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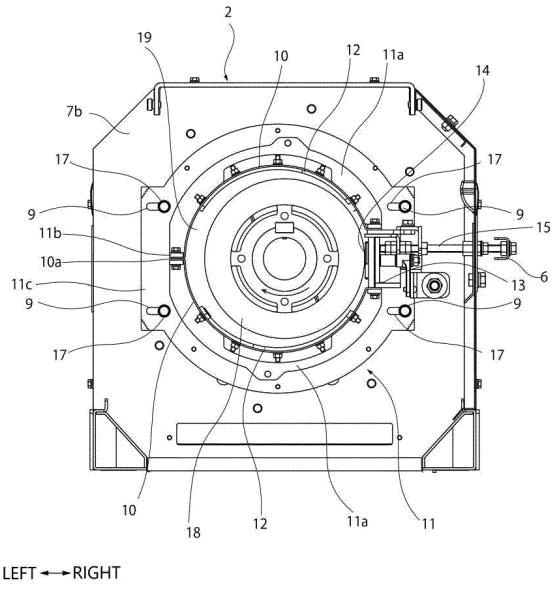
(54) HORIZONTAL TYPE GRAIN HULLING DEVICE

(57) An apparatus includes a grinding roller 18, a tubular screen 10 that surrounds the grinding roller 18 and forms a grain-polishing chamber 19 with the grinding roller 18, and a screen frame 11 having the screen 10 fixed thereto, in which the position of the axis of the screen frame 11 is adjustable with respect to the axis of the grinding roller 18, and the width dimension between the screen 10 and the outer peripheral face of the grinding roller 18 is adjustable.

FIG. 9



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Description

[Technical Field]

[0001] The present invention relates to a horizontal grain hulling apparatus for removing the hulls of grains.

[Background Art]

[0002] Conventionally, as an apparatus for removing the hulls of grains, there is known a grain hulling apparatus in which a grain-polishing chamber is formed on the interior side of a cylindrical screen, and a rotary grinding roller is provided in the grain-polishing chamber (see Patent Literature 1). Further, the grain hulling apparatus has a grain feed port formed on one end side of the grain-polishing chamber in the axial direction, and has a grain discharge port with an openable/closable lid formed on the other end side in the axial direction. The grain hulling apparatus is disposed in a tilted manner such that the feed port is located at a higher level and the discharge port is located at a lower level.

[0003] In such a tilted grain hulling apparatus, grains fed through the feed port pass through the grain-polishing chamber due to their gravity with the discharge port closed. While the grains pass through the grain-polishing chamber, the grains are ground while being stirred with the rotation of the grinding roller so that hulls are removed.

[0004] However, in such a tilted grain hulling apparatus, there have been cases where the grains fed to the grain-polishing chamber accumulate on the discharge port side, and such grains are ground with only a portion of the grinding roller on the discharge port side. This may result in decreased efficiency of hulling the grains as well as local wear of the grinding roller in an early stage.

[0005] Further, since a portion of the grain-polishing chamber around the discharge port is filled with a large number of grains, there have been cases where the pressure around the discharge port becomes too high to crush the grains, thereby increasing crushed grains.

[0006] Patent Literature 2 discloses a horizontal grinding-type grain-polishing machine in which cylindrical screens and a grinding roller are disposed substantially horizontally.

[0007] In such a horizontal grinding-type grain-polishing machine, the screens are split in the circumferential direction, and each split screen is eccentric with respect to the axis of the grinding roller. Further, the distance between the outer peripheral face of the grinding roller and each screen on the upstream side of the direction of rotation of the grinding roller is set long, but the distance between the outer peripheral face of the grinding roller and each screen is set gradually shorter at positions closer to the downstream side of the direction of rotation. Such a configuration allows the distance between the outer peripheral face of the grinding roller and each screen to be small. Thus, the horizontal grinding-type grain-polishing machine can hull grains in an accumulation portion where the density of grains is high, and then can grind the grains, which have reached the portion where the distance between the outer peripheral face of the grinding roller and each screen is long, with the entire surface of the grinding roller while turning the grains. Therefore, disposing the grinding roller horizontally can suppress local wear of the grinding roller and can reduce crushed grains.

[Citation List]

[Patent Literature]

[0008]

[Patent Literature 1] Japanese Patent Laid-Open No. 56-160957

[Patent Literature 2] Japanese Patent Laid-Open No. 9-57123

[Summary of Invention]

[Technical Problem]

[0009] However, in the horizontal grinding-type grain-polishing machine described in Patent Literature 2 above, the fastened portions on the opposite sides of each split screen have a number of elongated holes formed therein, and the screen is fixed to flap bases with fastening bolts passed through the respective elongated holes. In addition, to adjust the distance between the grinding roller and each screen according to the diameter of grains, for example, each screen is moved by loosening the fastening bolts on the opposite sides thereof. Thus, there has been a possibility that the curved shape of the screen may deform unless the amount of movement of the screen on the opposite sides thereof and that in the axial direction are set equal. Further, such an operation of adjusting each screen involves re-fastening of all of the fastening bolts. Thus, such an adjustment operation may be laborious.

[0010] It is an object of the present invention to provide a horizontal grain hulling apparatus that is unlikely to crush grains and in which local wear of a grinding roller can be can suppressed and the distance between the outer peripheral face of the grinding roller and each screen can be easily adjusted.

[Solution to Problem]

[0011] An invention according to claim 1 of the present application is a horizontal grain hulling apparatus including a grinding roller; a tubular screen that surrounds the grinding roller and forms a grain-polishing chamber with the grinding roller; and a screen frame having the screen fixed thereto, in which a position of an axis of the screen

frame is adjustable with respect to an axis of the grinding roller, and a width dimension between the screen and an outer peripheral face of the grinding roller is adjustable.

[0012] An invention according to claim 2 of the present application is the horizontal grain hulling apparatus according to claim 1, in which the position of the axis of the screen frame is adjustable in a left-right direction along a cross-section perpendicular to the axial direction.

[0013] An invention according to claim 3 of the present application is the horizontal grain hulling apparatus according to claim 1, in which the position of the axis of the screen frame is adjustable in a vertical direction along a cross-section perpendicular to the axial direction.

[0014] An invention according to claim 4 of the present application is the horizontal grain hulling apparatus according to claim 3, in which the position of the axis of the screen frame is adjustable such that a distance between a lower portion of the screen and the outer peripheral face of the grinding roller becomes longer than a distance between an upper portion of the screen and the outer peripheral face of the grinding roller.

[0015] An invention according to claim 5 of the present application is the horizontal grain hulling apparatus according to any one of claims 1 to 4, in which a resistive flap is provided in at least a portion where a distance between the screen and the outer peripheral face of the grinding roller is short, the resistive flap protruding from the screen toward the grain-polishing chamber.

[0016] An invention according to claim 6 of the present application is the horizontal grain hulling apparatus according to any one of claims 1 to 5, in which a resistive flap is provided in at least a portion where grains flow by falling in a direction of rotation of the grinding roller, the resistive flap protruding from the screen toward the grain-polishing chamber.

[0017] An invention according to claim 7 of the present application is the horizontal grain hulling apparatus according to claim 6, in which an amount of protrusion of the resistive flap is adjustable from outside a body that houses the grinding roller and the screen.

[0018] An invention according to claim 8 of the present application is the horizontal grain hulling apparatus according to any one of claims 1 to 7, in which a lid is rotatably attached to a discharge port, and a spiral guide plate is provided on an inner peripheral face of the screen, the spiral guide plate being adapted to guide grains to the discharge port.

[Advantageous Effects of Invention]

[0019] According to the present invention, the grain-polishing chamber can be made partially narrow along its cross-section perpendicular to the axial direction. Accordingly, it is possible to allow grains to accumulate in the narrow portion and be reliably hulled with the grinding roller. Further, after the grains have passed through the accumulation portion, the grains are ground with the entire surface of the grinding roller while being turned with the rotation of the grinding roller. Thus, grinding efficiency is high, and the pressure can be prevented from becoming too high so that crushed grains can be reduced. In addition, local wear of the grinding roller can also be prevented.

[0020] Further, it is possible to allow the entire screen to be eccentric with respect to the grinding roller only by moving the screen frame. Thus, there is no possibility that the curved shape of the screen will deform. Therefore, it is possible to easily adjust the width dimension between the screen and the outer peripheral face of the grinding roller without deforming the curved shape of the screen.

[0021] Furthermore, it is possible to adjust the distance between the screen and the outer peripheral face of the grinding roller according to the diameter or type of grains, for example. Thus, high versatility is provided.

[0022] If the screen frame is made adjustable in the left-right direction, it is possible to narrow the portion where grains flow by falling in the direction of rotation of the grinding roller and thus allow the grains to easily accumulate in the grain-polishing chamber, and thus reduce uneven grinding.

