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(54) WASHING MACHINE

(57) Disclosed is a washing machine, which can prevent the damage to washings and also can improve the cleaning force. The washing machine (1) includes: a washing tank (4) for receiving washings (S), a water pumping path (20) for pumping water stored in the washing tank (4) from an inlet (25) and spraying the water drawn through a flow path (26) into the washing tank (4) from outlets (22), a blocking member (27) for blocking the upper end of the flow path (26), and an impeller (13) for delivering the water stored in the washing tank (4) into the inlet (25) through rotation. The outlets (22) are of a lengthwise slit shape. The impeller (13) is arranged at a bottom (4D) of the washing tank (4) in a manner of being separated from washings (S).

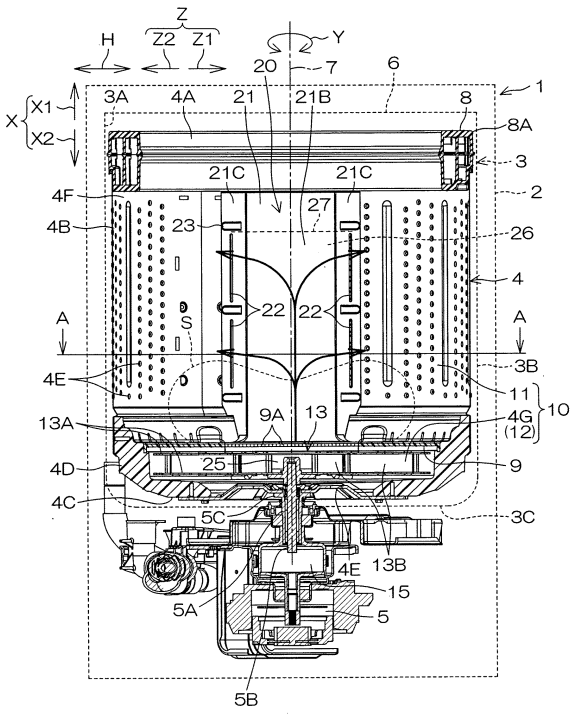

FIG. 1

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Description

TECHNICAL FIELD

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

BACKGROUND

[0002] In a washing machine described in the following patent literature 1, washing blades are arranged at a bottom of an inner tank for receiving washings in a freely rotating manner, and an inner tank shell and a passage shell are arranged inside the inner tank. When the washing blades rotate, washing water is drawn through a water passage of the inner tank shell and a water passage of the passage shell and then sprayed onto the washings inside the inner tank. Thus, the washings are washed.

[0003] In a washing machine described in the following patent literature 1, an impeller is arranged at an inner bottom of a washing and dehydrating tank, and a net for storing the washings is arranged in a position higher than the middle of the height direction in the washing and dehydrating tank.

Literatures in the existing art

Patent literature

[0004]

Patent literature 1: Japanese Laid-Open Patent Publication No. 8-309090
Patent literature 2: Japanese Laid-Open Patent Publication No. 10-235076

SUMMARY

Problems to be solved by the invention

[0005] The washing machine of the patent literature 1 may have the problem that the washings are damaged due to the friction of the rotating washing blades on the washings. Furthermore, the structure for only sprinkling the drawn washing water onto the washings has a limitation on improving the cleaning force of the washings.

[0006] The washing machine of the patent literature 2 separates the washings from the impeller by placing the washings on the net for storing the washings. Thus, the problem that the washings are damaged due to the friction of the rotating impeller on the washings can be eliminated. However, since only a region above the net for storing the washings in the washing and dehydrating tank can receive the washings, the capacity of the washing and dehydrating tank is reduced. In this case, since the washings cannot be sufficiently stirred in the washing and dehydrating tank, there is a limitation on improving the cleaning force of the washings.

[0007] The present invention is accomplished based on this background, and an objective of the present invention is to provide a washing machine which can prevent the damage to the washings and also can improve the cleaning force.

Solution for solving the problems

[0008] The present invention relates to a washing machine, which is characterized by including: a washing tank for receiving washings and storing water; a water pumping path having an inlet disposed at a bottom of the washing tank, a lengthwise slit-shaped outlet disposed at a position higher than the inlet, and a flow path extending upwards from the inlet to the outlet, for pumping water stored in the washing tank from the inlet and spraying the water drawn through the flow path into the washing tank from the outlets; blocking members arranged at the water pumping path, for blocking an upper end of the flow path; and an impeller, arranged at the bottom of the washing tank in a way of being separated from washings, for delivering the water stored in the washing tank into the inlet through rotation.

[0009] Furthermore, the present invention is characterized by including a separating member, which is arranged at the bottom of the washing tank, for dividing an internal space of the washing tank into a first space for configuring washings and a second space for configuring the impeller.

[0010] Furthermore, the present invention is characterized in that the blocking member is disposed at an upper end of the outlet.

[0011] Furthermore, the present invention is characterized in that the washing tank is a cylindrical washing tank having an axis extending longitudinally, and at each water pumping path, the outlets are biased towards a circumferential direction relative to a center of the inlet in the circumferential direction of the washing tank.

[0012] Furthermore, the present invention is characterized in that the outlets are arranged in a manner of facing the circumferential direction.

[0013] Furthermore, the present invention is characterized in that the outlets are arranged at two sides in the circumferential direction in the water pumping path.

[0014] Furthermore, the present invention is characterized in that the outlets are arranged at a single side in the circumferential direction in the water pumping path, and the present invention includes an inclined member, which is inclined in a manner of approaching the outlets, so that the flow path is gradually narrowed from the inlet to the outlets

Effects of the invention

[0015] According to the present invention, the impeller for delivering the water stored in the washing tank into the inlet of the water pumping path is arranged at the bottom of the washing tank in a manner of being sepa-

rated from the washings. Therefore, even when the impeller rotates for delivering the water, the washings may not be abraded by the impeller, and the damage to the washings can be prevented.

[0016] At the water pumping path, the upper end of the flow path extending upwards from the inlet to the outlet is blocked by the blocking member, and the outlet is in the lengthwise slit shape. Therefore, after the direction of the water which is pumped from the inlet and drawn through the flow path is changed by the blocking member, and after the flow rate of the water is increased through the lengthwise slender outlet, the water is injected. Thus, the water injected from the outlets is injected in various directions to form a band shape scattered in the longitudinal direction and is strongly sprinkled onto the washings in the washing tank, so that the washings are cleaned while being stirred in various directions. Therefore, the cleaning force is increased.

[0017] Furthermore, according to the present invention, an internal space of the washing tank is divided by the separating member into a first space for configuring the washings and a second space for configuring the impeller, so that the impeller can be reliably separated from the washings.

[0018] Furthermore, according to the present invention, since the blocking member is disposed at the upper end of the outlet, the flowing direction of the water drawn through the flow path can be changed before reaching the outlet. Thus, the water sprinkled from the outlets can be injected in various directions.

[0019] Furthermore, according to the present invention, at the water pumping path, the outlet is arranged in a manner of biasing towards the circumferential direction relative to the center of the inlet in the circumferential direction of the washing tank. Thus, the water flow pumped from the inlet and drawn through the flow path can be changed, and the drawn water can be strongly injected into the washing tank from the outlets. Therefore, the washings sprinkled with water can be effectively cleaned through sufficient stirring.

[0020] Furthermore, according to the present invention, since the outlets are arranged in a manner of facing the circumferential direction, the water drawn through the flow path can be injected in the circumferential direction from the outlets. Thus, the water injected in the circumferential direction can be used for cleaning the washings while the washings in the washing tank are stirred in a manner of rotating towards the circumferential direction.

[0021] Furthermore, according to the present invention, since the outlets are arranged at two sides in the circumferential direction of the water pumping path, the orientation of the water injected from the outlets can be changed from the outlets at one side and the outlets at the other side in the outlets at two sides relative to the rotating direction of the washing tank. Thus, at the water pumping path, since the water injected from each outlet can be sprinkled towards the washings in the washing tank in various directions, the washings can be effectively cleaned through the sufficient stirring in various directions.

[0022] Furthermore, according to the present invention, since the outlets are arranged at a single side in the circumferential direction in the water pumping path, in the case of arranging multiple water pumping paths side by side in the circumferential direction, the power loss of the water injected from the outlets of the adjacent water pumping paths due to the mutual collision can be prevented.

[0023] The flow path of the water pumping path is gradually narrowed from the inlet to the outlet through the inclined member. Thus, the flow rate of the water pumped from the inlet and drawn through the flow path can be increased along the direction towards the outlets. Therefore, the drawn water can be more strongly injected into the washing tank from the outlets. Thus, the washings sprinkled with the water can be effectively cleaned through the sufficient stirring.

BRIEF DESCRIPTION OF DRAWINGS

[0024]

Fig. 1 is a longitudinal sectional view illustrating an internal structure of a washing machine according to an embodiment of the present invention.

Fig. 2 is a three-dimensional top view illustrating an impeller included in a washing machine.

Fig. 3 is a three-dimensional bottom view illustrating an impeller.

Fig. 4 is a sectional view in an A-A direction of Fig. 1.

Fig. 5 is a three-dimensional top view illustrating a bottom and a water pumping path of a washing tank of a washing machine.

Fig. 6 is a three-dimensional top view illustrating a bottom and a water pumping path of a washing tank from a viewpoint different from Fig. 5.

Fig. 7 is a sectional view in a B-B direction of Fig. 4.

Fig. 8 is a longitudinal sectional view illustrating an internal structure of a washing machine according to a first variation embodiment of the present invention.

Fig. 9 is a sectional view in a C-C direction of Fig. 8.

Fig. 10 is a sectional view in a D-D direction of Fig. 9.

Fig. 11 is a longitudinal sectional view illustrating an internal structure of a washing machine according to a second variation embodiment of the present invention.

