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(54) WASHING MACHINE

(57) The present invention provides a washing machine capable of suppressing vibration and noise and capable of reducing a gap between a circumferential wall of an outer tub and a housing so as to reduce a useless space. The washing machine includes a box-shaped housing (2) having an internal space (Sp) opened upward; and a washing tub unit (4) suspended and supported through a hanger bar (3) in the internal space (Sp). The washing tub unit includes an outer tub (5) presented in a bottomed quasi-cylindrical shape; an inner tub (6) presented in a bottomed quasi-cylindrical shape, coaxially configured inside the outer tub (5) and rotatably supported by the outer tub; and a driving mechanism (7) arranged at a lower end of the outer tub (5) and configured to drive the inner tub (6) to rotate. A base end side (3A) of the hanger bar (3) is mounted in the vicinity of an upper end (24) of the housing (2), and a top end (3B) side is mounted at a lower portion of the outer tub (5). A center of gravity (Pc1) of the washing tub unit (4) is arranged at a position higher than a height center (Hb) in a vertical direction of the housing (2).

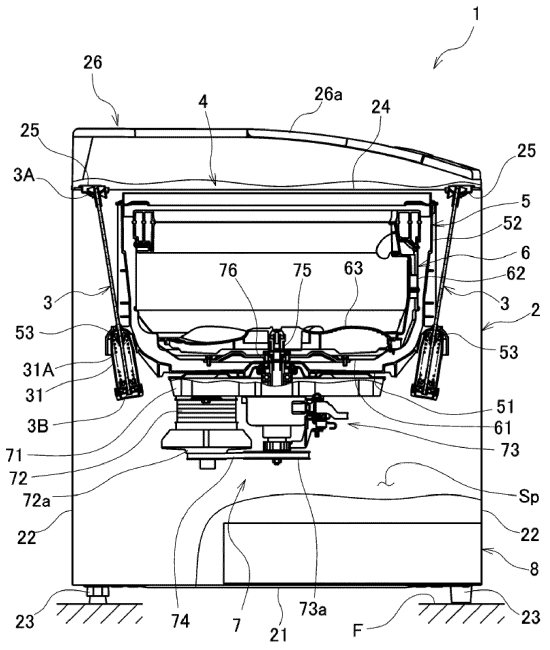

FIG. 1

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Description

TECHNICAL FIELD

[0001] The present invention relates to a washing machine capable of suppressing vibration and noise.

BACKGROUND

[0002] In the past, in an ordinary known washing machine, a bottomed quasi-cylindrical outer tub is supported inside a box-shaped housing and a washing and dewatering tub as an inner tub is rotatably supported at an inner side of the outer tub (for example, referring to patent literature 1).

[0003] Fig. 4 is a longitudinal section view schematically illustrating an example of an ordinary washing machine 101.

[0004] An outer tub 105 and an inner tub 106 are coaxially configured in an inner space Sp of a housing 2, and a bottom plate 161 of the inner tub 106 is provided with an agitator 63. Furthermore, a lower side of a bottom plate 151 of the outer tub 105 is provided with a driving mechanism 107 capable of selectively causing the inner tub 106 and the agitator 63 to rotate.

[0005] A washing tub unit 104 is formed by the outer tub 105, the inner tub 106 and the driving mechanism 107, and the washing tub unit 104 is suspended and supported inside the housing 2 through hanger bars 103. Each hanger bar 103 is configured obliquely at a specified angle θ, a base end 103A side is mounted at a suspending and fixing portion 25 arranged near an upper end 24 of the housing 2; and a top end 103B side is mounted at a suspended and supporting portion arranged at a lower portion of a circumferential wall 152 of the outer tub 105 via a damping mechanism 31. Thus, the washing tub unit 104 is elastically supported. Thus, excessive vibration caused by the rotation of the inner tub 106 and the agitator 63 in a washing or dewatering process can be inhibited.

[0006] Herein, width and depth dimensions of a place for arranging the above washing machine 101 are limited by a waterproof plate and a house layout in a family. That is, the arrangement area of the washing machine 101 shall not be too big. Furthermore, since the washing machine 101 is set to be capable of washing multiple washings, the washing capacity is designed to be big as far as possible, so that the washing machine becomes lengthwise.

[0007] Furthermore, the washing tub unit 104 which is also designed to be lengthwise like the housing 2 exists from a position near the upper end 24 to a position near a bottom surface 21 in a manner of occupying a majority of internal space Sp of the housing 2. Since the washing tub unit 104 is provided with the driving mechanism 107 having a weight at the bottom plate 151 forming the outer tub 105, a center-of-gravity position Pc is located below the center. Therefore, a height Hc0 of the center-of-gravity position Pc0 of the washing tub unit 104 is 30% of a height Hu from an arrangement surface F to the upper end 24 of the housing 2.

[0008] Furthermore, in order to effectively suppress the swinging rotation of the washing tub unit 104, the hanger bar 103 is preferably mounted at a position of a generally same height as the center-of-gravity Pc0 of the washing tub unit 104. Therefore, the above suspended and supporting portion 53 is arranged at the lower portion of the circumferential wall 152 of the outer tub 105. Therefore, a distance Ls0 from the suspending and fixing portion 25 forming a supporting point for installing the hanger bar 103 to a supporting point of the suspended and supporting portion is lengthened.