[0023] If the screen frame is made adjustable in the vertical direction, it is possible to narrow the upper portion of the grain-polishing chamber in which grains cannot easily accumulate. Accordingly, pressure is applied to grains even in the upper portion of the grain-polishing chamber, which allows for efficient hulling of the grains. Further, the difference between the pressure in the upper portion and that in the lower portion of the grain-polishing chamber becomes small. Consequently, it is possible to not only reduce uneven grinding of grains, but also eliminate the possibility that the lower portion of the grain-polishing chamber will be clogged with a large number of grains that have fallen, which would otherwise hinder the smooth feeding of the grains in the direction of the discharge port, and also prevent the generation of crushed grains due to high pressure.

[0024] If the resistive flap is provided such that it protrudes to the narrow portion of the grain-polishing chamber, it is possible to allow grains passing through the narrow portion to be blocked by the resistive flap and thus increase the time during which the grains accumulate on the upstream side of the direction of rotation of the grinding roller. This can further increase the grinding efficiency.

[0025] If the resistive flap is provided at a portion where grains flow by falling in the direction of rotation of the grinding roller, it is possible to allow the grains to easily accumulate in the grain-polishing chamber when the grains are delivered while being rotated, and thus allow the grains to be efficiently hulled.

[0026] If the amount of protrusion of the resistive flap is made adjustable from outside of the body, it is possible to adjust the amount of protrusion of the resistive flap according to the diameter of grains, for example, even while the apparatus is operating.

[0027] In the grain-polishing chamber, if the portion where grains flow by falling or the upper portion in which grains cannot easily accumulate is made narrow, pressure is evenly applied to the grains. Accordingly, it is possible to eliminate the need for a load around the discharge port, such as an anchor on the lid for the discharge port.

[0028] Consequently, the lid is easily opened with the force of moving the grains, and locally high pressure is not applied to the grains in the grain-polishing chamber. Thus, crushed grains are unlikely to be generated.

[Brief Description of Drawings]

[0029]

[Figure 1] Figure 1 is a perspective view of a horizontal grain hulling apparatus illustrating a first embodiment of the present invention.

[Figure 2] Figure 2 is a side view of the horizontal grain hulling apparatus illustrating the first embodiment of the present invention.

[Figure 3] Figure 3 is a perspective view of a state in which side covers of a body according to the first embodiment of the present invention are removed.

[Figure 4] Figure 4 is an exploded perspective view of a main part of a screen and a screen frame according to the first embodiment of the present invention.

[Figure 5] Figure 5 is an exploded perspective view of a main part of screens, screen frames, and a resistive flap according to the first embodiment of the present invention.

[Figure 6] Figure 6 is an exploded perspective view of the screens, the screen frames, and the resistive flap according to the first embodiment of the present invention.

[Figure 7] Figure 7 is a partially cutaway perspective view of the horizontal grain hulling apparatus illustrating the first embodiment of the present invention.

[Figure 8] Figure 8 is a cross-sectional view of the main part in a state where the screens and a grinding roller of the horizontal grain hulling apparatus illustrating the first embodiment of the present invention are arranged concentrically.

[Figure 9] Figure 9 is a cross-sectional view of the main part in a state where the screens and the grinding roller of the horizontal grain hulling apparatus illustrating the first embodiment of the present invention are arranged eccentrically.

[Figure 10] Figure 10 is a cross-sectional view of a main part in a state where screens and a grinding roller of a horizontal grain hulling apparatus illustrating a second embodiment of the present invention are arranged concentrically.

[Figure 11] Figure 11 is a cross-sectional view of the main part in a state where the screens and the grinding roller of the horizontal grain hulling apparatus illustrating the second embodiment of the present invention are arranged eccentrically.

[Description of Embodiments]

[0030] Hereinafter, embodiments of the present invention will be described with reference to the drawings, for example. It is needless to mention that the present invention is not limited to such embodiments.

[First embodiment]

[0031] Figures 1 to 9 illustrate a first embodiment of the present invention.

[0032] Figure 1 is a perspective view of a horizontal grain hulling apparatus illustrating the first embodiment. Figure 2 is a side view of the horizontal grain hulling apparatus illustrating the first embodiment. Figure 3 is a perspective view of a body according to the first embodiment. Figure 4 is a perspective view of a main part of a screen and a screen frame according to the first embodiment. Figures 5 and 6 are exploded perspective views of screens, screen frames, and a resistive flap. Figure 7 is a partially cutaway perspective view of the horizontal grain hulling apparatus illustrating the first embodiment. Figures 8 and 9 are cross-sectional views of the main part of the horizontal grain hulling apparatus illustrating the first embodiment.

[0033] In the following description, a cross-section is a cross-section perpendicular to the axial direction (i.e., front-rear direction) of a horizontal grain hulling apparatus 1, and the vertical direction and the left-right direction refer to directions along the cross-section.

[0034] As illustrated in Figures 1 and 2, in the present embodiment, a horizontal grain hulling apparatus 1 includes a body 2, a grinding roller 18 (see Figures 8 and 9) provided horizontally and rotatably in the body 2, cylindrical screens 10 (see Figures 8 and 9) surrounding the grinding roller 18 and forming a grain-polishing chamber 19 with the grinding roller 18, and screen frames 11 (see Figure 7) having the respective screens 10 fixed thereto. The grinding roller 18 and the screens 10 are attached to the body 2 substantially horizontally.

[0035] The body 2 has the shape of a horizontally long box, and has openable side covers 2a. A drive chamber 2b housing a motor (not illustrated), for example, is provided on one end (i.e., the rear end) side of the body 2 in the axial direction.

[0036] As illustrated in Figures 1 and 2, a grain feed hopper 3 is provided on the upper face of the rear end portion of the body 2 so as to allow grains fed through the grain feed hopper 3 to be delivered into the grain-polishing chamber 19.

[0037] A discharge port 4 is provided on the other end (i.e., the front end) face of the body 2 in the axial direction. The discharge port 4 is provided with a lid 5 rotatably attached thereto, and the discharge port 4 closed by the lid 5 extends to the outside of the body 2 from the front end portion of the grain-polishing chamber 19.

[0038] The lid 5 has no anchor attached thereto. Thus, when light pressure is applied to the lid 5 from inside the grain-polishing chamber 19, the lid 5 is opened and the discharge port 4 is released.

[0039] As illustrated in Figure 3, the rear end face of the body 2 is provided with a partition wall 7a that separates a portion in which grains move inside the body 2 from the drive chamber 2b.

[0040] A portion around the rear end, the intermediate portion, and the front end portion of the portion in which grains move inside the body 2 are respectively provided with support plates 7b, 7c, and 7d perpendicular to the axial direction. Each of the partition wall 7a and the support plates 7b, 7c, and 7d has a through-hole 8 formed in its center.

[0041] The grinding roller 18 is rotatably fixed inside the body 2. The grinding roller 18 has coupled thereto a screw roller (not illustrated) disposed below the grain feed hopper 3. The screw roller is coupled to and rotatably fixed to the motor in the drive chamber 2b via the through-hole 8 formed in the partition wall 7a. When the motor is driven, the screw roller and the grinding roller 18 rotate clockwise as illustrated in Figures 8 and 9.

[0042] As illustrated in Figures 4 to 6, each screen 10 is formed of a porous metal plate, and has a semicircular cross-section obtained by dividing a cylinder in half along its diameter, for example. In addition, the upper screen 10 and the lower screen 10, each having a semicircular shape, of the screens 10 are combined to form a cylindrical shape.

[0043] Left and right opposite side portions of each screen 10 have projecting pieces 10a formed thereon. The inner peripheral face of each screen 10 is provided with spiral guide plates 12 for sending grains, which have been loaded into the grain-polishing chamber 19 through the grain feed hopper 3, toward the discharge port 4. The guide plates 12 are attached with bolts from the outer periphery of each screen 10.

[0044] Each screen frame 11 includes semicircular interior frames 11a to be attached to the front end portion, the rear end portion, and the intermediate portion therebetween of each of the upper screen 10 and the lower screen 10. Further, each screen frame 11 includes coupling frames 11b extending in the axial direction and coupling the left and right end portions and the intermediate portions therebetween of the interior frames 11a. As illustrated in Figure 6, the interior frames 11a provided on the front end portion and the rear end portion of each screen 10 have annular exterior frames 11c attached thereto.

[0045] The inside diameter of each exterior frame 11c is substantially the same as the inside diameter of the screens 10, and the outside diameter of each exterior frame 11c is formed larger than the outside diameter of the interior frames 11a.

[0046] The coupling frames 11b provided on the left and right end portions of each interior frame 11a are fastened to the projecting pieces 10a of each screen 10 with bolts, for example, so that the screen frame 11 is fixed to the screen 10. The upper screen 10 and the upper screen frame 11 and the lower screen 10 and the lower screen frame 11 are coupled together via the coupling frames 11b and the projecting pieces 10a. In this manner, the screens 10 are fixed by the screen frames 11 so as to maintain the cylindrical shape. The right side portions of the upper screen 10 and the upper screen frame 11 and the right side portions of the lower screen 10 and the lower screen frame 11 are fixed together by sandwiching therebetween a flap frame 13 for supporting a resistive flap 14 (described below).