DETAILED DESCRIPTION

[0025] Embodiments of the present invention are described below with reference to the drawings.

[0026] Fig. 1 is a longitudinal sectional view illustrating an internal structure of a washing machine 1 according to an embodiment of the present invention.

[0027] Firstly, an outline of the washing machine 1 is

described with an up-down direction X of Fig. 1 as a reference. In the up-down direction X as a vertical direction, an upper side is called an upper side X1, and a lower side is called a lower side X2. Furthermore, the washing machine 1 also includes a washing and drying machine with a function of drying washings S.

[0028] The washing machine 1 includes a housing 2, an outer tank 3, a washing tank 4 and a motor 5.

[0029] The housing 2 is in a box shape. The outer tank 3, the washing tank 4 and the motor 5 are arranged in the housing 2.

[0030] The outer tank 3 is made of, for example, resin and formed in a cylindrical shape with a bottom. The outer tank 3 has a circumferential wall 3B which is in a generally-cylindrical shape with an opening portion 3A at the upper end, and a disc-shaped bottom wall 3C blocking a hollow portion of the circumferential wall 3B from the lower side X2. The opening portion 3A is opened and closed through a cover 6 connected with the circumferential wall 3B. Water such as tap water, bath water, a liquid dissolved with detergents and the like can be stored in the outer tank 3.

[0031] The washing tank 4 is formed in a cylindrical shape with a bottom, is one circle smaller than the outer tank and receives the washings S. The washing tank 4 has a circumferential wall 4B which is in a generally-cylindrical shape with an access opening 4A at the upper end, and a disc-shaped bottom wall 4C blocking a hollow portion of the circumferential wall 4B from the lower side X2. For example, the circumferential wall 4B is made of metal, a center portion of the bottom wall 4C is made of metal, and a peripheral portion of the bottom wall is made of resin. The bottom wall 4C and the lower end portion of the circumferential wall 4B which is connected with the bottom wall 4C form a bottom 4D of the washing tank 4. The washing tank 4 is coaxially received in the outer tank 3. The washing tank 4 at a state of being received in the outer tank 3 can rotate around a central shaft 7 which is used as an axis of the washing tank and extends to the up-down direction X. This washing machine 1 is a longitudinal-type washing machine with the washing tank 4 arranged in the longitudinal direction.

[0032] The access opening 4A is communicated with the opening portion 3A from the lower side X2, and the opening portion 3A and the access opening 4A are collectively opened and closed through the cover 6. A user of the washing machine 1 can take the washings S into and out of the washing tank 4 through the opened access opening 4A. The circumferential wall 4B and the bottom wall 4C are respectively provided with a through hole 4E, and the water in the outer tank 3 can be circulated between the outer tank 3 and the washing tank 4 via the through holes 4E. Thus, the washing tank 4 stores the water at a water level equal to a water level of the outer tank 3.

[0033] An annular shock absorber 8 is installed at the upper end portion of an inner circumferential surface 4F of the circumferential wall 4B. The shock absorber 8 is a member reducing the vibration of the rotating washing tank 4, and the liquid for facilitating the shock absorption is received in a hole 8A inside the shock absorber 8.

[0034] A concave portion 4G which is sunken downwards is formed at the upper surface of the bottom wall 4C. The concave portion 4G is a cylindrical space with a flat top and a flat bottom in a coaxial state with the bottom wall 4C. The washing tank 4 includes a separating member 9 arranged at the bottom 4D. The separating member 9 is a disc-shaped cover blocking the concave portion 4G from the top, and a plurality of through holes 9A are intensively formed at a center side of the cover. An internal space 10 of the washing tank 4 is divided by the separating member 9 into a first space 11 communicated with the access opening 4A and configured with the washings S and a second space 12 equivalent to the concave portion 4G.

[0035] The motor 5 is arranged at the lower side X2 of the bottom wall 3C of the outer tank 3 in the housing 2. An output shaft of the motor 5 is divided into a tubular first output shaft 5A extending towards the upper side X1 and a second output shaft 5B which is sufficiently inserted into the first output shaft 5A. The motor 5 selects one of the first output shaft 5A and the second output shaft 5B to output a driving force through a speed changing mechanism 15.

[0036] The first output shaft 5A extends towards the upper side X1 and successively penetrates through the circle center of the bottom wall 3C and the circle center of the bottom wall 4C of the washing tank 4. The first output shaft 5A has a flange portion 5C which is protruded between the bottom wall 3C and the bottom wall 4C in a brim manner, and is fixed to the bottom wall 4C through the flange portion 5C so as to realize connection with the washing tank 4. When the motor 5 is driven and transfers the driving force to the first output shaft 5A, the washing tank 4 rotates.

[0037] An impeller 13 is installed at the upper end, which is more protruded to the upper side X1 than the flange portion 5C, of the second output shaft 5B.

[0038] Fig. 2 is a three-dimensional view illustrating the impeller 13 viewed from the upper side X1, and Fig. 3 is a three-dimensional view illustrating the impeller 13 viewed from the lower side X2.

[0039] Referring to Fig. 2 and Fig. 3, the impeller 13 integrally includes a pair of discs 13A which are coaxially arranged in parallel in the vertical direction and a plurality of blades 13B which are erected between the pair of discs 13A and extend in a radiating manner by adopting the circle center of the disc 13A as a reference. In the pair of discs 13A, a circular through hole 13C (referring to Fig. 2) penetrating through the center portion of the disc 13A at the upper side X2 is formed thereon, and a plurality of circular through holes 13D (referring to Fig. 3) surrounding the circle center portion are formed at the circular plate 13A at the lower side X2. Each blade 13B linearly extends towards the peripheral edge of the disc 13A from the edge of the through hole 13C.

[0040] Referring to Fig. 1, the impeller 13 is configured at the second space (the aforementioned concave portion 4G of the bottom wall 4C) of the bottom wall 4D of the washing tank 4. Since the second space 12 is at a state of being separated from the first space 11 of the upper side X1 for configuring the washings S through the separating member 9, the impeller 13 is arranged at the bottom 4D in a manner of being separated from the washings S. The water stored in the washing tank 4 also exists between the pair of discs 13A via the through hole 9A of the separating member 9 and the through holes 13C and 13D of the pair of discs 13A of the impeller 13.

[0041] The upper end portion of the second output shaft 5B of the motor 5 is installed at the circle center portion of the disc 13A at the lower side X2. When the motor 5 is driven and transfers the driving force to the second output shaft 5B, the impeller 13 rotates. When the impeller 13 rotates, the washing tank 4 is at a stopped state.

[0042] Fig. 4 is a sectional view in an A-A direction of Fig. 1. As shown in Fig. 4, for convenience in description, the graphic representation of the aforementioned separating member 9 is omitted. Referring to Fig. 4, the circumferential direction of the inner circumferential surface 4F of the washing tank 4 is hereinafter called circumferential direction Y, and a radial direction of the inner circumferential surface 4F is called the radial direction Z. Both the circumferential direction Y and the radial direction Z are directions along the horizontal direction H. In the circumferential direction Y, the clockwise direction at the top view is called clockwise Y1, and the counterclockwise direction at the top view is called counterclockwise Y2. In the radial direction Z, one side facing the central shaft 7 is called a radial inner side Z1, and one side away from the central shaft 7 is called a radial outer side Z2.

[0043] Water pumping paths 20 are installed on the inner circumferential surface 4F of the washing tank 4. The number of the water pumping paths 20 may be set randomly and may be single or multiple. In the present embodiment, three water pumping paths 20 of the same shape and the same size are installed at the inner circumferential surface 4F at a state of being distributed in the circumferential direction Y. It should be noted that in Fig. 4, for convenience in description, only one water pumping path 20 is shown. A distance between every two adjacent water pumping paths 20 in the circumferential direction Y may be constant among all the water pumping paths 20 and may also be different according to different water pumping paths 20. The water pumping paths 20 are described below in detail by referring to the state of being installed at the washing tank 4.

[0044] Each water pumping path 20 includes a main body part 21 made of resin. The main body part 21 is of a long-edge cover shape in the up-down direction X and is erected at the inner circumferential surface 4F (also referring to Fig. 1) of the washing tank 4 from the radial inner side Z1 at a vertical posture between the shock absorber 8 and the bottom wall 4C of the washing tank 4. Therefore, the main body part 21 has a back surface 21A opposed to the inner circumferential surface 4F of the washing tank 4 and a surface 21B disposed at an opposite side of the back surface 21A and facing the side of the central shaft 7.

[0045] Fig. 5 and Fig. 6 are three-dimensional views illustrating the bottom 4D and the water pumping paths 20 of the washing tank 4 viewed from the upper side X1 at other viewpoints. Referring to Fig. 5 and Fig. 6, two end portions of the main body part 21 in the circumferential direction Y respectively form bending portions 21C covering almost a whole area in the up-down direction X and bent towards the radial outer side Z2. Each bending portion 21C is formed in a manner of inclining relative to the circumferential direction Y and the radial direction Z, and the surface 21B of each bending portion 21C is at a state of facing the circumferential direction Y. Furthermore, the upper end portion 21D of the main body part 21 is bent towards the radial outer side Z2 and erected between the bending portions 21C at two sides.

[0046] A lengthwise slit-shaped outlet 22 is formed at each bending portion 21C. In other words, the outlets 22 are arranged at two sides in the circumferential direction Y in the water pumping path 20. The outlets 22, for example, are arranged at each bending portion 21C side by side in the up-down direction X, and penetrate through the bending portions 21C in a manner of being exposed out of the back surface 21A and the surface 21B of the main body part 21. Each outlet 22 is arranged at the surface 21B of the bending portion 21C in a manner of facing the circumferential direction Y (also referring to Fig. 4).

