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(72) Inventor: **MIGAKI, Fumihiko**
Osaka 540-6207 (JP)

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(74) Representative: **Schwabe - Sandmair - Marx**
Patentanwälte
Stuntzstraße 16
81677 München (DE)

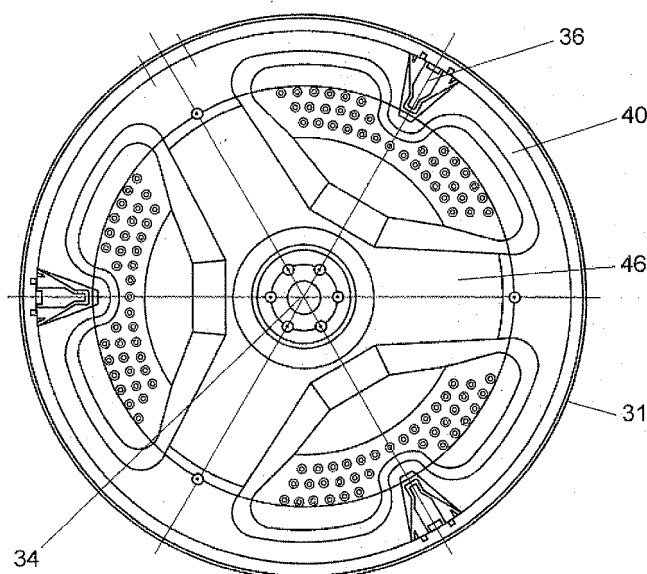
(71) Applicant: **Panasonic Corporation**
Osaka 571-8501 (JP)

(54) **DRUM-TYPE WASHING MACHINE**

(57) A drum-type washing machine includes a rotary drum (31) in which an axis of rotation (34) is horizontally arranged or is arranged so as to be inclined downward from the front surface side toward the back surface side, a water tank rotatably incorporating the rotary drum (31), and a motor for rotating the rotary drum (31), wherein the rotary drum (31) has a plurality of wall surface baffles

(36) on an inner wall surface and has a plurality of bottom surface baffles (46) on an inner bottom surface (40), and the wall surface baffles (36) and the bottom surface baffles (46) are alternately arranged on a circumference taking the axis of rotation (34) as a center. Thus, a laundry in the drum is dispersed and a washing performance is improved,

FIG. 2



Description

Technical Field

[0001] The present invention relates to a drum-type washing machine for washing a laundry in a rotary drum.

Background Art

[0002] Conventionally, in this type of washing machine, a configuration that baffles are provided in a rotary drum and configurations that an artifice is given to a shape of the baffles or a shape of the rotary drum are proposed in order to disperse a laundry (for example, refer to Patent Literature1).

[0003] Fig. 3 shows a sectional view of a conventional drum-type washing machine described in Patent Literature 1.

[0004] As shown in Fig. 3, a water tank 2 supported by a plurality of suspensions (not shown) are arranged in a housing 1. The water tank 2 has a substantially cylinder shape axisymmetrical about an axis of rotation. The axis of rotation of the water tank 2 is inclined forward and upward with respect to the horizontal direction in such a manner that a bottom surface portion 4a of the water tank 2 is lower than an opening portion 2a on a front surface side of the water tank 2. A drum 4 having a large number of holes 3 on a peripheral wall is arranged in the water tank 2. The drum 4 is driven and rotated by a drive device 5 provided in the bottom surface portion of the water tank 2 such as a motor. The drum 4 is rotated in a forward direction or in a reverse direction (i.e., forward-reverse rotation).

[0005] At the time of the forward-reverse rotation, clothing A in the drum 4 is brought up by a plurality of baffles 6 provided on the peripheral wall in the drum 4 and then dropped. Thereby, the clothing A is agitated. The baffles 6 extend toward the opening portion 2a from the bottom surface portion 4a in the drum 4 and protrude inwardly toward the rotation axis the drum 4. Size of the baffles 6 is larger on the side of the bottom surface portion 4a than on the side of the opening portion 2a.