[0047] In the present embodiment, two sets of the screens 10 and the screen frames 11 each combined into a cylindrical shape are disposed successively and coaxially as illustrated in Figure 6. The left and right opposite sides of the exterior frames 11c of the screen frames 11 facing each other are provided with knobs 16.

[0048] As illustrated in Figure 7, two sets of the screens 10 and the screen frames 11 arranged coaxially are disposed by sandwiching therebetween the support plate 7c provided at the intermediate portion of the body 2 in the axial direction. The exterior frames 11c of the screen frames 11 are disposed on the respective support plates 7b, 7c, and 7d of the body 2.

[0049] In addition, the respective exterior frames 11c of the screen frames 11 and the support plates 7b, 7c, and 7d are fixed together at their upper portions and lower portions on the left and right opposite sides. The exterior frames 11c and one of the support plates 7b, 7c, and 7d have formed therein elongated holes 9 that are long in the left-right direction as illustrated in Figure 8, and the exterior frames 11c and the support plates 7b, 7c, and 7d are fixed together with bolts 17 penetrating through the respective elongated holes 9. In the present embodiment, the elongated holes 9 are provided in the exterior frames 11c attached to the support plates 7b and 7d and in the support plate 7c.

[0050] With such a configuration, it is possible to move the exterior frames 11c in the left-right direction with respect to the support plates 7b, 7c, and 7d along the elongated holes 9 by loosening the bolts 17. In addition, the screen frames 11 can be moved together with the screens 10 with the cylindrical shape of the screens 10 maintained. Therefore, it is possible to adjust the position of the axis of the screens 10 in the left-right direction with respect to the axis of the grinding roller 18 without deforming the cylindrical shape of the screens, and adjust the width dimension between the screens 10 and the outer peripheral face of the grinding roller 18. The distance over which each screen 10 can move to each of the left and right sides is about 5 mm.

[0051] When moving the screen frames 11 and the screens 10, it is possible to easily move the screen frames 11 and the screens 10 in the left-right direction by pulling the knobs 16 provided on the exterior frames 11c while loosening the bolts 17.

[0052] As illustrated in Figure 8, when the bolts 17 are

inserted through the centers of the respective elongated holes 9, the central axis of the grinding roller 18 coincides with the central axis of the screens 10. However, as illustrated in Figure 9, when the screen frames 11 are moved to the left to be fixed with the bolts 17 inserted through the right ends of the respective elongated holes 9, the distance between the screens 10 and the outer peripheral face of the grinding roller 18 (i.e., the width of the grain-polishing chamber 19) becomes short on the right side and long on the left side.

[0053] When the right side portion of the grain-polishing chamber 19 is made narrow in this manner and the grinding roller 18 is rotated clockwise, grains are delivered while being rotated, and easily accumulate in the narrow portion of the grain-polishing chamber 19. Accordingly, the grains can be efficiently hulled.

[0054] In the present embodiment, the resistive flap 14 protruding toward the grain-polishing chamber 19 is disposed along the axial direction between the upper screen 10 and the lower screen 10 on the right side of the grain-polishing chamber 19 where the distance between the screens 10 and the outer peripheral face of the grinding roller 18 becomes short.

[0055] The resistive flap 14 is formed of a soft material, such as rubber, so as not to crush grains in the grain-polishing chamber 19, and operation bolts 15 are attached to a plurality of portions on the radially outer side face of the resistive flap 14. The operation bolts 15 penetrate through the side covers 2a to be exposed to the outside of the body 2, and have handles 6 at their distal ends.

[0056] The operation bolts 15 are screwed to the flap frame 13, and rotating the handles 6 can adjust the amount of protrusion of the resistive flap 14 in the grain-polishing chamber 19.

[0057] Since the flap frame 13 is fixed to the screens 10 and the screen frames 11, moving the screen frames 11 in the right-left direction can also move the resistive flap 14, and can hull grains further efficiently.

[0058] When grains are hulled with the horizontal grain hulling apparatus 1, the screens 10 are moved to the left side to allow the distance between the screens 10 and the outer peripheral face of the grinding roller 18 to be short on the right side and long on the left side. Then, the grinding roller 18 is rotated clockwise, and grains as raw material are fed to the grain-polishing chamber 19 from the grain feed hopper 3. The amount of movement of the screens 10 in the left-right direction and the amount of protrusion of the resistive flap 14 are adjusted according to the shape and size of grains and the hardness of hulls, for example.

[0059] The grains loaded into the grain-polishing chamber 19 fall leftward downward with the rotation of the grinding roller 18. Since the right side portion of the grain-polishing chamber 19 is narrow and the resistive flap 14 protrudes therein, the grains accumulate above the resistive flap 14 and thus are reliably ground with the grinding roller 18.

[0060] The grains having passed the resistive flap 14 are ground with the entire surface of the grinding roller 18 while turning with the rotation of the grinding roller 18, and then are moved to the discharge port 4 by the guide plates 12 of the screens 10.

[0061] The grains that are moved while being ground are polished until they reach the discharge port 4, and are discharged from the discharge port 4 as the lid 5 is pushed open by the grains. The screens 10 and the grinding roller 18 are provided horizontally, and pressure is evenly applied to the grains in the grain-polishing chamber 19. Accordingly, even without an anchor provided on the lid 5 for the discharge port 4, the lid 5 is easily opened with the force of moving the grains. Further, since locally high pressure is not applied to the grains in the grain-polishing chamber 19, the grains are unlikely to crush.

[0062] The removed hulls are discharged to the outside of the grain-polishing chamber 19 through holes formed in the screens 10, and then are discharged from the bottom of the body 2.

[Second embodiment]

[0063] Hereinafter, a second embodiment of the present invention will be described with reference to Figures 10 and 11. It should be noted that the descriptions of the regards similar to those of the first embodiment will be omitted, and only the regards different from those of the first embodiment will be described.

[0064] In the second embodiment, one of the exterior frames 11c of the screen frames 11 and the support plates 7b, 7c, and 7d have the elongated holes 9 formed therein along the vertical direction as illustrated in Figure 10. In the example illustrated, the exterior frame 11c attached to the support plate 7b has the elongated holes 9 formed therein. Accordingly, the positions of the screen frames 11 and the screens 10 can be adjusted in the vertical direction.

[0065] As illustrated in Figure 10, in a state where the bolts 17 are passed through the centers of the respective elongated holes 9 to allow the axis of the screens 10 to coincide with the axis of the grinding roller 18, the screen frames 11 and the screens 10 are moved downward to be fixed with the bolts 17 at the upper end portions of the respective elongated holes 9 as illustrated in Figure 11. Accordingly, the distance between the lower portion of the screens 10 and the outer peripheral face of the grinding roller 18 becomes longer than the distance between the upper portion of the screens 10 and the outer peripheral face of the grinding roller 18.

[0066] Accordingly, it is possible to narrow the upper portion of the grain-polishing chamber 19 in which grains cannot easily accumulate, and apply pressure to the grains therein. This allows for efficient hulling of grains even in the upper portion of the grain-polishing chamber 19. Further, the difference between the pressure applied to grains in the upper portion of the grain-polishing chamber 19 and that in the lower portion of the grain-polishing

chamber 19 becomes small. Consequently, it is possible to reduce uneven grinding of grains, and further prevent the lower portion of the grain-polishing chamber 19 from being clogged with a large number of grains that have fallen and also prevent the pressure applied to grains from becoming too high to crush the grains.

[0067] In the present embodiment, when the grinding roller 18 rotates clockwise, grains can easily accumulate in the grain-polishing chamber 19 while being rotated and delivered since the resistive flap 14 is provided on the right side of the grain-polishing chamber 19. Thus, the grains can be efficiently hulled.

[Other modified examples]

[0068] The present invention is not limited to the aforementioned embodiments. For example, the present invention also includes the following.

[0069] In the present embodiment, two pairs of screens 10 are successively provided in the axial direction, but only a pair of screens 10 may be provided.

[0070] In the present embodiment, the exterior frame 11c provided on the intermediate support plate 7c is provided with the knobs 16, but the present invention is not limited thereto, and all of the exterior frames 11c may be provided with knobs.

[0071] In the present embodiment, the right side portion of the grain-polishing chamber 19 is made narrow since the grinding roller 18 rotates clockwise, but when the grinding roller 18 rotates counterclockwise, the left side portion of the grain-polishing chamber 19 may be made narrow.

[0072] In the present embodiment, the resistive flap 14 is provided on the right side of the grain-polishing chamber 19, but (an)other resistive flap(s) 14 may also be provided on the left side of the grain-polishing chamber 19, the upper side of the grain-polishing chamber 19, and/or the lower side of the grain-polishing chamber 19, for example.