Current Technical Literature

[0009] Patent literature 1: Japanese Laid-Open Patent Publication No. 2011-240041

Problems to be solved by the invention

[0010] As described above, in the existing washing machine, since the center-of-gravity position of the washing tub unit is low, but the distance between the supporting points for suspending and supporting the washing tub unit is long, the swinging of the washing tub unit is increased along with the rotation of the inner tub and the agitator, causing a tendency that the vibration and the noise are increased. In addition, in order to prevent the washing tub unit from contacting the housing during swinging rotation, a gap is necessary to set between the circumferential wall of the outer tub and the housing, and the gap becomes a useless space, so that the washing capacity is limited.

SUMMARY

[0011] The purpose of the present invention is to effectively solve such problem and specifically to provide a washing machine capable of effectively suppressing vibration and noise of a washing tub unit and capable of reducing a gap between a circumferential wall of an outer tub and a housing so as to reduce a useless space.

Solution for solving the problems

[0012] In order to achieve related purposes, the present invention adopts the following solution.

[0013] Namely, a washing machine of the present invention includes a housing presented in a box shape and having an internal space opened upward; and a washing tub unit suspended and supported in the internal space through a hanger bar, wherein the washing tub unit has: an outer tub presented in a bottomed quasi-cylindrical shape; an inner tub presented in a bottomed quasi-cylindrical shape, coaxially configured inside the outer tub and rotatably supported by the outer tub; and a driving mechanism arranged at a lower end of the outer tub and

configured to drive the inner tub to rotate; a base end side of the hanger bar is mounted near an upper end of the housing, a top end side is mounted at a lower portion of the outer tub, and a center of gravity of the washing tub unit is set at a position higher than a vertical height center of the housing.

[0014] Furthermore, the hanger bar in the present invention are preferably mounted at a predetermined angle; the top end side is mounted at a suspended and supporting portion of the lower portion of a circumferential wall of the outer tub; and the suspended and supported portion is set at a position higher than a vertical height center of the housing.

[0015] Furthermore, in the present invention, preferably, the driving mechanism selectively drives the inner tub and an agitator arranged at a bottom of the inner tub by transferring a rotating force of a motor, and a depth of the inner tub is set to be in a range of 50% to 70% of a diameter of the inner tub.

[0016] Moreover, in the present invention, preferably, an accommodating portion is arranged below the washing tub unit.

[0017] Further, the accommodating portion is preferably a drawer in the present invention.

Effects of the invention

[0018] According to the present invention described above, since the washing tub unit is suspended and supported by from the upper end of the housing with the hanger bar as a supporting point, and the center of gravity is set at the position higher than the vertical height center of the housing, the swinging of the inner tub when the inner tub is driven by the driving mechanism to rotate is reduced, thereby reducing the vibration and noise. In addition, since the swinging rotation is reduced, correspondingly a gap between the circumferential wall of the outer tub and the housing can be narrowed, thereby reducing a useless space. Therefore, the washing capacity can be increased by correspondingly enlarging the diameters of the outer tub and the inner tub forming the washing tub unit.

[0019] Furthermore, according to the present invention in which the suspended and supporting portion where the top end side of the hanger bar is mounted is located at the position higher than the vertical height center of the housing, in the case that the dimension of the housing and the installation position of the hanger bars on the housing are set to be same as a conventional case, a distance between the supporting points supporting the washing tub unit through the hanger bars is reduced. Therefore, the swinging of the washing tub unit can be further reduced, and the vibration and noise can be further reduced. Furthermore, since the hanger bars are installed at the specified angle, and the distance between the supporting points is shortened, compared with the traditional washing machine, the circumferential wall of the outer tub can be disposed in an outer diameter direction, thereby reducing the useless space. Furthermore, by reducing the vibration, the gap between the outer tub and the housing and the gap between the outer tub and the inner tub are also allowed to be reduced, so that the diameters of the outer tub and the inner tub can be increased, and the washing capacity can be increased.

[0020] Furthermore, according to the present invention in which the depth of the inner tub is set to be in a range of 50% to 70% of the diameter, since the obliquity of the inner tub relative to the outer tub can be reduced without damaging the washing performance of the washing machine, the gap between the outer tub and the inner tub can be reduced, the washing capacity is further increased, and the amount of useless water (i.e. dead water) injected between the outer tub and the inner tub when in washing can be reduced. In addition, in a case of adopting the diameter the same as the traditional washing machine, since the depth of the inner tub is reduced, the washings become easy to take out. Furthermore, since a distance among the washings, water and agitator at the upper portion of the inner tub is reduced, and a stirring force generated by the agitator is easy to transfer, thereby reducing the load of a motor, and reducing manufacturing cost and energy consumption.

[0021] Furthermore, according to the present invention in which the accommodating portion is arranged below the washing tub unit, a space below the washing tub unit can be effectively utilized, thereby further improving the usability.

[0022] Particularly, according to the present invention in which the accommodating portion is the drawer, the accommodating portion can be used as an accommodating space of detergents, softening agents, or utensils related to the washing and the like, thereby further improving the usability.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023]

Fig. 1 is a longitudinal section view illustrating a washing machine of an embodiment of the present invention.

Fig. 2 is a longitudinal section view schematically illustrating the same washing machine.

Fig. 3 is a perspective view illustrating the same washing machine.

Fig. 4 is a longitudinal section view schematically illustrating an example of an existing washing machine.

