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(54) **WASHING MACHINE**

(57) The present invention provides a washing machine which can inhibit a damage to a strip-shaped part which extends from a washing drum and is connected with a part other than a washing drum. The washing machine (1) includes: a washing drum (3) which can rotate in a manner of intersecting an axis (J) with an up-down direction (Z); and a strip-shaped part (42) extending from a lower part (3A) of the washing drum (3) and connected with a part other than the washing drum (3). A rotating shaft (14) as a rotating center of the washing drum (3) is located in a position lower than the center (C) of the washing drum (3) in an axial direction (D) of the washing drum (3) or a center of gravity (G2) of the washing drum (3).

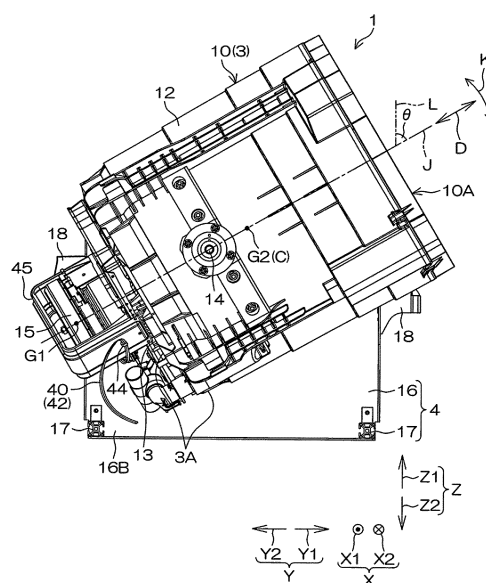


FIG. 3

Description**TECHNICAL FIELD**

[0001] The present invention relates to a washing machine.

BACKGROUND

[0002] In a clothes washing and drying machine described in a following patent literature 1, an outer drum part assembled with a rotating drum part with washings thrown therein is supported by a rotation supporting plate by means of an inclined rotation supporting shaft. A rotation driving motor for rotating the rotating drum part is fixed to a bottom of the outer drum part. The rotation supporting plate is supported by an outer frame of the clothes washing and drying machine by means of a hoisting rod. The outer drum part is provided with a rotation operating rope installing part, and an operating rope connected to the rotation operating rope installing part is coiled on a drum arranged on an inclined rotation motor of the outer frame. With the rotation of the inclined rotation motor, the operating rope moves upwards or downwards. Thus, the outer drum part obliquely rotates around the inclined rotation supporting shaft. Thus, the outer drum part is transversely inclined when the washings are thrown into the rotating drum part, and the outer drum part is erected along a perpendicular direction during washing, rinse and dewatering.

[0003] In the clothes washing and drying machine described in the patent literature 1, strip-shaped parts such as a wire for supplying power for the rotation driving motor and a drain pipe for draining water stored in the outer drum part are conceived to connect the outer drum part with the outer frame. Considering vibration of the outer drum part during washing and dewatering in washing operation, such strip-shaped parts may be loosened to a certain extent generally. Especially, it can be imagined that, in such structure that the outer drum part is rotated obliquely in the clothes washing and drying machine of the patent literature 1, looseness of the strip-shaped parts may be increased according to a size of a rotating range of the outer drum part. However, the strip-shaped parts which are loosened greatly may be damaged due to interference with surrounding parts such as the rotation driving motor and the like.

Related Technical Literature**Patent Literature**

[0004] Patent Literature 1: Japanese Laid-open patent publication No. 4-166196

SUMMARY

Problems to be solved by the invention

[0005] The present invention is based on the background, and aims to provide a washing machine which can inhibit damage to a strip-shaped part which extends from a washing drum and is connected with a part other than the washing drum.

Solution for solving the problems

[0006] The present invention provides a washing machine, including: a cylindrical washing drum, accommodating washings and capable of rotating in a manner of intersecting an axis of the cylindrical washing drum with a perpendicular direction; and a strip-shaped part, extending from a lower part of the washing drum and connected with a part other than the washing drum; wherein a rotating center of the washing drum is located in a position lower than a center of the washing drum in an axial direction of the washing drum or a center of gravity of the washing drum.

[0007] In addition, in the present invention, the washing machine includes: a supporting part, rotatably supporting the washing drum; where the strip-shaped part extends from the lower part of the washing drum and is connected with a lower end part of the supporting part.

[0008] In addition, in the present invention, the washing machine includes: a housing, configured to accommodate the washing drum; and an electrical part, fixed to the lower part of the washing drum; where the strip-shaped part is a wire which extends from the electrical part, and is connected with a part of the housing arranged in a position higher than the electrical part.

[0009] In addition, the present invention provides a washing machine, including: a cylindrical washing drum, accommodating washings and capable of rotating in a manner of intersecting an axis of the cylindrical washing drum with a perpendicular direction; and a strip-shaped part, penetrating through a rotating center or circumference of the rotating center of the washing drum from the lower part of the washing drum, extending out of the washing drum and connected with a part other than the washing drum.

[0010] In addition, in the present invention, the washing machine includes: a fixing part, configured to fix at least one part of the strip-shaped part to the washing drum.

Effects of the invention

[0011] According to the present invention, in the washing machine, the cylindrical washing drum rotates in a manner of intersecting an axis of the cylindrical washing drum with the perpendicular direction; and the strip-shaped part extending from the lower part of the washing drum is connected with a part other than the washing drum.

[0012] In the structure, the rotating center of the washing drum is located in a position lower than the center of the washing drum in an axial direction of the washing drum or a center of gravity of the washing drum. In other words, the rotating center of the washing drum is configured to be inclined towards the lower side of the washing drum in which the strip-shaped part is located. In this case, a rotating range of the lower part of the washing drum can be reduced during rotation of the washing drum. Thus, since looseness of the strip-shaped part which extends from the lower part of the washing drum can be inhibited to be small, the strip-shaped part is difficult to generate interference with surrounding parts. As a result, damage to the strip-shaped part can be inhibited.

[0013] In addition, according to the present invention, the strip-shaped part extending from the lower part of the washing drum is connected with the lower end part of the supporting part that rotatably supports the washing drum. In this case, the strip-shaped part is configured in such a manner that the part connected with the lower part of the washing drum is close to the part connected with the supporting part in an up-down direction. Thus, a moving range of the strip-shaped part can be inhibited to be small during rotation of the washing drum. Therefore, since looseness of the strip-shaped part from the lower part of the washing drum to the lower end part of the supporting part can be inhibited to be small, the strip-shaped part is difficult to generate interference with surrounding parts. As a result, damage to the strip-shaped part can be inhibited.

[0014] In addition, according to the present invention, the strip-shaped part as the wire which extends from an electrical part fixed to the lower part of the washing drum is connected with a part, arranged in a position higher than the electrical part, of the housing for accommodating the washing drum. In this case, since the strip-shaped part is configured to be away from the electrical part around the strip-shaped part upwards between the housing and the electrical part, the strip-shaped part is difficult to generate interference with the electrical part. As a result, damage to the strip-shaped part can be inhibited.

[0015] In addition, according to the present invention, in the washing machine, the cylindrical washing drum rotates in a manner of intersecting an axis of the cylindrical washing drum with the perpendicular direction; and the strip-shaped part extending from the lower part of the washing drum is connected with a part other than the washing drum.

[0016] In the structure, the strip-shaped part penetrates through the rotating center of the washing drum or the circumference of the rotating center extends from the washing drum. In other words, the strip-shaped part extends from a substantially unmovable part of the washing drum under rotation and is connected with a part other than the washing drum. Thus, a moving range of the strip-shaped part can be inhibited to be small during rotation of the washing drum. Therefore, since the looseness of the strip-shaped part can be inhibited to be small, the

strip-shaped part is difficult to generate interference with surrounding parts. As a result, damage to the strip-shaped part can be inhibited.

[0017] In addition, according to the present invention, since at least one part of the strip-shaped part is fixed to the washing drum through the fixing part, the moving range of the strip-shaped part can be further inhibited to be smaller during rotation of the washing drum. Therefore, since the looseness of the strip-shaped part can be further inhibited to be smaller, the strip-shaped part is difficult to generate interference with surrounding parts. As a result, damage to the strip-shaped part can be further inhibited.