[0006] When an inner diameter of the bottom surface portion 4a of the drum 4 is D1 and an inner diameter of a front surface portion of the drum 4 is D2, D1 is smaller than D2 ($D1 < D2$). That is, the drum 4 has a taper structure that a diameter of the front surface portion is larger than a diameter of the bottom surface portion (i.e., the taper structure that a diameter is larger on the front surface side).

[0007] An auxiliary baffle 21 is provided in the bottom surface portion 4a of the drum 4. The auxiliary baffle 21 is continuously connected to both side surfaces 6a of the baffles 6 so as to form an inclined surface 21 a spreading toward the bottom surface portion 4a of the drum 4. In any case of the forward-reverse rotation of the drum 4, the laundry can be moved to the side of the front surface portion of the drum 4 by the auxiliary baffle 21.

Patent Literature

[0008] Patent Literature 1: JP 2009-22688 A

5 Disclosure of Invention

Problems to be Solved by the Invention

[0009] However, the drum 4 in the above conventional configuration has the taper structure that the diameter is larger on the front surface side. Thus, when the drum 4 is rotated, the laundry is easily moved to the front surface side of the drum 4. Meanwhile, circumferential speed of the drum is high on the side of the bottom surface portion 4a of the drum 4. Thus, the laundry easily gets entangled (easily gets together). Since the laundry entangled in the bottom surface portion 4a of the drum 4 is moved to the front surface side of the drum 4, washing is not efficiently performed. Since the laundry is leaned to one side, an interior of the drum 4 becomes an imbalance state (unstable state), so that vibration becomes larger at the time of spin-drying.

[0010] The present invention is to solve the above conventional problems, and an object thereof is to provide a drum-type washing machine capable of reducing vibration at the time of spin-drying by efficiently performing an agitation action and dispersing a laundry.

Means to Solving the Issue

[0011] In order to solve the above conventional problems, a drum-type washing machine of the present invention includes a rotary drum in which an axis of rotation is horizontally arranged or is arranged so as to be inclined downward from a front surface side toward a back surface side, a water tank rotatably incorporating the rotary drum, and a motor for rotating the rotary drum, wherein the rotary drum has a plurality of wall surface baffles on an inner wall surface and has a plurality of bottom surface baffles on an inner bottom surface; and the wall surface baffles and the bottom surface baffles are alternately arranged on a circumference taking the axis of rotation as a center.

[0012] Thereby, vibration at the time of spin-drying is reduced by efficiently performing an agitation action and dispersing a laundry.

Effect of the Invention

[0013] With the drum-type washing machine of the present invention, the vibration at the time of spin-drying can be reduced by efficiently performing the agitation action and dispersing the laundry.

55 Brief Description of Drawings

[0014] These aspects and features of the present invention will become clear from the following description

taken in conjunction with the preferred embodiments thereof with reference to the accompanying drawings, in which:

Fig. 1 is a sectional view of a drum-type washing machine in an embodiment of the present invention; Fig. 2 is a sectional view showing a bottom surface portion of a rotary drum of the same drum-type washing machine; and Fig. 3 is a sectional view of a conventional drum-type washing machine.

DESCRIPTION OF AN EMBODIMENT

[0015] In a first aspect of the invention, a drum-type washing machine includes a rotary drum in which an axis of rotation is horizontally arranged or is arranged so as to be inclined downward from a front surface side toward a back surface side, a water tank rotatably incorporating the rotary drum, and a motor for rotating the rotary drum, wherein the rotary drum has a plurality of wall surface baffles on an inner wall surface and has a plurality of bottom surface baffles on an inner bottom surface, and the wall surface baffles and the bottom surface baffles are alternately arranged on a circumference taking the axis of rotation as a center. With such a configuration, vibration at the time of spin-drying can be reduced by efficiently performing an agitation action and dispersing a laundry.