[0047] Each bending portion 21c is respectively integrally provided with a projection 23 extending towards the radial inner side Z1 and disposed between the upper and the lower adjacent outlets 22, at upper side X1 of the outlet 22 disposed at the upper side X1 and at the lower side X2 of the outlet 22 disposed at the lower side X2. The projections 23 are protruded towards the radial inner side Z1 from the surface 21B of the main body part 21. As shown in Fig. 6, a threaded hole 23A is formed at the end surface of the radial outer side Z2 of each projection 23. The threaded hole 23A is also formed at the upper end portion 21D of the main body part 21. The threaded hole 23A is provided with a bolt (not shown) inserted from the radial outer side Z2 of the washing tank 4 in order to fix the water pumping path 20 at the washing tank 4.

[0048] At the back surface 21A of each bending portion 21C, the threaded hole 23A is configured at the outer side closer to the circumferential direction Y than the outlet 22. At the back surface 21A of the main body part 21, ribs 21E protruding towards the radial outer side Z2 and linearly extending along the up-down direction X are respectively arranged one by one at two sides in the circumferential direction Y. The ribs 21E are of a plate shape which is relatively thin in the circumferential direction Y and extend towards the lower side X2 from the upper end portion 21D between the threaded hole 23A and the outlet

22 in the circumferential direction Y at each bending portion 21C. The ribs 21E are configured adjacent to the outlets 22 in a manner of banding the outer sides of the outlets 22 in the circumferential direction Y.

[0049] Fig. 7 is a sectional view in a B-B direction of Fig. 4. Referring to Fig. 7, the lower end portion of the back surface 21A of the main body part 21 is integrally provided with an inlet member 24. The inlet member 24 is formed into a generally U-shaped plate shape (referring to Fig. 4) bent to be bulged towards the radial outer side Z2 when in top view. The width of the inlet member 24 in the circumferential direction Y is gradually narrowed towards the upper side X1. A lower portion 24A of the inlet member 24 is configured in a manner of more protruding downwards than the lower end of the main body part 21. An area entrapped by the generally-U-shaped lower portion 24A is an inlet 25 of the water pumping path 20. The inlet 25 is disposed at a position lower than the outlet 22 in the water pumping path 20. Furthermore, at each water pumping path 20, all outlets 22 are configured in a manner of biasing towards the circumferential direction Y relative to the center 25A of the inlet 25 in the circumferential direction Y.

[0050] Depressions 4H (also referring to Fig. 5) having the number same with that of the water pumping paths 20 and recessed towards the radial outer side Z2 from the second space 12 with the impeller 13 are formed at the bottom wall 4C of the washing tank 4, and the depressions 4H can receive the inlet member 24 of any water pumping path 20. Therefore, at the state where the water pumping path 20 is already installed at the washing tank 4, the inlet 25 is disposed at the bottom 4D of the washing tank 4 and is at a state of being communicated with the second space 12 from the radial outer side Z2 (referring to Fig. 5).

[0051] The back surface 21A of the main body part 21 is provided with a flow path 26. The flow path 26 is a space (also referring to Fig. 6) with an upper long edge and a lower long edge entrapped by the ribs 21E at two sides of the back surface 21A in the circumferential direction Y and is blocked by the inner circumferential surface 4F of the washing tank 4 from the radial outer side Z2. The lower end portion of the flow path 26 is entrapped by the back surface 21A of the main body part 21 and the inlet member 25 from the radial direction Z. The flow path 26 extends towards the upper side X1 to the outlet 22 from the inlet 25 in a manner of being communicated with the inlet 25 at the lower end and being communicated with the outlet 22 at the upper end.

[0052] The upper portion of the back surface 21A of the main body part 21 is integrally provided with a blocking member 27 (also referring to Fig. 6). The blocking member 27 is formed into a plate shape which is relatively thin in the up-down direction X, extends towards the horizontal direction H and is erected between the ribs 21E at two sides of the main body part 21. The blocking member 27 is disposed at the upper end of the uppermost outlet 22 of each bending portion 21C. A lower surface 27A of the blocking member 27 is flat in the horizontal direction H, and the upper end of the flow path 26 is at a state of being blocked by the lower surface 27A from the upper side X1. Therefore, the upper end of the flow path 26 is a tail end.

[0053] Referring to Fig. 1, when the impeller 13 rotates, the water stored at the bottom 4D of the washing tank 4 is delivered into the inlet 25 of each water pumping path 20 through the blades 13B of the impeller 13 and pumped into the flow path 26 from the inlet 25. As shown by a bold line arrow, the water pumped into the flow path 26 is drawn to the outlet 22 of the upper side X1 through the flow path 26 and then injected into the washing tank 4 from each outlet 22.

[0054] As described above, in the water pumping path 20, the upper end of the flow path 26 extending towards the upper side X1 to the outlet 22 from the inlet 25 is blocked by the blocking member 27 as shown in Fig. 7, and the outlet 22 is of a lengthwise slit shape. Therefore, the water is sprinkled after the direction of the water which is pumped from the inlet 25 and drawn through the flow path 26 is changed by the blocking member 27, and after the flow rate of the water is increased through the lengthwise slender outlet 22.

[0055] From the view of the rotating direction of the impeller 13, for the outlets 22 at two sides of the water pumping path 20 in the circumferential direction Y, on the basis that the outlet 22 at the downstream side is called a downstream side outlet 22A and the outlet 22 at the upstream side is called an upstream side outlet 22B, the water injection phenomenon from the outlet 22 is specifically described below. In Fig. 7, the outlet 22 at the right side is used as the downstream side outlet 22A, and the outlet 22 at the left side is served as the upstream side outlet 22B.

[0056] In the case where the impeller 13 rotates towards the clockwise direction Y1, the water drawn from the flow path 26 of the water pumping path 20 rises while flowing towards the clockwise direction Y1. The water already reaching the downstream side outlet 22A before arriving at the blocking member 27 is strongly upward obliquely injected towards the clockwise direction Y1 from the downstream side outlet 22A at the state where the flow rate is increased through the downstream side outlet 22A (referring to the bold solid line arrow).

[0057] On the other hand, the water running into the blocking member 27 arrives at the upstream side outlet 22B after being downward obliquely bounced towards the counterclockwise direction Y2 by the blocking member 27. As described above, the blocking member 27 is disposed at the upper end of the outlet 22, so that the flowing direction of the water drawn through the flow path 26 can be changed before arriving at the upstream side outlet 22B. The water arriving at the upstream side outlet 22B is downward obliquely injected strongly towards the counterclockwise direction Y2 from the upstream side outlet 22B at a state where the flow rate is increased by the upstream side outlet 22B.

[0058] Furthermore, in the case where the impeller 13 rotates towards the counterclockwise direction Y2, the phenomenon completely opposite to that in the case where the impeller 13 rotates towards the clockwise direction Y1 may occur. In other words, the positions of the downstream side outlet 22A and the upstream side outlet 22B in the circumferential direction Y are interchanged, and the water drawn from the flow path 26 is upward obliquely injected strongly towards the counterclockwise direction Y2 from the downstream side outlet 22A, and is downward obliquely injected strongly towards the clockwise direction Y1 from the upstream side outlet 22B (not shown).

[0059] As described above, the water pumping paths 20 with the outlets 22 arranged at two sides in the circumferential direction Y can change the orientation of the water injected from the outlet 22 through the outlets 22 at one side and the outlets 22 at the other side in the outlets at two sides corresponding to the rotating direction of the washing tank 4. Therefore, the water sprinkled from various outlets 22 is injected in various directions to form a band shape scattered in the longitudinal direction, and strongly sprinkled onto the washings S in the washing tank 4, so that the washings S are cleaned while being stirred in various directions through the complexly varied strong water flow. Therefore, the cleaning force can be increased. Furthermore, compared with a cross outlet, the lengthwise outlet 22 can make the flow of water injected from the outlet 22 complex.

[0060] As described above, at each water pumping path 20, the outlet 22 is arranged in a manner of biasing towards the circumferential direction Y relative to the center 25A of the inlet 25. Thus, the water flow pumped from the inlet 25 and drawn through the flow path 26 is changed, and the drawn water is strongly injected into the washing tank 4 from the outlet 22. Thus, the washings S sprinkled with the water can be effectively cleaned through the sufficient stirring.

[0061] Since all the outlets 22 are configured towards the circumferential direction Y, the water drawn through the flow path 26 can be injected towards the circumferential direction Y from the outlets 22. Thus, the washings S in the washing tank 4 can be cleaned while being stirred in a way of rotating towards the circumferential direction Y through the water injected towards the circumferential direction Y.

[0062] As described above, in the washing machine 1, as shown in Fig. 1, the impeller 13 is arranged at the bottom 4D of the washing tank 4 in a manner of being separated from the washings S. Particularly, since the internal space 10 of the washing tank 4 is divided by the separating member 9 into the first space 11 for configuring the washings S and the second space 120 for configuring the impeller 13, the impeller 13 can be reliably separated from the washings S. Therefore, even when the impeller 13 rotates for delivering the water, the washings S may not be abraded by the impeller 13, and the damage to the washings S can be prevented.

[0063] Furthermore, in the structure of separating the impeller 13 from the washings S through the separating member 9, since the impeller 13 can rotate at a high speed, the power of the water drawn from the flow path 26 of the water pumping path 20 can be increased, so that the water is more strongly injected into the washing tank 4 from the outlets 22 so as to sufficiently stir the washings S. Further, since the second space 12 is a concave portion 4G with a narrow top and bottom formed at the bottom 4C of the washing tank 4, the first space 11 (the capacity of the washing S) at the upper side X1 can be maximized as far as possible.

[0064] As described above, the washing machine 1 enables the washings to move violently so as to be cleaned through the strong and complex flow of the water injected from the water pumping path 20 of a simple structure rather than the existing impeller in the case where the washings S are not damaged. Thus, the washings S can be effectively cleaned while the damage to the washings S is prevented. Furthermore, since the water in the washing tank 4 can be repeatedly used for washing after being circulated through the flow path 26 of the water pumping path 26, less water can be used for washing.