BRIEF DESCRIPTION OF DRAWINGS

[0018]

FIG. 1 is a schematic three-dimensional diagram illustrating a washing machine in an embodiment of the present invention;

FIG. 2 is a left view illustrating a main part of a washing machine under a vertical state of a washing drum; FIG. 3 is a left view illustrating a main part of a washing machine under an inclined state of a washing drum;

FIG. 4 is a left view illustrating a main part of a washing machine in a first variation example under a vertical state of a washing drum;

FIG. 5 is a left view illustrating a main part of a washing machine in a first variation example under an inclined state of a washing drum;

FIG. 6 is a longitudinal section main view illustrating a washing machine in a second variation example; and

FIG. 7 is a longitudinal section main view illustrating a washing machine in a third variation example.

List of reference numerals

[0019] 1: Washing machine; 2: Housing; 2E: Part; 3: Washing drum; 3A: Lower part; 4: Supporting part; 14: Rotating shaft; 15: Motor; 16B: Lower end part; 40: Wire; 42: Strip-shaped part; 44: Fixing part; C: Center; D: Axial direction; G2: Center of gravity; J: Axis; Z: Up-down direction.

DETAILED DESCRIPTION

[0020] Embodiments of the present invention are specifically described below with reference to drawings. Fig. 1 is a schematic three-dimensional diagram illustrating a washing machine 1 in an embodiment of the present invention. An up-down direction in Fig. 1 is called as an up-down direction Z of the washing machine 1; a left-right direction in Fig. 1 is called as a front-rear direction Y of the washing machine 1; and a transverse direction approximately orthogonal to paper of Fig. 1 is called as a

left-right direction X. The up-down direction Z is also a perpendicular direction. In the up-down direction Z, an upper side is called as an upper side Z1; and a lower side is called as a lower side Z2. In the front-rear direction Y, a right side in Fig. 1 is called as a front side Y1; and a left side in Fig. 1 is called as a rear side Y2. In the left-right direction X, an outer side of the paper of Fig. 1 is called as a left side X1; and an inner side of the paper of Fig. 1 is called as a right side X2.

[0021] In the washing machine 1, although the washing machine 1 also includes a clothes washing and drying machine with a clothes drying function, the washing machine 1 is described by taking a washing machine which only executes washing operation as an example below without explaining the clothes drying function. The washing operation includes a washing process, a rinsing process and a dewatering process. The washing machine 1 includes: a housing 2, a washing drum 3 accommodated in the housing 2, a supporting part 4, a hoisting rod 5, a rotating part 6, an unlocking mechanism 7 and a driving mechanism 8.

[0022] The housing 2 is, for example, made of metal, and is formed in a shape of a box. A connecting surface 2C for connecting a front surface 2A and an upper surface 2B is arranged on the housing 2. The connecting surface 2C is, for example, an inclined surface which drops towards the front side Y1. An outlet-inlet (not shown) for throwing in and taking out washings from the washing machine 1 is formed in a manner of bridging the front surface 2A and the connecting surface 2C.

[0023] The washing drum 3 has a cylindrical overall shape, and includes an outer drum 10 and an inner drum 11. The outer drum 10 is, for example, made of resin, and is formed in a cylindrical shape with a bottom. In the washing process and the rinsing process, water is stored in the outer drum 10. An imaginary straight line passing through a center of a circle of the outer drum 10 is an axis J of the outer drum 10. The cylindrical outer drum 10 with a bottom has a circumferential wall 12 with substantially cylindrical shape configured along an axis J and a disc-shaped bottom wall 13 which blocks a hollow part of the circumferential wall 12 from the lower side Z2 along the axis J. A circular opening 10A encircled by an upper end edge of the circumferential wall 12 is formed in the upper end part of the washing drum 3 opposed to the bottom wall 13. The opening 10A is used for the washings thrown in and taken out from the washing machine 1 to pass. Metal rotating shafts 14 protruding to an outer side of the left-right direction X are arranged one by one on left and right side surfaces of the circumferential wall 12. Fig. 1 only shows the rotating shaft 14 on the left side X1. The pair of left and right rotating shafts 14 are configured in a same position when observed from the left-right direction X.

[0024] The inner drum 11 is, for example, made of metal, and is formed in a cylindrical shape with a bottom smaller than the outer drum 10 by one circle. The washings are accommodated into the inner drum 11. A circular

opening 11A through which the washings accommodated into the inner drum 11 pass is formed in an upper end part of the inner drum 11 on an opposed side of a bottom wall (not shown). The inner drum 11 is coaxially accommodated into the outer drum 10. Therefore, the axis of the inner drum 11 is the above axis J. The axis J is also the overall axis of the washing drum 3. An extending direction of the axis J is called as the axial direction D of the washing drum 3. In a state that the inner drum 11 is accommodated into the outer drum 10, an opening 11A of the inner drum 11 is located at an inner side of an opening 10A of the outer drum 10. The opening 10A and the opening 11A are opposite to the outlet-inlet (not shown) of the housing 2. Thus, the washings can be thrown in and taken out of the inner drum 11. A plurality of through holes 11C are formed in a circumferential wall 11B and a bottom wall of the inner drum 11; and water in the outer drum 10 passes between the outer drum 10 and the inner drum 11 via the through holes 11C. Therefore, a water level in the outer drum 10 is consistent with a water level in the inner drum 11. In washing operation, the inner drum 11 rotates around the axis J by accepting a driving force from a motor 15 (see FIG. 2 below) arranged in the housing 2.

[0025] The supporting part 4 is made of metal, and includes a pair of left and right side plates 16 and a beam member 17 erected between lower end parts of the pair of side plates 16. Each side plate 16 is formed in a substantially rectangular shape when observed from the left-right direction X, and is thin in the left-right direction X. A washing drum 3 is configured between the pair of side plates 16.

[0026] For the outer drum 10 of the washing drum 3, the rotating shaft 14 protruding to the left side X1 penetrates through the side plate 16 on the left side X1, and is supported rotatably by the side plate 16 on the left side X1 via a bearing (not shown). For the outer drum 10, the rotating shaft 14 (not shown) protruding to the right side X2 penetrates through the side plate 16 on the right side X2, and is supported rotatably by the side plate 16 on the right side X2 via a bearing (not shown). Thus, the washing drum 3 is supported by the supporting part 4, and can rotate around the rotating shaft 14 in a manner of intersecting the axis J with the up-down direction Z. Specifically, the washing drum 3 rotates along with the motor 15 (see FIG. 2). At this moment, the axis J is inclined to the front-rear direction Y relative to the up-down direction Z. A rotating direction of the washing drum 3 is called as a rotating direction K. The lower part of the washing drum 3 is formed by a part of the circumferential wall 12 of the outer drum 10, closer to the side of the bottom wall 13 than the rotating shaft 14 in the axial direction D, and the bottom wall 13.

[0027] A crossing angle at a sharp angle between an imaginary reference shaft L extending along the up-down direction Z and the axis J is a rotating angle θ of the washing drum 3 relative to the reference shaft L. The smaller the rotating angle θ , the closer to an erecting

posture the washing drum 3. The larger the rotating angle θ is, the more inclined to the front side Y1 the washing drum 3 is in such a manner that the opening 10A of the outer drum 10 and the opening 11A of the inner drum 11 face the front side Y1. The rotating angle θ can be changed at, for example, five levels of 0 degree, 15 degrees, 30 degrees, 45 degrees and 60 degrees. In this case, as an example of application in the washing machine 1, when the washings are thrown in the washing drum 3 at the beginning of the washing operation, the rotating angle θ is set as 45 degrees in such a manner that throwing of the washings becomes easy; and then, under a condition of detecting a load of the washings or supplying water to the washing drum 3, the rotating angle θ is set as 0 degree. Then, in the washing process and the rinsing process, to promote position alternation of the washings in the inner drum 11 to realize efficient washing and rinsing, the rotating angle θ is set to change between 0 degree and 60 degrees.

[0028] An opening 16A penetrating through the side plate 16 along the left-right direction X is formed in a region that the side plate 16 on the left side X1 is closer to the lower side Z2 than the rotating shaft 14. The opening 16A is formed in an approximately rectangular shape which is long in the front-rear direction Y. A supporting part 18 protruding to an outer side in the front-rear direction Y is arranged at a front end edge and a rear end edge of each side plate 16. The supporting part 18 can be formed integrally with the side plate 16, and can also be installed as, for example, another part made of resin, on the side plate 16.