[0073] In the present embodiment, two screens 10 split in the horizontal direction are used, but two screens 10 split in the diagonal direction may also be used. In such a case, the resistive flap 14 may be provided at a position around the upper region or the lower region of the portion where the distance between the screens 10 and the outer peripheral face of the grinding roller 18 becomes narrow, at the joined portion of the two split screens 10.

[0074] In the present embodiment, two split screens 10 are used, but three or more split screens 10 or an unsplit screen 10 may also be used. The resistive flap 14 may be provided at each of the joined portions of the split screens 10.

[0075] In the present embodiment, the projecting pieces 10a formed on the left and right opposite side portions of each screen 10 and the coupling frames 11b of each screen frame 11 are fixed together. In addition, it is also possible to provide flanges at opposite ends of each screen 10 in the axial direction and at the center of each screen 10 in the axial direction, and then fix the flanges to the interior frames 11a of each screen frame 11 with bolts, for example. Accordingly, the screens 10 and the screen frames 11 can be fixed together further securely with high strength against deformation of the cylindrical shape of the screens 10.

[0076] In the present embodiment, an anchor is not provided on the lid 5 for the discharge port 4, but an anchor or the like may be provided on the lid 5 so as to apply a load thereto as appropriate.

[0077] The technical matters of each of the aforementioned embodiments can be implemented by being applied to different embodiments.

[Reference Signs List]

[0078]

1	Horizontal grain hulling apparatus
2	Body
2a	Side cover
2b	Drive chamber
3	Grain feed hopper
4	Discharge port
5	Lid
6	Handle
7a	Partition wall
7b, 7c, 7d	Support plates
8	Through-hole
9	Elongated hole
10	Screen
10a	Projecting piece
11	Screen frame
11a	Interior frame
11b	Coupling frame
11c	Exterior frame
12	Guide plate
13	Flap frame
14	Resistive flap
15	Operation bolt
16	Knob
17	Bolt
18	Grinding roller
19	Grain-polishing chamber

Claims

1. A horizontal grain hulling apparatus comprising:

a grinding roller;
a tubular screen that surrounds the grinding roller and forms a grain-polishing chamber with the grinding roller; and
a screen frame having the screen fixed thereto, wherein:

a position of an axis of the screen frame is

adjustable with respect to an axis of the grinding roller, and
a width dimension between the screen and an outer peripheral face of the grinding roller is adjustable.

2. The horizontal grain hulling apparatus according to claim 1, wherein the position of the axis of the screen frame is adjustable in a left-right direction along a cross-section perpendicular to the axial direction.

3. The horizontal grain hulling apparatus according to claim 1, wherein the position of the axis of the screen frame is adjustable in a vertical direction along a cross-section perpendicular to the axial direction.

4. The horizontal grain hulling apparatus according to claim 3, wherein the position of the axis of the screen frame is adjustable such that a distance between a lower portion of the screen and the outer peripheral face of the grinding roller becomes longer than a distance between an upper portion of the screen and the outer peripheral face of the grinding roller.

5. The horizontal grain hulling apparatus according to any one of claims 1 to 4, wherein a resistive flap is provided in at least a portion where a distance between the screen and the outer peripheral face of the grinding roller is short, the resistive flap protruding from the screen toward the grain-polishing chamber.

6. The horizontal grain hulling apparatus according to any one of claims 1 to 5, wherein a resistive flap is provided in at least a portion where grains flow by falling in a direction of rotation of the grinding roller, the resistive flap protruding from the screen toward the grain-polishing chamber.

7. The horizontal grain hulling apparatus according to claim 6, wherein an amount of protrusion of the resistive flap is adjustable from outside a body that houses the grinding roller and the screen.

8. The horizontal grain hulling apparatus according to any one of claims 1 to 7,
wherein:

a lid is rotatably attached to a discharge port, and a spiral guide plate is provided on an inner peripheral face of the screen, the spiral guide plate being adapted to guide grains to the discharge port.

