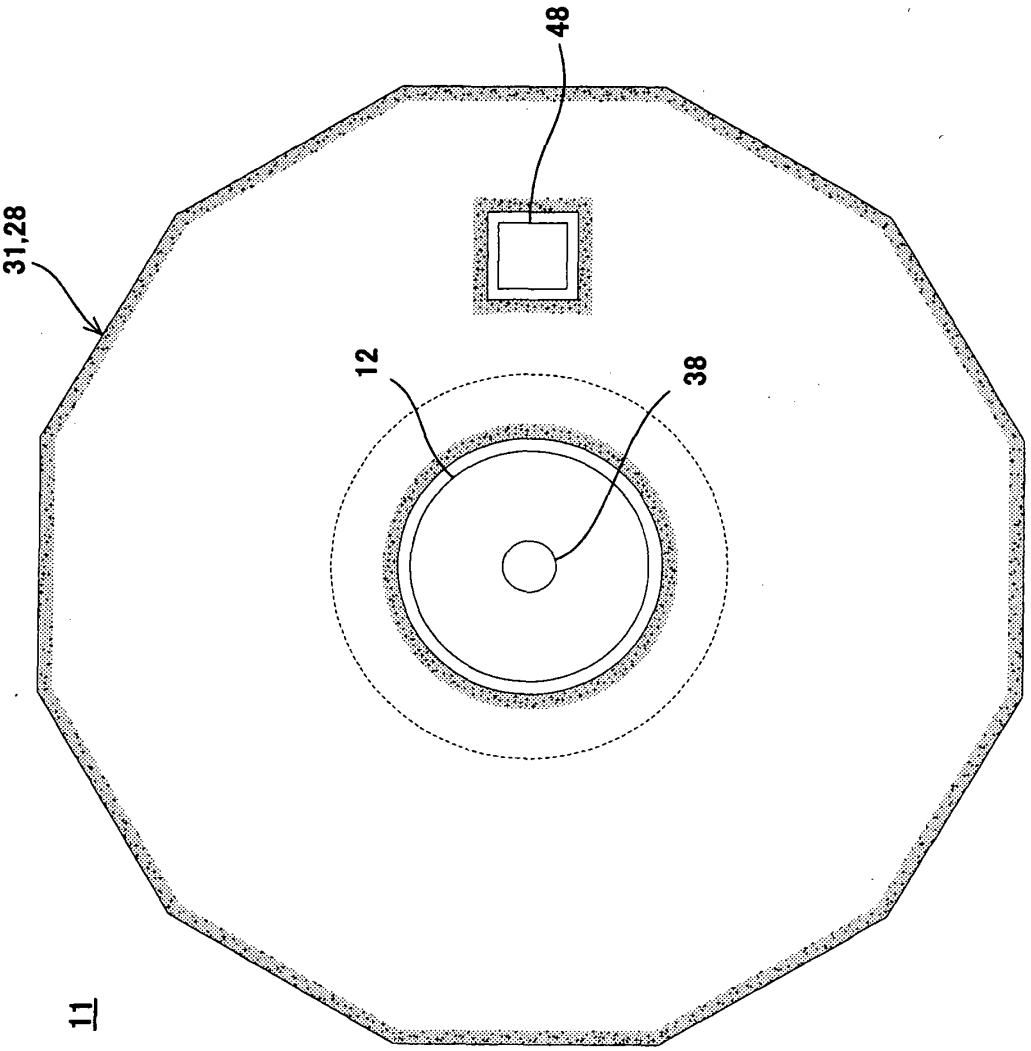