[0029] Hoisting rods 5 are formed in a shape of a rod having a friction damper 19 at the lower end part. Four hoisting rods 5 are arranged, and are respectively configured at four corners in the housing 2 when observed from top from the upper side Z1. The hoisting rods 5 are in a suspended state from the upper part of the housing 2, and specifically from a metal outer frame (not shown) forming part of the housing 2. In two hoisting rods 5 arranged front and back on the left side X1, a lower end part of the hoisting rod 5 on the front side Y1 is connected with the supporting part 18 at the front side Y1 of the side plate 16 on the left side X1, and a lower end part of the hoisting rod 5 on the rear side Y2 is connected with the supporting part 18 at the rear side Y2 of the side plate 16 on the left side X1. In two hoisting rods 5 arranged front and back on the right side X2, a lower end part of the hoisting rod 5 on the front side Y1 is connected with the supporting part 18 at the front side Y1 of the side plate 16 on the right side X2, and a lower end part of the hoisting rod 5 (not shown) on the rear side Y2 is connected with the supporting part 18 (not shown) at the rear side Y2 of the side plate 16 on the right side X2. Thus, the supporting part 4 having the side plates 16, the washing drum 3 supported by the supporting part 4, and the motor 15 (see FIG. 2) for rotating the inner drum 11 are elastically supported by the housing 2 via the hoisting rods 5.

[0030] The rotating part 6 is an approximately fan-shaped metal plate which is thin in the left-right direction X and protrudes to the front side Y1 when observed from the left-right direction X. The rotating part 6 has an outer circumferential edge 6A which is formed in a circular arc shape along the rotating direction K and protrudes to the front side Y1. A through hole 6B penetrating through the rotating part 6 along the left-right direction X is formed in a position on the rotating part 6 consistent with a center of curvature of the outer circumferential edge 6A. A plurality of concave parts 6C are formed in the outer circumferential edge 6A, and five concave parts 6C are formed herein. The concave parts 6C are sunken towards the through hole 6B, penetrate through the rotating part 6 along the left-right direction X, and are arranged and configured along the rotating direction K. A spacing between adjacent concave parts 6C can be fixed or different due to the position of the rotating part 6. In the present embodiment, corresponding to the rotating angle θ which is set as 0 degree, 15 degrees, 30 degrees, 45 degrees and 60 degrees, the spacing between other adjacent concave parts 6C is fixed as 15 degrees.

[0031] The rotating part 6 is configured to be closer to the left side X1 than the side plate 16 on the left side X1. The rotating shaft 14 protruding to the left side X1 of the outer drum 10 and penetrating through the side plate 16 on the left side X1 is inserted into the through hole 6B of the rotating part 6, and is fixed to the rotating part 6. Thus, the rotating part 6 is connected to the outer drum 10 in a manner of integral rotation via the rotating shaft 14.

[0032] In the rotating part 6 under the posture in Fig. 1, at the rear end of the outer circumferential edge 6A, an extending part 6D protruding to the lower side Z2 and specifically protruding to the outer side of a radial direction R of the rotating part 6 using the through hole 6B as a center is integrally arranged. A guiding hole 6E which is long in the radial direction R and penetrates through the extending part 6D along the left-right direction X is formed in the extending part 6D. The guiding hole 6E in the up-down direction Z is located in the same position as the opening 16A of the side plate 16 on the left side X1, and is always opposed to the opening 16A from the left side X1.

[0033] The unlocking mechanism 7 is fixed to a left side surface of the side plate 16 on the left side X1. The unlocking mechanism 7 includes a body part 21 and a locking part 22. An actuator (not shown) composed of a solenoid and the like is arranged on the body part 21. The locking part 22 is formed in a shape of a bulge protruding from the body part 21 to the rear side Y2, and is supported by the body part 21 in a manner of sliding to the front-rear direction Y. The actuator of the body part 21 is operated, so that the locking part 22 slides between an entering position for entering to the rear-most side Y2 and an exiting position for exiting to a front-most side Y1. The locking part 22 in Fig. 1 is in the entering position, and is in a state that the locking part 22 is embedded into the concave part 6C in the same position in the rotating

direction K. Thus, rotation of the rotating part 6 and the washing drum 3 is locked. In this state, when the locking part 22 exits to the exiting position, since the locking part 22 leaves the concave part 6C, the rotating part 6 and the washing drum 3 are unlocked.

[0034] The driving mechanism 8 includes a frame 23, a pair of supporting parts 24, a threaded shaft 25, a motor 26, a coupling 27, a nut member 28 and a sensor 29.

[0035] The frame 23 is formed by bending a metal plate into, for example, a crank shape, and is fixed to the side plate 16 from the right side X2 in an open manner of covering the opening 16A of the side plate 16 on the left side X1 from the right side X2. A pair of supporting parts 24 is fixed to the frame 23 in such a manner that the supporting parts 24 are arranged away from each other along the front-rear direction Y, and is in a state of protruding from the frame 23 to the left side X1. The threaded shaft 25 is formed in a cylindrical shape slenderly extending along the front-rear direction Y, and a screw thread 25A which extends helically is formed on an almost entire region of the outer circumferential surface. The threaded shaft 25 is rotatably supported on both ends by bearings 30 arranged on a pair of front and rear supporting parts 24.

[0036] The motor 26 is an ordinary electric motor, and has an output shaft 31 protruding to the rear side Y2 and configured coaxially with the threaded shaft 25. The front end part of the threaded shaft 25 and the output shaft 31 are connected via the coupling 27 in a manner of integral rotation. Therefore, when the motor 26 is driven to rotate the output shaft 31, the threaded shaft 25 and the output shaft 31 rotate integrally. The nut member 28 has an annular nut having a screw thread (not shown) which extends helically on the inner circumferential surface, and is externally embedded into the threaded shaft 25 in such a manner that the screw thread and the screw thread 25A of the threaded shaft 25 are in mutual threaded connection. When the threaded shaft 25 rotates with the driving of the motor 26, the nut member 28 integrally moves along the axial direction of the threaded shaft 25, i.e., the front-rear direction Y along with rotation of the threaded shaft 25. The nut member 28 is connected with the rotating part 6 via the connecting pin 32 through the connecting pin 32 fixedly inserted into the extending part 6D of the rotating part 6. Therefore, when the nut member 28 moves along the front-rear direction Y along with rotation of the threaded shaft 25, the rotating part 6 is pulled to the front-rear direction Y by the nut member 28, so as to rotate with the washing drum 3.

[0037] The sensor 29 is a sensor for detecting the rotating angle θ of the washing drum 3 according to a position of the nut member 28 in the front-rear direction Y, and as a sensor 29, can be selected from an optical sensor. In this case, the quantity of the sensors 29 is set to be the same as the quantity of the concave parts 6C of the rotating part 6, and the sensors 29 are fixed to the frame 23 in such a manner that the sensors 29 are arranged along the front-rear direction Y. A groove 29A

penetrating through the sensor 29 along the front-rear direction Y is formed in each sensor 29. The sensor 29 is in such a state that detection light transects the groove 29A along the up-down direction Z. A rod-shaped detected part 28A called as a limiting part is arranged on the nut member 28. When the rotating angle θ is any angle of 0 degree, 15 degrees, 30 degrees, 45 degrees and 60 degrees, the detected part 28A is embedded into the groove 29A of any sensor 29 so as to shield the detection light of the groove 29A. Therefore, five sensors 29 uniformly detect the rotating angle θ from 0 degree, 15 degrees, 30 degrees, 45 degrees and 60 degrees.

[0038] Fig. 2 is a left view illustrating a main part of a washing machine 1 under the rotating angle θ of 0 degree, i.e., under a vertical state of a washing drum 3. Fig. 3 is a left view illustrating a main part of a washing machine 1 under an inclined state of a washing drum 3, e.g., under the rotating angle θ of 60 degrees. With reference to Fig. 2, as mentioned above, the motor 15 configured to produce the driving force for rotating the inner drum 11 is one of electrical parts included in the washing machine 1, and is fixed to the bottom wall 13 of the outer drum 10 from the lower side Z2. The output shaft (not shown) of the motor 15 is connected with the inner drum 11 through a transmitting mechanism 33 such as a clutch mechanism and the like. A reference numeral G1 is given to the center of gravity of the motor 15. In another aspect, a reference numeral G2 is given to the overall center of gravity of the washing drum 3. The center of gravity G2 may be the center of gravity of an individual washing drum 3 like the present embodiment, or may be the center of gravity of an aggregate of water, washings and the washing drum 3 under a state that the water and the washings are accommodated in the washing drum 3.