FIG. 1

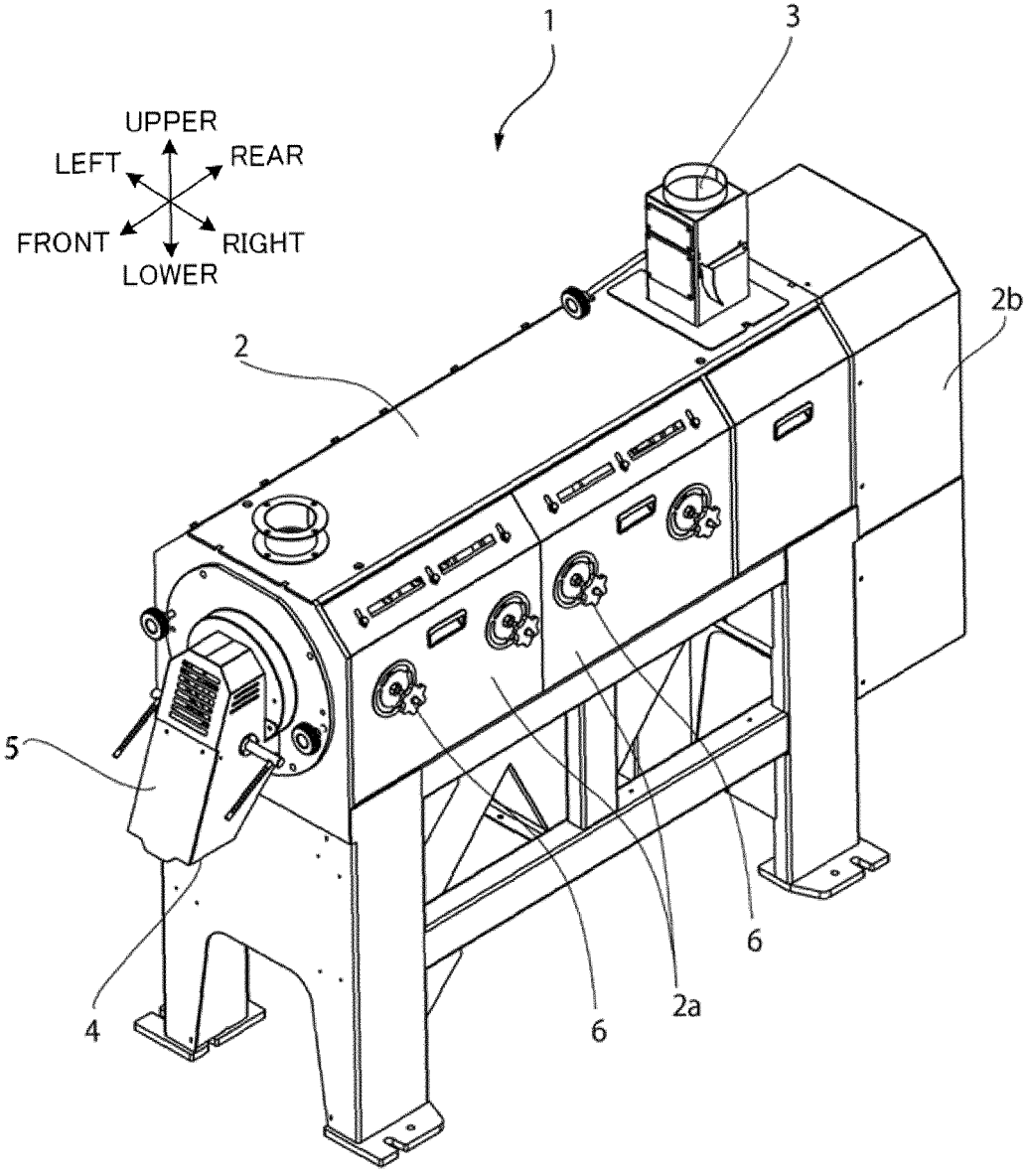


FIG. 2

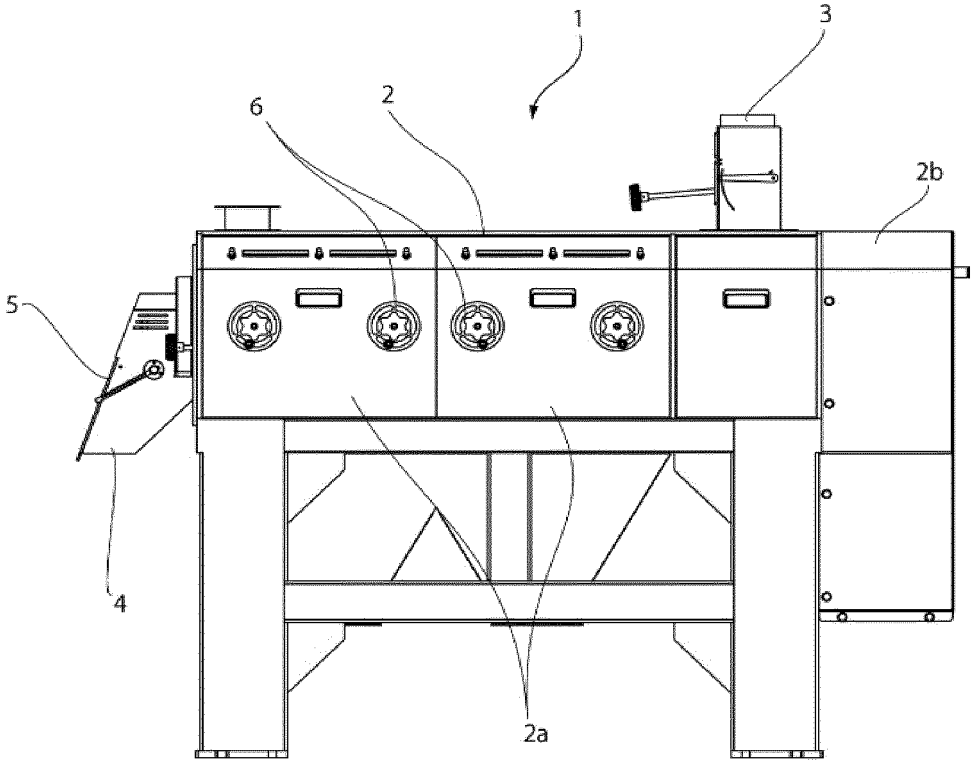


FIG. 3

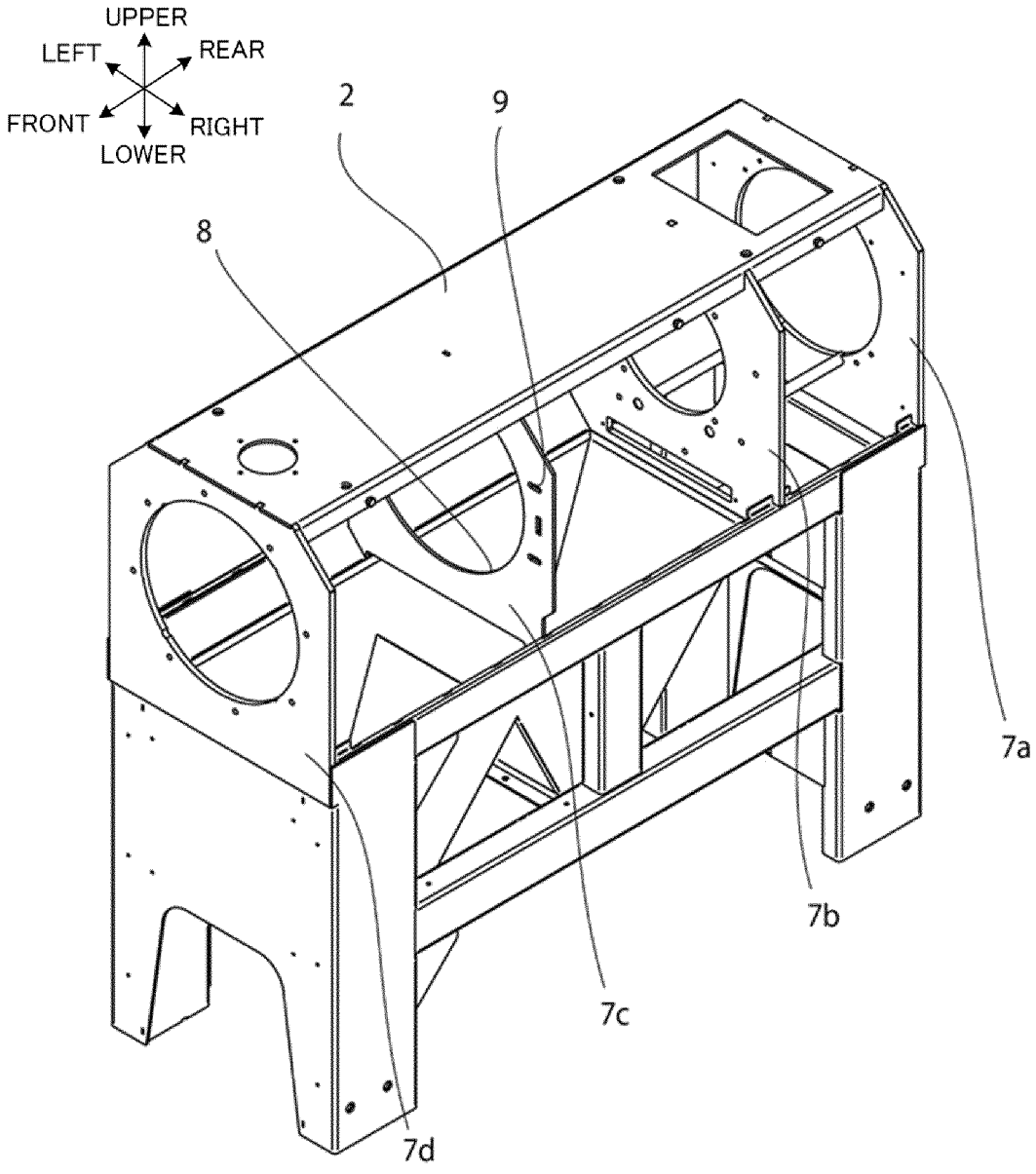


FIG. 4

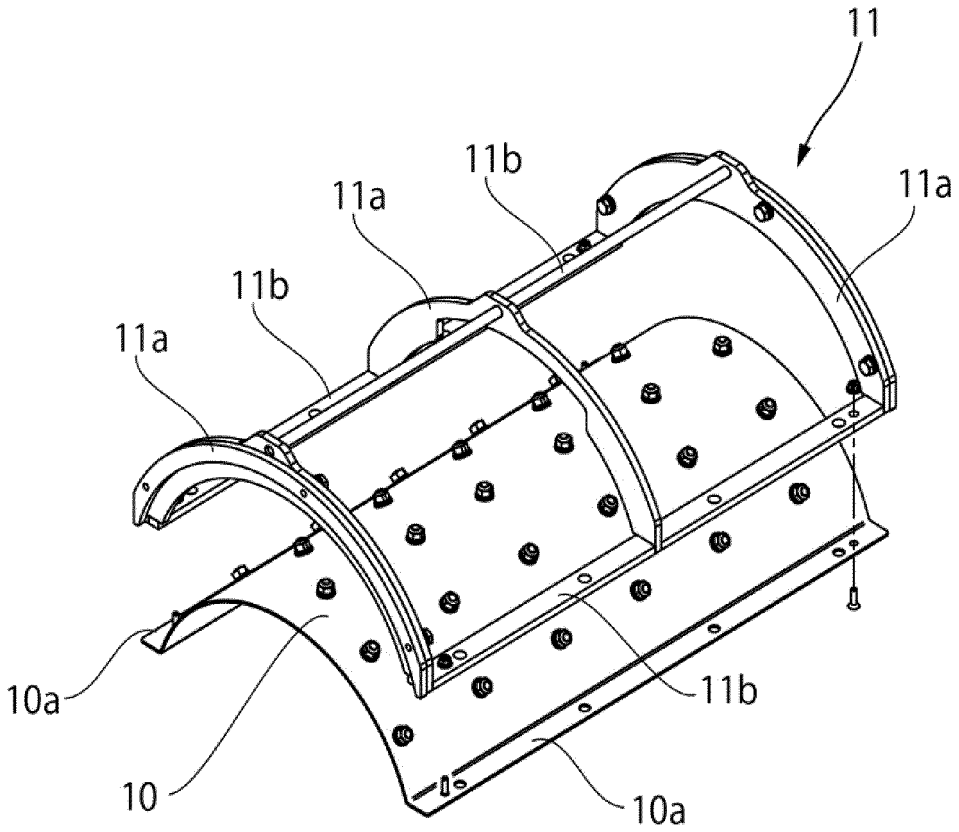


FIG. 5

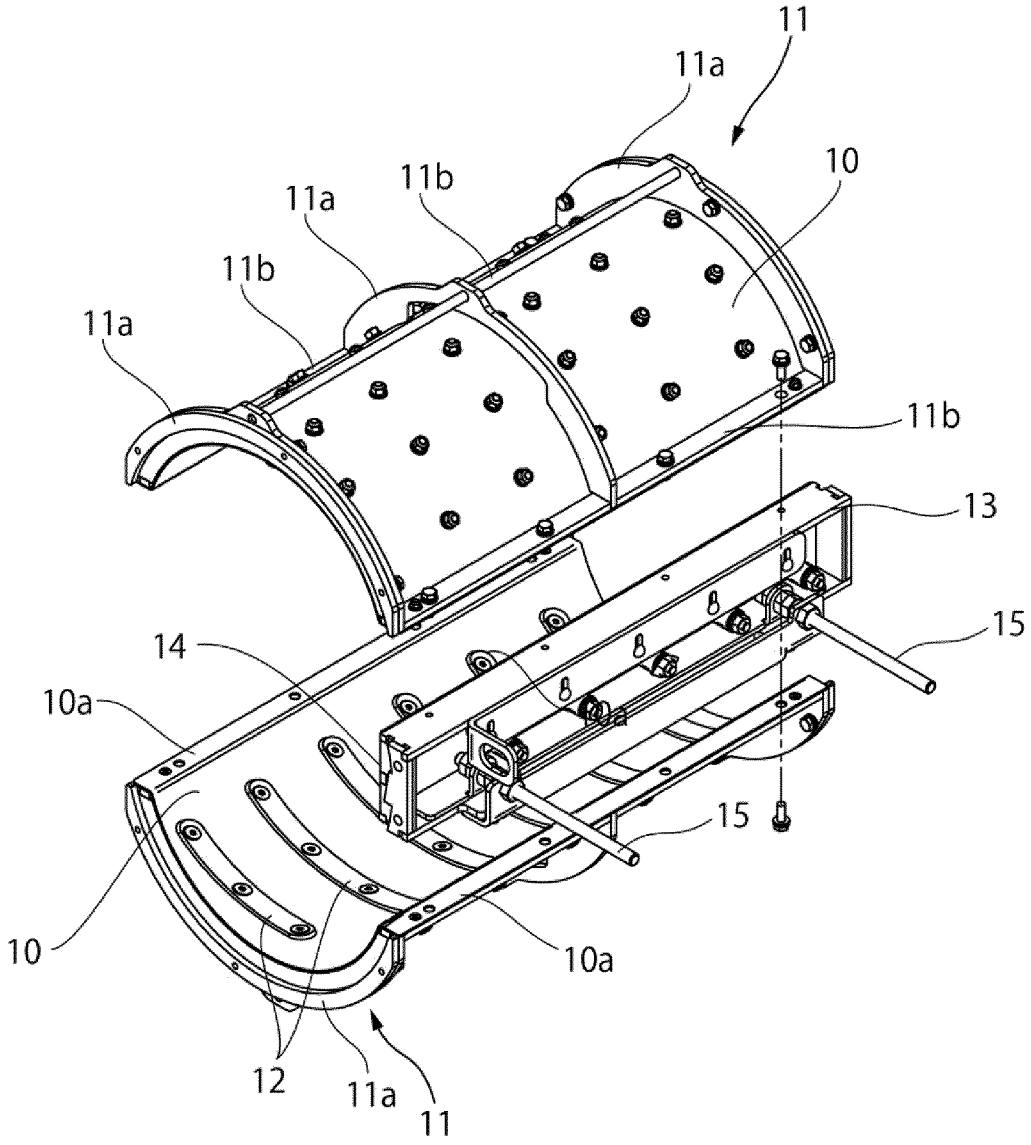