Fig. 4

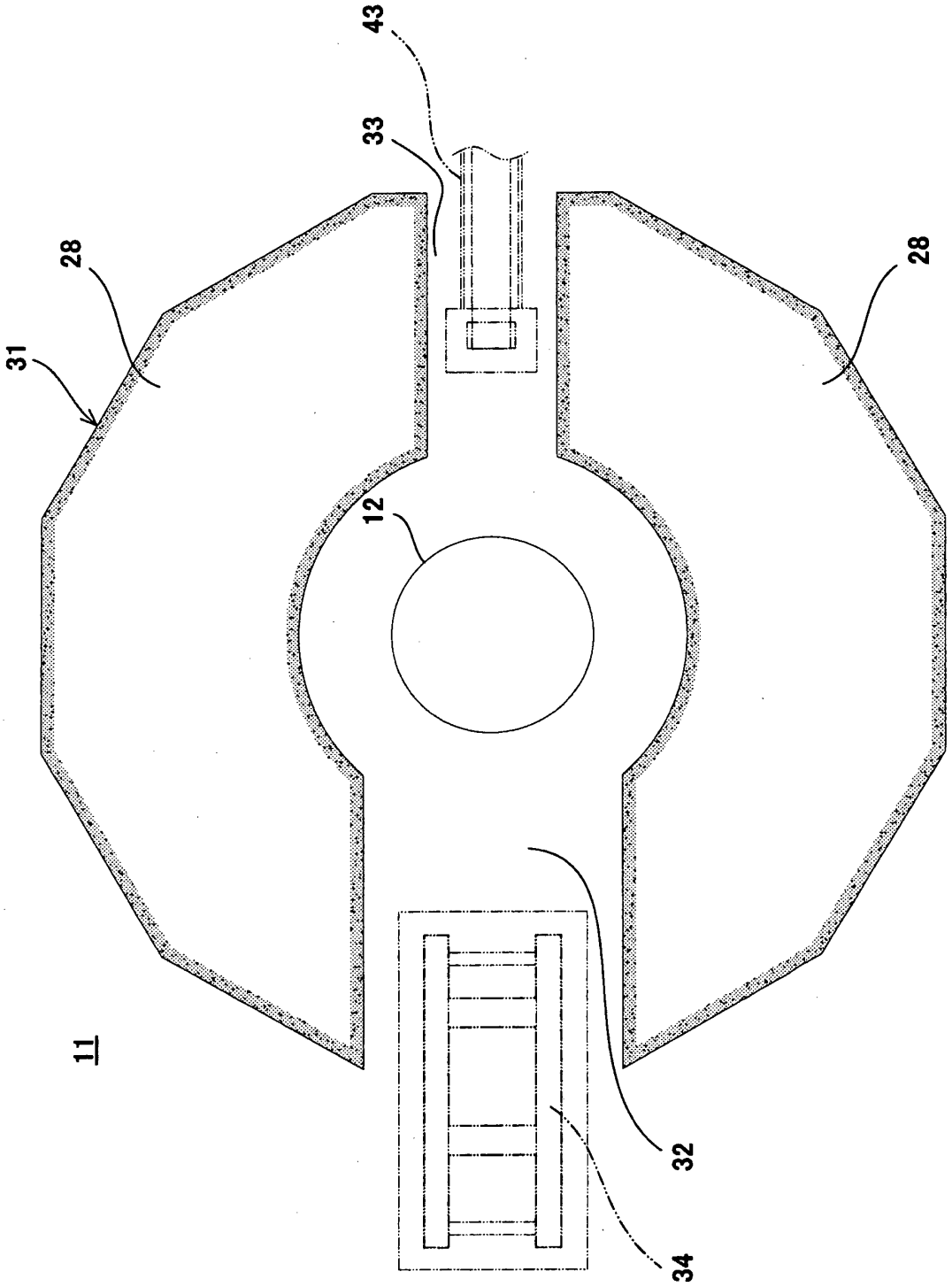
