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(54) **WASHING MACHINE**

(57) Disclosed is a washing machine (1), which includes a water level detection sensor (S) and a hose (8). The hose (8) is formed into a flexible cylindrical shape, and has a fixed portion (81) which is fixed to a suspension rod supporting portion (25) and is between a basal end portion (8a) connected to the water level detection sensor (S) and a top end portion (8b) connected to a washing drum (4). The washing machine (1) can keep the water level detection sensor (S) in steady operation while adopting a simple structure in which the number of components is limited, and thus the operation is steadier.

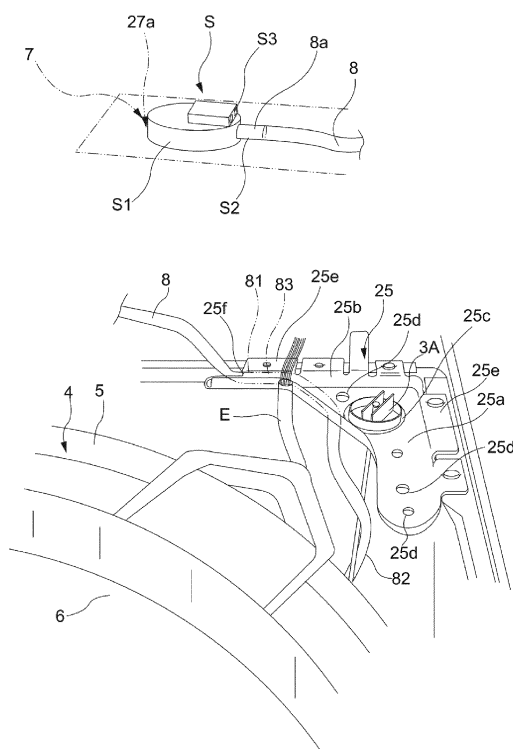


FIG. 3

Description

TECHNICAL FIELD

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

BACKGROUND

[0002] In the past, the following washing machine is generally known: a roughly cylindrical outer drum with a bottom is supported inside a box-shaped housing, and an inner drum as a washing and dewatering drum is rotatably supported at an inner side of the outer drum (for example, referring to patent literature 1).

[0003] Such a washing machine can stably perform a series of steps from rinsing to dewatering as long as clothes in an amount suitable for washing is accommodated in the inner drum and the washing is started.

[0004] The above washing machine is generally in such a state that various wires and pipes are connected between a control device arranged at an upper portion of the housing and the washing drum in order to suitably operate the washing drum.

[0005] Moreover, in such washing machine, according to volumes, configurations and weights of the clothes to be washed, the following conditions may occur: light clothes to be dewatered in the inner drum and the clothes located near an opening of the inner drum are flown out from the opening of the inner drum due to centrifugal force and then touch the wires and pipes exposed inward between the opening of the outer drum and the upper portion of the housing.

[0006] Moreover, a flexible hose connected to a water level detection sensor for detecting a water level in the washing drum is especially easy to be affected by an external force. One end of the hose is connected to an air trap portion of the washing drum which is generally arranged at a lower end portion of the washing drum, and the other end is connected to the water level detection sensor. The water level detection sensor is generally fixed to an upper panel arranged on the housing in a position above the washing drum.

[0007] The water level detection sensor is used to detect, through the hose, air pressure of the air trap portion, which is changed depending on the water level in the washing drum, and to determine the water level in the washing drum. Namely, once the hose is bent and dented, the following poor conditions may be caused: the air pressure of the air trap portion cannot be accurately transmitted to the water level detection sensor and the water level detection sensor cannot operate normally.

[0008] Specifically, the following condition may be caused: when an external force is applied to the hose that connects the washing drum and the water level detection sensor, a control system of the washing machine recognizes an abnormality, reports an error and also stops the operation.

[0009] Moreover, in the above patent literature 1, in order to protect the wires and pipes including the above hose, a housing inner wall for the wires is configured at the opening that faces the washing drum in the housing, and a protecting cover for protecting the wires is additionally arranged.

[0010] However, in order to provide such protecting cover, additional processing for forming a new opening in the inner wall of the housing is needed. Moreover, since additionally provided mechanism components are used additionally, more time will be taken in a manufacturing process.

Related Technical Literature

Patent Literature

[0011] Patent Literature 1: Japanese Laid-Open Patent Publication No. 9-285685

SUMMARY

Problems to be solved by the disclosure

[0012] A purpose of the present disclosure is to effectively solve such problems, so as to provide a washing machine capable of keep a water level detection sensor in a steady operation while adopting a simple structure with a reduced quantity of components, and thus the operation is steadier.

Solution for solving the problems

[0013] In order to achieve the purpose, the present disclosure adopts the following solution.