[0039] Regardless of the above defined center of gravity G2, the center of gravity G1 of the motor 15 and the center of gravity G2 of the washing drum 3 are configured on the axis J of the washing drum 3. Moreover, the rotating shaft 14 as the rotating center of the washing drum 3 is configured in a position lower than the center of gravity G2. Specifically, when observed from the left-right direction X, the rotating shaft 14 is configured between the center of gravity G1 and the center of gravity G2 on the axis J. Regardless of value of the rotating angle θ , a relationship between the center of gravity G1 and the position of the rotating shaft 14 and a relationship between the center of gravity G2 and the position of the rotating shaft 14 are identical (see FIG. 3).

[0040] The motor 15 fixed to the bottom wall 13 of the outer drum 10 is connected with a power line extending from a power substrate (not shown) fixed to the housing 2 and configured to supply power for the motor 15, and a signal line (a wire 40) extending from a control substrate (not shown) fixed to the housing 2 and configured to send a control signal to the motor 15. In addition, a hose-shaped drainage pipeline 41 configured to drain water stored in the outer drum 10 from the washing machine is arranged on the bottom wall 13. The drainage pipeline

41 penetrates through the housing 2, and is pulled out of the housing 2. In this way, the strip-shaped parts 42 such as the wire 40 and the drainage pipeline 41 extend from the bottom wall 13, i.e., from the lower part of the washing drum 3, and are connected with a part other than the washing drum 3. The part other than the washing drum 3 refers to the part which is always immobile, such as the power substrate, the control substrate and the housing 2.

[0041] The center of gravity G2 of the washing drum 3 may be the overall center C of the washing drum 3 in the axial direction D, or may be the center of gravity G2 inconsistent with the center C. In either case, the rotating shaft 14 as the rotating center of the washing drum 3 is required to be configured in a position lower than at least one of the center C and the center of gravity G2 of the washing drum 3. In this way, since the rotating shaft 14 is located in the position lower than the center C or the center of gravity G2 of the washing drum 3, the center C or the center of gravity G2 of the washing drum 3 is configured to be inclined towards the side of the lower part 3A in which the strip-shaped part 42 is located. In this case, a rotating range of the lower part 3A of the washing drum 3 can be reduced during rotation of the washing drum 3. Thus, since looseness of the strip-shaped part 42 which extends from the lower part 3A of the washing drum 3 can be inhibited to be small, the strip-shaped part 42 is difficult to generate interference with surrounding parts such as the motor 15 and the supporting part 4. As a result, damage to the strip-shaped part 42 can be inhibited.

[0042] Further, as mentioned above, under a condition that the rotating shaft 14 is configured between the center of gravity G1 and the center of gravity G2, since the balance of the aggregate of the washing drum 3 and the motor 15 is stable, the washing drum 3 can be rotated with small force and the inclined washing drum 3 after rotation can also be stabilized with small force. Therefore, a burden of the driving mechanism 8 for rotating the washing drum 3 and a burden of the unlocking mechanism 7 for locking the rotation of the washing drum 3 can be reduced (see FIG. 1).

[0043] The wire 40 as an example of the strip-shaped part 42 is emphatically explained below, but the following content of the wire 40 can also be used for the drainage pipeline 41. The wire 40 extends from the motor 15 on the lower part 3A of the washing drum 3, and is connected with the lower end part 16B of the side plate 16 on the right side X2 of the supporting part 4. The lower end part 16B is also the overall lower end part of the supporting part 4. The wire 40 penetrates through the lower end part 16B from left and right, and is connected with the power substrate (not shown) and the control substrate (not shown) of the housing 2.

[0044] In this case, the strip-shaped part 42 is configured in such a manner that the part 42A connected with the lower part 3A of the washing drum 3 is close to the part 42B connected with the lower end part 16B of the

supporting part 4 in the up-down direction Z. Thus, a moving range of the strip-shaped part 42 can be inhibited to be small during rotation of the washing drum 3. Therefore, since looseness of the strip-shaped part 42 which extends from the lower part 3A of the washing drum 3 to the lower end part 16B of the side plate 16 can be inhibited to be small, the strip-shaped part 42 is difficult to generate interference with surrounding parts. As a result, damage to the strip-shaped part 42 can be inhibited.

[0045] Fig. 4 is a left view illustrating a main part of the washing machine 1 in a first variation example under a vertical state of the washing drum 3. Fig. 5 is a left view illustrating a main part of a washing machine in a first variation example under an inclined state of the washing drum 3. In FIG. 4 and FIG. 5, a same reference numeral is given to the part which is the same as the part described in FIG. 1 to FIG. 3, and illustration of the part is omitted (like FIG. 6 and FIG. 7). In the first variation example shown in FIG. 4 and FIG. 5, the wire 40 which extends from the motor 15 is not connected with the side plate 16 but is pulled out of a space 43 between a pair of left and right side plates 16 to the rear side Y2 and is directly connected with the rear wall 2D of the housing 2. Specifically, the wire 40 is connected with a part 2E of the rear wall 2D arranged in a position higher than the motor 15.

[0046] In this case, since the wire 40 as the strip-shaped part 42 is configured to be away from the motor 15 around the strip-shaped part 42 to the upper side Z1 between the housing 2 and the motor 15, the wire 40 is difficult to generate interference with the motor 15 when the washing drum 3 is inclined. As a result, damage to the wire 40 can be inhibited.

[0047] Fig. 6 is a longitudinal section main view illustrating a washing machine 1 in a second variation example. For the second variation example, at least one of a pair of left and right rotating shafts 14 is formed to be hollow. In FIG. 6, the rotating shaft 14 on the left side X1 is formed to be hollow. Specifically, a through hole 14C with a substantially L shape (also see an enlarged view of a part encircled by a dashed circle in FIG. 6), which extends from the inlet 14A on the side of the bottom wall 13 of the outer drum 10 to the axial direction D, which is bent into an approximately right angle to the left side X1 and which is exposed from the outlet 14B in the left end surface of the rotating shaft 14, is formed in the rotating shaft 14. Based on the vertical state of the washing drum 3 in FIG. 6, the wire 40 is pulled out of the motor 15 to the upper side Z1, penetrates through the through hole 14C of the rotating shaft 14 on the left side X1 along the lower part 3A of the washing drum 3 according to a sequence of the inlet 14A and the outlet 14B, and extends from the rotating shaft 14 to the left side X1, thereby extending out of the washing drum 3.

[0048] In other words, the wire 40 extends from a movable part of the washing drum 3 which substantially does not rotate (i.e., the rotating shaft 14) and is connected with a part other than the washing drum 3. Thus, a moving

range of the wire 40 can be inhibited to be small during rotation of the washing drum 3. Therefore, since the looseness of the wire 40 can be inhibited to be small even if such a structure that the rotating shaft 14 is configured in a position lower than the center of gravity G2 and the center C of the washing drum 3 is adopted in above embodiments (see FIG. 1 to FIG. 3) and the first variation example (see FIG. 4 and FIG. 5), the wire 40 is difficult to generate interference with the surrounding parts. As a result, damage to the wire 40 can be inhibited. Of course, in the variation example 2, the rotating shaft 14 can also be configured in the position much lower than the center of gravity G2 and the center C. At this moment, since the looseness of the wire 40 can be further inhibited to be smaller, damage to the wire 40 can be further inhibited.

[0049] A fixing part 44 is arranged on the surface of the lower part 3A of the washing drum 3. The quantity of the fixing parts 44 can be arbitrarily set. In FIG. 6, one fixing part 44 is respectively arranged on the circumferential wall 12 and the bottom wall 13 of the outer drum 10, and a total of two fixing parts 44 are arranged. Each of the fixing part 44 is, for example, annular. A part of the wire 40 is inserted into the fixing part 44. Thus, since at least one part of the wire 40 is fixed to the washing drum 3, the moving range of the wire 40 can be further inhibited to be small during rotation of the washing drum 3. Therefore, since the looseness of the wire 40 can be further inhibited to be smaller, the wire 40 is difficult to generate interference with the surrounding parts such as the side plate 16 through integration with the washing drum 3. As a result, damage to the wire 40 can be further inhibited. It should be noted that the fixing part 44 can also be arranged on the motor 15, and strictly arranged on a bracket 45 (see FIG. 4) which is formed in an approximately U shape installed on the bottom wall 13 from the lower side Z2 and configured to accommodate the motor 15 on the inner side.