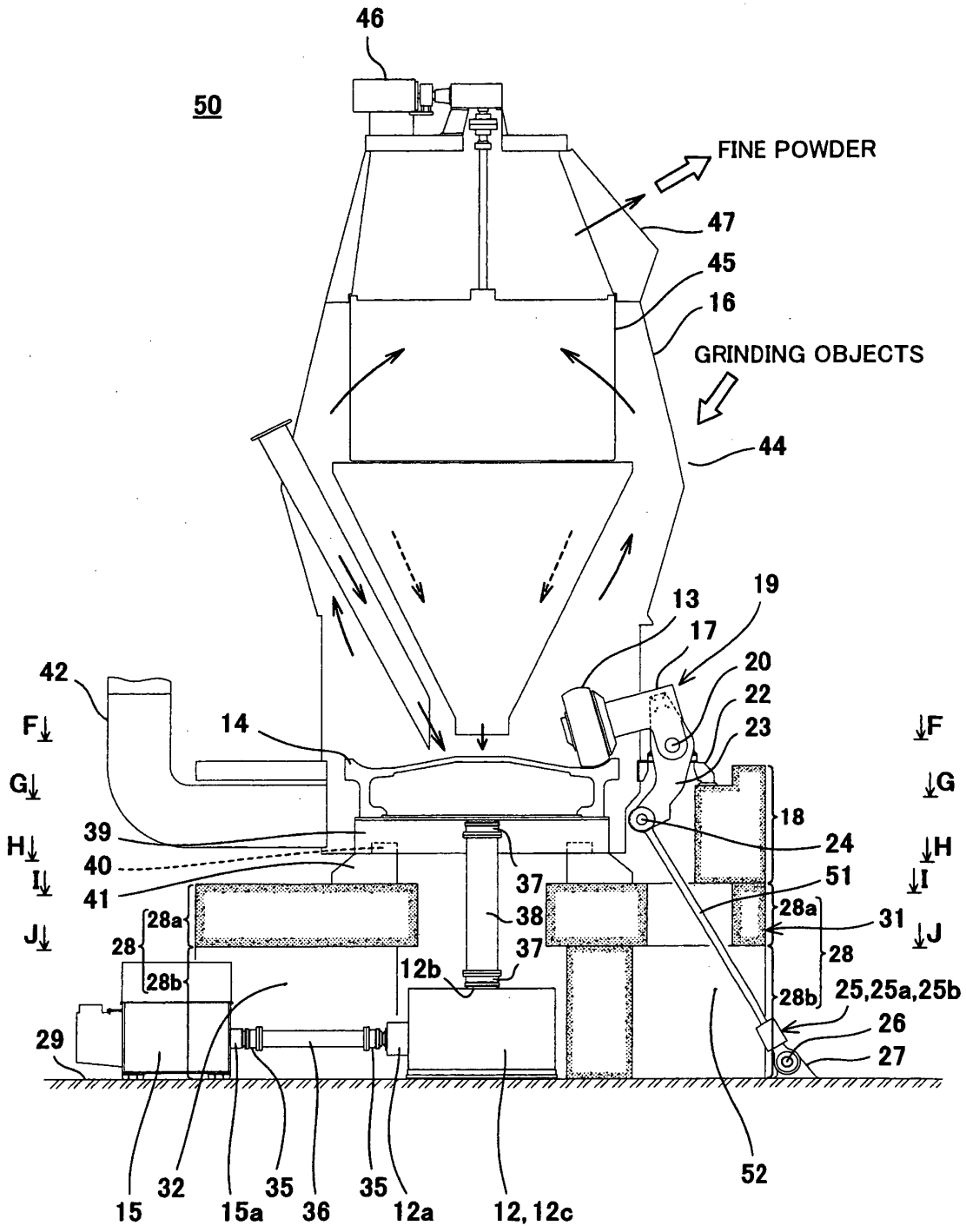