[0014] A washing machine of the present disclosure includes: a box-shaped housing having an internal space with an upper opening; a washing drum suspended and supported in the internal space by a suspension rod; a suspension rod supporting portion fixed to the housing and configured to support the suspension rod to the housing; a water level detection sensor arranged on an upper portion of the housing and configured to detect a water level in the washing drum; and a hose formed into a flexible cylindrical shape and having a fixed portion which is fixed to the suspension rod supporting portion between a basal end portion connected to the water level detection sensor and a top end portion connected to the washing drum.

[0015] In addition, in the present disclosure, the fixed portion is attached to a contacting surface provided on the suspension rod supporting portion.

[0016] In addition, in the present disclosure, the fixed portion is a clamped portion clamped between the housing and the suspension rod supporting portion.

[0017] In addition, in the present disclosure, the fixed portion is an opening insertion portion inserted into an opening of the suspension rod supporting portion.

[0018] In addition, in the present disclosure, the fixed portion is configured to be closer to the housing than an electrical wire electrically connected to the washing drum.

Effects of the disclosure

[0019] According to the present disclosure, in addition to a structure in which the suspension rod is used to support the washing drum, the hose is provided with the fixed portion fixed to the suspension rod supporting portion with increased strength. Thus, even if clothes come into contact with the hose during operation, the hose fixed to the suspension rod supporting portion is difficult to be affected. As a result, process defects in the operation caused by erroneous detection of the water level detection sensor due to abnormality of the hose can be reduced. In addition, according to the present disclosure, in a manufacturing process, piping treatment of the hose is facilitated, and poor conditions such as the hose biting into other elements, bending of the hose, dent by pressing and the like can be suppressed.

[0020] In addition, according to the present disclosure in which the fixed portion is attached to the contacting surface provided on the suspension rod supporting portion, the suspension rod supporting portion may play a role of covering the hose so that the hose is less liable to be affected by the clothes.

[0021] In addition, according to the present disclosure in which the fixed portion is a clamped portion clamped between the housing and the suspension rod supporting portion, the hose can be effectively maintained in a position in which the hose is difficult to contact with the clothes.

[0022] In addition, according to the present disclosure in which the fixed portion is an opening insertion portion inserted into an opening of the suspension rod supporting portion, the hose can be stably maintained regardless of actions of the washing drum and moving conditions of the clothes.

[0023] In addition, according to the present disclosure in which the fixed portion is configured to be closer to the housing than an electrical wire electrically connected to the washing drum, the electrical wire touches the clothes ahead of the hose so that the influence of the clothes on the hose can be reduced. Moreover, the electrical wire is positioned near the suspension rod supporting portion, so that the electrical wire is also difficult to be affected by the clothes.

BRIEF DESCRIPTION OF DRAWINGS

[0024]

FIG. 1 is a diagram illustrating an appearance of a washing machine 1 in an embodiment of the present disclosure;

FIG. 2 is a sectional view schematically illustrating

the washing machine 1;

FIG. 3 is a diagram for describing major parts of the washing machine 1; and

FIG. 4 is a diagram for describing a modification of the washing machine 1.

DETAILED DESCRIPTION

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

[0026] FIG. 1 is a perspective view illustrating a washing machine 1 in an embodiment of the present disclosure. The washing machine 1, when observed from top, has a substantially quadrangular shape. FIG. 2 illustrates a state that the washing machine 1 is cut along a diagonal line. In addition, the figure illustrates a general structure of the washing machine 1, and omits some parts irrelevant to the present invention. In addition, FIG. 3 is an enlarged structural diagram illustrating a part A and a part B shown in FIG. 1, and FIG. 4 is a diagram illustrating a modification of the part B in FIG. 3.

[0027] The washing machine 1 of the present embodiment shown in FIG. 1 and FIG. 2 is a so-called vertical washing machine and includes: a box-shaped housing 2 having an internal space with an upper opening, and a washing drum 4 suspended and supported by a suspension rod supporting portion 25 of the housing 2 through a suspension rod 3 in the box-shaped housing 2. Moreover, the washing drum 4 includes a roughly cylindrical outer drum 5 with a bottom, a roughly cylindrical inner drum 6 with a bottom that is coaxially provided in the outer drum 5, and a driving mechanism 7 arranged at the bottom of the outer drum 5. The driving mechanism 7 is an existing driving mechanism which, as a main body, includes a base member installed on a lower surface of a bottom plate 51 of the outer drum 5 and a motor installed on the base member.

[0028] The washing drum 4 is suspended and supported in the housing 2 through the suspension rod 3. The suspension rod 3 is configured to incline by a predetermined angle, and the basal end 3A side is mounted on the suspension rod supporting portion 25 provided in the vicinity of an upper end 24 of the housing 2, and the tip end 3B side is mounted on a suspended supporting portion 53 arranged at a lower portion of a circumferential wall 52 of the outer drum 5 via a damping mechanism. Thus, the washing drum 4 is elastically supported. Through such arrangement, vibration generated due to rotation of the inner drum 6 and a stirring blade 63 during washing or dewatering can be inhibited such that the vibration does not become too large.