[0016] In a second aspect of the invention, the bottom surface baffles protrude higher as the bottom surface baffles come closer to the axis of rotation of the rotary drum in the drum-type washing machine of the first aspect of the invention. With such a configuration, the laundry is pushed to the opening portion side of the rotary drum and dispersed.

[0017] Before the description of the present invention proceeds, it is to be noted that like parts are designated by like reference numerals throughout the accompanying drawings. Hereinbelow, embodiments of the present invention will be described with reference to the accompanying drawings. It should be noted that the present invention is not limited to this embodiment.

(Embodiment)

[0018] Fig. 1 shows a sectional view of a drum-type washing machine in the embodiment of the present invention.

[0019] As shown in Fig. 1, a rotary drum 31 has a cylindrical shape with a bottom. A large number of water passage holes 32 are provided on the entire surface of an outer peripheral portion of the rotary drum 31. A water tank 33 rotatably incorporates the rotary drum 31. An axis of rotation (rotation center axis) 34 passing through a rotation center of the rotary drum 31 is arranged so as to be inclined downward from the front surface side toward the back surface side of the drum-type washing

machine. A belt 47 is coupled to the axis of rotation 34, and a motor 35 positioned in the vicinity of the back surface side of the water tank 33 is coupled to the belt 47. By driving the motor 35, the rotary drum 31 is driven and rotated in a forward direction or in a reverse direction. An inclination angle of the rotary drum 31 and the axis of rotation 34 with respect to the horizontal direction is for example 10 degrees. On an inner wall surface of the rotary drum 31, a plurality of wall surface baffles 36 serving as protruding portions for agitating clothing are provided. On an inner bottom surface 40 of the rotary drum 31, a plurality of bottom surface baffles 46 protruding higher as the bottom surface baffles come closer to the axis of rotation 34 (i.e., the rotation center of the rotary drum 31) are formed. It should be noted that a case where the axis of rotation is arranged so as to be inclined downward from the front surface side toward the back surface side is described in the present embodiment. However, the axis of rotation may be horizontally arranged.

[0020] On the outer peripheral side of an inner bottom surface of the water tank 33, a ring shape projection 52 is formed. A gap between the inner bottom surface of the water tank 33 and an outer bottom surface of the rotary drum 31 is reduced by the ring shape projection 52 to an allowable extent in terms of manufacture. Thereby, wind flow speed at the time of spin-drying rotation is increased, and pressure (sound pressure) is lowered. Therefore, wind noise is reduced.

[0021] A drive shaft flange 51 for improving strength of the rotary drum 31 is fixed on the outer bottom surface side of the rotary drum 31.

[0022] A water tank unit 60 of a vibration system is configured by the rotary drum 31, the drive shaft flange 51, the water tank 33, the motor 35, and the like.

[0023] An opening portion is provided on an upward inclined surface of a washing machine main body 39 positioned on the front opening portion side of the water tank 33, and the opening portion is openably and closably covered by a lid body 37. By opening the lid body 37, a laundry can be taken out and brought into the rotary drum 31 through a clothing outlet/inlet 38 serving as an opening portion provided in the rotary drum 31.

[0024] In the washing machine main body 39, an anti-vibration member 41 is attached on the lower side, and a spring body 48 is attached on the upper side. The water tank unit 60 is oscillatably supported by the anti-vibration member 41 and the spring body 48.

[0025] One end of a drainage passage 42 is connected to a lower part of the water tank 33. The other end of the drainage passage 42 is connected to a drainage valve 43. By connecting the drainage passage 42 in such a way, washing water in the water tank 33 is drained to an exterior of the drum-type washing machine.

[0026] In the washing machine main body 39, a water supply valve 44 is provided on the upper side. A water supply passage 45 is connected to the water supply valve 44. The water supply passage 45 communicates with the water tank 33 via a detergent case 53 (not shown in Fig.