A list of reference numerals:

[0024]

1, 101: washing machine
2: housing
3, 103: hanger bar

3A, 103A: base end (of hanger bar)
3B, 103B: top end (of hanger bar)
4, 104: washing tub unit
5, 105: outer tub
6, 106: inner tub
7: driving mechanism
8: drawer (accommodating portion)
24: upper end (of housing)
51, 151: bottom plate
52, 152: circumferential wall
53: suspended and supporting portion
61, 161: bottom plate
62, 162: circumferential wall
63: agitator
72, 172: motor
73, 173: power distribution unit
Dp0, Dp1: depth (of inner tub)
Hb: height center of housing
Hc0, Hc1: height of center of gravity (of washing tub unit)
Hu: height of housing
Pc0, Pc1: center of gravity (of washing tub unit)
Sp: internal space
θ: angle (of hanger bar)

DETAILED DESCRIPTION

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

[0026] Fig. 1 is a longitudinal section view illustrating a washing machine 1 of embodiments of the present invention. The washing machine 1 has a substantially quadrangular shape in top view, and Fig. 1 illustrates a state that the washing machine 1 is sectioned at a position of a diagonal line. Furthermore, Fig. 1 is a diagram illustrating a general structure of the washing machine 1 and omitting portions unrelated to the present invention. It shall be noted that the same reference numerals are given to the portion in Fig. 1 same as that in the existing washing machine 101 shown in Fig. 4.

[0027] The washing machine 1 of the present embodiment shown in Fig. 1 is configured as a called vertical type washing machine and has a housing 2 and a washing tub unit 4 suspended and supported inside the housing 2 through hanger bars 3. In addition, the washing tub unit 4 has a bottomed quasi-cylindrical outer tub 5, a bottomed quasi-cylindrical inner tub 6 coaxially configured inside the outer tub, and a driving mechanism arranged at a bottom of the outer tub 5.

[0028] The housing 2 is formed by a substantially rectangular bottom surface 21 and four wall surfaces 22 erecting from the bottom surface 21 and is formed into a box shape having an internal space Sp opened upward. Moreover, four corners of the bottom surface 21 have feet 23. The vertical height of the housing 2 of the present embodiment refers to a height including the feet 23 and is defined as a height from an arrangement surface F to an upper end 24 of the housing 2. Four corners near the upper end 24 of the housing 2 are provided with hook-shaped suspending and fixing portions 25, and the suspending and fixing portions 25 suspend base end 3A sides of the hanger bars 3 so as to function as supporting points for hanging the hanger bars 3.

[0029] The upper portion of the housing 2 is provided with a cover 26 integrated with an operation panel, one portion of the cover 26 is configured as an opening and closing cover 26a, as shown in Fig. 2, and the internal space Sp can be opened and closed by changing the opening and closing cover to be in an open state PO and a closed state PC.

[0030] Returning to Fig. 1, the outer tub 5 forming the washing tub unit 4 is a bottomed quasi-cylindrical member having a substantially circular bottom plate 51 in top view for forming the bottom and a circumferential wall 52 erecting from an edge portion of the bottom plate 51. Hook-shaped suspended and supporting portions 53 are substantially uniformly and integrally configured at four portions of the lower portion of the circumferential wall 52 in top view. The suspended and supporting portions 53 can be mounted at top end 3B sides of the hanger bars 3.

[0031] The inner tub 6 is configured as a so-called washing and dewatering drum and formed into a bottomed quasi-cylindrical shape having a substantially circular bottom plate 61 in top view for forming the bottom and a circumferential wall 62 erecting from an edge portion of the bottom plate 61. The inner tub 6 is configured inside the outer tub 5 coaxially with the outer tub 5, and rotatably suspended and supported by the outer tub 5 through the driving mechanism 7. The bottom plate 61 and the circumferential wall 62 are provided with a plurality of water through holes not shown, and water in the inner tub 6 can be discharged through the water through holes. Furthermore, an agitator 63 generally called an impeller is coaxially arranged right above the bottom plate 61 of the inner tub 6.

[0032] The driving mechanism 7 includes a basal plate member 71 installed at the lower surface of a bottom plate 51 of the outer tub 5, a motor 72 installed at the basal plate member 71, and a power distribution unit 73 including a clutch. The motor 72 and the power distribution unit 73 respectively have a belt pulley 72a and a belt pulley 73a; and the peripheries of the belt pulleys 72a and 73a are wounded with an annular transmission belt 74, so that the power can be mutually transferred.

[0033] The power distribution unit 73 has two output shafts 75 and 76 coaxially assembled. The first output shaft 75 at the inner side is connected to the center of the above agitator 63, and the second output shaft 76 is connected to the bottom plate 61 of the inner tub 6. The power distribution unit 73 can selectively switch an output target of a driving force inputted from the motor 72 through the belt pulley 73a only to the first output shaft 75 or to both the first output shaft 75 and the second output shaft 76 according to an external instruction. Therefore, the washing machine 1 can only enable the

agitator 63 to rotate when in washing, and enables the inner tub 6 and the agitator 63 to rotate integrally when in dewatering.

[0034] Four hanger bars 3 are configured correspondingly to four corners of the housing 2. Each hanger bar 3 is slightly obliquely configured in such a manner that top ends 3B are close to each other, and the base ends 3A are suspended and fixed at the suspending and fixing portions 25 of the housing 2. Moreover, the top end 3B is provided with a damping mechanism 31 including a spiral spring 31A serving as an elastic member, and the upper end 31A of the damping mechanism 31 is suspended and fixed at the suspended and supporting portion 53 arranged at the outer tub 5. Thus, the washing tub unit 4 including the outer tub 5 is suspended and supported through four hanger bars 3.

[0035] Fig. 2 is a longitudinal section view schematically illustrating the washing machine 1. In Fig. 2, the same reference numerals are given to portions same as those in Fig. 1. Referring to Fig. 4 and Fig. 2, a dimensional relation of various portions is described below in detail.