[0065] The present invention is not limited to the embodiments described above, and various changes can be made to the present invention within the described scope of claims.

[0066] Fig. 8 is a longitudinal sectional view illustrating an internal structure of a washing machine according to a first variation embodiment of the present invention. As shown in Fig. 8, for convenience in description, the graphic representation of the aforementioned separating member 9 is omitted. Fig. 9 is a sectional view in a C-C direction of Fig. 8. Fig. 10 is a sectional view in a D-D direction of Fig. 9.

[0067] For example, in the aforementioned embodiments, although each water pumping path 20 is provided with the outlets 22 at two sides in the circumferential direction Y, the outlets 22 may also be arranged at a single side of the circumferential direction Y as shown in the first variation embodiment shown in Fig. 8 to Fig. 10. In this case, at the main body part 21 of the water pumping path 20, the bending portion 21C at one side where the outlet 22 is omitted forms the inclined member 40 inclined relative to the up-down direction X in a manner of approaching the outlet 22 when viewed from the radial inner side Z1.

[0068] Since the outlets 22 are arranged at a single side in the circumferential direction Y in various water pumping paths 20, in the case of arranging multiple water pumping paths 20 side by side in the circumferential direction Y, the power loss of the water injected from the outlets 22 of the adjacent water pumping paths 20 due to the mutual collision can be prevented. Of course, at this time, at each water pumping path 20, the outlets 22 are required to be arranged at the same side.

[0069] As shown in Fig. 10, the flow path 26 of the water pumping path 26 is gradually narrowed from the

inlet 25 to the outlet 22 through the inclined member 40. Thus, the flow rate of the water pumped from the inlet 25 and drawn through the flow path 26 may be higher when being closer to the outlet 22. Therefore, the drawn water can be more strongly injected into the washing tank 4 from the outlet 22. Thus, the washings S sprinkled with the water can be effectively cleaned through the sufficient stirring.

[0070] Specifically, in Fig. 10, the impeller 13 rotates towards the counterclockwise direction Y2. In the case where the outlet 22 is the aforementioned downstream side outlet 22A, before the water drawn through the flow path 26 runs into the blocking member 27, the water is upward obliquely injected strongly towards the counterclockwise direction Y2 from the downstream side outlet 22A (referring to the bold solid line arrow). On the other hand, in the case where the outlet 22 shown in Fig. 10 is the aforementioned upstream side outlet 22B, the water drawn through the flow path 26 is downward obliquely injected strongly towards the counterclockwise direction Y2 from the upstream side outlet 22B when running into the blocking member 27 (referring to the bold dotted line arrow).

[0071] Fig. 11 is a longitudinal sectional view illustrating an internal structure of a washing machine according to a second variation embodiment of the present invention. As shown in the first variation embodiment, in the case where the outlets 22 are arranged at the single side of the water pumping path 20, as shown in Fig. 11, the partition member 9 may also be omitted, and a conventional pulsator 45 is configured to replace the impeller 13. In this case, a back blade 45A equivalent to the blades 13B of the impeller 13 is arranged below the pulsator 45, and when the pulsator 45 rotates, the back blade 45A delivers the water stored in the washing tank 4 into the inlet 25 of the water pumping path 20.

[0072] Since the pulsator 45 contacts the washings S in the washing tank 4, in order to avoid the damage to the washings S, the pulsator 45 rotates preferably at a lower speed than the impeller 13. In this case, besides the soft stirring by the pulsator 45 rotating at a low speed, the washings S are also stirred through the power of the water (referring to the bold solid line) injected from the water pumping path 20. Thus, the washings S can be effectively cleaned while the damage to the washings S caused by the pulsator 45 is prevented. Of course, as shown in Fig. 11, the outlets 22 may also be arranged at two sides of the water pumping path 20.

[0073] Furthermore, the main body part 21 of the water pumping path 20 is of a cover shape, and the flow path 26 is a space divided into the back surface 21A of the main body part 21, a pair of ribs 21E of the back surface 21A, and the inner circumferential surface 4F of the washing tank 4. In other words, strictly speaking, the flow path 26 is collectively formed by the water pumping path 20 and the inner circumferential surface 4F of the washing tank 4. Alternatively, the main body part 21 may also be a hollow body, and the hollow portion forms the flow path 26, so that the structure of the flow path 26 is formed independently by the water pumping path 20.

Description of reference numerals:

[0074] 1: Washing machine; 4: Washing tank; 4D: Bottom; 7: Central shaft; 9: Separating member; 10: Internal space; 11: First space; 12: Second space; 13: Impeller; 20: Water pumping path; 22: Outlet; 25: Inlet; 25A: Center, 26: Flow path; 27: Blocking member; 40: Inclined member; S: Washings; X1: Upper side; Y: Circumferential direction.

Claims

1. A washing machine, comprising:

   a washing tank, for receiving washings and storing water;
   a water pumping path, having an inlet disposed at a bottom of the washing tank, a lengthwise slit-shaped outlet disposed at a position higher than the inlet, and a flow path extending upwards from the inlet to the outlet, for pumping water stored in the washing tank from the inlet and spraying the water drawn through the flow path into the washing tank from the outlets;
   blocking member, arranged at the water pumping path, for blocking an upper end of the flow path; and
   an impeller, arranged at the bottom of the washing tank in a manner of being separated from washings, for delivering the water stored in the washing tank into the inlet through rotation.

2. The washing machine according to claim 1, wherein the washing machine comprises a separating member, which is arranged at the bottom of the washing tank, for dividing an internal space of the washing tank into a first space for configuring washings and a second space for configuring the impeller.

3. The washing machine according to claim 1 or 2, wherein
   the blocking member is disposed at an upper end of the outlet.

4. The washing machine according to any one of claims 1-3, wherein
   the washing tank is a cylindrical washing tank with an axis extending longitudinally, and
   at the water pumping path, the outlets are arranged in a manner of biasing towards a circumferential direction relative to a center of the inlet in the circumferential direction of the washing tank.

5. The washing machine according to claim 4, wherein

the outlets are configured in a manner of facing the circumferential direction.

6. The washing machine according to claim 4 or 5, wherein
the outlets are arranged at two sides in the circumferential direction in the water pumping path.

7. The washing machine according to claim 4 or 5, wherein
the outlets are arranged at a single side in the circumferential direction in the water pumping path, and the washing machine comprises an inclined member, which is inclined in a manner of approaching the outlets, so that the flow path is gradually narrowed from the inlet to the outlet.

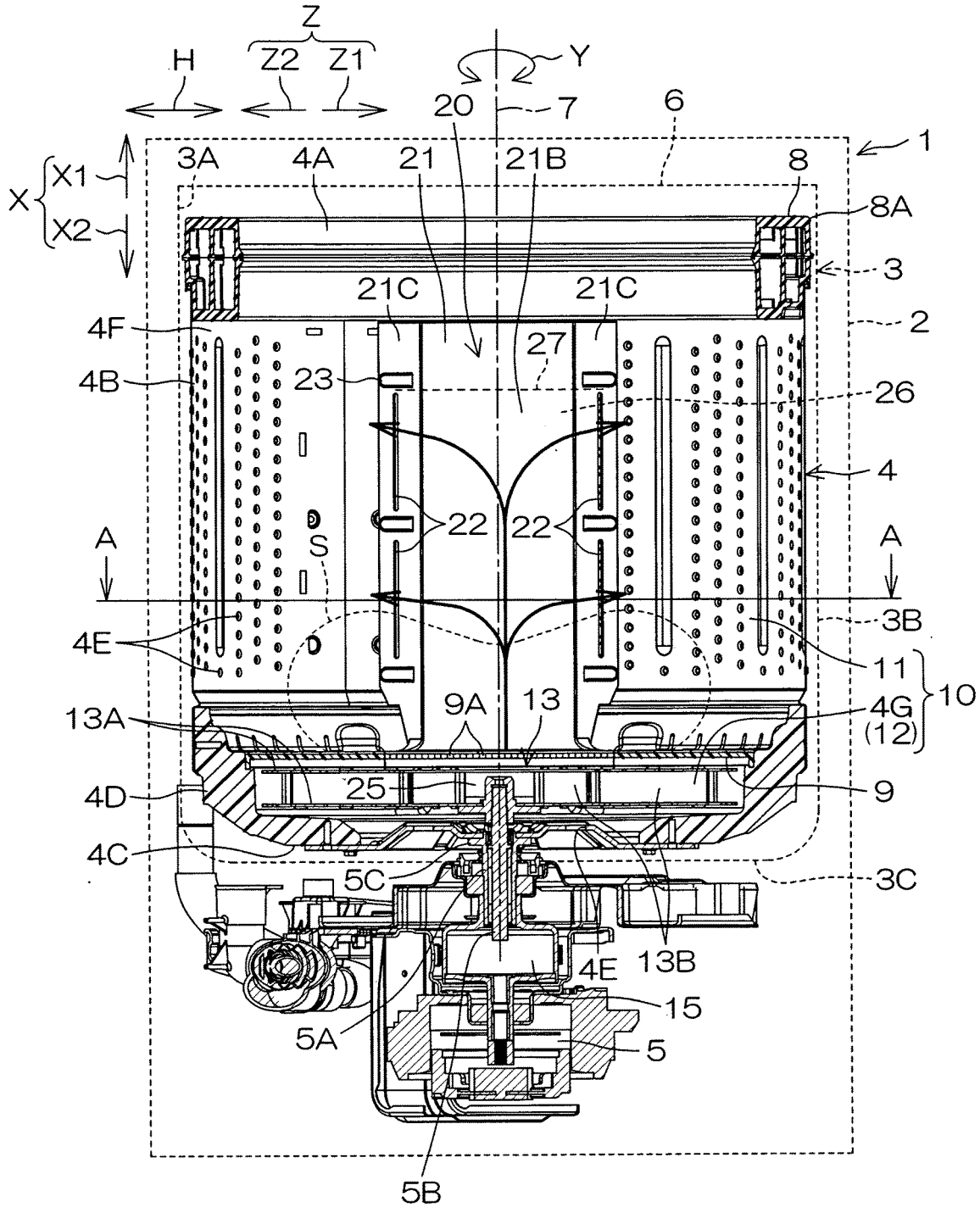
Z
H
Z2
Z1
Y
20
7
6
1
3A
4A
21
21B
8
X
X1
X2
8A
3
21C
21C
2
4F
27
4B
23
26
4
22
22
A
S
A
3B
4E
11
10
9A
13
4G
(12)
13A
25
9
4D
4C
5C
3C
4E
13B
15
5A
5
5B