[0029] The outer drum 5 constituting the washing drum 4 is a roughly cylindrical member with a bottom, and includes the bottom plate 51 that forms the bottom and is roughly circular when observed from top, as well as a circumferential wall 52 rising from the edge portion of the bottom plate 51. The lower portion of the circumferential wall 52 is integrally provided with hook-shaped suspend-

ed supporting portions 53 which are roughly evenly arranged at four positions when observed from top. The suspended supporting portions 53 may be mounted at the tip end 3B side of the suspension rod 3. Moreover, the vicinity of the lower end portion of the washing drum 4 is connected to a top end portion 8b of a hose 8 connected to the water level detection sensor S, which is used for correctly controlling the water injection to the washing drum unit and water drainage from the washing drum unit by using the water level detection sensor S.

[0030] Four suspension rods 3 are configured correspondingly to four corners of the housing 2. Each suspension rod 3 is disposed slightly inclined so that top ends 3B are close to each other, and the basal end 3A is suspended and fixed to the suspension rod supporting portion 25 of the above housing 2. Moreover, at the top ends 3B, damping mechanisms including coil springs as elastic members are installed. Upper ends of the damping mechanisms are suspended and fixed to the suspended and supported portions 53 arranged on the outer drum 5. Through such arrangement, the washing drum 4 including the outer drum 5 is suspended and supported by four suspension rods 3.

[0031] The housing 2 includes a roughly rectangular bottom 21 and four walls 22 rising from the bottom 21, and is formed into a box shape having an internal space with an upper opening. Moreover, four corners of the bottom 21 are each provided with a supporting feet. In addition, the suspension rod supporting portion 25 is arranged at the upper side of the housing 2 and is fixed to the wall 22 in a position corresponding to the basal end 3A of the suspension rod 3.

[0032] Moreover, the suspension rod supporting portion 25 is configured to support the suspension rods 3 to the housing 2, and functions as a supporting point for the suspension rod 3 by hanging and fixing the basal end 3A side of the suspension rod 3. The suspension rod supporting portion 25 is an existing suspension rod supporting portion and includes: a flat portion 25a which has a substantially L-shaped plan view, a standing surface 25b which stands upright from the flat portion 25a and is close to or in contact with the wall; a rod receiving hole 25c configured to hang and fix the basal end 3A of the suspension rod 3 in roughly center position of the flat portion 25a; a plurality of openings 25d formed in the flat portion 25a; and an installing flange 25e extending horizontally from the standing surface 25b to an outer side and installed on the housing 2.

[0033] Moreover, the suspension rod supporting portion 25 shown at a right side in FIG. 2 and located at an upper right side when observed from top also plays a role of guiding the hose 8 connected to the vicinity of the lower end of the washing drum 4 to the water level detection sensor S. In the present embodiment, a clamping portion 25f for clamping the hose 8 is formed between the wall 22 and the standing surface 25b. Moreover, the hose guided to the clamping portion 25f is properly guided to the water level detection sensor S fixed to the upper por-

tion of the housing 2, but the specific implementation will be described later in detail.

[0034] In addition, as shown in FIG. 1, the housing 2 includes the following elements on the upper portion: a cover 26 integrated with an operation panel; and an upper plate 27 arranged slightly below the cover 26. The upper plate 27 is configured to fix various mechanism parts mainly used for control such as the water level detection sensor S. The cover 26 includes: an opening-closing lid 26a located at a front side and can be opened and closed, and a fixed cover 26b for operatively supporting the opening-closing lid 26a at a rear side of the opening-closing lid.

[0035] Moreover, since the washing machine 1 has no clothes drying function, a middle cover is not provided. Namely, with the washing machine 1, it is easy to touch the washing drum 4 just by opening the opening-closing lid 26a. Moreover, since the above upper plate 27 is arranged directly below the fixed cover 26b, various mechanism parts fixed to the upper plate 27 cannot be touched by opening and closing the opening-closing lid 26a. In the present embodiment, as shown by virtual lines in FIG. 1, the water level detection sensor S is fixed in the vicinity of a left end portion of the upper plate 27. It should be noted that as mentioned above, since FIG. 2 is a diagram for illustrating the washing machine 1 by cutting the washing machine 1 along the diagonal line, the water level detection sensor S in the same figure appears near the center.

[0036] As shown by an enlarged view of the part A shown at the upper portion of FIG. 3, the water level detection sensor S is fixed to a sensor installing portion of the upper plate. The water level detection sensor S includes: a sensor body S1 which is in a roughly disk shape, a hose installing portion S2 arranged at one end side of the sensor body S1 and connected to the basal end portion 8a of the hose 8, and an electrical connection portion S3 located above the hose installing portion S2 and configured to connect an electrical wire E as shown by the lower side of the same figure. The water level detection sensor S is an ordinary water level detection sensor, and is used to detect, through the hose 8, the air pressure of an air trap portion (not shown in the figure) arranged on the washing drum 4, which is changed depending on a water level in the washing drum 4, and to determine the water level in the washing drum 4 accordingly. Namely, the hose 8 connected to the water level detection sensor S is not bent or excessively curved regardless of an action of the washing drum 4, which is a condition of correct operation. When any abnormality occurs in the hose 8 and the water level detection sensor S cannot be operated normally, a control system reports an error for a user through sound and display and also stops the operation of the washing machine 1.