[0036] Firstly, a height Hu of the housing 2 is defined as a dimension in the vertical direction from the arrangement surface F to the upper end 24 of the housing 2. In the present embodiment, an overall dimension of the housing 2 is set to be substantially same as that of the existing ordinary washing machine, and the height Hu of the shell 2 is set to be about 770mm which is the same as the housing of the existing washing machine.

[0037] Moreover, the bottom plate 61 of the inner tub 6 is arranged at a position higher than the existing washing machine, and the distance from the upper end 24 of the housing 2 to the bottom plate 61 is configured to be short.

[0038] Herein, the depth Dp1 of the inner tub 6 is defined as a dimension in the vertical direction from the upper end 24 of the housing 2 to the lowermost portion of the upper surface of the bottom plate 61 of the inner tub 6, and the diameter Di1 of the inner tub 6 is defined as a maximum diameter at an inner surface of the circumferential wall 62 of the inner tub 6. In the existing ordinary washing machine 101 (referring to Fig. 4), in the case that the depth Dp0 and the diameter Di0 of the inner tub 106 are defined same as above, generally the depth Dp0 of the inner tub 106 is about 110% of the diameter Di0 and is longer in a lengthwise direction.

[0039] Relative to this, in the washing machine 1 of the present embodiment, the depth Dp1 of the inner tub 6 is set as about 60% of the diameter Di1 and about half of the depth of the inner tub of the existing washing machine. Therefore, the washings can be easily taken in and out of the inner tub 6. Furthermore, since the height Hu of the housing 2 is same as that of the housing of the existing washing machine, the upper end 24 may not become too low and people do not need to bend down to take in and out the washings.

[0040] Furthermore, since the inner tub 6 is connected with the second output shaft 76, a height from the supported bottom plate 61 to the upper end 64 is reduced. Therefore, even in the case of taking the washings to a limit position of the upper end 64, the washings may also be imbalanced when in rotation, and the torque acting in a tilting direction of the inner tub 6 is also reduced. Therefore, relative displacement between the outer tub 5 and the inner tub 6 can be reduced, so that the gap Ci1 between the circumferential walls 52 and 62 of the outer tub 5 and inner tub 6 is smaller than the gap Ci0 between the circumferential walls 152 and 162 of the outer tub 105 and the inner tub 106 of the existing washing machine. Specifically, the gap Ci1 is set as about 80% of the existing gap CiO. Thus, the useless space can be further reduced; and moreover, useless water, i.e. dead water, entering the gap between the outer tub 5 and the inner tub 6 when in washing can also be reduced.

[0041] Furthermore, in the case that the stirring force generated by the agitator 63 needs to be transferred to the upper end 64 of the inner tub 6 when in washing, since the height to the upper end 64 is reduced, the stirring force can be set to be relatively small. Therefore, the capacity of the motor 72 can be set to be smaller than that of the existing motor 172; and moreover, the load resistance performance of the power distribution unit 73 is set to be smaller than that of the existing power distribution unit 173, so that the miniaturization and cost reduction of the driving mechanism 7 can be realized. Furthermore, the electric power consumption generated by the motor 72 can also be reduced, thereby reducing the operation cost.

[0042] Furthermore, as described above, when the bottom plate 61 of the inner tub 6 is set at a higher position, the bottom plate 51 of the outer tub 5 and the driving mechanism 7 mounted at the side of the lower surface side are also set at higher positions. Therefore, the integral center-of-gravity position Pc of the washing tub unit 4 is also set at a higher position.

[0043] Herein, the height Hc1 of the center Pc1 of the washing tub unit 4 is defined as a dimension in the vertical direction from the arrangement surface F to the center of the gravity Pc. In the existing ordinary washing machine 101 (referring to Fig. 4), in the case that the height Hc0 of the center of gravity Pc0 of the washing tub unit 104 is defined same as above, generally the height Hc0 of the center of gravity Pc0 is about 40% of the height Hu of the housing 2.

[0044] Relative to this, in the washing machine 1 of the present embodiment, the height Hc1 of the center of gravity Pc1 of the washing tub unit 4 is greater than 50% of the height Hu of the housing 2. That is, in the case that a half position of the height Hu of the housing 2 is defined as a height center Hb in the vertical direction of the housing 2, the center of gravity Pc1 of the washing tub unit 4 is higher than the position of the height center Hb.

[0045] Therefore, in the case that the agitator 63 and the inner tub 6 are driven by the driving mechanism 7 to rotate, and particularly during dewatering operation that

the agitator 63 and the inner tub 6 are integrally driven to rotate at high speed, even in the case of swinging rotation of the washing tub unit 4, since the upper end 24 of the housing 2 having the supporting points for suspending and supporting the hanger bars 2 is close to the center-of-gravity position Pc1, the swinging is reduced and the overall vibration and noise are reduced.

[0046] Furthermore, in the washing machine 1 of the present embodiment, as the bottom plate 51 of the outer tub 5 and the center-of-gravity position Pc1 of the washing tub unit 4 are set to be higher, the position of the suspended and supporting portion 53 for installing the top end 3B side of the hanger bar 3 is also higher than the position of the suspended and supporting portion of the existing washing machine. Specifically, the distance Ls1 from the suspending and fixing portion 25 for installing the base end 3A of the hanger bar 3 to the supporting point of the suspended and supporting portion 53 for installing the top end 3B side is reduced to be about 60% of the distance Ls0 between the supporting points of the existing washing machine. Therefore, the swinging of the washing tub unit 4 can be further reduced, thereby further reducing the vibration and noise.