1). Water supplied from the water supply passage 45 enters the detergent case 53, dissolves detergent in the detergent case 53, and enters the water tank 33 as the washing water. In such a way, the water supply valve 44 supplies the washing water into the water tank 33.

[0027] In the washing machine main body 39, a controller 56 is provided on the upper side. The controller 56 controls actions of the motor 35 and the like, and controls each step such as washing, rinsing, and spin-drying.

[0028] The motor 35 configured by a DC brushless motor or the like is controlled by the controller 56, a drive circuit (not shown), and the like in such a manner that forward-reverse rotation is variable and the rotation number is variable.

[0029] In an upper part of a front surface of the washing machine main body 39, an input setting portion 49 for a user to select a washing course or the like and a display portion 50 for displaying a selection result, a progress degree of the steps, an action error, and the like so as to notify the user are provided.

[0030] Fig. 2 is a sectional view to see the bottom surface side of the rotary drum 31 of the drum-type washing machine in the embodiment of the present invention.

[0031] In Fig. 2, as described above, the plurality of wall surface baffles 36 for agitating the clothing are provided on the inner wall surface of the rotary drum 31, and the plurality of bottom surface baffles 46 are provided on the inner bottom surface of the rotary drum 31. The wall surface baffles 36 and the bottom surface baffles 46 are alternately arranged on a circumference taking the axis of rotation 34 of the rotary drum 31 as a center. Fig. 2 shows a case where the three wall surface baffles 36 and the three bottom surface baffles 46 are provided. However, the number of the wall surface baffles 36 and the number of the bottom surface baffles 46 are not limited to this but can be appropriately set.

[0032] Actions and operations of the drum-type washing machine configured as above will be described below.

[0033] After opening the lid body 37, bringing the laundry into the rotary drum 31, and bringing a predetermined amount of detergent into the detergent case 53, the user operates the input setting portion 49 so as to start an operation of the drum-type washing machine. When the operation is started, a washing step is firstly executed (Step S1).

[0034] In the washing step, the washing water is supplied by activating the water supply valve 44. The supplied washing water passes through the water supply passage 45 and the detergent case 53 and enters the water tank 33 together with the detergent. After the washing water is supplied to a predetermined water level, the motor 35 is controlled so that rotation speed of the rotary drum 31 is increased to predetermined rotation speed. After that, actions of the rotary drum 31 consisting of forward rotation, pause, reverse rotation, and pause serve as one cycle, and repeating the cycle (washing action) is executed for a predetermined time.

[0035] It should be noted that the plurality of wall sur-

face baffles 36 and the bottom surface baffles 46 are alternately arranged on the circumference. Thus, as the rotary drum 31 is rotated, the laundry positioned on the lower side (laundry positioned in a right lower part of the rotary drum 31 in Fig. 1) is pushed upward by the bottom surface baffles 46. The laundry pushed upward is moved in the rotation direction by the wall surface baffles 36 and then dropped downward. By repeating this action, the drum-type washing machine in the present embodiment can three-dimensionally rotate the laundry in the rotary drum 31 so as to efficiently perform the washing action and disperse the laundry without entangling the laundry.

[0036] The laundry is brought up so as to be nipped between the wall surface baffles 36 and the bottom surface baffles 46. Therefore, the laundry is not easily slipped off the wall surface baffles 36 while being brought up by the wall surface baffles 36. After being pushed upward, the laundry is dropped. Thus, a beat-washing effect can be obtained so that a washing performance is improved.

[0037] The bottom surface baffles 46 protrude higher toward the opening portion side of the rotary drum 31 as the bottom surface baffles come closer to a center (axis of rotation 34) of the rotary drum 31. Thus, there is an effect of pushing the laundry to the opening portion side (front surface side) of the rotary drum 31 and dispersing the laundry when the laundry reaches the upper side by rotation of the rotary drum 31.