[0037] Herein, the washing machine 1 in the present embodiment includes the above water level detection sensor S and the hose 8. The hose 8 is flexible, has a cylindrical shape, and includes a fixed portion 81. The fixed portion 81 is between the basal end portion 8a con-

nected to the water level detection sensor S and the top end portion 8b connected to the washing drum 4 and is fixed to the suspension rod supporting portion 25.

[0038] Specific implementations of the hose 8 in the present embodiment are described below with reference to FIG. 3 and FIG. 4. The basal end portion 8a, as shown by the upper portion of FIG. 3, is firmly fixed to a hose installing portion 27a of the water level detection sensor S. The top end portion 8b is connected to the air trap portion. The air trap portion is arranged near the lower end of the washing drum 4, the air pressure of which is changed according to the water level in the washing drum 4. Since a structure of the air trap portion is a known technology, detailed description is omitted.

[0039] Moreover, as shown in FIG. 3 and FIG. 4, the hose 8 in the present embodiment includes the above fixed portion 81 and a winding portion 82 between the basal end portion 8a and the top end portion 8b. The winding portion 82 is drooped from the fixed portion 81 and is wound around and supported on the suspension rod.

[0040] The fixed portion 81 is used as the clamped portion 83 at the lower side of FIG. 3, and a part formed between a clamping surface 25f provided on the suspension rod supporting portion 25 and the wall 22 of the housing 2 is in contact with the clamping surface 25f and is clamped. As shown in the figure, the clamped portion 83 is arranged in a position which is slightly lower than the upper end of the washing drum 4. In addition, the washing drum 4 is powered, and the electrical wire E for transmitting various detection signals and control signals is located in a position close to the washing drum 4 near the clamped portion 83. In other words, the fixed portion 81 is arranged in such a manner that the fixed portion 81 is closer to the housing 2 than the electrical wire E electrically connected to the washing drum 4. Through such arrangement of the hose 8, even if the clothes extend into the hose 8 from the washing drum 4 during dewatering, the hose 8 is protected by the suspension rod supporting portion 25 and the electrical wire E and the hose 8 will not be damaged. In addition, since a top end side of the clamped portion 83 is further provided with the winding portion 82 wound on the suspension rod, the hose 8 is stably maintained in this attitude.

[0041] Moreover, in addition to the arrangement of the hose 8 shown in FIG. 3, as a modified example, the hose 8 can also be arranged as shown in FIG. 4.

[0042] FIG. 4 illustrates that the hose 8 is attached to the standing surface 25b of the suspension rod supporting portion 25, then an opening 25d provided in the suspension rod supporting portion 25 is inserted, and the hose 8 is drooped from the flat portion 25a and forms the winding portion 82. Namely, in the same figure, the figure illustrates an embodiment in which the hose 8 is used as the fixed portion 81 as an attached portion attached to the standing surface 25b of the suspension rod supporting portion 25 as well as an opening inserting portion 85 inserting the suspension rod supporting portion 25. In

this case, the standing surface 25b is equivalent to the attaching surface of the suspension rod supporting portion 25. When the hose 8 is arranged in this manner, the hose 8 is also protected by the suspension rod supporting portion 25 and the electrical wire E and the hose 8 will not be damaged by the clothes. In addition, since a top end side of an attaching portion 84 and the opening inserting portion 85 is also further provided with the winding portion 82 wound on the hoisting rod 3, the hose 8 is also stably maintained in this attitude.

[0043] As mentioned above, in the washing machine 1 in the present embodiment, the hose 8 has the fixed portion 81 fixed to the suspension rod supporting portion 25.

[0044] As mentioned above, according to the present embodiment, in addition to the structure in which the washing drum 4 is supported by the suspension rods 3, the fixed portion 81 fixed to the suspension rod supporting portion 25 with increased strength is provided on the hose 8. Thus, even if the clothes come into contact with the hose 8 during operation, the hose 8 fixed to the suspension rod supporting portion 25 is difficult to be affected. As a result, process defects in the operation caused by erroneous detection of the water level detection sensor S due to abnormality of the hose 8 can be reduced. In addition, according to the present embodiment, in a manufacturing process, piping treatment of the hose 8 is facilitated, and poor conditions such as the hose 8 biting into other elements, bending of the hose 8, dent by pressing and the like can be suppressed. Moreover, in the present embodiment, the effect described above is effectively demonstrated without implementing any additional component and processing to a composition manner of the washing machine 1.

[0045] In addition, in the washing machine 1 in the present embodiment, in any solution of FIG. 3 and FIG. 4, the fixed portion 81 is attached to the suspension rod supporting portion 25. Thus, the suspension rod supporting portion 25 plays a role of covering the hose 8, thereby achieving the structure that the hose 8 is difficult to be affected by the clothes.