[0047] Furthermore, the length La1 of the hanger bar 3 can also be shortened by shortening the distance Ls1 between the supporting points. Specifically, in the case of utilizing the damping mechanism same as before, the length La1 of the hanger bar 3 is changed to be about 70% of the length La0 of the hanger bar 103 of the existing washing machine. Therefore, an effect for reducing the manufacturing cost of parts and further narrowing the useless space in the housing 2 can be achieved.

[0048] Furthermore, each hanger bar 3 is inclinedly mounted at a predetermined angle θ such that the top end 3B sides are close to each other. Thus, a pulling force is applied to four corners of the washing tub unit 4 through each hanger bar 3, so that the stability of the central position of the housing 2 in top view can be improved. Specifically, the angle θ is also set to be about 9° same as that of the existing washing machine.

[0049] In the case that the hanger bars 3 are inclined at the specified angle θ, corresponding to the distance Ls1 between the supporting points for installing the hanger bars 3, a gap Co1 between the wall surface 22 of the housing 2 and the circumferential wall 52 of the outer tub 5 needs to be set. In the present embodiment, as described above, the distance Ls1 between the supporting points is set to be about 60% of the distance Ls0 between the supporting points of the existing washing machine, and correspondingly the circumferential wall 52 of the outer tub 5 is disposed in the outer diameter direction, thereby narrowing the useless space, and the gap Co1 is smaller than the gap Co0 of the existing washing machine. Specifically, the gap Co1 is set to be about 80% of the gap Co0 of the existing washing machine, and correspondingly the diameter of the outer tub 5 is increased.

[0050] Moreover, except that the gap Ci1 between the outer tub 5 and the inner tub 6 is set to be smaller than the gap Ci0 of the existing washing machine, by setting the gap Co1 between the wall surface 22 of the housing 2 and the circumferential wall 52 of the outer tub 5 to be smaller than the gap Co0 of the existing washing machine, the diameter Di0 of the inner tub 5 is increased correspondingly. Specifically, the diameter Di0 of the inner tub 5 is set to be about 115% of the diameter Di0 of the inner tub 105 of the existing washing machine, and the space in the radius direction is increased, thereby increasing the washing capacity. Therefore, the washing capacity is not reduced proportionally to the reduction of the depth Dp1, but a sufficient washing capacity can be ensured.

[0051] Furthermore, for the washing machine 1 of the present embodiment as described above, the washing tub unit 4 is integrally installed at the top, so that the lower side of the internal space Sp can be open to a large extent. Therefore, the space can be used to install the drawer 8 as the accommodating portion.

[0052] Fig. 3 is a perspective diagram illustrating the washing machine and illustrates a condition that the drawer 8 is drawn forwards. The lower portion of the wall surface 22 at the front side of the washing machine 1 is provided with a rectangular opening 22a which is longer in a transverse direction, and the inner side of the opening is provided with the drawer 8. Therefore, the space below the washing tub unit 4 (referring to Fig. 2) can be effectively utilized, thereby further narrowing the useless space. Furthermore, the drawer 8 is used as the accommodating space for detergents, bleaching agents and softening agents necessary for washing as well as utensils such as washing nets and the like, so that a peripheral environment of the washing machine in a tendency of disorder can be easily sorted and arranged, and the usability is further improved.

[0053] It shall be noted that a specific structure of each portion is not limited to the above embodiments.

[0054] For example, in the above embodiments, the accommodating portion 8 is configured as the drawer, and the accommodating portion can also be configured as a storage shelf with an opening and closing door.

[0055] Furthermore, various apparatuses for increasing additional functions can also be properly included and can be integrally configured to substitute the accommodating portion 8.

[0056] Furthermore, the dimension of each portion of the washing machine 1 is not limited to the above solution and can be appropriately changed.

[0057] Various variations can be made to other structures without departing from technical spirit of the present invention.

Claims

1. A washing machine, comprising:

a box-shaped housing having an internal space opened upward; and
a washing tub unit suspended and supported in the internal space through a hanger bar,
wherein the washing tub unit comprises an outer tub presented in a bottomed quasi-cylindrical shape; an inner tub presented in a bottomed quasi-cylindrical shape, coaxially configured inside the outer tub and rotatably supported by the outer tub; and a driving mechanism arranged at a lower end of the outer tub and configured to drive the inner tub to rotate;
a base end side of the hanger bar is mounted in the vicinity of an upper end of the housing, and a top end side is installed at a lower portion of the outer tub; and
a center of gravity of the washing tub unit is set at a position higher than a height center in a vertical direction of the housing.

2. The washing machine according to claim 1, wherein

the hanger bar is mounted at a predetermined angle, and the top end side is mounted at a suspended and supporting portion arranged at the lower portion of a circumferential wall of the outer tub; and
the suspended and supporting portion is set at a position higher than the height center in the vertical direction of the housing.

3. The washing machine according to claim 2, wherein

the driving mechanism selectively drives the inner tub and an agitator arranged at a bottom of the inner tub by transferring a rotating force of a motor; and
a depth of the inner tub is set in a range of 50% to 70% of a diameter of the inner tub.

4. The washing machine according to claim 2 or 3, wherein an accommodating portion is arranged below the washing tub unit.