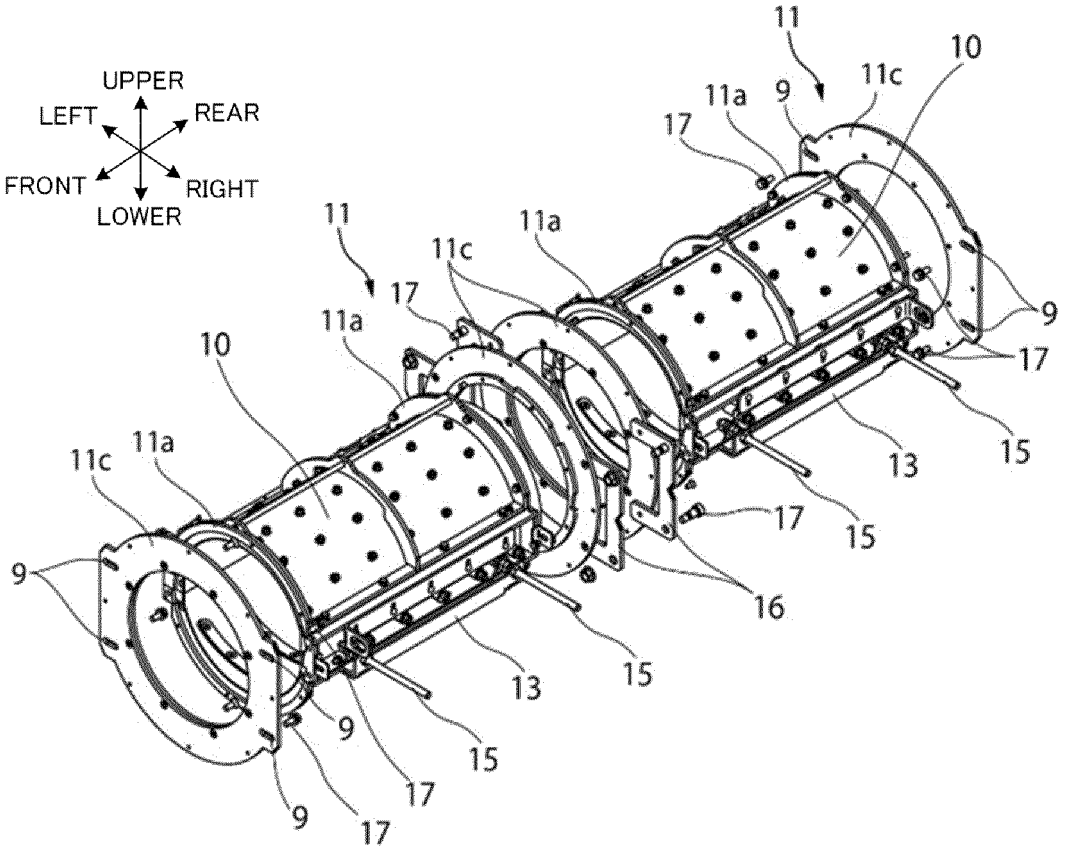


FIG. 6


UPPER
LEFT
REAR
FRONT
RIGHT
LOWER
11
10
11c
11a
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11
11c
11a
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11a
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FIG. 7