Fig. 5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GRINDING OBJECTS
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H
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40
41
I
J
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28
28b
37
38
37
12b
18
24
51
28a
31
28
28b
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15
32
15a
35
36
35
12a
12, 12c
52

Fig. 6

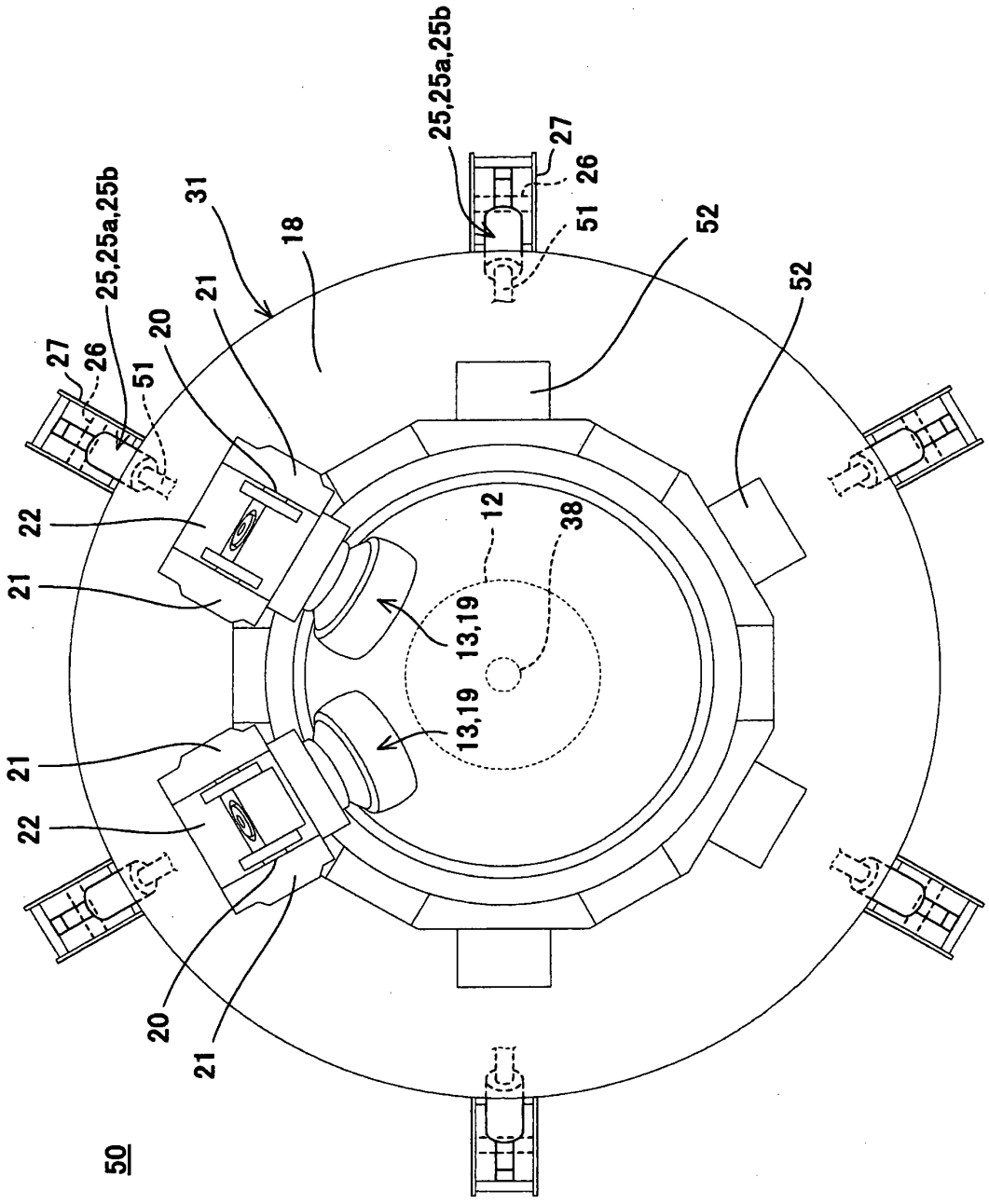
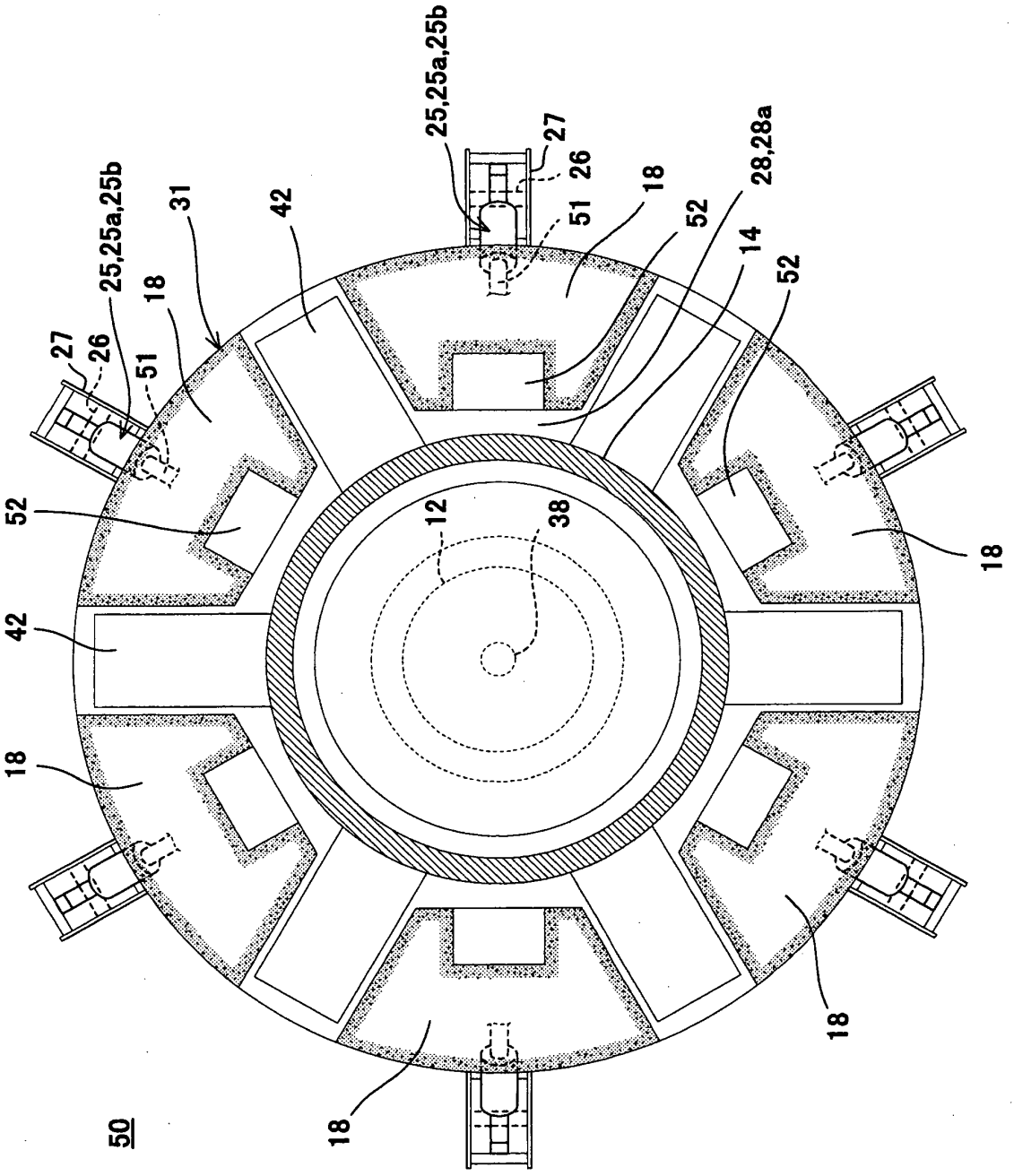