[0046] Further, in the present embodiment, the fixed portion 81 is used as the clamped portion 83 clamped between the housing 2 and the suspension rod supporting portion 25, so that the hose 8 can be effectively maintained in a position in which the hose 8 is difficult to contact the clothes.

[0047] In addition, in the present embodiment, as shown in FIG. 4, an implementation is adopted in which the fixed portion 81 is used as the opening inserting portion 85 by which the opening 25d of the suspension rod supporting portion 25 is inserted. Thus, regardless of the action of the washing drum 4 and the movement of the clothes, the hose 8 can be stably maintained.

[0048] Moreover, the fixed portion 81 is arranged in a position which is lower than the upper end of the washing drum 4. Thus, the fixed portion 81 is more difficult to be affected by the clothes coming out of the washing drum 4.

[0049] Further, in the present embodiment, the fixed portion 81 is provided closer to the housing 2 than the electrical wire E electrically connected to the washing drum 4. Thus, the electrical wire E touches the clothes ahead of the hose 8 so that the influence of the clothes on the hose 8 can be reduced. In addition, the electrical wire E is also arranged in the vicinity of the suspension rod supporting portion 25, so that the electrical wire E is also difficult to be affected by the clothes.

[0050] In addition, in the present embodiment, since the hose 8 has the winding portion 82 suspended from the fixed portion 81 and wound and supported on the suspension rod 3, a proper posture of protecting the hose 8 through the fixed portion 81 can be stably maintained and the hose 8 can be supported more stably.

[0051] The above describes embodiments and variation examples of the present disclosure in detail, but the present disclosure is not limited to the contents of above embodiments and variation examples. For example, in above embodiments, only the hose is fixed to the suspension rod supporting portion, but undoubtedly, the electrical wire can also be fixed to the suspension rod supporting portion.

[0052] In addition, the suspension rod supporting portion for fixing the fixed portion may be any one of four suspension rod supporting portions.

[0053] Further, sizes of each part of the washing machine is not limited to the above, and can be properly changed.

[0054] Various variations can be made to other structures without departing from the scope of the technical spirit of the present disclosure.

List of reference numerals

[0055]

1: washing machine
 2: housing
 25: suspension rod supporting portion
 3: suspension rod
 4: washing drum
 8: hose
 81: fixed portion
 82: winding portion
 83: clamped portion
 84: attaching portion
 85: opening inserting portion
 S: water level detection sensor

the internal space by a suspension rod;
 a suspension rod supporting portion fixed to the housing and configured to support the suspension rod to the housing;
 a water level detection sensor arranged on an upper portion of the housing and configured to detect a water level in the washing drum; and
 a hose formed into a flexible cylindrical shape and having a fixed portion which is fixed to the suspension rod supporting portion between a basal end portion connected to the water level detection sensor and a top end portion connected to the washing drum.

2. The washing machine according to claim 1, wherein the fixed portion is attached to a contacting surface provided on the suspension rod supporting portion.
3. The washing machine according to claim 1 or claim 2, wherein the fixed portion is a clamped portion clamped between the housing and the suspension rod supporting portion.
4. The washing machine according to claim 1 or claim 2, wherein the fixed portion is an opening insertion portion inserted into an opening of the suspension rod supporting portion.
5. The washing machine according to claim 1 or claim 2, wherein the fixed portion is configured to be closer to the housing than an electrical wire electrically connected to the washing drum.

Claims

1. A washing machine, comprising:
 a box-shaped housing having an internal space with an upper opening;
 a washing drum suspended and supported in