[0050] Fig. 7 is a longitudinal section main view illustrating a washing machine 1 in a third variation example. For the third variation example, a through hole 16C (also see an enlarged view of a part encircled by a dashed circle in FIG. 7) is formed around the rotating shaft 14 in at least one of a pair of side plates 16 of the supporting part 4. In FIG. 7, a through hole 16C is formed in the side plate 16 on the left side X1. Based on the vertical state of the washing drum 3 in FIG. 7, the wire 40 is pulled out of the motor 15 to the upper side Z1, penetrates through the through hole 16C of the rotating shaft 14 of the side plate 16 on the left side X1 along the lower part 3A of the washing drum 3, and extends from the side plate 16 to the left side X1, thereby extending out of the washing drum 3. It should be noted that the through hole 16C is formed in a position close to the rotating shaft 14 to the greatest extent so that the wire 40 inserted into the through hole 16C does not influence the operation of the rotating part 6, the unlocking mechanism 7 and the driving mechanism 8 (see FIG. 1).

[0051] In this case, like the variation example 2, since the wire 40 extends from a movable part of the washing drum 3 which substantially does not rotate and is connected with a part other than the washing drum 3, a moving range of the wire 40 can be inhibited to be small during rotation of the washing drum 3. Therefore, since the looseness of the wire 40 can be inhibited to be small, the wire 40 is difficult to generate interference with the surrounding parts. Thus, damage to the wire 40 can be inhibited. In the variation example 3, like the variation example 2, to further inhibit the looseness of the wire 40 to be smaller, the rotating shaft 14 can be configured in a position lower than the center of gravity G2 and the center C of the washing drum 3.

[0052] The present invention is not limited to above described embodiments, and can be changed in various modes within a scope recorded in claims.

[0053] For example, as the electrical part connected with the wire 40 in the washing drum 3, besides the above motor 15, a sensor configured to detect a water level and the like in the outer drum 10, and the above transmitting mechanism 33 can also be illustrated.

[0054] In addition, as long as the movement of the nut member 28 in the front-rear direction Y, i.e., the rotation of the washing drum 3, can be limited when the driving of the motor 26 is stopped, the unlocking mechanism 7 and the concave part 6C of the rotating part 6 can be omitted. Thus, stepless adjustment can be made to the rotating angle θ .

Claims

1. A washing machine, comprising:

a cylindrical washing drum, accommodating washings and capable of rotating in a manner of intersecting an axis of the cylindrical washing drum with a perpendicular direction; and
a strip-shaped part, extending from a lower part of the washing drum and connected with a part other than the washing drum;
wherein a rotating center of the washing drum is located in a position lower than a center of the washing drum in an axial direction of the washing drum or a center of gravity of the washing drum.

2. The washing machine according to claim 1, wherein the washing machine comprises:

a supporting part, rotatably supporting the washing drum;
wherein the strip-shaped part extends from the lower part of the washing drum and is connected with a lower end part of the supporting part.

3. The washing machine according to claim 1, wherein

the washing machine comprises:

a housing, configured to accommodate the washing drum; and
an electrical part, fixed to the lower part of the washing drum; 5
wherein the strip-shaped part is a wire which extends from the electrical part, and is connected with a part of the housing arranged in a position higher than the electrical part. 10

4. A washing machine, comprising:

a cylindrical washing drum, accommodating washings and capable of rotating in a manner of intersecting an axis of the cylindrical washing drum with a perpendicular direction; and 15
a strip-shaped part, penetrating through a rotating center or circumference of the rotating center of the washing drum from the lower part of the washing drum, extending out of the washing drum and connected with a part other than the washing drum. 20

5. The washing machine according to any one of claims 1-4, wherein the washing machine comprises: 25
a fixing part, configured to fix at least one part of the strip-shaped part to the washing drum.

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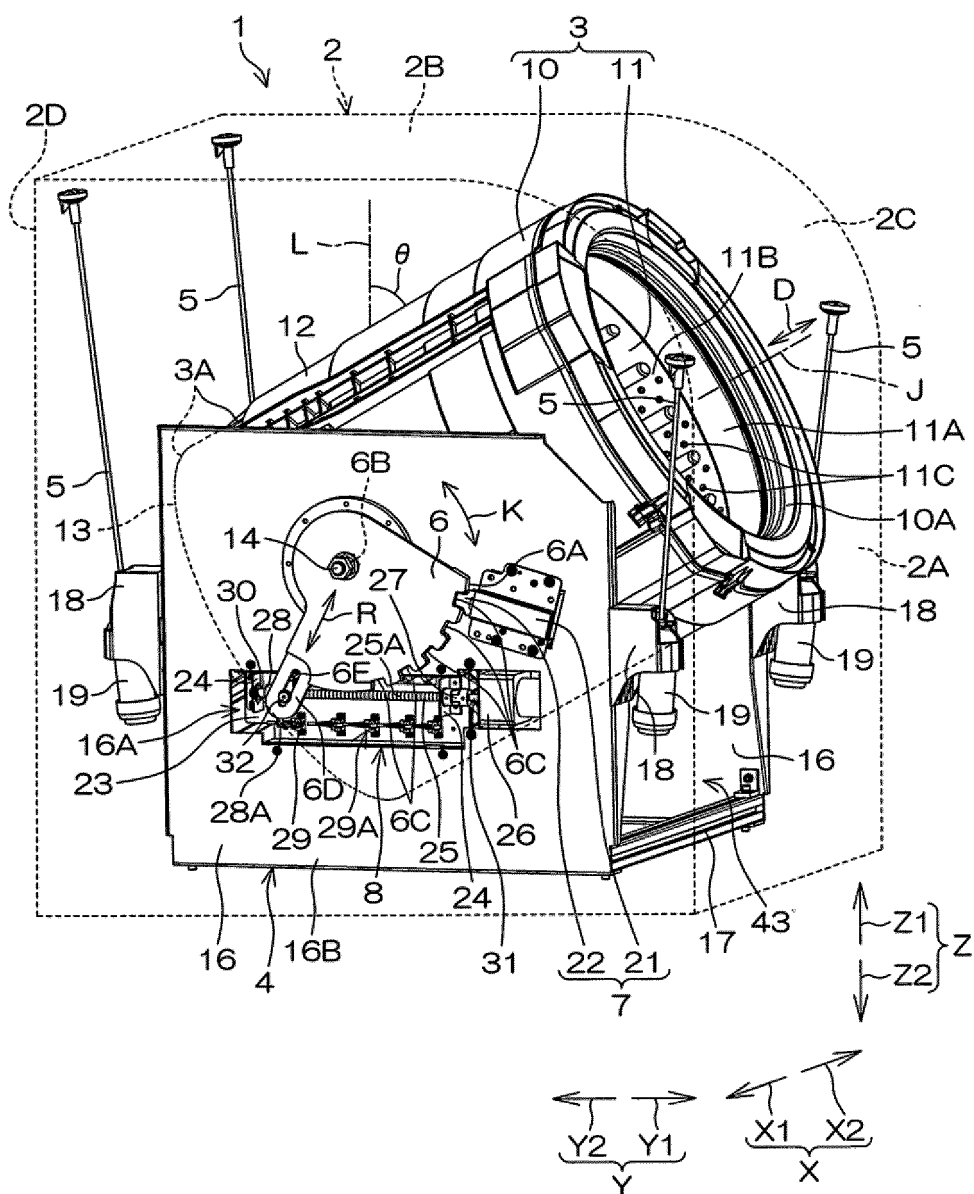