Fig. 7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12
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Fig. 8

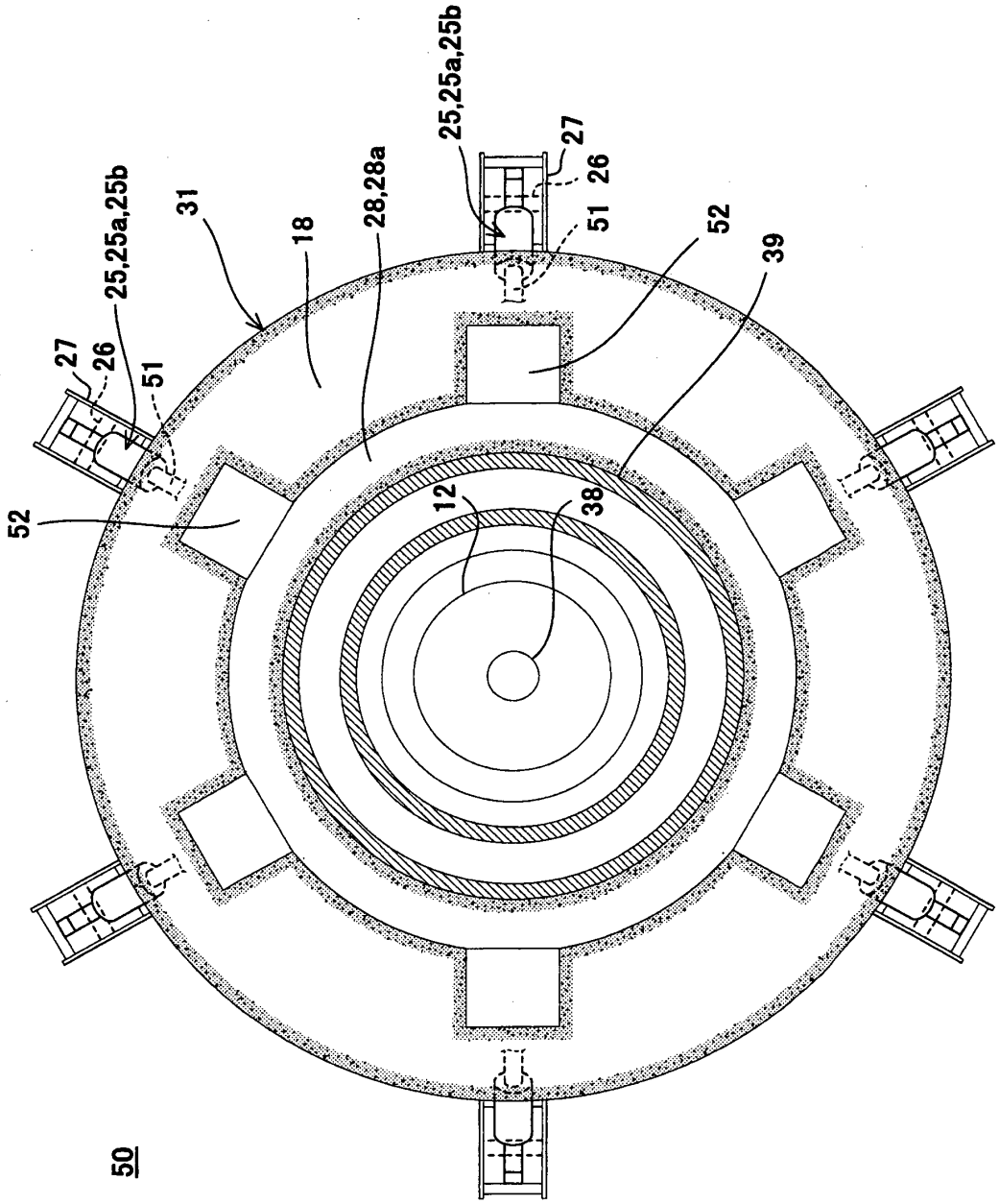


Fig. 9

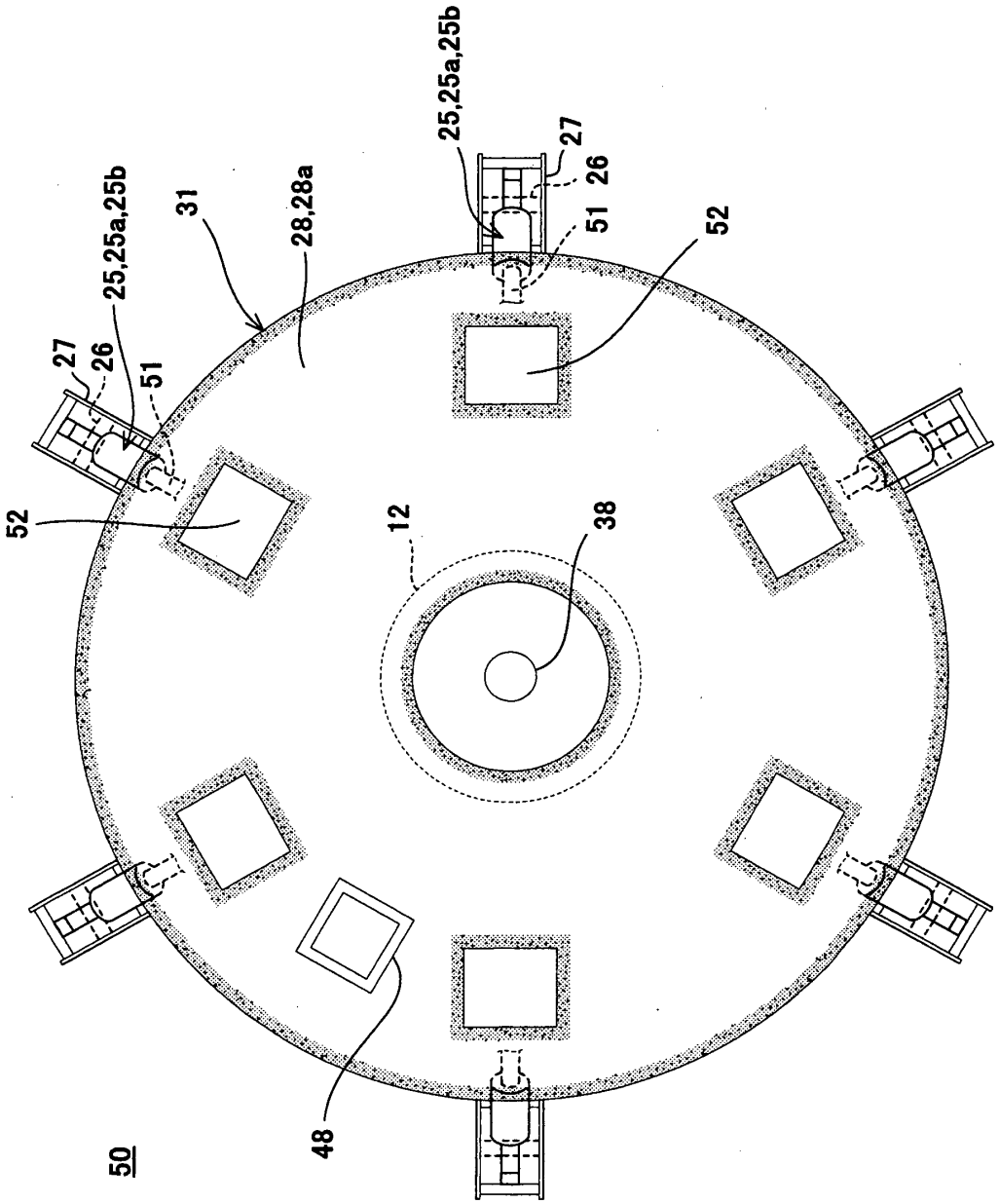
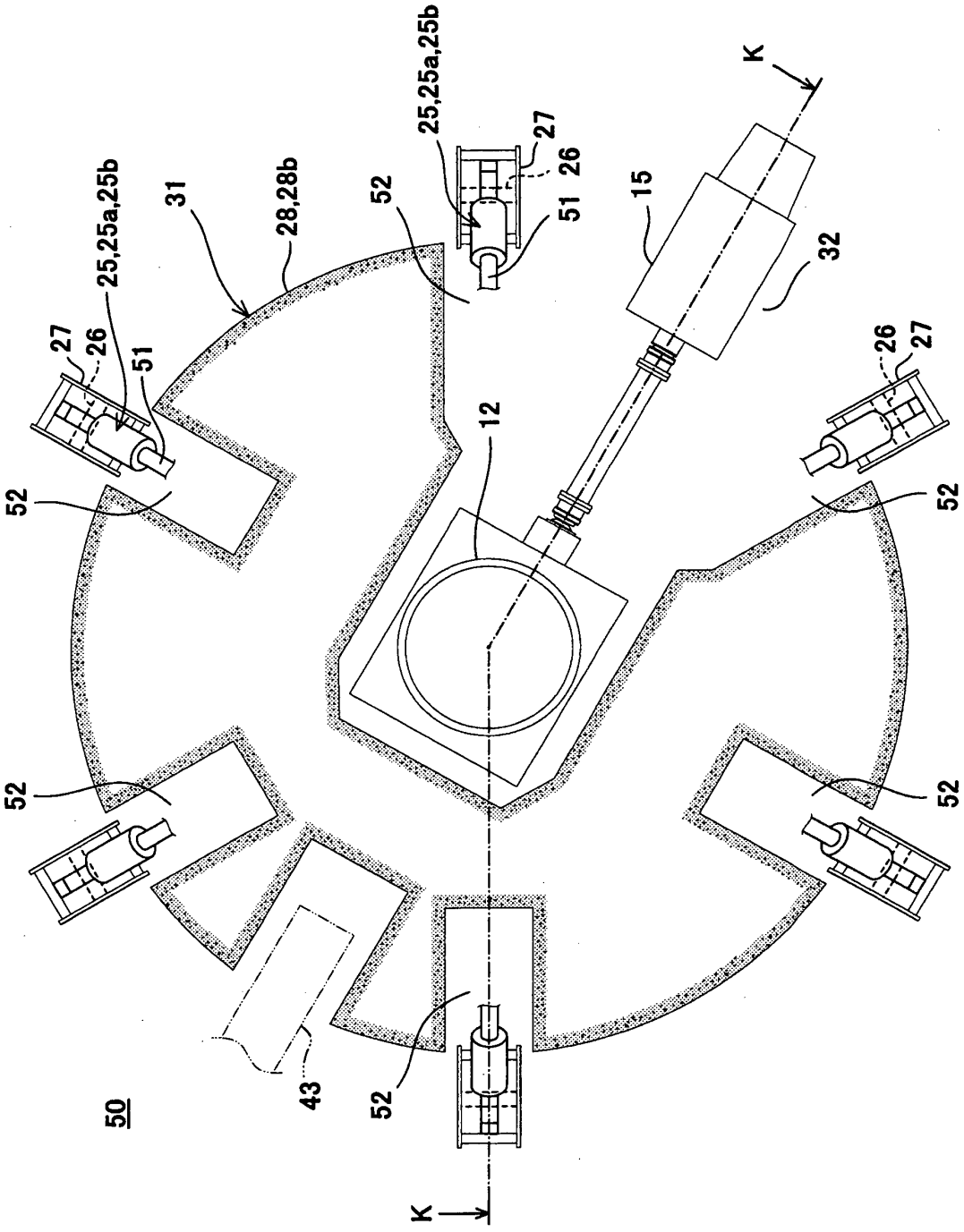


Fig. 10


25,25a,25b
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K
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28,28b
52
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32
25,25a,25b
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Fig. 11

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2012/007187

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 1996-2013
Kokai Jitsuyo Shinan Koho 1971-2013 Toroku Jitsuyo Shinan Koho 1994-2013

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	JP 2010-284629 A (Kawasaki Plant Systems, Ltd.), 24 December 2010 (24.12.2010), paragraphs [0018] to [0025]; fig. 1 to 3 (Family: none)	1-15
Y	JP 08-089829 A (Ube Industries, Ltd.), 09 April 1996 (09.04.1996), paragraphs [0009] to [0012]; fig. 1 to 4 (Family: none)	1-15
Y	JP 4477635 B2 (Loesche GmbH), 09 June 2010 (09.06.2010), claim 1; fig. 2 & US 2008/0245907 A1 & WO 2005/028112 A1	8,15

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

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
05 February, 2013 (05.02.13)	12 February, 2013 (12.02.13)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.	Authorized officer Telephone No.

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

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Patent documents cited in the description

- JP 2008525170 W **[0008]**