FIG. 1

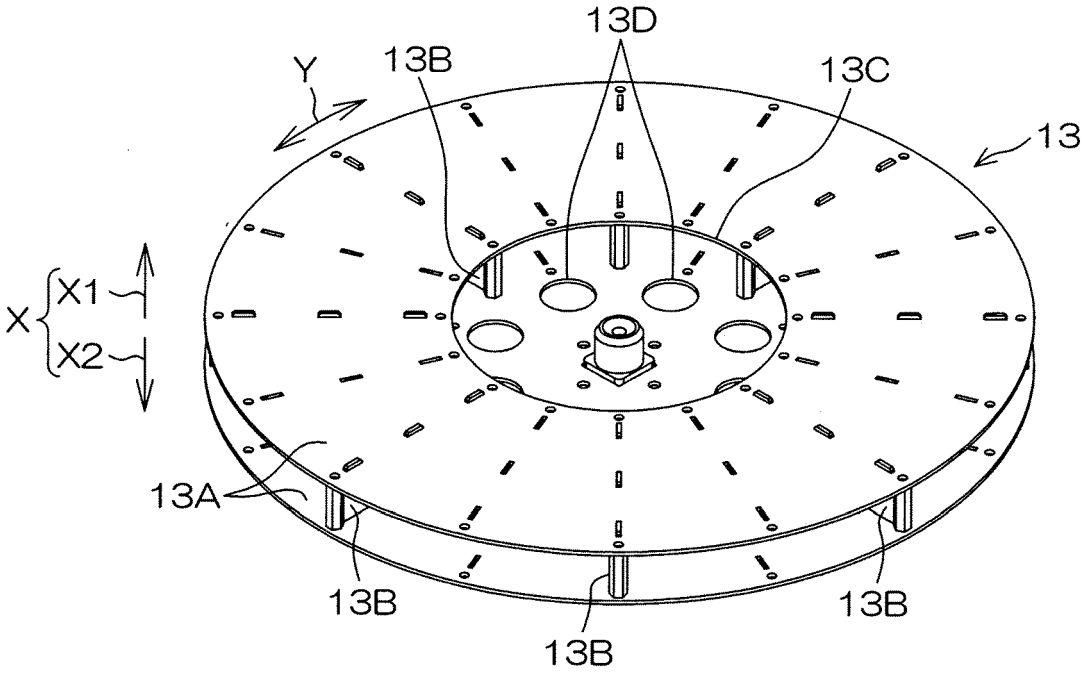
13D
Y
13B
13C
13
X
X1
X2
13A
13B
13B
13B

FIG. 2

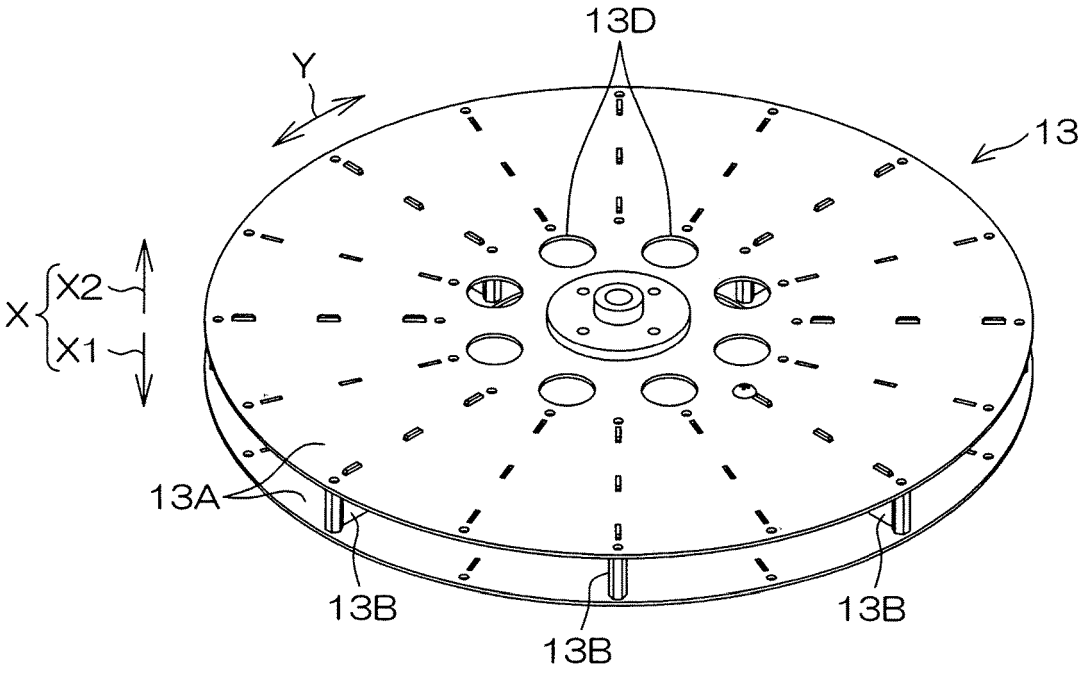
13D
Y
13
X
X2
X1
13A
13B
13B
13B

FIG. 3

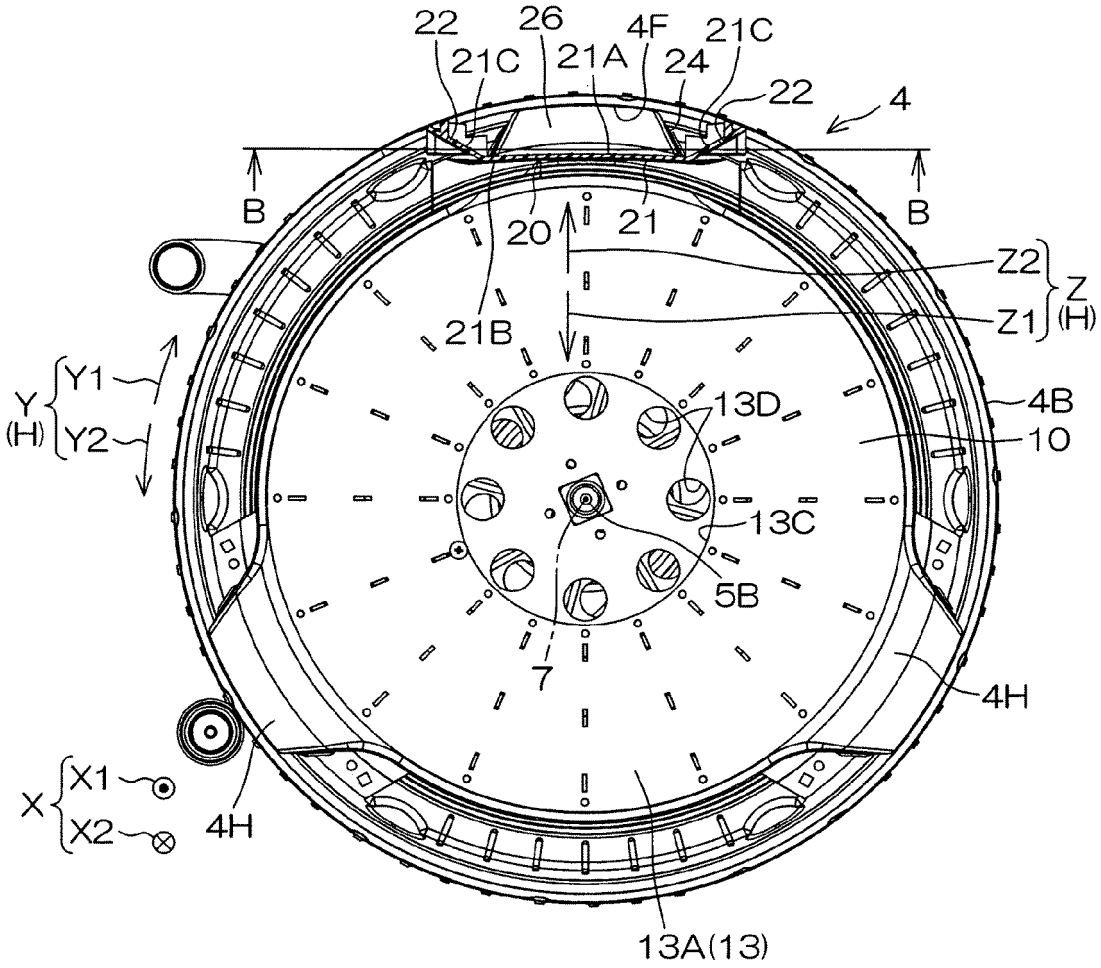
22
26
4F
21C
21C
21A
24
22
4
B
B
20
21
Z2
Z1
Z
(H)
21B
Y
(H)
Y1
Y2
13D
4B
10
13C
5B
7
4H
X
X1
X2
4H
13A(13)