FIG. 1

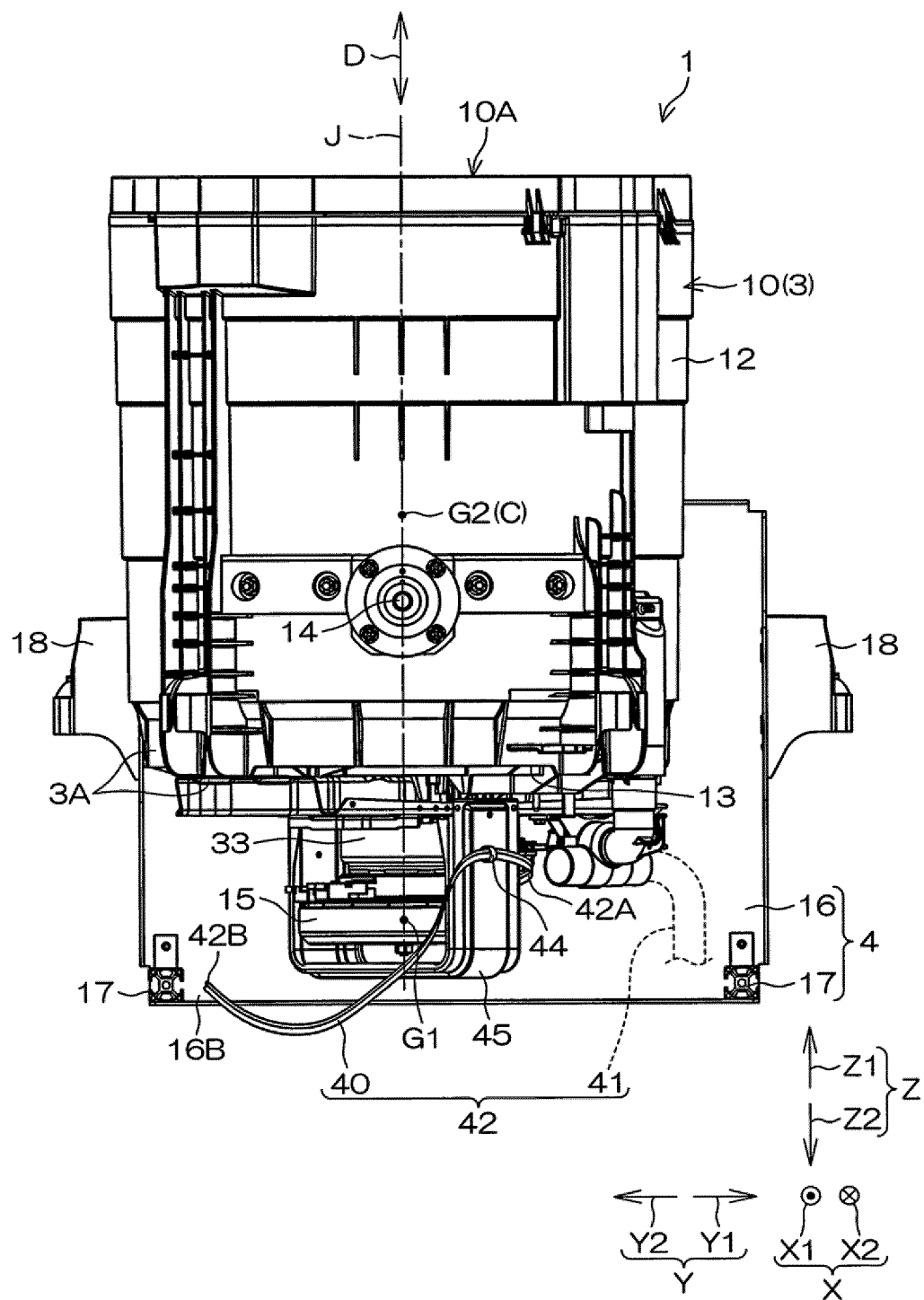


FIG. 2

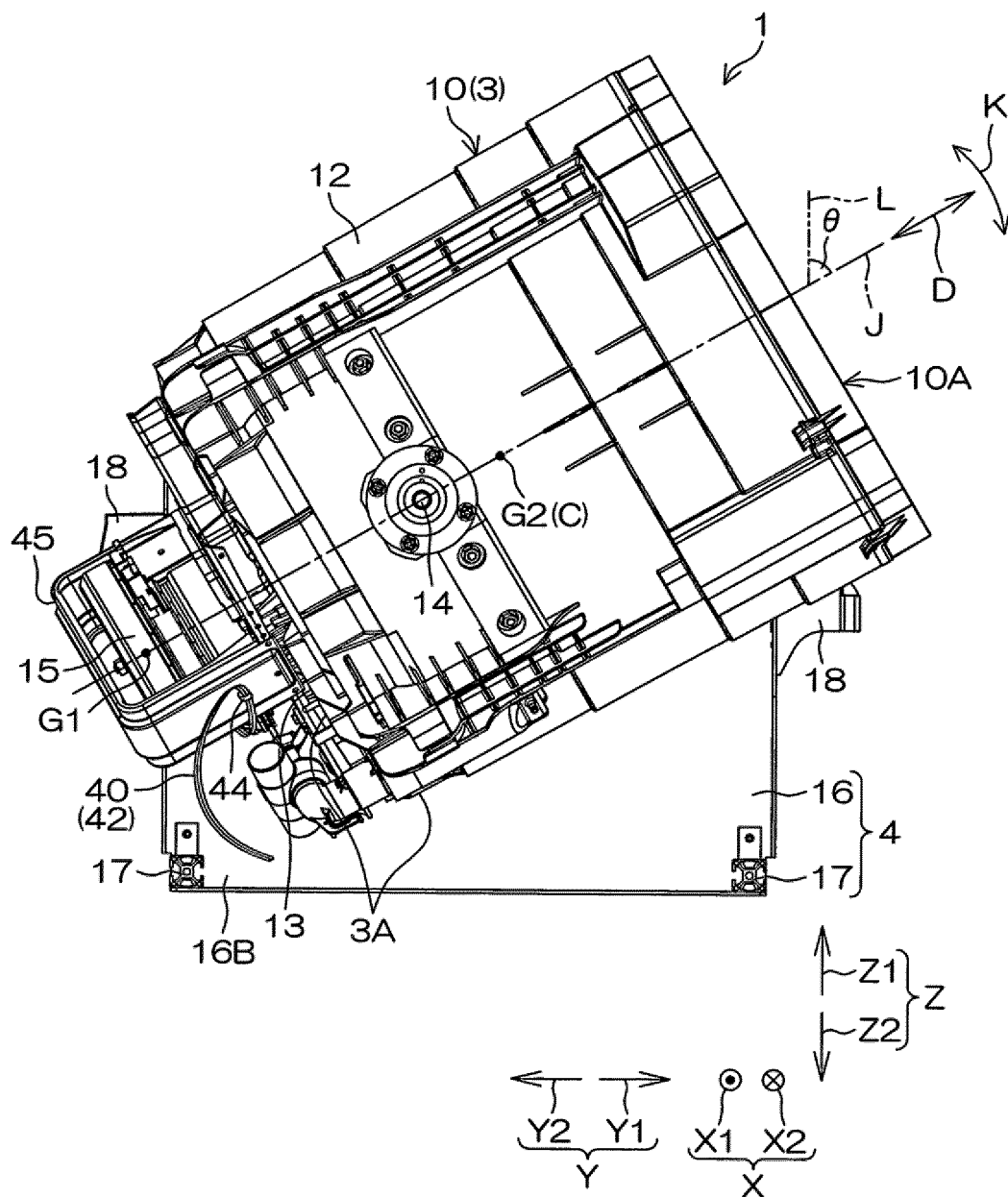


FIG. 3

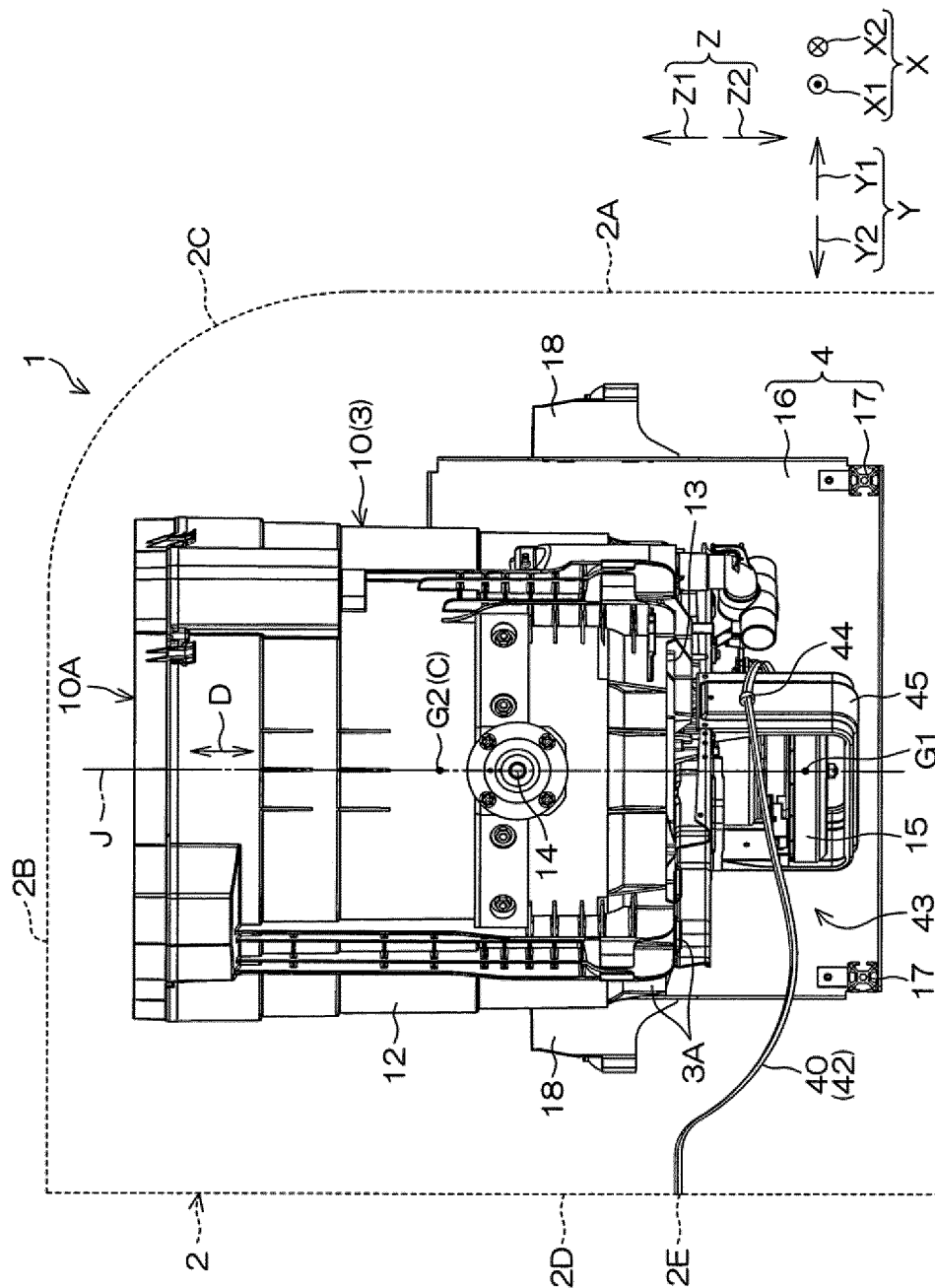


FIG. 4

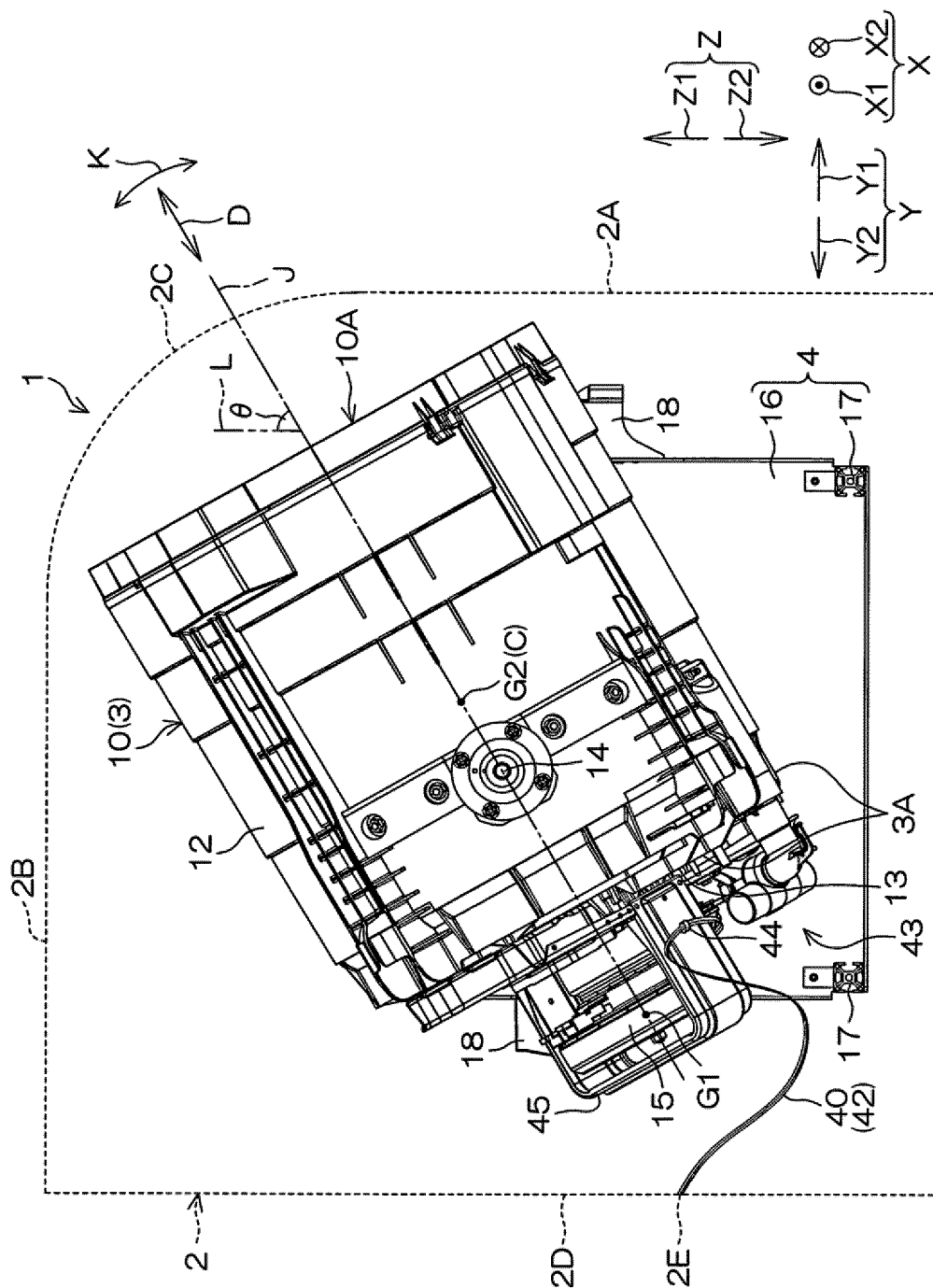


FIG. 5

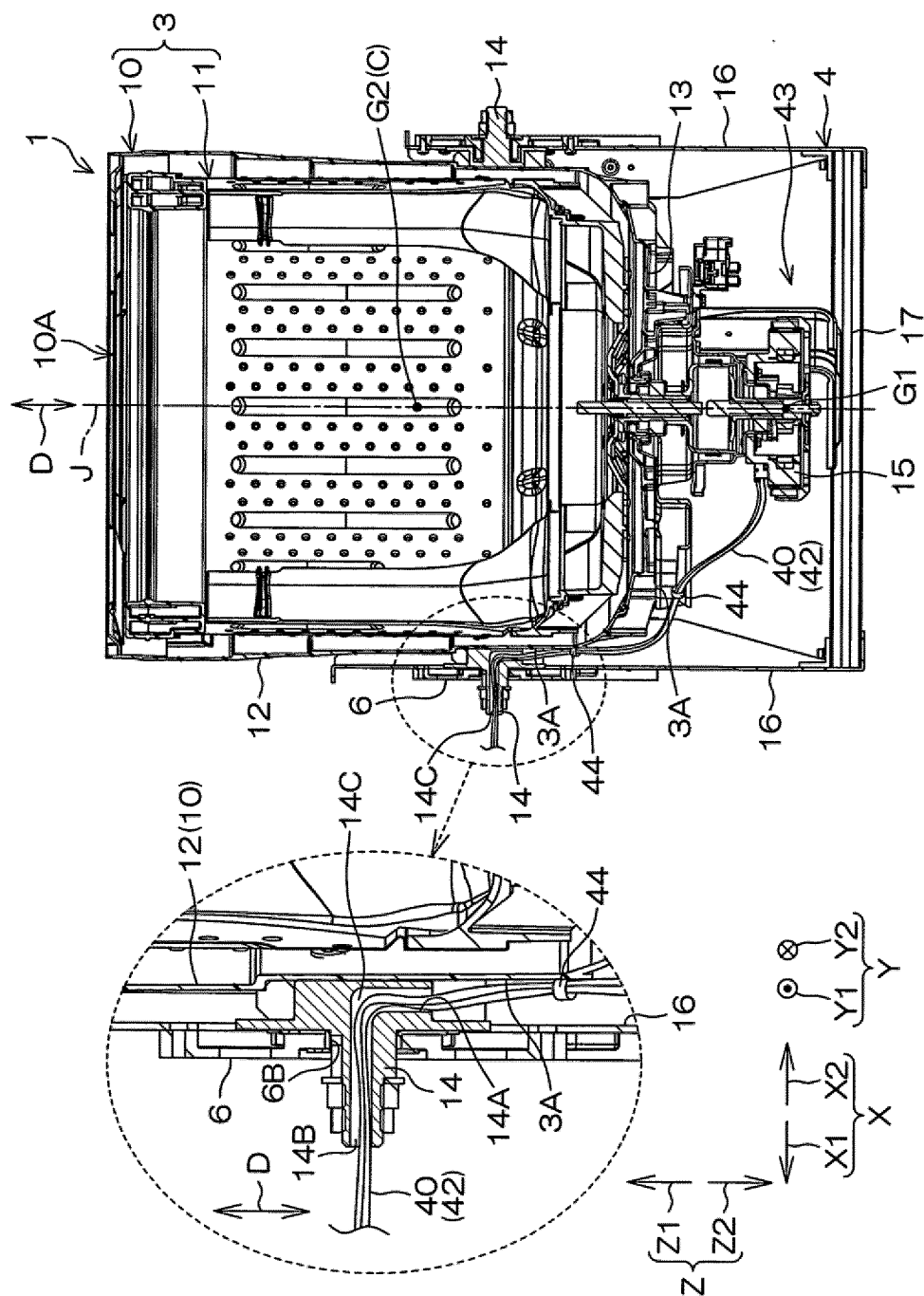


FIG. 6

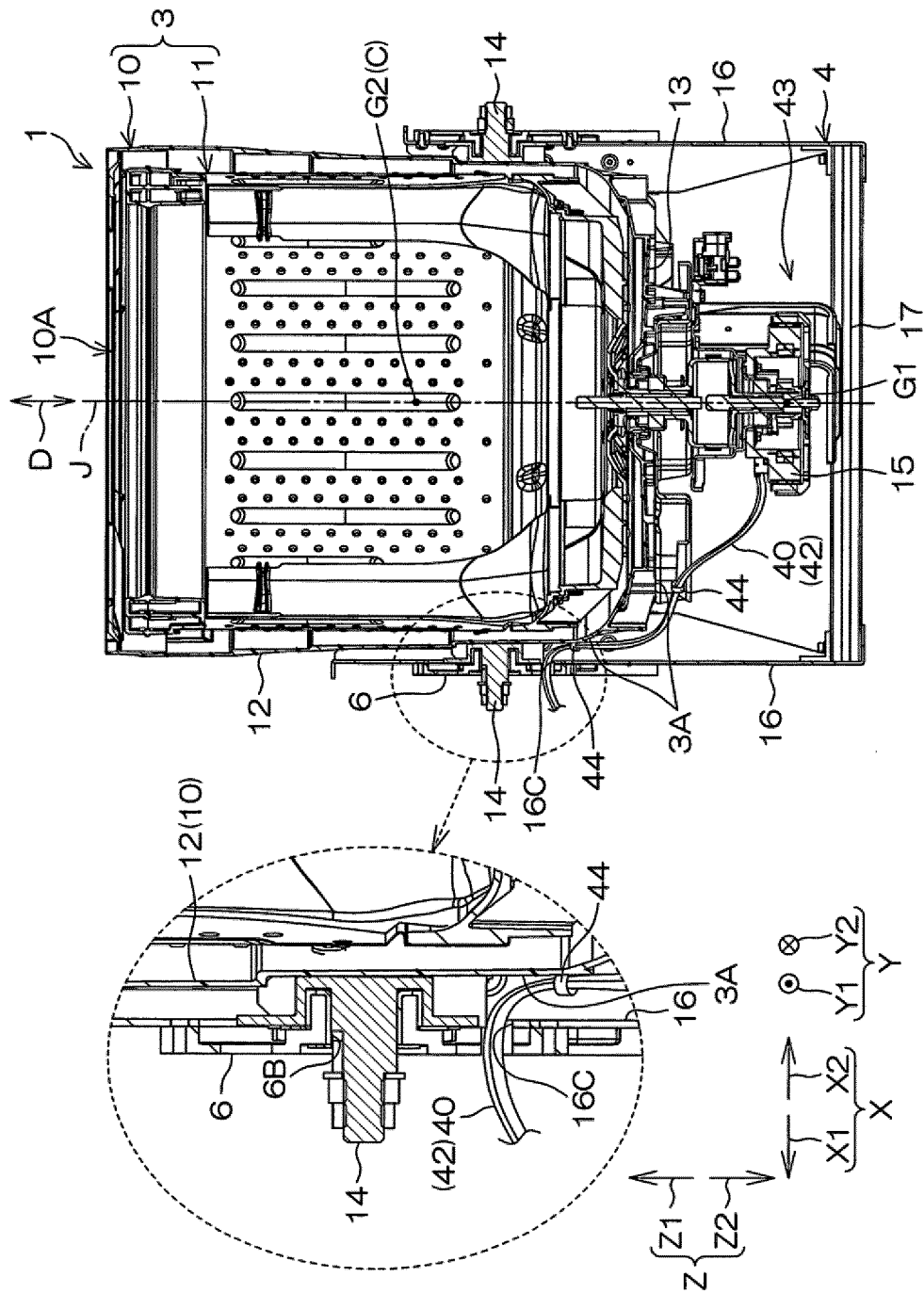


FIG. 7

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2016/097736

A. CLASSIFICATION OF SUBJECT MATTER

D06F 25/00 (2006.01) i; D06F 23/04 (2006.01) i; D06F 23/06 (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)

D06F 25/-, D06F 23/-, D06F 27/-

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

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

CNPAT, CNKI, EPODOC, WPI: power supply line, washing machine, wiring, wire, cable, intertwist+, interpos+, interferenc+,
interven+, through, shaft

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 8912711 A1 (MATSUSHITA ELECTRIC IND. CO., LTD.), 28 December 1989 (28.12.1989), description, page 1, and figures 14-15	1-2