5. The washing machine according to claim 4, wherein the accommodating portion is a drawer.

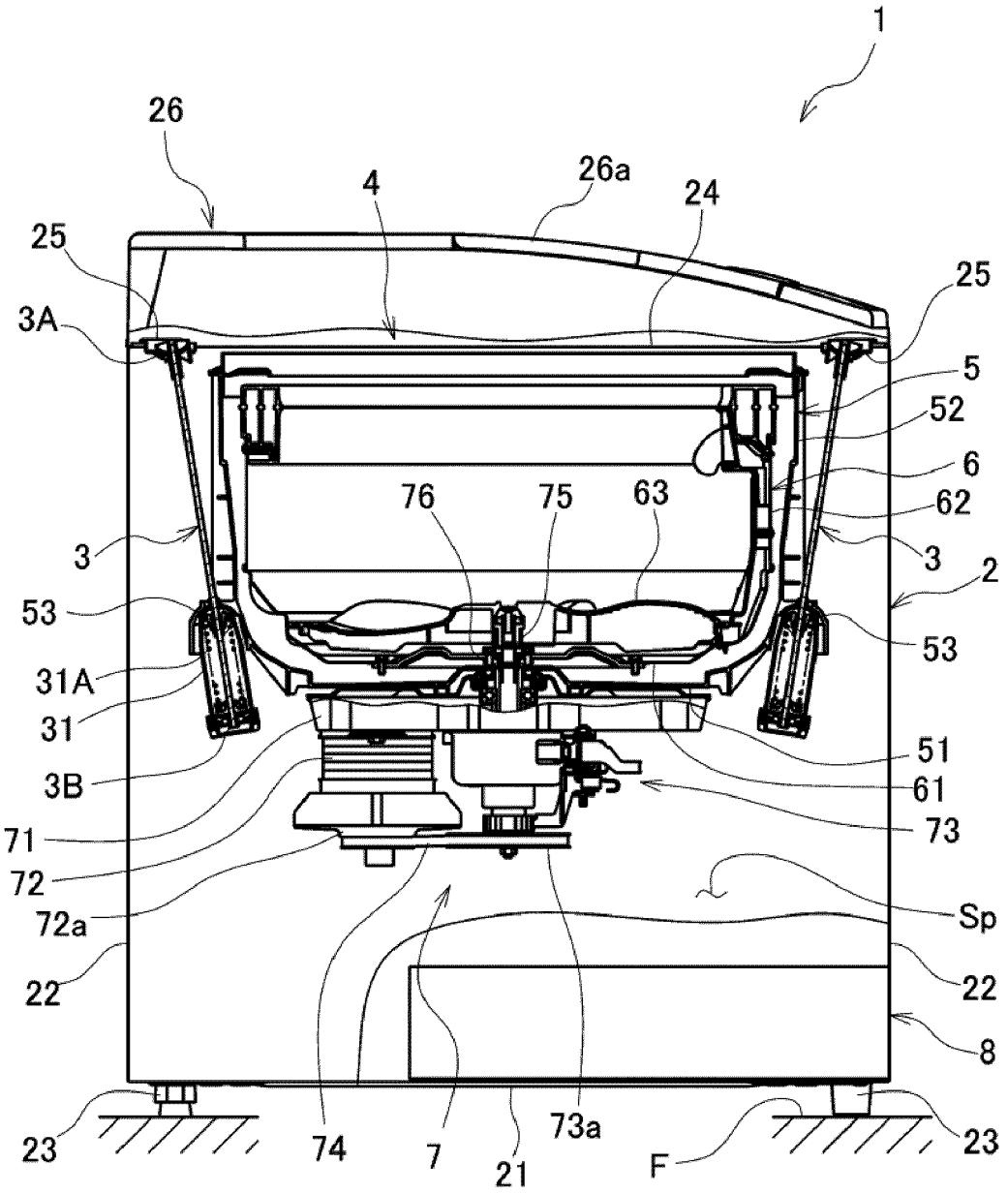
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FIG. 1

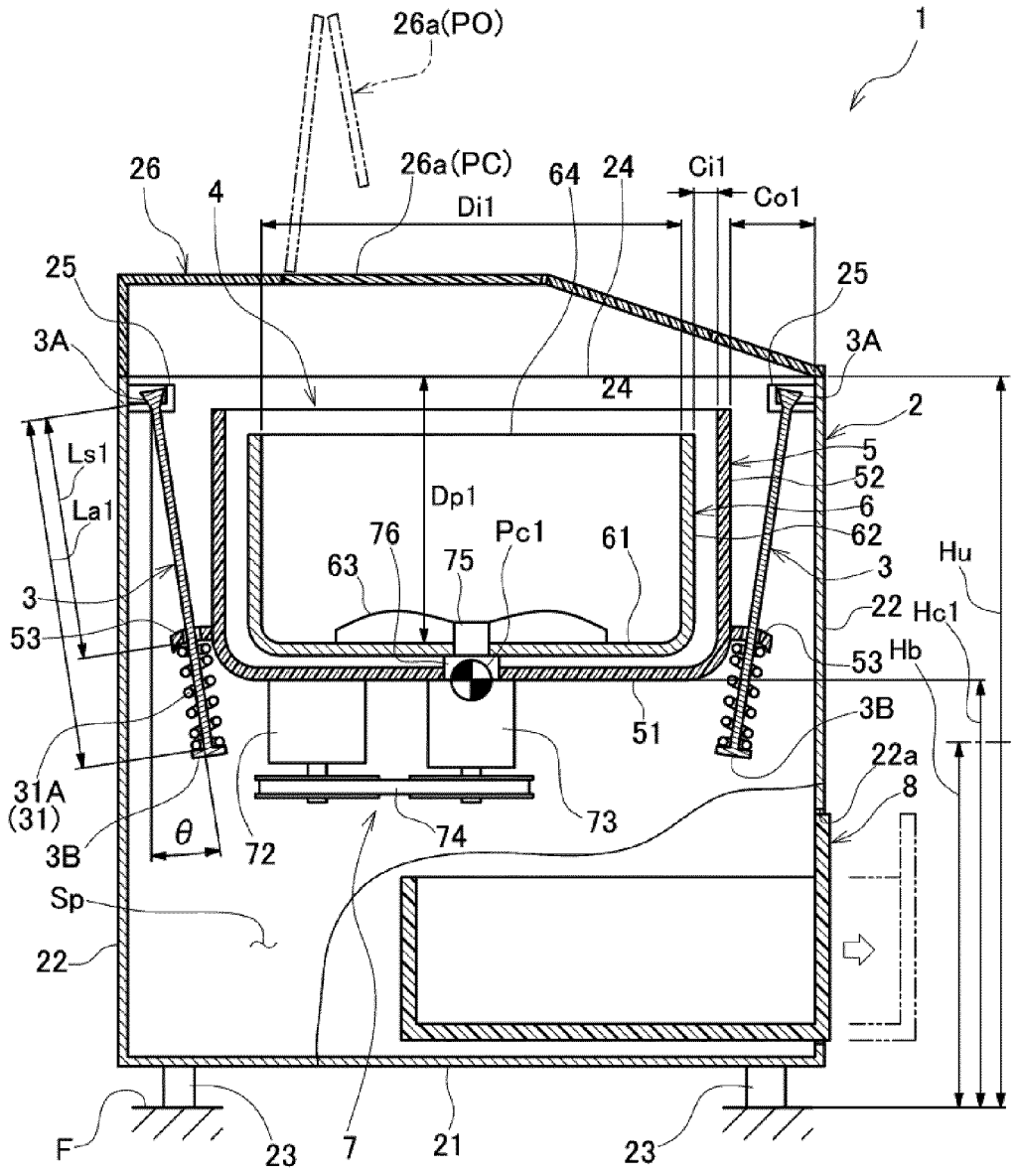
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FIG. 2