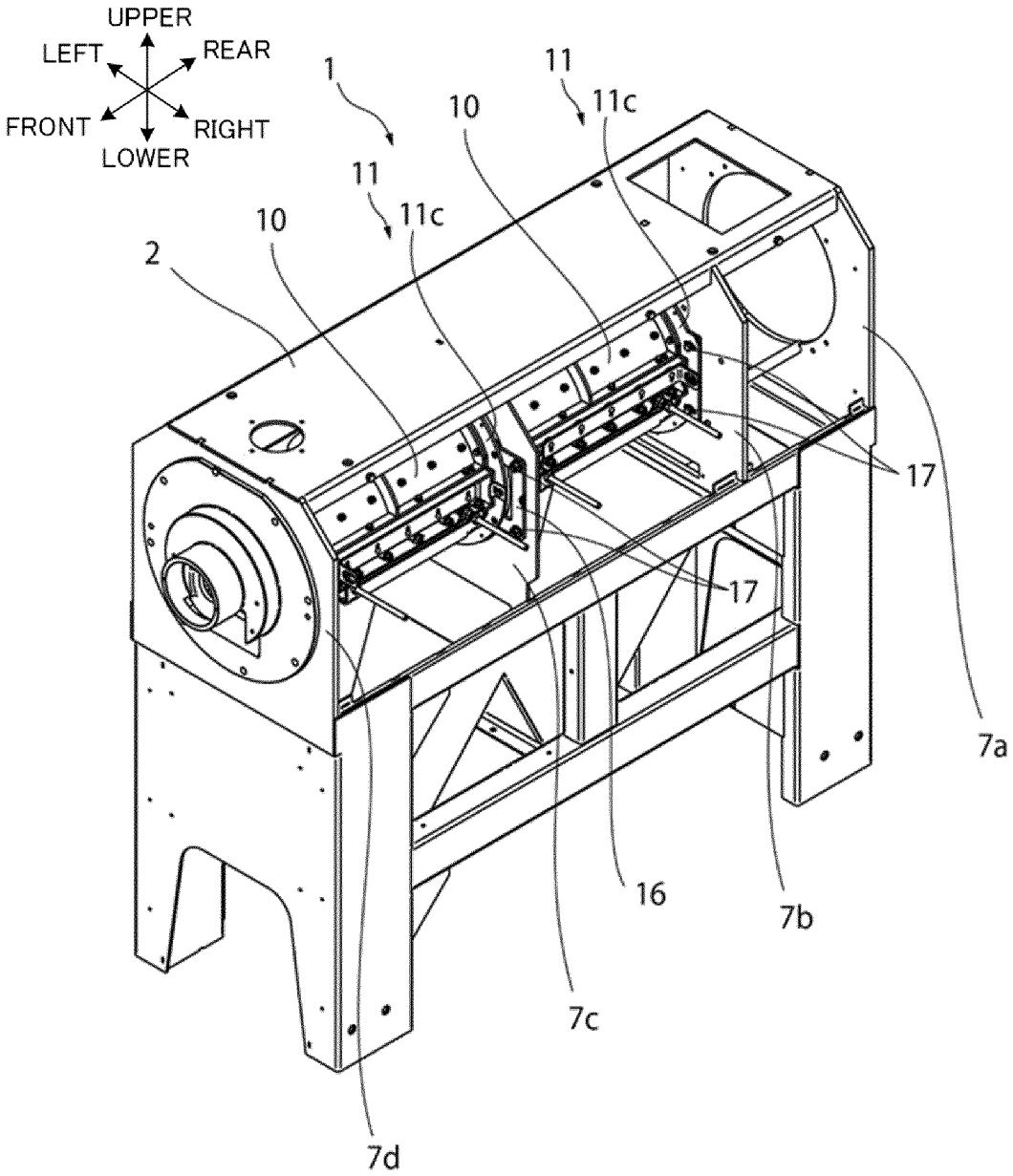
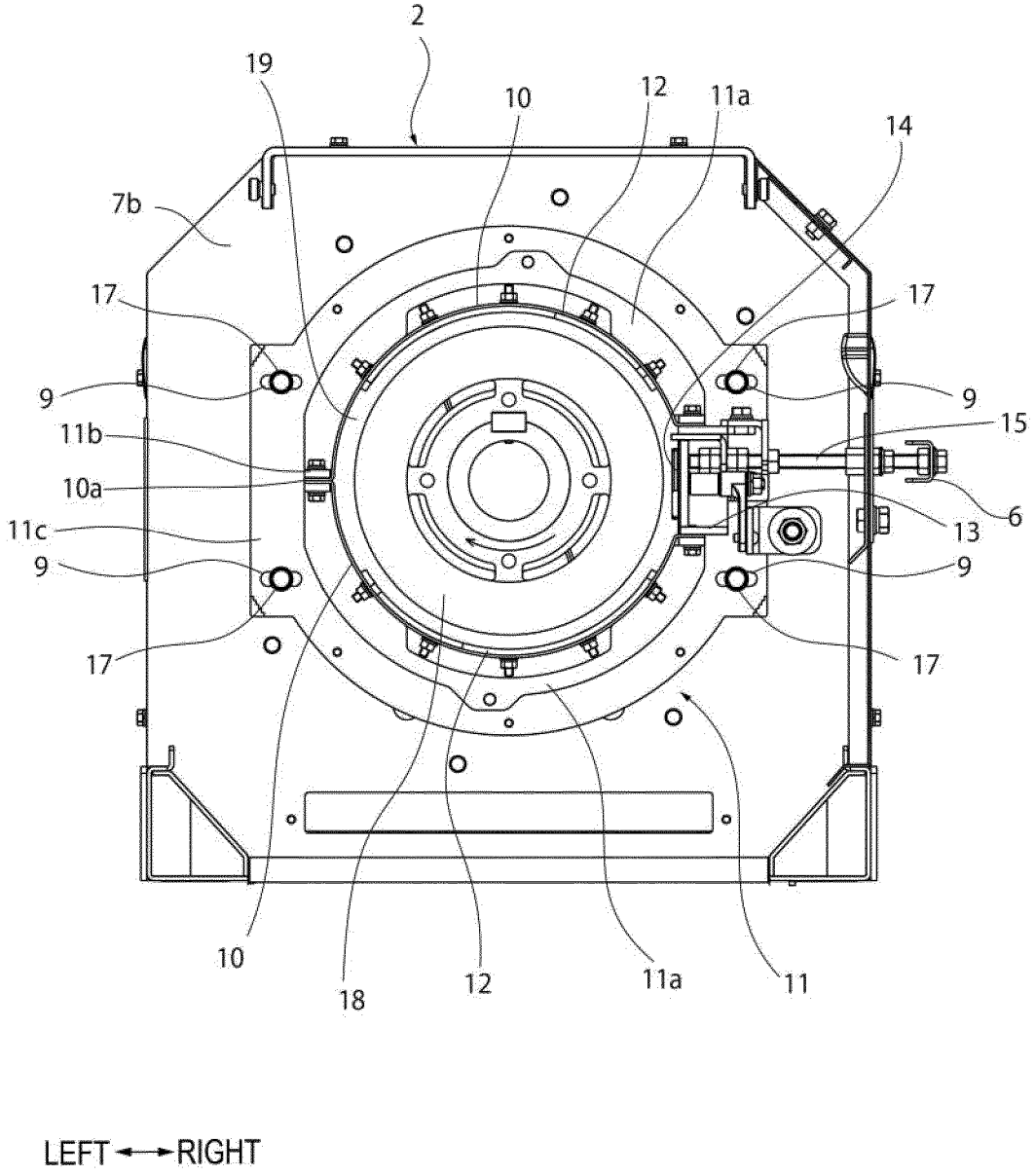


FIG. 8


2
19
10
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11a
14
7b
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9
15
11b
10a
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11c
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12
11a
11
LEFT
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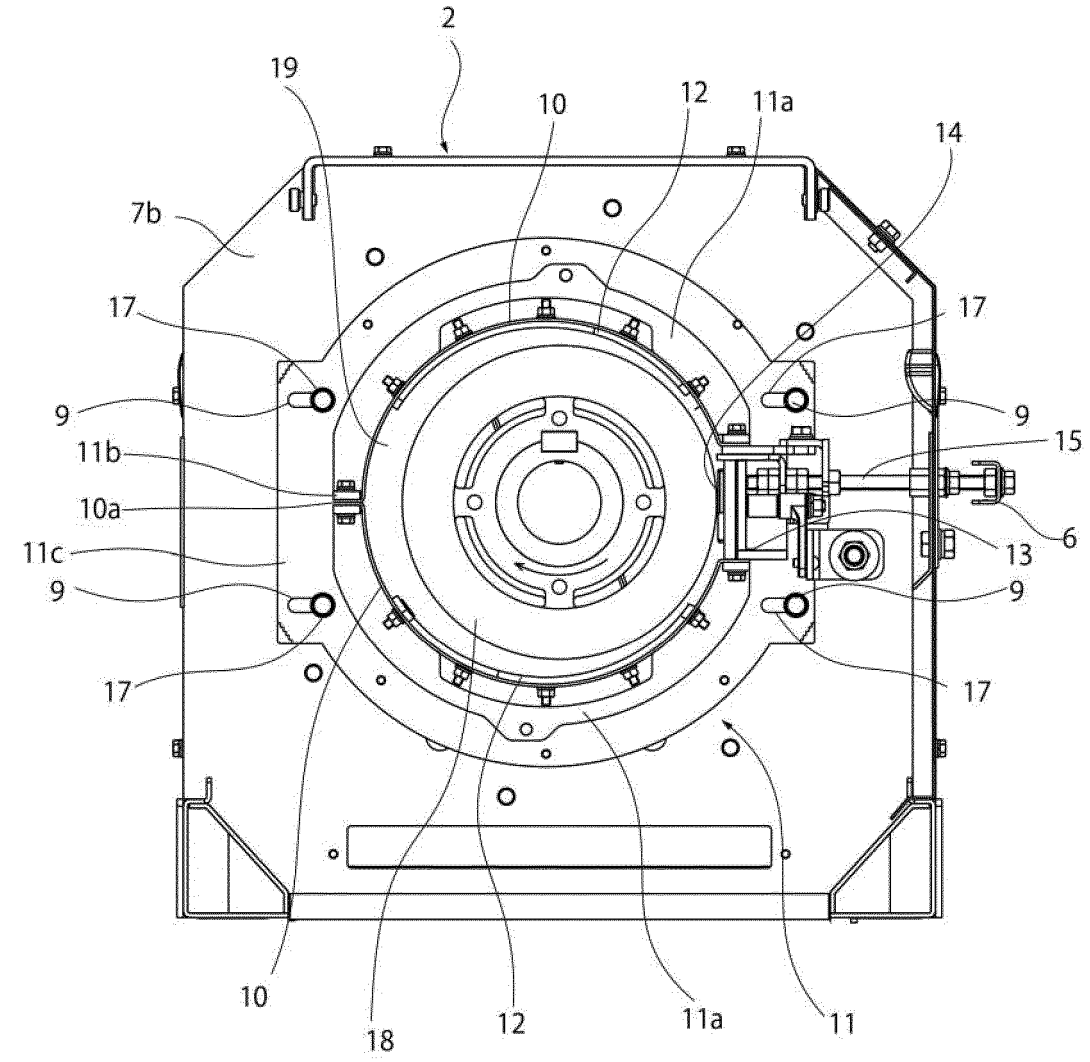
FIG. 9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11b
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10a
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11c
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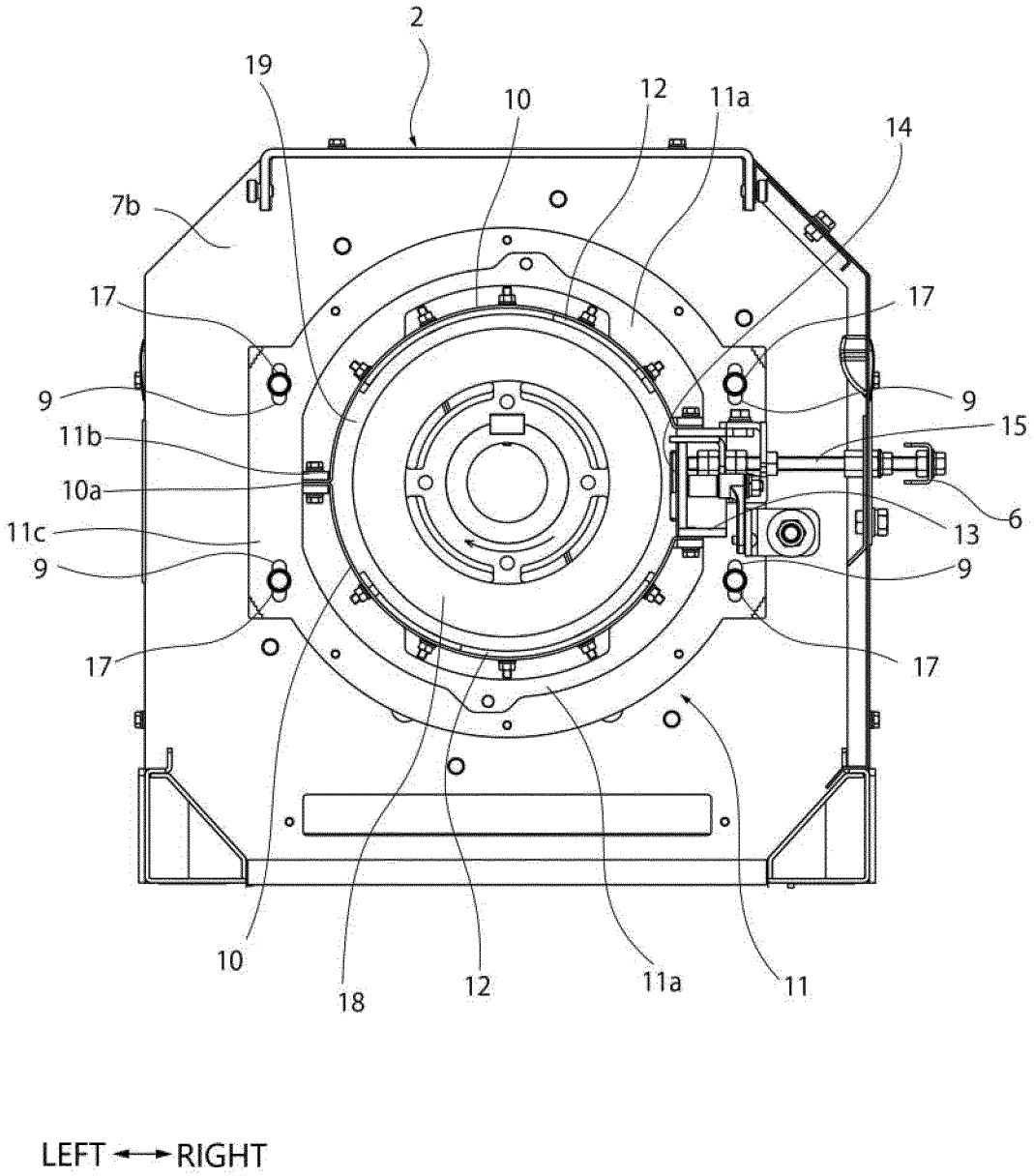
17
17
10
18
12
11a
11
LEFT ←→ RIGHT