Y	WO 8912711 A1 (MATSUSHITA ELECTRIC IND. CO., LTD.), 28 December 1989 (28.12.1989), description, page 1, and figures 14-15	3-5
Y	CN 104313830 A (CHENGDU KUAIDIAN TECHNOLOGY CO., LTD.), 28 January 2015 (28.01.2015), description, paragraphs 22-29, and figures 1-5	3-5
A	CN 1782209 A (LG ELECTRONICS (TIANJIN) APPLIANCES CO., LTD.), 07 June 2006 (07.06.2006), the whole document	1-5
A	JP 02249590 A (MITSUBISHI ELECTRIC CORP.), 05 October 1990 (05.10.1990), the whole document	1-5
A	JP 02124200 A (MATSUSHITA ELECTRIC IND. CO., LTD.), 11 May 1990 (11.05.1990), the whole document	1-5

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

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	"&" document member of the same patent family

Date of the actual completion of the international search
10 November 2016 (10.11.2016)

Date of mailing of the international search report
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2016/097736

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 02241487 A (MATSUSHITA ELECTRIC IND. CO., LTD.), 26 September 1990 (26.09.1990), the whole document	1-5

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

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2016/097736

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
WO 8912711 A1	28 December 1989	DE 68913717 D1	14 April 1994
		EP 0381765 A1	16 August 1990
		JP H02241488 A	28 September 1990
		US 5111673 A	12 May 1992
		KR 920010991 B1	26 December 1992
		JP H0292393 A	03 April 1990
		JP H02142596 A	31 May 1990
		JP H09187594 A	22 July 1997
		JP H02241489 A	26 September 1990
CN 104313830 A	28 January 2015	None	
CN 1782209 A	07 June 2006	None	
JP 02249590 A	05 October 1990	None	
JP 02124200 A	11 May 1990	None	
JP 02241487 A	26 September 1990	None	

Form PCT/ISA/210 (patent family annex) (July 2009)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 4166196 A [0004]