FIG. 4

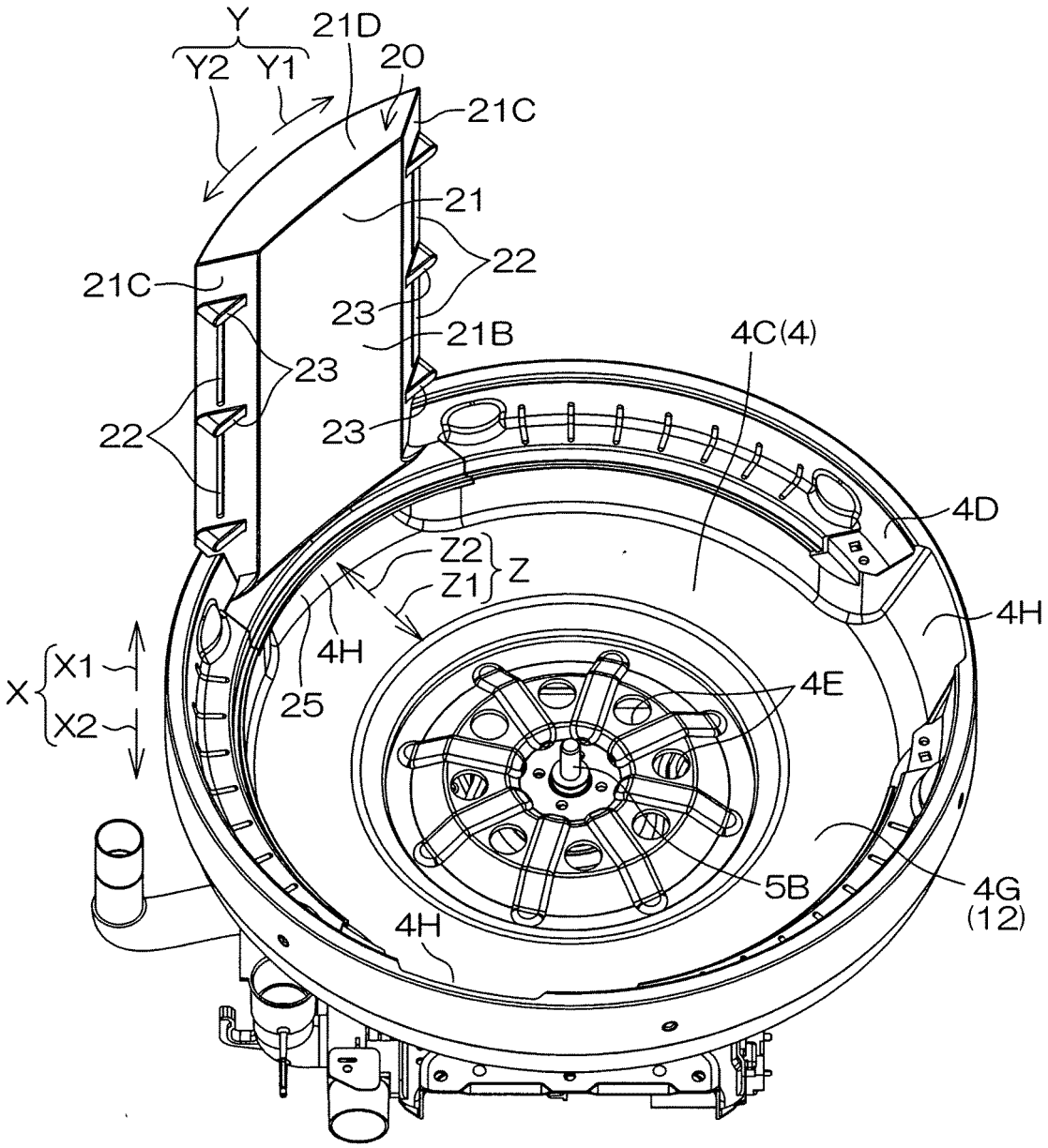
Y
Y2
Y1
21D
20
21C
21
22
21C
23
21B
4C(4)
23
22
23
4D
Z2
Z1
Z
4H
X
X1
X2
25
4H
4E
5B
4G
(12)
4H

FIG. 5

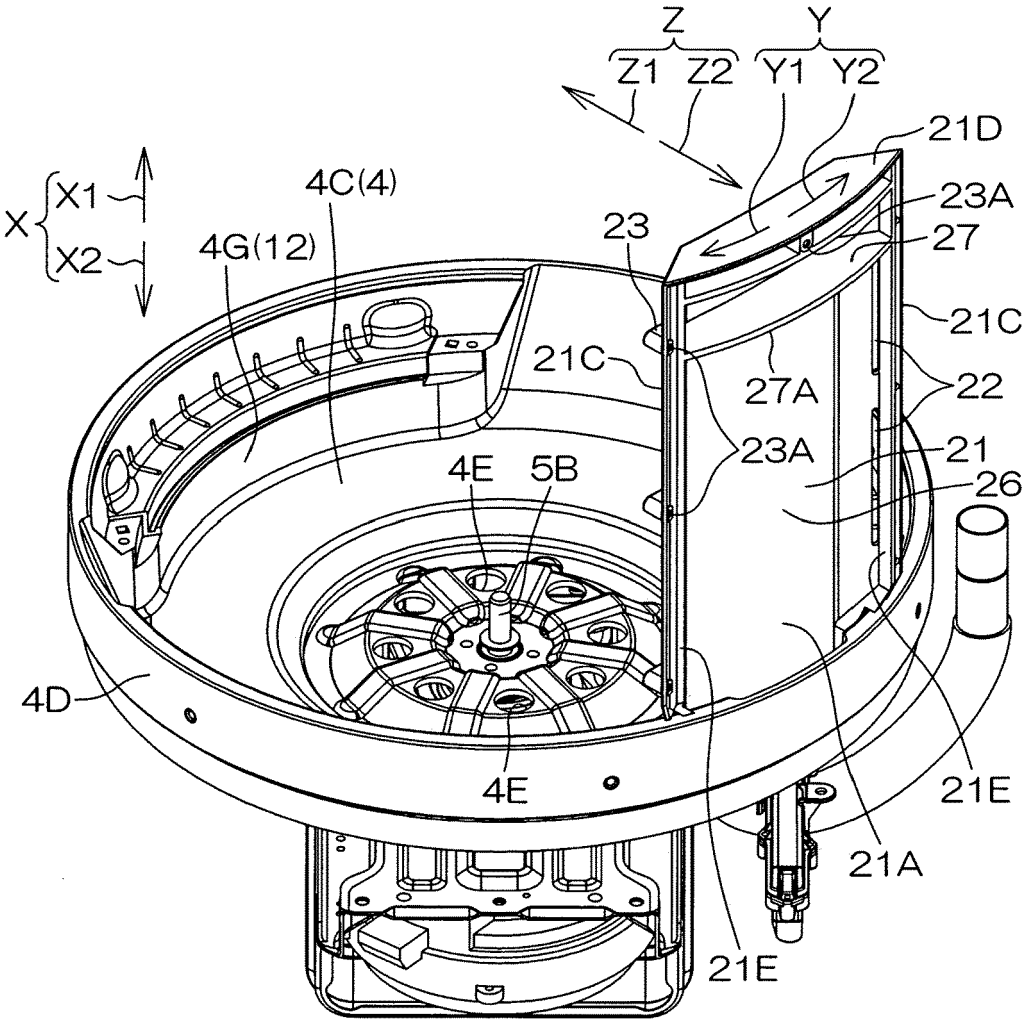
Z
Y
Z1
Z2
Y1
Y2
21D
23A
27
21C
22
21
26
X
X1
X2
4C(4)
4G(12)
23
21C
27A
23A
4E
5B
4D
4E
21E
21A
21E

FIG. 6

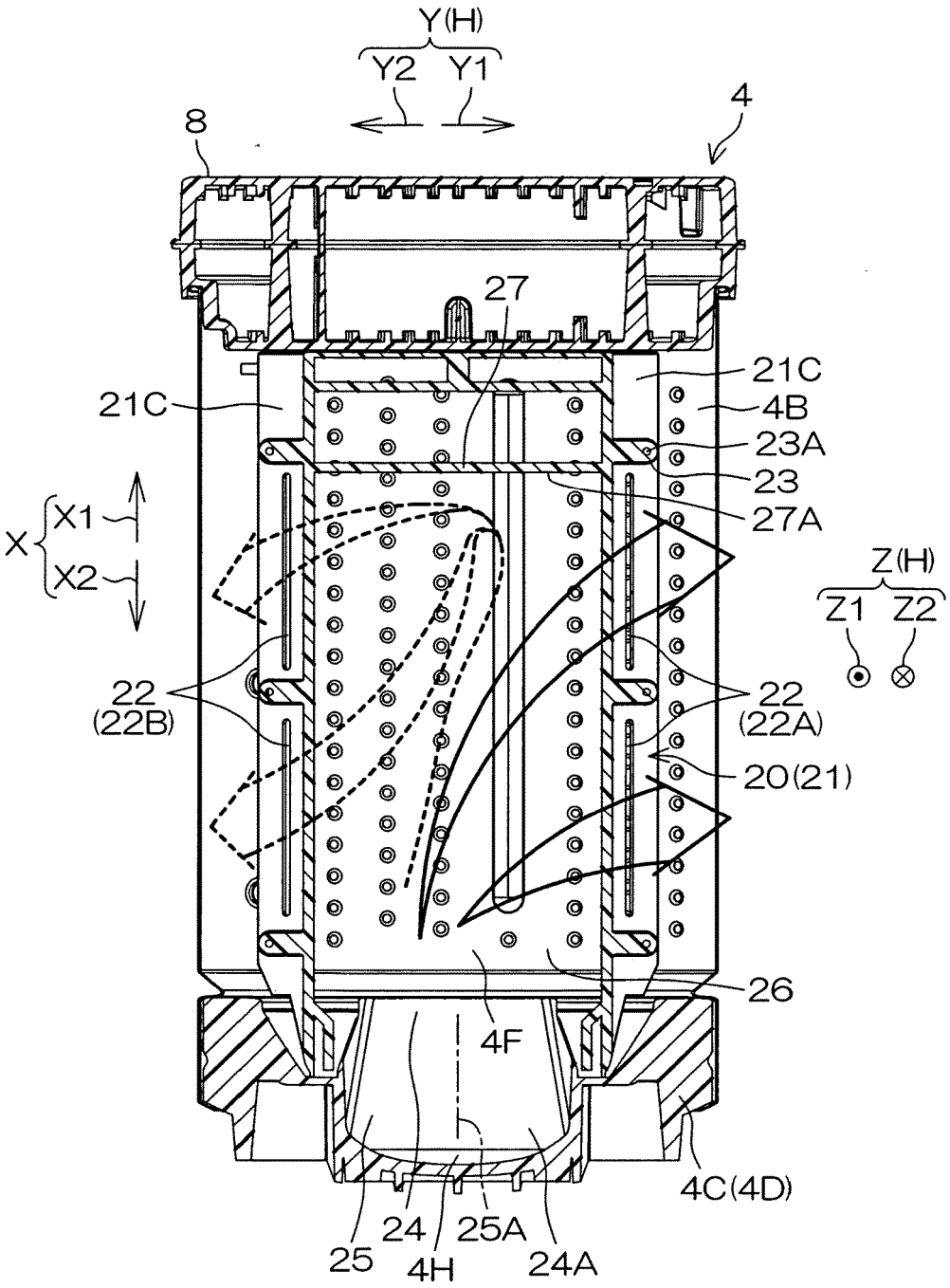
Y(H)
Y2
Y1
8
4
27
21C
21C
4B
23A
23
27A
X
X1
X2
Z(H)
Z1
Z2
22
(22B)
22
(22A)
20(21)
26
4F
4C(4D)
25
24
4H
25A
24A