[0038] After this washing action for a predetermined time, the washing step is finished. Next, a first drainage step (Step S2) is executed. After the first drainage step is executed, a rinsing step (Step S3) is executed. Also in the rinsing step, the same washing action as the washing step is performed. After that, a drainage step (Step S4) and a spin-drying step (Step S5) are executed.

[0039] As described above, in the drum-type washing machine according to the present embodiment, the plurality of wall surface baffles 36 provided on the inner wall surface of the rotary drum 31 and the plurality of bottom surface baffles 46 provided on the inner bottom surface of the rotary drum 31 are alternately arranged on the circumference taking the axis of rotation 34 of the rotary drum 31 as a center. By such arrangement, at the time of the washing step or the rinsing step, the laundry is not easily entangled and the laundry is three-dimensionally rotated in the rotary drum 31, so that an agitation action is efficiently performed. Therefore, the washing performance and a rinsing performance are improved, and the laundry is dispersed. By dispersing the laundry, vibration and noise are reduced at the time of spin-drying.

[0040] It is to be noted that, by properly combining the arbitrary embodiments of the aforementioned various embodiments, the effects possessed by them can be produced.

[0041] As described above, the washing machine according to the present invention can disperse the laundry in the rotary drum without entangling the laundry and efficiently perform the washing action and a rinsing ac-

tion. Thus, the washing machine can be applied to other washing machines and the like.

[0042] Although the present invention has been fully described in connection with the preferred embodiment thereof with reference to the accompanying drawings, it is to be noted that various changes and modifications are apparent to those skilled in the art. Such changes and modifications are to be understood as included within the scope of the present invention as defined by the appended claims unless they depart therefrom.

[0043] The entire disclosure of Japanese Patent Application No. 2011-036735 filed on February 23, 2011 including specification, drawings, and claims is incorporated herein by reference in its entirety.

DESCRIPTION OF REFERENCE SIGNS

[0044]

31:	ROTARY DRUM	20
33:	WATER TANK	
34:	AXIS OF ROTATION (ROTATION CENTER AXIS)	25
35:	MOTOR	
36:	WALL SURFACE BAFFLE	30
39:	WASHING MACHINE MAIN BODY	
46:	BOTTOM SURFACE BAFFLE	
56:	CONTROLLER	35

Claims

1. A drum-type washing machine, comprising:
 - a rotary drum in which an axis of rotation is horizontally arranged or is arranged so as to be inclined downward from a front surface side toward a back surface side;
 - a water tank rotatably incorporating the rotary drum; and
 - a motor for rotating the rotary drum; wherein the rotary drum has a plurality of wall surface baffles on an inner wall surface and has a plurality of bottom surface baffles on an inner bottom surface; and
 - the wall surface baffles and the bottom surface baffles are alternately arranged on a circumference taking the axis of rotation as a center.
2. The drum-type washing machine according to claim 1, wherein

the bottom surface baffles protrude higher as the bottom surface baffles come closer to the axis of rotation of the rotary drum.

Amended claims under Art. 19.1 PCT

1. (Amended) A drum-type washing machine, comprising:
 - a rotary drum in which an axis of rotation is horizontally arranged or is arranged so as to be inclined downward from a front surface side toward a back surface side;
 - a water tank rotatably incorporating the rotary drum; and
 - a motor for rotating the rotary drum; wherein the rotary drum has a plurality of wall surface baffles on an inner wall surface and has a plurality of bottom surface baffles on an inner bottom surface;
 - the wall surface baffles and the bottom surface baffles are alternately arranged on a circumference taking the axis of rotation as a center; and
 - the bottom surface baffles protrude higher as the bottom surface baffles come closer to the axis of rotation of the rotary drum.