FIG. 10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11a
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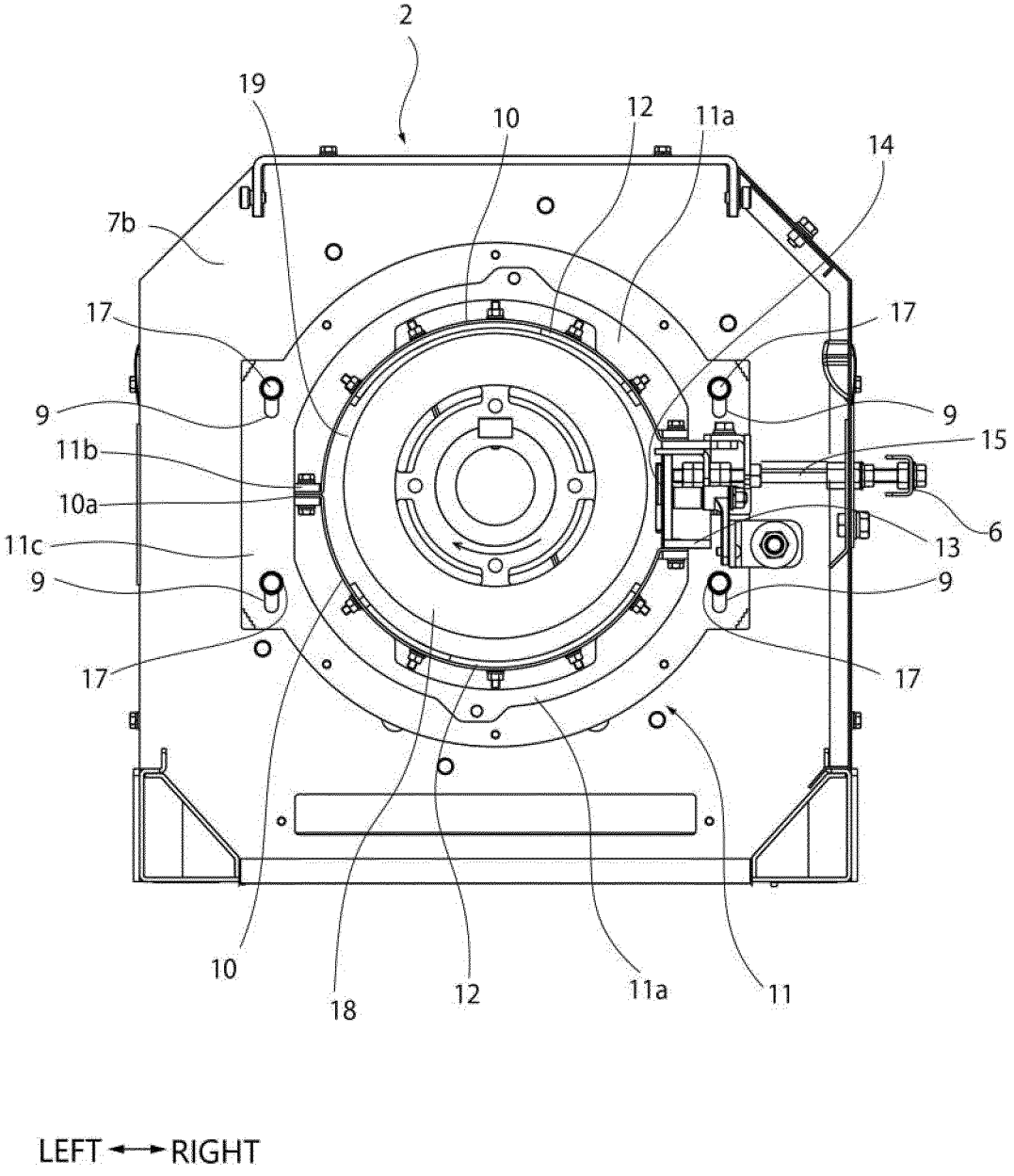
LEFT ⟷ RIGHT

FIG. 11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18
12
11a
11
LEFT
RIGHT

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2020/040130

A. CLASSIFICATION OF SUBJECT MATTER
B02B3/06(2006.01)i
FI: B02B3/06 104

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)
B02B1/00-3-14

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

Published examined utility model applications of Japan	1922-1996
Published unexamined utility model applications of Japan	1971-2020
Registered utility model specifications of Japan	1996-2020
Published registered utility model applications of Japan	1994-2020

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.
A	JP 9-57123 A (SEIREI IND CO., LTD.) 04 March 1997 (1997-03-04) paragraphs [0007]-[0016], fig. 1-2	1-8
A	JP 2015-112550 A (SATAKE CORPORATION) 22 June 2015 (2015-06-22) paragraph [0004], fig. 7	1-8
A	JP 56-160957 A (TANI, Shichiro) 11 December 1981 (1981-12-11) page 2, upper left column, line 2 to lower left column, line 9	1-8

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

* Special categories of cited documents:
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search 16 December 2020 (16.12.2020)	Date of mailing of the international search report 28 December 2020 (28.12.2020)
Name and mailing address of the ISA/ Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2020/040130

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
JP 9-57123 A	04 Mar. 1997	(Family: none)	
JP 2015-112550 A	22 Jun. 2015	CN 104707680 A KR 10-2015-0068901 A TW 201540364 A	
JP 56-160957 A	11 Dec. 1981	(Family: none)	

Form PCT/ISA/210 (patent family annex) (January 2015)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 56160957 A **[0008]**
- JP 9057123 A **[0008]**