FIG. 7

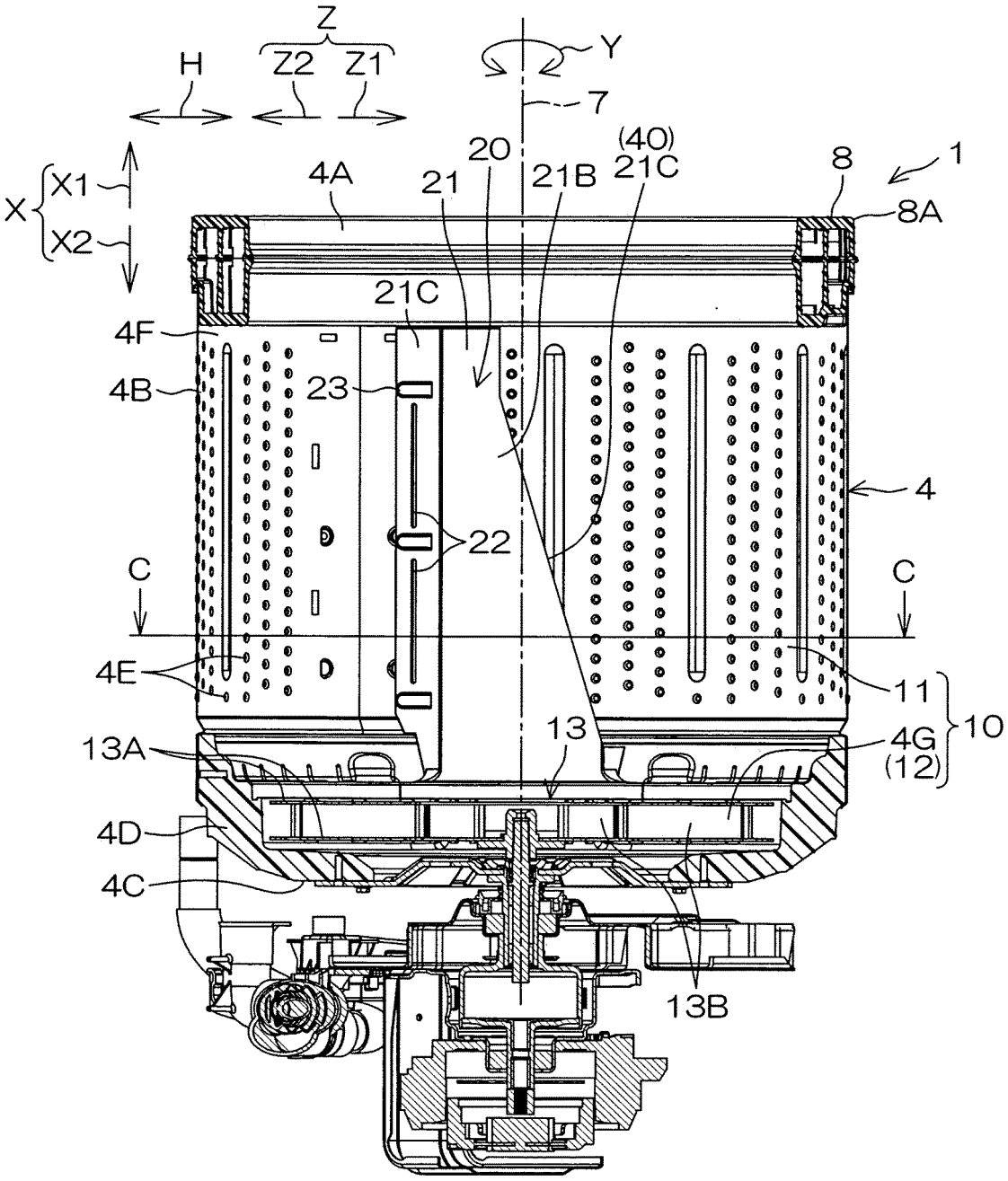
Z
H
Z2
Z1
Y
7
(40)
20
21
21B
21C
8
1
X
X1
X2
4A
8A
21C
4F
4B
23
4
22
C
C
4E
11
10
13A
13
4G
(12)
4D
4C
13B

FIG. 8

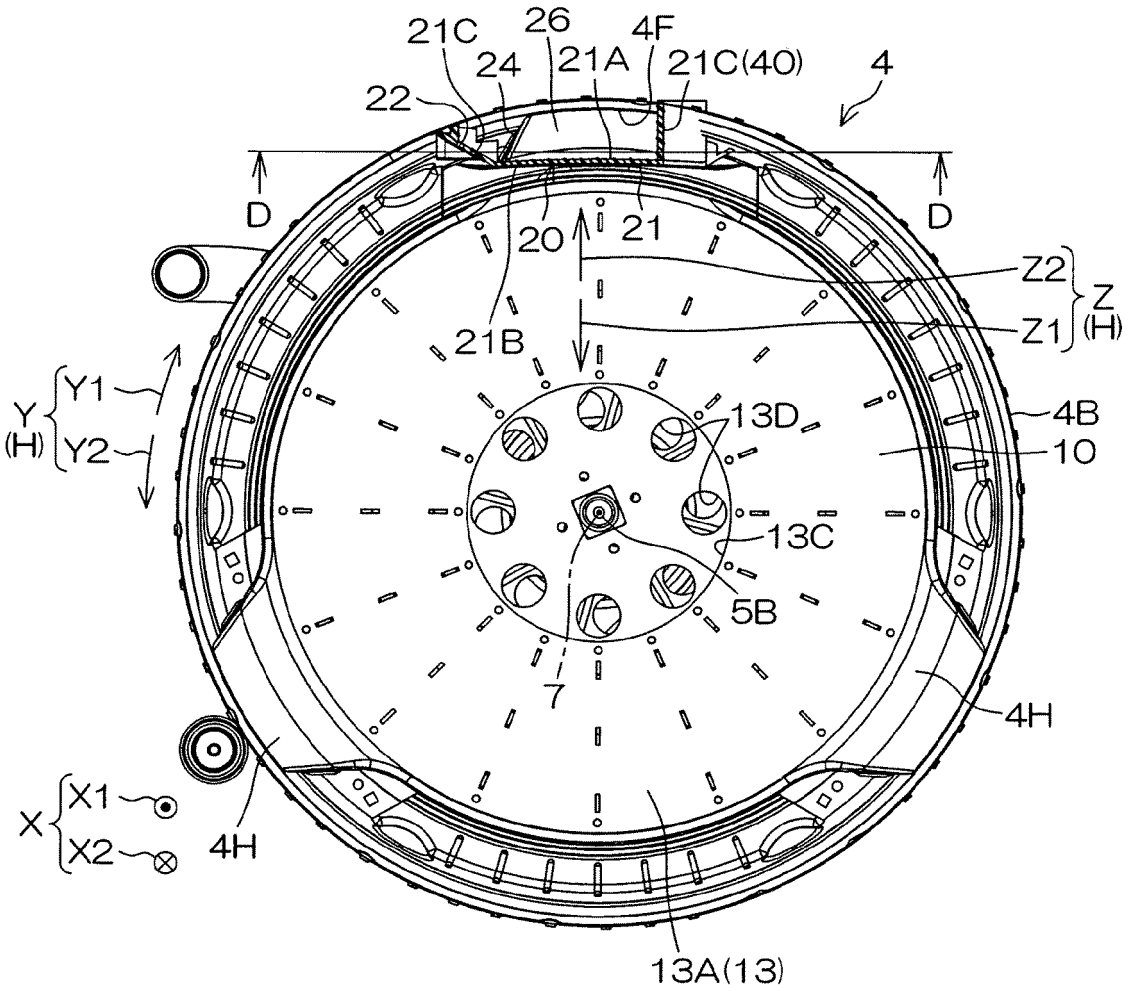
21C
26
4F
24
21A
21C(40)
4
22
D
D
20
21
Z2
Z
(H)
Z1
21B
Y
(H)
Y1
Y2
13D
4B
10
13C
5B
7
4H
X
X1
X2
4H
13A(13)