2. (Deleted)

FIG. 1

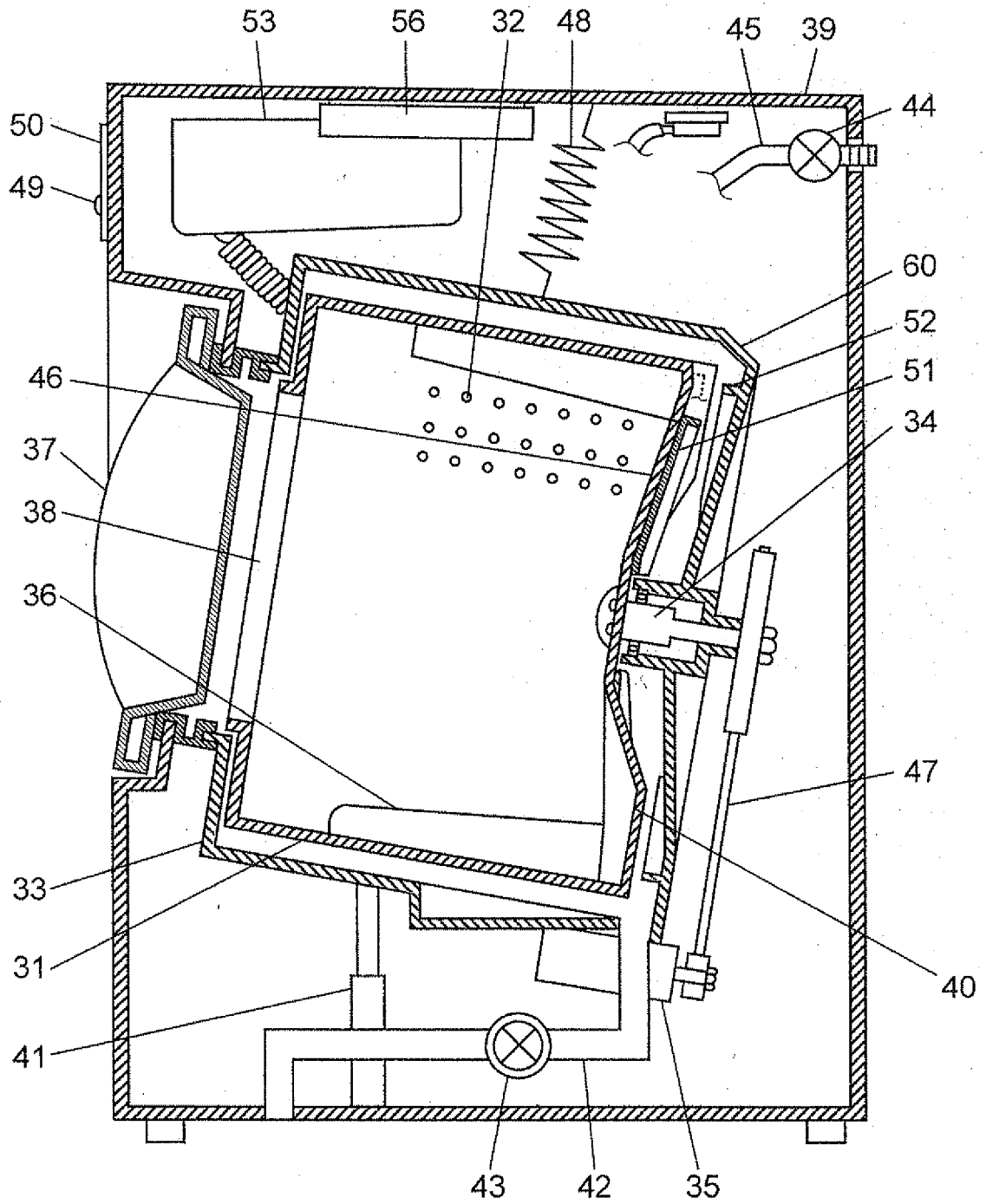


FIG. 2