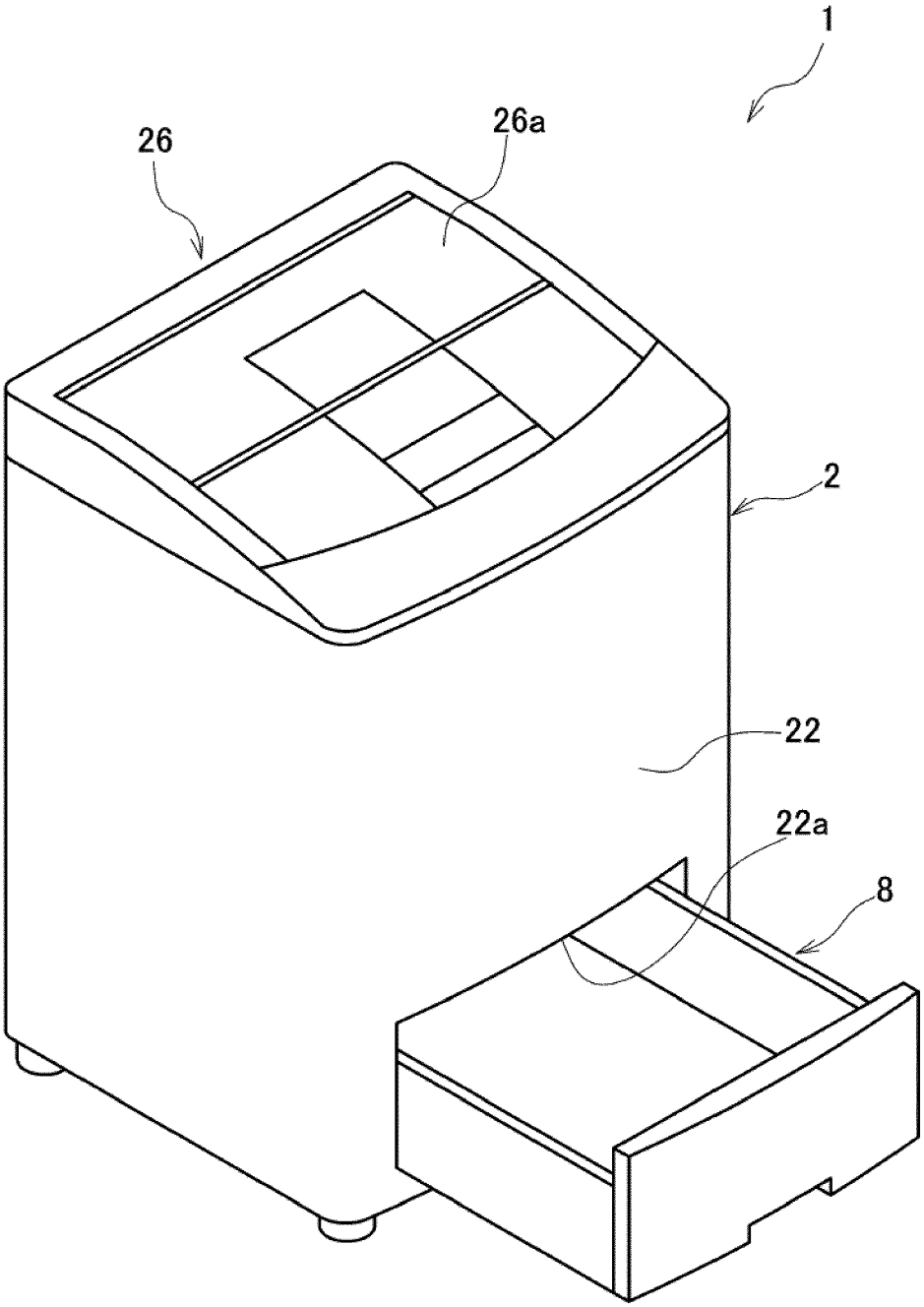

FIG. 3

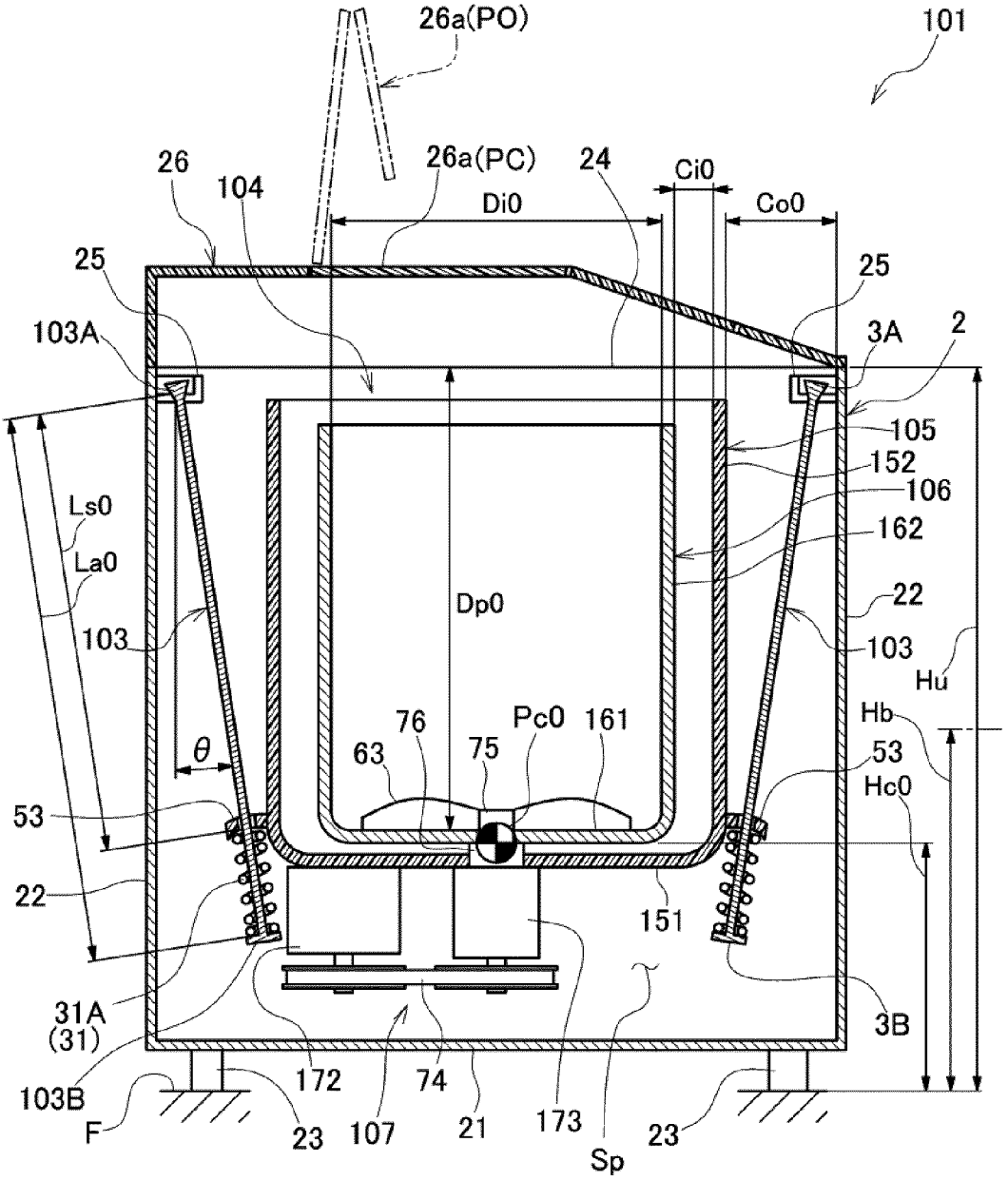
26a(PO)
101
26
104
26a(PC)
24
Ci0
Di0
Co0
25
25
103A
3A
2
105
152
106
162
Ls0
La0
Dp0
22
103
103
Hu
Hb
θ
76
Pc0
161
63
75
53
Hc0
53
22
151
31A
(31)
3B
103B
172
74
F
23
107
21
173
Sp
23

FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2015/097812

A. CLASSIFICATION OF SUBJECT MATTER

D06F 23/04 (2006.01) i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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)

DWPI, SIPOABS, CNABS: impeller, top open, above open, above, opening, high, low, barycenter, center of gravity, cg, centre of gravity, centre of mass, center of mass, wash???, tub, drum, height, top

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN 1978739 A (HAIER ELECTRONICS GROUP CO., LTD. et al.), 13 June 2007 (13.06.2007), description, paragraph 3, and figure 1	1-5
A	CN 2265389 Y (QINGDAO HAIER WASHING MACHINE CO., LTD.), 22 October 1997 (22.10.1997), the whole document	1-5
A	JP 2000014967 A (DAEWOO ELECTRONICS CO., LTD.), 18 January 2000 (18.01.2000), the whole document	1-5

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

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"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

"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

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
16 March 2016 (16.03.2016)	**22 March 2016 (22.03.2016)**
Name and mailing address of the ISA/CN: 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 **CHEN, Pengfei** Telephone No.: (86-10) **62084627**

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

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2015/097812

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN 1978739 A	13 June 2007	CN 1978739 B	12 May 2010
CN 2265389 Y	22 October 1997	None	
JP 2000014967 A	18 January 2000	US 6122942 A	26 September 2000
		JP 3784184 B2	07 June 2006

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 2011240041 A **[0009]**