FIG. 9

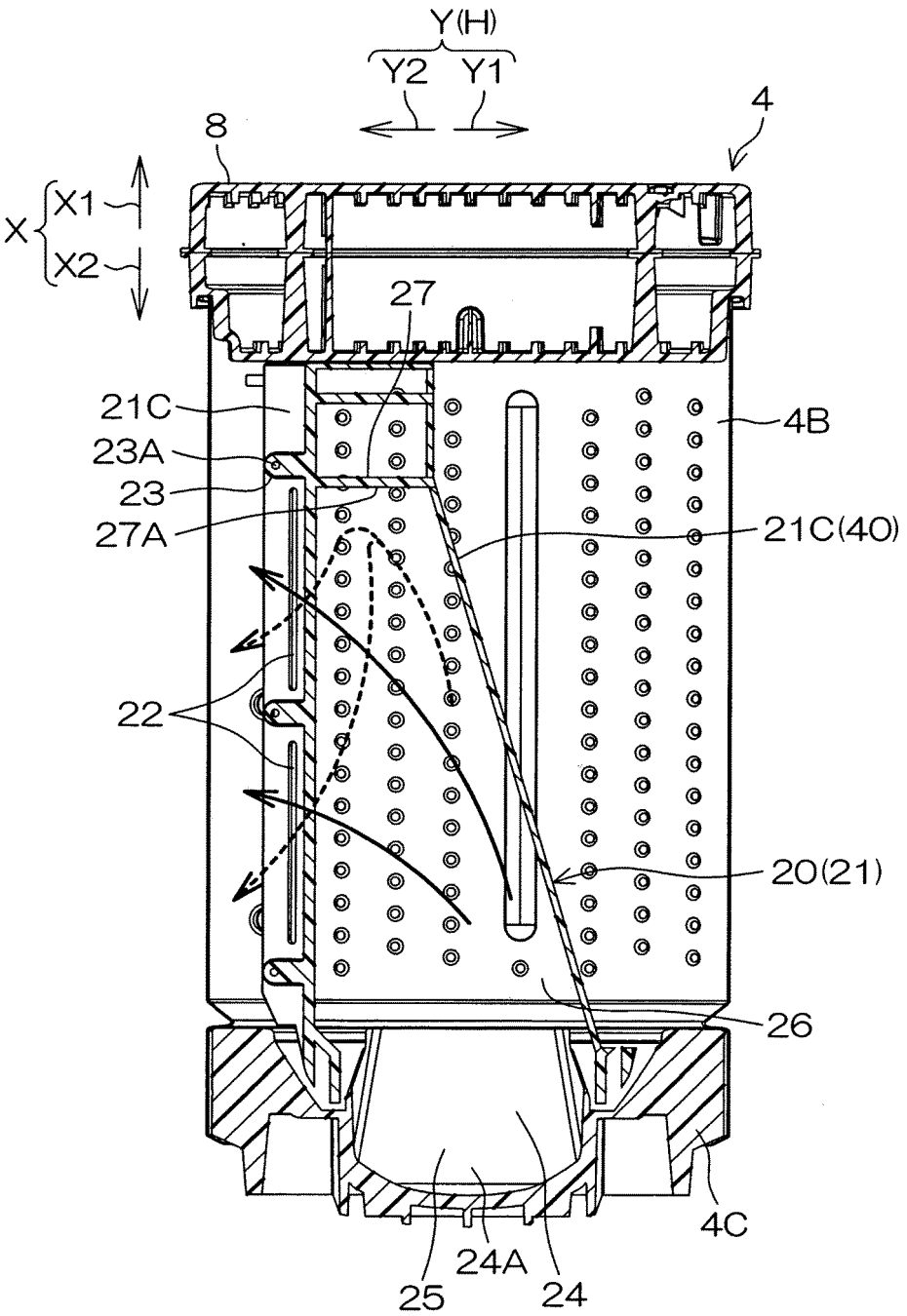
Y(H)
Y2
Y1
4
8
X
X1
X2
27
21C
23A
23
27A
4B
21C(40)
22
20(21)
26
4C
25
24A
24

FIG. 10

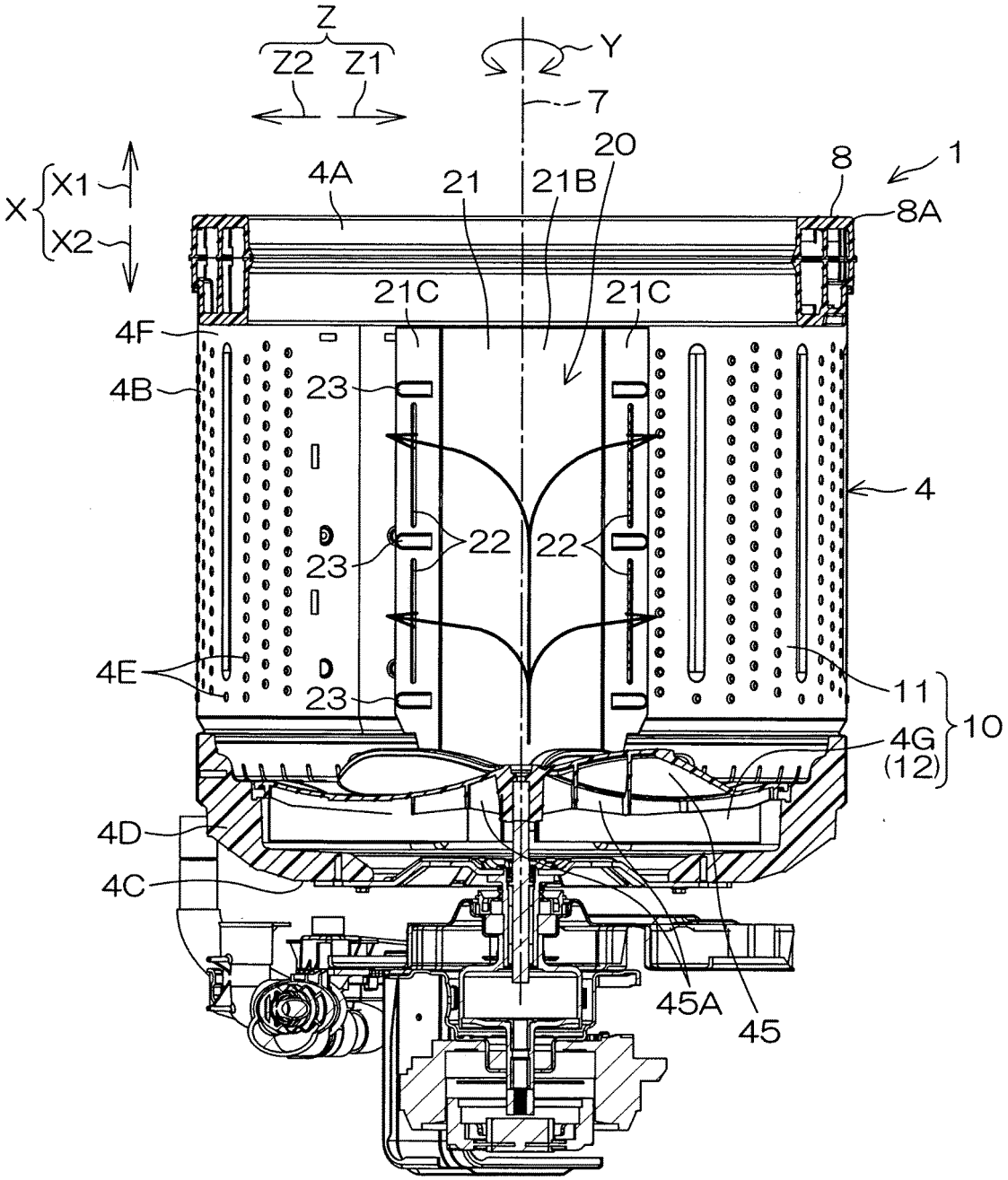
Z
Z2
Z1
Y
7
X
X1
X2
4A
21
21B
20
8
1
8A
21C
21C
4F
4B
23
4
22
22
23
4E
23
11
10
4G
(12)
4D
4C
45A
45

FIG. 11

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2015/090349

A. CLASSIFICATION OF SUBJECT MATTER

D06F 17/06 (2006.01) i; D06F 39/08 (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

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)

VEN; CNABS; CNTXT: impeller, agitator, stirrer, blade, stir, pulsator, turbine, turbo, separat+, apart+, compart+, divid+, water, circle, circulat+, cycle, pump+, cloth+, fabric, textile, laundry, wash+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 10235076 A (MATSUSHITA ELECTRIC IND CO., LTD.) 08 September 1998 (08.09.1998) description, paragraphs [0001]-[0084], and figures 1-20	1-7
X	JP 0884887 A (MATSUSHITA ELECTRIC IND CO., LTD.) 02 April 1996 (02.04.1996) description, paragraphs [0021]-[0044], and figures 1-5	1-7
PX	CN 104233692 A (TOSHIBA CORP et al.) 24 December 2014 (24.12.2014) description, paragraphs [0029]-[0108], and figures 1-22	1-7
A	CN 203700801 U (WUXI LITTLE SWAN CO., LTD.) 09 July 2014 (09.07.2014) the whole document	1-7

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

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"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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"&"document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
22 December 2015	29 December 2015
Name and mailing address of the ISA State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No. (86-10) 62019451	Authorized officer ZHANG, Zhen Telephone No. (86-10) 62084588

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

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2015/090349

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
JP 10235067 A	08 September 1998	JP 3823421 B2	20 September 2006
JP 0884887 A	02 April 1996	None	
CN 104233692 A	24 December 2014	TW 201522741 A	16 June 2015
		KR 20140148307 A	31 December 2014
		JP 2015002907 A	08 January 2015
CN 203700801 U	09 July 2014	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 8309090 A **[0004]**
- JP 10235076 A **[0004]**