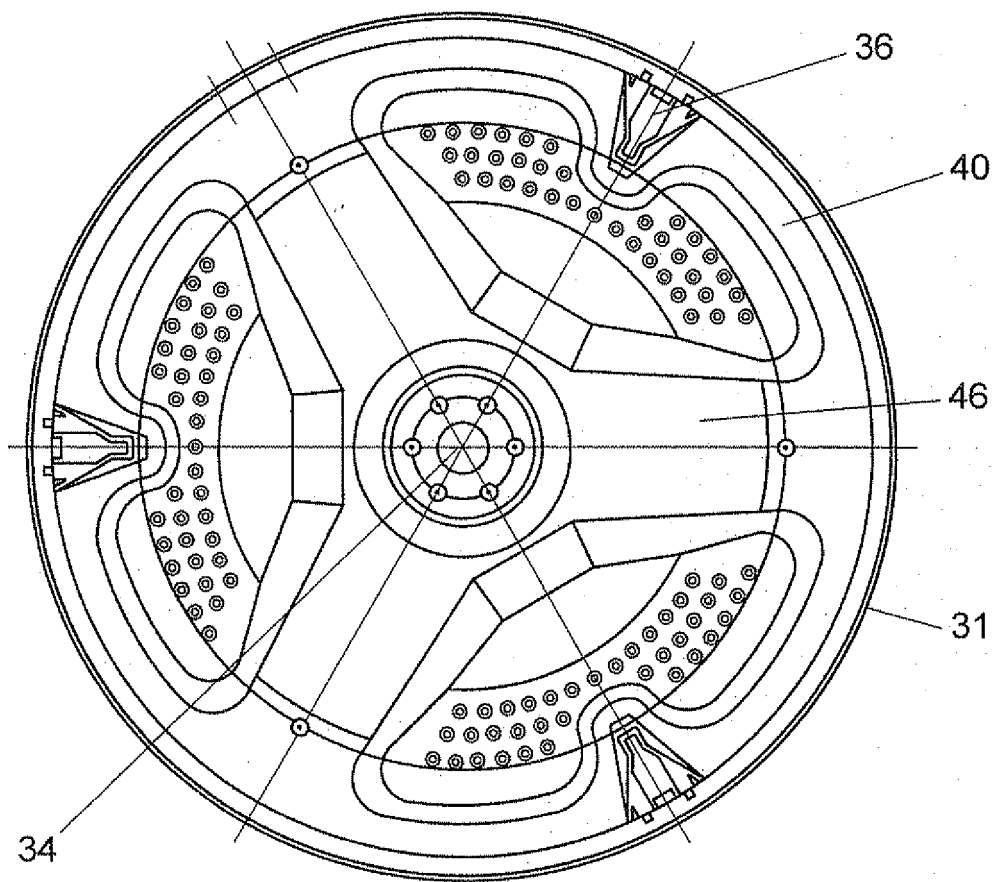
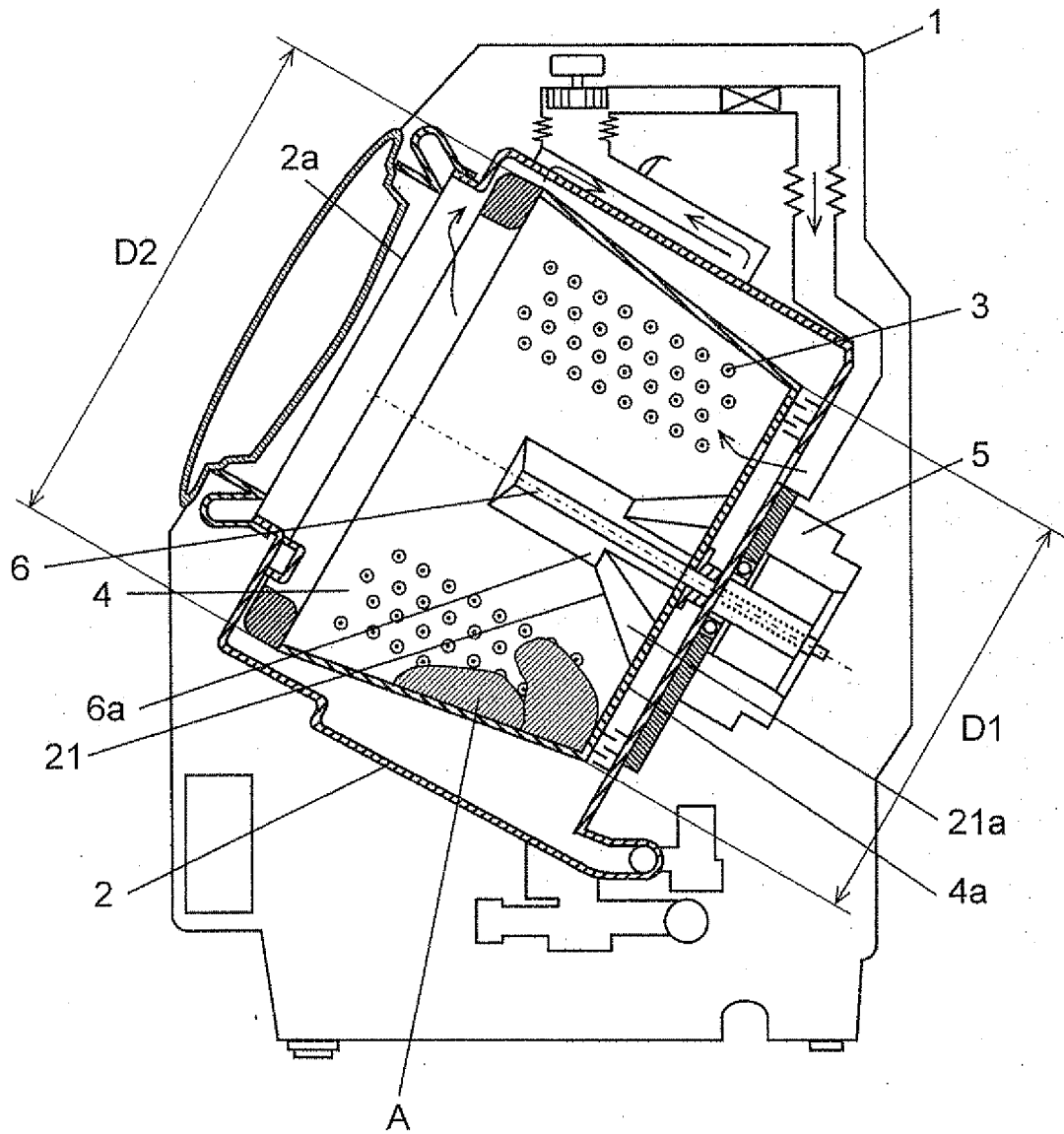