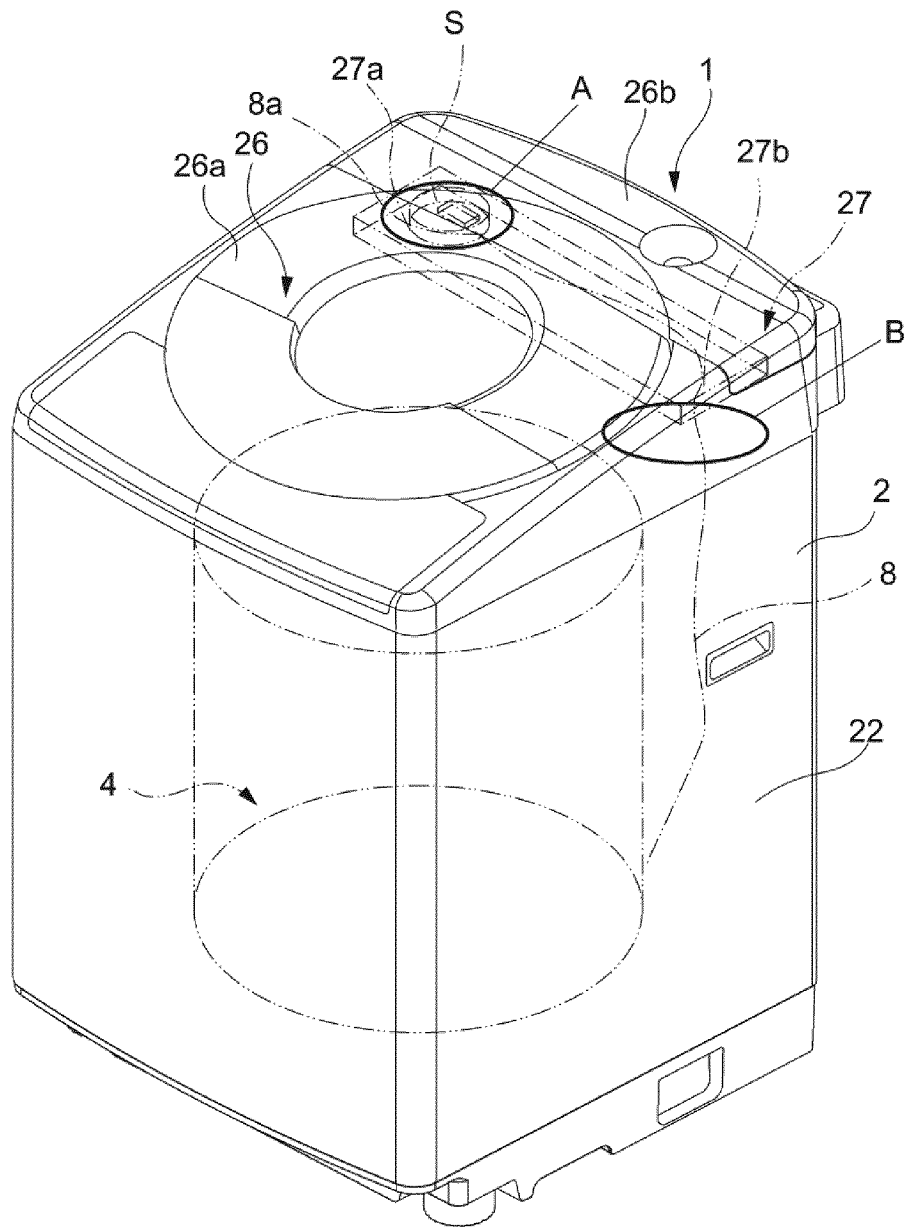


FIG. 1

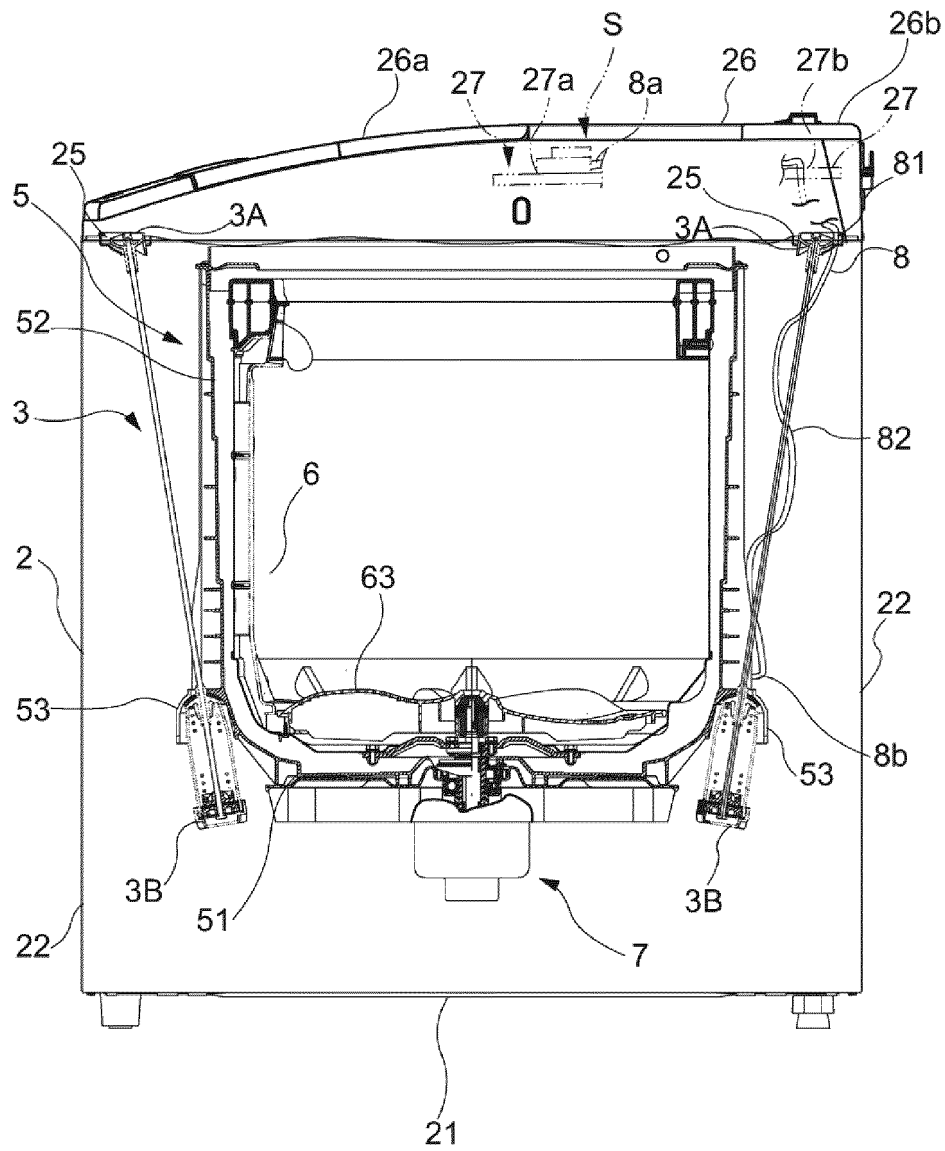


FIG. 2

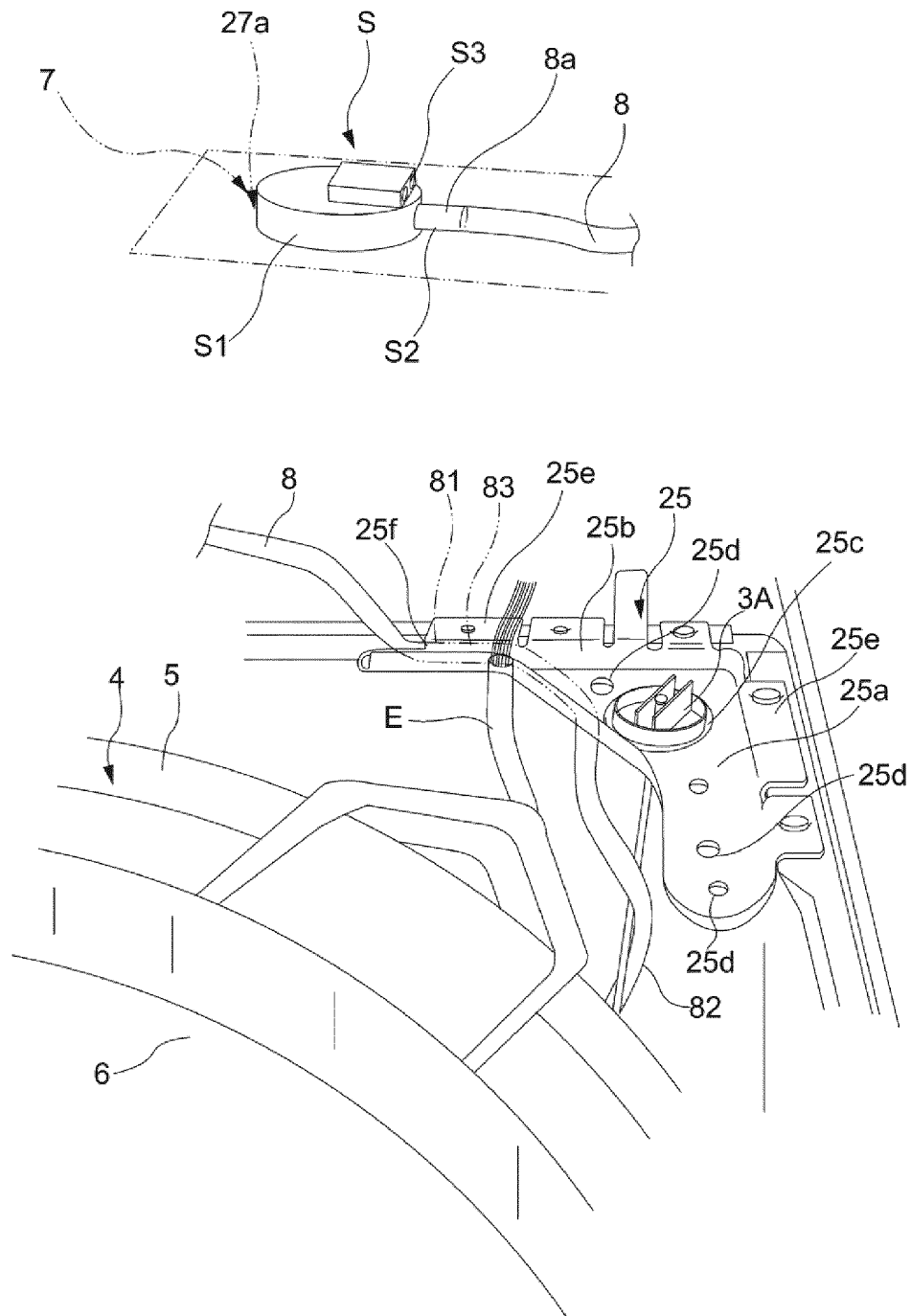


FIG. 3

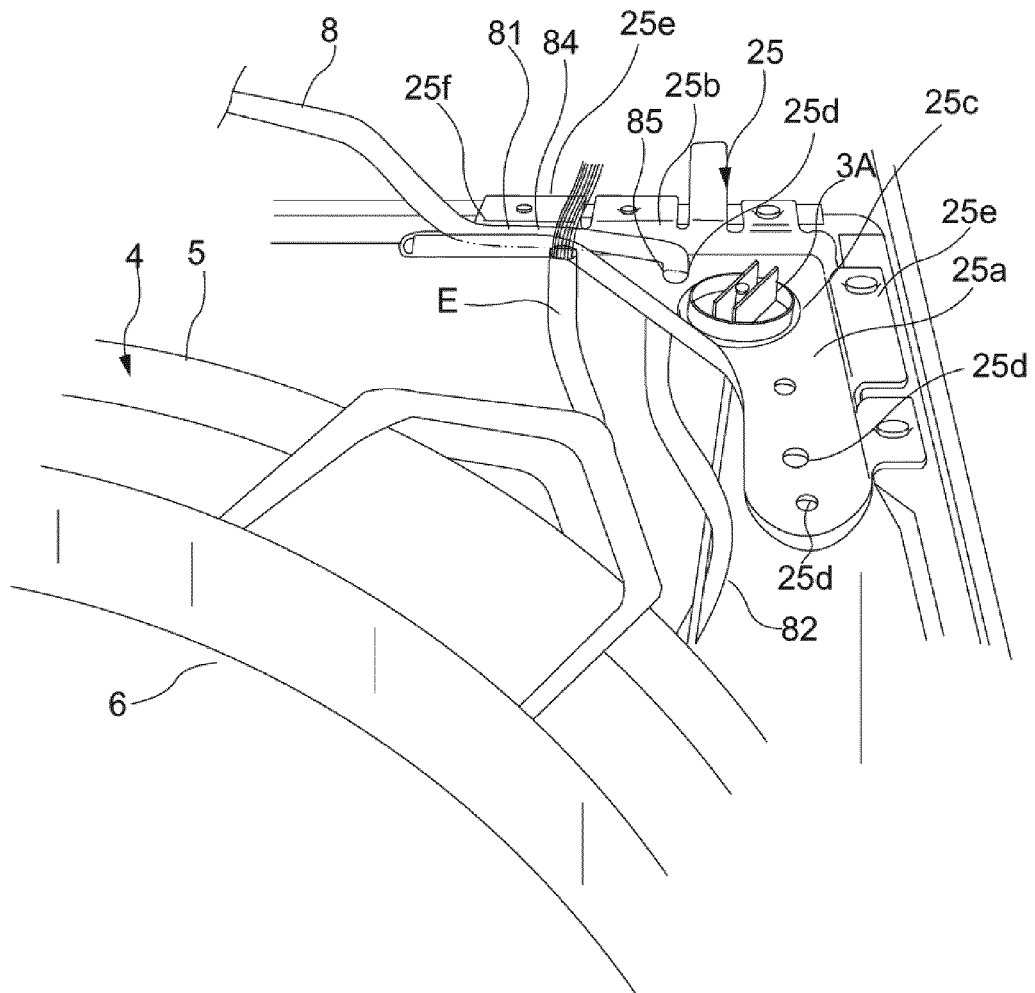


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2016/110240

A. CLASSIFICATION OF SUBJECT MATTER

D06F 37/00 (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)

CNPAT, CNKI, WPI, EPODOC: washing machine, clean, water level, burn, sense, wash+, machine, level, hose, flexible, soft, sensor?, detect+, transducer

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KR 100260731 B1 (SAMSUNG ELECTRONICS CO., LTD.), 01 July 2000 (01.07.2000), description, page 2, last paragraph to page 4, paragraph 1, and last two pages, figures	1-5
A	CN 203514043 U (XINYOU CONSTRUCTION MACHINERY CO., LTD.), 02 April 2014 (02.04.2014), the whole document	1-5
A	CN 2534215 Y (WU, Huaben), 05 February 2003 (05.02.2003), the whole document	1-5
A	JP 1-201298 A (HITACHI LTD.), 14 August 1989 (14.08.1989), the whole document	1-5
A	JP 2001-29689 A (HITACHI LTD.), 06 February 2001 (06.02.2001), the whole document	1-5

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

* Special categories of cited documents:

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“P” document published prior to the international filing date but later than the priority date claimed

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“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

04 February 2017 (04.02.2017)

Date of mailing of the international search report

27 February 2017 (27.02.2017)

Name and mailing address of the ISA/CN:
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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2016/110240

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
KR 100260731 B1	01 July 2000	None	
CN 203514043 U	02 April 2014	None	
CN 2534215 Y	05 February 2003	None	
JP 1-201298 A	14 August 1989	None	
JP 2001-29689 A	06 February 2001	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 9285685 A [0011]