FIG. 3



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2012/001204

A. CLASSIFICATION OF SUBJECT MATTER

D06F37/06(2006.01)i, D06F23/02(2006.01)i, D06F39/12(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)

D06F37/06, D06F23/02, D06F39/12

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

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2012
Kokai Jitsuyo Shinan Koho	1971-2012	Toroku Jitsuyo Shinan Koho	1994-2012

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2002-315985 A (Sanyo Electric Co., Ltd.),	1
A	29 October 2002 (29.10.2002), paragraph [0030]; fig. 2 (Family: none)	2
A	JP 7-116393 A (Matsushita Electric Industrial Co., Ltd.), 09 May 1995 (09.05.1995), entire text; all drawings (Family: none)	2
A	JP 9-215894 A (Matsushita Electric Industrial Co., Ltd.), 19 August 1997 (19.08.1997), entire text; all drawings & CN 1158921 A	2

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

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Date of the actual completion of the international search
16 March, 2012 (16.03.12)Date of mailing of the international search report
27 March, 2012 (27.03.12)Name and mailing address of the ISA/
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Form PCT/ISA/210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2012/001204

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 2006-223452 A (Toshiba Corp.), 31 August 2006 (31.08.2006), entire text; all drawings (Family: none)	2

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

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2009022688 A [0008]
- JP 2011036735 A [0043]